

DRAFT ENVIRONMENTAL ASSESSMENT

**REBUILDING THE TAUM SAUK PUMPED STORAGE PROJECT'S
UPPER RESERVOIR**

**Taum Sauk Pumped Storage Project
FERC No. 2277
Missouri**



**Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Administration and Compliance
888 First Street, NE
Washington, DC 20426**

June 2007

This page intentionally left blank.

TABLE OF CONTENTS

| | |
|---|-----------------|
| LIST OF FIGURES..... | iii |
| LIST OF TABLES..... | iv |
| ACRONYMS and ABBREVIATIONS..... | v |
| SUMMARY..... | vii |
| 1.0 APPLICATION..... | 1 |
| 1.1 Background..... | 1 |
| 2.0 PURPOSE OF ACTION AND NEED FOR POWER..... | 3 |
| 2.1 Purpose of Action..... | 3 |
| 2.2 Need for Power..... | 4 |
| 3.0 PROPOSED ACTION AND ALTERNATIVES..... | 5 |
| 3.1 Description of the Original Upper Dam..... | 5 |
| 3.2 Proposed Action..... | 6 |
| 3.2.1 Construction Schedule..... | 8 |
| 3.2.2 Proposed Environmental Measures..... | 8 |
| 3.2.2.1 Erosion Control Plan..... | 8 |
| 3.2.2.2 Spill Prevention, Control and Countermeasure Plan..... | 10 |
| 3.2.2.3 Measures to Prevent Overfilling..... | 12 |
| 3.3 No Action Alternative..... | 15 |
| 3.4 Staff Preferred Alternative..... | 15 |
| 3.5 Alternatives Considered but Eliminated from Further Analysis..... | 16 |
| 4.0 CONSULTATION AND COMPLIANCE..... | 17 |
| 4.1 Scoping and Comments..... | 17 |
| 4.2 Agency Consultation..... | 19 |
| 4.3 Compliance..... | 19 |
| 4.3.1 Water Quality Certification..... | 19 |
| 4.3.2 Section 404 Permit..... | 20 |
| 4.3.3 Essential Fish Habitat..... | 20 |
| 4.3.4 Endangered Species Act..... | 21 |
| 4.3.5 National Historic Preservation Act..... | 21_Toc168216250 |
| 5.0 ENVIRONMENTAL ANALYSIS..... | 21 |
| 5.1 General Description of the River Basin..... | 22 |
| 5.2 Cumulatively Affected Resources..... | 23 |
| 5.3 Engineering Review of Proposed Action..... | 23 |
| 5.4 Resource Issues and Mitigation Alternatives..... | 24 |
| 5.4.1 Geological and Soil Resources..... | 24 |
| 5.4.2 Water and Fisheries Resources..... | 35 |
| 5.4.2.1 Water Quantity..... | 38 |
| 5.4.2.2 Water Quality..... | 46 |
| 5.4.2.3 Fisheries Resources..... | 51 |

| | | |
|---------|--|----|
| 5.4.2.4 | Aquatic Macroinvertebrates | 57 |
| 5.4.2.5 | Effects of a Release from the Proposed ORS on Water Resources... | 61 |
| 5.4.3 | Terrestrial Resources | 64 |
| 5.4.3.1 | Wetlands | 72 |
| 5.4.4 | Threatened and Endangered Species..... | 73 |
| 5.4.5 | Cultural and Historic Resources..... | 78 |
| 5.4.6 | Recreation..... | 80 |
| 5.4.7 | Aesthetic, Air Quality and Noise Issues..... | 84 |
| 5.4.7.1 | Aesthetic Resources..... | 84 |
| 5.4.7.2 | Air Quality | 85 |
| 5.4.7.3 | Noise | 86 |
| 5.4.8 | Socioeconomics | 88 |
| 6.0 | FINDING OF NO SIGNIFICANT IMPACT..... | 91 |
| 7.0 | LITERATURE USED OR CITED..... | 92 |
| 8.0 | LIST OF PREPARERS | 95 |

LIST OF FIGURES

| | | |
|--------------|---|----|
| Figure 1-1. | General location of the Taum Sauk Project. | 2 |
| Figure 1-2. | Pre-event satellite photograph showing project area..... | 2 |
| Figure 5-1. | Shaded relief map of area..... | 25 |
| Figure 5-2. | Shaded topographic map of project..... | 26 |
| Figure 5-3. | View of upper reservoir prior to the breach..... | 27 |
| Figure 5-4. | View of bedrock immediately below failed embankment..... | 28 |
| Figure 5-5. | View of bedrock within failed embankment section..... | 28 |
| Figure 5-6. | Weathered rock and discontinuous clay seam in foundation dike.... | 29 |
| Figure 5-7. | Downstream view of breach..... | 32 |
| Figure 5-8. | Looking upstream from debris dam..... | 32 |
| Figure 5-9. | Upper reservoir showing rockfill material..... | 33 |
| Figure 5-10. | Preparation of laydown area 1..... | 34 |
| Figure 5-11. | Areas of land disturbance..... | 68 |

LIST OF TABLES

Table 5-1. Monthly flows, East Fork Black River above the Taum Sauk Project... 40

Table 5-2. Monthly flows, East Fork Black River below the Taum Sauk Project... 41

Table 5-3. Fish species collected from Taum Sauk Project’s lower reservoir..... 52

Table 5-4. Fish species collected in 2006 from the Project’s lower reservoir..... 53

Table 5-5. Fish species collected in the East Fork Black River. 54

Table 5-6. Fish species collected in Taum Sauk Creek..... 56

Table 5-7. Population and households, 1990 and 2000..... 89

Table 5-8. Housing units, 1990 and 2000. 89

Table 5-9. Employment, 1992 and 2002. 90

Table 5-10. Employment by sector, 2000..... 90

ACRONYMS AND ABBREVIATIONS

| | |
|--------------------|---|
| AIR | additional information request |
| Ameren or licensee | AmerenUE |
| ATV | All Terrain Vehicle |
| BMPs | Best Management Practices |
| BOC | Board of Consultants |
| cfs | cubic feet per second |
| CFRD | Concrete Faced Rockfill Dam |
| Commission or FERC | Federal Energy Regulatory Commission |
| Corps | U.S. Army Corps of Engineers |
| CRCC | conventional Roller Compacted Concrete |
| CWA | Clean Water Act |
| D2SI | Division of Dam Safety and Inspections |
| DEA | Draft Environmental Assessment |
| DO | dissolved oxygen |
| EA | Environmental Assessment |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act |
| ESCP | Erosion and Sedimentation Control Program |
| FPA | Federal Power Act |
| FWS | U.S. Fish and Wildlife Service |
| GWh | gigawatt-hours |
| HPMP | Historic Properties Management Plan |
| LMP | Land Management Plan |
| MCE | Missouri Coalition for the Environment |
| MDNR | Missouri Department of Natural Resources |
| MDOC | Missouri Department of Conservation |
| msl | mean sea level |
| MW | megawatt |
| NAAQS | national ambient air quality standards |
| National Register | National Register of Historic Places |
| NEPA | National Environmental Policy Act |
| NIOSH | National Institute for Occupational Safety and Health |
| ORS | overflow release structure |
| RCC | Roller Compacted Concrete |
| SHPO | State Historic Preservation Officer |
| SPCC | Spill Prevention, Control, and Countermeasure |
| USGS | United States Geological Survey |

SUMMARY

The Taum Sauk Pumped Storage Project (FERC No. 2277), located in southeast Missouri, is a hydroelectric facility with an upper reservoir located atop Proffit Mountain and a lower reservoir created by a conventional dam on the East Fork Black River. On December 14, 2005, the project's upper reservoir breached, rendering the hydroelectric facility inoperable. The upper reservoir was overtopped when the pumps filling the upper reservoir failed to shut off. Once overtopping began, erosion began to undercut the rockfill dam and soon formed a breach about 656 feet wide at the top of the dam and 496 feet at the base of the dam. The complete evacuation of the reservoir occurred within 25 minutes. As a result, the project has remained inoperable since the December 14 event.

On February 5, 2007, Ameren UE (licensee) filed design drawings and technical specifications, along with an environmental report, in support of its application to rebuild the project's upper reservoir. The licensee's Proposed Action involves building a new upper reservoir with a concrete-faced symmetrical Roller Compacted Concrete (RCC) dam. Construction of the new RCC dam would require the complete removal of the breached rockfill dam and the crushing of the rockfill to create aggregate suitable for the RCC mix. The new upper reservoir dam would be kidney-shaped, approximately 6,400 feet long and approximately 100 feet high. The surface area and storage volume of the new reservoir would be the same as the previous reservoir, at 54.5 acres and 4,360 acre feet, respectively. The Proposed Action would result in no changes to the lower reservoir, the number or size of pump/generator units, or in the operating requirements.

The Proposed Action involves the rebuilding of the upper reservoir in essentially the same footprint as the previous upper dam. Once authorized, construction is expected to take approximately 21 months. In order to determine the impacts and identify any mitigative measures that may be necessary as a result of the proposed rebuilding of the upper reservoir, Commission staff prepared this Environmental Assessment (DEA).

Part of the licensee's proposal involves withdrawing water from the lower reservoir for use in the construction of the RCC and other construction-related activities. To help ensure minimum effects on lower reservoir elevations and downstream flow releases to the East Fork Black River, during the rebuilding and initial refilling of the upper reservoir, staff recommends that the licensee consult with the resource agencies and develop a Final Water Management Plan. The plan, as described in this DEA, should be filed with the Commission for approval, before the start of construction.

Prior to the breach of the upper reservoir, leakage from the upper reservoir during normal operation had led to the development of several artificial springs and wetlands on Proffit Mountain. The proposed replacement dam has been designed with leakage prevention and seepage control features, therefore, seepage is expected to be substantially

less than what has occurred historically. As a result, any remaining previously created wetlands would be lost. The licensee indicated that it is consulting with the Missouri Department of Natural Resources (MDNR) to identify the areas of concern, and will work with the MDNR to resolve the agency's concerns. In order to keep the Commission apprised of the discussions surrounding the wetlands, staff recommends that the licensee file with the Commission for approval, the results of its ongoing consultation with the MDNR regarding how it proposes to resolve the concerns of the MDNR surrounding the wetlands created by leakage from the previous upper reservoir. The DEA states that resolution may include, but is not limited to, maintaining the existing wetlands or creating/replacing the wetlands.

The licensee's Proposed Action identifies a number of areas to be cleared, grubbed and graded to support the construction efforts. The majority of the land to be cleared has been previously disturbed, and served as lay down and staging areas for the original construction of the upper reservoir in the 1960's. However, the licensee also proposes to clean an additional 13.2 acres on a high forested hill adjacent to the upper reservoir. Based on aerial photographs, the area contains large trees and is heavily forested. It is not likely that the area was previously disturbed during construction of the original dike. The clearing and grading of this large forested area would cause long term negative adverse impacts to wildlife habitat, by removing a relatively large amount of stable habitat. Staff recommends that the licensee not clear this area.

After the completion of construction, the licensee proposes to revegetate the areas that were cleared, grubbed and used as staging and laydown areas. To ensure proper mitigation for the loss of cleared habitat, staff recommends that the licensee file, for Commission approval, a revegetation plan developed in consultation with MDNR, Missouri Department of Conservation and the U.S. Fish and Wildlife Service. Staff recommends that restoration of the staging and laydown areas include the removal of the hardfill cap and hardfill subgrade prior to placement of topsoil and native vegetative cover.

Lastly, staff recommends that the licensee develop in consultation with the resources agencies, a limited recreational plan that provides for reopening some of the recreational facilities at the lower reservoir as soon as possible. Facilities at the project include boating and fishing access, camping sites, hiking trails, wildlife areas, picnic areas, scenic overlooks and a museum. Since the breach, all recreational facilities have been closed at the project. However, in 2006, the lower reservoir was drained, dredged and cleared of debris that accumulated as a result of the breach. With rain events throughout the winter and spring of 2007, the lower reservoir has completely refilled and is currently spilling all inflow. With the construction work confined to the upper reservoir area, the lower reservoir is available to support limited recreational activity during the two-year construction period.

The rebuilding of the upper reservoir is necessary for the Taum Sauk Pumped Storage Project to resume operation. The proposed construction would occur in the same location as the previous upper reservoir, retaining a similar shape and volume of water. No operational changes are proposed. Operation of the project provides needed energy storage for periods when demand is high or when energy is needed in emergency circumstances. The licensee's proposed erosion control measures and implementation of Best Management Practices, together with staff's recommended mitigation measures should reduce, to the extent possible, impacts associated with the construction activities.

Based on our independent analysis as described in this DEA, the proposed rebuilding of the upper reservoir of the Taum Sauk Project does not constitute a major federal action significantly affecting the quality of the human environment.

DRAFT ENVIRONMENTAL ASSESSMENT

**Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Administration and Compliance
888 First Street, NE
Washington, DC 20426**

Taum Sauk Pumped Storage Project FERC Project No. 2277—Missouri

1.0 APPLICATION

Application Type: Proposal to rebuild the upper reservoir of the Taum Sauk Pumped Storage Project
Date Filed: February 5, 2007 and supplemented May 2, 2007
Applicant's Name: Ameren UE, (licensee or Ameren)
Water body: East Fork Black River
County and State: Reynolds County, Missouri
Federal Lands: The project does not occupy any federal lands

1.1 Background

The Taum Sauk Project, located in southeast Missouri (Figure 1-1), is a reversible pumped storage project and is utilized to supplement the generation and transmission facilities of Ameren UE. The project's primary features are a mountain top upper reservoir, a shaft and tunnel conduit leading to a 450-MW, two-unit pumpturbine, a motor-generator plant and a lower reservoir (Figure 1-2). It was the first of the large capacity pumped-storage stations to begin operation in the United States.

On December 14, 2005, the upper reservoir of the Taum Sauk Project breached rendering it inoperable. The project has remained inoperable since the December 14 event. The Commission, under the authority of the Federal Power Act (FPA), licenses and oversees the operation of non-federal hydropower projects in the United States. As part of its oversight capacity, the Commission implements a dam safety program through its Division of Dam Safety and Inspections (D2SI) to ensure that Commission-licensed projects comply with Federal dam safety standards and are designed, constructed and operated safely. The licensee requested to restore the project under its current license. Under Title 18 of the Code of Federal Regulations, Part 12, the D2SI Regional Engineer has the



Figure 1-1. General location of the Taum Sauk Project within the State of Missouri. (Source: Earthstar Geographics)



Figure 1-2. Pre-event satellite photograph showing the upper and lower reservoir, the powerhouse and the East Fork Black River along the Johnson Shut-Ins State Park. (Source: Google Earth, 2005)

authority to, among other things, require or authorize a licensee to take an action to repair or modify project works for the purpose of achieving or protecting the safety, stability, and integrity of project works. The licensee's Proposed Action to rebuild the upper reservoir falls under this authority.

Description of the December 14, 2005 Event

The upper reservoir of the Taum Sauk Project, which occupies the top of Proffit Mountain, was overtopped on the morning of December 14, 2005 when the pumps failed to shut off. Reservoir data indicated that pumping stopped at 5:15 AM with the initial breach forming at approximately the same time. Once overtopping began, erosion started at the downstream toe of the 10-foot-high parapet wall that capped the rockfill dike. Erosion progressed below the parapet wall, causing instability and resulting in the initial loss of one or two parapet wall sections. Subsequent erosion and the cutting of the rockfill embankment formed a breach about 656 feet wide at the top of the rockfill dam and 496 feet at the base of the dam. The peak discharge from the breach was about 273,000 cubic feet per second (cfs) which occurred within 10 minutes of the initial breach. The complete evacuation of the reservoir occurred within 25 minutes.

The breach flows traveled down the west side of Proffit Mountain into the East Fork of the Black River. Flows destroyed the home of the Johnson's Shut-Ins State Park superintendent, flooded motorists on Highway N, and significantly damaged the State Park, campground, and adjacent properties, before entering the Lower Taum Sauk Reservoir. Fortunately, there were no casualties. The lower dam stored most of the breached flows in the lower reservoir releasing a peak spillway discharge of approximately 1,600 cfs. This equates to about 1.1 feet over the spillway crest which is well within the capacity of the lower reservoir spillway. Upon leaving the Lower Dam area, flows proceeded downstream in the Black River to the town of Lesterville, Missouri, located approximately 3.5 miles downstream from the lower dam. The incremental rise in the river level at Lesterville was about two feet, which remained within the banks of the river. Breach flows carried debris and sediment scoured from the flow's path and deposited the material in the lower reservoir and river, with some clay material not settling out until reaching Clearwater Lake, approximately 20 miles downstream.

2.0 PURPOSE OF ACTION AND NEED FOR POWER

2.1 Purpose of Action

On February 5, 2007, the licensee filed design drawings, technical specifications, a calculation brief, and an environmental report in support of its application to rebuild the upper reservoir using roller compacted concrete. Prior to filing its request to rebuild the

upper reservoir, the licensee evaluated different engineering alternatives to restore the upper reservoir.

In order to determine impacts and identify any mitigative measures that may be necessary as a result of the proposed rebuilding of the upper reservoir, Commission staff have prepared this draft Environmental Assessment (DEA), which describes and evaluates the probable effects, including an assessment of the site-specific and cumulative effects, if any, of the Proposed Action and a no action alternative.

The focus of this document is to examine the impacts associated specifically with the licensee's proposal for rebuilding of the upper reservoir. It does not evaluate future operation of the pumped storage facility, as that is being evaluated under the Commission's relicensing proceeding. Important issues that are addressed in this DEA include erosion, water resources and fisheries, terrestrial resources, cultural resources, recreation resources, aesthetic resources, and regional socioeconomics. The preparation of this DEA has been supported by a scoping process to ensure the identification and analysis of all pertinent issues.

2.2 Need for Power

Prior to the December 14, 2005 event, the Taum Sauk Project was operated as a peaking and emergency reserve facility for Ameren's electrical system. As a pumped storage facility, all power was generated at the project by releasing water that had been previously pumped from the lower reservoir to the upper reservoir through reversible pump/generator units. Pumping to the upper reservoir occurred during periods of low energy demand. When the project was not in a pumping mode, it could be brought online quickly, replacing power lost to the system when a fossil-fueled generation facility had tripped offline. Project generation had occurred on a flexible schedule, as the start and duration of generation was determined by system demands. The project's primary purpose was to help meet energy demands during times of the day when residential use is the greatest. Therefore, power was usually generated in the afternoons on a daily basis, especially during the summer months. To accomplish this objective, water was pumped to the upper reservoir during the night and released for generation during the afternoon.

Pumped storage projects generate and store power during off-peak periods that can be provided rapidly during on-peak periods. The rebuilding of the Taum Sauk Project would allow power from the project to again be available in meeting part of the regional need for on-peak power. The project would also continue to provide a clean and renewable source of energy and to serve to displace nonrenewable fossil-fueled generation.

3.0 PROPOSED ACTION AND ALTERNATIVES

3.1 Description of the Original Upper Dam

The original upper dam is a continuous hilltop dike 6,562-ft-long, forming a kidney-shaped reservoir occupying the top of Proffit Mountain. The dike is a concrete-faced dumped rockfill dam from the foundation level to elevation 1570.0 ft mean sea level (msl) and a rolled rockfill between elevation 1570 and 1589 ft msl. A 10-foot-high, 1-foot-thick reinforced concrete parapet wall atop the fill extended the crest to elevation 1599 ft msl (approximately 100 feet total height) at the time of original construction. Both the upstream and downstream slopes are in a ratio of 1.3 feet horizontal to 1.0 feet vertical which is likely the natural angle of repose of the material. The crest is 12 feet wide. The pneumatically placed upstream concrete face slab has a design thickness of 10 inches, and is reinforced with No. 7 bars at 12 inches both ways. In actual placement, the slab thickness averaged nearly 18 inches due to the unevenness of the rockfill. The upstream concrete face has joints (with copper waterstops) located at the junctures with the parapet wall, the toe block and adjacent face panels.

The face slab was placed in panels, 60 feet wide at their widest dimension. Expansion joints between the slabs to accommodate movement, caused by settlement of the rockfill, used 3/4-in asphaltic expansion joint material and U-shaped copper water stops. A reinforced concrete plinth (toe block) was provided at the toe of the concrete face. Where the natural rock surface was substantially higher than the reservoir floor, the rock was excavated on a near-vertical slope and the plinth was at the top of the excavated rock. In these areas, the rock cut between the reservoir floor and the plinth was sealed with a 4-inch-thick layer of wire mesh-reinforced shotcrete. The entire reservoir bottom was sealed with two 2-inch-thick layers of hot-mix asphalt concrete placed over leveled and compacted quarry muck.

Around the edge of the asphaltic concrete, a single line grout curtain was constructed to limit seepage under the dam. A tunnel through the northern side of the dam provides access to the reservoir floor. The access tunnel is a concrete lined, 19-foot-diameter, horseshoe shape. The upstream face was fitted with a hinged steel bulkhead gate that opens into the reservoir. Drainage ditches surrounding the toe of the dike directed a large portion of the upper reservoir leakage into a collection pond. A small dike retains water in the collection pond, from where a maximum of about 10 cfs was pumped back into the upper reservoir. When the leakage rate exceeded the pump-back capacity, water spilled from the collection pond's small overflow spillway and eventually flowed into the lower reservoir.

3.2 Proposed Action

The licensee proposes to rebuild the existing, inoperable upper reservoir. The licensee stated that the new upper reservoir would occupy the existing footprint of the current reservoir, and that there would be no changes to the project boundary. The Proposed Action specifies a new upper reservoir that would result in a project with no changes in the operating parameters. The area of the new upper reservoir and the volume of water stored in the new upper reservoir would remain unchanged from the previous reservoir at 54.5 acres and 4,360 acre feet, respectively. The Proposed Action would result in no changes to the lower reservoir, the number or size of pump/generator units, or the transmission system.

Ameren's preferred design involves building a new upper reservoir with a concrete-faced symmetrical Roller Compacted Concrete (RCC) dam. The new upper dam would be founded on competent rock and the existing rockfill from the old dam would be used as aggregate for the RCC dam. The new upper reservoir dam would be kidney-shaped, approximately 6,400 feet long and approximately 100 feet high.

Construction of the new RCC dam would require the complete removal of the existing rockfill dam (approximately 3.2 million cubic yards of material) and the crushing of the rockfill to create aggregate suitable for the RCC mix. All rockfill material is currently anticipated to be utilized on site in construction of the dam, as buttress fill, or for road development, grading, parking lots, or other beneficial uses.

The licensee states in its proposal that preparation of the foundation would include removal of all soil and unsuitable weathered rock. The licensee added that some areas of the foundation are sloped at angles that are unsuitable for new construction; therefore, in addition to removal of the soil and weathered rock, there may be a need for blasting to improve the foundation. The licensee anticipates that all material removed for foundation preparation will be utilized on site as described above.

The licensee stated that according to current design parameters, approximately 110,000 tons of cement and 110,000 tons of fly ash will be used in the RCC and conventional concrete production. The licensee calculated that up to 15 cement trucks and 15 fly ash trucks would travel to the site each day, along local rural roads, for a period of 12 to 18 months. The licensee stated that it would comply with all regulations and permit conditions that may be established.

In order to efficiently construct the RCC dam, portable concrete plants would be erected on site, within the upper reservoir basin, to produce RCC and conventional concrete. The licensee stated that any water used during construction would be controlled so as to minimize discharge to waters of the state.

A summary of the work to be completed to rebuild the upper dam includes, but is not limited to, the following principal elements.

- Processing existing rockfill for suitable RCC mix to be used to rebuild the new upper reservoir dam.
- All necessary site survey work for control of construction elevations.
- Maintenance and final reshaping, to planned elevation, the upper reservoir dam toe ditch with associated retention pond and spillway.
- Site demolition including the demolition of the breached rockfill dam and its utilities.
- Earthwork and excavation related to the new upper reservoir dam construction including drilling, blasting and excavation of soil overburden and rock down to competent rock beneath the proposed dam, and preparation of the rock foundation surface (bench excavation and dental and leveling concrete), where required.
- Installation and operation of an aggregate processing plant producing aggregates for RCC. Conventional concrete aggregates would be imported from an approved off-site source. Supply and importation of cement required for all work items along with processing and transport of fly ash to the site.
- Construction of the RCC Upper Reservoir Dam including extruded curbs and all devices necessary for quality controls, i.e., thermocouples. Construction of base to crest vehicle access ways and crest travel way.
- Construction of a grout curtain and a dam drainage system.
- Construction of a downstream toe block, a gallery with adits, a new access tunnel with a water-tight door, an overflow release structure, and a crest guidewall - all with conventional concrete.
- Construction of all required gallery and adit drains with flumes and grating.
- Construction of all required blast-resistant doors, electrical and ventilation systems in the gallery and adits.
- Construction of crest travel way and overflow release structure guiderails.
- Removal of the existing dam asphalt floor and excavation under the asphalt of all unsuitable materials and re-fill. Construction of a new asphalt liner on the floor of the new upper reservoir dam with positive drainage to the penstock sump.
- Construction of new crest instrumentation house with well.
- Repair/Modification of the existing vertical shaft, tunnel and steel penstock.
- Installation of instrumentation and control system.
- Assistance as requested in start up of the upper reservoir.
- Land reclamation including revegetation of disturbed areas, site work, fencing, and lighting.

3.2.1 Construction Schedule

The preliminary project schedule outlines the major activities and milestones that are proposed for the project along with projected start dates, expected duration of activities, and projected finish dates. For the major construction activities including the construction of the RCC dam, overflow release structure, crest instrumentation house and final cleanup, the licensee anticipates a 21 month schedule. The general construction schedule indicates that the project would be ready for operation in June 2009.

