VIII - EFFECT OF WATER CONTROL PLAN

8-01 General. Although the only congressionally authorized purpose for San Antonio Dam is flood-control, water conservation operation as approved by the Office of the Chief of Engineers has also provided additional water supply benefits. The communities of Upland, Montclair, Pomona, Ontario, and Chino are protected from the floodwaters originating from the steep and rugged San Antonio Canyon. In addition to flood protection the above communities also benefit from augmented water supplies for their spreading operations, when the dam is operated for water conservation.

8-02 Flood Control.

a. Spillway Design Flood. Corps dams are designed to safely pass (i.e., without overtopping and/or dam failure) the Probable Maximum Flood (PMF). The PMF is based upon the most severe combination of rainfall and runoff conditions that could reasonably occur. In both the original and revised PMF flood routings the reservoir outlets were assumed blocked and the reservoir was filled to the spillway crest at the beginning of the flood.

(1) Original Criteria. The San Antonio Dam spillway was designed in 1951 to pass a flow of 53,700 cfs having a surcharge on the ogee crest of 16.9 ft. An additional 5.1 ft. of freeboard placed the top-of-dam at elevation 2,260 ft.

The original PMF was based on the U.S. Weather Bureau's estimate of maximum possible precipitation. A constant precipitation loss rate of 0.15 in/hr and a constant base flow of 1,300 cfs were used to develop the PMF. The resulting peak inflow to San Antonio Dam was 60,000 cfs with a total runoff volume of 18,500 ac-ft over a 22 hour period.

(2) Revised Criteria. The probable maximum flood was selected as the spillway design flood. Estimates of the probable maximum precipitation for the basin above San Antonio Dam site is given by the Hydrometerological Section of the United States Weather Bureau in the report dated August 1972, titled "Probable Maximum Thunderstorm Precipitation Estimates for Southwest States", which was revised 5 April 1973. The 6-hour basin average PMP thunderstorm had a maximum 1/4-, 1/2-, l-, 2-, 3-, 4-, 5-, and 6-hour precipitation values of 3.4, 5.0, 6.6, 8.4, 9.7, 10.5, 11.2, 11.9 inches respectively, compared with original 1/2-, l-, and 3-hour values of 3.1, 5.5, and 12.0 inches. A 15-minute time interval was selected as it provided adequate definition of unit hydrograph. The time distribution of rainfall was patterned after the rainfall-time sequence from EM 1110-2-1411. The basin lag time was reduced 15 percent to account for the reduction in time of concentration of rainfall excess characteristics of large floods where the hydraulic efficiency of the watershed was increased by high depths of flow. The loss rate was taken as a constant equal to 0.15 inches per hour for the entire duration of the storm. A basin n value of 0.05, along with the Mountain S-graph was used to develop the synthetic unit graph. A constant base flow of 1,300 cfs was adopted from the previous study. The probable maximum flood peak inflow for San Antonio Dam, using the updated PMP criteria, is 59,700 cfs which is almost identical to the original peak inflow. The

volume for the probable maximum flood, using the updated PMP criteria is 18,200 acre-feet as compared to the original estimate of 18,500 acre-feet. Plate 8-01 shows the revised PMF routing.

The revised spillway design (probable maximum) flood for San Antonio Dam was routed through the reservoir assuming all outlets blocked and the reservoir filled to spillway crest at the beginning of the flood. This routing (see pl. 801) resulted in a maximum water surface elevation of 2254.4 which is 5.6 feet below the existing top of dam (El. 2260).

Based on a design wind speed of 45 mph from the north and using the procedure described in ETL 1101-2-221, the calculated freeboard was 2.4 feet. However, a minimum freeboard of 3.0 feet is required for a Standard 1 dam with a protected downstream face (App. A, EC 110-2-163). The available freeboard is 5.6 feet.

b. Standard Project Flood (SPF). The Standard Project Flood selected as the reservoir design flood for San Antonio Dam has an inflow peak of 19,000 cubic feet per second and maximum 2-day volume of 22,500 acre-feet. The flood was based on the January 1943 storm which had flood-producing characteristics more severe than any storm that occurred during the 77-year period 1880-1956. This storm as transposed so that it was centered over the drainage area above the dam and was assumed to occur when ground conditions were similar to those existing prior to the March 1938 storm. Rainfall loss rates were assumed to vary from 0.80 inch per hour at the beginning of the storm to 0.15 inch per hour at the end of the storm with an average loss rate of 0.40 inch per hour. A base flow, varying from 400 cubic feet per second at beginning of storm runoff to a peak of 1,300 cubic feet per second was assumed. Snowmelt was not considered an appreciable factor in developing the flood.

(1) Original Criteria. The original planned reservoir regulation schedule restricted outflows from San Antonio Dam to 8,000 cfs. With this release constraint the SPF would form a maximum pool elevation 2,238 ft (i.e., spillway crest).

