# Taum Sauk Pumped Storage Energy Center

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**Ameren Missouri**

# AMEREN HYDRO GENERATION

- Keokuk Energy Center
  - 15 units, 140 MW, 102 years old
- Osage Energy Center
  - 8 units, 250 MW, 84 years old
- Taum Sauk Pumped Storage Energy Center
  - 2 units, 440 MW, 52 years old
- ~3% of Ameren generation



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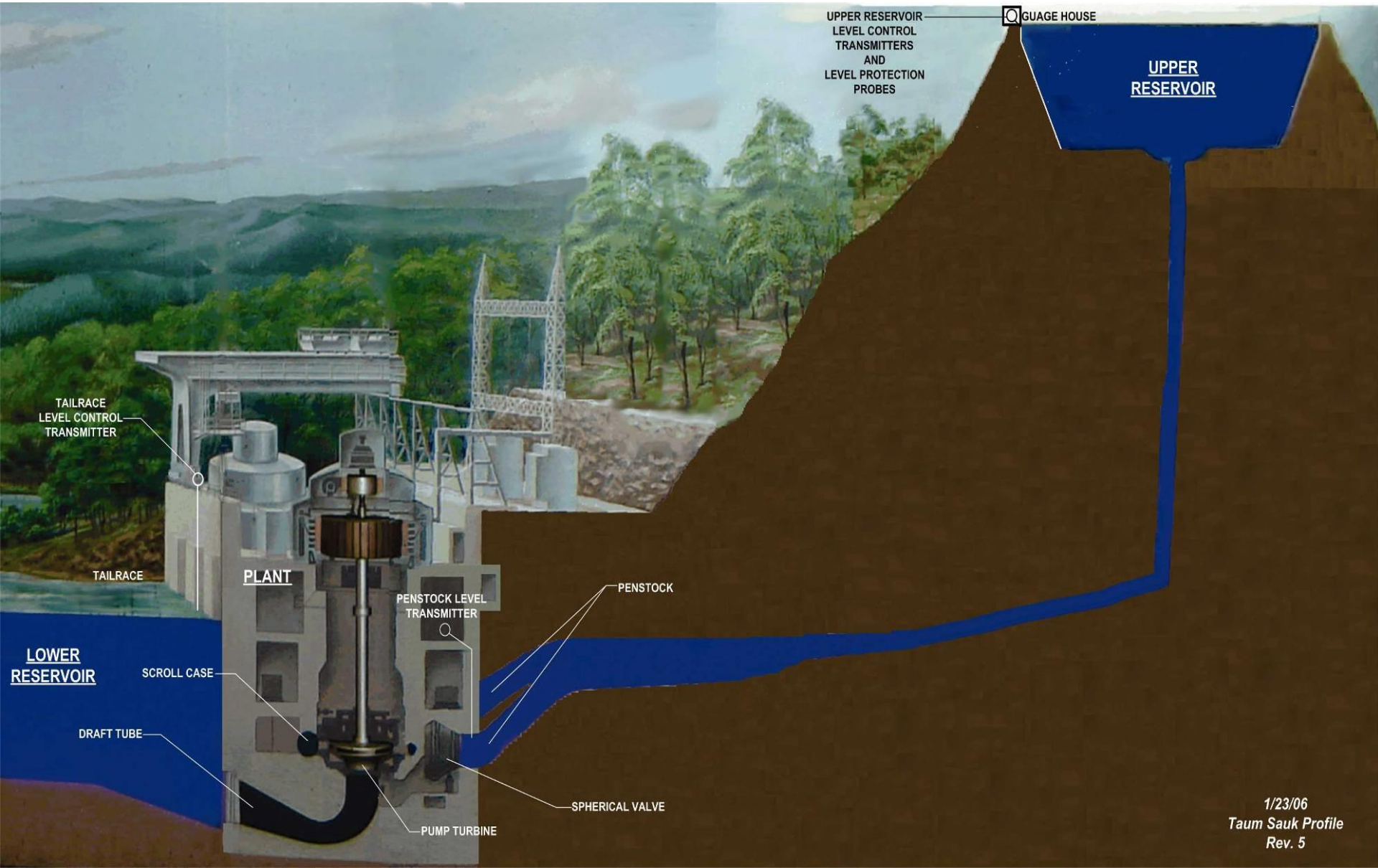
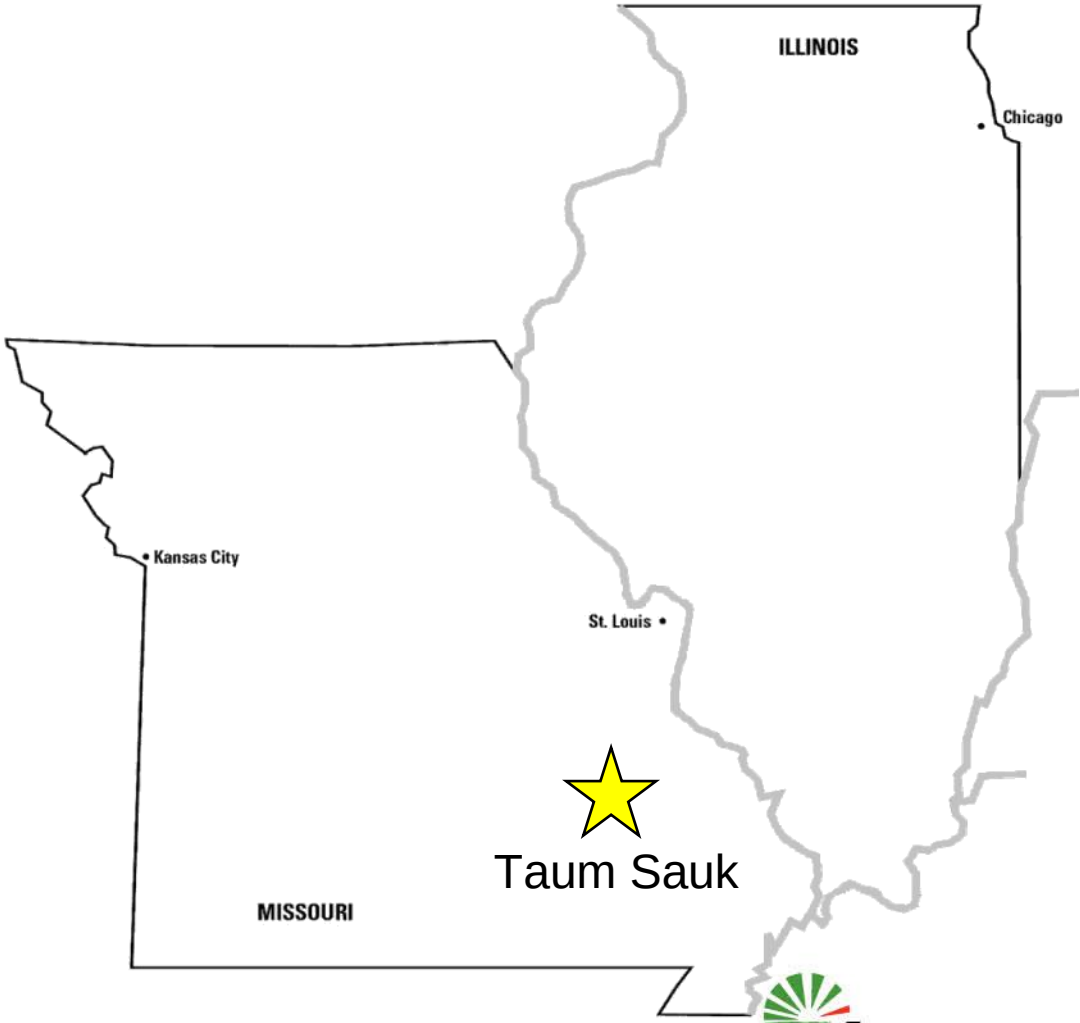
# PUMPED STORAGE OPERATION OVERVIEW



