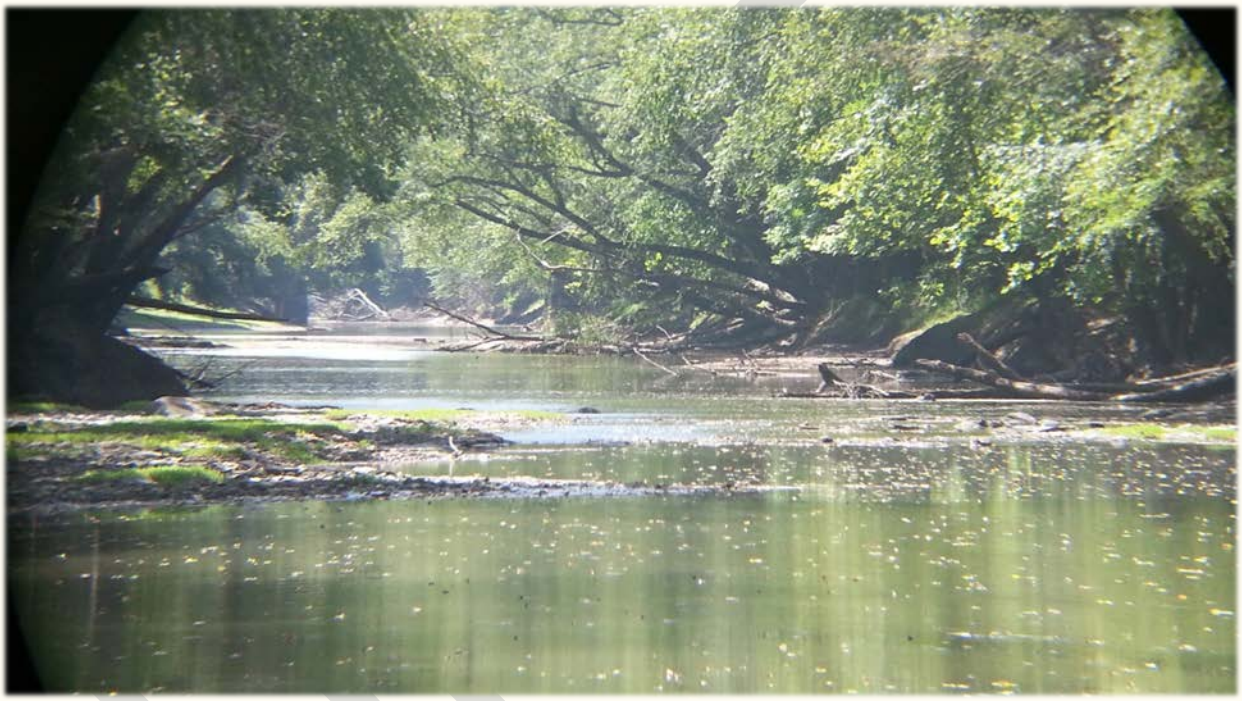
US Army Corps of Engineers ®
Wilmington District

DRAFT DETAILED PROJECT REPORT AND ENVIRONMENTAL ASSESSMENT

NEUSE RIVER GOLDSBORO SECTION 1135 PROJECT MODIFICATION FOR IMPROVEMENT OF THE ENVIRONMENT



Project Modification for Improvement of the Environment
Section 1135 of the Water Resources Development Act of 1986, as amended

December 2017

Executive Summary

This Continuing Authorities Program, Section 1135, Draft Integrated Detailed Project Report and Environmental Assessment (EA) presents the findings for the Neuse River-Goldsboro – Project Modification for Improvement of the Environment feasibility study. Included is documentation of the plan formulation process and potential environmental effects associated with proposed modifications for the Goldsboro, Neuse River, N.C. Federal Project, which was originally constructed in 1948.

The non-Federal sponsor for this study is the City of Goldsboro, NC. The project area is located in the Neuse River Basin in eastern North Carolina and centers on a 7-mile stretch of river just southwest of Goldsboro, NC, and the USACE-constructed cutoff channel within the same vicinity. Potential ecological benefits of the 1135 project extend beyond this immediate extent.

The overall goal of the Neuse River-Goldsboro Section 1135 study is modification of the existing USACE project for improvement of the environment. The original Federal project was constructed for the purpose of flood control along a segment of the Neuse River. Due to the negative impacts of flooding, particularly to agriculture, in 1941, Congress authorized the excavation of a cutoff channel approximately 6,400 feet long by-passed about 7.7 miles of the main stem of the Neuse. Within the cutoff channel a low-head weir was constructed to divert portions of the main stem flow into the cutoff channel during higher flows. The intended effect was a reduction in flood risk along the 7.7 by-passed section of the Neuse River.

Current environmental concerns of the non-Federal Sponsor and various resource agencies are that the reduced flow in the by-passed portion of the Neuse River is having a negative impact on riverine functionality and fish migration success. The diversion of flow into the cutoff channel reduces velocity and increases water surface area in the main stem. Additionally, there are negative impacts to anadromous fish migration. Anadromous fish are species that live as adults in the ocean but migrate upriver to spawn. Under numerous flow scenarios, both the main stem and cutoff channel provide attractive flows to anadromous fish species. As anadromous fish migrate up the Neuse River to reach upstream spawning habitat, a portion of these fish inadvertently leave the main stem and head up the cutoff channel until they reach the low head weir. Research suggests that these fish do not backtrack, but rather stay in the vicinity of the weir, greatly reducing their chance of reaching upstream spawning habitat.

This report summarizes baseline existing conditions in the study area, as well as projected future conditions without the project. This report also develops and discusses potential constructible alternatives for modification of the Federal project for improvement of the environment. A description and discussion of the likely array of alternative plans, including their benefits, costs, and environmental effects and outputs is provided. The report identifies a Recommended Plan that best meets the planning objective of improving riverine functionality within the by-passed section of the Neuse main stem. In this report, improved riverine functionality refers to increases in flow volume, velocity and river level toward a more natural state. It also refers to improving fish migration access to upstream spawning habitats.

The Recommended Plan is the construction of a new steel sheet pile weir structure to elevation 58.0' NAVD 88. This is 2 feet higher than the existing temporary weir the City of Goldsboro built in 2015 after receiving permission from USACE. The City built the temporary weir due to the severely deteriorated

state of the Federal project weir. The location of the new weir would be approximately 25' downstream of the City's temporary weir. As part of construction, the original Corps' weir will be cut off below grade. Post-construction, the City will remove their temporary weir. The flood risk management benefits of the Federally authorized project are not impacted by the Recommended Plan.

The estimated Total Project Cost for implementation of the Recommended Plan would be $1,730,969. The estimated Federal cost-share is $1,298,227. The non-Federal cost of the Recommended Plan is estimated to be $432,742, which is 25% of the total Design & Implementation phase costs. The period of analysis used to compute costs is 50 years with a FY17 federal interest rate of 2.875%. The Recommended Plan would return a greater portion of natural flow to the main stem of the Neuse River, providing uplift in ecological function to include increased food supply, increased velocity and improvement in successful fish migration upstream. The Plan will provide restoration benefits of 10,452 average annual functional units (AAFU) at an average annual cost of $55,382, which results in an average annual cost per AAFU of $5.30. The non-Federal sponsor fully supports the Recommended Plan.

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List of Acronyms

AAHU – Average Annual Habitat Units
BI – Biotic Index
C – Celsius
CAP – Continuing Authorities Program
CE/ICA – Cost Effective/ Incremental Cost Analysis
COV – Coverage
EA – Environmental Assessment
EBA – Environmental Benefits Analysis
EBT – Emphemeroptera, Plecoptera and Trichoptera
EBTBI – Emphemeroptera, Plecoptera and Trichoptera Biotic Index
ENV – Environmental
ER – Engineer Regulation
FRM – Flood Risk Management
FWOP – Future Without Project
HEC-RAS – Hydrologic Engineering Center – River Analysis System
H&H – Hydraulics and hydrology
HUC-4 – Hydrologic unit code sub-region level
ID – Identification
LER – Lands, Easements and Rights-of-way
LNBA – Lower Neuse Basin Association
M – Meter
MGD – Million gallons per day
Mg/L – Milligrams per liter
Mi2 – Square mile
MSL – Mean sea level
NAVD 88 – North American Vertical Datum 1988
NCDEQ – North Carolina Department of Environmental Quality

NCDOT – North Carolina Department of Transportation
NGO – Non-governmental organization
NPDES – National Pollutant Discharge Elimination System
NRCA – Neuse River Compliance Association
NS – Non-structural
O&M – Operation and Maintenance
OMRR&R - Operation, maintenance, repair, rehabilitation, and replacement
PDT – Project Delivery Team
pH – Potential of hydrogen
PPA – Project Partnership Agreement
RCRA – Resource Conservation and Recovery Act
S – Structural
ST – Sample total
s.u. – Standard unit for pH scale (0 to 14)
TMDL – Total Maximum Daily Load
USACE – United States Army Corps of Engineers
USEPA – United States Environmental Protection Agency
USGS – United States Geological Service
VA – Virginia
WOWA – Weighted Order Weighted Average
WQC – Water Quality Certification
WRDA – Water Resources Development Act
µS/cm – Micro-Siemens per centimeter

1.0 Study Authority

The Neuse River-Goldsboro study is being conducted under the authority of Section 1135, Project Modifications for Improvement of the Environment, of the Water Resources Development Act (WRDA) of 1986, as amended (P. L. 99-662). Section 1135 authorizes the U. S. Army Corps of Engineers (USACE) to initiate investigations and modify structures and operations of water resources projects constructed by the USACE for the purpose of improving the quality of the environment, as long as such modifications are feasible, consistent with authorized project purposes, and will improve the quality of the environment in the public interest. If it is determined that a USACE project contributed to the degradation of the quality of the environment, restoration measures may be implemented either at the project site or in other locations that have been affected by the project, subject to a determination that the restoration measures are not in conflict with authorized project purposes. The Goldsboro, Neuse River, N.C. Federal Project was authorized by the Flood Control Act of 1941. The original project authorization provided for the construction of a cutoff channel, 12 feet deep, 20 feet wide, and about 6,400 feet long across the bend in the Neuse River near Goldsboro, NC. The primary purpose of the Neuse River cutoff was to alleviate flooding along a 7.1 miles stretch of the Neuse River. The target of this flood reduction was primarily agricultural lands. The authorization also provided for operation and maintenance of the project by the Federal government.

2.0 Purpose and Need for Action

The purpose of this project is to improve current reductions in riverine functionality in the portion of the Neuse River that is by-passed by the Federal project. These reductions in functionality are in the form of reduced flow and velocity, lower river levels which limit food supply and lessen temperature regulation and dissolved oxygen levels, and reduced access to upstream spawning habitat for migrating anadromous fish - species that live as adults in the ocean but migrate upriver to spawn. These concerns have been expressed by both the non-Federal sponsor (City of Goldsboro), and several resource agencies. Improvement in riverine functionality can be made through the CAP 1135 Authority to increase river levels and flow velocity, and to improve access to upstream spawning habitat for migrating anadromous fish.

3.0 Location of Study Area

The project is located in central Wayne County, NC, just southwest of the City of Goldsboro, the non-Federal sponsor. The subject reach extends along the Neuse River from Stevens Mill Road, crossing to the Arrington Bridge Road crossing, and includes both the main stem of the Neuse River and the USACE-constructed Neuse River cutoff channel (Figures 1 and 2).

Figure 1. Map of Project Area. *Source: Princeton Hydro*

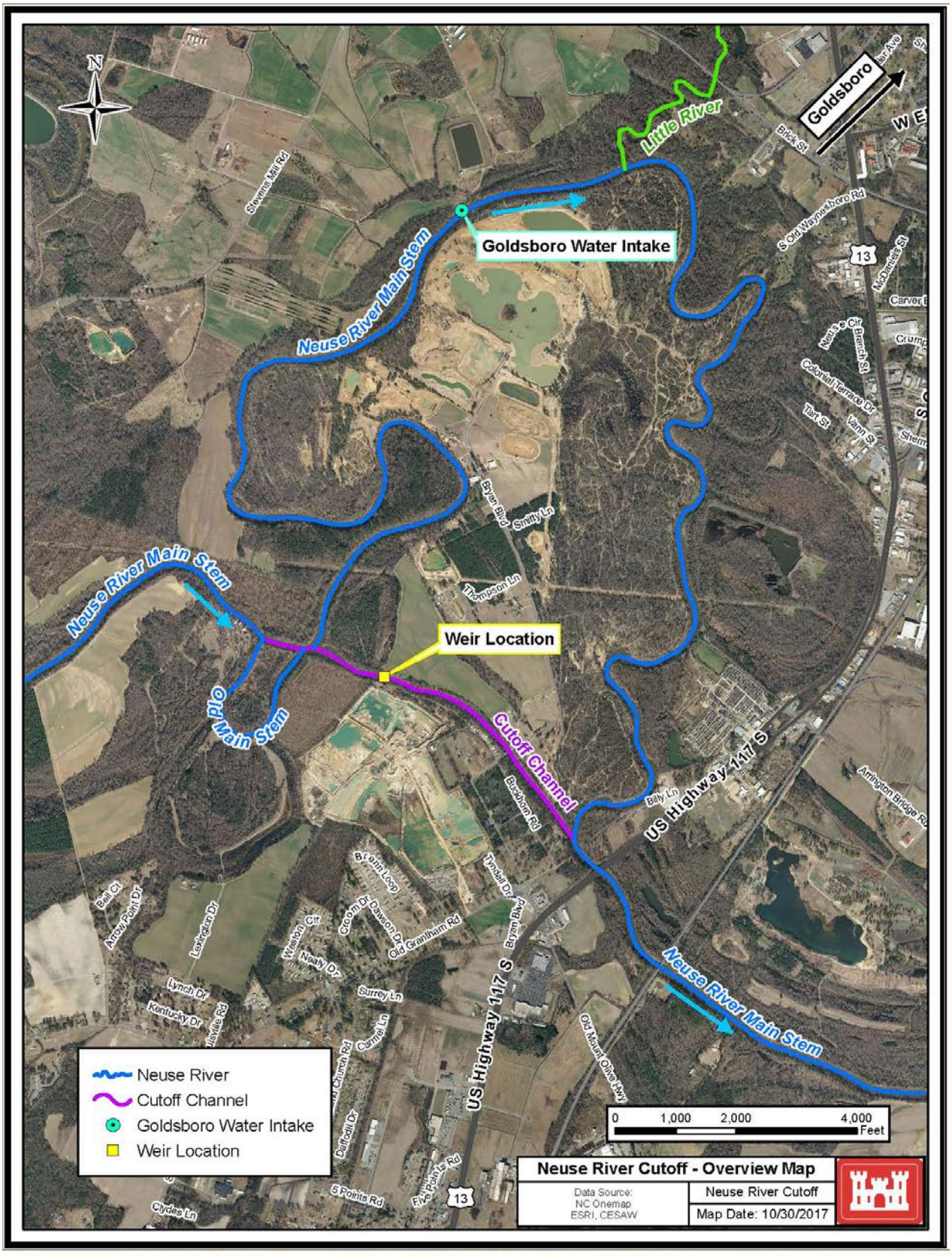


Figure 2. Subject Reach along the Neuse River, showing both the main stem of the river and the cutoff channel.

4.0 Plan Formulation and Evaluation of Alternatives

This section of the report will discuss problems, opportunities, objectives and constraints within the study. The development of measures and alternative plans to address objectives, and the process of selecting a recommended plan (i.e. selected alternative) are also addressed in this section of the report.

4.1 Assessment of Problems, Opportunities, Objectives and Constraints

4.1.1 Problems and Opportunities

A problem is an existing undesirable condition to be changed. An opportunity is a chance to create a future condition that is desirable.

The purpose of this feasibility study is to determine the feasibility of making modifications to the existing project to change the future condition and address specific problems and opportunities in the study area. Problems and opportunities have been identified by the Project Delivery Team (PDT) in several ways, including coordination with the sponsor and stakeholders, site visits, and data analysis.

Problem

There is a reduction in natural riverine function in the main stem of the Neuse River due to the Federal Project. Negative impacts include the following:

- Reduced flow volume for the 7.1 mile by-passed river stretch
- Reduced fish migration upstream of the Federal project

The diversion of flow from the main stem of the Neuse River through the cutoff channel impacts the river's functionality through a 7.1 mile reach (ending at the point at which the cutoff channel and main stem reunite). Lowering of the water level in the main stem may impact near-bank habitats by decreasing the average wetted width of the main stem channel and decreasing food supply.

Further contributing to the problem of reduced natural riverine function has been the persistent problem of recurrent weir degradation over time. Construction of the cutoff channel was completed in 1948 and included a low flow sheet pile weir near the upstream end of the trapezoidal channel. The weir has often been in a state of disrepair due to inadequate USACE funds to maintain it. The weir section was rebuilt in 1968 and 1983 due to deterioration and corrosion. In 2007, prompted by concerns that the degraded cutoff channel weir would breach and further reduce water depths and increase sedimentation in the main stem of the Neuse River, where their primary water intake is located, the City obtained required

approvals to repair the weir structure by placing rock stabilization along the upstream and downstream faces of the weir. However, the majority of the repair work conducted by the City washed out within a fairly short period of time after completion due to high flow events (see photos at right). Wilmington District staff conducted a site visit on June 16, 2015. At the time of the site visit and due to the failure of the 2007 weir repair, the City of Goldsboro was constructing a new temporary weir immediately downstream of the location of the USACE weir. Construction of the City's new temporary weir was completed in July 2015 and is considered a temporary measure pending Federal action.. The temporary weir structure is immediately downstream of the original weir (see photo at left). Although the City does not own the original weir, maintenance of the weir is a concern of the City, because it is deemed crucial to the operation of their water supply intake.

There is also concern from resource agencies and the non-Federal sponsor that the current cutoff channel configuration creates a reduction in fish passage efficiency for key riverine anadromous fish species, such as striped bass, American shad, Blueback Herring, American eel, and Atlantic sturgeon. The Atlantic sturgeon is a Federally listed endangered species. These fish migrate upstream in search of suitable spawning habitat. The cutoff channel weir is located approximately 4,100 feet upstream of the confluence of the cutoff channel and the main stem of the Neuse River. It is at this confluence that migrating fish decide which river reach to ascend. Under many flow conditions, both channels currently provide adequate depth and flow velocity to attract fish. Through personal communication with the City of Goldsboro, local fisherman have reported that the best fishing for striped bass and American shad, amongst others, is in the cutoff channel just below the weir. For fish enticed to ascend the cutoff channel, the weir acts as a barrier which obstructs passage upstream under all but very high flow conditions. Common fish behavioral preference is to swim into the flow stream instead of back-tracking to search for alternative passage routes. Anadromous fish swimming up the cutoff channel would not reach upstream spawning and nursery habitats located at various spots up to 92 miles upstream.

Opportunities

This project presents opportunities to make improvements to the environment in multiple ways:

- There is an opportunity to increase wetted width of the by-passed main stem channel.
- There is an opportunity to restore a portion of natural discharge to the by-passed main stem channel.
- There is an opportunity to improve habitat connectivity of the Neuse River in the vicinity of the Federal project to upstream river reaches, including the Little River. This improvement could increase fish migration upstream of the project area to identified spawning habitat. Finally, this project presents an opportunity to dovetail with objectives of the Neuse River Basin Feasibility Study (USACE 2012) to improve hydrologic connectivity of the Neuse River and to restore connections to important spawning habitat for migrating fish species.

4.1.2 Objectives and Constraints

Objective

A planning objective provides a clear statement of what an alternative plan should attempt to achieve. The following project specific planning objective and metrics were developed and will be evaluated on the USACE period of analysis, which for this project is defined as 50 years starting at the base year of project completion:

Improve natural riverine functionality in main stem of Neuse River. For the purposes of this report, improved riverine functionality refers to increases in flow volume, velocity and river level toward a more natural state. It also refers to improving fish migration access to upstream spawning habitats.

Constraints

A planning constraint is a restriction that limits the extent of the planning process. These are essentially things that should be avoided during plan formulation. The following are identified planning constraints of the project:

1) Cannot evaluate decommissioning of the Federal project. The CAP 1135 authority cannot be used as a vehicle to evaluate the decommissioning or de-construction of the Federal project. The project delivery team (PDT) recognized that decommissioning of the existing Federal project may be considered at some point in the future. However, the pros, cons and viability of that action would be addressed via a separate evaluation process, subject to available Federal funding.

2) Avoid diminishing any existing project flood risk management (FRM) benefits. The recommended plan cannot create a negative impact to land use.

3) Cannot consider the City's temporary weir as the Federal project to be modified. Any modification measures (e.g. raise weir height) must be done to the original Federal project, rather than the City's temporary weir.

4.2 Summary of Activities to Assess Existing Conditions

Multiple methods were used to assess the existing conditions of the project area. The following is a brief summary of those methods:

I. Review of existing data
    a. Historical documents
    b. Land coverage
    c. Geospatial data sets
II. New Survey data collection
    a. A bathymetric survey was conducted along portions of the Federal project cutoff channel and main stem of the Neuse River.
III. New Modeling
    a. A HEC-RAS model was developed to improve understanding of the hydrology and hydraulics of the river and cutoff channel, and the effect of the existing project. The model was also utilized to evaluate inundation of the project area under existing conditions.

IV. Site visits

a. The PDT conducted multiple site visits with the non-Federal sponsor and stakeholders to assess existing conditions on the ground.

4.3 Future Without-Project Conditions for Plan Formulation

The future without-project (FWOP) conditions are a forecast of the most likely future conditions that will exist in the study area if no action is taken. The FWOP is vitally important to the evaluation and comparison of alternative plans. The FWOP for the environmental setting is discussed in Section 5 of this report. Discussed in this section are planning assumptions that have been made during this feasibility study.

In the absence of a USACE Section 1135 project, the City of Goldsboro is likely to maintain their weir for an extended period of time. Although the City views their weir as a temporary measure, they appear sufficiently motivated to prevent a decrease in flows in the main stem of the Neuse River, as evidenced by past investment in repairs to the Federal project and construction of the temporary weir. Sedimentation at the intake is also a point of concern with the City. The City believes there may be a connection between reduced flow in the main stem and sedimentation issues at the water intake. The City conducted an analysis of relocating the City water intake in February 2017 (Schnabel Engineering 2017). Based on that analysis, the estimated cost of relocating the water intake system upstream of the Federal project is $5.6 million.

Without modification to the Federal project, it is assumed that the project's contribution to the interruption of access of migrating fish species to upstream spawning habitat would continue, along with reduced river discharge along the 7.1 mile by-passed main stem section. Although the City of Goldsboro and the resource agencies are supportive of addressing the issues, there are no plans beyond the proposed Section 1135 project for improving riverine functionality and habitat connectivity in the Neuse River in relation to the USACE cutoff channel.

4.4 Alternatives Considered

Alternatives are comprised of one or more management measures. Management measures are specific structural or nonstructural actions that would take place at geographical locations within the project areas. Management measures were selected to accomplish the planning objective and were evaluated based on planning criteria and planning constraints. Both structural (S) and nonstructural (NS) measures were identified. The minimum criteria established by the planning team for qualifying solutions are to 1) make a positive contribution to the planning objective, and 2) avoid planning constraints.

Table 1. List of Initial Measures

List of Initial Measures
Modify City's temporary weir
Replace USACE' weir at existing location
Move location of USACE' weir to head of cutoff channel
Build fish ladder structure at Federal weir
Add fish barrier to end of cutoff channel
Lay back banks and re-vegetate cutoff channel

Initial Measures Screened Out

Modify City's Temporary Weir. The PDT initially discussed modifying the City's recently constructed sheet pile weir with any alternative that would involve weir modifications. The measure was dropped from consideration due to violation of the planning constraint to avoid consideration of the City's weir as part of the original USACE project.

Add Fish Barriers at end of Cutoff. This measure would act as a fish barrier (such as a weir placed at the end of the cutoff) for the purpose of slowing and/or disrupting the flow coming from the cutoff channel, reducing the likelihood of fish following the weaker current up the cutoff channel. Many of the fish swimming upstream to spawn are attracted to higher velocity water, therefore by creating a lower velocity exiting the cutoff channel in comparison to the main channel of the Neuse River, the fish could be encouraged to continue on the route of the main stem. This measure was dropped from consideration due to concerns that the barrier could potentially act as an entrapment to fish that may get into the cutoff from upstream during high flows. Additionally, there were operations & maintenance (O&M) concerns with damming of debris, and flood storage capacity concerns that may result from sedimentation of the cutoff channel behind a fish barrier.

Lay Back Banks and Re-vegetate Cutoff Channel. A laying back of the stream bank in the cutoff channel could create a more natural embankment slope in the cutoff channel where significant erosion has occurred in the past. Any disturbed stream bank would need to be re-vegetated. Benefits originally considered included vegetating the banks of the cutoff with native tree and shrub species to reduce any erosion occurring within the cutoff, consequently reducing the sediment and nutrient loads being introduced into the Neuse River downstream. Other potential benefits of vegetation restoration along the banks include: cover and shade for aquatic species (regulating water temperature), shelter for terrestrial fauna, aquatic habitat diversity and food from leaf litter and woody debris. However, it was observed during the feasibility study that the embankments of the cutoff channel have stabilized at the surficial clay layers, due to solubility, porosity, and stratified density of the clays present. If additional sediment was added (non-clay soil types) to the embankments further erosion could potentially occur. Another means of erosion is possible if the current surficial clay layers are removed from the embankment, and if the subsurface soils are non-clay types of sediment, in which both options could lead to destabilization of the embankment through erosion. Also, there is already significant shading along the cutoff, making re-vegetation efforts unessential. Ultimately, this measure was screened out because it would be relatively ineffective at meeting the planning objective of improving the river functionality components of increased velocity, river level and improving fish access upstream.

The following matrix shows the initial screening of measures (Table 2):

Table 2. Screening of Measures

I.D.	Measure	Planning Objective	Planning Criteria		Planning Constraints			Screening Results
		Improve Natural Riverine Functionality in Main Stem of Neuse River	Technically Feasible	Environmentally Acceptable	Cannot Evaluate Decommissioning of the Federal Project	Avoid Diminishing Any Existing Project Flood Risk Management Benefits	Cannot Consider the City's Temporary Weir as Fed Project to be Modified	
A	No Action		N/A	N/A	N/A	N/A	N/A	**Carry Forward**
B	Replace USACE Weir at Existing Location with Elevated Height	**Yes**. Results in increased flows, wetted perimeter, and access to upstream habitat for migrating fish	Yes	Yes	Yes	Yes (HEC-RAS Modeling to determine impacts before final screening)	Yes	**Carry Forward**
C	Build Fish Ladder Structure at Federal Weir	**Yes**. Results in increased access to upstream habitat for migrating fish	Yes	Yes	Yes	Yes	Yes	**Carry Forward**
D	Move Location of USACE Weir to Head of Cutoff Channel	**Yes**. Results in increased flows, wetted perimeter, and access to upstream habitat for migrating fish	Yes	Yes	Yes	Yes (HEC-RAS Modeling to determine impacts before final screening)	Yes	**Carry Forward**
E	Modify City's Temporary Weir	**Yes**. Results in increased flows, wetted perimeter, and access to upstream habitat for migrating fish	Yes	Yes	Yes	Yes (HEC-RAS Modeling to determine impacts before final screening)	**No**	**Screen Out** (violation of constraint)
F	Add Fish Barrier at End of Cutoff Channel	**Yes**. Results in increased access to upstream habitat for migrating fish	Yes	**No** (fish trap risk)	Yes	**No** (reduction in storage capacity of cutoff channel due to potential sedimentation build up would result in negative flooding impacts)	Yes	**Screen Out** (violation of constraint and ENV concerns)
G	Lay Back Banks and Revegetate Cutoff Channel	**No**. Does not improve functionality of Main Stem of Neuse River	Yes	Yes	Yes	Yes	Yes	**Screen Out** (relatively ineffective at meeting objective)

After the initial screening of measures, there were no combinable measures that passed screening. The remaining measures were converted to alternatives. Alternative B, Modify Weir by Raising Height, was broken into 4 separate alternatives (B1, B2, B3 and B4) based on varying height raises as shown in Table 3.

Table 3. Weir Height by Alternative

Existing Weir Height	Elevation 56' NAVD88
B1	Elevation 57' NAVD88
B2	Elevation 58' NAVD88
B3	Elevation 59' NAVD88
B4	Elevation 60' NAVD88

Additionally, constructing a fish ladder at the weir was considered at existing weir height and in combination with an elevated weir (C1 and C2).

Alternatives were evaluated based on the planning criteria of completeness, effectiveness, efficiency and acceptability and with consideration of the planning constraints (Table 4).

Table 4. Planning Criteria Definitions for Alternatives Screening (USACE 1996).

PLANNING CRITERIA DEFINITIONS FOR ALTERNATIVES SCREENING	
Completeness	Is the alternative independently effective?
Effectiveness	Does the alternative meet the planning objective?
Efficiency	Is the alternative cost-effective?
Acceptability	Is the alternative feasible?

A qualitative evaluation of alternatives based on the planning criteria can be seen in figure 3.

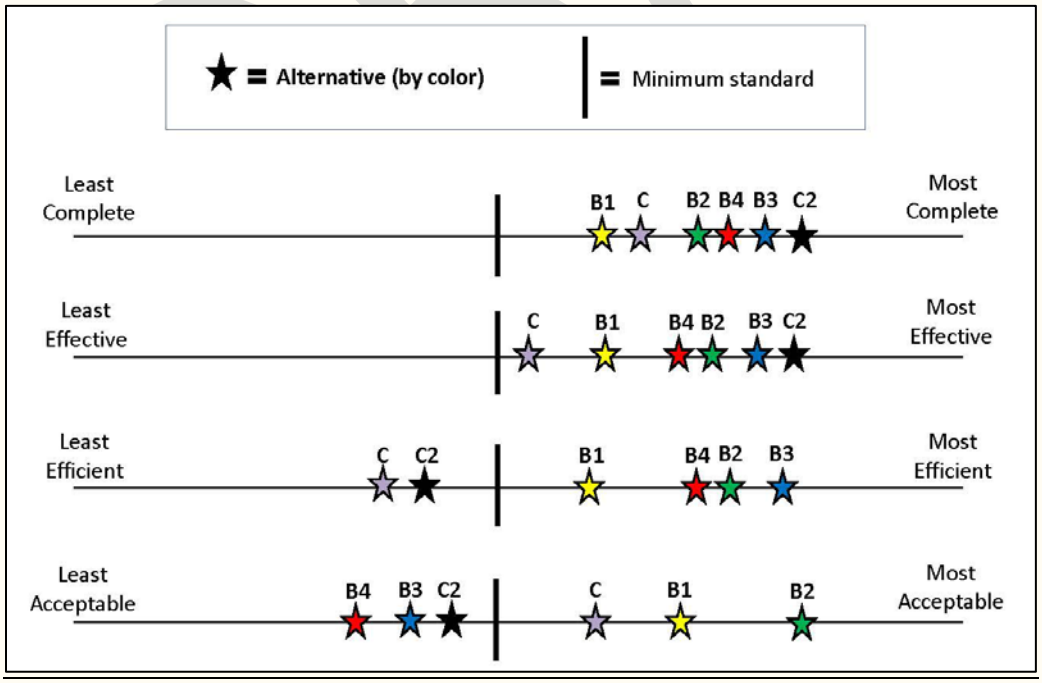


Figure 3. Planning criteria alternative evaluation

Initial Screening of Alternatives

C2 - Build Fish Ladder at Replaced USACE Weir Above 56' NAVD88. This alternative involves the construction of a fish ladder in combination with an elevated weir. The purpose of the fish ladder feature would be to allow an increased chance of passage for anadromous fish species that enter the cutoff channel. An alternative that combines a fish ladder structure with an elevated weir would also achieve improved flows and velocity in the main stem of the Neuse River by preventing diversion of flow into the cutoff channel under a greater number of flow scenarios. However, with an elevated weir there are acceptability concerns as the fish ladder structure would be dry and non-functioning a large portion of the year. Therefore, this alternative was screened out (Table 5).

D – Move Location of USACE Weir to Head of Cutoff Channel. Consideration was given to replacing the USACE weir at a new location at the head of the cutoff channel. The angle of the new weir could be configured to encourage the continuation of water flow down the main steam. It was projected that this location and configuration could reduce flow from entering the cutoff channel and instead direct a larger volume of water to the main stem. However, hydraulics and hydrology (H&H) modeling indicated that constructing a weir at this location did not provide greater re-direction of water. Additionally, concerns emerged that a weir at this intersecting point of the cutoff channel and main stem would create an issue with erosion. Ultimately, this alternative did not meet the acceptability standard due to erosional concerns associated with a weir at this intersecting point of the cutoff channel and main stem. Alternative D was therefore screened out as shown in tables 5 and 6.

Alternatives Carried Forward from Initial Screening

B1, B2, B3, B4 – Replace USACE Weir at Existing Location with Raised Height. Replacing the USACE weir at the existing location with a raised height was considered. Replacement rather than modification of the USACE weir would be required due to the USACE weir's severely deteriorated condition. As part of this alternative, the old USACE weir would be removed. The purpose of a weir height increase would be to restore a portion of natural flow to the main stem while avoiding the reduction of any existing project flood risk management benefits. This measure could reduce flow from entering the cutoff channel and instead would direct a larger volume of water to the natural river channel (main stem). The added volume could increase the flow velocity in sections of the natural channel, to include months (March – June) that anadromous fish are migrating through the river. This could lead to greater potential for migrating fish to be attracted to the natural channel instead of the cutoff channel. The increased flow of water within the Neuse could improve water quality by continuing the flow regime within the main stem even during lower flow periods. This maintained flow would benefit benthic fauna by continuing to create a stable temperature and DO within the by-passed section of the river. A higher weir elevation means more active flow in the natural river channel for a wider range of flow events. Weir height raises of up to 4ft (elevation 60') were considered for this alternative. Alternatives B1-B4 were carried forward through the initial screening with the understanding that H&H modeling and analysis would be needed to assess flooding impacts.

C1 – Build Fish Ladder Structure at Replaced USACE Weir at Elevation 56'. This alternative involves the construction of a fish ladder structure in combination with a rebuilt weir at existing height. The purpose of the fish ladder feature would be increase the chance of passage for anadromous fish species that enter the cutoff channel. Apart from increased fish passage efficiency, this alternative would not provide increased flow in the main stem or the benefits associated with increased flow. However, due

to its positive contribution to the planning objective while avoiding identified constraints, this alternative was carried forward.

The results of the initial screening of Alternatives is shown in the following matrix (Table 5):

Table 5. Initial Screening of Alternatives

I.D.	Alternative	Planning Objective	Planning Criteria				Planning Constraints			Screening Results
		Improve Natural Riverine Functionality in Main Stem of Neuse River	Completeness	Effectiveness	Efficiency	Acceptability	Cannot Evaluate Decommissioning of the Federal Project	Avoid Diminishing Any Existing Project Flood Risk Management Benefits	Cannot Consider the City's Temporary Weir as Fed Project to be Modified	
A	No Action		N/A	N/A	N/A	N/A	N/A	N/A	N/A	**Carry Forward to Final Array**
B1	Replace USACE Weir at Existing Location by Raising Height to 57' (1 ft. higher than existing conditions)	Yes	Yes (not dependent on other actions)	Yes (addresses objective)	Yes	Yes	Yes	**Evaluate viability using HEC-RAS and analysis**	Yes	**Pending H&H and analysis**
B2	Raise to 58'	Yes	Yes	Yes	Yes	Yes	Yes	**Evaluate viability using HEC-RAS and analysis**	Yes	**Pending H&H and analysis**
B3	Raise to 59'	Yes	Yes	Yes	Yes	Yes	Yes	**Evaluate viability using HEC-RAS and analysis**	Yes	**Pending H&H and analysis**
B4	Raise to 60'	Yes	Yes	Yes	Yes	Yes	Yes	**Evaluate viability using HEC-RAS and analysis**	Yes	**Pending H&H and analysis**
C1	Build Fish Ladder Structure at Federal Weir at 56'	Yes	Yes	Yes (addresses fish passage component of River functionality)	Yes	Yes	Yes	Yes	Yes	**Carry Forward to Final Array**
C2	Build Fish Ladder Structure at Replaced USACE Weir Above 56'	Yes	Yes	Yes	Yes	No (maintenance concerns with dry fish ladder)	Yes	Yes	Yes	**Screen Out** (does not meet acceptability standards)
D	Move Location of USACE Weir to Head of Cutoff Channel	Yes	Yes	Yes	Yes	**No** (induced erosion concerns)	Yes	Yes	Yes	**Screen Out** (does not meet acceptability standard)

A final screening of alternatives was done after applying analysis of H&H modeling and in consultation with the Savannah District Real Estate and Office of Counsel. See appendix A for details of H&H modeling and analysis.

Alternatives B3 and B4 were screened out due to a determination that they potentially violated the planning constraint to avoid diminishing any existing project flood risk management (FEM) benefits. Modeling and analysis indicated that both of these alternatives potentially induced flooding of an access road leading to private dwellings. Additionally, portions of over 200 parcels would potentially be periodically affected by inundation of up to 1 foot. Both of these could be considered a negative impact to land use.

Alternative B2's potential impacts were not considered significant. The access road periodically inundated by alternatives B3 and B4 was not impacted by alternative B2. Furthermore, the potential additional inundations of alternative B2 were minimal in depth and location.

A matrix illustrating the final screening of alternatives can be seen on the following page (Table 6):

Table 6. Final Screening of Alternatives

I.D.	Alternative	Planning Objective	Planning Criteria				Planning Constraints			Screening Results
		Improve Natural Riverine Functionality in Main Stem of Neuse River	Completeness	Effectiveness	Efficiency	Acceptability	Cannot Evaluate Decommissioning of the Federal Project	Avoid Diminishing Any Existing Project Flood Risk Management Benefits	Cannot Consider the City's Temporary Weir as Fed Project to be Modified	
A	No Action		N/A	N/A	N/A	N/A	N/A	N/A	N/A	**Carry Forward to Final Array**
B1	Replace USACE Weir at Existing Location by Raising Height to 57' (1 ft. higher than existing conditions)	Yes	Yes (not dependent on other actions)	Yes (addresses objective)	Yes	Yes	Yes	Yes	Yes	**Carry Forward to Final Array**
B2	Raise to 58'	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Carry Forward to Final Array**
B3	Raise to 59'	Yes	Yes	Yes	Yes	Yes	Yes	**No** (impacts to access road and land use)	Yes	**Screen Out** (violation of constraint)
B4	Raise to 60'	Yes	Yes	Yes	Yes	Yes	Yes	**No** (impacts to access road and land use)	Yes	**Screen Out** (violation of constraint)
C1	Build Fish Ladder Structure at Federal Weir at 56'	Yes	Yes	Yes (addresses fish passage component of River functionality)	Yes	Yes	Yes	Yes	Yes	**Carry Forward to Final Array**
C2	Build Fish Ladder Structure at Replaced USACE Weir Above 56'	Yes	Yes	Yes	Yes	No (maintenance concerns with dry fish ladder)	Yes	Yes	Yes	**Screen Out** (does not meet acceptability standards)
D	Move Location of USACE Weir to Head of Cutoff Channel	Yes	Yes	Yes	Yes	**No** (induced erosion concerns)	Yes	Yes	Yes	**Screen Out** (does not meet acceptability standard)

Based on the screening process, the final array of alternatives is as follows:

A - No Action

B1 - Replace Weir at Existing Location to Elevation 57'

B2 - Replace Weir at Existing Location to Elevation 58'

C1 - Construct Fish Ladder Over Weir at Elevation 56'

4.5 Costs of Final Alternatives

The following table shows preliminary cost estimates of the final array of alternatives. Costs include direct construction costs, supervision and administration, escalation and contingency.

Table 7. Cost of Final Alternatives

Alternative	Preliminary Cost
A - No Action	$0
B1 - Replace Weir at Existing Location to Elevation 57'	$1,424,000
B2 - Replace Weir at Existing Location to Elevation 58'	$1,456,000
C1 - Construct Fish Ladder Over Weir at Elevation 56'	$2,478,000

4.6 Environmental Benefits Analysis of Final Alternatives

An Environmental Benefits Analysis (EBA) is used to measure the increase in both the quality and quantity of a targeted ecosystem due to various proposed restoration measures and alternatives. For the Neuse-Goldsboro 1135 study, quality was measured in terms of a functional index. The functional index is multiplied by the linear feet (LF) of river having improved riverine function in order to generate a "functional unit" (FU) output. The environmental benefit resulting from a project alternative is calculated as the difference between the average annual functional units (AAFU) over the project life (50 years) in the with-project and without-project (no action) alternatives.

The Neuse-Goldsboro 1135 study evaluated environmental benefits within the riverine ecosystem of the Neuse River main stem in the vicinity of the USACE Neuse River Cutoff Federal Project. One of the constraints identified early-on in the planning phase of this project was the limited availability of useable data collected within the project area that would allow the application of many common USACE-approved EBA models, such as the US Fish and Wildlife Service's Habitat Suitability Indexes (HSI) or Fish Passage Connectivity Index. Many of the standard models that measure riverine function and fish health require data input such as temperature, dissolved oxygen, stream velocities, fish population survey data and sediment transport rates.

Additionally, a major project planning constraint is the requirement for the 1135 project to not have a negative effect on the flood damage reduction benefits of the existing Neuse Cutoff project. The potential environmental benefits to the riverine ecosystem were limited to that area within the existing stream banks of the main stem within the project area. Benefits were not calculated within the cutoff channel since it is not conducive to successful fish passage to upstream spawning areas. The data that was available for the project area was discharge rates that were recorded at a U.S. Geological Survey (USGS) station NEUSE RIVER NEAR GOLDSBORO, NC (station # 02089000) located just downstream of the project area. Using the gage data available, an USACE-approved model HEC-RAS was used to show

how the different alternatives affected flow within the main stem of the Neuse around the cutoff area. Additionally, the HEC-RAS model was used to show the percentage of time that the weir is not being over topped and increases to areas of river surface area along the bank.

Environmental Benefits Model

The environmental benefits model is a way of calculating the ecological benefits through quantitatively scoring the different alternatives based on the velocity calculations provided by the HEC-RAS model over the ~7.1 miles (or ~37,500 linear feet) of the main stem of the Neuse River.

- (Increase in Surface Area) x (37,500 lf) = Functional Unit A
- (% Weir not overtopping) x (37,500 lf) = Functional Unit B
- (Increases to velocity compared with striped bass swim speed) x (37,000 lf) = Functional Unit C

Based on professional judgement and coordination and input from local natural resource agencies US Fish and Wildlife Service and NC Wildlife Resources Commission (USFWS and NC WRC) it was decided that the three different Functional Unit outputs should be weighted according to the significance they held in regard to providing ecological uplift within the project area ecosystem.

- Functional Unit A was weighted by 2
- Functional Unit B was weighted by 2
- Functional Unit C was weighted by 6

Each of the final alternatives was then annualized over the 50-year project life and compared to the no action alternative.

Hydrologic Engineering Center – River Analysis System **(HEC-RAS) v5.0.3:**

A two-dimensional HEC-RAS (v5.0.3) model was created to depict the Neuse River in the vicinity of the cutoff channel. The model extents included both upstream and downstream portions of the Neuse River, as well as the entire length of the cutoff channel. The main stem was also included in the model extents. The upstream boundary was located approximately 9 river miles above the cutoff channel entrance. The downstream boundary was located approximately 2 river miles below the cutoff channel exit. HEC-RAS model extents are shown in Figure 4.

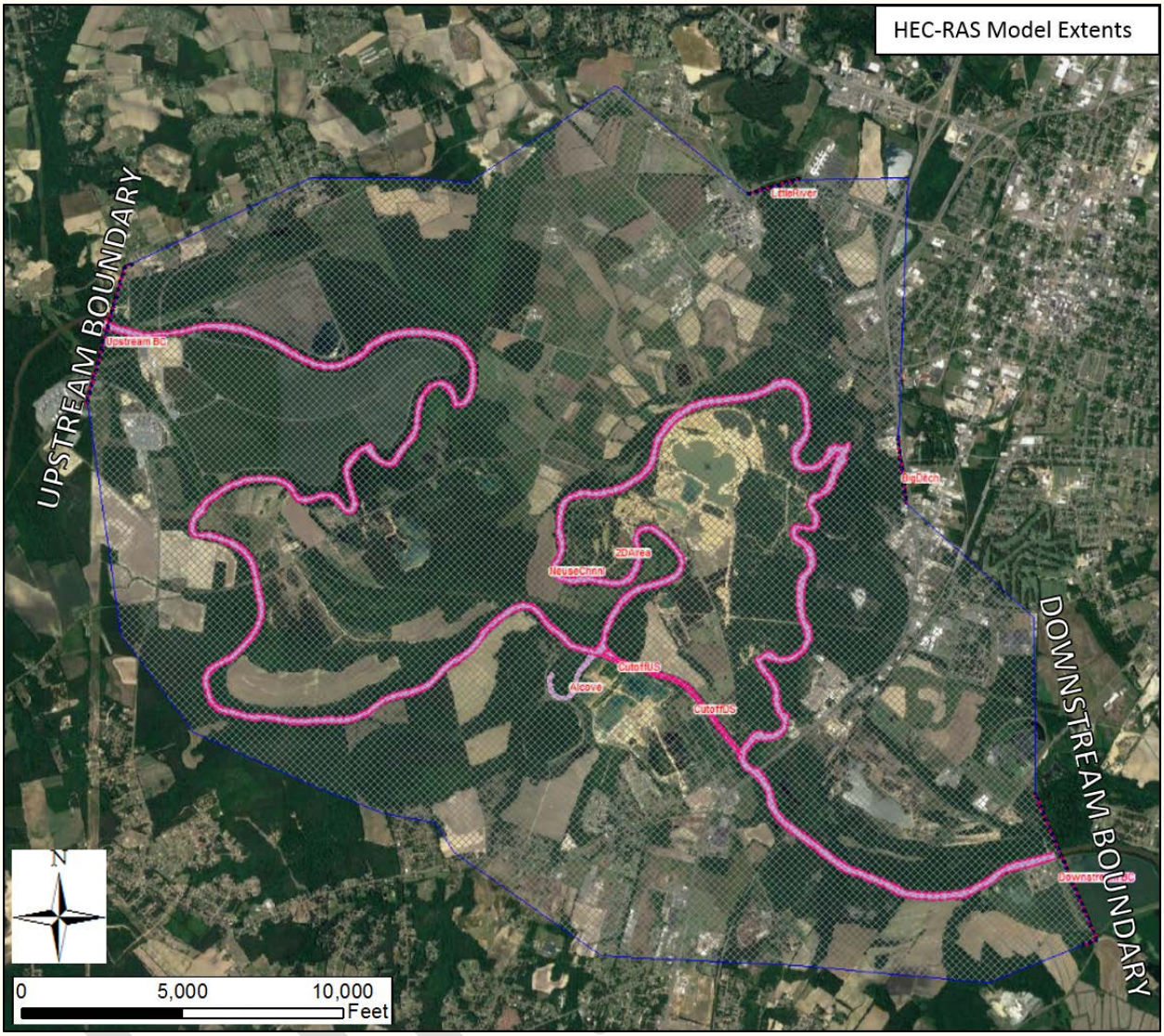


Figure 4. Extent of the HEC-RAS model

The purposes of a two-dimensional model were to simulate a range of low flow (<= bank full) conditions that would capture the effects of increasing the maximum elevation of the weir structure. A model in 2-D would also be able to accurately model the split flow conditions that exist at the cutoff channel entrance and exit.

Qualitative benefits:

Increases in surface area

Increases in riverine surface area improve the ecological function of the Neuse main stem by creating a more natural (pre-cutoff project) flow within the main stem that allows for increases in exchanges within the hyporheic zone (the subsurface space adjacent to the river in which ground water and river water is exchanged), benefiting macroinvertebrate distribution and diversity. This hyporheic zone is vital to a healthy functioning river ecosystem as it helps to regulate water temperatures; provides habitat and food sources for macroinvertebrates; and is important for biogeochemical cycling (i.e. water

cycle, nitrogen cycle, carbon cycle, oxygen cycle, and phosphorus cycle). The functional uplift provided by the main stem water surface area increase would likely be: increased food supply, continued stable dissolved oxygen rates within the river during low flow conditions and continued stable water temperatures. As seen in figure 5, between the alternatives A, B1, B2, B3 and B4, the compared surface area increases showed a positive linear relationship with alternative A showing no increase in surface area and each addition of 1' of weir raise adding additional acres of surface area. Alternative C was not included in this benefit analysis since it will have zero change in the height of the weir and will not change the surface area, therefore adding no additional benefit.

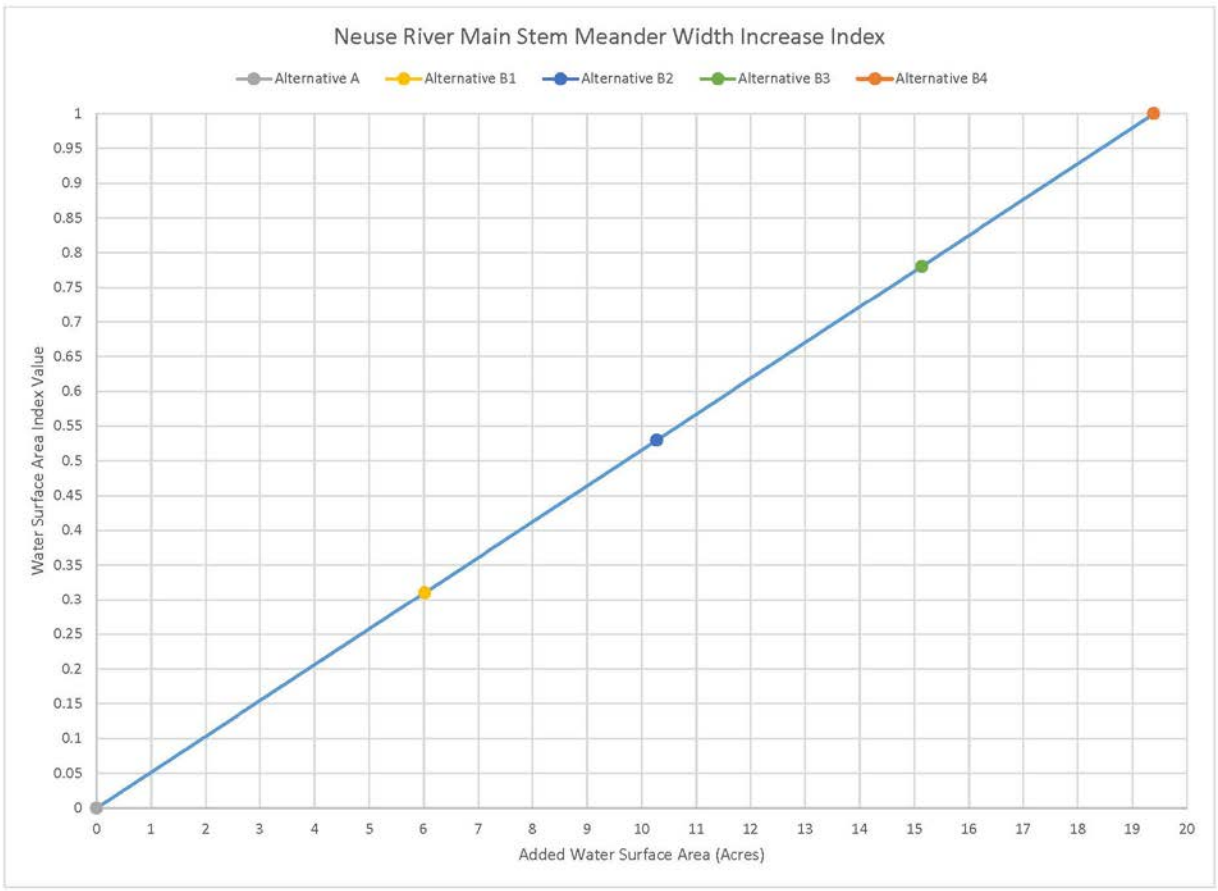


Figure 5. Graph of increased surface area of Neuse River Main Stem

Annual Weir Non-Overtopping

The amount of time (measured in percentage of year) that the river is held back behind (not overtopping) the cutoff weir is important as a measure for restoration in that it establishes the amount of time additional water flow is by-passing the cutoff channel and staying within the main stem. The additional time the flow stays within the main channel will be beneficial to anadromous species of fish found within the project area such as American shad, striped bass, hickory shad, and blueback herring. Anadromous fish are those species of fish that are born in fresh water and migrate downstream to the ocean to mature and live, but later return to the fresh water environment to spawn. These anadromous fish rely on the increased flow in the main stem of the Neuse to help guide their pathway as they migrate upstream to potential spawning areas. One of the concerns from natural resource agencies managing fisheries within the Neuse cutoff area has been that with the flows coming down through the

cutoff and the main stem of the Neuse simultaneously (especially during high migration months of March through June) a situation has been created that causes the fish to choose the wrong path (cutoff channel) and then become trapped by the weir and unable to swim any farther upstream. By increasing the percentage of time that the water does not overtop the cutoff weir and stays within the main channel, especially during the March-June time frame when anadromous fish species are most likely to be traveling upstream to spawn, there will be increased environmental benefit to the fisheries that utilize this portion of the Neuse River for migration and spawning. As seen in figure 6, between the alternatives A, B1, B2, B3 and B4, the compared percentage of time the water does not overtop the weir showed a positive linear relationship with A showing no increase in surface area and each addition 1' of weir raise adding additional amounts of time that the weir is not overtopped. Alternative C1 was not included in this benefit analysis since it will have zero change in the height of the weir and will not change the amount of time the weir is overtopped, therefore adding no additional benefit.

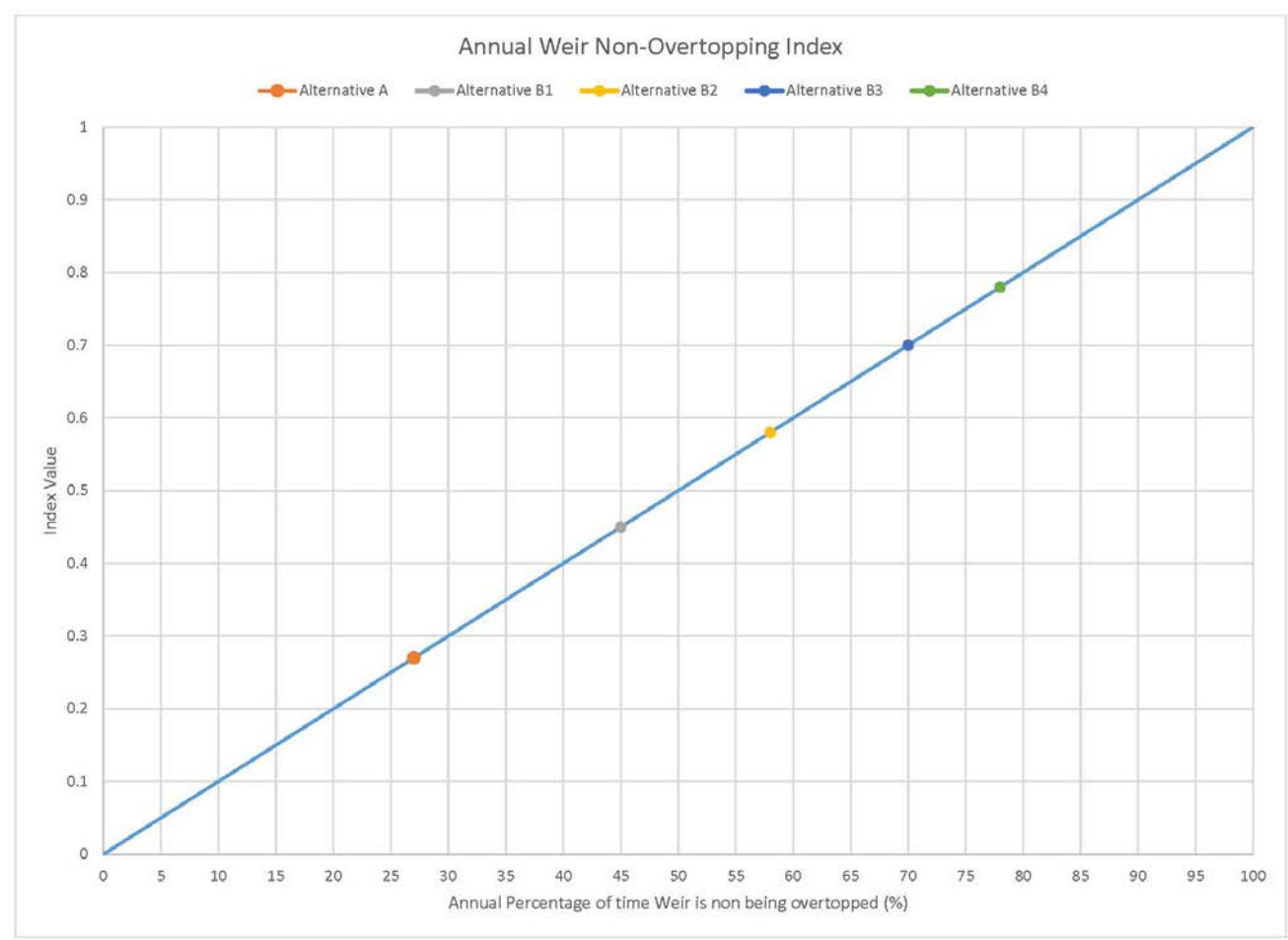


Figure 6. Graph of Annual Weir Non-Overtopping Index per Alternative

Increases to stream velocity within the Neuse River Main Stem

The increased velocity within the main stem of the Neuse created by reducing the flow through the cutoff channel was measured as a benefit to the ecosystem, so long as the fish migrating up the main stem were able to successfully swim against the increased flow. To measure the benefit, the known swim speed (ft/s) for striped bass (steady, cruising, and sprint) was plotted along with the increases in

the main stem stream velocities (ft/s) with each alternative. The swim speeds for striped bass were chosen as an indicator for this part of the EBA due to the limited availability of measurable swim speed data for the various anadromous fish found in the Neuse River project area; the striped bass swim speed data was referenced from the *National Engineering Handbook, Technical Supplement on Fish Passage and Screening Design*. As seen in figure 7, between the alternatives A, B1, B2, B3 and B4, the graph compared ideal swimming speeds of striped bass with the average stream velocity of the Neuse. Alternative A shows the baseline of continuing on with the existing weir at height 56' on swimming speed of the striped bass, alternatives B1 and B2 show how the increase in river velocity in feet/second positively correlates to more ideal swimming speeds for the striped bass. Whereas, alternatives B3 and B4 increased river velocities above the ideal swimming speed for the striped bass. Alternative C was not included in this benefit analysis since it will have zero change in the height of the weir and will not change the velocity of the river from alternative A, therefore adding no additional benefit.

