5750 Almaden Expressway, San Jose, CA 95118-3614 | (408) 265-2600 | www.valleywater.org

Santa Clara Valley Water District

30 Mansfield Road, P.O. Box 899, Hollister, CA 95024 | www.sbcwd.com

February 15, 2017

MEETING NOTICE

JOINT MEETING
SCVWD PACHECO RESERVOIR EXPLORATORY AD HOC COMMITTEE
SAN BENITO COUNTY WATER DISTRICT
PACHECO PASS WATER DISTRICT

SCVWD Board Members of the Pacheco Reservoir Exploratory Ad Hoc Committee
- Director Gary Kremen
- Director Richard P. Santos
- Direct John L. Varela

SBCWD Board Members of the Pacheco Reservoir Exploratory Ad Hoc Committee
- Director Sonny Flores
- Director John Tobias

PPWD Representatives
- Director TBD
- Director TBD

SCVWD Staff Support of the Pacheco Reservoir Exploratory Ad Hoc Committee
- Norma J. Camacho, Interim Chief Executive Officer
- James Fiedler, Chief Operating Officer, Water Utility
- Stanly Yamamoto, District Counsel
- Garth Hall, Deputy Operating Officer, Water Supply Division
- Cindy Kao, Imported Water Manager, Water Supply Division

SBCWD Staff Support of the Pacheco Reservoir Exploratory Ad Hoc Committee
Jeff Cattaneo, District Manager
Sara Singleton, Assistant Manager

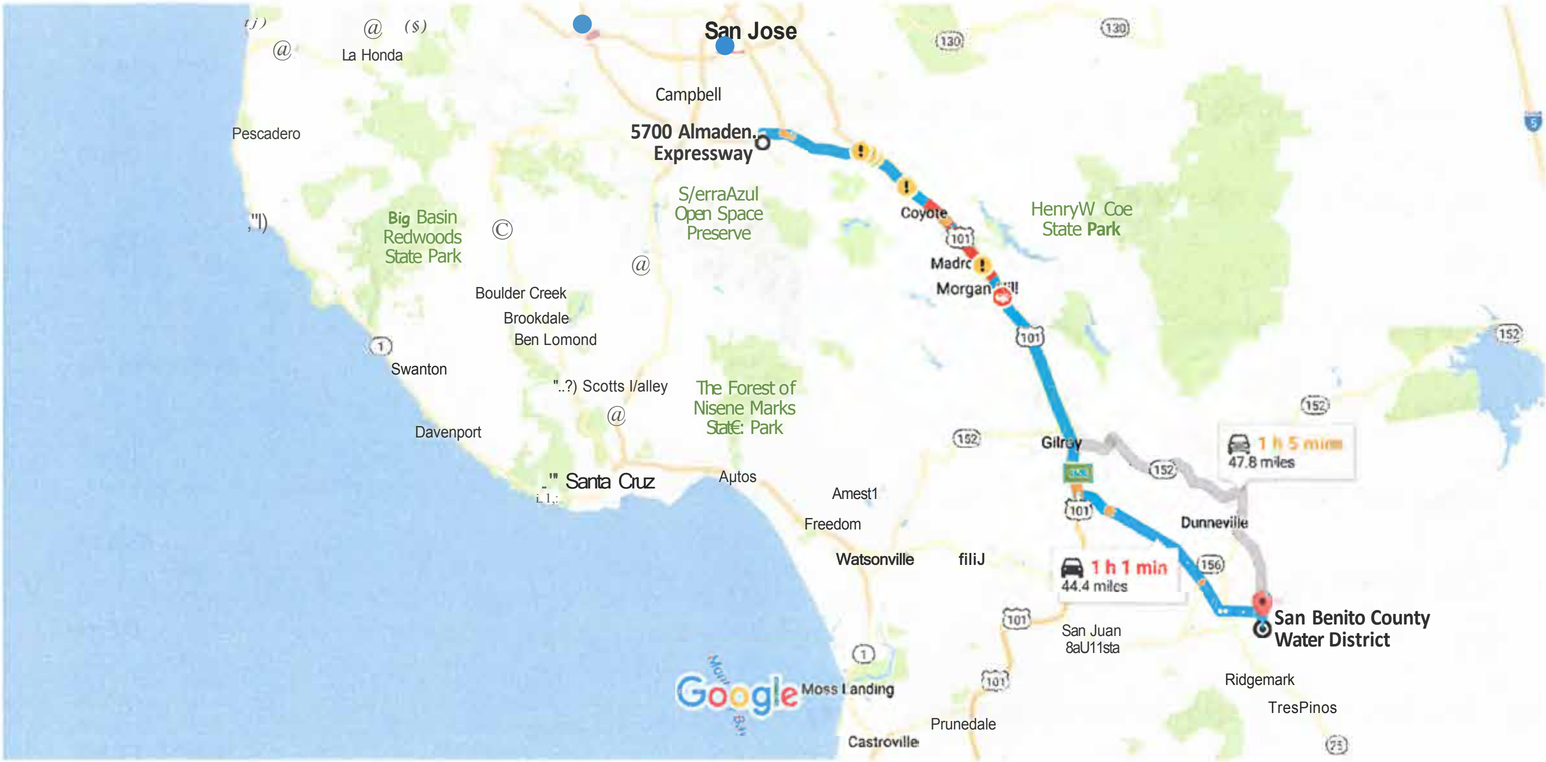
A joint meeting of the Santa Clara Valley Water District (SCVWD) Pacheco Reservoir Exploratory Ad Hoc Committee is to be held on **Thursday, February 23, 2017, at 3:00 p.m.** in the Conference Room located at the San Benito County Water District, 30 Mansfield Road, Hollister, California 95023.

Enclosed are the meeting agenda and corresponding materials. Please bring this packet with you to the meeting.

Enclosures

5700 Almaden Expressway to San Benito County Water District

Drive 44.4 miles, 1 h 1 min



5700 Almaden Expressway
San Jose, CA 95118
Get on CA-85 S
2 min (0.6 mi)

Take US-101 S to CA-25 S. Take exit 353 from US-101 S
26 min (29.6 mi)

Continue on CA-25 S. Drive to Mansfield Rd in San Benito County
18 min (14.1 mi)

San Benito County Water District
30 Mansfield Road, Hollister, CA 95023
These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

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	SCVWD Pacheco Reservoir Exploratory Ad Hoc Committee: Director John L. Varela Director Gary Kremen (Committee Chair) Director Richard P. Santos ***SBCWD Representatives:*** Director Sonny Flores Director John Tobias ***PPWD Representatives:*** Director TBD Director TBD	

AGENDA
JOINT MEETING
SCVWD PACHECO RESERVOIR EXPLORATORY AD HOC COMMITTEE
SAN BENITO COUNTY WATER DISTRICT
PACHECO PASS WATER DISTRICT
30 MANSFIELD ROAD
HOLLISTER, CA 95023

THURSDAY, FEBRUARY 23, 2017
3:00 P.M.

Time Certain:

3:00 p.m.	**1.**	**Call to Order/Roll Call**
	2.	**Time Open for Public Comment on Any Item Not on the Agenda** *Comments should be limited to two minutes. If the Committee wishes to discuss a subject raised by the speaker, it can request placement on a future agenda.*
	3.	**Introductions**
	4.	**Approval of Minutes** 4.1 Approval of Minutes – December 8, 2016, meeting
	5.	**Action Items:** 5.1 Preliminary Assessment of Enlarging Pacheco Reservoir and Potential Application for Proposition 1 Funding. (Garth Hall) **Recommendation:** A. Discussion among representatives of Pacheco Pass Water District (PPWD), San Benito County Water District (SBCWD), and SCVWD Pacheco Reservoir Exploratory Ad Hoc Committee (SCVWD) regarding the potential enlargement of Pacheco Reservoir and potential application for Proposition 1 funding. B. Discussion of draft principles of agreement; and C. Review information and recommend what action, if any, should be taken by the three Districts' respective Boards of Directors.
	6.	**Clerk Review and Clarification of Committee Actions**
	7.	**Adjourn**

Reasonable efforts to accommodate persons with disabilities wishing to attend committee meetings will be made. please advise the Clerk of the Board Office of any special needs by calling (408) 630-2277.

Meetings of this committee will be conducted in compliance with all Brown Act requirements. All public records relating to an open session item on this agenda, which are not exempt from disclosure pursuant to the California Public Records Act, that are distributed to a majority of the legislative body will be available for public inspection at the same time that the public records are distributed or made available to the legislative body, at the following location:

Santa Clara Valley Water District, Office of the Clerk of the Board
5700 Almaden Expressway, San Jose, CA 95118

PACHECO RESERVOIR EXPLORATORY AD HOC COMMITTEE PURPOSE:
The purpose of the Pacheco Reservoir Exploratory Ad Hoc Committee is to receive and discuss information on issues related to the LAFCO consideration of dissolution of Pacheco Pass Water District, the reorganization of its responsibilities and assets, as well as information related to the dam integrity and potential reservoir operating parameters for downstream aquatic habitat. The Committee representatives may assist their respective Board of Directors on policies and actions related to these matters.

PACHECO RESERVOIR EXPLORATORY COMMITTEE MEETING

DRAFT MINUTES

December 8, 2016

2:00 p.m.

A scheduled meeting of the Pacheco Reservoir Exploratory Ad Hoc Committee was held on December 8, 2016, in the Board Room of the San Benito County Water District, 30 Mansfield Road, Hollister, California.

1. **CALL TO ORDER/ROLL CALL:**
A meeting of the San Benito County Water District/Santa Clara Valley Water District Pacheco Reservoir Exploratory Ad Hoc Committee was called to order at 2:00 p.m. on December 8, 2016, in the Board Room of the San Benito County Water District, 30 Mansfield Road, Hollister, California.

San Benito County Water District (SBCWD) Board Members present were: Director John Tobias and Director Sonny Flores. SBCWD staff members in attendance were Jeff Cattaneo, Sara Singleton and Garrett Haertel.

Santa Clara Valley Water District (SCVWD) Board Members present were: Director Gary Kremen, Director Richard P. Santos and Director John L. Varela. SCVWD staff members in attendance were: Aaron Baker and Cindy Kao.

2. **TIME OPEN FOR PUBLIC COMMENT ON ANY ITEM NOT ON AGENDA**
There were no public comments.

3. **INTRODUCTIONS**
San Benito County Water District and San Benito County Water District attendees introduced themselves.

4. **APPROVAL OF MINUTES**

4.1 Approval of Minutes – March 21, 2016 Meeting
A motion was made by Director Tobias and seconded by Director Santos; the Minutes of March 21, 2016 were unanimously approved.

5. **ACTION ITEMS:**

5.1 Proposed Dissolution of Pacheco Pass Water District (PPWD) by San Benito County Local Agency Formation Commission (Cattaneo/Kao)
Recommendation: Receive and discuss information presented by staff and discuss possible next steps
Mr. Cattaneo reviewed the reason LAFCO sought to dissolve PPWD as it had no active board. At the recent election, 5 candidates ran unopposed and they now have a viable board. Discussion ensued about the assistance the two Districts could offer PPWD.

5.2 Preliminary assessment of the merits of enlarging Pacheco Reservoir and the potential for obtaining Proposition 1 funding (Kao/Cattaneo)
Recommendation: Receive and discuss information presented by staff and discuss possible next steps.
Ms. Kao reviewed the Evaluation of Pacheco Reservoir Enlargement and Potential Proposition 1 Funding Application. Discussion ensued regarding the benefits of pursuing the project and the funding for each District.

6.0 REVIEW INFORMATION FROM AGENDA ITEMS 5.1 AND 5.2 ABOVE AND RECOMMEND WHAT ACTION, IF ANY, SHOULD BE TAKEN BY THE TWO DISTRICTS' RESPECTIVE BOARDS OF DIRECTORS.

Action items:

1. **Ms. Kao to contact SCVWD's legal for management advice for PPWD.**
2. **Director Kremen suggested attending a future PPWD meeting.**
3. **SBCWD will take the lead in assisting PPWD with any organizational needs they may have.**
4. **Further pursuit of Pacheco Reservoir enlargement and Proposition 1 funding**

7.0 CLERK REVIEW AND CLARIFICATION OF COMMITTEE ACTIONS
There were no additional action items.

8.0 ADJOURNMENT
Chairperson Director Kremen adjourned the meeting at 2:53 p.m.

Santa Clara Valley Water District

Committee:	Pacheco Reservoir Exploratory Ad Hoc Committee
Meeting Date:	2/23/2017
Agenda Item No.:	5.1
Unclassified Manger:	G. Hall
Email:	ghall@valleywater.org

COMMITTEE AGENDA MEMO

SUBJECT: Preliminary Assessment of Enlarging Pacheco Reservoir and Potential Application for Proposition 1 Funding.

RECOMMENDED ACTION:

A. Discussion among representatives of Pacheco Pass Water District (PPWD), San Benito County Water District (SBCWD), and Santa Clara Valley Water District (SCVWD) regarding the potential enlargement of Pacheco Reservoir and potential application for Proposition 1 funding;

B. Discussion of draft principles of agreement; and

C. Review information and recommend what action, if any, should be taken by the three Districts' respective Boards of Directors.

SUMMARY:

At the January 31, 2017, Special Board meeting of the SCVWD Board of Directors, the board delegated the members of the Pacheco Reservoir Exploratory Ad Hoc Committee to meet with representatives of Pacheco Pass Water District (PPWD) and San Benito County Water District (SBCWD) regarding the potential enlargement of Pacheco Reservoir and development of a potential application for funding from the State's Proposition 1 Water Storage Investment Program. This item provides for that discussion among the parties.

Recently updated analyses suggests that enlargement of Pacheco Reservoir to roughly 130 TAF could provide significant water supply benefits, as well as possible ecosystem benefits in the San Francisco Bay Delta and local creeks that could make an expansion of Pacheco Reservoir eligible for Proposition 1 funding. Currently, landslides threaten the existing North Fork Dam that creates Pacheco Reservoir, and the California Division of Safety of Dams has identified a need to replace the spillway wall. An expansion project could be designed to address these infrastructure issues while expanding the reservoir to provide benefits to all three agencies.

Time available for submitting a Proposition 1 funding application is limited. Proposition 1 funding applications are due by early August 2017. SCVWD is considering securing a consultant to perform the analysis required for an application. Agreements with potential partners, including SBCWD and PPWD would also be needed. SBCWD has indicated a desire to partner with SCVWD on development of a Proposition 1 funding application; however, neither is planning to proceed without PPWD's support.

BACKGROUND:

Pacheco Reservoir is a 6 TAF reservoir owned by PPWD. It is located approximately 0.4 miles north of Pacheco Pass Highway (Highway 152) in Santa Clara County and is formed by the North Fork Dam, which was built in 1936 on the north fork of Pacheco Creek.

In February 1993, Wahler Associates produced a reconnaissance level report for SCVWD evaluating five alternative dam and reservoir sites to provide storage of excess imported water. That report found that an expansion of the Pacheco Reservoir is a feasible alternative that warranted further study. This report is provided as Attachment 1.

