# VII - WATER CONTROL PLAN

**7-01 General Objectives.** Prado Dam and Reservoir is Congressionally authorized to provide flood protection to the metropolitan area of Orange County. Therefore, the protection of the downstream floodplain shall take priority over protection from inundation of reservoir lands and leaseholders. Prompt advance notification of reservoir land leaseholders will be made whenever predicted water surface elevations will inundate leaseholders.

As recognized in the original project authorization and project design, Prado Dam has and continues to be regulated in order to minimize the waste of water to the Pacific Ocean, whenever such regulation does not interfere with or diminish the primary objective of flood control. During times of low flood threat, Prado Dam can be regulated to control the flows of the Santa Ana River so that outflow from the dam will not exceed the recharge capacity of the OCWD ground water replenishment facilities, located downstream from the dam.

Other Prado Dam regulation objectives include: minimizing adverse environmental impacts, minimizing impacts to endangered species, minimizing maintenance costs to the dam and downstream channel, minimizing impacts to reservoir lands and activities (i.e., to leaseholders), maintaining public health and safety, and minimizing water quality problems.

**7-02 Major Constraints.**

**a. Channel Capacity.** From past experience, when sustained flows in excess of 2,500 cfs have been released from Prado Dam, damage to the Santa Ana River channel has occurred. The unlined channel passing through the Green River Golf Course will begin to spill onto the golf course at releases greater than 4,000 cfs. Also the water surface of the Santa Ana River has reached the low cord of the Green River Golf Course access bridge. Other types of damage further downstream include: severe scour around bridge piers and drop structures, failure of drop structures, damages to levee embankments, and the rupture of a sewer line. Releases from Prado Dam have had to be reduced during the flood season so that emergency repairs to the channel could be accomplished.

Given the past performance history of the downstream Santa Ana River channel, releases from Prado Dam will be kept below 2,500 cfs for small to medium magnitude flood events. The maximum controlled release for larger flood events will remain 5,000 cfs. Plate 4-21a-b is a schematic of the lower Santa Ana River channel, showing the long-term and short-term channel capacities. During large releases, channel observers both from the Corps and the OCEMA, must be dispatched along

the Santa Ana River to observe the performance of the channel and to report any situation that may be of concern.

During a large flood event, local runoff may fill a major portion of the downstream channel. Because controlled releases from a flood control project should not cause or contribute to downstream flooding, releases from Prado Dam may need to be reduced during the intense portions of a significant flood event when downstream channel capacity is needed to convey runoff from the uncontrolled drainage area downstream of Prado Dam. Telemetry or reports from channel observers are used to determine the appropriate action.

**b.** Reservoir Deficiency. Because of the increase in the design storm and increased runoff resulting from urbanization of the watershed, the peak inflow for the reservoir design flood increased from 193,000 cfs to 282,000 cfs (for present conditions). The peak inflow for the Probable Maximum Flood (PMF) increased from 289,000 cfs to 670,000 cfs (For present conditions. See Table 4-2). The reservoir, which was originally believed to control a 200-year flood, can currently only control a 70-year flood. Major floods exceeding the capacity of the existing reservoir would cause catastrophic damage in an area inhabited by about two million people. A Standard Project Flood (SPF) would inundate over 110,000 acres of highly urbanized land, and directly involve hundreds of thousands of homes, thousands of businesses and factories and hundreds of schools; the direct damages from a flood of this magnitude are estimated at about 15 billion dollars. In spite of this information, the maximum controlled release from Prado Dam remains 5,000 cfs due to the conveyance limitation of the downstream channel with respect to extended reservoir releases.

Under current conditions, if the revised PMF were to occur, the existing dam would be overtopped by 4.3-ft causing even greater damage than that described for a SPF in the preceding paragraph. In the event that the water surface approaches the top of dam, the water control manager should consider opening the gates in an attempt to increase the release rate to avoid overtopping the dam.

**c.** Flooding within the Reservoir. As listed in Table 3-3, there are numerous environmental, public, and private concerns and developments located within the Prado Flood Control Basin. Because flood control is the primary purpose for Prado Dam, these concerns and developments are subject to inundation during operations. Although inundation of these concerns and developments during flood control operations is not an operational constraint, the water control manager should be aware of the effects of high water surface elevations on reservoir land uses at Prado Dam. The following paragraphs describe four of the more significant concerns within the Prado Flood Control Basin.