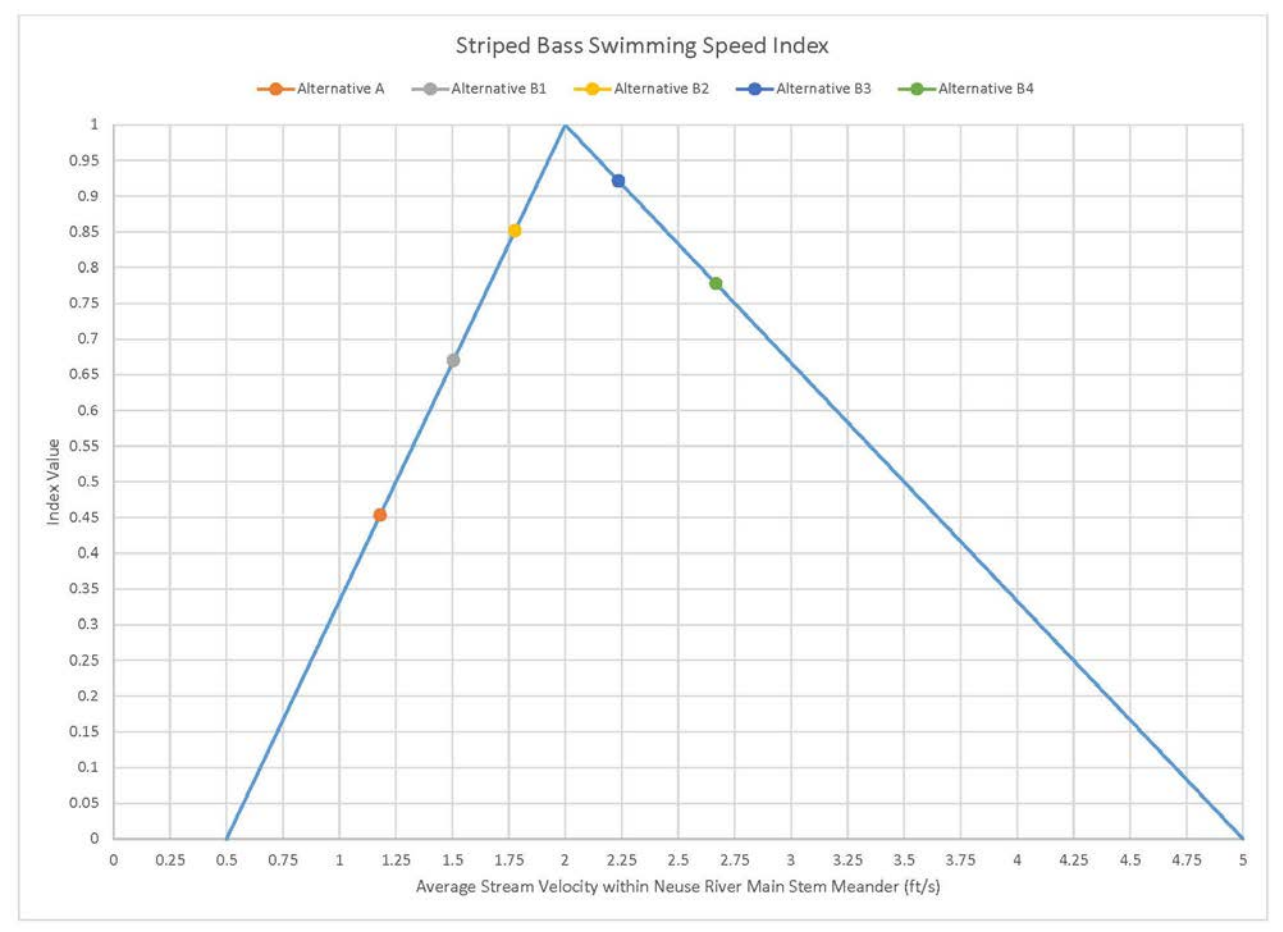


Figure 7. Graph of Striped Bass Swimming Speed Index vs. Main Stem Velocity

<u>Additional Miles of Spawning Habitat for Anadromous Fish Species Connected</u>

The restoration of flow to the main stem of the Neuse River will encourage migrating anadromous fish species to utilize the main channel of the Neuse River. By avoiding the cutoff channel, where fish have the potential to become trapped with no option to migrate upstream to suitable spawning and nursery areas, the fish have access to ~ 92 miles of spawning habitat upstream to the Milburnie Dam, located in

Raleigh, NC. Fish would also have access to ~ 4.3 miles of additional potential spawning habitat within the Little River tributary until they reach the low-head dam barrier. Additionally, if the Milburnie dam is removed in the future, an additional 15 miles of spawning habitat will be accessible for the anadromous fish all the way to Falls Lake Dam. This increase in connectivity for the fish species would support increases in anadromous fish populations that depend on the Neuse River for vital spawning and nursery habitat. These species include: striped bass (*Morone saxatilis*), blueback herring (*Alosa astivalis*), hickory shad (*Alosa mediocris*), American shad (*Alosa sapidissima*), and Atlantic sturgeon (*Acipenser oxyrhynchus*).

Total Benefits Output

For the No Action (without project) Alternative within the project area, a total Average Annual Functional Unit (AAFU) was calculated as a quantified assessment of ecological outputs. Functional units were calculated as the length of linear feet (LF) multiplied by the functional index of that length of river. AAFU were then calculated over the 50-year planning period of analysis.

For the river element of the ecosystem, 37,500 linear feet was calculated as the length of the river from above the existing cutoff area to below the cutoff area. This length was then multiplied by the functional index for the increase in surface area, annual percentage the weir is not over-topping, and the increase in velocity within the main stem of the river. These outputs were then weighted based on their importance in increasing river functionality. Index values for the alternatives considered are seen in table 8.

Table 8. Index Values for the Alternatives Considered in the EBA

Alternatives	Weighted Average Index Value x Main Stem Length	
A (No Action)	9741.667	Functional Units
B1 (1' Weir Raise)	15519.55	Functional Units
B2 (2' Weir Raise)	20194.04	Functional Units
B3 (3' Weir Raise)	22359.64	Functional Units
B4 (4' Weir Raise)	20000	Functional Units
C (Fish Ladder Addition)	9741.667	Functional Units

4.7 Cost Effective/ Incremental Cost Analysis (CE/ICA)

The environmental benefits and costs presented in the previous section were the inputs for a CE/ICA. The purpose of the CE/ICA analysis was to evaluate the effectiveness and efficiency of the alternatives producing environmental outputs. Guidance on the conduct of CE/ICA is in the Institute for Water Resources (IWR) Report #95-R-1, USACE, May 1995. The end product of a CE/ICA is the identification of a set of *best buy* plans. Best buy plans are the alternatives that provide the greatest increase in environmental output for the least increase in cost. Initially, all cost-effective alternatives (a cost-effective alternative is one where no other alternative can achieve the same level of output at a lower cost, or greater level of output at the same or less cost) are arrayed by increasing output to clearly show changes in cost (i.e., increments of cost) relative to changes in output (i.e., increments of output) of each cost-effective alternative plan compared to the without-project condition. The plan with the lowest incremental costs per unit of output of all plans is therefore considered the first best buy plan. After the first best buy plan is identified, all larger cost-effective plans are compared to the first best buy plan in terms of increases in (increments of) cost and increases in (increments of) output. The alternative plan with the lowest incremental cost per unit of output (for all cost-effective plans larger than the first best buy plan) is the second best buy plan. This process is continued until all the best buy alternative plans are identified.

The results of the cost and initial analysis conducted to compare alternatives are presented in Tables 9 and 10. These tables display the incremental costs and benefits for the best buy plans (with the exception of the No Action Alternative, which is always a Best Buy Plan), and is illustrated in Figure 8. The IWR Planning Suite software was used to conduct the CE/ICA.

Evaluation of the best buys from the initial analysis identified an array of best buy alternatives for comparison over the entire watershed. The PDT compared the best buys from each project area to determine whether the incremental environmental benefits justified the incremental costs. Based on this comparison, a single best buy alternative was selected from each project area, which was then used to create watershed-wide alternatives. Figure 8 shows the outputs of the CE/ICA.

It should be noted that alternatives B3 and B4 were removed from consideration for CE/ICA, as they were screened out from final consideration due to violation of a planning constraint.

Table 9. Proposed Alternatives and ROM Cost

ALTERNATIVE	TOTAL COST
B1 - Replace USACE Weir at Existing Location to Elevation 57' NAVD 88	$1,423,949
B2 – Replace USACE Weir at Existing Location to Elevation 58' NAVD 88	$1,455,969
C - Build Fish Ladder Structure over New Weir at Elevation 56' NAVD 88	$2,477,621

Table 10. Preliminary, Output, Costs and Benefits of Neuse Goldsboro 1135 Alternatives

Plan	Functional Units	Alternative Cost(ROM)	Interest During Construction	Total	Avg Annual Cost	Cost Effective?
No Action	0	$0		$0	$0	Best Buy
B1	5777.8807	$1,423,949	$3,370	$1,427,319	$54,164	Yes
B2	10452.378	$1,455,969	$3,446	$1,459,415	$55,382	Best Buy
C1	0	$2,477,621	$5,864	$2,483,485	$94,244	No

** Costs are at 2018 Price Levels*
***The FY18 discount rate of 2.75% was used to compute interest during construction and Avg Costs*

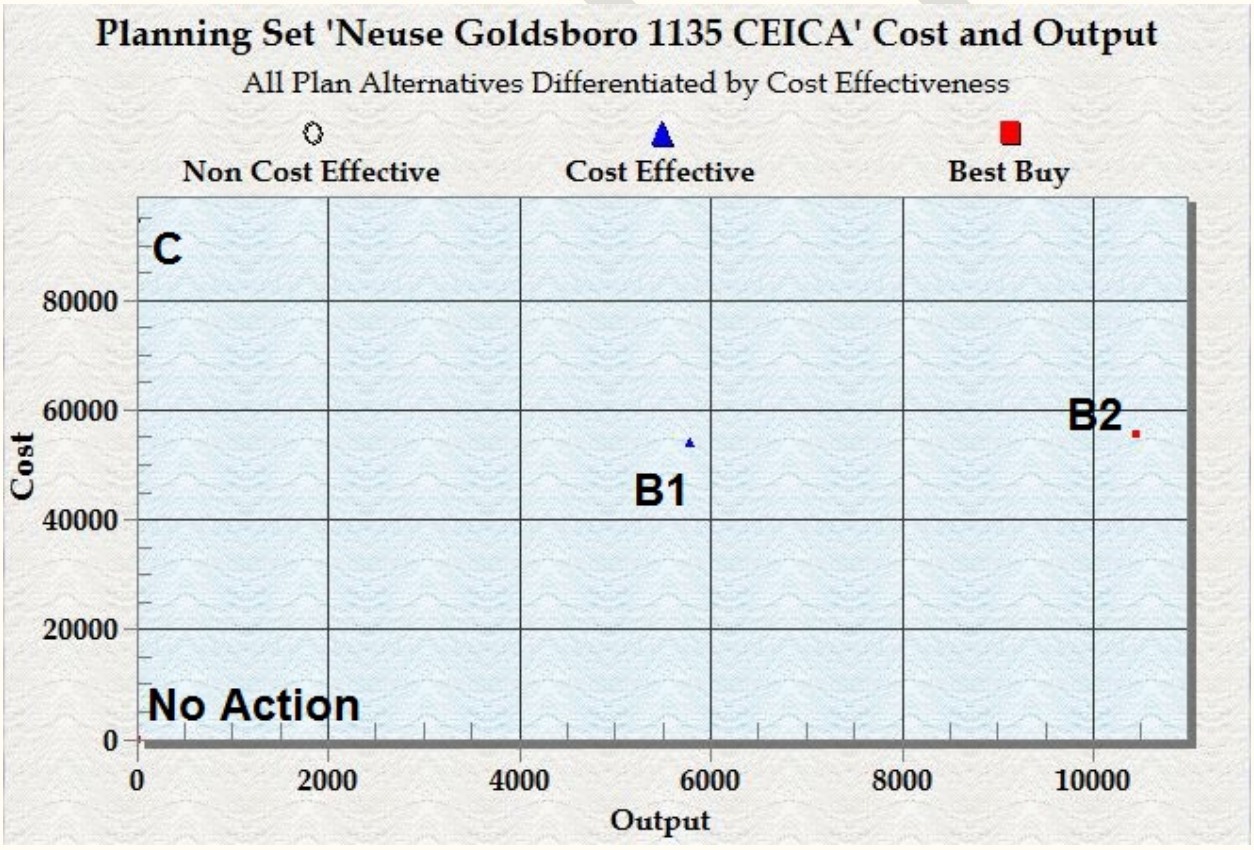


Figure 8. All Plan Analysis

For further details and economics and the cost effective/ incremental cost analysis, see Appendix B.

4.8 Resource Significance

This section provides a qualitative evaluation and summary of the alternative impacts to significant resources. Along with information from cost effectiveness and incremental costs analyses, information on the significance of ecosystem outputs will help determine whether a proposed environmental investment is worth the cost. The significance of the Neuse River-Goldsboro 1135 restoration outputs is herein recognized in three categories: *Institutional, Public*, and/or *Technical*.

Institutional Significance

Significance based on institutional recognition means that the importance of an environmental resource is acknowledged in the laws, adopted plans, and other policy statements of public agencies, tribes, or private groups. Sources of institutional recognition include public laws, executive orders, rules and regulations, treaties, and other policy statements of the Federal Government; plans, laws, resolutions, and other policy statements of states with jurisdiction in the planning area; laws, plans, codes, ordinances, and other policy statements of regional and local public entities with jurisdiction in the planning area; charters, bylaws, and other policy statements of private groups.

The state and several Federal agencies have prioritized efforts to improve aquatic quality in the Neuse River Basin and the estuary it feeds by funding programs that support activities to ensure the future of scarce aquatic resources. After designating the Basin as "Nutrient Sensitive Waters", the state funded several programs to improve water quality through education outreach and Basin planning (NCDENR 2002 and 2009a). The Neuse Agricultural Rule came about as part of the basin's designation as a Nutrient Sensitive Water, as a way for farmers within the water basin to reduce, manage, and record nutrient load entering the Neuse River from farming practices. The 2016 Annual Progress Report (Crop Year 2015) on the Neuse Agricultural Rule (15 A NCAC 2B.0238) recorded an estimated 53% reduction in nitrogen loss from agricultural lands compared to the 1991-1995 baseline, this reduction exceeds the 30% reduction goal that has been set for the basin. The nitrogen reduction is due in part to cropping shifts to crops which require lower nitrogen demands and application rates. In addition to nitrogen reducing agriculture processes, surrounding populated areas along the Neuse River implemented stormwater rules and nutrient load offsets that greatly limited new nutrient load runoff from entering the Neuse Basin from new development projects. Along with the stormwater rules, a riparian buffer rule was created that limited the development along the banks for the Neuse River and associated tributaries. Lastly, the state enacted strict nutrient limits for point source wastewater dischargers along the Neuse basin, further reducing nitrogen from known direct sources.

State and Federal agencies recognize the significance of potential anadromous fish spring migrations on the Neuse River. The Neuse River produced more catches of shad than any other river in North Carolina at the beginning of the 20th century. Since 1997, four dams have been removed from the Neuse (Quaker Neck Dam) and Little Rivers (Cherry Hospital, Rains Mill, and Lowell Mill dams) allowing migrating species to access 90 percent of their original spawning grounds (NCOEE 2010), with the exception of those that may divert up the cutoff channel of the Federal project. Additionally, USACE recommended modification of the Little River dam near Goldsboro as part of its 2012 Neuse River Basin Integrated Feasibility Report and Environmental Assessment.

The Neuse River has also been identified as one of the most threatened rivers in North America for 2017 by American Rivers, a Non–Governmental Organization (NGO) focused on conservation.

Public Significance

Significance based on public recognition means that some segment of the general public recognized the importance of an environmental resource, as evidenced by people engaged in activities that reflect an interest or concern for that particular resource. Such activities may involve membership in an organization, financial contributions to resource-related efforts, and providing volunteer labor and correspondence regarding the importance of the resource.

There has been increasing public awareness of the value of environmental resources within the Neuse River Basin. The Neuse River Foundation's Neuse River Spring Clean-up, which spans nearly 80 river miles from Falls Dam to below Smithfield (including sections of Crabtree Creek), encourages citizens to take a more active role in cleaning up the Neuse River. It has been one of the largest single-river clean-up events in the state. The annual summertime "Loose on the Neuse" is another organized clean up and paddle boarding event which has emerged on the Neuse River.

The Neuse Riverkeeper and Pamlico-Tar River Foundation merged in April 2015 to form the group named Sound Rivers. This group is a nonprofit organization that guards the health of the Neuse and Tar-Pamlico River Basins. Sound Rivers has three full-time "Riverkeepers", members who monitor and protect the river basins, serving as scientific experts and an educational resource for local communities in the watershed.

The Lower Neuse Basin Association (LNBA) and Neuse River Compliance Association (NRCA) was formed in 1994 by National Pollutant Discharge Elimination System (NPDES) permit holders with permitted flow equal to greater than 1.0 millions of gallons per day (mgd) or a governmental entity below Falls Lake Dam. The LNBA currently has 18 members (public and private) and monitors water quality at 48 sites in the Neuse Basin. Also, the LNBA provides funding to support the ModMon sampling program within the Neuse Estuary and the FerryMon sampling program in the lower portions of the Neuse River. These two sampling programs research and identify organic nitrogen by its source. The mission of the LNBA is to preserve the waters of the Lower Neuse Basin River through innovation and cost effective pollution reduction strategies. While the mission of the NRCA is to preserve water quality and achieve compliance with Total Maximum Daily Load (TMDL) requirements within the Neuse River.

The Neuse River serves as the water supply source for both municipal and industrial use for one-sixth's of the population in the State of North Carolina.

Technical Significance

Significance based on technical recognition means that the resource qualifies as significant based on its "technical" merits, which are based on scientific knowledge or judgment of critical resource characteristics. Technical significance should be described in terms of one or more of the following criteria: scarcity, representation, status and trends, connectivity, and limiting habitat.

Connectivity: The Neuse River feeds one of the nation's largest and most productive coastal estuaries (Albemarle-Pamlico). The Albemarle-Pamlico estuary system is a nursery for 90 percent of the commercial seafood species caught in North Carolina. The rivers and streams of the Neuse River Basin are spawning areas for shad, herring, Striped bass, Atlantic Sturgeon and other anadromous fish. (Figure 9).

Figure 9. Striped Bass in Federal Cutoff Channel (*source: NC Wildlife Resource Commission*)

Scarcity: The project area is listed by National Marine Fisheries Service (NMFS) as critical habitat for Atlantic Sturgeon. Atlantic Sturgeon is an endangered species of anadromous fish. The Neuse River Basin is home to 17 species of rare freshwater mussels and a rare snail species. Two of these mussels, the dwarf wedge mussel and Tar River spiny mussel, are Federally listed as endangered. The largest known population of the dwarf wedge mussel is found in the Connecticut River, but North Carolina has the greatest distribution of this mollusk, with tiny populations in small streams throughout 12 counties, including Johnston County, which is the next county upstream from the Federal project.

4.9 The Recommended Plan

Alternative B2 – Replace USACE Weir at Existing Location to Elevation 58.0' NAVD 88:

The proposed steel sheet pile weir structure will be constructed approximately 25' downstream of the City's existing temporary weir within the cutoff channel and to an elevation of 58.0' NAVD 88. The sheet piles will be driven to elevation 29.0' NAVD 88. The weir structure will extend up the stream banks and to a distance of 14' beyond the top of the slope on both sides. Removal of existing riprap approximately 10'-15' on either side of the proposed alignment will be necessary for the sheet pile installation.

Removal of the City's existing temporary steel sheet pile weir structure will be accomplished by the City of Goldsboro after the construction of the proposed weir is complete. The deteriorated and damaged condition of the USACE existing steel sheet pile weir due to rust and exposure to past pounding by heavy floating debris would most likely prevent the entire removal of the existing weir structure. Additionally, portions of the existing USACE weir were previously bent over as part of the construction of City's temporary weir. To reduce hazards to users of the river, the existing sheet pile will be cutoff approximately 18 " below the grade of the top of the existing riprap. This will be done in lieu of complete removal. The existing riprap immediately around the existing weir would be removed to allow for the cutting operation, and then would be placed back over the top of the cut off weir.

Much of the existing stone (riprap) placed as part of the past repairs on the downstream side of the weir has been displaced and scattered downstream, resulting in scouring of the bottom. New riprap is considered downstream of the new proposed weir to repair any scouring or other damages that have occurred since the most recent repairs in 2015. A 3-foot thick layer of riprap will be placed 15' downstream of the proposed new weir and tapered down to tie-in with the existing riprap. A 9"-12" thick layer of stone will be used as a bedding layer and as fill material for the proposed 3-foot thick layer of riprap. For the upstream potion of the proposed weir, either new riprap or a combination of new riprap and existing larger size riprap available onsite can be used. A 2-foot thick layer of riprap will be placed along the side slopes for a distance 15' downstream of the new proposed weir. Construction timeframe is approximately 3 months. For proposed weir cross section and profile, see figures 10 and 11.

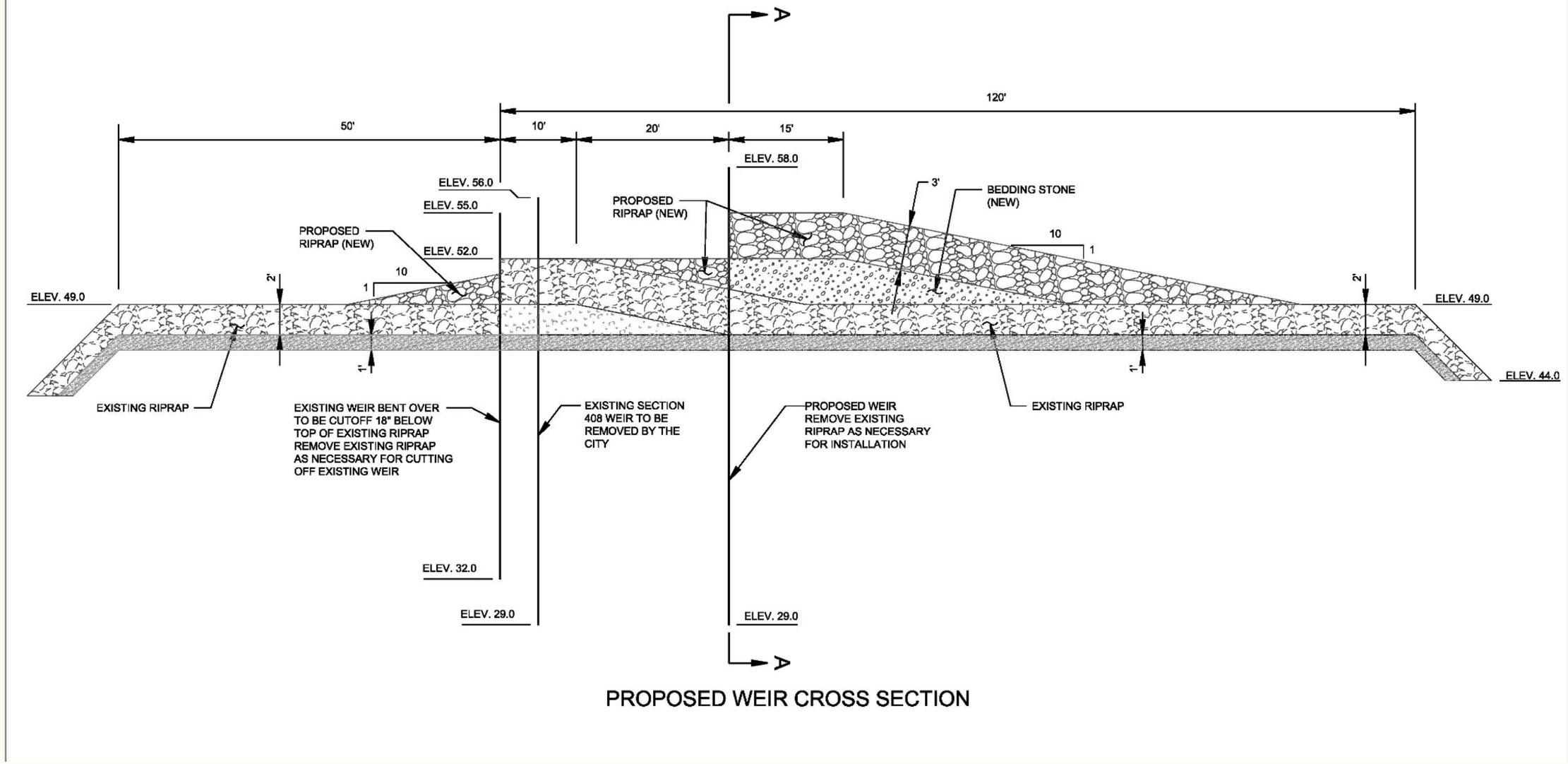
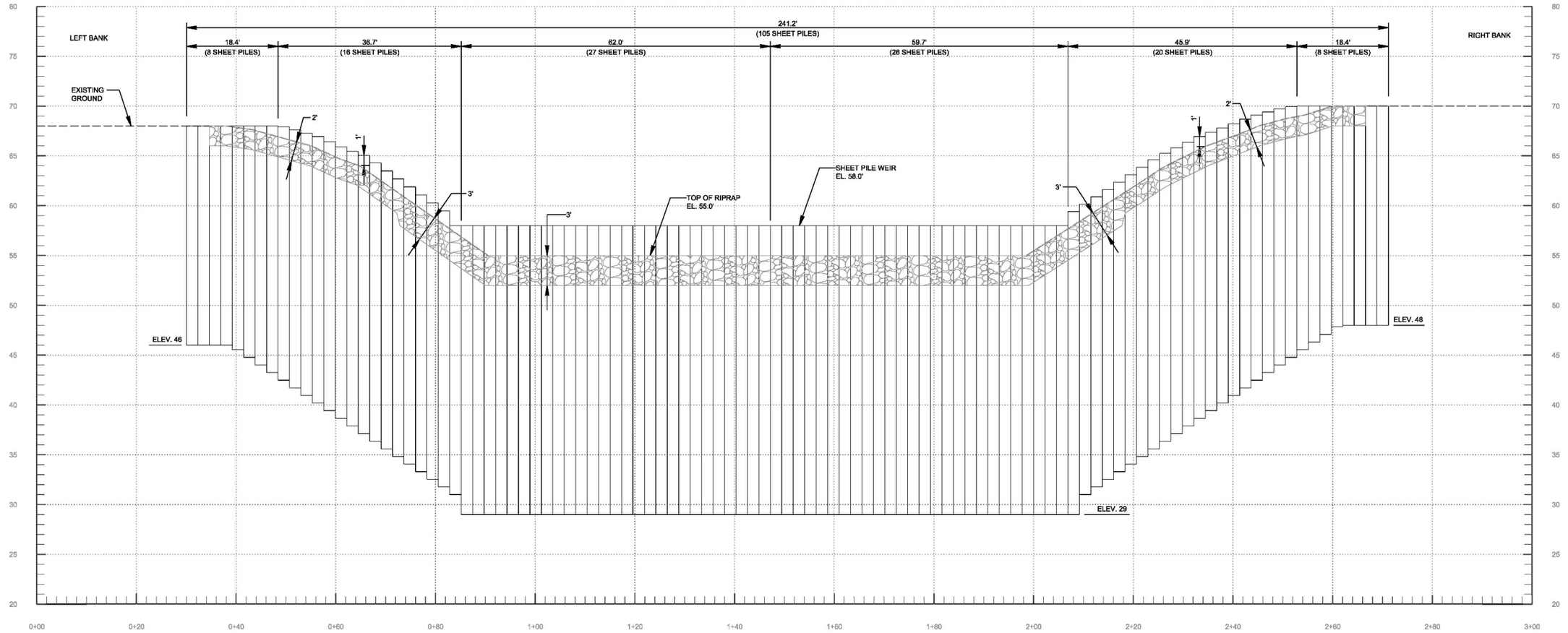


Figure 10. Proposed Weir Cross Section



NOTES:

1. PROPOSED SHEET PILE TO BE PZ-27 OR EQIVALENT AND AS DETERMINED FOR DESIGN.
2. THE LENGTH OF SHEET PILE ALONG BOTH STREAMBANKS TO VARY BETWEEN 22' TO 28'.

SECTION A-A PROPOSED WEIR PROFILE

Figure 11. Proposed Weir Profile

Construction of the new proposed weir structure and new riprap placement will require dewatering of the construction site. To avoid any impacts to water quality, proper sediment and erosion control features such as silt fence and cofferdams will be used during the construction. The USACE will comply will all conditions of the WQC. The contractor will be required to submit a dewatering work plan for approval. To facilitate dewatering operations, the existing USACE weir and the City's temporary weir will remain in place until the construction of the new weir is complete

Site Access and Staging Area

The site access and staging area will be along the south bank of the cutoff channel adjacent to the placement site of the recommended plan. Access runs through property owned by Mar-Mac Aggregates. The Contractor will coordinate site access and staging area within the Mar-Mac Aggregates Facility. Some minor clearing within the Mar-Mac Aggregates property adjacent to the proposed sheet pile weir structure may be necessary. Wayne County granted a perpetual easement to the United States of America on 16 August 1947. It is anticipated that construction will occur within the existing easement. The agriculture field located on north bank is within property owned by Scott James Lendell. It is assumed that no site access will be allowed from the north bank area.

Existing USACE Weir Structure Elevation Datum

Elevations presented on the US Army Corps of Engineers old design plans from 1968 may have been referenced to Mean Sea Level (MSL). The elevations appear to agree with the National Geodetic Vertical Datum of 1929 (NGVD 29). The elevation of the original wooden sheet pile structure is unknown. The existing steel sheet pile weir structure replaced the original wooden sheet pile structure in 1968 and was constructed to a top elevation of 56.0. Conversion of the existing weir elevation of 56.0 NGVD 29 to the current NAVD 88 datum elevation places the existing weir structure at elevation 55.0 NAVD 88. The City of Goldsboro constructed their temporary weir structure in 2015 to elevation 56.0 NAVD 88 or approximately one foot higher than the existing weir sheet pile structure.

Established Federal Emergency Management Agency (FEMA) baseflood elevations are not expected to be altered as a result of implementing the Recommended Plan. For more detail, refer to Section 7.4 of Appendix A.

For more information on design consideration, see appendix C.

5.0 Existing and Future-Without Project Conditions, and Impacts of the Proposed Action

5.1 Physical Resources

Geology and Topography

The project area is located within the Neuse River Basin in the Coastal Plains region of North Carolina. The general topography within the project area can be described as Inner Coastal Plain, Southeastern Plains and Southeastern Floodplains and Low Terraces (Within Wayne County the primary geologic units include: Surface Units: Felsic Metavolcanic Rock, Black Creek Formation, and Cape Fear Formation; and Tertiary Units: Castle Hayne Formation, and Yorktown Formation and Duplin Formation (USGS 2014). These mineral units are generally characterized by a surface layer of metavolcanic rock, clay, mud or sand; and a subsurface layer of limestone, dolomite, clay, mud or sand.

The proposed action would result in minimal impacts on the geology and topography surrounding the immediate project area, however these impacts would be temporary and limited to the construction phase of the project. No significant long term impacts are expected for the sediments within the project area.

The no action alternative would not involve any construction or earthwork therefore there would be no impacts to geology, topography or soils in the project area.

Sediments

Soils within the project area and nearby vicinity are included in the soil map (Figure 12) and in Table 11 (USDA, NRCS 2016). Prior to designing the new weir structure Schnabel Engineering completed a subsurface exploration program, which consisted to two (2) 45-feet deep open-hole mud rotary borings with Standard Penetration Tests (SPT) and sample collection. SPT/sampling depths were determined in the field during drilling. Two (2) rod drives utilizing ¼-inch diameter steel rods and a 16-pound hammer with a 2-foot free fall were also completed for the purpose of gathering additional soil stiffness data. Generally the upper 0.3-feet of each mud rotary boring consisted of fill (well graded quarry-run gravel). The remaining depth of each boring consisted of stream-deposited sediments (sediment/soil has been classified using the Unified Soils Classification System [USCS] ASTM standard 2487-92, 1994), including but not limited to clayey sand (SC), poorly graded sands (SP and SP-SM), well graded sands (SW-SC and SW-SM), and fat clay (CH). The borings encountered CH material at elevations 25.4-feet NAVD88 and 36.4-feet NAVD88, respectively. Surface elevation for each boring was approximately 69.0-feet NAVD88. Crest elevation for the new structure is 53.0-feet NAVD88 and termination depth for the sheet piles is 26.0-feet NAVD88. The Black Creek Formation is a lignitic (intermediate coal) clay, gray to black in color, containing thin beds of fine-grained micaceous sand and thick lenses of cross-bedded sand (NC Geological Survey, Geologic Map of North Carolina, Scale 1:500,000, 1985). USACE recommends conducting a geotechnical subsurface (and potentially surface investigation at the embankments of the river) investigation within the project area prior to the design and implementation phase of the proposed weir. A Scope of Work (SOW)/work plan detailing project objectives (work to be performed), required personnel, materials needed, days of work, and additional costs not mentioned will be generated at a later date.

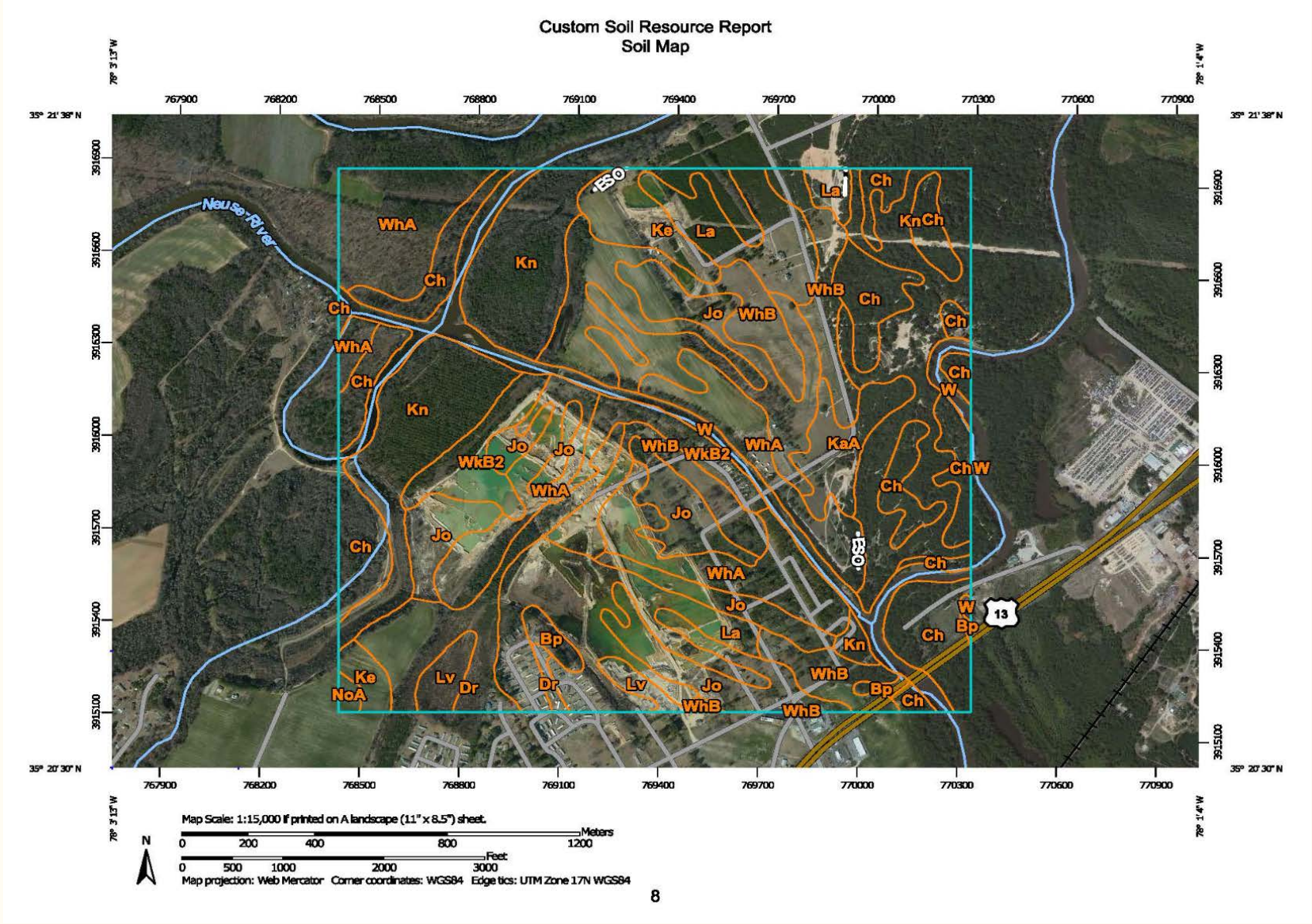


Figure 12: Soil Map of Neuse River Cutoff Area

Table 11: Neuse Cutoff Project Area Soil Unit Abbreviations and Names

Wayne County, Soil Survey : Soil Unit Abbreviations and Names	
Bp	Borrow Pit
Ch	Chewacla loam
Dr	Dragston loamy sand
Jo	Johns sandy loam
KaA	Kalmia loamy sand, 0 to 2 percent slopes
Ke	Kenansville loamy sand
Kn	Kinston loam
La	Lakeland sand
Lv	Lumbee sandy loam
NoA	Norfolk loamy sand, 0 to 2 percent slopes
W	Water
WhA	Wickham loamy sand, 0 to 2 percent slopes
WhB	Wickham loamy sand, 2 to 6 percent slopes
WkB2	Wickham sandy loam, 2 to 6 percent slopes

The soils within the project area are representative of soils likely to be located within marine terraces and floodplains. They are also soils that are classified as significant for prime farmland by the USDA.

The proposed action would result minimal impacts on sediments surrounding the immediate project area. Impacts would be limited to the construction area of the project (approximately 0.33 acres of disturbance within the stream and banks). Temporary impacts may occur in high ground previously disturbed for a construction staging area (~0.27 acres). No significant long term impacts are expected for the sediments within the project area.

The no action alternative would not involve any soil disturbing activity or earthwork, therefore there will be no impacts to soils.

Prime and Unique Agricultural Land

A review of the Soil Survey of Wayne County, North Carolina indicated that there are eight soil classes in the vicinity of the proposed project area that have been designated as prime or unique agricultural land by the Natural Resources Conservation Service (NRCS); they include: Chewacla loam, Dragston loamy sand, Johns sandy loam, Kalmia loamy sand, Kenansville loamy sand, Lumbee sandy loam, Norfolk loamy sand and Wickham loamy sand. Table 12 below shows the soil units within the project area vicinity and their NRCS Prime Farmland Classification.

Table 12. NRCS Prime Farmland Soils within Project Area Vicinity

Soil Unit Name	Prime Farmland Classification
Chewacla loam soil	Prime farmland if drained
Dragston loamy sand	Farmland of statewide importance
Johns sandy loam	Prime farmland if drained
Kalmia loamy sand soil	All areas classified as prime farmland
Kenansville loamy sand	Farmland of statewide importance
Lumbee sandy loam	Prime farmland if drained
Norfolk loamy sand	All areas classified as prime farmland
Wickham loamy sand	All areas classified as prime farmland

The proposed action will impact approximately 0.30 acres of surrounding prime farmland soils directly abutting the construction area of the new weir while heavy machinery is operating to construct the new weir and the old riprap is replaced with new riprap. However, the impacts will be temporary and limited to the area directly abutting the cutoff, thereby not significantly impacting area farmland soils that could potentially be utilized for agricultural uses. The proposed action will not result in permanent impacts to prime or unique agricultural land.

The no action alternative would not involve any earthwork or construction activities, leaving the surrounding areas of prime farmland undisturbed. The no action alternative would not impact prime or unique agricultural land.

Geomorphology and Dynamics within the Cutoff

When originally constructed in 1948, the cutoff channel had a bottom width of approximately 20 feet. Currently, the size of the cutoff channel has enlarged up to 150 feet in sections and the Neuse River now by-passes the natural meander upstream of the check dam (weir). This natural meander is shown in figure 2 as the blue-colored, U-shaped line labeled “Old Main Stem”. Historically, flow would take a 90-degree right turn, travel for 1,500 feet then make a 180-degree turn to the north – a classic horseshoe bend. Once constructed, the cutoff channel allowed the Neuse River to take a shorter, more direct route and, over time, it became the primary flow path. Presently, flow at the junction point will back up this remnant channel where stream velocity drops to practically zero. The upstream portion of this remnant channel has silted in and will only reconnect to the Neuse River during high flow events. It is unclear as to when this remnant reach became secondary to the cutoff channel. It is assumed that the cutoff channel above the junction was not designed to become the primary flow path for the Neuse River. This 800 foot section of cutoff channel likely discourages water from flowing north into the main stem, instead facilitating the flow east through the cutoff channel.

The cutoff channel has enlarged much more than the 25-percent assumed in the original project design. In some portions of the cutoff channel, the bottom width is as much as 100 to 200 feet across. The frequency in which the cutoff channel received flow from the Neuse River is likely a factor to this enlargement. Another factor may be the natural repose of soil material that makes up the cutoff channel footprint. Refer to Exhibit 1 and Exhibit 2 for a comparison of historic and current aerial photography of the upstream extents of the original Federal project.

Exhibit 1. Cutoff channel from 1950's. Neuse River still utilized meander as main flow path

Exhibit 2. Cutoff channel from 2010. Neuse River utilizes cutoff channel as main flow path

Functionally completed in 2015, the City of Goldsboro obtained approval from USACE to build a temporary weir immediately downstream of the federal project weir. The existing weir had deteriorated to the point in which repair was deemed impracticable. The original USACE design called for the weir to be constructed to an elevation of 56.0 feet, Mean Sea Level (MSL) datum. For reference, MSL was renamed the National Geodetic Vertical Datum of 1929 (NGVD29) in 1973. According to the 2013 Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) for Wayne County, the conversion from NGVD29 to the current standard vertical datum, NAVD88 is -1.02 feet. Therefore, the original USACE weir elevation was 54.98 feet, NAVD88. Following the hydrographic survey completed in November 2016 as part of this study, it was discovered that the City of Goldsboro's new weir had a crest elevation of 56.0 feet, NAVD88. This new weir is approximately 1 foot higher than the original USACE design. The weir height discrepancy was assumed to be unintentional and possibly caused by confusion during datum conversions. Additional information on the hydrology of the area and the hydraulic model development is available in Appendix A.

The proposed action would raise the height of the weir to elevation 58' NAVD 88 allowing for the positive flood reduction benefits to remain within the main stem of the Neuse River. Additionally, by raising the height of the weir there would be a positive benefit for the main stem of the Neuse River by returning a more natural flow of water to the main river system.

The no action alternative would continue to provide the positive flood reduction benefits to the main stem of the Neuse River. Conversely, the no action alternative would continue to have a negative effect on natural functionality of the main stem of the river by reducing natural flows in the main stem channel.

5.2 Water Resources

Surface Water

The project area is located within the Neuse River Basin, specifically the Upper Neuse subbasin (U.S. Geologic Survey Hydrologic Unit (HUC) # 03020201) and NC DWR sub-basin 03-04-12. The Upper Neuse River subbasin drains approximately 2,406 sq. miles and covers 1,539,932 acres. Within the project area, the main stem of the Neuse River travels through a previously constructed USACE flood control project which consists of a cutoff channel with a constructed weir.

Water Quality

Waters in the proposed project area are classified as C and Nutrient Sensitive Waters (NSW). Class C waters are protected for uses including fishing, wildlife, fish consumption, aquatic life including propagation, survival and maintenance of biological integrity, agriculture, and secondary recreation, where secondary recreation includes wading, boating and other uses involving infrequent human body contact with water. NSW are defined as needing additional nutrient management due to being subject to excessive growth of microscopic or macroscopic vegetation (N.C. Department of Environmental Quality (NCDEQ) Division of Water Resources (DWR), 2014). In the NCDEQ's Neuse River Basin/Subbasin Plan: the river, from the City of Goldsboro's water supply intake to the subbasin boundary, was categorized as impaired for fish consumption due to mercury in 2004; this impairment was based on fish tissue monitoring. There were no newly or previously 303(d) listed impaired waters within this subbasin or issues related to low dissolved oxygen reported in this subbasin (NCDWR 2009).

The proposed alternative is not expected to increase turbidity or lower dissolved oxygen rates within the main stem of the Neuse River or the cutoff channel, therefore no negative effects are anticipated. It is not clear wither the raised weir would have positive impact on the water quality of the Neuse River basin, more monitoring of the area would be required to determine any positive benefits.

The no action alternative would leave the cutoff channel and temporary weir in its current conditions, thereby not creating a change to the existing water quality of the project area.

Wetlands and Floodplains

Wetlands are areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, as defined by the *Federal Register* (33 CFR 328.3). Wetlands have three essential characteristics—hydrophytic vegetation, hydric soils, and wetland hydrology. Moreover, wetland habitats provide important services including nutrient cycling, wildlife habitat, and hydrologic storage.

The proposed action occurs within the banks of the cutoff channel of the Neuse River where there are no wetlands or floodplains present; therefore no wetlands or floodplains would be impacted by the proposed action. Pursuant to the Clean Water Act, a 404(b)(1) analysis is included in Appendix D.

The no action alternative also occurs within the banks of the cutoff channel of the Neuse River where there are no wetlands or floodplains present; therefore no wetlands or floodplains would be impacted by no action.

5.3 Biological Resources

Vegetation

Vegetation within the project area consists of a tree overstory containing bald cypress (*Taxodium distichum*), water oak (*Quercus nigra*), green ash (*Fraxinus pennsylvanica*), river birch (*Betula nigra*), laurel oak (*Quercus laurifolia*), sweet gum (*Liquidambar styraciflua*), sycamore (*Platanus occidentalis*), eastern red cedar (*Juniperus virginiana*), and loblolly pine (*Pinus taeda*). The shrub, herb and vines found within the understory along the project area contain: buttonbush (*Cephalanthus occidentalis*), American holly (*Ilex opaca*), grapevines (*Vitis rotundifolia*), red maple (*Acer rubrum*), and black willow (*Salix nigra*).

The project area also includes several invasive plant species growing along the bank of the main stem of the Neuse, as well as along the cut off channel. They include: Chinese privet (*Ligustrum sinense*), Chinaberry (*Melia azedarach*), Mimosa tree (*Albizia julibrissin*), Japanese stiltgrass (*Microstegium vimineum*), and lespedeza (*Lespedeza bicolor*).

The proposed action would result in ground disturbance along the sides of the bank where construction of the weir would take place (approximately 0.20 acres per side) and the disturbance within the stream would be approximately 0.33 acres for the removing and replacing of riprap. There is very little to no grading work expected as part of this project. The area around the banks where the weir ties in is previously disturbed, mostly stabilized with riprap and primarily vegetated with small herbaceous species and young shrubs and trees, including various invasive species. Following construction any disturbed bare ground will be reseeded with a native riparian species seed mix. Additionally, monitoring

for invasive vegetation and removal of any invasive vegetation found within the project site will be incorporated into the Operations and Maintenance Manual as part of the sponsor's yearly inspection.

The no action alternative would not involve construction of a new weir so there would be no change to existing vegetation within the project area.

Wildlife

Wildlife present within the Neuse River cutoff includes a mix of mammals, birds, reptiles and amphibians common to the North Carolina Upper Coastal Plain region. Mammals common along the cutoff project area include grey squirrels (*Sciurus carolinensis*), red fox (*Vulpes vulpes*), grey fox (*Urocyon cinereoargenteus*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*) and beaver (*Castor Canadensis*). The project area contains many common songbirds and raptors; a few examples include: northern cardinal (*Cardinalis cardinalis*), American robin (*Turdus migratorius*), red-winged blackbird (*Agelaius phoeniceus*), Carolina chickadee (*Poecile carolinensis*), black vulture (*Coragyps atratus*) and red-tailed hawk (*Buteo jamaicensis*).

The North Carolina Natural Heritage Program (NCNHP) provided information for the project area from the NCNHP database in a letter received during the scoping period, July 7, 2015. The NCNHP data showed records for two rare species, a natural area, and several conservation/managed areas within the project area. The two rare species were: an Amphibian called the Neuse River Waterdog (*Necturus lewisi*), a Federal species of concern and a butterfly called Checkered White (*Pontia protodice*). The project area also contains the NCNHP natural area NEU/Little River (Franklin/Wake/Johnston/Wayne) Aquatic Habitat. The complete list of the species and areas identified in the NCNHP database can be found in the NCNHP letter dated July 7, 2015 located in Appendix E.

The proposed action could temporarily displace some wildlife from the project area during a 90-day window due to construction noise and associated heavy equipment and the presence of workers. These impacts would likely be temporary. Wildlife would be expected to return to the area following construction. Construction is expected to take approximately 3 months. No permanent adverse impacts to wildlife or habitat area in the project area are expected.

The no action alternative would not involve construction of a new weir so there would be no change to existing wildlife habitat within the project area.

Threatened and Endangered Species

The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531-1543), provides a program for the conservation of threatened and endangered (T&E) plants and animals and the habitats in which they are found. In accordance with section 7 (a)(2) of the ESA, the USACE has been in consultation with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) to ensure that effects of the proposed project would not jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat of such species.

Updated lists of T&E species for the project area within Wayne County, NC were obtained from NMFS (Southeast Regional Office) and the USFWS Information, Planning and Conservation System website (http://ecos.fws.gov/ipac/) (Appendix F).

A review of the U.S. Fish and Wildlife Service (USFWS) IPac website (11/2/17) showed that the endangered red-cockaded woodpecker (*Picoides borealis*) could potentially be present within the project area. Currently there is no critical habitat designated for the red-cockaded woodpecker; however, its preferred habitat is mature longleaf pine savannas. There is no mature longleaf pine savanna habitat within the project area and it is unlikely that there would be any red-cockaded woodpeckers occurring within the project site.

The yellow lance (*Elliptio lanceolata*), a species of freshwater mussel that is proposed threatened (proposed rule for threatened listing on April 5, 2017) may also occur within the project area. The yellow lance is a bright yellow colored mussel that has an oblong shell reaching just over 3 inches long. The species primary habitat includes coarse to medium sand freshwater stream beds, and sometimes gravel substrates (NCWRC, 2017). Yellow lances move downstream with shifting sand and often settle in sand at the downstream end of stable sand and gravel bars in rivers and streams. Clean, moderately flowing water with high dissolved oxygen are critical for this species to survive. These species of mussels have a complex reproduction cycle, which involves the need for host fish (often white shiners (*Luxilus albeolus*) and pinewoods shiners (*Lythrurus matuntinus*). The species grow rapidly during the first few years of life become sexually mature at around 3 years old and then having slower growth as they age. The mussels are filter feeders, eating algae and other microscopic matter and organic debris (USFWS, 2017). There is no critical habitat designated for the yellow lance and the species has not been documented to exist within the project area. According to the USFWS *Species Status Assessment Report for the Yellow Lance Version 1.2* (March 2017), occurrence of the species within the Neuse River Basin is low. The species historical range includes North Carolina, Maryland and Virginia.

Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*), an endangered anadromous fish, could possibly be found within the project area during migration and spawning periods, which usually occur within the spring. Atlantic Sturgeon are a large species of fish that can grow to lengths up to 14 feet and weight as much as 800 pounds. Atlantic Sturgeon are bottom feeders with a diet that consists mostly of worms, shrimps, crabs, snails, and small fish. The fish have an average life span of around 60 years and although the exact age of maturity for the species found in North Carolina is not known, other close by populations in South Carolina usually reach maturity between the ages 5 to 13 years for males and 7 to 19 years for females. According to research completed by the NC Division of Marine Fisheries (NCDMF) the Roanoke River is the only river in North Carolina with a current spawning population of Atlantic Sturgeon; although, the historic spawning area for the species would have included the Tar/Pamlico, Neuse and Cape Fear Rivers (NCDMF, 2017). The species spawn in intervals of approximately 1 to 5 years for males and 2 to 5 years for females (NOAA Fisheries, 2017). The main stem of the Neuse River around the project area is listed by NMFS as critical habitat for Atlantic Sturgeon under 82 FR 39160 which became a final rule on August 17, 2017. Although, the project area is listed as Critical Habitat for Atlantic Sturgeon the USFWS IPAC website has not yet been updated to include the listing, therefore does not show on the most resent IPAC species list analysis included in Appendix F.

The proposed action could have a positive effect on the Atlantic Sturgeon by increasing flow in the main steam of the Neuse River and reducing the flow from the cutoff, thereby creating a condition within the main stem that the fish are more likely to follow. Fish staying within the main stem will be able to access ~ 92 miles of additional spawning habitat (also listed critical habitat) upstream of the cutoff channel in the Neuse River and ~4.3 miles upstream in the Little River. The proposed action will have no effect on other listed T&E species or their designated critical habitat.

Under the no action alternative, existing water levels within the Neuse River and the Neuse River cutoff would remain the same and the City of Goldsboro's temporary weir would remain in place within the cutoff channel. The no action alternative could potentially have a negative effect on the Federally endangered Atlantic Sturgeon species and its critical habitat that could occur with the project area. In the absence of the proposed project, the weir within the cut off channel may continue to act as a barrier to anadromous fish, such as the Atlantic sturgeon, and connectivity with spawning areas will not be improved.

Fisheries and Essential Fish Habitat

The Neuse River and the Neuse River cutoff area support various fisheries resources including several diadromous fish species. Fish species of interest within the project area include: Atlantic Sturgeon (*Acipenser oxyrinchus*), American Eel (*Anguilla rostrata*), Hickory Shad (*Alosa mediocris*), Blueback Herring (*Alosa aestivalis*), Alewife (*A. pseudoharengus*), American Shad (*A. sapidissima*), and Striped Bass (*Morone saxatilis*).

The North Carolina Wildlife Resources Commission (NCWRC) has designated the Neuse River from Pitchkettle Creek (near Grifton, North Carolina) upstream to Milburnie Dam, including Craven, Pitt, Lenoir, Wayne, Johnston, and Wake counties, as "Anadromous Fish Spawning Areas" (AFSA) as identified in rule 15A NCAC 10C .0603. These areas have been defined by the North Carolina Division of Marine Fisheries (NCDMF) as areas where evidence of spawning of anadromous fish have been documented based on NCDMF's sampling records through direct observation of spawning, capture of running ripe females, or capture of eggs or early larvae. The NCWRC maintains state jurisdiction over the AFSA within the Neuse River Cutoff.

The Magnuson-Stevens Fishery Conservation Act of 1976 governs marine fisheries resources and provides for protection of essential fisheries habitat (EFH). Based on review of the NOAA Habitat Conservation National Marine Fisheries Service's EFH Mapper, there are no EFH or Habitat Areas of Particular Concern (HAPC) identified at or in areas surrounding the proposed project area. The recommended plan and no action alternative will not result in any impacts to essential fish habitat (National Oceanic and Atmospheric Administration 2017).

The National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife, NC Wildlife Resources Commission, and the NC Division of Marine Fisheries have been notified of the proposed project and were involved in meetings prior to the selection of the recommended plan.

The project will be constructed during the months of July to February in order to avoid peak migratory fish movement within this section of the Neuse River. With this selected construction work window the proposed project will have no effect on threatened and endangered species found within the project area.

The proposed action of raising the weir 2' will result in a positive effect for anadromous fish found within the project area by increasing the velocity of water flow within the main stem of the Neuse River. This increase in flow will influence the migrating fish to stay within the main channel, so they avoid becoming trapped in the cutoff channel. By influencing migrating fish to stay in the main stem of the Neuse River, they are more likely to make it to more suitable spawning areas located upstream of the cutoff channel and within the Little River tributary.

The no action alternative may continue to cause migrating fish within this portion of the Neuse River to become confused on which channel to travel once they arrive at the confluence of the cutoff channel. Fish that swim into the cutoff channel often become trapped by the existing weir structure and are unable to successfully make it to upstream spawning areas.

Benthos

The benthic community in the proposed project area has been rated 'good' in benthic metrics for taxa richness (specifically counting the number of insects in the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), also known as EPT) by the North Carolina Department of Natural Resources' Division of Water Quality, Biological Assessment Branch (2017) after sampling wadable and non-wadable lotic (rapidly flowing) water of the Neuse River Basin. Sampling was conducted just upstream of the confluence of the cutoff channel and the main stem of the Neuse on July 30, 2010. As stated above this sampling location of the river showed a good rating for benthic EPT and was not considered an impaired water quality stream. Standard operating procedures for these surveys can be found at http://portal.ncdenr.org/c/document_library/get_file?uuid=f3cfa483-16de-4c18-95b7-93684c1b64aa&groupId=38364.

The proposed action could possibly have a slight positive impact on the benthic community within the project area. The increased flow of water within the Neuse could improve water quality by continuing the flow regime within the main stem even during lower flow periods, this maintained flow would which would benefit benthic fauna by continuing to create a stable temperature and DO within this section of the river. Within the existing footprint of the proposed 58' weir located in the cutoff, the area was previously disturbed with the construction of the City of Goldsboro's temporary weir and currently there is riprap placed in the downstream location where the USACE weir is proposed; it is unlikely that healthy benthic communities exist in this highly disturbed rip rap area so, no negative effects are anticipated to the benthic community in the vicinity of the cutoff.

The no action plan would not change the current condition of the benthic community. There would be no effect to the resource. See appendix G for details on benthic data.

5.4 Cultural Resources

The Neuse Basin contains a wealth of prehistoric and historic period sites that reflect more than 12,000 years of human discovery and settlement. Prehistoric sites within the Basin range from the typically limited physical remains of Paleo-Indian hunter-gatherers (~12,000 B.C.) to the extensive collections recovered from large agricultural villages that came to dominate the floodplain and terraces by the 1400s. The larger villages represent the final stages of Native American dominance, circa 1700 A.D.

European explorers who arrived at the eastern sounds first encountered Algonquian tribes. These Native Americans were the southernmost of the eastern Algonquian language family, which extended northward to the maritime provinces of Canada. The Carolina branch of the Algonquian occupied the central Tidewater region of North Carolina from the Neuse River north to the Chesapeake Bay. To the west of the Carolinas lived the Iroquoian-speaking Tuscarora, Meherrin, and Nottaway. At the western extremity of the Basin, the influential Occoneechee controlled trade and served as intermediaries between early European explorers and other Native American tribes.

Wayne County, NC was formed near 1787 and the town of Waynesborough grew around the Wayne County courthouse. Waynesborough served as the county seat and was a large NC population center until the construction of the Wilmington and Weldon Railroad in the 1840s allowed people to freely move to other nearby centers of commerce such as the new city of Goldsborough's Junction, which had its name shortened to Goldsborough and then further to Goldsboro. Waynesboro Historical Village exists to this day, allowing visitors a glimpse into the past. Goldsborough continued to grow in the mid-1860s as the rail line expanded to serve Charlotte and Beaufort.

Due to its established railway infrastructure, Goldsborough allowed for stationing of Confederate troops and supplies in the American Civil war. Goldsborough hosted The Battle of Goldsborough Bridge in 1862 and a Union offensive in 1865 during General Sherman's Carolinas Campaign. Following the civil war, some Union troops made permanent homes in Goldsborough. The city's spelling was changed to Goldsboro in 1869. North Carolina's 2nd congressional district, which included Wayne County, elected four Republican African Americans to Congress in the 19th century; with three being elected after the Reconstruction era.

Seymour Johnson Air Force Base, located on the outskirts of Goldsboro, was opened in 1942. With the Air Force Base came an increase in population and businesses catered to the influx in residents.

Section 106 of the National Historic Preservation Act requires Federal agencies to take into account the effects of their undertakings on historic properties. Construction of the proposed action, and materials and equipment staging, will take place in previously disturbed areas. Materials and equipment staging areas were used in construction of the temporary weir structure currently in place. The USACE has determined the proposed action would have no effect on cultural resources or historic properties. The NC SHPO and the Eastern Band of Cherokee Indians will have the opportunity to comment on this determination during public review of this document.

The no action alternative would not involve any construction or earthwork and, therefore, would have no effect on cultural resources or historic properties.

5.5 Socioeconomic Resources

Typical socio-economic and demographic data for Wayne County indicate lower than average income when compared to the rest of the state. North Carolina's economy is generally characterized by strong wholesale and retail trade, government and technology sectors. Easily developed land, accessible water supply, abundant natural resources, and the aesthetic beauty of the region are the fundamental building blocks of the local economy. Relative to the national economy, the manufacturing sector has played less of a role in North Carolina, including the study area. However, high technology manufacturing has begun to emerge as a significant sector in the State over the last two decades.

This section includes a description of the local economy and demographics of the study area. This descriptive information provides insight into the study area's socio-economic characteristics, and provides part of the basis for different facets of the economic impact evaluation work in the rest of this document.

Land Use and Agriculture

Existing land use in Wayne County can be described as a mixture of agrarian, urban, industrial, and mixed use. Wayne County, like many rural counties in Eastern North Carolina, has maintained a somewhat static agricultural presence during the past decade, and has seen an increase in the market value of the

agricultural products sold. Table 13 shows the agricultural characteristics of Wayne County, per the 2012 Census of Agriculture.