In August 2002, as part of the San Luis Low Point Improvement Project (SLLPIP), Montgomery Watson Harza (MWH) provided SCVWD with a technical memorandum to discuss options surrounding a new dam and reservoir at Pacheco Creek. The SLLPIP was a feasibility study by the US Department of the Interior, Bureau of Reclamation in cooperation with SCVWD and the San Luis & Delta-Mendota Water Authority. The SLLPIP is proposed to maintain a high quality, reliable and cost-effective water supply for SCVWD and other contractors of the San Felipe Division. The August 2002 technical memorandum is provided as Attachment 2.

On September 23, 2008, the SCVWD Board of Directors approved the "Principles of Agreement for a Joint Investigation of Future Alternatives for Pacheco Reservoir" (Principles of Agreement) (Attachment 3).

Although some of the investigations outlined in the Principles of Agreement were conducted, progress was delayed due to difficulty gaining access to private lands in the watershed for geologic and technical studies. No formal agreement between the parties was ever executed.

The California Division of Safety of Dams has identified a need to replace the spillway wall of the North Fork Dam.

In December 2011, the Santa Clara County Local Agency Formation Commission (LAFCO) adopted a Countywide Water Service Review Report that identified the following concerns with PPWD:

> "In summary, there are several concerns regarding the financing, operations and management of PPWD, including a lack of necessary revenue to complete essential capital improvements, lack of transparency and clarity in financial statements, inaccuracies in the District's accounting and State reporting, failure to submit a timely audited financial statement to the County, lack of a website to inform constituents of district activities and functions, lack of a means to track operations and water flows at the dams, extended board vacancies and a lack of contested elections."

Current Pacheco Reservoir Expansion Project

Recent analyses performed by the SCVWD indicates that Pacheco Reservoir could be expanded to 130 Thousand Acre-Feet (TAF) without inundating Henry Coe State Park, and that storage of imported water supplies in the enlarged reservoir may provide up to 100 TAF of critically dry year supply. An expanded reservoir may also provide water quality benefits, operational flexibility, emergency storage, flood protection, and ecosystem benefits. The capital cost of this expansion is currently estimated to be roughly $800 million; Operations and Maintenance (O&M) costs are roughly estimated to be $3.3 million annually. Staff is evaluating whether benefits will justify potential costs, and whether Proposition 1 funding opportunities may increase the affordability of this project. SBCWD has expressed interest in partnering with SCVWD if the decision is made to move forward with a funding application.

Pacheco Reservoir releases water to Pacheco Creek in Santa Clara County and drains to the Pajaro River and ultimately to Monterey Bay. The California Department of Fish and Wildlife has indicated that enhancement of the South Central Coast Steelhead run on Pacheco Creek is important and that recovery and fishery enhancement actions that could be taken for that water course could improve the fisheries habitat value. If expanding Pacheco Reservoir could lower water temperatures and increase summer flows, fisheries habitat value of the stream could be improved. The National Marine Fisheries Service, however has previously expressed concern about releasing San Francisco Bay Delta water into local creeks.

Proposition 1 Funding Available for Water Storage Projects

The California Water Commission (CWC), which is administering the $2.7 billion available in the Proposition 1 Water Storage Investment Program (WSIP), finalized its regulations on December 14, 2016. The due date for submittal is anticipated to be in early August 2017 and will be determined after the Office of Administrative Law approves the proposed WSIP regulations, anticipated to occur in March.

The CWC has identified multiple objectives that should be met in the application process, including more reliable water supplies, restoration of important species and habitat, and more resilient and sustainably managed water infrastructure. The WSIP allows for investment of public funds for public benefits associated with water storage. In other words, only the public benefits (environmental, flood protection, water quality, etc.) are eligible for funding. Water supply benefits are not eligible for funding under WSIP. Prior to approving funding, the CWC must make a determination that the project is feasible and that the expected benefits exceed the expected costs, among other requirements.

In considering whether to submit a Proposition 1 application, an application may be competing with other potential applicants for Proposition 1 WSIP funding. They include Sites Reservoir, Los Vaqueros Reservoir expansion project, and Temperance Flat with a total combined project cost of about $8 billion. There may ultimately be in excess of a dozen total Proposition 1 applicants, although given the stringent requirements for both qualifying for funding and for completing the required analyses, it will be challenging for smaller projects to complete the applications.

The Pacheco Reservoir Enlargement project could be eligible for up to 50 percent of its total cost if approved for Proposition 1 funding; however, ecosystem improvements must account for at least half of the public benefit cost share. Given the number and size of potential applicants, the potential funding level awarded to the Pacheco Reservoir project could potentially be less than 20% of the project cost, or $160 Million.

In order to receive WSIP funding, the applicant would need to enter into contract with each appropriate State agency, including potentially the California Department of Fish and Wildlife (CDFW), the State Water Resources Control Board (SWRCB), and the Department of Water Resources (DWR), to administer the public benefits of the project. The contracts would require implementation of an adaptive management plan that identifies trigger levels that initiate adaptive management actions, a decision making process that includes the administering State agency, assurances as determined by the administering State agency and the applicant regarding operations and O&M, and monitoring and reporting requirements, among other obligations. Potential costs will need to be developed as the project is better defined and would need to be covered by the project applicant, or may be funded through Prop 1 funds.

If the planning studies and economic analysis continue to indicate that the project would be a suitable storage project for PPWD, SBCWD, and SCVWD, a number of considerations and potential risks would have to be considered before a recommendation could be brought to the respective Boards to proceed with further planning, environmental analysis, design and construction. The considerations include which entity holds title to the land upon which the project would be constructed, environmental documentation including CEQA, permitting requirements, operational requirements, partnership commitments, stakeholder support, and design/construction uncertainties.

PRINCIPLES OF AGREEMENT:

To accomplish the work defined above, SCVWD, SBCWD and PPWD could consider establishing Principles of Agreement. Attachment 4 provides draft Principles of Agreement for discussion among PPWD, SBCWD, and SCVWD to facilitate progress on planning studies and funding applications for potentially enlarging Pacheco Reservoir.

NEXT STEPS:

The SCVWD Board will meet on February 28, 2017, to consider whether to move forward to secure a consultant to perform a feasibility assessment and potentially partner with SBCWD and PPWD to develop a Proposition 1 funding application. A decision will be made only if all parties provide their support. If the decision is to move forward, SCVWD would coordinate with PPWD and SBCWD to proceed with the following:

1. Revise, as needed, and finalize the Principles of Agreement

2. Secure a consultant to prepare the Proposition 1 funding application.

3. Develop the Proposition 1 funding application, which requires the following activities:

    a. Direct a consultant to evaluate whether project benefits exceed costs in order to qualify for Proposition 1 funding.

    b. Secure a formal resolution by PPWD's Board to support the Proposition 1 application for enlarging Pacheco Reservoir.

    c. Develop a cost-share-and-coordination agreement among SCVWD, SBCWD, and PPWD.

    d. Develop a memorandum of understanding between PPWD, SBCWD, and the SCVWD regarding objectives, interests, and coordination related to expanding Pacheco Reservoir.

    e. Coordinate with the resource agencies regarding quantification of fishery benefits.

f. Communicate with potential stakeholders, such as United States Bureau of Reclamation (USBR), CDFW, National Marine Fisheries Service (NMFS), and interested non-governmental organizations (NGO's).

g. Explore partnerships with other potential partners, such as State of California, USBR, SBCWD and PPWD.

If the consultant's benefit-cost assessment confirms that benefits exceed costs, the project is feasible, and there is a good chance of securing funding, then the following steps will be taken:

4. Coordinate and oversee the consultant to proceed with completing the Prop 1 funding application.

5. Meet with and obtain written support and draft agreements from resource agencies and potentially other entities in order to validate potential benefits described in a Proposition 1 funding application.

6. Submit an application for a Proposition 1 funding by the deadline.

7. Continue further study work towards enlargement of Pacheco Reservoir per the Principles of Agreement.

ESTIMATED COST OF FUNDING APPLICATION:

Proposition 1 funding applications are required to satisfy certain criteria and perform similar analyses utilizing the same or functionally similar modeling tools, and all must analyze the benefits to protected fish species in the San Francisco Bay Delta. Therefore, the estimated costs of preparing the Proposition 1 funding applications for other projects may be useful to estimate costs for developing funding applications for expanding Pacheco Reservoir. The costs of preparing a Proposition 1 funding application is significant and ranges from $900,000 for the Los Vaqueros Reservoir Expansion project to $15 million for the Sites Reservoir Project.

Staff anticipates that the preparation of a Proposition 1 funding application for an expanded Pacheco Reservoir will be significantly less complex than the analysis of Sites Reservoir and therefore significantly less costly. The cost will be more comparable to the cost of analysis for Los Vaqueros Reservoir Expansion. Staff estimates that the cost of preparing a Proposition 1 application for expansion of Pacheco Reservoir would be up to $900,000, depending on the extent of analysis determined to be needed. The consultant contract would be phased to allow for termination by SCVWD if at any time during the analysis it is determined that the costs of the project outweigh the potential benefits.

ATTACHMENT(S):

Attachment 1: February 1993 Report: Reconnaissance Level Evaluation of Alternative Dam and Reservoir Sites
Attachment 2: August 2002 Report: San Luis Reservoir Low Point Improvement Project Conceptual Alternative Summary: Alternative #4C: New Dam and Reservoir at Pacheco Creek
Attachment 3: September 23, 2008 Board Agenda Memo and Draft Principles of Agreement
Attachment 4: Draft Principles of Agreement
Attachment 5: Figure showing location of Pacheco Reservoir
Attachment 6: PowerPoint Presentation

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Aaron Baker

RECONNAISSANCE LEVEL EVALUATION

OF ALTERNATIVE DAM AND RESERVOIR SITES

Prepared for:

SANTA CLARA VALLEY WATER DISTRICT

February 1993

Prepared by:

WAHLER ASSOCIATES

IN ASSOCIATION WITH

NOLTE AND ASSOCIATES

Project SCV-145A

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FIGURES

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APPENDICES

Appendix

CHAPTER I

CHAPTER I
INTRODUCTION

A. GENERAL

This report presents the results of a reconnaissance-level study of potential reservoir sites being considered by the Santa Clara Valley Water District (the District) to provide for storage of excess imported water. The study was performed under the terms of an agreement, dated August 27, 1991, between the District and Wahler Associates

B. BACKGROUND

In the process of performing an overview study of its water utility, the District identified additional in-County storage capacity as one alternative which would help meet future water demands. This additional capacity would allow the District to more efficiently use both contracted and supplemental imported water supplies and to provide increased reliability to the Water Utility during dry periods.

The District therefore undertook a preliminary evaluation of thirteen possible reservoir sites in southeastern Santa Clara County. This general location was chosen because reservoirs here can be readily integrated with sources of imported water (the Pacheco Conduit or Santa Clara Conduit) and the District's system, whereas sites in the western County cannot.

The thirteen reservoir sites evaluated by the District were: San Felipe, Packwood and Clarks Canyon, in the Anderson Reservoir watershed; Blue Ridge, Coe and Los Osos, in the Coyote Reservoir watershed; Smith Creek, high in a watershed that is tributary to Coyote Creek below Anderson Reservoir; North Fork Pacheco, high in the North Fork Pacheco Creek watershed; Pacheco, also in the North Fork Pacheco Creek watershed, but near the Pacheco Pass Water District's existing North Fork Dam; and South Fork Pacheco, Ausaymas, Harper and Cedar Creek, in small watersheds tributary to Pacheco Creek and proximate to State Highway 152.

The District's evaluation determined that five sites should be studied further and that eight sites should be eliminated from current consideration because of the lack of storage volume. The five sites selected for further study were Packwood, Coe, Los Osos, Cedar Creek and Pacheco. The determining factors in this selection were available storage capacity, capital cost per acre foot of storage capacity, and ability to integrate and operate the reservoirs with the District's water distribution system. The reservoirs dropped from further consideration would be prohibitively expensive by comparison with the selected sites and severely restricted in available storage capacity by topographic conditions. The results of the District's study were published in a report entitled "Water Supply Master Plan Report - Preliminary Evaluation of Alternative Dam and Reservoir Sites", dated August 1991.

Based on the screening study, it is apparent that the basic potential reservoir locations selected for further study are the only viable storage alternatives that might meet the District's needs. These potential reservoirs are the subject of this report.

C. APPROACH

Evaluation of the five basic alternatives embraced both environmental and technical considerations, and involved a multi-step process. Basic information and data were reviewed on environmental and land use issues, regional geology and seismicity, and the District's system and requirements. An aerial reconnaissance was made of the reservoir sites to overview conditions and features in the reservoir area and their environs, and to identify promising locations for dams and appurtenant structures.

This was followed by more detailed ground reconnaissance. The ground reconnaissance examined conditions at each damsite identified during the aerial reconnaissance; selected preferred alignments for dams, spillways and outlet works; identified potential sources of construction materials; and examined close up other conditions within the reservoir areas, including potential environmental and physical constraints.

Conceptual designs, layouts and cost estimates were then prepared for each site. Because total storage capacity needed is yet to be finalized, the designs, layouts and cost estimates were prepared for several different sizes of reservoir, from which curves of cost versus storage capacity were constructed for each site. Costs of other facilities associated with the reservoirs, such as pipelines, pump stations, access roads, etc., were also accounted for.

Environmental and land use issues were examined to identify potential constraints to development of the candidate sites, and to permit, to the extent possible at this level of study, a preliminary comparison of the sites with regard to those issues.

CHAPTER II

CHAPTER II
SITES CONSIDERED

A. GENERAL

Locations of the dam and reservoir sites considered in this study are shown on Figure II-1. Several different reservoir sizes were examined at each site but, for clarity, only one size reservoir is outlined on the figure. The reservoir limits shown correspond to approximately 200,000 acre-feet of storage at the Packwood, Coe and Cedar Creek sites, and 350,000 acre-feet at the Los Osos site and two Pacheco sites (Pacheco B and Upper Pacheco, discussed below).

At the Packwood, Coe, Los Osos and Cedar Creek sites, there is essentially one suitable location for a dam. In the case of Pacheco, however, four potential alternatives were noted during the aerial reconnaissance. These alternatives are:

- expanding the existing Pacheco Reservoir by raising the existing North Fork Dam (designated herein as "Lower Pacheco");
- a damsite in the existing reservoir, approximately 0.3 mile upstream of the existing dam (designated "Pacheco A");
- a damsite in the existing reservoir, approximately 1.5 miles upstream of the existing dam (designated "Pacheco B"); and
- a damsite beyond the upstream limit of the existing reservoir, at a prominent topographic feature known as Chimney Rock, about 2.6 miles upstream of the existing dam (designated "Upper Pacheco").

B. PACKWOOD SITE

The Packwood site is situated in the Anderson Reservoir watershed, northeast of Leroy Anderson Dam. The damsite lies across Packwood Creek, immediately downstream of the confluence of Packwood and Hoover Creeks (Photo No. 1). Low point of the stream channel at the damsite is approximately Elevation 1,270 Mean Sea Level (MSL).

C. COE SITE

The Coe site is in the Coyote Reservoir watershed, upstream of the Los Osos site, and within Henry W. Coe State Park. The damsite is on Coyote Creek, immediately downstream of the confluence of the Middle and East Forks of that creek (Photo No. 2). Low point of the stream channel at the damsite is approximately Elevation 1,150 MSL.