3.2.2 Proposed Environmental Measures

3.2.2.1 Erosion Control Plan

In the licensee's Environmental Report, the licensee proposed an Erosion and Sedimentation Control Program (ESCP) to control storm water runoff from earth disturbance activities associated with the rebuilding of the upper reservoir. The purpose of the ESCP is to ensure the design of the erosion and sediment control measures, its implementation and management, and the maintenance of Best Management Practices (BMPs) are in place to reduce the amount of sediment and other pollutants in storm water discharges associated with the land disturbance activities; comply with the Missouri Water Quality Standards; and ensure compliance with the terms and conditions of the MDNR's General Permit for Land Disturbance. The licensee indicated that if any construction or maintenance conditions change, the ESCP would be revised accordingly to effectively control erosion and sedimentation. The main part of the licensee's plan is provided below.

The licensee stated that the area in the direct vicinity of the breached upper dam is considered the primary "project area". It is approximately 200 acres, all of which may be disturbed during construction. There are no streams or ponds at the site and drainage patterns are such that there is potential for storm water migration to various creeks and streams that are located at the base of Proffit Mountain or in the surrounding area. Therefore, outfalls that may receive waters from the construction site will be identified in the Land Disturbance Permit.

The licensee indicated that BMPs would be implemented to prevent erosion and sedimentation before, during and after construction. All perimeter and entrance BMPs would be installed before any earth disturbance activities are initiated. Inspection and maintenance would be performed throughout the construction period to prevent failure of the BMPs. The licensee stated that one or more of the following BMPs would be used to control erosion and sedimentation during construction: sedimentation pond (using existing pond); silt fence; compost filter sock; rockfill sedimentation control barriers; hay bales; erosion control matting; temporary revegetation; mulching; controlled excavation, transport, placement and compaction of earthen materials; stabilized access road surfaces;

water spray; proper construction, control, protection and maintenance of stockpiles; and good housekeeping. Functionally equivalent BMPs may be substituted if field conditions warrant.

The licensee stated that excavation, backfilling, placement, and compaction of earthen materials would be performed in accordance with the Project's specifications and excavations would be performed in a safe manner, and all excavated materials would be placed and compacted on-site, stockpiled, or disposed of off-site immediately upon excavation. The licensee added that any open excavation would be properly braced, supported and protected, and all bare and denuded earthen areas would be compacted and finish-rolled with a smooth drum compactor at the end of each workday to minimize the potential for erosion and to prevent excessive wetting and saturation in the event of precipitation. The licensee stated that stockpile areas would be seeded as the stockpile is completed and or when stockpiling areas are inactive. Erosion control matting or similar BMP controls would be used on the steep-sloped portions of the stockpile to prevent erosion during establishment of vegetation.

Only areas necessary for construction would be disturbed, cleared, or graded and areas not to be disturbed would be flagged or otherwise delineated. All sediment control measures would be constructed in accordance with the Contract Drawings and Specifications for the appropriate erosion control practices and areas to be filled would be cleared and grubbed to remove trees, vegetation, roots, and other objectionable material. The licensee added that all fills would be compacted to reduce erosion, slippage, settlement, subsidence, and other related problems. The licensee also stated that seeding and mulching would be performed in accordance with the project's Contract Drawings and Specifications and the existing pond would be used as a sedimentation pond during the construction activities.

Following construction, the licensee stated that storm water would continue to be collected in the perimeter ditch and conveyed to the existing pond and pollution control measures and systems would be maintained in good order. The licensee stated that these measures would be verified through inspections of all storm water and erosion and sedimentation control facilities, which will be conducted, at minimum, weekly as well as within 24 hours after every rainfall, to identify potential or actual disturbance or destruction of controls or incorrect management methods. Inspections and maintenance would be performed by the Contractor, with review inspections conducted by the Construction Manager. Inspections conducted by both the Contractor and the Construction Manager would include: evaluate the effectiveness of existing control measures and determine whether additional measures are necessary; observe structural measures, sedimentation controls, and other storm water BMPs to ensure proper installation, operation, and maintenance; and review locations where storm water leaves the site for evidence of erosion or sediment deposition. The licensee proposed to note any deficiencies in a weekly report of the inspection(s) and correct the problem

within seven calendar days of the inspection report. The licensee stated that the Contractor will be responsible for the management, recycling, and/or disposal of all waste materials including, but not limited to: excavated earthen materials that will be reused onsite; excess earthen materials; building demolition materials; excess building materials; temporary erosion and sedimentation control devices (e.g., compost filter sock, silt fence); sanitary waste, rubbish, litter and garbage; material packaging; concrete wash water; and all other waste waters that could adversely impact water quality. Wherever possible, recycling of excess materials is preferred. The Contractor will be responsible for planning and implementing effective material management, litter control and good housekeeping practices.

3.2.2.2 Spill Prevention, Control and Countermeasure Plan

The licensee developed a Spill Prevention, Control, and Countermeasure (SPCC) Plan to assure that the proposed rebuilding project remains in compliance with all applicable laws, regulations, and project specific permit requirements relative to prevention, control and mitigation of oil discharges. The purpose of the SPCC Plan is to identify potential environmental impacts of the proposed construction activities; describe measures implemented to prevent occurrence and control oil discharges; and to respond in a safe, effective, and timely manner to mitigate the impacts of a discharge. The licensee proposed that the SPCC Plan be implemented in accordance with the SPCC requirements contained in 40 CFR Part 112. The major components of the licensee's plan are described below.

The licensee stated that the SPCC Plan will be used as a reference for oil storage information and testing records, as a tool to communicate practices on preventing and responding to discharges with site personnel, as a guide on facility inspections, and as a resource during emergency response. The licensee added that the SPCC Plan would be revised under any of the following conditions: design, operation, or maintenance of the control measures is changed; design of the construction project is changed that could significantly affect the effectiveness of the controls described in the Plan; inspections indicate deficiencies in the SPCC Plan or any control measure; the SPCC Plan is determined to be ineffective in controlling discharge; or the Missouri Department of Natural Resources (MDNR) determines violations of Water Quality Standards may occur or have occurred.

Equipment items that will be present at the Project site include a number of excavators, dozers, hilifts, wheel loaders, pickups, pumps and generators. These store a minimal amount of lubricating oil and coolant (less than 55 gallons). The licensee stated that petroleum to be used will be contained in mobile tanks that would be set up close to the operating area of the equipment, and all oil storage tanks would meet the American Petroleum Institute tank construction standard. The licensee added that lubricating oil and other substances, including various grades of motor oil, gear oil, hydraulic oil,

coolant, and grease, will also be stored at the facility, but in quantities below the 55-gallon threshold for SPCC applicability.

Transfer of fuel oil from the storage tanks to the equipment would be accomplished according to established procedures. An operator would be present at all times. The storage tanks and fueling area would sit on an impervious surface constructed of textured geomembrane. The fueling area would be a depression sufficient to capture leaks and spills from the fueling operation and all discharges noticed by on-site personnel are to be reported to the Construction Supervisor. The Supervisor would then notify the Construction Manager, who is responsible for ensuring that all required discharge notifications have been made to the appropriate authorities as required. Discharges would typically be discovered during normal operations or during the inspections conducted at the site. Absorbent materials including rags, socks, mats, and oil dry (or similar material) would be kept available on-site for minor spills and used to limit the spread of a spill. One or more covered 55 gallon drums marked "impacted soil" will be kept adjacent to the lubricant storage box. The impacted material such as oil dry will then be transferred to the 55 gallon drum(s). A separate 55 gallon drum would be maintained for discarding rags, socks, and other similar material. When the drums are full, they will be disposed of properly at an approved landfill. If the quantity of impacted material is greater than the capacity of a drum, it will be stockpiled on and covered with plastic until a manifest has been generated and the material can be removed by a licensed hauler.

The licensee stated that the rebuilding project would be configured to minimize the likelihood of a discharge reaching navigable waters with the following measures provided:

- Tanks: Oil storage tanks will either be double-walled or provided with separate secondary containment.
- Leaks: All equipment used for work on this site will be inspected for leaks prior to mobilization. Operators are required to immediately report any deficiencies with their equipment to their on-site supervisor to minimize damage to the equipment or to the environment.
- Maintenance and Repairs: Large equipment, such as large dozers and articulated dump trucks, are equipped with EVAC systems to minimize the potential for spills and leaks. Equipment maintenance will be performed using drip/transfer pans to prevent inadvertent spills.
- Lubricants and Coolants: No open containers of new or used petroleum/chemical materials will be left unprotected. Empty containers will be kept in a covered trash receptacle. Hydraulic, gear, and engine oil and antifreeze will be stored inside drop

boxes. Each item will either be stored in its original manufactured container or in 55 gallon drums resting on plastic containment devices.

- Sorbent Materials: Sorbents, shovels, and other discharge response materials are currently stored in a shed located in close proximity to the loading area. This material is sufficient to contain small discharges (up to approximately 200 gallons).

- Physical Containment: The storage tanks and fuel transfer area will be set up on an impervious pad. The storage tanks are double-walled to provide integral secondary containment.

3.2.2.3 Measures to Prevent Overfilling

The licensee's Proposed Action includes a number of features that are designed to provide different levels of safeguards to prevent overtopping of a new upper reservoir. These features include the following elements.

Water Level Monitoring and Shutdown Equipment

The licensee proposes to install two independent monitoring devices to monitor the water level of the upper reservoir. The first device, referred to as Level Control, would be the primary equipment used to control the pump and generation cycles on a daily basis. The upper reservoir elevation would be controlled through five level transmitters. Water level readings from the five level transmitters would be transmitted and recorded at the Osage Hydro Plant on a continuous basis. Control of the pumps used for refilling the upper reservoir is set by the operator. The pumps can be stopped automatically at a programmed elevation or manually.

The second level of monitoring the upper reservoir elevation is referred to as Level Protection and is a backup to the Level Control system. This system is designed to provide an additional means to stop the pump cycle when a certain water elevation is reached. The Level Protection system uses two probes designed to trigger an alarm when the water reaches the level of either probe. These probes are designed to operate independently and to trigger a rapid shutdown of both pumps to prevent overtopping of the reservoir.

Another tier for safety control proposed in the rebuilding plan utilizes shut-off switches. The design specifies that the instrumentation and monitoring equipment will be connected to emergency shut-off switches on the pumps. The plan states that should all the normal operational shut-off modes fail, these switches would trigger an immediate shutdown of the pumps prior to overtopping of the dam.

Also to be installed on the top of the upper reservoir would be a 24 hour camera system that would allow Ameren's operations staff at two locations to visually monitor the water level. Should operation's personnel observe something out of the ordinary, staff could shut off the pumps locally or by remote control.

These features are designed to automatically shutdown the pumps when the upper reservoir level reaches a predetermined elevation. Under the current design, the overflow release structure is set at 1599.0 feet and the normal operational level, when the upper reservoir is full, is 1597.0 feet. Therefore, under normal operation there will be 2.0 feet of freeboard between the normal maximum operation level and the crest of the overflow release structure.

Overflow Release Structure

The licensee states that the overflow release structure (ORS) is designed to provide a safe, controlled discharge point in the event of overflowing of the upper reservoir. The objective of the ORS is to safely convey released water away from the toe of the dam in the case of a severe failure of all the multiple redundant monitoring and control systems. The licensee states that the ORS is not a part of the active operational system of the project.

The ORS is located in the southeast quadrant of the kidney-shaped upper reservoir and would discharge through a ravine to an upland tributary of Taum Sauk Creek. Taum Sauk Creek drains into the project's lower reservoir. The licensee stated that the location of the ORS was selected because it would have the least potential for impacting people and any overflow would be on Ameren owned lands.

The ORS has been designed to pass a peak release of 5,358 cfs which equates to both pumps operating at the time of the discharge. The overflow section is designed as a broad crested weir, with a low trapezoidal shape with the overall dimensions of 700 feet long, 27.5 feet wide crest, 2 feet deep, with 10H:1V side slopes (ramps in and out). The weir coefficient is estimated to be 2.63, as published by Brater and King (1976). The design flow would be distributed over the 700-foot width of the ORS correlating to a low full-flow unit discharge rate of 7.88 cfs per foot of width.

The design criteria specify that the overflow crest elevation will be set at 1599.00 feet, 2.0 feet below the crest of the dam and 5.5 feet below the top of the parapet wall (1604.5 feet). The top of the dam will be raised on either side to prevent spill beyond the sides of the ORS section, thereby directing all flow over the ORS and down the stepped-chute section. The discharge would be routed down the face of the ORS, which will be a chute consisting of concrete steps to provide energy dissipation for the flow. The steps will be 4 feet high and 2.4 feet wide. A stilling basin will be provided at the bottom of the chute to provide additional energy dissipation, prevent impact and scour at the toe of

the dam, and provide a safe scour-free flow release away from the toe of the dam. The stilling basin is 20 feet long and 700 feet wide, and has a 27-inch high counter-weir at the end of the basin.

Additional Instruments to Prevent Overflow

In addition to the gages, probes and physical features the licensee proposes to install to monitor and control the water level of the upper reservoir, the design also includes a number of alarms and checks to ensure safe operation of the project. Ameren proposes the following instrumentation to further prevent the overflowing of the upper reservoir.

Although the water level monitoring equipment that links the upper reservoir instruments to the pump-generator units are redundant, the communication links will not share the same physical media, route, support infrastructure, or power supply. The licensee added that the overall system will be designed so that failures will result in a detectable and safe scenario where pumps shut down prior to overflowing the reservoir. For instance, each time a pump or generation cycle is begun; the system will calculate the expected shutdown time and cause an alarm if pumps or generators are not shut down by that time. Further, the licensee stated, a discrete switch will be installed at a mid-level that is likely to be crossed on every pump or generation cycle. When the level switch is crossed the system will do a validity check on each of the analog signals with respect to this discrete level. If an analog deviates by more than a small amount, an alarm will be generated.

The design includes stainless steel pipes down the interior of the reservoir to house and serve as stilling wells for the monitoring instruments. The pipes would be securely fastened to the slope of the interior of the reservoir and terminate inside an instrument building. Each pipe may house multiple instruments; however, the groupings of instruments will be selected to minimize overall loss of operability in the event that a single pipe is compromised. In general, instruments will be appropriately fastened together and lowered into or raised out of a pipe as a group.

With respect to the power supplies, the proposed design plan illustrates that DC power supplies will also be redundant and that AC power, for control system elements, will be sourced from an uninterruptible power supply with adequate battery carryover to meet the system availability target. The licensee also proposes to install in the ORS an instrument that will notify the operator if a significant amount of flow is occurring in the weir (i.e., beyond normal levels of rain).

3.3 No Action Alternative

Under the no action alternative, the Commission would not authorize the rebuilding of the upper reservoir. Minimally, the existing upper reservoir would be made stable and safe from any future collapse. While this alternative would result in no adverse environmental impacts that would be associated with the construction of the new upper reservoir, it would essentially decommission the project. Without an upper reservoir, the hydroelectric facility would not be functional; therefore, no electrical generation would be produced at the Taum Sauk Project. The region's growing energy demand would need to be supplied by an alternative source, possibly fossil fuels, rather than the peaking power produced by the pumped storage project. The pump storage facility allows Ameren to generate electrical power as necessary when residential and industrial demands are high. Additionally, without the Taum Sauk Project, the local community would be negatively impacted due to the loss of tax revenue garnered from the facility.

3.4 Staff Preferred Alternative

Staff's preferred alternative for the rebuilding of the upper reservoir includes the environmental protection measures proposed in Ameren's environmental report and supplemental filing, with the following additional measures.

1) Staff recommends that restoration of the staging areas and laydown areas following construction include the removal of the hardfill cap and hardfill subgrade prior to placement of topsoil and vegetative cover. To ensure proper mitigation for the loss of forested habitat, the licensee should file for Commission approval, a reforestation plan developed in consultation with Missouri Department of Natural Resources, Missouri Department of Conservation and the U.S. Fish and Wildlife Service.

2) To help ensure minimum effects on reservoir elevations and downstream flow releases to the East Fork Black River during the upper reservoir rebuilding and refilling processes, staff recommends that the licensee develop and file, for Commission approval, a final water management plan after consultation with the resource agencies, prior to the start of any authorized construction. The plan as described in this document would cover both the construction and initial refilling periods proposed by the licensee.

3) Staff recommends that the additional, previously undisturbed 13.2 acres of forested land, located on the west side of the road near the lower west side of the upper reservoir (labeled as laydown area 3), not be cleared.

4) The licensee proposed to consult with the Missouri Department of Natural Resources to resolve the agency's wetland concerns. Staff recommends that the licensee file with the Commission for approval its proposal, along with the resource agencies'

comments and the licensee's responses to the comments, to resolve the issue surrounding the wetlands created by leakage from the previous upper reservoir.

5) Staff recommends that the licensee file a plan with the Commission for approval, developed in consultation with the resources agencies, that provides for reopening some of the recreational facilities at the lower reservoir as soon as possible.

3.5 Alternatives Considered but Eliminated from Further Analysis

In arriving at the proposed alternative for rebuilding the upper reservoir, the licensee's engineering consultant examined several other possible alternatives for restoring the project. The licensee evaluated repairing the existing rockfill dam. This option would have involved repairing the area that breached and other areas that overtopped on December 14, 2005. Under this scenario, the majority of the upper reservoir dam would remain as it was prior to the event and those areas that were compromised would be repaired. This option, however, was determined not to meet current safety standards and, therefore, eliminated from further consideration.

A second option that was evaluated involved building a conventional Roller Compacted Concrete (CRCC) dam. This option would have involved the complete removal of the existing rockfill dike and construction of a conventional RCC dam using the existing rockfill as aggregate. No additional (off-site) rock would be required for this option. However, geotechnical evaluations raised concerns about certain foundation weaknesses that may affect the constructability of this type of dam. Because of these safety considerations it was eliminated from further consideration.

A third option considered was construction of a Concrete Faced Rockfill Dam (CFRD). This option would entail a complete removal of the existing rockfill dike and the construction of a compacted CFRD to current design standards. A significant quantity of rock from off-site sources would be required for this option which would cause significant environmental impacts, such as: excavation of rock from a new or existing quarry; potential for runoff of silt from the quarry to impact waters of the state; and transportation of approximately 3.4 million cubic yards of rock necessary to construct the dam requiring approximately 900 truckloads per day running six days a week for approximately 495 days. The environmental impacts associated with quarrying the needed rockfill and the increased truck traffic on public roads with the potential for significant accidents and adverse impacts to air quality eliminated this alternative from further consideration.

The licensee indicated that the option that was selected, a concrete-faced symmetrical RCC dam, would have the least environmental impacts while meeting current safety standards. In arriving at the final design, the licensee noted that the footprint of the new dam would be similar to the existing dike, and the rock material of

the existing dike would be reused to form RCC for the new dam, essentially precluding the need for a new borrow area.

4.0 CONSULTATION AND COMPLIANCE

On February 5, 2007, Ameren requested, under 18 CFR Part 12, authorization to rebuild the upper reservoir and install equipment for the purpose of making the Taum Sauk Pumped Storage Project safely functional. Given the extensive construction activities associated with the proposal, the Commission initiated review of the Proposed Action under NEPA. This section details the process used to consult with the resource agencies and the public regarding the Proposed Action, and compliance with statutory requirements.

4.1 Scoping and Comments

Based on our review of the licensee's application staff issued a public notice of our intent to prepare an environmental document on February 13, 2007. On February 21, 2007, the Commission issued a Scoping Document that advised all participants as to the proposed scope of the environmental document and to seek additional information pertinent to the analysis of the rebuilding proposal.

Following issuance of the Scoping Document, Commission staff conducted two public scoping meetings on March 12, 2007, to identify issues and concerns surrounding the rebuilding of the upper reservoir. The first morning scoping meeting was held at the Missouri Department of Natural Resources' (MDNR) Conference Center in Jefferson City, Missouri. The evening scoping meeting was held in the project vicinity at Lesterville High School, in Reynolds County, Missouri. A court reporter recorded all comments and statements made at the scoping meetings, and these comments are part of the Commission's public record for this proceeding.

In addition to comments provided at the scoping meetings, the following entities provided written comments in response to the public notice or the Scoping Document. All comments received, whether spoken or written, were considered in the development of this NEPA document.

| <u>Entity</u> | <u>Date Filed</u> |
|---|-------------------|
| 1. Missouri Department of Conservation | January 26, 2007 |
| 2. Daniel Cytron | February 15, 2007 |
| 3. Missouri Coalition for the Environment | February 16, 2007 |
| 4. Missouri Chapter of the Sierra Club | February 22, 2007 |
| 5. David J. Malan | February 26, 2007 |
| 6. Missouri Department of Natural Resources | March 12, 2007 |

| | |
|---|----------------|
| 7. David J. Malan | March 14, 2007 |
| 8. Earlene Fox | March 14, 2007 |
| 9. Lesterville R-IV Schools, 87 letters from students, teachers, and parents | March 14, 2007 |
| 10. Missouri Parks Association | March 14, 2007 |
| 11. Missouri Department of Natural Resources | March 19, 2007 |
| 12. Absentee Shawnee Tribe of Oklahoma | April 4, 2007 |
| 13. Streamside Systems | April 6, 2007 |
| 14. Ozark Chapter of the Sierra Club | April 10, 2007 |
| 15. Missouri Department of Conservation | April 11, 2007 |
| 16. Missouri Department of Conservation | April 11, 2007 |
| 17. Missouri Department of Conservation | April 11, 2007 |
| 18. JoAnn Franklin | April 11, 2007 |
| 19. Missouri Parks Association | April 11, 2007 |
| 20. East Ozarks Audubon Society | April 12, 2007 |
| 21. Missouri Parks Association | April 16, 2007 |
| 22. Floyd E. Pinkley | April 16, 2007 |
| 23. David J. Malan | April 23, 2007 |
| 24. David J. Malan | April 23, 2007 |

Staff has carefully considered and addressed the stakeholders' comments and questions that are within the scope of the current proceeding that examines the proposed rebuilding of the Taum Sauk Project's upper reservoir, in order to focus the content of this document. The commentors raised the following issues that were within the scope of this proceeding:

- Process-oriented questions related to rebuilding the upper reservoir now rather than after it has been addressed during the relicensing process;
- Water usage during construction and flow management of the lower reservoir and the East Fork Black River;
- Design and construction;
- Safety issues regarding overfilling the upper reservoir once reconstructed;
- Operation of the proposed overflow release structure;
- Geotechnical and seismic;
- Staging and site preparation;
- General operation of the project;
- Clean up of the river due to the breach and State Park questions; and
- Potential effects on:

- fish and wildlife resources;
- water quality in the lower reservoir, East Fork Black River, and Taum Sauk Creek;
- recreation, noise and aesthetics;
- cultural resources,
- wetlands and erosion;
- local economy.

4.2 Agency Consultation

The licensee consulted with the MDNR and the Missouri Department of Conservation (MDOC) during the development of the environmental report. On November 30, 2006, the licensee provided a draft copy of its environmental report to approximately 120 parties including a number of resource agencies and tribal representatives. Prior to filing its rebuilding documents with the Commission, Ameren provided copies of its environmental report to members of the public and other stakeholders along with posting it on its website.

By letter dated January 23, 2007, the MDOC stated that it does not oppose the rebuilding of the upper reservoir provided the department's concerns about fish, forest, and wildlife issues are fully addressed. The MDOC also stated that it understands that the issue of excess fine sediment in the East Fork, due to discharge of fine sediments from the dam failure, is outside the scope of the upper reservoir rebuild. The licensee stated in its filing that it is continuing its discussions with the MDOC and the other regulatory and resource agencies on restoration and water management issues. The licensee indicated that, to the extent possible, MDOC's comments were incorporated into the environmental report filed with the Commission.

4.3 Compliance

4.3.1 Water Quality Certification

The federal Clean Water Act (CWA) gives authority to each state to issue a 401 Water Quality Certification (401 Certification) for any project that needs a Federal 404 Permit. Additionally, an applicant is required to obtain a 401 Certification for any activity that may result in a discharge into navigable waters. The 401 Certification is verification by the state that the project will not violate water quality standards. For the rebuilding of the upper reservoir, the MDNR is the state agency responsible for reviewing applications and issuing water quality certification. As part of the 401 Certification, the MDNR may require specific actions regarding projects to protect water quality. These required actions are called conditions. If 401 Certification is needed, the applicant, in

this case, the licensee, is required to provide to the permitting agency (FERC) certification from the state in which the discharge originates.

By letter dated January 30, 2007, the MDNR stated that it is not aware of any 401 permitting needs that are required for the potential rebuilding of the upper reservoir. The MDNR added that in the event the U.S. Army Corps of Engineers (Corps) requires a section 404 permit, based on activities necessary for the rebuilding of the upper reservoir, then the MDNR would work with Ameren to obtain the necessary 401 certifications.

4.3.2 Section 404 Permit

Section 404 of the Clean Water Act requires that anyone interested in depositing or discharging dredged or fill material into waters of the United States, including wetlands, must receive authorization for such activities. These discharges include return water from dredged material disposed on upland property and generally any fill material like rock, sand, or dirt. The Corps is responsible for administering the Section 404 permitting process. Activities in wetlands for which permits may be required include, but are not limited to:

- Placement of fill material
- Ditching activities when the excavated material is sidecast
- Levee and dike construction
- Mechanized land clearing
- Land leveling
- Most road construction
- Dam construction

The licensee consulted with the Corps regarding the proposed rebuilding of the upper reservoir. Since the proposed rebuilding of the upper reservoir is to take place on top of Proffit Mountain, the proposed project would not result in any fill material being deposited in waters or wetlands of the U.S or any activity in waters of the U.S.

4.3.3 Essential Fish Habitat

Section 3.5(b) of the Magnuson-Stevens fishery conservation and Management Act requires federal agencies to consult with the National marine fisheries Service on agency actions that may affect essential fish habitat. Based on the location of the proposed rebuilding of the upper reservoir, there will be no impacts to essential fish habitat.

