VENTURA COUNTY FLOOD CONTROL DISTRICT
CALIF.

# MATILIJA DAM

**reservoir operation**
**and modification**
**cost study**

## April 1975

CASITAS MUNICIPAL WATER DISTRICT
ORGANIZED 1952

VENTURA COUNTY
PUBLIC WORKS AGENCY
FLOOD CONTROL DISTRICT

CASITAS MUNICIPAL WATER DISTRICT

# MATILIJA DAM
# RESERVOIR OPERATION AND MODIFICATION COST STUDY

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April 1975

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## SECTION I

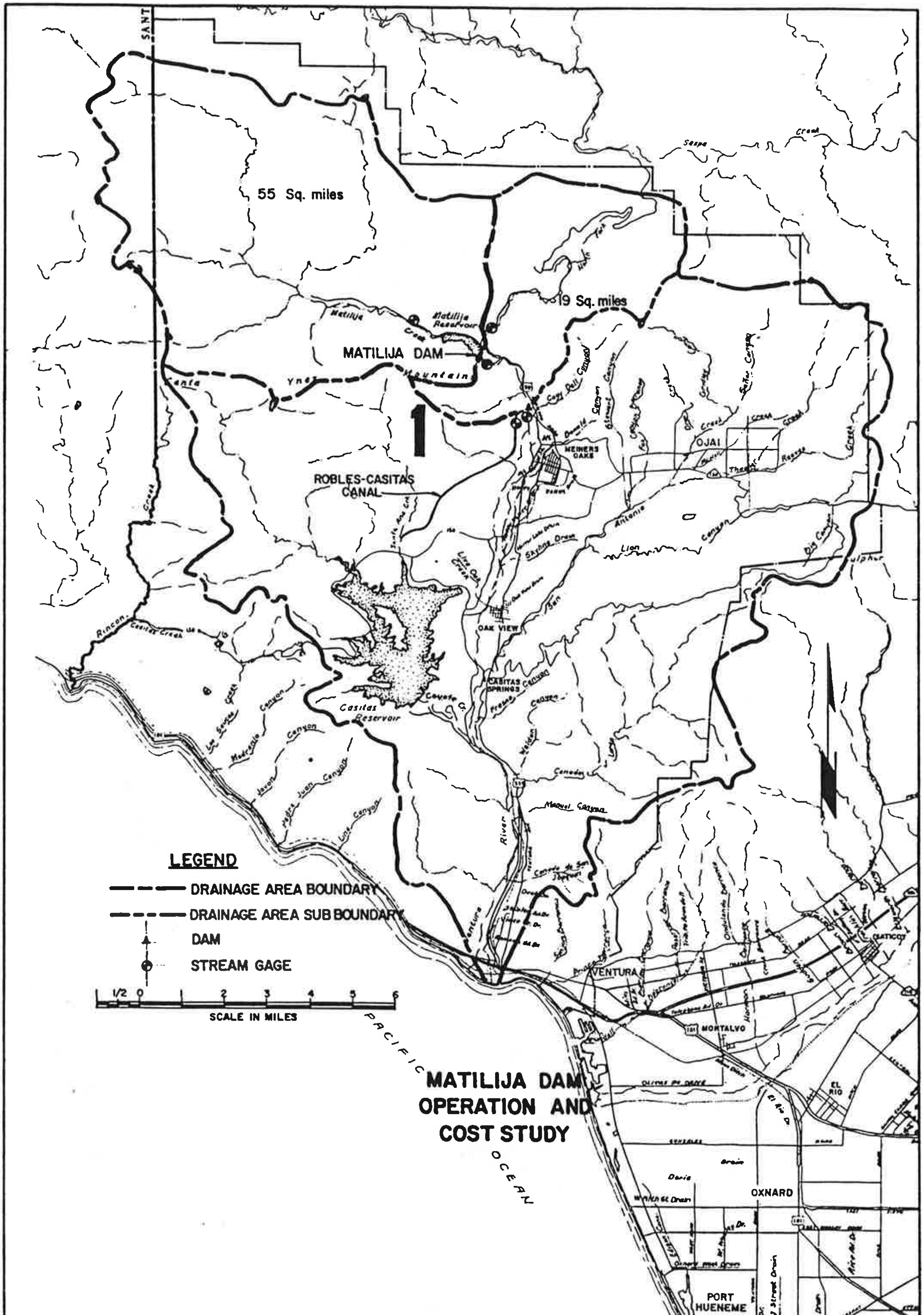
## INTRODUCTION

### PURPOSE OF STUDY

In a study completed in 1972 by the International Engineering Company, Inc., of San Francisco (IECO) for the Ventura County Flood Control District (FCD), the structural stability and current state of stresses in Matilija Dam were evaluated. The study found continued chemical expansion from an alkali-aggregate reaction in concrete flanking the existing spillway section which caused excessive cracking and made the concrete structurally ineffective. It was found that the footbridge spanning the notch near the left abutment would be stable for a horizontal acceleration of 0.1 g applied at Elevation 1095. However, for an earthquake measuring 6.5 to 7 on the Richter Scale occurring on the Santa Ynez fault, the footbridge was found to be unstable.

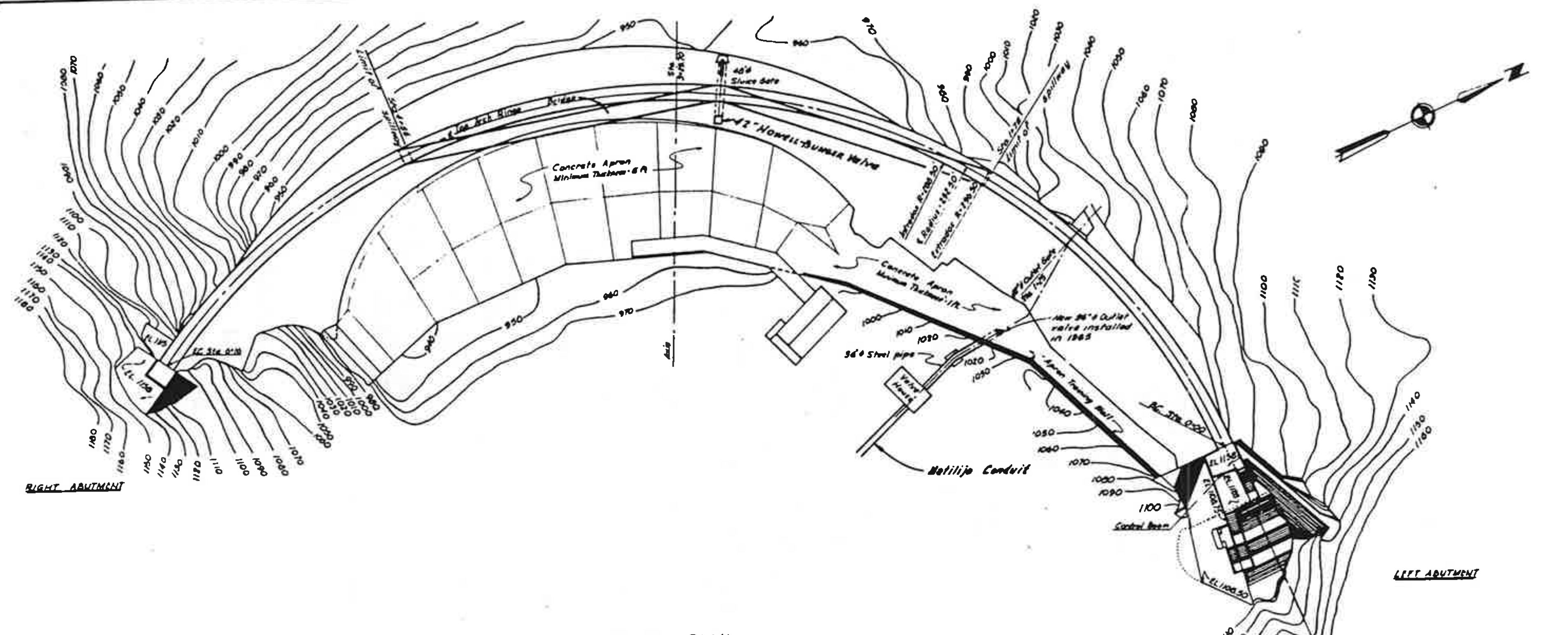
Recommendations by IECO included extensive testing of the concrete at various levels of the dam, an additional monitoring program of differential movement, and major modifications to the footbridge spanning the notch. More recent movement of concrete on the left side of the dam indicates a need for major modifications to the entire walkway crossing the dam, and the removal of additional sections of concrete flanking the spillway notch and above Elevation 1095.