D. LOS OSOS SITE

The Los Osos site (Photos Nos. 3 and 4) is in the Coyote Reservoir watershed, south and east of that reservoir. The damsite is located in a constriction of the Coyote Creek channel, about 1-1/2 miles upstream of Coyote Reservoir. Low point of the stream channel at the damsite is approximately Elevation 800 MSL.

E. CEDAR CREEK SITE

The Cedar Creek site is in a small watershed tributary to Pacheco Creek, just north of State Highway 152 (Photo No. 5). Low point of the Cedar Creek channel at the damsite is approximately Elevation 360 MSL.

F. PACHECO SITES

As indicated earlier, four possible alternative damsites were initially identified at Pacheco. Preliminary layouts were made of the four alternatives and the sites were further examined during the ground reconnaissance. Information on the existing North Fork Dam was reviewed at the office of the State of California Division of Safety of Dams. Based on the preliminary layouts and ground reconnaissance observations, the following preliminary conclusions were formulated about the four sites.

1. Lower Pacheco

Expanding the existing Pacheco Reservoir by raising North Fork Dam has some positive aspects. The site is closest of all the Pacheco alternatives to the Pacheco Conduit. For equal storage capacity, the site would not back up water as far into the watershed as would the other alternatives, and there is some environmental advantage to this. However, other factors combine to make this option less desirable than other Pacheco alternatives. Raising the dam to the height required for significant storage capacity would require a very long dam extension on the left abutment. The volume of embankment required would be much greater than at other sites. Moreover, that extension would be founded in an area of relatively weak, sheared shale whose inherent instability caused significant damage to the existing spillway some years ago. The damage has been remediated, but the shales are still prevalent in the area and their full depth and extent are unknown. It is likely that constructing a large dam on this foundation would at least require extensive ameliorative work. In any event, confirmation of technical and economic feasibility of the Lower Pacheco site would require an extensive exploration program if this alternative were to be pursued.

We do not, at this stage of investigation, rule out the Lower Pacheco alternative. However, it is our present judgement that, on technical and cost grounds, this site does not compare favorably with other alternatives.

2. Pacheco A

The Pacheco A damsite is topographically favorable and could provide storage equivalent to the Pacheco B and Upper Pacheco sites with a somewhat lower dam. It is closer to the Pacheco Conduit than the latter two alternatives and, like Lower Pacheco, would not back up water as far into the watershed. However, examination of exposures on the left abutment revealed highly weathered shale bedrock that probably extends to significant depth. The ground reconnaissance also indicated the possibility of old landslide deposits on this abutment. It is considered likely that deep excavations would be required to achieve a suitable foundation for a large dam at this site. We do not now rule out a dam here, but extensive subsurface exploration would be required to confirm its technical and economic feasibility. It is our present judgement that, on technical and cost grounds, this site does not compare favorably with the Pacheco B and Upper Pacheco sites.

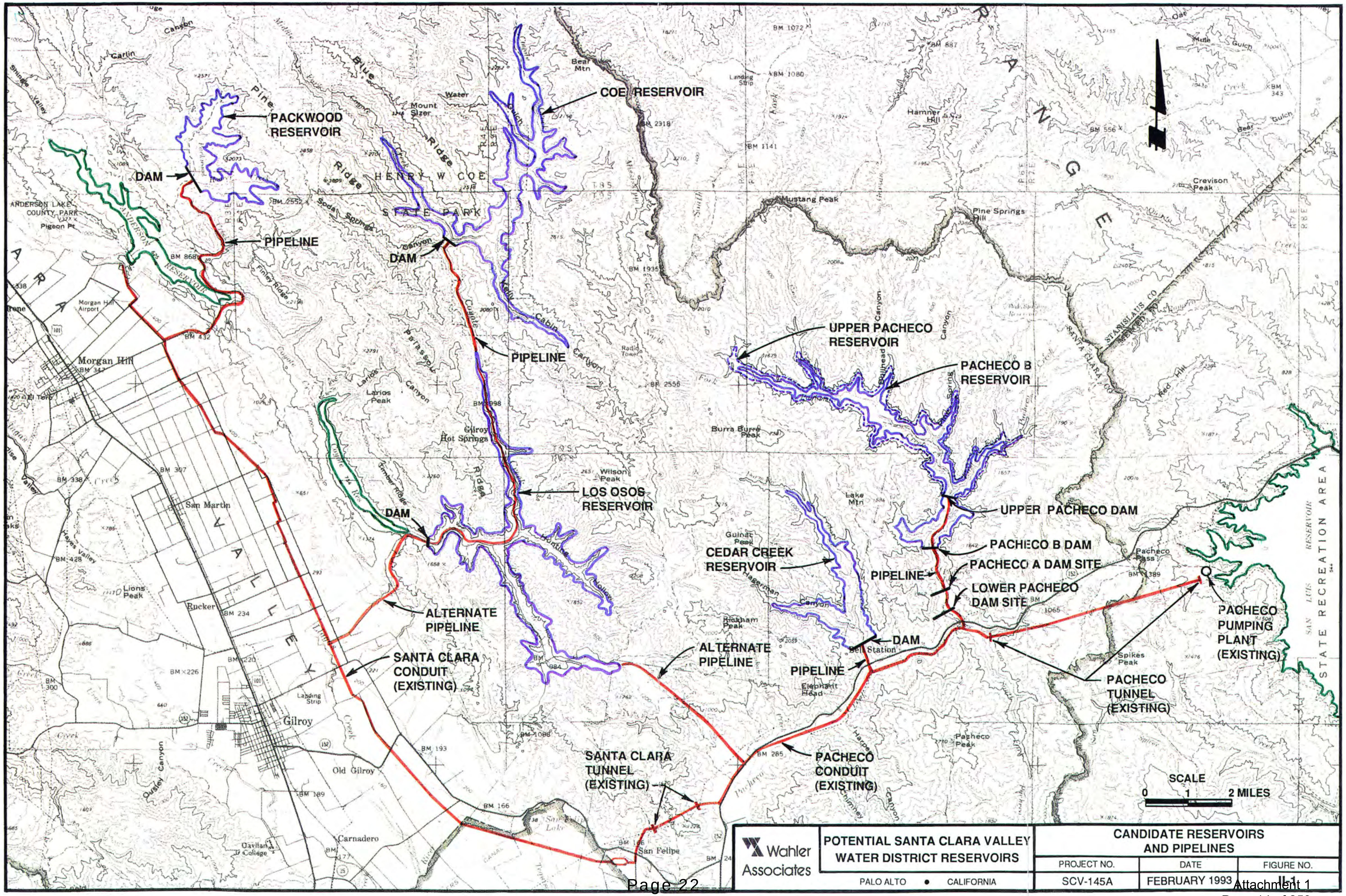
3. Pacheco B and Upper Pacheco

These two sites (Photos Nos. 6 and 7) are topographically efficient in that they can provide large storage capacity with a dam of reasonable size. Both sites appear to offer favorable foundation conditions, sound rock outcrops being exposed at both sites. Geologic conditions at these sites are discussed in more detail in Chapter III and Appendix 2. Low point of the stream channel is approximately Elevation 440 MSL at the Pacheco B damsiste and approximately Elevation 500 MSL at Upper Pacheco.

It is our present judgement that, on technical and economic grounds, these two sites are superior to the Lower Pacheco and Pacheco A sites.

4. Summary

Because there are, at this time, serious questions concerning the technical feasibility of constructing large dams at the Lower Pacheco and Pacheco A sites, the Pacheco B and Upper Pacheco sites were selected for development of project cost estimates. However, to cover the range of environmental and land use issues in the Pacheco area, those issues have been examined for the Lower Pacheco and Upper Pacheco alternatives (the sites farthest downstream and upstream, respectively).



Wahler Associates

POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS

PALO ALTO • CALIFORNIA

CANDIDATE RESERVOIRS AND PIPELINES

PROJECT NO.	DATE	FIGURE NO.
SCV-145A	FEBRUARY 1993	II-1

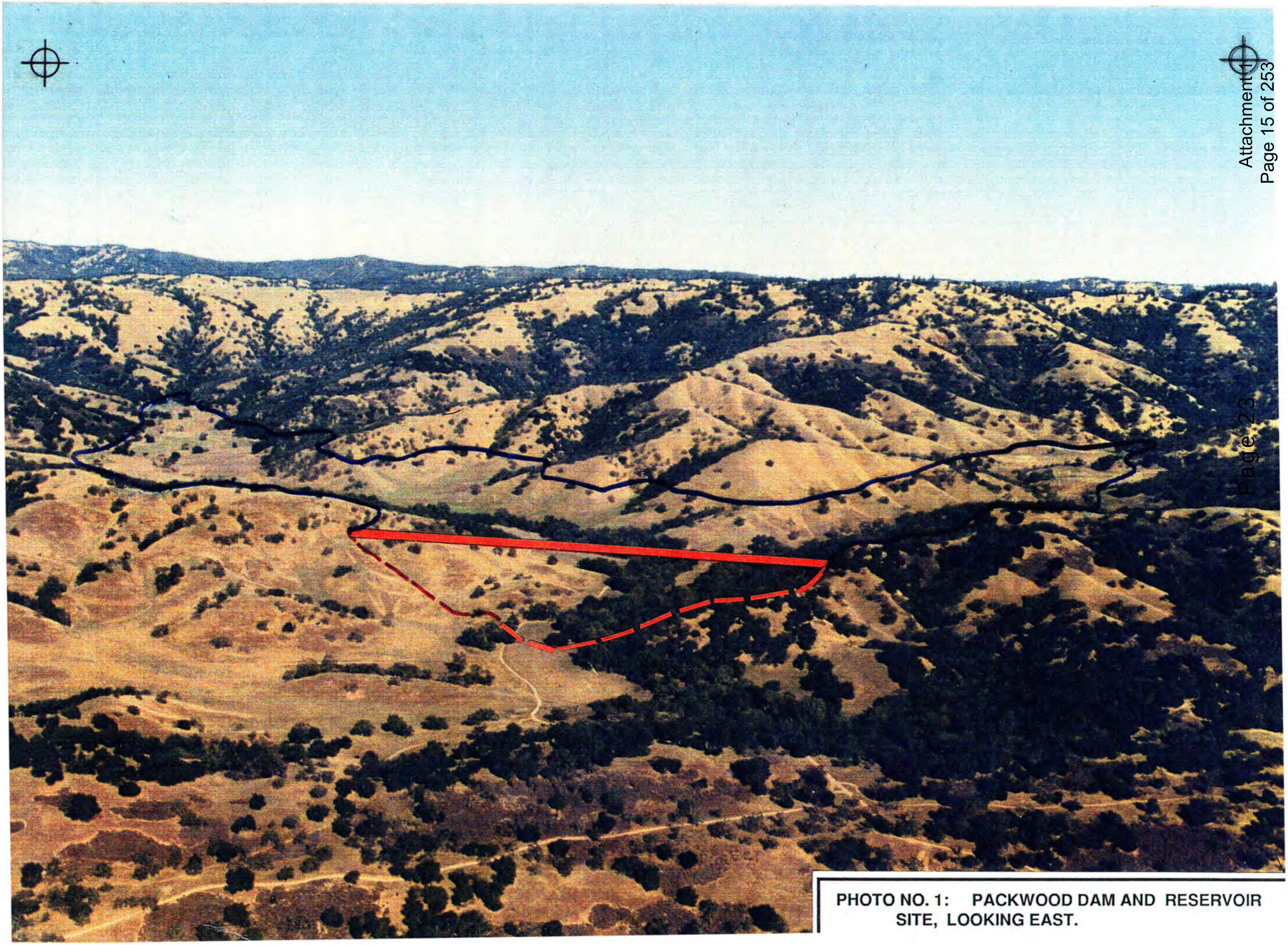


PHOTO NO. 1: PACKWOOD DAM AND RESERVOIR SITE, LOOKING EAST.

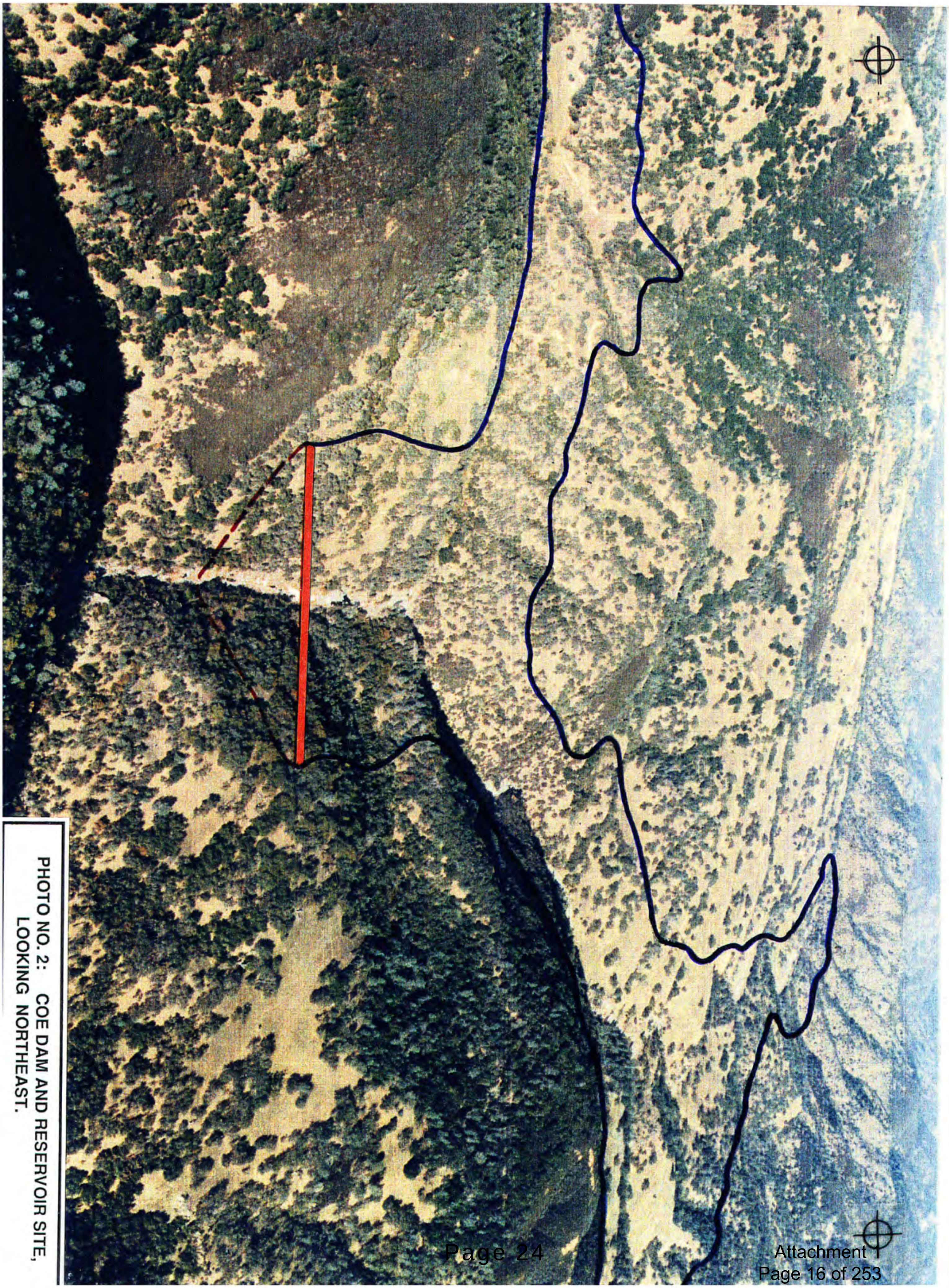


PHOTO NO. 2: COE DAM AND RESERVOIR SITE,
LOOKING NORTHEAST.