4.3.4 Endangered Species Act

Staff has identified from the U.S. Fish and Wildlife Service's (FWS) 2005 list of threatened and endangered species, four federally-listed threatened and endangered species that occur in Reynolds County, where the project is located. By letter dated March 23, 2007 to the FWS, staff stated that based on the licensee's proposed activities during reconstruction of the upper reservoir, and following our review of the life history of the identified species, staff determined that the proposed construction activities are not likely to adversely affect any federally listed endangered or threatened species; consequently, staff concluded that no formal consultation was necessary. Staff requested that the FWS indicate if they agree with our determination. No response from the FWS has been received.

4.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act requires the Commission to take into account the effect of agency actions on any historic properties and allow the Advisory Council on Historic Preservation a reasonable opportunity to comment on the Proposed Action. "Historic Properties" are defined as any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places.

By letter dated May 15, 2007 to the State Historic Preservation Officer (SHPO), staff identified the Area of Potential Affect (APE) as Proffit Mountain and land immediately surrounding the original dike that was previously disturbed by its original construction. This includes the upper reservoir bottom, existing area roads, the upper dam foundation, and several laydown and staging areas in the immediate vicinity of the original dam.

Commission staff reviewed the National Register of Historic Places (NRHP) and Commission documents to assess whether any historical resources, cultural resources or Tribal lands would be affected by rebuilding of the Taum Sauk upper reservoir. Based on the materials reviewed, staff determined that the licensee's Proposed Action would have no adverse effect on historic or cultural resources since there are none in the APE. Staff requested in our May 15th letter any comments from the SHPO on our determination.

5.0 ENVIRONMENTAL ANALYSIS

In this section staff describes the affected environment and provide our analysis of impacts associated with the proposed rebuilding of the upper reservoir of the Taum Sauk Project. The analysis examines the licensee's Proposed Action as well as environmental recommendations and mitigation alternatives that could reduce or eliminate possible environmental impacts.

Temporal Scope

The temporal scope of this analysis extends from the start of construction, approximately August 2007, through the reconstruction of the upper reservoir, and ends with the initial refilling of the upper reservoir. The subject of this analysis is the reconstruction of the upper reservoir, and does not extend into any project operation. Staff briefly reviews the possible effects of a release from the Overflow Release Structure during operation because it was not part of the original project. However, staff notes that the project is undergoing relicensing, a proceeding that will cover all aspects of project operation.

Geographic Scope

The geographic scope of the analysis defines the physical limits or boundaries of the Proposed Action's effects on the resources. Because the Proposed Action would affect resources differently, our study's geographic scope for each resource varies, as described in this chapter of the document.

5.1 General Description of the River Basin

The Taum Sauk Project is rurally located in Reynolds County, Missouri approximately 100 miles south of St. Louis and six miles north of Lesterville, Missouri (population approximately 690). The hydroelectric facility is a pumped storage plant with a 55-acre upper reservoir on Proffit Mountain and a 395-acre lower reservoir located on the East Fork Black River at its confluence with Taum Sauk Creek. The lower reservoir is generally operated as a run-of-river reservoir that provides storage for water to be pumped to the upper reservoir at night or during periods of low power demand. During periods of high energy demand, the two reversible pump/generators are used to generate electricity.

The Taum Sauk Project is near the upper end of the Black River drainage basin with approximately 88 square miles of drainage upstream from the lower reservoir. The project is located on the East Fork Black River which originates in the Mark Twain National Forest near Graniteville, MO. The East Fork Black River generally flows south through Johnson Shut-Ins State Park and then into the project's lower reservoir. The three mile stretch of the East Fork Black River that flows through the State Park is on Missouri's Clean Water Commission list of Outstanding State Resource Waters (10 CSR 20-7.031, as cited in Ameren 2007a).

Below the project's lower reservoir, the river continues to flow south for approximately six miles to the town of Lesterville, MO where it joins the West Fork Black River to form the Black River. The Black River continues to flow south through

Clearwater Lake before leaving the state in a southwest direction. There it flows into the White River in northeast Arkansas.

The project is located in the heavily forested St. François Mountains with large portions of the Mark Twain National Forest lying to the east and west of the project area. The project is near Taum Sauk Mountain and Taum Sauk Trail, Bell Mountain Wilderness, and Elephant Rocks State Park, and abuts Johnson Shut-Ins State Park. Some outstanding natural features of these mountains include igneous rock glaciers, igneous glades, extensive gravel washes, fens, and forests of oak, hickory and pine.

5.2 Cumulatively Affected Resources

Cumulative effects are defined as the impact on the environment which results from the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions (40 CFR § 1508.7). Cumulative effects can result from individually minor, but collectively significant actions taking place over a period of time, including hydropower and other water and land development activities. Based on information gathered through scoping and provided by the licensee, resource agencies and public, plus staff's independent analysis, staff has identified no resources that would be cumulatively affected by the proposed rebuilding of the upper reservoir for the Taum Sauk Project.

5.3 Engineering Review of Proposed Action

The planning and design process for the rebuilding of the Taum Sauk upper reservoir dam is required by FERC to ensure that the upper reservoir will be constructed and operated in a safe manner and meet all current design standards and criteria. FERC has required Ameren to convene an independent, Board of Consultants (BOC) to oversee and advise Ameren on the design, construction and proposed operation of the rebuilt project. The BOC is comprised of four, preeminent dam safety experts in the United States. The BOC is doing a careful review of the design, construction and proposed operation and will make recommendations for the design as well as advise Ameren if additional investigations or engineering evaluations are necessary. Ameren is then required to address the recommendations in the final design of the project.

Once the design has been approved by the BOC, Ameren is required to file the plans with FERC for our technical review of the design. In addition to FERC engineers reviewing every aspect of the design, the Commission has retained two additional expert consultants to assist in the review and oversee the design, construction and proposed operation of the project. FERC will provide a final overall review and acceptance of the proposed design with any needed modifications.

This DEA reviews the general design of the upper reservoir dam and the construction impacts associated with that design on environmental resources. Due to heightened security concerns following September 11, 2001, staff is unable to address detailed or specific design questions, which were raised in several comment letters, in this DEA due to Critical Energy Infrastructure Information restrictions.

5.4 Resource Issues and Mitigation Alternatives

5.4.1 Geological and Soil Resources

Geology of Southeast Missouri

The Saint Francois Mountains, a range located in southeast Missouri, is an outcrop of Precambrian igneous rock mountains rising over the Ozark Plateau. This range is one of the oldest exposures of igneous rock in North America. Formed through volcanic and intrusive activity over 1.4 billion years ago, nothing is left of these mountains but their roots. By comparison, the Appalachians started forming about 460 million years ago, and the Rockies a mere 70 million years ago. The St. Francois range was already twice as old as the Appalachians are today.

Unlike the rest of the mountainous areas in the Ozarks, the Saint Francois Mountains were formed by true volcanic activity. The localized vertical relief observed in most of the Ozarks, a dissected plateau, was caused by erosion. The volcanic activity that formed this mountain range is also thought to be the geological cause of the uplift of the Ozark Plateau. Geologists talk of the "Ozark dome" wherein elevations and stratigraphic inclines generally radiate down from the Saint Francois Mountains. These elevations may be the only area in the American Midwest never to have been submerged, existing as an island archipelago in the Paleozoic seas. Fossilized coral, the remains of ancient reefs, can be found among the rocks around the flanks of the mountains. These ancient reef complexes formed the localizing structures for the mineralizing fluids that resulted in the rich ore deposits of the area. The St. Francois Mountains are the center of the Missouri mining region yielding; iron, lead, barite, zinc, silver, manganese, cobalt, and nickel ores as well as granite and limestone quarries.

Mountains in this range include; Taum Sauk Mountain, Bell Mountain, Proffit Mountain, Pilot Knob Mountain, Hughes Mountain, Goggin Mountain, and Lead Hill Mountain. The Taum Sauk Hydroelectric Plant is actually not located on Taum Sauk Mountain, but on Proffit Mountain about five miles from Taum Sauk. Proffit Mountain is the termination of a ridge extending southwesterly from Taum Sauk Mountain. The elevations range from 500 feet to 1772 feet (Figures 5-1 and 5-2). Taum Sauk Mountain is the highest peak in the range, and the highest point in the state, with an elevation of 1772 feet. A part of the Ozark Trail winds through parts of the St. Francois Mountains,

including a popular section that crosses Taum Sauk and Proffit Mountains. (From Wikipedia.)

The St. Francois Mountains are only a small remnant of the original volcanic activity in the area. It is thought that two continental plates collided during Precambrian times and led to the creation of the original mountains. Most of the rocks in the area are lighter weight rocks of a granitic composition. The darker dikes in the area, commonly found in road cuts, are formed from more basaltic minerals in the area and formed when rifting in the area started to split the plates apart about 900,000 years ago. These darker and heavier minerals originated deeper in the earth's crust. This rift failed and is no longer active. Leftover faults from the collision and rift are now thought to form the New Madrid Fault Zone, which runs through far southeast Missouri. This fault zone is still active and has been responsible for some of the largest earthquakes in U.S. history.

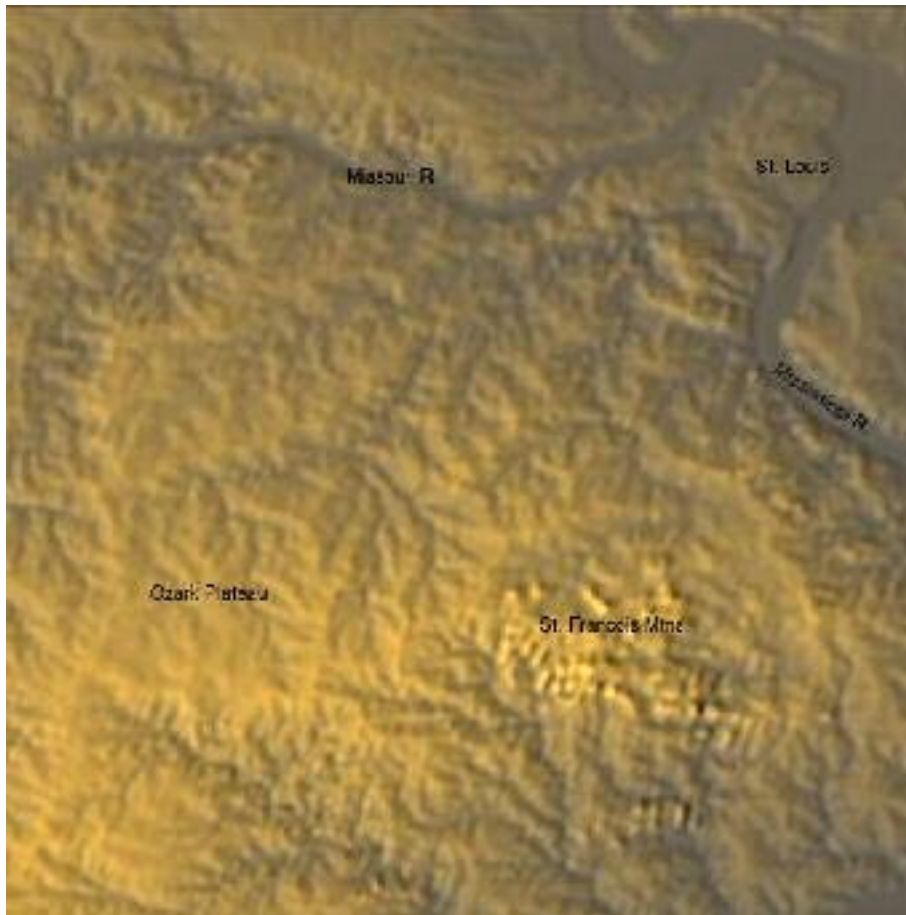


Figure 5-1. Shaded relief map of area. (Source: Wikipedia.)

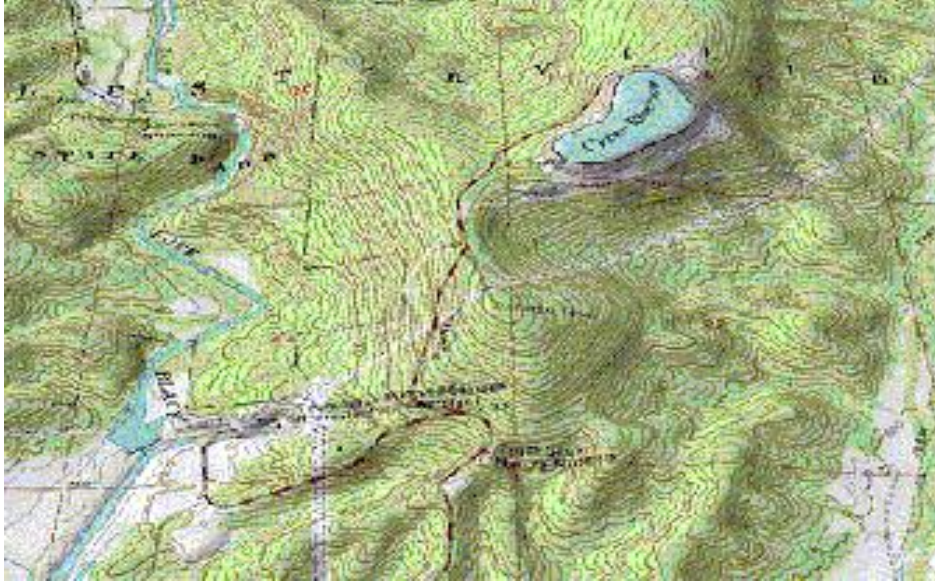


Figure 5-2. Shaded topographic map of project. (Source: Wikipedia)

Affected Environment

Upper Reservoir Geology

The top of Proffit Mountain was leveled and the excavated rock was used to construct the dike that forms the Upper Reservoir (Figure 5-3). The foundation area was stripped to bedrock during the dam failure. The bedrock is hard rhyolite porphyry with areas of closely spaced vertical joints (Figures 5-4 and 5-5). This rock is volcanic and formed by relatively quiet lava flows on the earth's surface. These rocks are fine grained but contain mineral crystals that formed before the rock was erupted. Even though they are 1.4+ billion years old, these rocks still exhibit flow patterns from the original lava flow.

The vertical joints are in an orthogonal set that run roughly N-NE and W-NW. A second set of slickenside joints with lower dip angles were observed that had a line of intersection in a northerly direction. This joint set dipped roughly 45 degrees west and 45 degrees east. The rhyolite porphyry rests on granite porphyry, the contact is dipping easterly and is exposed just downstream of the breach area. During original exploration, it was conjectured the rhyolite had flowed out on the weathered surface of the granite, scorching and baking it. This means that the granite porphyry may be older than the rhyolite porphyry. However, there are different opinions regarding the age and sequence of intrusions and it is probable the granite porphyry is younger.

The series of Precambrian rhyolites at the adjacent Church Mountain form a stratigraphic sequence of flows that strike N45°SW and dip 20°N, and reportedly have

similar strikes as the rhyolites of Taum Sauk. As described in a 1973 report of the geology of the adjacent Church Mountain, the principle rock formations are:

Precambrian Hogan Mountain Rhyolite. “The rhyolite is ‘typically reddish-brown, or reddish-purple in color and has a dense aphanitic groundmass. About 20 to 30 percent of the rock consists of salmon – red feldspar and glassy quartz phenocrysts. Flow layers, lighter in color than the massive rock, consist of microangular zones that generally dip at consistent low angles to the north and west... Many of the quartz phenocrysts and quartz grains in the ground mass are replaced by feldspar... The field relations and micro-textures suggest that this is a devitrified welded tuff’ ...”

Precambrian Munger Granite Porphyry. “This was encountered at the bottom of the upper Taum Sauk Dam... The predominant features are ‘orthoclase phenocrysts up to 8 mm in length and quartz up to 4 mm in diameter. The rock is brownish-red with greenish mottling due to fine-grained mafic minerals. Quartz comprises about 30 percent: orthoclase, 33 percent: oligoclase 33 percent: and extensively altered biotite and hornblende about 4 percent’ ...”.



Figure 5-3. View of upper Reservoir, prior to the breach.
(Source: Wikipedia)



Figure 5-4. View of bedrock immediately below failed embankment section. Note weathered clay in lower portions of the exposure. (Source: FERC Staff)



Figure 5-5. View of bedrock within, and immediately below failed embankment section. Note distribution of weathered rock (red-brown color) and topsoil (green-brown color). (Source: MDNR)

Breach (Upper Reservoir) Foundation Geology

An area of the foundation in the breach section contained clay with low to moderate plasticity and weathered rock in the area just beneath the breach. The clay appears to be a residual weathering product of the bedrock and in areas, relict bedrock structure can be observed in partially and completely decomposed clay remnants. No records were made available that indicate the extent of clay that was left in the breach area. The clay appeared saturated and contained groove marks from debris. This area was over-excavated in the footprint of the reservoir due to the clay foundation conditions, forming the “fish-pond” area of the reservoir floor. There was also some remnant soils found in the breach area (Figure 5-6).



Figure 5-6. Weathered rock and discontinuous clay seam foundation just downstream of fish-pond area. (Source: FERC Staff)

According to the 1964 Union Electric Company memo on “Leakage From Upper Pond” (pages 1-2) “...the exposed rhyolite at levels uncovered still contain fingers of weathered rock....on the west side a deeper zone of weathering was excavated near drill hole #18 about where considerable spring flow is found at the outer toe. An inclined clay band at Sta. 6+00 on the west side apparently crossed the floor of the pond and occurs on

the opposite side of the basin. The clay band was trenched and back-filled with concrete before material in the rockfill or seal cover was placed. These geologic zones are reflected in response of pond by seepage that collect upon reaching the underlying rock and by air bubbles near the west bank along the clay band, following initial filling of the pond. Most of the exploratory drill holes in rhyolite had substantial loss of water... ..that led to asphalt lining of the pond floor... ..indicat(ing) that joints are communicative. At the north end (Panels 90-95) a sudden increase in losses between January 8-10 (1964) was caused by open channels (under the asphalt lining and) in bedrock under the dam where eroded material had been removed by gradual piping. It was necessary to add concrete cutoff in this section, fill the visible channels and attempt to control water movement along bedrock joints by means of a shallow grout curtain across the floor at the northern end of the pond. The work was largely successful but should be watched for further aggravated losses beyond the section that was repaired.”

According to the August 1968 Union Electric Company memo on “Review of Safety Report – Upper Reservoir” (page 4) “...the rhyolite porphyry...is generally fresh, dense, moderately to abundantly jointed... ..Overburden ran from a few feet thickness to as much as 65 feet. Several significant clay seams, gently dipping, and up to 4 feet in thickness were encountered. Under the rockfill these seams were either excavated and plugged with concrete or covered with small compact rock. Weathered rock was left in place wherever its competence was judged equivalent to the rockfill. However, within the inside 70 feet of the base of the rockfill all weathered material was stripped to sound rock. A filter zone and several layers of compacted rock were placed over questionable areas where piping of the foundation might be possible. Low areas or depressions in the natural topography were filled with compacted rock.”

According to the August 1967 Union Electric Company memo on “Taum Sauk Upper Reservoir Report on Safety” (page 2) “The... ..rhyolite porphyry is an excellent high compressive strength rock that should have stabilized in its settlement. However, the formation contained frequent zones of soft weathered rock, all of which could not have been selectively wasted. The frequent cycling of the water load should not cause continued adjustment of competent rock but would affect poor rock. Actually, there is no other experience with such frequent cycling of load on a dumped rockfill, and whether a dumped rockfill of all sound rock would have stabilized by this time (1967) is not known. I believe a fill of 100% competent rock would have stabilized and that the percentage of weathered rock in the Taum Sauk is the cause.”

During a geologic inspection conducted on April 12-13, 2006, it was noted that there is a shear zone that cuts through the breach area. There appeared to be a component of left lateral displacement across the shear zone. The exposed rhyolite beds in the breach area were composed of three to four discrete flows, separated by very thin to thin clay rich seams. The rhyolite complex rests on a saprolitic soil that was interpreted to be heavily weathered granite. The underlying granite appeared moderately weathered with

alteration of the feldspars near the overlying contact with the saprolite, and was less weathered deeper in the profile. The rhyolite sequence varied from dark red-brown to purple brown flows with occasional lineation of the phenocrysts. The rhyolite resting on the saprolite was black and contained veins of clay near the base. The contact between the rhyolite and granite was water bearing. The saprolite varied from several inches to as much as 10-feet in thickness. Based on construction documentation, the saprolite appears to be present in the shaft and therefore may extent beneath the entire reservoir at unknown depths. Rock outcrops on the southwest side of the reservoir indicate the contact between the granite and rhyolite passes beneath the reservoir foot print, possibly in the area of Panel 60-75. However, more site work is needed to define the location of this contact. Boring information taken in preparation for reconstruction of the Upper Reservoir indicates that there is as much as 200 feet of relief on the granite surface, within the immediate reservoir area.

Area Soils

Soil in the project area is shallow and generally consists of stone and gravel. In the valleys and floodplains of the area, soils are alluvial in nature. To keep river-borne sediment from reducing the Lower Reservoir storage capacity or blocking the canal between the power plant and the lake, a bin wall dam was constructed to trap gravel in the East Fork of the Black River just upstream of the reservoir. In the past 30 years, this gravel trap has been cleaned out five times. Each time approximately 30,000 cubic yards of material were removed, thus providing some indication of the amount of source soil material available.

There is considerable diversity in the soils in the surrounding area of the project, which is reflected in the variation in slopes, vegetation, and geomorphology, thus subdividing the area into four main sub-areas: 1) the upper slopes of Proffit Mountain with slopes of up to 27 percent; 2) lower elevation uplands with slopes ranging from 5 to 15 percent, including relatively level benches overlooking creeks; 3) creek bottomlands; and 4) the upper reaches of the lower Taum Sauk Reservoir, which consists of flooded creek bottomlands. A transmission line divides the upper and lower slopes of Proffit Mountain, with extremely steep terrain with occasional rock outcroppings and boulder fields from the transmission line up to the upper reservoir, and a decrease in the severity of the slope from the transmission line to the Taum Sauk Creek floodplain.

The erosive force of the water from the breach removed all topsoil to bedrock in an approximate 200-yard swath, down the face of the Proffit Mountain (Figure 5-7) along the course of an intermittent unnamed tributary. Also, seen in Figure 5-7 is the shallowness of the topsoil along the tree line.



Figure 5-7. Downstream view from breach. (Source: FERC Staff)

A break in the slope of the terrain is located where the unnamed tributary joins the East Fork Black River at the lower portion of the mountain. Most of the deposition of eroded sediments and rock fill from the dam embankment occurred at this point, forming a debris dam (Figure 5-8) and pond at the approximate location of U.S. Geological Survey gage station (No. 070661270) which was severely damaged during the event. The material deposited at this point ranged from boulders several feet in diameter to sand and fine silts. Concrete, rebar, and sections of the geomembrane lining from the Upper reservoir were also present in the debris field, thus creating a new soil deposit in this area.



Figure 5-8. Looking upstream from debris dam.
(Source: FERC Staff)

Environmental Impacts and Recommendations

Effects of Construction

The licensee's proposal to reuse the material comprising the existing rockfill dam by processing the material through a crushing plant. This processed material would comprise the aggregate utilized in a RCC hardfill dam (Figure 5-9).



Figure 5-9. Drained upper reservoir basin showing the rockfill materials after removal of the concrete face panels. (Source: FERC Staff)

In the event that the quantity of materials from the existing dam is not sufficient for the construction of the new RCC hardfill dam, the option exists for additional material to be mined from the base grades in the floor of the upper reservoir. This procedure would not be expected to significantly alter the topography of the site as the anticipated volume of additional material needed (if any) is expected to be minimal when compared with that used for construction of the earlier dam. Additionally, any rock excavation within the upper reservoir basin for this purpose would not be expected to have any significant adverse environmental impacts.

The proposed construction activities would have a minor impact on the soils on the site. There are four areas which have been cleared or would be cleared and grubbed to provide areas for construction offices, stockpile storage, erection and operation of aggregate crushing plants, concrete and RCC batch plants, equipment storage and laydown areas for construction equipment, a site of an electrical substation, and water

storage and distribution system. Some of these areas were previously disturbed during the original construction of the upper reservoir.

These areas are located outside the footprint of the upper reservoir, but adjacent to it (Figure 5-11 in section 5.4.3). The description of the areas are as follows:

- Area 1 – North end of upper reservoir – 5.14 acres (Figure 5-10)
- Area 2 – South west side of the upper reservoir – 15.2 acres
- Area 3 – adjacent to Area 2 and Staging Area – 13.2 acres
- Staging Area – South side of upper reservoir – 3.7 acres
- Parking Area (existing) - Boat Landing - 2.5 acres



Figure 5-10. Preparation of Laydown Area 1. The fill material from the upper reservoir (sediment and concrete debris) was used to level the site. A hardfill cap will be placed over the top of the area. (Source: FERC Staff)

The disturbance of these areas will create the potential for soil erosion, however, these areas would be mitigated by the implementation of the proposed Erosion Control Plan described in section 3.2.2.1 and the use of Best Management Practices to control erosion during construction. Examples of best management practices include the use of silt fences, silt containment barriers, filter socks, rock lined drainage channels, erosion

control matting, and finally establishing vegetation. The details of the means of controlling erosion and sedimentation are included in the project technical specifications, Division 02 Site Work, Section 02430 Erosion and Sedimentation Control, dated May 2007. The contract drawings show typical details of the applications of these control measures.

No new access roads will be constructed. All traffic will be confined to existing roadways.

Post Construction

Upon completion of the construction activities it is envisioned that the majority of these construction support areas would no longer be needed. As the sites are decommissioned, staff recommends that the areas be rehabilitated with soil and native vegetative covers as discussed further under Terrestrial Resources section. The decommissioning should entail the removal of the hardfill cap and hardfill subgrade prior to placement of the soil and vegetative cover. With implementation of the licensee's Erosion Control Plan and Best Management Practices, together with our recommendations in this DEA, staff believes the Proposed Action would not have adverse impacts to the geology and soils in the area.

