US Army Corps of Engineers®
Little Rock District

Bull Shoals Lake, Arkansas

WATER SUPPLY STORAGE REALLOCATION REPORT

Reallocation of Storage at Bull Shoals Lake, Arkansas, for Ozark Mountain Regional Public Water Authority and Marion County Regional Water District

July 2010
Final Feasibility Report and Environmental Assessment

EXECUTIVE SUMMARY

Reallocation of Storage at Bull Shoals Lake, Arkansas, for Ozark Mountain Regional Public Water Authority and Marion County Regional Water District

This report presents the results of a study to reallocate storage in Bull Shoals Lake to the Ozark Mountain Regional Public Water Authority and to the Marion County Regional Water District for Municipal and Industrial water supply. This reallocation is in response to two separate requests for Municipal and Industrial water supply: the Ozark Mountain Regional Public Water Authority request for a reallocation sufficient to yield 6 million gallon per day and the Marion County Regional Water District request for a reallocation sufficient to yield an additional 1 million gallons per day. Marion County Regional Water District has an existing water supply storage agreement with the U.S. Army Corps of Engineers to purchase 880 acre-feet of storage from the conservation (hydroelectric power) pool at Bull Shoals Lake. The study concludes that reallocating 11,886.541 acre-feet at Bull Shoals Lake from the conservation pool is the most efficient means to meet the requests of Ozark Mountain Regional Public Water Authority and Marion County Regional Water District.

Ozark Mountain Regional Public Water Authority serves 22,000 people through shallow wells, deep wells, or springs. The majority of the member water systems struggle to meet customer demands from their existing sources. In addition, the Arkansas Department of Health has stated the well water has excessive and dangerous levels of radium, fluoride, and hydrogen sulfide, and they have declared the need for an alternative water supply for these communities as their top priority. The Environmental Protection Agency has certified that many of these water sources are not safe for human consumption.

In October 2009, it was announced Ozark Mountain Regional Public Water Authority will receive $56 million in grant and loan funding from the United Status Department of Agriculture through the American Recovery and Reinvestment Act of 2009. These funds will be used for constructing an intake structure and treatment plant adjacent to Bull Shoals Lake, 115 miles of transmission lines, and booster pumping stations to transport the water across the rugged terrain in the Ozark Mountains. However, these funds must be obligated by September 2010; and Ozark Mountain Regional Public Water Authority must first have a water supply storage agreement executed with U.S. Army Corps of Engineers by August 2010. This water supply reallocation report is an element of the larger overall Ozark Mountain water system project.

Marion County Regional Water District is the only water provider currently utilizing Bull Shoals Lake as a municipal water source. Currently, they have a water supply allocation of 880 acre-feet intended to provide a 1 million gallon per day yield. Their demands have steadily increased since 1990. On October 6, 2009, Marion County Regional Water District requested the Little Rock District reallocate storage sufficient to supply an additional 1 million gallon per day. Due to their need for additional water, this request was included in this study to make a total request for storage to yield 7 million gallon per day.

The requested reallocation of storage to yield 7 million gallons per day, consists of 10,188.463 acre-feet for Ozark Mountain Regional Public Water Authority and 1,698.077 acre-feet for Marion County Regional Water District for a total of 11,886.541 acre-feet. This total of 11,886.541 acre-feet represents less than 1 percent of the total conservation storage of 1,236,000 acre-feet in Bull Shoals Lake.

As a test of financial feasibility, the annual cost of the reallocated storage at Bull Shoals Lake, was compared to the annual cost of the next most likely, least costly alternative that would provide an equivalent quality and quantity of water which Ozark Mountain Regional Public Water Authority and Marion County Regional Water District would undertake in the absence of utilizing a reallocation at Bull Shoals Lake. The next most likely, least costly alternative was determined to be a reallocation from Norfork Lake. The results of the comparison indicate reallocating from Bull Shoals Lake has the least total annual cost for Ozark Mountain Regional Public Water Authority, $4,396,500 compared to the $5,758,300 total annual cost of reallocating from Norfork Lake. Reallocating from Bull Shoals Lake has the least annual cost for Marion County Regional Water District, $283,700, when compared with the annual cost of reallocating from Norfork Lake of $1,745,400.

Located in north-central Arkansas, Bull Shoals Lake is a U.S. Army Corps of Engineers project authorized for the purposes of flood control and hydroelectric power and authorized uses of recreation, fish/wildlife, and water supply. With a 2012 planned implementation of the White River Minimum Flows Project, the existing storage capacity in Bull Shoals Lake will be 2.127 million acre-feet of flood control storage, 1.236 million acre-feet of conservation storage, and 2.045 million acre-feet of inactive storage, for a total storage of 5.408 million acre-feet. The reallocation of 11,886.541 acre-feet of storage from the conservation pool for Municipal and Industrial water supply to Ozark Mountain Regional Public Water Authority and Marion County Regional Water District would begin in 2012 prior to the White River Minimum Flows Project.

Hydrologic studies, as required by EC 1110-2-210, Water Supply Storage and Risk Reduction Measures for Dam Safety, dated 16 July 2009, indicate that pool changes resulting from this proposed water storage reallocation would have no effect on pool elevation at extreme floods such as the Probable Maximum Flood and the Infrequent Flood Event (300 year return period). There are no dam safety issues created by or made worse by the proposed reallocation. A letter from the Dam Safety Officer is included in Appendix E of this report. Drilling and testing of the foundation rock was completed in January and February of 2010. The results of the testing program and stability analysis have significantly raised the confidence level in the safety of Bull Shoals Dam and done nothing but reaffirm its status as a DSAC 4 dam.

An Environmental Assessment as directed by the National Environmental Policy Act is included as Appendix C. The Environmental Assessment for the recommendation to reallocate 11,886.541 acre-feet from the conservation pool was prepared in accordance with NEPA requirements. A Finding of No Significant Impact was drafted and is included in Appendix C. Due to negative impacts to hydroelectric power production, a credit to the accounting records for Southwestern Power Administration would be made in accordance with ER-1105-2-100, Appendix E-57d(3).

The conclusion for this water supply storage reallocation study is to reallocate 11,886.541 acre-feet, consisting of 10,188.463 acre-feet for Ozark Mountain Regional Public Water Authority and 1,698.077 acre-feet for Marion County Regional Water District at Bull Shoals Lake from the conservation pool.

In consideration of the right to utilize the storage space at Bull Shoals for Municipal and Industrial water supply, the two water authorities will pay the Government for their proportional share of the cost of the storage. The reduced pricing for low income communities authorized by Section 322 of the Water Resources Development Act of 1990 has been applied where the eligibility requirements are met. Of the total 10,188.463 acre-feet of storage providing a total of 6 million gallons per day for Ozark Mountain Regional Public Water Authority (OMRPWA), the cost is $1,669,990 for the 10,096.675 acre feet storage to provide approximately 5.946.000 gallons per day to the portions of the system eligible for the low income pricing. The cost to OMRPWA for the remaining storage of 91.788 acre feet, providing approximately 54,000 gallons per day, is under consideration by the Department of the Army, and will add an additional cost of not more than $18,472 to the amount to be paid by OMRPWA. Marion County Regional Water District is eligible for low income pricing, at which the 1,698.077 acre feet of storage to provide 1 million gallons per day will cost $280,861. Ozark Mountain Regional Public Water Authority and Marion County Regional Water District will also be responsible for their proportional shares of the annual Operations and Maintenance costs calculated to be 0.2293% and 0.0382%, respectively. Hydroelectric power losses, flood losses, and recreation losses were evaluated for the conservation, flood control and inactive pools.

Reallocation of conservation pool storage from Bull Shoals Lake for water supply is to a higher and better use for the following reasons.

- Unsafe existing water supplies for many members of OMRPWA because of naturally occurring radium and other constituents
- Inadequate water supplies during summer months
- Lack of feasible local alternatives for water supply
- Limited population and economic growth in the area due to water supply limitations
- Relatively small impact on hydroelectric power production and the power marketing authority will receive accounting record credits for the small impacts

To provide the requested 6 million gallons per day for Ozark Mountain Regional Public Water Authority (OMRPWA) and 1 million gallons per day for Marion County Regional Water District (MCRWD), new water supply storage agreements between the water authorities and the U.S. Army Corps of Engineers will be required - two with OMRPWA and one with MCRWD. Agreements have been prepared and accompany this storage reallocation report under separate cover.

ABBREVIATIONS AND ACRONYMS

ac-ft (AF)	Acre-feet
ADH	Arkansas Department of Health
ARRA	American Recovery and Reinvestment Act
Corps	U.S. Army Corps of Engineers
CPI	Consumer Price Index
DSAC	Dam Safety Action Classification
DYMS	Dependable Yield Mitigation Storage
EA	Environmental Assessment
EL	Elevation
ENR	Engineering News Report
EOP	Environmental Operating Principles
ER	Engineering Regulation
ESI	Engineering Services Inc.
EWDAA	Energy and Water Development Appropriations Act
FCA	Flood Control Act
FONSI	Finding of No Significant Impact
FT	Feet
FY	Fiscal Year
GPD	Gallons Per Day
M&I	Municipal and Industrial
MCRWD	Marion County Regional Water District
MGD	Million Gallons Per Day
MSL	Mean Sea Level
NED	National Economic Development
NEPA	National Environmental Policy Act
OMRPWA	Ozark Mountain Regional Public Water Authority
OMRR&R	Operations Maintenance Repair, Rehabilitate, and Replace
PFMA	Potential Failure Mode Analysis
PL	Public Law
SUPER	USACE Southwestern Division's Reservoir System Model
SWD	U.S. Army Corps of Engineers, Southwestern Division
SWL	U.S. Army Corps of Engineers, Little Rock District
SWPA	Southwestern Power Administration
USACE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	U.S. Geological Survey
WRDA	Water Resources Development Act
WRMF	White River Minimum Flows

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Purpose of Report

1.0 PURPOSE OF REPORT

1.1 Request for Municipal and Industrial Supply

Ozark Mountain Regional Public Water Authority (OMRPWA) – OMRPWA is a coalition of 20 water systems that was formed in 2004 to pursue a future water supply for the north central Arkansas region. OMRPWA serves a population of about 22,000 in Newton, Searcy, and parts of Boone, Marion, Johnson, and Pope Counties, see Figure 1.1. Current raw water sources include shallow wells, deep wells, springs, or ground water purchased from neighboring water systems.

The following is a list of OMRPWA members:

NEWTON COUNTY
City of Jasper
Mt. Sherman Water Association
Nail-Swain Water Association
East Newton County Water Association
Mockingbird Hill Water Association
Deer Community Water Association
Lurton-Pelsor Water Association
Town of Western Grove
Parthenon Water Association

SEARCY COUNTY
SP&G Water Association
(St. Joe, Pindall & Gilbert)
City of Marshall
South Mountain Water Association
SDM Water Association
(Snowball, Dongola & Marsena)
Town of Leslie
Morning Star Water Association

BOONE COUNTY
Town of Valley Springs
Town of Diamond City
Town of Lead Hill
Lake Bull Shoals Estates

MEMBERS AT LARGE
National Park Service
(Buffalo National River)

Several member water systems have elevated levels of radium and fluoride that exceed the national primary drinking water standards. EPA has certified that many of the sources used by members of OMRPWA are unsafe for human consumption and the Arkansas Department of Health (ADH) has issued Administrative Orders to some members for continuing to supply unsafe water (ESI 2009a). As a result, ADH has identified the need for an alternative supply for these communities as their highest priority (ADH, 2009).

For more than 30 years the region has struggled to find clean and reliable sources of water. A regional water supplier has worked without success to develop a water supply from the Buffalo River watershed. The plan was under environmental review for about ten years where it received permitting challenges and a legal challenge by the National Park Service because of the designation of the Buffalo River as the nation’s first national river. Ultimately, progress on the project was stopped because of the environmental hurdles.

Bull Shoals and Norfork Lakes remain as the only local clean, reliable, and readily available sources of water for OMRPWA.

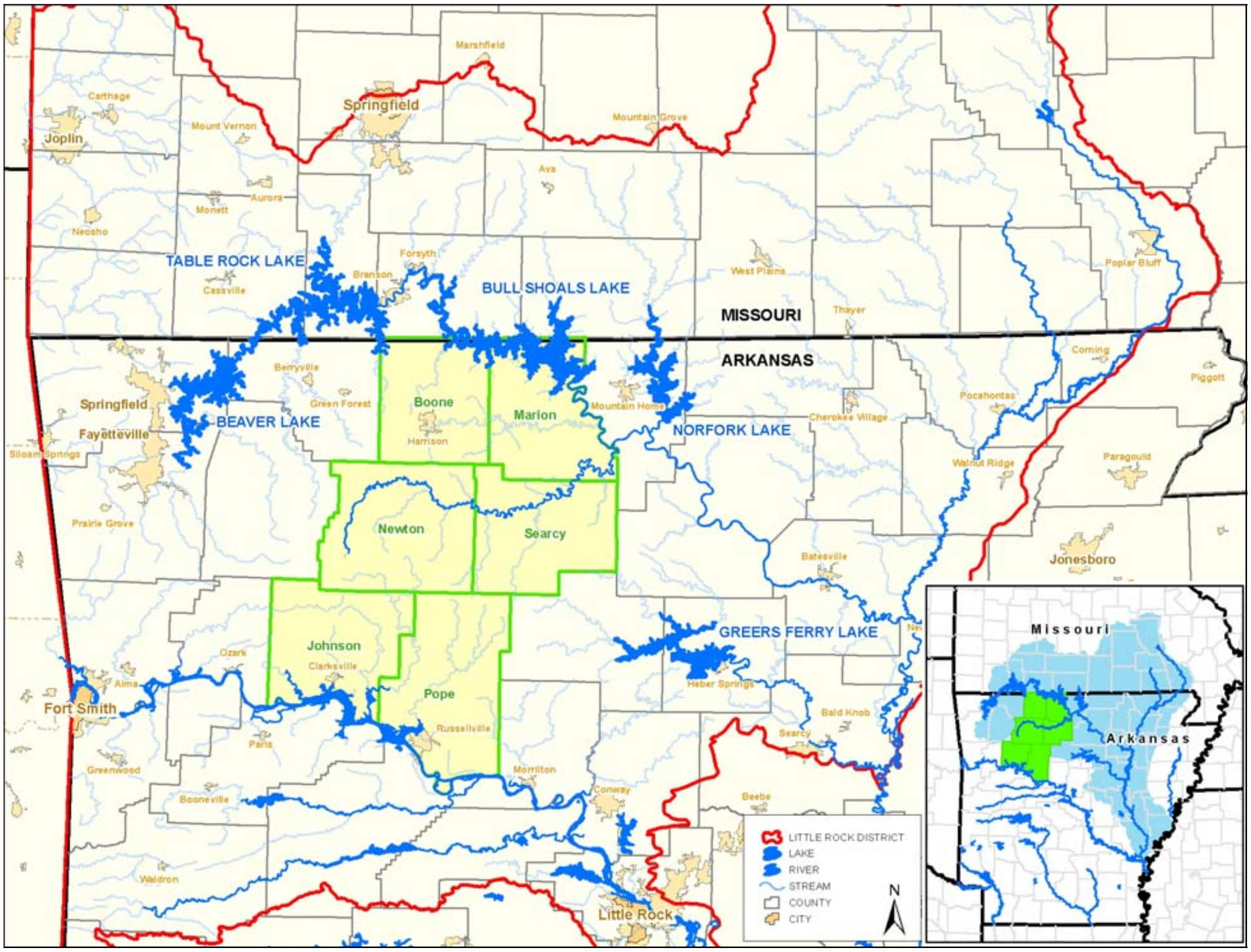

Figure 1.1 Counties Needing a Long-Term Water Source

OMRPWA commissioned a preliminary engineering report (available at the Little Rock District Corps of Engineers offices) to evaluate the demand for water and water supply alternatives (ESI 2009a, 2009b). Twelve alternatives were evaluated that included purchasing water from neighboring water systems, new supplies from U.S. Army Corps of Engineers' (USACE) reservoirs, and construction of new facilities to treat and convey the supplies to member systems. This report concluded that a 6 MGD supply from Bull Shoals Lake is the most cost-effective alternative and sufficient to meet the future demands of the member water systems. Therefore, OMRPWA requested, in a letter dated October 8, 2009, that the Corps reallocate storage sufficient to supply 6 million gallons per day (MGD) from Bull Shoals Lake.

<u>Marion County Regional Water District (MCRWD)</u> - MCRWD is currently the only water provider utilizing Bull Shoals Lake as a municipal water source. MCRWD has a water supply allocation of 880 acre-feet (ac-ft) from Bull Shoals Lake intended to provide a 1 MGD yield (ESI 1982). Their demands have steadily increased since 1990 (ESI 2009a). In 2007 and 2008, MCRWD sold an average 0.89 MGD and 0.84 MGD respectively. Peak summer usage is 1.2 MGD and their treatment plant capacity is 2.0

MGD (ESI 2009b). In a letter dated, October 6, 2009, MCRWD requested that Little Rock District reallocate storage sufficient to supply an additional 1 MGD (for a total yield of 2 MGD) to allow for additional growth.

The following is a list of MCRWD members:

<u>MARION COUNTY</u>
City of Bull Shoals
City of Flippin
City of Summit
City of Yellville

MCRWD also serves rural Marion County and the cities of Bruno and Pyatt plan to connect to the system. Because of MCRWD's need for additional water, the additional 1 MGD request for MCRWD was included in this Reallocation Report to make a total request for storage to yield 7 MGD.

<u>Overall Water System Project verses Corps Action</u> - In the fall of 2009, the United States Department of Agriculture (USDA) secured $56 million in America Reinvestment and Recovery Act (ARRA) funds to construct a water intake structure and treatment system adjacent to Bull Shoals Lake. The ARRA funds must be obligated by September 2010; therefore, OMRPWA must first have a signed water storage agreement executed with the Corps for storage of the water by August 2010. OMRPWA's letter dated February 1, 2007, originally requested 12 MGD; however, since the report showed that 6 MGD would be sufficient, OMRPWA resubmitted a letter on October 8, 2009, requesting the Corps reallocate storage sufficient to supply 6 MGD.

This study evaluates whether reallocation of storage at Bull Shoals lake to provide 7 MGD yield is in the Federal interest. If there is a Federal interest, the study will also determine the pool to be reallocated.

The Corps reallocation action is to determine from which pool of Bull Shoals Lake to reallocate storage to provide a total yield of 7 MGD. This reallocation request is a precursor to the larger overall Ozark Mountain water system project. In addition to the water supply agreement with the Corps, OMRPWA is constructing a water treatment plant, intake structure, and distribution lines funded with USDA's Rural Development funds. With the addition of one filter and one pump, the capacity of this water treatment facility is 6 MGD and it has a storage tank of 1,000,000 gallons. The water treatment facility will be located adjacent to the south side of Bull Shoals Lake near Diamond City, Arkansas.

1.2 Authority for Reallocation to Municipal and Industrial (M&I) Water Supply

1.2.1 Water Supply Act of 1958, as Amended

General authority for the Corps to reallocate existing storage space at Corps reservoirs to M&I water supply is contained in the Water Supply Act of 1958 (Title III of Public Law 85-500), as amended, 33 U.S.C. 390b. Reallocation of storage that would seriously affect other project purposes, or that involve major structural or operational changes to the project, require Congressional authorization. Reallocations not seriously affecting other project purposes, and that do not involve major structural or operational changes, may be approved by the Secretary or the Army. The Chief of Engineers has delegated authority to approve reallocations consisting of the lesser of: a) 15 percent of total storage capacity allocated to all authorized project purposes; or b) 50,000 ac-ft. Nevertheless, even such a reallocation may require Secretarial approval due to other aspects of the proposal, including reduced pricing for non-Federal cost of storage payments for low income communities under Section 322 of the Water Resources Development Act of 1990. The non-Federal interest requesting a reallocation must agree to pay 100 percent of the first costs (investment costs) of the reallocation. Such payment may be amortized over a period of up to thirty years, with interest as specified in the Water Supply Act, as amended.

1.2.2 Public Law 88-140, Recognizing Permanent Rights to Storage

The non-Federal interest may acquire a permanent right to the use of storage under the authority of Public Law 88-140 (October 16, 1963), 43 U.S.C. 390c.-f. Such right is obtained by the non-Federal interest upon completion of payment of the first costs (investment costs) of the reallocation, and may be utilized as long as the project is operated by the Government. The non-Federal interest remains responsible for its proportionate share of annual operation and maintenance costs, and of reconstruction, rehabilitation, and replacement costs for project features, allocated to its water supply storage. Such storage also remains subject to equitable reallocation among project purposes due to sedimentation.

1.2.3 Section 322 of the Water Resources Development Act (WRDA) of 1990

Provision of reduced pricing of storage space for low income communities is contained in Section 322 of WRDA 1990 (33 U.S.C. 2324). Section 322 defines the term “low income community” as a community with a population of less 20,000 which is located in a county with per capita income less than the per capita income of two-thirds of the counties in the United States. If a low income community requests water supply storage space in a Corps project, and such space is available or may be made available through reallocation, the Secretary may provide such space to the community up to an amount sufficient to yield 2,000,000 gallons per day at the following price.

The price shall be the greater of:

1) the updated construction cost of the project allocated to provide such amount of water supply storage space or $100 per acre-foot of storage space, whichever is less, or
2) the value of the benefits which are lost as a result of providing such water supply storage space.

Section 2
Project Background

2.0 PROJECT BACKGROUND

2.1 Project Authorization, Construction, and Operation History

White River System

The White River Lake System is made up of five multipurpose storage reservoirs (Beaver, Table Rock, Bull Shoals, Norfork, and Greers Ferry Lakes) and also a small flood control reservoir (Clearwater) on the Black River. System operation includes six control points on the White River, four control points on the Black River and one control point on the Little Red River. The White River Basin has changed dramatically over the last 50 years and to accommodate the many changes, the regulating plan for the system has been updated many times as well. Also due to these changes, the data recorded at gage locations is not uniform. In order to represent a uniform condition in the basin for the purposes of frequency and duration analyses, the White River System model was developed using the USACE Southwestern Division Reservoir Regulation Simulation Computer Model (SUPER) to simulate the operations of the many reservoirs in the basin and produce a modified period of record for each control point.

In accordance with EC 1105-2-407, Planning Models Improvement Program: Model Certification, it was necessary to consider whether the SUPER model required certification as a planning model for the purpose of its use in the reallocation study. The SWD Water Management and Reallocation Studies PCX lead reviewed the document Protocols for Certification of Planning Models, dated July 2007, and determined that the SUPER model meets the definition of an engineering model. “Models that represent engineering systems such as models used to perform hydrologic and hydraulic analyses are engineering models and not Planning Models”. Therefore, model certification for the SUPER model was not required.

In the guidance presented in the Engineering and Construction Bulletin No. 2007-6, “Model Certification Issues for Engineering Software in Planning Studies”, dated 10 April 2007, it required the Engineering Community of Practice to ensure that the application and proper use of the software is documented in the Independent Technical Review process. In March of 2010, Mr. Ron Bell, P.E. SWD, Chief, Water Management and Infrastructure Branch, stated “The Southwestern Division Reservoir Regulation Computer Model (commonly referred to as “SUPER”) is an excellent reservoir system simulation model which has been used in SWD for many years. It has proven to provide very accurate results when compared to actual system operations. It is a well tested model and should be considered acceptable for use. The PCX reviewed and recommended approval for the use of the SUPER model in this study. The Southwestern Division Water Management Branch and the USACE Hydropower Analysis Center have approved the model for period of record hydrology simulations and hydropower economic analyses in the region and it use was adequately reviewed in this study. Application of the model to the economic analyses for flood damage reduction and recreation benefits were appropriate to the scope and complexity of the study, and these outputs were also adequately reviewed.

The White River Basin Water Management Plan (1998 update) provides a comprehensive system of water control regulation which encompasses the entire White River Basin, incorporates all the basin projects and their many purposes, and provides seasonal flood control and hydroelectric power releases based on the agricultural practices of the lower basin and other land uses downstream of the projects. The plan also addresses the needs of the downstream trout fishery by providing a mechanism to maintain cool water temperatures based on monitored and forecasted ambient air temperatures. It also provides a deviation procedure to respond to unforeseen and emergency conditions which are not included in the plan or for which the plan is singularly inadequate. White River Minimum Flows (WRMF), which reallocates flood control pool storage for maintaining minimum flows in the White River, has been approved and is at the end of the engineering and design phase. The management plan will be updated to include WRMF when implemented. This project is described in detail in Section 2.4.2 of this report.

Bull Shoals Lake

The Bull Shoals Dam and Lake is one of the system of five Corps dams and lakes in the White River Basin Project, which was authorized for flood control, hydroelectric power, and other purposes, including recreation and fish/wildlife, by the Flood Control Act of 28 June 1938, as modified by the Flood Control Act of 1941. The Water Supply Act of 1958 provides general authorization for construction or reallocation of storage for water supply uses at all Corps lakes, provided such construction or reallocation does not seriously affect other authorized project purposes. The Chief of Engineers has delegated authority to approve reallocations of up to 15 percent of total storage capacity, or 50,000 ac-ft, whichever is less. Section 304 of the Water Resources Development Act of 1996 included recreation and fish and wildlife mitigation as purposes of the five-lake system White River Basin Project, to the extent that the additional purposes do not adversely affect flood control, power generation, or other authorized purposes of the project. The White River Minimum Flows (WRMF) Project to be implemented at Bull Shoals Lake is authorized in Section 132(a) of the FY2006 Energy and Water Development Appropriations Act (Public Law 109-103), which authorizes and directs the Secretary to reallocate storage at Bull Shoals and Norfork Lakes to provide minimum flows necessary to sustain tail water trout fisheries. This legislation also repealed previous WRMF authorizations in WRDA 1999 and WRDA 2000. In summary, Bull Shoals Lake has authorized purposes of flood control, hydroelectric power, and authorized uses of recreation, fish and wildlife mitigation, water supply and minimum flows.

Dam construction was started in 1947 and completed in 1951. The powerhouse and switchyard were completed in 1952. Bull Shoals Lake ‘construction’ was considered complete with the installation in December 1963 of the final two generating units for a total eight turbines at a cost of about $86 million (www.swl.usace.mil/parks/bullshoals/damandlake.html). Recreation began in 1948 with the stocking of rainbow trout in the tailwater. A small water supply reallocation was implemented in 1988 for the MCRWD.

2.2 Project Location, Purpose and Outputs

Bull Shoals Dam is on the White River approximately seven miles northwest of Mountain Home, Arkansas. The lake extends into southern Missouri including Taney and Ozark Counties. The lake is one of five multiple-purpose projects constructed in the upper White River Basin for the primary purposes of flood control and power generation.

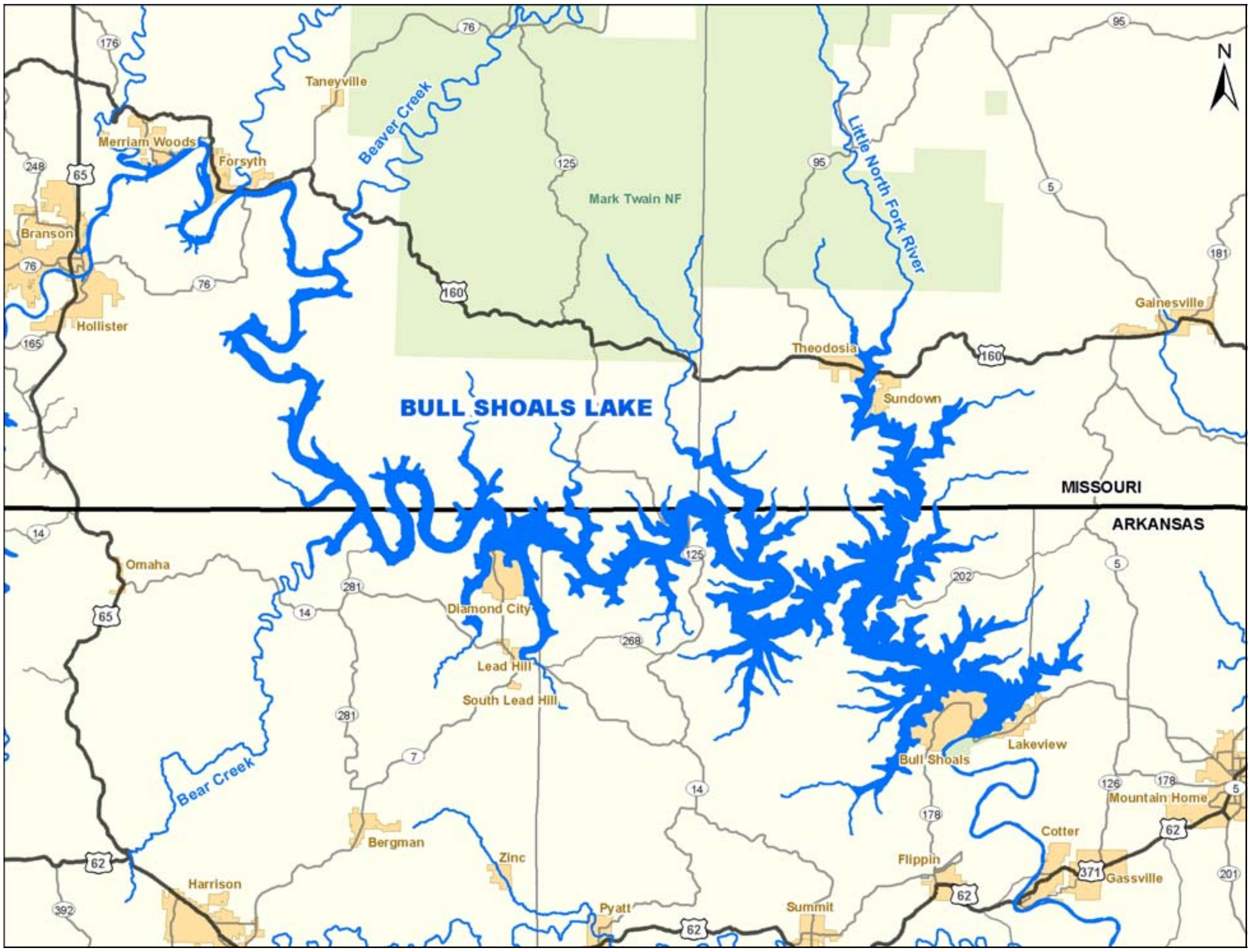

Figure 2.1 Bull Shoals Lake and Surrounding Area

Bull Shoals Dam and Lake are operated and maintained by the USACE, Little Rock District. Bulls Shoals Lake and its tailwater provide important trout habitat within the five White River Lakes System of the Ozark Mountains in north central Arkansas.

Current project outputs for Bull Shoals Lake through Fiscal Year (FY) 2008 (USACE 2009) include:

- $190 million estimated for cumulative flood damages prevented;
- 3 million visitors annually for recreational use of the lake and land resources (www.swl.usace.mil/parks/bullshoals/damandlake.html);
- 753,700 megawatt-hours for annual hydroelectric power generation; and
- 0.85 MGD average daily demand and 1.2 MGD peak summer daily demand for

water supply by MCRWD (ESI 2009b).

2.3 Project Data

The main dam has a maximum height above the river bed of 258 feet and extends approximately 2,256 feet in length. The Bull Shoals Dam supports 17 spillway crest gates and is the fifth largest concrete dam in the United States. Bull Shoals Lake encompasses 45,440 surface acres and a shoreline of 740 miles at the top of the design conservation pool (654 feet). The lake's upstream drainage basin is 6,036 square miles. The existing project storage allocations will change with implementation of WRMF.

The WRMF Project Report and the Record of Decision were approved by the Assistant Secretary of the Army (Civil Works) in January 2009. Alternative BS-3, the recommended plan specific to Bull Shoals Lake, was authorized by the 2006 Energy and Water Development Appropriations Act Section 132(a). Alternative BS-3 will reallocate five feet of flood control storage, totaling 233,000 ac-ft for a target minimum flow release of 800 cfs. The top of the conservation pool will be raised five feet from elevation 654 to 659 ft. In anticipation of this change, the storage capacity in the lake will be 2.127 million ac-ft of flood control storage, 1.236 million ac-ft of conservation storage, and 2.045 million ac-ft of inactive storage, for a total storage of 5.408 million ac-ft. The project is currently in engineering and design phase and is expected to be implemented, so the base condition and without project condition assumes the WRMF reallocation is in place, however, reallocation of storage for WRMF will occur after the OMRPWA and MCRWD reallocation.

Table 2.1 summarizes the physical features of Bull Shoals Lake with the proposed alternative BS-3 implemented. Figure 2.2 is a schematic of Bull Shoals dam and lake with pool elevations and volumes.

Table 2.1 Bull Shoals Lake Physical Features (After Reallocation for White River Minimum Flows)

Feature	Elevation(1)	Area (acres)	Storage Volume (ac-ft)	Equivalent Runoff (2) (inches)
Top of dam (3)	708			
Design pool	703	79,730	6,013,000	18.7
Top of flood control pool	695	71,240	5,408,000	16.8
Spillway crest (17 tainter gates 40' wide by 28' high)	667	52,510	3,682,500	11.4
Top of conservation pool (4)	659	48,005	3,281,000	10.2
Top of conservation pool (5)	654	45,440	3,048,000	9.5
Top of inactive pool	628.5	33,795	2,045,000	6.4
Probable maximum drawdown	588	20,260	964,400	3.0
Sluice invert (16 sluices 4' wide by 9' high)	477.06	829	8,380	-
Streambed	450	0	0	
Usable storage				
Flood control storage	695-659		2,127,000	
Conservation storage	659-628.5		1,236,000	
Inactive storage (hydropower, rec. fish/wildlife, sediment)	628.5-588		1,080,600	
Inactive storage - below el 588	588-450		964,400	

(1) Feet, mean sea level (msl)
(2) 6036 square miles of drainage area upstream of dam
(3) Top of dam has a 3-foot concrete parapet
(4) White River Minimum Flow Reallocation (Alt. BS-3)
(5) Current operation

The base condition is with the WRMF authorized reallocation from the flood pool, which will raise the elevation from 654.00 ft to elevation 659.0 ft. This reduces the flood pool storage by 233,000 ac-ft. Thus the flood pool will have 2,127,000 ac-ft of storage for flood reduction purposes between elevation 659.00 ft and 695.00 ft. The conservation pool was increased by the 233,000 ac-ft for a total of 1,236,000 ac-ft between elevation 628.50 ft and 659.00 ft to provide storage for WRMF, water supply and hydroelectric power. The inactive pool has storage of 2,045,000 ac-ft between elevation 628.50 ft and 450.00 ft. The elevation of the lowest invert (sluice) is 477.06 ft, leaving a "dead" storage of about 8,380 ac-ft. The inactive pool provides storage for additional head for hydroelectric power, recreation and fish habitat, and sediment. Also, this storage is available for emergency uses during drought conditions that include hydroelectric power operations and M&I water supply. The maximum probable drawdown is elevation 588.00 ft which has been estimated as the lowest elevation that the turbines could operate in a safe mode. The storage remaining below 588.00 ft is 964,400 ac-ft.

Bull Shoals Lake

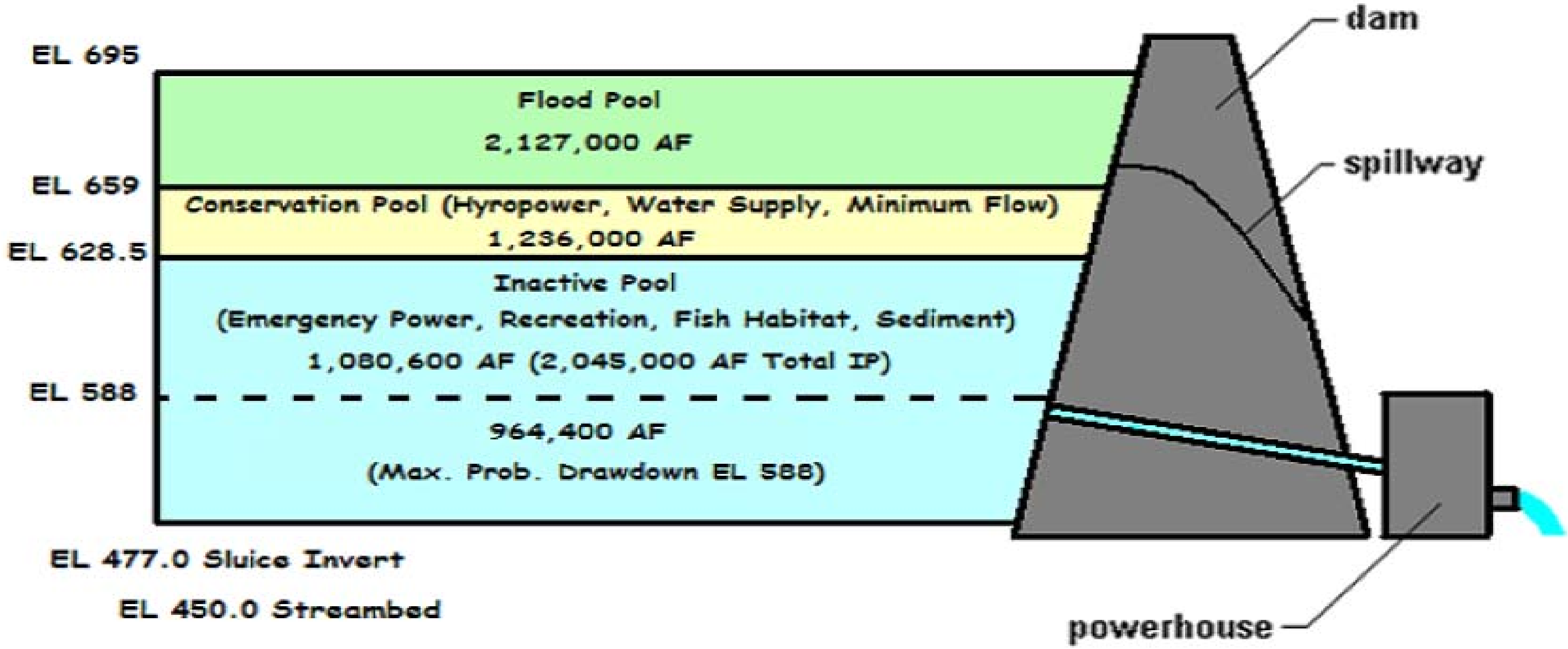

Figure 2.2 Bull Shoals Lake and Dam with Pool Elevations and Volumes

The reservoir system is operated to maintain a balance in the remaining portion of the seasonally defined flood control storage space. Downstream river flow criteria have been established at downstream control points to achieve project benefits. The regulating discharge criteria are supplied for all stream control points (including reservoir outflow controls) as a seasonal function of a system state parameter. Runoff forecast and these criteria are used by a system model which iteratively computes reservoir discharges which balances the remaining reservoir storage without exceeding downstream control point criteria. Consequently, the reallocation of storage at Bull Shoals Lake for increased water supply demands also has impacts at Norfork Lake.

2.4 Previous Water Storage Projects

2.4.1 Marion County Regional Water District Water Supply Agreement

MCRWD was reallocated storage for 880 ac-ft, intended to yield 1 MGD. As part of this study, the volume required to yield 1 MGD will be updated based on the current reallocation request and the reallocation for the WRMF Project, which reallocated storage from the flood control pool. When reallocation of storage from the flood control pool would impact existing water supply users and hydropower users, Dependable Yield Mitigation Storage (DYMS) to compensate the existing water supply users must be considered in the analysis (ER-1105-2-100).

Dependable (Firm) yield is based on the available inflow, the available storage, and the critical low flow period at a specific location in the watershed, i.e., Bull Shoals Lake. Increasing the conservation storage increases yield but reduces the dependable yield of the users because the dependable yield per unit of storage is reduced. This occurs because inflow into the lake remains the same. Since more users are sharing the same inflow, the yield per unit of storage decreases even though the total yield of the project increases. Therefore to compensate the existing water supply users the new user would contract for their needed storage plus the additional storage to maintain the existing users' dependable yield. This additional storage required to keep existing users whole is termed DYMS.

The Base condition (No Action), Alternative 1, has the existing user, MCRWD, being made whole because of WRMF. Although OMRPWA/MCRWD will contract for storage prior to WRMF, they will not make the existing Marion County yield whole, but only provide DYMS under the assumption that Marion County is already whole at 1 MGD. The reallocation analysis for OMRPWA/MCRWD is for Ozark Mountain to provide DYMS for existing Marion County supply, then Marion County to provide DYMS for Ozark Mountain and existing Marion County supply.

2.4.2 White River Minimum Flows Project

Section 132(a) of the FY2006 Energy and Water Development Appropriations Act (EWDAA, Public Law 109-103) authorized implementation of plans BS-3 at Bull Shoals and NF-7 at Norfork Lakes in the White River basin to provide minimum flow releases to enhancements that provide national benefit and shall be a Federal expense in accordance with section 906 (e) of 1986, of WRDA as described in the WRMF Report, Arkansas and Missouri dated July 2004. Also, Section 132 repealed Section 374 of the WRDA 1999 and Section 304 of WRDA 2000, rescinding authorization to reallocate storage at Table Rock Lake, Greers Ferry Lake, and Beaver Lake for minimum flows. The repeal does not eliminate further consideration of alternative plans. WRMF is at the end of the engineering and design phase and has been fully funded by Construction General and ARRA funds.

Section 3
Plan Formulation

3.0 PLAN FORMULATION

This section documents the urgency and need for water, the preliminary screening of reallocation alternatives, and the final reallocation alternatives to evaluate in detail. The evaluation of alternatives was guided by USACE's Environmental Operating Principles (EOP) and compliance with the Campaign Plan. An assessment of how those Administration goals were applied is presented in Sections 6.3.1 and 6.3.2.

During plan formulation, the goal is to identify and perform an initial evaluation of preliminary alternatives for water supply. Consideration of all reasonable alternatives is required under the Economic and Environmental Principles for Water and Related Land Resources Implementation Studies. The National Environmental Policy Act (NEPA) requires Federal agencies to incorporate environmental considerations in their planning and decision-making process. The Planning Guidance Notebook, Engineering Regulation (ER 1105-2-100), Appendix E and Appendix H, require the formulation and evaluation of a full range of reasonable alternative plans. Alternatives are formulated to take into account the overall problems, needs, and opportunities afforded by the proposed action. Those alternatives are assessed consistent with the national objective of contributing to National Economic Development (NED) and protecting the Nation's Environment, and consistent with Federal laws and regulations. The NED objective for water supply is to provide the most cost-effective water supply source to meet the region's future Municipal and Industrial requirements when considering economic, social, and environmental impacts of the potential reallocation.

3.1 Urgency and Need for Water

Current water sources include shallow wells, deep wells, or springs. The majority of the member water systems struggle to meet customer demands from their existing sources. In addition, the ADH has stated the well water has excessive and dangerous levels of radium, fluoride, and hydrogen sulfide, and they have declared the need for an alternative water supply for these communities as their top priority. The Environmental Protection Agency has certified that many of these water sources are not safe for human consumption.

In October 2009, it was announced OMRPWA will receive $56 million in grant and loan funding from the USDA through the ARRA Act of 2009. These funds will be used for constructing an intake structure and treatment plant adjacent to Bull Shoals Lake, 115 miles of transmission lines, and booster pumping stations to transport the water across the rugged terrain in the Ozarks. However, these funds must be obligated by September 2010; therefore, OMRPWA must first have a water supply storage agreement executed with USACE by August 2010.

Short Term Interim Action (Critical Needs Phase) verses Long Term Solution – The short term interim action, the Critical Needs Phase, already funded by USDA, Rural Utilities Service, will provide safe water to some Ozark Mountain customers until the long-term new overall water system is constructed. The Critical Needs Phase includes a pipeline between the city of Marshall and the water systems under Administrative Orders from the

Arkansas Department of Health to not consume water (these are Mt. Sherman Water Association, South Mountain Water Association, Snowball, Dongola & Marsena Water Association, and Morning Star Water Association). This pipeline will allow clean water from Marshall to be blended with contaminated water to reduce the overall contaminant levels. While the blended water is a short-term solution, Marshall can not sustain the flow to these water systems during dry periods. These pipelines are being put into place now and their costs are included in the without project conditions. The without project condition would be the Critical Needs facilities in place for a few of the OMRPWA customers and no new water system and continued health and safety risks associated with contaminated water for the majority of OMRPWA's customers.

If the reallocation does not take place, a safe water supply system will still be needed. As discussed in Section 4.2, the next most likely alternative is reallocation of storage in Norfolk Lake and the construction of the associated intake, water treatment plant, pipelines, pumping stations and storage tanks.

This water supply reallocation report is an element of a larger overall Ozark Mountain water system project. The water supply agreement between USACE and OMRPWA will be combined with the construction of a water treatment plant, intake structure, and distribution lines adjacent to Bull Shoals Lake and funded with USDA's Rural Development funds to complete the overall water system project.

3.2 Preliminary Reallocation Alternatives for OMRPWA

The preliminary screening of alternatives for a long term source of water supply for this region includes the following; groundwater wells, treating groundwater, existing surface reservoirs, construction of new surface water reservoirs, purchasing treated water from one or more wholesale water providers, and consideration of conservation methods as a nonstructural measure.

3.2.1 Groundwater Wells

As a result of large scale groundwater withdrawals primarily for rice farming, groundwater levels in the state are declining. Declining aquifer water levels create a multitude of problems. Because of the excessive withdrawals of groundwater, the dependable yield has been approached or exceeded in the alluvial and Sparta aquifers. The Arkansas Natural Resources Commission has declared these aquifers at "critical groundwater levels" due to the dependable yield concerns relating to poor water quality and to saline intrusions consistent with declining groundwater levels.

The members of OMRPWA currently depend on wells with poor water quality drilled twenty to fifty years ago to access a groundwater supply. Deep wells in this region have excess amounts of naturally occurring radium 226, radium 228, fluoride, uranium, radon, and hydrogen sulfide. For the past three years, this area has remained the ADH's top priority due to the serious health risks associated with these contaminants in the drinking water (ADH, 2009). Similar conditions occur in Southern Missouri where radionuclides are present in both shallow and deep aquifers, (Petersen, 1999).

Due to these issues with both limited quantity and poor quality, utilizing groundwater sources were not considered any further.

3.2.2 Treating Groundwater

In 2003, the South Mountain Water Association and the Snowball, Dongola & Marsena Water Association retained Engineering Services, Inc. to evaluate solutions to the high levels of radium and fluoride found in the existing water supply. Several treatment options were considered. Treatment for radium would create residuals that would be classified as a hazardous waste which can not be disposed in Arkansas landfills. Handling the concentrated residuals would be expensive, dangerous, and pose a significant environmental threat to the Buffalo National River Watershed. Due to these issues, groundwater treatment facilities were not considered any further.

3.2.3 Existing Surface Reservoirs

Beaver Lake is the most upstream impoundment on the White River watershed. Reallocation from Beaver Lake not only impacts the flood damages prevented and hydroelectric power generation at Beaver Lake, but also Table Rock Lake and Bull Shoals Lake. Given the greater distance to Beaver Lake than to Bull Shoals, and the greater impacts to other authorized purposes, reallocating from Beaver Lake was not considered any further.

Table Rock Lake is the next impoundment downstream from Beaver Lake. Reallocation from Table Rock Lake would impact flood damages prevented and hydroelectric power generation at Bull Shoals Lake. Given the slightly greater distance to Table Rock Lake than to Bull Shoals, and the greater impact to the other authorized purposes, reallocating from Table Rock Lake was not considered any further.

Greers Ferry Lake is another impoundment in the White River watershed. The distance from the OMRPWA area to Greers Ferry Lake is somewhat comparable to the distance from Bull Shoals; however, Greers Ferry has design complications. Water from Bull Shoals would be gravity fed to an area with existing water infrastructure, while water from Greers Ferry Lake would have to be pumped uphill through new infrastructure. Water quality from Greers Ferry Lake is good. Cost estimates to construct a new water treatment plant at Greers Ferry and pump the water to OMRPWA and MCRWD customers were estimated at $7,299,281 annually of which $60,000 is the water cost. The details of these costs are shown in Tables 4.14 and 4.15 in Section 4.

Norfork Lake has ample capacity for water supply; however, the location of the lake with respect to the OMRPWA members is a long distance and the rugged terrain between Norfork Lake and the OMRPWA members makes this water source very expensive. Only one other utility utilizes Norfork Lake as a water source. The city of Mountain Home has been allocated approximately 10,000 ac-ft from Norfork Lake for municipal water supply. Water quality from Norfork Lake is good. Cost estimates to construct a new water treatment plant at Norfork Lake and pump the water to OMRPWA and

MCRWD customers were estimated at $5,758,341 annually of which $166,600 is the water cost. The details of these costs are shown in Tables 4.14 and 4.15 in Section 4. Of the existing surface reservoir alternatives, Greers Ferry and Norfork Lake are the only viable alternatives.

Bull Shoals Lake's water quality is excellent resulting in minimal chemical additions being required to achieve full scale water treatment. Only one water provider utilizes Bull Shoals Lake as a municipal water source. Currently, MCRWD has contracted for 880 ac-ft of storage from the conservation pool. Bull Shoals Lake's overall storage capacity is approximately 5,408,000 ac-ft. Therefore, due to the high quality of water and the large overall storage capacity of Bull Shoals Lake, this lake was carried forward in the final reallocation alternatives to be evaluated in detail.

3.2.4 Development of New Surface Reservoirs

Searcy County worked from 1989 until 2003 to develop a long-term surface water supply for the residents of Searcy County. The Searcy County Regional Water District was formed in order to develop a regional water supply and provide treated water to the residents of Searcy County. They retained a consulting engineer, prepared a preliminary engineering report, made application for state and federal funding, and began work on the environmental phase of the project. Since the selected watershed was on a tributary of the Buffalo National River, extensive environmental studies were required to determine the long-term effect of the watershed on the Buffalo National River. On March 1, 1972, the United States Congress established the Buffalo National River as America's first national river. After 10 years of environmental review, legal challenges, permitting challenges, debate and discussion, the National Park Service and USACE stopped progress on the project. Meanwhile, families within the Buffalo River drainage basin continue to drink water contaminated with radium, fluoride, uranium, and radon. Since 2004, Searcy County has fully backed the efforts of the OMRPWA in developing a water source to serve the region.

In summary, development of a reservoir large enough to supply the region is severely hindered by the proximity of the Buffalo National River. Therefore, this alternative was not evaluated any further.

3.2.5 Purchase Water from One or More Wholesale Water Providers

Purchase of water from several wholesale water providers to deliver to OMRPWA was evaluated: purchase water from Carroll-Boone Regional Water District, purchase water from the city of Clarksville, purchase water from the city of Russellville, and purchase water from MCRWD. Given that Carroll-Boone Regional Water District is currently requesting reallocation of storage from Beaver Lake, Carroll-Boone Regional Water District does not have surplus water to sell, and was not evaluated any further. Given that MCRWD is currently requesting reallocation of storage within this report, MCRWD does not have surplus water to sell and was not evaluated any further.

The remaining wholesale water providers are the city of Clarksville and the city of Russellville. According to discussions with the city of Russellville, the city does not have surplus water to sell. According to the Clarksville Light & Water Plant Engineer, the current capacity of the water treatment plant is 15 MGD, and the plant has the ability to sell 7 to 8 MGD. Costs for this alternative are estimated at $8.7 million, of which $4.4 million is the water cost. The details of these costs are shown in Tables 4.14 and 4.15 in Section 4.

Of the wholesale water alternatives, the purchase of water from Clarksville is the only viable alternative.

3.2.6 Non-Structural Solutions – Conservation

The non-structural alternative is to conserve water to reduce the need for additional sources of water supply. However, water conservation is not a reasonable solution to the continued health risks associated with a contaminated water supply. Furthermore, the current per capita water usage is 79% that of the state of Arkansas (Section 4.1.3 contains per capita water usage numbers) and strenuous conservation measures are currently practiced and further conservation measures would not significantly reduce OMRPWA's water needs. Therefore, this measure was screened from further consideration.

3.3 Preliminary Reallocation Alternatives for MCRWD

3.3.1 Structural Solutions

An Environment Assessment for MCRWD, prepared by Engineering Services, Inc., dated May 1982 (ESI, 1982), evaluated the following alternatives for MCRWD: Bull Shoals Lake, Mountain Home Water System, and Harrison Water System.

The source of water for the Mountain Home Water System is Norfolk Lake. This alternative involves purchasing treated water and construction of transmission lines, water storage tanks, and a booster pumping station to convey the water to the MCRWD service area. An economic analysis found that connection to the Mountain Home Water System would cost more to construct and operate than the proposed system at Bull Shoals Lake (ESI, 1982).

The Harrison Water System alternative includes purchasing treated water from the City of Harrison and constructing transmission lines, a 1,000,000 storage tank and a booster pumping station to convey water to the MCRWD service area. An economic analysis found that this option was not as cost-effective as developing a supply from Bull Shoals Lake (ESI, 1982).

Because the two viable alternatives for water supply were not cost effective compared to developing a supply from Bull Shoals Lake, MCRWD signed a water supply agreement on April 1988 to withdraw 880 ac-ft of storage from the conservation pool of Bull Shoals Lake. Currently, MCRWD has a water treatment facility at the town of Bull Shoals, Arkansas, with a maximum capacity of 4 MGD.

Given that Mountain Home Water System is currently requesting reallocation of storage from Norfork Lake, Mountain Home Water System does not have sufficient water to sell, and it was not evaluated any further. Without another contract with USACE for additional storage in Bull Shoals Lake, MCRWD would likely try to request reallocated storage from Norfork Lake.

3.3.2 Non-Structural Solutions

The non-structural alternative is to conserve water to reduce the need for additional sources of water supply. Water conservation can include altering the demand for water by water rationing and pricing methods. MCRWD users have a per capita daily usage rate at half the state's average water usage, and they have below average system leakage (a range of 5% to 9% compared to a national average of 10% to 12%). While water conservation could improve over time with gradual replacement of older plumbing fixtures, the quantity of water gained through conservation is judged to be insignificant. Therefore, this alternative was not evaluated any further.

3.4 Final Reallocation Alternatives for OMRPWA and MCRWD to Evaluate in Detail

Based on the preceding analysis, purchasing water supply storage from Bull Shoals Lake and constructing a water treatment plant adjacent to the lake is the most cost effective alternative for OMRPWA. Figure 3.1 shows a general layout of their proposed water treatment facilities.

Since MCRWD is already purchasing 880 ac-ft from Bull Shoals Lake, purchasing an additional 1,698 ac-ft from Bull Shoals Lake is the most cost effective alternative for MCRWD.

Cost estimates supporting the selection of reallocating storage from Bull Shoals Lake for both OMRPWA and MCRWD are provided in Sections 4.2.1 and 4.2.2.

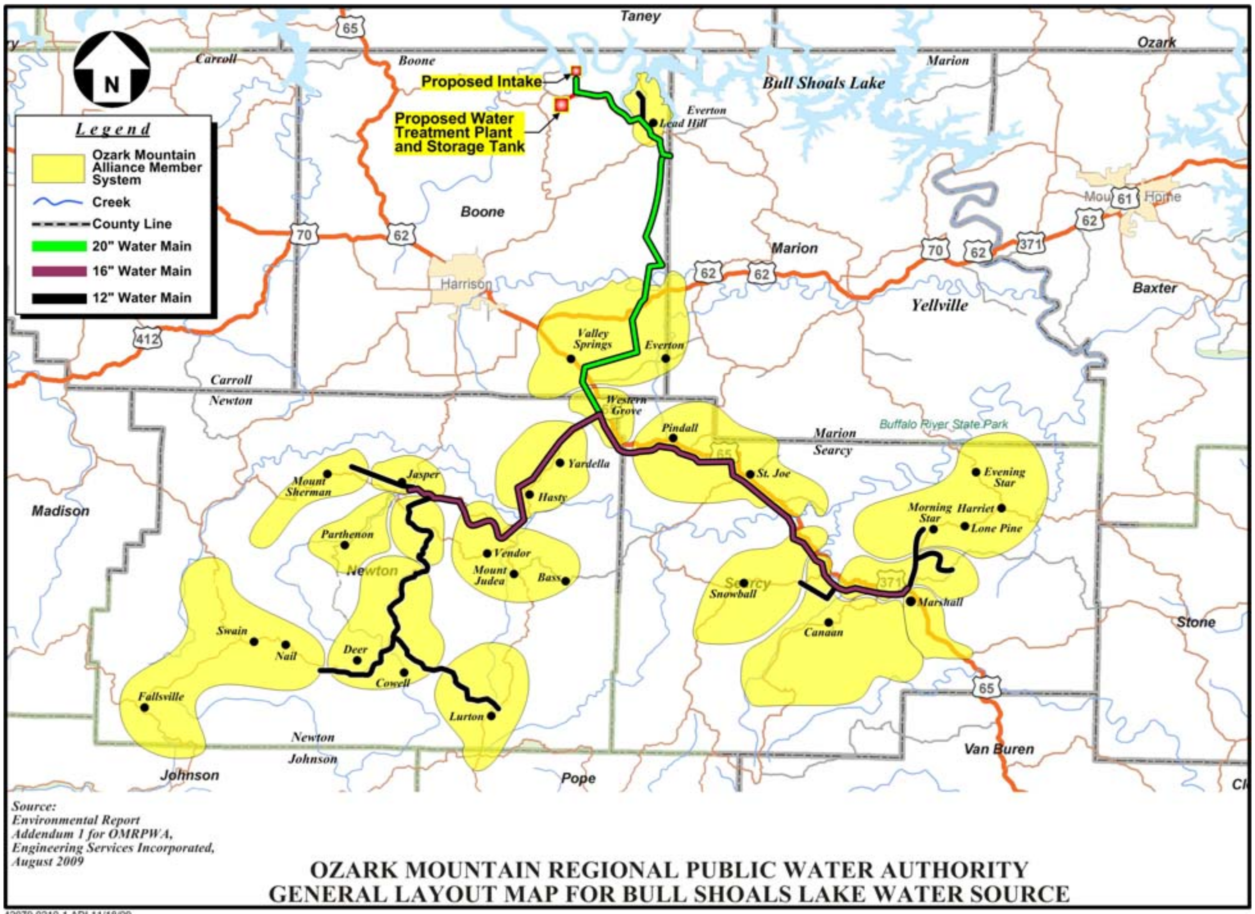

Figure 3.1 General Layout Map for Proposed OMRPWA Facilities on Bull Shoals Lake

The final alternatives for reallocating storage from Bull Shoals Lake that will be evaluated in detail include the following:

- Alternative #1, No action alternative
- Alternative #2, Reallocation from the conservation pool
- Alternative #3, Reallocation from the flood control pool
- Alternative #4, Reallocation from the inactive pool

All of these alternatives assume that WRMF will be implemented after the water supply reallocation for OMRPWA and MCRWD.

To evaluate reallocating 6 MGD for OMRPWA and 1 MGD for MCRWA at Bull Shoals Lake, alternatives were analyzed using the SUPER program for conservation, flood control, and inactive storage reallocation.

Brief descriptions of the alternatives that were evaluated using the SUPER hydraulic and economic output data for Bull Shoals Lake are as follows:

Alternative 1 - No Action. The existing condition represents the current 1,698.077 ac-ft of water supply storage within the conservation pool. The top of pool is at elevation 659.0 feet. The seasonal pool plan is also part of this condition that raises the top of conservation pool, with White River Minimum Flows implemented, to elevation 662.0 feet from 15 May to 15 June and then to 661 feet from 15 July to 30 September.

Alternative 2 - Reallocation from the conservation pool. This alternative would reallocate an additional 11,886.541 ac-ft of storage from the conservation pool for water supply. The total water supply storage would be 13,584.617 ac-ft including the current allocation. The top of pool elevation, with White River Minimum Flows implemented, would be at elevation 659.0 feet, with seasonal pool raises.

Alternative 3 - Reallocation from the flood control pool. This alternative would reallocate 11,948.151 ac-ft from flood control pool for water supply. The top of conservation pool, with WRMF implemented, would be raised to elevation 659.25 with seasonal pool raises. The total water supply storage would be 13,646.229 ac-ft including the current allocation. Dependable yield mitigation storage is included (13.221 ac-ft) to keep existing water supply users' yield whole to compensate for the reduction in the dependable yield which occurs when the conservation pool is expanded.

Alternative 4 - Reallocation from the inactive pool. This alternative would reallocate 11,943.284 ac-ft from the inactive pool for water supply. The top of conservation pool, with White River Minimum Flows implemented, would remain at 659.0 feet with seasonal pool raises and the bottom of conservation pool would be lowered to 628.14 feet. The total water supply storage would be 13,641.361 ac-ft including the current allocation. Dependable yield mitigation storage is included (12.975 ac-ft) to keep existing water supply users' yield whole to compensate for the reduction in the dependable yield which occurs when the conservation pool is expanded.

The alternatives are summarized in Table 3.1.

Table 3.1 Storage Reallocation Alternatives

Alternative	Water Supply Storage – this action (ac-ft)	Total Water Supply Storage (ac-ft)*	Seasonal Pool Plan	Top of Conservation Pool Elevation (feet)
Alternative #1 – No Action	No Reallocation	1,698.077	Yes	659.0
Alternative #2 – Reallocate from conservation	11,886.541 from Conservation Pool	13,584.617	Yes	659.0
Alternative #3 – Reallocate from flood control	11,934.930 from Flood Pool 13.221 for DYMS	13,646.229	Yes	659.25
Alternative #4 – Reallocate from inactive	11,930.309 from Inactive Pool 12.975 for DYMS	13,641.361	Yes	659.0 **

*This action plus contracted storage of 880 ac-ft and White River Minimum Flows dependable yield mitigation storage of 818 ac-ft.
** Bottom of Conservation Pool lowered to elevation 628.14 feet.

Section 4
Economic Analysis

4.0 ECONOMIC ANALYSIS

4.1 Water Supply and Demand Analysis

4.1.1 Existing Condition

The members of ORMPWA currently depend on wells with poor water quality. Some of the wells in this region have excess amounts of radium 226, radium 228, fluoride, uranium, radon, hydrogen sulfide, and other undesirable naturally occurring substances which are difficult to treat. State and federal water quality regulators have declared many of these water sources unsafe for consumption. The ADH has placed many of the water systems under Administrative Order for continuing to provide unsafe water supplies. Members that do not have contamination issues have source quantity issues. Water shortages are realized most summers, even when "water conservation" orders are implemented. The ADH has issued an Administrative Order Warning to the city of Marshall for not having enough water to serve its customers. As a result of low yields, the cities of Marshall and Jasper cannot extend service to hundreds of households. The families in the region haul water or drink water from shallow contaminated wells. Table 4.1 shows the members of ORMPWA, and the source quality and quantity for each of the member systems.

As shown in an Environmental Assessment Report for MCRWD (ESI 1982), the groundwater concerns in Marion County mirror those of neighboring Newton, Boone, and Carroll counties: low yield problems and possibility of contamination.

Table 4.1 Ozark Mountain Regional Public Water Authority Water Quality and Quantity Data

County	2008 Population	Source Quality Issues	Quantity Issues
Newton			
City of Jasper	1,530	*	Yes
Mt Sherman	775	Radium	Yes
Nail-Swain	1,975	None	Yes
East Newton County	1,650	Radium, Hydrogen Sulfide	No
Mockingbird Hill	800	Hydrogen Sulfide, Iron	No
Deer	900	*	Yes
Lurton-Pelsor	300	Iron	Yes
Western Grove	1,070	Radium, Iron	Yes
Parthenon	400	*	Yes
Subtotal	9,400		
Searcy			
SPG	1,400	Flouride	No
Marshall	2,400	None	Yes
South Mountain	700	Radium	Yes
SDM	400	Radium, Flouride	Yes
Leslie	800	Radium	Yes
Morning Star	1,375	Flouride	Yes
Subtotal	7,075		
Boone			
Valley Springs	3,750	Radium, Iron	Yes
Diamond City	700	Radium	No
Lead Hill	515	Radium	No
Lake Bull Shoals Estates	60	None	No
Subtotal	5,025		

* Violates the Surface Water Treatment Rule of the National Primary Drinking Water Regulations
Source: Preliminary Engineering Report Amendment 1 (August 2009), Engineering Services Inc.

The Preliminary Engineering Report (ESI 2009b), provided a table of average daily and peak daily water usage for 2004 and 2008 for OMRPWA (as shown in Table 4.2), and provided a table of water sold by MCRWD for 1990 to 2008 (as shown in Table 4.3).

Table 4.2 Ozark Mountain Regional Public Water Authority Daily Water Use

	2004		2008	
Water System	**Average Daily Usage (gallons)**	**Peak Daily Usage (gallons)**	**Average Daily Usage (gallons)**	**Peak Daily Usage (gallons)**
Newton County				
City of Jasper	163,000	281,000	105,740	210,000
Mt Sherman	42,000	78,000	55,000	78,000
Nail-Swain	30,000	88,000	25,000	110,000
East Newton County	110,000	150,000	141,377	180,000
Mockingbird Hill	58,000	105,000	48,000	90,000
Deer	25,000	94,000	42,000	94,000
Lurton-Pelsor	30,000	90,000	14,791	85,000
Western Grove	70,000	85,000	56,151	97,000
Parthenon	22,000	66,000	27,000	65,000
Searcy County				
SPG	106,000	261,000	176,300	261,000
Marshall	337,000	533,000	305,000	450,000
South Mountain	29,000	130,000	51,000	100,000
SDM	30,000	75,000	29,500	75,000
Leslie	70,000	108,000	70,000	108,000
Morning Star	106,000	219,000	105,000	219,000
Boone County				
Valley Springs	264,000	471,000	274,000	448,000
Diamond City	65,000	230,000	70,230	230,000
Lead Hill	40,000	75,000	56,038	75,000
Lake Bull Shoals Estates	6,400	27,000	2,775	27,000
Members at Large				
Buffalo National River (Park Service)	10,000	30,000	10,000	30,000
TOTAL	**1,613,400**	**3,196,000**	**1,664,902**	**3,032,000**

Source: Table 4.5(A), Preliminary Engineering Report Amendment 1 (August 2009), Engineering Services Inc.

Table 4.3 Marion County Regional Water District Water Sold

Year	Water Sold to Member Entities (Millions Gallons)*
1990	188.59
1991	110.07
1992	117.30
1993	233.61
1994	250.11
1995	267.24
1996	277.12
1997	266.86
1998	280.55
1999	285.10
2000	284.47
2001	278.56
2002	274.93
2003	271.75
2004	272.67
2005	284.90
2006	298.87
2007	323.37
2008	309.13
* Preliminary Engineering Report Amendment 1, August 2009; Engineering Services Inc.	

4.1.2 Population Growth

Estimates of future water use are the product of the projected number of customers and a projected value of water use per customer. Table 4.4 shows the population from 1970 to 2060, for counties in which ORMPWA operates. Table 4.5 shows the population from 1970 to 2060 for Marion County.

Table 4.4 Ozark Mountain Regional Public Water Authority Projected Population in Member Counties

County	1970	1980	1990	2000	**Annual Growth 1970-2000**	2010*	2020*	2030*	2040*	2050*	2060*	**Annual Growth 2000-2060**
Newton	5,859	7,745	7,685	8,639	1.30%	8,400	8,674	8,973	9,257	9,547	9,837	0.17%
Searcy	7,790	8,825	7,819	8,276	0.20%	8,046	7,781	7,535	7,281	7,030	6,779	-0.32%
Boone	19,110	26,119	28,360	36,041	2.13%	38,070	42,228	46,394	50,570	54,740	58,910	0.85%
TOTAL	32,759	42,689	43,864	52,956	1.61%	54,516	58,683	62,902	67,108	71,317	75,526	0.59%
Population projection for 2010-2030 provided by Center for Business and Economic Research, University of Arkansas. Growth rate extrapolated to 2060 by Little Rock District.												

Table 4.5 Marion County Regional Water District Projected Population in Marion County

County	1970	1980	1990	2000	**Annual Growth 1970-2000**	2010*	2020*	2030*	2040*	2050*	2060*	**Annual Growth 2000-2060**
Marion	7,105	11,352	12,039	16,173	2.80%	18,283	20,600	23,071	25,444	27,842	30,240	1.14%
Population projection for 2010-2030 provided by Center for Business and Economic Research, University of Arkansas. Growth rate extrapolated to 2060 by Little Rock District.												

The rate of population growth for the populations of Newton, Searcy, and Boone counties averaged 1.6% annually between 1970 and 2000. The rate of population growth, as estimated by the Center for Business and Economic Research at the University of Arkansas, for 2000 to 2060 averages 0.59% annually. The rate of population growth for Marion County averaged 2.8% annually between 1970 and 2000. The rate of growth for 2000 to 2060 averages 1.14% annually. As the OMRPWA member towns have grown, the members have not been able to extend water service to new customers. Currently, there are unfulfilled extension requests for Mt. Sherman, Nail-Swain, East Newton County, Deer, Western Grove, SPG, Marshall, and South Mountain. The ADH will not allow these extensions until an adequate water source is available. The lack of safe, clean water is a burden to the residents of these counties, and is a detriment to growth.

4.1.3 Water Usage

According to data in the Preliminary Engineering Report Amendment 1 (ESI 2009b), the per capita usage of water for the members of OMRPWA averages 77.44 gallons per day (gpd), excluding the Buffalo River National Park Service. Per capita usage calculated from the data in Table 4.2 shows higher-than-average per capita usage for the city of Marshall and the SPG Water Association (more than one standard deviation above the mean). Table 4.6 provides the average per capita usage information, corrected with available data for Marshall and Leslie (which purchases water from Marshall). Data representing water use by sector was not available for many of the members of OMRPWA. The average per capita daily usage for OMRPWA members is 78.0 gpd.

Currently, many people in Newton, Searcy, and Boone counties are very conservative with household water usage. As shown in Table 4.6, many communities have average per capita use of less than 70 gpd. According to "Estimated Water Use of Water in the United States in 2005," USGS states that the average per capita use for Arkansas is 89 gpd for self-supplied water and 99 gpd for public-supplied water. As the members of OMRPWA obtain clean, safe and reliable water, their per capita usage is expected to rise from 78 gpd to 90 gpd (a 15% increase). A 15% increase in usage was used as a conservative estimate of increased usage, rather than using the state USGS average per capita use of 99 gpd for public-supplied water.

Table 4.6 Ozark Mountain Regional Public Water Authority Daily Water Use

Water System	Average Daily Usage (gallons)*	Users*	Per Capita Usage (gallons)
Newton County			
City of Jasper	105,740	1,530	70
Mt Sherman	55,000	775	70
Nail-Swain***	25,000	1,975	10
East Newton County	141,377	1,650	90
Mockingbird Hill	48,000	800	60
Deer	42,000	900	50
Lurton-Pelsor	14,791	300	50
Western Grove	56,151	1,070	50
Parthenon	27,000	400	70
Searcy County			
SPG	176,300	1,400	130
Marshall**	178,500	2,400	70
South Mountain	51,000	700	70
SDM	29,500	400	70
Leslie**	84,500	800	110
Morning Star	105,000	1,375	80
Boone County			
Valley Springs	274,000	3,750	70
Diamond City	70,230	700	100
Lead Hill	56,038	515	110
Lake Bull Shoals Estates	2,775	60	50
SUBTOTAL* **	1,517,902	19,525	
Average Per Capita Daily Usage (gallons)* **			78.0

*Tables 4.4(A) and 4.5(A) Preliminary Engineering Report Amendment 1 (August 2009); Engineering Services Inc.
**Based on City of Marshall data for 2006: Replacing ESI estimate of 305,000 with 178,500 for Marshall. Replacing ESI estimate of 70,000 with 84,500 for Leslie.
***Excluding Nail-Swain as an outlier, without secondary data to confirm usage.

Using the usage data presented in Table 4.3 and the population data in Table 4.5, per capita usage can be calculated for MCRWD and is presented in Table 4.7.

Table 4.7 Marion County Regional Water District Water Use

Year	Water Sold to Member Entities (Millions Gallons)*	Average Daily Use (gallons)	Population**	Per Capita Average Daily
1990	188.59	516,700	12,039	42.9
1991	110.07	301,600		
1992	117.30	321,400		
1993	233.61	640,000		
1994	250.11	685,200		
1995	267.24	732,200		
1996	277.12	759,200		
1997	266.86	731,100		
1998	280.55	768,600		
1999	285.10	781,100		
2000	284.47	779,400	16,173	48.2
2001	278.56	763,200		
2002	274.93	753,200		
2003	271.75	744,500		
2004	272.67	747,000		
2005	284.90	780,500		
2006	298.87	818,800		
2007	323.37	885,900		
2008	309.13	846,900	17,655	48.0

* Preliminary Engineering Report Amendment 1 (August 2009), Engineering Services Inc.
** Center for Business and Economic Research, University of Arkansas

As stated previously, the users of MCRWD are very conservative with their water. Like the OMRPWA users, their per capita average daily usage is expected to rise, from 48 gpd to 55 gpd (a 15% increase).

4.1.4 Peaking Factor

The peaking factor is the ratio of the maximum flow during a specified time interval to the average annual flow. As seen in Table 4.2, the peaking factor for OMRPWA equals a ratio of 2:1. According to officials at MCRWD the peaking factor for their system is 1:1.

4.1.5 Water Demand

Given population data, average per capita daily usage, and peaking factors, current and future water demand can be estimated for OMRPWA and MCRWD. For this evaluation, the base year is 2012, given two years either to obtain a water supply contract with USACE or to negotiate a contract with another entity for water. With acquisition of clean and safe water, the members of OMRPWA can grant the current requests for extensions. These individuals are added to the 2008 population to create a Base Year Population.

Data for water demand by usage (residential, commercial, industrial, agricultural, etc.) is unavailable for the water systems within OMRPWA and MCRWD.

Three growth scenarios were developed for this evaluation: Low, Mid, and High. For the purpose of calculating future demand, the Mid-Growth scenario is used to forecast population. Population forecast is presented in Table 4.8. Water demand for OMRPWA is shown in Table 4.9.

Table 4.8 Ozark Mountain Regional Public Water Authority Population Growth

Water System	Current Users	Extension Requests	2012 Base Population	Annual Growth Rate			2062 Population		
				Low	Mid	High	Low	Mid	High
Newton County									
City of Jasper	1,530								
Mt Sherman	775	37							
Nail-Swain	1,975	250							
East Newton County	1,650	113							
Mockingbird Hill	800			**0.17%**	**1.30%**	**2.43%**			
Deer	900	62							
Lurton-Pelsor	300								
Western Grove	1,070	125							
Parthenon	400								
Subtotal*	**9,400**	**587**	**9,987**				**10,872**	**19,051**	**33,174**
Searcy County									
SPG	1,400	100							
Marshall	2,400	500							
South Mountain	700	50		**-0.32%**	**0.20%**	**0.72%**			
SDM	400								
Leslie	800								
Morning Star	1,375								
Subtotal	**7,075**	**650**	**7,725**				**6,581**	**8,537**	**11,058**
Boone County									
Valley Springs	3,750								
Diamond City	700								
Lead Hill	515			**0.85%**	**2.13%**	**3.41%**			
Lake Bull Shoals Estates	60								
Subtotal	**5,025**	**0**	**5,025**				**7,672**	**14,415**	**26,870**
SUBTOTAL	**21,500**	**1,237**	**22,737**				**25,126**	**42,002**	**71,102**

Source: Preliminary Engineering Report Amendment 1 (August 2009), Engineering Services, Inc.

*Population of Newton County is 8,298. Users of the Western Grove, Lurton-Peslor, and Nail-Swain cross county borders.

Table 4.9 Ozark Mountain Regional Public Water Authority Water Demand Forecast - Mid Growth, Mid Usage

Year	Users			Average Usage (gpcd*)	Average Daily Use (gpd**)			Peaking Factor	Maximum Daily Use (gpd**)		
	Low	Mid	High		Low	Mid	High		Low	Mid	High
2012	22,737	22,737	22,737	90	2,046,330	2,046,330	2,046,330	2.0	4,092,660	4,092,660	4,092,660
2022	23,196	25,706	28,560	90	2,087,627	2,313,540	2,570,425	2.0	4,175,254	4,627,080	5,140,850
2032	23,664	29,063	35,875	90	2,129,757	2,615,670	3,228,748	2.0	4,259,514	5,231,340	6,457,496
2042	24,142	32,859	45,063	90	2,172,737	2,957,310	4,055,677	2.0	4,345,475	5,914,620	8,111,354
2052	24,629	37,150	56,604	90	2,216,585	3,343,500	5,094,395	2.0	4,433,170	6,687,000	10,188,789
2062	25,126	42,002	71,102	90	2,261,318	3,780,180	6,399,143	2.0	4,522,636	7,560,360	12,798,286

* Gallons per capita per day
** Gallons per day

The equivalent tables for MCRWD are Table 4.10 and Table 4.11.

Table 4.10 Marion County Regional Water District Population Growth

	Base Population	Annual Growth Rate			2062 Population		
		Low	Mid	High	Low	Mid	High
Marion County	18,779	1.20%	2.80%	4.40%	34,096	74,701	161,695

Table 4.11 Marion County Regional Water District Water Demand Forecast - Mid Growth, Mid Usage

Year	Population			Average Usage (gpcd*)	Average Daily Use (gpd**)			Peaking Factor	Maximum Daily Use (gdp**)		
	Low	Mid	High		Low	Mid	High		Low	Mid	High
2012	18,779	18,779	18,779	55	1,032,845	1,032,845	1,032,845	1.0	1,032,845	1,032,845	1,032,845
2022	21,158	24,752	28,885	55	1,163,698	1,361,360	1,588,694	1.0	1,163,698	1,361,360	1,588,694
2032	23,839	32,624	44,431	55	1,311,129	1,794,320	2,443,684	1.0	1,311,129	1,794,320	2,443,684
2042	26,859	43,000	68,342	55	1,477,238	2,365,000	3,758,808	1.0	1,477,238	2,365,000	3,758,808
2052	30,262	56,676	105,122	55	1,664,392	3,117,180	5,781,694	1.0	1,664,392	3,117,180	5,781,694
2062	34,096	74,701	161,695	55	1,875,257	4,108,555	8,893,241	1.0	1,875,257	4,108,555	8,893,241

* Gallons Per Capita Per Day
** Gallons Per Day

These estimates are based on historic population growth using census data and historic growth patterns provided by the University of Arkansas.

4.1.6 Water Supply

For members of OMRPWA, the three sources of water that are free of radium 226, radium 228, fluoride, radon, and hydrogen sulfide are from the city of Marshall, Nail-Swain, and Lake Bull Shoals Estates. The water supplied by these entities totals approximately 700,000 gpd. This supply is not expected to increase over time. The water deficit for OMRPWA is shown in Table 4.12. OMRPWA has requested an amount of storage which can yield 6 MGD. Their project through USDA will construct a water treatment facility for 4.5 MGD, expandable to 6 MGD. Given the water demand forecast, OMRPWA has a current need for 3.4 MGD, expanding to 4.5 MGD by 2032 and 6 MGD by 2052.

Table 4.12 Ozark Mountain Regional Public Water Authority Water Supply Forecast - Water Deficit

Year	Maximum Daily Use (gdp*)			Water Supply (gpd*)**	Water Deficit (gpd*)		
	Low	Mid	High		Low	Mid	High
2012	4,092,660	4,092,660	4,092,660	700,000	3,392,660	3,392,660	3,392,660
2022	4,175,254	4,627,080	5,140,850	700,000	3,475,254	3,927,080	4,440,850
2032	4,259,514	5,231,340	6,457,496	700,000	3,559,514	4,531,340	5,757,496
2042	4,345,475	5,914,620	8,111,354	700,000	3,645,475	5,214,620	7,411,354
2052	4,433,170	6,687,000	10,188,789	700,000	3,733,170	5,987,000	9,488,789
2062	4,522,636	7,560,360	12,798,286	700,000	3,822,636	6,860,360	12,098,286
* Gallons per day							
** Non-contaminated sources: Nail-Swain, Marshall, Leslie, and Lake Bull Shoals Estates							

For MCRWD, the only source of water is through the USACE water supply contract for 880 ac-ft along with 818 ac-ft dependable yield mitigation from WRMF implementation. The yield from the total storage equals approximately 1 MGD. The water deficit for MCRWD is shown in Table 4.13.

Table 4.13 Marion County Regional Water District Water Supply Forecast - Water Deficit

Year	Maximum Daily Use (gdp*)			Water Supply (gpd*)	Water Deficit (gpd*)		
	Low	Mid	High		Low	Mid	High
2012	1,032,845	1,032,845	1,032,845	1,000,000	32,845	32,845	32,845
2022	1,163,698	1,361,360	1,588,694	1,000,000	163,698	361,360	588,694
2032	1,311,129	1,794,320	2,443,684	1,000,000	311,129	794,320	1,443,684
2042	1,477,238	2,365,000	3,758,808	1,000,000	477,238	1,365,000	2,758,808
2052	1,664,392	3,117,180	5,781,694	1,000,000	664,392	2,117,180	4,781,694
2062	1,875,257	4,108,555	8,893,241	1,000,000	875,257	3,108,555	7,893,241
* Gallons Per Day							

4.2 Water Supply Alternatives Benefits

According to the Water Supply Handbook (IWR Report 96-PS-4):

> Briefly describe each of the alternatives investigated as alternative sources of water. Such sources could be "no action", wells, and/or a pipe line from another reservoir. This documents the users alternative to reallocation of storage in the Federal reservoir and is considered to be the "benefit" associated with reallocation. This "benefit" value (economic and environmental) should be higher than the economic and environmental cost associated with reallocation. These alternatives should be described in enough detail to establish a price for a similar quality and quantity of water that is being received from the Federal project.

Section 3 presents several without-project alternatives developed for OMRPWA and

MCRWD. These alternatives include purchasing water wholesale from the city of Clarksville, requesting reallocated storage from Norfork, and requesting reallocated storage from Greers Ferry. Each source is of equal quality, and each source is measured in equal quantity. In Section 6.0, the least cost most likely alternative will be compared to the annual cost of reallocated storage from Bull Shoals Lake.

4.2.1 Alternatives for Ozark Mountain Regional Public Water Authority

4.2.1.1 Reallocate Water from Greers Ferry

This alternative consists of constructing a water treatment facility on Greers Ferry Lake to treat water supplied to the OMRPWA members. The water treatment facility would be constructed near Greers Ferry Lake. The treated water transmission mains would then be installed from Greers Ferry Lake through Searcy County to Newton and Boone Counties to serve all OMRPWA members.

4.2.1.2 Reallocate Water from Norfork

This alternative consists of constructing a water treatment facility on Norfork Lake to treat water supplied to the OMRPWA members. The water treatment facility would be constructed near Salesville. The treated water transmission mains would then be installed from Norfork Lake through Searcy County to Newton and Boone Counties to serve all OMRPWA members.

4.2.1.3 Purchase Water from the City of Clarksville

According to the Clarksville Light & Water plant engineer, the current capacity of the water treatment plant is 15 MGD, and has the ability to sell 7 to 8 MGD. Wholesale price for water is approximately $2 per 1,000 gallons.

4.2.1.4 Alternatives Summary

Preliminary cost estimates for these three alternatives are presented in Tables 4.14 and 4.15. Costs are listed at the Fiscal Year (FY) 2010 price level, which began October 1, 2009. FY 2010 levels are obtained by indexing up base year prices to October 2009 levels. Given these cost estimates, requesting reallocation of storage from Norfork Lake is the most likely least cost alternative and will be carried forward and compared to the cost of storage from Bull Shoals Lake in Section 6.1.

Table 4.14 Ozark Mountain Regional Public Water Authority Cost Estimate for 6 MGD

	Clarksville	Norfork	Greers Ferry
Construction Item			
New Water Treatment Facility	$0	$6,750,000	$9,033,300
Intake Structure and Raw Water Pumping Facility	$0	$2,800,000	$7,039,300
Pipe	$42,470,000	$44,916,500	$51,215,500
Trenching	$8,228,500	$8,412,500	$11,747,200
Booster Pumping Stations	$2,150,000	$3,000,000	$624,700
Water Storage Tanks	$2,650,000	$3,150,000	$2,921,800
Estimated Construction Cost	**$55,498,500**	**$69,029,000**	**$82,581,800**
Contingency (10%)	$5,549,900	$6,902,900	$8,258,200
Preliminary Engineering and Environmental Report	$50,000	$50,000	$50,000
Planning, Engineering and Design (6.5%)	$3,607,400	$4,486,900	$5,367,800
Construction Supervision (10%)	$5,549,900	$6,902,900	$8,258,200
Environmental, Legal, Real Estate, Administrative	$475,000	$475,000	$475,000
Project First Cost	**$70,730,700**	**$87,846,700**	**$104,991,000**
Operations, Maintenance, Repair, Rehabilitation, and Replacement			
Administrative	$10,000	$20,000	$20,000
Operating Salary, Taxes, Insurance	$80,000	$160,000	$160,000
Operator Vehicle, Insurance, Fuel	$12,500	$12,500	$12,500
Insurance for Facilities	$7,500	$30,000	$30,000
Accounting and Auditing	$17,500	$17,500	$17,500
Utilities	$12,800	$12,800	$12,800
Laboratory	$2,500	$20,000	$20,000
Intake and Water Treatment Facility Electrical	$0	$150,000	$150,000
Booster Pumping Electrical	$450,000	$450,000	$1,200,000
Chemicals	$0	$50,000	$50,000
Water Cost*	$4,380,000	$166,600	$60,000
Arkansas Department Environmental Quality Permits & Fees	$5,000	$5,000	$5,000
Miscellaneous	$5,000	$5,000	$5,000
Major Repair, Rehabilitation, and Replacement	$25,000	$60,000	$60,000
Annual Costs	**$5,007,800**	**$1,159,400**	**$1,802,800**
*Calculated water cost based on $2 per thousand gallons for Clarksville; calculated water cost based on updated cost of storage for Norfork and Greers Ferry.			
Sources: Preliminary Engineering Report (May 2005, revised April 2009), Engineering Services, Inc. Figure 5.9; Figure 5.15; 10% concept design by SWL engineers; recalculated contingency, PED, supervision percentages using typical SWL percentages			

Table 4.15 Ozark Mountain Regional Public Water Authority Economic Analysis

	Clarksville	Norfork	Greers Ferry
Period of Analysis (years)	50	50	50
Interest Rate	4.375%	4.375%	4.375%
Construction Period, years	1.667	1.667	1.667
Project First Costs	$70,730,700	$87,846,700	$104,991,000
Interest during Construction	$3,959,000	$4,917,000	$5,876,000
Total Project Cost	**$74,689,700**	**$92,763,700**	**$110,867,000**
Annual Costs:			
Interest	$3,267,700	$4,058,400	$4850,400
Amortization	$435,200	$540,500	$646000
OMRR&R	$5,007,800	$1,159,400	$1,802,800
Total Annual Costs	**$8,710,700**	**$5,758,300**	**$7,299,200**

4.2.2 Alternatives for Marion County Regional Water District

Given that MCRWD currently has a water storage contract for 880 ac-ft in Bull Shoals Lake, this section provides a limited comparison to the cost of alternatives listed in Section 3.

Preliminary cost estimates for three alternatives are presented at the FY 2010 price level in Tables 4.16 and 4.17. Given these cost estimates, requesting reallocation of storage from Norfork Lake is the most likely least cost alternative and will be carried forward and compared to the cost of storage from Bull Shoals Lake in Section 6.1.

Table 4.16 Marion County Regional Water District Cost Estimate for 1 MGD

	Clarksville	Norfork	Greers Ferry
Construction Item			
New Water Treatment Facility	$0	$3,616,000	$3,610,000
Intake Structure and Raw Water Pumping Facility	$0	$1,561,000	$1,560,000
Pipe	$43,177,000	$7,667,000	$17,190,000
Trenching	$8,749,000	$3,829,000	$8,590,000
Booster Pumping Stations	$2,550,000	$135,000	$270,000
Water Storage Tanks	$2,650,000	$1,385,000	$1,380,000
Estimated Construction Cost	**$57,126,000**	**$18,193,000**	**$32,600,000**
Contingency (10%)	$5,712,600	$1,819,300	$3,260,000
Preliminary Engineering and Environmental Report	$50,000	$50,000	$50,000
Planning, Engineering and Design (6.5%)	$3,713,200	$1,182,500	$2,119,000
Construction Supervision (10%)	$5,712,600	$1,819,300	$3,260,000
Environmental, Legal, Real Estate, Administrative	$475,000	$475,000	$475,000
Project First Cost	**$72,789,400**	**$23,539,100**	**$41,764,000**
Operations, Maintenance, Repair, Rehabilitation & Replacement			
Administrative	$10,000	$20,000	$20,000
Operating Salary, Taxes, Insurance	$80,000	$160,000	$160,000
Operator Vehicle, Insurance, Fuel	$12,500	$12,500	$12,500
Insurance for Facilities	$7,500	$30,000	$30,000
Accounting and Auditing	$17,500	$17,500	$17,500
Utilities	$12,800	$12,800	$12,800
Laboratory	$2,500	$20,000	$20,000
Intake and Water Treatment Facility Electrical	$0	$60,000	$60,000
Booster Pumping Electrical	$360,000	$82,500	$360,000
Chemicals	$0	$20,000	$20,000
Water Cost*	$730,000	$27,800	$10,000
Arkansas Department Environmental Quality Permits & Fees	$5,000	$5,000	$5,000
Miscellaneous	$5,000	$5,000	$5,000
Major Repair, Rehabilitation, and Replacement	$15,000	$40,000	$40,000
Annual Costs	**$1,257,800**	**$513,100**	**$772,800**
*Calculated water cost based on $2 per thousand gallons for Clarksville; calculated water cost based on updated cost of storage for Norfork and Greers Ferry.			
10% design by SWL engineers; recalculated contingency, PED, supervision percentages use typical SWL percentages			

Table 4.17 Marion County Regional Water District

Economic Analysis	Clarksville	Norfork	Greers Ferry
Period of Analysis (years)	50	50	50
Interest Rate	4.375%	4.375%	4.375%
Construction Period, years	1.667	1.667	0.500
Project First Costs	$72,789,400	$23,539,100	$41,764,000
Interest During Construction	$4,074,000	$1,317,000	$2,338,000
Total Project Cost	**$76,863,400**	**$24,856,100**	**$44,102,000**
Annual Costs:			
Interest	$3,362,800	$1,087,500	$1,929,500
Amortization	$447,900	$144,800	$257,000
OMRR&R	$1,257,800	$513,100	$772,800
Total Annual Costs	**$5,068,500**	**$1,745,400**	**$2,959,300**

Section 5
Derivation of User Cost

5.0 DERIVATION OF USER COST

5.1 Yield/Storage Analysis

Three options will be evaluated to reallocate storage in Bull Shoals Lake. The effects of reallocating storage from current flood storage, conservation (hydroelectric power) storage, and inactive storage will be considered. Appendix D contains the in-depth hydroelectric power analysis. Current storage and associated expected yields are based on a conservation pool located between elevations 628.5 and 659 which contains 1,236,000 ac-ft of storage. The dependable yield of this storage during the drought of record was determined to be 727.882 MGD.

5.1.1 Conservation Pool

When storage is reallocated from the conservation pool there is no change in the yield/storage ratio of the pool. The reallocation is made directly from hydroelectric power storage causing both a reduction in their existing storage and a reduction in their yield. A reallocation from the existing conservation pool for OMRPWA of 10,188.463 ac-ft of hydroelectric power storage to M&I water supply purposes is estimated to provide a dependable yield of 6.0 MGD. The reallocation will reduce hydroelectric power yield by 6 MGD and their storage by 10,188.463 ac-ft. A reallocation from the existing conservation pool for MCRWD of 1,698.077 ac-ft of hydroelectric power storage to M&I water supply purposes is estimated to provide a dependable yield of 1 MGD. The reallocation will reduce hydroelectric power yield by 1 MGD and their storage by 1,698.077 ac-ft. A review of this information is shown in Table 5.1

Table 5.1 Firm Yield Storage and Dependable Yield Mitigation Storage at Bull Shoals Lake
Alternative 2 - Reallocation From Conservation Pool

Water Supply User	Proposed Conservation Pool Top EL 659.00 FT		
	Proposed Yield MGD	Proposed Storage AF	DYMS AF
Marion County Regional (2nd reallocation)	**1.000**	**1,698.077**	
Ozark Mountain Regional (1st reallocation)	**6.000**	**10,188.463**	
Marion County Regional	1.000	1,698.077	
Minimum Flows	71.686	121,729.000	
Hydroelectric power	648.196	1,100,686.382	
Total Yield (as per SUPER data)	727.882		
Total Storage (as per SUPER data)		1,236,000.000	
Yield/Storage Ratio	0.0005889014		

5.1.2 Flood Pool

As the storage in the conservation pool is increased by reallocation from the flood pool, the yield/storage relationship changes. To determine the yield as the storage is increased it is necessary to reference the yield/storage curve for Bull Shoals Lake. The new dependable yield was determined by using the SUPER model. This method determined that 1,248,000 ac-ft of storage to provide a yield of 731.631 MGD would raise the top of the conservation pool by 0.25 feet (3 inches), from 659 to 659.25.

When storage is taken from the flood pool by raising the top of the conservation pool, the yield/storage ratio typically decreases and the amount of storage allocated to each existing water supply user must be increased to maintain their expected yield. This additional storage is called "dependable yield mitigation storage" or DYMS. As stated in EC 1105-2-100, Reallocation of Flood Control Storage to Municipal and Industrial Water Supply – Compensation Considerations, "It is Corps policy not to provide DYMS for hydroelectric power as is done for existing water supply users." Therefore, no DYMS is added to hydroelectric power which results in their storage remaining constant and their yield decreasing. Each time additional storage is requested for reallocation from the flood pool, a calculation is made estimating the requested dependable yield, and the DYMS for existing users.

Since OMRPWA is expected to sign a water supply contract before MCRWD, Ozark will be the first to provide DYMS to other water supply users if a reallocation from the flood pool is made. In this case, the only other water user is MCRWD, with an existing contract for 880 ac-ft of storage (and an additional 818.077 ac-ft DYMS from WRMF project). To keep Marion County whole, Ozark will have to provide 6.781 ac-ft of storage to Marion County water users. A review of this information is provided in Table 5.2.

Table 5.2 Firm Yield Storage and Dependable Yield Mitigation Storage at Bull Shoals Lake - Alternative 3 – Reallocation From Flood Pool, OMRPWA

Water Supply User	Proposed Conservation Pool Top EL 659.22 FT*		
	Proposed Yield MGD	**Proposed Storage AF**	**DYMS AF**
Marion County Regional (2nd reallocation)	0.000	0.000	
Ozark Mountain Regional (1st reallocation)	**6.000**	**10,229.151**	
Marion County Regional	1.000	1,704.859	**6.781**
Minimum Flows	71.401	121,729.000	
Hydroelectric power	652.590	1,112,572.923	
Total Yield (as per SUPER data)	731.181		**6.781**
Total Storage (as per SUPER data)		1,246,560.000	
Yield/Storage Ratio	0.0005865589		
*NOTE: Rounding up to pool elevation 659.22 results in 324.067 ac-ft of non-allocated storage.			

When MCRWD signs a supplemental water supply contract, Marion County will provide DYMS to other water supply users: Ozark and themselves. To keep OMRPWA whole, Marion County will have to provide 5.520 ac-ft of storage to Ozark water users, and 0.920 ac-ft to their own users. A review of this information is provided in Table 5.3.

Table 5.3 Firm Yield Storage and Dependable Yield Mitigation Storage at Bull Shoals Lake - Alternative 3 - Reallocation From Flood Pool, MCRWD

Water Supply User	**Proposed Conservation Pool Top EL 659.25 FT***		
	Proposed Yield MGD	**Proposed Storage AF**	**DYMS AF**
Marion County Regional (2nd reallocation)	**1.000**	**1,705.779**	
Ozark Mountain Regional (1st reallocation)	6.000	10,234.671	**5.520**
Marion County Regional	1.000	1,705.779	**0.920**
Minimum Flows	71.363	121,729.000	
Hydroelectric power	652.238	1,112,572.923	
Total Yield (as per SUPER data)	731.631		**6.440**
Total Storage (as per SUPER data)		1,248,000.000	
Yield/Storage Ratio	0.0005862426		
*NOTE: Rounding up to pool elevation 659.25 ft results in 51.849 ac-ft of non-allocated storage.			

5.1.3 Inactive Pool

At Bull Shoals Lake, while the inactive pool is between elevations 450 and 628.5, the maximum probable drawdown is elevation 588. The inactive pool from elevations 588 to 628.5 contains storage for the following authorized purposes: emergency power and water supply, and uses of recreation, fish habitat, and sediment.

As the storage in the conservation pool is increased by reallocation from the inactive pool, the yield/storage relationship changes. To determine the yield as the storage is increased it is necessary to reference the yield/storage curve for Bull Shoals Lake. The new dependable yield was determined by using the SUPER model. This method determined that 1,248,240 ac-ft of storage providing a yield of 732.032 MGD, modifies the bottom of the conservation pool from elevations 628.5 to 628.14.

When storage is taken from the inactive pool by lowering the bottom of the conservation pool the yield/storage ratio typically decreases and the amount of storage allocated to each existing water supply user must be increased to maintain their expected yield. This additional storage is called “dependable yield mitigation storage” or DYMS. As stated in EC 1105-2-100, Reallocation of Flood Control Storage to Municipal and Industrial Water Supply – Compensation Considerations, “It is Corps policy not to provide DYMS for hydroelectric power as is done for existing water supply users.” Therefore, no DYMS is added to hydroelectric power which results in their storage remaining constant and their yield decreasing. Each time additional storage is requested for reallocation from the inactive pool, a calculation is made estimating the requested dependable yield, and the DYMS for existing users.

Since OMRPWA is expected to sign a water supply contract before MCRWD, Ozark will be the first to provide DYMS to other water supply users. In this case, the only other water user is MCRWD, with an existing contract for 880 ac-ft of storage (and an additional 818.077 ac-ft DYMS from White River Minimum Flows project). To keep Marion County whole, Ozark will have to provide 6.113 ac-ft of storage to Marion County water users. A review of this information is provided in Table 5.4.

Table 5.4 Firm Yield Storage and Dependable Yield Mitigation Storage at Bull Shoals Lake - Alternative 4 - Reallocation From Inactive Pool, OMRPWA

Water Supply User	Proposed Bottom Conservation Pool Top EL 659.00 FT - Bottom 628.19 FT*		
	Proposed Yield MGD	**Proposed Storage AF**	**DYMS AF**
Marion County Regional (2nd reallocation)	0.000	0.000	
Ozark Mountain Regional (1st reallocation)	**6.000**	**10,225.139**	
Marion County Regional	1.000	1,704.190	**6.113**
Minimum Flows	71.429	121,729.000	
Hydroelectric power	652.846	1,112,572.923	
Total Yield (as per SUPER data)	731.456		**6.113**
Total Storage (as per SUPER data)		1,246,540.000	
Yield/Storage Ratio	0.0005867891		
*NOTE: Rounding down to pool elevation 628.19 ft results in 308.748 of non-allocated storage.			

When MCRWD signs a supplemental water supply contract, Marion County will provide DYMS to other water supply users: Ozark and themselves. To keep OMRPWA whole, Marion County will have to provide 5.882 ac-ft of storage to Ozark water users, and 0.980 ac-ft to their own users. A review of this information is provided in Table 5.5.

Table 5.5 Firm Yield Storage and Dependable Yield Mitigation Storage at Bull Shoals Lake - Alternative 4 - Reallocation From Inactive Pool, MCRWD

Water Supply User	Proposed Bottom Conservation Pool Top EL 659.00 FT - Bottom 628.14 FT*		
	Proposed Yield MGD	**Proposed Storage AF**	**DYMS AF**
Marion County Regional (2nd reallocation)	**1.000**	**1,705.170**	
Ozark Mountain Regional (1st reallocation)	6.000	10,231.021	**5.882**
Marion County Regional	1.000	1,705.170	**0.980**
Minimum Flows	71.388	121,729.000	
Hydroelectric power	652.470	1,112,572.923	
Total Yield (as per SUPER data)	732.032		**6.862**
Total Storage (as per SUPER data)		1,248,240.000	
Yield/Storage Ratio	0.0005864517		
*NOTE: Rounding down to pool elevation 628.14 ft results in 296.716 ac-ft of non-allocated storage.			

5.2 Impacts to Other Project Purposes

5.2.1 Hydroelectric Power Benefits Foregone

Hydroelectric power benefits are based on the cost of the most likely alternative source of power. When storage is reallocated for water supply and an impact occurs to hydroelectric power, the power benefits foregone are equivalent to the cost of replacing the lost power with the most likely alternative source of power.

The power benefits foregone can be divided into two components: lost energy benefits and lost capacity benefits. In the case of water supply withdrawals, there is usually a loss of energy benefits. Lost energy benefits are based on the loss in generation (both at-site and downstream) as a result of water being diverted from the reservoir for water supply rather than passing through the hydroelectric power plant.

In addition, there could be a loss of capacity benefits as a result of a loss in dependable capacity at the project. Dependable capacity could be lost as a result of:

- a loss in head due to lower post-withdrawal reservoir elevations
- a reduction in the usability of the capacity due to inadequate energy to support the full capacity during low-flow periods.

The hydroelectric power benefits foregone due to the two possible reallocations are listed in Table 5.6 in FY 2010 dollars.

Table 5.6 Hydroelectric Power Benefits Foregone

	Alternatives		
	Conservation Pool	**Flood Pool**	**Inactive Pool**
Bull Shoals			
Annual energy benefits foregone (peak)	$68,232.00	$59,505.00	$63,990.00
Annual energy benefits foregone (off-peak)	$9,970.00	($4,142.00)	$9,597.00
Annual capacity benefits foregone	$116.00	($116.00)	$116.00
Total Bull Shoals	$78,318.00	$55,247.00	$73,703.00
Norfork*			
Annual energy benefits foregone (peak)	($2,644.00)	$2,723.00	($2,429.00)
Annual energy benefits foregone (off-peak)	$2,010.00	($1,636.00)	$1,851.00
Annual capacity benefits foregone	$243.00	$0.00	$243.00
Total Norfork	($391.00)	$1,087.00	($335.00)
Annual Hydroelectric Power Benefits Foregone	$77,927.00	$56,334.00	$73,368.00

Note: Negative numbers appearing in the table are hydropower benefits which come from a reallocation, rather than benefits foregone from the reallocation. Negative are a negligible amount of the total Hydropower Benefits Foregone.
*Associated impacts to Norfork, not Norfork next most likely alternative.

The 1998 data for Bull Shoals show the generating capability to be the same for all alternatives but the generation was less than the capability, limiting the supportable capacity in that year of the analysis. The dependable capacity is the average supportable capacity over the period of the simulation. The dependable capacity loss was greatest for the reallocation from Flood Control storage.

The reservoir system is operated to maintain a balance in the remaining portion of the seasonally defined flood control storage space. Downstream river flow criteria have been established at downstream control points to achieve project benefits. The regulating discharge criteria are supplied for all stream control points (including reservoir outflow controls) as a seasonal function of a system state parameter. Runoff forecast and these criteria are used by a system model which iteratively computes reservoir discharges which balances the remaining reservoir storage without exceeding downstream control point criteria. Consequently, the reallocation of storage at Bull Shoals Lake for increased water supply demands also has impacts at Norfork Lake.

5.2.2 Hydroelectric Power Revenues Foregone

Hydroelectric power revenues foregone are based on the value of the lost power based on the power marketing agency's rates. The energy charge is applied to the average annual energy losses and the capacity charge is applied to the loss in marketable capacity. The hydroelectric power revenues foregone due to the three possible reallocations are listed in Table 5.7 in FY 2010 dollars.

Table 5.7 Hydroelectric Power Revenues Foregone

Revenue Foregone	Alternatives		
	Conservation Pool	Flood Pool	Inactive Pool
Bull Shoals			
Annual energy revenues foregone (peak)	$17,075.00	$13,755.00	$15,943.00
Annual energy revenues foregone (off-peak)	$2,098.00	($903.00)	$1987.00
Annual capacity revenues foregone	$759.00	($537.00)	$703.00
Total Bull Shoals	$19,932.00	$12,315.00	$18,633.00
Norfork*			
Annual energy revenues foregone (peak)	($643.00)	$291.00	($597.00)
Annual energy revenues foregone (off-peak)	$499.00	($17.00)	$473.00
Annual capacity revenues foregone	$147.00	($294.00)	$0.00
Total Norfork	$3.00	($20.00)	($124.00)
Annual Hydroelectric Power Revenues Foregone	$19,935.00	$12,295.00	$18,509.00
Note: Negative numbers appearing in the table are hydropower benefits which come from a reallocation, rather than benefits foregone from the reallocation. Negative are a negligible amount of the total Hydropower Benefits Foregone. *Associated impacts to Norfork, not Norfork next most likely alternative.			

5.2.3 Hydroelectric Power Replacement Cost

In the case of hydroelectric power, the power benefits foregone are, by definition, identical to the NED cost of replacement power, based on the cost of the most likely alternative source of replacement power. Therefore, the replacement cost of power is the value of the power benefits foregone as shown in Table 5.6.

5.2.4 Flood Control Benefits Foregone

SUPER was used to simulate the hydrology and hydraulics for existing conditions and model storage reallocation and release scenarios. SUPER simulated the water management operations of the White River multipurpose reservoir system based upon a 69-year hydrological record. SUPER also contains modules that relate benefits and losses for project purposes to the hydrologic and hydraulic modeling scenarios. When the White River Basin is operated as a whole system, changes at Bull Shoals affect pool elevations and durations. These affect the hydropower releases and flood releases made at all the other lakes, which in turn, affect the pool elevations and durations at all of the other White River Basin Lakes. Given the system effects, impacts to all the White River Basin Lakes are listed in the following tables.

The SUPER model analyzed the incremental change in flood storage capability and simulated future conditions along downstream river reaches. The annual losses are the incremental difference in flood damages for the "with" and "without" project conditions. The reaches downstream of Bull Shoals and Norfork reservoirs are very rural and consist primarily of farmland and forests. The flood damages estimated at Bull Shoals and

Norfork consist of potential damages to crops, such as corn, cotton, rice, soybeans, and pastures. There are several small communities within close proximity to the White River; the largest are Batesville and Newport, Arkansas. SUPER model stage damage curves contain a code for "other damages" representing the few fences, barns, and other structures. For flood control calculations, the SUPER model relies upon historic depth-damage curves for the White River Basin, adjusted in 1994 for changes in the structure and crop inventory. Price levels are adjusted from 1994 prices to FY 2010 prices using the ENR Construction Cost Index. (Given that flood damages are a combination of agricultural and structural damages, a ratio of the Index of Annual Average Prices Received by Farmers was made between 2009 and 1994. The ratio equaled 1.43; the ratio of ENR Construction Cost Index from 1994 to 2009 equaled 1.59.) Table 5.8 shows the flood damages updated to FY 2010 prices for the base condition and the three alternatives.

Table 5.8 Average Annual Downstream Flood Damages by Alternative - October 2009 values ($1,000)

Reach	Base	Conservation	Flood	Inactive
Table Rock	193.6	192.9	193.9	193.1
Bull Shoals	17.8	17.8	17.8	17.8
Greers Ferry	1.6	1.6	1.6	1.6
Poplar Bluff (Upper)	144.5	144.3	144.8	144.3
Poplar Bluff (Lower)	3,337.6	3,337.3	3,346.4	3,337.3
Corning	1,321.7	1,321.3	1,322.1	1,321.3
Pocahontas	1,527.4	1,527.4	1,527.2	1,527.4
Black Rock (Upper)	2,963.4	2,963.5	2,963.1	2,963.5
Black Rock (Lower)	1,259.4	1,259.4	1,259.1	1,259.4
Calico Rock	592.1	592.1	592.8	592.1
Batesville (Upper)	48.2	48.0	48.2	48.0
Batesville (Lower)	1,256.7	1,256.9	1,257.9	1,256.9
Newport	6,352.7	6,350.6	6,352.5	6,350.6
Augusta	3,097.4	3,101.6	3,097.7	3,101.6
Georgetown	3,658.5	3,658.3	3,655.0	3,658.3
Clarendon (Upper)	1,124.5	1,123.7	1,123.9	1,123.7
Clarendon (Middle)	4,582.8	4,586.3	4,586.8	4,586.4
Clarendon (Lower)	5,548.9	5,546.5	5,549.7	5,547.4
Total Flood Damages	**37,028.8**	**37,029.7**	**37,040.2**	**37,031.0**
Change In Flood Damages ($1000)		**0.9535**	**11.4423**	**2.2249**
Change in Flood Damages ($)		**954**	**11,442**	**2,225**

In-pool losses are those damages within the lake reservoir area that would include recreation facilities, such as boat ramps, camping, and picnic facilities. Losses shown in Table 5.9 provide a comparison of each alternative with the base condition.

Table 5.9 Average Annual In-Pool Damages by Alternative - October 2009 values ($1,000)

	Base	Conservation	Flood	Inactive
Beaver	47.4	47.4	47.2	47.4
Table Rock	121.7	121.7	121.7	121.7
Bull Shoals	123.0	122.1	123.2	122.1
Norfork	126.8	126.7	127.0	126.7
Greers Ferry	149.1	149.1	149.1	149.1
Clearwater	28.4	28.4	28.4	28.4
Total Flood Damages	**596.4**	**595.3**	**596.6**	**595.3**
Change In Flood Damages ($1000)		**-1.1**	**0.2**	**-1.1**
Change in Flood Damages ($)		**-1,112**	**159**	**-1,112**

The amount of flood damage associated with implementation of this storage reallocation is considered to be insignificant when compared to the total flood damages the reservoirs are estimated to prevent. For comparison, in FY 2009 Bull Shoals Lake is estimated to have prevented $10,200,000 in flood damages. Also, in FY 2009, Norfork Lake is estimated to have prevented $2,700,000 in flood damages.

5.2.5 Recreation Benefits

The impact to lake recreation was calculated using the SUPER model. SUPER uses seasonal visitor day curves to calculate recreation benefits with respect to pool elevation. The SUPER model analyzes historical information to estimate damages based on changes to stage and duration levels. There is a negative correlation between high-water conditions and visitor accessibility. SUPER model used the historical data and unit day values to determine the change in recreation benefits. If storage is reallocated from the conservation pool or inactive pool, there is no rise in the conservation pool. Recreational changes are negligible. If storage is reallocated from the flood pool, there is a three-inch raise to the top of the conservation pool. Since the White River Basin Lakes are operated as a system, the changes in Bull Shoals pool elevations and pool durations affect the hydropower and flood releases at both Bull Shoals and Norfork. In turn, the other White River Basin Lakes' pool elevations and durations are affected. A reallocation from the flood pool, while only three inches of storage, has rippling effects across the recreational opportunities of the entire White River Basin.

The unit day value estimate was based on a point scale where points were assigned, by informed opinion, to five different categories: Recreation Experience, Availability of Opportunity, Carrying Capacity, Accessibility, and Environmental Quality. This value was used in conjunction with the SUPER model's stage duration and visitor data to determine the change in recreation benefits due to a change in stage and duration.

Recreation visitation data was updated in SUPER in 1994. To adjust the values to FY2010, an analysis of the five unit day value categories and annual visitor hours was performed. To assess the possible change in Recreation Experience, Availability of Opportunity, Carrying Capacity, Accessibility, and Environmental Quality, a group of District personnel, who are familiar with the White River lakes, were given the

Guidelines for Assigning Points for General Recreation (Table 1, Economic Guidance Memorandum 10-03 and asked to compare the five categories of recreational experience at each lake in 1994 to 2010. No significant changes have occurred that would change the total point values for each lake. Visitor hours for each lake were compiled for the years 1994 to 2010. The only lake with a significant change in visitor hours is Table Rock. Visitor hours between 1994 – 1996 ranged between 35 million and 40 million; visitor hours between 1997 and 2008 ranged between 14 million and 20 million. Given that recreational benefits is a combination of unit day value and visitor days, the SUPER benefits for Table Rock were multiplied by ½ to adjust for the 50 percent drop in visitation. To update unit day values, SUPER recreational benefits were indexed with the Consumer Price Index from July 1994 to October 2009. While this methodology would not be used in a study where recreation is a significant portion of the benefits – it is warranted in this specific study.

Changes in annual recreation benefits are shown in Table 5.10 for each alternative as compared to the base condition. A reduction in recreation benefits, a negative value, would indicate a potential loss and/or cost as modeled by SUPER.

Table 5.10 Average Annual Recreational Benefits by Alternative- October 2009 values ($1,000)

	Base	Conservation	Flood	Inactive
Beaver	9,016.7	9,016.9	9,016.9	9,016.9
Table Rock	4,206.6	4,206.7	4,206.5	4,206.7
Bull Shoals	13,898.9	13,900.4	13,883.0	13,900.2
Norfork	6,815.6	6,815.8	6,814.8	6,815.8
Greers Ferry	16,347.3	16,347.2	16,347.2	16,347.2
Clearwater	1,176.1	1,176.1	1,176.1	1,176.1
Total Recreation Benefits	51,461.3	51,463.1	51,444.5	51,463.0
Change In Recreation ($1000)		1.8	-16.8	1.7
Change in Recreation ($)		1,823.4	-16,774.9	1,677.5

5.2.6 Total Impacts

The hydroelectric power losses, flood losses, and recreation losses are collected in Table 5.11.

Table 5.11 Average Annual Net Benefits from Reallocation- October 2009 values ($)

	Conservation	Flood	Inactive
Losses			
Hydropower	77,927	56,334	73,368
Flood Downstream	954	11,442	2,225
Flood In Pool	-1112	159	-1,112
Recreation	-1,823	16,775	-1,677
Total Losses	**$75,945**	**$84,710**	**$72,803**
Benefits			
Water Supply	139,850	140,575	140,519
Net Benefit	**$63,905**	**$55,865**	**$67,716**

5.3 Updated Cost of Storage

5.3.1 Ozark Mountain Regional Public Water Authority

The value of the 10,188.463 ac-ft of storage is estimated at $2,050,361 based on the standard method for calculating updated cost of storage. Total Usable Storage (4,443,600 AF) is calculated as the Flood Pool (2,127,000AF; EL 659 to 695) plus the Conservation Pool (1,236,000 AF; EL 628.5 to 659) plus the Inactive Pool (1,080,600 AF; EL 588 to 628.5). The value of the storage was determined by first computing the cost at the midpoint of construction by using the use of facilities cost allocation procedure as follows:

Project Joint-Use Cost x Storage Reallocated (AF) / Total Usable Storage (AF)

The cost allocated to the storage on this basis is escalated to present day price levels using the estimated 2010 Civil Works Construction Cost Index System. Computations to determine the value of the 10,188.463 ac-ft of reallocated storage for OMRPWA are:

$894,245,000 (FY2010) x 10,188.463 / 4,443,600 = $2,050,361

A storage cost update for FY2010 for Bull Shoals is shown in Table 5.12. These costs will be adjusted to the current rates at the time the water supply agreements are signed and cost indexed to the appropriate fiscal year and interest rate. Calculations for the value of the storage are shown in Table 5.13.

5.3.2 Marion County Regional Water District

The value of the 1,698.077 ac-ft of storage is estimated at $341,727 based on the standard method for calculating updated cost of storage. Total Usable Storage (4,443,600 AF) is calculated as the Flood Pool (2,127,000AF; EL 659 to 695) plus the Conservation Pool (1,236,000 AF; EL 628.5 to 659) plus the Inactive Pool (1,080,600 AF; EL 588 to 628.5). The value of the storage was determined by first computing the cost at the midpoint of construction by using the use of facilities cost allocation procedure as follows:

Project Joint-Use Cost x Storage Reallocated (AF) / Total Usable Storage (AF)

The cost allocated to the storage on this basis is escalated to present day price levels using the estimated 2010 Civil Works Construction Cost Index System. Computations to determine the value of the 1,698.077 ac-ft of reallocated storage for MCRWD are:

$894,245,000 (FY2010) x 1,698.077 / 4,443,600 = $341,727

A storage cost update for FY2010 for Bull Shoals is shown in Table 5.12. These costs will be adjusted to the current rates at the time the water supply agreements are signed and cost indexed to the appropriate fiscal year and interest rate. Calculations for the value of the storage are shown in Table 5.14.

Table 5.12 Updated Project Cost Estimate Bull Shoals Lake, Arkansas and Missouri

Categories	Initial Project Cost 1948 Prices	ENR Index 1948	ENR Index Jul 67	Jul 67 CWCCIS Index	FY 10 CWCCIS Index [1]	FY 10 Project Cost	Purpose
Land and Damages	5,674,600	461	1,078	100		86,540,000	J
Relocations	5,573,800	461	1,078	100	709.46	92,469,000	J
Reservoir	3,943,900	461	1,078	100	764.98	70,549,000	J
Dam & Spillway							
Main Dam	38,318,300	461	1,078	100	705.21	631,892,000	J
Power Intake Works	2,113,900	461	1,078	100	705.21	34,859,000	P
Outlet Works (exclusive of power)	2,888,000	461	1,078	100	705.21	47,625,000	F
Powerhouse, switchyard, and equipment							
Units 1-4	15,862,900	461	1,078	100	664.79	246,595,000	P
Units 5-6	5,600,000	872	1,078	100	664.79	46,023,000	P
Units 7-8	5,200,000	901	1,078	100	664.79	41,360,000	P
Roads, railroads and bridges	315,600	461	1,078	100	709.46	5,236,000	J
Reservoir development	134,200	461	1,078	100	699.31	2,195,000	J
Buildings, grounds, and utilities	328,000	461	1,078	100	699.31	5,364,000	J
Permanent operating equipment	106,800	461	1,078	100	699.31	1,746,000	P
	86,060,000					1,312,453,000	
SUMMARY							
Specific Costs							
Flood Control	2,888,000					47,625,000	
Power	28,883,600					370,583,000	
SUBTOTAL	31,771,600					418,208,000	
Total Joint-use Cost	**54,288,400**					**894,245,000**	
TOTAL PROJECT COST	**86,060,000**					**1,312,453,000**	

[1] CWCCIS factors are taken from EM1110-2-1304, dated 30 September 2009. Land values are based on the weighted average update of the other project features.

Table 5.13 Ozark Mountain Regional Public Water Supply - Annual Repayment Cost for Reallocated Storage

Item	Amount
Storage Required, ac.-ft.	10,188
Water Supply Yield, MGD	6
Interest Rate, percent	4.125%
Repayment Period, years	30
Project Storage	
Flood Control ac-ft	2,127,000
Conservation ac-ft	1,236,000
Inactive ac-ft	1,080,600
Total	4,443,600
Percent of Usable Project Storage	0.2293%
Joint-Use Project Cost	
Initial Construction (2010 Price Level)	$894,245,000
O&M (Estimated Average Annual)	1,858,531
Allocated Water Supply	
Storage Cost	2,050,361
Annual Cost of Storage	
Investment*	115,610
O&M**	4,261
Total	119,871
* Based on 4.125% interest rate and 30-year repayment period.	
** Based on 0.23% of the estimated average annual joint-use O&M cost.	

Table 5.14 Marion County Regional Water District - Annual Repayment Cost for Reallocated Storage

Item	Amount
Storage Required, ac.-ft.	1,698
Water Supply Yield, MGD	1
Interest Rate, percent	4.125%
Repayment Period, years	30
Project Storage	
Flood Control ac-ft	2,127,000
Conservation ac-ft	1,236,000
Inactive ac-ft	1,080,600
Total	4,443,600
Percent of Usable Project Storage	0.0382%
Joint-Use Project Cost	
Initial Construction (2010 Price Level)	$894,245,000
O&M (Estimated Average Annual)	1,858,531
Allocated Water Supply	
Storage Cost	341,727
Annual Cost of Storage	
Investment*	19,268
O&M**	710
Total	19,979
*Based on 4.125% interest rate and 30-year repayment period.	
**Based on 0.0382% of the estimated average annual joint-use O&M cost.	

5.3.3 Total Updated Cost of Storage

The total value of the 11,886.541 ac-ft of storage is estimated at $2,392,088 based on the standard method of calculating updated cost of storage.

5.3.4 Low Income Pricing

Provision of reduced pricing of water supply storage space for low income communities is contained in Section 322 of the 1990 WRDA (33 U.S.C 2324). That statute reads as follows:

Sec. 322. REDUCED PRICING FOR CERTAIN WATER SUPPLY STORAGE.

- *(a) Provision of Storage Space – If a low income community requests the Secretary to provide water supply storage space in a water resources development project operated by the Secretary and if the amount of space requested is available or could be made available through reallocation of water supply storage space in the project or through modifications to operation of the project, the Secretary may provide such space to the community at a price determined under subsection (c)*
- *(b) Maximum Amount of Storage Space – The maximum amount of water supply storage space which may be provided to a community under this section may not exceed an amount of water supply storage space sufficient to yield 2,000,000 gallons of water per day.*
- *(c) Price – The Secretary shall provide water supply storage space under this section at a price which is the greater of –*
  - *a. The updated construction cost of the project allocated to provide such an amount of water supply storage space or $100 per acre foot of storage space, whichever is less; and*
  - *b. The value of the benefits which are lost as a result of providing such water supply storage space.*
- *(d) Determinations – For purposes of subsection (c), the determinations of updated construction costs and value of benefits lost shall be made by the Secretary on the basis of the most recent information available.*
- *(e) Inflation Adjustment of Dollar Amount – The $100 amount set forth in subsection (c) shall be adjusted annually by the Secretary for changes in the Consumer Price Index of All Urban Consumers published by the Bureau of Labor Statistics.*
- *(f) Non-Federal Responsibilities – Nothing in this section shall be construed as affecting the responsibility of non-Federal interests to provide operation and maintenance costs assigned to water supply storage provided under this section.*
- *(g) Low Income Community Defined – The term "low income community" means a community with a population of less than 20,000 which is located in a county with a per capita income less than the per capita income of two-thirds of the counties in the United States.*

5.3.4.1 Ozark Mountain Regional Public Water Authority

The communities which form the OMRPWA are located within Boone, Johnson, Newton, Marion, Pope, and Searcy counties in Arkansas. Each community has a population of less than 20,000 (as seen in Table 4.1) and has a current average daily usage of less than 2,000,000 gallons of water per day. With future growth and higher per capita usage, each community would still have a current average daily usage of less than 2,000,000 gallons of water per day. The U.S. has 3,092 counties, including the District of Columbia. When their per capita income is ranked highest to lowest, the lowest third of counties are ranked 1 to 1,036. Given the most recent income data from the Economic Guidance Memorandum #09-05, the counties' per capita income is provided in Table 5.15. Almost all of the area serviced by OMPWRA is located in the five counties which fall within the lowest third of counties and for which Section 322 reduced pricing is available. Only Pope County does not fall within the lowest third of counties and only a small portion of the area served by OMPWRA falls within Pope County.

Table 5.15 County Per Capita Income (1999)

County	Income	County Rank
Pope	$25,693	1,098
Boone	$25,422	1,026
Marion	$22,075	343
Johnson	$21,495	267
Newton	$19,620	96
Searcy	$19,373	80
Lowest Third	$25,477	1,036

The total storage reallocation for OMRPWA is 10,188.463 ac-ft to provide an estimated yield of 6,000,000 gallons per day. Of that total, 10,096.675 ac-ft, estimated to yield 5,946,000 gallons per day, is eligible for the reduced pricing for low income communities. Using the reduced pricing, the cost of this storage will be $1,669,990, rather than the $2,031,889 based on the standard calculation of updated cost of storage. Table 5.16 provides the calculation. The reduced price of $165.40 for each acre foot was determined by indexing $100 per acre foot to 2010 price levels using the Consumer Price Index. Per Section 322, the price so adjusted must be lower than the updated cost of storage, but greater than the value of benefits lost for providing such storage space. As shown in Table 5.17, that is the case here--$1,669,990 is less than the standard updated cost of storage and more than the $77,927 in hydropower benefits foregone.

The part of the OMRPWA system servicing Pope County is the Lurton-Pelsor Water Association (LWPA), representing .9% of the average daily use served by OMRPWA. The LWPA serves a remote rural area spanning the Newton-Pope County line that includes the small communities of Lurton in Newton County and Pelsor in Pope County. Pelsor and the surrounding area are isolated from the rest of Pope County by the Ozark National Forest. They rely on Newton County for several public services, including water and fire protection, and share a zip code centered in Newton County. The pricing of the 91.788 ac-ft of storage necessary to yield 54,000 gallons per day for the LWPA is under consideration by the Department of the Army, but will be no more than the updated cost of storage for this storage, which is $18,472.

Summing the two portions of the system, total cost of storage for OMRPWA will be not more than $1,688,462 at FY2010 (October 2009) price level.

Because of the different methods for storage pricing, there will be two water storage agreements between OMPWRA and the Government—Agreement No. 1 for 10,096.675 ac-ft and Agreement No. 2 for 91.788 ac-ft. Each agreement will reflect the principle amount owing, amortized over a thirty year period at the interest rate required by the Water Supply Act of 1958, as amended.

5.3.4.2 Marion County Regional Water District

The communities which form MCRWD are located in Marion County, Arkansas. In Marion County, each community has a population of less than 20,000 (with the largest town, Bull Shoals, having a population of 2,138). MCRWD is requesting storage that yields less than 2,000,000 gallons of water per day. Marion County has a per capita income less than the per capita income of two-thirds of the counties in the United States. Given that MCRWD meets the terms of eligibility for a “low income community” the cost of the storage is calculated using the reduced price of $165.40 for each acre foot ($100 per acre foot indexed to 2010 price levels using the Consumer Price Index). Table 5.16 provides the calculation. The adjusted Low Income Price is lower than the updated cost of storage, and greater than the value of benefits lost for providing such storage space. Therefore, the cost of storage to MCRWD is $280,861.

Table 5.16 Low Income Price Adjusted for Inflation

	1990 price	CPI 1990	CPI OCT 2009	2010 price per ac-ft	Acre Feet	Low-Income Cost of Storage
OMRPWA Agreement No. 1	$100	130.7	216.177	$165.40	10,096.675	$1,669,990
MCRWD	$100	130.7	216.177	$165.40	1,698.077	$280,861

(NOTE: Pricing for OMPWRA Agreement No. 2 for 91.788 ac-ft is under consideration, but would not be more than the standard updated cost of storage of $18,472.)

5.4 Summary of Derivation of User Cost

The cost to the user is determined as the higher of benefits or revenues forgone, replacement cost, or the updated cost of storage (in this reallocation, the cost of storage is adjusted for low income pricing). Table 5.17 summarizes these four methods of cost derivation in FY 2010 (October 2009) price levels and shows that the cost to the user is governed by the cost of storage adjusted for low income pricing. For the total reallocation of 11, 886.541 ac-ft, the total user cost is not more than $1,969,323

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Table 5.17 Derivation of User Cost Summary - October 2009 values ($)

	Conservation	Flood	Inactive
Hydroelectric Power Revenues Foregone	$19,935	$12,295	$18,509
Hydroelectric Power Total Benefits Forgone	$77,927	$56,334	$73,368
Replacement Costs	$77,927	$56,334	$73,368
Updated Cost of Storage - Total	$2,392,088		
OMRPWA	$2,050,361		
Marion County	$341,727		
Cost of Storage (Low Income Pricing) - Total	Not more than $1,969,323		
OMRPWA with 10,096.675 ac-ft at low income pricing and 91.788 ac-ft at not more than standard updated cost of storage	Not more than $1,688,462		
Marion County at low income pricing	$280,861		

Section 6
Other Considerations

6.0 OTHER CONSIDERATIONS

6.1 Test of Financial Feasibility

As a test of financial feasibility, the annual cost of the reallocated storage, (determined in Section 5.3), is compared to the annual cost of the next most likely, least costly alternative that would provide an equivalent quality and quantity of water which the local interests would undertake in absence of utilizing reallocation at Bull Shoals Lake.

6.1.1 Ozark Mountain Regional Public Water Authority

Tables 6.1 and 6.2 present the cost of water supply storage space from Bull Shoals Lake. The tables also present the estimated annual cost for the next most likely, least costly alternative: reallocation of storage from Norfork Lake. This cost is expressed as an estimated annual charge using a 4.375 percent interest rate and a 50-year period of analysis.

As shown in Tables 6.1 and 6.2, reallocation from Bull Shoals Lake has the least total annual cost, $4,396,500, when compared with the annual cost of reallocation from Norfork Lake of $5,758,300.

Table 6.1 Ozark Mountain Regional Public Water Authority - Cost Estimate for 6 MGD

	Norfork	Bull Shoals
Construction Item		
New Water Treatment Facility	$6,750,000	$6,750,000
Intake Structure and Raw Water Pumping Facility	$2,800,000	$2,800,000
Pipe	$44,916,500	$30,719,000
Trenching	$8,412,500	$6,263,500
Booster Pumping Stations	$3,000,000	$1,800,000
Water Storage Tanks	$3,150,000	$2,950,000
Estimated Construction Cost	**$69,029,000**	**$51,282,500**
Contingency (10%)	$6,902,900	$5,128,300
Preliminary Engineering and Environmental Report	$50,000	$50,000
Planning, Engineering and Design (6.5%)	$4,486,900	$3,333,400
Construction Supervision (10%)	$6,902,900	$5,128,300
Environmental, Legal, Real Estate, Administrative	$475,000	$475,000
Project First Cost	**$87,846,700**	**$65,397,500**
OMRR&R		
Administrative	$20,000	$20,000
Operating Salary, Taxes, Insurance	$160,000	$160,000
Operator Vehicle, Insurance, Fuel	$12,500	$12,500
Insurance for Facilities	$30,000	$30,000
Accounting and Auditing	$17,500	$17,500
Utilities	$12,800	$12,800
Laboratory	$20,000	$20,000
Intake and Water Treatment Facility Electrical	$150,000	$150,000
Booster Pumping Electrical	$450,000	$300,000
Chemicals	$50,000	$50,000
Water Cost*	$166,600	$120,000
Arkansas Department Environmental Quality Permits & Fees	$5,000	$15,000
Miscellaneous	$5,000	$15,000
Major Repair, Rehabilitation, and Replacement	$60,000	$50,000
Annual Costs	**$1,159,400**	**$972,800**
*Calculated water cost based on updated cost of storage for Norfork and Bull Shoals, see Table 5.13 for Bull Shoals calculation.		
Sources: Preliminary Engineering Report (May 2005, revised April 2009), Engineering Services, Inc. Figures 5.5, 5.6, 5.11, 5.12; recalculated contingency, PED, supervision percentages using typical SWL percentages.		

Table 6.2 Ozark Mountain Regional Public Water Authority Economic Analysis

	Norfork	Bull Shoals
Period of Analysis (years)	50	50
Interest Rate	4.375%	4.375%
Construction Period, years	1.667	1.667
Project First Costs	$87,846,700	$65,397,500
Interest During Construction	$4,917,000	$3,660,000
Total Project Cost	**$92,763,700**	**$69,057,500**
Annual Costs:		
Interest	$4,058,400	$3,021,300
Amortization	$540,500	$402,400
OMRR&R	$1,159,400	$972,800
Total Annual Costs	**$5,758,300**	**$4,396,500**

6.1.2 Marion County Regional Water District

Tables 6.3 and 6.4 present the cost of water supply storage space from Bull Shoals Lake. The table also presents the estimated annual cost for the next most likely, least costly alternative: reallocation of storage from Norfork Lake. This cost is expressed as an estimated annual charge using a 4.375 percent interest rate and a 50-year period of analysis.

As shown in Tables 6.3 and 6.4, reallocation from Bull Shoals Lake has the least total annual cost, $283,700, when compared with the annual cost of reallocation from Norfork Lake of $1,745,400.

Table 6.3 Marion County Regional Water District Cost Estimate for 1 MGD

	Norfork	Bull Shoals*
Construction Item		
New Water Treatment Facility	$3,616,000	$500,000
Intake Structure and Raw Water Pumping Facility	$1,561,000	$1,561,000
Pipe	$7,667,000	$0
Trenching	$3,829,000	$0
Booster Pumping Stations	$135,000	$1,000,000
Water Storage Tanks	$1,385,000	$0
Estimated Construction Cost	**$18,193,000**	**$3,061,000**
Contingency (10%)	$1,819,300	$306,100
Preliminary Engineering and Environmental Report	$50,000	$0
Planning, Engineering and Design (6.5%)	$1,182,500	$199,000
Construction Supervision (10%)	$1,819,300	$306,100
Environmental, Legal, Real Estate, Administrative	$475,000	$20,000
Project First Cost	**$23,539,100**	**$3,892,200**
Operations, Maintenance, Repair, Rehabilitation, and Replacement		
Administrative	$20,000	$5,000
Operating Salary, Taxes, Insurance	$160,000	$0
Operator Vehicle, Insurance, Fuel	$12,500	$0
Insurance for Facilities	$30,000	$0
Accounting and Auditing	$17,500	$5,000
Utilities	$12,800	$0
Laboratory	$20,000	$0
Intake and Water Treatment Facility Electrical	$60,000	$10,000
Booster Pumping Electrical	$82,500	$10,000
Chemicals	$20,000	$20,000
Water Cost**	$27,800	$20,000
Arkansas Department Environmental Quality Permits & Fees	$5,000	$0
Miscellaneous	$5,000	$5,000
Major Repair, Rehabilitation, and Replacement	$40,000	$5,000
Annual Costs	**$513,100**	**$80,000**
***Costs are incremental for an additional 1 MGD. MCRWD already draws water from Bull Shoals. Incremental costs include 4 pumps, 4 filters, and a clarification system.		
**Calculated water cost based on updated cost of storage for Norfork and Bull Shoals, see Table 5.14 for Bull Shoals calculation.		
10% concept design by SWL engineers; recalculated contingency, PED, supervision percentages using typical SWL percentages		

Table 6.4 Marion County Regional Water District Economic Analysis

	Norfork	Bull Shoals
Period of Analysis (years)	50	50
Interest Rate	4.375%	4.375%
Construction Period, years	1.667	0.500
Project First Costs	$23,539,100	$3,892,200
Interest During Construction	$1,317,440	$217,000
Total Project Cost	**$24,856,540**	**$4,109,200**
Annual Costs:		
Interest	$1,087,500	$179,800
Amortization	$144,800	$23,900
OMRR&R	$513,100	$80,000
Total Annual Costs	**$1,745,400**	**$283,700**

6.2 Cost Account Adjustments to Power Marketing Agency

A water supply reallocation from Bull Shoals Lake will have an adverse affect on Southwestern Power Administration. Therefore, a credit to the accounting records should be made based on the estimated loss of power outputs and the current rates charged by Southwestern Power Administration. The period of analysis for the Bull Shoals Lake project will end in the year 2059. The annual capacity and energy credits are tabulated in Appendix D, Hydroelectric Power Analysis Center Report, Section 7.2, page 41 and 42. As provided in Table 7-7 of the Hydroelectric Power Analysis Center Appendix, the estimated annual credit to the accounting records is $54,826. This credit is based on capacity credits and energy credits. The capacity credits, $625, are based on capacity benefits through 2025 and capacity revenues from 2026 to 2059. The energy credits, $54,201, are based on energy benefits through 2025 and energy revenues from 2026 to 2059. All figures were brought to a present value using a 4.375 percent interest rate and a 50-year time horizon.

6.3 Environmental Considerations

6.3.1 Environmental Operating Principles

The USACE Civil Works environmental mission ensures that all Corps projects, facilities and associated lands meet environmental standards.

Principle 1. Environmental Sustainability – Project design/operation will result in supporting and sustaining a minor increase in aquatic habitat.

Principle 2. Interdependence of life and the physical environment – The reallocation will have minimal impacts on the environment and the hydrology downstream of Bull Shoals Lake.

Principle 3. Seek balance and synergy among human development activities and natural systems – In providing needed M&I water supply to north central Arkansas, the natural system was judged not to be significantly impacted. The reallocation's environmental assessment resulted in a Finding of No Significant Impact (FONSI).

Principle 4. Continue to accept corporate responsibility and accountability – The reallocation complies with all applicable laws.

Principle 5. Assess and mitigate cumulative impacts to the environment – This reallocation assessed with previous reallocations of storage at Bull Shoals Lake and the construction of the water treatment plant for OMRPWA, does not require any separable ecosystem mitigation.

Principle 6. Build and share knowledge – Coordination with state and federal resource agencies resulted in an appropriate storage reallocation project for Bull Shoals Lake and the analysis was conducted using past experiences.

Principle 7. Respect the views of individuals and groups – Input from resource agencies and the public were adequately addressed and incorporated.

6.3.2 Campaign Plan

The 2009 Campaign Plan is used to establish priorities, focus transformation initiatives, measure and guide progress, and adapt to the needs of the future.

Goal 1. Ready for All Contingencies: Deliver USACE support to combat, stability and disaster operations through forward deployed and reachback capabilities. This goal is not applicable to this project.

Goal 2. Engineering Sustainable Water Resources: Deliver enduring and essential water resource solutions through collaboration with partners and stakeholders. Reallocation at Bulls Shoals Lake for M&I water supply will deliver an essential water resource solution through collaboration with local partners and stakeholders.

Goal 3. Delivering Effective, Resilient, Sustainable Solutions: Deliver innovative, resilient, sustainable solutions to the Armed Forces and the Nation. This project is an effective and efficient tool to deliver a safe and reliable water supply to OMRPWA and MCRWD.

Goal 4. Recruit and Retain Strong Teams: Build and cultivate a competent, disciplined, and resilient team equipped to deliver high quality solutions. Expertise used to develop and evaluate the alternatives for the water supply storage reallocation at Bull Shoals Lake can be transferred to other projects.