In view of the continuing need for costly modifications to the dam to maintain its structural integrity, and the very significant reduction in storage capacity from the "as built" reservoir configuration, questions were raised regarding the future benefit of maintaining Matilija Reservoir as an active storage facility. On March 12, 1974, the Ventura County Board of Supervisors authorized staff to participate in a detailed study of Matilija Dam and Reservoir to determine probable costs of necessary



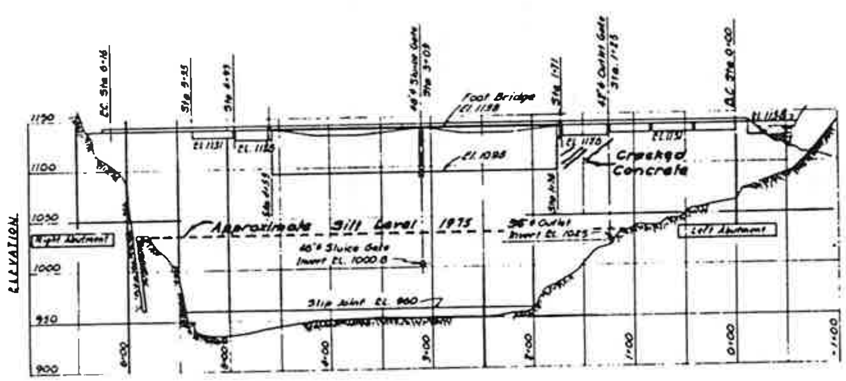
55 Sq. miles
19 Sq. miles
MATILIJA DAM
Matilija Reservoir
Matilija Creek
Santa Ynez Mountain
ROBLES-CASITAS CANAL
Casitas Reservoir
OJAI
MEINERS OAKS
OAK VIEW
CASITAS SPRINGS
VENTURA
MONTALVO
EL RIO
OXNARD
PORT HUENEME
SAUTICOY
Rincon Creek
Casitas Creek
Coyote Cr.
Ventura River
Manuel Canyon
Lion Canyon
San Antonio
Sespe Creek
LEGEND
DRAINAGE AREA BOUNDARY
DRAINAGE AREA SUB BOUNDARY
DAM
STREAM GAGE
1/2 0 1 2 3 4 5 6
SCALE IN MILES
PACIFIC OCEAN
MATILIJA DAM OPERATION AND COST STUDY


PLATE 1




GENERAL PLAN

20 10 0 20 40 60 80 Feet




LONGITUDINAL PROFILE

(Along ℄ of Top Arch Ring)

50 25 0 50 100 150 200 Feet

FLOOD CONTROL DISTRICT

MATILIJA DAM

GENERAL LAYOUT

OPERATION & COST STUDY

PLATE 2

modifications and revised testing program, and to determine expected benefits to Casitas Municipal Water District (CMWD) for water stored in Matilija and diverted to Lake Casitas. Costs for the $15,000 study were to be shared equally between the FCD and the CMWD. Results of the study and overall approach used are described in this report.

## HISTORICAL BACKGROUND

Matilija Dam is located on Matilija Creek in the upper reaches of the Ventura River Watershed about five miles northwest of Ojai (Plate 1). The dam was designed for the FCD by Donald R. Warren Company Engineers, and it was constructed by Atkinson-Kier-Bressi and Bevanda. The construction contract was signed on June 18, 1946, and construction began later that year. On March 14, 1948, the sluice gate was closed and the reservoir began its initial storage of water from the Matilija Creek Watershed.

The dam has an average height of 190 feet and a crest length of 620 feet. The arch section varies from a thickness of 8 feet at the crest to 35 feet at the base. In addition to an uncontrolled overflow spillway, the dam has two outlet pipes. A 48-inch diameter outlet pipe is located near the center of the arch at Station 3+09, and its invert is at Elevation 1000.8. It has a 48-inch sluice gate at the upstream entrance and a 42-inch Howell-Bunger regulating valve at the downstream end.

A 36-inch diameter outlet pipe is located near the left abutment at Station 1+25, and its invert is at Elevation 1025.0. This outlet connects Matilija Reservoir with the distribution system of the CMWD. It has a 36-inch sluice gate at the upstream entrance, and a 36-inch Butterfly valve is located in the line just below the dam which facilitates the bypassing of flows directly to the streambed. See Plate 2 for general layout of dam and location of outlet works.

Original storage capacity in Matilija Reservoir was 7,018 acre-feet (AF) and primary purposes of the reservoir are water conservation and flood control in the Ventura River Watershed.

During the January 1952 storm, storage capacity in Matilija Reservoir reduced the peak inflow from 8,800 cubic feet per second (cfs) to a peak outflow of 3,530 cfs. Storage in the reservoir during the February 1962 storm, reduced peak inflow from 6,570 cfs to a peak outflow of 5,130 cfs. Because of a reduced storage capacity and the extreme runoff rates associated with the 1969 flood, the reservoir filled early in that storm period and it had little effect on peak attenuation during that event.

From 1948 through calendar year 1958, a total of 3,085 AF of water from Matilija Reservoir was sold for beneficial use in the Ojai area, and 9,613 AF were spread in the Ojai spreading basin.

On January 1, 1959, the Ventura River Municipal Water District (VRMWD), now CMWD, assumed responsibility for the operation and related maintenance of Matilija Dam and pipelines to Ojai for the purpose of integrating their conservation capabilities with the Casitas Project. Flood flows were to be stored in Matilija and later released for diversion to Lake Casitas in the Robles-Casitas Diversion Canal. As payment for rental of Matilija Dam for the agreed-upon 50-year operating period, VRMWD agreed to pay the remaining bonded indebtedness on the dam amounting to $2,388,750. Final payment was to be made on June 1, 1979, after 20 years of the 50-year agreement period.

On August 20, 1964, Bechtel Corporation of San Francisco was authorized to perform a preliminary review of Matilija Dam for the purpose of evaluating the condition of the structure with respect to its safety. Their preliminary analysis indicated that concrete deterioration and pattern cracking was occurring in concrete placed during the late stages of construction. Noticeable yielding in the left abutment was also discovered. Following a more thorough review of data supplied by the testing and monitoring program, it was decided to lower the crest of the dam by 30 feet. In late 1965, a notch was cut in the central portion of the dam 30 feet deep by 280 feet wide. Cutting the notch reduced the original storage capacity from 7,018 AF to 3,856 AF.

In January 1969, the maximum storm of record occurred in the Ventura River system and a second storm of similar magnitude followed in February. Runoff filled the reservoir, causing the dam to spill a total of 27 days during the 1968-69 water year. The storms deposited over 1,000 AF of debris in the reservoir during the 1969 storm and further reduced the storage capacity to 2,473 AF. At the present time, Matilija can store about 2,376 AF of water.

2,376
- 800
1,576

20 years - 1,576 / 65 [illegible]

12 years

## SECTION II

## FINDINGS AND CONCLUSIONS

FINDINGS:

From the analyses and results of this study, findings are as follows:

1. Using the current operation plan for Matilija Reservoir and the Robles Diversion Canal, initiated on December 14, 1970, (except as noted in Item b), below) it is calculated that:

1959-1973 Period

a) 33,740 AF of surplus storm flows in Matilija Reservoir could have been diverted to Lake Casitas.

b) 24,856 AF of surplus storm flows were actually stored in Matilija Reservoir for diversion to Lake Casitas. (Prior to December 14, 1970, other operation plans were in effect.)

c) 5,629 AF were stored in Matilija Reservoir for emergency summertime storage and 12,676 AF for convenience storage of low flows less than 50 cfs.

