

Hoosier Dam Mitigation Bank Chatham County, NC

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Prospectus



February 2014



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Hoosier Dam Mitigation Bank Prospectus

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Hoosier Dam Umbrella Mitigation Bank

Prospectus

The Bank Sponsor, 130 of Chatham, LLC, proposes to establish the Hoosier Dam Umbrella Mitigation Bank (Bank) to provide compensatory stream mitigation credits to offset unavoidable impacts to jurisdictional streams authorized under Sections 401 and 404 of the Clean Water Act and Section 10 of the Rivers and Harbor Act. The proposed Bank site is located on the Rocky River in Chatham County approximately 5 ½ miles upstream of its confluence with the Deep River in Hydrologic Unit 03030003 (Figure 1). The Bank shall be planned and designed by Wildlands Engineering, Inc. (Wildlands) as an umbrella bank, with the initial bank site encompassing the Hoosier Dam and a significant length of Rocky River and several tributaries upstream of the current dam.

1.0 Mitigation Bank Introduction and Objectives

1.1 Introduction

The Hoosier Dam is located on the Rocky River in Chatham County within the Cape Fear River Basin. The dam impounds approximately 22,425 feet of Rocky River and six perennial tributary streams. Prior to construction of the Hoosier Dam, a boulder dam was installed on the Rocky River approximately 4,800 feet upstream of Hoosier Dam that created a smaller impoundment on the river (Figure 2). This historic boulder dam was inundated when the larger Hoosier Dam was constructed, but was left in place.

The U.S. Fish & Wildlife Service (FWS) has designated sections of the Rocky River upstream and downstream from Hoosier Dam, as well as a section of Bear Creek just below the dam, as Critical Habitat for the Cape Fear shiner, a federally listed endangered species (FWS, 1988). The non-impounded sections of the Rocky River and Bear Creek exhibit very high quality riverine habitat that supports a diverse collection of aquatic species including the Cape Fear shiner and other species of concern, such as the Eastern creekshell (*Villosa delumbis*) and the Carolina creekshell (*Villosa vauhaniana*). The dam represents a significant blockage to aquatic species' migration and as a result, FWS has documented declines in the disconnected Cape Fear shiner population upstream of the dam (FWS, 1988). Removal of the blockage created by the dam to provide access to these high-quality reaches would be of substantial long-term benefit to aquatic communities including the Cape Fear shiner.

The Hoosier Dam Mitigation Bank includes over 22,425 linear feet (LF) of the Rocky River and six perennial tributaries. The Bank will be created through the following river restoration activities:

- De-watering of Reeves Lake, the impoundment created by Hoosier Dam
- Development and implementation of a sediment management plan for the historically inundated areas of Rocky River and six tributaries
- Seeding, planting, and stabilization of the historic riverbank and exposed soils as the water level in Reeves Lake drops to minimize sediment discharge to downstream reaches
- Removal of the full extent of the Hoosier Dam, including the embankment, spillway, and adjacent powerhouse facility; and restoration of Rocky River at the dam site
- Removal of the remnant rock dam that is located approximately, 4,800 feet upstream of Hoosier Dam (with reuse of the boulders for fish habitat enhancement measures)

- Restore shallow water habitat for the Cape Fear shiner immediately upstream of the dam – extent to be determined based on topographic survey and geomorphic and sediment assessments
- Continue efforts to preserve the existing forested riparian buffer along Rocky River and its tributaries within the limits of the Bank

1.2 Bank Location

The proposed Bank site (35° 38' 08"N, 79° 12' 40"W) is located in Chatham County, along N.C. Highway 87 approximately 6 miles south of the of the Town of Pittsboro, North Carolina (Figure 1). The subject site is located on the Rocky River approximately 5 ½ miles upstream of its confluence with the Deep River (HUC 03030003).

To access the site from Raleigh, drive south on US-1S for approximately 31 miles. Exit onto NC-87N/US-15N/US-501N/Hawkins Ave and drive north for approximately 6.1 miles. Turn left onto Walter Bright Road and proceed west for approximately 0.5 miles. Turn right to stay on Walter Bright Road and proceed west for another 0.6 miles. Turn right onto Asbury Church Road and proceed north for approximately 0.6 miles. Turn left onto Mays Chapel Road and proceed north for approximately 1.0 mile. Turn right onto Woody Dam road and proceed for approximately 0.5 miles to the dam site on the right.

1.3 Bank Objectives

The Bank will provide numerous ecological benefits within the Rocky River and Cape Fear River Basin. Expected improvements to aquatic species, aquatic habitat, water quality, and ecological processes from the Bank are listed below in Table 1:

Table 1. Bank Goals and Methods of Achievement
Hoosier Dam Mitigation Bank Prospectus

<i>Improve water quality</i>	Seasonal thermal stratification within Reeves Lake (See Section 3.2.5) has negatively affected water temperatures and dissolved oxygen concentrations within the impoundment and downstream of Hoosier Dam. The 2012 303(d) list identifies Reeves Lake as "water quality limited" due to elevated levels of chlorophyll a, which is an indicator of excessive algal growth resulting from high nutrient loads flowing into the lake. Releases from Hoosier Dam can degrade water quality downstream in the Rocky River and Deep River. By removing the dam and the impoundment, the Bank will significantly improve water quality within this reach of Rocky River and to downstream reaches of the Rocky River and Deep River.
<i>Restoration of an appropriate flow regime and aquatic community</i>	Once the impoundment is drained and the dam embankment, spillway, and powerhouse are removed, the more natural flow regime (lotic conditions) of the Rocky River will be restored. The build-up of sediment within Reeves Lake will be removed once the lake is drained, and natural shallow water habitat preferred by the Cape Fear shiner will be restored on Rocky River and the lower reaches of six perennial tributaries. This may include placement of in-stream structures to improve habitat diversity. This will promote establishment of the appropriate aquatic community.
<i>Restoration of habitat for Federal protected aquatic species</i>	Habitat will be restored for the federally-listed Cape Fear shiner through removal of the dam and impoundment, and restoration of the appropriate riverine (lotic) habitat and natural flow regime.

<i>Restoration of passage for aquatic species</i>	Although not an anadromous species, removal of the dam embankment, spillway, powerhouse, and other facilities will connect critical habitat areas and restore passage for the Cape Fear shiner and other aquatic species.
<i>Preservation and restoration of wooded buffers</i>	The Bank Sponsor has purchased a significant amount of the riparian areas along the Rocky River and Tributaries 2, 3, 4, and 5 (See Figures 5 through 5d). Forested riparian buffers owned by the Bank Sponsor in the Bank will be preserved, while those that have been cleared by previous land use activities will be restored with native vegetation. Over time, the Bank Sponsor plans to pursue opportunities to protect and restore additional riparian buffers within the Bank along the Rocky River and its tributaries.
<i>Benefits to downstream water bodies</i>	Coarse sediment has been captured in the impoundment due to reduced flow velocities caused by the impoundment. Once the natural flow regime is re-introduced, a more natural sediment supply and transport will be restored within the inundated section and to downstream reaches of the Rocky River.

