

## VII - WATER CONTROL PLAN

7-01. General Objectives. The Lake Red Rock project was originally authorized for the primary purposes of flood control and low flow augmentation for water quality. Recreation and fish and wildlife facilities were subsequently authorized (see section 3-01).

Operation of the Lake Red Rock project in conjunction with the Saylorville Lake project provides flood control benefits to the communities downstream of these lakes, including communities along the Mississippi River below the confluence with the Des Moines River. Agreements pertaining to low flow augmentation for water quality have been reached with the City of Des Moines Water Works, Alliant Energy, and the State of Iowa for a minimum flow of 270 cfs at SE 6th Street in Des Moines and 300 cfs at Ottumwa. Conservation storage of 75,000 acre-feet formerly reserved at Lake Red Rock was reallocated to Saylorville Lake due to the high rate of sedimentation at Lake Red Rock. Following reallocation of storage to Saylorville Lake, 50,000 acre-feet of storage remains allocated in Lake Red Rock for low flow augmentation. A contract with the State of Iowa for water supply storage allows for a request by the State of Iowa for additional Saylorville Lake releases to account for industrial and municipal water supply demand below Lake Red Rock. The additional release is then passed through Lake Red Rock. A final objective was to implement a drought contingency operation plan that would ration water during extreme drought periods. The Drought Contingency Plan (August 1996) for Lake Red Rock and Saylorville Lake is Appendix B of the Master Reservoir Regulation Manual and is summarized in Schedule C of Exhibit B.

7-02. Constraints. The authorized plan of regulation considers several regulatory constraints regarding the operation of Lake Red Rock Dam. These include the downstream channel capacity, discharge and flood stage on the Des Moines River at Ottumwa and Keosauqua, flood stage on the Mississippi River at Burlington, IA, and Quincy, IL, emergency reservoir level, and minimum low-flow requirements. In regulation of the conservation pool, low-flow augmentation has priority over recreational needs.

Other constraints relate to the physical operation of the project. The maximum release at the outlet is controlled by the pool elevation. As can be seen from plate 2-7 the pool must be above elevation 751 feet NGVD to release 30,000 cfs through the conduits. Gate settings of 6, 7, and 8 feet should be avoided whenever possible on individual outlet gates to minimize vibrations. Gates 1 and 14 are vented individually. Gates 2 through 13 are vented in groups of three with the vents being closest to gates 2, 5, 10, and 13. When operating gates within

each group of three, the gate farthest away from the vent should be opened first and closed last.

7-03. Overall Plan for Water Control. The overall plan for the Lake Red Rock project implements a tandem regulation plan in conjunction with Saylorville Lake to provide a comprehensive scheme for conservation and flood control within the Des Moines River Basin. To achieve system operation of the two reservoirs, Saylorville Dam is operated to balance the percentage of flood control storage utilized at each reservoir as much as possible while satisfying other operational constraints. A floodway corridor between Saylorville Dam and the Sixth Avenue bridge in Des Moines, Iowa, was established to increase downstream channel capacity. The corridor incorporates approximately 18 miles of shoreline and 2,336 acres of land. Other components of the overall plan for water control are the Avon Station Remedial Works, Carlisle Remedial Works and the Des Moines Local Protection Works. For conservation storage, the plan of operation is designed to maintain the necessary minimum low-flow in the downstream reaches of the Des Moines River.

Integrated components of the Lake Red Rock project are as follows:

- (1) Saylorville Lake for flood control.
- (2) Floodway corridor for flood damage reduction and recreation.
- (3) Des Moines Local Flood Protection Works for flood control.
- (4) Avon Station Remedial Works for flood control and recreation.
- (5) Carlisle Remedial Works for flood control.
- (6) Saylorville conservation pool for water supply and low-flow augmentation.

7-04. Standing Instructions to Project Personnel.

These instructions, as listed in Exhibit B of this manual, are furnished to the Project Operations Manager. They outline the steps to be taken by the Project Operations Manager for collecting and transmitting hydrologic data and reading and recording of all gages and gate settings on the dam when communication with the District Office is disrupted.