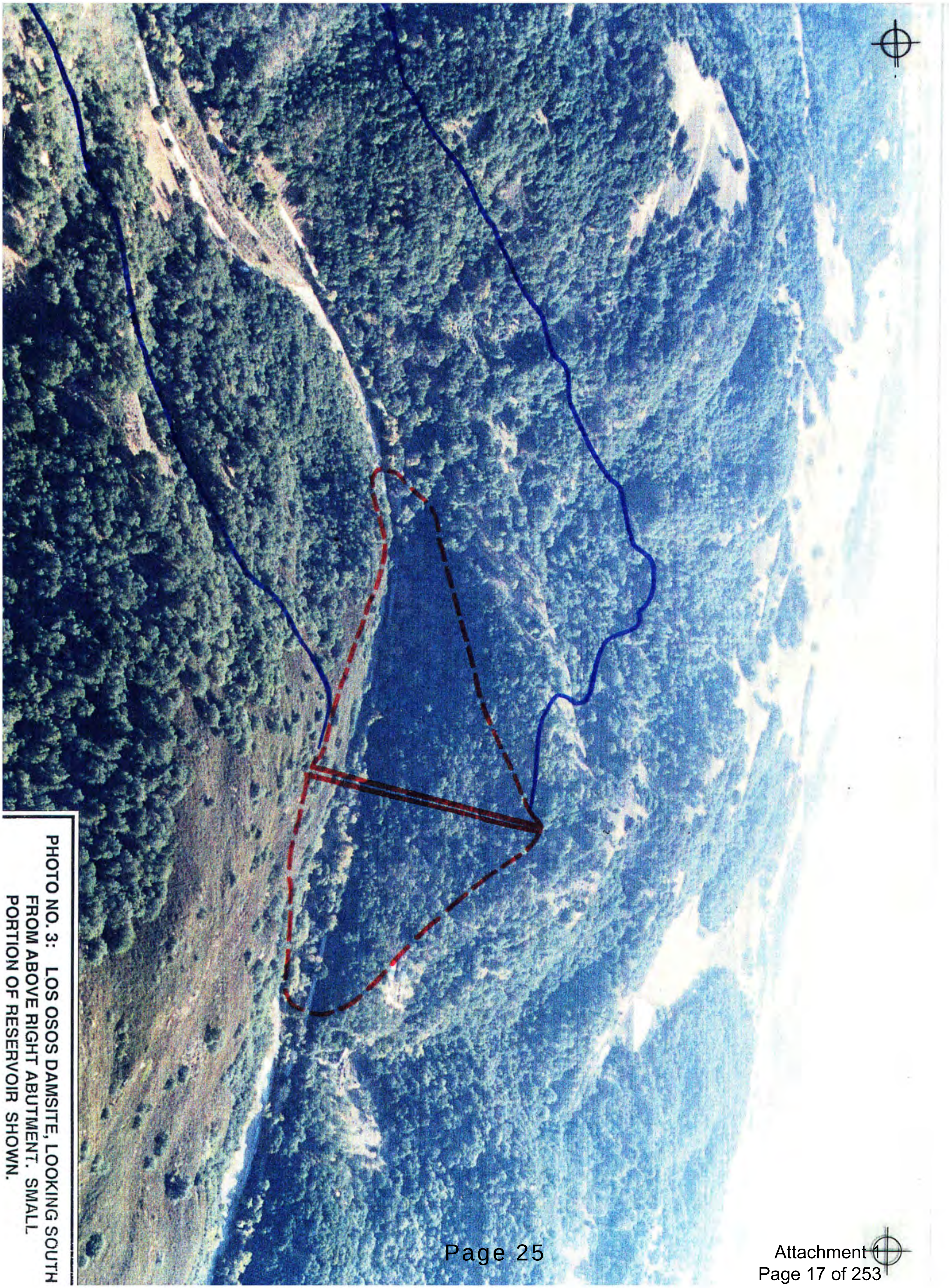


PHOTO NO. 3: LOS OSOS DAMSITE, LOOKING SOUTH FROM ABOVE RIGHT ABUTMENT. SMALL PORTION OF RESERVOIR SHOWN.

PHOTO NO. 4: LOS OSOS RESERVOIR SITE, LOOKING NORTHWEST. PROPOSED SADDLE DAM ACROSS CAÑADA ROAD IN FOREGROUND. MAIN DAMSITE NOT VISIBLE.

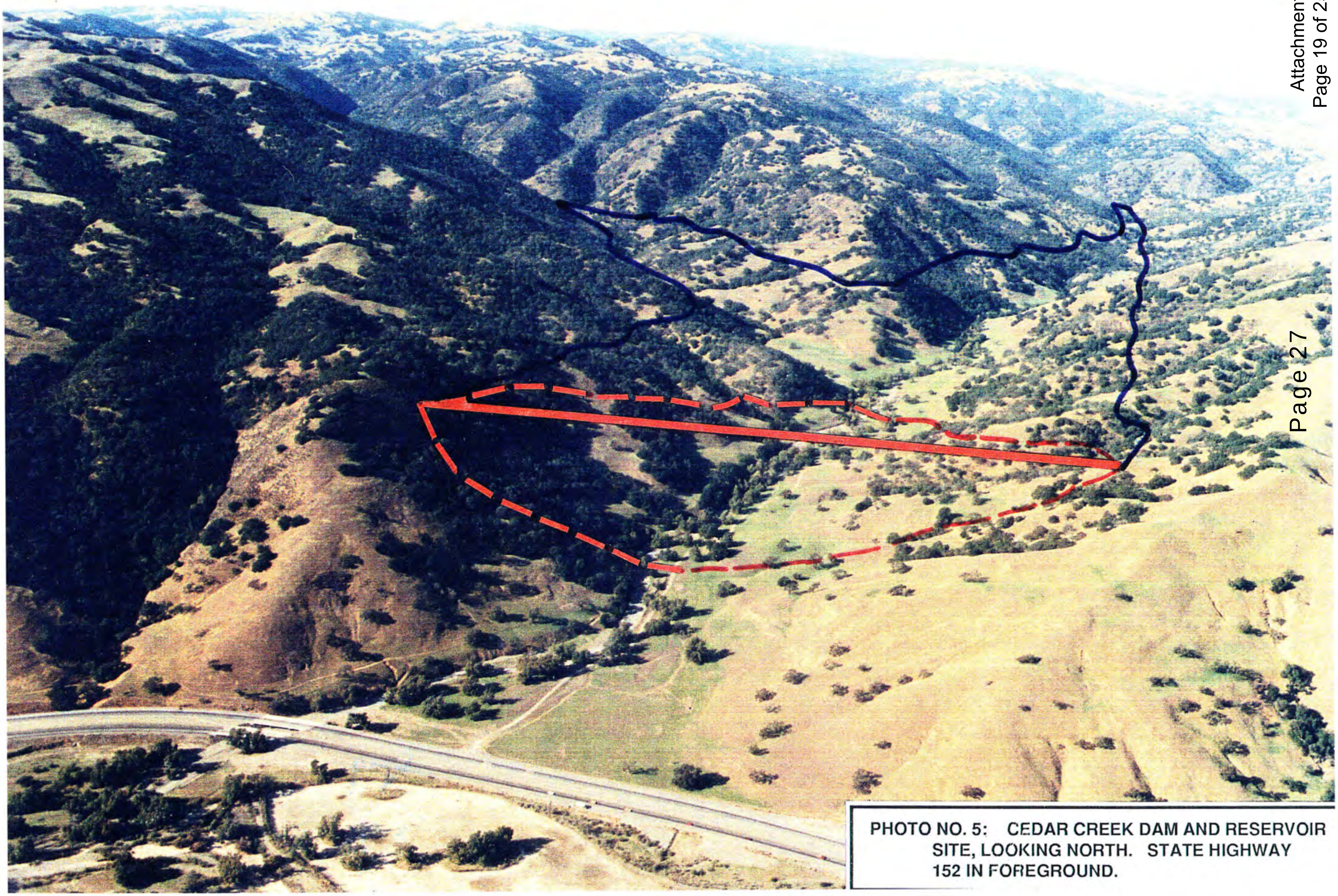


PHOTO NO. 5: CEDAR CREEK DAM AND RESERVOIR SITE, LOOKING NORTH. STATE HIGHWAY 152 IN FOREGROUND.

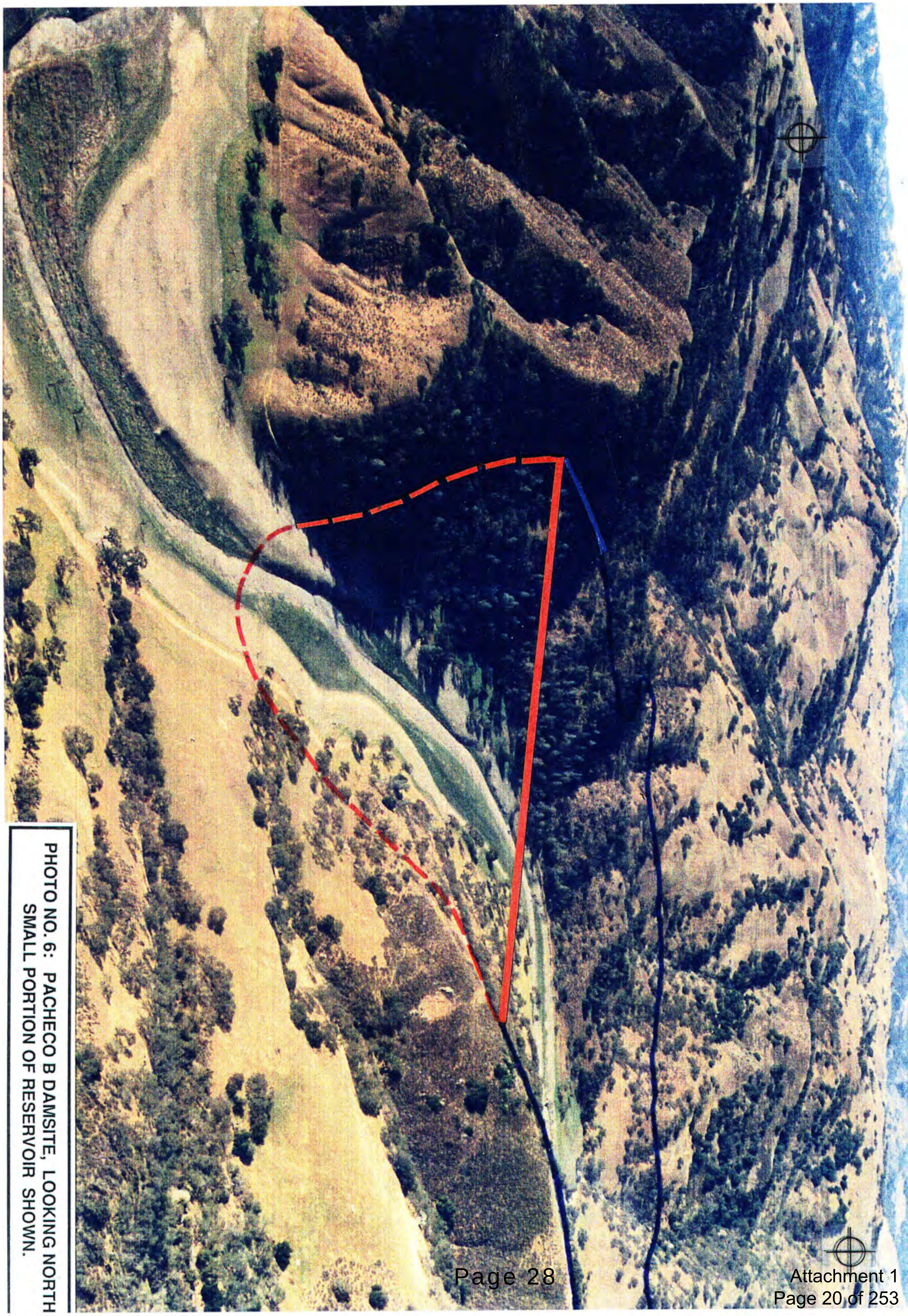


PHOTO NO. 6: PACHECO B DAMSITE, LOOKING NORTH
SMALL PORTION OF RESERVOIR SHOWN.

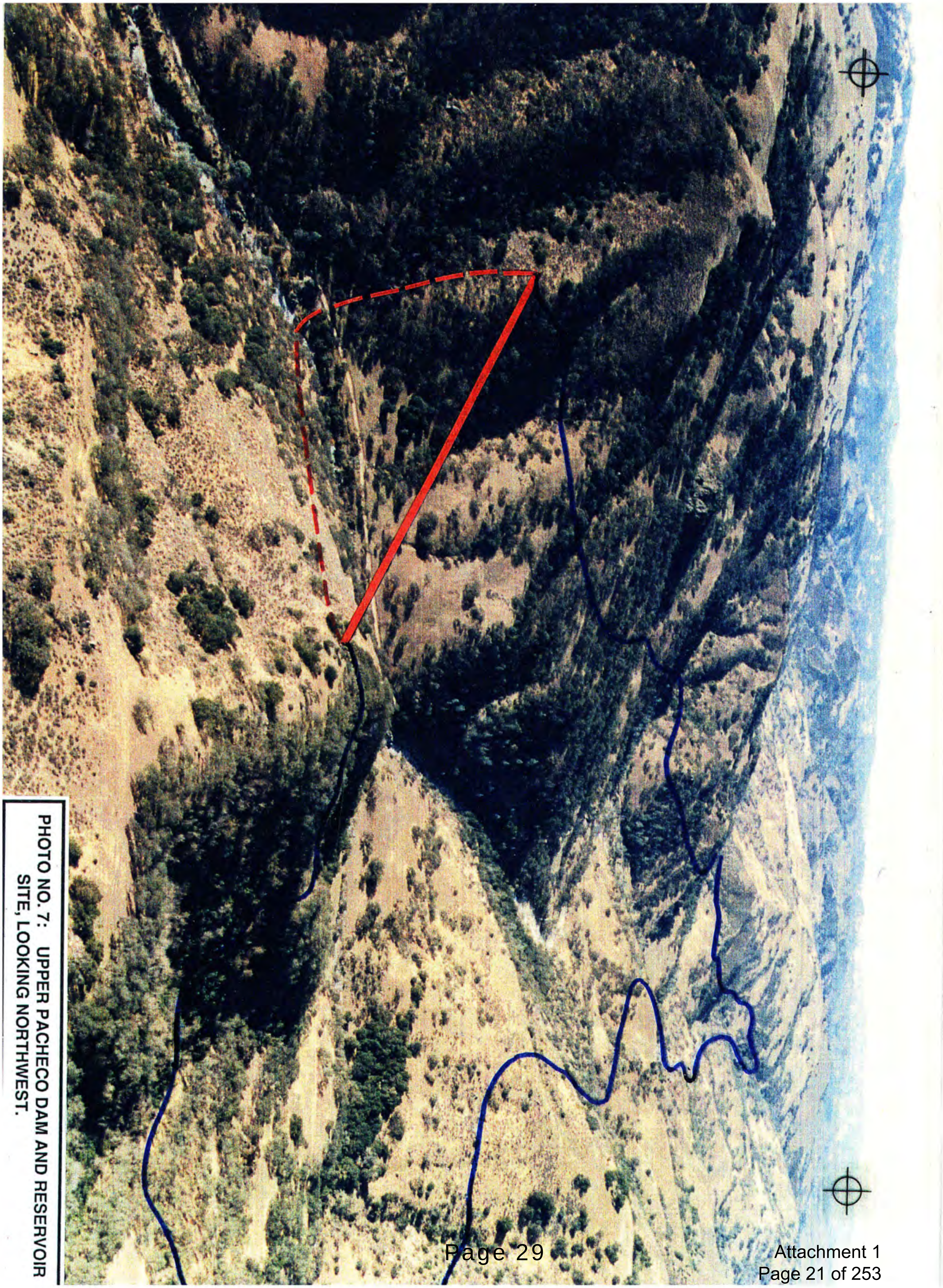


PHOTO NO. 7: UPPER PACHECO DAM AND RESERVOIR SITE, LOOKING NORTHWEST.

