WATER CONTROL PLAN

- Overall Objectives
- Project Purposes
  - Flood Control
  - Hydroelectric Power Generation
  - Water Supply
  - Fish and Wildlife
  - Recreation
  - Incidental Benefits to Mississippi River
General Objectives. Mark Twain Lake is a flood control reservoir with multiple purposes. The purposes include hydroelectric power generation, water supply, fish and wildlife and recreation. There are also incidental benefits to Mississippi River navigation. The pool at elevation 606.0 feet NGVD retains one hundred percent of available flood control storage and one hundred percent of the joint-use storage for the other project purposes, namely hydroelectric power generation, water supply, fish and wildlife and recreation.
General Objectives/Overall Plan

1. Growing Season. Growing season typically is considered from April 1\textsuperscript{st} to October 31\textsuperscript{st}, but may vary depending on seasonal conditions. Growing season shall be complete when a significant amount of crops have been harvested as determined by consultation with local farming interests.

Downstream conditions should be evaluated to determine the maximum release that would be non-damaging. Releases are limited to 10,000 cfs, based on downstream conditions. The maximum release will be restricted to 6,000 cfs if the stage of the Mississippi River at Louisiana and/or St. Louis is at or forecast to be at or above flood stage below elevation 615.0 feet NGVD. Releases will be reduced to 2,000 cfs 24-hrs prior to crest on the Mississippi River and may be increased 24-hrs after crest.
For pool elevations exceeding 615.0 feet NGVD, maximum releases become 12,000 cfs, based on downstream conditions.

2. **Dormant Season.** Dormant season shall be considered to exist from November 1st to March 31st, but may vary based on seasonal conditions. During this period, the release rate may reach the maximum of 12,000 cfs independent of pool elevations.
Flood Control

Objective. The objective of flood control is flood damage reduction downstream of the project. Flood damage reduction benefits extend along both the Salt River and the Mississippi River downstream of the project.

During the growing season (April 1\textsuperscript{st} to October 31\textsuperscript{st}), the release will normally be 10,000 cfs or less (based on downstream conditions) until elevation 615.0 feet NGVD is exceeded. The growing season typically is considered from April 1\textsuperscript{st} to October 31\textsuperscript{st}, but may vary depending on seasonal conditions. Growing season shall be complete when a significant amount of crops have been harvested as determined by consultation with local farming interests. Releases may be restricted because of flooding on the Lower Salt River or on the Mississippi River at Louisiana and/or St. Louis, Missouri.
Flood Control

Lower Zone of Flood Control Pool (Elevation 606.0 – 615.0 ft NGVD). Seasonal channel capacities, prevailing flow and forecast stages downstream of the Reregulation Dam are considered when operating in this zone.

(a) The maximum release rate from the Reregulation Pool is 12,000 cfs during the dormant season (November 1st to April 1st).

(b) During crop season, the release rate from the Reregulation Pool will normally vary less than 10,000 cfs, based on downstream conditions. The nature of hydroelectric power generation is such that the release rate from Cannon Dam will normally vary between 0 cfs and 12,000 cfs.

The maximum release will be restricted to 6,000 cfs if the stage of the Mississippi River at Louisiana and/or St. Louis is at or forecast to be at or above flood stage. Releases will be reduced to 2,000 cfs 24-hrs prior to crest on the Mississippi River and may be increased 24-hrs after crest.
Flood Control

Upper Zone of Flood Control Pool (Elevation 615.0 - 638.0 ft NGVD). Seasonal channel capacities, prevailing flow and forecast stages downstream of the Reregulation Dam are considered when operating in this zone.

(a) The maximum release rate from the Reregulation Pool is 12,000 cfs during the dormant season (November 1st to April 1st).

(b) During crop season, the release rate from the Reregulation Pool may be increased to 12,000 cfs, based on downstream conditions. The nature of hydroelectric power generation is such that the release rate from Cannon Dam will normally vary between 0 cfs and 12,000 cfs.
Flood Control

Surcharge Pool (Above Elevation 638.0 feet NGVD). The minimum release from Mark Twain Lake is 12,000 cfs. If the inflow rate is greater than 12,000 cfs, PLATE 5-5 should be used in order to determine the appropriate release rate from Mark Twain Lake. PLATE 5-5 contains the surcharge pool regulation curves for the surcharge pool release rate.

