

CONSISTENCY DETERMINATION

**HYDROLOGIC RESTORATION and IMPROVED WATER
MANAGEMENT PROJECT
ALLIGATOR RIVER NATIONAL WILDLIFE REFUGE**

DARE COUNTY, NORTH CAROLINA



**U. S. FISH AND WILDLIFE SERVICE
ALLIGATOR RIVER NATIONAL WILDLIFE REFUGE COMPLEX
MANTEO, NORTH CAROLINA**

MAY 2015

CONSISTENCY DETERMINATION
Hydrologic Restoration and Improved Water Management Project
Alligator River National Wildlife Refuge

Project Description

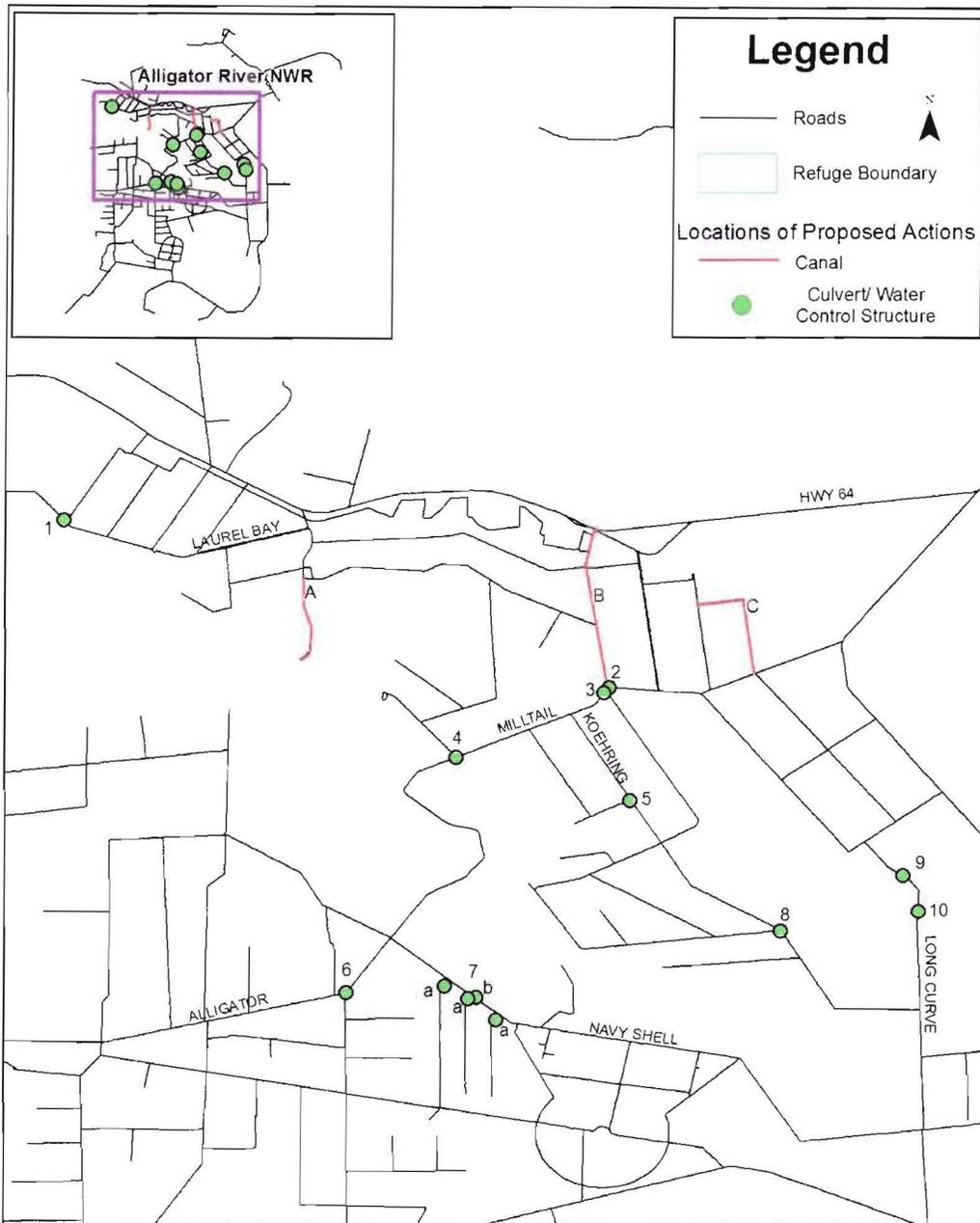
The Alligator River National Wildlife Refuge Complex is part of a larger refuge complex called the Coastal North Carolina National Wildlife Refuges Complex. Refuges in the larger complex include Alligator River, Pea Island, Mackay Island, Currituck, Pocosin Lakes, and Roanoke River National Wildlife Refuges. The Alligator River National Wildlife Refuge Complex consists of two refuges. Alligator River National Wildlife Refuge is located in Dare and Hyde Counties, and Pea Island National Wildlife Refuge is located in Dare County. Pea Island National Wildlife Refuge was established in 1938, and Alligator River National Wildlife Refuge was established in 1984. Pea Island National Wildlife Refuge is an approximate 5,000-acre refuge located on a dynamic barrier island on North Carolina's Outer Banks, and it provides beach, dune, marsh, and maritime shrub habitat for many migrant bird species especially shorebirds and waterfowl as well as federally-listed endangered and threatened species such as the loggerhead sea turtle, green sea turtle, and piping plover. Alligator River National Wildlife Refuge (ARNWR) consists of over 153,000 acres of riverine swamp, non-riverine swamp, pocosin, pine and hardwood forests, marsh, and agricultural land. The refuge provides valuable habitat for a variety of wildlife, including many neo-tropical migrant bird species, waterfowl, black bear, and several federally-listed endangered and threatened species such as the red wolf and red-cockaded woodpecker.

The proposed hydrologic restoration and improved water management actions are a combination of normal refuge activities and a cooperative effort between the ARNWR, The Nature Conservancy North Carolina Chapter (TNC), and the United States Air Force (USAF). The ARNWR, TNC, and USAF have partnered together to influence approximately 65,000 acres of land on the ARNWR and Dare County Bombing Range. Joint management efforts are intended to facilitate controlling drainage and provide for more water retention within the project area to reduce wildfire potential, improve firefighting readiness, and restore a water regime more closely resembling historic (pre-canal) conditions to benefit habitat preservation for local wildlife. Normal refuge activities are focused on improving water control and drainage in wetlands as well as the farming units of the refuge in support of management to provide quality habitat for waterfowl and other migratory birds. This Consistency Determination (CD) is intended only for those portions on ARNWR and, in 2 locations, at or near the Department of Defense (DOD) boundary line as shown in Figure 1.

This CD involves a total of 12 projects designed to improve water management capabilities on ARNWR and restore a more natural wetland hydrology to forested wetlands in various locations on habitat north of Milltail Creek. All sites involve activities ranging from cleaning debris and floating vegetation from existing canals and structures that are currently creating moderate to severe flow impediments to removing/replacing damaged structures within the same footprint. There will be one new structure in a new location. Assumptions made to evaluate impacts from the overall project are:

1. Canal widths and depths are estimated. Lengths were measured from aerial photographs.
2. The "Total Affected - - " columns represent a canal total.
3. For net impacts, the Buffalo City Road Canal was estimated to be 75% obstructed.
4. For net impacts, Gadwall Road and Milltail Road Canals were estimated to be 25% obstructed.
5. Most impacts are temporary. There will be no change in canal dimensions, location, or function.
6. Permanent impacts are primarily associated with not being able to recover 100% of the temporary fill.
7. The "Temporary Marsh Fringe Impact" assumes 1.5 feet only on the work side of the canal.