Effects of No Action Alternative

Under a no-action alternative, the project's upper reservoir would not be rebuilt and refilled. The upper reservoir area would, however, be decommissioned and stabilized to a degree that would make the area safe. Decommissioning activities would also occur at the powerhouse, and in the areas of the intake/tailrace and dam at the lower reservoir. Considerably more erosion and sediment control and spill prevention planning would be necessary, and chances of adverse impacts to water quality would increase.

5.4.2 Water and Fisheries Resources

Description of East Fork Black River Basin and Project Waters

The Taum Sauk Project is located within the upper sub-basin of the Black River on the East Fork Black River,¹ with a drainage area of approximately 88 square miles upstream of the project's lower reservoir. The drainage is within the Ozark Plateau, originating in the Mark Twain National Forest in Iron County near Graniteville, Missouri, to the northwest of Taum Sauk Mountain, the highest point in Missouri. The river flows

¹ The upper sub-basin includes the Black River above Clearwater Lake, including the East Fork Black River and the West Fork Black River, and their tributaries.

generally south through the Johnson's Shut-Ins State Park before flowing into the northwest corner of the project's lower reservoir (see Fig. X). Average gradient in the East Fork Black River is 35 feet/mile with gradients up to 200 feet/mile due to the shut-ins² in the park (MDOC 2004a; Ameren 2004 and 2007a).

The project's lower reservoir is located at the confluence of the East Fork Black River and Taum Sauk Creek, in a steep-sided gorge. A sediment trap (bin wall dam) was constructed across the river at the upstream end of the lower reservoir to prevent gravel from reducing the reservoir's storage capacity or blocking the excavated open channel and tailrace to the pumped-storage generating plant. Water passes the bin wall dam when its elevation exceeds the bin wall height at full pool. Some river flow also passes through the bin wall when the reservoir is at lower elevations. In the past 30 years, the gravel trap area has been cleaned out five times. Each time, approximately 30,000 cubic yards of material has been removed (Ameren 2007a; MDOC 2004a).

During project operation prior to the December 14, 2005 breach of the project's upper reservoir, the Taum Sauk Project pumped water, in approximately daily cycles, through its reversible pump/generator units from the lower reservoir into the upper reservoir, located atop Proffit Mountain, and then released it to run back down through the tunnel and penstock through the project powerhouse, generating power, and back into the lower reservoir. Since the refilling of the lower reservoir following a drawdown to remove sediment and debris deposited by the December 2005 breach, water has flowed through the lower reservoir and over the spillway dam unimpeded.

After passing the lower reservoir dam, the East Fork Black River flows south approximately eight miles to where it reaches the town of Lesterville, Missouri and joins the West Fork Black River to form the Black River, which continues south through Clearwater Lake and the Mark Twain National Forest north of Poplar Bluff, Missouri, before flowing into Arkansas. The river then continues to flow in a generally south-southwest direction until it flows into the White River in Northeast Arkansas near Jacksonport.

Taum Sauk Creek, with its tributary Little Taum Sauk Creek, is the only significant tributary to the project's lower reservoir. The creek forms on the eastern slopes of Taum Sauk Mountain, north of the project in Iron County, Missouri, and flows in a generally southerly direction into Reynolds County to its confluence with the eastern arm of the lower reservoir, adding to the reservoir's inflows. During the drier and hotter

² Shut-ins are canyon-like gorges that form where streams cut through areas of erosion-resistant igneous rock (St. Francois Knobs Conservation Opportunity Area: Ozark Shut-Ins, Conservation Commission of the State Of Missouri, 2005).

periods of the year, Taum Sauk Creek surface flow is intermittent and surface water is limited to isolated pools.

Scope of Water Resources Assessment

Within the Water Resources section, staff examined the possible effects of the licensee's proposal to rebuild and refill the upper reservoir, over an approximate two-year period, on the water resources of the immediate project area. This section does not examine the effects of project operation on water resources. Within this section's scope are water levels and water quality in the lower project reservoir, and flows and water quality in the East Fork Black River downstream. Also included are effects to water quality in Taum Sauk Creek.

Several commentors expressed concerns regarding project operation prior to the upper reservoir breach. For example, the Missouri Coalition for the Environment (MCE) asserted that flows from the lower reservoir to the East Fork Black River were intermittently reduced or even shut down, resulting in damage to the river, changes in aquatic vegetation, and loss of fish habitat. Project operation and its effects on aquatic resources are outside of the scope of this DEA, and will be carefully examined during the relicensing process.

Similarly, some commentors addressed water loss through leakage and evaporation from the project's upper reservoir as a factor that interferes with the project's ability to operate in a run-of-river manner (inflow-approximating-outflow). Staff notes that these two factors would have little or no effect on reservoir elevations and river flows during the proposed reconstruction of the upper reservoir, which staff addresses here, because the upper reservoir would not be in use, and water would not be cycling between the two reservoirs during the rebuild period. Water would be present in the upper reservoir only at the end of the period considered in this analysis, when the upper reservoir would be refilled. As indicated, normal project operation is outside of the scope of this analysis, and will be carefully examined during the Commission's relicensing process.

The MDNR has commented that the study area should include the East Fork Black River from the lower reservoir downstream to its confluence with the West Fork, a reach of approximately 5 miles. David Braatz commented that the river was impacted by the breach with clay for 20 miles downstream, to and including Clearwater Lake. This document takes the impacts of the 2005 upper reservoir breach into account where the information is relevant to describing the affected environment. The scope of analysis for the rebuild regarding the East Fork Black River downstream of the lower reservoir should be defined by the areas that could be affected by flow release or water quality impacts resulting from the proposed upper reservoir reconstruction.

Some commentors alleged that the licensee is in violation of State clean water standards, and that this should be taken into account in the upper reservoir rebuilding plan. Those issues are outside the scope of this document. The MDNR notified the licensee, in a January 30, 2007 letter, that it is not aware of any section 401 water quality permitting issues associated with the upper reservoir rebuild, and that the agency would work expeditiously with the licensee to obtain any certifications that may become necessary. The MDNR correspondence is reviewed under the Consultation and Compliance section above.

Commenting entities also asked why the clean up of remaining sediments in Johnson's Shut-Ins State Park upstream, and the lower reservoir, are being treated as separate activities from the upper reservoir rebuild. Staff notes that restoration work in the park is currently under way, and involves both the licensee and Missouri resource agencies. The work, including the methods of sediment removal, is under the jurisdiction of the State.

5.4.2.1 Water Quantity

Affected Environment

Lower Reservoir

The project's lower reservoir has a surface area of 395 acres when the water is at the lower dam's spillway crest, which is at an elevation of 765 feet msl, and a volume of 6,350 acre-feet (Ameren 2007a; FERC 2005). During project operation prior to the December 2005 breach of the upper reservoir, the "live" storage of the project, that is, the amount of water that was run from the upper reservoir, through the turbines, and into the lower reservoir, and then pumped back to the upper reservoir, approximately on a daily basis, was about 2,200 acre-feet in volume. This caused the lower reservoir's water surface to fluctuate up to 15 feet. The maximum water elevation at the lower reservoir was 750 feet msl, the normal lower elevation was 737 msl, and the minimum elevation, occurring only in dry years, was 734 msl (FERC 2005; FERC 2003).

Currently, with the project not generating, the lower reservoir operates in a run-of-river mode, with inflows and outflows being approximately equal, and reservoir elevations being controlled by inflow and the elevation of the lower dam spillway.

River and Stream Flows

After the breach of the upper reservoir, and except for some periods of the approved drawdown of the lower reservoir for silt and debris removal,³ the East Fork Black River has generally flowed through the lower project reservoir in a run-of-river mode. Taum Sauk Creek supplies the lower reservoir with seasonal, ungaged inflows that are part of the flows released at the lower reservoir dam to the East Fork Black River downstream. As noted by the MDNR in their comments, there are no permanent tributaries to the river reach below the dam, making flows almost entirely dependent on releases from the lower reservoir. Some unquantified lower reservoir water gain and loss probably continues to occur through precipitation, evaporation, and possibly groundwater movement.

Normally, flow releases from the Taum Sauk Project's lower reservoir are governed by article 32 of the project license, which essentially requires that project outflow approximate total inflow to the lower reservoir.⁴ This has been accomplished through spill over the dam's overflow spillway, use of an 8-foot by 10-foot slide gate at the dam, and operation of a 16-inch diameter sluice pipe equipped with a valve. Specifically, license article 32 requires the release of water over and/or through the lower dam continuously at a rate wherein the total flow from the lower reservoir is approximately equal to the natural inflow to the lower reservoir, except as modified by the Commission pursuant to article 31. License article 31 states that, "operation regarding use, storage, and discharge of water from the reservoirs shall be controlled by such reasonable rules and regulations as the Commission may prescribe for the protection of life, health, and property, and in the interest of the fullest practicable conservation and utilization of such waters for power purposes, and other beneficial public uses, including recreational purposes; and the licensee shall release water from the lower reservoir at such a rate as the Commission may prescribe, and as prescribed by article 32". Therefore, the Commission can prescribe other release requirements at times, as necessary.

Beginning on October 1, 2001, the U.S. Geological Survey (USGS) began monitoring flows in the East Fork Black River upstream of the Taum Sauk Project. The

³ The drawdown of the lower reservoir began in July 2006, and was continued until the end of November, when a high flow event refilled the reservoir. The reservoir was then maintained at an elevation of approximately 723 ft msl from mid-January 2007 to the beginning of March, to accommodate completion of dredging activities behind the dam. Refilling was completed in April 2007, and water levels exceeded 750 ft msl, allowing spills to add to the flows in the river downstream.

⁴ 34 FPC 598-608 (1965), as modified in 35 FPC 316-319 (1966).

monthly average range of flows from this gaging station is shown in Table 5-1. In considering inflows to the lower reservoir, it must be remembered that this information does not take into account flows from the ungaged Taum Sauk Creek, which enters the lower reservoir, providing additional inflows primarily during high-flow periods of the year. The average of the monthly mean flows provided in Table 5-1 is 79.1 cfs.

Table 5-1. Monthly flows, in cfs, in the East Fork Black River above the Taum Sauk Project lower reservoir dam, October 2001 through September 2005 (USGS Station No. 07061270, upstream of the dam where the river flows under Hwy N). (Source: USGS, as cited in Ameren 2007a.)

| Month | Minimum flow | Mean flow | Maximum flow |
|--------------|---------------------|------------------|---------------------|
| January | 39.3 | 100.5 | 180.6 |
| February | 47.6 | 68.4 | 98.3 |
| March | 48.0 | 123.0 | 222.9 |
| April | 64.6 | 116.2 | 196.2 |
| May | 24.0 | 302.8 | 745.8 |
| June | 6.87 | 17.2 | 24.2 |
| July | 8.63 | 10.5 | 12.3 |
| August | 9.21 | 11.6 | 15.5 |
| September | 5.75 | 8.2 | 11.2 |
| October | 5.72 | 13.4 | 26.7 |
| November | 15.9 | 86.5 | 146.4 |
| December | 72.0 | 91.0 | 124.5 |

Exact inflow contributions from Taum Sauk Creek to the lower reservoir are unknown because of the lack of gages on that stream, but the creek carries significant flows during wet periods, and is reduced to intermittent flows with standing pools in dry periods.

The USGS maintained a streamflow gage on the East Fork Black River at Lesterville, downstream of the lower reservoir dam, from January 1, 1960 to January 15, 1991. To estimate historical flows downstream of the reservoir, data for monthly average flows over a 10-year period from January 15, 1981 through January 15, 1991 were used, as shown in Table 5-2. The average of the monthly mean flows provided in Table 5-2 is 158.2 cfs. These records reflect the effects of periods when the Taum Sauk Project was operating and both reservoirs were part of the system, and water gains and losses from precipitation, evaporation, and significant leakage may have occurred. Data from this gage also reflect inflow from Taum Sauk Creek, which may have been considerable during high-flow periods. Leakage from the upper reservoir, most of which was captured in the perimeter ditch and pumped back to the upper reservoir, averaged approximately

20 to 40 cfs, with occasional increases to as much as 100 cfs during some periods. A geomembrane liner was installed in the upper reservoir in 2004, reducing that leakage to as little as 5 cfs.

Table 5-2. Monthly flows, in cfs, in the East Fork Black River below the Taum Sauk Project lower reservoir dam, January 15, 1981 through January 15, 1991 (USGS Station No. 07061300, East Fork Black River at Lesterville, MO). (Source: USGS, as cited in Ameren 2007a.)

| Month | Minimum flow | Mean flow | Maximum flow |
|--------------|---------------------|------------------|---------------------|
| January | 4.7 | 125.5 | 3,120 |
| February | 5.2 | 228.5 | 4,070 |
| March | 4 | 193.5 | 4,580 |
| April | 5.8 | 236.1 | 4,650 |
| May | 1.1 | 219.8 | 3,880 |
| June | 0.05 | 137.6 | 3,400 |
| July | 0.75 | 32.9 | 2,000 |
| August | 0 | 59.0 | 4,630 |
| September | 0 | 40.8 | 1,930 |
| October | 0 | 51.1 | 2,050 |
| November | 1 | 261.8 | 4,300 |
| December | 1.9 | 312.1 | 6,260 |

The MDNR, in its comments dated April 11, 2007, indicated that the entire period of record for this gage should be used in estimating historical flows, subtracting periods of gage malfunction or flow interruptions caused by reservoir construction. Staff examined USGS flow records for the period starting 1965, two years after the project was constructed and the same year the project was licensed (1965), through November 2006, the last month for which it is available. Staff notes that USGS records for this gage are not available from 1991 through 2005. Average flows for each month of the longer period for which data are available were very similar to the average monthly flows in Table 5-1, and the mean of the average monthly flows for this expanded period is 129.3 cfs.

As indicated, the flows given in Tables 5-1 and 5-2 above were recorded while the project was in operation, and water was being pumped to the upper reservoir generally on a daily basis. Because of the almost entirely unquantified effects of (1) upper reservoir leakage that may have allowed some water to leave the project system, (2) evaporation from the upper and lower reservoirs, (3) precipitation into both reservoirs, and (4) seasonal ungaged inflows from Taum Sauk Creek, these records must be used carefully in discussing relationships to downstream flow releases, and in looking for effects relevant to the rebuilding of the upper reservoir.

Environmental Impacts and Recommendations

Effects of Refilling the Lower Reservoir

Several entities commented on aspects of refilling the lower reservoir following the controlled drawdown in 2006 to remove material deposited by the breach of the upper reservoir. The Sierra Club wrote that a refill plan should be developed in agreement with the MDOC and MDNR, and those two agencies provided comments on what a lower reservoir refilling plan would need to contain. However, as noted previously, these concerns were negated after a series of high flows events refilled the lower reservoir, to the point of spilling at the lower dam, allowing outflow from the reservoir to approximate inflow.

Effects of Construction Withdrawals on Lower Reservoir Elevations and Flow Releases to the East Fork Black River

The licensee's proposal to withdraw water from the lower reservoir for use in construction of the upper reservoir appears to have the ability to affect lower reservoir levels and flow releases downstream, and engendered comments to that effect. Many of the commentors indicated that a water management plan was needed that would ensure river flows would not be interrupted by the rebuilding work, and the MCE commented that the only deviations from run-of-river operation that should be allowed should be for flushing sediment from the river. The MDOC specifically noted that the lower reservoir would need to be full to facilitate downstream sediment transport in the river. The MDNR requested that a water management plan be provided that includes information on the magnitude and frequency of releases from the lower reservoir, and clarification regarding flow-release structures and methods for sustained releases during low reservoir elevations.

The licensee indicates that the outflow-approximating-inflow requirement of license article 32 would not need to be altered to accomplish the rebuild, and that higher inflows would be released over the dam as spill. During the construction phase of the proposed work, up to 450,000 gallons of water per day, for approximately 200 days, would be pumped from the lower reservoir for use in rebuilding the upper reservoir. This, the licensee has calculated, would be equivalent to about 0.7 cfs, which, for illustration, would be too small a rate to be measured at the gaging station on the river downstream. The water would be pumped to a 750,000 gallon holding tank near the construction area, so variations in rate of end use would not affect the rate of withdrawal. The licensee indicates that, over the withdrawal period, the withdrawal would present a very small impact on the available reservoir water volume. The licensee indicates that, if the entire anticipated volume of water necessary for the 2-year rebuild were taken from the lower reservoir instantaneously, the water level would only be reduced by about 0.9

feet. The licensee also points out that recent events have demonstrated that a single significant storm event can raise the water level of the reservoir up to 24 inches.

During the construction water withdrawal period, the lower reservoir level would be maintained at or near 750 feet msl, the elevation of the lower dam spillway crest. This would help ensure the release of water downstream at rates approximating inflows to the reservoir. As an additional measure to ensure the release of flows, a gate small sluice gate in the dam would be maintained in a 5-percent open position to pass 1.2 to 1.7 cfs at all times, dependent on pressure from water surface elevation. Natural high inflow events would be passed over the spillway as increases in reservoir levels occurred.

As currently envisioned, the proposal should cause very little fluctuation in the lower reservoir during the upper reservoir rebuild, and flow releases from the lower dam to the East Fork Black River should approximate inflow from the river upstream plus any flows contributed to the reservoir by Taum Sauk Creek.

However, to help ensure minimum effects on reservoir elevations, on which downstream flow releases greatly depend, staff recommends that the licensee be required to file a Final Water Management Plan prior to the start of any construction. The final plan should identify: (1) all water withdrawals and returns from the lower reservoir and their withdrawal and return rates, and their expected periods of use; (2) all methods that would be used to release water from the lower reservoir to the river; (3) what measures would be taken to ensure that reservoir outflows approximate inflows, particularly during periods of low inflow; (4) water level monitoring methods and frequencies to be used during the construction period; and (5) the lowest reservoir level at which any type of withdrawals would be allowed to continue during the rebuild period. Further, staff recommends that the Final Water Management Plan include the initial upper reservoir refilling period when water would be drawn from the lower reservoir using the pump/generators. Staff also recommends that the final plan address any seasonal concerns regarding maintenance of water levels and flow releases, such as spawning of recovering fish populations, as necessary. The Final Water Management Plan, developed in consultation with the Missouri resource agencies, should include copies of comments on a complete draft of the final plan from the MDOC and the MDNR, and should satisfactorily respond to any issues raised by those agencies. Finally, the plan should contain a schedule for monthly reporting of lower reservoir level and flow release information to the Commission, accompanied by explanations of any notable fluctuations shown in the data. Any significant fluctuations in water levels or flow releases caused by the proposed work should be reported to the Commission within 3 days of occurrence.

On the basis of the available information, and provided that the licensee's Final Water Management Plan as filed with the Commission addresses the elements identified above, the Proposed Action should not have any significant adverse impacts on water

elevations at the lower reservoir, or on flow releases to the East Fork Black River, during the construction period.

Effects of Refilling the Upper Reservoir on Water Levels in the Lower Reservoir and Flow Releases to the East Fork Black River

The initial refilling of the upper reservoir, if it were accomplished in one pumping cycle, as performed under normal project operation, would temporarily but significantly fluctuate water levels in the lower reservoir, and could also alter flow release rates at the lower reservoir dam if flow release mechanisms were not appropriately operated. Several commentors have indicated concerns specific to fluctuations in flow releases that could be caused by the upper reservoir refilling process. For example, the MDNR indicated that it is not clear whether flow releases from the lower reservoir (during initial upper reservoir refilling or during instrumentation testing and verification) would be sustained.

The licensee's proposal indicates that a final plan for the initial upper reservoir refilling has yet to be fully developed, as the plan would involve the installation and testing of new monitoring and control equipment, and approvals from state and federal agencies, and the Commission. According to the information available, refilling would occur over the course of 20 days, with approximately eight steps in the refilling process. Water would be raised to a specified elevation, held for several days, and then partially released back into the lower reservoir, and then water would be raised in the upper reservoir to a higher level, and released again. Instruments and measuring points would be monitored and checked until steady-state conditions were reached before filling to the next level. Time would be added to the periods to verify operation and performance, as necessary.

The level of the lower reservoir during upper reservoir refilling would be controlled so that outflow continued to approximate inflow. This would be accomplished through operation of the gates on the dam at the lower reservoir, either locally at the Taum Sauk Project or remotely from the licensee's Osage Project, No. 459. Gate movement would be automated and would be controlled through a computer program, or by operating personnel, but could also be moved manually on-site if necessary. The licensee indicates that it intends to fine-tune the gate controls over the next two years to improve management of downstream releases.

The licensee's plans for control of lower reservoir levels and flow releases, reviewed under the section above, would be in effect during the upper reservoir refilling period, and staff recommends that the upper reservoir refilling plan should be made a part of the Final Water Management Plan for clarity.

Staff understands that all aspects of operation of the lower dam gates to manage releases into the river in an approximate run-of-river fashion have not yet been

determined, as the licensee has written. However, further general information on upper reservoir refilling and maintenance of lower reservoir water levels and releases is needed, particularly involving release methods, and the system's ability to "keep pace" with water level changes created during the upper reservoir refilling period. Therefore, staff recommends that the licensee's Final Water Management Plan address these issues, to the degree possible, to help ensure impacts to reservoir levels and flow releases to the river are no more than minimal.

Staff also recommends that the initial steps in the refilling of the upper reservoir be accomplished as slowly as possible, so that the pumping periods change lower reservoir elevations as slowly as possible, to decrease chances of impacting flow releases from the dam, and to help avoid disturbing and resuspending any remaining sediments in the intake/tailrace area. Staff realizes the minimization of the upper reservoir refilling rate would need to be done in accordance with: (1) the operating parameters of the reversible pump-generators, and (2) the necessary engineering and monitoring requirements for safely refilling of the upper reservoir.

The upper reservoir refilling process should not exceed short-term adverse impacts to water quantity in the lower reservoir or flow releases to the river downstream, provided the licensee completes and follows a Final Water Management Plan as described in this and previous sections, and refilling is accomplished as slowly as possible.

Staff does not foresee any effects to flow rates in Taum Sauk Creek during the upper reservoir reconstruction or refilling period.

Effects of No-Action Alternative on Water Quantity

Under a no-action alternative, the project's upper reservoir would not be rebuilt and refilled. The upper reservoir area would, however, be decommissioned and stabilized to a degree that made the area safe. Some construction-related activities at the upper reservoir would still occur, but on a more limited scale than what is proposed. Water withdrawals from the lower reservoir might still be necessary, but likely on a smaller scale. Withdrawals for refilling the upper reservoir would not be necessary. Therefore, there would likely be no adverse impacts to water quantity under a No-Action Alternative.

5.4.2.2 Water Quality

Affected Environment

The upper East Fork Black River is forested, is fed by numerous springs, and has good to excellent water quality. The river is not listed on the Missouri or U.S. Environmental Protection Agency (EPA) list of impaired streams. (MDOC 2004a).

The MDNR has identified certain waters as “Missouri Outstanding State Resource Waters” (OSR), which are “high quality waters with a significant aesthetic, recreational or scientific value which are specifically designated as such by the Clean Water Commission” (10 CSR 20-7.020, in MDNR 2005a). A three-mile reach of the East Fork Black River that flows through Johnson’s Shut-Ins State Park is on the State’s list of such waters. Similarly, a 5.5-mile reach of Taum Sauk Creek in Iron and Reynolds counties, beginning at a location within the licensee’s property, is also listed (10 CSR 20-7.031, as cited in Ameren 2007a).

Missouri waters are classified for beneficial uses that set the maximum allowable concentrations for physical, chemical, and bacteriological parameters. The East Fork Black River classification is P, “streams that maintain permanent flow during drought conditions.” Designated uses of the river in the project area are LWW, “livestock and wildlife watering,” AQL, “protection of warm water aquatic life and human health/fish consumption” WBC, “whole body contact recreation,” and DWS, “drinking water supply.” Whole body contact is the highest rating for surface waters. The project’s lower reservoir is classified as L3, “other lakes which are waters of the State,” and has been assigned uses ratings of LLW, AQL, and BTG, “Boating and Canoeing.” Classifications for Taum Sauk Creek and Little Taum Sauk Creek are both C, indicating they are intermittent, but maintain permanent pools which support aquatic life, rated LWW and AQL (10 CSR 20-7.031, in MDNR 2005a).

The applicable state water quality limits for protection of aquatic life in general warm water fisheries are as follows. Temperature: Water contaminant sources and physical alteration of the water course shall not raise or lower the temperature of a stream more than 5 degrees Fahrenheit (°F), or 2.77 °C, and shall not cause or contribute to stream temperatures in excess of 90 °F or 32.22 °C. pH: Water contaminants shall not cause pH to be outside the range of 6.5 to 9.0 standard pH units. Dissolved Oxygen: Water contaminants shall not cause dissolved oxygen to be lower than 5 milligrams per liter (mg/l). Turbidity: Water contaminants shall not cause or contribute to turbidity or color that will cause substantial visible contrast with the natural appearance of the streams or lakes or interfere with beneficial uses.

As emphasized by several parties providing comments, the East Fork Black River, prior to the December 2005 breach event, was known for its extremely clear and

clean water, lacking in turbidity and siltation. It supported fisheries and high biodiversity, and attracted many visitors to the nearby parks and the general area each year.

Clearly, the project's lower reservoir, and The East Fork Black River from Johnson's Shut-Ins State Park downstream through the project area and then through the confluence with the West Fork and further downstream, were impacted to differing degrees by the upper dam breach in December 2005, which carried considerable debris and sediment loads into the system.

The licensee has estimated that approximately 757,000 cubic yards of sediment were deposited in the lower reservoir, and that 4,500 cubic yards of material from the event is now located in the river downstream of the reservoir. Evaluations of the amount of material located upstream of the upper reservoir bin wall and within the state park are ongoing (Ameren 2007b).