Table 13. Agriculture Profile, Wayne County, NC

	2012	2007	% Change
Number of Farms	563	723	-22
Land In Farms	191,195 acres	175,265 acres	+9
Average Size of Farm	340 acres	242 acres	+40
Market Value of Products Sold	$577,224,000	$501,176,000	+15
Average Per Farm	$1,025,264	$693,190	+48

While the County Comprehensive Plan anticipates growth in the urban sector, the Neuse 1135 study area lies within the 100-year floodplain (labeled conservation area as defined by Wayne County Land Use Plan) where no growth or development is expected. A map of the land use strategy is located below as figure 13.

Employment

The unemployment rate for North Carolina is 9.8 percent (Access NC, North Carolina Economic Data), while the unemployment rate for Wayne County is 5.8 percent, which represents approximately 3,000 persons over the age of 16 that are in the labor force but unemployed.

Income

Personal per capita income in North Carolina is $25,920 (2015), but is somewhat lower in the Wayne County, at $21,204. As well as having a considerably lower than average per capita income, the study area's median household income is comparable to that of the county and state. At $40,390, it falls short of the state average ($46,868). The 2015 Census data reports seem to indicate a higher than state average household occupancy rate, at 2.56 persons per household in the study area while the state average household sizes is 2.54. In 2008 it was reported that 18.4 percent of North Carolina's population lived below the poverty level, while 15.4 percent of residents in Wayne County were below the poverty level. Nationally, the poverty level was 14.5 percent in 2015.

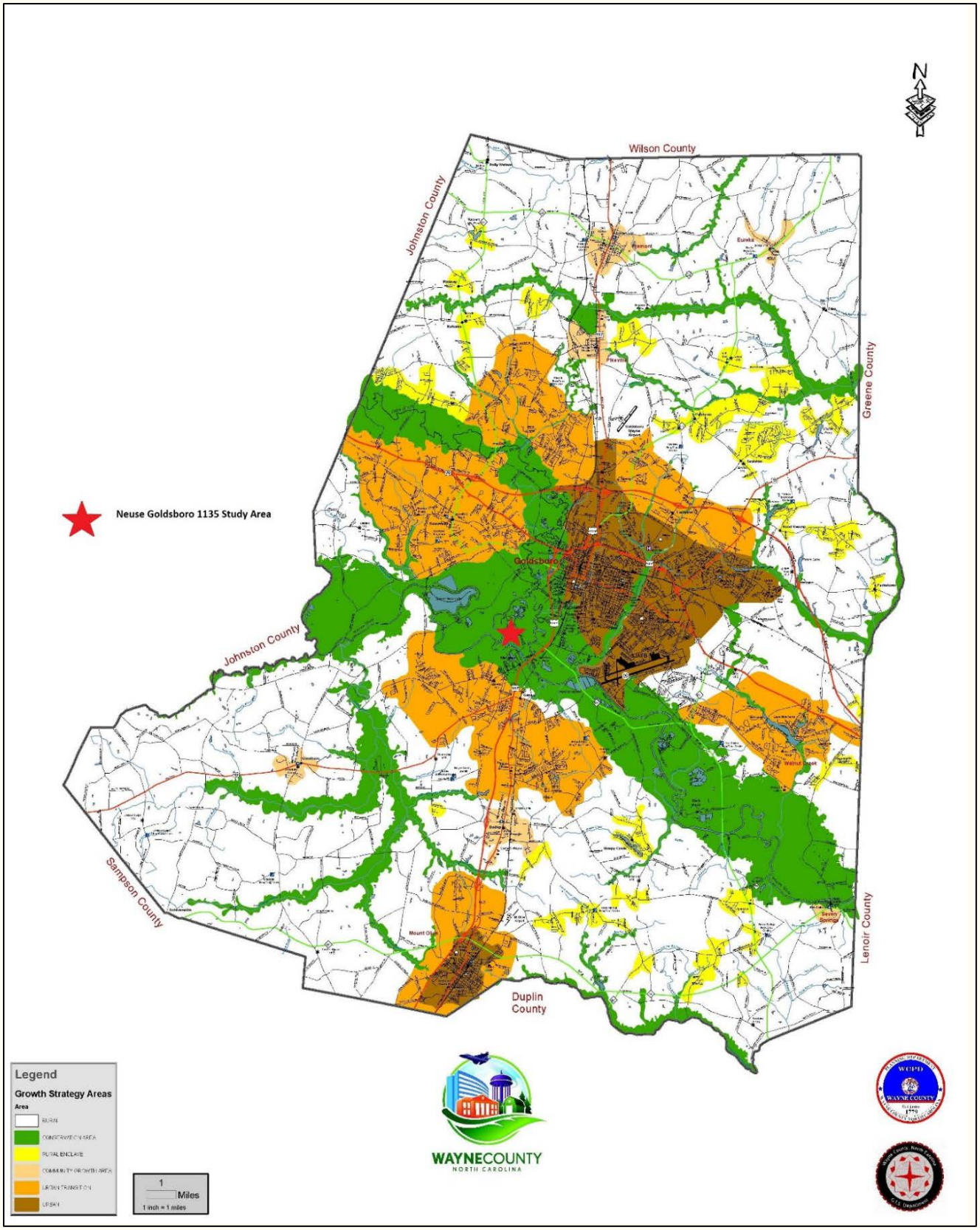


Figure 13. Wayne County Land Use Plan Growth Strategy. *Source: Wayne County NC Planning Department*

Recreation

Wayne County can be described as having a variety of recreational resources, including hunting, fishing, and other waterborne activities. Project area recreation may include: nature study, fishing, canoeing, kayaking, and other non-invasive recreation forms.

Demand for regional recreation was assessed through the North Carolina State Comprehensive Outdoor Recreation Plan (SCORP), and through collaboration with NCDEQ and the various state and Federal agencies involved in the planning process. The existing county usage, from the 2015 SCORP, is described in table 14.

The section of the Neuse River in the project vicinity is a popular fishing area with a NCWRC public boat access ramp within 5.5 miles upstream (Steven's Mill Access) and 2.5 miles downstream (Goldsboro Access) of the proposed project.

Table 14: Wayne County Recreational Usage

Type of Park Acreage or Outdoor Recreational Facility	Residents Per Unit	State Rank
Population	124,150	**25**
Athletic Fields	5718	93
Athletic Courts	3544	61
Picnic Shelters	5990	59
Playgrounds	8986	74
Trails Miles (all types)	4522	61
Local Park Acres	337	63

United States Census Bureau / American FactFinder. "Annual Estimates of the Resident Population: 2016

It is not anticipated that any modifications to the existing project will impact the socioeconomic environment of the study area, or that a 'No Action' plan would have any impact as well.

5.6 Air Quality

The Clear Air Act requires U.S. Environmental Protection Agency (USEPA) to set National Ambient Air Quality Standards for six common air pollutants. These common air pollutants (also known as *criteria pollutants*) are found all over the United States. They include particle pollution (often referred to as particulate matter or PM) including PM10 (10 micron-sized particles) and PM2.5 (2.5 micron-sized particles), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. These pollutants can harm human health and the environment in addition to causing property damage. Of the six criteria pollutants, particle pollution and ground-level ozone represent the most widespread health threats. USEPA calls these pollutants criteria pollutants because the agency regulates them through the establishment of standards for non-exceedance on the basis of human health risk or environmentally based risk criteria (science-based guidelines). The resulting set acceptable limits for these pollutants are called the *primary standards*. Another set of non-exceedance limits intended to prevent environmental and property damage is called the *secondary standards.*

The Washington Regional Office of the North Carolina Department of Environmental Quality (NCDEQ) has air quality jurisdiction for the project area. The ambient air quality for Wayne County has been determined to be in compliance with the National Ambient Air Quality Standards, and is designated an attainment area (N.C. Division of Air Quality).

The proposed action would not be expected to adversely affect air quality since the work sites are not within any nonattainment areas for ozone or fine particle (PM2.5 or PM10) standards designated by the NC DAQ. There is the potential for temporary impacts to air quality during the construction phase of the project; these impacts will be minor and limited to the approximate 3 month construction time frame.

The no action alternative will not create any new regulated air emissions or result in any increase in air emissions. Therefore, the no action alternative would have no effects on the air quality of this attainment area.

5.7 Noise

Noise levels in the vicinity of the Neuse River Cutoff project area are variable and often include vehicle traffic from overpass bridges and adjacent roads crossing the cutoff, heavy machinery from the sand and gravel quarry adjacent to the project area, and seasonal agricultural activities.

The proposed action could cause noise levels to be temporarily elevated during construction activities. The proposed project construction is expected to comply with the *Wayne County, North Carolina – Code of Ordinances*, Chapter 30, Article III, Noise. Any elevated noise levels due to construction activity will be temporary and the construction should take approximately 3 months to complete. No long term increases in noise levels are expected.

The no action alternative would not involve construction within the cutoff channel therefore there would be no increases in noise levels.

5.8 Hazardous, Toxic, and Radioactive Wastes (HTRW)

The United States Environmental Protection Agency's (EPA) Envirofacts website was queried to identify the presence of EPA-regulated facilities within Goldsboro, NC. The Envirofacts website contains information collected from regulatory programs and other data relating to environmental activities with the potential to affect air, water, and land resources in surrounding areas. Currently within the

Goldsboro area there are no active RCRA (Resource Conservation and Recovery Act) facilities or potential hazardous waste sites that are part of Superfund. Based on an Envirofacts web search of the City of Goldsboro, NC there are 100 facilities that have reported hazardous waste activities: 1 Other Hazardous Waste Activities, 2 Large Quantity Generators, 36 Conditionally Exempt Small Quantity Generators (CESQGs), 48 Unspecified Universe, 36 Small Quantity Generators (SQGs) (EPA *EnviroFacts*, 2016). None of these EPA listed sites are located within the project area.

The proposed action, which consists of raising the weir height to 58' (2' above the existing weir height), will not result in the production of HTRW. Additionally, there are no HTRW sites within the project area, so there is no effect to HTRW.

No HTRW sites are located within the currently authorized cutoff channel or surrounding project area, therefore the no action alternative will not have an effect on HTRW, nor will the no action result in the creation of HTRW.

5.9 Aesthetics

The majority of the land along the banks of the project area, including the main stem of the Neuse and the cutoff channel, is currently forested and being used for agricultural, mineral mining, or recreational off-road vehicle use (Busco Beach). The project area has little public access or viewing other than from limited areas visitors can enter from the Busco Beach off-road vehicle park.

The proposed action will build a new weir in place of the old depilated Corps weir and replace old undersized riprap with new correctly sized riprap, thereby improving the overall appearance of the weir area within the cutoff. This will be a positive effect on the aesthetics within the project area.

The no action alternative will have a negative effect on the aesthetics within the project area.

5.10 Environmental Impact Comparison of Alternatives

The table below provides a brief summary and comparison of impacts to the physical and natural environment for the alternatives considered (Table 15).

Table 15: Comparison of Impacts to Resources

Resource	**Alternatives**	
	Construct a 58' weir (Proposed Action)	***No Action***
Geology & Topography	Minimal temporary impacts to geology and topography during construction, no long term effects	No effect
Sediments	Minimal temporary impacts to sediment during construction, no long term effects	No effect
Geomorphology and Dynamics within the Cutoff	Positive benefit for the Neuse river system by restoring natural riverine function which will improve fish migration by lessening flows from the cutoff and adding additional flows to the main stem of the Neuse.	Possible negative effect on migration of anadromous fish due to competing flows from the cutoff channel and the main stem of the Neuse is not improved

Resource	Alternatives	
	Construct a 58' weir (Proposed Action)	***No Action***
Prime and Unique Agricultural Land	Possible temporary impacts during construction, no long term effects	No effect
Water Quality	It is not clear wither the raised weir would have positive impact on the water quality of the Neuse River basin, more monitoring of the area would be required to determine any positive benefits	No effect
Wetlands & Floodplain	No effect	No effect
Vegetation	Possible temporary impacts during construction, no long term effects	No effect
Wildlife	Possible temporary impacts during construction, no long term effects	No effect
Threatened and Endangered Species	Positive effect on the Atlantic Sturgeon by increasing flow in the main steam of the Neuse River, thereby influencing more of the species to keep to the main stem rather than diverting up the cutoff to the weir. . Fish staying within the main stem will be able to access ~ 92 miles of additional spawning habitat (also listed critical habitat) upstream of the cutoff channel in the Neuse River and ~4.3 miles upstream in the Little River. The proposed action will have no effect on other listed T&E species or their designated critical habitat.	Potential negative effect on the federally endangered Atlantic sturgeon species and its critical habitat that could occur with the project area. The weir within the cut off channel will continue to act as a barrier to anadromous fish, such as the Atlantic sturgeon.
Fisheries and Essential Fish Habitat	Positive effect for anadromous fish found within the project area by increasing the velocity of water flow within the main stem of the Neuse River. This increase in flow will influence the migrating fish to stay within the main channel, so they avoid becoming trapped in the cutoff channel. By influencing migrating fish to stay in the main stem of the Neuse River, they are more likely to make it to more suitable spawning areas located upstream of the cutoff channel and within the Little River tributary	Negative effect on migrating fish within this portion of the Neuse River due to fish being trapped in the cutoff channel. Fish that swim into the cutoff channel often become trapped by the existing weir structure and are unable to successfully make it to upstream spawning areas

Resource	Alternatives	
	Construct a 58' weir (Proposed Action)	***No Action***
Benthos	The proposed action could possibly have a slight positive impact on the benthic community within the project area. The increased flow of water within the Neuse could improve water quality by continuing the flow regime within the main stem even during lower flow periods, this maintained flow would which would benefit benthic fauna by continuing to create a stable temperature and DO within this section of the river. Within the existing footprint of the proposed 58' weir located in the cutoff, the area was previously disturbed with the construction of the City of Goldsboro's temporary weir and currently there is riprap placed in the downstream location where the Corps' weir is proposed; it is unlikely that healthy benthic communities exist in this highly disturbed rip rap area so, no negative effects are anticipated to the benthic community in the vicinity of the cutoff	No effect
Cultural Resources	No effect	No effect
Socioeconomic Resources	No effect	No effect
Air Quality	Temporary local effects to air quality with increased emissions from construction equipment during the 3 month construction of the project.	No effect
Noise	Temporary local effects during construction, no long term effects	No effect
HTRW	No effect	No effect
Aesthetics	The proposed action will build a new weir in place of the old depilated Corps weir and replace old undersized riprap with new correctly sized riprap, thereby improving the overall appearance of the weir area within the cutoff. This will be a positive effect on the aesthetics within the project area.	No effect

5.11 Cumulative Impacts

The Federal Executive Branch's Council on Environmental Quality defines cumulative impact as "the impact on the environment [that] results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7, National Environmental Policy Act of 1969, as amended).

During the scoping process significant or potentially significant cumulative impacts issues associated with the proposed action were identified such as the need for improved anadromous fish passage up the main stem of the Neuse River by removing barriers and restoration of water flows to the Neuse River without increasing flooding on surrounding property. The scoping process established the geographic project area, time frame for the analysis, and identified other actions affecting resources and the surrounding ecosystem.

The affected environment described in this report found in Sections 5.1-5.9 highlights the current baseline condition and identifies resources, ecosystems and human communities found within the project area. The proposed action was evaluated for regulatory and policy compliance. Additionally, scientific data available for the project area was analyzed and included in the report to show how the natural and human environment would respond to the construction of a 58' weir and any possible effects from the weir height change.

The proposed action to construct a weir at elevation 58' within the cutoff channel will have minimal impacts on the natural and physical resources within the proposed project area. A summary of these impacts (cause-and-effect relationships) are listed in this repot in section 5.10 Table 16. Minor short-term impacts to water quality, air quality and noise may occur within the immediate footprint of the weir while construction is taking place. The proposed action will likely have a positive long term effect on the fisheries resources found within the Neuse River by increasing the connectivity of the anadromous fish to spawning areas located 92 miles upstream of the confluence of the cutoff and the additional spawning areas 4.3 miles upstream within the Little River.

Cumulative impacts associated with the proposed action will be minor and temporary short-term. In summary, the proposed action is expected to result in an overall improvement to fisheries resources of the Neuse River and have no long-term negative effects. Mitigation will not be required for implantation of the proposed action.

Monitoring for the Neuse River Goldsboro 1135 will include collecting flow data within the main stem of the Neuse River at 5 (this number could be increased) designated areas that correlate with existing river bathometry survey points. These 5 locations will be sampled by the Corps once prior to construction to establish a baseline data set, once during the construction phase of the weir, and then annually for 5 consecutive years post construction. The sampling of the flow will be done using a portable flow meter that will allow for the river flow to be measured at the 5 prescribed locations. The goal of the flow monitoring will be to show an increase in flow within the main stem of the Neuse post construction. The increased in flow will show that more water is staying within the main stem thereby restoring the river to a more natural flow regime which will enhance the natural function of the ecosystem and provide for more connectivity for anadromous fish. The Neuse River-Goldsboro 1135 is not a feasible

candidate for Adaptive Management and additional information on this topic can be found in section 12.2 of this report.

6.0 Inland Water Analysis and Climate Change Considerations

Guidance for incorporating climate change impacts to inland hydrology in Civil Works studies, designs, and project is covered in *Engineering and Construction Bulletin No. 2016-25. Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects*, and "applies to all hydrologic analysis supporting planning and engineering decisions having an extended decision time frame. It provides guidance for incorporating climate change information in hydrologic analysis in accordance with the USACE overarching climate change adaption policy. This policy requires consideration of climate change in all current and future studies to reduce vulnerabilities and enhance the resilience of our water resources infrastructure." Applicable climate change language from a concurrent water supply re-allocation study within the Neuse River basin has been re-used in this analysis.

Overall, no strong signal exists within the qualitative and quantitative analyses described herein to indicate definitive climate change impacts that would warrant modifications to the historic hydrologic data sets being used in this study.

More detail is provided in section 8.0 of Appendix A.

7.0 Detailed Cost Estimate for Recommended Plan

The following costs are estimates that have not yet been certified. Adjustments to the estimates will occur as the project moves through final costs certification and into detailed design.

RECOMMENDED PLAN, "REBUILD WEIR TO ELEVATION 58.0 NAVD 88"
NEUSE RIVER-GOLDSBORO SECTION 1135 MODIFICATION OF FEDERAL PROJECT FOR IMPROVEMENT OF THE ENVIRONMENT

ESTIMATED TOTAL PROJECT COSTS
(all costs include contingency in accordance with Appendix H)

	2017 Q4 Price Level
	Prices
Direct Construction Costs	$1,159,211
Contingency	$231,842
Supervision and Administration (5.6% cost to construct)	$64,916
TOTAL PROJECT COST (without detailed design and real estate)	$1,455,969
Detailed Design	$275,000
Real Estate	$25,000 (all costs)
TOTAL PROJECT COST (with detailed design and real estate)	$1,730,969

ESTIMATED FEDERAL COST:	$1,298,227 (75%)
ESTIMATED NON-FEDERAL COST:	$432,742 (25%)

8.0 Real Estate Requirements

There will be minimal Real Estate requirements for this project. Wayne County granted a perpetual easement to the United States of America on 16 August 1947. It is anticipated that construction will occur within the existing easement. The non-Federal sponsor will be responsible for obtaining a staging and laydown area for a period of 18 months. Land located just to the south side of the cutoff contains approximately 90 acres and is a suitable area for staging of equipment and materials. The parcel currently supports a rock quarry operation, but there is sufficient reclaimed area for staging/laydown.

For further details regarding real estate requirements and related information, consult Appendix I.

9.0 Summary Coordination, Public Views, and Comments

9.1 Scoping

Initial comments and input were requested through a scoping letter that was mailed to Federal, state and local agencies and local municipalities on June 8, 2015. The scoping letter requested comments from agencies, interest groups and the public to identify significant resources and issues of concern with regard to the proposed project. A comment from the NC Wildlife Resources Commission comments mentioned that the resource agencies were in favor of the Corps looking into alternatives to improve conditions at the cutoff. While the NCDEQ Surface Water Protection Section commented that they recommend the cutoff channel be filled and the impact area restored to a forested state, thereby restoring the Neuse River's full flow and bed load carrying capacity. Scoping comments were received from NMFS, NC Natural Heritage Program, NCDEQ Surface Water Protection Section, NCDEQ Division of Waste Management Underground Storage Tank Section, NC Wildlife Resources Commission, and the NC Department of Public Safety.

9.2 Agency Meeting and Site Visit

A state and Federal agency site visit was held September 28, 2016 on site at the Neuse River cutoff project area in Goldsboro, NC. Meeting attendees included: U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), North Carolina Wildlife Resources Commission (NCWRC), representatives from the City of Goldsboro, and the USACE. The meeting was requested in a scoping letter submitted by NMFS on July 6, 2015. The meeting allowed the participating resource agencies a chance to see the proposed project area, including the cutoff, weir, and areas upstream and downstream of the cutoff. During the meeting alternatives for improvement of the area were discussed, as well as, potential restoration ideas and resource agency concerns.

9.3 National Environmental Policy Act (NEPA)

To ensure the draft integrated feasibility report and EA included an assessment of impacts on all significant resources in the project area, the Wilmington District circulated a scoping letter dated June 8, 2015 as stated in Section 9.1 above. All identified agency and stakeholder concerns were considered during the development of this EA. This draft report and EA will be sent out for a 30-day public review and all comments received will be considered during the development of the final report.

10.0 Status of Environmental Compliance (Including Executive Orders)

10.1 Clean Water Act

The proposed action has been evaluated under the Section 404(b)(1) (P.L. 95-2017) and is included in Appendix D. The proposed action will require a NCDWR 401WQC for the construction of the weir, pursuant to the Clean Water Act. The proposed action will be covered under WQC # 4089 for maintenance of existing flood control facilities. A copy of the WQC can be found in Appendix K. Written concurrence for the NCDWR WQC will be obtained prior to the start of work. To avoid any impacts to

water quality, proper sediment and erosion control features such as silt fence and cofferdams will be used during the construction. The USACE will comply will all conditions of the WQC.

Upon completion of the NEPA and Section 401 processes, the proposed action will be in compliance with the Clean Water Act. The no action alternative complies with sections 404 and 401 of the Clean Water Act.

10.2 Executive Order 11988 (Floodplain Management)

This Executive Order states that each Federal agency shall avoid long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development whenever practical.

The proposed action would be constructed within the 1 percent floodplain (100 year). However, this project is considered environmental restoration and is not anticipated to create any significant change to the 1 percent floodplain (100 year), therefore no adverse effects to the floodplain are expected. There are no viable alternatives to provide ecological lift to the Neuse main stem project area that are outside of the floodplain. The proposed weir raise to elevation 58' will not result in any changes to the floodplain, so there will be no losses of natural and beneficial floodplain values. It is not expected that the proposed action will induce development within the floodplain. Additionally, this draft report will also be circulated for public review.

The no action alternative would not construct or alter any features within the project area located within the 100-year floodplain, therefore the no action alternative would not have an impact on the floodplains within the Neuse River cutoff area.

10.3 Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations)

Environmental justice is defined as the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EPA further defines fair treatment to mean that no group of people should bear a disproportionate share of the negative environmental consequences of industrial, governmental, or commercial operations or policies.

The proposed action will provide positive benefits to the Neuse River ecosystem which will result in positive benefits to the communities of Goldsboro and lands surrounding the project area. The proposed action will not have the potential for disproportionate health or environmental effects on minorities or low-income populations or communities and will be in full compliance with Executive Order 12898 following completion of the NEPA process.

10.4 Executive Order 11593 (Protection and Enhancement of the Cultural Environment)

This Executive Order states that the Federal Government shall provide leadership in preserving, restoring and maintaining the historic and cultural environment of the Nation. Agencies of the executive branch of the Government shall (1) administer the cultural properties under their control in a spirit of stewardship and trusteeship for future generations, (2) initiate measures necessary to direct their policies, plans, and programs in such a way that Federally owned sites, structures, and objections of historical, architectural or archaeological significance are preserved, restored and maintained for the inspiration and benefit of the people, and (3), in consultation with the Advisory Council on Historic

Preservation, institute procedures to assure that Federal plans and programs contribute to the preservation and enhancement of non-Federally owned sites, structures and objects of historical, architectural, or archaeological significance.

The proposed action will not affect cultural resources and will be in full compliance with Executive Order 11593 following completion of the NEPA process.

10.5 Executive Order 11990 (Protection of Wetlands)

This Executive Order mandates each Federal agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

The proposed action would not result in placement of fill in wetlands. Additionally, the proposed work will not result in significant negative hydrologic or salinity changes affecting wetlands. The proposed action will be in compliance with Executive Order 11990 following the completion of the NEPA process.

10.6 Executive Order 13045 (Protection of Children from Environmental Health Risks)

This Executive Order mandates Federal agencies to identify and assess environmental health and safety risks that may disproportionately affect children as a result of the implementation of Federal policies, programs, activities, and standards.

In Wayne County, persons under 18 years old make up about 23.9% of the population or about 29,672 people. Student enrollment for the 2012-2013 school year was about 19,468 students and there are 31 public schools in Wayne County (U.S. Census 2016).

No long-term adverse impacts on schools, residential and commercial areas, or other known gathering places for children are anticipated with the proposed action. The proposed action will be in compliance with Executive Order 13045 following the completion of the NEPA process.

10.7 Executive Order 13693 (Planning for Federal Sustainability in the Next Decade)

Executive Order (EO) was issued 19 March 2015 (EO 13693 Planning for Federal Sustainability in the Next Decade). Federal leadership will continue to drive national greenhouse gas reductions and support preparations for the impacts of climate change through a combination of more efficient Federal operations such as outlined in EO 13693. There is an opportunity for agencies to reduce direct greenhouse gas emissions for at least 40 percent over the next decade while fostering innovation, reducing spending and strengthening the communities where Federal facilities are located. The first priority should be placed on reduction of energy use and cost and secondly finding renewable or alternative energy solutions. Employing this strategy for the next decade calls for expanded and updated Federal environmental performance goals with a clear overarching objective of reducing greenhouse gas emissions across Federal operations and the Federal supply chain.

The proposed action is the least cost, engineeringly sound, environmentally acceptable (Federal Standard) plan. Wilmington District will continue to implement positive changes to meet the goals outlined in EO 13693. The proposed action will be in compliance with Executive Order 13693 following the completion of the NEPA process.

10.8 Executive Order 13112 (Invasive Species)

This Executive Order mandates Federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

The proposed action will not promote invasive species proliferation within the project area or surrounding area. Any subsequent occurrence of any invasive species in the project vicinity would not solely be the result of the implementation of the recommended plan. The project area will be seeded with native riparian seed mix after project construction and monitoring for invasive vegetation and removal of any invasive vegetation found within the project site will be incorporated into the Operations and Maintenance Manual as part of the sponsor's yearly inspection. The proposed action will be in compliance with Executive Order 13112 following the completion of the NEPA process.

10.9 Executive Order 13186 (Protection of Migratory Birds)

This Executive Order mandates agencies to protect and conserve migratory birds and their habitats pursuant to the Migratory Bird Treaty Act of 1918, as amended.

Migratory birds are found along the banks and riverine areas of the Neuse River and the Neuse River cutoff channel. The birds use these areas for foraging and roosting habitat. The proposed action will require construction to build the proposed weir and remove the old weir. This construction will create noise, and have associated heavy equipment and the presence of workers. Impacts to the birds from the noise and presence of construction equipment could include limited ability for birds to sing and communicate with each other for mating, predator warning, and defending territory. Birds may also leave the areas around the project during construction, but will likely return once the project is complete. These impacts would likely be temporary and after completion of construction to migratory birds or their habitat in the project area are expected.

The proposed action will be in compliance with Executive Order 13186 following the completion of the NEPA process.

See table 16 for the relationship of the proposed action to Federal laws and policies.

Table 16: The relationship of the proposed action to Federal Laws and Policies

Title of Public Law	**US CODE**	***Compliance Status**
Abandoned Shipwreck Act of 1987	43 USC 2101	Full Compliance
Anadromous Fish Conservation Act of 1965, As Amended	16 USC 757 a et seq.	Full Compliance
Antiquities Act of 1906, As Amended	16 USC 431	Full Compliance
Archeological and Historic Preservation Act of 1974, As Amended	16 USC 469	Full Compliance
Archeological Resources Protection Act of 1979, As Amended	16 USC 470	Full Compliance
Clean Air Act of 1972, As Amended	42 USC 7401 et seq.	Full Compliance
Clean Water Act of 1972, As Amended	33 USC 1251 et seq.	Full Compliance
Coastal Zone Management Act of 1972, As Amended	16 USC 1451 et seq.	Full Compliance
Endangered Species Act of 1973	16 USC 1531	Full Compliance
Estuary Program Act of 1968	16 USC 1221 et seq.	Full Compliance
Equal Opportunity	42 USC 2000d	Full Compliance
Farmland Protection Policy Act	7 USC 4201 et seq.	Full Compliance
Fish and Wildlife Coordination Act of 1958, As Amended	16 USC 661	Full Compliance
Historic and Archeological Data Preservation	16 USC 469	Full Compliance
Historic Sites Act of 1935	16 USC 461	Full Compliance
Magnuson Fishery Conservation and Management Act – Essential Fish Habitat	16 USC 1801	Full Compliance
National Environmental Policy Act of 1969, As Amended	42 USC 4321 et seq.	Full Compliance
National Historic Preservation Act of 1966, As Amended	16 USC 470	Full Compliance
National Historic Preservation Act Amendments of 1980	16 USC 469a	Full Compliance
Native American Religious Freedom Act of 1978	42 USC 1996	Full Compliance
Executive Orders		*Full
Protection and Enhancement of Environmental Quality	11514/11991	Full Compliance
Protection and Enhancement of the Cultural Environment	11593	Full Compliance
Floodplain Management	11988	Full Compliance
Protection of Wetlands	11990	Full Compliance
Federal Actions to Address Environmental Justice and Minority and Low-Income Populations	12898	Full Compliance
Planning for Federal Sustainability in the Next Decade	13693	Full Compliance
Invasive Species	13112	Full Compliance

compliance once the NEPA process is complete.

11.0 Plan Implementation

11.1 Non-Federal Responsibilities

The City of Goldsboro has agreed to accept the role of non-Federal sponsor in the event of approval of a final Detailed Project Report. The City of Goldsboro has statutory authority under the Federal Water Resources Development Law of 1969 (G.S. 143-215.38 et.seq.) to make binding commitments to carry out the non-Federal responsibilities related to USACE projects, including making cash contributions to projects. In order to implement the Recommended Plan, the City of Goldsboro, as the non-Federal sponsor, would be responsible for the following:

1. Without cost to the U.S. Government, provision of legally sufficient title to real estate for all necessary land, easements, rights-of-way, and access routes necessary for project construction and subsequent operation and maintenance. Land provisions would include:

    a. construction site to accommodate all Federal project modification features to be constructed, and

    b. temporary staging area of acceptable location and acreage for contractor's use during construction period. Staging area will be a previously disturbed site.

2. In accordance with ER 1105-2-100, Appendix F, F-32, the non-Federal sponsor is responsible for 25 percent of total project costs during the design and implementation period. In accordance with the terms of the project partnership agreement (PPA), the non-Federal sponsor must provide all land, easements and right-of-ways (LER) required for the project, participate in the Project Coordination Team, and perform necessary non-Federal audits. The non-Federal sponsor also must perform investigations necessary to identify the existence and extent of hazardous substances on LER required for the project except for the investigations necessary to identify the existence and extent of hazardous substances on LER owned by the United States and administered by the USACE. If the value of the non-Federal sponsor's contributions listed above is less than 25 percent of total project costs, the non-Federal sponsor must make cash payment so that its contributions equal 25 percent of total project costs. The amount of cash contribution is currently estimated to be $432,742. This cash amount will vary depending on the actual real estate costs and in-kind services, if any.

3. Operation, maintenance, repair, rehabilitation, and replacement (OMRR&R) is a 100% non-Federal responsibility. OMRR&R is required to keep the project in viable condition to satisfy its design function over a long period of time. This funding would not be provided during the initial implementation of the project, but would become a yearly responsibility of the non-Federal sponsor upon completion of the construction phase. For section 1135 projects, OMRR&R work is usually performed by the non-Federal sponsor. However, upon request by the non-Federal sponsor, the Government may perform the OMRR&R of a Section 1135 project modification on behalf of the non-Federal sponsor, if the entire Section 1135 project modification is on lands for which the USACE has the necessary real estate interest and is responsible for operation and maintenance (i.e. the land has not been leased to another agency for fish and wildlife purposes). In such event, the non-Federal sponsor must pay the Government, in advance of performance of such work, for the costs of OMRR&R attributable to the Section 1135 project modification.

4. Satisfy all provisions of the PPA regarding non-Federal sponsor responsibilities in implementing the project.

11.2 Federal Responsibilities

In order to implement the Recommended Plan, the USACE would provide the Federal share of project cost, to equal project first cost less the total non-Federal share, not including Annual Operation and Maintenance expenses. The Federal share of project cost is currently estimated to be $1,298,227 which is 75% of Total Project Costs (not including Feasibility Phase costs). Federal expenditures shall not exceed $10 million for the entire project, including feasibility study costs. The USACE would also provide the following:

1. Review and certification of Real Estate provisions.
2. Design and Implementation of the project.
3. Contracting for project construction.
4. Supervision and Administration of project construction.

11.3 In-kind Contributions

In-kind contributions are work performed by and/or materials provided by the non-Federal sponsor pursuant to an executed agreement for which the sponsor receives a credit toward its share of total project costs if the work (and materials) is determined to be integral to the project. At this time, the non-Federal sponsor does not intend to provide any in-kind contributions for this project.

11.4 Project Partnership Agreement (PPA)

After approval of a final Detailed Project Report for this Neuse River-Goldsboro Section 1135 project, the PPA would be executed. A PPA is a legally binding agreement between the USACE and a non-Federal sponsor (in this case, the City of Goldsboro, NC) for construction of a water resources project, in this case, modification of the existing USACE Goldsboro Cutoff Project for improvement of the environment. The PPA would describe the project and the responsibilities of the USACE and the City of Goldsboro in the cost sharing and execution of project work.

11.5 Sponsor Views

The City of Goldsboro has expressed support for this project and has agreed to accept the role of non-Federal sponsor in event of approval of a final feasibility report. The City of Goldsboro supports the alternative of weir modification to elevation 58’ NAVD88. Since this alternative is also the Federally Recommended Alternative, it is considered the Recommended Plan.

12.0 Monitoring and Adaptive Management

12.1 Monitoring Plan

In accordance with Section 2039 of the Water Resources Development Act of 2007 (WRDA 2007), feasibility studies for ecosystem restoration are required to include a plan for monitoring the success of the ecosystem restoration. “Monitoring includes the systematic collection and analysis of data that

provides information useful for assessing project performance, determining whether ecological success has been achieved, or whether adaptive management may be needed to attain project benefits." Accordingly, Section 2039 also directs that a Contingency Plan (Adaptive Management Plan) be developed for all ecosystem restoration projects.

The goal of monitoring for the project is to measure whether the project objectives have been met or not. Monitoring will be carried out until the project has been determined to be successful in meeting ecological project goals, as required by Section 2039 of WRDA 2007, as noted in paragraph 3.c of the implementation guidance. Pre-construction, during-construction, and post-construction monitoring shall be conducted by the USACE and cost shared with the local sponsor. Cost-shared post construction monitoring will continue for 5 years for this sponsor.

Monitoring for the Neuse River Goldsboro 1135 will include collecting flow data within the main stem of the Neuse River at 5 (this number could be increased) designated areas that correlate with existing river bathymetry survey points. These 5 locations will be sampled by the USACE once prior to construction to establish a baseline data set, once during the construction phase of the weir, and then annually for 5 consecutive years post construction. The sampling of the flow will be done using an averaged velocity-area float method that will allow for the river flow to be measured at the 5 prescribed locations. The goal of the flow monitoring will be to show an increase in flow within the main stem of the Neuse post construction. An increase in flow will show that more water is staying within the main stem thereby restoring the river to a more natural flow regime which will enhance the natural function of the ecosystem and provide for more connectivity for anadromous fish.

The Neuse River Goldsboro 1135 will be considered successful if at the end of the 5 years the site is documented to have a measurable increase in average flow velocity during a particular flow condition. This flow will be defined as a condition where the current cutoff weir would have been overtopped pre-construction but would be prevented from overtopping post-construction.

Costs:

Cost for labor: $3,000 (estimate of manpower to sample and compile labor)

Number of Sampling Events (7):

The total cost for project monitoring will be: $21,000

* monitoring costs included as part of Total Project Costs and are cost shared on a 75% Federal/ 25% Non-Federal basis.

12.2 Adaptive Management

The primary incentive for implementing an adaptive management program is to increase the likelihood of achieving desired project outcomes given the identified uncertainties. All projects face uncertainties with the principal sources of uncertainty including (1) incomplete description and understanding of relevant ecosystem structure and function, (2) imprecise relationships between project management actions and corresponding outcomes, (3) engineering challenges in implementing project alternatives, and (4) ambiguous management and decision-making processes.

Given these uncertainties, adaptive management provides an organized, coherent, and documented process that suggests management actions in relation to measured project performance compared to desired project outcomes. In the case of the Neuse River Goldsboro 1135 project, an adaptive management program would be very challenging to implement in the event that the weir raise does not meet success criteria.

During the Neuse River 1135 feasibility process it became clear that the project may not be a candidate for adaptive management based on the Recommended Plan. The current Recommend Plan is to replace the existing weir with a weir that higher in elevation (58' NAVD 88). Building the weir to a higher elevation such as 59' or 60' was screened out during the study evaluation process due to the increasing negative effects of flooding and back water on portions of the Neuse River upstream of the weir. These effects conflicted with the purpose and intent of the original project weir as a flood control feature.

Additionally, other alternatives such as lowering the weir would not result in an increase to the flow within the main stem of the Neuse River and would not result in any benefits or improvements to the Neuse River ecosystem. Other potential adaptive features, such as installation of a fish barrier, at the confluence of the cutoff were considered and screened out during the feasibility study.

After evaluation, the Neuse River-Goldsboro 1135 is not a feasible candidate for Adaptive Management.

13.0 Recommendations

The Tentatively-Selected Plan, Alternative B2, has been determined to be the plan that would provide the greatest ecosystem restoration benefits in the most cost effective manner within the cost and planning constraints of the Section 1135 Authority, and is also the plan most desirable to the local sponsor while having minimal adverse environmental impacts. This plan has therefore been selected as the Recommended Plan for implementation, upon approval of a final feasibility report and execution of a PPA.

14.0 References

Civil-Geotechnical-Surveying CESI. Hydrographic Survey Neuse River Cutoff Goldsboro, North Carolina. 2016.

Federal Emergency Management Agency. Wayne County, North Carolina Flood Insurance Study. 2013

Harvey E Jobson and David C. Froehlich, United States Geological Survey. Open-File Report 88-707. Basic Hydraulic Principles of Open-Channel Flow. 1988

Municipal Code Corporation. *Wayne County, North Carolina – Code of Ordnances*.

National Oceanic and Atmospheric Administration (NOAA). (2017). Essential Fish Habitat Mapper. Retrieved from <http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html>.

NOAA Fisheries. (2017). *Atlantic Sturgeon*. Retrieved from < https://www.fisheries.noaa.gov/species/atlantic-sturgeon >.

North Carolina Department of Agriculture and Consumer Services (NCDA&CS). (2016). *2016 Annual Progress Report (Crop Year 2015) on the Neuse Agricultural Rule (15 A NCAC 2B.0238)*. Retrieved from <http://www.ncagr.gov/SWC/watershed/documents/Final_Neuse_CY2015_Annual_Report.pdf >.

North Carolina Department of Environmental Quality (NCDEQ), Division of Air Quality. (2017). *Attainment Planning: Designation Status Maps*. Retrieved from < http://www.ncair.org/planning/attainment/>.

North Carolina Department of Environmental Quality (NCDEQ), Division of Marine Fisheries. (2017). *Atlantic Sturgeon*. Retrieved from <http://portal.ncdenr.org/web/mf/atlantic-sturgeon>.

North Carolina Department of Environmental Quality (NCDEQ): Division of Water Resources (DWR), Water Science Section. *Benthic Macroinvertebrate Assessment Data Website: Benthos Sampling Results*. Retrieved from <https://ncdenr.maps.arcgis.com/apps/webappviewer/index.html?id=8b1c7bf2303740e88fc2d870b054e1bd>.

North Carolina Department of Environmental Quality (NCDEQ): Division of Water Resources (DWR). *Neuse River Basinwide Water Quality Plan*. (2009). Retrieved from web 27 October 2017. https://files.nc.gov/ncdeq/Water%20Quality/Planning/BPU/BPU/Neuse/Neuse%20Plans/2009%20Plan/NR%20Basinwide%20Plan%202009%20-%20Final.pdf

North Carolina Department of Environmental Quality (NCDEQ): Division of Water Resources (DWR). *North Carolina Integrated Report 305(b) List and the Impaired Waters 303(d) List* (2014). Retrieved from web 7 September 2016. http://deq.nc.gov/about/divisions/water-resources/planning

North Carolina Department of Public Safety, Emergency Management, North Carolina Geodetic Survey. LiDAR Quality Control Report – 2014 Statewide LiDAR Project. 2015.

North Carolina Wildlife Resources Commission (NCWRC). *Yellow Lance*. (2017). Retrieved from <http://www.ncwildlife.org/Learning/Species/Mollusks/Yellow-Lance>.

Schnabel Engineering. Feasibility Study – Relocation and Redesign of the Intake Structure on the Neuse River, City of Goldsboro, Goldsboro, NC. 2017

United States Geological Survey. Measurement of Bedload Transport in Sand-Bed Rivers: A Look at Two Indirect Sampling Methods. Geological Survey Scientific Investigations Report 2010-5091. 2010

United States Department of Agriculture. Natural Resources Conservation Service. Part 654 Stream Restoration Design National Engineering Handbook. Technical Supplement 14N Fish Passage and Screening Design. 210-VI-NEH, August 2007.

U.S. Army Corps of Engineers. Rivers and Harbors – Wilmington, N.C., District. Report of the Chief of Engineers, U.S. Army 1941, Part I, Vol. I. Annual Reports, War Department. 1941.

U.S. Army Corps of Engineers – Wilmington District. Water Control Manual, Falls Lake Project, Neuse River Basin, North Carolina. 1990.

U.S. Army Corps of Engineers – Neuse River Basin Integrated Feasibility Report and Environmental Assessment. 2012.

U.S. Army Corps of Engineers. Engineering and Construction Bulletin No. 2016-25. Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects. Issued: 16 Sep 16. Expires: 16 Sep 18. 2016.

U.S. Army Corps of Engineers – Water Resources Support Center. Planning Manual. IWR Report 96-R-21. November 1996.

U.S. Army Corps of Engineers – Wilmington District (USACE SAW). Falls Lake Reallocation Study. Draft Final Report. 2017.

U.S. Census Bureau. (2016). Quick Facts, Wayne County, North Carolina. Retrieved from https://www.census.gov/quickfacts/fact/table/waynecountynorthcarolina/AGE295216#viewtop

U.S. Department of Agriculture (USDA): Natural Resources Conservation Service (NRCS). *Custom Soil Resource Report for Wayne County, North Carolina*. Retrieved from web 2 September 2016. http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

U.S. Department of Agriculture (USDA): Natural Resources Conservation Service (NRCS). 1974. *Soil Survey of Wayne County, North Carolina*. Retrieved from web 2 September 2016.http://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/north_carolina/wayneNC1974/text.pdf

U.S. Environmental Protection Agency (EPA). Envirofacts. (2016). Retrieved from web 6 September 2016. http://www.epa.gov/enviro/.

U.S. Fish and Wildlife Service. 2017. *Species status assessment report for the Yellow Lance* (*Elliptio lanceolata*). Version 1.2. March, 2017. Atlanta, GA.

U.S. Fish and Wildlife Service. (2017). *Yellow Lance* (*Elliptio lanceolata*). Retrieved from <https://www.fws.gov/southeast/wildlife/mussels/yellow-lance/>.

U.S. Fish and Wildlife Service. 2017. *IPAC Endangered Species Review; species list*. Retrieved from web 12 May 2017. https://ecos.fws.gov/ipac/.

U.S. Geological Survey (USGS). *Mineral Resources On-Line Spatial Data: Geologic Units in Wayne County, North Carolina*. Retrieved from web 2 September 2016. http://mrdata.usgs.gov/geology/state/fips-unit.php?code=f37191.

War Department, Office of the Chief of Engineers. House of Representatives, 77th Congress 1st Session. Document No. 327. Neuse River, N.C., Letter from the Secretary of War. 1941.

Wayne County, NC, 2011. Retrieved from web 24 August 2016. <https://www.municode.com/library/nc/wayne_county/codes/code_of_ordinances?nodeId=COORCOWANOCA>.

APPENDIX A

Hydraulic and Hydrology (H&H)

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Exhibits

Tables

Figures

Acronyms

AEP – Annual Exceedance Probability
CAP – Continuing Authorities Program
CFS – Cubic feet per second
EBA – Environmental Benefits Analysis
FEMA – Federal Emergency Management Agency
FIS – Flood Insurance Study
HEC-RAS – Hydrologic Engineering Center – River Analysis System
HEC-SSP – Hydrologic Engineering Center – Statistical Software Package
LiDAR – Light Detection and Ranging
NAVD88 – National American Vertical Datum of 1988
NGVD29 – National Geodetic Vertical Datum of 1929
NLCD – National Land Cover Database
SAW – U.S. Army Corps of Engineers - Wilmington District
USACE – United States Army Corps of Engineers
USGS – United States Geological Survey
WSEL – Water Surface Elevation

1 Project Location and Description

The Federal cut-off channel and weir is located on the Neuse River in Wayne County, due Southwest of Goldsboro, North Carolina. The original purpose of the project was flood control. It is approximately 100 river miles downstream of the U.S. Army Corps of Engineers (USACE) Falls Dam. The Goldsboro, Neuse River, N.C. Federal Project map is shown in Figure 1. Historic design documentation is sparse. What information is known about the original design is described in the following text is from House of Representatives Document No. 327 (1941):

> The Plan of improvement proposed: The plan of improvement proposed contemplates the excavation of a cut-off channel across the bend located above mile 95, as shown on the accompanying maps. It is proposed to construct the cut-off by excavating a pilot cut in the form of a spillway channel having a bottom width of 20 feet and side slopes of 1 and 1.5, leaving the river at mile 102.5 and emptying back into the stream at mile 94.8. This spillway channel would be about 6,400 feet long (including 180 feet of river crossing), while the distance around the bends is about 7.7 miles; the low-water slope in this distance has a fall of about 7.5 feet. It is proposed to excavate the upper end of the cut-off to an initial elevation of about 2 feet above the low-water plane. So that at the lower stages a portion of the flow would continue to pass through the existing channel and furnish sufficient water to dilute the effluent from the Goldsboro sanitary sewer outlet, located just below the mouth of Little River. A check dam of creosoted timber piles protected by riprap, located near the upper end of the cutoff, in included in the plan in order to insure the maintenance of the low-water flow in this section of the river. At higher stages the cut-off would divert a portion of the flood discharge on the steeper gradient of about 5 feet per mile. Calculations given in detail in Appendix A (not available), indicate that during a flood similar to that of April 1936, when the Goldsboro gage registered 25.3 feet, the initial cut would effect a reduction of head of 0.2 foot at Beaverdam Swamp, 1.3 feet at the head of the cut-off, and 0.7 foot at the mouth of Little River, decreasing to practically nothing at the highway bridge. It is expected that erosion will increase the discharge capacity of the cut-off by about 25 percent within a few years then the reduction in head at the head of the cut-off would be 1.7 feet, and 0.9 foot at the mouth of Little River.

This Federal project is unusual for the Wilmington District in that it was one of the only Flood Control (non-impoundment) Projects federally built and federally maintained. It is much more common for a project similar to this to be federally designed and built, then turned over to the local sponsor for maintenance. Perhaps due to this fact, it had undergone several weir repairs throughout its project life. The original timber pile design was replaced with metal sheet piles in 1968. Additional riprap was added to the downstream face of the weir in 1983. In 2007 the City of Goldsboro elected to replace riprap on the upstream and downstream face of the existing weir. Finally, in 2015, the City of Goldsboro constructed a new weir just downstream of the original. This new weir is further discussed in the following section.

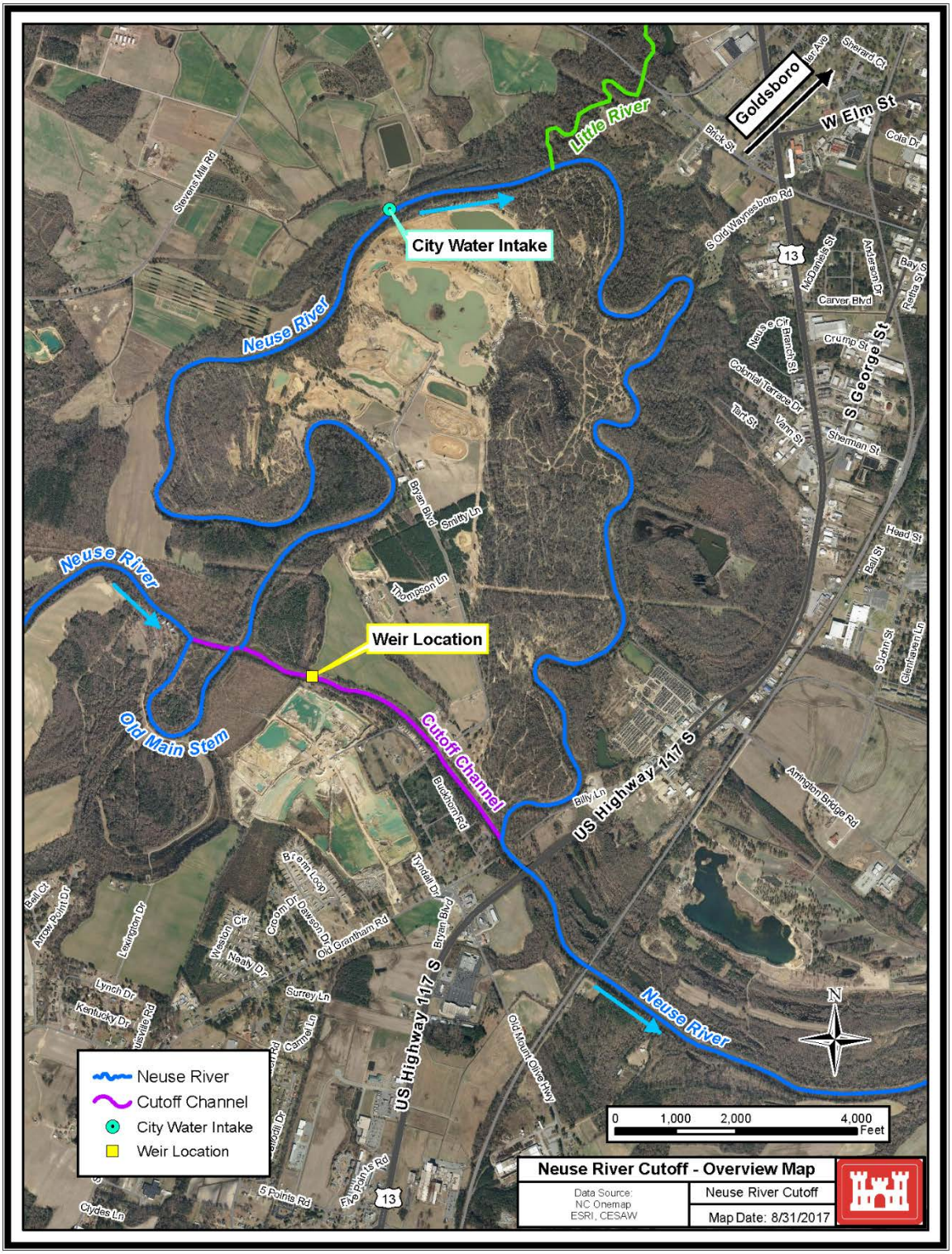


Figure 1 Neuse River Cut-off Overview Map

2 Existing Conditions

Currently, the size of the cut-off channel has enlarged such that the Neuse River now bypasses the natural meander upstream of the check dam (weir). This natural meander is shown in Figure 1 as the blue-colored, U-shaped line labeled “Old Main Stem”. The upstream end of the natural meander appears to have partially silted in and likely only experiences flow during high water events. Historically, flow would take a 90-degree right turn, travel for 1,500 feet then make a 180-degree turn to the north – a classic horseshoe bend. Once constructed, the cutoff channel allowed the Neuse River to take a shorter, more direct route and, over time, it became the primary flow path. Presently, flow at the junction point will back up this remnant channel where stream velocity drops to practically zero. The upstream portion of this remnant channel has silted in and will only reconnect to the Neuse River during high flow events. It is unclear as to when this remnant reach became secondary to the cutoff channel. It is assumed the cutoff channel above the junction was not designed to become the primary flow path for the Neuse River. Furthermore, there is now development near the vicinity of this portion of meander. This 800 foot section of cut-off channel likely discourages water from flowing north into the main stem, instead flowing east through the cut-off channel.

The cut-off channel has enlarged much greater than the 25-percent assumed in the original project design. In some portions of the cut-off channel the bottom width is as much as 100 to 200 feet across. The frequency in which the cut-off channel received flow from the Neuse River is likely a factor to this enlargement. Another factor may be the natural repose of soil material that makes up the cut-off channel footprint. Refer to Exhibit 1 and Exhibit 2 for a comparison of historic and current aerial photography of the upstream extents of the original Federal project.

Functionally completed in 2015, the City of Goldsboro went through a Section 408 process to essentially replace the existing cut-off channel weir structure. The existing weir had deteriorated to the point in which repair was deemed impracticable. The new weir structure was constructed within 20 feet downstream of the original weir and to a crest height of 56.0 feet, in the National American Vertical Datum of 1988 (NAVD88). It should be noted that the original design called for a crest height of 56.0 feet, in the National Geodetic Vertical Datum of 1929 (NGVD29). The county-wide datum conversion from NGVD29 to NAVD88 was -1.02 feet, per the 2013 Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS). The reasons are unknown as for why the 2015 weir was constructed a foot higher than the original design specifications. To date, there have been no significant comparative effects documented by either USACE or the City of Goldsboro related to the 1-foot taller weir.

Exhibit 1 Cut-off channel from 1950's. Neuse River still utilized meander as main flow path

Exhibit 2 Cut-off channel from 2010. Neuse River utilizes cut-off channel as main flow path

2.1 Watershed Description

The project area is in the Neuse River Basin. A United States Geological Survey (USGS) gage, ID 02089000, approximately 2 miles downstream of the cutoff exit, has a drainage area of 2,400 square miles. The watershed in this portion of the Neuse River is a mix of urban and rural development. The Neuse River immediately upstream of the cutoff channel entrance has a drainage area of approximately 2,059 square miles. The Neuse River immediately downstream of the cutoff channel exit has a drainage area of approximately 2,386 square miles. Two named streams drain into the Neuse within the Main stem meander. The Little River, with a watershed area of 315 square miles, drains into the Neuse near the midpoint of the meander. Big Ditch, with a watershed area of only 3 square miles, enters the Neuse roughly 1 mile downstream of the Little River confluence.

2.2 Developments in the Flood Plain at Goldsboro

The Neuse River flood plain is about 3 miles wide in the vicinity of Goldsboro. Most of the lands are agriculture, except along main traffic arteries where commercial and residential development has been heavy. The flood plain lands, being quite extensive, are generally under heavy development pressures. The flood plain development includes residential, commercial, and some industrial. Railroads, highways, utility lines, sewage treatment facilities, water treatment works, prisons, and a State hospital are also located in the flood plain. Urban expansion has and will probably continue to extend into the flood plain. The Little River flood plain is about 1.5 miles wide. This area has not been developed extensively for structural purposes because there are few traffic arteries across the flood plain. Most of the development which has occurred is along the roads that cross Little River flood plain on ground above the FEMA-established 1-percent floodplain. A notable exception to this is the N.C. State Hospital and Farm (Cherry Hospital) which is located in an area subject to flooding from both Neuse River and Little River. Little River flood plain is presently undeveloped; however, residential areas border this flood plain and development pressures are substantial.

2.3 Upstream Regulation

In 1983 USACE-built Falls Dam and reservoir began impounding water from the Neuse River approximately 100 river miles upstream of the Neuse River Cutoff project. The effects of regulation on current project benefits offered by the Neuse River Cutoff were not compared to pre-Falls Dam project benefits. Similarly, any statistical analyses performed on gaged river flow along the Neuse only considered a period of record from 1983 to current.

2.4 Bank Stability

Review of historic and current aerial imagery, as well as LiDAR topography, indicated that the banks of the Neuse River within the 7-mile meander reach are dynamic in nature. However, due to project constraints, there is currently not a concern of impacting bank stability within the project area.

2.5 Bed Stability

The nearby USGS stream gage, approximately 2 river miles downstream of the cut-off channel, was used to assess historical bed stability. USGS will routinely inspect the gage site and make stage – discharge rating shifts based on current sedimentation of the channel associated with their measuring equipment. Based on the rating documentation, the gage has witnessed 14 rating shifts throughout its period of record, 1930 - present. Six rating shifts have occurred post Fall Dams flow regulation with the longest span between shifts being approximately fourteen years. As this portion of the Neuse River consists primarily of a sandy bottom soil composition, it is not unusual to see a rating shift following a fairly significant (not necessarily major) flood event. For example, there was a rating shift following Hurricane Floyd in 1999 but not after Hurricane Matthew in 2016.

3 Hydrology

3.1 Nearby Stream Gages

Recorded data and statistics from the USGS gage *02089000 Neuse River near Goldsboro, NC* was applied to the H&H analysis of the project area. Location of the stream gage relative to the project area is shown in Figure 2. The gage site is approximately 11,500 linear feet downstream of the cutoff channel confluence.

The following data summary was extracted from the USGS inventory website (https://waterdata.usgs.gov):

02089000 Neuse River near Goldsboro, NC

LOCATION - Lat 35°20'15", long 77°59'51" referenced to North American Datum of 1983, Wayne County, NC, Hydrologic Unit 03020202, on left bank at downstream side of bridge on Secondary Road 1915, 0.2 mi upstream from Stony Creek, 1.5 mi downstream of Seaboard Coast Line Railroad bridge, 3.2 mi south of Wayne County courthouse in Goldsboro, 4.3 mi downstream of Little River, and 135 mi upstream from mouth. Refer to Table 1 for additional stream gage information.

Table 1 USGS 02089000 Neuse River near Goldsboro, NC Summary of All Available Data

DRAINAGE AREA - 2,399 mi².
SURFACE-WATER RECORDS
PERIOD OF RECORD - February 1930 to current year.
REVISED RECORDS - WSP 1333: 1931, 1935. WDR NC-81-1: Drainage area.
REMARKS - Flow regulated by Falls Lake (station 02087182).
For Water Year 2014: Records good except those for estimated daily discharges, which are poor.
For Water Year 2015: Records good.
EXTREMES OUTSIDE PERIOD OF RECORD - Floods of June 1866 and July 1919, reached stages of about 29 and 28 ft, respectively, at site 2.3 mi upstream at present datum, from flood profiles of U.S. Army Corps of Engineers. Flood of October 5, 1929, reached a stage of 27.3 ft at railroad bridge at present datum; discharge, 38,600 ft³/s.
EXTREMES FOR PERIOD OF RECORD - POST REGULATION Maximum Discharge: 38,500 ft³/s, Sept. 20, 1999; Maximum Gage-Height: 28.85 Sept. 20, 1999.
EXTREMES FOR PERIOD PRIOR TO REGULATION - Prior to regulation, maximum discharge: 30,700 ft³/s, September 27, 1945; gage height: 26.72 ft at site and datum then in use; minimum discharge: 76 ft³/s, September 26, 1968.