(2) Revised Criteria (1978). At the time of project completion in 1956, it was determined that sufficient downstream channel freeboard existed to permit a maximum release of up to 8,500 cfs for short periods of time. With this revised schedule the SPF would form a maximum pool elevation of 2230.7 ft. This is 7.3 ft. below spillway crest which indicates that San Antonio Dam provides better than SPF protection.

(3) The 1991 Operations Criteria. The recent hydraulic analysis (See Sect. 7-02, a. (2)) has shown that the maximum channel capacity below San Antonio Dam is 8,000 cfs. The reservoir design flood (SPF) is routed through the Dam, with reduced gate openings for maximum release set at 8,000 cfs and the maximum water surface elevation reached 2231.92 ft. This is about 6.08 feet below the spillway crest (2238 ft.) leaving approximately 1034 ac-ft of emergency flood-control storage space to spillway crest relative to net capacity. Plate 8-02 shows the revised routing of the SPF through San Antonio Dam.

c. Other Floods.

(1) Storms and floods of January 1969. A series of storms that began on January 18 and continued through January 27 was caused by a strong flow into southern California of very warm, moist air originating over the tropical Pacific Ocean south and east of Hawaii. This series of storms was interrupted by a brief ridge of high pressure that moved through the area on January 22 and 23 and caused a short break in the rainfall. Except for this lull on January 22 and 23, heavy precipitation occurred during most of the January 18-26 period. An intense downpour occurred on January 25. Nine-day totals ranged from 10 to 20 inches in the lowlands and from 25 to more than 50 inches over mountain areas of southern California. The total storm amount at Mt. Baldy Notch was nearly 53 inches, including 28.25 inches during the two-day period 24-25 January. Lytle Creek Ranger Station recorded over 42 inches. Peak discharge on San Antonio Creek (USGS 11-0730) 4.5 mi. above San Antonio Dam was 16,400 cfs on 25 January, while peak inflow to San Antonio Reservoir was recorded at 6570 cfs on 25 January. Plate 8-03 displays storm data for this flood event at San Antonio Reservoir.

(2) Storms and floods of February 1969. The storm series that occurred in late February 1969 climaxed more than a month of extremely heavy, recurring rainfall in southern California. The storms occurred as a number of Pacific cyclones traveled southward off the west coast of the United States and then curved inland across California carrying copious quantities of moisture. Several cold fronts and other disturbances that moved across southern California from 22 February through 24 February dropped moderately heavy amounts of precipitation. Early on 25 February a strong cold front moved slowly southeastward across southern California; the front was accompanied by strong low-level winds that, when lifted by the mountains, resulted in great quantities of orographic precipitation. As a result, rainfall was generally heavy everywhere and particularly heavy in the mountains. Total storm amounts recorded at selected mountain stations were 19.5 inches at Mt. Baldy Notch, including 12.45 inches on in two days, 24-25 February, and 14.22 inches at nearby Lytle Creek, including 11.85 inches during the same two days. Peak discharge on San Antonio Creek (USGS 11-0730) 4.5 mi. above San Antonio Dam was 4,560 cfs on 25 February, while peak hourly inflow to San Antonio Dam was 3132 cfs on 25 February. San Antonio Dam recorded a higher proportion of the discharge, reflecting more highly saturated soil conditions due to the prior January 18-26 storm. Plate 8-04 displays storm data for this flood event at San Antonio Reservoir.

(3) Storm and flood of February 1978. After several moderately heavy storms during January and early February 1978, one low-latitude Pacific storm developed west of southern California and moved into the area during the night of 9-10 February. After a day of heavy rain in the San Gabriel and San Bernardino Mountains on 9 February, a major cloudburst struck portions of coastal southern California during the early hours of 10 February, with brief intensities exceeding 3 inches per hour. The very heaviest rain fell in Los Angeles County, but several stations in the Santa Ana River Basin reported intense rainfall between 0200 and 0400 hours 10 February, including 1.6 inches in 2 hours at Lytle Creek Ranger Station and 1.2 inches in 1 hour at Running Springs, in the mountains east of San Antonio Creek. The peak hourly

discharge on San Antonio Creek for that period was 2070 cfs at San Antonio Dam on 10 February at 0600 hours. Plate 8-05 displays storm data for this flood event at San Antonio Reservoir.

(4) Storm and flood of March 1978. In a pattern very similar to that of exactly 40 years earlier, a series of low-latitude Pacific storms moved in southern California at the end of February and beginning of March 1978. There were four major periods of rainfall during the storm period: 28 February, 1 March, 4 March, and 5 March. Total rain from 27 February through 6 March exceeded 29 inches in the eastern San Gabriel Mountains, with Lytle Creek Ranger Station recording 29.62 inches. The heaviest sustained rain fell during the mornings of 1 March and again during mid-day 4 March. The Lytle Creek station measured up 2.7 inches in 3 hours on 4 March. With the ground highly saturated from an already very wet winter, runoff from these storms was very high, especially in terms of flood volumes. The water surface elevation behind San Antonio Dam reached 2198 ft NGVD on 15th of March. The peak flow for the storm period on San Antonio Creek was 2040 cfs on 5th of March.

