Lake Lou Yaeger
Aquatic Ecosystem Restoration Project
Continuing Authorities Program, Section 206

City of Litchfield
Montgomery County, Illinois

Draft Feasibility Report

St. Louis District
September 2016

TABLE OF CONTENTS
(*Sections required by NEPA)

EXECUTIVE SUMMARY

The Lake Lou Yaeger, Litchfield, IL study was conducted under the authority of Section 206 of the Water Resources Development Act of 1996 (Public Law 104-305), as amended, which authorizes the Secretary of the Army to carry out a program of aquatic ecosystem restoration for projects of relatively smaller scope, cost and complexity. Lake Lou Yaeger is located just northeast of the City of Litchfield in Montgomery County, Illinois. The lake provides public access for fishing, boating, swimming and camping.

The lake is experiencing degradation of its aquatic ecosystem habitat due to sediment contributions from the surrounding watersheds, as well as wind and ice-induced bank erosion. To potentially address these problems, the study developed an array of measures with the objectives of restoring herbaceous emergent wetlands and improving habitat for aquatic organisms. While developing and evaluating these measures, the study sought to avoid impacts to the dam and water supply intake, as well as avoiding or minimizing impacts to private landowners and recreation activities. The study examined sediment control measures (retention basins and strategic lake drawdowns), shoreline protection measures (revetment and breakwaters), and in-lake structure measures (plantings and fish habitat).

After careful consideration of all of the potential measures, the study screened out measures that had high long-term maintenance costs, were inefficient (high cost with low benefits), were ineffective, or had potential for induced flooding, recreation impacts or environmental impacts. This screening reduced the measures down to one: In-lake sediment retention basins. Four locations were considered initially but only two were found to be effective enough to be examined in detail. Both alternatives consisted of an in-lake rock structure (berm) which would retain sediment entering the northern part of the lake, thereby restoring wetlands upstream of the structure and improving aquatic habitat downstream of the structure. The primary physical differences between the two alternatives were the specific locations and the amount of material required to build the rock berm.

Both alternatives are located at relatively narrow parts of the lake, downstream of the confluence of the Shop Creek and Shoal Creek. In both alternatives, a rock berm would be constructed between the east and west banks of the lake. The initial design calls for the top of the berm to be 6 inches below the height of the spillway crest. Preliminary hydraulic analysis indicates that this does not significantly increase lake water surface elevations for flows up through 20,000 cubic feet per second (approximately a 1% chance recurrence 48-hour rainfall event). Any potential rise in the water surface elevation is projected to be very small and to occur within the boundary of the land owned by the City. After construction, in order to avoid destruction of the restored wetland vegetation, motorized boats would not be permitted upstream of the berm.

Habitat models were used to calculate the benefits of each alternative. These benefits were compared to the costs of each alternative and the most cost-effective alternative was identified as the tentatively selected plan (TSP). Alternative 1a is the TSP and includes restoration of 32 acres of emergent wetland upstream of the berm while also restoring habitat for aquatic species downstream of the berm. The preliminary estimated total first cost of the TSP is $818,800 and it

is anticipated to yield 127 net average annual Habitat Units (HU). This results in an average annual cost of $270 per HU over the 50-year period of analysis.

The required cost sharing for implementation of a Section 206 project is 65% Federal and 35% non-Federal. The sponsor is the City of Litchfield, IL. With a total project first cost of $818,800, repayment of pre-FCSA costs in the amount of $44,600, and monitoring and adaptive management costs of $21,700, the City's share of the implementation cost is $338,780. A portion of the City's share would be credit for acquisition of easements, currently estimated to be $111,500. The remainder of the City's share ($227,280) will be contributed in cash or in-kind services.

Lake Lou Yaeger, Litchfield, IL
Section 206 – Aquatic Ecosystem Restoration
Draft Feasibility Report with Integrated Environmental Assessment

1. INTRODUCTION*

1.1. Purpose

The Lake Lou Yaeger, Litchfield, IL Project (Project) is currently completing a Feasibility-level study in the Continuing Authorities Program (CAP) for the purpose of aquatic ecosystem restoration. The non-Federal Sponsor (NFS) is the City of Litchfield which owns and operates Lake Lou Yaeger. The purpose of the report is to present the results of an evaluation of alternatives for aquatic ecosystem restoration within the lake. Following approval of the Report, the next steps include updating the Project Management Plan for the design and construction phase and signing of a Project Partnership Agreement for the cost sharing of the design and construction.

1.2. Authority and Scope

Section 206 of the Water Resources Development Act of 1996 (Public Law 104-303), as amended, authorizes the Secretary of the Army to carry out a program of aquatic ecosystem restoration for projects of relatively smaller scope, cost and complexity. Unlike the traditional Corps of Engineers (Corps) civil works projects that are of wider scope and complexity, the Continuing Authorities Program is a delegated authority to plan, design, and construct certain types of water resource and environmental restoration projects without project-specific Congressional authorization.

The study will consider opportunities to address aquatic ecosystem degradation in the lake and evaluate potential actions that would restore degraded ecosystem structure, function, and dynamic processes in ways that are in the public interest and are cost effective.

1.3. Location

Lake Lou Yaeger (approximately 1,300-acres) is located just northeast of the City of Litchfield in Montgomery County, Illinois. It is 48 miles northeast of St. Louis, Missouri and 37 miles south of Springfield, Illinois (See Figure 1.1).

The lake was built in 1966 under the Watershed Protection and Flood Prevention Act (Public Law 83-566, 1954, as amended) program for water supply, flood control, and recreation. The lake provides public access for fishing, boating, swimming and camping.

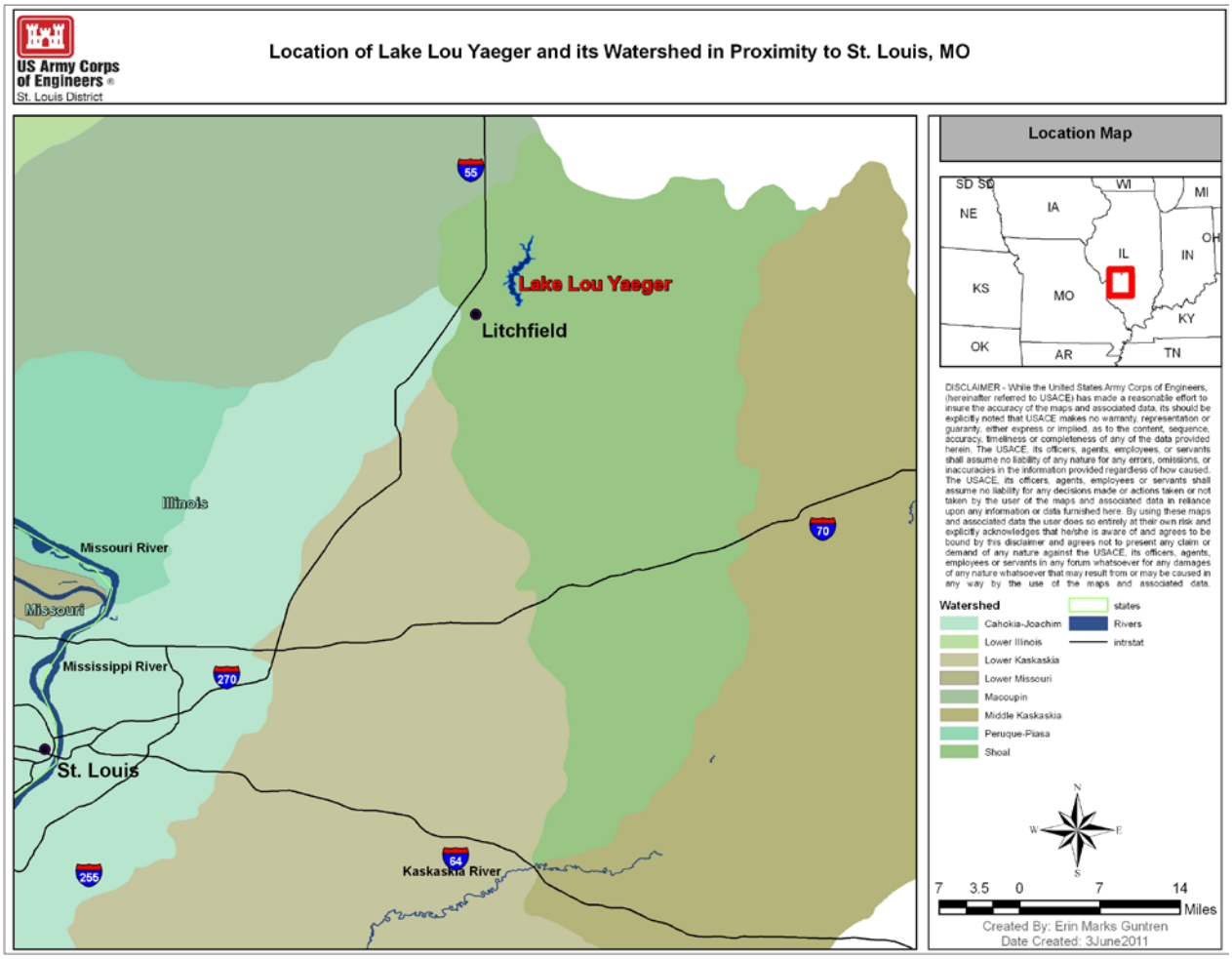

Figure 1.1 Study Location

1.4. Study Process and Report Format

Development of the feasibility study followed the Corps of Engineers' six-step planning process specified in Engineer Regulation (ER) 1105-2-100. The process identifies and responds to problems and opportunities associated with the Federal objective and specified non-Federal concerns. The process provides a flexible, systematic, and rational framework to make determinations and decisions at each step. This allows the interested public and decision makers to be fully aware of the basic assumptions employed; the data and information analyzed; the areas of risk and uncertainty; and the significant implications of each alternative plan.

As part of identifying the Tentatively Selected Plan, a number of alternative plans are developed and compared with the "No Action" alternative, allowing for the ultimate identification of the National Ecosystem Restoration (NER) Plan. The NER plan reasonably maximizes ecosystem restoration benefits compared to costs, considering the cost effectiveness and incremental cost of implementing other restoration options. In addition to considering the system benefits and costs, the process leading to the identification of the NER plan will consider information that cannot be quantified, such as environmental significance and scarcity, socioeconomic impacts, and historic properties information.

The steps used in the plan formulation process are outlined as follows:

1. Identify Problems and Opportunities. The specific problems and opportunities are identified, and the causes of the problems discussed and documented. Specific goals and objectives to solve the identified problems are outlined.

2. Inventory and Forecast Resource Conditions. This step characterizes and assesses existing conditions in the Project area and forecasts the most probable *without-project condition*, also known as the *No Action Alternative*, over the period of analysis. The without-project condition describes the area and its uses as anticipated over a 50-year period of analysis without any restoration implemented as a result of this study, taking into account reasonable foreseeable actions of others. The with-project condition describes the area and its uses as anticipated if restoration measures are implemented by the Corps. This assessment gives the basis by which to compare various alternative plans and their impacts.

3. Formulate Alternative Plans. Potential features are proposed to meet the identified objectives. Specific design measures are developed for these features. These measures are combined into alternative plans in a systematic manner to ensure that reasonable alternatives are evaluated.

4. Evaluate Alternative Plans. The evaluation of each alternative consists of measuring or estimating the environmental benefits, costs, technical considerations, and social and economic effects of each plan, and determining the difference between the without- and with-project conditions. A key measure for evaluation of alternative plans is a cost-effectiveness incremental cost analysis and evaluation of significance.

5. Compare Alternative Plans. Alternative plans are compared, focusing on the differences among the plans identified in the evaluation phase and public comment. As part of the evaluations, the *Best Buy* plans—those plans that provide the greatest increase in benefits for the least increase in cost—are identified.

6. Select Recommended Plan. A Recommended Plan, or NER Plan, is selected. If a viable plan is not identified, the recommended plan will be the No Action Alternative. In most cases, the NER Plan will be selected from among the Best Buy plans and are evaluated based on acceptability, completeness, effectiveness, efficiency and reasonableness of costs. The recommended plan will be selected after considering public comments received during a public review period.

The Report is organized to follow the planning process and therefore does not follow exactly the planning steps as they occurred. The planning process is iterative. As such, as additional information was learned in subsequent steps, it was necessary to revisit and repeat portions of the previous step(s).

1.5. Related Studies and Reports

Lake Lou Yaeger, IL, Wetland Restoration Projects, Federal Interest Determination (USACE, 2012).
This report is the first product in a Section 206 study. It presents an initial analysis of the ecosystem restoration problems and opportunities and recommended further study.

Lake Lou Yaeger Resource Plan (Natural Resources Conservation Service, 2001)
The Lake Lou Yaeger Watershed Committee, in cooperation with the Montgomery County Soil and Water Conservation District and the USDA Natural Resources Conservation Service, prepared a watershed plan for the City of Litchfield, Illinois. The purpose of the plan was to define the existing and future needs of the watershed and lake, to identify a set of alternatives to address those needs, and to encourage joint public and private action to implement the alternatives.

Kaskaskia River Basin, IL, Ecosystem Restoration Project, General Investigations Study (USACE, ongoing).
This study is currently evaluating the ecosystem restoration problems and opportunities of the Kaskaskia Watershed. The study area encompasses the Lake Lou Yaeger project area.

2. ASSESSMENT OF EXISTING RESOURCES*

Chapter 2 assesses the existing conditions of resources within the project area and is organized by resource topic. This is not a comprehensive discussion of every resource within the project area, but rather focuses on those aspects of the environment that were identified as relevant issues during scoping or may be affected by the alternatives. The environmental consequences on these resources are described in Chapter 9.

2.1. Existing Features.

Lake Lou Yaeger was created by damming the West Fork of Shoal Creek, creating an impoundment approximately 8 miles long. The lake was constructed in 1964, and reached normal impoundment water levels during May of 1966. The predominant uses of this lake are public water supply, boating recreation, sport fishing, and flood control. Buffer lands surrounding the lake are primarily upland forest habitat. In general, marginal lands bordering the lower portion of the lake, and the western shoreline, are more developed and have more permanent recreational facilities, than marginal lands in the upper portions of the lake or along the eastern shoreline.

2.2. Hydraulic and Hydrologic Conditions

Lake Lou Yaeger collects drainage from approximately 74,550 total acres. The upper end of Lake Lou Yaeger is fed by three main tributaries: Blue Grass Creek, Shoal Creek, and Shop Creek (formally Shoal Creek No 2 and consisting of 3 parts, Shop Creek, Five Mile Lake and Three Mile Creek), which together total approximately 59,392 acres. Shop Creek flows into Five Mile Lake, an existing detention feature located approximately 1.4 miles upstream from

Lake Lou Yaeger. Three Mile Creek flows into the lower end of Five Mile Lake and is the name of the portion of the waterway between Five Mile Lake and Lake Lou Yaeger. However, for this study's purposes, calculations were based on Shop Creek, Five Mile Lake and Three Mile Creek as one waterway and referred to as Shop Creek. Five Mile Lake was constructed in 1966, the same year as Lake Lou Yaeger, but is considered effectively full of sediment at this time and is no longer functioning as a sediment retention basin. The relationships of these three watersheds, as well as their sizes can be seen in Figure 2.1 and Table 2.1, respectively.

Table 2.1: The areas of the respective watersheds that were analyzed.

Watershed name	Area (acres)
Shoal Creek	19,756
Blue Grass Creek	15,188
Shop Creek	24,448

Past sediment deposition in the lake (location and magnitude) was estimated using the 2011 hydrosurvey, 1966 topographic survey, Natural Resources Conservation Service (NRCS) average annual sediment yield values for both Blue Grass Creek and the Upper West Fork of Shoal Creek watersheds, and average annual sediment yield value for Shop Creek from the "Restoration Plan for Lake Lou Yaeger" (January 1995). Additionally, based upon historical aerial photography from Google Earth, the upper (northern) section of Lake Lou Yeager has been relatively shallow over the last decade.

An Isopach analysis, which is the comparison of 2 surveys, was done to generate a sedimentation volume between the 2011 hydrosurvey and the old pre-1964 topographic map (which was digitized in Arc-GIS). The input data and results are seen in Figures 2.2 (the pre-1964 topography), 2.3 (the 2011 hydrosurvey) and 2.4 (the Isopach). The pre-1964 topographic map was a survey from before Lake Lou Yaeger was created. A positive number (yellow to brown) indicates an increase in bed elevation, a negative number (blue to purple) indicates a decrease in bed elevation.