6.4 Summary of Views of Federal, State and Local Interests

Public Workshops – Summer 2009

A public workshop was held on June 30, 2009, from 6 to 8 pm at the Gaston's Visitor Center at Bull Shoals Dam with 74 people attending. A second public workshop was held in Diamond City, AR on July 1, 2009, from 6 to 8 pm at the Diamond City Community Center with 24 people attending. There were no comments in opposition to the proposed reallocation of 7 MGD from Bull Shoals Lake (conservation pool, flood pool, or inactive pool) for OMRPWA and MCRWD.

Agency Scoping Letters – Fall 2009

Scoping coordination letters were sent out September 15, 2009, requesting agency comments and concerns regarding an Environmental Assessment for the Reallocation at Bull Shoals Lake. No major concerns have been received to date. Table 6.5 lists the agencies that received coordination letters and indentifies concerns noted in the responses received.

Table 6.5 Project Agency/Office Coordination

Agency/Office Solicited	Response Received	Response/Concerns
Missouri Addressees:		
U.S. Fish and Wildlife Service Columbia, MO 65203	Oct. 19, 2009	No protected species or critical habitat within project area
U.S. Department of Agriculture St. Louis, MO 63141		No response received to date
U.S. Natural Resources Conservation Service Springfield, MO 65802	Oct. 19, 2009	Will comment upon reviewing draft EA
Missouri NRCS State Office Columbia, MO 65203		No response received to date
Missouri State Historic Preservation Office Jefferson City, MO 65102	Oct. 21, 2009	Project not likely to affect any known cultural resources within project area
Arkansas Addressees:		
Arkansas Historic Preservation Program Little Rock, AR 72201	Oct. 9, 2009	No known historic properties will be affected by this undertaking
Department of Finance & Administration Little Rock, AR 72203	Sep. 22, 2009	Will comment upon reviewing draft EA
Arkansas Soil and Water Conservation Comm. Little Rock, AR 72201		No response received to date
Arkansas Forestry Commission Little Rock, AR 72201		No response received to date
Arkansas Game and Fish Commission Little Rock, AR 72205	Sep. 25, 2009	Concerns were in regards to new water supply pipeline that will be required under a different action
Arkansas Dept of Environmental Quality Little Rock, AR 72118		No response received to date
Arkansas Natural Heritage Commission Little Rock, AR 72201		No response received to date
U.S. Geological Survey Little Rock, AR 72211		No response received to date
Arkansas Natural Resources Commission Little Rock, AR 72201		No response received to date

Agency/Office Solicited	Response Received	Response/Concerns
Arkansas Department of Parks and Tourism Little Rock, AR 72201		No response received to date
Arkansas Department of Health Little Rock, AR 72205		No response received to date
U.S. Department of Agriculture, NRCS Little Rock, AR 72201	Sep. 24, 2009	No effect on Prime Farmland or Farmland of Statewide Importance
Arkansas Highway and Transportation Department Little Rock, AR 72211		No response received to date
U.S. Fish and Wildlife Service Conway, AR 72032	Nov. 5, 2009	No federally listed endangered, threatened or candidate species present within project area
Other Addressees:		
Southwestern Power Administration Tulsa, OK 74103	Oct. 20, 2009	Impacts and costs of increased air emissions should be quantified and impacts to hydropower should be detailed. Strongly objects to the use of the inactive pool as a viable alternative for the report and EA
U.S. Environmental Protection Agency, Region 6 Dallas, TX 75202		No response received to date
National Park Service, Midwest Region Omaha, NE 68102		No response received to date
FEMA, Region VI Denton, TX 76210	Oct. 15, 2009	Possible negative impacts on identified special flood hazard areas within project area. Also, referred to floodplain managers for Marion and Baxter Counties.

ENVIRONMENTAL ASSESSMENT (EA) PUBLIC REVIEW / COMMENTS SUMMARY

The draft environmental assessment (Draft EA) and reallocation report for this action were released concurrently for public review and comment on May 11, 2010. The comment period ran for 30 days from May 11, 2010 to June 11, 2010 and was announced via a public notice which ran in five (5) newspapers covering the project area. These newspapers are identified in the Affidavit of Insertion included in Appendix C. Copies of the Draft EA and Reallocation Report were mailed on compact disk to recipients listed on the mailing list included in this attachment. In addition, an electronic copy was posted on the Little Rock District webpage. Hardcopies were made available at the Mountain Home Project Office, the Searcy County Library, the Marion County Library in Yellville, Arkansas and at the Little Rock District headquarters building. A mailing list, copies of the public notice, newspaper notices, and other information pertaining to the public review period are included in Appendix C.

Overall, ten (10) comment letters from agencies and private individuals were received during the comment period. Included were letters from eight (8) agencies or organizations and two (2) individual citizens. Copies of all letters are included in Appendix C. A brief description of each comment letter and, where appropriate, a summary of substantial comments raised are provided below. In addition, a brief summary of the Little Rock District's evaluation of substantial issues raised in these comments is also included.

COMMENTS RECEIVED

Department of Energy, Southwestern Power Administration (letter dated June 11, 2010). The Southwestern Power Administration (SWPA) provided a significant number of comments on matters ranging from water supply needs and withdrawal rates, concern over USACE policies regarding reallocating storage for water supply, hydropower crediting calculations and procedures, methods of alternatives evaluation and resulting selection of the proposed plan, and consideration of the inactive pool for storage reallocation. In addition, SWPA identified the need to provide revisions based on an alternate Southwestern power marketing area, recently-renewed contracts, and recently-updated power rates.

A thorough analysis of comments received from SWPA was conducted by the Little Rock District and the Corps' Hydropower Analysis Center (HAC). Based on a review of the appropriate power marketing area and newly-revised rates, HAC revised calculations in its hydropower report (Reallocation Report, Appendix D). Similar changes were reflected in updates to the Reallocation Report and EA, as appropriate. Many comments received from SWPA concern long-standing and well-known areas of disagreement between SWPA and the Corps regarding USACE policy for evaluating impacts to hydropower and hydropower crediting procedures. In instances where Corps policy was applicable to methodology used in this study, such policy was consistently applied. These policy issues will likely continue to be a point of disagreement between the Corps and SWPA on this and future reallocations involving hydropower considerations.

One comment provided by SWPA was a recommendation to evaluate a flood pool reallocation alternative employing hydropower yield protection operation ("HYPO"), a methodology similar to dependable yield mitigation storage (DYMS) for existing water supply users. Such an analysis was conducted by the Little Rock District for the White River Minimum Flow (WRMF) study at Bull Shoals Lake. However, there are several distinctions between WRMF and the current study. These include special project-specific authorizing legislation, a reallocation for non-municipal and industrial (M&I) water supply purposes for WRMF, a reallocation of nearly twenty (20) times the storage volume for WRMF relative to the currently-proposed action, and a much greater adverse effect on hydropower. While not in accordance with USACE policy, alternative evaluation using HYPO was conducted for WRMF based on these considerations and the project-specific authority. The current USACE policy regarding existing hydropower users is that compensation may be considered through minor operational changes for the reallocation from the flood control pool to M&I water supply, and therefore, HYPO is not a viable consideration for the currently-proposed action.

Southwestern Power Resources Association (letter dated June 11, 2010). The Southwestern Power Resources Association (SPRA) provided comments which were very similar in nature and specific content to those provided by SWPA. In summary, SPRA expressed concern over an appropriate power marketing area, newly-revised hydropower rates, calculations of the hydropower impacts of storage reallocations including pricing, the period included in the evaluation, definition of usable storage, and cumulative effects of past reallocations.

The Little Rock District and HAC thoroughly evaluated comments received from SPRA. As many of these issues were similar to those raised by SWPA, conclusions were likewise similar. Most of the comments were addressed by identifying the USACE policy used in the evaluation of hydropower impacts and crediting procedures. Where necessary based on newly-revised rates and other considerations, revisions were incorporated in the HAC report, the reallocation report, and EA. In instances where comments provided by SPRA were in conflict with USACE policy, USACE policy was consistently applied.

The SPRA likewise provided comments regarding cumulative effects on hydropower production and mitigation considerations for such effects. The USACE believes that mitigation for hydropower effects is provided for by credits to SWPA in accordance with Corps' policy and procedures. Finally, SPRA commented that the EA should consider cumulative effects of storage reallocations on greenhouse gas emissions at the 24 Corps projects from which SWPA markets hydroelectric energy and capacity owing to replacement of hydropower losses by thermal generation. While the EA does provide estimates of the increase in greenhouse gas emissions resulting from the proposed action, the widespread geographic range of the 24 Corps projects and uncertainties regarding location of thermal generation facilities make it difficult to quantify cumulative effects on ambient air quality. It should be noted, however, that such thermal facilities are subject to air quality regulations and permitting requirements aimed at attainment of air quality standards.

T. David Carruth, Attorney at Law (letter dated June 10, 2010). Mr. Carruth provided comments reported to be on behalf of himself, "the White River Conservancy, and are available as comments for the Arkansas Wildlife Federation, the Clarendon Chamber of Commerce and a lose *[sic]* association of individuals who use the waters of the White River for recreation, fishing and hunting. This association is known as the B.P.F.M.A.O.R.R.R." Mr. Carruth commented that he had trouble accessing the draft Reallocation Report and EA for review from the Corps' website and for that reason requested an extension of the comment period. He also expressed concerns that the reallocation of water supply storage would "have a profound impact on both the human and natural environment." He stated that "Water supply is not an authorized use of the water impounded by Bull Shoals Dam." He expressed concern about how the reallocated water supply storage will be managed and utilized, as well as how downstream waters will be managed. He expressed the opinion that the "allocation should not take place", that a full environmental impact study should be conducted, and that to do less "would be in violation of the National Environmental Policy Act."

The Little Rock District has thoroughly evaluated Mr. Carruth's comments. The Corps provided opportunity for document review via the internet and hard copies in four (4) locations throughout the state, to include the Mountain Home Project Office, the Searcy County Library, the Marion County Library, and Little Rock District Office. During the comment period, the majority of the responses received indicated that the individuals or agencies had reviewed documents with no indications of problems or inabilities in accessing the documents, thus validating the distribution methods. There were also no known problems with the website link throughout the comment period. Therefore, it was determined that there was no reason for extending the comment period.

Other concerns expressed are addressed in the Environmental Assessment and Finding of No Significant Impact. These two documents complete the requirements called for by the National Environmental Policy Act of 1970 (42 USC 4321, *et seq.*, as amended), under guidelines set for by the Council on Environmental Quality (CEQ) regulations (40 CFR, Parts 1500-1508). The Bull Shoals Dam and Lake Project is a multi-purpose reservoir. The project was authorized for flood control, hydroelectric power and other purposes, including fish/wildlife and recreation, by the Flood Control Act of 28 June 1938, as modified by the Flood Control Act of 1941.The Water Supply Act of 1958 provides general authorization for construction or reallocation of storage for water supply uses at all Corps lakes, provided such construction or reallocation does not seriously affect other authorized project purposes. The Chief of Engineers has delegated authority to approve reallocations of up to 15 percent of total storage capacity, or 50,000 ac-ft, whichever is less. This report concluded the reallocation for water supply will have no significant impacts to the authorized operating purposes of Bull Shoals Lake which include flood control, hydropower, water supply and fish and wildlife. The USACE does not operate for or regulate the downstream use of the water in the White River System.

<u>Arkansas Game and Fish Commission (letter dated June 1, 2010):</u> The Arkansas Game and Fish Commission (AGFC) did not have any specific concerns with the proposed reallocation of water supply storage in Bull Shoals Lake from a fish and wildlife management standpoint.

The Little Rock District acknowledges these comments.

<u>Arkansas Department of Health (letter dated May 13, 2010):</u> The Arkansas Department of Health (ADH) reviewed the proposed project and concluded that it would provide the local area with a safe drinking water supply.

The Little Rock District acknowledges these comments.

<u>Department of Arkansas Heritage (letter dated May 13, 2010):</u> The Department of Arkansas Heritage (DAH) concluded that the proposed project would not affect any known historic properties.

The Little Rock District acknowledges these comments.

U. S. Fish and Wildlife Service (USFWS) (letter dated June 3, 2010): The USFWS concurred with the assessment that this project will have no significant negative environmental impacts. Therefore, the Service had no objection to the proposed issuance of a Finding of No Significant Impact for the proposed action.

The Little Rock District acknowledges these comments.

Federal Emergency Management Agency (FEMA): FEMA requested that the county floodplain administrators be contacted for the review of the project and possible permit requirements for the proposed project.

The Little Rock District determined that the proposed action will result in no impact to floodplains; therefore, county floodplain administrators were not involved.

Comments from Individuals: Additional comments were provided by two (2) individual citizens (undated and handwritten letters by Mr. Gary Honeycutt, and one with an illegible signature and no return address). Both are included in this attachment. The comments from these individuals focused on the potential negative impacts of reallocating storage for water supply. All of the concerns expressed by these individuals are addressed in the Environmental Assessment and Finding of No Significant Impact. One individual questioned the authority to utilize Bull Shoals Lake for public water supply. The other individual seemed to focus on the use of the land that Bull Shoals Lake occupies for a public water supply reservoir.

The Little Rock District operates the Bull Shoals Dam and Lake Project as a multi-purpose reservoir, as authorized by the Congress of the United States. The project was authorized for flood control, hydroelectric power and other purposes, including fish/wildlife and recreation, by the Flood Control Act of 28 June 1938, as modified by the Flood Control Act of 1941. The Water Supply Act of 1958 provides general authorization for construction or reallocation of storage for water supply uses at all Corps lakes, provided such construction or reallocation does not seriously affect other authorized project purposes. The Chief of Engineers has delegated authority to approve reallocations of up to 15 percent of total storage capacity, or 50,000 ac-ft, whichever is less. This report concluded the reallocation for water supply will have no significant impacts to the authorized operating purposes of Bull Shoals Lake.

CONCLUSIONS

The draft and final EA were prepared in accordance with ER 200-2 "Procedures for Implementing NEPA," which provides guidance for implementation of the procedural provisions of the National Environmental Policy Act (NEPA) of 1970 (42 USC 4321 *et seq.*, as amended) for the Civil Works Program of the U.S. Army Corps of Engineers, per regulations set forth by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500-1508).

After careful evaluation of all comments received, the conclusions and recommendations expressed in the draft report and EA remain the same. None of the comments received warrant a change to the conclusion that the proposed action has no significant effects on the environment.

Therefore an Environmental Impact Statement (EIS) is not warranted and a "Finding of No Significant Impact" (FONSI) is appropriate.

6.5 Risk and Uncertainty

Forecasting the future is a delicate task. Section 4 presents three distinct growth scenarios for population. Even with these scenarios, the quality of the forecast diminishes as the time period grows. To have a consistent period of analysis throughout this document, a 50-year period of analysis is used. However, it should be noted that the quality of the forecast diminishes over the time horizon. Water demand forecasts for 2020 are more likely to be accurate than water demand forecasts for 2052.

The selection of the pool with the least benefits foregone (the conservation pool) is sensitive to the calculation of flood damage benefits and recreational benefits foregone, especially as the dollar difference in losses is small, as well as the fluctuation in energy and capacity prices. Selection of the flood pool or inactive pool would change the required ac-ft of storage, the credits to the Power Marketing Agency, and the users' costs.

6.6 Summary of Dam Safety Considerations

In December 2008 Bull Shoals Dam was rated Dam Safety Action Classification (DSAC) IV after being screened in June 2005 as part of a nationwide portfolio risk assessment. EC 1110-2-210, Water Supply Storage and Risk Reduction Measures for Dam Safety, dated 16 July 2009, requires a review of the Potential Failure Mode Analysis (PFMA) for the dam and an analysis of the effect of a higher pool elevation on the probable failure due to seismic or hydrologic conditions. In addition, analysis of the effects (if any) that a higher pool elevation might have on the structure is required. Hydrologic studies indicate that pool changes resulting from this proposed water storage reallocation would have no effect on pool elevation at extreme floods such as the Probable Maximum Flood and the Infrequent Flood Event (300 year return period). Sliding stability was judged to be the most likely failure mode resulting from an increase in pool. The completed analysis indicates that the structure is stable under all load conditions and that there are no known dam safety issues created or made worse by the proposed storage reallocation in this study. A memo from the Dam Safety Officer summarizing the analysis is included in Appendix E of this report.

Drilling and testing of the foundation rock was completed in January and February of 2010. A series of 10 borings were drilled beneath the dam in order to determine the correct design values to be used. These samples were then tested by an accredited laboratory and the results were reviewed by a panel of recognized experts – both from the Corps and the private sector. Structural engineers took the specific values and conducted an analysis related to sliding stability since it was determined to be the governing failure mode for the project. The results indicated that: a) the effect on sliding stability due to a minor increase or decrease in the pool was basically immeasurable, and b) all monoliths are stable against sliding forces. Sliding safety factors were computed for the following load conditions: normal pool, 300 year pool (or record pool), seismic, and extreme hydrological (probable maximum flood). The computed sliding safety factors for all monoliths were above factor of safety criteria except for a single overflow monolith. This particular monolith (#26) possessed a factor of safety of 1.45 at normal pool. This was due to the quality of the rock found in the single boring taken below that monolith. While this is below the 2.0 generally required at normal pool, it is still well above 1.0, thereby alleviating any immediate concerns about the monolith's stability. It is believed that additional testing in the downstream passive wedge would likely result in an increase in the actual cohesion value. If similar to the other 9 borings taken across the dam this monolith would also meet established factor of safety criteria. However, without that data a more conservative assumption was used in the analysis.

The results of the testing program and stability analysis have significantly raised the confidence level in the safety of Bull Shoals Dam and done nothing but reaffirm its status as a DSAC 4 dam. In addition, the dam has an excellent record of performance throughout its nearly 60 year life. Its performance during the record pools of 2008 (near 300 year event) was exemplary. The district should use normal budget processes to complete the additional testing and analysis needed to establish the final design rock strengths for Monolith #26. While not expected, if those values turn out to be significantly lower than the values already used, a determination will then need to be made as to whether the issue is significant enough to warrant a reconsideration of the dam's DSAC rating.

Pursuant to ER 1105-2-100, costs of project modification for dam safety will follow the provisions of Section 1203(a)(1) of WRDA '86. Under these provisions, fifteen (15) percent of the costs of the modification are allocated among purposes and shared with appropriate project sponsors in the same percent as the joint-use expenditures are allocated in the original cost allocation. Where water supply storage is reallocated, the terms of the reallocation agreement will form the basis for the assignment of dam safety costs.

Section 7
Selected Alternative

7.0 SELECTED ALTERNATIVE

7.1 Description

Based on the analysis contained in Section 6.1, purchasing water supply storage from Bull Shoals Lake and constructing a water treatment plant adjacent to the lake is the most cost effective alternative for OMRPWA. Since MCRWD is already purchasing 880 ac-ft from Bull Shoals Lake, purchasing an additional 1,698 ac-ft from Bull Shoals Lake is the most cost effective alternative for MCRWD.

In Section 3.4, the following alternatives for reallocating storage from Bull Shoals Lake were evaluated in detail:

- Alternative #1, No action alternative
- Alternative #2, Reallocation from the conservation pool
- Alternative #3, Reallocation from the flood control pool
- Alternative #4, Reallocation from the inactive pool

All of these alternatives assume that White River Minimum Flows will be implemented after the water supply reallocation for OMRPWA and MCRWD.

As described in Section 5.2.6., the lowest-impact reallocation in terms of hydroelectric power, flood and recreation benefits is a reallocation from the inactive pool, Alternative 4. In the original screening of alternatives there was no singular reason to discount the use of the inactive pool at Bull Shoals Lake for reallocation of water storage for water supply. During detailed analysis of the alternatives, the total economic losses to the other project purposes were so close that it was mathematically indistinguishable between the inactive pool and conservation pool. Reallocation to water supply from the conservation pool was preferred as it does not impact current water control plans in the basin and it preserves the existing environmental benefits of the inactive pool in extreme drought conditions. Therefore, the Little Rock District recommended a reallocation from conservation pool in the Draft Report.

Based on comments received from SWPA on the Draft Report the District re-calculated losses to hydropower based on new 2010 rates. Although reallocating storage from the inactive pool for water supply shows slightly more net economic benefits in the revised calculations, these are not sufficiently great enough to outweigh the non-monetary environmental costs of reallocating storage from the inactive pool. The environmental benefits of the inactive pool include storage for fish and wildlife, and contingency pool for emergency water supply and hydropower head in drought conditions. Given the totality of analysis, reallocating storage from the conservation pool is still the alternative that best maximizes net economic benefits while preserving existing environmental benefits. Reallocating storage from the conservation pool is the District's recommended alternative. The recommended plan is supported by SWPA's opinion that the inactive pool should not be considered.

In addition, since the reallocation is from the conservation pool there is no change in pool elevation.

Using the standard method of calculating updated cost of storage, the total value of the 11,886.541 ac-ft of storage is estimated at $2,392,088, with a cost of $2,050,361 to OMRPWA for 10,188.463 ac-ft of storage and a cost of $341,727 to MCRWD for 1,698.077 ac-ft. However, most of the OMRPWA service area and all of the MCRWD service area meet the requirements specified in Section 322 of WRDA 1990 to be eligible for reduced pricing for low income communities. Applying the Section 322 reduced pricing, the cost of storage for OMRPWA is $1,669,990 for 10,096.675 ac-ft to provide approximately 5.946.000 gallons per day to the portions of the system eligible for the low income pricing. The additional cost to OMRPWA for the remaining 91.788 ac-ft of storage, to provide approximately 54,000 gallons per day, is under consideration by the Department of the Army, but will be no more than the updated cost of storage which is $18,472. Under the Section 322 reduced pricing, the cost of storage for MCRWD is $280,861 for 1,698.077 ac-ft to provide 1 million gallons per day.

7.2 Rationale for Selection

The majority of the member water systems struggle to meet customer demands from their existing sources which include shallow wells, deep wells, or springs. In addition, the ADH has stated the well water has excessive and dangerous levels of radium, fluoride, and hydrogen sulfide, and they have declared the need for an alternative water supply for these communities as their top priority. The Environmental Protection Agency has certified that many of these water sources are not safe for human consumption. Reallocation of 11,886.541 ac-ft from the conservation pool to water supply is the most efficient means to satisfy the projected water demands for the OMRPWA and MCRWD.

This would bring the identified total water supply storage to 13,585 ac-ft. A reallocation of water supply storage from hydroelectric power storage does not occur until water supply agreements are signed by all parties and the water supply user starts to pay for the storage. Therefore, the actual reallocation is incremental and is implemented upon execution of water supply agreements. Storage identified for reallocation, but not under agreement, is still considered hydroelectric power storage; however, it no longer becomes a dependable source of power.

The study to reallocate 11,886.541 ac-ft of storage from hydroelectric power to water supply complies with NEPA. An EA, included as Appendix C, was conducted and determined that no significant environmental impacts are anticipated to occur as a result of the proposed reallocation action. Impacts will occur to hydroelectric power production at Bull Shoals Dam; however, SWPA will receive credits to the accounting records. The annual capacity and energy credits are tabulated in Appendix D, Hydroelectric Power Analysis Center Report, Section 7.2, page 41 and 42.

The traditional USACE policy has been to transfer credits to hydropower accounts that are only sufficient to make up for amounts the power marketing agency could not collect because it would sell less hydropower. It has not been the Corps policy to reimburse the power marketing agency or their customers directly for their purchase of alternative power. When there is a loss of revenue from existing purposes, or additional operation and/or maintenance expenses are incurred from existing purposes because of a water supply storage reallocation, these charges will be shown as a direct charge against the water supply function. Traditionally, if hydropower revenues were to be reduced because of a water supply storage reallocation, the power marketing agency could be credited for the amount of revenues foregone to the Treasury because of the reallocation. This credit is typically estimated as a uniform annual credit. Traditional policy is distributed through the Planning Guidance Notebook, ER 1105-2-100, 22 April 2000, and is further explained in the Water Supply Handbook, Revised IWR Report 96-PS-4.

A FONSI was approved by the USDA on August 24, 2009 that addresses the impacts of the proposed pipeline from the treatment plant near Bull Shoals Lake to serve the customers of OMRPWA. This FONSI covered the intake, water treatment plant, and distribution system.

Section 8
Implementation

8.0 IMPLEMENTATION

8.1 Federal and Non-Federal Costs

Federal Costs

A water supply reallocation from Bull Shoals Lake will have an adverse affect on SWPA. Therefore, a credit to the accounting records should be made based on the estimated loss of power outputs and the current rates charged by SWPA (ER 1105 -2-100). An annual amount of $54,826 will be credited to hydropower during the 30-year water user payment period. This credit is based on capacity credits plus energy credits calculated for the 50-year period of analysis and annualized over the 30-year water supply payment period. The annual capacity credits, $625, are based on capacity benefits through 2025 and capacity revenues from 2026 to 2059. The annual energy credits, $54,201, are based on energy benefits through 2025 and energy revenues from 2026 to 2059. The annual capacity and energy credits are tabulated in Appendix D, Hydroelectric Power Analysis Center Report and summarized in Tables 7-7 and 8-3 of that appendix. The annual amortized water supply user payments are more than sufficient to cover the hydropower credit amount.

Non-Federal Costs

In consideration of the right to utilize the storage space at Bull Shoals Lake [and the water supply conduit] for Municipal and Industrial water supply purposes, the OMRPWA and MCRWD shall pay to the Government the cost of storage as listed below as principal owing, amortized over a thirty year period at the interest rate required by the Water Supply Act of 1958, as amended:

- The cost of storage to OMRPWA under Agreement No. 1 at reduced low income pricing of $1,669,990
- The cost of storage to OMRPWA under Agreement No. 2 at not more than $18,472; and
- The cost of storage to MCRWDat reducing low income pricing of $280,861.

The Little Rock District shall operate and maintain Bull Shoals Lake and Dam. OMRPWA and MCRWD shall pay a share of the costs of such operation and maintenance calculated to be 0.2293%, and 0.0382%, respectively. OMRPWA and MCRWD shall be responsible for operation and maintenance of all installations and facilities which they may construct for the diversion or withdrawal of water, and shall bear all costs of construction, operation and maintenance of such installations and facilities.

8.2 Federal and Non-Federal Responsibilities

Federal Responsibilities

The Little Rock District shall reallocate storage (conservation pool) at Bull Shoals Lake so as to include storage of M&I water supply for the OMRPWA and MCRWD. The Government reserves the right to control and use all storage in Bull Shoals Lake in accordance with authorized purposes. The Government reserves the right to take such measures as may be necessary in the operation of Bull Shoals Lake and Dam to preserve life and/or property, including the right not to make downstream releases during such periods of time as deemed necessary, in its sole discretion, to inspect, maintain or repair the Federal facilities.

Sedimentation surveys will be made by the District Engineer during the term of the water storage agreement at intervals not to exceed fifteen (15) years unless the District Engineer determines that such surveys are unnecessary.

Non-Federal Responsibilities

The regulation of the use of water withdrawn or released from the reallocation of storage space at Bull Shoals Lake shall be the sole responsibility of the OMRPWA and MCRWD. The OMRPWA and MCRWD have full responsibility to acquire in accordance with State laws and regulations, and, if necessary, to establish or defend, any and all water rights needed for utilization of the storage provided under their water supply storage agreements.

OMRPWA and MCRWD agree to furnish and install, without cost to the Government, suitable meters or measuring devices satisfactory to the District Engineer for the measurement of water which is withdrawn from Bull Shoals Lake by any means other than through the Project outlet works. OMRPWA and MCRWD shall furnish to the Government monthly statements of all such withdrawals.

During any construction, operation, and maintenance by the OMRPWA and MCRWD of any facilities, specific actions will be taken to control environmental pollution which could result from such activity and to comply with applicable Federal, State, and local laws and regulations concerning environmental pollution. Particular attention should be given to:

a. Reduction of air pollution by control of burning, minimization of dust, containment of chemical vapors, and control of engine exhaust gases, and of smoke from temporary heaters;
b. Reduction of water pollution by control of sanitary facilities, storage of fuels and other contaminants, and control of turbidity and siltation from erosion;
c. Minimization of noise levels;
d. On site and off site disposal of waste and spoil; and,
e. Prevention of landscape defacement and damage.

8.3 Proposed Schedule

The proposed implementation schedule for reallocation at Bull Shoals Lake is as follows:

OMRPWA and MCRWD:

- Sign Water Supply Storage Agreement No. 1 with OMRPWA, August 2010
- Sign Water Supply Storage Agreement No. 2 with OMRPWA, September 2010
- Sign Water Supply Agreement with MCRWD, September 2010
- OMRPWA starts construction of USDA-funded Water Treatment Plant (expected to take approximately 20 months), October 2010.

WRMF:

- Implement WRMF Project, Spring 2012.

8.4 Proposed Agreements

8.4.1 Water Supply Storage Agreement Considerations

Reallocation of storage at Bull Shoals Lake will be implemented by the following three (3) water supply agreements:

- Water Supply Storage Agreement No. 1 (for 10,096.675 ac-ft) between the Department of the Army and Ozark Mountain Regional Public Water Authority for the Reallocated Water Storage Space in Bull Shoals Lake, Arkansas;
- Water Supply Storage Agreement No. 2 (for 91.788 ac-ft) between the Department of the Army and Ozark Mountain Regional Public Water Authority for the Reallocated Water Storage Space in Bull Shoals Lake, Arkansas; and
- Water Storage Agreement (for 1,698.077 ac-ft) between the Department of the Army and Marion County Regional Water District for the Reallocated Water Storage Space in Bull Shoals Lake, Arkansas.

8.4.2 Real Estate Easement Considerations

The following Government (Corps) Real Estate easements are required to implement the reallocation for OMRPWA at Bull Shoals Lake:

- Water Intake area [includes water intake facility, access road, parking area and a 300-foot restrictive easement area around the intake] and 8.56 acres easement
- Pipeline: temporary construction area license (1.57 acres) and permanent easement (3.93 acres)

A map of the real estate easements is provided in Figure 8.1. The cost for these outgrants to the water authority is $0. These instruments would be granted to the applicant for the benefit of the general public pursuant to the provisions of the water storage agreement.

Current policy authorizes the USACE to collect non-statutory mitigation for the impacts to the project, as well as administrative fees for evaluation and processing.

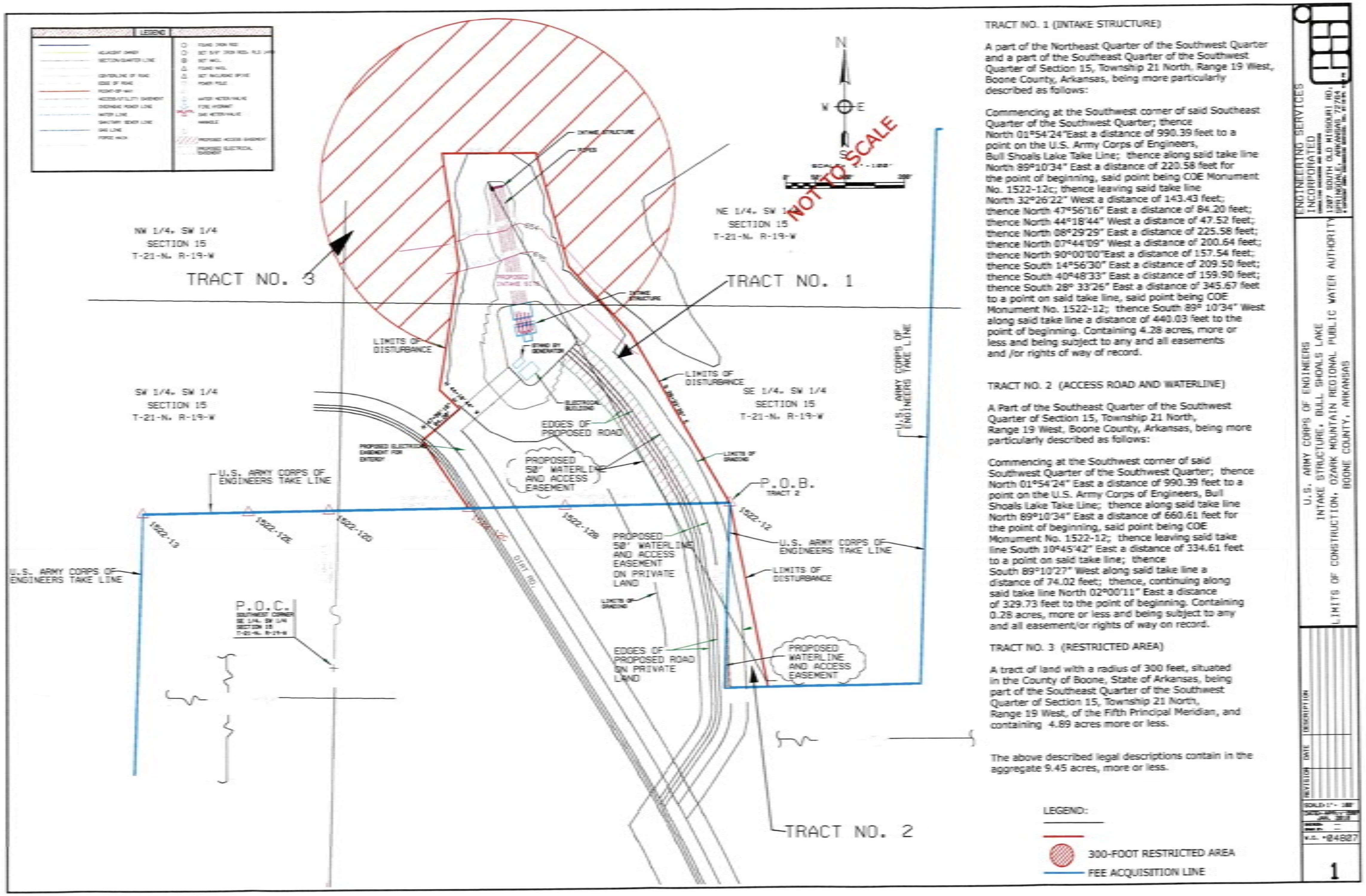

Figure 8.1 Real Estate Easements Location Map

Section 9
Conclusions and Recommendations

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 Findings

The OMRPWA is requesting 6 MGD and MCRWD is requesting an additional 1 MGD of water supply from Bull Shoals Lake. Located in north central Arkansas, Bull Shoals Lake is a Corps project authorized for the purposes of flood control, hydroelectric power, and uses of recreation, fish/wildlife, and water supply. Construction of the dam started in 1947, and Bull Shoals Lake construction was considered complete in 1963 with the installation of the final two generating units for a total of eight turbines.

Bull Shoals Lake encompasses 45,400 surface acres, a shoreline of 740 miles at the top of the design conservation pool (654 feet) and an upstream drainage basin of 6,036 square miles. The existing project storage allocations will change with implementation of WRMF. In anticipation of the WRMF, the storage capacity in the lake will be 2.127 million ac-ft of flood control storage, 1.236 million ac-ft of conservation storage, and 2.045 million ac-ft of inactive storage, for a total storage of 5.408 million ac-ft.

OMRPWA's long-term maximum daily water supply needs are approximately 7.6 MGD. The user's cost to reallocate adequate storage to provide the requested 6 MGD totals not more than $1,688,462, consisting of $1,669,990 under Agreement No. 1 based upon low income pricing, and not more than $18,472 under Agreement No. 2. OMRPWA will also pay 0.2293% for their portion of the Operations and Maintenance of Bull Shoal Lake.

MCRWD's long-term maximum daily water supply needs are approximately 4 MGD. The only current source of water is through the USACE water supply contract for 880 ac-ft at Bull Shoals Lake along with 818 ac-ft dependable yield mitigation from WRMF implementation. The user's cost to reallocate adequate storage to provide an additional 1 MGD is $280,861 based on low-income pricing. MCRWD will also pay 0.0382% for their portion of the Operations and Maintenance of Bull Shoals Lake.

A water supply reallocation from Bull Shoals Lake will have an adverse affect on SWPA. Therefore, an annual amount of $54,826 will be credited to hydropower accounting records during the 30-year water user payment period. This credit is based on the estimated loss of power outputs and the current rates charged by SWPA, and calculated by capacity credits plus energy credits. The annual capacity credits, $625, are based on capacity benefits through 2025 and capacity revenues from 2026 to 2059. The annual energy credits, $54,201, are based on energy benefits through 2025 and energy revenues from 2026 to 2059.

The cost of reallocating storage from Bull Shoals Lake was compared to the most likely and least costly alternative, reallocation from Norfolk Lake. Reallocation from Bull Shoals Lake was found to be a less costly alternative than reallocation from Norfolk Lake. In the original screening of alternatives there was no singular reason to discount the use of the inactive pool at Bull Shoals Lake for reallocation of water storage for water supply. During detailed analysis of the alternatives, the total economic losses to the other project purposes were so close that it was mathematically indistinguishable between the inactive pool and conservation pool. Reallocation to water supply from the conservation pool was preferred as it does not impact current water control plans in the basin and it preserves the existing environmental benefits of the inactive pool in extreme drought conditions. Therefore, the Little Rock District recommended a reallocation from conservation pool in the Draft Report.

Based on comments received from SWPA on the Draft Report the District re-calculated losses to hydropower based on new 2010 rates. Although reallocating storage from the inactive pool for water supply shows slightly more net economic benefits in the revised calculations, these are not sufficiently great enough to outweigh the non-monetary environmental costs of reallocating storage from the inactive pool. The environmental benefits of the inactive pool include storage for fish and wildlife, and contingency pool for emergency water supply and hydropower head in drought conditions. Given the totality of analysis, reallocating storage from the conservation pool is still the alternative that best maximizes net economic benefits while preserving existing environmental benefits. Reallocating storage from the conservation pool is the District's recommended alternative. The recommended plan is supported by SWPA's opinion that the inactive pool should not be considered.

According to the Water Supply Handbook, "reallocation is considered to be a reassignment of the usage of existing storage space in a reservoir project to a higher and better use. In this process, economic, political and public welfare issues are taken into consideration," (Revised IWR Report 96-PS-4). Reallocation of conservation pool storage from Bull Shoals Lake for water supply is to a higher and better use for the following reasons.

- Unsafe existing water supplies for many members of OMRPWA because of naturally occurring radium and other contaminants
- Inadequate water supplies during summer months
- Lack of feasible local alternatives for water supply
- Limited population and economic growth in the area due to water supply limitations
- Relatively small impact on hydroelectric power production and the power marketing authority will receive accounting record credit for the small impacts

An environmental assessment was conducted to determine the environmental impacts of the proposed reallocation. The EA and the FONSI are located in Appendix C.

The OMRPWA and MCRWD requests for the Municipal and Industrial water supply storage from the conservation pool at Bull Shoals Lake would meet the future water supply needs of north central Arkansas.

9.2 Recommendation of District Engineer

Based on the 2010 Environmental Assessment, Finding of No Significant Impacts and pursuant to the Water Supply Act of 1958 (Public Law 85-100) as amended, it is recommended to reallocate 11,886.541 ac-ft of conservation pool storage at Bull Shoals Lake from hydropower purpose to Municipal and Industrial water supply as the most efficient means to satisfy the current and projected water demands for the OMRPWA and MCRWD. It is important to note that the reallocated storage is intended to yield the requested 7 MGD, but the USACE makes no warranty of yield. This would bring the identified total water supply storage at Bull Shoals Lake to 13,585 ac-ft.

Date:____________________ ________________________________

Glen A. Masset

Colonel, U.S. Army

District Engineer

Section 10
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10.0 REFERENCES

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Appendix A
Hydrology and Hydraulics

US Army Corps
of Engineers

Little Rock District

APPENDIX A

HYDROLOGIC AND HYDRAULIC REPORT

BULL SHOALS LAKE
WATER SUPPLY STORAGE REALLOCATION

OZARK MOUNTAIN REGIONAL PUBLIC WATER AUTHORITY
AND
MARION COUNTY REGIONAL WATER DISTRICT

March 2010

CESWL-EC-H

BULL SHOALS LAKE WATER SUPPLY STORAGE REALLOCATION

OZARK MOUNTAIN REGIONAL PUBLIC WATER AUTHORITY

AND MARION COUNTY REGIONAL WATER DISTRICT

HYDROLOGIC AND HYDRAULIC REPORT

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1. **General**

This study investigated the feasibility of storage reallocations in Bull Shoals Lake for water supply that would provide a firm yield (or dependable yield) of 6 MGD for Ozark Mountain Regional Public Water Authority (OMRPWA) and an additional 1 MGD for Marion County Regional Water District (MCRWD). A comparative analysis of impacts, based on derived duration and frequency curves for reallocation plans versus existing or base conditions was performed for the White Rive Lakes (Beaver, Table Rock, Bull Shoals, Norfork and Greers Ferry), and also downstream of these, at White River control points (Calico Rock, Batesville, Newport, Augusta and Georgetown). In order to provide the requested water supply demands, the reallocation of currently authorized storage allocations was examined. The alternatives investigated are for the reallocation of storage from the conservation pool, the flood pool, or the inactive pool. The four plans explored in this study are henceforth referred to as; Base (existing), Conservation, Flood, and Inactive; where the Base plan represents the current authorized reallocation of flood storage for Minimum Flows from Bull Shoals (conservation pool elevation at 659.0 feet, msl) and Norfork Lakes.

1.1 Scope of Work

Storage volumes for reallocations of the proposed water supply yields were determined. Hydrologic and hydraulic studies were performed to determine, frequency and duration for pool elevation, lake outflow, river stage, and river discharge for each of the respective reallocation alternatives.

1.2 Bull Shoals Lake Project Data

The main dam has a maximum height above the river bed of 258 feet and extends approximately 2,256 feet in length. Bull Shoals Dam has 17 gated spillway crest gates and is the fifth largest concrete dam in the United States. Bull Shoals Lake encompasses 45,440 surface acres and a shoreline of 740 miles at the top of the design conservation pool (654 feet, msl). Bull Shoals drainage basin is 6,036 square miles, including Beaver and Table Rock Lakes.

The White River Minimum Flows Project Report and the Record of Decision were approved by the Assistant Secretary of the Army (Civil Works) in January 2009. Alternative BS-3, the recommended plan specific to Bull Shoals Lake, was authorized by the 2006 Energy and Water Development Appropriations Act Section 132(a). Alternative BS-3 reallocated five feet of flood control storage, totaling 233,000 acre-feet for a target minimum flow release of 800 cfs. The authorized top of the conservation pool will be raised five feet from elevation 654 to 659 feet, msl. With this implementation, the storage capacity in the lake will be 2.127 million acre-feet (AF) for flood control storage; 1.236 million AF of conservation storage for Minimum Flow, hydropower, and water supply; and 2.045 million AF of inactive storage for Commander approved emergency uses, including hydropower, fish habitat, recreation, water supply, and sediment storage. Total project storage is 5.408 million AF. The Minimum Flows project is currently in the planning, engineering and design phase.

Table 1 summarizes the physical features of Bull Shoals Lake with the authorized Alternative BS-3 implemented.

Table 1
Bull Shoals Lake Physical Features

Feature	**Elevation**(1)	**Area** (acres)	**Storage Volume** (ac-ft)	**Equivalent Runoff**(2) (inches)
Top of dam (3)	708			
Design pool	703	79,730	6,013,000	18.7
Top of flood control pool	695	71,240	5,408,000	16.8
Spillway crest (17 tainter gates 40’ wide by 28’ high)	667	52,510	3,682,500	11.4
Top of conservation pool (4)	659	48,005	3,281,000	10.2
Top of conservation Pool (5)	654	45,440	3,048,000	9.5
Top of inactive pool	628.5	33,795	2,045,000	6.4
Probable maximum drawdown	588	20,260	964,400	3.0
Sluice invert (16 sluices 4’ wide by 9’ high)	477.06	829	8,380	-
Streambed	450	0	0	
Total storage			5,408,000	
Flood control storage	695-659		2,127,000	
Conservation storage (min flows, hydropower & water supply)	659-628.5		1,236,000	
Inactive storage(hydropower, fish, recreation, sediment)	628.5-450		2,045,000	
(1) Feet, msl (2) 6036 sq mi of drainage area upstream of dam (3) Top of dam has a 3-foot concrete parapet (4) White River Minimum Flow Reallocation (Alt. BS-3) (5) Current operation				

1.3 Methods and Procedures

Basic hydrologic and hydraulic data for each alternative were computed in order to make the necessary comparisons of each alternative to the Base plan. This data was used to develop annual pool elevation-frequency, pool elevation-duration, and annual lake discharge-frequency and lake discharge-duration for each of the White River Lakes. The data was also used to develop annual stage-frequency, stage-duration, annual discharge-frequency and discharge-duration for the specified control points along the White River. The duration analysis was performed for annual, monthly, and seasonal (Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec) time periods.

2. Hydrologic Analysis

2.1 General

The basic hydrologic data used for this study were developed using the White River Basin hydrologic routing model, "Southwestern Division Reservoir Regulation Simulation Computer Model" (SUPER), which was developed by Southwestern Division and updated through the years to reflect the current regulating plan and hydropower operations. A discussion of this computer model is provided in Appendix A-1. For this study, the Base condition is the authorized reallocation (approved January 2009) of flood storage for Minimum Flows in Bull Shoals and Norfork Lakes. The Base condition also utilizes the hydropower load operations developed by Southwestern Power Administration (SWPA) in August 2009. This model has been used in the Little Rock District for all studies involving changes to the White River System since the 1970s. The model was calibrated to documented historical events at specific control points. The calibrated model was then used to simulate a period of record from 1 January 1940 through 31 December 2008 for the base condition and for each respective alternative reallocation. These simulations were analyzed for Water Years 1941 though 2008 resulting in a continuous 68-year period of record daily flows, stages and pool elevations for base conditions and for each respective alternative at the White River Lakes and specific control points along the White River. The SUPER Model simulations for each alternative and the Base plan are listed in Table 2 along with a brief description for each simulation.

Table 2 SUPER MODEL SIMULATIONS		
ALTERNATIVE PLANS	SUPER RUN ID	DESCRIPTION
Alternative 1 – Base (No Action)	W09X02	No Reallocation, Current Plan of Operation with Authorized Minimum Flows
Alternative 2 - Conservation	W09X03	Reallocation From Conservation Pool
Alternative 3 – Flood	W09X04	Reallocation From Flood Pool
Alternative 4 – Inactive	W09X05	Reallocation from Inactive Pool

2.2 <u>Sediment in Bull Shoals Lake</u>

The White River above Bull Shoals Dam has a relatively low sediment load, 0.027 percent of average annual flow, and was estimated at the time of design to be about 1,210 acre-feet per year. Sediment ranges have been obtained at only five (5) locations since the project was completed in 1952. These ranges were obtained in 1964 and 1979. In those 15 years only one (1) range on Big Creek indicated any measurable deposition. Although the lake is now over 55 years old, there have been no reported sediment problems. Storage in Bull Shoals for sediment is not quantified but listed as one of the project purposes of the inactive pool. The inactive pool contains 2,045,000 acre-feet of storage below elevation 628.5 feet. The maximum probable drawdown is estimated to be elevation 588 feet and is the elevation at which hydropower operations would most likely cease. The storage below elevation 588 feet, sometimes referred to as the dead pool, is 964,400 acre-feet. Assuming that sediment was accruing in Bull Shoals Lake at the original estimated rate of 1,210 ac-ft per year; then, approximately 12.5 percent of the storage below elevation 588 feet, or less than 6 percent of the total inactive pool storage, would be filled in a 100 year period. Therefore, impacts from sediment deposition should not be an issue if reallocation of storage in the upper portion of the inactive pool for water supply was approved.

2.3 Spillway Adequacy for Probable Maximum Flood (PMF)

The Spillway Adequacy Study for Bull Shoals Dam was done in 1980 and indicated a hydrologic deficiency due to overtopping by the Probable Maximum Flood (PMF). An updated spillway adequacy study for Bull Shoals is scheduled for completion by the end of FY 2010. However, routing the 1980 PMF through Bull Shoals showed no difference in maximum pool elevation based on the top of conservation pool at elevation 659.0 feet (currently authorized-Base) versus 659.25 feet (reallocation from flood pool-Flood).

2.4 White River Projects - Firm Yield

Firm yield is the amount of water available for a specific use on a dependable basis during the life of the project. SUPER model mini runs were used to determine firm yield.

Project Inflow Assumptions

1) The firm yield was established utilizing the inflow created only by the intervening area through the drought of record. For Bull Shoals the drought of record was from 22 May 1961 until 16 May 1966. No inflows from upstream reservoir power or flood control releases were considered (including the house unit release).

2) The only contribution to inflow from upstream reservoirs consists of the established leakage rate and, where applicable, the fish hatchery release.

Project Outflow Assumptions

1) The established reservoir leakage rate was considered.

2) Where applicable, the fish hatchery release was considered.

3) There were no releases for power generation.

2.5 Yield-Storage Analysis

The yield at any location is dependent on the amount of inflow. The firm yield is determined based on the storage available during the critical low flow period less any required losses. These losses are basically evaporation, leakage, and releases for downstream users. For the analysis the inflow, evaporation, leakage, and downstream releases remain constant. Therefore, only changes to the available storage impact the yield at a specific location (Bull Shoals Dam). That is, for each change in storage the yield changes. For any increase in the project’s storage the yield/storage ratio (YSR) is reduced thus requiring an increase in storage to maintain a given yield.

The conservation pool is the authorized storage for water supply and hydropower. Whenever the conservation pool storage is reallocated for Municipal and Industrial Water Supply, there is no change to the YSR. However, hydropower storage is reduced on a one to one ratio. When the conservation pool storage is increased by reallocation of other usable project storages, then the YSR is decreased and the current water supply user’s storage must be increased to maintain yield. This additional storage is called “dependable yield mitigation storage” or DYMS and is the responsibility of the requesting entity. DYMS only applies to the current water supply users. Hydropower storage remains the same and their yield is reduced.

The useable storages available for reallocation from Bull Shoals is from the conservation storage (YSR remains the same), flood storage (YSR is reduced), or inactive storage (YSR is reduced).

2.5.1 Alternative 1 - Base Condition (No Action)

The current top of conservation pool at elevation (EL) 654.0 feet (FT) has storage of 1,003,000 acre-feet (AF) and a firm yield of 656.335 MGD (1015.5 CFS). Additional SUPER runs were made for incremental storage amounts in order to determine associated project storage yields. Figure 1 shows the firm yield for additional storage reallocated from the flood pool. The Base condition for this study includes an authorized 5-foot increase in the top of conservation pool that correlates to an additional 233,000 AF of storage for Minimum Flows (Alternative BS-3), thus providing conservation pool storage of 1,236,000 AF.

The Base condition conservation pool is at EL 659.0 FT with a yield of 727.882 MGD (1126.2 cfs). “Dependable yield mitigation storage” (DYMS) was applied in the Minimum Flows (MF) reallocation to make Marion County Regional Water

District (MCRWD) whole at 1 MGD, thus increasing MCRWD's authorized storage of 880 AF to 1,698.077 AF. Also, "Hydropower Yield Protection Operation" (HYPO) was applied for MF increasing hydropower storage from 1,002,120 AF to 1,112,572.923 AF although yield was reduced slightly from 655.759 MGD to 655.196 MGD. See Table 3.

Figure 1
Elevation-Storage-Yield Curve
(Conservation plus Flood Pool)

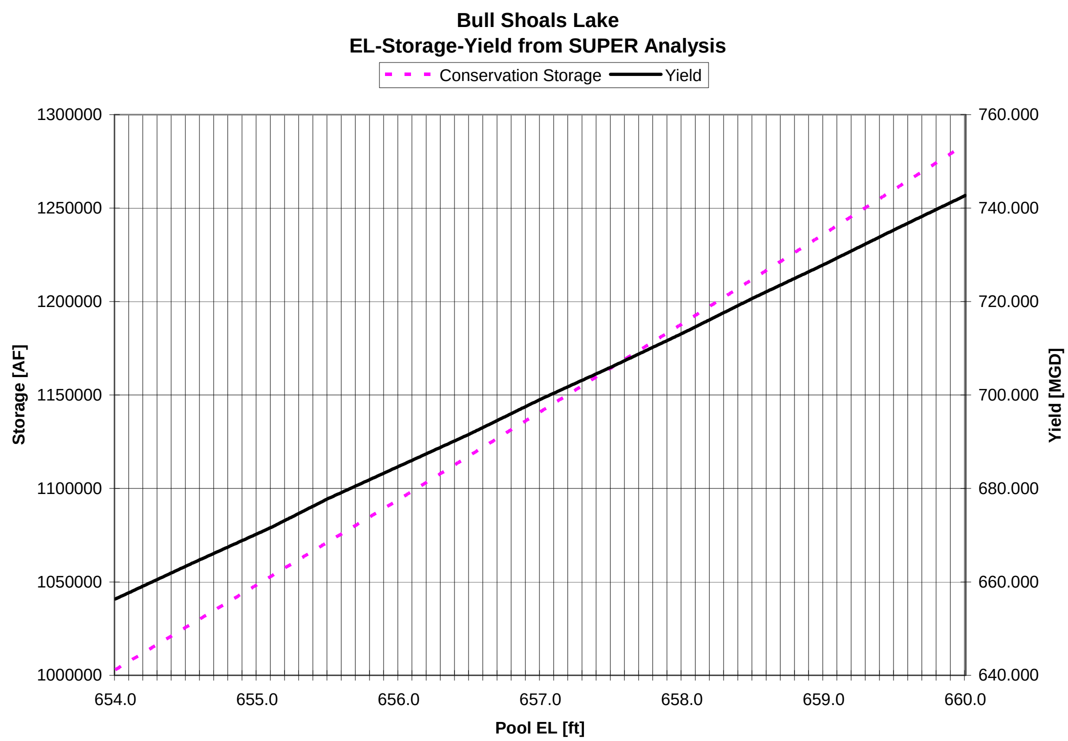


TABLE 3

FIRM YIELD STORAGE
AND
DEPENDABLE YIELD MITIGATION STORAGE
AT
BULL SHOALS LAKE

ALTERNATIVE 1 - BASE CONDITION (NO ACTION)

	Existing Conservation Pool		
	Top EL 659.00 FT		
Water Supply User	Current Yield	Current Storage	DYMS HYPO
	MGD	AF	AF
Marion County Regional (additional request)	0.000	0.000	
Ozark Mountain Regional (new request)	0.000	0.000	
Marion County Regional	1.000	1698.077	818.077
Minimum Flows	71.686	121729.000	
Hydropower	655.196	1112572.923	110,452.923
Total Yield (as per SUPER data)	727.882		111,271.000
Total Cons. Storage (as per SUPER data)		1236000.000	
Yield/Storage Ratio	0.0005889014		

2.5.2 Alternative 2 - Conservation Pool Reallocation

Reallocation of the conservation pool storage for the requested yields of 6 MGD for OMRPWA and 1 MGD for MCRWD would require 11,886.541 AF (OMRPWA: 10,188.463 AF and MCRWD: 1,698.077 AF). The reallocation would come entirely from the existing hydropower storage allocation and would reduce the hydropower yield by 7 MGD, from 655.196 MGD to 648.196 MGD. Hydropower storage would be reduced to 1,100,686.382 AF. This reallocation of existing conservation storage would require no DYMS for existing water supply users since the yield/storage ratio would remain unchanged for MCRWD and MF. The conservation storage of 1,236,000 AF has a firm yield of 727.882 MGD. See Table 4.

TABLE 4 FIRM YIELD STORAGE AND DEPENDABLE YIELD MITIGATION STORAGE AT BULL SHOALS LAKE ALTERNATIVE 2 – OMRPWA and MCRWD REALLOCATION FROM CONSERVATION POOL			
	Proposed Conservation Pool		
	Top EL 659.00 FT		
Water Supply User	Proposed Yield	Proposed Storage	DYMS
	MGD	AF	AF
Marion County Regional (2nd reallocation)	**1.000**	**1698.077**	
Ozark Mountain Regional (1st reallocation)	**6.000**	**10188.463**	
Marion County Regional	1.000	1698.077	
Minimum Flows	71.686	121729.000	
Hydropower	648.196	1100686.382	
Total Yield (as per SUPER data)	727.882		
Total Storage (as per SUPER data)		1236000.000	
Yield/Storage Ratio	0.0005889014		

2.5.3 Alternative 3 - Flood Pool Reallocation

Reallocation of storage for yields of 6 MGD for OMRPWA and 1 MGD for MCRWD from the existing flood pool storage would require raising the top of conservation pool 0.25 feet from existing EL 659.00 FT to EL 659.25 FT and would require 11,948.151 AF of additional total storage. OMRPWA would require 10,235.933 AF and MCRWD would require 1,712.218 AF of contracted storage.

Increasing the conservation storage by raising the top of conservation pool would reduce the yield/storage ratio and thus DYMS would be required for all existing water supply users except hydropower and MF as their storage remains the same. MF yield would be reduced from 71.686 MGD to 71.363 MGD as yield was not guaranteed. The reduction in the yield/storage ratio associated with raising the top of the conservation pool would reduce the yield associated with the hydropower storage by 2.958 MGD, from the existing 655.196 MGD to 652.238 MGD.

Since OMRPWA will be the first to contract for storage, they will have a required DYMS amount of 6.781 AF to make the current MCRWD yield whole. This would require raising the top of conservation pool 0.22 feet to EL 659.22 FT. See Table 5. The MCRWD purchase includes DYMS of 6.440 AF, 5.520 AF for OMRPWA and 0.920 AF MCRWD in order that their yields remain whole. This would require raising the top of conservation pool 0.03 feet to EL 659.25 FT. Rounding the pool elevation up to the nearest hundredth of a foot (659.25 ft) actually results in 51.848 AF of non-allocated storage. See Table 6.

Raising the top of conservation pool to EL 659.24 FT (as opposed to 659.25 FT) would have resulted in reducing the existing hydropower storage allocation by about 425 AF.

The new top of conservation pool at EL 659.25 FT would have a storage of 1,248,000 AF and firm yield of 731.631 MGD.

TABLE 5

FIRM YIELD STORAGE
AND
DEPENDABLE YIELD MITIGATION STORAGE
AT
BULL SHOALS LAKE

ALTERNATIVE 3 – OMRPWA REALLOCATION FROM FLOOD POOL

	Proposed Conservation Pool		
	Top EL 659.22 FT		
Water Supply User	Proposed Yield	Proposed Storage	DYMS
	MGD	AF	AF
Marion County Regional (2nd reallocation)	0.000	0.000	
Ozark Mountain Regional (1st reallocation)	**6.000**	**10229.151**	
Marion County Regional	1.000	1704.859	**6.781**
Minimum Flows	71.401	121729.000	
Hydropower	652.590	1112572.923	
Total Yield (as per SUPER data)	731.181		**6.781**
Total Storage (as per SUPER data)		1246560.000	
Yield/Storage Ratio	0.0005865589		

NOTE: Rounding up to pool elevation 659.22′ results in 324.067 ac-ft of non-allocated storage.

TABLE 6 FIRM YIELD STORAGE AND DEPENDABLE YIELD MITIGATION STORAGE AT BULL SHOALS LAKE ALTERNATIVE 3 – MCRWD REALLOCATION FROM FLOOD POOL			
	Proposed Conservation Pool		
	Top EL 659.25 FT		
Water Supply User	Proposed Yield	Proposed Storage	DYMS
	MGD	AF	AF
Marion County Regional (2nd reallocation)	**1.000**	**1705.779**	
Ozark Mountain Regional (1st reallocation)	6.000	10234.671	**5.520**
Marion County Regional	1.000	1705.779	**0.920**
Minimum Flows	71.363	121729.000	
Hydropower	652.238	1112572.923	
Total Yield (as per SUPER data)	731.631		**6.440**
Total Storage (as per SUPER data)		1248000.000	
Yield/Storage Ratio	0.0005862426		

NOTE: Rounding up to pool elevation 659.25 ft results in 51.849 ac-ft of non-allocated storage.

2.5.4 Alternative 4 - Inactive Pool Reallocation

Reallocation of storage for yields of 6 MGD for OMRPWA and 1 MGD for MCRWD from the existing inactive pool storage would require lowering the bottom of conservation pool 0.36 feet from existing EL 628.50 FT to EL 628.14 FT and would require 11,943.284 AF of additional total storage. OMRPWA would require 10,231.252 AF and MCRWD would require 1,712.032 AF of contracted storage.

Increasing the conservation storage by lowering the bottom of conservation pool would reduce the yield/storage ratio and thus DYMS would be required for all existing water supply users except hydropower and MF. MF yield would be reduced from 71.686 MGD to 71.388 MGD as yield was not guaranteed. The reduction in the yield/storage ratio associated with lowering the bottom of the conservation pool would reduce the yield associated with the hydropower storage by 2.726 MGD, from the existing 655.196 MGD to 652.470 MGD.

Since OMRPWA will be the first to contract for storage, they will have a required DYMS amount of 6.113 AF to make the current MCRWD yield whole. This would require lowering the bottom of conservation pool 0.31 feet to EL 628.19 FT. See Table 7. The MCRWD purchase includes DYMS of 6.862 AF, 5.882 AF for OMRPWA and 0.980 AF MCRWD in order that their yields remain whole. This would require lowering the bottom of conservation pool 0.05 feet to EL 628.14 FT. Rounding the pool elevation down to the nearest hundredth of a foot (628.14 ft) actually results in 296.716 AF of non-allocated storage. See Table 8.

Lowering the bottom of conservation pool to EL 628.15 FT (as opposed to 628.14 FT) would have resulted in reducing the existing hydropower storage allocation by about 42 AF.

The new bottom of conservation pool at EL 628.14 FT would have storage of 1,248,240 AF and firm yield of 732.032 MGD.

Figure 2 shows the firm yield for additional storage reallocated from the inactive pool that is associated with the Base condition.

TABLE 7

FIRM YIELD STORAGE
AND
DEPENDABLE YIELD MITIGATION STORAGE
AT
BULL SHOALS LAKE

ALTERNATIVE 4 – OMRPWA REALLOCATION FROM INACTIVE POOL

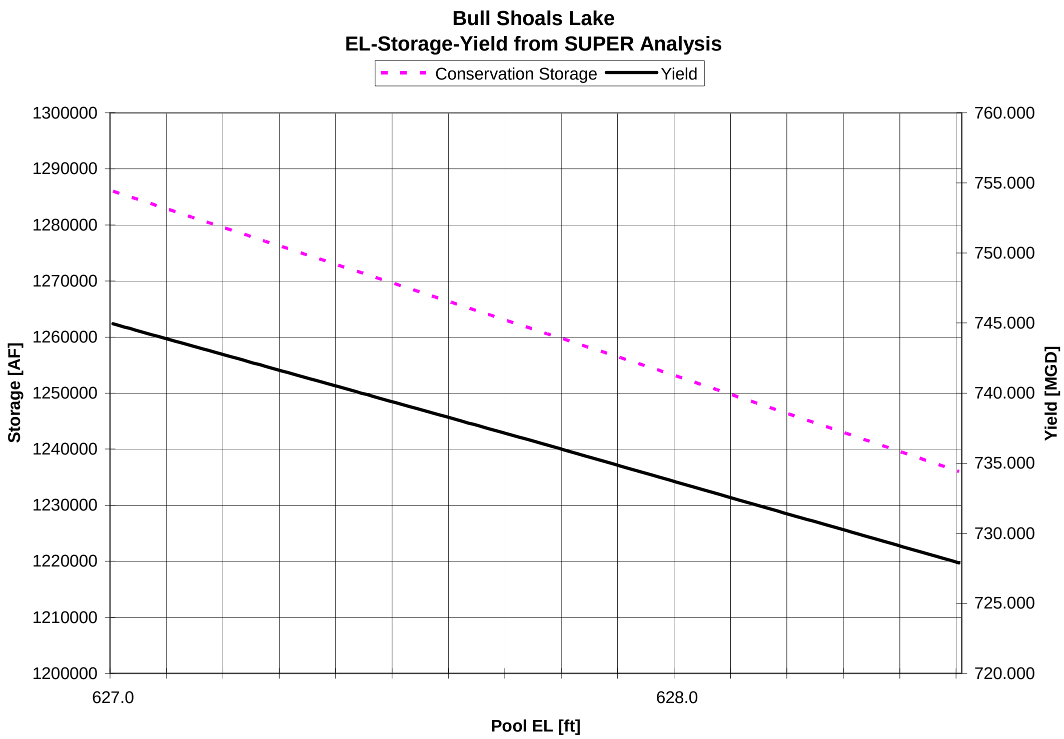
	Proposed Bottom Conservation Pool		
	Top EL 659.00 FT - Bottom 628.19 FT		
Water Supply User	Proposed Yield	Proposed Storage	DYMS
	MGD	AF	AF
Marion County Regional (2nd reallocation)	0.000	0.000	
Ozark Mountain Regional (1st reallocation)	**6.000**	**10225.139**	
Marion County Regional	1.000	1704.190	**6.113**
Minimum Flows	71.429	121729.000	
Hydropower	652.846	1112572.923	
Total Yield (as per SUPER data)	731.456		**6.113**
Total Storage (as per SUPER data)		1246540.000	
Yield/Storage Ratio	0.0005867891		

NOTE: Rounding down to pool elevation 628.19 ft results in 308.748 ac-ft of non-allocated storage.

TABLE 8 FIRM YIELD STORAGE AND DEPENDABLE YIELD MITIGATION STORAGE AT BULL SHOALS LAKE ALTERNATIVE 4 – MCRWD REALLOCATION FROM INACTIVE POOL			
	Proposed Bottom Conservation Pool		
	Top EL 659.00 FT - Bottom 628.14 FT		
Water Supply User	Proposed Yield	Proposed Storage	DYMS
	MGD	AF	AF
Marion County Regional (2nd reallocation)	**1.000**	**1705.170**	
Ozark Mountain Regional (1st reallocation)	6.000	10231.021	**5.882**
Marion County Regional	1.000	1705.170	**0.980**
Minimum Flows	71.388	121729.000	
Hydropower	652.470	1112572.923	
Total Yield (as per SUPER data)	732.032		**6.862**
Total Storage (as per SUPER data)		1248240.000	
Yield/Storage Ratio	0.0005864517		

NOTE: Rounding down to pool elevation 628.14 ft results in 296.716 ac-ft of non-allocated storage.

Figure 2
Elevation-Storage-Yield Curve
(Conservation plus Inactive Pool)



2.6 Frequency Data

The daily average river flows, river stages, lake outflows, and pool elevations computed from the SUPER model simulations were used in developing the annual series discharge-frequency curves at each lake and control point for the Base condition and for each alternative reallocation plan. Although the SUPER data output is daily average, the estimated peak flow and stage data for significant events was investigated and found to range from one (1) to five (5) percent higher. However, since relative comparisons are being used to determine plan impacts it was determined that use of the daily averages would not change the findings of this study.

2.7 Duration Data

The daily average river flows, river stages, lake outflows, and pool elevations resulting from the SUPER model simulations were used to develop pool elevation-duration, lake outflow-duration, river flow-duration and river stage-duration at each lake and control point for Base conditions and for alternative reallocation plans based on daily values.

3. Hydraulic Analysis

No hydraulic modeling (HEC-RAS) was done for determining water surface elevations along the downstream reaches of the White River due to the lack of economic data. It was determined that the economic impacts associated with flood control that are computed in SUPER for the downstream control points would suffice for this study. These flood damage impacts are shown in Chapter 5, Section 5.2.4, Flood Control Benefits Foregone. The flows and stages were based on the SUPER routings and the latest rating curves available (SWL Reservoir Control’s DSS data base) at the control points.

4. Results

4.1 White River Lakes

The impacts to the lakes from a frequency and duration analysis are very minor. Visual examination show little differences in the alternatives. However, although slight, the alternatives do have some impact. Chapter 5, Section 5.2.4, Flood Control Benefits Foregone, addresses the flood damage impacts; and Chapter 5, Section 5.2.1, Hydropower Benefits Foregone, addresses the hydropower impacts. Appendix D, Hydropower Analysis Center Report, contains the SUPER output results pertinent to the hydropower analysis.

4.1.1 Frequency

The five maximum flood events for Bull Shoals Lake that were computed from the SUPER model simulations during the 68-year period-of-record for each alternative are shown in Table 9. There are minimal differences in the maximum pool elevations for these five events. The maximum impacts to pool elevation are at the lower frequencies with an increase of about 0.3 feet for the reallocation from the flood pool alternative. Since the White River is operated as a system, any modifications to any one lake can impact the other lakes in the system. The impacts to the other lakes five maximum events are insignificant.

The five minimum pool elevations during drought events for Bull Shoals Lake are shown in Table 9. The maximum impacts of the alternatives are all less than 0.4 feet with the reallocation from the conservation pool having the greatest impact. The impacts to the other lakes for these events are less than 0.1 feet.

Table 9

Bull Shoals Lake Pool Elevations for Five Flood and Five Drought Events

For SUPER Model Simulations W09X02 (Base), W09X03 (Conservation), W09X04 (Flood) and W09X05 (Inactive)

for the Period of Simulation WY1941-2008

FLOOD EVENTS	**BULL SHOALS LAKE**			
	Pool Elevation	Pool Elevation	Pool Elevation	Pool Elevation
	W09X02	W09X03	W09X04	W09X05
	Base	Conservation	Flood	Inactive
	Max Pool EL	Max Pool EL	Max Pool EL	Max Pool EL
1945	697.40	697.40	697.40	697.40
1957	695.89	695.89	695.89	695.89
1973	695.70	695.69	695.70	695.69
2008	695.39	695.39	695.38	695.39
1990	694.80	694.80	694.81	694.80
DROUGHT EVENTS	**BULL SHOALS LAKE**			
	Pool Elevation	Pool Elevation	Pool Elevation	Pool Elevation
	W09X02	W09X03	W09X04	W09X05
	Min Pool EL	Min Pool EL	Min Pool EL	Min Pool EL
	Bottom Conservation Pool (BCP) 628.5 feet			BCP 628.14 feet
1953-1957	643.17	642.87	643.28	642.91
1980-1982	644.65	644.27	644.70	644.33
1999-2002	645.52	645.24	645.67	645.30
2005-2007	646.26	645.93	646.28	645.98
1961-1966	647.03	646.65	647.07	646.71

Table 10 shows the maximum difference in Bull Shoals Lake releases (outflow) increased by less than 0.1 percent for the Flood alternative and reduced by less that 0.1 percent for the Conservation and Inactive alternatives for the 1945 flood event which is the maximum outflow for the period of simulation.

Graphical plots and tabulated frequency data of the maximum and minimum pool elevations and outflow for Bull Shoals Lake are shown in Appendix A-2, Bull Shoals Lake Elevation and Outflow Frequency. The impacts at the other four lakes were less than at Bull Shoals and deemed negligible and thus not presented in this report. The results are available in the Hydrology and Hydraulics Section of the Little Rock District upon request.

Table 10
Downstream Control Points Flows and Stages
For SUPER Model Simulations W09X02 (Base), W09X03 (Conservation), W09X04 (Flood) and W09X05 (Inactive)
for the Period of Simulation WY1941-2008

CONTROL POINTS	Downstream Impacts for the Maximum Flood Event (1945)*							
	Max Flow (dsf)				Max Stage (feet)			
	W09X02	W09X03	W09X04	W09X05	W09X02	W09X03	W09X04	W09X05
Bull Shoals Outflow	131,709	131,692	131,731	131,693	N/A	N/A	N/A	N/A
Calico Rock (FS 19)	251,865	251,851	251,904	251,851	43.34	43.34	43.34	43.34
Batesville (FS 15)	299,015	299,003	299,057	299,003	28.66	28.66	28.66	28.66
Newport (FS 26)	313,854	313,842	313,896	313,842	33.74	33.74	33.74	33.74
Georgetown (FS 21)	259,662	259,648	259,698	259,648	32.98	32.98	32.99	32.98

*1945 event represented the greatest impacts above FS for the simulation period WY1941-2008 and visual examination of the 1957, 1973, 1990 and 2008 events showed less impacts than 1945 event.
FS = Flood Stage

4.1.2 Duration

Appendix A-3, Bull Shoals Lake Elevation and Outflow Duration, presents the graphical plots and tables for annual pool elevations and lake outflow duration for Bull Shoals Lake. The comparative duration results in the plots and tables show a maximum change of 0.3 feet in the pool and only a very minor change at the outflow. The impacts at the other four lakes were less than at Bull Shoals and deemed negligible and thus not presented in this report. The results are available in the Hydrology and Hydraulics Section of the Little Rock District upon request.

4.2 White River

The impacts to the downstream control points from a frequency and duration analysis are very minor. Visual examination show little differences in the alternatives. However, although slight, the alternatives do have some impact. Chapter 5, Section 5.2.4, Flood Control Benefits Foregone, addresses the flood damage impacts.

4.2.1 Frequency

Table 10 shows the maximum difference in flows and stages at the downstream control points increased by less than 0.1 percent for the Flood alternative and decreased by less than 0.1 percent for the Conservation and Inactive alternatives for the 1945 flood event which is the maximum event for the period of simulation.

Graphical plots and tabulated frequency data of the maximum flow and stage for the downstream control points, Calico Rock and Newport are shown in Appendix A-4, Downstream Control Points, Calico Rock and Newport, Flow and Stage Frequency. The impacts at the other control points were deemed negligible and thus not presented in this report. The results are available in the Hydrology and Hydraulics Section of the Little Rock District upon request.

4.2.2 Duration

Appendix A-5, Downstream Control Points, Calico Rock and Newport, Flow and Stage Duration, presents the graphical plots and tables for annual flow and stage for the downstream control points, Calico Rock and Newport. The impacts at the other control points were deemed negligible and thus not presented in this report. The results are available in the Hydrology and Hydraulics Section of the Little Rock District upon request.

5. Conclusions

The reallocation of storage in Bull Shoals Lake for water supply will provide a firm yield (dependable yield) of 6 MGD for Ozark Mountain Regional Public Water Authority and an additional 1 MGD for Marion County Regional Water District. This reallocation will have a minimal hydrological impact on the authorized purposes of the White River System whether reallocated from the flood, conservation or inactive pools.

6. References

EM 1110-2-1420 Hydrologic Engineering Requirements for Reservoirs, 31 October 1997.

EM 1110-2-1419 Hydrologic Frequency Analysis, 5 March 1993.

ER 1165-2-119 Modifications to Completed Projects, 20 September 1982.

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IWR Report 96-PS-4 (Revised) Water Supply Handbook, December 1998.

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

Reservoir Regulation Manual for Beaver, Table Rock, Bull Shoals, and Norfork Reservoirs, Revised October 1966.

Drought Contingency Plan – Appendix V to Master Water Control Manual – White River Basin Arkansas and Missouri, October 1989.

Power Benefits Foregone Due to Water Supply Withdrawals, White River Basin Projects, September 10, 1997.

White River Minimum Flows Reallocation Report, July 2004.
White River Basin, Arkansas Minimum Flows, November 2008 (Revised January 2009).

APPENDIX A-1

SUPER MODEL DESCRIPTION

SOUTHWESTERN DIVISION RESERVOIR REGULATION SIMULATION COMPUTER MODEL DESCRIPTION (SUPER)

1.0 General. The Southwestern Division Reservoir Regulation Computer Model (commonly referred to as “SUPER”) is a tool for evaluating the impacts, both hydrologic and economic, of a given regulation plan for a multipurpose system of reservoirs. The following brief description pertains only to the features associated with the hydrologic aspects of simulated flood control operations. The following topics are covered:

* Hydrologic Input Data,
* Reservoir System and Regulation Plan Description Data,
* Simulation of Streamflow Forecast,
* Mandatory Flood Release Schedule,
* Regulation Targets and Available Channel Space Determination,
* Forecast Reservoir Levels and Target Balance Levels, and
* Flood Control Release Schedule Development.

2.0 Hydrologic Input Data. The “SUPER” computer model is a period of record simulation model using a routing interval of one day. The hydrologic input to the model, for every reservoir and stream control point, is the period of record uncontrolled area flow. That is, at any of these controls, the input hydrograph constitutes all flow which is attributable to the drainage above that point but below the first upstream reservoir on the tributaries that contribute to that point. The development of these uncontrolled data hydrographs is based on computations that utilize all available pertinent daily records and multi-reach storage vs. discharge (Puls) stream routing relationships. The hydrologic input data is an estimate of the period of record hydrographs that would result if all reservoirs in the modeled area were of infinite storage capacity and no releases were ever made.

3.0 Reservoir System and Regulation Plan Description Data. The basic input data required to describe the reservoirs includes area-capacity curves, maximum discharge curves, and minimum (induced surcharge) discharge curves. In addition, the relationship of the reservoirs to one another is defined by a seasonal function of storage vs.

level for each reservoir. The purpose for these is to provide operational priority to achieve balance among the reservoirs. Two reservoirs are considered in balance when they are at the same level as determined from their respective storage-level functions and contents. The relationship of each reservoir control point to other reservoir and stream control points is provided by a set of Muskingum stream routing coefficients for each control point below the reservoir. This provides the way for determined releases to be routed downstream from each reservoir to be added to the input uncontrolled area hydrographs to produce the regulated hydrograph at the downstream control points. The regulating discharge criteria are supplied for all stream control points (including reservoir outflow controls) as a seasonal function of a system state parameter. The parameter can be null, the current level or the forecast level of a particular reservoir, or the percent of flood storage forecast to be used in a specified group of reservoirs.

4.0 Simulation of Streamflow Forecast. The “SUPER” model iterates sequentially through each day of the period of record determining releases that adhere to the plan of flood control regulation, taking into account hydrologic conditions on each particular day. In order to achieve realism in the flood release schedules each day, it is necessary to simulate a forecast of the flows expected as reservoir inflow and at the stream control points. The objective is for the simulated forecast to be reasonably equivalent to a real-time forecast, based on the rainfall and stream flow data that would be available at that time. The forecast is simulated at each model control point by use of an input specified number of days, beginning with the current day, in which flows are known perfectly. Beyond the span of perfect knowledge, future flows are estimated by use of the input normal recession factors for each individual control point.

5.0 Mandatory Flood Release Schedule. The mandatory flood release schedule is the first major determination made each day of the period of record. These releases are forced releases made only from the flood pool and surcharge pool because the flood pool would be exceeded during the forecast period. The procedure is to determine a release schedule that begins immediately and will minimize the maximum outflow rate and will stay within the restraints provided by the minimum discharge curve and the maximum discharge curve. This schedule is computed for the forecast period beginning with upstream reservoirs. The mandatory release schedule for a reservoir, once determined, is routed downstream from that reservoir and added to the inflow forecast of the first reservoir downstream of it. In this manner, mandatory flood releases from upstream reservoirs are taken into account when the downstream reservoir's mandatory release schedule is computed. In addition, mandatory releases are routed and added to the forecast hydrographs at all control points between the reservoir and its nearest downstream reservoir.

6.0 Regulation Targets and Available Channel Space Determination. Subsequent to the development and routing of the mandatory release schedule, the flood regulation target flow is determined for each day of the forecast period based on the input regulating discharge function, the current date, and the appropriate parameter for each control point. Once this is accomplished, the space available, by day through the forecast period for flood releases, is determined for each control point by subtracting the forecast flow from the regulating discharge target.

7.0 Forecast Reservoir Levels and Target Balance Levels. The next major step performed by the model is to determine the maximum level each reservoir would reach during the forecast and scheduling period if no flood releases in addition to the mandatory releases were made. Once this is done, all reservoirs are arranged in order by maximum forecast level. Several stream flow control points were designated in the input as “key” control points and the reservoirs that are subject to each of these “key” control points were identified. A target balance level is then determined for each “key” control point where the forecast storage in the identified reservoirs that are above the target balance level equals the release volume that can be moved through the available channel space at the “key” control point over the forecast and release scheduling period. The target balance levels for all of the “key” control points are then arranged in order by level to form the basis for a series of iterations through the entire system of reservoirs. During each of these iterations, all of the reservoirs which are forecast to be above that level are considered in the development of the flood control release schedules.

8.0 Flood Control Release Schedule Development. A series of iterations are performed in which the flood control release schedules for the system of reservoirs are incrementally increased. There is one iteration for each of the target balance levels determined for the “key” control points considered in descending order of magnitude by level. On a particular iteration, only those reservoirs that were forecast to be higher than the corresponding target balance level are considered, and on any iteration the maximum volume of flood water that is subject to scheduling is limited to the volume of water above the highest target balance level which is associated with any “key” control point to which it is subject. For each reservoir, in turn, during a particular iteration, all of the control points and reservoirs below that reservoir are evaluated to develop a schedule which releases the flood water at the earliest possible time but is subject to the constraints listed below.

(a) The first flood release (current day) cannot exceed the previous day release plus the allowable rising release change rate.

(b) The adjacent day's release schedule cannot vary by more than a prescribed amount.

(c) As the flood pool nears empty, the release schedule must decrease each day at a rate no greater than the maximum allowable falling release change rate.

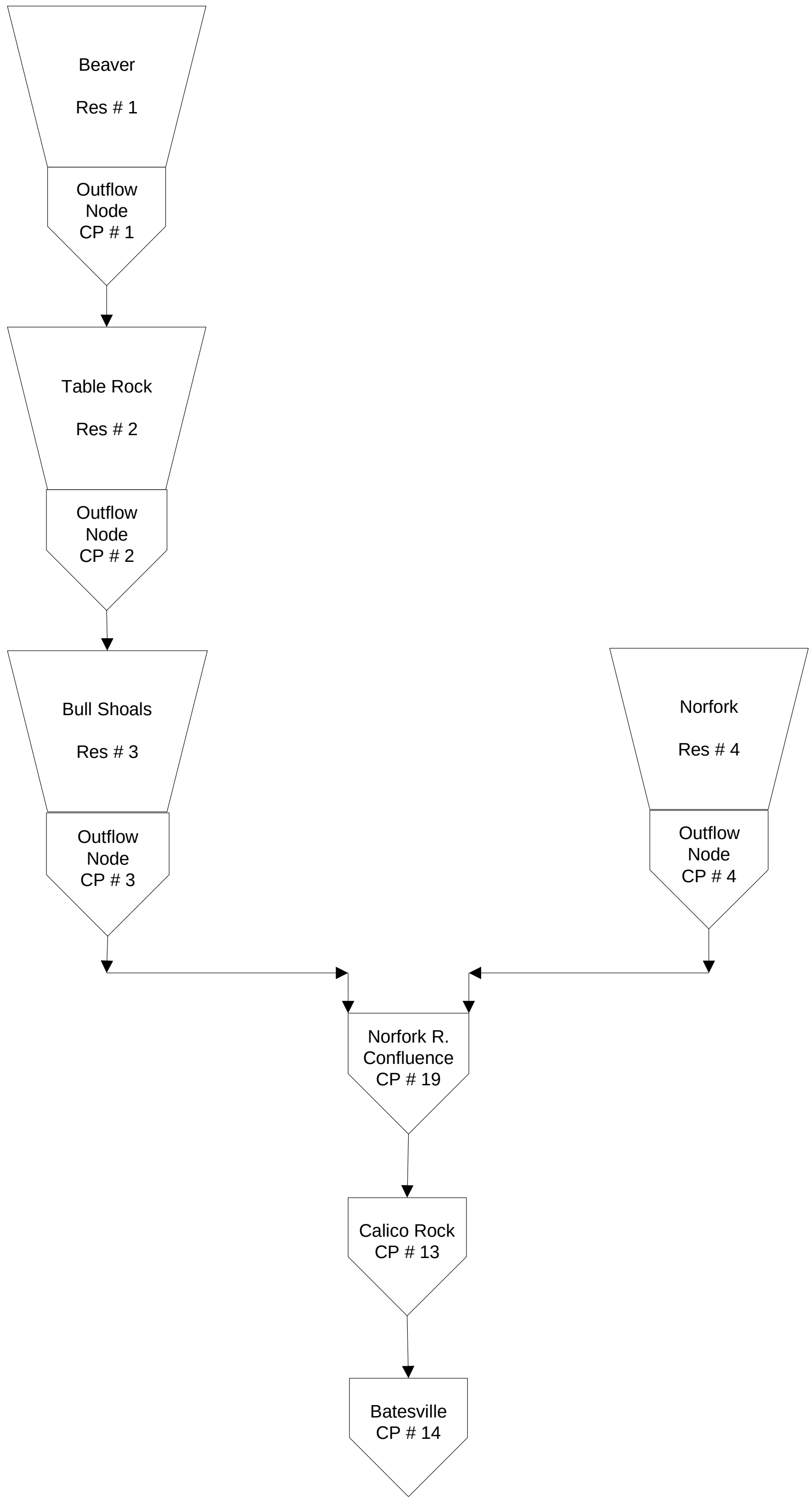
(d) The routed releases must not exceed the available space at non-“key” control points giving consideration to space that already has been reserved for another reservoir's release schedule. For “key” control points, only a share of the space can be considered for use by the current reservoir based on its reservation established during development of the target balance level associated with that control point.

(e) Space is available for storage in downstream tandem reservoirs above each reservoir's forecast maximum level but below the target balance level unless it has already been reserved for another reservoir's release schedule. The available storage space in the downstream reservoir is used to reduce the release schedule that is evaluated at control points below the downstream reservoir.

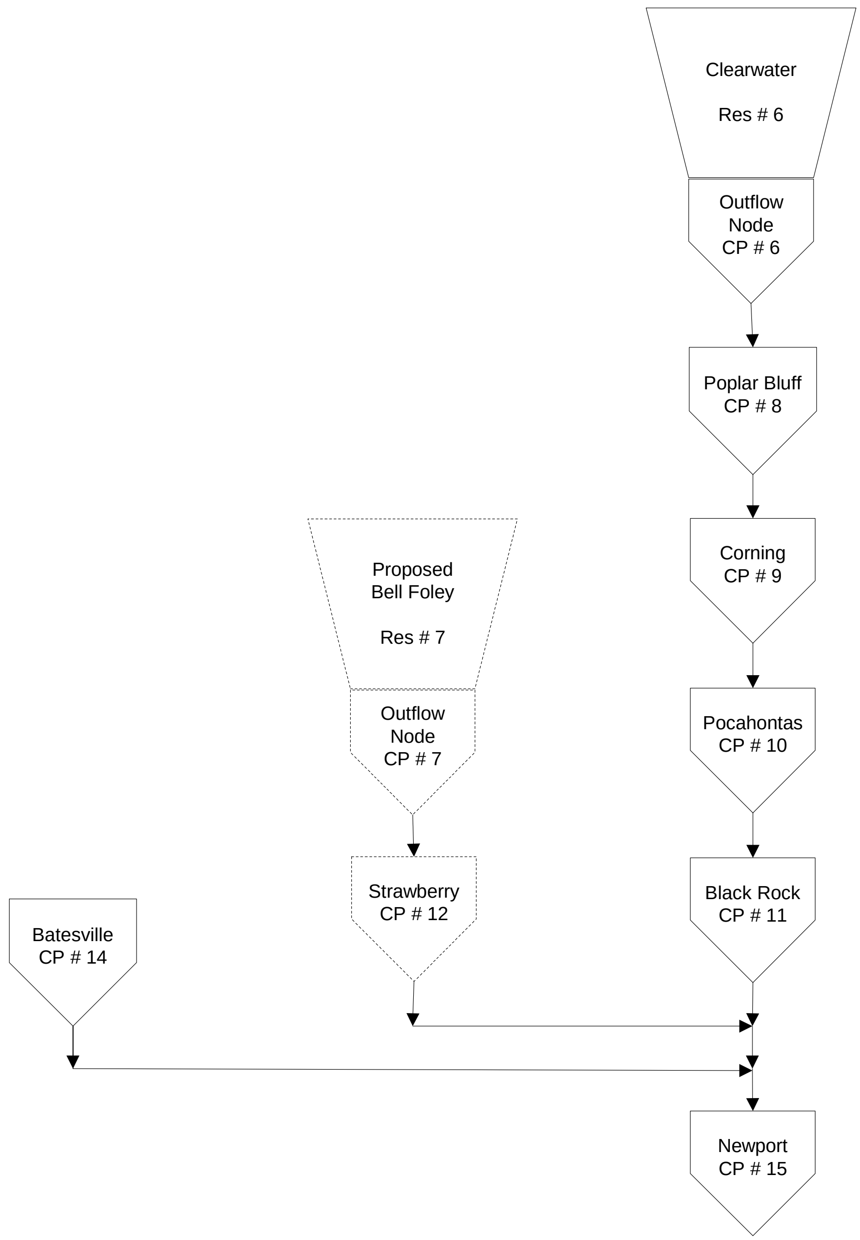
As the procedure scans each of the downstream control points, it continues to either reduce the schedule to fit the available space or to leave the schedule as determined to be the allowable at upstream controls until a final schedule is achieved that is within all constraints.

The White River Basin Reservoir Regulation Simulation Model (SUPER) Schematic is shown in the next three pages.

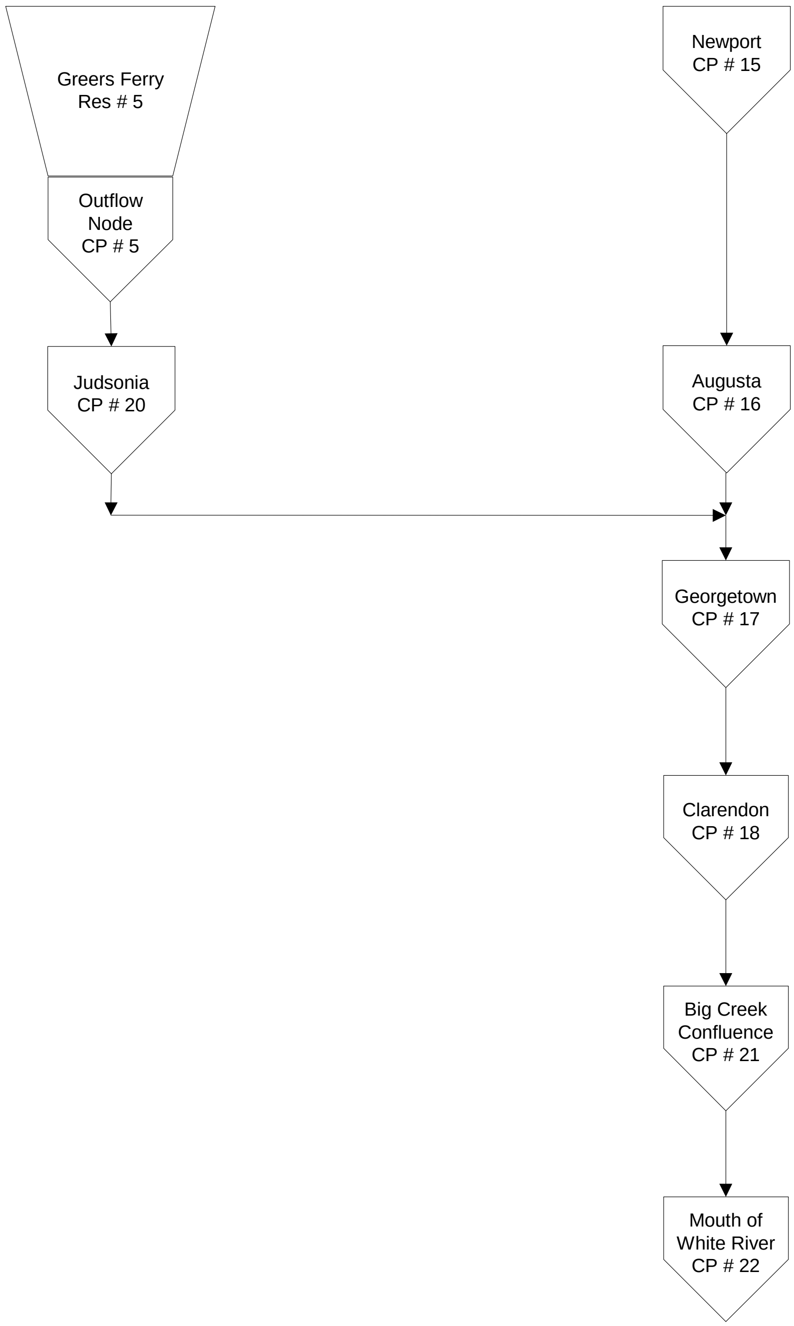
White River Basin Reservoir Regulation Simulation Model Schematic
(White River above Batesville)



White River Basin Reservoir Regulation Simulation Model Schematic
(White River above Newport and below Batesville)



White River Basin Reservoir Regulation Simulation Model Schematic
(White River below Newport)

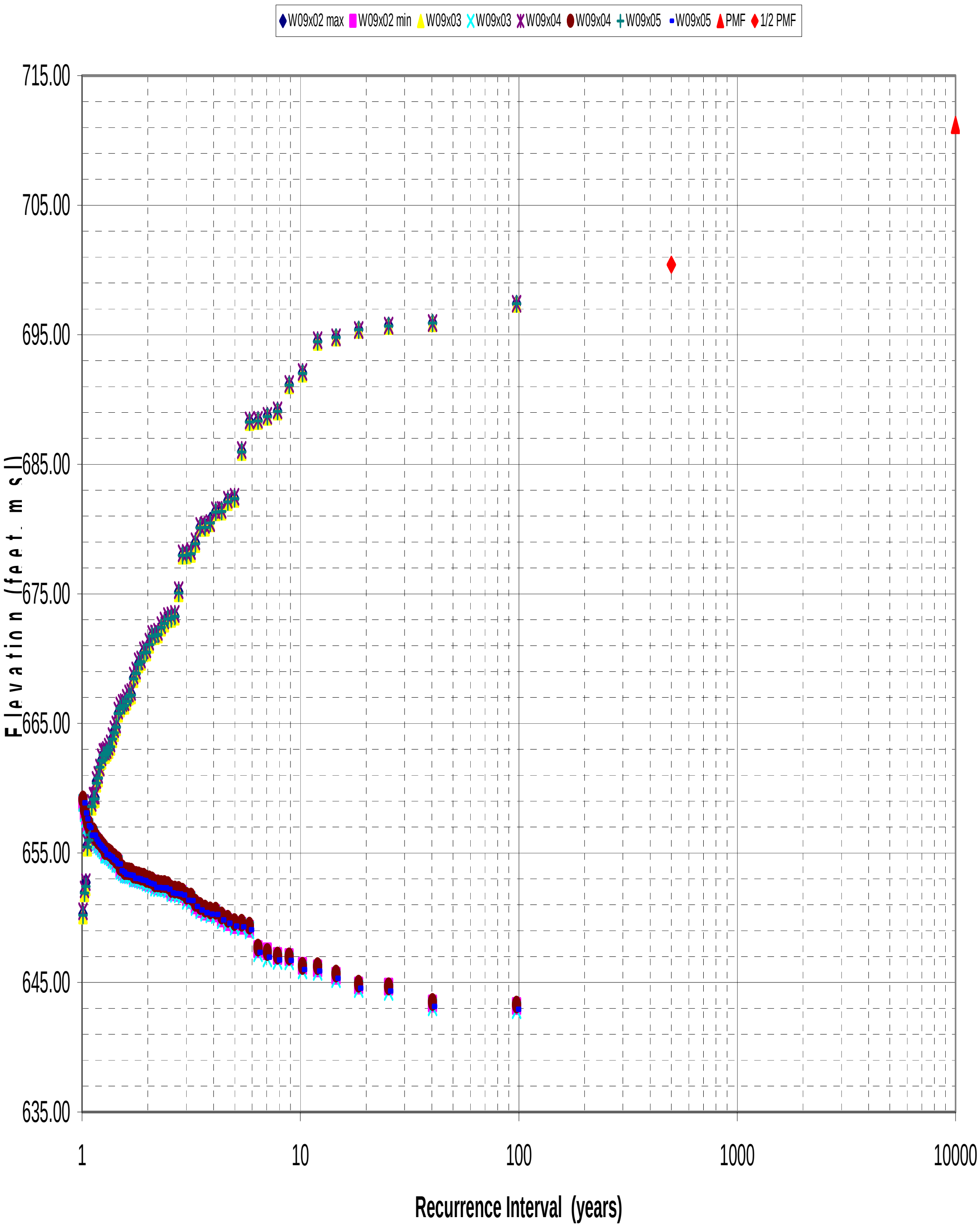


APPENDIX A-2

BULL SHOALS LAKE

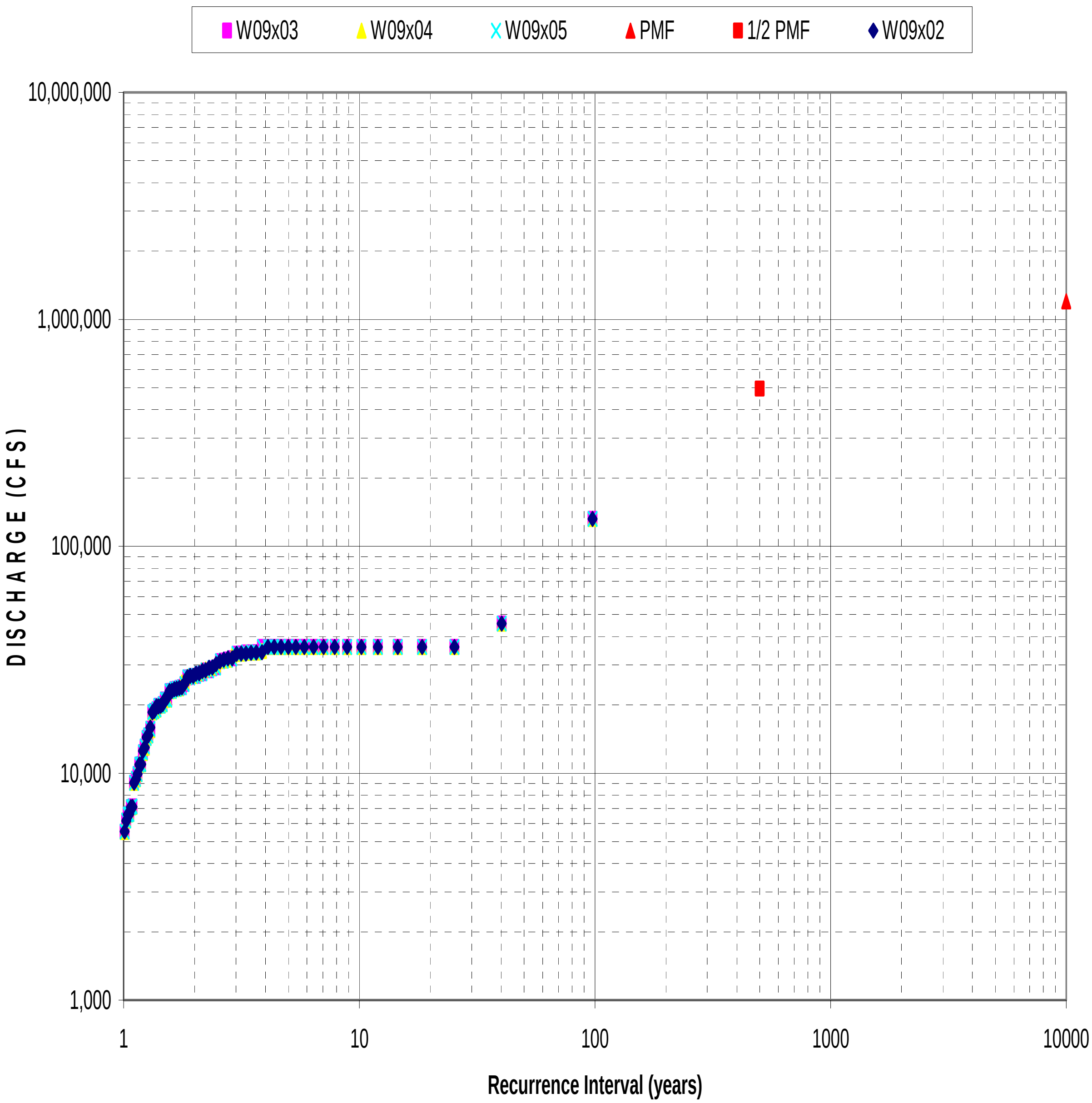
ELEVATION AND OUTFLOW FREQUENCY

BULL SHOALS LAKE
ELEVATION FREQUENCY CURVE



Bull Shoals SUPER Max/Min Pool Elevations																		
	W09x02				W09x03				W09x04				W09x05				median plotting position	RI (years)
rank	water year	max	water year	min	water year	max	water year	min	water year	max	water year	min	water year	max	water year	Min		
1	45	697.4	55	643.2	45	697.4	55	642.9	45	697.4	55	643.3	45	697.4	55	642.9	1.02	97.71
2	57	695.9	54	643.4	57	695.9	54	643.1	57	695.9	54	643.5	57	695.9	54	643.1	2.49	40.24
3	73	695.7	82	644.7	73	695.7	82	644.3	73	695.7	82	644.7	73	695.7	82	644.3	3.95	25.33
4	8	695.4	81	644.8	8	695.4	81	644.5	8	695.4	81	644.9	8	695.4	81	644.5	5.41	18.49
5	90	694.8	1	645.5	90	694.8	1	645.2	90	694.8	1	645.7	90	694.8	1	645.3	6.87	14.55
6	43	694.5	0	646.1	43	694.5	0	645.8	43	694.6	0	646.2	43	694.5	0	645.9	8.33	12.00
7	61	692.0	7	646.3	61	692.0	7	645.9	61	692.1	7	646.3	61	692.0	7	646.0	9.80	10.21
8	2	691.1	6	647.0	2	691.1	6	646.6	2	691.2	6	647.0	2	691.1	6	646.7	11.26	8.88
9	74	689.1	64	647.0	74	689.1	64	646.7	74	689.2	64	647.1	74	689.1	64	646.7	12.72	7.86
10	85	688.7	65	647.4	85	688.7	65	646.9	85	688.8	65	647.3	85	688.7	65	646.9	14.18	7.05
11	79	688.4	57	647.6	79	688.4	57	647.2	79	688.5	57	647.7	79	688.4	57	647.3	15.64	6.39
12	50	688.3	53	649.1	50	688.3	53	649.0	50	688.4	53	649.4	50	688.3	53	649.1	17.11	5.85
13	95	686.0	56	649.4	95	686.0	56	649.3	95	686.1	56	649.6	95	686.0	56	649.3	18.57	5.39
14	94	682.4	2	649.4	94	682.3	2	649.3	94	682.5	2	649.6	94	682.3	2	649.3	20.03	4.99
15	51	682.2	67	649.7	51	682.1	67	649.6	51	682.3	67	649.9	51	682.1	67	649.6	21.49	4.65
16	58	681.4	66	649.9	58	681.4	66	649.8	58	681.5	66	650.2	58	681.4	66	649.8	22.95	4.36
17	93	681.3	48	650.3	93	681.3	48	650.2	93	681.4	48	650.5	93	681.3	48	650.2	24.42	4.10
18	46	680.6	80	650.3	46	680.5	80	650.3	46	680.5	80	650.6	46	680.5	80	650.3	25.88	3.86
19	4	680.1	89	650.5	4	680.1	89	650.4	4	680.3	89	650.7	4	680.1	89	650.4	27.34	3.66
20	75	680.1	90	650.7	75	680.1	90	650.6	75	680.3	90	650.9	75	680.1	90	650.6	28.80	3.47
21	49	678.9	72	650.9	49	678.9	72	650.8	49	679.1	72	651.2	49	678.9	72	650.9	30.26	3.30
22	91	678.1	4	651.4	91	678.1	68	651.3	91	678.3	4	651.6	91	678.1	4	651.3	31.73	3.15
23	86	678.0	68	651.6	86	678.0	4	651.3	86	678.2	68	651.7	86	678.0	68	651.4	33.19	3.01
24	83	678.0	5	651.8	83	678.0	5	651.7	83	678.1	5	652.0	83	678.0	5	651.7	34.65	2.89
25	97	675.1	79	651.9	97	675.1	79	651.8	97	675.3	79	652.1	97	675.1	79	651.8	36.11	2.77
26	88	673.3	41	652.0	88	673.3	73	651.9	88	673.4	73	652.2	88	673.3	73	651.9	37.57	2.66
27	98	673.1	73	652.0	98	673.1	41	651.9	98	673.4	41	652.2	98	673.1	41	651.9	39.04	2.56
28	60	673.1	88	652.2	60	673.1	88	652.2	60	673.3	88	652.5	60	673.1	88	652.2	40.50	2.47
29	66	672.7	45	652.4	66	672.7	63	652.3	66	672.9	45	652.6	66	672.7	45	652.3	41.96	2.38
30	68	672.4	77	652.4	68	672.4	77	652.3	68	672.6	77	652.6	68	672.4	77	652.3	43.42	2.30
31	52	671.9	71	652.4	52	671.9	45	652.3	52	672.1	71	652.6	52	671.9	63	652.3	44.88	2.23
32	69	671.8	63	652.5	69	671.8	71	652.3	69	671.9	63	652.6	69	671.8	71	652.3	46.35	2.16
33	84	671.7	96	652.7	84	671.7	96	652.6	84	671.9	96	652.9	84	671.7	96	652.6	47.81	2.09
34	70	671.1	52	652.7	70	671.1	52	652.6	70	671.3	52	652.9	70	671.1	52	652.6	49.27	2.03
35	92	670.5	3	652.8	92	670.5	3	652.7	92	670.7	3	653.0	92	670.5	3	652.7	50.73	1.97
36	78	670.5	85	652.9	78	670.5	85	652.9	78	670.6	85	653.1	78	670.5	85	652.9	52.19	1.92
37	47	669.8	42	653.0	47	669.8	42	652.9	47	669.9	42	653.2	47	669.8	42	652.9	53.65	1.86
38	99	669.6	60	653.0	99	669.6	60	653.0	99	669.8	60	653.3	99	669.6	60	653.0	55.12	1.81
39	76	668.9	47	653.1	76	668.9	47	653.0	76	669.1	47	653.3	76	668.9	47	653.0	56.58	1.77
40	42	668.5	59	653.1	42	668.4	59	653.0	42	668.7	59	653.3	42	668.4	59	653.0	58.04	1.72
41	71	667.2	61	653.3	71	667.2	61	653.3	71	667.4	61	653.5	71	667.2	61	653.3	59.50	1.68
42	5	667.1	8	653.3	5	667.1	8	653.3	5	667.3	8	653.6	5	667.1	8	653.3	60.96	1.64
43	89	666.8	99	653.3	89	666.7	99	653.3	89	667.0	84	653.6	89	666.7	99	653.3	62.43	1.60
44	72	666.4	84	653.4	41	666.4	84	653.3	41	666.6	99	653.6	41	666.4	84	653.3	63.89	1.57
45	41	666.4	44	653.6	72	666.4	44	653.5	72	666.6	44	653.8	72	666.4	44	653.5	65.35	1.53
46	53	666.2	97	653.7	53	666.2	97	653.6	53	666.4	97	653.9	53	666.2	97	653.6	66.81	1.50
47	48	665.8	86	654.2	48	665.8	86	654.1	48	666.0	86	654.4	48	665.8	86	654.1	68.27	1.46
48	65	664.7	98	654.2	65	664.7	98	654.2	65	664.9	98	654.4	65	664.7	98	654.2	69.74	1.43
49	96	664.4	83	654.5	96	664.3	83	654.4	96	664.6	83	654.7	96	664.3	83	654.4	71.20	1.40
50	44	663.8	70	654.5	44	663.8	70	654.5	44	664.0	70	654.8	44	663.8	70	654.5	72.66	1.38
51	59	663.2	78	654.7	59	663.2	78	654.7	59	663.5	78	655.0	59	663.2	78	654.7	74.12	1.35
52	82	663.0	95	654.8	82	663.0	95	654.8	82	663.2	95	655.1	82	663.0	95	654.8	75.58	1.32
53	3	662.8	43	654.9	3	662.7	43	654.9	3	662.9	43	655.1	3	662.7	43	654.9	77.05	1.30
54	55	662.6	87	654.9	55	662.6	87	654.9	55	662.8	87	655.2	55	662.6	87	654.9	78.51	1.27
55	62	662.6	62	655.3	62	662.6	62	655.2	62	662.8	62	655.5	62	662.6	62	655.2	79.97	1.25
56	7	662.1	92	655.4	7	662.1	92	655.3	7	662.4	92	655.6	7	662.1	92	655.3	81.43	1.23
57	80	661.5	49	655.6	80	661.6	49	655.5	80	661.6	49	655.8	80	661.6	49	655.5	82.89	1.21
58	87	660.8	76	655.7	87	660.8	76	655.6	87	661.0	76	655.9	87	660.8	76	655.6	84.36	1.19
59	63	660.5	69	655.9	63	660.3	69	655.9	63	660.6	69	656.1	63	660.4	69	655.9	85.82	1.17
60	56	659.3	94	656.1	1	659.2	94	656.0	56	659.4	94	656.3	1	659.2	94	656.0	87.28	1.15
61	1	659.2	91	656.4	56	659.1	51	656.3	1	659.4	51	656.6	56	659.1	51	656.3	88.74	1.13
62	77	658.7	93	656.4	77	658.6	93	656.4	77	658.9	93	656.6	77	658.6	93	656.4	90.20	1.11
63	67	656.5	51	656.4	67	656.3	91	656.4	67	656.7	91	656.6	67	656.4	91	656.4	91.67	1.09
64	6	656.2	50	657.0	6	656.0	50	657.0	6	656.2	50	657.2	6	656.0	50	657.0	93.13	1.07
65	0	655.6	46	657.1	0	655.4	46	657.1	0	655.8	46	657.4	0	655.4	46	657.1	94.59	1.06
66	64	652.7	58	657.6	64	652.4	58	657.6	64	652.8	58	657.9	64	652.4	58	657.6	96.05	1.04
67	54	652.0	75	658.1	54	651.9	75	658.1	54	652.2	75	658.3	54	651.9	75	658.1	97.51	1.03
68	81	650.3	74	658.9	81	650.2	74	658.9	81	650.5	74	659.1	81	650.2	74	658.9	98.98	1.01

BULL SHOALS LAKE
OUTFLOW FREQUENCY CURVE

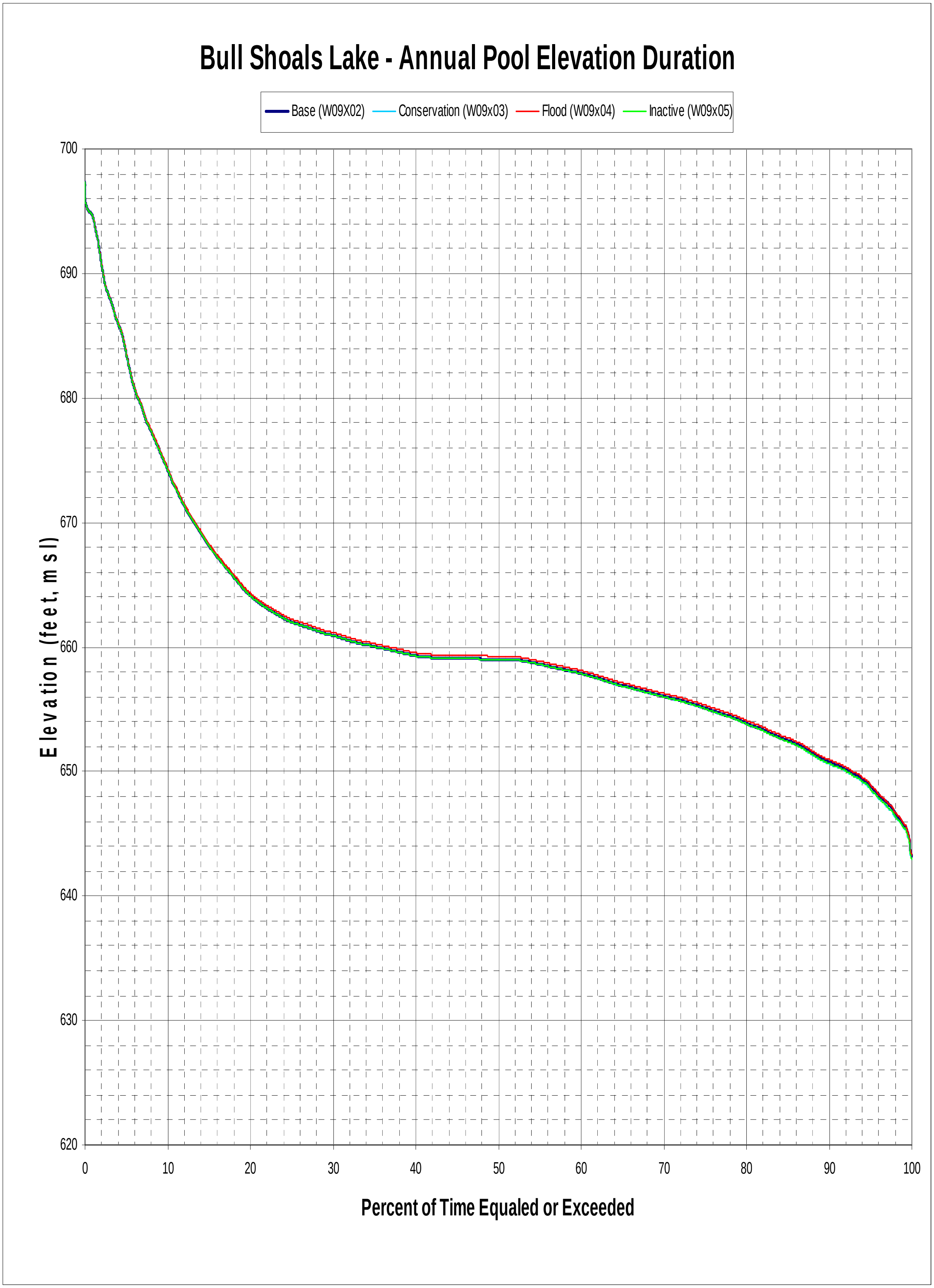


Bull Shoals – Outflow (DSF)										
	W09x02		W09x03		W09x04		W09x05		Median Plotting Position	Recurrence Interval (years)
Rank	water year	max	water year	max	water year	max	water year	max		
1	45	131709	45	131692	45	131731	45	131692	1.02	97.71
2	57	45673	57	45643	57	45670	57	45648	2.49	40.24
3	42	36000	42	36000	42	36000	42	36000	3.95	25.33
4	43	36000	43	36000	43	36000	43	36000	5.41	18.49
5	47	36000	47	36000	47	36000	47	36000	6.87	14.55
6	50	36000	50	36000	50	36000	50	36000	8.33	12.00
7	51	36000	51	36000	51	36000	51	36000	9.80	10.21
8	52	36000	52	36000	52	36000	52	36000	11.26	8.88
9	69	36000	69	36000	69	36000	69	36000	12.72	7.86
10	73	36000	73	36000	73	36000	73	36000	14.18	7.05
11	75	36000	75	36000	75	36000	75	36000	15.64	6.39
12	83	36000	83	36000	83	36000	83	36000	17.11	5.85
13	85	36000	85	36000	85	36000	85	36000	18.57	5.39
14	88	36000	88	36000	88	36000	88	36000	20.03	4.99
15	91	36000	89	36000	91	36000	89	36000	21.49	4.65
16	93	36000	91	36000	93	36000	91	36000	22.95	4.36
17	97	36000	93	36000	97	36000	93	36000	24.42	4.10
18	74	34127	97	36000	89	34600	97	36000	25.88	3.86
19	95	34016	74	34129	95	34062	74	34129	27.34	3.66
20	94	33970	95	34043	74	34046	95	34043	28.80	3.47
21	49	33707	94	33997	94	33923	94	33997	30.26	3.30
22	89	33659	49	33685	49	33746	49	33685	31.73	3.15
23	68	33611	68	33611	68	33599	68	33611	33.19	3.01
24	5	32077	5	32080	71	32907	5	32080	34.65	2.89
25	71	32028	90	31674	90	31654	90	31674	36.11	2.77
26	90	31676	71	31305	86	31477	71	31305	37.57	2.66
27	86	31165	86	31158	5	31239	86	31158	39.04	2.56
28	65	30228	92	29215	65	30075	92	29215	40.50	2.47
29	92	29197	98	28973	92	29204	98	29061	41.96	2.38
30	98	29152	78	28342	98	28990	78	28342	43.42	2.30
31	78	28373	46	28340	78	28640	46	28340	44.88	2.23
32	46	28216	44	27599	46	28384	44	27599	46.35	2.16
33	44	27561	84	27408	44	27603	84	27408	47.81	2.09
34	84	27503	41	26869	84	27497	41	26869	49.27	2.03
35	41	26869	8	26820	41	26869	8	26820	50.73	1.97
36	8	26832	2	26498	8	26816	65	26505	52.19	1.92
37	2	26502	65	26391	2	26597	2	26498	53.65	1.86
38	87	24799	87	24755	87	25365	87	24755	55.12	1.81
39	99	23946	99	23935	99	25117	99	23935	56.58	1.77
40	4	23767	4	23767	4	23651	4	23767	58.04	1.72
41	55	23531	55	23517	55	23515	55	23517	59.50	1.68
42	60	23474	60	23474	60	23474	60	23474	60.96	1.64
43	58	23048	58	23040	58	23098	58	23040	62.43	1.60
44	61	22978	61	22975	61	22978	61	22975	63.89	1.57
45	70	21602	70	21119	76	21066	70	21119	65.35	1.53
46	76	21067	76	21067	70	21025	76	21067	66.81	1.50
47	53	20148	53	20142	53	20134	53	20142	68.27	1.46
48	59	19804	59	19820	82	19859	59	19820	69.74	1.43
49	82	19676	82	19815	59	19829	82	19815	71.20	1.40
50	79	19674	79	19108	79	19066	79	19098	72.66	1.38
51	66	18811	66	18811	66	18711	66	18811	74.12	1.35
52	48	18563	48	18580	48	18576	48	18580	75.58	1.32
53	3	15887	3	15670	3	15464	3	15669	77.05	1.30
54	7	14673	7	14676	7	14675	7	14676	78.51	1.27
55	72	14375	72	14308	72	14289	72	14308	79.97	1.25
56	80	12999	80	13087	80	12973	80	13106	81.43	1.23
57	62	12543	62	12382	62	12288	62	12382	82.89	1.21
58	56	10966	56	10975	56	10958	56	10974	84.36	1.19
59	96	10902	96	10908	96	10897	96	10904	85.82	1.17
60	6	9922	6	9934	6	9919	6	9932	87.28	1.15
61	0	9419	0	9429	0	9412	0	9428	88.74	1.13
62	1	9076	1	9065	1	9065	1	9065	90.20	1.11
63	54	7121	54	7130	54	7116	54	7129	91.67	1.09
64	63	7079	63	7087	63	7072	63	7082	93.13	1.07
65	77	6618	77	6623	77	6614	77	6622	94.59	1.06
66	81	6562	81	6577	81	6559	81	6569	96.05	1.04
67	64	6179	64	6192	64	6180	64	6190	97.51	1.03
68	67	5526	67	5531	67	5522	67	5530	98.98	1.01

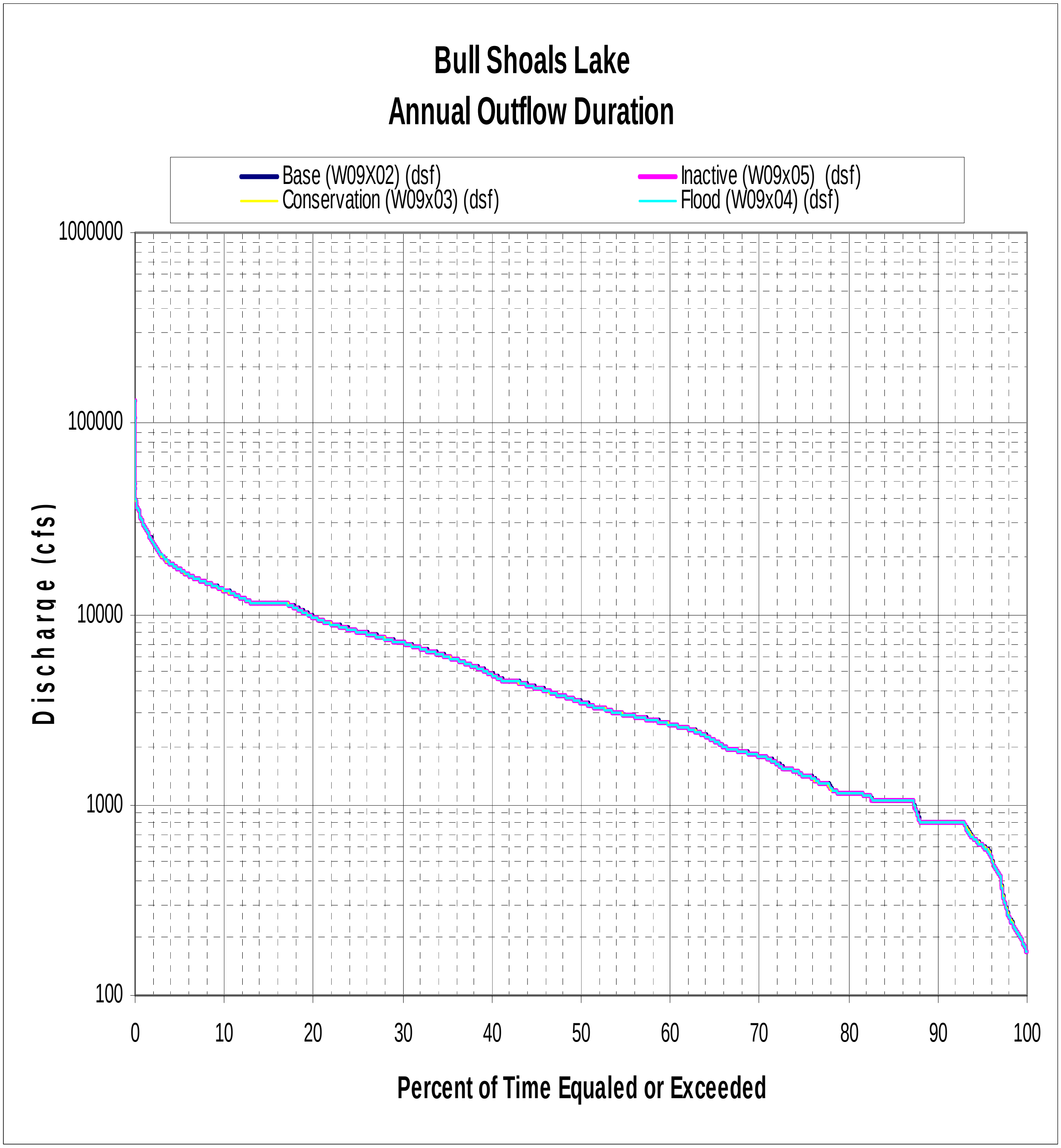
APPENDIX A-3

BULL SHOALS LAKE

ELEVATION AND OUTFLOW DURATION


Bull Shoals Lake - Annual Pool Elevation Duration
Base (W09X02)
Conservation (W09x03)
Flood (W09x04)
Inactive (W09x05)
700
690
680
670
660
650
640
630
620
0
10
20
30
40
50
60
70
80
90
100
E le v a tio n (fe e t, m s l)
Percent of Time Equaled or Exceeded

Bull Shoals Lake					Bull Shoals Lake		
Annual Pool Elevation-Duration					Differences in Annual Pool Elevation (Alternative minus Base)		
Percent Equaled or Exceeded	Base (W09X02)	Conservation (W09x03)	Flood (W09x04)	Inactive (W09x05)	Conservation (W09x03)	Flood (W09x04)	Inactive (W09x05)
1	694.4	694.4	694.5	694.4	0.0	0.0	0.0
2	690.7	690.7	690.8	690.7	0.0	0.1	0.0
5	683.5	683.5	683.6	683.5	0.0	0.1	0.0
10	674.2	674.2	674.3	674.2	0.0	0.1	0.0
15	668.1	668.1	668.3	668.1	0.0	0.2	0.0
20	664.2	664.1	664.3	664.1	0.0	0.2	0.0
25	662.0	662.0	662.2	662.0	0.0	0.2	0.0
30	660.9	660.9	661.2	660.9	0.0	0.2	0.0
35	660.1	660.0	660.3	660.0	0.0	0.2	0.0
40	659.3	659.3	659.5	659.3	0.0	0.2	0.0
45	659.1	659.1	659.3	659.1	0.0	0.2	0.0
50	659.0	659.0	659.3	659.0	0.0	0.3	0.0
55	658.6	658.6	658.9	658.6	0.0	0.2	0.0
60	657.9	657.8	658.1	657.8	0.0	0.2	0.0
65	656.9	656.8	657.1	656.8	-0.1	0.2	-0.1
70	656.1	656.0	656.3	656.0	-0.1	0.2	-0.1
75	655.1	655.0	655.3	655.0	-0.1	0.2	-0.1
80	653.9	653.8	654.1	653.8	-0.1	0.2	-0.1
85	652.5	652.4	652.7	652.4	-0.1	0.2	-0.1
90	650.8	650.6	651.0	650.6	-0.2	0.2	-0.2
95	648.8	648.6	648.9	648.6	-0.3	0.1	-0.2
100	643.2	642.9	643.3	642.9	-0.3	0.1	-0.3


Bull Shoals Lake
Annual Outflow Duration
Base (W09X02) (dsf)
Conservation (W09x03) (dsf)
Inactive (W09x05) (dsf)
Flood (W09x04) (dsf)
1000000
100000
10000
1000
100
Discharge (cfs)
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Equaled or Exceeded

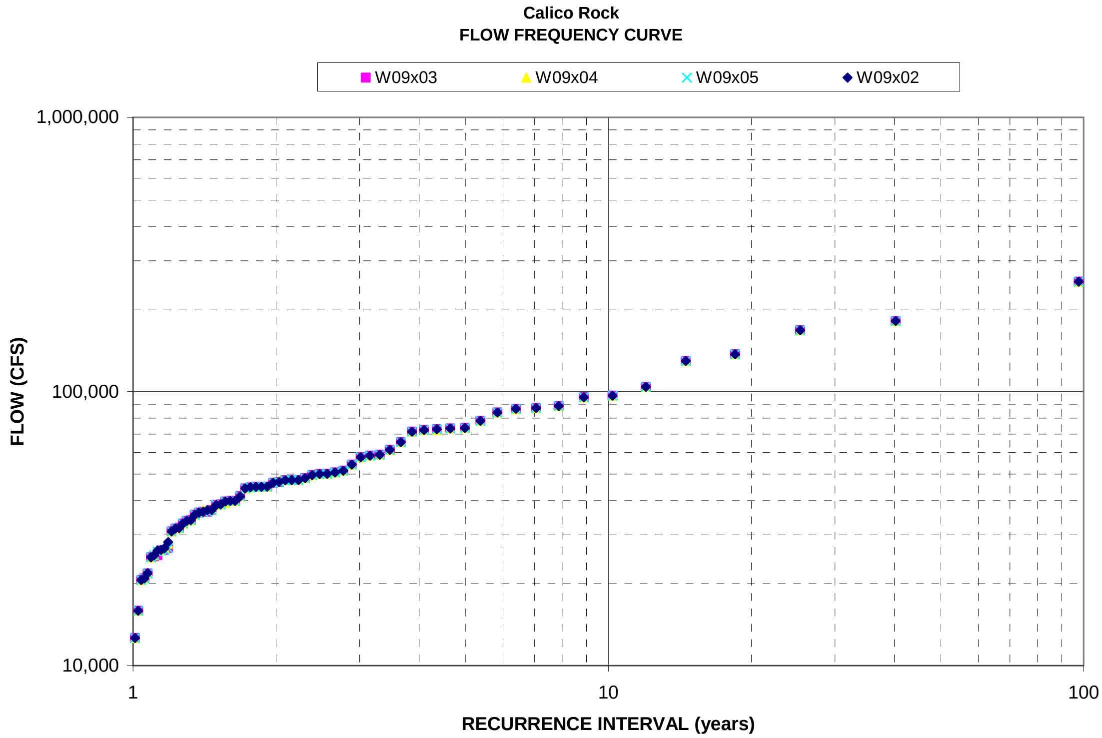
Bull Shoals Lake					Bull Shoals Lake		
Annual Outflow-Duration					Differences in Annual Outflow (DSF) (Alternative minus Base)		
Percent Equaled or Exceeded	Base (W09X02) (dsf)	Conservation (W09x03) (dsf)	Flood (W09x04) (dsf)	Inactive (W09x05) (dsf)	Conservation (W09x03) (dsf)	Flood (W09x04) (dsf)	Inactive (W09x05) (dsf)
1	29152	29069	29084	29069	-83	-68	-83
2	23857	23767	23767	23767	-90	-90	-90
5	17093	17070	17096	17067	-23	3	-26
10	13350	13342	13362	13342	-8	12	-8
15	11580	11580	11580	11580	0	0	0
20	9643	9629	9624	9629	-14	-19	-14
25	8107	8088	8078	8089	-19	-29	-18
30	7079	7069	7057	7066	-10	-22	-13
35	5960	5939	5930	5939	-21	-30	-21
40	4820	4809	4806	4810	-11	-14	-10
45	4109	4103	4098	4103	-6	-11	-6
50	3461	3455	3452	3454	-6	-9	-7
55	2971	2969	2968	2970	-2	-3	-1
60	2642	2641	2638	2640	-1	-4	-2
65	2164	2159	2158	2158	-5	-6	-6
70	1807	1804	1802	1803	-3	-5	-4
75	1419	1419	1419	1419	0	0	0
80	1158	1157	1157	1157	-1	-1	-1
85	1044	1044	1044	1044	0	0	0
90	800	800	800	800	0	0	0
95	612	612	608	608	0	-4	-4
100	172	172	172	172	0	0	0

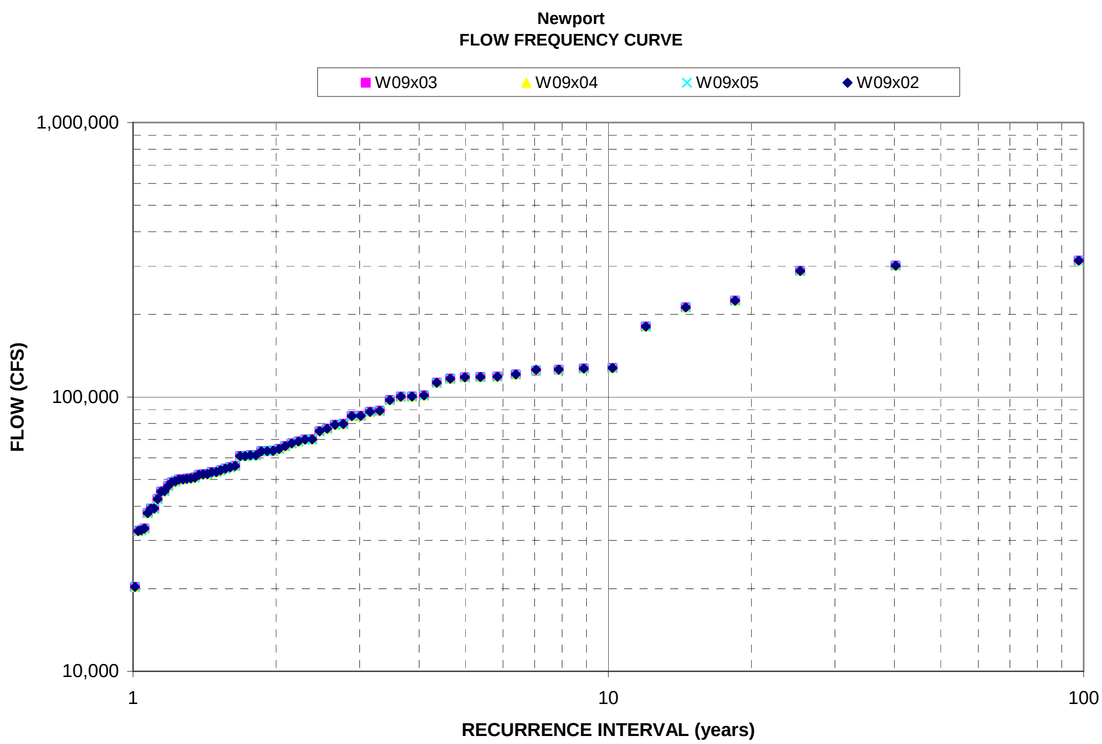
APPENDIX A-4

DOWNSTREAM CONTROL POINTS

CALICO ROCK AND NEWPORT

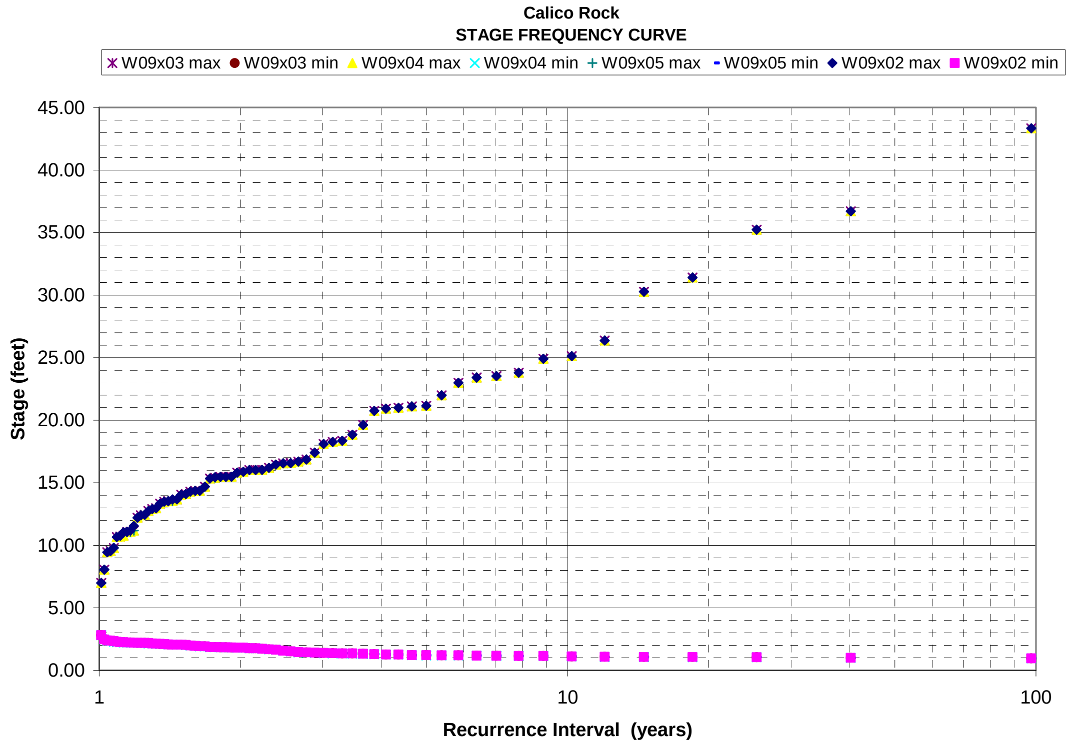
FLOW AND STAGE FREQUENCY

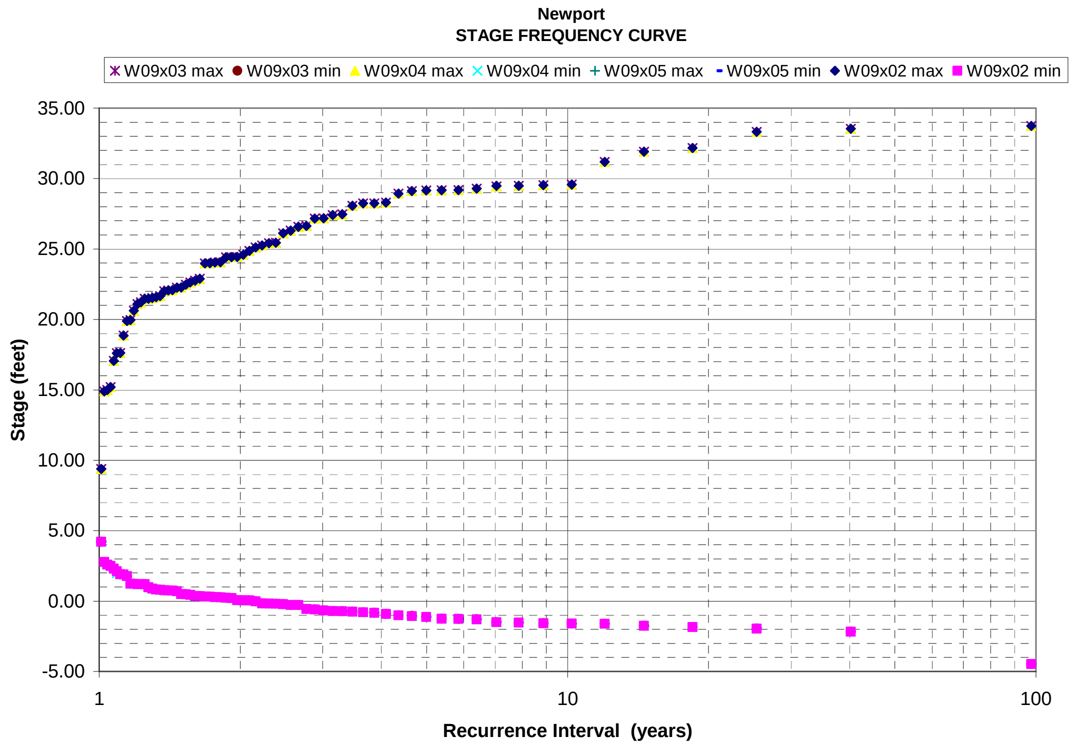

Calico Rock
FLOW FREQUENCY CURVE
W09x03
W09x04
W09x05
W09x02
1,000,000
100,000
10,000
FLOW (CFS)
1
10
100
RECURRENCE INTERVAL (years)


Newport
FLOW FREQUENCY CURVE
W09x03
W09x04
W09x05
W09x02
1,000,000
100,000
10,000
FLOW (CFS)
1
10
100
RECURRENCE INTERVAL (years)