# TAUM SAUK BASICS

- Location: Reynolds County, Missouri
- Production Capacity: 440 MW
- Maximum Operating Head: 860 ft
- Number of Units:  2 pump turbines
- Began Operation: 1963
- Reservoir Size:
  - Upper: 51 acres
  - Lower: 370 acres
- Type:
  - Upper: Concrete Gravity—Sym. RCC
  - Lower: Concrete Gravity
- Height:
  - Upper: Approx. 125 ft above bedrock
  - Lower: 55 ft
- Length:
  - Upper: 6800 ft
  - Lower: 390 ft

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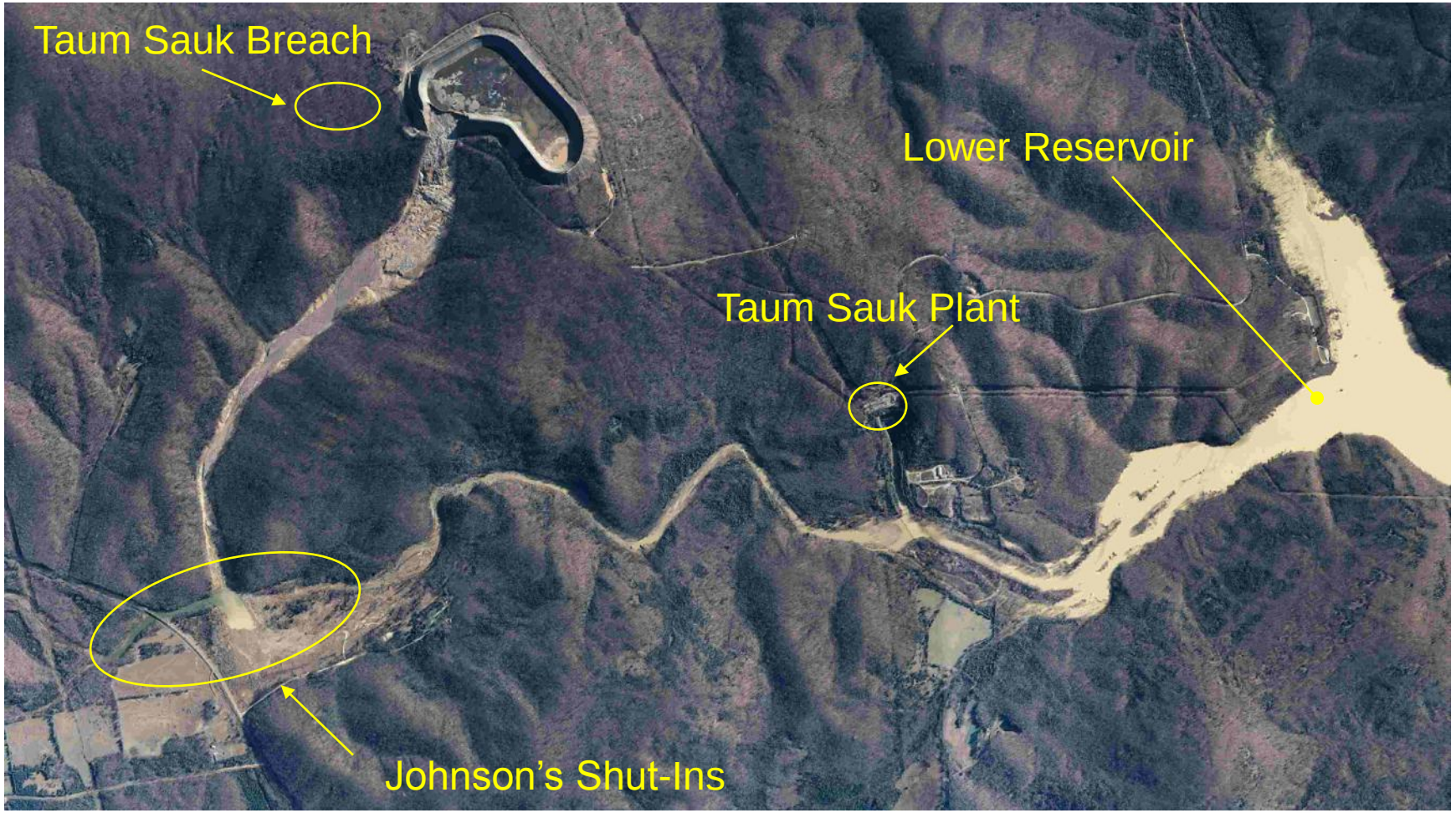
# INCIDENT SITE



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# WATER LEVEL CONTROL SYSTEMS

- ***Level Control*** **– Normal Operations**
  - **Low & High Probes**
    - **Differential Pressure & Radar**
    - **Run-time Checks**
- ***Level Protection***
  - **High Level & High-High Level Probes**
    - **Conductivity**
    - **Mechanical Float Switch**
- **Continuous Video Camera & Staff Gage**
  - **Including adequate lighting**
- **Overflow Release Structure (ORS)**
  - **Ultrasonic Gap Switch**
- **Redundant Power Systems, Including a UPS**