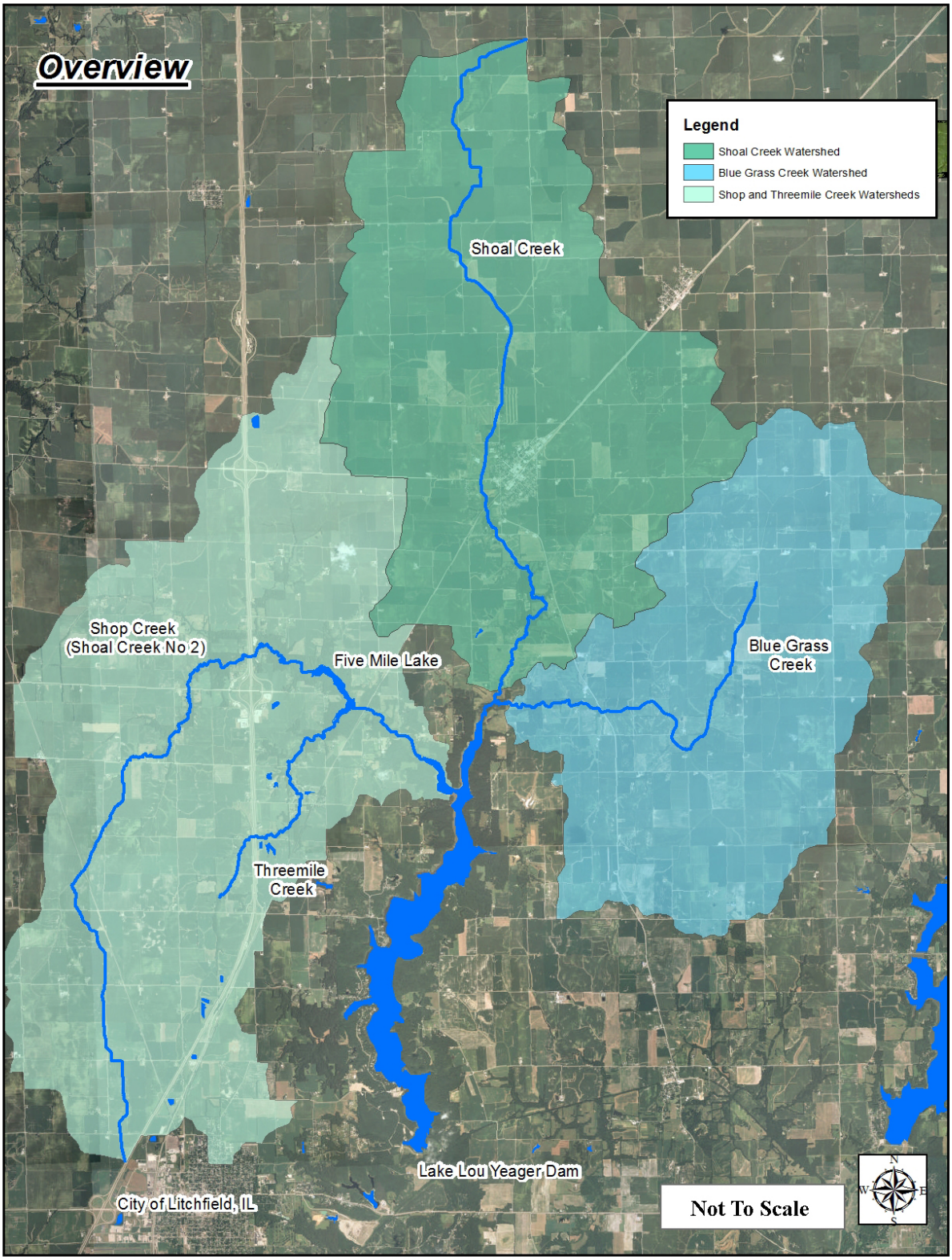

Figure 2.1. The three primary watersheds analyzed for the study.

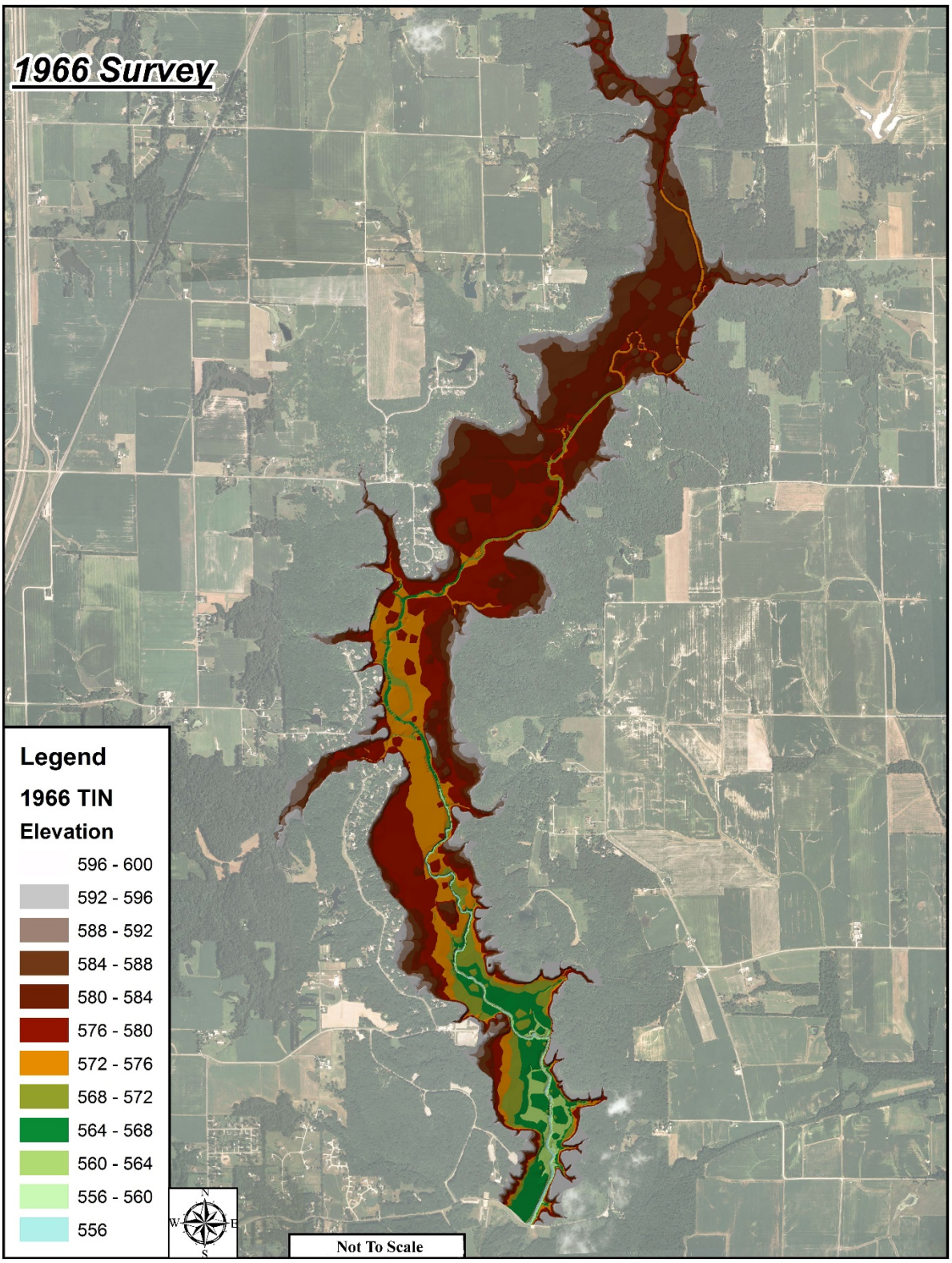

Figure 2.2: 1966 Survey of the Lake Lou Yaeger basin before the reservoir was filled

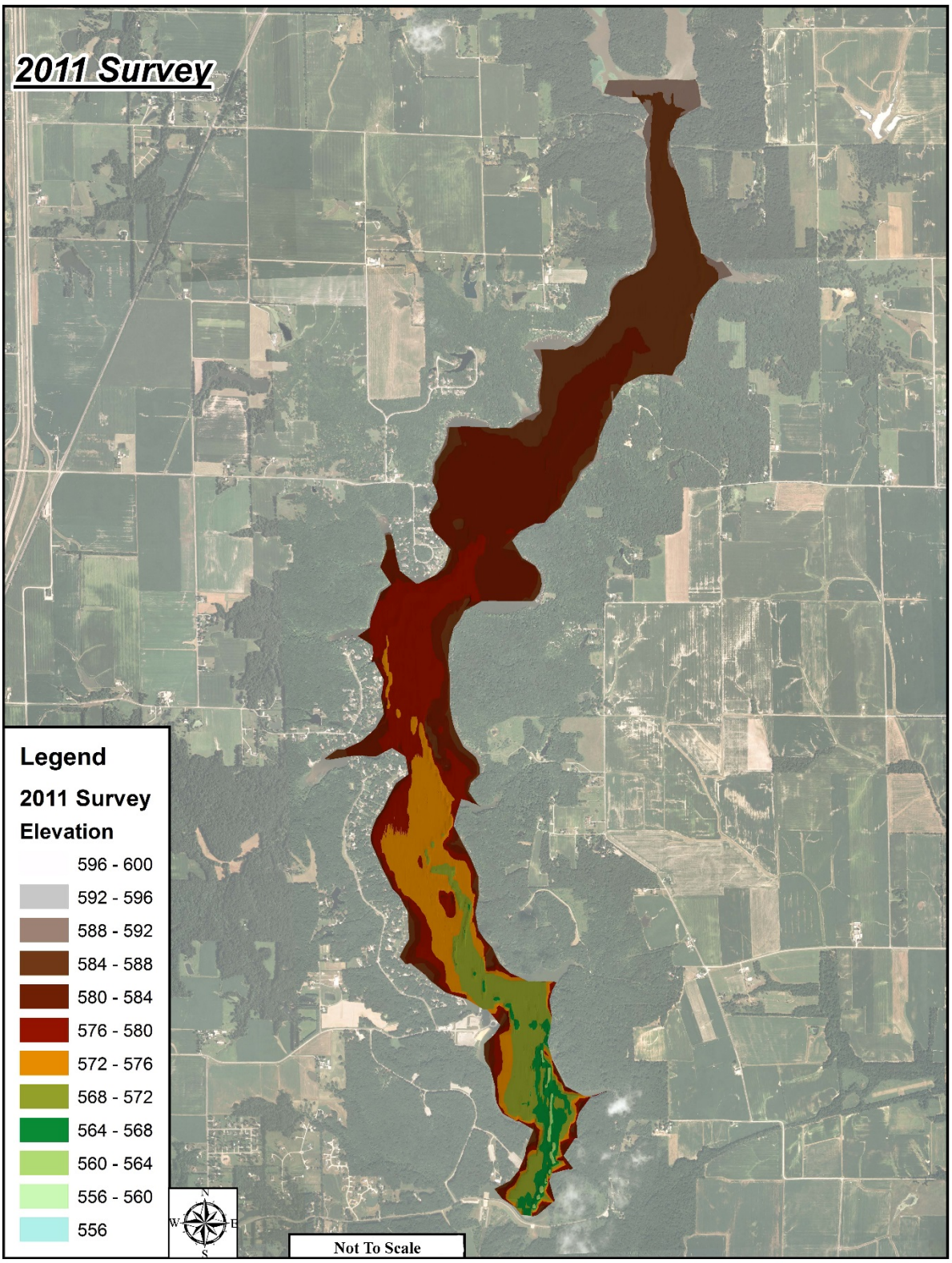

Figure 2.3: 2011 Bathymetric survey

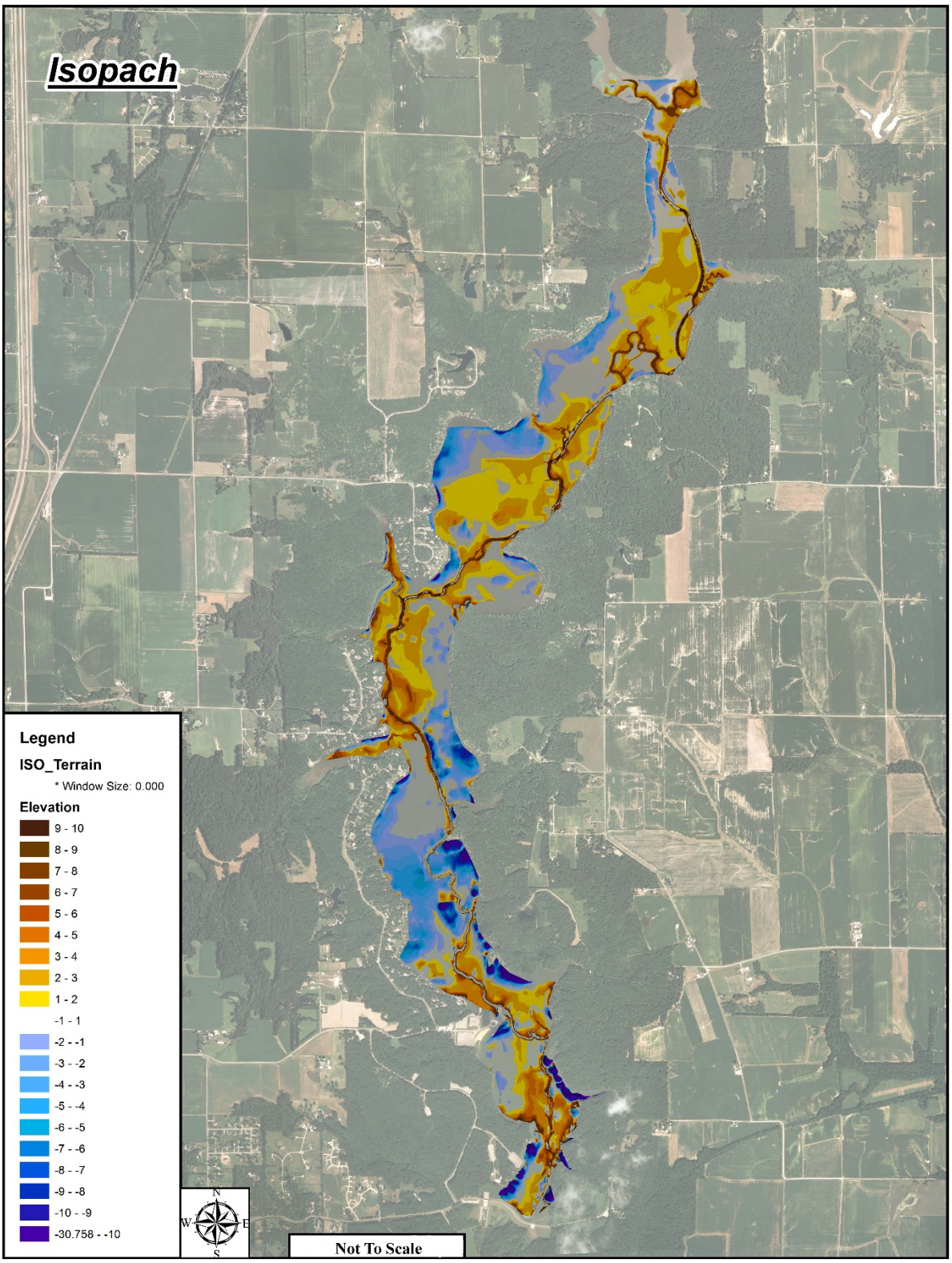

Figure 2.4: Isopach analysis comparing the 1966 and 2011 surveys

In Figure 2.4, the analysis shows areas of shallowing (positive numbers) and deepening (negative numbers). From this figure, we can ascertain where the most sediment deposition has occurred, creating shallower and deeper areas in the lake.

2.3. Historic and Cultural Resources

The project area is situated within the Prairie Peninsula environment of central Illinois. The Prairie Peninsula consisted of extensive prairies on flat upland landforms and narrow strips of woodland along stream valleys. Most prehistoric settlement in the eastern Prairie Peninsula focused on the forested river valleys. The largest and most complex settlements were located in and along major valleys, and site densities appear to be highest there as well.

From 1974 to 1977 the panhandle of Montgomery County, directly north of the project area, was systematically sample-surveyed for archaeological sites by a team from Northwestern University (Asch 1978). The survey was a stratified probabilistic sample that covered 13.7 km^2 or 4% of the study area. This data was later incorporated with GIS to create a high resolution predictive model of prehistoric archaeological site location in a poorly drained upland prairie region of central Illinois (Warren and Asch 2000). The findings of this study were that prehistoric inhabitants most likely had a bimodal settlement pattern in which prehistoric hunter-gathers focused their activities on both valleys and upland knolls. It would appear that prehistoric land-use strategies in this area were geared toward two sets of resources: (1) aquatic-riparian resources that were concentrated along upland stream courses, and (2) prairie or forest resources that were broadly dispersed across the glaciated uplands. The different modes of settlement could have a seasonal dimension in which valley resources were exploited at one time of year and upland resources at another. This would indicate that the location of Lake Lou Yaeger project area falls within a high probability area for prehistoric settlements.

In 1964, in anticipation of the construction of the Litchfield Reservoir (Lake Lou Yaeger) an archeological survey was undertaken by Don Henson of Southern Illinois University. Based on Illinois Archaeological Survey site forms this survey identified six prehistoric archaeological sites (11MY41–11MY46) that have since been inundated by the creation of the lake. Five of these sites have been identified as Archaic village sites, one of which also has a possible Mississippian component. The sixth site is a mound site that has not been assigned to a cultural period. None of these properties were evaluated for National Register eligibility. Six additional sites (11MY16, 11MY24, 11MY25, 11MY160, 11MY161, 11MY162) have been identified in the vicinity of Lake Lou Yaeger - two prehistoric and four historic. Four of the sites have been determined not eligible for the National Register while no determination has been made for the remaining two.

The Illinois Historic Preservation Agency has identified four archaeological surveys in the immediate vicinity of Lake Lou Yaeger. In 1997 and in 2005 archaeological surveys for the construction of waterlines on either side of Lake Lou Yaeger were undertaken (Burns 1997 and Burrows 2005). In 1994 an archaeological survey for a proposed golf club was completed at the southern end of the lake adjacent to the dam and spillway (Halpin 1994). Most recently in 2012 a Phase I archaeological survey was completed for a proposed horse campground at Lake Lou Yaeger.

2.4. **Natural Resources.**

Principal natural resources in the immediate study area are the forested lands and open waters of Lake Lou Yaeger. While much of the land buffering the reservoir is forested, the remainder of the watershed drainage is largely agricultural. The oak-hickory forests surrounding the lake are typical of the native cover found within the Southern Till Plain Natural Division of central and southern Illinois. Pre-settlement vegetation was a mixture of 60 percent forest to 40 percent prairie and wetlands. A variety of trees, woodland and prairie plants cover the slopes of the stream valley.