CHAPTER III

CHAPTER III
SITE CONDITIONS

A. GENERAL

Conditions at the reservoir sites, with regard to issues ordinarily of importance in development of a water resources project, are summarized below, by site. Environmental and land use issues, and geotechnical conditions, are also discussed in more detail in the Appendices.

Regional seismicity will impact the sites to varying degrees, depending on proximity of any given site to major active faults and the magnitudes of earthquakes occurring on the faults. The area of study is a region of high seismic activity and large earthquakes can be expected on any of several faults in the future. The dominant active faults in the area are the Calaveras and San Andreas Faults. The Ortigalita Fault is mapped as a Holocene fault by the California Division of Mines and Geology. The latter fault might therefore be considered, by some definitions, a potentially active fault. Table III-1 summarizes the relationships of these faults to the reservoir sites under study, and indicates the estimated peak bedrock accelerations at the sites from the Maximum Credible Earthquake occurring on each of the faults. From the standpoint of seismic dam design criteria, the Maximum Credible Earthquake is the only earthquake of interest to the State of California Division of Safety of Dams.

All of the reservoir alternatives being examined as a part of this study were sized to accommodate a relatively large volume of imported water. Annual local yields to these reservoirs represent only about 2% to 11% of the total reservoir volume. Therefore, with respect to existing conditions, all of the proposed reservoir alternatives would serve to attenuate the local peak flow rates, thus reducing the risk of downstream flooding. This is particularly true of the Packwood and Cedar Creek alternatives which have extremely small tributary drainage areas as compared to the other alternatives.

B. PACKWOOD SITE

1. Environmental

The Packwood site contains no known plant or animal species currently on State or Federal lists of threatened or endangered species. However, there is some potential for the occurrence of the red-legged frog and the California tiger salamander, which are currently being proposed for uplisting to Threatened or Endangered by the U.S. Fish and Wildlife Service. Biological field studies would be required to determine the presence or absence of these species.

The site contains suitable habitat for the reintroduced Tule elk and pronghorn, both of which are known to use the site. Neither of these species is threatened or endangered, but the loss of this habitat would be considered a significant impact by the California Department of Fish and Game.

The site contains about 9 miles of creek channels subject to permit authority of the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. The site ranks sixth (last) in importance among the six sites studied, in terms of potential loss of high quality riparian woodland. It ranks fifth in importance in terms of potential loss of valley oak woodland.

No prehistoric sites have been recorded in the vicinity of Packwood Valley to date. However, the setting of the valley floor would have been very favorable for Native American habitation; so it is highly likely that field surveys would result in the discovery of previously unrecorded sites.

The Packwood Valley is a pristine agricultural valley. However, due to its isolation and inaccessibility, the aesthetic value of this site has limited public importance as a visual resource. The valley contains no unique or outstanding visual features which would be lost due to creation of a reservoir here.

2. Land Use

The site contains one ranch complex with several dwellings on the west side of Packwood Valley (the Los Huecos Ranch). The southern and central portions of Packwood Valley are in cultivation, while upper Packwood and Hoover Valley are used for grazing. There are no public roads or major utilities within the site boundaries. No development applications are pending or proposed. The site is not located within any existing or proposed parks, open space preserves, trail corridors or scenic routes.

3. Seismicity

The active Calaveras Fault passes 0.7 mile to the southwest of the damsite and would clearly be the controlling fault. In the event of the Maximum Credible Earthquake occurring on the Calaveras Fault, very strong shaking would be experienced at the site.

4. Geology

The damsite is underlain by bedrock units of the Berryessa Formation, consisting of interbedded sandstone, siltstone and shale. A competent foundation for an earthfill dam appears achievable with excavations averaging about 10 feet on the left abutment, 6 feet on the right abutment and 20 feet in the stream channel area. Beneath the impervious zone of the dam, a somewhat deeper excavation is anticipated. Seepage potential at the damsite is considered relatively low because of favorable bedding dips coupled with the presence of interbedded shale. There are no known faults at the damsite.

The Madrone Springs Fault passes through the upper end of the Packwood Creek arm of the proposed reservoir. However, this fault is classified as pre-Quaternary (i.e., no evidence of displacement in at least the last 2 million years) and is therefore not considered active. At the upper end of Packwood Creek, some landslides have been mapped in the proposed reservoir area. The potential for their reactivation is considered low. In any event, these landslides are remote from the damsite, and would pose no threat to the dam.

5. Construction Materials

A substantial supply of impervious clay is readily available in the Packwood Valley arm of the proposed reservoir, and a supplemental source exists in Hoover Valley.

The remaining material available consists of bedrock of the Berryessa Formation that forms the ridges and slopes in the vicinity. It is anticipated that this source would produce a random material largely breaking down into a clayey, sandy gravel. Relatively small amounts of rock could be generated by selectively sorting from thick, hard sandstone beds of the Berryessa Formation. Within the limits of the proposed reservoir, the volume of random material available is limited to just a few million cubic yards. To construct dams of the sizes required for the range of storage capacities studied, it would be necessary to borrow large quantities of this type of material outside the reservoir limits.

Sand and gravel for filter and drain zones of the dam, and aggregate for concrete, would have to be obtained from off-site sources.

C. COE SITE

1. Environmental

As with all the other potential reservoir sites, the red-legged frog and the California tiger salamander (Federal candidate species proposed for uplisting) could be present on the Coe site. There is also some potential that this site supports pronghorn. If so, the California Department of Fish and Game would likely consider the loss of this habitat a significant impact.

Defined channels subject to Corps of Engineers jurisdiction extend approximately 16 lineal miles within the proposed dam and reservoir area. The site ranks second behind Los Osos in importance, in terms of potential loss of high quality riparian woodland. It also ranks second after Los Osos in terms of potential loss of valley oak woodland.

Four recorded archaeological sites exist within the proposed dam and reservoir area. Three of these sites include midden deposits which would require low to moderate levels of study/mitigation. The fourth site contains human burials and would require a high level of study/mitigation. The Coe site is ranked third in significance for known on-site prehistoric resources among the potential reservoir sites under consideration.

One recorded site of historic importance is present within the reservoir area, and would require a moderate level of study/mitigation.

The interior of Coe Park is generally very scenic, particularly along the forks of Coyote Creek. A band of scenic rock outcrops ("Rock House Ridge") crosses the northeast arm of the reservoir site creating additional visual interest. Due to its rugged terrain, variety of landscape, and virtually pristine natural condition, the interior of Coe State Park is considered to be scenically valuable as a large expanse of wilderness area.

2. Land Use

The proposed dam and reservoir lie within an area of the Park which is developed for non-intensive recreational uses such as hiking/backpacking, mountain biking and horse packing. The reservoir would inundate portions of the extensive trail system, as well as several designated backcountry camping areas.

The northeasterly reaches of the reservoir would occupy portions of several private in-holdings within the State Park.

There are no structures, roads or utilities within the dam and reservoir area. There is no cultivation or grazing within the Park boundaries.

The area of the proposed reservoir site is designated as "Special Management Area" in the Henry Coe State Park General Plan (1985), where the intent is to retain the existing wilderness character for the area, and where detailed planning is deferred to the future. However, it is clearly the intent of the Park Plan that the wilderness character of this area be preserved by the prohibition of man-made elements, and even enhanced by the removal of the few existing man-made elements which are present. Under the current Park General Plan, there are no roads or visitor-serving structures planned for this part of the State Park.

3. Seismicity

The Calaveras Fault is 4.3 miles southwest of the damsite and would be the controlling fault. In the event of the Maximum Credible Earthquake occurring on this fault, strong shaking would be experienced at the site.

4. Geology

The damsite is underlain by bedrock units of the Franciscan Complex -- mainly graywacke, interbedded shale, siltstone and sheared shale. In the channel area, strong, fresh bedrock is exposed at or near surface, and a suitable foundation can generally be achieved with an excavation averaging about 5 feet deep. On the abutments, excavation depths ranging from 20 to 50 feet (averaging about 35 feet) would probably be required. Weak zones in the form of sheared, soft shale exist in the foundation and these zones would require special treatment, involving significant overexcavation and dental (backfill) concrete work. These shear zones appear as narrow linear surface structures (up to 5 feet wide).

A published geologic map of Santa Clara County shows a probable fault passing through the damsite. This probable fault appears to be part of the Madrone Springs Fault Zone. If so, the fault would not be considered active. Nevertheless, if the Coe site were to be further considered, a feasibility-level study should include investigation of this fault and its probable impact on foundation conditions and performance.

Extensive landslides have been mapped on slopes in the Middle Fork Coyote Creek arm of the reservoir. It is possible that these landslides might be reactivated by rising and falling reservoir levels. The irregular shape of the reservoir would probably ameliorate the effect of wave action from massive landsliding (if any were to occur). The landslides should therefore pose no threat to the dam.

5. Construction Materials

There is no source of an adequate supply of impervious material, nor are there substantial sources of other earthfill material. This deficiency dictates consideration of alternative types of dam, and a roller-compacted concrete (RCC) dam has been considered at this site. A substantial potential rock quarry site exists just upstream of the damsite on the left (south) side of the East Fork Coyote Creek. Several other scattered sources also exist in the reservoir area. A significant amount of aggregate for an RCC dam could be produced from these areas.

D. LOS OSOS SITE

1. Environmental

There is a band of serpentine bedrock which passes through the site north-to-south near the mouth of Hunting Hollow, and just off-site to the west at Gilroy Hot Springs. This may indicate the presence of several rare plant and invertebrate animal species which are endemic to serpentinite-based habitats. While it is highly unlikely that any listed threatened or endangered species are present (e.g., the Bay checkerspot butterfly), it is quite possible that other species of concern to the U.S. Fish and Wildlife Service, which are currently candidates for listing (e.g., serpentine phalangid, micro-blind harvestman, Opler's longhorn moth), may be present.

As with all the other potential reservoir sites, the red-legged frog and the California tiger salamander are potentially present at this site. There is a strong possibility that the Los Osos site supports pronghorn, and to a lesser extent Tule elk. If so, the California Department of Fish and Game would likely consider the loss of this habitat as a significant impact.

There is some possibility that Golden Eagles may nest in one of the larger trees found on the valley floor. If so, this would be of concern to both the State and Federal resource agencies.

Defined channels subject to Corps of Engineers' jurisdiction comprise approximately 28 lineal miles within the proposed dam and reservoir area. The site ranks by far the highest in importance, in terms of potential loss of high quality riparian habitat. It also ranks highest in terms of potential loss of valley oak woodland.

There is one recorded archaeological site within the proposed dam and reservoir area. This site contains bedrock mortars and would require a low level of study/mitigation.

There are eight recorded sites of historic significance within or in the immediate vicinity of the proposed dam and reservoir area, including the old Gilroy Hot Springs site. It is anticipated that three of these sites would require moderate levels of study/mitigation, while the remaining five sites would require only low levels of study/mitigation.

The Los Osos site offers a variety of rural scenery. The upper arm along Coyote Creek is characterized by enclosed woodland along the creek, while the views along Cañada Road consist of longer roadside views over rolling pasture and savanna woodland. This area is considered to have scenic value by the County, as indicated by the designation of all the public roads as "Local Roads Needing Scenic Protection". It is an important consideration that this is one of the very few areas where public roadway access is available into the interior of the Mount Hamilton Range.

2. Land Use

There are two existing ranch complexes, a disused CDF station, and one new house within the proposed dam and reservoir area. There is also another ranch complex in close proximity to the proposed southern abutment of the main dam.

Approximately 10 miles of public road exist within the proposed reservoir area (portions of Gilroy Hot Springs Road, Cañada Road, and Jamieson Road), along with appurtenant utilities. Gilroy Hot Springs Road is particularly important because it will provide access to the recently approved Gilroy Hot Springs Resort, as well as a new entrance planned there for Henry Coe State Park (see below).

Agricultural activities include the cultivation of hay and grazing in Cañada de Los Osos, and grazing in Hunting Hollow.

In the northern-most two mile reach of the proposed reservoir, the eastern bank of Coyote Creek, opposite Gilroy Hot Springs, lies within the boundaries of Henry Coe State Park.

The County of Santa Clara Board of Supervisors recently approved a General Plan amendment to allow a new resort development at the site of the old Gilroy Hot Springs Resort on the northerly arm of the proposed reservoir on Coyote Creek. The new resort was approved for 70 rooms, recreational and eating facilities, plus a package plant for wastewater treatment. Most of the resort would be outside the proposed reservoir area (i.e., above 1,120-foot elevation), except for the package treatment plant, much of the parking area, and the main access road.

The County General Plan - Land Use Element designates the major portion of the dam and reservoir area as "Ranchlands", which would permit very limited land divisions, with the exception of the recently approved General Plan Amendment for the Gilroy Hot Springs Resort, as discussed above. A small area at the confluence of Coyote Creek and Cañada de Los Osos is designated as a site of a future flood control reservoir.

The Regional Parks, Trails and Scenic Highways Element of the County General Plan designates the entire Coyote Creek corridor from Coe State Park to Coyote Reservoir as a proposed Park, including a proposed trail corridor along the banks of the creek. All of the public roads within the reservoir area are designated as "Local Roads Needing Scenic Protection".

The County's Open Space Preservation Program document identifies Cañada de Los Osos as an additional site for a proposed park.

The Henry Coe State Park General Plan designates Gilroy Hot Springs as a planned future park entrance, with the visitor support facilities to be located on the easterly bank of Coyote Creek opposite the Gilroy Hot Springs Resort site.

3. Seismicity

The Calaveras Fault lies 1.1 miles southwest of the damsite and would clearly be the controlling fault. In the event of the Maximum Credible Earthquake occurring on this fault, very strong shaking would be experienced at the site.

4. Geology

The damsite is underlain by marine sedimentary rocks consisting of massive sandstone in the upstream area of the dam footprint and interbedded shale, siltstone and sandstone in most of the footprint area. Both the massive sandstone and the interbedded shale, siltstone and sandstone should provide a strong competent foundation for an embankment dam. It is estimated that a competent foundation can be achieved with excavations averaging 20 feet in depth on the abutments, and 30 feet in the channel area. Beneath the impervious zone of the dam, a somewhat deeper excavation is anticipated. Seepage potential is relatively low because of favorable bedding dips combined with the presence of interbedded shale.