1.4 Qualifications of Bank Sponsor

Bank Sponsor and Contact Information:

Bank Sponsor

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Authorized Agent

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The Bank Sponsor, 130 of Chatham, LLC, is a private land holding company that focuses on the acquisition, restoration and preservation of properties that possess high ecological values. As of January 2013, their land portfolio has eclipsed 35,000 acres and includes land in the mountain, foothill, piedmont and coastal regions of North Carolina. 130 of Chatham, LLC has worked with consultant Unique Places, LLC over the last four years to implement innovative techniques for restorative land management and conservation on their land holdings. Once a property is acquired, the project team completes ecological surveys of natural communities and rare species, and uses this information to develop comprehensive restoration and forest management plans.

The Bank Sponsor is working with Wildlands and Schnabel Engineering (Schnabel) to develop and execute the dam removal and river restoration portion of the management plan for the Bank. Wildlands is a fully licensed engineering firm with offices in North Carolina, South Carolina, and Virginia. Wildlands specializes in the design and permitting of stream and wetland restoration and mitigation with a particular focus on ecosystem renewal. Our diverse team of engineers, ecologists, biologists, and hydrologists has assessed over 250 miles of streams for restoration feasibility, designed and permitted over 75 miles of stream enhancement and restoration work, and managed construction on over 50 miles of restoration.

Wildlands currently holds a contract with American Rivers for planning, design, permitting, and construction oversight on dam removal projects throughout the southeast U.S. Through this contract, Wildlands is currently providing these services to American Rivers on several dam removal projects in North Carolina, including removal of the Upper Swepsonville Dam in North Carolina.

Schnabel offers specialized talents in the analysis, design, and construction support for all types of dams, including new dams, rehabilitations, and removals. Since 1994, Schnabel has provided these services on over 800 dams, most of which are in the southeast US. In North Carolina, Schnabel has been involved in several dam removal projects of similar size and complexity as the Hoosier Dam:

- Upper Kings Creek Watershed Restoration and Dam Removal, Kings Mountain, NC
- X-Way Dam Breach Design, Crossway, NC
- Joe Lambeth Dam Removal, Trinity, NC
- Lake Townsend Dam Removal and Replacement, Greensboro, NC
- Salem Lake Dam Removal and Replacement, Winston-Salem, NC

2.0 Establishment and Operation of Mitigation Bank

2.1 Ownership Agreements and Long-term Strategy

Rocky River Hydro, LLC owns fee simple title for the Bank site, which also conveyed the dam, hydropower facility, hydropower license, and old boulder dam. Rocky River Hydro, LLC is owned by Mr. Timothy Sweeney, who also owns 130 of Chatham, LLC. The landowner has signed the Landowner Authorization Form allowing the United States Army Corps of Engineers (USACE) to enter the site for assessment purposes. A copy of the Landowner Authorization Form is included in the Appendix.

Upon completion of the review process for the Bank Prospectus, the Sponsor will submit a detailed draft Mitigation Plan and Banking Instrument for the Bank. The banking instrument will provide detailed information regarding bank operation including long-term management and maintenance. Once the final Mitigation Plan is approved and the accompanying Banking Instrument executed by members of the Interagency Review Team (IRT), the Sponsor will record a conservation easement for the dam site and forested riparian buffers within the limits of the Bank. The proposed conservation easement will help to ensure that only IRT-allowable activities take place. The long-term stewardship of the conservation easement will be transferred to an IRT-approved non-profit organization once the Bank's monitoring success criteria have been achieved.

2.2 Assurance of Sufficient Water Rights

The Bank lies on the main stem of the Rocky River, with a drainage area of over 200 square miles, and on six perennial tributaries. The Bank Sponsor has purchased the dam, power facility, the parcels that contain the dam structure, and all associated rights. These two factors will provide adequate assurance of sufficient water rights to support the long-term sustainability of the bank.

2.3 Proposed Service Area

The Bank will be established to provide mitigation to compensate for impacts to Waters of the United States and/or State Waters within Cape Fear Hydrologic Unit (HU) 03030003 and portions of HU 03030004, as discussed below (Figure 3).

HU 03030003 includes portions of Chatham, Forsyth, Guilford, Alamance, Randolph, Montgomery, Moore, and Lee counties. It also contains the urban areas southeast of the Triad, and lies along the US-15/501 and US1/64 corridors. Population growth within Cape Fear subbasin 03-06-12 is expected to increase by approximately 100,000 people over the next 20 years. The Bank will provide mitigation for

unavoidable impacts to Waters of the U.S. and State Waters caused by new development that will likely occur to support this level of population growth.

To date, Cape Fear HU 03030003 has experienced low to moderate demand for stream mitigation units. The Carbonton Dam Mitigation Project produced a supply of mitigation credits that significantly exceeds demand in this basin. As a result, it is very unlikely that the NC Ecosystem Enhancement Program (the largest single purchaser of mitigation credits in the state) will need additional stream mitigation credits in this basin within the foreseeable future.

Given the physiographic similarity and proximity, and to help maintain the economic viability of the Bank, the proposed service area also contains portions of Cape Fear HU 03030004 (Figure 3). HU 03030004 includes the urban growth area in southwest Wake County around Raleigh and Cary, and parts of Harnett and Wake counties. Historically, this portion of HU 03030004 has experienced moderate demand for stream mitigation units, but this area is not currently served by an existing stream mitigation bank. The boundary between these two HUs is arbitrary since this portion of HU 03030004 has similar physiographic characteristics (central Piedmont) as HU 03030003, and excludes the Sand Hills and coastal plain. Additionally, from an ecological perspective, it is likely the Cape Fear shiner and other aquatic species that would benefit from this project move between these two watersheds. For these reasons, providing compensatory mitigation for this area of HU 03030004 by the Bank is consistent with regulatory policy.

2.4 *Need and Feasibility of Mitigation Bank*

2.4.1 Need

The Cape Fear shiner is a federally-listed endangered species that only occurs only in North Carolina. Based on the FWS 1988 Cape Fear shiner Recovery Plan (Recovery Plan), only three critical habitat areas have been identified in Chatham, Lee, Randolph, Harnett, and Moore counties, North Carolina: (1) a 4.1 mile reach of the Rocky River upstream of Hoosier Dam; (2) 7.3 miles of the Rocky River and Deep River downstream of Hoosier Dam, which includes 0.5 miles of Bear Creek; and (3) 1.5 miles of Fork Creek. These isolated populations and the limited critical habitat areas put the Cape Fear shiner at serious risk for long-term survival.

