US Army Corps of Engineers

Little Rock District

Draft Environmental Assessment

Beaver Lake
Master Plan Revision
March 2018

BEAVER LAKE
MASTER PLAN REVISION
ENVIRONMENTAL ASSESSMENT

SECTION **PAGE**

Table of Contents

Appendix A: Public Comments (See Scoping Report)

Part 1: Scoping Report

Appendix B: Local, State & Federal Agency Coordination Letters (See Scoping Report)

Part 1 Agency Scoping Letters

Appendix C: Alternative Maps

BEAVER LAKE
MASTER PLAN REVISION
ENVIRONMENTAL ASSESSMENT

LIST OF TABLES AND FIGURES

1.0 INTRODUCTION

The Master Plan is the strategic land use document that guides the comprehensive management and development of all recreational, natural, and cultural resources throughout the life of the water resource project. The Master Plan guides the efficient and cost-effective management, development, and use of project lands. It is a vital tool for the responsible stewardship and sustainability of project resources for the benefit of present and future generations.

The Master Plan guides and articulates Corps' responsibilities pursuant to Federal laws to preserve, conserve, restore, maintain, manage, and develop the project's lands, waters, and associated resources. The Master Plan is a dynamic operational document projecting what could and should happen over the life of the project and is intended to be flexible to respond to changing conditions. The Master Plan deals in concepts, not in details, of design or administration. Detailed management and administration functions are addressed in the Operational Management Plan (OMP), which implements the concepts of the Master Plan into operational actions.

Master Plans are required to be developed and kept current for Civil Works projects operated and maintained by the Corps and they include all land (fee, easements, or other interests) originally acquired for the projects and any subsequent land (fee, easements, or other interests) acquired to support the operations and authorized missions of the project.

The Master Plan is not intended to address the specifics of regional water quality, shoreline management, or water level management; these areas are covered in the project's updated shoreline management plan, which is being revised concurrently with the Master Plan. However, specific issues identified through the Master Plan revision process are being communicated and coordinated with the appropriate internal Corps resource (i.e. Operations for shoreline management) or external resource agency (i.e. Arkansas Department of Environmental Quality-water quality) responsible for that specific area.

The revised Master Plan updates Design Memorandum No. 13-4, Updated Master Plan for Development and Management of Beaver Lake (USACE 1976).

With the Master Plan revision, an Environmental Assessment (EA) was completed to evaluate existing conditions and potential impacts of proposed alternatives. The EA is prepared pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR,1500–1517), and the Corps implementing regulation, Policy and Procedures for Implementing NEPA, Engineer Regulation (ER) 200-2-2 (1988).

2.0 PURPOSE AND NEED FOR ACTION

2.1 Purpose and Need

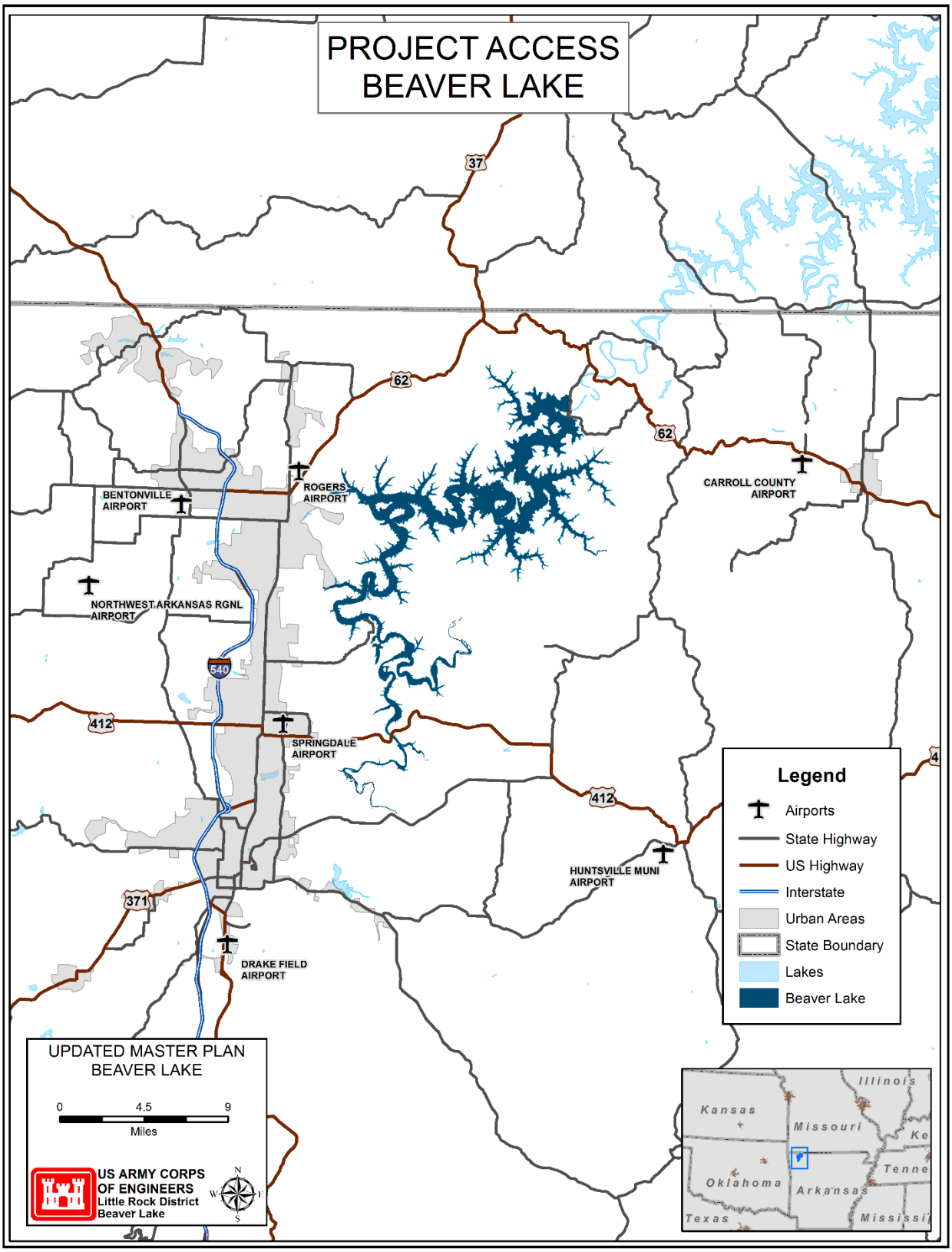
The Beaver Lake Master Plan is the required USACE approval document (ER 1130-2-550, Chapter 3) that guides all use and development on the project's more than 38,000 acres of Federal public lands and waters for environmental stewardship and recreation related purposes, throughout the life of the project. Beaver Lake's Master Plan was last updated in 1976, and it is now out of date.

The need for the proposed action is based on the age of the current plan and the changed conditions around the lake and in lake use. The preliminary Master Plan for Beaver Lake was approved in March 1961 and the original Master Plan was approved in December 1963. A Master Plan was approved in October 1969; the last update to the Master Plan was completed in 1976. There are currently 23 supplements to the 1976 Master Plan. From 1976 to the present, public use patterns have remained similar, but trends, facility and service demands have shifted in the past 41 years due to the increase in visitation and tourism. Beaver Lake incurs recreation pressure for both private shoreline and public recreation use, resulting in environmental and management issues, which cause sustainability concerns. Over the last four decades, the existing plan format and mapping technology has become outdated and is not compliant with current Master Plan format and current Corps policies/regulations, budget processes, business line performance measures, and priorities are not reflected in the existing Master Plan.

2.2 Project History

Beaver Lake is a multiple purpose water resource development project initially authorized for flood control, hydropower generation and other beneficial uses by the Flood Control Act dated 3 September 1954. The inclusion of storage in the lake for municipal and industrial water supply was authorized by the Water Supply Act of 1958. Beaver Lake is a major component of a comprehensive plan for water resource development in the White River Basin of Arkansas and Missouri. The project is located in the scenic Ozark Mountain region of northwestern Arkansas in Benton, Washington, Carroll and Madison counties-Figure 2.1. The total area contained in the Beaver project, including both land and water surface, consists of 38,138 acres owned in fee. Of this total, 1,432 acres are in flowage easement. The White River drainage area above Beaver Lake is approximately 1,186 square miles. The region is characterized by narrow ridges between deeply cut valleys that are well wooded with deciduous trees and scattered pine and cedar. When the lake is at the top of the conservation pool (elevation 1120.43 feet above mean sea level), the water area is 28,299 surface acres with 490 miles of shoreline within the lands owned in fee. The shoreline is irregular with topography primarily consisting of steep bluffs and gentle slopes.

Construction of Beaver Dam was initiated in March 1960. The dam was completed in June 1966, and the powerhouse and switchyard were completed in 1965. Beaver Lake was declared operational for public use in 1965. There are 12 public use areas around Beaver Lake. There are 11 parks on the lake presently operated by the Corps of Engineers. The State of Arkansas owns and operates Hobbs State Park Conservation Area, which covers 12,056 acres, and Devil's Eyebrow Natural Area, which covers 2,503 acres. Both properties are adjacent to USACE lands. There are two parks, Ventris, and Blue Springs that have been reduced to lake access only. One Park (Big Clifty) is operated by Carroll County, Arkansas. A more detailed description of Corps parks is located in the Beaver Lake Master Plan.


PROJECT ACCESS
BEAVER LAKE
37
62
62
ROGERS AIRPORT
BENTONVILLE AIRPORT
NORTHWEST ARKANSAS RGNL AIRPORT
CARROLL COUNTY AIRPORT
540
412
SPRINGDALE AIRPORT
412
HUNTSVILLE MUNI AIRPORT
371
DRAKE FIELD AIRPORT
Legend
Airports
State Highway
US Highway
Interstate
Urban Areas
State Boundary
Lakes
Beaver Lake
UPDATED MASTER PLAN
BEAVER LAKE
0
4.5
9
Miles
US ARMY CORPS OF ENGINEERS
Little Rock District
Beaver Lake
N
W
E
S
Illinois
Kansas
Missouri
Oklahoma
Arkansas
Texas

1

Figure 2.1 Beaver Lake and Surrounding Area

Table 2.1 Pertinent Data of Beaver Dam and Lake

PERTINENT DATA OF THE DAM AND LAKE	
General Information	
Purpose, Stream, State	FC, P, WS, R, F&W White R., Arkansas1
Drainage area, square miles	1,186
Average annual rainfall over the drainage area, inches, approximately	45.4
Dam	
Length in feet	2,575
Height, feet above streambed	228
Top of dam elevation, feet above mean sea level	1,142
Generators	
Main units, number	2
Rated capacity each unit, kilowatts	56,000
Lake	
Nominal bottom of power drawdown Elevation, feet above mean sea level	1,050
Area, acres	9,750
Nominal top of conservation pool Elevation, feet above mean sea level	1,120.43
Area, acres	28,299
Length of shoreline, miles	490
Nominal top of flood-control pool Elevation, feet above mean sea level	1,130
Area, acres	31,487
Length of shoreline, miles	547
(1) FC – flood control, P – power, WS-water supply,	
R-recreation, F&W-Fish and Wildlife	

3.0 ALTERNATIVES

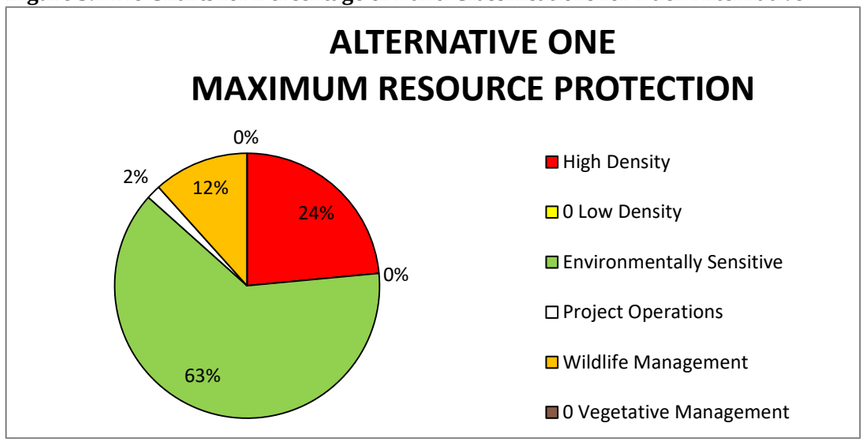
Alternatives evaluated in this EA are depicted in Table 3.1, and in Figure 3.1. The alternatives include: Alternative 1 (Maximum Resource Protection); Alternative 2 (Balanced Resource Management-Preferred); Alternative 3 (Current Resource Management); Alternative 4 (No Action - 1976 Plan); and Alternative 5 (Moderate Resource Protection). For a more detailed map analysis of the Preferred Alternative 2, refer to Appendix D of the Beaver Master Plan, which contains topographic maps depicting land classification and flowage easement areas around the shoreline. A complete set of maps for each alternative is located in an appendix to this document.

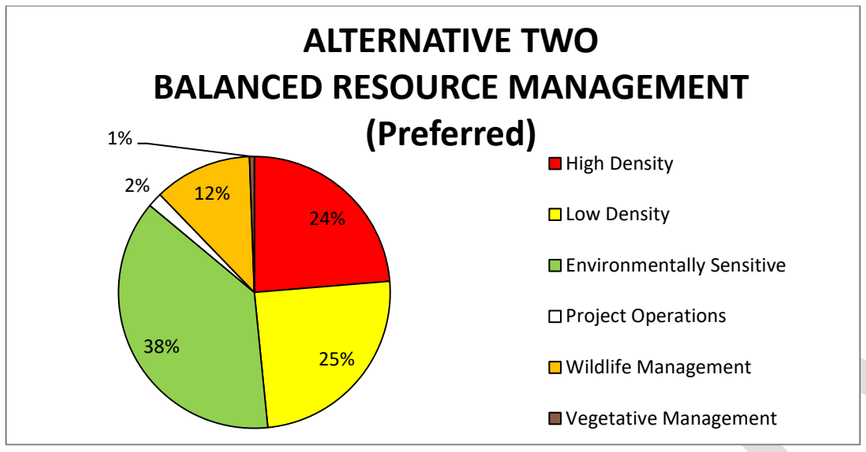
In this EA development, the different alternatives are compared to the No Action Alternative in order to evaluate potential positive and negative effects on the natural and human environment based on the various shoreline acreage classifications determined by each action alternative. All evaluated alternatives were provided for public review after completion of the draft EA. Public comments were collected during the public comment period and considered in the development of the final EA and the final updated Master Plan. Based on public comments received, the final EA would compare all action alternatives to the Preferred Action or to a modified alternative that is developed, based on public preferences. The Final EA presents the Selected Alternative and provides the basis for the agency decision under NEPA.

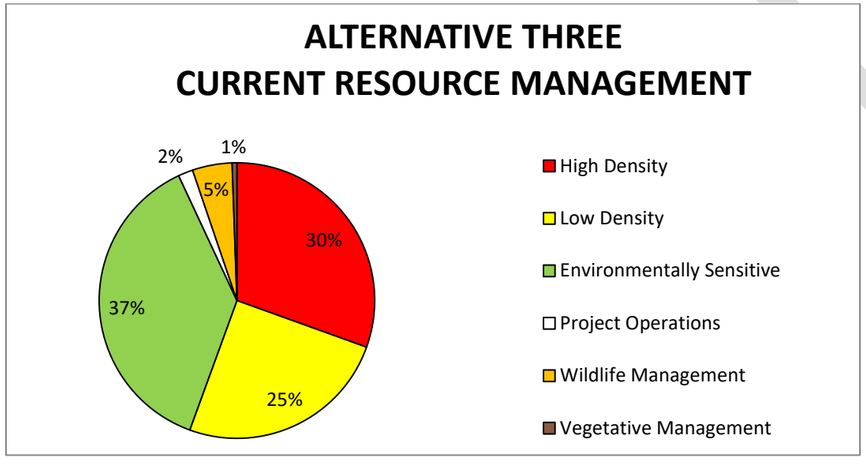
Table 3.1 Comparison of Land Classifications by Alternative

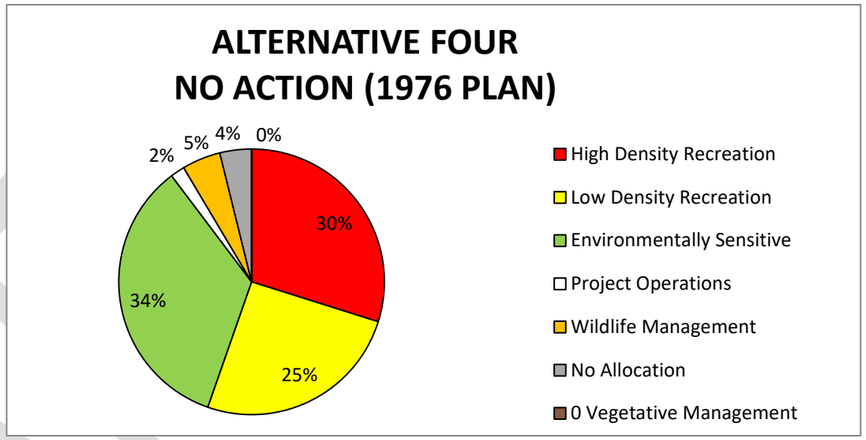
Land Classification	Alternative 1 Maximum Resource Protection		Alternative 2 Balanced Resource Management--Preferred		Alternative 3 Current Resource Management		Alternative 4 No Action (1976 Plan)		Alternative 5 Moderate Resource Protection	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
High Density	2,306.8	24%	2,324.8	24%	2,992.7	30%	2,929.9	30%	2,306.8	24%
Low Density	0.0	0%	2,426.0	25%	2,459.7	25%	2,501.8	25%	3,750.7	38%
Environmentally Sensitive	6,192.9	63%	3,692.7	38%	3,678.1	37%	3,371.7	34%	2,387.1	24%
Project Operations	170.0	2%	170.0	2%	170.0	2%	171.1	2%	170.0	2%
Wildlife Management	1,143.0	12%	1,143.0	12%	457.1	5%	460.3	5%	1,143.0	12%
Vegetative Management	0	0%	56.1	1%	55.0	1%	0.0	0%	55.0	1%
Not Allocated	0	0%	0.0	0%	0.0	0%	377.9	4%	0.0	0%

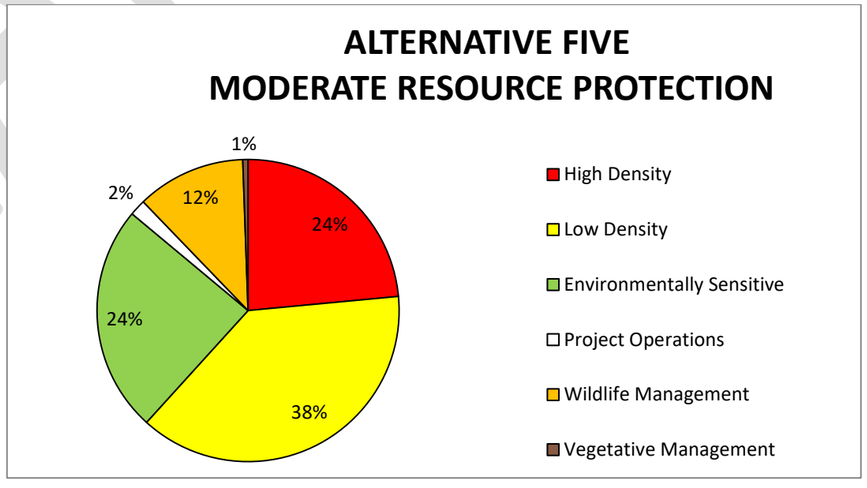
Figure 3.1 Pie Charts for Percentage of Land Classifications for Each Alternative











3.1 Maximum Resource Protection (Alternative 1)

Under the Maximum Resource Protection Alternative 2,306.8 acres, representing 24% of the shoreline, are classified as High Density lands. This represents a 6.4% reduction from the High Density acreage in the No Action Alternative. The 2,501.8 acres of Low Density lands in the No Action Alternative have been reclassified as Environmentally Sensitive lands, totaling 6,192.9 acres (63%) of the 9,812.6 shoreline acres. Wildlife Management lands are increased from 460.3 acres in the No Action Alternative to 1,143.0 acres in this alternative (5% to 12%). Project Operation lands total 170.0 acres (2%) under this alternative.