1973-2009 Period

a) 29,752 AF (826 AF/year) is the projected capability for the storage in Matilija Reservoir of surplus flood flows for later diversion to Lake Casitas using present outlet capacity, and providing adequate storage capacity is available in Lake Casitas.

b) 11,010 AF is the projected potential of Matilija Reservoir for emergency summertime storage and 18,744 AF for convenience storage of low flows less than 50 cfs.

2. Because of the continuing movement of piers supporting the walkways and deterioration of concrete above the notch, portions of the walkways are considered hazardous and must be removed. At present, the structural adequacy of that portion of the dam below the notch is considered satisfactory. Tests are underway to verify this condition.

3. An investigation of future alternatives for the operation or disposition of Matilija Dam was completed and costs of five alternatives are summarized in Table 5, Page 19. Costs shown in Table 5 are estimated for the remaining life of the existing agreement between CMWD and FCD, which is about 34 years. The summary shows that because of the high cost of an alternative water supply, the elimination of Matilija Reservoir as a water conservation facility, (Alternatives 1 and 2) will cost at least 5.8 million dollars between 1974 and 2009. Maintaining Matilija Reservoir as a water conservation facility with specified modifications would cost between 2.28 million dollars and 2.80 million dollars between 1974 and 2009. An environmental assessment of alternatives considered in this study has been completed and is included in a separate document.

## CONCLUSIONS

Conclusions of this study are as follows:

1. Results of the study indicate that a more economical alternative source of water is not available, and unless Matilija Dam is found to be unsafe, hazardous, or otherwise unfit for operation or storage of waters, its continued operation as a water conservation reservoir is in the best interests of the public.

2. The State Division of Safety of Dams requires that at least one outlet be maintained in a safe, operational condition. They have indicated that the dewatering time associated with the existing 36-inch outlet located near the left abutment is adequate.

3. The apparent least costly alternative is Alternative 4, which includes abandonment of the 48-inch center outlet; and modifications and enlargement of the 36-inch outlet to maintain the present maximum release capability of 500 cfs, installation of a Howell-Bunger regulating valve on the enlarged outlet, replacement of the riser on the enlarged outlet, removal of all walkways from the left abutment to the right side of the notch, and removal of cracked concrete left of the notch. This alternative assumes that concrete below the notch is structurally satisfactory. Total cost to both agencies of this alternative to the year 2009 including modifications, operation and maintenance and bond payments is estimated to be $2,284,000, and it would retain Matilija Reservoir as an active flood control and water conservation reservoir.

a) The cost for modifications of this alternative are estimated to be $640,000 (See Table 5, Page 19.).

## SECTION III

## RECOMMENDATIONS

It is recommended that:

1. Matilija Dam be modified in accordance with the least costly alternative described in Alternative 4.

2. When plans and specifications for the modifications specified in Alternative 4 have been prepared, the feasibility of negotiating an amendment to the existing agreement between the CMWD and FCD should be considered. Provisions that may be considered in the amendment are:

a) The CMWD will continue to operate and maintain the facility as specified in the existing agreement until either the silt level reaches Elevation 1085, the usable storage capacity is reduced to less than 500 acre-feet, or it has been determined by either the State Division of Safety of Dams, the State Division of Industrial Safety, or by mutual agreement between the CMWD and FCD that the dam is unsafe, hazardous, or otherwise unfit to operate or store water.

b) The FCD will transfer ownership of the Matilija pipelines to the CMWD.

c) In the event that the CMWD must discontinue operation of Matilija Dam for any of the reasons listed above, the FCD will assume complete responsibility for the operation and disposition of the facility and will reimburse the CMWD for any bond prepayments.

d) The CMWD will share in the cost of modifications to Matilija Dam described in Alternative 4 up to that portion of the alteration attributable to the operation of Matilija Dam as a water conservation facility.

## SECTION IV

## WATERSHED YIELD AND RESERVOIR OPERATION

During and immediately following storm events since 1959, the CMWD diverts surplus streamflow from the upper Ventura River to Lake Casitas. Turnout to the diversion canal is located approximately one mile below the confluence of Matilija Creek and North Fork Matilija Creek (Plate 1), and the canal has a maximum capacity of 500 cfs.

The streamflow that is diverted to Lake Casitas originates from the 55-square-mile controlled watershed above Matilija Dam, and the uncontrolled drainage area of about 19 square miles between the dam and the diversion canal. Runoff from most of the uncontrolled drainage area is measured by the streamgaging station on North Fork of Matilija Creek. Continuous runoff records from North Fork began in October 1933. An additional streamflow recorder is located in the study watershed about 0.4 mile below Matilija Dam, and its record began in October 1927. A streamflow recorder was located at the upstream end of the reservoir from May 1948 to January 1969 when it was destroyed. The recorder at this location was not rebuilt. Recorders are also maintained at the Robles Diversion Dam on both the diversion canal and the Ventura River immediately downstream from the dam.

To isolate the quantity of water diverted to Lake Casitas from storage in Matilija Reservoir only, requires a detailed analysis of runoff rates in conjunction with the operation plan of the reservoir. This complex analysis is possible with electronic data processing techniques.

A computer program was written by the FCD that considers inflow to Matilija Reservoir together with flow measured by the gaging station on North Fork and flow conditions in the Robles Diversion Canal. During the first phase of this study, if the combined flows were less than 520 cfs (500 cfs for diversion and 20 cfs for release to downstream uses) inflows were released from Matilija Dam up to a maximum combined flow of 520 cfs. If the combined flows were greater than 520 cfs, the regulating valve on Matilija Dam would close and excess flow would be stored for later release and diversion. Water that is stored for later release and diversion is considered a benefit accruing to CMWD because of Matilija Reservoir and only those releases were considered in the study.

Another alternative operations' method investigated considered the 36-inch outlet near the left abutment as the only outlet available for release. That outlet has a maximum discharge of only about 200 cfs and it necessitated a reevaluation of the beneficial storage capacity of Matilija.

To consider storage in the reservoir lost to siltation, a debris production routine was added to the computer program. An equation recently developed by the United States Geological Survey for computing debris yields from watersheds in Ventura County was converted to daily debris production and programmed. Storage in Matilija Reservoir lost to siltation has been measured on three occasions: 1958, 1964, and 1970. The debris yield equation was tested and verified on the Control Data 6600 computer using daily inflows to the reservoir from 1948 through 1969. Some adjustment was necessary to ensure that computed deposition matched known deposition for the years 1958, 1964, and 1970.

Using daily streamflow rates, the computer program performs the following operations.

1. Using daily data from the streamflow recorder above the reservoir and the verified debris yield equation, compute debris inflow.

2. Add debris inflow to current deposition in reservoir and compute new storage table.

3. Consider reservoir inflow and flow in North Fork and compute release for downstream uses and diversion.

4. Adjust reservoir storage.

5. Update running totals of debris inflows, streamflow, downstream uses, spillway flow, and storage released from Matilija and diverted to Lake Casitas.

6. Repeat steps 1 through 5 with following day's reservoir inflow.

PHASE 1 STUDY - (OPERATION WITH 48-INCH OUTLET)

The operation criteria for Matilija Reservoir used in this study was developed by the CMWD and became effective on December 14, 1970. The reservoir is operated as follows:

1. On November 1 of each year, reduce reservoir level to the minimum pool of 533 AF.

2. Store excess flows in Matilija only when discharge at diversion canal exceeds 520 cfs.

3. Release from Matilija such that flow in diversion canal is at least 50 cfs.

4. Draw reservoir to minimum pool of 533 AF as soon as possible after storm.

5. On April 1 of each year, allow reservoir level to increase to around 1,000 AF for emergency summertime storage.

BENEFICIAL STORAGE, 1959-1973 - The quantity of water available each year from Matilija for diversion to Lake Casitas during the historic period from 1959 through water year 1973 was computed in three steps. In the first step, the debris deposition routine was verified and it, therefore, considered all inflows to Matilija Reservoir from 1948 through water year 1969. When the computed deposition matched the measured deposition in 1958, 1964, and 1970, the debris yield equation was satisfactorily verified, and the resulting storage yield represented storage available for diversion to Lake Casitas during that period. Cutting of the notch in 1965 was included as input data to the program.