Critical habitat areas #1 and #2 above are separated only by Hoosier Dam and its impoundment, Reeves Lake (Figure 4). Therefore, construction of Hoosier Dam has had two significant impacts on the Cape Fear shiner. First, the dam creates a blockage to fish movement that has disconnected two of the three critical habitat areas and prevents interaction between the two resident populations. Secondly, the impoundment caused by the dam inundates the shallow, rocky riverine habitat preferred by the Cape Fear shiner. The Recovery Plan states that dam construction in the Cape Fear River system has probably had the most serious impact on the species. A primary goal of the Recovery Plan is to re-establish the Cape Fear shiner into historic habitat. By removing Hoosier Dam and restoring the shallow water habitat preferred by the Cape Fear shiner, the Bank will play an important role in expanding its habitat and helping to strengthen the population that exists on Rocky River, Bear Creek, and Deep River.

Every two years, the NCDWQ publishes a list of impaired water bodies according to the Clean Water Act (Section 303(d)) and 40 CFR 130.7, known as the 303(d) list. The list is a comprehensive public accounting of all water bodies that do not meet water quality standards including designated uses, numeric and narrative criteria, and anti-degradation requirements defined in 40 CFR 130.7. Standards violations may be due to a single or multiple pollutants; and the source of impairment could be from point sources and/or nonpoint sources. North Carolina's methodology is strongly based on aquatic life use support guidelines.

The 2012 303(d) list identifies Reeves Lake as “water quality limited” due to chlorophyll a, which is an indicator of excessive algal growth resulting from high nutrient loads flowing into the lake. The water quality within Reeves Lake likely varies seasonally, with low dissolved oxygen levels, stratified temperatures, and high chlorophyll a levels during the summer due to warmer temperatures and the effects of the impoundment. By removing the dam and the impoundment, the Bank will significantly improve water quality within this reach of Rocky River and to downstream reaches of the Rocky River and Deep River. A more detailed discussion of water quality is presented in Section 3.2.5.

2.4.2 Feasibility

Hoosier Dam consists of a small powerhouse, a run-of-river spillway, and a short earthen embankment to the left of the spillway. A portion of the spillway on the left river bank (looking downstream) consists of a concrete gravity section with a nearly vertical downstream face. The right side of the spillway consists of a slab and buttress section with eight bays, which extend to the powerhouse on the right side of the dam. Downstream of the dam, the majority of the river channel is exposed rock. The left river bank directly downstream of the structure has been benched and armored with riprap.

Schnabel has performed several borings on the left and right abutments as part of the geotechnical investigation. These borings were performed to evaluate subsurface conditions for removal of the dam and embankment, and for the design of potential stream bank stabilization measures. Based on the borings and field observations, the right bank adjacent to the powerhouse consists of very dense residual soils with remnant rock structure (often referred to as transition material) underlain by rock. The natural steep banks and exposed weathered rock adjacent to the dam indicate that the boring is representative of this area. Based on our drilling and observations, minor grading after removal of the dam may be required to transition the bank from the narrower valley upstream of the dam to the wider valley downstream.

The left bank adjacent to the dam consists of a fill layer, 18 to 28-feet-deep, underlain by a thin layer of very dense residual soils with remnant rock structure (often referred to as transition material) and then rock. The fill soils would be expected to be highly erosive. The fill soils observed in the borings are likely the result of original dam construction. For demolition of the training wall during removal of the dam and for stabilization of the bank, the fill slope behind the wall and upstream of the dam will be graded to match the grades of the slope downstream of the dam.

The removal of Hoosier Dam, draining the impoundment, and restoration of the Rocky River and its tributaries is proposed to occur through a staged approach, carefully designed to minimize potential disturbances to water quality or aquatic life:

- Phase I – Dewatering Reeves Lake and Sediment Management, which will consist of the following activities:
 - Draining of the reservoir during the cooler months of the year (late fall through early winter) through the existing powerhouse
 - Removal of power generation and ancillary equipment from the powerhouse
 - Potential sediment removal, as determined by the Sediment Management Plan, as the water levels drop (sediment management is discussed in more detail in Section 3.2.6)
- Phase II – Initial Dam Removal and River Bank Stabilization, which will consist of the following activities:
 - Selective demolition of the dam to lower the spillway crest and establish a stream channel notch through multiple bays of the slab and buttress section of the dam that will maintain instream flow to support downstream aquatic communities

- Re-establish and stabilize the river channel immediately upstream and downstream of the dam structure based on comparison to reference conditions downstream of the dam and upstream of the impoundment. Stabilization of the river banks will be accomplished by removal of the embankment fill to establish a stable slope angle prior to demolition of the retaining wall.
- Seeding, planting, and stabilization of the historic riverbank and exposed soils
- Phase III - Final Dam Removal and River Restoration, which will consist of the following activities:
 - Removal of the remaining portions of the dam and final stabilization and grading in the areas adjacent to the dam.
 - Potential sediment removal as determined in the Sediment Management Plan
 - Removal of the remnant rock dam that is located approximately 4,800 feet upstream of Hoosier Dam (incorporate these boulders into habitat enhancement measures on Rocky River)
 - Stabilization and restoration of the Rocky River and its tributaries
 - Restore shallow water habitat for the Cape Fear shiner immediately upstream of the dam – extent to be determined based on topographic survey and geomorphic and sediment assessments
 - Restoration of riparian buffers areas under the ownership of the Bank Sponsor that have been cleared by previous owners
- Phase IV – Additional Buffer Preservation and Restoration, which will consist of the following activities:
 - Continued efforts to protect, preserve and restore the forested riparian buffers along the Rocky River and its tributaries within the Bank limits

Bank Sponsor will coordinate with Wildlands and Schnabel to develop the Demolition Plan and Sediment Removal Management Plan to minimize water quality and ecological impacts to the Rocky River and downstream water bodies. These plans will be submitted to the IRT for review and approval.

3.0 Ecological Suitability of Site

3.1 Bank Site Characterization

Hoosier Dam and Reeves Lake are located within the Piedmont physiographic region and the Carolina Slate Belt, which is characterized by low summertime base flows. The Rocky River originates in the eastern portion of Forsyth County and flows southeast through Guilford, Randolph, Chatham, and Lee counties before its confluence with the Deep River. The Bank has a watershed area of approximately 200 square miles at Hoosier Dam.

The Bank is located within Cape Fear River subbasin 03-06-12 (NCDWQ 2005). The population within the subbasin in Year 2000 was approximately 20,000 residents. Land use within the subbasin is predominately forest (70 percent) and agriculture (27 percent), with less than 2 percent urban development.

Hoosier Dam is a concrete buttress dam with an attached hydroelectric powerhouse. The dam was built in 1922, and is constructed of reinforced concrete, with a total length (including the powerhouse), of 235 feet and an average structural height of 25 feet. The hydroelectric facility at Hoosier Dam contains three small turbines that were operated by Hoosier Hydroelectric, Inc., as a small renewable energy producer. In October, 2012, the renewable energy contract with Progress Energy Carolinas was terminated, and in 2013 a new contract between Rocky River Hydro LLC (the current owner) and Duke

Energy Progress was established. The dam will continue to be operated as a hydroelectric facility until removal.