Figure 1. Proposed water management actions on Alligator River National Wildlife Refuge, Dare County, North Carolina.



Impacts associated with cleaning or replacing culverts were derived from the information presented in Appendix I, Table 1. Analysis of cofferdam impacts is presented in Appendix I, Table 2. Canal cleanout impacts were analyzed using the information in Appendix I, Table 3.

Since funding is not available to accomplish all of the tasks in this CD in one mobilization, the work will need to be done as funding and staff time become available. Projects were prioritized to accomplish the work needing to be done. Table 1 presents a prioritized list of the actions to be completed as funding becomes available. Each project will be discussed based upon the priority assigned by the Refuge. However, projects may not be completed in priority order due to factors such as weather, efficient use of staff and resources, and funding.

Table 1: Table of proposed actions for the ARNWR hydrologic restoration and improved water management project in Dare County, North Carolina. The “Map ID” number corresponds with the numbers and letters shown in Figure 1.

Map ID	Culvert ID	Action	Priority
1	LB	Replace clogged and damaged culvert and riser with same	2
2	4-1	Clean out/Replace silted 48” x 30’ culvert	5
3	3-1	Remove and replace 96” x 40’ culvert and riser with 72” x 40’ culvert with risers	12
4	1-2	Clean out/Replace silted 36” x 40’ culvert	3
5	2-2	Clean out/Replace silted 48” x 30’ culvert	4
6	13-5	Clean out/Replace silted 48” x 40’ culvert	7
7	14-1	Clean out/Replace 3 silted 30” x 30’ culvert; Install new 60” diameter x 60’ culvert with 72” riser	8a, 8b
8	5-2	Clean out/Replace silted 48” x 40’ culvert	6
9	6-1, 9-1, 9-3, 6-2	Remove 4 culverts (30” x 45’)	11
10	6-4, 6-5	Remove 2 culverts (30” x 45’, 30” x 40’)	10
	Canal ID		
A	Buffalo City	Clean vegetation and debris from canal along Buffalo City Rd. from end of road north to Sawyer Lake Road, approximately 1.3 miles	1
B	Milltail	Clean debris from canal along Milltail Road from Hwy. 64 to Long Curve Road, approximately 2.3 miles	13
C	Gadwall	Clean debris from canal along Gadwall Road from Link Road to Bobcat Road, approximately 1.7 miles	9

Project Descriptions by Priority

Priority 1 (Map ID A): Buffalo City Road Canal

The borrow canal created when Buffalo City Road was constructed has become plugged with woody debris (including several substantial logs) and floating vegetation mats to the point that water flow is severely restricted. As this is a wind driven system, the impaired drainage affects the flow of water into the Refuge farm unit when it is time to flood the land and affects discharge when the water has to be drawn down for management purposes. In addition to Refuge management, this impairment to water flow is impacting forested wetlands due to an extended hydroperiod. The combined effect of Buffalo City Road and the impaired drainage in the canal is creating a “beaver dam effect” as shown in these images.





The Refuge is proposing to remove the logs and other woody debris along with the floating vegetation. Approximate total length of this project is 6,864 ft (1.3 mi). All work will be done from Buffalo City Road and material removed from the canal will be hauled to a disposal site at the Refuge Borrow Pit. Woody material and herbaceous vegetation will be burned when it dries. As shown in Table 2, the total estimated acreage of the canal is approximately 6.3 acres with a total estimated volume of approximately 40,675.6 yd³. Since the canal is approximately 65% obstructed, the entire canal will be affected but direct impacts will occur by removing those obstructions. This will result in a net impact of 4.1 acres of canal habitat with approximately 26,439.1 yd³ of material being hauled away. Approximately 0.15 acres of marsh fringe will be impacted.

There will be short-term impacts associated with the removal of flow impediments. Most of the impacts will be a result of disturbance to the organic muck substrate within the canal. Turbidity at

the immediate work site is expected to increase over local area but is not expected to affect a large area due to the sluggish flows in the canal system. Turbidity curtains will be deployed to contain the turbidity plume near the project site. There will be a reduction in benthic attachment substrate, but all woody material will not be removed. Invertebrates such as crayfish may realize relatively short-term impacts and vertebrates such as frogs, turtles, and snakes will be affected over a relatively brief period of time. Adjacent forested wetlands will benefit as more natural flow of water will occur within the man-made canal. Primarily due to low DO and low pH, the canal provides very little habitat for a healthy fish population and use by anadromous species has not been documented. This project will not result in placement of temporary or permanent fill in either wetlands or open water.

Priority 2 (Map ID 1): Culvert Replacement – Beaver Road

This project is a maintenance project within the ARNWR Farm Unit perimeter dike. The existing culvert consists of a flash board riser (57" wide X 8ft w/1ft dropped solid bottom) attached to a 48" discharge pipe 40 ft long. This structure is damaged and has become clogged by vegetation and woody debris. The flash-board riser attached on the upstream end enables water management but complicates cleaning the culvert. The structure must be replaced to be effective.



The Refuge is proposing to remove the existing damaged structure and replace it with the same size and type of structure. All work will be done within the existing footprint and from an existing road, resulting in no new disturbance.

Two cofferdams will be required in the Laurel Bay Road Canal to facilitate culvert replacement. One cofferdam will be constructed of temporary fill material "upstream" of the existing structure and a second will be required on the "downstream" side. Canal width is approximately 40 feet so each cofferdam will affect approximately 740.5 ft² (0.017 ac) of open water canal habitat. The canal is approximately 6 feet deep at this point. Total cofferdam impact will be about 1,438 ft² (0.033 ac) of affected area and about 320 yd³ of fill material. To the maximum possible, cofferdam fill material will be removed immediately after project completion. Access for placing the cofferdam fill material and removing it will impact an additional small area of emergent wetland fringe. This area is about 2 ft X 25 ft for a total area of 50 ft² (0.001 ac) of temporary

impact on each side of the structure. Total marsh fringe impact would be about 100 ft² (0.002 ac). A culvert in the Beaver Dam Road Canal will be closed off by pacing boards in the structure if possible or with sheet piling.

Turbidity will increase on a localized basis but will not affect a large area due to a lack of flow in the canal system when the water is not being pumped. Turbidity curtains will be deployed to contain the turbidity plume near the project site. Primarily due to low DO and low pH the canal provides marginal habitat value for a healthy fish population. Due to the isolated nature of this canal, there is no use by anadromous species.

Priority 3 (Map ID 4): Water Control Structure Cleaning – Milltail & Sandy Ridge Roads

This project is simply a maintenance project within the ARNWR. The existing structure consists of a flash board riser (57" wide X 8ft w/1ft dropped solid bottom) attached to a 36" discharge pipe 40 ft long crossing underneath Milltail Road and discharges from the Milltail Road Canal into the Sandy Ridge Road Canal wherein water flows predominantly to the west towards Milltail Creek. Over time the discharge pipe has become silted with organic muck and woody debris. The Refuge is proposing to clean the pipe out to improve flows through the canal system. Cleaning the pipe would result in disturbance of an area equal to the approximate volume of the pipe, approximately 10.5 yd³. There would be a slight increase in turbidity for a short distance downstream.

For the purpose of impact assessment, a "worst case" scenario is included in this analysis. If the culvert is replaced, the project would require three cofferdams. One cofferdam would span a canal approximately 30 feet wide and two of the dams would span a canal approximately 50-feet wide. These dams would affect a total open water area of 0.056 ac with a total volume of about 611.1 yd³ of temporary fill. Each cofferdam would affect approximately 0.002 ac of marsh fringe for a total impact of 0.006 ac. As a result of not being able to recover 100% of the temporary fill, the project would impact about 0.0033 ac of open water canal bottom habitat with a volume of 30.6 yd³ of unrecoverable fill material. Turbidity would increase in the immediate project area and for a short distance downstream. Turbidity curtains will be deployed to contain the turbidity plume near the project site.