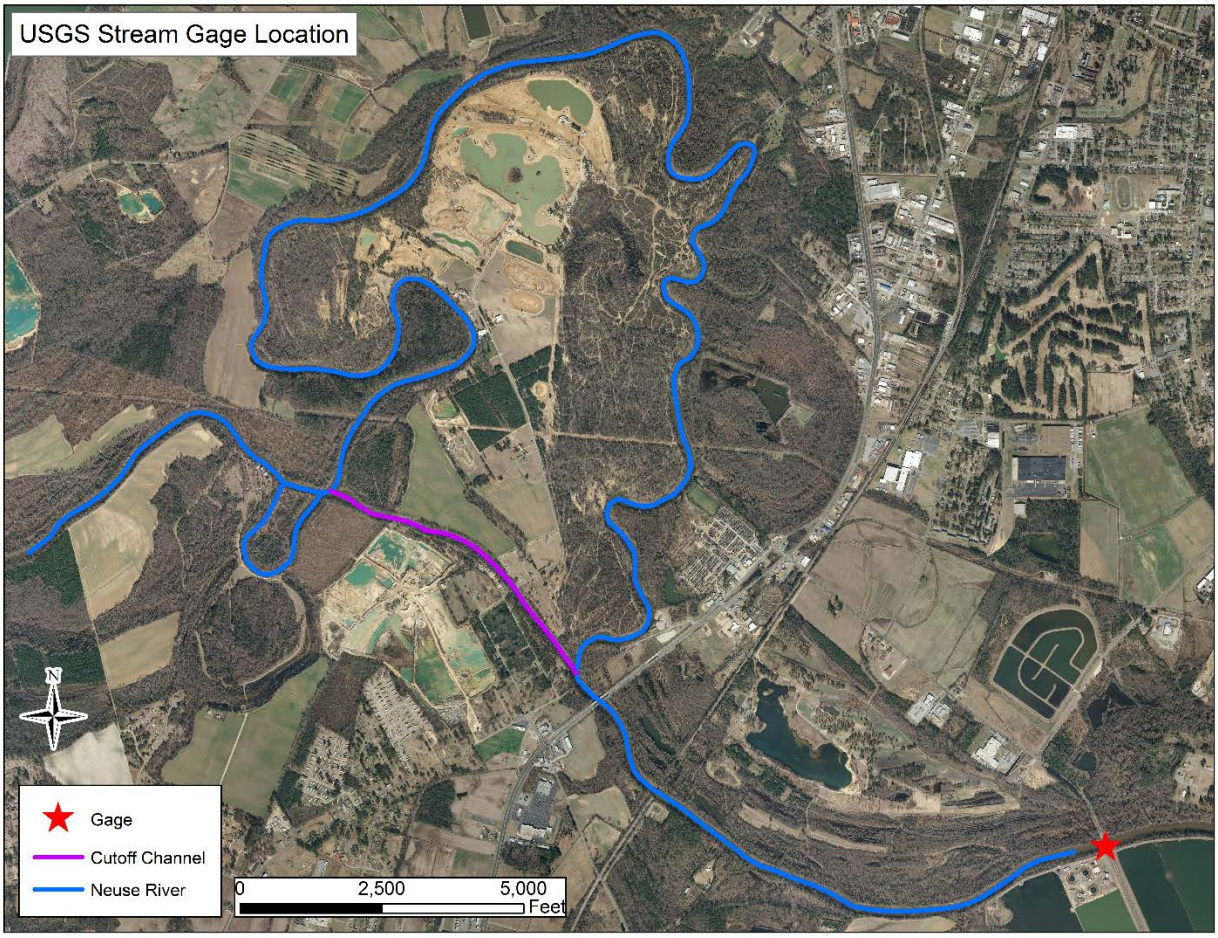


Figure 2 USGS Stream Gage Location

3.2 Statistical Analysis of Hydrologic Data

A Bulletin 17B frequency analysis of the USGS Goldsboro gage was conducted for a period of record covering Water Years 1983 to 2016. Hydrologic Engineering Center – Statistical Software Package (HEC-SSP) (v2.1) software was used to perform this analysis. A regional skew and mean squared error value of 0.4 and 0.302, respectively, were chosen for the generalized skew. The Expected Probability Curve was computed due to the relative short period of record due to upstream Falls Dam regulation. The resulting analytical curve and table is shown in Figure 3. For comparison, as shown in Table 2, Annual Exceedance Probability (AEP) of the 0.10 (10-year), 0.02 (50-year), and 0.01 (100-year) events were within 9-percent of the same discharges from the 2013 effective FEMA FIS.

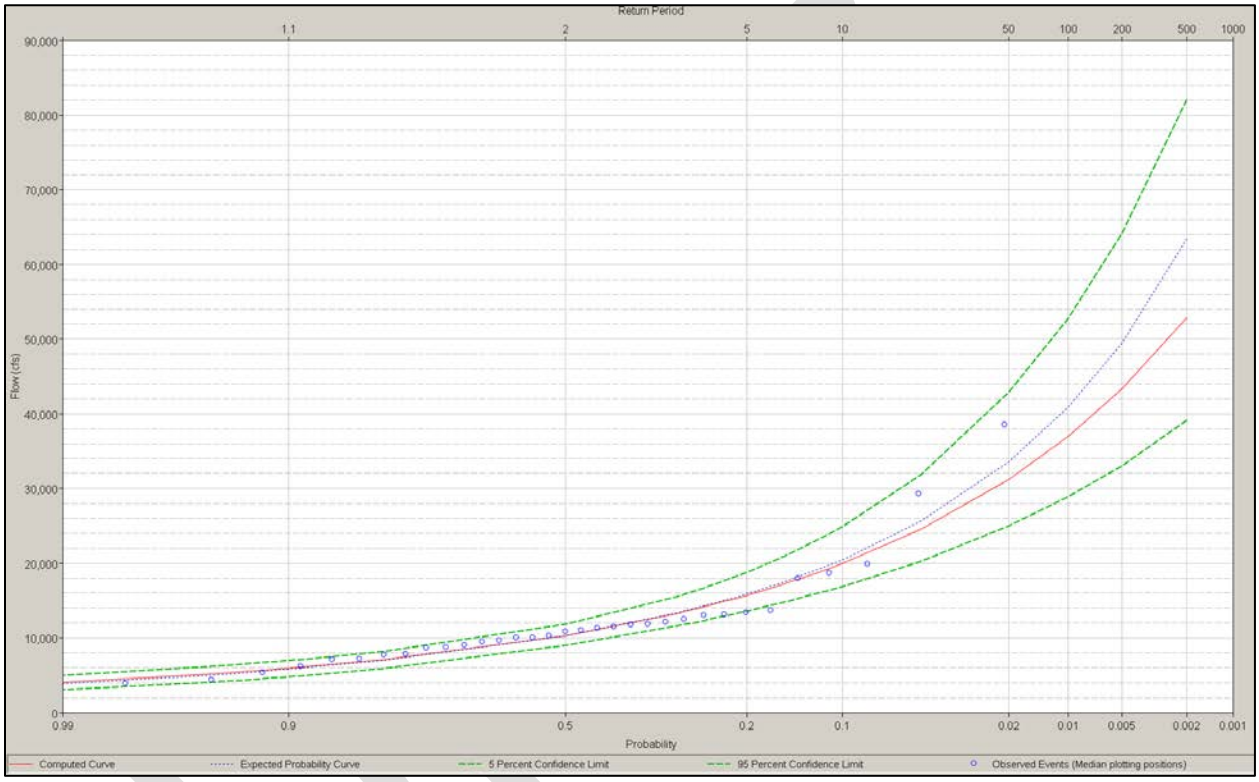


Figure 3 USGS Goldsboro Gage HEC-SSP Bulletin 17B Analytical Curve WY1983-2016

Table 2 USGS Goldsboro Stream Gage HEC-SSP vs. 2013 FIS Discharge

AEP Event (year)	HEC-SPP Discharge (cfs)	FIS Discharge (cfs)
0.1 (10)	20,434	22,536
0.02 (50)	33,622	33,243
0.01 (100)	40,899	39,093

3.3 Flow Statistics for Existing Conditions - Weir Overtopping

A series of historical photography, dates ranging from 2002 to 2016, was analyzed to develop a rough elevation-discharge rating curve for the weir location. Judgment was used to estimate either the amount (feet) of weir exposed or overtopped. Timestamps of the photographs, when available, were used to relate water surface elevation at the weir location to recorded flow, measured in cubic feet per second (cfs), at the downstream USGS Goldsboro stream gage location. Elevation-discharge points were plotted in Microsoft Excel and a linear trendline was fitted to the points. Elevation of the current top of weir was then used in the trendline equation to determine an average discharge at the stream gage location. As a result, any measured discharge at the USGS gage location that exceeded ~700 cfs would initiate weir overtopping.

4 Hydraulic Model Development

A two-dimensional Hydrologic Engineering Center – River Analysis System (HEC-RAS) (v5.0.3) model was created to depict the Neuse River in the vicinity of the cutoff channel. The model extents included both upstream and downstream portions of the Neuse River as well as the entire length of the cutoff channel. The main stem meander was also included in the model extents. The upstream boundary was located approximately 9 river miles above the cutoff channel entrance. The downstream boundary was located approximately 2 river miles below the cutoff channel exit.

The purposes of a two-dimensional model was to simulation a range of low flow (<= bank full) conditions that would capture the effects of increasing the maximum elevation of the weir structure. A model in 2-D would also be able to more accurately model the split flow conditions that exist at the cutoff channel entrance and exit.

4.1 Terrain

A Triangulated Irregular Network was created from 2014 Quality Level 2 (QL2) LiDAR. Bathymetry Data from existing FIS-based HEC-RAS models (Neuse River, Little River, and Big Ditch) as well as hydrographic surveys were used to “burn” in stream footprints. Cross Sections from the 2013 effective FEMA FIS HEC-RAS model are shown in Figure 4. For the FEMA model, surveys were taken at bridges as well as approximately every 4,000 feet between bridges. LiDAR data was collected between January 30, 2014 and March 13, 2014 during leaf-off conditions. The QL2 collection specified a Fundamental Vertical Accuracy (FVA) of 18.2 centimeters at the 95-percent confidence level to support 1-foot contour interval. The final terrain model is shown in Figure 5.

4.2 Land Cover

The National Land Cover Database 2011 (NLCD 2011) dataset was used to assign land cover types within the geometry area. Classifications are shown in Figure 6.

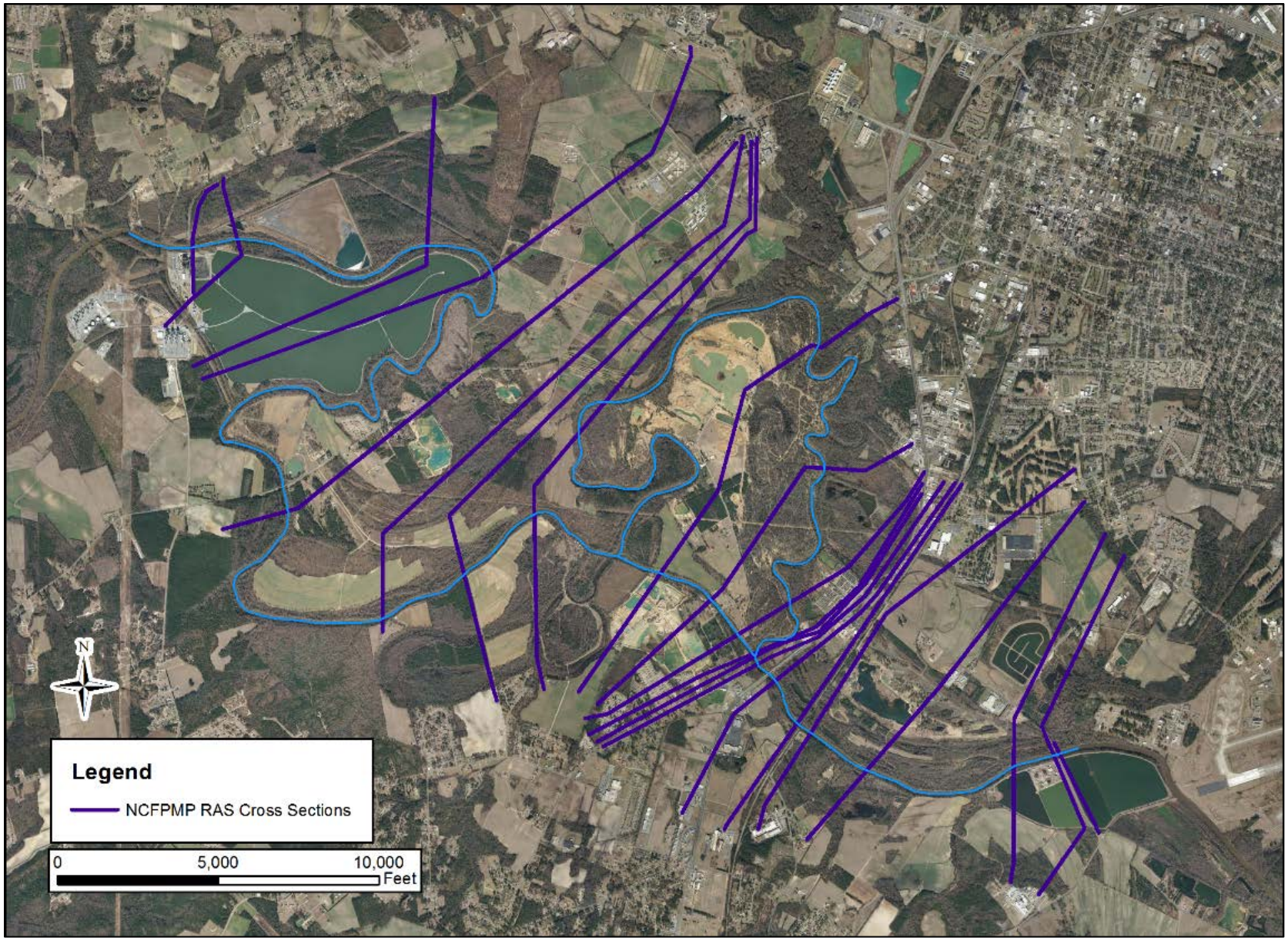


Figure 4 2013 Effective FIS HEC-RAS Cross Sections

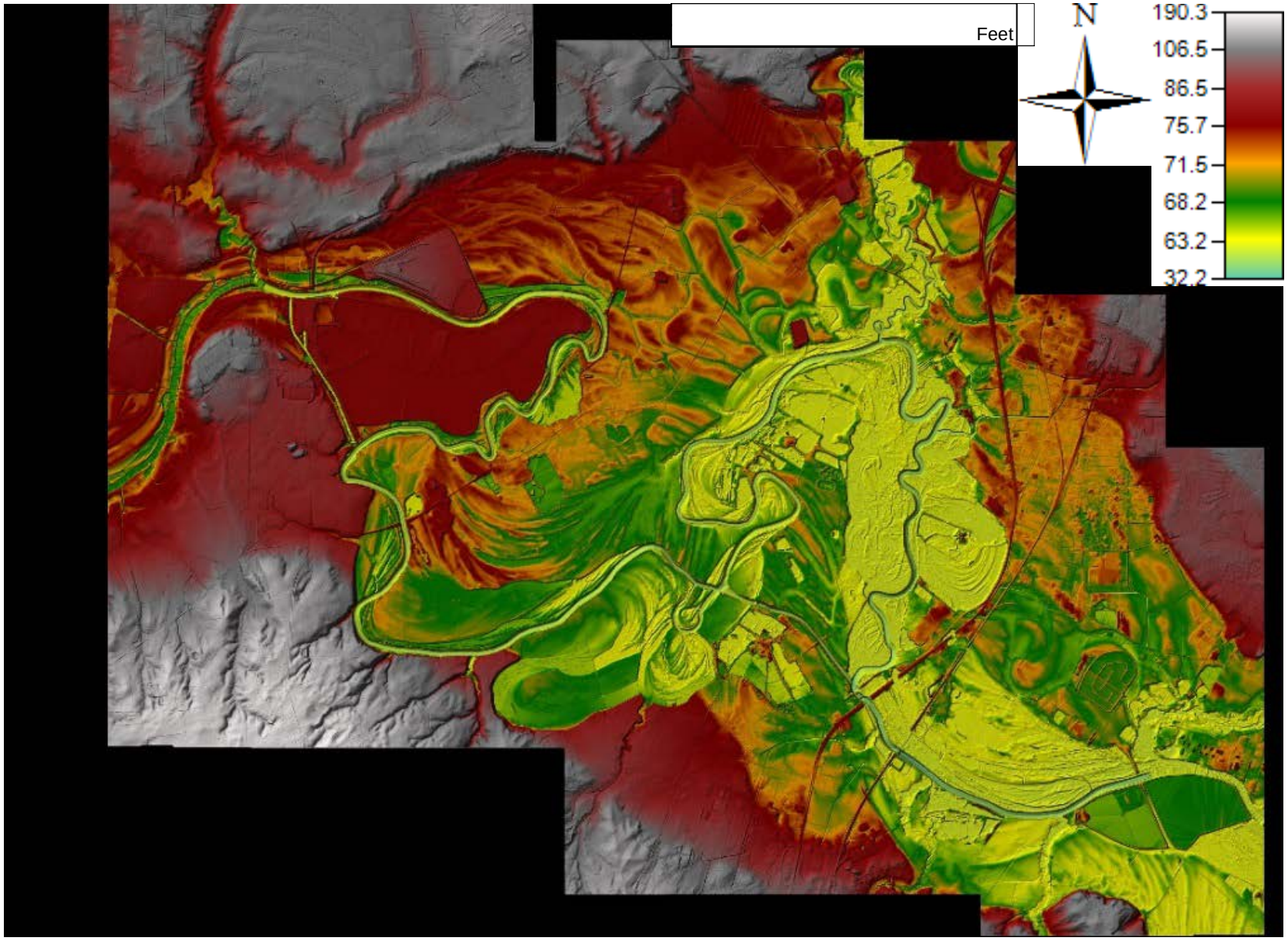


Figure 5 QL2 LiDAR

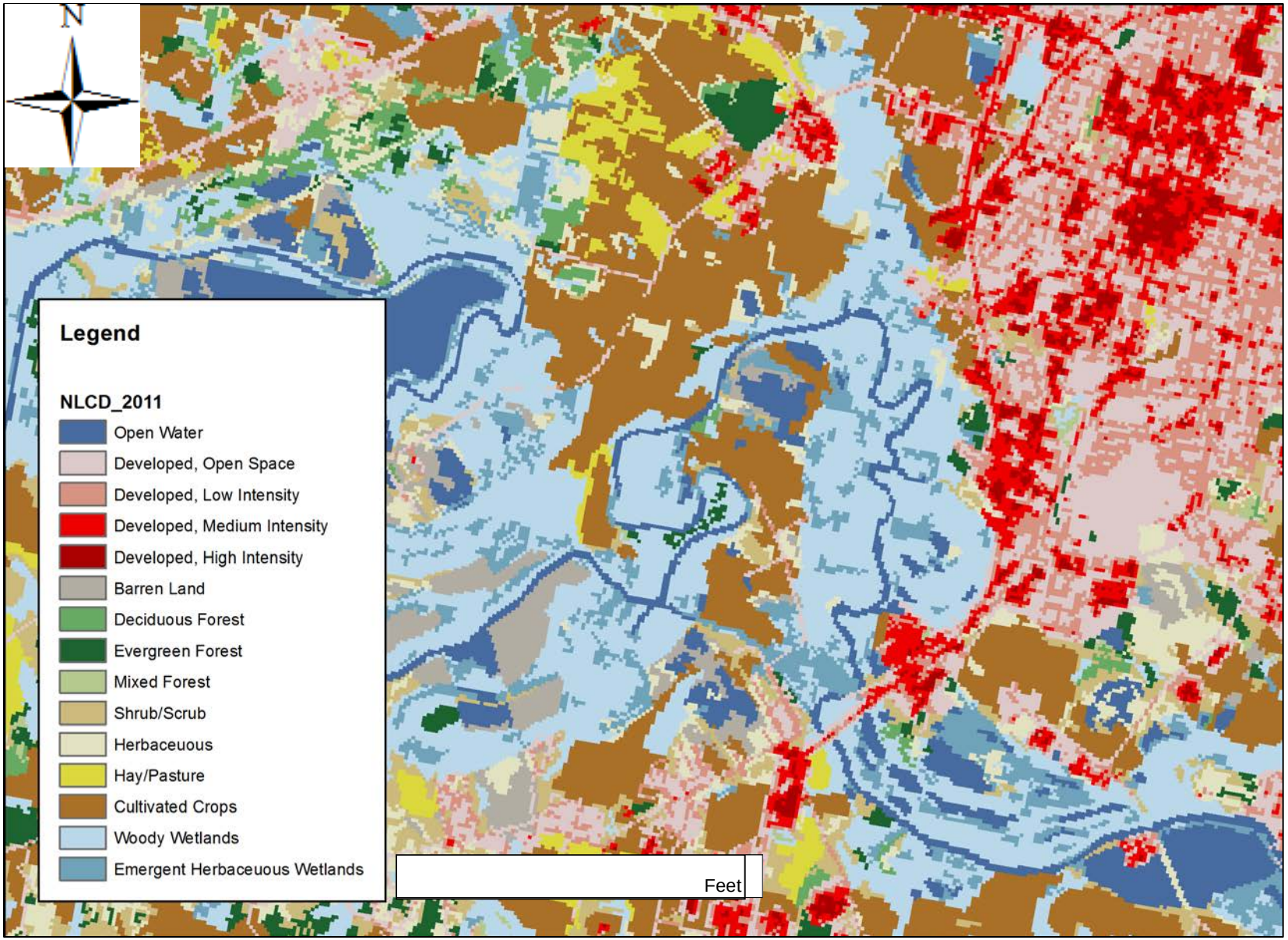


Figure 6 Land Classification for Project Area

4.3 Survey Data

Under a USACE contract, a hydrographic survey was conducted in November 2016 by McKim & Creed, Inc. on behalf of CESI Land Development Services. The survey included twenty nine hydrographic (XYZ) cross sections, see Figure 7 for cross section locations. The survey data did not completely tie into LiDAR, and because water levels during the survey were lower than when LiDAR was collected, data gaps were present. These gaps were filled by linear interpolation between the hydrographic survey and LiDAR. The Hydrographic survey report quoted a horizontal positional accuracy of 0.06 feet and a vertical accuracy of 0.14 feet.

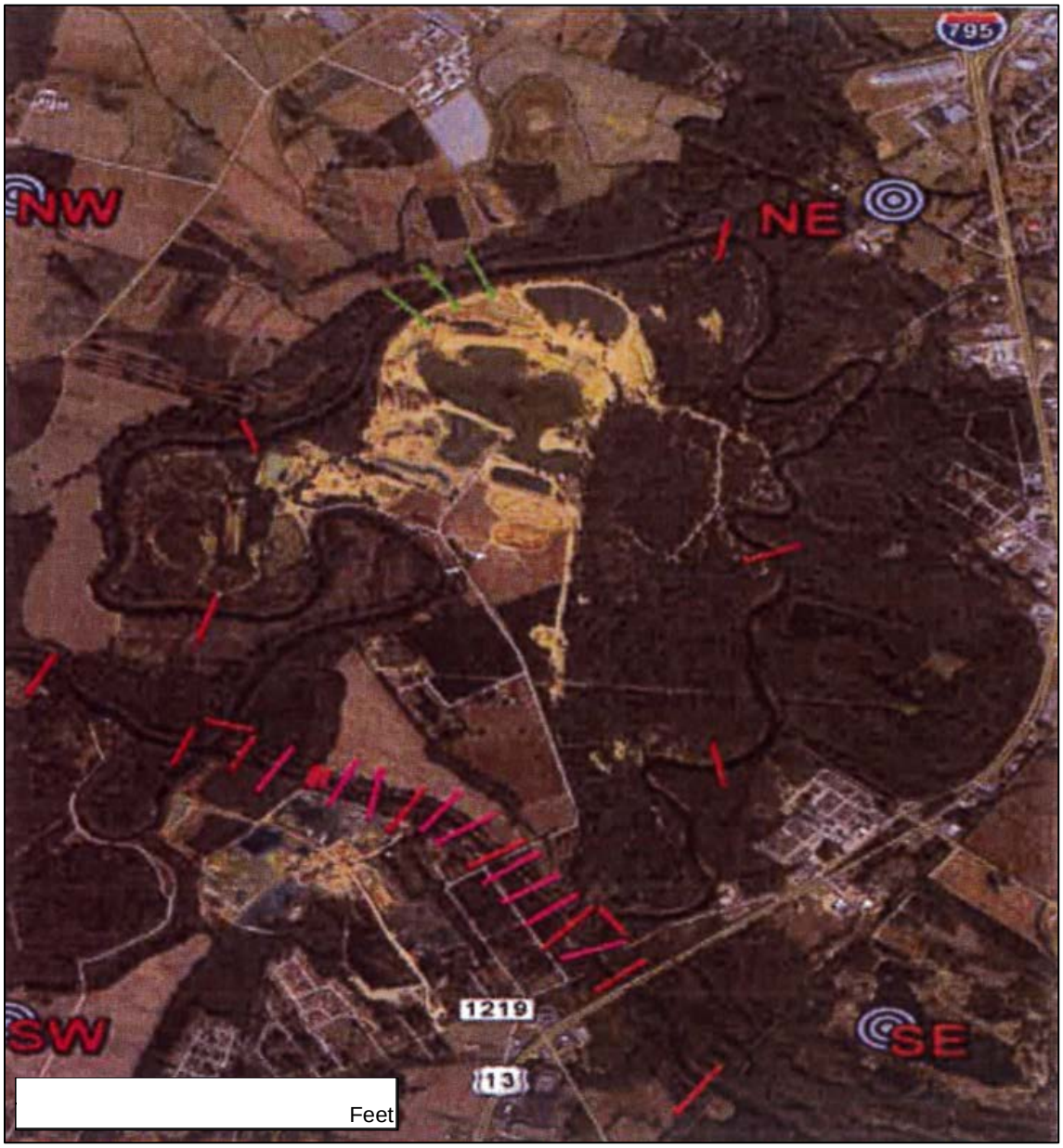


Figure 7 2016 Hydrographic Survey Cross Section Locations

4.4 Geometry

The two-dimensional mesh covered approximately 20 square miles and is shown in Figure 8. The mesh consisted of 100-foot by 100-foot square grid cells in the overbank and floodplain areas. Breaklines were placed along the bank tops of the Neuse River and cutoff channel, as well as along the existing weir crest. A grid cell spacing of 50-foot by 50-foot and 25-foot by 25-foot was used for the Neuse River and cutoff channel, respectively. A grid cell spacing of 10' by 10' was used for the weir centerline.

Geometry data from the effective 2013 FIS, one-dimensional, steady HEC-RAS model was incorporated into the 2-D model. The FIS cross section data supplemented the hydrographic survey data to produce a preliminary stream network. FIS cross sections were surveyed approximately every 4,000 feet along the Neuse River within the project area. As mentioned above, this network was then used to "burn" the bathymetry data into the LiDAR-based terrain model.

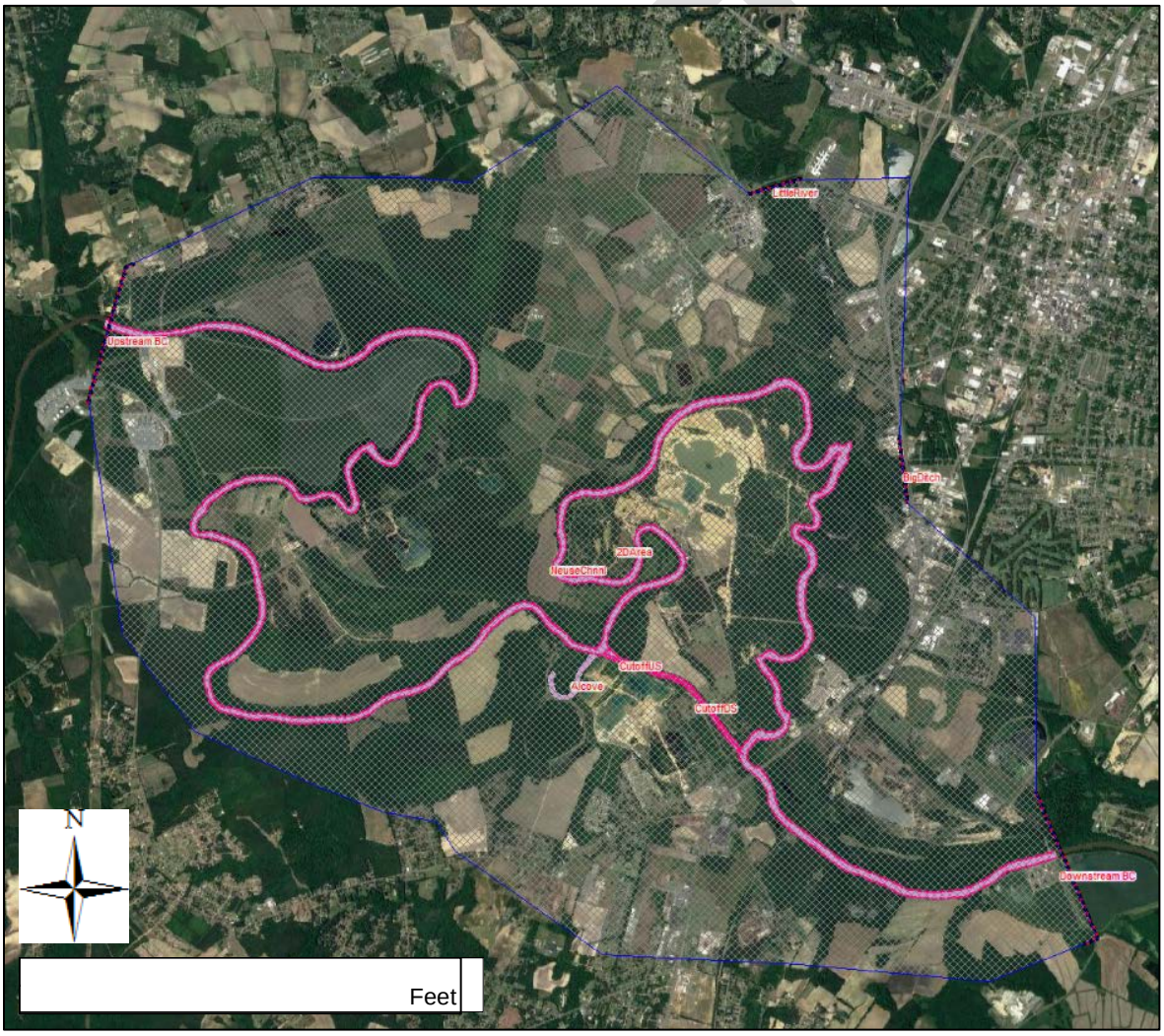


Figure 8 HEC-RAS Geometry Mesh

4.5 Bridges

The existing FIS model included some but not all bridge structures within the project area. This lack of a complete set of bridge survey data was one reason for the decision to not include any bridge structure within the 2-dimensional geometry. Primarily, for this project's purpose, it was assumed bridge piers would not obstruct flow during normal flows and that only during significant high flow would bridge decks potentially influence the hydraulics. As discussed in detail in Section 7 of this appendix, increased water levels produced by any of the proposed weir structures were no longer discernable from existing conditions during significant flow events. In this particular case, "significant" refers to flow high enough to reach known low chord elevations of bridge decks that were included in the FIS model.

4.6 Weir Structure

The existing and proposed dimensions of the weir structure within the cutoff channel were modeled by modifying the geometry-associated terrain. A series of terrain datasets were created by iterating the maximum weir elevation between existing (elevation 56 feet) up to 60 feet in 1-foot increments. Example of terrain manipulation within HEC-RAS is shown in Figure 9.

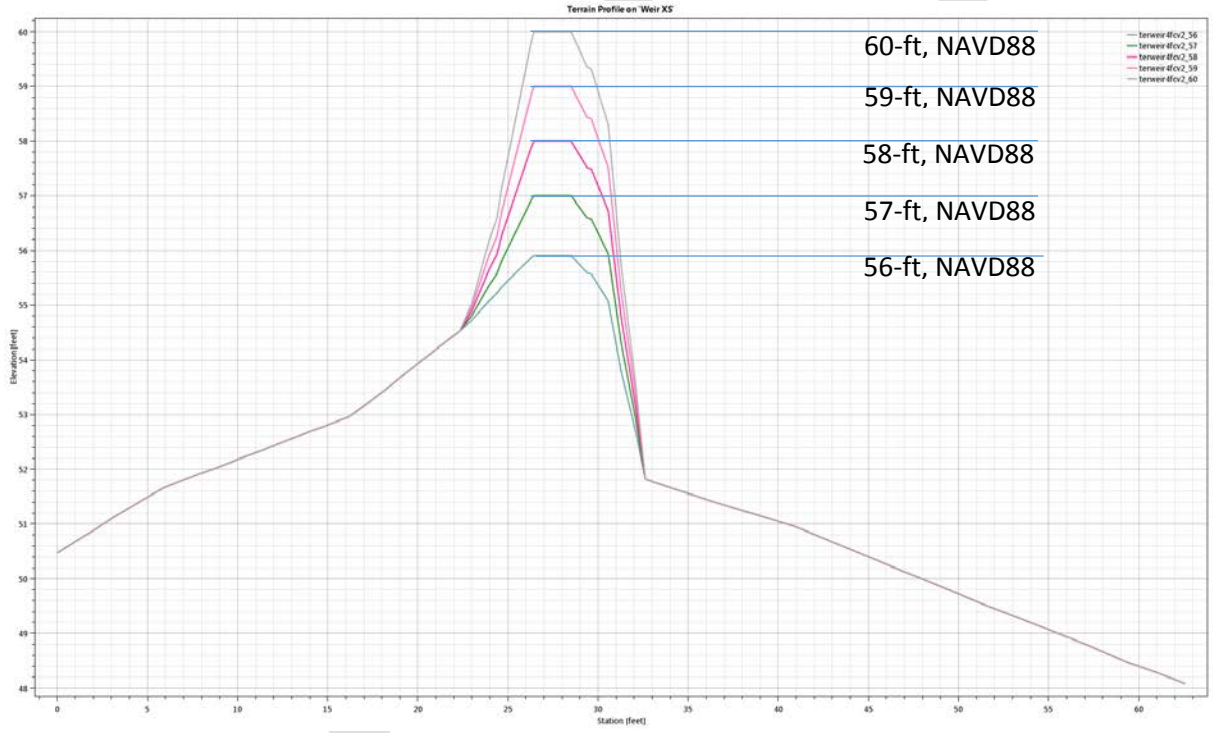


Figure 9 Example of Terrain Manipulation for Weir Modeling

4.7 Manning's roughness

Manning's n values were assigned to the geometry mesh by converting NLCD 2011 classification to land use. While the raster resolution of the NLCD 2011 was adequate for overbank and floodplain areas, land cover polygons were created to cover the Neuse and cutoff channel bank-to-bank footprint. Table 3 lists the land use types and n value assignment. An n value of 0.025 was chosen for the Neuse River main channel, based on suggested values for a channel described as "clean, winding, some pools and shoals" then applied to a major stream (top width at flood stage more than 100 feet) (FHWA). Channel n values for the Cutoff channel, both upstream and downstream of the weir structure, were higher in comparison due to the presence of more shoaling and ineffective flow areas.

Table 3 HEC-RAS Manning's N Values

Land Cover Type	Base Manning's n	Neuse	Cutoff U/S Weir	Cutoff D/S Weir
Open Water	0.035	0.025	0.035	0.045
Developed, Open Space	0.06	0.025	0.035	0.045
Developed, Low Intensity	0.08	0.025	0.035	0.045
Developed, Medium Intensity	0.09	0.025	0.035	0.045
Developed, High Intensity	0.1	0.025	0.035	0.045
Barren Land	0.09	0.025	0.035	0.045
Deciduous Forest	0.12	0.025	0.035	0.045
Evergreen Forest	0.2	0.025	0.035	0.045
Mixed Forest	0.15	0.025	0.035	0.045
Shrub/Scrub	0.15	0.025	0.035	0.045
Herbaceuous	0.15	0.025	0.035	0.045
Hay/Pasture	0.15	0.025	0.035	0.045
Cultivated Crops	0.12	0.025	0.035	0.045
Woody Wetlands	0.22	0.025	0.035	0.045
Emergent Herbaceuous Wetlands	0.2	0.025	0.035	0.045

4.8 Unsteady Flow Data

A flow hydrograph was used as the primary upstream boundary condition. The upstream boundary was located near the Beaverdam Creek point discharge to the Neuse River (1,948 square mile drainage area) that is used in the effective FIS (FEMA, 2013). Two additional flow hydrograph boundary conditions were inserted to simulate the added flow from the Little River and Big Ditch tributaries. Discharge measurements at the USGS gage at Goldsboro were transferred to the three boundary flow hydrographs through a ratio of drainage area at each location.

For a majority of flows analyzed, the shape of the boundary hydrographs consisted of a linear ramp up of discharge, roughly 100 cfs/hr, from zero to a maximum discharge. After reaching maximum discharge, the value was held for the remainder of the simulation time window. This allowed the model to sufficiently act as a continuous hydrologic simulation during normal bankfull conditions. The conservative ramp up of discharge, 100 cfs/hr, was based on weighing the rising hydrograph limb of multiple historical events measured at the USGS Goldsboro gage that ranged in magnitude from 12,000 cfs to 53,700 cfs. A range of hydrographs was derived covering events that occur sub-annually up to the approximate 0.05 AEP (20-year) event.

The downstream boundary condition was set to a normal depth and was located along the Neuse River at the USGS Goldsboro stream gage. A normal depth value of 0.0005 was applied to all flow events below 5,000 cfs. This value was primarily based on average bed slope, and energy gradient for the range of flood events analyzed under the 2013 FIS (0.10, 0.02, 0.01, 0.002 AEP). Generally, for conditions at or below 5,000 cfs, flow stays within the main river channel. For more significant flows,

above 5,000 cfs, a more mild normal depth value of 0.00015 was used to account for the influence of overbank roughness values.

4.9 Unsteady Flow Analysis

The Diffusion Wave equation set was used in all analyses. A Simulation Time Window spanned roughly 20 days. For the computation settings, a computation interval of 1-minute was used. Computation intervals less than 1-minute did not produce a significant difference in computed WSEL or flow velocity but did significantly increase computation time.

4.10 Model Validation

The only high water marks available in the project area were from Hurricanes Floyd (1999) and Hurricane Matthew (2016). As these two events were extreme and the purpose of this model was to analyze low flow conditions, validation to high water marks was not considered. Instead, only the stage-discharge rating curve at the USGS Goldsboro gage was used to validate the model. Figure 10 and Table 4 provide a comparison of computed water surface elevations from model runs to the established stage-discharge rating. Overall, the model agreed well with observed data, though seemed to struggle with discharge events that produced initial overbank flooding. Initial overbank flooding was non-contiguous, occurring in portions of the Main Stem Meander as well as downstream of the cut-off channel confluence, near the USGS stream gage location. An attempt at empirical validation was also made based on various photographs taken of the weir structure over the previous ~15 years, either by USACE staff during inspections, or by others. Photograph timestamps, when available, were used to determine flow at the USGS Goldsboro gage. That discharge was then modeled and the computed water surface at the weir structure was compared to the photograph.

Table 4 Hydraulic Model Calibration USGS Rating vs Computed

Discharge Event (cfs)	USGS Rating Elevation (ft, NAVD88)	Computed Elevation (ft, NAVD88)
665	46.0	46.2
1,100	47.1	47.1
1,600	47.8	47.9
2,300	49.2	48.9
3,200	50.8	50.0
5,000	54.1	55.3
7,000	57.4	57.8
7,500	58.2	58.3
7,750	58.4	58.5
8,000	58.7	58.8
10,000	60.7	60.5
12,500	62.5	62.2
17,500	64.9	65.0

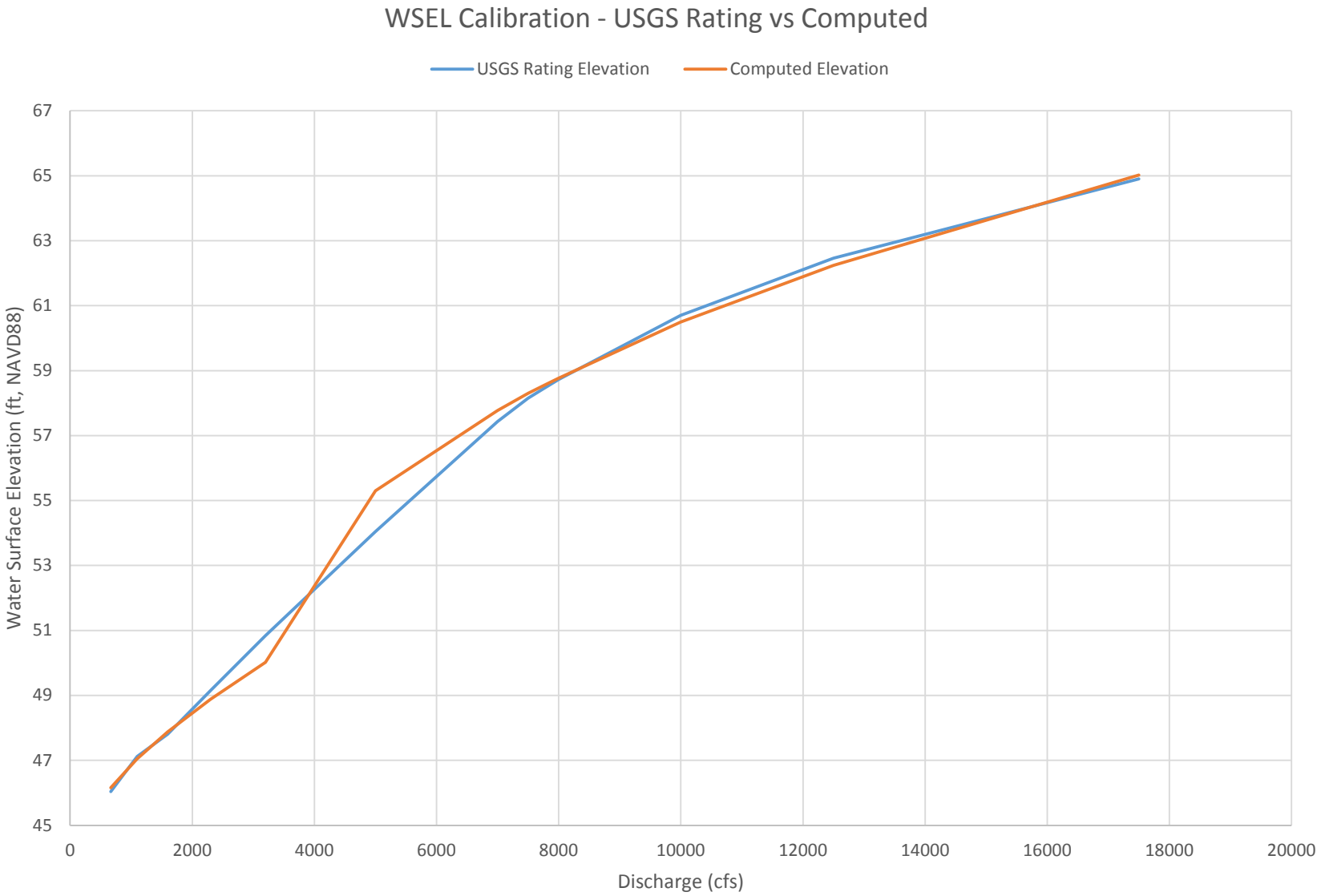


Figure 10 Hydraulic Model Calibration USGS Rating vs Computed

4.11 Sensitivity Analysis

A range of Manning's n values for the channel portion of the Neuse River and cutoff channel were modeled to determine their sensitivity to resulting water surface elevations at the USGS Goldsboro gage. Only channel values were analyzed due to the fact that the majority of modeled events stayed within the stream banks. Modeled values ranged from 0.025 to 0.055. Evaluating at the stream gage location for a 2,300 cfs channel flow, and increasing channel Manning's n value from 0.025 to 0.035 produced a ~2.0-percent increase in stage. Similarly, increasing channel Manning's n value from 0.025 to 0.055 produced a ~5.4-percent increase in stage.

Change in computed WSEL from a geometry mesh resolution for overbank areas of smaller than the final value (100 ft x 100 ft grid) was insignificant. Likewise, smaller mesh resolutions for the Neuse River channel, cutoff channel, and weir faces did not produce a significant difference in computed WSEL. These smaller meshes did, however, significantly increased computation time.

5 Qualitative H&H Benefits of the Current Federal Project

The existing federal project provides flood reduction benefits to the main stem of the Neuse River. Two primary functions of the project are the following: (1) During low flow, The capacity of the main stem of the Neuse River remains unchanged when compared to conditions prior to existence of the cutoff channel. Flow is obstructed by the weir, unable to utilize the cutoff channel, and remains within the main stem. (2) During high flow, the weir is overtopped and the cutoff channel is utilized, allowing a portion of flow from the Neuse to bypass the main stem. By utilizing the capacity of the cutoff channel, the water surface elevation of the main stem is reduced, thus providing flood reduction benefits.

In the absence of a detailed project report or equivalent document, the original intended design frequency or protection level was not known. The cutoff channel was intended to be utilized once water levels rose above the natural river banks of the Neuse at the upstream horseshoe bend. The weir would then continue to deflect water back to the Neuse as long as water levels stay below the weir top. Once water overtops the weir it is able to utilize the full length of the cutoff channel thus alleviating water levels in the main stem. The cutoff channel, below the weir, would actively convey water in a downstream direction as long as water stays within its banks. It was assumed that once water overtops the cutoff channel's banks, it had reached it full capacity, as floodplain interaction disrupts the downstream direction of flow conveyance. A series of higher flow events was routed through the two-dimensional HEC-RAS model under existing conditions to determine the frequency at which the cutoff channel no longer functions as intended. The cutoff channel was considered to no longer function once water increases above bankfull condition, It was determined that a flow event of 17,500 cfs at the USGS Goldsboro gage, or an approximate 0.25-AEP (7-year) event would produce a bankfull condition within the cutoff channel.

6 Project Alternatives

6.1 Screening of Preliminary Alternatives

6.1.1 Increase Weir Height near Current Location

This alternative would allow for a larger volume of water to remain within the main stem of the Neuse River. During non-overtopping weir flow, and excluding leakage at the weir, the only contributing flow within the cutoff channel would originate from the exit of the cutoff channel through backwater effects. The intent of this alternative was to maintain the main stem as controlling velocity at the junction of the main stem and cutoff channel exit. A higher weir would be overtopped less often. The concern of this alternative was whether or not the added height would prevent the federal project from operating as intended. Currently, the weir is overtopped under a relatively common flow, meaning that there is active flow within the cutoff channel approximately 73-percent of the time throughout a given water year (based on statistical analysis). An effect of the weir at its current location was that a volume of water was allowed to enter the cutoff channel and impound upstream of the weir under non-overtopping flow conditions. The backed-up water disrupted velocity of the main stem at the junction of the cutoff channel entrance. This effect would continue to exist in this alternative. This alternative was carried forward to the final array to be modeled and analyzed in greater detail.

6.1.2 Move Location of Weir to Cut-off Channel Entrance

The intent of this alternative was to train flow from the main stem to continue north at the junction of the cutoff channel entrance. Currently under non-overtopping flow at the weir, water will back up to the junction and disrupt velocity. A weir positioned parallel to the main stem would attempt to accomplish this. Logically, this may also help alleviate sedimentation in the main stem for some distance downstream of this junction. However, sediment transport analysis was not done and benefits of relocating the weir to the entrance of the cutoff channel would not likely persist throughout the entire reach of the main stem meander. The disruption of velocities at the exit of the cutoff channel would still exist in this alternative. The southern alignment of the old main stem at the cutoff channel entrance would also continue to disrupt velocities in this alternative. This alternative would remove ~1,200 linear feet of cut-off channel that currently experiences constant flow. This would add available storage volume downstream of the weir to handle overtopping flow. Inversely, this removal of storage that handles constant flow may negatively impact backwater effects created by the weir. Finally, the current weir location took advantage of the floodplain's geomorphology by tying into the face of a natural high ridge. A weir at the cut-off channel entrance would be unable to tie into this existing height ridge which may lead to stability concerns. In summary, partially due to this alternative's close proximity to upstream development and the potential hydraulic conflict of a weir structure adjacent to the historic southern alignment, it was not included in the final array.

6.1.3 Move Location of Weir to Cut-off Channel Entrance and Increase Height

This alternative relocates the weir to the entrance of the cutoff channel. Base implementation of this alternative, identical to the previous alternative, includes increasing the weir height. Similar to the preceding alternative, this was not considered in the final array.

6.1.4 Incorporate Fish Passage into Cut-off Channel Weir

A rock ramp or similar design incorporated into the cut-off channel weir would in theory allow for fish to migrate past the weir barrier during overtopping flows. The primary issue with this alternative would be ensuring adequate flow over the ramp without violating the project constraint of preserving flood damage reduction benefits offered by the existing Federal project. Consistent overtopping flow would require lowering the weir height below existing conditions. This would reduce available flood storage of the cut-off channel downstream of the weir while also exacerbating existing environmental concerns within the Neuse River Main Stem. Therefore, in order to carry this alternative forward, a non-traditional design was required. However, incorporating a fish passage into a weir with an elevation above 56 feet, NAVD88, was screened out due to efficiency and acceptability concerns during the planning process (see section 4.4 of the main report).

6.2 Final Array of Alternatives

The final array consisted of five (5) alternatives. They are as follows:

- Alternative B1: A new weir constructed near its existing location to a crest elevation of 57.0 feet, NAVD88. This crest elevation is 1.0 foot higher than existing conditions.
- Alternative B2: A new weir constructed near its existing location to a crest elevation of 58.0 feet, NAVD88. This crest elevation is 2.0 foot higher than existing conditions.
- Alternative B3: A new weir constructed near its existing location to a crest elevation of 59.0 feet, NAVD88. This crest elevation is 3.0 foot higher than existing conditions.
- Alternative B4: A new weir constructed near its existing location to a crest elevation of 60.0 feet, NAVD88. This crest elevation is 4.0 foot higher than existing conditions.
- Alternative C: This alternative consisted of a rock ramp structure constructed to a crest elevation of 56.0 feet, NAVD88. This crest elevation is equal to existing conditions. For the H&H analysis, this alternative was treated the same as existing conditions. As such, it yielded a zero-change in water surface elevation and flow velocity. The effects and benefits of this alternative were captured through a qualitative narrative in the Environmental Appendix.

As detailed above, the range of weir heights ranged from a 1-foot to 4-foot increase. Early in the project planning process initial modeling indicated that a weir crest elevation above 60-feet, NAVD88, created adverse flooding impacts. Based on this preliminary information the max height increase was evenly divided into 4, 1-foot increments.

7 Hydraulic Analysis of Project Alternatives

7.1 General Hydraulic Trends for Weir Raises

There were three critical locations within the project area that helped distinguish relative impacts of the proposed alternatives: the cut-off channel entrance junction, cut-off channel exit junction, and cut-off channel weir. To capture the influence of these locations, the project area was divided into five separate reaches. Starting at the confluence of Beaverdam Creek tributary with the Neuse River and traveling in a downstream direction: Reach (1) Neuse River Upstream, Reach (2) Neuse River Main Stem, Reach (3) Cutoff Upstream, Reach (4) Cutoff downstream, and Reach (5) Neuse River Downstream. Each reach was defined by a distinct change in the hydraulic influence of the cutoff channel and weir. Reach (1) was the segment of the Neuse River between the Beaverdam Creek tributary and the junction of the Neuse with the cutoff channel entrance. Reach (2) was the segment of the Neuse immediately downstream of the cutoff channel entrance junction and extended to the cutoff channel exit junction. Reach (3) was the cutoff channel immediately downstream of the entrance junction and extended the upstream face of the cutoff channel weir. Reach (4) was the segment of the cutoff channel immediately downstream of the cutoff weir and extended along the cutoff channel to the exit junction. Reach (5) was the segment of the Neuse River immediately downstream of the exit junction and extended to the USGS gage location. Reaches are shown in Figure 11.

The following model observations were made by comparing proposed conditions to existing conditions under the same flow rates: As the height of the cutoff weir was increased, the following changes in hydraulics were characteristic of each reach.

- Reach (1) was characterized by an increased in Water Surface Elevation (WSEL) and a decrease in flow velocity.
- Reach (2) saw an increase in both WSEL and flow velocity.
- Reach (3) saw an increase in WSEL and a decrease in flow velocity.
- Reach (4) saw a decrease in both WSEL and flow velocity.
- Reach (5) saw no noticeable change in WSEL or flow velocity.

The characteristics of Reach (1) described above were considered backwater effects caused by the weir. Under proposed weir raise conditions, a portion of the water held back by the weir at the cutoff channel entrance junction flows in a downstream direction into Reach (2). This results in both an increase in water surface elevation and flow velocities within Reach (2).

Conversely, a portion of water held back by the weir will attenuate upstream at the junction into Reach (1). This condition effectively raises the water surface elevation when compared to existing conditions while under the same flow rate. This also effectively reduces flow velocities upstream of the junction.

The attenuation of backwater effects meant that the portion of Reach (1) immediately upstream of the junction experienced the greatest increase in WSEL and decrease in velocity. The relative backwater effects were reduced as the distance to the weir increased.

The backwater effect was greatest when flow conditions were near the top of each weir raise alternative. Refer to Figure 13 for a comparison of backwater effects caused by each weir raise alternative. The location for which these effects were computed was immediately upstream of the start of the cut-off channel. For reference, this was near the development (fish camp) on the right overbank of the Neuse River. This backwater effect continued to exist after the weir was overtopped. As higher flow rates were routed through the project area, increasing the amount of overtopping flow, the

backwater effect was characterized by a dampening trend. This trend, rather than a horizontal constant value, was most likely due to the ability of Reach (2) to handle more flow volume when compared to the capacity of the cutoff channel. Another reason for this trend could be the relative difference in wetted perimeter of the cutoff channel for flow up the top of the weir and for when higher flows utilize the cutoff channel above the weir. For example, while the backwater effect for Alternative B4 (yellow line) in Figure 13 peaked near 3200 cfs with an increase in WSEL of ~2.4 feet, the effect persisted until roughly 14,000 cfs where the increase in WSEL was essentially zero.

The range of discharges shown in Figure 13 was considered to be relatively frequent events, based on a statistical analysis of flow records at the USGS gage. Initial overtopping discharges for all alternatives were determined to occur more frequently than a 0.99 AEP (1-year) event. An initial overtopping flow under existing conditions was expected to occur 73-percent of the time in any given water year. Alternative B1 was expected to be overtopped 55-percent of the time in any given water year. Alternative B2 was expected to be overtopped 42-percent of the time in any given water year. Alternative B3 was expected to be overtopped 30-percent of the time in any given water year. Alternative B4 was expected to be overtopped 22-percent of the time in any given water year. A 17,000 cfs discharge, where the backwater effect no longer persisted for any alternatives, was expected to occur at a 0.25 AEP or a 7-year event.

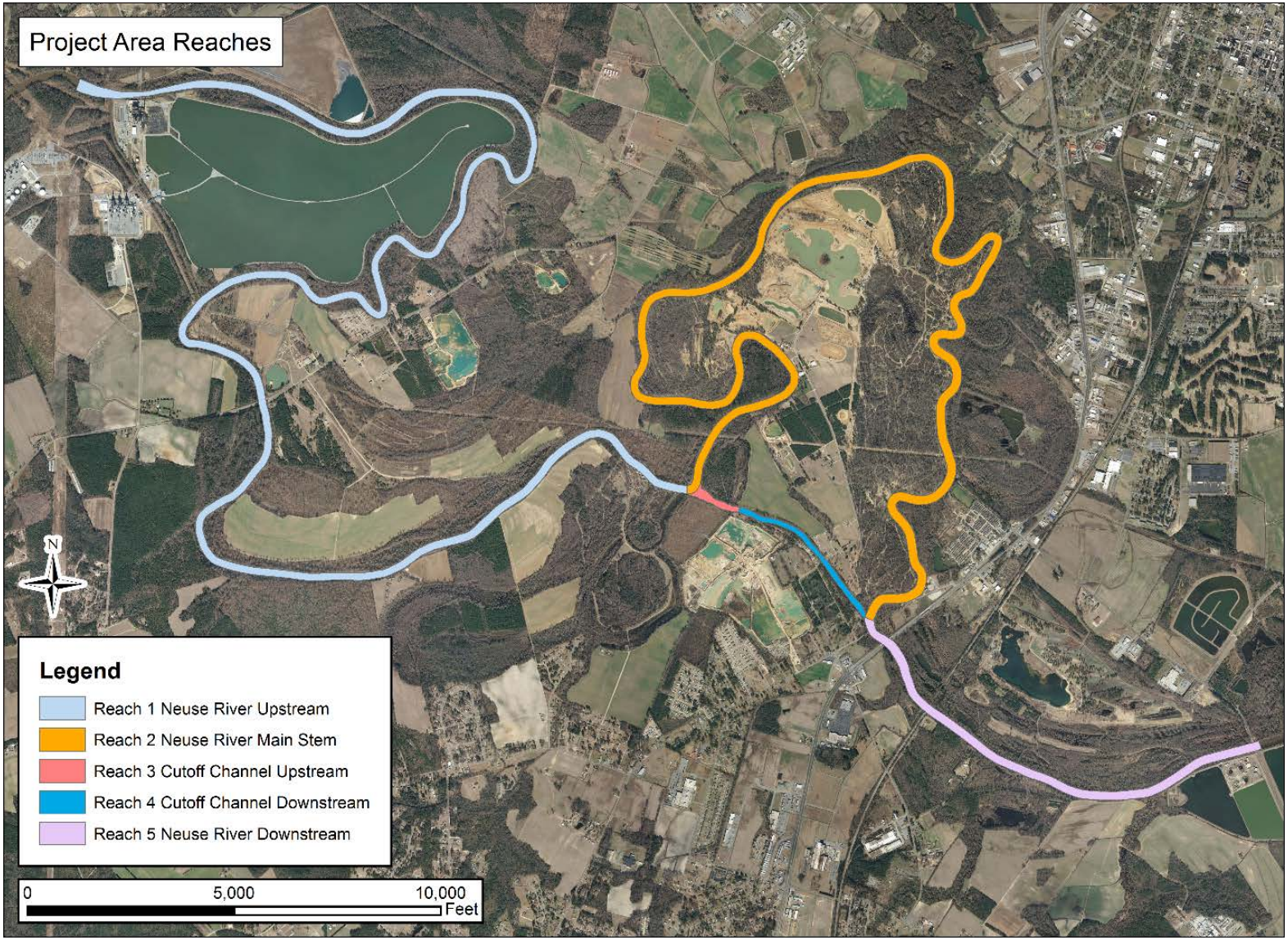


Figure 11 Project Reaches for Comparison of Alternatives

7.2 Water Surface Elevations within Project Area

Indicator values at thirteen (13) locations within the Neuse River and Cut-off Channel are shown in Figure 12. These locations were picked to best represent the dynamic hydraulic effects of the cut-off channel and weir structure. Locations 1-3 represent the Neuse River upstream of the cut-off channel. Location 4 is the junction of the cut-off channel entrance. Locations 5-8 represent the Neuse River main stem meander. Location 9 is the junction of the cut-off channel exit or confluence. Location 10 is the downstream USGS Goldsboro stream gage. Location 11 represents the cut-off channel upstream of the weir structure. Locations 12 and 13 represent the cut-off channel downstream of the weir structure. Table 5 through Table 13 contain a comparison of computed water surface elevations for a range of discharge events at each indicator location for existing conditions and alternatives B1-B4.

