Hydrologic Restoration on the Lower Suwannee National Wildlife Refuge
Plan and Phase I Implementation

Dixie and Levy Counties, Florida

Background

The Lower Suwannee National Wildlife Refuge (Refuge) is on the west coast of Florida, at the southern end of the Big Bend Region and within the South Atlantic and Peninsular Florida Landscape Conservation Cooperatives where the region has been identified as key area for the protection of hardwood forests, pine and scrub, coastal uplands, and estuaries. The Refuge is located in southern Dixie and western Levy Counties, approximately 50 miles southwest of the City of Gainesville, near the towns of Chiefland, Cedar Key, and Suwannee. The Refuge was established on April 10, 1979 under the authority of the Fish and Wildlife Act of 1956 to protect, enhance and restore habitats in the Lower Suwannee River ecosystem. The Refuge provides protection for one of the largest undeveloped river delta-estuarine systems in the continental U.S., including 30 miles of salt marsh habitat along the Gulf Coast. The Refuge is approximately 53,000 acres in size and is within an 88,000-acre approved acquisition area. Within the refuge acquisition boundary, there are 51 named creeks and rivers totaling approximately 126 miles, as well as nearly 400 miles of unnamed streams. The Suwannee River flows through the refuge and approved acquisition boundary for 33 miles, varying from 450 to 1,250 feet in width and average depth of between 10 and 12 feet.

The Big Bend coastline is unique in that its freshwater supply derives nearly as much from overland sheet flow and seepage from springs and porous limestone along a broad coastal front as it does from river flow. This large and unique estuarine system has the second largest seagrass area in the Eastern Gulf of Mexico (3,000 km^2), and along the coastline are tidal creeks, oyster reefs and salt marshes where physical and ecological dynamics are strongly influenced by the Suwannee River and surface flow from adjacent wetlands. Other natural communities within the region and Refuge include bottomland forests, cypress dominated sloughs, cypress and cedar islands, hydric, mesic, and xeric hammocks, and flatwoods. Combined, these systems support diverse commercial and recreational activities, where a large proportion of all jobs are directly dependent on natural resources (farming, forestry, fishing, and nature-based tourism) compared with statewide averages in Florida. The hard clam aquaculture industry has an annual statewide impact of $50 million and supports over 500 jobs, mostly in the nearby Cedar Key area.

Estuaries are globally defined by having intermediate salinities, with this feature contributing prominently to their structure, productivity, and ecosystem services. Over 90% of fish and shellfish harvested in the U.S. spend some portion of its life cycle in estuaries, and intermediate salinities are functionally important for supporting those life stages. Within the Suwannee River estuary, recruitment of both freshwater and marine fishes is affected by freshwater flows. Past and future alterations in the hydrology of the system could therefore reduce fish abundance and influence recreational fisheries. Similarly, commercial fisheries for species like blue crab,

oysters, and stone crab are strongly influenced by salinity conditions in the estuary and associated nutrient inputs via freshwater flow.

Oysters in particular play a crucial role in the estuaries of the Big Bend. The eastern oyster (*Crassostrea virginica*) prefers intermediate salinities, and mortality increases exponentially at higher average salinities. Offshore oyster reefs in the Big Bend Coast of Florida have declined by 88% during the last 30 years, with the most likely mechanism being the cascading effects induced by high salinity in the estuary (Seavey et al. 2011). In the Lower Suwannee Sound, reefs parallel to the shore serve as leaky dams, detaining freshwater. Repeated episodes of reduced freshwater flow in this estuary can lead to permanent loss of the reefs, and erosion of these buffering structures. This result in a reinforcement of the pattern – lower elevation reefs suffer higher and more frequent mortality because the waters are less buffered and more often salty.

Refuge Impacts to Hydrology

Within the Refuge, there are approximately 143 miles of roads and trails as inventoried by Refuge staff, consisting mostly of primary and secondary roads utilized for access and management. The Refuge maintains a comprehensive database of all roads, trails, and water resource structures within the property. All of the maintained roads are former logging roads constructed to access timber stands for harvest. The roads were built using onsite material excavated from either side of the road bed creating roadside ditches and borrow pits which still remain. Approximately 25 miles of these roads and trails within the Refuge are not maintained, needed, or are no longer utilized by the Refuge. Within this network of roads and trails, the Refuge maintains more than 100 culverts, 5 concrete bridges, and 46 low water crossings.

Natural hydrologic function and connectivity to the Suwannee River floodplain is negatively impacted by large portions of the historic road and ditch network. Preliminary assessments by the Refuge, U.S. Geological Survey, and University of Florida staff indicate that these roads function as levees or dikes even though they are not intended or designated as such. Roads and trails cause the temporary impoundment of water and in some instances redirect flow into culverts, disrupting sheet flow. This blockage of surface flow means that much of this water does not make it to the estuary because it is detained long enough to evapotranspire inland.