According to samplings performed by a contractor to Ameren in February 2006, event-related sediment deposited in the main body of the lower reservoir was 23 to 42 inches in depth in places. However, event-related sediment that traveled all the way to Clearwater Lake, approximately 20 miles downstream, had settled to at most 0.1 inches in depth in the lake. Further sampling in June 2006 found the lower reservoir sediment deposits have settled to about one-half of earlier depths (MACTEC 2007). The licensee has since removed an estimated 637,000 cubic yards of event material from the lower reservoir, much of it from the upstream end. Regarding the East Fork Black River, the licensee indicates that some sediment removal and channel enhancement work has been performed, and it has committed resources to future restoration and enhancement within the park and its river reach (Ameren 2007b). This work is being coordinated with the State and is under its jurisdiction.

Currently, much of the remaining debris and sediment have settled out in deposits of varying depths throughout the system, significantly modifying some areas covered in this analysis, including parts of the lower reservoir and the river downstream through the coating rocks and filling of pools downstream of the reservoir.

Although the water quality of the project's lower reservoir and the East Fork Black River has improved over time since the breach occurred, these waters are still chronically affected to varying degrees, and can still be acutely affected during some periods. Natural events such as precipitation and runoff likely cause increases in turbidity through resuspension of material deposited from the breach, even though some settling, compaction, and dispersion of the material continues, making it less available for resuspension over time. Clean-up and restoration work in the river and the reservoir will continue to reduce available material from the breach event, but this work could also

temporarily raise turbidity at times. However, possible turbidity increases from such work is normally significantly reduced through erosion and sediment control efforts.

Dissolved oxygen (DO) concentrations and temperatures in the lower reservoir and the river channel downstream may also continue to be slightly altered from historic patterns due to elements of the 2005 breach, primarily during low-flow periods. For example, with the project not operating, the circulation of water through the upper reservoir is not taking place, and this may affect DO concentrations, and increase algal growth, resulting in unknown levels of decreased water clarity, possibly affecting DO levels. Reservoir temperature patterns may vary slightly from those that existed before the breach due to increased absorption of solar radiation caused by lack of reservoir circulation, possibly resulting in the release of warmer water downstream. Generally, however, the water quality of the project's lower reservoir and the East Fork Black River below the dam is likely to continue to improve since the breach event in December 2005, but may not meet State requirements at all times, particularly for turbidity.

The MDOC raised the question of whether recent modifications to the smaller gate at the lower reservoir dam would allow water releases to improve downstream water quality, such as DO and temperature. The modifications to the gate allow water to be released from different levels of the reservoir, following manual adjustments. According to the licensee, the gate could be used to release cooler water from deeper in the reservoir if necessary, and the water temperature plus the release agitation would increase DO downstream. The anticipated need for its use during the rebuild has not otherwise emerged as an issue. However, releases from the gate should improve downstream water quality in any event, and would be adjustable to further influence water quality should it become an issue, if identified by the Corps or the MDNR.

Taum Sauk Creek is on the opposite side of the upper reservoir from the breach location. Therefore, the water quality of Taum Sauk Creek was not affected by the dam breach, because no breach flows descended into its drainage. However, if the drainage area received any groundwater through leakage from the upper reservoir before the liner was installed in 2004, that input would have been decreased after the liner was installed, and any leakage input would have been further decreased after the upper reservoir failed and has since stood empty. A continued decrease in groundwater flows could be expected after any rebuild and operation of the upper reservoir, because a newly-constructed upper reservoir should leak considerably less than its predecessor.

Environmental Impacts and Recommendations

Effects of Upper Reservoir Construction on Water Quality

Several commentors expressed concern that the proposed work could cause erosion and sedimentation that could affect the river and also Taum Sauk Creek. The

MDNR inquired how storm water would be managed as it runs off the floor of the upper reservoir during construction. The MDNR indicated that steps for sediment control, if water was to flow down the pump shaft to the lower reservoir, should be explained.

The Proposed Action would not occur in or immediately adjacent to the lower reservoir or flowing waters. During construction, procedures would be in place to prevent transport of silt, sediment, or hazardous materials into area waters. As described earlier under Proposed Action and Alternatives, an Erosion and Sediment Control Plan (ESCP) would be used to control erosion and runoff from work areas. All work would occur on Ameren property.

Rock dust, fly ash, and cement dust would be generated by the proposed work, which would settle in the dewatered basin of the upper reservoir (the primary work area during the rebuild) and on its embankments. Under the ESCP, curing water, dust control spray, and precipitation would wash most of the dust into a collection area on the floor of the basin. This rinse water and precipitation would be pumped through hoses running out of the reservoir basin through the vehicle access tunnel on the northeast side, and into the perimeter ditch around the outside base of the upper reservoir. From there, the water would drain to an existing one-acre sedimentation settling pond, which discharges, if necessary, to a rock-and-rubble discharge channel, in accordance with an MDNR Land Disturbance Permit. The sediment pond's size should be more than adequate to handle rinsing water and precipitation runoff. However, the licensee is in the process of calculating the possible need to increase the volume of the pond by steepening its sides, and therefore not increasing the size of its footprint. These features would be inspected and maintained once a week, or after each significant rainfall (Ameren 2007a, 2007b).

The shaft and tunnel in the upper reservoir floor, leading to the project's penstocks, turbines, and lower reservoir, would have a waterproof barrier surrounding it to prevent runoff water from entering the shaft during construction. The tunnel itself would be dewatered and sealed during the work because a steel liner would be installed in part of the system at same time. A sedimentation filter would be installed at the base of the tunnel to prevent any sediment in the shaft from entering the lower reservoir (Ameren 2007a, 2007b).

Toward the end of the construction process, the crusher plant and concrete batch plants located in the upper reservoir basin would be demobilized and any remaining aggregate would be removed. While final designs have not been completed, it is expected that the asphalt floor in the upper reservoir would be removed and a new one would be laid. At that point, no remaining aggregate or crusher dust should remain, and reservoir refilling would proceed (Ameren 2007a, 2007b).

The licensee's plans to prevent erosion, sedimentation, and runoff pollution from the upper reservoir basin during and after construction activities appear adequate to

protect water quality during the rebuild period. However, staff recommends that a final visual inspection of the upper reservoir basin be made by supervisory-level personnel immediately prior to the refilling process, to ensure that no significant quantities of construction material would become suspended and flushed to the lower reservoir.

A Spill Prevention, Control, and Countermeasure (SPCC) plan, as also described under Proposed Action and Alternatives, would be used to ensure that the work remains in compliance with all applicable laws, regulations, and project-specific permit requirements relative to prevention, control and mitigation of oil and fuel discharges.

Staff recommends that the licensee ensure that all parties involved in the proposed work review all water quality protection measures pertinent to the Proposed Action before and during any construction. Staff notes that, under the Commission's regulations, both of the above plans would need to be approved by the Commission's Division of Dam Safety - Chicago Regional Office (CRO) before the start of construction as part of the Quality Control and Inspection Plan.

No adverse impacts to water quality resulting from runoff or spills should occur under the Proposed Action if the licensee follows the plans referenced above, following review and approval of the plans by the Commission's CRO, and also follows the recommended measures as discussed. The licensee would also have to ensure compliance with any further requirements provided by the Corps and the MDNR, under section 401 and 404 of the Clean Water Act permitting procedures.

Effects of Reservoir Water Level and River Flow Fluctuations on Water Quality

Work-related changes in water levels within the lower reservoir and changes in downstream flows in the river could lead to the resuspension of remaining sediment deposited by the December 2005 breach event. However, as indicated under Water Quantity, staff believes that effects to water quantity should not exceed, at most, short-term adverse impacts due to water withdrawals for construction and upper reservoir refilling, if the licensee's final water management plan follows the recommendations provided under the Water Quantity section. Therefore, there should be little or no adverse impacts to water quality during the construction period due to construction-related water level alterations.

Effects of Upper Reservoir Refilling on Water Quality

The MDNR raised the issue of transfer of sediment between the upper and lower reservoirs during upper reservoir refilling and routine pumping operation, which could lead to resuspension and redistribution of sediment. Staff can address the initial refilling of the upper reservoir in this analysis, but, as noted in earlier sections, routine project operation is outside the scope of this document.

Upper reservoir refilling should have, at most, short-term minor adverse impacts on water quality provided that the Final Water Management Plan contains the elements described under Water Quantity, and refilling and release rates during that process are kept as low as possible to avoid turbulence that could resuspend any remaining sediments in the upstream end of lower reservoir, in the vicinity of the intake/tailrace area. As has been noted, most of the sediments in the intake/tailrace area have already been removed by the licensee, and remaining sediments in the reservoir have compacted, indicating they should be less likely to be suspended.

Effects of Use of Overflow Release Structure

Effects of a release through the Overflow Release Structure on water resources are addressed with effects on Fisheries and Aquatic Resources in a section following Fisheries and Aquatic Resources, below.

Effects of No-Action Alternative on Water Quality

Under a no-action alternative, the project's upper reservoir would not be rebuilt and refilled. The upper reservoir area would, however, be decommissioned and stabilized to a degree that made the area safe. Decommissioning activities would also occur at the powerhouse, and in the areas of the intake/tailrace and dam at the lower reservoir. Considerably more erosion and sediment control and spill prevention planning would be necessary, and there would be a greater possibility of adverse impacts to water quality.

5.4.2.3 Fisheries Resources

The scope of our assessment of possible effects to fisheries resources is tied to the scope of our assessment of water resources. Thus, staff includes the lower project reservoir, the East Fork Black River downstream of the reservoir, and Taum Sauk Creek, in our analyses and assumes an approximately two-year period for the rebuild and refilling work.

As explained under Water Resources, the effects of the December 2005 upper reservoir breach are outside of the scope of this analysis, although they are taken into account to understand and describe the existing local environment. For example, staff received comments on observations of cloudy water and fine particulates in the river upstream in Johnson's Shut-Ins State Park, and the impacts of these problems on sight-feeding fishes. Such comments are important regarding the existing environment, but they are outside of the physical and temporal scope of the proposal to rebuild the upper reservoir.

Current and future fisheries-related restoration work in the East Fork Black River and the lower reservoir also falls outside of this analysis, as does future project operation. For example, construction of shallow-water fish habitat structures and the establishment of emergent aquatic vegetation in the lower reservoir are not considered in this DEA, because they are not directly attached to the proposal to rebuild the upper reservoir. These issues, raised by the MDOC and the Sierra Club, may be addressed through the licensee's ongoing consultation with the State resource agencies, or in the project relicensing process.

However, concerns regarding changes in lower reservoir surface elevations during the rebuild and refilling process and resulting effects to shallow-spawning fish are within the scope, and addressed below.

Affected Environment

Lower Reservoir Resources

Before the upper reservoir breach, the MDOC managed the lower reservoir for recreational fisheries and conducted annual spring electrofishing surveys of black bass and sunfish populations. The lower reservoir supported a typical warm water game fish community dominated by several bass and sunfish species, as shown in Table 5-3. Non-game fish species were not recorded in the reports from which these data were drawn.

Table 5-3. Fish species collected from the Taum Sauk Project's lower reservoir. (Source: Ameren 2007a, from MDOC annual sampling data)

| Common name | Scientific name |
|------------------|------------------------------|
| Largemouth bass | <i>Micropterus salmoides</i> |
| Smallmouth bass | <i>M. dolomieu</i> |
| Spotted bass | <i>M. punctulatus</i> |
| Shadow bass | <i>Ambloplites ariommus</i> |
| Bluegill sunfish | <i>Lepomis macrochirus</i> |
| Green sunfish | <i>L. cyanellus</i> |
| Redear sunfish | <i>L. microlophus</i> |
| Longear sunfish | <i>L. megalotis</i> |
| White crappie | <i>Pomoxis annularis</i> |
| Muskellunge | <i>Esox masquinongy</i> |
| Channel catfish | <i>Ictalurus punctatus</i> |

Annual MDOC sampling data demonstrated that the composition of the lower reservoir's game fish community, including the abundance of bluegills, remained fairly

constant, although catch per unit effort for largemouth bass had been well below management goals. Proportional stock density and relative stock density, and measures of species size structure, met or exceeded management objectives (Cieslewicz 1998, 1999, 2000, 2001, 2002, and 2003, as cited in Ameren 2007a).

From mid-July through late August 2006, a licensee's consultant performed fish relocation and salvaging at the lower reservoir as it was being de-watered for removal of breach-related material. During this effort, the species listed in Table 5-4 were collected. Of these species, gizzard shad, carp, golden redhorse, channel catfish, redear sunfish, and largemouth bass were numerically the most abundant.

Table 5-4. Fish species collected during summer 2006 dewatering of the Taum Sauk Project's lower reservoir. (Source: Ameren 2007a)

| Common name | Scientific name |
|--------------------|-------------------------------|
| Gizzard shad | <i>Dorosoma cepedianum</i> |
| Muskellunge | <i>Esox masquinongy</i> |
| Common carp | <i>Cyprinus carpio</i> |
| Golden redhorse | <i>Moxostoma erythrurum</i> |
| Yellow bullhead | <i>Ameiurus natalis</i> |
| Channel catfish | <i>Ictalurus punctatus</i> |
| Brindled madtom | <i>Noturus miurus</i> |
| Shadow bass | <i>Ambloplites ariommus</i> |
| Green sunfish | <i>Lepomis cyanellus</i> |
| Bluegill | <i>Lepomis macrochirus</i> |
| Longear sunfish | <i>Lepomis megalotis</i> |
| Redear sunfish | <i>Lepomis microlophus</i> |
| Smallmouth bass | <i>Micropterus dolomieu</i> |
| Largemouth bass | <i>Micropterus salmoides</i> |
| Black crappie | <i>Pomoxis nigromaculatus</i> |
| Logperch | <i>Percina caprodes</i> |

It is expected that the majority of the fishes in the project's lower reservoir were lost through the December 2005 breach of the upper reservoir, and the during the summer 2006 drawdown of the lower reservoir.

Currently, the fish fauna of the lower reservoir is likely to be slowly recovering through migration of riverine species from the East Fork Black River upstream and Taum Sauk Creek that can successfully utilize reservoir habitat. These fishes likely include members of the fish families that were present in past samplings of the lower reservoir, the river upstream of the project, and Taum Sauk Creek, such as bass, sunfish, catfish,

suckers, and some minnow species. It will take an unknown number of years of recruitment, reproduction, and supplemental stocking efforts for the reservoir to regain a sport fishery similar to that which existed prior to the December 2005 breach event. Stable reservoir water levels, continued improvements in water quality, any work to establish aquatic plant life, and recolonization of invertebrates for forage, and careful monitoring would also be necessary.

East Fork Black River Resources

The State classifies the East Fork Black River as a warm water fishery, with very good water quality, as indicated earlier. The MDOC reports that 64 fish species have been collected from the upper East Fork Black River sub-basin (MDOC 2004a). Earlier collections made by the MDNR downstream of the project, near Lesterville, and upstream, within Johnson's Shut-ins State Park, found 42 species, listed in Table 5-5.

Table 5-5. Fish species that have been collected in the East Fork Black River. (Source: Ameren 2007a, from MDNR collection data)

| Common name | Species | Downstream of lower dam | Upstream, in State Park |
|---------------------|-------------------------------|--------------------------------|--------------------------------|
| Longear sunfish | <i>Lepomis megalotis</i> | X | X |
| Bluegill | <i>L. macrochirus</i> | X | X |
| Redear sunfish | <i>L. microlophus</i> | X | |
| Green sunfish | <i>L. cyanellus</i> | X | X |
| Redspotted sunfish | <i>L. miniatus</i> | X | |
| Shadow bass | <i>Ambloplites ariommus</i> | X | |
| Rock bass | <i>A. rupestris</i> | | X |
| Largemouth bass | <i>Micropterus salmoides</i> | X | X |
| Smallmouth bass | <i>M. dolomieu</i> | X | X |
| Spotted bass | <i>M. punctulatus</i> | | X |
| Grass pickerel | <i>Esox americanus</i> | | X |
| Greenside darter | <i>Etheostoma blennioides</i> | | X |
| Rainbow darter | <i>E. caeruleum</i> | | X |
| Fantail darter | <i>E. flabellare</i> | | X |
| Orangethroat darter | <i>E. spectabile</i> | | X |
| Banded darter | <i>E. zonale</i> | | X |
| Logperch | <i>Percina caprodes</i> | | X |
| Channel catfish | <i>Ictalurus punctatus</i> | X | |
| Yellow bullhead | <i>Ameiurus natalis</i> | X | X |
| Ozark madtom | <i>Noturus albater</i> | | X |
| Northern hogsucker | <i>Hypentelium nigricans</i> | X | X |
| Creek chubsucker | <i>Erimyzon oblongus</i> | | X |

| | | | |
|------------------------|--------------------------------|---|---|
| Golden redbhorse | <i>Moxostoma erythrurum</i> | X | |
| Black redbhorse | <i>M. duquesnei</i> | X | |
| Central stoneroller | <i>Campostoma anomalum</i> | | X |
| Largescale stoneroller | <i>C. oligolepis</i> | | X |
| Whitetail shiner | <i>Cyprinella galacturus</i> | | X |
| Hornyhead chub | <i>Nocomis biguttatus</i> | | X |
| Bigeye shiner | <i>Notropis amblops</i> | | X |
| Wedgespot shiner | <i>N. greenei</i> | | X |
| Rosyface shiner | <i>N. rubellus</i> | | X |
| Telescope shiner | <i>N. telescopus</i> | | X |
| Ozark minnow | <i>N. nubilus</i> | | X |
| Bleeding shiner | <i>Luxilus zonatus</i> | | X |
| Southern redbelly dace | <i>Phoxinus erythrogaster</i> | | X |
| Bluntnose minnow | <i>Pimephales notatus</i> | | X |
| Creek chub | <i>Semotilus atromaculatus</i> | | X |
| Common carp | <i>Cyprinus carpio</i> | X | |
| Gizzard shad | <i>Dorosoma cepedianum</i> | X | |
| Blackspotted topminnow | <i>Fundulus olivaceus</i> | | X |
| Northern studfish | <i>F. catenatus</i> | | X |
| Mottled sculpin | <i>Cottus bairdi</i> | | X |

Taum Sauk Creek Resources

Taum Sauk Creek flows into the eastern arm of the lower reservoir after draining an area to the east of the upper reservoir, on the opposite side from the 2005 breach, and its resources were not affected by the scouring and sediment deposition that affected the East Branch Black River. Taum Sauk Creek is an intermittent stream for most of its length, but does contain permanent deep pools that support aquatic life. In 2001, the MDOC conducted electrofishing, kick, and drag samples at locations one and three miles upstream of the confluence with the lower reservoir, collecting 33 fish species, indicating an excellent diversity of fishes (Table 5-6).

A visual inspection of the creek in September 2006 by Commission staff found hogsuckers, largemouth or smallmouth bass, at least two species of sunfish, and at least two species of darters, as well as crayfish and numerous aquatic insects in large standing pools. Bank erosion at bends and restrictions and debris piles indicated that the creek carries significant flows during other parts of the year.⁵

⁵ Field notes from September 14, 2006 visit to Taum Sauk Project locality, B. Peter Yarrington.

Table 5-6. Fish species collected in Taum Sauk Creek.

| Common name | Scientific name |
|------------------------|----------------------------------|
| Northern hogsucker | <i>Hypentelium nigricans</i> |
| Black redhorse | <i>Moxostoma duquesnei</i> |
| Yellow bullhead | <i>Ameiurus natalis</i> |
| Shadow bass | <i>Ambloplites ariommus</i> |
| Grass pickerel | <i>Esox americanus</i> |
| Largescale stoneroller | <i>Campostoma oligolepis</i> |
| Central stoneroller | <i>C. pullum</i> |
| Stoneroller | <i>C. anomalum</i> |
| Striped shiner | <i>Luxilus chrysocephalus</i> |
| Bleeding shiner | <i>L. zonatus</i> |
| Hornyhead chub | <i>Nocomis biguttatus</i> |
| Big eye chub | <i>Notropis amblops</i> |
| Bigeye shiner | <i>N. boops</i> |
| Ozark minnow | <i>N. nubilus</i> |
| Telescope shiner | <i>N. telescopus</i> |
| Southern redbelly dace | <i>Phoxinus erythrogaster</i> |
| Bluntnose minnow | <i>Pimephales notatus</i> |
| Creek chub | <i>Semotilus atromaculatus</i> |
| Creek chubsucker | <i>Erimyzon oblongus</i> |
| Northern studfish | <i>Fundulus catenatus</i> |
| Blackspotted topminnow | <i>F. olivaceus</i> |
| Bluegill | <i>Lepomis macrochirus</i> |
| Longear sunfish | <i>L. megalotis</i> |
| Redear sunfish | <i>L. microlophus</i> |
| Ohio logperch | <i>Percina caprodes caprodes</i> |
| Green sunfish | <i>Lepomis cyanellus</i> |
| Ozark madtom | <i>Noturus albater</i> |
| Brindled madtom | <i>N. miurus</i> |
| Ozark sculpin | <i>Cottus hypselurus</i> |
| Brook darter | <i>Etheostoma burri</i> |
| Rainbow darter | <i>E. caeruleum</i> |
| Barred fantail darter | <i>E. flabellare flabellare</i> |
| Greenside darter | <i>E. blennioides</i> |

Source: MDOC 2004a; MDOC, unpublished data; MDNR, 2005a. Assembled in Ameren 2007a. **Note:** Nomenclature is consistent with MDOC records and may not agree with American Fisheries Society standards (Nelson et al. 2004).

5.4.2.4 Aquatic Macroinvertebrates

The scope of our assessment of possible effect to aquatic macroinvertebrates is similar to the scope of our assessment to fisheries resources. With an approximate two-year period for the rebuild and refilling of the upper reservoir, included in our analysis is the lower project reservoir, the East Fork Black River downstream of the reservoir, and Taum Sauk Creek.

Affected Environment

Lower Reservoir

Monitoring information on aquatic invertebrates historically present in the Lower Reservoir is almost non-existent (Ameren 2007a). In its 2004 relicensing document, the licensee indicated that the highly invasive Asiatic clam *Corbicula* has been found throughout the lower reservoir (Ameren 2004). Although limited information is available, it can be assumed that the reservoir harbored populations of crayfish and other crustaceans, mollusks, insect larvae, and other invertebrates similar to other established reservoirs with good water quality, with diversity affected to some degree by the regular water level fluctuations of daily project operations.

As is likely with fishes, aquatic macroinvertebrate populations in the lower reservoir should now be recovering from the 2005 breach event and the subsequent 2006 drawdown. Fishes and invertebrates are now likely recolonizing the lower reservoir at differing rates, both between and within the two groups. Availability of habitat and food, rates of dispersal, and reproductive rates will be among the factors affecting recolonization rates, as will competition and predation from other species.

East Fork Black River and Taum Sauk Creek

Intensive monitoring of aquatic insect populations has been conducted in the West Fork and Middle Fork Black River in order to assess impacts related to mining activities. However, earlier information is very limited on species of aquatic invertebrates present in the East Fork Black River (Ameren 2007a). But, given the good water quality of the East Fork Black River, it is expected that a diverse and species-rich community of aquatic insects has existed in the East Fork.

The licensee indicated (Ameren 2007b) that stream biological communities were surveyed by a contractor in the East Fork Black River above the lower reservoir as part of earlier relicensing studies in 2005, and that the MDNR has periodically sampled benthic macroinvertebrates in the river inside the park. The licensee has reviewed the contractor's data, but has not been provided access to the State's information. In the spring and fall of 2006, another contractor surveyed benthic macroinvertebrates in the river above and below the area affected by the breach. A preliminary report on the 2006

data is under review, but it shows that the river's macroinvertebrate communities were substantially impaired in the river from slightly above the area directly impacted by the breach downstream to the head of the lower reservoir, but that the area is recovering rapidly. The licensee states that, downstream of the lower reservoir, macroinvertebrate communities were found to be minimally impacted, despite prolonged periods of high turbidity and moderate event-related sediment deposition.

Three species of crayfish have recently been collected in the upper Black River basin: the woodland crayfish, *Orconectes hylas*, the spothanded crayfish, *O. punctimanus*, and Hubb's crayfish, *Cambarus hubbsi* (MDOC 2004a). These crayfish species generally inhabit streams with low turbidity, free-flowing water, and gravel and large rubble substrates.

The MDOC identified four mussel species and one clam species collected in the upper Black River basin in a study conducted in 1981-1982. They are the giant floater (*Anodonta grandis*), fatmucket (*Lampsilis siliquoidea*), northern broken-ray (*L. reeviana brittsi*), squawfoot (*Strophitus undulatus*), and also the non-native invasive Asiatic clam (*Corbicula fluminea*) (MDOC 2004a).

A more recent mussel survey was conducted throughout the Black River drainage in 2003. While species diversity was high for the lower sub-basin, below Clearwater Lake, only one species, the broken-ray mussel, was found at a single site, below the lower reservoir, in the upper sub-basin. A second site was surveyed in the East Fork Black River, and no evidence of mussels was found, although the broken-ray and the giant floater were historically found there (Hutson and Barnhart 2004, as cited in Ameren 2007a). The broken-ray prefers cool, clear water typical of headwaters of spring-fed streams and is generally found in small gravel with good current (Oesch 1995, as cited in cited in Ameren 2007a). Mussels are filter feeders. Good water quality and low siltation are general characteristics of suitable mussel habitat. Substrate characteristics such as gravel or sandy bottoms are also necessary for many mussel species.

The Sierra Club indicated in its comments that the MDOC has documented a number of aquatic invertebrates in Taum Sauk Creek, including a Missouri endemic amphipod, *Allocrangonyx hubrichti*, which is State-listed. The group also wrote that the State-listed St. Francis River crayfish may occur in Taum Sauk Creek, and that the upper Black River basin may contain several species of conservation concern, such as the critically imperiled amphipod *Caecidotea serrata*, and that there may be records for the critically imperiled Ozark hellbender. The Sierra Club did not provide any references for this information. The licensee indicated that is contacting the MDOC to see if this information can be documented. No further information has been received to date. However, State-listed species are considered within the living Aquatic Resources section in this DEA, and are not treated under as a separate section, as are federally-listed species.