3.2 Balanced Resource Management-Preferred (Alternative 2)

Changes from Alternative 4 to Alternative 2 increases resource protection by reclassifying some Low Density lands to Environmentally Sensitive Areas. Unused Limited Development Areas (i.e. no existing shoreline use permits) were reclassified to Environmentally Sensitive Areas. All comments received during the Scoping phase were considered and reclassifications were made where feasible. Low Density lands are reduced by 75.8 acres from the No Action Alternative to 2,426.0 acres, representing 25% of available shoreline. High Density lands are reduced by 605.1 acres, and at 2,324.8 acres, comprise 24% of the shoreline. Environmentally Sensitive lands are increased by 321.0 acres (total of 3,692.7 acres or 38%), while Wildlife Management lands gained 682.7 acres, totaling 1,143.0 acres (12%). Project Operation lands decreased by 1.1 acres for a total 170.0 acres (2%). Vegetative management acreage totaled 56.1 acres (2%) under this alternative.

3.3 Current Resource Management (Alternative 3)

Under Alternative 3, the land classifications were mapped to reflect current land and resource management practices; agency and public comments received during the Scoping phase were considered during the mapping process.

Changes from Alternative 4 to Alternative 3 included reclassifying portions of undeveloped Low Density land to Project Operations or Environmentally Sensitive Area; reclassifying lands that contained active shoreline use permits or Limited Development Areas to Low Density; and lands that had no allocation were classified to match current land use. Alternative 3 has 2,992.7 acres (30%) classified as High Density, a 62.8 acre increase; 2,459.7 acres (25%) as Low Density, 42.1 acre decrease; 2,459.7 acres (25%), 3,678.1 acres (37%) classified as Environmentally Sensitive a 306.4 acre increase; 457.1 acres (5%), a 3.2 acre decrease Wildlife Management; and 55 acres increase (1%) classified as Vegetative Management. Project Operations encompasses 170.0 acres (2%) a 1.1 acre decrease.

3.4 No Action-1976 Plan (Alternative 4)

The No Action Alternative land classification, which is based on the 1976 master plan, does not accurately reflect the land use activities or resource management of the lake. In addition, this alternative does not address resource management laws, policies, and regulations that were implemented after the 1976 Beaver Lake Master Plan.

Under the No Action Alternative, the 1976 Master Plan land use classifications will remain the same and none of the 9,812.6 acres of land around the lake will be reclassified. This alternative will continue to allow for increased land and water based impacts within the Low Density land classification.

3.5 Moderate Resource Protection (Alternative 5)

Alternative 5 has the most potential for growth of private exclusive use (i.e. boat docks and vegetation modification) and passive recreational uses such as trails. Changes from Alternative 4 to Alternative 5 include reclassifying some High Density areas (i.e. future Corps parks) to Wildlife Management; many Environmentally Sensitive Areas were reclassified to Low Density. All comments received during the Scoping phase were considered and reclassifications were made where feasible. High Density acreage is reduced by 623.1 acres (2,306.8 acres or 24%) from the No Action Alternative. Low Density is increased by 1,248.9 acres, representing a 12.7% increase in acreage, totaling 3,750.7 acres (38%). Environmentally Sensitive lands was reduced by 984.6 acres to 2,387.1 acres (24%), and Wildlife Management lands increased by 682.7 acres to 1,143.0 acres, representing 12% of available lands. Project Operations lands were decreased 1.1 acres for a total 170.0 acres (2%). Vegetative Management lands were increased by 55.0 acres for a total of 55.0 acres (1%).

4.0 AFFECTED ENVIRONMENT

4.1 Project Setting

Beaver Lake is located in the Ozark Highlands of Carroll, Washington, Benton, and Madison Counties, 6 miles west of Eureka Springs, Arkansas. Having 490 miles of shoreline (at conservation pool) and over 28,000 water surface acres, Beaver Lake is the largest reservoir in northwest Arkansas and the first federal impoundment on the White River.

Despite being located adjacent to the fast-growing communities of Fayetteville, Springdale, Bentonville, and Rogers, Arkansas and a regional population of over 500,000, the lake provides open spaces and a quality outdoor recreation opportunity. Many arms and coves of the lake offer secluded areas for traditional activities such as fishing, skiing, sailing and scuba diving, but also allow for passive recreation opportunities like photography and nature observation. Limestone bluffs, striking vistas, and heavily wooded shorelines combine to offer a natural setting for all types of outdoor activities. Recreation areas offering developed facilities to support camping, boating, and swimming are located across the lake. Commercial concessions, such as marinas and resorts, provide services ranging from fuel and supplies to overnight lodging.

4.2 Climate

The climate in the Beaver Lake area is classified as humid subtropical according to the Köppen climate model. A humid subtropical climate is characterized by hot, usually humid summers and mild to cool winters. The Köppen definition of this climate is for the coldest month's mean temperature to be between 26.6 °F (−3 °C) and 64.4 °F (18 °C), and the warmest month to be above 71.6 °F (22 °C). Some climatologists prefer to use 32 °F (0 °C) as the lower bound for the coldest month's mean temperature. Under the modern Trewartha climate classification, climates are termed Humid Subtropical when they have mean temperatures of 50 °F (10 °C) for eight or more months a year. In most locations classed within this system, the mean temperature of the coldest month is between 35 °F (3 °C) and 65 °F (18 °C). Some climatologists consider the Trewartha grouping of subtropical climates to be more real-world and fitting on a global scale.

While technically classified as humid subtropical, the climate in the Beaver Lake area is considered moderate. The area experiences all four seasons and does receive cold air masses from the north; however some of the Arctic masses are blocked by the higher elevations of the Ozarks.

Average temperatures range from a high of 88 °F (31.1 °C) and low of 27 °F (-2.7 °C) in nearby Rogers, Arkansas. Extreme temperatures rarely exceed 96 °F (35.6 °C) and 13°F (-10.6 °C). Late summer is the time of maximum heat and least rainfall. During the winter months, midday temperatures in the basin are relatively warm, around 55 º to 60 º F. Some short periods of cold weather occur with temperature ranging from 0 º to 10 º F. On winter nights, temperatures from 40 º F to below freezing are common. Highest recorded temperature in Rogers, Arkansas was 114 °F (45.6 °C) (recorded in July 1954). The lowest temperature recorded was −16 °F (−26.7 °C), in February 1996.

The relative humidity typically ranges from 41% (comfortable) to 91% (very humid) over the course of the year, rarely dropping below 24% (dry) and reaching as high as 100% (very humid). The air is *driest* around April 9, at which time the relative humidity drops below 49%

(comfortable) three days out of four; it is *most humid* around June 3, exceeding 87% (very humid) three days out of four.

Dew point is often a better measure of how comfortable a person will find the weather than relative humidity because it more directly relates to whether perspiration will evaporate from the skin, thereby cooling the body. Lower dew points feel drier and higher dew points feel more humid. Over the course of a year, the dew point typically varies from 19°F (dry) to 71°F (muggy) and is rarely below 4°F (dry) or above 74°F (very muggy). There are two periods in the year that are most comfortable: The first is between April 18 and June 6 and the second is between September 3 and October 23. The air feels neither too dry nor too muggy during these periods (https://weatherspark.com/averages/31495/Rogers-Arkansas-United-States).

Average annual rainfall for the Beaver Lake area is 45 inches per year. Precipitation is weakly seasonal, with a bimodal pattern: wet seasons in the spring and fall, and relatively drier summers and winters, but some rain in all months. The spring wet season is more pronounced than fall, with the highest rainfall typically occurring in May. The average annual snowfall for the Beaver area is about 12 inches. Snow packs are usually short lived and are not commonly a concern for flooding.

Climate change is an area of concern due to the potential for effects on many aspects of the environment, especially those related to water resources. The U.S. Global Change Research Program (USGCRP) summarized information regarding climate change and its potential effects in regional assessments (http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts). In the Midwest, which extends from Minnesota to Missouri, extreme events such as heat waves, droughts and heavy rainfall events are projected to occur more frequently. Should these events become significant enough to impact the operation of Beaver Lake, the Master Plan and associated documents (i.e. Operations Management Plan and Shoreline Management Plan) would be reviewed and revised, if necessary.

4.3 Topography, Geology, and Soils

The depositional environment of the rocks found in the Arkansas Ozarks is one of a relatively shallow continental shelf, sloping toward deeper water generally toward the south. This shelf emerged many times during the Paleozoic resulting in numerous unconformities throughout the sequence. The Ozark Plateaus region of Arkansas is made up of generally flat-lying Paleozoic age strata divided into three plateau surfaces. The lowest and northern-most plateau is the Salem Plateau. The Springfield Plateau stands above the Salem a few hundred feet and is generally capped by lower Mississippian age limestones and cherts. The southernmost and highest plateau of the Ozarks is the Boston Mountains. All of these plateaus are deeply dissected by numerous streams throughout the area. The faulting in the Ozarks is generally normal; most faults displaying a displacement down on the southern side. However, some observations reveal that a few strike-slip faults may be present. Gentle folds are noted but are generally of very low amplitude. The depositional environment of the rocks found in the Arkansas Ozarks is one of a relatively shallow continental shelf, sloping toward deeper water generally toward the south.

Beaver Lake is part of the Springfield Plateau that occupies primarily the western and southwestern flanks of the Ozark Plateau province. The Springfield Plateau in this region rises to an elevation of approximately 1400 feet and in many areas, forms extensive plains. Hilly areas occur where rivers and their tributaries cut into the plateau surface, most notably in the vicinity of

the White River and Beaver Lake. As streams like the Buffalo National River cut through the plateau down to the level of the White River, they sometimes carve spectacular bluffs.

Lower Ordovician, Middle to Upper Devonian and Lower and Upper Mississippian age strata are present around Beaver Lake. Upper Ordovician and Devonian strata crop out around Beaver Lake and its tributaries. The Lower Mississippian Boone Formation comprises the surface rock over the majority of the area and forms the surface of the heavily dissected Springfield Plateau. In addition to the Boone Formation, Cotter and Jefferson City formations (Jefferson City formation has not been successfully differentiated from the Cotter Formation in Arkansas), and the Powel formation, all of Ordovician age are present in the area. Formations in the Devonian strata include the Chattanooga, Clifty and Penters.

The Boone Formation consists of gray, fine- to coarse-grained fossiliferous limestone interbedded with chert. This formation caps the higher hills in the area. Since limestone is easily dissolved by water, cave and solution (karst) features are prominent. The Boone Formation is well known for dissolutional features, such as sinkholes, caves, and enlarged fissures. Surface water may drain directly into channels in limestone, where it can move rapidly and without filtration to the surface as a spring, at a location that is unpredictable without extensive testing. Therefore, water pollution problems are of particular concern in this region. The thickness of the Boone Formation is 300 to 350 feet in most of northern Arkansas, but as much as 390 feet has been reported.

The Cotter Dolomite is composed of dolostone of predominantly two types: a fine-grained, argillaceous, earthy textured, relatively soft, white to buff or gray dolostone called "cotton rock", and a more massive, medium-grained, gray dolostone that weathers to a somewhat hackly surface texture and becomes dark on exposure. The formation contains chert, some minor beds of greenish shale, and occasional thin interbedded sandstone. The thickness is about 340 feet in the vicinity of Cotter, but the interval may range up to 500 feet thick in places.

The Powell Dolomite is generally a fine-grained, light-gray to greenish-gray, limy, argillaceous dolostone with thin beds of shale, sandstone, sandy dolostone, and occasionally chert. The formation’s thickness may be as much as 215 feet, but is often much thinner.

The Chattanooga Shale Formation is typically black, fissile clay shale that weathers into thin flakes. The beds are usually cut by prominent joints creating polygonal blocks upon weathering. The upper part of the formation may be slightly sandy and usually contains abundant pyrite. Thickness ranges from 0 to about 85 feet; normally averaging about 30 feet (AGS).

The Clifty Formation is thin, very sandy limestone and sandstone. Maximum thickness of this formation is only four feet, but is usually thinner, averaging 2 feet or less (AGS).

The Penters Chert is a fine-grained, fossiliferous, dolomitic, limestone with some chert and siliceous replacement overlain by a massive, dense, mottled gray chert with some patches of fine-grained limestone. The thickest outcrop exposure is about 25 feet; however, at least one report suggests a maximum thickness of about 90 feet (AGS).

The strata throughout the region are nearly horizontal. One predominant geological feature of the lake area is a low, persistent, limestone bluff, which occurs just above the Ordovician-Mississippian contact.

The faulting in the Ozarks is generally normal; most faults displaying a displacement down on the southern side. Lineaments and faults characteristic of northwest Arkansas are present around Beaver Lake. The Fayetteville Fault lies beneath Beaver Lake. This fault is the west side of a graben that has down-dropped the Boone Formation to lake level. The Starkey Fault bounds the east side of the graben. Both faults trend approximately N 450E. One section of the Starkey fault trends N 60-700E. The Clantonville Lineament – Monocline is a northeast to southwest trending structural feature that extends from north of Clantonville to Ventris Hollow. The location of this feature was determined from the 1:24,000 three dimensional quadrangle and from structural disparities in the Lower Mississippian rock units. This structural feature could be responsible for the presence of lead-zinc mineralization in an old prospect near Clantonville (north of Beaver Lake). The trend of this lineament to monocline is N 30-400E. Paleokarst features within the top of the Powell Dolomite are present around Beaver Lake and coincident with a lineament in Limekiln Hollow near Garfield, northwest of Beaver Lake. Figure 4.1 depicts geological formations and fault lines located in this region.

In general, the soils of the Ozark Plateaus are residual and are formed on a broad, domed, upwarp consisting mostly of limestone and dolomite. The main difference in the soils is due to different rocks from which the soils were formed. The main geologic materials are cherty limestone; cherty, very siliceous dolomite; cherty, siliceous dolomite; and alluvium, which are weathered and water transported products of the first three materials. Glade-rock soil occurs where the cherty, very siliceous dolomite is exposed to the soil formation. Dolomite is more resistant to weathering than limestone and siliceous dolomite is even more resistant, so very shallow soil results. In areas where the dolomite is less siliceous, more weathering has taken place; however, the soils produced are not as deep as soils formed by limestone.

The following eight soils associations are found in and around the Beaver project area: Captina-Nixa, Captina-Nixa-Pickwick, Clarksville-Nixa-Baxter, Corydon-Sogn, Enders-Allegheny-Mountainburg, Razort-Captina-Etowah, Linker-Apison-Hector, and Captina-Pembroke.

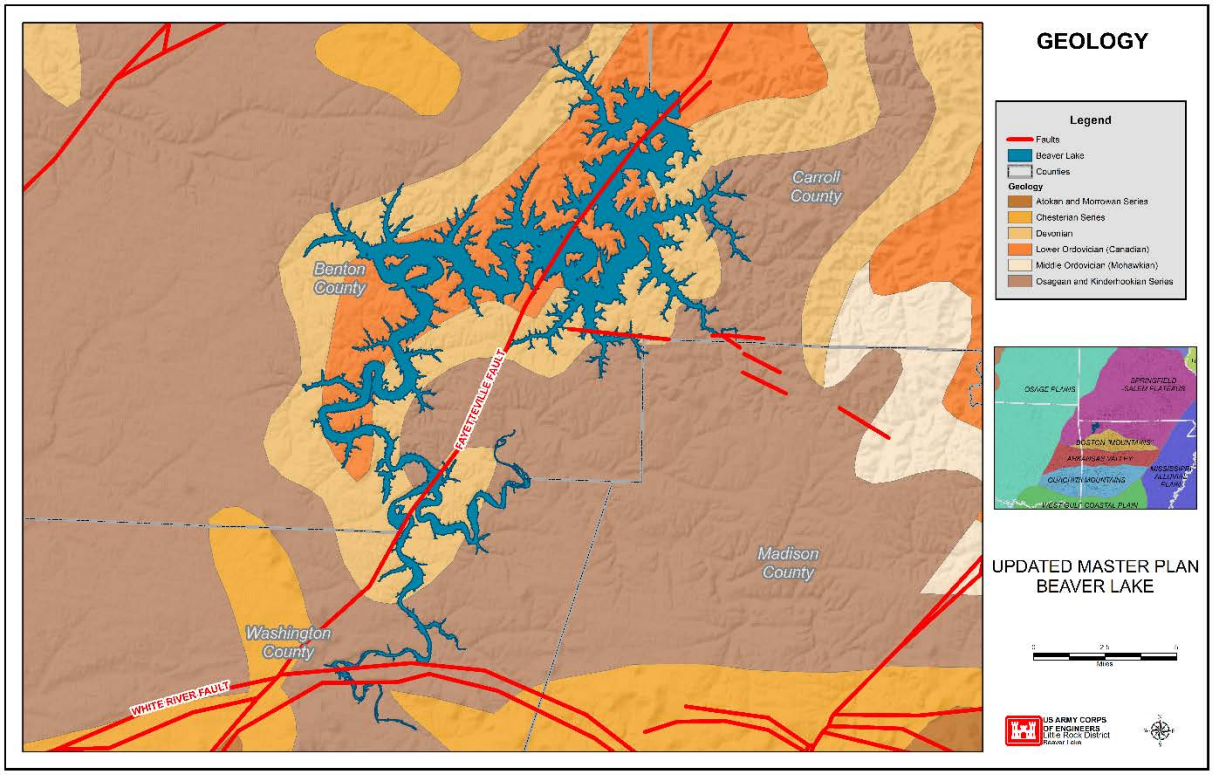


Figure 4.1 Geology of Beaver Lake Watershed

4.4 Aquatic Environment

4.4.1 Hydrology and Groundwater

In the Interior Highlands of western and northern Arkansas ground-water supplies are more limited than in the Coastal Plain. Much of the Ozark Plateaus region is underlain by carbonate rocks, which are quite soluble in the presence of water. Solution by ground water has caused many large openings through which water passes so quickly that contaminants from the surface cannot be filtered out. Signs of these openings are caves, sink holes, springs and lost stream segments. As a consequence, the water in shallow wells may not be suitable for human consumption without treatment.

Three aquifers, which are part of the Ozark Plateaus Aquifer System, are located within northern Arkansas. The Springfield Plateau aquifer is generally under unconfined conditions, with ground water movement occurring through fractures and solution cavities formed by dissolution of carbonate rock. Local discharge is through springs and streams. The Ozark aquifer is generally under confined conditions, especially where overlain by the units of the Ozark Confining Unit (Chattanooga Shale). Most wells in the Springfield Plateau and upper units in the Ozark aquifer yield 5-10 gpm on the average, with yields greater than 25 gpm in rare cases.

The third aquifer, the Roubidoux Formation and the Gunter Sandstone Member of the Gasconade Formation in northern Arkansas occur at greater depth and constitute the only significant aquifer system in the Ozarks. Both are permeable sandstone and carbonate units of Ordovician age. These aquifers serve as the principal source of high-quality water for many communities in northern Arkansas where surface water sources are unavailable. Together these units may yield up to 500

gpm to wells. These formations do not outcrop anywhere in Arkansas but instead outcrop in southern Missouri.

4.4.2 Water Quality

The waters of the Arkansas portion of the White River watershed have all been designated by the Arkansas Department of Environmental Quality (ADEQ) for fisheries, primary and secondary contact recreation, and domestic, agricultural, and industrial water supplies (ADEQ, 2012). Beaver Lake is classified by ADEQ as a Type A water body, which includes most larger lakes of several thousand acres in size, in upland forest dominated watersheds, having an average depth of 30 to 60 feet, and having low primary production (i.e., having a low trophic status if in natural [unpolluted] condition). Beaver Lake, like all other lakes of its size in the Ozark region, stratifies chemically and thermally in the late spring with stratification extending into late fall and early winter. During the warmer months, lake waters of the upper layer (the epilimnion) are warmer and contain more dissolved oxygen, while the denser, lower layer waters (the hypolimnion) are colder and contain very little or no dissolved oxygen, thus undesirable for fish habitat.

