VIII - EFFECT OF WATER CONTROL PLAN

8-01 General. The water control plan presented in this manual provides for greater releases from Fullerton Dam, under non-damaging circumstances, than the previous water control plan. The increased releases will take advantage of the downstream channel improvements made by OCEMA in the 1970's. The plan also incorporates the real-time analysis of three hydrologic parameters; water surface elevation, rainfall, and downstream flow, to more readily react to increasing local runoff entering the downstream channel. The intent of the plan is to make the optimum use of the downstream channel to increase available flood control space, thereby increasing the level of protection provided by the dam.

8-02 Flood Control.

a. Spillway Design Flood. The spillway of a dam is designed to pass the maximum inflow resulting from the most severe combination of rainfall and runoff conditions that might reasonably be expected to occur. This hypothetical flood is called the Probable Maximum Flood (PMF), and the spillway must withstand the PMF without threatening to overtop the dam or causing damage to any dam structure.

(1) Original Criteria. The 1939 spillway design flood for Fullerton Dam was computed using the modified rational method and a hypothetical 4 day storm. The fourth day of this storm produced 9 inches of rain, as averaged over the Fullerton Dam drainage area, and resulted in a peak inflow of 9,300 cfs. This sharp inflow peak created a maximum spillway surcharge of 8.4 feet and a spillway flow of 3,380 cfs. The top of the dam was set at 307 ft. NGVD, providing 8.6 feet of freeboard.

(2) Revised Criteria. A 1969 interim report addressing the hydrology of Fullerton Dam (ref. c in pl. 1-01) led to a new PMF for judging the performance of the Fullerton Dam spillway. The new storm is 6 hours in duration and has an average areal precipitation depth of 8 inches. The watershed characteristics used to produce the PMF include a loss rate of 0.10 inches/hour, 40 percent impervious cover in the valley portion of the watershed, and a base flow of 15 cfs/sq. mi. from the Puente Hills area.

The revised PMF routing, as shown on plate 8-01, assumes an initial water surface elevation of 290 ft. NGVD (spillway crest). The peak inflow of 16,000 cfs produces a spillway outflow of 5,650 cfs, and the resulting freeboard of 5.5 feet is considered adequate. The water control plan does not affect the PMF routing as presented in the 1969 Review of Design Features of Existing Dams (ref. i, pl. 1-01).

b. Standard Project Flood. The Standard Project Flood (SPF) represents the runoff event that would result from the most severe combination of rainfall and watershed conditions that are considered reasonably characteristic of an area. The Corps of Engineers began using the SPF as the criteria for protecting urban areas in 1952, and, until recently, it served as the Reservoir Design Flood for the construction of flood control dams.

(1) Original Reservoir Design Flood. The reservoir design flood was computed from a 4 day storm with an increasing inflow peak on each successive day. The total 4 day rainfall was 14.28 inches, and the 24 hour rainfall on the 4th day was 7 inches, resulting in a peak inflow of 4,600 cfs. The total storm runoff volume was 1,730 acre feet. The rainfall distribution and modified rational method used to compute the runoff produced a sharply peaked inflow hydrograph. Based on this inflow pattern and a controlled outflow of 240 cfs, the spillway crest was set at an elevation of 290 ft. NGVD.

(2) Current Standard Project Flood. The standard project flood presented here was originally developed for the previous Reservoir Regulation manual. The storm of 30 December 1933-1 January 1934, which was centered over the La Crescenta area north of Los Angeles, was transposed over the Fullerton Dam drainage area to produce the current SPF. The storm was centered to produce the greatest project storm rainfall amounts that would be consistent with reasonable assumptions concerning the causative meteorological situation. The maximum 1-, 6-, 24-, and 42-hour (total storm) average precipitation over the area was 0.80, 3.38, 9.25, and 10.20 inches, respectively.

A synthetic unit hydrograph was used to compute runoff from rainfall. An average variable loss rate of 0.20 inches/hour with a minimum of 0.10 inches/hour was used for the Puente Hills, and a constant 0.20 inches/hour was assumed in the valley areas. Forty percent of the valley area was considered impervious, and a baseflow of 10 cfs/square mile was used for the Puente Hills. Using an 'n' value of 0.025 and the Fullerton S-graph, a peak discharge of 2100 cfs was computed with a total flood volume of 1,750 AF. Although these values appear similar to the original reservoir design flood, the SPF shown on plate 8-02 represents a significantly greater critical volume event, because the inflow is continuous for a period of approximately 24 hours, as opposed to four short-term inflow events spread over 4 days.

c. Flood of 16-18 February 1980. The period of 13-18 February 1980 contained multiple large runoff events into Fullerton Reservoir, as described in Section 4-06j. Within this five day period, a large portion of the runoff volume occurred between 0600 hours 16 February and 0600 hours 18 February. Because it represented a significant challenge to the flood control facility, this shorter time period was selected to test the water control plan described in this manual.

The three elements needed to fully implement the plan are Fullerton Dam water surface elevations, detailed precipitation records, and the flow record of the Fullerton Creek at Richmond Avenue gauge (FCKR). All three records were available in sufficient detail to test the plan. The results of comparison between the previous and the current water control plans are shown on plate 8-03.