During the 1969 flood, the streamflow recorder above Matilija Reservoir was destroyed and it was not replaced. It was, therefore, necessary to synthesize reservoir inflows after 1969 using daily change in storage and streamflow recorded at the gaging station just below the dam. Second step of the study, therefore, consisted of running synthesized inflows for the period 1969 through water year 1973.

According to the reservoir operating plan, inflows to Matilija that are stored and diverted to Lake Casitas consist of the following three components.

1. Storm flows that would normally pass to the ocean.

2. Summertime emergency storage between April 1 and November 1.

3. Temporary storage of flows less than 50 cfs.

The CMWD indicates that Items 2 and 3, above, represent flows that would normally be diverted, even without the availability of Matilija Reservoir. Those flows are stored in Matilija only as a convenience and in any economic analysis they should not be assigned the same value as storm flows that would normally pass to the ocean. It was, therefore, decided that inflow volumes stored in Matilija and later diverted to Lake Casitas would be tabulated in their three components.

The final step in this analysis consisted of a modified computer run that totaled only diverted storm flows and ignored emergency summertime storage and storage of flows less than 50 cfs. Emergency summertime storage was determined each year by subtracting 533 AF (minimum pool) from reservoir storage at the close of the water year. Since these flows were normally diverted around November 1 of each year, the computer totaled them in the water year beginning October 1. However, the inflows were stored during the previous water year and they were, therefore, tabulated as beneficial storage during that year.

Convenience storage of flows less than 50 cfs was then found by subtracting from results of steps 1 and 2, results from the modified computer run and summertime storage. Table 1 includes a summary of total beneficial storage capability of Matilija Reservoir for the period 1948 through 1973, beneficial storage by components, and an estimate by the CMWD of storm flows actually diverted to Lake Casitas from 1959 through 1973. The total of actual beneficial flood storage is different from computed storage because the operation plan used in the study became effective in 1970, and an operation plan represents ideal conditions that may not be rigidly followed during every runoff period.

BENEFICIAL STORAGE, 1973-2009 - To estimate the expected future benefits of Matilija Reservoir, two alternatives were considered. The first assumes that reservoir siltation continues at the historic rate from 1948 through 1969, and that no cleanout takes place. This analysis would define both the beneficial storage capability during this study period and the approximate remaining usable life of the reservoir by 2009, assuming no cleanout.

Since it is not possible at this time to predict what runoff cycles will occur in the future, it was decided to use the historical period in various combinations to estimate future benefits, and average the results. Three assumed hydrologic cycles were run. The first considered that the 1948 through 1973 period occurred again in that sequence.

TABLE 1

BENEFICIAL STORAGE CAPABILITY OF MATILIJA RESERVOIR
WATER YEARS 1949 - 1973

| Water Year | Annual Total AF | Conserved Storm Flow Only AF | Summer Emergency Storage AF | Storage of Flows Less Than 50 cfs AF | Actual Conserved Storm Flows AF |
|---|---|---|---|---|---|
| 1949 | 0 | 0 | 0 | 0 | |
| 50 | 0 | 0 | 0 | 0 | |
| 51 | 0 | 0 | 56 | 0 | |
| 52 | 13,364 | 10,687 | 561 | 2,621 | |
| 53 | 1,408 | 0 | 99 | 847 | |
| 54 | 997 | 0 | 523 | 898 | |
| 55 | 523 | 0 | 178 | 0 | |
| 56 | 1,323 | 712 | 503 | 433 | |
| 57 | 702 | 0 | 521 | 199 | |
| 58 | 17,233 | 15,414 | 512 | 1,298 | |
| 59 | 2,166 | 1,137 | 514 | 517 | 0 |
| 1960 | 599 | 0 | 42 | 85 | 0 |
| 61 | 66 | 0 | 0 | 24 | 0 |
| 62 | 7,056 | 6,140 | 529 | 916 | 4,414 |
| 63 | 622 | 0 | 133 | 93 | 0 |
| 64 | 192 | 0 | 464 | 59 | 0 |
| 65 | 945 | 0 | 515 | 481 | 0 |
| 66 | 10,850 | 8,206 | 576 | 2,129 | 6,000 |
| 67 | 7,478 | 3,417 | 538 | 3,485 | 3,193 |
| 68 | 546 | 0 | 592 | 8 | 0 |
| 69 | 7,987 | 6,046 | 603 | 1,349 | 1,900 |
| 1970 | 3,100 | 1,950 | 579 | 547 | 1,680 |
| 71 | 3,786 | 1,924 | 450 | 1,283 | 1,900 |
| 72 | 1,006 | 0 | 94 | 556 | 194 |
| 1973 | 6,158 | 4,920 | -- | 1,144 | 5,575 |
| TOTAL 1959-73 | 52,557 | 33,740 | 5,629 | 12,676 | 24,856 |
| AVERAGE 1959-73 | 3,503 | 2,249 | 375 | 845 | 1,657 |

The second cycle considered that that period occurred in reverse order (1973-1948). For the third cycle, water years from the period 1948 through 1973 were selected at random. In the second cycle analyzed, the 1969 event occurred again on two occasions - 1978 and again in 2003. Under those conditions, remaining storage in Matilija Reservoir in 2009 would be only about 160 AF. The 1969 event occurred only once during the remaining two cycles and usable storage by 2009 was estimated to be about 750 AF, under those conditions.

Results from the three cycles are tabulated in Table 2, which shows that water temporarily stored in Matilija and later diverted to Lake Casitas during the period 1973-2009 ranges from 52,204 AF to 64,543 AF. The average of the three cycles is about 58,000 AF, making an average annual of about 1,622 AF/year. Since results from the first cycle analyzed (1948 through 1973 data in sequence) were very close to the three cycle average, it was decided to run only that cycle for all future analyses. This would reduce excessive computer runs and it would produce consistent results that could be easily compared.

Using the 1948-1973 cycle, the expected future benefits were then separated into the three storage components consisting of excess storm flows, emergency summertime storage and convenience storage of flows less than 50 cfs. The results are tabulated in Table 3.

The second alternative that was considered in evaluating future benefits from Matilija Reservoir assumed that all debris deposited since 1948 was removed from the reservoir and that beginning in 1973 the original storage table applied. However, spillway elevation was considered to be Elevation 1095 to conform with the alteration that was done in 1965.

The cleanout routine was run using the 1948 through 1973 data and results are tabulated in the last column of Table 2. The tabulation shows that a complete reservoir cleanout will provide an additional 41,000 AF for diversion to Lake Casitas during the period 1973-2009. This additional benefit was not separated into the three storage components.

## PHASE 2 STUDY - (OPERATION WITH 36-INCH OUTLET)

Because of deteriorating concrete and the possibility of unstable bridges, access to the center outlet has become unsafe and necessary alterations were found to be very costly. Therefore, this study was undertaken to evaluate the effect on benefits of abandoning the central 48-inch outlet and using only the 36-inch outlet located near

## TABLE 2

EXPECTED BENEFICIAL STORAGE CAPABILITY OF MATILIJA RESERVOIR, WATER YEARS 1974-2009. VARIOUS HYDROLOGIC CONDITIONS, PRESENT RESERVOIR CONFIGURATION, CLEANOUT CONFIGURATION.