This undesirable water, when discharged downstream from hydropower generation, may cause some problems in the tailwaters. To combat this problem, the dissolved oxygen content is monitored and various management measures are implemented to improve the dissolved oxygen concentration in the hydropower releases. A highly productive trout fishery has been established in the Beaver tailwaters by the Arkansas Game and Fish Commission because of the available discharge of cold water from the dam, which is reaerated by turbulence as it flows downstream..

As the stratified epilimnion cools in the late fall and winter, the layers begin to mix (de-stratify) and dissolved oxygen (DO) is more evenly distributed. This condition is more favorable to the fishery of the lake and overall water quality.

The upper 1500 acres of Beaver Lake has been listed by the Arkansas Department of Environmental Quality (ADEQ) on Arkansas' 303(d) list of impaired waters, approved by the Environmental Protection Agency (EPA), due to turbidity (ADEQ, 2008). According to the Arkansas 303(d) list, these excessive levels impact the local fisheries as well as primary contact, both designated uses of Beaver Lake. The elevated turbidity levels are due to excessive silt from surface erosion from agriculture activities, unpaved road surfaces, in-stream erosion – mainly from unstable stream banks, and any other land surface disturbing activity. The Draft 2010 Integrated Water Quality and Monitoring Report (ADEQ, 2010) added pathogen indicator bacteria as a contaminant for the same area of Beaver Lake. Surface erosion activities are listed as the probable source for this contaminant as well.

Clean Water Act requires states to list waters that do not meet Federal water quality standards or have a significant potential not to meet standards as a result of point source dischargers or non-point source run-off. Subsequent to listing on the 303(d) list, the statute requires that the states develop and set the Total Maximum Daily Load (TMDL) for water bodies on the list within 13 years. A TMDL establishes the maximum amount of a pollutant that can enter a specific water body without violating the water quality standards. Values are normally calculated amounts based on dilution and the assimilative capacity of the water body. TMDLs have not been established by ADEQ for the upper Beaver Lake area.

4.4.3 Fish Species and Habitat

The impoundment of the White River, War Eagle River, and other tributary streams and rivers which form Beaver Lake resulted in changes in the composition of the fish populations. Smallmouth bass was the principal game fish found in the White River and War Eagle River prior to impoundment. Arkansas Game and Fish Commission (AGFC) is the agency primarily responsible for managing the fishery and through their efforts, a variety of fish species are well-established in the lake. Sport fish species currently found include: largemouth bass, spotted bass, smallmouth bass, white bass, striped bass, hybrid white-striped bass, walleye, flathead catfish, channel catfish, white crappie, black crappie, and various species of sunfish. Due to the quality and diversity of the fishery, Beaver Lake serves as a national fishing destination, hosting hundreds of fishing tournaments annually.

Beaver Lake was first impounded in 1966 and much of the standing timber was cut prior to the impoundment. Since impoundment, the few remaining native forests that were submerged provided little structure and forage habitat for fish. Since this limited habitat has degraded over time, in 1986, AGFC began an artificial habitat improvement project with the primary objective to improve fish habitat within Beaver Lake. Since 1987, hundreds of fish habitat structures known as "fish attractors" have been placed in Beaver Lake by AGFC. AGFC continues to fund the maintenance of the attractors each year, adding fresh cover to keep the attractors productive and increasing the habitat.

In 1990, AGFC began a program for the public to bring their discarded Christmas trees to be used as fish attractors to enhance fish habitat. Thousands of these trees have been sunk by Corps personnel, AGFC personnel, and volunteers since the program began.

Walleye, smallmouth bass, striped bass, hybrid white-striped bass, walleye, and paddlefish have been introduced into Beaver Lake to add diversity to the fishery. Natural reproduction of striped bass and hybrid white-striped bass does not occur in Beaver Lake. Since 2004, AGFC stocks approximately 100,000 walleye, 30,000 channel catfish, 30,000 blue catfish, and 200,000 striped bass each year. While natural reproduction occurs in white crappie, black crappie, largemouth bass, and smallmouth bass, AGFC supplements this reproduction by occasional stockings of these species. Historically, there have also been introductions of northern pike, blue catfish, lake trout, and threadfin shad.

Wilson Lake in the Fayetteville area was used for the supply hatchery for warm water species until 1986. In 1986, a 30 acre fish nursery pond was constructed by AGFC on the north shore of the Blackburn Creek arm of Beaver Lake for the purpose of rearing game fish for stocking purposes. Historically, over 10,000 channel and blue catfish were raised in the summer months and 15,000 walleye in the spring months for stocking purposes. Since 1986, the fish nursery pond has been used to rear black crappie, largemouth bass, smallmouth bass, and walleye for stocking directly into the lake.

The impoundment of Beaver Lake in 1965 caused environmental changes in the tailwater portion of the White River from Beaver Dam to Table Rock Lake downstream. Hypolimnetic discharge from Beaver Dam created cold-water habitat that was unsuitable for native, warm-water species, such as smallmouth bass. To mitigate for the loss of the warm-water fishery, the AGFC began

stocking rainbow trout into Beaver tailwaters in 1966. Brown trout were first stocked in 1985 to increase the diversity of trout species available to anglers. Cutthroat trout and brook trout were introduced in 1989 and 1994 to further improve the quality of anglers' trout fishing experiences. The Beaver tailwater fishery has gained popularity over the last few decades and is currently among the most popular trout fishing locations in Arkansas.

The Norfork National Fish Hatchery, built and operated by the U.S. Fish and Wildlife Service (USFWS) in 1957, supplies all trout that are stocked into Beaver tailwater. Intensive stocking of trout is necessary due to a range of environmental factors that limit natural reproduction in the fishery. Currently, an average of 96,000 rainbow trout and 5,000 brown trout are stocked each year; cutthroat trout and brook trout stockings were discontinued in 2002 and 2004, respectively. Biologists from the AGFC are responsible for trout management in the Beaver tailwater. This fishery was the first trout water managed by the AGFC as part of their strategic planning process and an individual management plan for the Beaver tailwater fishery was developed in 2005. The Beaver Tailwater Management Plan can be found on the AGFC website (www.agfc.com).

4.5 Terrestrial Resources

4.5.1 Wildlife

White-tailed deer and eastern wild turkey are common game animals found and hunted in the Beaver Lake area. Black bear have also become common in the area and are hunted on lands around the lake. The largest recent harvest occurred on the lands surrounding the upper lake in Washington County. The principal small game species found in the open upland areas include bobwhite quail, cottontail rabbit, and mourning dove. Gray and fox squirrels are common in upland wooded areas and are also popular for sportsmen. Furbearing animals found in the Beaver Lake area include coyote, red fox, gray fox, otter, mink, muskrat, beaver, bobcat, and raccoon. Habitat management that includes wildlife food plot plantings, mowing, soil disturbance, removal of exotic species and application of prescribed fire provide benefit to these populations.

Since 1966, AGFC has leased lands and waters at Beaver Lake for fish and wildlife management. From the 1970's through the 1990's, food plots were established in various areas for wildlife management, but have not been funded in recent years.

The common goldeneye, hooded merganser, bufflehead, and ring-necked duck are the predominant migratory waterfowl species visiting Beaver Lake. Mallards, gadwall, and other duck species are also present; however, they are only transient visitors as their characteristic feeding habits of obtaining food from shallow waters is limited. Resident Canada geese are so numerous in many coves and recreation areas that their presence has become a nuisance.

Ring-billed gulls are seen frequently around the Beaver Lake area. Greater and lesser yellow legs, pelicans, and large flocks of horned grebes are also seen during their peak migration in the spring and fall. Beaver Lake is also one of the few places where visitors can see both the turkey vulture and the black vulture at the same time in the winter. Beaver Lake has also become a popular place that visitors come to observe bald eagles, commonly wintering 150 or more birds and hosting 5-6 breeding pairs during the nesting period of March to June. The surrounding woodlands and grasslands serve as prime nesting areas for resident and neotropical migratory songbirds.

4.5.2 Vegetation

The area surrounding the lake is mostly forested. Trees and shrubs around the lakeshore include upland oak and hickory species, persimmon, honey locust, hawthorn, dogwood, redbud, coralberry, smooth and winged sumac, and buttonbush. Frequent periods of inundation keep a thin strip of government owned lands around the lake in early stages of succession. Red cedar and short-leafed pine, the principal evergreens, are dispersed throughout the region and are found in many large, scattered groups. Ground covers consist of greenbrier, sedges, and native grasses.

Plant communities also include post oak savannas and glades. The post oak savanna ecosystem exhibits an open canopy of low density trees allowing considerable light penetration to the understory. This permits a wide variety of herbaceous species to perpetuate under natural disturbances such as fire. Dolomite/limestone glades, which are characterized by barrens-like communities of prairie type native forbs and grasses, occur on the shallow soil over outcroppings of bedrock.

The largest tract of public land adjoining Beaver Lake is the 12,056 acre Hobbs State Park – Conservation Area (HSP-CA). HSP-CA adjoins Beaver Lake shoreline for approximately 26-miles. The tract serves as the single largest landholding around the lake, as well as in Benton County. Although the title ownership to the tract is under Arkansas Department of Parks and Tourism, HSP-CA is co-managed by three state agencies: Arkansas State Parks, Arkansas Game & Fish Commission and Arkansas Natural Heritage Commission. Arkansas State Parks has developed facilities to include a state-of-the-art Visitor Center (the nature center for Northwest Arkansas), 36-miles of trails including multi-use (hike, mountain bike and equestrian), development of a significant historic site, the only public shooting range in Northwest Arkansas, as well as infrastructure and support amenities (maintenance complex, staff residences, restrooms, etc.).

Devil's Eyebrow Natural Area borders more than 5 miles of the northernmost shoreline of Beaver Lake. It is more than 2,089 acres in size and very diverse with more than 550 vascular plant species documented, 25 of which are of state conservation concern. Staff and contractors of the Arkansas Natural Heritage Commission and the Arkansas Game and Fish Commission own and manage the land.

The Devil's Eyebrow area is home to Black Maple (Acer nigrum) trees. This is the only known location of this species in Arkansas. Also identified in the area is the Rock Elm (Ulums Thomasii).

4.5.3 Wetlands

Located within the Springfield Plateau of the Ozark Mountains region of northern Arkansas, the area surrounding Beaver Lake is characterized by limestone, dolomite, or chert geology. The many rivers and streams flowing through the region have created a landscape of level highlands dissected by rugged valleys rich in karst features such as caves and sinkholes. Associated with these streams and landscape features are a variety of wetland habitats representative of the five wetland classes occurring within the region. These wetland classes include depressions, flats, fringe, riverine, and slope. It is possible, and perhaps even likely, that all of these classes of wetlands occur in the general area of Beaver Lake. However, those most likely to occur in the area immediately surrounding the lake are fringe (most likely reservoir), riverine (most likely spring runs) and slope wetlands (most likely calcareous slope). More detailed descriptions of these

classes, subclasses, and community types can be found at the Arkansas Multi-Agency Wetland Planning Team web site: www.mawpt.org.

4.6 Threatened and Endangered Species

There are many species in the Ozarks that are considered either threatened or endangered. Species become imperiled for a variety of reasons including over-hunting, over fishing, and habitat loss as a result of human development and pollution; of these, habitat loss is the main contributor that imperils most species. A threatened species is one that is likely to become endangered within the foreseeable future. An endangered species is one in danger of extinction throughout all or a significant portion of its range.

The bald eagle (*Halieetus leucocephalus*) is common during the winter months around Beaver Lake. Most winter counts range in the total of 100 to 150 in numbers. In the early 1990's, there were also two golden eagles documented on Beaver Lake. In addition, there are currently four to five bald eagle nests located around the lake. Although the bald eagle was delisted by USFWS in 2007 due to recovery of the species, both the bald and golden eagles are still protected in accordance with the Bald and Golden Eagle Protection Act. Beaver Lake was also home for multiple years to the only known leucistic eagle. This attracted ornithologists from across the nation to possibly see this rare bird.

The Pigeon Roost Cave is home to the Gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), and Northern long-eared bat (*Myotis septentrionalis)*. USACE works closely with the U.S. Fish and Wildlife Service, AGFC, and ASP to protect the USACE owned cave recharge area and manage the project lands and waters of Beaver Lake to protect the bat habitat. Transient populations of gray, Indiana bats, and northern long-eared bats are documented in other caves located on and near the Beaver Lake area.

Beaver Lake is also home to the Ozark cavefish (*Amblyopsis rosae*).

Missouri Bladderpod (*Physaria filiformis*) is a federally listed Threatened species in the mustard family endemic to calcareous glades and barrens in the Interior highlands of Missouri and Arkansas. This species was originally found by R Dalton and J. Dow in 1992. The direction of this location was imprecise and attempt's to relocate the population was unsuccessful until May, 2002 where it was relocated by the Arkansas National Heritage Commission, Missouri Department of Conservation and US Fish and Wildlife Service.

The following species listed in Table 4.1 are from the U.S. Fish and Wildlife Service's federally classified status list of species and the Arkansas Natural Heritage data sets which have been reported and identified on project lands. There are other threatened and endangered species that are known to be in the general area.

Table 4.1 Threatened, Endangered, and Species of Concern

Common Name	Scientific Name	Federal/State Status	State/Global Rank
Bald Eagle	*Halieetus leucocephalus*	*Protected under Bald and Golden Eagle Protection Act	

Gray Bat	*Myotis grisescens*	E/E	S3/G3
Indiana Bat	*Myotis sodalis*	E/E	S3/G3
Northern long eared Bat	*Myotis septentrionalis*	E/E	S3/G3
Ozark Cavefish	*Amblyopsis rosae*	T/E	S1/G3
Missouri Bladderpod	*Physaria filiformis*	T	S2/G3
Ozark Cornsalad	*Valerianella ozarkana*	Inv	S3/G3
Mackenzie's Blue Wild Rye	*Elymus glaucus ssp. mackenzi*	Inv	S1/G5
Black Maple	*Acer saccharum var. nigrum*	Inv	S1/ G5T5
Rock Elm	*Ulmus Thomasii*	Inv	S1/ G5T5
Grotto Salamander	*Eurycea spelaea*	Inv	S3/G4
Great Plains Ratsnake	*Pantherophis emoryi*	Inv	S3/G5
Wood's False Hellebore	*Veratrum woodii*	Inv	S3/G5
Great Plains Skink	*Plestiodon obsoletus*	Inv	S1/G5
Trelease's Larkspur	*Delphinium treleasei*	Inv	S3/G3
Isopod	*Caecidotea stiladactyla*	Inv	S3/G3G4
Isopod	*Caecidotea steevesi*	Inv	S1/G3G4
Bat Cave Isopod	*Caecidotea macropropoda*	Inv	S2/G2G3
Rope Dodder	*Cuscuta glomerata*	Inv	S1/G5
Wood Frog	*Lithobates sylvaticus*	Inv	S3/G5
Land Snail	*Gastrocopta rogersensis*	Inv	S2/G3G4
Longnose Darter	*Percina nasuta*	Inv	S2/G3
Hairy Rockcress	*Arabis hirsute var. adpressipilis*	Inv	S1?/G5T4Q
Sand Phlox	*Phlox bifida*	Inv	S3/G5?
Ozark Cave Amphipod	*Stygobromus ozarkensis*	Inv	S2/G4
Sulphur Springs Diving Beetle	*Heterosternuta sulphuria*	Inv	S1?/G1?

FEDERAL STATUS CODES

LE = Listed Endangered; the U.S. Fish and Wildlife Service has listed this species as endangered under the Endangered Species Act.

STATE STATUS CODES

INV = Inventory Element; The Arkansas Natural Heritage Commission is currently conducting active inventory work on these elements. Available data suggests these elements are of conservation concern. These elements may include outstanding examples of Natural Communities, colonial bird nesting sites, outstanding scenic and geologic features as well as plants and animals, which, according to current information, may be rare, peripheral, or of an undetermined status in the state. The ANHC is gathering detailed location information on these elements.

GLOBAL RANKS

G3 = Vulnerable globally. At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.

G4 = Apparently secure globally. Uncommon but not rare; some cause for long-term concern due to declines or other factors.

G5 = Secure globally. Common, widespread and abundant.

T-RANKS= T subranks are given to global ranks when a subspecies, variety, or race is considered at the state level. The subrank is made up of a "T" plus a number or letter (1, 2, 3, 4, 5, H, U, X) with the same ranking rules as a full species.

STATE RANKS

S1 = Critically imperiled in the state due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors making it vulnerable to extirpation.

S2 = Imperiled in the state due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it vulnerable to extirpation.

S3 = Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

GENERAL RANKING NOTES

Q = A "Q" in the global rank indicates the element's taxonomic classification as a species is a matter of conjecture among scientists.

Source: Arkansas Natural Heritage Commission

4.6.1 Invasive species

In accordance with Executive Order (EO) 13112, an invasive species means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health. Invasive species can be microbes, plants, or animals that are non-native to an ecosystem. In contrast, exotic species, as defined by EO 11987, include all plants and animals not naturally occurring, either presently or historically, in any ecosystem of the United States. Invasive species can take over and out compete native species by consuming their food, taking over their territory, and altering the ecosystem in ways that harm native species. Invasive species can be accidentally transported or they can be deliberately introduced because they are thought to be helpful in some way. Invasive species cost local, state, and federal agencies billions of dollars every year.

The Beaver Project is not protected from the spread of invasive species. Locally the project office works with its partners, AGFC, University of Arkansas Extension Services and United States Department of Agriculture, to help stop the spread of some of the Ozarks most unwanted species. These would include feral hogs, zebra mussels, sericea lespedeza, gypsy moth and the emerald ash borer. Project rangers post signage in all the recreation areas to communicate the dangers of spreading invasive species on project lands and waters. Rangers also place emerald ash borer and gypsy moth traps on project lands to monitor any infestations of these species.

4.6 Archaeological and Historic Resources

4.6.1 Paleontology

Beaver Lake is situated in the Springfield Plateau region of the Ozark Highlands. Geologically, rocks in the Ozark Highlands are dominated by well-lithified sandstones, shales, limestones, and dolostones of Paleozoic age. A thin drape of younger unconsolidated clays, sands, and gravel, termed alluvium, is often found in valley floors and associated with the streams and rivers.

Lower Ordovician, Middle to Upper Devonian and Lower and Upper Mississippian age strata are present around Beaver Lake. The Ordovician and Devonian strata crop out around Beaver Lake and its tributaries. Primary formations associated with the Lower Ordovician strata include the Cotter and Powell Dolomite. The fossils known from the Cotter and Powell Dolomite are rare, but include gastropods, cephalopods, trilobites and reef-building algae.

Formations associated with the Middle to Upper Devonian include the Chattanooga Shale, Clifty and Penters. Fossils are typically rare to absent in these formations. Brachiopods and conodonts have been collected on a few occasions.

The Upper Mississippian strata consists of the Boone Formation, which is gray, fine- to coarse-grained fossiliferous limestone interbedded with chert. Crinoids are the most common fossil found in the formation, but brachiopods, bryozoa, mollusks, corals, shark material, trilobites, conodonts, and others fossils are known.

4.6.2 Cultural Resources

The following is a brief history of the human occupation of Arkansas and the Beaver Lake area:

Paleo-Indian (12,000-8,000 B.C.) – The earliest documented archeological manifestation in the Ozark area relates to what the Paleo-Indian or Early Hunting Horizon. There is evidence of Paleo-Indian inhabitants in the Ozark Highlands indicated by the presence of Clovis, Cumberland, and Folsom bifaces in isolated instances in Boone and Newton Counties, Arkansas. No Paleo-Indian sites have been excavated in the Ozarks, only surface sites and multi-component shelter sites are present.