(1) Least Bell's Vireo Nesting Habitat. The willow-dominated riparian habitat within the flood control basin is being considered as critical habitat for the LBVI, which is listed as an endangered species. Taking of an endangered species is considered a federal offense and is punishable by fine and/or imprisonment. As defined in The Endangered Species Act of 1973 (PL 93-205) the term "take" means to harass, harm, pursue, hunt, shoot, wound, trap, kill, capture or collect, or to attempt to engage in any such conduct. Taking of LBVI's, therefore, includes destruction of the nesting habitat or disturbing the birds or their nests in such a way as to cause the birds to abandon their nesting sites. The LBVI are migratory birds which inhabit the flood control basin from about mid-March through September. Impoundment of water during the nesting season is closely monitored and regulated to minimize adverse effects to the habitat and nesting activities of the LBVI.

(2) Corona Municipal Airport. This is a recreational airport managed by the City of Corona and used primarily for small private planes. The airport is located between elevations 514-ft and 536-ft. A rising water surface warning is given by the ROC to avoid inundation of privately owned aircraft and other movable airport facilities.

(3) Corona Percolation Ponds. Land is leased by the City of Corona from the Federal Government for an effluent spreading area (ten ponds covering approximately 60 acres) and effluent pipeline and access road (elevations 534-540-ft.). The spreading grounds are designed to handle five million gallons per day (7.7 cfs) of treated effluent. In the past, the City of Corona has alleged that high water surface elevations within Prado Reservoir have caused a detrimental reduction in the percolation rates of the ponds.

(4) Prado Petroleum Company. The Prado Petroleum Company, which operates 13 oil wells within the Prado Reservoir, has filed an inverse condemnation suit against the United States. Their contention is that water conservation activities have resulted in a taking of Prado Petroleum's mineral rights.

Prado Petroleum has stated that their oil production is curtailed when the reservoir reaches WSE 492.0-ft because of saturated ground conditions that limit their ability to access, service, or repair pipelines that carry oil from the well field area to a central processing plant on the south side of the flood control basin. Although, many of the wells can be operated when submerged, maintenance of the wells is difficult if not impossible.

In addition to reduced profitability, Prado Petroleum is concerned that the meandering Santa Ana River may, once again, cause the rupture of one of their oil lines. On January 23, 1983 the meandering Santa Ana River undermined one of their oil towers causing it to topple and rupture an oil line. Between 2,000 and 3,000 gallons of oil were spilled into Prado Reservoir. The clean-up operation was

coordinated through the EPA and the U.S. Coast Guard. The U.S. Government had to file suit against Prado Petroleum in an attempt to recover the costs of the clean-up operation. In an out-of-court settlement Prado Petroleum agreed to reimburse the U.S. Government for 50% of the clean-up costs.

After prolonged inundations it takes as long as three weeks for access roads to dry out sufficiently for oil and gas maintenance vehicles to pass. Surface saturation due to a rise in the ground water table could also cause the access roads to remain impassable for even longer periods of time.

Three of the wells are located on a Federal lease and the remaining ten wells are located on a private lease (SARDCO lease). Table 7-1 lists the elevations at which the wells are located. Plate 2-11 shows the locations of the wells within the flood control basin. The following two sections summarize both the federal and private leases involved in the litigation:

**Table 7-1**

Prado Dam Oil Well Survey
(June 1990)

| Well Number | Elevation (ft) |
|---|---|
| SARDCO Lease | |
| 1 | 508.0 |
| 2 | 495.8 |
| 3 | 501.8 |
| 4 | 501.5 |
| 6 | 502.9 |
| 7 | 503.7 |
| 8 | 494.5 |
| 9 | 495.1 |
| 10 | 493.2 |
| 11 | 504.2 |
| Federal Lease | |
| 1 | 496.7 |
| 2 | 496.5 |
| 3 | 496.2 |

(a) Federal Lease. The Federal lease was issued by the Bureau of Land Management in 1965 to Prado Petroleum's predecessor-in-interest, Don C. Winkler. Prado Petroleum acquired the Federal Lease in 1983.The Federal lease gives the lessee:

> the exclusive right and privilege to drill for, mine, extract, remove and dispose of all oil and gas deposits ... [in the leased area for a stated primary term, and] ... so long thereafter as oil or gas is produced in paying quantities; ...