In 1990 the City of Litchfield Council dedicated 266 acres of the buffer zone on the less developed eastern side of the lake as a conservation area. This tract of open woodlands, prairie barrens (flat land with sparse vegetation), deep ravines, ridges, and cliffs was dedicated to preserve the existing remnants of oak-hickory forest, barrens, and prairie on lake property. Shoal Creek Volunteers, a nongovernmental organization formed in 1990 has primary management responsibility for the Shoal Creek Conservation Area. This site has been designated as being of statewide significance for the high quality of its barrens community. It is home to nearly 750 species of plants. The 714 current taxa include 10 orchid species, 13 fern species, 80 grasses, and 43 sedge. The plant species range from the very common to the rare and endangered. Savanna Blazing Star (*Liatris scariosa* var. *nieuwlandii*) and Buffalo Clover (*Trifolium reflexum*) are state threatened.

Additionally, a survey of mushrooms conducted in the area during the 1993-1994 period identified 65 different species. Complete lists of vascular plants and mushrooms collected at the Shoal Creek Conservation Area are included in Appendix C.

2.4.1. Geology and Soils.

Information in this section was largely drawn from the 2009 Soil Survey for Montgomery County, IL, published by the U.S. Department of Agriculture, Natural Resources Conservation Service. The project study area is located in Montgomery County in southwestern Illinois. This county is in the Springfield Plain, which is in the Till Plains section of the Central Lowland Province of the Interior Plains Physiographic Division. Most of Montgomery County is on a nearly level to gently sloping ground moraine. As a result of geologic erosion, areas adjacent to the stream valleys and drainageways are gently sloping to very steep. Soils are of loess and till, rather light and a characteristic "claypan" can be found.

Glacial deposits from the Illinois Episode of the Pleistocene Epoch exerted the most influence on the current landscape. The glacial till is commonly 25 to 50 feet thick but is likely much thicker in some of the deep valleys. The till is covered predominantly by loess, typically ranging from 40 to 60 inches in thickness in nearly level to gently sloping areas (Fehrenbacher and others, 1986). The till is exposed in the more sloping areas throughout the county.

Soils in the project area are primarily Hickory silt loam with slopes ranging from 10 to 35 percent. Other soil types present in the vicinity are Homen silt loam with 5 to 10 percent slopes,

and small areas of Shoals and Terril loams, rarely flooded with 1 to 4 percent slopes. None of the soils in the vicinity of the proposed rock berm feature are classified as hydric, and the Hickory soil types are more likely to erode than the other soil types found in the project area. The predominate Hickory and Homen soil types are not classified as prime farmland, while Shoals and Terril loams are classified prime if drained.

2.4.2. Aquatic Resources.

Lake Lou Yaeger, a constructed reservoir formed by the impoundment of the West Branch of Shoal Creek, is the principal aquatic resource in the study area. The lake comprises approximately 1,300 acres of open water, with a shoreline length of 24.9 miles. Maximum depth of the lake is 31 feet, and it has an average depth of 10 feet.

2.4.3. Wetlands.

No targeted survey of existing wetlands in the project area has been conducted. However, examination of the U.S. Fish and Wildlife Service's National Wetlands Inventory maps indicate that existing forested and non-forested wetlands in the Lake Lou Yaeger watershed are limited to small tracts along the main channels of the upper reaches of Shoal Creek, Bluegrass Creek, and Shop Creek. Additionally, a number of farm impoundments are located in the upper reaches of the small tributaries that feed directly into the main portion of Lake Lou Yaeger.

2.4.4. Fisheries.

At least 15 fish species swim in the shallow, fertile waters of Lake Lou Yaeger. At this time, no species are being stocked by the Illinois Department of Natural Resources (IDNR) on an annual basis. Principal sport fish in the lake include bluegill, white crappie, channel catfish, and largemouth bass. Other species noted or collected by IDNR during general population surveys conducted in 2003, 2006, and 2009 include yellow bullhead, black bullhead, black crappie, flathead catfish, freshwater drum, gizzard shad, golden shiner, green sunfish, longear sunfish, orangespotted sunfish, and common carp.

Recent years' sampling results by IDNR have caused the agency to rate the status of bluegill, white crappie, and channel catfish populations from good to very good. Largemouth bass populations in the lake are rated as "developing." A rearing pond for largemouth bass is functional on City property. The City does stock 5" to 8" largemouth bass annually in an effort to maintain the predator base. IDNR has indicated they will stock the lake with 4 inch largemouth bass, if available, in 2016. At the present time, there are no zebra mussels in this lake. In 2012, a single pacu, a fish native to the Amazon River basin, was caught by a fisherman in the lake. It is likely this specimen was a discarded aquarium pet.

2.4.5. Wildlife.

The project area provides habitat for an array of game and nongame wildlife species. Many of these are listed as trust species by the U.S. Fish and Wildlife Service. Trust species include resident and migratory birds, as well as Federally listed endangered and threatened species.

While there have been no surveys specifically targeting the immediate project site, surveys of butterflies and breeding birds conducted by volunteers at the nearby Shoal Creek Conservation Area identified 71 species of butterflies (one of these, the swamp metalmark, is a State listed endangered species) and 75 bird species as confirmed or potentially breeding in the survey area.

2.4.6. Endangered, Threatened, and Protected Species

Examination of a Trust Resources Report generated in May 2016 for the project area from the U.S. Fish and Wildlife's iPaC website revealed that three Federally listed species may potentially occur in this area: the Indiana bat (*Myotis sodalis*), currently listed as endangered; the northern long-eared bat (*Myotis septentrionalis*), currently listed as threatened; and the eastern prairie fringed orchid (*Platanthera leucophaea*), listed threatened. No designated critical habitat for these or any other species is known to be present in the project area and vicinity.

2.5. **Environmental Quality.**

2.5.1. Air Quality.

Air quality in the project area is generally good. No source of emissions currently exists within any of the alternative sites. The EPA *Green Book Nonattainment Areas for Criteria Pollutants* (Green Book) maintains a list of all areas within the United States that are currently designated nonattainment areas with respect to one or more criteria air pollutants. Nonattainment areas are discussed by county or metropolitan statistical area (MSA). MSAs are geographic locations, characterized by a large population nucleus, that are comprised of adjacent communities with a high degree of social and economic integration. MSAs are generally composed of multiple counties. Review of the Green Book indicates that Montgomery County, IL is in attainment for all federal NAAQS pollutants (http://www.epa.gov/oar/oaqps/greenbk/multipol.html).

2.5.2. Water Quality.

The watershed of Shoal Creek that drains to the Lake Lou Yaeger impoundment is approximately 74,550 acres, making a watershed to lake surface ratio of 58.7:1. Lakes with a high watershed/lake surface ratios (>25:1) have a greater potential for large sediment and nutrient loads into the lake.

Funding under the Federal and State clean lakes programs has been used by the Illinois EPA through its Section 319 program to support lake owners' interest and commitment to long-term comprehensive lake management. Nonpoint source pollution control recommendations contained in diagnostic/feasibility studies and watershed-based plans serve to supplement program initiatives and goals. Diagnostic/feasibility studies were completed for Lake Lou Yaeger in 1995 and implementation has since begun. Causes of impairment addressed in these studies were total particulates (TP), dissolved oxygen (DO) and total suspended solids.

2.5.3 Hazardous, Toxic and Radioactive Waste.

A Phase I Site Assessment was completed on June 27, 2016. This assessment revealed no recognized environmental conditions in connection with the potential project. The Phase I Site Assessment is included as Appendix G.

2.5.4 Noise

The project study area is a relatively rural location where ambient noise levels are relatively low. There are many different noise sources throughout the area including commercial and recreational boats and other recreational vehicles; automobiles and trucks, and all-terrain vehicles; aircraft; machinery and motors; and industry-related noise. However, these sources are somewhat widely distributed, and there are no sensitive human receptors located in proximity to the rock berm construction site or any of the feasible proposed restoration sites.

2.6. **Socioeconomic Resources and Human Use.**

2.6.1 Demographics

The town of Litchfield and other communities that utilize Lake Lou Yaeger as a water supply are located in Montgomery County, Illinois, in the south central portion of the state. Litchfield is the largest community in the county with a population of 6,939 as recorded in the 2010 census (2015 population is estimated at 7,015). Total population of the county was estimated at 28,898 from 2015 census data. More than half of the county's population resides in the four largest cities: Litchfield, Hillsboro (the county seat), Coffeen, and Raymond.

Estimates of Litchfield demographics from 2010 data indicate there were 2,772 households, and 1,785 families residing in the city. The population density was 1,338.5 people per square mile (517.0/km²). There were 3,011 housing units at an average density of 591.4 per square mile (228.4/km²). The racial makeup of the city was 98.31% White, 0.37% African American, 0.18% Native American, 0.26% Asian, 0.01% Pacific Islander, 0.22% from other races, and 0.65% from two or more races. Hispanic or Latino of any race were 0.95% of the population.
There were 2,772 households out of which 31.3% had children under the age of 18 living with them, 48.7% were married couples living together, 11.9% had a female householder with no husband present, and 35.6% were non-families. 32.5% of all households were made up of individuals and 17.0% had someone living alone who was 65 years of age or older. The average household size was 2.37 and the average family size was 2.97.

In the city the population was spread out with 25.6% under the age of 18, 7.5% from 18 to 24, 26.6% from 25 to 44, 20.0% from 45 to 64, and 20.3% who were 65 years of age or older. The median age was 38 years. For every 100 females there were 86.1 males. For every 100 females age 18 and over, there were 80.3 males.

The median income for a household in the city was $28,717, and the median income for a family was $34,139. Males had a median income of $26,238 versus $19,545 for females. The per capita

income for the city was $14,612. About 15.7% of families and 16.6% of the population were below the poverty line, including 22.9% of those under age 18 and 11.2% of those age 65 or over.

Low-income populations as of 2000 cover those whose income is $23,850 for a family of four and are identified using the Census Bureau's statistical poverty threshold. The Census Bureau defines a "poverty area" as a Census tract with 20 percent or more of its residents below the poverty threshold and an "extreme poverty area" as one with 40 percent or more below the poverty level. This is updated annually at http://aspe.hhs.gov/poverty/14poverty.cfm

Minority populations are those persons who identify themselves as Black, Hispanic, Asian American, American Indian/Alaskan Native, and Pacific Islander. A minority population exists where the percentage of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population. No minority populations were found to exist in the Lake Lou Yaeger study area.

2.6.2. Recreation and Aesthetics.

In addition to serving as the primary water supply for Litchfield and providing flood protection to areas in the watershed downstream of the dam, Lake Lou Yaeger is an important recreational resource to the city and surrounding region. The lake is publicly accessible and existing facilities offer a wide range of recreation opportunities to users. These include, but are not limited to, boating, fishing, swimming, camping (both primitive and developed), hiking and equestrian trails, picnic pavilions and the Shoal Creek Nature Preserve. The Lake offers more than 350 unimproved camping/picnicking sites which may be leased on a seasonal basis, as well as more than 400 lake accessible only annual lease sites, many with boat docks (Lake Lou Yaeger Master Plan, 2015).

3. PROBLEMS AND OBJECTIVES*

3.1. Problem Identification

In general, the aquatic ecosystem degradation problem at the lake is loss of habitat due to sediment deposition and shoreline erosion. This is resulting in loss of lake depth and surface area, and loss of aquatic habitat and wetlands.

Lake Lou Yaeger has seen a reduction in surface area and depth due to sediment contribution from the surrounding watershed and the northern tributaries, as well as wind and ice-induced bank erosion. The Lake Lou Yaeger Resource Plan (2001) says that between 1966 and 1990 the volume of the lake was estimated to be only approximately 73% of the original lake's volume and 14% of the lake's surface area had been lost (approximately 9.13 surface area acres per year). This analysis shows that sediment entering the lake from the watershed and northern tributaries is contributing to fish habitat problems at Lake Lou Yaeger by reducing the amount of available deep water habitat and raising temperatures resulting in reduced dissolved oxygen levels. Furthermore, increased turbidity caused by excess sedimentation often smothers fish eggs, larvae, and benthic invertebrates, clogs the gills of delicate fry, and prohibits visual

predation, mate location, and parental care. Lastly, wind and ice-induced bank erosion has degraded the eastern shoreline, resulting in high vertical banks which provide minimal cover and foraging habitat for fish and other wildlife. (See photo 1.)

In addition to reduction in fish habitat, the bank erosion is causing a loss of shallow water habitat and shoreline wetlands. From the 1780's to the 1980's, the State of Illinois lost 85-90% of its wetlands (Dahl, T.E. 1990). In that same time frame the United States saw a decline of 30%. When compared with other states, the scope of wetland loss in Illinois is clear. Illinois ranks sixth in overall percentage of wetland loss, behind California, Indiana, Iowa, Missouri, and Ohio. In terms of acres of wetland loss, Illinois ranks fifth. Only Florida, Texas, Louisiana, and Arizona have lost more acres. Due to the large percentage and acreage of wetlands that have been lost, Illinois is in the top 10 percent of states with the greatest overall wetland loss over the past 200 years.

Photo 1: Portions of lake with no revetment (left side) and off-shore revetment (right side).

In summary, the aquatic ecosystem problems identified at Lake Lou Yaeger for evaluation during this study include:

- Loss of lake surface area due to sedimentation
- Reduction in lake depth due to sedimentation
- Loss of shoreline wetlands due to bank erosion
- Loss of shallow water habitat due to bank erosion and sedimentation
- Low levels of dissolved oxygen due to sedimentation

3.2. Opportunities

Opportunities exist to restore wetland habitat, function, and process; restore shallow water fisheries habitat, and maintain deep water habitat. Any restoration of wetlands in Illinois is significant both regionally and nationally because of the massive extent to which they have been lost.

Based upon historical accounts of early Illinois, it is likely that this area contained wetlands prior to modern settlement and agricultural practices. This proposed project is located in a still fairly flat part of the watershed, just upstream of the major topographic relief. Although higher in the watershed, it would have been subject to dependable hydrologic inputs. Beaver were very common in this setting and it would have been an ideal location for dam construction because of its hydrologic and topographical advantages. The type of wetland they maintained would have been historically common and functionally identical to the type we have the opportunity to restore.

Wetlands are recognized as a nationally significant resource because of their regulation and protection by the Clean Water Act and Executive Order 11990: Protection of Wetlands. In addition, wetlands are beneficial to waterfowl which are a nationally significant resource recognized by the Migratory Bird Treaty Act of 1918.

The following opportunities were identified for this study:

- Restore wetland habitat, function and process
- Allow for shallow water fisheries habitat
- Maintain deep water habitat

Although not the primary focus of the study, there are incidental opportunities to:

- Increase recreation opportunities
- Sustain water supply capability

3.3. Goals and Objectives

Initial discussions explored potential objectives to restore habitat for migratory and shorebirds, increase overwintering habitat, reduce invasive plant species, and improve water quality (dissolved oxygen, nutrients, etc). As the study progressed, it became apparent that habitats for birds and overwintering habitat for fish was plentiful in the lake and any potential restoration actions would not result in a meaningful increase to those habitats. Additionally, invasive plant species are already substantially addressed by the City's annual winter lake drawdown (by exposing the sediment to both freezing and loss of water, aquatic plants that have no overwintering structures are destroyed). Additional action regarding invasive plant species was determined to be unwarranted. Finally, water quality improvements fall outside the scope of the project's authority and therefore could not be considered for potential actions.

Therefore, the project goal is to restore, to the extent practical, quality, functional wetlands and habitat for aquatic organisms in Lake Lou Yaeger.

An objective is a statement of what an alternative should try to achieve. It should be related to the problems and/or opportunities already identified. The following objectives have been identified for this study:

Over the 50-year period of analysis,

- Restore herbaceous emergent wetlands
- Improve habitat for aquatic organisms

The study will evaluate each alternative's ability to meet these objectives by utilizing a habitat evaluation model.

3.4. Planning Constraints

A constraint is a restriction that limits the extent of the planning process for a particular study. It should focus on things that alternative plans should try to avoid. All studies have common constraints regarding complying with existing laws and policies, and avoid and minimized impact to cultural resources and threatened and endangered species. In addition to those standard constraints, for this study the team identified the following study-specific constraints:

- Avoid impacts to the dam and water supply intake
- Avoid or minimize impacts to private landowners
- Avoid or minimize impacts to recreation

3.5. Future Without Project

The without-project condition describes the area and its uses as anticipated over a 50-year period of analysis without any restoration implemented as a result of this study. This is the baseline conditions against which each of the various alternative plans and their impacts are compared.

3.5.1 Continued Sponsor Operation and Maintenance Responsibilities

For the future without project condition, it is assumed that the City will continue to operate and maintain the lake in accordance with the requirements of the program under which the lake was constructed (Watershed Protection and Flood Prevent Act, Public Law 83-566, 1954, as amended). For each structure/dam built under this PL 83-566, the Sponsor assumes responsibility for O&M of the dam. There is a signed Operation and Maintenance (O&M) Agreement and O&M Plan which identify the responsibilities. The City has two agreements with NRCS for dam inspection and maintenance of the two dams affiliated with the lake - the Five Mile Bridge dam, which is the dam at the silt basin to the northwest of the lake; and the Lake Lou Yaeger dam, the main dam at the south end of the lake. These agreements were established in 1981 with the former United States Department of Agriculture, Soil Conservation Service (now Natural Resources Conservation Service - NRCS). The City of Litchfield is responsible for funding the inspection of the dams and writing and filing the dam reports. The City does this through a private engineering firm. Additional responsibilities for the dams include maintaining desirable

vegetation, removing brush and woody vegetation, removing debris, and repairing damage to the earthworks, conduits, or other structural components.