An old landslide exists on the right abutment downstream of the location of the proposed dam. This landslide represents a constraint in siting the dam. For reservoirs smaller than about 350,000 to 400,000 acre-feet, it appears that a dam can be accommodated without impacting the landslide. Beyond that, the dam footprint would begin to encroach into the slide area.

The inactive Madrone Springs Fault passes through the proposed reservoir area, but well upstream of the damsite. The potential activation of landslides by reservoir inundation is very low. A few landslides have been mapped in the reservoir area, but most are at higher elevations, above maximum proposed water surface elevation. They are also remote from the damsite, and would therefore not adversely impact the dam.

5. Construction Materials

An extensive source of impervious material is available in the alluvial valley of Cañada de Los Osos, located 3 to 6 miles from the damsite. This material, which ranges from sandy clay to clayey, sandy gravel, would be an excellent material for use in the impervious zone of the dam. It appears that an adequate supply is available within the proposed reservoir limits to more than meet the needs of the sizes of dam investigated.

Sand and gravel exist in the alluvial valley of Coyote Creek from the damsite up to 3-1/2 miles upstream. This is also an excellent construction material, suitable for use in a substantial transition/drain zone. There appears to be an ample supply within the proposed reservoir limits.

Rock can be obtained by developing a quarry in a sandstone ridge upstream of the right abutment of the dam. The sandstone here is hard and massive, and appears durable. This material could be used in outer rockfill zones of the dam. In order to generate an adequate supply of rock, it would be necessary to extend the quarry well above the maximum reservoir elevation.

The three basic types of available material offer the opportunity to construct a dam which can be zoned to provide resistance to very strong seismic shaking. The availability of these materials is fortuitous given the proximity of the Calaveras Fault to the Los Osos damsite.

E. CEDAR CREEK SITE

1. Environmental

As with all the other potential reservoir sites, the proposed-for-listing red-legged frog and California tiger salamander are potentially present at this site.

The site contains approximately 7.5 miles of creek channel subject to Corps of Engineers jurisdiction. The site ranks fifth in importance, in terms of potential loss of high quality riparian woodland. It ranks sixth (last) in importance in terms of potential loss of valley oak woodland.

There are no recorded archaeological sites within the proposed dam and reservoir site. However, the topographic and ecological settings of the valley would have been very favorable for Native American habitation; so it is highly likely that field surveys would result in the discovery of previously undiscovered sites.

There are no known sites of historic importance within the proposed dam and reservoir site.

The proposed damsite is within view of State Route 152, a designated State Scenic Highway, but the proposed dam and reservoir site is largely obscured from view of the highway by the oak savanna woodland covering the valley floor.

2. Land Use

There are no structures, roads or utilities within the proposed dam and reservoir area. Agricultural activity consists solely of cattle grazing on the valley floor and lower surrounding slopes.

The site is not within any existing or proposed parks, open space preserves or trail corridors.

3. Seismicity

The active Calaveras and San Andreas Faults are 8.2 miles and 17.5 miles, respectively, southwest of the damsite. The Maximum Credible Earthquake (MCE) occurring on either of these faults would result in moderate to strong shaking at the site. It is likely that a Magnitude 7.5 MCE on the Calaveras Fault would produce a slightly higher peak acceleration at the site than would a Magnitude 8.5 MCE on the San Andreas Fault. On the other hand, a somewhat longer duration might be associated with the San Andreas event. Detailed seismic studies would be required to determine which would be the controlling event.

4. Geology

The damsite is underlain by bedrock of the Franciscan Complex, portions of which appear to be melange bedrock. The melange consists of pervasively sheared siltstone or shale matrix containing hard, resistant masses of graywacke, schist, chert and greenstone. Associated with this are interbedded sandstone, siltstone and shale. The bedding is variable because of folding and faulting.

The bedrock units of the Franciscan Complex should generally provide adequate foundation for an earthfill dam. It is estimated that an adequate foundation can be achieved with excavations generally averaging about 10 feet on the abutments and about 20 feet in the stream channel area. Beneath the impervious zone of the dam, a somewhat deeper excavation is anticipated. Weak, sheared clay shale zones are expected to be encountered in the foundation, and these would require substantial additional special treatment.

The reservoir area is underlain by bedrock units of the Franciscan Complex. A few landslides have been mapped in the reservoir area, and these might be reactivated by reservoir operation. However, the potential for landsliding is expected to be low, and in any case should not impact dam safety. No known faulting exists at the damsite or in the reservoir area.

5. Construction Materials

The availability of suitable construction material is one of the most critical issues at this site. No readily available sources of clay have been identified, nor have other fine-grained soils been found in quantity on-site. Consequently, production of materials suitable for use in the impervious zone of the dam would be a very difficult process. Any fine-grained material would have to be derived from the Franciscan Complex bedrock, requiring careful selection in the borrow areas, as well as application of specially-designed heavy duty spiked rollers to break down bedrock fragments.

It is anticipated that, after excavation, the bulk of the remaining material would consist of randomly mixed soil and rock. Most of this material would probably classify as a sandy gravel to clayey sandy gravel, which could be utilized in outer random zones of the dam. Rock materials could be obtained by selectively sorting rock from the excavated bedrock materials.

The relatively small reservoir area, coupled with the large volumes of material required for a dam at this site, would necessitate extensive borrowing outside the limits of the proposed reservoir. It is anticipated that most of the material required to construct the dam would have to come from such sources.

Sand and gravel for filter and drain zones of the dam, and aggregate for concrete, would have to be obtained from off-site sources.

F. PACHECO B SITE

1. Environmental

As noted in Chapter II, environmental studies in the Pacheco area were performed for the Lower Pacheco and Upper Pacheco sites. This substantially covered the range of potential Pacheco reservoirs that were identified, from farthest downstream to farthest upstream. The Pacheco B site is located only about one-mile downstream of the Upper Pacheco site. Environmental conditions and considerations at the Pacheco B site are therefore very similar to those at the Upper Pacheco site (see Section G of this Chapter).

2. Land Use

There are no public roads or utilities within the proposed dam and reservoir area. The proposed dam would be sited in the existing Pacheco Lake, requiring evacuation of that reservoir and removal of the existing North Fork Dam.

The O'Connor Ranch is the only inhabited site within the reservoir area. Grazing of cattle and horses currently takes place within the site.

For the sizes of reservoir considered in this study, the upper reaches of the proposed reservoir along Pacheco Creek would extend somewhat into Henry Coe State Park, the encroachment obviously depending on the size of reservoir involved. For example, a 150,000 acre-foot reservoir would encroach approximately 1/4-mile, whereas a 350,000 acre-foot reservoir would encoach about 1-1/2 miles. The Park's General Plan designates a large portion of the park as wilderness; however, that designation does not extend as far south as the upper reaches of the proposed reservoir.

The State Parks and Recreation Department plans to construct a southern entrance road to Coe State Park, commencing from Highway 152 at Bell Station, and following the existing gravel road along the ridgeline northward into the Park at Dowdie Ranch. The northward extension of this road further into the Park, as planned, would cross Pacheco Creek at approximately Elevation 760. This would be beyond the upstream reservoir limit for storage capacities up to about 200,000 acre-feet, but under the maximum water surface for storage capacities in excess of that.

3. Seismicity

The active Calaveras and San Andreas Faults are 11 miles and 20 miles, respectively, southwest of the damsite. The potentially active Ortigalita Fault is 8.7 miles northeast of the damsite. The Maximum Credible Earthquake occurring on any of these faults would result in moderate to strong shaking at the site. As is the case at the Cedar Creek site, seismic studies would be required to determine which would be the controlling event. The Pacheco B and Upper Pacheco sites are the most favorable sites from the standpoint of earthquake shaking.

4. Geology

The damsite is underlain by bedrock of the Franciscan Complex. The rocks consist of interbedded graywacke sandstone, siltstone and shale, and are anticipated to be typically folded and sheared. However, the bedrock should provide a strong, competent foundation for an embankment dam. It is estimated that a competent foundation can be achieved with excavations averaging 15 feet in depth on the abutments, 20 feet near the base of the abutments, and 20 feet in the channel area. Beneath the impervious zone of the dam, a somewhat deeper excavation is anticipated. Foundation seepage potential is considered low to moderate, but can be mitigated by grouting.

Landslide deposits exist within the reservoir area, and these might be subject to reactivation by rising and falling reservoir levels. However, the landslides are remote from the damsite. It is also unlikely that massive, rapid movement would occur in these types of landslides. Consequently, they are not expected to pose a threat to the dam. As noted below, these landslides are potential sources of construction materials, which would afford an opportunity for mitigation by reshaping.

5. Construction Materials

There are no extensive uniform sources of impervious clay, such as the alluvial areas at the Los Osos and Packwood sites. Potential sources of clay are the landslide deposits, which are generally derived from the Franciscan melange consisting of mixed sheared shale and clay and various types of rock components. These materials are typically heterogeneous and would require sorting of rockier, less clayey zones. In order to obtain substantial quantities of clay, it would be necessary to extend the borrow area limits well above maximum reservoir level. These potential sources of impervious material occur at distances of 2 to 5 miles from the damsite, and at elevations of up to 1,000 feet.

Bedrock ridges and bedrock slopes within the reservoir area offer potential sources of material for random zones of the dam. These bedrock units consist of interbedded sandstone, siltstone and shale, with included masses of sandstone, chert and greenstone. It is anticipated that the bedrock units would, after excavation and handling, generate primarily a semi-pervious clayey, sandy gravel. The more massive hard rock would have to be separated, but could be used in a rockfill zone. For smaller reservoirs (say, in the range of 150,000 to 200,000 acre-feet), it is possible that all the required random zone material could be obtained within the reservoir limits. The size of dam required to store larger volumes of water may necessitate borrowing above the reservoir limits.

Chimney Rock, about one mile upstream of the damsite, provides a potential source of rockfill for outer shells of the dam, as do other scattered sources within the reservoir area. For larger reservoirs it may be necessary to extend Chimney Rock quarry limits above the reservoir level. Sand and gravel for filter and drain zones of the dam would have to be obtained from off-site sources.

G. UPPER PACHECO SITE

1. Environmental

The San Joaquin kit fox, a federally listed Endangered species, may use portions of the site occasionally, since it is located at the western margin of the known range for the

kit fox. As with all the other potential reservoir sites, the red-legged frog and California tiger salamander are potentially present at this site.

The site contains approximately 14 miles of creek channel subject to Corps of Engineers jurisdiction. It ranks third in importance, after Los Osos and Coe, in terms of potential loss of high quality riparian habitat. It also ranks third in terms of potential loss of valley oak woodland.

There are seven recorded archaeological sites within the proposed dam and reservoir site. It is anticipated that one of these sites will require low levels of study/mitigation, three will require moderate levels, and the remaining three sites will require high levels of study/mitigation due to the presence of human skeletal remains.

There are no known sites of historic importance within the proposed dam and reservoir site.

2. Land Use

There are no public roads or utilities within the proposed dam and reservoir area.

The O'Connor Ranch is the only inhabited site within the reservoir area. Grazing of cattle and horses currently takes place within the site.

The upper reaches of the proposed reservoir along Pacheco Creek could extend into Henry Coe State Park by as much as 2 miles. The Park's General Plan designates a large portion of the park as wilderness; however, that designation does not extend as far south as the upper reaches of the reservoir on Pacheco Creek which would lie within the park boundaries.

The planned southern entrance road to Coe State Park, which would cross Pacheco Creek at approximately Elevation 760, could be well under the maximum water surface.

3. Seismicity

The active Calaveras and San Andreas Faults are 12 miles and 21.4 miles, respectively, southwest of the damsite. The potentially active Ortigalita Fault is 7.7 miles northeast. Shaking at the site due to the Maximum Credible Earthquake occurring on any of these faults would be very similar to the effects at the Pacheco B site.

4. Geology

The damsite is underlain by bedrock units of the Franciscan Complex. Exposures of graywacke, thinly-bedded chert, interbedded sandstone, siltstone and shale are evident along the creek channel. Shear zones and sheared shale typical of the Franciscan melange are also evident. Fresh, competent rock occurs at or near the surface along the channel, with local areas of alluvium and large boulders. It is estimated that a strong, competent foundation for an embankment dam can be achieved with excavations averaging about 10 feet in depth in the channel area and 15 feet on the abutments. Beneath the impervious zone of the dam, a somewhat deeper excavation is anticipated. Foundation seepage potential is considered generally low to moderate. However, where openly-fractured, contorted chert occurs in the foundation, high grout takes would be anticipated.

As noted for the Pacheco B site, landslide deposits existing within the reservoir area might be subject to reactivation by rising and falling reservoir levels. However, they are not expected to pose a threat to the dam, and can be mitigated by reshaping in the process of obtaining material for construction of the dam.

5. Construction Materials

As is the case for the Pacheco B site, potential sources of impervious materials are the landslide deposits. Again, in order to obtain substantial quantities of clay, it would be necessary to extend the borrow area limits well above maximum reservoir level.

As with the Pacheco B site, bedrock ridges and bedrock slopes offer potential sources of material for random zones of the dam. The materials would be similar to those described for the Pacheco B site. However, in order to generate large volumes of material, it would be necessary in this case to extend the borrow areas well beyond the limits of the reservoir.

Because Chimney Rock forms an abutment at this damsite, it is not available as a source of rock. Therefore, the sources of rock are the scattered outcrops of sandstone graywacke or greenstone within the proposed reservoir area. It is likely that these sources will produce limited quantities. It is estimated that about 2 million cubic yards are available from several sources ranging in distance 2 to 7 miles from the damsite. The random material source may also generate additional rock which will require sorting.

Sand and gravel for filter and drain zones of the dam would have to be obtained from off-site sources.

TABLE III-1

SANTA CLARA VALLEY WATER DISTRICT STORAGE RESERVOIR SITES
REGIONAL SEISMICITY - SIGNIFICANT FAULTS

DAM SITE	ACTIVE OR POTENTIALLY ACTIVE FAULT	DISTANCE AND DIRECTION FROM DAMSITE (MILES)	MAXIMUM CREDIBLE EARTHQUAKE (MAGNITUDE)	PROBABLE MAXIMUM BEDROCK ACCELERATIONS [2]
PACHECO B	CALAVERAS	11.0 SOUTHWEST	7.5	0.40 g
	SAN ANDREAS	20.0 SOUTHWEST	8.5	0.35 g
	OCTIGALITA [1]	8.7 NORTHEAST	7.0	0.40 g
UPPER PACHECO	CALAVERAS	12.0 SOUTHWEST	7.5	0.39 g
	SAN ANDREAS	21.4 SOUTHWEST	8.5	0.34 g
	OCTIGALITA	7.7 NORTHEAST	7.0	0.41 g
CEDAR CREEK	CALAVERAS	8.2 SOUTHWEST	7.5	0.42 g
	SAN ANDREAS	17.5 SOUTHWEST	8.5	0.37 g
	OCTIGALITA	11.2 NORTHEAST	7.0	0.33 g
LOS OSOS	CALAVERAS	1.1 SOUTHWEST	7.5	0.71 g
	SAN ANDREAS	13.0 SOUTHWEST	8.5	0.43 g
	OCTIGALITA	17.3 NORTHEAST	7.0	0.24 g
COE	CALAVERAS	4.3 SOUTHWEST	7.5	0.56 g
	SAN ANDREAS	18.0 SOUTHWEST	8.5	0.37 g
	OCTIGALITA	13.7 NORTHEAST	7.0	0.30 g
PACKWOOD	CALAVERAS	0.7 SOUTHWEST	7.5	0.71 g
	SAN ANDREAS	14.7 SOUTHWEST	8.5	0.41 g
	OCTIGALITA	18.0 NORTHEAST	7.0	0.24 g

[1] ORTIGALITA MAPPED AS HOLOCENE FAULT IN CDMG MAP SHOWING RECENCY OF FAULTING OF SAN FRANCISCO - SAN JOSE QUADRANGLE, CALIFORNIA. PUBLISHED 1991

[2] FROM SEED AND IDRISS, 1982.