A stipulation of the Federal lease reads:

> (1) That all rights under this lease are subordinate to the rights of the United States to flood and submerge the lands, permanently or intermittently in connection with the operation and maintenance of the Prado Flood Control Basin Project.

(b) SARDCO Lease. The private lease is for drilling rights on land which is currently owned by the OCWD. In 1967 OCWD acquired the lands from the Santa Ana River Development Company (SARDCO) by condemnation. Pursuant to the final order of condemnation, OCWD received title to the land for the purpose of:

> augment [ing] water supplies of the ORANGE COUNTY WATER DISTRICT and the conservation of water within and outside said District.

subject to:

1. the perpetual flowage easement which was granted in favor of the United States in 1944, and
2. an oil and gas lease (the SARDCO lease) allowing no more than 8 drilling islands, 2 acres in surface area each, measured at elevation 516 ft.

The perpetual flowage easement gives the United States the following right:

> The right to prohibit human habitation, and a perpetual easement to flood and inundate any or all of said Parcels ... intermittently as may be required from time to time, incidental to the successful operation and maintenance of the Prado Flood Control Basin for controlling storm water run-off, ...

The SARDCO lease gives the lessee the following right:

> the sole and exclusive right ... to drill for, produce, extract and take oil, gas ... (and water for its operations) from the land ... with the right of surface entry ... at all times ... together with rights-of-way for passage over, upon and across, and ingress and egress to and from, said lands, ... for so long as oil or gas ... is produced in paying quantities ...

**7-03 Overall Plan for Water Control.** Flood protection to the lower Santa Ana River floodplain is achieved through the joint functioning of Prado Dam and the OCEMA improved downstream channel. Prado Dam captures and stores flood runoff and the downstream channel safely conveys the reservoir releases through the floodplain to the Pacific Ocean.

The OCEMA channel has sustained severe structural damage in prior flood events (1969, 1978, 1980, and 1983) in which long duration flood control releases were made from Prado Dam. The structural problems were primarily the result of sediment degradation problems in the earth-bottomed channel.

Operational experience in the more recent flood events of 1980 and 1983 along with improvements and repairs to the channel subsequent to these floods, indicate the capability of the channel to handle sustained reservoir releases of up to about 2,500 cfs without significant degradation problems. Therefore, the Prado Dam Water Control Plan has been formulated to utilize up to one-third of the reservoir storage if reservoir releases can be limited to 2,500 cfs. However, whenever more than one-third of reservoir storage is projected to be filled (based on forecasted flood inflow), reservoir releases are increased to greater than 2,500 cfs. The increase in releases to greater than 2,500 cfs is made recognizing the risk of possible structural damage to the downstream channel and the possibility of loss or reductions of channel conveyance capability that could result.

In summary, the Prado Dam Water Control Plan is designed to limit the exposure of the downstream channel to possible structural damage by controlling smaller flood events with smaller non-damaging (to the channel) releases, and reserving larger reservoir releases for larger flood events.

**7-04 Standing Instructions to the Project Operator for Water Control.** The standing instructions to the project operator for regulation of Prado Dam and Reservoir are given in Exhibit A. During periods of normal communications, the dam tender will receive operating instructions from water control managers operating the Reservoir Operations Center (ROC), located at the District Office in Los Angeles. In the event that communication with the ROC is interrupted, the dam tender should follow the standing instructions in Exhibit A.

**7-05 Flood Control.** The water control plan for Prado Dam and Reservoir was developed with primary consideration given to:

(1) The operation plan that was approved by the Office of the Chief in August, 1969.
(2) The operational experience gained from the past 20 years of operation.

(3) The hydraulic performance characteristics of the downstream channel.
(4) The endangered species within the reservoir, specifically, the least Bell's vireo (LBVI).