PL 83-566 has a rehabilitation component which is administered by the NRCS. If funds are available in this program, they can be used for the following purposes:

> (1) Protecting the integrity of the dam or extending the useful life of the dam beyond the original evaluated life expectancy.
>
> (2) Correcting damage to the dam from a catastrophic event (100-year frequency rainfall event or a storm event that produces a flow in the auxiliary spillway of at least two feet or more in depth).
>
> (3) Correcting the deterioration of structural components that are deteriorating at an abnormal rate.
>
> (4) Upgrading the dam to meet changed land use conditions in a watershed served by the dam or changed safety criteria applicable to the dam.
>
> (5) Decommissioning (removal) of the structure and stabilizing the site.

The rehabilitation program does not cover activities that are defined as operation and maintenance. Operation is defined as "administration, management, and performance of non-maintenance activities needed to keep a practice safe and functioning as planned." This includes being cognizant of changes in watershed conditions, both upstream and downstream from completed practices, that may alter the overall function of the project, so appropriate actions can be taken promptly. Maintenance is defined as "recurring activities necessary to retain or restore a practice in a safe and functioning condition, including the management of vegetation, the repair or replacement of failed components, the prevention or treatment of deterioration, and the repair of damages caused by flooding and vandalism."

3.5.2 Climate Change

Potential climate change issues, such as growing season lengths and changes in precipitation patterns, are significant scientific uncertainties for all environmental projects. For the future without action condition, it was determined that potential changes in runoff timing, volume, and sediment loads would affect all of the problems, opportunities, and potential actions equally and would not likely impact decision making. Therefore, the team made no effort to quantify potential climate change impacts.

The project area is a regulated reservoir. Consequently the potential impacts of regional climate change, whether the effect is to increase or decrease the amount of precipitation/runoff, would be expected to be lessened due to the ability to regulate outflows from the reservoir. For this reason, the team assumed that no drastic alteration of aquatic habitat conditions would occur as a result of future changes in climate during the planning period.

3.5.3 Future Hydrologic and Hydraulic Conditions

The study assumed that the hydrologic and hydraulic conditions in the lake and watershed would not change significantly over the period of analysis. The upstream watershed is largely agricultural and there are no known major developments planned. The hydraulic conditions in the upper lake and tributaries would likely change gradually over time as additional sediment is delivered to the lake. This future condition is considered in the study's analysis. See Table 4.2 for calculated lake depths over time.

3.5.4 Future Aquatic Habitat Conditions

The aquatic habitat is not expected to change significantly over time for most of the lake. The exception is the northern end of the lake which will see measurable changes over time due to continued sediment deposition. This is considered in the analysis and can be seen in the calculations of lake depths over time (Table 4.1) and in the benefits analysis is Appendix C. The team projected that without the project, sediment would continue to accumulate at the northern end of the lake, with escalating encroachment farther downstream. Additionally, the team projected that deeper areas of the lake would eventually be lost, thus reducing essential deepwater and overwintering habitat.

Corps procedures for ecosystem restoration studies call for consideration of the significance of the resources to be restored. For this study, the primary focus is on restoration of wetlands and habitat for aquatic species. Wetlands have acknowledged institutional significance, as documented in Executive Order 11990, the Clean Water Act Sections 401 and 404; and the Migratory Bird Treaty Act of 1918. There is public significance demonstrated by both private and public land acquisition and the popularity of activities such as duck hunting which depend on wetlands. For technical significance, migratory waterfowl utilize the lake and surrounding wetlands during migration as resting, rearing, and feeding areas. Additionally, emergent and littoral wetlands act as buffers reducing watershed inputs into the lake.

With regard to aquatic habitat outside of wetlands, institutional significance is demonstrated by the attention and monetary support from Congressional representatives in the Illinois Capital Improvement Bill. The public recognizes the significance of the aquatic habitat by supporting the Henry Eilers Shoal Creek Conservation Area and the participation in the EPA Lake Monitoring Program. For technical significance, Lake Lou Yaeger provides a valuable habitat (large lake habitat) in central Illinois and in turn provides needed habitat for a variety of native fish species.

4. POTENTIAL PROJECT FEATURES

In order to accomplish the proposed objectives, potential features were proposed for consideration in this feasibility study. The potential measures are described in the following sections.

4.1. Potential Measures

Potential measures are actions that could contribute to achieving the Project objectives. Measures are considered the building blocks of alternatives. Alternatives often consist of multiple measures.

Table 4.1 identifies the types of measures that could potentially address each of the identified objectives.

OBJECTIVES	POTENTIAL MEASURES
1. Restore herbaceous emergent wetlands	Sediment Retention Lake Drawdown Revetment Plantings
2. Improve habitat for aquatic organisms	Sediment Retention Lake Drawdown Revetment Breakwaters Non-Revetment Bank Stabilization Plantings Fish Habitat Structure

Table 4.1. List of potential measures to address identified objectives.

The measures listed in Table 4.1 have been grouped into three categories for ease of discussion: sediment control, shoreline protection, and in-lake structure measures. To facilitate combining the measures into alternatives, each measure is given an alpha-numerical designation.

4.1.1 Sediment Control Measures

These measures are designated with the letter *S*, indicating *sediment*.

S0 – No Action. The "No Action" measures means that sediment control features would not be implemented.

S1 – In-Lake Sediment Retention Basin(s). This measure consists of construction of one or more sediment retention basins near the intersection of Raymond Spur (also known as West Fork Shoal Creek) and the Five Mile Bridge Spur (also known as Shop Creek) at the north end of Lake Lou Yaeger. In the Federal Interest Determination, this was conceptualized as a rock berm. The rock berm concept is only one possible design for this measure. The exact number and location of the basins will need to be determined and may result in the creation of additional measures identified as S1a, S1b, etc. (or some similar designation). Preliminarily, three general locations have been identified, all at the northern end of the lake where the two primary watersheds (Shop Creek and Shoal Creek) enter the lake. To construct the sediment basin the lake may need to be drawn down (Measure S4). This measure is combinable with any one of the L or P measures.

S2 – Lake Drawdown. This measure consists of lowering the lake 4 to 5 feet in the Spring and/or Summer to compact the soil for erosion control and would be needed for construction of above mentioned retention basins. The drawdown would also be beneficial for moist soil plants to colonize the exposed land providing food and habitat for wildlife. This measure is combinable with any one of the L or P measures but would have a significant impact on recreation in the lake.

S3 – New Tributary Sediment Retention Basin(s). This measure would construct sediment retention structures in one or more of the tributaries at the north end of the lake. The exact number and location of the basins will need to be determined and may result in the creation of additional measures identified as S3a, S3b, etc. (or some similar designation). Preliminarily, four general locations have been identified – one on Shop Creek, two on West Fork Shoal Creek, and one on Blue Grass Creek. Based on experience on other studies, these tributary sediment retention basins may not be policy compliant, as they are not within the floodplain of the lake.

S4 – Restore Existing Sediment Retention Basin. This measure would remove accumulated sediment from "Five Mile Lake", an existing sediment retention basin which has reached (or nearly reached) its sediment storage capacity. Five Mile Lake is located on Shop Creek, which appears to be the largest contributor of sediment to Lake Lou Yaeger. This measure may result in a mitigation requirement if wetlands or other critical habitat has developed as the lake has become more shallow.

4.1.2 Shoreline Protection Measures.

These measures are designated with the letter *P,* indicating *protection.*

P0 – No Action. The "No Action" measure means that shoreline protection measures would not be implemented.

P1 – On-shore revetment. Approximately 30,000 lineal feet of the lake shore require protection (exact length can vary). This measure consists of placing riprap on the shore in areas where erosion is most severe and highly erodible soils are present. Extending riprap into the water 8-10 feet provides ideal fish habitat.

P2 – Off-shore revetment. Approximately 30,000 lineal feet of the lake shore require protection (exact length can vary). This measure consists of placing riprap approximately 15 feet from the shoreline providing shoreline protection from wind fetch and allows plant growth. Excavated material from any of the "S" measures could be used to fill in the area between the riprap and the eroded shoreline creating additional littoral wetland habitat.

P3 – Breakwaters. Breakwaters (constructed in sections further from shore) could be constructed in areas with severe wind fetch induced erosion.

P4 – Non-Revetment bank stabilization. This measure would use bank stabilization methods such as lunkers or root wads that also provide fish habitat. Lunkers are open, wooden

box structures designed to eventually be buried under the edge of stream or lake banks to provide undercut bank habitat for fish and other aquatic organisms. Root wads are tree stumps with some roots still attached which are buried in the bank with the root wad extending into the water.

4.1.3. In-Lake Structure Measures

These measures are designated with the letter *L*, indicating *lake.*

L0 – No Action. The "No Action" measure means that in-lake structures would not be implemented.

L1 – Plantings. This measure would consist of planting native plants in suitable areas of the lake. However, the lake does not currently have large areas that would allow implementation of this measure to yield significant benefits as a stand-alone measure. Therefore, this measure must be combined with another measure which restores suitable areas for planting (such as revetment or sediment retention).

L2 – Fish Habitat Structure. This measure consists of constructing artificial reefs with rock or other natural material. Underwater reefs from riprap could be constructed on selected sites and in water deep enough not to be a hazard to lake users. Snags and trees should be left in the water, and more should be added. This is excellent fish habitat. Additional trees from surrounding upland forest management could be used as a source for woody fish habitat.

4.2. Preliminary Screening of Measures

Initial screening was performed using qualitative assessments of the effectiveness and acceptability of the measures. Secondary screening utilized an assessment of existing habitat conditions combined with professional judgment regarding conceptual costs and benefits.

4.2.1 Initial Screening

Each measure was discussed to determine whether any could be screened from further consideration. The team identified the following preliminary screening criteria:

- High Operation, Maintenance, Repair, Rehabilitation and Reconstruction (OMRR&R) cost (qualitative assessment)
- High cost combined with low benefits (qualitative assessment)
- Potential for induced flooding
- Impacts to recreation (unacceptable to the public)
- Environmental mitigation required

Initially, the following measures were screened from further consideration for the indicated reasons:

S2 – Lake Drawdown. This measure was screened out due to the large impact to recreation. The primary purpose of the drawdown is to allow colonization and growth of moist soil plants. This would necessitate the drawdown(s) to occur in Spring and/or Summer, which is

a time when recreational use of the lake is at its peak, and would disrupt recreational use of the lake. This would be unacceptable to the public and the sponsor (impacts to recreation).

S3 – New Tributary Sediment Retention Basin(s). This measure was screened out due to the potentially large cost of construction and land acquisition combined with high OMRR&R costs.

S4 – Restore Existing Sediment Retention Basin. Further examination of Five Mile Lake demonstrated that a substantial amount of mitigation would be required if any significant amount of excavation was performed. The potential restoration benefits for the lake were not likely to offset or exceed the required mitigation. This measure was screened from further consideration (mitigation, high cost with low benefits)

P3 – Breakwaters. Because the shoreline erosion problem is the result of small waves, it was determined that the Off-Shore Revetment measure (P2) would be sufficient to address the problem and these larger (and farther off shore) breakwaters would not be necessary. This measure was screened from further consideration.

P4 – Non-Revetment Bank Stabilization. Further research into this measure revealed many stream-related applications but few lake-based applications. The study team did not feel that it would be effective in reducing the wave-wash erosion problem and would likely have high OMRR&R costs. This measure was screened from further consideration (high OMRR&R cost).

4.2.2 Secondary Screening

The study team then performed some initial data gathering and preliminary analyses to better define the extent of the identified problems and potential value of the ecosystem restoration opportunities. These were the team's findings:

1) There are no threatened or endangered species or any species of special significance utilizing the lake's aquatic habitat. Additionally, the observable structural fish habitat near the shoreline appeared to be plentiful. Adding more fish habitat structure (measure L2) would not yield significant benefits.

2) The northern end of the lake (approximately 200 acres or roughly 20% of the lake's surface area) has seen significant sediment deposition, reducing depths to an average of 3 feet and many areas are shallower. This allows the water temperatures to rise and levels of dissolved oxygen to be reduced in this area. It also reduces overwintering habitat in this area and may eventually prevent fish from accessing the tributaries. However, the lake currently has a significant amount of deeper water which remains cool, has sufficient dissolved oxygen, and provides plentiful overwintering habitat (see Table 4.2 which shows that the lake overall has an average depth of 11.7 feet). Additionally, it was found that the fish species in the lake do not require access to the tributary watersheds for their life cycle needs.

3) Available data showing the topography of the "lake bottom" before the lake was constructed was compared to a bathymetric survey conducted in 2011. This allowed the study team to determine the location and depth of sediment deposition over time. Due to the inability to survey very shallow areas, the 2011 bathymetric survey only covered 1,099 of the lake's total acres (approximately 1,300). This was considered sufficient coverage to allow for reliable average depth calculations.

   This information was then extrapolated into the future (assuming similar sedimentation rates and deposition patterns) to determine if there would be any significant habitat loss over the standard 50-year period of analysis. Three overlapping areas near the northern end of the lake (the area of greatest deposition) were evaluated, as well as the lake as a whole.

   These locations and the calculated average depth changes are displayed in the following table:

Table 4.2. Locations and resulting calculations for lake depth changes over time

Location (by station – in feet above the dam)	Surface Area (acres)*	Avg Depth 2011 (feet)*	Avg Depth at Year 50 (feet)*	Years to Zero Avg Depth*
28500 and Upstream	31	3.3	0.9	70
23000 and Upstream	191	4.9	2.8	125
11750 and Upstream	694	8.4	6.8	297
Entire Lake	1099	11.7	10.6	794
*Note: Each reported area and depth includes the entire area upstream of that station (i.e. the numbers in each column are cumulative)				

4) The eastern shoreline erosion, while ongoing in areas not already addressed by the sponsor, does not appear to be making a significant contribution to the problems of lake depth and is not significantly reducing the total amount of wetlands in the lake. Therefore, it does not appear that the remaining shoreline protection measures (P1 and P2) would yield sufficient benefits to warrant further consideration.

In conclusion, only measures S1 (In-Lake Sediment Retention) and L1 (Plantings) were carried forward after preliminary screening of measures.

4.3. Formulation of Alternatives

Because the plantings measure is not a stand-alone measure, the two alternatives considered for evaluation are S1 (In-Lake Sediment Retention alone) and S1L1 (In-Lake Sediment Retention with Plantings). For ease of terminology, these two alternatives will simply be called Retention (S1) and Retention with Plantings (S1L1).

Retention (S1)

The purpose of the Retention alternative is to capture suspended sediments coming into the lake from the tributaries and, over time, create shallow areas that support wetland restoration. The

most cost-effective berm construction would be achieved via a rock structure placed strategically to balance its size with the acreage of wetlands to be restored.

Given that the vast majority of the sediments entering the lake are coming from Shop Creek (on the west) and Shoal Creek (on the east), the team considered four locations in the northern end of the lake for implementation of this measure. Table 4.3 contains the rationale for site selections and Figure 4.1 shows the location of each site.

Table 4.3. Site Selection Rationale for Retention Alternative (S1)

Site	Rationale for Site Selection
1	The most downstream site considered. This is the narrowest point of the lake downstream of the confluence of the two tributaries. Sites farther downstream would require much larger structures.
1a	Slightly upstream of Site 1 but still downstream of the confluence of the two tributaries. This site has existing road access where Site 1 would require a temporary road to be constructed over private property.
2	Located on Shop Creek just above the confluence with Shoal Creek. This would be a smaller structure than Sites 1 and 1a. This site has existing road access.
3	Located on Shoal Creek just above the confluence with Shop Creek. This would be a smaller structure than Sites 1 and 1a. This site does not have existing road access.

Additional habitat output could possibly be achieved by locating the berm "downstream" in the lake from Site 1. However, sites farther downstream were eliminated from consideration due to concerns with construction access (and associated mitigation for tree clearing) and increased recreation impacts as more of the lake would be eliminated from motorized access.

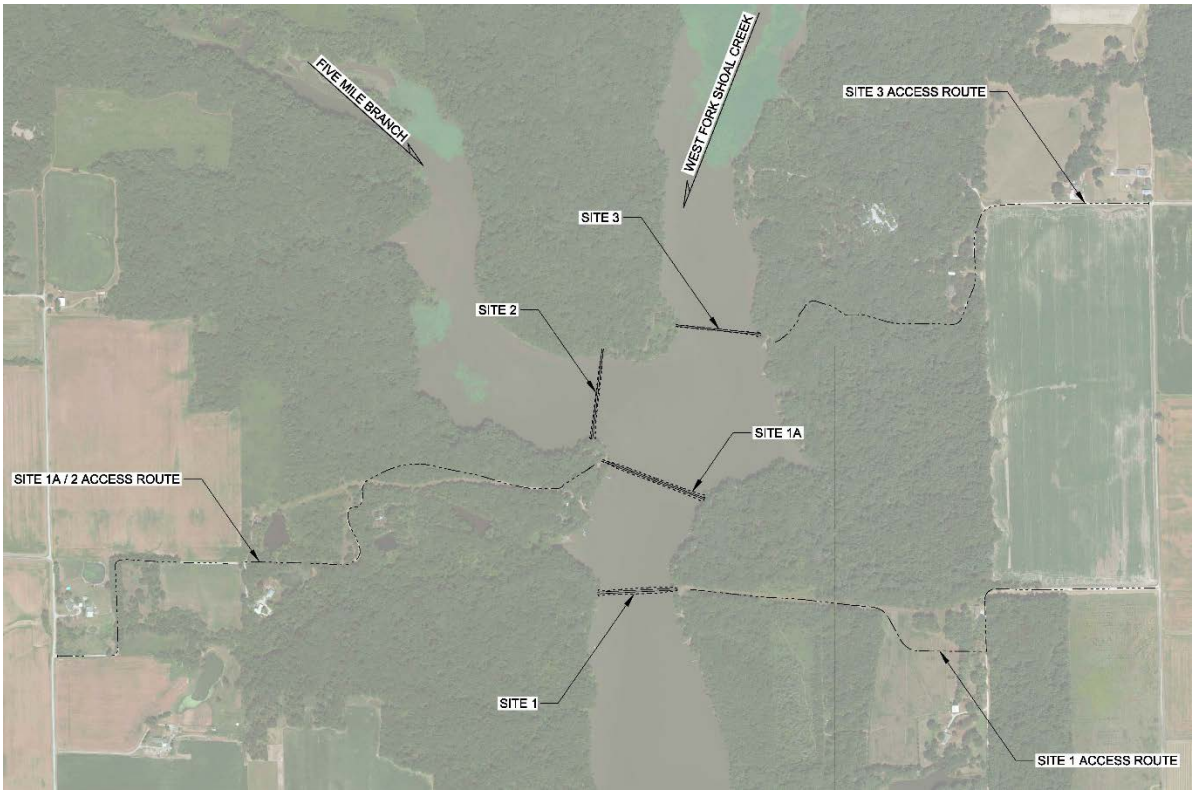

Figure 4.1. Locations considered for Alternative S1.