All work will be done within the existing footprint and from an existing road resulting in no new disturbance. Primarily due to low DO and low pH, the canal provides marginal habitat value for a healthy fish population and use by anadromous species within this interior canal system has not been documented.

Priority 4 (Map ID 5): Culvert Cleaning – Koehring & Cypress Roads

This project is a maintenance project within the ARNWR. The existing structure consists of a flash board riser (57" wide X 8ft w/1ft dropped solid bottom) attached to a 48" discharge pipe 30 ft long crossing underneath Cypress Road flowing water primarily through the Koehring Road Canal and the Cypress Road Canal. Over time the 48" X 30' discharge pipe has become silted with organic muck and woody debris. The Refuge is proposing to clean the pipe out to improve flows through the canal system. Cleaning the pipe would result in disturbance of an area equal to the approximate volume of the pipe, approximately 14.0 yd³. There would be some increase in turbidity for a short distance downstream.

For the purpose of impact assessment, a "worst case" scenario is included in this analysis. If the culvert is replaced, the project would require four cofferdams. Each cofferdam would span a canal approximately 30 feet wide with a depth of about 5 feet. These dams would affect a total open water area of 0.039 ac with a total volume of about 311.1 yd³ of temporary fill. Each cofferdam would affect approximately 0.001 ac of marsh fringe for a total impact of 0.004 ac. As a result of not being able to recover 100% of the temporary fill, the project would impact about 0.0019 ac of open water canal bottom habitat with a volume of 15.6 yd³ of unrecoverable fill material.

Turbidity would increase in the immediate project area and for a short distance downstream. Turbidity curtains will be deployed to contain the turbidity plume near the project site. All work will be done within the existing footprint and from an existing road, resulting in no new disturbance. Primarily due to low DO and low pH, the canal provides marginal habitat value for a healthy fish population and use by anadromous species within this interior canal system has not been documented.





Priority 5 (Map ID 2): Culvert Removal – Long Curve & Milltail Roads

This project is a maintenance project within the ARNWR. The existing structure consists of a flash board riser (57" wide X 8ft w/1ft dropped solid bottom) attached to a 48" discharge pipe, 40 ft long crossing underneath Long Curve Road at the intersection with Milltail Road. This structure can also be used to flow water into the farm unit. Over time the 48" X 40' discharge pipe has become silted with organic muck and woody debris. The Refuge is proposing to remove the structure as it serves no useful purpose and has been a source of vandalism in the past. Removing the structure will result in disturbance of an area of the Long Curve Road bed slightly larger than the pipe, approximately 14.0 yd³. There would be some increase in turbidity for a short distance around the project site, primarily within a farm unit canal.

Removing the culvert will require two cofferdams. One of the cofferdams would span the Long Curve Road Canal which is approximately 40 feet wide with a depth of about 6 feet. The second cofferdam would be constructed across the Milltail Road Canal which is approximately 50 feet wide and about 6 feet deep. These cofferdams would affect a total open water area of 0.045 ac with a total volume of about 427 yd³ of temporary fill. Each cofferdam would affect approximately 0.001 ac of marsh fringe for a total impact of 0.002 ac. As a result of not being able to recover 100% of the temporary fill, the project would impact about 0.0022 ac of open water canal bottom habitat with a volume of 21.3 yd³ of unrecoverable fill material.



Turbidity would increase in the immediate project area and for a short distance downstream. Turbidity curtains will be deployed to contain the turbidity plume near the project site. All work will be done within the existing footprint and from an existing road resulting in no new disturbance. Primarily due to low DO and low pH the canal provides marginal habitat value for a healthy fish

population and use by anadromous species within this interior canal system has not been documented.

Priority 6 (Map ID 8): Culvert Cleaning – Koehring & Pollack Roads

This project is a maintenance project within the ARNWR. The existing structure consists of a flash board riser (57" wide X 8ft w/1ft dropped solid bottom) attached to a 48" discharge pipe 40 ft long crossing underneath Pollack Road at the intersection with Koehring Road allowing flows to continue through the Koehring Road Canal and down the Pollack Road Canal. Over time the 48" X 40' discharge pipe has become silted with organic muck and woody debris. The Refuge is proposing to clean the discharge pipe out to improve flows through the canal system. Cleaning the pipe would result in disturbance of an area equal to the approximate volume of the pipe, approximately 18.6 yd³. There would be some increase in turbidity for a short distance downstream.

For the purpose of impact assessment, a "worst case" scenario is included in this analysis. If the culvert is replaced, the project would require four cofferdams. Each cofferdam would span a canal approximately 30 feet wide with a depth of about 5 feet. These dams would affect a total open water area of 0.039 ac with a total volume of about 311.1 yd³ of temporary fill. Each cofferdam would affect approximately 0.001 ac of marsh fringe for a total impact of 0.004 ac. As a result of not being able to recover 100% of the temporary fill, the project would impact about 0.0019 ac of open water canal bottom habitat with a volume of 15.6 yd³ of unrecoverable fill material.



Turbidity would increase in the immediate project area and for a short distance downstream. Turbidity curtains will be deployed to contain the turbidity plume near the project site. All work will be done within the existing footprint and from an existing road resulting in no new disturbance.

Primarily due to low DO and low pH the canal provides marginal habitat value for a healthy fish population and use by anadromous species within this interior canal system has not been documented.

Priority 7 (Map ID 6): Culvert Cleaning – Milltail & Alligator Roads

This project is a maintenance project within the ARNWR. The existing structure consists of a flash board riser (57" wide X 8ft w/1ft dropped solid bottom) attached to a 48" discharge pipe 40 ft long crossing underneath Milltail Road near the intersection with Alligator Road. Flows through this system may be towards Milltail Creek or Alligator River depending upon wind direction. Over time the 48" X 40' discharge pipe has become silted with organic muck and woody debris. The Refuge is proposing to clean the discharge pipe out to improve flows through the canal system. Cleaning the pipe would result in disturbance of an area equal to the approximate volume of the pipe, approximately 18.6 yd³. There would be some increase in turbidity for a short distance downstream.

For the purpose of impact assessment, a "worst case" scenario is included in this analysis. If the culvert is replaced, the project would require four cofferdams. Each cofferdam would span a canal approximately 40 feet wide with a depth of about 6 feet. These dams would affect a total open water area of 0.066 ac with a total volume of about 640.0 yd³ of temporary fill. Each cofferdam would affect approximately 0.001 ac of marsh fringe for a total impact of 0.004 ac. As a result of not being able to recover 100% of the temporary fill, the project would impact about 0.0033 ac of open water canal bottom habitat with a volume of 32.0 yd³ of unrecoverable fill material. Turbidity would increase in the immediate project area and for a short distance downstream.



All work will be done within the existing footprint and from an existing road resulting in no new disturbance. Primarily due to low DO and low pH the canal provides marginal habitat value for a

healthy fish population and use by anadromous species within this interior canal system has not been documented.