The Water Control Diagram (Plate 7-01) illustrates the water control plan for Prado Dam. As shown on the water control diagram, release ranges are prescribed for given elevation ranges within the reservoir. Plate 7-02 indicates the storage volumes between each release range.

Under "Normal Communication Conditions" the release rate is determined by the water control manager at the ROC. The water control manager examines the current hydrometeorologic conditions, and the weather and runoff forecast for the Santa Ana River Basin. Section 6-02 of this Water Control Manual describes the use of three inflow forecast methods available to the water control manager; namely: a) the Santa Ana River Real-Time (SARRT) Water Control System, b) the QPF/API algorithm, and c) the Recession Limb Inflow Forecast Model. The following sections provide further information regarding specific regulation constraints for each release range shown on Plate 7-01.

It should be noted that the upper WSE's for each release range are "target" WSE's. The water control manager's decisions regarding the regulation of Prado Dam are based upon available weather and runoff forecasts. Since weather and runoff forecasts are rarely 100% accurate, it is anticipated that the target WSE's will, at times, be exceeded. Whether or not the water control manager deems it necessary to implement the regulation guidelines of the next release range will depend upon the magnitude of encroachment into the next release range and the current weather and runoff forecast.

**a.** <u>WSE 460.0 - 490.0 (Debris Pool)</u>. (Release Range: 0 - 500 cfs) The debris pool is allowed to fill prior to flood control releases in order to prevent debris from entering and plugging the outlet works. There are no seasonal restrictions for inundation of the debris pool. Releases from the debris pool are normally coordinated with the OCWD and are set equal to the spreading capacity of the downstream groundwater recharge facility.

**b.** <u>WSE 490.0 - 494.0 (Buffer Pool)</u>. (Release Range: 200 - 2,500 cfs) The August 1969 water control plan transitioned from low debris pool water conservation releases to a maximum flood control release of 5,000 cfs, between the elevations of 490.0-ft and 490.8-ft (i.e., an increase in WSE of only 0.8-ft). Due to the channel erosion problems experienced on the Santa Ana River when prolonged releases from Prado Dam have exceeded 2,500 cfs (see section 4-09h), a buffer pool has been established which allows the water control manager to control small flood events without using large potentially channel damaging releases. The buffer pool, therefore, allows the water control manager to:

1. Minimize oscillation in the magnitude of reservoir releases, thereby reducing potential stream bank erosion in the Santa Ana River Canyon.
2. Reduce the oscillation in the release magnitude for a safer operation with respect to public use of the canyon.
3. Facilitate coordination with the OCWD groundwater recharge facility by providing the ability to temporarily curtail releases to permit the reconstruction of in-stream diversion dikes for groundwater recharge downstream.
4. Simplify the lengthy public notification process when a smoother, less abrupt transition from low to large releases is adopted.

Due to the presence of the endangered LBVI within the Prado Flood Control Basin, buffer pool regulation differs slightly during the winter flood season and the non-flood season as described below.

(1) Winter Flood Season. (15 September to 15 March) A release rate of between 200 and 2,500 cfs is calculated based on a real-time forecast of inflow volume (as described in Chapter 6) so as not to exceed elevation 494-ft. The drawdown release rate will be coordinated with the OCWD to maximize the conservation of water through ground water recharge (Note: a minimum release of 200 cfs is required except for temporary release cutbacks to facilitate OCWD's reconstruction of in-stream diversion dikes). Note that releases greater than 600 cfs will wash away OCWD's in-channel sand diversion dikes.

If a significant amount of inflow to the dam is forecast, the reservoir can be drawn down to the debris pool elevation of 490-ft within 24 hours, while releasing non-damaging flows i.e., releases at or below 2,500 cfs. Exhibit E outlines the procedure with which the water control manager can determine the required release. Several combinations of initial and forecasted conditions are presented.