Calico Rock – Flow (DSF)										
	W09x02		W09x03		W09x04		W09x05		Median Plotting Position	Recurrence Interval (years)
rank	water year	max	water year	max	water year	max	water year	max		
1	45	251865	45	251851	45	251904	45	251851	1.02	97.71
2	83	180899	83	180899	83	180899	83	180899	2.49	40.24
3	8	167339	8	167339	8	167336	8	167339	3.95	25.33
4	49	136846	49	136846	49	136844	49	136846	5.41	18.49
5	4	129234	4	129234	4	129234	4	129234	6.87	14.55
6	74	104124	74	104124	74	104124	74	104124	8.33	12
7	90	96522	90	96522	90	96521	90	96522	9.8	10.21
8	73	95235	73	95235	73	95235	73	95235	11.26	8.88
9	72	88632	72	88632	72	88632	72	88632	12.72	7.86
10	61	87034	61	87034	61	87032	61	87034	14.18	7.05
11	43	86427	43	86427	43	86424	43	86427	15.64	6.39
12	57	83970	57	83970	57	83969	57	83970	17.11	5.85
13	66	78236	66	78238	66	78234	66	78238	18.57	5.39
14	7	73633	7	73635	7	73632	7	73634	20.03	4.99
15	2	73435	2	73436	2	73435	2	73436	21.49	4.65
16	85	72824	85	72858	68	72419	85	72858	22.95	4.36
17	68	72421	68	72421	85	72214	68	72421	24.42	4.1
18	69	71426	69	71426	69	71423	69	71426	25.88	3.86
19	46	65395	46	65395	46	65393	46	65395	27.34	3.66
20	97	61327	97	61327	97	61326	97	61327	28.8	3.47
21	95	58868	95	58868	95	58868	95	58868	30.26	3.3
22	52	58394	52	58394	52	58393	52	58394	31.73	3.15
23	50	57570	50	57570	50	57568	50	57570	33.19	3.01
24	93	54147	93	54148	93	54151	93	54148	34.65	2.89
25	88	51458	88	51469	88	51441	88	51469	36.11	2.77
26	77	50681	77	50681	77	50680	77	50681	37.57	2.66
27	70	50133	70	50133	70	50133	70	50133	39.04	2.56
28	89	49986	89	49987	89	49984	89	49987	40.5	2.47
29	47	49591	47	49591	47	49591	47	49591	41.96	2.38
30	51	48311	51	48311	51	48307	51	48311	43.42	2.3
31	84	47553	84	47553	87	47605	84	47553	44.88	2.23
32	82	47501	82	47501	84	47551	82	47501	46.35	2.16
33	87	47457	87	47451	82	47500	87	47451	47.81	2.09
34	64	46821	64	46823	98	47181	64	46823	49.27	2.03
35	98	46534	98	46522	64	46820	98	46522	50.73	1.97
36	42	45058	42	45037	42	45011	42	45037	52.19	1.92
37	60	44957	60	44957	60	44955	60	44957	53.65	1.86
38	75	44920	75	44919	75	44916	75	44919	55.12	1.81
39	91	44769	91	44679	91	44699	91	44679	56.58	1.77
40	96	44351	96	44352	96	44347	96	44352	58.04	1.72
41	94	41459	94	41469	94	41461	94	41469	59.5	1.68
42	1	39944	1	39945	1	39943	1	39944	60.96	1.64
43	78	39918	78	39918	78	39921	78	39918	62.43	1.6
44	5	39686	5	39687	5	39230	5	39687	63.89	1.57
45	55	38801	55	38802	55	38801	55	38802	65.35	1.53
46	41	38609	41	38609	41	38608	41	38609	66.81	1.5
47	71	36981	92	36927	71	37142	92	36927	68.27	1.46
48	92	36927	71	36413	99	37050	71	36413	69.74	1.43
49	99	36401	99	36390	92	36925	99	36390	71.2	1.4
50	86	36196	86	36196	86	36374	86	36196	72.66	1.38
51	53	35519	53	35520	53	35514	53	35520	74.12	1.35
52	59	33954	59	33954	59	33954	59	33954	75.58	1.32
53	79	33729	79	33729	79	33731	79	33729	77.05	1.3
54	54	33029	54	33030	54	33024	54	33025	78.51	1.27
55	0	31809	0	31809	0	31808	0	31809	79.97	1.25
56	48	31639	48	31639	48	31637	48	31638	81.43	1.23
57	58	30882	58	30879	58	30898	58	30879	82.89	1.21
58	65	28253	56	26825	65	27862	56	26825	84.36	1.19
59	56	26824	62	26425	56	26823	62	26425	85.82	1.17
60	62	26426	44	26344	62	26425	44	26344	87.28	1.15
61	44	26344	76	25279	44	26344	65	26112	88.74	1.13
62	76	25279	65	25034	76	25278	76	25279	90.2	1.11
63	3	24871	3	24871	3	24871	3	24871	91.67	1.09
64	80	21764	80	21706	80	21754	80	21703	93.13	1.07
65	81	20848	81	20854	81	20845	81	20853	94.59	1.06
66	6	20533	6	20534	6	20533	6	20534	96.05	1.04
67	67	15860	67	15862	67	15854	67	15857	97.51	1.03
68	63	12616	63	12618	63	12614	63	12617	98.98	1.01

Newport – Flow (DSF)										
	W09x02		W09x03		W09x04		W09x05		Median Plotting Position	Recurrence Interval (years)
rank	water year	max	water year	max	water year	max	water year	max		
1	45	313854	45	313842	45	313896	45	313842	1.02	97.71
2	8	300965	8	300965	8	300962	8	300965	2.49	40.24
3	83	287827	83	287827	83	287827	83	287827	3.95	25.33
4	73	224482	73	224482	73	224482	73	224482	5.41	18.49
5	49	212340	49	212340	49	212338	49	212340	6.87	14.55
6	75	180631	75	180631	75	180630	75	180631	8.33	12
7	43	127638	43	127638	43	127636	43	127638	9.8	10.21
8	89	126864	89	126865	89	126862	89	126865	11.26	8.88
9	57	125847	74	125683	57	125985	74	125683	12.72	7.86
10	74	125683	57	124773	74	125683	57	124998	14.18	7.05
11	61	120817	61	120817	61	120816	61	120817	15.64	6.39
12	79	118602	79	118602	79	118601	79	118602	17.11	5.85
13	4	118110	4	118110	4	118110	4	118110	18.57	5.39
14	77	117932	77	117932	77	117931	77	117932	20.03	4.99
15	69	116657	69	116657	69	116654	69	116657	21.49	4.65
16	50	112616	50	112616	50	112614	50	112616	22.95	4.36
17	2	101362	2	101362	2	101361	2	101362	24.42	4.1
18	90	100350	90	100350	90	100349	90	100350	25.88	3.86
19	64	100283	64	100286	64	100283	64	100286	27.34	3.66
20	66	97334	66	97334	66	97334	66	97334	28.8	3.47
21	46	89004	46	89004	46	89003	46	89004	30.26	3.3
22	58	88254	58	88254	58	88253	58	88254	31.73	3.15
23	85	85376	85	85377	85	85376	85	85377	33.19	3.01
24	7	85120	7	85121	7	85120	7	85121	34.65	2.89
25	88	79727	88	79727	88	79727	88	79727	36.11	2.77
26	68	79192	68	79193	68	79190	68	79193	37.57	2.66
27	91	76721	91	76721	91	76720	91	76721	39.04	2.56
28	82	75012	82	75015	82	75012	82	75014	40.5	2.47
29	52	70109	52	70098	52	70098	52	70098	41.96	2.38
30	84	69926	84	69926	84	69925	84	69926	43.42	2.3
31	70	68748	70	68748	70	68748	70	68748	44.88	2.23
32	97	67769	97	67769	97	67769	97	67769	46.35	2.16
33	51	66167	51	66167	51	66166	51	66167	47.81	2.09
34	72	64574	72	64574	72	64573	72	64574	49.27	2.03
35	93	63584	93	63584	93	63586	93	63584	50.73	1.97
36	53	63519	53	63519	53	63519	53	63519	52.19	1.92
37	42	63457	42	63457	42	63456	42	63457	53.65	1.86
38	5	61340	5	61340	5	61340	5	61340	55.12	1.81
39	60	61298	60	61298	60	61296	60	61298	56.58	1.77
40	47	60935	47	60935	47	60933	47	60935	58.04	1.72
41	1	60901	1	60902	1	60901	1	60902	59.5	1.68
42	78	55989	78	55989	78	55997	78	55989	60.96	1.64
43	98	55421	98	55421	98	55422	98	55421	62.43	1.6
44	95	54855	95	54855	95	54855	95	54855	63.89	1.57
45	48	54091	48	54091	48	54089	48	54090	65.35	1.53
46	56	53232	56	53232	56	53230	56	53231	66.81	1.5
47	3	53139	3	53139	3	53138	3	53139	68.27	1.46
48	92	52352	92	52353	92	52350	92	52353	69.74	1.43
49	55	52230	55	52231	55	52228	55	52230	71.2	1.4
50	94	52000	94	51995	94	51994	94	51995	72.66	1.38
51	62	50830	62	50825	62	50825	62	50825	74.12	1.35
52	59	50533	59	50533	59	50532	59	50533	75.58	1.32
53	86	50334	86	50334	86	50341	86	50334	77.05	1.3
54	87	50136	87	50136	87	50136	87	50136	78.51	1.27
55	65	50134	65	50121	65	50130	65	50121	79.97	1.25
56	99	49286	99	49286	99	49286	99	49286	81.43	1.23
57	44	48839	44	48831	44	48830	44	48831	82.89	1.21
58	0	47345	0	47346	0	47343	0	47344	84.36	1.19
59	71	45403	71	45403	71	45403	71	45403	85.82	1.17
60	96	45193	96	45194	96	45190	96	45194	87.28	1.15
61	54	42443	54	42443	54	42440	54	42441	88.74	1.13
62	80	39229	80	39229	80	39228	80	39229	90.2	1.11
63	76	39175	76	39175	76	39174	76	39175	91.67	1.09
64	67	37766	67	37767	67	37762	67	37763	93.13	1.07
65	41	33176	41	33166	41	33166	41	33166	94.59	1.06
66	63	32692	63	32693	63	32691	63	32692	96.05	1.04
67	6	32438	6	32438	6	32437	6	32438	97.51	1.03
68	81	20329	81	20332	81	20326	81	20330	98.98	1.01


Calico Rock
STAGE FREQUENCY CURVE
W09x03 max
W09x03 min
W09x04 max
W09x04 min
W09x05 max
W09x05 min
W09x02 max
W09x02 min
Stage (feet)
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1
10
100
Recurrence Interval (years)


Newport
STAGE FREQUENCY CURVE
W09x03 max
W09x03 min
W09x04 max
W09x04 min
W09x05 max
W09x05 min
W09x02 max
W09x02 min
Stage (feet)
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
1
10
100
Recurrence Interval (years)

Calico Rock – Stage (feet, msl)																		
	W09x02				W09x03				W09x04				W09x05				median plotting position	RI (years)
rank	water year	max	water year	min	water year	max	water year	min	water year	max	water year	min	water year	max	water year	min		
1	45	43.3	65	0.96	45	43.3	65	0.96	45	43.3	65	0.96	45	43.3	65	0.96	1.02	97.71
2	83	36.7	0	1	83	36.7	0	1	83	36.7	0	1	83	36.7	0	1	2.49	40.24
3	8	35.2	67	1.05	8	35.2	67	1.05	8	35.2	45	1.05	8	35.2	45	1.05	3.95	25.33
4	49	31.4	8	1.06	49	31.4	8	1.06	49	31.4	67	1.05	49	31.4	67	1.05	5.41	18.49
5	4	30.3	70	1.06	4	30.3	70	1.06	4	30.3	8	1.06	4	30.3	8	1.06	6.87	14.55
6	74	26.4	45	1.09	74	26.4	45	1.09	74	26.4	70	1.06	74	26.4	70	1.06	8.33	12.00
7	90	25.1	63	1.11	90	25.1	63	1.11	90	25.1	63	1.11	90	25.1	63	1.11	9.80	10.21
8	73	24.9	88	1.14	73	24.9	88	1.14	73	24.9	88	1.14	73	24.9	88	1.14	11.26	8.88
9	72	23.8	64	1.15	72	23.8	64	1.15	72	23.8	64	1.15	72	23.8	64	1.15	12.72	7.86
10	61	23.5	98	1.16	61	23.5	98	1.16	61	23.5	98	1.16	61	23.5	98	1.16	14.18	7.05
11	43	23.4	1	1.18	43	23.4	1	1.18	43	23.4	1	1.18	43	23.4	1	1.18	15.64	6.39
12	57	23	81	1.2	57	23	81	1.2	57	23	81	1.19	57	23	81	1.19	17.11	5.85
13	66	22	2	1.2	66	22	2	1.2	66	22	2	1.19	66	22	2	1.19	18.57	5.39
14	7	21.1	77	1.2	7	21.1	77	1.2	7	21.1	77	1.2	7	21.1	77	1.2	20.03	4.99
15	2	21.1	6	1.21	2	21.1	6	1.21	2	21.1	6	1.21	2	21.1	6	1.21	21.49	4.65
16	85	21	54	1.26	85	21	54	1.26	68	20.9	54	1.25	85	21	54	1.26	22.95	4.36
17	68	20.9	72	1.26	68	20.9	72	1.26	85	20.9	72	1.26	68	20.9	72	1.26	24.42	4.10
18	69	20.7	55	1.29	69	20.7	55	1.29	69	20.7	55	1.29	69	20.7	55	1.29	25.88	3.86
19	46	19.6	57	1.33	46	19.6	57	1.33	46	19.6	48	1.31	46	19.6	48	1.31	27.34	3.66
20	97	18.8	82	1.36	97	18.8	82	1.36	97	18.8	57	1.33	97	18.8	57	1.33	28.80	3.47
21	95	18.4	61	1.36	95	18.4	61	1.36	95	18.4	82	1.36	95	18.4	82	1.36	30.26	3.30
22	52	18.3	90	1.37	52	18.3	90	1.37	52	18.3	61	1.36	52	18.3	61	1.36	31.73	3.15
23	50	18.1	4	1.39	50	18.1	4	1.39	50	18.1	90	1.37	50	18.1	90	1.37	33.19	3.01
24	93	17.4	41	1.42	93	17.4	41	1.42	93	17.4	4	1.38	93	17.4	4	1.38	34.65	2.89
25	88	16.9	99	1.45	88	16.9	99	1.45	88	16.8	41	1.42	88	16.9	41	1.42	36.11	2.77
26	77	16.7	48	1.46	77	16.7	48	1.46	77	16.7	99	1.44	77	16.7	99	1.44	37.57	2.66
27	70	16.6	78	1.51	70	16.6	78	1.51	70	16.6	78	1.51	70	16.6	78	1.51	39.04	2.56
28	89	16.5	53	1.57	89	16.5	53	1.57	89	16.5	53	1.57	89	16.5	53	1.57	40.50	2.47
29	47	16.5	68	1.65	47	16.5	68	1.65	47	16.5	68	1.65	47	16.5	68	1.65	41.96	2.38
30	51	16.2	3	1.68	51	16.2	3	1.68	51	16.2	3	1.68	51	16.2	3	1.68	43.42	2.30
31	84	16	87	1.73	84	16	87	1.73	87	16	87	1.73	84	16	87	1.73	44.88	2.23
32	82	16	7	1.76	82	16	7	1.76	84	16	7	1.76	82	16	7	1.76	46.35	2.16
33	87	16	89	1.77	87	16	89	1.77	82	16	89	1.77	87	16	89	1.77	47.81	2.09
34	64	15.9	56	1.81	64	15.9	56	1.81	98	16	56	1.81	64	15.9	56	1.81	49.27	2.03
35	98	15.8	93	1.81	98	15.8	93	1.81	64	15.9	93	1.81	98	15.8	93	1.81	50.73	1.97
36	42	15.5	80	1.83	42	15.5	80	1.83	42	15.5	80	1.83	42	15.5	80	1.83	52.19	1.92
37	60	15.5	44	1.84	60	15.5	44	1.84	60	15.5	44	1.84	60	15.5	44	1.84	53.65	1.86
38	75	15.5	50	1.84	75	15.5	50	1.84	75	15.5	50	1.84	75	15.5	50	1.84	55.12	1.81
39	91	15.4	76	1.85	91	15.4	76	1.85	91	15.4	76	1.85	91	15.4	76	1.85	56.58	1.77
40	96	15.3	84	1.86	96	15.3	84	1.86	96	15.3	84	1.86	96	15.3	84	1.86	58.04	1.72
41	94	14.7	51	1.92	94	14.7	51	1.92	94	14.7	51	1.91	94	14.7	51	1.92	59.50	1.68
42	1	14.4	96	1.93	1	14.4	96	1.93	1	14.4	96	1.93	1	14.4	96	1.93	60.96	1.64
43	78	14.3	79	1.95	78	14.3	79	1.95	78	14.4	79	1.95	78	14.3	79	1.95	62.43	1.60
44	5	14.3	91	1.99	5	14.3	91	1.99	5	14.2	91	1.99	5	14.3	91	1.99	63.89	1.57
45	55	14.1	66	2.03	55	14.1	66	2.03	55	14.1	66	2.03	55	14.1	66	2.03	65.35	1.53
46	41	14.1	49	2.05	41	14.1	92	2.04	41	14.1	92	2.04	41	14.1	92	2.04	66.81	1.50
47	71	13.7	85	2.05	92	13.7	85	2.05	71	13.7	49	2.05	92	13.7	85	2.05	68.27	1.46
48	92	13.7	92	2.05	71	13.5	49	2.05	99	13.7	85	2.06	71	13.5	49	2.05	69.74	1.43
49	99	13.5	73	2.07	99	13.5	73	2.07	92	13.7	73	2.07	99	13.5	73	2.07	71.20	1.40
50	86	13.5	62	2.1	86	13.5	62	2.1	86	13.5	62	2.1	86	13.5	62	2.1	72.66	1.38
51	53	13.3	47	2.11	53	13.3	74	2.1	53	13.3	74	2.1	53	13.3	74	2.1	74.12	1.35
52	59	13	74	2.13	59	13	47	2.11	59	13	47	2.11	59	13	47	2.11	75.58	1.32
53	79	12.9	95	2.14	79	12.9	95	2.14	79	12.9	95	2.14	79	12.9	95	2.14	77.05	1.30
54	54	12.7	5	2.18	54	12.7	5	2.18	54	12.7	58	2.14	54	12.7	5	2.18	78.51	1.27
55	0	12.4	59	2.2	0	12.4	59	2.2	0	12.4	5	2.18	0	12.4	59	2.2	79.97	1.25
56	48	12.4	42	2.2	48	12.4	42	2.2	48	12.4	59	2.2	48	12.4	42	2.2	81.43	1.23
57	58	12.2	69	2.2	58	12.2	69	2.2	58	12.2	42	2.2	58	12.2	69	2.2	82.89	1.21
58	65	11.5	52	2.22	56	11.2	52	2.22	65	11.4	69	2.2	56	11.2	52	2.22	84.36	1.19
59	56	11.2	75	2.22	62	11.1	75	2.22	56	11.2	52	2.22	62	11.1	75	2.22	85.82	1.17
60	62	11.1	83	2.23	44	11.1	83	2.23	62	11.1	75	2.22	44	11.1	83	2.23	87.28	1.15
61	44	11.1	60	2.24	76	10.8	60	2.24	44	11.1	83	2.23	65	11	60	2.24	88.74	1.13
62	76	10.8	43	2.24	65	10.7	43	2.24	76	10.8	60	2.24	76	10.8	43	2.24	90.20	1.11
63	3	10.7	86	2.3	3	10.7	86	2.3	3	10.7	43	2.24	3	10.7	86	2.3	91.67	1.09
64	80	9.8	94	2.34	80	9.78	94	2.34	80	9.8	86	2.3	80	9.78	94	2.34	93.13	1.07
65	81	9.54	97	2.38	81	9.54	97	2.38	81	9.54	94	2.34	81	9.54	97	2.38	94.59	1.06
66	6	9.45	58	2.4	6	9.45	58	2.4	6	9.45	97	2.38	6	9.45	58	2.4	96.05	1.04
67	67	8.05	71	2.47	67	8.05	71	2.47	67	8.05	71	2.47	67	8.05	71	2.47	97.51	1.03
68	63	6.99	46	2.81	63	6.99	46	2.81	63	6.99	46	2.81	63	6.99	46	2.81	98.98	1.01

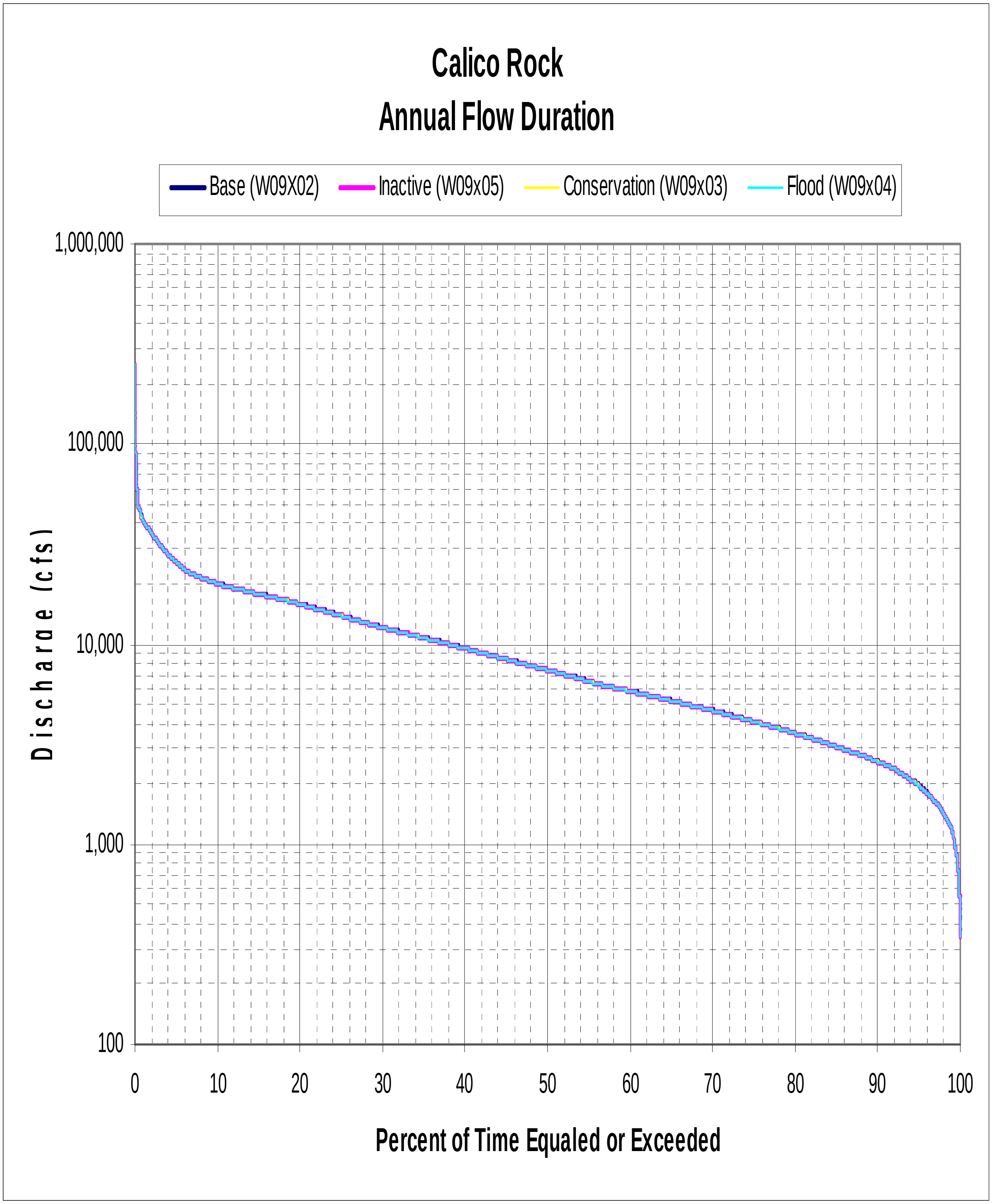
Newport – Stage (feet, msl)																		
	W09x02				W09x03				W09x04				W09x05				median plotting position	RI (years)
rank	water year	max	water year	min	water year	max	water year	min	water year	max	water year	min	water year	max	water year	min		
1	45	33.7	72	-4.463	45	33.7	72	-4.463	45	33.7	72	-4.464	45	33.7	72	-4.464	1.02	97.71
2	8	33.5	88	-2.176	8	33.5	88	-2.176	8	33.5	88	-2.177	8	33.5	88	-2.177	2.49	40.24
3	83	33.3	43	-1.951	83	33.3	43	-1.95	83	33.3	43	-1.952	83	33.3	43	-1.95	3.95	25.33
4	73	32.2	77	-1.842	73	32.2	77	-1.842	73	32.2	77	-1.844	73	32.2	77	-1.843	5.41	18.49
5	49	31.9	55	-1.75	49	31.9	55	-1.75	49	31.9	55	-1.751	49	31.9	55	-1.751	6.87	14.55
6	75	31.2	71	-1.611	75	31.2	71	-1.611	75	31.2	71	-1.613	75	31.2	71	-1.611	8.33	12.00
7	43	29.6	73	-1.595	43	29.6	73	-1.595	43	29.6	73	-1.596	43	29.6	73	-1.595	9.80	10.21
8	89	29.5	64	-1.573	89	29.5	64	-1.572	89	29.5	64	-1.574	89	29.5	64	-1.573	11.26	8.88
9	57	29.5	41	-1.521	74	29.5	41	-1.521	57	29.5	41	-1.522	74	29.5	41	-1.522	12.72	7.86
10	74	29.5	2	-1.499	57	29.4	2	-1.499	74	29.5	2	-1.5	57	29.5	2	-1.5	14.18	7.05
11	61	29.3	57	-1.29	61	29.3	57	-1.289	61	29.3	57	-1.291	61	29.3	57	-1.29	15.64	6.39
12	79	29.2	1	-1.266	79	29.2	1	-1.266	79	29.2	1	-1.267	79	29.2	1	-1.267	17.11	5.85
13	4	29.2	65	-1.249	4	29.2	65	-1.249	4	29.2	65	-1.249	4	29.2	65	-1.249	18.57	5.39
14	77	29.2	45	-1.124	77	29.2	45	-1.124	77	29.2	45	-1.125	77	29.2	45	-1.124	20.03	4.99
15	69	29.1	82	-1.061	69	29.1	82	-1.06	69	29.1	82	-1.062	69	29.1	82	-1.061	21.49	4.65
16	50	28.9	70	-1.004	50	28.9	70	-1.004	50	28.9	70	-1.004	50	28.9	70	-1.004	22.95	4.36
17	2	28.3	56	-0.905	2	28.3	56	-0.905	2	28.3	56	-0.905	2	28.3	56	-0.905	24.42	4.10
18	90	28.2	54	-0.843	90	28.2	54	-0.843	90	28.2	54	-0.845	90	28.2	54	-0.844	25.88	3.86
19	64	28.2	87	-0.788	64	28.2	87	-0.788	64	28.2	87	-0.788	64	28.2	87	-0.788	27.34	3.66
20	66	28.1	90	-0.758	66	28.1	90	-0.758	66	28.1	90	-0.758	66	28.1	90	-0.758	28.80	3.47
21	46	27.5	81	-0.716	46	27.5	81	-0.716	46	27.5	81	-0.717	46	27.5	81	-0.717	30.26	3.30
22	58	27.4	98	-0.714	58	27.4	98	-0.714	58	27.4	98	-0.715	58	27.4	98	-0.715	31.73	3.15
23	85	27.2	44	-0.667	85	27.2	44	-0.667	85	27.2	44	-0.667	85	27.2	44	-0.667	33.19	3.01
24	7	27.2	63	-0.587	7	27.2	63	-0.585	7	27.2	63	-0.588	7	27.2	63	-0.586	34.65	2.89
25	88	26.6	69	-0.558	88	26.6	69	-0.558	88	26.6	69	-0.56	88	26.6	69	-0.558	36.11	2.77
26	68	26.6	83	-0.282	68	26.6	83	-0.282	68	26.6	83	-0.283	68	26.6	83	-0.282	37.57	2.66
27	91	26.3	0	-0.271	91	26.3	0	-0.271	91	26.3	0	-0.272	91	26.3	0	-0.272	39.04	2.56
28	82	26.1	4	-0.219	82	26.1	4	-0.219	82	26.1	4	-0.219	82	26.1	4	-0.219	40.50	2.47
29	52	25.4	67	-0.187	52	25.4	67	-0.187	52	25.4	67	-0.189	52	25.4	67	-0.187	41.96	2.38
30	84	25.4	66	-0.18	84	25.4	66	-0.18	84	25.4	66	-0.181	84	25.4	66	-0.18	43.42	2.30
31	70	25.3	68	-0.163	70	25.3	68	-0.162	70	25.3	68	-0.164	70	25.3	68	-0.164	44.88	2.23
32	97	25.1	86	-0.025	97	25.1	86	-0.025	97	25.1	86	-0.026	97	25.1	86	-0.025	46.35	2.16
33	51	24.9	79	0.056	51	24.9	79	0.056	51	24.9	79	0.055	51	24.9	79	0.056	47.81	2.09
34	72	24.6	61	0.059	72	24.6	61	0.059	72	24.6	61	0.058	72	24.6	61	0.059	49.27	2.03
35	93	24.4	80	0.066	93	24.4	80	0.067	93	24.4	80	0.066	93	24.4	80	0.067	50.73	1.97
36	53	24.4	62	0.204	53	24.4	62	0.203	53	24.4	62	0.203	53	24.4	62	0.203	52.19	1.92
37	42	24.4	92	0.245	42	24.4	92	0.245	42	24.4	92	0.245	42	24.4	92	0.245	53.65	1.86
38	5	24.1	84	0.269	5	24.1	84	0.269	5	24.1	84	0.269	5	24.1	84	0.269	55.12	1.81
39	60	24.1	91	0.287	60	24.1	91	0.287	60	24	91	0.286	60	24.1	91	0.287	56.58	1.77
40	47	24	89	0.313	47	24	89	0.314	47	24	89	0.312	47	24	89	0.314	58.04	1.72
41	1	24	6	0.318	1	24	6	0.318	1	24	6	0.317	1	24	6	0.317	59.50	1.68
42	78	22.9	5	0.354	78	22.9	5	0.354	78	22.9	5	0.354	78	22.9	5	0.354	60.96	1.64
43	98	22.8	53	0.359	98	22.8	53	0.36	98	22.8	53	0.358	98	22.8	53	0.36	62.43	1.60
44	95	22.6	75	0.433	95	22.6	75	0.433	95	22.6	75	0.433	95	22.6	75	0.433	63.89	1.57
45	48	22.5	8	0.482	48	22.5	8	0.482	48	22.5	8	0.482	48	22.5	8	0.482	65.35	1.53
46	56	22.3	76	0.497	56	22.3	76	0.498	56	22.3	76	0.496	56	22.3	76	0.498	66.81	1.50
47	3	22.3	99	0.692	3	22.3	99	0.692	3	22.3	99	0.691	3	22.3	99	0.691	68.27	1.46
48	92	22.1	60	0.744	92	22.1	60	0.745	92	22.1	60	0.743	92	22.1	60	0.745	69.74	1.43
49	55	22.1	47	0.75	55	22.1	47	0.75	55	22.1	47	0.749	55	22.1	47	0.75	71.20	1.40
50	94	22	3	0.775	94	22	3	0.775	94	22	3	0.774	94	22	3	0.775	72.66	1.38
51	62	21.7	48	0.798	62	21.7	48	0.798	62	21.7	48	0.798	62	21.7	48	0.798	74.12	1.35
52	59	21.6	95	0.82	59	21.6	95	0.82	59	21.6	95	0.819	59	21.6	95	0.82	75.58	1.32
53	86	21.5	59	0.886	86	21.5	59	0.886	86	21.5	59	0.884	86	21.5	59	0.886	77.05	1.30
54	65	21.5	97	0.992	87	21.5	97	0.992	87	21.5	97	0.991	87	21.5	97	0.992	78.51	1.27
55	87	21.5	96	1.194	65	21.5	96	1.194	65	21.5	49	1.194	65	21.5	96	1.194	79.97	1.25
56	99	21.2	49	1.195	99	21.2	49	1.195	99	21.2	96	1.194	99	21.2	49	1.195	81.43	1.23
57	44	21.1	42	1.202	44	21.1	42	1.202	44	21.1	42	1.202	44	21.1	42	1.202	82.89	1.21
58	0	20.6	78	1.226	0	20.6	78	1.227	0	20.6	78	1.225	0	20.6	78	1.225	84.36	1.19
59	71	20	93	1.229	71	20	93	1.229	71	20	93	1.229	71	20	93	1.229	85.82	1.17
60	96	19.9	52	1.771	96	19.9	52	1.771	96	19.9	52	1.769	96	19.9	52	1.771	87.28	1.15
61	54	18.9	7	1.886	54	18.9	7	1.886	54	18.9	7	1.885	54	18.9	7	1.886	88.74	1.13
62	80	17.6	85	1.909	80	17.6	85	1.909	80	17.6	85	1.908	80	17.6	85	1.909	90.20	1.11
63	76	17.6	58	2.124	76	17.6	58	2.125	76	17.6	58	1.974	76	17.6	58	2.125	91.67	1.09
64	67	17.1	50	2.301	67	17.1	50	2.301	67	17.1	50	2.301	67	17.1	50	2.301	93.13	1.07
65	41	15.2	74	2.488	41	15.2	74	2.488	41	15.2	74	2.488	41	15.2	74	2.488	94.59	1.06
66	63	15	46	2.592	63	15	46	2.592	63	15	46	2.591	63	15	46	2.592	96.05	1.04
67	6	14.9	94	2.776	6	14.9	94	2.776	6	14.9	94	2.774	6	14.9	94	2.776	97.51	1.03
68	81	9.38	51	4.209	81	9.38	51	4.21	81	9.38	51	4.208	81	9.38	51	4.21	98.98	1.01

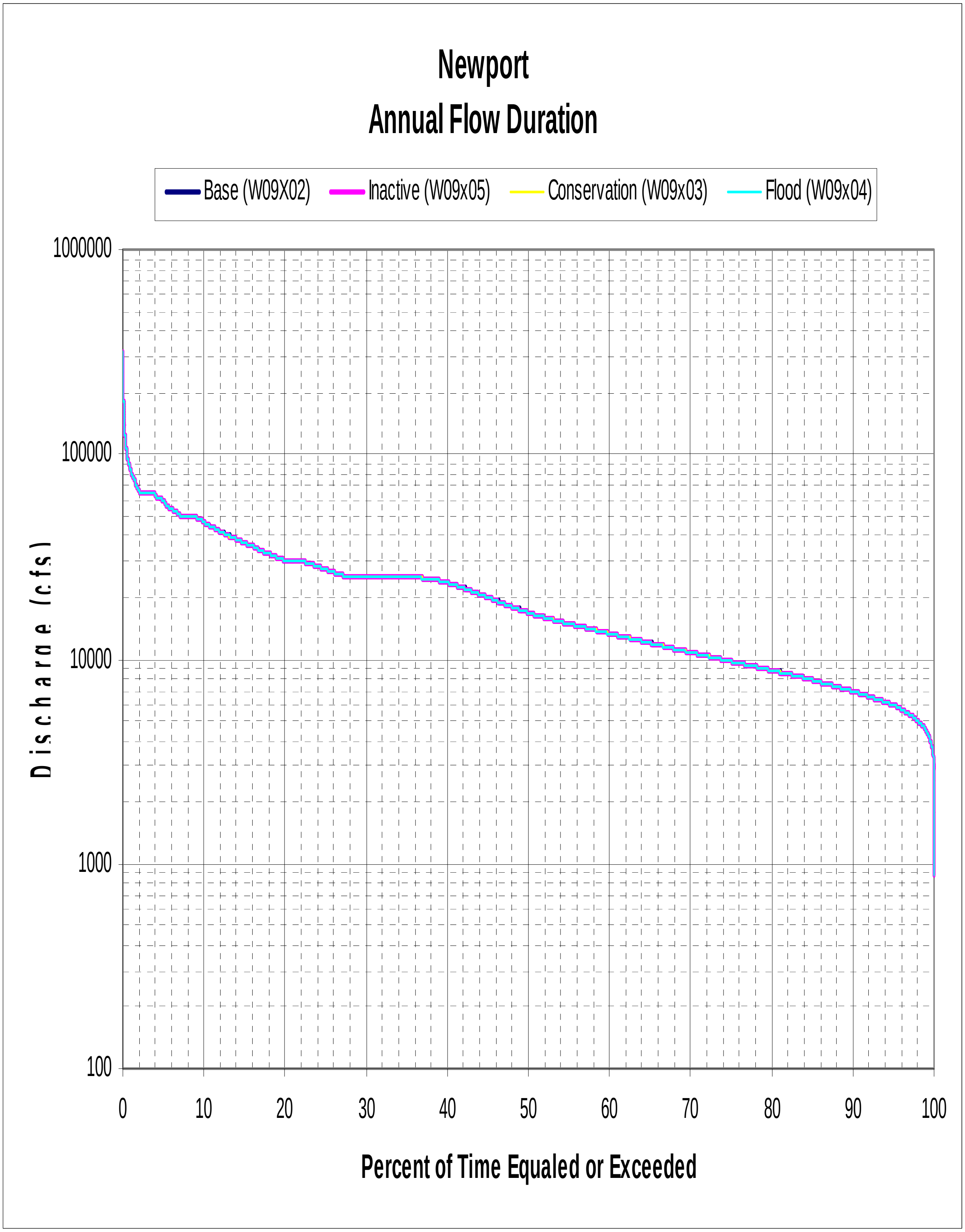
APPENDIX A-5

DOWNSTREAM CONTROL POINTS

CALICO ROCK AND NEWPORT

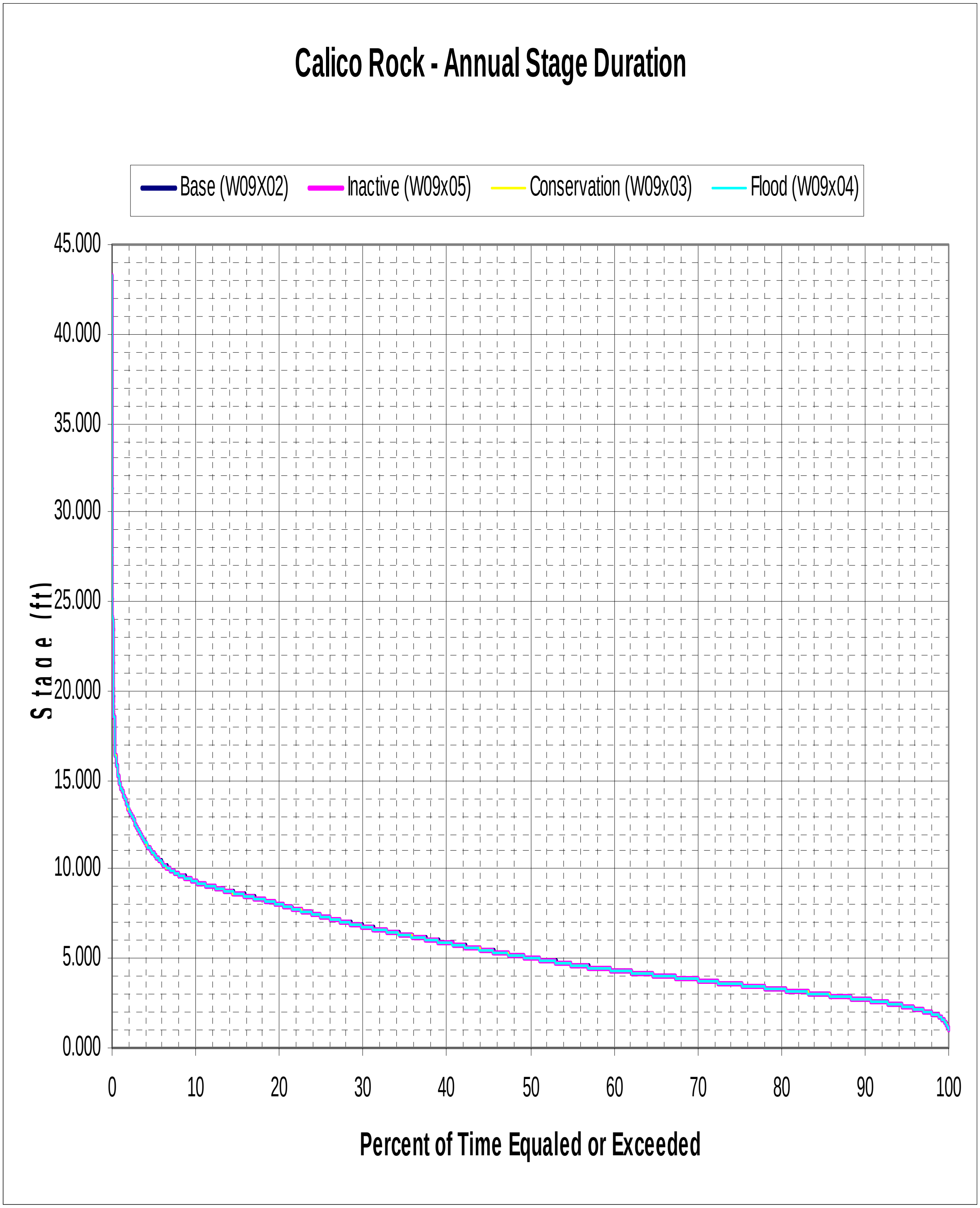
FLOW AND STAGE DURATION


Calico Rock
Annual Flow Duration
Base (W09X02)
Inactive (W09x05)
Conservation (W09x03)
Flood (W09x04)
1,000,000
100,000
10,000
1,000
100
Discharge (cfs)
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Equaled or Exceeded

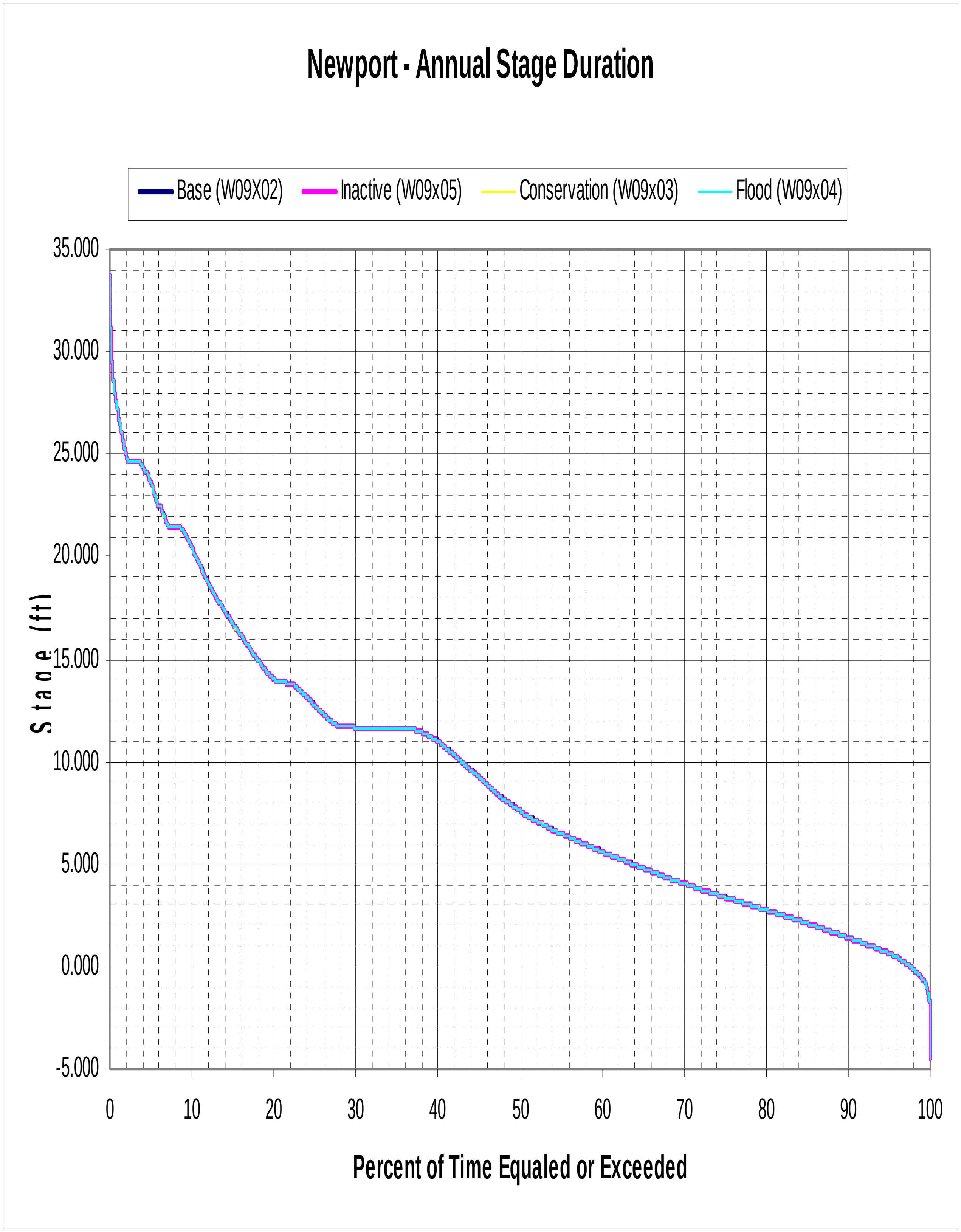

Newport
Annual Flow Duration
Base (W09X02)
Inactive (W09x05)
Conservation (W09x03)
Flood (W09x04)
1000000
100000
10000
1000
100
Discharge (cfs)
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Equaled or Exceeded

Calico Rock					Calico Rock		
Annual Flow-Duration					**Differences in Annual Flow (DSF) (Alternative minus Base)**		
Percent Equaled or Exceeded	Base (W09X02)	Conservation (W09x03)	Flood (W09x04)	Inactive (W09x05)	Conservation (W09x03)	Flood (W09x04)	Inactive (W09x05)
1	41565	41565	41562	41565	0	-3	0
2	35664	35641	35671	35641	-23	7	-23
5	25711	25591	25632	25602	-120	-79	-109
10	20081	20062	20058	20059	-19	-23	-22
15	17806	17796	17799	17796	-10	-7	-10
20	15848	15834	15820	15834	-14	-28	-14
25	13865	13847	13827	13847	-18	-38	-18
30	12129	12114	12104	12115	-15	-25	-14
35	10762	10738	10731	10738	-24	-31	-24
40	9533	9525	9520	9524	-8	-13	-9
45	8411	8396	8391	8397	-15	-20	-14
50	7429	7420	7419	7421	-9	-10	-8
55	6520	6512	6509	6513	-8	-11	-7
60	5833	5827	5824	5826	-6	-9	-7
65	5221	5217	5212	5215	-4	-9	-6
70	4660	4656	4652	4655	-4	-8	-5
75	4104	4103	4098	4101	-1	-6	-3
80	3585	3579	3574	3579	-6	-11	-6
85	3080	3078	3076	3077	-2	-4	-3
90	2587	2586	2583	2584	-1	-4	-3
95	1968	1966	1962	1962	-2	-6	-6
100	349	349	349	349	0	0	0

Newport					Newport		
Annual Flow-Duration					**Differences in Annual Flow (DSF) (Alternative minus Base)**		
Percent Equaled or Exceeded	Base (W09X02)	Conservation (W09x03)	Flood (W09x04)	Inactive (W09x05)	Conservation (W09x03)	Flood (W09x04)	Inactive (W09x05)
1	83537	83537	83537	83537	0	0	0
2	66393	66393	66391	66393	0	-2	0
5	59070	59060	59065	59060	-10	-5	-10
10	46908	46868	46886	46868	-40	-22	-40
15	36985	36959	36998	36959	-26	13	-26
20	30435	30413	30409	30413	-22	-26	-22
25	27459	27407	27404	27409	-52	-55	-50
30	25121	25120	25120	25120	-1	-1	-1
35	25050	25046	25044	25046	-4	-6	-4
40	23665	23627	23606	23627	-38	-59	-38
45	20101	20069	20059	20069	-32	-42	-32
50	16910	16889	16884	16892	-21	-26	-18
55	14863	14860	14851	14861	-3	-12	-2
60	13316	13317	13308	13317	1	-8	1
65	11993	11988	11983	11988	-5	-10	-5
70	10792	10791	10788	10791	-1	-4	-1
75	9749	9750	9743	9749	1	-6	0
80	8812	8812	8809	8812	0	-3	0
85	7898	7898	7894	7897	0	-4	-1
90	6948	6950	6945	6947	2	-3	-1
95	5954	5954	5952	5953	0	-2	-1
100	892	892	891	891	0	-1	-1



Calico Rock - Annual Stage Duration
Base (W09X02)
Inactive (W09x05)
Conservation (W09x03)
Flood (W09x04)
45.000
40.000
35.000
30.000
25.000
20.000
15.000
10.000
5.000
0.000
Stage (ft)
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Equaled or Exceeded



Newport - Annual Stage Duration
Base (W09X02)
Inactive (W09x05)
Conservation (W09x03)
Flood (W09x04)
Stage (ft)
35.000
30.000
25.000
20.000
15.000
10.000
5.000
0.000
-5.000
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Equaled or Exceeded

Calico Rock					Calico Rock		
Annual Stage-Duration					**Differences in Annual Stage (Feet) (Alternative minus Base)**		
Percent Equaled or Exceeded	Base (W09X02)	Conservation (W09x03)	Flood (W09x04)	Inactive (W09x05)	Conservation (W09x03)	Flood (W09x04)	Inactive (W09x05)
1	14.721	14.721	14.721	14.721	0.000	0.000	0.000
2	13.365	13.359	13.366	13.359	-0.006	0.001	-0.006
5	10.881	10.848	10.860	10.852	-0.033	-0.021	-0.029
10	9.318	9.313	9.312	9.312	-0.005	-0.006	-0.006
15	8.644	8.641	8.642	8.641	-0.003	-0.002	-0.003
20	8.045	8.041	8.037	8.041	-0.004	-0.008	-0.004
25	7.398	7.393	7.386	7.393	-0.005	-0.012	-0.005
30	6.818	6.812	6.809	6.813	-0.006	-0.009	-0.005
35	6.333	6.324	6.322	6.324	-0.009	-0.011	-0.009
40	5.879	5.876	5.874	5.876	-0.003	-0.005	-0.003
45	5.447	5.441	5.439	5.442	-0.006	-0.008	-0.005
50	5.051	5.048	5.047	5.048	-0.003	-0.004	-0.003
55	4.665	4.662	4.661	4.662	-0.003	-0.004	-0.003
60	4.363	4.360	4.359	4.359	-0.003	-0.004	-0.004
65	4.083	4.081	4.079	4.081	-0.002	-0.004	-0.002
70	3.813	3.811	3.810	3.811	-0.002	-0.003	-0.002
75	3.540	3.539	3.537	3.539	-0.001	-0.003	-0.001
80	3.265	3.262	3.259	3.262	-0.003	-0.006	-0.003
85	2.993	2.992	2.991	2.992	-0.001	-0.002	-0.001
90	2.707	2.706	2.705	2.705	-0.001	-0.002	-0.002
95	2.318	2.316	2.314	2.314	-0.002	-0.004	-0.004
100	0.958	0.958	0.958	0.958	0.000	0.000	0.000

Newport					Newport		
Annual Stage-Duration					**Differences in Annual Stage (Feet) (Alternative minus Base)**		
Percent Equaled or Exceeded	Base (W09X02)	Conservation (W09x03)	Flood (W09x04)	Inactive (W09x05)	Conservation (W09x03)	Flood (W09x04)	Inactive (W09x05)
1	27.041	27.041	27.041	27.041	0.000	0.000	0.000
2	24.899	24.899	24.899	24.899	0.000	0.000	0.000
5	23.571	23.569	23.570	23.569	-0.002	-0.001	-0.002
10	20.469	20.456	20.462	20.456	-0.013	-0.007	-0.013
15	16.742	16.732	16.747	16.732	-0.010	0.005	-0.010
20	14.040	14.031	14.029	14.031	-0.009	-0.011	-0.009
25	12.735	12.711	12.710	12.712	-0.024	-0.025	-0.023
30	11.676	11.676	11.676	11.676	0.000	0.000	0.000
35	11.643	11.642	11.641	11.642	-0.001	-0.002	-0.001
40	11.002	10.984	10.974	10.984	-0.018	-0.028	-0.018
45	9.264	9.248	9.243	9.248	-0.016	-0.021	-0.016
50	7.608	7.596	7.593	7.598	-0.012	-0.015	-0.010
55	6.485	6.483	6.478	6.483	-0.002	-0.007	-0.002
60	5.595	5.596	5.591	5.596	0.001	-0.004	0.001
65	4.803	4.800	4.797	4.800	-0.003	-0.006	-0.003
70	4.057	4.057	4.054	4.056	0.000	-0.003	-0.001
75	3.377	3.378	3.373	3.377	0.001	-0.004	0.000
80	2.748	2.748	2.746	2.748	0.000	-0.002	0.000
85	2.110	2.110	2.108	2.110	0.000	-0.002	0.000
90	1.409	1.410	1.406	1.408	0.001	-0.003	-0.001
95	0.639	0.640	0.638	0.638	0.001	-0.001	-0.001
100	-4.463	-4.463	-4.464	-4.464	0.000	-0.001	-0.001

Appendix B
Pertinent Correspondence

1.0 DOCUMENTATION OF OPPORTUNITY FOR PUBLIC REVIEW OF ACTION

Public Workshops – Summer 2009

A public workshop was held on June 30, 2009, from 6 to 8 pm at the Gaston's Visitor Center at Bull Shoals Dam with 74 people attending. A second public workshop was held in Diamond City, AR on July 1, 2009, from 6 to 8 pm at the Diamond City Community Center with 24 people attending. There were no comments in opposition to the proposed reallocation of 6 MGD from Bull Shoals Lake (conservation pool or flood pool or a combination of both) for OMRPWA and MCRWD. Therefore, the decision was made to proceed with an Environmental Assessment, not an Environmental Impact Statement, for the reallocation study.

Agency Scoping Letters – Fall 2009

Scoping coordination letters were sent out September 15, 2009, requesting agency comments and concerns regarding an Environmental Assessment for the Reallocation at Bull Shoals Lake. No major concerns have been received to date. Table 6.1 lists the agencies that received coordination letters and indentifies concerns noted in the responses received.

Table 1.1 Project Agency/Office Coordination

Agency/Office Solicited	Response Received	Response/Concerns
Missouri Addressees:		
U.S. Fish and Wildlife Service Columbia, MO 65203	Oct. 19, 2009	No protected species or critical habitat within project area
U.S. Department of Agriculture St. Louis, MO 63141		No response received to date
U.S. Natural Resources Conservation Service Springfield, MO 65802	Oct. 19, 2009	Will comment upon reviewing draft EA
Missouri NRCS State Office Columbia, MO 65203		No response received to date
Missouri State Historic Preservation Office Jefferson City, MO 65102	Oct. 21, 2009	Project not likely to affect any known cultural resources within project area
Arkansas Addressees:		
Arkansas Historic Preservation Program Little Rock, AR 72201	Oct. 9, 2009	No known historic properties will be affected by this undertaking
Department of Finance & Administration Little Rock, AR 72203	Sep. 22, 2009	Will comment upon reviewing draft EA
Arkansas Soil and Water Conservation Comm. Little Rock, AR 72201		No response received to date
Arkansas Forestry Commission Little Rock, AR 72201		No response received to date
Arkansas Game and Fish Commission Little Rock, AR 72205	Sep. 25, 2009	Concerns were in regards to new water supply pipeline that will be required under a different action

Agency/Office Solicited	Response Received	Response/Concerns
Arkansas Dept of Environmental Quality Little Rock, AR 72118		No response received to date
Arkansas Natural Heritage Commission Little Rock, AR 72201		No response received to date
U.S. Geological Survey Little Rock, AR 72211		No response received to date
Arkansas Natural Resources Commission Little Rock, AR 72201		No response received to date
Arkansas Department of Parks and Tourism Little Rock, AR 72201		No response received to date
Arkansas Department of Health Little Rock, AR 72205		No response received to date
U.S. Department of Agriculture, NRCS Little Rock, AR 72201		No effect on Prime Farmland or Farmland of Statewide Importance
Arkansas Highway and Transportation Department Little Rock, AR 72211		No response received to date
U.S. Fish and Wildlife Service Conway, AR 72032		No federally listed endangered, threatened or candidate species present within project area
Other Addressees:		
Southwestern Power Administration Tulsa, OK 74103	Oct. 20, 2009	Impacts and costs of increased air emissions should be quantified and impacts to hydropower should be detailed. Strongly objects to the use of the inactive pool as a viable alternative for the report and EA
U.S. Environmental Protection Agency, Region 6 Dallas, TX 75202		No response received to date
National Park Service, Midwest Region Omaha, NE 68102		No response received to date
FEMA, Region VI Denton, TX 76210	Oct. 15, 2009	Possible negative impacts on identified special flood hazard areas within project area. Also, referred to floodplain managers for Marion and Baxter Counties.

Letter and Views of Other Federal, State and/or Local Interests Affected by the Action are located in Appendix C.

PUBLIC REVIEW / COMMENTS SUMMARY

The draft environmental assessment (Draft EA) and reallocation report for this action were released concurrently for public review and comment on May 11, 2010. The comment period ran for 30 days from May 11, 2010 to June 11, 2010 and was announced via a public notice which ran in five (5) newspapers covering the project area. These newspapers are identified in the Affidavit of Insertion included in Appendix C. Copies of the Draft EA and Reallocation Report were mailed on compact disk to recipients listed on the mailing list included in this attachment. In addition, an electronic copy was posted on the Little Rock District webpage. Hardcopies were made available at the Mountain Home Project Office, the Searcy County Library, the Marion County Library in Yellville, Arkansas and at the Little Rock District headquarters building. A mailing list, copies of the public notice, newspaper notices, and other information pertaining to the public review period are included in Appendix C.

Overall, ten (10) comment letters from agencies and private individuals were received during the comment period. Included were letters from eight (8) agencies or organizations and two (2) individual citizens. Copies of all letters are included in Appendix C. A brief description of each comment letter and, where appropriate, a summary of substantial comments raised are provided below. In addition, a brief summary of the Little Rock District's evaluation of substantial issues raised in these comments is also included.

COMMENTS RECEIVED

Department of Energy, Southwestern Power Administration (letter dated June 11, 2010). The Southwestern Power Administration (SWPA) provided a significant number of comments on matters ranging from water supply needs and withdrawal rates, concern over USACE policies regarding reallocating storage for water supply, hydropower crediting calculations and procedures, methods of alternatives evaluation and resulting selection of the proposed plan, and consideration of the inactive pool for storage reallocation. In addition, SWPA identified the need to provide revisions based on an alternate Southwestern power marketing area, recently-renewed contracts, and recently-updated power rates.

A thorough analysis of comments received from SWPA was conducted by the Little Rock District and the Corps' Hydropower Analysis Center (HAC). Based on a review of the appropriate power marketing area and newly-revised rates, HAC revised calculations in its hydropower report (Reallocation Report, Appendix D). Similar changes were reflected in updates to the Reallocation Report and EA, as appropriate. Many comments received from SWPA concern long-standing and well-known areas of disagreement between SWPA and the Corps regarding USACE policy for evaluating impacts to hydropower and hydropower crediting procedures. In instances where Corps policy was applicable to methodology used in this study, such policy was consistently applied. These policy issues will likely continue to be a point of disagreement between the Corps and SWPA on this and future reallocations involving hydropower considerations.

One comment provided by SWPA was a recommendation to evaluate a flood pool reallocation alternative employing hydropower yield protection operation ("HYPO"), a methodology similar to dependable yield mitigation storage (DYMS) for existing water supply users. Such an analysis was conducted by the Little Rock District for the White River Minimum Flow (WRMF) study at Bull Shoals Lake. However, there are several distinctions between WRMF and the current study. These include special project-specific authorizing legislation, a reallocation for non-municipal and industrial (M&I) water supply purposes for WRMF, a reallocation of nearly twenty (20) times the storage volume for WRMF relative to the currently-proposed action, and a much greater adverse effect on hydropower. While not in accordance with USACE policy, alternative evaluation using HYPO was conducted for WRMF based on these considerations and the project-specific authority. The current USACE policy regarding existing hydropower users is that compensation may be considered through minor operational changes for the reallocation from the flood control pool to M&I water supply, and therefore, HYPO is not a viable consideration for the currently-proposed action.

<u>Southwestern Power Resources Association (letter dated June 11, 2010).</u> The Southwestern Power Resources Association (SPRA) provided comments which were very similar in nature and specific content to those provided by SWPA. In summary, SPRA expressed concern over an appropriate power marketing area, newly-revised hydropower rates, calculations of the hydropower impacts of storage reallocations including pricing, the period included in the evaluation, definition of usable storage, and cumulative effects of past reallocations.

The Little Rock District and HAC thoroughly evaluated comments received from SPRA. As many of these issues were similar to those raised by SWPA, conclusions were likewise similar. Most of the comments were addressed by identifying the USACE policy used in the evaluation of hydropower impacts and crediting procedures. Where necessary based on newly-revised rates and other considerations, revisions were incorporated in the HAC report, the reallocation report, and EA. In instances where comments provided by SPRA were in conflict with USACE policy, USACE policy was consistently applied.

The SPRA likewise provided comments regarding cumulative effects on hydropower production and mitigation considerations for such effects. The USACE believes that mitigation for hydropower effects is provided for by credits to SWPA in accordance with Corps' policy and procedures. Finally, SPRA commented that the EA should consider cumulative effects of storage reallocations on greenhouse gas emissions at the 24 Corps projects from which SWPA markets hydroelectric energy and capacity owing to replacement of hydropower losses by thermal generation. While the EA does provide estimates of the increase in greenhouse gas emissions resulting from the proposed action, the widespread geographic range of the 24 Corps projects and uncertainties regarding location of thermal generation facilities make it difficult to quantify cumulative effects on ambient air quality. It should be noted, however, that such thermal facilities are subject to air quality regulations and permitting requirements aimed at attainment of air quality standards.

<u>T. David Carruth, Attorney at Law (letter dated June 10, 2010).</u> Mr. Carruth provided comments reported to be on behalf of himself, "the White River Conservancy, and are available as comments for the Arkansas Wildlife Federation, the Clarendon Chamber of Commerce and a lose *[sic]* association of individuals who use the waters of the White River for recreation, fishing and hunting. This association is known as the B.P.F.M.A.O.R.R.R." Mr. Carruth commented that he had trouble accessing the draft Reallocation Report and EA for review from the Corps' website and for that reason requested an extension of the comment period. He also expressed

concerns that the reallocation of water supply storage would "have a profound impact on both the human and natural environment." He stated that "Water supply is not an authorized use of the water impounded by Bull Shoals Dam." He expressed concern about how the reallocated water supply storage will be managed and utilized, as well as how downstream waters will be managed. He expressed the opinion that the "allocation should not take place", that a full environmental impact study should be conducted, and that to do less "would be in violation of the National Environmental Policy Act."

The Little Rock District has thoroughly evaluated Mr. Carruth's comments. The Corps provided opportunity for document review via the internet and hard copies in four (4) locations throughout the state, to include the Mountain Home Project Office, the Searcy County Library, the Marion County Library, and Little Rock District Office. During the comment period, the majority of the responses received indicated that the individuals or agencies had reviewed documents with no indications of problems or inabilities in accessing the documents, thus validating the distribution methods. There were also no known problems with the website link throughout the comment period. Therefore, it was determined that there was no reason for extending the comment period.

Other concerns expressed are addressed in the Environmental Assessment and Finding of No Significant Impact. These two documents complete the requirements called for by the National Environmental Policy Act of 1970 (42 USC 4321, *et seq.*, as amended), under guidelines set for by the Council on Environmental Quality (CEQ) regulations (40 CFR, Parts 1500-1508). The Bull Shoals Dam and Lake Project is a multi-purpose reservoir. The project was authorized for flood control, hydroelectric power and other purposes, including fish/wildlife and recreation, by the Flood Control Act of 28 June 1938, as modified by the Flood Control Act of 1941.The Water Supply Act of 1958 provides general authorization for construction or reallocation of storage for water supply uses at all Corps lakes, provided such construction or reallocation does not seriously affect other authorized project purposes. The Chief of Engineers has delegated authority to approve reallocations of up to 15 percent of total storage capacity, or 50,000 ac-ft, whichever is less. This report concluded the reallocation for water supply will have no significant impacts to the authorized operating purposes of Bull Shoals Lake which include flood control, hydropower, water supply and fish and wildlife. The USACE does not operate for or regulate the downstream use of the water in the White River System.

<u>Arkansas Game and Fish Commission (letter dated June 1, 2010):</u> The Arkansas Game and Fish Commission (AGFC) did not have any specific concerns with the proposed reallocation of water supply storage in Bull Shoals Lake from a fish and wildlife management standpoint.

The Little Rock District acknowledges these comments.

<u>Arkansas Department of Health (letter dated May 13, 2010):</u> The Arkansas Department of Health (ADH) reviewed the proposed project and concluded that it would provide the local area with a safe drinking water supply.

The Little Rock District acknowledges these comments.

Department of Arkansas Heritage (letter dated May 13, 2010): The Department of Arkansas Heritage (DAH) concluded that the proposed project would not affect any known historic properties.

The Little Rock District acknowledges these comments.

U. S. Fish and Wildlife Service (USFWS) (letter dated June 3, 2010): The USFWS concurred with the assessment that this project will have no significant negative environmental impacts. Therefore, the Service had no objection to the proposed issuance of a Finding of No Significant Impact for the proposed action.

The Little Rock District acknowledges these comments.

Federal Emergency Management Agency (FEMA): FEMA requested that the county floodplain administrators be contacted for the review of the project and possible permit requirements for the proposed project.

The Little Rock District determined that the proposed action will result in no impact to floodplains; therefore, county floodplain administrators were not involved.

Comments from Individuals: Additional comments were provided by two (2) individual citizens (undated and handwritten letters by Mr. Gary Honeycutt, and one with an illegible signature and no return address). Both are included in this attachment. The comments from these individuals focused on the potential negative impacts of reallocating storage for water supply. All of the concerns expressed by these individuals are addressed in the Environmental Assessment and Finding of No Significant Impact. One individual questioned the authority to utilize Bull Shoals Lake for public water supply. The other individual seemed to focus on the use of the land that Bull Shoals Lake occupies for a public water supply reservoir.

The Little Rock District operates the Bull Shoals Dam and Lake Project as a multi-purpose reservoir, as authorized by the Congress of the United States. The project was authorized for flood control, hydroelectric power and other purposes, including fish/wildlife and recreation, by the Flood Control Act of 28 June 1938, as modified by the Flood Control Act of 1941. The Water Supply Act of 1958 provides general authorization for construction or reallocation of storage for water supply uses at all Corps lakes, provided such construction or reallocation does not seriously affect other authorized project purposes. The Chief of Engineers has delegated authority to approve reallocations of up to 15 percent of total storage capacity, or 50,000 ac-ft, whichever is less. This report concluded the reallocation for water supply will have no significant impacts to the authorized operating purposes of Bull Shoals Lake

CONCLUSIONS

The draft and final EA were prepared in accordance with ER 200-2 "Procedures for Implementing NEPA," which provides guidance for implementation of the procedural provisions of the National Environmental Policy Act (NEPA) of 1970 (42 USC 4321 *et seq.*, as amended) for the Civil Works Program of the U.S. Army Corps of Engineers, per regulations set forth by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500-1508).

After careful evaluation of all comments received, the conclusions and recommendations expressed in the draft report and EA remain the same. None of the comments received warrant a change to the conclusion that the proposed action has no significant effects on the environment. Therefore an Environmental Impact Statement (EIS) is not warranted and a "Finding of No Significant Impact" (FONSI) is appropriate.

Appendix C
NEPA Documentation and FONSI

Bull Shoals Lake, Arkansas

US Army Corps of Engineers®
Little Rock District

ENVIRONMENTAL ASSESSMENT

Reallocation of Water Storage at Bull Shoals Lake, Arkansas, for the Ozark Mountain Regional Public Water Authority and Marion County Regional Water District

FINAL July 2010

ENVIRONMENTAL ASSESSMENT
FINAL

Reallocation of Water Storage at Bull Shoals Lake, Arkansas, for the Ozark Mountain Regional Public Water Authority

US Army Corps of Engineers®
Little Rock District

July 2010

FINDING OF NO SIGNIFICANT IMPACT

FINDING OF NO SIGNIFICANT IMPACT

NAME OF PROPOSED ACTION: Ozark Mountain Regional Public Water Authority (OMRPWA) and Marion County Regional Water District (MCRWD), Water Supply Storage Reallocation, Bull Shoals Lake, Arkansas.

PURPOSE AND NEED FOR THE PROPOSED ACTION: The Little Rock District, U.S. Army Corps of Engineers proposes that 11,886.541 acre-feet of conservation pool storage in Bull Shoals Lake be reallocated from hydropower purpose to water supply storage to satisfy the Municipal and Industrial water supply needs of OMRPWA and MCRWD **(Alternative 2)**. The top of conservation pool is 659.00 NGVD29, with seasonal differences. The total water supply storage would be 13,584.617 acre-feet (1,698.077 acre-feet previously reallocated from the conservation pool and an additional 11,886.541 acre-feet reallocated from the conservation pool).

ALTERNATIVES: In addition to the Proposed Action (reallocation from the conservation pool), reallocation of storage from the flood and inactive pools were considered, as well as the No-Action alternative, were considered in the preparation of an Environmental Assessment (EA) for this Proposed Action:

No Action (Alternative 1): The existing condition represents the current 1,698.077 acre-feet of water supply storage within the conservation pool. The top of pool is at elevation 659.00 feet. The seasonal pool plan is also part of this condition that raises the top of conservation pool, with the White River Minimum Flows (WRMF) Project implemented, to elevation 662.0 feet from 15 May to 15 June and then to 661.00 feet from 15 July to 30 September.

Reallocation from the flood pool (Alternative 3): This alternative would reallocate 11,948.151 acre-feet from the flood control pool for water supply storage. The top of the conservation pool, with the WRMF Project implemented, would be raised to elevation 659.25 with seasonal pool raises. The total water supply storage would be 13,646.229 acre-feet, including the existing allocation. Dependable yield mitigation storage is included (13.221 acre-feet) to keep existing water supply users' yield whole to compensate for the reduction in the dependable yield which occurs when the conservation pool is expanded.

Reallocation from the inactive pool (Alternative 4): This alternative would reallocate 11,943.284 acre-feet from the inactive pool for water supply storage. The top of the conservation pool, with WRMF implemented, would remain at 659.0 feet with seasonal pool raises and the bottom of the conservation pool would be lowered to 628.14 feet. The total water supply storage would be 13,461 acre-feet, including the existing allocation. Dependable yield mitigation storage is included (12.975 acre-feet) to keep existing water supply users' yield whole to compensate for the reduction in the dependable yield which occurs when the conservation pool is expanded.

ANTICIPATED ENVIRONMENTAL IMPACTS:

Consideration of the environmental effects of the proposed action have been disclosed in the *Environmental Assessment, Reallocation of Water Storage at Bull Shoals Lake, Arkansas, for the Ozark Mountain Regional Public Water Authority and Marion County Regional Water District, July, 2010*, prepared by the U.S. Army Corps of Engineers, Little Rock District, and which is hereby incorporated by reference into this document. It has been determined that there will be no significant environmental impacts as a result of the implementation of this action; and, it is therefore necessary in order to prepare this Finding Of No Significant Impact (FONSI). This determination of significance is required by 40 CFR 1508.13. Additionally, 40 CFR 1508.27 defines significance at it relates to consideration of environmental effects of a direct, indirect or cumulative nature.

Criteria that must be considered in making this finding are addressed below, in terms of both context and intensity. The significance of both short and long term effects must be viewed in several contexts: society as a whole (human, national); the affected region; the affected interests; and the locality. The context for this determination is primarily local, as shown in Figures 1.1 and 2.1 of the EA. The context for this action is not highly significant geographically, nor is it controversial in any significant way. Consideration of intensity refers to the magnitude and intensity of impact, where impacts may be both beneficial and adverse. Within this context, the magnitude and intensity of impacts resulting from this decision are not significant. The determination for each impact topic is listed below:

1. **The degree to which the action results in both beneficial and adverse effects. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.** The EA indicates that there will be beneficial effects such as the availability of increased water supply to meet Municipal and Industrial needs of the region served by OMRPWA and MCRWD until the year 2025 by implementation of Alternative 2 (Proposed Action). Perhaps more importantly, the proposed action alternative provides a source of safe drinking water to a region with long-standing health issues associated with the current water supply. The EA also indicates that any negative effects, such as a small loss of hydropower benefits, will be minimal.

2. **The degree to which the action affects public health or safety.** No adverse effects to public health or safety will result from the Proposed Action. Under existing conditions, no significant amounts of hazardous materials are identified in the immediate area of the Proposed Action. Implementing the Proposed Action would not create hazardous conditions affecting public health or safety.

3. **The degree to which the action affects unique characteristics of the potentially affected area, such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.** No such unique characteristics or resources have been identified in the project area.

~~4.~~ **The degree to which effects on the quality of the human environment are likely to be highly controversial.** The project will benefit the public, therefore the Little Rock District, Corps of Engineers does not regard this activity as controversial. Eight comments were received from agencies or organizations and two comments were received from individuals during the public review period from May 11, 2010 to June 11, 2010. Two of the groups responding, Southwestern Power Administrations (SWPA) and Southwestern Power Resources Association (SPRA), disagreed with the manner in which hydropower losses were calculated and the two individuals expressed concern about issues unrelated to the proposed action. Other comments received were either supportive or minimal in nature. In synopsis, the public comments do not reflect a high degree of controversy.

5. **The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.** Reallocation of water supply storage from Bull Shoals Lake has occurred once in the past. Although this reallocation is larger, there is no uncertainty involving the impacts or risks of this action.

6. **The degree to which the action may establish a precedent for future actions with significant impacts.** The reallocation of water supply storage at Bull Shoals Lake is situation specific and will not establish any precedent for future action that has significant impacts.

7. **Whether the action is related to other actions with individually insignificant but cumulatively significant impacts.** Cumulative effects analyses for the physical and biological resources that would potentially be affected are presented in the EA. The Proposed Action would not result in any significant cumulative impacts in regard to any reasonably foreseeable action in the project area.

8. **The degree to which the action may adversely affect items listed or eligible for listing in the National Register of Historic Places, or other significant scientific, cultural or historic resources.** As previously stated in Item 3 above, no known historic structures or archaeological sites would be affected by the Proposed Action.

9. **The degree to which the action may adversely affect an endangered or threatened species or its critical habitat.** As disclosed in the EA, Section 4.4.3, coordination with the USFWS indicates that no T&E species are anticipated to be impacted by the Proposed Action.

10. **Whether the action threatens a violation of Federal, State or local law or requirements imposed for the protection of the environment.** No such violations will occur. Continued coordination with regulatory agencies will be ongoing to ensure compliance with all federal, state, regional, and local regulations and guidelines

CONCLUSIONS:

The impacts identified in the prepared EA have been thoroughly discussed and assessed. No impacts identified in the EA would cause any significant adverse effects to the human environment. Therefore, due to the analysis presented in the EA and comments received from a 30-day public review period that began on May 11, 2010, and ended on June 11, 2010, it is my decision that the preparation of an Environmental Impact Statement (EIS) as required by the National Environmental Policy Act (NEPA) is unwarranted and a "Finding of No Significant Impact" (FONSI) is appropriate. The signing of this document indicates the Corps' final decision of the proposed action as it relates to NEPA. The EA and FONSI will be held on file in the Planning and Environmental Division for future reference. Consultation with regulatory agencies will be ongoing to ensure compliance with all federal, state, regional, and local regulations and guidelines.

Date

Glen A. Masset
Colonel, US Army
District Engineer

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Introduction

1.0 INTRODUCTION

1.1 Purpose and Need

The purpose of this environmental assessment (EA) is to evaluate the impacts of the proposed reallocation of water storage at Bull Shoals Lake, Arkansas, to meet the Municipal and Industrial (M&I) needs of the North Central Arkansas region.

The proponent of this action, the Ozark Mountain Regional Public Water Authority (OMRPWA) is a coalition of 20 water systems that was formed in 2004 to pursue a future water supply for the north central Arkansas region. OMRPWA serves a population of about 22,000 in Newton, Searcy, and parts of Boone, Marion, Johnson, and Pope Counties (see Figure 1.1 for the location of the counties involved). Raw water sources include shallow wells, deep wells, springs, or ground water purchased from neighboring water systems (see Figure 1.2 for a general layout map of OMRPWA member areas with color coding for water supply sources in the areas).

Following is a list of OMRPWA members:

<u>Newton County</u>
City of Jasper
Mt. Sherman Water Association
Nail-Swain Water Association
East Newton County Water Association
Mockingbird Hill Water Association
Deer Community Water Association
Lurton-Pelsor Water Association
Town of Western Grove
Parthenon Water Association

<u>Searcy County</u>
SP&G Water Association
(St. Joe, Pindall & Gilbert)
City of Marshall
South Mountain Water Association
SDM Water Association
(Snowball, Dongola & Marsena)
Town of Leslie
Morning Star Water Association

<u>Boone County</u>
Town of Valley Springs
Town of Diamond City
Town of Lead Hill
Lake Bull Shoals Estates

<u>Members At Large</u>
National Park Service
(Buffalo National River)

Several member water systems have elevated levels of radium and fluoride that exceed the national primary drinking water standards. EPA has certified that many of the sources used by members of OMRPWA are unsafe for human consumption and the Arkansas Department of Health (ADH) has issued Administrative Orders to some members for continuing to supply unsafe water (ESI 2009a). As a result, ADH has identified the need for an alternative supply for these communities as their highest priority (ADH, 2010).

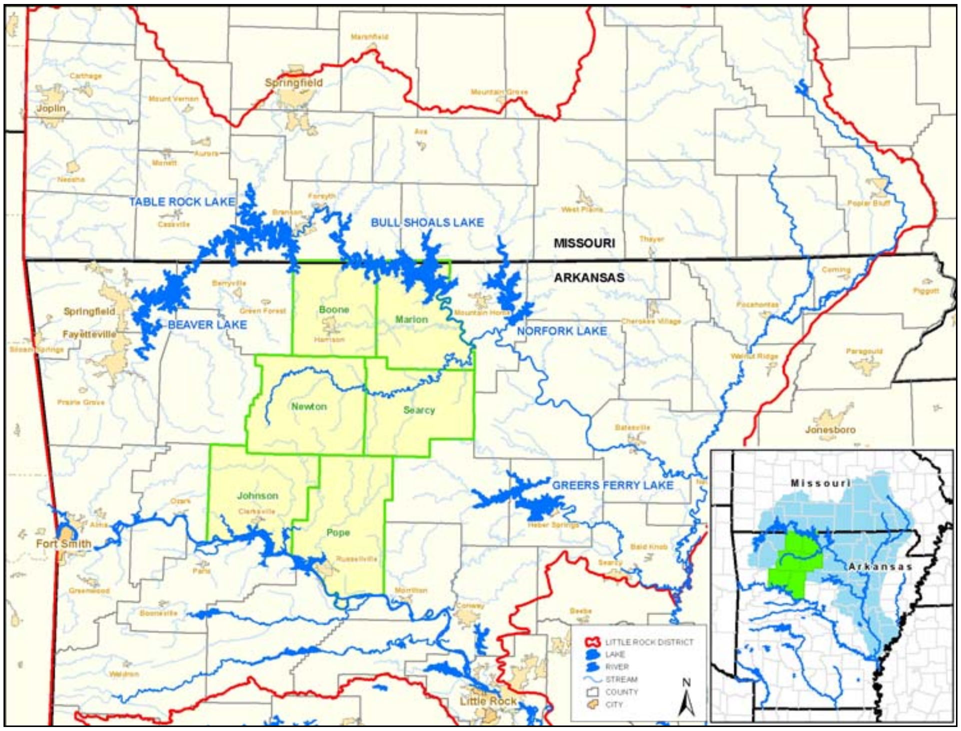


Figure 1.1 Arkansas Counties Served by OMRPWA Members

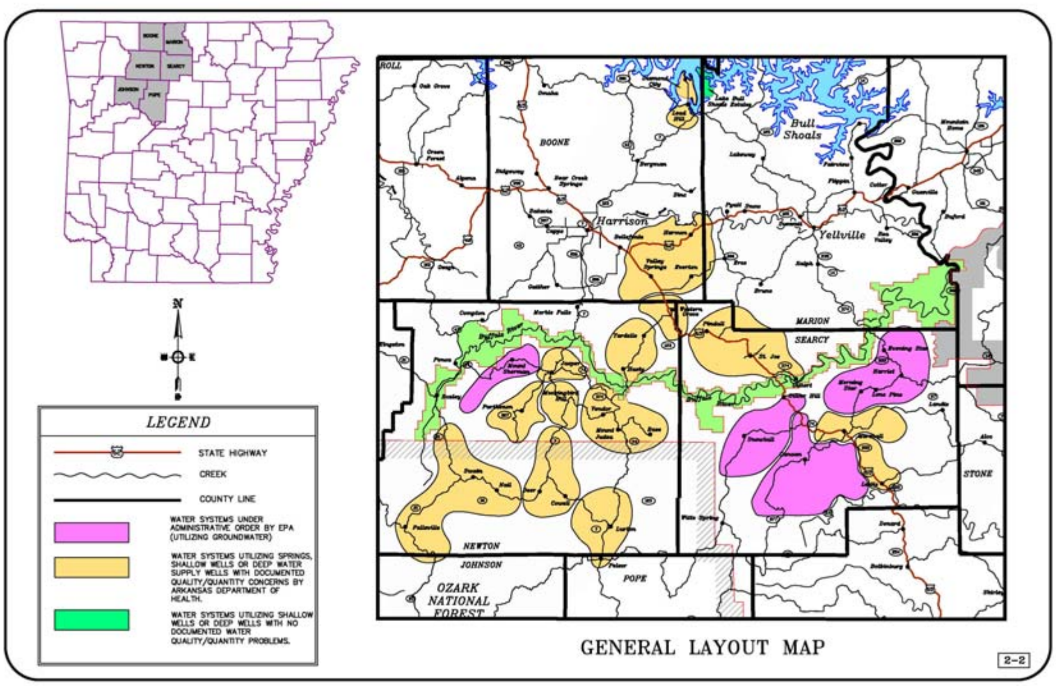


Figure 1.2 OMRPWA Area General Layout Map

Source: Ozark Mountain Regional Public Water Authority, Preliminary Engineering Report North Central Arkansas, April 2009, prepared by Engineering Services, Inc.

For more than 30 years the region has struggled to find clean and reliable sources of water. A regional water supplier has worked without success to develop a water supply from the Buffalo River watershed. The plan was under environmental review for about 10years where it received permitting challenges and a legal challenge by the National Park service because of the designation of the Buffalo River as the nation's first national river. Ultimately, progress on the project was stopped because of the environmental hurdles.

Bull Shoals and Norfork Lakes remain as the only local clean, reliable, and readily available sources of water for OMRPWA.

OMRPWA commissioned a preliminary engineering report to evaluate the demand for water and water supply alternatives. That report (Ozark Mountain Regional Public Water Authority, Preliminary Engineering Report Amendment No. 1 – North Central Arkansas, August 2009, prepared by Engineering Services, Inc. (ESI) and Ozark Mountain Regional Public Water Authority, Preliminary Engineering Report North Central Arkansas, April 2009, prepared by ESI), evaluated twelve alternatives that included purchasing water from neighboring water systems, new supplies from U.S. Army Corps of Engineers' (USACE) reservoirs, and construction of new facilities to treat and convey the supplies to member systems. This report concluded that a 6 MGD supply from Bull Shoals Lake is the most cost-effective alternative and sufficient to meet the future demands of the member water systems. Therefore, OMRPWA requested, in a letter dated October 8, 2009, that the Corps reallocate storage sufficient to supply 6 million gallons per day (MGD) from Bull Shoals Lake.

Marion County Regional Water District (MCRWD) - Only one water provider currently utilizes Bull Shoals Lake as a municipal water source. MCRWD has a water supply allocation of 880 acre-feet from Bull Shoals Lake intended to provide a 1 MGD yield (ESI 1982). In 2007 and 2008, MCRWD sold an average 0.89 MGD and 0.84 MGD respectively. Peak summer usage is 1.2 MGD and their treatment plant capacity is 2.0 MGD (ESI 2009b). In a letter dated October 6, 2009, MCRWD requested that Little Rock District reallocate storage sufficient to supply an additional 1 MGD (for a total yield of 2 MGD) to allow for additional growth. Therefore, the MCRWD request for an additional 1 MGD allocation has been incorporated into this EA.

The following is a list of MCRWD members:

<u>Marion County</u>

City of Bull Shoals
City of Flippin
City of Summit
City of Yellville

MCRWD also serves rural Marion County and the cities of Bruno and Pyatt plan to connect to the system.

Most of the member entities pump the water from their well(s) adding only chlorine for disinfection before distributing it to their customers. Only five of the 20 systems provide some method of filtration prior to customers drinking. Also, due to a fluctuation in ground water levels many systems experience serious water shortages during the late summer months leaving some families without water.

Short Term Interim Action (Critical Needs Phase) verses Long Term Solution: The short term interim action, the Critical Needs Phase, already funded by USDA, Rural Utilities Service, will provide safe water to some OMRPWA customers until the long-term new overall water system is constructed. The Critical Needs Phase includes a pipeline between the city of Marshall and the water systems under Administrative Orders from the ADH to not consume water (these are Mt. Sherman Water Association, South Mountain Water Association, Snowball, Dongola & Marsena Water Association, and Morning Star Water Association). This pipeline will allow clean water from Marshall to be blended with contaminated water to reduce the overall contaminant levels. While the blended water is a short-term solution, Marshall cannot sustain the flow to these water systems during dry periods. This water supply system is being put into place now and the associated costs are included in the without project conditions.

See Figure 1.3 for a depiction of the Critical Needs Phase improvements.

In October 2009, it was announced OMRPWA will receive $56 million in grant and loan funding from the U.S. Department of Agriculture (USDA) through the American Recovery and Reinvestment Act (ARRA) of 2009. These funds will be used for constructing the water intake structure and treatment plant adjacent to Bull Shoals Lake, transmission lines, and booster pumping stations to transport the water across the rugged terrain in the Ozarks. However, these funds must be obligated by September 2010; and in order to obligate the funds, OMRPWA must first have a water supply storage agreement executed with USACE by August 2010.

As a result of the study conducted by ESI, OMRPWA has formulated a plan to develop a new source of water supply by constructing a water intake, treatment, and distribution system for water from Bull Shoals Lake that would provide needed additional water supply for its members.

The proposed OMRPWA project includes the construction of a new water transmission system for OMRPWA members designed to provide approximately at least 4.5 MGD (but have capacity to deliver up to 6.0 MGD) to the region in order to meet current water consumption needs. The project currently includes the following features:

- Construct a water intake structure on Bull Shoals Lake;
- Construct a water treatment facility to be located near Diamond City, AR;
- Install 115 miles of ductile iron transmission lines connecting the intake structure and treatment facility to OMRPWA member systems;
- Construct water storage tanks, which will supply water by gravity flow to each bulk customer; and,
- Construct booster pumping stations and install pressure reducing valves in order to serve the mountainous regions.

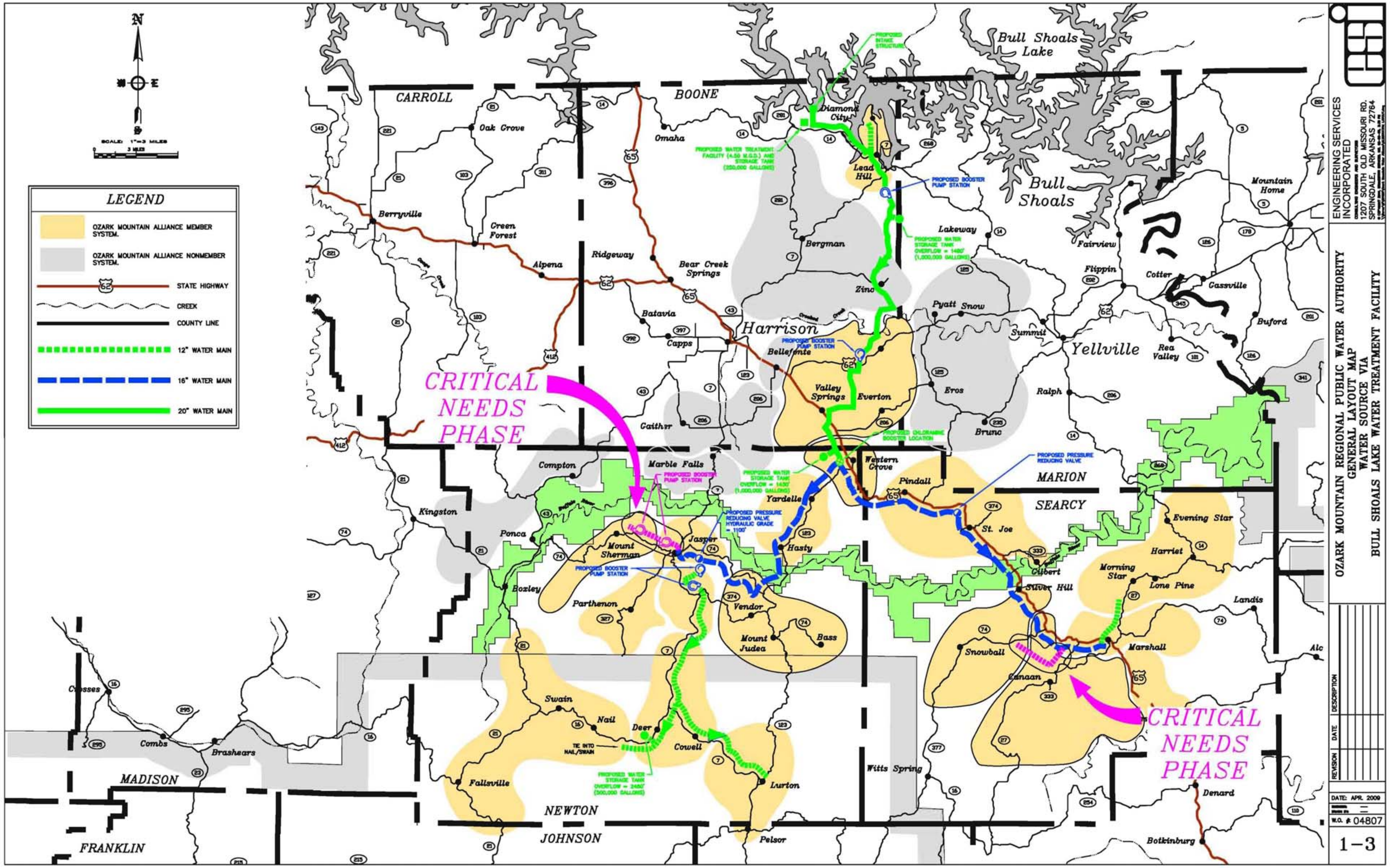


Figure 1.3 OMRPWA - Schematic of Critical Needs Phase

An environmental assessment was prepared on this proposed project under NEPA guidelines and a Finding of No Significant Impact (FONSI) was signed on 24 August 2009 by the USDA Rural Utilities Service (RUS). A copy of that FONSI is provided in Attachment 5. Therefore, this EA does not address the construction of that new water transmission system, rather only the reallocation of water storage at Bull Shoals Lake. Because this proposed action is currently planned and evaluated, it is considered part of the baseline conditions for the conduct of this EA, and the EA for that proposed action (*Environmental Report for Ozark Mountain Regional Public Water Authority to serve North Central Arkansas*, January 2008 [Revised May 2009] and *Environmental Report, Amendment No. 1, for Ozark Mountain Regional Public Water Authority to serve North Central Arkansas,* August 2009) is hereby incorporated by reference into this EA (40 CFR 1502.21) (see Attachment 5 for a copy of the EA and FONSI). See Figure 1.4 for an illustration of the proposed new OMRPWA water intake and distribution system.

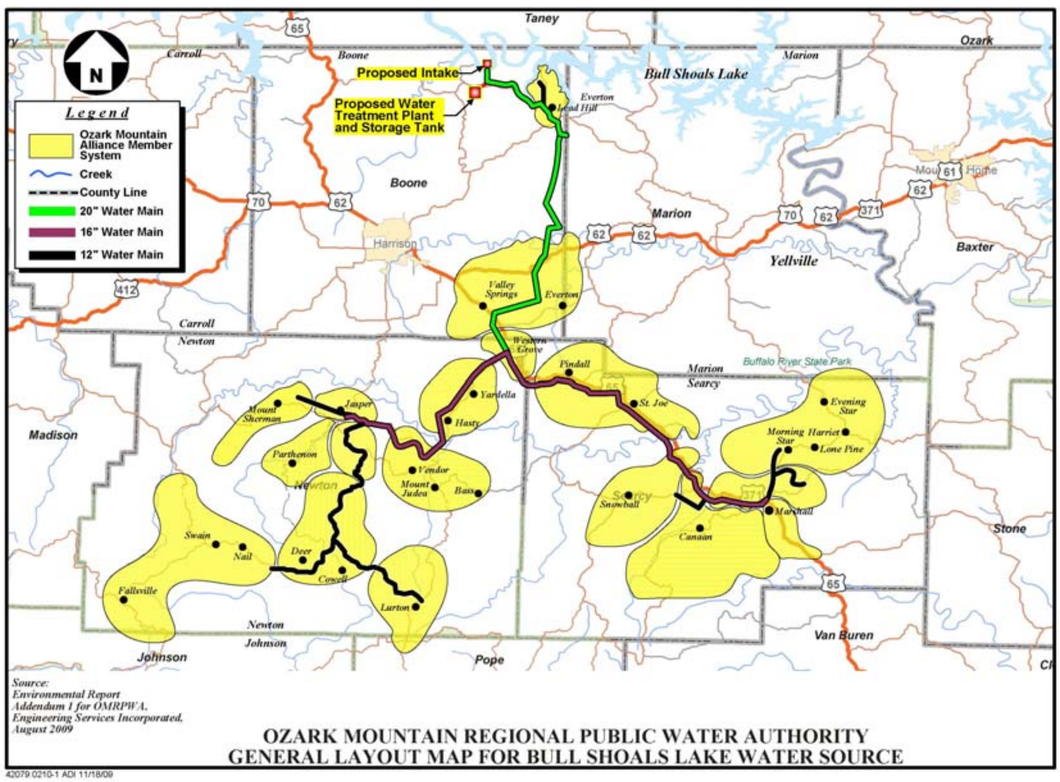


Figure 1.4 Proposed New OMRPWA Water Transmission System

As part of the system of the five multipurpose White River Basin lakes Bull Shoals Dam and Lake is managed primarily for flood control, hydro-power generation, and to a lesser extent recreation, fish and wildlife, and water supply. Additionally, reallocation of storage to provide tail water minimum flows will be implemented in the near future under the White River Minimum Flow Project. Because all of the storage space in the lakes is already allocated to existing purposes and no unused storage or surplus storage is available, there would need to be a reallocation of storage to fulfill the request of OPRPWA and MCRWD for an increase in water supply usage.

This environmental assessment (EA) is being prepared under the guidelines of the National Environmental Policy Act (NEPA) of 1970 (42 USC 4321 *et seq.*, as amended, per regulations set forth by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500-1508) (ER 200-2-2).

1.2 Background

White River System

The White River Lake System is made up of five multipurpose storage reservoirs (Beaver, Table Rock, Bull Shoals, Norfork, and Greers Ferry Lakes) and also a small flood control reservoir (Clearwater) on the Black River. System operation includes six control points on the White River, four control points on the Black River and one control point on the Little Red River. The White River Basin has changed dramatically over the last 50 years and to accommodate the many changes, the regulating plan for the system has been updated many times as well. Also due to these changes, the data recorded at gage locations is not uniform. In order to represent a uniform condition in the basin for the purposes of frequency and duration analyses, the White River System model was developed using the USACE Southwestern Division Regulation Simulation Computer Model (SUPER) to simulate the operations of the many reservoirs in the basin and produce a modified period of record for each control point.

The White River Basin Water Management Plan (1998 update) provides a comprehensive system of water control regulation which encompasses the entire White River Basin, incorporates all the basin projects and their many purposes, and provides seasonal flood control and hydropower releases based on the agricultural practices of the lower basin and other land uses downstream of the projects. The plan also addresses the needs of the downstream trout fishery by providing a mechanism to maintain cool water temperatures based on monitored and forecasted ambient air temperatures. It also provides a deviation procedure to respond to unforeseen and emergency conditions which are not included in the plan or for which the plan is singularly inadequate.

In January 2009, the White River Minimum Flows (WRMF) Project Report was completed and a Record of Decision (ROD) was signed which would reallocate 233,000 acre-feet of flood control storage to the conservation pool for minimum flow releases. The target minimum flow of 800 cubic feet per second (cfs) release includes 160 cfs from normal leakage through the closed wicket gates, 590 cfs release through one of the main hydropower turbines, and 50 cfs existing release through the house hydropower Station Service Unit. With this change, the storage capacity is 2.127 million acre-feet of flood control storage, 1.236 million acre-feet in the conservation pool, and 2.045 million acre-feet of storage in the inactive pool, for a total storage of 5.408 million acre-feet.

The WRMF Project Report and the Record of Decision were approved by the Assistant Secretary of the Army (Civil Works) in January 2009. Alternative BS-3, the recommended plan specific to Bull Shoals Lake, was authorized by the 2006 Energy and Water Development Appropriations Act Section 132(a). Alternative BS-3 will reallocate five feet of flood control storage, totaling 233,000 ac-ft for a target minimum flow release of 800 cfs. The top of the conservation pool will be raised five feet from elevation 654 to 659 ft. In anticipation of this change, the storage capacity in the lake will be 2.127 million ac-ft of flood control storage, 1.236 million ac-ft of conservation storage, and 2.045 million ac-ft of inactive storage, for a total storage of 5.408

million ac-ft. The project is currently at the end of the engineering and design phase and is expected to be implemented, so the base condition and without project condition assumes the WRMF reallocation is in place, however, reallocation of storage for WRMF will occur after the OMRPWA and MCRWD reallocation.

Bull Shoals Lake

The Bull Shoals Reservoir was authorized for flood control and future hydroelectric power by the Flood Control Act of 1938 (P.L. 75-761) and was modified by the Flood Control Act of 1941 (P.L. 77-228) to include hydroelectric power and other beneficial uses (fish/wildlife and recreation). The Water Supply Act of 1958 (P.L. 85-500) authorized water supply uses for the lake, and the Chief of Engineers has discretion to reallocate up to 15-percent of total storage capacity or 50,000 acre-feet (whichever is less) if there is no significant impact to other authorized project purposes. Section 304 of the Water Resources Development Act (WRDA) of 1996 (P.L. 104-303) authorized recreation and fish and wildlife mitigation as purposes of the project. Minimum flows to be implemented at Bull Shoals Lake (Alternative BS-3) as a result of the WRMF Project were authorized in Section 132 of the 2006 Energy and Water Development Appropriations Act (P.L. 109-103). This legislation also repealed previous WRDA 1999 and 2000 authorities for minimum flows. In summary, Bull Shoals Lake has authorized purposes of flood control and hydroelectric power and authorized uses of recreation, fish and wildlife mitigation, and water supply.

Dam construction was started in 1947 and completed in 1951. The powerhouse and switchyard were completed in 1952. Bull Shoals Lake 'construction' was considered complete with the installation in December 1963 of the final two generating units for a total eight turbines at a cost of about $86 million (www.swl.usace.mil/parks/bullshoals/damandlake.html). Recreation began in 1948 with the stocking of rainbow trout in the tailwater. A small water supply reallocation was implemented in 1988 for the MCRWD.

Bull Shoals Dam and Lake are operated by the U. S. Army Corps of Engineers, Little Rock District. Bulls Shoals tail water provides important trout habitat within the White River Lake System of the Ozark Mountains in north central Arkansas. In January 2009, the WRMF Report and ROD were approved and signed, as a result 233,000 acre-feet of flood control storage is planned to be reallocated to the conservation pool to provide minimum flow releases to the lower White River. With this anticipated change, the storage capacity will be 2.127 million acre-feet of flood control storage, 1.236 million acre-feet in the conservation pool, and 2.045 million acre-feet of storage in the inactive pool, for a total storage of 5.408 million acre-feet.

Table 1.1 summarizes the current physical features of Bull Shoals Lake.

Table 1.1 Bull Shoals Lake Physical Features (After Reallocation for White River Minimum Flows)

Feature	Elevation(1)	Area (acres)	Storage Volume (acre-feet)	Equivalent Runoff(2) (inches)
Top of dam (3)	708			
Design pool	703	79,730	6,013,000	18.7
Top of flood control pool	695	71,240	5,408,000	16.8
Spillway crest (17 tainter gates 40' wide by 28' high)	667	52,510	3,682,500	11.4
Top of conservation pool (4)	659	48,005	3,281,000	10.2
Top of conservation pool (5)	654	45,440	3,048,000	9.5
Top of inactive pool	628.5	33,795	2,045,000	6.4
Probable maximum drawdown	588	20,260	964,400	3.0
Sluice invert (16 sluices 4' wide by 9' high)	477.06	829	8,380	-
Streambed	450	0	0	
Flood control storage	695-659		2,127,000	
Conservation storage	659-628.5		1,236,000	
Inactive storage (hydropower, fish, recreation, sediment	628.5-450		2,045,000	
(1) Feet, NGVD29 (2) 6036 square miles of drainage area upstream of dam (3) Top of dam has a 3-foot concrete parapet (4) White River Minimum Flow Reallocation (Alt. BS-3) (5) Current operation				

The base condition is with the WRMF authorized reallocation from the flood pool which will raise the elevation from 654.00 ft to elevation 659.0 ft. This reduces the flood pool storage by 233,000 ac-ft. Thus the flood pool will have 2,127,000 ac-ft of storage for flood reduction purposes between elevation 659.00 ft and 695.00 ft. The conservation pool was increased by the 233,000 ac-ft for a total of 1,236,000 ac-ft between elevation 628.50 ft and 659.00 ft to provide storage for WRMF, water supply and hydroelectric power. The inactive pool has storage of 2,045,000 ac-ft between elevation 628.50 ft and 450.00 ft. The elevation of the lowest invert (sluice) is 477.06 ft, leaving a "dead" storage of about 8,380 ac-ft. The inactive pool provides storage for additional head for hydroelectric power, recreation and fish habitat, and sediment. Also, this storage is available for emergency uses during drought conditions that include hydroelectric power operations and M&I water supply. The maximum probable drawdown is elevation 588.00 ft which has been estimated as the lowest elevation that the turbines could operate in a safe mode. The storage remaining below 588.00 ft is 964,400 ac-ft.

Current project outputs for Bull Shoals Lake through Fiscal Year (FY) 2008 include:

- $190 million estimated for cumulative flood damages prevented;
- 3 million visitors annually for recreational use of the lake and land resources;
- 753,700 megawatt hours for annual hydropower generation; and
- 0.85 MGD average daily demand for water supply by MCRWA.

There is currently one Municipal and Industrial (M&I) water supply reallocation from Bull Shoals Lake. It is for MCRWD for 880 acre-feet, intended to yield 1 MGD. As part of this study, the volume required to yield 1 MGD will be updated based on the current reallocation request as well as the reallocation for the WRMF Project, previously summarized in this section.

<u>Overall Water System Project verses Corps Action</u>

In the fall of 2009, the United States Department of Agriculture (USDA) secured $56M in America Reinvestment and Recovery Act (ARRA) funds to construct a water intake structure and treatment system adjacent to Bull Shoals Lake. The ARRA funds must be obligated by September 2010; therefore, OMRPWA must first have a signed water storage agreement executed with the Corps for storage of the water by August 2010. OMRPWA's letter dated February 1, 2007, originally requested 12 MGD; however, since the ESI report showed that 6 MGD would be sufficient, OMRPWA resubmitted a letter on October 8, 2009, requesting the Corps reallocate storage sufficient to supply 6 MGD.

The Corps reallocation action is to determine if there is a Federal interest, and if so, from which pool of Bull Shoals Lake to reallocate storage to provide a total yield of 7 MGD. This reallocation request is a precursor to the larger overall Ozark Mountain water system project. In addition to the water supply agreement with the Corps, OMRPWA is constructing a water treatment plant, intake structure, and distribution lines funded with USDA's Rural Development funds. With the addition of one filter and one pump, the capacity of this water treatment facility is 6 MGD and it has a storage tank of 1,000,000 gallons. The water treatment facility will be located adjacent to the south side of Bull Shoals Lake near Diamond City, Arkansas. The environmental impacts of that project, including the intake, pumping, and treatment facilities, as well as the pipeline distribution system, have been previously addressed in a separate EA and FONSI, previously cited in Section 1.1, and are therefore not addressed in this EA. This EA addresses the reallocation of water supply storage in Bull Shoals Lake only.

Figure 1.5 is a schematic of the dam, with lake and pool elevations and current allocation volumes.

1.3 Project Location

Bull Shoals Lake is a reservoir created by Bull Shoals Dam on the White River, which is located approximately seven miles northwest of Mountain Home, Arkansas. The lake extends from North Central Arkansas in Marion, Boone, and Baxter counties into South Central Missouri in Taney and Ozark counties, as shown in Figure 1.6. A more detailed description of the project location and area can be found in Section 4.0 Affected Environment of this EA.

Bull Shoals Lake

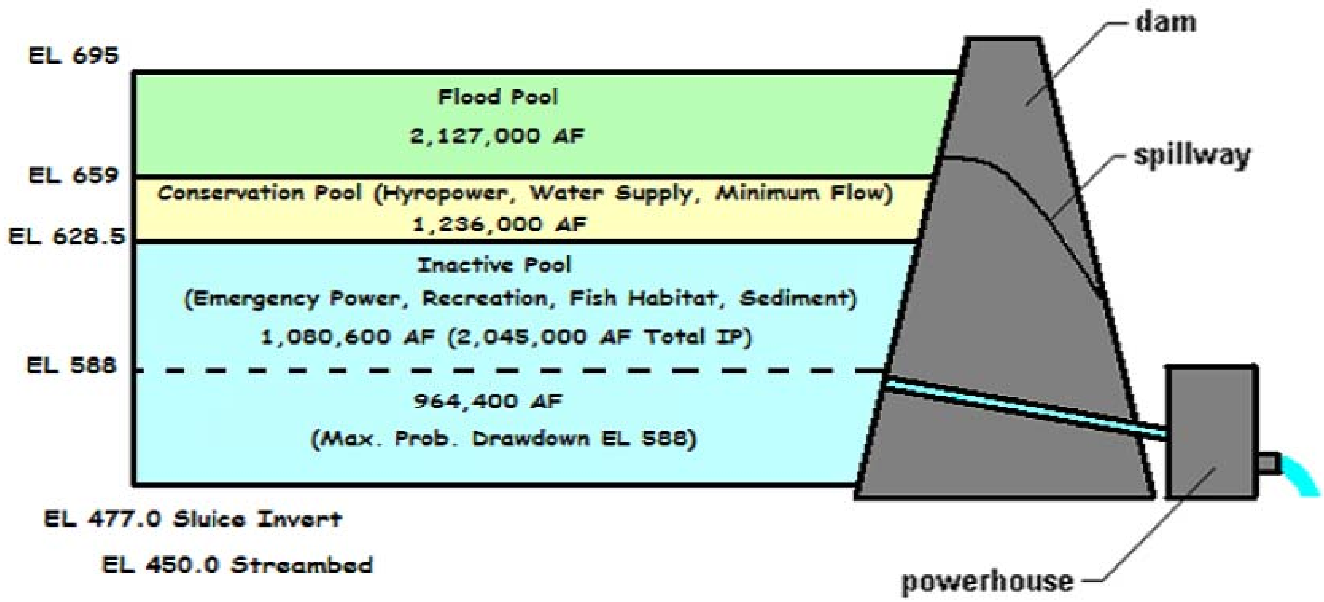


Figure 1.5 Bull Shoals Lake Pool Elevations and Volumes

1.4 Project Authority

1.4.1 Water Supply Act of 1958, as Amended

General authority for the Corps to reallocate existing storage space at Corps reservoirs to M&I water supply is contained in the Water Supply Act of 1958 (Title III of Public Law 85-500), as amended, 33 U.S.C. 390b. Reallocation of storage that would seriously affect other project purposes, or that involve major structural or operational changes to the project, require Congressional authorization. Reallocations not seriously affecting other project purposes, and that do not involve major structural or operational changes, may be approved by the Secretary or the Army. The Chief of Engineers has delegated authority to approve reallocations consisting of the lesser of: a) 15 percent of total storage capacity allocated to all authorized project purposes; or b) 50,000 acre-feet. Nevertheless, even such a reallocation may require Secretarial approval due to other aspects of the proposal, including reduced pricing for non-Federal cost of storage payments for low income communities under Section 322 of the Water Resources Development Act of 1990. The non-Federal interest requesting a reallocation must agree to pay 100 percent of the first costs (investment costs) of the reallocation. Such payment may be amortized over a period of up to thirty years, with interest as specified in the Water Supply Act, as amended.

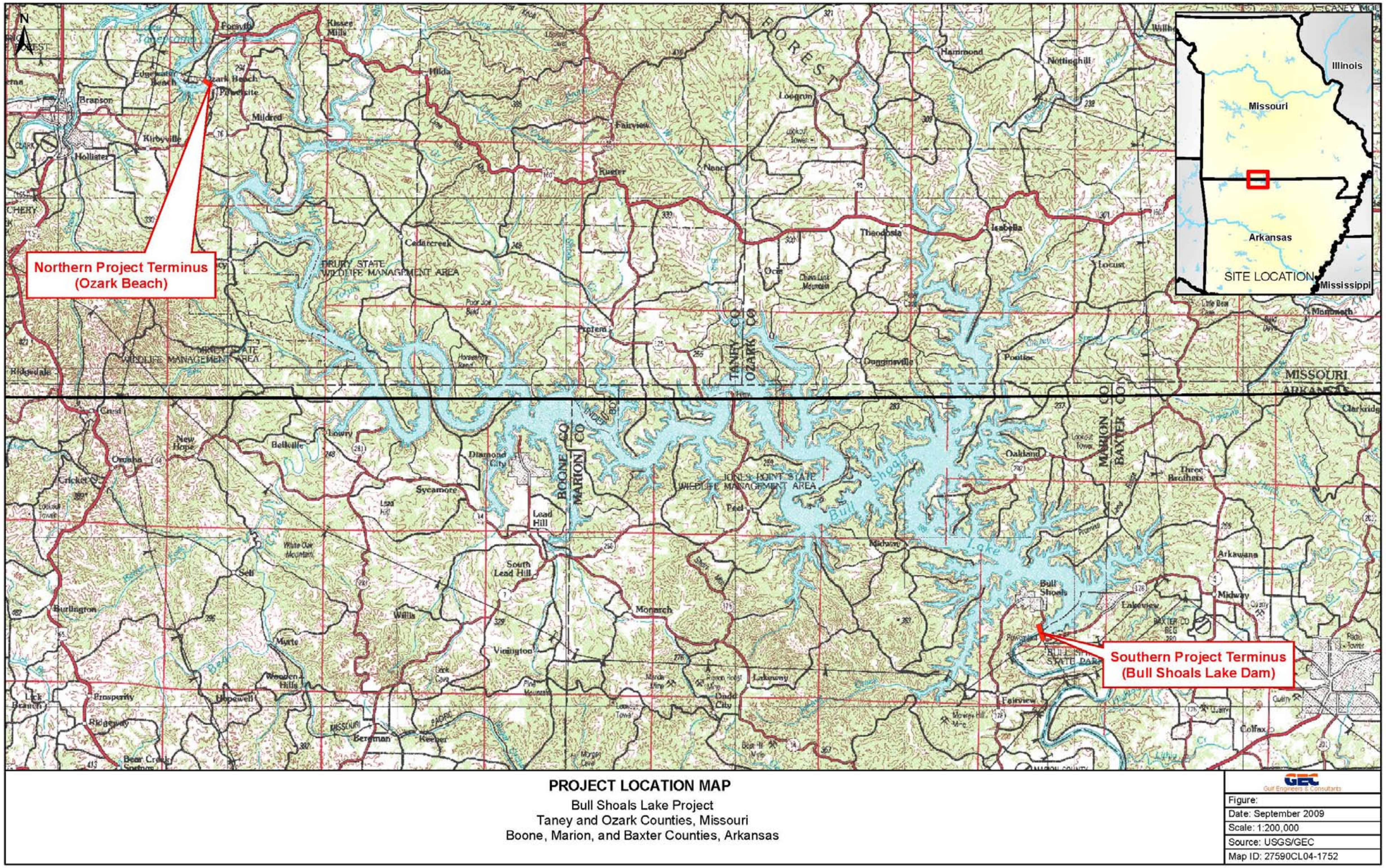


Figure 1.6 Project Location Map

1.4.2 Public Law 88-140, Recognizing Permanent Rights to Storage

The non-Federal interest may acquire a permanent right to the use of storage under the authority of Public Law 88-140 (October 16, 1963), 43 U.S.C. 390c.-f. Such right is obtained by the non-Federal interest upon completion of payment of the first costs (investment costs) of the reallocation, and may be utilized as long as the project is operated by the Government. The non-Federal interest remains responsible for its proportionate share of annual operation and maintenance costs, and of reconstruction, rehabilitation, and replacement costs for project features, allocated to its water supply storage. Such storage also remains subject to equitable reallocation among project purposes due to sedimentation.

1.4.3 Section 322 of the Water Resources Development Act (WRDA) of 1990

Provision of reduced pricing of storage space for low income communities is contained in Section 322 of WRDA 1990 (33 U.S.C. 2324). Section 322 defines the term "low income community" as a community with a population of less 20,000 which is located in a county with per capita income less than the per capita income of two-thirds of the counties in the United States. If a low income community requests water supply storage space in a Corps project and such space is available or may be made available through reallocation, the Secretary may provide such space to the community up to an amount sufficient to yield 2,000,000 gallons per day at the following price.

The price shall be the greater of:

1) the updated construction cost of the project allocated to provide such amount of water supply storage space or $100 per acre-foot of storage space, whichever is less, or
2) the value of the benefits which are lost as a result of providing such water supply storage space.

1.4.4 Previous Water Storage Projects

<u>Marion County Regional Water District Water Supply Agreement</u>

MCRWD was reallocated storage for 880 ac-ft, intended to yield 1 MGD. As part of this study, the volume required to yield 1 MGD will be updated based on the current reallocation request and the reallocation for the WRMF Project, which reallocated storage from the flood control pool. When reallocation of storage from the flood control pool would impact existing water supply users and hydropower users, Dependable Yield Mitigation Storage (DYMS) to compensate the existing water supply users must be considered in the analysis (ER-1105-2-100).

Dependable (Firm) yield is based on the available inflow, the available storage, and the critical low flow period at a specific location in the watershed, i.e., Bull Shoals Lake. Increasing the conservation storage increases yield but reduces the dependable yield of the users because the dependable yield per unit of storage is reduced. This occurs because inflow into the lake remains the same. Since more users are sharing the same inflow, the yield per unit of storage decreases even though the total yield of the project increases. Therefore to compensate the existing water supply users the new user would contract for their needed storage plus the additional storage to maintain the existing users' dependable yield. This additional storage required to keep existing users whole is termed DYMS.

The Base condition (No Action), Alternative 1, has the existing user, MCRWD, being made whole because of WRMF. Although OMRPWA/MCRWD will contract for storage prior to WRMF, they will not make the existing Marion County yield whole, but only provide DYMS under the assumption that Marion County is already whole at 1 MGD. This means that if for some reason WRMF is not implemented then the existing Marion County supply will not have the dependable yield of 1 MGD but will maintain the yield that they currently have for their 880 ac-ft of storage. Also the new users (OMRPWA/MCRWD) will have contracted storage that will provide more dependable yield than requested. The reallocation analysis for OMRPWA/MCRWD is for Ozark Mountain to provide DYMS for existing Marion County supply, then Marion County to provide DYMS for Ozark Mountain and existing Marion County supply. Under this “NO” WRMF scenario the existing Marion County supply would have to obtain additional storage in order to have a dependable yield of 2 MGD, because their current storage does not provide 1 MGD yield.

White River Minimum Flows Project

Section 132(a) of the FY2006 Energy and Water Development Appropriations Act (EWDAA, Public Law 109-103) authorized implementation of plans BS-3 at Bull Shoals and NF-7 at Norfork Lakes in the White River basin to provide minimum flow releases to enhancements that provide national benefit and shall be a Federal expense in accordance with section 906 (e) of 1986, of WRDA as described in the WRMF Report, Arkansas and Missouri dated July 2004. Also, Section 132 repealed Section 374 of the WRDA 1999 and Section 304 of WRDA 2000, rescinding authorization to reallocate storage at Table Rock Lake, Greers Ferry Lake, and Beaver Lake for minimum flows. The repeal does not eliminate further consideration of alternative plans. WRMF is at the end of the engineering and design phase and has been fully funded by Construction General and ARRA funds.

1.5 Project Scoping

The Little Rock District, USACE conducted two workshops in the project area near Mountain Home, Arkansas. The first workshop was held on June 30, 2009 at the Bull Shoals Lake Visitor Center and the second was held in Diamond City, AR, on July 1, 2009. Approximately 100 people attended and there were no negative comments on the study. This positive response at the public meetings indicated that public controversy is not a factor in determining the significance of the effects of the proposed action. Therefore, after assessing that the proposed action will not be controversial, along with the other factors for determining significance, the decision was made to proceed with an Environmental Assessment in lieu of an Environmental Impact Statement. Copies of public workshop press releases can be found in Attachment 1, Public Scoping Materials.

1.6 Public Review/Comments

The draft environmental assessment (Draft EA) and reallocation report for this action were released concurrently for public review and comment on May 11, 2010. The comment period ran for 30 days from May 11, 2010, to June 11, 2010. All information pertaining to the public comment period, copies of comments received, summary of major issues identified in comments, and Little Rock District’s summary conclusions regarding relevant issues are contained in Attachment 3.

Section 2.0 Description of Proposed Action

2.0 DESCRIPTION OF PROPOSED ACTION

The preferred alternative for the Proposed Action is reallocation from the Conservation Pool (Alternative 2). This alternative would reallocate an additional 11,886.541 acre-feet of storage from the conservation pool for water supply. The total water supply storage would be 13,584.617 acre-feet including the current allocation. The top of pool elevation, with White River Minimum Flows implemented, would be at elevation 659.0 feet. Alternative 2 is further described in Section 3.0 of this EA and Section 7.1 of the Reallocation Report.

The main dam has a maximum height above the river bed of 258 feet and extends approximately 2,256 feet in length. The Bull Shoals Dam supports 17 spillway crest gates and is the fifth largest concrete dam in the United States. Bull Shoals Lake encompasses 45,440 surface acres and a shoreline of 740 miles at the top of the design conservation pool (654 feet). The lake's upstream drainage basin is 6,036 square miles. The existing project storage allocations will change with implementation of WRMF.

The WRMF Project Report and the Record of Decision were approved by the Assistant Secretary of the Army (Civil Works) in January 2009. Alternative BS-3, the recommended plan specific to Bull Shoals Lake, was authorized by the 2006 Energy and Water Development Appropriations Act Section 132(a). Alternative BS-3 will reallocate five feet of flood control storage, totaling 233,000 ac-ft for a target minimum flow release of 800 cfs. The top of the conservation pool will be raised five feet from elevation 654 to 659 ft. In anticipation of this change, the storage capacity in the lake will be 2.127 million ac-ft of flood control storage, 1.236 million ac-ft of conservation storage, and 2.045 million ac-ft of inactive storage, for a total storage of 5.408 million ac-ft. The project is currently in engineering and design phase and is expected to be implemented, so the base condition and without project condition assumes the WRMF reallocation is in place, however, reallocation of storage for WRMF will occur after the OMRPWA and MCRWD reallocation.

The proposed action also includes the construction and implementation of the new OMRPWA water transmission system including a new water intake facility at Bull Shoals Lake, and water treatment/pumping plant nearby on existing USACE property, as well as a pipeline transportation/distribution system to deliver the increased water supply to customers. This action has been previously evaluated under NEPA guidelines for environmental impacts and was determined to result in no significant impact to the natural or human environments. The EA and FONSI for that action are hereby incorporated into this EA by reference and the NEPA documents are included in Attachment 5 to this EA.

Table 2.1 summarizes the physical features of Bull Shoals Lake with the proposed alternative BS-3 implemented. Figure 3 is a schematic of Bull Shoals dam and lake with pool elevations and volumes.

The base condition is with the WRMF authorized reallocation from the flood pool which will raise the elevation from 654.00 ft to elevation 659.0 ft. This reduces the flood pool storage by 233,000 ac-ft. Thus the flood pool will have 2,127,000 ac-ft of storage for flood reduction purposes between elevation 659.00 ft and 695.00 ft. The conservation pool was increased by the 233,000 ac-ft for a total of 1,236,000 ac-ft between elevation 628.50 ft and 659.00 ft to provide storage for WRMF, water supply and hydroelectric power. The inactive pool has storage of 2,045,000 ac-ft between elevation 628.50 ft and 450.00 ft. The elevation of the lowest invert (sluice) is 477.06 ft, leaving a "dead" storage of about 8,380 ac-ft. The inactive pool provides storage for additional head for hydroelectric power, recreation and fish habitat, and sediment. Also, this storage is available for emergency uses during drought conditions that include hydroelectric power operations and M&I water supply. The maximum probable drawdown is elevation 588.00 ft which has been estimated as the lowest elevation that the turbines could operate in a safe mode. The storage remaining below 588.00 ft is 964,400 ac-ft.

Table 2.1 Bull Shoals Lake Physical Features (After Reallocation for White River Minimum Flows)

Feature	Elevation(1)	Area (acres)	Storage Volume (ac-ft)	Equivalent Runoff (2) (inches)
Top of dam (3)	708			
Design pool	703	79,730	6,013,000	18.7
Top of flood control pool	695	71,240	5,408,000	16.8
Spillway crest (17 tainter gates 40' wide by 28' high)	667	52,510	3,682,500	11.4
Top of conservation pool (4)	659	48,005	3,281,000	10.2
Top of conservation pool (5)	654	45,440	3,048,000	9.5
Top of inactive pool	628.5	33,795	2,045,000	6.4
Probable maximum drawdown	588	20,260	964,400	3.0
Sluice invert (16 sluices 4' wide by 9' high)	477.06	829	8,380	-
Streambed	450	0	0	
Usable storage				
Flood control storage	695-659		2,127,000	
Conservation storage	659-628.5		1,236,000	
Inactive storage	628.5-450		2,045,000	
(1) Feet, mean sea level (msl) (2) 6036 square miles of drainage area upstream of dam (3) Top of dam has a 3-foot concrete parapet (4) White River Minimum Flow Reallocation (Alt. BS-3) (5) Current operation				

Section 3.0
Alternatives

3.0 ALTERNATIVES

3.1 Plan Formulation

During plan formulation the goal is to identify and perform an initial evaluation of preliminary measures and alternatives for water supply. Consideration of all reasonable alternatives is required under the Economic and Environmental Principles for Water and Related Land Resources Implementation Studies. The National Environmental Policy Act (NEPA) requires Federal agencies to incorporate environmental considerations in their planning and decision-making process. The Planning Guidance Notebook, Engineering Regulation (ER 1105-2-100), Appendix E and Appendix H, of the Water Resources Report, requires the formulation and evaluation of a full range of reasonable alternative plans.

Alternatives are formulated to take into account the overall problems, needs, and opportunities afforded by the proposed action. Those alternatives are assessed consistent with the national objective of contributing to National Economic Development (NED) and protecting the Nation's Environment, and consistent with Federal laws and regulations. The NED objective for water supply is to provide the most cost-effective water supply source to meet the region's future Municipal and Industrial requirements. The identification of measures and the evaluation of measures and alternatives were guided by the Corps Environmental Operating Principles (EOP) and compliance with the Campaign Plan. An assessment of how those Administration goals were applied and further details on the plan formulation and alternative selection process are presented in the Water Supply Storage Reallocation Report (sections 6.0 and 3.0, respectively).

<u>Urgency and Need for Water</u> - Current water sources include shallow wells, deep wells, or springs. The majority of the member water systems struggle to meet customer demands from their existing sources. In addition, the ADH has stated the well water has excessive and dangerous levels of radium, fluoride, and hydrogen sulfide, and they have declared the need for an alternative water supply for these communities as their top priority. The Environmental Protection Agency has certified that many of these water sources are not safe for human consumption.

In October 2009, it was announced OMRPWA will receive $56 million in grant and loan funding from the USDA through the ARRA Act of 2009. These funds will be used for constructing an intake structure and treatment plant adjacent to Bull Shoals Lake, 115 miles of transmission lines, and booster pumping stations to transport the water across the rugged terrain in the Ozarks. However, these funds must be obligated by September 2010; therefore, OMRPWA must first have a water supply storage agreement executed with USACE by August 2010.

<u>Short Term Interim Action (Critical Needs Phase) verses Long Term Solution</u> – The short term interim action, the Critical Needs Phase, already funded by USDA, Rural Utilities Service, will provide safe water to some Ozark Mountain customers until the long-term new overall water system is constructed. The Critical Needs Phase includes a pipeline between the city of Marshall and the water systems under Administrative Orders from the Arkansas Department of Health to not consume water (these are Mt. Sherman Water Association, South Mountain Water Association, Snowball, Dongola & Marsena Water Association, and Morning Star Water Association). This pipeline will allow clean water from Marshall to be blended with contaminated water to reduce the overall contaminant levels. While the blended water is a short-term solution, Marshall can not sustain the flow to these water systems during dry periods.

These pipelines are being put into place now and their costs are included in the without project conditions. The without project condition would be the Critical Needs facility in place for a few of the OMRPWA customers and no new water system and continued health and safety risks associated with contaminated water for the majority of customers for OMRPWA. If the reallocation does not take place, a safe water supply system will still be needed. As discussed in Section 6, the next most likely alternative is reallocation of storage in Norfolk Lake and the construction of the associated intake, water treatment plant, pipelines, pumping stations and storage reservoirs.

This water supply reallocation report is an element of a larger overall Ozark Mountain water system project. The water supply agreement between USACE and OMRPWA will be combined with the construction of a water treatment plant, intake structure, and distribution lines adjacent to Bull Shoals Lake and funded with USDA's Rural Development funds to complete the overall water system project. Therefore, the EA and FONSI for the implementation and construction of the new water transmission system are incorporated into this EA by reference and included in Attachment 5 of this EA.

<u>Overall Water System Project verses Corps Action</u> - In the fall of 2009, the United States Department of Agriculture (USDA) secured $56M in America Reinvestment and Recovery Act (ARRA) funds to construct a water intake structure and treatment system adjacent to Bull Shoals Lake. The ARRA funds must be obligated by September 2010; therefore, OMRPWA must first have a signed water storage agreement executed with the Corps for storage of the water by August 2010. OMRPWA's letter dated February 1, 2007, originally requested 12 MGD; however, since the ESI report showed that 6 MGD would be sufficient, OMRPWA resubmitted a letter on October 8, 2009, requesting the Corps reallocate storage sufficient to supply 6 MGD.

The Corps reallocation action is to determine if there is Federal interest, and if so, from which pool of Bull Shoals Lake to reallocate storage to provide a total yield of 7 MGD. This reallocation request is a precursor to the larger overall Ozark Mountain water system project. In addition to the water supply agreement with the Corps, OMRPWA is constructing a water treatment plant, intake structure, and distribution lines funded with USDA's Rural Development funds. With the addition of one filter and one pump, the capacity of this water treatment facility is 6 MGD and it has a storage tank of 1,000,000 gallons. The water treatment facility will be located adjacent to the south side of Bull Shoals Lake near Diamond City, Arkansas.

It must be emphasized here again that this EA does not address the construction of a new water transmission system, which has been previously addressed under a separate NEPA document, only the reallocation of water storage at Bull Shoals Lake for OMRPWA and MCRWD.

3.2 OMRPWA Preliminary Alternatives Eliminated From Further Consideration

In the Preliminary Engineering Report prepared by Engineering Services, Inc., revised May 2009, the preliminary screening of alternatives for a long term source of water supply for this region includes the following; groundwater wells, treating groundwater, existing surface reservoirs, construction of new surface water reservoirs, purchasing treated water from one or more wholesale water providers, and consideration of conservation methods as a nonstructural measure. The report recommended the construction of a new water intake, treatment, and distribution system at Bull Shoals Lake, which has been previously evaluated and assessed under NEPA guidelines and determined to have no significant environmental impacts.

3.2.1 Ground Water Wells

As a result of large scale groundwater withdrawals primarily for rice farming, groundwater levels in the state are declining. Declining aquifer water levels create a multitude of problems. Because of the excessive withdrawals of groundwater, the dependable yield has been approached or exceeded in the alluvial and Sparta aquifers. The Arkansas Natural Resources Commission has declared these aquifers at “critical groundwater levels” due to the dependable yield concerns relating to poor water quality and to saline intrusions consistent with declining groundwater levels.

The members of OMRPWA currently depend on wells with poor water quality drilled 20 to 50 years ago to access a groundwater supply. Deep wells in this region have naturally occurring excess amounts of radium 226, radium 228, fluoride, uranium, radon, and hydrogen sulfide. For the past three years, this area has remained the ADH’s top priority due to the serious health risks associated with these contaminants in the drinking water (ADH, 2009). Similar conditions occur in southern Missouri, where radionuclides are present in both shallow and deep aquifers.

Due to these issues with both limited quantity poor quality, utilizing groundwater sources were not considered any further.

3.2.2 Treating Groundwater

In 2003, the South Mountain Water Association and the Snowball, Dongola & Marsena Water Association retained Engineering Services, Inc. to evaluate solutions to the high levels of radium and fluoride found in the existing water supply. Several treatment options were considered. Treatment for radium would create residuals that would be classified as a hazardous waste which cannot be disposed in Arkansas landfills. Handling the concentrated residuals would be expensive, dangerous, and pose a significant environmental threat to the Buffalo National River Watershed. Due to these issues, groundwater treatment facilities were not considered any further.

3.2.3 Existing Surface Reservoirs

Beaver Lake is the first impoundment on the White River watershed. Reallocation from Beaver Lake not only impacts the flood damages prevented and hydropower generation at Beaver Lake, but also Table Rock Lake and Bull Shoals Lake. Given the greater distance to Beaver Lake than to Bull Shoals, and the greater impacts to other authorized purposes, reallocating from Beaver Lake was not considered any further.

Table Rock Lake is the next impoundment downstream from Beaver Lake. Reallocation from Table Rock Lake would impact flood damages prevented and hydropower generation at Bull Shoals Lake. Given the slightly greater distance to Table Rock Lake than to Bull Shoals, and the greater impact to the other authorized purposes, reallocating from Table Rock Lake was not considered any further.

Greers Ferry Lake is another impoundment in the White River watershed. The distance from the OMRPWA area to Greers Ferry Lake is somewhat comparable to the distance from Bull Shoals; however, Greers Ferry has design complications. Water from Bull Shoals would be gravity fed to an area with existing water infrastructure, while water from Greers Ferry Lake would have to be pumped uphill through new infrastructure. Water quality from Greers Ferry Lake is good.

Cost estimates to construct a new water treatment plant at Greers Ferry and pump the water to OMRPWA and MCRWD customers were estimated at $7,299,281 of which $60,000 is the water cost. Due to the high cost of taking the reallocation from Greers Ferry Lake, this alternative was not considered any further.

Norfork Lake has ample capacity for water supply and is the next most likely alternative to reallocating storage at Bull Shoals Lake; however, the location of the lake with respect to the OMRPWA members is a long distance and the rugged terrain between Norfork Lake and the OMRPWA members makes this water source very expensive. Only one other utility utilizes Norfork Lake as a water source. The city of Mountain Home has been allocated approximately 10,000 acre-feet from Norfork Lake for municipal water supply. Water quality from Norfork Lake is good. Cost estimates to construct a new water treatment plant at Norfork Lake and pump the water to OMRPWA and MCRWD customers were estimated at $5,758,341 of which $166,600 is the water cost. Due to the high cost of taking the reallocation from Norfork Lake, this alternative was not considered any further.

Bull Shoals Lake's water quality is excellent resulting in minimal chemical additions being required to achieve full scale water treatment. Only one water provider utilizes Bull Shoals Lake as a municipal water source. Currently, 880 acre-feet of storage is reallocated from the flood control pool to the conservation pool so that MCRWD can obtain 1 MGD. Bull Shoals Lake's overall storage capacity is approximately 5,408,000 acre-feet. Therefore, due to the high quality of water and the large overall storage capacity of Bull Shoals Lake, this lake was carried forward in the final reallocation alternatives to be evaluated in detail.

3.2.4 Development of New Surface Reservoirs

Searcy County worked from 1989 until 2003 to develop a long-term surface water supply for the residents of Searcy County. The Searcy County Regional Water District was formed in order to develop a regional water supply and provide treated water to the residents of Searcy County. They retained a consulting engineer, prepared a preliminary engineering report, made application for state and federal funding, and began work on the environmental phase of the project. Since the selected water shed was on a tributary of the Buffalo National River, extensive environmental studies were required to determine the long-term effect of the watershed on the Buffalo National River. On March 1, 1972, the United States Congress established the Buffalo National River as America's first national river. After 10 years of environmental review, legal challenges, permitting challenges, debate and discussion, the National Park Service and the Corps of Engineers stopped progress on the project. Meanwhile, families within the Buffalo River drainage basin continue to drink water contaminated with radium, fluoride, uranium, and radon. Since 2004, Searcy County has fully backed the efforts of the OMRPWA in developing a water source to serve the region.

In summary, development of a reservoir large enough to supply the region is severely hindered by the proximity of the Buffalo National Park. Therefore, this alternative was not evaluated any further.

3.2.5 Purchase Water from Wholesale Providers

Several wholesale water providers to deliver water to OMRPWA were evaluated: purchase water from Carroll-Boone Regional Water District, purchase water from the city of Clarksville, purchase water from the city of Russellville, and purchase water from MCRWD. Given that

Carroll-Boone Regional Water District is currently requesting reallocation of storage from Beaver Lake, Carroll-Boone Regional Water District does not have surplus water to sell, and was not evaluated any further. Given that MCRWD is currently requesting reallocation of storage within this report, MCRWD does not have surplus water to sell and was not evaluated any further.

The remaining wholesale water providers are the city of Clarksville and the city of Russellville. According to discussions with the city of Russellville, the city does not have surplus water to sell. According to the Clarksville Light & Water Plant Engineer, the current capacity of the water treatment plant is 15 million gallons per day, and the plant has the ability to sell 7 to 8 million gallons per day. Costs for this alternative are estimated at $8.7M of which $4.4M is the water cost.

Of the wholesale water alternatives, the purchase of water from Clarksville is the only viable alternative.

3.2.6 Non-Structural Solutions (Conservation)

The non-structural alternative is to conserve water to reduce the need for additional sources of water supply. Water conservation can include altering the demand for water by water rationing and pricing methods. Several communities are at 50 percent of the state’s average per capita usage rate, and have below average system leakage (2 percent compared to an average of 10 percent to 12 percent). While water conservation could improve over time with gradual replacement of older plumbing fixtures, the quantity of water gained through conservation is judged to be insignificant.

Due to the insufficient quantity available under this alternative, it was eliminated from further consideration.

3.3 MCRWD Preliminary Alternatives Eliminated From Further Consideration

3.3.1 Structural Solutions

An Environment Assessment for MCRWD, prepared by Engineering Services, Inc., dated May 1982 (ESI, 1982), evaluated the following alternatives for MCRWD: Bull Shoals Lake, Mountain Home Water System, and Harrison Water System.

The source of water for the Mountain Home Water System is Norfolk Lake. This alternative involves purchasing treated water and construction of transmission lines, water storage tanks, and a booster pumping station to convey the water to the MCRWD service area. An economic analysis found that connection to the Mountain Home Water System would cost more to construct and operate than the proposed system at Bull Shoals Lake (ESI, 1982).

The Harrison Water System alternative includes purchasing treated water from the City of Harrison and constructing transmission lines, a 1,000,000 gallon storage tank and a booster pumping station to convey water to the MCRWD service area. An economic analysis found that this option was not as cost-effective as developing a supply from Bull Shoals Lake (ESI, 1982).

Because the two viable alternatives for water supply were not cost effective compared to developing a supply from Bull Shoals Lake, MCRWD signed a water supply agreement on April 1988 to withdraw 880 ac-ft of storage from the conservation pool of Bull Shoals Lake.

Currently, MCRWD has a water treatment facility at the town of Bull Shoals, Arkansas, with a maximum capacity of 4 MGD.

Given that Mountain Home Water System is currently requesting reallocation of storage from Norfork Lake, Mountain Home Water System does not have sufficient water to sell, and it was not evaluated any further. Without another contract with USACE for additional storage in Bull Shoals Lake, MCRWD would likely try to request reallocated storage from Norfork Lake.

3.3.2 Non-Structural Solutions

The non-structural alternative is to conserve water to reduce the need for additional sources of water supply. Water conservation can include altering the demand for water by water rationing and pricing methods. MCRWD users have a per capita daily usage rate at half the state's average usage, and they have below average system leakage (a range of 5 percent to 9 percent compared to a national average of 10 percent to 12 percent). While water conservation could improve over time with gradual replacement of older plumbing fixtures, the quantity of water gained through conservation is judged to be insignificant. Therefore, this alternative was not evaluated any further.