Land use directly adjacent to the Bank is predominantly undisturbed woodland, with areas of pasture and pine plantations (Figure 4). The entire Site impoundment is bordered by a mature riparian buffer that varies in width from 40 feet to over 200 feet.

Hoosier Dam and Reeves Lake are responsible for the loss of natural flow regime and shallow water habitat to approximately 22,425 linear feet of stream ecosystem (16,060 linear feet within the Rocky River and 6,365 linear feet of perennial tributaries).

3.2 Baseline Site Conditions

3.2.1 Existing Streams

Reeves Lake occurs within the main channel of Rocky River, and is a “run of the river” impoundment with water depths ranging from 6 feet up to approximately 25 feet. Near the dam site, the impounded reach of Rocky River contains the remnant floodplain which was cleared just prior to filling Reeves Lake. Farther upstream, the impoundment is restricted to the historic river channel. The six tributaries inundated by Reeves Lake have widths that range from 10 to 20 feet, with varying depths that are dependent upon the relationship between the channel thalweg and the elevation of the dam crest. The stream beds of the tributaries just upstream of the limits of Reeves Lake consist primarily of boulder, cobble, and gravel substrate with shallow riffles. No headcuts were noted during a visual assessment of these reaches.

Wildlands will complete a geomorphic assessment and a determination of perennial versus intermittent flow for each of the tributaries, and provide copies of the completed data sheets in the Mitigation Plan. The potential need for restoration or stabilization measures of these tributaries following the draining of the impoundment and removal of the dam will be assessed and discussed in the Mitigation Plan.

3.2.2 Wetlands

Bank Sponsor will perform a jurisdictional determination of wetlands adjacent to the Rocky River and on each tributary affected by the impounded water. The primary source of hydrology will be identified for each wetland area, potential acreage loss and/or change in wetland type and function will be assessed, and mitigation measures will be considered based on this information. This information will be provided in the Mitigation Plan.

3.2.3 Soils

Several borings were taken adjacent to the left and right abutments as part of the geotechnical investigation. These borings were performed to evaluate subsurface conditions for the removal of the dam facility and for stabilization of the river bank. Based on the borings and our field observations, the right bank adjacent to the powerhouse consists of shallow residual soils underlain by rock. The left bank adjacent to the dam consists of a fill layer, 18 to 28-feet-deep, underlain by a shallow transition zone and then rock.

According to the NRCS Soil Survey for Chatham County (Figure 6), the riparian soils further upstream along the Rocky River consists primarily of silty clay loam (BaE and NaD), with smaller occurrences of sandy loam (PeB and PsB), silty clay loam (CkC), and silty loam (GoE). None of these soil types are characterized as hydric.

3.2.4 Existing Riparian Buffer Vegetation

Except for a small area cleared at the dam site, the existing riparian buffer along the Rocky River is completely forested around Reeves Lake, with buffer widths that range from approximately 75 feet to

well over 300 feet. At this time, the Bank Sponsor has purchased and protected approximately 35% of the riparian buffer along the Rocky River within the bank limits (See Figures 5a through 5d). The banks of the river are forested with riparian vegetation typical of the region, such as river birch (*Betula nigra*), box elder (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), shagbark and bitternut hickory (*Carya spp.*), and swamp chestnut, cherrybark, and willow oaks (*Quercus spp.*). Several pine plantations and pasture areas have encroached within 100 feet of the riverbank; otherwise, the riparian forest is largely intact for 100 feet or more on both riverbanks.

Except for Tributary 4, the banks of the six perennial tributaries are also forested with riparian vegetation typical of the region, such as river birch, box elder, green ash, sycamore, shagbark and bitternut hickory, and swamp chestnut, cherrybark, and willow oaks. At this time, the Bank Sponsor has purchased and protected 100% of the riparian buffer along Tributaries 3 and 4, and approximately 33% of the riparian buffer along Tributary 2 (See Figures 5a through 5d). Most of the riparian corridor along Tributary 4 has been cleared with only a narrow row of trees along the top of bank. The parcel that contains Tributary 4 is now under the ownership of the Bank Sponsor, which will allow the riparian buffer to be restored with native vegetation as part of the Mitigation Plan. The Bank Sponsor will continue to pursue opportunities to purchase or protect the intact riparian buffers along Tributaries 1, 5, and 6.

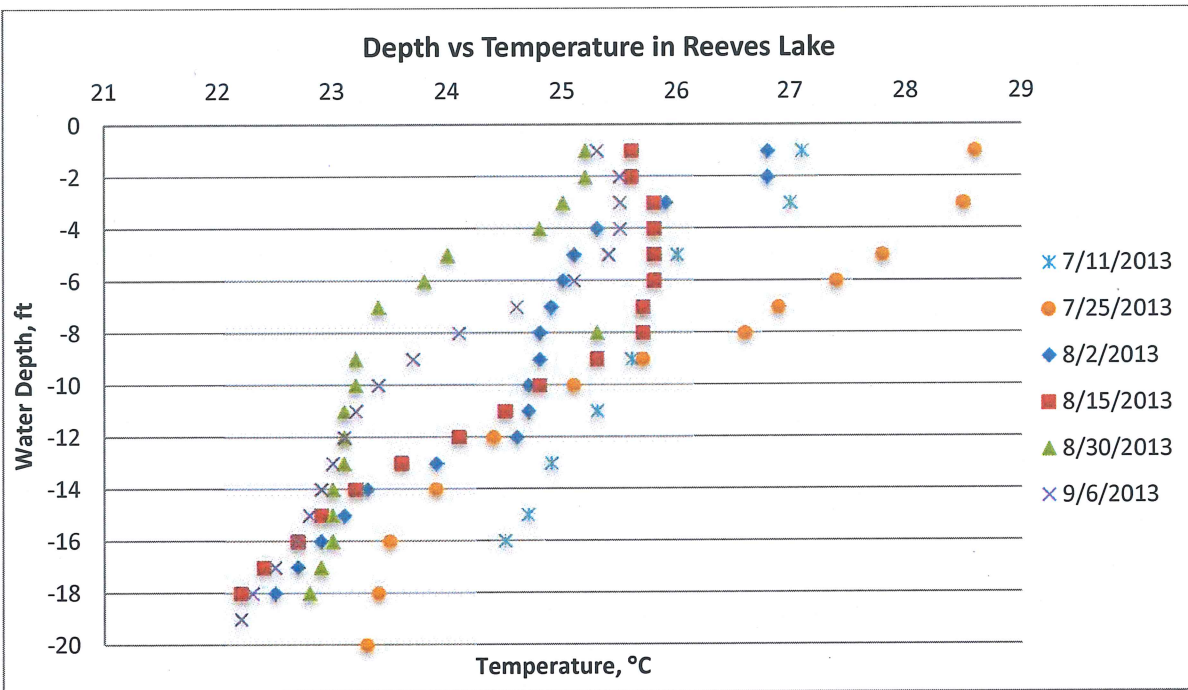
3.2.5 Water Quality

Local water quality data within this reach of the Rocky River is not available from federal or state agencies. Therefore, Wildlands performed an initial assessment of water quality in Reeves Lake and in the Rocky River upstream and downstream of the Hoosier Dam between July 15, 2013 and September 6, 2013. This initial assessment of water quality was focused on establishing a better understanding of (1) the baseline water quality in the Rocky River and Reeves Lake, and (2) the extent that Reeves Lake may be acting as either a source or a sink for pollutants, primarily sediment and nutrients.