In addition to hydrologic alterations associated with the Refuge road network, portions of the flatwoods within the Refuge were utilized for commercial silviculture prior to public ownership and as such, many historically wet areas were bedded prior to pine plantings. Silvicultural bedding is a site preparation technique utilized by timber companies, which includes a series of linear mounds and alternating trenches designed to improve soil aeration and nutrient concentration on wet and/or nutrient poor sites. The trenches associated with bedding channel water are detrimental to the sheet flow of water across the landscape. Additionally, an artifact of these bedding practices is the isolation of extensive wetlands within the historic plantation areas

within the Refuge. The construction of planting beds results in the deposition of soil and other debris around wetlands, interrupting hydrologic connections and sheet flow through the creation of berms.

While silvicultural and forest management restoration activities are a primary component of the overall natural resource management of the Refuge, many opportunities exist to improve hydrologic function within these areas and compliment other important hydrologic restoration and enhancement activities. These activities include:

- The removal of silvicultural beds in conjunction with other planned forest management activities.
- The removal of berms surrounding wetlands within bedded flatwoods areas.

The identification of these potential actions will be included in the comprehensive engineering assessment of hydrologic restoration and enhancement needs (discussed below); however, implementation of hydrologic restoration activities associated with silvicultural areas will occur in future phases concomitantly with Refuge timber harvest and overarching forest management and restoration strategies.

Refuge Proposal for Hydrologic Restoration and Enhancement

Management actions to address salinity issues in the lower Suwannee Sound are complex and challenging. However, one simple strategy is to restore hydrologic connectivity of the estuary to adjacent forested wetlands and riverine floodplain of the Refuge. The project is the obvious first step in the restoration of the natural hydrology and movement of water through the Refuge to the lower Suwannee Sound. The project will not only improve the health of the estuary through restored freshwater inputs, but will also help sustain the economic viability of recreational and commercial fishing, ecologically important oyster reefs, federally-protected species, and the significant shellfish industry in the region.

Restoring surface water flow conditions by reducing barriers from roads and ditches in this region is expected to enhance freshwater flow in the area's tidal creeks and within the Suwannee River itself, improving these fish and wildlife resources. The use of intertidal oyster reefs by wintering American oystercatchers (*Haematopus palliatus*) in this area is estimated to sustain 15% of the continental population. Studies have found high-tide oystercatcher roosts to be limited in number and located in offshore oyster reef habitat, which has experienced an 88% decline in area over the past 30 years. Offshore, high-tide roost habitat is a limiting factor and thus needs to be sustained to continue conserving the American oystercatcher. Additionally, the Suwannee River contains the most highly abundant population of the threatened Gulf Sturgeon (*Acipenser oxyrinchus desotoi),* and its life history requires groundwater flow from springs during summer for thermal refuge, as well as productive estuarine conditions during winter for feeding. This project is adjacent to designated Critical Habitat for Gulf Sturgeon. This project will also compliment the recently GEBF-funded $8.3 million restoration of the Lone Cabbage

Oyster Reef, immediately adjacent to and downstream of the Levy County work proposed in this plan.

Comprehensive Hydrologic Restoration Plan

Using easily proven methodologies, existing data sets including LIDAR, and working with key partners including the Suwannee River Water Management District, University of Florida, U.S. Geological Survey, and the U.S. Fish and Wildlife Service, the Refuge, through this proposal seeks to first develop a comprehensive engineering assessment of hydrologic restoration and enhancement needs. It is anticipated that major deliverables of this assessment will include an analysis of existing LIDAR data, hydrologic analysis including GIS-based basin delineations and flow accumulation estimates, site investigations and mapping, and more detailed cost estimates. Through site evaluations and rankings, this assessment will ultimately identify and prioritize areas that will be targeted for road removal, culvert replacement, the installation of additional culverts and low water crossings, ditch plugs, bridges, and areas of silvicultural bed and berm removal.

Phase 1 Implementation – Levy County

In the Levy County portion of the property, the most significant impact areas appear to occur in the Sandfly Creek, Black Point Swamp, and Gopher River basins. Additional areas within the Refuge are similarly affected by the historic network of roads which impedes the sheet flow of water across the landscape. While some sheet flow of water is captured and channelized into roadside ditches and directed underneath roads through culverts and, in a few cases, bridges, there are numerous opportunities to restore hydrologic functions through:

- The replacement of undersized and dilapidated culverts.
- The installation of additional culverts, low water crossings, ditch plugs, and bridges.
- The removal or breaching of abandoned roads and trails and subsequent filling of roadside ditches.