3.4 Final Alternatives Considered for Both OMRPWA and MCRWD

After review of the economic analysis for all alternatives, production of the treated water has a tremendous long-term advantage over purchasing treated water from an existing bulk wholesaler. Therefore, in order for the OMRPWA and MCRWD to keep long-term rates to a minimum, it is more economical to construct a water treatment facility and produce drinking water for its members. Based on the above analysis, purchasing water supply storage from Bull Shoals Lake and constructing a OMRPWA water treatment plant on Bull Shoals Lake is viable and the most cost effective alternative. MCRWD will utilize existing infrastructure to distribute its share of the increased water supply to its members.

The new OMRPWA water transmission system includes a new water intake facility at Bull Shoals Lake, and water treatment/pumping plant nearby on existing USACE property, as well as a pipeline transportation/distribution system to deliver the increased water supply to customers. This action has been previously evaluated under NEPA guidelines for environmental impacts and was determined to result in no significant impact to the natural or human environments. The EA and FONSI for that action are hereby incorporated into this EA by reference and the NEPA documents are included in Attachment 5 to this EA.

To evaluate reallocating 6 MGD for OMRPWA and 1 MGD for MCRWA on Bull Shoals Lake, alternatives were analyzed using the SUPER program for conservation, flood control, and inactive storage reallocation.

Brief descriptions of the alternatives that were evaluated using SUPER economic output data for Bull Shoals Lake are as follows:

Alternative 1 - No Action. The existing condition represents the current 1698.077 ac-ft of water supply storage within the conservation pool. The top of pool elevation is 659.00 feet. The seasonal pool plan is also part of this condition that raises the top of conservation pool to elevation 662.0 feet from 15 May to 15 June and then to 661 feet from 15 July to 30 September. This alternative includes the reallocation of water supply implemented under the WRMF Project.

Alternative 2 - Reallocation from the conservation pool (The Proposed Action). This alternative would reallocate an additional 11,886.541 acre-feet of storage from the conservation pool for water supply. The total water supply storage would be 13,584.617 ac-ft. The top of pool elevation would be 659.0 feet, with seasonal pool raises.

Alternative 3 - Reallocation from the flood control pool. This alternative would reallocate 11,948.151 ac-ft from flood control pool for water supply. The top of conservation pool would be raised to elevation 659.25 with seasonal pool raises. The total water supply storage would be 13,646.229 ac-ft, including the existing allocation. Dependable yield mitigation storage is included (13.221 ac-ft) to keep existing water supply users' yield whole to compensate for the reduction in the dependable yield which occurs when the conservation pool is expanded.

Alternative 4 - Reallocation from the inactive pool. This alternative would reallocate 11,943.284 ac-ft from the inactive pool for water supply. The top of conservation pool would remain at 659.0 feet with seasonal pool raises and the bottom of conservation pool would be lowered to 628.14 feet. The total water supply storage would be 13,461.361 acre-feet, including the existing allocation. Dependable yield mitigation storage is included (12.975 acre-feet) to keep existing water supply users' yield whole to compensate for the reduction in the dependable yield which occurs when the conservation pool is expanded.

Additional details of these alternatives are presented in tabular form in Table 3.1.

Table 3.1 Storage Reallocation Alternatives

Alternative	Water Supply Storage – this action (acre-feet)	Total Water Supply Storage (acre-feet)*	Seasonal Pool Plan	Top of Conservation Pool Elevation (feet)
Alternative #1 – No Action	No Reallocation	1,698.077	Yes	659.0
Alternative #2 – Reallocate from conservation	11,886.541 from Conservation Pool	13,584.617	Yes	659.0
Alternative #3 – Reallocate from flood control	11,934.930 from Flood Pool 13.221 for DYMS	13,646.229	Yes	659.25
Alternative #4 – Reallocate from inactive	11,930.209 from Inactive Pool 12.975 for DYMS	13,641.361	Yes	659.0 **

*This action plus contracted storage of 880 ac-ft and White River Minimum Flows dependable yield mitigation storage of 818 ac-ft.
** Bottom of Conservation Pool lowered to elevation 628.14 feet.

Section 4.0
Affected Environment

4.0 AFFECTED ENVIRONMENT

Much of the information contained in this section, establishing the baseline conditions for the project area, was drawn directly and indirectly from the Final Environmental Impact Statement for the WRMF Project (Revised, January 2009).

4.1 Climate

The climate of the Bull Shoals Lake area is classified as Humid Sub-tropical (Cfa), but it is located at the northern limits of that climate and is very close to the southern border of a more northern climate, Humid Continental (warm summer sub-type) (Dfa). Average annual precipitation in nearby Harrison, Arkansas, is approximately 46.6 inches of rainfall and 15.8 inches of snow. The most significant snowfall typically occurs from late-December to mid-March, and is usually less than three inches per event. Mean maximum temperatures in Harrison are approximately 90° Fahrenheit (F) throughout most of July and August, and in the middle 40° F range throughout most of December, January, and February. Mean minimum temperatures in the area are approximately 70° F in July and August, and in the middle 20° F range throughout late December to mid-February (NOAA, Earth Systems Research Laboratory, 2009).

4.2 Land Use

The White River floodplain, of which Bull Shoals Lake is part, includes a total of 787,170 acres. An unpublished report from the U.S. Department of Agriculture divides the White River floodplain into cropland (55.7 percent), pasture land (2.7 percent), woodland (32.9 percent) water (4.8 percent), and other (3.9 percent). Outside the immediate flood plain, there are considerable acreages of public lands administered by the State wildlife agencies of Arkansas and Missouri, the Corps of Engineers, the U.S. Forest Service, and the National Park Service.

Private landowners own the majority of land in the Ozark Mountains. Major land uses includes timber production and grazing with less than 3.0 percent in cultivated land. Among the areas held by public landholders, the U.S. Forest Service manages almost one million acres, and the National Park Service manages some 90,000 acres. In addition, the U.S. Army Corps of Engineers oversees four reservoirs that have inundated more than 175,000 acres. The State of Arkansas owns and manages more than 45,000 acres in the Ozarks, most of which is set aside for hunting and fishing.

The area immediately surrounding Bull Shoals Lake is mostly rural, undeveloped land, with a few scattered residences and is gently sloped to steep, typical of the Ozark Highlands Ecoregion. Approximately 90 percent of the surrounding land is a mix of forest (pine and hardwood mix) and agricultural, with the remaining 10 percent being mostly hardwood forest (University of Arkansas website, Center for Spatial Technologies, 2009). The project study area around Bull Shoals Lake contains 101,196 acres of land, of which 100,090 acres are owned in fee and 1,106 acres are managed by flowage easement. The 71,240 acres below the top of the flood control pool 695 feet NGVD29 and 75 acres required for the dam and appurtenant works are allocated for Project Operations. There are 9,505 acres allocated for recreation-intensive use and 22,718 acres for wildlife management, which includes areas located below the flood control pool level.

The Land Use/Land Cover data is presented in figures 4.1 (Arkansas land use) and 4.2 (Missouri land use) (please note that the Missouri land use map extends south of the state line for some distance into Arkansas). This data comes from the Gap Analysis Program (GAP), which is a "scientific method for identifying the degree to which native animal species and natural plant communities are represented" in the United States' network of conservation lands. The "gaps" in gap analysis refer to animal species and plant communities that are not adequately represented in conservation lands. GAP is funded and coordinated by United States Geological Survey, but is a cooperation among almost five hundred state and federal agencies, academic and nonprofit institutions, and businesses. Because of the diversity and large number of agencies involved, each state may have different methods of GAP data collection and classification. In Arkansas, 36 land use and land cover classes were derived from 1992 Landsat Thematic Mapper satellite data. In Missouri, 15 land use and land cover classes were derived from 2005 satellite data.

Table 4.1 provides a more detailed description of land use categories presented in Figure 4.2 for GAP mapping of the Missouri portion of Bull Shoals Lake. Table 4.2 presents public land use areas within a five-county area surrounding Bull Shoals Lake, along with the agency charged with management of the public area.

4.3 Physiography/Geology/Soils/Prime Farmlands

4.3.1 Physiography

Bull Shoals Lake is included in the White River Basin. Much of the following discussion of the physiolography, geology, soils and prime farmlands of the Bull Shoals Lake area is adapted from the White River Basin Minimum Flows Final Environmental Impact Statement published in February 2009. Therefore, many references are made to the White River Basin in the following paragraphs, but those references are intended to be applied to the Bull Shoals Lake area in this document.

The White River Basin encompasses parts of two major physiographic divisions, the Interior Highlands and the Atlantic Plain. Each is further divided into provinces and sections. See Figure 4.3 for divisions, provinces, and sections of the State of Arkansas.

The Salem Plateau is the lowest of the plateaus making up the Ozark Plateau province. The Salem Plateau lies essentially north and east of the White River and forms the drainage area of its eastern tributaries. The Springfield Plateau, which lies south and west of the White River in this region, is represented by isolated knobs, such as Bull Shoals Mountain, in the immediate vicinity of the dam. These plateau surfaces are now intricately and deeply dissected by the dendritic pattern of the White River drainage system. The area is characterized by narrow, flat-topped ridges between deeply cut valleys. The prominent topographic features of the area are the extensive and deeply cut meanders of the White River and its principal tributaries. The White River follows a meandering course through a narrow valley, which has an asymmetrical valley profile at the sharp river bends. A steep, rock bluff forms the valley wall on the outside of the bends and a long, gentle, slip-off slope forms the inside valley wall. Along straight courses of the river between bends, both valley walls are steep and more or less symmetrical.

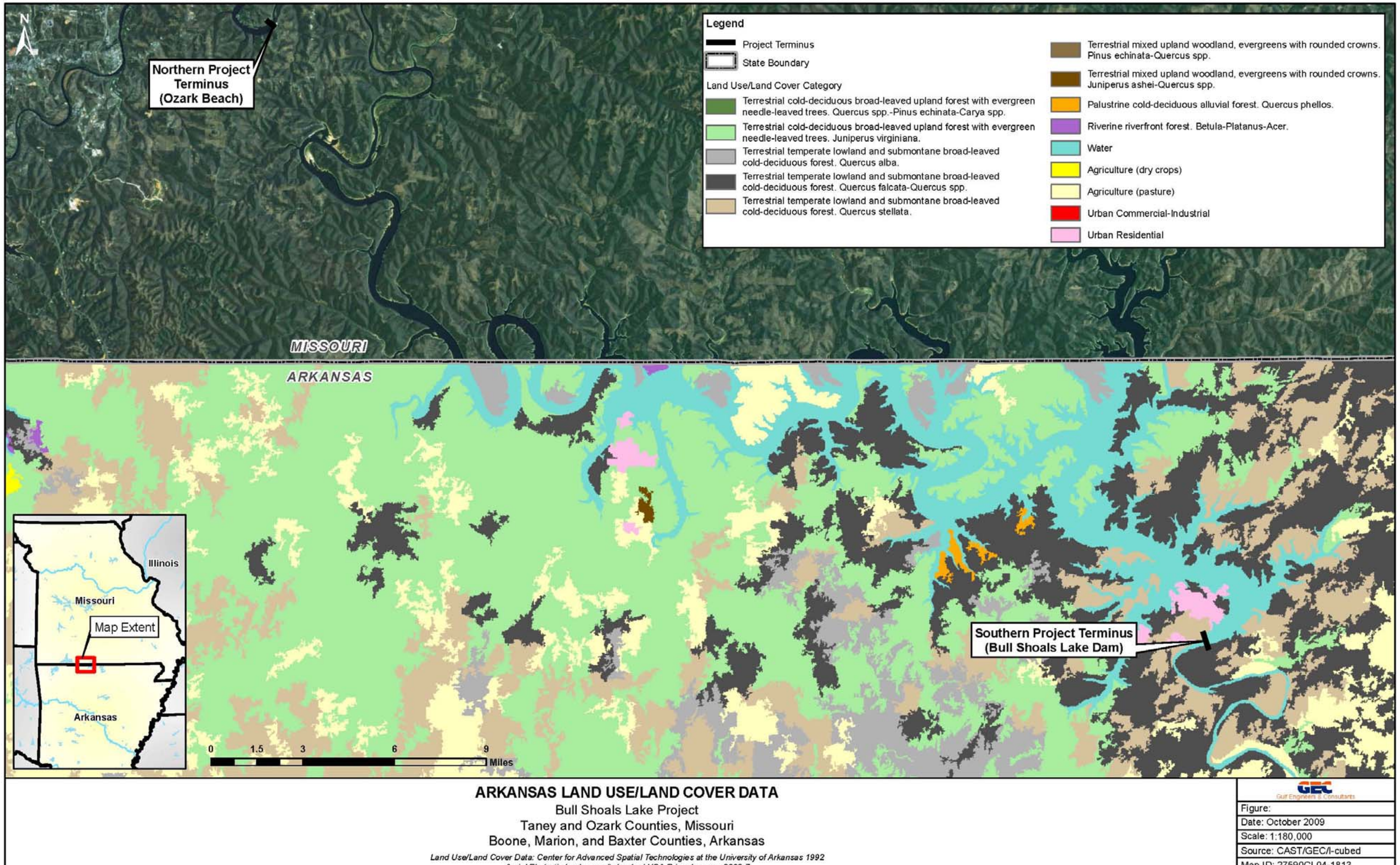


Figure 4.1 Arkansas Land Use/Land Cover Data

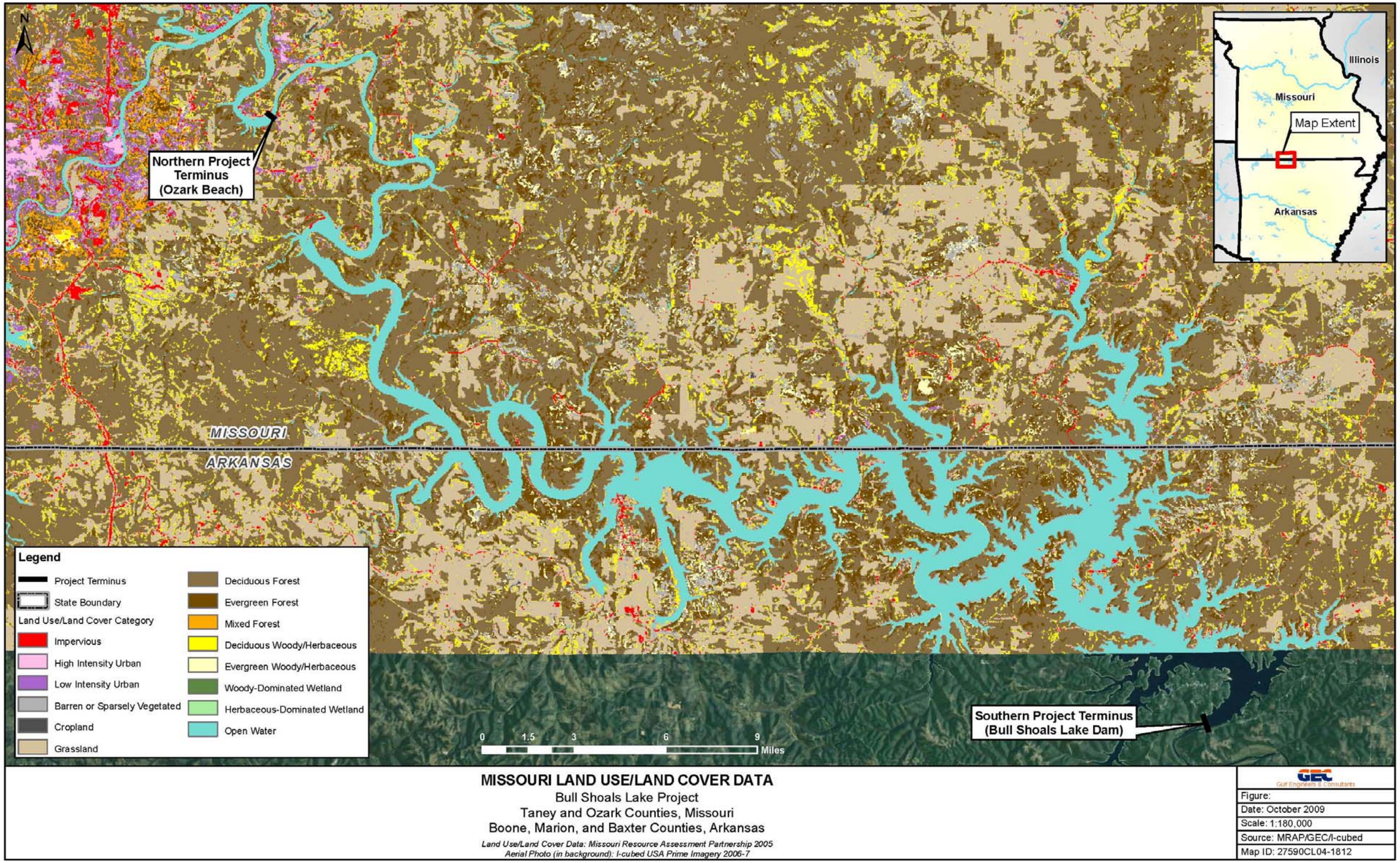


Figure 4.2 Missouri Land Use/Land Cover Data

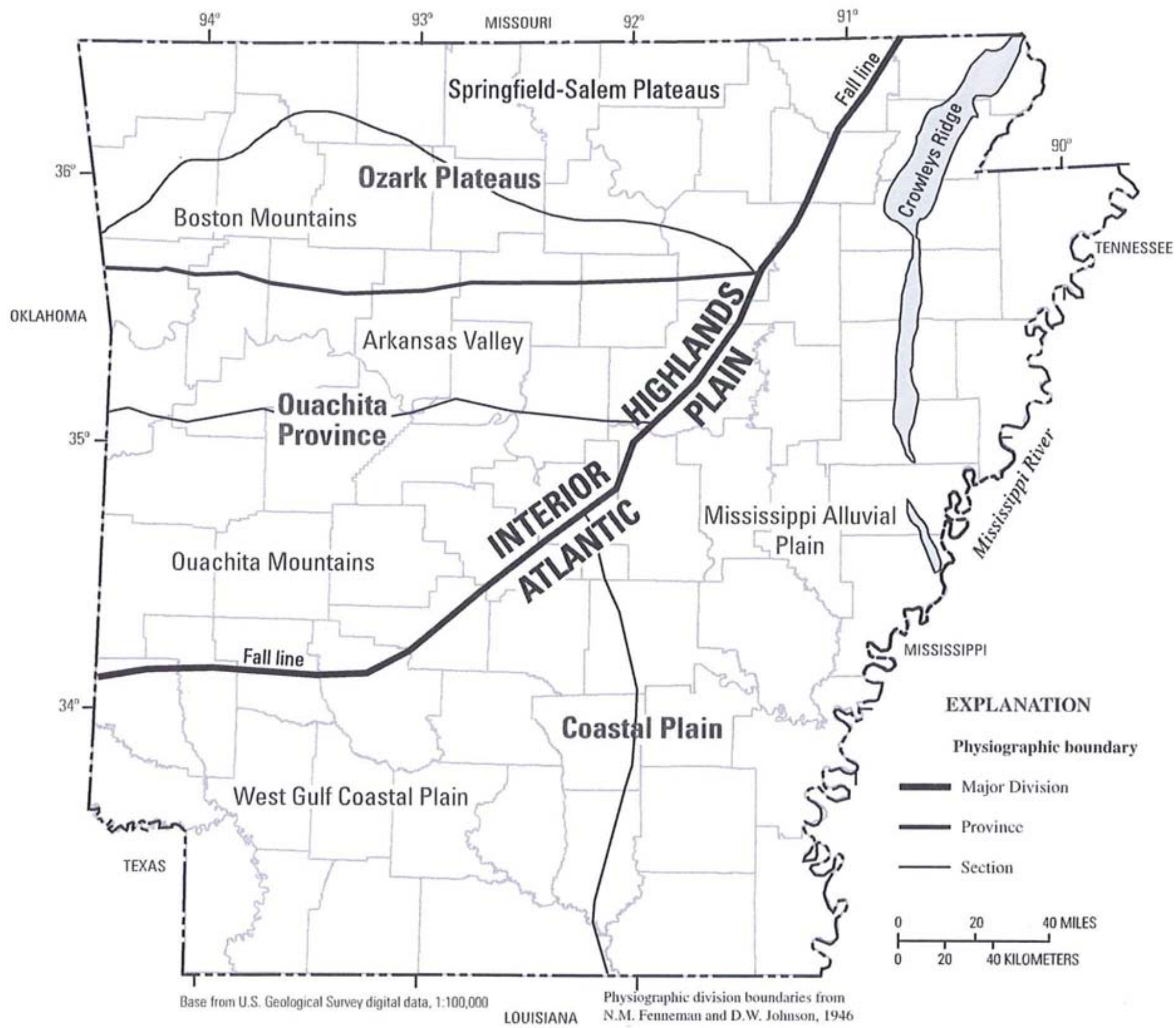
Table 4.1 Missouri Land Use/Land Cover Category Descriptions

Impervious	Non-vegetated, impervious surfaces. Areas dominated by streets, parking lots, buildings. Little, if any, vegetation
High Intensity Urban	Vegetated urban environments with a high density of buildings
Low Intensity Urban	Vegetated urban environments with a low density of buildings
Barren or Sparsely Vegetated	Minimally vegetated areas including bluffs, quarries, and natural expanses of rock, mud, or sand. Areas in transition
Cropland	Predominantly cropland including row, close-grown, and forage crops
Grassland	Grasslands dominated by native warm season or non-native cool season grasses
Deciduous Forest	Forest with greater than 60% cover of deciduous trees
Evergreen Forest	Forest with greater than 60% cover of evergreen trees
Mixed Forest	Forest with greater than 60% cover of a mixture of deciduous and evergreen trees
Deciduous Woody/Herbaceous	Open Woodland (including young woodland) with less than 60% cover of deciduous trees
Evergreen Woody/Herbaceous	Open Woodland (including young woodland) with less than 60% cover of evergreen trees
Mixed Woody/Herbaceous	Open Woodland (including young woodland) with less than 60% cover of deciduous and evergreen trees
Woody-Dominated Wetland	Forest with greater than 60% cover of trees with semi-permanent or permanent flood waters
Herbaceous-Dominated Wetland	Woody shrubland with less than 60% cover of trees with semi-permanent or permanent flood waters
Open Water	Rivers, lakes, ponds, and other open water areas

Table 4.2 Bull Shoals Lake Area Public Land Use Areas

Area Name	Management Responsibility[1]	County	Acres	Impoundment Acres
Caney Mountain CA	MDC	Ozark	7,882	0
Ruth and Paul Henning CA	MDC	Taney/Stone	1,534	
Shepherd of the Hills Fish Hatchery and Visitor Center	MDC	Taney	211	
Hollister Towersite	MDC	Taney	180	
Boston Ferry CA	MDC	Taney	180	
Hilltop Towersite	MDC	Taney	3	
Drury-Mincy CA	MDC	Taney	5,699	
Branson MDC Office	MDC	Taney	4	
Cedar Creek Towersite	MDC	Taney	4	
Cooper Creek Access	MDC/EDEC	Taney	29	
Bull Shoals Lake WMA	USCOE/MDC	Various	62,326	45,440
Lake Taneycomo	USCOE/MDC	Taney	NA[2]	2,080
Empire Park	MDC/EDEC	Taney	3	
Table Rock Lake WMA	USCOE/MDC	Various	24,102	43,100
Table Rock State Park	MDNR	Taney	356	
Hercules Glades Wilderness	USFS	Taney	12,315	
Mark Twain National Forest	USFS	Numerous	186,253	
Wildcat Shoals Access	AG&FC	Baxter	2	
Bull Shoals Nursery Pond	AG&FC	Boone	NA[2]	
Bull Shoals State Park	ADP&T	Marion	660	
Crooked Creek Access	AG&FC	Marion	2	
Marion County WMA	AG&FC	Marion	120	
Pot Shoals Net Pen Project	AG&FC	Marion	90	
Ranchette Access	AG&FC	Marion	1	
Marion County Access	AG&FC	Marion	NA[2]	
White Hole Access	AG&FC	Marion	NA[2]	
Jones Point WMA	AG&FC	Marion	NA[2]	
Norfork Lake WMA	USCOE	Baxter	10,000	
Sylamore WMA	USFS/AG&FC	Baxter/Marion	1,280	

WMA = Wildlife Management Area
CA = Conservation Area
[1]Management responsibility - ADP&T = Arkansas Department of Parks & Tourism; AG&FC = Arkansas Game & Fish Commission; MDC = Missouri Department of Conservation; MDNR = Missouri Department of Natural Resources; EDEC = Empire District Electric Company; NPS = National Park Service; USCOE = United States Army Corps of Engineers; USFS = United States Forest Service
[2]NA indicates that no area was reported at these areas.
Sources: URL: http://www.mdc.mo.gov/fish/watershed/whriver/landuse/390lut10.htm;
URL: http://www.mdc.mo.gov/fish/watershed/whriver/landuse/390lut11.htm;
URL: http://www.agfc.com/data-facts-maps/publicland/wma.aspx.



Source: Summary of Aquifer Test Data for Arkansas -- 1940-2006, USGS, Aaron L. Pugh, 2008.

Figure 4.3 Physiographic Provinces of Arkansas

The elevations of the lake area vary from 450 feet NGVD29 in the streambed to 1,100 feet NGVD29 on the adjacent hills and ridge tops. The land generally rises from the narrow alluvial bottom in steep slopes to narrow upland plateaus or ridges. In general, the entire area may be classified as rough and broken.

4.3.1.1 Interior Highlands Division

The Interior Highlands include about three-fourths of the White River Drainage Basin and are characterized by plateau surfaces entrenched by steep-walled valleys. The nearly flat, plateau surfaces tend to delay runoff. Where the plateau surfaces are underlain by calcareous rocks, karst topography develops. This enhances infiltration of precipitation. Karst features are locally prominent in both the Salem and Springfield plateaus (MDNR 1986a). Several faults are present in the watershed, but most have only tens of feet of displacement (MDNR 1986a). The fractured limestone of the watershed allows a direct conduit from the surface water to ground water, making aquifers underlying the watershed extremely susceptible to contamination (USGS 1996).

The Interior Highlands surrounding Bull Shoals Lake are within the Ozark Plateaus province. The basin includes parts of the Springfield-Salem Plateaus and Boston Mountains section. The Salem Plateau is underlain by rocks of Ordovician age or older. The Springfield Plateau is underlain by rocks of Mississippian age.

The upland parts of the plateaus are the remains of an old erosional surface. The surface has been modified by continued solution and erosion resulting in a somewhat lowered surface. Local relief of the upland surface generally does not exceed 50 feet. Valleys dividing the upland surfaces range in depth from 50 to 100 feet near their head, to as much as 1,500 feet in the entrenched meanders of larger streams near their mouths.

> *The Boston Mountains are a dissected plateau approximately 200 miles long and 35 miles wide. This plateau is underlain by sedimentary rocks of Pennsylvanian age, and bounded on the north by a conspicuous escarpment. Toward the east and west, the summit level declines gradually to that of the surrounding surface. The summit slope is toward the south and is similar to the dip of the underlying formations. It is nearly flat close to the main crest and is steeper near the south edge. Along the southern boundary, the Boston Mountains merges with the hills of the Arkansas Valley section of the Ouachita province.*

The Interior Highlands is separated abruptly from the Coastal Plain by the Fall Line. The Fall Line is the westernmost boundary of rocks of Cretaceous or younger age except for Recent alluvium in stream valleys of the Interior Highlands.

4.3.1.2 Atlantic Plain

Approximately one-fourth of the White River Basin is in the Mississippian Alluvial Plain section of the Coastal Plain province. Topography of the Atlantic (Coastal) Plain is characterized by flat monotonous plains traversed by sluggish meandering streams. Crowley’s Ridge, an important physiographic feature, forms part of the eastern border of the basin area and rises as much as 200 feet above the general level of the Atlantic Plain. The land surface of the rest of the Atlantic Plain is principally made up of Quaternary age terrace deposits and flood plain deposits of the Mississippi River and its tributaries. The land surface slopes southward from an altitude of about 300 feet NGVD29 at Poplar Bluff, Missouri, to about 150 feet NGVD29 at the mouth of White River.

The Grand Prairie region, a low terrace, lies between the White River and Bayou Meto (Arkansas River Basin) south of Wattensaw Bayou, and includes most of Arkansas County and parts of Lonoke, Prairie, and Monroe counties.

In the lower parts of the White River Basin, the drainage divides into the White River and other tributaries of the Mississippi River that are poorly defined and difficult to determine. In many places, the divide is formed by a levee or dike.

4.3.2 Geology

The strata in the region of Bull Shoals Lake have a slight dip to the south. The region is on the southern flank of a large regional dome with its nucleus in the igneous rocks of the St. Francis Mountains, about 200 miles to the northeast. Locally, short anticlines and dome structures with as much as 90 feet of structural relief are noted in the exposures along the White River. Faults with small displacements are found in the vicinity. There is no record of any seismic activity originating in the Bull Shoals Lake area. It is believed that all faults in the region are static and no future movements are expected. Three rock formations of Ordivician age are present above the river level within the region. These formations include the Cotter, Powell, and Everton. The Jefferson City formation underlies the Cotter, and is present only a few feet below river level at Bull Shoals Dam. These formations consist largely of dolomite limestone with occasional lenses of sandstone and shale. The Everton and Powell formations are not present at the dam, but cap the nearby hills. The capped hills are remnants of the Springfield Plateau surface.

The uplands of the Salem Plateau are underlain by Jefferson City dolomite and the Roubidoux formation, and the valleys are floored by Gasconade dolomite of the Ordivician age. The Springfield Plateau is underlain by Mississippian limestones. The Boston Mountain Plateau is underlain by resistant clastic rocks of Pennsylvanian age. The Eureka Springs escarpment is the boundary between the Mississippian limestone and the Springfield Plateau and the Devonian limestone of the Salem Plateau.

The large dolomite mass, which is present in the Ozarks, has tremendous water storing capability, and the Salem Plateau is the locality for the greatest number and largest springs in Missouri, followed secondly by the Springfield Plateau. The large reservoirs in the southern part of the watershed probably cover many springs. Karst features are locally prominent in both the Salem and Springfield plateaus (MDNR 1968a). Several faults are present in the watershed, but most have only tens of feet of displacement (MDNR 1986a). The fractured limestone of the watershed allows a direct linkage from surface waters to ground waters, making aquifers underlying the watershed extremely susceptible to contamination from the surface (USDA, 1996). Figure 4.4 depicts the geology of the White River Basin.

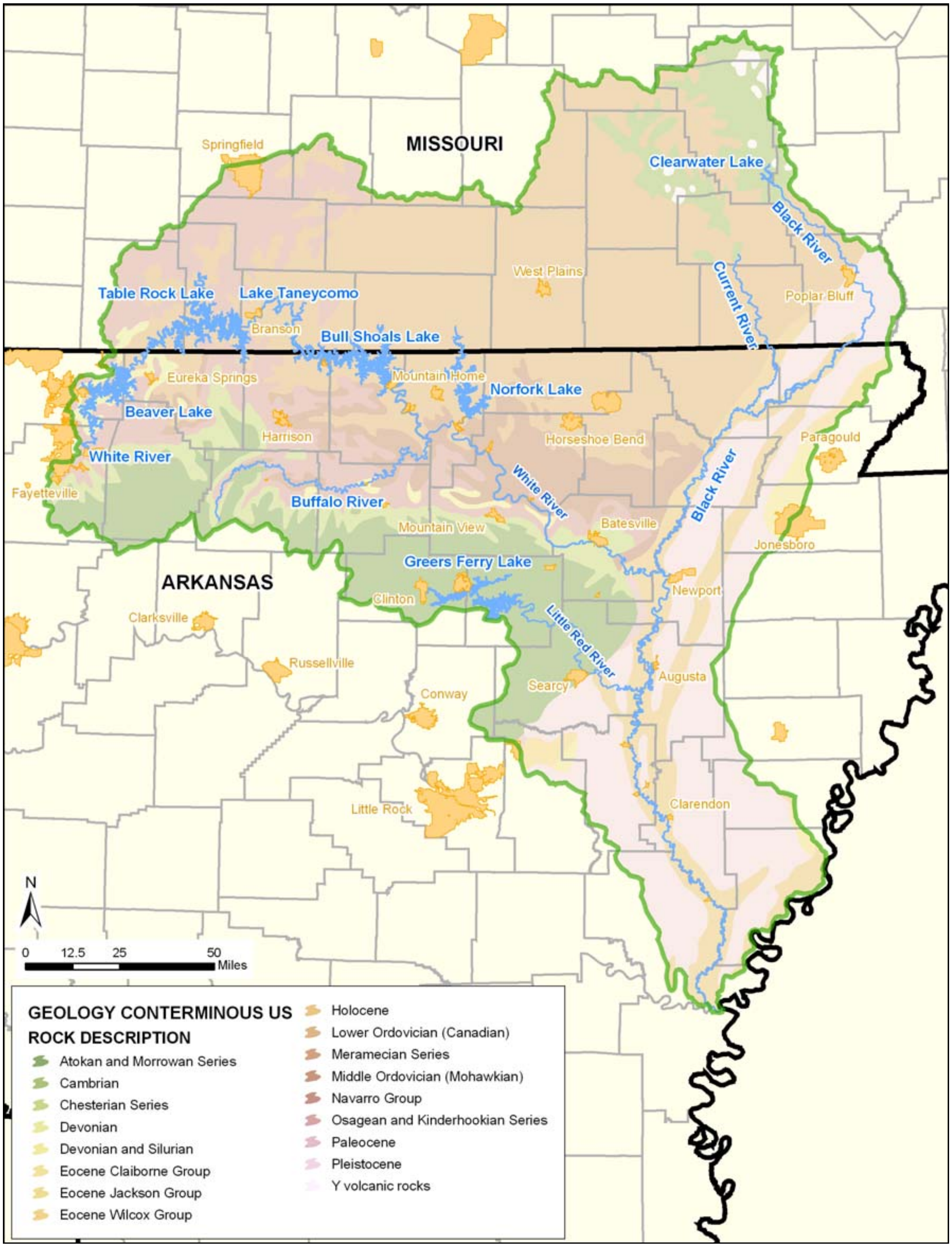


Figure 4.4 Geology of the White River Drainage Basin

4.3.3 Topography

Bull Shoals Lake is located within two physiographic areas of the Ozark Highland. The Salem Plateau is exposed across northern and central Baxter County. The Springfield Plateau is exposed in parts of west central and across most of southern Marion County and most of southern Baxter County, and the Missouri counties of Taney and Ozark. The Salem Plateau is characterized by gently sloping to rolling uplands, and steep, stony side slopes with outcrops of dolomite. The elevation ranges from about 700 to 1,000 feet above sea level. There are a few broad areas on uplands that have a gradient of 1 to 8 percent.

The Springfield plateau is adjacent to and higher in elevation than the Salem plateau. This plateau has been strongly dissected by streams. Steep, V-shaped valleys separated by gently sloping to moderately sloping land characterize it. The side slopes have a gradient of 12 to 50 percent. The elevation atop the ridges ranges from about 1,000 to 1,200 feet above sea level. There are a few broad areas on uplands where the gradient is 1 to 8 percent. Stream valleys are entrenched and are commonly less than one-fourth mile wide. Most flood plains are 100 to 1,000 feet wide.

A general description of Bull Shoals Lake is gently sloped to steep inclines typical of the Ozark highlands. Bluffs of near vertical slope are present where the original White River channel has eroded the residual limestone substrate. Upper reaches of several small tributaries contain small flood plains and gentle slopes of less than five percent. Primary ridges and connecting spur ridges have 0 to 10 percent slope with side slopes ranging from 10 to 25 percent inclines. Aspect is generally described as easterly in nature for all land occurring on the west side of the reservoir and westerly in nature for land occurring on the east side of the reservoir, however the presence of ridges and drainages create aspects of all directions.

4.3.4 Soils and Prime Farmlands

Soils in the Missouri portion of the study area are of the Ozark type. The major soil association is Gasconade-Opequon-Clarksville, found in the western and central portions. A Captina-Clarksville-Doniphan association is present on the watershed’s eastern edge. Other minor soil associations include Nixa-Clarksville, along the Missouri-Arkansas border, and Needleye-Viration-Wilderness, near the northwest corner.

Soils in the Missouri portion of the watershed are generally acidic and of moderate to low fertility. Productivity of watershed soils varies widely, with forest and grassland being the dominant land cover. A typical watershed landscape consists of broad, forested areas on moderately steep to very steep slopes and small pastures and cultivated fields on smoother ridge tops and in level valley bottoms. Tall fescue is the main grass used for pastures. Native, tall and mid-tall grasses are found in glade and savannah areas. They are less common than before European settlement. The moisture holding capacity of these soils is limited, adding to the general unsuitability for crop production.

Ozark soils vary widely in character. Some soils are infertile, stoney-clay type soils, while others are loess-capped and fertile. Some watershed soils are stone free, while others may have a stone content exceeding 50 percent, and some areas may have no soils covering bedrock. The majority of the watershed is dominated by stoney, cherty soils found on steep slopes with lower stone contents found in soils on more level areas. Soils in Missouri become less stoney on the western fringe of the watershed. Soils in the watershed are formed from residue high in iron, which oxidizes on exposure, giving the soil a red color. Soils formed in the residuum from cherty limestone or dolomite, range from deep to shallow and contain a high percentage of chert in most places. Soils formed in a thin mantle of loess are found on the ridges and have fragipans, which restrict root penetration. Soils formed in loamy, sandy and cherty alluvium are found in narrow bottomland areas, and are the most fertile soils in the watershed.

Soils in the Arkansas portion of the watershed are also Ozarkian. Major soil associations include Clarksville-Nixa-Noark, Captina-Nixa-Tonti, and Arkana-Moko in the Salem and Springfield plateaus and Linker-Mountainburg-Sidon and Enders-Nella-Moutainburg-Steprock in the Boston Mountains.

Soils in the Upper White River area below Bull Shoals Lake and above Batesville, Arkansas, include the following associations: Talbott-Colbert, Corydon-Sogn, and Sogn-Mountainburg in Baxter County; Sturkie-Peridge, Noark-Portia, Arkana-Moko and Brockwell-Boden-Portia in Izard and Stone counties; Clarksville-Gepp-Ventris, Beasley-Gasconade, and Egam-Arrington in Independence County. The Sturkie, Portia and Egam soil series contain lands classified as prime farmlands; while the other series listed contain none. The Corydon-Sogn association is the primary soil association in the vicinity of Bull Shoals Lake. Neither the Corydon nor the Sogn soils are classified as prime farmlands.

Soil resources in the vicinity of the Lower White River include the Sharkey-Boudre association in Woodruff County, the Sharkey-Commerce association in Monroe County, the Sharkey and Newellton-Sharkey-Tunica associations in Phillips County, the Sharkey-Acadia association in Arkansas County, and the Sharkey association in Desha County. The above soils, with the exception of the Commerce series in Monroe County and the Sharkey and Acadia series in Arkansas County, are classified as prime farmlands.

4.4 Water Resources

4.4.1 Surface Waters

4.4.1.1 Lakes

Bull Shoals Lake is located on the White River and was formed by the construction of the Bull Shoals Hydroelectric Dam in Marion County, Arkansas, which was begun in 1947 and completed in 1951. The elevation of the top of the conservation pool is approximately 659 feet NGVD29 with the flood pool being at 695 feet NGVD29. The conservation pool top area is approximately 48,005 acres and the flood pool top area is approximately 71,240 acres. The shoreline length of the design conservation pool is approximately 740 miles, and the flood pool is approximately 1,050 miles in length. Bull Shoals Lake is located within the White River Drainage Basin, which drains an area of approximately 27,765 square miles in northern Arkansas and southern Missouri. Bull Shoals Lake drains approximately 6,036 square miles of the White River Drainage Basin and has an average depth of 67 feet. The authorized purposes of Bull Shoals Lake are flood control and hydropower generation; and, its authorized uses are recreation, fish and wildlife support, water supply (by the Water Supply Act of 1958) and tail water minimum flows (by the WRMF Project).

There are five other large lakes in the Bull Shoals Lake vicinity: (1) Beaver Lake, (2) Table Rock Lake; (3) and Lake Taneycomo on the White River upstream of Bull Shoals; (4) Norfork Lake approximately 20 miles to the east of Bull Shoals Lake on the North Fork River; and (5) Greers Ferry Lake on the Little Red River, approximately 60 miles to the south of Bull Shoals Lake. With the implementation of the WRMF Project, the total water storage capacity of Bull Shoals Lake is 5.408 million acre-feet, with 2.127 million acre-feet of flood control storage, 1.236 million acre-feet of conservation storage, and 2.045 million acre-feet of inactive storage.

Existing authorized water supply storage is 880 acre-feet at one million gallons per day (mgd) in the conservation pool from flood control by MCRWD and 233,000 acre-feet (242 mgd) soon to be reallocated from the flood control pool for use under the WRMF Project.

4.4.1.2 Rivers

Bull Shoals Lake is an impounded area of the White River which begins at an elevation of approximately 2,050 feet NGVD29 near the Ozark National Forest in northwest Arkansas. The river runs southeast through northeast Arkansas to its confluence with a branch of the Arkansas River very near its confluence with the Mississippi River in Desha County, Arkansas. The White River flows about one-third of its length through the Ozark highlands to about Independence County, Arkansas, where it enters a lowlands area with lower gradient change. The upper one-third of the river has a gradient change of about three to four feet per mile and the lowlands portion averages about one foot per mile. The flood plain ranges from 200 to 400 feet in width in the highlands to two miles in the lowlands below Independence County.

Other than Bull Shoals Dam, there are three other dams forming lakes on the upper White River:

1) the Empire District Electric Company Dam at Ozark Beach that forms Lake Taneycomo
2) Table Rock Dam which forms Table Rock Lake
3) Beaver Dam forming Beaver Lake.

Norfork Lake is impounded on the North Fork River about 4.8 miles north of its confluence with the White River. The North Fork River empties into the White River in Baxter County approximately 25 miles south of Bull Shoals Dam, just north of a portion of the Ozark National Forest. It drains approximately 1,825 square miles of the Salem Plateau in northern Arkansas and Southern Missouri.

Another major tributary to the White River is the Buffalo River running easterly to the south of Bull Shoals Lake and meeting the White River in Marion County. The Buffalo River is America’s first National River and remains as one of the few unpolluted rivers in the lower 48 states, with both swift-running and placid stretches. About 135 miles of the river’s 150-mile length is set aside as the Buffalo National River. It begins as a small stream in the Boston Mountains about 15 miles from the beginning of the national river designated area. The river winds its way through massive limestone cliffs and bluffs while travelling eastward through the Ozark Mountains to the White River. The river’s high quality waters serve as an ideal recreation source as well as aquatic habitat offering sport fishing for smallmouth bass, channel catfish, green and long-eared sunfish, and spotted bass.

Other major rivers in the Bull Shoals Lake area include the Little Red River in the southern part of the basin, and the Current River and Black River in the eastern portion of the basin. The Current River empties into the Black River in Randolph County, Arkansas and the Black River joins the White River in Independence County.

4.4.2 Ground Water Quality/Aquifers

Most ground water withdrawn from water wells occurs in the Quaternary alluvium in the Bull Shoals Lake area, with most wells being completed at a depth of about 200 – 300 feet below surface. The recharge (outcrop) area for this formation is in southern Missouri. The formation is made up of predominantly limestone, dolomite, sandstone, and shale. The primary porosity of these rocks has been greatly reduced by compaction and cementation, thus a reduction in their ability to supply large withdrawal rates. Ground water occurs mainly in fractures and joints in the sandstone and in solution openings in the limestone and dolomite.

Much of the ground water produced in this area contains high levels of radium 226, radium 228, fluoride, uranium, radon, hydrogen sulfide, and other undesirable naturally occurring substances which are difficult to treat. The radium 226, radium 228, fluoride, and radon levels found in many wells consistently exceed the maximum contaminate (MCL) levels established by the *National Primary Drinking Water Regulations*. Wells completed in shallower water bearing layers are often infiltrated with surface runoff water that tends to contain contaminants that pose potential health risks (ESI, 2009).

The ADH has placed many of the OMRPWA water systems under Administrative Order for continuing to provide unsafe water supplies. Members that do not have contamination issues have source quantity issues. Water shortages are realized most summers, even when “water conservation” orders are implemented. The ADH has issued an Administrative Order Warning to the city of Marshall for not having enough water to serve its customers. As a result of low yields, the cities of Marshall and Jasper cannot extend service to hundreds of households. The families in the region haul water or drink water from shallow contaminated wells. Table 4.3 shows the members of ORMPWA, and the source quality and quantity for each of the member systems.

4.4.3 Surface Water Quality

Overall surface water quality in the Bull Shoals Lake area is very high and has been designated as an Extraordinary Resource Water Body by the Arkansas Pollution Control and Ecology Commission. It is therefore subject to more stringent regulations controlling pollution discharge and in-stream activities. 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, 2002).

Table 4.3 Ozark Mountain Regional Public Water Authority Data

County	2008 Population	Source Quality Issues	Quantity Issues
Newton			
City of Jasper	1,530	*	Yes
Mt Sherman	775	Radium	Yes
Nail-Swain	1,975	None	Yes
East Newton County	1,650	Radium, Hydrogen Sulfide	No
Mockingbird Hill	800	Hydrogen Sulfide, Iron	No
Deer	900	*	Yes
Luton-Pelsor	300	Iron	Yes
Western Grove	1,070	Radium, Iron	Yes
Parthenon	400	*	Yes
Subtotal	9,400		
Searcy			
SPG	1,400	Fluoride	No
Marshall	2,400	None	Yes
South Mountain	700	Radium	Yes
SDM	400	Radium, Fluoride	Yes
Leslie	800	Radium	Yes
Morning Star	1,375	Fluoride	Yes
Subtotal	7,075		
Boone			
Valley Springs	3,750	Radium, Iron	Yes
Diamond City	700	Radium	No
Lead Hill	515	Radium	No
Lake Bull Shoals Estates	60	None	No
Subtotal	5,025		

*Violates the Surface Water Treatment of the National Primary Drinking Water
Source: Preliminary Engineering Report Amendment 1 (August 2009), Engineering Services, Inc.

Bull Shoals 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). This is mainly due to temperature stratification, which is natural and occurs in many deep reservoirs such as Bull Shoals Lake. 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. 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.

In 2004, ADEQ placed the first three miles of the Bull Shoals tail water on the Water Quality Limited Waterbodies list (303(d) list) due to violation of the 6 mg/L dissolved oxygen (DO) standard. The listed source of the DO violation is hydropower (HP). Section 303(d) of the 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 been established by ADEQ for the 3.0 miles of the White River below Bull Shoals Dam. While the first three miles below the Bull Shoals dam is listed on the 303 (d) list, Bull Shoals Lake is not.

In January 2009 the USACE completed the WRMF Study, which will increase the minimum flow below the dam to 800 cfs to benefit the aquatic habitat and may result in water quality improvements in the tail water.

For the Missouri potion of Bull Shoals Lake, the Missouri Department of Natural Resources and the Clean Water Commission are responsible for setting and enforcing water quality standards within the State of Missouri. Classified waters in the state are categorized according to their beneficial water usage. Major reservoirs like Bull Shoals Lake are usually several thousand acres in size and are classified by the state as L2 (comparable to Type A in Arkansas). Bull Shoals Lake, in addition to maintaining L2 water quality standards, is also subject to four other water quality standards: (1) livestock and wildlife watering; (2) protection of warm water aquatic life and human health/fish consumption; (3) whole body contact recreation; and (4) boating and canoeing water quality standards (MDNR, 1996b).

4.4.4 Hydropower

A report was prepared by the USACE Hydropower Analysis Center (HAC) for the proposed project that provides details of the hydropower benefits and economic analysis associated with the Ozark Mountain Regional Public Water Authority's (OMRPWA) request for reservoir storage sufficient to supply 6 MGD (10.83 cfs) from Bull Shoals Lake. A pending water supply request by Marion County Regional Water District (MCRWD) for 1 MGD was included in this study. Analysis of hydropower impacts for reallocating hydropower storage to water supply storage in Bull Shoals Lake includes the computation of the following values:

- power benefits foregone
- revenues foregone
- credit to the Federal power marketing agency

Values were computed for each of these parameters for the proposed reallocation of reservoir storage.

Five existing Corps of Engineers lakes (Beaver Lake, Table Rock Lake, Bull Shoals Lake, Norfork Lake and Greers Ferry Lake) were constructed between 1940 and 1970 in the White River Basin of Arkansas and Missouri. The five lakes are multi-purpose reservoirs authorized for the primary purposes of flood control and hydroelectric power generation. Other authorized purposes are water supply, recreation and fish and wildlife. A map of the White River Basin is shown in Figure 1-1. Hydropower impacts were computed only for Bull Shoals and Norfork

Lakes because hydrologic effects are shown to be negligible (Hydraulics and Hydrology Report-Appendix A) at the other lakes in the system.

The reservoir system is operated to maintain a balance in the remaining portion of the seasonally defined flood control storage space. Downstream river flow criteria have been established at downstream control points to achieve project benefits. The regulating discharge criteria are supplied for all stream control points (including reservoir outflow controls) as a seasonal function of a system state parameter. Runoff forecast and these criteria are used by a system model which iteratively computes reservoir discharges which balances the remaining reservoir storage without exceeding downstream control point criteria.

4.5 Cultural Resources

4.5.1 Human History

The following is a brief history of the human population of the Bull Shoals Lake area:

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 marks the beginning of the Woodland period- pottery. Ceramics had begun to appear during the Archaic period, but their proliferation marks the beginning of the Woodland period. Pottery signifies 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 marks 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 include 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, 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.

4.5.2 Previous Investigation on the White River Area

The last broad cultural resources inventory for the White River area was conducted in 1988 for the *Cultural Resources Priority Plan for the U.S. Army Engineer District, Little Rock, 1988* (Blakey and Bennet, Jr., 1988). Only a few minor surveys have been conducted since that project was completed. The Table below represents the most up to date site information according the records of the Arkansas Archeological Survey and the Missouri Department of Natural Resources.

4.5.3 Recorded Cultural Resources in the Lake Area

The last cultural resources inventory for the White River area was conducted in 1988 for the *Cultural Resources Priority Plan for the U.S. Army Engineer District, Little Rock,* 1988 (Blakely and Bennet, Jr., 1988). It should be kept in mind that this inventory only represents sites recorded before 1988 and many have been recorded since that date. In addition, many more sites have yet to be recorded. Table 4.4 summarizes the previously recorded resources at Bull Shoals Lake, as of 1988.

A coordination letter was submitted to the State of Arkansas, Arkansas Historic Preservation Program, requesting views on the proposed project and the potential for known historic or pre-historic sites to be located within the project area. The response received from the Arkansas State Historic Preservation Officer (SHPO) is included in Section 12.0, Agency Coordination. For the portion of Bull Shoals Lake in Missouri, a representative of the Missouri Historic Preservation Program, Ms. Judith Deel with the Missouri State Historic Preservation Office, was consulted by telephone on October 21, 2009, requesting her agency's views on the proposed project.

Table 4.4 Previously Recorded Resources at Bull Shoals Lake

Type of Site	Number of Sites
Historic	3
Prehistoric	114
Multicomponent	20
Total	137
National Register Eligibility Status	
Not Evaluated	131
Not Eligible	5
Eligible	1

4.6 Biological Resources

4.6.1 Fish and Wildlife

Bull Shoals Lake is located in the north central portion of Arkansas and the south central portion of Missouri within the Ozark Highlands Ecoregion. Specifically, the lake is within the White River Hills Sub Ecoregion, which is characterized by the Springfield and Salem plateaus along with highly dissected forested slopes. The plateaus are utilized as pastureland and hayland; whereas, the slopes are generally vegetated with oak-hickory forests.

The lake fishery is managed in a cooperative effort between the Arkansas Game and Fish Commission (AGFC) and the Missouri Department of Conservation. Bull Shoals Lake is a warm water fishery with most endemic species of the Ozark Highlands Ecoregion present. Black bass species, white and striped bass, walleye, crappie, channel, flathead and blue catfish, and various sunfish species are common game fish for the lake. Stocking programs of certain game fish occur on the lake at various times of the year and an annual report of stocking rates and species is prepared by AGFC.

Common terrestrial wildlife species to the area include raccoons, opossums, river otters, muskrats, gray and red foxes, gray and red squirrels, beavers, minks, cottontail rabbits, coyotes, skunks, bobwhite quail, eastern wild turkeys, and white-tailed deer. A variety of migratory game birds, such as geese, ducks, and mourning doves as well as various species of neo-tropical and passerine songbirds are found in abundance throughout the project area.

4.6.2 Protected Species

In addition to the typical wildlife species, this area with its diverse habitats is also home to many rare species. Attachment 4 provides a list of these rare species (but not all protected) in the Bull Shoals Lake area by county (Missouri Department of Conservation, 2009 and Arkansas Natural Heritage Program, 2009). Species of greatest concern are those that are listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS). Within the general project area are the listed species Tumbling Creek cavesnail, gray myotis, Ozark big-eared bat, and the Indiana bat. Although the bald eagle was delisted in 2007, it continues to be protected by the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act. The bald eagle regularly utilizes the lake as hunting grounds and is known to nest along the river downstream of the lake. It has been determined by the USFWS that no impact to these resources is expected to result from the proposed project. See Section 12.0 for copies of the responses.

The Tumbling Creek cavesnail (a Federally endangered species) is a very small, pale, blind snail that occurs only within the Tumbling Creek Cave in Taney County, Missouri, approximately 3.2 miles north of Bull Shoals Lake. Surveys of the cave in 2001 have revealed only 40 individuals and continued monitoring has shown a decline in these numbers since that survey (USFWS, 2009). As a result of coordination with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act for the White River Basin Minimum Flows EIS, it was concluded that the reallocation of five feet of storage of the flood pool of Bull Shoals Lake may affect, but would not likely adversely affect the species (USFWS, 2003).

Another endangered species, the gray bat, is also found within the project area. Karst features within the project area provide the necessary habitat for maternity and hibernacula population of this species. The gray bat is the largest of the genus within the project area, weighing from seven to 16 grams. This species can be distinguished from the other species by its unicolored fur on its back and by the wing membrane connecting to the ankle instead of at the toe, as in the other bats. Tumbling Creek Cave supports a large maternity colony of gray bats and according to the Gray Bat Five-Year Review published in 2009, the population within this cave is increasing; however, the overall classification remains the same for this species.

The Indiana bat is another endangered bat that has also been observed within the project area. This bat is roughly two inches long and weighs from six to nine grams. A small hibernating population was historically found within the Tumbling Creek Cave but since 1998, there have been no observations of a hibernating population of this species within the cave (USFWS, 2009). According to the 2009 Indiana Bat Five-Year Review from the USFWS, the population of Indiana bats within 11 Missouri hibernacula declined drastically from 1980 through 1997 but that decline has slowed from 1997 to the present. The many karst features within the project area provide the necessary habitat required by this species and continued management of known populations will provide the protection required to reverse this decline.

Also found in the project area is the Ozark big-eared bat. This bat is medium sized and weighs seven to 12 grams with long ears and distinctive facial glands on either side of the snout. The range of this species is generally within the Ozark Highlands and Boston Mountains ecoregions in northeast Oklahoma, northwest Arkansas, and southwest Missouri utilizing the abundance of caves in the region for hibernation and maternity sites. According to the Ozark Big-Eared Bat Five-Year Review from the USFWS, the census counts for maternity sites indicate that the population of this species is fairly stable (www.naturalheritage.org/rarespecies, www.mdc.mo.gov/cgi-bin/heritage, www.fws.gov/midwest/endangered).

4.6.3 Vegetation

The Ozark Highlands Ecoregion is characterized as a high plateau dissected by deep rugged valleys formed by streams and rivers. Vegetation types within this region include oak-hickory forests, oak-hickory-pine forests, bluestem prairies and cedar glades. Post oaks, blackjack oaks, and black hickory are the dominant species found in the dry upland forests and the areas of sandstone bedrock contain species such as shortleaf pine and various species of oak. The mesic slope forests include species such as white oak, northern red oak, bitternut hickory, and flowering dogwood. The glades within this region are dominated by little bluestem and baldgrass, but with the suppression of fire the eastern red cedars have invaded these prairie habitats. Along the rivers, streams, and lake shores the riparian habitats are characterized by birch and silver maple. Normal operation of the Bull Shoals Dam has created a region along the shoreline that has little or no vegetation, but upslope of this region the shoreline is undeveloped and heavily forested.

4.6.4 Wetlands

Located within the Salem Plateau of the Ozark Mountains region of northern Arkansas and southern Missouri, the project area 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. Table 4.5 presents these wetland classes with their respective subclasses and community types. It is possible, and perhaps even likely, that all of these classes of wetlands occur in the general area of Bull Shoals Lake. However, those most likely to occur in the area immediately surrounding the lake are fringe (most likely reservoir and connected lacustrine fringe) 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.

4.7 Air Quality

Bull Shoals Lake is located in the Ozark Mountains, remote from heavy smoke-producing industry or large mining operations. The air is very clean and smog is virtually unknown in this region.

The Clean Air Act of 1977 (CAA), as amended requires Federal facilities to comply with all Federal, state, interstate, and local requirements regarding the control and abatement of air pollution in the same manner as any nongovernmental entity, including any requirement for permits. No particular Federal requirements are involved that are not already incorporated into Arkansas and Missouri State law. The "Conformity Rule" of the Clean Air Act (CAA) of 1977, as amended states that all Federal actions must conform to appropriate State Implementation Plans (SIPs). This rule took effect on January 31, 1994, and at present applies only to Federal actions in nonattainment areas (those not meeting the National Ambient Air Quality Standards for the criteria pollutants in the CAA). The areas of north central Arkansas and south central Missouri where Bull Shoals Lake is located are considered "attainment areas" and are therefore exempt from the "Conformity Rule" of the CAA.

Table 4.5 Project Area Wetland Classifications

CLASSIFICATION		
Class	**Subclass**	**Community Types**
Depressions	Headwater Depression	Headwater Swamp
	Isolated Depression	Mountaintop Depression Sinkhole Sandpond Valley Train Pond Unconnected Alluvial Depression
	Connected Depression	Connected Floodplain Depression
Flats	Alkali Flats	Alkali Wet Prairie Alkali Post Oak Flat
	Non-Alkali Flats	Wet Tallgrass Prairie Pine Flat Hardwood Flat Post Oak Flat
Fringe	Reservoir Fringe	Reservoir Shore
	Connected Lacustrine Fringe	Connected Lake Margin
	Isolated Lacustrine Fringe	Unconnected Lake Margin
Slope	Calcareous Slope	Calcareous Perennial Seep
	Non-Calcareous Slope	Non-calcareous Perennial Seep Bayhead Wet Weather Seep Sandstone Glade
Riverine	Spring Run	Spring Run
	High-Gradient Riverine	High-Gradient Riparian Zone
	Mid-Gradient Riverine	Mid-Gradient Floodplain Mid-Gradient Backwater
	Low-Gradient Riverine	Low-Gradient Overbank Low-Gradient Backwater Sand Prairie
	Riverine Impoundment	Beaver Complex Wildlife Management Impoundment

4.8 Recreation

The Bull Shoals project area contains 101,196 acres; 100,090 acres owned in fee and 1,106 acres are managed by flowage easement. The 71,240 acres below the top of Flood Control Pool elevation (695 NGVD29) and 75 acres required for the dam and appurtenant works are allocated for Project Operations. There are 9,505 acres allocated for recreation-intensive use and 22,718 acres for wildlife management, which includes areas located below the Flood Control Pool elevation. Figure 4.5 depicts Bull Shoals Lake and its immediate surrounding area.

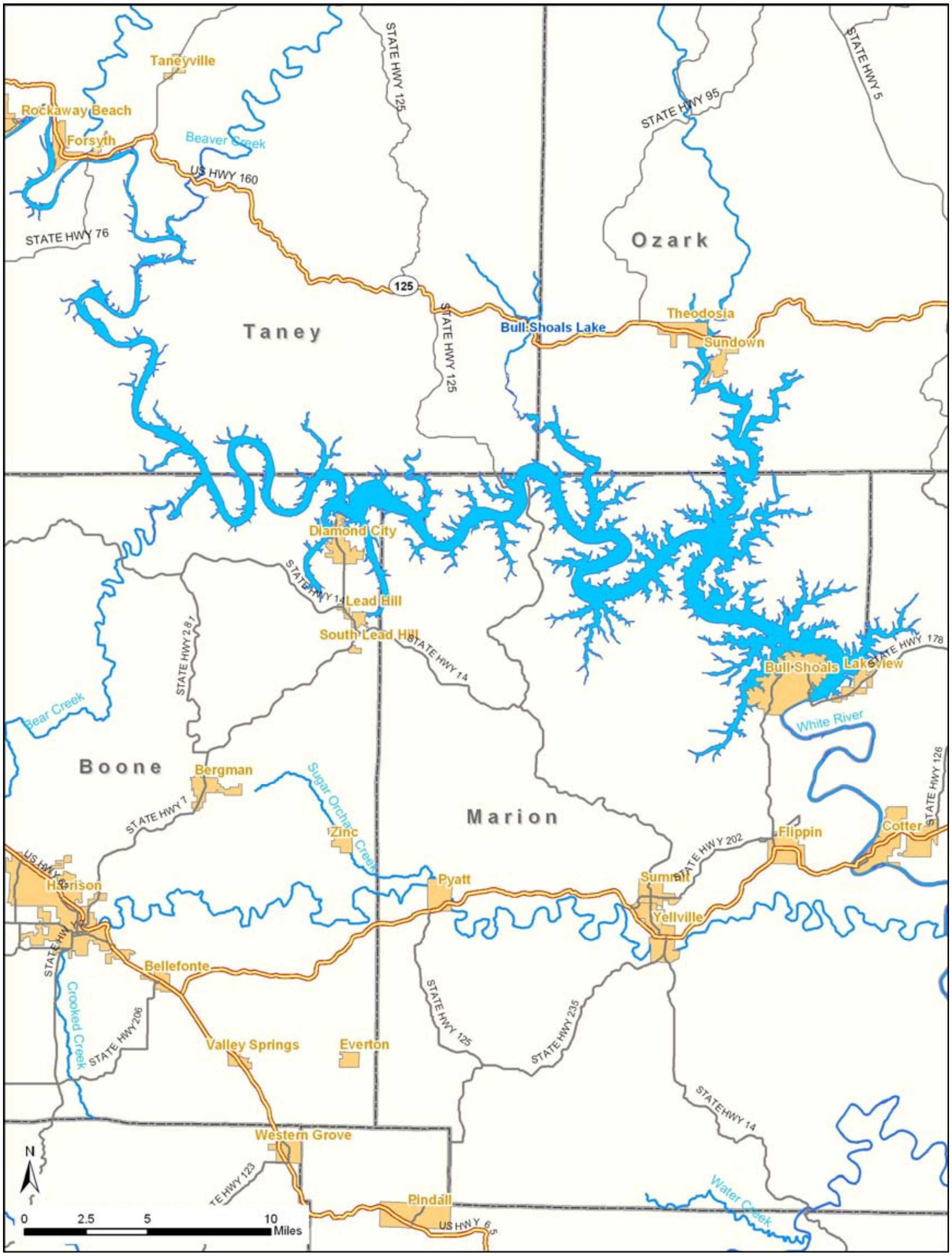


Figure 4.5 Bull Shoals Lake and Surrounding Area

Table 4.6 depicts the natural and recreational resource benefits that are derived from Bull Shoals Lake.

Table 4.6 Natural and Recreational Resource Benefits at Bull Shoals Lake

Social Benefits		
Facilities	**Visits (person-trips)**	**Benefits in Perspective**
- 30 recreation areas	- 5,552,500 in total	
- 89 picnic sites	- 277,625 picnickers	By providing opportunities for active recreation, Corps lakes
- 930 camping sites	- 30,371 campers	help combat one of the most significant of the nation's health
- 18 playgrounds	- 1,277,075 swimmers	problems: lack of physical activity.
- 14 swimming areas	- 166,575 water skiers	
- 13 trail miles	- 2,609,675 boaters	
- 1 fishing docks	- 2,221,000 sightseers	Recreational programs and activities at Corps lakes also help
- 28 boat ramps	- 2,887,300 fishermen	strengthen family ties and friendships; provide opportunities
- 13 marinas	- 333,150 hunters	for children to develop personal skills, social values, and
- 2,058 marina slips	- 888,400 others	self-esteem; and increase water safety.
Economic Benefits		
5,552,500 visits per year resulted in:		**Benefits in Perspective**
- $95.87 million in visitor spending within 30 miles of the Corps lake.		The money spent by visitors to Corps lakes on trip expenses adds to the local and national economies by supporting jobs and generating income. Visitor spending represents a sizable component of the economy in many communities around Corps lakes.
- 67% of the spending was captured by local economy as direct sales effects.		
With multiplier effect, visitor trip spending resulted in:		
- $122.22 million in total sales.		
- $65.36 million in total income.		
- Supported 3,277 jobs in the local community surrounding the lake.		
Environmental Benefits		
		Benefits in Perspective
- 62,326 land acres		
- 45,440 water acres		Recreation experiences increase motivation to learn more
- 740 shoreline miles		about the environment; understanding and awareness of
- 126 acres reforested		environmental issues; and sensitivity to the environment.
- 2,100 environmental education contacts		

Source: Value to the Nation web site at www.CorpsResults.us. Use Fast Facts to view this and other reports.

Public recreational support facilities are located in 19 parks operated by the Corps of Engineers, Arkansas State Parks, local governments and a marina. These parks include 18 boat ramps, 11 campgrounds, 13 picnic shelters, 11 marinas, seven designated swim areas, and hundreds of miles of undeveloped shoreline.

Park areas offer campsites, playgrounds, hiking trails, group picnic shelters, designated swimming areas, and boat-launching ramps. Over 740 miles of shoreline provide opportunities for photography, wildlife viewing, and relaxation. Fees are charged for the use of some facilities. Concessionaire-operated marinas provide boat and motor rentals, fuel and other related supplies and services.

Table 4.7 presents the amenities available and the various parks in the Bull Shoals Lake area.

Table 4.7 Bull Shoals Lake Recreation Areas and Amenities

Recreation Area	Public Launch Ramp	Designated Swim Beach	Group Picnic Shelter	Public Playground	Public Camp Ground	Electrical Outlets	Public Drinking Water	Waterborne Restrooms	Showers	Vault Toilet	Sanitary Dump Station	Marina	Marine Dump Station	Scuba Air	Café or Snack Bar	Lodging	Laundromat
Beaver Creek	•		•	•	•	•	•	•	•	•	•	•			✈	✈	✈
Buck Creek	•	•	•	•	•	•	•	•	•	•	•	•		✈	✈	✈	
Bull Shoals	•				•	•	•			•	✈	•	•	•	✈	✈	✈
Bull Shoals State Park	•		•	•	•	•	•	•			•	•			✈	✈	✈
Dam Site	•		•	•	•	•	•	•			•	✈			✈	✈	✈
Highway 125	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	
Highway K	•											•					
Kissee Mills					•												
Lakeview	•	•	•	•	•	•	•	•	•	•	•	•		✈	✈	✈	✈
Lead Hill	•	•	•	•	•	•	•	•	•	•	•	•	•	✈	✈	✈	✈
Oakland	•	•	•	•	•	•	•	•	•	•	•	•	•		✈	✈	✈
Ozark Isle	•			•	•	•	•	•	•	•		✈	✈		✈	✈	✈
Point Return	•	•	•	•	•		•			•	•	✈			✈	✈	
Pontiac	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	✈	
River Run	•			•	•	•	•	•	•	•	•	✈			✈	✈	✈
Shadow Rock	•		•	•	•	•	•	•	•		•				✈	✈	✈
Spring Creek	•																
Theodosia	•	•	•	•	•	•	•	•	•	•	•	•			•	•	✈
Tucker Hollow	•		•	•	•	•	•	•	•	•	•	•				•	
Woodward	•															✈	

• = Available on Project Lands ✈ = Available Nearby

Source: White River Basin, Minimum Flows FEIS, Revised Jan. 2009, USACE.

Trout fishing in northwest Arkansas and southwest Missouri is not only a favorite recreational pursuit but also generates a significant, positive contribution to state and regional economies. The trout fisheries in Arkansas are unique, as they are non-native to Arkansas waters. Except for brown trout, the trout fishery in these waters is largely a put and take population. There is little doubt that a significant number of trout fishermen originate out of the Ozark region to enjoy these 'world class' fisheries. When implemented, the increased minimum flow for the White River will result in an increased wetted perimeter and water quality benefits for the tail water fishery.

Numerous sport fishing magazines have described the Corps tailwaters as some of the best trout fishing streams in the world. The current all tackle world record brown trout was caught in the Little Red River (the Greers Ferry Lake tail water) in 1992. It weighed 40 lbs 4 oz. Large brown and rainbow trout are present in the White River waters in Arkansas and Missouri. The current Missouri state record brown trout was taken from Lake Taneycomo in 2005 and weighed 27 lbs 10 oz.

Growth rates as high as three pounds per year have historically been reported in the White River system. However, these good fisheries are far short of the fishery, stream ecology, recreation and economic potentials that could be realized with increased minimum flows.

It is important to keep in mind that the life expectancy of naturally occurring trout is on the average four to eight years. In put-and- take fisheries a very large portion of the rainbow trout are caught annually and replenished by stocking. The brown trout persist for longer periods since they are generally harder to catch than rainbows. The larger trout take several years to acquire memorable and trophy sizes (USACE, 1989). In 1987, Barnes and Hudy indicated that more trophy size brown trout exist per mile in some reaches of the White River than any other river in the world.

4.9 Hazardous, Toxic and Radioactive Waste

A limited HTRW investigation was performed for the Bull Shoals Lake project area in general accordance with guidance from ER 1165-2-132 and ASTM Standard E 2247-08, *Environmental Site Assessments: Phase I Environmental Site Assessment Process for Forestland or Rural Property*. The goal of this effort is to identify recognized environmental condition (REC) sites or potential REC sites in connection with the study area. The following is a summary of the initial investigation.

An environmental database search was completed by Banks Environmental Data, Inc. (Banks) to locate REC sites within the area surrounding Bull Shoals Lake. Ten federal and 11 state databases were reviewed. The environmental database report developed by Banks includes reports on each REC site tracked with information about the cause(s) for listing and the site’s current status. This information is utilized to determine which, if any, sites warrant scrutiny for the potential presence of HTRW.

4.9.1 Limitations

This limited HTRW assessment was conducted in general accordance with guidelines set forth by Part 7 of ER 1165-2-132 and ASTM Standard E 2247-08. Accordingly, no guarantee is made or intended that all site conditions were observed or that all records were reviewed.

Much of the information provided in the report was compiled from public records and other sources maintained by third parties. Although reasonable care was exercised in its preparation, The USACE cannot be held responsible for errors, omissions, or inaccurate information from third parties.

Finally, any changes in project actions from those provided the USACE may render the recommendations and conclusions presented in this report void.

4.9.2 Environmental Database Review

A thorough search of Federal, state, and local government web-based environmental databases was conducted to obtain and review records and documents that would aid in identifying known or potential environmental concerns in or near the study area.

Table 4.9 provides the results of the search for potential REC sites listed in federal and state environmental databases as part of the environmental records review for the study area. In addition to plottable sites, a search for orphan sites (sites that are only identified as being within the same ZIP code[s] as the property) was conducted. Maps of plottable sites from all databases reviewed are presented in the complete Banks report, a copy of which can be obtained upon request to the USACE, Little Rock District, Environmental Planning Branch, ATTN: Mr. Michael Rodgers, 700 West Capitol Avenue, Little Rock, AR 72201.

4.9.3 Findings

A summary of the results of the search for potential REC sites as outlined in the environmental database report are presented in Table 4.8. The fact that 28 sites of registered underground storage tanks (USTs) or aboveground storage tanks (ASTs) exist within the search area is not a significant concern, as this is typical throughout the country. The two reported leaking USTs (LUSTs) appear to have been removed and/or cleaned up several years ago. The one spill reported appears to be a small quantity of gasoline that occurred at a service station, which should not present a threat to Bull Shoals Lake.

4.10 Socioeconomics

The region of economic impact consists of 47 counties spread across two states. Thirty-three counties, the majority, are in Arkansas. The remaining 14 counties are in southern Missouri. These counties represent the Bull Shoals survey area. Table 4.9 shows historical, current, and projected population counts of the counties and the states.

Population growth for the study area has been mixed over the past 20 years. Thirty-nine of the 47 counties had population increases during the past 20 years, three counties had decreases in population and five counties had population decreases in the 1980s and increases during the 1990s. Population forecasts show a similar trend through 2005; six counties are estimated to have population declines while the remaining counties are estimated to have increases. Data was not available for eight of 14 Missouri counties. The states of Arkansas and Missouri have had below average growth when compared to the National statistic, 15.9 percent. Arkansas' and Missouri's populations increased 13.7 and 9.3 percent during the 1990s, respectively. Although

both states had population increases that were below that of the National statistic, 32 of the 47 counties had population increases that were greater than the National increase; the range of growth for the counties is -8.2 percent (Woodruff, Arkansas) to 66.3 percent (Christian, Missouri).

Table 4.8 Environmental Database Research Results Summary for Bull Shoals Lake

Database	Radius (mi)	Site	1/8 mile	1/4 mile	1/2 mile	>1/2 mile	Orphan	Totals
Federal								
NPL	1.00	---	---	---	---	---	---	0
NPL De-listed	0.50	---	---	---	---		---	0
CERCLIS	0.50	---	---	---	---		---	0
NFRAP	0.50	---	---	---	---		---	0
RCRA TSD	0.50	---	---	---	---		---	0
RCRA COR ACT	1.00	---	---	---	---	---	---	0
RCRA GEN	0.25	---	---	---			---	0
ERNS	0.25	---	---	---			---	0
Federal IC/EC	0.50	---	---	---	---		---	0
Tribal Lands	1.00	---	---	---	---	---	---	0
State								
State/Tribal Sites	1.00	---	---	---	---	---	---	0
State/Tribal SWL	0.50	---	---	---	---		---	0
State Spills 90	0.25	1	---	---			---	1
State/Tribal UST/AST	0.25	---	---	---			28	28
State/Tribal LUST	0.50						2	2
State/Tribal EC	0.50	---	---	---	---		---	0
State/Tribal IC	0.25	---	---	---			---	0
State/Tribal VCP	0.50	---	---	---	---		---	0
State/Tribal Brownfields	0.50	---	---	---	---		---	0
State Other	0.25	---	---	---			---	0
Totals		1	---	---	---	---	30	31

Notes:
1. --- indicates no sites/items were found.
2. LUST and UST values represent facilities, some of which contain multiple tanks.
3. Some sites are listed in multiple databases.
4. Orphan sites are sites are those that are in the databases within the zip codes searched, but are not plottable on maps due to an absence of GIS data.
5. Shaded areas indicate search not required per ASTM Standard E2247-08.

Source: Banks Information Solutions, Inc., 2009.

Table 4.9 County and State Populations

County / State	1980 Popuation	1990 Popuation	Percent Change 1980 - 1990	2000 Population	Percent Change 1990 - 2000	2005 Population Estimate[1]
ARKANSAS	*2,286,435*	*2,350,725*	*2.8%*	*2,673,400*	*13.7%*	*2,794,974*
Baxter, AR	27,409	31,186	13.8%	38,386	23.1%	39,931
Benton, AR	78,115	97,499	24.8%	153,406	57.3%	186,540
Boone, AR	26,067	28,297	8.6%	33,948	20.0%	35,846
Calhoun, AR	6,079	5,826	-4.2%	5,744	-1.4%	5,670
Carroll, AR	16,203	18,654	15.1%	25,357	35.9%	27,272
Cleburne, AR	16,909	19,411	14.8%	24,046	23.9%	26,142
Conway, AR	19,505	19,151	-1.8%	20,336	6.2%	20,655
Crawford, AR	36,892	42,493	15.2%	53,247	25.3%	58,122
Faulkner, AR	46,192	60,006	29.9%	86,014	43.3%	96,916
Franklin, AR	14,705	14,897	1.3%	17,771	19.3%	18,387
Fulton, AR	9,975	10,037	0.6%	11,642	16.0%	12,017
Independence, AR	30,147	31,192	3.5%	34,233	9.7%	35,320
Izard, AR	10,768	11,364	5.5%	13,249	16.6%	13,344
Jackson, AR	21,646	18,944	-12.5%	18,418	-2.8%	16,889
Johnson, AR	17,423	18,221	4.6%	22,781	25.0%	23,536
Logan, AR	20,144	20,557	2.1%	22,486	9.4%	22,845
Lonoke, AR	34,518	39,268	13.8%	52,828	34.5%	59,278
Madison, AR	11,373	11,618	2.2%	14,243	22.6%	15,059
Marion, AR	11,334	12,001	5.9%	16,140	34.5%	16,739
Newton, AR	7,756	7,666	-1.2%	8,608	12.3%	8,760
Perry, AR	7,266	7,969	9.7%	10,209	28.1%	10,760
Pope, AR	39,021	45,883	17.6%	54,469	18.7%	57,377
Prairie, AR	10,140	9,518	-6.1%	9,539	0.2%	9,316
Pulaski, AR	340,613	349,660	2.7%	361,474	3.4%	368,133
Searcy, AR	8,847	7,841	-11.4%	8,261	5.4%	8,196
Sebastian, AR	95,172	99,590	4.6%	115,071	15.5%	121,443
Sharp, AR	14,607	13,637	-6.6%	17,119	25.5%	17,928
Stone, AR	9,022	9,775	8.3%	11,499	17.6%	11,883
Van Buren, AR	13,357	14,008	4.9%	16,192	15.6%	16,697
Washington, AR	100,494	113,409	12.9%	157,715	39.1%	177,709
White, AR	50,835	54,676	7.6%	67,165	22.8%	72,352
Woodruff, AR	11,222	9,520	-15.2%	8,741	-8.2%	8,162
Yell, AR	17,026	17,759	4.3%	21,139	19.0%	21,943
MISSOURI	*4,916,686*	*5,117,073*	*4.1%*	*5,595,211*	*9.3%*	*N/A*
Barry, MO	24,408	27,547	12.9%	34,010	23.5%	35,179
Christian, MO	22,402	32,644	45.7%	54,285	66.3%	N/A
Dallas, MO	12,096	12,646	4.5%	15,661	23.8%	N/A
Douglas, MO	11,594	11,876	2.4%	13,084	10.2%	N/A
Greene, MO	185,302	207,949	12.2%	240,391	15.6%	N/A
Howell, MO	28,807	31,447	9.2%	37,238	18.4%	37,930
Lawrence, MO	28,973	30,236	4.4%	35,204	16.4%	N/A
McDonald, MO	14,917	16,938	13.5%	21,681	28.0%	22,128
Newton, MO	40,555	44,445	9.6%	52,636	18.4%	N/A
Ozark, MO	7,961	8,598	8.0%	9,542	11.0%	9,538
Polk, MO	18,822	21,826	16.0%	26,992	23.7%	N/A
Stone, MO	15,587	19,078	22.4%	28,658	50.2%	31,160
Taney, MO	20,467	25,561	24.9%	39,703	55.3%	44,029
Webster, MO	20,414	23,753	16.4%	31,045	30.7%	N/A

[1] Population estimates obtained from the Center for Business and Economic Research, University of Arkansas

Source: White River Basin, Minimum Flows FEIS, Revised January 2009, USACE.

The cost of water supply storage in a public reservoir to a public water system, which is ultimately passed on to the consumer, is affected by the income status of the counties served by the water system, as defined by Section 322 of the Water Resources Development Act of 1990.

Provision of reduced pricing of water supply storage space for low income communities is contained in Section 322. That statute reads as follows:

Sec. 322. REDUCED PRICING FOR CERTAIN WATER SUPPLY STORAGE.

- *(h) Provision of Storage Space – If a low income community requests the Secretary to provide water supply storage space in a water resources development project operated by the Secretary and if the amount of space requested is available or could be made available through reallocation of water supply storage space in the project or through modifications to operation of the project, the Secretary may provide such space to the community at a price determined under subsection (c)*
- *(i) Maximum Amount of Storage Space – The maximum amount of water supply storage space which may be provided to a community under this section may not exceed an amount of water supply storage space sufficient to yield 2,000,000 gallons of water per day.*
- *(j) Price – The Secretary shall provide water supply storage space under this section at a price which is the greater of –*
  - *a. The updated construction cost of the project allocated to provide such an amount of water supply storage space or $100 per acre foot of storage space, whichever is less; and*
  - *b. The value of the benefits which are lost as a result of providing such water supply storage space.*
- *(k) Determinations – For purposes of subsection (c), the determinations of updated construction costs and value of benefits lost shall be made by the Secretary on the basis of the most recent information available.*
- *(l) Inflation Adjustment of Dollar Amount – The $100 amount set forth in subsection (c) shall be adjusted annually by the Secretary for changes in the Consumer Price Index of All Urban Consumers published by the Bureau of Labor Statistics.*
- *(m) Non-Federal Responsibilities – Nothing in this section shall be construed as affecting the responsibility of non-Federal interests to provide operation and maintenance costs assigned to water supply storage provided under this section.*
- *(n) Low Income Community Defined – The term "low income community" means a community with a population of less than 20,000 which is located in a county with a per capita income less than the per capita income of two-thirds of the counties in the United States.*

The communities which form the OMRPWA are located within Boone, Johnson, Newton, Marion, Pope, and Searcy counties in Arkansas. Each community has a population of less than 20,000 (as seen in Table 4.1) and has a current average daily usage of less than 2,000,000 gallons of water per day. With future growth and higher per capita usage, each community would still have a current average daily usage of less than 2,000,000 gallons of water per day. The U.S. has 3,092 counties, including the District of Columbia. When their per capita income is ranked highest to lowest, the lowest third of counties are ranked 1 to 1,036. Given the most recent income data from the Economic Guidance Memorandum #09-05, the counties' per capita income is provided in Table 4.10. Almost all of the area serviced by OMPWRA is located in the five counties which fall within the lowest third of counties and for which Section 322 reduced pricing is available. Only Pope County does not fall within the lowest third of counties and only a small portion of the area served by OMPWRA falls within Pope County.

Table 4.10 County Per Capita Income (1999)

County	Income	County Rank
Pope	$25,693	1,098
Boone	$25,422	1,026
Marion	$22,075	343
Johnson	$21,495	267
Newton	$19,620	96
Searcy	$19,373	80
Lowest Third	$25,477	1,036

The total storage reallocation for OMRPWA is 10,188.463 ac-ft to provide an estimated yield of 6,000,000 gallons per day. Of that total, 10,096.675 ac-ft, estimated to yield 5,946,000 gallons per day, is eligible for the reduced pricing for low income communities. Using the reduced pricing, the cost of this storage will be $1,669,990, rather than the $2,031,889 based on the standard calculation of updated cost of storage. Table 4.11 provides the calculation. The reduced price of $165.40 for each acre foot was determined by indexing $100 per acre foot to 2010 price levels using the Consumer Price Index. Per Section 322, the price so adjusted must be lower than the updated cost of storage, but greater than the value of benefits lost for providing such storage space. As shown in Table 5.17, that is the case here--$1,669,990 is less than the standard updated cost of storage and more than the $77,927 in hydropower benefits foregone.

The part of the OMRPWA system servicing Pope County is the Lurton-Pelsor Water Association (LWPA), representing .9% of the average daily use served by OMRPWA. The LWPA serves a remote rural area spanning the Newton-Pope County line that includes the small communities of Lurton in Newton County and Pelsor in Pope County. Pelsor and the surrounding area are isolated from the rest of Pope County by the Ozark National Forest. They rely on Newton County for several public services, including water and fire protection, and share a zip code centered in Newton County. The pricing of the 91.788 ac-ft of storage necessary to yield 54,000 gallons per day for the LWPA is under consideration by the Department of the Army, but will be no more than the updated cost of storage for this storage, which is $18,472. Summing the two portions of the system, total cost of storage for OMRPWA will be not more than $1,688,462 at FY2010 (October 2009) price level.

The communities which form MCRWD are located in Marion County, Arkansas. In Marion County, each community has a population of less than 20,000 (with the largest town, Bull Shoals, having a population of 2,138). MCRWD is requesting storage that yields less than 2,000,000 gallons of water per day. Marion County has a per capita income less than the per capita income of two-thirds of the counties in the United States. Given that MCRWD meets the terms of eligibility for a “low income community” the cost of the storage is calculated using the reduced price of $165.40 for each acre foot ($100 per acre foot indexed to 2010 price levels using the Consumer Price Index). Table 4.11 provides the calculation. The adjusted Low Income Price is lower than the updated cost of storage, and greater than the value of benefits lost for providing such storage space. Therefore, the cost of storage to MCRWD is $280,861.

Table 4.11 Low Income Price Adjusted for Inflation

	1990 price	CPI 1990	CPI OCT 2009	2010 price per ac-ft	Acre Feet	Low-Income Cost of Storage
OMRPWA Agreement No. 1	$100	130.7	216.177	$165.40	10,096.675	$1,669,990
MCRWD	$100	130.7	216.177	$165.40	1,698.077	$280,861

(NOTE: Pricing for OMPWRA Agreement No. 2 for 91.788 ac-ft is under consideration, but would not be more than the standard updated cost of storage of $18,472.)

4.11 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations. On February 11, 1994, President Clinton issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations.

The purpose of this executive order is to avoid the disproportionate placement of adverse environmental, economic, social, or health impacts from Federal actions and policies on minority and low-income populations or communities. An element emanating from this order was the creation on an Interagency Federal Working Group on Environmental Justice comprised of the heads of seventeen Federal departments and agencies, including the U.S. Army. Each department or agency is to develop a strategy and implementation plan for addressing environmental justice.

It is U.S. Army Corps of Engineers policy to fully comply with Executive Order 12898 by incorporating environmental justice concerns in decision-making processes supporting Army policies, programs, projects, and activities. In this regard, the Army ensures that it would identify, disclose, and respond to potential adverse social and environmental impacts on minority and/or low-income populations within the area affected by a proposed Army action. The initial step in this process is the identification of minority and low-income populations that might be affected by implementation of the proposed action or alternatives. For environmental justice considerations, these populations are defined as individuals or groups of individuals, which are subject to an actual or potential health, economic, or environmental threat arising from existing or proposed Federal actions and policies. Low income is defined as the aggregate annual mean income for a family of four in 2000 of $17,601.

The race and income demographics of the three counties also differ from State and National statistics. Table 4.12 details the race populations, per capita income, and poverty levels for the 47 counties, Arkansas, and Missouri.

The study area race profile is predominantly white with only a few of the counties having non-white populations that make up more than 10 percent of the population. Of the 47 counties 36 have non-white populations that make up less than 10 percent of the population. This contrast is also apparent when compared to the non-white population percentages of the states and nation. Arkansas' and Missouri's non-white population percentages are 20 percent and 15.1 percent, respectively; and the National percentage is 24.9 percent. Forty-four of the 47 counties have non-white populations that are less than National percentage. This difference is most likely a result of the study area rural location. The race profile non-white population range is from 1.8 percent (Cleburne, Arkansas) to 36.0 percent (Pulaski, Arkansas).

Income statistics for the study area are also well off state and national values. Forty of the 47 counties in the study area have per capita income below their respective state's value. Arkansas and Missouri per capita income, in 1999 dollars, was $16,904 and $19,936, respectively. The National statistic is $21,587; when comparing the counties to the National value, all 47 counties have per capita income less than $21,587. The per capita income range is from $12,536 (Searcy, Arkansas) to $21,466 (Pulaski, Arkansas). Again, this contrast is most likely a result of the rural location of the study area. Almost all of the OMPWRA service area is located in the five counties which fall within the lowest third of counties and for which Section 322 reduced pricing is available. Only Pope County does not fall within the lowest third of counties and only a small portion of the area served by OMPWRA falls within Pope County. The part of the OMRPWA system servicing Pope County is the Lurton-Pelsor Water Association (LWPA), representing .9% of the average daily use served by OMRPWA. The LWPA serves a remote rural area spanning the Newton-Pope County line that includes the small communities of Lurton in Newton County and Pelsor in Pope County. Pelsor and the surrounding area are isolated from the rest of Pope County by the Ozark National Forest. They rely on Newton County for several public services, including water and fire protection, and share a zip code centered in Newton County. The pricing of the 91.788 ac-ft of storage for LWPA is under consideration by the Department of the Army, but will be no more than the updated cost of storage. Marion County, supplied by MCRWD, is eligible for the status of "low income community;" and, therefore MCRWD is eligible under Section 322 for a reduced cost of storage for the reallocated water storage at Bull Shoals Lake.

Lastly, the study area's poverty levels are below their respective state value, but not to the severity of the latter two categories. The percentage of persons in poverty for 24 of the 47 counties is above that of Arkansas and Missouri values of 15.8 percent and 11.7 percent, respectively. When compared to the National statistic of 12.4 percent, 41 of the 47 counties have a greater percentage of poverty. The poverty statistics range is from 9.1 percent (Christian, Missouri) to 27.0 percent (Woodruff, Arkansas).

Table 4.12 County and State Race, Income, and Poverty Data

County / State	Total Race Population	White Population	% Non-White Pop. (2000)	Per Capita Income (1999 $'s)	% Persons in Poverty (1999 %)
ARKANSAS	*2,673,400*	*2,138,598*	20.0%	$16,904	15.8%
Baxter, AR	38,386	37,547	2.2%	16,859	11.1%
Benton, AR	153,406	139,399	9.1%	19,377	10.1%
Boone, AR	33,948	33,132	2.4%	16,175	14.8%
Calhoun, AR	5,744	4,280	25.5%	15,555	16.5%
Carroll, AR	25,357	23,741	6.4%	16,003	15.5%
Cleburne, AR	24,046	23,613	1.8%	17,250	13.1%
Conway, AR	20,336	17,137	15.7%	16,056	16.1%
Crawford, AR	53,247	49,087	7.8%	15,015	14.2%
Faulkner, AR	86,014	75,973	11.7%	17,988	12.5%
Franklin, AR	17,771	17,091	3.8%	14,616	15.2%
Fulton, AR	11,642	11,371	2.3%	15,712	16.3%
Independence, AR	34,233	32,490	5.1%	16,163	13.0%
Izard, AR	13,249	12,773	3.6%	14,397	17.2%
Jackson, AR	18,418	14,840	19.4%	14,564	17.4%
Johnson, AR	22,781	21,344	6.3%	15,097	16.4%
Logan, AR	22,486	21,690	3.5%	14,527	15.4%
Lonoke, AR	52,828	48,089	9.0%	17,397	10.5%
Madison, AR	14,243	13,665	4.1%	14,736	18.6%
Marion, AR	16,140	15,740	2.5%	14,588	15.2%
Newton, AR	8,608	8,385	2.6%	13,788	20.4%
Perry, AR	10,209	9,762	4.4%	16,216	14.0%
Pope, AR	54,469	51,055	6.3%	15,918	15.2%
Prairie, AR	9,539	8,092	15.2%	15,907	15.5%
Pulaski, AR	361,474	231,211	36.0%	21,466	13.3%
Searcy, AR	8,261	8,035	2.7%	12,536	23.8%
Sebastian, AR	115,071	94,745	17.7%	18,424	13.6%
Sharp, AR	17,119	16,630	2.9%	14,143	18.2%
Stone, AR	11,499	11,185	2.7%	14,134	18.9%
Van Buren, AR	16,192	15,673	3.2%	16,603	15.4%
Washington, AR	157,715	138,796	12.0%	17,347	14.6%
White, AR	67,165	62,811	6.5%	15,890	14.0%
Woodruff, AR	8,741	5,932	32.1%	13,269	27.0%
Yell, AR	21,139	18,312	13.4%	15,383	15.4%
MISSOURI	*5,595,211*	*4,748,083*	15.1%	$19,936	11.7%
Barry, MO	34,010	31,999	5.9%	14,980	16.6%
Christian, MO	54,285	52,824	2.7%	18,422	9.1%
Dallas, MO	15,661	15,262	2.5%	15,106	17.9%
Douglas, MO	13,084	12,673	3.1%	13,785	17.5%
Greene, MO	240,391	224,859	6.5%	19,185	12.1%
Howell, MO	37,238	35,902	3.6%	13,959	18.7%
Lawrence, MO	35,204	33,682	4.3%	15,399	14.1%
McDonald, MO	21,681	19,440	10.3%	13,175	20.7%
Newton, MO	52,636	49,086	6.7%	17,502	11.6%
Ozark, MO	9,542	9,310	2.4%	14,133	21.6%
Polk, MO	26,992	26,253	2.7%	13,645	16.3%
Stone, MO	28,658	27,983	2.4%	18,036	12.8%
Taney, MO	39,703	38,202	3.8%	17,267	12.4%
Webster, MO	31,045	29,866	3.8%	14,502	14.8%

Source: White River Basin, Minimum Flows FEIS, Revised January 2009, USACE.

Economic activity in the study area is varied, but each county hosts a majority of North American Industry Classification System (NAICS) sectors. The Arkansas counties account for nearly two-thirds of the persons employed in the state; this is due in part to the inclusion of Pulaski County, which accounts for 22 percent of the persons employed in the state. Annual payroll in the study area is greater than $16.8 billion; over 68 percent of total payroll in the state, and again this is in large part to Pulaski County, which accounts for 26 percent of the state total annual payroll. Arkansas also has a total of 63,185 business establishments, of which, over 61 percent are located in the study area. Pulaski County accounts for over 12,000 establishments or 19.1 percent.

The Missouri counties account for a less robust portion of their state profile in most part because only 14 counties from Missouri were included in the study area. The number of persons employed, annual payroll, and total business establishments are 247,423, $5.6 billion, and 16,900, respectively. This accounts for 10.3, 7.9, and 11.7 percent of the Missouri totals.

See the discussion on low income community status under Section 322 of WRDA (1999) in Section 4.10 and how that affects water supply storage costs passed on to the consumer.

Section 5.0 Environmental Consequences

5.0 ENVIRONMENTAL CONSEQUENCES

Evaluation of the environmental consequences that are expected to result from the implementation of the proposed action is accomplished by a comparison of the "future without project conditions" (the No-Action Alternative) to the "future with project conditions" the (Proposed Action Alternatives).

It must also be emphasized here that both the future with and without project conditions include the implementation of the WRMF Project, which results in the raising of normal pool levels in Bull Shoals Lake a maximum of approximately five feet. The impacts of that action have been fully addressed in the *Final Environmental Impact Statement, White River Basin, Arkansas, Minimum Flows, Revised January 2009*.

It is also reiterated here that this EA incorporates by reference the EA and FONSI completed and signed by RUS for the new OMRPWA water transmission system and all of its components; i.e., the water intake facility at Bull Shoals Lake, the water treatment plant, pumping stations, and pipeline distribution network. Therefore, none of those specific components are addressed again in this EA, rather any impacts from that project are taken into account under the existing conditions considerations.

The action alternatives addressed in this EA analyze the future with project conditions under three separate scenarios: reallocation from the conservation pool; reallocation from the flood pool; and, reallocation from the inactive pool. Only one of the considered action alternatives results in a physical difference to lake levels, reallocation from the flood pool (Alternative 3), raises the top of the conservation pool by approximately 0.25 ft. (3 inches). Reallocation from the inactive pool (Alternative 4) would lower the top of the inactive pool by approximately 0.36 ft. (4 inches), but does not have any physical effect on the lake surface level.

Therefore, the final alternatives considered for assessing environmental impacts in this EA are: Alternative No. 1 – No-Action; Alternative No. 2 – Reallocation from the Conservation Pool (the Proposed Action); Alternative No. 3 – Reallocation from the Flood Pool; and, Alternative No. 4 – Reallocation from the Inactive Pool.

The Proposed Action is Alterative No. 2 – Reallocation from the Conservation Pool.

5.1 Land Use

<u>Alternative 1 – No-Action:</u> No changes to land use are expected under this alternative.

<u>Alternative 2 – Reallocation from the Conservation Pool:</u> Because this alternative involves no construction, no direct impacts to land use are expected from the proposed action. However, an indirect effect may be the increase in land development as a result of the project area becoming more attractive to recreation/vacation seekers, as well as new permanent residents with the improvements to drinking water quality and the quantity of water available that this project will bring. This increase in population and business ventures would possibly result in more land being converted from undeveloped to commercial or residential use; although, this would be expected to be gradual and take place over an extended period of time.

<u>Alternative 3 – Reallocation from the Flood Pool:</u> Anticipated impacts would be similar to those under Alternative 2.

Alternative 4 – Reallocation from the Inactive Pool: Anticipated impacts would be similar to those under Alternative 2.

5.2 Geology/Soils/Prime Farmlands

Alternative 1 – No-Action: No changes to these related resources are anticipated under this alternative.

Alternative 2 – Reallocation from the Conservation Pool: Because the proposed action involves no construction of facilities and results in no changes to lake levels, it is not expected that there will be any effects to geological formations, floodplains, soils, or prime farmlands within the project area.

Alternative 3 – Reallocation from the Flood Pool: Anticipated impacts would be similar to those under Alternative 2.

Alternative 4 – Reallocation from the Inactive Pool: Anticipated impacts would be similar to those under Alternative 2.

5.3 Water Resources

5.3.1 Surface Waters

Alternative 1 – No-Action: No impacts to surface waters are expected under this alternative.

Alternative 2 – Reallocation from the Conservation Pool: Because this alternative results in no changes to lake water levels or quality, no significant impacts to surface waters are expected under this alternative. Calculations by the USACE SUPER computer model for impacts caused by water storage reallocations show minor beneficial impacts to flood control, hydropower and recreational resources (quantified in dollar amounts) within the proposed project area. Please see Table 5.11 of the Reallocation Report for a summary of these impacts.

Alternative 3 – Reallocation from the Flood Control Pool: This alternative would result in a slight rise in the pool level (approximately 0.25 ft.), but it is not considered significant due to normal slight changes in the pool level due to physical influences such as precipitation events, evaporation, wind, droughts, etc. No other impacts to surface waters are expected under this alternative.

Alternative 4 – Reallocation from the Inactive Pool: Anticipated impacts would be similar to those under Alternative 2.

5.3.2 Ground Water/Aquifers

Alternative 1 – No-Action: No impacts to ground water or aquifers are expected under this alternative. However, in the absence of a water supply plan, the population of north central Arkansas would continue to lack enough good quality drinking water available at a reasonable cost and would experience the continued threat to their life and health due to long term exposure to the radioactive pollutants in the existing water supply from ground water. They would also continue to be at risk for their safety due to a lack of water for emergency services.

Alternative 2 – Reallocation from the Conservation Pool: This alternative will not result in any changes to ground water levels or affect ground water in any way; therefore, no impacts to ground water quality are expected under this alternative.

Alternative 3 – Reallocation from the Flood Control Pool: Anticipated impacts would be similar to those under Alternative 2.

Alternative 4 – Reallocation from the Inactive Pool: Anticipated impacts would be similar to those under Alternative 2.

Under Alternatives 2 through 4 above, current ground water levels, which are lower within the cone of depression around withdrawal wells under heavy use, may recover slightly with reduced use of ground water for M&I by OMRPWA.

5.3.3 Surface Water Quality

Alternative 1 – No-Action: No impacts to surface water quality are expected under this alternative.

Alternative 2 – Reallocation from the Conservation Pool: Because surface waters will not be impacted under this alternative, no impacts to surface water quality are expected under this alternative.

Alternative 3 – Reallocation from the Flood Control Pool: Anticipated impacts would be similar to those under Alternative 2.

Alternative 4 – Reallocation from the Inactive Pool: Anticipated impacts would be similar to those under Alternative 2.

5.3.4 Hydropower

Alternative 1 – No-Action: No changes to hydropower are anticipated under this alternative.

Alternative 2 – Reallocation from the Conservation Pool: Under the proposed action alternative, reallocation of storage from the conservation pool storage for the M&I water needs would reduce the amount of storage available in the lake for other purposes such as hydropower generation.

Hydropower benefits are based on the cost of the most likely alternative source of power. When storage is reallocated for water supply and an impact occurs to hydropower, the power benefits foregone are equivalent to the cost of replacing the lost power with the most likely alternative source of power.

The power benefits foregone can be divided into two components: (1) The lost energy benefits and (2) lost capacity benefits. In the case of water supply withdrawals, there is usually a loss of energy benefits, and lost energy benefits are based on the loss in generation (both at-site and downstream) as a result of water being diverted from the reservoir for water supply rather than passing through the hydro plant.

The second power-related cost is the revenue foregone.

"The Corps does not market the power it produces; marketing is done by the Federal power marketing agencies (Southeastern Power Administration, Southwestern Power Administration, Western Area Power Administration, Bonneville Power Administration, Alaska Power Administration) through the Secretary of Energy." ER 1105-2-100, Planning Guidance Notebook (22 April 2000), Appendix E, paragraph E-42, b(2).

This is the value of the lost hydropower based on the PMA's (power marketing agency) current energy rates.

There will be some negative impact to hydropower benefits at the Bull Shoals Dam Power Generation Station. Table 5.1 summarizes hydropower benefits foregone due to storage reallocation from conservation storage, flood control storage, and inactive storage in Bull Shoals Lake.

Table 5.1 Annual Power Benefits Foregone Due to Reallocation of Storage in Bull Shoals Lake

Alternative	Hydropower Benefits Foregone
Conservation Pool	$77,927.00
Flood Control Pool	$56,334.00
Inactive Pool	$73,368.00

In addition to hydropower benefits foregone as a result of the proposed action, there will also be some hydropower revenues foregone. Table 5.2 summarizes power revenues forgone due to proposed action alternatives.

Table 5.2 Hydropower Revenue Foregone Due to Reallocation in Bull Shoals Lake

Alternative	Hydropower Revenue Foregone
Conservation Pool	$19,935.00
Flood Control Pool	$12,295.00
Inactive Pool	$18,509.00

For a more detailed discussion on hydropower benefits and revenues foregone, please see Section 5.2.1 of the Water Supply Storage Reallocation Report and Section 4.4.4 of this EA.

<u>Alternative 3 – Reallocation from the Flood Pool:</u> Lake levels are expected to increase by approximately 0.25 foot (3 inches). See Tables 5.1 and 5.2 above for annual hydropower benefits and revenues foregone under this alternative.

<u>Alternative 4 – Reallocation from the Inactive Pool:</u> See Tables 5.1 and 5.2 above for annual hydropower benefits and revenues foregone under this alternative.

5.4 Cultural Resources

Alternative 1 – No-Action: Because this alternative involves no construction or land disturbance activities, no cultural resources within the project area will be impacted by this alternative.

Alternative 2 – Reallocation from the Conservation Pool: No cultural resources with the project area will be impacted by this alternative. The Arkansas SHPO replied to the coordination letter submitted for the proposed project that no known historic properties will be affected by this undertaking. A copy of the coordination letter with the reply affixed (stamped and signed) is included in Attachment 1.

Ms. Judith Deel with the Missouri SHPO stated in a telephone conversation on the proposed project that with the reallocation of water supply in Bull Shoals Lake resulting in a less than one-foot change in lake water levels and no new construction occurring on the Missouri side of the lake, there would be little to no impact on cultural resources. Ms. Deel also stated that if the change in the normal operating level of the lake was ever determined to be greater than one foot, further coordination would be required. A copy of the email message from the archaeologist who conducted the telephone interview, documenting Ms. Deel's response, is included in Attachment.

The only known members of a recognized Native American Tribe to be within the proposed project area are of the Osage who are mainly located north of the Bull Shoals Lake area. No comments were received by the Osage Nation.

Alternative 3 – Reallocation from the Flood Pool: Anticipated impacts would be similar to those under Alternative 2.

Alternative 4 – Reallocation from the Inactive Pool: Anticipated impacts would be similar to those under Alternative 2.

5.5 Biological Resources

Alternative 1 – No-Action: No impacts are expected to biological resources under the No-Action Alternative.

Alternative 2 – Reallocation from the Conservation Pool: The proposed action alternative will have no physical effect on lake surface levels. Although several protected species are located within the project area, the U.S. Fish and Wildlife Service offices in both Arkansas and Missouri agreed that no significant impact to those species is likely as a result of the proposed project. Expanding this line of thinking to all biological resources of the project area, due to the benign nature of the action, it is anticipated that this alternative will have no impact on biological resources of the project area.

Alternative 3 – Reallocation from the Flood Pool: Under this alternative, there will be an increase in lake levels of approximately 0.25 foot. However, in comparison to normal fluctuations in lake water levels due to natural occurrences, this increase will be insignificant to fish and wildlife, protected species, vegetation, and wetlands and floodplains resources of the project area.

Alternative 4 – Reallocation from the Inactive Pool: Anticipated impacts would be similar to those under Alternative 2.

5.6 Air Quality

Alternative 1 – No-Action: Because this alternative involves no addition of new air emission sources or changes to existing emission sources, it is not anticipated to have any significant impacts to air quality within the project area.

Alternative 2 – Reallocation from the Conservation Pool: Implementation of the proposed action alternative may result in a slight decrease in hydropower production during severe drought conditions. Under this scenario, electrical power may have to be increased from other hydropower plants, nuclear power plants, or combustion power plants fueled by fossil fuels such as coal, oil or natural gas. Even if all additional power were supplied from combustion plants, air quality within the project area would not be significantly impacted.

The proposed action of reallocation of storage from the conservation pool will decrease both dependable capacity and energy available from the Bull Shoals Lake power plant. To make up for this loss, power would have to be provided from alternative sources. If the increase power generation were provided by combustion power plants, the increase in emissions could potentially have a minor effect on the air quality in the region of production. Assuming the weight of pollutants emitted by a fossil fuel generation plant to be proportional to power production, the increase in pollutants for this increase in power production would be insignificant based upon the following analysis. To analyze this potential impact, tables 5.3 and 5.4 reflect information gathered from the Department of Energy and the Environmental Protection Agency.

Table 5.3 Southwestern Power Administration (SWPA) Marketing Region Emission Rates for Coal and Natural Gas Power Generation

*SO_2	*NO_X	*CO_2
0.006	0.003	1.697
*all units in lbs/kWh		

5.4 Arkansas and Missouri Annual Emissions

	*Annual SO_2	*Annual NO_X	*Annual CO_2	*Ozone Season NO_X
Arkansas	71,132.21	38,011.21	29,375,197.8	16,918.57
Missouri	295,031.83	128,506.86	83,903,379.0	45,188.35
*All units in tons				

Data from EPA's E-GRID2007 database includes the following Year 2005 information for the states of Arkansas and Missouri.

Assuming that annual energy losses equal 1,360,000 kWh for the conservation pool, 794,000 kWh for the flood control pool, and 1,360,000 kWh for the inactive pool and using the SWPA emissions rate averages from combustion plants for comparison purposes, Table 5.5 reflects the annual increase in emissions that would occur because of the reallocations, if the potential loss of power were generated by combustion power generation.

Table 5.5 Annual Increase in Emissions

	SO_2	NO_X	CO_2
Rates	0.006 lbs/kWh	0.003 lbs/kWh	1.697 lbs/kWh
Conservation Pool	8,160	4,080	2,307,920
Flood Control Pool	4,764	2,382	1,347,418
Inactive Pool	8,160	4,080	2,307,920

Percentages of emission increases from the proposed water supply reallocation for the states of Arkansas and Missouri are shown in Table 5.6.

The data presented in Table 5.6 shows the annual increase of pollutant emissions expected to result if the power generation that would be lost because of the proposed action were generated by a combustion power plant. The increased emissions would not significantly increase the health risks to humans associated with exposure to the pollutants. Therefore, the impact to the air quality of the project area and region is considered to be insignificant.

Alternative 3 – Reallocation from the Flood Pool: Anticipated impacts would be similar to those under Alternative 1.

Alternative 4 – Reallocation from the Inactive Pool: Anticipated impacts would be similar to those under Alternative 1.

Table 5.6 Emission Increases for Arkansas and Missouri – If Power is Replaced by Combustion Plants

	Arkansas		
	Percent Annual Increase		
Reallocation Source	SO_2	NO_X	CO_2
Conservation Pool	0.019600	0.018339	0.013423
Flood Control Pool	0.019660	0.018396	0.013465
Inactive Pool	0.019600	0.018339	0.013423
	Missouri		
	Percent Annual Increase		
Reallocation Source	SO_2	NO_X	CO_2
Conservation Pool	0.004725	0.005424	0.004700
Flood Control Pool	0.004740	0.005441	0.004714
Inactive Pool	0.004725	0.005424	0.004700

5.7 Recreation

The impact to lake recreation was calculated using the SUPER model. SUPER uses seasonal visitor day curves to calculate recreation benefits with respect to pool elevation. The SUPER model analyzes historical information to estimate damages based on changes to stage and duration levels. There is a negative correlation between high-water conditions and visitor accessibility. SUPER model used the historical data and unit day values to determine the change in recreation benefits. If storage is reallocated from the conservation pool or inactive pool, there is no rise in the conservation pool. Recreational changes are negligible. If storage is reallocated from the flood pool, there is a three-inch raise to the top of the conservation pool. Since the White River Basin Lakes are operated as a system, the changes in Bull Shoals pool elevations and pool durations affect the hydropower and flood releases at both Bull Shoals and Norfork. In turn, the other White River Basin Lakes' pool elevations and durations are affected. A reallocation from the flood pool, while only three inches of storage, has rippling effects across the recreational opportunities of the entire White River Basin.

The unit day value estimate was based on a point scale where points were assigned, by informed opinion, to five different categories: Recreation Experience, Availability of Opportunity, Carrying Capacity, Accessibility, and Environmental Quality. This value was used in conjunction with the SUPER model's stage duration and visitor data to determine the change in recreation benefits due to a change in stage and duration.

Recreation visitation data was updated in SUPER in 1994. To adjust the values to FY2010, an analysis of the five unit day value categories and annual visitor hours was performed. To assess the possible change in Recreation Experience, Availability of Opportunity, Carrying Capacity, Accessibility, and Environmental Quality, a group of District personnel, who are familiar with the White River lakes, were given the Guidelines for Assigning Points for General Recreation (Table 1, Economic Guidance Memorandum 10-03 and asked to compare the five categories of recreational experience at each lake in 1994 to 2010. No significant changes have occurred that would change the total point values for each lake. Visitor hours for each lake were compiled for the years 1994 to 2010. The only lake with a significant change in visitor hours is Table Rock. Visitor hours between 1994 – 1996 ranged between 35 million and 40 million; visitor hours between 1997 and 2008 ranged between 14 million and 20 million. Given that recreational benefits is a combination of unit day value and visitor days, the SUPER benefits for Table Rock were multiplied by ½ to adjust for the 50 percent drop in visitation. To update unit day values, SUPER recreational benefits were indexed with the Consumer Price Index from July 1994 to October 2009. While this methodology would not be used in a study where recreation is a significant portion of the benefits – it is warranted in this specific study.

Changes in annual recreation benefits are shown in Table 5.7 for each alternative as compared to the base condition. A reduction in recreation benefits, a negative value, would indicate a potential loss and/or cost as modeled by SUPER.

Table 5.7 Average Annual Recreational Benefits by Alternative October 2009 values ($1,000)

	Base	Conservation	Flood	Inactive
Beaver	9,016.7	9,016.9	9,016.9	9,016.9
Table Rock	4,206.6	4,206.7	4,206.5	4,206.7
Bull Shoals	13,898.9	13,900.4	13,883.0	13,900.2
Norfork	6,815.6	6,815.8	6,814.8	6,815.8
Greers Ferry	16,347.3	16,347.2	16,347.2	16,347.2
Clearwater	1,176.1	1,176.1	1,176.1	1,176.1
Total Flood Damages	51,461.3	51,463.1	51,444.5	51,463.0
Change In Recreation ($1000)		1.8	-16.8	1.7
Change in Recreation ($)		1,823.4	-16,774.9	1,677.5

Alternative 1 – No-Action: No impacts to recreation are expected under this alternative.

Alternative 2 – Reallocation from the Conservation Pool: If storage is reallocated from the conservation pool, there is no rise in the conservation pool. Recreational changes are negligible. The impact to lake recreation was calculated using the SUPER model. Under the proposed action alternative, there would be the highest net gain in recreational benefits of the action alternatives.

Changes in annual recreation benefits are shown in Table 5.7 for each alternative as compared to the base condition. A reduction in recreation benefits, a negative value, would indicate a potential loss and/or cost as modeled by SUPER.

Alternative 3 – Reallocation from the Flood Pool: Under this alternative, there would be a net loss to recreational benefits for Bull Shoals Lake. If storage is reallocated from the flood pool, there is a three-inch raise to the top of the conservation pool. Since the White River Basin Lakes are operated as a system, the changes in Bull Shoals pool elevations and pool durations affect the hydropower and flood releases at both Bull Shoals and Norfork. In turn, the other White River Basin Lakes' pool elevations and durations are affected. A reallocation from the flood pool, while only three inches of storage, has rippling effects across the recreational opportunities of the entire White River Basin.

Alternative 4 – Reallocation from the Inactive Pool: If storage is reallocated from the inactive pool, there is no rise in the conservation pool. Recreational changes are negligible, but this alternative would result in a slight net gain in recreational benefits.

5.8 Hazardous, Toxic and Radioactive Waste

Alternative 1 – No-Action: Because this alternative involves no construction or land disturbance, no REC sites will be impacted; therefore, no impacts to hazardous, toxic or radioactive wastes (HTRW) are expected under this alternative.

Alternative 2 – Reallocation from the Conservation Pool: Under this alternative, anticipated impacts would be similar to those of Alternative 1.

Alternative 3 – Reallocation from the Flood Pool: Although this alternative would result in a very minor increase in lake levels, no REC sites have been identified in close proximity. Therefore, no impacts to HTRW are anticipated under this alternative.

Alternative 4 – Reallocation from the Inactive Pool: Impacts anticipated under this alternative would be similar to Alternative 1.

5.9 Socioeconomics

Alternative 1 – No-Action: The relationship of water supply to the socioeconomic atmosphere of north-central Arkansas is a very close one. Without the implementation of the proposed action, residents and visitors to the north-central Arkansas area will continue to be provided with water of impaired quality. This could have a negative impact on socioeconomics by influencing some residents to move from the area and discouraging new residents and visitors from coming in. As a result, future development of the area, and jobs that may be created as a result, may be curtailed. Tables 5.8 and 5.9 present the expected future population growth by county for the four counties of the project area.

Table 5.8 Ozark Mountain Regional Public Water Authority Projected Population in Member Counties

County	1970	1980	1990	2000	Annual Growth 1970-2000	2010*	2020*	2030*	2040*	2050*	2060*	Annual Growth 2000-2060
NEWTON	5,859	7,745	7,685	8,639	1.30%	8,400	8,674	8,973	9,257	9,547	9,837	0.17%
SEARCY	7,790	8,825	7,819	8,276	0.20%	8,046	7,781	7,535	7,281	7,030	6,779	-0.32%
BOONE	19,110	26,119	28,360	36,041	2.13%	38,070	42,228	46,394	50,570	54,740	58,910	0.85%
TOTAL	32,759	42,689	43,864	52,956	1.61%	54,516	58,683	62,902	67,108	71,317	75,526	0.59%

*Population projection for 2010-2030 provided by Center for Business and Economic Research, University of Arkansas. Growth rate extrapolated to 2060 by Little Rock District

Table 5.9 Marion County Water Authority Projected Population in Marion County

County	1970	1980	1990	2000	Annual Growth 1970-2000	2010*	2020*	2030*	2040*	2050*	2060*	Annual Growth 2000-2060
MARION	7,105	11,352	12,039	16,173	2.80%	18,283	20,600	23,071	25,444	27,842	30,240	1.14%

*Population projection for 2010-2030 provided by Center for Business and Economic Research, University of Arkansas. Growth rate extrapolated to 2060 by Little Rock District

The rate of population growth for the populations of Newton, Searcy, and Boone counties averaged 1.6 percent annually between 1970 and 2000. The rate of population growth, as estimated by the Center for Business and Economic Research at the University of Arkansas, for 2000 to 2060 averages 0.59 percent annually. The rate of population growth for Marion County averaged 2.8 percent annually between 1970 and 2000. The rate of growth for 2000 to 2060 averages 1.14 percent annually. As the OMRPWA member towns have grown, the members have not been able to extend water service to new customers. Currently, there are unfulfilled extension requests for Mt. Sherman, Nail-Swain, East Newton County, Deer, Western Grove, SPG, Marshall, and South Mountain. The Arkansas Board of Health will not allow these extensions until an adequate water source is available. The lack of safe, clean water is a burden to the residents of these counties, and is a detriment to growth.

Future water supply demands, current water supply, along with the resulting deficits for both OMRPWA and Marion County are shown in tables 5.10 and 5.11.

Alternative 2 – Reallocation from the Conservation Pool: The implementation of the water supply reallocation of the proposed action alternative will provide the project area with a reliable supply of good quality water for expected future growth and water supply demands. Under this alternative, area governments, civic and public organizations and businesses will be able to plan for growth in an organized and confident manner that will benefit both current and new residents and visitors to the region.

Table 5.10 Ozark Mountain Regional Public Water Authority Water Supply Forecast - Water Deficit

Year	Maximum Daily Use (gdp*)			Water Supply (gpd*)**	Water Deficit (gpd*)		
	Low	Mid	High		Low	Mid	High
2012	4,092,660	4,092,660	4,092,660	700,000	3,392,660	3,392,660	3,392,660
2022	4,175,254	4,627,080	5,140,850	700,000	3,475,254	3,927,080	4,440,850
2032	4,259,514	5,231,340	6,457,496	700,000	3,559,514	4,531,340	5,757,496
2042	4,345,475	5,914,620	8,111,354	700,000	3,645,475	5,214,620	7,411,354
2052	4,433,170	6,687,000	10,188,789	700,000	3,733,170	5,987,000	9,488,789
2062	4,522,636	7,560,360	12,798,286	700,000	3,822,636	6,860,360	12,098,286
* Gallons per day							
** Non-contaminated sources: Nail-Swain, Marshall, Leslie, and Lake Bull Shoals Estates							

Table 5.11 Marion County Regional Water District Water Supply Forecast - Water Deficit

Year	Maximum Daily Use (gdp*)			Water Supply (gpd*)	Water Deficit (gpd*)		
	Low	Mid	High		Low	Mid	High
2012	1,032,845	1,032,845	1,032,845	1,000,000	32,845	32,845	32,845
2022	1,163,698	1,361,360	1,588,694	1,000,000	163,698	361,360	588,694
2032	1,311,129	1,794,320	2,443,684	1,000,000	311,129	794,320	1,443,684
2042	1,477,238	2,365,000	3,758,808	1,000,000	477,238	1,365,000	2,758,808
2052	1,664,392	3,117,180	5,781,694	1,000,000	664,392	2,117,180	4,781,694
2062	1,875,257	4,108,555	8,893,241	1,000,000	875,257	3,108,555	7,893,241
* Gallons Per Day							

Alternative 3 – Reallocation from the Flood Pool: Impacts anticipated under this alternative would be similar to Alternative 2.

Alternative 4 – Reallocation from the Inactive Pool: Anticipated impacts would be similar to those under Alternative 2.

5.10 Environmental Justice

Alternative 1 – No-Action: Under this alternative it is anticipated that low income communities served by OMRPWA in Boone, Marion, Johnson, Newton and Searcy Counties and Lurton-

Pelsor in Pope County, as well as communities in Marion County served by MCRWD, would be disproportionately adversely affected.

Alternative 2 – Reallocation from the Conservation Pool: Under the proposed action alternative, no disproportional adverse impacts are anticipated to any racial or ethnic minority, low-income, or otherwise disadvantaged population within the project area. Conversely, the implementation of this alternative is anticipated to improve the water quality supplied to the low income communities served by OMRPWA and MCRWD.

Alternative 3 – Reallocation from the Flood Pool: Anticipated impacts would be similar to those under Alternative 2.

Alternative 4 – Reallocation from the Inactive Pool: Anticipated impacts would be similar to those under Alternative 2.

Section 6.0
Cumulative Impacts

6.0 CUMULATIVE IMPACTS

Cumulative impacts are defined in 40 CFR 1508.7 as those impacts that result from:

> *". . .the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."*

Cumulative impacts result when the effects of an action are added to or interact with other effects in a delineated geographic space and within a defined time period. The combination of these effects, and any resulting environmental degradation, is the focus of cumulative impact analysis. The concept of cumulative impacts considers all disturbances, direct or indirect, because cumulative impacts result in the compounding of the effects of all actions over time. Consequently, the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or community of the proposed action and all other actions affecting that item regardless of the entity (i.e., federal, non-federal, or private) responsible for the actions.

Activities that may result in cumulative impacts include, but are not limited to, the addition of materials to the environment from multiple sources, repeated removal of materials or organisms from the environment, and repeated environmental changes over large areas and long periods. Complicated cumulative effects occur when stresses of different types combine to produce a single effect or suite of effects. Large, contiguous habitats can be fragmented, making it difficult for organisms to locate and maintain populations in disjunctive habitat fragments. Cumulative impacts may also occur when the timing of perturbations is so close in space that their effects overlap.

In assessing cumulative impacts, consideration should be given to the following items:

- The degree to which the proposed action affects public health and safety;
- Unique characteristics of the geographic area;
- The degree to which the possible effects on the human environment are highly controversial; and
- Whether the action is related to other actions with individually insignificant but cumulatively significant impacts on the environment.

Council on Environmental Quality (CEQ) regulations explicitly state that cumulative impacts must be evaluated and with direct and indirect effects of alternatives in NEPA documents. By mandating the assessment of cumulative impacts, the regulations ensure that the range of actions considered in NEPA documents includes not only the proposed action but also all past, present, or reasonably foreseeable future actions that could contribute to cumulative impacts. With this guidance in mind, the following section discusses actions that have been identified that when combined with the current proposed action of storage reallocation from Bull Shoals Lake could have a cumulative effect on the environment.

6.1 Geographic and Temporal Boundaries

This analysis begins with the establishment of a set of geographic and temporal boundaries within which the cumulative effects of past, present, and reasonably foreseeable future actions will be assessed. Defining these boundaries is an important process in refining the scope of the cumulative impact assessment.

6.1.1 Geographic Boundaries

The geographic boundaries for the Bull Shoals Lake project area include the lake itself, the surrounding shoreline, and the upland habitat and communities immediately adjacent to the shoreline.

The Bull Shoals Lake begins at the Bull Shoals Dam, which is located at river mile 79.0 on the White River. The lake is about seven miles northwest of Mountain Home. The lake is located mainly within Marion and Boone Counties, Arkansas, but also extends into Baxter County, Arkansas, as well as Taney and Ozark Counties, Missouri. The lake surface area covers 48,005 acres (at 659 ft. NGVD). The lake drains approximately 6,036 square miles of surrounding land.

6.1.2 Temporal Boundaries

The cumulative impacts from past actions at Bull Shoals Lake involve predominantly the impoundment of the White River and one subsequent reallocation of water supply storage from the lake. Because significant impacts to natural resources and human communities began with the impoundment of the lake, the temporal boundary for cumulative impact is considered to have begun in 1947, when dam construction began. Because the lake was created under the authority of the Flood Control Act of 1938, it will remain an authorized project until Congress determines otherwise. Consequently, the lake's status must be considered indefinite and no future temporal boundary can be established for cumulative impacts assessment.

6.2 Past Actions

6.2.1 Past Engineering Projects

The only significant engineering project undertaken for Bull Shoals Lake was the creation of the lake by the construction of Bull Shoals Dam and the impoundment of the White River, which was completed in 1951. The creation of Bull Shoals Lake altered aquatic and terrestrial habitat in the project area, converting the area within the lake's footprint from a riverine to a lacustrine environment. The creation of the lake significantly transformed environmental and economic conditions in the region. Human communities and industries in the footprint of the lake were forced to relocate. Cultural resources within the new lake footprint may have been inundated. The portion of the main stem of the White River, where the lake was formed, was transformed from a lotic (free-flowing) aquatic habitat to a lentic (static) aquatic habitat. Additionally, the surrounding uplands within the lake footprint were likewise converted to a lotic aquatic habitat. This habitat conversion restricted the terrestrial habitat diversity in the region but increased the available aquatic habitat, resulting in the proliferation of a number of game fish species. The increase in fish species together with the increased area for water sports led to an increase in recreational opportunities and activities in the region, which in turn led to the growth of communities to support recreation at the lake. Therefore, the creation of Bull Shoals Lake resulted in a net benefit to socioeconomic conditions in the project area.

6.2.2 Water Storage Projects

There has been only one M&I water supply storage reallocation from Bull Shoals Lake since the project's inception. The Corps reallocated 880 acre-feet under the general authority of the Water Supply Act of 1958, as amended, for use by Marion County Regional Water District, intended to yield 1 MGD water supply.

As part of this study, the volume required to yield 1 MGD will be updated based upon the current reallocation request, as well as the reallocation for the WRMF Project summarized below.

The WRMF Project report and the ROD were completed in January 2009. Project BS-3, the recommended plan specific to Bull Shoals Lake was authorized by the FY06 EWDAA Section 132(a). Plan BS-3 reallocates five feet of flood control storage, totaling 233,000 acre-feet, for the target minimum flow release of 800 cfs. The top of the conservation pool will be raised 5 feet from elevation 654 to 659 feet NGVD29.

6.3 Present Actions

6.3.1 Current and Pending Engineering Projects

Current engineering project outputs for Bull Shoals Lake through Fiscal Year (FY) 2008 (U.S. Army Corps of Engineers Little Rock District, White River Basin, Arkansas Minimum Flows Project Report, January 2009) include:

- $190 million estimated for cumulative flood damages prevented;
- 3 million visitors annually for recreational use of the lake and land resources;
- 753,700 megawatt hours for average annual hydropower generation; and
- 0.85 MGD average daily demand for water supply by Marion County Regional Water Authority.

6.3.2 Current and Pending Storage Reallocations

There is currently one M&I water supply storage reallocation from Bull Shoals Lake. It is for MCRWD for 880 acre-feet, intended to yield 1 MGD.

The WRMF Project report and the ROD were completed in January 2009. Project BS-3, the recommended plan specific to Bull Shoals Lake was authorized by the FY06 EWDAA Section 132(a). Plan BS-3 reallocates five feet of flood control storage, totaling 233,000 acre-feet, for the target minimum flow release of 800 cfs. The top of the conservation pool was raised 5 feet from elevation 654 to 659 feet NGVD29. The project is nearing the end of the engineering and design phase.

6.4 Reasonably Foreseeable Future Actions

6.4.1 Future OMRPWA and MCRWD Water Delivery Systems

With the population of north central Arkansas area expected to continue increasing at the current rate, it is reasonable to expect that OMRPWA (and perhaps MCRWD, as well) may seek additional water supply at some future time. Another reallocation would likely require additional infrastructure (pumping plants, treatment facilities, pipelines, etc.).

There are currently plans to construct a new water delivery system for OMRPWA members that would provide approximately 4.5 MGD to the region in order to meet current water consumption, although it would be designed to provide 6.0 MGD, as needed in the future. The project currently includes the following features:

- Construct a water intake structure on Bull Shoals Lake;
- Construct a 6.0 MGD water treatment facility to be located near Diamond City, Arkansas;
- Install ductile iron transmission lines connecting the intake structure and treatment facility to OMRPWA member systems;
- Construct water storage tanks, which will supply water by gravity flow to each bulk customer; and,
- Construct booster pumping stations and install pressure reducing valves in order to serve the mountainous regions.

The environmental effects of this proposed action have been evaluated in an EA completed by the USDA Rural Utility Service (RUS) in August 2009, which resulted in a finding of no significant impact. The cumulative effects of this proposed action in combination with the impacts being evaluated in this EA are not anticipated to result in any significant adverse environmental impacts.

Additional future water supply needs could also result in the need to develop new water supply sources such as creating reservoirs by damming other currently free-flowing rivers and streams, which would result in the loss of wildlife habitat and the alteration of existing aquatic habitat in those stream sections affected by the dams. Economic impacts would also be felt by land owners who would be affected by the acquisition of their property for use in the reservoirs.

Potential impacts from future infrastructure improvements will require detailed analysis and documentation of compliance with federal laws such as the NEPA, Endangered Species Act (ESA), and the National Historic Preservation Act (NHPA), among others, before any construction begins, if any federal agencies are involved or any federal funds are utilized to plan or construct these improvements.

Potential impacts, depending on the amount of the reallocation of storage and/or the exact location of water treatment facilities, pipeline routes, etc. could have impacts on most of the resources identified in this EA, such as land use, water resources, biological resources, cultural resources, and floodplains and wetlands. Permits such as that required under Section 404 of the Clean Water Act for impact to wetlands would almost certainly be required for any pipeline crossings of streams and other water bodies.

Currently, MCRWD intends to use the existing infrastructure to supply water from Bull Shoals Lake. No additional treatment facilities or line work are currently planned by MCRWD and are, therefore, not considered part of this reallocation.

6.5 Cumulative Impacts Assessment

Table 6.1 summarizes the cumulative impacts resulting from the proposed action and any reasonably foreseeable future actions related to the proposed action. Cumulative impacts are assessed individually for each significant resource discussed in Section 4.0.

6.6 Summary and Conclusion

The most significant environmental impacts, in consideration of cumulative effects, undoubtedly occurred at the time of construction of the Bull Shoals Dam and the creation of Bull Shoals Lake in the late 1940s.

Future reallocations, depending on size, areas impacted, and design features, could result in adverse cumulative impacts (at least potentially) to almost all of the resources evaluated above. Minor temporary impacts to biological and water resources and soils will likely result from the construction of new pump stations and pipelines. Potential impacts to cultural resources could result from pipeline and pump station construction, should any such resources be disturbed by construction activities. Minor permanent cumulative impacts to air quality, the noise environment, and HTRW sources would occur should diesel power be selected for the pump.

With the increase in availability of water for municipal and industrial use will likely come an increase in development and population in the project areas. These actions could result in minor adverse impacts to land use, water resources, cultural resources, biological resources, air quality, and the noise environment. However, beneficial impacts may occur to the socioeconomic structure and recreational opportunities and facilities as a result of the proposed action and reasonably foreseeable future actions.

Table 6.1 Cumulative Impacts Assessment

Resource Area	Past Actions	Proposed Action Reallocation/ Present Actions	Reasonably Foreseeable Future Actions	Cumulative Impact
Land Use	These actions resulted in the removal of some lands from agricultural or industrial use due to submersion. Some lands were also removed by increased development of lands surrounding the lakes.	Potential increase in development due to availability of additional M&I water supply.	Potential increase in development due to availability of additional M&I water supply.	Lands inundated by the formation of the lakes have been eliminated from human use. Otherwise, no change from current conditions.
Topography, Physiography, and Soils	Submersion of upland terrestrial soils from lake creation converted upland soils to aquatic soils. Some area soils were converted to urban environment because of an increase in development resulting from additional M&I water supply. Flood control benefits from construction of dam.	Potential conversion of soils to urban environment could result if development increases because of additional M&I water supply.	Potential conversion of soils to urban environment could result if development increases because of additional M&I water supply.	Soils inundated by the formulation of the lakes have been converted from terrestrial to aquatic soils. Some soils in the vicinity of the lakes have been converted to urban environment because of increased development of areas surrounding the lakes.
Water Resources	These actions have increased the quantity of water available in the project area by creating Bull Shoals Lake. Increase in water needs from increase in development due to availability of M&I water supply.	These actions have reduced, to a minor amount, the quantity of water in Bull Shoals Lake available for other purposes. Potential increase in future water needs from potential increase in development due to availability of additional M&I water supply.	Future pipeline crossings of streams and other water bodies could potentially require Section 404 permits.	Congressional approval may be required for future storage reallocations at Bull Shoals Lake should they exceed the Corps' limit of 50,000 AF.

Resource Area	Past Actions	Proposed Action Reallocation/ Present Actions	Reasonably Foreseeable Future Actions	Cumulative Impact
Cultural Resources	Submersion of some cultural resources caused by increase in water levels resulting from lake creation.	No adverse effects anticipated from storage reallocations due to no change in water levels.	Potential adverse effect due to construction depending upon future infrastructure locations and route of pipelines. Cultural resources investigations would be required to obtain necessary clearances prior to construction. Possibility of minor cultural resource disturbance from potential increase in development due to availability of additional M&I water supply.	Original formation of lakes likely resulted in loss of some cultural resources.
Biological Resources	Habitat disturbance resulting from the conversion of lotic aquatic and terrestrial upland and wetland habitat to lentic aquatic habitat. Increase in aquatic habitat and, in particular, fishery resources.	Possibility of minor habitat disturbance from potential increase in development due to availability of additional M&I water supply.	Possibility of minor habitat disturbance from future water treatment plant and pipeline construction. Coordination with state and federal agencies would insure no significant impacts to valuable habitat. Future regional water needs may result in the necessary damming and reservoir construction of currently free-flowing rivers. This would result in the loss of wildlife habitat and the alteration of existing aquatic habitat.	Original formation of lakes converted significant amounts of land from wildlife habitat to aquatic habitat. Only minor construction related habitat disturbance due to new water intake and pipeline. No endangered or threatened species would be impacted.
HTRW	None	None	HTRW investigations would be performed prior to construction.	None, currently.

Resource Area	Past Actions	Proposed Action Reallocation/ Present Actions	Reasonably Foreseeable Future Actions	Cumulative Impact
Air Quality	Increases in air emissions due to additional thermal (coal, etc.) generation of electricity resulting from a small loss in hydropower generation.	Minor increases in air emissions due to additional thermal (coal, etc.) generation of electricity resulting from a small loss in hydropower generation.	Potential minor and temporary increases in emissions if other sources of power generation are required to mitigate hydropower losses from future infrastructure improvements.	Potential minor increase in emissions if other sources of electrical power generation are required to mitigate hydropower losses.
Noise	Temporary increases in noise emissions from construction activities.	None	Possible temporary increases in noise emissions from construction activities should infrastructure improvements be included.	None
Socioeconomic	Creation of significant amount of hydropower benefits. Benefit to local growth potential because of a reliable safe water supply.	Loss of an insignificant amount of hydropower benefits. Benefit to local growth potential because of a reliable safe water supply.	Benefit to local economic growth potential because of a reliable water supply distribution. Should increased regional water supply needs result in the creation of new reservoirs on rivers and streams, local economic impacts could result from the acquisition of land from land owners for reservoir use.	Cumulative impacts to hydropower production could result from future storage reallocations as a result of decreased storage. Whether this impact would be significant depends upon the size of future reallocations and is in fact regulated by the authority given to the Chief of Engineers in paragraph 4-32d(1) of ER 1105-2-100, Policy and Planning, which states that the Commander, USACE is authorized to reallocate up to 15 percent or 50,000 AF, whichever is less, of the total storage capacity allocated to all authorized project purposes, provided the reallocation has no severe effect on other authorized purposes and will not involve major structural or operational changes.

Resource Area	Past Actions	Proposed Action Reallocation/ Present Actions	Reasonably Foreseeable Future Actions	Cumulative Impact
Recreation	The formation of Bull Shoals Lake created significant new recreational opportunities for the area. No adverse impacts to any existing recreation resources.	No significant adverse impacts to any recreational resources.	No significant adverse impacts to any recreational resources.	No adverse cumulative impacts to recreation.

Section 7.0
Environmental Compliance

7.0 ENVIRONMENTAL COMPLIANCE

Table 7.1 presents amplifying information on the environmental compliance of the proposed project.

Table 7.1 Status of Project with Applicable Laws and Statutes

Item	Compliance
<u>Federal Statutes</u> Archaeological and Historic Preservation Act, as amended, 16 U.S.C. 469, et. Seq.	Full
Clean Air Act of 1977, as amended, 42 U.S.C. 7609, *et seq.*	Full
Clean Water Act, as amended, (Federal Water Pollution Control Act) 33 U.S.C. 1251, *et seq.*	Full
Coastal Zone Management Act, 16 U.S.C. 1451, et seq.	N/A
Endangered Species Act, 16 U.S.C. 1531, *et seq.*	Full
Estuary Protection Act, 16 U.S.C. 1221, *et seq.*	N/A
Federal Water Project Recreation Act, 16 U.S.C. 460-12, *et seq.*	Full
Fish and Wildlife Coordination Act, 16 U.S.C. 661, *et seq.*	Full
Land and Water Conservation Fund Act, 16 U.S.C. 460/ -460/-11, *et seq.*	N/A
Marine Protection, Research and Sanctuary Act, 33 U.S.C. 1401, *et seq.*	N/A
National Environmental Policy Act, 42 U.S.C. 4321, *et seq.*	Ongoing
National Historic Preservation Act, 16 U.S.C. 470a, *et seq.*	Full
Rivers and Harbor Act, 33 U.S.C. 401, *et seq.*	N/A
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, *et seq.*	N/A
Wild and Scenic Rivers Act, 16 U.S.C. 1271, *et seq.*	Full
<u>Executive Orders, Memorandums, etc.</u> Executive Order 11988, Floodplain Management, May 24, 1977 (42 CFR 26951; May 25, 1977)	Full
Executive Order 11990, Protection of Wetlands, May 24, 1977 (42 CFR 26961; May 25, 1977)	Full
Council on Environmental Quality Memorandum of August 11, 1980: Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act.	Full
Executive Order 12114, Environmental Effects Abroad of Major Federal Actions.	N/A
Executive Order 12898, Feb. 11, 1994, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	Full
<u>State and Local Policies</u> Arkansas Water Quality Standards	Full

Notes:
<u>Full Compliance (Full)</u>: Having met all requirements of the statute, E.O. or other environmental requirements for the current stage of planning.
<u>Ongoing</u>: Coordination ongoing, and will be completed prior to signing of FONSI.
<u>Not Applicable (N/A)</u>: No requirements for the statute, E.O. or other environmental requirement for the current stage of planning.

Section 8.0
Conclusions

8.0 CONCLUSIONS

This EA has evaluated the proposed action of reallocating water supply storage from Bull Shoals Lake. The EA has considered and evaluated the reallocation of storage from the flood control pool, the conservation pool (hydropower pool), and the inactive pool; along with the No-Action Alternative. Consideration was given to alternatives such as water withdrawal from groundwater sources, existing surface water sources, development of new reservoirs, purchase of water from other water authorities, and structural and non-structural solutions. These alternatives were not viable either economically and/or environmentally and would not meet the needs of the sponsor.