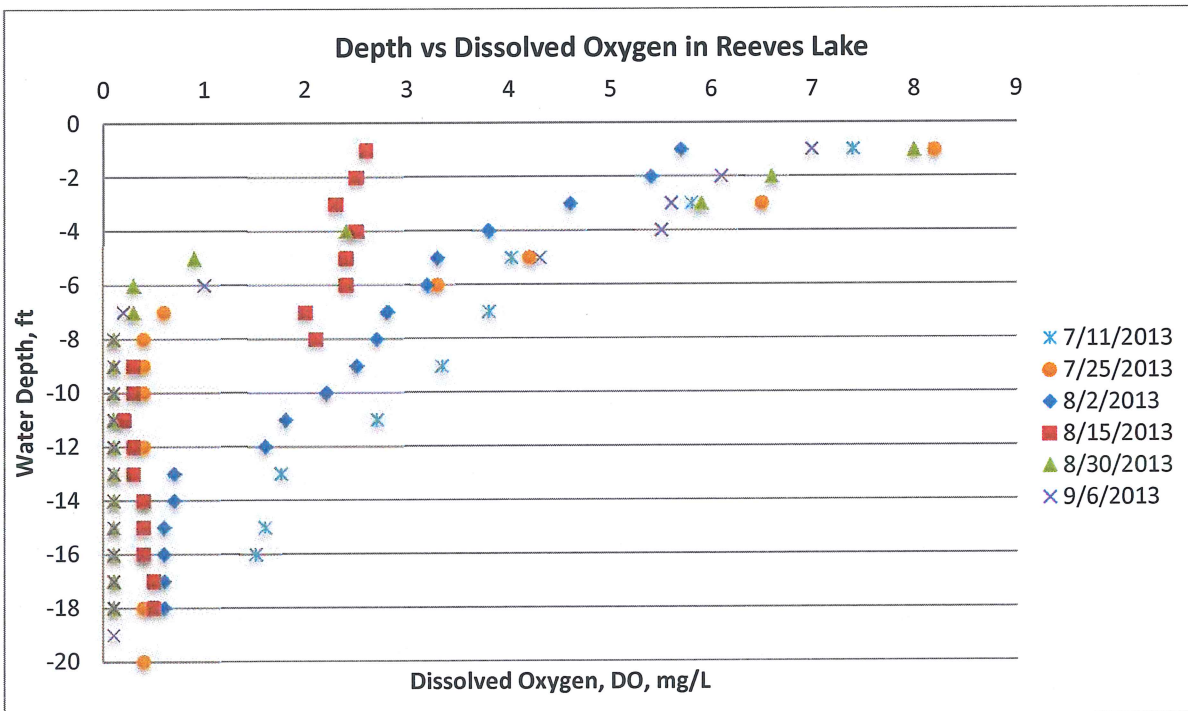
Baseline Water Quality

On six dates during the summer of 2013 (7/11/2013, 7/25/2013, 8/2/2013, 8/15/2013, 8/30/2013, 9/6/2013), temperature and dissolved oxygen (DO) profiles were measured in Reeves Lake. Each variable was measured for every foot of depth at a location approximately 100 feet upstream of Hoosier Dam. Such profiles give an indication of the extent of thermal stratification that occurs in Reeves Lake, and the effect it has on aquatic life that can be supported in the impoundment.

The temperature profiles plotted on the graph below show temperatures ranging from 26.8 °C at the surface to 22.2 °C at a depth of 19 ft. In a study of the Cape Fear shiner by Hewitt et al. (2006), the habitats with the best survivability and growth rate had temperatures ranging from 26.4°C to 28.1°C. This range was only achieved on three sampling dates and only within the top four feet of lake depth.



The DO profiles plotted on the graph below show a dramatic decrease in DO concentrations in the first six feet of depth, typically dropping from 5 to 8 mg/L near the surface to below 1 mg/L near the bottom. All samples fall below 5 mg/L within the first four feet of depth. The aforementioned study by Hewitt et al. (2006) indicated the best habitat for Cape Fear shiner has a DO range from 5.8-12.5 mg/L.



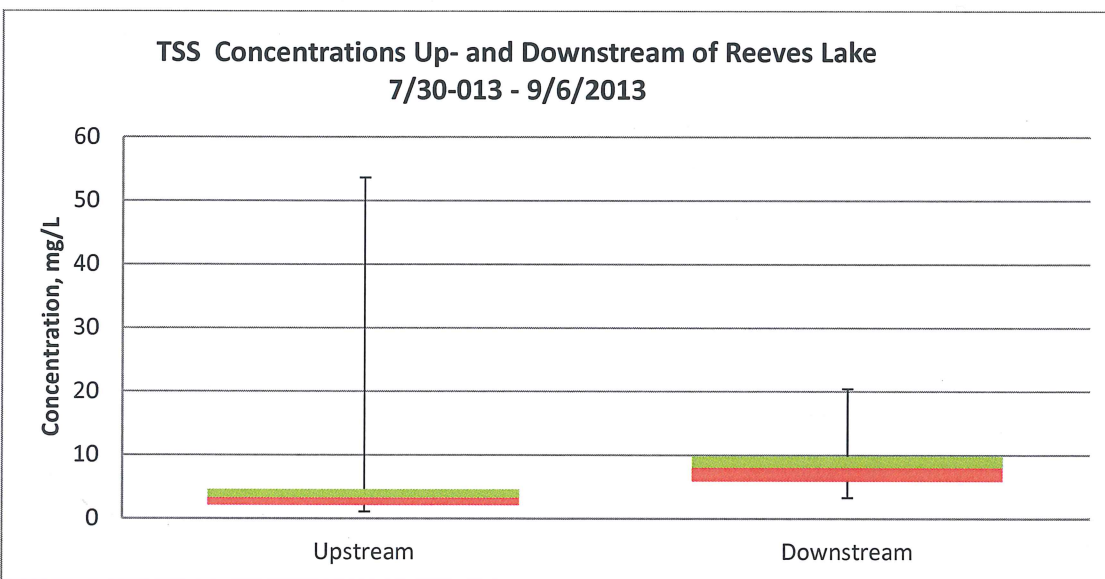
This temperature and DO data indicate that suitable water quality for the Cape Fear shiner and many other aquatic species may only exist in the top four feet of the water column in the impoundment; however, the shallow water habitat preferred by the Cape Fear shiner does not exist there. Additionally, the DO is below 1 mg/l for the majority of the water column (6ft-19ft), which isn't conducive to supporting most aquatic life.