(a) If Mark Twain Lake pool elevation is forecast (water on ground) to reach surcharge pool, the discharge may be determined from the surcharge pool regulation curves (PLATE 5-5).
Hydroelectric Power

**Objective.** The objective is to obtain the maximum amount of power generation revenue the project is capable of producing in conjunction with other project purposes.

**General Regulation Procedure.** When within the joint-use pool, hydroelectric power production will be scheduled so as to meet the needs of SWPA. Normal lake drawdown within the joint-use pool as the result of power production will be limited to 2.0 feet per calendar week (i.e., Sunday through Saturday) and 4.0 feet per month (i.e., any consecutive four calendar week period) during May through October. During the remainder of the year, normal lake drawdown will be limited to 2.0 feet per week with no monthly maximum. Care will be taken to meet the power needs of SWPA everyday, but final control always rests with the Regulating Office. The need may exist to curtail hydroelectric power production on an immediate basis for downstream conditions. Cannon Dam Power Plant was designed to produce 58,000 KW of electrical power (installed capacity) as a peaking plant.
Water Supply

**Objective.** The State of Missouri and the Federal Government have negotiated the water supply contracts which are shown in EXHIBIT C.

**Regulation Procedure.** The State of Missouri shall provide a letter of request to the Finance Office for water to be taken from the State water supply account. All water taken directly from either Mark Twain Lake or the Reregulation Pool will be metered and a monthly accounting will be forwarded to the Finance Office. The Finance Office will maintain records of joint-use storage water released from the project for water supply, in addition to the metered readings.
a. Objective. The objective is to ensure that the quality of water released from the Reregulation Pool meets the State of Missouri standards under 10 CSR 20 -7.031 (4)(J) Dissolved Oxygen. This regulation states that waters of the state of Missouri must maintain a level of 5 mg/L dissolved oxygen.

b. Regulation Procedure. In coordination between the Water Quality Office and the Water Control Office, tainter gate releases from Mark Twain Lake may be required in order to improve downstream water quality conditions. These decisions will be based upon dissolved oxygen data collection real-time within the Reregulation Pool, located at the Reregulation Pool stream gage. If the dissolved oxygen levels drop below the 5 mg/L criteria based on 10 CSR 20-7.031, subsection (4) part J Dissolved Oxygen, the preferred method of releases into the Reregulation Pool would be discharging water through the tainter gates.
Fish Spawn

Current WCM wording:

- The objective is to enhance fish and wildlife habitat to as great an extent as possible without conflicting with the achievement of other project purposes.
  - The pool elevation of Mark Twain Lake will be regulated whenever possible so as to minimize the amount of fluctuation during the period of time when fish are spawning.

Proposed Alternatives

- Fish Spawn up to pool elevation:
  - 608.0 thru 615.0
In regard to the Mark Twain Lake Water Control Manual Update, we noticed a proposed change in pool elevation for Fish Spawn between 23 April and 1 May - 15 June. Our understanding of this proposed alternative would require a constant or slightly rising pool elevation up to 613.0 feet above mean sea level.

It is our understanding of the Profile of Water Storage at Clarence Cannon Dam and Mark Twain Lake, that the Top of the joint-use pool is 606. Joint-use storage being:

- Power
- Water supply
- Recreation
- **Fish and wildlife**
- Inactive storage.

Storage between 606 Top of the joint-use pool and 638 Top of flood control pool is for **flood control storage**.

Therefore, the consensus is that the maintenance/raising of the pool elevation above 606 Top of joint-use pool for **any use other than flood storage** would greatly endanger, if not, significantly increase the risk of inadequate flood storage during the crop season.

As we discussed last week, please consider increasing the maximum elevation during the fish spawn period to 615 for about a 21 day period during the last two weeks of May, 1st week of June.