Priority 8a (Map ID 7): Culvert Cleaning – Navy Shell Road & Spring Road, Taylor Road, & Magnolia Road

This project is a maintenance project within the ARNWR and adjacent to the Dare County Bombing Range and consists of cleaning/replacing 3 culverts. The existing culverts cross underneath Taylor Road, Spring Road and Magnolia road providing for aquatic exchange between the adjacent habitat units. Over time the 30" X 30' culverts have become silted with organic muck and woody debris. The Refuge is proposing to clean the culverts out to improve flows through the canal system and restore a more natural hydrologic regime to the affected forested wetlands within the canal system. Cleaning each pipe would result in disturbance of an area equal to the approximate volume of the pipe, approximately 5.5 yd³ for a total of about 16.5 yd³. If the condition of the culvert warrants replacement, they will be replaced. These culverts can be replaced under "wet" conditions, thereby eliminating the need for cofferdams.

Navy Shell Road/Spring Road Culvert



Navy Shell Road/Taylor Road Culvert



Navy Shell Road/Magnolia Road Culvert



There would be some increase in turbidity for a short distance downstream. Turbidity curtains will be used to offset and contain the turbidity plume. All work will be done within the existing footprint resulting in no new disturbance. All work will be done from an existing road. Primarily due to low DO and low pH, the canal provides marginal habitat value for a healthy fish population and use by anadromous species within this interior canal system has not been documented.

Priority 8b (Map ID 7): Water Control Structure Installation – Navy Shell Road & Taylor Road

This project is a maintenance project within the ARNWR and adjacent to the Dare County Bombing Range and consists of installing one new culvert to enhance water management capabilities by maintaining a more natural aquatic regime in forested wetlands. At the present time, sustained water level is too high and is killing trees due to extended inundation. The new structure will be installed underneath Navy Shell Road approximately 50 feet east of the intersection with Taylor Road. The new structure will consist of a 72" riser, 9 ft long with a 1 ft dropped solid bottom connected to a 60 inch diameter discharge pipe 60 feet long.

For the purpose of impact assessment, a “worst case” scenario is included in this analysis. Installing the culvert will require two cofferdams in the Navy Shell Road Canal. Each cofferdam would span a canal approximately 50 feet wide with a depth of about 6 feet. These dams would affect a total open water area of 0.055 ac with a total volume of about 533.3 yd³ of temporary fill. Each cofferdam would affect approximately 0.001 ac of marsh fringe for a total impact of 0.002 ac. A third cofferdam would be required on the south side of Navy Shell Road in a canal approximately 30 feet wide and about 5 feet deep. This dam would affect a total open water area of about 0.01 ac with a total volume of about 77.8 yd³ of temporary fill. The cofferdam would affect approximately 0.001 ac of marsh fringe. As a result of not being able to recover 100% of the temporary fill, the project would impact about 0.0033 ac of open water canal bottom habitat with a volume of 30.6 yd³ of unrecoverable fill material. Sheet piling would be used on one end of the Taylor Road culvert in lieu of a fourth cofferdam.

Navy Shell Road New Water Control Structure Site (Map ID 7; Project 8b) – South side



Navy Shell Road New Water Control Structure Site (Map ID 7; Project 8b) – North side



Turbidity would increase in the immediate project area and for a short distance downstream. Turbidity curtains will be deployed to contain the turbidity plume near the project site. Primarily due to low DO and low pH the canal provides marginal habitat value for a healthy fish population and use by anadromous species within this interior canal system has not been documented.

Priority 9 (Map ID C): Gadwall Road Canal

This project is a maintenance project within the ARNWR. The borrow canal was created when Gadwall Road was constructed and it has become plugged mostly with mats of alligator weed and some woody debris. The floating vegetation mats are sufficient for restricting water flow to the point of impacting the Refuge's ability to efficiently remove water from the farm unit during the spring and summer and flow water into the management units during the fall and winter. Gadwall Road also serves as a perimeter dike for the farm unit.



The Refuge is proposing a two-pronged approach to improving water management capabilities with this farm unit canal. First the alligator weed will be treated with an approved herbicide and allowed sufficient time for die-off. After die-off, an excavator will remove the dense and thick root mats. This vegetation will either be trucked to a burn site on the Refuge or allowed to decompose in the farm field. The extent of the project area is from Link Road to Bobcat Road. Approximate total length of this project is 8,125 ft (1.6 mi). The total area affected by this project is approximately 6.2 acres of open water canal habitat. Removing materials affecting flow will result in a net volume of about 4,986.7 yd³. Through removal of the impediments to flow, the net area directly impacted is estimated to be approximately 1.5 acres of shallow open water within the canal. Approximately 0.08 ac of marsh fringe may be temporarily impacted by this project. These impacts are temporary and relatively short-term.

All work will be done from either Gadwall Road or the farm fields, and woody material removed from the canal will be hauled to a disposal site at the Refuge Borrow Pit. The hauled material will be burned when it dries. Muck and sediment will be evenly spread over the farm fields. None of the proposed work will increase the original dimensions or function of the existing canal. There will be no temporary or permanent fill placed into wetlands as a result of this project.

There will be short-term impacts associated with the removal of flow impediments. Most of the impacts will be a result of disturbance to the organic muck substrate within the canal resulting in elevated turbidity. Turbidity curtains will be used to offset and contain the turbidity plume. Primarily due to low DO and low pH the canal provides marginal habitat value for a healthy fish population and use by anadromous species within this interior canal system has not been documented. Primarily due to low DO and low pH the canal provides very little habitat for a healthy fish population and use by anadromous species does not occur due to the isolated location of the canal. Invertebrates such as crayfish may realize relatively short-term impacts while vertebrates such as frogs, turtles, and snakes will be affected over a relatively brief period of time. The primary benefit from this project will be improved water management capabilities for managing habitat for migratory birds and other wildlife and for farming operations.

Priority 10 (Map ID 10): Culvert Removal/Replacement – Long Curve Road

This project is a maintenance project within the ARNWR. The project consists of removing 1 culvert measuring 30"X45' and 1 culvert measuring 30"X40'. These culverts were installed when this section of Long Curve Road was consistently flooded during even minor storm events. Since the road was upgraded to a gravel road, these culverts are no longer needed.



All work will be done from an existing road. The project will impact aquatic habitat on a short-term basis proportional to the volume of each culvert (total of 15.5 yd³). The impact on open water will be less than 10 ft² (0.00023 ac) for each culvert for a total impact of 20 ft² (0.00046 ac).

The impact on marsh fringe will be about 30 ft² (0.00069 ac) for each culvert at each end for a total impact of 60 ft² (0.0014 ac) per culvert. Total marsh fringe impact for excavation of both culverts will be about 120 ft² (0.0028 ac). As the structures are underneath the road, there will be no temporary or permanent fill placed into wetlands. Upon excavation and removal of the culverts, the road bed will be backfilled and covered with crushed stone. Cofferdams will not be required for this project. Primarily due to low DO and low pH the canal provides marginal habitat value for a healthy fish population and use by anadromous species has not been documented.

Priority 11 (Map ID 9): Culvert Removal/Replacement – Long Curve Road

This project is a maintenance project within the ARNWR. The project consists of removing four (4) culverts underneath Long Curve Road. These culverts measure 30”X45’ each and they were installed when this section of Long Curve Road was consistently flooded during even minor storm events. Since the road was upgraded to a gravel road, these culverts are no longer needed.



All work will be done within an existing culvert footprint and from an existing road, resulting in no new disturbance. The project will impact aquatic habitat on a short-term basis proportional to the volume of each culvert (total of 32.8 yd³). The impact on open water will be less than 10 ft² (0.00023 ac) for each culvert for a total impact of 40 ft² (0.00092 ac). The impact on marsh fringe will be about 30 ft² (0.00069 ac) for each culvert at each end for a total impact of 60 ft² (0.0014 ac) per culvert. Total marsh fringe impact for excavation of the four culverts will be about 240 ft² (0.0055 ac). As the structures are underneath the road, there will be no temporary or permanent fill placed into wetlands. Upon excavation and removal of the culverts, the road bed will be backfilled and covered with crushed stone. Cofferdams will not be required for this project. Primarily due to low DO and low pH the canal provides marginal habitat value for a healthy fish population and use by anadromous species has not been documented.