(2) Non-Flood Season. (15 March to 15 September) In order to avoid impacts to the LBVI during their nesting season, the regulation is slightly modified during the non-flood season. Starting 15 March, the minimum release will either be: equal to the inflow (up to 2,500 cfs), or the OCWD ground water recharge facility capacity, or 200 cfs, which ever is greatest. The objective is to prevent a rise in the reservoir pool elevation which would adversely impact nesting LBVI.

c. WSE 494.0 - 520.0. (Release Range: 2,500 - 5,000 cfs) The water control manager computes a release magnitude based upon the criteria of not exceeding WSE 520-ft. If 520-ft will be exceeded the release rate should be 5,000 cfs. The forecasted reservoir inflow (current event plus succeeding events) can be determined using the forecast methods described in Chapter 6. Historically, sustained reservoir releases greater than 2,500 cfs have resulted in severe invert degradation and

significant structural damage along the lower Santa Ana River. Channel observers should be dispatched to monitor river conditions when releases exceed 2,500 cfs for an extended period of time. Should damage to the OCEMA channel occur, releases from Prado Dam may need to be cut back.

**d.** WSE 520.0 - 543.0. (Release: 5,000 cfs) Reservoir stages above 520-ft require the maximum scheduled release of 5,000 cfs. Since historical releases of 5,000 cfs have caused significant channel invert and side slope damage, channel observers should be dispatched to monitor river conditions. Should damage to the OCEMA channel occur, releases from Prado Dam may need to be cut back.

**e.** WSE 543.0 - 544.3 (Spillway Flow). (Release: 5,000 cfs) Flood control releases through the outlet works are reduced as the reservoir pool level rises above the spillway crest so as to maintain outflow from spillway plus outlet works at a maximum outflow of 5,000 cfs. As the WSE approaches the spillway, frequent communication between the ROC and the dam tender should occur so that the transfer of reservoir outflow from the outlet works to the spillway can be closely monitored.

**f.** WSE 544.3 and above (Spillway Flow). (Release Range: 5,000 cfs and above) All outlet gates are closed at reservoir pool levels of 544.3-ft and above (i.e., uncontrolled spillway discharge only). Under the extremely remote circumstance that the dam embankment were in danger of overtopping, the outlet gates are to be opened to minimize the possibility of dam failure. NOTE that the maximum design release from the outlet works is 17,000 cfs and that the design capacity of the outlet stilling basin is 10,000 cfs.

**g.** Reservoir Regulation Schedule. Plate A-01 is the reservoir regulation schedule which presents the recommended gate settings for the above described release ranges under both "Normal Communication Conditions" and "No-Communication Conditions". The reservoir regulation schedule can be applied to both the rising and falling limb of a flood event.

**7-06** Recreation. Water is neither impounded nor released for either upstream or downstream recreational purposes. Recreational activities within the reservoir are adversely affected when inundation occurs.

Downstream of Prado Dam, the Green River Golf Course and Featherly Park are adversely affected when flood control releases in excess of approximately 2,500 cfs are made. These facilities are within the Santa Ana River flood plain and are therefore subject to flooding.

**7-07 Water Quality.** This water control plan does not specifically address any water quality concerns. The U.S. Fish and Wildlife Service, Santa Ana Watershed Project Authority (SAWPA), the California Regional Water Quality Control Board (Santa Ana Region), and the OCWD monitor various aspects of water quality upstream and downstream of Prado Dam.

During emergencies, the water control manager can operate Prado Dam to contain pollution spills either in or downstream of Prado Dam and Reservoir. Such was the case in 1983 when an oil spill occurred within the reservoir. The water control manager was requested by the U.S. Coast Guard to maintain a constant water surface elevation to facilitate the clean-up operation.

**7-08 Fish and Wildlife.** The importance of biological resources has been recognized in several Federal environmental laws, including NEPA, the Fish and Wildlife Coordination Act, and the Endangered Species Act. The first two laws require that the conservation of biological resources, by preventing or minimizing damages, shall receive equal consideration and be coordinated with other features of water resources programs. The Endangered Species Act stipulates that each Federal Agency shall ensure that agency's actions are not likely to jeopardize the continued existence of any endangered or threatened species or result in destruction or adverse impacts to critical habitat for such species. These acts also require Federal agencies to coordinate with the U.S. Fish and Wildlife Service and State agencies regarding such matters.

