CONVERSION OF WASTEWATER PONDS FOR WETLAND MITIGATION

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Abstract. The Conceptual Wetland Mitigation Plan for Phase II expansion to the John J. Briscoe Reservoir (Briscoe Reservoir) near Monroe, Georgia uses innovative approaches to restoring palustrine wetland functions to existing lacustrine habitats. This paper presents strategies for the design of forested and scrub-shrub wetland habitats in former wastewater treatment ponds and wetland design approach and monitoring methodology. The plan includes a full compliment of mitigation techniques (i.e., wetland restoration, preservation, creation, and enhancement) to compensate for loss of wetland functions due to permanent inundation.

INTRODUCTION

The Briscoe Reservoir Mitigation Project will show that former wastewater treatment ponds can effectively be converted to palustrine forested and scrub/shrub wetland systems. Transformation of wastewater treatment ponds to palustrine wetland systems creates preferable ecological habitats and provides an improved environment for functions of water quality, flood abatement, and wildlife habitat (Mitsch and Gosselink, 1993). The mitigation proposed for habitat alterations associated with Phase II construction of the Briscoe Reservoir will achieve a forested and scrub/shrub wetland system capable of performing desirable wetland functions. Conversion of the deepwater habitat of the ponds to forested and scrub-shrub wetlands will be accomplished by draining the ponds, by restoring historical hydrologic flows to the system and by planting a vegetative community following a model developed in mature wetland systems along the Alcovy River. Minor engineering structures will be used to ensure proper hydrology is present for forested and scrub/shrub wetland development.

In addition, an original approach to determine the project success will be assessed by tree survival counts and by application of a modified approach to the Routine Determination as promulgated in the 1987 *Federal Manual.* The monitoring effort will determine percent tree survival, determine if extended periods of hydrology are being achieved, and assess whether a hydrophytic plant community is being recruited into the system by review of the ground cover stratum.

Phase I of the Briscoe Reservoir, located north of the City of Monroe, Georgia on Beaverdam Creek, was constructed in 1991 as a municipal water supply source for the City. Water supply demand in Walton County has been growing rapidly, and the existing reservoir is approaching its limits to meet water supply needs during drought periods. To meet the projected water supply requirements for this vigorous growth, Phase II construction of the Briscoe Reservoir is currently being designed and permitted. Phase II construction will complete a recommended water supply alternative for the City of Monroe, the City of Loganville, and much of unincorporated Walton County as developed in the Northeast Georgia Water Resources Management Study (ACOE, 1987) and updated in the Utilities Master Plan Study for Walton County (JJ&G, 1992).

Construction of Phase II of the Monroe Water, Light and Gas Commission's Briscoe Reservoir will alter 28.2 acres from palustrine wetland habitats to lacustrine wetland habitats. An additional 9 acres of palustrine habitat will receive increased levels of inundation, but should not entirely be converted to a permanent lacustrine habitat. Several mitigation concepts have been proposed to compensate for the alteration of palustrine habitat types. For the purposes of this paper, specifics associated with the use of wastewater treatment ponds, the design of a model forested wetland community, and the methods for monitoring to assess the progress of the mitigation project will be discussed. Although not discussed in this text, the project will also include wetland preservation along Beaverdam Creek, wetland restoration and enhancement along Wolf Creek and an unnamed tributary to Beaverdam Creek, and wetland creation adjacent to Double Springs Church Road.

The goal of providing acceptable compensation for inundated wetlands for the overall project will be accomplished by attaining the following objectives:

- Provide mitigation upstream of the reservoir to improve the water quality entering the reservoir from agricultural production lands.
- Provide mitigation within tributary systems to the Alcovy River to improve overall water quality and flood abatement in the river system.

- Create a hydrologic regime that would provide surface and subsurface hydrology at a frequency and duration conducive to wetland conditions in the restoration areas and to supplement the hydrologic periods in the enhancement areas.
- Revegetate the mitigation areas with native species that would produce a highly diversified forest capable of high mast yields for wildlife. Species composition and species diversity for revegetation of mitigation areas will be determined by studies conducted in mature forested wetland habitats along the Alcovy River.
- Develop an aesthetic planting scheme that will eliminate the 'row-effect' common to many wetland restoration efforts.