Priority 12 (Map ID 3): Culvert Removal/Replacement – Blueberry Road and Milltail Road

This project is a maintenance project within the ARNWR. The project consists of removing one (1) culvert measuring 96”X40’ and replacing it with one (1) water control structure consisting of a flashboard riser (102”X 8ft with a 1 ft dropped, solid bottom) attached to a 72”X40’ culvert discharge pipe. Beaver guards may be installed on this structure on an experimental basis and, hopefully, reduce maintenance costs associated with removal of beaver dams and debris. The newly installed water control structure will be in the same footprint as the removed culvert. This structure will greatly improve water management capabilities for restoring a more natural wetland hydrology and will be used to manage hydrology for reducing the potential and severity of wildfire.



All work will be done within an existing culvert footprint and from an existing road resulting in no new disturbance. Open water habitat will be affected to the extent of the volume of the culvert (74.4 yd³) and turbidity is expected to increase adjacent to the project site. Turbidity curtains will be used to contain the turbidity plume. Approximately 480 ft² (0.011 ac) of road bed will be excavated to remove the existing culvert. The new structure will be placed into the same footprint and covered with the excavated material. There is a marsh fringe at the project site and some impacts will occur to this wetland type due to coffer dam construction/removal and removing the culvert in preparation for installing the water control structure.

Two cofferdams will be required to install the flash board riser structure. Each cofferdam would be L-shaped and would effectively span 2 canals. The “upstream” cofferdam system would span the Milltail Road Canal and would intersect with the cofferdam spanning the Blueberry Road Canal. The Milltail Canal section is about 50 feet wide and would impact about 0.028 ac of open water habitat with a total volume of 266.7 yd³. The Blueberry Canal segment is about 40 feet wide and would impact 0.017 ac of open water habitat with a total volume of about 160 yd³. Total impacts from this cofferdam system are estimated to be 0.045 ac of open water habitat with a volume of 386.7 yd³.

The “downstream” cofferdam system would span the Milltail Road Canal (about 50 feet) and would then tie back into Blueberry Road across a Phragmites marsh and partially blocked ditch (about 30 feet). The Milltail Canal section is about 50 feet wide and would impact about 0.028 ac of open water habitat with a total volume of 266.7 yd³. The Blueberry Road ditch segment is about 30 feet wide and would impact 0.010 ac of open water habitat with a total volume of about 77.8 yd³. Total impacts from this cofferdam system are estimated to be 0.038 ac of open water habitat with a volume of 344.5 yd³.

Total open water impacts from the two cofferdam systems is approximately 0.083 ac requiring about 731.2 yd³ of temporary fill. Each cofferdam would impact an area of marsh fringe about 6 feet wide by about 24 feet long at each end on the road shoulder side slopes. With two road “tie-ins” per cofferdam this amounts to a total area of 288 ft² per cofferdam for a total impact of 576 ft² (0.013ac) of road shoulder marsh fringe habitat. An additional area of wetland impact where each dam intersects to create the L-shape is about 24 feet wide by about 40 feet long for a total area of about 960 ft² per dike. This amounts to an additional wetland impact of 1920 ft² (0.044 ac) of wetland impact.

As the new water control structure will be underneath Blueberry Road and totally within the existing footprint, there will be no permanent fill expansion into wetlands. As a result of not being able to recover 100% of the temporary fill, the project would impact about 0.007 ac of open water canal bottom habitat and wetlands with a volume of 36.6 yd³ of unrecoverable fill material. Turbidity would increase in the immediate project area and for a short distance downstream but would be contained through the use of silt curtains.

Primarily due to low DO and low pH the canal provides marginal habitat value for a healthy fish population and use by anadromous species has not been documented at or near this site.

Priority 13 (Map ID B): Milltail Road Canal

The borrow canal created when Milltail Road was constructed has become plugged in some locations with woody debris and floating vegetation mats sufficient for restricting water flow to the point of impacting the Refuge’s ability to efficiently remove water from the farm unit during the spring and summer and flow water into the management units during the fall and winter. Milltail Road also serves as a perimeter dike for the farm unit.



The Refuge is proposing to remove the woody debris along with some muck and floating vegetation from the beginning of the canal near US Highway 64 Road to Long Curve Road. Approximate total length of this project is 12,144 ft (2.3 mi) and the approximate average width of the canal is 30 feet. The total area affected by this project is approximately 8.4 acres of open water canal habitat. Removing materials affecting flow will result in a net volume of about 6,746.7 yd³. Through removal of the impediments to flow, the net area directly impacted is estimated to be approximately 2.1 acres of shallow open water within the canal. Approximately 0.10 ac of marsh fringe may be temporarily impacted by this project. These impacts are temporary and relatively short-term.

All work will be done from either Milltail Road or the farm fields and woody material removed from the canal will be hauled to a disposal site at the Refuge Borrow Pit. The hauled material will be burned when it dries. Muck and sediment will be evenly spread over the farm fields. None of the proposed work will increase the dimensions or function of the existing canal. There will be no

temporary or permanent fill placed into wetlands as a result of this project. There will be short-term impacts associated with the removal of flow impediments. Most of the impacts will be a result of disturbance to the organic muck substrate within the canal. Invertebrates such as crayfish may realize relatively short-term impacts while vertebrates such as frogs, turtles, and snakes will be affected over a relatively brief period of time. Primarily due to low DO and low pH the canal provides very little habitat for a healthy fish population and use by anadromous species does not occur due to the isolated status of the canal. The primary benefit from this project will be improved water management capabilities for managing habitat for migratory birds and other wildlife and for farming operations.

The Refuge has attempted to minimize wetland impacts to the maximum extent possible. Where there will be impacts an attempt was made to overestimate impacts rather than underestimate them. Table 2 summarizes the approximate impacts on a project-by-project basis. Since each project will be completed as time, funding, and weather conditions allow, the total impact estimates will not occur at one point in time. Instead, individual project impacts will be occurring on a smaller scale and all projects will be completed over a period of several months. Each project site will most likely be partially or fully recovered from the relatively short-term and temporary effects before the next project begins at a new location.

Table 2. Summary of wetland impacts resulting from the hydrologic restoration and water management improvement project at ARNWR, Dare County, North Carolina.

MAP ID	Net Wetland Impact (ac)			Net Impact by Type (ac)	
	Open water	Marsh fringe	Total (all wetlands)	Temporary	Permanent*
1	0.033	0.002	0.0350	0.0333	0.0017
2	0.029	0.003	0.0320	0.0306	0.0014
3	0.083	0.013	0.0960	0.089	0.007
4	0.056	0.003	0.0590	0.0557	0.0033
5	0.039	0.004	0.0430	0.0411	0.0019
6	0.066	0.004	0.0700	0.0667	0.0033
7a	0.019	0.002	0.0210	0.02	0.001
7b	0.065	0.002	0.0670	0.0651	0.0019
8	0.012	0	0.0120	0.012	0
9	0.00092	0.0055	0.00642	0.00642	0
10	0.0014	0.0028	0.0042	0.0042	0
A	4.1	0.15	4.250	4.25	0
B	2.1	0.10	2.200	2.20	0
C	1.5	0.08	1.580	1.58	0
TOTAL	8.104	0.371	8.476	8.454	0.018

* Based upon using the same footprint as the previous structure with no new fill in wetlands or open water habitat.