An "emergency" is considered to exist when communication either by facsimile or telephone cannot be established between the

Project Manager and the Water Control Section during a significant period of time, and gate changes are necessary. Emergency situations can be minor in nature or of a magnitude demanding immediate action. During such situations, the operation of the reservoir is in accordance with provisions contained in the Standing Instructions listed in Exhibit B of this manual.

7-05. Flood Control. Techniques pertaining to the regulation of storage allocated to flood control in Lake Red Rock may be classified as method C as defined in, *Engineering Manual, EM 1110-2-3600, Management of Water Control Systems, 30 November 1987*. This provides for maximum damage reduction during ordinary flood events until the lower part of the storage is filled and then providing a fixed schedule of releases to assure greater control of larger flood volumes of approximate design magnitude. The Regulation Schedule is contained in Exhibit B.

The reservoir regulation schedule has been prepared to achieve the objectives outlined in paragraph 7-01, insofar as possible. Maximum reduction in discharge at downstream control stations is provided during periods when there is less utilization of flood control storage. As more storage capacity is utilized, the degree of downstream protection is reduced. For reduction of flooding along Des Moines River during the growing and non-growing seasons approximately 80 percent of the reservoir flood control capacity is utilized prior to the large magnitude flood level of 775 feet NGVD. The reservoir regulation schedule is given in the Standing Instructions in Exhibit B of this manual.

a. Objectives. Lake Red Rock is operated considering downstream control points at Ottumwa and Keosauqua, Iowa, on the Des Moines River and Burlington, Iowa and Quincy, Illinois on the Mississippi River. Storage in Saylorville Lake will be kept in balance with Lake Red Rock, insofar as possible, within the framework of operational constraints.

b. Constraints.

(1) Emergency constraint. An emergency is assumed to exist when the pool level is at or forecasted to exceed elevation 775 feet. Above this level, the large magnitude flood regulation Schedule B will be followed, and all other constraints will be disregarded.

(2) Control point constraint. The regulation plan for Lake Red Rock utilizes control points along the Des Moines River located at Ottumwa, Iowa and Keosauqua, Iowa and control points on the Mississippi River located at Burlington, Iowa and Quincy, Illinois. Regulation for control points applies when Lake Red Rock is between or forecasted to be between elevation 742 and 775

feet NGVD. Holdouts are determined according to the regulation schedule located in Schedule A, Exhibit B, minimizing flooding in the respective downstream reaches. A minimum flow release of 5,000 cfs will be made when operating for control points.

Flood protection along the Des Moines River for the reach downstream of Lake Red Rock, is provided by regulating releases, to the extent possible, to avoid exceeding the downstream constraints at Ottumwa and Keosauqua, Iowa. The controlling stages at Ottumwa are 7.5 feet (8.7 feet if the pool is above 760) during the growing season and 10.8 feet during the non-growing season. The controlling stages at Keosauqua are 17.6 feet (18.4 feet if the pool is above 760) during the growing season and 19.6 feet during the non-growing season. Holdouts will not be in excess of that required to meet the Des Moines River control point constraints.

Operation of Lake Red Rock for Mississippi River flooding begins when the stage is at, or forecasted to be at or exceed 18.5 feet, for Burlington, Iowa or 20.0 feet at Quincy, Illinois. Holdouts for flooding along the Mississippi River will not be in excess of that required to limit the Quincy stage to 20.0 feet. The release is determined as the maximum allowable considering all constraints.

(3) Downstream channel constraint. In the reach of the Des Moines River from Red Rock Dam to the mouth, the channel capacity increases from approximately 18,000 cfs to more than 24,000 cfs with 3 feet of freeboard as registered at the Ottumwa and Keosauqua gages, respectively. During the non-growing season (16 December through 01 May) larger discharges can be tolerated through the two reaches without causing excessive damage. During the growing season (01 May through 15 December), if the lake level is between conservation pool 742 feet NGVD and 760 feet NGVD and the outlet capacity permits, inflows will be released up to a maximum outflow of 18,000 cfs. However, when the lake level is between 760 and 775 the maximum outflow is 22,000 cfs. During the non-growing season (16 December through 01 May), a maximum outflow of 30,000 c.f.s. is permitted when the lake level is between elevation 742 and 775.