The proposed action, the reallocation from the conservation pool, results in fewer potentially adverse impacts to the environment than the other alternatives presented in this EA. The proposed action would have a slight annual hydropower benefits reduction ($77,927.00), but that reduction is not substantial when the existing current reductions are considered (for details on methods and calculations for hydropower benefits foregone, please see Section 4.4.4). There have been no significant impacts to the natural or human environment identified as a result of this assessment of the proposed Ozark Mountain Water Public Water Authority and Marion County Regional Water District Water Supply Storage Reallocation.

The OMRPWA and MCRWD requests for the Municipal and Industrial water supply storage from the conservation pool at Bull Shoals Lake would meet the future water supply needs of north central Arkansas.

In accordance with NEPA statutory and CEQ regulation guidelines, based upon the analysis in this Environmental Assessment, it is recommended that a Finding of No Significant Impacts (FONSI) be prepared for the reallocation of 11,886.541 ac-ft of conservation pool at Bull Shoals Lake from hydropower purpose to Municipal and Industrial water supply for OMRPWA and MCRWD pursuant to the Water Supply Act of 1958, Public Law 85-500, as amended.

Section 9.0
List of Preparers

9.0 LIST OF PREPARERS

Patrick MacDanel, Wildlife Biologist, Sr. Project Manager, Environmental Sciences & Engineering Department, G.E.C., Inc., Baton Rouge, Louisiana

Jennifer Lindquist, Geologist, Environmental Sciences & Engineering Department, G.E.C., Inc., Baton Rouge, Louisiana

Cade E. (Eddy) Carter, P.E., Civil Engineer, Dept. Mgr., Environmental Sciences & Engineering Department, G.E.C., Inc., Baton Rouge, Louisiana

Barry McCoy, Wildlife Biologist, Environmental Sciences & Engineering Department, G.E.C., Inc., Baton Rouge, Louisiana

Lauren Lafitte, Urban Planner/GIS Analyst, GIS Department, G.E.C., Inc., Baton Rouge, Louisiana

Section 10.0 References

10.0 REFERENCES

U.S. Army Corps of Engineers, Little Rock District, 2008, *Final Environmental Impact Statement, White River Basin, Arkansas, Minimum Flows* (Revised January 2009) and all references cited in that document.

Engineering Services, Inc., May 2005, *Preliminary Engineering Report for Ozark Mountain Regional Public Water Authority to Serve North Central Arkansas* (Revised April 2009).

Engineering Services, Inc., August 2009, *Preliminary Engineering Report Amendment No. 1 for Ozark Mountain Regional Public Water Authority to Serve North Central Arkansas.*

Engineering Service, Inc., January 2008, *Environmental Report for Ozark Mountain Water Authority to Serve North Central Arkansas* (Revised May 2009).

Engineering Services, Inc., August 2009, *Environmental Report Amendment No. 1 for Ozark Mountain Public Water Authority to Serve North Central Arkansas.*

U.S. Army Corps of Engineers, Hydropower Analysis Center, 2010, *Ozark Mountain Regional Public Water Authority, Bull Shoals & Norfork Lakes, Arkansas, Water Supply Reallocation, Power Benefits Foregone.*

U.S. Army Corps of Engineers, Little Rock District, 2010, *Hydrologic and Hydraulic Report on Bull Shoals Storage Reallocation for Ozark Mountain Regional Public Water Authority and Marion County Regional Water District.*

Pugh, Aaron L., U.S. Geological Survey, 2008, *Summary of Aquifer Test Data for Arkansas – 1940-2006.*

Sabo, George III, Ann M. Early, Jerome C. Rose, Barbara A. Burnett, Louis Vogele, Jr., and James P. Harcourt, 1988, *Human Adaptation in the Ozark-Ouachita Mountains.*

Blakely, Jeffery A. and W. J. Bennet, Jr., 1988, *Cultural Resources Priority Plan for the U.S. Army Corps of Engineers, Little Rock District,* Archeological Assessments Report No. 76.

U.S. Fish and Wildlife Service (USFWS 2003), *Tumbling Creek Cavesnail Technical/Agency Recovery Plan,* Ft. Snelling, MN. 77 pp.

Environmental FirstSearch Report, October 7, 2009, Banks Environmental Data

Finding Of No Significant Impact, August 24, 2009, Rural Utility Service, U.S. Department of Agriculture

Section 11.0 Public Involvement/ Workshops

11.0 PUBLIC INVOLVEMENT/WORKSHOPS

A public workshop was held on June 30, 2009, from 6 to 8 pm at the Gaston's Visitor Center at Bull Shoals Dam with 74 people attending. A second public workshop was held in Diamond City, Arkansas on July 1, 2009, from 6 to 8 p.m. at the Diamond City Community Center with 24 people attending. Copies of news releases announcing these two meetings are included in Attachment 1, Public Scoping Materials. There were no comments in opposition to the proposed reallocation of 7 MGD from Bull Shoals Lake (conservation pool or flood pool or a combination of both) for OMRPWA and MCRWD. Therefore, the decision was made to proceed with an Environmental Assessment, not an Environmental Impact Statement, for the reallocation study.

Please see Attachment 1 for copies of press releases published for announcement of the workshops.

Section 12.0
Agency Coordination

12.0 AGENCY COORDINATION

Coordination letters were sent out September 15, 2009, requesting agency comments and concerns regarding an Environmental Assessment for the Reallocation at Bull Shoals Lake. No major concerns have been received to date. Please see Section 12.0 Agency Coordination for a complete list of agencies, organizations, and offices solicited for their views on the proposed project.

Table 12.1 lists agencies, organizations, and offices solicited for their views on the proposed project, along with summary descriptions of any responses received to date.

Table 12.1 Project Agency/Office Coordination

Agency/Office Solicited	Response Received	Response/Concerns
Missouri Addressees:		
U.S. Fish and Wildlife Service Columbia, MO 65203	Oct. 19, 2009	No protected species or critical habitat within project area.
U.S. Department of Agriculture St. Louis, MO 63141		
U.S. Natural Resources Conservation Service Springfield, MO 65802	Oct. 19, 2009	Will comment upon reviewing draft EA.
Missouri NRCS State Office Columbia, MO 65203		No response received to date.
Missouri State Historic Preservation Office Jefferson City, MO 65102	Oct. 21, 2009	Project not likely to affect any known cultural resources within project area.
Arkansas Addressees:		
Arkansas Historic Preservation Program Little Rock, AR 72201	Oct. 9, 2009	No known historic properties will be affected by this undertaking.
Department of Finance & Administration Little Rock, AR 72203	Sep. 22, 2009	Will comment upon reviewing draft EA.
Arkansas Soil and Water Conservation Comm. Little Rock, AR 72201		No response received to date.
Arkansas Forestry Commission Little Rock, AR 72201		No response received to date.

Arkansas Game and Fish Commission Little Rock, AR 72205	Sep. 25, 2009	Concerns were in regards to new water supply pipeline that will be required under a different action.
Arkansas Dept of Environmental Quality Little Rock, AR 72118		No response received to date.
Arkansas Natural Heritage Commission Little Rock, AR 72201		No response received to date.
U.S. Geological Survey Little Rock, AR 72211		No response received to date.
Arkansas Natural Resources Commission Little Rock, AR 72201		No response received to date.
Arkansas Department of Parks and Tourism Little Rock, AR 72201		No response received to date.
Arkansas Department of Health Little Rock, AR 72205		No response received to date.
U.S. Department of Agriculture, NRCS Little Rock, AR 72201	Sep. 24, 2009	No effect on Prime Farmland or Farmland of Statewide Importance.
Arkansas Highway and Transportation Department Little Rock, AR 72211		No response received to date.
U.S. Fish and Wildlife Service Conway, AR 72032	Nov. 5, 2009	No federally listed endangered, threatened or candidate species present within project area.
Other Addressees:		
Southwestern Power Administration Tulsa, OK 74103	Oct. 20, 2009	Impacts and costs of increased air emissions should be quantified and impacts to hydropower should be detailed. Strongly objects to the use of the inactive pool as a viable alternative for the report and EA.
U.S. Environmental Protection Agency, Region 6 Dallas, TX 75202		No response received to date.
National Park Service, Midwest Region		No response received to date.

Omaha, NE 68102 FEMA, Region VI Denton, TX 76210	Oct. 15, 2009	Possible negative impacts on identified special flood hazard areas within project area. Also, referred to floodplain managers for Marion and Baxter Counties.

For a copy of an example coordination letter mailed to the addressees in the above table, and copies of correspondence received thus far, please go to Attachment 2, Initial Agency Coordination.

Attachment 1
Public Scoping Materials

US Army Corps of Engineers®
Little Rock District

Release No. 63-09 **Contact: P.J. Spaul**

Phone: (501) 324-5551

For Release: Immediately

Downloadable District news is available at http://www.swl.usace.army.mil/news&info/newsrel.html on the World Wide Web.

WORKSHOP SET TO DISCUSS WATER SUPPLY PROPOSAL AT BULL SHOALS LAKE

LITTLE ROCK, Ark., June 8 --The Army Corps of Engineers' Little Rock District will host a public workshop June 30 to provide information and gather public input about the proposed reallocation of storage space in Bull Shoals Lake to provide four to six million gallons of water a day supply to Ozark Mountain Regional Public Water Authority.

The meeting will be held from 6 to 8 p.m. Tuesday, June 30, in the James A. Gaston Visitor Center at the Bull Shoals-White River State Park adjacent to Bull Shoals Dam.

OMRPWA is a coalition of 22 water systems in Arkansas that was formed in 2004 to pursue a future water supply for the north central Arkansas area. The authority serves 22,000 people in Boone, Newton, Searcy and parts of Marion counties.

Studies of the proposed storage reallocation are about to begin, and Corps officials are conducting the workshop to help dispel rumors and gather public input. Among other things, the studies will determine whether the potential reallocation would come from the flood pool or the conservation pool. If it comes from the flood pool, there will be minimal lake level changes. If it comes from the conservation pool, there will be no change in the lake level.

The meeting will be an open house format. Interested persons are invited to drop by any time during the two-hour workshop to review information about the proposal, ask questions one-on-one of the study team, and submit written comments. All interested parties are urged to attend.

-MORE-

WORKSHOP SET TO DISCUSS WATER SUPPLY PROPOSAL…

For those who are unable to attend but who would like to submit comments, please mail them to Little Rock Engineer District, attn: CESWL-PE, P.O. Box 867, Little Rock, AR 72203-0867. Submissions must be postmarked by June 30. You can also send comments by e-mail by June 30 to Renee.S.Wright@usace.army.mil.

--30--

US Army Corps of Engineers®
Little Rock District

News Release

Release No. 66-09 **Contact: P.J. Spaul**

Phone: (501) 324-5551

For Release: Immediately

Downloadable District news is available at http://www.swl.usace.army.mil/news&info/newsrel.html on the World Wide Web.

SECOND WORKSHOP SET TO DISCUSS WATER SUPPLY PROPOSAL FOR BULL SHOALS LAKE

LITTLE ROCK, Ark., June 12 --The Army Corps of Engineers Little Rock District has announced it will hold a second public workshop, this one on July 1 in Diamond City, Ark., to discuss and gather input about the proposed reallocation of storage space in Bull Shoals Lake to provide water supply to Ozark Mountain Regional Public Water Authority.

The second workshop will be held from 6 to 8 p.m. July 1 at the Diamond City Community Center at 232 Grand Ave. Last week the Corps announced the first workshop will be held from 6 to 8 p.m. June 30 in the James A. Gaston Visitor Center at the Bull Shoals-White River State Park.

OMRPWA is a coalition of 22 water systems that serve 22,000 people in Boone, Newton, Searcy and parts of Marion counties. It is seeking lake storage to provide four to six million gallons of water a day.

Studies are about to begin, and Corps officials are conducting the workshops to help dispel rumors and gather public input. Among other things, the studies will determine whether the potential reallocation would come from the flood pool or the conservation pool. If it comes from the flood pool, there will be minimal lake level changes. If it comes from the conservation pool, there will be no change in the lake level.

Interested persons are invited to drop by any time during the two-hour workshops to review the proposal, ask questions one-on-one of the study team, and submit written comments.

-MORE-

For those who are unable to attend either workshop but who would like to submit comments, please mail them to Little Rock Engineer District, attn: CESWL-PE, P.O. Box 867, Little Rock, AR 72203-0867. Submissions must be postmarked by June 30. You can also send comments by e-mail by June 30 to Renee.S.Wright@usace.army.mil.

--30--

Attachment 2
Initial Agency Coordination

EXAMPLE COORDINATION LETTER

15 September 2009

To: [ADDRESSEE]

RE: Preparation of an Environmental Assessment
For Ozark Mountain Regional Public Water Authority
Water Supply Reallocation
Bull Shoals Lake, Arkansas

Dear Madame/Sir:

On behalf of our client, the U.S. Army Corps of Engineers, Little Rock District (USACE-SWL), G.E.C., Inc. (GEC), is submitting the following information regarding an Environmental Assessment (EA) that GEC is preparing under guidelines set forth by the National Environmental Policy Act (NEPA). This EA will evaluate the reallocation of water storage from Bull Shoals Lake, Arkansas.

In February 2007, the Ozark Mountain Regional Public Water Authority (OMRPWA) requested that the Little Rock District reallocate storage sufficient to supply six (6) million gallons per day (MGD) from Bull Shoals Lake for Municipal and Industrial (M&I) purposes. OMRPWA is a coalition of 22 water systems in the north central Arkansas area that serves about 22,000 people in Newton, Searcy, and parts of Boone, Marion, Johnson and Pope Counties. In order to approve this request, the Little Rock District must conduct a reallocation study including an EA for this proposed action.

GEC respectfully requests any information from your office within 30 days of the date of this letter regarding existing environmental resources within the project area. If comments are not received by this date, we will assume your agency has no comments on the proposed action. Should you have any questions or require further information, please contact me at (225) 612-4117 or macdanel@gecinc.com; or, Mike Rodgers with the Little Rock District at (501) 324-5030 or Michael.r.rodgers@usace.army.mil.

Sincerely,

Patrick S. MacDanel
Senior Environmental Scientist/Wildlife Biologist

Please submit comments to:

Patrick S. MacDanel
GEC, Inc.
P.O. Box 84010
Baton Rouge, LA 70808

77634
COE
~~63024~~
~~USFWS~~
~~632457~~
~~COE~~

GEC
Gulf Engineers & Consultants

15 September 2009

Arkansas Historic Preservation Program
Attn: Ms. Frances McSwain
1500 Tower Building
323 Center Street
Little Rock, AR 72201

AHPP
SEP 21 2009

RE: Preparation of an Environmental Assessment For Ozark Mountain Regional Public Water Authority Water Supply Reallocation Bull Shoals Lake, Arkansas

Dear Madame/Sir:

On behalf of our client, the U.S. Army Corps of Engineers, Little Rock District (USACE-SWL), G.E.C., Inc. (GEC), is submitting the following information regarding an Environmental Assessment (EA) that GEC is preparing under guidelines set forth by the National Environmental Policy Act (NEPA). This EA will evaluate the reallocation of water storage from Bull Shoals Lake, Arkansas.

In February 2007, the Ozark Mountain Regional Public Water Authority (OMRPWA) requested that the Little Rock District reallocate storage sufficient to supply six (6) million gallons per day (MGD) from Bull Shoals Lake for Municipal and Industrial (M&I) purposes. OMRPWA is a coalition of 22 water systems in the north central Arkansas area that serves about 22,000 people in Newton, Searcy, and parts of Boone, Marion, Johnson and Pope counties. In order to approve this request, the Little Rock District must conduct a reallocation study including an EA for this proposed action.

GEC respectfully requests any information from your office within 30 days of the date of this letter regarding existing environmental resources within the project area. If comments are not received by this date, we will assume your agency has no comments on the proposed action. Should you have any questions or require further information, please contact me at (225) 612-4117 or macdanel@gecinc.com; or Mike Rodgers with the Little Rock District at (501) 324-5030 or Michael.r.rodgers@usace.army.mil.

Sincerely,

Patrick S. MacDanel

Patrick S. MacDanel
Senior Environmental Scientist/Wildlife Biologist

Date 10-5-09
No known historic properties will be affected by this undertaking. This effect determination could change should new information come to light.
Frances McSwain
Frances McSwain, Deputy State Historic Preservation Officer

Please submit comments to:

Patrick S. MacDanel
GEC, Inc.
P.O. Box 84010
Baton Rouge, LA 70808

Patrick MacDanel

From: Page, Christopher M SWL [Christopher.M.Page@usace.army.mil]
Sent: Wednesday, October 21, 2009 8:48 AM
To: Patrick MacDanel
Cc: Rodgers, Michael R SWL
Subject: [NEWSENDER] - MO SHPO Call - Message is from an unknown sender

Patrick,

I spoke with Judith Deel in the Missouri SHPO's office this morning and she stated that because the physical impacts to Bull Shoals in Missouri is small, they would just coordinate the project through their natural resources department. That said, she said if the impacts were determined to be larger (i.e. a foot or more of water level change) further coordination would be required.

As far a letter to the Osage is concerned this scoping letter probably won't elicit a response from them, but as soon as actual impacts to the normal operating water level are known we will probably need to coordinate with them further. If you have any questions or need any further information please let me know.

Thanks,

Chris

Christopher M. Page, RPA
District Archeologist
Little Rock District
US Army Corps of Engineers
PO Box 867
Little Rock, AR 72203-0867
(501) 324-5752
christopher.m.page@usace.army.mil

Patrick MacDanel

From: Mike Smith [Mike.Smith@mdc.mo.gov]
Sent: Monday, October 19, 2009 7:37 AM
To: Patrick MacDanel
Cc: Michael.r.rodgers@usace.army.mil; David Thorne
Subject: [NEWSENDER] - EA Preparation for Ozark Mountain Regional Public Water Authority Water Supply Reallocation Bull Shoals Lake, AR - Message is from an unknown sender

Mr. MacDanel:

The Department of Conservation contacted Mr. Michael Rodgers, USACE regarding this matter. He indicated there would be a public review of the assessment next spring. We are going to wait for the completion of that document before considering whether additional comment is warranted.

Sincerely,

MS

Michael S. Smith
Policy Coordinator
Missouri Department of Conservation
PO Box 180
Jefferson City, MO 65102-0180
573-522-4115 ext. 3152
573-526- 4495 FAX

Patrick MacDanel

From: Rodgers, Michael R SWL [Michael.R.Rodgers@usace.army.mil]
Sent: Friday, September 25, 2009 1:54 PM
To: Mike Smith
Cc: Patrick MacDanel
Subject: RE: Preparation of EA for Ozark Mtn Regional Public Water Authority - Water Supply Reallocation

Mike

Complete answers are not available at this time but preliminary analysis showed that 6-8000 acre feet would yield the 6 MGD depending on which pool (Conservation or Flood) the storage would be reallocated from. Reallocation from the conservation pool will not result in a pool elevation change and a flood pool reallocation could result in approximately 0.25 feet change in the top of conservation pool elevation. The Water Reallocation Report which is currently under development will identify specifics and which pool to take the storage from.

There will be a 30 day public review period of those documents when complete (next spring). The letter that GEC sent is an early agency coordination effort soliciting information that we should be aware of to be included and/or considered in the development of the EA.

Give me a call if you would like

Thanks

Mike Rodgers
501-324-5030

-----Original Message-----
From: Mike Smith [mailto:Mike.Smith@mdc.mo.gov]
Sent: Friday, September 25, 2009 11:36 AM
To: Rodgers, Michael R SWL
Subject: Preparation of EA for Ozark Mtn Regional Public Water Authority - Water Supply Reallocation

Mr. Rodgers: Do you have any additional information on this reallocation request? I have received a request from GEC for comments . I would be interested in knowing more about the reallocation process specific to Bull Shoals. Also, some relative sense as to what the amount of water means to pool elevations and other users and uses. It doesn't like that much water.

Thanks,

MS

Michael S. Smith

Policy Coordinator

Missouri Department of Conservation

PO Box 180

Jefferson City, MO 65102-0180

573-522-4115 ext. 3152

573-526- 4495 FAX

Patrick MacDanel

From: Tracy Copeland [Tracy.Copeland@dfa.arkansas.gov]

Sent: Tuesday, September 22, 2009 8:33 AM

To: Patrick MacDanel

Subject: [NEWSENDER] - "Needing Copy of Bull Shoals Lake, AR- Environmental Assessment" - Message is from an unknown sender

Good Morning Mr. MacDanel:
I called you earlier this morning after receiving your letter regarding an Environmental Assessment For Ozark Mountain Regional Public Water Authority Water Supply Reallocation in Bull Shoals Lake, Arkansas...Our office will need copies of the Environmental Assessment, as soon as possible, so it can be sent out to our 13 Member Technical Review Committee, requesting their comments should they have any.
Should you have questions, please call out office at (501) 682-1074.
Sincerely,
Tracy

Scott Henderson
Director

Loren Hitchcock
Deputy Director

Keeping the Natural State natural.

Arkansas Game and Fish Commission

Mike Gibson
Assistant Director

Mike Armstrong
Assistant Director

September 23, 2009

Mr. Patrick MacDanel
GEC, Inc.
P.O. Box 84010
Baton Rouge, LA 70808

Re: Dear Mr. MacDanel:

Biologists from our agency have reviewed the Environmental Assessment request for the Ozark Mountain Regional Public Water Authority Water Supply Reallocation – Bull Shoals Lake, Arkansas which is located in Newton, Searcy, Boone, Marion, Johnson and Pope Counties, Arkansas. We are submitting the following comments to reduce possible impacts to fish and wildlife resources.

- All wetlands in the project area should be avoided or impacts should be minimized where possible. Unavoidable impacts should be mitigated.
- All stream crossings should use best management practices for erosion control.
- Stream crossing sites should be surveyed for freshwater mussels or evaluated by a malacologist to assess their potential for freshwater mussels.
- Large streams should be crossed by attaching a pipe to a bridge if possible or by boring under the streambed. If these two options are unachievable, then the work should be scheduled for June, July, or August to avoid peak spawning times and our agency should be contacted prior to construction.
- Applicant should be advised that this area has some karst topography and could potentially have impacts to cave recharge zones. For information about these zones we suggest contacting David Kampwerth who is a karst biologist that works for the U.S. Fish and Wildlife Service. His number is (501) 513-4477.

We recommend that you contact the U.S. Fish and Wildlife Service for an endangered species review, since our agency adheres to the federal listing and you will need to get clearance from them. Their address is 110 South Amity Rd., Suite 300, Conway, Arkansas 72032.

If our agency can be of further assistance, please feel free to contact us.

Sincerely,

Robert K. Leonard

Robert K. Leonard, Biologist
River Basins Division

Cc: Mark Oliver
David Goad
USFWS, Conway Office
State Clearinghouse

GEC
Gulf Engineers & Consultants

RECEIVED
SEP 21 2009
By

15 September 2009

U.S. Fish and Wildlife Service
Mr. Charlie Scott, Field Supervisor
101 Park Deville Drive, Suite A
Columbia, MO 65203

RE: Preparation of an Environmental Assessment For Ozark Mountain Regional Public Water Authority Water Supply Reallocation Bull Shoals Lake, Arkansas

Dear Madame/Sir:

On behalf of our client, the U.S. Army Corps of Engineers, Little Rock District (USACE-SWL), G.E.C., Inc. (GEC), is submitting the following information regarding an Environmental Assessment (EA) that GEC is preparing under guidelines set forth by the National Environmental Policy Act (NEPA). This EA will evaluate the reallocation of water storage from Bull Shoals Lake, Arkansas.

In February 2007, the Ozark Mountain Regional Public Water Authority (OMRPWA) requested that the Little Rock District reallocate storage sufficient to supply six (6) million gallons per day (MGD) from Bull Shoals Lake for Municipal and Industrial (M&I) purposes. OMRPWA is a coalition of 22 water systems in the north central Arkansas area that serves about 22,000 people in Newton, Searcy, and parts of Boone, Marion, Johnson and Pope counties. In order to approve this request, the Little Rock District must conduct a reallocation study including an EA for this proposed action.

GEC respectfully requests any information from your office within 30 days of the date of this letter regarding existing environmental resources within the project area. If comments are not received by this date, we will assume your agency has no comments on the proposed action. Should you have any questions or require further information, please contact me at (225) 612-4117 or macdanel@gecinc.com; or Mike Rodgers with the Little Rock District at (501) 324-5030 or Michael.r.rodgers@usace.army.mil.

Sincerely,

Patrick S. MacDanel

"The U.S. Fish and Wildlife Service (Service) has reviewed the proposed action and determined that no federally listed species, candidate species, or designated critical habitat occurs within the project area. Furthermore, the Service has determined that this action will have negligible impacts on wetlands, migratory birds, and other priority fish and wildlife resources."

Charlie Scott 10/14/09

Field Supervisor Date

ogist

Please submit comments to:

Patrick S. MacDanel
GEC, Inc.
P.O. Box 84010
Baton Rouge, LA 70808

GEC
Gulf Engineers & Consultants

Margaret Harney
Environmental Coordinator
U.S. Fish and Wildlife Service
Log# TA0097- CPA0095
Oct 29, 2009
Date

15 September 2009

RECEIVED
SEP 18 2009
ARK FIELD OFFICE

U.S. Fish and Wildlife Service
Attn: Mr. Mark Sattelberg
110 South Amity Rd., Suite 300
Conway, AR 72032

RE: Preparation of an Environmental Assessment For Ozark Mountain Regional Public Water Authority Water Supply Reallocation Bull Shoals Lake, Arkansas

No federally listed endangered, threatened or candidate species present

Dear Madame/Sir:

On behalf of our client, the U.S. Army Corps of Engineers, Little Rock District (USACE-SWL), G.E.C., Inc. (GEC), is submitting the following information regarding an Environmental Assessment (EA) that GEC is preparing under guidelines set forth by the National Environmental Policy Act (NEPA). This EA will evaluate the reallocation of water storage from Bull Shoals Lake, Arkansas.

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Sincerely,

Patrick S. MacDanel

Patrick S. MacDanel
Senior Environmental Scientist/Wildlife Biologist

Please submit comments to:

Patrick S. MacDanel
GEC, Inc.
P.O. Box 84010
Baton Rouge, LA 70808

U.S. Department of Homeland Security
FEMA Region 6
800 North loop 288
Denton, TX 76209-3698

FEMA

October 9, 2009

Patrick S. MacDanel
Senior Environmental Scientist
GEC, Inc.
P.O. Box 84010
Baton Rouge. LA 70808

Re: Ozark Mountain Regional Public Water Authority
Water Supply Reallocation
Bull Shoals Lake, Arkansas

Dear Mr. MacDanel:

We have received your letter dated September 15, 2009. Thank you for the opportunity to comment on the above-proposed project.

The concerns of the Federal Emergency Management Agency (FEMA) are directed toward the National Flood Insurance Program (NFIP) and the possible negative impact upon identified special flood hazard areas within the outlined project boundaries.

The counties of Marion and Baxter Counties do not participate in the National Flood Insurance Program (NFIP). Any development that may take place within the county must be reviewed and appropriate permits issued to ensure compliance with their adopted county rules or regulations. Our records show that Mr. James Giles is the County Judge for Marion County and he can be reached at (870) 449-6231. Our records show that Mr. Joe Bodenhamer is the County Judge for Baxter County and he can be reached at (870) 425-2755.

Coordination with the County Judge for Marion County and Baxter County can ensure that this project is in compliance with any County regulations/requirements.

Sincerely,

Roy B. McClure

Roy B. McClure, CFM
Natural Hazards
Program Specialist

GEC
Gulf Engineers & Consultants

2009 SEP 18 A 10: 28

15 September 2009

FEMA, Region VI
Attn: Mr. Gary Jones
800 North Loop 288
Denton, TX 76210

**RE: Preparation of an Environmental Assessment
For Ozark Mountain Regional Public Water Authority
Water Supply Reallocation
Bull Shoals Lake, Arkansas**

Dear Madame/Sir:

On behalf of our client, the U.S. Army Corps of Engineers, Little Rock District (USACE-SWL), G.E.C., Inc. (GEC), is submitting the following information regarding an Environmental Assessment (EA) that GEC is preparing under guidelines set forth by the National Environmental Policy Act (NEPA). This EA will evaluate the reallocation of water storage from Bull Shoals Lake, Arkansas.

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Sincerely,

Patrick S. MacDanel
Senior Environmental Scientist/Wildlife Biologist

Please submit comments to:

Patrick S. MacDanel
GEC, Inc.
P.O. Box 84010
Baton Rouge, LA 70808

Department of Energy
Southwestern Power Administration
One West Third Street
Tulsa, Oklahoma 74103-3502

October 15, 2009

Patrick S. MacDanel
Senior Environmental Scientist/Wildlife Biologist
Gulf Engineers & Consultants, Inc.
P.O. Box 84010
Baton Rouge, LA 70808

Dear Mr. MacDanel:

This is in response to your letter dated September 15, 2009, requesting information pertaining to the preparation of an Environmental Assessment (EA) for a proposed water storage reallocation at Bull Shoals Lake for the Ozark Mountain Regional Public Water Authority (OMRPWA). Southwestern Power Administration (Southwestern) is pleased to offer comments to assist you in the development of the EA.

Southwestern is an agency within the U.S. Department of Energy which is responsible for marketing the hydroelectric power and energy from 24 Corps of Engineers (Corps) projects in the region, including Bull Shoals Dam. As the Federal agency responsible for marketing the hydropower from Bull Shoals, Southwestern has concerns with the storage reallocation request. Federal hydropower will be the project purpose most adversely affected by the proposed reallocation. As stated in the coordination meeting on September 24, 2009, at the Little Rock District (LRD) office, the proposed reallocation should meet three criteria: 1) the reallocated storage is to satisfy an immediate need for water supply; 2) the reallocation is the lowest cost alternative for the water supply; and 3) Federal hydropower must be properly compensated for losses due to the reallocation. The third criterion is typically not met in Corps studies.

Southwestern understands that OMRPWA originally requested water supply storage in Bull Shoals Reservoir yielding 12 million gallons per day (MGD) and has since reduced that request to 6 MGD. We are concerned that the Corps calculations greatly underestimate the impacts to the Federal hydropower purpose. Corps energy loss calculations are based on the yield of the contracted storage, but water supply users are able to withdraw more than the "safe yield" of the storage in all years except the critical drought period without depleting their contracted storage. The Corps energy loss calculations should include additional withdrawals above the yield of contracted storage, or the water supply storage contract should limit the amount the user can withdraw to only the yield of the contracted storage.

It is imperative that the economic impacts of the reallocation alternatives be properly evaluated. In almost all reallocation studies evaluated by Southwestern, reallocation of flood storage provides the least benefits foregone and is the National Economic Development (NED) plan. We would expect the same result in the current study. In addition to a flood pool reallocation, the use of storage for hydropower yield protection operation (HYPO) is an available option that should be utilized. Corps ER 1105-2-100 recommends the use of operational changes, when possible, to compensate hydropower users. The use of HYPO, similar to dependable yield mitigation storage (DYMS) for existing water supply users, is another method of protecting the hydropower purpose. LRD has the discretion to include HYPO and in fact did so in the White River Minimum Flow Study. It is a viable alternative that should be considered in formulating the NED plan. The use of HYPO as part of a storage reallocation would maintain the current yield of the hydropower storage and, therefore, minimize the hydropower losses, especially capacity and on-peak energy losses.

Southwestern is also concerned with the environmental impacts and the potential for high costs of replacement energy and capacity relating to greenhouse gas (GHG) emissions. Capacity and energy to replace the renewable hydropower lost as a result of the reallocation will likely come from a fossil-fuel generating plant, resulting in increased GHG emissions. With the current emphasis on climate change legislation, non-renewable generation that results in the increased GHG emissions could have significant additional costs associated with climate change legislation currently pending in Congress. The environmental impacts and potential costs of the increased emissions should be quantified and included in the EA.

We appreciate the opportunity to provide comments concerning the preparation of the reallocation report and EA for the proposed storage reallocation. Please contact Michael Denny at 918-595-6683 or Michael.Denny@swpa.gov if you have any questions concerning our comments.

Sincerely,

Michael R. Denny

for George Robbins
Director
Division of Resources and Rates

cc:
Ted Coombes
Executive Director
Southwestern Power Resources Association

Email message sent from SWPA to USACE Little Rock District on 30 SEP 2010

09/30/09

Southwestern Power Administration (Southwestern) does not recall any mention of inactive storage as a storage reallocation alternative during the September 24 meeting, and we cannot find any mention of it in the meeting minutes. Southwestern strongly opposes the consideration of inactive storage as an alternative for storage reallocation for water supply in all storage reallocation studies. That opposition is based in part on the following points:

1. Inactive storage is set aside for hydropower head and/or the storage of sediment expected to accumulate over the life of the project. By definition, it is inactive or unusable. Reallocation of that storage would in effect lower the bottom of the conservation pool. Typically, at hydropower projects, the size of the inactive storage is designed to provide sufficient head for hydropower generation.

2. The Little Rock District produced a report in September 1968 entitled "White River Rule Curve Studies – 1968, White River Hydroelectric System." Section V of that report discusses the possible use of a portion of the inactive storage as emergency power storage. Emergency power storage could potentially be utilized to sustain firm power generation during a more severe drought than had been experienced at the time. It would be for emergency use only in a significant drought. Use of the inactive storage for any other purpose was not contemplated and would negatively impact hydropower production.

3. The Little Rock District draft storage reallocation report for the Trout Production Facility at Beaver Lake dated July 2000 mentions and dismisses the consideration of inactive storage as a reallocation alternative, citing ER 1105-2-100:

   Inactive Pool. This pool is used to provide a hydraulic head for hydropower generation, space for sediment storage, and an area for recreation and fish habitat. Per paragraph 4-32d, page 4-55, Engineering Regulation 1105-2-100, dated 28 December 1990, this storage is not to be included as usable storage when computing the water user's pro-rata share of updated cost of storage. Therefore, this pool was excluded from these analyses as a storage option.

   The latest version of ER 1105-2-100, dated April 22, 2000, includes similar language concerning the calculation of the updated cost of storage on page E-217: "In this computation, usable storage does not include space set aside for sediment distribution or for hydropower head." Based on that definition, inactive storage is not "usable" and should not be considered for reallocation.

4. In the Little Rock District storage reallocation report for the Mid Arkansas Water Alliance at Greers Ferry Lake dated June 2007, inactive storage is not contemplated as an option for reallocation, in recognition that it is not usable storage. On page 7, the report states:

Two options will be evaluated for reallocation of storage in Greers Ferry Lake. The effects of reallocating storage from current flood control storage or conservation (hydropower) storage will be considered. These are the ***only usable storage spaces*** *in Greers Ferry Lake.* (emphasis added)

5. As in the previously mentioned report for Greers Ferry, the Little Rock District draft storage reallocation report for the City of Mountain Home, Arkansas, at Norfork Lake dated August 2007, similarly dismisses inactive storage as an option to be considered for reallocation. On page 10, the report contains similar language to the June 2007 report for Greers Ferry:

   Two options will be evaluated for reallocation of storage in Norfork Lake. The effects of reallocating storage from current flood control, or hydropower storage will be considered. These are the ***only usable storage spaces*** *in Norfork Lake.* (emphasis added)

6. In the recently completed White River Minimum Flows Study performed by the Little Rock District, the Corps performed an evaluation of various reallocation scenarios at Beaver, Table Rock, Bull Shoals, Norfork, and Greers Ferry. In recognition of the fact that inactive storage is not usable for any purpose other than hydropower head and sediment storage, the Corps did not consider that storage space as an alternative for reallocation at any of the five projects. Inactive storage at Bull Shoals was correctly excluded from consideration for that study, as it should be for the current study.

In consideration of all the examples mentioned here as well as many others that could be noted, the Corps should dismiss any consideration of inactive storage at Bull Shoals and all other projects for the current study and for future studies.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
Room 3416, Federal Building
700 West Capitol Avenue
Little Rock, Arkansas 72201-3225

SEP 2 1 2009

Patrick S. MacDanel
GEC, Inc.
P.O. Box 84010
Baton Rouge, Louisiana 70808

Dear Mr. MacDanel:

This letter is in response to your request for information related to Prime Farmland or Farmland of Statewide Importance for the Water Supply Reallocation for the Ozark Mountain Regional Public Water Authority for Bull Shoals Lake, Arkansas. After visiting with Mike Rogers, Little Rock District (USACE-SWL), it was determined that this reallocation would not affect the current flood pool of Bull Shoals Lake. This reallocation will have no affect on Prime Farmland or Farmland of Statewide Importance. Enclosed is form AD1006 for your use.

Should you have any questions or need additional information, please call me at (501) 301-3172 or email at edgar.mersiovsky@ar.usda.gov.

Sincerely,

EDGAR P. MERSIOVSKY
Assistant State Soil Scientist

Enclosure

cc: Luis Hernandez, Soil Survey Region 16 Leader/State Soil Scientist, NRCS, Little Rock, AR

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 9/15/09
Name Of Project Bull Shoals Lake-Water Supply Reallocation	Federal Agency Involved USACE
Proposed Land Use Water Supply	County And State Boone and Marion Counties, Arkansas
PART II *(To be completed by NRCS)*	Date Request Received By NRCS 9/18/09

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply -- do not complete additional parts of this form).*	Yes ☐	No ☑	Acres Irrigated	Average Farm Size
Major Crop(s)	Farmable Land In Govt. Jurisdiction Acres: %		Amount Of Farmland As Defined in FPPA Acres: %	
Name Of Land Evaluation System Used	Name Of Local Site Assessment System		Date Land Evaluation Returned By NRCS	

	Maximum Points	Alternative Site Rating Site A	Site B	Site C	Site D
PART III *(To be completed by Federal Agency)*					
A. Total Acres To Be Converted Directly					
B. Total Acres To Be Converted Indirectly					
C. Total Acres In Site		0.0	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information					
A. Total Acres Prime And Unique Farmland					
B. Total Acres Statewide And Local Important Farmland					
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted					
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value					
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*		0	0	0	0
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use					
2. Perimeter In Nonurban Use					
3. Percent Of Site Being Farmed					
4. Protection Provided By State And Local Government					
5. Distance From Urban Builtup Area					
6. Distance To Urban Support Services					
7. Size Of Present Farm Unit Compared To Average					
8. Creation Of Nonfarmable Farmland					
9. Availability Of Farm Support Services					
10. On-Farm Investments					
11. Effects Of Conversion On Farm Support Services					
12. Compatibility With Existing Agricultural Use					
TOTAL SITE ASSESSMENT POINTS	160	0	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	0	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	0	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	0	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 – Federal agencies involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form.

Step 2 – Originator will send copies A, B and C together with maps indicating locations of site(s), to the Natural Resources Conservation Service (NRCS) local field office and retain copy D for their files. (Note: NRCS has a field office in most counties in the U.S. The field office is usually located in the county seat. A list of field office locations are available from the NRCS State Conservationist in each state).

Step 3 – NRCS will, within 45 calendar days after receipt of form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland.

Step '4 – In cases where farmland covered by the FPPA will be converted by the proposed project, NRCS field offices will complete Parts II, IV and V of the form.

Step 5 – NRCS will return copy A and B of the form to the Federal agency involved in the project. (Copy C will be retained for NRCS records).

Step 6 – The Federal agency involved in the proposed project will complete Parts VI and VII of the form.

Step 7 – The Federal agency involved in the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA and the agency's internal policies.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

Part I: In completing the "County And State" questions list all the local governments that are responsible for local land controls where site(s) are to be evaluated.

Part III: In completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them.

2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities) that will cause a direct conversion.

Part VI: Do not complete Part VI if a local site assessment is used.

Assign the maximum points for each site assessment criterion as shown in § 658.5 (b) of CFR. In cases of corridor-type projects such as transportation, powerline and flood control, criteria #5 and #6 will not apply and will, be weighed zero, however, criterion #8 will be weighed a maximum of 25 points, and criterion #11 a maximum of 25 points.

Individual Federal agencies at the national level, may assign relative weights among the 12 site assessment criteria other than those shown in the FPPA rule. In all cases where other weights are assigned relative adjustments must be made to maintain the maximum total weight points at 160.

In rating alternative sites, Federal agencies shall consider each of the criteria and assign points within the limits established in the FPPA rule. Sites most suitable for protection under these criteria will receive the highest total scores, and sites least suitable, the lowest scores.

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, adjust the site assessment points to a base of 160. Example: if the Site Assessment maximum is 200 points, and alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \times 160 = 144 \text{ points for Site "A."}$$

Attachment 3
Draft EA and Reallocation Report Public Review/Comments

PUBLIC REVIEW / COMMENTS SUMMARY

The draft environmental assessment (Draft EA) and reallocation report for this action were released concurrently for public review and comment on May 11, 2010. The comment period ran for 30 days from May 11, 2010 to June 11, 2010 and was announced via a public notice which ran in five (5) newspapers covering the project area. These newspapers are identified in the Affidavit of Insertion included in this attachment. Copies of the Draft EA were mailed on compact disk to recipients listed on the mailing list included in this attachment. In addition, an electronic copy was posted on the Little Rock District webpage. Hardcopies were made available at the Mountain Home Project Office, the Searcy County Library, the Marion County Library in Yellville, Arkansas and at the Little Rock District headquarters building. A mailing list, copies of the public notice, newspaper notices, and other information pertaining to the public review period follow in this attachment.

Overall, ten (10) comment letters from agencies and private individuals were received during the comment period. Included were letters from eight (8) agencies or organizations and two (2) individual citizens. Copies of all letters are included in this attachment. A brief description of each comment letter and, where appropriate, a summary of substantial comments raised are provided below. In addition, a brief summary of the Little Rock District's evaluation of substantial issues raised in these comments is also included.

COMMENTS RECEIVED

Department of Energy, Southwestern Power Administration (letter dated June 11, 2010). The Southwestern Power Administration (SWPA) provided a significant number of comments on matters ranging from water supply needs and withdrawal rates, concern over USACE policies regarding reallocating storage for water supply, hydropower crediting calculations and procedures, methods of alternatives evaluation and resulting selection of the proposed plan, and consideration of the inactive pool for storage reallocation. In addition, SWPA identified the need to provide revisions based on an alternate Southwestern power marketing area, recently-renewed contracts, and recently-updated power rates.

A thorough analysis of comments received from SWPA was conducted by the Little Rock District and the Corps' Hydropower Analysis Center (HAC). Based on a review of the appropriate power marketing area and newly-revised rates, HAC revised calculations in its hydropower report (Reallocation Report, Appendix D). Similar changes were reflected in updates to the Reallocation Report and EA, as appropriate. Many comments received from SWPA concern long-standing and well-known areas of disagreement between SWPA and the Corps regarding USACE policy for evaluating impacts to hydropower and hydropower crediting procedures. In instances where Corps policy was applicable to methodology used in this study, such policy was consistently applied. These policy issues will likely continue to be a point of disagreement between the Corps and SWPA on this and future reallocations involving hydropower considerations.

One comment provided by SWPA was a recommendation to evaluate a flood pool reallocation alternative employing hydropower yield protection operation ("HYPO"), a methodology similar to dependable yield mitigation storage (DYMS) for existing water supply users. Such an

Department of Arkansas Heritage (letter dated May 13, 2010): The Department of Arkansas Heritage (DAH) concluded that the proposed project would not affect any known historic properties.

The Little Rock District acknowledges these comments.

U. S. Fish and Wildlife Service (USFWS)(letter dated June 3, 2010): The USFWS concurred with the assessment that this project will have no significant negative environmental impacts. Therefore, the Service had no objection to the proposed issuance of a Finding of No Significant Impact for the proposed action.

The Little Rock District acknowledges these comments.

Federal Emergency Management Agency (FEMA): FEMA requested that the county floodplain administrators be contacted for the review of the project and possible permit requirements for the proposed project.

The Little Rock District determined that the proposed action will result in no impact to floodplains; therefore, county floodplain administrators were not involved.

Comments from Individuals: Additional comments were provided by two (2) individual citizens (undated and handwritten letters by Mr. Gary Honeycutt, and one with an illegible signature and no return address). Both are included in this attachment. The comments from these individuals focused on the potential negative impacts of reallocating storage for water supply. All of the concerns expressed by these individuals are addressed in the Environmental Assessment and Finding of No Significant Impact. One individual questioned the authority to utilize Bull Shoals Lake for public water supply. The other individual seemed to focus on the use of the land that Bull Shoals Lake occupies for a public water supply reservoir.

The Little Rock District operates the Bull Shoals Dam and Lake Project as a multi-purpose reservoir, as authorized by the Congress of the United States. The project was authorized for flood control, hydroelectric power and other purposes, including fish/wildlife and recreation, by the Flood Control Act of 28 June 1938, as modified by the Flood Control Act of 1941. The Water Supply Act of 1958 provides general authorization for construction or reallocation of storage for water supply uses at all Corps lakes, provided such construction or reallocation does not seriously affect other authorized project purposes. The Chief of Engineers has delegated authority to approve reallocations of up to 15 percent of total storage capacity, or 50,000 ac-ft, whichever is less. This report concluded the reallocation for water supply will have no significant impacts to the authorized operating purposes of Bull Shoals Lake.

CONCLUSIONS

The draft and final EA were prepared in accordance with ER 200-2 “Procedures for Implementing NEPA”, which provides guidance for implementation of the procedural provisions of the National Environmental Policy Act (NEPA) of 1970 (42 USC 4321 *et seq.*, as amended) for the Civil Works Program of the U.S. Army Corps of Engineers, per regulations set forth by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500-1508).

analysis was conducted by the Little Rock District for the White River Minimum Flow (WRMF) study at Bull Shoals Lake. However, there are several distinctions between WRMF and the current study. These include special project-specific authorizing legislation, a reallocation for non-municipal and industrial (M&I) water supply purposes for WRMF, a reallocation of nearly twenty (20) times the storage volume for WRMF relative to the currently-proposed action, and a much greater adverse effect on hydropower. While not in accordance with USACE policy, alternative evaluation using HYPO was conducted for WRMF based on these considerations and the project-specific authority. The current USACE policy regarding existing hydropower users is that compensation may be considered through minor operational changes for the reallocation from the flood control pool to M&I water supply, and therefore, HYPO is not a viable consideration for the currently-proposed action.

<u>Southwestern Power Resources Association (letter dated June 11, 2010).</u> The Southwestern Power Resources Association (SPRA) provided comments which were very similar in nature and specific content to those provided by SWPA. In summary, SPRA expressed concern over an appropriate power marketing area, newly-revised hydropower rates, calculations of the hydropower impacts of storage reallocations including pricing, the period included in the evaluation, definition of usable storage, and cumulative effects of past reallocations.

The Little Rock District and HAC thoroughly evaluated comments received from SPRA. As many of these issues were similar to those raised by SWPA, conclusions were likewise similar. Most of the comments were addressed by identifying the USACE policy used in the evaluation of hydropower impacts and crediting procedures. Where necessary based on newly-revised rates and other considerations, revisions were incorporated in the HAC report, the reallocation report, and EA. In instances where comments provided by SPRA were in conflict with USACE policy, USACE policy was consistently applied.

The SPRA likewise provided comments regarding cumulative effects on hydropower production and mitigation considerations for such effects. The USACE believes that mitigation for hydropower effects is provided for by credits to SWPA in accordance with Corps' policy and procedures. Finally, SPRA commented that the EA should consider cumulative effects of storage reallocations on greenhouse gas emissions at the 24 Corps projects from which SWPA markets hydroelectric energy and capacity owing to replacement of hydropower losses by thermal generation. While the EA does provide estimates of the increase in greenhouse gas emissions resulting from the proposed action, the widespread geographic range of the 24 Corps projects and uncertainties regarding location of thermal generation facilities make it difficult to quantify cumulative effects on ambient air quality. It should be noted, however, that such thermal facilities are subject to air quality regulations and permitting requirements aimed at attainment of air quality standards.

<u>T. David Carruth, Attorney at Law (letter dated June 10, 2010).</u> Mr. Carruth provided comments reported to be on behalf of himself, "the White River Conservancy, and are available as comments for the Arkansas Wildlife Federation, the Clarendon Chamber of Commerce and a lose *(sic)* association of individuals who use the waters of the White River for recreation, fishing and hunting. This association is known as the B.P.F.M.A.O.R.R.R.". Mr. Carruth commented that he had trouble accessing the draft Reallocation Report and EA for review from the Corps' website and for that reason requested an extension of the comment period. He also expressed

concerns that the reallocation of water supply storage would “have a profound impact on both the human and natural environment”. He stated that “Water supply is not an authorized use of the water impounded by Bull Shoals Dam”. He expressed concern about how the reallocated water supply storage will be managed and utilized, as well as how downstream waters will be managed. He expressed the opinion that the “allocation should not take place”, that a full environmental impact study should be conducted, and that to do less “would be in violation of the National Environmental Policy Act”.

The Little Rock District has thoroughly evaluated Mr. Carruth’s comments. The Corps provided opportunity for document review via the internet and hard copies in four (4) locations throughout the state, to include the Mountain Home Project Office, the Searcy County Library, the Marion County Library, and Little Rock District Office. During the comment period, the majority of the responses received indicated that the individuals or agencies had reviewed documents with no indications of problems or inabilities in accessing the documents, thus validating the distribution methods. There were also no known problems with the website link throughout the comment period. Therefore, it was determined that there was no reason for extending the comment period.

Other concerns expressed are addressed in the Environmental Assessment and Finding of No Significant Impact. These two documents complete the requirements called for by the National Environmental Policy Act of 1970 (42 USC 4321, *et seq.*, as amended), under guidelines set for by the Council on Environmental Quality (CEQ) regulations (40 CFR, Parts 1500-1508). The Bull Shoals Dam and Lake Project is a multi-purpose reservoir. The project was authorized for flood control, hydroelectric power and other purposes, including fish/wildlife and recreation, by the Flood Control Act of 28 June 1938, as modified by the Flood Control Act of 1941.The Water Supply Act of 1958 provides general authorization for construction or reallocation of storage for water supply uses at all Corps lakes, provided such construction or reallocation does not seriously affect other authorized project purposes. The Chief of Engineers has delegated authority to approve reallocations of up to 15 percent of total storage capacity, or 50,000 ac-ft, whichever is less. This report concluded the reallocation for water supply will have no significant impacts to the authorized operating purposes of Bull Shoals Lake which include flood control, hydropower, water supply and fish and wildlife. The USACE does not operate for or regulate the downstream use of the water in the White River System.

<u>Arkansas Game and Fish Commission (letter dated June 1, 2010):</u> The Arkansas Game and Fish Commission (AGFC) did not have any specific concerns with the proposed reallocation of water supply storage in Bull Shoals Lake from a fish and wildlife management standpoint.

The Little Rock District acknowledges these comments.

<u>Arkansas Department of Health (letter dated May 13, 2010):</u> The Arkansas Department of Health (ADH) reviewed the proposed project and concluded that it would provide the local area with a safe drinking water supply.

The Little Rock District acknowledges these comments.

Department of Arkansas Heritage (letter dated May 13, 2010): The Department of Arkansas Heritage (DAH) concluded that the proposed project would not affect any known historic properties.

The Little Rock District acknowledges these comments.

U. S. Fish and Wildlife Service (USFWS)(letter dated June 3, 2010): The USFWS concurred with the assessment that this project will have no significant negative environmental impacts. Therefore, the Service had no objection to the proposed issuance of a Finding of No Significant Impact for the proposed action.

The Little Rock District acknowledges these comments.

Federal Emergency Management Agency (FEMA): FEMA requested that the county floodplain administrators be contacted for the review of the project and possible permit requirements for the proposed project.

The Little Rock District determined that the proposed action will result in no impact to floodplains; therefore, county floodplain administrators were not involved.

Comments from Individuals: Additional comments were provided by two (2) individual citizens (undated and handwritten letters by Mr. Gary Honeycutt, and one with an illegible signature and no return address). Both are included in this attachment. The comments from these individuals focused on the potential negative impacts of reallocating storage for water supply. All of the concerns expressed by these individuals are addressed in the Environmental Assessment and Finding of No Significant Impact. One individual questioned the authority to utilize Bull Shoals Lake for public water supply. The other individual seemed to focus on the use of the land that Bull Shoals Lake occupies for a public water supply reservoir.

The Little Rock District operates the Bull Shoals Dam and Lake Project as a multi-purpose reservoir, as authorized by the Congress of the United States. The project was authorized for flood control, hydroelectric power and other purposes, including fish/wildlife and recreation, by the Flood Control Act of 28 June 1938, as modified by the Flood Control Act of 1941. The Water Supply Act of 1958 provides general authorization for construction or reallocation of storage for water supply uses at all Corps lakes, provided such construction or reallocation does not seriously affect other authorized project purposes. The Chief of Engineers has delegated authority to approve reallocations of up to 15 percent of total storage capacity, or 50,000 ac-ft, whichever is less. This report concluded the reallocation for water supply will have no significant impacts to the authorized operating purposes of Bull Shoals Lake.

CONCLUSIONS

The draft and final EA were prepared in accordance with ER 200-2 “Procedures for Implementing NEPA”, which provides guidance for implementation of the procedural provisions of the National Environmental Policy Act (NEPA) of 1970 (42 USC 4321 *et seq.*, as amended) for the Civil Works Program of the U.S. Army Corps of Engineers, per regulations set forth by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500-1508).

After careful evaluation of all comments received, the conclusions and recommendations expressed in the draft report and EA remain the same. None of the comments received warrant a change to the conclusion that the proposed action has no significant effects on the environment. Therefore an Environmental Impact Statement (EIS) is not warranted and a "Finding of No Significant Impact" (FONSI) is appropriate.

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Atlanta, GA 30345

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U.S. Department of Agriculture
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FEMA, Region VI
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Environmental Coordinator
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Jefferson City, MO 65102

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Tribal Historic Preservation Officer
Caddo Nation of Oklahoma
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Binger, OK 73009

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Ms. Loretta Sutton
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(MS 2342)
Washington, DC 20240

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT CORPS OF ENGINEERS
POST OFFICE BOX 867
LITTLE ROCK, ARKANSAS 72203-0867

REPLY TO
ATTENTION OF

(501) 324-5751 □ FAX: 501-324-5605 □ http://www.swl.usace.army.mil

May 10, 2010

Planning and Environmental Division
Environmental Branch

«fn» «ln»
«title»
«agency»
«office»
«add1»
«add2»
«city», «state» «zip»

Dear «salutation» «ln»:

Enclosed for your review is a compact disc containing a copy of the water supply storage reallocation report for the Ozark Mountain Regional Public Water Authority (OMRPWA) and the Marion County Regional Water District (MCRWD), Bull Shoals Lake, Arkansas. The draft water supply report includes, as Appendix C, the Draft Environmental Assessment (DEA) and Draft Finding of No Significant Impact. The DEA has been prepared in accordance with the National Environmental Policy Act (NEPA) and U.S. Army Corps of Engineers Engineering Regulation ER-200-2-2. The draft document presents results of the feasibility study to reallocate a total of 11,866.54 acre feet (AF) storage from the Bull Shoals Lake conservation pool to the two water districts and associated potential impacts to the human environment. This total AF represents less than one percent of the total conservation pool storage of 1,236,000 AF in the lake.

Your comments are requested as part of a 30-day public review period and should be received no later than June 11, 2010. Written comments should be provided to Mr. Patrick MacDanel, at GEC, Inc., P.O. Box 84010, Baton Rouge, LA 70808 or by e-mail to macdanel@gecinc.com. For more information you may contact Patrick MacDanel (212-612-4117) or Mike Rodgers (501-324-5030) at the Little Rock District Office.

Sincerely,

Dana Coburn
Chief, Environmental Branch

Enclosure

U.S. Army Corps of Engineers
Little Rock District

News Release

Back to News Release Index

Release No: 43-10
Release: Immediately
May 10, 2010
Contact:
Laurie Driver, 501-324-5551
Laurie.T.Driver@usace.army.mil

COMMENTS SOUGHT ON PROPOSED BULL SHOALS LAKE WATER SUPPLY

LITTLE ROCK, Ark. -- The Army Corps of Engineers' Little Rock District is seeking public comments through June 11 on environmental documents that examine a proposed reallocation of storage in Bull Shoals Lake to provide additional water supply for two regional water districts.

The Ozark Mountain Regional Public Water Authority and the Marion County Regional Water District are seeking to use Bull Shoals Lake as a water source to provide water supply into the future for more than 22,000 customers in the north central Arkansas area.

The documents are a Draft Feasibility Report, which includes a Draft Environmental Assessment and a Draft Finding of No Significant Impact. The report presents the results of a study to reallocate 11,866.54 acre feet of storage from the conservation pool to the two water utilities. Ozark Mountain's share would yield 6 million gallons per day, and Marion County's share would yield 1 million gallons per day.

The draft documents indicate the reallocation would cause no significant adverse effects to the human environment, and an Environmental Impact Statement will not be required.

The documents can be reviewed between 7:45 a.m. and 4:30 p.m. weekdays at the Mountain Home Project Office at 324 West 7th, Mountain Home, at the Searcy County Library at 202 East Main Street, Marshall, at the Marion County Library at 308 Old Main, in Yellville or at the Little Rock District Office in Room 7403 of the Federal Building at 700 W. Capitol Ave. in Little Rock. The documents can also be viewed on the Internet at http://www.swl.usace.army.mil/ and click "Proposed Bull Shoals Water Supply."

Written comments should be mailed to Mr. Patrick MacDanel at GEC Inc., P.O. Box 84010, Baton Rouge, LA 70808 or e-mailed to macdanel@gecinc.com. Mailed comments must be post-marked by June 11 and e-mailed comments must be received by then to become part of the official record.

For more information contact Mike Rodgers at (501-324-5030) at the Army Corps of Engineers Little Rock District Office.

Arkansas Press Services, Inc
411 S. Victory Street
Little Rock, AR 72201-2932
(501) 374-1500 • Fax (501) 374-7509

AFFIDAVIT OF INSERTION

This is to certify that the advertisement for US ARMY CORPS of ENGINEERS "Public Notice: Proposed Reallocation for Water Supply on Bull Shoals Lake Seeks Public Comments"

Appeared in the ARKANSAS DEMOCRAT-GAZETTE on May 11, 2010; in the HARRISON DAILY TIMES and MOUNTAIN HOME BAXTER BULLETIN on May 12, 2010; and in the FLIPPIN MOUNTAINEER-ECHO and MARSHALL MOUNTAIN WAVE on May 13, 2010; with tearsheets also attached as evidence.

(Print Media Planner/Buyer)

State of Arkansas

County of Pulaski

Sworn to and subscribed before me this 19 *day of* May*, 2010.*

TERRI DIANE COBB
NOTARY
My Comm. Expires
SEPT. 1, 2014
PUBLIC
PULASKI COUNTY, ARK.

Terri Diane Cobb
Notary Public

My commission expires
9-1-2014

... for Attorney General. Before being elected, ... was employed by Real Practices, a medical and real-estate development firm based in Northwest Arkansas.

Jim Milum, chairman of the Board of Trustees of North Arkansas College, will give the invocation and benediction. Diplomas will be awarded by Dr. Jeff Olson.

...rosity and ... and the university

... new funds, the Morris ... Jack and Jessie Morris ... lma Douglas Scholarship, ... AIE Endowed Scholarship ... Scholarships.

...eer with General Electric, ... resident at Thorsen Tool ... d as the president and ... is own company, Lyons ... ls a master's degree from ... rsity, and Betty Morris ... rom Syracuse University. ... en, Ron and Robert, and ... Ron, is a 1984 graduate ... is, and one granddaughter, ... university in 2008.

The Misunderstood Epidemic: Depression

A film that explores the difficulties faced by those coping with varying levels of depression.

Immediately following the documentary, AETN presents

HOUSE CALLS-"Depression"

This program features host Dr. T Glenn Pait interviewing Dr. Lawrence Miller, Medical Director for the Arkansas Department of Human Services, Division of Behavior Health Services and Kim Arnold, Executive Director for the Arkansas Chapter of the National Alliance for Mental Illness (NAMI Arkansas).

Tuesday, May 18, 7-8:30 p.m. on AETN

AETN

This outreach initiative is made possible through funding from Iron Zeal Films. The Misunderstood Epidemic: Depression is a production of Iron Zeal Films and is presented by KPBS.

PUBLIC NOTICE

PROPOSED REALLOCATION FOR WATER SUPPLY ON BULL SHOALS LAKE CORPS SEEKS PUBLIC COMMENTS

Public Involvement: The Army Corps of Engineers' Little Rock District is seeking public comments through June 11 on environmental documents that examine a proposed reallocation of storage in Bull Shoals Lake to provide additional water supply for the Ozark Mountain Regional Public Water Authority and the Marion County Regional Water District.

Information: The documents are a Draft Feasibility Report, which includes a Draft Environmental Assessment and a Draft Finding of No Significant Impact. The report presents the results of a study to reallocate 11,866.54 acre feet of storage from the conservation pool to the two water districts. The 6 million gallons per day requested by OMRPWA will be provided by 10,188.463 acre feet of storage and 1,698.077 acre feet will provide one million gallons per day for Marion County.

The draft documents indicate the reallocation would cause no significant adverse effects to the human environment, and an Environmental Impact Statement will not be required.

Point of Contact: The documents can be reviewed between 7:45 a.m. and 4:30 p.m. weekdays at the Mountain Home Project Office at 324 West 7th, Mountain Home, at the Searcy County Library at 202 East Main Street, Marshall, at the Marion County Library at 308 Old Main, in Yellville or at the Little Rock District Office in Room 7403 of the Federal Building at 700 W. Capitol Ave. in Little Rock. The documents can also be viewed on the Internet at www.swl.usace.army.mil and click "Proposed Bull Shoals Water Supply."

Written comments should be mailed to Mr. Patrick MacDanel at GEC Inc., P.O. Box 84010, Baton Rouge, LA 70808 or e-mailed to macdanel@gecinc.com. Mailed comments must be post-marked by June 11 and e-mailed comments must be received by then to become part of the official record.

For more information contact Mike Rodgers at (501-324-5030) at the Army Corps of Engineers Little Rock District Office.

Flippin 5-13

Saint Joe AR

Chance L. Case
Kristen Carey Dornburg
*Michael S. Elliott
Jessica M. Fletcher
Tiffany Dawn Harmon
**Amber R. Jones
Jordan Methvin
*Joe C. Reed
Tressa D. Scott
Dawn M. Stills
Tara Leanne Warren

... LPN at ... Arkansas Regional Medical Center sings and plays his guitar for recuperative care patients every other Sunday.

Medicare requires that activities are offered for Recuperative Care patients twice daily. Examples of activities would be puzzles, cards, ball toss, play-doh, etc. Anything that mimics an activity they enjoy and may have done or still do when they are at home. Most of NARMC activities are done one on one as patients may be unable to go to the Activity Room for

PUBLIC NOTICE

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For more information contact Mike Rodgers at (501-324-5030) at the Army Corps of Engineers Little Rock District Office.

Marshall 5-13

...ATIVE MU

UNOPPOSED DEMO
VOTE

FOR...............................

GOV
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JUDGE TIM FOX..............

EVELYN MOOREHEAD.....

Court of Appe
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JUDGE RHONDA WOOD..

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...Lute, special assistant
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PUBLIC NOTICE

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Ar Kansas Democrat Gazette 5-11

...of the school year — after the tornado destroyed a pre-kindergarten building and damaged other parts of the campus, Superintended John Sheridan said.

Siblings Maria and Alejandro Martinez sifted through debris Tuesday at the site where their mobile home had stood. The storm had blown it off of its foundation and threw it 50 feet away, scattering their furniture, appliances and other household items around the yard.

Alejandro, 14, said the family was inside their home when it started moving Monday evening. They were thrown from the home and suffered cuts and bruises. Their father, who also was at home, had a broken arm, they said.

"It started shaking and ... were expected ... but they were not predicted to be as severe, said meteorologist Ty Judd with the National Weather Service.

"We're not looking at what we saw yesterday," Judd said. He said a preliminary estimate counted 10 tornado touchdowns in Oklahoma Monday.

Gov. Brad Henry on Tuesday declared a state of emergency in 56 Oklahoma counties. He and U.S. Reps. Tom Cole and Mary Fallin were scheduled to tour damaged areas in central Oklahoma.

In Kansas, the most serious damage was reported in Belmont, west of Wichita, where several homes were hit and there were widespread power outages. But no injuries were reported.

PUBLIC NOTICE

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For more information contact Mike Rodgers at (501-324-5030) at the Army Corps of Engineers Little Rock District Office.

Harrison 5-12

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NGINEERS "Public Notice:
s Public Comments"

11, 2010; in the HARRISON
on May 12, 2010; and in the
AIN WAVE on May 13, 2010;

(Print Media Planner/Buyer)

, 2010.

Notary Public

My commission expir
9-1-201

• Serving Arkansas 137 Years

...g Ten denies rumors

COLUMBUS, Ohio (AP) - Big Ten commissioner Jim ...elany e-mailed conference ...fficials Tuesday to stamp ...ut a rumor that four schools ...ad already been offered a ...nance to join the league.

Ohio State athletic direc...r Gene Smith confirmed ...uesday that Delany had ...ashed a report that the Big ...en had offered expansion ...ots to Missouri, Nebraska, ...otre Dame and Rutgers.

Asked if there was any...ing to that speculation, ...nith said, "Nothing. There's ... truth to it whatsoever. Ac...ally, Jim sent us all an e-...ail telling us there's no truth to that — which we knew. There's no extensions of offers that have been made, so that's not true."

The conference is looking at expanding from its current 11 members so that it can extend the reach of its lucrative cable network and add a league championship game in football.

The Big Ten athletic directors will meet May 17-19 in downtown Chicago. They will be joined by faculty representatives, senior women's administrators and the head coaches in football and men's and women's basketball. But Smith said the meetings were routine and nothing would be decided in terms of expansion.

"This is our normal meetings, the ones we have every year," Smith said. "Jim (Delany) will probably give us an update on what the consultant has shared, and I don't even know if the consultant report is done. He'll give us an update and then move on doing what he's been doing. I think they meet with the (university) presidents in June or something like that. So the timeline hasn't changed, but there won't be any action next week."

...ushing suspended for HCG

NEW YORK (AP) — ...ouston Texans linebacker ...ian Cushing tested posi...e for HCG, a fertility drug ...at is on the NFL's banned ...bstance list.

A person familiar with ...shing's case told The As...ciated Press on Tuesday ...at Cushing had one posi...e test last September, then ...bsequently tested negative ...veral times. The person ...oke on condition of ...onymity because the test ...sults were supposed to re...ain confidential.

"He had one low-level ...sitive test for HCG in Sep...nber, and then every test ...er that was negative," the ...rson said. "He has said he ...s no idea where the posi...e test came from."

The NFL has suspended ...shing for the first four ...nes of the season. He won ... AP's NFL Defensive ...okie of the Year honor in ...uary for outstanding on...ld performance. Now, the ... is taking a revote for the ...ard, as well as All-Pro out...e linebacker because ...shing made the second ...m.

ESPN first reported the banned substance was human chorionic gonadotropin, which is widely taken by steroid users to help restart natural testosterone production. HCG can mitigate the side effects of ending a cycle of drugs. It's also used to induce ovulation and treat ovarian disorders in women.

PUBLIC NOTICE

PROPOSED REALLOCATION FOR WATER SUPPLY ON BULL SHOALS LAKE CORPS SEEKS PUBLIC COMMENTS

Public Involvement: The Army Corps of Engineers' Little Rock District is seeking public comments through June 11 on environmental documents that examine a proposed reallocation of storage in Bull Shoals Lake to provide additional water supply for the Ozark Mountain Regional Public Water Authority and the Marion County Regional Water District.

Information: The documents are a Draft Feasibility Report, which includes a Draft Environmental Assessment and a Draft Finding of No Significant Impact. The report presents the results of a study to reallocate 11,866.54 acre feet of storage from the conservation pool to the two water districts. The 6 million gallons per day requested by OMRPWA will be provided by 10,188.463 acre feet of storage and 1,698.077 acre feet will provide one million gallons per day for Marion County.

The draft documents indicate the reallocation would cause no significant adverse effects to the human environment, and an Environmental Impact Statement will not be required.

Point of Contact: The documents can be reviewed between 7.45 a.m. and 4:30 p.m. weekdays at the Mountain Home Project Office at 324 West 7th, Mountain Home, at the Searcy County Library at 202 East Main Street, Marshall, at the Marion County Library at 308 Old Main, in Yellville or at the Little Rock District Office in Room 7403 of the Federal Building at 700 W. Capitol Ave. in Little Rock. The documents can also be viewed on the Internet at www.swl.usace.army.mil and click "Proposed Bull Shoals Water Supply."

Written comments should be mailed to Mr. Patrick MacDanel at GEC Inc., P.O. Box 84010, Baton Rouge, LA 70808 or e-mailed to macdanel@gecinc.com. Mailed comments must be post-marked by June 11 and e-mailed comments must be received by then to become part of the official record.

For more information contact Mike Rodgers at (501-324-5030) at the Army Corps of Engineers Little Rock District Office.

...

...GINEERS "Public Notice: Public Comments"

..., 2010; in the HARRISON ...n May 12, 2010; and in the ...WAVE on May 13, 2010;

...t Media Planner/Buyer)

...7, 2010.

Teri Deane Cole

Notary Public

My commission expires 9-1-2014

PUBLIC NOTICE

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For more information contact Mike Rodgers at (501-324-5030) at the Army Corps of Engineers Little Rock District Office.

Arkansas Department of Health

4815 West Markham Street • Little Rock, Arkansas 72205-3867 • Telephone (501) 661-2000
Governor Mike Beebe
Paul K. Halverson, DrPH, FACHE, Director and State Health Officer

Engineering Section, Slot 37 Ph 501-661-2623 Fax 501-661-2032
www.HealthyArkansas.com/eng/ After Hours Emergency 501-661-2136

May 13, 2010

Ms. Dana Coburn
Department of the Army
Little Rock District Corps of Engineers
P.O. Box 867
Little Rock, AR72203-0867

RE: Draft Reallocation Report
Ozark Mountain Public Water Authority (OMPWA)
Marion County Regional Water Authority (MCRWA)
Bull Shoals Lake

Ms. Coburn:

This office has reviewed the above referenced report and concur with the reallocation that would provide water to OMPWA and additional water to MCRWA for the purposes of providing a safe drinking water supply to the areas served by these utilities.

If you have any questions concerning our support of this reallocation, please feel free to contact this office.

Sincerely,

Jeff Stone, P.E.
Chief Engineer
Engineering Section

RH:JS:CSC:KY

Cc: Mr. Tim Mays, Engineering Services, Inc.

The Department of
Arkansas
Heritage

Mike Beebe
Governor

Cathie Matthews
Director

Arkansas Arts Council
*
Arkansas Natural Heritage Commission
*
Delta Cultural Center
*
Historic Arkansas Museum
*
Mosaic Templars Cultural Center
*
Old State House Museum

Arkansas Historic Preservation Program

1500 Tower Building
323 Center Street
Little Rock, AR 72201
(501) 324-9880
fax: (501) 324-9184
tdd: (501) 324-9811
e-mail:
info@arkansaspreservation.org
website:
www.arkansaspreservation.com

An Equal Opportunity Employer

May 13, 2010

Mr. Patrick MacDanel
GEC, Inc.
Post Office Box 84010
Baton Rouge, Louisiana 70808

RE: Multi County - General
Section 106 Review - COE
Water Supply Storage Reallocation Report; Bull Shoals Lake
AHPP Tracking No: 72431

Dear Mr. MacDanel:

This letter is written in response to your inquiry regarding properties of architectural, historical, or archeological significance in the area of the referenced project. The staff of the Arkansas Historic Preservation Program has reviewed the records pertaining to the area in question, and reported that the proposed undertaking will not affect any known historic properties. This effect determination could change should new information come to light.

Thank you for the opportunity to comment on this undertaking. If you have any questions, please contact Steve Imhoff of my staff at (501) 324-9880.

Sincerely,

Frances McSwain

Frances McSwain
Deputy State Historic Preservation Officer

cc: Dr. Richard Allen, Cherokee Nation
Mr. Earl J. Barbry, Tunica-Biloxi Tribe of Louisiana, Inc.
Ms. Margaret Bell, Wichita & Affiliated Tribes
Mr. Robert Cast, Caddo Nation
Ms. Dana Coburn, Little Rock District, Corps of Engineers
Dr. Ann M. Early, Arkansas Archeological Survey
Ms. Tamara Francis, The Delaware Nation
Dr. Andrea A. Hunter, Osage Nation
Ms. Karen Kaniatobe, Absentee Shawnee Tribe
Ms. Lisa Larue-Stopp, United Keetoowah Band of Cherokees
Ms. Belinda Pryor, Shawnee Tribe of Oklahoma
Ms. Glenna J. Wallace, Eastern Shawnee Tribe of Oklahoma
Ms. Carrie V. Wilson, Quapaw Tribe of Oklahoma

Scott Henderson
Director

Keeping the Natural State natural.

Arkansas Game and Fish Commission

Loren Hitchcock
Deputy Director
Mike Armstrong
Assistant Director

June 1, 2010

Mrs. Dana Coburn
U.S. Army Corps of Engineers
Planning and Environmental Division
P.O. Box 867
Little Rock, Arkansas 72203-0867

Dear Mrs. Coburn:

Your letter to Scott Henderson dated May 10, 2010, concerning the water supply storage reallocation report, has been referred to me for reply.

Biologists from our Agency have reviewed the water supply storage reallocation report, for the Ozark Mountain Regional Public Water Authority and the Marion County Regional Water District, concerning Bull Shoals Lake, Arkansas. The draft document presents results of the feasibility study to reallocate 11,867 acre-feet (AF) of storage from Bull Shoals Lake conservation pool to the two water districts. Since this 11,867 AF of water represents less than one percent of the total conservation pool storage of 1,236,000 AF in the lake and equals less than 3 inches of water at the conservation pool, we do not have specific problems with this removal from a fish and wildlife management standpoint.

We appreciate the opportunity to review this project proposal. If our agency can be of further assistance with the proposed project, don't hesitate to call us.

Sincerely,

Robert K. Leonard

Robert K. Leonard, Biologist
Ecological & Engineering Services

Cc: David Goad
Mark Oliver
USFWS, Conway Office

T. David Carruth, Attorney at Law

P. O. Box 91
152 Madison Street
Clarendon, Arkansas 72029

870-747-3839 office
870-747-5695 fax
870-747-1130 mobile

June 10, 2010

Mr. Patrick McDanel
GEC, Inc.
P. O. Box 84010
Baton Rouge, LA 70808

Re: Bull Shoals Lake Proposed Reallocation
Via email to macdanel@gecinc.com

Dear Mr. McDaniel:

These comments are submitted in regard to a Public Notice of a proposed reallocation for water supply on Bull Shoals Lake of 11,866.54 acre feet to two water districts. The first is the Ozark Mountain Regional Public Water Authority and the other is Marion County Regional Water District. These comments are made on behalf of myself, the White River Conservancy and are available as comments for the Arkansas Wildlife Federation, the Clarendon Chamber of Commerce and a lose association of individuals who use the waters of the White River for recreation, fishing and hunting. This association is known as the B.P.F.M.A.O.R.R.R. I thank you and the Corps of Engineers for the opportunity to comment.

First, I attempted to open the file on the website listed in the Public Notice, www.swl.usace.army.mil however the file would not open. Therefore, I have been unable to read the reports regarding this proposal, i.e. the Draft Feasibility Report, the Draft Environmental Assessment and Draft Finding of No Significant Impact. I would request that the problem be investigated and, if it is determined the problem was in the USCOE website, that it be corrected and the time for comment be extended.

As to the proposal to "reallocate" water from Bull Shoals Lake for the two water districts, I submit that such a reallocation will have a profound impact on both the human and natural environment. Because of this impact, an environmental impact statement should be prepared prior to any reallocation.

Bull Shoals Dam was installed on the White River for the purpose of flood ***control*** as a result of flood events in the lower Mississippi River valley. The Congressionally authorized purposes for the dam and the impounded water are flood control and hydro-power generation. Water supply is not an authorized use of the water impounded by Bull Shoals Dam. It is the authorization for flood ***control*** which causes there to be a strong likelihood of impact to the human and natural environment if the proposed allocation is implemented.

As stated, Bull Shoals Dam was installed to control flooding on the White and Mississippi Rivers. Its purpose is to hold back runoff so that high level crests downstream are reduced or eliminated. Instead of the water traveling down the White River resulting in a high crest, the water is withheld in the Lake until the downstream flood event passes. Then the impounded water is released gradually so as not to cause further flooding. But management of the dam and water levels can release water into the lower White River system at a time when it is needed for the lower river ecosystem, aquifer recharge of the alluvial aquifer or agricultural irrigation. The current construction of the Grand Prairie Area Demonstration Project makes such a situation assured. Said another way, because Bull Shoals Dam was built for flood control, once the Grand Prairie and other projects are completed, the flood water impounded in Bull Shoals Lake should be released from the lake so that it can be picked up for irrigation by the White River Regional Irrigation District.

This result is supported not only by the authorization for Bull Shoals Dam, but by Arkansas law as pronounced by the Arkansas Supreme Court in the 1955 case of Harris vs. Brooks. Under Harris vs. Brooks uses other than domestic use are equal in priority. If there is a conflict, a latter use much yield to a prior use. By "allocating" water for an unauthorized use, i.e. water supply, the users of that water are subject to being enjoined by users of an authorized use and/or prior users.

Certainly either or both of the water districts could counter this by saying that the proposed reallocated water will be used for domestic purposes. However, this cannot be assured. The water is being used for a, "Public Water Authority" and "Regional Water District." This water Authority and water District assumably distribute the water to its customers for sale. This is not a domestic use but a commercial one, i.e. the sale of water. Certainly the argument will be advanced that this Authority and District sell the water to domestic users. Perhaps, but it is equally as likely the water is also distributed to car washes, restaurants, laundry mats and other industrial and commercial users. This is not domestic use but commercial use of the water. Certainly not an authorized use of the dam and impounded water. It is also not one worthy of higher consideration as to irrigation water.

For these reasons, I submit that the allocation should not take place and, at least, the impact to both the human and natural environment on both the upper and lower White River should be studied in more detail. Therefore, a full environmental impact study should be conducted. To do less, given the facts and consequences of this allocation, would be in violation of the National Environmental Policy Act.

Again, thank you for the opportunity to comment. Please investigate the issue regarding the website and, if the time for comment is extended, please advise as I would like to read the documents and make such comments as may be appropriate.

Very truly yours,

/s/ David Carruth

T. David Carruth

Mr. MacDaniel;

It is impossible for me to express the enormous amount or contempt that I have for the Corps of Engineers in regard to Bull Shoals Lake. First it was the "Minimum Flow" attack on the lake & now you want to start using the lake for public water supply. This is an out-rage. You guys will not be sastified until you completely drain the lake.

WE ARE JUST NOW STARTING TO HAVE DECENT RAINFALL. FOR THE PAST THREE YEARS BULL SHOALS HAS HAD SOME GOOD SPAWNS. PRIOR TO THIS WE HAVE HAD NEAR DROUGHT CONDITIONS. THIS WAS CAUSED IN PART BY USING LAKE NORFORK AS A WATER SUPPLY FOR MT. HOME ARKANSAS.

BULL SHOALS CANNOT PROVIDE ALL OF THIS. YOU <u>LIED</u> TO US ABOUT THE "MINIMUM FLOW" ISSUE AND YOU ARE LYING TO US ABOUT WHAT WILL HAPPEN

WHEN YOU START DRAINING THE LAKE FOR PUBLIC WATER. KEEP YOUR CORRUPT HANDS OFF BULL SHOALS.

IN CONCLUSION; WHY DON'T YOU GET OFF YOUR BUTTS & MAKE TYSON FOODS PAY UP. THEY HAVE POLLUTED ARKANSAS WITH THEIR CHICKEN PLANTS. MY FINAL STATEMENT IS THIS: THE CORPS OF ENGINEERS HAS LONG OUT LIVED IT'S USEFULLNESS. YOU GUYS ARE WORKING FOR THE FEDERAL GOVERNMENT, PROBABLY GOT

YOUR JOB BECAUSE YOU ~~D~~ KNEW SOME ONE, OR YOUR DADDY ~~BE~~ HAD CONNECTIONS. YOU HAVE TOO MUCH TIME ON YOUR HANDS. IF YOU WANT TO DO SOMETHING GO TO THE OIL SPILL & HELP THEM.

Sincerely,

[signature]

U. S. Department of Homeland Security
FEMA Region 6
800 North Loop 288
Denton, TX 76209-3698

FEMA

FEDERAL EMERGENCY MANAGEMENT AGENCY
REGION VI
MITIGATION DIVISION

PUBLIC NOTICE REVIEW/ENVIRONMENTAL CONSULTATION

☐ We have no comments to offer. ☒ We offer the following comments:

WE WOULD REQUEST THAT THE COUNTY FLOODPLAIN ADMINISTRATOR BE CONTACTED FOR THE REVIEW AND POSSIBLE PERMIT REQUIREMENTS FOR THIS PROJECT.

REVIEWER: Mayra G. Diaz DATE: 5/12/10

940-898-5541
Natural Hazards Program Specialist

I read an article in our local newspaper regarding comments of the issue of Marion County Ark. using the Bull Shoals as a public water supply, I thought that this was designed for flood control, My Dad Stanford Honeycutt helped build the dam I had a lot of relatives who had to give up their lands for this why do you want to change things also the few farms left, ~~so~~ PS the lake took the best land, we use the spring branches for watering our livestock, what is this going to do to us would it not be a lot better to drill wells, also what about the Recreation areas of the lake levels what will this do to the economy, PS I believe God gave us this land to use and take care of I have a well myself Mt Home can drill their own wells we in Missouri should not have to supply them water just because they want the convience of it, we should not have to give up our freedoms just because they want to take them, we in America don't want to look at the right or wrong problem some of the big wigs in Ark. are wanting to pad their pockets if you will really check things out you will find I'm right, also what would happen

(Over)

If you had an earthquake and the Dam got busted they would loose their water supply verses if they had their wells they would not have this problem.

Thanks

Gary Honeycutt
HCR 2 Box 27
Wasola, Mo 65773

417-265-0008

PS What about the New Madrid fault

SOUTHWESTERN POWER RESOURCES ASSOCIATION

PARTNERS WITH THE RIVER · HYDROPOWER TO THE PEOPLE

June 11, 2010

Mr. Patrick MacDanel
GEC Inc.
P.O. Box 84010
Baton Rouge, LA 70808

RE: Draft Water Supply Storage Reallocation Report, Reallocation of Storage at Bull Shoals Lake, Arkansas, for Ozark Mountain Regional Public Water Authority and Marion County Regional Water District (Draft Bull Shoals Reallocation Report)

Dear Mr. MacDanel:

On behalf of Southwestern Power Resources Association (SPRA), I respectively submit the following comments concerning the above cited document. SPRA represents the rural electric cooperatives and municipally owned electric utilities that purchase the energy and capacity generated at 24 Corps of Engineers multipurpose projects in this region, including the Bull Shoals project. This energy and capacity is marketed to our membership by Southwestern Power Administration (SWPA), an agency of the U.S. Department of Energy.

The draft reallocation report makes a compelling case for reallocation of storage at Bull Shoals Lake to meet the municipal and industrial (M&I) water supply needs of Ozark Mountain Regional Public Water Authority (Ozark Mountain) and Marion County Rural Water District (Marion County). SPRA recognizes the need for quick action on these M&I water supply requests, both because of Ozark Mountain's contaminated drinking water supply source and because of the need to obligate available funding from the American Recovery and Reinvestment Act (ARRA).

We are quite concerned, therefore, about several fatal flaws in the data and report provided by the Corps' Hydropower Analysis Center (HAC), which serve as the basis for the determination of which pool should serve as the source for the storage reallocation, compensation to the hydropower purpose for impacts of the proposed storage reallocation, and determination of costs assigned to any reallocated storage. These flaws include:

- Use of pricing data for electric energy and capacity from the Southeast Electric Reliability Council (SERC). SWPA markets the energy and capacity from the Bull Shoals project in the Southwest Power Pool (SPP) region. This pricing data serves as the basis for compensation for hydro benefits foregone during the remaining term of SWPA's

918.622.7800 • 918.622.8141 (fax) • www.sprahydro.com • information@sprahydro.com

P.O. Box 471827 • Tulsa, Oklahoma • 74147

outstanding contracts.[1] To the extent that SERC prices do not reflect SPP prices, hydropower impacts will not be correctly compensated.

- Assumption that SWPA's outstanding contracts for hydro energy and capacity marketed from Bull Shoals expire in 2015. In fact, contracts extend through the year 2025. Even using the Corps' flawed procedure of limiting hydro compensation to benefits foregone during the remaining term of outstanding wholesale power contracts, the HAC report would have the Corps shortchanging compensation of the power purpose for 10 years.
- Use of outdated SWPA rates for energy and capacity to determine hydropower compensation for revenues foregone. The HAC report uses an energy charge of 7.00 mills/kWh and a capacity charge of \$30.72/kW-year[2]. In actuality, SWPA's current rates for these commodities are 15.30 mills/kWh for on-peak energy; an off-peak energy rate of 8.60 mills/kWh; and a capacity charge of 48.94/kW-year. The HAC report uses energy and capacity charges *which have not been in effect since 2002* as the basis for compensating the hydropower purpose for the remaining life of the project after current contracts expire.[3] Thus, the estimated compensation for power revenues foregone again shortchanges hydropower customers.
- The Corps uses the highest of benefits foregone, revenues foregone, replacement costs and updated cost of storage to determine the cost to be charged for reallocated storage. In the instant case, the draft reallocation report concludes that updated cost of storage (either using full updated costs or reduced costs if low-income status is granted) is the highest of the four calculations.[4] However, if correct replacement costs for energy and capacity from the SPP region (rather than the incorrect SERC region used by HAC) were used, it is possible that replacement costs/benefits foregone would be greater than the updated cost of storage (whether using full updated cost of storage or reduced costs eligible to low-income counties).

Here is where the rub comes. Corps policy restricts hydropower compensation to no more than the revenue received for the reallocated storage.[5] To secure the ARRA funding needed to complete the acquisition of Bull Shoals storage and construct infrastructure needed to treat and deliver this new source of M&I water, contracts for storage must be signed in August and September of 2010. If, in its haste to complete the contracts within these time constraints, the Corps includes storage costs in the contracts that are less than the compensation due to the power purpose, hydropower customers risk receiving full and just compensation due them unless the

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[1] SPRA disagrees with limiting hydro compensation based on benefits foregone only for the remainder of outstanding contracts (see arguments below).
[2] The actual capacity charge listed on p. 37 of Appendix D of the draft reallocation report is \$30.72/W-year. This is obviously a typographical error and yet another example of the sloppy job done in preparing the report.
[3] Again, SPRA disagrees with this policy as providing incomplete compensation to the hydropower purpose.
[4] Draft Reallocation Report, p. 5-16.
[5] Yet another policy with which SPRA disagrees.

Corps waives its policy of limiting compensation to the revenues received for the reallocated storage.

SPRA has no desire to derail funding for a reallocation that needs to take place. To the contrary, we believe all efforts should be made to replace Ozark Mountain's contaminated drinking water sources as soon as possible. To accommodate this end, we offer the following alternatives:

- Accept the hydropower compensation as recommended by SWPA in its letter of January 28, 2010 and its most recent comments submitted on the instant draft reallocation report, and use these costs as the basis for the cost charged for reallocated storage.
- Waive the Corps' policy of limiting hydro compensation to the revenues received from reallocated storage and fully compensate the power purpose on the basis of accurate data.
- Include a provision in the contracts that the costs for reallocated storage are estimates only, and that the costs will be updated after compensation due the power purpose is recalculated using accurate data.

SPRA must strongly protest any contractual actions that would prevent full and fair compensation of the power purpose for all impacts associated with the proposed storage reallocation.

Other Comments

SPRA has read the comments submitted by SWPA and supports them in their entirety. As SWPA noted, many of these reflect long-standing issues that have been aired in previous reallocation proposals. Rather than again delving at length in these issues, we list them briefly below. This treatment should not be taken, however, as any indication that we feel any less strongly about these items than those previously set forth.

Specifically:

- SPRA supports SWPA's estimates of energy and capacity losses associated with the proposed reallocation as being much more accurate than those provided by HAC.
- HAC's estimates of hydroelectric energy and capacity losses are based on the dependable yield of the storage that would be reallocated. Traditionally, however, M&I water supply storage contracts do not limit storage withdrawals to the dependable yield, except during droughts that approach the drought of record. SPRA supports SWPA's adjustment of energy and capacity losses to correctly reflect withdrawals in excess of the dependable yield of the storage to be provide Ozark Mountain and Marion County.
- Use of platt's M2M Power product does not accurately reflect the replacement cost of energy during the "super-peak" and thus does not reflect the product marketed by SWPA to SPRA's members.

- SWPA markets only hydroelectric energy and capacity. Further, marketed capacity is limited to dependable capacity; *e.g.* capacity that remains available during the drought of record. It is appropriate, therefore, to determine capacity losses on the basis of the drought of record – the same process used by the Corps to determine yield impacts to existing M&I water supply customers when a storage reallocation takes place.
- SWPA's 1980 Final Power Allocations provide for renewal of its wholesale power supply contracts with SPRA's members on the basis of current capacity allocations. The impacts of the proposed reallocations on energy and capacity do not end with the term of the existing power contracts; rather, they will continue for the life of the project. Compensation of the power purpose should reflect replacement costs for energy and capacity losses for the economic life of the project.
- ER 1105-2-100 states that storage reallocations or additions "should serve immediate needs." In practice, immediate need has been limited to the following 10 years. The draft report recommends the reallocation of sufficient storage to provide 6 million gallons per day (MGD) to Ozark Mountain and 1 MGD to Marion County (raising the total yield of Marion County's Bull Shoals storage to 2 MGD). However, the draft reallocation report estimates that in the year 2022 (10 years from the estimated first withdrawals from the reallocated storage – the functional definition of immediate need) Ozark Mountain's average daily use will range from less than 2.1 MGD to as much as 2.6 MGD. The mid-range estimate for Ozark Mountain's maximum daily use in 2022 is only 4.6 MGD.[6] For Marion County, estimated average daily use in 2022 is from less than 1.2 MGD to less than 1.6 MGD, while the mid-range estimate of maximum daily use in 2022 is less than 1.4 MGD.[7] Obviously, the immediate needs of Ozark Mountain and Marion County are much less than 6.0 and 2.0 MGD, respectively. The reallocation should be adjusted to reflect projected water supply needs in the year 2022.
- SPRA agrees with SWPA's computations that indicate reallocation from the flood control pool is the NED Plan and should be recommended. As noted by SWPA, HAC computations showing a greater loss of capacity from a flood pool reallocation than from a conservation pool reallocation just don't make sense and reflect the general accuracy of the entire HAC report. SPRA concurs that a reallocation from the flood control pool would greatly reduce the impacts on capacity and on-peak energy.
- SPRA concurs with SWPA that the Corps' Little Rock District has the discretion to reallocate a sufficient amount of additional flood pool storage to maintain the dependable yield of the power pool, and that such action has been taken in the White River Minimum Flows reallocation. A flood pool reallocation that maintains the yield of the power pool would eliminate capacity losses and limit most energy losses to off-peak periods, thus greatly reducing the impacts on the power purpose and reducing required compensation.

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[6] Table 4.9, p. 4-8, draft reallocation report.
[7] Table 4.10, p. 4-9, draft reallocation report.

- ER 1105-2-100 clearly states that "usable storage does not include space set aside for sediment distribution or for hydropower head." Portions of the draft reallocation report exploring reallocation from the inactive storage should be removed from the report, and future reallocation reports should not include reallocation from inactive storage as a viable alternative.
- The draft Environmental Assessment (EA) is required to assess the cumulative effects on hydro production of past reallocations, the current proposal and anticipated future reallocations. This would include not only storage reallocations at Bull Shoals, but reallocations that have taken place or can be reasonably anticipated at all 24 Corps projects from which SWPA markets hydroelectric energy and capacity. The draft EA should be revised to include this data, and the cumulative effects should be considered and, if necessary, mitigated.
- The draft EA should consider the cumulative impacts of past, proposed, and reasonably anticipated future storage reallocations on greenhouse gas emissions at the 24 Corps projects from which SWPA markets hydroelectric energy and capacity. The HAC report concludes that thermal generation would be the most likely alternative to hydro energy and capacity lost due to the proposed reallocations. Hydro generation does not produce greenhouse gases; generation from coal and natural gas does. The draft EA should carefully quantify the increase in greenhouse gas emissions anticipated due to the shift to thermal power generation to offset losses associated with the past, proposed and previous storage reallocations at the 24 Corps projects.

SPRA respectfully requests a copy of the reallocation report after it is revised to reflect public comment and is forwarded to the Southwestern Division for review.

Sincerely,

Ted Coombes

Ted Coombes
Executive Director

Department of Energy
Southwestern Power Administration
One West Third Street
Tulsa, Oklahoma 74103-3519

June 11, 2010

Mr. Patrick MacDanel
GEC Inc.
P.O. Box 84010
Baton Rouge, LA 70808

Dear Mr. MacDanel:

This letter provides the comments of Southwestern Power Administration (Southwestern) on the Draft Water Supply Storage Reallocation Report, Reallocation of Storage at Bull Shoals Lake, Arkansas, for Ozark Mountain Regional Public Water Authority and Marion County Regional Water District, dated May 2010. Southwestern's preliminary estimate of the hydropower impacts of the proposed reallocation was provided to the U.S. Army Corps of Engineers (Corps) on January 28, 2010, and is included in the draft report. Southwestern has several major concerns with the proposed reallocation which are summarized in the following paragraphs. Most of those major concerns were discussed in our January 28 letter. In addition, please find Southwestern's specific comments on the report detailed in Enclosure 1.

Corps guidance states that "All reallocations or additions of storage should be to serve immediate needs" (ER 1105-2-100). The Corps has typically interpreted "immediate needs" to be those needs up to ten years in the future. The draft report reveals that Ozark Mountain Regional Public Water Authority (OMRPWA) will not need 6 million gallons per day (MGD) for over forty years, stating "OMRPWA has a current need for 3.4 MGD, expanding to 4.5 MGD by 2032 and 6 MGD by 2052." The draft report does not demonstrate an "immediate need" for the 6 MGD included in the reallocation request. The reallocation should only be requested to meet the demonstrated needs over the next ten years. The construction of a water treatment facility with a capacity of 4.5 MGD also seems to verify that amount will be sufficient to meet the needs of OMRPWA for the next ten to twenty years. OMRPWA has already reduced their request from 12 MGD to 6 MGD. They should further reduce their request to no more than 4.5 MGD. As Marion County is doing now, OMRPWA can request additional storage later when they have additional need.

Southwestern has provided comments for all recent water storage reallocation reports prepared by the Corps' Little Rock District (LRD) for storage at LRD projects. The issues and disagreements between Southwestern and the Corps concerning hydropower impacts of storage reallocations and the compensation due to Federal hydropower are long-standing. Recently, to ensure adequate compensation to Federal hydropower for one of the largest storage reallocations ever performed by the Corps, Congress directed Southwestern to compute the hydropower impacts of the White River Minimum Flows project. For another recent major reallocation, the Secretary of the Army, recognizing that Corps policy shortchanges Federal hydropower, overruled both the Corps' Tulsa District and Corps Headquarters and agreed with Southwestern on the issue of compensation for hydropower lost as a result of a reallocation of up to 300,000 acre-feet at Lake Texoma. Agreement between the Corps and the Federal hydropower interests on the issues would simplify the preparation and evaluation of future storage reallocation reports and would speed the approval of the reports. We urge the Corps to work with Southwestern and the other Power Marketing Administrations to resolve those long-standing issues.

Southwestern is concerned that the Corps' calculations underestimate the impacts to the Federal hydropower purpose. The Corps' simulation models and energy loss calculations are based on the yield of the contracted storage. However, based on the Corps' water storage accounting procedures and lack of contractual limitations, water supply users are able to withdraw more than the "safe yield" of the storage in all but the critical drought without depleting their contracted storage. Accordingly, Southwestern included what it calls "additional energy losses" in its calculations to conservatively account for withdrawals in excess of the yield of the contracted storage. The Corps' energy loss calculations should include additional withdrawals above the yield of contracted storage, or the water supply storage contract should limit the amount the user can withdraw to only the yield of the contracted storage. Also, the Corps' calculates the capacity benefits foregone based on an average capacity loss, unlike its calculation of capacity revenues foregone which is based on the critical period capacity loss. All of the Corps' capacity loss calculations should reflect actual market conditions and use the critical period method for a more accurate calculation of the capacity lost due to the proposed storage reallocation.

Additionally, the calculations by the Corps' Hydropower Analysis Center (HAC) are based on several flawed assumptions. The first concerns Southwestern's marketing area. HAC incorrectly assumed that Southwestern markets its hydropower in the Southeastern Electric Reliability Council (SERC) region instead of the Southwest Power Pool (SPP) region. HAC must correct its report and calculations to reflect Southwestern's presence in the SPP area. Second, the dependable capacity calculations were developed utilizing 1956 as the critical year. The critical year for Southwestern's system was at one time 1956, but Southwestern has utilized 1954 as the critical year for its system since 2001 when it added four additional projects into its interconnected system. Third, the HAC report utilized rates for Southwestern which were last used in 2002. Southwestern's rates as of January 1, 2010, are included in our specific comments on the HAC report. The revenues foregone calculations must be recomputed to reflect Southwestern's current rates. The HAC calculations must be updated in both the HAC report and in the main report. Finally, it is unclear why Norfork is included in the HAC report. The proposed reallocation is at Bull Shoals, and the report states that the impacts at Norfork are negligible. Norfork should be removed from the report. The HAC report appears to be a poor, cut and paste effort that should be completely updated.

Southwestern performed its own analysis of the reallocation alternatives using the Corps' SUPER model, and a summary of the analysis is included in Enclosure 2. That analysis revealed that a reallocation from flood storage would have significantly less impact on hydropower energy and capacity than the conservation or inactive pool options if the hydropower impacts are properly quantified and valued. In addition, Southwestern performed a SUPER evaluation of a flood storage reallocation including hydropower yield protection operation (HYPO) storage for hydropower. The use of HYPO, similar to dependable yield mitigation storage (DYMS) for existing water supply users, would maintain the current yield of the hydropower storage and, therefore, minimize the hydropower losses, especially capacity and on-peak energy losses. LRD has the discretion to include HYPO and in fact did so in the White River Minimum Flow Study. The results from Southwestern's analysis of a flood storage reallocation including HYPO are included for your consideration. Based on Southwestern's analysis, the National Economic Development plan for the proposed reallocation is a flood storage reallocation including HYPO.

Southwestern continues to oppose the consideration of inactive storage as a reallocation alternative. Inactive storage is set aside for hydropower head and/or the storage of sediment expected to accumulate over the life of the project. LRD has not considered the reallocation of inactive storage since the early 1990s. Since that time, reallocation reports developed by LRD have correctly recognized that the inactive storage is not appropriate storage for reallocation consideration. In Corps design and study reports which discuss the inactive storage at Bull Shoals, the only use considered for that storage other than hydropower head is emergency power storage. A reallocation of any portion of the inactive storage was not contemplated. The alternative should be removed from consideration, and inactive storage should not be considered a viable alternative in any future reallocation study. Otherwise, it should be treated the same as a reallocation from hydropower storage.

We appreciate the opportunity to provide comments on the draft report. Hydropower is the project purpose most affected by storage reallocations. Therefore, it is vital to Federal hydropower and our customers that the hydropower losses are properly quantified and valued. Please contact Mr. Michael Denny at 918-595-6683 or *michael.denny@swpa.gov* if you have any questions.

Sincerely,

Michael R. Denny

for George Robbins
Director
Division of Resources and Rates

Enclosures (2)

cc: Ted Coombes (SPRA)

June 11, 2010

Southwestern Power Administration Comments on the Draft Water Supply Storage Reallocation Report – Reallocation of Storage at Bull Shoals Lake, Arkansas, for Ozark Mountain Regional Public Water Authority and Marion County Regional Water District dated May 2010

(Note: Paragraphs are numbered from the beginning of the referenced section or sub-section)

1. Page iii, EXECUTIVE SUMMARY, Paragraph 10, Sentence 1. For the proposed reallocation of conservation storage, the storage amount for Marion County Regional Water District should be 1,698.077 as stated throughout the report and not 1,698.007.

2. Page iii, EXECUTIVE SUMMARY, Paragraph 11, Sentence 3. Inactive storage should not have been considered in the study. The inactive storage is set aside for hydropower head, sediment distribution, and emergency power storage. It was not designed for reallocation to municipal and industrial water supply storage. Southwestern strongly opposes the consideration of inactive storage as an alternative for reallocation to water supply storage.

3. Page iii, EXECUTIVE SUMMARY, Paragraph 12, Fifth bullet. While one storage reallocation may have a "relatively small impact" on hydroelectric power production, the cumulative effect of multiple reallocations will undoubtedly have a significant effect on Federal hydropower. The hydropower impacts of even the smallest storage reallocation must be properly quantified and valued by the Corps.

4. Page v, TABLE OF CONTENTS. Please correct alignment issues with the table.

5. Page 2-2, 2.0 PROJECT BACKGROUND, 2.1 Project Authorization, Construction, and Operation History, Bull Shoals Lake, Paragraph 1, Sentence 1. Fish/wildlife and recreation were not added as authorized project purposes at Bull Shoals in the Flood Control Act of 1941. Recreation and fish and wildlife mitigation were added as project purposes at Bull Shoals in Section 304 of WRDA 1996, "to the extent that the additional purposes do not adversely affect flood control, power generation, or other authorized purposes of the project." Please correct.

6. Page 2-2, 2.0 PROJECT BACKGROUND, 2.1 Project Authorization, Construction, and Operation History, Bull Shoals Lake, Paragraph 1, Sentence 3. The language originally authorizing minimum flows was in Section 374 of WRDA 1999 and in Section 304 of WRDA 2000. The specific minimum flows alternative being implemented at Bull Shoals, Alternative BS-3, was authorized in Section 132 of Public Law 109-103. That legislation repealed the authorizations in WRDA 1999 and WRDA 2000. Please correct.

7. Page 2-3, 2.0 PROJECT BACKGROUND, 2.2 Project Location, Purpose, and Outputs, Paragraph 3, Third bullet. The average annual generation at Bull Shoals from 1964

through 2009 is 753,700 megawatt-hours (MWh), not the 518,284 MWh shown in the report.. Please correct.

8. Page 2-4, 2.0 PROJECT BACKGROUND, 2.3 Project Data, Table 2.1 Bull Shoals Lake Physical Features (After Reallocation for White River Minimum Flows). Inactive storage should be listed as the entire storage below elevation 628.5. Please correct.

9. Page 2-4, 2.0 PROJECT BACKGROUND, 2.3 Project Data, Table 2.1 Bull Shoals Lake Physical Features (After Reallocation for White River Minimum Flows). According to the Corps' Engineering Regulation 1105-2-100, "usable storage does not include space set aside for sediment distribution or for hydropower head." Inactive storage is being utilized for its designed purposes and should not be included in the table as "Usable storage." Please correct.

10. Page 2-5, 2.0 PROJECT BACKGROUND, 2.3 Project Data, Paragraph 4, Sentences 7 and 8. As correctly stated, the inactive storage provides for hydropower head and sediment. See previous comment. Sentence 8 states that the inactive storage is "available for emergency uses during drought conditions that include hydroelectric power operations and M&I water supply." It is being utilized as designed and is available for emergency use only, not for permanent reallocation to another project purpose. Please remove consideration of inactive storage from the report and environmental assessment.

11. Page 2-6, 2.0 PROJECT BACKGROUND, 2.3 Project Data, Figure 2.2 Bull Shoals Lake and Dam with Pool Elevations and Volumes. The inactive storage should be shown as all storage below elevation 628.5. Please correct.

12. Page 3-5, 3.0 PLAN FORMULATION, 3.3 Preliminary Reallocation Alternatives for MCRWD, 3.3.1 Structural Solutions, Paragraph 4, Sentence 2. The sentence states that MCRWD's water treatment facility has a maximum capacity of 4 MGD. Even with the new storage allocation, MCRWD will only have contracted for storage with a yield of 2 MGD. As Southwestern continues to assert in comments on storage reallocations for water supply, the water supply contracts should limit the withdrawals of the water supply users. Compensation to Federal hydropower is based on energy losses which are calculated based on the yield of the contracted storage, which is a minimum amount available to the water supply user.

13. Page 3-8, 3.0 PLAN FORMULATION, 3.4 Final Reallocation Alternatives for OMRPWA and MCRWD to Evaluate in Detail. In its preliminary comments provided to the Corps on January 28, 2010, Southwestern presented an additional alternative utilizing flood storage and hydropower yield protection operation (HYPO) storage. A summary of Southwestern's analysis is included in Enclosure 2. HYPO was utilized in the White River Minimum Flows study and should be considered a viable alternative in storage reallocations. Please include an evaluation of the additional alternative in the report.

14. Page 4-9, 4.0 ECONOMIC ANALYSIS, 4.1 Water Supply and Demand Analysis, 4.1.6 Water Supply, Paragraph 1, Sentence 7. Corps guidance states that "All reallocations or additions of storage should be to serve immediate needs" (ER 1105-2-100). The Corps has typically interpreted "immediate needs" to be those needs up to ten years in the future. The sentence states that "OMRPWA has a current need for 3.4 MGD, expanding to 4.5 MGD by 2032 and 6 MGD by 2052." The draft report does not demonstrate an "immediate need" for the 6 MGD included in the reallocation request. The construction of a water treatment facility with a capacity of 4.5 MGD also seems to verify that amount will be sufficient to meet the needs of OMRPWA for the next ten to twenty years. OMRPWA has already reduced their request from 12 MGD to 6 MGD. They should further reduce their request to no more than 4.5 MGD. As Marion County is doing now, OMRPWA can request additional storage later when they have additional need.

15. Page 5-1, 5.0 DERIVATION OF USER COST, 5.1 Yield/Storage Analysis, Paragraph 1, Sentences 1 and 2. The additional alternative presented by Southwestern (see Enclosure 2) should be considered in the report. See comment 13.

16. Page 5-2, 5.0 DERIVATION OF USER COST, 5.1 Yield/Storage Analysis, 5.1.2 Flood Pool, Paragraph 2, Sentences 3 and 4. It may not be Corps "policy" to include DYMS for hydropower, but it was included as HYPO storage in the White River Minimum Flows Study. Southwestern's analysis, included in Enclosure 2, revealed a flood pool alternative including HYPO storage to be the alternative with the greatest net benefits. See Comment 13.

17. Page 5-3, 5.0 DERIVATION OF USER COST, 5.1 Yield/Storage Analysis, 5.1.3 Inactive Pool. Paragraph 1, Sentence 2. As noted previously, the inactive storage is "available for emergency uses during drought conditions that include hydroelectric power operations and M&I water supply." It is being utilized as designed and is available for emergency use only, not for permanent reallocation to another project purpose. Please remove consideration of inactive storage from the report and environmental assessment.

18. Page 5-5, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.1 Hydroelectric Power Benefits Foregone. The section correctly states that hydroelectric energy and capacity are lost when storage is reallocated for water supply. However, the Corps' study underestimates the amount of energy and capacity lost and the value of the lost energy and capacity. Southwestern's analysis (see Enclosure 2) is a more accurate reflection of the magnitude and value of the losses and correctly incorporates how the capacity and energy are currently marketed.

19. Page 5-6, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.1 Hydroelectric Power Benefits Foregone, Table 5.6 Hydroelectric Power Benefits Foregone. The Corps' report significantly undervalues the energy and capacity lost due to the proposed reallocation. Southwestern's analysis (see Enclosure 2) provides a more realistic accounting of the benefits foregone.

20. Page 5-6, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.1 Hydroelectric Power Benefits Foregone, Table 5.6 Hydroelectric Power Benefits Foregone. The benefits foregone are incorrectly based on energy prices in the Southeastern Electric Reliability Council (SERC) region and not the Southwest Power Pool (SPP) region. It should be corrected. See comments on Hydropower Analysis Center (HAC) report.

21. Page 5-6, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.1 Hydroelectric Power Benefits Foregone, Paragraph 5, Sentence 1. It is not logical to think that a reallocation of flood control storage would result in a greater capacity loss than a reallocation of conservation storage. The result reveals a flawed methodology in the analysis and a lack of knowledgeable review and study oversight. Southwestern's analysis (see Enclosure 2) provides a more reasonable and accurate calculation of the capacity losses resulting from the proposed reallocation.

22. Page 5-6, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.1 Hydroelectric Power Benefits Foregone, Paragraph 6, Sentence 2. Southwestern does not market "average" capacity. The capacity marketed by Southwestern must be available at all times, including through the critical drought. The capacity must be dependable to be marketable. Please recalculate using the correct critical year.

23. Page 5-6, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.1 Hydroelectric Power Benefits Foregone, Paragraph 6, Sentence 3. See Comment 21.

24. Page 5-7, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.2 Hydroelectric Power Revenues Foregone, Table 5.7 Hydroelectric Power Revenues Foregone. The revenues foregone are based on underestimated energy and capacity losses resulting from the proposed reallocation. Southwestern's analysis (see Enclosure 2) is a more accurate reflection of the magnitude of the losses in the current market.

25. Page 5-7, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.2 Hydroelectric Power Revenues Foregone, Table 5.7 Hydroelectric Power Revenues Foregone. The revenues foregone are based on Southwestern rates in place from January 1998 to October 2002. Please update the table based on Southwestern's current rates as shown in Enclosure 2 and in the comments on the HAC report.

26. Page 5-7, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.2 Hydroelectric Power Revenues Foregone, Table 5.7 Hydroelectric Power Revenues Foregone. Negative revenues foregone, or hydropower benefits, are not logical and reflect a flawed methodology in the analysis. It appears there is no understanding of hydropower operations at even the basic level.

27. Page 5-7, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.3 Hydroelectric Power Replacement Cost. See Comments 19 and 20.

28. Page 5-8, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.4 Flood Control Benefits Foregone, Paragraph 2, Sentence 7. The sentence states the SUPER economic data for flood control calculations was last updated in 1994. The SUPER economic data should be updated to account for the five-foot pool rise for White River minimum flows and raising the lake facilities, and the flood damage analysis should be recalculated.

29. Page 5-9, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.4 Flood Control Benefits Foregone, Table 5.9 Average Annual In-Pool Damages by Alternative – October 2009 values ($1,000). See previous comment.

30. Page 5-9, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.4 Flood Control Benefits Foregone, Paragraph 4, Sentence 1. The reallocation is referred to as a "water" reallocation. The reallocation will be a reallocation of storage, not water. Please correct.

31. Page 5-9, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.5 Recreation Benefits, Paragraph 1, Sentence 11 (last sentence). Presumably, the sentence is referring to a reallocation from the flood pool and not the conservation pool. An annual impact of $16,800, mainly at Bull Shoals, compared to annual recreation benefits of over $51 million at six projects is hardly a "rippling effect." Please delete the biased statement from the report.

32. Page 5-9, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.5 Recreation Benefits, Paragraph 3, Sentence 1. The sentence states the SUPER recreation visitation data was last updated in 1994. The SUPER recreation visitation data should be updated to account for the five-foot pool rise for White River minimum flows and raising the lake facilities, and the recreation benefits analysis should be recomputed.

33. Page 5-10, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.5 Recreation Benefits, Table 5.10 Average Annual Recreational Benefits by Alternative – October 2009 values ($1,000). See previous comment.

34. Page 5-11, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.6 Total Impacts, Table 5.11 Average Annual Net Benefits from Reallocation – October 2009 values ($). If hydropower losses are properly quantified and valued, a reallocation of flood storage, especially with HYPO storage for hydropower, would provide the greatest net benefits as revealed in Southwestern's analysis (see Enclosure 2).

35. Page 5-11, 5.0 DERIVATION OF USER COST, 5.3 Updated Cost of Storage, 5.3.1 Ozark Mountain Regional Public Water Authority, Paragraph 1, Sentence 2. According

to the Corps' Engineering Regulation 1105-2-100, "usable storage does not include space set aside for sediment distribution or for hydropower head." Inactive storage is being utilized for its designed purposes and should not be included in the Total Usable Storage calculation. Please correct.

36. Page 5-11, 5.0 DERIVATION OF USER COST, 5.3 Updated Cost of Storage, 5.3.2 Marion County Regional Water District, Paragraph 1, Sentence 2. See previous comment.

37. Page 6-5, 6.0 OTHER CONSIDERATIONS, 6.2 Cost Account Adjustments to Power Marketing Agency, Paragraph 1, Sentences 7 and 8. Energy and capacity benefits and revenues foregone must be corrected to reflect correct assumptions. See comments on the HAC report for details.

38. Page 6-5, 6.0 OTHER CONSIDERATIONS, 6.2 Cost Account Adjustments to Power Marketing Agency, Paragraph 1, Sentences 7 and 8. Why do capacity and energy credits for benefits foregone only go through the year 2015? Southwestern's last current contract with customers taking energy from the project expires in 2025. Further, Southwestern's 1980 Final Power Allocation provides renewal of the contracts with the current power allocations. Therefore, the benefits lost are throughout the project life. Please correct the credits to Southwestern.

39. Page 6-8, 6.0 OTHER CONSIDERATIONS, 6.5 Risk and Uncertainty, Paragraph 2, Sentences 1 and 2. Hydropower benefits foregone are also highly sensitive to fluctuations in energy and capacity prices. Selection of the flood pool, with reduced energy and capacity losses, should result in the greatest net benefits among the reallocation alternatives.

40. Page 6-9, 6.0 OTHER CONSIDERATIONS, 6.6 Summary of Dam Safety Considerations, Paragraph 1, Sentence 6. The proposed project is a reallocation of storage, not water.

41. Page 7-1, 7.0 SELECTED ALTERNATIVE, 7.1 Description, Paragraph 3, Sentence 2. Southwestern's analysis revealed the "lowest-impact" reallocation is a reallocation of flood control storage utilizing HYPO storage for hydropower. Proper project formulation should consider the alternative provided by Southwestern in Enclosure 2.

42. Page 7-1-2, 7.0 SELECTED ALTERNATIVE, 7.2 Rationale for Selection, Paragraph 2. The purpose of the paragraph is unclear. Do OMRPWA and MCRWD intend to contract for the identified storage in increments? If so, the reallocation should be sized to provide the water supply users' immediate needs. See Comment 14.

43. Page 7-2, 7.0 SELECTED ALTERNATIVE, 7.2 Rationale for Selection, Paragraphs 3 and 4. Southwestern will receive credit for its losses. However, if the amount and value of the losses are underestimated in accordance with the current draft report, Federal hydropower and its customers will suffer the impacts.

44. Page 7-2, 7.0 SELECTED ALTERNATIVE, 7.2 Rationale for Selection, Paragraphs 3 and 4. Southwestern's 1980 Final Power Allocation provides renewal of the contracts with the current power allocations. Therefore, the benefits lost are throughout the project life. Current Corps policy fails to recognize that fact.

45. Page 8-1, 8.0 IMPLEMENTATION, 8.1 Federal and Non-Federal Costs, Federal Costs, Paragraph 1, Sentences 4 and 5. Why do capacity and energy credits for benefits foregone only go through the year 2015? Southwestern's last current contract with customers taking energy from the project expires in 2025. Further, Southwestern's 1980 Final Power Allocation provides renewal of the contracts with the current power allocations. Therefore, the benefits lost are throughout the project life. Please correct the credits to Southwestern.

46. Page 9-1, 9.0 CONCLUSIONS AND RECOMMENDATIONS, 9.1 Findings, Paragraph 5, Sentences 4 and 5. See previous comment.

47. Page C-6, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, TABLE OF CONTENTS, Section 6.3.2. The section title should be "Current and Pending Storage Reallocations." Please correct.

48. Page C-17, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 1.0 INTRODUCTION, 1.2 Background, Bull Shoals Lake, Paragraph 1. See Comments 5 and 6 on a similar paragraph in the reallocation report.

49. Page C-18, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 1.0 INTRODUCTION, 1.2 Background, Bull Shoals Lake, Paragraph 4, Sentences 7 and 8. As correctly stated, the inactive storage provides for hydropower head and sediment. Sentence 8 states that the inactive storage is "available for emergency uses during drought conditions that include hydroelectric power operations and M&I water supply." It is being utilized as designed and is available for emergency use only, not for permanent reallocation to another project purpose. Please remove consideration of inactive storage from the report and environmental assessment.

50. Page C-20, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 1.0 INTRODUCTION, 1.2 Background, Bull Shoals Lake, Figure 1.5 Bull Shoals Lake Pool Elevations and Volumes. The inactive storage should be shown as all storage below elevation 628.5. Please correct.

51. Pages C-25-26, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 2.0 DESCRIPTION OF PROPOSED ACTION, Paragraph 6, Sentences 7 and 8. As correctly stated, the inactive storage provides for hydropower head and sediment. Sentence 8 states that the inactive storage is "available for emergency uses during drought conditions that include hydroelectric power operations and M&I water supply." It is being utilized as designed and is available for emergency use only, not for

permanent reallocation to another project purpose. Please remove consideration of inactive storage from the report and environmental assessment.

52. Page C-50, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 4.0 AFFECTED ENVIRONMENT, 4.4 Water Resources, 4.4.4 Hydropower. As is typical in Corps studies, the HAC analysis underestimates the hydropower losses and the value of those losses. See comments on HAC report.

53. Page C-73-74, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 5.0 ENVIRONMENTAL CONSEQUENCES, 5.3 Water Resources, 5.3.4 Hydropower. See previous comment.

54. Page C-78, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 5.0 ENVIRONMENTAL CONSEQUENCES, 5.7 Recreation, Paragraph 1, Sentence 11. An annual impact of $16,800, mainly at Bull Shoals, compared to annual recreation benefits of over $51 million at six projects is hardly a “rippling effect.” Please delete the biased statement from the report.

55. Page C-84, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 6.0 CUMULATIVE IMPACTS, Paragraph 5, Sentence 3 (last sentence). The current proposed action is a reallocation of storage, not water. Please correct.

56. Page C-86, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 6.0 CUMULATIVE IMPACTS, 6.3 Present Actions, 6.3.2 Current and Pending Water Reallocations. The heading should be “Current and Pending Storage Reallocations.” Please correct.

57. Page C-89-91, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 6.0 CUMULATIVE IMPACTS, 6.5 Cumulative Impacts Assessment, Table 6.1 Cumulative Impacts Assessment. All references to water reallocation should be corrected to say storage reallocation.

58. Page C-96, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 8.0 CONCLUSIONS, Paragraph 2, Sentence 2. The cumulative impact of multiple reallocations resulting in “slight annual hydropower benefits reductions” is incorrect and will have a major impact on Federal hydropower and its customers. Corps policy must be changed to allow the Corps to properly evaluate the impact of the hydropower losses. Those losses are real and do have a “substantial” impact.

59. Page C-132 (estimated), APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, Attachment 6 Agency Coordination, October 15, 2009, letter from Southwestern Power Administration to Mr. Patrick MacDanel. The document dated 09/30/09 accompanying the letter was actually sent to the Corps in an email on September 30, 2009. It articulates Southwestern’s arguments against consideration of inactive storage for reallocation and includes reasons the Corps has used in past studies to eliminate inactive storage from consideration. Please properly identify.

60. Title Page, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT. It is unclear why Norfork is included in the Hydropower Analysis Center (HAC) report. The proposed reallocation is at Bull Shoals. Norfork is not downstream of Bull Shoals and should not be impacted by the proposed reallocation. Please remove Norfork from the report.

61. Page 2, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 1. INTRODUCTION, 1.2 Project Description, 1.2.2 Bull Shoals Lake, Paragraph 2, Sentence 4. The Corps completed a storage reallocation report, not a water reallocation report. Please correct.

62. Page 2, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 1. INTRODUCTION, 1.2 Project Description, 1.2.3 Norfork Lake. See Comment 60. Norfork Lake should be removed from the report.

63. Page 10, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 2. POWER BENEFITS FOREGONE, 2.7 Simulation with SWD-SUPER Streamflow Routing Model, Paragraph 2. See Comments 60 and 62. Impacts at the other White River lakes were "deemed negligible and thus not presented." However, impacts at Norfork were shown in the report to be negligible and were presented. Why? Additional analysis including Norfork seems to have been a lot of additional work and pages in the report with no discernible benefit. The proposed reallocation is at Bull Shoals, and the impacts will be at Bull Shoals. Please remove Norfork from the report.

64. Page 15, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 3. ENERGY BENEFITS FOREGONE, 3.4 Computation of Energy, Table 3-6 Average Monthly Energy Losses at Bull Shoals & Norfork Lakes under Reallocation Alternatives. All computed energy losses are based on water supply withdrawals equal to the yield of the reallocated storage. However, the water supply users can withdraw more than the yield in all years except a critical drought. The water supply contract should limit the user's withdrawals to the yield. Since that is not the case, Southwestern's analysis (see Enclosure 2) includes an additional energy loss to account for those increased withdrawals.

65. Page 16, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 3. ENERGY BENEFITS FOREGONE, 3.5 Basis for Computing Energy Benefits Foregone, 3.5.1 Energy Value. Previously, Platts produced a "High Fuel" energy cost scenario that was representative of the cost of replacing lost hydroelectric energy due to a reallocation. Unfortunately, Platts no longer produces that product. The M2M Power product is more of a "base cost" energy price forecast that is not representative of the "super-peak" product marketed by Southwestern and significantly underestimates the value of lost hydropower. More representative energy costs must be identified and used.

66. Page 17, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 3. ENERGY BENEFITS FOREGONE, 3.5 Basis for Computing Energy Benefits Foregone, 3.5.2 Procedure. Power generated at Bull Shoals and Norfork, like that generated at the other projects in Southwestern's interconnected system, is marketed primarily to customers in the Southwest Power Pool (SPP) region and not in the SERC region. The report should be corrected to reflect that throughout and the price forecasts for the SPP region should be utilized in the calculations.

67. Page 18, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 3. ENERGY BENEFITS FOREGONE, 3.5 Basis for Computing Energy Benefits Foregone, 3.5.2 Procedure, Paragraph 3. See Comment 65. Platts price forecasts are not representative of the "super-peak" product marketed by Southwestern, and those forecasts underestimate the value of replacing the lost hydropower due to a reallocation. More realistic energy values are required.

68. Page 18, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 3. ENERGY BENEFITS FOREGONE, 3.5 Basis for Computing Energy Benefits Foregone, 3.5.2 Procedure, Paragraph 4. Nominal dollars should be utilized to properly reflect the future replacement cost of lost energy. The energy losses are already undervalued in the Platts estimates. Using constant dollars that do not accurately reflect expected future conditions further magnifies the error.

69. Page 19, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 3. ENERGY BENEFITS FOREGONE, 3.5 Basis for Computing Energy Benefits Foregone, 3.5.2 Procedure, Figure 3-3. See previous comment.

70. Page 21, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.1 Dependable Capacity, 4.1.1 Dependable Capacity Evaluation Method, Paragraph 1, Sentence 2. Southwestern's system is hydropower only. The average availability method is not applicable. The capacity marketed by Southwestern must be available at all times. Southwestern doesn't market "average" capacity. The capacity must be dependable to be marketable. Southwestern has a longstanding disagreement with the Corps on the use of the average availability method to represent how the capacity is marketed and used in Southwestern's marketing area.

71. Page 21, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.1 Dependable Capacity, 4.1.1 Dependable Capacity Evaluation Method, Paragraph 2. See previous comment. To properly evaluate its loss of marketable capacity, Southwestern used the critical period method. HAC uses the critical period method in its evaluation of the capacity loss for revenues foregone, in recognition that the lost capacity is no longer dependable or marketable by Southwestern. The HAC analysis should also use the critical period method to properly quantify the lost capacity for benefits foregone.

72. Pages 21-22, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.1 Dependable Capacity, 4.1.1 Dependable Capacity Evaluation Method, Paragraph 3 and Figure 4-1. Southwestern markets its hydropower primarily in the SPP region. Please change all references to SERC to reflect SPP and SPP data.

73. Page 23, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.1 Dependable Capacity, 4.1.4 Criteria for Computing Dependable Capacity, Paragraph 1, Sentence 1. The critical year for Southwestern's system was at one time 1956, but Southwestern has utilized 1954 as the critical year for its system since 2001 when it added four additional projects into its interconnected system. Please correct the analysis to utilize 1954 as the critical year for Southwestern's system.

74. Pages 24-29, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.1 Dependable Capacity, 4.1.6 Dependable Capacity Evaluation Method and 4.1.7 Dependable Capacity Losses Summarized. The average availability method utilized by HAC simply does not capture the true impact of the capacity lost due to the reallocation. The small capacity losses calculated, as well as calculating a greater capacity loss in a flood storage reallocation, are indications of a flawed methodology. For more realistic capacity losses, see Southwestern's analysis (see Enclosure 2).

75. Page 29, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.1.7 Dependable Capacity Losses Summarized, Table 4-6 Dependable Capacity Losses. Both this table and Table 6-2 on page 38 say they are dependable capacity losses while showing different values. Please clarify.

76. Pages 29-35, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.2 Computation of Capacity Values. Even though the screening curve methodology used by HAC results in a higher capacity unit value, Southwestern believes the cost of a combustion turbine should be utilized as a much simpler methodology and as the most likely source for replacing lost hydropower capacity.

77. Page 36, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 5. BENEFITS FOREGONE. When the energy and capacity losses and the value of the lost energy are underestimated, the results are an underestimation of the power benefits foregone due to the reallocation. See Southwestern's analysis in Enclosure 2 for a more realistic picture of the hydropower benefits foregone.

78. Page 37, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE. The HAC report utilized rates for Southwestern which were last used in 2002. As of January 1, 2010, Southwestern's on-peak energy rate is 15.30 mills/kWh and its off-peak energy rate is 8.60 mills/kWh. Southwestern's current

capacity charge is $48.94/kW-yr. Please update the report to reflect Southwestern's current rates.

79. Page 37, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE. When the energy and capacity losses and the value of the lost energy and capacity are underestimated, the results are an underestimation of the power revenues foregone due to the reallocation. See Southwestern's analysis in Enclosure 2 for a more realistic picture of the hydropower revenues foregone.

80. Page 37, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE, 6.1 Average Energy Loss, Table 6-1 Average Energy Loss Due to Reallocation of Storage in Bull Shoals and Norfork Lakes. All computed energy losses are based on water supply withdrawals equal to the yield of the reallocated storage. However, the water supply users can withdraw more than the yield in all years except a critical drought. The water supply contract should limit the user's withdrawals to the yield. Since that is not the case, Southwestern's analysis includes an additional energy loss to account for those increased withdrawals. Please correct analysis.

81. Page 38, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE, 6.2 Capacity Loss, Table 6-2 Dependable Capacity Loss Due to Reallocation of Storage in Bull Shoals and Norfork Lakes. Both this table and Table 4-6 on page 29 say they are dependable capacity losses while showing different values. Please clarify.

82. Page 38, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE, 6.2 Capacity Loss, Table 6-2 Dependable Capacity Loss Due to Reallocation of Storage in Bull Shoals and Norfork Lakes. The small capacity losses calculated, as well as calculating a capacity gain in a flood storage reallocation, are indications of a flawed methodology. For more realistic capacity losses, see Southwestern's analysis.

83. Page 38, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE, 6.3 Marketable Capacity vs. Dependable Capacity. For Southwestern, dependable capacity and marketable capacity are synonymous. If the capacity is not dependable, it can not be marketed. The critical period method should be utilized to determine the capacity losses.

84. Page 39, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE, 6.4 Total Revenues Foregone, Table 6-3 Hydropower Revenue Foregone Due to Reallocation of Storage in Bull Shoals and Norfork Lakes. The values should be recalculated to reflect Southwestern's current rates. See Comment 78.

85. Pages 41-47, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 7 CREDIT TO POWER MARKETING AGENCY, 7.1 Remaining Period of Contract

and 7.2 Computation of Credit to Power Marketing Agency. Southwestern's last current contract with customers taking energy from the project expires in 2025. Further, Southwestern's 1980 Final Power Allocation provides renewal of the contracts with the current power allocations. Therefore, the benefits lost are throughout the project life. Please correct the PMA credits.

Southwestern Power Administration
Hydropower Impacts of Proposed Reallocation at Bull Shoals
For Ozark Mountain Regional Public Water Authority
And Marion County Regional Water District
June 11, 2010

Bull Shoals - Benefits Foregone	Conservation Storage	Flood Storage	Inactive Storage	Flood w/HYPO
Reduction in streamflow (mgd)	7.0	7.0	7.0	7.0
Annual on-peak energy losses (MWh)	1,360	643	1,360	0
Additional on-peak energy losses (MWh) [1]	1,374	643	1,374	0
Total on-peak energy losses (MWh)	2,734	1,285	2,734	0
Annual off-peak energy losses (MWh)	0	151	0	300
Additional off-peak energy losses (MWh) [1]	0	731	0	1,374
Total off-peak energy losses (MWh)	0	882	0	1,674
On-peak energy value ($/MWh) [2]	56.93	56.93	56.93	56.93
Off-peak energy value ($/MWh) [2]	33.51	33.51	33.51	33.51
Average Annual Energy Benefits Foregone	**$155,647**	**$102,711**	**$155,647**	**$56,096**
Capacity losses (kW)	1,111	520	1,111	0
Capacity value ($/kW-year) [3]	59.20	59.20	59.20	59.20
Average Annual Capacity Benefits Foregone	**$65,771**	**$30,784**	**$65,771**	**$0**
Average Annual Hydropower Benefits Foregone	**$221,418**	**$133,495**	**$221,418**	**$56,096**
Annual Flood Control Benefits Foregone Downstream [4]	**$954**	**$11,442**	**$2,225**	**$40,525**
Annual Flood Control Benefits Foregone In Pool [4]	**($1,112)**	**$159**	**($1,112)**	**$3,337**
Annual Recreation Benefits Foregone [4]	**($1,823)**	**$16,775**	**($1,677)**	**$32,893**
Average Annual Total Benefits Foregone	**$219,437**	**$161,871**	**$220,854**	**$132,851**

Base Run includes White River Minimum Flows alternative BS-3 - Top of power pool raised five feet.
Conservation, Flood, and Inactive Alternatives as modeled by the Little Rock District.
Flood Pool with Hydropower Yield Protection Operation (HYPO) modeled by Southwestern Power Administration.

[1] Additional losses are SWPA estimates based on user's ability to withdraw more than the yield in all years except the critical drought.

[2] Energy Benefit Values based on Platts High Fuel values for SPP - October 2009.

[3] Capacity Benefit Values based on FERC values from Hydropower Analysis Center - October 2009. Capacity Benefit Values based on combustion turbine (Arkansas).

[4] SUPER Flood Control and Recreation Benefits foregone for Conservation, Flood, and Inactive Alternatives from the May 2010 Draft Report - Section 5, Page 5-11, Table 5.11.
SUPER benefits foregone for SWPA's HYPO Alternative based on LRD Section 5 methodology.

Southwestern Power Administration

Hydropower Impacts of Proposed Reallocation at Bull Shoals
For Ozark Mountain Regional Public Water Authority
And Marion County Regional Water District
June 11, 2010

Bull Shoals - Revenues Foregone	Conservation Storage	Flood Storage	Inactive Storage	Flood w/HYPO
Reduction in streamflow (mgd)	7.0	7.0	7.0	7.0
Annual on-peak energy losses (MWh)	1,360	643	1,360	0
Additional on-peak energy losses (MWh)[1]	1,374	643	1,374	0
Total on-peak energy losses (MWh)	2,734	1,285	2,734	0
Annual off-peak energy losses (MWh)	0	151	0	300
Additional off-peak energy losses (MWh)[1]	0	731	0	1,374
Total off-peak energy losses (MWh)	0	882	0	1,674
On-peak energy value ($/MWh)[2]	15.30	15.30	15.30	15.30
Off-peak energy value ($/MWh)[2]	8.60	8.60	8.60	8.60
Average Annual Energy Revenues Foregone	**$41,830**	**$27,246**	**$41,830**	**$14,396**
Capacity losses (kW)	1,111	520	1,111	0
Capacity value ($/kW-year)[3]	48.94	48.94	48.94	48.94
Average Annual Capacity Revenues Foregone	**$54,373**	**$25,449**	**$54,373**	**$0**
Average Annual Hydropower Revenues Foregone	**$96,203**	**$52,695**	**$96,203**	**$14,396**

Base Run includes White River Minimum Flows alternative BS-3 - Top of power pool raised five feet.
Flood, Conservation, and Inactive Alternatives as modeled by the Little Rock District.
Flood Pool with Hydropower Yield Protection Operation (HYPO) modeled by Southwestern Power Administration.

[1]Additional losses are SWPA estimates based on user's ability to withdraw more than the yield in all years except the critical drought.

[2]Energy Revenue Values based on Southwestern's rates as of January 1, 2010.

[3]Capacity Revenue Values based on Southwestern's rates as of January 1, 2010.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
110 S. Amity Road, Suite 300
Conway, Arkansas 72032
Tel.: 501/513-4470 Fax: 501/513-4480

IN REPLY REFER TO:

June 3, 2010

Mr. Patrick MacDanel
GEC, Inc.
P.O. Box 84010
Baton Rouge, LA 70808

Dear Mr. MacDanel

The U.S. Fish and Wildlife Service (Service) has reviewed the Draft Environmental Assessment (DEA) for the proposed water supply storage reallocation for the Ozark Mountain Regional Public Water Authority (OMRPWA) and the Marion County Regional Water District (MCRWD), Bull Shoals Lake, Arkansas. Our comments and recommendations are submitted in accordance with the National Environmental Policy Act of 1969, Executive Order 12372, Endangered Species Act of 1973 (Public Law 93-205, as amended) and the Fish and Wildlife Coordination Act (Public Law 85-624; 16 U.S.C. 661-666e.).

The Proposed draft document presents results of the feasibility study to reallocate a total of 11,866.55 acre feet (AF) storage from the Bull Shoals Lake conservation pool to the two water districts and associated potential impacts to the human environment. This total AF represents less than one percent of the total conservation pool storage of 1,236,000 AF in the lake.

The Service concurs with the assessment that this project will have no significant negative environmental impacts. Therefore, the Service has no objection to the proposed issuance of a finding of no significant impact for the proposed action. If you have any questions, please contact me at (501) 513-4489.