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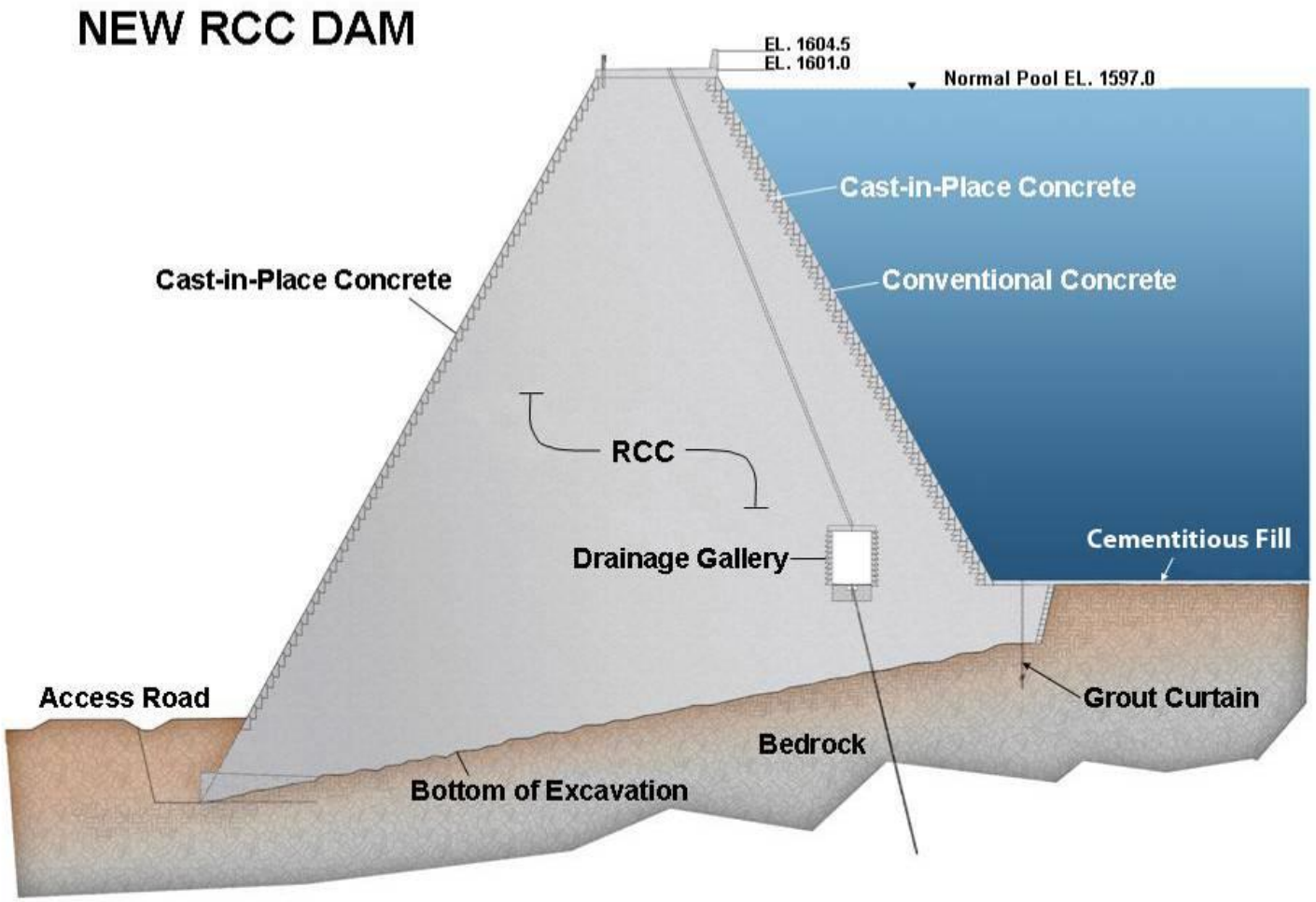
UR WARRICK
CABINET 1
UR WARRICK
CABINET 2
WARNING


02/06/2010 11:33

# DESIGN CROSS SECTION



# FOUNDATION EXCAVATION




10

# AGGREGATE PRODUCTION




11

# ON-SITE RCC BATCH PLANTS




12

# UPPER RESERVOIR OCTOBER 29, 2008

# COMPLETED REBUILD NOVEMBER, 2009

# UPPER RESERVOIR MILESTONES

- **Breach occurred December 14, 2005**
- **FERC authorization to reconstruct the Upper Reservoir Dam on August 15, 2007**
- **Initial RCC placement October 10, 2007**
- **Final RCC placement November 2009 (2,838,216 C.Y. RCC)**
- **Total concrete required was 3,200,640 C.Y.**
- **Over 800 personnel on-site at height of construction**
- **First filling of the Upper Reservoir on February 27, 2010**
- **Plant returned to commercial operation on April 15, 2010**