| Water Year | Expected Beneficial Storage: 1948-1973 Data | 1973-1948 Data | Random Selection | Cleanout 1948-1973 Data |
|---|---|---|---|---|
| 1974 | 536. | 6,556. | 3,664. | 0. |
| 75 | 301. | 1,092. | 450. | 0. |
| 76 | 0. | 3,105. | 94. | 0. |
| 77 | 6,541. | 2,772. | 1,188. | 9,454. |
| 78 | 1,408. | 5,565. | 503. | 1,408. |
| 79 | 997. | 611. | 237. | 997. |
| 1980 | 523. | 5,680. | 577. | 523. |
| 81 | 1,323. | 5,259. | 490. | 1,323. |
| 82 | 616. | 1,057. | 6,399. | 616. |
| 83 | 8,961. | 574. | 2,850. | 12,286. |
| 84 | 2,166. | 556. | 579. | 2,166. |
| 85 | 599. | 2,418. | 3,321. | 599. |
| 86 | 66. | 529. | 537. | 66. |
| 87 | 3,031. | 94. | 7,248. | 4,482. |
| 88 | 622. | 1,181. | 7,921. | 622. |
| 89 | 192. | 2,547. | 994. | 192. |
| 1990 | 946. | 629. | 672. | 946. |
| 91 | 6,738. | 1,435. | 5,522. | 10,290. |
| 92 | 6,026. | 503. | 5,948. | 7,464. |
| 93 | 546. | 394. | 2,191. | 546. |
| 94 | 2,364. | 1,357. | 1,361. | 7,960. |
| 95 | 1,027. | 1,711. | 648. | 3,116. |
| 96 | 2,361. | 430. | 1,595. | 3,803. |
| 97 | 1,006. | 157. | 636. | 1,006. |
| 98 | 1,896. | 0. | 513. | 6,176. |
| 99 | 428. | 1,915. | 828. | 536. |
| 2000 | 301. | 936. | 508. | 301. |
| 01 | 0. | 1,754. | 246. | 0. |
| 02 | 1,547. | 885. | 422. | 6,589. |
| 03 | 1,195. | 502. | 473. | 1,408. |
| 04 | 267. | 0. | 3,112. | 997. |
| 05 | 349. | 0. | 318. | 523. |
| 06 | 956. | 0. | 0. | 1,323. |
| 07 | 457. | 0. | 1,508. | 616. |
| 08 | 1,491. | 0. | 762. | 9,065. |
| 2009 | 668. | 0. | 228. | 2,166. |
| TOTAL | 58,451. | 52,204. | 64,543. | 99,565. |

## TABLE 3

### ESTIMATED BENEFICIAL STORAGE CAPABILITY OF MATILIJA RESERVOIR WATER YEARS 1974 - 2009

| Water Year | Annual Total AF | Conserved Storm Flow Only AF | Summer Emergency Storage AF | Storage of Flows Less Than 50 cfs AF |
|---|---|---|---|---|
| 1974 | 536. | 0. | 145. | 536. |
| 75 | 301. | 0. | 0. | 156. |
| 76 | 0. | 0. | 95. | 0. |
| 77 | 6,541. | 4,335. | 511. | 2,111. |
| 78 | 1,408 | 0. | 99. | 897. |
| 79 | 997. | 0. | 511. | 898. |
| 1980 | 523. | 0. | 178. | 12. |
| 81 | 1,323. | 712. | 503. | 433. |
| 82 | 616. | 0. | 491. | 113. |
| 83 | 8,961. | 7,662. | 511. | 808. |
| 84 | 2,166. | 1,137. | 511. | 518. |
| 85 | 599. | 0. | 42. | 88. |
| 86 | 66. | 0. | 0. | 24. |
| 87 | 3,031. | 1,600. | 511. | 1,431. |
| 88 | 622. | 0. | 133. | 111. |
| 89 | 192. | 0. | 464. | 59. |
| 1990 | 946. | 0. | 511. | 482. |
| 91 | 6,738. | 4,088. | 511. | 2,139. |
| 92 | 6,026. | 1,963. | 511. | 3,552. |
| 93 | 546. | 0. | 511. | 35. |
| 94 | 2,364. | 2,268. | 506. | 0. |
| 95 | 1,027. | 488. | 492. | 33. |
| 96 | 2,361. | 475. | 450. | 1,394. |
| 97 | 1,006. | 0. | 94. | 556. |
| 98 | 1,896. | 1,776. | 428. | 26. |
| 99 | 428. | 0. | 145. | 0. |
| 2000 | 301. | 0. | 0. | 156. |
| 01 | 0. | 0. | 95. | 0. |
| 02 | 1,547. | 1,128. | 349. | 324. |
| 03 | 1,195. | 0. | 99. | 846. |
| 04 | 267. | 0. | 349. | 168. |
| 05 | 349. | 0. | 178. | 0. |
| 06 | 956. | 338. | 344. | 440. |
| 07 | 457. | 0. | 343. | 113. |
| 08 | 1,491. | 1,596. | 197. | 0. |
| 2009 | 668. | 186. | 192. | 285. |
| TOTAL | 58,451 A.F. | 29,752 A.F. | 11,010 A.F. | 18,744 A.F. |
| AVERAGE | 1,624 A.F./YR. | 826 A.F./YR. | 306 A.F./YR. | 521 A.F./YR. |

the left abutment. Since the 36-inch outlet is smaller and located at a higher elevation, its maximum discharge is only about 200 cfs. With a smaller outlet, the operation study would specify storage in the reservoir during times in which it was not previously required, and Matilija would be storing water while the diversion canal was running at less than full capacity. Since all water stored in the reservoir, and later released for diversion, is counted as a benefit to the CMWD, this change to a smaller outlet would show a false benefit. Also, the need for storage earlier in a storm period indicates more frequent spillway flow and much of the spillway flow is lost from the system because the diversion canal is limited to 500 cfs.

A routine was added to the computer program that would compute, on a daily basis, the total streamflow lost from the system below the Robles Diversion Dam when the canal was running at its full capacity. The program was run using the 1948 through 1973 data with the central 48-inch outlet and again using the smaller 36-inch outlet. Volumes of water lost from the system during each run were totaled and the difference represents the decrease in benefits to the CMWD imposed by the change in outlet facilities. Results from the computer runs are tabulated in Table 4. The computations show an average annual reduction in flows diverted to Lake Casitas of 128 AF/year, using only the 36-inch outlet for releases.

## TABLE 4

EXCESS RIVER FLOW BELOW ROBLES DIVERSION
CANAL USING 48" AND 36" OUTLETS

| Water Year | Annual Excess 48" Outlet AF | Annual Excess 36" Outlet AF | Annual Excess Difference AF |
|---|---|---|---|
| 1974 | 0. | 0. | |
| 75 | 0. | 0. | |
| 76 | 12,722. | 13,483. | - 761. |
| 77 | 0. | 0. | |
| 78 | 0. | 0. | |
| 79 | 0. | 0. | |
| 1980 | 0. | 0. | |
| 81 | 0. | 0. | |
| 82 | 0. | 0. | |
| 83 | 22,829. | 24,526. | -1,697. |
| 84 | 0. | 0. | |
| 85 | 0. | 0. | |
| 86 | 0. | 0. | |
| 87 | 23,819. | 24,202. | - 383. |
| 88 | 0. | 0. | |
| 89 | 0. | 0. | |
| 1990 | 0. | 0. | |
| 91 | 16,085. | 16,717 | - 632. |
| 92 | 3,801. | 4,163. | - 362. |
| 93 | 0. | 0. | |
| 94 | 99,814. | 100,497. | - 683. |
| 95 | 1,588. | 1,585. | + 3. |
| 96 | 1,908. | 2,004. | - 96. |
| 97 | 0. | 0. | |
| 98 | 10,555. | 10,584. | - 29. |
| 99 | 0. | 0. | |
| 2000 | 0. | 0. | |
| 01 | 0. | 0. | |
| 02 | 15,876. | 15,870 | + 6 |
| 03 | 0. | 0. | |
| 04 | 0. | 0 | |
| 05 | 0 | 0 | |
| 06 | 369. | 366. | + 3. |
| 07 | 0. | 0. | |
| 08 | 28,873. | 28,867. | + 6. |
| 2009 | 999. | 996. | + 3. |
| TOTAL | 239,238. | 243,860. | -4,622. |
| AVERAGE | 6,646. A.F./YR. | 6,774. A.F./YR. | 128. A.F./YR. |

## SECTION V

## ALTERNATIVE PLANS FOR

## FUTURE MATILIJA DAM OPERATION

In the reservoir operation study, it was found that with continued operation of the 48-inch center outlet a total of almost 30,000 AF of surplus storm flows could be temporarily stored in Matilija Reservoir and later diverted to Lake Casitas during the 36-year period from 1973 through 2009. If the 48-inch center outlet were abandoned and only the 36-inch outlet used for all releases, a total of about 25,000 AF of storm flows could be stored in Matilija and diverted to Lake Casitas during that same 36-year period. However, costly modifications associated with the continued operation of Matilija Reservoir as a water conservation facility, and the possibility of additional modifications at some future time, made it necessary to evaluate all practical options regarding the future operation and use of Matilija Dam.