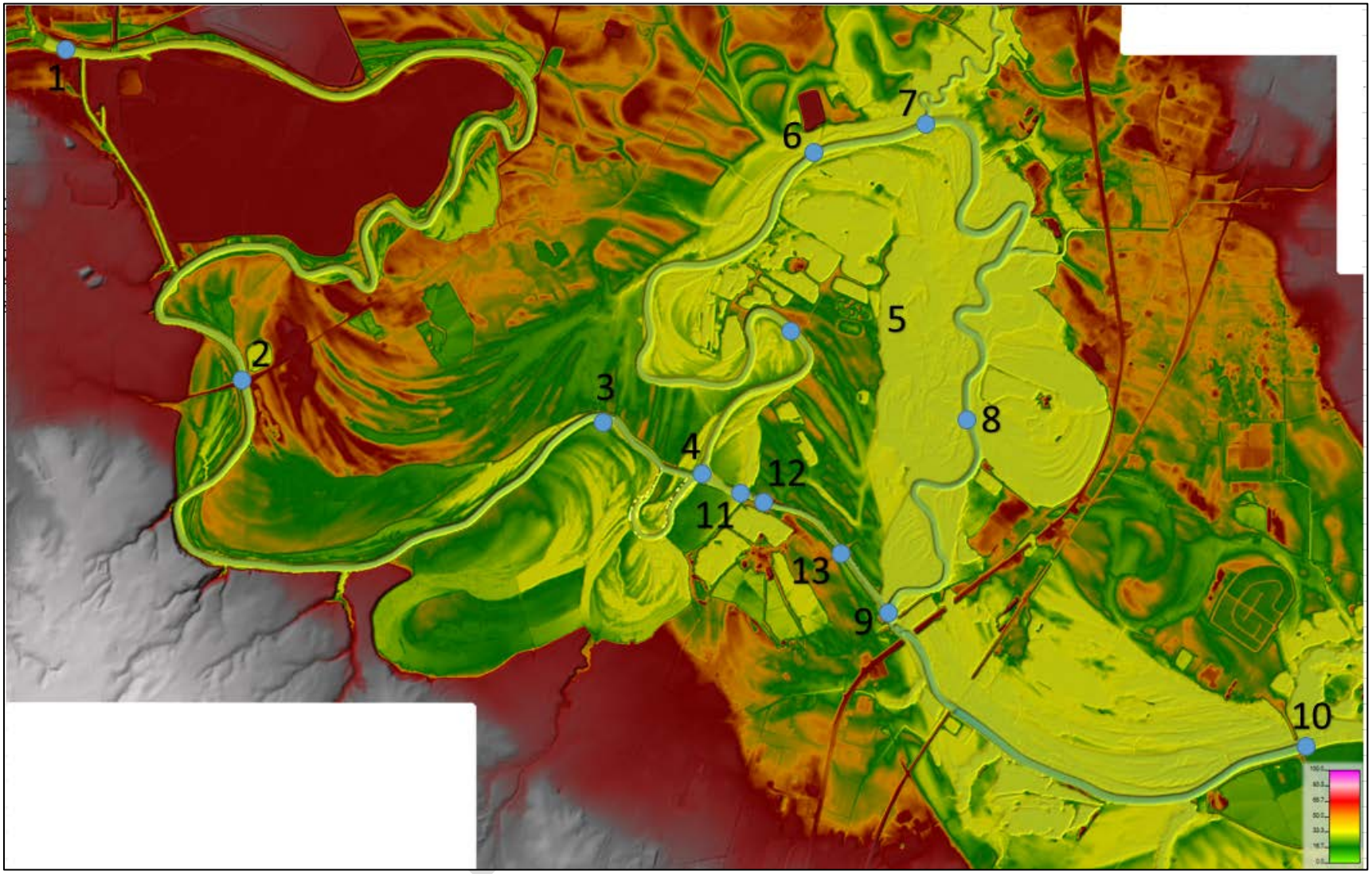


Figure 12 EBA Indicator Value Locations

Table 5 Computed Water Surface Elevations for Existing Conditions Weir Overtopping Flow

Discharge Event: **665 cfs**
Frequency: Stream gage flow will equal or exceed 665 cfs 73% of time in a given WY

Indicator Location	Computed Water Surface Elevation (ft, NAVD88)				
	Existing Conditions	Alt B1	Alt B2	Alt B3	Alt B4
1	59.71	59.71	59.71	59.71	59.71
2	56.46	56.46	56.46	56.46	56.46
3	55.97	55.97	55.97	55.97	55.97
4	55.88	55.88	55.88	55.88	55.88
5	54.93	54.93	54.93	54.93	54.93
6	52.30	52.30	52.30	52.30	52.30
7	51.86	51.86	51.86	51.86	51.86
8	51.31	51.31	51.31	51.31	51.31
9	48.59	48.59	48.59	48.59	48.59
10	46.18	46.18	46.18	46.18	46.18
11	55.88	55.88	55.88	55.88	55.88
12	48.59	48.59	48.59	48.59	48.59
13	48.59	48.59	48.59	48.59	48.59

Table 6 Computed Water Surface Elevations for Alternative B1 Weir Overtopping Flow

Discharge Event: **1100 cfs**
Frequency: Stream gage flow will equal or exceed 1100 cfs 55% of time in a given WY

Indicator Location	Computed Water Surface Elevation (ft, NAVD88)				
	Existing Conditions	Alt B1	Alt B2	Alt B3	Alt B4
1	60.80	60.87	60.87	60.87	60.87
2	57.21	57.71	57.71	57.71	57.71
3	56.36	57.07	57.07	57.07	57.07
4	56.22	56.97	56.97	56.97	56.97
5	55.24	55.95	55.95	55.95	55.95
6	52.89	53.57	53.57	53.57	53.57
7	52.53	53.13	53.13	53.13	53.13
8	52.00	52.48	52.48	52.48	52.48
9	49.87	49.87	49.87	49.87	49.87
10	47.07	47.07	47.07	47.07	47.07
11	56.20	56.97	56.97	56.97	56.97
12	50.46	49.87	49.87	49.87	49.87
13	49.99	49.87	49.87	49.87	49.87

Table 7 Computed Water Surface Elevations for Alternative B2 Weir Overtopping Flow

Discharge Event: **1600 cfs**
Frequency: Stream gage flow will equal or exceed 1600 cfs 42% of time in a given WY

Indicator Location	Computed Water Surface Elevation (ft, NAVD88)				
	Existing Conditions	Alt B1	Alt B2	Alt B3	Alt B4
1	61.69	61.73	61.82	61.82	61.82
2	57.92	58.37	58.80	58.80	58.80
3	56.68	57.41	58.06	58.06	58.06
4	56.46	57.25	57.93	57.93	57.93
5	55.51	56.22	56.90	56.90	56.90
6	53.45	53.97	54.67	54.67	54.67
7	53.16	53.58	54.24	54.24	54.24
8	52.66	52.89	53.49	53.49	53.49
9	51.01	50.20	51.01	51.01	51.01
10	47.92	47.92	47.92	47.92	47.92
11	56.34	57.24	57.93	57.93	57.93
12	52.10	50.79	51.01	51.01	51.01
13	51.30	50.33	51.01	51.01	51.01

Table 8 Computed Water Surface Elevations for Alternative B3 Weir Overtopping Flow

Discharge Event: **2300 cfs**
Frequency: Stream gage flow will equal or exceed 2300 cfs 30% of time in a given WY

Indicator Location	Computed Water Surface Elevation (ft, NAVD88)				
	Existing Conditions	Alt B1	Alt B2	Alt B3	Alt B4
1	62.74	62.76	62.81	62.90	62.90
2	58.83	59.14	59.47	59.88	59.88
3	57.23	57.81	58.44	59.13	59.13
4	56.91	57.55	58.23	58.97	58.97
5	55.98	56.54	57.22	57.95	57.95
6	54.24	54.53	55.11	55.84	55.84
7	54.01	54.21	54.74	55.43	55.43
8	53.52	53.54	53.94	54.54	54.54
9	52.27	51.47	51.47	52.27	52.27
10	48.93	48.91	48.91	48.92	48.92
11	56.70	57.48	58.21	58.97	58.97
12	53.56	52.64	51.96	52.27	52.27
13	52.70	51.83	51.59	52.27	52.27

Table 9 Computed Water Surface Elevations for Alternative B4 Weir Overtopping Flow

Discharge Event: **3200 cfs**
Frequency: Stream gage flow will equal or exceed 3200 cfs 22% of time in a given WY

Indicator Location	Computed Water Surface Elevation (ft, NAVD88)				
	Existing Conditions	Alt B1	Alt B2	Alt B3	Alt B4
1	63.71	63.72	63.75	63.82	63.91
2	59.72	59.91	60.16	60.50	60.86
3	57.88	58.33	58.87	59.51	60.11
4	57.43	57.95	58.56	59.28	59.96
5	56.54	57.00	57.58	58.28	59.01
6	55.13	55.25	55.70	56.25	56.99
7	54.94	55.00	55.40	55.92	56.60
8	54.47	54.34	54.63	55.00	55.60
9	53.50	52.75	52.75	52.76	53.50
10	50.05	50.04	50.04	50.04	50.05
11	57.06	57.77	58.49	59.26	59.96
12	55.08	54.33	53.80	53.24	53.51
13	54.07	53.30	53.09	52.89	53.51

Table 10 Computed Water Surface Elevations for ~0.99 AEP Discharge Event

Discharge Event: **Bankfull, ~5800 cfs**
Frequency: 0.99 AEP (~1-year)

Indicator Location	Computed Water Surface Elevation (ft, NAVD88)				
	Existing Conditions	Alt B1	Alt B2	Alt B3	Alt B4
1	65.90	65.90	65.91	65.94	65.98
2	61.57	61.63	61.73	61.90	62.13
3	59.67	59.83	60.06	60.43	60.87
4	59.10	59.30	59.62	60.11	60.67
5	58.44	58.62	58.90	59.37	59.92
6	57.60	57.69	57.85	58.14	58.55
7	57.52	57.59	57.73	57.97	58.32
8	57.16	57.21	57.28	57.41	57.61
9	56.76	56.78	56.80	56.81	56.81
10	55.79	55.82	55.84	55.86	55.86
11	58.62	58.91	59.36	59.98	60.62
12	58.28	58.19	58.01	57.67	57.22
13	57.33	57.30	57.24	57.11	56.95

Table 11 Computed Water Surface Elevations for ~0.80-AEP Discharge Event

Discharge Event: **7000 cfs**
Frequency: 0.80 AEP (~1.25-year)

Indicator Location	Computed Water Surface Elevation (ft, NAVD88)				
	Existing Conditions	Alt B1	Alt B2	Alt B3	Alt B4
1	66.83	66.84	66.84	66.86	66.90
2	62.51	62.53	62.57	62.69	62.91
3	60.63	60.68	60.77	61.02	61.44
4	60.25	60.31	60.43	60.73	61.20
5	59.76	59.81	59.92	60.19	60.60
6	59.17	59.21	59.27	59.41	59.65
7	59.10	59.12	59.17	59.30	59.51
8	58.81	58.82	58.85	58.91	59.03
9	58.50	58.50	58.50	58.50	58.50
10	57.78	57.78	57.78	57.78	57.78
11	59.88	59.97	60.13	60.54	61.09
12	59.73	59.69	59.59	59.41	59.10
13	58.93	58.91	58.88	58.80	58.70

Table 12 Computed Water Surface Elevations for ~0.50-AEP Discharge Event

Discharge Event: **10000 cfs**
Frequency: 0.50 AEP (~2-year)

Indicator Location	Computed Water Surface Elevation (ft, NAVD88)				
	Existing Conditions	Alt B1	Alt B2	Alt B3	Alt B4
1	68.88	68.88	68.88	68.89	68.91
2	64.69	64.70	64.71	64.74	64.81
3	62.90	62.92	62.93	62.98	63.10
4	62.59	62.61	62.63	62.68	62.80
5	62.27	62.28	62.29	62.33	62.43
6	61.79	61.80	61.80	61.82	61.87
7	61.73	61.73	61.74	61.76	61.80
8	61.47	61.47	61.47	61.48	61.50
9	61.22	61.22	61.22	61.22	61.22
10	60.50	60.50	60.50	60.50	60.50
11	62.34	62.36	62.38	62.44	62.59
12	62.28	62.27	62.25	62.22	62.15
13	61.58	61.57	61.57	61.56	61.53

Table 13 Computed Water Surface Elevations for ~0.15-AEP Discharge Event

Discharge Event: **17500 cfs**
Frequency: 0.15 AEP (~7-year)

Indicator Location	Computed Water Surface Elevation (ft, NAVD88)				
	Existing Conditions	Alt B1	Alt B2	Alt B3	Alt B4
1	73.46	73.46	73.46	73.46	73.46
2	69.29	69.29	69.29	69.29	69.30
3	67.31	67.31	67.31	67.32	67.32
4	66.96	66.96	66.96	66.97	66.98
5	66.64	66.64	66.64	66.64	66.65
6	66.18	66.18	66.18	66.18	66.19
7	66.13	66.14	66.14	66.14	66.14
8	65.96	65.96	65.96	65.96	65.96
9	65.74	65.74	65.74	65.74	65.74
10	65.03	65.03	65.03	65.03	65.03
11	66.78	66.78	66.77	66.78	66.80
12	66.74	66.74	66.73	66.73	66.73
13	66.08	66.08	66.08	66.08	66.08

7.2.1 Backwater Effects Associated with Weir Raises

To best illustrate the full extent of backwater effect created by the cut-off channel weir structure, a computed water surface elevation – discharge relationship was developed at indicator location 4. This relationship is shown in Figure 13. Figure 13 is important in that it showed that the largest increases in WSEL occurred under relative frequent events (sub-annually), and that the difference in WSEL gradually converge to near zero at the 0.25-AEP (~7-year) event. A series of figures was produced to illustrate the attenuating characteristic of the cut-off channel weir structure. In Figure 14 computed WSEL for existing conditions and alternatives B1 through B4 was plotted against river distance along the centerline profile of the Neuse River. The discharge event for Figure 14 was bankfull flow under existing conditions, or approximately 5,700 cfs at the USGS Goldsboro gage. Initial overtopping locations for overbank flow were shown as red dots. Figure 15 depicts a similar comparison but at a larger flow, specifically a 0.80 AEP (1.25-year) event. Lastly, Figure 16 depicts the same comparison at a 0.50 AEP (2-year) event. Centerline stationing of the Neuse River shown in Figure 17 was provided to spatially locate X-axis river distance on Figures 11, 12, and 13. These figures show that not only does the hydraulic weir effects attenuate spatially but also in intensity of flow event.

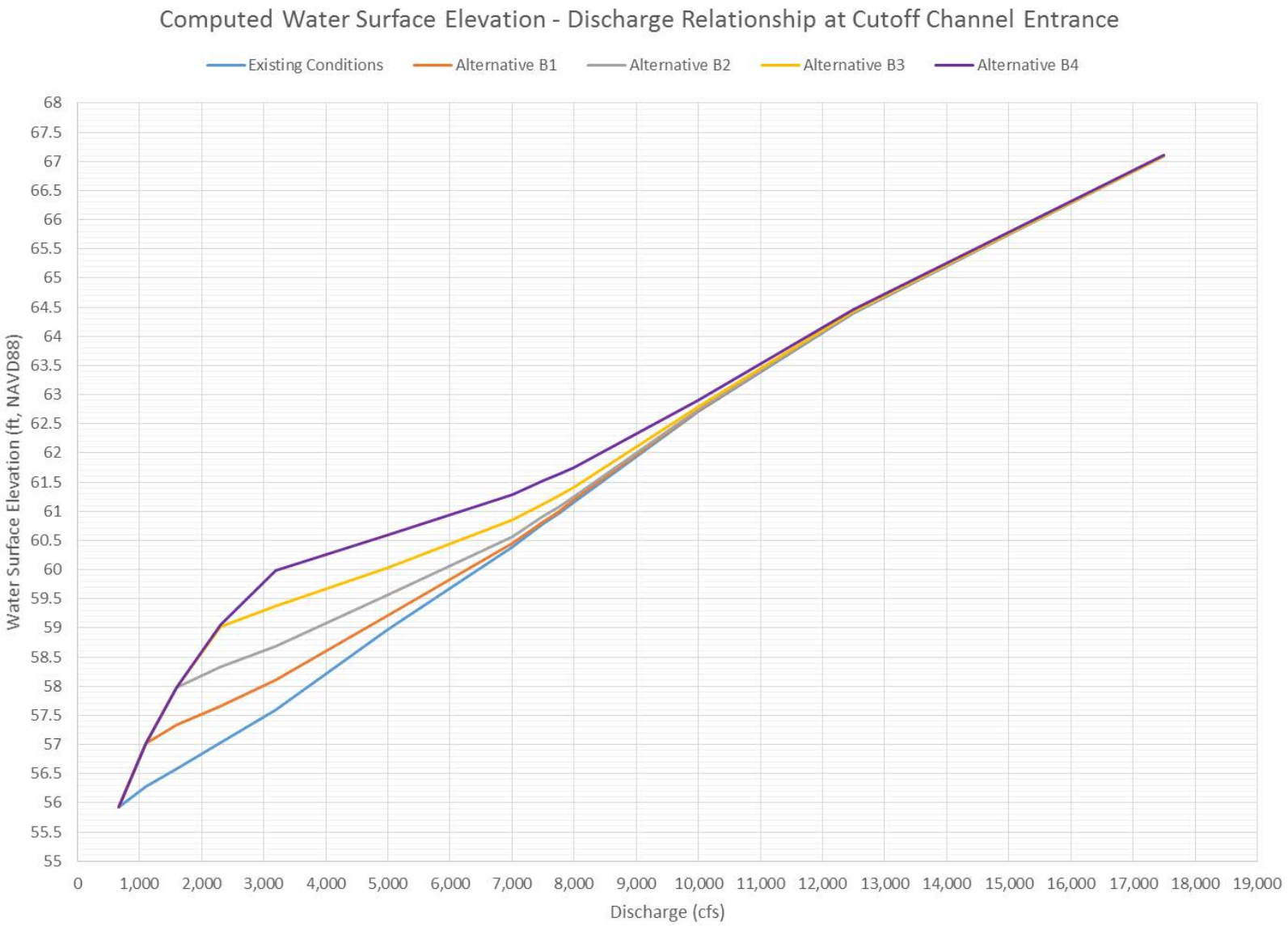


Figure 13 Backwater Effects Associated with Alternatives B1 through B4

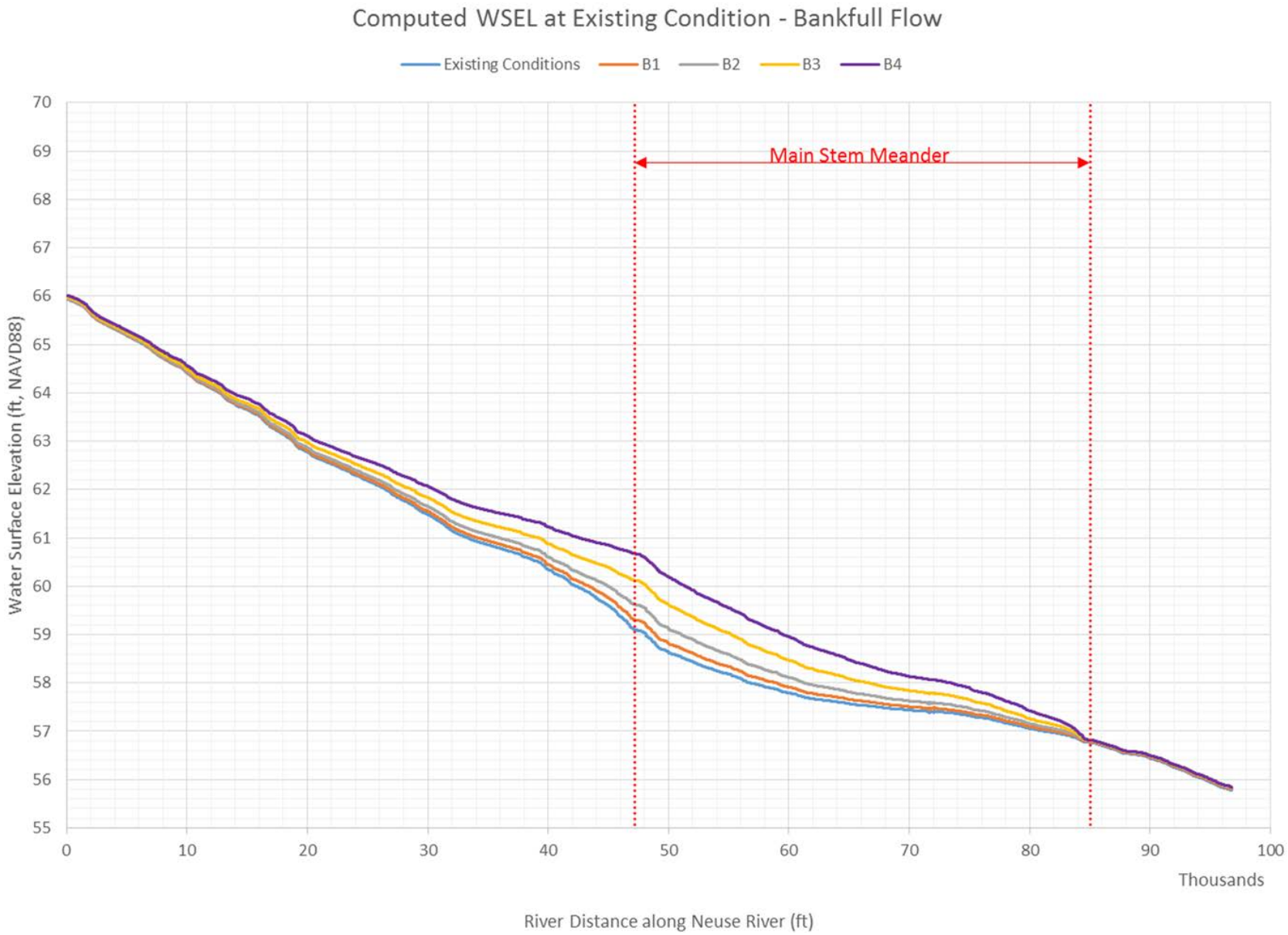


Figure 14 Comparison of Alternatives for Computed WSEL at Existing Conditions – Bankfull Flow

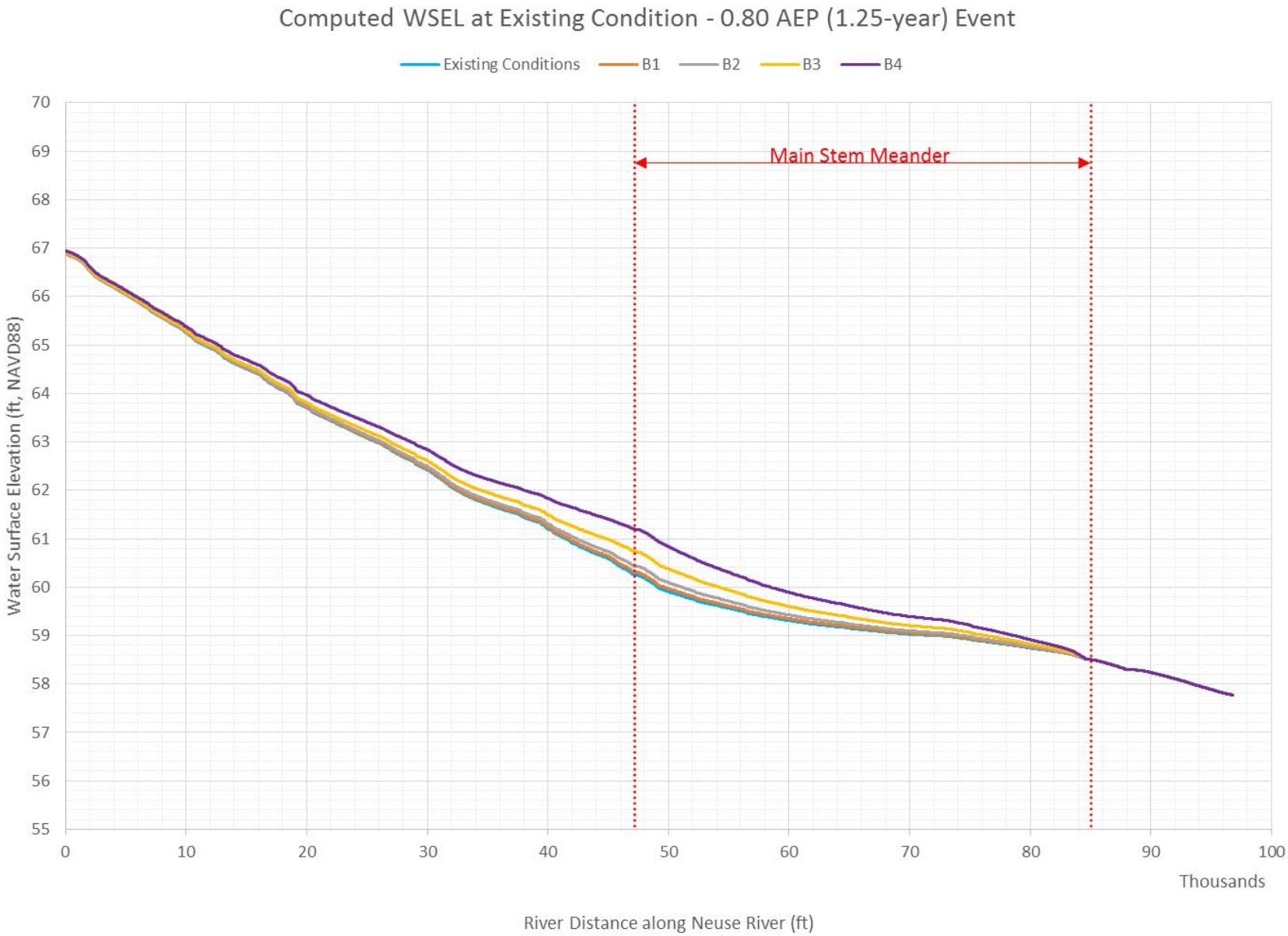


Figure 15 Comparison of Alternatives for Computed WSEL at Existing Conditions – 0.80 AEP (1.25-year) Event

Figure 16 Comparison of Alternatives for Computed WSEL at Existing Conditions – 0.50 AEP (2-year) Event

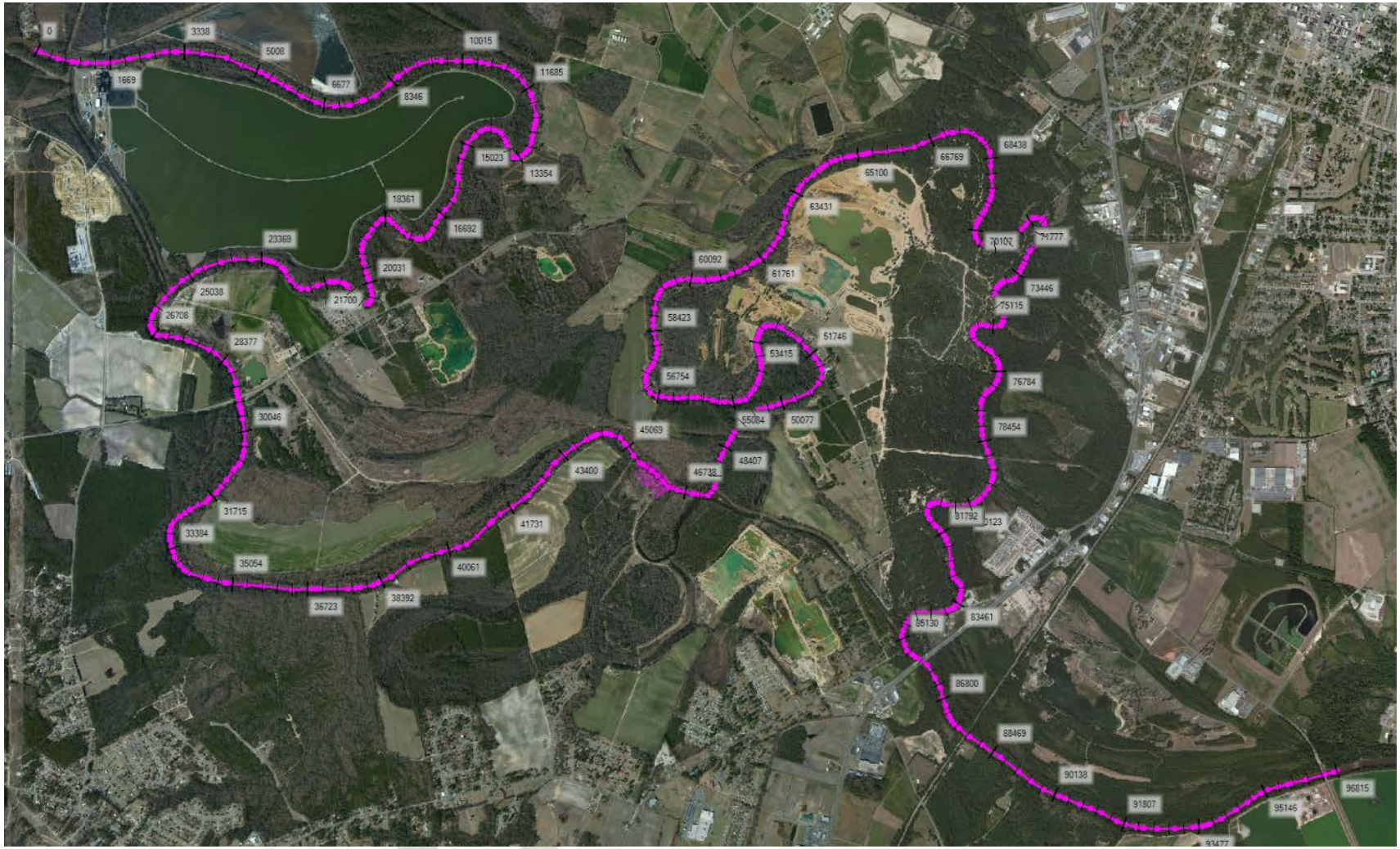


Figure 17 Neuse River Centerline Stationing

7.2.2 Inundation Associated with Weir Raises

Modeled inundation footprints of the flow events in which the weir backwater effects exist were analyzed to determine the extent of Neuse River overbank inundation for existing conditions and Alternatives B1 through B4. The extents are described as (1) additional water depth confined to the existing conditions inundation footprint and (2) newly-inundated footprint surface area and water depth. The Neuse River overbank is defined by the Ordinary High Water Mark (33 CFR Ch. II 328.4 (e)).

For the backwater effects shown in Figure 13, a right skew bias existed when comparing increase water surface elevation, proposed versus existing conditions, and discharge event. In other words, there was an inverse relationship between increased WSEL caused by the weir and discharge event, once flow began overtopping the weir. This relationship required multiple analyses beyond just the discharge event that caused the peak increase in WSEL. Furthermore, this discharge event was different for each weir raise alternative. This created a challenge in determining a single discharge event to equally compare all alternatives.

Based on the criteria described above, the majority of increase in inundation footprint associated with alternative B1 was confined to within the stream banks of the Neuse River within the Project area. During the 0.50 AEP or 2-year event, Alternative B1 added an additional average of 0.01 feet (0' min to 0.01' max) of water depth to the existing 1,677 acres already flooded during existing conditions. It inundated 2.2 acres of previously dry land with a maximum water depth of 0.01 feet.

During the .80 AEP or 1.25-year event, Alternative B2 added an additional average of 0.07 feet (0' min to 0.19' max) of water depth to the existing 812.4 acres already flooded during existing conditions. It inundated 20 acres of previously dry land with a maximum water depth of 0.19 feet. During the 0.50 AEP or 2-year event, Alternative B2 added an additional average of 0.01 feet (0' min to 0.03' max) of water depth to the existing 1,677 acres already flooded during existing conditions. It inundated 5.7 acres of previously dry land with a maximum water depth of 0.03 feet.

During the .80 AEP or 1.25-year event, Alternative B3 added an additional average of 0.37 feet (0.04' min to 1.02' max) of water depth to the existing 812.4 acres already flooded during existing conditions. It inundated 50 acres of previously dry land with a maximum water depth of 1.02 feet. During the 0.50 AEP or 2-year event, Alternative B3 added an additional average of 0.03 feet (0' min to 0.08' max) of water depth to the existing 1,677 acres already flooded during existing conditions. It inundated 5.7 acres of previously dry land with a maximum water depth of 0.08 feet.

During the .80 AEP or 1.25-year event, Alternative B4 added an additional average of 0.37 feet (0' min to 0.96' max) of water depth to the existing 812.4 acres already flooded during existing conditions. It inundated 101 acres of previously dry land with a maximum water depth of 0.96 feet. During the 0.50 AEP or 2-year event, Alternative B4 added an additional average of 0.09 feet (0' min to 0.2' max) of water depth to the existing 1,677 acres already flooded during existing conditions. It inundated 41 acres of previously dry land with a maximum water depth of 0.2 feet.

Alternatives B2, B3, and B4 produced increase water surface elevations that overtopped the stream banks during a 0.99 AEP (1-year) flow event and consequently encroached the surrounding floodplain. It was important to note that during existing conditions overbank inundation already existed for the 0.99 AEP (1-year) event. Significance of these increased WSEL's associated with difference alternatives required close coordination with Real Estate and Counsel given modeling accuracy and underlying data sources.

Locations of newly inundated area were non-contiguous throughout the project area. To help illustrate this fact, a series of inundation maps were produced to depict the flooding footprint for existing conditions and alternatives B1 through B4. Inundation depths under existing and proposed conditions during the 0.80 AEP (1.25-year) event are shown in Figure 18 through Figure 22.

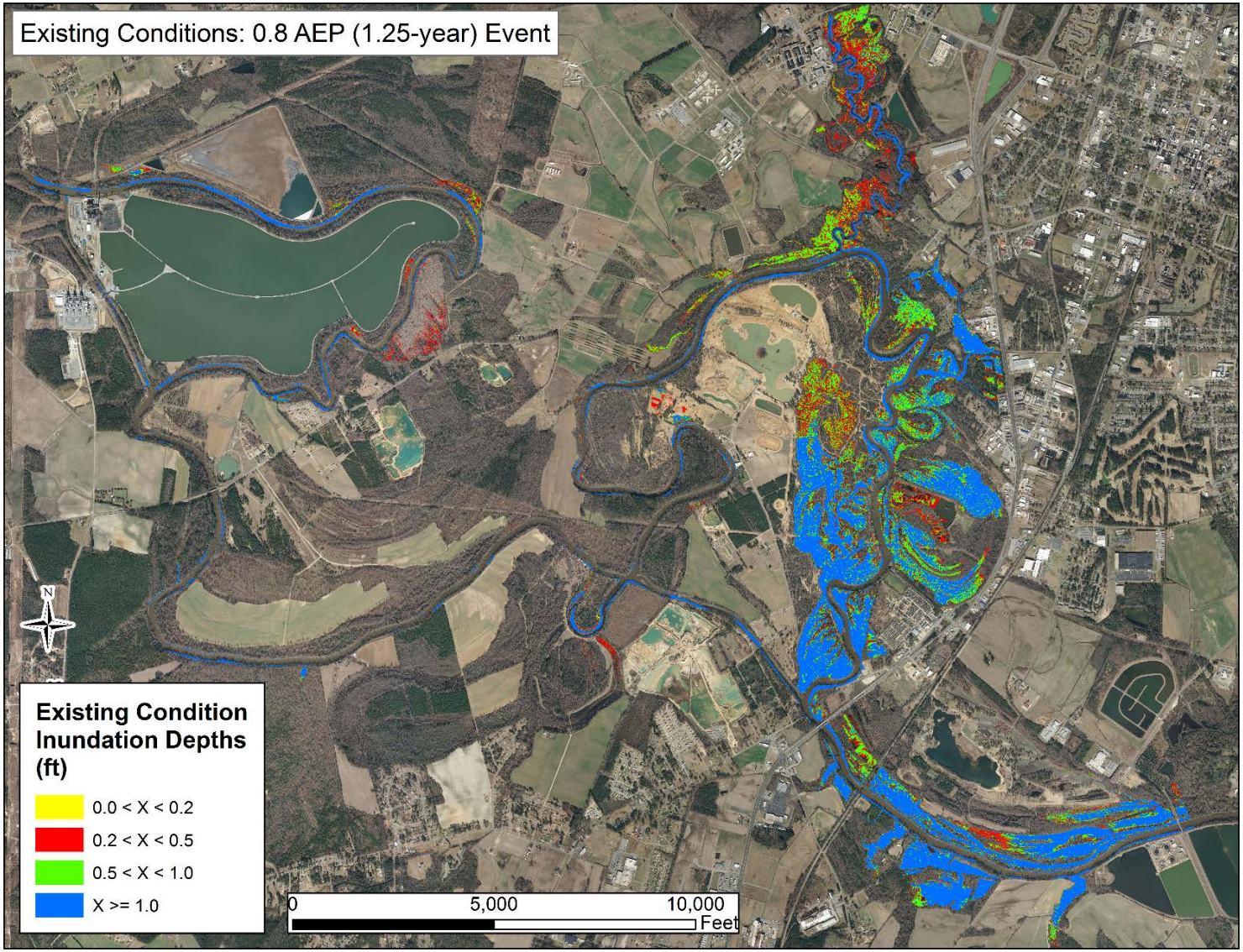


Figure 18 Computed Inundation Depths under Existing Conditions for the 0.80-AEP (1.25-year) Event

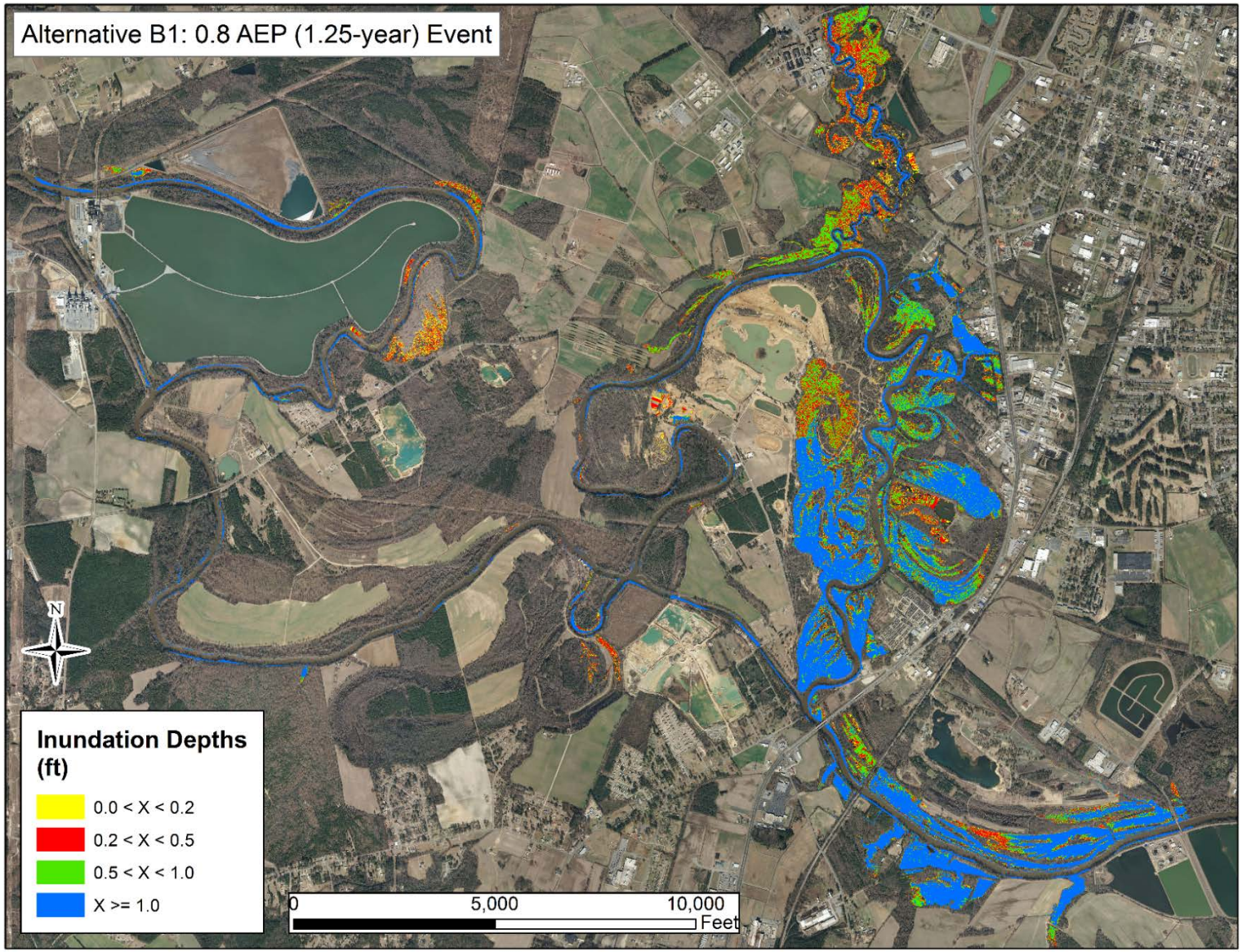


Figure 19 Computed Inundation Depths under Alternative B1 Conditions for the 0.80-AEP (1.25-year) Event

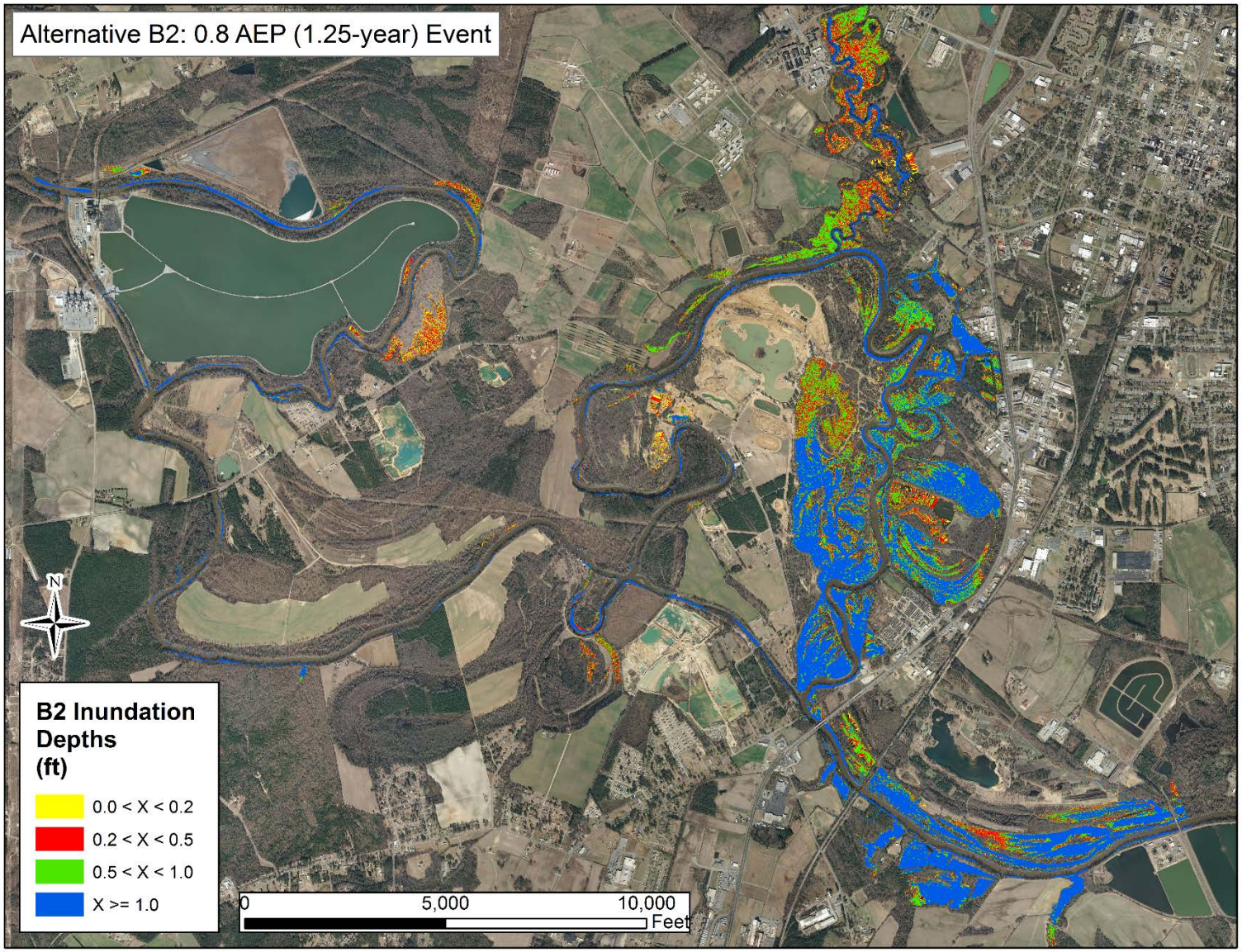


Figure 20 Computed Inundation Depths under Alternative B2 Conditions for the 0.80-AEP (1.25-year) Event

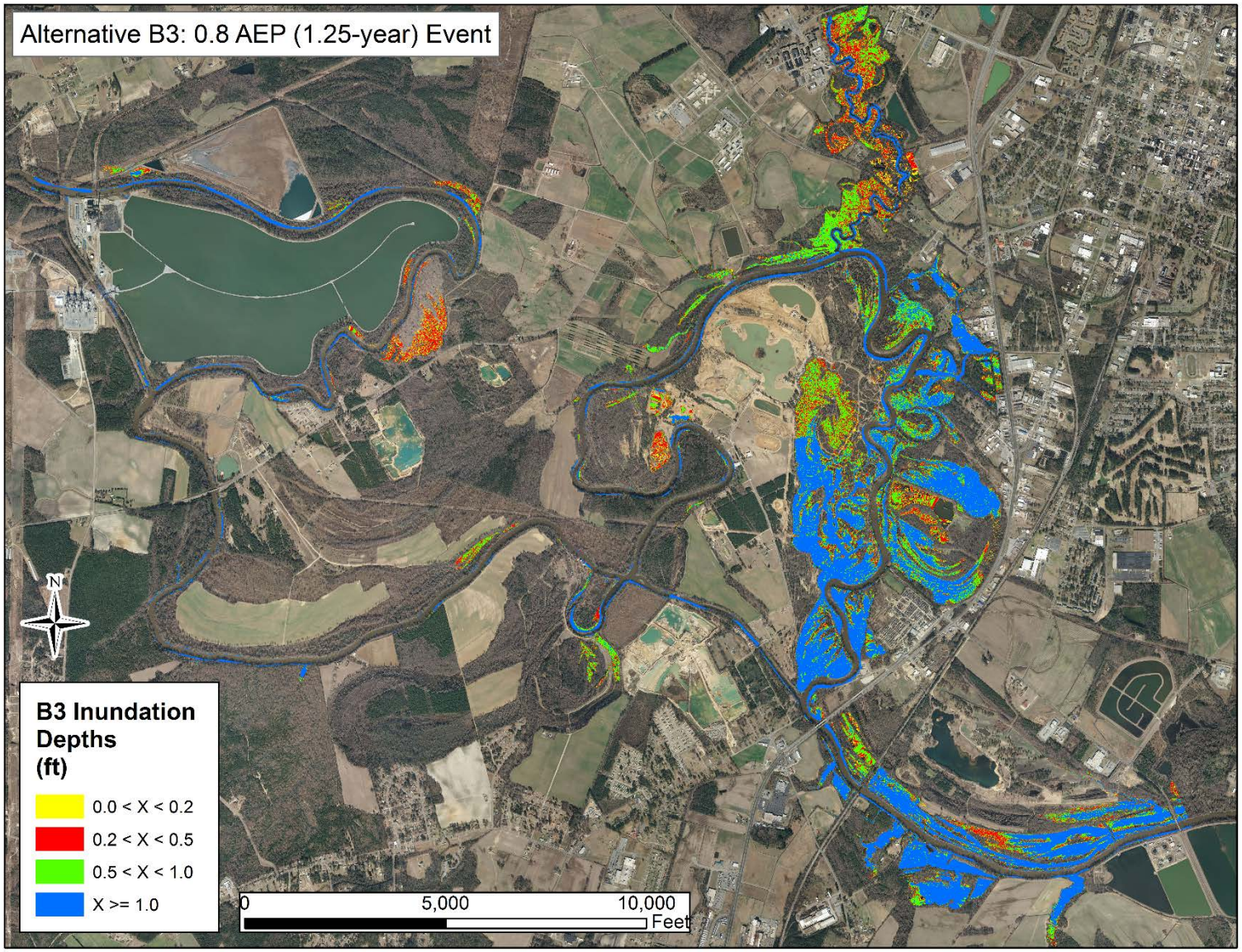


Figure 21 Computed Inundation Depths under Alternative B3 Conditions for the 0.80-AEP (1.25-year) Event

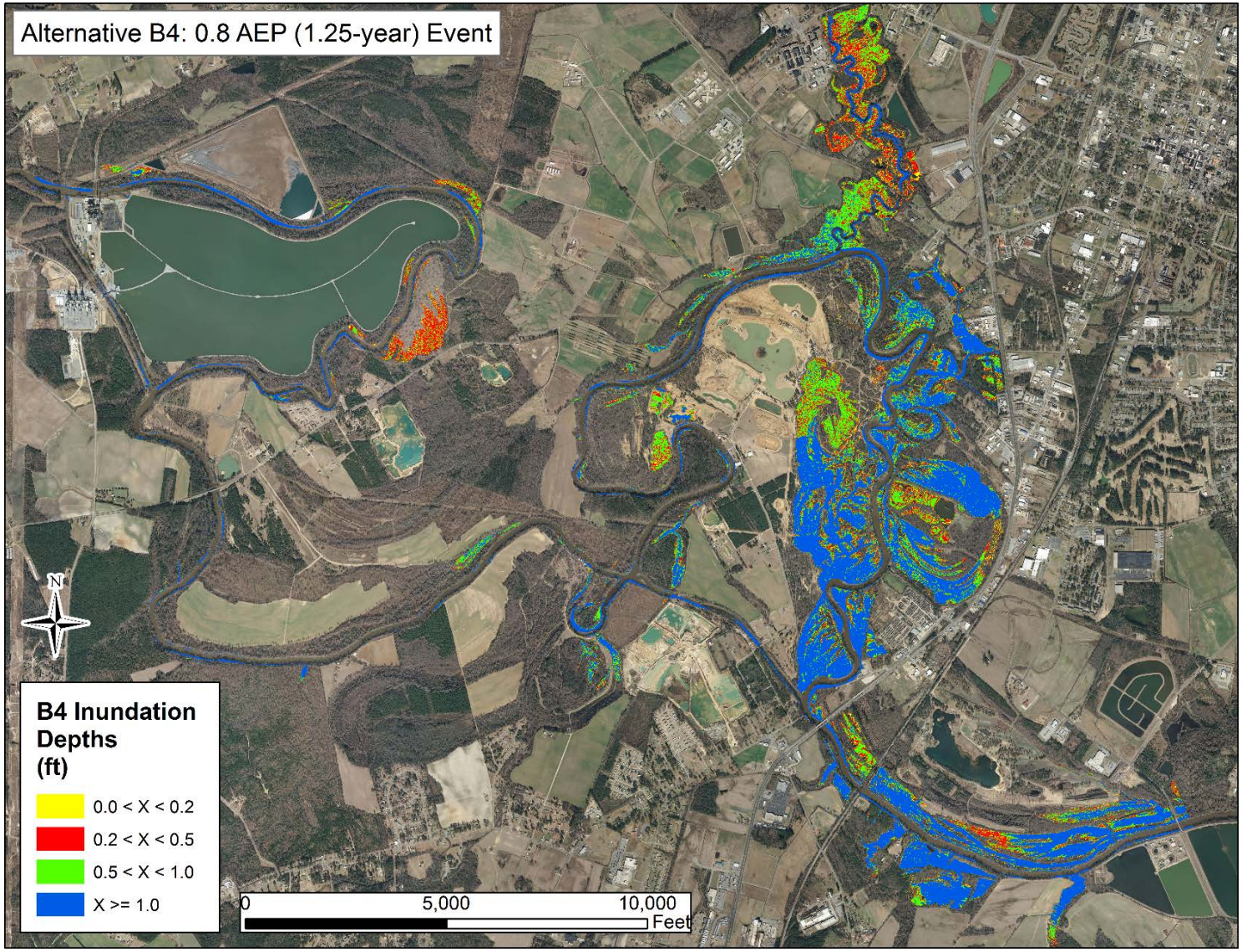


Figure 22 Computed Inundation Depths under Alternative B4 Conditions for the 0.80-AEP (1.25-year) Event

7.3 Hydraulic Parameters for EBA Model

The Environmental Benefits Model (EBA) relied heavily on hydraulic modeling due to the overall lack of applicable environmental data in the project area. Computed variables from the HEC-RAS model were used to develop EBA model indicators. Model indicators were developed for existing conditions and for each of the final alternatives. The indicators were:

- (1) Channel flow velocity,
- (2) Channel surface area, and
- (3) Annual weir overtopping percentage.

(1) Channel flow velocity was a direct output of the hydraulic model. (2) Channel surface area was determined by a geospatial analysis of computed water surface elevations confined to the channel width over the 37,500-linear feet of the Neuse River main stem meander. (3) Annual weir overtopping percentage was developed through a statistical analysis of hourly discharge recorded at the USGS Goldsboro stream gage. The period of record covered water years post-Falls Dam regulation.

7.3.1 EBA Indicator Values of Flow Velocity

Tabulated indicator values of flow velocity under existing conditions are shown in Table 14. There was a direct correlation between an increase in WSEL and an increase in flow velocity. Therefore, WSEL values were also included. Discharge events taken from the USGS Goldsboro stream gage at or below 665 cfs will not overtop the existing weir. Therefore, there would be a zero-change in indicator value for any final alternative while flows are at or below 665 cfs. Indicator values during Alternative B1 conditions are compared to existing conditions in Table 15. During Alternative B1 conditions, discharge events taken at the USGS Goldsboro stream gage above 1100 cfs will initiate weir overtopping. Similarly, indicator values during Alternative B2 conditions are compared to existing conditions in Table 16. During Alternative B2 conditions, discharge events taken at the USGS Goldsboro stream gage above 1600 cfs will initiate weir overtopping. Indicator values during Alternative B3 conditions are compared to existing conditions in Table 17. During Alternative B3 conditions, discharge events taken at the USGS Goldsboro stream gage above 2300 cfs will initiate weir overtopping. Lastly, indicator values during Alternative B4 conditions are compared to existing conditions in Table 18. During Alternative B4 conditions, discharge events taken at the USGS Goldsboro stream gage above 3200 cfs will initiate weir overtopping. The comparison tables referenced above were based on initial weir overtopping flows because it was at that particular discharge event that weir effects of increasing WSEL and flow velocity were greatest.

Table 14 Indicator Values under Existing Conditions

Existing Conditions																
Indicator Location	**Discharge Event at USGS Goldsboro Stream Gage**															
	***665 cfs**		**1100 cfs**		**1600 cfs**		**2300 cfs**		**3000 cfs**		**3200 cfs**		**4500 cfs**		**17500 cfs**	
	WSEL	Vel	WSEL	Vel	WSEL	Vel	WSEL	Vel	WSEL	Vel	WSEL	Vel	WSEL	Vel	WSEL	Vel
1	59.71	0.94	60.80	1.18	61.69	1.42	62.74	1.70	63.52	1.86	63.71	1.92	65.01	2.29	73.49	4.30
2	56.46	0.94	57.21	1.37	57.92	1.76	58.83	2.20	59.97	2.59	59.72	2.71	60.81	3.04	69.30	4.76
3	55.97	0.80	56.36	1.22	56.68	1.42	57.23	1.90	57.74	2.31	57.88	2.43	58.95	3.00	67.33	4.69
4	55.88	0.40	56.22	0.60	56.46	0.83	56.91	1.18	57.32	1.46	57.43	1.53	58.40	1.91	66.98	3.07
5	54.93	1.45	55.24	1.41	55.51	1.46	55.98	1.55	56.42	1.62	56.54	1.62	57.73	1.64	66.66	2.93
6	52.30	0.99	52.89	1.04	53.45	1.07	54.24	1.12	54.94	1.18	55.13	1.19	56.87	1.24	66.21	1.70
7	51.86	1.30	52.53	1.34	53.16	1.36	54.01	1.42	54.75	1.47	54.94	1.49	56.78	1.49	66.16	1.52
8	51.31	0.98	52.00	1.14	52.66	1.28	53.52	1.45	54.28	1.61	54.47	1.63	56.43	1.77	65.98	1.92
9	48.59	0.55	49.87	0.82	51.01	1.08	52.27	1.41	53.25	1.71	53.50	1.78	55.97	2.07	65.77	3.35
10	46.18	2.09	47.07	2.63	47.92	3.11	48.93	3.64	49.81	4.06	50.05	4.16	54.63	3.22	65.03	4.04
11	55.88	0.01	56.20	0.38	56.34	0.80	56.70	1.80	56.98	2.44	57.06	2.60	57.93	3.47	66.81	4.20
12	48.59	0.07	50.46	0.23	52.10	0.50	53.56	1.13	54.78	1.48	55.08	1.57	57.36	2.04	66.75	3.10
13	48.59	0.08	49.99	0.91	51.30	1.49	52.70	2.10	53.79	2.59	54.07	2.71	56.48	3.11	66.11	3.97

WSEL: water surface elevation in ft, NAVD88

Vel: flow velocity in ft/s

*Flows above 665 cfs initiates weir overtopping under existing conditions

Table 15 Comparison of Indicator Values between Alternative B1 and Existing Conditions

Indicator Location	*1100 cfs Discharge Event at USGS Goldsboro Stream Gage			
	Existing Conditions		Alternative B1	
	WSEL	Vel	WSEL (%Change)	Vel (%Change)
1	60.80	1.18	60.87 (+0.001)	1.18 (0)
2	57.21	1.37	57.71 (+0.009)	1.28 (-0.066)
3	56.36	1.22	57.07 (+0.013)	0.95 (-0.221)
4	56.22	0.60	56.97 (+0.013)	0.55 (-0.083)
5	55.24	1.41	55.95 (+0.013)	1.67 (+0.184)
6	52.89	1.04	53.57 (+0.013)	1.33 (+0.279)
7	52.53	1.34	53.13 (+0.011)	1.63 (+0.216)
8	52.00	1.14	52.48 (+0.009)	1.39 (+0.219)
9	49.87	0.82	49.87 (0)	0.82 (0)
10	47.07	2.63	47.07 (0)	2.63 (0)
11	56.20	0.38	56.97 (+0.014)	0.01 (-0.974)
12	50.46	0.23	49.87 (-0.012)	0.1 (-0.565)
13	49.99	0.91	49.87 (-0.0024)	0.12 (-0.868)

WSEL: water surface elevation in ft, NAVD88

Vel: flow velocity in ft/s

*Flows above 1100 cfs initiates weir overtopping under Alternative B1 conditions

Table 16 Comparison of Indicator Values between Alternative B2 and Existing Conditions

Indicator Location	*1600 cfs Discharge Event at USGS Goldsboro Stream Gage			
	Existing Conditions		Alternative B2	
	WSEL	Vel	WSEL (%Change)	Vel (%Change)
1	61.69	1.42	61.82 (+0.002)	1.45 (+0.021)
2	57.92	1.76	58.80 (+0.015)	1.57 (-0.108)
3	56.68	1.42	58.06 (+0.024)	1.17 (-0.176)
4	56.46	0.83	57.93 (+0.026)	0.68 (-0.181)
5	55.51	1.46	56.90 (+0.025)	1.92 (+0.315)
6	53.45	1.07	54.67 (+0.023)	1.60 (+0.495)
7	53.16	1.36	54.24 (+0.020)	1.88 (+0.382)
8	52.66	1.28	53.49 (+0.016)	1.71 (+0.336)
9	51.01	1.08	51.01 (0)	1.02 (-0.556)
10	47.92	3.11	47.92 (0)	2.99 (-0.386)
11	56.34	0.80	57.93 (-0.028)	0.01 (-0.988)
12	52.10	0.50	51.01 (-0.021)	0.11 (-0.780)
13	51.30	1.49	51.01 (-0.006)	0.14 (-0.906)

WSEL: water surface elevation in ft, NAVD88

Vel: flow velocity in ft/s

*Flows above 1600 cfs initiates weir overtopping under Alternative B2 conditions

Table 17 Comparison of Indicator Values between Alternative B3 and Existing Conditions

Indicator Location	*2300 cfs Discharge Event at USGS Goldsboro Stream Gage			
	Existing Conditions		Alternative B3	
	WSEL	Vel	WSEL (%Change)	Vel (%Change)
1	62.74	1.70	62.90 (+0.003)	1.66 (-0.024)
2	58.83	2.20	59.88 (+0.018)	1.90 (-0.136)
3	57.23	1.90	59.13 (+0.033)	1.53 (-0.195)
4	56.91	1.18	58.97 (+0.036)	0.88 (-0.254)
5	55.98	1.55	57.95 (+0.035)	2.36 (+0.523)
6	54.24	1.12	55.84 (+0.029)	2.02 (+0.804)
7	54.01	1.42	55.43 (+0.026)	2.30 (+0.620)
8	53.52	1.45	54.54 (+0.019)	2.26 (+0.559)
9	52.27	1.41	52.27 (0)	1.41 (0)
10	48.93	3.64	48.92 (-0.0002)	3.64 (0)
11	56.70	1.80	58.97 (+0.040)	0.01 (-0.994)
12	53.56	1.13	52.27 (-0.024)	0.10 (-0.912)
13	52.70	2.10	52.27 (-0.082)	0.19 (-0.910)

WSEL: water surface elevation in ft, NAVD88

Vel: flow velocity in ft/s

*Flows above 2300 cfs initiates weir overtopping under Alternative B3 conditions

Table 18 Comparison of Indicator Values between Alternative B4 and Existing Conditions

Indicator Location	*3200 cfs Discharge Event at USGS Goldsboro Stream Gage			
	Existing Conditions		Alternative B4	
	WSEL	Vel	WSEL	Vel
1	63.71	1.92	63.91(+0.003)	1.88 (-0.021)
2	59.72	2.71	60.86(+0.019)	2.18 (-0.196)
3	57.88	2.43	60.11(+0.039)	1.86 (-0.235)
4	57.43	1.53	59.96(+0.044)	1.07 (-0.301)
5	56.54	1.62	59.01(+0.044)	2.74 (+0.691)
6	55.13	1.19	56.99(+0.034)	2.44 (+1.050)
7	54.94	1.49	56.60(+0.030)	2.69 (+0.805)
8	54.47	1.63	55.60(+0.021)	2.80 (+0.718)
9	53.50	1.78	53.50(0)	1.79 (+0.006)
10	50.05	4.16	50.05(0)	4.18 (+0.005)
11	57.06	2.60	59.96(+0.051)	0.01 (-0.996)
12	55.08	1.57	53.51(-0.029)	0.13 (-0.917)
13	54.07	2.71	53.51(-0.010)	0.22 (-0.919)

WSEL: water surface elevation in ft, NAVD88

Vel: flow velocity in ft/s

*Flows above 3200 cfs initiates weir overtopping under Alternative B4 conditions

7.3.2 EBA Indicator Values of Neuse River Channel Surface Area

Similar to stream flow, it was determined that there was direct correlation in an increase in water surface elevation an increase in channel surface area. Alternative B1 created an additional 3 acres of surface area within the ~7-mile reach of the Neuse River main stem meander when compared to existing condition during the initial weir overtopping discharge event at the USGS Goldsboro stream gage. Alternatives B2, B3, and B4 created an additional 5, 6.5, and 7.5 acres, respectively.