Retention with Plantings (S1L1)

This alternative would add Plantings to any or all of the Retention sites previously described. Adding plantings would have the effect of increasing the rate of habitat restoration and/or guiding the plant selection (as opposed to letting natural regeneration occur unassisted).

4.4. Screening of Alternatives

The study team utilized the same analysis conducted for the existing and future without project conditions to estimate the effects of the four Retention berm locations on sediment deposition. The changes in lake depths were calculated over time to estimate the timing and quantity of wetland restoration in each area. The results of the analysis for berm sites 2 and 3 revealed that there was no appreciable difference between the future without project and the future with project conditions (i.e., the areas upstream of the proposed sites for berms 2 and 3 are anticipated to convert to wetlands at approximately the same rate in both scenarios). Therefore, there is no real benefit to investing in berms at these locations.

After further consideration, the study team determined that the existing seed bank in the study area should be able to allow for natural regeneration and therefore the added cost of plantings would be unwarranted. Therefore, Alternative S1L1 was eliminated from further consideration. However, if post-project monitoring reveals an undesirable level of invasive species generation,

corrective action could be taken as an adaptive management measure. Additional information about monitoring and adaptive management can be found in Section 6.5.

5. EVALUATION OF FEASIBLE PROJECT ALTERNATIVES*

Only the Retention alternative was carried forward into full evaluation. For reasons previously stated, the alternative was only evaluated as Sites 1 and 1a. For simplicity and for the remainder of the analysis, the Retention alternatives at Sites 1 and 1a are referred to simply as Alternative 1 and Alternative 1a.

Alternative 1 Description

Alternative 1 is located at a relatively narrow part of the lake, downstream of the confluence of the Shop Creek and Shoal Creek. (See Figure 4.1). A rock berm would be constructed from the east bank to the west bank of the lake at this location. The initial design calls for the top of the berm to be 6 inches below the height of the spillway crest. Figures 5.1 and 5.2 show a typical section and a profile of the berm, respectively. All elevations shown are referenced to the North American Vertical Datum of 1988 (NAVD88).

Preliminary hydraulic analysis indicates that this does not increase lake water surface elevations for flows up through 20,000 cubic feet per second (approximately a 1% chance recurrence 48-hour rainfall event) in the future without project condition and only increases water surface elevations by 0.26 feet in the with-project condition. This rise in the water surface elevation in the with-project condition is projected to occur within boundary of the land owned by the City. More detailed analyses are needed to confirm these conclusions and to examine greater rainfall events. After construction, in order to avoid destruction of the restored wetland vegetation, motorized boats would not be permitted upstream of the berm. Additionally, the 6 inches of water flowing over the berm during normal pool conditions would not support the passage of motorized boats.

The berm would be constructed from 1000 lb riprap. This sizing is based on preliminary calculations of flow velocities and anticipated turbulence during winter drawdown flow conditions. Quantities of riprap were calculated assuming 50% of the stone would be lost or settle into the soft sediments of the lake bottom during and following construction. The proposed design for the in-lake berm is to have a 10 foot wide crown and 1V:3H slopes. The 10 foot crown was selected to allow for the construction of the berm in wet conditions. Given the wide crown, future design will consider whether physical barriers are needed to discourage motorized use of the berm crown when it is exposed during winter drawdown. Bankline revetment is also included in the design to prevent lake flows from flanking the berm.

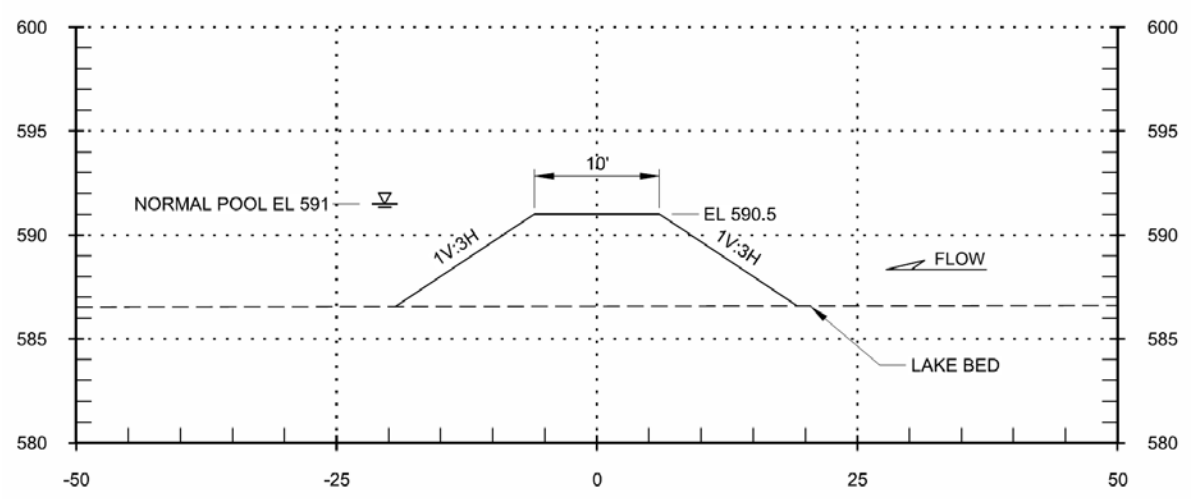

Figure 5.1 Alternative 1 Typical Section

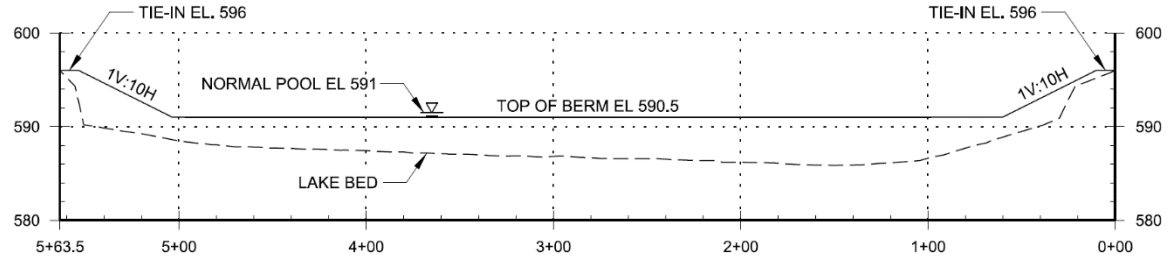

Figure 5.2 Alternative 1 Profile

There is access to this site from the east off of County Road 650 East and a private road called Privacy Lane. It would require construction of a temporary road crossing private land. It is anticipated that only a temporary construction easement is required because there would be no regular OMRR&R requirements. Inspections of the berm can be conducted via boat during winter drawdown. Approximately 1.3 acres of temporary construction and access easements are required for the berm construction.

Additionally, because the berm will impact recreation by eliminating all boat access from the lower lake to the area above the berm and there is no other public vehicular access to the area, this alternative includes improvements to an existing road on the east side of the lake which will facilitate non-motorized recreational access to the lake above the berm. For these road improvements, approximately 1.4 acres of permanent easement will be acquired.

Additional information about the berm design can be found in Appendix B.

Alternative 1a Description

Alternative 1a is also located at a relatively narrow part of the lake, downstream of the confluence of the Shop Creek and Shoal Creek and upstream of Alternative 1 (See Figure 4.1). The design of the berm at this location is essentially the same as Alternative 1, with differing quantities of materials. A rock berm would be constructed from the west bank to the east bank of the lake at this location. The initial design calls for the top of the berm to be 6 inches below the

height of the spillway crest. Preliminary hydraulic analysis indicates that this does not increase lake water surface elevations for flows up through 20,000 cubic feet per second (approximately a 1% chance recurrence 48-hour rainfall event) in the future without project condition and only increases water surface elevations by 0.26 feet in the with-project condition. This rise in the water surface elevation in the with-project condition is projected to occur within boundary of the land owned by the City. More detailed analyses are needed to confirm these conclusions and to examine greater rainfall events. After construction, in order to avoid destruction of the restored wetland vegetation, motorized boats would not be permitted upstream of the berm. Additionally, the 6 inches of water flowing over the berm during normal pool conditions would not support the passage of motorized boats.

Alternative 1a would have a similar section and profile as Alternative 1 (see Figures 5.1 and 5.2, respectively). The exiting lake bed elevations would be the primary difference.

There is access to this site from the west off of Cemetery Lane, which is partially located on private land and partially on Sponsor-owned land. Improvements would be needed for the existing roadway. Because the berm will impact recreation by eliminating all boat access from the lower lake to the area above the berm and there is no other public vehicular access to this area, a permanent easement will be acquired and the road improvements will be left in place following construction in order to facilitate non-motorized recreational access to the lake above the berm. This will also facilitate inspections of the berm, though no regular OMRR&R is anticipated to be needed for the berm. Approximately 1.4 acres of permanent easements are required.

Additional information about the berm design can be found in Appendix B.

5.1. Environmental Outputs

The Habitat Evaluation Procedure (HEP) of the U.S. Fish and Wildlife Service was used to analyze aquatic habitat quality at Lake Lou Yaeger. HEP involves the selection of representative faunal species (indicator or evaluation species) and the subsequent evaluation of habitat quality relative to the species. The method is based on individual “habitat suitability index” (HSI) models (which range from 0.0 to 1.0) for each selected indicator species. The model also requires a structured evaluation of pertinent variables indicative of habitat quality for the indicator species. “Habitat units” (HU's) are then calculated based on the products of habitat size and HSIs. Impacts are defined by the HEP method as the difference between with-project and without-project HU’s over the same time period. Appendix C contains a detailed description of the calculation of environmental outputs.

Alternative 1 Habitat Restoration
Non-forested (emergent) wetland habitat is proposed to be restored upstream of the berm. Representative wetland species selected to evaluate the benefits of restoring this habitat were the slider turtle and mink. These species models were selected simply as indicators of the quality of the existing and estimated future habitat that would benefit numerous species. In no way were the habitat restoration goals tailored to meet the particular needs of these two species.

HU's were calculated that numerically represent the restored acreage and the habitat quality of those acres. The evaluation estimates that over 40 acres of wetlands can be restored over the 50-year evaluation period.

Habitat improvements downstream of the berm due to reduced sedimentation were estimated using Bluegill and White Crappie models. Again, representative lake species were selected to evaluate the number of habitat units restored.

These restored habitat units are calculated over the 50-year period of analysis and result in "average annual habitat units" (AAHUs). This preliminary analysis resulted in a net total of 139 AAHUs for Alternative 1. The net annual impact reflects the difference between the future with- and future without- aquatic ecosystem conditions. As displayed in Table 5.1, approximately 139 more habitat units (HUs) would be available for indicator species every year during the life of the proposed project than would be available if the proposed project was not implemented.

Table 5.1. Alternative 1 Average Annual Habitat Units for indicator species for both future with- and future without- proposed ecosystem restoration conditions calculated using HEP.

Condition	AAHUs With Proposed Action	AAHU's Without Proposed Action	Net Annual Impact (rounded)
Non-Forest Wetlands	55	28	26
Open Water Habitat	896	783	113
Total	**951**	**811**	**139**

Alternative 1a Habitat Restoration

Construction of a berm at Alternative 1a would yield the same types of benefits but different in different quantities due to the reduced area of restoration and different sediment accumulation rates. The same evaluation described above estimated that approximately 32 acres of wetlands could be restored over the 50-year evaluation period. As displayed in Table 5.2, this preliminary analysis resulted in a net total of 127 AAHU's for Alternative 1a.

Table 5.2. Alternative 1a Average Annual Habitat Units for indicator species for both future with- and future without- proposed ecosystem restoration conditions calculated using HEP.

Condition	AAHU's With Proposed Action	AAHU's Without Proposed Action	Net Annual Impact
Non-Forest Wetlands	49	27	22
Open Water Habitat	896	791	105
Total	**945**	**818**	**127**

5.2. Cost Effectiveness Evaluation and Incremental Cost Analysis of Alternatives

Comparison of alternative feature designs and combinations of features is accomplished through cost effectiveness evaluation and incremental cost analysis. Cost-effectiveness evaluation is used to identify the least costly solution to achieve a range of project benefits. Incremental cost analysis is a tool that can assist in making decisions on the scale or size of the project or of individual features by determining changes in costs associated with increasing levels of benefits.

Quantities and costs were estimated for both alternatives. Designs for both alternatives are similar, with the primary differences lying in the quantity of rock and the construction access. Costs for monitoring and adaptive management are anticipated to be the same for both sites.

The preliminary total first cost estimate for Alternative 1 is $1,215,200. This includes $1,026,700 for design and construction, as well as $188,500 in LERRD (Lands, Easements, Rights of Way, Relocations, and Disposal) costs.

The preliminary total first cost estimate for Alternative 1a is $818,800. This includes $707,300 for design and construction, as well as $111,500 in LERRD costs.

The estimated total first costs were annualized at April 2016 (FY16) price level. Costs were annualized over a 50 year period of analysis using the FY16 discount rate of 3.125%. A 50 year period of analysis was selected as ecosystem restoration benefits for each alternative are expected to exceed the 50 year time horizon. Even though benefits are expected to last longer than 50 years, ER 1105-2-100 states that the maximum planning horizon that can be used for non-major multipurpose reservoir projects is 50 years.

Table 5.3 summarizes the construction costs for each alternative. Engineering and design (E&D) costs consist primarily of the development of contracting documents but also include engineering support during construction to inspect progress and the final product. In addition to the actual

construction contract, construction costs also include supervision and administration of the contract, as well as an amount for contingencies.

Table 5.4 summarizes the annualized costs for each alternative. OMRR&R costs are for maintenance of the recreational access road. Activities associated with monitoring and adaptive management (M&AM) costs are described in Section 6.5. The total M&AM cost for both alternatives is $25,000. OMRR&R activities are described in Section 6.3 and are anticipated to cost $10,000 every 10 years. The period of construction is anticipated to last less than 1 year, therefore the annualized costs do not include any interest during construction.

Table 5.3. Summary of Total Project First Costs

	E&D	Construction	LERRD	Total First Cost
Alternative 1	$146,000	$880,700	$188,500	$1,215,200
Alternative 1a	$98,300	$609,000	$111,500	$818,800

Table 5.4. Summary of Annualized Costs

	Total First Cost	Annualized First Cost	Annualized OMRR&R	Annualized M&AM	Total Annualized Cost
Alternative 1	$1,215,200	$48,356	$867	$864	$50,088
Alternative 1a	$818,800	$32,582	$867	$864	$34,314

The previously calculated Average Annual Habitat Units (AAHU's) are summarized in Table 5.5 for both the wetlands and sediment reduction subsets.

Table 5.5. Summary of Lake Lou Yaeger Average Annual Habitat Units

Alternative 1	AAHU
Upper Lake (Wetlands)	26
Lower Lake (Sediment Reduction)	113
Total	139

Alternative 1a	AAHU
Upper Lake (Wetlands)	22
Lower Lake (Sediment Reduction)	105
Total	127

The three alternatives (No Action, Alternative 1 and Alternative 1a) were evaluated using the IWR Planning Suite II tool. The IWR Planning Suite II tool was developed to aide environmental and ecosystem restoration planning studies to perform cost-effectiveness and incremental cost analyses (CE/ICA) on alternatives. CE output determines which alternatives are the least costly for a given level of environmental output. ICA evaluates the efficiency of the cost-effective alternatives, to determine which provide the greatest increase in output for the least increase in

cost. The primary assumption used to conduct the Lake Lou Yaeger CE/ICA was that AAHUs for all analyzed habitats were assumed to have equal value in comparing alternative plans.

Of the three alternatives submitted into IWR Planning Suite II tool, all were determined to be cost effective (meaning there were no other plans that achieved the same benefits for less cost) and all were determined to be best buys. Best buy plans are the cost effective plans which provide the greatest increase in benefits for the least increase in cost. Table 5.6 shows the three alternatives' cost effectiveness. Figure 5.1 and Figure 5.2 show the same results of the output in a graphical format.