The LBVI, an endangered species, is a small, gray, migratory songbird that feeds mainly on insects. Their nests are usually low in thickets along willow-dominated riparian habitats with lush understory vegetation (Photo 7-1). The LBVI arrives in its breeding habitat in mid-March to early April, and departs in late August and September for its wintering range, which is unknown but possibly includes southern Baja California. The decline of the LBVI is attributed to the widespread loss of riparian habitats and from brood parasitism by the brown-headed cowbird (*Molothrus ater*).

Areas of the Prado Flood Control Basin are recognized as important habitat for the LBVI. When the LBVI nests within the Prado Basin, the U.S. Fish and Wildlife Service closely monitors the nesting locations. The Water Control Plan, as described in Section 7-05, addresses these concerns by ensuring that maximum flood control releases will be made during the nesting season. This will reduce the likelihood of "taking" LBVI's. The maximum desired WSE during the nesting season is 490.0-ft.

A minimum flow of 60-cfs is desired in the downstream channel to provide a constant flow of water for fish habitat between the dam and the OCWD groundwater spreading facilities. Although there is no formal agreement between the Corps and

any other agency requiring this minimum flow, the Corps does attempt to maintain this minimum flow whenever possible.

**Photo 7-1:** Nesting least Bell's vireo

**7-09** **Water Supply**. The water control plan allows the water control manager to release water in a manner that facilitates the OCWD groundwater recharge activities when the weather and runoff forecasts are favorable. Sections 7-05a and 7-05b describe the specific conditions related to water conservation releases.

**7-10** **Prado Dam Maintenance**. When Prado Dam was completed in April 1941 the outlet works consisted of two ungated outlets and six gated outlets. At the request of the OCWD and the OCEMA both ungated outlets have been plugged. The 7-ft by 12-ft cable-operated tractor gates were not designed or constructed for year-round reservoir impoundments. Therefore, the months of July, August, and September (typically the lowest runoff months of the year) have been designated as the period when routine maintenance of the dam, outlet works, and embankment will be scheduled. Scheduling of dam maintenance operations has a high priority, in relation to other project objectives.

For maintenance activities requiring a dry reservoir area, such as servicing of the gates, a release schedule which provides for outflow equal to inflow will be prepared. Conversely, for maintenance of the downstream gage, outlet channel, or energy dissipator, it may be necessary to curtail reservoir releases, thereby creating an impoundment. In this latter instance, the month of September is the most favorable time period because the LBVI begin their fall migration in September.

Construction-Operations Division should formally notify Engineering Division at the start of the flood season of the desired maintenance period and the type of maintenance activities.

**7-11 Deviation from Normal Regulation.** There may be instances when it is necessary for the regulation of Prado Dam to deviate from the established flood control plan described in this chapter. Prior approval of deviations is required from the ROC, except for emergencies as described in paragraph 7-11a below.

**a. Emergencies.** Emergencies may take the form of drownings or other accidents, chemical spills, and failure of operational facilities. Necessary action should be taken immediately to contend with emergencies. In any action taken, assessment of the situation by the dam tender should rely on his knowledge of the dangers involved. The ROC must be informed of any deviations due to emergencies as soon as practical. Emergency deviations do not require prior approval by SPD, but coordination with SPD must be made as soon as practical.

**b. Unplanned Minor Deviations.** Instances arise periodically which require minor deviations from the normal regulation of the reservoir. Construction activities are the primary source of these deviations. Downstream maintenance of culverts and channel sections are another reason for minor regulation changes. Each request is analyzed on its own merits. Consideration is given to the potential of flooding and possible alternative measures. Approval for these minor deviations must be obtained from the ROC.

**c. Planned Deviations.** There are planned instances which require deviations from normal regulation. Each condition will be judged on its own merits. Requests for planned deviations must be coordinated through the Reservoir Regulation Section at CESPL. As per the MEMORANDUM FOR Commander, Los Angeles District, from the Division Commander dated March 20, 1991:

> All planned deviations from approved water control plans for reservoir projects within the South Pacific Division must be coordinated with the Coastal Engineering and Water Management Division at CESPD. Approval must be given prior to implementation of the deviation.