7.3.3 EBA Indicator Values of Annual weir overtopping percentage

The intent of this indicator value was to weigh the presumed increase in average stream flow the main stem meander of the Neuse River would experience, given a particular alternative. As the height of the cut-off weir structure increased, more flow was kept in the main stem meander. An initial weir overtopping flow under existing conditions was expected to occur 73-percent of the time in any given water year. Alternative B1 was expected to be overtopped 55-percent of the time in any given water year. Alternative B2 was expected to be overtopped 42-percent of the time in any given water year. Alternative B3 was expected to be overtopped 30-percent of the time in any given water year. Alternative B4 was expected to be overtopped 22-percent of the time in any given water year.

7.4 Project Impact to FEMA Baseflood Elevations

Established FEMA baseflood elevations are not expected to be altered in any way as a result of implementing any of the alternatives within the final array. This is because the 0.01-AEP (historically referred to as the 100-year) flow discharge FEMA uses to establish baseflood elevations is several magnitudes larger than the flow discharges associated with weir raises that would produce an increase in WSEL. Essentially, the flooding footprint of the 0.01-AEP event is expansive enough over the floodplain that the hydraulic effect of the weir structure is insignificant, regardless of whether the weir height is increased by 1 foot or increased by 4 feet.

7.5 Sedimentation Analysis

Hydraulic modeling of sediment transport and deposition associated with analyzing project alternatives was not done due to overall lack of field survey-verified data. Summation of project-related affects was instead determined qualitatively. General statements associating an increase in velocity to a decrease in deposition should be made with caution as “The processes governing sediment transport are complex. As such, accurate observations of sediment transport are crucial to provide data to properly formulate understanding of the sediment transport process” (USGS, 2010). Based on the minor relative changes produced by the recommend plan to the existing flow regime, in both discharge and velocity, current sedimentation transport and deposition within the project area is unlikely to be significantly altered. Locations within the project area determined most sensitive to sedimentation was immediately upstream and downstream of the weir structure. Routine maintenance and/or project inspections carried out by the sponsor are expected to be the primary means of documenting any significant changes in sedimentation that may occur in the vicinity of the cutoff channel and weir structure.

8 Climate Change

Guidance for incorporating climate change impacts to inland hydrology in Civil Works studies, designs, and project is covered in *Engineering and Construction Bulletin No. 2016-25. Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects*, and "applies to all hydrologic analysis supporting planning and engineering decisions having an extended decision time frame. It provides guidance for incorporating climate change information in hydrologic analysis in accordance with the USACE overarching climate change adaption policy. This policy requires consideration of climate change in all current and future studies to reduce vulnerabilities and enhance the resilience of our water resources infrastructure." Applicable climate change language from a concurrent water supply re-allocation study within the Neuse River basin has been re-used in the following paragraphs (USACE SAW, 2017).

The *USACE Screening-Level Climate Change Vulnerability Assessment Tool at the Watershed-Scale (VA Tool)* was one tool used to assess climate change impacts. This tool, based upon the HUC-4 watershed scale, determined specific indicators of vulnerability representing two primary USACE business lines related to both the original Goldsboro, Neuse River, N.C. Federal Project and CAP 1135 Project – Flood Risk Reduction and Ecosystem Restoration.

For the Neuse-Pamlico watershed (HUC 0302), this tool shows that the project area is projected to not be vulnerable with respect to flood risk reduction for the 21st century for all wet and dry projected scenarios. Refer to Figure 23 for 21st century projected scenarios related to Flood Risk Reduction. While there is an increase in the Weighted Order Weighted Average (WOWA) scores between year 2050 and year 2085 for both the Dry and Wet scenarios (45.1 to 47.6 for Dry and 48.2 to 52.0 for Wet, respectively), the future increases still do not exceed the 20% vulnerability threshold.

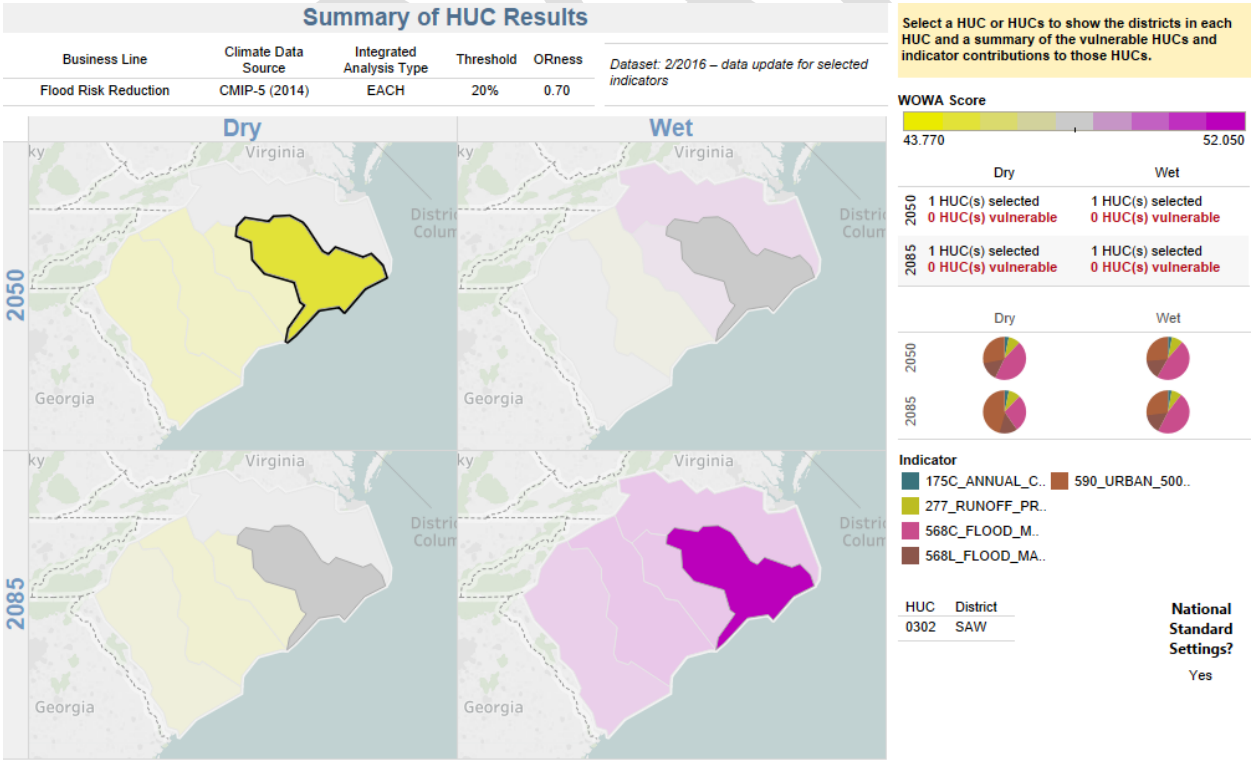


Figure 23 Projected Vulnerability for Neuse-Pamlico Watershed with respect to Flood Risk Reduction

For the Neuse-Pamlico watershed (HUC 0302), this tool shows that the project area is projected to be vulnerable with respect to ecosystem restoration for the 21st century for all dry projected scenarios. Refer to Figure 24 for 21st century projected scenarios related to ecosystem restoration. A breakdown of indicators under the dry scenario for ecosystem restoration is shown in Table 19. While there is an increase in the Weighted Order Weighted Average (WOWA) scores between year 2050 and year 2085 for the Wet scenario (72.2 to 72.5), the future increases still do not exceed the 20% vulnerability threshold.

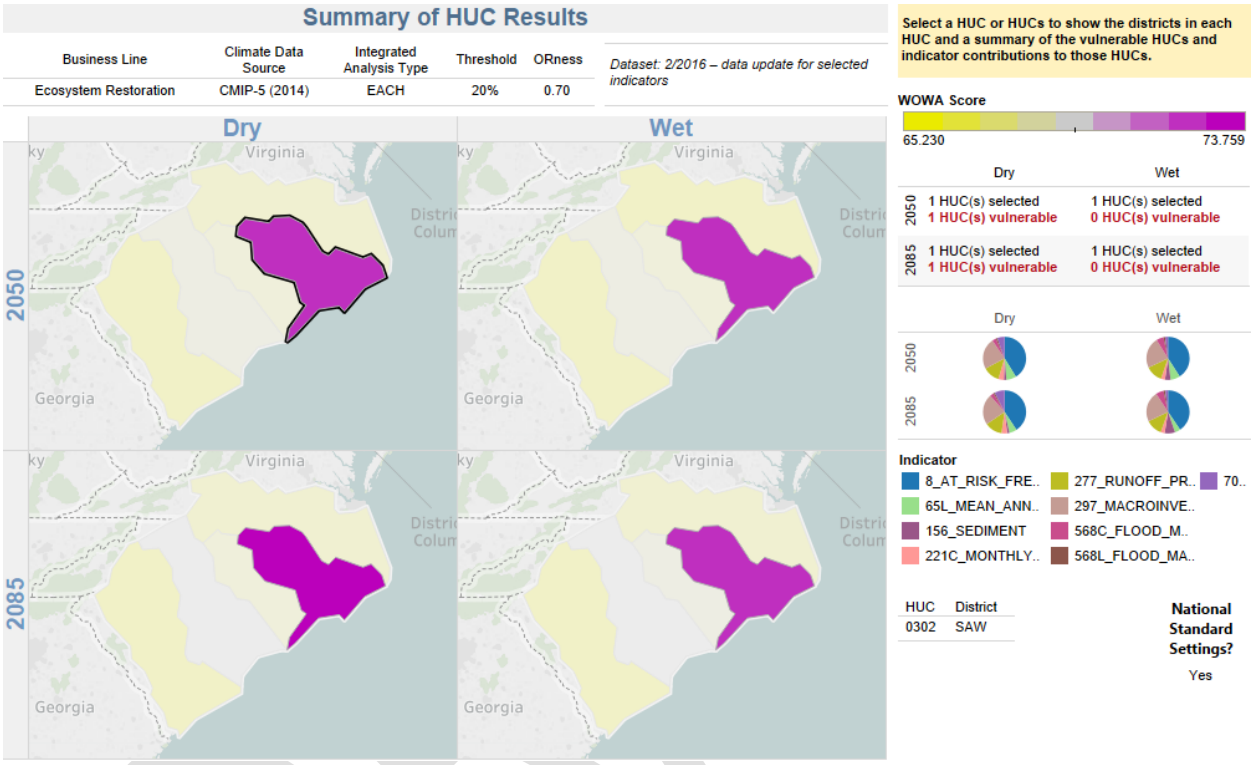


Figure 24 Projected Vulnerability for Neuse-Pamlico Watershed with respect to Ecosystem Restoration

Table 19 Ecosystem Restoration Business Line HUC 0302 Dry Scenario Summary

Ecosystem Restoration Business Line HUC 0302 Dry Scenario Summary			
Indicator	**Description**	**2050 Percentage**	**2085 Percentage**
8_AT_RISK_FRESHWATER_PLANT	*Percentage of wetland and riparian plant communities that are at risk of extinction, based on remaining number and condition, remaining acreage, threat severity, etc*	43.2	43
65L_MEAN_ANNUAL_RUNOFF	*Mean runoff: average annual runoff, excluding u*	5.8	5.4
156_SEDIMENT	*The ratio of the change in the sediment load in the future to the present load.*	2	1.8
221C_MONTHLY_COV	*Measure of short-term variability in the region's hydrology: 75th percentile of annual ratios of the standard deviation of monthly runoff to the mean of monthly runoff. Includes upstream freshwater inputs (cumulative).*	6.2	6.1
277_RUNOFF_PRECIP	*Median of: deviation of runoff from monthly mean times average monthly runoff divided by deviation of precipitation from monthly mean times average monthly precipitation.*	15.2	15.2
297_MACROINVERTEBRATE	*The sum (ranging from 0-100) of scores for six metrics that characterize macroinvertebrate assemblages: taxonomic richness, taxonomic composition, taxonomic diversity, feeding groups, habits, pollution tolerance.*	17.4	17.3
568C_FLOOD_MAGNIFICATION	*Change in flood runoff: ratio of indicator 571C (monthly runoff exceeded 10% of the time, including upstream freshwater inputs) to 571C in base period.*	3.1	3.1
568L_FLOOD_MAGNIFICATION	*Change in flood runoff: Ratio of indicator 571L (monthly runoff exceeded 10% of the time, excluding upstream freshwater inputs) to 571L in base period.*	1.2	1.2
700C_LOW_FLOW_REDUCTION	*Change in low runoff: ratio of indicator 570C (monthly runoff exceeded 90% of the time, including upstream freshwater inputs) to 570C in base period.*	5.8	6.9

While the VA tool identifies watersheds that may or may not be vulnerable, it may not be appropriate to cascade those results to the project by default because projects are of finer spatial scales, especially since the Neuse river basin is actually a separate river basin entirely, but is combined with the Tar-Pamlico river basin for the climate model. To compensate for these considerations, the ECB and ETL are employed to assess conditions at the finer spatial scales.

The USACE Climate Hydrology Assessment Tool was used to examine observed and projected trends in Neuse-Pamlico watershed hydrology to support the qualitative assessment, based on analysis of projected annual maximum monthly flows for the 93 climate ensembles through the year 2099. As expected for this type of qualitative analysis, there is considerable variability in these maximum flows (Figure 25); however, numerous maximum flows after year 2024 do exceed all maximum flows prior to 2040, resulting in the overall projected trend in mean annual maximum monthly flows over time for the Neuse-Pamlico watershed (Figure 26). This may suggest potential for flood risk impacts in the future. This result is qualitative only.

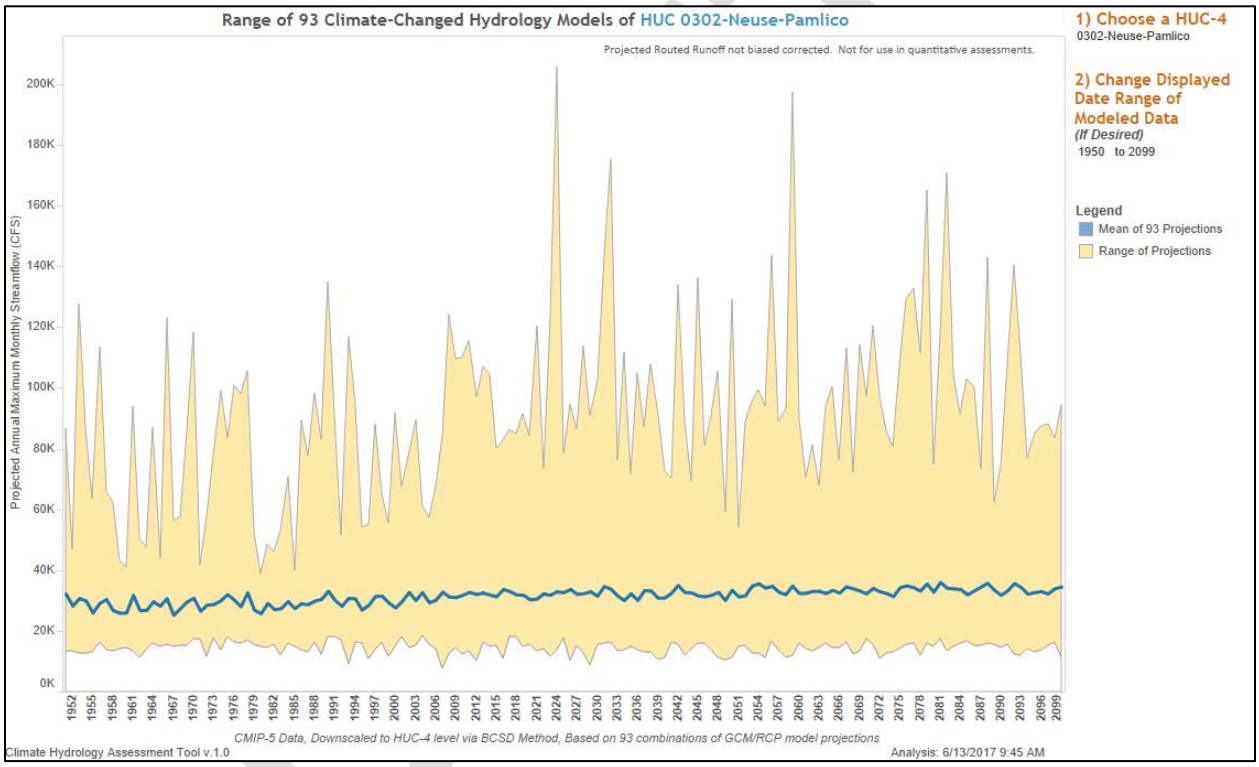


Figure 25 Range of Projected Annual Maximum Monthly Streamflow for Neuse-Pamlico Watershed

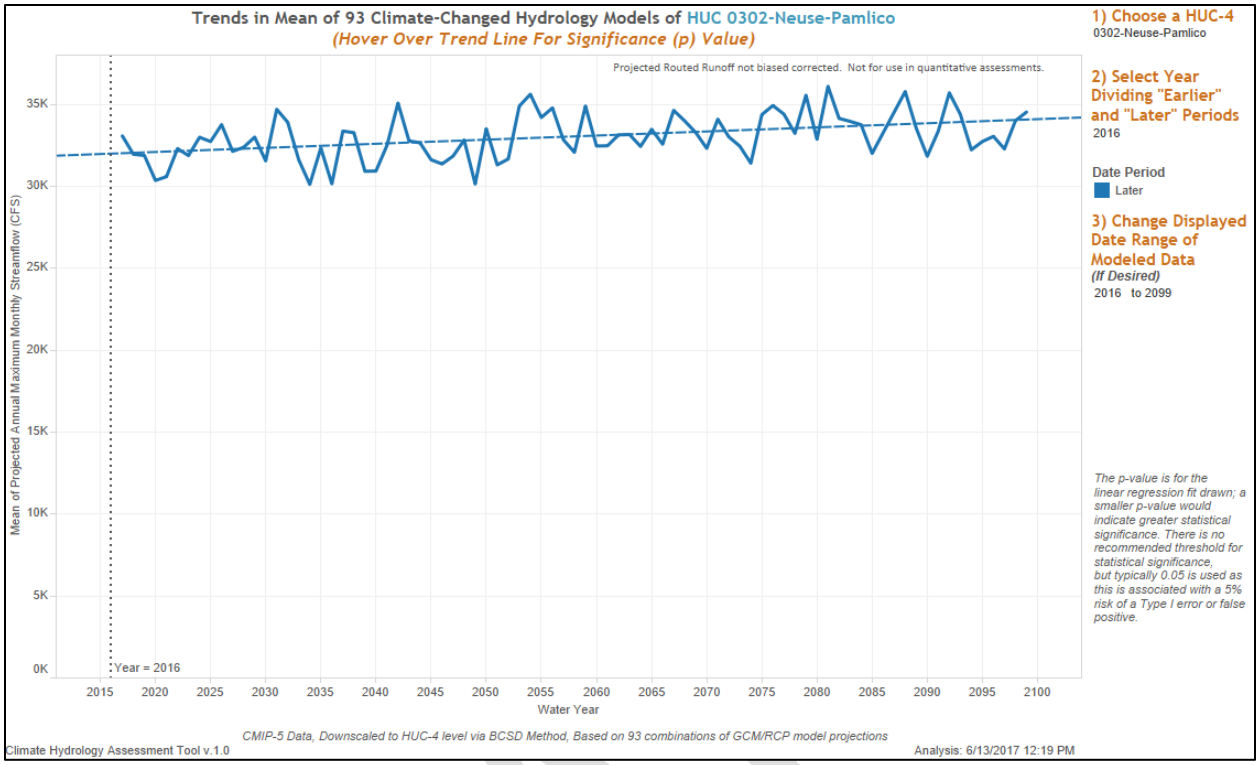


Figure 26 Trends in Mean Projected Annual Maximum Monthly Streamflows for the Neuse-Pamlico Watershed

Figure 27 comes from the *Climate Hydrology Assessment Tool (ECB 2016-25)* tool and shows the annual maximum streamflow and the trend line associated with the annual values for the USGS 02089000 Neuse River near Goldsboro, NC stream gage, nearest the project area. Over the full period of record for this gage, the trend lines for this gage shows a downward trend in annual maximum streamflows when evaluating the entire period of record (since 1930); however, when the period of analysis is reduced to reflect only the regulated period since Falls went into operation, then there is no discernable trend for this downstream gage (Figure 28).

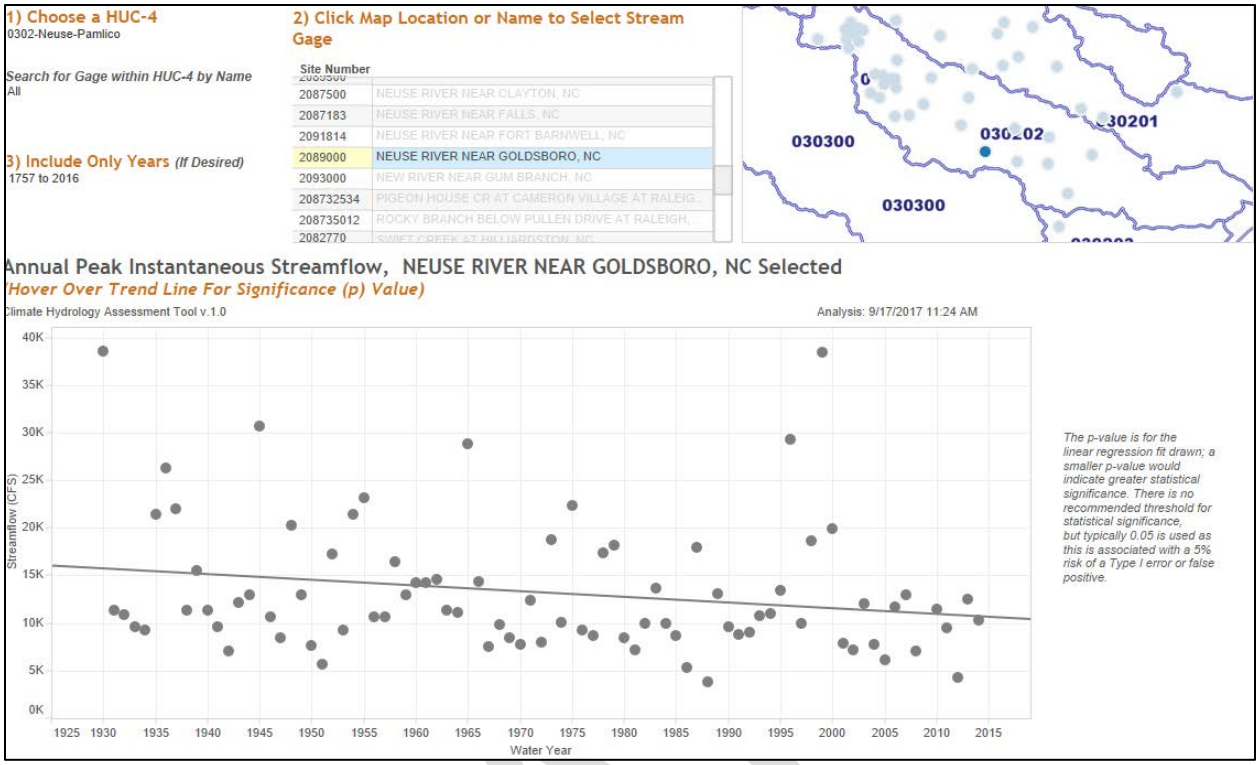


Figure 27 Annual Maximum Streamflow for Neuse River near Goldsboro, NC

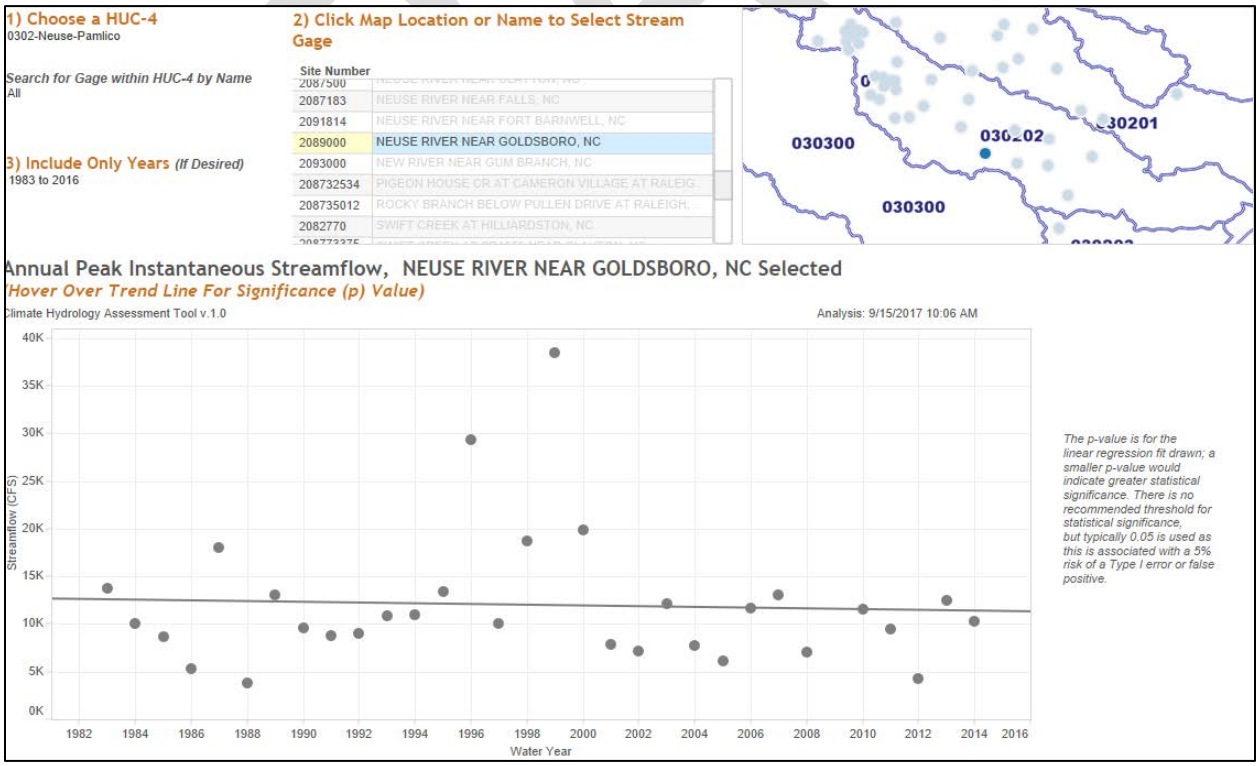


Figure 28 Annual Maximum Streamflow for Neuse River near Goldsboro, NC

The Nonstationarity Detection Tool was also used to examine the hydrologic time series at the USGS Neuse River near Goldsboro stream gage. Nonstationarity Detector results are shown in Figure 29. A minor change in the mean, standard deviation, and variance was detected by two methodologies for this gage. It is unclear what might have contributed to this. The results of the nonstationarity detection analysis indicate that overall, there has been no statistically significant change in streamflow statistics, as measured by the annual maximum flood, over the long-term period of record for the gage that could potentially adversely affect flood risk reduction/ecosystem restoration vulnerabilities.

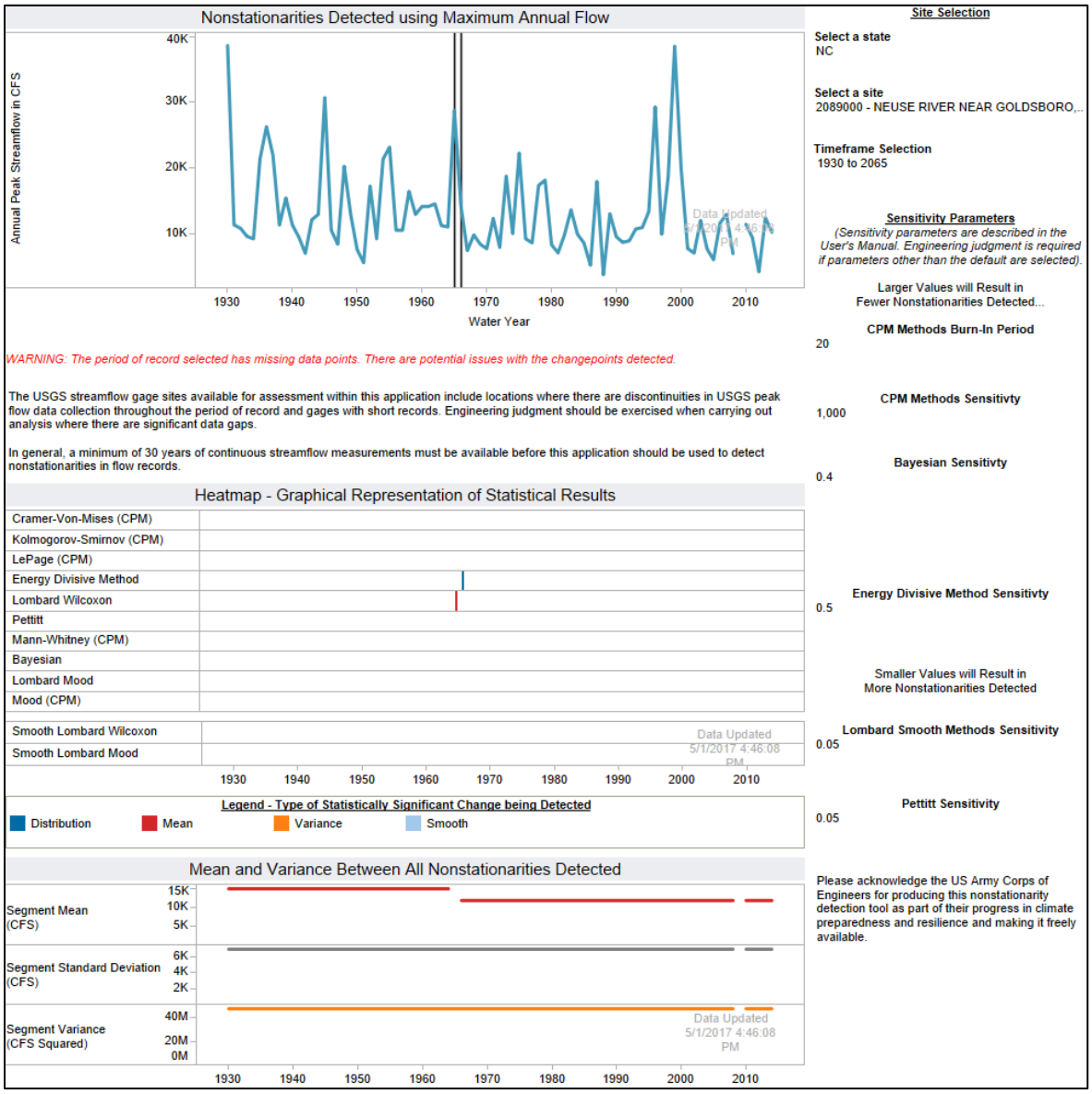


Figure 29 Nonstationarity Analysis of Maximum Annual Flow for Neuse River near Goldsboro, NC

Overall, no strong signal exists within the qualitative and quantitative analyses described herein to indicate definitive climate change impacts that would warrant modifications to the historic hydrologic data sets being used in this study.

9 References

U.S. Army Corps of Engineers. Engineering and Construction Bulletin No. 2016-25. Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects. Issued: 16 Sep 16. Expires: 16 Sep 18. 2016.

U.S. Army Corps of Engineers – Wilmington District (USACE SAW). Falls Lake Reallocation Study. Draft Final Report. 2017.

Federal Emergency Management Agency. Wayne County, North Carolina Flood Insurance Study. 2013

Civil-Geotechnical-Surveying CESI. Hydrographic Survey Neuse River Cutoff Goldsboro, North Carolina. 2016.

U.S. Department of Transportation, Federal Highway Administration. Introduction to Highway Hydraulics. FHWA publication number NHO-08-090. 2008

North Carolina Department of Public Safety, Emergency Management, North Carolina Geodetic Survey. LiDAR Quality Control Report – 2014 Statewide LiDAR Project. 2015.

United States Geological Survey. Measurement of Bedload Transport in Sand-Bed Rivers: A Look at Two Indirect Sampling Methods. Geological Survey Scientific Investigations Report 2010-5091. 2010

United States Department of Agriculture. Natural Resources Conservation Service. Part 654 Stream Restoration Design National Engineering Handbook. Technical Supplement 14N Fish Passage and Screening Design. 210-VI-NEH, August 2007.

Harvey E Jobson and David C. Froehlich, United States Geological Survey. Open-File Report 88-707. Basic Hydraulic Principles of Open-Channel Flow. 1988

War Department, Office of the Chief of Engineers. House of Representatives, 77th Congress 1st Session. Document No. 327. Neuse River, N.C., Letter from the Secretary of War. 1941.

U.S. Army Corps of Engineers. Rivers and Harbors – Wilmington, N.C., District. Report of the Chief of Engineers, U.S. Army 1941, Part I, Vol. I. Annual Reports, War Department. 1941.

U.S. Army Corps of Engineers – Wilmington District. Water Control Manual, Falls Lake Project, Neuse River Basin, North Carolina. 1990.

APPENDIX B

Economics and Incremental Cost Analysis

Appendix B: Economic and Incremental Cost Analysis

1.1 ECONOMIC AND SOCIAL CONSIDERATIONS

This appendix presents the socio-economic issues related to the Neuse River Goldsboro Section 1135 project implementation.

The primary effects of the project are the costs of implementation (National Economic Development [NED] cost), and the environmental benefits (i.e. ecosystem restoration and improvements). These costs and benefits are incorporated into a Cost Effectiveness/Incremental Cost Analysis (CE/ICA) which is a main tool used in the socio-economic evaluation of an environmental restoration project.

The primary effects of the project include the costs of implementation as well as the ecosystem restoration and improvement benefits. Project implementation costs are monetarily expressed in terms of the net national project cost (NED costs). Project costs have regional impacts as expenditures on the project within the regional economy that could cause changes in local and regional earnings, sales, and employment. While the costs of implementation are expressed in traditional monetary terms, ecosystem improvement, the most significant beneficial effect of the project is not expressed in monetary terms. Ecosystem improvement is expressed in terms of National Ecosystem Restoration benefits in accordance with U.S. Army Corps of Engineers (USACE) policy. For ecosystem restoration projects, a plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the federal objective shall be selected.

The potential economic impacts of the alternative restoration plans are secondary consequences of the environmental improvements and hydrologic changes that are expected to result from the proposed structural and operational modifications to the project study area. These projected impacts are contingent upon the successful implementation and operation of restoration plans and subsequent outputs and therefore, subject to the uncertainties inherent in ecosystem restoration activities. Due to the challenges inherent in quantifying National Ecosystem Restoration (NER) effects or benefits, quantifying the resulting NED impact is also a challenge.

Nonetheless, there are methods for evaluating the economic efficiencies of producing these alternative restoration plans.

In order to evaluate the economic efficiencies of the span of project alternatives, an analysis of the NED costs and NER benefits of each alternative is undertaken. Specifically, a CE/ICA is utilized to determine the alternatives that provided the least unit cost per unit of benefits.

This appendix is responsible for considering a variety of social conditions relevant to the project. These social conditions are intricately interconnected with the economics of the project. They include elements such as population, water demand, recreation, environmental justice, and a variety of other considerations.

1.2 Elements of the Socio-economic Investigation

This investigation assesses the economic effects of the alternative ecosystem restoration plans formulated in the feasibility phase of the Neuse Goldsboro 1135 project. The economic evaluation of the alternative restoration plans includes the elements discussed in the following sub-sections.

1.2.1 Evaluation of Project Costs

Project costs include all expenditures required to implement the alternative plans. The federal government and the City of Goldsboro would share these costs. Neuse 1135 project costs include those for initial construction; lands; relocations; rights of way; rehabilitation, replacement, and repair; and operations and maintenance (O&M) (including the costs of post-construction monitoring and adaptive management).

1.2.2 Regional Economic Development Effects

The potential Regional Economic Development (RED) effects of the Recommended Plan include changes in income, employment, or economic output of the region. Given the cost and, negligible multiplier effects associated with low project cost, RED will not be used as a consideration in plan selection.

1.2.3 Other Social Effects

The potential social effects of the Recommended Plan include effects on minority, elderly, and disadvantaged groups, population displacement, and effects on community cohesion. Given the remote location of the project area, OSE will not be a consideration in plan selection.

1.3 Methodology

A number of factors were considered prior to developing the methodologies used to evaluate the economic effects of the alternative restoration plans. These factors include: available analytical tools, economic theory, federal policy, obtainable data, and time and budgetary constraints. These factors are discussed in the sections to follow.

1.3.1 Without-Plan and With-Plan Conditions

Proper definition of the without-plan and with-plan conditions is critical to the planning process. The without-plan condition is the most likely condition expected to exist in the future in the absence of a proposed project. The future without plan condition is the benchmark against which alternative future with-plans are evaluated. National and regional socio-economic parameters considered include income, employment, population and other aggregate projections such as

land use trends, water supply and water demand. Comparisons of conditions with the implementation of alternative plans to future without-plan conditions were performed to identify the beneficial and adverse effects of the proposed plans. Depending on the alternative and the type of economic impact changes resulting from implementation of a restoration plan, it may be desirable or undesirable when compared to the future without-plan condition. For example, alternatives that include modifications to the current system to provide additional drainage areas may result in fewer economic losses associated with urban flood damage. This would be a desirable ancillary benefit of restoration.

1.3.2 Economic Analysis Methodology

Consistent with USACE guidance, neither a traditional benefit-cost ratio nor a net NED analysis is required for NER plans. For ecosystem restoration projects, a plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the federal objective shall be selected. The methodologies used to conduct economic analysis studies for the project were based on a combination of factors, including: economic theory, USACE's ecosystem restoration and economic evaluation policies, and the characteristics of methodologies used by economists to value ecosystem benefits. For this study, the alternative restoration plans were compared using information in monetary and non-monetary units. The economic analysis of the Neuse Goldsboro 1135 restoration plans include: (1) the NED costs (in monetary terms), (2) the anticipated environmental benefits resulting from restoration measures (in non-monetary terms), (3) the positive and adverse regional economic effects (RED) and social effects resulting from project implementation.

This section of the report addresses the above items. The economic basis for making policy decisions about whether to invest public funds in ecosystem restoration for the project is comparing monetary costs and non-monetary benefits in order to determine whether the expenditure is justified. The costs of ecosystem restoration projects include: initial construction costs; major rehabilitation and repair costs; O&M costs; post construction monitoring costs; and adverse NED effects, if any (not anticipated). Typically, these costs can be expressed in monetary (i.e., dollar) terms.

The principal challenge of ecosystem restoration economics is estimating the value of restoration benefits. The primary purpose of each alternative plan is ecosystem restoration. The benefits of ecosystem restoration are usually expressed by ecologists in non-monetary units, such as acres of specific habitat created, indices of biological productivity associated with habitat improvement, or increased abundance and/or diversity of particular species of plants or animals.

Expressing the costs and benefits of alternatives in a common, monetary metric would facilitate selection of the best restoration plan for a given site. However, calculating the monetary value of environmental amenities is both difficult and controversial. Environmental amenities are public goods that are generally not exchanged in the marketplace. For marketable commodities (i.e., items that people buy and sell), the demand and prices paid for these goods can be used as "proxies" for determining their value to consumers. In the absence of data on consumers' expenditures for environmental amenities, resource economists have attempted to develop

techniques that can be used to estimate their value using indirect indicators of consumers' "willingness to pay" for ecosystem restoration. For goods and services that are not purchased in the marketplace, non-market valuation approaches must be used to infer their value to the public. There are direct and indirect use values for these goods and services. Use values refer to the value consumers obtain from using a good that is related to an environmental amenity.

Non-consumptive use values refer to the value obtained by a user in cases for which the good remains to be used by others in the future, such as catch-and-release fishing or bird watching. It is reasonable to expect that the alternative restoration plans will generate additional use values to the public. Non-market activities that would benefit from restoration plans include recreational fishing, subsistence activities, and a variety of eco-tourism related activities (e.g., bird watching, hiking and canoeing).

Non-use values include the values the public obtains from simply knowing that the good or resource is available, even if they have not used it previously. Individuals may value a good simply from knowing it exists (existence value) or because they may want to have the opportunity to use it at some future time (option value).

Again, it is reasonable to expect that the alternative restoration plans will generate additional non-use values to the public. The tremendous interest in and support for ecosystem restoration, not just in North Carolina but throughout the Nation is an indication that a broad segment of society values the ecosystem, even though most have never experienced the area first hand.

As specified in USACE's ecosystem restoration policy (EC 1105-2-210: Ecosystem Restoration in the Civil Works Program), ecosystem restoration projects are not subject to traditional benefit- cost analyses. An ecosystem restoration proposal must still be justified by comparing the monetary costs and non-monetary benefits of restoring degraded ecosystems. USACE ecosystem restoration evaluation procedures focus on the non-monetary benefits of restoration, comparing these benefits to monetary costs using CE/ICA procedures.

2.0 AREA, POPULATION AND ECONOMY

The sections that follow evaluate the economic impacts of the alternative restoration plans.

The people who live in the study area, and the economic activity, in which they are engaged, comprise important components of the area's total environment.

Any course of action forthcoming from this study could have effects throughout an economic system as well as the natural ecosystem(s), the health and sustenance of which are the impetus for this investigation. The economic system is connected with the natural ecosystem and in general is ultimately dependent upon it for survival. This connection is especially strong in the study area.

Adverse changes in the health and condition of the natural system can cause severe

negative impacts on the economic system, particularly in the study area for this feasibility study. Conversely, in this study area, beneficial changes to the natural system are expected to have a strong positive effect on the economic system. It is significant, therefore, to describe and understand the general economic and social environment within which such changes could take place. Although the main focus of economic impact evaluation efforts undertaken for this study has been to describe the economic impacts and benefits of alternatives being considered for implementation, describing the broader context for these evaluation efforts is also necessary and important.

Competition for regional water resources has intensified with the increase in population and industry growth. This places a strain on existing resources, which will eventually surpass the readily available sources. When the needs of the natural system are then factored in, demands become greater and conflicts among competing water users would become even more severe. While most people recognize the need for a healthy ecosystem to support the region's economy and jobs, many people are concerned that restoration projects could displace businesses, limit development, reduce available water supply and reduce job opportunities. By contrast, continued degradation of the project's ecosystem would adversely affect lifestyles in and around the study area.

2.1 Project Area

The project is located in central Wayne County, NC, just southwest of the City of Goldsboro. The City of Goldsboro is the non-Federal sponsor. The subject reach extends along the Neuse River from Stevens Mill Road crossing to the Arrington Bridge Road crossing, and includes both the main stem of the Neuse River and the USACE-constructed Neuse River cutoff channel

Figure 2.1.1 illustrates the location of the project area.

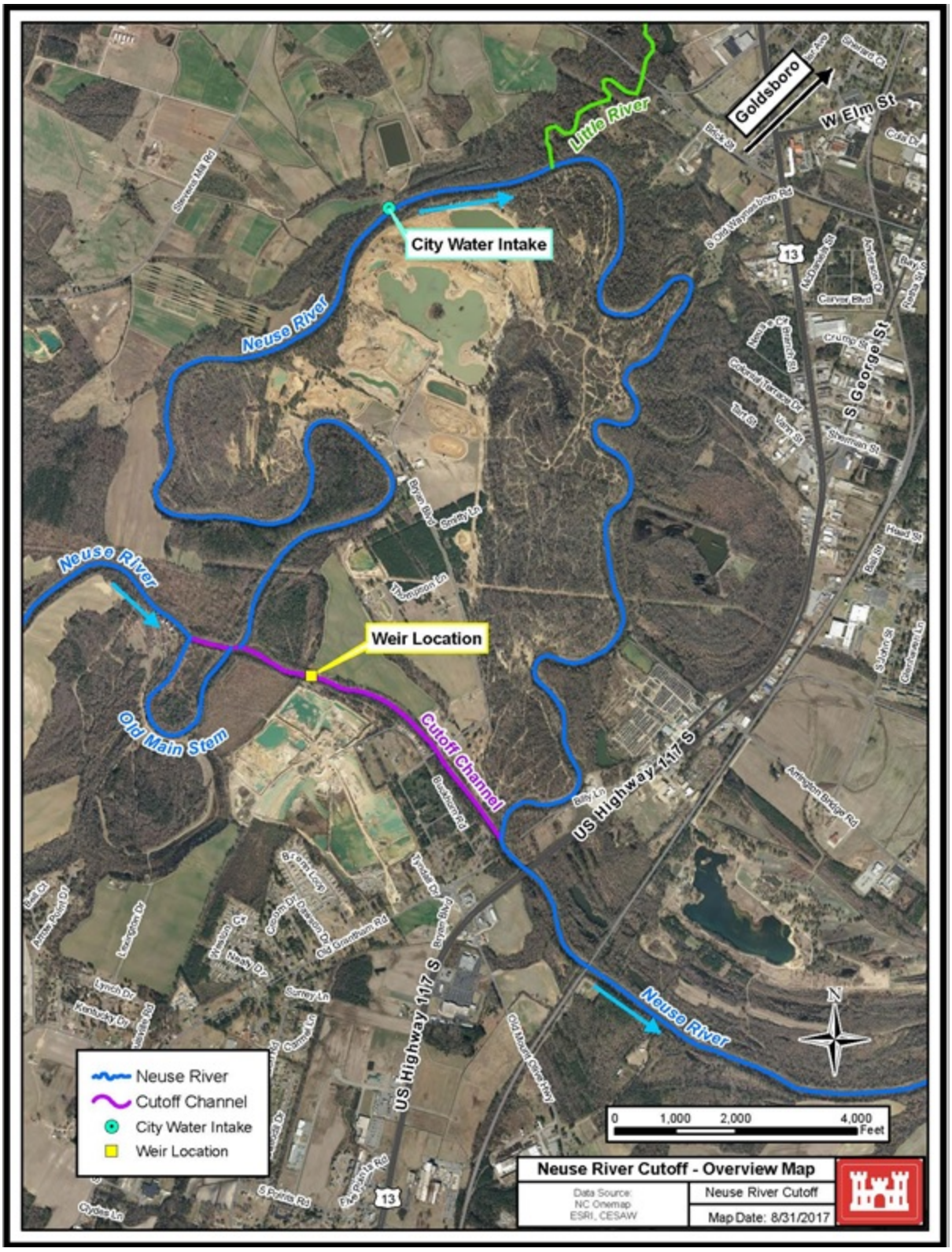


FIGURE 2.1.11: MAP OF NEUSE GOLDSBORO 1135 STUDY AREA

2.2 General

Typical socio-economic and demographic data for Wayne County indicate lower than average income when compared to the rest of the state. North Carolina's economy is generally characterized by strong wholesale and retail trade, government and technology sectors. Easily developed land, accessible water supply, abundant natural resources, and the aesthetic beauty of the region are the fundamental building blocks of the local economy. Relative to the national economy, the manufacturing sector has played less of a role in North Carolina, including the study area. However, high technology manufacturing has begun to emerge as a significant sector in the State over the two decades.

2.3 Population and Demographics

This section includes a description of the local demographics around the study area. This descriptive information provides insight into the study area's socio-economic characteristics, and provides part of the basis for different facets of the potential economic impact of work in the rest of this document.

The following Tables 2.3-1 represent the existing and trending population, gender, ethnic, and age profiles of the Neuse Goldsboro 1135 study area.

Table 2.3.1: Wayne County Population Profile, 2015

POPULATION AND GROWTH		
Year	Population	Growth
2015	124,132	0.50%
2010	122,623	0.80%
2019 Projected	127,767	0.50%
POPULATION BY AGE		
Age	Number	% of Population
0--19	32,916	26.40%
20--29	18,070	14.50%
30--39	15,840	12.70%
40--49	15,580	12.50%
50--59	17,211	13.80%
60+	25,158	20.20%
POPULATION BY SEX		
Female	62,677	51.10%
Male	59,956	48.90%
POPULATION BY RACE		
White	72,135	58.80%
Black	38,499	31.40%
Native American	481	0.40%
Asian	1,431	1.20%
Hispanic/Latino	12,162	9.90%
Two or more races	2,824	2.30%

Source: US Census Bureau, State and County QuickFacts, 2015

2.4 Economy

Land Use and Agriculture

Existing land use in Wayne County can be described as a mixture of agrarian, urban, industrial, and mixed use. Wayne County, like many rural counties in Eastern North Carolina, have maintained a somewhat static agricultural presence during the past decade, and has seen an increase in the market value of the agricultural products sold. Table 2.4-1 shows the agricultural characteristics of Wayne County, per the 2012 Census of Agriculture.

Table 2.4.1 Agriculture Profile, Wayne County, NC

	2012	2007	% Change
Number of Farms	563	723	-22
Land In Farms	191,195 acres	175,265 acres	+9
Average Size of Farm	340 acres	242 acres	+40
Market Value of Products	$577,224,000	$501,176,000	+15
Average Per Farm	$1,025,264	$693,190	+48

While the County Comprehensive Plan anticipates growth in the urban sector, a conservation area has been established and recognized by the County planners and the Neuse 1135 study area lies within the conservation area. A map of the land use strategy is listed as figure 2.4.1.

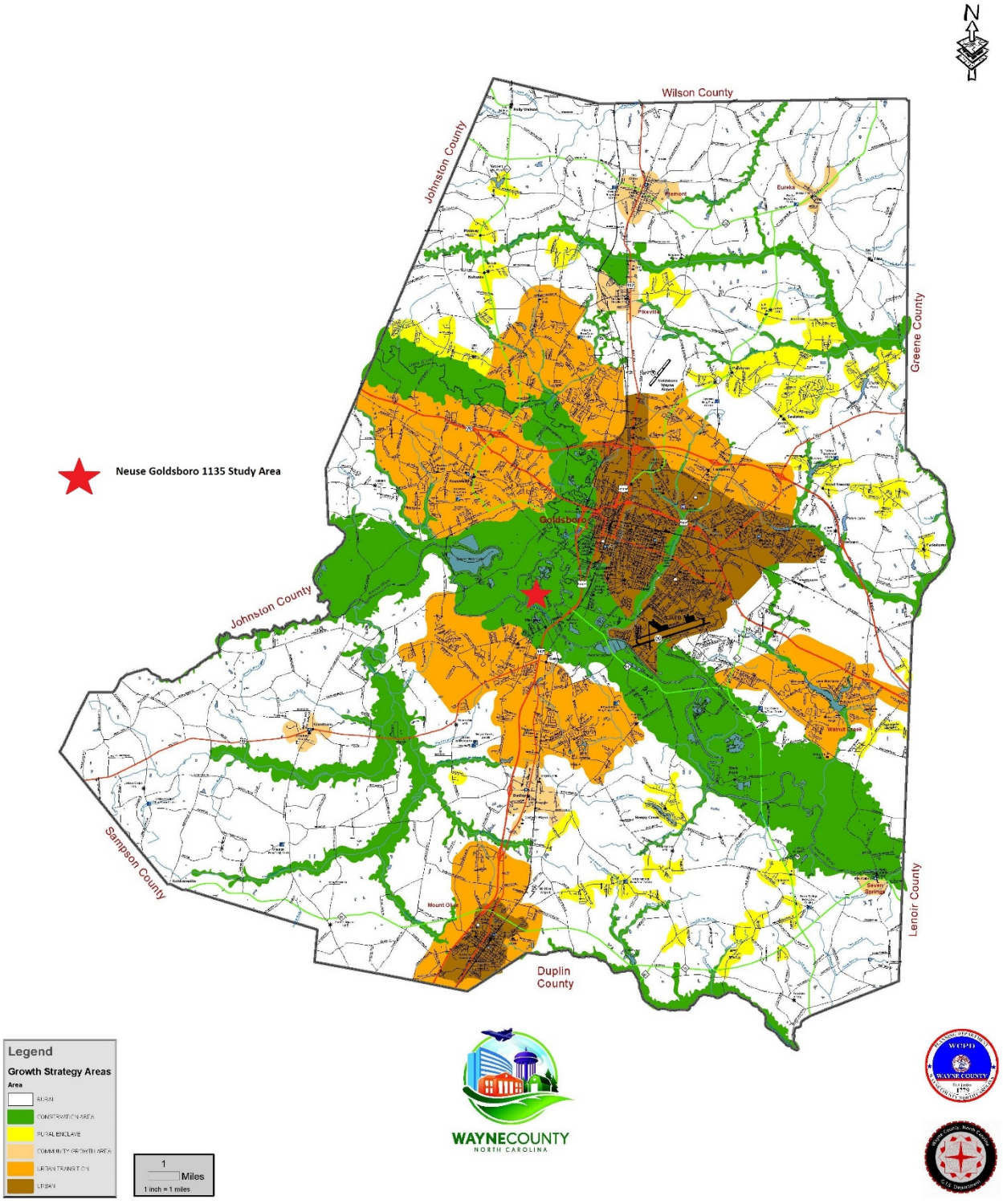


Figure 2.4.1 Wayne County Land Use Plan Growth Strategy
Source: Wayne County NC Planning Department

Employment

The unemployment rate for North Carolina is 9.8 percent (Access NC, North Carolina Economic

Data), while the unemployment rate for Wayne County is 5.8 percent, which represents approximately 3,000 persons over the age of 16 that are in the labor force.

Income

Personal per capita income in North Carolina is $25,920 (2015), but is somewhat lower in the Wayne County, at $21,204. As well as having a considerably lower than average per capita income, the study area's median household income is comparable to that of the county and state. At $ 40,390, it falls short of the state average ($46,868). 2015 Census data reports seem to indicate a higher than state average household occupancy rate, at 2.56 persons per household in the study area while the state average household sizes is 2.54. In 2008 it was reported that 18.4 percent of North Carolina's population lived below the poverty level, while 15.4 percent of residents in Wayne County were below the poverty level. Nationally, the poverty level was 14.5 percent in 2015.

3.0 RECREATION

Wayne County can be described as having a variety of recreational resources, including hunting, fishing, and other waterborne activities.
Project area recreation may include: nature study, fishing, canoeing, kayaking, and other non-invasive recreation forms.

Demand for regional recreation was assessed through the North Carolina State Comprehensive Outdoor Recreation Plan (SCORP), and through collaboration with NCDENR and the various state and federal agencies involved in the planning process. The existing county usage, from the 2015 SCORP, is described in Table 3.0.1.

This section of the Neuse River is a popular fishing area with a NCWRC public boat access ramp within 5.5 miles upstream (Steven's Mill Access) and 2.5 miles downstream (Goldsboro Access) of the proposed project.

Table 3.0.1: Wayne County Recreational Usage

Type of Park Acreage or Outdoor Recreational Facility	Residents Per Unit	State Rank
Population	124,150	**25**
Athletic Fields	5718	93
Athletic Courts	3544	61
Picnic Shelters	5990	59
Playgrounds	8986	74
Trails Miles (all types)	4522	61
Local Park Acres	337	63

It is not anticipated that any proposed action will impact recreational activities within the study area

4.0 PLAN FORMULATION

Alternatives are combinations of management measures, to address the problem identified at the site, and to address site-specific objectives. Environmental benefits derived from implementation of an alternative are defined as the increase in Average Annual Functional Units gained from that alternative, when compared to the No-Action Alternative. Costs used for alternatives comparison all done to the same level of detail, and differ from those that are shown for the Recommended Plan, due to refinement of the details associated with the Recommended Plan, and the final results of the Cost-Effectiveness/Incremental Cost Analysis.

4.1 Results of Plan Formulation

The results of plan formulation can be found in the Main Report.

5.0 PLAN SELECTION

The following sections compare the combinations of site alternatives presented in the previous section using cost-effective/incremental cost analysis (CE/ICA). First, CE/ICA was performed on the array of alternatives for each site, and the results were used to select a single alternative from each site for further consideration. Another CE/ICA was then performed on this final array of alternatives. These results, in combination with a comparison of alternatives in Section 5.2 using the four (4) accounts (national economic development, environmental quality, regional economic development, and other social effects), was used to establish the National Ecosystem Restoration plan (NER) as presented in Section 5.3.

5.1 Cost-Effectiveness/Incremental Cost Analysis (CE/ICA)

The environmental benefits and costs presented in the previous section were the inputs for a CE/ICA. The purpose of the analysis was to evaluate the effectiveness and efficiency of the site alternatives at producing environmental outputs. Guidance on the conduct of CE/ICA is in IWR Report #95-R-1, USACE, May 1995. The end product of a CE/ICA is the identification of a set of *best buy* plans. Best buy plans are the alternatives that provide the greatest increase in environmental output for the least increase in cost. Initially, all cost-effective alternatives (a cost- effective alternative is one where no other alternative can achieve the same level of output at a lower cost, or greater level of output at the same or less cost) are arrayed by increasing output to clearly show changes in cost (i.e., increments of cost) relative to changes in output (i.e., increments of output) of each cost-effective alternative plan compared to the without-project condition. The plan with the lowest incremental costs per unit of output of all plans is therefore considered the first best buy plan. After the first best buy plan is identified, all larger cost- effective plans are compared to the first best buy plan in terms of increases in (increments of) cost and increases in (increments of) output. The alternative plan with the lowest incremental cost per unit of output (for all cost-effective plans larger than the first best buy plan) is the second best buy plan. This process is continued until all the best buy alternative plans are identified.