Effect of Reeves Lake

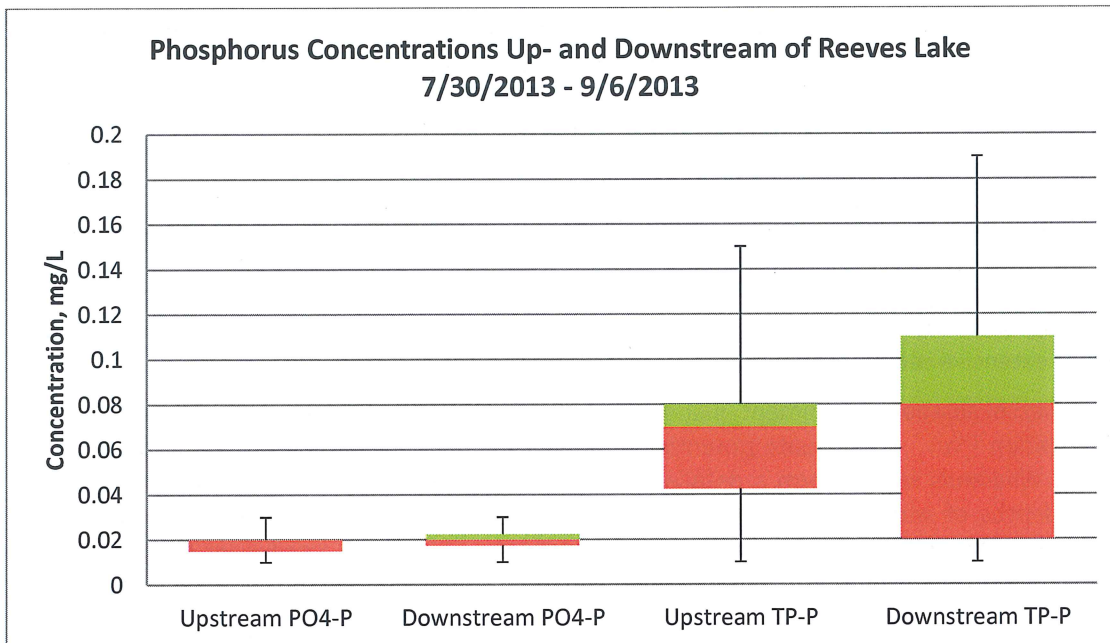
To develop a better understanding of the effect Reeves Lake may have on the water quality of the Rocky River and downstream water bodies, two ISCO Brand water samplers were installed: (1) the Upstream Station is located upstream of the impoundment approximately 350 feet east of the bridge at Pittsboro Goldston Rd, and (2) the Downstream Station is located approximately 350 ft downstream of Hoosier Dam. The two ISCO samplers collected a water sample every four hours, four days a week between July 15, 2013 and September 6, 2013. A total of 72 water quality samples collected at each station were tested for Total Suspended Solids (TSS), Nitrate (NO_3^-), Ammonium (NH_4^+), Total Kjeldahl Nitrogen (TKN), Phosphate (PO_4^{2-}), Total Phosphorus (TP) and Total Dissolved Nitrogen (TDN).

All data from samples were separated into two groups by station (Upstream or Downstream) for analysis. The data populations were then analyzed using a 2-tailed T-test to determine if they were significantly different from one another ($p < 0.05$, $n=72$).

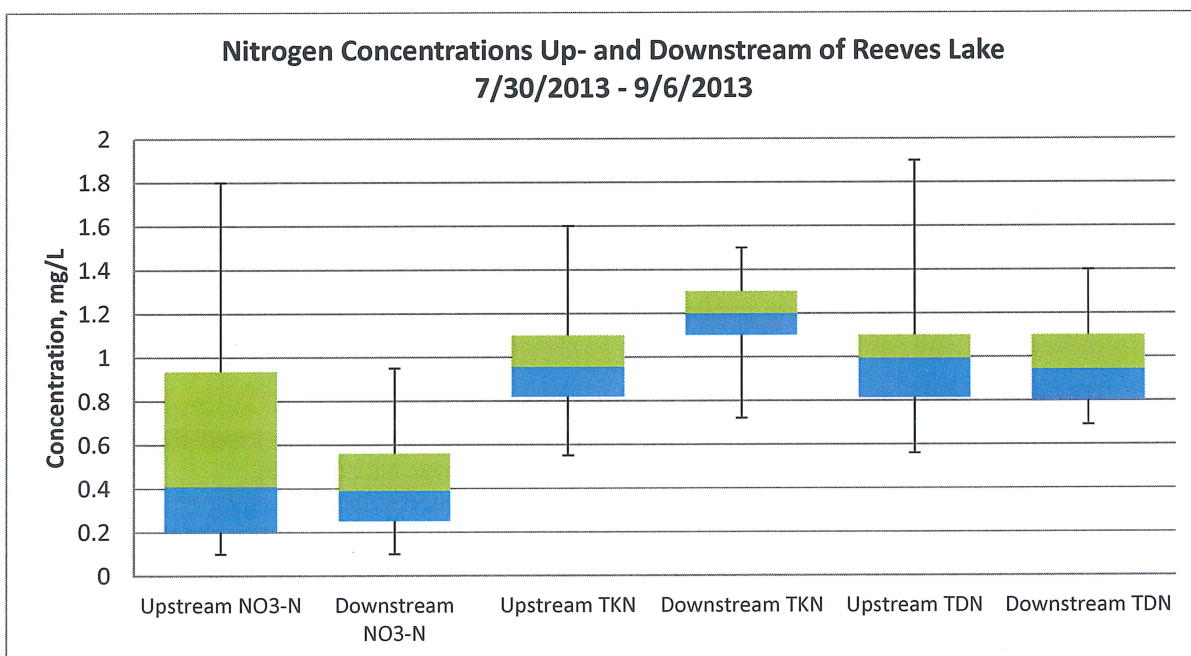
For TSS, results of the T-test indicated a significant difference between the two stations, with the Downstream Station having a higher average concentration (8.3 mg/L) than the Upstream Station (4.6 mg/L) ($p= 4.7 \times 10^{-6}$). This may be due to turbulence at the dam causing re-suspension of settled sediment and other particulates.



For phosphorus, a less distinct difference was found between the Upstream and Downstream Stations. While PO_4^{2-} did not vary significantly between the two stations, TP had slightly higher average concentrations downstream (0.08 mg/L) than upstream (0.06 mg/L) ($p=5.5 \times 10^{-7}$). Since TP mainly occurs in particulate form in lotic ecosystems, it is not surprising that this would correlate with the results for TSS.



Several species of nitrogen were also sampled and evaluated. The aqueous forms of Nitrogen (NO_3^- and TDN) were higher upstream of the impoundment ($\text{NO}_3^- = 0.58 \text{ mg/L}$, $p=0.011$ and $\text{TDN} = 1.02 \text{ mg/L}$, $p=0.034$) than downstream of the impoundment ($\text{NO}_3^- = 0.42 \text{ mg/L}$, $\text{TDN} = 0.96 \text{ mg/L}$). This is likely due to the amount of phytoplankton in summer using NO_3^- for energy production when there is a lack of oxygen. However, the overall nitrogen levels (TKN) were greater downstream (1.17 mg/L , $p=1.6 \times 10^{-12}$) than upstream (0.98 mg/L).