CHAPTER IV

CHAPTER IV
SITE LIMITATIONS

A. GENERAL

Factors or conditions that may limit the potential for storage or the ability to permit a project are discussed below, by site. Many of these items are simply potential limitations, which may be disposed of by further investigation. Others are known limitations which would definitely impact a project at the site. There is one potential limitation that might be common to all sites, but which in any event must be investigated at all sites. That is the red-legged frog and California tiger salamander, candidate species currently being proposed for listing as threatened or endangered under the federal Endangered Species Act. At this time, we do not know whether these species are present at any or all sites, but the potential exists. If they are found to occur at any site, it will be virtually impossible to obtain permission from the U.S. Fish and Wildlife Service to develop that site if a suitable alternative site is available which does not have these species present. Until a field biological survey is completed, the red-legged frog and California tiger salamander must be considered a potential limitation at all sites.

B. PACKWOOD SITE

There do not appear to be any known insurmountable environmental or land use constraints which would potentially be fatal to the construction of a dam and reservoir here. A comparison with other reservoir sites indicates that Packwood is one of the least sensitive sites in terms of potential impacts to environmental resources. The site's greatest value is that it provides suitable habitat for the reintroduced Tule elk and pronghorn, both of which are known to use the site. Since Packwood is the only potential reservoir site known to provide habitat for both these sensitive species, the Department of Fish and Game would likely be opposed to a dam and reservoir at this site.

Topographically, the Packwood site is a very inefficient dam site, requiring a large dam to provide moderate storage capacity. This is reflected in the high cost estimates included in Chapter V. The narrow ridges forming extensions of both abutments of the dam also become a limiting factor for storage capacities greater than about 150,000 to 200,000 acre-feet. More detailed geotechnical studies would be required to establish the safe limit.

The availability of construction materials is a third limiting factor at this site. There is probably enough impervious material to construct a dam impounding on the order of 150,000 acre-feet. Whether there is enough to go much beyond that capacity is problematic, and detailed exploration would be required to address that question. There is an unlimited supply of random material with which to construct the bulk of the dam, but most of this would have to come from outside the proposed reservoir limits.

C. COE SITE

It is doubtful that the proposed dam and reservoir would be deemed to be consistent with the goals of the State Parks Department which call for largely preserving Coe State Park as a wilderness area. It does not appear that this inconsistency could be reconciled without a major change in the State policy with respect to Coe State Park.

A comparison with the other potential reservoir sites indicates that the Coe site is one of the most environmentally sensitive sites overall, if not the most sensitive site, under consideration. It has among the largest quantities of high quality valley oak woodland and wetland present on-site. While this is generally a reflection of its relatively large size, these factors nonetheless would lend added weight to arguments for the continued preservation of the site as a wilderness area.

The configuration of the abutments at the damsite may limit storage capacity by restricting the height of the dam. Above the elevation required to impound approximately 200,000 acre-feet, both abutments become narrow (the left abutment, especially so). Consequently, it is a concern whether, at elevations higher than this, there would be enough rock mass downstream of the dam to safely support the load imposed by a concrete gravity dam. Detailed exploration and testing, and siting studies, would be required at the feasibility level to evaluate this. For purposes of developing cost versus storage curves, dams were laid out providing storage capacities up to 300,000 acre-feet. Nevertheless, it is considered likely that abutment conditions may limit storage to considerably less than that capacity.

D. LOS OSOS SITE

The most significant potential impact associated with the Los Osos site would be cutting off public roadway access to the recently approved Gilroy Hot Springs Resort and Henry Coe State Park from the southwest. Given the steepness and ruggedness of the surrounding terrain, it would be difficult and costly to provide a suitable replacement access road, particularly one which would involve a minimum amount of grading and environmental impact.

A comparison with the other potential reservoir sites indicates that the Los Osos site is one of the most environmentally sensitive sites under consideration. It has by far the most high quality riparian woodland and wetland present, as well as the largest woodland acreage overall. The Los Osos site may also provide habitat for the pronghorn and Golden Eagle, which would increase its sensitivity relative to most other sites, particularly when compared to the three sites to the southeast (the Cedar Creek site and the Pacheco sites). The Los Osos site also carries the second greatest land use impacts (after the Coe site).

While none of the above considerations would necessarily be insurmountable or prove fatal to the Los Osos site, the provision of adequate mitigation and compensation could become very costly.

The planned new resort at Gilroy Hot Springs might have some impact on the maximum storage capacity. Most of the resort would be above Elevation 1,120 MSL. That elevation would be approximately the water surface corresponding to 400,000 acre-feet of storage. However, in times of heavy runoff when the reservoir is spilling, the surcharge level would be considerably above that elevation. Thus, if the resort goes forward as planned, it would be necessary to limit storage to something less than 400,000 acre-feet if flooding of the resort is to be avoided.

It also appears that the landslide on the right abutment downstream of the proposed dam may represent a constraint on reservoirs larger than about 350,000 to 400,000 acre-feet. Above that approximate storage range, dams of the sizes required would encroach on the landslide area. An extensive geotechnical study would be necessary to determine whether this would, as a practical matter, limit storage capacity, or whether the situation can be adequately mitigated.

E. CEDAR CREEK SITE

There do not appear to be any known insurmountable environmental or land use constraints which would potentially be fatal to the construction of a dam and reservoir here. A comparison with other reservoir sites indicates that Cedar Creek is one of the least sensitive sites in terms of potential impacts to environmental resources.

Topographically, the Cedar Creek site is a very inefficient dam site, requiring a large dam to provide moderate storage capacity. This is reflected in the high cost estimates included in Chapter V.

The most serious technical limitation at the Cedar Creek site is the lack of suitable construction material, especially impervious soils. As indicated in Chapter III, it would be necessary to borrow extensively outside the limits of the reservoir to obtain the large volumes required to build a dam at this site. Most of the material would be derived from the Franciscan Complex bedrock, which by and large would produce materials lacking in fines. Consequently, production of materials suitable for use in the impervious zone of the dam would require specialized equipment and techniques to break down the material; however, there is some question whether, as a practical matter, this can be done at all. For purposes of developing project cost estimates, we have assumed that impervious materials can be generated. However, there is a distinct possibility that the amount of impervious material that can be practically obtained would be very limited.

F. PACHECO B SITE

There do not appear to be any known insurmountable environmental or land use constraints which would potentially be fatal to the construction of a dam and reservoir here. However, whether the reservoir encroachment into Henry Coe State Park would limit available storage capacity or be an insurmountable obstacle to development of larger reservoirs is a question here. This can only be determined through further exploration of this issue with the California Department of Parks and Recreation.

There do not appear to be any physical limitations that would be fatal to construction of a dam and reservoir at the Pacheco B site. It would be necessary to obtain impervious material from areas located above reservoir levels, and for very large storage capacities the same would be true of other materials. However, this is generally the situation to various degrees at all the sites -- in come cases to a much greater degree than at Pacheco B.

G. UPPER PACHECO SITE

There do not appear to be any known insurmountable environmental or land use constraints which would potentially be fatal to the construction of a dam and reservoir here. However, whether reservoir encroachment into Henry Coe State Park would limit available storage capacity or be an insurmountable obstacle to development of even a small reservoir is also a question at this site. This can only be determined through further exploration of this issue with the California Department of Parks and Recreation. By comparison with Pacheco B, the Upper Pacheco site requires significantly higher water surface elevations for comparable volumes of storage. Consequently, the encroachment here would be more than that of a reservoir impounded by a dam at the Pacheco B site. If encroachment were to become an irreconcilable issue, storage capacity of the Upper Pacheco site would be very limited.

There do not appear to be any physical limitations that would be fatal to construction of a dam and reservoir at the Upper Pacheco site. As at Pacheco B, it would be necessary to obtain impervious material from areas located above reservoir levels. For large storage capacities, the same would be true of other materials. As indicated above, this is generally the situation to various degrees at all the sites.

CHAPTER V

CHAPTER V
PROJECT DESCRIPTIONS AND COSTS

A. GENERAL

For each alternative project, several sizes of reservoir have been laid out and total project costs have been estimated in 1992 dollars. With this data, curves of cost per acre-foot of storage versus reservoir size have been developed for each alternative project. These curves provide a comparison of the cost effectiveness of the various-sized projects that have been studied, and also can be extrapolated to provide cost information for other-sized reservoirs.

The dam is a major cost element in most of the alternative projects. For purposes of this reconnaissance-level study, the layout and design of all embankment-type dam alternatives are based on the following criteria:

- Internal "zones" have been dimensioned to maximize the utilization of locally available construction materials, and to provide for control of seepage through the dam.

- Outer slopes have been estimated to provide stability under both normal reservoir conditions and during strong earthquake shaking.

- Freeboard of 20 feet has been provided above normal maximum reservoir level.

Because of its height and the seismic environment, the roller-compacted concrete (RCC) dam chosen as most suitable for the Coe site has been dimensioned and detailed based on a fairly conservative composite of current practice in this relatively young technology.

The cost associated with the conveyance systems required to import water from the Pacheco/Santa Clara Conduit range from being a minor part of total costs to being a major component of total costs, depending upon the alternative project. The major variables which impact the costs of the conveyance facilities are:

- **Total Head**: This consists of the head difference between the lowest expected head in the Conduit and the highest expected head in the reservoir, plus the head-loss expected in the conveyance pipeline. The total head requirement and flow rate determine the size of the pumping facilities.

- **Flow Rate**: The flow rate assumed will determine the pipe size of the conveyance facilities, as well as the head loss component of the Total Head.

- **Length of Pipeline**: The length of pipeline will also affect the head loss component of the Total Head.

For purposes of the cost comparisons presented in this report, it has been assumed that the conveyance facilities for all alternative projects would be sized for a flow rate of 270 cubic-feet-per-second (cfs). This flow rate corresponds to the maximum amount of excess pipeline capacity expected to be available from the Pacheco/Santa Clara Conduit during the winter months (16,473 acre-feet in December). This assumed flow rate, combined with the required head and pipeline lengths for each alternative, provide the necessary information to size and estimate capital costs of the conveyance facilities.

Appendix 4 of this report presents all of the back-up information on how the size and cost of the various conveyance alternatives were determined.

Descriptions of the dams and other key elements of each alternative project are presented below, along with a summary of project costs and cost versus storage curves. Detailed cost estimates for all alternatives are contained in Appendix 3. The costs of environmental mitigation have not been included in the total costs of the alternative projects at this time. More detailed studies will need to be carried out to define these costs.

B. PACKWOOD RESERVOIR ALTERNATIVE

1. Project Description

The principal elements of the project would consist of an embankment-type dam, spillway, outlet works, and conveyance facilities. A typical layout and cross-section of the dam are shown on Figure V-1, and reservoir area-capacity curves are shown on Figure V-2.

Dam

The dam would be a zoned earthfill structure with a maximum height of between 250 and 360 feet, depending on reservoir storage capacity. The dam would consist of a wide, impervious core, flanked by shells of random material, with an inclined chimney drain at the downstream face of the core to intercept seepage, connecting to a blanket drain beneath the downstream shell. Although it may be possible to separate rock for riprap and downstream slope protection from the random borrow materials, it has been conservatively assumed, for purposes of estimating construction costs, that all slope protection materials would be provided from off-site quarries.

Because of its close proximity to the Calaveras Fault, and the lack of high-strength construction materials at the site, the dam is more conservatively designed than most of the other alternative projects. The wider-than-normal impervious core and the flatter upstream and downstream slopes are intended to reflect this necessary conservatism.

Spillway

The spillway would be located on the right abutment, and would consist of an unlined approach channel, an ungated overflow weir, an up to 1,500-foot-long reinforced concrete chute, and an up to 600-foot-long stilling basin.

Outlet Works

The reinforced concrete outlet works would consist of a sloping, multi-port inlet structure on the left abutment upstream of the dam, and an up to 2,200-foot-long conduit passing beneath the dam on the left side of the channel.

Conveyance Facilities

The proposed turn-out from the Pacheco/Santa Clara Conduit for this alternatiave is at East Dunne Avenue near Morgan Hill. From the turn-out, the pipeline would run northeast along East Dunne Avenue, across Coyote Creek, continuing on East Dunne along Anderson Reservoir, over a ridge to the Packwood Creek Canyon. From this point the pipeline would follow the canyon up to the reservoir site.

Imported water stored under this alternative could be released either back through the conveyance pipeline or down Packwood Creek, which is a tributary to Anderson Reservoir. The fact that Packwood Creek is tributary to Anderson Reservoir provides additional reliability to the District's water supply in the event of failure of the Santa Clara Conduit at the Calaveras Fault during an earthquake. Water released downstream to Anderson Reservoir can be used to generate power at the existing hydro-electric plant, and can also be diverted through the Coyote Pumping Plant and Cross Valley Pipeline to Calero Reservoir. With the proposed pump station properly equipped, water released back through the pipeline could be used to generate supplemental peaking power for sale to P.G.&E. Water released through the pipeline could also be diverted through the Coyote Pumping Plant and Cross Valley Pipeline to Calero Reservoir.

The conveyance facilities would require about 37,000 feet of 84-inch diameter pipe and access road.

2. Costs

A summary of estimated total costs of the various-sized reservoirs is presented in Table V-1, and a cost curve showing total cost per acre-foot of storage versus reservoir size is shown on Figure V-3.

C. COE RESERVOIR ALTERNATIVE

1. Project Description

The principal elements of the project would consist of a roller-compacted concrete dam, and integral spillway and outlet works. A typical layout and cross-section of the dam are shown on Figure V-4, and reservoir area-capacity curves are shown on Figure V-5.

Dam

The dam would have a maximum height of between 285 and 390 feet, depending on reservoir storage capacity. The upstream face of the dam would consist of a conventional concrete facing to provide water tightness. An access gallery would be formed within the body of the dam, from which a grout curtain and drainage holes would be installed in the foundation. Aggregates for roller-compacted concrete and for conventional concrete in the upstream face of the dam, the spillway and outlet works would be produced from on-site sources.

Spillway

The spillway would consist of an ungated overflow structure formed within the body of the dam near the center of the Coyote Creek channel, and a stilling basin at the downstream toe of the dam. All spillway components would be conventional, formed concrete.

Outlet Works

The outlet works would consist of a multi-level intake structure on the upstream face of the dam, the outlet conduit within the dam, and a valve chamber and stilling basin at the downstream toe of the dam.