Also, could you consider and include some language about managing for an extended (100 days?) period of higher elevation (at least 615) during mid April through late July one of every four years.
Fish Spawn

**Comment 3**

When the dam was conceived its primary purpose was flood control, but the cost could be better justified for multi use as electric generation and recreation. It is difficult to balance these competing needs; however, one must be cognizant that the primary purpose is flood control. The fish spawn in the lake is incidental to flood control and must not be allowed to interfere with that purpose. Both purposes can be served only if maintaining a constant pool or rising elevation provides an elevation is 606 feet. Spring time flood pool should have no allocation to fish spawn.

**Comment 4**

This letter is in regards to the Missouri Department of Conservation (MDOC) request to raise the level of Mark Twain Lake. We feel going from 606 to 613, during the growing season, would negatively effect flood control in the Salt River basin. As they (MDOC) currently have control of the pool from 567.2 to 606 for wildlife, fish spawn, ect., we feel anything over 606 would be better suited for flood control. Thank you for your attention to this matter.
Fish Spawn

- Fish Spawn Elevations within the Flood Control Pool at other St. Louis District Projects
  - Lake Shelbyville – 602.0 (5.6%)
    - Equivalent to 608.6 at Mark Twain Lake
  - Carlyle Lake – 447.0 (7.5%)
    - Equivalent to 609.4 at Mark Twain Lake
Fish Spawn

- Flood Control Utilization at Mark Twain Lake
  - 608.0 – 4.3%
  - 609.0 – 6.6%
  - 610.0 – 8.9%
  - 611.0 – 11.3%
  - 612.0 – 13.7%
  - 613.0 – 16.1%
  - 614.0 – 18.7%
  - 615.0 – 21.3%
Fish Spawn

- Flood Control Utilization at Mark Twain Lake
  - For Elevations 608 thru 615
    - 1 ft of storage = 0.2” of runoff
    - For example:
      ▶ 2” of rainfall with 50% runoff = 1” of runoff = 5 ft of flood control storage

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<th>Elevation</th>
<th>608.0</th>
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<td>1.2”</td>
<td>1.0”</td>
<td>0.8”</td>
<td>0.6”</td>
<td>0.4”</td>
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# Fish Spawn

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<tr>
<th>Years of spawn out of 101 yr</th>
<th>Preferred Plan</th>
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<tbody>
<tr>
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<tr>
<td>608.0</td>
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<td>69%</td>
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<tr>
<td>613.0 to 615.0</td>
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54 Days
Fish and Wildlife

Objective. The objective is to enhance fish and wildlife habitat to as great an extent as possible without conflicting with the achievement of other project purposes. The Water Control Office coordinates with the Missouri Department of Conservation and the Mark Twain Lake Project Office to provide optimum fish spawning conditions each Spring and enhance waterfowl habitat.

Regulation. The pool elevation of Mark Twain Lake will be regulated from April 23rd to June 15th whenever possible so as to minimize the amount of fluctuation during spawn. This effort is in coordination with SWPA, COE and Missouri Department of Conservation. The Chief of Water Control Operations, taking into account all project purposes, hydrologic conditions and weather forecasts may attempt to moderate pool fluctuations during critical fish spawn when the pool elevation is 610.0 feet NGVD or below coordinated with Missouri Department of Conservation and Mark Twain Lake personnel.
**Recreation**

**Objective.** The objective is to provide the best possible water conditions to support recreational activities such as boating, swimming, fishing, hunting, camping, etc., consistent with the procedures outlined in 7-03. Recreational areas are located on the shoreline of Mark Twain Lake's 18,600-acre joint-use pool. These areas are operated by the COE, the Missouri State Park Board and concessionaires.

**Regulation Procedure.** Fluctuations within the joint-use pool, 606.0 feet NGVD, are limited to 2.0 feet per week and 4.0 feet per month in order to enhance recreation during May 1st through October 31st. Little regulation can be done within the Reregulation Pool to enhance recreation. Within the Reregulation Pool, large pool fluctuations and high flow velocities can be expected during power generation at Cannon Dam.
Incidental Benefits to the Mississippi River

Objective and Regulation Procedure. The navigation project purpose assigned to Clarence Cannon Dam and Mark Twain Lake is achieved incidentally on the Mississippi River during low-flow periods by the release of water for non-consumptive water supply, for water quality enhancement, for improvement of downstream fisheries, and for hydroelectric power generation.