Archaic (8,000-500 B.C.) - Around 8,000 years ago, the climate began to change. The Pleistocene epoch gave way to the Holocene. Warmer temperatures, along with increased hunting efficiency, brought about the extinction of the megafauna that the Paleo-Indians had followed. Archaic people relied on the animals and plants that we see today. Settlement patterns were seasonal, with bands of people staying in one area for entire seasons before moving on to the next settlement. From these base camps, hunting parties were sent out, sometimes for days, to kill game. Archaic period hunting camps abound in the White River area.

Woodland (500 B.C. – A.D. 900) - One major technological change marked the beginning of the Woodland period- pottery. Ceramics had begun to appear during the Archaic period, but their proliferation marked the beginning of the Woodland period. Pottery signified an increasing reliance on domesticated plants. Horticulture had now spread throughout most of the Eastern Woodlands, with the White River area being no exception. The bow and arrow became a part of the tool assemblage, further increasing the efficiency of hunting game. For the most part, however, the Woodland period is very poorly understood in the White River area. Unfortunately, only a few sites containing Woodland period components have been studied.

Mississippian (A.D. 900 – 1541) - The Mississippian period generally marked the transition to full-scale agriculture and a chiefdom level of politics. An influence of religion from Mesoamerica spread rapidly throughout the southeastern U.S. Large mound sites were constructed, elaborate trade networks were established, and populations dramatically increased. Ozark adaptations, however, were unique during the Mississippian period. Domesticated crops were grown in the river valleys, but hunting and gathering likely made up the bulk of the food supply. Small Mississippian period mound sites did exist in the White River area, such as the Loftin Site, inundated by Table Rock Lake. Other Mississippian sites in the area included open-air village sites and rock shelters. It had been speculated that these communities were "outposts" of the Caddo culture located to the southwest. Recently, however, researchers have demonstrated that these societies simply interacted with one another on a frequent basis, with no evidence of Caddo colonization.

Protohistoric / Historic Periods (A.D. 1541 –1865) - The Protohistoric period began with the De Soto expedition into the Southeastern United States. Generally speaking, De Soto did not enter the Ozarks, but the aftermath of his expedition definitely did enter the area. Diseases the Spaniard and his men brought with them, such as smallpox and influenza, had a devastating effect. The tribes inhabiting the area had no immunity against these diseases, and up to 90 percent of the populations were decimated. During this time period, the Ozarks were primarily being used as a hunting ground for the Osage, who were centered more to the north.

Euro-American settlement began in the Ozarks in the late 18th century. People generally subsisted on a combination of hunting wild game and herding domesticated animals. With the creation of the Arkansas Territory in 1819, people from the upland South, or Appalachia, began to move into the Ozarks. These people brought with them many aspects of their culture, including fundamentalist religion, unique architectural styles, and an aptitude for farming rocky terrain. Although slave holding was not unheard of, it certainly was not the norm. A few major battles of the Civil War, such as Pea Ridge, were fought in the area. Theoretically, the battle of Pea Ridge solidified Union control over southern Missouri. In reality, the entire Ozark region was hostage to Bushwhackers, or outlaws that roamed the land and robbed people indiscriminately.

Previous Investigations in the Beaver Lake Area

During the past seventy years scientific investigation of archaeological sites in the Beaver Lake area has been carried out in several phases. In 1922 and 1923, Mark R. Harrington of Phillip Academy was the first archeologist to excavate sites on the area that is now Beaver Lake. He excavated 13 bluff shelters. Between 1928 and 1935, the work of Harrington was continued by S.C. Dellinger of the University of Arkansas Museum. Dellinger supervised the excavation of 21 rock shelters. In the early 1960's, a series of surveys were conducted by several archeologists from the University of Arkansas Museum. Today, there are 280 known archeological sites along or immediately adjacent to Beaver Lake. Of these, 271 are identified as prehistoric, seven are historic and two sites have no known cultural affiliation.

Table 4.2 Previously Recorded Resources at Beaver Lake

Type of Site	Number of Sites
Historic	7
Prehistoric	271
No known cultural affiliation	2
Total	280
National Register Eligibility Status	
Not Evaluated	132
Not Eligible	5
Eligible	1

4.7 Air Quality

The U.S. Environmental Protection Agency (EPA) has the primary responsibility for regulating air quality nationwide. The Clean Air Act (42 U.S.C. 7401 et seq.), as amended, requires the EPA to set National Ambient Air Quality Standards (NAAQS) for wide-spread pollutants from numerous and diverse sources considered harmful to public health and the environment. The Clean Air Act established two types of national air quality standards classified as either "primary" or "secondary." Primary standards set limits to protect public health, including the health of at-risk populations such as people with pre-existing heart or lung diseases (such as asthmatics), children, and older adults. Secondary standards set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings.

EPA has set NAAQS for six principal pollutants, which are called "criteria" pollutants. These criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), particulate matter less than 10 microns (PM10), particulate matter less than 2.5 microns (PM2.5), sulfur dioxide (SO2) and lead (Pb). If the concentration of one or more criteria pollutants in a geographic area is found to exceed the regulated "threshold" level for one or more of the NAAQS, the area may be classified as a non-attainment area. Areas with concentrations of criteria pollutants that are below the levels established by the NAAQS are considered either attainment or unclassifiable areas.

The study area is located within the Northwest Arkansas Intrastate Air Quality Control Region (40 CFR §81.140). The area is classified as being in attainment for all NAAQS.
The Current Air Data Air Quality Index Summary Report for the Fayetteville, Rogers, Springdale area show that the area had 338 good days and 27 moderate days of air quality in 2016 (EPA 2016). Situated between the cities of Rogers (west) and Eureka Springs (east), Beaver Lake is east of the Fayetteville area in a relatively rural setting with no nearby heavy emissions producing manufacturing or large mining operations. Air in the region is very clean and smog is virtually unknown, and none of the present purposes of the project contribute to air pollution. Other sources of air quality impairment such as open burning are not a problem. Arkansas state laws restrict open burning, which is allowed in only residential areas and for certain controlled agricultural, forestry, wildlife, and industrial activities. The law does not apply to ceremonial fires and campfires.

4.8 Socio-Economic Resources

The area of analysis includes counties adjacent to the lake where the water providers requesting allocations operate water systems (Benton, Boone, Carroll, Madison and Washington) counties, and other counties that make up a at least a portion of the Upper White River Basin (both in Missouri and Arkansas). In addition, to the above counties, these include: Barry, Christian, Douglas, Greene, Madison, Marion, Taney and Webster.

Data from the 2010 Census, the U.S. Bureau of Labor Statistics, and the 2013 American Community Survey for population, employment, were used to summarize socioeconomic conditions in the Project area. Table 4.3 shows 2014 population, 2010 population density, and net migration rates for each county in the area. With the exception of Benton, Greene, and Washington counties, the study area is largely rural. Near term growth in most counties is positive and more or less in line with state and national average rates; however, population in Douglas County, Missouri has declined slightly since the 2010 Census. With overall increases approaching 10 percent over the last four years, the fastest growing counties include Benton (Arkansas), Washington (Arkansas), and Christian. Benton and Washington counties host one of the three Project sponsors (Benton Washington County Water District). Population density ranges from 16 persons per square mile in Douglas County, Missouri to 356 in Greene County, Missouri.

Table 4.3 Population Levels and Trends in the Project Area

Region or county	2010 Population	2014 Population	Population percent change (2010-2013)	Population density (persons per square mile)
United States	308,745,538	318,857,056	3.3%	35
State of Arkansas	2,872,684	2,933,369	2.1%	51
State of Missouri	2,915,918	2,966,369	1.7%	87
Barry (Missouri)	35,597	35,662	0.2%	44
Benton (Arkansas)[a]	221,339	242,321	9.5%	181
Boone (Arkansas)[a]	36,903	37,196	0.8%	57
Carroll (Arkansas)[a]	27,446	27,744	1.1%	40
Christian (Missouri)	74,422	82,101	10.3%	96
Douglas (Missouri)	13,684	13,546	-1.0%	16
Greene (Missouri)	275,174	285,865	3.9%	356
Madison (Arkansas)[a]	15,717	15,740	0.1%	17
Marion (Missouri)	28,781	28,920	0.5%	65
Taney (Missouri)	51,675	52,412	1.4%	24
Washington (Arkansas)[a]	203,065	220,792	8.7%	83
Webster (Missouri)	36,202	36,888	1.9%	52
Total project area	1,020,005	1,079,187	5.8%	84

[a] Indicates that a county hosts water systems served by project sponsors.
Source: U.S. Census Bureau: 2013 American Community Survey. Accessed online: 14 August, 2015.

Key income indicators (per capita income and median household income) for counties in the Project area vary with lower values characteristic of rural counties and higher values for urban counties (Table 4.4). Average per capita income weighted by population for the entire basin is $23,750 and the median household income is $46,605, both of which are lower than national figures (16 and 12 percent respectively); however both figures are comparable to state level per capita and household income. Earnings in counties supplied by Project sponsors are generally close to state figures, and median household income in Boone and Benton counties is considerably higher than the state value. Douglas County, Missouri is the only county where income measures are significantly lower than statewide figures. The distribution of employment by occupation category in most counties tends to follow national and state allotments.

Table 4.4 Existing Employment and Income in the Project Area

County	Per capita income	Median household income	Total civilian workforce	Management, business, science, and arts	Natural resources, construction, and maintenance	Production and transportation	Sales and office workers	Service
United States	$28,155	$53,046	141,864,697	51,341,226	25,645,065	34,957,520	12,863,316	17,057,570
State of Arkansas	$23,045	$39,633	1,245,432	388,270	214,286	300,168	135,496	207,212
State of Missouri	$25,649	$59,527	2,770,617	956,605	498,458	696,630	247,212	371,712
Barry (Missouri)	$19,489	$38,710	14,297	3,923	1,764	3,708	2,931	1,971
Benton (Arkansas)[a]	$26,715	$61,706	103,176	35,624	8,887	16,879	27,044	14,742
Boone (Arkansas)[a]	$22,160	$47,585	88,035	40,794	5,235	6,626	20,867	14,513
Carroll (Arkansas)[a]	$20,637	$36,584	11,843	2,987	1,557	2,965	2,303	2,031
Christian (Missouri)	$25,134	$52,838	37,289	13,403	3,260	4,376	10,028	6,222
Douglas (Missouri)	$16,404	$32,130	4,924	1,062	951	1,018	1,240	653
Greene (Missouri)	$23,520	$40,337	132,328	44,998	9,714	15,500	36,225	25,891
Madison (Arkansas[a]	$18,754	$43,737	6,474	1,622	1,056	1,608	1,304	884
Marion (Missouri)	$21,909	$42,046	12,881	3,910	1,067	2,562	2,789	2,553
Taney (Missouri)	$20,231	$38,461	22,601	5,299	1,861	1,736	7,093	6,612
Washington (Arkansas[a]	$23,264	$41,248	99,115	34,172	17,131	24,353	9,012	14,447
Webster (Missouri)	$19,955	$50,033	14,347	3,555	2,171	2,631	3,525	2,465
Total project area	$23,570	$46,605	547,310	191,349	54,654	83,962	124,361	92,984

[a] Indicates that a county hosts water systems served by project sponsors.
Source: U.S. Census Bureau: 2013 American Community Survey. Accessed online: 18 August, 2015.

In counties adjacent to Beaver Lake, tourism and recreation is also an important part of local economies. Given the scenic and natural beauty of northwest Arkansas, Beaver Lake is a popular recreation venue for instate and out of state visitors. On average from 1999 through 2012, about 2.5 million people visited the lake for at least one day (Table 4.5). Beaver Lake has a variety of recreational facilities (Table 4.6). Paved access roads wind through 11 developed parks with 681 campsites. Other facilities include swimming beaches, hiking trails, boat launching ramps, sanitary dump stations, and picnic shelters. Seven parks contain year-around commercial marinas, which

offer grocery items, fuel, boat rental and storage, fishing guides and other supplies and related services.

Table 4.5 Annual Number of Visitors to Beaver Lake Arkansas (1999 through 2012)

Year	No. of visitors
1999	2,388,827
2000	2,826,853
2001	2,909,192
2002	2,998,615
2003	3,763,057
2004	5,168,720
2005	3,144,639
2006	2,724,809
2007	3,151,898
2008	2,470,292
2009	2,572,053
2010	2,749,764
2011	2,366,977
2012	2,457,662
Average (1999 through 2012)	

Source: U.S. Army Corps of Engineers, Little Rock District

Table 4.6 Recreation Facilities at Beaver Lake Arkansas

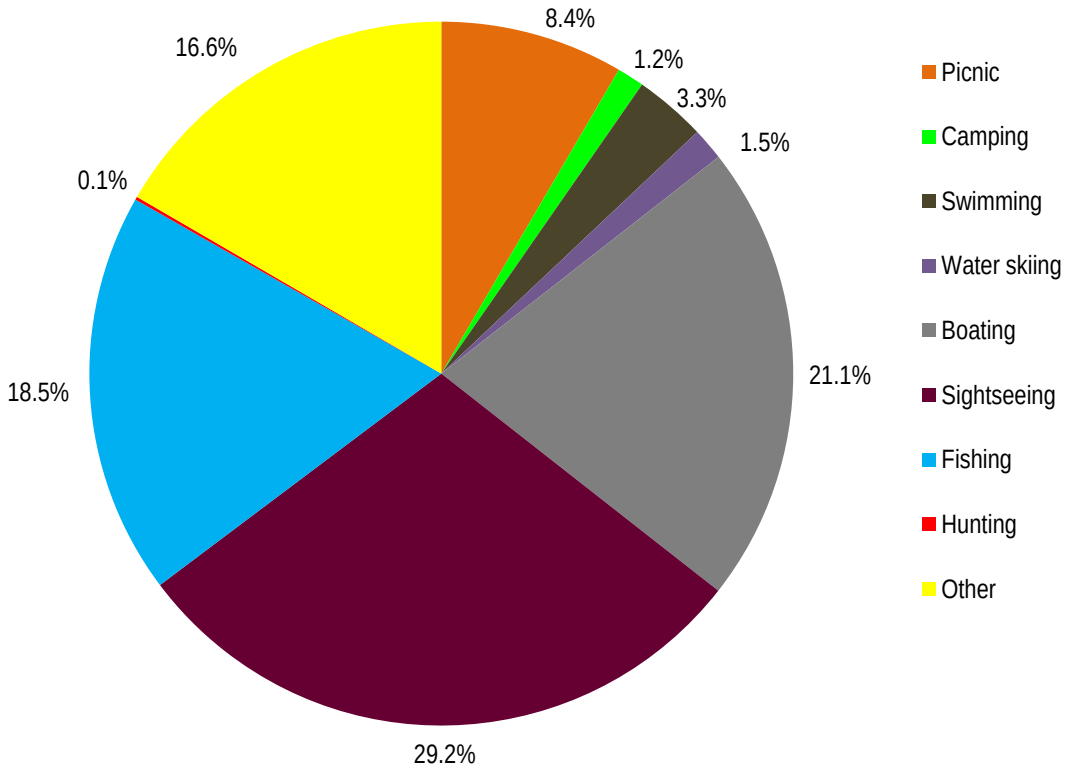
Facilities	Number of sites
Recreation sites	28
Picnic sites	174
Camping sites	681
Playgrounds	19
Swimming areas	12
Trails	21
Trail miles	26
Fishing docks	1
Boat ramps	20
Marina slips	1,799

Source: U.S. Army Corps of Engineers, Little Rock District

Accounting for almost one half of reported activities, water sports (swimming, boating, skiing and fishing) are popular at Beaver (Figure 4.2). There are 20 boat launches, and the lake is home for

rainbow and German trout, and other fish including bass, crappie, bream, stripers, and catfish. In addition to fishing and hunting, many other sports and activities await the visitor, picnicking, hiking and sightseeing are also reported recreational opportunities at or near Beaver Lake.

Figure 4.2
Distribution of Visitor Activities at Beaver Lake



Recreation at the lake has substantial impact to local economies based on surveys of visitor spending and attendance at Corps projects. Based on 2012 data, roughly 2.45 million people visited Beaver Lake, and spent $84.7 million in local economies within 30 miles of the lake in 2012. This spending generated $65.6 million in business sales revenue, and supported about 955 full and part time jobs with $17.1 million in labor income.

The primary transportation system at Beaver Lake serves visitors and workers driving to and from recreation and service areas. The road system is maintained by counties and the state, and are high-standard, paved roads. Public access to the park requires a road system, although once visitors reach the park, designated parking areas are available from which miles of trails can be

accessed. Nearby residents can access the park via foot or bike. Several U.S., State highways, and county roads access the lake. The primary access roads to the shoreline are U.S. Highway 412 and 62 and State Highways 264, 187, 127 and 12. Several state highways and county roads access the lake (Table 4.7).

Table 4.7 Access Roads to the Beaver Lake Shoreline

Gateway Towns	Lake Access Road
Lowell	SH 264
Pilgrims Rest and Blue Springs	SH 95, SH 502 and SH 507
Bethel Heights	SH 264
Rogers and Prairie Creek	SH 12
Avoca	CR 74 and CR 1751
Garfield	CR 99, SH, CR 1717, and CR 1720
Clantonville	CR 89
Busch and Holiday Springs	SH187

Source: U.S. Army Corps of Engineers Little Rock District

4.9 Recreation Resources

The recreational resource of Beaver Lake Project is considered to be of great importance to this Northwest Arkansas region. The Corps of Engineers has taken advantage of the natural and scenic beauty and constructed a variety of recreational facilities around the lake. Beaver Lake Project offers many recreational activities such as sightseeing, camping, swimming, picnicking, SCUBA diving, boating, water skiing/wakeboarding, canoeing/kayaking, nature study, bird watching, fishing, hunting, and hiking. There are eleven designated recreation areas on Beaver Lake operated by the Corps of Engineers. Carroll County Arkansas has a lease to maintain and operate one park. Seven full-service marinas are owed-operated by commercial concessionaires. Twenty-five boat ramps are licensed to local County or State Government. Seven limited-motel/resorts have facilities on Government property and are owned-operated by lease agreement. Beaver Lake's parks are some of the busiest in the nation. This is evidenced by total fee collections ranking as one of the highest in the Corps Engineers, consistently ranking number 5 or below. The interest in using the project's resources of land and water in and around the parks has been on the steady increase as the Northwest Arkansas area continues to grow at a fast pace. The population of the area has exceeded 750,000 and is estimated to rapidly exceed 1,000,000 in the next few years with no end in sight. This will only increase the use of existing park areas on Beaver Lake. See Chapter 2 of the updated Master Plan for detailed recreational facility identification and information.

4.10 Health and Safety

Safety of project visitors and project staff are the highest priority in daily project operations. Facilities and recreational areas are routinely evaluated to ensure sites are safe for visitor use. Project staff conducts numerous water safety programs and public announcements to educate children and project visitors about ways to be safe on the lake.

4.11 Aesthetics

Management objectives include maintaining scenic vistas while limiting impacts that would negatively affect aesthetics. Natural landscapes and views of undeveloped lands are an important feature that enhances the recreational experience. The perimeter lands around Beaver Lake provide a natural setting that is aesthetically pleasing as well as buffering the lake from development and negative impacts such as erosion and storm water runoff. However, there are problems in maintaining these aesthetic qualities. Project resource staff is continually investigating trespasses that include activities such as timber cutting and land destruction by unauthorized off road vehicles. In addition, litter and illegal trash dumping both on project lands and project waters are continual problems. Vandalism within recreation areas also occurs. Other concerns that impact aesthetics are demands put upon project resources for uses such as road and utility line corridors.

5.0 ENVIRONMENTAL CONSEQUENCES

The following table summarizes the resources that are likely to be affected by each of the alternatives for an update of the Beaver Master Plan including the No Action alternative. A detailed discussion of the potential impacts of each of the alternatives follows the synopsis provided in the table.

The Preferred Alternative is Alternative 2, the Balanced Resource Management alternative. Lands were reclassified to reflect the current land use; portions of Low Density lands were reclassified to Environmentally Sensitive and portions of Environmentally Sensitive lands were reclassified to Low Density. High Density lands total 2,324.8 acres; Low Density lands total 2,426.0 acres; Environmentally Sensitive Area lands total 3,692.7 acres; Wildlife Management lands total 1,143.0 acres; Project Operations lands total 170.0 acres; and Vegetative Management lands total 56.1 acres.