(4) Balancing constraint. Flood control storage between Lake Red Rock and Saylorville Lake will be kept in balance in terms of percent of storage utilized, by reducing outflows from Saylorville Lake as necessary while satisfying other constraints.

c. Normal flood control operation. Normal flood control operation is accomplished by regulation of releases through operation of 14 conduit gates. The basic objective is to release the maximum permissible outflow as limited by the conduit capacity and other constraints outlined above.

d. Large magnitude flood operation. Large magnitude flood operation takes effect when the pool level is at or forecast to exceed 775 feet NGVD. Releases as specified in the Regulation Schedule B will be made through the outlet conduits until the required release rate exceeds the gated conduit capacity. At this point the outflow will be transitioned to the Spillway. Outflow rates will be increased as the pool continues to rise in accordance with the schedule shown in Schedule B. At pool elevation 785 feet NGVD the spillway tainter gates will be opened sufficiently to maintain the pool at 785 until unrestricted discharge prevails.

7-06. Recreation. Lake Red Rock has many recreational opportunities that are supplied by the Corps of Engineers, including boat ramps, swimming beaches, campsites, and trails. The Corps builds, staffs, and maintains these facilities but does not specifically regulate the reservoir for them.

A number of conditions occasionally occur which affect recreational activities at the lake. Long-term drought can leave boat ramps landlocked while reduced outflows can limit fishing in the tailwater area. Conversely, floods may inundate boat ramps, parking lots, picnic areas, and trails. While high velocity outflows can improve fishing downstream of the reservoir, it also produces dangerous turbulence in and just downstream of the stilling basin. This can produce a life-threatening situation for fishermen and boaters choosing to ignore warnings and enter the restricted area near the outlet structure.

7-07. Water Quality. Water quality releases are intended to be met at least 90 percent of the time as defined in the Post Authorization Report. Water quality objectives are part of the authorized project purposes contained in the Senate Document (S/D 9/85/1). The objectives are met by maintaining a minimum flow of 200 cfs from Saylorville dam to the confluence with the Raccoon River, 270 cfs from the confluence to the sewage treatment plant (Des Moines river mile 199), and 300 cfs below that point to Ottumwa. Low-flow releases from Saylorville Lake need to be adjusted such that minimum low-flow requirements in the specified reaches are satisfied until Saylorville Lake falls to elevation 827 feet NGVD at which time water rationing begins. The conservation storage in Lake Red Rock is then utilized to satisfy the Ottumwa minimum constraint of 300 cfs until Lake Red falls to elevation 734 NGVD at which time water rationing begins.

7-08. Fish and Wildlife. The conservation pool is normally maintained at elevation 742 feet NGVD. However, at the written request of the Iowa Department of Natural Resources (IDNR) the pool may be gradually raised as much as two feet to an elevation of 744 feet NGVD during the fall season (September, October,

November). The request by IDNR should be sent to CEMVR by September 1 each year. The timing of the pool raise greatly enhances the waterfowl food supply along the shoreline of the pool. In addition, large numbers of shore birds use the upper portion of the conservation pool. The pool can be held at the 744 NGVD level until 15 December, then lowered to 742 feet NGVD before the lake freezes over.

7-09. Water Supply. There are no provisions for water supply storage in Lake Red Rock. However, the State of Iowa has a contract with the Federal Government for water supply storage in Saylorville Lake. Requirements for water supply are addressed in the Saylorville Lake Water Control Manual. The water supply contract allows the State of Iowa to request additional Saylorville Lake releases to account for industrial and municipal water supply demand below Lake Red Rock. The additional release is then passed through Lake Red Rock. Flows into Lake Red Rock are measured at the Runnels, Iowa, gage, which is funded by the State of Iowa. The Water Supply contract for Saylorville Lake requires that the Board of Water Works Trustees of the City of Des Moines and Alliant Energy reimburse the State of Iowa for gage operation. Ottumwa is the monitoring point downstream of Lake Red Rock.