Environmental Impacts and Recommendations

Effects of Construction Water Withdrawals on Fisheries and Aquatic Resources

As indicated under Water Quantity, above, staff believes that no significant effects to water levels or flow releases would be caused by proposed water withdrawals for construction, if the licensee follows an approved Final Water Management Plan, including staff's recommendations. Therefore, there should be no adverse impacts to fisheries or aquatic resources in the lower reservoir or the East Fork Black River due to changes in water levels or flow releases during the upper reservoir rebuild period.

However, there could be some opportunity for impingement and entrainment of fishes in the lower reservoir. The water pump would be suspended from a truss attached to the raised left abutment of the bin wall dam, holding it out over the tailrace area at the reservoir's upstream end. The intake would be located approximately 15 feet from the bin wall dam, subject to field adjustments. The intake would be set at a depth of approximately 730 msl, in a location where the reservoir bottom is at a depth of approximately 724 msl. The mesh size on the intake would be 0.25 inch x 0.25 inch, and the calculated maximum intake velocity would be 2.6 to 4.2 feet per second, a rate necessary for the pumping of the water up the mountain to the upper reservoir. This rate would not be used at all times, and would not be continuous over the course of each day, week, or month (Ameren 2007a, 2007b).

This rate of construction water withdrawal has some potential to impinge juvenile fishes, and impinge or possibly entrain larval fishes. The sustained swimming speeds and darting speeds of young fish are generally less than 2.5 feet per second (Bell 1991). The probability of these impacts occurring would exist almost entirely in the spring and summer, after any recovering reservoir fish populations spawn, and juveniles resulting from springtime spawns in the river upstream could be washed down to the reservoir with higher flows. However, staff believes that any impacts to current populations from impingement or entrainment would be short-term and very minor. The amount of water being withdrawn from the total lower reservoir volume would be small, and the location of the withdrawal would be in a deep area where few smaller fishes would be found in any season. Similarly, little if any adverse impact to other living aquatic resources would likely occur due to the volume and the location of the withdrawal.

Effects of Upper Reservoir Refilling on Fisheries and Aquatic Resources

Lower Reservoir Water Levels and Flow Releases

If the initial refilling of the upper reservoir caused significant elevational changes in the lower reservoir during spring or early summer, spawning nests of any recovering populations of sunfish and bass could temporarily be exposed, resulting in a partial or total loss of a year class of these fishes. In addition, if the initial refilling of the upper reservoir were to cause turbulence in the lower reservoir, it could result in the resuspension of sediments causing unquantifiable impacts to aquatic plants, some invertebrates, and early life stages of fishes through smothering, and also to other invertebrates and larger fishes through interference with respiration. It could also reduce the ability of some sight-feeding fishes to find food.

However, as indicated under Water Quantity, staff does not believe that the upper reservoir refilling should exceed, at most, short-term minor adverse impacts to water quantity in the lower reservoir or flow releases to the river downstream, provided the licensee's Final Water Management Plan sufficiently addresses our recommendations. Therefore, staff would expect only short-term minor adverse impacts to fishes and other living aquatic resources during upper reservoir refilling.

Impingement and Entrainment of Lower Reservoir Fishes

An unknown amount of impingement and entrainment of lower reservoir fishes could occur at the project trashracks during initial upper reservoir refilling. Although staff believes that the recently-refilled lower reservoir does not likely contain high enough densities of fishes to make entrainment an issue, there is not enough current information on which to base an accurate assessment. The trashracks on the intakes in the lower reservoir are half-inch steel with 6-inch spacing center-to-center on its lower section, and treated oak boards with 4-inch open spacing above. No information has been provided concerning flow rates at the trashracks during pumping to the upper reservoir, but the licensee has indicated that there have historically been no observations of injured fish near the trashracks in the lower reservoir, or in the upper reservoir. Because the lower reservoir historically sustained good game and non-game fish populations, regardless of the fact that a large amount of the reservoir ran back and forth through the project's pump/generators on an approximately daily basis, staff concludes that the limited pumping involved in the initial refilling of the upper reservoir, particularly when done in stages, and if performed at low pumping rates, would not have any adverse impact on lower reservoir fish populations.

Effects of Water Quality on Fisheries and Aquatic Resources

Aside from the possible effects to water quality that could occur due to sediment disturbance during upper reservoir refilling, as discussed above, the Proposed Action would be unlikely to create any water quality problems that would affect existing fish populations or other aquatic resources in the lower reservoir, East Fork Black River downstream of the reservoir, or Taum Sauk Creek. As discussed earlier under Water Resources, no adverse impacts to water quality should occur under the Proposed Action if the licensee follows its erosion and sediment control plan and SPCC plan, with our recommended measures, and as approved by the Commission's CRO, and any further water quality protection requirements provided by the Corps or the MDNR.

Effects of No-Action Alternative on Fisheries and Aquatic Resources

Under a no-action alternative, the project's upper reservoir would not be rebuilt and refilled. The decommissioning and stabilizing work in the upper reservoir area, as well as in other project areas that might be required, would likely not affect area fisheries and aquatic resources through water level fluctuations. However, there would be a higher chance of adverse effects to fishes and other living aquatic resources from erosion and sedimentation, and from hazardous materials spills, due to the increased amount of work at more and varied locations throughout the project, that would likely be necessary for a decommissioning.

5.4.2.5 Effects of a Release from the Proposed Overflow Release Structure on Water Resources, Fisheries and Aquatic Resources

As described earlier in Section 3.2.2.3, the licensee's proposed Overflow Release Structure (ORS) would be designed to safely convey any overflow release of water away from the toe of the upper reservoir dam in the event of a failure of multiple redundant monitoring and control systems. The ORS would be located in the southeast quadrant of the upper reservoir, and would discharge to a ravine and an upland tributary of Taum Sauk Creek, which, as described earlier, is an intermittent stream that drains into the project's lower reservoir.

The ORS would utilize a broad-crested weir, 700 feet in length. The ORS has been designed for a peak release of 5,358 cfs, which would be distributed over the width of the ORS, and would descend down a series of energy-dissipating steps to a stilling basin at the bottom of a chute, which would provide additional energy dissipation.

As described in Section 5.4.3, Terrestrial Resources, below, water and eroded material would enter the headwaters of the unnamed tributary of Taum Sauk Creek approximately 1,300 feet down-gradient of the toe of the ORS, in a heavily wooded area where soils are shallow. Flows and material would then proceed approximately 3,000 feet to where the tributary joins Taum Sauk Creek. According to information provided by the licensee, the gradient of the unnamed tributary is approximately 13 percent,

flattening in its lower reach to about 2.5 percent. Taum Sauk Creek is a meandering stream with an approximate gradient of 0.8 percent, occupying a relatively broad stream valley, which is rock bottomed, occasionally deep-cut, and can be 15 to 40 feet wide.

Magnitude

While it is clearly not possible to predict the volume or magnitude of an emergency overflow event, should one ever occur, the licensee has calculated a maximum flow potential from the ORS of 5,358 cfs, stating that it would be approximately equivalent to the impact of a 100-year frequency interval flood event. However, as the MDOC states, a 5,000 cfs overflow of the ORS would be much more destructive to Taum Sauk Creek than a natural 5,000 cfs flow because of the sediment and debris it would be carrying off Proffit Mountain. Also, the MDNR has commented that erosion and sedimentation resulting from an overflow event may not be confined to Ameren property, as fines may be transported further downstream. The MDOC and MDNR provide good points, in that the energy from a significant ORS release would be directed down a generally specific path in a very episodic event, with high erosion potential, and the extent of impact from an emergency release cannot be entirely known, despite careful planning and modeling. Such factors as the amount of water released, the duration of the release, the exact route that flows would take, the degree of existing ground saturation, and existing streamflows in intermittent Taum Sauk Creek and its tributary could all affect the impact of an overflow release on natural resources.

Water Resources

The effects of an emergency release of an unknown volume of water from the ORS on water quantity and flows in the project area are difficult to assess. Effects would be highly dependent on flows and volumes already present in affected areas, to include the unnamed tributary, lower Taum Sauk Creek, the project's lower reservoir, and the East Fork Black River downstream. If Taum Sauk Creek were carrying higher seasonal flows, and the lower reservoir was spilling significant inflow to the river downstream, flows from an ORS release could be somewhat attenuated. However, if a release from the ORS were to occur during a drier part of the year, when lower Taum Sauk Creek had minimal flows or was reduced to standing pools, the ORS flow could represent virtually all the flow in the creek from the entry point on downstream to the lower reservoir, approximately two miles downstream, for a period of time. The ORS flow could then slightly increase the level of the lower reservoir and the rate of flows released to the river downstream.

The effects of an ORS release on water quality in the project area are also difficult to assess, and the level of effects would again depend on a number of factors. If the volume of the release were not large and natural flows in the project area were high, sedimentation and debris would be more easily transported through the system and could

have less of an effect on water quality in Taum Sauk Creek and waters downstream. However, if a maximum design flow peak release were to occur, especially during a natural low-flow period, it could cause much more significant effects to Taum Sauk Creek in and around the area of the initial impact of ORS flows, and downstream at bends and areas of restriction, such as bank destruction and heavy erosion, streambed scour, and bank and floodplain vegetation removal. Some suspended material carried downstream would fall out of suspension at bends and in pools, and lighter or finer material, such as some wood and sediment, would be carried into the lower reservoir and deposited. Turbidity would increase in the river below the lower dam for an unknown distance downstream. Further, if the lower reservoir were at a lower level when an ORS release occurred, the sudden increase in flows through Taum Sauk Creek could cause an unknown degree of additional erosion in the area where the creek joins the lower reservoir, causing an increase of suspended material entering the lower reservoir and released to the river.

Turbidity that could result from an ORS release into Taum Sauk Creek, the lower reservoir, and the river downstream would last an unknown period of time, depending on factors such as the magnitude and duration of the release, and the rate of natural flows in the system that would help to flush debris and sediments to the reservoir and, to some degree for suspended sediments, downstream and through the river. Material that fell out of suspension in the creek, reservoir, and river would collect in areas of lesser velocity, and could coat the existing substrate with new material, in some areas changing the bottom topography and the character of the substrates.

Fisheries and Aquatic Resources

Effects to fishes and other living aquatic resources from an ORS release would be closely tied to the levels of effects to water quality and changes to substrate. Movement of bedload material and sediment can cause abrasion to fishes, particularly those in early life stages. It can also affect fishes' ability to respire and find food. As material settles to the bottom, the filling in of spaces within substrate can smother eggs and young fishes, and remove vital habitat needed by young fishes and adults of some species. Effects to aquatic invertebrates from initial movement of material during sudden high flows include crushing and grinding of all aquatic life stages, and smothering of habitat by sediment deposition. Invertebrates not immediately disabled or killed by these impacts can be affected by waterborn silt through interference with respiration and feeding, especially the many species which use filtering methods for food collection, which include many aquatic insect larvae as well as mussels. Regardless of the volume or duration of the release, the strongest effects of an emergency ORS release to fishes and other aquatic species would likely occur in Taum Sauk Creek, with lesser effects in the lower reservoir and for some undetermined distance in the river downstream.

Conclusion

While a peak release from the ORS would have the potential to cause adverse impacts to water quality, fishes, and other living aquatic resources, the likelihood of a release of that scale would be minimal, due to the proposed operating control, safety and monitoring systems, as described in Section 3.2.2.3, Water Level Monitoring and Shutdown Equipment. As the licensee has indicated, its proposed ORS would prevent any significant damage or failure of the upper dam, and would limit the impact of any release, should one ever occur, to an area with the least potential for impacting people, where there are no parks, and affecting predominantly Ameren property.

5.4.3 Terrestrial Resources

Affected Environment

The Taum Sauk project is located in the heavily forested St. Francois Mountains with two large portions of the Mark Twain National Forest lying to the east and west of the project. The nearby St. Francois Mountains Natural Area, just north of the upper reservoir, is a 7,028 acre area that includes all of Taum Sauk Mountain, Proffit Mountain Conservation Area, and 80 acres of Johnson's Shut-Ins State Park. Natural features of the area include parts of seven igneous knobs of the St. Francois Mountains, many unique natural terrestrial communities, and geologic features. The area contains the greatest concentration of high quality features known on public land in the region, including outstanding igneous glade/savanna complexes, geologic features and an Ozark headwater stream recognized as an Outstanding State Resource Water (MDOC 1999). As part of MDOC's Comprehensive Wildlife strategy, the entire project is included in the St. Francois Knobs Conservation Opportunity Area. These conservation opportunity areas contain significant wildlife resources, and have been identified as some of the best places to conserve Missouri's native wildlife and their habitats. The MDOC's Natural Heritage Program has identified 47 high-quality communities in the Black River upper sub-basin, although none have been identified in the vicinity of the site (Rizzo 2007). In general, this sub-basin contains both upland and bottom land forest.

The upper reservoir of the Taum Sauk Project is located on Proffit Mountain. This region lies on the western edge of the central hardwood region, which stretches from Missouri to Pennsylvania and from Tennessee to the Lake States. The MDOC (2001) states that the forests of this region contain more than 70 deciduous tree species, several evergreens, and many shrub and forest plants. Oak and hickory make up the majority of trees in the area. The forests are dominated by oaks such as white, black, scarlet, and northern red oak and the less common southern red, chinkapin, burr and pin oak. Hickory makes up a small percentage, but is a consistent part of the forest. Other large tree species include blackgum, red and sugar maple, ash, elm, black walnut and red cedar. Smaller tree species include dogwood, sassafras, redbud, service berry, eastern hop hornbeam, and American hornbeam (Rizzo 2007, MDOC 2001).

The forested upland surrounding the upper reservoir provides habitat for many wildlife species. Common mammals that may be found in the upland wooded areas include whitetail deer, coyote, bobcat, red and gray foxes, raccoons, mice, rabbits, skunks, and gray, flying and fox squirrels. The MDOC lists over 125 species of birds found in Reynolds County, with 10 species associated with upland habitat. They include purple finch, ruffed grouse, Cooper's hawk, sharp-shinned hawk, ovenbird, warbler species, and wip-poor-will (MDOC 2007). Other common species of birds that may be found in upland habitat include great-horned owl, wild turkey, blackbird, crow, grackle and song birds such as bunting, blue jay, cardinal, finch, mocking bird, robin, and sparrow (Rizzo 2007). In the forested bottomland areas and riverine and reservoir areas there are number of bird species such as wood duck, mallard, Canada goose, heron, flycatcher, pileated woodpecker, various warblers, gnatcatcher, wren, wood thrush and barred owl (Rizzo 2007). According to the East Ozarks Audubon society, the area may include the cerulean warbler, a species of special concern. Additionally, approximately 15 amphibian species and 18 reptilian species are found in the forested and aquatic areas of the region. The species include seven frog and one toad species; six salamander species and the red-river mudpuppy; 12 snake species such as the copperhead, black rat, eastern garter, kingsnake, and timber rattlesnake; four turtle species; and two skink species.

The area bordering the lower reservoir consists of oak-hickory upland forest with sporadic-leaf pine common along the edge. There is no private development located on the mountain or along the shoreline of the lower reservoir, except for a campsite developed by the licensee for public use. Disturbance to forested areas within the project is limited to the campsite development, trails and the daily short-term inundation during normal higher water levels resulting at the end of the peaking power generation cycle. Sycamore, river birch, red maple, and willow trees are subjected to short-term inundation by project operation.

Overflow Release Structure

As described earlier in section 3.2.2.3, the ORS was designed to convey water over the top of the dam, in the unlikely event the redundant shut-down systems fail. The water would flow toward a ravine that leads back to the lower reservoir. Discharge would be released to the mountainside of Proffit Mountain immediately down-gradient of the ORS. This area is a relatively steep ravine (50 percent slope), which drains to the headwater of an unnamed tributary to Taum Sauk Creek approximately 1,300 feet down-gradient of the toe of the ORS. This area is heavily wooded, and the soil depths are shallow. The unnamed tributary is approximately 3,000 feet long from the midpoint of interception of discharge flow to the junction with Taum Sauk Creek. Taum Sauk Creek is a small, meandering stream with an approximate gradient of 0.8 percent in a relatively broad stream valley. It is rock bottomed, occasionally deep-cut, and can be 15 to 40 feet wide.

In the event of a release, water flow would have the tendency to expand or contract depending on the topographic shape and erosion of the slope. Based on the topography, the flow would have the tendency to spread out over an area wider than 700 feet, however it could concentrate as it encounters existing rills and gullies. Based on modeling, the maximum velocity estimated would be approximately 20 feet per second. The maximum flow of a potential overflow from the ORS is 5,358 cubic feet per second.

Effects of Proposed Action and Recommendations

Terrestrial resources within the proposed construction area would be impacted during clearing and grubbing of forested areas. Existing shrub and young trees that are currently providing habitat for bird and small mammal species would be eliminated. Habitat will be lost for a number of years until construction is complete, the area is reseeded and enough time has passed to allow for re-growth. In addition to loss of habitat, construction noise and human activity would cause additional disturbance to wildlife species, causing many of the local wildlife species to relocate away from construction activities. However this is expected to be a short term impact. Once construction is complete, and the large amount of human activity has been removed from the area, wildlife should return to nearby forested areas and conditions similar to those before construction.

During rebuilding of the upper reservoir the licensee is proposing to clear and grub forested and vegetated areas near the upper reservoir and along project roads for construction purposes (Figure 5-11). This area includes, in addition to areas that have been previously cleared, 6.6 additional acres around the perimeter of the dike, 0.7 acre for a road to a boring location near the powerplant, 2.4 acres for parking near the lower reservoir, 3.1 acres for road widening and 13.2 acres for an additional laydown area. The 6.6 additional acres around the perimeter of the dike, currently contains bushy vegetation and small trees. The licensee states these sites would be cleared, grubbed and graded so as to drain to an existing drainage ditch, then to the existing sedimentation pond through a specially constructed erosion control system. These areas were previously disturbed during the original construction of the project in the early 1960s.

The licensee proposes to clear and grub an additional 13.2 acres for a laydown area located on the west side of the road, near the lower west side of the upper reservoir. This area, labeled as laydown area 3, is a high forested hill, located adjacent to laydown area 2. In order for the licensee to use this area, it would have to clear all forested vegetation and the topography graded to a flat, usable surface. The grubbing and grading of this area would lead to permanent alteration of the topography, causing a permanent alteration of stormwater run off and soil erosion in the area. Based on aerial photographs, the area contains large trees and is heavily forested. Clearing and grading this area would cause an additional scar on the land surface. Considering the distance from the current

dike, and the age of the existing trees, it is unlikely this entire area was previously disturbed during construction of the original dike. The clearing and grading of such a large forested area would cause long term negative effects on wildlife habitat, by removing a relatively large amount of stable habitat. For these reasons, staff recommends that the licensee not clear this area.

The vegetation needing to be cleared for a road to a boring location, a parking area near the lower reservoir and for road widening are relatively small parcels of land and are in locations already impacted by the current construction activities, or were previously disturbed during the original construction of the project. Therefore, no significant impacts are expected to affect wildlife habitat or terrestrial resources in these areas.

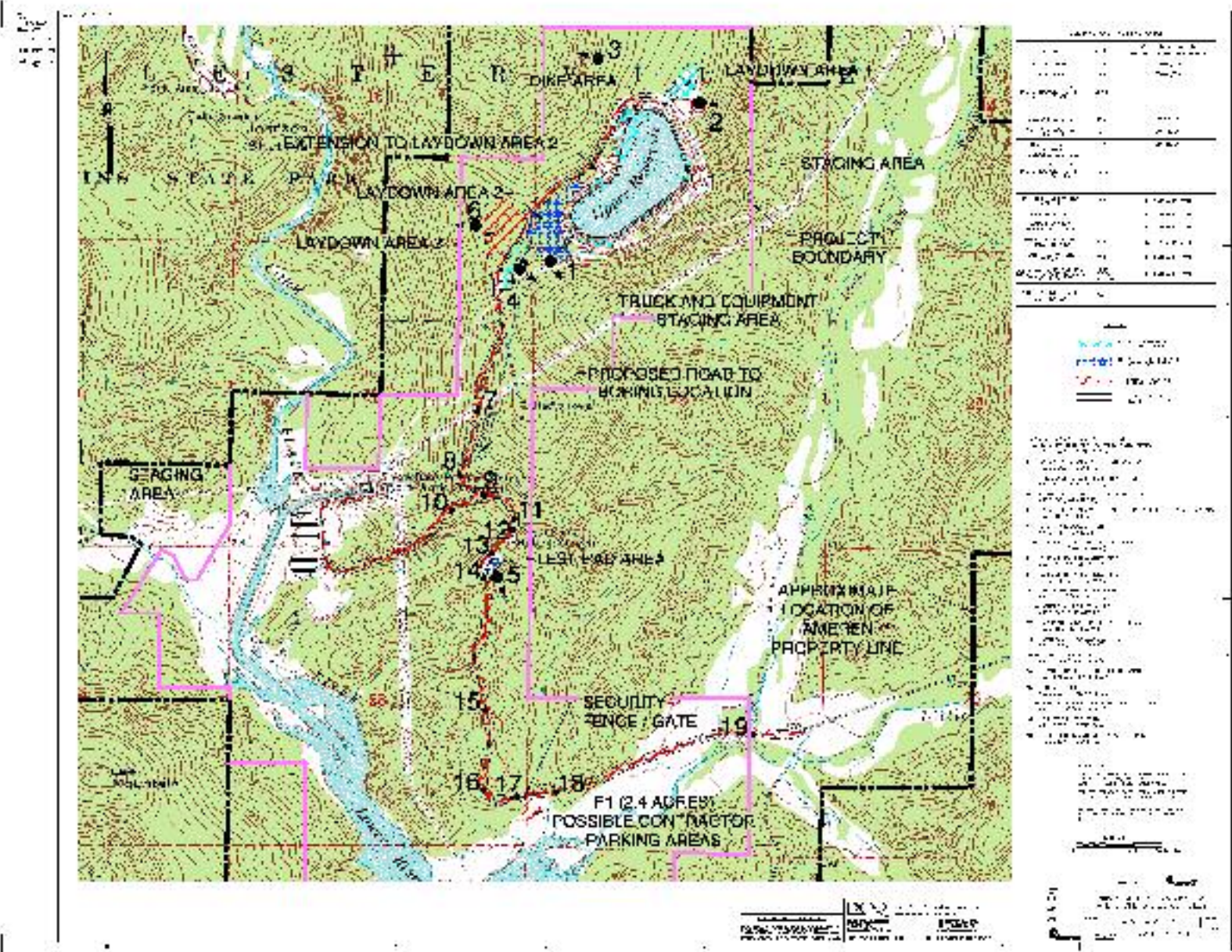


Figure 5.11 - Areas of Land Disturbance. (Source: Ameren 2007b)

There also is a possibility of soil erosion in the areas of clearing and grubbing. However, the licensee is proposing to install erosion and sedimentation control measures. The areas that have been cleared may lose valuable topsoil during heavy rain or from grubbing activities. This material would be deposited into the sediment pond associated with the erosion and sedimentation control measures. Around the reservoir and the planned location of all stockpiles is a perimeter ditch which leads to a sedimentation pond designed to trap and control runoff containing sediment from construction. Erosion from any activities that occur outside the perimeter ditch will be controlled with erosion control devices and best management practices that are approved by the MDNR. Stabilization measures will be implemented no later than 14 days after work has temporarily or permanently ceased in the area. Erosion controls should be placed so that they contain soils as close as possible to their original location, so as to minimize soil loss. With these erosion and control measures in place, there would be no significant effects on terrestrial resources in the area.

The deforestation and removal of vegetation in the proposed laydown and staging areas can cause a negative impact to terrestrial resources unless the area is re-vegetated. Without proper reforestation practices there may be the potential for nuisance or invasive plant species to colonize the area. Reseeding of these areas needs to be done with the goal of restoring the area back to pre-cleared conditions. In order to mitigate for the loss of vegetation and wildlife habitat, these areas need to be reseeded with plant, grass, and tree species that are currently present in the surrounding areas. The licensee states (in their May 2, 2007 filing) that reseeded guidelines were established per the Missouri Field Guide to Protecting Water Quality. Based on review of this guide, it appears that reseeded will be mostly of grass species. According to the licensee's erosion and sedimentation control measure design drawings, they plan to seed erosion control structures with annual rye grass, buffalo grass, birdsfoot trefoil, wheat and rye. The licensee does not mention what type of re-seeding efforts that would take place for the large amount of cleared acreage in the proposed and current laydown and staging areas once construction is complete. The licensee is proposing to follow the Missouri field guide, however, review of this document provides information for stabilizing soil in areas such as embankments, and dikes, with grassy vegetation for erosion and stormwater control. The document is not intended for reforesting large acreage of land.

By clearing and grubbing these areas, the licensee is essentially removing certain types of wildlife habitat. Special care needs to be taken to restore this habitat back to its original state as closely as possible. Reseeding with grass, as proposed by the licensee, may not be the best approach, as rye grass, buffalo grass, birdsfoot trefoil, wheat and rye are not the predominate species of the area. Special attention also needs to be addressed when choosing a seed mixture, so as

not to introduce invasive or exotic species into the area. Proper consultation with the resource agencies is necessary to determine the proper seed mixture and plant species needed to reforest this large area.

In order for proper mitigation for the loss of forest and forested habitat, staff recommends that the licensee develop a reforestation plan in consultation with MDNR, MDOC and FWS. Proper reseeding efforts need to be determined in order to assure a successful and timely reforestation of the cleared acreage. The licensee should consult with these agencies to determine the proper species and ratio of species to reseed or plant that are suitable for Proffit Mountain. This may include grasses, bush vegetation, and multiple species of tree saplings, ideally replanting those species that were cleared, or those species present in the immediate vicinity. These areas may need to be monitored to assure that the plantings are surviving and whether or not additional plants are needed over time. Also, consultation needs to include methods for preparing the area post-construction, to assure proper soil conditions are present before seeding and planting. The licensee should file its reforestation plan with the Commission, for approval, within one year of any final EA and written authorization to rebuild the upper reservoir. The plan should include a vegetation monitoring component, the resource agencies' comments, and the licensee's response to the comments.