Under this alternative, High Density acreage decreased and was primarily reclassified to Wildlife Management which reflects current utilization of the lands. This included the High Density areas of Blackburn Creek Future Park, Bear Creek Island Future Park, Slate Gap Future Park, and Pine Top Future Park.

Vegetative Management classification was added to this alternative. This is a new land classification and includes lands located within the Devil's Eyebrow Natural Area. This area was classified as Low Density and Environmental Sensitive lands under the 1976 Master Plan.

Alternative 1, Maximum Resource Protection, reclassifies all Low Density lands to Environmentally Sensitive Areas (in comparison to the No Action alternative). Existing permitted shoreline uses are grandfathered and no new shoreline use permits would be issued. Comments received during the Scoping phase were considered, but most were not implemented due to not being feasible under this alternative.

Under Alternative 3, Current Resource Management, the land classifications were mapped to reflect current land and resource management practices; agency and public comments received during both scoping phases were considered during the mapping process.

Changes from Alternative 4 (No Action) to Alternative 3 included reclassifying portions of undeveloped Low Density land to Wildlife Management, Project Operations, or Environmentally Sensitive Area; reclassifying lands that contained active shoreline use permits or Limited Development Areas to Low Density; and lands that had no allocation were classified to match current land use.

Under Alternative 4, the No Action Alternative, the 1976 Master Plan land use classifications will remain the same and none of the 9,812.6 acres of land around the lake will be reclassified. This alternative will continue to allow for increased land and water based impacts within the Low Density land classification.

Current land classifications do not accurately reflect the land use activities or resource management of the lake. In addition, this alternative does not address resource management laws, policies, and regulations that were implemented after the 1976 Beaver Lake Master Plan.

Alternative 5 has the most potential for growth of private exclusive use (i.e. boat docks and vegetation modification) and passive recreational uses such as trails. Changes from Alternative 4 to Alternative 5 include reclassifying some High Density areas (i.e. future Corps parks) to Wildlife Management; many Environmentally Sensitive Areas were reclassified to Low Density. All comments received during both scoping phases were considered and reclassifications were made where feasible.

Table 5.1 Resource Impact with Implementation of Alternatives

Resource Category	Alternative 1 Maximum Resource Protection	Alternative 2 - Balanced Resource Management (Preferred)	Alternative 3 Current Resource Management	Alternative 4 No Action	Alternative 5 Moderate Resource Protection
Climate, Topography, Geology and Soils	The Maximum Resource Protection Alternative is the most protective of all alternatives in terms of potential impacts on climate, topography, geology, and soils due to the classification of all low density acreage to environmentally sensitive.	The Balanced Resource Management Alternative would have less potential impacts on climate, topography, geology and soils than the No Action Alternative due to a reduction in low density and high density acreage.	There would be an impact, although not significant, on climate, topography and geology as a result of implementation of the Current Resource Management Alternative due to the potential for new development around the lake provided by a larger proportion of high density designated lands (62.8 more acres than No Action), but also a 42.1 acre reduction in low density lands.	There would be an impact, although not significant, on climate, topography and geology as a result of implementation of the No Action Alternative due to the potential for new development around the lake provided by a large proportion of high density designated lands.	The Moderate Resource Protection Alternative is the least protective of all alternatives in terms of potential impacts on climate, topography, geology, and soils due to the classification of 38% of available lands to low density.
Aquatic Environment	The hydrology and groundwater components of Beaver Lake would change from the existing condition due to the implementation of the Maximum Resource Protection Alternative. Water quality may be improved due to the elimination of low density lands and the potential for new development.	The Balanced Resource Management Alternative is similar to the No Action Alternative in terms of potential impacts to the hydrology and groundwater components of the aquatic environment, but water quality would be enhanced due to reduced potential for new development from a reduction in high and low density lands, and increased acreage in environmentally sensitive and wildlife management lands.	The Current Resource Management Alternative is similar to the No Action Alternative in terms of potential impacts to the hydrology and groundwater components of the aquatic environment, but water quality would be enhanced due to a 306.4 acre increase in environmentally sensitive lands.	The No Action Alternative would result in little to no impacts on the hydrology and groundwater components of the aquatic environment Water quality impacts would likely be minimally impacted under this alternative due to the potential for continued shoreline development.	The Moderate Resource Protection Alternative would have the greatest potential impacts on the hydrology and groundwater components of the aquatic environment, and would be less protective of water quality due to the large component of low density lands and the increased potential for new development.

Resource Category	Alternative 1 Maximum Resource Protection	Alternative 2 Balanced Resource Management (Preferred)	Alternative 3 Current Resource Management	Alternative 4 No Action	Alternative 5 Moderate Resource Protection
Terrestrial Resources	The Maximum Resource Protection Alternative would have the greatest positive impact on the lakeside terrestrial resources of all the alternatives evaluated due to the elimination of low density lands and the reduction in potential new development.	Implementation of the Balanced Resource Management Alternative would have a positive impact on terrestrial resources in comparison to the No Action Alternative. Due to an increase in environmentally sensitive and wildlife management lands, this would have a positive benefit to the acreage around the lake.	Implementation of the Current Resource Management Alternative would have a positive impact on terrestrial resources in comparison to the No Action Alternative. Due to an increase in environmentally sensitive lands, this would have a positive benefit to the wildlife and vegetation around the lake.	Under the No Action Alternative there is no modification of existing low density acres. Based on this, the potential exists for continual degradation of shoreline vegetation due to probable increased development and subsequent vegetation removal/mowing activities.	The Moderate Resource Protection Alternative would have the greatest potential impacts on the terrestrial resources due to the large component of low density lands and the increased potential for new development. This could potentially result in vegetation loss and disruption of migration corridors and feeding areas for many wildlife species.
Threatened & Endangered Species	The Maximum Resource Protection Alternative could have a significant positive impact on Threatened, Endangered, Protected, or Species of State Concern, due to the fact that this alternative would eliminate all low density lands reducing the potential for future development. There would be positive effects on lakeside flora and fauna due to shoreline protection.	The Balanced Resource Management Alternative would likely have no significant impact on any listed Threatened, Endangered, Protected, or Species of State Concern. Due to the increase in Environmentally Sensitive and Wildlife Management lands, there may be some positive benefits to any or all the listed species.	The Current Resource Management Alternative would likely have no significant on any listed Threatened, Endangered, Protected, or Species of State Concern. Due to the increase in Environmentally Sensitive there may be some positive benefits to any or all the listed species.	The No Action Alternative would likely have little to no impacts on any species listed Threatened, Endangered, Protected, or Species of State Concern.	The Moderate Resource Protection Alternative could have a negative impact on Threatened, Endangered, Protected, or Species of State Concern, due to the fact that this alternative would reduce environmentally sensitive lands by 984.6 acres, while increasing low density lands by 1,248.9 acres, increasing the potential for future development. There would be negative effects on lakeside flora and fauna from this alternative.

Resource Category	Alternative 1 Maximum Resource Protection	Alternative 2 Balanced Resource Management (Preferred)	Alternative 3 Current Resource Management	Alternative 4 No Action	Alternative 5 Moderate Resource Protection
Archaeological & Historic Resources	The Maximum Resource Protection Alternative would have the highest potential to avoid and decrease impacts on cultural resource sites and historic properties compared to all the alternatives due to the reclassification of all Low Density acreage to Environmentally Sensitive lands.	The Balanced Resource Management Alternative would likely have little to no impacts on cultural resource sites or historic properties. There is a reduction in both high and low density lands, with a corresponding increase in environmentally sensitive and wildlife management lands which would enhance protection of these resources.	The Current Resource Management Alternative would likely have slightly less potential impacts on cultural resources and historic properties than the No Action Alternative due to the reclassification of 306.4 acres from no allocation to environmentally sensitive lands.	Under the No Action Alternative, the greatest potential for effects to cultural resources and historic properties would occur in the areas classified as Low Density, High Density, and No Allocation.	Under the Moderate Resource Protection Alternative, the amount of low density acreage would increase and environmentally sensitive land would decrease. This alternative would raise the potential for impacts on cultural resource sites or historic properties.
Air Quality	Implementation of the Maximum Resource Protection Alternative would have the greatest positive impact to air quality of all the evaluated alternatives due to the elimination of Low Density lands and thereby a decrease in future development	Implementation of the Balanced Resource Management Alternative would result in some reduction in negative air quality impacts as compared to the No Action Alternative due to a decrease in low density acreage and thereby a decrease in future development.	Implementation of the Current Resource Management Alternative would result in the air quality around the lake would remain the same as currently exists. There could be an increase in vehicular exhaust emissions due to localized development, and associated construction equipment. No violations of the current National Ambient Air Quality Standards (NAAQS) established by the EPA would be expected under this alternative.	Under the No Action Alternative, the air quality around the lake would remain the same as currently exists. There could be an increase in vehicular exhaust emissions due to localized development, and associated construction equipment. No violations of the current National Ambient Air Quality Standards (NAAQS) established by the EPA would be expected under this alternative. .	Under the Moderate Resource Protection Alternative, the amount of low density acreage would increase and environmentally sensitive land would decrease. This alternative would raise the potential for impacts on air quality due to the potential for increased development in low density lands.

Resource Category	Alternative 1 Maximum Resource Protection	Alternative 2 Balanced Resource Management (Preferred)	Alternative 3 Current Resource Management	Alternative 4 No Action	Alternative 5 Moderate Resource Protection
Socio-economics	The Maximum Resource Protection Alternative may have negative impacts on the socio-economic situation in the counties surrounding Beaver Lake due to the reclassification of all Low Density lands to Environmentally Sensitive acreage.	The Balanced Resource Management Alternative may have minimal negative impact on the socio-economic situation in the counties surrounding Beaver Lake since this alternative reduces High Density lands by 605.1 acres and Low Density lands by 75.8 acres from the No Action Alternative.	The Current Resource Management Alternative would likely have minimal impact on the socio-economic situation in the counties surrounding Beaver Lake since this alternative reflects how the lake is currently managed and operated. The major change from No Action is classification of the No Allocation lands to Environmentally Sensitive, Vegetative Management, and Project Operations.	The No Action Alternative may have some positive impact on the socio-economic situation in the counties surrounding Beaver Lake due to the potential for future development in the Low Density, High Density and No Allocation lands.	The Moderate Resource Protection Alternative may have positive impacts on the socio-economic situation in the counties surrounding Beaver Lake due to an increase of 1,248.9 acres in Low Density lands, as compared to the No Action Alternative.
Recreation Resources	Under the Maximum Resource Protection Alternative, areas around Beaver would receive greater protection since all Low Density lands would be reclassified as Environmentally Sensitive. This may enhance the recreational experience for wildlife viewing, hunting, fishing, and lake aesthetics.	The Balanced Resource Management Alternative would reclassify some high and low density acreage to environmentally sensitive and wildlife management lands. Implementation of this alternative would allow more recreation in the wildlife viewing, hiking, and hunting arena.	The Current Resource Management Alternative would reclassify shoreline acreage to reflect current uses. Implementation of this alternative would allow continued public recreation use of the lake while sustaining the natural, cultural, and socio- economic resources of the area. Current unclassified lands are predominantly classified as Environmentally Sensitive lands.	Provision of recreational facilities and services would continue at Beaver Lake without an update to the Beaver Lake Master Plan. However, the master plan would not accurately reflect the current status of project facilities. Lands with no classification would remain unclassified.	The Moderate Resource Protection Alternative would have some positive boating and fishing recreation impact as potential opportunities would be increased, due to an increase in Low Density lands.

Resource Category	Alternative 1 Maximum Resource Protection	Alternative 2 Balanced Resource Management (Preferred)	Alternative 3 Current Resource Management	Alternative 4 No Action	Alternative 5 Moderate Resource Protection
Health & Safety	The Maximum Resource Protection Alternative would most likely promote a safer lake environment, by indirectly reducing boat traffic due to the conversion of all Low Density lands to Environmentally Sensitive. Recreational boating experiences and boater satisfaction may be impacted. Water quality may be positively impacted due to reduced development and a decrease in fuel and oil leakage.	The Balanced Resource Management Alternative would still allow potential development opportunities, but not to the degree to cause significant boat congestion or increase water related accidents. The increase in Environmentally Sensitive and Wildlife Management areas could result in an increase in human exposure to insects and wildlife. The availability of recreational opportunities, balanced with conservation of natural environment could lead to better health, both mental and physical, for lake users.	The Current Resource Management Alternative would still allow potential development opportunities, but not to the degree to cause significant boat congestion or increase water related accidents. The increase in Environmentally Sensitive lands could result in an increase in human exposure to insects and wildlife. The availability of recreational opportunities, balanced with conservation of natural environment could lead to better health, both mental and physical, of visiting populations.	The No Action Alternative would retain current land classifications, in which potential development could impact water quality. Continued development may lead to increased water traffic, with the potential for increased accidents and pollution.	The Moderate Resource Protection Alternative would most likely have a negative impact on safety by indirectly increasing boat traffic due to an increase in Low Density lands by 1,248.9 acres. Recreational boating experiences and boater satisfaction may be impacted. Water quality may be negatively impacted due to potential increased development and an increase in fuel and oil leakage.
Aesthetics	Under the Maximum Resource Protection Alternative the conversion of all Low Density lands to Environmentally Sensitive would enhance the unspoiled and untamed aesthetic of the landscape. This alternative would maintain the area of pristine shoreline and preserve regions of boulders, bluffs, and mature forest flora that currently dominate views.	Under the Balanced Resource Management Alternative, the addition of 682.7 acres of wildlife management lands and 321.0 acres of environmentally sensitive lands and the nearby shore would enhance a sense of the pristine nature of the lake. The developed areas are, for the most part, shielded from the lake view, which preserves the viewscapes of those recreating on the lake.	Under the Current Resource Management Alternative, the addition of 306.4 acres of environmentally sensitive lands and 55.0 acres to vegetative management, and the limited development would continue to promote the sense of a relatively pristine shoreline. The developed areas are, for the most part, shielded from the lake view, which preserves the viewscapes of those recreating on the lake.	Under the No Action Alternative the visual characteristics surrounding the Beaver Lake landscape could potentially change due to continued development in the High Density, Low Density and No Allocation lands.	Under the Moderate Resource Protection Alternative, the visual characteristics around the lake could potentially change to the detriment of aesthetics. The addition of 1,249.9 acres of Low Density lands and a reduction of 984.6 acres of Environmentally Sensitive lands would diminish the unspoiled and untamed aesthetic of this landscape.

5.1 Climate

5.1.1 Maximum Resource Protection (Alternative 1)

The Maximum Resource Protection Alternative is the most protective alternative in terms of potential impacts on climate. While this alternative retains 2,306.8 acres of High Density lands, 2,501.8 acres of Low Density lands were converted to either Environmentally Sensitive or Wildlife Management lands. The combination represents 75% of available acreage around the lake which protects the shoreline from vegetation modification. This reclassification would provide for the most vegetation protection, which could result in increased shade and improved climate conditions.

5.1.2 Balanced Resource Management (Preferred Alternative 2)

The Balanced Resource Management Alternative is more protective than the No Action Alternative in terms of potential impacts on air and water temperature modification. A conversion of both High Density and Low Density lands to Environmentally Sensitive and Wildlife Management lands would reduce the potential for development, which reduces the potential impact on climate due to vegetation removal.

5.1.3 Current Resource Management (Alternative 3)

The Current Resource Management Alternative is more protective than the No Action Alternative in terms of potential impacts on air and water temperature modification. A conversion of 42.1 acres of Low Density lands and a portion of the No Allocation lands provides a 306.4 acre increase to Environmentally Sensitive lands. This would reduce the potential for development, which reduces the potential impact on climate due to vegetation removal.

5.1.4 No Action (Alternative 4)

There could be some potential impact to climate as a result of implementation of the No Action alternative. Of the 9,812.6 total land acres, 5,431.7 acres are classified as either High Density or Low Density lands under this alternative. This potential for development could modify the vegetation component near the shoreline, allowing more sunlight penetration. Greater temperature fluctuations generally occur when woody vegetation is removed from an area. Reduced ground cover could cause an increase in sedimentation during rainfall events, which could increase the turbidity of the water, resulting in a potential for a slight increase in water temperature.

5.1.5 Moderate Resource Protection (Alternative 5)

The Moderate Resource Protection Alternative allows for more potential development than the other alternatives, and could potentially have a greater impact on climate around Beaver Lake. The most significant change from the No Action Alternative is the conversion of 984.6 acres of Environmentally Sensitive lands to Low Density, resulting in 3,750.7 acres in this classification, and with the 2,306.8 acres of High Density lands in this alternative, the combination represents 62% of available acreage around the lake.

5.2 Topography, Geology and Soils

5.2.1 Maximum Resource Protection (Alternative 1)

The Maximum Resource Protection Alternative is different from the No Action Alternative in terms of potential impacts to topography, geology and soils. There would be less impact to the existing conditions regarding these features. High Density recreation acreage encompass 2,306.8 acres, representing 24% of the lake shore acreage, while the Low Density lands have been reclassified to Environmentally Sensitive lands. Under this alternative the combination of Environmentally Sensitive and Wildlife Management lands would represent 75% of available acreage around the lake. This alternative would have significant positive effects due to reduced erosion and lake sedimentation due to vegetation retention. This additional buffer helps reduce storm water velocity and surface scour during storm events.

5.2.2 Balanced Resource Management (Preferred Alternative 2)

The Balanced Resource Management Alternative is more restrictive than the No Action Alternative in terms of potential impacts to topography, geology and soils. There would be little to no change in impacts on the existing conditions regarding these features due to the fact that this alternative generally reflects current lake usage patterns. High Density Recreation acreage would be reduced from the No Action Alternative (2,929.9 acres), to 2,324.8 acres, and the Low Density recreation acreage has been reduced from 2,501.8 to 2,426.0 acres. These lands would be reclassified to Environmentally Sensitive and Wildlife Management lands, which provide more of a vegetated lake buffer area. This vegetation helps to reduce storm water velocity and acts as a filtering mechanism. This would help reduce erosion and sediment deposition in the lake.

5.2.3 Current Resource Management (Alternative 3)

The Current Resource Management Alternative is slightly more restrictive than the No Action Alternative in terms of potential impacts to topography, geology and soils. There would be little to no change in impacts on the existing conditions regarding these features due to the fact that this alternative reflects current lake usage patterns. High Density Recreation acreage would be increased from the No Action Alternative (2,929.9 acres) to 2,992.7 acres and Low Density recreation acreage has been reduced from 2,501.8 to 2,459.7 acres. The no allocation lands would be primarily reclassified to Environmentally Sensitive lands, which provide additional vegetated lake buffer area. This vegetation helps to reduce storm water velocity and acts as a filtering mechanism. This would help reduce erosion and sediment deposition in the lake.

5.2.4 No-Action (Alternative 4)

The No Action Alternative could allow potential development on the 377.9 acres of No Allocation lands, but due to the fragmentation of this acreage around the shoreline, there would be only minor impacts on the topography, geology and soils. High Density recreation acreage comprises 30% of available shoreline (2,929.9 acres), while Low Density lands comprise an additional 25% (2,501.8 acres). The combination of High Density and Low Density recreation lands represents 55% of available acreage around the lake. With the majority of shoreline acres consisting of these classifications, some potential impacts from erosion and sedimentation would result from the implementation of this alternative.

5.2.5 Moderate Resource Protection (Alternative 5)

Soil erosion would persist due to development being allowed under this alternative. Approximately 62% of available acreage (6,57.5 acres) around the lake is currently classified

as High and Low Density recreation (24% and 38%, respectively). High Density acreage allows development of intense recreational activities including campgrounds, parks, marinas, resorts and other public development infrastructure. This development results in soil disturbance, vegetation removal and transforming some pervious surfaces to impervious areas. It also promotes erosion during construction activities and increased runoff velocity after development is completed. The remaining pervious surfaces around these developed areas would become more impervious due to increased foot traffic from recreational activity. Of the activities associated with Low Density land classification—primitive camping, fishing, hunting, trails, wildlife viewing and shoreline use permits—the shoreline use permits would typically have the greatest impacts on soil disruption and subsequent erosion.