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# TAUM SAUK DAM VS. HOOVER DAM

## Taum Sauk Dam

- **Total Concrete – 3.2 Million Cubic Yards**
- Total Cement Used – 1.1 Million Barrels
- Total Excavation – 4.6 Million Cubic Yards
- Personnel at Height – 800
- Construction Duration – 2 Years
- Total Height – Approx. 100 Feet

## Hoover Dam

- **Total Concrete – 3.25 Million Cubic Yards**
- Total Cement Used – 5 Million Barrels
- Total Excavation – 1.76 Million Cubic Yards
- Personnel at Height – 5,200
- Construction Duration – 2 Years
- Total Height – 726.4 Feet



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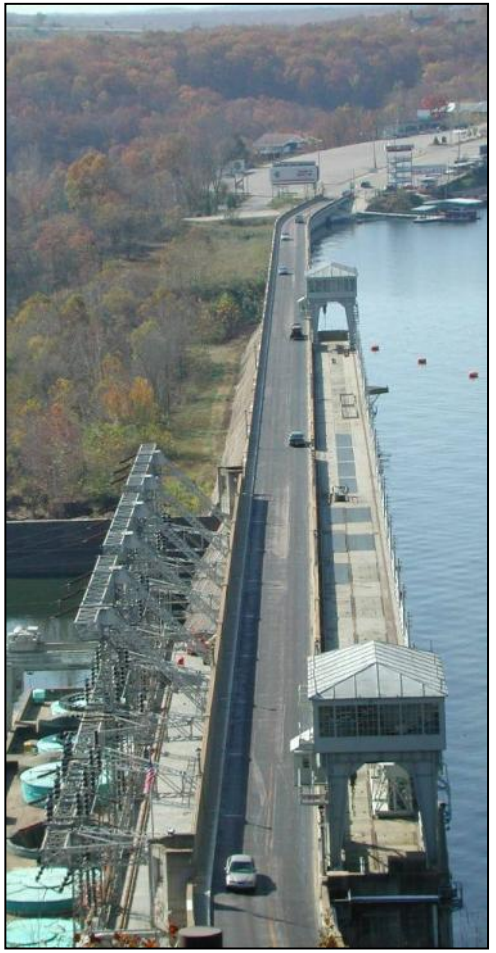
# CHANGES IN AMEREN AFTER INCIDENT

- Settlement agreement between Ameren and FERC required Ameren to implement a Dam Safety Program
- Increased awareness of potential dam hazards
- Developed computerized commitment tracking system
- Renewed dedication to dam safety at all facilities
- QMS Implementation



# TAUM SAUK RECENT ACTIVITIES

- Complete electrical systems upgrade (ICE) during rebuild outage
- Unit 1 generator failure in June, 2011
  - Returned to service in April, 2012 (10 months)
- Fall 2013 Outage
  - Rewound Unit 2 generator, completed Feb. 2014
  - Larger servomotors to address wicket gate (turbine ctrl valve) operation
  - Penstock inspection, first drain of upper reservoir
  - Replaced inlet valve seals on both units
  - Scroll case weld repairs
- Summer 2015 Outage
  - Unit 1 Turbine Inlet Valve (TIV) seal wiped
  - Requires draining the upper reservoir to repair (both units out of service)



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# NEW TAUM SAUK LICENSE – JULY 2014

- Original license 1960 – 2010
- New license is for 30 years, 2014-2044
- New plans required, coordinate with MDC, MDNR, USFWS
  - Water Management Plan
  - Bat Management
  - Fish Recovery
  - Historic Property Management
  - Recreation Management
  - Rock and Sediment Management



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# NEW TAUM SAUK LICENSE

- Annual requirements
  - Water Management report
  - Two USGS gauge payments
  - Fish stocking and fish habitat report
  - Upper and Lower Reservoir re-vegetation report
  - Annual FERC administration fee
  - Rock and Sedimentation report
- Modifications required
  - Revise upper reservoir lighting
  - Add fish habitat
  - Remove construction parking lot structures
  - Finalize building plans (security, museum, visitor center)



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