Sincerely,

Lindsey Lewis
Environmental Coordinator

Attachment 4
Lists of Rare Species

Missouri Department of Conservation

MDC Heritage Database Results for Taney County

Species and natural communities of conservation concern in Taney county

Scientific Name	Common Name	State Rank (Code)	Global Rank (Code)	State Status (Code)	Federal Status (Code)
Cave		Apparently Secure S4	Not Ranked GNR		
Creeks and small rivers (ozark)			Not Ranked GNR		
Dolomite glade		Vulnerable S3	Not Ranked GNR		
Dry chert woodland		Apparently Secure S4	Not Ranked GNR		
Dry limestone/dolomite woodland		Vulnerable S3	Not Ranked GNR		
Effluent cave			Not Ranked GNR		
Limestone glade		Imperiled S2	Not Ranked GNR		
Limestone/dolomite talus		Apparently Secure S4	Not Ranked GNR		
Pond marsh		Critically Imperiled S1	Not Ranked GNR		
Wet pit cave			Not Ranked GNR		
Orobanche multiflora	A Broomrape	Critically Imperiled S1	Secure G5		
		Unranked	Apparently Secure		

Bryum cyclophyllum	A Moss	S?	Secure G4G5		
Syntrichia papillosa	A Moss	Unranked S?	Secure G5		
Panicum portoricense	A Panic Grass	Critically Imperiled Unranked S1?	Secure G5T5		
Triodanis lamprosperma	A Venus' Looking Glass	Imperiled S2	Secure Inexact Numeric Rank G5?		
Cheilanthes alabamensis	Alabama Lip-fern	Critically Imperiled S1	Apparently Secure Secure G4G5		
Macrochelys temminckii More Information	Alligator Snapping Turtle	Imperiled S2	Vulnerable Apparently Secure G3G4		
Etheostoma euzonum euzonum	Arkansas Saddled Darter	Imperiled S2	Vulnerable Apparently Secure G3G4T3		
Yucca arkansana	Arkansas Yucca	Imperiled S2	Secure G5		
Brackenridgia ashleyi	Ashley's Isopod	Imperiled S2	Critically Imperiled Vulnerable G1G3		
Aimophila aestivalis More Information	Bachman's Sparrow	Imperiled S2	Vulnerable G3	Endangered E	
Haliaeetus leucocephalus More Information	Bald Eagle	Vulnerable S3	Secure G5		
Phlox bifida ssp.		Critically	Vulnerable Secure		

stellaria More Information	Bifid Phlox	Imperiled S1	Inexact Numeric Rank G5?T3		
Coragyps atratus More Information	Black Vulture	Vulnerable S3	Secure G5		
Callirhoe bushii More Information	Bush's Poppy Mallow	Imperiled S2	Vulnerable G3		
Causeyella dendropus	Causeyella Cave Millipede	Imperiled S2	Critically Imperiled Vulnerable G1G3		
Noturus flavater More Information	Checkered Madtom	Vulnerable Apparently Secure S3S4	Vulnerable Apparently Secure G3G4		
Carex cherokeensis More Information	Cherokee Sedge	Imperiled S2	Apparently Secure Secure G4G5		
Sisyrinchium atlanticum	Eastern Blue-eyed Grass	Imperiled S2	Secure G5		
Crotaphytus collaris More Information	Eastern Collared Lizard	Apparently Secure S4	Secure G5		
Callicarpa americana	French Mulberry	Critically Imperiled S1	Secure G5		
Myotis grisescens More Information	Gray Bat	Vulnerable S3	Vulnerable G3	Endangered E	Endangered E
Geococcyx californianus More Information	Greater Roadrunner	Vulnerable S3	Secure G5		
Eurycea spelaea More Information	Grotto Salamander	Imperiled Vulnerable S2S3	Apparently Secure G4		
			Apparently		

Carpiodes velifer More Information	Highfin Carpsucker	Imperiled S2	Secure Secure G4G5		
Myotis sodalis More Information	Indiana Bat	Critically Imperiled S1	Imperiled G2	Endangered E	Endangered E
Mustela frenata More Information	Long-tailed Weasel	Imperiled S2	Secure G5		
Cissus trifoliata	Marine Vine	Imperiled S2	Secure G5		
Stygobromus ozarkensis	Ozark Cave Amphipod	Vulnerable Unranked S3?	Apparently Secure G4		
Gomphus ozarkensis	Ozark Clubtail	Vulnerable S3	Apparently Secure G4		
Somatochlora ozarkensis More Information	Ozark Emerald	Imperiled Vulnerable S2S3	Vulnerable G3		
Notropis ozarcanus More Information	Ozark Shiner	Imperiled S2	Vulnerable G3		
Tradescantia ozarkana More Information	Ozark Spiderwort	Imperiled S2	Vulnerable G3		
Spilogale putorius interrupta More Information	Plains Spotted Skunk	Critically Imperiled S1	Apparently Secure Secure G5T4	Endangered E	
Toxolasma lividus More Information	Purple Lilliput	Imperiled S2	Imperiled G2		
Necturus maculosus louisianensis More Information	Red River Mudpuppy	Unrankable SU	Apparently Secure Secure G5T4		
Ambystoma annulatum More Information	Ringed Salamander	Vulnerable S3	Apparently Secure G4		
Glyceria acutiflora	Sharp-scaled	Vulnerable	Secure		

	Manna Grass	S3	G5		
Paspalum setaceum var. setaceum More Information	Slender Paspalum	Critically Imperiled S1	Secure G5T5		
Stenosiphon linifolius	Stenosiphon	Imperiled S2	Secure G5		
Limnothlypis swainsonii More Information	Swainson's Warbler	Imperiled S2	Apparently Secure G4	Endangered E	
Carex timida	Timid Sedge	Critically Imperiled Imperiled S1S2	Imperiled Vulnerable G2G3		
Antrobia culveri More Information	Tumbling Creek Cavesnail	Critically Imperiled S1	Critically Imperiled G1	Endangered E	Endangered E
Eriogonum longifolium var. longifolium	Umbrella Plant	Imperiled S2	Apparently Secure G4T4		
Astranthium ciliatum	Western Daisy	Imperiled S2	Secure G5T5		
Ophiogomphus westfalli More Information	Westfall's Snaketail	Vulnerable S3	Vulnerable G3		
Orconectes williamsi More Information	Williams' Crayfish	Imperiled S2	Vulnerable Apparently Secure G3G4		
Fragaria vesca var. americana	Woodland Strawberry	Critically Imperiled S1	Secure G5T5		

Return to Heritage Search Map

Missouri Department of Conservation

MDC Heritage Database Results for Ozark County

Species and natural communities of conservation concern in Ozark county

Scientific Name	Common Name	State Rank (Code)	Global Rank (Code)	State Status (Code)	Federal Status (Code)
Creeks and small rivers (ozark)			Not Ranked GNR		
Dolomite glade		Vulnerable S3	Not Ranked GNR		
Dry chert woodland		Apparently Secure S4	Not Ranked GNR		
Dry-mesic chert woodland		Apparently Secure S4	Not Ranked GNR		
Headwater streams (ozark)			Not Ranked GNR		
Mdc cave			Not Ranked GNR		
Oxbows and sloughs (ozark)			Not Ranked GNR		
Ozark fen		Imperiled S2	Not Ranked GNR		
Liatris scariosa var. nieuwlandii	A Blazing Star	Imperiled S2	Vulnerable Secure Inexact Numeric Rank G5?T3T		
Orobanche multiflora	A Broomrape	Critically Imperiled S1	Secure G5		
Amblytropidia mysteca	A Glade Grasshopper	Unrankable SU	Secure G5		
Pardalophora saussurei	A Glade Grasshopper	Vulnerable S3	Secure G5		

Usnea angulata	A Lichen	Critically Imperiled S1	Vulnerable Secure G3G5		
Brachythecium acutum	A Moss	Unrankable SU	Questionable Taxonomy Not Ranked GNRQ		
Mnium thomsonii	A Moss	Unranked S?	Secure G5		
Ptychomitrium sinense	A Moss	Critically Imperiled S1	Apparently Secure Secure G4G5		
Carex arkansana	A Sedge	Vulnerable S3	Apparently Secure G4		
Carex fissa var. fissa More Information	A Sedge	Critically Imperiled S1	Vulnerable Apparently Secure Inexact Numeric Rank G4?T3T		
Cheilanthes alabamensis	Alabama Lip-fern	Critically Imperiled S1	Apparently Secure Secure G4G5		
Macrochelys temminckii More Information	Alligator Snapping Turtle	Imperiled S2	Vulnerable Apparently Secure G3G4		
Etheostoma euzonum euzonum	Arkansas Saddled Darter	Imperiled S2	Vulnerable Apparently Secure G3G4T3		
Yucca arkansana	Arkansas Yucca	Imperiled S2	Secure G5		
Agalinis auriculata More Information	Auriculate False Foxglove	Vulnerable S3	Vulnerable G3		

Aimophila aestivalis More Information	Bachman's Sparrow	Imperiled S2	Vulnerable G3	Endangered E	
Haliaeetus leucocephalus More Information	Bald Eagle	Vulnerable S3	Secure G5		
Marshallia caespitosa var. signata	Barbara's Buttons	Critically Imperiled S1	Apparently Secure G4T4		
Ursus americanus More Information	Black Bear	Vulnerable S3	Secure G5		
Caecidotea antricola	Cave Isopod	Apparently Secure S4	Secure G5		
Dendroica cerulea More Information	Cerulean Warbler	Imperiled Vulnerable S2S3	Apparently Secure G4		
Noturus flavater More Information	Checkered Madtom	Vulnerable Apparently Secure S3S4	Vulnerable Apparently Secure G3G4		
Amsonia ciliata var. filifolia	Ciliate Blue Star	Imperiled Vulnerable S2S3	Apparently Secure Secure Inexact Numeric Rank G5?T4?		
Crotaphytus collaris More Information	Eastern Collared Lizard	Apparently Secure S4	Secure G5		
Carex communis var. communis	Fibrous-root Sedge	Imperiled S2	Secure G5T5		
Eurybia furcata More Information	Forked Aster	Imperiled S2	Vulnerable G3		
Clematis fremontii	Fremont's Leather Flower	Vulnerable S3	Secure G5		
Callicarpa americana	French Mulberry	Critically Imperiled	Secure G5		

		S1			
Macromia pacifica	Gilded River Cruiser	Vulnerable S3	Apparently Secure G4		
Myotis grisescens More Information	Gray Bat	Vulnerable S3	Vulnerable G3	Endangered E	Endangered E
Geococcyx californianus More Information	Greater Roadrunner	Vulnerable S3	Secure G5		
Eurycea spelaea More Information	Grotto Salamander	Imperiled Vulnerable S2S3	Apparently Secure G4		
Polypremum procumbens	Juniper-leaf	Imperiled S2	Secure G5		
Gomphus ozarkensis	Ozark Clubtail	Vulnerable S3	Apparently Secure G4		
Cryptobranchus alleganiensis bishopi More Information	Ozark Hellbender	Critically Imperiled S1	Imperiled Vulnerable Apparently Secure G3G4T2	Endangered E	Candidate C
Notropis ozarcanus More Information	Ozark Shiner	Imperiled S2	Vulnerable G3		
Tradescantia ozarkana More Information	Ozark Spiderwort	Imperiled S2	Vulnerable G3		
Spilogale putorius interrupta More Information	Plains Spotted Skunk	Critically Imperiled S1	Apparently Secure Secure G5T4	Endangered E	
Necturus maculosus louisianensis More Information	Red River Mudpuppy	Unrankable SU	Apparently Secure Secure G5T4		
Ambystoma annulatum	Ringed Salamander	Vulnerable S3	Apparently Secure		

More Information			G4		
Accipiter striatus More Information	Sharp-shinned Hawk	Vulnerable S3	Secure G5		
Cypripedium reginae More Information	Showy Lady-slipper	Imperiled Vulnerable S2S3	Apparently Secure G4		
Carex laxiculmis	Spreading Sedge	Imperiled S2	Secure G5		
Stenosiphon linifolius	Stenosiphon	Imperiled S2	Secure G5		
Carex timida	Timid Sedge	Critically Imperiled Imperiled S1S2	Imperiled Vulnerable G2G3		
Tingupa pallida	Tingupa Cave Millipede	Apparently Secure S4	Apparently Secure G4		
Eriogonum longifolium var. longifolium	Umbrella Plant	Imperiled S2	Apparently Secure G4T4		
Hydrocotyle verticillata	Water Pennywort	Critically Imperiled S1	Secure G5		
Ophiogomphus westfalli More Information	Westfall's Snaketail	Vulnerable S3	Vulnerable G3		

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Heritage Database Codes

TERMS AND DEFINITIONS

FEDERAL STATUS

The federal status is derived from the provisions of the Endangered Species Act of 1973, as amended, which is administered by the U.S. Fish and Wildlife Service. Passage of the Endangered Species Act of 1973 gave the United States one of the most far-reaching laws ever enacted by any country to prevent the extinction of imperiled animals and plants. Protecting endangered and threatened species and restoring them to the point where their existence is no longer jeopardized is the primary objective of the Fish and Wildlife Service's Endangered Species Program.

E: Endangered:
: Any species which is in danger of extinction throughout all or a significant portion of its range.

T: Threatened:
: Any species which is likely to become endangered within the foreseeable future.

C: Candidate:
: Plants or animals which the Service is reviewing for possible addition to the list of endangered and threatened species.

PE: Proposed Endangered:
: Species officially proposed for listing as endangered; final ruling not yet made.

PT: Proposed Threatened:
: Species officially proposed for listing as threatened; final ruling not yet made.

STATE STATUS

Rule 3CSR10-4.111 of the Wildlife Code of Missouri and certain state statutes apply to state Code listed species.

E: "Endangered":
: Determined by the Department of Conservation under constitutional authority.

GLOBAL RANK

A numeric rank (G1 through G5) of relative endangerment based primarily on the number of occurrences of the Element (i.e., species, subspecies, or variety) globally. Other factors in addition to the number of occurrences are considered when assigning a rank, so the numbers of occurrences suggested for each numeric rank below are not absolute guidelines.

G1: Critically Imperiled:
Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 5 or fewer occurrences or very few remaining individuals (<1,000) or acres (<2000) or linear miles.

G2: Imperiled:
Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction or elimination. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or linear miles (10 to 50).

G3: Vulnerable:
Vulnerable globally either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction or elimination. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.

G4: Apparently Secure:
Uncommon but not rare (although it may be rare in parts of its range, particularly on the periphery), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern. Typically more than 100 occurrences and more than 10,000 individuals.

G5: Secure:
Common; widespread and abundant (although it may be rare in parts of its range, particularly on the periphery). Not vulnerable in most of its range. Typically with considerably more than 100 occurrences and more than 10.000 individuals.

G#G#: Range Rank:
A numeric range rank (e.g., G2G3) is used to indicate uncertainty about the exact status of a taxon. Ranges cannot skip more than one rank (e.g., GU should be used rather than G1G4).

GNR: Not Ranked:
Status has not been assessed.

GU: Unrankable:
Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. Note: Whenever possible, the most likely rank is assigned and the question mark qualifier is added (e.g., G2?) to express uncertainty, or a range rank (e.g., G2G3) is used to delineate the limits (range) of uncertainty.

GH: Possibly Extinct/Extirpated:
Known from only historical occurrences, but may nevertheless still be extant; further searching needed.

GX: Presumed Extinct:
Believed to be extinct throughout its range. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

SUBRANK:

T: Taxonomic Subdivision:
Rank applies to a subspecies or variety.

QUALIFIERS:

?: Inexact Numeric Rank:
Denotes inexact numeric rank. (The ? is not used in combination with range ranks.)

Q: Questionable Taxonomy:
Distinctiveness of this entity as a taxon or community at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, inclusion of this taxon in another taxon, or inclusion of this community within another community, with the resulting Element having a lower-priority (numerically higher) conservation status rank.

STATE RANK

A numeric rank (S1 through S5) of relative endangerment based primarily on the number of occurrences of the Element (i.e., species, subspecies, or variety) within the state. Other factors considered when assigning a rank include: abundance, population trends, distribution, number of protected sites, degree of threat, suitable habitat trends, level of survey effort and life history. Thus, the number of occurrences suggested for each numeric rank below are not absolute guidelines. Missouri species of conservation concern typically do not fall within the range of S4-S5.

S1: Critically Imperiled:
Critically imperiled in the nation or state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically 5 or fewer occurrences or very few remaining individuals (<1,000).

S2: Imperiled:
Imperiled in the nation or state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the nation or state (1,000 to 3,000).

S3: Vulnerable:
Vulnerable in the nation or state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.

S4: Apparently Secure:
Uncommon but not rare, and usually widespread in the nation or state. Possible cause of long-term concern. Usually more than 100 occurrences and more than 10,000 individuals.

S5: Secure:
Common, widespread, and abundant in the nation or state. Essentially ineradicable under present conditions. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

S#S#: Range Rank:
A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status of the Element. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

S?: Unranked:
Species is not yet ranked in the state.

SU: Unrankable:
Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

SE: Exotic:
An exotic established in the state; may be native in nearby regions (e.g., house finch or catalpa in eastern U.S.)

SA: Accidental/Nonregular:
Accidental or casual in the state (i.e., infrequent and outside usual range).

SP: Potential:
Potentially occurring in the state but no occurrences reported.

SR: Reported:
Element reported in the state but without persuasive documentation which would provide a basis

for either accepting or rejecting (e.g., misidentified specimen) the report.

SRF: Reported Falsely:

Element erroneously reported in the state and the error has persisted in the literature.

SH: Historical:

Element occurred historically in the state (with expectation that it may be rediscovered). Perhaps having not been verified in the past 20 years, and suspected to be still extant.

SX: Extirpated:

Element is believed to be extirpated from the state.

QUALIFIERS:

?: Inexact or Uncertain:

Denotes inexact or uncertain numeric rank. (The ? qualifies the character immediately preceding it in the SRANK. The ? is not used in combination with range ranks.)

Print Window

Boone

Name	Status Federal	Status State	Rank Global	Rank State
Animals - Invertebrates				
Arrhopalites clarus (a springtail)	-	INV	G4	S1S2
Bombus fervidus (golden northern bumblebee)	-	INV	GNR	S1
Caecidotea ancyla (an isopod)	-	INV	G3G4	S1?
Caecidotea stiladactyla (an isopod)	-	INV	G3G4	S1?
Cicindela duodecimguttata (twelve-spotted tiger beetle)	-	INV	G5	S3S4
Crosbyella distincta (a cave obligate harvestman)	-	INV	G1G2	S1
Gastrocopta rogersensis (a land snail)	-	INV	G3G4	S2
Gryllotalpa major (prairie mole cricket)	-	INV	G3	S1S2
Laphria vorax (a robberfly)	-	INV	GNR	S1
Lirceus bidentatus (an isopod)	-	INV	G1?	S1?
Orconectes williamsi (William's crayfish)	-	INV	G3	S1
Animals - Vertebrates				
Empidonax traillii (Willow Flycatcher)	-	INV	G5	S1B,S3N
Myotis grisescens (gray myotis)	LE	INV	G3	S2S3
Terrapene ornata ornata (ornate box turtle)	-	INV	G5T5	S2
Thryomanes bewickii (Bewick's Wren)	-	INV	G5	S2B,S3N
Plants - Vascular				
Amorpha canescens (leadplant)	-	INV	G5	S1
Antennaria neglecta (field pussytoes)	-	INV	G5	S1
Calopogon oklahomensis (Oklahoma grass-pink)	-	INV	G4?	S2
Carex bicknellii (a caric sedge)	-	INV	G5	S1
Carex gravida (a caric sedge)	-	INV	G5	S2S3
Carex opaca (a caric sedge)	-	SE	G5T4	S2S3
Castanea pumila var. ozarkensis (Ozark chinquapin)	-	INV	G5T3	S3S4
Cypripedium kentuckiense (Kentucky lady's-slipper)	-	INV	G3	S3
Delphinium treleasei (Trelease's larkspur)	-	INV	G3	S3
Echinacea paradoxa var. paradoxa (Bush's yellow coneflower)	-	ST	G2T2	S2
Erythronium mesochoreum (prairie trout lily)	-	INV	G4G5	S1S2
Gentiana puberulenta (downy gentian)	-	INV	G4G5	S2
Helianthus pauciflorus ssp. pauciflorus (prairie sunflower)	-	INV	G5T5?	S1
Heuchera villosa var. arkansana (Arkansas alumroot)	-	INV	G5T3Q	S3
Lithospermum incisum (fringed puccoon)	-	INV	G5	S2S3
Nemastylis nuttallii (Nuttall's pleat-leaf)	-	INV	G4	S2
Pediomelum esculentum (prairie turnip)	-	INV	G5	S2
Penstemon cobaea (showy beard-tongue)	-	INV	G4	S3

Perideridia americana (American squaw-root)	-	INV	G4	S2
Potentilla arguta (tall cinquefoil)	-	ST	G5	S1S2
Sida elliottii (a sida)	-	INV	G4G5	S2S3
Silene regia (royal catchfly)	-	ST	G3	S2
Solidago gattingeri (Gattinger's goldenrod)	-	INV	G3?Q	S1
Symphyotrichum sericeum (silky aster)	-	INV	G5	S2
Trillium pusillum var. ozarkanum (Ozark least trillium)	-	INV	G3T3	S3
Viburnum molle (soft-leaved arrow-wood)	-	INV	G5	S1
Viola pedatifida (prairie violet)	-	INV	G5	S2
Zephyranthes chlorosolen (rain lily)	-	INV	G5	S1S2
Zizia aptera (golden Alexanders)	-	INV	G5	S1S3

Special Elements - Natural Communities

Central Interior Highlands Calcareous Glade and Barrens	-	INV	GNR	SNR
Ozark Prairie and Woodland	-	INV	GNR	SNR

Special Elements - Other

Colonial nesting site, water birds	-	INV	GNR	SNR

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Print Window

Baxter

Name	Status Federal	Status State	Rank Global	Rank State
Animals - Invertebrates				
Arrhopalites clarus (a springtail)	-	INV	G4	S1S2
Caecidotea dimorpha (an isopod)	-	INV	G2G3	S1?
Caecidotea stiladactyla (an isopod)	-	INV	G3G4	S1?
Epioblasma triquetra (snuffbox)	-	INV	G3	S1
Gastrocopta rogersensis (a land snail)	-	INV	G3G4	S2
Lampsilis abrupta (pink mucket)	LE	INV	G2	S2
Somatogyrus crassilabris (thicklipped pebblesnail)	-	INV	GX	SX
Animals - Vertebrates				
Ambystoma annulatum (ringed salamander)	-	INV	G4	S3
Cryptobranchus alleganiensis bishopi (Ozark Hellbender)	C	INV	G3G4T2Q	S2
Cyprinella camura (bluntface shiner)	-	INV	G5	SH
Erimystax harryi (Ozark chub)	-	INV	G3G4Q	S3S4
Eurycea spelaea (grotto salamander)	-	INV	G4	S3
Haliaeetus leucocephalus (Bald Eagle)	-	INV	G5	S2B,S4N
Lampetra appendix (American brook lamprey)	-	INV	G4	S2?
Myotis grisescens (gray myotis)	LE	INV	G3	S2S3
Notropis ozarcanus (Ozark shiner)	-	INV	G3	S2
Rana sylvatica (wood frog)	-	INV	G5	S3
Typhlichthys subterraneus (southern cavefish)	-	INV	G4	S1
Plants - Vascular				
Acalypha deamii (Deam's copperleaf)	-	INV	G4?	S1
Arabis shortii var. shortii (Short's rockcress)	-	INV	G5T5	S1
Argyrochosma dealbata (powdery cloak fern)	-	INV	G4G5	S2
Arnoglossum reniforme (great Indian plantain)	-	INV	G4	S2
Brickellia grandiflora (tassel flower)	-	INV	G5	S2
Carex careyana (Carey's caric sedge)	-	INV	G4G5	S3
Carex davisii (Davis' caric sedge)	-	INV	G4	S3
Carex gracillima (graceful caric sedge)	-	INV	G5	S1
Carex gravida (a caric sedge)	-	INV	G5	S2S3
Carex hirtifolia (a caric sedge)	-	INV	G5	S3
Carex hitchcockiana (Hitchcock's caric sedge)	-	INV	G5	S1S2
Carex leptalea var. harperi (threadstem caric sedge)	-	INV	G5T4T5	S2S3
Carex mesochorea (a caric sedge)	-	INV	G4G5	S2
Carex shortiana (Short's caric sedge)	-	INV	G5	S2
Carex sparganioides (a caric sedge)	-	INV	G5	S3

Carex suberecta (a caric sedge)	-	INV	G4	S2
Carex timida (a caric sedge)	-	INV	G2G3	S2S3
Castanea pumila var. ozarkensis (Ozark chinquapin)	-	INV	G5T3	S3S4
Cheilanthes eatonii (Eaton's lip fern)	-	INV	G5?	SH
Cypripedium reginae (showy lady's-slipper)	-	SE	G4	S1
Delphinium treleasei (Trelease's larkspur)	-	INV	G3	S3
Diphasiastrum digitatum (southern running-pine)	-	INV	G5	S1S2
Dryopteris celsa (log fern)	-	INV	G4	S2
Dryopteris goldiana (giant wood fern)	-	INV	G4	S1
Dryopteris x australis (southern hybrid log fern)	-	INV	GNA	S1
Dryopteris x leedsii (Leed's hybrid log fern)	-	INV	GNA	S1
Echinacea paradoxa var. paradoxa (Bush's yellow coneflower)	-	ST	G2T2	S2
Elymus churchii (Church's wild rye)	-	INV	G2G3	S2?
Euonymus obovatus (running strawberry bush)	-	INV	G5	S3
Hexalectris spicata var. spicata (crested coralroot)	-	INV	G5T4T5	S2
Hieracium scabrum (rough hawkweed)	-	INV	G5	S2
Huperzia lucidula (shining club-moss)	-	INV	G5	S2S3
Juglans cinerea (butternut)	-	INV	G4	S3
Leavenworthia uniflora (glade cress)	-	INV	G4	S3
Melanthium woodii (false hellebore)	-	INV	G5	S3
Mentha arvensis (field mint)	-	INV	G5	S1
Mimulus ringens var. ringens (monkey flower)	-	INV	G5T5	S1S2
Mitella diphylla (two-leaf bishop's cap)	-	INV	G5	S2
Pediomelum esculentum (prairie turnip)	-	INV	G5	S2
Penstemon cobaea (showy beard-tongue)	-	INV	G4	S3
Phacelia gilioides (hairy scorpionweed)	-	INV	G5	S2S3
Plantago cordata (heartleaf plantain)	-	ST	G4	S2
Prenanthes crepidinea (nodding rattlesnake-root)	-	INV	G4	S1
Ranunculus aquatilis var. diffusus (white water crowfoot)	-	INV	G5T5	S2S3
Rhynchospora capillacea (capillary beakrush)	-	INV	G4	S2
Scutellaria bushii (Bush's skullcap)	-	ST	G3	S2
Silene ovata (ovate-leaved catchfly)	-	ST	G3	S3
Solidago ptarmicoides (white-flowered goldenrod)	-	INV	G5	S1S2
Spiranthes lucida (shining ladies'-tresses)	-	INV	G5	S2
Stenosiphon linifolius (false gaura)	-	ST	G5	S1
Stylophorum diphyllum (celandine poppy)	-	INV	G5	S3
Tradescantia ozarkana (Ozark spiderwort)	-	INV	G3	S3
Valerianella ozarkana (Ozark cornsalad)	-	INV	G3	S3
Viola canadensis var. canadensis (Canada violet)	-	INV	G5T5	S2
Zannichellia palustris (horned pondweed)	-	INV	G5	S2S3

Special Elements - Natural Communities

Central Interior Highlands Calcareous Glade and Barrens	-	INV	GNR	SNR
Ozark-Ouachita Dry-Mesic Oak Forest	-	INV	GNR	SNR

Special Elements - Other

Colonial nesting site, water birds	-	INV	GNR	SNR

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Print Window

Marion

Name	Status		Rank	
	Federal	State	Global	State
Animals - Invertebrates				
Alasmidonta marginata (elktoe)	-	INV	G4	S3
Caecidotea dimorpha (an isopod)	-	INV	G2G3	S1?
Caecidotea stiladactyla (an isopod)	-	INV	G3G4	S1?
Cyclonaias tuberculata (purple wartyback)	-	INV	G5	S3?
Cyprogenia aberti (western fanshell)	-	INV	G2G3Q	S2
Epioblasma triquetra (snuffbox)	-	INV	G3	S1
Lasmigona costata (flutedshell)	-	INV	G5	S3
Millerelix peregrina (white liptooth)	-	INV	G2	SNR
Ptychobranchus occidentalis (Ouachita kidneyshell)	-	INV	G3G4	S3
Rimulincola divalis (a beetle)	-	INV	G1	S1
Venustaconcha pleasii (bleedingtooth mussel)	-	INV	G3G4	S3
Villosa iris (rainbow)	-	INV	G5Q	S2S3
Animals - Vertebrates				
Corynorhinus townsendii ingens (Ozark big-eared bat)	LE	INV	G4T1	S1
Erimystax harryi (Ozark chub)	-	INV	G3G4Q	S3S4
Eurycea spelaea (grotto salamander)	-	INV	G4	S3
Haliaeetus leucocephalus (Bald Eagle)	-	INV	G5	S2B,S4N
Lampetra aepyptera (least brook lamprey)	-	INV	G5	S2?
Lampetra appendix (American brook lamprey)	-	INV	G4	S2?
Limnothlypis swainsonii (Swainson's Warbler)	-	INV	G4	S3B
Myotis grisescens (gray myotis)	LE	INV	G3	S2S3
Myotis sodalis (Indiana bat)	LE	INV	G2	S1
Notropis ozarcanus (Ozark shiner)	-	INV	G3	S2
Rana sylvatica (wood frog)	-	INV	G5	S3
Plants - Vascular				
Amorpha canescens (leadplant)	-	INV	G5	S1
Arabis shortii var. shortii (Short's rockcress)	-	INV	G5T5	S1
Argyrochosma dealbata (powdery cloak fern)	-	INV	G4G5	S2
Asclepias incarnata ssp. incarnata (northern swamp milkweed)	-	INV	G5T5	S2
Brickellia grandiflora (tassel flower)	-	INV	G5	S2
Callirhoe bushii (Bush's poppy mallow)	-	INV	G3	S3
Carex hitchcockiana (Hitchcock's caric sedge)	-	INV	G5	S1S2
Carex mesochorea (a caric sedge)	-	INV	G4G5	S2
Carex pellita (a caric sedge)	-	INV	G5	SH
Carex sparganioides (a caric sedge)	-	INV	G5	S3

Carex stricta (tussock sedge)	-	INV	G5	S3
Carex suberecta (a caric sedge)	-	INV	G4	S2
Carex timida (a caric sedge)	-	INV	G2G3	S2S3
Castanea pumila var. ozarkensis (Ozark chinquapin)	-	INV	G5T3	S3S4
Delphinium treleasei (Trelease's larkspur)	-	INV	G3	S3
Desmodium illinoense (Illinois tick trefoil)	-	INV	G5	S2
Euonymus obovatus (running strawberry bush)	-	INV	G5	S3
Juglans cinerea (butternut)	-	INV	G4	S3
Leavenworthia uniflora (glade cress)	-	INV	G4	S3
Lithospermum incisum (fringed puccoon)	-	INV	G5	S2S3
Pediomelum esculentum (prairie turnip)	-	INV	G5	S2
Penstemon cobaea (showy beard-tongue)	-	INV	G4	S3
Perideridia americana (American squaw-root)	-	INV	G4	S2
Philadelphus hirsutus (mock orange)	-	INV	G5	S2S3
Phlox bifida (sand phlox)	-	INV	G5?	S3
Rhynchospora capillacea (capillary beakrush)	-	INV	G4	S2
Ribes cynosbati (prickly gooseberry)	-	INV	G5	S2S3
Silene regia (royal catchfly)	-	ST	G3	S2
Spiranthes lucida (shining ladies'-tresses)	-	INV	G5	S2
Stylophorum diphyllum (celandine poppy)	-	INV	G5	S3
Symphyotrichum sericeum (silky aster)	-	INV	G5	S2
Tradescantia ozarkana (Ozark spiderwort)	-	INV	G3	S3
Valerianella ozarkana (Ozark cornsalad)	-	INV	G3	S3
Waldsteinia fragarioides (barren strawberry)	-	INV	G5	S1

Special Elements - Natural Communities

Central Interior Highlands Calcareous Glade and Barrens	-	INV	GNR	SNR
Ozark-Ouachita Dry Oak Woodland	-	INV	GNR	SNR
Ozark-Ouachita Fen	-	INV	GNR	SNR

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LEGEND

STATUS CODES

FEDERAL STATUS CODES

C	=	Candidate species. The U.S. Fish and Wildlife Service has enough scientific information to warrant proposing this species for listing as endangered or threatened under the Endangered Species Act.
LE	=	Listed Endangered; the U.S. Fish and Wildlife Service has listed this species as endangered under the Endangered Species Act.
LT	=	Listed Threatened; the U.S. Fish and Wildlife Service has listed this species as threatened 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 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.
SE	=	State Endangered; this is an administrative designation applied by the Arkansas Natural Heritage Commission to native plant taxa which are in danger of being extirpated from the state.
ST	=	State Threatened; this is an administrative desgination applied by the Arkansas Natural Heritage Commission to native plant taxa which are believed likely to become endangered in Arkansas in the foreseeable future, based on current inventory information.

DEFINITION OF RANKS

Global Ranks

G1	=	Critically imperiled globally. At a very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	=	Imperiled globally. At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
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.
GH	=	Of historical occurrence, possibly extinct globally. Missing; known from only historical occurrences, but still some hope of rediscovery.
GU	=	Unrankable. Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
GX	=	Presumed extinct globally. Not located despite intensive searches and virtually no likelihood of rediscovery.
GNR	=	Unranked. The global rank not yet assessed.
GNA	=	Not Applicable. A conservation status rank is not applicable.
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.
S4	=	Apparently secure in the state. Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	=	Secure in the state. Common, widespread and abundant.
SH	=	Of historical occurrence, with some possibility of rediscovery. Its presence may not have been verified in the past 20-40 years. A species may be assigned this rank without the 20-40 year delay if the only known occurrences were destroyed or if it had been extensively and unsuccessfully sought.
SU	=	Unrankable. Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SX	=	Presumed extirpated from the state. Not located despite intensive searches and virtually no likelihood of rediscovery.
SNR	=	Unranked. The state rank not yet assessed.
SNA	=	Not Applicable. A conservation status rank is not applicable.

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.
RANGES=		Ranges are used to indicate a range of uncertainty about the status of the element.
?	=	A question mark is used to denote an inexact numeric rank.
B	=	Refers to the breeding population of a species in the state.
N	=	Refers to the non-breeding population of a species in the state.

Attachment 5
EA and RUS FONSI

ENVIRONMENTAL REPORT

FOR

OZARK MOUNTAIN REGIONAL PUBLIC WATER AUTHORITY

TO SERVE

NORTH CENTRAL ARKANSAS

JANUARY 2008
(REVISED APRIL 2009)

Prepared In Accordance With:
RUS Bulletin 1794A-602
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1.0 PURPOSE AND NEED OF THE PROPOSAL

1.1 Project Description (Proposed Action)

The Ozark Mountain Regional Public Water Authority (OMRPWA) was formed in 2004 to assist small cities, communities, and rural water systems in North Central Arkansas secure a safe and dependable long term water supply for over 21,500 persons. OMRPWA has been working extremely hard since April of 2004 in trying to obtain and develop a long term regional water supply for Newton County, Searcy County, and portions of Boone, Marion, Johnson, and Pope Counties. Since most of the water systems have similar problems, it made sense that they act together to formulate a plan that will best serve the region. Having each system constructing long term water sources individually would be extremely expensive and not very cost effective.

A collaborative effort on behalf of the member water systems to formulate a long-term water source plan that will best serve the region made sense since a number of member water systems share common water quality and quantity problems, and the fact that the individual evaluation of water sources for each public water system would be prohibitively expensive. The public water systems that are currently members of the OMRPWA are listed below:

NEWTON COUNTY
- City of Jasper
- Mt. Sherman Water Association
- Nail-Swain Water Association
- East Newton County Water Association
- Mockingbird Hill Water Association
- Deer Community Water Association
- Lurton-Pelsor Water Association
- Town of Western Grove
- Parthenon Water Association

SEARCY COUNTY
- SP&G Water Association
  (St. Joe, Pindall & Gilbert)
- City of Marshall
- South Mountain Water Association
- SDM Water Association
  (Snowball, Dongola & Marsena)
- Town of Leslie
- Morning Star Water Association

BOONE COUNTY
- Town of Valley Springs
- Town of Diamond City
- Town of Lead Hill
- Lake Bull Shoals Estates

MEMBERS AT LARGE
- Buffalo River (National Park Service)

Engineering Services, Inc. (ESI) was contracted by OMRPWA to conduct a detailed feasibility study and make recommendations on a long-term water source for the region. After an intensive evaluation of water sources and transmission alternatives, construction of a new regional water system to serve the 20 member entities was recommended. The system will need to provide approximately 6 million gallons per day to the region in order to meet current water consumption as well as expected future growth. The current project includes leaving the Buffalo River drainage basin and constructing the following:

- Construct a water intake structure on Bull Shoals Lake;
- Construct a 6 million gallon per day water treatment facility to be located near Diamond City, Arkansas;
- Install ductile iron transmission lines connecting the intake structure and treatment facility to the OMRPWA member systems;
- Construct water storage tanks, which will supply water by gravity flow to each bulk customer; and
- Construct booster pumping stations and install pressure reducing valves in order to serve the mountainous regions.

25 Years of Effort to Develop a Safe and Plentiful Drinking Water Supply

The North Central Arkansas region has worked very hard over the past 25 years to develop a long term regional water supply. Since the early 1980's, four (4) separate studies have been completed by four (4) separate organizations. These are listed below:

- Water Supply for Newton and Searcy Counties
  Arkansas Soil and Water Comm. (Recommended Watershed Development in BNR basin)
- Preliminary Engineering Report - Searcy County Regional Water District
  NRS Consulting Engineer's (Recommended Watershed Development in BNR basin)
- Water Needs Feasibility Study - NW Ark. Resource Conservation & Dev. Council
  Crafton, Tull & Associates (Recommended Watershed in Wild and Scenic basin)
- Feasibility Study - Ozark Mountain Regional Public Water Authority
  Engineering Services, Inc. (Recommended Obtaining Source from Bull Shoals)

The first three (3) reports prepared recommended developing a watershed in either Searcy or Newton County in order to supply a safe and plentiful water supply for the region. Permitting, legal challenges, and environmental concerns have stopped development of any impoundments within the Buffalo River drainage basin and delayed a safe water supply for over 25 years. Families within the Buffalo River drainage basin continue to drink water contaminated with radium, fluoride, uranium, radon, and other contaminants.

It should be noted, Searcy County has worked since the late 1980's to develop a long term surface water supply for the residents of Searcy County. The Searcy County Regional Water District (SCRWD) was formed in order to develop a regional water supply and provide treated water to the residents of Searcy County.

The SCRWD made good progress in the early stages of developing the water supply. They retained a consulting engineer, prepared a preliminary engineering report, made application for state and federal funding, and began work on the environmental phase of the project. However, since the selected watershed was on a tributary of the Buffalo National River, extensive environmental studies were required to determine the long term effect of the watershed on the Buffalo National River. After approximately ten (10) years of environmental review, debate and discussion, the National Park Service determined that the District would have to provide detailed environmental impact studies to determine the long term effects of the watershed development. The cost of these studies was anticipated to be in excess of $500,000, which is not feasible for the District. Ultimately, progress on the SCRWD regional water supply was stopped. Therefore, the SCRWD fully supports the efforts of the Ozark Mountain Regional Water Public Authority in developing a water source to serve the region.

Impact of Living Within the Buffalo River Drainage Basin

On March 1, 1972, the United States Congress established the Buffalo National River as America's first national river. While the beauty of the Buffalo River and entire Ozark Mountain region is truly a blessing, thousands of families within the Buffalo River drainage basin are suffering from the lack of a safe and plentiful water supply. Due to the Buffalo National River watershed regulations, OMRPWA or other water systems are unable to tap into local water resources normally available for drinking water. This inability to tap into the Buffalo River drainage basin is adding $15 - $20 million to the total project cost.

This additional cost is the primary reason this project is forced to request such a large amount of grant funds. It is unfair and punitive that families within this protected basin would be required to pay substantially more for water than other customers throughout the State.

Full Support of National Park Service (Watershed Rehabilitation / Protection for Buffalo River Basin)

The National Park Service and the Department of Interior fully support our project. We have worked closely with the National Park Service to select a route that avoids sensitive environmental areas. The National Park Service has also indicated this project will provide an environmental enhancement to the Buffalo National River. Please refer to the excerpt below from a letter from the National Park Service.

"This proposal is the least environmentally impacting way to supply safe, dependable, and affordable water to the region as well as provide direct benefits for the Buffalo National River (America's 1st National River) and the one million Americans that visit this resource each year. This project will also alleviate damming the Buffalo River tributaries to provide water to individual districts, and eliminate the Cities of Marshall and Leslie withdrawing from Hughes Spring / Brush Creek, a tributary to the Buffalo National River. It will also lessen the

dependency of the region on groundwater by replacing wells with a single surface water source, thus reducing withdrawal from aquifers feeding the Buffalo River."

OMRPWA Progress to Date

The OMRPWA has made tremendous progress since forming in 2004. The Board of Directors have conducted productive monthly meetings since 2005 and maintained close contact with state and federal agencies concerning the project. Interest in the project remains passionate, and the member entities are hopeful that construction can begin soon. Shown below are some of the items completed since inception of the OMRPWA.

- Determined the organization structure of the Alliance and elected board of directors;
- 9 Board of Directors; 3 from Searcy County, 3 from Newton County, and 3 from Boone County;
- Worked very closely with the Arkansas Department of Health, USDA Rural Development, Arkansas Natural Resources Commission, U.S. Fish and Wildlife and the National Park Service.
- Conducted frequent informative meetings in Boone, Newton and Searcy Counties;
- Retained consulting engineer and legal counsel;
- Received $25,000 grant funding to conduct feasibility study, and received $60,000 to complete cultural resources survey of the project.
- Completed Feasibility Study and Environmental Report;
- Prepared funding applications through federal, state, and local sources;
- Conducted public hearing in order to achieve water plan compliance;
- Published public notices in accordance with USDA and USACE procedures;
- Requested allocation from USACE from Bull Shoals Reservoir;
- Obtained environmental approval in accordance with USDA / NEPA guidelines;
- Obtained approximately $6.7 million from the State of Arkansas;
- Plans and specifications are approximately 70% complete and will be submitted to the review agencies in stages to expedite the review process.
- State of Arkansas authorized use of $250,000 to begin acquisition of properties and easements;
- Easement documents are 70% complete by the attorney and abstractors; and
- Water purchase contracts are currently being signed by all member entities.

A vicinity map showing the project area can be found on the following page.

INSERT PROJECT VICINITY MAP

1.2 Purpose and Need of the Proposal

Historically, this area of North Central Arkansas has suffered from the lack of a good, safe, and plentiful water supply. This region has over thirty (30) public water systems that receive their water supply from either deep wells, shallow wells, or ground water purchased from neighboring water systems. The members of the Ozark Mountain Regional Public Water Authority (OMRPWA) currently depend on both deep and shallow wells with poor water quality drilled twenty to fifty years ago to access a groundwater supply. Many deep wells in this region have excess amounts of radium 226, radium 228, fluoride, uranium, radon, hydrogen sulfide, and other undesirable naturally occurring substances which are difficult to treat. Shallow wells are often infiltrated with surface water runoff that tends to contain contaminants that pose potential health risks. Since only 5 of the 20 members provide water treatment beyond chlorine disinfection, the quality of the water distributed to their customers is a serious issue.

State and federal water quality regulations have tightened making many of these water sources unsafe by current water quality standards. Consequently, the EPA has certified that many of these water sources in the area are unsafe for consumption and the Arkansas Department of Health has placed many of the systems under Administrative Order since the 1990's for continuing to provide unsafe water supplies. Many of these systems have been facing relentless legal issues and fines by the Arkansas Department of Health. Since 2005, the following OMRPWA member systems have been required to publish information in the local newspapers indicating that their water supply is/was unsafe for consumption:

- Mt. Sherman Water Association
- East Newton County Water Association
- Deer Community Water Association
- Lurton-Pelsor Water Association
- Town of Western Grove
- South Mountain Water Association
- SDM Water Association *(Snowball, Dongola & Marsena)*
- Morning Star Water Association
- Town of Valley Springs

The twenty (20) public water systems that make up the OMRPWA are eager to develop and implement a long term water supply, as the water quality throughout North Central Arkansas is a serious issue. The majority of the water supplies throughout North Central Arkansas contain excessive amounts of radium 226, radium 228, uranium, fluoride, radon, hydrogen sulfide, and other undesirable substances. The radium 226, radium 228, fluoride, and radon levels found in many of these water supplies consistently exceed the maximum contaminate levels (MCL) established by the federal *National Primary Drinking Water Regulations*. The maximum allowable contaminate level for radium is 5 pCi/L, and several members of the OMRPWA exceed this level. It should also be noted that most of the other systems are just below the MCL of 5 pCi/L. Likewise, the fluoride levels found in many of the water supplies throughout North Central Arkansas are excessive. Although the primary maximum contaminant level for fluoride in drinking water is 4 mg/L to protect against adverse health effects, a secondary maximum contaminant level of 2 mg/L was set to protect against cosmetic dental effects linked to excess fluoride consumption, such as discoloration, enamel loss, and pitting of the teeth. Many of the OMRPWA systems are above this secondary 2.0 mg/L concentration with three of the systems exceeding the 4.0 mg/L concentration.

Data for each water system was obtained from individual water systems and through sanitary surveys which were conducted by the Arkansas Department of Health. After carefully reviewing data from each system, it was determined that eighteen (18) of the twenty (20) members of the OMRPWA had water quality or water quantity problems, as documented by the Arkansas Department of Health.

In May of 2005, the original Preliminary Engineering Report for the OMRPWA was submitted to the appropriate agencies for review. OMRPWA's regional proposal was presented to the Arkansas Department of Health and they agreed that progress on the Regional Water Project is critical in order to achieve better water quality and avoid pending legal issues. Every year since OMRPWA's conception, this project has remained the Arkansas Department of Health's top (1^{st}) priority project due to the serious health risks associated with the drinking water. This top ranking is primarily due to the immediate health concerns associated with drinking contaminated water as well as inadequate yields of water for other member systems.

Economic Opportunities and a Better Way of Life

Due to the unsafe water supply and limited water supply available from existing wells and springs, Searcy County, Newton County, and portions of Boone and Marion Counties have never had opportunities to solicit or obtain industrial or commercial development. That is the primary reason why the Median Household Incomes in Searcy and Newton County are some of the poorest in the state, ranking 2nd and 8th lowest incomes in the State respectively. This project will give them an opportunity for a much better way of life and healthier way of life.

Benefits of Proposed Project

The social and environmental benefits of this project are rare and unique. Not only will this project provide a safe, plentiful, and dependable water supply, but it will also act as a watershed protection / rehabilitation to the Buffalo National River. Some of the benefits of the proposed project are as follows:

- Safe Water Supply and Plentiful Water Supply (free from cancer causing contaminants);
- No Damming of any Tributaries of Buffalo River or other Scenic Rivers;
- Environmental Enhancement by allowing aquifers currently used to replenish the BNR;
- Economic Growth and a Better Way of Life. It gives communities, cities, and towns an opportunity that they have never had.

2.0 ALTERNATIVES TO THE PROPOSED ACTION

There were several alternatives considered to provide safe and plentiful water for the Ozark Mountain Regional Public Water Authority. The Ozark Mountain Regional Public Water Authority will have three (3) basic options:

1. Purchase treated water from one or more wholesale water providers;
2. Construct the OMRPWA's own surface water treatment facilities; or
3. A combination of purchasing water from a wholesale provider and constructing the OMRPWA's own treatment facilities.

Several important factors must be considered in evaluating alternatives to provide a long term water source for the region. Some of these factors include:

1. Capacity of water supply;
2. Quality of water supply;
3. Location of water supply;
4. Pumping requirements;
5. Capacity of existing water treatment facilities;
6. Cost of water from wholesale providers;
7. Cost to treat and distribute water from a new water treatment facility; and
8. Capital costs required to implement the alternative.

We have evaluated twelve (12) alternatives for implementing a long term regional water supply for the Authority. The Preliminary Engineering Report further details the alternatives considered. A list of each alternative with brief description follows:

ALTERNATIVE	DESCRIPTION OF ALTERNATIVE
A	**Marion County Regional Water District (Purchase Water)** *Upgrade existing water treatment facilities, water transmission mains, and water storage capacity. Construct water transmission mains to serve OMRPWA Members (via Hwy 412 & 65).*
B	**Carroll-Boone Regional Water District (Purchase Water)** **Construct Water Treatment Facility on Bull Shoals Lake** *Construct water treatment facilities on Bull Shoals Reservoir and connect to the Carroll - Boone Water District to purchase a supplemental supply. Construct water transmission mains to serve OMRPWA Members.*
C	**Construct Water Treatment Facility on Bull Shoals Lake** *Construct water treatment facilities on Bull Shoals Reservoir and construct water transmission mains to serve OMRPWA Members.*
D	**Construct Water Treatment Facility on Greers Ferry Lake** **Construct Water Treatment Facility on Bull Shoals Lake** *Construct water treatment facilities on Greers Ferry Lake to serve Searcy County and construct a water treatment facility on Bull Shoals Reservoir to serve Newton and Boone Counties. Construct water transmission mains to serve OMRPWA Members.*

ALTERNATIVE	DESCRIPTION OF ALTERNATIVE
E	**Clinton Water System (Purchase Water)** **Carroll-Boone Regional Water District (Purchase Water)** *Connect to the Clinton Water System and provide treated water to Searcy County via a water transmission main. Connect to Carroll - Boone Water District and provide treated water to Newton and Boone County via a water transmission mains.*
F	**Construct Water Treatment Facility on Norfork Lake** *Construct water treatment facilities on Norfork and construct water transmission mains to serve OMRPWA Members.*
G	**Marion County Regional Water District (Purchase Water)** *Upgrade existing water treatment facilities, water transmission mains, and water storage capacity. Construct water transmission mains to serve OMRPWA Members (via Highway 14 to Searcy County and via Highway 412 & 65 to Newton County).*
H	**City of Clarksville (Purchase Water)** *Connect to the Clarksville Water System and provide treated water to OMRPWA members via water transmission mains.*
I	**City of Russellville (Purchase Water)** *Connect to the Russellville Water System and provide treated water to OMRPWA members via water transmission mains.*
J	**Marion County Regional Water District (Purchase Water)** **Carroll-Boone Regional Water District (Purchase Water)** *Increase the capacity of the water treatment facilities from 2 to 6 mgd and perform water transmission mains upgrades to the Marion County District. Also, connect to the Carroll - Boone Water District for a supplemental water supply. Construct water transmission mains to serve OMRPWA Members.*
K	**City of Clarksville (Purchase Water)** **Construct Water Treatment Facility on Bull Shoals Lake** *Connect to the Clarksville Water System and provide treated water to OMRPWA members via south of the Buffalo National River. Also, construct water treatment facilities on Bull Shoals Reservoir and serve OMRPWA members north of the Buffalo National River.*
L	**City of Russellville (Purchase Water)** **Construct Water Treatment Facility on Bull Shoals Lake** *Connect to the Russellville Water System and provide treated water to OMRPWA members via south of the Buffalo National River. Also, construct water treatment facilities on Bull Shoals Reservoir and serve OMRPWA members north of the Buffalo National River.*

Surface Water Sources Considered

Each of the alternatives described in the previous section was analyzed for water quality, water quantity and capacity, reliability, and environmental impact. The final step in the selection process is to compare the economic impact of constructing the water system for the Ozark Regional Public Water Authority. These include the capital costs and the total life cycle costs associated with each alternative. Capital costs and operation and maintenance costs are broken down for each alternative in the previous section of this report. A 20 year and 30 year life cycle costs which takes into consideration the probable loan conditions, projected usage, construction costs, operation and maintenance expenses, and the cost to purchase water (where appropriate).

A chart summarizing the economic analysis of the six (6) most practical alternatives is found on the next page followed by a breakdown of each 20 and 30 year life cycle cost analysis.

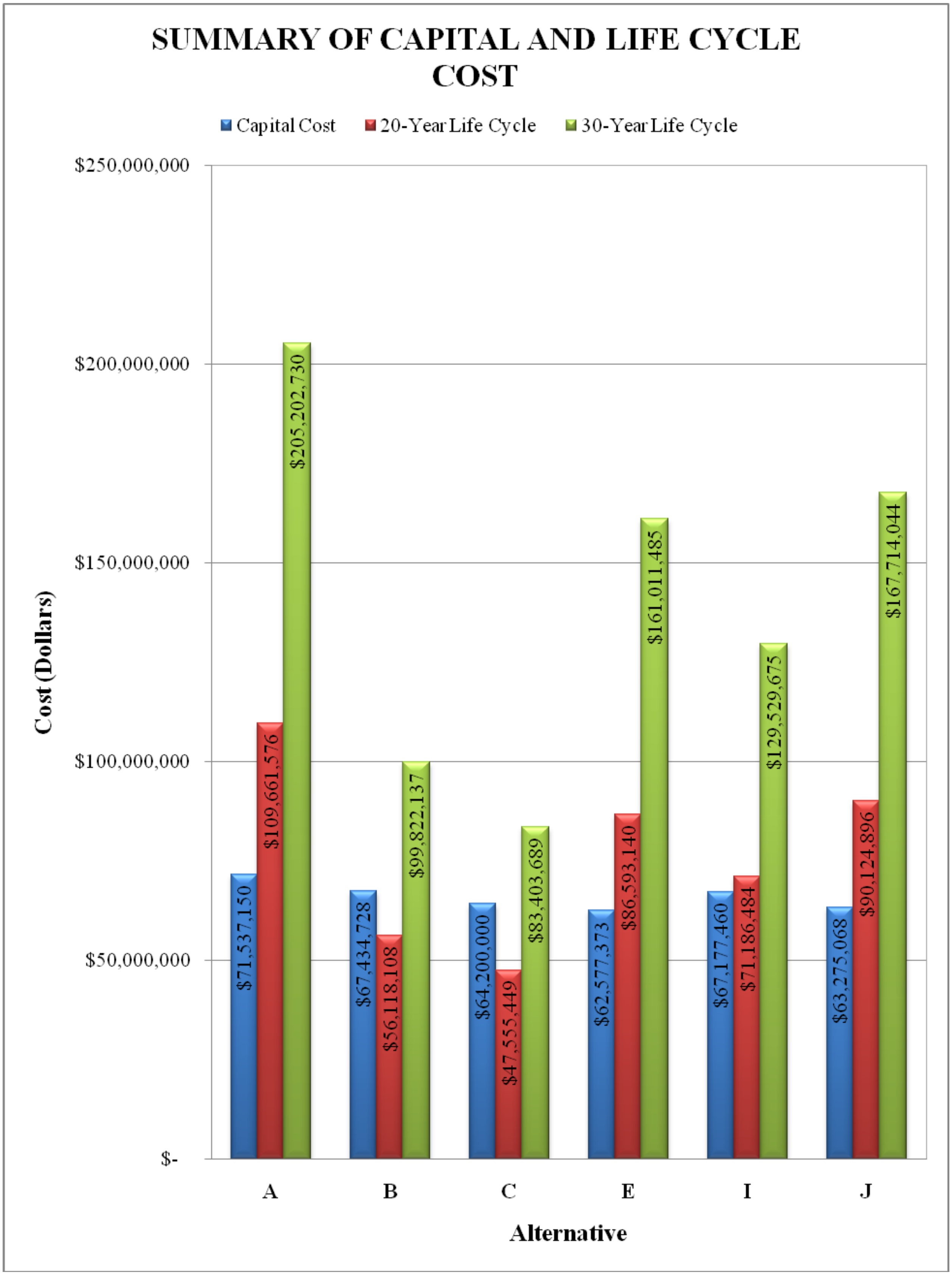
Alternative Selected

After careful review of the economic analysis for all alternatives, it is evident that production of the treated water has a tremendous long term advantage over purchasing treated water from an existing bulk wholesaler. Therefore, in order for the OMRPWA to keep long term rates to a minimum, it is in the best interest for the Authority to construct a water treatment facility and produce drinking water for its member entities. This long term savings is most evident when evaluating the four (4) alternatives with the lowest capital cost and comparing them with the 20 year and 30 year life cycle costs, as shown below:

		Life Cycle Costs	
Alternative	Capital Cost	20 Yr	30 Yr
"E" (Buy from Clinton/Carroll-Boone)	$62,577,373	$ 86,593,140	$161,011,485
"J" (Buy from MCRWD / Carroll-Boone)	$63,275,068	$ 90,124,896	$167,714,044
"C" (Construct Bull Shoals WTP)	$64,200,000	$ 47,555,449	$ 83,403,689
"I" (Purchase from City of Russellville)	$67,177,460	$ 71,186,484	$129,529,675

Based our evaluation of the 12 alternatives, Alternate "C" (Construct WTP on Bull Shoals) is the most cost effective for the OMRPWA. It is our recommendation that the Authority proceed with constructing an intake structure and water treatment facility on Bull Shoals Lake near Lead Hill. The treated water would then be delivered via water transmission mains, booster stations, and water storage tanks to all members of the OMRPWA.

Again, the engineering design information is discussed more in-depth in the Preliminary Engineering Report.


SUMMARY OF CAPITAL AND LIFE CYCLE COST
Capital Cost
20-Year Life Cycle
30-Year Life Cycle
Cost (Dollars)
$250,000,000
$200,000,000
$150,000,000
$100,000,000
$50,000,000
$-
$71,537,150
$109,661,576
$205,202,730
$67,434,728
$56,118,108
$99,822,137
$64,200,000
$47,555,449
$83,403,689
$62,577,373
$86,593,140
$161,011,485
$67,177,460
$71,186,484
$129,529,675
$63,275,068
$90,124,896
$167,714,044
A
B
C
E
I
J
Alternative

Conclusions and Recommendations

1. The twenty (20) water systems that make up the Ozark Mountain Regional Public Water Authority are in dire need of a safe, dependable, and plentiful water supply. This region receives their water supply from either deep wells, shallow wells, or purchases ground water from neighboring water systems. Deep wells in this region have excessive levels of one or more contaminants. These contaminants include radium 226, radium 228, uranium, radon, fluoride, hydrogen sulfide, and other undesirable substances.

2. Several of these systems are under Administrative Order by the Arkansas Department of Health for continuing to use unsafe water supplies. Over half of these systems are required to frequently publish information in local newspapers indicating their water supply is unsafe for consumption.

3. Since most of the water systems in this region have similar problems, it makes sense these water systems to work together to formulate a long term water source plan that will best serve the region. Each system evaluating long term water sources individually is expensive and not very cost effective.

4. The Median Household Income (MHI) for this region is extremely low. The MHI in Newton County is $24,756 per year, and the MHI in Searcy County is $21,397 per year. Based on the latest MHI data, the only county in the State of Arkansas with a lower MHI than Searcy County is Lee County. Unfortunately, the overall MHI for State of Arkansas ranks 48 among the 50 states. The U.S. average MHI is $43,527 per year compared to the Arkansas Average of $31,845 per year.

5. Of the twelve (12) alternatives studied, we recommend that the Ozark Mountain Regional Public Water Authority construct a new regional water system to serve the 20 member entities throughout North Central Arkansas. The construction would consist of a new intake structure on Bull Shoals Reservoir, a water treatment facility located west of Diamond City, ductile iron water transmission mains to each entity, water storage tanks, along with master meters, valves, etc.

6. In order for the Ozark Mountain Regional Public Water Authority to keep long term water costs to a minimum, it is recommended that the Authority maintain control over the wholesale water cost by constructing a water treatment facility and producing the potable water required. Alternate "C" is the most cost effective long term water source and energy efficient alternative. The total cost of this alternative is $64,200,000.

7. The project as proposed is intended to be an area wide solution to the serious water quality and quantity problems these water systems are experiencing. This project will alleviate the problem for those water systems unable to meet the new water quality standards. Also, a significant cost savings will be realized by those systems since

they will not have to finance improvements to their existing treatment systems and since the existing treatment systems can be discontinued.

8. Based on projected water sales, the project can justify a loan of approximately $19,410,000. The balance of the funds needed could be obtained in grants from various agencies.

9. It is recommended that the Ozark Mountain Regional Public Water Authority seek financing as outlined in this report to construct the facilities to implement a long term water supply for North Central Arkansas.

10. It is critical that funding for this project be pursued and secured as quickly as possible or many of the OMRPWA members may receive enforcement action from the EPA and Arkansas Department of Health.

3.0 AFFECTED ENVIRONMENT/ENVIRONMENTAL CONSEQUENCES

This section of the Environmental Report focuses on responses received from government agencies regarding the project. This section describes the areas under construction, the environmental resources affected, and the mitigation required if necessary. The correspondence letters summarized below can be found in Exhibit C.

3.1 Land Use/Important Farmland/Formally Classified Lands

3.1.1 Affected Environment – The project consists of constructing a water transmission system to serve existing and proposed customers within the counties. A water treatment facility, a booster pumping stations and water storage tanks will be constructed to provide adequate pressure to the proposed member entities. This project will extend from the Bull Shoals Lake paralleling United States Highway 65, United States Highway 62/412, Arkansas Highway 14, Arkansas Highway 123, Arkansas Highway 16, Arkansas Highway 7, Arkansas Highway 333, Arkansas Highway 27, and Arkansas Highway 74. Other roads that are paralleled are Lead Hill Zinc Road, Meeks Creek Road, Manor Road, County Road 24 and County Road 333. Please refer to Exhibit A for a preliminary layout map of the project.

- ADEQ determined perennial streams would be crossed that include the Buffalo River, Crooked Creek, West Sugarloaf Creek, and Bear Creek. The Buffalo River would be crossed in two locations, by attaching the water main to the existing bridges. The other streams would be trench crossings.
- NRCS determined that farmland would be crossed by the transmission lines or the water facilities.
- AGC determined that the geology of the region produces karst terrain that has such features as saves, sinkholes, and springs that can be encountered during construction projects.
- AGFC determined that streams will be crossed and possible karst terrain might be encountered.
- AFC determined that forest resources will be crossed
- ADPT determined that several park lands have been developed in the project region.
- NPS determined that the water lines will cross the Buffalo National River.

3.1.2 Environmental Consequences –Best Management Practices will be implemented during construction of this project, as recommended by several agencies. Specifically, the BMP describes the procedure to be followed if a cave is encountered. If a cave is found within 300 feet of the project area, work will cease in that area and U.S. Fish and Wildlife will be notified immediately.

- ADEQ determined the project will not physically alter a significant segment of the streams and will not violate the water quality criteria. They recommended Best Management Practices shall be utilized to prevent sedimentation and turbidity. The contractor shall perform all work in low flow conditions if possible and shall provide the ADEQ a stream crossing schedule.

- NRCS determined there would be no adverse impact on formal farmland, as all lines and water facilities appear to be the best and least intrusive route and/or sites. There will be no conversion of any prime or important farmlands as a result of this project.
- AGFC recommended BMPs be used for erosion control and that stream crossings be performed in June, July, and August to avoid spawning periods.
- AFC determined that there will be no long term adverse impacts on the forest resources of the area as provisions are in place to reduce and offset any temporary environmental impacts.
- ADPT requested that any disturbed park property must be restored to its original condition upon construction completion.
- NPS recommended approval of the project and has submitted a Determination of Effect that is included in the Exhibit C.

<u>Mitigation</u> – No mitigation will be needed on this resource, as no prime or important farmland is present. However, Best Management Practices will be implemented for specific land uses during construction of this project, as recommended by several agencies. Best Management Practices are outlined in Exhibit G of this report.

3.2 Floodplains

3.2.1 <u>Affected Environment</u> – The project contains some flood plain areas where the water mains cross creeks and streams. The primary streams crossed with this project are Crooked Creek, West Sugarloaf Creek, Bear Creek, Little Buffalo River, and the Buffalo River. The Buffalo River and the Little Buffalo River will be crossed by attaching water mains to the bridge structures. The FEMA Flood Plain Maps for this area of Newton, Searcy, Boone and Marion Counties are shown in Exhibit B.

3.2.2 <u>Environmental Consequences</u> – The creek crossings will be constructed during low or no flow, and preferably during the months of July, August or September. The Best Management Practice plan will be implemented throughout this project, with special considerations made to the creek crossings. Section 404 permits from the U.S. Army Corps of Engineers will be required for each creek crossing. A copy of this permit is included in Exhibit C.

3.2.3 <u>Mitigation</u> – All water main crossings of the flood plain will be restored to the original shape and contours to reduce any environmental impacts.

3.3 Wetlands

3.3.1 Affected Environment – The project crosses Crooked Creek, West Sugarloaf Creek, Bear Creek, Little Buffalo River, and the Buffalo River. There are no hydric soils or wetlands within the project area. The reply letters from the Arkansas Game and Fish Commission and the U. S. Army Corps of Engineers are contained in Exhibit C.

3.3.2 Environmental Consequences – There are no known adverse environmental consequences for wetlands due to these improvements. If any wetland areas are found to be present, they will be avoided.

3.3.3 Mitigation – Under Section 404 of the Clean Water Act, a permit is required from the U.S. Army Corps of Engineers for any construction activity that affects or crosses "waters of the United States". A copy of the permit is included in Exhibit C.

3.4 Historical Properties

3.4.1 Affected Environment – The State Historic Preservation Officer (SHPO) has been contacted regarding this project. The report by Weaver & Associates is contained in Exhibit C, which indicates 20 of the 47 known archeological sites are outside the Area of Potential Effect. The reply letter is also contained in Exhibit C indicates 16 known historic sites that are located in close proximity to the proposed project area.

3.4.2 Environmental Consequences – There are no known adverse environmental consequences for cultural resources due to these improvements. However, a professional archeologist will monitor site 3SE265 during construction, which is a 19th century gravesite. A qualified archeologist will be retained to monitor all earthmoving activities at this site during the construction of the waterline. If the gravesite is encountered, all work will be stopped in the area and the grave will be removed and reinterred in accordance with state law. Construction in some locations will be limited to within existing right-of-way corridors.

3.4.3 Mitigation – As requested by SHPO, a cultural resources survey of portions of the project where slope gradients are less than or equal to 12% was conducted to determine the presence of additional unrecorded sites. The results of this survey are included in Exhibit C.

Mitigation will be established, if necessary, to avoid impacting significant historical sites, should any be encountered. If cultural materials are encountered during construction, work will cease in the immediate area. Notification will be made to the State Historical Preservation Officer and the Rural Development State Environmental Coordinator. Work in the area of the finding will not commence until authorization by the above agencies.

3.5 Biological Resources

3.5.1 Affected Environment – There are no known impacts of the project to the biological resources in this project area.

3.5.2 Environmental Consequences – It is anticipated that the project will not have a significant impact on threatened or endangered species or their habitat. However, several endangered and threatened species are known to be present in Project Counties. The endangered species are: Gray Bat (*Myotis grisescens*), Indiana Bat (*Myotis sodalis*), Ozark Big-eared Bat (*Corynorhimus townsendii ingens*), Pink Mucket (*Lampsilis abrupta*), and Scaleshell (*Leptodea leptodon*). The American Bald Eagle (*Haliaeetus leucocephalus*) is a threatened species found in the Project Counties. The project should not adversely affect these species, since the Contractor will utilize a Best Management Practice plan and follow suggestions by the U.S. Fish and Wildlife Service. Specifically, the BMP describes that if a cave is found within 300 feet of the project area, work will cease in that area and U.S. Fish and Wildlife will be notified immediately. The BMPs are outlined in Exhibit G of this report.

The Department of Arkansas Heritage expressed concern for the following sites:

Type of Elements	T/R/S	Comments
Plant	T15N/R16W/S18	East bank of ditch on Hwy 65
Animals	T15N/R19W/S06	Buffalo National River
Animals	T16N/R19W/S36	Buffalo National River
Animal	T16N/R19W/S04	Spring at Yardelle
Animal	T16N/R21W/S26	Little Buffalo River
Plant & Animal	T15N/R16W/S20	Bluffs along east side of Hwy. 65
Animal	T15N/R16W/S28	Bluffs along east side of Hwy. 65
Plant	T15N/R21W/S02	Roadside, Hwy. 7 (West side)
Plant	T15N/R21W/S11	Roadside, Hwy. 7 (West side)
Plant	T20N/R18W/S05	Roadside
Plants in glade community	T20N/R18W/S09	0.2 miles east of jct. Hwy. 14 & Hwy 7 (North side of Hwy. 14)
Plant	T20N/R18W/S28	Roadside, Lead Hill-zinc Road (West side)
Plants in glade community	T21N/R18/S20	Jct. 7 & Sunset Drive, Jct. Cedar & Short Street
Plants in glade community	T21N/R18W/S29	East side of Hwy. 7
Plants in glade community	T21N/R19W/S26	North side of road

Also, the Arkansas Natural Heritage Commission has the following special conditions regarding glade species within the proposed project area:

"Glades often support rare plant species, including the federally threatened plant, Missouri Bladderpod (Lesquerella filiformis). Where possible efforts should be made to avoid and limit impact to glade habitat. Work should be kept as narrow as possible, and glades should not be used to stage materials or park equipment."

The process of addressing glades is presented in the Best Management Practices attached in Exhibit G.

3.5.3 <u>Mitigation</u> – Proper mitigating measures will be taken during construction as recommended by the U.S. Fish and Wildlife Service and the Arkansas Natural Heritage Commission. Provisions will be taken regarding common construction procedures and restoration of the project areas. The contractor will restore all disturbed areas to existing conditions, and measures will be taken to avoid soil erosion, degradation, and siltation into adjacent waters. Wherever necessary, the disturbed area will be terraced to prevent soil erosion and runoff. Slopes will be restored to original grades and will be stabilized by over-seeding, matting, and diversion of runoff to deter erosion.

If a cave, sinkhole, losing stream, or spring is found within the project area, a buffer zone of 300 feet will be established around the feature and the Service will be contacted. This project will utilize the Best Management Practice plan (BMP) as recommended by the above agency. Copies of the reply letters from the U.S. Army Corps of Engineers, Arkansas Natural Heritage Commission, Arkansas Game and Fish Commission, Arkansas Natural Resources Commission, and the U.S. Fish and Wildlife Service are shown in Exhibit C.

3.6 Water Quality Issues

3.6.1 <u>Affected Environment</u> – Construction of the proposed improvements and extensions will not result in any discharge into streams that will affect water quality in the area. Construction measures will be taken to avoid soil erosion, degradation, and siltation into adjacent waters to prevent adverse impact to water quality in creeks. A letter from the Arkansas Department of Environmental Quality (ADEQ) is included in Exhibit C. In accordance with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, a permit is required from the U.S. Army Corps of Engineers for construction of the intake structure and for all stream crossings. A copy of the permit from the Corps is included in Exhibit C of this report.

3.6.2 Environmental Consequences – Construction of the proposed project will not have a significant impact to water quality in the area with regards to groundwater, creeks, and streams. The Owner will be required to submit a Storm Water Pollution Prevention Plan to ADEQ for approval before construction begins.

3.6.3 Mitigation – According to the letter from ADEQ, it will be necessary to implement Best Management Practices to reduce turbidity impacts to streams. A Storm Water Pollution Prevention Plan will be submitted to AEDQ and a construction permit will be obtained. The Authority has already received a Section 10 and Section 404 permit from the U.S. Army Corps of Engineers which is included in Exhibit C of this report.

3.7 Coastal Resources

3.7.1 Affected Environment – The project is not located in a coastal area.

3.7.2 Environmental Consequences – There are no environmental consequences for the project concerning coastal resources.

3.7.3 Mitigation – There are no mitigation measures for the proposed project regarding coastal resources.

3.8 Socio-Economic / Environmental Justice Issues

3.8.1 Affected Environment – The Cities and Counties will benefit from the proposed improvements by having a clean and safe drinking water supply. These improvements will allow economic development to occur in an area where economic development has been stagnant.

3.8.2 Environmental Consequences – The proposed project will not result in any adverse environmental effects to minorities or low-income population. There is no known civil rights impact due to this project.

3.8.3 Mitigation – There are no mitigation measures for the proposed project regarding environmental justice issues.

3.9 Miscellaneous Issues

3.9.1 Transportation

3.9.1.1 Affected Environment – The major transportation routes within the project area are provided by United States Highway 62/412 and Highway 65, and Arkansas State Highways 14, 123, 16, 7, 333, 27, and 74. Other county roads also provide transportation into the area. In areas where the lines cross U.S. or State Highways, permits will be obtained from the Arkansas Highway and Transportation Department (AHDT). Standard requirements of the AHTD will be met.

3.9.1.2 Environmental Consequences – No changes or modifications of traffic patterns will arise as a result of the improvements made. No existing capacities of the transportation facilities in the area will be exceeded as a result of this project.

3.9.1.3 Mitigation – There are no mitigation measures for the proposed project regarding transportation in the area.

3.9.2 Air Quality

3.9.2.1 Affected Environment – The Project counties are unclassified in the National Ambient Air Quality Standards for all six criteria air pollutants and therefore general conformity does not apply.

3.9.2.2 Environmental Consequences – The only air emissions with this project will be from the machinery used during the actual construction of this project and dust produced during construction activities. The quantity of such emissions and dust will be minimal and will not significantly impact air quality in the project area.

3.9.2.3 Mitigation – There are no mitigation measures for the proposed project regarding air quality issues.

3.9.3 Solid Waste Management

3.9.3.1 Affected Environment – There will be no additional solid waste continuously generated by this project.

3.9.3.2 Environmental Consequences – There are no known environmental consequences for solid waste disposal.

3.9.3.3 Mitigation – There are no mitigating measures proposed for the project regarding solid waste issues.

3.9.4 Noise

3.9.4.1 Affected Environment – The proposed project will not create any additional noise, with the exception of the noise created during construction. This noise will be temporary and confined to limited areas.

3.9.4.2 Environmental Consequences – There are no known environmental consequences for noise.

3.9.4.3 Mitigation – There are no mitigating measures proposed for the project regarding noise.

4.0 Summary of Mitigation

Some mitigating measures are necessary for this project regarding environmental resources in the area. A full-time resident inspector will be at the construction site to ensure construction plans and the Contractor will follow mitigating measures. The OMRPWA will also be actively involved with construction of this project. The engineer to ensure that adverse environmental impacts associated with this project do not occur will provide periodic inspections. The following is a summary of the mitigation measures required for this project:

Environmental Mitigation Summary		
SECTION	**ENVIRONMENTAL RESOURCE**	**MITIGATION MEASURES REPORTED**
3.1	Land Use	None
3.2	Flood Plains	Flood plain will be restored to the original shape and contours.
3.3	Wetlands	Avoid wetland areas.
3.4	Cultural Resources	A cultural resources survey was obtained. If cultural materials are encountered during construction, work will cease in the immediate area. Notification will be made to the State Historical Preservation Officer. Site 3SE265 will be monitored by a professional archeologist.
3.5	Biological Resources	Stop work if cave is found within 300 ft. of project area. Notify U.S. Fish and Wildlife Services immediately. Utilize BMP's as required. An alternative route may be utilized to avoid caves.
3.6	Water Quality	Implement BMP's as required. Owner shall submit a Storm Water Pollution Prevention Plan to ADEQ. A Section 10 and 404 permit from the U.S. Army Corps of Engineers has been obtained and is included in this report.
3.7	Coastal Resources	None
3.8	Socio-Economic/Environmental Justice	None
3.9	Miscellaneous Items	None

5.0 Correspondence

Various federal and state agencies were contacted to review and comment on potential environmental impacts that the proposed project may have on resources in the area. The list below indicates the agency contacted and additional measures required.

AGENCY	ADDITIONAL MEASURES REQUIRED
USDA Natural Resources Conservation Service	None
U.S. Army Corp of Engineers	See 6.0 Exhibit C
Arkansas Historical Preservation Program	See 6.0 Exhibit C
Arkansas Natural Resources Commission	See 6.0 Exhibit C
U.S. Forest Service	None
U.S. Fish and Wildlife Service	See 6.0 Exhibit C
Federal Emergency Management Agency	None
Arkansas Department of Health	None
Northwest Arkansas Planning and Development District	None
State Clearinghouse	None
Arkansas Department of Environmental Quality	See 6.0 Exhibit C
Arkansas Geological Commission	None
Arkansas Game and Fish Commission	See 6.0 Exhibit C
Arkansas Highway and Transportation Department	See 6.0 Exhibit C
Arkansas Department of Parks and Tourism	None

All correspondence has been included in Exhibit C.

6.0 Exhibits

The exhibits included in this section are as follows:

A. Preliminary Layout Map
B. Topographic Maps, County Road Maps, Soil Survey Maps, FEMA Flood Plain Maps
C. Comment Letter from State and Federal Agencies
D. Letters of Support
E. Civil Rights Impact Analysis
F. Demographic Characteristics of Newton, Searcy, Boone, and Marion County
G. Best Management Practices

7.0 List of Preparers

The list below indicates the companies and people involved in preparing this document:

Engineering Services, Inc.

Tim Mays
Jason Appel
Chris Waller
Michael Wier
Gary King
Jim Harrelson
Frantz Battenfield
Lisa Deaton
Jim Vetters
Vickie Wright

Weaver & Associates, LLC

Zachary P Konkol
Troy O. Martin
Bryan A. Stetzer
Louella W Weaver

EXHIBIT G

BEST MANAGEMENT PRACTICES

ENVIRONMENTAL REPORT
AMENDMENT NO. 1

FOR

OZARK MOUNTAIN REGIONAL PUBLIC WATER AUTHORITY

TO SERVE

NORTH CENTRAL ARKANSAS

AUGUST 2009

<u>Prepared In Accordance With:</u>
RUS Bulletin 1794A-602
March 2008
Version 1.2

TABLE OF CONTENTS

INTRODUCTION TO AMENDMENT NO. 1

This Amendment to the Environmental Report (originally dated January 2008 and revised June 2009) is presented to provide clarification or to revise items from the aforementioned report in response to comments provided to this office by USDA Rural Development on July 17, 2009.

Below are the six (6) comments from the USDA Rural Development in italics with responses in normal text. The following changes or additions have been made:

1. **Comment:** *The Sections on pp. 1-2 through 1-4, starting with the paragraph entitled "25 Years of Effort" should be deleted.*
   Response: A revised Section 1.1 has been included in this Amendment with the referenced section removed.

2. **Comment:** *The Conclusions and Recommendations under Section 2.0 re-state elements and of the purpose and need, are irrelevant to the environmental and alternatives analysis, or are inappropriate. The entire section should be deleted. The last full paragraph on page 2-3 is sufficient to summarize the alternatives analysis.*
   Response: A revised Section 2.0 has been included in this Amendment with the referenced section removed. A revised financial analysis is also included.

3. **Comment:** *On page 3-1, it is stated that the Arkansas Forestry Commission determined that the Ozark National Forest will be crossed. The AFC letter in Exhibit C, Section M, says nothing about this and in any case the AFC would not have jurisdiction over USFS land. Correspondence from the USFS from the Ozark, NF, Big Piney Ranger District refers to permit issuance pending environmental review. Please clarify when the Ozark NF would issue the permit and whether its issuance is dependent on the adequacy of our environmental assessment.*
   Response: A revised Section 3.1 has been included and removes National Forest comment attributed to the Arkansas Forestry Commission. Mitigation required by the U.S. Forest Service includes preparation of a biological (including botanical) study of the project. The U.S. Forest Service provides this study. However, due to a project backlog, the Ozark Regional Public Water Authority retained a private company to perform the field study which is attached as Exhibit BB. The U.S. Forest Service then prepared their Biological Evaluation which is attached as Exhibit CC. After concurrence from the U.S. Fish and Wildlife Service, the U.S. Forest Service will complete a separate analysis based on these reports plus the Environmental Report which includes a public comment period. They estimate that this could be completed in 90 to 120 days. Once this analysis is completed, a permit can be issued. Also, no herbicides will be used on Forest Service land. A mist net survey is required for Indiana Bats before any timber is cut down unless construction activities are implemented between December 1st and March 15th. Section 3.5.3 has been revised to include these mitigations. A copy of the letter from the U.S. Forest Service (dated August 19, 2009) is included in the Amended Exhibit C. A revised Section 4.0, Summary of Mitigation, is also included in this Amendment.

4. **Comment:** *It does not appear that consultation under NHPA S. 106 has been concluded. RUS has not made a finding to the SHPO, and no tribes were consulted.*
Response: An additional mitigation to be added to Section 3.4.3 has been included in this Amendment. Responses from the Quapaw Tribe and the Osage Nation are included in the amended Exhibit C. A revised Section 4.0, Summary of Mitigation, is also included in this Amendment.

5. **Comment:** *Section 3.6.3 states that "The system (OMRPWA) will obtain a water allocation report from the Corps of Engineers and a water allocation agreement prior to beginning construction." This statement needs more detail and supporting information. What is the time frame for completion of the report and issuance of the agreement?*
Response: The Authority is working to secure water allocation from Bull Shoals Reservoir for the purpose of providing drinking water to member entities on or before August 2010. The U.S. Army Corps of Engineers has provided a letter showing a timeline that includes approving the "Water Storage Agreement" by August 2, 2010. The mitigation section of Water Quality Issues (Section 3.6.3) has been amended.

6. **Comment:** *Concurrence from the U.S. Fish and Wildlife Service on threatened and endangered species is 3 years old and needs to be verified/updated.*
Response: U.S. Fish and Wildlife verifies in a letter dated July 21, 2009 that they have no additional concerns to add to their previous comments already included in the Environmental Report. A copy of that letter is attached to this Amendment. However, they have requested adaptation of new Best Management Practices (BMP's) being developed by the Service for the Natural Gas Pipeline and Maintenance Activities in the Fayetteville Shale Area. This is added as a mitigation to Section 3.5.3 and a revised Section 4.0, Summary of Mitigation.

ADDITIONAL REVISIONS/ADDITIONS TO ORIGINAL ENVIRONMENTAL REPORT

1. The environmental assessment was advertised three times in the Harrison Daily Times (July 7-9, 2009). The only response was from Michael and Elba Cotignola (in a letter dated July 15, 2009). Both their letter and a response from Engineering Services, Inc. (dated July 28, 2009) are included in Exhibit AA.

2. The Preliminary Engineering Report has been amended (August 2009) reducing the capacity of the water treatment plant from 6 million gallons per day to 4.5 million gallons per day. All references in the Environmental Report should be considered revised to match.

1.0 PURPOSE AND NEED OF THE PROPOSAL

DELETE SECTION 1.1 AND REPLACE WITH THE FOLLOWING REVISED SECTION:

1.1 Project Description (Proposed Action)

The Ozark Mountain Regional Public Water Authority (OMRPWA) was formed in 2004 to assist small cities, communities, and rural water systems in North Central Arkansas secure a safe and dependable long term water supply for over 21,500 persons. OMRPWA has been working extremely hard since April of 2004 in trying to obtain and develop a long term regional water supply for Newton County, Searcy County, and portions of Boone, Marion, Johnson, and Pope Counties. A collaborative effort on behalf of the member water systems to formulate a long-term water source plan that will best serve the region made sense since a number of member water systems share common water quality and quantity problems, and the fact that the individual evaluation of water sources for each public water system would be prohibitively expensive. The public water systems that are currently members of the OMRPWA are listed below:

NEWTON COUNTY
- City of Jasper
- Mt. Sherman Water Association
- Nail-Swain Water Association
- East Newton County Water Association
- Mockingbird Hill Water Association
- Deer Community Water Association
- Lurton-Pelsor Water Association
- Town of Western Grove
- Parthenon Water Association

SEARCY COUNTY
- SP&G Water Association
  (St. Joe, Pindall & Gilbert)
- City of Marshall
- South Mountain Water Association
- SDM Water Association
  (Snowball, Dongola & Marsena)
- Town of Leslie
- Morning Star Water Association

BOONE COUNTY
- Town of Valley Springs
- Town of Diamond City
- Town of Lead Hill
- Lake Bull Shoals Estates

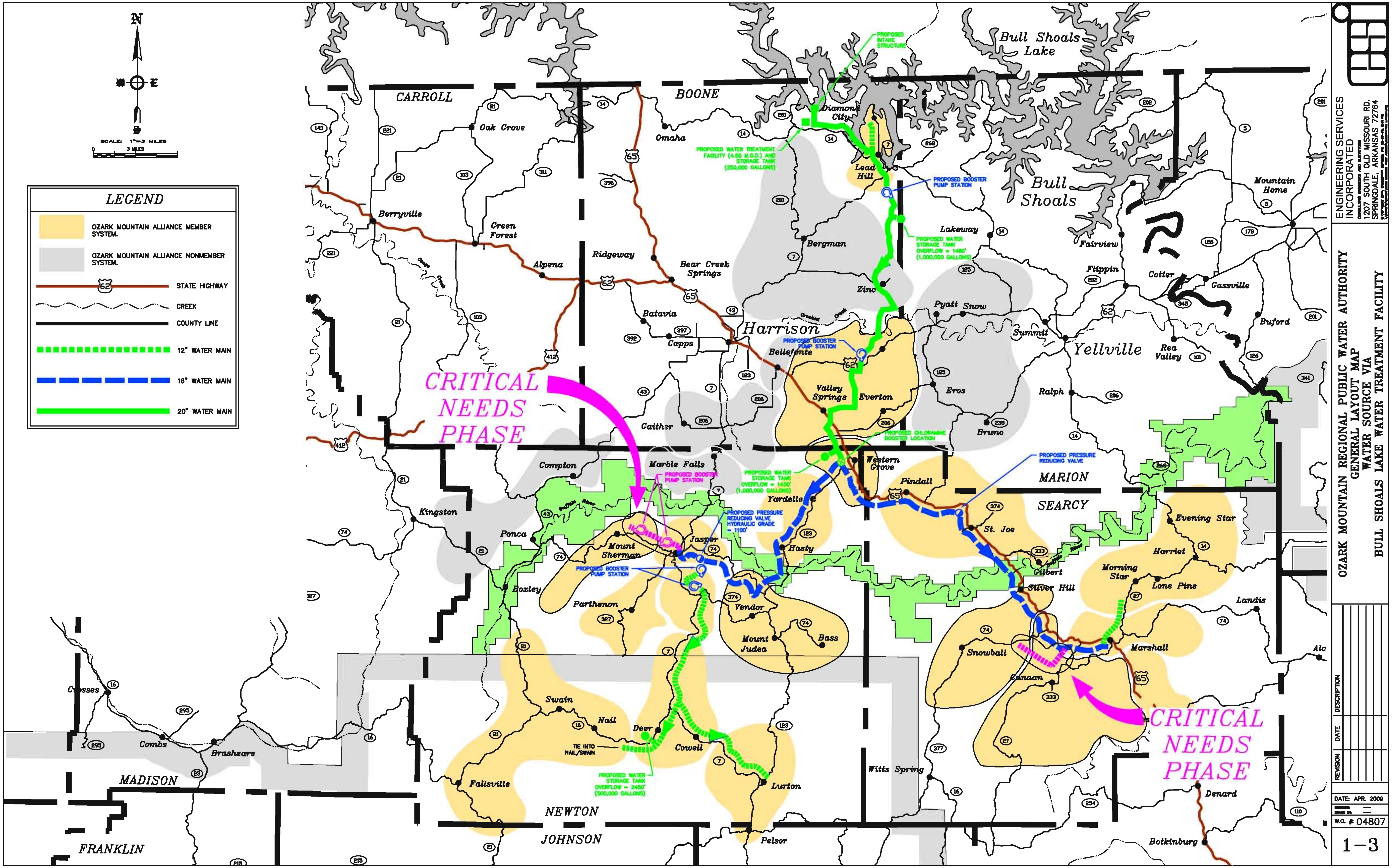
MEMBERS AT LARGE
- Buffalo River (National Park Service)

Engineering Services, Inc. (ESI) was contracted by OMRPWA to conduct a detailed feasibility study and make recommendations on a long-term water source for the region. After an intensive evaluation of water sources and transmission alternatives, construction of a new regional water system to serve the 20 member entities was recommended. The system will need to provide approximately 4.5 million gallons per day to the region in order to meet current water consumption as well as expected future growth. The current project includes leaving the Buffalo River drainage basin and constructing the following:

- Construct a water intake structure on Bull Shoals Lake;
- Construct a 4.5 million gallon per day water treatment facility to be located near Diamond City, Arkansas;
- Install ductile iron transmission lines connecting the intake structure and treatment facility to the OMRPWA member systems;
- Construct water storage tanks, which will supply water by gravity flow to each bulk customer; and
- Construct booster pumping stations and install pressure reducing valves in order to serve the mountainous regions.

A vicinity map showing the project area can be found on the following page.

Remaining text from Section 1.1 from original Environmental Report deleted.



LEGEND
OZARK MOUNTAIN ALLIANCE MEMBER SYSTEM.
OZARK MOUNTAIN ALLIANCE NONMEMBER SYSTEM.
STATE HIGHWAY
CREEK
COUNTY LINE
12" WATER MAIN
16" WATER MAIN
20" WATER MAIN
SCALE: 1"=3 MILES
CRITICAL NEEDS PHASE
CRITICAL NEEDS PHASE
Bull Shoals Lake
Bull Shoals
CARROLL
BOONE
MARION
SEARCY
NEWTON
MADISON
JOHNSON
FRANKLIN
Harrison
Yellville
PROPOSED INTAKE STRUCTURE
PROPOSED WATER TREATMENT FACILITY (4.50 M.G.D.) AND STORAGE TANK (250,000 GALLONS)
PROPOSED BOOSTER PUMP STATION
PROPOSED WATER STORAGE TANK OVERFLOW = 1480' (1,000,000 GALLONS)
PROPOSED CHLORAMINE BOOSTER LOCATION
PROPOSED WATER STORAGE TANK OVERFLOW = 1430' (1,000,000 GALLONS)
PROPOSED PRESSURE REDUCING VALVE HYDRAULIC GRADE = 1100'
PROPOSED PRESSURE REDUCING VALVE
PROPOSED WATER STORAGE TANK OVERFLOW = 2450' (500,000 GALLONS)
TIE INTO NAIL/SWAIN
ENGINEERING SERVICES INCORPORATED
1207 SOUTH OLD MISSOURI RD. SPRINGDALE, ARKANSAS 72764
OZARK MOUNTAIN REGIONAL PUBLIC WATER AUTHORITY
GENERAL LAYOUT MAP
WATER SOURCE VIA
BULL SHOALS LAKE WATER TREATMENT FACILITY
REVISION
DATE
DESCRIPTION
DATE: APR. 2009
W.O. # 04807
1-3

DELETE SECTION 2.0 AND REPLACE WITH FOLLOWING REVISED SECTION:

2.0 ALTERNATIVES TO THE PROPOSED ACTION

There were several alternatives considered to provide safe and plentiful water for the Ozark Mountain Regional Public Water Authority. The Ozark Mountain Regional Public Water Authority will have three (3) basic options:

1. Purchase treated water from one or more wholesale water providers;
2. Construct the OMRPWA's own surface water treatment facilities; or
3. A combination of purchasing water from a wholesale provider and constructing the OMRPWA's own treatment facilities.

Several important factors must be considered in evaluating alternatives to provide a long term water source for the region. Some of these factors include:

1. Capacity of water supply;
2. Quality of water supply;
3. Location of water supply;
4. Pumping requirements;
5. Capacity of existing water treatment facilities;
6. Cost of water from wholesale providers;
7. Cost to treat and distribute water from a new water treatment facility; and
8. Capital costs required to implement the alternative.

We have evaluated twelve (12) alternatives for implementing a long term regional water supply for the Authority. The Preliminary Engineering Report further details the alternatives considered. A list of each alternative with brief description follows:

ALTERNATIVE	DESCRIPTION OF ALTERNATIVE
A	**Marion County Regional Water District (Purchase Water)** *Upgrade existing water treatment facilities, water transmission mains, and water storage capacity. Construct water transmission mains to serve OMRPWA Members (via Hwy 412 & 65).*
B	**Carroll-Boone Regional Water District (Purchase Water)** **Construct Water Treatment Facility on Bull Shoals Lake** *Construct water treatment facilities on Bull Shoals Reservoir and connect to the Carroll - Boone Water District to purchase a supplemental supply. Construct water transmission mains to serve OMRPWA Members.*
C	**Construct Water Treatment Facility on Bull Shoals Lake** *Construct water treatment facilities on Bull Shoals Reservoir and construct water transmission mains to serve OMRPWA Members.*
D	**Construct Water Treatment Facility on Greers Ferry Lake** **Construct Water Treatment Facility on Bull Shoals Lake** *Construct 2 water treatment facilities, one on Greers Ferry Lake to serve Searcy County and one on Bull Shoals Reservoir to serve Newton and Boone Counties. Construct water transmission mains to serve OMRPWA Members.*

ALTERNATIVE	DESCRIPTION OF ALTERNATIVE
E	**Clinton Water System (Purchase Water)** **Carroll-Boone Regional Water District (Purchase Water)** *Connect to the Clinton Water System and provide treated water to Searcy County via a water transmission main. Connect to Carroll - Boone Water District and provide treated water to Newton and Boone County via a water transmission mains.*
F	**Construct Water Treatment Facility on Norfork Lake** *Construct water treatment facilities on Norfork and construct water transmission mains to serve OMRPWA Members.*
G	**Marion County Regional Water District (Purchase Water)** *Upgrade existing water treatment facilities, water transmission mains, and water storage capacity. Construct water transmission mains to serve OMRPWA Members (via Highway 14 to Searcy County and via Highway 412 & 65 to Newton County).*
H	**City of Clarksville (Purchase Water)** *Connect to the Clarksville Water System and provide treated water to OMRPWA members via water transmission mains.*
I	**City of Russellville (Purchase Water)** *Connect to the Russellville Water System and provide treated water to OMRPWA members via water transmission mains.*
J	**Marion County Regional Water District (Purchase Water)** **Carroll-Boone Regional Water District (Purchase Water)** *Increase the capacity of the water treatment facilities and perform water transmission mains upgrades to the Marion County District. Also, connect to the Carroll - Boone Water District for a supplemental water supply. Construct water transmission mains to serve OMRPWA Members.*
K	**City of Clarksville (Purchase Water)** **Construct Water Treatment Facility on Bull Shoals Lake** *Connect to the Clarksville Water System and provide treated water to OMRPWA members via south of the Buffalo National River. Also, construct water treatment facilities on Bull Shoals Reservoir and serve OMRPWA members north of the Buffalo National River.*
L	**City of Russellville (Purchase Water)** **Construct Water Treatment Facility on Bull Shoals Lake** *Connect to the Russellville Water System and provide treated water to OMRPWA members via south of the Buffalo National River. Also, construct water treatment facilities on Bull Shoals Reservoir and serve OMRPWA members north of the Buffalo National River.*

Surface Water Sources Considered

Each of the alternatives described in the previous section was analyzed for water quality, water quantity and capacity, reliability, and environmental impact. The final step in the selection process is to compare the economic impact of constructing the water system for the Ozark Regional Public Water Authority. These include the capital costs and the total present worth costs associated with each alternative. The present worth analysis takes into account capital costs, operation and maintenance, wholesale water costs, and salvage value. All values are based on current market prices.

Alternative Selected

After careful review of the economic analysis for all alternatives, it is evident that production of the treated water has a tremendous long term advantage over purchasing treated water from existing bulk wholesalers. Therefore, in order for the OMRPWA to keep long term rates to a minimum, it is in the best interest for the Authority to construct a water treatment facility and produce drinking water for its member entities. This long term savings is most evident when evaluating the five (5) alternatives with the lowest capital cost and comparing them with the 20 year and 30 year present worth costs, as shown below:

		Present Worth Value	
Alternative	**Capital Cost**	**20 Yr**	**30 Yr**
"B" (Bull Shoals WTP/Buy from Carroll-Boone)	$ 66,832,228	$ 63,104,919	$ 79,789,050
"C" (Construct Bull Shoals WTP)	***$ 62,995,000***	***$ 57,378,418***	***$ 70,114,833***
"E" (Buy from Clinton/Carroll-Boone)	$ 62,577,373	$ 70,865,092	$ 88,674,720
"I" (Purchase from City of Russellville)	$ 67,177,460	$ 68,606,558	$ 84,618,806
"J" (Buy from MCRWD / Carroll-Boone)	$ 62,973,818	$ 74,634,629	$ 91,432,719

Based our evaluation of the 12 alternatives, Alternate "C" (Construct WTP on Bull Shoals) is the most cost effective for the OMRPWA. It is our recommendation that the Authority proceed with constructing an intake structure and water treatment facility on Bull Shoals Lake near Lead Hill. The treated water would then be delivered via water transmission mains, booster stations, and water storage tanks to all members of the OMRPWA.

Again, the engineering design information is discussed more in-depth in the Preliminary Engineering Report.

"Conclusions and Recommendations" section from original Environmental Report is deleted.

3.0 AFFECTED ENVIRONMENT/ENVIRONMENTAL CONSEQUENCES

THE FOLLOWING ADDITIONS OR REVISIONS SHOULD BE MADE:

DELETE SECTION 3.1 AND REPLACE WITH THE FOLLOWING REVISED SECTION:

3.1 Land Use/Important Farmland/Formally Classified Lands

3.1.1. Affected Environment – The project consists of constructing a water transmission system to serve existing and proposed customers within the counties. A water treatment facility, a booster pumping stations and water storage tanks will be constructed to provide adequate pressure to the proposed member entities. This project will extend from the Bull Shoals Lake paralleling and/or crossing United States Highway 65, United States Highway 62/412, Arkansas Highway 123, Arkansas Highway 16, Arkansas Highway 7, Arkansas Highway 27, and Arkansas Highway 74. Other roads that are paralleled are Lead Hill Zinc Road, Meeks Creek Road, Manor Road, County Road 24 and County Road 333. Overall the project will affect approximately 450 acres of land mostly along the narrow linear route of the water transmission main. Please refer to Exhibit A for a preliminary layout map of the project.

- The Natural Resources Conservation Service determined that farmland would be crossed but no important farmland would be converted as a result of the construction of the transmission lines or the water treatment and storage facilities.
- The U.S. Forest Service is reviewing existing cultural and biological studies provided and will complete their own public comment period and NEPA analysis. Approximately 3.2 miles of water transmission mains are proposed to cross the Ozark National Forest. The U.S. Forest Service expects to issue the construction permit within 90 to 120 days. (Also refer to Biological Resources – Section 3.5)
- The Arkansas Department of Parks and Tourism determined that several park lands have been developed in the project region.
- The National Parks Service determined that the water lines will cross the Buffalo National River. The Buffalo River would be crossed in two locations by attaching the water main to existing vehicular bridges.

3.1.2. Environmental Consequences –Best Management Practices will be implemented during construction of this project, as recommended by several agencies.

- The Natural Resources Conservation Service determined there would be no adverse impact on important farmland, as all lines and water facilities appear to be the best and least intrusive route and/or sites. There will be no conversion of any prime or important farmlands as a result of this project.

- The Arkansas Forestry Commission determined that there will be no long term adverse impacts on the forest resources of the area as provisions are in place to reduce and offset any temporary environmental impacts.
- The U.S. Forest Service will complete its public comment period and conduct review of cultural and biological information provided in this report. The U.S. Forest Service expects to issue the construction permit within 90 to 120 days. (Also refer to Biological Resources – Section 3.5)
- The Arkansas Department of Parks and Tourism requested that any disturbed park property must be restored to its original condition upon construction completion.
- NPS recommended approval of the project and has submitted a Determination of Effect that is included in Exhibit C of the original Environmental Report.

3.1.3 Mitigation –No further mitigation will be needed on this resource with regards to prime or important farmland as none are present. However, Best Management Practices will be implemented for specific land uses during construction of this project, as recommended by several agencies. Best Management Practices are outlined in Exhibit G of the original Environmental Report.

Also, the U.S. Forest Service has issued a letter stating that they will be reviewing existing cultural and biological information in the report, and they will complete their own NEPA analysis and public comment period. Issuance of the permit is expected in 90 to 120 days. Other mitigation includes mist netting for Indiana Bats unless construction activities in specific areas are conducted between December 1st and March 15th. The Biological Evaluation is also being forwarded to the U.S. Fish and Wildlife for concurrence. No herbicides or pesticides can be used on U.S. Forest Service lands. Please refer to Section 3.5 – Biological Resources.

3.4 Historic (or Cultural) Properties

Add the Following to Section 3.4.3 to Mitigation:

3.4.3 The USDA Rural Development State Office contacted Native American tribes potentially affected by the project (Quapaw Tribe and Osage Nation). Responses from the Quapaw Tribe and the Osage Nation are included in the amended Exhibit C. The Osage Nation requests that construction operations cease and the Osage Nation Historic Preservation Office be contacted if human remains are encountered.

3.5 Biological Resources

Add the Following to Section 3.5.3 to Mitigation:

3.5.3 U.S. Fish and Wildlife verifies in a letter dated July 21, 2009 that they have no additional concerns to add to their previous comments already included in the environmental report. A copy of that letter is attached in an amendment to Exhibit C. However, they have requested adaptation of new Best Management Practices (BMP's) being developed by the Service for the Natural Gas Pipeline and Maintenance Activities in the Fayetteville Shale Area. The U.S. Forest Service required a private consultant Biological Study, which is attached as Exhibit BB. The U.S. Forest Service concurred with the Biological Study then prepared their Biological Evaluation which is attached as Exhibit CC. The U.S. Forest Service will complete a separate NEPA analysis based on these reports plus the Environmental Report which includes a public comment period. They estimate that this could be completed in 90 to 120 days. Once this analysis is completed, a permit can be issued. Also, no herbicides will be used on Forest Service land. A mist net survey is required for Indiana Bats before any timber is cut down unless construction activities are implemented between December 1st and March 15th. A copy of their letter is included in the Amended Exhibit C.

3.6 Water Quality Issues

Add the Following to Section 3.6.3 to Mitigation:

3.6.3 The Authority is working to secure water allocation from Bull Shoals Reservoir for the purpose of providing potable drinking water to member entities on or before August 2010. Two public meetings were held in Diamond City and Bull Shoals, respectively. Over 100 people were in attendance. There were no adverse comments received at these meeting opposing the project.

The U.S. Army Corps of Engineer's provided a letter dated August 24, 2009, detailing the schedule that is being implemented in order to obtain the water allocation from Bull Shoals Reservoir by August 2, 2010.

DELETE SECTION 4.0 AND REPLACE WITH THE FOLLOWING REVISED SECTION:

4.0 Summary of Mitigation

Some mitigating measures are necessary for this project regarding environmental resources in the area. A full-time resident inspector will be at the construction site to ensure construction plans and the Contractor will follow mitigating measures. The OMRPWA will also be actively involved with construction of this project. The engineer to ensure that adverse environmental impacts associated with this project do not occur will provide periodic inspections. The following is a summary of the mitigation measures required for this project:

Environmental Mitigation Summary		
SECTION	**ENVIRONMENTAL RESOURCE**	**MITIGATION MEASURES REPORTED**
3.1	Land Use	Best Management Practices. Restore land to original grade and condition. A permit to cross U.S. National Forest Service is expected to be obtained within 90 to 120 days. Also refer to U.S. Forest Service mitigation within Section 3.5 - Biological Resources.
3.2	Flood Plains	Flood plain will be restored to the original shape and contours. Section 404 (stream crossings) and Section 10 (intake structure) permits obtained from the Corps of Engineers.
3.3	Wetlands	Avoid wetland areas.
3.4	Cultural Resources	A cultural resources survey was obtained. If cultural materials are encountered during construction, work will cease in the immediate area. Notification will be made to the State Historical Preservation Officer (SHPO). Site 3SE265 will be monitored by a professional archeologist. Water transmission main will be routed to avoid identified known historic sites either to across road or into existing disturbed corridors. Work will cease and the Osage Nation Historic Preservation Office and the State Historical Preservation Officer will be contacted if human remains are found.

3.5	Biological Resources	Stop work if cave is found within 300 ft. of project area. Notify U.S. Fish and Wildlife Services immediately. Utilize BMP's as required. An alternative route may be utilized to avoid caves. Coffer dams (or other flow diversion techniques) utilized to protect streams. Restore land to original grade and condition. Avoid glades and do not use for storage or to stage equipment. Adaptation of new BMP's developed by the Service for the Natural Gas Pipeline and Maintenance Activities in the Fayetteville Shale Area requested by U.S. Fish and Wildlife. On U.S. Forest Service land, mist net surveys for Indiana Bats are required before any timber is cut down unless construction is implemented between December 1st and March 15th. No herbicides are permitted on U.S. Forest land.
3.6	Water Quality	Implement BMP's as required. Owner shall submit a Storm Water Pollution Prevention Plan to ADEQ. A Section 10 and 404 permit from the U.S. Army Corps of Engineers has been obtained and is included in this report. Attach water line to bridge across Buffalo National River. Restore trench line to original grade and condition. Work closely with the U.S. Army Corps of Engineer's to obtain water allocation from Bull Shoals Reservoir before August 2, 2010.
3.7	Coastal Resources	None
3.8	Socio-Economic/Environmental Justice	None
3.9	Miscellaneous Items	None

6. Exhibits

The following exhibits have been revised as follows for this Amendment:

Amended Exhibit C: Comment Letters from State and Federal Agencies

Add USDA Letter to Quapaw Tribe Dated July 23, 2009 and Follow Up Dated August 11, 2009

Add Response from Quapaw Tribe Dated August 11, 2009

Add USDA Letter to Osage Nation Dated July 23, 2009 and Follow Up Dated August 11, 1009

Add Letter from Osage Nation Dated August 14, 2009

Add Letter from U.S. Fish and Wildlife Dated July 21, 2009

Add Letter from U.S. Forest Service Dated August 19, 2009

Add Letter from U.S. Army Corps of Engineers Dated August 24, 2009

Exhibit AA: Advertisement of Environmental Assessment and Response Letter

Advertisement of Environmental Assessment (Harrison Daily Times)

Letter from Michael and Elba Cotignola (Dated July 15, 2009)

Letter from Engineering Services, Inc. to Michael and Elba Cotignola (Dated July 28, 2009)

Exhibit BB: Summary Report for Biological Evaluation Field Survey

Exhibit CC: Biological Evaluation Report

AMENDED EXHIBIT C

ADDITIONAL COMMENT LETTERS FROM FEDERAL AND STATE AGENCIES

USDA Letter to Quapaw Tribe (July 23, 2009)
Follow Up Letter to Quapaw Tribe (August 11, 2009)
Response from Quapaw Tribe (August 11, 2009)

USDA Letter to Osage Nation (July 23, 2009)
Follow Up Letter to Osage Nation (August 11, 2009)
Letter from Osage Nation (August 14, 2009)

U.S. Fish and Wildlife (July 21, 2009)

U.S. Forest Service (August 19, 2009)

U.S. Army Corps of Engineer's (August 24, 2009)

USDA Rural Development
United States Department of Agriculture
Rural Development
Arkansas State Office

July 23, 2009

QUAPAW TRIBE OF OKLAHOMA
NAGPRA and Section 106 Review Coordinator
Ms. Carrie V. Wilson
223 E. Lafayette
Fayetteville, AR 72701

Dear Ms. Wilson,

The USDA Rural Development Agency continues to identify historic properties of religious and cultural significance to Indian Tribes that may have potential for impact by the Agency programs, services, and its applicant's activities. Therefore, we will always consult with those federally recognized Tribes and organizations that attach religious and cultural significance to historic properties regardless of their location during the Agency's Section 106 review process.

Rural Development has consulted with the Arkansas State Historic Preservation Officer (SHPO) on a project known as Ozark Mountain Regional Water Authority. The project consists of a new water treatment plant near Bull Shoals Lake in the vicinity of Diamond City and multiple transmission lines with tanks and pump stations in Boone, Newton, and Searcy Counties of Arkansas.

The Agency's goal with this letter is to obtain any comments or suggestions from the **Quapaw Tribe of Oklahoma** concerning the proposed project. We have provided a map of the area showing approximate locations for the project's components, correspondence from SHPO, and a copy of the Phase I Cultural Resources Survey that was completed.

For further information contact Larry Duncan, State Environmental Coordinator, 501-301-3265.

Sincerely,

Sherry L. Smith

SHERRY L. SMITH
Acting State Director

Attachments

Duncan, Larry - Little Rock, AR

From: Duncan, Larry - Little Rock, AR
Sent: Tuesday, August 11, 2009 10:55 AM
To: 'nagpra.106@earthlink.net'
Subject: Section 106 Review for Ozark Mtn. Regional Water Authority

Ms. Carrie V. Wilson,
Section 106 Review Coordinator
Quapaw Tribe of Oklahoma

This email is to follow-up on our conversation earlier this morning discussing the previous letter to you by USDA-Rural Development that pertain to the new water system that Rural Development, along with the State of Arkansas, was attempting to fund for construction. Along with the letter, we provided a map showing proposed site of water treatment site on Bull Shoals Lake and the path of the transmission lines to the various water systems in three counties (Boone, Newton, & Searcy), correspondence from SHPO, and a copy of the Cultural Resource Survey. We requested any comments or suggestions you might have concerning this project.

In our conversation you stated that as long as Arkansas SHPO signed-off on project and the Cultural Resource Survey, and we followed their guidance, you were okay with it.
Again, I thank you for your time and apologize for the hurry, since the project is time sensitive.

Sincerely,

Larry Duncan

Larry Duncan, PE
State Engineer & Environmental Coordinator
USDA - Rural Development
Little Rock, Arkansas
501-301-3269

Duncan, Larry - Little Rock, AR

From: Carrie V. Wilson [nagpra.106@earthlink.net]

Sent: Tuesday, August 11, 2009 12:17 PM

To: Duncan, Larry - Little Rock, AR

Subject: Re: Section 106 Review for Ozark Mtn. Regional Water Authority

I concur with the SHPO's findings of no effect.
Carrie Wilson

-----Original Message-----
From: "Duncan, Larry - Little Rock, AR"
Sent: Aug 11, 2009 10:54 AM
To: "'nagpra.106@earthlink.net'"
Subject: Section 106 Review for Ozark Mtn. Regional Water Authority

Ms. Carrie V. Wilson,
Section 106 Review Coordinator
Quapaw Tribe of Oklahoma

This email is to follow-up on our conversation earlier this morning discussing the previous letter to you by USDA-Rural Development that pertain to the new water system that Rural Development, along with the State of Arkansas, was attempting to fund for construction. Along with the letter, we provided a map showing proposed site of water treatment site on Bull Shoals Lake and the path of the transmission lines to the various water systems in three counties (Boone, Newton, & Searcy), correspondence from SHPO, and a copy of the Cultural Resource Survey. We requested any comments or suggestions you might have concerning this project.

In our conversation you stated that as long as Arkansas SHPO signed-off on project and the Cultural Resource Survey, and we followed their guidance, you were okay with it.
Again, I thank you for your time and apologize for the hurry, since the project is time sensitive.

Sincerely,

Larry Duncan

Larry Duncan, PE
State Engineer & Environmental Coordinator
USDA - Rural Development
Little Rock, Arkansas
501-301-3269

Red Sun Cultural Resource Consulting
223 E. Lafayette St.
Fayetteville, AR 72701
Phone: 479-442-7576, Fax: 479-575-5453

USDA Rural Development
United States Department of Agriculture
Rural Development
Arkansas State Office

July 23, 2009

THE OSAGE NATION
Tribal Historic Preservation Officer
Dr. Andrea A. Hunter, Director
P.O. Box 779
Pawhuska, OK 74056

Dear Dr. Hunter,

The USDA Rural Development Agency continues to identify historic properties of religious and cultural significance to Indian Tribes that may have potential for impact by the Agency programs, services, and its applicant's activities. Therefore, we will always consult with those federally recognized Tribes and organizations that attach religious and cultural significance to historic properties regardless of their location during the Agency's Section 106 review process.

Rural Development has consulted with the Arkansas State Historic Preservation Officer (SHPO) on a project known as Ozark Mountain Regional Water Authority. The project consists of a new water treatment plant near Bull Shoals Lake in the vicinity of Diamond City and multiple transmission lines with tanks and pump stations in Boone, Newton, and Searcy Counties of Arkansas.

The Agency's goal with this letter is to obtain any comments or suggestions from the **Osage Nation** concerning the proposed project. We have provided a map of the area showing approximate locations for the project's components, correspondence from SHPO, and a copy of the Phase I Cultural Resources Survey that was completed.

For further information contact Larry Duncan, State Environmental Coordinator, 501-301-3265.

Sincerely,

Cherry L. Smith

CHERRY L. SMITH
Acting State Director

Attachments

Duncan, Larry - Little Rock, AR

From:	Duncan, Larry - Little Rock, AR
Sent:	Tuesday, August 11, 2009 11:31 AM
To:	'ahunter@osagetribe.org'
Subject:	Section 106 Review for Ozark Mtn. Regional Water Authority

Dr. Andrea A. Hunter
Tribal Historic Preservation Officer
The Osage Nation

This email is to follow-up on my attempt to contact you by phone earlier this morning. I was hoping to discuss the previous letter of July 23rd that was sent to you by USDA-Rural Development and pertained to the new water system that Rural Development, along with the State of Arkansas, was attempting to fund for construction. Along with the letter, we provided a map showing proposed site of water treatment site on Bull Shoals Lake and the path of the transmission lines in three counties (Boone, Newton, & Searcy) to the various water systems (22 utilities), correspondence from SHPO, and a copy of the Cultural Resource Survey.

We requested any comments or suggestions you might have concerning this project. Arkansas SHPO has signed-off on project and Cultural Resource Survey, and we will be adhering to their guidance. Since the project is time sensitive I was asked to attempt to contact you by phone. Again, I thank you for your time and apologize for the hurry.

Sincerely,

Larry Duncan

Larry Duncan, PE
State Engineer & Environmental Coordinator
USDA - Rural Development
Little Rock, Arkansas
501-301-3269

08/17/2009 16:31 5013013293 COMMUNITY PROGRAMS PAGE 02/02

AUG-17-2009 15:09 From:CULURAL PRESERVATION 19182875376 To:5013013293 P.1/1

SEAL OF OSAGE NATION ®

TRIBAL HISTORIC PRESERVATION OFFICE

Date: August 14, 2009 **File: 0809-752AR-8**

RE: Ozark Mountain Regional Water Authority Treatment Plant and Transmission Lines in Boone, Newton, and Searcy counties, Arkansas

Larry Duncan
State Environmental Coordinator
USDA – Rural Development
Federal Building, Room 3416
700 West Capitol Avenue
Little Rock, AR 72201-3225

Dear Mr. Duncan,

The Osage Nation Historic Preservation Office has received the cultural resources survey report for the proposed project listed as **Ozark Mountain Regional Water Authority Treatment Plant and Transmission Lines in Boone, Newton, and Searcy counties, Arkansas.** The Osage Nation Historic Preservation Office concurs with the recommendation for Phase II assessment or avoidance for 3NW16/41, 3NW17/18/92, 3NW1235, 3SE117, 3SE265, and 3SE532 as well as construction monitoring by a professional archaeologist for 3SE265.

In accordance with the National Historic Preservation Act, (NHPA) [16 U.S.C. 470 §§ 470-470w-6] 1966, undertakings subject to the review process are referred to in S101 (d)(6)(A), which clarifies that historic properties may have religious and cultural significance to Indian tribes. Additionally, Section 106 of NHPA requires Federal agencies to consider the effects of their actions on historic properties (36 CFR Part 800) as does the National Environmental Policy Act (43 U.S.C. 4321 and 4331-35 and 40 CFR 1501.7(a) of 1969).

The Osage Nation anticipates reviewing and commenting on the recommended Phase II assessments or avoidance plans for the project listed as Ozark Mountain Regional Water Authority Treatment Plant and Transmission Lines in Boone, Newton, and Searcy counties, Arkansas.

The Osage Nation has a vital interest in protecting its historic and ancestral cultural resources. **If human remains or associated elements are discovered during the mitigation or construction process, we ask that work cease immediately and the Osage Nation Historic Preservation Office be contacted.**

Should you have any questions or need any additional information please feel free to contact me at the number and/or email address listed below. Thank you for consulting with the Osage Nation on this matter.

Andrea A. Hunter

Dr. Andrea A. Hunter
Tribal Historic Preservation Officer

James Munkres

James Munkres
Archaeologist I

627 Grandview, Pawhuska, OK 74056, (918) 287-5328, Fax (918) 287-5376

United States Department of the Interior

FISH AND WILDLIFE SERVICE
110 S. Amity Road, Suite 300
Conway, Arkansas 72032
Tel.: 501/513-4470 Fax: 501/513-4480

IN REPLY REFER TO:

July 21, 2009

Mr. Tim Mays
Engineering Services, Inc.
1207 S. Old Missouri Rd.
Springdale, AR 72765-0282

RE: Request for Updated Environmental Information Regarding the
Ozark Mountain Regional Public Water Authority
Searcy County, Newton County, and Portions of Boone and Marion Counties

Dear Mr. Mays:

The U.S. Fish and Wildlife Service (Service) previously provided the following comments in a July 21, 2006 letter from you requesting environmental information for the early planning process of the Ozark Mountain Regional Water Authority's project in north central Arkansas. The Service does not have any additional concerns since writing that letter and only has one additional recommendation at this time. Therefore we would like to reiterate the previous comments with the one additional recommendation:

> The Service reviewed the comments provided by the National Park Service (NPS) and we support and concur with the strategy and plan that you both propose. In addition, we are actively requesting and searching for information to assist you and NPS in making your determinations and in the development of appropriate Best Management Practices (BMPs). We will provide you and NPS with any new information, issues, or recommendations as it becomes available. However, based on current information we do not anticipate any environmental issues that can not be resolved through normal consultation, mitigation, and/or minor project modifications.
>
> According to our records, there are no federally listed or proposed threatened or endangered species occurring in the impact area of the project. However, there are several listed threatened and endangered species that have documented ranges extending into these counties including the Ozark Big-Eared Bat (*Corynorhinus townsendii ingens*), Bald Eagle (*Haliaeetus leucocephalus*), Pink Mucket (*Lampsilis abrupta*), Scaleshell (*Leptodea leptodon*), Indiana bat (*Myotis sodalis*), and Gray bat (*Myotis grisescens*). The Environmental Report should indicate that these threatened and endangered species are known or have been known to occur in the project area; however, the Service does not expect any of these species to be affected by the proposed project. Therefore, no further consultation regarding threatened and endangered species is required at this time.
>
> There are no known caves within the project impact area; however, much of the geology in the Ozarks is comprised of a karst topography resulting in interaction of surface waters within these watersheds with the hydrogeologic processes of large and complex underlying cave ecosystems. Excavation, trenching, blasting, drilling, and associated activities within these areas, across fractures, and/or at stream crossings in karst habitat could have detrimental impacts on species within these streams and the connected cave ecosystems. Water and air flow may be diverted or lost if new openings are created or natural ones area closed, thus altering both surface and subsurface ecosystems and possibly resulting in the loss of species and habitat. In addition, activities associated with the project could result in the leaking or spilling of chemicals such as petroleum or

chlorinated water into these systems, which could significantly alter water chemistry resulting in species mortality and/or extirpation of sensitive species. However, with careful and proper consideration of these concerns through the use of BMPs and with further consultation with the resource agencies, the potential for adverse affects to the fish and wildlife resources may be significantly reduced or avoided.

The Service has advised and commented on similar projects in this region. With proper coordination and consultation applicants and the Service have cooperated to develop BMPs that accomplished the applicant's goals while reducing project impacts and potential impacts to fish and wildlife resources in addition to conserving karst ecosystems. The Service offers its assistance to you and the Alliance through further consultation and cooperation to accomplish our mutual goals. Please find attached to this letter an example of appropriate BMPs titled, "Community Growth Best Management Practices for Conservation of the Cave Springs Cave Recharge Zone". We recommend adapting these BMPs for this project as appropriate.

As stated in our previous letter, we are encouraged by the efforts of the Alliance to develop a long term, safe, economical, and environmentally conscious water supply to serve the dire needs of these north central Arkansas communities. After reviewing the various alternatives we are in agreement that the Bull Shoals Reservoir option would provide an affordable, long term, and high quality water source with minimal environmental impacts. We fully support the concept and look forward to further cooperation and coordination through the project development and environmental review process. We offer our encouragement, assistance, and cooperation to you and the Alliance toward accomplishing this vitally important project.

The only additional recommendation that the Service has at this time is that you consider and adapt new BMPs being developed by the Service for the Natural Gas Pipeline Construction and Maintenance Activities in the Fayetteville Shale Area – Upper Little Red River Watershed into the BMPs for this project. Many of the BMPs for construction of pipelines and the control of sediment and erosion in Ozark Mountain terrain and geology are applicable to this project and would assist in minimizing impacts. The BMPs are not yet finalized, but will be available in the near future. You may request a copy of the BMPs from the Service or download them from our website at: http://arkansas-es.fws.gov/, once they are available. If you have any questions or require any assistance please contact me at 501-513-4489.

Sincerely,

Lindsey Lewis
Environmental Coordinator

C:\Documents and Settings\LCL\My Documents\PROJECTS\FY2009\OzarkMountainWaterAlliance\Comments.doc

USDA United States Department of Agriculture
Forest Service
Big Piney Ranger District
12000 SR 27
Hector, AR 72843
479-284-3150
FAX 479-284-2015
Hwy 7 North
P.O. Box 427
Jasper, AR 72641
870-446-5122
FAX 870-446-2063

File Code: 2700
Date: August 19, 2009

Tim Mays
Engineering Services, Inc.
1207 S. Old Missouri Rd.

Dear: Mr. Mays

The U.S. Forest Service is aware of the lack of adequate community water in our area and encouraged by the efforts of the Water Alliance to develop a long term, and environmentally sensitive water distribution system to serve the needs of our area. The Forest Service cannot issue a permit for the water line until we have complied with the National Environmental Policy Act (NEPA). We will utilize information from your environmental report/assessment and the information your heritage and biological surveys; however we will have to complete a separate analysis which includes a public comment opportunity. An estimated timeline of 90 to 120 days for the completion of the NEPA process before issuance of the permit could be accomplished. Once the decision is signed and any appeal period is over the issuance of a permit can be done in a matter of days.

Enclosed is a copy of the Biological Evaluation (BE) by Wildlife Biologist, Dwayne Rambo. The BE included the cumulative effects within the proclamation boundary with the possible use of herbicide on private lands however, no herbicide use on Forest Service lands has been evaluated. The BE used information from your biological surveys conducted in August of 2009. Our Forest Plan in collaboration with the U.S. Fish and Wildlife Service established a standard that biological surveys are only valid for two years. Therefore if implementation is not completed by June 1, 2011 additional mist net surveys for Indiana Bats will be required unless activities are implemented between December 1st. and March 15th. The BE will be sent to the U.S. Fish and Wildlife Service for concurrence, however, additional mitigation may be required by the Fish and Wildlife Service.

We look forward to further cooperation and coordination through as this project moves forward. If you have any questions or require any assistance please contact Terrell Hope at 870-446-5122 ext. 5135.

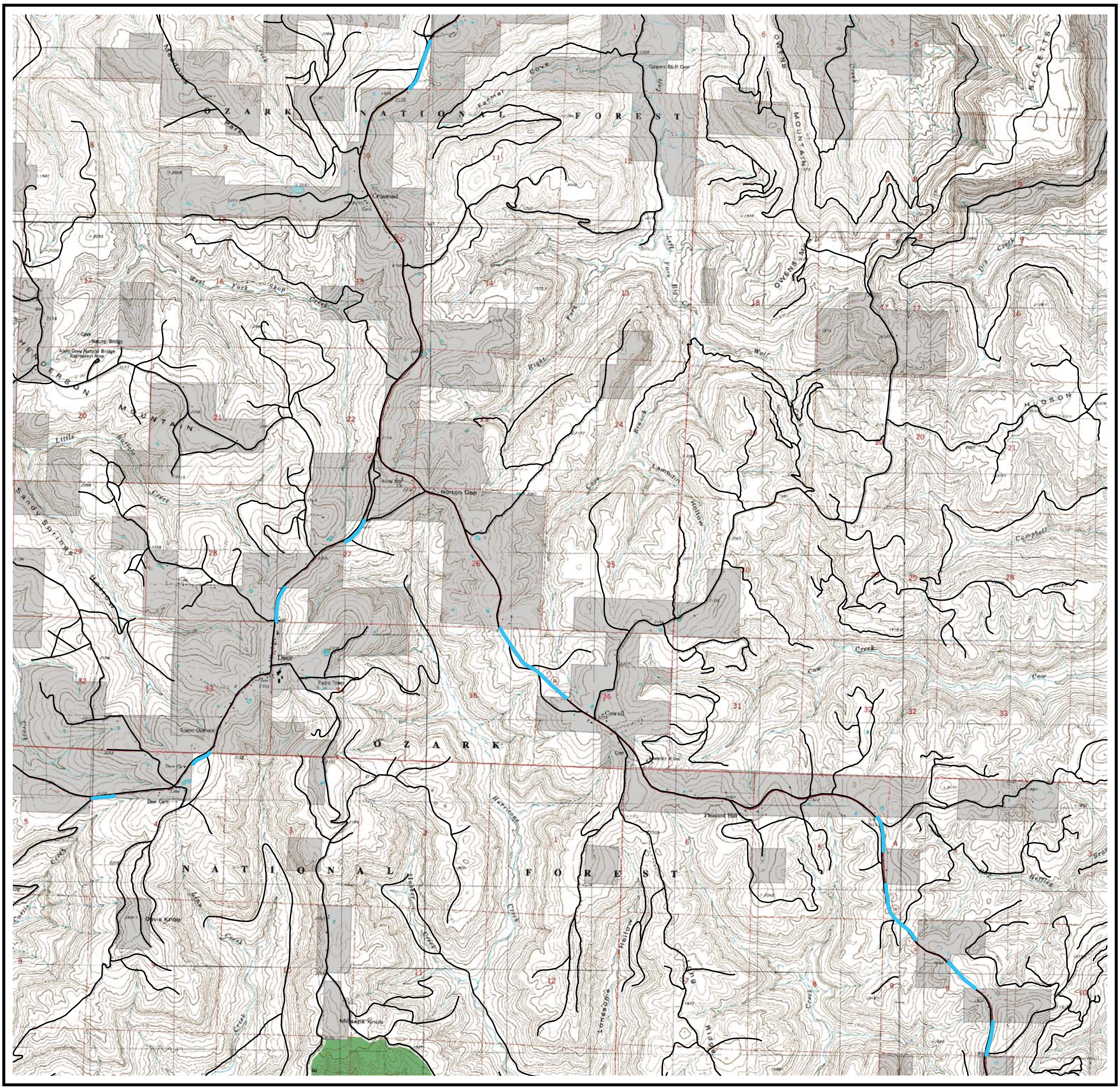
Sincerely,

/s/ Gary D. Knudsen
GARY D. KNUDSEN
Acting District Ranger Big Piney

cc: Judi Henry

Ron Klouzek
Dwayne Rambo
Terrell Hope
Bruce Davenport

Ozark Mtn Regional Public Water Authority



Legend

- Water Line Location Across Goverment
- Roads_with_INFRA_061808
- fs_private

The Forest Service uses the most current and complete data available. GIS data and product accuracy may vary. They may be: developed from sources of differing accuracy, accurate only at certain scales, based on modeling or interpretation, incomplete while being created or revised, etc. Using GIS products for purposes other than those for which they were created, may yield inaccurate or misleading results.

The Forest Service reserves the right to correct, update, modify, or replace GIS products without notification. For more information, contact:
Ozark-St. Francis National Forest, 605 West Main, Russellville, AR 72608, (479)964 - 7211

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT CORPS OF ENGINEERS
POST OFFICE BOX 867
LITTLE ROCK, ARKANSAS 72203-0867

August 24, 2009

Planning and Environmental Office

Mr. Jim Maras, Deputy Assistant Administrator
USDA, Rural Development Utilities Program
1400 Independence Ave, SW
Washington, DC 20250

Dear Mr. Maras:

This letter confirms that the U.S. Army Corps of Engineers, Little Rock District, is conducting a water storage reallocation study on Bull Shoals Reservoir for the Ozark Mountain Regional Public Water Authority (OMRPWA). This study is conducted in response to a letter from OMRPWA received in February 2007. OMRPWA requested a water storage reallocation from Bull Shoals Reservoir adequate to supply 6 million gallons a day (MGD) for municipal water supply. The Little Rock District has committed over $250,000 in funds necessary to initiate the study and to complete the reallocation report, Environmental Assessment (EA) and draft water supply agreement in August 2010. We recognize the urgency of OMRPWA to obtain the water supply agreement by this date in order to commit $60 million from USDA American Recovery and Reinvestment Act funds to construct the water in-take structure, treatment plant and distribution lines.

We conducted two public meetings in June 2009 and did not receive any opposition to the proposed reallocation. Therefore, the decision was made to proceed with an EA, not an Environmental Impact Statement (EIS), in accordance with the National Environmental Policy Act (NEPA). During the course of this study, if potential significant impacts are identified, an EIS may be required. If an EIS is required, study costs will increase and it would add 12-18 months to the overall process.

The water storage reallocation report will analyze the water supply needs, alternative sources for water, and perform economic and environmental analysis of impacts from reallocating water from either the flood control or conservation (hydropower) pool of the reservoir. The study will determine the costs related to reducing the storage in the flood control pool or the hydropower pool which will include impacts to Southwestern Power Administration, the federal hydropower permittee. OMRPWA must prove their ability to pay for the water. The water storage agreement will outline the annual requirement for payment of the water storage and OMPRWA's portion of operations and maintenance (O&M) of the reservoir.

The proposed study schedule will include a 30-day public review of the draft EA, internal quality control and quality assurance reviews, and policy compliance reviews. Final report approval resides with Headquarters, U.S. Army Corps of Engineers and must occur prior to the Assistant Secretary of the Army for Civil Works approving the draft water storage agreement. No water can be allocated or withdrawn until the water storage agreement is approved and signed. We are proceeding forward with the full intent of providing an approved reallocation report and water storage agreement in August 2010. If at any time it appears that the schedule would significantly slip we will inform you, OMRPWA, and interested Congressional representatives of the reasons why and the impact on the completion date. Some of the critical milestones for completion of the report and water storage agreement are as follows:

Draft Water Storage Reallocation Schedule (Milestones)	
TASK	COMPLETION DATE
Coordination Meeting (Study team members and Contractor)	Sep 2009
Coordination Meeting (Alternatives Review)	Jan 2010
Draft Water Reallocation Report, Draft EA, and Draft Water Storage Agreement	Mar 2010
30 Day Public Review of Draft EA/Report	Jun 2010
Final Reallocation Report Approval	July 2010
Water Storage Agreement Approval	Aug 2010

We appreciate that you recognize our commitment along with the potential uncertainties associated with completing a reallocation report, EA, and water storage agreement of such complexity. We look forward to working with you as an integral member of the project team, and we will continue to keep you informed along the way.

If you have any questions or need additional information, please contact Dr. Randy Hathaway, Deputy District Engineer at 501-324-5053.

Sincerely,

Donald E. Jackson, Jr.
Colonel, Corps of Engineers
District Engineer

Copy Furnished:

Mr. Andy Anderson
Ozark Mountain Regional Public Water Authority
P.O. Box 1020
Diamond City, AR 72630

Mr. Rickey Carter
USDA
700 West Capitol
Mail Room 3416
Little Rock, AR 72201

Mr. Tim Mays
Engineering Services, Inc.
P.O. Box 282
Springdale, AR 72765-0282

Senator Blanche Lincoln
355 Dirksen Senate Office Building
Washington, DC 20510

Senator Blanche Lincoln
912 West Fourth Street
Little Rock, AR 72201

Senator Mark Pryor
255 Dirksen Senate Office Building
Washington, DC 20510

Senator Mark Pryor
The River Market
500 Clinton Ave
Suite 401
Little Rock, AR 72201

Congressman Marion Berry
2305 Fayburn H.O.B.
Washington, DC 20515

Congressman Marion Berry
108 E. Huntington
Jonesboro, AR 72401

Congressman John Boozman
1519 Longworth House Office Building
Washington, DC 20515

Congressman John Boozman
4943 Old Greenwood Road
Suite 1
Fort Smith, AR 72903

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
POST OFFICE BOX 867
LITTLE ROCK, ARKANSAS 72203-0867

REPLY TO
ATTENTION OF

August 26, 2009

Planning and Environmental Office

Mr. Jim Maras, Deputy Assistant Administrator
USDA, Rural Development Utilities Program
1400 Independence Ave, SW
Washington, DC 20250

Dear Mr. Maras:

This letter serves as a follow up to our letter dated August 24, 2009 in regards to the Ozark Mountain Regional Public Water Authority (OMRPWA) water storage reallocation study. The Corps of Engineers does not object to USDA requiring as a mitigation measure of your Environmental Assessment the condition that the water reallocation study be completed and a water supply agreement be executed before OMPRWA begins any construction.

If you have any questions or need additional information, please contact Dr. Randy Hathaway, Deputy District Engineer at 501-324-5053.

Sincerely,

Donald E. Jackson, Jr.
Colonel, Corps of Engineers
District Engineer

Copy Furnished:

Mr. Andy Anderson
Ozark Mountain Regional Public Water Authority
P.O. Box 1020
Diamond City, AR 72630

Mr. Rickey Carter
USDA
700 West Capitol
Mail Room 3416
Little Rock, AR 72201

Mr. Tim Mays
Engineering Services, Inc.
P.O. Box 282
Springdale, AR 72765-0282

Senator Blanche Lincoln
355 Dirksen Senate Office Building
Washington, DC 20510

Senator Blanche Lincoln
912 West Fourth Street
Little Rock, AR 72201

Senator Mark Pryor
255 Dirksen Senate Office Building
Washington, DC 20510

Senator Mark Pryor
The River Market
500 Clinton Ave
Suite 401
Little Rock, AR 72201

Congressman Marion Berry
2305 Fayburn H.O.B.
Washington, DC 20515

Congressman Marion Berry
108 E. Huntington
Jonesboro, AR 72401

Congressman John Boozman
1519 Longworth House Office Building
Washington, DC 20515

Congressman John Boozman
4943 Old Greenwood Road
Suite 1
Fort Smith, AR 72903

EXHIBIT AA

ADVERTISEMENT OF ENVIRONMENTAL ASSESSMENT

Advertisement of Environmental Assessment (Harrison Daily Times)

Michael and Elba Cotignola Letter (July 15, 2009)
Response from Engineering Services, Inc. (July 28, 2009)

Notice of Availability of Environmental Assessment

The USDA, Rural Utilities Service has received an application for financial assistance

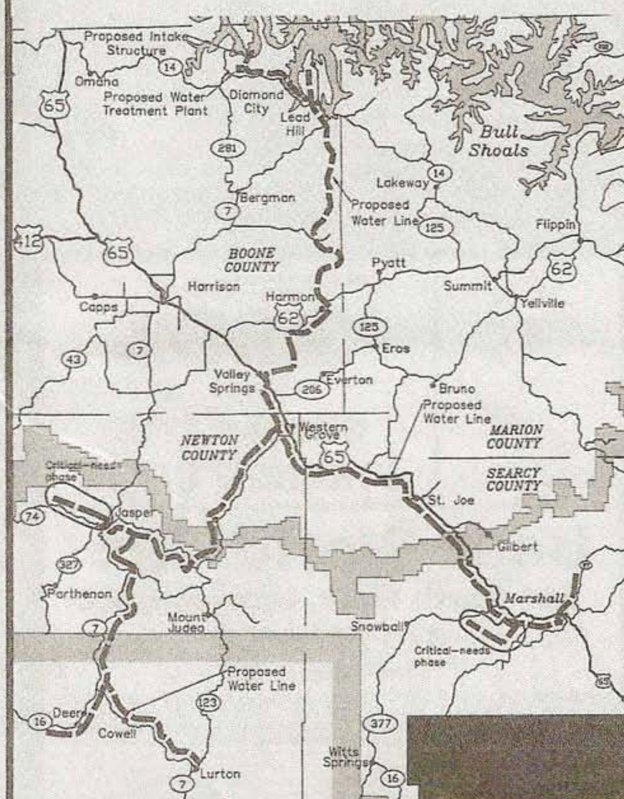
from the Ozark Mountain Regional Public Water Authority. As required by the National Environmental Policy Act, the Rural Utilities Service prepared an Environmental Assessment that evaluated the potential environmental effects and consequences of the proposed project. This notice announces the availability of the Environmental Assessment for public review and comment.

The project consists of a regional water system to serve over 20 municipal and rural water systems in Newton County, Searcy County, and portions of Boone and Marion Counties. The proposed project includes a water intake structure on Bull Shoals Lake, a water treatment facility west of Lead Hill, water transmission mains, water storage tanks, and booster pumping facilities. The proposed project location is hilly with some relatively flat areas. The project will cross private lands. To minimize any impact to environmentally sensitive areas, alternate routes will be considered when possible. Area streams, being of major concern, will be crossed when flows are at a minimum. Siltation screens will be employed to reduce turbidity and disturbances to stream beds, and best management practices will be used throughout the construction phase of the project to reduce runoff into sensitive areas.

Twelve alternatives were developed and thoroughly evaluated. Several important factors were considered in evaluating a long term water supply for the region. Some of these factors include: (1) capacity of water supply; (2) quality of water supply; (3) location of water supply; (4) pumping requirements; (5) capacity of existing water treatment facilities; (6) cost of water from wholesale providers; (7) cost to treat and distribute water from new facilities; (8) environmental disturbances; (9) capital costs to implement the alternatives; and (10) twenty-five year cost of the alternatives. Following a detailed economic and environmental evaluation, it was determined that the water supply from Bull Shoals Lake was most effective.

Copies of the Environmental Assessment are available for review at Rural Development at 402 North Walnut Street, Suite 130, Harrison, Arkansas 72601, (870) 741-4424. For further information contact Rural Development. Any person interested in commenting on this proposed should submit comments to the address above no later than 30 days from this publication.

A general location map of the proposal is shown below.



Ozark Mountain Regional Public Water Authority

Certificate of Publication

Environmental Assessment

STATE OF ARKANSAS

SS

COUNTY OF BOONE

I, Carol Lawson upon oath state that I am Business Manager of the HARRISON DAILY TIMES, a daily newspaper published at Harrison, Boone County, Arkansas, and that said newspaper has a bona fide circulation in said county, that the annexed advertisement was inserted, and published, in said newspaper for 37 consecutive weeks, as follows: 1st insertion

on the 7 day of July 2009

2nd on the 8 day of July 2009

3rd on the 9 day of July 2009

4th on the ____ day of ____ 20____

5th on the ____ day of ____ 20____

6th on the ____ day of ____ 20____

Carol Lawson

Business Manager

Subscribed and sworn to before me this 10th day of July 2009

Linda Treat, D.C.

FEE 550.88

...f Availability of
...ental Assessment

...ities Service has received an application for ...tain Regional Public Water Authority. As ...nvironmental Policy Act, the Rural Utilities ...ironmental Assessment that evaluated the ...ffects and consequences of the proposed ...nces the availability of the Environmental ...ew and comment.

...of a regional water system to serve over ...water systems in Newton County, Searcy ...oone and Marion Counties. The proposed ...take structure on Bull Shoals Lake, a water ...Lead Hill, water transmission mains, water pumping facilities. The proposed project relatively flat areas. The project will cross ... any impact to environmentally sensitive ...be considered when possible. Area streams, ...ll be crossed when flows are at a minimum. ...ployed to reduce turbidity and disturbances ...nagement practices will be used throughout the project to reduce runoff into sensitive

...ere developed and thoroughly evaluated. ...were considered in evaluating a long term ...on. Some of these factors include: (1) ...2) quality of water supply; (3) location of ...requirements; (5) capacity of existing water ...st of water from wholesale providers; (7) ...water from new facilities; (8) environmental ...sts to implement the alternatives; and (10) ...alternatives. Following a detailed economic ...on, it was determined that the water supply most effective.

RECEIVED
2009 JUL 20 AM 9: 27
HARRISON SERVICE CENTER

7/15/2009

To Whom This May CONCERN

Hi, how ARE you Today
This letter Comes From
Michael & Elba Cotignola
OF 40 YEARS

OUR Home Address is
160-21 99th STREET
HOWARD BEACH NY
11414

WE ARE WRITING YOU NOW
ASKING FOR YOUR TIME AND
HELP SINCE WE OWN
PROPERTY IN BOONE
COUNTY ARKANSAS.

#1 - IN 1992 WE bought
A 1 ACRE LAKE FRONT LOT
OFF OF HWY # 65-14 RIGHT
bEFOR THE
CRICKET CREEK MARINA
ON TABLE ROCK LAKE
FOR ONLY $4,500 WITH 221'
ON THE WATER.