5.3 Aquatic Environment

5.3.1 Hydrology and Groundwater

5.3.1.1 Maximum Resource Protection (Alternative 1)

The Maximum Resource Protection Alternative is likely to be more protective than the No Action Alternative in terms of potential impact on the hydrology and groundwater components of the aquatic environment. The hydrology and groundwater conditions are generally controlled by the watershed drainage and existing geology of the area. Since 75% of the land is classified as Environmentally Sensitive and Wildlife Management, rainfall would be much more likely to be absorbed, thereby replenishing the groundwater to a greater degree.

There would be little to no change in the wetland status from the existing condition due to implementation of the Maximum Resource Protection alternative. Most of the limited wetland acreage has been identified in the lower reaches of the major tributary streams, therefore the limited High Density shoreline development along the main body of the lake would have little impact to this resource.

5.3.1.2 Balanced Resource Management (Preferred Alternative 2)

The Balanced Resource Management Alternative is different than the No Action Alternative in terms of potential impacts to the hydrology and groundwater components of the aquatic environment. The hydrology and groundwater conditions are generally a function of the watershed drainage and existing geology of the area, but having 49% of the land classified as High and Low Density lands in this alternative, as compared to 55% in the No Action Alternative, as well as 50% more Environmentally Sensitive and Wildlife Management lands, would enhance rainfall absorption and slow runoff velocity due to retention of shoreline vegetation.

5.3.1.3 Current Resource Management (Alternative 3)

The Current Resource Management Alternative is slightly different than the No Action Alternative in terms of potential impacts to the hydrology and groundwater components of the aquatic environment. The 377.9 acres of unallocated lands in the No Action Alternative were converted primarily to Environmentally Sensitive lands, with 55.0 acres classified as Vegetative Management lands. This additional undevelopable acreage would enhance rainfall absorption and slow runoff velocity due to retention of additional shoreline vegetation.

5.3.1.4 No-Action (Alternative 4)

The hydrology and groundwater components of Beaver Lake would not substantially change from the existing condition due to the implementation of a No Action Alternative. The potential for additional development under this alternative would have some effect on reducing percolation through the soil layers due to ground cover removal, and potentially increasing storm water velocity.

Wetland areas are relatively limited within Beaver Lake and throughout the adjacent government property surrounding the lake and would not undergo any significant change from existing conditions due to implementation of the No Action Alternative.

5.3.1.5 Moderate Resource Protection (Alternative 5)

The Moderate Resource Protection Alternative would increase Low Density acreage by 1,248.9 (38%), while reducing High Density acreage by 623.1 (24%) compared to the No Action Alternative. After factoring in the loss of 984.6 acres of Environmentally Sensitive lands and an increase of 682.7 acres of Wildlife Management lands, this represents a net gain of 2% in potentially developable shoreline acreage, which would have a slightly negative effect on percolation through the soil layers due to ground cover removal, and potentially increasing storm water velocity.

5.3.2 Water Quality

5.3.2.1 Maximum Resource Protection (Alternative 1)

Implementation of the modified Maximum Resource Protection Alternative should result in positive benefits to water quality due to a reduction in both High Density and Low Density acreage by 623.1 and 2,501.8 acres respectively as compared to the No Action Alternative. There is a corresponding major increase in Environmentally Sensitive acreage, from 3,371.7 acres to 6,192.9 acres, which represents a gain of 2,821.2 acres. These land reclassifications would serve to limit development on these lands, thereby reducing impacts to ground disturbance and subsequent increased erosion. Wildlife Management lands increased from 460.3 acres to 1,143.0 acres, representing a gain of 682.7 acres. These factors would reduce erosion sedimentation and pollutants scoured from reduced impervious surfaces, with additional benefits of retention of more shoreline vegetation, better fishery habitat, increased water clarity and cooler water temperature conditions due to the decrease of turbidity and sediment deposition.

5.3.2.2 Balanced Resource Management (Preferred Alternative 2)

Implementation of the Balanced Resource Management Alternative may result in positive benefits to water quality due to a reduction in both High Density and Low Density acreage by 605.1 and 75.8 acres respectively as compared to the No Action Alternative. There is a corresponding increase in Environmentally Sensitive acreage, from 3,371.7 acres to 3,692.7 acres, which represents a gain of 321.0 acres. These land reclassifications would serve to limit development on these lands, thereby reducing impacts to ground disturbance and subsequent increased erosion. Wildlife Management lands increased from 460.3 acres to 1,143.0 acres, representing a gain of 682.7 acres. These factors would reduce erosion sedimentation and pollutants scoured from reduced impervious surfaces, with additional benefits of retention of more shoreline vegetation,

better fishery habitat, increased water clarity and cooler water temperature conditions due to the decrease of turbidity and sediment deposition.

5.3.2.3 Current Resource Management (Alternative 3)

Implementation of the Current Resource Management Alternative may result in minimal positive benefits to water quality due to a reduction in Low Density acreage by 42.1 acres as compared to the No Action Alternative. Additional potential positive benefits may result from the classification of 377.9 acres of unallocated lands primarily to Environmentally Sensitive acreage, which increased from 3,371.7 acres to 3,678.1 acres, which represents a gain of 306.4 acres. These land reclassifications would serve to limit development on these lands, thereby reducing impacts to ground disturbance and subsequent increased erosion. These factors would reduce erosion sedimentation and pollutants scoured from reduced impervious surfaces, with additional benefits of retention of more shoreline vegetation, better fishery habitat, increased water clarity and cooler water temperature conditions due to the decrease of turbidity and sediment deposition.

5.3.2.4 No-Action (Alternative 4)

Lake fluctuations, associated with power production and flood control procedures, causing changes in the environment along the shoreline of the lake. Turbidity from heavy rainfall has a temporary, adverse effect on Beaver Lake. During these periods of increased runoff, urban areas and other parts of the terrain, especially those that have had the protective vegetation removed, contribute silt and other suspended particles to the tributaries. While implementation of the No Action Alternative is relatively independent of the existing watershed drainage on the lake water quality, potential continued development around the lake shoreline would exacerbate water quality issues due to potential increased erosion, localized increases in turbidity and increased sedimentation in the lake following storm events. Under the No Action Alternative, High Density recreation land classification would be 2,929.9 acres (30% of total available area), Low Density recreation lands would be 2,501.8 acres (25%), Environmentally Sensitive lands would include 3,371.7 acres (34%), Wildlife Management lands would total 460.3 acres (5%), while 377.9 acres have no current classification. Based on the current classification, the potential exists for continual degradation of shoreline vegetation due to potential increased development and subsequent vegetation removal and mowing activities. This would result in negative impacts to water quality due to increased storm water velocity, scour and sedimentation.

5.3.2.5 Moderate Resource Protection (Alternative 5)

The Moderate Resource Protection Alternative would result in a potentially greater degree of water quality impairment, as compared to the No Action Alternative. Potentially developable lands in this alternative consist of 2,306.8 acres of High Density lands, representing 24% of the available shoreline acreage, but Low Density lands include 3,750.7 acres, which represent 38% of available shoreline. Environmentally Sensitive lands have been reduced by 984.6 acres, representing 24%, while Wildlife Management lands represent 12% of available shoreline acreage. These land classifications could potentially remove the highest amount of vegetated shoreline due to potential increased development. This would result in negative impacts to water quality due to increased storm water velocity, scour and sedimentation.

5.3.3 Fish Species and Habitat

5.3.3.1 Maximum Resource Protection (Alternative 1)

The Maximum Resource Protection Alternative would enhance the fish resources in Beaver Lake to the greatest degree of all evaluated alternatives. A comparison with the No Action Alternative shows a 623.1 acre reduction in High Density lands, with all Low Density lands being converted to Environmentally Sensitive lands. The resulting acreage (6,192.9 acres) represents 63% of total shoreline acreage. Along with the 1,143.0 acres of Wildlife Management lands in this alternative, 75% of the total shoreline acreage would retain its natural shoreline vegetation. Shoreline vegetation provides a buffer area that would attenuate storm water runoff, reduce scour and sedimentation, improve fish cover and spawning habitat, and provide a cleaner substrate for macro-invertebrate colonization, which improves the food supply for fish.

5.3.3.2 Balanced Resource Management (Preferred Alternative 2)

Implementation of the Balanced Resource Management Alternative would have a positive effect on the lake fishery resource as compared to the No Action Alternative. There is a 75.8 acre reduction in Low Density recreation land classification , a 605.1 acre reduction in High Density lands, a 321.0 acre increase in Environmentally Sensitive lands classification (3,692.7 total acres) and an increase in Wildlife Management lands from 460.3 acres to 1,142.0 acres, which results in 12% of available acreage classified as Wildlife Management lands. The increases in lands classified in these two areas would serve as additional protection for lakeside vegetation and preservation of overhanging vegetation, which provides cover for fish, reduces storm flow velocity, reduces erosion scour, and reduces sedimentation. These factors improve spawning habitat, thereby potentially enhancing fish population dynamics in the lake.

5.3.3.3 Current Resource Management (Alternative 3)

Implementation of the Current Resource Management Alternative would have a small positive effect on the lake fishery resource as compared to the No Action Alternative. There is a 42.1 acre reduction in Low Density recreation land classification and a 306.4 acre increase in Environmentally Sensitive lands classification (3,678.1 total acres). Most of this increase came from unallocated lands in the No Action Alternative, which could have potentially been developed. The increases in lands classified in these two areas would serve as additional protection for lakeside vegetation and preservation of overhanging vegetation, which provides cover for fish, reduces storm flow velocity, reduces erosion scour, and reduces sedimentation. These factors improve spawning habitat, thereby potentially enhancing fish population dynamics in the lake.

5.3.3.4 No-Action (Alternative 4)

The fishery of Beaver Lake may have potential minor impacts from the implementation of the No Action alternative, which has 55% of available shoreline acreage classified as High and Low Density lands. Implementation of the No Action alternative would allow potential development around much of the shoreline. Development often results in vegetation removal down to water's edge, which impacts shoreline stability, removes fish cover provided by overhanging vegetation, tree trunks and roots, and exacerbates storm water erosion and sedimentation. During the spring spawning season this sedimentation has the potential to disrupt spawning activity and productivity in the coves and lake arms where spawning commonly occurs.

5.3.3.5 Moderate Resource Protection (Alternative 5)

The Moderate Resource Protection Alternative would have a greater potential impact, when compared to the No Action Alternative, in terms of potential negative benefits to the lake fishery. A comparison with the No Action Alternative shows an increase of 1,248.9 acres of Low Density lands, as well as a reduction of 623.1 acres of High Density lands. In this alternative, 62% of the available shoreline acreage would be classified as in these two categories, thereby having a majority of the natural shoreline vegetation subject to potential modification, soil disruption, and potential increased erosion. Environmentally Sensitive lands are reduced by 984.6 acres, which would potentially further reduce available shoreline vegetative filtering and cover for fish. Implementation of this alternative would likely have a negative effect on the fish and fish habitat of Beaver Lake.

5.4 Terrestrial Resources

5.4.1 Wildlife

5.4.1.1 Maximum Resource Protection (Alternative 1)

The Maximum Resource Protection Alternative would convert all of the existing Low Density lands to Environmentally Sensitive and Wildlife Management acreage. Based on this reclassification, this alternative would result in significant positive effects on terrestrial resources around the shoreline of the lake. White-tailed deer and eastern wild turkey are common game animals found and hunted in the Beaver Lake area. Black bear have also become common in the area and are hunted on the more remote areas of Beaver Lake. Gray and fox squirrels are common in upland wooded areas and are also popular with sportsmen. All these wildlife species fare better in a natural, undeveloped vegetation cover. This alternative would provide the most wildlife benefits in this regard. Some habitat management activities, including wildlife food plot plantings, removal of exotic species and application of prescribed fire would potentially benefit these populations as well.

5.4.1.2 Balanced Resource Management (Preferred Alternative 2)

Implementation of the Balanced Resource Management Alternative would have a positive effect on terrestrial resources, when compared to the No Action alternative. There would be a 75.8 acre reduction in Low Density recreation land classification (to 2,426.0 acres), a 605.1 acre reduction in High Density lands (to 2,324.8 acres), a 3% increase in Environmentally Sensitive lands classification (3,692.7 total acres) and an increase in Wildlife Management lands from 460.3 acres to 1,143.0 acres. This would result in 12% of available acreage classified as Wildlife Management lands. The increases in lands classified as Environmentally Sensitive and Wildlife Management land would provide additional protection for lakeside vegetation, and preservation of habitat for wildlife and migratory bird species. The buffer of natural vegetation that remains along the shoreline from this designated acreage would potentially enhance migration and feeding activities for many species of wildlife.

5.4.1.3 Current Resource Management (Alternative 3)

Implementation of the Current Resource Management Alternative could have a small positive effect on terrestrial resources, when compared to the No Action alternative. There would be a 42.1 acre reduction in Low Density recreation land classification (to 2,459.7 acres), a 62.8 acre gain in High Density lands (to 2,992.7), and a 3.1% increase in Environmentally Sensitive lands classification (3,678.1 total acres). The increase in lands classified as Environmentally Sensitive would provide some additional protection for lakeside vegetation, and preservation of habitat for wildlife and migratory bird species. The buffer of natural vegetation that remains along the

shoreline from this designated acreage would potentially enhance migration and feeding activities for many species of wildlife.

5.4.1.4 No-Action (Alternative 4)

Under the No Action Alternative, shoreline lands would be classified into High Density recreation lands (2,929.9 acres, or 30% of total available area), Low Density recreation lands (2,501.8 acres or 25%), Environmentally Sensitive lands (3,371.7 acres or 34%), and Wildlife Management lands (460.3 acres or 5%), while 377.9 acres have no current classification. Based on the current shoreline classification, the potential exists for continual degradation of shoreline vegetation due to increased development and potential vegetation removal and mowing activities. Unclassified lands are potentially developable, resulting in 59% of the shoreline acreage subject to possible increased or new development. This would result in negative effects to wildlife due to potential removal of trees and understory vegetation (with the highest potential in the High Density lands), thus altering food sources and migratory patterns of insects, birds and mammal species.

5.4.1.5 Moderate Resource Protection (Alternative 5)

The Moderate Resource Protection Alternative is more likely to increase negative potential effects to the terrestrial resources and land use patterns than the No Action Alternative. A proposed increase in Low Density lands to 3,750.7 acres, would result in 38% of available acreage classified as Low Density. This additional low density land would potentially be available for development, and may have some negative effect on wildlife species and activity. High Density lands are reduced by 623.1 acres from the original 2,929.9 acres in the No Action Alternative. A potentially smaller amount of good habitat for wildlife would be available under this alternative.

5.4.2 Vegetation

5.4.2.1 Maximum Resource Protection (Alternative 1)

The Maximum Resource Protection Alternative would convert all the existing Low Density lands and 623.1 acres of High Density lands to Environmentally Sensitive and Wildlife Management acreage. Based on the reclassification of 3,124.9 acres, this alternative would result in significant positive effects on the vegetation resources around the shoreline of the lake due to the restrictions placed on vegetation modification actions under the majority of the land classifications remaining. Some habitat management activities, including wildlife food plot plantings, removal of exotic species and application of prescribed fire would still take place under this alternative and could potentially be beneficial to the area.

5.4.2.2 Balanced Resource Management (Preferred Alternative 2)

Implementation of the Balanced Resource Management Alternative would have a positive effect on the shoreline vegetation, when compared to the No Action alternative. There would be a 75.8 acre reduction in Low Density recreation land classification (2,426.0 total acres), a 605.1 acre reduction in High Density lands (2,324.8 total acres), a 321.0 acre increase in Environmentally Sensitive lands classification (3,692.7 total acres) and an increase in Wildlife Management lands from 460.3 acres to 1,143.0 acres, which results in 12% of available acreage classified as Wildlife Management lands. The increases in lands classified as Environmentally Sensitive and Wildlife Management land would serve as additional protection for lakeside vegetation and subsequent preservation of habitat for wildlife and migratory bird species. The

buffer of natural vegetation that remains along the shoreline from this designated acreage would enhance migration and feeding activities for many species of wildlife, as well as mediate storm water velocity and scour.

5.4.2.3 Current Resource Management (Alternative 3)

Implementation of the Current Resource Management Alternative would have a small positive effect on the shore line vegetation, when compared to the No Action alternative. The most significant change from the No Action Alternative is a classification of 377.9 acres of unallocated lands, with 306.4 acres being moved to the Environmentally Sensitive lands classification (3,678.1 total acres). The increase in land classified as Environmentally Sensitive would serve as additional protection for lakeside vegetation and subsequent preservation of habitat for wildlife and migratory bird species. The buffer of natural vegetation that remains along the shoreline from this designated acreage would enhance migration and feeding activities for many species of wildlife, as well as mediate storm water velocity and scour.

5.4.2.4 No-Action (Alternative 4)

Under the No Action Alternative, shoreline lands would be classified into High Density recreation lands (2,929.9 acres, or 30% of total available area), Low Density recreation lands (2,501.8 acres or 25%), Environmentally Sensitive lands (3,371.7 acres or 34%), and Wildlife Management lands (460.3 acres or 5%), while 377.9 acres have no current classification. Based on this, the potential exists for continued degradation of shoreline vegetation due to increased development and subsequent vegetation removal and mowing activities. Unclassified lands are potentially developable, resulting in 59% of the shoreline acreage subject to possible increased or new development. This would result in potential negative effects to the natural shoreline vegetation composition due to potential removal of trees and understory vegetation, thus possibly altering food sources and migratory patterns of insects, birds and mammal species, as well as increasing a potential for increased storm water erosion effects.

5.4.2.5 Moderate Resource Protection (Alternative 5)

The Moderate Resource Protection Alternative would result in less protection to the lakeshore vegetation than that of the No Action Alternative. A proposed decrease in High Density lands of 623.1 acres is offset by a 1,248.9 acre increase in Low Density lands, and would result in 62% of shoreline acreage available for potential development. An increase in Wildlife Management lands of 682.7 acres is also offset by a decrease of 984.6 acres in the Environmentally Sensitive lands classification. This would result in the greatest potential negative effects to the natural shoreline vegetation composition of all evaluated alternatives due to potential removal of trees and understory vegetation. This action would have an impact on wildlife food sources and migratory patterns of insects, birds and mammal species, as well as increasing a potential for increased storm water erosion effects.

5.5 Threatened and Endangered Species

5.5.1 Maximum Resource Protection (Alternative 1)

The Maximum Conservation Alternative would likely provide the most protection for any species listed as Threatened, Endangered, Protected, or Species of State Concern due to the reclassification of 3,124.9 acres from High and Low Density lands to Environmentally Sensitive and Wildlife Management lands. Potentially developable lands under this

alternative include only 2,306.8 acres of High Density lands, representing 24% of available shoreline acreage. Due to the significant increase of Environmentally Sensitive and Wildlife Management acreage from the No Action land classifications, there may be potential positive benefits to any or all the listed species, and possibly other yet undiscovered species that may exist in the area.

5.5.2 Balanced Resource Management (Preferred Alternative 2)

The Balanced Resource Management Alternative would likely have some potential to positively impact on listed threatened, endangered, protected, or species of state concern based on the reductions in High and Low Density lands acreage, and increases in Environmentally Sensitive and Wildlife Management lands acreage, as compared to the No Action Alternative. Due to the reclassification of 680.9 acres from High and Low Density lands to Environmentally Sensitive and Wildlife Management lands classifications, there may be potential positive benefits to any or all the listed species, and possibly other yet undiscovered species that may exist in the area. This is due to the higher level of protection offered by the Environmentally Sensitive and Wildlife Management land classifications.

