Felsenthal and Upper Ouachita National Wildlife Refuges
Water Quality Monitoring Research Funding Proposal

Affected Environments

The 65,000-acre Felsenthal National Wildlife Refuge (NWR) is located in southeastern Arkansas 5 miles west of the town of Crossett, Arkansas and 35 miles east of El Dorado, Arkansas. Felsenthal NWR is bisected by the Ouachita and Saline Rivers and contains a 15,000-acre reservoir created by the US Army Corps of Engineers Felsenthal Lock and Dam. Additional aquatic resources within the refuge include a vast network of sloughs, bayous, lakes, and up to 40,000 acres of seasonally-flooded bottomland hardwood forest. These wetlands provide critical high-quality wintering habitats for migratory waterfowl, wintering/nesting bald eagles, and numerous trust wildlife species. Felsenthal NWRs wetlands also provide a highly-productive fishery and the area is considered to be the most used outdoor recreation area in southern Arkansas. Public use on Felsenthal NWR was nearly 300,000 visits in 2011. The estimated value of recreational visits to Felsenthal NWR in 2011 was greater than $10 million.

The 47,000-acre Upper Ouachita NWR is located in northeastern Louisiana with its northern boundary on the Arkansas-Louisiana state line. Upper Ouachita NWR is bisected by 13.7 miles of the Ouachita River and is approximately 3 miles south of Felsenthal NWR. Upper Ouachita NWR supports high concentrations of wintering waterfowl, geese, wading birds, raptors, and a small population of nesting bald eagles. Wetland habitats dominate the refuge and include nearly 20,000 acres seasonally-flooded bottomland hardwoods, over 9,000 acres of reforested bottomland hardwoods, 1,182 acres of moist-soil impoundments, and 2,910 acres of open water.

Background

A 26-mile pipeline is being constructed to discharge wastewater from the city of El Dorado's Water Utilities (2 sewage treatment facilities), El Dorado Chemical Company, Lion Oil Company, and the Chemtura Chemical Company into the Ouachita River 25 miles upstream from the Felsenthal NWR. As of November 2012, the pipeline was 60% complete and is expected to be complete by July 2013.
The city of El Dorado's 2 sewage treatment plants as well as El Dorado Chemical Company cannot meet current National Pollutant Discharge Elimination System (NPDES) (Clean Water Act) guidelines for the small streams into which they have historically discharged. The other 2 pipeline partners, Lion Oil Refinery and Chemtura Chemical Company have had NPDES discharge issues in the past with Total Dissolved Solids and high temperatures of discharges, respectively. The 2 latter companies' discharge essentially consists of cooling tower water. It seems that their motivation for joining the pipeline partnership is to be good corporate citizens as well as to avoid future NPDES issues associated with evolving environmental laws. It is their discharge that provides dilution for the other 2 entities to be able to go into the proposed pipeline.

The discharges from El Dorado Water Utilities south sewage treatment, Lion Oil Refinery, and Chemtura Chemical Company currently flow into Bayou de Loutre, a stream that empties into the Ouachita River south of Sterlington, LA, some 60 miles southeast of El Dorado, and several miles downstream of

Felsenthal Lock and Dam. This stream is a swampy, wetland system that has the capacity to filter and/or assimilate much of the nutrient output from the aforementioned discharges before entering the Ouachita River.

The effluents from El Dorado Water Utilities north treatment plant and El Dorado Chemical Company drain into Flat Creek, then through a system of small streams and swamps before entering Smackover Creek, and then the Ouachita River, approximately 11 river-miles upstream of Thatcher (Calion) Lock and Dam. These small streams and swamps also have the potential to filter and/or assimilate nutrients from wastewater discharges before entering the Ouachita River.

The pipeline will combine all of the discharges mentioned above into one discharge point directly into the Ouachita River, approximately 25 miles upstream of the boundary of Felsenthal NWR and then into the Upper Ouachita NWR. Other public resources at risk from the pipeline's effluent include the Arkansas Game and Fish Commission's Beryl Anthony Wildlife Management Area and Arkansas State Park's Moro Bay State Park. This change in discharge location will bypass wetlands that have traditionally filtered out at least some of the nutrients from these effluents. The pipeline will also divert a significant amount of effluent that has traditionally entered the Ouachita River downstream of our refuges to a point upstream of both refuges. With this alteration in discharge locations for these entities, additional organic nutrients (phosphorus and nitrates) will enter Felsenthal and Upper Ouachita NWRs and may contribute to ecosystem degradation.

The current pipeline permit allows for a discharge of 20 million gallons per day of effluent from the 4 entities combined. The permitted limit for phosphorus would allow 60,882 lbs. per year to be added to the Ouachita River (based on monthly averages, not maximums). The permitted limit for ammonia nitrogen would allow 831,962.75 lbs. per year to be emptied into the river at the discharge point (again based on monthly averages). The permit does not limit discharges of other forms of nitrogen besides ammonia.