Temporary Fill

Cofferdams: Culverts and water control structures can be replaced under either “wet” or “dry” conditions. Straight culverts can be installed or replaced under either condition with the proper equipment. Water

control structures need to be placed into the drainage system at the right with the invert at the correct elevation and as level/vertical as possible to ensure proper function. Best results for water control structures are achieved when they are installed under “dry” conditions. Installing under “dry” conditions requires the use of cofferdams, or in some situations, sheet piling. Given the soils and conditions at ARNWR, the most practical method is to use temporary fill for cofferdams. Depending upon canal dimensions and the number of intersecting canals, from one to four cofferdams will be required for replacing water control structures. As can be seen from the analysis in Appendix I, Table 2, each cofferdam can impact from 0.01 ac up to 0.028 ac of open water in the canal system. Temporary fill for cofferdams will be kept to the minimum amount necessary to create safe working conditions. Cofferdams are not required for the canal cleaning projects.

Temporary Fill Removal: The volume of temporary fill material placed in any of the project area canals and wetlands will be removed upon project completion to the maximum extent possible. However, it is not possible to remove 100% of the fill material in the canal due to fluid properties resulting from interaction of fill material with canal water. Original elevations and contours, if any are affected, will be restored as precisely as possible upon completion of the project and seeding/mulching will be done where necessary.

Permanent Fill

There will be little to no permanent new fill in wetlands of open water for this project. Limited permanent fill will occur only to the extent that not all of the temporary fill used for cofferdams will be recoverable and limited amount of fill will slough off when backfilling over replaced structures. By assuming a 5% loss of the temporary fill, the Refuge’s best estimate is approximately 0.12 acre of permanent fill (1109.8 yd³) resulting from this project. Although we know cofferdams will not be required for all projects, this estimate is a “worst case” estimate as it assumes there will be four cofferdams for each of the canal widths and that all culvert/water control structure projects will require 4 cofferdams. Measures will be taken to minimize the amount of new, permanent fill in wetlands and open water canal habitat to the maximum extent possible. Cofferdams will not be used at project sites where the Refuge determines work can be done under “wet” conditions at the time of project implementation. Upon completion of construction each project site will be seeded and mulched as necessary.

Forested Wetland Resilience

Some effects of climate change are clearly visible on the Albemarle Peninsula: the area’s peat soils may be degrading more quickly due to the interaction of peat, saltwater, and certain microbes and natural plant communities are undergoing changes in species composition from woody trees and shrubs to marsh as a result of saltwater intrusion. As land managers, we can take steps now to make this Peninsula’s ecosystems more resilient to climate change. Slowing the rate of salt water intrusion will reduce the rate of transition from forested wetlands to brackish/salt marsh. Based upon what has been learned from the Point Peter Road and Lake Worth Road projects the Refuge believes this hydrologic restoration and improved water management project will add substantial resilience to the forested and emergent wetlands affected by the canal system on these portions of the Refuge. In addition, maintaining a more natural wetland hydrology will reduce the potential for wildfires.

NEPA Compliance

Under Department of Interior policy this project is considered to be a Categorical Exclusion pursuant to the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.). The enclosed Environmental Action Statement provides references to the departmental manual if further documentation is needed.

Dare County Land Use Plan

The existing land use is classified as conservation in the Dare County Land Use Plan. Basically, the conservation classification would allow residential development but discourages other types of development not considered to be “traditional accessory uses”. This project is designed to minimize the

extent of disturbed area and will enhance the abilities of the Department of Defense and the Refuge to reduce wildfire potential through improved water management capabilities. Although there will be additional disturbed area, effects of this disturbance will be short-term and there will be an overall net benefit to adjacent and nearby ecosystems as a result of this work.

There will be few, if any long-term impacts resulting from this overall project beyond those that occurred when canal and road network was first constructed. Most, if not all, of the impacts that will occur would be considered short term and they have been minimized to the maximum extent possible. In addition, this project will contribute to an additional body of knowledge regarding adaptive management strategies that may be feasible on a local, regional, or landscape scale within the context of rising sea level. Managing for more natural wetland conditions will result in greater habitat resilience to the effects from rising sea level and will improve and extend the quality of habitat for migratory birds, other wildlife, and invertebrates over the project life and will, hopefully, offset short-term impacts. For these reasons, the Service believes that the proposed project is fully consistent with the spirit and intent of the conservation classification in the Dare County Land Use Plan.

Coastal Management Program Objectives and Policies

Projects within Areas of Environmental Concern

Pursuant to 15A NCAC 07H .0205, management objectives have been established for conservation of coastal wetlands for the purpose of preserving and perpetuating their biological, social, economic and aesthetic values. To fulfill these objectives, uses which are not water-dependent are not allowed in coastal wetlands pursuant to 15A NCAC 07H .0208(a)(1). Coastal wetlands are defined by administrative code as those salt marshes or other marshes subject to regular or occasional flooding by tides, including wind tides and include some, if not all of 10 species of plants. There will be a small fringe (less than 1.5 feet wide) of coastal wetlands along the nearly vertical canal banks at some of the project sites. A best estimate is that a range of about 0.001 ac up to about 0.008 ac of these wetlands would be impacted temporarily by these projects when the water control structures are cleaned or replaced and a total of about 0.08 ac up to about 0.15 ac would be affected by the canal cleanout projects. These relatively small impacted areas should recover within the first growing season. Bare soil will be stabilized by seeding and mulching. From this information we have concluded that the proposed project is consistent with the management objectives of 15A NCAC 07H .0205.

Pursuant to 15A NCAC 07H .0206, management objectives have been established for conservation of estuarine waters for the purpose of preserving and perpetuating their biological, social, economic and aesthetic values. To fulfill these objectives, uses which are not water-dependent are not allowed in estuarine waters pursuant to 15A NCAC 07H .0208(a)(1). Estuarine waters are defined to include all of the waters of the Atlantic Ocean within the boundary of North Carolina and all of the waters of the bays, sounds, rivers, and tributaries thereto seaward of the dividing line between coastal fishing waters and inland fishing waters. Cleaning and replacing the existing culverts and water control structures are water dependent activities. There will be a need to construct temporary cofferdams in farm fields and inland canal waters for installation of the water control structures in the canal system. Sheet piling will also be considered instead of a cofferdam for this work in some areas. Where cofferdams are used, they will be constructed from sandy material that is relatively silt free to minimize increases in turbidity. In addition, turbidity curtains will be used to minimize effects from a turbidity plume. All fill material will be removed upon project completion. Although there will be some short-term impacts from the overall project, the long-term net benefit to project area wetlands and the adjacent estuary will more than offset those impacts. Based upon the information provided in the statutes and administrative codes, there are no features in the design of this project that would be inconsistent with the management objectives of 15A NCAC 07H .0206.

Pursuant to 15A NCAC 07H .0207, management objectives have been established for development of public trust areas for the purpose of protecting public rights for navigation, recreation, and management

of public trust areas for the purpose of saving and perpetuating their biological, economic and aesthetic values. To fulfill these objectives, uses which are not water-dependent are not allowed in public trust areas pursuant to 15A NCA C 07H .0208(a)(1). Public trust areas are defined as waters of the Atlantic Ocean and lands thereunder from the mean high water mark to the seaward limit of the State jurisdiction, including all natural bodies of water subject to measurable lunar tides and lands thereunder to the mean high water mark. These public trust areas include all navigable water bodies and lands thereunder to the mean high water level or mean water level as the case may be. There are no features in the design of this project that would affect public trust areas in a permanent, adverse way. The general public has and will continue to have access to these waters within the Refuge and those waters adjacent to the Pamlico Sound, including all tributaries thereof. We have determined that the project will not result in long-term direct impact on waters of the State of North Carolina and therefore will not have a permanent, adverse impact on public trust areas. Based on the above information the proposed project is consistent with management objectives of 15A NCAC 07H.0207.