Preliminary results from this water quality study indicate that Reeves Lake is acting more as a source for nutrients and TSS rather than as a sink for these water quality parameters. High inputs from tributaries and biogeochemical interactions within the impoundment itself could be the cause; however without a more detailed study it cannot be determined at this time.

3.2.6 Sediment Characterization and Management

Wildlands performed an initial survey of sediment quantity in July 2013. Water depths over 22 feet were found along the historic alignment of the Rocky River for a distance of approximately 1500 feet upstream of the Hoosier Dam. Depths ranging from 15 feet to less than 3 feet were found across the historic floodplain of the river within the existing impoundment. This preliminary data appears to indicate that extensive sedimentation above Hoosier Dam has not occurred.

A more detailed evaluation of sediment quantity and quality above the Hoosier Dam will be completed for the Mitigation Plan. To evaluate potential negative effects of the sediment captured within the Rocky River, Wildlands will perform a detailed bathymetric survey of Reeves Lake to determine the extent and depths of sediment buildup upstream of the dam in order to estimate the quantity of sediment likely to be mobilized upon dam removal. Wildlands will perform a sediment characterization to estimate the portion of fines vs. coarse-grained sediment. Wildlands will also engage staff with the U.S. Fish and Wildlife Service (USFWS) to develop a Tier 1 review of the extent, quality, and potential risks associated with the sediment contained within Reeves Lake. If the Tier 1 finds that further information is needed, a Tier 2 analysis (toxicity testing) will be performed. This information (mobile sediment load, sediment characterization, estimates of background sediment load, and findings of the Tier 1), and the sensitivity of downstream aquatic communities, will inform the Draft Sediment Management Plan that will be submitted to the IRT for approval. The Sediment Management Plan will be developed such that the risk of short-term impacts to sensitive aquatic communities downstream is minimized, and long-term impacts are avoided altogether.

3.2.7 FERC License

The hydroelectric facility at Hoosier Dam contains three small turbines that are operated by Rocky River Hydro LLC, as a small renewable energy producer under contract to Duke Energy Progress. Due to its low generating capacity (approximately 230 kW), the hydroelectric facility was issued Exemption #3586 to the Federal Energy Regulatory Commission licensing process on December 16, 1981.

The Bank Sponsor will surrender the Exemption #3586 to the FERC License in compliance with FERC Regulation 4.102. The petition to surrender the exemption will include a report that provides the reason for surrendering the exemption, a description of how the dam, spillway, and hydropower facility will be disposed, and a plan and schedule outlining the procedures proposed for removal and restoration of the dam site to assure public and environmental safety. During this process, the Bank Sponsor will consult with fish and wildlife agencies on restoration of the dam site and adjacent lands.

3.2.8 Threatened and Endangered Species

Consultation with USFWS and a search of the USFWS database for federally listed threatened and endangered species identified four listed species in Chatham County, NC (Table 2).

**Table 2. Federally Listed Threatened and Endangered Species
in Chatham County, NC**

Species	Federal Status ¹	County
Vertebrate		
Cape Fear shiner (<i>Notropis mekistocholas</i>)	E	Chatham
Red-Cockaded woodpecker (<i>Picoides borealis</i>)	E	Chatham
Vascular Plant		
American chaffseed (<i>Schwalbea americana</i>)	E	Chatham
Michaux's sumac (<i>Rhus michauxii</i>)	E	Chatham
¹ E = Endangered		

As described previously, the Bank site lies between two critical habitat areas for the Cape Fear shiner, a federally-listed endangered species that only occurs only in North Carolina. Critical habitat areas #1 and #2 described previously are separated only by Hoosier Dam and Reeves Lake. These isolated populations and the limited critical habitat areas put the Cape Fear shiner at serious risk for long-term survival. Since this project may affect the Cape Fear shiner, consultation with the USFWS under Section 7 of the Endangered Species Act will likely be required.

Wildlands will coordinate with the USFWS and the USACE during the initial informal consultation process on issues related to the Cape Fear shiner populations upstream and downstream of Hoosier Dam, and conduct a site review to determine if habitat conditions are conducive for the other listed species. If formal consultation under Section 7 is required, Wildlands will prepare a biological assessment (BA) at the appropriate time. All surveys for rare, threatened, and endangered species will be conducted by personnel qualified and permitted to identify those species.

3.2.9 Cultural Resources

A preliminary search of the North Carolina State Historic Preservation Office for cultural and historic resources indicated there are no known National Register Properties or previous archaeological survey sites within the Bank site. It is anticipated that a Phase I Cultural Survey will be required to ensure no impact to cultural or historic resources, and to coordinate the removal of the dam and hydropower facility.

4.0 Mitigation Work Plan

As described previously in Section 2.4.2, draining Reeves Lake, removing Hoosier Dam, and restoring the Rocky River and its tributaries are proposed to occur through a staged approach:

- Phase I – Dewatering Reeves Lake and Sediment Management
- Phase II – Initial Dam Removal and River Bank Stabilization
- Phase III - Final Dam Removal and River Restoration
- Phase IV – Additional Buffer Preservation and Restoration

The overall Mitigation Work Plan will guide the activities during each of these phases, and will consist of the following components to ensure the Bank will meet its goals while minimizing potential disturbances to water quality or aquatic life, with a special emphasis to protect the remaining populations of the Cape Fear shiner:

Dam Demolition and Dewatering Work Plan: Wildlands has partnered with Schnabel to prepare the Dam Demolition and Dewatering Work Plan based on the results of the geotechnical investigation and structural analysis of the existing dam. The Dam Demolition and Dewatering Plan will be designed to ensure that the demolition of Hoosier Dam and the initial dewatering of Reeves Lake occurs in a manner that minimizes water quality and ecological impacts to downstream water bodies and aquatic communities while maintaining instream flows.

Sediment Management Plan: Wildlands will develop the Sediment Removal Management Plan for the Rocky River and its tributaries based on the results of the detailed bathymetric survey, sediment characterization, and the Tier 1 sediment assessment. The measures and procedures in this plan will be implemented prior to initial dewatering of Reeves Lake and continue throughout the project implementation and monitoring period.

River Restoration Plans: Wildlands will prepare the construction documents and technical specifications for restoration of the newly exposed river banks and shallow water habitat that is appropriate for this reach of the Rocky River. The plans will also contain any restoration or stabilization measures necessary to protect or restore the tributaries once Reeves Lake is drained.

Wooded Buffer Restoration Plans: Wildlands will prepare restoration plans for cleared buffers within the bank limits that will contain the plant materials list, specifications for the plant material, and planting details.