#2 - THEN IN 2008 WE
bought A 60' X 120'
LOT IN DIAMOND CITY
ALSO IN BOONE COUNTY
ARKANSAS.
THIS LOT HAS WATER/
SEWER & ELIC
TO IT THE OTHER

ONE DOES NOT YET.

A- I'M WRITING YOU RIGHT NOW ASKING YOU TO PLEASE MAIL US COPIES OF THE ENVIRONMENTAL ASSESMENT

B- WE ARE ALSO WRITING YOU NOW IN SUPPORT OF THIS WATER PROJECT BECAUSE WE BELIEVE THAT ITS IMPORTANT PLUS WILL HELP WITH AREA GROWTH AND DEVELOPMENT

C- IF YOU LOOK AT DIAMOND CITY ON YOU MAP

by DIAMOND CITY

YOUS PLAN TO build A
PROPOSED INTAKE STRUCTURE
(QUESTION) CAN YOU EXPLAIN TO US WHAT THAT IS PLUS WHAT IT WILL MEAN FOR OUR LAND IN DIAMOND CITY ARKANSAS

SO PLEASE DONT FORGET US OK
WE LOOK FOWARD TO GETING COPIES OF YOUR ENVIRONMENTAL ASSESSMENT. AND ANSWERS TO OUR OUR QUESTION

D- WE DONT OWN OR KNOW HOW TO USE A COMPUTER SO COULD YOU PUT US ON A "NEW LETTER LIST"
THANK YOU FOR YOUR TIME AND HELP
Michael + Ellen Kitzinger

FAX to Bill Rowland, USDA

Engineering Services, Inc.

1207 S. Old Missouri Rd • P.O. Box 282 • Springdale, Arkansas 72765-0282
Phone: 479-751-8733 • Fax: 479-751-8746

July 28, 2009

Sent Via UPS
Signature Required

Michael and Elba Cotignola
160-21 99th Street
Howard Beach, NY 11414

RE: Ozark Mountain Regional Public Water Authority
Boone County, Arkansas

Dear Mr. and Mrs. Cotignola:

Thank you for your letter regarding the proposed intake structure on Bull Shoals Reservoir for the Ozark Mountain Regional Public Water Authority. Enclosed is a copy of the Environmental Assessment as requested. This project will provide safe, clean, and reliable drinking water to 20 cities and rural water systems in North Central Arkansas including the Diamond City water system. In addition to the intake structure, the proposed project calls for construction of a water treatment plant and an extensive distribution system that will deliver water over a three county area.

Once the system is in place, your water provider (Diamond City) will cease operation of its deep well and obtain treated surface water from Bull Shoals Reservoir. This will result in an increased available and more reliable water supply for Diamond City. Also, the quality of water will increase with the change from a groundwater source to a surface water source. The groundwater in many deep wells in this part of Arkansas have a history of high levels of radium and other contaminants. Although Diamond City's groundwater has not exceeded the allowable level of radium, current radium levels are nearing the maximum as determined by the Arkansas Department of Health and the Environmental Protection Agency.

We appreciate your support of this project. We know it will improve the quality of life for small cities and rural areas of North Central Arkansas and provide opportunities for economic development.

If you have any questions, please feel free to contact us for more information.

Sincerely,

Tim J. Mays, P.E.
Secretary-Treasurer

Enclosures

cc: Mr. Rickey Carter, USDA Rural Development
Mr. Andy Anderson, Ozark Mountain Regional Public Water Authority

EXHIBIT BB

SUMMARY REPORT FOR BIOLOGICAL EVALUATION FIELD STUDY

Final Summary Report
Biological Evaluation Field Survey
Ozark Mountain Regional Public Water Authority
Proposed Water Main
Newton County, Arkansas

Provided To:
Big Piney Ranger District
Ozark-St. Francis National Forests

Prepared by

John S. Osborne, Wildlife Biologist
11 Butler Lane
Russellville, AR 72802

August 13, 2009

Introduction

The purpose for this Biological Evaluation (BE) field survey was to identify, map, and describe species of concern within the right of way proposed for installation of a water main along Arkansas Highways 7 and 16. The proposed water main will cross national forest lands on the Big Piney Ranger District of the Ozark-St. Francis National Forests (OSF).

The Field survey was designed in accordance with contract specifications provided by the OSF to search for populations of federally listed species (T&E), Regional Forester listed sensitive species (RFSS), non-native invasive species (NNIS), caves and bluff shelters, and uncommon habitats of management concern.

This field survey has been procured and provided to the OSF by Engineering Services Inc., Springdale, AR. (ESI) The field survey will be used by the Forest Service to support the preparation of a BE for the proposed project.

Methods

A walk through survey of all Forest Service lands within Newton County, Arkansas along the proposed water main corridor was planned using maps provided by ESI. A review of the OSF GIS database indicated occurrence of 5 RFSS plants within the landscape area of the proposed water main as follows:

French's Shooting Star *Dodecatheon frenchii*
Blue Ridge Catchfly *Silene ovata*
Ozark Chinquapin *Castanea pumila var. ozarkensis*
Ozark Spiderwort *Tradescantia ozarkana*
Moore's Delphinium *Delphinium newtonianum*

A pre-field review of aerial imagery was done to become familiar with forest conditions, access, and to search for possible rare communities or habitats of management concern. Transects to be searched were digitized using Garmin mapsource software and were downloaded into a Garmin GPS map 60csx GPS unit. Transect history was recorded using this same GPS unit. Track logs of all walk through transects were defined using Forest Service naming conventions. Individual waypoints representing individual element occurrence records were also defined using the naming conventions. Notes were collected at each waypoint and digital images of RFSS and NNIS were taken at each location. Digital images were identified using Forest Service naming conventions.

Results

Field survey was done August 08 and 10, 2009 A total of 4.5 miles of transects were surveyed. The track logs are summarized in Table 1.

Table 1. Track Log Summary, Ozark Regional Water Main Biological Evaluation Field Survey

Track Number	Waypoints Associated with Track
BE080809A	None
BE080809B	ALJU080809B1
BE080809C	CAPU080809C1
BE080809D	ALJU080809D1, CAPU080809D1, CAPU080809D2
BE080809E	SPDI081009E1 (Diana Fritillary Butterfly, species of concern)
BE081009A	ALJU081009A1, MIVI081009A1
BE081009B	None
BE081009C	None
BE081009D	ROMU081009D1, ROMU081009D2, ACST081009D1 (Sharp-shinned Hawk, species of concern)

This summary shows the waypoints associated with each track log using standard naming conventions. Naming conventions are shown in Attachment 1.

A narrative of individual waypoints is shown in Table 2. Garmin mapsource gdb files showing both tracks and waypoints are included in Attachment 3.

Species and Habitats Encountered

No federally listed T&E species were identified during this field survey. No rare communities or habitats of management concern were encountered as part of this survey.

The dominant forest cover types for the areas surveyed were immature dry oak-hickory forest and immature dry pine-oak forest. The dominant and co-dominant trees were of small saw timber and/or round wood size. All of the area surveyed had been impacted by a severe ice storm the previous winter which resulted in many of the remaining trees having broken tops. Dead and down large woody debris was abundant on the forest floor. Transects surveyed occurred on upper slopes and ridge tops with variable aspect. Small inclusions of dry-mesic oak hickory forest was noted where transects crossed the upper reaches of ephemeral streams. Linear patches of herbaceous open land, shrub-scrub, and early successional oak-hickory forest were encountered within existing power line rights of way.

These cover types would provide suitable foraging habitat for Gray bat *myotis grisescens,* Indiana bat *Myotis sodalis,* and Ozark big-eared bat *Corhnorhinus townsendii ingens*. These forested areas adjacent to the proposed water main would also provide suitable breeding habitat for Indiana bat.

Regional Forester Sensitive Species

Ozark chinquapin *Castanea pumila var. ozarkensis,* was found at 3 locations generally near the intersection of State Highway 7 and State Highway 16. Single and multiple individual Ozark chinquapin plants were encountered. None of the stems or sprout clumps encountered showed sign of reproduction and all of the stems showed sign of chestnut blight infection. The naming conventions used for individual waypoints are shown in Attachment 1. Digital images of all Ozark chinquapin locations are included in Attachment 2.

Table 2. GPS coordinates and field notes for Ozark chinquapin locations

Waypoint Number / Coordinates	Notes
CAPU080809C1 N 35.84230 W093.19814	Found 1 Ozark chinquapin sprout clump about 2 feet tall. This sprout shows sign of blight infection and previous die back. Seed production is not possible due to the small size of this sprout. Habitat in the area is closed canopy dry oak-hickory forest. There were no additional sprout clumps noted in the general area of this record.
CAPU080809D1 N 35.84920 W093.19642	Found 2 Ozark chinquapin sprout clumps about 2.5 feet tall separated by about 6 feet. These sprouts show sign of blight infection and previous die back. No seed production would be possible due to the small size of these sprouts. Habitat in the area is closed canopy dry oak-hickory forest. There were no additional sprout clumps noted in the general area of this record
CAPU080809D2 N 35.84758 W093.19661	Found 2 Ozark chinquapin sprout clumps each about 4 feet tall separated by about 2 feet. These sprouts show sign of blight infection and previous die back. No seed production would be possible due to the small size of these sprouts. Habitat in the area is closed canopy dry oak-hickory forest. There were no additional sprout clumps noted in the general area of this record

Non-Native Invasive Species

GPS coordinates and field notes for non-native invasive species locations are shown it table 3. The naming conventions used for individual waypoints are shown in Attachment 1. Digital images of all NNIS locations are included in Attachment 2.

Table 3. Non-native Invasive Species Field Notes

Waypoint Number / Coordinates	Notes
ALJU080809B1 N 35.83564 W093.20800	Found 1 mimosa tree adjacent to the road and house at the north end of the Track. The tree is about 6 feet tall. There was no landline found at this location and it is possible that the location might be on private land. Having worked on this forest, I have knowledge that there are a number of landline disputes between Forest Service and private landowners in this general area.
ALJU080809D1 N 35.85270 W093.19546	Found 1 mimosa tree growing in the middle of the existing Deer waterline right of way. The tree is about 12 feet tall and there is no sign of reproduction from this tree. Control would be very easy right now with a combination of cutting and herbicide application.
ALJU080810A1 N 35.80209 W093.12722	Found multiple mimosa trees in and adjacent to the power line right of way. The extent of spread of this site is approximately .01 acre. There are about 8-10 seedlings in the vicinity of a 7 foot tall tree in the middle of the power line and there is a tree about 12 feet tall down slope of the right of way. Other Mimosa trees were noted upslope along State Highway 7. Herbicide control of all of the stems in the area would be the only way to stop the spread of this tree. Soil disturbance with the installation of the water main would probably increase the number of mimosa trees in the area.
MIVI081009D1 N 35.80767 W093.12817	Found a dense stand of microsteguum in the existing buried telephone line right of way which is adjacent to the proposed water main. The extent of coverage is an area about 10 feet wide and 100 feet long. This species is growing in partial shade and will no doubt colonize the adjacent proposed water main right of way. Herbicide control prior to installation of the water main would reduce the chance that this species would become established on the water main right of way
ROMU081009D1 N35.82268 W93.17330	Found multiple Multiflora rose clumps near the intersection of an old forest road and State Highway 7. Not surprisingly there is an old home site close by. The clumps are scattered over an area about .05 acre and comprise about 5-10% of the total ground cover. This site could be easily treated with herbicide
ROMU081009D2 N 35.82569 W93.17308	Found 1 clump of Multiflora rose in the middle of the old abandoned forest road. This single plant could be easily treated with herbicide.

Species of Concern

2 species of management concern were noted during this survey. These species were reported because they are uncommon and known to be declining range wide or are uncommon as breeding species on the Ozark-St. Francis National Forests. These locations are provided as a courtesy to forest managers.

Table 4 Species of Concern

Waypoint Number / Coordinates	Notes
SPDI080809E1 N 35.89135 W093.19113	Observed 1 female Diana Fritillary butterfly in the power line right of way. The observation was brief with no opportunity to get a photograph. Populations of this butterfly have declined range wide and the species is uncommon in the interior highlands.
ACST081009D1 N 35.82526 W093.17323	Flushed a Sharp-shinned Hawk from the forest canopy adjacent to the old closed road. The observation was brief with no opportunity to photograph the bird. Sharp-shinned Hawks are an uncommon breeding species for this area but are a common winter migrant. This observation is post breeding season but prior to the onset of fall migration suggesting this might have been a breeding bird.

Attchment 1. Naming Conventions for Track Logs, Waypoints and Digital Images:

Threatened and Endangered Species

Scientific Name	Common Name	Abbreviation
Myotis grisescens	Gray Bat	mygr
Myotis sodalis	Indiana Bat	myso
Corynorhinus townsendii ingens	Ozark Big-eared Bat	coti
Cambarus zophonastes	Hell Creek Cave Crayfish	cazo
Lesquerella filiformis	Missouri Bladderpod	lefi
Alligator mississippiensis	American Alligator	almi
Amblyopsis rosae	Ozark Cavefish	amro
Scaphirhynchus albus	Pallid Sturgeon	scal
Nicrophorus americanus	American Burying Beetle	niam
Campephilus principalus	Ivory-billed Woodpecker	ibwo
Sterna antillarum	Interior Least Tern	ilte
Potamilus capax	Fat Pocketbook	poca
Lampsilis streckeri	Speckled Pocketbook	last
Lampsilis abrupta	Pink Mucket	laab
Leptodea leptodon	Scaleshell Mussel	
Inflectarius magazinensis	Magazine Mountain Shagreen	inma
Cambarus aculabrum	Cave Crayfish	caac
Lindera mellissifolia	Pondberry	lime
Geocarpon minimum	Geocarpon	gemi

Regional Regional Forester’s Sensitive Species and Other Species of Interest

Scientific Name	Common Name	Abbreviation
Myotis leibii	Eastern small-footed bat	myle
Aimophila aestivalis	Bachman's sparrow	basp
Haliaeetus leucocephalus	Bald Eagle	baea
Dendroica ceruea	Cerulean Warbler	cewa
Eurycea tynerensis	Oklahoma salamander	oksa
Notropis ozarcanus	Ozark shiner	nooz
Percina nasuta	Longnose darter	pena
Typhlichthys subterraneus	Southern cavefish	tysu
Orconectes williamsi	William's crayfish	orwi
Lampsilis rafinesqueana	Neosho mucket	lara
Paduniella nearctica	Nearctic paduneillan caddisfly	pane
Lirceus bicuspidatus	An isopod	libi
Amorpha ouachitensis	Ouachita false indigo	amou
Callirhoe bushii	Bush's poppymallow	cabu
Castanea pumila var. ozarkensis	Ozark chinquapin	capu
Cypripedium kentuckiense	Southern Lady's slipper	cyke
Delphinium newtonianum	Moore's delphinium	dene
Delphinium treleasei	Glade larkspur	detr
Dodecatheon frenchii	French's shooting star	dofr
Draba aprica	Open-ground draba	drap
Eriocaulon koernickianum	Small-headed pipewort	erko
Fothergilla major	Large witchalder	foma
Juglans cinerea	Butternut	jubu
Neviusia alabamensis	Alabama snow-wreath	neal
Quercus acerifolia	Mapleleaf oak	quac
Schisandra glabra	Bay starvine	scga
Silene ovata	Blue Ridge catchfly	siov
Silene regia	Royal catchfly	sire
Solidago ouachitensis	Ouachita Mountain goldenrod	soou
Tradescantia ozarkana	Ozark spiderwort	troz
Trillium pusillum var. ozarkanum	Ozark least trillium	trpu
Valerianella nuttallii	Nuttall's cornsalad	vanu
Valerianella ozarkana	Ozark cornsalad	vaoz

Rare Communities, Habitats, or Features of Interest

Rare Community or Habitat of Interest	Abbreviation
Glade	glade
Seep	seep
Sinkhole	sink
Wetland	wetlnd
Pond (man made)	pond
Bluff shelter	blsh
Cane break	cane
Vernal pond (natural)	vpond
Cave	cave
Historic Evidence of Fire	fire
Homesite	home

Non-native Invasive Species

Scientific Name	Common Name	Abbreviation
Ailanthus altissima	Tree of Heaven	aial
Elaegnus umbellata	Autumn Olive	elum
Lonicera japonica	Japanese Honeysuckle	loja
Lespedeza bicolor	Lespedeza Bicolor	lebi
Lespedeza cuneata	Lespedeza Sericea	lecu
Microsteguum vimineum	Japanese Stilt Grass	mivi
Paulownia tomentosa	Princess Tree	pato
Rosa multiflora	Multiflora Rose	romu
Ligustrum sp.	Privet	lisp
Pueraria montana	Kudzu	pumo
Alliaria petiolata	Garlic Mustard	alpe
Centaurea beibersteiniil	Spotted Knapweed	cebe
Albizia julibrissin	*Silktree, Mimosa*	alju
Lythrum salicaria	Purple Loosestrife	lysa
Wisteria sinense	Asian Wisteria	wisi
Melilotus alba	Sweetclover	meal

Attchment 2. Photos taken at RFSS and NNIS locations:

CAPU080809C1

CAPU080809D1

CAPU080809D2

ALJU080809B1

ALJU080809D1

MIVI081009A1

ROMU081009D1

ROMU081009D2

EXHIBIT CC

BIOLOGICAL EVAULATION REPORT
U.S. FOREST SERVICE

Ozark Mountain Regional Water Project
Biological Evaluation
FOR
Federally Listed & Regional Forester's Sensitive SPECIES

Ozark-St. Francis National Forest
Big Piney Ranger Districts
Newton County, Arkansas

Prepared by
Ronald D. Rambo
District Wildlife Biologist

Introduction

The purpose of this Biological Evaluation (BE) is to identify the likely effects of the proposed action and alternatives on Federally-listed Threatened and Endangered. The Biological Evaluation is done to ensure that Forest Service actions do not contribute to loss of viability or trend toward Federal listing of any species; to comply with the requirements of the Endangered Species Act that actions of Federal agencies not jeopardize or adversely modify critical habitat of Federally-listed or proposed species; to provide a process and standard by which to ensure that Threatened and Endangered species receive full consideration in the decision making process; and to ensure compliance with Biological Assessment for the OSFNF Land and Resource Management Plan (7/27/05) and the September 22 2005 Biological Opinion for the American Burying Beetle OSFNF Arkansas. The best available science was used in the site specific analysis for all species covered in this BE. The BE will be divided into two sections a Federally Threatened and Endangered Section and a Regional Forester's Sensitive Species Section.

Project Location:
The project area is adjacent to highway 7 from the northern proclamation boundary south to Lurton Arkansas and west from intersection of highway 7 and 16 to Deer, Arkansas. For specific, see attached maps.

Proposed Management Actions:
The Big Piney Ranger District is proposing to issue a permit to allow the Ozark Mountain Regional Public Water Authority (OMRPWA) to construct approximately 3.2 miles of waterline on National Forest Land. The Right of way for the line will be 25 feet wide. Within the right of way, a trench measuring 30 inches wide by 54 inches deep will be dug. A 12 " ductile iron pipe will be laid at least 36 inches deep. It is estimated that the project will need 2 to 3 months to complete. All federal lands will be seeded, fertilized and mulched, as required by U.S. Forest Service officials. No additional work areas for construction of the 12" water transmission main will be required on federal lands. Areas for storage of materials and equipment will be acquired on private lands. Once installed and operational, the water transmission main will be used 365 days a year to transport treated water to nearby water associations and communities. The OMRPWA will have booster pumping facilities and water storage tanks on private property

It is anticipated that the brush will be removed (by cutting / trimming) every three (3) to four (4) years. The Ozark Mountain Regional Public Water Authority (OMRPWA) will not use herbicides or pesticides for maintaining the right-of-way on U.S. Forest Service properties. Also since most of the proposed water transmission main is adjacent to or within other existing utility right-of-ways, maintenance performed may be shared by utilities. It is likely that in addition to the water transmission main on U.S. Forest Service property, a couple of water valves will be installed. All valves will be below grade with only the top of the valve box visible from the ground. The valve boxes are typically flush with the ground. The valve is operated via a 2" nut on top of the valve, which is accessed through the valve box. At these valve locations, a visual marker will be placed at the Arkansas Highway Department Right-of-Way to allow for the operations manager to identify the locations of the valves. Other than opening and closing valves, little maintenance is required. In the event a leak is found on the transmission main along U.S. Forest Service property, the leak will be repaired, cleaned-up, seeded, fertilized and mulched. OMRPWA will contact the local U.S. Forest Service to advise of the repair activities.

Assumptions of the Project Analysis

- Mature forest cover is maintained within 100 feet slope distance from the top of bluffs and 200 feet slope distance from the base to provide wildlife habitat associated with unique landform. Within this zone, activities are limited to those needed to ensure public safety or to maintain and improve habitat for federally listed species or other species whose viability is at risk.

- Herbicides and application methods are chosen to minimize risk to human and wildlife health and the environment. Diesel oil will not be used as a carrier for herbicides, except as it may be a component of a formulated product when purchased from the manufacturer. Vegetable oils will be used as a carrier for herbicides when available and compatible with the application proposed.

- Herbicides are applied at the lowest rate effective in meeting project objectives and according to guidelines for protecting human and wildlife health. Application rate and work time must not exceed levels that pose an unacceptable level of risk to human or wildlife health. If the rate or exposure time being evaluated causes the Margin of Safety or the Hazard Quotient computed for a proposed treatment to fail to achieve the current Forest Service Region 8 standard for acceptability (acceptability requires a MOS > 100 or, using the SERA Risk Assessments found on the Forest Service website, a HQ of < 1.0), additional risk management must be undertaken to reduce unacceptable risks to acceptable levels or an alternative method of treatment must be used.

- Weather is monitored and the project is suspended if temperature, humidity, and/or wind do not meet the criteria shown in Table 3-2.

  - **Table 3-2: Necessary Criteria for Herbicide Application.**

Application Techniques	Temperatures Higher Than	Humidity Less Than	Wind (at Target) Greater Than
Ground			
Hand (cut surface)	NA	NA	NA
Hand (other)	98°	20%	15 mph
Mechanical (liquid)	95°	30%	10 mph
Mechanical (granula	NA	NA	10 mph

- No soil-active herbicide is ground applied within 30 feet of the drip line of non-target vegetation specifically designated for retention (e.g., den trees, hardwood inclusions, adjacent untreated stands) within or next to the treated area. However, chemical side pruning is allowed in this buffer if necessary, but movement of herbicide to the root systems of non-target plants must be avoided. Buffers are clearly marked before treatment so applicators can easily see and avoid them.

- No herbicide is ground broadcast within 60 feet of any known threatened, endangered, proposed, or sensitive species except for endangered bats. Selective applications may be done closer than 60 feet, but only when supported by a site-specific analysis. Selective herbicide treatments using a non-soil active herbicide may be used closer than 60 feet to protect TES plants from encroachment by invasive plants.

- Application equipment, empty herbicide containers, clothes worn during treatment, and skin are not cleaned in open water or wells. Mixing and cleaning water must come from a public water supply and be transported in separate labeled containers.

- Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas.

- Herbicide will not be used within the appropriate SMZs or within 300 feet of any public or domestic water intake. Selective treatments may occur within SMZs only when a site-specific analysis of actions to prevent significant environmental damage such as noxious weed infestations supports a "Finding of No Significant Impact" (FONSI), and then using only herbicides labeled for both terrestrial and aquatic use within these areas.

- Promote and implement current Best Management Practices (BMPs) for forestry as recommended by the Arkansas Forestry Commission to all management activities in order to control non-point source pollution and comply with state water quality standards.

- Tree cutting are prohibited in primary and secondary Indiana bat zones between May 1 and November 30. Adjustments to these dates may be made on a project-specific basis through coordination with the Arkansas Field Office, USFWS. Site-specific inventories are good for two calendar years from the date of survey completion.

- Tree cutting and salvage operations can occur between December 1 and March 15 without a site-specific inventory. Additional coordination with USFWS is not required.

All standards and guidelines set forth in the Forest Plan and the State Best Management Practices (BMPs) would be followed in all alternatives for the various activities proposed in the project on Forest Service Land.

Consultation History:
The US Forest Service sent a Biological assessment that assessed the potential effects of implementation of the 2005 Revised Land and Resource Management Plan for the Ozark-St. Francis National Forest to the US Fish and Wildlife Service (USFWS) for review on August 9, 2005. USFWS sent a concurrence letter and initiated formal consultation in accordance with Section 7 (a) 2 of the Endangered Species Act on August 17, 2005.

On September 22, 2005, A non-jeopardy Biological Opinion for the American Burying Beetle (Nicrophorus americanus) was issued on the effects of implementation of the 2005 Revised Land and Resource Management.

Species Considered
Federally Endangered or Threatened known or likely to occur on Ozark National Forest are in Tables 1. Presence and absence of these species in or around the project area was determined by using Arkansas Heritage Database; fish, crayfish, and Mussel information from John Harris (November 2003), Henry Robison (2004), Chris Davidson (2004), Thomas Buchanan, (2004) and the Ozark-St. Francis National Forest SVE Database (SVE).

The Arkansas Heritage Database contains information on specific locations for Threatened and Endangered species as well as sensitive species. This information is compiled from field surveys and research conducted by the Arkansas Game and Fish Commission, U.S. Forest Service, and other agencies.

SVE is a database that was compiled by the U.S. Forest Service in partnership with various State and Federal Agencies, local and regional organizations, universities and local experts. This database contains information on distribution, species status, species habitat and conservation strategies for all species of concern on the forest. This information will be periodically updated as new information becomes available.

Project Surveys
The following surveys have been conducted in the project area:

- Bat Mist Net Surveys, Dr. Thomas Risch (ASU)
- Walk through surveys for sensitive and federally threatened and endangered species and rare communities, Steve Osborne.

General Surveys
Surveys that were used to determine potential habitats and distribution within the vicinity of the project are

- Winter eagle surveys
- Forest bat surveys
- Arkansas breeding bird survey routes
- Christmas Bird count,
- Spring Migration Bird Count.

Federally Listed (Endangered or Threatened) Species:

Nineteen federally listed species have been identified by the US Fish and Wildlife Service, Conway Office as occurring or having the potential to occur on the Ozark-St. Francis National Forests. These species are listed below in Table 1.

Sixteen of these federally listed species, from Table 1 were eliminated from consideration because 1) they do not occur on the Forest, 2) their known distribution is well outside the counties that make up the Big Piney Ranger District or the project does not contain potential habitat. These species are in regular type (i.e. not bolded) in Table 1. The proposed action will have "*no effect*" on these species or their habitat and they will not be considered further in this BA/E. No further consultation with the US Fish and Wildlife Service for these species is required. Indiana Bat, Ozark Big Eared Bat and Gray bat will be given further consideration in this document due to their known occurrence or presences of potential habitats within the project area. These species are indicated in **bold print** in Table 1.

Critical Habitat

The Endangered Species Act (1973) defines "critical habitat" for a threatened or endangered species as follows: "(i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and(ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species."

There is no critical habitat for any federally-listed species on the Big Piney Ranger District of the OSFNF. There is no known occupied or unoccupied habitat required for recovery of any of these species discussed here in the project area, or the Big Piney Ranger District.

White-nose Syndrome

In the Northeast, bat populations are experiencing massive die offs due to a cold loving fungus called the white-nose syndrome (WNS). The syndrome is named after the white coloration that typically appears around the muzzle of infected individuals. The fungus is a member of the group Geomyces that live in soil, water and air. This group of fungus can grow and reproduce in refrigerator-level temperatures. This syndrome has killed over 100,000 hibernating bats in New York Vermont, Western Massachusetts and northwestern Connecticut. Currently, the vector or source of this fungus is unknown. WNS has infected populations of Indiana bat in the Northeast and conservationists are extremely concerned that it will spread to new populations of bats. Currently no WNS has been documented in Arkansas.

Gray Bat (*Myotis grisescens*)

Life History/Species and Habitat Description / Distribution

Gray bat (Federally Endangered) are medium-sized with a wingspan of 10-11 inches, and are the largest *Myotis* species in the eastern United States. They have grayish-brown fur and are the only *Myotis* species whose wing membrane attaches to their ankle instead of the base of the first toe. The gray bat range is limited to the limestone karst areas of the southeastern and central United States.

The gray bat is primarily restricted to cave habitats and will rarely use other habitats. This species has very specific cave requirements; as a result, less than five percent of available caves are utilized. These requirements vary depending on time of year, age, and sex. Summer caves must be warm (55^o-77^o F), or with restricted rooms that can trap the body heat of roosting bats, and winter caves are very cold with a range in temperature between 42^o and 52^o F. These caves are deep with vertical walls and act as cold air traps. During transient periods, gray bats may use transient caves that have less restrictive requirements than summer and winter caves. In addition, males and yearling females will use a wider variety of caves and roost sites throughout the year than mature females.

Summer caves are typically located within 1 mile, rarely over 2 miles, from rivers and reservoirs over which they forage. Gray bats primarily forage on emergent aquatic insects.

Gray bats breed at winter caves during September. Females will store sperm over the winter and become pregnant after emerging in late March. A single offspring is born in late May or early June. Young become volant 20 to 25 days after birth.

Reasons for the decline of the gray bat are as follows:

1. Human disturbance of the bats,
2. Human disturbance to the environment such as vegetation manipulation in riparian areas and around caves, and road construction across streams,
3. Cave destruction from impoundments,
4. Cave commercialization, and
5. Natural sources of mortality.

Site-Specific Effects

This project will be within 2 miles of a known hibernaculum for this species. The primary concern is potential affects to foraging habitat from loss of prey base due to increase sedimentation rates in local streams. The risk of this project increasing sedimentation in the streams to the point of affecting aquatic biota is low due to the location of the line, on ridge tops. In addition, the seeding and mulching the line will further reduce the risk.

No caves were identified in the project area during surveys and the project is approximately 2 miles from a known occupied cave. This project will not affect cave habitats.

Cumulative Effects

The project does contain approximately 11.8 miles of line on privateland within the proclamation boundary and another 100 miles outside. Activities in these areas will include use of herbicide for maintenance of line construction of facilities for boosters and storage of equipment along with the activities identified above. In a letter from The US Fish and Wildlife Service dated 07/21/09, the Service stated they did not expect any effects to this species from these activities.

Effects Determination

The determination for gray bats is **No Effect**.

Indiana Bat (*Myotis sodalis*)

Life History/Species and Habitat Description/Distribution

The Indiana bat (Federally Endangered) is a medium-sized bat with a total length of 3 to 4 inches and a wingspan of 9.5 to 10.5 inches. This bat closely resembles the little brown bat (*Myotis lucifigus*) and the northern long-eared bat (*Myotis septentrionalis*). The Indiana bat usually has a distinctly keeled calcar; hind feet tend to be small with shorter hairs on the toes that do not extend beyond the toenails; and fur exhibits a faint three-colored pattern when parted, basal 2/3 brownish black followed by a narrow grayish band and a cinnamon brown tip. The fur of the belly and chest on an Indiana bat is lighter than the flat pinkish-brown fur of the back, but this character is not as distinct for the Indiana bat as the little brown bat and northernlong-ear bat. Also, the Indiana bat has a smaller sagittal crest and tends to have a smaller, lower, and narrower braincase than the little brown bat. The Indiana bat is found throughout the eastern half of the United States.

Indiana bats hibernate in caves and mines during the winter. These sites tend to have temperatures between 39^{o} and 46^{o} F and relative humidity above 74% and below saturation. The Indiana bat has been documented using sites other than caves and mines (e.g. hydroelectric dam), but these sites have favorable microclimates. Summer habitat for Indiana bats are floodplains, and riparian and upland forest with trees that have ex-foliating bark for roosting. This bat will also use old fields and pastures with scattered trees for foraging habitats. Some tree species the Indiana bat will use for roosting are American beech (*Fagus grandifolia*), black gum (*Nyssa sylvatica*), black locust (*Robinia pseudo-acacia*), elm (*Ulmus* spp.), hickory (*Cayra* spp.), maple (*Acer* spp.), pine (*Pinus* spp.), oak (*Quercu*s spp.), sassafras (*Sassafras albidum*), sourwood (*Oxydendrum arboreum*), sweet birch (*Betula lenta*), and yellow buckeye (*Aesculus octandra*). Most of these tree species have the proper characteristics for roost sites after they are dead or dying, but species such as shagbark hickory and white oak are used while they are still living. Romme, et al. (1995) found that maternity roost sites were usually located in areas with 60 to 80% canopy cover. Indiana bats will also utilize roosts where the canopy closure is higher than 80% when temperatures are above normal or during periods of precipitation.

Indiana bats forage in and around the forest tree canopy for aquatic and terrestrial flying insects. Some of these insects are moths (Lepidoptera), caddisflies (Trichoptera), stoneflies (Plecoptera), beetles (Coleoptera), flies (Diptera), leafhoppers and treehoppers (Homoptera), and lacewings (Neuroptera). Foraging heights are usually from 6 to 100 feet above ground level. Also, canopy closure for foraging habitat has been found to range from 30% to 100% in floodplain habitats.

Indiana bats begin to swarm in August-September, and breeding usually occurs in the latter half of this time period. After mating, females will enter directly into hibernation and store sperm over the winter. Females become pregnant after emerging the following spring. Indiana bats typically form maternity colonies with 100 or fewer adult bats. Young are born in late June or early July, and become volant within a month after birth.

Arkansas population estimate from priority 1 and 2 hibernacula and priority 3 and 4 when available for 2007 is 1,829 bats which is slightly down from 2,067 bats in 2005. This estimate is 0.4 % of the rangewide population estimate of 468,184.

Possible reasons for the decline of the Indiana bat are:

1. Human disturbance and vandalism of hibernacula caves,
2. Improper cave gates and structures,
3. Natural hazards such as cave collapsing or flooding,
4. Changes in cave microclimates,
5. Changes in land use practices (e.g. fire suppression and an increase in density of forest surrounding hibernacula caves), and
6. Chemical contamination.

Site-Specific Effects

The project is within a 5 mile buffer zone for Indiana Bat. The primary concern for this species is potential loss of prey base due to increase sedimentation in local streams, direct mortality of individuals from cutting trees, and loss of potential roost trees.

The potential risk to the species prey base is low for the reasons identified in the gray bat section.

Risk of direct mortality of individuals from cutting trees would be highest for non-volant young. There are no known maternity sites on the Ozark National Forest or in Arkansas. Older volant individuals are highly mobile and are not likely to be harmed by this activity. In addition, these trees will be removed adjacent to state highways with a considerable amount of traffic. The disturbance is likely to reduce the suitability of these trees for roost.

If the trees are cut between December 1 and March 15th, any risk to the bat will be eliminated and no further measures will need to be taken. Outside of this time period, surveys will have to occur within 2 years of the actual removal of trees. Surveys were conducted between June and August 15th of 2009 in and around the proposed project area. No bats were captured. Additional surveys will not need to be done until June 1, 2011.

The surrounding area has more than 6 suitable roost trees per acre on average so the loss of these trees will not affect the species potential roosting habitat in that area

Cumulative Effects

See Gray bat section for potential cumulative effects. Also the project is only expected to affect approximately 28 acres of forested land within the proclamation boundary of the Ozark National Forest.

Effects Determination

Indiana bats have been documented in the vicinity of the project area. No Indiana bats were identified during recent mist net surveys conducted in and around the project area but it is within 5 miles of known locations for this species. There is some risk of direct harm or mortality of individuals from the tree cutting operation but it is considered extremely low. For this reason, the determination is MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT.

Ozark Big-eared Bat
(*Corynorhinus townsendii ingens*)

Life History/Species and Habitat Description / Distribution

The Ozark big-eared bat is the larges and reddest of the five subspecies of *Corynorhinus townsendii*. The species is medium-sized and weighs from 0.2-0.4 ounces. It has very large (1 inch) ears that connect at the base across the forehead. The snout has prominent lumps due to the large facial glands. The Ozark big-eared bat closely resembles the eastern big-eared bat, but has tan instead of white underparts and brown instead of gray dorsal hair.

This species historically occurred in Northeastern Oklahoma, Northwestern Arkansas and Southwestern Missouri. The total population is believed to be comprised of less than 2000 individuals with the majority in Oklahoma. The Ozark big-eared bat is believed to be extirpated from Missouri. This species has been reported in Crawford, Marion, Franklin, and Washington counties in AR.

This species inhabits karst regions dominated by mature hardwood forests and utilizes caves year around as roost. It primarily forages on lepidoptera. The primary threat is believed to be disturbance and vandalism of their cave habitats.

Site Specific effects

This species has not been document on the Big Piney Ranger District, but potential sign of Ozark Big-eared bat use has been documented on the District. As stated in the gray bat section, no caves were identified in the project area; therefore potential cave habitats would not be affected and due to the size of the trench that will be constructed it is not likely to affect caves adjacent to the project area.

The project area would be suitable forage habitat. The construction of a 25 foot wide corridor would not affect the suitability of the project area for foraging. In fact where it meanders outside of the existing right of way, bats are known to utilize these areas for both travel and foraging.

Cumulative Effect

This project is only expected to affect 28 acres of forested habitats within the proclamation boundary of the Ozark national Forest. Also see the gray bat section for additional information.

Effects Determination
This project is not expected to affect potential or known habitats for this species. For this reason, the determination is **NO EFFECT**.

Effects Determination
The activities identified in this project can affect sedimentation rates in the streams, but with the project standards, these effects should be insignificant and are not likely to affect the aquatic biota. For this reason, a determination of **MAY AFFECT, NOT LIKELY TO ADVERSLY AFFECT** is made for this species.

Regional Forester's Sensitive Species
Site-Specific Effects & Determinations

Thirty-two species occurring or having the potential to occur on the Ozark-St. Francis National Forests have been identified by the Regional Forester (Region 8) as Sensitive. These species are listed in Table 2.

28 of the Forest Sensitive species, taken from Table 2, were eliminated from further consideration for projects on the Ozark National Forest. These eliminated species either 1) do not occur on the Big Piney Ranger District, 2) do not have potential habitat in the project area, and/or 3) do not occur as defined by the known and historic ranges of these species and habitat requirements. These species are in regular type (i.e., not in bold) in the following table. Therefore the proposed project will have "**no impact**" on these species, and they will not be considered further in this BE.

The remaining Sensitive species will be given further consideration in this document due to their known occurrence on the Big Piney Ranger District or their potential for occurrence due to the presence of suitable habitat and nearby records. These species are indicated in bold print in Table 2.

Bald Eagle (*Haliaeetus leucocephalus*)

Life History/Species and Habitat Description /Distribution
Bald eagles are large birds with a body length of 32 inches and wingspan of 80 inches. Adult birds have a brown body with a white head and tail. Immatures are brown, mottled irregularly with white until approximately their fourth year. This eagle is similar to the golden eagle, but can be distinguished from it by the bald eagle's much heavier bill, legs feathered halfway down the tarsus, flying with deep strokes, and soaring on flattened wings. Bald eagles occur in most of the United States and Canada.

The bald eagle is associated with aquatic environments throughout the majority of its range. Fish is the primary prey item. They will also feed on many other types of prey such as waterfowl and small mammals, and have been observed feeding on carrion, especially in wintering areas.

Nesting activities may begin as early as January with incubation and rearing of young occurring from March through mid-May. Nesting sites are usually in mature trees along shorelines, but they may also use cliffs or rock outcrops where large trees are not available. These sites are typically within two miles of water. Females lay one to three eggs, depending on environmental conditions and the fitness of the female. Incubation lasts about 35 days, and young fledge 10-14 weeks after hatching. In Missouri, most young fledge from June 1 to mid-July.

Reasons for the decline of the bald eagle have been well documented:

- Environmental contamination, particularly organochlorine insecticides like DDT-caused egg-shell thinning and reproductive failure and the illegal use of pesticides,

- Human disturbance of eagle nests and night roosts,

- Intentional killing by shooting or poisoning, and

- The degradation and alteration of roosting and nesting habitats.

Site-specific and Cumulative Effects
No communal roost or even secondary roosts were identified in the project area for this species. If the area is used, it is probably only transient in nature. US Fish and Wildlife Service also looked at the potential effects to this species for the entire project and found that the project is not expect to impact this species (letter dated 2009 signed by Lindsey Lewis).

Impacts Determination
The determination is NO impact.

An Isopod (*Lirceus Bicuspidatus*)
Life History/ Habitat Description / Distribution

This Isopod is found in small cave streams, seeps and small headwater streams but optimal habitat is believed to be spring runs. Little is known about the life history and distribution of this species. It has been recorded in the Arkansas River drainage in the Boston and Ouachita Mountains ecoregions, and White River drainage in the Boston Mountain and Ozark Highlands ecoregions, Threats to species are believed to be point source pollution and sedimentation form resource extraction.

Direct, indirect and cumulative effects
There is some potential of contamination of aquatic habitats from use of herbicide, and chlorinated water. The Fish and Wildlife Service has assisted in developing BMPs to reduce the potential of contamination of the water. Along with Forest Plan Standards, this should minimize the risk to this species

Effects Determination
The determination is May Impact individuals but not likely to cause a trend to federal listing or a loss of viability.

Ozark Chinquapin (*Castanea pumila var. ozarkensis*
Life History/ Habitat Description / Distribution
Ozark chinquapin, Castanea pumila var. ozarkensis is a forest sensitive species. Until the introduction into this country of the chestnut blight (Endothia parasitica) and its subsequent spread, the Ozark chinquapin had been considered a locally abundant and widespread tree species in the Interior Highland region. As a result of the spread of this parasite, few mature trees of this species still exist although sprouting from stumps is quite common (Tucker, 1980).

This species is found on all Ozark NF districts, except the St. Francis NF.

Direct, Indirect and Cumulative Impactss:
Three sprout clumps were identified in the project area. All were infected with the blight. These activities will remove these individuals on Forest Service land and potential others from privateland. There is some risk from the herbicide spray on privatelands.

Impacts Determination
This species has been documented in the project area. The primary threat to the species is the chestnut blight. This species is wide spread on the district and Ozark National Forest. In addition the area affect is relatively small 28 acres over 15 miles; for these reasons, the determination is May Impact individuals but not likely to cause a trend to federal listing or a loss of viability.

Moore's larkspur (*Delphinium newtonianum*)
Life History/ Habitat Description / Distribution
Moore's delphinium is endemic to and locally abundant in two disjunct regions of the Interior Highlands regions of Arkansas, but it is unknown from either Missouri or Oklahoma. Preliminary biological data indicates it is of widespread occurrence within a relatively small area in the Ozark National Forest, where it occurs in both mature and early successional vegetation types. Moore's delphinium "prefers light to heavy shade of hardwoods, a moist loamy clay or sandy clay loam" (Kral, 1983). It also occurs on sites having at least some pine in the overstory and along roads, trails, and openings in forested areas (Tucker, 1990).

Direct, indirect and cumulative Impacts
This species is known to occur in the project area. Construction of the corridor may remove individuals from the project area but likely to re-colonize the area from the surrounding area. In fact, the narrow corridors will open the canopy some and increase the suitability for this species along the edges of the corridor. On National Forest land, where herbicide will not be applied the species will probably persist in the area after the implementation of the project. Herbicide treatment could impact individuals on privateland.

Impacts Determination
This species is common on the District, particularly in this area and is likely to continue to persist in the project area. For these reasons, the determination is May Impact individuals but not likely to cause a trend to federal listing or a loss of viability.

/s/ Ronald DRambo 8/18/09

District Wildlife Biologist Date

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Databases and Websites

Ozark-St. Francis National Forest SVE Database

Arkansas Natural Heritage Commission database

http://www.natureserve.org/explorer/
http://www.fws.gov/northeast/white_nose.html
http://www.fws.gov/midwest/endangered/mammals/inba/index.html

Personal Communications

Margaret Harney, Acting Field Supervisor, U.S. Fish and Wildlife Service, Conway Arkansas

Steve Osborne, Wildlife Biologist, Russellville Arkansas.

Table 2. A list of Regional Forester's Sensitive Speceis considered in this project BE. Species in Bold were identified or found to have potential habitat.

Group	Scientific Name	Common Name	G-Rank
Amphibian	Eurycea tynerensis	Oklahoma salamander	G3
Bird	Aimophila aestivalis	Bachman's sparrow	G3
Bird	**Haliaeetus leucocephalus**	**Bald Eagle**	**G4**
Crustacean	Orconectes williamsi	A crayfish	G2
Fish	Notropis ozarcanus	Ozark shiner	G3
Fish	Percina nasuta	Longnose darter	G3Q
Fish	Typhlichthys subterraneus	Southern cavefish	G3
Insect	Paduniella nearctica	Nearctic paduneillan caddisfly	G1?
Other Invert.	**Lirceus bicuspicatus**	**An isopod**	**G3Q**
Mammal	Myotis leibii	Eastern small-footed bat	G3
Mollusk	Lampsilis rafinesqueana	Neosho mucket	G2
Vascular Plant	Amorpha ouachitensis	Ouachita false indigo	G3Q
Vascular Plant	Callirhoe bushii	Bush's poppymallow	G3
Vascular Plant	**Castanea pumila var. ozarkensis**	**Ozark chinquapin**	**G5T3**
Vascular Plant	Cypripedium kentuckiense	Southern Lady's slipper	G3
Vascular Plant	**Delphinium newtonianum**	**Moore's larkspur**	**G3**
Vascular Plant	Delphinium treleasei	Glade larkspur	G3
Vascular Plant	Dodecatheon frenchii	French's shooting star	G3
Vascular Plant	Draba aprica	Open-ground draba	G3
Vascular Plant	Eriocaulon koernickianum	Small-headed pipewort	G2
Vascular Plant	Fothergilla major	Large witchalder	G3
Vascular Plant	Juglans cinerea	Butternut	G3G4
Vascular Plant	Neviusia alabamensis	Alabama snow-wreath	G2
Vascular Plant	Quercus acerifolia	Mapleleaf oak	G1
Vascular Plant	Schisandra glabra	Bay starvine	G3
Vascular Plant	Silene ovata	Ovate-leaf catchfly	G2G3
Vascular Plant	Silene regia	Royal catchfly	G3
Vascular Plant	Solidago ouachitensis	Ouachita Mountain goldenrod	G3
Vascular Plant	Tradescantia ozarkana	Ozark spiderwort	G3
Vascular Plant	Trillium pusillum var. ozarkanum	Ozark least trillium	G3T3
Vascular Plant	Valerianella nuttallii	Nuttall's cornsalad	G1G2
Vascular Plant	Valerianella ozarkana	Ozark cornsalad	G3

Table 1 – Federally Threatened and Endangered species considered in this BE. This table includes scientific name, common name, status, occurrence and determinations.

Species	Common	Status	Comments	Determination
Lesquerella filiformis	Missouri Bladderpod	T	Not reported on the Ozark National Forest. No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Lindera mellissifolia	Pondberry	E	Not reported on the Ozark National Forest. No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Geocarpon minimum	Geocarpon	T	Known from only 4 southern counties. Not reported on the Ozark National Forest. No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Potamilus capax	Fat Pocketbook	T	Not reported on the Ozark National Forest. No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Lampsilis abrupta	Pink Mucket	E	Not reported on the Ozark National Forest.No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Leptodea leptodon	Scaleshell Mussel	E	Not reported on the Ozark National Forest.No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Lampsilis streckeri	Speckled Pocketbook Mussel	E	Occurs in the Little Red River. No element of occurrence records or potential habitat in the analysis area.. This species has been found down stream of the project area	May affect Not likely to adversely affect.
Cambarus aculabrum	Cave Crayfish	E	Only occurs in Northwest Arkansas. No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Cambarus zophonastes	Hell Creek Cave Crayfish	E	No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Amblyopsis rosae	Ozark Cavefish	T	Only occurs in Northwest Arkansas. No element of occurrence records or potential habitat in the analysis area	NO EFFECT

Table 1. Continued.

Species	Common	Status	Comments	Determination
Scaphirhynchus albus	Pallid Sturgeon	E	Known from the St. Francis and Mississippi Rivers. No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Nicrophorus americanus	American Burying Beetle	E	Occurs on western edge of Mt. Magazine District. No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Inflectarius magazinensis	Magazine Mountain Shagreen	T	Occurs in restricted habitat on Mt. Magazine. No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Alligator mississippiensis	American Alligator	T	Found on St. Francis NF. No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Sterna antillarum	Interior Least Tern	E	Found on St. Francis NF. No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Campephilus principalus	Ivory-billed Woodpecker	E	Not reported on the Ozark National Forest. No element of occurrence records or potential habitat in the analysis area	NO EFFECT
Myotis grisescens	**Gray Bat**	**E**	**No occurrences within 19 miles of the project, but potential habitat does exist**	**NO EFFECT**
Myotis sodalis	**Indiana Bat**	**E**	**No occurrences within 19 miles of the project, but potential habitat does exist**	**May Affect Not Likely to Adversely Affect**
Corynorhinus townsendii ingens	**Ozark Big-eared Bat**	**E**	**Not reported on the Big Piney Ranger District, but potential habitat does exist**	**NO EFFECT**

EXHIBIT F – Notification Letter to Processing Office of a Finding of No Significant Impact Letter

United States Department of Agriculture
Rural Development
Arkansas State Office

SUBJECT: Ozark Mountain Regional Public Water Authority
Long Term Regional Water Supply
Finding of No Significant Impact

TO: Rural Development Area 1 Office
Harrison, Boone County, Arkansas
Attn: Bill Rowland, Area Specialist

In accordance with 7 CFR Part 1794, Rural Utilities Service's Environmental Policies and Procedures, I have reviewed and approved a Finding of No Significant Impact for the above project. To inform the public of our decision, please direct the applicant to publish the appropriate public notice. An example of a public notice for the Finding of No Significant Impact can be found in Appendix B-4 in Bulletin 1794-602.

If you have any questions, please contact Larry Duncan, State Environmental Coordinator at 501-301-3269.

David A. Rankin

for CHERRY L. SMITH
Acting State Director
Rural Development

August 24, 2009
Date

EXHIBIT A – Environmental Report/Environmental Documentation
Acceptance Letter

United States Department of Agriculture
Rural Development
Arkansas State Office

August 24, 2009

SUBJECT: Ozark Mountain Regional Public Water Authority
Long Term Regional Water Supply
Exhibit A – Environmental Report/Environmental Documentation

TO: Area 1 Office
Harrison, Boone County, Arkansas
Attn: Bill Rowland, Area Specialist

FROM: Larry Duncan
State Environmental Coordinator

I have reviewed the Environmental Report/Environmental Documentation for the Ozark Mountain Regional Public Water Authority's Long Term Regional Water Supply project and have made the following determinations:

CONCURRENCE WITH CLASSIFICATION OF PROPOSAL

☐ Categorical Exclusion with an Environmental Report (7CFR 1794.22(b) and (c))

☒ Environmental Assessment (7 CFR 1794.23 (a) and (b))

ACCEPTANCE OF ENVIRONMENTAL REPORT/ENVIRONMENTAL DOCUMENTATION.

☒ Acceptable

☐ Unacceptable. In order to bring the report into compliance with regulatory and Agency requirements please address the items listed in Exhibit B.

PUBLIC NOTIFICATION REQUIREMENTS

Please inform the applicant to publish the following public notices in the non-classified section of newspapers of local circulation:

- ☐ **CATEGORICAL EXCLUSION**
  - ☐ **NO PUBLIC NOTICE REQUIRED**
  - ☐ **PRELIMINARY NOTICE**

  The items checked shall be included in this public notice:

  - ☐ Important Farmland (conversion of)
  - ☐ Floodplains (Facility construction in, not utility lines)
  - ☐ Wetlands (Facility construction, not utility lines)
  - ☐ Cultural Resources (Adverse Effect of)
- ☒ **ENVIRONMENTAL ASSESSMENT**
  - ☐ **NOTICE ANNOUNCING THE AVAILABILITY OF ENVIRONMENT ASSESSMENT**

  If any of the following are checked integrate the information normally included in a Preliminary Notice.

  - ☐ Important Farmland (Conversion of)
  - ☐ Floodplains (Facility construction in, not utility lines)
  - ☐ Wetlands (facility construction in, not utility lines)
  - ☐ Cultural Resources (Adverse effect of)
  - ☒ **FINDING OF NO SIGNIFICANT IMPACT**
- ☐ **SEE EXHIBIT C FOR SPECIFIC PUBLIC NOTICE REQUIRMENTS**

If you have any questions, please call me at 501-301-3269.

Larry Duncan

Larry Duncan
State Environmental Coordinator

EXHIBIT D – Recommendation of a Finding of No Significant Impact Letter

USDA
Rural Development

United States Department of Agriculture
Rural Development
Arkansas State Office

SUBJECT: Ozark Mountain Regional Public Water Authority
Long Term Regional Water Supply
Recommendation of a Finding of No Significant Impact

TO: Cherry L. Smith
State Director

I have reviewed the environmental documentation for **Ozark Mountain Regional's New Water Supply** project. In accordance with 7 CFR Part 1794, Rural Utilities Service's Environmental Policies and Procedures, the proposed project meets the classification criteria for an Environmental Assessment. The public review period is complete and all public comments and outstanding issues have been addressed and resolved to the extent practicable. Therefore in accordance with 40 CFR 1508.13, I recommend that the Agency issue a determination that the proposed project will not have a significant effect on the human environment and that an Environmental Impact Statement will not be prepared.

Attached for your approval is the Finding of No Significant Impact document. Please sign, forward the document to the Rural Development processing office and the attached cover letter and have them request that the applicant publish a public notice informing the public of our decision.

Larry Duncan
State Environmental Coordinator
Rural Development

August 24, 2009
Date

EXHIBIT E – Finding of No Significant Impact Letter

USDA Rural Development

United States Department of Agriculture
Rural Development
Arkansas State Office

SUBJECT: Ozark Mountain Regional Public Water Authority
Long Term Regional Water Supply
Finding of No Significant Impact

TO: Project File

The attached Environmental Assessment has been prepared and reviewed in accordance with the National Environmental Policy Act, as amended (42 U.S.C. 6941 et seq.); the Council on Environmental Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR Parts 1500-1508); and 7 CFR Part 1794, Rural Utilities Service's Environmental Policies and Procedures. Upon review of the environmental documentation included and referenced in the Environmental Assessment, I find that the proposed project will not have a significant impact on the human environment and for which an Environmental Impact Statement therefore will not be prepared.

Wal A. Kuhne
for CHERRY L. SMITH
Acting State Director
Rural Development

August 24, 2009
Date

Delivered to Emily 9-24-09

community publishers

Harrison Daily Times

PO BOX 40 * 111 West Rush Avenue * Harrison, AR 72601 * Phone (870)741-2325 * FAX (870)741-5632

Affidavit

Before me, a notary public, personally appeared CAROL LAWSON, who being duly sworn, states that the following ad(s)

Notice

Appeared in the Harrison Daily Times on:

Sep. 1, 2 & 3

For Ozark Mt Regional public water Authority.

Cost $ 901.44

Carol Lawson

CAROL LAWSON
Business Manager

State Arkansas

County Boone

Sworn to and subscribed before me

This 8th day of September, 2009.

Notary Public Seal

LINDA A. TREAT NOTARY PUBLIC BOONE ARKANSAS Expires 2-13-2014

Linda A. Treat

Notary Public Signature

My Commission Expires
2-13-2014

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honor would be
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when it is a desti-
redding? I feel a
oarrassed to send
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—*Deborah*

Deborah: If the
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is kept the secret
raps. Covering up
social embarrass-
ike hiding evi-
a crime.
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to a family that
onspire to com-
me against chil-
d that the family
; need to seek
grandpa and
ie sister-in-law,
ill have no choice
eak off the
ent and call the
es. I know from
experience the
ffect childhood
ouse causes.

—*Been There*

bird showed no physical signs of trauma. After he was notified of the dead bird, Bunch contacted the Harrison Animal Control officer who came and retrieved the dead swan. He was later told that nothing on the outside seemed array.

Bunch speculated that the bird might have ingested a lead fishing sinker or something else from the bottom of the lake.

Earlier this year, two of the trumpeter swans from the Boxley pond paid a short visit to Lake Harrison.

FILE PHOTO

This pair of mute swans appeared on Lake Harrison this summer, and were inseparable until one of them was found dead of undetermined causes several weeks ago. The widowed swan has stayed on the lake.

LEE H. DUNLAP/STAFF

TABS FOR RONALD

Patty Turney (right) presents 7,200 pop tabs to Robin Reeves of the Harrison McDonald's. The tabs will be sent to St. Jude's Hospital to help operate the Ronald McDonald House there. Turney is a breast and kidney cancer survivor.

Notice of a Finding of No Significant Impact

The USDA, Rural Utilities Service has received an application for financial assistance from the Ozark Mountain Regional Public Water Authority. The proposal consists of a regional water system to serve approximately 20 municipal and rural water systems in Newton County, Searcy County, and portions of Boone and Marion Counties. The proposed project includes a water intake structure on Bull Shoals Lake, a water treatment facility west of Lead Hill, water transmission mains, water storage tanks, and booster pumping facilities. The proposed project will avoid designated wetlands, avoid historic properties, and not convert any important farmlands.

As required by the National Environmental Policy Act and agency regulations, the Rural Utilities Service prepared an Environmental Assessment of the proposal that assessed the potential environmental effects of the proposal and the effect of the proposal may have on historic properties. The Environmental Assessment was published on July 7th, 8th, and 9th, 2009 for a 30-day public comment period. One letter was received in support of the overall project and requested review of the Environmental Report. A copy of the Environmental Report was made available for review on July 28, 2009 to meet this request. Upon consideration of the applicant's proposal, federal and state environmental regulatory and natural resource agencies have assessed the potential environmental effects of the proposed project and determined that the proposal will not have a significant effect on the human environment and for which an Environmental Impact Statement will not be prepared. The basis of this determination was arrived at through contact with federal agencies, state agencies, local agencies, and general public in accordance with NEPA procedures.

In order to avoid or minimize any adverse environmental impacts, the Rural Utilities Service will require the applicant to incorporate the certain mitigation measures into the proposal's design. These measures include implementing Best Management Practices; obtaining all required permits; water mains routed to avoid wetlands, historical properties, and glades; provide an on-site archeologist for SHPO Site #3SE265; cease work if cultural materials are encountered until investigated and resolved; cease work if a cave is found within 300 ft of construction and notify the U.S. Fish and Wildlife Service; restore land to original slopes and grades; mist net surveys required for Indiana Bats before timber is cut on U.S. Forest Service land between March 16th and November 30th; Storm Water Pollution Prevention Plan submitted to the Arkansas Department of Environmental Quality; attach water mains to vehicular bridges when crossing the Buffalo River; prohibit use of herbicides and pesticides on federal properties; and obtain water allocation from the U.S. Army Corps of Engineers.

Copies of the Environmental Assessment can be reviewed or obtained at the Rural Development office at 402 North Walnut Street, Suite 219, Harrison, Arkansas 72601. For further information, please contact Mr. Bill Rowland at (870) 741-8600 ext. 5.

A general location map is shown below.

cation may lead to anemia

ie doctors at the
who took a real
ie sorted through
cords and found
panion had been
escription acid-
dicine for about
medication that
bit iron from
orbed. Bingo!
this has hap-
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cal of our neigh-
ds and acquain-
o have been on

throughout the body. The result is fatigue, weakness, shortness of breath, poor appetite, irritability, a pale or ashen color to the skin and more.

The most common reasons for this condition are blood loss, a lack of iron in the diet and an inability to absorb iron. Afflictions such as Crohn's or celiac disease affect the intestine's ability to absorb nutrients from digested

fibroids or to identify other causes of heavy menstrual bleeding.

Unfortunately for your partner, he was late being diagnosed and his quality of life suffered dramatically. Fortunately, he finally found someone who took the time to get a complete history to include his medications and the physician made the connection. At long last, he is on the right track.

· Annie: This is in ...e to "Not Family ...hose fiance's ...a molested his ...nd sister and the ...as kept the secret ...wraps. Covering up ...d social embarrass- ...like hiding evi- ...of a crime.

...needs to tell her ...hat she cannot ...nto a family that ...conspire to com- ...rime against chil- ...nd that the family ...rs need to seek ...: grandpa and the sister-in-law, ...will have no choice ...break off the ...nent and call the ...ties. I know from ...d experience the effect childhood ...abuse causes.

—*Been There*

LEE H. DUNLAP/STAFF

TABS FOR RONALD

Patty Turney (right) presents 7,200 pop tabs to Robin Reeves of the Harrison McDonald's. The tabs will be sent to St. Jude's Hospital to help operate the Ronald McDonald House there. Turney is a breast and kidney cancer survivor.

...ication may lead to anemia

...the doctors at the ...l who took a real ..., he sorted through ...records and found ...npanion had been ...prescription acid- ...medicine for about ...rs, medication that ...hibit iron from ...bsorbed. Bingo!

...: this has hap- ...we have heard ...veral of our neigh- ...iends and acquain- ...who have been on ...ption acid-reflux ...e for a period of ...d who have also ...agnosed with iron- ...cy anemia. They, ...ve had to endure ...rm testing. Have ...rd of this before? ...the problem just ...up overnight?

...R READER: Iron- ...cy anemia is a con- ...in which blood ...equate amounts of ...red blood cells, the ...lls that carry oxy- ...the body's tissues ...provide energy. ...: significant iron, ...y cannot produce ...hemoglobin, a ...ent in red blood ...t allows oxygenat- ...d to be carried throughout the body. The result is fatigue, weakness, shortness of breath, poor appetite, irritability, a pale or ashen color to the skin and more.

The most common reasons for this condition are blood loss, a lack of iron in the diet and an inability to absorb iron. Afflictions such as Crohn's or celiac disease affect the intestine's ability to absorb nutrients from digested food. And some medications, such as those taken for combating excess stomach acid, are known to interfere with iron absorption. Thus, I'm quite surprised your partner's primary-care physician, who prescribed the medication, was in the dark.

Diagnostic testing to identify possible underlying causes includes endoscopy, colonoscopy and ultrasound (for women). The endoscopy you refer to was to discover a possible bleed from an ulcer or hiatal hernia. A colonoscopy zeros in on possible bleeding from the colon. Ultrasound is ordered to rule out uterine fibroids or to identify other causes of heavy menstrual bleeding.

Unfortunately for your partner, he was late being diagnosed and his quality of life suffered dramatically. Fortunately, he finally found someone who took the time to get a complete history to include his medications and the physician made the connection. At long last, he is on the right track.

Dr. Peter Gott is a retired physician and the author of the book "Dr. Gott's No Flour, No Sugar Diet," available at most chain and independent bookstores, and the recently published "Dr. Gott's No Flour, No Sugar Cookbook."

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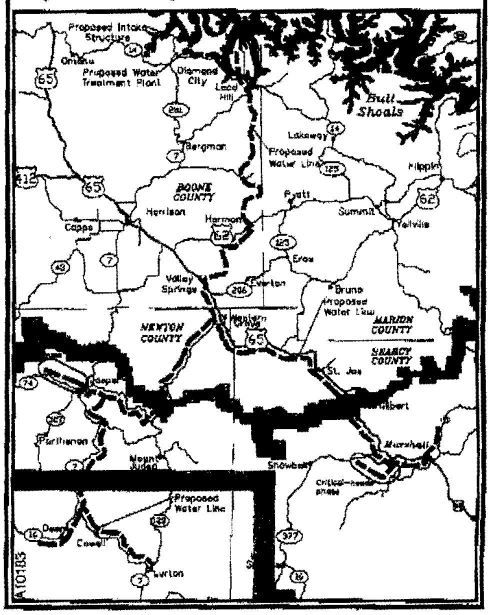
A general location map is shown below.



Appendix D
Hydroelectric Power

US Army Corps
of Engineers ®

OZARK MOUNTAIN
REGIONAL PUBLIC WATER AUTHORITY

BULL SHOALS & NORFORK LAKES, ARKANSAS.


WATER SUPPLY STORAGE
REALLOCATION

January 2010
(Revised July 2010)

prepared for
U.S. Army Corps of Engineers
Little Rock District
Little Rock, Arkansas

PREPARED BY
HYDROPOWER ANALYSIS CENTER

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OZARK MOUNTAIN
REGIONAL PUBLIC WATER AUTHORITY

BULL SHOALS AND NORFORK LAKES, ARKANSAS.

WATER SUPPLY STORAGE REALLOCATION

POWER BENEFITS FOREGONE

January 2010
(Revised July 2010)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ADDENDA

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1. INTRODUCTION

1.1. Purpose and Scope

This report, prepared by the Hydropower Analysis Center (HAC) for the Little Rock District (SWL), Corps of Engineers, presents details of the hydropower benefits and economic analysis associated with the Ozark Mountain Regional Public Water Authority's (OMRPWA) request for reservoir storage sufficient to supply 6 MGD from Bull Shoals Lake. A pending water supply storage request by Marion County Regional Water District (MCRWD) for 1 MGD was included in the study. Analysis of hydropower impacts for reallocating hydropower storage to water supply storage in Bull Shoals Lake includes the computation of the following values:

- power benefits foregone
- revenues foregone
- credit to the Federal power marketing agency

Values were computed for each of these parameters for the proposed reallocation of reservoir storage.

1.2. Project Description

1.2.1. White River System

Five existing Corps of Engineers lakes (Beaver Lake, Table Rock Lake, Bull Shoals Lake, Norfork Lake and Greers Ferry Lake) were constructed between 1940 and 1970 in the White River Basin of Arkansas and Missouri. The five lakes are multi-purpose reservoirs authorized for the primary purposes of flood control and hydroelectric power generation. Other authorized purposes are water supply, recreation and fish and wildlife. A map of the White River Basin is shown in Figure 1-1. Hydropower impacts were computed only for Bull Shoals and Norfork Lakes because hydrologic effects are shown to be negligible at the other lakes in the system (Main Report, Appendix A).

1.2.2. Bull Shoals Lake

Bull Shoals Lake is located downstream of the Beaver and Table Rock projects on the White River and seven miles north of Cotter, AR. The lake is one of four multiple-purpose projects constructed in the upper White River Basin for flood control and power generation. Current storage capacity of the lake is 2.36 million acre-feet in the flood control storage and 3.4 million acre-feet of hydropower storage in the conservation pool, or about 5.76 million acre-feet of total storage. The lake drains an area of about 6,036 square miles. The authorized purposes of the project are flood control, navigation, hydropower, water supply, fish and wildlife, and recreation.

The Water Supply Act of 1958 authorized water supply for the lake and the Chief of Engineers has discretion to reallocate up to 50,000 acre-feet if there is no significant impact to other authorized project purposes. Any allocation for water supply must be reallocated from the hydropower, flood control, or inactive pool. Currently, there is one water supply agreement at Bull Shoals Lake with Marion County Regional Water District for 880 acre-feet for 1 MGD out of the conservation pool. SWL recently completed a water storage reallocation report in February 2009 for reallocating 5 feet of the flood control pool or 233,000 acre-feet for the White River Minimum Flows Project.

The dam structure, which is 256 feet high and 2,256 feet long, was completed in July 1951, and the powerhouse and switchyard were completed in July 1953. Commercial hydropower generation began in 1953. The project powerplant has 340 megawatts of installed hydro capacity and generates an average of 753,700 MWh annually.

1.2.3. Norfork Lake

Norfork Dam is located at river mile 4.8 on the North Fork River, about 4 miles northeast of Norfork, Arkansas. The reservoir extends into Ozark County, Missouri, and Baxter and Fulton Counties, Arkansas, has a maximum storage of 1,983,000 acre-feet, and drains an area of 1,806 square miles in the North Fork River basin. The project is operated for flood control, recreation, and hydropower.

The dam structure, which is 216 feet high and 2,624 feet long, was completed in 1944, and the powerhouse and switchyard were completed in October of 1949. Commercial hydropower generation began in 1944. The project powerplant has 80.55 megawatts of installed hydro capacity and generates an average of 184,000 MWh annually.

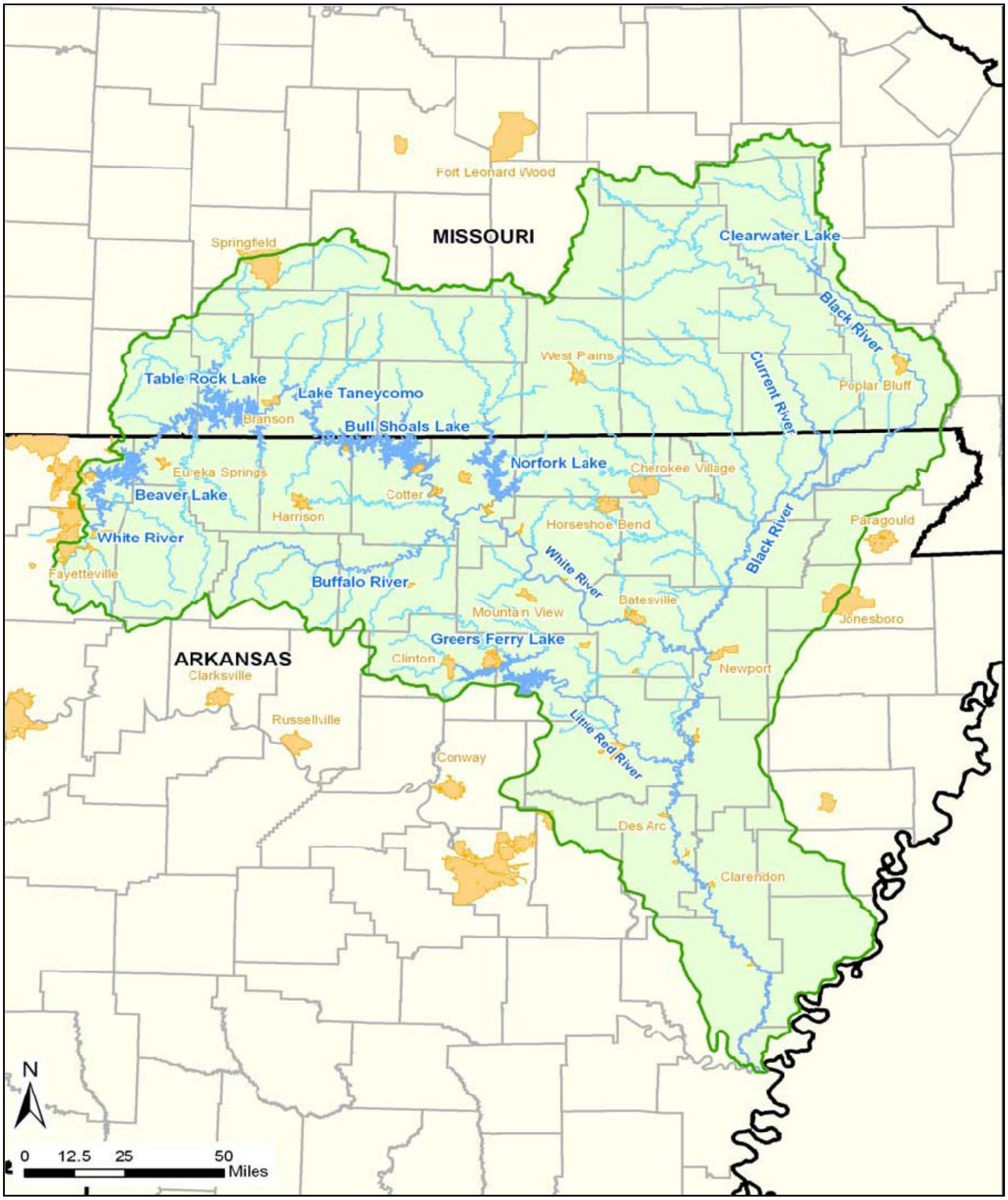

Figure 1-1. The White River System

1.2.4. Reservoir System Regulation Plan

The reservoir system is designed to maintain a balance between Bull Shoals, Norfolk Lake, and the other system reservoirs in the seasonally defined flood control storage space. Downstream river flow criteria have been established at downstream control points to achieve project benefits for authorized purposes. The regulating discharge criteria are supplied for all stream control points (including reservoir outflow controls) as a seasonal function of a system state parameter. Runoff forecast and these criteria are used by a system model which iteratively computes reservoir discharges and balances the remaining reservoir storage without exceeding downstream control point criteria. Consequently, the reallocation of storage at Bull Shoals Lake for increased water supply demands also has impacts at Norfork Lake.

1.3. The Cost of Water Supply Reallocation.

The procedures for computing the cost of storage reallocation addressed in this study are outlined in ER 1105-2-100, *Planning Guidance Notebook* (22 April 2000), Appendix E, paragraph E-57, d(2). These procedures require that the reallocation cost charged to the water supply customers be the highest of the following;

- power benefits foregone
- power revenues foregone
- replacement costs of power
- updated cost of storage

Although reservoir storage reallocations could result in impacts to other project purposes this report determines the impacts to hydropower. Therefore, power benefits foregone in this evaluation are a power related impact. The revenue foregone and replacement cost of power are also power-related. The updated cost of storage is non-power related and Little Rock District will compute the updated cost of storage based upon the storage necessary to yield the requested withdrawals.

The following paragraphs briefly describe each of these power-related values.

1.4. Power Benefits Foregone.

Hydropower benefits are normally based on the cost of the most likely alternative thermal source of power. When conservation storage is reallocated for water supply the lost hydropower will be replaced with the most likely alternative thermal source of power.

The power benefits foregone can be divided into two components, lost energy and lost capacity benefits. In the case of water supply withdrawals, there is usually a loss of energy benefits, which are based on the loss in generation (both at-site and downstream) as a result of water being diverted from the reservoir for water supply rather than passing through the hydropower plant. In addition, there could be a loss of capacity benefits as a result of a loss in dependable capacity at the project. Loss of dependable capacity could be a result of:

- a loss in head due to lower post-withdrawal reservoir elevations

- a reduction in supportable capacity due to inadequate water to support the full capacity during low-flow periods (i.e., low-flow periods that reduce the amount of water that can be passed through the generators)

The details of energy benefit computations are described in Chapter 3, and capacity benefit computations are shown in Chapter 4.

1.5. Revenue Foregone.

The second power-related cost is the revenue foregone.

> "The Corps does not market the power it produces; marketing is done by the Federal power marketing agencies (Southeastern Power Administration, Southwestern Power Administration, Western Area Power Administration, Bonneville Power Administration, Alaska Power Administration) through the Secretary of Energy." ER 1105-2-100, *Planning Guidance Notebook* (22 April 2000), Appendix E, paragraph E-42, b(2).

This is the value of the lost hydropower based on the PMA's (power marketing agency) current energy rates. The calculations for revenue foregone are contained in Chapter 6.

1.6. Replacement Cost of Power.

The third power-related cost is the cost of replacement power. This is a National Economic Development (NED) cost similar to power benefits foregone, and is therefore a redundant value in the case of hydropower. NED power benefits foregone are based on the cost of the most likely alternative, which in fact is the cost of replacement power. Replacement cost is included in the guidance as one of the four alternative cost methods to be evaluated because it has meaning when storage is reallocated from functions other than hydropower. For example, if the objective is to reallocate flood control storage to water supply, the replacement cost of flood control storage would have to be considered, because this storage would have an entirely different value than the flood control benefits foregone. However, for a hydropower/conservation storage reallocation, the replacement cost of hydropower is identical to the power benefits foregone.

Note that Appendix E, paragraph d(2)(c)(3), *Planning Guidance Notebook* (22 April 2000), also discusses a replacement cost based on financial or actual market prices, but this is an entirely different value than the replacement cost discussed in the paragraph above. The market-based replacement cost is market-based replacement cost used to compute a possible credit to the power marketing agency. If the water supply reallocation results in less hydropower being available to the marketing agency for delivery to its customers, the marketing agency will receive a credit to offset additional costs that they might incur and to reduce their repayment obligation. The calculation of this value is described in Chapter 7.

1.7. Procedure.

Development of the value of hydropower for the this analysis included the following steps:

For Value of Energy :

- Run the SWD-SUPER model to obtain daily generation for each alternative, including the existing condition.
- Determine average generation, both On-Peak and Off-Peak, for each alternative, for each month of the year, over the simulation period.
- Determine the annualized On-Peak and Off-Peak energy price for each month of the year over the forecast period using prices based on the **platts "***M2M Power Curve"*, (Chapter 3 below).
- Apply the annualized monthly On-Peak and Off-Peak energy prices to the average generation for each month of the year to determine annualized On-Peak and Off-Peak energy value for each alternative for each calendar month.
- Sum the annualized energy values of the months of the year for each alternative, for On-Peak and Off-Peak generation, to obtain each alternative's On-Peak and Off-Peak average annual energy value.

For Value of Equivalent Thermal Capacity:

- Run the SWD-SUPER model to obtain daily peaking capability for each alternative, including the existing condition.
- Determine the thermal equivalent capacity for each alternative using the average availability method (Chapter 4 below).
- Utilize historical generation data to develop an annual generation-duration curve
- Utilize FERC procedures to develop a capacity value for each thermal replacement generation type.
- Perform a screening curve analysis to determine the composite equivalent capacity value for the most likely, least-cost combination of thermal types of generation.
- Apply the composite capacity value to the annual thermal equivalent capacity to determine annual capacity value for each alternative.

1.8. Study Participants.

This report was prepared by the Hydropower Analysis Center (HAC) of the Portland District, Corps of Engineers. The primary HAC point of contact is Russ Davidson;

Telephone: (503) 808-4222;
E-mail: russell.l.davidson@usace.army.mil,
Address: Post Office Box 2946, Portland, Oregon 97204-2946,
ATTN: CENWP-HDC-H.

Michael Egge and Douglas Symes performed the HAC Agency Technical Review. Ms. Renee S. Wright was the Project Manager and Ms. Cherilyn M. Gibbs, economist, Little Rock District (SWL) served as study manager (telephone: (501) 324-5036, at U.S. Army Corps of Engineers, Little Rock District, P.O. Box 867, Little Rock, AR 72203-0867. Mr. Chris D. Reicks, of the Little Rock District performed hydrologic engineering studies using the SWD-SUPER model.

2. POWER BENEFITS FOREGONE

The details of energy and capacity benefit computation are described in Chapter 3 and Chapter 4, respectively. This chapter describes some of the terminology, methodology, and basic assumptions required for computing power benefits foregone.

2.1. Power Unit Values (Prices).

The power benefits foregone are computed multiplying electric power unit values by the loss in generation and dependable capacity at both Bull Shoals and Norfork Lakes. The capacity unit value multiplied by the dependable capacity loss, represents the cost of constructing an increment of equivalent thermal capacity to replace the lost hydropower capacity. The monthly On-Peak and Off-Peak energy prices (unit values) are multiplied by the loss in average monthly generation is cost of producing replacement energy in the regional power system.

These values are derived using NED economic criteria, in accordance with the U.S. Water Resources Council's Economics and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, previously referenced as ER 1105-2-100, *Planning Guidance Notebook* (22 April 2003).

2.2. Interest Rate.

The interest rate used in computing power benefits foregone due to water supply storage reallocation is the current (Fiscal Year 2010) Federal interest rate of 4-3/8 percent.

2.3. Period of Analysis.

The economic period of analysis for this study is 50 years. The “Period of Analysis” as defined in *Planning Guidance Notebook*, Section 2-4j, for a multiple-purpose reservoir project, is not to exceed 100 years. Section E-63 i(1)(a)(1), “Benefits Foregone”, defines the period of analysis for storage reallocations as the greater of (a) the remaining economic life of the project, or (b) 50 years. Benefits foregone for this analysis are computed assuming the water supply contract will be implemented in 2010. The power on-line date, total economic life, and remaining economic life for the project are shown in Table 2-1.

Table 2-1. Pertinent Study Data Hydropower and Economic Parameters

	Bull Shoals	Norfork
Power		
Installed Capacity	340.0 MW	80.6 MW
Power-on-Line (POL)	1959	1944
Marketable Capacity	376.0 MW	76.9 MW
Economic		
Total Project Life	100yrs	100 yrs
Remaining Life	49 yrs	34yrs
Interest Rate	4-3/8%	4-3/8%
Period of Analysis	50 yrs	50yrs

2.4. Price Level.

The capacity unit value and fuel prices used in determining the energy unit value are based on 2009 price levels which are assumed to apply over the entire period of analysis.

2.5. Rounding and Totals.

Some parts of the study analysis were performed using spreadsheet software. Arithmetic operations and totals were taken to full decimal accuracy within the spreadsheet. Tables found within this report have been rounded to a specified level of accuracy after the mathematical computations have been performed; therefore, rounded totals may not equal the summation of rounded values.

2.6. Most Likely Thermal Generation Alternative.

As described in Section 4.2.4, the most likely, least costly combination of thermal generation plant types to replace the Bull Shoals and Norfork Lake generation is about 32% Coal-fired Steam, 10% natural gas-fired combined cycle and 58% natural gas-fired combustion turbine, determined by using the screening curve analysis method. Thermal generation replacement alternatives are used in power system modeling to displace the lost hydropower capacities at Bull Shoals and Norfork Lakes.

2.7. Simulation with SWD-SUPER Streamflow Routing Model.

The SWD-SUPER streamflow routing model was used to simulate the operation of White River Basin system which includes Bull Shoals and Norfork Lakes on a daily time-step according to existing guidelines for reservoir and system operation. The simulations used in the analysis were based on a period of record of 69 years, from 1940 through 2008.

Hydrologic analyses of the SUPER model results in the Hydraulics and Hydrology Report (Main Report, Appendix A) show the impacts at the other four lakes were much less than at Bull Shoals and deemed negligible and thus not presented. Hydropower losses of energy and capacity were computed for both Bull Shoals and Norfork Lakes because they are operated together to meet downstream seasonal water flow and quality goals and to validate the assumption that negligible hydraulics and hydrology impacts would also produce negligible hydropower impacts. Hydropower impacts at Norfork Lake are shown in this report to also be negligible. Hydropower impacts at the other lakes in the system were not analyzed.

3. ENERGY BENEFITS FOREGONE

Energy benefits foregone have traditionally been computed as the product of the energy loss (in megawatt-hours) and an (unit value) energy price ($/MWh). The energy price is based on the cost of energy from a combination of thermal generating plants that would replace the lost energy from the hydropower plant due to operational and/or structural changes.

The value of lost energy benefits can be calculated using several methods, but for this analysis, an hourly system production cost model by **platts** (described in Section 3.5.1) was used to calculate the marginal price of the lost energy. This approach better accounts for the manner in which hydropower is used in the particular power system being considered, providing a more accurate measure of the energy benefits foregone.

The present value of the monthly energy prices (values) are amortized to produce an annualized monthly price. The product of the annualized monthly energy price and the energy loss due to water withdrawals represents the annual energy benefits foregone for that alternative.

3.1. Water Supply Withdrawal Alternatives Considered.

The full use of existing water supply contracts are accounted for in the base case, Existing Condition. Little Rock District (SWL) requested the Hydropower Analysis Center (HAC) to evaluate the following alternative reservoir storage reallocations which will yield an additional 10.83 cfs (9.28 cfs for OMRPWA and 1.55 cfs for MCRWD):.

- **No action** - Existing Condition will include White River Minimum Flows
  (SUPER model run #W09X02)

- **Reallocation from the conservation pool**
  (Bull Shoals-increase withdrawal rate by 10.83cfs)
  (SUPER model run #W09X03)

- **Reallocation from the flood control pool**
  (Bull Shoals-increase withdrawal rate by 10.83 cfs)
  (Bull Shoals-raise top of conservation pool +0.25 ft.)
  (SUPER model run #W09X04)

- **Reallocation from the inactive pool**
  (Bull Shoals-increase withdrawal rate by 10.83 cfs)
  (Bull Shoals-lower bottom of conservation pool -0.36 ft.)
  (SUPER model run #W09X05)

3.2. Reallocation Authority.

Authority for the Corps to reallocate existing storage space to M&I water supply is contained in Public Law 85-500, Title III, Water Supply Act of 1958, as amended. The Secretary of the Army is authorized to cooperate with local interests in providing storage space for M&I water supply in U.S. Army Corps of Engineers projects as long as the local interests agree to pay the costs associated with the storage space. The Chief of Engineers has the discretionary authority to reallocate the lesser of 15% or 50,000 acre feet of the total storage capacity in Bull Shoals Lake provided the reallocation has no severe effect on other authorized purposes and will not involve major structural or operational changes. If so, Congressional authorization is required.

3.3. Study Assumptions.

The evaluation of energy benefits foregone due to water supply withdrawals from Bull Shoals Lake was performed based on the following assumptions;

- These simulations include the Minimum Flow Plan with updated hydrology and power loads which are described elsewhere.
- Water supply withdrawals are considered "consumptive use," implying that none of the withdrawal amount taken from Bull Shoals Lake reservoir will be returned to either the reservoir or the stream reach below the reservoir.
- The seasonal water supply withdrawal rates from Bull Shoals Lake are made at a uniform rate throughout the year.
- Hydrologic analyses (Main Report, Appendix A) show the impacts at the other four lakes were much less than at Bull Shoals and deemed negligible.

3.4. Computation of Energy.

Energy associated with the reallocation of storage alternatives at Bull Shoals Lake was computed by the Little Rock District using the stream flows from the historical period of record (1940–2008) in the SWD-SUPER streamflow routing model.

Regional definition for on-peak hours of generation is 6am to 10pm, weekdays and Saturday. The off-peak hours of generation are the remaining hours. Generation is considered on-peak up to the plant capability for 16 hours. Off-peak generation is any excess generation. Shown in Table 3-1 below is the simulated energy production for the week of April 28, 1941 at Bull Shoals under existing conditions. The capability is constant so the maximum On-Peak production would be 16 hours of generation at the plant capability of 391 MW (6,256 MWH). Excess production would be Off-Peak energy. Production on the weekend would also be Off-Peak energy.

Table 3-1. On-Peak & Off-Peak Energy Allocation

Date	Day	Weekday	CAPABILITY	ENERGY PRODUCTION	Peak Energy	Off-Peak Energy
			MW	MWh	MWh	MWh
28-Apr-41	Monday	1	391.0	7,001.00	6,256.00	745.00
29-Apr-41	Tuesday	2	391.0	4,666.60	4,666.60	0.00
30-Apr-41	Wednesday	3	391.0	4,220.20	4,220.20	0.00
1-May-41	Thursday	4	391.0	8,972.80	6,256.00	2,716.80
2-May-41	Friday	5	391.0	6,339.30	6,256.00	83.30
3-May-41	Saturday	6	391.0	4,632.50	4,632.50	0.00
4-May-41	Sunday	7	391.0	9,384.00	0.00	9,384.00

Average monthly on-peak and off-peak energy for each alternative analyzed are shown below in Tables 3-2 through 3-5. Table 3-6 summarizes the corresponding energy loss under each reallocation alternative.

Table 3-2. Average Monthly Energy Generated at Bull Shoals & Norfork Lakes under Existing Conditions (1940 – 2008)

	BULL SHOALS		NORFORK	
	Peak Energy	Off-Peak Energy	Peak Energy	Off-Peak Energy
	MWh	MWh	MWh	MWh
Jan	49,694	11,691	13,402	2,767
Feb	34,163	6,606	8,874	1,879
Mar	52,425	13,623	13,114	3,646
Apr	43,998	11,021	10,995	2,751
May	37,266	6,884	9,069	1,990
Jun	59,719	11,221	14,543	3,518
Jul	73,633	9,829	19,443	2,612
Aug	68,247	6,704	16,813	1,569
Sep	42,922	4,369	11,515	1,521
Oct	21,694	2,301	7,648	936
Nov	21,324	2,305	5,448	443
Dec	50,530	13,065	13,076	2,644
Annual Avg Energy	**655,235**		**170,215**	

Table 3-3. Average Monthly Energy Generated at Bull Shoals & Norfork Lakes Reallocation from Conservation Storage (1940 – 2008)

	BULL SHOALS		NORFORK	
	Peak Energy	Off-Peak Energy	Peak Energy	Off-Peak Energy
	MWh	MWh	MWh	MWh
Jan	49,572	11,661	13,392	2,754
Feb	34,088	6,538	8,876	1,875
Mar	52,187	13,555	13,115	3,641
Apr	43,891	10,986	10,984	2,747
May	37,210	6,873	9,073	1,993
Jun	59,599	11,228	14,529	3,529
Jul	73,545	9,827	19,461	2,588
Aug	68,176	6,684	16,809	1,593
Sep	42,878	4,455	11,524	1,491
Oct	21,692	2,279	7,685	923
Nov	21,259	2,293	5,464	440
Dec	50,401	12,996	13,070	2,646
Annual Avg energy	**653,875**		**170,200**	

Table 3-4. Average Monthly Energy Generated at Bull Shoals & Norfork Lakes Reallocation from Flood Control Storage (1940 – 2008)

	BULL SHOALS		NORFORK	
	Peak Energy	Off-Peak Energy	Peak Energy	Off-Peak Energy
	MWh	MWh	MWh	MWh
Jan	49,594	11,673	13,385	2,784
Feb	34,092	6,600	8,875	1,862
Mar	52,361	13,652	13,123	3,596
Apr	43,934	11,037	10,994	2,779
May	37,254	6,879	9,063	1,986
Jun	59,702	11,307	14,551	3,511
Jul	73,458	9,845	19,436	2,625
Aug	68,185	6,700	16,781	1,631
Sep	42,775	4,426	11,525	1,504
Oct	21,663	2,283	7,677	924
Nov	21,252	2,295	5,455	446
Dec	50,444	13,027	13,053	2,629
Annual Avg Energy	**654,441**		**170,198**	

Table 3-5. Average Monthly Energy Generated at Bull Shoals & Norfork Lakes Reallocation from Inactive Storage (1940 – 2008)

	BULL SHOALS		NORFORK	
	Peak Energy	Off-Peak Energy	Peak Energy	Off-Peak Energy
	MWh	MWh	MWh	MWh
Jan	49,586	11,663	13,392	2,754
Feb	34,094	6,542	8,875	1,876
Mar	52,216	13,558	13,115	3,641
Apr	43,895	10,997	10,984	2,747
May	37,213	6,873	9,072	1,992
Jun	59,600	11,228	14,529	3,530
Jul	73,545	9,827	19,461	2,588
Aug	68,183	6,677	16,808	1,595
Sep	42,878	4,455	11,524	1,490
Oct	21,693	2,279	7,685	923
Nov	21,264	2,293	5,464	440
Dec	50,405	12,999	13,069	2,646
Annual Avg Energy	**653,875**		**170,200**	

Table 3-6. Average Monthly Energy Losses at Bull Shoals & Norfork Lakes under Reallocation Alternatives

	from Conservation Pool				from Flood Control Pool				from Inactive Storage			
	Bull Shoals		Norfork		Bull Shoals		Norfork		Bull Shoals		Norfork	
	Peak Energy Loss	Off-Peak Energy Loss	Peak Energy Loss	Off-Peak Energy Loss	Peak Energy Loss	Off-Peak Energy Loss	Peak Energy Loss	Off-Peak Energy Loss	Peak Energy Loss	Off-Peak Energy Loss	Peak Energy Loss	Off-Peak Energy Loss
	MWh	MWh	MWh	MWh	MWh	MWh	MWh	MWh	MWh	MWh	MWh	MWh
Jan	122	30	10	14	100	18	17	-16	108	28	10	13
Feb	75	68	-2	4	71	6	-1	17	69	64	-1	4
Mar	238	68	-2	4	64	-28	-9	50	209	65	-2	5
Apr	107	34	11	4	64	-16	1	-28	103	24	11	4
May	56	11	-3	-3	12	5	6	3	52	11	-3	-3
Jun	121	-6	14	-11	17	-85	-8	7	119	-6	14	-12
Jul	88	2	-18	24	175	-15	7	-14	88	2	-18	24
Aug	71	20	4	-24	62	4	32	-62	64	28	5	-26
Sep	44	-86	-9	30	147	-57	-10	17	43	-86	-9	31
Oct	2	22	-36	13	31	17	-29	12	1	22	-37	13
Nov	65	12	-17	3	72	9	-8	-3	60	12	-17	3
Dec	128	69	6	-2	86	38	23	16	124	67	7	-2
Annual Avg Energy Loss	1,116	244	-42	58	899	-105	19	-2	1,042	231	-39	55
	1,360		**16**		**794**		**17**		**1,273**		**16**	

3.5. Basis for Computing Energy Benefits Foregone.

3.5.1. Energy Value.

The energy values used to determine the value of energy impacts for this reallocation study are based on information developed by **platts** *M2M Power*, a wholesale North American power market forecast service. **platts** is a Division of the McGraw-Hill Companies, Inc. **platts**' data sets are proprietary and are used under subscription by the Corps of Engineers' *Hydropower Analysis Center.*

platts uses $\text{AURORA}_{\text{XMP}}$, an electric energy market model owned and licensed by EPIS, Incorporated to forecast market clearing prices for electric power. **platts** estimates both On-Peak and Off-Peak energy values on a monthly basis for a 20 year forecast period from 2009 through 2028.

The hourly market-clearing price is based upon a fixed set of resources dispatched in least-cost order to meet demand while subject to emissions limits. The hourly price is set equal to the variable cost of the marginal resource needed to meet the last unit of demand. A long-term resource optimization feature within the AURORA model allows generating resources to be added or retired based on economic profitability. Market-clearing price and the resource portfolio are interdependent. Market-clearing price affects the revenues any particular resource can earn and consequently will affect which resources are added or retired. AURORA sets the market-clearing price using assumptions on demand levels (load) and supply costs. The demand forecast implicitly includes the effect of price elasticity over time. The supply side is defined by the cost and operating characteristics of individual electric generating plants, including resource capacity, heat rate, and fuel price. AURORA recognizes the effect that transmission capacity and prices have on the system's ability to move generation output between areas. Additional information in "M2M Power Curve-Methodology Guide" is available to service subscribers.

In providing input data to AURORA, **platts** utilizes numerous other models and data sources including the following:

- Electricity Demand model
- Coal Market model
- Gas Market model
- **platts** NEWGen database of new generating capacity
- SO_2 and NO_x emissions allowance price forecasting model
- $\text{AURORA}_{\text{XMP}}$ electricity simulation and capacity expansion model

3.5.2. Procedure

platts has defined market areas for which it develops indexes and assessments that do not have significant internal transmission constraints but also reflects the cost of wheeling power between systems. Though many of the White River projects lie within the market area designated "Into-Entergy", Southwestern Power Administration (SWPA) indicated that the power generated at Bull Shoals is marketed to preference customers in the Southwestern Power Pool (SPP) in Kansas, Oklahoma, Arkansas, Louisiana and Texas..SPP is one of 10 regional reliability councils in the North American Electric Reliability Council (NERC) organization which ensures the reliability and security of electricity transmission.

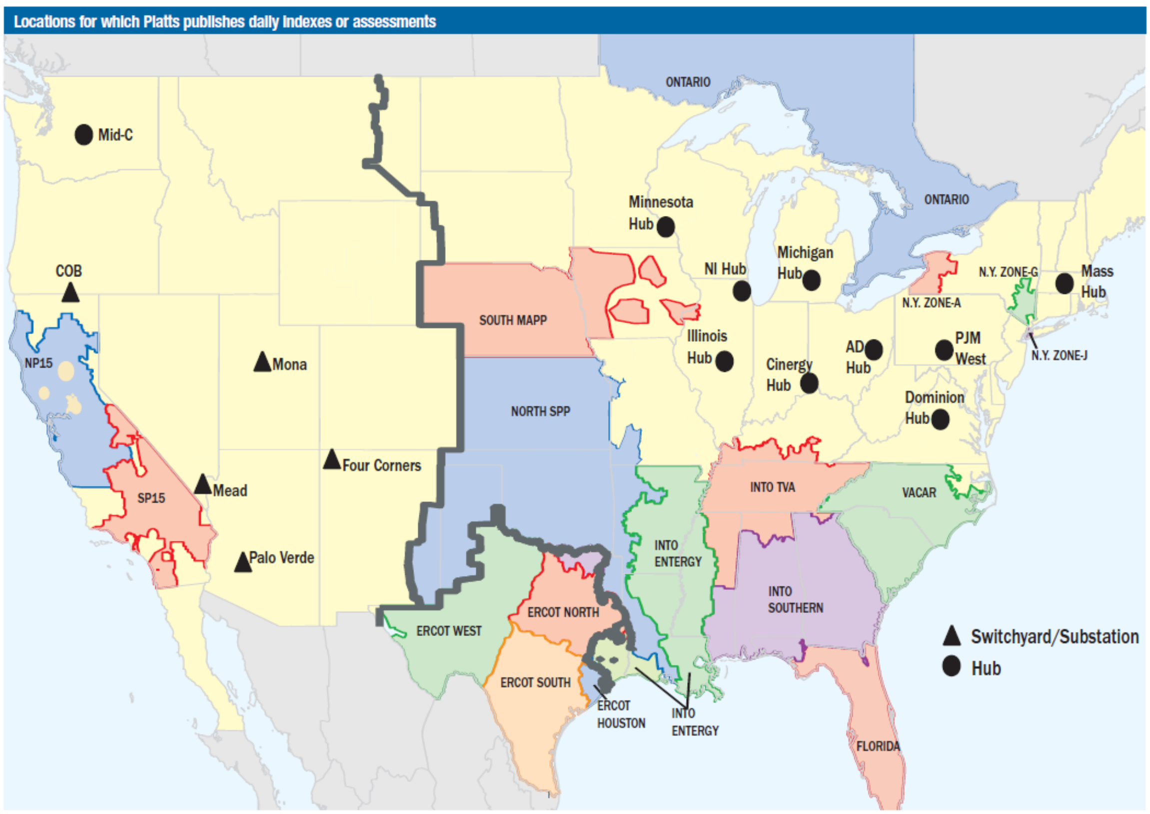

Figure 3-1. Locations for which *platts* publishes daily indexes or assessments.

The power values used in this report are based on the January 2009 Price Forecast release by the **platts** M2M Power and represent conditions at that time. The forecast assumes that average hydrologic conditions occur for each year of the simulation. To determine the estimated marginal market value of energy, the average annual generation in megawatt-hours was multiplied by a annualized average annual energy price.

platts indexes or assessments for the market area of North SPP were unavailable at the time when data was delivered for this study. *In lieu* of more current data for SPP a set of monthly conversion factors between SPP and SERC were developed from a prior **platts** data set. The conversion factors were applied to platts M2M Power "Into-ENTERGY" (SERC) to produce the On-Peak and Off-Peak energy values for SPP.

The forecasted monthly prices provided by **platts** provides a 20 year forecast of projected marginal market energy prices on both a monthly and annual basis for the period 2009 through 2028. These forecasted monthly prices are provided in nominal dollars. **platts** provides energy values for both "On-Peak" and "Off-Peak" periods in Figure 3-2. ("On-Peak" hours are 16 hours each workday and Saturday with remaining hours considered "Off-Peak")

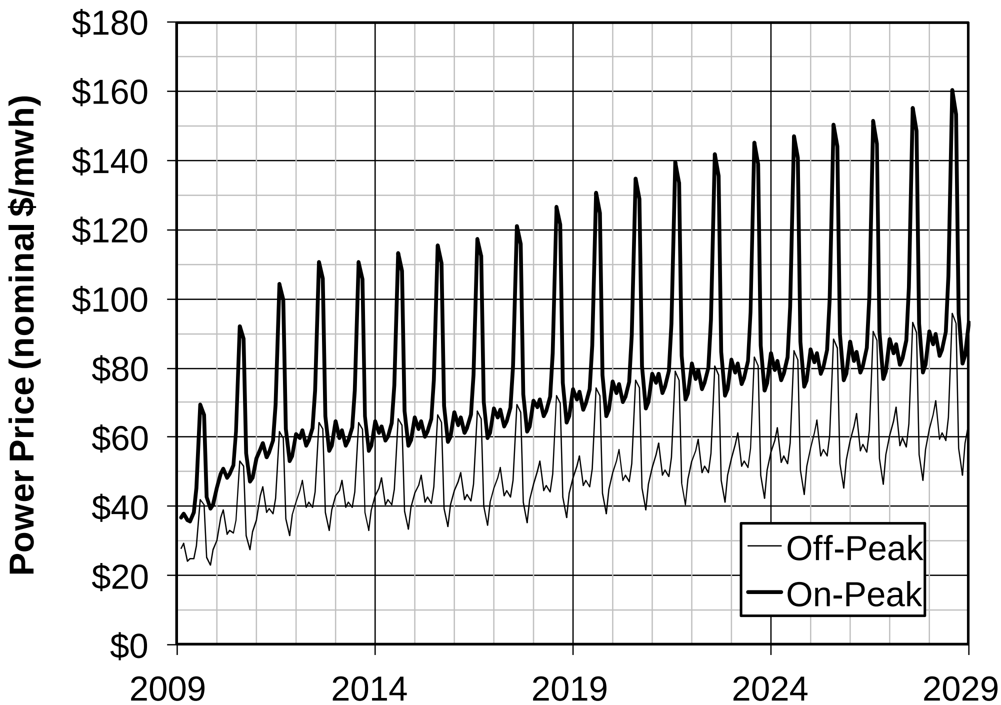

Figure 3-2. Forecast of marginal energy prices (nominal dollars)

Each of the monthly prices in nominal dollars was converted to constant 2009 dollars based on the annual inflation rates used by **platts**, as shown in Table 3-7. The forecast of marginal energy prices in constant 2009 dollars is shown in Figure 3.3. Constant dollar prices beyond the 20-yr forecast were assumed to be unchanged.

Table 3-7 Inflation Rates

	Inflation Factor	PLATTS Inflation (derived)	FED long-term inflation
2009	1.0000	2.52%	
2010	1.0263	2.63%	
2011	1.0536	2.65%	
2012	1.0816	2.66%	
2013	1.1103	2.66%	
2014	1.1391	2.59%	
2015	1.1681	2.55%	
2016	1.1990	2.64%	
2017	1.2315	2.72%	
2018	1.2655	2.76%	
2019	1.3005	2.76%	
2020	1.3361	2.74%	
2021	1.3727	2.74%	
2022	1.4103	2.73%	
2023	1.4489	2.74%	
2024	1.4887	2.74%	
2025	1.5294	2.74%	
2026	1.5630		2.20%
2027	1.5974		2.20%
2028	1.6326		2.20%

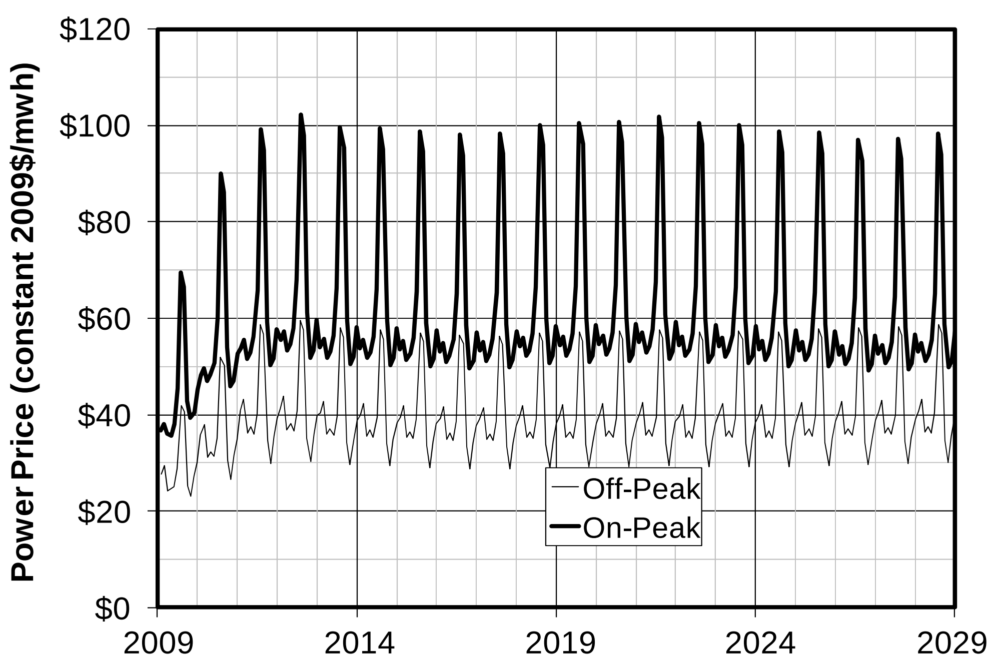

Figure 3-3. Forecast of marginal energy prices (constant 2009 dollars)

To develop the annualized On-Peak and Off-Peak prices for each calendar month, the present value of each month of the 50-year period of analysis was calculated using the Federal discount rate of 4.375%. The resulting fifty present values for each calendar month were then summed and amortized over the 50 year period-of-analysis at the Federal discount rate. The resulting annualized prices for each calendar month are shown in Table 3-6.

Table 3-8. Marginal (constant dollar) Energy Price

Month	Peak Price $/MWh	Off-Peak Price $/MWh
Jan	$53.36	$40.09
Feb	$55.12	$42.54
Mar	$51.32	$35.71
Apr	$52.56	$36.92
May	$55.80	$35.51
Jun	$65.44	$39.55
Jul	$98.55	$57.76
Aug	$94.31	$55.93
Sep	$58.91	$34.15
Oct	$50.00	$29.51
Nov	$51.38	$35.02
Dec	$57.40	$38.65

Federal Discount Rate = 4.375%
Price Level = Jan 2009
Constant 2009
Period of Analysis = 50 years

4. CAPACITY BENEFITS FOREGONE

Capacity benefits foregone are defined as the product of the loss in dependable capacity and a capacity unit value, which represent the capital cost of constructing replacement thermal capacity.

4.1. Dependable Capacity

A hydropower project's dependable capacity is a measure of the amount of capacity that the project can reliably contribute towards meeting system peak power demands. If a hydropower project always maintains approximately the same head, and there is always an adequate supply of stream flow so that there is enough generation for the full capacity to be usable in the system load, the full installed capacity can be considered dependable. In some cases even the overload capacity is dependable.

However, at storage projects, normal reservoir drawdown can result in a loss of capacity due to a loss in head. At other times, stream flows in low flow periods may result in insufficient generation to support the available capacity in the load. Dependable capacity accounts for these factors by giving a measure of the amount of capacity that can be provided with some degree of reliability during peak demand periods.

4.1.1. Dependable Capacity Evaluation Method

Dependable capacity can be computed in several ways. The method that is most appropriate for evaluating a hydropower plant’s dependable capacity in a predominantly thermal-based power system is the average availability method, as described in Section 6-7g of EM 1110-2-1701, *Hydropower*, dated 31 December 1985. The occasional unavailability of a portion of hydro project's generating capacity due to hydrologic variations should be treated in the same manner as the occasional unavailability of all or part of a thermal plant's generating capacity due to forced outages.

This assumption is not appropriate in power systems where hydropower is a majority resource, because adverse hydrology can affect all of the hydropower projects in a system simultaneously, with a resulting long-term reduction in capacity at all projects. In such systems, hydropower dependable capacity must be based on the capacity available under adverse hydrologic conditions or critical period.

This is not the case in a large, diverse power system, where hydropower represents only a small portion of the region's generating resources. When defining a hydropower project contribution to meeting peak loads in this type of system, random hydrologic variations can be considered equivalent to random thermal generating plant forced outages. SPP (2009) is primarily a thermal-based power system with only a small amount of hydropower in Figure 4-1. Therefore, average availability method is the most appropriate method for measuring dependable capacity for this analysis.

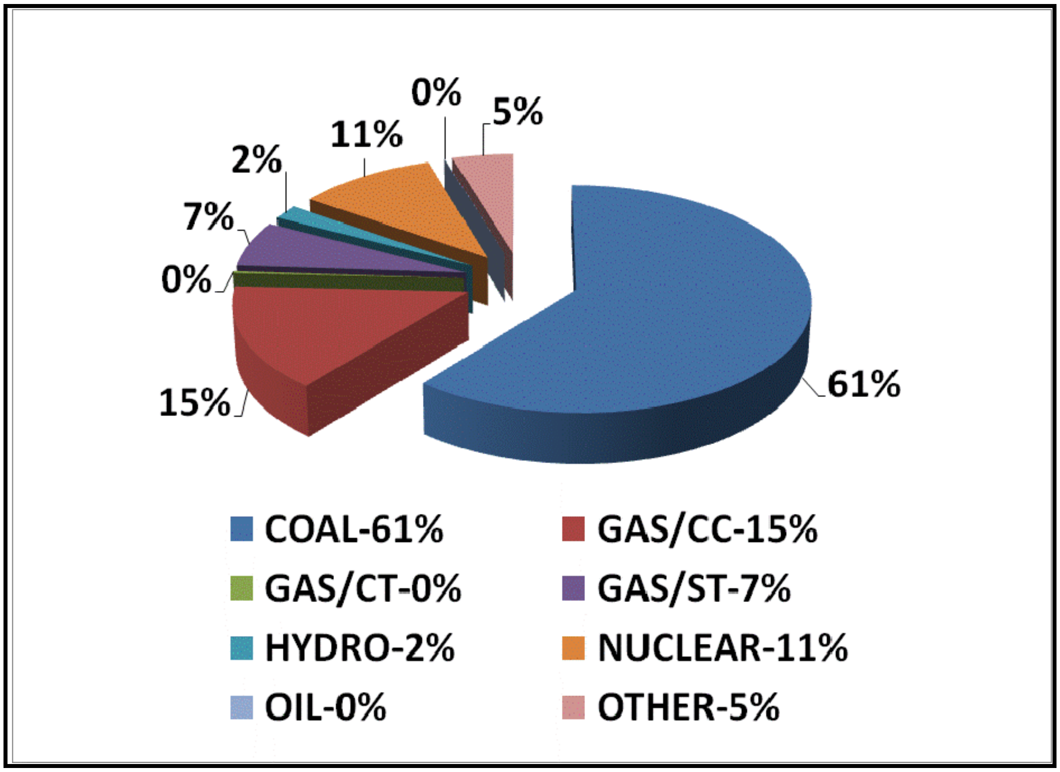

Figure 4-1. Generation Resources by Fuel Type for SPP 2009

4.1.2. Computation of Dependable Capacity

Under the average availability method Norfork Lakes occasionally loses capacity due to loss of head or due to inadequate energy to support the available capacity. Similarly, there are periods when the full peaking capacity is both available and usable. The average availability method attempts to measure the average capacity available during the peak demand periods of the year.

4.1.3. Hydrologic Period of Analysis

In order to evaluate the average dependable capacity for a project, a long-term record of project operation must be used. Actual project operating records can be used, but the period of operation may not be long enough to give a statistically reliable value. Furthermore, operating changes may have occurred over the life of the project, which would make actual data somewhat inconsistent.

A reliable alternative method is the use of a period-of-record computer simulation of system operation. As described in Section 1.1.19, the Little Rock District provided a daily simulation of the White River projects over the period 1940 to 2008 (69 years). This simulation, which was performed using the SWD-SUPER streamflow routing model, served as the basis of this study's dependable capacity computations.

4.1.4. Criteria for Computing Dependable Capacity

The PMA's criterion for sustained capacity at Bull Shoals and Norfork Lakes has been approximated by examining the project's contribution to meeting total system capacity requirements in the water year 1954, which the PMA uses to measure system marketable capacity. Dependable capacity is based on the amount of capacity that can be supported in the peak demand period of mid-May through mid-September in the SPP region. Table 4-1 list the dependable capacity parameters used in computing dependable capacity at Bull Shoals and Norfork Lakes.

Table 4-1. Dependable Capacity Parameters

	Bull Shoals	**Norfork**
Average weekly energy (MWh) **1/**	5,851	2,477
SWPA marketable capacity (MW)	376.0	76.9
Hours on peak per week **2/**	15.56	32.22

1/ For 17 weeks beginning closest to May 15 in 1954 computed from the SWD-SUPER model output.
2/ Average weekly energy divided by SWPA marketable capacity.

The average weekly energy output at Bull Shoals and Norfork Lakes during mid-May through mid-September 1954 was obtained from the SWD-SUPER streamflow routing model simulation for the Existing Condition. The number of hours that the project is required to support capacity was then determined by dividing the average weekly energy by the amount of capacity that the PMA markets from the Bull Shoals and Norfork Lakes.

4.1.5. Dependable Capacity Computation Procedure

The average weekly energy for the peak demand period was computed for each year and divided by 15.56 hours (for Bull Shoals) or 32.22 hours (for Norfork) in order to determine how much capacity could be supported during the peak demand months of each year.

For each year, a comparison was made between the supportable capacity and the project machine capability for that year. In all cases, the capacity that could actually be supported was limited to that portion of the potential supportable capacity that did not exceed project machine capability.

The following example summarizes the computations performed to determine average supportable (usable) capacity at Bull Shoals Lake during the peak demand months of mid-May through mid-September in 1954 under existing conditions shown in Table 4.1 above:

- Average weekly energy during mid-May through mid-September 1954 without diversion is 5,851 MWh

- Average weekly machine capability during mid-May through mid-September 1954 is 391.0 MW
- Potential support capacity during mid-May through mid-September 1954 is 5,851 MWh / 15.56 hours or 376.0 MW
- Actual support capacity during mid-May through mid-September 1954 is the minimum of machine capability or potential support capacity or MIN (391.0 MW, 376.0 MW) = 376.0 MW.

4.1.6. Dependable Capacity Losses

Tables 4-2 through 4-5 show the dependable capacity computations for alternative reallocations. Below is the explanation of calculations shown in the tables that follow. The dependable capacity lost is summarized in Table 4-6.

- Column A: Year.
- Column B: Average weekly energy for the 17 weeks of mid-May through mid-September beginning on the Monday nearest May 15^{th}.
- Column C: Column B/Hours on Peak.
- Column D: Average weekly machine capability for the 17 weeks of mid-May through mid-September beginning on the Monday nearest May 15^{th}. *(You will note at Bull Shoals that the machine capability (available capacity) does not vary during the annual critical period which is due to the balanced reservoir system operation)*
- Column E: The lesser of Column C and Column D.

Table 4-2. Dependable Capacity Calculation Existing Condition

Bull Shoals Lake					Norfork Lake				
Marketable Capacity		376 MW			**Marketable Capacity**		76.9 MW		
Hours on Peak		15.56			**Hours on Peak**		32.22		
Critical Year		1954			**Critical Year**		1954		
A	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**
Year	**Weekly Energy**	**Potential Supportable Capacity**	**Machine Capability**	**Actual Supportable Capacity**	**Year**	**Weekly Energy**	**Potential Supportable Capacity**	**Machine Capability**	**Actual Supportable Capacity**
1940	7,442	478.2	391.0	391.0	1940	2,206	68.5	87.5	68.5
1941	9,612	617.7	391.0	391.0	1941	1,960	60.8	86.6	60.8
1942	14,731	946.7	391.0	391.0	1942	4,148	128.7	88.2	88.2
1943	35,834	2302.9	391.0	391.0	1943	6,290	195.3	92.4	92.4
1944	12,863	826.7	391.0	391.0	1944	2,503	77.7	86.8	77.7
1945	39,608	2545.4	391.0	391.0	1945	7,881	244.6	92.5	92.5
1946	16,229	1042.9	391.0	391.0	1946	5,938	184.3	90.6	90.6
1947	18,445	1185.4	391.0	391.0	1947	4,004	124.3	88.3	88.3
1948	11,453	736.1	391.0	391.0	1948	2,410	74.8	88.1	74.8
1949	15,761	1012.9	391.0	391.0	1949	4,334	134.5	88.2	88.2
1950	19,846	1275.4	391.0	391.0	1950	4,093	127.1	92.5	92.5
1951	19,622	1261.0	391.0	391.0	1951	4,621	143.5	90.8	90.8
1952	15,056	967.6	391.0	391.0	1952	4,968	154.2	87.5	87.5
1953	11,291	725.7	391.0	391.0	1953	2,875	89.2	86.7	86.7
1954	5,851	376.0	391.0	376.0	1954	2,477	76.9	78.9	76.9
1955	11,635	747.7	391.0	391.0	1955	2,566	79.6	84.6	79.6
1956	12,315	791.4	391.0	391.0	1956	3,467	107.6	82.3	82.3
1957	41,344	2657.1	391.0	391.0	1957	6,805	211.2	92.5	92.5
1958	23,540	1512.8	391.0	391.0	1958	6,094	189.2	92.4	92.4
1959	10,599	681.1	391.0	391.0	1959	3,092	96.0	86.7	86.7
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1998	12,757	819.9	391.0	391.0	1998	4,394	136.4	87.1	87.1
1999	19,099	1227.4	391.0	391.0	1999	3,560	110.5	87.6	87.6
2000	9,798	629.7	391.0	391.0	2000	2,214	68.7	82.4	68.7
2001	6,489	417.0	391.0	391.0	2001	1,799	55.8	83.1	55.8
2002	23,881	1534.7	391.0	391.0	2002	5,345	165.9	92.5	92.5
2003	9,093	584.4	391.0	391.0	2003	2,478	76.9	86.5	76.9
2004	20,946	1346.1	391.0	391.0	2004	5,531	171.7	89.3	89.3
2005	4,590	295.0	391.0	295.0	2005	2,103	65.3	86.2	65.3
2006	8,711	559.8	391.0	391.0	2006	3,452	107.1	83.5	83.5
2007	9,245	594.1	391.0	391.0	2007	2,628	81.6	86.7	81.6
2008	36,445	2342.2	391.0	391.0	2008	5,327	165.4	92.5	92.5
Average Supportable Capacity (MW)				**388.130**	**Average Supportable Capacity (MW)**				**84.202**

Table 4-3. Dependable Capacity Calculation Reallocation from Conservation Storage

Bull Shoals Lake					Norfork lake				
Marketable Capacity		376	MW		Marketable Capacity		76.9	MW	
Hours on Peak		15.56			Hours on Peak		32.22		
Critical Year		1954			Critical Year		1954		
A	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**
Year	**Weekly Energy**	**Potential Supportable Capacity**	**Machine Capability**	**Actual Supportable Capacity**	**Year**	**Weekly Energy**	**Potential Supportable Capacity**	**Machine Capability**	**Actual Supportable Capacity**
1940	7,406	476.0	391.0	391.0	1940	2,203	68.4	87.5	68.4
1941	9,606	617.3	391.0	391.0	1941	1,960	60.8	86.6	60.8
1942	14,713	945.5	391.0	391.0	1942	4,147	128.7	88.2	88.2
1943	35,821	2302.1	391.0	391.0	1943	6,298	195.5	92.4	92.4
1944	12,844	825.4	391.0	391.0	1944	2,503	77.7	86.8	77.7
1945	39,720	2552.6	391.0	391.0	1945	7,840	243.3	92.5	92.5
1946	16,210	1041.8	391.0	391.0	1946	5,949	184.7	90.6	90.6
1947	18,428	1184.3	391.0	391.0	1947	4,003	124.3	88.3	88.3
1948	11,425	734.3	391.0	391.0	1948	2,410	74.8	88.1	74.8
1949	15,741	1011.6	391.0	391.0	1949	4,333	134.5	88.2	88.2
1950	19,839	1275.0	391.0	391.0	1950	4,098	127.2	92.5	92.5
1951	19,603	1259.8	391.0	391.0	1951	4,623	143.5	90.8	90.8
1952	15,041	966.7	391.0	391.0	1952	4,968	154.2	87.5	87.5
1953	11,275	724.6	391.0	391.0	1953	2,875	89.3	86.7	86.7
1954	5,850	376.0	391.0	376.0	1954	2,477	76.9	78.9	76.9
1955	11,615	746.5	391.0	391.0	1955	2,571	79.8	84.6	79.8
1956	12,308	791.0	391.0	391.0	1956	3,467	107.6	82.3	82.3
1957	41,188	2647.0	391.0	391.0	1957	6,762	209.9	92.5	92.5
1958	23,529	1512.1	391.0	391.0	1958	6,099	189.3	92.4	92.4
1959	10,583	680.1	391.0	391.0	1959	3,092	96.0	86.7	86.7
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1998	12,738	818.6	391.0	391.0	1998	4,391	136.3	87.1	87.1
1999	19,077	1226.0	391.0	391.0	1999	3,559	110.5	87.6	87.6
2000	9,797	629.6	391.0	391.0	2000	2,214	68.7	82.4	68.7
2001	6,489	417.0	391.0	391.0	2001	1,799	55.8	83.1	55.8
2002	23,874	1534.3	391.0	391.0	2002	5,349	166.0	92.5	92.5
2003	9,079	583.5	391.0	391.0	2003	2,478	76.9	86.5	76.9
2004	20,922	1344.6	391.0	391.0	2004	5,531	171.7	89.3	89.3
2005	4,590	295.0	391.0	295.0	2005	2,103	65.3	86.2	65.3
2006	8,708	559.6	391.0	391.0	2006	3,452	107.2	83.5	83.5
2007	9,228	593.0	391.0	391.0	2007	2,628	81.6	86.7	81.6
2008	36,471	2343.8	391.0	391.0	2008	5,336	165.6	92.5	92.5
		Average Supportable Ca		**388.129**			**Average Supportable Ca**		**84.200**

Table 4-4. Dependable Capacity Calculation Reallocation from Flood Control Storage

Bull Shoals Lake

Marketable Capacity 376 MW
Hours on Peak 15.56
Critical Year 1954

A	B	C	D	E
Year	Weekly Energy	Potential Supportable Capacity	Machine Capability	Actual Supportable Capacity
1940	7,411	476.3	391.0	391.0
1941	9,605	617.3	391.0	391.0
1942	14,718	945.9	391.0	391.0
1943	35,857	2304.4	391.0	391.0
1944	12,849	825.8	391.0	391.0
1945	39,720	2552.6	391.0	391.0
1946	16,223	1042.6	391.0	391.0
1947	18,423	1184.0	391.0	391.0
1948	11,433	734.8	391.0	391.0
1949	15,760	1012.9	391.0	391.0
1950	19,883	1277.8	391.0	391.0
1951	19,641	1262.3	391.0	391.0
1952	15,004	964.3	391.0	391.0
1953	11,269	724.2	391.0	391.0
1954	5,851	376.0	391.0	376.0
1955	11,619	746.7	391.0	391.0
1956	12,319	791.7	391.0	391.0
1957	41,240	2650.3	391.0	391.0
1958	23,528	1512.1	391.0	391.0
1959	10,583	680.1	391.0	391.0
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1998	12,694	815.8	391.0	391.0
1999	19,077	1226.0	391.0	391.0
2000	9,798	629.7	391.0	391.0
2001	6,490	417.1	391.0	391.0
2002	23,891	1535.4	391.0	391.0
2003	9,077	583.3	391.0	391.0
2004	20,935	1345.4	391.0	391.0
2005	4,590	295.0	391.0	295.0
2006	8,712	559.9	391.0	391.0
2007	9,229	593.1	391.0	391.0
2008	36,471	2343.8	391.0	391.0

Average Supportable Capacity (MW) **388.131**

Norfork Lake

Marketable Capacity 76.9 MW
Hours on Peak 32.22
Critical Year 1954

A	B	C	D	E
Year	Weekly Energy	Potential Supportable Capacity	Machine Capability	Actual Supportable Capacity
1940	2,203	68.4	87.5	68.4
1941	1,960	60.8	86.6	60.8
1942	4,152	128.9	88.2	88.2
1943	6,312	195.9	92.4	92.4
1944	2,503	77.7	86.8	77.7
1945	7,840	243.3	92.5	92.5
1946	5,952	184.8	90.6	90.6
1947	4,008	124.4	88.3	88.3
1948	2,410	74.8	88.1	74.8
1949	4,333	134.5	88.2	88.2
1950	4,058	126.0	92.5	92.5
1951	4,605	142.9	90.9	90.9
1952	4,978	154.5	87.5	87.5
1953	2,875	89.3	86.6	86.6
1954	2,478	76.9	78.9	76.9
1955	2,572	79.8	84.6	79.8
1956	3,467	107.6	82.3	82.3
1957	6,761	209.9	92.5	92.5
1958	6,114	189.8	92.4	92.4
1959	3,092	96.0	86.7	86.7
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1998	4,419	137.2	87.1	87.1
1999	3,568	110.8	87.6	87.6
2000	2,215	68.7	82.4	68.7
2001	1,799	55.8	83.1	55.8
2002	5,345	165.9	92.5	92.5
2003	2,478	76.9	86.5	76.9
2004	5,531	171.7	89.3	89.3
2005	2,103	65.3	86.1	65.3
2006	3,452	107.2	83.5	83.5
2007	2,628	81.6	86.7	81.6
2008	5,336	165.6	92.5	92.5

Average Supportable Capacity (MW) **84.202**

Table 4-5. Dependable Capacity Calculation Reallocation from Inactive Storage

Bull Shoals Lake

Marketable Capacity	**376**
Hours on Peak	**15.56**
Critical Year	**1954**

Norfork Lake

Marketable Capacity	**76.9**
Hours on Peak	**32.22**
Critical Year	**1954**

Bull Shoals Lake					Norfork Lake				
A	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**
Year	**Weekly Energy**	**Potential Supportable Capacity**	**Machine Capability**	**Actual Supportable Capacity**	**Year**	**Weekly Energy**	**Potential Supportable Capacity**	**Machine Capability**	**Actual Supportable Capacity**
1940	7,406	476.0	391.0	391.0	1940	2,203	68.4	87.5	68.4
1941	9,606	617.3	391.0	391.0	1941	1,960	60.8	86.6	60.8
1942	14,713	945.5	391.0	391.0	1942	4,147	128.7	88.2	88.2
1943	35,821	2302.1	391.0	391.0	1943	6,298	195.5	92.4	92.4
1944	12,844	825.4	391.0	391.0	1944	2,503	77.7	86.8	77.7
1945	39,720	2552.6	391.0	391.0	1945	7,840	243.3	92.5	92.5
1946	16,210	1041.8	391.0	391.0	1946	5,949	184.7	90.6	90.6
1947	18,428	1184.3	391.0	391.0	1947	4,003	124.3	88.3	88.3
1948	11,425	734.3	391.0	391.0	1948	2,410	74.8	88.1	74.8
1949	15,741	1011.6	391.0	391.0	1949	4,333	134.5	88.2	88.2
1950	19,839	1275.0	391.0	391.0	1950	4,098	127.2	92.5	92.5
1951	19,603	1259.8	391.0	391.0	1951	4,623	143.5	90.8	90.8
1952	15,041	966.7	391.0	391.0	1952	4,968	154.2	87.5	87.5
1953	11,275	724.6	391.0	391.0	1953	2,875	89.3	86.7	86.7
1954	5,850	376.0	391.0	376.0	1954	2,477	76.9	78.9	76.9
1955	11,615	746.5	391.0	391.0	1955	2,571	79.8	84.6	79.8
1956	12,309	791.0	391.0	391.0	1956	3,467	107.6	82.3	82.3
1957	41,198	2647.6	391.0	391.0	1957	6,762	209.9	92.5	92.5
1958	23,529	1512.1	391.0	391.0	1958	6,099	189.3	92.4	92.4
1959	10,583	680.1	391.0	391.0	1959	3,092	96.0	86.7	86.7
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1998	12,738	818.6	391.0	391.0	1998	4,391	136.3	87.1	87.1
1999	19,077	1226.0	391.0	391.0	1999	3,559	110.5	87.6	87.6
2000	9,797	629.6	391.0	391.0	2000	2,214	68.7	82.4	68.7
2001	6,489	417.0	391.0	391.0	2001	1,799	55.8	83.1	55.8
2002	23,874	1534.3	391.0	391.0	2002	5,349	166.0	92.5	92.5
2003	9,079	583.5	391.0	391.0	2003	2,478	76.9	86.5	76.9
2004	20,922	1344.6	391.0	391.0	2004	5,531	171.7	89.3	89.3
2005	4,590	295.0	391.0	295.0	2005	2,103	65.3	86.2	65.3
2006	8,709	559.7	391.0	391.0	2006	3,452	107.2	83.5	83.5
2007	9,228	593.0	391.0	391.0	2007	2,628	81.6	86.7	81.6
2008	36,471	2343.8	391.0	391.0	2008	5,336	165.6	92.5	92.5
Average Supportable Capacity (MW)				**388.129**	**Average Supportable Capacity (MW)**				**84.200**

4.1.7. Dependable Capacity Losses Summarized.

Dependable capacity losses are summarized in Table 4-6 below. The capacity benefit foregone is slightly larger for reallocation from flood control storage. The magnitude of the difference in impact is a very small (±1 KW). The data for Bull Shoals 1998 in Tables 4-2 thru 4-5 show the generating capability to be the same for all alternatives but the generation was less than the capability, limiting the supportable capacity in that year of the analysis. The dependable capacity is the average supportable capacity over the period of the simulation of the reallocation from Flood Control. There is a small dependable capacity gain for the reallocation from Flood Control storage as shown in Tables 4-2 and 4-4.

Table 4-6. Dependable Capacity Losses

	Bull Shoals Lake		Norfork Lake	
	Dependable Capacity	Depenable Capacity Loss	Dependable Capacity	Depenable Capacity Loss
	MW	MW	MW	MW
Existing Conditions	388.130	---	84.202	---
From Conservation	388.129	0.001	84.200	0.002
From Flood Control	388.131	(0.001)	84.202	0.000
From Inactive	388.129	0.001	84.200	0.002

4.2. Computation of Capacity Values

Hydropower benefits are based on the cost of the most likely thermal generation alternative that would carry the same increment of load as the proposed hydropower project or modification. Capacity benefits are intended to measure the investment cost of thermal generating plant capacity that would be needed to replace the lost capacity due to the water withdrawals from the reservoir. Capacity benefits are computed as the product of the dependable capacity loss and a capacity unit value, which is based on the unit cost of constructing the most likely thermal generating alternative.

4.2.1. Most Likely Thermal Generating Alternative

A screening curve analysis was conducted to determine the mix of thermal resources that would be the most likely, least-cost generation plant alternative to the Bull Shoals and Norfork Lakes. The type of alternative plants considered were coal-fired steam (base loads displacement), gas-fired combined cycle (intermediate loads displacement), and gas-fired combustion turbine (peak loads displacement). The screening curve analysis for Bull Shoals and Norfork Lakes is described in Section 4.2.3.

4.2.2. Values Used in Screening Curve Analysis

Capacity unit values for coal-fired steam, gas-fired combined cycle and combustion turbine plants were computed using procedures developed by the Federal Energy Regulatory Commission (FERC). Capacity values were computed based on a 4-3/8 percent interest rate and 2009 price levels. Adjusted capacity values are shown in Table 4-7. The adjusted capacity values incorporate adjustments to account for differences in reliability and operating flexibility between hydropower and thermal generating power plants. See EM 1110-2-1701, *Hydropower*, Section 9-5c for further discussion on the capacity value FERC adjustments.

Operating costs for coal-fired steam, gas-fired combined cycle and gas-fired combustion turbine plants were developed using information obtained from the publication EIA Electric Power Monthly (DOE/EIA-0226) and other sources. The information obtained included fuel costs, heat rates and variable O&M costs. The resulting values, based on 2009 price levels, are shown in Table 4-7. Since current Corps of Engineers policy does not allow the use of real fuel cost escalation, these values were assumed to apply over the entire period of analysis.

Table 4-7. Plant Capacity and Operating Costs

Thermal Generating Plant Type	Adjusted Capacity Cost	Operating Cost
	$/KW-Year	$/MWh
Coal-Fired Steam	$234.32	$18.12
Combined Cycle	$124.06	$58.11
Combustion Turbine	$59.53	$91.70

4.2.3. Screening Curve Analysis

The values shown in Table 4-7 were used to develop a screening curve for each of the thermal generating plant types. A screening curve is a plot of total plant cost [fixed (capacity) cost plus variable (operating) cost] versus annual plant factor.

A screening curve analysis consists of the following steps:

- Construct total plant cost (in $/kW-year) versus annual plant factor (in percent) diagram which includes a curve for each thermal generating plant type; this screening curve will show which type of plant is least cost in each plant factor range.

- Construct a generation-duration curve from simulated daily generation for the existing condition for the period of record as a typical operating year, for the increment of generation being analyzed.

- From the screening curve, determine the “breakpoints” (the plant factors at which the least cost plant type changes).

- Find the points on the generation-duration curve where the percent of time generation is numerically identical to the plant factor breakpoints defined in the preceding step; these intersection points define the portion of the generation that would be carried by each thermal generation plant type.

The plot for each thermal generation type was developed by computing the annual plant cost for various plant factors ranging from zero to 100 percent. The annual costs were computed using the following equation:

$$AC = CV + (EV * 0.0876 * PF)$$

where: AC = annual thermal generating plant total cost ($/kW-year)
CV = thermal generating plant capacity cost ($/kW-year)
EV = thermal generating plant operating cost ($/MWh)
PF = annual plant factor (percent)

The resulting screening curve for Bull Shoals and Norfork Lakes is shown in Figure 4-2. Figure 4-3 and Figure 4-4 show generation-duration curves for both lakes.

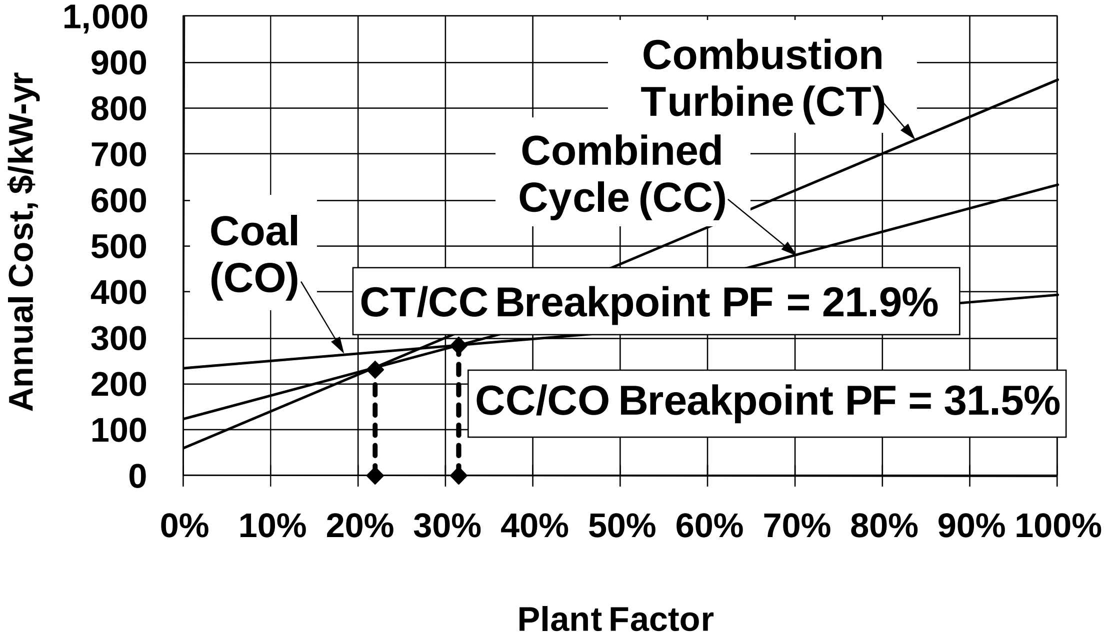


Figure 4-2. Thermal Screening Curve

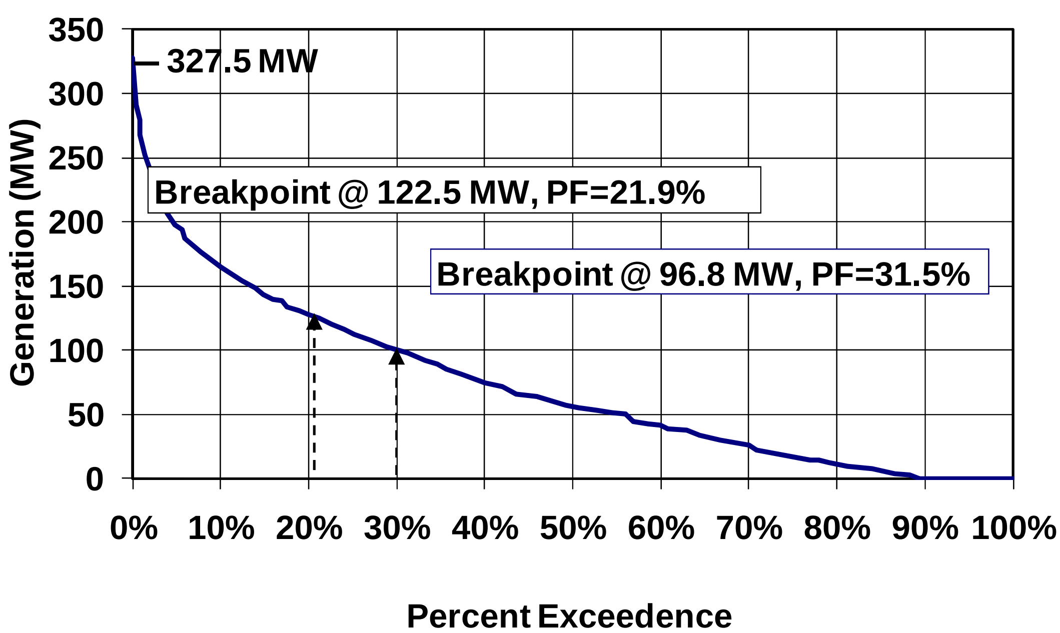


Figure 4-3. Generation Duration Curve for Bull Shoals Lake

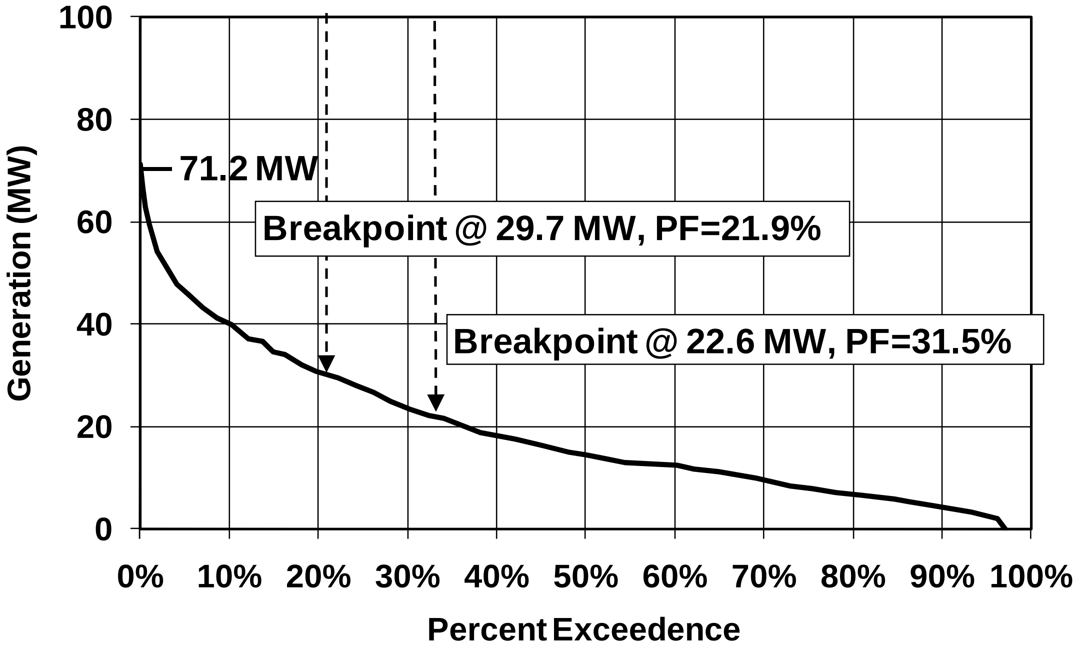


Figure 4-4. Generation Duration Curve for Norfork Lake

4.2.4. Least-Cost Thermal Mix

The breakpoint plant factors (20.5% and 30.1% percent) obtained from the screening curve were matched to the same percent exceedence on the generation-duration curves in order to determine the megawatt of generation for the three types of thermal plants. Using the Norfork curve as an example (Figure 4-4), a generation value of 29.7MW was obtained for the 21.9% breakpoint, while a generation value of 22.6 MW was obtained for the 31.5% breakpoint. These two values of generation were then used to divide the generation-duration curve into three components: a 41.5 MW (71.2 MW – 29.7 MW) combustion-turbine (upper) component, a 7.1 MW (29.7 MW – 22.6 MW) combined-cycle (middle) component, and a 22.6 MW (22.6 MW – 0 MW) coal-fired steam (lower) component. Thus, the most likely, least-cost thermal alternative to the Norfork project's generation was found to be 41.5 MW of gas-fired combustion turbine, 7.1 MW of gas-fired combined cycle, and 22.6 MW of coal-fired steam.