Table 5.6. Lake Lou Yaeger Cost Effectiveness

	Net Total AAHU	Annualized Cost	Average Cost per AAHU	Cost Effectiveness
No Action Plan	0	$ 0	0	Best Buy
Alternative 1	139	$50,088	$360	Best Buy
Alternative 1a	127	$34,314	$270	Best Buy

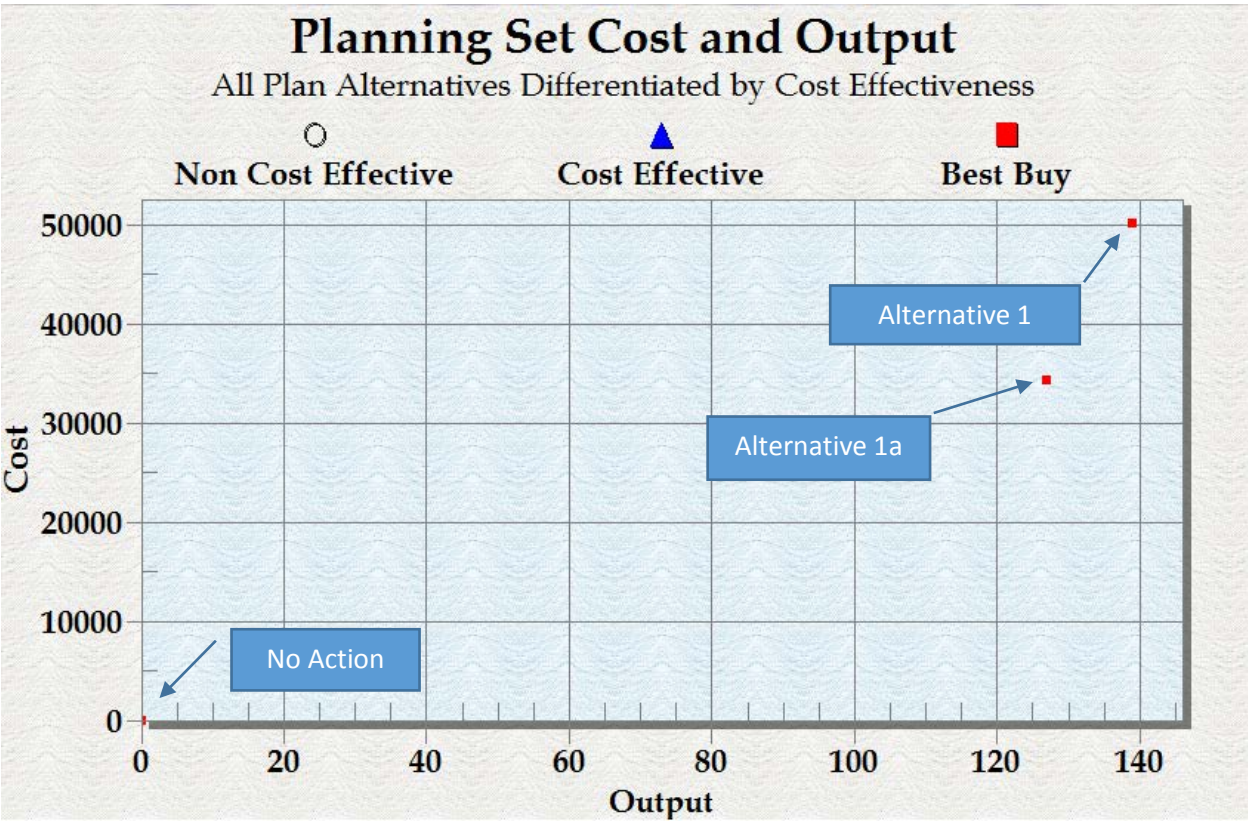

Figure 5-1. Lake Lou Yaeger Cost Effective Plans

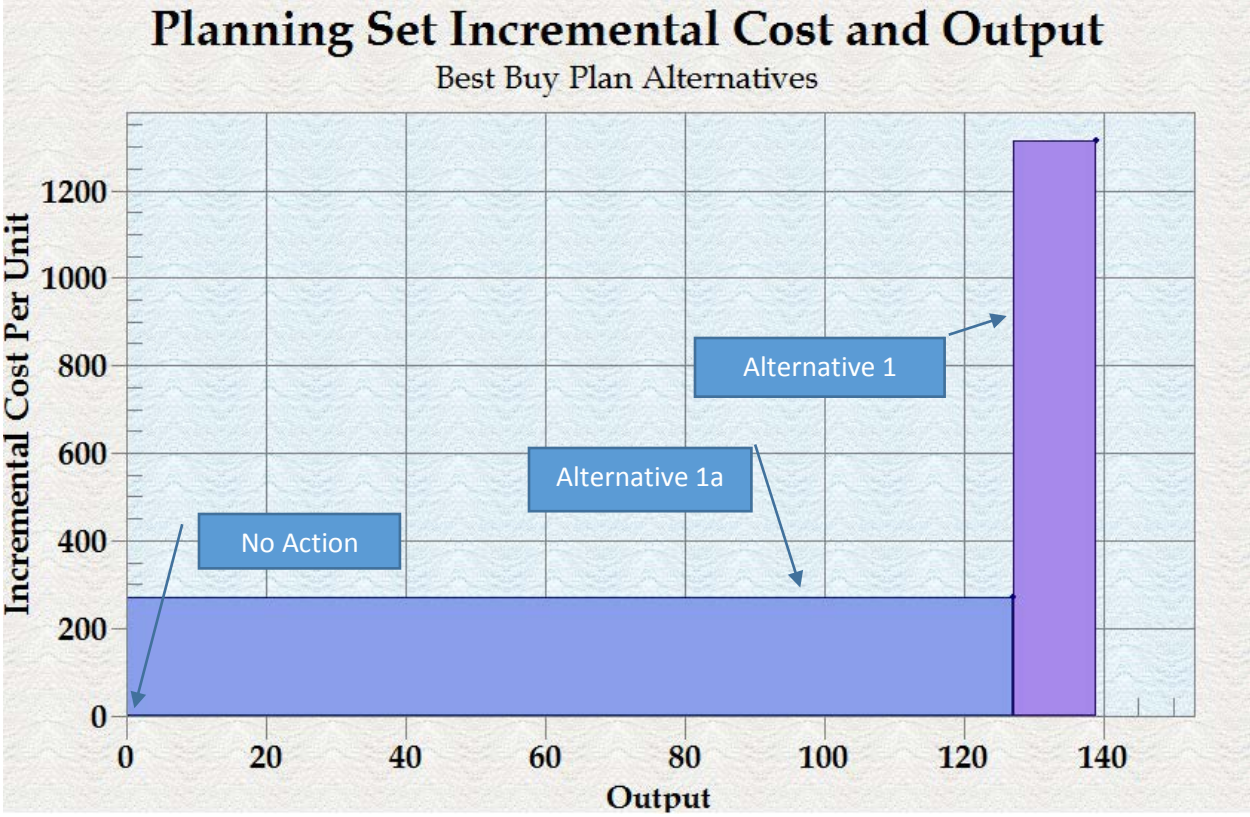

Figure 5-2. Lake Lou Yaeger Best Buy Plans

5.3. Completeness, Effectiveness, Efficiency and Acceptability

The Corps study team evaluated all three alternatives using the four evaluation criteria of the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&G paragraph 1.6.2 (c)). The four criteria are as follows:

Completeness. Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. To establish the completeness of a plan, it is helpful to list those factors beyond the control of the planning team that are required to make the plan's effects (benefits) a reality.

The no action plan is not complete because it does not contain any investments that would yield habitat benefits. Both action alternatives are equally complete in that they may be constructed and maintained independent of influences outside the Federal and Sponsor's control. Additionally, the design and costs of both alternatives account for all investments needed to realize the targeted benefits.

Effectiveness. Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities. An effective plan is responsive to the identified needs and makes a significant contribution to the solution of some problem or to the realization of some opportunity. It also contributes to the attainment of planning objectives. The most effective alternatives make significant contributions to all the planning objectives.

The no action plan is not effective because it does not address any of the problems or opportunities previously identified. Both action alternatives are effective at addressing the identified problems and opportunities. Alternative 1 is more effective than Alternative 1a because it yields more restoration benefits.

Both action alternatives contribute to the incidental opportunities related to water supply and recreation identified in Section 3.2. By capturing sediment in the northern part of the lake, the remainder of the lake will experience reduced rates of sediment deposition and loss of lake depths. This will extend the lake's ability to support water supply needs and recreation activities. Given the overall size of the lake and the relative proximities of the alternatives to each other, there is not anticipated to be any appreciable difference between the two alternatives related to their contribution to these incidental opportunities.

Efficiency. Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.

Although it is the least costly alternative, the no action plan is not efficient because it is also not effective. Alternative 1a is more efficient than Alternative 1 because it yields more restoration benefits at a lower cost than Alternative 1.

Acceptability. Acceptability is defined as the workability and viability of the alternative plan with respect to acceptance by Federal and non-Federal entities and the public and the compatibility with existing laws, regulations, and public policies.

The no action plan is not acceptable because it does not address any of the problems or opportunities. Both action plans have support from the Sponsor. The lake users and landowners in the vicinity are likely to view both alternatives similarly and have concerns about motorized boat access in the area above the berms. Both alternatives include access for non-motorized vessels above the berm, which may alleviate some of these concerns. The adjacent landowners may also have residual concerns about induced flooding, even after reading the analysis in this report. However, these are not anticipated to be widespread concerns.

5.4. Value Analysis

Per ER 11-1-321, Value Engineering (VE), states that the VE program applies to all procurement acquisitions that are federally funded, managed, and or executed by the Corps of Engineers, including Civil Works construction projects. ER 11-1-321, change 1 dated 01 January 2011 provides that the VE study applicability is for total Project costs of $1 million or more. The project cost does not meet this threshold and, therefore, neither a Value Analysis (VA) nor a VE will be required.

5.5. National Ecosystem Restoration Plan

Using the results from the four P&G criteria as well as the incremental cost analysis, the study team determined that Alternative 1a is the NER plan. This determination was based on the following considerations:

- This is the most effective plan
- This is the most efficient plan
- There are no significant differences between the two plans with regard to completeness or acceptability.

5.6. Tentatively Selected Plan

Because the project purpose is ecosystem restoration, and there are no opportunities to add recreation features to the final array of alternatives, potential National Economic Development (NED) and Regional Economic Development (RED) benefits were not evaluated. It is possible that the incidental benefits to water supply and recreation could contribute to RED benefits. However, any effects are anticipated to be the same for both of the final alternatives.

The comparison of the Environmental Quality (EQ) for both plans yields very similar environmental benefits (with Alternative 1 being slightly more than the NER plan) and no negative environmental effects. A consideration of Other Social Effects (OSE) such as life and safety factors, energy requirements, and community impacts yields no difference between the two final alternatives.

Therefore, the tentatively selected plan (TSP) is the NER plan. The TSP involves construction of a rock berm to encourage sediment deposition upstream of the berm. This will result in the restoration of 32 acres of emergent wetland upstream of the berm and also restore habitat for aquatic species downstream of the berm. The preliminary estimated total first cost of the project is $818,800 and it is anticipated to yield 127 net AAHU's. This results in an average annual cost of $270 per AAHU.

6. TENTATIVELY SELECTED PLAN: DESIGN, CONSTRUCTION, OMRR&R CONSIDERATIONS*

6.1. Design Considerations

The Project has been developed to a feasibility level of design, with consideration given to the relative simplicity of the design. Design details are included in the technical appendices. As with all feasibility level studies, these details would be refined in the Plans and Specifications (P&S) Stage.

6.1.1. Hydrologic/Hydraulic Considerations

Simplifying assumptions were made to estimate the sedimentation rates and locations. Due to the relatively simplicity and low project risk, a limited amount of additional detailed design work will be needed to refine the sedimentation estimates.

Storm events up through 20,000 cubic feet per second (approximately a 1% chance recurrence, 48-hour rainfall event) were modeled to determine if the berm would increase upstream water surface elevations. No upstream effects were found for the modeled storm events in the future without project condition and minor increases to water surface elevations of 0.26 feet in the with-project condition. This rise in the water surface elevation in the with-project condition is projected to occur within boundary of the land owned by the City. During the design phase, additional modeling will be performed to confirm that there are no adverse effects for larger storm events.

6.1.2. Geotechnical Considerations

Estimates of riprap loss in the lake bed were based on the general knowledge that the lake bottom is comprised of unconsolidated sediments and organic material.

6.1.3. Civil Design Considerations

Preliminary design was based on LiDar and available bathymetry. The data may need to be updated and/or ground surveys may be needed.

6.2. Construction Considerations

The lake will need to be drawn down a minimum 2-3 feet from normal pool elevation of 591 during construction to allow for exposure of the top of grade of the berm during construction and to allow for dumping or rock and shaping of the structure. This will not de-water the site, therefore construction will be done in the wet. A draw down to expose the entire lake bed would be preferred but dewatering the site will not be required. The proposed design for the in-lake berm is to have a 10 foot wide crown and 1V:3H slopes. The 10 foot crown was selected to allow for the construction of the berm in wet conditions. It is assumed that the contractor will dump the required large stone with a smaller choke stone on top starting on one side of the lake and working across until the in-lake berm is complete.

6.3. OMRR&R Cost Considerations

Once constructed, the berm is anticipated to be self-sustaining and not anticipated to need any regular OMRR&R during the 50-year period of analysis. Most of the time, flow velocities are expected to be low and unlikely to dislodge any stone. During winter drawdown, velocities are expected to increase over the berm and flow will become more turbulent. However, due to the necessary construction method, the berm's robustness is anticipated to be sufficient to handle these conditions. Therefore, needs for repair, replacement or rehabilitation are not anticipated.

There is no need to remove debris from the structure or perform any other routine maintenance. Due to the construction methodology, it is not anticipated that the stone will experience any significant settlement over time. The berm is an entirely passive feature and has no operational requirements.

Additionally, the wetlands, once established, will be self-sustaining and not require any maintenance activities during the 50-year period of analysis. Monitoring and adaptive management needs (which are not considered OMRR&R) are described in Section 6.5.

The recreation access road will require long-term maintenance, as needed. For the purpose of this study, it was estimated to require approximately 3 inches of gravel to be added to one third of the road every 10 years. Preliminary calculations estimate that this will cost approximately $10,000 every 10 years.

6.4. Real Estate Considerations

The proposed access to site 1a uses an existing road. The existing road is named Cemetery Lane which is a gravel road that connects 2 residences and several of the lakes west bank camping sites to East 5th Road. Cemetery Lane is partially located on private land and the sponsor's property. It is assumed that the entire length of Cemetery Lane will require improvement to sustain the transport of construction equipment. At some locations the access road would need to allow for the passage of large construction equipment. The access road will also require a permanent easement for approximately 1.4 acres of land.

6.5. Risk and Uncertainty and Adaptive Management.

Areas of risk and uncertainty have been analyzed and were defined so that decisions could be made with some knowledge of the degree of reliability of the estimated benefits and costs of alternative plans. Risk is defined as the probability or likelihood for an outcome. Uncertainty refers to a lack of knowledge. Uncertainty about the likelihood for an outcome results from a lack of knowledge about critical elements or processes contributing to risk or natural variability in the same elements or processes.

The study team worked to manage risk in developing project measures. It developed measures by expanding on and referencing successful similar work completed by the Corps and other resource agencies. The team used their experience from previous projects to identify possible risks and decrease uncertainty in plan formulation. The study team believes there is no significant risk or uncertainty that may prohibit eventual success of the proposed habitats measures. The Corps would avoid significant risk by proper design, appropriate site selection, and sound monitoring.

The study team predicts the rock berm would have very low risk of failure based on extensive hydraulic experience and modeling. This is a simple structure designed to withstand large flood and ice events and it is not anticipated to require future maintenance. The sponsor will inspect the structure to assure it remains functional and intact – this will be completed as part of the sponsor's operation and maintenance requirements.

The study team determined that uncertainties surrounding the success of the project are primarily linked to the following: 1) successful establishment of desirable aquatic vegetation in the wetland area, and 2) possible higher than estimated sedimentation rates in the wetland area.

The City already has a program for control of invasive species and the tentatively selected plan calls for allowing the vegetation in the wetland area to establish from the available seed bank. The study team identified the success of persistent aquatic vegetation as having the highest degree of uncertainty, especially in the dynamic and complex nature of a flowing water environmental ecosystem. Therefore, the team determined if natural revegetation does not occur within a 5-year post construction period, supplemental planting efforts would ensure wetland success. The supplemental planting would include native wetland plant species found in this region in Illinois. Costs are included for annual post-construction monitoring ($1000 per year for 5 years), as well as the costs for potential plantings at year 5.

Higher than estimated sedimentation rates is another potential source of unsuccessful vegetation establishment in the wetlands. Monitoring of sedimentation rates will be accomplished by observing vegetation establishment (included in the vegetation monitoring previously described). If sedimentation appears to be depositing at rates that are detrimental to wetland vegetation establishment in the wetlands, the berm may be modified to allow additional flow to pass. A preliminary cost for modifying the berm is included at year 5. Table 7.1 lays out the monitoring and adaptive management costs over time, with year 0 being the year construction is completed.

Table 7.1. Monitoring and Adaptive Management Costs Over Time

	Years Post-Construction					
Costs for	0	1	2	3	4	5
Monitoring		$1,000	$1,000	$1,000	$1,000	$1,000
Adaptive Management			$20,000			
Totals		**$1,000**	**$21,000**	**$1,000**	**$1,000**	**$1,000**
Note: Year 2 adaptive management includes plantings ($5000) and berm modification ($15,000)						

The non-Federal sponsor will collect data and participate in annual monitoring site visits. The Corps will determined if plantings or berm modification is needed and will collaborate with the sponsor regarding implementation. Appendix H contains the detailed monitoring and adaptive management plan.

7. SCHEDULE FOR DESIGN AND IMPLEMENTATION

Completion of the Feasibility Study is scheduled for early 2017. If both Federal and Sponsor funding for Design and Implementation is available, design could begin in 2017 and construction could complete in 2018.