PROPOSED MITIGATION IN FORMER WASTEWATER TREATMENT PONDS (MOUNTAIN CREEK MITIGATION SITE)

Wastewater treatment ponds on Mountain Creek will be restored to forested wetland systems with areas of scrub/shrub wetlands, in an attempt to both reestablish the wetland hydrology and provide a constructive use for the closed ponds. The mitigation site currently exists as inactive wastewater treatment ponds for the City of Monroe. Through the construction of the ponds, the land was changed from an upland/riverine/palustrine system to a lacustrine system. The ponds no longer receive effluent from the city's wastewater treatment system. To first determine the potential suitability of the ponds for restoration as palustrine wetlands, it was critical to establish that potential contaminants would not threaten the wetlands or potential wildlife utilizing the wetlands. Accordingly, pond sediment samples were taken from 2 locations in each of the 3 ponds to test for contaminants within the benthic sediments. The samples were analyzed for the 10 metals listed under the EPA 503 regulations for agricultural application of wastewater sludges (i.e., sludges that could be applied to agriculture crops without potential contamination). Laboratory analysis demonstrated that all metals were either below the detection limits or below the limits established in the 503 regulation, with the exception of Molybdenum, which was just above the detection limit and not considered to be statistically significant.

Prior to mechanical manipulation of the site, much of the area probably would have supported a broad-leaved lowland forest. The wetland portions of the historical community would have followed Cowardin et. al. (1979) classification as a palustrine forested, broad-leaved deciduous wetland with a seasonally saturated hydrologic regime and a riverine, lower perennial, streambed with a cobble-gravel bottom. In their present state, the wastewater treatment ponds are classified as an artificially diked, lacustrine system. Vegetation in the system consists of algae within the deepwater habitats and herbaceous species around the edge of the system. Mountain Creek formerly flowed through the area; however, the creek was relocated to the east of the site when the ponds were constructed in 1964.

Two major soil series occurred on the Mountain Creek Mitigation Site. The most abundant soil was the Wehadkee silt loam, a group in the Wehadkee series of the Alluvial lands-Chewacla-Wehadkee association. This association is characterized by soils that are usually found in thick deposits along streams. The second and less abundant soil was the Louisa fine sandy loam in the Louisa series of the Lloyd-Davidson association. Louisa series are upland soils (15% to 45% slopes) that formed primarily from the weathering of mica schist and mica gneiss.

MOUNTAIN CREEK MITIGATION PLAN

Hydrologic analysis will model the expected frequency and duration of flood events at the Mountain Creek site for an average year. The analysis will predict the potential water surface elevations driven by given rainfall events.

Methods necessary to restore the hydrology of the mitigation site to historical levels will be determined following the hydrologic analysis of the site. The earth dams currently impounding water in the ponds will be either partially or completely removed. Thus, the flow of Mountain Creek will be returned through the ponds. A series of braided channels will be developed to allow movement of water throughout the site. A diffuser will be placed on the upper reach of the system to slow and evenly distribute the flow of water to the braided channels. The current man-made channel around the wetland will be retained for flood diversion to protect the wetland. Prior to releasing the water back to the original streambed of the creek on the lower end of the system, a small lacustrine system will be developed.

The mitigation will return the area to forested wetlands through most of the system, with scrub/shrub and emergent wetlands in the lower portion of the system. Emphasis will be placed on establishing a diverse community capable of high mast yields with species indigenous to forested wetlands in Walton County. Because Mountain Creek is impounded, an appropriate model of the vegetative species and species distribution will be determined from undisturbed wetland systems along the Alcovy River.

PROPOSED WETLAND COMMUNITY MODEL

Aerial photography and field surveys will identify undisturbed, mature forested wetland systems. Soil surveys will be used to determine if wetland study areas have soils similar to the mitigation areas. Similarities of the respective hydrologic regimes will be qualitatively assessed and correlated with expected hydrologic regimes of the mitigation site.

Each stratum will be assessed within five 0.1-acre circular plots. Data from the plots will reflect species density, dominance, and overall diversity. Tree and shrub spacing will be mapped to scale. Estimates of percent cover of herbaceous species will be taken; however, this data will only be useful in comparing percent cover in the final monitoring effort. This is because the ground cover vegetation will change in both species composition and percent cover due to increased sunlight, regardless of hydrologic regime.

From the field studies, a wetland community model will be derived for both the Mountain Creek and the Wolf Creek Mitigation Sites. Vegetation identified during the development of the model community will be planted in similar densities throughout the restoration and enhancement areas of the site. Both tree species and shrub species will be planted to accelerate the development of the wetland mitigation project.

Trees used to revegetate the mitigation site will be in the range of 3 to 5 years growth. Planting older trees should provide for a better survivability rate because of less competition from herbaceous species and less harm from predation. Tree and shrub saplings will be planted following densities in the wetland community model.

After the ponds are drained, hydric soils from current wetland habitats within the proposed Phase II reservoir will be spread across the Mountain Creek Mitigation Site to accelerate the development of microbial activity and to provide a hydrophytic vegetation seed source. The site will be planted with a ground cover capable of colonizing the mitigation site prior to hydrologic modifications. The goal of the cover would be to retard the growth of invasive herbaceous and woody species. Planting of the ground cover should not cause a loss of planted trees and shrubs through competition of soil nutrients or sunlight. A detailed tree species list will be developed following field studies and submitted to the ACOE for approval.