7-10. Drought Contingency. During low-flow periods, the reservoir will attempt to maintain flows for water quality and water supply in accordance with the schedule shown in Exhibit B. This regulation schedule was developed by simulating reservoir operation over the period of record. Although the selected regulation plan proved to be effective for historic droughts, it does not guarantee that it will be the most effective plan for future droughts. Therefore, this plan of operation will be followed unless some unforeseen circumstance indicates that a different regulation procedure would serve the region better.

During a severe drought, it is important to develop an operating scheme for levels below the full conservation pool level which attempt to minimize deficits in demand as much as possible. One means of systematizing an operating scheme is by using a hedging rule, which involves a system of rationing based on pool levels. The philosophy behind the rule is that small deficits should be encouraged during the early months of a drought to avoid severe deficits later.

In assessing the effects of a worsening drought the Rock Island District assembles the views of State agencies, local governments, and large industrial users of water. Possible changes to Exhibit B, Schedule C, might be to advance or delay the point where rationing begins or to change water supply releases from a monthly to a weekly schedule. A more detailed

discussion concerning drought contingency can be found in *Appendix C, Master Reservoir Regulation Manual, Drought Contingency Plan, Lake Red Rock and Saylorville Lake, Oct 1996.*

7-11. Flood Emergency Action Plans. The U.S. Army Corps of Engineers last published an Emergency Action Plan that addresses extremely rare flow events from Red Rock Dam in April 1995. The included notification chart is updated on an annual basis. Copies of the Emergency Action Plan are available at the U.S. Army Corps of Engineers, Rock Island District Office in the following offices: Water Control, Emergency Management, and the Engineering Division. The Emergency Action Plan is also available at the Administration Office located at the Lake Red Rock Dam.

7-12. Other. At times the reservoir may have to be regulated for health or safety reasons or to aid construction efforts upstream or downstream of the dam. Deviations are discussed in the following paragraphs. If an emergency drawdown is warranted, the basic guidelines for such operations will be in accordance with *Engineering Regulation, ER 1110-2-50, Engineering and Design, Low Level Discharge Facilities for Drawdown of Impoundments, 22 August 1975.* Drawdown time requirements for various average inflow rates are shown on plate 7-1.

Periodically it is necessary to keep local interests affected by reservoir operation informed of forecasted water levels. Downstream areas are affected by major changes in release rates. The Public Affairs Office for the District is responsible for issuing informational bulletins to area news media for public dissemination. The Water Control Section furnishes hydrologic and operational information for press releases. Under certain emergency conditions, as described under flood warnings in the Standing Instructions listed in Exhibit B of this manual, the Operations Manager will keep the public informed of changes in reservoir outflow rates.

7-13. Deviation from Normal Regulation. The District Commander is occasionally requested to deviate from normal regulation of the reservoir. Prior approval is required from the Division Office except as noted in subparagraph "a" below. Depending on the time frame, a formal request for a deviation from normal regulation should be sent to the Division Office by letter or electronic mail. The communication should tell what the desired deviation is, why it is needed, and how long it will last. In the case of a dire emergency, notification of the deviation should be sent to the Division Office as soon as possible before, during, or after the deviation has taken place.

a. Emergencies. Some emergencies such as drowning, accidents, chemical spills or other temporary pollution problems require water control actions be taken immediately unless such actions would create equal or worse conditions. The Division Office must be informed of the nature of the deviation as soon as practicable. A written description of the deviation, how long it was or will be in effect, and the reason it was needed should be sent to the Division Water Control Manager.

b. Unplanned Minor Deviations. Unplanned instances create a temporary need for minor deviations from the normal regulation plan, although they are not considered emergencies. Construction accounts for the major portion of these incidents. Typical examples include utility stream crossings, bridgework, and major construction contracts. Deviations are sometimes necessary to carry out maintenance and inspection of facilities. Requests for changes in release rates involve periods ranging from a few hours to a few days. Each request is analyzed on its own merits. In evaluation of the proposed deviation, consideration must be given to upstream watershed conditions, potential flood threat, condition of the lake, and alternative measures that can be taken. Requests generally are granted providing there are no adverse effects on the overall regulation of the reservoir for authorized purposes. Approval of these minor deviations normally will be obtained from the division office by telephone. A written explanation of the deviation and its cause will be furnished by letter or electronic mail to the Division Water Control Manager.