In view of the continued chemical expansion and present inaccessibility of portions of the dam, the "do nothing" alternative was not considered an acceptable solution. Therefore, a total of six possible alternatives were considered in this study.

### ALTERNATIVE 1:

In this alternative, the FCD would reassume control of the dam, relieve the CMWD of financial responsibilities relating to the dam, and destroy the structure by removing all concrete above Elevation 1040 - the present silt pool elevation (Plate 2). This alternative would save all future O&M costs and the cost of modifications to the footbridge, risers, and outlet facilities. However, the remaining bonded indebtedness, amounting to about $519,000, would still need to be paid, and the CMWD will request reimbursement from the FCD for their prepayment of bonds since 1959. The destruction of Matilija Dam would also necessitate the location of an alternative source of water supply to replace the 826 AF/year loss from Matilija Reservoir; and, with no Matilija Dam, an increase in siltation would occur in the reservoir behind Robles Diversion Dam requiring more frequent cleanout operations.

COST TO DESTROY DAM - Prior to cutting the notch in 1965, various modification schemes were considered and associated costs were estimated. Alternatives considered in that analysis were the complete removal of Matilija Dam to Elevation 980, the original streambed elevation, and the removal of all concrete above Elevation 1000 and Elevation 1020. The present silt level in Matilija Reservoir at the dam is about Elevation 1040, as shown in Plate 2. Using the 1965 cost data updated to 1975 prices, the cost of removing all concrete above Elevation 1040 was estimated to be about $1,200,000 and it is tabulated in Table 5.

COST OF ALTERNATIVE WATER SUPPLY - The possibility of enlarging the Robles Diversion Canal has been evaluated on various occasions since its construction as part of the Casitas Project in 1959. An enlargement of the canal from its present capacity of 500 cfs to 2200 cfs would increase the safe yield for Lake Casitas by about 2250 AF/year. Present cost of the enlargement project is estimated to be about $11 million.

The loss of Matilija Reservoir represents a loss of about 826 AF/year, which is about 37 percent of the increased yield from an enlarged canal. Therefore, the cost associated with the development of an alternative water supply was estimated to be 37 percent of $11 million, or about $4,150,000.

COST OF ADDITIONAL DIVERSION DAM CLEANOUT - The reservoir formed by the Robles Diversion Dam is estimated to hold about 40,000 cy of debris. When the reservoir fills, and prior to cleanout, additional debris passes through the dam outlet works and is deposited downstream in the Ventura River. Each year debris enters the reservoir from the 19-square-mile uncontrolled watershed; and, when necessary, the debris is removed and stored during the dry summer months.

With Matilija Dam removed, an additional 55 square miles of watershed area will be contributing debris to the reservoir behind Robles Diversion Dam and siltation will occur more rapidly, requiring more frequent cleanouts. The increased cost of reservoir cleanout was estimated to be about $200,000 from 1974 through 2009.

MATILIJA CONDUITS - In addition to Matilija Dam, the Matilija Project included a 43,000 foot pipeline extending from the dam to the City of Ojai. Conduit sizes range from 12" to 36" in diameter. This conduit system represents a portion of the distribution system for the CMWD, and it is connected with conduits from Lake Casitas. If Matilija Dam is destroyed,

TABLE 5
SUMMARY OF PROBABLE FUTURE MATILIJA COSTS
BY ALTERNATIVE AND AGENCY1/
(Dollars)

| | ALTERNATIVE | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| | Destroy dam to elevation 1040. | FCD operate & control dam. Abandon 48" outlet. Open 36" outlet. | CMWD operate & control dam. Abandon 48" outlet. Operate 36" outlet. 200 cfs maximum release. | CMWD operate & control dam. Abandon 48" outlet. Enlarge 36" outlet. 500 cfs maximum release. | CMWD operate & control dam. Operate 48" & 36" outlets. 500 cfs maximum release. |
| CASITAS MUNICIPAL WATER DISTRICT: | | | | | |
| Alternative source of water. | 4,150,000 | 4,150,000 | 625,000 | 0 | 0 |
| Additional cleanout behind Robles Dam. | 200,000 2/ | 0 | 0 | 0 | 0 |
| Remaining bond payments. | 52,000 | 52,000 | 519,000 | 519,000 | 519,000 |
| Annual O&M @ $8,100/year. | 0 | 0 | 310,000 | 310,000 | 310,000 |
| CMWD share of structural modifications. | - | 0 | See footnote 5. | See footnote 5. | See footnote 5. |
| Subtotal | 4,402,000 | 4,202,000 | 1,454,000 | 829,000 | 829,000 |
| Credit | (1,017,000) | (1,017,000) | ( 240,000) | 0 | 0 |
| Net cost to CMWD. | 3,385,000 | 3,185,000 | 1,214,000 | 829,000 | 829,000 |
| FLOOD CONTROL DISTRICT: | | | | | |
| Remove dam to elevation 1040. | 1,200,000 | - | - | - | - |
| Remaining bond payments. | 467,000 | 467,000 | - | - | - |
| Reimburse CMWD for bond prepayments. | 1,017,000 | 1,017,000 | - | - | - |
| Reimburse CMWD for 128 AF/year. | - | - | 240,000 4/ | - | - |
| Monitoring and testing program. | - | 115,000 | 115,000 | 115,000 | 115,000 |
| Annual O&M @ $20,000/year. | - | 700,000 | 700,000 | 700,000 | 700,000 |
| Structural modifications. | - | 314,000 3/ | 532,000 5/ | 640,000 5/ | 693,000 5/ |
| Subtotal | 2,684,000 | 2,613,000 | 1,587,000 | 1,455,000 | 1,508,000 |
| Credit | 0 | 0 | See footnote 5. | See footnote 5. | See footnote 5. |
| Net cost to FCD. | 2,684,000 | 2,613,000 | 1,587,000 | 1,455,000 | 1,508,000 |
| Total Net Cost. (1974-2009) | 6,069,000 | 5,798,000 | 2,801,000 | 2,284,000 | 2,337,000 |

1/ Costs other than known bond redemption payments are rough approximations and estimated based on the total cost in 1975.

2/ Cost considers maximum of one cleanout per year and it does not consider costs associated with canal shutdown from excessive siltation.

3/ Assuming the center outlet is abandoned and only the 36" outlet is used for releases, and walkways are removed. No Howell-Bunger valve and no operation for conservation.

4/ Since this alternative uses only the 36" outlet and maximum releases are limited to 200 cfs, CMWD loses an average of 128 AF/year. This cost represents a reimbursement for that loss.

5/ This cost represents the total modification cost. Portions of this cost may be shared by CMWD and the amount will be determined by negotiation.

representatives from the CMWD have expressed an interest in assuming ownership of the conduits and making them a permanent part of their distribution system.

Bonds totaling $3,400,000 were sold to finance the Matilija Project. Records regarding the cost of conduits only are not complete and it was necessary to estimate the conduit costs using current prices and project that total back to 1948. The analysis found that the conduits cost about $332,000, which represents about ten percent of the total Matilija Project bonded indebtedness. Therefore, if the FCD assumes responsibility for the disposition of Matilija Dam prior to the final payment of bonds by the CMWD, it is anticipated that ten percent of the remaining bonds would be paid by the CMWD, as payment for the conduits.

BOND PREPAYMENTS - From 1959 through 1974, the CMWD made bond payments totaling about $1,870,000. These payments were considered rental payments for their use of Matilija Reservoir and, of that total, about $1,130,000 represents rental prepayments to ensure debt retirement on the project by 1979. With the destruction of Matilija Dam, the CMWD would demand reimbursement of those prepayments. Considering the conduits cost about ten percent of the total project, reimbursement would amount to ninety percent of the prepayment, or about $1,017,000. See Table 5 for a summary of all costs of this alternative.

ALTERNATIVE 2:

In this alternative, the FCD would reassume control of the dam, relieve the CMWD of financial responsibilities relating to the dam, abandon the center 48-inch outlet, and release inflows through the 36-inch outlet. The 36-inch outlet would remain open and no attempt would be made to operate the facility for water conservation. The existing steel riser located at the 36-inch outlet would be lined with concrete, and the walkways extending from the left abutment to the right side of the notch (Station 4+55) would be removed. Cracked and deteriorating concrete above Elevation 1095 and left of the notch would also be removed. A program to test the present stability and behavior of concrete in the dam, and a revised program to monitor differential movement would be necessary.