8. COST ESTIMATES

Preliminary cost estimates supporting the identification of the TSP are located in Appendix E. The estimated total project cost for Alternative 1a is $818,800.

8.1. Cost-Sharing and Implementation Considerations

The sponsor is the City of Litchfield, IL. The sponsor's cost sharing requirements consist of three primary components: 1) 35% of the cost of design and implementation (including land

acquisition), 2) 35% of the monitoring and adaptive management costs, and 3) 50% of the study costs incurred after the first $100,000 was expended and before the Feasibility Cost Sharing Agreement (FCSA) was executed (referred to as "pre-FCSA cost").

With a design and implementation cost of $818,800, the City's 35% is $286,580. A portion of the City's share of design and implementation would be credit for acquisition of the required permanent easements, currently estimated to be $111,500. The remainder of the City's share ($175,080) can be contributed in cash or in-kind services. The pre-FCSA cost must be contributed in cash but the monitoring and adaptive management costs can be provided in cash or work in kind. Table 8.1 summarizes both the Federal and the non-Federal cost-sharing requirements. Because the monitoring and adaptive management costs occur over time, they are presented in the table as their net present value so that all costs are presented in 2016 dollars.

Table 8.1. Summary of Project Cost-Sharing

	Non-Federal	Federal	Total
Design and Implementation Cost*	$286,580 (35%)	$532,220 (65%)	$818,800
Easement acquisition	$111,500	$0	
Cash or In-Kind	$175,080	$532,220	
Pre-FCSA Cost	$44,600	($44,600)	
Monitoring and Adaptive Management	$7,600	$14,100	$21,700
Total	**$338,780**	**$501,720**	**$840,500**

*All costs are in 2016 dollars.

9. ENVIRONMENTAL EFFECTS*

9.1. Cultural Resources

No known historic properties have been identified within the project area therefore no adverse impacts are anticipated to cultural resources. The access road has not been previously surveyed in accordance with Section 106 of the National Historic Preservation Act. Prior to acquisition of the permanent easement, a Phase I cultural resources survey will be completed forany areas of the road that will be improved beyond the existing footprint and any potential historic properties will be avoided. Preliminary coordination with the Illinois Historic Preservation Agency can be found in Appendix F.

9.2. Natural Resources.

9.2.1. Geology and Soils (Prime Farmland).

As noted in Section 2.4.1 above, none of the soils in the area proposed for project construction are classified as prime. For this reason, no impacts to lands designated as prime farmland are expected to result from the proposed action or feasible alternatives.

9.2.2. Aquatic Resources.

The primary impact of the proposed action on aquatic resources in the project area will be the establishment of a physical barrier (partially) separating the existing Lake Lou Yaeger into two distinct zones. The main body (lower portion) of the lake will remain deepwater aquatic habitat, while much of the upper reach (upstream of the rock berm) will gradually transition from deep aquatic to wetland habitat.

Construction of the proposed ecosystem restoration project is not expected to affect the existing water supply function of Lake Lou Yaeger, and should not significantly reduce the ability of the lake to meet anticipated future water demand by the city of Litchfield or other communities that currently obtain their water supply from this source.

9.2.3. Wetlands

The proposed action is expected to increase the extent of functional wetland habitat in the project area over what would be anticipated to occur under the No Action alternative, by increasing the rate of sediment deposition in the shallow upper portions of the reservoir. The habitat evaluation conducted for this project indicated that implementation of the preferred alternative will result in a net increase of 32 acres of nonforested wetland, over the No Action alternative. Wetlands created or accelerated through this method would connect to and build on existing wetland habitat along the channels of Shop, Shoal, and Blue Grass Creeks. At this time no mitigation is expected to be required for this project. This determination will be revisited in the PED phase if any design modifications are proposed.

9.2.4. Fishery Resources

The increase in wetland habitat anticipated to result from the proposed action will benefit centrarchids and other fish species in Lake Lou Yaeger by providing additional spawning and nursery habitat, thereby increasing survival and recruitment opportunities for hatchling and young-of-year fish.

9.2.5. Wildlife Resources

No significant adverse effects to wildlife resources are expected to result from the proposed action. Implementation of the tentatively selected plan will result in long-term benefits to wetland wildlife in the project area.

9.2.6. Threatened and Endangered Species Biological Assessment

USACE has coordinated with the U.S. Fish and Wildlife Service (FWS) regarding this project. FWS has indicated that neither a Planning Aid Letter nor a Coordination Act Report is necessary for this report and FWS will complete its review and coordination during the public review period.

Federally listed endangered and threatened species known to occur or potentially occurring in Montgomery County include the Indiana bat (*Myotis sodalis*), currently listed as endangered; the northern long-eared bat (*Myotis septentrionalis*), currently listed as threatened; and the eastern prairie fringed orchid (*Platanthera leucophaea*), listed threatened.

The Indiana bat utilizes large trees with peeling bark or cavities as summer roosts, forages in upland forests or small stream corridors with well-developed riparian woods, and uses caves or mines as winter hibernacula. The northern long-eared bat roosts and forages in upland woods and forests during summer months, and hibernates in caves and mines during winter months, swarming in surrounding wooded areas in autumn. No hibernacula for either species is present in the vicinity of the proposed project. If clearing of trees in the construction area is necessary, such clearing will be restricted to the period 1 November through 31 March, when bats are unlikely to be present. For this reason, USACE has determined that the proposed action is not likely to adversely affect either the Indiana bat or the northern long-eared bat.

The eastern prairie fringed orchid grows in a wide variety of habitats, from mesic prairie to wetlands such as sedge meadows, marsh edges, even bogs. This orchid is a perennial plant that grows from an underground tuber. Flowering begins from late June to early July, and lasts for 7 to 10 days. This species is not documented as occurring in the immediate project area vicinity, and does not appear on the list of plant species recorded for the nearby Shoal Creek Conservation Area. For these reasons, USACE has determined that the proposed project will not affect the eastern prairie fringed orchid.

No significant adverse impacts to bald eagles, other migratory birds, or state listed threatened and endangered species are expected to result from the proposed action. Increased wetland habitat should provide benefits to wetland-dependent migratory birds and state-listed plant and animals that utilize the project area.

9.2.7. Air Quality

The proposed action would cause localized, temporary increases in exhaust emissions from equipment and vehicles during construction and placement activities. These impacts would be limited through emissions controls during activities, in compliance with USACE, USEPA, IEPA, and local laws and regulations. The action as proposed will not result in significant or long-term adverse impacts to air quality.

9.2.8. Water Quality

No significant adverse effects to water quality are anticipated to result from the proposed action. Construction of the rock berm will result in an increase in the rate of sedimentation above the berm. At the same time, rates of sedimentation in lake areas downstream of the berm should decrease somewhat.

9.3. Aesthetics

Aesthetic values will be affected somewhat over the long term by the placement of a partial barrier between the upper and lower portions of the lake. Upper lake viewsheds will develop to a

more marsh like state, while the lower lake would be expected to retain its current open water character.

9.4 Noise

The project study area is a relatively rural location where ambient noise levels are relatively low. There are many different noise sources throughout the area including commercial and recreational boats and other recreational vehicles; automobiles and trucks, and all terrain vehicles; aircraft; machinery and motors; and industry-related noise. However, these sources are somewhat widely distributed, and there are no sensitive human receptors located in proximity to the rock berm construction site or any of the feasible proposed restoration sites.

9.5. Safety

Signage of the proposed structure will be necessary following construction to warn boaters of its location, due to the 6" clearance between the top elevation of the berm and the water surface. Provided this feature is adequately signed as a potential navigation hazard, no significant impacts to public safety are expected to result from project implementation.

9.6. Existing and Potential Water Supplies; Water Conservation; Water Related

Construction of the proposed ecosystem restoration project is not expected to affect the existing water supply function of Lake Lou Yaeger, and should not significantly reduce the ability of the lake to meet anticipated future water demand by the city of Litchfield or other communities that currently obtain their water supply from this source.

9.7. Socioeconomic Resources

As specified by Section 122 of Rivers, Harbors & Flood Control Act of 1970 (P.L. 91-611), seventeen environmental quality categories of impacts were reviewed and considered in arriving at the final determination. The following socioeconomic categories were considered: displacement of people, aesthetic values, community cohesion, desirable community growth, tax revenues, property values, public facilities, public services, desirable regional growth, employment, business and industrial activity, displacement of farms, man-made resources, natural resources, air and water. Long term significant impacts from the tentatively selected plan to these identified points are not expected. Temporary minor impacts from constructions activities would occur on some categories as listed below:

Considered Points of Environmental Quality	Construction Effects
Displacement of people	no effects
Aesthetic values	no effects
Community cohesion	no effects
Desirable community growth	no effects
Tax revenues	no effects
Property values	no effects
Public facilities	no significant adverse effects
Public services	no effects
Desirable regional growth	no effects
Employment	no effects
Business and industrial activity	Minor beneficial effects
Displacement of farms	no effects
Man-made resources	no effects

9.8. Recreation

Minor adverse effects may result from the closing of upper portions of the lake to motorized boat traffic following project construction. However, non-motorized boat traffic will still be able to utilize the upper lake, accessing it via the included road improvements. Other recreational activities are unlikely to be significantly affected by the proposed action.

9.9. Parks, National and Historic Monuments, National Seashores, Wild and Scenic Rivers, Wilderness Areas, Research Sites, Etc.

No national and historic monuments, national seashores, wild and scenic rivers, wilderness areas, or research sites are located in the project area and as a consequence, no impacts to these resources are anticipated. No significant impacts to existing park facilities or designated natural areas, such as the Shoal Creek Conservation Area or the Roberts Cemetery Savanna Nature Preserve, are expected to result from the proposed action.

9.10. Prime and Unique Farmland

The proposed project will not result in any impacts to prime farmland or conversion of lands currently classified as prime to other uses.

9.11. Environmental Effects of Non-Preferred Alternatives

Under the no action alternative, the processes of sedimentation and loss of lake storage would continue at the present rate. No reduction in turbidity or suspended solids would occur in the lower lake, and the extent of forested and non-forested wetlands in the upper reaches of the lake

and major tributaries would remain the same or increase only slightly. Construction of the proposed rock berm at alternate location would have positive and negative impacts similar to the preferred alternative, but lesser in quantity commensurate with the reduced size of the area being affected.

9.12. Hazardous, Toxic and Radioactive Wastes (HTRW)

A Phase I Site Assessment is complete and contained in Appendix G. No HTRW concerns were identified.

9.13. Cumulative Impacts

Consideration of cumulative effects requires a broader perspective than examining just the direct and indirect effects of a proposed action. It requires that reasonably foreseeable future impacts be assessed in the context of past and present effects on important resources. Often it requires consideration of a larger geographic area than just the immediate project area. One of the most important aspects of cumulative effects assessment is that it requires consideration of how actions by others (including those actions completely unrelated to the proposed action) have and will affect the same resources. In assessing cumulative effects, the key determinant of importance or significance is whether the incremental effect of the proposed action will alter the sustainability of resources when added to other present and reasonably foreseeable future actions.

Cumulative environmental effects for the proposed ecosystem restoration project were assessed in accordance with guidance provided by the Council on Environmental Quality (CEQ) and U.S. Environmental Protection Agency (USEPA 315-R-99-002). This guidance provides an eleven-step process for identifying and evaluating cumulative effects in NEPA analyses.

The overall cumulative impact of the proposed Lake Lou Yaeger ecosystem restoration project is considered to be socially and economically beneficial, and to have no long term adverse environmental impact. Minor environmental impact resulting from berm construction includes adding rock fill to approximately 0.5 acre of shallow aquatic habitat.

Through this environmental assessment, cumulative effects issues and assessment goals are established, spatial and temporal boundaries are determined, and reasonably foreseeable future actions are identified. Cumulative effects are assessed to determine if sustainability of any of resources is significantly affected, with the goal of determining the incremental impact to key resources that would occur should the proposal be permitted. The spatial boundary being considered is the general area of the ecosystem restoration project. Three temporal boundaries were considered:

a. Past –1830s because this is the approximate time that the landscape was in its natural state, a vast prairie/wetland/woodland mosaic.

b. Present – 2016 when the decision was being made on the most beneficial ecosystem restoration project.

c. Future – 2065, the year used for determining project life end.

Projecting the reasonably foreseeable future actions is difficult. The proposed action (ecosystem restoration) is reasonably foreseeable. Actions by others that may affect the same resources are not as clear. Projections of those actions must rely on judgment as to which are reasonable based on existing trends and, where available, projections from qualified sources. Reasonably foreseeable does not include unfounded or speculative projections. In this case, reasonably foreseeable future actions include:

a. Continued growth in both population and water consumption within the watershed.

b. Continued conversion of agricultural and natural land to urban land use.

c. Continued application of environmental requirements such as those under the Clean Water Act.

The past has brought much alteration to the physical resources of the Shoal Creek watershed. Geology, soils, topography, hydrology and fluvial geomorphology have all been modified to suit human needs for purposes of habitation, commerce and recreation. As a result, water and sediment quality are impacted due to site-specific and watershed-scale alterations, as well as by daily activities such as road salting, industrial and municipal discharge, poor agricultural practices and by contaminants from transportation/vehicles.

It is reasonably foreseeable that agricultural land will be converted to small residential subdivisions or other types of development, or else purchased by conservation organizations for ecological restoration purposes. In some cases this can potentially improve water quality in terms of nutrient loading, but in other instances it may introduce other types of contaminants such as petroleum, surfactants, nutrients (sewage and lawn fertilizers) and other chemicals.

Municipalities have adopted development and stormwater management ordinances, but they are not always applied to the full intent. Best management practices are not sufficient to prevent the influx of nutrients and other chemicals into streams and wetlands from existing domestic, agricultural and industrial land uses. Given the past, current and future condition of the Shoal Creek watershed, the implementation of the proposed project poses only minor impacts relative to the vast array and quantity of adverse effects caused by development, agriculture and industry.

The ecological diversity of the Shoal Creek watershed has suffered as a result of previous significant physical resource alterations. Extreme landscape modification since European settlement has caused nearly 90% of the original land cover to be converted to agricultural, residential, commercial and industrial land uses. Considering past, current and future conditions of the watershed, implementation of the present ecosystem restoration project applies minor cumulative impact in terms of the vast array and magnitude of significant effects caused by development, agriculture and industry. There are no significant losses of resources identified in terms of plant, insect, fish, amphibian, reptile, bird, or mammal taxa or to the habitats they occupy due to implementation of the tentatively selected plan.

9.14. Probable Adverse Impacts Which Cannot Be Avoided

Closing off of the upper portion of Lake Lou Yaeger to boat traffic would be the primary unavoidable adverse effect of project implementation.

9.15. Relevant Laws and Regulations

The selected NER plan will be in compliance with all applicable federal environmental laws. Table 9-1 identifies relevant federal environmental laws and current compliance status.

Table 9-1. Relationship of TSP to Environmental Protection Statutes and Other Environmental Requirements

Federal Policies	Compliance
Archaeological and Historic Preservation Act, 16 U.S.C. 469, *et seq.*	Partial compliance
Analysis of Impacts on Prime and Unique Farmland (CEQ Memorandum, 11 Aug 80)	Not applicable
Clean Air Act, as amended, 42 U.S.C. 1857h-7, *et seq.*	Full compliance
Clean Water Act, 33 U.S.C. 1857h-7, et seq.	Full compliance
Coastal Zone Management Act, 16 U.S.C. 1451, *et seq.*	Not applicable
Endangered Species Act, 16 U.S.C. 1531, *et seq.*	Partial compliance
Farmland Protection Policy Act, 7 U.S.C., 4201, *et seq.*	Not applicable
Federal Water Project Recreation Act, 16 U.S.C. 460-1(12), *et seq.*	Full compliance
Fish and Wildlife Coordination Act, 16 U.S.C. 601, *et seq.*	Partial compliance
Flood Plain Management (Executive Order 11988)	Full compliance
Land and Water Conservation Fund Act, 16 U.S.C. 460/-460/-11, *et seq.*	Not applicable
Marine Protection Research and Sanctuary Act, 33 U.S.C. 1401, *et seq.*	Not applicable
National Environmental Policy Act, 42 U.S.C. 4321, *et seq.*	Partial compliance
National Historic Preservation Act, 16 U.S.C. 470a, *et seq.*	Partial compliance
Protection of Wetlands (Executive Order 11990)	Full compliance
River and Harbor Act, 33 U.S.C. 403, *et seq.*	Full compliance
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, *et seq.*	Full compliance
Wild and Scenic Rivers Act, 16 U.S.C. 1271, *et seq.*	Full compliance

Full compliance. Having met all requirements of the statute for the current stage of planning (either preauthorization or postauthorization)
Partial compliance. Full compliance will be attained after all investigations, reports, or coordination have been completed.

Not applicable. No requirements for the statute required; compliance for the current stage of planning

9.15.1. Floodplain Management, Executive Order 11988

Preliminary analysis indicates no change in pre-construction flood heights or level of flood protection is expected to occur as a result of proposed ecosystem restoration measures. This action should not adversely impact floodplains or floodplain values. Additional analysis during the design phase will be needed to confirm this conclusion. If necessary, the berm design will be modified to ensure no impacts to flood heights or flood protection.

9.15.2. Protection of Wetlands, Executive Order 11990

The proposed action would not involve significant adverse impacts to wetlands. The proposed action is expected to increase the extent of functional wetland habitat in the project area over what would be anticipated to occur under the No Action alternative, by increasing the rate of sediment deposition in the shallow upper portions of the reservoir.