Release rates are higher with the current plan than were actually achieved during the inflow event. The resulting shorter impoundment period will improve the dam's level of protection in a multiple storm event. Note the cutback in dam releases at 1800 hours on 16 February. This was due to increasing flows at the downstream gauge, indicating potential stress on the channel capacity's ability to handle both dam releases and local uncontrolled inflow. Downstream flow volumes decreased after a short period, and larger dam outflows were resumed.

Using the current water control plan, the peak water surface elevation at Fullerton Dam reservoir would have been reduced from the actual elevation of 279.6 ft. NGVD at 1900 hours 16 February, to an elevation of 277.4 ft. NGVD.

d. 100-Year Flood Routing. The 10-year flood inflow hydrograph was developed using the inflow frequency curve and the SPF runoff pattern. The 100-year flood was routed following the Reservoir Regulation schedule shown in Exhibit B. As shown on plate 8-06, the peak inflow of 3,030 cfs was reduced to a peak outflow of 710 cfs. The peak pool elevation was 292.4 ft. NGVD, 2.4 feet above spillway crest, resulting in spillway flow.

8-03 Recreational and Cultural Resources.

The water control plan will not affect any known cultural resources within the basin. The State Historic Preservation Officer concurred that there are no National Register or National Register eligible properties (letter dated 26 July 1985).

Under the current plan greater releases will be made, reducing the peak water surface elevation for specific events. This will reduce any impact that dam operations may have on existing recreational facilities water at higher elevations.

8-04 Water Quality.

Residence time for impounded water using the current plan will be decreased only a small amount compared to the previous plan. This will not affect surface or ground water quality.

8-05 Fish and Wildlife.

The reduced inundation time due to the current water control plan will not affect vegetation in any significant manner. Reduced inundation time will decrease any adverse impacts to wildlife. No threatened, endangered or candidate species have been observed during site visits to the reservoir area, and none are expected to be affected by the revised schedule. A finding of no significant environmental impact resulting from the water control plan was issued in the Environmental Assessment for Fullerton Dam Water Control Plan, dated August 1988 (pl. 1-01, u, Exhibit C).

8-06 Frequencies.

a. Peak Inflow and Outflow Probabilities. Discharge-frequency values in this manual were developed by routing inflow hydrographs representing specific frequency events through Fullerton Dam, using the Reservoir Regulation schedule shown in Exhibit B. Plate 4-15 shows two inflow peak durations, instantaneous and 24 hour. Based upon these curves, the greatest instantaneous inflow event recorded at Fullerton Reservoir (3,800 cfs, WY 1941) has approximately a 90 year return period, and the 24 hour maximum inflow event of 356 cfs (WY 1979) has only a 25 year return period.

The outflow curve, plate 8-04, reflects the Fullerton Dam Water Control Plan following the Reservoir Regulation schedule shown in Exhibit B. The curve shows a plateau at 450 cfs, which relates to the plan's recommended maximum release. The most frequent end of the curve (2 year to 10 year return period), is based primarily on historic operations adjusted to account for the new plan.

b. Pool Elevation Duration and Frequency. Plate 8-05 is the computed elevation frequency (filling frequency) curve for Fullerton Dam based upon 1985 conditions. These conditions include 25 percent of impervious cover in the drainage area above Fullerton Reservoir, runoff routing conditions, and the Reservoir Regulation schedule specified in Exhibit B. The curve shows that the return period for pool elevation at spillway crest is approximately 80 years. However, even if both outlet gates are maintained fully open throughout an entire inflow event, the dam cannot contain a 100 year flood without spillway flow.

8-07 Other Studies.

a. Hydrology. The "Interim Report, Review of Design Features of Existing Dams, Hydrology and Hydraulic Review of Prado, Brea, Fullerton, and Salinas Dams" dated November 1969 (see pl. 1-01, i), presents the derivation of the Probable Maximum and Standard Project Floods used in this manual.

b. Channel and Floodway Improvements. No studies addressing the downstream channel have been conducted by the U.S. Army Corps of Engineers since construction at Fullerton Dam. 100-year design discharges were presented by the Hydrology Section of the Orange County Flood Control District in the "Hydrology Report, Fullerton Creek Channel from Coyote Creek Channel to Fullerton Dam, 100-Year Local Flood Design Discharges" revision dated June 1974 (pl. 1-01, m). The LAD's Santa Ana River Basin Orange County Interim 3 study of Coyote Creek and tributaries is scheduled to begin in fiscal year 1988.

A Flood Insurance Study was completed by the Federal Insurance Administration in July, 1977 (pl. 1-01, q). This study mentions the inadequacy of protection levels in Fullerton Creek at Chapman Avenue; and in Bastanchury Channel. A "Project Report for Fullerton Creek Channel from Wilshire Avenue to Chapman Avenue" was prepared by the Orange County Environmental Management Agency (OCEMA) in April, 1986. This report addresses the capabilities of the Fullerton Creek Channel at Chapman Avenue (see pl. 1-01, t), and suggested possible improvement plans. OCEMA is currently implementing these improvements, and periodically issues reports concerning further planned channel improvements.

Fullerton Dam was evaluated during the on-going "Los Angeles County Drainage Area (LACDA) Review Study", but because of its strictly local influence, Fullerton Dam was not included in the alternative analysis phase of that study.