5.5.3 Current Resource Management (Alternative 3)

The Current Resource Management Alternative may potentially have some positive effects on any listed threatened, endangered, protected, or species of state concern based on the classification of 306.4 acres of the 377.9 unallocated acres in the No Action Alternative to Environmentally Sensitive lands. This is due to the higher level of protection offered by the Environmentally Sensitive land classification. The Bald Eagle, *Haliaeetus leucocephalus*, was removed from the threatened listing in 2007 by the USFWS, but it still remains a protected species. While there have been reports of nesting in some locations around the lake perimeter, this species is not confined to a particular area around the lake, and should not be significantly affected by implementation of this alternative.

5.5.4 No-Action (Alternative 4)

While similar to Alternative 3, the No Action Alternative could potentially have some negative effects on listed Threatened, Endangered, Protected, or Species of State Concern based on the presence of 377.9 acres of unallocated lands, which could be potentially developable acreage. Along with the 2,929.9 acres of High Density lands and 2,501.8 acres of Low Density lands, 59% of available shoreline could be potentially impacted. This may result in some potential negative effects to listed species based on possible development activity on this shoreline acreage.

5.5.5 Moderate Resource Protection (Alternative 5)

The Moderate Resource Protection Alternative would result in less protection to the lakeshore vegetation than that of the No Action Alternative. A proposed decrease in High Density lands of 623.1 acres is offset by a 1,248.9 acre increase in Low Density lands, and would result in 62% of shoreline acreage available for potential development. An increase in Wildlife Management lands of 682.7 acres is also offset by a decrease of 984.6 acres in the Environmentally Sensitive lands classification. This would result in the greatest potential negative effects to the natural shoreline vegetation composition of all evaluated alternatives due to potential removal of trees and understory vegetation. This action could have a potential impact on feeding and roosting activity of the three listed species of bats, and well as possible impacts on existing habitat of the listed species of herbaceous plants.

5.6 Archaeological and Historic Resources

5.6.1 Maximum Resource Protection (Alternative 1)

The Maximum Resource Protection Alternative would result in the greatest benefit to preservation of cultural resource sites and historic properties. Under this alternative, there would not be any areas identified as Low Density and approximately 75% of all land would be classified as Environmentally Sensitive and Wildlife Management. This alternative is very preservation-oriented and would constitute the best opportunity to minimize any potential effects to cultural resource sites and historic properties. High Density recreation would decrease by 623.1 acres to approximately 24 % of the land coverage. This would minimize the amount of development potential on lands adjacent to Beaver Lake, and subsequently minimize adverse effects on cultural resources.

5.6.2 Balanced Resource Management (Preferred Alternative 2)

Under the Balanced Resource Management Alternative, the area classified as Environmentally Sensitive and Wildlife Management would increase. With the proposed increases in both the Wildlife Management Areas and Environmentally Sensitive Area classifications, there would be minimal potential for ground disturbing activities along the shoreline, thus decreasing the potential for effects on cultural resources. In areas that were classified as High Density under the No Action Alternative that have no planned development or currently is park buffer area, would be changed to Environmentally Sensitive or Wildlife Management in an effort to preserve the scenic, historical, archaeological, scientific, water quality, or ecological value of the overall project.

5.6.3 Current Resource Management (Alternative 3)

Under the Current Resource Management Alternative, the area classified as Environmentally Sensitive would increase by 306.4 acres over the No Action Alternative. With the proposed increase in Environmentally Sensitive Area classification, there would be less potential for ground disturbing activities along the shoreline, thus decreasing the potential for effects on cultural resources. In areas that were classified as Low Density under the No Action Alternative and that have no permits or houses, and undeveloped lots, would be changed to Environmentally Sensitive or Vegetative Management in effort to preserve the scenic, historical, archaeological, scientific, water quality, or ecological value of the overall project.

5.6.4 No-Action (Alternative 4)

Under the No-Action Alternative there would be no change in the current Master Plan land classifications as designated under the 1976 MP. Under this alternative, the greatest potential for effects on cultural resources and historic properties would occur in the areas classified as Low and High Density Recreation and those lands with no classification. Cultural Resources under the No Action Alternative would be at risk of disturbance in areas where the land classification would allow for intensive development. Any new ground disturbing activities on USACE lands would require a permit to be issued prior to commencement of the activity. Through the site review process prior to issuance of a permit or any federal action, unknown

sites would be identified, and known sites would be evaluated for their significance and eligibility for the National Register of Historic Places pursuant to 36 CFR Part 800 of the National Historic Preservation Act. Cultural Resource sites within Low Density or High Density classification areas could potentially undergo the most severe impact due to the fact that activities such as boat dock construction and shoreline use permits result in a degree of ground disturbance which could pose a threat to intact cultural deposits. Potential mitigation for impact to cultural or historic sites would be the requirement for a cultural or historic resource site evaluation. If evaluation of site identifies a cultural or historic resource, avoidance of the action would be recommended.

5.6.5 Moderate Resource Protection (Alternative 5)

Under the Moderate Resource Protection Alternative, High Density land classification would be decreased by 623.1 acres around Beaver Lake. However, Low Density would be increased to the highest acreage of all evaluated alternatives, thereby creating a larger potential for development as compared to the Preferred Alternative. Environmentally Sensitive lands would be reduced by 984.6 acres, while Wildlife Management Areas would be increased by 682.7 acres, with the difference attributed to the gain in Low Density land acreage. This alternative would have the greatest potential for negative impacts to cultural resources based on the large increase in the Low Density land classification as compared to the No Action Alternative or other action alternatives.

5.7 Socio-Economic Resources

5.7.1 Maximum Resource Protection (Alternative 1)

The Maximum Conservation Alternative would have an effect on the socio-economic situation in the counties that surround Beaver Lake due to the decreased High Density acreage and the reclassification of all Low Density lands to Environmentally Sensitive and Wildlife Management acreage. An indirect impact from this alternative would be a reduction in tax revenue to local counties, essentially reducing their economic development, due to the fact that the Corps would not grant new permits allowing expansion or new development. Total housing units would likely stay the same due to the decreased availability of recreation (private shoreline uses) at the lake resulting in minimal new development, but it is unlikely that property values would change. It is unlikely that other facets of socio-economics would change due to the implementation of this alternative.

5.7.2 Balanced Resource Management (Preferred Alternative 2)

The Balanced Resource Management Alternative would likely have a minimal effect on the socio-economic situation in the counties surrounding Beaver Lake when compared to the No Action Alternative. Population would be expected to stay the same or decline slightly due to the slight decrease in High Density and Low Density acreage and the conversion of 1,003.7 acres to Environmentally Sensitive and Wildlife Management lands. Although under this Preferred Alternative, the demographic makeup of the population would likely be unaffected. Total housing units would stay the same or decrease due to the decreased availability of recreation at the lake, but it is unlikely that housing values would change as a result of the alternative. The economy of the area would likely stay the same or have a slight decline if this alternative is implemented.

5.7.3 Current Resource Management (Alternative 3)

The Current Resource Management Alternative would likely have less of a positive effect on the socio-economic situation in the counties surrounding Beaver Lake than the No Action Alternative. Population would be expected to stay the same or possibly decline slightly due to the classification of unallocated lands to Environmentally Sensitive and Wildlife Management lands. The demographic makeup of the population would likely be unaffected. Total housing units would stay the same or decrease due to the decreased availability of recreation at the lake, but it is unlikely that housing values would change as a result of the alternative. The economy of the area would likely stay the same or have a slight decline if this alternative is implemented.

5.7.4 No-Action (Alternative 4)

The No Action Alternative may have the most effect on the socio-economic situation in the counties surrounding Beaver Lake due to the fact that 59% of the available shoreline acreage is classified as High or Low Density lands, and no allocation lands. While the potential for some development exists around the lake, current population growth and the demographic makeup of the population are expected to remain similar to the current rates and percentages the area experiences now. Housing units and their values would not be affected if the No Action alternative is implemented. It is likely that changes in the socio-economic conditions of the Beaver area would be the result of outside influences, and not those created by the No Action alternative.

5.7.5 Moderate Resource Protection (Alternative 5)

The Moderate Resource Protection Alternative would result in a more positive effect on the socio-economic situation, as compared to the No Action Alternative. Low Density acreage in this alternative would be 3,750.7 acres, representing 38% of available shoreline acreage. The economy in the area could possibly grow slightly due to a potential increased opportunity for development, which would typically enhance recreation opportunities on the lake.

5.8 Recreation Resources

5.8.1 Maximum Resource Protection (Alternative 1)

Under the Maximum Conservation Alternative, some recreation opportunities would be reduced, such as private boat docks, due to an increase in the area classified as Environmentally Sensitive, which does not allow most types of development. This alternative would also limit commercial opportunities based on the proposed 2,306.8 acres of High Density classification. Although it minimizes potential for development, it would improve land-based recreational opportunities such as hunting, hiking, bird watching. This alternative also would improve viewscapes along the lake since it would allow for native flora and fauna to thrive.

5.8.2 Balanced Resource Management (Preferred Alternative 2)

Under the Balanced Resource Management Alternative, all lands would be classified and some of the existing classifications would be changed. This proposed update in classification would be structured to achieve a balance based on the present public use of the lake while sustaining the natural, cultural, and socio- economic resources of the area and reflecting the current management and operation of lands at Beaver Lake. Under Alternative 2, the current High and Low Density lands, comprising 55% of available shoreline acreage, would be reduced to 49%, while Environmentally Sensitive and Wildlife Management lands, at 34% and 5%, respectively,

would increase to 38% and 12% of shoreline acreage. These classifications reflect existing lake usage, with fishing, boating, hunting and wildlife viewing dominating the recreational activity on the lake. The proposed increase in Wildlife Management and Environmentally Sensitive classified lands action would assist in forging stronger partnerships between public and private entities for recreational and wildlife conservation opportunities. The retention of 50% of the natural shoreline vegetation would lead to improved water quality, due to the buffering and filtering capability of this vegetation.

5.8.3 Current Resource Management (Alternative 3)

Under the Current Resource Management Alternative, all lands would be classified and some of the No Action Alternative classifications would be changed. This proposed update in classification would be structured to achieve an established use of all public lands around the lake while sustaining the natural, cultural, and socio- economic resources of the area and reflecting the current management and operation of lands at Beaver Lake. Under this alternative, the High and Low Density lands, comprising 55% of available shoreline acreage, would be remain similar to the No Action Alternative, while Environmentally Sensitive lands, at 34% , would increase to 37% of shoreline acreage due primarily to the classification of unallocated lands. These classifications reflect current lake usage, with fishing, boating, hunting and wildlife viewing dominating the recreational activity on the lake. The proposed increase in Environmentally Sensitive classified lands would assist in forging stronger partnerships between public and private entities for recreational and wildlife conservation opportunities.

5.8.4 No-Action (Alternative 4)

Provision of recreational facilities and services would continue at Beaver Lake without an update to the Beaver Lake Master Plan. However, the plan by which the Resource Manager and staff operate would not accurately reflect the current status of project facilities. Nor would there be additional measures in place, such as trail corridors and additional land use designations, to better accommodate recreational needs while protecting the natural resources. Currently, there are several boat docks outside of areas currently zoned for them and under the No Action Alternative these uses would remain inconsistent with the Master Plan. A total of 377.9 acres of shoreline would remain unclassified, generating confusion about which uses are allowed in these areas.

5.8.5 Moderate Resource Protection (Alternative 5)

The Moderate Resource Protection Alternative would result in a more positive effect on the lake recreation, as compared to the No Action Alternative. Low Density acreage in this alternative would be 3,750.7 acres, representing 38% of available shoreline acreage. This could allow for more development, and a potential for increased private dock construction. This would likely enhance recreation opportunities on the lake, but would reduce recreational activities like hiking, bird watching, and hunting due to the loss of approximately 984.6 acres of shoreline due to a reduction in Environmentally Sensitive lands.

5.9 Air Quality

5.9.1 Maximum Resource Protection (Alternative 1)

Implementation of the Maximum Resource Protection Alternative would result in much less of an impact to existing air quality than that of the No Action Alternative, due to the reduction in lands classified for development around the Beaver Lake shoreline. Since the majority of the available acreage would be classified as Environmentally Sensitive and Wildlife Management lands (75% of total available acreage), this would result in much less potential vehicular traffic, boat traffic, construction equipment usage, and mower exhaust emissions on these lands.

5.9.2 Balanced Resource Management (Preferred Alternative 2)

Implementation of the Balanced Resource Management Alternative would also result in some positive change in air quality impacts, as that noted under the No Action Alternative. Since this alternative would incorporate more shoreline acreage into the Environmentally Sensitive and Wildlife Management land classification, there would likely be a reduction in potential development, local vehicular exhaust emissions, and construction equipment activity, which would avoid or reduce potential impacts on localized air quality. No violations of the current NAAQS established by EPA would be expected as a result of the implementation of this alternative.

5.9.3 Current Resource Management (Alternative 3)

Implementation of the Current Resource Management Alternative would also result in insignificant change in air quality impacts as noted under the No Action Alternative. Since this alternative would incorporate 306.4 additional shoreline acres into the Environmentally Sensitive land classification, there would likely be a reduction in potential development, local vehicular exhaust emissions, and construction equipment activity, which would avoid or reduce potential impacts on localized air quality. No violations of the current NAAQS established by EPA would be expected as a result of the implementation of this alternative.

5.9.4 No Action (Alternative 4)

Under the No Action alternative, the air quality around the lake would remain similar to that currently existing. There would likely be increases in vehicular exhaust emissions due to localized development, and the associated construction equipment and traffic in the area. However, no violations of the current National Ambient Air Quality Standards (NAAQS) established by EPA would be expected as a result of the implementation of this alternative.

5.9.5 Moderate Resource Protection (Alternative 5)

Implementation of the Moderate Resource Protection Alternative may result in more air quality impacts, as compared to the No Action Alternative. This alternative would reclassify an additional 1,248.9 acres to Low Density lands. This additional Low Density acreage would result in a greater potential for more development, which could lead to increased local vehicular exhaust emissions. This effect could be potentially significant on a short term basis, due to an increase in construction activity, vehicular emissions, vegetation removal, and other air impacts from development and increased lake usage activities. Due to the excellent air quality in the

Beaver Lake area, no violations of the current NAAQS established by EPA would be expected as a result of the implementation of this alternative.

5.10 Health & Safety

5.10.1 Maximum Resource Protection (Alternative 1)

This alternative limits development to 2,306.8 acres of High Density lands, which would imply that there would be more limited access to Beaver Lake, potentially causing a decrease in water-based recreational opportunities. Although water-based activities would be impacted, there would be an increase in land-based recreation opportunities such as hiking, hunting and wildlife observation. There could also be some partnership opportunities with conservation-based organizations within the region. The decrease in rate of development could also have positive impacts on water quality by reducing runoff quantity and velocity from rainfall events, which would decrease sedimentation and shoreline contaminants to the water.

5.10.2 Balanced Resource Management (Preferred Alternative 2)

The recreational opportunities, balanced with conservation of natural environment could lead to better health, both mental and physical, of the visiting population. Implementation of the Balanced Resource Management Alternative could result in some reduction of traffic congestion on the water, and a lower potential for water related incidents. The increase in Environmentally Sensitive and Wildlife Management Areas could potentially increase exposure to insects and animals, which is generally understood by the public who utilize these lands.

5.10.3 Current Resource Management (Alternative 3)

The recreational opportunities, balanced with conservation of natural environment could lead to better health, both mental and physical, of the visiting population. Implementation of the Current Resource Management Alternative may result in reduced traffic congestion on the water due to classification of 377.9 acres of unallocated land primarily to Environmentally Sensitive lands, possibly resulting in reduced development, and a lower potential for water related incidents. The increase in Environmentally Sensitive lands could potentially increase visitors' exposure to insects and animals, which is generally understood by the public who utilize these lands.

5.10.4 No Action (Alternative 4)

Safety of project visitors and project staff are highest priority in daily project operations. The No Action Alternative would have 55% of available shoreline acreage classified for High and Low Density development, as well as an additional 377.9 acres of unallocated lands (which could be developed). This would allow for a higher potential for a reduction in lake water quality, as described in Section 5.3.2. There could potentially be an increase in boat traffic on the lake and a possible increase in congestion, creating additional safety issues. The lake could experience increased user conflict, for example, boats vs. personal watercrafts. Under the No Action Alternative, populations who recreate at the lake could be exposed to health risks associated with impaired water quality, such as *E. coli,* and potential hazardous run off due to the overall potential for increased recreation at the lake.

5.10.5 Moderate Resource Protection (Alternative 5)

The Moderate Resource Protection Alternative would have 62% of available shoreline acreage classified for High and Low Density development. An increase of 1,248.9 acres of Low Density lands could create more potential private dock development, and associated ground disturbance. This would result in a higher potential for increased erosion, and a reduction in lake water quality. There could potentially be an increase in boat traffic on the lake, and a possible increase in congestion, creating additional safety issues. The lake could experience increased user conflict, for example, boats vs. personal watercrafts. Populations who recreate at the lake could be exposed to health risks associated with impaired water quality, such as *E. coli,* and potential hazardous run off due to the overall potential for increased recreation at the lake.

5.11 Aesthetics

5.11.1 Maximum Resource Protection (Alternative 1)

Implementation of the Maximum Resource Protection Alternative would minimize all activities which could disturb the scenic beauty and aesthetics of the lake. This alternative would be the most aesthetically pleasing for those recreating along the lake, but could potentially be a hindrance to property owners and their viewshed of the lake. The user experience in areas such as Corps parks would still be relatively peaceful at most times, with the aesthetic of domesticated nature. However, some of the more developed and heavily used parks could experience annual wear and deterioration of acreage and existing facilities due to the potential increased usage of these parks.

5.11.2 Balanced Resource Management (Preferred Alternative 2)

The wide panorama of Beaver Lake and the nearby shore conveys a sense of enormity to the lake, and the conversion of 75.8 acres of Low Density lands and 605.1 acres of High Density lands to Environmentally Sensitive and Wildlife Management acreage would help to preserve the sense of relatively pristine shoreline. The natural vegetation along the shoreline would enhance the viewscapes of the people recreating on the lake, while potentially impeding the view of the lake from the shore. Under this proposed alternative, property owners could work with Corps staff to determine the appropriate vegetation management measures for their specific property location adjacent to the shoreline of the lake.

5.11.2 Current Resource Management (Alternative 3)

Implementation of this alternative would convert the 377.9 acres of unallocated lands primarily to Environmentally Sensitive and Vegetative Management lands, which would aid in preserving the sense of relatively pristine shoreline. The natural vegetation along the shoreline would enhance the viewscapes of the people recreating on the lake, while potentially impeding the view of the lake from the shore. Under this proposed alternative, approximately 44% of the lake shoreline would remain protected from potential development.

5.11.3 No-Action (Alternative 4)

Aesthetics is an important feature that enhances the recreational experience. Lands around Beaver Lake provide a natural setting that is aesthetically pleasing as well as buffering the lake from views of development and clearings. Under the No-Action Alternative the visual character of the landscape would slowly change due to potential continued development increasing the

amount of land with views of development and human structures. This would increase the amount of visual contrast between the natural and developed landscapes around the lake. Visual contrast is a measure of impact on visual quality and aesthetics. Dock development would eliminate the unspoiled and untamed aesthetic of this landscape. Road and utility line corridors also impact aesthetics and visual resources at Beaver. Since the lake is partially surrounded by pockets of residential and commercial development, these demands would continue to increase. In many instances, requests for new shoreline use permits are in areas where the natural vegetation and landscape would be disturbed.

5.11.4 Moderate Resource Protection (Alternative 5)

Implementation of the Moderate Resource Protection Alternative would have the most impact in regards to aesthetics of all evaluated alternatives. Under this alternative there would be 1,248.9 more acres of Low Density lands compared to the No Action Alternative, which would have the potential for additional boat dock construction and vegetation modification permits, and with a reduction of 984.6 acres of Environmentally Sensitive lands, some visual impacts to aesthetics would be expected.