9.15.3 Rivers and Harbors Act

Section 122 of the Rivers and Harbors Act of 1970 (Public Law 91-611, 84 STAT. 1823) requires that consideration be given to possible adverse economic, social and environmental effects. It also requires that final decisions on the project be made in the best overall public interest, taking into consideration the need for flood control, navigation and associated purposes; and the associated costs of eliminating or minimizing the following adverse effects:

Air, water and noise pollution;
Destruction or disruption of man-made and natural resources, esthetic values, community cohesion, and availability of public facilities and services;
Adverse employment effects;
Tax and property value losses;
Injurious displacement of people, businesses and farms;
Disruption of desirable community and regional growth.

Implementation of the proposed action would have no significant impacts on Section 122 identified economic, social or environmental resources.

9.15.4. Clean Water Act, as amended

As currently developed, both proposed alternatives would require a Clean Water Act (Section 404) permit, but both would fall under Nationwide Permit (NWP) 27 - Aquatic Habitat Restoration, Establishment, and Enhancement Activities. Because the proposed action meets the conditions of a Nationwide permit, no 404(b)(1) Evaluation has been prepared and no public notice process will be required. Following development of detailed design, review of regulatory requirements for the proposed action under Sections 404 and 401 of the Clean Water Act will be made in coordination with IEPA and IDNR Office of Water Resources. The proposed action would be in full compliance with these requirements prior to implementation.

9.15.5. Clean Air Act, as amended

The proposed action is expected to be in compliance with the Act. Mobile source emissions (construction vehicle exhaust fumes, fugitive dust) were estimated to be *de minimis* for criteria air pollutants. Based on these findings, the proposed project demonstrates conformity.

9.15.6. Invasive Species, Executive Order 13112

On February 3, 1999, President Clinton issued EO 13112 to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause by establishing the National Invasive Species Council.

The proposed action is consistent with EO 13112 as it will use relevant programs and authorities to prevent the introduction of invasive species and not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere.

9.15.7. Migratory Bird Habitat Protection, Executive Order 13186, and Bald and Golden Eagle Protection Act of 1940

Executive Order 13186 proclaims the intent to support the conservation of previous migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions. This Executive Order requires environmental analyses of Federal actions required by the NEPA or other established environmental review processes evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern. In addition, each Federal agency shall restore and enhance the habitat of migratory birds, as practicable. Implementation of the proposed action would result in benefits to migratory birds.

9.15.8. Endangered Species Act

USACE has determined that the project is not likely to adversely affect any Federally listed endangered or threatened species currently Federally listed, proposed for Federal listing, or a candidate for Federal listing. No designated Critical Habitat for any Federally listed species will be affected by the proposed action. The U.S. Fish and Wildlife Service (FWS) has indicated that neither a Planning Aid Letter nor a Coordination Act Report is necessary for this report and FWS will complete its review and coordination during the public review period. Comments received as a result of coordination, when received, will be included in Appendix F of the Final Report.

Pending completion of coordination with the IDNR, the proposed action is not expected to have significant or long-term adverse effects to any state-listed threatened or endangered species.

9.15.9. Fish and Wildlife Coordination Act, as amended

Project plans are being coordinated with the USFWS. Coordination responses, when received, will be included in Appendix F. The proposed action will be in full compliance.

9.15.10. Preparing the U.S. for the Impacts of Climate Change, Executive Order 13653

Executive Order 13653 requires Federal agencies to undertake actions enhancing climate preparedness and resilience, including the identification and assessment of climate change related impacts on and risks to the agency's ability to accomplish its missions, operations, and programs. USACE has considered and evaluated the risk associated with climate change on the effectiveness of the proposed action and is therefore considered to be in compliance with this Executive Order.

9.15.11. Farmland Protection Policy Act, as amended

The proposed project would not result in the conversion of any prime, unique, or state or locally important farmland to nonagricultural uses. The preferred alternative would be in full compliance.

9.15.12. Environmental Justice, Executive Order 12898

Executive Order 12898 of 1994 and the Department of Defense's Strategy on Environmental Justice of 1995, which direct Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations.

Minority populations are those persons who identify themselves as Black, Hispanic, Asian American, American Indian/Alaskan Native, and Pacific Islander. A minority population exists where the percentage of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population.

Low-income populations as of 2000 cover those whose income is $23,850 for a family of four and are identified using the Census Bureau's statistical poverty threshold. The Census Bureau defines a "poverty area" as a Census tract with 20 percent or more of its residents below the poverty threshold and an "extreme poverty area" as one with 40 percent or more below the poverty level. This is updated annually at http://aspe.hhs.gov/poverty/14poverty.cfm

A potential disproportionate impact may occur when the percent minority (50 percent) and/or percent low-income (20 percent) population in an Environmental Justice study area are greater than those in the reference community. The proposed action will not result in any change in land use or other impacts that would disproportionately affect minority or low-income populations, and is therefore considered to be in compliance with this EO.

9.15.13. National Historic Preservation Act, as amended

Pending completion of the Section 106 process it is anticipated the USACE will find the proposed undertaking will have no adverse effects on any district, site, building, structure, or object that is included or eligible for inclusion in the National Register. Initial coordination with the Illinois Historic Preservation Office is included in Appendix F. The proposed action will be in full compliance.

9.16. Short-Term versus Long-Term Productivity

The temporary increase in noise and the slight, temporary decrease in air and water quality which would occur during construction, are minor, temporary negative environmental impacts associated with a project that would produce positive ecosystem benefits.

9.17. Irreversible Resource Commitments

The fuel which machinery uses and construction materials such as clay and stone would be irretrievable commitments of resources associated with this project. There are no irrecoverable losses of resources identified with respect to geology, soils, topography, hydrology, water quality or fluvial geomorphology due to implementation of the tentatively selected plan.

9.18. Relationship of the Proposed Project to Other Planning Efforts

The proposed action is consistent with known land-use plans for this area.

10. PROJECT PERFORMANCE ASSESSMENT MONITORING

At this time, the study team has not developed a detailed Monitoring and Adaptive Management (M&AM) plan. An outline of the proposed monitoring and adaptive management is included in Section 6.5.

Monitoring needs would likely be limited, as the system is passive once constructed. Monitoring plans focus on the overall project goal (to restore, to the extent practical, quality, functional wetlands and habitat for aquatic organisms in Lake Lou Yaeger) and objectives (Restore herbaceous emergent wetlands; improve habitat for aquatic organisms) and are developed to be consistent with USACE implementation guidance for Section 2039 of the WRDA 2007, *Monitoring Ecosystem Restoration*. Monitoring activities will therefore concentrate on changes in water depths upstream of the rock berm and observations of vegetation (coverage and species composition) above the berm.

Potential adaptive management needs currently identified include concerns with invasive species recruitment in the wetland area and flow-related concerns over the dike leading to design modifications.

11. REAL ESTATE REQUIREMENTS

Approximately 1.4 acres of permanent easements are required. Appendix D contains more detailed information about the real estate requirements.

12. ENVIRONMENTAL OPERATING PRINCIPALS

The tentatively selected plan is consistent with the USACE Environmental Operating Principles by

1. Fostering sustainability as a way of life throughout the organization;
2. Proactively considering environmental consequences of all Corps activities and act accordingly;
3. Creating mutually supporting economic and environmentally sustainable solutions;

4. Continuing to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps which may impact human and natural environments;
5. Considering the environment in employing a risk management and systems approach throughout life cycles of projects and programs;
6. Leveraging scientific, economic, and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner;
7. Employing an open, transparent process that respects views of individuals and groups interested in Corps activities.

The team consistently used the EOP's in the formulation, evaluation, and selection process by assessing the risks throughout the life of the planning process and incorporating those risks as evaluation criteria. The TSP promotes sustainability and economically sound features by incorporating the most natural and least cost methods for restoring wetlands and habitat for aquatic organisms. Alternative formulation involved collaborative interactions with multiple agencies and stakeholders and the general public were engaged via public meetings and other public forums.

13. FEDERAL RESPONSIBILITIES

The Federal Government will provide 65 percent of the first costs of the construction, as well as monitoring and adaptive management costs. The total estimated project cost is $818,800, therefore the Federal portion of this Project is estimated at $532,220.USACE will prepare the plans and specifications; complete all NEPA requirements; execute a Project Partnership Agreement (PPA) with the Sponsor; advertise and award a construction contract; and perform construction contract supervision and administration.

14. NON-FEDERAL RESPONSIBILITIES

The City of Litchfield, IL, is the NFS for this Project. This section describes the responsibilities of the NFS in conjunction with the Federal Government to implement the tentatively selected plan.

A model Section 206 PPA will be reviewed by the NFS and its legal representation. The NFS is aware of the responsibilities. The PPA will be executed prior to implementation. A letter of intent to serve as the NFS will be provided in Appendix F.

In general, and in accordance with Section 206 of Public Law 104-303, the non-Federal Sponsor shall cost share 35 percent of the total project cost, including provision of all lands, easements, rights-of-way, and necessary relocations, as well as monitoring and adaptive management costs. The sponsor will be responsible for operating and maintaining the Project at 100 percent non-Federal expense upon completion of construction.

Specifically, the non-Federal Sponsor shall:

- provide all lands, easements, rights-of-way and relocations determined by the Federal Government to be necessary for construction, operation, and maintenance of the Project.

- provide, during construction, any additional costs as necessary to make the total non-Federal contributions equal to 35 percent of the total Project costs. The non-Federal Project cost share is estimated at $338,780. The NFS may receive credit towards its share of Project costs for the value of the LERRD provided for Project purposes. The estimated costs of the LERRD required for the Project is approximately $111,500. The NFS is anticipated to provide monitoring and adaptive management work-in-kind as part of their cost share responsibilities.
- for so long as the Project is authorized, operate, maintain, repair, replace, and rehabilitate the completed Project or functional portion of the completed Project, at no cost to the Federal Government, in accordance with the applicable Federal and state laws and any specific directions prescribed by the Federal Government. The operation, maintenance, repair, replacement, and rehabilitation costs are estimated at $10,000 every ten years.
- hold and save the Federal Government from damages due to the construction and operation and maintenance of the Project, except where such damages are due to the fault or negligence of the Federal Government or its contractors.
- grant the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon land which the NFS owns or controls for access to the Project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project.
- keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the Project to the extent and in such detail as will properly reflect total Project costs for a minimum of three years after completion of the accounting for which such books, records, documents, and other evidence are required.
- perform, or cause to be performed, any investigations for hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way necessary for construction, operation, and maintenance of the Project; except that the non-Federal Sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Federal Government determines to be subject to the navigation servitude without prior specific written direction by the Federal Government.
- assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA-regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines are necessary for construction, operation, and maintenance of the Project.
- agree that, as between the Federal Government and the NFS, the NFS shall be the operator of the Project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the Project in a manner that will not cause liability to arise under CERCLA
- prevent obstructions of, or encroachments on, the Project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) that might reduce the aquatic ecosystem restoration, hinder its operation and maintenance, or interfere with the proper function such as any new development on Project lands or the addition of facilities that would degrade the benefits of the Project.
- comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601- 4655), and the Uniform Regulations contained in 49 C.F.R. Part 24, in acquiring

lands, easements, and rights-of-way required for construction, operation, maintenance, repair, replacement, and rehabilitation of the Project, including those required for relocations, the borrowing of material, or disposal of dredged or excavated material, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

- comply with all applicable Federal and state laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements, including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq*.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq*.) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)
- provide the non-Federal share of that portion of the costs of data recovery activities associated with historic preservation that are in excess of the 1 percent of the total amount authorized to be appropriated for the Project, in accordance with the cost sharing provisions of the Project Partnership Agreement.
- not use Federal funds to meet the non-Federal Sponsor's share of total Project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.
- Participate with the District in monitoring and adaptively managing the finished Project to assure the Project meets its environmental restoration goals.

15. COORDINATION, PUBLIC VIEWS, AND COMMENTS*

A public scoping meeting was held in Litchfield in December 2013. The attendees were presented with general information about the study authority, the problems as they were understood at that time, and the study process going forward. They were invited to ask questions and comment on any additional problems or opportunities that they believed should be considered during the study. Comments received during the meeting included concerns about reducing sediment input from upstream, removing sediment from areas around boat ramps, ways to reduced localized sediment inputs, and possible conflicting uses of the lake (flood control, water supply, recreation).

The results of preliminary analysis and measure screening were presented to the Litchfield City Council in July 2015. The Council meeting is open to the public and there were representatives of the public and the press in attendance.

In accordance with NEPA, a 30-day public review period of the draft integrated report will be conducted. During this review period, a public meeting will be held to present the report's recommendation(s). The public's comments will be collected and considered as the report is being finalized.

Coordination with the U.S. Fish and Wildlife Service (FWS) has occurred throughout the study period. The FWS declined to provide a planning aid letter, citing the small size of the project. They also declined to participate in the habitat evaluation effort, due to resource issues. The FWS will complete its Fish and Wildlife Coordination Act review during the public review of the report.

The local office of the Natural Resources Conservation Service (NRCS) was consulted to confirm the City's lake maintenance requirements, as well as to understand and utilize as practicable past NRCS analyses related to the sedimentation concerns at the lake.

The Corps has provided written notification to the State of Illinois' Historic Preservation Agency that there is a proposed project and requests concurrence with the proposed investigation and monitoring plan. A copy of this letter is provided in Appendix F.

16. CONCLUSIONS AND RECOMMENDATIONS

The tentatively selected plan (TSP) involves construction of a rock berm to encourage sediment deposition upstream of the berm. This will result in the restoration of 32 acres of emergent wetland upstream of the berm and also restore habitat for aquatic species downstream of the berm. The preliminary estimated total first cost of the project is $818,800 and it is anticipated to yield 127 net AAHU's. This results in an average annual cost of $270 per HU.

It is proposed that the ecosystem features identified as the tentatively selected plan proceed with implementation in accordance with the cost sharing provisions set forth in this report. This recommendation is made with the provision that, prior to project implementation, the non-Federal sponsor shall enter into a binding agreement with the Secretary of the Army to perform the identified items of local cooperation.

The recommendations contained herein reflect the information available at this time, and current Department of the Army, and U.S. Army Corps of Engineer policies governing formulation of projects. The recommendations do not reflect the program and budget priorities inherent to the formulation of a national Civil Works construction program, not the perspective of higher review levels within the Executive Branch of the U.S. Government.

17. REFERENCES

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DRAFT

FINDING OF NO SIGNIFICANT IMPACT

SECTION 206 ECOSYSTEM RESTORATION

FEASIBILITY REPORT

WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

LAKE LOU YAEGER

CITY OF LITCHFIELD

MONTGOMERY COUNTY, ILLINOIS

I. I have reviewed and evaluated the documents concerning the proposed Lake Lou Yaeger Aquatic Ecosystem Restoration Project, located in Montgomery County, Illinois. The project involves the construction of a rock berm across the upper end of the lake to encourage sediment deposition and the development of non-forest emergent wetland upstream of the berm. This project is projected to result in the net restoration of 32 acres of non-forest emergent wetland upstream of the berm, and also to reduce sediment deposition downstream of the berm, resulting in improved habitat for aquatic organisms.

II. As part of this evaluation, I have considered:

a). Existing Resources and Future without Project with the No Action Alternative;

b). Impact to Existing Resources with Alternative 1a – Construction of an in-lake sediment detention berm at site 1a (Tentatively Selected Plan).

III. The possible consequences of these alternatives have been studied for physical, environmental, cultural, social and economic effects. Significant factors evaluated as part of my review include:

a. The Project is anticipated to improve the habitat value of Lake Lou Yaeger for wetland-utilizing fish and wildlife, and to decrease the rate of loss of deepwater habitat/lake storage over time.

b. Land use after the project should remain unaltered, and no significant social or economic impacts to the project area are expected.

c. No recreational or commercial fisheries; national and historic monuments, national seashores, wild and scenic rivers, wilderness areas, research sites, etc. would be adversely impacted by the project.

d. Aside from temporary disturbances during construction, no long-term significant adverse impacts to natural or cultural resources are anticipated. USACE has determined that no federally protected species would be affected by the proposed action. No hazardous and toxic waste issues are expected. No significant cumulative impacts are anticipated. No disproportionately high and adverse human health or environmental impacts on minority populations and low-income populations would occur (environmental justice).

e. Compliance with Clean Water Act Section 404, and Rivers and Harbors Act Section 10 is achieved under Nationwide Permit 27 for Aquatic Habitat Restoration, Establishment, and Enhancement Activities. Compliance with Section 106 of the National Historic Preservation Act (NHPA) will be achieved by avoidance or mitigation of all adverse impacts to any historic properties eligible for inclusion in the National Register of Historic Places within the area of potential effect. Compliance with the Archaeological and Historic Preservation Act will be achieved upon completion of coordination. The Fish and Wildlife Service will review the document during public review to ensure compliance with the Endangered Species Act and Fish and Wildlife Coordination Act. Compliance with the National Environmental Policy Act will be achieved with the signing of this document. The project is in compliance with all other applicable laws and regulations as documented in Table 9.1 of the Integrated Environmental Assessment.

f. The "No Action" alternative was evaluated and would be unacceptable to recommend as it does not meet the project purpose of restoring quality, functional wetlands and habitat for aquatic organisms in Lake Lou Yaeger.

IV. Based on the disclosure of the Tentatively Selected Plan impacts contained within the Environmental Assessment, no significant impacts to the environment are anticipated. The proposed action has been coordinated with the appropriate resource agencies, and there are no significant unresolved issues. I find that the proposed Lake Lou Yaeger Aquatic Ecosystem Restoration Project, located in Montgomery County, Illinois, would not significantly affect the

quality of the human environment. Therefore, I have determined that an Environmental Impact Statement is not required.

_____ _____

Date

Anthony P. Mitchell

Colonel, U.S. Army

District Commander