Another possible effect of construction on terrestrial resources during the rebuild is the potential of landslides down Proffit Mountain during dismantling of the existing dike. This would cause alteration of the topography and forest, as well as cause destruction of wildlife habitat. However, the portions of the dike that were thought to be unstable have been stabilized. The remaining portions will be removed from the inside of the reservoir, so that the direction of a collapse, if it were to occur, would be into the interior of the reservoir.

Effects of ORS

The overflow release structure, if ever used, would cause some damage to the terrestrial resources in the path of the overflow. In the event of an overflow from the upper reservoir, water would be discharged through the ORS and down the forested mountainside, and ultimately deposited into Taum Sauk Creek. Although the engineering controls would dissipate energy from the release, and the amount of water could be minimal, there is a potential for damage in the form of soil erosion, up-rooting of vegetation, sediment deposition and stream scour. Once the water reaches the Taum Sauk Creek valley, the flow could expand upstream, downstream, and laterally across the bank of the creek. The flow would then proceed to the lower reservoir approximately two miles downstream.

Assuming the worst-case-scenario, the path of water from the ORS would likely cause some degree of scour down the side of the mountain, eroding top soil, and vegetation along its path. The thin soils of the area are more likely to lead to damage and movement of vegetation if a release occurs. Erosion of soil from the mountain side could lead to the destruction of forest in that area if the soil is not deep enough to support tree root structure. This vegetative material and sediment would then be deposited into Taum Sauk Creek causing an increase in stream turbidity. Depending on the amount of water, scour and sediment deposition, the stream morphology of the area could be altered, especially in those areas already experiencing stream bank erosion. Also, as stated by the MDNR, in its comments dated April 11, 2007, sedimentation from erosion due to an overflow event may not be confined to Ameren property, as fines may be transported further downstream.

Based on a hydrologic evaluation of the Taum Sauk Creek watershed, the maximum flow potential from the ORS of 5358 cfs, is approximately equivalent to the impact of the 100-year frequency interval flood event. However, as the MDOC states, a 5000 cfs overflow of the ORS would be much more destructive to Taum Sauk Creek than a natural 5000 cfs flow because of the sediment and debris it would be carrying off Proffit Mountain.

While the use of the ORS under the worse-case scenario has the potential to cause negative effects, the likelihood is minimal considering the new safety and monitoring methods. The use of an ORS is preferred rather than allowing water to flow unrestricted over the crest of the dam in an unknown location, and possibly causing a breach.

Effects of No Action Alternative

The no-action alternative of not rebuilding the upper reservoir, but instead stabilizing the current dike, would have similar effects on the terrestrial resources of the area when compared to rebuild activities. Construction activities would still need to take place for stabilization work. Impacts would cause disruption to wildlife habitat due to noise and human activity. Similar land disturbance would occur from construction activities since dismantling a large dike would still require a significant human disturbance to Proffit Mountain. The staging areas currently in place would experience some erosion and would also need proper re-seeding.

5.4.3.1 Wetlands

Affected Environment

According to the FWS National Wetland Inventory, Wetlands Mapper, approximately 55 acres of wetlands are located around the perimeter of the lower reservoir. The majority of these wetlands are classified as freshwater forested/shrub palustrine wetlands that are diked or impounded. A few acres are classified as freshwater emergent palustrine wetlands that are semipermanently flooded and diked or impounded.

The wetlands surrounding the lower reservoir are all classified as diked or impounded, indicating the elevation of the lower reservoir controls the hydrology of these wetlands. The tributary inflows, precipitation and the former daily or twice daily fluctuation of the reservoir level resulting from the pump-storage operations of the project most likely influenced and controlled the hydrology of these wetland areas.

No wetlands were documented in the immediate vicinity of the upper reservoir, or in the areas that would be impacted by construction activities. However, according to the MDNR, the existence of leakage from the previous dam, created numerous artificial springs and wetlands, and the microenvironment, including biota, have adapted to this change. The MDNR assumes that the replacement reservoir will not continue this modified hydrology.

There are approximately 37 acres of freshwater forested/shrub wetland along Taum Sauk Creek in the area that would be impacted if the overflow release structure was used. These wetlands are also classified as freshwater forested/shrub palustrine wetlands that are temporarily flooded.

Effects of Proposed Action and Recommendations

Effects of construction on the wetlands of the area will be minimal and short-term. There are no wetlands surrounding the upper reservoir to be affected. The wetlands surrounding the lower reservoir could be affected by water withdrawal for construction purposes, however when compared to the amount of daily fluctuation these wetlands experienced during normal pump-storage operations, fluctuations from construction would be negligible. Therefore, the wetlands surrounding the lower reservoir would not be negatively affected by the Proposed Action.

Leakage from the previous upper reservoir had lead to the development of several artificial springs and wetlands on Proffit Mountain. The proposed

replacement dam has been designed with leakage prevention and seepage control features, such as concrete barriers and gallery drains, to collect and convey any seepage that may occur. Therefore, seepage would be significantly less than that which occurred at the previous dike. These proposed water control features would be put into place so that the stability of the dam would not be compromised by internal hydraulic forces. As a result these wetlands, which mostly likely have degraded or no longer exist since the breach, would be lost. The MDNR requests mitigation be put in place for the loss of these springs and wetlands. The licensee responded by stating they will consult with the MDNR to identify these areas of concern, and will work with the MDNR to resolve their concerns.

Staff recommends that the licensee file with the Commission within six months of issuance of any final EA and written authorization to rebuild the upper reservoir, the results of its ongoing consultation with the MDNR regarding how it proposes to resolve the concerns of the MDNR surrounding the wetlands created by leakage from the previous upper reservoir. Resolution may include, but is not limited to, maintaining the existing wetlands or creating/replacing the wetlands.

In the event of spill over the ORS, the flow, depending on the magnitude, may enter some wetlands along Taum Sauk Creek. If this occurs, sediment and debris may be deposited into the wetlands near Taum Sauk Creek. This may cause the loss of some wetland plant species, the loss of wetland habitat, and may change the hydraulic properties of the wetland. However, the likelihood of the ORS ever being used is highly unlikely. Therefore, no significant impacts are projected to occur to wetlands due to the Proposed Action.

Effects of No Action Alternative

Under the no-action alternative, the lower reservoir would remain full and the wetlands would no longer be subjected to daily water level fluctuations. Assuming the water level in the reservoir remains full, the wetlands surrounding the lower reservoir would remain in place and continue to be effected by the hydrology of the reservoir. The wetlands along Taum Sauk Creek would not be affected, as no change would occur in the area. The wetlands created from leakage from the original dike would also be lost if the upper reservoir is not rebuilt.

5.4.4 Threatened and Endangered Species

Affected Environment

The FWS lists four species in Reynolds County, MO, as either threatened or endangered (FWS 2005). The Bald Eagle (*Haliaeetus leucocephalus*) and

Mead's Milkweed (*Asclepias meadii*) are listed as threatened, and the Gray bat (*Myotis grisescens*) and Hine's emerald dragonfly (*Somatochlora hineana*) are listed as endangered.

Bald Eagle

The Bald Eagle is currently listed as threatened under the ESA, and is considered a Missouri State endangered species. The Bald Eagle is a large raptor with a wing span of about 7 feet. Adults have a dark brown body and wings, white head and tail, and a yellow beak. Juveniles, until about 6 years of age, are mostly brown with white molting on the body, tail and undersides of the wings.

Habitat for the bald eagle consists of deciduous and mixed forest riparian habitat along coasts, rivers and lakes. They prefer areas with limited human activity. Winter roost sites typically consist of large cottonwoods associated with food sources such as waterfowl and fish. In Missouri, sycamore trees are the most common nesting trees, followed by cottonwood and bald cypress. They tend to use the same roosts each year, which are usually located in areas protected from harsh weather and human disturbance. The breeding season of bald eagles varies with latitude. In general, the tendency is for winter breeding in the south with a progressive shift toward spring breeding in northern locations.

Bald Eagles are generally solitary, but during winter migrations they become sociable, forming flocks in areas where trees are available for roosting. Missouri is one of the leading states in wintering eagles. During a 2003 annual winter eagle count, a total of 2,208 bald eagles were recorded, while it is estimated that Missouri's summer eagle population is only about 200 (MDOC 2005).

On July 12, 1995, the FWS reclassified the bald eagle from endangered to threatened throughout the 48 contiguous states. Delisting from the federal list of threatened and endangered species was proposed in 1999 because recovery goals were reached around 1990. As of the date of this DEA, the FWS has reached a court-approved agreement allowing the agency to make a final determination on the eagle's status no later than June 29, 2007 (FWS 2007).

Mead's Milkweed

Mead's Milkweed is currently listed as threatened under the ESA, and is a state endangered species. Mead's Milkweed is a herbaceous perennial with an erect stem growing 1 to 2 ½ feet tall. It has a smooth stem with milky sap, 2 to 6 pairs of opposite, tapering leaves, and a nodding inflorescence. It is one of a dozen species of milkweeds that occur in Missouri glades and prairies, and familiarity with the group is needed in order to accurately identify the species.

A single plant may consist of multiple stems of varying sizes. The shorter, thinner stems usually do not flower. Stems arise from the plant's rootstock or from a spreading rhizome and may be separated by a meter or more from each other. This perennial herb is long-lived, taking 15 years or more to mature from a germinated seed to flowering plant. After maturing, it can persist indefinitely.

Mead's milkweed flowers from late May to mid-June. Pollination occurs by bumblebees and miner bees. Flowers occur in one nodding cluster to the top of the stem. The cluster can have from 5 to 14 individual flowers, which are yellow-green or greenish cream and may be tinged with purple. Individual flowers have five tubular hood-shaped structures with a slender "horn" extending from each one. Green pods develop after flowering and usually mature by mid-September. The pods can grow to 1 ½ to 4 inches long. Once mature, the pods dry and split down the sides to release seeds with a parachute-like cluster of attached hairs. (MDOC 2004b)

In Missouri, Mead's milkweed is found on dry-mesic and mesic prairies and on igneous glades. Remnant prairie habitats along roadsides and railroad right-of-ways can also provide suitable habitat. It is threatened by destruction and alteration of tallgrass prairie due to farming, and residential and commercial development. It formerly occurred throughout the eastern tall grass prairie region of the central United States, from Kansas through Missouri and Illinois, and north to southern Iowa and northwest Indiana. It is currently known in 34 counties in eastern Kansas, Missouri, south-central Iowa, and southern Illinois. In Iron and Reynolds counties, the species are contained in the igneous glades within the St. Francois Mountains of the Ozark Natural Division. Populations of Mead's Milkweed are known to occur on public lands on Proffit Mountain (MDOC 2004b), and according to the Missouri Parks Association, may occur where the transmission line intersections a glade complex on the Slopes of Proffit Mountain. According to the East Ozark's Audubon Society, a population occurs on nearby Church Mountain.

Gray Bat

The Gray bat is currently listed as endangered under the ESA, and is also a state endangered species. Gray bats are distinguished from other bats by the unicolor fur on their back. Following their molt in July or August, gray bats have dark fur which often bleaches to a chestnut brown or russet. The gray bat weighs from 7 to 16 grams, and is the largest member of its genus in the eastern United States. The gray bat's wing membrane connects to the foot at the ankle instead of at the base of the first toe, as in other species of *Myotis*. Females give birth to a

single young in late May or early June. They feed on a variety of flying aquatic and terrestrial insects present along rivers or lakes.

Gray bat colonies are restricted entirely to caves or cave-like habitats. During the summer, the bats are highly selective for caves providing specific temperature (58 to 77 degrees Fahrenheit) and roost conditions. Usually these caves are located within two miles of a river or a reservoir. In the winter, the bats utilize only deep, vertical caves having a temperature of 42 to 52 degrees Fahrenheit. There are only eight known caves that are believed to house roughly 95 percent of the hibernating population (MDOC 2004c). Three of these caves are in Missouri and are located in Shannon and Laclede counties (MDOC 2004c). The MDOC and the East Ozarks Audubon Society state that there is a 1994 record of gray bats in Wicks cave, located about 2 miles from the lower reservoir.

Gray bats are endangered largely because of their nature to live in very large numbers in only a few caves. As a result they are extremely vulnerable to disturbance. Disturbance during hibernation can cause the bats to leave the cave while under low energy reserves, causing mortality. Likewise, disturbing females when flightless young are present can cause the frightened females to flee and drop their young.

Hine's Emerald Dragonfly

The Hine's emerald dragonfly is currently listed as endangered under the ESA, and is also a state endangered species. It is an extremely rare dragonfly and is the only one on the Federal List of Endangered Species. The specie lives in calcareous spring-fed marshes and sedge meadows overlaying dolomite bedrock. It has brilliant emerald-green eyes and a dark brown and metallic green body, with yellow stripes on its sides. Its body is about 2.5 inches long and it has a wingspan of about 3.3 inches.

The species prefers ties with groundwater fed, shallow, slow-flowing water through vegetation. Currently, this species of dragonfly can be found in Illinois, Michigan, Missouri and Wisconsin.

Adult males defend small breeding territories and mate with females who enter the territory. Females lay eggs by repeatedly plunging the tip of their tails into shallow water. Later in the season or the following spring, immature dragonflies, or nymphs, hatch. The nymphs live in the water for 2 to 4 years, shedding their skin multiple times. The nymphs then crawl out of the water and sheds their skin a final time, emerging as flying adults. The adults may live only 4 to 5 weeks.

Habitat loss and degradation is the greatest threat to the Hine's emerald dragonfly. Their wetland habitats have been drained and filled for urban and industrial development. Also, contamination of wetland by pesticides or other pollutants pose a threat.

Effects of Proposed Action

Under the Proposed Action there would not be any significant impacts to threatened or endangered species. Construction activities under the Proposed Action are mostly limited to the upper reservoir, where these species, with the possible exception of the bald eagle, are not likely to be present. There are no known documented cases where these species are known to exist in the immediate vicinity of the upper reservoir, or within the construction area.

Bald eagles have been seen to transit through the project area. However, bald eagles avoid areas with a large amount of human disturbance. The area surrounding the upper reservoir has had major construction and infrastructure stabilization since the breach in December of 2005. Due to the high amount of human disturbance, it is unlikely that bald eagles, if present before, would have remained in the area since the breach. Noise and human activity most likely would have caused them to relocate. Additionally, once the rebuild is complete, and there is no longer activity in the area, the bald eagle is likely to return.

Mead's milkweed requires specific habitat that is not available in the area immediately surrounding the upper reservoir. Since the species occurs in dry-mesic prairies and glades, it is not likely to be found in the area surrounding the upper reservoir, which is predominantly forest. As stated by the Missouri Parks Association, the largest concentrations of the federally listed Mead's Milkweed in the region may occur where the transmission line for the project intersects a glade complex on the slopes of Proffit Mountain. Construction activities will not impact this area of Proffit Mountain.

There are no known caves in the immediate vicinity of the Taum Sauk Project that provide habitat to the endangered grey bat. Since the grey bat is limited to specific habitat requirements in terms of roosting caves, it is highly unlikely that this species is present. If there is gray bat cave located two miles from the lower reservoir, as stated by MDOC and the Audubon Society, it is unlikely to be impacted given the distance from the construction atop Proffit Mountain.

Similarly, Hine's emerald dragonfly requires calcareous spring-fed marshes and sedge meadows for habitat, none of which are located in the vicinity of the

upper reservoir. Therefore, it is unlikely this species occurs in the proposed rebuild area or would be impacted by the Proposed Action.

Overflow release structure

A field reconnaissance study was performed, in addition to record review, to identify natural resources of unique quality and/or designated status that may be subject to the effect of overflow of the proposed overflow release structure. The results of the study indicated that no unique natural areas or populations of rare, threatened or endangered species were observed to occur in the designated flow area of the overflow release structure.

Effects of No-Action Alternative

There would be no effect on endangered species as a result of the no-action alternative. Similar to rebuild construction, the effects of construction to stabilize the upper reservoir would not affect the bald eagle. The other species are not known to exist in the area that would be affected by stabilization efforts.

5.4.5 Cultural and Historic Resources

Affected Environment

The Ozark Mountains, including Reynolds County, were well inhabited during the Archaic periods (7500-600 B.C.). Early and Middle Archaic sites are located on river terraces and other lowland features, and Late Archaic sites are found on levees, ridge slopes, and ridge tops overlooking river valleys. Subsistence consisted of small-game hunting during this period, and hunting continued to be a primary activity in the Ozarks during the Woodland period (after 600 B.C.). More sophisticated agricultural development and large settlements with ceremonial mounds and defensive earthworks became prominent during the Mississippian period (900 A.D.-1700 A.D.); however, this development was limited to major river bottoms.⁶

The Taum Sauk Project is in the traditional territory of the Osage people. They inhabited villages on the Osage and Missouri rivers during the winter, and made frequent hunting trips into the Ozarks during the summer. Lands were taken from the Osage beginning in 1808. Tribes potentially including the Delaware, Kickapoo, Miami, Piankashaw, Peoria, Sauk, Fox, and Shawnee are also believed

⁶ as reported in the Environmental Report for the Taum Sauk Plant Upper Reservoir Dam FERC Project No. 2277 filed February 5, 2007 referencing Chapman and Chapman, 1983; O'Brien and Wood, 1998.

to have utilized the Taum Sauk area in some way, although their movements in Missouri are not well-documented. These groups had fled the area or were moved west of the Mississippi River in the late eighteenth and early nineteenth centuries. There are no known major, permanent settlements in this area, probably due to the rugged topography, and it was most likely used as hunting grounds.

The French settled what is now Missouri in the early eighteenth century, and the Taum Sauk area became known as the “Irish Wilderness” when Irish Catholics settled part of a Spanish land grant in 1799. The land became part of America as part of the Louisiana Purchase in 1803. Following the War of 1812, German, Irish, and English immigrants settled into the area. Missouri became a state in 1821. Missouri remained in the union during the Civil War. A decisive battle was lost by the confederates at Fort Davidson, which is approximately 10 miles north of Taum Sauk Mountain.

In the late 1800s to early 1900s, agriculture, mining, and lumber developed into important economic activities in Missouri, with lead mining and lumbering being the most prominent in the Ozarks. Small livestock farming was also significant. The Mark Twain National Forest was established in the Taum Sauk region in the 1930s, and recreational activities, such as fishing and river rafting, became primary sources of income for people in the Ozark area.

No previously recorded historical or archaeological properties listed on the National Register of Historic Places (NRHP) are located in the Taum Sauk Project area. The licensee hired a contractor to perform a phase I archaeological survey of the area of potential impact of rebuilding the upper reservoir and the proposed location of the ORS. Several prehistoric and historic sites were identified during the study, but they were found to be ineligible, or not fully evaluated for inclusion on the NRHP. All were outside of the area to be disturbed by construction activities, and therefore only potentially impacted by utilization of the ORS.

Effects of Proposed Action and Recommendations

Cultural and Historic Resources

The areas to be impacted by construction activities associated with the rebuilding of the Taum Sauk upper reservoir are all areas that have been disturbed by previous construction activities. Due to that fact that no culturally or historically significant artifacts, remains, buildings, or other resources have been found or identified in the project area, the Proposed Action is not expected to have any impact on cultural or historic resources. If changes are made to the work footprint or staging areas, the licensee should conduct an archaeological survey of

those areas prior to authorization and any ground-disturbing activity to ensure that no significant cultural resources are impacted.

In addition, the licensee states in the environmental report that the work plan for the proposed rebuild will specify that, if cultural antiquities are found during construction, work will stop and authorities will be consulted to make a determination of how to proceed (Shawnee Tribe 2007). The Commission sent a letter to the Missouri SHPO on May 15, 2007, indicating that staff determined that the licensee's Proposed Action would have no adverse effect on historic or cultural resources.

Overflow Release Structure

As previously indicated, the prehistoric and historic sites identified by the phase I archaeological survey are all outside of the construction area for the upper reservoir. Therefore, they were only evaluated for their potential to be impacted in the event of a release from the ORS. The archaeological contractor found it unlikely that a release from the ORS would impact any of the sites identified in their study. So, even though not all sites were fully evaluated, a preliminary evaluation did not indicate that any of the sites found were culturally or historically significant enough for inclusion on the NRHP. In addition, given the redundant water control measures to be put in place, it is expected that the ORS will not be utilized. Given all of these factors, staff does not believe that the Proposed Action, including the proposed location of the ORS, would have any impact on historic or cultural resources in the area.

Effects of No-Action Alternative

Under the no-action alternative, the licensee would decommission the project and stabilize the facilities to make the area safe. Staff would not expect that activities to stabilize the upper reservoir and surrounding area would have any impact on cultural or historic resources at the project.

5.4.6 Recreation

Affected Environment

The area around the Taum Sauk Project is a network of parks, natural areas, wilderness areas and trails, including the Ozark Trail, located in the St. Francois Mountains, characterized by oak-hickory forest and unique rocky glades. Johnson's Shut-Ins State Park is adjacent to the project; Taum Sauk Mountain State Park, parts of the Mark Twain National Forest, Elephant Rocks State Park, Fort Davidson State Historic Site, St. Joe State Park, and Missouri Mines State

Historic Site are all within approximately 20 miles of the project. These wilderness areas and parks are used for hiking, backpacking, climbing, camping, picnicking, horseback riding, cycling, fishing, swimming, and some off-road ATV use. Canoeing, kayaking, and rafting the Black River are one of the area's primary commercial recreational activities.

All land within the Taum Sauk Project area is owned by the licensee, and much of this land remains wooded and fits in aesthetically with the forested, mountainous lands surrounding the project area. The 395-acre lower reservoir is on the East Fork Black River in a remote, heavily forested area and its rocky shoreline is undeveloped. Recreation facilities within the project include: a visitor's center with exhibits explaining pumped-storage; a museum with displays on the area's geology, wildlife, fisheries, and history; 25 picnic areas; a 20-acre campground with 25 basic campsites; a one-lane concrete boat ramp; and a parking area at the lower reservoir. Handicapped access is limited at the lower reservoir. There are two scenic overlooks at the lower reservoir, one at the dam and one at the boat launch area; and at the upper reservoir there is a viewing platform with handicapped access that provides panoramic views of Johnson Shut-Ins State Park and Taum Sauk Mountain State Park.

According to the licensee's environmental report, the Taum Sauk Project's recreational facilities attracted around 30,000 recreation-days of use per year. As of 2003, most recreational facilities were at 10 to 25 percent capacity, with the exception of the visitor's center (75 percent capacity) and museum (50 percent capacity).

Effects of Proposed Project and Recommendations

There may be short-term, unquantifiable effect on the recreational experience of hikers and other visitors to the parks and trails in the surrounding area from the noise of blasting, construction activities and associated traffic. This could negatively impact businesses dependent on recreation and tourism in the short term. However, some workers may need to be hired from outside the area, which could potentially increase business for hotels, house rentals and restaurants during the construction period. Both positive and negative impacts, would be temporary and, following the rebuilding of the upper reservoir, business for local establishments would be expected to return to levels similar to or slightly more than those before the breach.

There have been and would continue to be short term impacts to project-provided recreation during the rebuilding of the upper reservoir since access to the lower reservoir's recreational amenities have been closed since the December 2005 event and are proposed to remain closed. The licensee plans to make the

project's recreational facilities available to the public after construction of the upper reservoir is complete due to safety concerns. The MDNR commented that there may be a danger to tourists in state parks in the event of a rockslide from the unstable parts of the dam. However, the licensee states that the work on the unstable portions of the dam has already been completed, so that these areas are not in danger of sliding during construction activities.

With the exception of the placement of the water withdrawal pipe near the bin wall located in the vicinity of the powerhouse (needed to pump water up the mountain for concrete production and dust abatement), all remaining construction activity would take place at the upper reservoir. With the exception of delivery traffic, all heavy equipment would be confined to the upper reservoir and, therefore, there would be no more substantial traffic in the lower reservoir area than is expected on the rural county roads. Although the licensee proposes to close all recreation amenities at the project during construction, staff sees no reason why a number of the recreational facilities at the lower reservoir cannot be reopened during this period.

As stated earlier there is boating access, hiking trails, wildlife areas, and picnic areas at the project. The Commission's Environmental and Public Use Inspection Report (2003) states that the lower reservoir area is leased to the MDOC and MDOC staff maintain the camping area. Additionally, it states that the boat launch is maintained cooperatively between MDOC and the licensee, as are most of the recreational enhancements at the project, generally utilizing a 25 year lease. With Johnson's Shut-Ins State Park closed, limited access to the 395-acre lower reservoir area would provide much-needed recreational opportunities to the public.

In 2006, the lower reservoir was drained, dredged and cleared of debris that accumulated in and along the shores of the lower reservoir. With rain events throughout the winter and spring (2006/2007), the lower reservoir has completely refilled and is currently spilling all inflow. Water withdrawal, as stated by the licensee, is expected to be less than a total of one foot drawdown over the two year construction season. Therefore, aside from changes in the level due to natural precipitation and flow variances, the lower reservoir elevation is expected to stay relatively stable over the two year construction period; much more so than the daily fluctuations experienced during normal pump/storage operation. And, although the lower reservoir has not been restocked with fish, invariably, colonization has taken place from species upstream, which present fishing opportunities for the undeterred angler.

Therefore, in order to maximize public usage during the summer of 2007, staff recommend that within 15 days of issuance of the final EA, the licensee file

for Commission approval, a plan, developed in consultation with the MDOC and MDNR, that details the specific recreational amenities that will be available to the general public throughout the construction period. Different facilities may be opened or closed at different times of the year. The plan should provide for updated signage to inform users of any restrictions, including cautionary traffic signage, if necessary. Further, the licensee's proposal should allow for modifications to the plan for the summer of 2008 based on usage during 2007 and changes in construction activities. The plan should incorporate the recommendations of the resource agencies or provide a detailed explanation, based on project specific information, for exclusion of the recommendation.