With these conditions the dam would continue trapping silt from the Matilija Creek Watershed, saving the CMWD additional clean-out costs in the reservoir behind Robles Diversion Dam, amounting to about $200,000, as shown in Alternative 1. The FCD would save the cost of removing the dam to Elevation 1040; however, those savings would be offset by costs associated with the revised monitoring and testing program, annual operation and maintenance costs, and necessary structural modifications. In addition, the concrete testing program, or some future testing program, may indicate the need for future modifications, including destruction not anticipated at this time. Costs for future modifications, or dam removal, cannot be estimated at this time, however, they represent a potential expenditure that may need to be considered.

In this alternative, conduits would be purchased by the CMWD, and they would need to replace the 826 AF/year loss with an alternative source of water. Those costs were estimated in Alternative 1.

REVISED MONITORING AND TESTING PROGRAM - The report prepared by IECO in August 1972 recommended an additional monitoring and testing program to further evaluate the structural behavior and physical quality of concrete in Matilija Dam. Among their recommendations were:

1. A system of targets suitably spaced should be installed in the crest, on the downstream face of the dam, and at both abutments as part of the long-term program of monitoring the movements of the structure. These targets should be surveyed at quarterly intervals during the year by precise triangulation.

2. Comprehensive tests should be conducted on concrete cores secured from different locations in the dam to determine the present structural properties of the concrete in the existing dam.

3. Petrographic examination of portions of concrete cores should be performed to determine the presence of or potential for alkali-aggregate reaction and chemical expansion.

4. Thermometers should be embedded at suitable locations in the core drill holes before these are grouted to monitor the temperature conditions in the dam concrete and ambient temperatures concurrently with measurements of the movements of the structure.

5. Sonic testing of concrete in the dam for evaluation of its in situ quality should be undertaken if core drilling reveals presence of poor-quality concrete.

On December 17, 1974, a contract was awarded for construction of the revised monitoring program indicated in Recommendation Number 1. In addition to installation of the recommended target and triangulation system, this contract includes the relocation of lead wires for all four strain gages in the right abutment to the valve house below the left abutment. Cost of this project is $25,800.

Costs for the proposed testing program (Recommendation Numbers 2, 3, 4, and 5) were estimated by IECO in September 1972 and the costs were recently updated to 1975 prices as follows:

| | |
|---|---|
| Concrete core drilling | $30,000 |
| Laboratory tests. | 10,000 |
| Petrographic examination. | 5,000 |
| Nondestructive seismic test. | 10,000 |
| Salary, travel, report and miscellaneous expenses. | 23,000 |
| | $78,500 |

Total cost of the recommended monitoring and testing program is, therefore, about $115,000 and it is anticipated that this program will be completed this fiscal year.

OPERATION AND MAINTENANCE COSTS - The FCD performs ongoing maintenance of the dam and reservoir consisting of removing and disposing of floating debris and debris that has accumulated on the reservoir banks, repair of fences and damage caused by vandalism, and the construction of access facilities associated with the deformation monitoring program. Included in the operation and maintenance costs are the monitoring of the strain gages biweekly and immediately following storms and earthquakes, a regular survey of telltale plates quarterly and immediately following storms and earthquakes, office computation and graphing of the deformation data, transmittal of deformation data to the State Division of Safety of Dams, and coordinating with the State for periodic inspections of the dam and review of deformation data.

Operation and maintenance costs were tabulated since detailed records became available in 1966 and the average annual cost was found to be about $20,000.

STRUCTURAL MODIFICATIONS - At present, access is required to the center of the dam to service the 48-inch outlet located there. The only all-weather access is provided by the concrete bridges from the left abutment to the notch and steel truss bridge spanning the notch to the center pier. The 1972 analysis by IECO found that the present concrete footbridge - left of the notch - was supported by cracked and deteriorating concrete above Elevation 1095, and they recommended that it be replaced by a steel truss bridge similar to the central span. The new pier required for support should then be founded on the sound concrete below Elevation 1095.

As a result of their inspections, the State Division of Safety of Dams has specified that eventually the existing steel riser structures at the 48-inch and 36-inch outlets must be lined with concrete. Preliminary estimates indicated that the recommended footbridge modifications and lining of the risers would be extremely costly, and it was decided that other alternatives would be explored.

Since the reservoir would not be used as a water conservation facility in this alternative, it was found that the center outlet, with its Howell-Bunger regulating valve, would not be needed. Elimination of the center outlet would avoid the need to concrete line one riser and to maintain access to the center pier. However, it would be necessary to remove the concrete walkways left of the notch and steel truss footbridges spanning the notch to avoid the possibility of them falling at some later time.

Costs for the structural modifications in this alternative are as follows:

1. Alteration to existing walkways:

| | |
|---|---|
| a. Earthwork. | $ 30,000 |
| b. Concrete removal. | 90,000 |
| c. Miscellaneous facilities. | 10,000 |
| Subtotal | $130,000 |

2. Concrete riser for 36-inch outlet: (State Dam Safety Requirements)

| | |
|---|---|
| a. Site preparation and silt removal. | $ 20,000 |
| b. Riser structure - 68 feet high. | 60,000 |
| c. Appurtenant facilities. | 20,000 |
| Subtotal | $100,000 |

| | |
|---|---|
| Total Alternative 2. | $230,000 |
| + 15% contingency. | 35,000 |
| Construction. | 265,000 |
| Design @ 10%. | 27,000 |
| Construction inspection @ 8%. | 22,000 |
| | $314,000 |

ALTERNATIVE 3:

This is the first of three alternatives that were considered for modifying the dam in accordance with a specified modification scheme and continue operating the reservoir under the same institutional arrangement as at present. The CMWD would continue making bond payments and operating the facility in accordance with the present agreement with the FCD.

In this alternative the 48-inch center outlet is abandoned, a Howell-Bunger regulating valve is installed on the 36-inch outlet, and all releases are made through the 36-inch outlet. A new control house will be constructed and all electrical and power facilities will be replaced. The monitoring and testing program described in Alternative 2 will be required, and the walkways removed and riser located at the 36-inch outlet replaced as discussed previously.

Results of the operation study indicate that use of the 36-inch outlet restricts the maximum release capability to 200 cfs and reduces the benefit to the CMWD by about 128 AF/year from present operations. This alternative would require the FCD to reimburse the CMWD for the 128 AF/year loss and it would be necessary for the CMWD to locate an alternative source of water supply.

COST OF ALTERNATIVE WATER SUPPLY - In Alternatives 1 and 2, it was found that if the CMWD no longer had use of Matilija Reservoir, they would lose about 826 AF/year of divertable storm flows during the period 1973 through 2009. The cost of replacing that loss with an enlarged diversion canal was found to be about $4,150,000. With the valve arrangement specified in this alternative, the CMWD would lose about 128 AF/year, which represents about 15 percent of the loss with no dam. Therefore, it is anticipated that the 128 AF/year loss will cost the CMWD about 15 percent of $4,150,000, or $625,000 to replace with an enlarged canal.

Under these conditions, the FCD would reimburse the CMWD a total of $240,000 for the 128 AF/year loss for the period 1974 through 2009 at the current water rate of $55/AF.

OPERATION AND MAINTENANCE COSTS - It is anticipated that operation and maintenance costs to the FCD will conform to present experience and they will average about $20,000/year as discussed in Alternative 2.

Detailed records of operation and maintenance expenditures have been maintained by the CMWD since 1959. Their expenditures are associated with valve adjustments at the dam and operation of the diversion facilities. Since 1959, they have averaged $8,100/year.