c. Planned Deviations. Each request should be analyzed on its merits. Sufficient data on flood potential, lake and watershed conditions, possible alternative measures, benefits to be expected, and probable effects on other authorized and useful purposes, must be considered. These considerations, along with the district recommendation, will be presented by letter or electronic mail to the Division Water Control Manager for review and approval.



**LAKE RED ROCK REGULATION**

<p align="center"><b>SCHEDULE A</b></p> <p align="center"><b>Normal Flood Control Operation</b></p> <p align="center"><b>Pool Elevation: between 742 and 775 ft NGVD</b></p>	<p align="center"><b>Reservoir</b></p> <p align="center"><b>Pool: steady, rising, or falling</b></p> <p align="center"><b>Forecast: Peak below elevation 775 ft NGVD</b></p>
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<b>Condition</b>	<b>Operation</b>
<p align="center"><b>A-I</b></p> <p align="center"><b>16 Dec thru 30 Apr</b></p>	<p>Maintain conservation pool level 742 ft NGVD by releasing up to 30,000 cfs. Outflow is limited by the conduit capacity.</p>
<p align="center"><b>A-II</b></p> <p align="center"><b>16 Dec thru 30 Apr</b></p> <p>Stage at Ottumwa or Keosauqua above or forecast to exceed 10.8 feet and 19.6 feet respectively.</p>	<p>Provided inflow is in excess of 5,000 cfs, release not less than 5,000 cfs to avoid exceeding control stage at respective stations in so far as possible. Otherwise release not less than inflow except as permitted by Schedule D.</p>
<p align="center"><b>A-III</b></p> <p align="center"><b>01 May thru 15 Dec</b></p> <p>Reservoir at or above Permanent pool elevation 742 (744 or designated Fall pool; 15 Sep-15 Dec) but lower than 775.</p>	<p>Maintain conservation pool level by releasing up to 18,000 cfs (22,000 cfs if pool above 760) except as limited by Conditions A-IV and A-V.</p>
<p align="center"><b>A-IV</b></p> <p align="center"><b>01 May thru 15 Dec</b></p> <p>Stage at Ottumwa or Keosauqua above or forecast to exceed 7.5 feet and 17.6 feet respectively. If Pool is higher than 760 use stage of 8.7 feet and 18.4 feet respectively.</p>	<p>Provided inflow is in excess of 5,000 cfs, release not less than 5,000 cfs to avoid exceeding control stage at respective stations in so far as possible. Otherwise release not less than inflow except as permitted by Schedule D.</p>

**LAKE REI ROCK REGULATION**

<b>SCHEDULE A (continued)</b> <b>Normal Flood Control Operation</b>	<b>Reservoir</b> <b>Pool: steady, rising, or falling</b>
<b>Pool Elevation: between 742 and 775 ft NGVD</b>	<b>Forecast: Peak below elevation 775 ft NGVD</b>

<b>A-V</b>  <b>Any date</b> Stage at, above or forecast to exceed 18.5 feet on Mississippi River Gage at Burlington, IA, or 20.0 feet at Quincy, IL.	<p>Set release to reduce flooding along the Mississippi River in so far as possible. Release maximum allowable outflow considering all constraints as follows:</p> <p>If pool elevation is between conservation pool and elevation 760.0 and inflow is less than 5,000 cfs, release not less than inflow, otherwise release not less than 5,000 cfs.</p> <p>If pool elevation is between elevation 760.0 and elevation 766.5 and inflow is less than 15,000 cfs, release not less than inflow, otherwise release not less than 15,000 cfs except as limited by Conditions A-II and A-IV.</p> <p>If pool elevation is between elevation 766.5 and elevation 775.0 and inflow is less than 25,000 cfs, release not less than inflow, otherwise release not less than 25,000 cfs except as limited by Conditions A-II, A-III and A-IV.</p>
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**LAKE RED ROCK REGULATION**