Within Phase 1 Implementation, approximately 2.5 miles of abandoned roads and trails are identified for removal or breaching, as well as locations for 50 low water crossings, 20 pipe culverts, and 8 box culverts with hydrologic improvements affecting approximately 16,000 acres within the Refuge. Additional benefits are expected beyond the Refuge boundary and include state and private lands and state waters in creeks, the Suwannee River, and extensive coastal areas of the Gulf of Mexico. Additional hydrologic restoration work is anticipated in this area and will be identified and prioritized in the engineering assessment.

Future Phase Implementation – Dixie County

In the Dixie County portion of the Refuge, the most significant impacts appear to occur in the California Swamp basin east of the Dixie Mainline Road and portions of the California Creek and Shired Creek basins, all of which were likely tidal in the early 1900s prior to road construction. Similar to Phase 1 Implementation in Levy County, numerous opportunities to restore hydrologic functions in this area exist through:

- The replacement of undersized and dilapidated culverts.
- The installation of additional culverts, low water crossings, ditch plugs, and bridges.
- The removal or breaching of abandoned roads and trails and subsequent filling of roadside ditches.

Additional funding requests for restoration activities as determined in the hydrologic restoration plan are expected to be submitted during future openings of Gulf of Mexico funding portals.

Proposed Restoration Techniques and Benefits Table

Proposed Restoration Technique	Estimated Need	Restoration Benefit
Install Pipe or Corrugated Metal Culvert	20	Increased hydrologic connectivity across roads and trails, aid in the restoration of sheet flow, improved water quality downstream, and restoration of vegetative communities.
Install Box Culvert	8	Increased hydrologic connectivity across roads and trails, aid in the restoration of sheet flow, improved water quality downstream, and restoration of vegetative communities.
Install Low Water Crossing	50	Increased hydrologic connectivity and sheet flow across road bed while still providing vehicular passage, restoration of vegetative communities.
Road Removal	2.5 miles	Restore large areas of sheet flow, improved water quality, restoration of vegetative communities.

Note: Cross section schematics and other engineering specifications will be identified for individual tasks in the hydrologic restoration plan.

Permitting

Hydrologic restoration on the Refuge will require compliance with all pertinent State and Federal environmental laws and regulations including but not limited to the National Environmental Policy Act (NEPA), Endangered Species Act (ESA), National Historic Preservation Act (NHPA), Clean Water Act (CWA), and state statutes requiring an environmental resource permit (ERP) to prevent flooding and protect wetlands and water quality.

Based on current knowledge of threatened and endangered species and cultural resources in the area, complying with the ESA and NHPA are not anticipated to be problematic. Proposed restoration actions will undergo an intra-agency Section 7 (ESA) consultation on appropriate species, and a review of Section 106 of the NHPA. If deemed necessary, activities will be coordinated with the State Historic Preservation Office (SHPO). To comply with NEPA, the proposed restoration actions will be reviewed in accordance with Department of Interior and U.S. Fish and Wildlife Service policy to determine their effects on the human environment (the natural and physical environment and the relationship of people with that

environment). Preliminary informal internal scoping for NEPA decision making indicate the proposed actions will likely qualify as Categorical Exclusions (CatEx), a form of NEPA compliance intended to expedite project implementation in cases where actions have no significant impacts. A more formal internal scoping of NEPA will be performed after the hydrologic restoration plan is complete and before implementation begins.

Proposed Cost Schedule

Phase/Task	Cost/Unit	Estimated Need	Total
Hydrologic Restoration Plan[1]	$85,000	1	$85,000
Sub Total	-----	-----	**$85,000**
Phase 1 Implementation – Levy County			
Road Removal[1]	$100,000/mile	2.5 miles	$250,000
Low Water Crossings[2]	$8,000	50	$400,000
Pipe Culverts[3]	$12,000	20	$240,000
Box Culverts[4]	$58,000	8	$464,000
Sub Total	-----	-----	**$1,354,000**
Monitoring	4% of Phase 1	1	$54,000
TOTAL	-----	-----	**$1,493,000**

[1]Cost estimate derived from Suwannee River Water Management District Contractor; Jones, Edmunds & Associates, Inc.
[2]Cost estimate derived from a number of sources with similar projects including Lower Suwannee & Cedar Key National Wildlife Refuge and St. Johns River Water Management District.
[3]Cost estimate derived from *Devil's Hammock (Suwannee River Water Management District) Hydrologic Restoration Plan.Jones, Edmunds & Associates, Inc.Gainesville, Florida*
[4]Cost estimate derived from a number of sources with similar projects including Lower Suwannee & Cedar Key National Wildlife Refuge and Ducks Unlimited.