5.12 Cumulative Impacts

Cumulative impacts are those that may result from the incremental impact of the evaluated alternatives added to those of other past, present, or reasonably foreseeable future actions in the local area. The Master Plan for Beaver Lake was last approved in 1976; this was followed by multiple supplements over the last 40 years. During that time, public use patterns have remained similar, but trends, facility and service demands have shifted in the past 40 years due to the need for alternative experiences in recreation and tourism. Visitation to the lake has remained fairly constant from 2009 to 2012, averaging approximately 2.5 million visitors per year; however, the demand for high quality recreational experiences remain. Beaver Lake receives pressure for both private shoreline and public recreation use, resulting in management concerns regarding the overall sustainability of the lake. With public use at project facilities changing, reallocations of services at these facilities need to be addressed. Changes involving recreation area closures and improvements have occurred during the last four decades to meet the evolving public use. In addition, cooperative agreements are being considered in order to operate and maintain facilities, which would reduce the financial burden on the tax payers.

Two main themes came out of the scoping process, which was a cumulative exercise involving private and public entities, and local, state and federal agencies—improved water quality and maintenance of the environmental setting around the lake. Preservation of the natural shoreline and lack of extensive development has enhanced and maintained good water quality since the lake was constructed. The upper 1,500 acres of Beaver Lake has been listed by the Arkansas Department of Environmental Quality (ADEQ) on Arkansas' 303(d) list of impaired waters, approved by the Environmental Protection Agency (EPA), due to turbidity (ADEQ, 2008). According to the Arkansas 303(d) list, these excessive levels impact the local fisheries as well as primary contact, both designated uses of Beaver Lake. The elevated turbidity levels are due to excessive silt from surface erosion from agriculture activities, unpaved road surfaces, in-stream erosion – mainly from unstable stream banks, and any other land surface disturbing activity. The Draft 2010 Integrated Water Quality and Monitoring Report (ADEQ, 2010) added pathogen indicator bacteria as

a contaminant for the same area of Beaver Lake. Surface erosion activities are listed as the probable cause.

Existing conditions at the lake allow for some degree of development on 55% of available acreage, with an additional 377.9 acres having no specific land classification, but it should be noted that reclassification of lands under the Preferred Alternative would enhance water quality by restricting Low Density recreation development, increasing the amount of Environmentally Sensitive and Wildlife Management acreage, thereby retaining more of the natural shoreline vegetation. Approximately 52% of the linear shoreline would have a natural vegetated shoreline due to these land reclassifications identified in the Preferred Alternative. There would be insignificant impacts to climate, topography, geology and soils under this alternative. The aquatic environment of the lake should benefit from a potential reduction in storm water runoff velocity, reduced sedimentation, improved water quality, and a cleaner substrate for macroinvertebrate production and fish spawning activity. This alternative would also enhance wildlife foraging and movement patterns, offer more protection for threatened and endangered species that inhabit the area, and result in minimal impacts to cultural resources. A provision for additional potential development opportunities coupled with an abundance of lands remaining in their natural condition would balance and enhance recreational experiences, which would potentially stimulate the socio-economics of the area. This balanced approach should provide a safe and aesthetically pleasing recreational experience for the public that visits and/or lives at Beaver Lake.

Continued collaboration and coordination with state and federal resource agencies, as well as local agencies and watershed groups, is necessary to monitor, evaluate and remediate aging infrastructure, failing septic systems around the shoreline, and potential water quality impacts. Coordination with these entities could also evaluate and promote watershed enhancement programs that would serve to institute stream bank stabilization, land improvement and conservation programs, and implementation of best management practices to reduce watershed runoff and erosion.

As management of Beaver Lake ensues, the Corps would continue to coordinate with Federal, State, and local agencies to avoid, minimize or mitigate potential impacts.

6.0 ENVIRONMENTAL COMPLIANCE

Compliance with Federal Acts and Executive Orders are summarized in the following table.

Act/Executive Order	Status	Compliance
Wetlands (EO 11990)	No effect	C
Prime/Unique Farmlands	N/A	N/A
Floodplain Management (EO 11988)	N/A	N/A
Clean Water Act		
Section 404	No effect	N/A
Section 401	No effect	N/A
NPDES	No effect	N/A
Fish and Wildlife Coordination Act	No effect	C
Endangered Species Act	No effect	C
National Historic Preservation Act	No effect	C
Environmental Justice (EO 12898)	No effect	C
Clean Air Act	No effect	C
Comprehensive Environmental Response Compensation and Liability Act (CERCLA)	N/A	N/A
Resource Conservation and Recovery Act (RCRA)	N/A	N/A
Wild and Scenic Rivers Act	N/A	N/A
Rivers and Harbors Act	N/A	N/A
N/A—not applicable C--Compliant		

Table 6: Federal Act/Executive Order Compliance

6.1 Fish and Wildlife Coordination Act

The Corps is required to coordinate with the USFWS and AGFC under the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 USC 661 et. seq.). Coordination was initiated with a scoping notice; no concerns were raised by these agencies. Review of the Environmental Assessment was completed during the draft release; no concerns were identified.

6.2 Endangered Species Act

The Endangered Species Act (ESA) requires the determination of possible effects on species or degradation of habitat critical to Federally-listed endangered or threatened species. Implementation of an updated Master Plan is not likely to affect threatened or endangered species. Individual requests for use of project lands would be evaluated to ensure compliance with this Act.

6.3 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations* requires Federal agencies to promote "nondiscrimination in Federal programs substantially affecting human health and environment". In response to this directive, Federal Agencies must identify and address a disproportionately high and adverse human health and environmental effects of their programs, policies, and activities on minority and low-income populations. The final step in the environmental justice evaluation process is to

evaluate the impact of the project on the population and to ascertain whether target populations are affected more adversely than other residents.

Implementing the Master Plan Revision would not disproportionately affect minority or low-income populations.

6.4 Cultural Resource Requirement

Section 106 of the National Historic Preservation Act of 1966 requires the Corps to identify historic properties affected by the Selected Alternative and to evaluate the eligibility of those properties for the National Register of Historic Places. Section 110 of the Act requires the Corps to assume responsibility for the preservation of historic properties in its ownership. The Act also requires Federal agencies to provide the Advisory Council on Historic Preservation an opportunity to comment on undertakings through the process outlined in the Council's regulations (36 CFR 800).

There would be no effect on cultural resources with implementation of an updated Master Plan. Individual requests for use of project lands would be evaluated on a case-by-case basis to ensure compliance with this act.

7.0 Scoping and Public Concern

7.1 Introduction

No single agency has complete oversight of stewardship activities on the public lands and waters surrounding Beaver Lake. Responsibility for natural resource and recreation management falls to several agencies that own or have jurisdiction over these public lands and waters.

Increasingly, competition for the use of these lands and waters and their natural resources can create conflicts and concerns among stakeholders. The need to coordinate a cooperative approach to protect and sustain these resources is compelling. Many opportunities exist to increase the effectiveness of Federal programs through collaboration among agencies and to facilitate the process of partnering between government and non-government agencies. To sustain healthy and productive public lands and water with the most efficient approach requires individuals and organizations to recognize their unique ability to contribute to commonly held goals. The key to progress is building on the strengths of each sector, achieving goals collectively that could not be reasonably achieved individually. Given the inter- jurisdictional nature of Beaver Lake, partnering opportunities exist and can promote the leveraging of limited financial and human resources. Partnering and identification of innovative approaches to deliver justified levels of service defuse polarization among interest groups, and lead to a common understanding and appreciation of individual roles, priorities, and responsibilities.

To the extent practical, this Master Plan and a proactive approach to partnering would position Beaver Lake to aggressively leverage project financial capability and human resources in order to identify and satisfy customer expectations, protect and sustain natural and cultural resources and recreational infrastructure, and programmatically bring Corps management efforts and outputs up to a justified level of service. Public involvement and extensive coordination within the Corps of Engineers and with other affected agencies and organizations is a critical feature required in developing or revising a Project Master Plan.

Agency and public involvement and coordination have been a key element in every phase of the Beaver Lake Master Plan/Shoreline Management Plan revision.

7.2 Scoping

As part of the initial phase of the environmental process, an agency scoping meeting was held on March 9, 2015. Three public scoping open houses were hosted on March 10-12, 2015 to gather public comments on the MP revision process and issues that should be examined as part of the environmental analysis. The open houses also provided the public an opportunity to ask questions and get more information about the current MP and the revision process. The process of determining the scope, focus, and content of a NEPA document is known as “scoping.” Scoping is a useful tool to obtain information from the public and governmental agencies. In particular, the scoping process was used as an opportunity to get input from the public and agencies about the vision for the MP update and the issues that the MP should address. Open house attendees were provided a comment card that asked for responses to specific questions in

addition to providing general comments about the plan and the environmental review. The specific questions included:

- How would you like to see Beaver Lake in 20 years?
- What about Beaver Lake is most important to you?
- What about Beaver Lake is least important to you?
- What changes, if any, would you like to see at the lake?

USACE published notice of the scoping meetings through an email blast, a direct mail postcard, press releases, display ads in several regional and local papers, and announcements on the Beaver Lake Master Plan webpage, the Beaver Lake Facebook page, and the Little Rock District Facebook page. The postcard notice and email blast were sent to landowners adjacent to USACE-owned lands around the lake, dock permit holders, marina and resort owners, dock builders, National Recreation Reservation Service (NRRS) customers, and local area fishing permit licensees. Postcards were sent to those for whom only a postal address was available; all others received the email notice. Agency coordination letters were sent to potentially interested resource agencies with regulatory authority inviting requesting their participation in the process. The 30-day comment period was held from March 2 to April 3, 2015. Agencies, community groups, members of the public, and other interested parties submitted 403 letters, e-mails, comment cards, and faxes or made oral comments at an open house during this period.

A final scoping report documenting and analyzing all comments submitted to the Corps was completed by CDM Smith in September 2015.

As noted earlier, the PDT recommended and received approval to initiate the shoreline management plan update process concurrently with the master plan revision process at Beaver Lake in September 2015. In doing so, the team recognized a 'rescoping' for both plans would be required.

To continue the process and 'rescope', an agency scoping workshop was held on March 17, 2016.Three public scoping workshops were hosted on March 15-17, 2016 to gather public comments on the combined MP and SMP revision process and issues that should be examined as part of the environmental analysis. The workshops also provided the public an opportunity to ask questions and get more information about the current MP and SMP and the revision process.

Comments submitted to USACE during both sets of scoping workshops were considered together in developing alternatives and guiding the environmental analysis of proposed revisions to both plans.

The rescoping process was used as an opportunity to get input from the public and agencies about the vision for the MP and SMP updates and the issues that the MP and SMP should address. Workshop attendees were provided a comment card that asked for responses to specific questions in addition to soliciting general comments about the plans and the environmental review. The comment card advised people that all comments previously submitted would continue to be considered. The specific questions included:

- Please provide your comments and suggestions on items to update in the Beaver Lake SMP.
- How would you like to see Beaver Lake in 20 years?
- What changes, if any, would you like to see at the lake?
- What about Beaver Lake is most and least important to you?

USACE published notice of the scoping workshops through an email blast, a direct mail postcard, press releases, display ads in several regional and local newspapers, and announcements on the Beaver Lake MP/SMP webpage and the Little Rock District Facebook page. The postcard notice and email blast were sent to landowners adjacent to USACE-owned lands around the lake, dock permit holders, marina and resort owners, dock builders, National Recreation Reservation Service (NRRS) customers, prior commenters from the 2015 Master Plan comment period ,and local area fishing permit licensees. Postcards were sent to those for whom only a postal address was available; all others received the email notice. Agency coordination letters were sent to resource agencies with regulatory authority requesting their participation in the process.

USACE accepted comments on both the Beaver Lake MP Revision and Beaver Lake SMP Update throughout the entire scoping comment period from March 7 through April 8, 2016. Agencies, community groups, members of the public, and other interested parties submitted 268 letters, emails, comment cards, and faxes or made oral comments at a workshop during this period.

A final rescoping report documenting and analyzing all comments submitted to the Corps was completed by CDM Smith in May 2016.

7.3 Draft Master Plan and Draft Shoreline Management Plan/Draft Environmental Assessments

The draft release of the Beaver Lake Master Plan and associated documents is scheduled for March 2018.

7.4 Final Master Plan/Final EA.

The Final Master Plan will be completed in xxxx 2018, with public workshops scheduled in xxxx 2018.

Public workshop format will be similar to the Scoping and Draft Release workshops; however, no comments will be accepted as the plan is final.

8.0 Conclusions

The Master Plan for Beaver Lake was last approved in 1976; this was followed by multiple supplements over the last 40 years. During that time, public use patterns have remained similar, but trends, facility and service demands have shifted in the past 40 years due to the need for alternative experiences in recreation and tourism. Visitation to the lake has remained fairly constant from 2009 to 2012; however, the demand for high quality recreational experiences remain. Beaver Lake receives pressure for both private shoreline and public recreation use, resulting in management concerns regarding the overall sustainability of the lake. With public use at project facilities changing, reallocations of services at these facilities need to be addressed. Changes involving recreation area closures and improvements have occurred during the last four decades to meet the evolving public use. In addition, cooperative agreements are being considered in order to operate and maintain facilities, which would reduce the financial burden on the tax payers

The Master Plan is not intended to address the specifics of regional water quality, shoreline management, or water level management; these areas are covered in a project's shoreline management plan or water management plan. However, specific issues identified through the Master Plan revision process can still be communicated and coordinated with the appropriate internal Corps resource (i.e. Operations for shoreline management) or external resource agency (i.e. Arkansas Dept. of Environmental Quality for water quality) responsible for that specific area. To facilitate this action, the current Master Plan development evaluated four alternatives relative to their potential impacts on the land and water resources of Beaver Lake.

These alternatives spanned the gamut of increased shoreline protection to increased shoreline development and the potential effects on the human, terrestrial, and aquatic environment from their implementation. A no action alternative looked at leaving the lake as it currently exists in terms of developable areas and protected areas. Of the 9,812.6 acres of available land around the lake, 55% of this is classified as High and Low density recreation (30% high), with potential future development occurring. While 34% of available acreage is classified as Environmentally Sensitive lands, 377.9 acres of land currently has no classification. Under each of the action alternatives, the lands with no classification are allocated to one of the land classifications.

The action alternatives included a Maximum Resource Protection Alternative, Balanced Resource Management Alternative, a Current Resource Management Alternative, and a Moderate Resource Protection Alternative. The Maximum Resource Protection Alternative (Alternative 1) shifted the majority of the available shoreline acreage toward future preservation, with 24% classified as High Density recreation, 63% classified as Environmentally Sensitive, and 12% classified as Wildlife Management lands. Potential effects from this would be decreased vegetation removal and a reduction in soil erosion due to the reclassification of lands previously included as high and low density lands, having the potential for construction and conversion of pervious surfaces to impervious. This construction activity is generally detrimental to water quality and terrestrial and aquatic wildlife species. Development has the potential to increase the number of boats on the lake,

increased health and safety issues, aesthetic impacts, and impaired recreational experiences for many visitors. The Balanced Resource Management Alternative also include the 24% High Density lands, while keeping the 25% of Low Density lands. Environmentally Sensitive and Wildlife Management classifications are 38% and 12%, respectively. Vegetative Management classification would include 56.1 acres, or 1% of shoreline acreage. This action would preserve shoreline vegetation, reduce stormwater runoff quantity and velocity, resulting in less in-lake sedimentation and turbidity, and improve water quality. This action also has the potential to improve health and safety issues, aesthetics, terrestrial and aquatic wildlife habitat. This alternative seeks to balance all components of lake usage, including the provision for growth and recreation potential, while protecting and preserving terrestrial and aquatic resources.

9.0 Bibliography

Arkansas Department of Parks and Tourism. 2009. Statewide Comprehensive Outdoor Recreation Plan. January 2009 through December 2013.
Executive Order No. 13112. Invasive Species. 3 February 1999.

Executive Order No. 11987. Exotic Organisms. 24 May 1977.

Executive Order No. 13148. Greening the Government Through Leadership in Environmental Management. 21 April 200.

Executive Order No. 13423. Strengthening Federal Environmental, Energy, and Transportation Management. 24 January 2007.

Executive Order No. 13514. Federal Leadership in Environmental, Energy, and Economic Performance. 5 October 2009.

Howard, Lynn, E.1963. Archeological Survey in Beaver Region of Arkansas. Report on file at the U.S. Army Corps of Engineers, Little Rock District.

Kasul, Richard, Daniel Stynes, Lichu Lee, Wen-Huei Chang, R. Scott Jackson, Christine Wibowo, Sam Franco, and Kathleen Perales. Characterization of Park Visitors, Visitation Levels, and Associated Economic Impacts of Recreation at Bull Shoals, Norfork, and Table Rock Lakes. November 2010.

Lee, Aubra Lane. 1986. Cultural Resources Investigations at Beaver Lake, Arkansas. Report on file at the U.S. Army Corps of Engineers, Little Rock District.

Spears, Carol, Nancy Myer, and Hester Davis. 1975. Watershed Summary of Archeological and Historic Resources in the White River Basins, Arkansas and Missouri. Report on file at the U.S. Army Corps of Engineers, Little Rock District.

U.S. Army Corps of Engineers (USACE). 1975. Beaver Dam and Reservoir, White River,

Missouri and Arkansas, Updated Master Plan for Reservoir Development and Management, Design Memorandum 17-E.

USACE. 2013. Engineer Regulation 1130-2-550, Project Operations, Recreation Operations and Maintenance, Guidance and Procedures. HQUSACE.

USACE. 2013. Engineer Pamphlet 1130-2-550, Project Operations, Recreation Operations and Maintenance, Guidance and Procedures. HQUSACE.

USACE. 2008. Engineer Regulation 1130-2-540, Environmental Stewardship Operations and Maintenance Guidance and Procedures. HQUSACE.

USACE. 2008. Engineer Pamphlet 1130-2-540, Environmental Stewardship Operations and Maintenance Guidance and Procedures. HQUSACE.

USACE. 2013. USACE Dam Safety Program. Accessed at: www.usace.army.mil/Missions/CivilWorks/DamSafetyProgram/ProgramActivities.aspx

USACE. 1993. White River Basin, Arkansas and Missouri, Water Control Master Manual.

USACE. 2013. Little Rock District Water Management website. Accessed at: www.swl-wc.usace.army.mil

United States Census Bureau. 2013. Easy Facts Website. Accessed at: http://www.census.gov/easystats/

10.0 List of Preparers

EA Preparation
Robert Singleton, Biologist, CESWL-PE
Craig Hilburn, Biologist, CESWL-PE

Master Plan and EA Review
Bennie Rorie, OPM, Greers Ferry Lake, CESWL-OP-GF
Rebecca Shortt, Real Estate, Table Rock Lake, CESWL-RE-M
Rodney Raley, Chief Ranger, Table Rock Lake, CESWL-OP-TR
Tiffany Smith, Chief Ranger, Dierks Lake, CESWL-OP-MW-I
William Penn, SWL GIS Program Manager
Jerry Fuentes, Sacramento District, CESPK-PD
Nancy Sandburg, Sacramento District, CESPK-PD-RA
Dawn Sullo, Sacramento District, CESPK-PD

Master Plan Preparation
Dana Coburn/Project Manager, CESWL-PE
Sean Harper, OPM, Beaver Lake
Michael Richard, Deputy OPM, Beaver Lake
Jared Trammel, Chief Ranger, Beaver Lake
Michael Hurley, Chief Ranger, Beaver Lake
Karen Niesler, Real Estate Specialist, Beaver Lake (retired)
Cheryl Wanko, Real Estate Specialist, Beaver Lake
Tony Porter, Deputy OPM, Millwood/Tri-Lakes, CESWL-OP-MW
Jason Gramlich, Natural Resource Specialist, CESWL-OP-O
DeAnn Lehigh, Attorney, CESWL-OC
Tricia Tannehill, GIS Specialist, CESWL-OP-O
Miles Brown, Chief, Public Affairs Office
Laurie Driver, Public Affairs Office
Jay Woods, Public Affairs Office
Russ Wallace, Economics, CESWL-PE

Appendix A: Public Comments

(See Scoping Report)

Appendix B Local, State & Federal Agency Coordination Letters

(See Scoping Report)

Appendix C Alternative Maps