(5) Storm and flood of February 1980. The floods of February 1980 resulted from a series of low-latitude Pacific storms that moved into southern California from out of the west. The heaviest bursts of rain occurred on 14, 16, and 19 February. Rainfall intensities of 1 inch per hour for 5 to 6 hours was observed in the Sepulveda Basin during the afternoon of 16 February. Briefer bursts occurred in other areas, where Lytle Creek Ranger Station reported exactly 1 inch in 1 hour and 2.6 inches in 3 hours. The water surface elevation behind San Antonio Dam reached 2225.6 ft NGVD on 6 March. The peak flow for the storm period on San Antonio Creek was 1624 cfs on 16th of February. Plate 8-06 displays storm data for this flood event at San Antonio Reservoir.

(6) Storm and flood of February-March 1983. During the winter of 1982-1983 a series of low-latitude Pacific storms moved into southern California from the west from late November through February. These storms were the result of atmospheric flow patterns associated with the strongest El Nino condition since at least 1891. The rains climaxed between 25 February and 2 March 1983, during which a storm reminiscent of those of 5 and 45 years earlier moved into southern California at the end of February and first of March 1983. Up to 20 inches fell in the Lytle Creek area (approximately 8 inches of it on 1 March), with 12-18 inches in other San Gabriel Mountain areas and 8-10 inches over the foothill areas. The heaviest rainfall occurred with the passage of a strong occluded cold front during the late morning of 1 March, with peak intensities well in excess of 1 inch per hour. Several stations experienced rainfall having return periods in excess of 100 years for durations between 30 minutes and 6 hours. One Los Angeles County cloudburst of 2 inches in 5 minutes (Bel Air Hotel, 1 March 1983) was more than 4 times the 100-year rainfall for that duration at that station. Plate 8-07 displays storm data for this flood event at San Antonio Reservoir.

The rainfall through late February had saturated the ground everywhere, resulting in very favorable runoff conditions when the storm of 1-2 March dropped warm rain over the basin. The maximum hourly inflow to San Antonio Reservoir on 1 March was 998 cfs with maximum reservoir level 2188 ft.

8-03 Recreation. There are no recreational facilities either upstream or downstream of San Antonio Dam which depend on or are affected by the inflows to San Antonio Dam.

8-04 Water Quality. The short residence time of floodwaters does not appreciably affect the water quality within the reservoir.

8-05 Fish and Wildlife. The short inundation time does not adversely affect the vegetation within the reservoir and has minimal adverse affects on wildlife. There are currently no threatened, endangered, or candidate species within the reservoir. There are no fisheries within the reservoir. A Finding of No Significant Impact (FONSI) for this Water Control Plan was issued in the Environmental Assessment for the San Antonio Dam Water Control Plan, dated June 1991 (Exhibit D).

8-06 Water Supply. San Antonio Dam can be operated for water conservation below water surface elevation 2,176 ft. when runoff and weather forecasts indicate that no compromise of the flood control purpose of the dam will occur.

Regulation of the dam for water conservation enables augmentation of local water supply through the downstream groundwater recharge of floodwaters released.

8-07 Hydroelectric Power. There are no hydroelectric power facilities at San Antonio Dam.

8-08 Navigation. San Antonio and Chino Creeks are ephemeral streams and therefore not suitable for navigation. During floodflows the steep supercritical flows preclude safe use of the waterways and so navigation of any kind is prohibited at all times.

8-09 Frequencies.

a. Peak Inflow and Outflow Probabilities. Plate 8-08 is an analytical graph of the peak inflow frequency at San Antonio Dam computed from the historical records at the damsite from 1931 to 1990. Plates 8-09 and 8-10 are best fit graphical curves of median plotting points of peak annual outflow and reservoir elevation data of San Antonio Dam. The table on plate 8-11 gives specific values of inflow, outflow and filling frequency for San Antonio Reservoir as derived from curves shown on plates 8-08, 8-09, and 8-10.

b. Pool Elevation Frequency. Plate 8-10 shows the computed elevation frequency curve for San Antonio Dam. The values for this curve at specific return periods is listed on plate 8-11.

8-10 Other Studies.

a. Hydrology. The "Interim Report on Hydrology and Hydraulic Review of Design Features of Existing Dams for Carbon Canyon, San Antonio, and Tahchevah Dams" dated August 1978 reevaluated the hydrology of the San Antonio Canyon upstream of San Antonio Dam. The Probable Maximum Flood routing presented on plate 8-01 was taken from this report.

b. Channel and Floodway Improvements. The cursory report "San Antonio Creek and Chino Creeks Channel Updated Hydrologic Study" dated April 1986 determined that portions of the downstream channel are no longer capable of carrying either the Standard Project Flood or the 100-year flood. In light of this information, the San Bernardino County Flood Control District is currently developing a Master Drainage Plan for the area. One of the primary goals of the study will be to accurately identify the inadequate portions of both San Antonio and Chino Creeks so that corrective measures can be taken.