Commonly, the 15,000-acre permanent pool of Felsenthal Reservoir is approximately 20-40% covered in aquatic vegetation by mid-summer. Arkansas Game and Fish Commission sampling data shows that in areas captured by aquatic vegetation, fish standing crops are virtually non-existent. There are a number of examples in the scientific literature, as well as a number of aquatic plant ecology experts who are on record stating that a net addition of nutrients to a system with aquatic vegetation is likely to promote additional growth and possibly expand the coverage of aquatic plants. We believe that this potential exists on Felsenthal NWR.

Because of high quantities of aquatic vegetation, as well as the general morphology of the Felsenthal reservoir, fish die-offs occur in backwater areas of this reservoir every summer due to low dissolved oxygen level. The low dissolved oxygen levels can also be attributed to the overall fertility of this system. During periods of low-flow, the stagnant backwater areas develop algae blooms, and the resulting die-offs coupled with the oxygen demand of aquatic plants during nighttime hours lead to these low dissolved oxygen levels. The most common fish species in these die-offs include largemouth

bass, crappie, bluegill, redear sunfish, and drum. We believe that a net addition of nutrients to this system has the potential to increase the fertility of these backwater areas, which could lead to more extensive fish die-offs during summer, low-flow periods. We believe that the moderate fish die-offs that presently occur have little to no population level effects, but that more extensive die-offs could affect fish population abundances in this reservoir.

Goals and Objectives

Our goal is to protect the aquatic habitats within Felsenthal and Upper Oauchita National Wildlife Refuges in the face of newly-emerging threats to those habitats. Our initial objective is to collect baseline, site-specific water quality data within Felsenthal and Upper Oauchita National Wildlife Refuges including, but not limited to, measures of eutrophication (chlorophyll, total algae, PH, temperature, DO). We hope to collect this baseline data during spring-summer 2013, prior to implementation of the pipeline. Our next objective is to continue water quality sampling on our refuges to document changes in our baseline parameters after implementation of the pipeline. If we document eutrophication or degradation of our aquatic habitats through pipeline effluent, then we will work towards curtailing these negative effects on our aquatic system.

Proposed Action

Years of legal action to stop the implementation of the pipeline have failed and the use of the pipeline is expected to occur by late summer/early fall 2013. Baseline water quality data does not exist for Felsenthal or Upper Ouachita NWRs. In the absence of these data, it is impossible to address the impacts that eutrophication and added contaminants may have on the system.

We propose to implement a water quality monitoring effort within Felsenthal and Upper Ouachita NWRs. To determine the amount of eutrophication over time, we propose to monitor chlorophyll-*a*. Chlorophyll is the pigment that allows plants (including algae) to use sunlight to convert simple molecules into organic compounds through photosynthesis. Of the several kinds of chlorophyll, Chlorophyll-*a* is the predominant type found in green plants and algae. Measuring chlorophyll-*a* concentrations in water is a surrogate for actually measuring algae biomass, which is far more expensive and time consuming. A certain amount of algae is naturally present in all healthy aquatic systems. By measuring chlorophyll-*a*, we would determine the amount of food available to fuel the aquatic system's food web. Too little chlorophyll-*a* indicates that there may not be enough food to support an abundant biological community. On the other hand, too much chlorophyll-*a* indicates that nutrient levels in the lake may be artificially high (eutrophication).

We plan to monitor chlorophyll *a* during five sampling events over the summer/growing season (May through September) using a sampling technique that collects water throughout the lake's photic zone. The photic zone is the upper portion of the water column where sunlight penetrates and supports growth and reproduction of free-floating algae. The photic zone is commonly defined as twice the Secchi disk transparency measurement. Once the water sample is obtained, a known volume of water will be pushed through a filter disk, which collects the algal cells. The filter disk is frozen and delivered to a laboratory for analysis.

In addition to chlorophyll-*a* monitoring, analyses may include measurement of: total phosphorus, orthophosphate phosphorus, nitrate-nitrite, ammonia nitrogen, and TKN. Water temperature, pH, and secchi depth will be measured at each collection site. The suite of variables measured will be determined by financial considerations.

Cooperators/Partners

US Fish and Wildlife Service (Felsenthal and Upper Ouachita NWRs), Arkansas Game and Fish Commission – Fisheries Division (contact: Jason Olive), and Arkansas Department of Environmental Quality – Water Division (contact: Jim Wise)

Budget

Equipment	
EXO2 Sonde, 10 meter vented level depth, 6 Sensor Ports, 1 Wiper Port	$5,800.00
EXO Central Wiper, EXO2, Ti	$990.00
EXO Optical DO Sensor, Ti	$1,920.00
EXO ISE02 pH Sensor Assembly, Unguarded, Ti	$445.00
EXO Conductivity/Temperature Sensor, Ti	$780.00
EXO Turbidity Sensor, Ti	$1,760.00
EXO Total Algae - PC Sensor, Ti	$3,315.00
EXO fDOM Sensor	$2,070.00
pH 7 buffer, 1L	$18.00
pH 10 buffer, 1L	$18.00
1000 uS/cm Conductivity buffer, 1 L	$23.00
Turbidity Std. 100 NTU (6026), 123 NTU (6136), 1 Gallon	$300.00
Shipping (est.)	$60.00
In-kind match by ADEQ	
Lab analyses of Chlorophyll-*a* (6 samples once a month)	$0.00
TOTAL	**$17,499.00**

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