The results of the cost and initial analysis conducted to compare alternatives are presented in Tables 5.1.1 and 5.1.2 These tables display the incremental costs and benefits for the best buy plan (with the exception of the No Action Alternative, which is always a Best Buy Plan), and are illustrated in Figures 5.1.1 and 5.1.2 . IWR Planning Suite software was used to conduct the CE/ICA.

Evaluation of the best buys from the initial analysis identified an array of best buy alternatives for comparison over the entire watershed. The PDT compared the best buys from each project area to determine whether the incremental environmental benefits justified the incremental costs. Based on this comparison, a single best buy alternative was selected from each project area, which was then used to create watershed-wide alternatives.

Table 5.1.1 Proposed Measures and ROM Cost

ALTERNATIVE	TOTAL COST
B1-Raise Height of Weir by 1 Foot and Keep Same Location	$1,423,949
B2-Raise Height of Weir by 2 Foot and Keep Same Location	$1,455,969
C-Build Fish Passage Structure at Current Weir Location	$2,477,621

Table 5.1.2 Preliminary, Output, Costs and Benefits of Neuse Goldsboro 1135 Alternatives

Plan	Functional Units/Lift	Alternative* Cost(ROM)	Interest During Construction	Total	Avg Annual Cost**	Cost Effective ?
No Action	0	$0		$0	$0	Best Buy
B1	5777.8807	$1,423,949	$3,370	$1,427,319	$54,164	Yes
B2	10452.378	$1,455,969	$3,446	$1,459,415	$55,382	Best Buy
C	0	$2,477,621	$5,864	$2,483,485	$94,244	No

** Costs are at 2018 Price Levels*
***The FY18 discount rate of 2.75% was used to compute interest during construction and Avg Costs*

Figure 5.1.1 All Plan Analysis

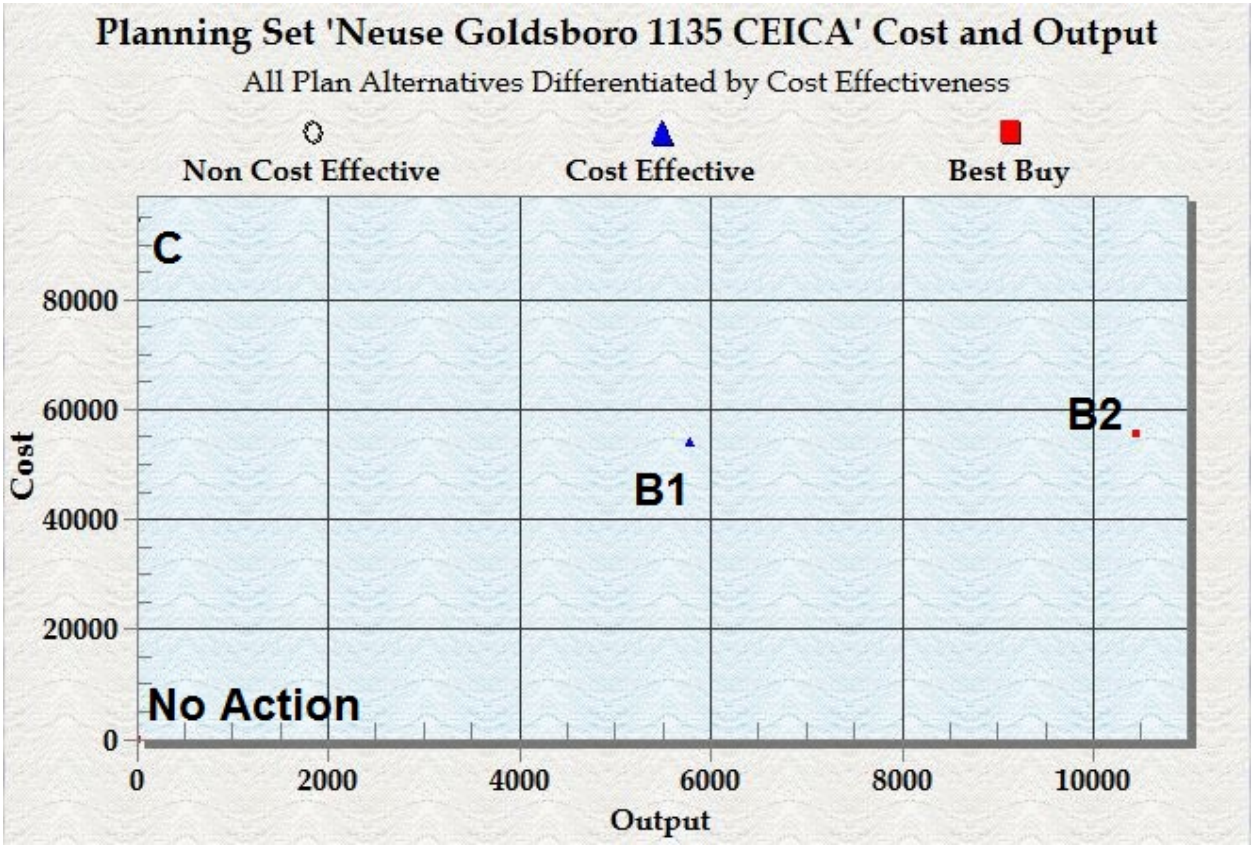
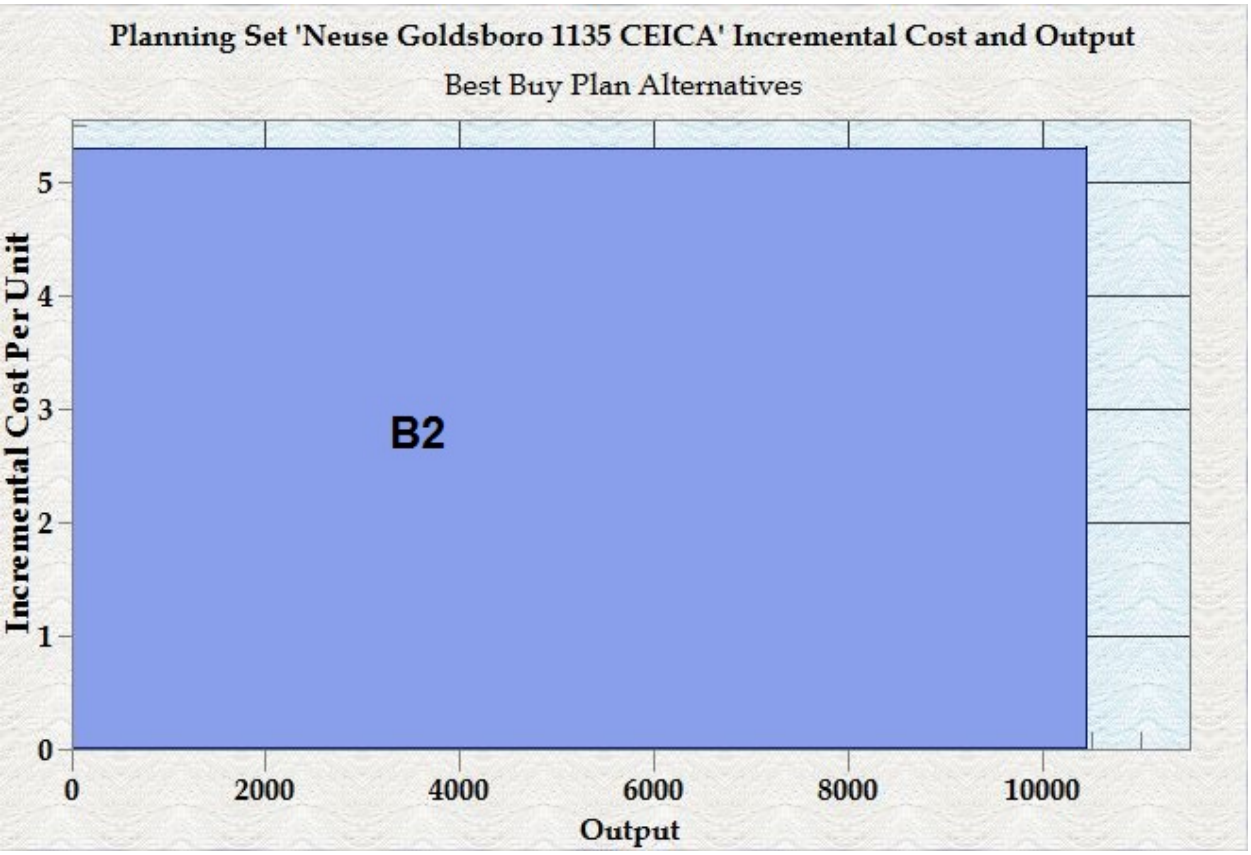


Figure 5.1.2 All Plan Best Buy Analysis



5.2 Identification of the National Ecosystem Restoration (NER) Plan

The NER Plan is the plan which provides the most benefits at the least per unit average annual cost. Using this criteria, B2 is the NER Plan for the project, providing approximately .19 habitat units for every dollar spent annually. The next comparable plan, B1, provides approximately .11 habitat units for every project dollar spent.

6.0 REGIONAL ECONOMIC IMPACTS

The following regional economic impacts could be addressed based on the interest of the local sponsor or State.

6.1 Employment Stability

It is not assumed that there will be employment impacts as a result of building this project.

6.2 Displacement of People and Businesses

Implementation of damage reduction measures under consideration is not expected to displace people or businesses.

7.0 OTHER SOCIAL EFFECTS

The OSE account could consider the effects of alternative plans in areas that are not already contained in the NED and RED accounts. The categories of effects contained within the OSE account include:

- Urban and community impacts
- Life, health, and safety factors
- Displacement

It is not anticipated that the proposed project will impact considerations associated with the OSE account.

8.0 ENVIRONMENTAL JUSTICE

Executive Order (E.O.) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires the federal government to achieve environmental justice by identifying and addressing high, adverse and disproportionate effects

of its activities on minority and low-income populations. E.O. 12898, Environmental Justice, states that the proposed action would not result in adverse human health or environmental effects. Any impacts of the action would not be disproportionate towards any minority or low-income population. The activity does not (a) exclude persons from participation in, (b) deny persons the benefits of, or (c) subject persons to discrimination because of their race, color, or national origin. The activity would not impact "subsistence consumption of fish and wildlife." It requires the analysis of information such as the race, national origin, and income level for areas expected to be impacted by environmental actions. It also requires federal agencies to identify the need to ensure the protection of populations relying on subsistence consumption of fish and wildlife, through analysis of information on such consumption patterns, and the communication of associated risks to the public.

It is not anticipated that the proposed project will impact Environmental Justice considerations.

APPENDIX C

Design Considerations

APPENDIX C - DESIGN CONSIDERATIONS

The stone size and gradation used in the original design and subsequent early repairs is unknown and cannot be determined in the field or from the available plans and information found on the project and repairs made to the project in the past. A stone thickness layer of 24" and 36" were used as part of the repairs in the past but no indication of the stone size and gradation were specified. The riprap design and analysis was primarily based on using a stone size and gradation much larger than what may have been placed in the past. The riprap design also considered other Stone Protection projects where the velocities and flows were much greater than the anticipated flows in the cutoff and over the proposed weir. The past repairs in 1982 included some information concerning the stone size and gradation requirement and is noted below:

The riprap shall be reasonably well graded from the minimum size stone permitted, weighing 5 pounds to the maximum size stone permitted, weighing 300 pounds; however, 50 percent by weight of the mass shall consist of stones which weigh 50 pounds or more. Ten (10) percent may weigh between 200 and 300 pounds. Not more than 15 percent by weight of the riprap shall have its breadth nor the thickness of any piece less than one-third of its length. Not more than 1% by weight for inclusion of dirt, sand, clay and rock fines will be permitted. An allowance of 5% by weight for inclusion of quarry spalls will be permitted.

The maximum size stone weighing 300 pounds equates to an 18" maximum size stone with a 27" thick layer of riprap. Most of the past repairs consisted of additional riprap being placed downstream of the sheet pile weir, which had been displaced and scattered downstream. The City of Goldsboro sheet pile weir constructed in 2014 used the largest size of riprap available on site to be placed on the downstream side of their weir. No riprap design or analysis was accomplished as part of the City of Goldsboro construction of their weir. No riprap design or analysis was accomplished to determine appropriate riprap size and gradation for the proposed weir for this phase of the project. The preliminary design intent and consideration for the proposed weir structure would be to use a larger stone size and gradation sufficient to meet the design site conditions, flows and potential scour anticipated through the channel and over the top of the weir. NCDOT Class I and/or NCDOT Class II Riprap appears to have a maximum stone size that is greater than what has been used in the past and should be sufficient for the riprap design for the proposed weir. NCDOT Class I and/or NCDOT Class II Riprap has been used on other Stone Protection projects with greater velocities and flows than the anticipated velocities and flows in the Cutoff channel. A more detailed riprap design and analysis will be accomplished in the final design phases of the project to determine appropriate size, gradation and thickness layer. Preliminary consideration for the proposed weir would be to use NCDOT Class I or NCDOT Class II riprap placed in 3-foot thick layer of riprap and the 2-foot thick layer along the side slopes. The gradation range for NCDOT Class I and II is as follows:

Required Stone Size, Inches			
Stone Type	**Minimum**	**Midrange**	**Maximum**
I	5	10	17
II	9	14	23

The gradation range for Bedding layer and fill material is as follows:

Required Stone Size, Inches			
Stone Type	**Minimum**	**Midrange**	**Maximum**
A	2	4	6
B	5	8	12

Riprap stone and bedding stone shall consist of fresh, sound, hard, dense, durable, crystalline igneous or metamorphic rock which shall be separated from bedrock by quarrying. The unit weight, saturated surface dry (SSD), of the stone shall range from 162 pounds per cubic foot to 187 pounds per cubic foot. The specific gravity shall range between 2.60 and 3.00.

Recommendations

The Recommended Plan would consist of a constructing a new sheet pile weir structure 25' downstream of the existing City of Goldsboro weir structure to an elevation of 58.0' NAVD88 with a 3-foot thick layer of stone (riprap) placed over a layer of bedding stone along downstream area of the new steel sheet pile weir and a 2-foot thick layer of stone (riprap) along both downstream banks for a distance of approximately 15 feet. The stream banks would be cleared and graded to a 3H:1V slope or flatter for placement of the stream bank slope protection. Backfill material and/or bedding layer consisting of NCDOT Class A or B riprap stone would be placed under the 3-foot thick layer of riprap and to fill any voids within the existing riprap. A geotextile layer will be used for the 2-foot thick layer along the stream banks. Removal of the existing City of Goldsboro weir and the cutting off of the existing Corps weir to occur after completion of the new proposed weir structure and riprap placement.

APPENDIX D

404 (b)(1)

APPENDIX D

Draft Detailed Project Report and Environmental Assessment

Neuse River Goldsboro Section 1135 Project

Modification For Improvement of the Environment

Preliminary Evaluation of Section 404 (b) (1) Guidelines 40 CFR 230

Section 404 Public Notice No. CESAW-ECP-PE

1. Review of Compliance (230.10(a)-(d)) A review of the NEPA Document indicates that:	**Preliminary 1/**	**Final 2/**
a. The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem to fulfill its basic purpose (if no, see section 2 and NEPA document);	YES ☒ NO☐	YES☐ NO☐
b. The activity does not: 1) violate applicable State water quality standards or effluent standards prohibited under Section 307 of the CWA; 2) jeopardize the existence of federally listed endangered or threatened species or their habitat; and 3) violate requirements of any federally designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies);	YES ☒ NO☐	YES☐ NO☐
c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organism's dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values (if no, see section 2);	YES☒ NO☐	YES☐ NO☐
d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic		

ecosystem (if no, see section 3.03). YES☒ NO☐* YES☐ NO☐

2. Technical Evaluation Factors (Subparts C-F)	N/A	Not Significant	Significant
a. Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)			
(1) Substrate impacts.		X	
(2) Suspended particulates/turbidity impacts		X	
(3) Water column impacts.		X	
(4) Alteration of current patterns and water circulation.		X	
(5) Alteration of normal water fluctuations/hydroperiod.		X	
(6) Alteration of salinity gradients.	NA		
b. Biological Characteristics of the Aquatic Ecosystem (Subpart D)			
(1) Effect on threatened/endangered species and their habitat.		X	
(2) Effect on the aquatic food web.		X	
(3) Effect on other wildlife (mammals birds, reptiles, and amphibians).		X	
c Special Aquatic Sites (Subpart E)			
(1) Sanctuaries and refuges.	NA		
(2) Wetlands.	NA		
(3) Mud flats.	NA		
(4) Vegetated shallows.	NA		
(5) Coral reefs.	NA		
(6) Riffle and pool complexes.	NA		
d. Human Use Characteristics (Subpart F)			
(1) Effects on municipal and private water supplies.		X	
(2) Recreational and commercial fisheries impacts		X	
(3) Effects on water-related recreation.		X	
(4) Aesthetic impacts.		X	
(5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves.		X	

3. Evaluation of Dredged or Fill Material (Subpart G) 3/

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)

(1) Physical characteristics	☒
(2) Hydrography in relation to known or anticipated sources of contaminants	☒
(3) Results from previous testing of the material or similar material in the vicinity of the project	☒
(4) Known, significant sources of persistent pesticides from land runoff or percolation	☒
(5) Spill records for petroleum products or designated (Section 311 of CWA) hazardous substances	☒
(6) Other public records of significant introduction of contaminants from industries, municipalities, or other sources	☒
(7) Known existence of substantial material deposits of substances, which could be released in harmful quantities to the aquatic environment by man-induced discharge activities	☒
(8) Other sources (specify).	☐

Reference: 1: U.S. Environmental Protection Agency. *Envirofacts*. (2016). Retrieved from <http://www.epa.gov/enviro/>.

b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredge or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and disposal sites and not likely to result in degradation of the disposal site.** YES ☒ NO☐

*

4. Disposal Site Determinations (230.11(f)).

a. The following factors as appropriate, have been considered in evaluating the disposal site.

(1) Depth of water at disposal site ☒

(2) Current velocity, direction, and variability at disposal site ☒

(3) Degree of turbulence ☒

(4) Water column stratification ☒

(5) Discharge vessel speed and direction ☒

(6) Rate of discharge ☒

(7) Dredged material characteristics (constituents, amount and type of material, settling velocities). ☒

(8) Number of discharges per unit of time ☒

(9) Other factors affecting rates and patterns of mixing (specify)

b. An evaluation of the appropriate factors in 4a above indicates that the disposal site and/or size of mixing zone are acceptable. YES ☒ NO ☐*

5. Actions to Minimize Adverse Effects (Subpart H).

All appropriate and practicable steps have been taken, through application of recommendations of 230.70-230.77, to ensure minimal adverse effects of the proposed discharge. YES ☒ NO ☐*

For water quality see Section 5.2 of the EA. For fisheries see Section 5.3 of the EA.
For threatened and endangered species see Section 5.3 of the EA.

6. Factual Determinations (230.11).

A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short- or long-term environmental effects of the proposed discharge as related to:

a. Physical substrate at the disposal site (review sections 2a, 3, 4, and 5). YES ☒ NO ☐*

b. Water circulation, fluctuation, and salinity (review sections 2a, 3, 4, and 5). YES ☒ NO ☐*

c. Suspended particulates/turbidity (review sections 2a, 3, 4, and 5). YES ☒ NO ☐*

d Contaminant availability (review sections 2a, 3, and 4). YES ☒ NO ☐*

e. Aquatic ecosystem structure and function (review sections 2b and c, 3, and 5). YES ☒ NO ☐*

f. Disposal site (review sections 2, 4, and 5). YES ☒ NO ☐*

g. Cumulative impact on the aquatic ecosystem. YES ☒ NO ☐*

h. Secondary impacts on the aquatic ecosystem. YES ☒ NO ☐*

7. Findings.

a. The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines ☒

b. The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines with the inclusion of the following conditions: ☐

c The proposed disposal site for discharge of dredged or fill material does not comply with the Section 404(b)(1) guidelines for the following reasons(s):

(1) There is a less damaging practicable alternative. ☐

(2) The proposed discharge will result in significant degradation of the aquatic ecosystem ☐

(3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem. ☐

8.

Elden J. Gatwood Chief, Planning and Environmental Branch	Robert J. Clark Colonel, U.S. Army District Commander
Date_____	Date _____

*A negative, significant, or unknown response indicates that the permit application may not be in compliance with the Section 404(b)(1) Guidelines.

1/ Negative responses to three or more of the compliance criteria at this stage indicate that the proposed projects may not be evaluated using this "short form procedure." Care should be used in assessing pertinent portions of the technical information of items 2 a-d, before completing the final review of compliance.

2/ Negative response to one of the compliance criteria at this stage indicates that the proposed project does not comply with the guidelines. If the economics of navigation and anchorage of Section 404(b)(2) are to be evaluated in the decision-making process, the "short form evaluation process is inappropriate."

3/ If the dredged or fill material cannot be excluded from individual testing, the "short-form" evaluation process is inappropriate.

APPENDIX E

NEPA Correspondence

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
http://sero.nmfs.noaa.gov

July 6, 2015 F/SER47:FR/pw

(Sent via Electronic mail)

Colonel Kevin P. Landers, Sr., Commander
U.S. Army Corps of Engineers Wilmington District
69 Darlington Avenue
Wilmington, North Carolina 28403-1398

Attention: Ms. Teresa Bullard

Dear Ms. Colonel Landers:

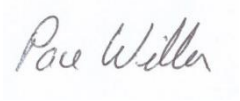
The NOAA's National Marine Fisheries Service (NMFS) has received the request from the U. S. Army Corps of Engineers dated June 10, 2015, to provide scoping comments for potential alternatives to modify the Neuse River cutoff on the Neuse River, near Goldsboro, in Wayne County. As the nation's federal trustee for the conservation and management of marine, estuarine, and anadromous fishery resources, the following comments are provided pursuant to authorities of the Fish and Wildlife Coordination Act and the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

The cutoff channel, originally 12 feet deep, 20 feet wide, and about 6,400 feet long across a bend in the Neuse River, has a low flow sheet-pile weir near the upstream end of the cutoff channel. The Wilmington District and the City of Goldsboro are investigating potential alternatives to the cutoff. When constructed, the primary purpose of the project was to alleviate flooding along the Neuse River and secondarily to provide a pool the City of Goldsboro could use as its primary water supply. The weir is currently in an "unacceptable" condition and the City has relocated its water intake within the main stem of the Neuse River. The deteriorated condition of the weir and cutoff result in sedimentation and reduced water depths at the City's water intake.

Fisheries resources potentially in the project area of interest to the NMFS are the following diadromous species: Atlantic Sturgeon (*Acipenser oxyrinchus*), American Eel (*Anguilla rostrata*), Blueback Herring (*Alosa aestivalis*), Hickory Shad (*A. mediocris*), Alewife (*A. pseudoharengus*), American Shad (*A. sapidissima*), and Striped Bass (*Morone saxatilis*). The cutoff potentially provides spawning and nursery habitat for the four herring and shad species and habitat for the American Eel and Striped Bass. The NMFS recommends the USACE meet with the four resource agencies (NMFS, U.S. Fish and Wildlife Service, North Carolina Wildlife Resources Commission, North Carolina Division of Marine Fisheries) prior to the issuance of an Environmental Assessment to discuss options and issues.

Thank you for the opportunity to provide these comments. Please direct related correspondence to the attention of Mr. Fritz Rohde at our Beaufort Field Office, 101 Pivers Island Road, Beaufort, North Carolina 28516-9722, or at (252) 838-0828.

Sincerely,



/ for

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

cc: USACE, Teresa.R.Bullard@usace.army.mil
USFWS, John_Ellis@fws.gov, Wilson_Laney@fws.gov
NCWRC, Maria.Dunn@ncwildlife.org, Jeremy.McCargo@ncwildlife.org
NCDMF, Anne.Deaton@ncdenr.gov
F/SER4, David.Dale@noaa.gov
F/SER47, Fritz.Rohde@noaa.gov

Neuse 1135 - Scoping Comments Received:

NMFS (contact Fritz Rhode) – Email: July 6, 2015:

- Fisheries resources potentially in the project area of interest to the NMFS are the following diadromous species: Atlantic Sturgeon (*Acipenser oxyrinchus*), American Eel (*Anguilla rostrata*), Blueback Herring (*Alosa aestivalis*), Hickory Shad (*A. mediocris*), Alewife (*A. pseudoharengus*), American Shad (*A. sapidissima*), and Striped Bass (*Morone saxatilis*). The cutoff potentially provides spawning and nursery habitat for the four herring and shad species and habitat for the American Eel and Striped Bass.
- The NMFS recommends the USACE meet with the four resource agencies (NMFS, U.S. Fish and Wildlife Service, North Carolina Wildlife Resources Commission, North Carolina Division of Marine Fisheries) prior to the issuance of an Environmental Assessment to discuss options and issues.

NCWRC (Gabriela Garrison) – Letter: July 10, 2015:

- Within this area of the Neuse River, there is potential spawning habitat for the following anadromous fish species: striped bass (*Morone saxitilis*); hickory shad (*Alosa mediocris*); American shad (*Alosa sapidissima*); blueback herring (*Alosa aestivalis*); Atlantic sturgeon (*Acipenser oxyrinchus*); and alewife (*Alosa pseudoharengus*). Currently some anadromous fish ascend the Cutoff in the spring during their spawing migration. Fish cannot move past the weir at the upstream end of the Cutoff, therefore the Cutoff likely reduces spawning success. If the Cutoff and weir are modified, and natural flows are restored in the Neuse River, these species will likely migrate up the original channel and continue on to suitable spawning habitat.
- Additionally, with a large portion of the Neuse River flow going into the Cutoff, flow regimes during high flow periods have been altered and sedimentation has increased in the natural river channel, resulting in reduced water depths.
- The NCWRC supports efforts to evaluate alternatives to improve conditions at the Cutoff. We recommend that the agencies of interest, specifically the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the North Carolina Division of Marine Fisheries, NCWRC and the USACE, arrange a meeting(s) to discuss the potential issues as well as determine plausible and realistic solutions.

City of Goldsboro (Karen Brashear) – Letter: July 8, 2015:

- Heavy sediment depositions continue to impact the City's drinking water intake structure located in the oxbow of the Neuse River making it challenging to produce water at times. …….. If flows are not restored in this section of the river, the City will need to relocate its drinking water intake to deeper water upstream of the Corp' cut-off canal to ensure adequate source water for its drinking water system.

- …the elevation of the weir allows water to bypass the Neuse River at relatively low river levels (4.91 feet per USGS 02089000), not just in flood conditions. A higher weir elevation would maintain natural flow in the river under non-flood conditions.
- Environmentally it makes sense to restore the natural flows back to the Neuse River and prevent diversion of the natural flows through the cut-off canal creating an attraction to fish to be lured into a possible "fish trap" at the Flood Control Structure weir.
- It is our hope that the restoration of the natural flow and environmental conditions in the oxbow of the Neuse River will have a positive outcome for the City of Goldsboro drinking water supply as well as the natural environment.

<u>NC Natural Heritage Program (Allison Weakley) – Letter: July 7, 2015:</u>

- The NCNHP database shows records for two rare species, a natural area, and several conservation/managed areas within the estimated project area. The estimated project area is based on the reach of the Neuse River and cutoff channel from Stevens Mill Road to Arrington Bridge Road as shown in the map included in the scoping document.
- Rare species from list are:
    - Neuse River Waterdog (*Necturus lewisi*) an amphibian with historical occurrence in the area (Federal Species of Concern)
    - Checkered White Butterfly (*Pontia protodice*) currently found in the area (state significantly rare)
- Natural Areas Documented Within Estimated Project area:
    - NEU/ Little River (Franklin/ Wake/ Johnston/ Wayne) Aquatic Habitat

<u>NC DWR- Water Quality Regional Operations Section- Washington Regional Office (Roberto Sheller) – Letter: June 17, 2015:</u>

- On February 14, 2014 this Office issued General Certification (GC) 3883 for replacement of the failing sheet pile structure and placement of riprap within the riparian buffer for stream bank stabilization. At the time of the initial site review it was noted that the failing sheet pile structure had created a hydraulic jump within the manmade channel of the Neuse River and if structure should fail would result in a significant head cut moving up the Neuse River. An active head cut of this size within the Neuse River would significantly add to the bed load of the river and result in downstream water quality degradation.
- It was noted that an instream bar has formed upstream of the sheet pile structure. Shoaling is also occurring upstream of the instream bar and within the old channel indicating insufficient water velocities to move sediment bed load. The flow regime of this section of the Neuse River has been altered by the construction of the cutoff and sheet pile structure and has resulted in impacts to the natural pattern, dimension, and profile of the Neuse River.
- It is recommended that the cutoff channel be filled and the impacted area restored to a forested state. The Neuse River's full flow would be restored to the natural river channel and the bed load carrying capacity restored.

NCDENR- Division of Waste Management (Scott Bullock) – Letter: June 29, 2015:

- The Washington Regional Office (WaRO) UST Section recommends removal of any abandoned or out-of-use petroleum USTs or petroleum above ground storage tanks (ASTs) within the project area. The UST Section should be contacted regarding use of a proposed or on-site petroleum USTs or ASTs.
- Any petroleum USTs or ASTs must be installed and maintained in accordance with applicable local, state, and federal regulations. For additional information on petroleum ASTs it is advisable that the North Carolina Department of Insurance, USEPA, local fire department, and Local Building Inspectors be contacted.
- Any petroleum spills must be contained ad the area of impact must be properly restored. Petroleum spills of significant quantity must be reported to the North Carolina Department of Environment & Natural Resources – Division of Waste Management Underground Storage Tank Section in the Washington Regional Office.
- Any soils excavated during demolition or construction that show evidence of petroleum contamination, such as stained soil, odors, or free product must be reported immediately to the local Fire Marshall to determine whether explosive or inhalation hazards exist. Also, notify the UST Section of the Washington Regional Office. Petroleum contaminated soils must be handled in accordance with all applicable regulations.

NC Department of Public Safety – Division of Emergency Management (Dan Brubaker) – Letter: June 29, 2015:

- Executive Order 11988 requires an eight-step review process that federal agencies, including the U.S. Army Corps of Engineers, should carry out as part of their decision-making on projects that have potential impacts to or within the floodplain. Any work within the SFHA of studied streams, based on the current Flood Insurance Rate Map, should follow these guidelines in order to avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains. The eight steps are summarized below. Please describe how this eight-step review process has been or will be accomplished.
    - A. Determine if a proposed action is in the base floodplain (that area which has a one percent or greater chance of flooding in any given year.
    - B. Conduct early public review, including public notice.
    - C. Identify and evaluate practicable alternatives to locating in the base floodplain, including alternative sites outside of the floodplain.
    - D. Identify impacts of the proposed action.
    - E. If impacts cannot be avoided, develop measures to minimize the impacts and restore and preserve the floodplain, as appropriate.
    - F. Reevaluate alternatives.
    - G. Present the findings and a public explanation.
    - H. Implement the action.

- Work within the floodway of the Neuse River will require either a No-Rise study (if the proposed project does not increase flood levels during the base flood discharge) prior to permitting and construction. Projects must not increase flood levels on any existing structures.
- The base flood elevations for the City of Goldsboro, Wayne and adjoining Counties may increase or decrease as a result of the proposed physical changes to the Neuse River hydraulics. In accordance with 44 CFR 65.3, a Letter of Map Revision shall be required within six months of the completion of the project documenting the physical changes affecting the flooding conditions.
- All utilities should be protected to the regulatory flood protection elevation as described in the City of Goldsboro and Wayne County's ordinances and 44 CFR 60.3.

North Carolina
Department of Administration

Pat McCrory, Governor

Bill Daughtridge, Jr., Secretary

July 16, 2015

Ms. Teresa Bullard
Department of Army
Corps of Engineers
69 Darlington Avenue
Wilmington, North Carolina 28403-1343

Re: SCH File # 15-E-0000-0666; SCOPING; Proposal is to investigate potential alternatives to modify the Neuse River cutoff project. Project area extends along the Neuse River from Stevens Mill Road and includes the main stem and Neuse River cutoff channel.

Dear Ms. Bullard:

The above referenced environmental impact information has been submitted to the State Clearinghouse under the provisions of the National Environmental Policy Act.

Attached to this letter are comments made in the review of this document. The Division of Emergency Management has requested additional information prior to their concurrence with the above referenced document.

Therefore, pursuant to 1 NCAC 25 .0506(c), this office requests that a supplemental document providing the additional information requested by the Division of Emergency Management be submitted to the Clearinghouse for further review and comment.

Sincerely,

Crystal Best
State Environmental Review Clearinghouse

Attachments

cc: Region P

Mailing Address:
1301 Mail Service Center
Raleigh, NC 27699-1301

Telephone: (919)807-2425
Fax (919)733-9571
State Courier #51-01-00
e-mail state.clearinghouse@doa.nc.gov

Location Address:
116 West Jones Street
Raleigh, North Carolina

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

MEMORANDUM

To: Crystal Best
State Clearinghouse

From: Lyn Hardison
Division of Environmental Assistance and Customer Service
Environmental Assistance and Project Review Coordinator

RE: 15-0666
Scoping – Proposal is to investigate potential alternatives to modify the Neuse River cutoff project. Project area extends along Neuse River from Stevens Mill Road and includes the main stem and Neuse River cutoff channel
Wayne County

Date: July 9, 2015

The Department of Environment and Natural Resources has reviewed the proposal for the referenced project. Based on the information provided, several of our agencies have offered some valuable information that will assist the applicant in preparing the necessary environmental document(s). The comments are attached for the applicant's consideration.

The Department agencies will continue to be available to assist the applicant through the environmental review and permitting processes.

Thank you for the opportunity to respond.

Attachments

North Carolina Department of Environment and Natural Resources
Office of Land and Water Stewardship

Pat McCrory
Governor

Bryan Gossage
Director

Donald R. van der Vaart
Secretary

July 7, 2015

TO: Lyn Hardison, NCDENR State Clearinghouse Coordinator

FROM: Allison (Schwarz) Weakley, North Carolina Natural Heritage Program Allison Weakley

SUBJECT: Scoping – Feasibility study by U.S. Army Corps of Engineers to investigate potential alternatives to modify the Neuse River cutoff project - Stevens Mill Road to Arrington Bridge Road, Goldsboro, Wayne County, North Carolina

REFERENCE: Project No. 15-0666

Thank you for the opportunity to provide information from the North Carolina Natural Heritage Program (NCNHP) database for the proposed project referenced above. The NCNHP database shows records for two rare species, a natural area, and several conservation/managed areas within the estimated project area. The estimated project area is based on the reach of the Neuse River and cutoff channel from Stevens Mill Road to Arrington Bridge Road as shown in the map included in the scoping document.

Attached are tables showing records from the NCNHP database for element occurrences (rare species and natural communities), natural areas, and conservation/managed areas that have been documented within the estimated project area and within a one-mile radius of the estimated project area. Also attached is a map that shows natural heritage resources documented within the estimated project area and within a one-mile radius. The locations of natural areas and conservation/managed areas may be viewed by accessing the Natural Heritage Data Explorer (NHDE) online map viewer, or by downloading and using GIS data; both options are available from the NCNHP Data Services webpage (see www.ncnhp.org).

Please note that occurrences of rare species documented within one mile of the proposed project area increase the likelihood that these species may be present within the project area if suitable habitat exists. The use of Natural Heritage Program data should not be substituted for actual field surveys if needed, particularly if the project area contains suitable habitat for rare species. If rare species are found during field surveys, the NCNHP would appreciate receiving this information so that we may update our database.

The NCNHP is glad to provide more detailed information for natural heritage resources within a more site-specific context as the feasibility study moves forward and as requested. Please feel free to contact me at Allison.Weakley@ncdenr.gov or 919-707-8629 if there are questions or additional information is needed.

Natural Heritage Element Occurrences, Natural Areas, and Managed Areas Intersecting the Project Area
Neuse River Cutoff Project - Stevens Mill Rd to Arrington Bridge Rd, Goldsboro
Project No. 15-0666
July 7, 2015
NCNHDE-450

Element Occurrences Documented Within Estimated Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Amphibian	4929	Necturus lewisi	Neuse River Waterdog	1979-01-15	Historical	3-Medium	Species of Concern	Special Concern	G2	S2
Butterfly	32084	Pontia protodice	Checkered White	2001-10-21	Current	3-Medium	---	Significantly Rare	G4	S1S2

Natural Areas Documented Within Estimated Project Area

Site Name	Representational Rating	Collective Rating
NEU/Little River (Franklin/Wake/Johnston/ Wayne) Aquatic Habitat	n/a (Not Applicable)	C1 (Exceptional)

Managed Areas Documented Within Estimated Project Area*

Managed Area Name	Owner	Owner Type
Cherry Research Farm	NC Department of Agriculture, Research Stations Division	State
Cherry Research Farm	NC Department of Agriculture, Research Stations Division	State
Cherry Research Farm	NC Department of Agriculture, Research Stations Division	State
Old Waynesborough Park	Old Waynesborough Commission	Private
Wayne Correctional Center	NC Department of Public Safety	State
Wayne County Open Space	Wayne County	Local Government
Conservation Reserve Enhancement Program Easement	NC Department of Agriculture, Division Soil and Water Conservation	State
Conservation Reserve Enhancement Program Easement	NC Department of Agriculture, Division Soil and Water Conservation	State

*NOTE: If the proposed project intersects with a conservation/managed area, please contact the landowner directly for additional information. If the project intersects with a Dedicated Nature Preserve (DNP), Registered Natural Heritage Area (RHA), or Federally-listed species, NCNHP staff may provide additional correspondence regarding the project.

Definitions and an explanation of status designations and codes can be found at https://ncnhde.natureserve.org/content/help. Data query generated on July 7, 2015; source: NCNHP, Q2 April 2015. Please resubmit your information request if more than one year elapses before project initiation as new information is continually added to the NCNHP database.

Natural Heritage Element Occurrences, Natural Areas, and Managed Areas Within a One-mile Radius of the Project Area
Neuse River Cutoff Project - Stevens Mill Rd to Arrington Bridge Rd, Goldsboro
Project No. 15-0666
July 7, 2015
NCNHDE-450

Element Occurrences Documented Within a One-mile Radius of the Estimated Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Status	Accuracy	Federal Status	State Status	Global Rank	State Rank
Amphibian	24033	Hyla andersonii	Pine Barrens Treefrog	1968-06	Historical	5-Very Low	---	Significantly Rare	G4	S3
Amphibian	24319	Hyla andersonii	Pine Barrens Treefrog	1979-10-09	Historical	4-Low	---	Significantly Rare	G4	S3
Amphibian	4929	Necturus lewisi	Neuse River Waterdog	1979-01-15	Historical	3-Medium	Species of Concern	Special Concern	G2	S2
Bird	22224	Haliaeetus leucocephalus	Bald Eagle	2006	Historical	3-Medium	Bald/Golden Eagle Protection Act	Threatened	G5	S3B,S3N
Bird	26223	Ixobrychus exilis	Least Bittern	2008-07-12	Current	2-High	---	Special Concern	G5	S2S3B
Bird	19015	Picoides borealis	Red-cockaded Woodpecker	1979-02	Historical	4-Low	Endangered	Endangered	G3	S2
Butterfly	32084	Pontia protodice	Checkered White	2001-10-21	Current	3-Medium	---	Significantly Rare	G4	S1S2
Freshwater Fish	17447	Noturus furiosus	Carolina Madtom	1979-08-13	Historical	3-Medium	Species of Concern	Threatened	G2	S2
Freshwater Fish	16142	Noturus furiosus	Carolina Madtom	1985-05-19	Historical	3-Medium	Species of Concern	Threatened	G2	S2
Mammal	7957	Corynorhinus rafinesquii macrotis	Rafinesque's Big-eared Bat - Coastal Plain subspecies	1905	Historical	5-Very Low	Species of Concern	Special Concern	G3G4T3	S3
Reptile	16872	Heterodon simus	Southern Hognose Snake	1995-PRE	Current	5-Very Low	Species of Concern	Special Concern	G2	S2
Reptile	16843	Heterodon simus	Southern Hognose Snake	1995-PRE	Current	4-Low	Species of Concern	Special Concern	G2	S2

Natural Areas Documented Within a One-mile Radius of the Estimated Project Area

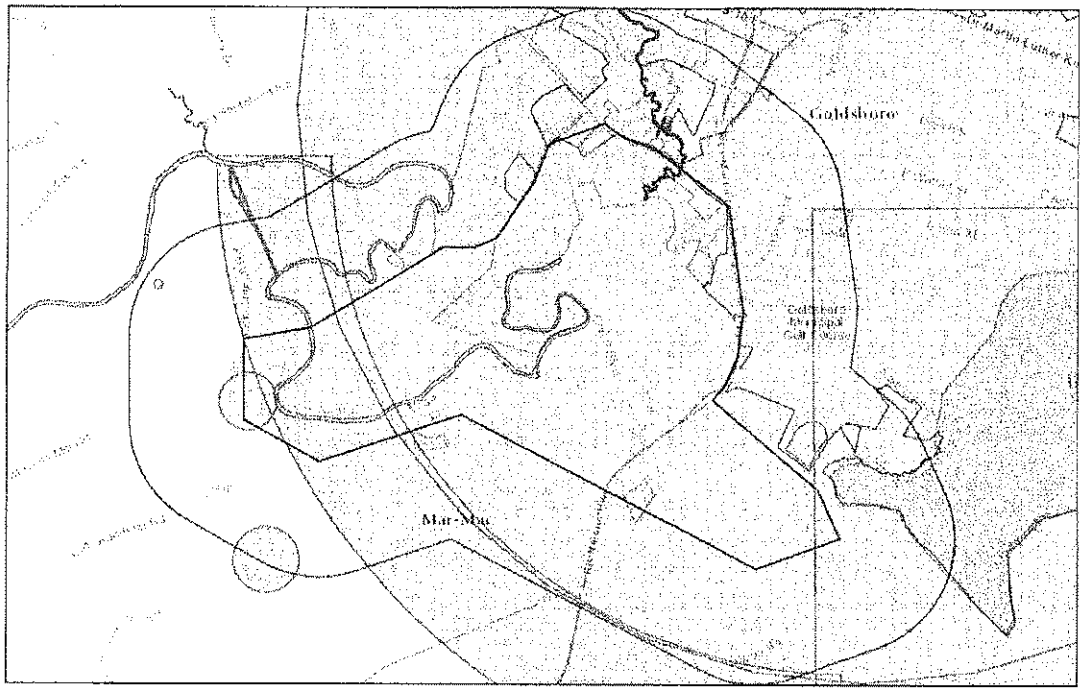
Site Name	Representational Rating	Collective Rating
NEU/Little River (Franklin/Wake/Johnston/ Wayne) Aquatic Habitat	n/a (Not Applicable)	C1 (Exceptional)

Managed Areas Documented Within a One-mile Radius of the Estimated Project Area

Managed Area Name	Owner	Owner Type
Cherry Research Farm	NC Department of Agriculture, Research Stations Division	State
Cherry Research Farm	NC Department of Agriculture, Research Stations Division	State
Cherry Research Farm	NC Department of Agriculture, Research Stations Division	State
Cherry Research Farm	NC Department of Agriculture, Research Stations Division	State
Cherry Research Farm	NC Department of Agriculture, Research Stations Division	State
Cherry Research Farm	NC Department of Agriculture, Research Stations Division	State
Cherry Research Farm	NC Department of Agriculture, Research Stations Division	State
Goldsboro Correctional Center	NC Department of Public Safety	State
Old Waynesborough Park	Old Waynesborough Commission	Private
Seymour Johnson Air Force Base	US Department of Defense	Federal
Wayne Correctional Center	NC Department of Public Safety	State
Wayne County Open Space	Wayne County	Local Government
Conservation Reserve Enhancement Program Easement	NC Department of Agriculture, Division Soil and Water Conservation	State
Conservation Reserve Enhancement Program Easement	NC Department of Agriculture, Division Soil and Water Conservation	State
Conservation Reserve Enhancement Program Easement	NC Department of Agriculture, Division Soil and Water Conservation	State
Conservation Reserve Enhancement Program Easement	NC Department of Agriculture, Division Soil and Water Conservation	State
NC Ecosystem Enhancement Program Easement	NC DENR, Ecosystem Enhancement Program	State
NC Ecosystem Enhancement Program Easement	NC DENR, Ecosystem Enhancement Program	State
NC Ecosystem Enhancement Program Easement	NC DENR, Ecosystem Enhancement Program	State
NC Ecosystem Enhancement Program Easement	NC DENR, Ecosystem Enhancement Program	State
NC Ecosystem Enhancement Program Easement	NC DENR, Ecosystem Enhancement Program	State

Definitions and an explanation of status designations and codes can be found at https://connect.natureserve.org/content/help. Data query generated on July 7, 2015; source: NCNHP, Q2 April 2015. Please resubmit your information request if more than one year elapses before project initiation as new information is continually added to the NCNHP database.

NCNHDE-450: Neuse River Cutoff Project - Stevens Mill Rd to Arrington Bridge Rd, Goldsboro



July 7, 2015

- Project Boundary
- Buffered Project Boundary
- Natural Heritage Element Occurrence (NHEO)
- NHP Natural Area (NHNA)
- Managed Area (MAREA)

1:59,277

0 0.5 1 2 mi

0 0.75 1.5 3 km

Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp, GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL

State of North Carolina
Department of Environment and Natural Resources
INTERGOVERNMENTAL REVIEW - PROJECT COMMENTS

Reviewing Office: Washington

Project Number 15-0666 Due Date: 7/10/2015
County Wayne

After review of this project it has been determined that the ENR permit(s) and/or approvals indicated may need to be obtained in order for this project to comply with North Carolina Law. Questions regarding these permits should be addressed to the Regional Office indicated on the reverse of the form. All applications, information and guidelines relative to these plans and permits are available from the same Regional Office.

	PERMITS	SPECIAL APPLICATION PROCEDURES or REQUIREMENTS	Normal Process Time (statutory time limit)
☐	Permit to construct & operate wastewater treatment facilities, sewer system extensions & sewer systems not discharging into state surface waters.	Application 90 days before begin construction or award of construction contracts. On-site inspection. Post-application technical conference usual.	30 days (90 days)
☐	NPDES - permit to discharge into surface water and/or permit to operate and construct wastewater facilities discharging into state surface waters.	Application 180 days before begin activity. On-site inspection. Pre-application conference usual. Additionally, obtain permit to construct wastewater treatment facility-granted after NPDES. Reply time, 30 days after receipt of plans or issue of NPDES permit-whichever is later.	90-120 days (N/A)
☐	Water Use Permit	Pre-application technical conference usually necessary	30 days (N/A)
☐	Well Construction Permit	Complete application must be received and permit issued prior to the installation of a well.	7 days (15 days)
☐	Dredge and Fill Permit	Application copy must be served on each adjacent riparian property owner. On-site inspection. Pre-application conference usual. Filling may require Easement to Fill from N.C. Department of Administration and Federal Dredge and Fill Permit.	55 days (90 days)
☐	Permit to construct & operate Air Pollution Abatement facilities and/or Emission Sources as per 15 A NCAC (2Q.0100 thru 2Q.0300)	Application must be submitted and permit received prior to construction and operation of the source. If a permit is required in an area without local zoning, then there are additional requirements and timelines (2Q.0113).	90 days
☐	Permit to construct & operate Transportation Facility as per 15A NCAC (2D.0800, 2Q.0601	Application must be submitted at least 90 days prior to construction or modification of the source.	90 days
☒	Any open burning associated with subject proposal must be in compliance with 15 A NCAC 2D.1900	N/A	60 days (90 days)
☐	Demolition or renovations of structures containing asbestos material must be in compliance with 15 A NCAC 20.1110 (a) (1) which requires notification and removal prior to demolition. Contact Asbestos Control Group 919-707-5950.		
☐	Complex Source Permit required under 15 A NCAC 2D.0800		
☐	The Sedimentation Pollution Control Act of 1973 must be properly addressed for any land disturbing activity. An erosion & sedimentation control plan will be required if one or more acres to be disturbed. Plan filed with proper Regional Office (Land Quality Section) At least 30 days before beginning activity. A fee of **$65** for the first acre or any part of an acre. An express review option is available with additional fees.		20 days (30 days)
☐	Sedimentation and erosion control must be addressed in accordance with NCDOT's approved program. Particular attention should be given to design and installation of appropriate perimeter sediment trapping devices as well as stable stormwater conveyances and outlets.		(30 days)
☐	Mining Permit	On-site inspection usual. Surety bond filed with ENR Bond amount varies with type mine and number of acres of affected land. Any arc mined greater than one acre must be permitted. The appropriate bond must be received before the permit can be issued.	30 days (60 days)
☐	North Carolina Burning permit	On-site inspection by N.C. Division Forest Resources if permit exceeds 4 days	1 day (N/A)
☐	Special Ground Clearance Burning Permit - 22 counties in coastal N.C. with organic soils	On-site inspection by N.C. Division Forest Resources required "if more than five acres of ground clearing activities are involved. Inspections should be requested at least ten days before actual burn is planned."	1 day (N/A)
☐	Oil Refining Facilities	N/A	90-120 days (N/A)
☐	Dam Safety Permit	If permit required, application 60 days before begin construction. Applicant must hire N.C. qualified engineer to: prepare plans, inspect construction. certify construction is according to ENR approved plans. May also require permit under mosquito control program. And a 404 permit from Corps of Engineers. An inspection of site is necessary to verify Hazard Classification. A minimum fee of $200.00 must accompany the application. An additional processing fee based on a percentage or the total project cost will be required upon completion.	30 days (60 days)

County Wayne		Project Number: 15-0666 Due Date: 7/10/2015	Normal Process Time (statutory time limit)
PERMITS		SPECIAL APPLICATION PROCEDURES or REQUIREMENTS	
☐	Permit to drill exploratory oil or gas well	File surety bond of $5,000 with ENR running to State of NC conditional that any well opened by drill operator shall, upon abandonment, be plugged according to ENR rules and regulations.	10 days N/A
☐	Geophysical Exploration Permit	Application filed with ENR at least 10 days prior to issue of permit. Application by letter. No standard application form.	10 days N/A
☐	State Lakes Construction Permit	Application fee based on structure size is charged. Must include descriptions & drawings of structure & proof of ownership of riparian property.	15-20 days N/A
☐	401 Water Quality Certification	N/A	60 days (130 days)
☐	CAMA Permit for MAJOR development	$250.00 fee must accompany application	55 days (150 days)
☐	CAMA Permit for MINOR development	$50.00 fee must accompany application	22 days (25 days)
☐	Several geodetic monuments are located in or near the project area. If any monument needs to be moved or destroyed, please notify: N.C. Geodetic Survey, Box 27687 Raleigh, NC 27611		
☐	Abandonment of any wells, if required must be in accordance with Title 15A. Subchapter 2C.0100.		
☐	Notification of the proper regional office is requested if "orphan" underground storage tanks (USTS) are discovered during any excavation operation.		
☐	Compliance with 15A NCAC 2H 1000 (Coastal Stormwater Rules) is required.		45 days (N/A)
☐	Catawba, Jordan Lake, Randalman, Tar Pamlico or Neuse Riparian Buffer Rules required.		
☐	Plans and specifications for the construction, expansion, or alteration of a public water system must be approved by the Division of Water Resources/Public Water Supply Section prior to the award of a contract or the initiation of construction as per 15A NCAC 18C .0300 et. seq. Plans and specifications should be submitted to 1634 Mail Service Center, Raleigh, North Carolina 27699-1634. All public water supply systems must comply with state and federal drinking water monitoring requirements. For more information, contact the Public Water Supply Section, (919) 707-9100.		30 days
☐	If existing water lines will be relocated during the construction, plans for the water line relocation must be submitted to the Division of Water Resources/Public Water Supply Section at 1634 Mail Service Center, Raleigh, North Carolina 27699-1634. For more information, contact the Public Water Supply Section, (919) 707-9100.		30 days

Other comments (attach additional pages as necessary, being certain to cite comment authority)

Division	Initials	No comment	Comments	Date Review
DAQ	RMB	☒	No comments	6/19/15
DWR-WQROS (Aquifer & Surface)	RLS	☐ ☐	SEE ATTACHED COMMENTS	/ / 6/17/15
DWR-PWS	DL	☒		7/7/15
DEMLR (LQ & SW)	PHM	☒		6/18/15
DWM - UST	JSB	☐	PLEASE SEE ATTACHED COMMENTS	6/29/15

REGIONAL OFFICES

Questions regarding these permits should be addressed to the Regional Office marked below.

☐ **Asheville Regional Office**
2090 US Highway 70
Swannanoa, NC 28778
(828) 296-4500

☐ **Mooresville Regional Office**
610 East Center Avenue, Suite 301
Mooresville, NC 28115
(704) 663-1699

☐ **Wilmington Regional Office**
127 Cardinal Drive Extension
Wilmington, NC 28405
(910) 796-7215

☐ **Fayetteville Regional Office**
225 North Green Street, Suite 714
Fayetteville, NC 28301-5043
(910) 433-3300

☐ **Raleigh Regional Office**
3800 Barrett Drive, Suite 101
Raleigh, NC 27609
(919) 791-4200

☐ **Winston-Salem Regional Office**
450 West Hanes Mill Road, Suite 300
Winston-Salem, NC 27105
(336) 771-9800

☒ **Washington Regional Office**
943 Washington Square Mall
Washington, NC 27889
(252) 946-6481

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

John Skvarla III
Secretary

MEMO

To: Harold Brady, SEPA Coordinator
Lyn Hardison, Environmental Coordinator, Office of Legislative & Intergovernmental Affairs

From: Roberto L. Scheller, Senior Environmental Specialist

Subject: **Comments on Project Review for U.S. Army Corps of Engineers, Wayne County (Project # 15-0666)**

Date: June 17, 2015

The Surface Water Protection Section review of the subject project to investigate potential alternatives to modify the Neuse River cutoff project with the following comments:

1. On February 14, 2014 this Office issued General Certification (GC) 3883 for replacement of the failing sheet pile structure and placement of riprap with in the riparian buffer for stream bank stabilization. At the time of the initial site review it was noted that the failing sheet pile structure had created a hydraulic jump within the manmade channel of the Neuse River and if structure should fail would result in a significant head cut moving up the Neuse River. An active head cut of this size within the Neuse River would significantly add to the bed load of the river and result in downstream water quality degradation.
2. It was noted that an instream bar has formed upstream of the sheet pile structure. Shoaling is also occurring upstream of the instream bar and within the old channel indicating insufficient water velocities to move sediment bed load. The flow regime of this section of the Neuse River has been altered by the construction of the cutoff and sheet pile structure and has resulted in impacts to the natural pattern, dimension, and profile of the Neuse River.
3. It is recommended that the cutoff channel be filled and the impacted area restored to a forested state. The Neuse River's full flow would be restored to the natural river channel and the bed load carrying capacity restored.

If you should have any questions or require additional information you may e-mail me at roberto.scheller@ncdenr.gov or contact me by phone at 252-948-3940.

Division of Water Resources – Water Quality Regional Operations Section – Washington Regional Office
943 Washington Square Mall, Washington, NC 27889
Phone: 252-946-6481 \ FAX: 252-945-3716\Internet: www.ncdenr.gov

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

TO: Lyn Hardison, Environmental Coordinator

FROM: Scott Bullock, Regional UST Supervisor JSB

COPY: Robert Davies, Corrective Action Branch Head

COPY: Kathleen Lance, Administrative Secretary

DATE: June 29, 2015

RE: Environmental Review – Project Number 15-0666– Scoping – Proposal is to investigate potential alternatives to modify the Neuse River cutoff project. Project area extends along the Neuse River from Stevens Mill Road and includes the main stem and Neuse River cutoff channel.

I searched the Petroleum Underground Storage Tank (UST) and Non-UST Databases and those databases indicated three petroleum releases (Incidents 15276, WA-89063, and WA-25823). Those incidents were closed out without restrictions. I reviewed the above proposal and determined that this project should not have any adverse impact upon groundwater. The following comments are pertinent to my review:

1. The Washington Regional Office (WaRO) UST Section recommends removal of any abandoned or out-of-use petroleum USTs or petroleum above ground storage tanks (ASTs) within the project area. The UST Section should be contacted regarding use of any proposed or on-site petroleum USTs or ASTs. We may be reached at (252) 946-6481.

2. Any petroleum USTs or ASTs must be installed and maintained in accordance with applicable local, state, and federal regulations. For additional information on petroleum ASTs it is advisable that the North Carolina Department of Insurance at (919) 661-5880 ext. 239, USEPA (404) 562-8761, local fire department, and Local Building Inspectors be contacted.

3. Any petroleum spills must be contained and the area of impact must be properly restored. Petroleum spills of significant quantity must be reported to the North Carolina Department of Environment & Natural Resources – Division of Waste Management Underground Storage Tank Section in the Washington Regional Office at (252) 946-6481.

4. Any soils excavated during demolition or construction that show evidence of petroleum contamination, such as stained soil, odors, or free product must be reported immediately to the local Fire Marshall to determine whether explosive or inhalation hazards exist. Also, notify the UST Section of the Washington Regional Office at (252) 946-6481. Petroleum contaminated soils must be handled in accordance with all applicable regulations.

5. Any questions or concerns regarding spills from petroleum USTs, ASTs, or vehicles should be directed to the UST Section at (252) 946-6481.

If you have any questions or need additional information, please contact me at 252-948-3906.

943 Washington Sq. Mall, Washington, NC 27889
Phone:252-946-6481 \ Internet: http://portal.ncdenr.org/web/wm

North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

MEMORANDUM

TO: Lyn Hardison, Environmental Assistance Coordinator
NCDENR Division of Environmental Assistance and Customer Services

FROM: Gabriela Garrison
Eastern Piedmont Coordinator
Habitat Conservation

DATE: July 10, 2015

SUBJECT: Request for Environmental Scoping for an Alternatives Analysis to Modify the Neuse River Cutoff Project, Wayne County, DENR Project No. 15-0666.

Biologists with the North Carolina Wildlife Resources Commission (NCWRC) have reviewed the subject document. Comments are provided in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e), North Carolina Environmental Policy Act (G.S. 113A-1 through 113A-10; 1 NCAC 25) and North Carolina General Statutes (G.S. 113-131 et seq.).

The U.S. Army Corps of Engineers (USACE) and the City of Goldsboro are examining alternatives to modify the Neuse River Cutoff in Wayne County. The Cutoff, originally 12 feet deep, 20 feet wide and 6,400 feet long, was constructed in 1948 across a bend in the Neuse River. The primary purpose was to alleviate flooding conditions in that area. There is a low flow, sheet pile weir situated in the upstream portion of the Cutoff channel; it is six feet high and 200 feet long, with an 85-foot wide spillway. The Cutoff is now approximately 200 feet wide. Until recently, the weir had not been maintained and was in a deteriorating condition. In 2015, the City of Goldsboro completed a project to temporarily augment the weir by constructing a new sheet pile weir in close proximity to the dilapidated weir.

The USACE has proposed conducting a feasibility study to determine the possibility of restoring natural flows to the Neuse River in the vicinity of the Cutoff, as well as analyze measures to accomplish restoration. Such measures may include rehabilitation (or removal) of the weir or modification (or removal) of the Cutoff while still maintaining flood control functions.

Within this area of the Neuse River, there is potential spawning habitat for the following anadromous fish species: striped bass (*Morone saxitilis*); hickory shad (*Alosa mediocris*); American shad (*Alosa sapidissima*); blueback herring (*Alosa aestivalis*); Atlantic sturgeon (*Acipenser oxyrinchus*); and alewife (*Alosa pseudoharengus*). Currently some anadromous fish ascend the Cutoff in the spring during their spawning migration. Fish cannot move past the weir at the upstream end of the Cutoff, therefore the Cutoff likely reduces spawning success. If the Cutoff and weir are modified, and natural flows are restored in the Neuse River, these species will likely migrate up the original channel and continue on to suitable spawning habitat. Additionally, with a large portion of the Neuse River flow going into the

Mailing Address: Division of Inland Fisheries • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

July 10, 2015
Neuse River Cutoff
DENR Project No.: 15-0666

Cutoff, flow regimes during high flow periods have been altered and sedimentation has increased in the natural river channel, resulting in reduced water depths.