Pursuant to 15A NCAC 07H .0209, management objectives have been established to ensure that coastal shoreline development is compatible with the dynamic nature of shorelines, and North Carolina's objectives for conserving and managing the important natural feature's of the estuarine and ocean systems. Coastal shorelines are defined as estuarine shorelines and public trust shorelines. Estuarine shoreline areas of environmental concern are those non-ocean shorelines extending from the normal high water level or normal water level along the estuarine waters, estuary sounds, bays, fresh and brackish waters, and public trust areas for a distance 75 feet landward. Except for the Buffalo City Road Canal, none of the overall project features fall within the boundaries of the estuarine shoreline area of environmental concern. Since most of the work associated with this overall project will be completed from existing roads and farm fields and because there will be no change in the function or capacity of any of the structures beyond their original design other than to restore a more natural wetland hydrology and provide for more efficient water management capabilities, the Service believes that the proposed project will not have any long-term or significant impact on either the public trust or the estuarine shoreline areas of environmental concern. We further believe the project is fully consistent with the management objectives of 15A NCAC 07H .0209.

Pursuant to 15A NCAC 07H .0303, management objectives have been established to ensure that development in ocean hazard areas is compatible with the goals of eliminating unreasonable danger to life while achieving a balance between the financial, safety, and social factors involved in development of these areas. Ocean hazard areas include ocean erodible areas, where there exists a substantial possibility of excessive erosion and significant shoreline fluctuation; high hazard flood areas; inlet hazard areas; and un-vegetated beach areas. The proposed project is not located within or in reasonable proximity to any ocean hazard areas as defined at 15A NCAC 07H .034. No further analysis is required regarding the proposed project's consistency with the objective of 15A NCAC 07H .0303.

Pursuant to 15A NCAC 07H .0505, management objectives have been established to both protect habitats necessary for survival of threatened and endangered plants and animals, and minimize land use impacts that might jeopardize these habitats. Since the refuge provides habitat for the red-cockaded woodpecker, red wolf, American alligator and is within the historic range of sensitive joint vetch, an Intra-Service Section 7 Biological Evaluation was prepared by the refuge and reviewed by the U. S. Fish & Wildlife Service, Division of Ecological Services. The conclusion from this evaluation was that the proposed project is not likely to have an adverse effect on any listed species. Based on this determination, the proposed project is consistent with the management objectives of 15A NCAC 07H .0505.

Pursuant to 15A NCAC 07H .0506, management objectives have been established to protect the features of designated coastal complex natural areas for the purpose of safeguarding these areas' biological relationships, and educational, scientific and aesthetic values. The project does not contain any design feature that would be inconsistent with the management objectives of 15A NCAC 07H .0506.

Pursuant to 15A NCAC 07H .0507, management objectives have been established to protect unique coastal geologic formations for the purpose of preserving the formation's physical components that serve as important scientific and educational sites, or as valuable scenic resources. Aside from considering the barrier island system as a unique geologic formation, the only designated unique coastal geologic formation in the area is Jockey's Ridge (15A NCAC 07H .0507[c][3]). Jockey's Ridge is located within the Town of Nags Head more than 20 miles from the proposed project site. Therefore, implementing the project will have no effect on this designated, unique coastal geologic formation and it is consistent with the management objectives of 15A NCAC 07H .0507.

Pursuant to 15A NCAC 07H .0509, management objectives have been established to conserve significant coastal archeological resources for the purpose of preserving their value as scientific, educational, and aesthetic resources. Based upon coordination with Mr. Rick Kanaski, USFWS Region 4 Archaeologist, who has coordinated the project with the State Historic Preservation Office (SHPO), there are no cultural or archaeological resources that would be affected by this project. Similarly, this project will not affect the historical or cultural landscape values of the refuge as defined by Section 106 of the National Historic Preservation Act (16 U.S.C. 470f). Therefore the proposed structure is consistent with the management objectives of 15A NCAC 07H .0509.

Pursuant to 15A NCAC 07H .0510, management objectives have been established to conserve significant coastal historic architectural resources for the purpose of preserving their value as scientific, educational, and aesthetic resources. Based upon coordination with Mr. Rick Kanaski, USFWS Region 4 Archaeologist who has coordinated the project with the State Historic Preservation Office, there are no historic architectural resources that would be affected by this project. Therefore the proposed structure is consistent with the management objectives of 15A NCAC 07H .0509.

Pursuant to 15A NCAC 07H .0600, management objectives have been established for all AECs for the purpose of preventing pollution of shellfish waters, maintaining aircraft safety, and preventing noise pollution resulting from airspace activity. The proposed project will not adversely affect any of these resources. Shellfish water quality in surrounding estuarine waters may improve as a consequence of improving outflow management with the project. Therefore the project is consistent with the management objectives of 15A NCAC 07H .0600.

Projects Outside Areas of Environmental Concern

Pursuant to 15A NCAC 07M .0301, it is the policy of North Carolina to foster, improve, enhance, and ensure optimum access to the public beaches and waters of the 20 coastal counties concurrent with needs of private property owners and protection of important coastal natural resources on public beaches and water. The proposed project will have no effect on public beaches of the area. Therefore, the project is consistent with the public access policy outlined at 15 NCAC 07M .0301.

Pursuant to 15A NCAC 07M .0401, it is the policy of North Carolina that development of energy resources and facilities shall avoid significant adverse impacts upon vital coastal resources or uses, and public trust or access areas. To foster compliance with this policy, Impact Assessments are required for Major Energy Facilities as defined at 15A NCAC 07M .0402(b). Neither the refuge nor the water management project meet the definition of a Major Energy Facility. Therefore, no further action is required regarding the consistency of the CCP with the energy policy outlined at 15 NCAC 07M .0401.

Pursuant to 15A NCAC 07M .0501, it is the policy of North Carolina that all state agencies coordinate activities in coastal areas for the purpose of reducing the damage from coastal disasters. In accordance with this policy, local governments must include disaster planning activities in their land use plans, temporary emergency housing must be located outside of hazardous areas, and building repair and reconstruction activities must comply with the standards of the Guidelines for Areas of Environmental Concern, North Carolina Building Code (including wind resistant standards), the National Flood

Insurance Program, and local reconstruction plans. There are no features of this project wherein there is a requirement to conform to all federal, state, and local building codes and flood insurance guidelines. Based on the above information, the project is consistent with the guidelines and policies of 15A NCAC 07M .0501.

Pursuant to 15A NCAC 07M .0601, it is the policy of North Carolina that floating structures used for residential or commercial purposes not infringe upon public trust rights nor discharge into public trust waters. The project does not involve construction or use of floating structures; therefore, no further action is required regarding the consistency of the proposed project with the floating structure policy outlined at 15A NCAC 07M .0601

Pursuant to 15A NCAC 07M .0701, it is the policy of North Carolina that adverse impacts to coastal lands and waters will be mitigated through proper planning, site selection, compliance with development standards, and creation or restoration of coastal resources. For a project requiring mitigation to be approved, pursuant to 15A NCAC 07M .0703 the following conditions must be met: there must be no reasonable and prudent alternatives to the project design or site; the entire project must be dependent upon close proximity to public trust waters and coastal wetlands; the public benefits must clearly outweigh the long range adverse effects to the environment; and all reasonable means and measures to lessen the impacts of the project are incorporated into the project design. No permanent or long-term adverse impacts to coastal lands or waters are anticipated; therefore, no further action is required regarding the consistency of the proposed project with mitigation guidelines and policies outlined at 15 NCAC 07M .0701.