The placement of a viewing platform on the new upper reservoir, similar to the previous platform, is still being evaluated by the licensee with respect to safety concerns. If the licensee determines that it is not safe and does not replace it, there will be a minor adverse impact to recreational opportunities in the immediate project area. However, this issue (a viewing platform at the upper reservoir) will be resolved during the relicensing process for the Taum Sauk Project. Be that as it may, the viewing platforms at the lower reservoir will remain, and there are several hiking trails that offer scenic views of the surrounding mountains, so the previous platform at the upper reservoir was not the only vantage point for panoramic views and therefore, a unique, irreplaceable recreational experience in the area.

With implementation of a limited recreation plan during the construction period, the Proposed Action should not have any long term significant impacts on recreation at the project.

Responses to Comments on the Proposed Plan

The MDC commented that the licensee's environmental report should clarify that the public amenities have been closed to the public since December 14, 2005, in addition to being closed during construction. The Sierra Club asked when the recreational amenities that were affected by the breach will be reopened to the public. Staff notes that the restoration of the surrounding area is being done as a separate matter from the proposed rebuilding of the upper reservoir; however, as stated, the project's recreational opportunities are expected to be available to the public following construction.

Several comments were made regarding the possibility of expanding or adding recreational amenities at the project. This DEA addresses the licensee's proposal to return the project to its previous condition, including all recreational amenities that were available to the public. The December 2005 incident resulted in the closing of the project's recreational amenities. The opportunity for

additional recreational opportunities at the project is a discussion more appropriate during the relicensing proceeding.

Effects of No-Action Alternative

Under the no-action alternative, the licensee would not rebuild the upper reservoir. The upper reservoir would be stabilized and the project may be decommissioned. Work in the upper reservoir area, as well as in other project areas that might be required to secure the project, would affect recreational opportunities. The licensee would not continue to maintain the recreational facilities at the lower reservoir, i.e. the picnic areas, campground, boat ramp, parking area, and scenic overlooks, and these would be closed. The licensee would also close the visitor's center and museum. Therefore, the no-action alternative would result in a net loss of recreational facilities in the Taum Sauk area.

5.4.7 Aesthetic, Air Quality and Noise Issues

5.4.7.1 Aesthetic Resources

Affected Environment

The Taum Sauk Project is surrounded by three state parks: Johnson's Shut-Ins, Elephant Rocks and Taum Sauk Mountain, providing forested landscape scenery. The Taum Sauk section of the Ozark Trail passes within approximately one half mile of the upper reservoir along Proffit Mountain. The peak of Taum Sauk Mountain, which is the highest point in Missouri, is within approximately six miles of the upper reservoir. The upper reservoir may be visible from the peak of Taum Sauk Mountain.

Prior to the breach at the upper reservoir, there was a viewing platform with handicapped access at the upper reservoir that provided for a panoramic view of Johnson Shut-Ins State Park and Taum Sauk Mountain State Park. Also, there was access from the upper reservoir to the Taum Sauk Trail connecting to the Ozark Trail.

Effects of Proposed Project

The impact of construction activity regarding the rebuilding of the upper reservoir on nearby recreational areas, outside the project boundary, is expected to remain the same as it was prior to the breach, since the footprint of the new reservoir will be the same as the previous reservoir. The reservoir may be visible from several prominent hiking destinations, so there is an aesthetic impact from

having a large, mountaintop reservoir located in the middle of a relatively remote, rugged, mountainous wilderness area. However, the overall impact will be the same as it was prior to the breach, and in fact some visitors may enjoy the views of the reservoir, so it is not clear that this impact is entirely negative. Nevertheless, during the rebuilding period, there could be a negative short term impact for hikers seeking a respite from development, due to construction related activities.

Several entities commented on the differences in the appearance of the new dam, such as it being lighter in color or higher, that may make it more prominent than the previous dam. However, the dam and reservoir are notable features on the landscape, regardless of its shade, so staff does not believe the new dam, which is essentially the same height and shape as the previous dam, will have a more significant impact on the aesthetics of the area than the previous dam.

5.4.7.2 Air Quality

Affected Environment

The U.S. Environmental Protection Agency (EPA) and the state, through the MDNR, regulate air quality in the proposed construction area. EPA has established national ambient air quality standards (NAAQS) for criteria pollutants that include carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), lead (Pb), ozone (O₃), particulate matter less than 10 microns (μ) in diameter (PM₁₀), and fine particulate matter less than 2.5 μ in diameter (PM_{2.5}).

To identify an area by its air quality, EPA designates all geographic areas in the state as attainment, non-attainment, or unclassifiable. An area is designated attainment for a particular pollutant if its air quality meets the NAAQS for that pollutant. When air quality in an area meets all standards, the area is considered to be in attainment. If the concentration of a criteria pollutant in an area is found to exceed the regulated or threshold level of the NAAQS, the area is called non-attainment for that particular pollutant. A designation of unclassifiable is made when there is currently insufficient data for determining attainment or non-attainment.

The area considered in this DEA for the rebuilding of the upper reservoir of the Taum Sauk Project is located in Reynolds County, Missouri. Reynolds County is part of the Southeast Missouri Intrastate Air Quality Control Region, and is in attainment for all of the criteria air pollutants. Industrial sources proposing construction or modifications, such as Ameren's proposed rebuilding project, must apply for construction permits from the MDNR's Air Pollution Control Program.

Effects of Proposed Project

Construction activities under the Proposed Action, including operation of the rock-crushing plant, primary RCC plant, secondary RCC plant, conventional concrete plant, and asphalt plant would cause some criteria pollutant emissions in the area of the proposed project construction. Additionally, exhaust emissions from work-related vehicles and machinery would be elevated during construction. Short-term fugitive dust emissions would be generated due primarily to land clearing, transporting of rockfill from the existing dike to the rock crusher, and transporting of raw materials, such as fly ash and cement, to the proposed project site.

Ameren has obtained construction permits from the MDNR's Air Pollution Control Program for the proposed rebuilding of the upper reservoir. The permits authorize and set forth conditions for the construction of the following air contaminant sources: rock-crushing plant, primary RCC plant, and secondary RCC plant. In addition to including an analysis of the potential sources of pollutants, the permits include provisions for the control of fugitive emissions through best management practices and restrictions on the minimum distance to the nearest property boundary. A draft permit has been issued by the MDNR's Air Pollution Control Board for the conventional concrete plant. Ameren states in its May 16, 2007 letter to the Commission that the draft permit is in the process of being finalized. Ameren also explains in its May 16, 2007 letter that MDNR is aware of its intent to apply for a construction permit for the asphalt plant, which will be mobilized at a later time in the proposed construction schedule.

During the construction of Ameren's Proposed Action, there would be minor, localized effects on air quality. The Proposed Action would result in only short-term, minor impacts to the local air quality, and no long-term impacts.

5.4.7.3 Noise

Affected Environment

Noise is generally defined as unwanted sound. It is emitted from various sources including airplanes, factories, railroads, and highway vehicles. The magnitude of noise is described by its sound pressure. Because the range of sound pressure varies greatly, a logarithmic scale is used to relate sound pressures to some common reference level, the decibel (dB). Therefore, a sound pressure level is equivalent to a certain number of decibels.

Because sound pressure levels expressed in decibels are based on a logarithmic scale, they cannot be added or subtracted in the usual arithmetical

manner. If a sound of 70 dB is added to another sound of 70 dB, the increase is only 3 dB to 73 dB, not a doubling to 140 dB. If two sounds are of different levels, the lower level adds less to the higher level as their difference increases. For example, if the difference is as much as 10 dB, the lower level adds nearly nothing to the higher level. Adding 60 dB to a 70 dB sound increases the total sound pressure level less than 0.5 dB. Additionally, a decrease of 3 dB in sound pressure level means that the noise has been reduced to half of its original level.

In 1974, the EPA identified indoor and outdoor noise levels to protect public health and welfare against hearing loss, annoyance, and activity interference (EPA, 1974). A 24-hour exposure level of 70 dB was identified as the limit of environmental noise which will protect against hearing damage. Levels of 55 dB outdoors and 45 dB indoors are identified as desirable limits to protect from activity interference and annoyance. These levels of noise are considered those which will permit spoken conversation and other activities such as sleeping, working, and recreation. The levels are not single event or peak levels, but are 24-hour averages. Further, these levels are not regulatory goals or requirements; they represent levels of environmental noise required to protect the public health and welfare with an adequate margin of safety (EPA, 2007).

Effects of Proposed Project

The Taum Sauk Project is located on Proffit Mountain, and is bordered by lands owned by the State, leased by the State, and owned by private property holders. Ameren's Proposed Action would entail construction work likely taking place during both day and night hours. Noise from the construction and blasting events would occur in the project area and would be heard off-site. In its May 2, 2007 report filed with the Commission, Ameren states that blasting would not take place at night. The anticipated blasting events would occur one to two times per day for a period estimated to be less than one year. Proper maintenance of construction vehicles, which would help to minimize noise, would be the responsibility of Ameren's contractor. Ameren would also keep construction activities under surveillance to control noise.

As shown by Ameren in its May 2, 2007 report, the distance from the construction site to the nearest private property is 6,270 feet. Using the results of an equipment noise study performed and published by the National Institute for Occupational Safety and Health, Ameren cites that the maximum noise level for a surface mining rock crusher is 111 dB (NIOSH, 2006). Assuming that the rock crusher to be used at the construction site has an immediate noise level of 115 dB, Ameren estimates that the noise level at the closest private property would be approximately 70 dB (within range of noise levels for normal conversation and street traffic). This estimated noise level when the rock crusher is operating does

not include the effects of attenuation due to the walls of the dike, tree and plant cover, or elevation change between the construction site and the private property.

Construction noise represents a temporary effect on the ambient noise levels in the proposed construction area. Noise levels would attenuate and be below maximum noise levels on the State and privately owned property which abuts Ameren's property line. The Proposed Action would result in only short-term noise impacts, and no long-term impacts.

Effects of No Action Alternative

Under the no action alternative, the upper reservoir would not be rebuilt, but instead would be stabilized to prevent any future collapse. Construction activities would still need to take place for stabilization work resulting in minor short term impacts to aesthetic resources, air quality and noise levels. The impacts on air quality and noise levels, however, would be minimal as the on-site plants would not be set up and operated and the transportation of materials would significantly decrease. The duration of the construction activities would be less than the Proposed Action and the visual integrity of the mountain would be more natural.

5.4.8 Socioeconomics

Affected Environment

The Taum Sauk Project is located in Reynolds and Iron Counties in the St. Francois Mountain region of the Missouri Ozarks, approximately 90 miles south of St. Louis, Missouri. The two-county area encompasses 1,363 square miles. Because the area is relatively isolated and lacks interstate highway access, it has not attracted many of the higher-paying employment opportunities nor experienced the income gains of counties within the St. Louis Metropolitan Area.

Population and Households

In 2000, the population of the two counties in the Taum Sauk Project area was 17,386 which represents less than one percent of the total state population. The population of Iron County had decreased from 10,726 residents to 10,697 during the period from 1990 to 2000. Populations of the two counties are presented in Table 5-7. Reynolds County, where the majority of the project facilities are located, had a population of only 6,689 people in 2000.

Table 5-7. Population and households, 1990 and 2000. (Source: U.S. Census Bureau, 2000.)

| COUNTY | TOTAL POPULATION | | CHANGE IN POPULATION | NO. OF HOUSEHOLDS | | HOUSEHOLD GROWTH |
|--------------|------------------|--------|----------------------|-------------------|-------|------------------|
| | 1990 | 2000 | | 1990 | 2000 | |
| Iron | 10,726 | 10,697 | (29) | 3,995 | 4,197 | 202 |
| Reynolds | 6,661 | 6,689 | 28 | 2,542 | 2,721 | 179 |
| Total Region | 17,387 | 17,386 | (1) | 6,537 | 6,918 | 381 |

In 2000, the number of households (occupied housing units) within the two-county area totaled 6,918. Between 1990 and 2000, the area gained just a few hundred households and experienced a net loss of one person in population.

Housing

In 2000, the U.S. Census Bureau found that the housing stock within the project area totaled 8,666 units. As shown in Table 5-8, the total housing stock increased by about 5 percent from 1990 to 2000. The total number of units in this area occupied seasonally or occasionally, as second or vacation homes, was nearly static.

Table 5-8. Housing units, 1990 and 2000. (Source: U.S. Census Bureau, 2000.)

| COUNTY | TOTAL HOUSING UNITS | | CHANGE IN NUMBER | NO. OF SEASONAL UNITS | | MOBILE HOMES IN 2000 |
|--------------|---------------------|-------|------------------|-----------------------|------|----------------------|
| | 1990 | 2000 | | 1990 | 2000 | |
| Iron | 4,700 | 4,907 | 207 | 244 | 232 | 998 |
| Reynolds | 3,537 | 3,759 | 222 | 555 | 558 | 766 |
| Total Region | 8,237 | 8,666 | 429 | 799 | 790 | 1,764 |

The two counties also permit mobile homes and recreational vehicles to be occupied on residential lots. In 2000, the U.S. Census Bureau determined that the area's housing stock included 1,764 mobile homes, representing about 20 percent of the total housing stock.

Employment

As shown in Table 5-9, a total of 6,136 people in the labor force within the project area were employed in 2002. The unemployment rate for the two-county area averaged 10.7 percent, as compared with the state average of 4.9 percent (Rizzo, 2007).

Table 5-9. Employment, 1992 and 2002. (Source: Missouri Economic Research and Information Center, 2004.)

| COUNTY | NO. OF EMPLOYED RESIDENTS | | CHANGE IN NUMBER | NO. OF UNEMPLOYED RESIDENTS | | CHANGE IN NUMBER |
|--------------|---------------------------|-------|------------------|-----------------------------|------|------------------|
| | 1992 | 2002 | | 1992 | 2002 | |
| Iron | 3,690 | 4,084 | 394 | 509 | 458 | (51) |
| Reynolds | 2,673 | 2,052 | (621) | 249 | 199 | (50) |
| Total Region | 6,363 | 6,136 | (227) | 758 | 657 | (101) |

In 2000, the number of full-time and part-time jobs within the project area averaged 4,138 (U.S. Census Bureau, 2000). The majority of people in the labor force, about 56 percent, were employed in mining or manufacturing. Other types of employment in the area are presented below in Table 5-10.

Table 5-10. Employment by sector, 2000. (Source: U.S. Census Bureau, 2000.)

| INDUSTRY | NUMBER OF PERSONS EMPLOYED | PERCENT |
|-------------------------------------|----------------------------|------------|
| Agriculture | 33 | 1 |
| Construction | 109 | 3 |
| Mining | 1,486 | 36 |
| Manufacturing | 840 | 20 |
| Wholesale Trade | 99 | 2 |
| Retail Trade | 492 | 12 |
| Transportation and Public Utilities | 122 | 3 |
| Fire | 105 | 3 |
| Services | 852 | 20 |
| Total | 4,138 | 100 |

Income

The median household income for 2000 was \$25,867 in Reynolds County and \$26,080 in Iron County. Eleven years prior, the median household income was \$17,008 in Reynolds County and \$17,303 in Iron County (U.S. Census Bureau, 2000). Overall, this area has experienced an average increase of about 52 percent in the median household income from 1989 to 2000 (Rizzo, 2007).

Effects of Proposed Project

Ameren indicates in its May 2, 2007 report filed with the Commission that its contractor will hire qualified workers for approximately 200 to 250 positions. Some of the employees might need to temporarily relocate to the project area from elsewhere during the construction period. Employees would also be hired from the existing local area work force. Expecting few construction personnel to relocate to the project area, staff concludes that there would be no substantial in-migration of people, no excessive demand for rental housing, little or no increased

demand for permanent housing, and little or no increased demand for government facilities or services associated with the construction work force.

The proposed rebuilding of the upper reservoir would contribute directly to the economy by providing employment and earnings, which also contribute indirectly to the economy through employee purchase of goods and services. The project-related construction employment and payroll would have a positive short-term effect on the local economy.

Rebuilding of the upper reservoir and allowing continued project operations at the Taum Sauk Project would provide a positive long-term effect on the local economy. As noted in the letters from the Lesterville R-IV School District community filed with the Commission on March 14, 2007, the project provides a large source of tax revenue and funding for the school district. Various commentors state that Ameren pays 53 percent of the local taxes, which support staff salaries and school programs. Additionally, Ameren states in its January 2007 Environment Report that it is a strong community partner, donating millions of dollars each year through the Ameren Corporation Charitable Trust to programs in education, services for youth and elderly, and the environment in its Missouri and Illinois service areas.

Effects of No Action Alternative

Under the no action alternative, the upper reservoir would not be rebuilt, but instead would be made stable and safe from any future collapse. Although construction activities would still need to take place for the stabilization work, the work force would be much smaller than that needed to rebuild the reservoir. The positive short-term effect on the local economy would be minimal. Not rebuilding the upper reservoir would have a negative long-term effect on the economy due to the loss of tax revenue garnered from the project. The reduction in the available regional power supply that would occur as a result of the loss of project generation could also have a negative effect on the local economy.

6.0 FINDING OF NO SIGNIFICANT IMPACT

The rebuilding of the upper reservoir is necessary for the Taum Sauk Pumped Storage Project to resume operation. The proposed construction activities would occur in the same location as the previous upper reservoir, retaining a similar shape and volume of water. No operational changes are proposed. Operation of the project provides needed energy storage for periods when demand is high or when energy is needed in emergency circumstances. The licensee's and staff's mitigation measures should reduce to the extent possible, impacts associated with the construction activities.

On the basis of our independent analysis, the proposed rebuilding of the upper reservoir of the Taum Sauk Project, with the licensee's and staff's recommended mitigation measures, would not constitute a major federal action significantly affecting the quality of the human environment.

7.0 LITERATURE USED OR CITED

Ameren. 2007a. Environmental Report: Taum Sauk Plant Upper Reservoir Dam, FERC No. 2277. Prepared by Paul C. Rizzo Associates, Inc., Monroeville, PA. Dated January 31, 2007, filed with the Federal Energy Regulatory Commission on February 5, 2007.

_____. 2007b. Report: Response to Commission Comments and Response to Stakeholder Comments on Environmental Report. Taum Sauk Plant Upper Reservoir Dam, FERC Project No. 2277. Prepared by Paul C. Rizzo Associates, Inc., Monroeville, PA. Dated April 30, 2007, filed with the Federal Energy Regulatory Commission on May 2, 2007.

_____. 2006a. Report to the Federal Energy Regulatory Commission containing Ameren's Taum Sauk Lower Reservoir Restoration Plan, dated April 18, 2006, filed with the Federal Energy Regulatory Commission on April 19, 2006.

_____. 2006b. Report to the Federal Energy Regulatory Commission containing a copy of a Memorandum of Understanding regarding the Taum Sauk Lower Reservoir Restoration Plan, dated June 29, 2006, filed with the Federal Energy Regulatory Commission on June 30, 2006.

_____. 2006c. Draft Environmental Report: Taum Sauk Plant Upper Reservoir Dam, FERC No. 2277. Prepared by Paul C. Rizzo Associates, Inc. Monroeville, PA. Dated August 2006. Unfiled report.

_____. 2004. Initial consultation document for relicensing the Taum Sauk Project, FERC No. 2277, dated December 17, 2004, filed with the Federal Energy Regulatory Commission on December 21, 2004.

Bell, Milo C. 1991. Fisheries Handbook of Engineering Requirements and Biological Criteria. Published by the U.S. Army Corps of Engineers, North Pacific Division, Fish Passage Development and Evaluation Program, Portland, Oregon.

Federal Power Commission (FPC). 1965. Order Issuing License (Major), Union Electric Company, Project No. 2277. Issued August 26, 1965. 34 FPC 598-608. Includes standard terms and conditions for unconstructed major projects, Form L-11, effective July 1, 1965.

Federal Energy Regulatory Commission (FERC). 2006. Report of Findings on the Overtopping and Embankment Breach of the Upper Dam - Taum Sauk Pumped Storage Project, FERC No. 2277. FERC Taum Sauk Investigation Team, April 28, 2006.

_____. 2005. Operation Report for the Taum Sauk Project (No. 2277), for the period of September 30, 2004 to August 25, 2005. Office of Energy Projects, Division of Dam Safety and Inspections, Chicago Regional Office. December 15, 2005.

_____. 2003. Environmental and Public Use Inspection Report for the Taum Sauk Project (No. 2277), conducted on June 17, 2003. Office of Energy Projects, Division of Dam Safety and Inspections, Chicago Regional Office. November 7, 2003.

Federal Power Act (FPA). 1920. Title 16 United States Code, Chapter 12, Subpart I, §§ 791a-797, 798-824a, and 824b-825r, June 10, 1920, as amended.

Hutson, C. and C. Barnhart, 2004. Survey of Endangered and Special Concern Mussel Species in the Sac, Pomme de Terre, St. Francis, and Black River Systems of Missouri, 2001-2003. Endangered Species Grant Final Report. Grant No. E-1-36. Prepared for Missouri Department of Conservation.

MACTEC Engineering and Consulting, Inc., 2007. Clearwater Lake Sediment Core Survey. Prepared for Ameren, St Louis, MO. April 20, 2007.

Missouri Department of Natural Resources (MDNR), Division of Environmental Quality. 2006. Taum Sauk Reservoir Area Water Quality. Accessed February 21, 2007. <http://www.dnr.mo.gov/env/taumsauk/index.html>

Missouri Department of Natural Resources, Division of Environmental Quality. 2005a. Laws and Rules: Link to Title 10, Division 20-Clean Water Commission. Accessed February 21, 2007 and May 10, 2007. <http://www.dnr.mo.gov/env/wpp/rules/index.html>

_____, Division of State Parks. 2005b. Plants and Animals of Taum Sauk Mountain State Park. Accessed February 21, 2007. (Accessed by Ameren

- October 14, 2004.) <http://www.mostateparks.com/taumsauk/plantsanimals.htm>
- _____. Division of State Parks. 2006. Johnson's Shut-Ins State Park Closes for Redevelopment. Accessed February 21, 2007. <http://www.mostateparks.com/jshutins.htm>
- Missouri Department of Conservation (MDOC). 2007. Missouri Fish and Wildlife Information System. http://mdc4.mdc.mo.gov/applications/mofwis/Mofwis_Search1.aspx
- _____. 2005. The Bald Eagle in Missouri. September 2005.
- _____. 2004a. MDOC Online: Black River Watershed: Inventory and Assessment. Accessed February 21, 2007. <http://www.mdc.mo.gov/fish/watershed/black/contents/>
- _____. 2004b. Management Guidelines for: Mead's Milkweed (*Asclepiasmeadii* Torrey ex A. Gray). Last modified September 21, 2004.
- _____. 2004c. Endangered Species Guidesheet: Gray Bat. Modified September 18, 2004.
- _____. 2001. Missouri's forests today. <http://mdc.mo.gov/forest/landE/forests/today.html>. Last modified July 23, 2001.
- _____. 1999. St. Francois Mountains Natural Area. www.mdc.mo.gov/areas/natareas.P148-1.html. Last modified February 16, 1999.
- National Environmental Policy Act (NEPA). 1969 as amended. (Pub. L. 91-190. 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, section 4 (b), Sept. 13, 1982). Commission Regulations at 18 CFR 380.4.
- National Institute for Occupational Safety and Health, (NIOSH). 2006. Limestone Mining – Is it Noisy or Not?
- Nelson, J.S., E.J. Crossman, H. Espinosa-Perez, L.T. Findley, C.R. Gilbert, R.N. Lea, and J.D. Williams. 2004. Common and Scientific Names of Fishes from the United States, Canada, and Mexico. American Fisheries Society: Special Publication 29. Bethesda, Maryland. 386 pp.

Rydlund, P.H., Jr. 2006. Peak discharge, flood profile, flood inundation, and debris movement accompanying the failure of the upper reservoir at the Taum Sauk storage facility near Lesterville, Missouri. U.S. Geological Survey Science Investigations Report 2006-5284.

U. S. Environmental Protection Agency (EPA). 2007. EPA Identifies Noise Levels Affecting Health and Welfare.
www.epa.gov/history/topics/noise/01.htm

_____. 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.

U.S. Fish and Wildlife Service (FWS). 2007a. Wetlands Online Mapper.
<http://wetlandsfws.er.usgs.gov/NWI/>

_____. 2007b. www.fws.gov/migratorybirds/baldeagle.htm

_____. 2006. Threatened and Endangered Species. Hine's Emerald Dragonfly *Somatochlora hineana*. March 2006.

_____. 2005. www.fws.gov/midwest/endangered/lists/missouri-cty.html. Revised July 2005.

_____. 1997. Threatened and Endangered Species. Gray Bat *Myotis grisescens*. September 18, 1997.

8.0 LIST OF PREPARERS

Thomas J. LoVullo – EA Coordinator, Purpose and Need for Action, Proposed Action and Alternatives, Consultation and Compliance. (Senior Technical Expert, M.S., Fisheries Science)

Hillary Berlin – Cultural Resources/Heritage Resources, Recreation, and Aesthetic Resources. (Environmental Biologist, M.P. Environmental Planning)

Frank Calalgno, Jr. – Geology and Soil Resources. (Senior Engineering Geologist and Senior Physical Security Specialist, M.S. Geology)

Andrea Shriver – Terrestrial Resources, Threatened and Endangered Species. (Ecologist, M.S. Biology)

Linda Stewart – Aesthetic Resources, Air and Noise Quality, Socioeconomics.
(Civil Engineer, M.S. Civil Engineering)

Olaf Weeks – Geology and Soil Resources. (Civil Engineer, M.S. Soil Science)

B. Peter Yarrington – Water Resources, Fisheries and Aquatic Resources. (Senior
Fisheries Biologist, M.S. Fisheries Science)