STRUCTURAL MODIFICATIONS - Costs of structural modifications for this alternative are estimated as follows:

1. Valve and outlet works:

| | | |
|---|---|---|
| a. | Approximately 60 feet of 36-inch steel pipe and connection to existing. | $ 15,000 |
| b. | 36-inch Howell-Bunger valve. | 70,000 |
| c. | Concrete pedestal and valve housing. | 30,000 |
| d. | Grouted rock riprap slope protection. | 3,000 |
| e. | Miscellaneous | 2,000 |
| | Subtotal | $120,000 |

2. Control house:

| | | |
|---|---|---|
| a. | Approximately 200 square feet and miscellaneous. | $ 5,000 |

3. Electrical and power facilities:

| | | |
|---|---|---|
| a. | Rework of 480 v. switchboard. | $ 7,000 |
| b. | Rework of 120-240 v. switchboard. | 3,000 |
| c. | New wiring for 42-inch sluice and new Howell-Bunger valve. | 15,000 |
| d. | Modification of facilities in chlorine and valve houses. | 12,000 |
| | Subtotal | $ 37,000 |

4. Removal of existing walkways:

| | | |
|---|---|---|
| a. | Earthwork. | $ 30,000 |
| b. | Concrete removal. | 90,000 |
| c. | Miscellaneous | 10,000 |
| | Subtotal | $130,000 |

5. Concrete riser for 36-inch outlet: (State Dam Safety Requirements)

| | | |
|---|---|---|
| a. | Site preparation and silt removal. | $ 20,000 |
| b. | Riser structure - 68 feet high. | 60,000 |
| c. | Appurtenant facilities. | 20,000 |
| | Subtotal | $100,000 |

| | |
|---|---|
| TOTAL ALTERNATIVE 3 | $392,000 |
| + 15% Contingency. | 59,000 |
| Construction. | 451,000 |
| Design @ 10%. | 45,000 |
| Construction Inspection @ 8%. | 36,000 |
| | $532,000 |

## ALTERNATIVE 4:

The modification scheme associated with this alternative includes abandonment of the 48-inch center outlet, enlargement of the 36-inch outlet to allow a maximum release of 500 cfs, and installation of a Howell-Bunger regulating valve on the enlarged 36-inch outlet. Other alterations and improvements will remain as discussed in Alternative 3 and they will consist of a new control house, replacement of all electrical and power facilities, replacement of the riser located at the enlarged 36-inch outlet, removal of all walkways from the left abutment to the right side of the notch (Station 4+55), and removal of cracked and deteriorating concrete left of the notch. This alternative will include the monitoring and testing program described in Alternative 2.

Since benefits to the CMWD will remain as computed in the Phase I Operation Study and listed in Table 3, an alternative water supply will not be necessary. The remaining bonds, amounting to about $519,000, will be paid by the CMWD. Operation and maintenance costs and costs for the monitoring and testing program will remain as estimated in Alternative 3.

STRUCTURAL MODIFICATIONS - Costs of structural modifications for this alternative are estimated as follows:

1. Valve and outlet works:

| | | |
|---|---|---|
| a. | Approximately 100 feet of 48-inch steel pipe and connection to existing. | $ 25,000 |
| b. | Salvage and reinstallation of existing 42-inch Howell-Bunger valve. | 40,000 |
| c. | Concrete pedestal and valve housing structure. | 35,000 |
| d. | Grouted rock riprap slope protection. | 5,000 |
| e. | Miscellaneous facilities. | 5,000 |
| f. | New sluice gate, including stem, appurtenances and installation. | 40,000 |
| g. | Cost of boring through the dam. | 30,000 |
| | Subtotal | $180,000 |

2. Concrete riser for new 48-inch outlet: (State Dam Safety Requirements)

| | | |
|---|---|---|
| a. | Site preparation and silt removal. | $ 20,000 |
| b. | Riser structures - 68 feet high. | 70,000 |
| c. | Appurtenant facilities. | 30,000 |
| | Subtotal | $120,000 |

3. 2., 3., and 4. Same as Alternative 3.

| | |
|---|---|
| Subtotal | $172,000 |
| TOTAL ALTERNATIVE 4 | $472,000 |
| + 15% Contingency. | 71,000 |
| Construction. | $543,000 |
| Design @ 10%. | 54,000 |
| Construction Inspection @ 8%. | 43,000 |
| | $640,000 |

ALTERNATIVE 5:

In this alternative the existing 48-inch center outlet is retained and access to it is restored. Both the walkways extending from the left abutment to the right side of the notch (Station 4+55) and cracked and deteriorating concrete above Elevation 1095 and left of the notch are removed. Since access will be by means of the spillway crest, the center outlet will be inaccessible during storms when the dam is spilling.

Remaining bond payments, operation and maintenance costs, and costs for the revised monitoring and testing program remain as shown in Alternatives 3 and 4. Costs for structural modifications would be similar to the previous two alternatives; however, an additional riser will need to be replaced, and because of the need for maintaining access to the center outlet, costs for future structural modifications will be considerably higher.

STRUCTURAL MODIFICATIONS - Costs are estimated as follows:

1. Removal of existing walkways and installation of new access.

| | |
|---|---|
| a. Earthwork. | $ 30,000 |
| b. Concrete removal. | 80,000 |
| c. New access facilities. | 40,000 |
| d. Miscellaneous facilities. | 30,000 |
| Subtotal | $180,000 |

2. Control house:

| | |
|---|---|
| a. Approximately 200 square feet and miscellaneous. | 5,000 |

3. Electrical and power facilities:

| | |
|---|---|
| a. Rework of 480 v. switchboard. | $ 7,000 |
| b. Rework of 120-240 v switchboard. | 3,000 |
| c. New wiring for outlet facilities. | 30,000 |
| d. Modification of facilities in chlorine and valve houses. | 15,000 |
| Subtotal | $ 55,000 |

4. Concrete riser for 48-inch outlet: (State Dam Safety Requirements)

| | |
|---|---|
| a. Site preparation and silt removal. | $ 30,000 |
| b. Riser structure - 90 feet high. | 120,000 |
| c. Appurtenant facilities. | 20,000 |
| Subtotal | $170,000 |

5. Concrete riser for 36-inch outlet: (State Dam Safety Requirements)

| | |
|---|---|
| a. Site preparation and silt removal. | $ 20,000 |
| b. Riser structure - 68 feet high. | 60,000 |
| c. Appurtenant facilities. | 20,000 |
| Subtotal | $100,000 |

| | |
|---|---|
| TOTAL ALTERNATIVE 5 | $510,000 |
| + 15% Contingency. | 77,000 |
| Construction | 587,000 |
| Design @ 10%. | 59,000 |
| Construction Inspection @ 8%. | 47,000 |
| | $693,000 |

ALTERNATIVE 6:

The operation study discussed in Section IV evaluated the increase in storage yield of Matilija Reservoir associated with a complete reservoir cleanout. Inflow data for the 1948 through 1973 period were run using the "as built" storage table and the results are tabulated in Table 2 for water years 1974 through 2009. The table shows that diverted storm flows would approximate 100,000 AF during this period, which is about 41,000 AF more than continued operation with the present reservoir configuration and 48-inch outlet.

A complete reservoir cleanout would include the removal of somewhere around 3,200,000 cubic yards (2,000 AF) of debris. In a 1968 cleanout of San Gabriel Reservoir in Los Angeles County, the cleanout cost approximately $0.80/cubic yard for a 7,000,000 cubic yard contract. In 1970, 4,000,000 cubic yards were removed from Big Tujunga Reservoir in Los Angeles County at a unit cost of $1.37/cubic yard. It is anticipated that the 1975 cost for a smaller cleanout contract than the Los Angeles County projects would be considerably higher than $1.37/cubic yard, and would probably cost somewhere around $2.00/cubic yard. Therefore, the cost for a complete cleanout of Matilija Reservoir would approximate $6,000,000. The cost per AF of 41,000 AF of storm flows conserved from 1973 through 2009 would, therefore, be about $145/AF.

A reservoir cleanout may also involve costly environmental considerations regarding the location of suitable disposal areas and the transportation of debris from the reservoir. Matilija Reservoir is located in the Las Padres National Forest and it would be necessary to coordinate the project with the U.S. Forest Service and perform the cleanout work in accordance with their specifications. The location of an environmentally acceptable disposal area may not be possible.

In view of the excessive cleanout costs and environmental considerations associated with this proposal, it was decided that this project does not appear practical at this time. Costs for this alternative are not shown in Table 5.