4.3. Composite Unit Capacity Value

A composite or weighed unit capacity values were computed for Bull Shoals and Norfork Lake projects. These values were used for the computation of capacity benefits by applying the capacity components of the least-cost thermal alternative as weighting factors to the corresponding adjusted unit capacity values. The derivation of the composite unit capacity value for Bull Shoals and Norfork Lake projects are shown below.

4.3.1. Bull Shoals Lake Composite Capacity Value

Wt. Coal CV = $234.32/kw-yr *[96.8 MW/(96.8 MW+25.7MW+205.0 MW)]
= $ 69.26/kw-yr

Wt. CC CV = $124.06/kw-yr* [25.7 MW/(96.8 MW+25.7MW+205.0 MW)]
= $ 9.74/kw-yr

Wt. CT CV = $59.53/kw-yr * [205.0 MW/(96.8 MW+25.7MW+205.0 MW)]
= $ 37.26/kw-yr

Composite Capacity Value = $69.26/kw-yr + $9.72/kw-yr + $37.26/kw-yr
= **$ $116.26/kw-yr**

4.3.2. Norfork Lake Composite Capacity Value

Wt. Coal CV = $234.32/kw-yr * [22.6MW/ (41.5MW+7.1MW + 22.6MW]
= $74.33/kw-yr

Wt. CC CV = $124.06/kw-yr * [6.7MW/ (41.5MW+7.1MW + 22.6MW]
= $12.36/kw-yr

Wt. CT CV = $59.53/kw-yr * [41.5MW/ (41.5MW+7.1MW + 22.6MW]
= $ $34.71/kw-yr

Composite Capacity Value = $74.33/kw-yr + $12.36/kw-yr + $34.71/kw-yr
= **$121.40/kw-yr**

The capacity unit value is then applied to the respective dependable capacity losses in Table 4-6 of Section 4.1.6 to obtain the loss in capacity benefits for each case. These computations are summarized in Chapter 5.

5. BENEFITS FOREGONE

One of the objectives of this study was to identify power benefits foregone due to the proposed storage reallocation from Conservation Storage, from Flood Control Storage, and from Inactive Storage in Bull Shoals and Norfork Lakes. Annual energy losses were computed and then multiplied by the energy unit value to arrive at annual energy benefits foregone. Annual dependable capacity losses were computed and then multiplied by the composite capacity unit value to arrive at annual capacity benefits foregone. Capacity benefits foregone were then added to energy benefits foregone to arrive at total hydropower benefits foregone due to water supply withdrawals.

5.1. Summary of Power Benefits Foregone

Table 5-1 summarizes total hydropower benefits foregone due to storage reallocation from Conservation Storage, from Flood Control Storage, and from Inactive Storage in Bull Shoals and Norfork Lakes. The data in Table 5-1 is derived from information developed in prior sections of this report. Table 3-6 provides the Peak and Off-Peak lost energy and Table 3-8 provides the annualized price by calendar month of the energy lost. Dependable capacity lost is described in Table 4-6. The composite unit value for capacity is found in Section 4.3.

Table 5-1. Hydropower Benefits Foregone Due to Reallocation of Storage in Bull Shoals and Norfork Lakes

		Bull Shoals Lake			
		Annual Energy Loss		**Capacity Loss**	**TOTAL**
from Conservation	Peak	$68,232			
	Off-Peak	$9,970	$78,202	$116	**$78,318**
from Flood Control	Peak	$59,505			
	Off-Peak	($4,142)	$55,363	($116)	**$55,247**
from Inactive	Peak	$63,990			
	Off-Peak	$9,597	$73,587	$116	**$73,703**
		Norfork Lake			
		Annual Energy Loss		**Capacity Loss**	**TOTAL**
from Conservation	Peak	($2,644)			
	Off-Peak	$2,010	($634)	$243	**($391)**
from Flood Control	Peak	$2,723			
	Off-Peak	($1,636)	$1,087	$0	**$1,087**
from Inactive	Peak	($2,429)			
	Off-Peak	$1,851	($578)	$243	**($335)**

6. REVENUE FOREGONE

Revenue foregone are based on the current contract rates of the PMA for Bull Shoals and Norfork Lakes project power generation. The rates that are in effect are as follows;

On-Peak Energy Rate: 15.30 mills/KWh
Off-Peak Energy Rate: 8.60 mills/KWh
Capacity Charge: $48./KW-yr

To compute revenues foregone, the energy charge is applied to the average annual energy losses and the dependable capacity loss in the year 1954 (the PMA's most critical operating year).

6.1. Average Energy Loss

The average annual energy loss under each reallocation alternative, from Table 3-6, is summarized in Table 6-1.

Table 6-1. Average Energy Loss Due to Reallocation of Storage in Bull Shoals and Norfork Lakes

		Bull Shoals Lake		Norfork Lake	
		Annual Energy Loss (MWh)			
	Peak	1,116		(42)	16
from Conservation	Off-Peak	244	1,360	58	
	Peak	899		19	17
from Flood Control	Off-Peak	(105)	794	(2)	
	Peak	1,042		(39)	16
from Inactive	Off-Peak	231	1,273	55	

6.2. Capacity Loss

The amount of dependable capacity at Bull Shoals and Norfork Lakes is based on the capacity that can be supported during the 1954 peak demand period. The loss in dependable capacity is shown below in Table 6-2.

Table 6-2. Dependable Capacity Loss Due to Reallocation of Storage in Bull Shoals and Norfork Lakes

Critical Year 1956	Bull Shoals Lake		Norfork Lake	
	Dependable Capacity	Depenable Capacity Loss	Dependable Capacity	Depenable Capacity Loss
	MW	MW	MW	MW
Existing Conditions	376.000	**---**	76.900	**---**
From Conservation	375.985	**0.015**	76.897	**0.003**
From Flood Control	376.011	**(0.011)**	76.906	**(0.006)**
From Inactive	375.986	**0.014**	76.900	**0.000**

6.3. Marketable Capacity vs. Dependable Capacity

The 1954 critical water year was designated by the PMA and the supportable capacity computation for that year is shown in Tables 4-2 through 4-5. Also, shown in these tables is the dependable capacity. The difference between the two parameters measures different quantities. The dependable capacity is an NED value, which is intended to measure the economic impact on the region as a whole, while the marketable capacity is a financial parameter that applies only to a single entity, the PMA. Dependable capacity is computed based on the critical period average of historical period years, while marketable capacity is computed based on adverse water conditions and peak power demand during a single year.

6.4. Total Revenues Foregone

The PMA's annual revenue foregone under each reallocation alternative is the sum of the annual energy revenue foregone and the annual capacity revenue foregone. Annual energy revenue foregone is the product of the annual On-Peak and Off-Peak energy loss (Table 6-1) and the energy charges, while annual capacity revenue foregone is the product of the loss in dependable capacity during the peak demand period of 1954

(Table 6-2) and the capacity charge. Total revenue foregone for the reallocation alternatives from Bull Shoals and Norfork Lakes are summarized in Table 6-3.

Table 6-3. Hydropower Revenue Foregone Due to Reallocation of Storage in Bull Shoals and Norfork Lakes

		Bull Shoals Lake			
		Annual Energy Loss		**Capacity Loss**	**TOTAL**
from Conservation	Peak	$17,075			
	Off-Peak	$2,098	$19,173	$759	**$19,932**
from Flood Control	Peak	$13,755			
	Off-Peak	($903)	$12,852	($537)	**$12,315**
from Inactive	Peak	$15,943			
	Off-Peak	$1,987	$17,929	$703	**$18,632**
		Norfork Lake			
		Annual Energy Loss		**Capacity Loss**	**TOTAL**
from Conservation	Peak	($643)			
	Off-Peak	$499	($144)	$147	**$3**
from Flood Control	Peak	$291			
	Off-Peak	($17)	$274	($294)	**($20)**
from Inactive	Peak	($597)			
	Off-Peak	$473	($124)	$0	**($124)**

7. CREDIT TO POWER MARKETING AGENCY

Project costs originally allocated to hydropower are being repaid through power revenues which are based on rates designed by the Federal power marketing agency (PMA) to recover allocated costs plus interest within 50 years of the date of commercial power operation. If a portion of the storage is reallocated from hydropower to water supply, the PMA's repayment obligation must be reduced in proportion to the lost energy and marketable capacity.

Planning Guidance Notebook, Appendix E-57d(3) of ER 1105-2-100 (22 April 2002) states that;

> "If hydropower revenues are being reduced as a result of the reallocation, the power marketing agency will be credited for the amount of revenues to the Treasury foregone as a result of the reallocation assuming uniform annual repayment."

Paragraph d(2)(b) states that;

> "Revenues foregone to hydropower are the reduction in revenues accruing to the Treasury as a result of the reduction in hydropower outputs based on the Baseline rates charged by the power marketing agency. Revenues foregone from other project purposes are the reduction in revenues accruing to the Treasury based on any Baseline repayment agreements."

For purposes of estimating what this cost will be, the energy and marketable capacity values and energy and capacity charges from Chapter 6 will be used. No annual escalation rate will be applied to the energy and capacity charges to cover the PMA's estimated real increase in rates in the future, in accordance with paragraph 4-32d(2)(b) of ER 1105-2-100 cited above.

ER 1105-2-100 also allows the marketing agency credit for any additional costs above the lost revenue to recover costs of purchased power to meet the obligations of the current power sales contract(s) relating to the marketing of power from the hydro project(s) where storage is being reallocated. The continuation of Appendix E-57d(3), provides the following guidance:

> "In instances where Baseline contracts between the power marketing agency and their customer would result in a cost to the Federal Government to acquire replacement power to fulfill the obligations of contracts, an additional credit to the power marketing agency can be made for such costs incurred during the remaining period of the contracts."

In both cases the credit in each year will be based on the revenue actually lost or the replacement costs actually incurred (and documented) by the power marketing agency. However, for purposes of providing an estimate of this credit, the cost of replacement power will be based on the same power values and energy and average dependable capacity losses as were used in the benefits foregone calculations.

7.1. Remaining Period of Contract

The length of time remaining under the current power sales contracts had to be identified to determine how many years the PMA credit would be based on cost of replacement power. Contract information provided by the PMA indicated that current contracts for all power marketed from the Bull Shoals and Norfork Lakes will expire in 2025. For this reason, the cost of replacement power will be the basis for the PMA credit until the present contracts expire in 2025. Following 2025 the PMA credit will be based on revenue foregone for the remaining economic life of the project.

7.2. Computation of Credit to Power Marketing Agency

Tables 7-1 through 7-6 show the computation of PMA capacity and energy credits. The benefit foregone for lost energy and lost dependable capacity were taken from Table 5-1. The revenue foregone for lost energy and marketable capacity were taken from Table 6-3. Following are explanations of the columns in Table 7-1 through Table 7-6;

- Column 1 - end of the analysis period 2059
- Column 2 - capacity benefit is from Table 5-1.
- Column 3 - capacity revenue is from Table 6-3.
- Column 4 - power from this project is marketed under a contract that will expire in 2025. Capacity credits are based upon capacity benefits until 2025, and capacity revenues foregone from 2025 to the end of project economic life.
- Column 5 - energy benefit is from Table 5-1.
- Column 6 - energy revenue is from Table 6-3.
- Column 7 - energy credits are calculated as described in Column (4).
- Column 8 - amortization factor at 4-3/8 percent interest
- Column 9 - column 4 x column 8
- Column 10 - column 7 x column 8
- Column 11 - column 9 + column 10

Following is the calculation of the expected average annual PMA credit for the alternative storage reallocations in Bull Shoals and Norfork Lakes analyzed in this report.

Table 7-1. Annual PMA Capacity and Energy Credit for Reallocation from Bull Shoals Lake Conservation Zone

(1) Year	(2) Capacity Benefit ($)	(3) Capacity Revenue ($)	(4) Annual Capacity Credit ($)	(5) Energy Benefit ($)	(6) Energy Revenue ($)	(7) Annual Energy Credit ($)	(8) Present-Worth Factor	(9) Present-Worthed Capacity Credit ($)	(10) Present-Worthed Energy Credit ($)	(11) Total Power Credit ($)
2010	$116	----	$116	$78,202	----	$78,202	1.0000	$116	$78,202	$78,318
2011	$116	----	$116	$78,202	----	$78,202	0.9581	$111	$74,924	$75,035
2012	$116	----	$116	$78,202	----	$78,202	0.9179	$106	$71,784	$71,890
2013	$116	----	$116	$78,202	----	$78,202	0.8794	$102	$68,775	$68,877
2014	$116	----	$116	$78,202	----	$78,202	0.8426	$98	$65,892	$65,990
2015	$116	----	$116	$78,202	----	$78,202	0.8073	$94	$63,130	$63,224
2016	$116	----	$116	$78,202	----	$78,202	0.7734	$90	$60,484	$60,573
2017	$116	----	$116	$78,202	----	$78,202	0.7410	$86	$57,949	$58,034
2018	$116	----	$116	$78,202	----	$78,202	0.7100	$82	$55,520	$55,602
2019	$116	----	$116	$78,202	----	$78,202	0.6802	$79	$53,192	$53,271
2020	$116	----	$116	$78,202	----	$78,202	0.6517	$76	$50,963	$51,038
2021	$116	----	$116	$78,202	----	$78,202	0.6244	$72	$48,827	$48,899
2022	$116	----	$116	$78,202	----	$78,202	0.5982	$69	$46,780	$46,849
2023	$116	----	$116	$78,202	----	$78,202	0.5731	$66	$44,819	$44,886
2024	$116	----	$116	$78,202	----	$78,202	0.5491	$64	$42,940	$43,004
2025	$116	----	$116	$78,202	----	$78,202	0.5261	$61	$41,141	$41,202
2026	----	$759	$759	----	$19,173	$19,173	0.5040	$382	$9,664	$10,046
2027	----	$759	$759	----	$19,173	$19,173	0.4829	$366	$9,259	$9,625
2028	----	$759	$759	----	$19,173	$19,173	0.4627	$351	$8,871	$9,222
2029	----	$759	$759	----	$19,173	$19,173	0.4433	$336	$8,499	$8,835
2030-2051	----	$759	$759	----	$19,173	$19,173	----	----	----	----
2052	----	$759	$759	----	$19,173	$19,173	0.1656	$126	$3,174	$3,300
2053	----	$759	$759	----	$19,173	$19,173	0.1586	$120	$3,041	$3,162
2054	----	$759	$759	----	$19,173	$19,173	0.1520	$115	$2,914	$3,029
2055	----	$759	$759	----	$19,173	$19,173	0.1456	$110	$2,792	$2,902
2056	----	$759	$759	----	$19,173	$19,173	0.1395	$106	$2,675	$2,780
2057	----	$759	$759	----	$19,173	$19,173	0.1336	$101	$2,562	$2,664
2058	----	$759	$759	----	$19,173	$19,173	0.1280	$97	$2,455	$2,552
2059	----	$759	$759	----	$19,173	$19,173	0.1227	$93	$2,352	$2,445
								$8,367	$1,102,108	$1,110,475
				Years of Analysis				50	50	50
				Annualization Factor				0.04958	0.04958	0.04958
				Annualized PMA Credit				**$415**	**$54,639**	**$55,054**

Table 7-2. Annual PMA Capacity and Energy Credit for Reallocation from Bull Shoals Lake Flood Control Zone

(1) Year	(2) Capacity Benefit ($)	(3) Capacity Revenue ($)	(4) Annual Capacity Credit ($)	(5) Energy Benefit ($)	(6) Energy Revenue ($)	(7) Annual Energy Credit ($)	(8) Present-Worth Factor	(9) Present-Worthed Capacity Credit ($)	(10) Present-Worthed Energy Credit ($)	(11) Total Power Credit ($)
2010	($116)	----	($116)	$55,363	----	$55,363	1.0000	($116)	$55,363	$55,247
2011	($116)	----	($116)	$55,363	----	$55,363	0.9581	($111)	$53,042	$52,931
2012	($116)	----	($116)	$55,363	----	$55,363	0.9179	($106)	$50,819	$50,713
2013	($116)	----	($116)	$55,363	----	$55,363	0.8794	($102)	$48,689	$48,587
2014	($116)	----	($116)	$55,363	----	$55,363	0.8426	($98)	$46,648	$46,550
2015	($116)	----	($116)	$55,363	----	$55,363	0.8073	($94)	$44,693	$44,599
2016	($116)	----	($116)	$55,363	----	$55,363	0.7734	($90)	$42,819	$42,730
2017	($116)	----	($116)	$55,363	----	$55,363	0.7410	($86)	$41,025	$40,939
2018	($116)	----	($116)	$55,363	----	$55,363	0.7100	($82)	$39,305	$39,223
2019	($116)	----	($116)	$55,363	----	$55,363	0.6802	($79)	$37,657	$37,579
2020	($116)	----	($116)	$55,363	----	$55,363	0.6517	($76)	$36,079	$36,003
2021	($116)	----	($116)	$55,363	----	$55,363	0.6244	($72)	$34,567	$34,494
2022	($116)	----	($116)	$55,363	----	$55,363	0.5982	($69)	$33,118	$33,048
2023	($116)	----	($116)	$55,363	----	$55,363	0.5731	($66)	$31,730	$31,663
2024	($116)	----	($116)	$55,363	----	$55,363	0.5491	($64)	$30,400	$30,336
2025	($116)	----	($116)	$55,363	----	$55,363	0.5261	($61)	$29,125	$29,064
2026	----	($537)	($537)	----	$12,852	$12,852	0.5040	($270)	$6,478	$6,207
2027	----	($537)	($537)	----	$12,852	$12,852	0.4829	($259)	$6,206	$5,947
2028	----	($537)	($537)	----	$12,852	$12,852	0.4627	($248)	$5,946	$5,698
2029	----	($537)	($537)	----	$12,852	$12,852	0.4433	($238)	$5,697	$5,459
2030-2051	----	($537)	($537)	----	$12,852	$12,852	----	----	----	----
2052	----	($537)	($537)	----	$12,852	$12,852	0.1656	($89)	$2,128	$2,039
2053	----	($537)	($537)	----	$12,852	$12,852	0.1586	($85)	$2,039	$1,953
2054	----	($537)	($537)	----	$12,852	$12,852	0.1520	($82)	$1,953	$1,872
2055	----	($537)	($537)	----	$12,852	$12,852	0.1456	($78)	$1,871	$1,793
2056	----	($537)	($537)	----	$12,852	$12,852	0.1395	($75)	$1,793	$1,718
2057	----	($537)	($537)	----	$12,852	$12,852	0.1336	($72)	$1,718	$1,646
2058	----	($537)	($537)	----	$12,852	$12,852	0.1280	($69)	$1,646	$1,577
2059	----	($537)	($537)	----	$12,852	$12,852	0.1227	($66)	$1,577	$1,511
								($6,320)	$773,579	$767,260
				Years of Analysis				$50	50	50
				Annualization Factor				$0	0.04958	0.04958
				Annualized PMA Credit				**($313)**	**$38,352**	**$38,039**

Table 7-3. Annual PMA Capacity and Energy Credit for Reallocation from Bull Shoals Lake Inactive Zone

(1) Year	(2) Capacity Benefit ($)	(3) Capacity Revenue ($)	(4) Annual Capacity Credit ($)	(5) Energy Benefit ($)	(6) Energy Revenue ($)	(7) Annual Energy Credit ($)	(8) Present-Worth Factor	(9) Present-Worthed Capacity Credit ($)	(10) Present-Worthed Energy Credit ($)	(11) Total Power Credit ($)
2010	$116	----	$116	$73,587	----	$73,587	1.0000	$116	$73,587	$73,703
2011	$116	----	$116	$73,587	----	$73,587	0.9581	$111	$70,503	$70,614
2012	$116	----	$116	$73,587	----	$73,587	0.9179	$106	$67,547	$67,654
2013	$116	----	$116	$73,587	----	$73,587	0.8794	$102	$64,716	$64,818
2014	$116	----	$116	$73,587	----	$73,587	0.8426	$98	$62,003	$62,101
2015	$116	----	$116	$73,587	----	$73,587	0.8073	$94	$59,404	$59,498
2016	$116	----	$116	$73,587	----	$73,587	0.7734	$90	$56,914	$57,004
2017	$116	----	$116	$73,587	----	$73,587	0.7410	$86	$54,529	$54,615
2018	$116	----	$116	$73,587	----	$73,587	0.7100	$82	$52,243	$52,325
2019	$116	----	$116	$73,587	----	$73,587	0.6802	$79	$50,053	$50,132
2020	$116	----	$116	$73,587	----	$73,587	0.6517	$76	$47,955	$48,031
2021	$116	----	$116	$73,587	----	$73,587	0.6244	$72	$45,945	$46,018
2022	$116	----	$116	$73,587	----	$73,587	0.5982	$69	$44,019	$44,089
2023	$116	----	$116	$73,587	----	$73,587	0.5731	$66	$42,174	$42,241
2024	$116	----	$116	$73,587	----	$73,587	0.5491	$64	$40,406	$40,470
2025	$116	----	$116	$73,587	----	$73,587	0.5261	$61	$38,713	$38,774
2026	----	$703	$703	----	$17,929	$17,929	0.5040	$354	$9,037	$9,391
2027	----	$703	$703	----	$17,929	$17,929	0.4829	$340	$8,658	$8,998
2028	----	$703	$703	----	$17,929	$17,929	0.4627	$325	$8,295	$8,620
2029	----	$703	$703	----	$17,929	$17,929	0.4433	$312	$7,947	$8,259
2030-2051	----	$703	$703	----	$17,929	$17,929	----	----	----	----
2052	----	$703	$703	----	$17,929	$17,929	0.1656	$116	$2,968	$3,085
2053	----	$703	$703	----	$17,929	$17,929	0.1586	$112	$2,844	$2,955
2054	----	$703	$703	----	$17,929	$17,929	0.1520	$107	$2,725	$2,832
2055	----	$703	$703	----	$17,929	$17,929	0.1456	$102	$2,610	$2,713
2056	----	$703	$703	----	$17,929	$17,929	0.1395	$98	$2,501	$2,599
2057	----	$703	$703	----	$17,929	$17,929	0.1336	$94	$2,396	$2,490
2058	----	$703	$703	----	$17,929	$17,929	0.1280	$90	$2,296	$2,386
2059	----	$703	$703	----	$17,929	$17,929	0.1227	$86	$2,200	$2,286
								-----------	-----------	-----------
								$7,855	$1,036,031	$1,043,886
				Years of Analysis				50	50	50
				Annualization Factor				0.04958	0.04958	0.04958
				Annualized PMA Credit				**$389**	**$51,363**	**$51,753**

Table 7-4. Annual PMA Capacity and Energy Credit for Norfork Lake with Reallocation from Conservation Zone

(1) Year	(2) Capacity Benefit ($)	(3) Capacity Revenue ($)	(4) Annual Capacity Credit ($)	(5) Energy Benefit ($)	(6) Energy Revenue ($)	(7) Annual Energy Credit ($)	(8) Present-Worth Factor	(9) Present-Worthed Capacity Credit ($)	(10) Present-Worthed Energy Credit ($)	(11) Total Power Credit ($)
2010	$243	----	$243	($634)	----	($634)	1.0000	$243	($634)	($391)
2011	$243	----	$243	($634)	----	($634)	0.9581	$233	($607)	($374)
2012	$243	----	$243	($634)	----	($634)	0.9179	$223	($582)	($359)
2013	$243	----	$243	($634)	----	($634)	0.8794	$214	($558)	($344)
2014	$243	----	$243	($634)	----	($634)	0.8426	$205	($534)	($329)
2015	$243	----	$243	($634)	----	($634)	0.8073	$196	($512)	($316)
2016	$243	----	$243	($634)	----	($634)	0.7734	$188	($490)	($302)
2017	$243	----	$243	($634)	----	($634)	0.7410	$180	($470)	($290)
2018	$243	----	$243	($634)	----	($634)	0.7100	$173	($450)	($277)
2019	$243	----	$243	($634)	----	($634)	0.6802	$165	($431)	($266)
2020	$243	----	$243	($634)	----	($634)	0.6517	$158	($413)	($255)
2021	$243	----	$243	($634)	----	($634)	0.6244	$152	($396)	($244)
2022	$243	----	$243	($634)	----	($634)	0.5982	$145	($379)	($234)
2023	$243	----	$243	($634)	----	($634)	0.5731	$139	($363)	($224)
2024	$243	----	$243	($634)	----	($634)	0.5491	$133	($348)	($215)
2025	$243	----	$243	($634)	----	($634)	0.5261	$128	($334)	($206)
2026	----	$147	$147	----	($144)	($144)	0.5040	$74	($72)	$2
2027	----	$147	$147	----	($144)	($144)	0.4829	$71	($69)	$2
2028	----	$147	$147	----	($144)	($144)	0.4627	$68	($67)	$1
2029	----	$147	$147	----	($144)	($144)	0.4433	$65	($64)	$1
2030-2051	----	$32	$147	----	($144)	($144)	----	----	----	----
2052	----	$147	$147	----	($144)	($144)	0.1656	$24	($24)	$0
2053	----	$147	$147	----	($144)	($144)	0.1586	$23	($23)	$0
2054	----	$147	$147	----	($144)	($144)	0.1520	$22	($22)	$0
2055	----	$147	$147	----	($144)	($144)	0.1456	$21	($21)	$0
2056	----	$147	$147	----	($144)	($144)	0.1395	$20	($20)	$0
2057	----	$147	$147	----	($144)	($144)	0.1336	$20	($19)	$1
2058	----	$147	$147	----	($144)	($144)	0.1280	$19	($18)	$1
2059	----	$147	$147	----	($144)	($144)	0.1227	$18	($18)	$0
								-----------	-----------	-----------
								$4,226	($8,827)	($4,601)
				Years of Analysis				50	50	50
				Annualization Factor				0.04958	0.04958	0.04958
				Annualized PMA Credit				**$210**	**($438)**	**($228)**

Table 7-5. Annual PMA Capacity and Energy Credit for Norfork Lake with Reallocation from Flood Control Zone

(1) Year	(2) Capacity Benefit ($)	(3) Capacity Revenue ($)	(4) Annual Capacity Credit ($)	(5) Energy Benefit ($)	(6) Energy Revenue ($)	(7) Annual Energy Credit ($)	(8) Present-Worth Factor	(9) Present-Worthed Capacity Credit ($)	(10) Present-Worthed Energy Credit ($)	(11) Total Power Credit ($)
2010	$0	----	$0	$1,087	----	$1,087	1.0000	$0	$1,087	$1,087
2011	$0	----	$0	$1,087	----	$1,087	0.9581	$0	$1,041	$1,041
2012	$0	----	$0	$1,087	----	$1,087	0.9179	$0	$998	$998
2013	$0	----	$0	$1,087	----	$1,087	0.8794	$0	$956	$956
2014	$0	----	$0	$1,087	----	$1,087	0.8426	$0	$916	$916
2015	$0	----	$0	$1,087	----	$1,087	0.8073	$0	$877	$877
2016	$0	----	$0	$1,087	----	$1,087	0.7734	$0	$841	$841
2017	$0	----	$0	$1,087	----	$1,087	0.7410	$0	$805	$805
2018	$0	----	$0	$1,087	----	$1,087	0.7100	$0	$772	$772
2019	$0	----	$0	$1,087	----	$1,087	0.6802	$0	$739	$739
2020	$0	----	$0	$1,087	----	$1,087	0.6517	$0	$708	$708
2021	$0	----	$0	$1,087	----	$1,087	0.6244	$0	$679	$679
2022	$0	----	$0	$1,087	----	$1,087	0.5982	$0	$650	$650
2023	$0	----	$0	$1,087	----	$1,087	0.5731	$0	$623	$623
2024	$0	----	$0	$1,087	----	$1,087	0.5491	$0	$597	$597
2025	$0	----	$0	$1,087	----	$1,087	0.5261	$0	$572	$572
2026	----	($294)	($294)	----	$274	$274	0.5040	($148.00)	$138	($10)
2027	----	($294)	($294)	----	$274	$274	0.4829	($141.80)	$132	($10)
2028	----	($294)	($294)	----	$274	$274	0.4627	($135.86)	$127	($9)
2029	----	($294)	($294)	----	$274	$274	0.4433	($130.16)	$121	($9)
2030-2051	----	($294)	($294)	----	$274	$274	----	----	----	----
2052	----	($294)	($294)	----	$274	$274	0.1656	($48.61)	$45	($3)
2053	----	($294)	($294)	----	$274	$274	0.1586	($46.58)	$43	($3)
2054	----	($294)	($294)	----	$274	$274	0.1520	($44.62)	$42	($3)
2055	----	($294)	($294)	----	$274	$274	0.1456	($42.75)	$40	($3)
2056	----	($294)	($294)	----	$274	$274	0.1395	($40.96)	$38	($3)
2057	----	($294)	($294)	----	$274	$274	0.1336	($39.24)	$37	($3)
2058	----	($294)	($294)	----	$274	$274	0.1280	($37.60)	$35	($3)
2059	----	($294)	($294)	----	$274	$274	0.1227	($36.02)	$34	($2)
								-----------	-----------	-----------
								($2,708)	$15,384	$12,676
				Years of Analysis				50	50	50
				Annualization Factor				0.04958	0.04958	0.04958
				Annualized PMA Credit				**($134)**	**$763**	**$628**

Table 7-6. Annual PMA Capacity and Energy Credit for Norfork Lake with Reallocation from Inactive Zone

(1) Year	(2) Capacity Benefit ($)	(3) Capacity Revenue ($)	(4) Annual Capacity Credit ($)	(5) Energy Benefit ($)	(6) Energy Revenue ($)	(7) Annual Energy Credit ($)	(8) Present-Worth Factor	(9) Present-Worthed Capacity Credit ($)	(10) Present-Worthed Energy Credit ($)	(11) Total Power Credit ($)
2010	$243	----	$243	($578)	----	($578)	1.0000	$243	($578)	($335)
2011	$243	----	$243	($578)	----	($578)	0.9581	$233	($554)	($321)
2012	$243	----	$243	($578)	----	($578)	0.9179	$223	($531)	($308)
2013	$243	----	$243	($578)	----	($578)	0.8794	$214	($508)	($295)
2014	$243	----	$243	($578)	----	($578)	0.8426	$205	($487)	($282)
2015	$243	----	$243	($578)	----	($578)	0.8073	$196	($467)	($270)
2016	$243	----	$243	($578)	----	($578)	0.7734	$188	($447)	($259)
2017	$243	----	$243	($578)	----	($578)	0.7410	$180	($428)	($248)
2018	$243	----	$243	($578)	----	($578)	0.7100	$173	($410)	($238)
2019	$243	----	$243	($578)	----	($578)	0.6802	$165	($393)	($228)
2020	$243	----	$243	($578)	----	($578)	0.6517	$158	($377)	($218)
2021	$243	----	$243	($578)	----	($578)	0.6244	$152	($361)	($209)
2022	$243	----	$243	($578)	----	($578)	0.5982	$145	($346)	($200)
2023	$243	----	$243	($578)	----	($578)	0.5731	$139	($331)	($192)
2024	$243	----	$243	($578)	----	($578)	0.5491	$133	($317)	($184)
2025	$243	----	$243	($578)	----	($578)	0.5261	$128	($304)	($176)
2026	----	$0	$0	----	($124)	($124)	0.5040	$0	($62)	($62)
2027	----	$0	$0	----	($124)	($124)	0.4829	$0	($60)	($60)
2028	----	$0	$0	----	($124)	($124)	0.4627	$0	($57)	($57)
2029	----	$0	$0	----	($124)	($124)	0.4433	$0	($55)	($55)
2030-2051	----	$0	$0	----	($124)	($124)	----	----	----	----
2052	----	$0	$0	----	($124)	($124)	0.1656	$0	($20)	($20)
2053	----	$0	$0	----	($124)	($124)	0.1586	$0	($20)	($20)
2054	----	$0	$0	----	($124)	($124)	0.1520	$0	($19)	($19)
2055	----	$0	$0	----	($124)	($124)	0.1456	$0	($18)	($18)
2056	----	$0	$0	----	($124)	($124)	0.1395	$0	($17)	($17)
2057	----	$0	$0	----	($124)	($124)	0.1336	$0	($17)	($17)
2058	----	$0	$0	----	($124)	($124)	0.1280	$0	($16)	($16)
2059	----	$0	$0	----	($124)	($124)	0.1227	$0	($15)	($15)
								-----------	-----------	-----------
								$2,875	($7,980)	($5,104)
				Years of Analysis				50	50	50
				Annualization Factor				0.04958	0.04958	0.04958
				Annualized PMA Credit				**$143**	**($396)**	**($253)**

7.3. Summary of Credits

Table 7-7 list a summary of credit due the PMA for the alternative reallocations in Bull Shoals and Norfork Lakes.

Table 7-7. Annual Credit Due PMA Due to Reallocation from Bull Shoals and Norfork Lakes

Alternatives	Bull Shoals Lake		
	Energy	Capacity	Total
From Conservation	$54,639	$415	**$55,054**
From Flood Control	$38,352	($313)	**$38,039**
From Inactive	$51,363	$389	**$51,753**
	Norfork Lake		
From Conservation	($438)	$210	**($228)**
From Flood Control	$763	($134)	**$628**
From Inactive	($396)	$143	**($253)**

8. SUMMARY OF RESULTS

8.1. Power Benefits Foregone

Summarizing the data developed in Chapters 2 through 5, power benefits foregone for the alternative reallocations in Bull Shoals and Norfork Lakes are as follows (from Table 5-1):

Table 8-1. Annual Power Benefits Foregone

Alternatives	Bull Shoals Lake	Norfork Lake	TOTAL
From Conservation	$78,318	($391)	$77,927
From Flood Control	$55,247	$1,087	$56,334
From Inactive	$73,703	($335)	$73,368

8.2. Replacement Cost

As noted in Section 1.6, the replacement cost of power as used in determining the cost of the reallocation to the water supply customer is identical in each case to the hydropower benefits foregone presented in Chapter 5.

8.3. Revenue Foregone

Summarizing the data developed in Chapters 6, the power revenue foregone for alternative reallocations in Bull Shoals and Norfork Lakes are as follows (from Table 6-3)

Table 8-2. Annual Revenue Foregone

Alternatives	Bull Shoals Lake	Norfork Lake	TOTAL
From Conservation	$19,932	$3	$19,935
From Flood Control	$12,315	($20)	$12,295
From Inactive	$18,632	($124)	$18,509

8.4. PMA Credit

Summarizing the data developed in Chapter 7, PMA credits for the project is as follows (from Table 7-7).

Table 8-3. Annual PMA Credit

Alternatives	Bull Shoals Lake	Norfork Lake	TOTAL
From Conservation	$55,054	($228)	$54,826
From Flood Control	$38,039	$628	$38,667
From Inactive	$51,753	($253)	$51,500

ADDENDUM A

platts' M2M Power Curve

data obtained under subscription

SENSITIVE:
Proprietary Information

For internal Use ONLY

SPP/SERC-Entergy conversion factors

Month	Off Peak Energy	Peak Energy
Jan	0.98	1.04
Feb	1.04	1.05
Mar	0.96	1.01
Apr	1.00	1.03
May	1.00	1.10
Jun	1.04	1.18
Jul	1.28	1.42
Aug	1.32	1.38
Sep	0.93	1.07
Oct	0.95	1.00
Nov	0.96	1.01
Dec	0.99	1.01

ADDENDUM B

FERC Capacity and Energy Cost by Thermal Generation Type and by State in SERC subregion-Entergy

State	CO		CC		CT	
	Capacity $/KW-yr	Energy $/MWh	Capacity $/KW-yr	Energy $/MWh	Capacity $/KW-yr	Energy $/MWh
Arkansas	$230.90	$20.06	$123.74	$60.81	$59.20	$96.05
Missouri	$241.30	$16.87	$124.72	$59.11	$60.19	$93.30
Oklahoma	$230.77	$17.44	$123.74	$54.40	$59.20	$85.76
Average	**$234.32**	**$18.12**	**$124.06**	**$58.11**	**$59.53**	**$91.70**

			Date Run
COAL-FIRED STEAM POWER VALUE			11/13/09
PROJECT NAME:	OMRPWA-WS-Reallocation		
LOCATION:	Arkansas		
FINANCING:	FEDERAL @	4.375 %	
Capacity Value	**$230.90**	per kW-yr	
Energy Value	**$20.06**	per MWh	

PROGRAM INPUT DATA			
		State Index Number	4
		State Location	AR
Cost Level Date	11/1/2009	H-W Index Reg No	4
Single unit capacity	600	ROW ($/acre)	2526
Capacity factor	0.65	Clearing % of ROW	0.60
Trans Voltage	345	Rec Sub Land Cost	23763
Transformer MVA	200	Plant Invest	1551
No of Trans	6	FC Mov-Ave Time Frame	60
No of Trans Pos	2	Fuel Cost	160.2
Single or Three Phase	1	Heat Rate	10730
Length Line 1	50	Variable O&M	2.87
Length Line 2	0	Fixed O&M	71.25
Line 1: Total Circuits	3	O&M update	3.07
No of Single Circ	1	Plant update	2.92
No of Double Circ	1	Transmission update	2.64
Line 2: Total Circuits	0	Depreciation Plant (%)	1.67
No of Single Circ	0	Deprec Sub (%)	1.67
No of Double Circ	0	Deprec Trans Tower (%)	0.58
		Deprec Trans Pole (%)	1.67
Cost of Money (%)	4.375		
Plant Life	30	Fed Inc Tax (%)	0.000
Substation Life	30	Fed Misc Tax (%)	0.000
Trans (towers) Life	50	State & Local Tax (%)	0.000
Trans (poles) life	30		
		Hydro Flex Adjust	0.050
Plant insurance (%)	0.25	Alt Mechanical Avail	0.850
Trans Insurance (%)	0.10	Hydro Mech Avail	0.980
Sub insurance (%)	0.25	Mech Avail Adjust	0.153

	Date Run
COAL-FIRED STEAM POWER VALUE	06/24/10

PROJECT NAME: OMRPWS WS-Reallocation
LOCATION: Missouri
FINANCING: FEDERAL @ 4.375 %

Capacity Value	**$241.30**	per kW-yr
Energy Value	**$16.87**	per MWh

PROGRAM INPUT DATA

		State Index Number	26
		State Location	MO
Cost Level Date	11/1/2009	H-W Index Reg No	3
Single unit capacity	600	ROW ($/acre)	2579
Capacity factor	0.65	Clearing % of ROW	0.60
Trans Voltage	345	Rec Sub Land Cost	24263
Transformer MVA	200	Plant Invest	1669
No of Trans	6	FC Mov-Ave Time Frame	60
No of Trans Pos	2	Fuel Cost	135.3
Single or Three Phase	1	Heat Rate	10130
Length Line 1	50	Variable O&M	3.17
Length Line 2	0	Fixed O&M	71.44
Line 1: Total Circuits	3	O&M update	3.07
No of Single Circ	1	Plant update	3.21
No of Double Circ	1	Transmission update	3.26
Line 2: Total Circuits	0	Depreciation Plant (%)	1.67
No of Single Circ	0	Deprec Sub (%)	1.67
No of Double Circ	0	Deprec Trans Tower (%)	0.58
		Deprec Trans Pole (%)	1.67
Cost of Money (%)	4.375		
Plant Life	30	Fed Inc Tax (%)	0.000
Substation Life	30	Fed Misc Tax (%)	0.000
Trans (towers) Life	50	State & Local Tax (%)	0.000
Trans (poles) life	30		
		Hydro Flex Adjust	0.050
Plant insurance (%)	0.25	Alt Mechanical Avail	0.850
Trans Insurance (%)	0.10	Hydro Mech Avail	0.980
Sub insurance (%)	0.25	Mech Avail Adjust	0.153

Date Run

COAL-FIRED STEAM POWER VALUE

06/24/10

PROJECT NAME: OMRPWS WS-Reallocation
LOCATION: Oklahoma
FINANCING: FEDERAL @ 4.375 %

Capacity Value	**$230.77**	per kW-yr
Energy Value	**$17.44**	per MWh

PROGRAM INPUT DATA

		State Index Number	37
		State Location	OK
Cost Level Date	11/1/2009	H-W Index Reg No	4
Single unit capacity	600	ROW ($/acre)	2579
Capacity factor	0.65	Clearing % of ROW	0.60
Trans Voltage	345	Rec Sub Land Cost	24263
Transformer MVA	200	Plant Invest	1551
No of Trans	6	FC Mov-Ave Time Frame	60
No of Trans Pos	2	Fuel Cost	135.3
Single or Three Phase	1	Heat Rate	10730
Length Line 1	50	Variable O&M	2.93
Length Line 2	0	Fixed O&M	71.25
Line 1: Total Circuits	3	O&M update	3.07
No of Single Circ	1	Plant update	2.92
No of Double Circ	1	Transmission update	2.64
Line 2: Total Circuits	0	Depreciation Plant (%)	1.67
No of Single Circ	0	Deprec Sub (%)	1.67
No of Double Circ	0	Deprec Trans Tower (%)	0.58
		Deprec Trans Pole (%)	1.67
Cost of Money (%)	4.375		
Plant Life	30	Fed Inc Tax (%)	0.000
Substation Life	30	Fed Misc Tax (%)	0.000
Trans (towers) Life	50	State & Local Tax (%)	0.000
Trans (poles) life	30		
		Hydro Flex Adjust	0.050
Plant insurance (%)	0.25	Alt Mechanical Avail	0.850
Trans Insurance (%)	0.10	Hydro Mech Avail	0.980
Sub insurance (%)	0.25	Mech Avail Adjust	0.153

				Date Run
COMBINED CYCLE POWER VALUE				11/13/09
	PROJECT NAME:	OMRPWA-WS-Reallocation		
	LOCATION:	Arkansas		
	FINANCING:	FEDERAL @	4.375%	
Capacity Value		**$123.74**	**per kW-yr**	
Energy Value		**$60.81**	**per MWh**	
PROGRAM INPUT DATA			State Index Number	4
			State Abbr. (exact)	AR
Cost Level Date	11/1/2009		H-W Index Reg No	4
Single unit capacity	150		ROW ($/acre)	2510
Capacity factor	0.20		Clearing % of ROW	0.60
Trans Voltage	230		Rec Sub Land Cost	23609
Transformer MVA	200		Plant Invest	882
No of Trans	1		FC Mov-Ave Time Frame	60
No of Trans Positions	1		Fuel Cost	744.3
Single or Three Phase	3		Heat Rate	8030
Length Line 1	0		Variable O&M	1.04
Length Line 2	0		Fixed O&M	49.57
Line 1: Total Circuits	2		O&M update	3.07
No of Single Circ	2		Plant update	2.92
No of Double Circ	0		Transmission update	2.64
Line 2: Total Circuits	0		Depreciation Plant (%)	1.67
No of Single Circ	0		Deprec Sub (%)	1.67
No of Double Circ	0		Deprec Trans Tower (%)	0.58
			Deprec Trans Pole (%)	1.67
Cost of Money (%)	4.375			
Plant Life	30		Fed Inc Tax (%)	0.000
Substation Life	30		Fed Misc Tax (%)	0.000
Trans (towers) Life	50		State & Local Tax (%)	0.000
Trans (poles) life	30			
			Hydro Flex Adjust	0.025
Plant insurance (%)	0.25		Alt Mechanical Avail	0.900
Trans Insurance (%)	0.10		Hydro Mech Avail	0.980
Sub insurance (%)	0.25		Mech Avail Adjust	0.089

Date Run

COMBINED CYCLE POWER VALUE

06/24/10

PROJECT NAME: OMRPWS WS-Reallocation
LOCATION: Missouri
FINANCING: FEDERAL @ 4.375%

Capacity Value	$124.72	per kW-yr
Energy Value	$59.11	per MWh

PROGRAM INPUT DATA

		State Index Number	26
		State Abbr. (exact)	MO
Cost Level Date	11/1/2009	H-W Index Reg No	3
Single unit capacity	150	ROW ($/acre)	2579
Capacity factor	0.20	Clearing % of ROW	0.60
Trans Voltage	230	Rec Sub Land Cost	24263
Transformer MVA	200	Plant Invest	893
No of Trans	1	FC Mov-Ave Time Frame	60
No of Trans Positions	1	Fuel Cost	722.9
Single or Three Phase	3	Heat Rate	8030
Length Line 1	0	Variable O&M	1.06
Length Line 2	0	Fixed O&M	49.57
Line 1: Total Circuits	2	O&M update	3.07
No of Single Circ	2	Plant update	3.21
No of Double Circ	0	Transmission update	3.26
Line 2: Total Circuits	0	Depreciation Plant (%)	1.67
No of Single Circ	0	Deprec Sub (%)	1.67
No of Double Circ	0	Deprec Trans Tower (%)	0.58
		Deprec Trans Pole (%)	1.67
Cost of Money (%)	4.375		
Plant Life	30	Fed Inc Tax (%)	0.000
Substation Life	30	Fed Misc Tax (%)	0.000
Trans (towers) Life	50	State & Local Tax (%)	0.000
Trans (poles) life	30		
		Hydro Flex Adjust	0.025
Plant insurance (%)	0.25	Alt Mechanical Avail	0.900
Trans Insurance (%)	0.10	Hydro Mech Avail	0.980
Sub insurance (%)	0.25	Mech Avail Adjust	0.089

	Date Run
COMBINED CYCLE POWER VALUE	06/24/10

PROJECT NAME: OMRPWS WS-Reallocation
LOCATION: Oklahoma
FINANCING: FEDERAL @ 4.375%

Capacity Value	$123.74	per kW-yr
Energy Value	$54.40	per MWh

PROGRAM INPUT DATA

		State Index Number	37
		State Abbr. (exact)	OK
Cost Level Date	11/1/2009	H-W Index Reg No	4
Single unit capacity	150	ROW ($/acre)	2579
Capacity factor	0.20	Clearing % of ROW	0.60
Trans Voltage	230	Rec Sub Land Cost	24263
Transformer MVA	200	Plant Invest	882
No of Trans	1	FC Mov-Ave Time Frame	60
No of Trans Positions	1	Fuel Cost	664.3
Single or Three Phase	3	Heat Rate	8030
Length Line 1	0	Variable O&M	1.06
Length Line 2	0	Fixed O&M	49.57
Line 1: Total Circuits	2	O&M update	3.07
No of Single Circ	2	Plant update	2.92
No of Double Circ	0	Transmission update	2.64
Line 2: Total Circuits	0	Depreciation Plant (%)	1.67
No of Single Circ	0	Deprec Sub (%)	1.67
No of Double Circ	0	Deprec Trans Tower (%)	0.58
		Deprec Trans Pole (%)	1.67
Cost of Money (%)	4.375		
Plant Life	30	Fed Inc Tax (%)	0.000
Substation Life	30	Fed Misc Tax (%)	0.000
Trans (towers) Life	50	State & Local Tax (%)	0.000
Trans (poles) life	30		
		Hydro Flex Adjust	0.025
Plant insurance (%)	0.25	Alt Mechanical Avail	0.900
Trans Insurance (%)	0.10	Hydro Mech Avail	0.980
Sub insurance (%)	0.25	Mech Avail Adjust	0.089

Date Run

COMBUSTION TURBINE POWER VALUE

11/13/09

PROJECT NAME: OMRPWA-WS-Reallocation

LOCATION: Arkansas

FINANCING: FEDERAL @ 4.375%

Capacity Value	$59.20	per kW-yr
Energy Value	$96.05	per MWh

PROGRAM INPUT DATA

		State Index Number	4
		State Location	AR
Cost Level Date	11/1/2009	H-W Index Reg No	4
Single unit capacity	100	ROW ($/acre)	2277
Capacity Factor	0.10	Clearing % of ROW	0.60
Transmission Voltage	230	Rec Sub Land Cost	21480
Transformer MVA	125	Plant Invest	463
No of Trans	2	FC Mov-Ave Time Frame	60
No of Trans Pos	2	Fuel Cost	744.3
Single or Three Phase	3	Heat Rate	12870
Length Line 1	0	Variable O&M	0.26
Length Line 2	0	Fixed O&M	16.26
Line 1: Total Circuits	2	O&M update	3.07
No of Single Circ	2	Plant update	2.92
No of Double Circ	0	Transmission update	2.64
Line 2: Total Circuits	0	Depreciation Plant (%)	1.67
No of Single Circ	0	Deprec Sub (%)	1.67
No of Double Circ	0	Deprec Trans Tower (%)	0.58
		Deprec Trans Pole (%)	1.67
Cost of Money (%)	4.375		
Plant Life	30	Fed Inc Tax (%)	0.000
Substation Life	30	Fed Misc Tax (%)	0.000
Trans (towers) Life	50	State & Local Tax (%)	0.000
Trans (poles) life	30		
		Hydro Flex Adjust	0.025
Plant insurance (%)	0.25	Alt Mechanical Avail	0.900
Trans Insurance (%)	0.10	Hydro Mechanical Avail	0.980
Sub insurance (%)	0.25	Mech Avail Adjust	0.089

Date Run

COMBUSTION TURBINE POWER VALUE

06/24/10

PROJECT NAME: OMRPWS WS-Reallocation
LOCATION: Missouri
FINANCING: FEDERAL @ 4.375%

Capacity Value	$60.19	per kW-yr
Energy Value	$93.30	per MWh

PROGRAM INPUT DATA

		State Index Number	26
		State Location	MO
Cost Level Date	11/1/2009	H-W Index Reg No	3
Single unit capacity	100	ROW ($/acre)	2274
Capacity Factor	0.10	Clearing % of ROW	0.60
Transmission Voltage	230	Rec Sub Land Cost	21467
Transformer MVA	125	Plant Invest	470
No of Trans	2	FC Mov-Ave Time Frame	60
No of Trans Pos	2	Fuel Cost	722.9
Single or Three Phase	3	Heat Rate	12870
Length Line 1	0	Variable O&M	0.27
Length Line 2	0	Fixed O&M	16.26
Line 1: Total Circuits	2	O&M update	3.07
No of Single Circ	2	Plant update	3.21
No of Double Circ	0	Transmission update	3.26
Line 2: Total Circuits	0	Depreciation Plant (%)	1.67
No of Single Circ	0	Deprec Sub (%)	1.67
No of Double Circ	0	Deprec Trans Tower (%)	0.58
		Deprec Trans Pole (%)	1.67
Cost of Money (%)	4.375		
Plant Life	30	Fed Inc Tax (%)	0.000
Substation Life	30	Fed Misc Tax (%)	0.000
Trans (towers) Life	50	State & Local Tax (%)	0.000
Trans (poles) life	30		
		Hydro Flex Adjust	0.025
Plant insurance (%)	0.25	Alt Mechanical Avail	0.900
Trans Insurance (%)	0.10	Hydro Mechanical Avail	0.980
Sub insurance (%)	0.25	Mech Avail Adjust	0.089

			Date Run

COMBUSTION TURBINE POWER VALUE

06/24/10

PROJECT NAME: OMRPWS WS-Reallocation
LOCATION: Oklahoma
FINANCING: FEDERAL @ 4.375%

Capacity Value	$59.20	per kW-yr
Energy Value	$85.76	per MWh

PROGRAM INPUT DATA

		State Index Number	37
		State Location	OK
Cost Level Date	11/1/2009	H-W Index Reg No	4
Single unit capacity	100	ROW ($/acre)	2274
Capacity Factor	0.10	Clearing % of ROW	0.60
Transmission Voltage	230	Rec Sub Land Cost	21467
Transformer MVA	125	Plant Invest	463
No of Trans	2	FC Mov-Ave Time Frame	60
No of Trans Pos	2	Fuel Cost	664.3
Single or Three Phase	3	Heat Rate	12870
Length Line 1	0	Variable O&M	0.27
Length Line 2	0	Fixed O&M	16.26
Line 1: Total Circuits	2	O&M update	3.07
No of Single Circ	2	Plant update	2.92
No of Double Circ	0	Transmission update	2.64
Line 2: Total Circuits	0	Depreciation Plant (%)	1.67
No of Single Circ	0	Deprec Sub (%)	1.67
No of Double Circ	0	Deprec Trans Tower (%)	0.58
		Deprec Trans Pole (%)	1.67
Cost of Money (%)	4.375		
Plant Life	30	Fed Inc Tax (%)	0.000
Substation Life	30	Fed Misc Tax (%)	0.000
Trans (towers) Life	50	State & Local Tax (%)	0.000
Trans (poles) life	30		
		Hydro Flex Adjust	0.025
Plant insurance (%)	0.25	Alt Mechanical Avail	0.900
Trans Insurance (%)	0.10	Hydro Mechanical Avail	0.980
Sub insurance (%)	0.25	Mech Avail Adjust	0.089

SWPA Report

Department of Energy
Southwestern Power Administration
One West Third Street
Tulsa, Oklahoma 74103-3519

June 11, 2010

Mr. Patrick MacDanel
GEC Inc.
P.O. Box 84010
Baton Rouge, LA 70808

Dear Mr. MacDanel:

This letter provides the comments of Southwestern Power Administration (Southwestern) on the Draft Water Supply Storage Reallocation Report, Reallocation of Storage at Bull Shoals Lake, Arkansas, for Ozark Mountain Regional Public Water Authority and Marion County Regional Water District, dated May 2010. Southwestern's preliminary estimate of the hydropower impacts of the proposed reallocation was provided to the U.S. Army Corps of Engineers (Corps) on January 28, 2010, and is included in the draft report. Southwestern has several major concerns with the proposed reallocation which are summarized in the following paragraphs. Most of those major concerns were discussed in our January 28 letter. In addition, please find Southwestern's specific comments on the report detailed in Enclosure 1.

Corps guidance states that "All reallocations or additions of storage should be to serve immediate needs" (ER 1105-2-100). The Corps has typically interpreted "immediate needs" to be those needs up to ten years in the future. The draft report reveals that Ozark Mountain Regional Public Water Authority (OMRPWA) will not need 6 million gallons per day (MGD) for over forty years, stating "OMRPWA has a current need for 3.4 MGD, expanding to 4.5 MGD by 2032 and 6 MGD by 2052." The draft report does not demonstrate an "immediate need" for the 6 MGD included in the reallocation request. The reallocation should only be requested to meet the demonstrated needs over the next ten years. The construction of a water treatment facility with a capacity of 4.5 MGD also seems to verify that amount will be sufficient to meet the needs of OMRPWA for the next ten to twenty years. OMRPWA has already reduced their request from 12 MGD to 6 MGD. They should further reduce their request to no more than 4.5 MGD. As Marion County is doing now, OMRPWA can request additional storage later when they have additional need.

Southwestern has provided comments for all recent water storage reallocation reports prepared by the Corps' Little Rock District (LRD) for storage at LRD projects. The issues and disagreements between Southwestern and the Corps concerning hydropower impacts of storage reallocations and the compensation due to Federal hydropower are long-standing. Recently, to ensure adequate compensation to Federal hydropower for one of the largest storage reallocations ever performed by the Corps, Congress directed Southwestern to compute the hydropower impacts of the White River Minimum Flows project. For another recent major reallocation, the Secretary of the Army, recognizing that Corps policy shortchanges Federal hydropower, overruled both the Corps' Tulsa District and Corps Headquarters and agreed with Southwestern on the issue of compensation for hydropower lost as a result of a reallocation of up to 300,000 acre-feet at Lake Texoma. Agreement between the Corps and the Federal hydropower interests on the issues would simplify the preparation and evaluation of future storage reallocation reports and would speed the approval of the reports. We urge the Corps to work with Southwestern and the other Power Marketing Administrations to resolve those long-standing issues.

Southwestern is concerned that the Corps' calculations underestimate the impacts to the Federal hydropower purpose. The Corps' simulation models and energy loss calculations are based on the yield of the contracted storage. However, based on the Corps' water storage accounting procedures and lack of contractual limitations, water supply users are able to withdraw more than the "safe yield" of the storage in all but the critical drought without depleting their contracted storage. Accordingly, Southwestern included what it calls "additional energy losses" in its calculations to conservatively account for withdrawals in excess of the yield of the contracted storage. The Corps' energy loss calculations should include additional withdrawals above the yield of contracted storage, or the water supply storage contract should limit the amount the user can withdraw to only the yield of the contracted storage. Also, the Corps' calculates the capacity benefits foregone based on an average capacity loss, unlike its calculation of capacity revenues foregone which is based on the critical period capacity loss. All of the Corps' capacity loss calculations should reflect actual market conditions and use the critical period method for a more accurate calculation of the capacity lost due to the proposed storage reallocation.

Additionally, the calculations by the Corps' Hydropower Analysis Center (HAC) are based on several flawed assumptions. The first concerns Southwestern's marketing area. HAC incorrectly assumed that Southwestern markets its hydropower in the Southeastern Electric Reliability Council (SERC) region instead of the Southwest Power Pool (SPP) region. HAC must correct its report and calculations to reflect Southwestern's presence in the SPP area. Second, the dependable capacity calculations were developed utilizing 1956 as the critical year. The critical year for Southwestern's system was at one time 1956, but Southwestern has utilized 1954 as the critical year for its system since 2001 when it added four additional projects into its interconnected system. Third, the HAC report utilized rates for Southwestern which were last used in 2002. Southwestern's rates as of January 1, 2010, are included in our specific comments on the HAC report. The revenues foregone calculations must be recomputed to reflect Southwestern's current rates. The HAC calculations must be updated in both the HAC report and in the main report. Finally, it is unclear why Norfork is included in the HAC report. The proposed reallocation is at Bull Shoals, and the report states that the impacts at Norfork are negligible. Norfork should be removed from the report. The HAC report appears to be a poor, cut and paste effort that should be completely updated.

Southwestern performed its own analysis of the reallocation alternatives using the Corps' SUPER model, and a summary of the analysis is included in Enclosure 2. That analysis revealed that a reallocation from flood storage would have significantly less impact on hydropower energy and capacity than the conservation or inactive pool options if the hydropower impacts are properly quantified and valued. In addition, Southwestern performed a SUPER evaluation of a flood storage reallocation including hydropower yield protection operation (HYPO) storage for hydropower. The use of HYPO, similar to dependable yield mitigation storage (DYMS) for existing water supply users, would maintain the current yield of the hydropower storage and, therefore, minimize the hydropower losses, especially capacity and on-peak energy losses. LRD has the discretion to include HYPO and in fact did so in the White River Minimum Flow Study. The results from Southwestern's analysis of a flood storage reallocation including HYPO are included for your consideration. Based on Southwestern's analysis, the National Economic Development plan for the proposed reallocation is a flood storage reallocation including HYPO.

Southwestern continues to oppose the consideration of inactive storage as a reallocation alternative. Inactive storage is set aside for hydropower head and/or the storage of sediment expected to accumulate over the life of the project. LRD has not considered the reallocation of inactive storage since the early 1990s. Since that time, reallocation reports developed by LRD have correctly recognized that the inactive storage is not appropriate storage for reallocation consideration. In Corps design and study reports which discuss the inactive storage at Bull Shoals, the only use considered for that storage other than hydropower head is emergency power storage. A reallocation of any portion of the inactive storage was not contemplated. The alternative should be removed from consideration, and inactive storage should not be considered a viable alternative in any future reallocation study. Otherwise, it should be treated the same as a reallocation from hydropower storage.

We appreciate the opportunity to provide comments on the draft report. Hydropower is the project purpose most affected by storage reallocations. Therefore, it is vital to Federal hydropower and our customers that the hydropower losses are properly quantified and valued. Please contact Mr. Michael Denny at 918-595-6683 or *michael.denny@swpa.gov* if you have any questions.

Sincerely,

Michael R. Denny

for George Robbins
Director
Division of Resources and Rates

Enclosures (2)

cc: Ted Coombes (SPRA)

June 11, 2010

Southwestern Power Administration Comments on the Draft Water Supply Storage Reallocation Report – Reallocation of Storage at Bull Shoals Lake, Arkansas, for Ozark Mountain Regional Public Water Authority and Marion County Regional Water District dated May 2010

(Note: Paragraphs are numbered from the beginning of the referenced section or sub-section)

1. Page iii, EXECUTIVE SUMMARY, Paragraph 10, Sentence 1. For the proposed reallocation of conservation storage, the storage amount for Marion County Regional Water District should be 1,698.077 as stated throughout the report and not 1,698.007.

2. Page iii, EXECUTIVE SUMMARY, Paragraph 11, Sentence 3. Inactive storage should not have been considered in the study. The inactive storage is set aside for hydropower head, sediment distribution, and emergency power storage. It was not designed for reallocation to municipal and industrial water supply storage. Southwestern strongly opposes the consideration of inactive storage as an alternative for reallocation to water supply storage.

3. Page iii, EXECUTIVE SUMMARY, Paragraph 12, Fifth bullet. While one storage reallocation may have a "relatively small impact" on hydroelectric power production, the cumulative effect of multiple reallocations will undoubtedly have a significant effect on Federal hydropower. The hydropower impacts of even the smallest storage reallocation must be properly quantified and valued by the Corps.

4. Page v, TABLE OF CONTENTS. Please correct alignment issues with the table.

5. Page 2-2, 2.0 PROJECT BACKGROUND, 2.1 Project Authorization, Construction, and Operation History, Bull Shoals Lake, Paragraph 1, Sentence 1. Fish/wildlife and recreation were not added as authorized project purposes at Bull Shoals in the Flood Control Act of 1941. Recreation and fish and wildlife mitigation were added as project purposes at Bull Shoals in Section 304 of WRDA 1996, "to the extent that the additional purposes do not adversely affect flood control, power generation, or other authorized purposes of the project." Please correct.

6. Page 2-2, 2.0 PROJECT BACKGROUND, 2.1 Project Authorization, Construction, and Operation History, Bull Shoals Lake, Paragraph 1, Sentence 3. The language originally authorizing minimum flows was in Section 374 of WRDA 1999 and in Section 304 of WRDA 2000. The specific minimum flows alternative being implemented at Bull Shoals, Alternative BS-3, was authorized in Section 132 of Public Law 109-103. That legislation repealed the authorizations in WRDA 1999 and WRDA 2000. Please correct.

7. Page 2-3, 2.0 PROJECT BACKGROUND, 2.2 Project Location, Purpose, and Outputs, Paragraph 3, Third bullet. The average annual generation at Bull Shoals from 1964

through 2009 is 753,700 megawatt-hours (MWh), not the 518,284 MWh shown in the report.. Please correct.

8. Page 2-4, 2.0 PROJECT BACKGROUND, 2.3 Project Data, Table 2.1 Bull Shoals Lake Physical Features (After Reallocation for White River Minimum Flows). Inactive storage should be listed as the entire storage below elevation 628.5. Please correct.

9. Page 2-4, 2.0 PROJECT BACKGROUND, 2.3 Project Data, Table 2.1 Bull Shoals Lake Physical Features (After Reallocation for White River Minimum Flows). According to the Corps' Engineering Regulation 1105-2-100, "usable storage does not include space set aside for sediment distribution or for hydropower head." Inactive storage is being utilized for its designed purposes and should not be included in the table as "Usable storage." Please correct.

10. Page 2-5, 2.0 PROJECT BACKGROUND, 2.3 Project Data, Paragraph 4, Sentences 7 and 8. As correctly stated, the inactive storage provides for hydropower head and sediment. See previous comment. Sentence 8 states that the inactive storage is "available for emergency uses during drought conditions that include hydroelectric power operations and M&I water supply." It is being utilized as designed and is available for emergency use only, not for permanent reallocation to another project purpose. Please remove consideration of inactive storage from the report and environmental assessment.

11. Page 2-6, 2.0 PROJECT BACKGROUND, 2.3 Project Data, Figure 2.2 Bull Shoals Lake and Dam with Pool Elevations and Volumes. The inactive storage should be shown as all storage below elevation 628.5. Please correct.

12. Page 3-5, 3.0 PLAN FORMULATION, 3.3 Preliminary Reallocation Alternatives for MCRWD, 3.3.1 Structural Solutions, Paragraph 4, Sentence 2. The sentence states that MCRWD's water treatment facility has a maximum capacity of 4 MGD. Even with the new storage allocation, MCRWD will only have contracted for storage with a yield of 2 MGD. As Southwestern continues to assert in comments on storage reallocations for water supply, the water supply contracts should limit the withdrawals of the water supply users. Compensation to Federal hydropower is based on energy losses which are calculated based on the yield of the contracted storage, which is a minimum amount available to the water supply user.

13. Page 3-8, 3.0 PLAN FORMULATION, 3.4 Final Reallocation Alternatives for OMRPWA and MCRWD to Evaluate in Detail. In its preliminary comments provided to the Corps on January 28, 2010, Southwestern presented an additional alternative utilizing flood storage and hydropower yield protection operation (HYPO) storage. A summary of Southwestern's analysis is included in Enclosure 2. HYPO was utilized in the White River Minimum Flows study and should be considered a viable alternative in storage reallocations. Please include an evaluation of the additional alternative in the report.

14. Page 4-9, 4.0 ECONOMIC ANALYSIS, 4.1 Water Supply and Demand Analysis, 4.1.6 Water Supply, Paragraph 1, Sentence 7. Corps guidance states that “All reallocations or additions of storage should be to serve immediate needs” (ER 1105-2-100). The Corps has typically interpreted “immediate needs” to be those needs up to ten years in the future. The sentence states that “OMRPWA has a current need for 3.4 MGD, expanding to 4.5 MGD by 2032 and 6 MGD by 2052.” The draft report does not demonstrate an “immediate need” for the 6 MGD included in the reallocation request. The construction of a water treatment facility with a capacity of 4.5 MGD also seems to verify that amount will be sufficient to meet the needs of OMRPWA for the next ten to twenty years. OMRPWA has already reduced their request from 12 MGD to 6 MGD. They should further reduce their request to no more than 4.5 MGD. As Marion County is doing now, OMRPWA can request additional storage later when they have additional need.

15. Page 5-1, 5.0 DERIVATION OF USER COST, 5.1 Yield/Storage Analysis, Paragraph 1, Sentences 1 and 2. The additional alternative presented by Southwestern (see Enclosure 2) should be considered in the report. See comment 13.

16. Page 5-2, 5.0 DERIVATION OF USER COST, 5.1 Yield/Storage Analysis, 5.1.2 Flood Pool, Paragraph 2, Sentences 3 and 4. It may not be Corps “policy” to include DYMS for hydropower, but it was included as HYPO storage in the White River Minimum Flows Study. Southwestern’s analysis, included in Enclosure 2, revealed a flood pool alternative including HYPO storage to be the alternative with the greatest net benefits. See Comment 13.

17. Page 5-3, 5.0 DERIVATION OF USER COST, 5.1 Yield/Storage Analysis, 5.1.3 Inactive Pool. Paragraph 1, Sentence 2. As noted previously, the inactive storage is “available for emergency uses during drought conditions that include hydroelectric power operations and M&I water supply.” It is being utilized as designed and is available for emergency use only, not for permanent reallocation to another project purpose. Please remove consideration of inactive storage from the report and environmental assessment.

18. Page 5-5, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.1 Hydroelectric Power Benefits Foregone. The section correctly states that hydroelectric energy and capacity are lost when storage is reallocated for water supply. However, the Corps’ study underestimates the amount of energy and capacity lost and the value of the lost energy and capacity. Southwestern’s analysis (see Enclosure 2) is a more accurate reflection of the magnitude and value of the losses and correctly incorporates how the capacity and energy are currently marketed.

19. Page 5-6, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.1 Hydroelectric Power Benefits Foregone, Table 5.6 Hydroelectric Power Benefits Foregone. The Corps’ report significantly undervalues the energy and capacity lost due to the proposed reallocation. Southwestern’s analysis (see Enclosure 2) provides a more realistic accounting of the benefits foregone.

20. Page 5-6, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.1 Hydroelectric Power Benefits Foregone, Table 5.6 Hydroelectric Power Benefits Foregone. The benefits foregone are incorrectly based on energy prices in the Southeastern Electric Reliability Council (SERC) region and not the Southwest Power Pool (SPP) region. It should be corrected. See comments on Hydropower Analysis Center (HAC) report.

21. Page 5-6, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.1 Hydroelectric Power Benefits Foregone, Paragraph 5, Sentence 1. It is not logical to think that a reallocation of flood control storage would result in a greater capacity loss than a reallocation of conservation storage. The result reveals a flawed methodology in the analysis and a lack of knowledgeable review and study oversight. Southwestern's analysis (see Enclosure 2) provides a more reasonable and accurate calculation of the capacity losses resulting from the proposed reallocation.

22. Page 5-6, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.1 Hydroelectric Power Benefits Foregone, Paragraph 6, Sentence 2. Southwestern does not market "average" capacity. The capacity marketed by Southwestern must be available at all times, including through the critical drought. The capacity must be dependable to be marketable. Please recalculate using the correct critical year.

23. Page 5-6, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.1 Hydroelectric Power Benefits Foregone, Paragraph 6, Sentence 3. See Comment 21.

24. Page 5-7, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.2 Hydroelectric Power Revenues Foregone, Table 5.7 Hydroelectric Power Revenues Foregone. The revenues foregone are based on underestimated energy and capacity losses resulting from the proposed reallocation. Southwestern's analysis (see Enclosure 2) is a more accurate reflection of the magnitude of the losses in the current market.

25. Page 5-7, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.2 Hydroelectric Power Revenues Foregone, Table 5.7 Hydroelectric Power Revenues Foregone. The revenues foregone are based on Southwestern rates in place from January 1998 to October 2002. Please update the table based on Southwestern's current rates as shown in Enclosure 2 and in the comments on the HAC report.

26. Page 5-7, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.2 Hydroelectric Power Revenues Foregone, Table 5.7 Hydroelectric Power Revenues Foregone. Negative revenues foregone, or hydropower benefits, are not logical and reflect a flawed methodology in the analysis. It appears there is no understanding of hydropower operations at even the basic level.

27. Page 5-7, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.3 Hydroelectric Power Replacement Cost. See Comments 19 and 20.

28. Page 5-8, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.4 Flood Control Benefits Foregone, Paragraph 2, Sentence 7. The sentence states the SUPER economic data for flood control calculations was last updated in 1994. The SUPER economic data should be updated to account for the five-foot pool rise for White River minimum flows and raising the lake facilities, and the flood damage analysis should be recalculated.

29. Page 5-9, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.4 Flood Control Benefits Foregone, Table 5.9 Average Annual In-Pool Damages by Alternative – October 2009 values ($1,000). See previous comment.

30. Page 5-9, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.4 Flood Control Benefits Foregone, Paragraph 4, Sentence 1. The reallocation is referred to as a "water" reallocation. The reallocation will be a reallocation of storage, not water. Please correct.

31. Page 5-9, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.5 Recreation Benefits, Paragraph 1, Sentence 11 (last sentence). Presumably, the sentence is referring to a reallocation from the flood pool and not the conservation pool. An annual impact of $16,800, mainly at Bull Shoals, compared to annual recreation benefits of over $51 million at six projects is hardly a "rippling effect." Please delete the biased statement from the report.

32. Page 5-9, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.5 Recreation Benefits, Paragraph 3, Sentence 1. The sentence states the SUPER recreation visitation data was last updated in 1994. The SUPER recreation visitation data should be updated to account for the five-foot pool rise for White River minimum flows and raising the lake facilities, and the recreation benefits analysis should be recomputed.

33. Page 5-10, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.5 Recreation Benefits, Table 5.10 Average Annual Recreational Benefits by Alternative – October 2009 values ($1,000). See previous comment.

34. Page 5-11, 5.0 DERIVATION OF USER COST, 5.2 Impacts to Other Project Purposes, 5.2.6 Total Impacts, Table 5.11 Average Annual Net Benefits from Reallocation – October 2009 values ($). If hydropower losses are properly quantified and valued, a reallocation of flood storage, especially with HYPO storage for hydropower, would provide the greatest net benefits as revealed in Southwestern's analysis (see Enclosure 2).

35. Page 5-11, 5.0 DERIVATION OF USER COST, 5.3 Updated Cost of Storage, 5.3.1 Ozark Mountain Regional Public Water Authority, Paragraph 1, Sentence 2. According

to the Corps' Engineering Regulation 1105-2-100, "usable storage does not include space set aside for sediment distribution or for hydropower head." Inactive storage is being utilized for its designed purposes and should not be included in the Total Usable Storage calculation. Please correct.

36. Page 5-11, 5.0 DERIVATION OF USER COST, 5.3 Updated Cost of Storage, 5.3.2 Marion County Regional Water District, Paragraph 1, Sentence 2. See previous comment.

37. Page 6-5, 6.0 OTHER CONSIDERATIONS, 6.2 Cost Account Adjustments to Power Marketing Agency, Paragraph 1, Sentences 7 and 8. Energy and capacity benefits and revenues foregone must be corrected to reflect correct assumptions. See comments on the HAC report for details.

38. Page 6-5, 6.0 OTHER CONSIDERATIONS, 6.2 Cost Account Adjustments to Power Marketing Agency, Paragraph 1, Sentences 7 and 8. Why do capacity and energy credits for benefits foregone only go through the year 2015? Southwestern's last current contract with customers taking energy from the project expires in 2025. Further, Southwestern's 1980 Final Power Allocation provides renewal of the contracts with the current power allocations. Therefore, the benefits lost are throughout the project life. Please correct the credits to Southwestern.

39. Page 6-8, 6.0 OTHER CONSIDERATIONS, 6.5 Risk and Uncertainty, Paragraph 2, Sentences 1 and 2. Hydropower benefits foregone are also highly sensitive to fluctuations in energy and capacity prices. Selection of the flood pool, with reduced energy and capacity losses, should result in the greatest net benefits among the reallocation alternatives.

40. Page 6-9, 6.0 OTHER CONSIDERATIONS, 6.6 Summary of Dam Safety Considerations, Paragraph 1, Sentence 6. The proposed project is a reallocation of storage, not water.

41. Page 7-1, 7.0 SELECTED ALTERNATIVE, 7.1 Description, Paragraph 3, Sentence 2. Southwestern's analysis revealed the "lowest-impact" reallocation is a reallocation of flood control storage utilizing HYPO storage for hydropower. Proper project formulation should consider the alternative provided by Southwestern in Enclosure 2.

42. Page 7-1-2, 7.0 SELECTED ALTERNATIVE, 7.2 Rationale for Selection, Paragraph 2. The purpose of the paragraph is unclear. Do OMRPWA and MCRWD intend to contract for the identified storage in increments? If so, the reallocation should be sized to provide the water supply users' immediate needs. See Comment 14.

43. Page 7-2, 7.0 SELECTED ALTERNATIVE, 7.2 Rationale for Selection, Paragraphs 3 and 4. Southwestern will receive credit for its losses. However, if the amount and value of the losses are underestimated in accordance with the current draft report, Federal hydropower and its customers will suffer the impacts.

44. Page 7-2, 7.0 SELECTED ALTERNATIVE, 7.2 Rationale for Selection, Paragraphs 3 and 4. Southwestern's 1980 Final Power Allocation provides renewal of the contracts with the current power allocations. Therefore, the benefits lost are throughout the project life. Current Corps policy fails to recognize that fact.

45. Page 8-1, 8.0 IMPLEMENTATION, 8.1 Federal and Non-Federal Costs, Federal Costs, Paragraph 1, Sentences 4 and 5. Why do capacity and energy credits for benefits foregone only go through the year 2015? Southwestern's last current contract with customers taking energy from the project expires in 2025. Further, Southwestern's 1980 Final Power Allocation provides renewal of the contracts with the current power allocations. Therefore, the benefits lost are throughout the project life. Please correct the credits to Southwestern.

46. Page 9-1, 9.0 CONCLUSIONS AND RECOMMENDATIONS, 9.1 Findings, Paragraph 5, Sentences 4 and 5. See previous comment.

47. Page C-6, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, TABLE OF CONTENTS, Section 6.3.2. The section title should be "Current and Pending Storage Reallocations." Please correct.

48. Page C-17, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 1.0 INTRODUCTION, 1.2 Background, Bull Shoals Lake, Paragraph 1. See Comments 5 and 6 on a similar paragraph in the reallocation report.

49. Page C-18, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 1.0 INTRODUCTION, 1.2 Background, Bull Shoals Lake, Paragraph 4, Sentences 7 and 8. As correctly stated, the inactive storage provides for hydropower head and sediment. Sentence 8 states that the inactive storage is "available for emergency uses during drought conditions that include hydroelectric power operations and M&I water supply." It is being utilized as designed and is available for emergency use only, not for permanent reallocation to another project purpose. Please remove consideration of inactive storage from the report and environmental assessment.

50. Page C-20, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 1.0 INTRODUCTION, 1.2 Background, Bull Shoals Lake, Figure 1.5 Bull Shoals Lake Pool Elevations and Volumes. The inactive storage should be shown as all storage below elevation 628.5. Please correct.

51. Pages C-25-26, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 2.0 DESCRIPTION OF PROPOSED ACTION, Paragraph 6, Sentences 7 and 8. As correctly stated, the inactive storage provides for hydropower head and sediment. Sentence 8 states that the inactive storage is "available for emergency uses during drought conditions that include hydroelectric power operations and M&I water supply." It is being utilized as designed and is available for emergency use only, not for

permanent reallocation to another project purpose. Please remove consideration of inactive storage from the report and environmental assessment.

52. Page C-50, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 4.0 AFFECTED ENVIRONMENT, 4.4 Water Resources, 4.4.4 Hydropower. As is typical in Corps studies, the HAC analysis underestimates the hydropower losses and the value of those losses. See comments on HAC report.

53. Page C-73-74, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 5.0 ENVIRONMENTAL CONSEQUENCES, 5.3 Water Resources, 5.3.4 Hydropower. See previous comment.

54. Page C-78, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 5.0 ENVIRONMENTAL CONSEQUENCES, 5.7 Recreation, Paragraph 1, Sentence 11. An annual impact of $16,800, mainly at Bull Shoals, compared to annual recreation benefits of over $51 million at six projects is hardly a “rippling effect.” Please delete the biased statement from the report.

55. Page C-84, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 6.0 CUMULATIVE IMPACTS, Paragraph 5, Sentence 3 (last sentence). The current proposed action is a reallocation of storage, not water. Please correct.

56. Page C-86, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 6.0 CUMULATIVE IMPACTS, 6.3 Present Actions, 6.3.2 Current and Pending Water Reallocations. The heading should be “Current and Pending Storage Reallocations.” Please correct.

57. Page C-89-91, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 6.0 CUMULATIVE IMPACTS, 6.5 Cumulative Impacts Assessment, Table 6.1 Cumulative Impacts Assessment. All references to water reallocation should be corrected to say storage reallocation.

58. Page C-96, APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, 8.0 CONCLUSIONS, Paragraph 2, Sentence 2. The cumulative impact of multiple reallocations resulting in “slight annual hydropower benefits reductions” is incorrect and will have a major impact on Federal hydropower and its customers. Corps policy must be changed to allow the Corps to properly evaluate the impact of the hydropower losses. Those losses are real and do have a “substantial” impact.

59. Page C-132 (estimated), APPENDIX C, DRAFT ENVIRONMENTAL ASSESSMENT, Attachment 6 Agency Coordination, October 15, 2009, letter from Southwestern Power Administration to Mr. Patrick MacDanel. The document dated 09/30/09 accompanying the letter was actually sent to the Corps in an email on September 30, 2009. It articulates Southwestern’s arguments against consideration of inactive storage for reallocation and includes reasons the Corps has used in past studies to eliminate inactive storage from consideration. Please properly identify.

60. Title Page, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT. It is unclear why Norfork is included in the Hydropower Analysis Center (HAC) report. The proposed reallocation is at Bull Shoals. Norfork is not downstream of Bull Shoals and should not be impacted by the proposed reallocation. Please remove Norfork from the report.

61. Page 2, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 1. INTRODUCTION, 1.2 Project Description, 1.2.2 Bull Shoals Lake, Paragraph 2, Sentence 4. The Corps completed a storage reallocation report, not a water reallocation report. Please correct.

62. Page 2, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 1. INTRODUCTION, 1.2 Project Description, 1.2.3 Norfork Lake. See Comment 60. Norfork Lake should be removed from the report.

63. Page 10, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 2. POWER BENEFITS FOREGONE, 2.7 Simulation with SWD-SUPER Streamflow Routing Model, Paragraph 2. See Comments 60 and 62. Impacts at the other White River lakes were "deemed negligible and thus not presented." However, impacts at Norfork were shown in the report to be negligible and were presented. Why? Additional analysis including Norfork seems to have been a lot of additional work and pages in the report with no discernible benefit. The proposed reallocation is at Bull Shoals, and the impacts will be at Bull Shoals. Please remove Norfork from the report.

64. Page 15, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 3. ENERGY BENEFITS FOREGONE, 3.4 Computation of Energy, Table 3-6 Average Monthly Energy Losses at Bull Shoals & Norfork Lakes under Reallocation Alternatives. All computed energy losses are based on water supply withdrawals equal to the yield of the reallocated storage. However, the water supply users can withdraw more than the yield in all years except a critical drought. The water supply contract should limit the user's withdrawals to the yield. Since that is not the case, Southwestern's analysis (see Enclosure 2) includes an additional energy loss to account for those increased withdrawals.

65. Page 16, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 3. ENERGY BENEFITS FOREGONE, 3.5 Basis for Computing Energy Benefits Foregone, 3.5.1 Energy Value. Previously, Platts produced a "High Fuel" energy cost scenario that was representative of the cost of replacing lost hydroelectric energy due to a reallocation. Unfortunately, Platts no longer produces that product. The M2M Power product is more of a "base cost" energy price forecast that is not representative of the "super-peak" product marketed by Southwestern and significantly underestimates the value of lost hydropower. More representative energy costs must be identified and used.

66. Page 17, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 3. ENERGY BENEFITS FOREGONE, 3.5 Basis for Computing Energy Benefits Foregone, 3.5.2 Procedure. Power generated at Bull Shoals and Norfork, like that generated at the other projects in Southwestern's interconnected system, is marketed primarily to customers in the Southwest Power Pool (SPP) region and not in the SERC region. The report should be corrected to reflect that throughout and the price forecasts for the SPP region should be utilized in the calculations.

67. Page 18, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 3. ENERGY BENEFITS FOREGONE, 3.5 Basis for Computing Energy Benefits Foregone, 3.5.2 Procedure, Paragraph 3. See Comment 65. Platts price forecasts are not representative of the "super-peak" product marketed by Southwestern, and those forecasts underestimate the value of replacing the lost hydropower due to a reallocation. More realistic energy values are required.

68. Page 18, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 3. ENERGY BENEFITS FOREGONE, 3.5 Basis for Computing Energy Benefits Foregone, 3.5.2 Procedure, Paragraph 4. Nominal dollars should be utilized to properly reflect the future replacement cost of lost energy. The energy losses are already undervalued in the Platts estimates. Using constant dollars that do not accurately reflect expected future conditions further magnifies the error.

69. Page 19, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 3. ENERGY BENEFITS FOREGONE, 3.5 Basis for Computing Energy Benefits Foregone, 3.5.2 Procedure, Figure 3-3. See previous comment.

70. Page 21, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.1 Dependable Capacity, 4.1.1 Dependable Capacity Evaluation Method, Paragraph 1, Sentence 2. Southwestern's system is hydropower only. The average availability method is not applicable. The capacity marketed by Southwestern must be available at all times. Southwestern doesn't market "average" capacity. The capacity must be dependable to be marketable. Southwestern has a longstanding disagreement with the Corps on the use of the average availability method to represent how the capacity is marketed and used in Southwestern's marketing area.

71. Page 21, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.1 Dependable Capacity, 4.1.1 Dependable Capacity Evaluation Method, Paragraph 2. See previous comment. To properly evaluate its loss of marketable capacity, Southwestern used the critical period method. HAC uses the critical period method in its evaluation of the capacity loss for revenues foregone, in recognition that the lost capacity is no longer dependable or marketable by Southwestern. The HAC analysis should also use the critical period method to properly quantify the lost capacity for benefits foregone.

72. Pages 21-22, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.1 Dependable Capacity, 4.1.1 Dependable Capacity Evaluation Method, Paragraph 3 and Figure 4-1. Southwestern markets its hydropower primarily in the SPP region. Please change all references to SERC to reflect SPP and SPP data.

73. Page 23, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.1 Dependable Capacity, 4.1.4 Criteria for Computing Dependable Capacity, Paragraph 1, Sentence 1. The critical year for Southwestern's system was at one time 1956, but Southwestern has utilized 1954 as the critical year for its system since 2001 when it added four additional projects into its interconnected system. Please correct the analysis to utilize 1954 as the critical year for Southwestern's system.

74. Pages 24-29, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.1 Dependable Capacity, 4.1.6 Dependable Capacity Evaluation Method and 4.1.7 Dependable Capacity Losses Summarized. The average availability method utilized by HAC simply does not capture the true impact of the capacity lost due to the reallocation. The small capacity losses calculated, as well as calculating a greater capacity loss in a flood storage reallocation, are indications of a flawed methodology. For more realistic capacity losses, see Southwestern's analysis (see Enclosure 2).

75. Page 29, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.1.7 Dependable Capacity Losses Summarized, Table 4-6 Dependable Capacity Losses. Both this table and Table 6-2 on page 38 say they are dependable capacity losses while showing different values. Please clarify.

76. Pages 29-35, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 4. CAPACITY BENEFITS FOREGONE, 4.2 Computation of Capacity Values. Even though the screening curve methodology used by HAC results in a higher capacity unit value, Southwestern believes the cost of a combustion turbine should be utilized as a much simpler methodology and as the most likely source for replacing lost hydropower capacity.

77. Page 36, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 5. BENEFITS FOREGONE. When the energy and capacity losses and the value of the lost energy are underestimated, the results are an underestimation of the power benefits foregone due to the reallocation. See Southwestern's analysis in Enclosure 2 for a more realistic picture of the hydropower benefits foregone.

78. Page 37, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE. The HAC report utilized rates for Southwestern which were last used in 2002. As of January 1, 2010, Southwestern's on-peak energy rate is 15.30 mills/kWh and its off-peak energy rate is 8.60 mills/kWh. Southwestern's current

capacity charge is $48.94/kW-yr. Please update the report to reflect Southwestern's current rates.

79. Page 37, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE. When the energy and capacity losses and the value of the lost energy and capacity are underestimated, the results are an underestimation of the power revenues foregone due to the reallocation. See Southwestern's analysis in Enclosure 2 for a more realistic picture of the hydropower revenues foregone.

80. Page 37, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE, 6.1 Average Energy Loss, Table 6-1 Average Energy Loss Due to Reallocation of Storage in Bull Shoals and Norfork Lakes. All computed energy losses are based on water supply withdrawals equal to the yield of the reallocated storage. However, the water supply users can withdraw more than the yield in all years except a critical drought. The water supply contract should limit the user's withdrawals to the yield. Since that is not the case, Southwestern's analysis includes an additional energy loss to account for those increased withdrawals. Please correct analysis.

81. Page 38, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE, 6.2 Capacity Loss, Table 6-2 Dependable Capacity Loss Due to Reallocation of Storage in Bull Shoals and Norfork Lakes. Both this table and Table 4-6 on page 29 say they are dependable capacity losses while showing different values. Please clarify.

82. Page 38, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE, 6.2 Capacity Loss, Table 6-2 Dependable Capacity Loss Due to Reallocation of Storage in Bull Shoals and Norfork Lakes. The small capacity losses calculated, as well as calculating a capacity gain in a flood storage reallocation, are indications of a flawed methodology. For more realistic capacity losses, see Southwestern's analysis.

83. Page 38, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE, 6.3 Marketable Capacity vs. Dependable Capacity. For Southwestern, dependable capacity and marketable capacity are synonymous. If the capacity is not dependable, it can not be marketed. The critical period method should be utilized to determine the capacity losses.

84. Page 39, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 6. REVENUE FOREGONE, 6.4 Total Revenues Foregone, Table 6-3 Hydropower Revenue Foregone Due to Reallocation of Storage in Bull Shoals and Norfork Lakes. The values should be recalculated to reflect Southwestern's current rates. See Comment 78.

85. Pages 41-47, APPENDIX D, HYDROPOWER ANALYSIS CENTER REPORT, 7 CREDIT TO POWER MARKETING AGENCY, 7.1 Remaining Period of Contract

and 7.2 Computation of Credit to Power Marketing Agency. Southwestern's last current contract with customers taking energy from the project expires in 2025. Further, Southwestern's 1980 Final Power Allocation provides renewal of the contracts with the current power allocations. Therefore, the benefits lost are throughout the project life. Please correct the PMA credits.

Southwestern Power Administration

Hydropower Impacts of Proposed Reallocation at Bull Shoals
For Ozark Mountain Regional Public Water Authority
And Marion County Regional Water District
June 11, 2010

Bull Shoals - Benefits Foregone	**Conservation Storage**	**Flood Storage**	**Inactive Storage**	**Flood w/HYPO**
Reduction in streamflow (mgd)	7.0	7.0	7.0	7.0
Annual on-peak energy losses (MWh)	1,360	643	1,360	0
Additional on-peak energy losses (MWh)[1]	1,374	643	1,374	0
Total on-peak energy losses (MWh)	2,734	1,285	2,734	0
Annual off-peak energy losses (MWh)	0	151	0	300
Additional off-peak energy losses (MWh)[1]	0	731	0	1,374
Total off-peak energy losses (MWh)	0	882	0	1,674
On-peak energy value ($/MWh)[2]	56.93	56.93	56.93	56.93
Off-peak energy value ($/MWh)[2]	33.51	33.51	33.51	33.51
Average Annual Energy Benefits Foregone	**$155,647**	**$102,711**	**$155,647**	**$56,096**
Capacity losses (kW)	1,111	520	1,111	0
Capacity value ($/kW-year)[3]	59.20	59.20	59.20	59.20
Average Annual Capacity Benefits Foregone	**$65,771**	**$30,784**	**$65,771**	**$0**
Average Annual Hydropower Benefits Foregone	**$221,418**	**$133,495**	**$221,418**	**$56,096**
Annual Flood Control Benefits Foregone Downstream[4]	**$954**	**$11,442**	**$2,225**	**$40,525**
Annual Flood Control Benefits Foregone In Pool[4]	**($1,112)**	**$159**	**($1,112)**	**$3,337**
Annual Recreation Benefits Foregone[4]	**($1,823)**	**$16,775**	**($1,677)**	**$32,893**
Average Annual Total Benefits Foregone	**$219,437**	**$161,871**	**$220,854**	**$132,851**

Base Run includes White River Minimum Flows alternative BS-3 - Top of power pool raised five feet.
Conservation, Flood, and Inactive Alternatives as modeled by the Little Rock District.
Flood Pool with Hydropower Yield Protection Operation (HYPO) modeled by Southwestern Power Administration.

[1]Additional losses are SWPA estimates based on user's ability to withdraw more than the yield in all years except the critical drought.

[2]Energy Benefit Values based on Platts High Fuel values for SPP - October 2009.

[3]Capacity Benefit Values based on FERC values from Hydropower Analysis Center - October 2009.
Capacity Benefit Values based on combustion turbine (Arkansas).

[4]SUPER Flood Control and Recreation Benefits foregone for Conservation, Flood, and Inactive Alternatives from the May 2010 Draft Report - Section 5, Page 5-11, Table 5.11.
SUPER benefits foregone for SWPA's HYPO Alternative based on LRD Section 5 methodology.

Southwestern Power Administration
Hydropower Impacts of Proposed Reallocation at Bull Shoals
For Ozark Mountain Regional Public Water Authority
And Marion County Regional Water District
June 11, 2010

Bull Shoals - Revenues Foregone	Conservation Storage	Flood Storage	Inactive Storage	Flood w/HYPO
Reduction in streamflow (mgd)	7.0	7.0	7.0	7.0
Annual on-peak energy losses (MWh)	1,360	643	1,360	0
Additional on-peak energy losses (MWh)[1]	1,374	643	1,374	0
Total on-peak energy losses (MWh)	2,734	1,285	2,734	0
Annual off-peak energy losses (MWh)	0	151	0	300
Additional off-peak energy losses (MWh)[1]	0	731	0	1,374
Total off-peak energy losses (MWh)	0	882	0	1,674
On-peak energy value ($/MWh)[2]	15.30	15.30	15.30	15.30
Off-peak energy value ($/MWh)[2]	8.60	8.60	8.60	8.60
Average Annual Energy Revenues Foregone	**$41,830**	**$27,246**	**$41,830**	**$14,396**
Capacity losses (kW)	1,111	520	1,111	0
Capacity value ($/kW-year)[3]	48.94	48.94	48.94	48.94
Average Annual Capacity Revenues Foregone	**$54,373**	**$25,449**	**$54,373**	**$0**
Average Annual Hydropower Revenues Foregone	**$96,203**	**$52,695**	**$96,203**	**$14,396**

Base Run includes White River Minimum Flows alternative BS-3 - Top of power pool raised five feet.
Flood, Conservation, and Inactive Alternatives as modeled by the Little Rock District.
Flood Pool with Hydropower Yield Protection Operation (HYPO) modeled by Southwestern Power Administration.

[1]Additional losses are SWPA estimates based on user's ability to withdraw more than the yield in all years except the critical drought.
[2]Energy Revenue Values based on Southwestern's rates as of January 1, 2010.
[3]Capacity Revenue Values based on Southwestern's rates as of January 1, 2010.

January 28, 2010

Ms. Renee Wright
Project Manager
Planning and Environmental Office
U.S. Army Corps of Engineers, Little Rock District
P.O. Box 867
Little Rock, AR 72203-0867

Dear Ms.Wright:

This letter provides the evaluation of Southwestern Power Administration (Southwestern) of the hydropower impacts of the proposed storage reallocation at Bull Shoals Lake for the Ozark Mountain Regional Public Water Authority (OMRPWA) and the Marion County Water District. Southwestern appreciates the opportunity to participate in the study process. The results of Southwestern's calculations for both the original alternatives and the "Plan B" alternatives are included.

As you are aware, Southwestern has provided comments for all recent water storage reallocation reports prepared by the Little Rock District (LRD) for storage at LRD projects (primarily Beaver Lake and Greers Ferry Lake). The issues and disagreements between Southwestern and the U.S. Army Corps of Engineers (Corps) concerning hydropower impacts of storage reallocations and the compensation due to Federal hydropower are long-standing. The Corps established a Water Supply Task Force in 2006, which includes the Corps, Southwestern, Southeastern Power Administration (Southeastern), and customers for both Southwestern and Southeastern. The Task Force was set up by the Corps to discuss and hopefully resolve those long-standing issues. Southwestern urges the Corps to press forward with the Task Force and its work. Agreement between the Corps and the Federal hydropower interests would simplify the preparation and evaluation of future storage reallocation reports and would speed the approval of the reports.

We are concerned that the Corps calculations greatly underestimate the impacts to the Federal hydropower purpose. Corps energy loss calculations are based on the yield of the contracted storage. Water supply users are able to withdraw more than the "safe yield" of the storage in all but the critical drought without depleting their contracted storage. Accordingly, Southwestern has included what it calls "additional energy losses" in its calculations to conservatively account for withdrawals in excess of the yield of the contracted storage. The Corps energy loss calculations should include additional withdrawals above the yield of contracted storage, or the water supply storage contract should limit the amount the user can withdraw to only the yield of the contracted storage.

Southwestern's analysis of the reallocation using the Corps' SUPER model reveals that a reallocation from flood storage would have significantly less impact on hydropower energy and capacity than the conservation or inactive pool options if the hydropower impacts are properly quantified and valued. In addition to a flood storage reallocation, the use of storage for hydropower yield protection operation (HYPO) is an available option that should be utilized. Corps ER 1105-2-100 recommends the use of operational changes, when possible, to compensate hydropower users. The use of HYPO, similar to dependable yield mitigation storage (DYMS) for existing water supply users, is another method of protecting the hydropower purpose. LRD has the discretion to include HYPO and in fact did so in the White River Minimum Flow Study. It is a viable alternative that should be considered in formulating the NED plan. The use of HYPO as part of a storage reallocation would maintain the current yield of the hydropower storage and, therefore, minimize the hydropower losses, especially capacity and on-peak energy losses. Southwestern performed its own SUPER evaluation of a flood storage reallocation including HYPO, and the results from that analysis are included for your consideration. Based on Southwestern's calculations, the NED plan for the proposed reallocation is a flood storage reallocation including HYPO.

Southwestern is disappointed that the Corps is even considering the use of inactive storage as an alternative in its study, and we have previously expressed our disagreement with that decision. Inactive storage is set aside for hydropower head and/or the storage of sediment expected to accumulate over the life of the project. LRD has not considered the reallocation of inactive storage since the early 1990s. Since that time, reallocation reports developed by LRD have correctly recognized that the inactive storage is not appropriate storage for reallocation consideration. Southwestern has reviewed Corps design and study reports which discuss the inactive storage at Bull Shoals. In those documents, the only use considered for that storage other than hydropower head is emergency power storage. A reallocation of any portion of the inactive storage was not contemplated. The alternative should be removed from consideration, and inactive storage should not be considered a viable alternative in any future reallocation study. Otherwise, it should be treated the same as a reallocation from hydropower storage.

We appreciate the opportunity to provide our hydropower impact calculations for the reallocation study. As hydropower is the project purpose most affected by storage reallocations, it is vital that the hydropower losses are properly quantified and valued. Contact Mr. Michael Denny at 918-595-6683 or michael.denny@swpa.gov if you have any questions.

Sincerely,

George Robbins
Director
Division of Resources and Rates

Southwestern Power Administration

Hydropower Impacts of Proposed Reallocation at Bull Shoals
For Ozark Mountain Regional Public Water Authority
And Marion County Regional Water District
January 28, 2010
PRELIMINARY RESULTS

Bull Shoals - Plan A - Benefits Foregone	Conservation Storage	Flood Storage	Inactive Storage	Flood w/HYPO
Reduction in streamflow (mgd)	7.0	7.0	7.0	7.0
Annual on-peak energy losses (MWh)	1,360	643	1,360	0
Additional on-peak energy losses (MWh)[1]	1,374	643	1,374	0
Total on-peak energy losses (MWh)	2,734	1,285	2,734	0
Annual off-peak energy losses (MWh)	0	151	0	300
Additional off-peak energy losses (MWh)[1]	0	731	0	1,374
Total off-peak energy losses (MWh)	0	882	0	1,674
On-peak energy value ($/MWh)[2]	56.93	56.93	56.93	56.93
Off-peak energy value ($/MWh)[2]	33.51	33.51	33.51	33.51
Average Annual Energy Benefits Foregone	**$155,647**	**$102,711**	**$155,647**	**$56,096**
Capacity losses (kW)	1,111	520	1,111	0
Capacity value ($/kW-year)[3]	59.20	59.20	59.20	59.20
Average Annual Capacity Benefits Foregone	**$65,771**	**$30,784**	**$65,771**	**$0**
Average Annual Hydropower Benefits Foregone	**$221,418**	**$133,495**	**$221,418**	**$56,096**
Annual Flood Control Benefits Foregone[4]	**($159)**	**$11,601**	**$1,112**	**$43,862**
Annual Recreation Benefits Foregone[4]	**($1,823)**	**$16,775**	**($1,677)**	**$32,893**
Average Annual Total Benefits Foregone	**$219,436**	**$161,871**	**$220,853**	**$132,851**

Base Run includes White River Minimum Flows alternative BS-3 - Top of power pool raised five feet.
Conservation, Flood, and Inactive Alternatives as modeled by the Little Rock District.
Flood Pool with Hydropower Yield Protection Operation (HYPO) modeled by Southwestern Power Administration.

[1]Additional losses are SWPA estimates based on user's ability to withdraw more than the yield in all years except the critical drought.

[2]Energy Benefit Values based on Platts High Fuel values for SPP - October 2009.

[3]Capacity Benefit Values based on FERC values from Hydropower Analysis Center - October 2009.
Capacity Benefit Values based on combustion turbine (Arkansas).

[4]SUPER Flood Control and Recreation Benefits foregone for Conservation, Flood, and Inactive Alternatives from the Little Rock District - Draft Section 5.
SUPER benefits foregone for SWPA's HYPO Alternative based on LRD Section 5 methodology.

Southwestern Power Administration

Hydropower Impacts of Proposed Reallocation at Bull Shoals
For Ozark Mountain Regional Public Water Authority
And Marion County Regional Water District
January 28, 2010
PRELIMINARY RESULTS

Bull Shoals - Plan A - Revenues Foregone	**Conservation Storage**	**Flood Storage**	**Inactive Storage**	**Flood w/HYPO**
Reduction in streamflow (mgd)	7.0	7.0	7.0	7.0
Annual on-peak energy losses (MWh)	1,360	643	1,360	0
Additional on-peak energy losses (MWh)[1]	1,374	643	1,374	0
Total on-peak energy losses (MWh)	2,734	1,285	2,734	0
Annual off-peak energy losses (MWh)	0	151	0	300
Additional off-peak energy losses (MWh)[1]	0	731	0	1,374
Total off-peak energy losses (MWh)	0	882	0	1,674
On-peak energy value ($/MWh)[2]	15.30	15.30	15.30	15.30
Off-peak energy value ($/MWh)[2]	8.60	8.60	8.60	8.60
Average Annual Energy Revenues Foregone	**$41,830**	**$27,246**	**$41,830**	**$14,396**
Capacity losses (kW)	1,111	520	1,111	0
Capacity value ($/kW-year)[3]	48.94	48.94	48.94	48.94
Average Annual Capacity Revenues Foregone	**$54,373**	**$25,449**	**$54,373**	**$0**
Average Annual Hydropower Revenues Foregone	**$96,203**	**$52,695**	**$96,203**	**$14,396**

Base Run includes White River Minimum Flows alternative BS-3 - Top of power pool raised five feet.
Flood, Conservation, and Inactive Alternatives as modeled by the Little Rock District.
Flood Pool with Hydropower Yield Protection Operation (HYPO) modeled by Southwestern Power Administration.

[1]Additional losses are SWPA estimates based on user's ability to withdraw more than the yield in all years except the critical drought.
[2]Energy Revenue Values based on Southwestern's rates as of January 1, 2010.
[3]Capacity Revenue Values based on Southwestern's rates as of January 1, 2010.

Southwestern Power Administration

Hydropower Impacts of Proposed Reallocation at Bull Shoals
For Ozark Mountain Regional Public Water Authority
And Marion County Regional Water District
January 28, 2010
PRELIMINARY RESULTS

Bull Shoals - Plan B	**Conservation Pool**		**Inactive Pool**	
	Benefits	Revenues	Benefits	Revenues
Reduction in streamflow (mgd)	7.0	7.0	7.0	7.0
Annual on-peak energy losses (MWh)	1,357	1,357	1,357	1,357
Additional on-peak energy losses (MWh)[1]	1,374	1,374	1,374	1,374
Total on-peak energy losses (MWh)	2,731	2,731	2,731	2,731
Annual off-peak energy losses (MWh)	0	0	0	0
Additional off-peak energy losses (MWh)[1]	0	0	0	0
Total off-peak energy losses (MWh)	0	0	0	0
On-peak energy value ($/MWh)[2]	56.93	15.30	56.93	15.30
Off-peak energy value ($/MWh)[2]	33.51	8.60	33.51	8.60
Average Annual Energy Value Foregone	**$155,476**	**$41,784**	**$155,476**	**$41,784**
Capacity losses (kW)	1,111	1,111	1,111	1,111
Capacity value ($/kW-year)[3]	59.20	48.94	59.20	48.94
Annual Capacity Value Foregone	**$65,771**	**$54,373**	**$65,771**	**$54,373**
Annual Hydropower Value Foregone	**$221,247**	**$96,158**	**$221,247**	**$96,158**
Annual Flood Control Benefits Foregone		**-**		**-**
Annual Recreation Benefits Foregone		**-**		**-**
Average Annual Total Benefits Foregone		**-**		**-**

Base Run is conservation pool at 654.00 - no minimum flows, no seasonal pool.
Conservation and Inactive Alternatives as modeled by the Little Rock District.

[1]Additional losses are SWPA estimates based on user's ability to withdraw more than the yield in all years except the critical drought.

[2]Energy Benefit Values based on Platts High Fuel values for SPP - October 2009.
Energy Revenue Values based on Southwestern's rates as of January 1, 2010.

[3]Capacity Benefit Values based on FERC values from Hydropower Analysis Center - October 2009.
Capacity Benefit Values based on combustion turbine (Arkansas).
Capacity Revenue Values based on Southwestern's rates as of January 1, 2010.

Department of Energy
Southwestern Power Administration
One West Third Street
Tulsa, Oklahoma 74103-3502

October 15, 2009

Patrick S. MacDanel
Senior Environmental Scientist/Wildlife Biologist
Gulf Engineers & Consultants, Inc.
P.O. Box 84010
Baton Rouge, LA 70808

Dear Mr. MacDanel:

This is in response to your letter dated September 15, 2009, requesting information pertaining to the preparation of an Environmental Assessment (EA) for a proposed water storage reallocation at Bull Shoals Lake for the Ozark Mountain Regional Public Water Authority (OMRPWA). Southwestern Power Administration (Southwestern) is pleased to offer comments to assist you in the development of the EA.

Southwestern is an agency within the U.S. Department of Energy which is responsible for marketing the hydroelectric power and energy from 24 Corps of Engineers (Corps) projects in the region, including Bull Shoals Dam. As the Federal agency responsible for marketing the hydropower from Bull Shoals, Southwestern has concerns with the storage reallocation request. Federal hydropower will be the project purpose most adversely affected by the proposed reallocation. As stated in the coordination meeting on September 24, 2009, at the Little Rock District (LRD) office, the proposed reallocation should meet three criteria: 1) the reallocated storage is to satisfy an immediate need for water supply; 2) the reallocation is the lowest cost alternative for the water supply; and 3) Federal hydropower must be properly compensated for losses due to the reallocation. The third criterion is typically not met in Corps studies.

Southwestern understands that OMRPWA originally requested water supply storage in Bull Shoals Reservoir yielding 12 million gallons per day (MGD) and has since reduced that request to 6 MGD. We are concerned that the Corps calculations greatly underestimate the impacts to the Federal hydropower purpose. Corps energy loss calculations are based on the yield of the contracted storage, but water supply users are able to withdraw more than the "safe yield" of the storage in all years except the critical drought period without depleting their contracted storage. The Corps energy loss calculations should include additional withdrawals above the yield of contracted storage, or the water supply storage contract should limit the amount the user can withdraw to only the yield of the contracted storage.

It is imperative that the economic impacts of the reallocation alternatives be properly evaluated. In almost all reallocation studies evaluated by Southwestern, reallocation of flood storage provides the least benefits foregone and is the National Economic Development (NED) plan. We would expect the same result in the current study. In addition to a flood pool reallocation, the use of storage for hydropower yield protection operation (HYPO) is an available option that should be utilized. Corps ER 1105-2-100 recommends the use of operational changes, when possible, to compensate hydropower users. The use of HYPO, similar to dependable yield mitigation storage (DYMS) for existing water supply users, is another method of protecting the hydropower purpose. LRD has the discretion to include HYPO and in fact did so in the White River Minimum Flow Study. It is a viable alternative that should be considered in formulating the NED plan. The use of HYPO as part of a storage reallocation would maintain the current yield of the hydropower storage and, therefore, minimize the hydropower losses, especially capacity and on-peak energy losses.

Southwestern is also concerned with the environmental impacts and the potential for high costs of replacement energy and capacity relating to greenhouse gas (GHG) emissions. Capacity and energy to replace the renewable hydropower lost as a result of the reallocation will likely come from a fossil-fuel generating plant, resulting in increased GHG emissions. With the current emphasis on climate change legislation, non-renewable generation that results in the increased GHG emissions could have significant additional costs associated with climate change legislation currently pending in Congress. The environmental impacts and potential costs of the increased emissions should be quantified and included in the EA.

We appreciate the opportunity to provide comments concerning the preparation of the reallocation report and EA for the proposed storage reallocation. Please contact Michael Denny at 918-595-6683 or Michael.Denny@swpa.gov if you have any questions concerning our comments.

Sincerely,

Michael R. Denny

for George Robbins
Director
Division of Resources and Rates

cc:
Ted Coombes
Executive Director
Southwestern Power Resources Association

09/30/09

Southwestern Power Administration (Southwestern) does not recall any mention of inactive storage as a storage reallocation alternative during the September 24 meeting, and we cannot find any mention of it in the meeting minutes. Southwestern strongly opposes the consideration of inactive storage as an alternative for storage reallocation for water supply in all storage reallocation studies. That opposition is based in part on the following points:

1. Inactive storage is set aside for hydropower head and/or the storage of sediment expected to accumulate over the life of the project. By definition, it is inactive or unusable. Reallocation of that storage would in effect lower the bottom of the conservation pool. Typically, at hydropower projects, the size of the inactive storage is designed to provide sufficient head for hydropower generation.

2. The Little Rock District produced a report in September 1968 entitled "White River Rule Curve Studies – 1968, White River Hydroelectric System." Section V of that report discusses the possible use of a portion of the inactive storage as emergency power storage. Emergency power storage could potentially be utilized to sustain firm power generation during a more severe drought than had been experienced at the time. It would be for emergency use only in a significant drought. Use of the inactive storage for any other purpose was not contemplated and would negatively impact hydropower production.

3. The Little Rock District draft storage reallocation report for the Trout Production Facility at Beaver Lake dated July 2000 mentions and dismisses the consideration of inactive storage as a reallocation alternative, citing ER 1105-2-100:

   Inactive Pool. This pool is used to provide a hydraulic head for hydropower generation, space for sediment storage, and an area for recreation and fish habitat. Per paragraph 4-32d, page 4-55, Engineering Regulation 1105-2-100, dated 28 December 1990, this storage is not to be included as usable storage when computing the water user's pro-rata share of updated cost of storage. Therefore, this pool was excluded from these analyses as a storage option.

   The latest version of ER 1105-2-100, dated April 22, 2000, includes similar language concerning the calculation of the updated cost of storage on page E-217: "In this computation, usable storage does not include space set aside for sediment distribution or for hydropower head." Based on that definition, inactive storage is not "usable" and should not be considered for reallocation.

4. In the Little Rock District storage reallocation report for the Mid Arkansas Water Alliance at Greers Ferry Lake dated June 2007, inactive storage is not contemplated as an option for reallocation, in recognition that it is not usable storage. On page 7, the report states:

Two options will be evaluated for reallocation of storage in Greers Ferry Lake. The effects of reallocating storage from current flood control storage or conservation (hydropower) storage will be considered. These are the ***only usable storage spaces*** *in Greers Ferry Lake.* (emphasis added)

5. As in the previously mentioned report for Greers Ferry, the Little Rock District draft storage reallocation report for the City of Mountain Home, Arkansas, at Norfork Lake dated August 2007, similarly dismisses inactive storage as an option to be considered for reallocation. On page 10, the report contains similar language to the June 2007 report for Greers Ferry:

   Two options will be evaluated for reallocation of storage in Norfork Lake. The effects of reallocating storage from current flood control, or hydropower storage will be considered. These are the ***only usable storage spaces*** *in Norfork Lake.* (emphasis added)

6. In the recently completed White River Minimum Flows Study performed by the Little Rock District, the Corps performed an evaluation of various reallocation scenarios at Beaver, Table Rock, Bull Shoals, Norfork, and Greers Ferry. In recognition of the fact that inactive storage is not usable for any purpose other than hydropower head and sediment storage, the Corps did not consider that storage space as an alternative for reallocation at any of the five projects. Inactive storage at Bull Shoals was correctly excluded from consideration for that study, as it should be for the current study.

In consideration of all the examples mentioned here as well as many others that could be noted, the Corps should dismiss any consideration of inactive storage at Bull Shoals and all other projects for the current study and for future studies.

Appendix E
Dam Safety Considerations

CESWL-EC 10 March 2010

MEMORANDUM FOR RECORD

SUBJECT: Reallocation of Storage at Bull Shoals Lake, Arkansas for Ozark Mountain Regional Public Water Authority and Marion County Regional Water District - Dam Safety Officer Opinion

1. Summary. Engineering Circular 1110-2-210, Water Supply Storage and Risk Reduction Measures for Dam Safety, dated 16 July 2009, emphasizes the importance of dam safety as part of any new water supply agreement. In instances where a rise in pool is being proposed, a review of the Potential Failure Mode Analysis (PFMA) for the dam is required. In addition, an analysis of the effects (if any) that a higher pool elevation might have on the structure is also required. Hydrologic studies indicate that pool changes resulting from this proposed water storage reallocation would have no effect on pool elevation at extreme floods such as the Probable Maximum Flood and the Infrequent Flood Event (300 year return period). In fact, in the case of this study the recommended plan is actually for the water to come from conservation storage – something that would marginally lessen the force on the dam as well as the water elevation.

Bull Shoals has generally exhibited good performance throughout its life with only minor deficiencies noted during the regular periodic inspections. Despite this, it is important to understand that dams are structures that change over time. The nature and extent of the changes depend on many internal and external factors. A Dam Safety Action Classification (DSAC) rating may change in the future with changes in condition of the dam, consequences of failure, or new knowledge of potential failure modes. In December 2008 Bull Shoals Dam was rated DSAC 4 after being screened in June 2005 as part of a nationwide portfolio risk assessment. Despite the fact that this dam was found to be in good overall shape, it was still deemed prudent to investigate the likely governing failure mode as identified during the dam's initial screening before any dam safety recommendations on this water reallocation study were made. In this light, sliding stability was judged to be the failure mode which would be studied in greater detail. The completed analysis indicates that the structure is stable under all load conditions and that there are no known dam safety issues created by or made worse by the proposed water reallocation in this study. For this reason the water reallocation study should be allowed to proceed.

2. Geology. The Bull Shoals Dam is founded on sedimentary rock and consists of dolomites which belong to two formations of Ordovician age, the Cotter and the Jefferson City. Rock of which these two formations are composed is very similar consisting for the most part of dolomite layers that range from thin bedded (4-inches) to massive bedded (23-feet) and from dense to crystalline. Many of the beds are siliceous; some are sandy; and some are argillaceous. Chert occurs as nodules and lenses ranging up to 5-feet thick. The Cotter formation contains a few thin sandstone beds ranging from 4-inches to 2-feet

Encl 6A

in thickness. Shale occurs as thin seams from 0.06 to 2 inches thick and as thin films on partings and bedding planes in the rock. The foundation rock in the area has a slight regional dip to the southwest (downstream) with some minor folding of the foundation rock beneath the structure. No large faults are located beneath the structure.

According to the *Bull Shoals Dam, Analysis of Design dated October 1946*, the dam was designed using a coefficient of sliding friction of 0.65 (phi angle of 33 degrees) coincident with a unit shear resistance of foundation material (cohesion) of 400 pounds per square inch (psi). Information could not be found to determine the basis of these assumptions in the research of available historical documents. It appears that data from the Norfork Dam foundation rock investigation (which preceded the Bull Shoals design) may have been used.

3. Stability Analysis. In a desire to be thorough in the analysis and because of the lack of site specific data at Bull Shoals Dam, the Little Rock District made the decision to undertake a representative sampling/testing program prior to drawing any dam safety conclusions. A series of 10 borings were drilled beneath the dam in order to determine the correct design values to be used. These samples were then tested by an accredited laboratory and the results were reviewed by a panel of recognized experts – both from the Corps and the private sector. While specific values were used for individual monoliths, the average values used for the entire dam were: a) foundation failure plane: cohesion = 0 psi, phi angle = 31 degrees, and b) rock passive wedge: cohesion = 69 psi, phi angle = 32 degrees. Structural engineers took the specific values and conducted an analysis related to sliding stability since it was determined to be the governing failure mode for the project. The results indicated that: a) the effect on sliding stability due to a minor increase or decrease in the pool was basically immeasurable, and b) all monoliths are stable against sliding forces. Sliding safety factors were computed for the following load conditions: normal pool, 300 year pool (or record pool), seismic, and extreme hydrological (probable maximum flood). The computed sliding safety factors for all monoliths were above factor of safety criteria except for a single overflow monolith. This particular monolith (#26) possessed a factor of safety of 1.45 at normal pool. This was due to the quality of the rock found in the single boring taken below that monolith. While this is below the 2.0 generally required at normal pool, it is still well above 1.0, thereby alleviating any immediate concerns about the monolith's stability. It is believed that additional testing in the downstream passive wedge would likely result in an increase

in the actual cohesion value. If similar to the other 9 borings taken across the dam this monolith would also meet established factor of safety criteria. However, without that data a more conservative assumption was used in the analysis.

4. Conclusions and Recommendations. There are no known dam safety issues created by or made worse by the proposed water reallocation and the study should be allowed to proceed. In fact, taking the water from conservation storage actually provides a small benefit both from a structural and hydrologic perspective. The results of the testing program and stability analysis have significantly raised the confidence level in the safety of Bull Shoals Dam and done nothing but reaffirm its status as a DSAC 4 dam. In addition, the dam has an excellent record of performance throughout its nearly 60 year life. Its performance during the record pools of 2008 (near 300 year event) was exemplary. The district should use normal budget processes to complete the additional testing and analysis needed to establish the final design rock strengths for Monolith #26. While not expected, if those values turn out to be significantly lower than the values already used, a determination will then need to be made as to whether the issue is significant enough to warrant a reconsideration of the dam's DSAC rating.

Anthony J. Batey, PE
Chief, Engineering & Construction Division
Little Rock District Dam Safety Officer

CF:
SWL Dam Safety Program Manager (Oberle)

Appendix F
Real Estate Plan

1. There are no real estate interests needed for the water reallocation study for Ozark Mountain Regional Public Water Authority (OMRPWA) at Bull Shoals Lake.

2. However, if the project is approved the following Government (Corps) Real Estate easements are required to implement the reallocation for OMRPWA at Bull Shoals Lake:

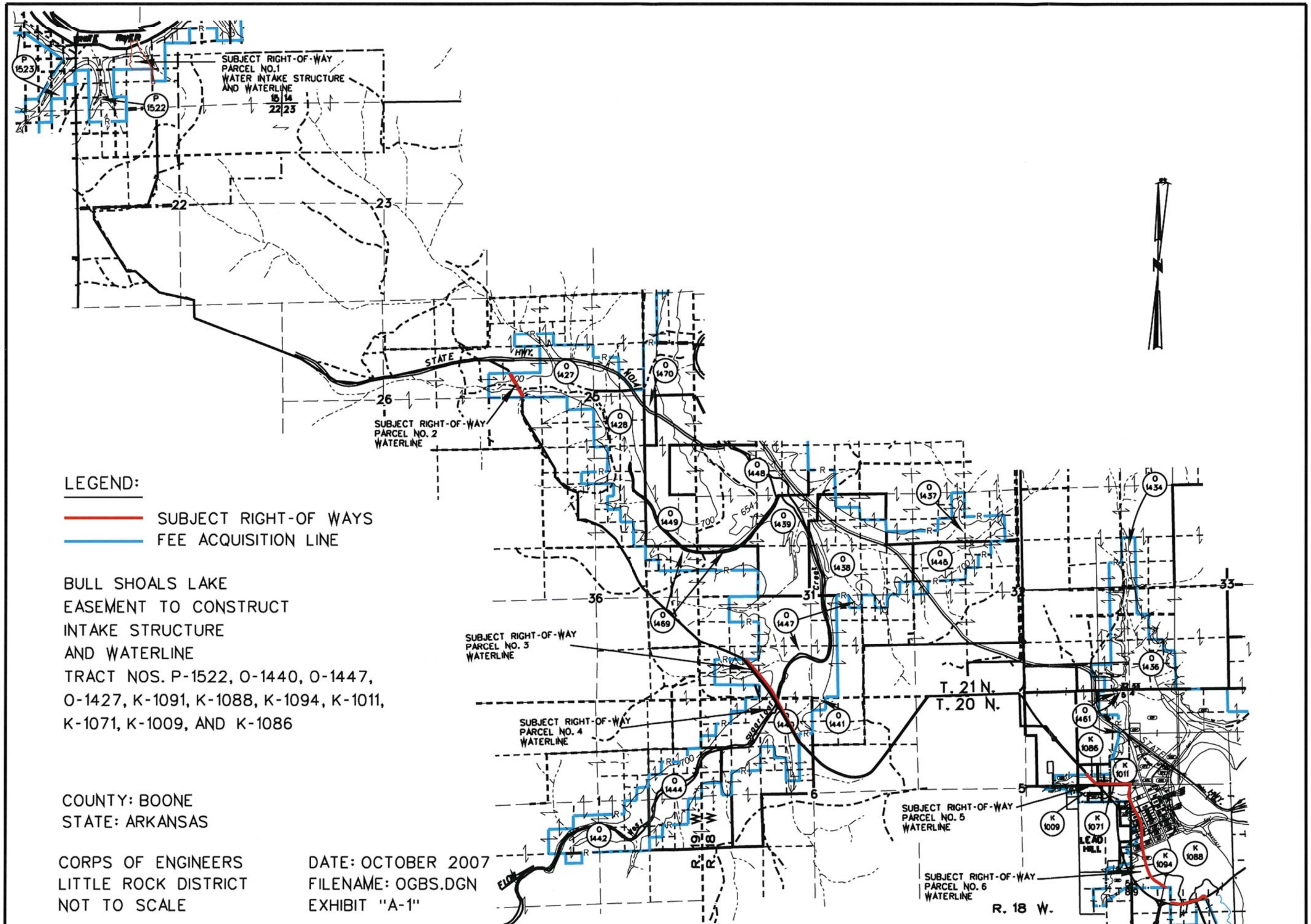
3. Water Intake area [includes water intake facility, access road, parking area and a 300-foot restrictive easement area around the intake] and 8.56 acres easement
Pipeline: temporary construction area license (1.57 acres) and permanent easement (3.93 acres)

4. Maps of the proposed real estate easements are provided as Exhibits "A-1", "A-2", and "A-3". The cost for these outgrants to the water authority is $0. These instruments would be granted to the applicant for the benefit of the general public pursuant to the provisions of a Water Supply Contract.

5. Current policy authorized the USACE to collect non-statutory mitigation for the impacts to the project, as well as administrative fees for evaluation and processing.

Joe Craig

Joe Craig
Sr. Realty Specialist
Real Estate



LEGEND:

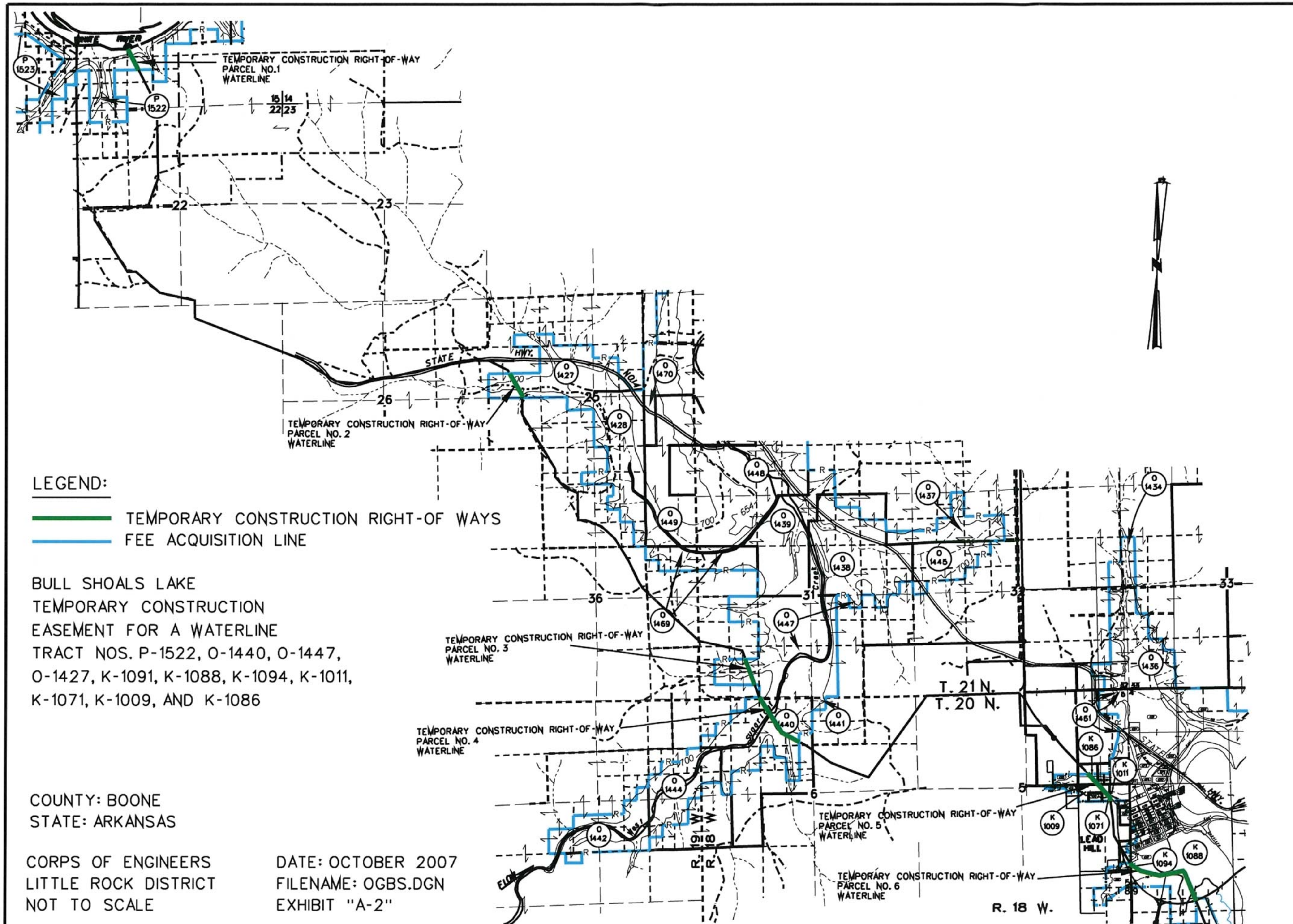
SUBJECT RIGHT-OF WAYS
FEE ACQUISITION LINE

BULL SHOALS LAKE
EASEMENT TO CONSTRUCT
INTAKE STRUCTURE
AND WATERLINE
TRACT NOS. P-1522, O-1440, O-1447,
O-1427, K-1091, K-1088, K-1094, K-1011,
K-1071, K-1009, AND K-1086

COUNTY: BOONE
STATE: ARKANSAS

CORPS OF ENGINEERS
LITTLE ROCK DISTRICT
NOT TO SCALE

DATE: OCTOBER 2007
FILENAME: OGBS.DGN
EXHIBIT "A-1"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TEMPORARY CONSTRUCTION RIGHT-OF WAYS
FEE ACQUISITION LINE
BULL SHOALS LAKE
TEMPORARY CONSTRUCTION
EASEMENT FOR A WATERLINE
TRACT NOS. P-1522, O-1440, O-1447,
O-1427, K-1091, K-1088, K-1094, K-1011,
K-1071, K-1009, AND K-1086
COUNTY: BOONE
STATE: ARKANSAS
CORPS OF ENGINEERS
LITTLE ROCK DISTRICT
NOT TO SCALE
DATE: OCTOBER 2007
FILENAME: OGBS.DGN
EXHIBIT "A-2"
TEMPORARY CONSTRUCTION RIGHT-OF-WAY
PARCEL NO.1
WATERLINE
TEMPORARY CONSTRUCTION RIGHT-OF-WAY
PARCEL NO. 2
WATERLINE
TEMPORARY CONSTRUCTION RIGHT-OF-WAY
PARCEL NO. 3
WATERLINE
TEMPORARY CONSTRUCTION RIGHT-OF-WAY
PARCEL NO. 4
WATERLINE
TEMPORARY CONSTRUCTION RIGHT-OF-WAY
PARCEL NO. 5
WATERLINE
TEMPORARY CONSTRUCTION RIGHT-OF-WAY
PARCEL NO. 6
WATERLINE
WHITE RIVER
P 1523
P 1522
STATE HWY. 101
O 1427
O 1470
O 1428
O 1448
O 1449
O 1439
O 1437
O 1434
O 1445
O 1438
O 1469
O 1447
O 1436
O 1440
O 1441
O 1461
O 1444
O 1442
K 1086
K 1011
K 1009
K 1071
K 1094
K 1088
LEAD HILL
T. 21 N.
T. 20 N.
R. 19 W.
R. 18 W.
R. 18 W.
22
23
26
25
36
31
32
33
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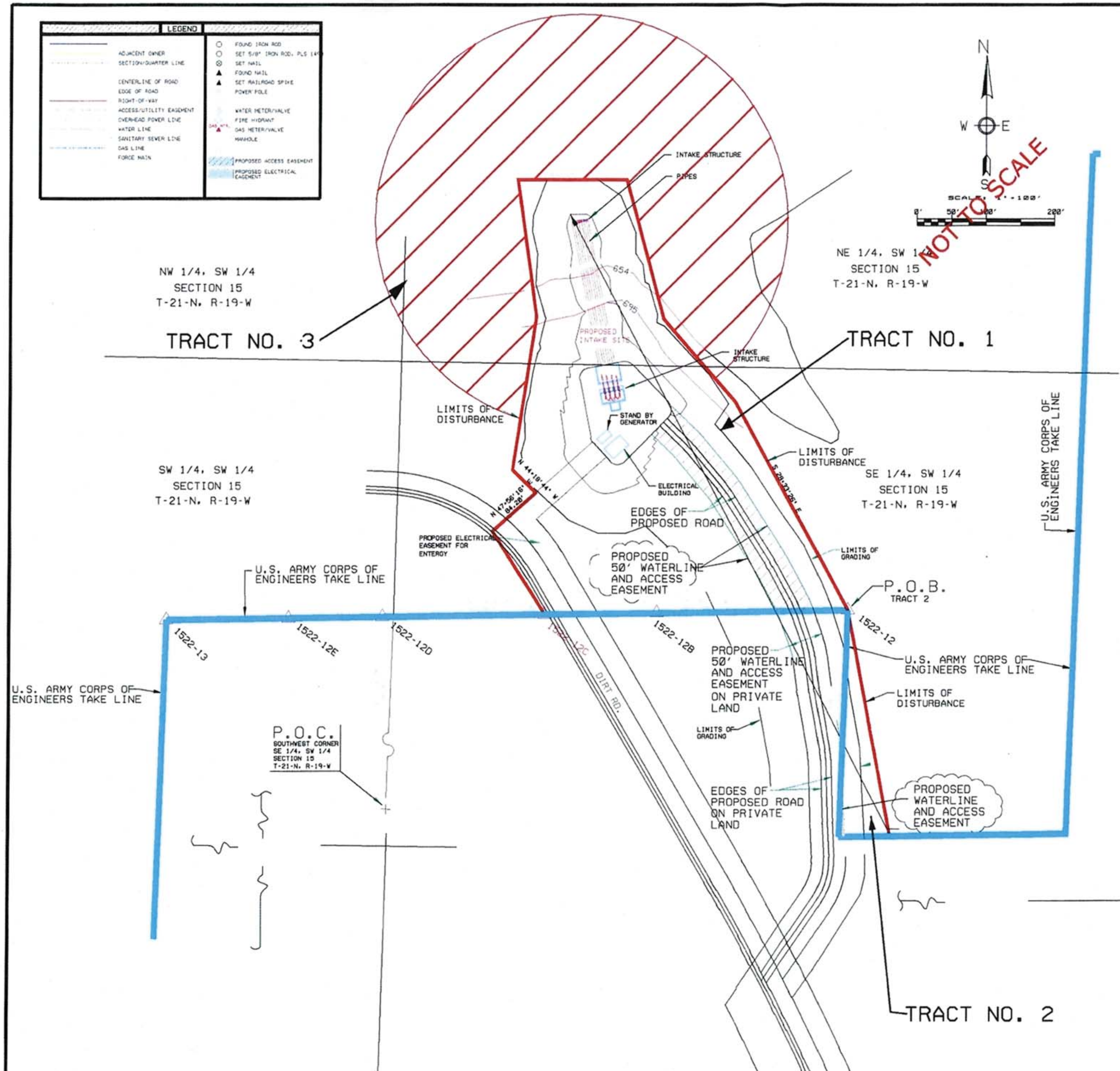

TRACT NO. 1 (INTAKE STRUCTURE)

A part of the Northeast Quarter of the Southwest Quarter and a part of the Southeast Quarter of the Southwest Quarter of Section 15, Township 21 North, Range 19 West, Boone County, Arkansas, being more particularly described as follows:

Commencing at the Southwest corner of said Southeast Quarter of the Southwest Quarter; thence North 01°54'24"East a distance of 990.39 feet to a point on the U.S. Army Corps of Engineers, Bull Shoals Lake Take Line; thence along said take line North 89°10'34" East a distance of 220.58 feet for the point of beginning, said point being COE Monument No. 1522-12c; thence leaving said take line North 32°26'22" West a distance of 143.43 feet; thence North 47°56'16" East a distance of 84.20 feet; thence North 44°18'44" West a distance of 47.52 feet; thence North 08°29'29" East a distance of 225.58 feet; thence North 07°44'09" West a distance of 200.64 feet; thence North 90°00'00"East a distance of 157.54 feet; thence South 14°56'30" East a distance of 209.50 feet; thence South 40°48'33" East a distance of 159.90 feet; thence South 28° 33'26" East a distance of 345.67 feet to a point on said take line, said point being COE Monument No. 1522-12; thence South 89° 10'34" West along said take line a distance of 440.03 feet to the point of beginning. Containing 4.28 acres, more or less and being subject to any and all easements and /or rights of way of record.

TRACT NO. 2 (ACCESS ROAD AND WATERLINE)

A Part of the Southeast Quarter of the Southwest Quarter of Section 15, Township 21 North, Range 19 West, Boone County, Arkansas, being more particularly described as follows:

Commencing at the Southwest corner of said Southwest Quarter of the Southwest Quarter; thence North 01°54'24" East a distance of 990.39 feet to a point on the U.S. Army Corps of Engineers, Bull Shoals Lake Take Line; thence along said take line North 89°10'34" East a distance of 660.61 feet for the point of beginning, said point being COE Monument No. 1522-12; thence leaving said take line South 10°45'42" East a distance of 334.61 feet to a point on said take line; thence South 89°10'27" West along said take line a distance of 74.02 feet; thence, continuing along said take line North 02°00'11" East a distance of 329.73 feet to the point of beginning. Containing 0.28 acres, more or less and being subject to any and all easement/or rights of way on record.

TRACT NO. 3 (RESTRICTED AREA)

A tract of land with a radius of 300 feet, situated in the County of Boone, State of Arkansas, being part of the Southeast Quarter of the Southwest Quarter of Section 15, Township 21 North, Range 19 West, of the Fifth Principal Meridian, and containing 4.89 acres more or less.

The above described legal descriptions contain in the aggregate 9.45 acres, more or less.

LEGEND:

INTAKE STRUCTURE BOUNDARY

300-FOOT RESTRICTED AREA

FEE ACQUISITION LINE

ENGINEERING SERVICES INCORPORATED
CONSULTING ENGINEERS AND SURVEYORS
1207 SOUTH OLD MISSOURI RD.
SPRINGDALE, ARKANSAS 72764

U.S. ARMY CORPS OF ENGINEERS
INTAKE STRUCTURE, BULL SHOALS LAKE
LIMITS OF CONSTRUCTION, OZARK MOUNTAIN REGIONAL PUBLIC WATER AUTHORITY
BOONE COUNTY, ARKANSAS

REVISION	DATE	DESCRIPTION

SCALE: 1" = 100'
DATE: APR., 2009
JAN. 2010
W.O. 04807

1

EXHIBIT "A-3"