Pursuant to 15A NCAC 07M .0801, it is the policy of North Carolina that no land or water use shall cause the degradation of water quality so as to impair traditional uses of coastal water such as fishing, swimming, hunting, boating, and commerce. Because all waters of the State within the coastal area have potential for uses requiring optimal water quality pursuant 15A NCAC 07M .0802(c) methods must be adopted to control development so as to eliminate harmful runoff which may impact the sounds and rivers of the coastal areas. No adverse impacts to water quality are anticipated; therefore, no further action is required regarding the consistency of the proposed project with mitigation guidelines and policies outlined at 15 NCAC 07M .0801.

Pursuant to 15A NCAC 07M .0901, it is the policy of North Carolina that use of aircraft for the purpose of managing and protecting coastal resources, detecting violations of environmental rules and laws, and performing public health, safety and welfare services is of vital public interest. To insure access to airspace, pursuant to 15A NCAC 07M .0901 access corridors free of special use airspace designations shall be preserved along the length of the barrier island and laterally at intervals not to exceed 25 miles for the purpose of providing unobstructed access to the coastline, and development of aviation related projects shall, to the maximum extent practicable facilitate use of aircraft by local, state, and federal government agencies. The project is not aviation related, nor is it proposing an aircraft access corridor; therefore, no further action is required regarding consistency with the aircraft usage policy outlined at 15 NCAC 07M .0901,

North Carolina Dredge and Fill Law

The proposed facility will result in temporary filling in estuarine waters for cofferdams and a construction staging area. Essentially no permanent new fill will be required for cleaning or replacing structures described in this project. There will be some unavoidable permanent fill since it is not possible to retrieve all of the temporary cofferdam fill material and small amounts of fill will slough off when covering replaced structures. The total amount of unavoidable, permanent fill is estimated to be less than 0.12 ac for all of the projects. The refuge is in the process of obtaining Nationwide Permit 3 which authorizes construction of temporary cofferdams. Therefore, no further action is required regarding compliance with NCGS 113.229

Required State and Local Permits

Due to the relatively small extent of “on-the-ground” impacts, this project does not require either a Stormwater Management Plan or a Sediment and Erosion Control Plan. However, stringent measures will be incorporated to prevent or minimize adverse impacts due to runoff. Silt curtains will be used and any disturbed site will be re-vegetated as work at the site is completed. All fill temporary fill material will be taken either from the Long Curve Road Borrow Pit site of the Stumpy Point Disposal Cell containing clean, fine-to-medium medium grain sand dredged from the federal Stumpy Point Navigation Channel and the state Emergency Ferry terminal channel and basin.

Conclusion

Although this project involves mostly routine maintenance or management actions with regard to refuge lands, we recognize that there are components that may have not been subjected to a sufficient review as defined by Section 113A-103(5)(a) and Section 113A-103(5)(b) of the North Carolina General Statutes. Consequently, we are submitting this Consistency Determination for your consideration. The refuge staff is committed to working cooperatively with all State and Federal agencies to ensure full compliance with law, regulation, and policy at all times. Consequently, we have determined that implementation of this hydrologic restoration and improved water management project as planned is fully consistent with the enforceable policies of North Carolina’s federally approved Coastal Management Program. If you have questions please contact Dennis Stewart, Refuge Biologist at (252) 473-1132 ext. 231.

APPENDIX I

HYDROLOGIC RESTORATION and IMPROVED WATER MANAGEMENT PROJECT

Impact Assessment Tables

Appendix I, Table 1a: CULVERT IMPACT AREA ESTIMATES							
Volume of Culverts							
Dia (in)	Radius (in)	length (ft)	length (in)	V (in ³)	V (yd ³)	Quantity	Vol _{tot}
30	15	30	360	254340	5.5	1	5.5
30	15	40	480	339120	7.3	1	7.3
30	15	45	540	381510	8.2	2	16.4
36	18	40	480	488333	10.5	1	10.5
36	18	45	540	549374	11.8	2	23.6
48	24	30	360	651110	14.0	2	27.9
48	24	40	480	868147	18.6	2	37.2
72	36	40	480	1953331	41.9	1	41.9
96	48	40	480	3472589	74.4	1	74.4
	0		0	0	0.0		0.0
	0		0	0	0.0		0.0
						13	244.5
Appendix I, Table 1b: Disturbed Area During Installation/Cleaning							
Length (ft)*	Width (ft)	Area (ft ²)	Acreage	Depth (ft)	V(yd ³)each	V(yd ³) _{TOT}	V(yd ³) _{NET}
34	5	170	0.004	5	31.5	31.5	26.0
44	5	220	0.005	5	40.7	40.7	33.5
49	5	245	0.006	5	45.4	90.7	74.4
44	6	264	0.006	5	48.9	48.9	38.4
49	6	294	0.007	5	54.4	108.9	85.3
34	8	272	0.006	6	60.4	120.9	93.0
44	8	352	0.008	6	78.2	156.4	119.2
44	10	440	0.010	8	130.4	130.4	88.5
44	12	528	0.012	10	195.6	195.6	121.1
	Tot	2785			685.5	924.0	679.5
	Tot (ac)	0.06					

* = length of culvert plus riser width plus "installation zone"

Appendix I, Table 2a: Cofferdam Impact Assessment							
Canal Dimensions		Cofferdam Width (ft)	Impacts per cofferdam		# Cofferdams required	Total Cofferdam Impact	
Width (ft)	Depth (ft)		Area (ac)	Volume (yd ³)		Area (ac)	Volume (yd ³)
30	5	14	0.010	77.8	1	0.010	77.8
30	5	14	0.010	77.8	2	0.019	155.6
30	5	14	0.010	77.8	3	0.029	233.3
30	5	14	0.010	77.8	4	0.039	311.1
40	6	18	0.017	160.0	1	0.017	160.0
40	6	18	0.017	160.0	2	0.033	320.0
40	6	18	0.017	160.0	3	0.050	480.0
40	6	18	0.017	160.0	4	0.066	640.0
50	6	24	0.028	266.7	1	0.028	266.7
50	6	24	0.028	266.7	2	0.055	533.3
50	6	24	0.028	266.7	3	0.083	800.0
50	6	24	0.028	266.7	4	0.110	1066.7

Appendix I, Table 2b: Permanent Fill Impact Analysis*			
Canal Width**	# Cofferdams***	Area (ac)	Volume (yd ³)
30	4	0.02	171.11
40	4	0.04	352.00
50	4	0.06	586.67
TOTAL		0.12	1109.78

*Assumes 5% loss from temporary fill; ** Each of the canal widths will require cofferdams; ***Each project site will require 4 cofferdams

Appendix I, Table 3a: CANAL CLEANOUT IMPACTS - TOTAL						
CANAL	Canal Length (ft)	Canal Width (ft)	Canal Depth (ft)	Total Affected Area (ft ²)	Total Affected Area (ac)	Total Affected Volume (yd ³)
Buffalo City Road (1.3 mi)	6,864	40	4	274560	6.3	40675.6
Gadwall Road (1.7 mi)	8,976	30	2	269280	6.2	19946.7
Milltail Road (2.3 mi)	12,144	30	2	364320	8.4	26986.7

Appendix I, Table 3b: CANAL CLEANOUT IMPACTS - NET						
CANAL	Net Impacted Area (ac)	Net Impacted Volume (yd ³)	Temporary Marsh Fringe Impact (ft ²)	Temporary Marsh Fringe Impact (ac)		
Buffalo City Road	4.1	26439.1	6692.4	0.15		
Gadwall Road	1.5	4986.7	3366	0.08		
Milltail Road	2.1	6746.7	4554	0.10		