**d.** Monthly Gate Exercise. In order to ensure that the outlet works gates remain functional throughout the year and to free any accumulations of sediment or debris from the gate pulley and cable mechanisms, a monthly gate exercise is performed on the first Monday of each month. This may be postponed if conditions so warrant. The monthly gate exercise is as follows:

1) The dam tender checks with the ROC to determine the "wait" period between gate exercises (See Appendix F).
2) The dam tender checks the downstream channel from the downstream gage to the outlet works to assure no one is immediately downstream of the outlet works.
3) All gates are closed.
4) Each gate is individually raised to 5-ft and then immediately closed. When an impoundment exists at Prado Dam, the water control manager will determine a wait period between the opening of each individual gate.
5) All gates are returned to the original settings.
6) The downstream gage is checked to verify the outflow has returned to pre-gate exercise conditions.

Appendix F outlines the calculation procedure for determining the wait period between the operation of each individual gate.

The OCWD should be informed of the exercise to verify that no adverse conditions would be encountered downstream as a result of the sudden increase in flow from the gate exercise. OCWD should be informed that the sharp increases in flow will quickly attenuate as they progress downstream. For example an instantaneous outflow of 1,100 cfs will appear as a peak of 500 cfs at the SAR7 gage located a 1/4 mile downstream from Prado.

**e.** Drought Contingency Plan. Engineer Regulation 1110-2-1941 (Drought Contingency Plans) directs water control managers to "evaluate and establish the limits of flexibility under existing authorities to modify project regulation and to use existing storage to respond to periods of water shortages."

Prado Dam is located in a semi-arid region of the southwest where the consumptive use of water greatly exceeds local supply. Most of the water consumed in southern California is imported at great expense from remote sources such as the Colorado River and the Sierra Nevada Mountains. The entire storage space of the normally dry Prado Reservoir is allocated for flood control, although water conservation is a project purpose. Therefore, the adopted water control plan for Prado Dam was formulated with features that maximize the amount of water that can be conserved without adversely affecting the level of flood protection provided, or significantly impacting environmental resources (reference sections 7-05 through 7-

09). In essence the normal mode of project regulation is specifically geared to drought as this is the normal circumstance for the region.

A seasonal expansion (i.e., from March to September when the flood potential is small) of the water conservation capability of Prado Dam will occur upon formal adoption of the recommendations found in the "Review Report of Prado Dam Operation for Water Conservation", U.S. Army Corps of Engineers, Los Angeles District, dated January 1991. The report recommends adoption of seasonal re-regulation of Prado Dam to permit storage of water for conservation up to WSE 505-ft, provided OCWD agrees to mitigate adverse impacts to reservoir recreational facilities, biological resources, and other land users.

An emergency water conservation operation plan for Prado Dam was implemented during March and April of 1991 in response to the regions five year drought. A March 4, 1991 agreement among the OCWD, the USFWS, and the Corps permitted the operation of Prado Dam for water conservation up to about elevation 500-ft. This emergency water conservation plan was then implemented during the months of March and April of 1991. The emergency water conservation plan, which was only valid for the 1991 water year, permitted the regulation of Prado Dam in a manner consistent with the Prado Dam Water Conservation Study. As part of the arrangements to permit the emergency water conservation operation, the OCWD agreed to either fund or directly implement appropriate environmental mitigation measures to ensure the long term preservation of the least Bells vireo, an endangered migratory songbird which nests within the reservoir area from March to September.

**7-12 Rate of Release Change**. The maximum permissible rate of change in the release rate is dependent upon the magnitude of the current release. When increasing or decreasing the release rate one should consider the possibility of: structural damage to downstream improvements, levee bank sloughing due to rapid bank de-watering, and public safety, particularly in the Santa Ana Canyon just downstream of Prado Dam. Furthermore, OCEMA and OCWD will be notified prior to any significant change of release. Based upon past operational experience, the maximum permissible rates of release change shown in Table 7-2 should be followed under normal operating conditions.

**Table 7-2**

Maximum Permissible Rate
of Release Change at Prado Dam

| Current Rate of Release (cfs) | Maximum Rate of Change per 1/2 Hour (cfs) |
|---|---|
| 0 - 300 | 100 |
| 300 - 1,000 | 250 |
| 1,000 - 2,500 | 400 |
| 2,500 - 5,000 | 625 |