The NCWRC supports efforts to evaluate alternatives to improve conditions at the Cutoff. We recommend that the agencies of interest, specifically the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the North Carolina Division of Marine Fisheries, NCWRC and the USACE, arrange a meeting(s) to discuss the potential issues as well as determine plausible and realistic solutions.

Thank you for the opportunity to review and comment on this project. If I can be of further assistance, please contact me at (910) 409-7350 or gabriela.garrison@ncwildlife.org.

Ec: Jeremy McCargo, NCWRC
Vann Stancil, NCWRC
Karen Brashear, City of Goldsboro
Fritz Rohde, NOAA
John Ellis, USFWS

NORTH CAROLINA STATE CLEARINGHOUSE
DEPARTMENT OF ADMINISTRATION
INTERGOVERNMENTAL REVIEW

COUNTY: WAYNE

H12: OTHER

STATE NUMBER: 15-E-0000-0666
DATE RECEIVED: 06/15/2015
AGENCY RESPONSE: 07/10/2015
REVIEW CLOSED: 07/15/2015

MS CAROLYN PENNY
CLEARINGHOUSE COORDINATOR
DPS - DIV OF EMERGENCY MANAGEMENT
FLOODPLAIN MANAGEMENT PROGRAM
MSC # 4218
RALEIGH NC

JUN 16 2015

REVIEW DISTRIBUTION

DENR - COASTAL MGT
DENR LEGISLATIVE AFFAIRS
DEPT OF CULTURAL RESOURCES
DEPT OF TRANSPORTATION
DPS - DIV OF EMERGENCY MANAGEMENT
EASTERN CAROLINA COUNCIL

PROJECT INFORMATION

APPLICANT: Department of Army
TYPE: National Environmental Policy Act
Scoping

DESC: Proposal is to investigate potential alternatives to modify the Neuse River cutoff project. Project area extends along the Neuse River from Stevens Mill Road and includes the main stem and Neuse River cutoff channel.

The attached project has been submitted to the N. C. State Clearinghouse for intergovernmental review. Please review and submit your response by the above indicated date to 1301 Mail Service Center, Raleigh NC 27699-1301.

If additional review time is needed, please contact this office at (919)807-2425.

AS A RESULT OF THIS REVIEW THE FOLLOWING IS SUBMITTED: ☐ NO COMMENT ☑ COMMENTS ATTACHED

SIGNED BY: John D Barbach DATE: 29 June 2015

JUL 2015
RECEIVED
DCM

North Carolina Department of Public Safety

Division of Emergency Management
Geospatial and Technology Mapping

Pat McCrory, Governor
Frank L. Perry, Secretary

Michael A. Sprayberry, Director

June 29, 2015

State Clearinghouse
N.C. Department of Administration
1301 Mail Service Center
Raleigh, North Carolina 27699-1301

Subject: Intergovernmental Review State Number: 15-E-0000-0666
Neuse River Cutoff Project, City of Goldsboro, Wayne County

As requested by the North Carolina State Clearinghouse, the North Carolina Department of Public Safety Division of Emergency Management Risk Management reviewed the proposed project listed above and offers the following comments:

1) Executive Order 11988 requires an eight-step review process that federal agencies, including the U S Army Corps of Engineers, should carry out as part of their decision-making on projects that have potential impacts to or within the floodplain. Any work within the SFHA of studied streams, based on the current Flood Insurance Rate Map, should follow these guidelines in order to avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains. The eight steps are summarized below. Please describe how this eight-step review process has been or will be accomplished.

    a. Determine if a proposed action is in the base floodplain (that area which has a one percent or greater chance of flooding in any given year).

    b. Conduct early public review, including public notice.

    c. Identify and evaluate practicable alternatives to locating in the base floodplain, including alternative sites outside of the floodplain.

    d. Identify impacts of the proposed action.

    e. If impacts cannot be avoided, develop measures to minimize the impacts and restore and preserve the floodplain, as appropriate.

    f. Reevaluate alternatives.

    g. Present the findings and a public explanation.

    h. Implement the action.

MAILING ADDRESS:
4218 Mail Service Center
Raleigh NC 27699-4218
www.ncem.org

GTM OFFICE LOCATION:
4105 Reedy Creek Road
Raleigh, NC 27607
Telephone: (919) 825-2341
Fax: (919) 825-0408

2) Work within the floodway of the Neuse River will require either a No-Rise study (if the proposed project does not increase flood levels during the base flood discharge), or a Conditional Letter of Map Revision (if the proposed project will increase the flood levels during the base flood discharge) prior to permitting and construction. Projects must not increase flood levels on any existing structures.

3) The base flood elevations for the City of Goldsboro, Wayne and adjoining Counties may increase or decrease as a result of the proposed physical changes to the Neuse River hydraulics. In accordance with 44 CFR 65.3, a Letter of Map Revision shall be required within six months of the completion of the project documenting the physical changes affecting the flooding conditions.

4) All utilities should be protected to the regulatory flood protection elevation as described in the City of Goldsboro and Wayne County's ordinances and 44 CFR 60.3.

If you have any questions, please contact Dan Brubaker, P.E., CFM, the NC NFIP Engineer at (919) 825-2300, by email at dan.brubaker@ncdps.gov or at the address shown on the footer of this document.

Sincerely,

John D. Brubaker, P.E., CFM
NFIP Engineer
Risk Management

cc: John Dorman, Program Director
John Gerber, NFIP State Coordinator

Rama Chittilla, Civil Engineer, City of Goldsboro
Connie R. Price, Planning Director, Wayne County

File

Natasha Earle

NORTH CAROLINA STATE CLEARINGHOUSE
DEPARTMENT OF ADMINISTRATION
INTERGOVERNMENTAL REVIEW

COUNTY: WAYNE

H12: OTHER

STATE NUMBER: 15-E-0000-0666
DATE RECEIVED: 06/15/2015
AGENCY RESPONSE: 07/10/2015
REVIEW CLOSED: 07/15/2015

MS CARRIE ATKINSON
CLEARINGHOUSE COORDINATOR
DEPT OF TRANSPORTATION
STATEWIDE PLANNING - MSC #1554
RALEIGH NC

REVIEW DISTRIBUTION

DENR - COASTAL MGT
DENR LEGISLATIVE AFFAIRS
DEPT OF CULTURAL RESOURCES
DEPT OF TRANSPORTATION
DPS - DIV OF EMERGENCY MANAGEMENT
EASTERN CAROLINA COUNCIL

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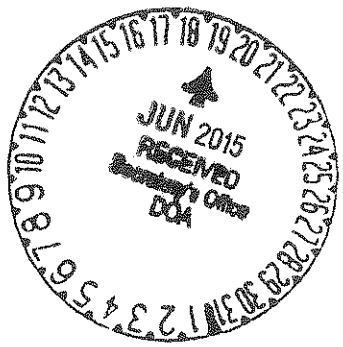
If additional review time is needed, please contact this office at (919)807-2425.

AS A RESULT OF THIS REVIEW THE FOLLOWING IS SUBMITTED: ☑ NO COMMENT ☐ COMMENTS ATTACHED

SIGNED BY: Natasha Earle DATE: 6/17/2015



North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

MEMORANDUM

TO: Lyn Hardison, Environmental Assistance Coordinator
NCDENR Division of Environmental Assistance and Customer Services

FROM: Gabriela Garrison
Eastern Piedmont Coordinator
Habitat Conservation

DATE: July 10, 2015

SUBJECT: Request for Environmental Scoping for an Alternatives Analysis to Modify the Neuse River Cutoff Project, Wayne County, DENR Project No. 15-0666.

Biologists with the North Carolina Wildlife Resources Commission (NCWRC) have reviewed the subject document. Comments are provided in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e), North Carolina Environmental Policy Act (G.S. 113A-1 through 113A-10; 1 NCAC 25) and North Carolina General Statutes (G.S. 113-131 et seq.).

The U.S. Army Corps of Engineers (USACE) and the City of Goldsboro are examining alternatives to modify the Neuse River Cutoff in Wayne County. The Cutoff, originally 12 feet deep, 20 feet wide and 6,400 feet long, was constructed in 1948 across a bend in the Neuse River. The primary purpose was to alleviate flooding conditions in that area. There is a low flow, sheet pile weir situated in the upstream portion of the Cutoff channel; it is six feet high and 200 feet long, with an 85-foot wide spillway. The Cutoff is now approximately 200 feet wide. Until recently, the weir had not been maintained and was in a deteriorating condition. In 2015, the City of Goldsboro completed a project to temporarily augment the weir by constructing a new sheet pile weir in close proximity to the dilapidated weir.

The USACE has proposed conducting a feasibility study to determine the possibility of restoring natural flows to the Neuse River in the vicinity of the Cutoff, as well as analyze measures to accomplish restoration. Such measures may include rehabilitation (or removal) of the weir or modification (or removal) of the Cutoff while still maintaining flood control functions.

Within this area of the Neuse River, there is potential spawning habitat for the following anadromous fish species: striped bass (*Morone saxitilis*); hickory shad (*Alosa mediocris*); American shad (*Alosa sapidissima*); blueback herring (*Alosa aestivalis*); Atlantic sturgeon (*Acipenser oxyrinchus*); and alewife (*Alosa pseudoharengus*). Currently some anadromous fish ascend the Cutoff in the spring during their spawning migration. Fish cannot move past the weir at the upstream end of the Cutoff, therefore the Cutoff likely reduces spawning success. If the Cutoff and weir are modified, and natural flows are restored in the Neuse River, these species will likely migrate up the original channel and continue on to suitable spawning habitat. Additionally, with a large portion of the Neuse River flow going into the

Mailing Address: Division of Inland Fisheries • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

July 10, 2015
Neuse River Cutoff
DENR Project No.: 15-0666

Cutoff, flow regimes during high flow periods have been altered and sedimentation has increased in the natural river channel, resulting in reduced water depths.

The NCWRC supports efforts to evaluate alternatives to improve conditions at the Cutoff. We recommend that the agencies of interest, specifically the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the North Carolina Division of Marine Fisheries, NCWRC and the USACE, arrange a meeting(s) to discuss the potential issues as well as determine plausible and realistic solutions.

Thank you for the opportunity to review and comment on this project. If I can be of further assistance, please contact me at (910) 409-7350 or gabriela.garrison@ncwildlife.org.

Ec: Jeremy McCargo, NCWRC
Vann Stancil, NCWRC
Karen Brashear, City of Goldsboro
Fritz Rohde, NOAA
John Ellis, USFWS

APPENDIX F

IPAC Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Ecological Services Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
Phone: (919) 856-4520 Fax: (919) 856-4556

In Reply Refer To: November 02, 2017
Consultation Code: 04EN2000-2017-SLI-0542
Event Code: 04EN2000-2018-E-00205
Project Name: Neuse-Goldsboro 1135

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The species list generated pursuant to the information you provided identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Section 7 of the Act requires that all federal agencies (or their designated non-federal representative), in consultation with the Service, insure that any action federally authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species. A biological assessment or evaluation may be prepared to fulfill that requirement and in determining whether additional consultation with the Service is necessary. In addition to the federally-protected species list, information on the

species' life histories and habitats and information on completing a biological assessment or evaluation and can be found on our web page at http://www.fws.gov/raleigh. Please check the web site often for updated information or changes

If your project contains suitable habitat for any of the federally-listed species known to be present within the county where your project occurs, the proposed action has the potential to adversely affect those species. As such, we recommend that surveys be conducted to determine the species' presence or absence within the project area. The use of North Carolina Natural Heritage program data should not be substituted for actual field surveys.

If you determine that the proposed action may affect (i.e., likely to adversely affect or not likely to adversely affect) a federally-protected species, you should notify this office with your determination, the results of your surveys, survey methodologies, and an analysis of the effects of the action on listed species, including consideration of direct, indirect, and cumulative effects, before conducting any activities that might affect the species. If you determine that the proposed action will have no effect (i.e., no beneficial or adverse, direct or indirect effect) on federally listed species, then you are not required to contact our office for concurrence (unless an Environmental Impact Statement is prepared). However, you should maintain a complete record of the assessment, including steps leading to your determination of effect, the qualified personnel conducting the assessment, habitat conditions, site photographs, and any other related articles.

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

Not all Threatened and Endangered Species that occur in North Carolina are subject to section 7 consultation with the U.S Fish and Wildlife Service. Atlantic and shortnose sturgeon, sea turtles,when in the water, and certain marine mammals are under purview of the National Marine Fisheries Service. If your project occurs in marine, estuarine, or coastal river systems you should also contact the National Marine Fisheries Service, http://www.nmfs.noaa.gov/

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office. If you have any questions or comments, please contact John Ellis of this office at john_ellis@fws.gov.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Raleigh Ecological Services Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
(919) 856-4520

Project Summary

Consultation Code: 04EN2000-2017-SLI-0542

Event Code: 04EN2000-2018-E-00205

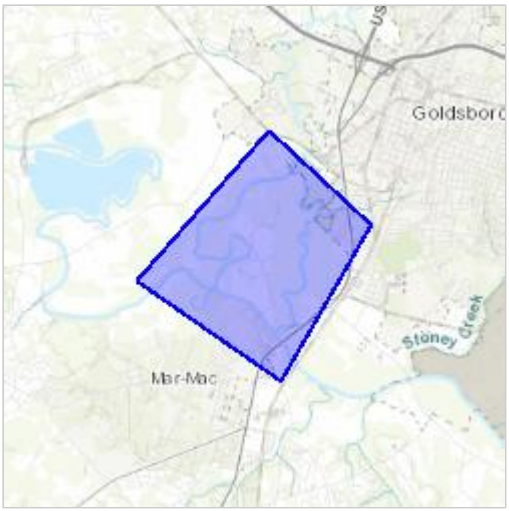
Project Name: Neuse-Goldsboro 1135

Project Type: LAND - RESTORATION / ENHANCEMENT

Project Description: 1135 Ecosystem restoration nepa write-up

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/35.36056261182753N78.03316027254536W



Counties: Wayne, NC

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on this species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

Birds

NAME	STATUS
Red-cockaded Woodpecker *Picoides borealis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7614	Endangered

Clams

NAME	STATUS
Yellow Lance *Elliptio lanceolata* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4511	Proposed Threatened

Critical habitats

There are no critical habitats within your project area under this office's jurisdiction.

APPENDIX G

Benthic Data

Benthos Site Details

Waterbody	Location	Station ID	Date	Bioclassification
NEUSE R	US 117	JB136	30 Jul 2010	Good

County	8 digit HUC	Latitude	Longitude	Elevation (ft)
Wayne	03020201	35.349840	-78.024720	50

Level IV Ecoregion	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southeastern Floodplains and Low Terraces	326.0	28.0	0.6

Upstream NPDES Dischargers (> 1 MGD or < 1 MGD and within 1 mile)	NPDES Number	Volume (MGD)

Landuse (%)	Forest	Developed	Impervious	Cultivation	Grass/Herb/Shrub	Wetland	Water	Barren

Water Quality Parameters	2010	2005	2000
Temperature (°C)	29.8	24.0	25.0
Dissolved Oxygen(mg/L)	5.7	6.2	5.5
Specific Conductance (µS/cm)	214	160	152
pH (s.u.)	6.8	6.8	6.6

No Image Available

Habitat Assessment Scores (max score)	

Substrate (%)	Boulder (0), Cobble (), Gravel (), Sand (90), Silt (10)	Water Clarity	Turbid

Sample Date	Sample ID	Method	ST	EPT	BI	EPT BI	Bioclassification
30 Jul 2010	11053	Full Scale	55	22	5.54	4.62	Good
06 Oct 2005	9759	Full Scale	71	24	5.30	4.27	Good
29 Aug 2000	8290	Full Scale	66	23	5.88	4.55	Good-Fair
08 Aug 1995	6936	Full Scale	53	16	5.34	4.50	Good-Fair
19 Jul 1991	5739	Full Scale	77	29	5.29	4.40	Good

Print Page

APPENDIX H

Cost Engineering

APPENDIX H – COST ENGINEERING NARRATIVE

Rough Order of Magnitude Estimate of Cost for Neuse River-Goldsboro Section 1135
Continuing Authorities Program (CAP), Neuse River Cutoff Project Alternatives
City of Goldsboro, Wayne County, North Carolina
US Army Corps of Engineers, Wilmington District

ESTIMATE NARRATIVE

This Rough Order of Magnitude Estimate (ROM) of cost is based on five preliminary designs and quantities provided by the PDT for the Neuse River-Goldsboro Section 1135 Continuing Authorities Program (CAP), Neuse River Cutoff Project located in the City of Goldsboro, Wayne County, North Carolina.

Many alternatives were considered before narrowing down to the measures that were carried forward for further consideration: modifying weir to elevation 57' (NAVD88), elevation 58', elevation 59' and elevation 60', and building a fish passage structure at the weir elevation 56'. The existing USACE weir would be built back with an increased height in the immediate vicinity. The specific height would be defined during H&H modeling (initial modeling indicated a limit to 4 feet maximum). This measure could reduce flow from entering the cutoff channel and direct a larger volume of water to the natural river channel. The added volume in sections of the natural channel would have positive impacts on riverine functionality in the by-passed main stem such as increased velocity and wetted perimeter. A higher weir elevation means more active flow in the natural river channel for a wider range of flow events. The increased velocity in the natural river channel would continue to the confluence of the downstream end of the cutoff channel, which would increase potential for migrating fish to be attracted toward the natural channel instead of the cutoff channel.

A fish passage structure (such as a baffled pass or rock ramp pass) would allow for anadromous fish species (Atlantic Sturgeon, several shad species, and Striped Bass) to pass through the cutoff to reach upstream spawning and nursery habitat. Currently these fish species are unable to pass through the cutoff to upstream areas due to the height of the weir. There is concern among the resource agencies that a portion of these fish that take the cutoff channel upstream stop their migration once they hit the weir, preventing them from reaching the spawning grounds farther upstream. The Atlantic Sturgeon is listed as a Federally Endangered Species. It is noted that building a fish ladder in the cutoff may conflict with the objective of increasing a more natural flow for improvement in main stem functionality due to need to limit weir height to ensure fish ladder function.

The four measures for modifying the weir height are as follows:

- Replace USACE weir at existing location at elevation 57' NAVD88
- Replace USACE weir at existing location at elevation 58' NAVD88
- Replace USACE weir at existing location at elevation 59' NAVD88
- Replace USACE weir at existing location at elevation 60' NAVD88
- Build fish ladder structure at weir elevation 56'

ROM Estimate of Cost for Neuse River-Goldsboro Section 1135 CAP, Neuse River Cutoff Project Alternatives, City of Goldsboro, Wayne County, North Carolina, USACE, Wilmington District – Estimate Narrative

The cost estimate was developed using MCACES 4.3, the 2015 MCACES Cost Book escalated to today's rates, project invoice records for similar work and vendor submissions/catalog pricing. MII Equipment per 2014 Region 03 (Southeast USA) library was also used for this estimate.

We are assuming a prime contractor with several subcontractors. The subcontractor specialties are for survey work, hauling, demolition and a crane subcontractor. The prime contractor job office overhead (JOOH) rate is set at 20%. The anticipated monthly cost for the prime contractor is $35,700 – which includes a fulltime superintendent, and a part time QC manager and safety officer, monthly trailer overhead, toilets, electricity, etc. The surveying subcontractor's JOOH rate was also set at 16% because of the nature of their work and typically they are a smaller firm, which tend to have higher rates. The remaining subcontractors have their JOOH rates set between 5 % and 10%.

The productivity rate was set at 85% based on the restrictive site access. A labor factor of 10% was added to the Davis Bacon wage rates, which typically run on the lower side. A sales tax of 7% was incorporated to account for the tax rate in Wayne County, North Carolina. A 20% contingency was applied for unseen/unknown construction costs. The projected construction duration was assumed to last 90 days based on review of similar type projects and previous records of production. A five day, 8 hour per day without overtime factors was assumed.

Construction assumptions: It was assumed that 80% of the existing riprap be removed and replaced. The existing riprap material would be hauled off site to an appropriate disposal facility that is approximately 20 miles away. It is recommended that the majority (or a portion) of the riprap be reused as under layer for larger stone to be supplied and for possible downstream shore erosion control.

Instead of removing the entire existing weir structure, we are assuming that the structure will be cut and removed as close to the riverbed as possible.

During construction, the surface and subsurface water are to be controlled so that dry conditions are available during excavation and site preparation.

The table below shows a comparison of costs between the five alternatives:

Alternative	Total Cost
Replace USACE weir at existing location at elevation 57' NAVD88	$1,423,948.55
Replace USACE weir at existing location at elevation 58' NAVD88	$1,455,969.02
Replace USACE weir at existing location at elevation 59' NAVD88	$1,505,805.84
Replace USACE weir at existing location at elevation 60' NAVD88	$1,551,112.27

Build Fish Passage Structure at Weir Elevation 56’	$2,477,620.77

The PDT chose the replacing of the USACE weir at the existing location at elevation 58’ NAVD88as the preferred alternative.

_____

Leslie Bowles-Early
Civil/Cost Engineer
USACE-SAW-ECP-ET
(910) 251-4689

APPENDIX I

Real Estate

APPENDIX I - REAL ESTATE

NEUSE RIVER GOLDSBORO SECTION 1135 PROJECT
MODIFICATION FOR IMPROVEMENT OF THE ENVIRONMENT

REAL ESTATE SUMMARY

Table of Contents

SECTION 1. THE REAL ESTATE REPORT

1.1 Statement of Purpose

This report is tentative in nature, focuses on the Recommended Plan, and is to be used for planning purposes only. There may be modifications to the plans that occur during the Design and Implementation (DI) phase, thus changing the final acquisition area(s) and/or administrative and land cost. The Real Estate Appendix is intended to support the Detailed Project Report and Environmental Assessment for the Neuse River Goldsboro, North Carolina Section 1135 project. The author of this report is familiar with the Project area. The City of Goldsboro will be the non-Federal sponsor for the project. Date of this report is November, 2017.

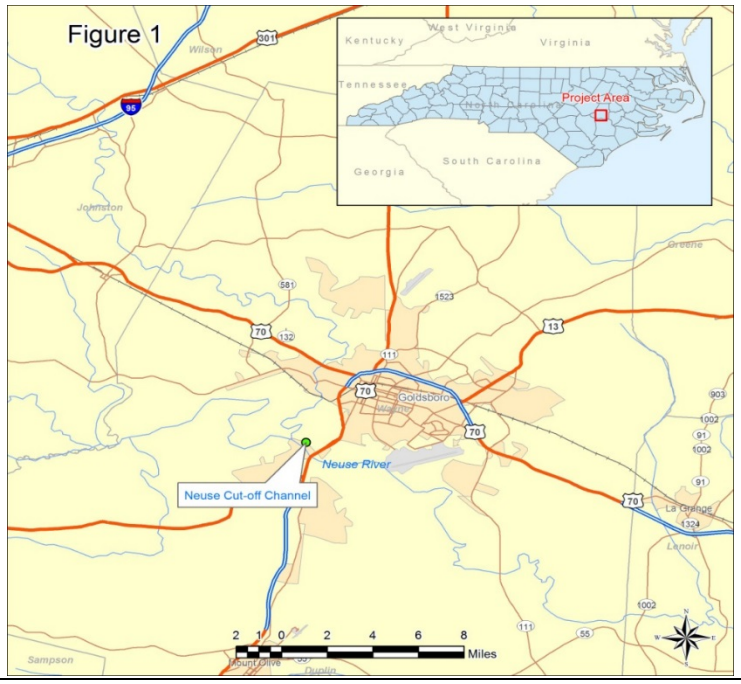
1.2 Study Authority

Section 1135 of the Water Resources Development Act (WRDA) (P.L. 99-662) of 1986, as amended, provided authority for this study.

1.3 Project Location

The project area is located in the Neuse River Basin and centers on a 7-mile stretch of river, just southwest of the City of Goldsboro. The subject reach extends along the Neuse River from Stevens Mill Road crossing to the Arrington Bridge Road crossing, and includes both the main stem of the Neuse River and the USACE-constructed Neuse River cutoff channel (Figure 1.3-1).

Figure 1.3-1. Project Vicinity/Location Map



1.4 Project Description

The project is modification of the existing Corps project for improvement of the environment. The original Federal project was constructed for the purposes of flood control along a segment of the Neuse River. Due to negative flooding impacts, particularly to agriculture, Congress authorized in 1941 the excavation of a cut-off channel approximately 6,400 feet long which would by-pass 7.1 miles of the main stem Neuse. Within the cut-off channel a low-head weir was constructed which would divert portions of the main stem flow into the cut-off channel during higher flows. The intended effect was a reduction in flood risk along the 7.1 mile by-passed section of the Neuse River. The original project constructed in 1948 also provides for operation and maintenance of the project by the Federal Government. The weir section was rebuilt in 1960 and 1980 due to deterioration and corrosion.

In 2007, prompted by concerns that the degraded cutoff channel weir would breach and further reduce water depths and increase sedimentation in the main stem of the Neuse River where their primary water intake is located, the City of Goldsboro, repaired the dam under Federal permit by placing rock stabilization along the upstream and downstream faces of the weir. However, the majority of the repair work blew out not long after completion and the stabilizing rock was scoured out. Due to the failure of the 2007 weir repair, the City of Goldsboro (City) completed construction of a new weir stabilization (Section 408) project in July 2015. This project is considered a temporary measure until completion of a federal project. The Section 408 structure is immediately downstream of the original Federal weir. Although the City does not own the original weir, continued long term maintenance of the weir is a concern of the City since the weir is viewed by the City as crucial to the operation of their water supply intake.

The proposed project makes improvements to the environment in multiple ways. The project will increase wetted width of the by-passed main stem channel and restore a portion of natural discharge to the by-passed main stem channel. The project will improve habitat connectivity of the cutoff channel to upstream river reaches, which can increase fish migration upstream of the project area to identified spawning habitat. Finally, this project will improve hydrologic connectivity of the Neuse River and restore connections to important spawning habitat for migrating fish species.

The Recommended Plan will construct a steel sheet pile weir to an elevation of 58.0' NAVD 88 approximately 25' downstream of the existing Section 408 weir within the main channel. Removal of the existing Section 408 steel sheet pile weir structure will be accomplished by the City after the construction of the proposed new weir. The deteriorated and damaged condition of the existing steel sheet pile weir due to rust and exposure to past pounding by heavy floating debris would most likely prevent the entire removal of the existing weir structure. The original 1948 constructed weir that was bent over during construction of the Section 408 weir will be cutoff below the grade of the top of the existing riprap. The non-Federal sponsor fully supports the Recommended Plan.

1.5 Real Estate Requirements

There will be minimal Real Estate requirements for this project. Wayne County granted a perpetual easement to the United States of America on 16 August 1947. It is anticipated that construction will occur within the existing easement. The nonfederal sponsor will be responsible for obtaining a staging and laydown area for a period of 18 months. Land located just to the south side of the cutoff contains approximately 90 acres and is a suitable area for staging of equipment and materials. The parcel currently supports a rock quarry operation, but there is sufficient reclaimed area for staging/laydown.

1.6 Utility/Facility Relocation

There are no utility/facility relocations with this project.

1.7 Existing Projects

With the exception of the existing Neuse River Cutoff Project authorized by the Flood Control Act of 1941, there are no other federal projects within the study area.

1.8 Environmental Impacts

Environmental Impacts are addressed in the main report.

1.9 Project Sponsor Responsibilities and Capabilities

The City of Goldsboro, North Carolina will be the non-Federal Project Sponsor (NFS). The NFS has the responsibility to acquire all real estate interests required for the Project. The NFS shall accomplish all alterations and relocations of facilities, structures and improvements determined by the government to be necessary for construction of the Project. The sponsor will have operation and maintenance responsibility for the project after construction is completed.

Title to any acquired real estate will be retained by the NFS and will not be conveyed to the United States Government. Prior to advertisement of any construction contract, the NFS shall furnish to the government an Authorization for Entry for Construction (Exhibit “A” to the Real Estate Appendix) to all lands, easements and rights-of-way, as necessary. The NFS will also furnish to the government evidence supporting their legal authority to grant rights-of-way to such lands. The NFS shall comply with applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, approved 2 January 1971, and amended by Title IV of the Surface Transportation Uniform Relocation Assistance Act of 1987, Public Law 100-17, effective 2 April 1989, in acquiring real estate interests for the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act(s). An Assessment of the Non-Federal Sponsor’s Capability to Acquire Real Estate is at Exhibit “B” to the Real Estate Appendix

The non-Federal sponsor is entitled to receive credit against its share of project costs for the value of lands it provides and the value of the relocations that are required for the project. Generally, for the purpose of determining the amount of credit to be

afforded, the value of the Land, Easements, Rights-of-Way, Relocation and Disposal areas (LERRDs) is the fair market value of the real property interest, plus certain incidental costs of acquiring those interests, that the non-federal sponsor provided for the project as required by the Government.

The NFS should not acquire lands required for the project prior to execution of the Project Partnership Agreement (PPA). Should the NFS proceed with acquisition of lands prior to execution of the PPA, it is at the risk of not receiving credit or reimbursement for any costs incurred in the connection with the acquisition process should the PPA not be signed. There is also risk in acquiring lands either not needed for the project or not acquired in compliance with requirements for crediting purposes in accordance with 49 CFR Part 24, dated March 2, 1989.

1.10 Government Owned Property

No Government owned lands are within the LERRDs required for the project. The US Army Corps of Engineers completed construction of the Goldsboro, Neuse River, Federal Project in 1948, authorized by the Flood Control Act of 1941. The original project authorization provided for a cutoff channel and the primary purpose was to alleviate flooding. Real estate interests acquired by Wayne County, North Carolina, for the original project included 43.10 acres. Wayne County, North Carolina granted a perpetual easement to the United States of America on 16 August 1947.

1.11 Historical Significance

Historical significance is addressed in the Cultural Resources section in the main report.

1.12 Mineral Rights

There are no known mineral activities within the scope of the proposed project.

1.13 Hazardous, Toxic, and Radioactive Waste (HTRW)

No hazardous or toxic waste sites are known to occur in the project area, nor will any toxic substances be introduced as part of this project.

1.14 Navigation Servitude

Navigation Servitude is not applicable to this project.

1.15 Zoning Ordinances

Zoning ordinances are not of issue with this project. Application or enactment of zoning ordinances is not to be used in lieu of acquisition.

1.16 Induced Flooding

There will be no flooding induced by the construction or the operation and maintenance of the project.

1.17 Public Law 91-646, Relocation Assistance Benefits

There are no relocations of individuals, businesses or farms for this project.

1.18 Attitude of Property Owners

The project is fully supported. There are no known objections to the project from landowners within the project area.

1.19 Acquisition Schedule

The project sponsor is responsible for acquiring real estate interests required for the project. There will be a real estate requirement for about three acres for a staging/laydown area. Land located just to the south side of the cut-off contains approximately 90 acres and is suitable for staging of equipment and materials. The parcel currently supports a rock quarry operation, but there is sufficient reclaimed area for a staging/laydown area. It is projected the construction can be accomplished within 3 months, and can begin when final plans and specs have been completed and the PPA has been executed. The Project Sponsor, Project Manager and Real Estate Technical Manager will formulate the milestone schedule upon project approval to meet dates for advertisement and award of a construction contract.

1.20 Estates for Proposed Project

There will be minimal real estate acquisition required for this project. Real Estate interests acquired for the original project includes 43.10 acres that was acquired by Wayne County, North Carolina. Wayne County granted a perpetual easement to the United States of America on 16 August 1947. The easement is about 6,400 feet in length and 300 feet in width. It is anticipated that the preliminary proposed plan will be constructed within the existing easement.

The standard temporary work area easement will be used for the staging area and for an access route into the site.

TEMPORARY WORK AREA EASEMENT

A temporary easement and right-of-way in, over and across (the land described in Schedule A) (Tracts Nos. _____, _____, and _____), for a period not to exceed 18 months, beginning with date possession of the land is granted to The City of Goldsboro, North Carolina (Sponsor), for use by the Sponsor, its representatives, agents, and contractors as a work area, including the right to move, store and remove equipment and supplies, and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the Neuse River Goldsboro Section 1135 Project, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation structures, or obstacles within the limits of the right-of-way, reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or

abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

1.21 Real Estate Estimate

The real estate requirements are minimal for this project. The sponsors will be required to provide an interagency agreement. The estimated real estate costs include the Administrative costs are those costs incurred for verifying ownership of lands, certification of those lands required for project purposes, legal opinions, analysis or other requirements that may be necessary during Planning, Engineering and Design (PED). A 25% contingency is applied to the estimated total for these items. Table 1.21-1 is a summary of the real estate cost.

Table 1.21-1. Real Estate Estimate

Neuse Goldsboro Sec 1135- Estimate		
a. Lands		
Staging Area 3.5 acres		2,000
b. Improvements		0
(Residential)		0
(Commercial)		0
c. Mineral Rights		0
d. Damages		0
e. P.L. 91-646 Relocation costs		0
f. Acquisition Cost - Admin (1 ownership)		18,000
Federal	3,000	
Non-federal	15,000	
	18,000	
Sub-Total		20,000
Contingencies (25%)		5,000
TOTAL		**25,000**
ROUNDED		**25,000**

1.22 Chart of Accounts

The cost estimate for all Federal and non-Federal real estate activities necessary for implementation of the project after completion of the feasibility study for land acquisition, construction, LERRD, and other items are coded as delineated in the Cost Work Breakdown Structure (CWBS). This real estate cost estimate is then incorporated into the Total Current Working Estimate utilizing the Microcomputer Aided Cost Engineering System (MCACES).

Table 1.22-1. Chart of Accounts

01AX	Contingencies (25%)	$	$	$
	Subtotal	$	$	$
01B	LANDS AND DAMAGES			
01B40	Acq/Review of PS	$ 3,000.00	$	$ 3,000.00
01B20	Acquisition by PS	$	$ 15,000.00	$ 15,000.00
01BX	Contingencies (25%)	$ 750.00	$ 3,750.00	$ 4,500.00
	Subtotal	$ 3,750.00	$ 18,750.00	$ 22,500.00
01G	Temorary Permits/Lic/ROEs			
01G10	By Govt			
01G20	By PS	$	$ 2,000.00	$ 2,000.00
01G30	By Govt on Behalf of PS	$	$	$
01GX	Contingencies (25%)	$		
	Subtotal	$	$ 2,000.00	$ 2,000.00
01H	AUDIT			
01H10	Real Estate Audit	$	$	$
01HX	Contingencies (15%)	$	$	$
	Subtotal	$	$	$
01R	REAL ESTATE LAND PAYMENTS			
01R1B	Land Payments by PS	$	$ -	$ -
01R2B	PL91-646 Relocation Pymt by PS	$	$ -	$ -
01R2D	Review of PS	$	$	$
01RX	Contingencies (25%)	$	$ -	$ -
	Subtotal	$	$ -	$ -
	TOTALS	$ 3,750.00	$ 20,750.00	$ 24,500.00
	ROUNDED TO			**$ 25,000.00**

Exhibits

Exhibit A - Authorization For Entry For Construction

Exhibit B – Assessment of Non-Federal Sponsor's Real Estate Acquisition Capability

AUTHORIZATION FOR ENTRY FOR CONSTRUCTION

I _____, _____ for the
(Name of accountable official) (Title)

(Sponsor Name) _____, do hereby certify that the ___(Sponsor Name) has acquired the real property interest required by the Department of the Army, and otherwise is vested with sufficient title and interest in lands to support construction for (Project Name, Specifically identified project features, etc.). Further, I hereby authorize the Department of the Army, its agents, employees and contractors, to enter upon _____
(identify tracts)

to construct (Project Name, Specifically identified project features, etc.) as set forth in the plans and specifications held in the U. S. Army Corps of Engineers' (district, city, state)

WITNESS my signature as _____ for the
(Title)

(Sponsor Name) this __ day of _____, 20_____.

BY: _____
(Name)

_____
(Title)

ATTORNEY'S CERTIFICATE OF AUTHORITY

I, _____ , _____ for the
(Name) (Title of legal officer)

(Sponsor Name), certify that _____ has
(Name of accountable official)

authority to grant Authorization for Entry; that said Authorization for Entry is executed by the proper duly authorized officer; and that the Authorization for Entry is in sufficient form to grant the authorization therein stated.

WITNESS my signature as _____ for the
(Title)

(Sponsor Name), this_____day of_____, 20____.

BY: _____
(Name)

_____
(Title)

Exhibit A

Assessment of Non-Federal Sponsor's
Real Estate Acquisition Capability
Noyes Cut Satilla River Basin Section 1135

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? **YES**

b. Does the sponsor have the power to eminent domain for this project? **YES**

c. Does the sponsor have "quick-take" authority for this project? **YES**

d. Are any of the land/interests in the land required for this project located outside the sponsor's political boundary? **NO**

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? **NO**

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P. L. 91-646, as amended? **NO**

b. If the answer to II.a. is "yes", has a reasonable plan been developed to provide such training? (yes/no)

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? **YES**

d. Is the sponsor's projected in-house staffing level sufficient considering its other work load, if any, and the project schedule? **YES**

e. Can the sponsor obtain contractor support, if required in a timely fashion? **YES**

f. Will the sponsor likely request USACE assistance in acquiring real estate? **YES - only in advisory capacity**

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site? **YES**

b. Has the sponsor approved the project/real estate schedule/milestones? **NO – Project Milestone will be developed during PED; will be joint effort between RE, PM and NFS**

Exhibit B
1st page

IV. Overall Assessment:

a. Has the sponsor performed satisfactory on other USACE projects? **YES**

b. With regard to the project, the sponsor is anticipated to be: **Highly capable**

V. Coordination:

a. Has this assessment been coordinated with the sponsor? **YES**

b. Does the sponsor concur with this assessment? **YES**

Prepared by:

_____
Patricia Casey
Senior Realty Specialist

Reviewed and approved by:

_____
Ralph J. Werthmann
Chief, Real Estate Division

Exhibit B
2nd page

APPENDIX J

FONSI

US Army Corps
of Engineers
WILMINGTON DISTRICT

DRAFT FINDING OF NO SIGNIFICANT IMPACT

DETAILED PROJECT REPORT AND ENVIRONMENTAL ASSESSMENT
NEUSE RIVER GOLDSBORO SECTION 1135
MODIFICATION FOR IMPROVEMENT OF THE ENVIRONMENT

The U.S. Army Corps of Engineers, Wilmington District (Corps), has conducted an environmental assessment in accordance with the National Environmental Policy Act of 1969, as amended. The Corps assessed the effects of the following action in the Draft Integrated Feasibility Report and Environmental Assessment (EA), dated October 2017, for the Neuse River Goldsboro Section 1135 Modification for Improvement of the Environment. The final recommendation is contained in the Detailed Project Report and Environmental Assessment. The Recommended Plan consists of the following:

- Replace weir at existing location at elevation 58.0 NAVD 88

Six alternatives including the No Action and the Recommended Plan, were evaluated. The analysis conducted for the Neuse River Goldsboro 1135 study indicated that the proposed steel sheet pile weir structure should be constructed approximately 25' downstream of the existing Section 408 weir and to an elevation of 58.0' NAVD 88. A 3-foot thick layer of stone (riprap) would be placed over a layer of bedding stone along downstream area of the new steel sheet pile weir, and a 2-foot thick layer of stone (riprap) would be placed along both downstream banks for a distance of approximately 15 feet. The streambanks would be cleared and graded to a 3H:1V slope or flatter for placement of the streambank slope protection. Backfill material and/or bedding layer consisting of NCDOT Class A or B riprap stone would be placed under the 3-foot thick layer of riprap and to fill any voids within the existing riprap. A geotextile layer will be used for the 2-foot thick layer along the stream banks. Removal of the existing Section 408 weir and the cutting off of the existing Corps weir would occur after completion of the new proposed weir structure and riprap placement. The Recommended Plan is the environmentally preferable alternative and will provide positive environmental benefits for the surrounding Neuse River system, including restoration of natural riverine function and increased connectivity for anadromous fish.

All practicable means to avoid and minimize adverse environmental effects have been incorporated into the Recommended Plan. The Recommended Plan would not result in any negative impacts to federally-listed threatened or endangered species or their designated critical habitat.

The Recommended Plan will not impact sites listed on or eligible for inclusion on the National Register of Historic Places.

The Recommended Plan will not result in unavoidable adverse impacts.

Technical, environmental, economic, and cost-effectiveness criteria used in the formulation of alternative plans were those specified in the Water Resource Council's 1983 Economic and Environmental Principles for Water and Related Land Resources Implementation Studies. All applicable laws, executive orders, regulations, and local government plans were considered in the evaluation of the alternatives. It is my determination that the Recommended Plan does not constitute a major federal action that would significantly affect the quality of the human environment; therefore, preparation of an Environmental Impact Statement is not required.

Date:_____

_____
Robert J. Clark
Colonel, U.S. Army
District Commander

APPENDIX K

Water Quality Certification

STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF WATER RESOURCES

WATER QUALITY GENERAL CERTIFICATION NO. 4089

GENERAL CERTIFICATION FOR PROJECTS ELIGIBLE FOR US ARMY CORPS OF ENGINEERS

- **NATIONWIDE PERMIT NUMBER 15 (US COAST GUARD APPROVED BRIDGES),**
- **NATIONWIDE PERMIT NUMBER 31 (MAINTENANCE OF EXISTING FLOOD CONTROL FACILITIES), AND**
- **REGIONAL GENERAL PERMIT 198500194 (ARTIFICIAL REEFS AND FISH ATTRACTORS)**

Water Quality Certification Number 4089 is issued in conformity with the requirements of Section 401, Public Laws 92-500 and 95-217 of the United States and subject to the North Carolina Regulations in 15A NCAC 02H .0500 and 15A NCAC 02B .0200 for the discharge of fill material to surface waters and wetland areas as described 33 CFR 330 Appendix A (B) (15 and 31) of the US Army Corps of Engineers regulations and in the Regional General Permit 198500194.

The State of North Carolina certifies that the specified category of activity will not violate applicable portions of Sections 301, 302, 303, 306 and 307 of the Public Laws 92-500 and 95-217 if conducted in accordance with the conditions hereinafter set forth.

Effective date: March 19, 2017

Signed this day March 3, 2017

By

for S. Jay Zimmerman, P.G.
Director

Activities meeting any one (1) of the following thresholds or circumstances require *written approval* for a 401 Water Quality Certification from the Division of Water Resources (DWR):

a) If any of the conditions of this Certification (listed below) cannot be met; or
b) Any permanent fill into or modification of wetlands or waters; or
c) Any stream relocation or stream restoration; or
d) Any impacts to waters, or to wetlands adjacent to waters, designated as: ORW (including SAV), HQW (including PNA), SA, WS-I, WS-II, Trout, or North Carolina or National Wild and Scenic River; or
e) Any impacts to coastal wetlands [15A NCAC 07H .0205], or Unique Wetlands (UWL); or
f) Any impact associated with a Notice of Violation or an enforcement action for violation(s) of NC Wetland Rules (15A NCAC 02H .0500), NC Isolated Wetland Rules (15A NCAC 02H .1300), NC Surface Water or Wetland Standards (15A NCAC 02B .0200), or State Regulated Riparian Buffer Rules (15A NCAC 02B .0200); or
g) Any impacts to subject water bodies and/or state regulated riparian buffers along subject water bodies in the Neuse, Tar-Pamlico, or Catawba River Basins or in the Randleman Lake, Jordan Lake or Goose Creek Watersheds (or any other basin or watershed with State Regulated Riparian Area Protection Rules [Buffer Rules] in effect at the time of application) *unless:*
    i) The activities are listed as "EXEMPT" from these rules; or
    ii) A Buffer Authorization Certificate is issued by the NC Division of Coastal Management (DCM); or
    iii) A Buffer Authorization Certificate or a Minor Variance is issued by a delegated or designated local government implementing a state riparian buffer program pursuant to 143-215.23.

Activities included in this General Certification that do not meet one of the thresholds listed above do not require written approval.

I. GENERAL CONDITIONS:

1. When written authorization is required, the plans and specifications for the project are incorporated into the authorization by reference and are an enforceable part of the Certification. Any modifications to the project require notification to DWR and may require an application submittal to DWR with the appropriate fee. [15A NCAC 02H .0501 and .0502]

2. No waste, spoil, solids, or fill of any kind shall occur in wetlands or waters beyond the footprint of the impacts (including temporary impacts) as authorized in the written approval from DWR; or beyond the thresholds established for use of this Certification without written authorization. [15A NCAC 02H .0501 and .0502]

No removal of vegetation or other impacts of any kind shall occur to state regulated riparian buffers beyond the footprint of impacts approved in a Buffer Authorization or Variance or as listed as an exempt activity in the applicable riparian buffer rules. [15A NCAC 02B .0200]

3. In accordance with 15A NCAC 02H .0506(h), compensatory mitigation may be required for losses of greater than 150 linear feet of streams and/or greater than one (1) acre of wetlands. Impacts to isolated and other non-404 jurisdictional wetlands shall not be combined with 404 jurisdictional wetlands for the purpose of determining when impact thresholds trigger a mitigation requirement. For linear publicly owned and maintained transportation projects that are not determined to be part of a larger common plan of development by the US Army Corps of Engineers, compensatory mitigation may be required for losses of greater than 150 linear feet per stream.

   Compensatory stream and/or wetland mitigation shall be proposed and completed in compliance with G.S. 143-214.11. For applicants proposing to conduct mitigation within a project site, a complete mitigation proposal developed in accordance with the most recent guidance issued by the US Army Corps of Engineers Wilmington District shall be submitted for review and approval with the application for impacts.

4. All activities shall be in compliance with any applicable State Regulated Riparian Buffer Rules in Chapter 2 of Title 15A.

5. When applicable, all construction activities shall be performed and maintained in full compliance with G.S. Chapter 113A Article 4 (Sediment and Pollution Control Act of 1973). Regardless of applicability of the Sediment and Pollution Control Act, all projects shall incorporate appropriate Best Management Practices for the control of sediment and erosion so that no violations of state water quality standards, statutes, or rules occur. [15A NCAC 02H .0506(b)(3) and (c)(3) and 15A NCAC 02B .0200].

   Design, installation, operation, and maintenance of all sediment and erosion control measures shall be equal to or exceed the requirements specified in the most recent version of the *North Carolina Sediment and Erosion Control Manual*, or for linear transportation projects, the *NCDOT Sediment and Erosion Control Manual*.

   All devices shall be maintained on all construction sites, borrow sites, and waste pile (spoil) sites, including contractor-owned or leased borrow pits associated with the project. Sufficient materials required for stabilization and/or repair of erosion control measures and stormwater routing and treatment shall be on site at all times.

   For borrow pit sites, the erosion and sediment control measures shall be designed, installed, operated, and maintained in accordance with the most recent version of the *North Carolina Surface Mining Manual*. Reclamation measures and implementation shall comply with the reclamation in accordance with the requirements of the Sedimentation Pollution Control Act and the Mining Act of 1971.

If the project occurs in waters or watersheds classified as Primary Nursery Areas (PNAs), SA, WS-I, WS-II, High Quality Waters (HQW), or Outstanding Resource Waters (ORW), then the sedimentation and erosion control designs shall comply with the requirements set forth in 15A NCAC 04B .0124, *Design Standards in Sensitive Watersheds*.

6. Sediment and erosion control measures shall not be placed in wetlands or waters except within the footprint of temporary or permanent impacts authorized under this Certification. Exceptions to this condition require application to and written approval from DWR. [15A NCAC 02H .0501 and .0502]

7. Erosion control matting that incorporates plastic mesh and/or plastic twine shall not be used along streambanks or within wetlands. Exceptions to this condition require application to and written approval from DWR. [15A NCAC 02B .0201]

8. An NPDES Construction Stormwater Permit (NCG010000) is required for construction projects that disturb one (1) or more acres of land. The NCG010000 Permit allows stormwater to be discharged during land disturbing construction activities as stipulated in the conditions of the permit. If the project is covered by this permit, full compliance with permit conditions including the erosion & sedimentation control plan, inspections and maintenance, self-monitoring, record keeping and reporting requirements is required. [15A NCAC 02H .0506(b)(5) and (c)(5)]

   The North Carolina Department of Transportation (NCDOT) shall be required to be in full compliance with the conditions related to construction activities within the most recent version of their individual NPDES (NCS000250) stormwater permit. [15A NCAC 02H .0506(b)(5) and (c)(5)]

9. All work in or adjacent to streams shall be conducted so that the flowing stream does not come in contact with the disturbed area. Approved best management practices from the most current version of the *NC Sediment and Erosion Control Manual*, or the *NC DOT Construction and Maintenance Activities Manual*, such as sandbags, rock berms, cofferdams, and other diversion structures shall be used to minimize excavation in flowing water. Exceptions to this condition require application to and written approval from DWR. [15A NCAC 02H .0506(b)(3) and (c)(3)]

10. If activities must occur during periods of high biological activity (e.g. sea turtle nesting, fish spawning, or bird nesting), then biological monitoring may be required at the request of other state or federal agencies and coordinated with these activities. [15A NCAC 02H .0506(b)(2) and 15A NCAC 04B .0125]

    All moratoriums on construction activities established by the NC Wildlife Resources Commission (WRC), US Fish and Wildlife Service (USFWS), NC Division of Marine Fisheries (DMF), or National Marine Fisheries Service (NMFS) shall be implemented. Exceptions to this condition require written approval by the resource agency responsible for the given moratorium. A copy of the approval from the resource agency shall be forwarded to DWR.

Work within a designated trout watershed of North Carolina (as identified by the Wilmington District of the US Army Corps of Engineers), or identified state or federal endangered or threatened species habitat, shall be coordinated with the appropriate WRC, USFWS, NMFS, and/or DMF personnel.

11. Culverts shall be designed and installed in such a manner that the original stream profiles are not altered and allow for aquatic life movement during low flows. The dimension, pattern, and profile of the stream above and below a pipe or culvert shall not be modified by widening the stream channel or by reducing the depth of the stream in connection with the construction activity. The width, height, and gradient of a proposed culvert shall be such as to pass the average historical low flow and spring flow without adversely altering flow velocity. [15A NCAC 02H .0506(b)(2) and (c)(2)]

    Placement of culverts and other structures in streams shall be below the elevation of the streambed by one foot for all culverts with a diameter greater than 48 inches, and 20% of the culvert diameter for culverts having a diameter less than or equal to 48 inches, to allow low flow passage of water and aquatic life.

    If multiple pipes or barrels are required, they shall be designed to the mimic existing stream cross section as closely as possible including pipes or barrels at flood plain elevation and/or sills where appropriate. Widening the stream channel shall be avoided.

    When topographic constraints indicate culvert slopes of greater than 5%, culvert burial is not required, provided that all alternative options for flattening the slope have been investigated and aquatic life movement/connectivity has been provided when possible (e.g. rock ladders, cross vanes, etc.). Notification, including supporting documentation to include a location map of the culvert, culvert profile drawings, and slope calculations, shall be provided to DWR 60 calendar days prior to the installation of the culvert.

    When bedrock is present in culvert locations, culvert burial is not required provided that there is sufficient documentation of the presence of bedrock. Notification, including supporting documentation such as, a location map of the culvert, geotechnical reports, photographs, etc. shall be provided to DWR a minimum of 60 calendar days prior to the installation of the culvert. If bedrock is discovered during construction, then DWR shall be notified by phone or email within 24 hours of discovery.

    If other site-specific topographic constraints preclude the ability to bury the culverts as described above and/or it can be demonstrated that burying the culvert would result in destabilization of the channel, then exceptions to this condition require application to and written approval from DWR.

Installation of culverts in wetlands shall ensure continuity of water movement and be designed to adequately accommodate high water or flood conditions. When roadways, causeways, or other fill projects are constructed across FEMA-designated floodways or wetlands, openings such as culverts or bridges shall be provided to maintain the natural hydrology of the system as well as prevent constriction of the floodway that may result in destabilization of streams or wetlands.

The establishment of native woody vegetation and other soft stream bank stabilization techniques shall be used where practicable instead of rip-rap or other bank hardening methods.

12. Bridge deck drains shall not discharge directly into the stream. Stormwater shall be directed across the bridge and pre-treated through site-appropriate means to the maximum extent practicable (e.g. grassed swales, pre-formed scour holes, vegetated buffers, etc.) before entering the stream. Exceptions to this condition require application to and written approval from DWR. [15A NCAC 02H .0506(b)(5)]

13. Application of fertilizer to establish planted/seeded vegetation within disturbed riparian areas and/or wetlands shall be conducted at agronomic rates and shall comply with all other Federal, State and Local regulations. Fertilizer application shall be accomplished in a manner that minimizes the risk of contact between the fertilizer and surface waters. [15A NCAC 02B .0200 and 15A NCAC 02B .0231]

14. If concrete is used during construction, then all necessary measures shall be taken to prevent direct contact between uncured or curing concrete and waters of the state. Water that inadvertently contacts uncured concrete shall not be discharged to waters of the state. [15A NCAC 02B .0200]

15. All proposed and approved temporary fill and culverts shall be removed and the impacted area shall be returned to natural conditions within 60 calendar days after the temporary impact is no longer necessary. The impacted areas shall be restored to original grade, including each stream's original cross sectional dimensions, planform pattern, and longitudinal bed profile. For projects that receive written approval, no temporary impacts are allowed beyond those included in the application and authorization. All temporarily impacted sites shall be restored and stabilized with native vegetation. [15A NCAC 02H .0506(b)(2) and (c)(2)]

16. All proposed and approved temporary pipes/culverts/rip-rap pads etc. in streams shall be installed as outlined in the most recent edition of the *North Carolina Sediment and Erosion Control Planning and Design Manual* or the *North Carolina Surface Mining Manual* or the *North Carolina Department of Transportation Best Management Practices for Construction and Maintenance Activities* so as not to restrict stream flow or cause dis-equilibrium during use of this Certification. [15A NCAC 02H .0506(b)(2) and (c)(2)]

17. Any rip-rap required for proper culvert placement, stream stabilization, or restoration of temporarily disturbed areas shall be restricted to the area directly impacted by the approved construction activity. All rip-rap shall be placed such that the original stream elevation and streambank contours are restored and maintained. Placement of rip-rap or other approved materials shall not result in de-stabilization of the stream bed or banks upstream or downstream of the area or in a manner that precludes aquatic life passage. [15A NCAC 02H .0506(b)(2)]

18. Any rip-rap used for stream or shoreline stabilization shall be of a size and density to prevent movement by wave, current action, or stream flows and shall consist of clean rock or masonry material free of debris or toxic pollutants. Rip-rap shall not be installed in the streambed except in specific areas required for velocity control and to ensure structural integrity of bank stabilization measures. [15A NCAC 02H .0506(b)(2)]

19. Applications for rip-rap groins proposed in accordance with 15A NCAC 07H .1401 (NC Division of Coastal Management General Permit for construction of Wooden and Rip-rap Groins in Estuarine and Public Trust Waters) shall meet all the specific conditions for design and construction specified in 15A NCAC 07H .1405.

20. All mechanized equipment operated near surface waters shall be inspected and maintained regularly to prevent contamination of surface waters from fuels, lubricants, hydraulic fluids, or other toxic materials. Construction shall be staged in order to minimize the exposure of equipment to surface waters to the maximum extent practicable. Fueling, lubrication and general equipment maintenance shall not take place within 50 feet of a waterbody or wetlands to prevent contamination by fuels and oils. [15A NCAC 02H .0506(b)(3) and (c)(3) and 15A NCAC 02B .0211(12)]

21. Heavy equipment working in wetlands shall be placed on mats or other measures shall be taken to minimize soil disturbance. [15A NCAC 02H .0506(b)(3) and (c)(3)]

22. In accordance with 143-215.85(b), the applicant shall report any petroleum spill of 25 gallons or more; any spill regardless of amount that causes a sheen on surface waters; any petroleum spill regardless of amount occurring within 100 feet of surface waters; and any petroleum spill less than 25 gallons that cannot be cleaned up within 24 hours.

23. If an environmental document is required under the State Environmental Policy Act (SEPA), then this General Certification is not valid until a Finding of No Significant Impact (FONSI) or Record of Decision (ROD) is issued by the State Clearinghouse. If an environmental document is required under the National Environmental Policy Act (NEPA), then this General Certification is not valid until a Categorical Exclusion, the Final Environmental Assessment, or Final Environmental Impact Statement is published by the lead agency. [15A NCAC 01C .0107(a)]

24. This General Certification does not relieve the applicant of the responsibility to obtain all other required Federal, State, or Local approvals before proceeding with your project, including those required by, but not limited to, Sediment and Erosion Control, Non-Discharge, Water Supply Watershed, and Trout Buffer regulations.

25. The applicant and their authorized agents shall conduct all activities in a manner consistent with State water quality standards (including any requirements resulting from compliance with §303(d) of the Clean Water Act), and any other appropriate requirements of State and Federal Law. If DWR determines that such standards or laws are not being met, including failure to sustain a designated or achieved use, or that State or Federal law is being violated, or that further conditions are necessary to assure compliance, then DWR may revoke or modify a written authorization associated with this General Water Quality Certification. [15A NCAC 02H .0507(d)]

26. When written authorization is required for use of this Certification, upon completion of all permitted impacts included within the approval and any subsequent modifications, the applicant shall be required to return a certificate of completion (available on the DWR website https://edocs.deq.nc.gov/Forms/Certificate-of-Completion). [15A NCAC 02H .0502(f)]

27. Additional site-specific conditions, including monitoring and/or modeling requirements, may be added to the written approval letter for projects proposed under this Water Quality Certification in order to ensure compliance with all applicable water quality and effluent standards. [15A NCAC 02H .0507(c)]

28. If the property or project is sold or transferred, the new Permittee shall be given a copy of this Certification (and written authorization if applicable) and is responsible for complying with all conditions. [15A NCAC 02H .0501 and .0502]

II. GENERAL CERTIFICATION ADMINISTRATION:

1. In accordance with North Carolina General Statute 143-215.3D(e), written approval for a 401 Water Quality General Certification must include the appropriate fee. An applicant for a CAMA permit under Article 7 of Chapter 113A of the General Statutes for which a water quality Certification is required shall only make one payment to satisfy both agencies; the fee shall be as established by the Secretary in accordance with 143-215.3D(e)(7).

2. This Certification neither grants nor affirms any property right, license, or privilege in any waters, or any right of use in any waters. This Certification does not authorize any person to interfere with the riparian rights, littoral rights, or water use rights of any other person and this Certification does not create any prescriptive right or any right of priority regarding any usage of water. This Certification shall not be interposed as a defense in any action respecting the determination of riparian or littoral rights or other rights to water use. No consumptive user is deemed by virtue of this Certification to possess any prescriptive or other right of priority with respect to any other consumptive user regardless of the quantity of the withdrawal or the date on which the withdrawal was initiated or expanded.

3. This Certification grants permission to the Director, an authorized representative of the Director, or DWR staff, upon the presentation of proper credentials, to enter the property during normal business hours. [15A NCAC 02H .0502(e)]

4. This General Certification shall expire on the same day as the expiration date of the corresponding Nationwide Permit and/or Regional General Permit. The conditions in effect on the date of issuance of Certification for a specific project shall remain in effect for the life of the project, regardless of the expiration date of this Certification. This General Certification is rescinded when the US Army Corps of Engineers reauthorizes any of the corresponding Nationwide Permits and/or Regional General Permits or when deemed appropriate by the Director of the Division of Water Resources.

5. Non-compliance with or violation of the conditions herein set forth by a specific project may result in revocation of this General Certification for the project and may also result in criminal and/or civil penalties.

6. The Director of the North Carolina Division of Water Resources may require submission of a formal application for Individual Certification for any project in this category of activity if it is determined that the project is likely to have a significant adverse effect upon water quality, including state or federally listed endangered or threatened aquatic species, or degrade the waters so that existing uses of the water or downstream waters are precluded.

7. Public hearings may be held prior to a Certification decision if deemed in the public's best interest by the Director of the North Carolina Division of Water Resources.

History Note: Water Quality Certification (WQC) Number 4089 issued March 3, 2017 replaces WQC Number 3887 issued March 19, 2012; WQC Number 3694 issued November 1, 2007; WQC Number 3628 issued March 19, 2007; WQC Number 3488 issued December 31, 2004; and WQC Number 3348 issued March 18, 2002.