<p align="center"><b>SCHEDULE B</b></p> <p align="center"><b>Large Magnitude Flood Operation</b></p> <p><b>Pool Elevation: above 775 feet NGVD</b></p>	<p align="center"><b>Reservoir</b></p> <p align="center"><b>Pool: steady, rising, or falling</b></p> <p align="center"><b>Forecast: Peak above elevation 775 feet NGVD</b></p>
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<b>Condition</b>	<b>Operation</b>																												
<p align="center"><b>B-I</b></p> <p align="center"><b>Any date</b></p> <p>Reservoir elevation is above or forecast to exceed elevation 775 ft NGVD.</p>	<p>When the predictions indicate that anticipated runoff from a storm will appreciably exceed the storage capacity remaining in the reservoir when operated under schedule A, release rates will be made in accordance with the following schedule:</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: left;">Pool Elev</th> <th style="text-align: left;">Outflow cfs</th> </tr> </thead> <tbody> <tr><td>775</td><td>30,000</td></tr> <tr><td>776</td><td>35,000</td></tr> <tr><td>777</td><td>40,000</td></tr> <tr><td>778</td><td>45,000</td></tr> <tr><td>779</td><td>50,000</td></tr> <tr><td>780</td><td>60,000</td></tr> <tr><td>780.5</td><td>80,000</td></tr> <tr><td>781</td><td>100,000</td></tr> <tr><td>781.5</td><td>115,000</td></tr> <tr><td>782</td><td>130,000</td></tr> <tr><td>783</td><td>130,000</td></tr> <tr><td>784</td><td>130,000</td></tr> <tr><td>785</td><td>Open spillway tainter gates as necessary to maintain reservoir elevation 785 until uncontrolled spillway and outlet conduit discharge prevails, then allow reservoir to continue rising with uncontrolled spillway and outlet conduit discharge.</td></tr> </tbody> </table>	Pool Elev	Outflow cfs	775	30,000	776	35,000	777	40,000	778	45,000	779	50,000	780	60,000	780.5	80,000	781	100,000	781.5	115,000	782	130,000	783	130,000	784	130,000	785	Open spillway tainter gates as necessary to maintain reservoir elevation 785 until uncontrolled spillway and outlet conduit discharge prevails, then allow reservoir to continue rising with uncontrolled spillway and outlet conduit discharge.
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## LAKE RED ROCK REGULATION

<b>SCHEDULE C</b> <b>Drought Operation for Water Quality</b> <b>Low Flow Augmentation</b>	<b>Reservoir</b> <b>Any date reservoir is below</b> <b>elevation 742.0 NGVD</b>
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Condition	Operation
Pool is above elevation 734 ft NGVD.	Release not less than 300 cfs.
Pool is between elevation 733 and 734 ft NGVD.	Release 290 cfs.
Pool is between elevation 732 and 733 ft NGVD.	Release 275 cfs.
Pool is between elevation 731 and 732 ft NGVD.	Release 250 cfs.
Pool is between elevation 730 and 731 ft NGVD.	Release 225 cfs.
Pool is between elevation 729 and 730 ft NGVD.	Release 200 cfs.
Pool is between elevation 723 and 729 ft NGVD.	Release 175 cfs.
Pool is between elevation 718 and 723 ft NGVD.	Release 150 cfs.
Pool is below elevation 718 ft NGVD.	Release 100 cfs.

**LAKE RED POOL REGULATION**

<b>SCHEDULE D</b> <b>Flash Flood Operation</b> <b>Pool Elevation: between 742.0</b> <b>and 760.0 feet NGVD</b>	<b>Reservoir</b> <b>Pool: steady, rising, or falling</b>
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<b>Condition</b>	<b>Operation</b>
<b>1 Apr thru 30 Oct</b> Reservoir elevation at or below 760.0 and stage at Ottumwa at, above, or forecast to exceed 10.8 feet.	Release not less than 500 cfs to control flows at Ottumwa insofar as possible for a maximum of 48 hours.