When developing the wetland community model, a concerted attempt will be made to ensure that species are planted within appropriate hydrologic regimes. The *Biodiversity of the Southeastern United States: Lowland Terrestrial Communities* (Shartz, et. al., 1992) will be used to determine if a species would exist as a dominant or associate species in a given hydrologic regime. Shartz, et. al., describe various vegetative communities that occur at varying durations and frequencies of inundation in the Southeast.

PROPOSED MITIGATION MONITORING PLAN

Mitigation monitoring will begin the following spring after completing the fall plantings, and will include both hydrologic and vegetation monitoring. This straightforward monitoring plan will both assess the success of the planted tree species and determine the overall success of the mitigation effort by analysis of the natural revegetated ground cover stratum. This approach will effectively establish whether or not a wetland habitat is being achieved for the duration of the monitoring period.

Monthly monitoring of both surface and subsurface water on the mitigation site will be necessary to insure that proper hydrology has been restored to the site. Surface water will be measured by a gaging station, and subsurface water will be monitored by a series of piezometers. Data retrieved from these instruments will be analyzed to determine if adjustments need to be made in the water retention system.

Both qualitative and quantitative sampling will be used to determine the level of success for the Mountain Creek mitigation project. Qualitative evaluations will be conducted quarterly for the initial two years after completion of hydrologic modifications and replanting of vegetation. Beginning the third season, qualitative assessments will be conducted in the spring following leaf development and again in the fall, concurrent with the quantitative monitoring period. The spring and fall qualitative monitoring will continue through the 5th year.

Quantitative sampling will consist of randomly establishing an adequate number of 0.1-acre circular plots throughout the mitigation property. Both planted tree species and tree species entering the mitigation area from natural recruitment will be assessed and counted toward the success of the project. The quantitative monitoring periods will collect data to reflect species survival and overall species density and diversity. Diameter at breast height (dbh) measurements will be taken to document growth of both the planted and recruited vegetation; however, this data will not be used to determine success of the project.

A routine determination will be done within each study plot. Following methods in the *Federal Manual*, each parameter will be evaluated. One deviation from the *Federal Manual* would be in the evaluation of the vegetation parameter. Planted tree species would not be considered in gathering the data because they were artificially introduced into the system and may continue to survive even though they may not naturally colonize the area, or may simply adapt to a wide range of habitats (for example, *Acer rubrum*).

The vegetation parameter would focus on the ground cover stratum, including both herbaceous vegetation and all woody vegetation under 2' height. Office analysis of the cover values would consist of using a modified approach to the prevalence index as outlined in the 1989 *Federal Manual* for identifying jurisdictional systems. This computation is useful because it allows the rating of plant species on a scale indicative of the plant's probability of occurrence for wetland, transitional, or upland habitats. The modified approach uses cover values for each species in a plot rather than a frequency of occurrence. The resulting prevalence index for a given plot would range from a value of 1 (obligate wetland community) to a value of 5 (upland community).

The prevalence index will be computed for each plot and for the overall project area. For computing the overall project area, the sum of prevalence values for each plot will be taken as representative of each group. All plots with an obligate index will be added, all plots with a Facultative wetland index will be added, and so forth. The values will be computed following the above index and an overall community index will be ascertained.

DOCUMENTING MITIGATION RESULTS

Project success or failure for both the Wolf Creek and Mountain Creek Mitigation Sites will be determined following the 5th year of monitoring. A successful project will achieve the following objectives:

- A final survival rate of 80% of all planted vegetation. Although this number is higher than normal for mitigation projects, a lower number of trees will be planted per acre, based on densities in natural wetland forests adjacent to the project. Final plantings per acre will be determined in pre-mitigation field studies of average densities of mature forested wetland in the project area.
- Proven periods of extended surface and subsurface hydrology.
- Hydrophytic herbaceous community developed because of increased hydrology. Determination that the herbaceous community is hydrophytic will be based on a prevalence index rating of vegetative cover values.

Other qualitative studies will be performed to support a determination of a successful wetland mitigation. The studies will include benthics analysis, photographic documentation, and wildlife assessment.

CONCLUSION AND DISCUSSION

Development of forested and scrub-shrub wetland habitats by converting wastewater treatment ponds can be an effective mitigation technique to compensate for inundating palustrine habitats. Development of wetland habitats can be modelled from undisturbed forested wetlands naturally occurring in the project area. Planting of tree species should be spatially consistent with natural communities and should follow densities common to natural communities.

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