Monitoring Plan: Wildlands will prepare a monitoring plan for the Bank, which will include pre- and post-removal monitoring to document the geomorphic, water quality, and biological conditions at the Bank site. The monitoring plan will contain the following components and continue for 7 years after construction activities are completed:

- Water quality monitoring focused on temperature, dissolved oxygen, and chlorophyll a
- Aquatic surveys (e.g., fish, mussel, and benthic macroinvertebrates) to document the pre-removal and post-removal aquatic communities within the Bank, above the impoundment, and below the dam, with an emphasis on showing a shift from lentic to lotic communities
- Geomorphic surveys of the six tributaries to the Rocky River

Each of these components of the overall Mitigation Work Plan will be submitted to the IRT for review and approval prior to the start of construction activities.

5.0 Determination of Mitigation Credits

Guidance for determining mitigation credits for dam removal projects was initially provided in the document *Determining Appropriate Compensatory Mitigation Credit for Dam Removal Projects in North Carolina*, which was developed cooperatively by the U.S. Army Corps of Engineers, Wilmington District, the U.S. Environmental Protection Agency, Region 4, the U.S. Fish and Wildlife Service, the N.C. Division of Water Quality, the N.C. Wildlife Resources Commission, and the N.C. Division of Water Resources in June, 2008. This guidance document has since been withdrawn, however its principles have been applied to generate the proposed stream mitigation units described below.

The upstream limits of the impounding effect of the Hoosier Dam on Rocky River and six perennial tributaries were initially estimated based on the water level of Reeves Lake and LIDAR data for the tributaries. The upper limits of these inundated areas were visited, photographed, and field verified using hand-held global positioning system equipment (Figure 5). The final lengths for the Rocky River and each of the six tributaries will be confirmed by a topographic survey of the limits of the impounded area. A summary of the proposed credits is provided in Table 3.

**Table 3. Proposed Stream Mitigation Units
Hoosier Dam Mitigation Bank**

Mitigation Criteria		Length (LF)	Credit Ratio or Factor	Stream Mitigation Units (SMU)
I.(A) – Credit for improving the water quality of Rocky River, its tributaries, and downstream water bodies	Rocky River	16,060	1:1	16,060
	Tributary 1	680	1:1	680
	Tributary 2	1,345	1:1	1,345
	Tributary 3	1,130	1:1	1,130
	Tributary 4	1,375	1:1	1,375
	Tributary 5	1,230	1:1	1,230
	Tributary 6	605	1:1	605
Subtotal				22,425
I.(C) – Credit for Rare, Endangered, and Threatened Species	Restoration of habitat	True	1.0	0
	Recolonization of associated species	True	1.0	0
	Recolonization of targeted species	True	1.0	0
Subtotal				0
II.(B) – Wooded Buffers Protected	Rocky River	36%	0.95	845
	Tributary 1	0%	1.0	0
	Tributary 2	16%	1.0	0
	Tributary 3	100%	0.75	377
	Tributary 4	87%	0.75	458
	Tributary 5	0%	1.0	0
	Tributary 6	0%	1.0	0
Subtotal				1,680
Total SMUs				24,105

The credits listed above for the tributaries 1, 2, 5, and 6 will only be generated if the Bank Sponsor is able to protect and preserve a minimum 50 foot wide wooded buffer along both sides of the stream for at least 50% of the length.

Based on initial comments from the IRT, generation of stream mitigation credits for water quality improvements and restoration of rare, threatened, and endangered species for the Rocky River and the six perennial tributaries will not exceed a ratio of 1:1. The bank sponsor proposes to preserve riparian buffers along a significant portion of the mainstem of Rocky River and its tributaries. This approach to preserving buffers along the mainstem has not been undertaken on any previously approved dam removal mitigation projects. For this reason, we propose to generate credit above the base 1:1 ratio following the methodology in the rescinded dam removal guidance. The final number of stream mitigation units generated by the Bank will be based on coordination and approval by the IRT. Given the above credit ratios, factors for dam removal, and restoration of habitat for the Cape Fear shiner, a federally protected aquatic species, an estimated 24,105 stream mitigation units will be available from the establishment of the Bank.

Use of credits from the Bank to offset stream impacts authorized by federal permits or state water quality certifications must be in compliance with the Clean Water Act, Section 404 (b)(1) guidelines and other applicable state and federal legislation, regulations, and policies. Prior to the release of credits, the following requirements will be met:

1. IRT approval of the final Mitigation Plan;

2. Execution of the banking instrument;
3. Recordation of the conservation easements; and
4. Establishment of appropriate financial assurances.

The credit release schedule shown below in Table 4 is in compliance with the Monitoring Requirements and Performance Standards for Compensatory Mitigation in North Carolina, February 9, 2013.

**Table 4. Credit Release Schedule
Hoosier Dam Mitigation Bank**

Task	<i>Percentage of Credits Released</i>
Site Establishment – Execution of MBI, approval of final Mitigation Plan, delivery of Financial Assurances, recordation of Conservation Easement, 404 permit	15%
Construction Phase Complete – All initial physical and biological improvements made pursuant to the Mitigation Plan	15%
Year 1 Monitoring	10%
Year 2 Monitoring	20%
Year 3 Monitoring	10%
Year 4 Monitoring	5%
Year 5 Monitoring	10%
Year 6 Monitoring	5%
Year 7 Monitoring	10%

6.0 Maintenance and Long-term Sustainability

6.1 Maintenance

Adaptive measures will be developed or appropriate remedial actions will be implemented in the event that the site or a specific component of the site fails to achieve the success criteria outlined in the final Banking Instrument. The project-specific monitoring plan developed during the design phase will identify an appropriate threshold for maintenance intervention based on the monitored items. Any actions implemented will be designed to achieve the success criteria which will be specified in the Banking Instrument, and will include a work schedule and updated monitoring criteria.

6.2 Long Term Management Provisions

The Bank Sponsor will institute a Long Term Management Plan responsible for assessing the condition of the mitigation site and implementing maintenance provisions to maintain performance of the site. The proposed conservation easement will help to ensure that only IRT-allowable activities take place and will be transferred to an IRT approved non-profit organization once monitoring success criteria have been achieved.

To monitor the project's continued success, the Long Term Management Plan will be implemented following the seven-year monitoring period. Key restoration and stabilization measures will be inspected annually or less frequently as needed to ensure that the project remains stable. Sources of instability or other deficiencies will be addressed. Invasive plant and aquatic species will be managed annually or less frequently as needed to ensure the long term survivability of the planned communities. All reporting will be documented and kept on file for future reference.

7.0 References

- Hewitt, Amanda H. et al. 2006. Influence of Water Quality and Associated Contaminants on Survival and Growth of the Endangered Cape Fear shiner (*Notropis Mekistocholas*). *Environmental Toxicology and Chemistry*. 25:9. pp. 2388-2298.
- United States Department of Agriculture (USDA), 2006. Natural Resources Conservation Service, Soil Survey of Chatham County, North Carolina.

FIGURES