Conveyance Facilities

Two turn-out and pipeline alignments were considered for the Coe Reservoir alternative:

a. Ridge Route: The proposed turn-out from the Pacheco/Santa Clara Conduit for this alternative is at East Dunne Avenue near Morgan Hill. From the turn-out, the pipeline would run northeast along East Dunne Avenue, across Coyote Creek near the upstream end of Anderson Reservoir. From this point, the pipeline would turn and follow Coyote Creek Canyon upstream to Otis Canyon, running up Otis Canyon, over the ridge (Elevation 2,530) to Rough Gulch Canyon. The pipe would follow Rough Gulch Canyon downstream to its confluence with Coyote Creek, where it would turn and follow the creek upstream to the proposed dam site.

Imported water stored under this alternative could only be released down Coyote Creek to Anderson Reservoir, as the ridge elevation of 2,530 is higher than the maximum proposed reservoir elevation. Due to this constraint, and the enormous pumping station that would be required, this alternative has been eliminated from further consideration.

b. Canyon Route: The proposed turn-out from the Pacheco/Santa Clara Conduit for this alternative is at Roop Road near the City of Gilroy. From the turn-out, the pipeline would follow Roop Road eastward to the upstream end of Coyote Reservoir, where it would turn and follow Gilroy Hot Springs Road up the Coyote Creek Canyon to the proposed dam site.

Imported water stored under this alternative could be released either back through the conveyance pipeline or down Coyote Creek to Anderson Reservoir. The fact that the proposed Coe Reservoir would be on Coyote Creek, the major tributary to Anderson Reservoir, provides additional reliability to the District's water supply in the event of failure of the Santa Clara Conduit at the Calaveras Fault during an earthquake. Water released downstream to Anderson Reservoir can be used to generate power at the existing hydro-electric plant, and can alsos be diverted through the Coyote Pumping Plant and Cross Valley Pipeline to Calero Reservoir. With the proposed pump station properly equipped, water released back through the pipeline could be used to generate supplemental peaking power for sale to P.G.&E. Water released through the pipeline could also be diverted through the Coyote Pumping Plant and Cross Valley Pipeline to Calero Reservoir.

The conveyance facilities for the Canyon Route would require about 73,000 feet of 84-inch diameter pipe and access road.

2. Costs

A summary of estimated total costs of the various-sized reservoirs is presented in Table V-1, and a cost curve showing total cost per acre-foot of storage versus reservoir size is shown on Figure V-6.

D. LOS OSOS RESERVOIR ALTERNATIVE

1. Project Description

The principal elements of the project would consist of an embankment-type dam, spillway, outlet works, and conveyance facilities. A typical layout and cross-section of the dam are shown on Figure V-7, and reservoir area-capacity curves are shown on Figure V-8.

Dam

The dam would be a zoned earthfill structure with a maximum height of between 255 and 350 feet, depending on reservoir storage capacity. The dam would consist of a wide, impervious core, flanked by transition zones of processed sand/gravel and outermost zones of quarried rockfill. The downstream sand/gravel transition zone would provide for control of seepage through the dam. The rockfill outer shells would provide erosion protection.

The close proximity of the dam to the Calaveras Fault is substantially mitigated by the availability of high quality construction materials. The wider-than-normal impervious core is intended to provide protection during strong earthquake shaking, yet is very practical because of the abundance of impervious material in Cañada de Los Osos. The generous sand and gravel zones flanking the core will act as drains and control saturation within the dam, while the outer rockfill shells will provide substantial strength. This favorable combination of zoning permits steeper outer slopes than the Packwood Creek alternative.

Spillway

The spillway would be located on the left abutment, and would consist of an unlined approach channel, an ungated overflow weir, an up to 1,850-foot-long reinforced concrete chute, and an up to 600-foot-long stilling basin.

Outlet Works

The reinforced concrete outlet works would consist of a sloping, multi-port inlet structure on the left abutment upstream of the dam, and an up to 1,900-foot-long conduit passing beneath the dam on the left side of the channel.

Conveyance Facilities

There are two turn-out and pipeline alignments for the Los Osos Reservoir alternative:

a. **Canyon Route**: The proposed turn-out from the Pacheco/Santa Clara Conduit for this alternative is at Roop Road near the City of Gilroy. From the turn-out, the pipeline would follow Roop Road eastward to the upstream end of Coyote Reservoir, where it would turn and follow Gilroy Hot Springs Road up the Coyote Creek Canyon to the proposed dam site.

Imported water stored under this alternative could be released either back through the conveyance pipeline or down Coyote Creek to Anderson Reservoir. The fact that Los Osos Canyon is tributary to Anderson Reservoir provides additional reliability to the District's water supply in the event of failure of the Santa Clara Conduit at the Calaveras Fault during an earthquake. Water released downstream to Anderson Reservoir can be used to generate power at the existing hydro-electric plant, and can also be diverted through the Coyote Pumping Plant and Cross Valley Pipeline to Calero Reservoir. With the proposed pump station properly equipped, water released back through the pipeline could be used to generate supplemental peaking power for sale to

P.G.&E. Water released through the pipeline could also be diverted through the Coyote Pumping Plant and Cross Valley Pipeline to Calero Reservoir.

The conveyance facilities for the Canyon Route would require about 21,000 feet of 84-inch diameter pipe and access road.

b. Ridge Route: The proposed turn-out from the Pacheco/Santa Clara Conduit for this alternative is approximately 10,000 feet west of the Pacheco Ranger Station along Highway 152. From the turn-out, the pipeline and access road would follow an unnamed canyon over a ridge (Elevation 1,250) to Cañada de Los Osos, which is a tributary to Coyote Creek and the proposed reservoir site.

Imported water stored under this alternative could be released down Coyote Creek to Anderson Reservoir. The fact that Los osos Canyon is tributary to Anderson Reservoir provides additional reliability to the District's water supply in the event of failure of the Santa Clara Conduit at the Calaveras Fault during an earthquake. Water released downstream to Anderson Reservoir can be used to generate power at the existing hydro-electric plant, and can also be diverted through the Coyote Pumping Plant and Cross Valley Pipeline to Calero Reservoir. This alternative is unique from all of the others which are tributary to Anderson Reservoir in that it would provide a link between the Pacheco/Santa Clara Conduit and the SCVWD system *upstream* of the Conduit's crossing of the Calaveras Fault. This would provide an *additional* level of protection for the valley's water supply in the event of a major earthquake, since pumping from the conduit may still be possible.

The conveyance facilities for the Ridge Route would require about 23,000 feet of 84-inch diameter pipe and access road.

c. Average Annual Yield: Part of the water stored at Los Osos would be locally-generated flows from the upper Coyote Creek watershed. Preliminary calculations indicate that the average annual yield for this watershed, upstream of the proposed Los Osos site, would range between 12,000 and 15,000 acre-feet. Thus between 12,000 and 15,000 acre-feet of additional volume could be available in Anderson Reservoir for the storage of excess imported water (through the Coyote Pumping Plant) on an average annual basis.

2. Costs

A summary of estimated total costs of the various-sized reservoirs is presented in Table V-1 and a cost curve showing total cost per acre-foot of storage versus reservoir size is shown on Figure V-9. For cost estimating purposes, it was assumed that the conveyance facilities would follow the Canyon Route. For comparison, for a reservoir elevation of 1,025 feet, the capital costs for pipelines, pump stations and access roads for an alignment on the Ridge Route are approximately $7.8 million more than for an alignment on the Canyon Route, in 1992 dollars.

E. CEDAR CREEK RESERVOIR ALTERNATIVE

1. Project Description

The principal elements of the project would consist of an embankment-type dam, spillway, outlet works, and conveyance facilities. A typical layout and cross-section of the dam are shown on Figure V-10, and reservoir area-capacity curves are shown on Figure V-11.

Dam

The dam would be a zoned earthfill structure with a maximum height of between 290 and 425 feet, depending on reservoir storage capacity. The dam would consist of an impervious core, flanked by shells of random material, with a vertical chimney drain at the downstream face of the core to intercept seepage, connecting to a blanket drain beneath the downstream shell. Although it may be possible to separate rock for riprap and downstream slope protection from the random borrow materials, it has been conservatively assumed, for purposes of estimating construction costs, that all slope protection materials would be provided from off-site quarries.

The unavailability of high-strength construction materials and the limited availability of material for the impervious core of the dam would suggest a conservative design similar to that for Packwood, however, the greater distance from the Calaveras Fault mitigates these drawbacks, resulting in slightly steeper outer slopes.

Spillway

The spillway would be located on the right abutment, and would consist of an unlined approach channel, an ungated overflow weir, an up to 2,300-foot-long reinforced concrete chute, and an up to 600-foot-long stilling basin.

Outlet Works

The reinforced concrete outlet works would consist of a sloping, multi-port inlet structure on the left abutment upstream of the dam, and an up to 2,100-foot-long conduit passing beneath the dam on the left side of the channel.

Conveyance Facilities

The turn-out from the Pacheco Conduit for the Cedar Creek Reservoir alternative would be approximately 3,500 feet west of Bell Station. From the turn-out, the pipeline would cross under Highway 152, and then the pipeline and access road would follow the Cedar Creek Canyon up to the proposed dam site.

Reservoir water could be released by gravity back through the conveyance pipeline. With the pump station properly equipped, water released back through the pipeline could be used to generate supplemental peaking power for sale to PG&E. In addition, if the water were released through the pipeline, it could be diverted through the Coyote Pumping plant and Cross Valley Pipeline to Calero Reservoir.

Cedar Creek damsite is situated to the east of the Calaveras fault, and releases to the District's system would have to be made through the Pacheco/Santa Clara Conduit. If this conduit were to be interrupted by an earthquake on the Calaveras fault, the additional system reliability provided by the Packwood, Coe and Los Osos alternatives would not be available.

The conveyance facilities would require about 3,000 feet of 84-inch diameter pipe and access road.

2. Costs

A summary of estimated total costs of the various-sized reservoirs is presented in Table V-1, and a cost curve showing total cost per acre-foot of storage versus reservoir size is shown on Figure V-12.

F. PACHECO B RESERVOIR ALTERNATIVE

1. Project Description

The principal elements of the project would consist of an embankment-type dam, spillway, outlet works, and conveyance facilities. A typical layout and cross-section of the dam are shown on Figure V-13, and reservoir area-capacity curves are shown on Figure V-14.

Dam

The dam would be a zoned earthfill structure with a maximum height of between 300 and 405 feet, depending on reservoir storage capacity.

In order to prevent encroachment of the existing North Fork Pacheco Reservoir on the downstream slope of the proposed dam, the existing North Fork Dam would have to be decommissioned. It has been assumed, for purposes of estimating construction costs, that most of the materials in the existing embankment would be suitable for placement in the proposed dam, and that the existing outlet works and portions of the existing spillway would be demolished.

The new dam would consist of an impervious core, flanked by transition zones of random material, and outermost zones of quarried rockfill. A vertical chimney drain at the downstream face of the core would be required to control seepage through the dam, connecting to a blanket drain beneath the downstream shell. The rockfill outer shells would provide erosion protection.

The greater distance of the dam from the Calaveras Fault, and the availability of high quality rockfill materials for the outer shells justifies the steepest outer slopes of any of the embankment dam alternatives.

Spillway

The spillway would be located on the right abutment, and would consist of an unlined approach channel, an ungated overflow weir, an up to 1,900-foot-long reinforced concrete chute, and an up to 300-foot-long stilling basin.

Outlet Works

The reinforced concrete outlet works would consist of a sloping, multi-port inlet structure on the left abutment upstream of the dam, and an up to 2,000-foot-long conduit passing beneath the dam on the left side of the channel.

Conveyance Facilities

The turn-out from the Pacheco Conduit for the Pacheco B Reservoir alternative would be directly opposite Pacheco Canyon, approximately 500 feet south of Highway 152. From the turn-out, the pipeline would head toward Pacheco Canyon, under the highway. The access road and the pipeline would then follow the canyon to the proposed dam site.

Reservoir water could be released by gravity back through the conveyance pipeline. With the pump station properly equipped, water released back through the pipeline could be used to generate supplemental peaking power for sale to PG&E. In addition, if the water were released through the pipeline, it could be diverted through the Coyote Pumping plant and Cross Valley Pipeline to Calero Reservoir.

The Pacheco B damsite is situated to the east of the Calaveras fault and releases to the District's system would have to be made through the Pacheco/Santa Clara Conduit. If this conduit were to be interrupted by an earthquake on the Calaveras fault, the additional system reliability provided by the Packwood, Coe and Los Osos alternatives would not be available.

The conveyance facilities would require about 11,000 feet of 84-inch diameter pipe and access road.

2. Costs

A summary of estimated total costs of the various-sized reservoirs is presented in Table V-1, and a cost curve showing total cost per acre-foot of storage versus reservoir size is shown on Figure V-15.

G. UPPER PACHECO RESERVOIR ALTERNATIVE

1. Project Description

The principal elements of the project would consist of an embankment-type dam, spillway, outlet works, and conveyance facilities. A typical layout and cross-section of the dam are shown on Figure V-16, and reservoir area-capacity curves are shown on Figure V-17.

Dam

The dam would be a zoned earthfill structure with a maximum height of between 300 and 410 feet, depending on reservoir storage capacity. The dam would consist of an impervious core, flanked by shells of random material, with a vertical chimney drain at the downstream edge of the core to intercept seepage, connecting to a blanket drain beneath the downstream shell. Although it may be possible to separate rock for riprap and downstream slope protection from the random borrow materials, it has been conservatively assumed, for purposes of estimating construction costs, that all slope protection materials would be provided from off-site quarries.

The unavailability of high-strength construction materials and the limited availability of material for the impervious core of the dam requires more conservative design than the Pacheco B alternative, which is reflected in the flatter outer slopes.

Spillway

The spillway would be located on the left abutment, and would consist of an unlined approach channel, an ungated overflow weir, an up to 2,200-foot-long reinforced concrete chute, and an up to 350-foot-long stilling basin.

Outlet Works

The reinforced concrete outlet works would consist of a sloping, multi-port inlet structure on the right abutment upstream of the dam, and an up to 2,700-foot-long conduit passing beneath the dam along the channel.

Conveyance Facilities

The turn-out from the Pacheco Conduit for the Upper Pacheco Reservoir alternative would be directly opposite Pacheco Canyon, approximately 500 feet south of Highway 152. From the turn-out, the pipeline would head toward Pacheco Canyon, under the highway. The access road and pipeline would then run up the canyon to the proposed dam site.

Reservoir water could be released by gravity back through the conveyance pipeline. With the pump station properly equipped, water released back through the pipeline could be used to generate supplemental peaking power for sale to PG&E. In addition, if the water were released through the pipeline, it could be diverted through the Coyote Pumping Plant and Cross Valley Pipeline to Calero Reservoir.

The Upper Pacheco damsite is situated to the east of the Calaveras fault and releases to the District's system would have to be made through the Pacheco/Santa Clara Conduit. If this conduit were to be interrupted by an earthquake on the Calaveras fault, the additional system reliability provided by the Packwood, Coe and Los Osos alternatives would not be available.

The conveyance facilities would require about 18,000 feet of 84-inch diameter pipe and access road.

2. Costs

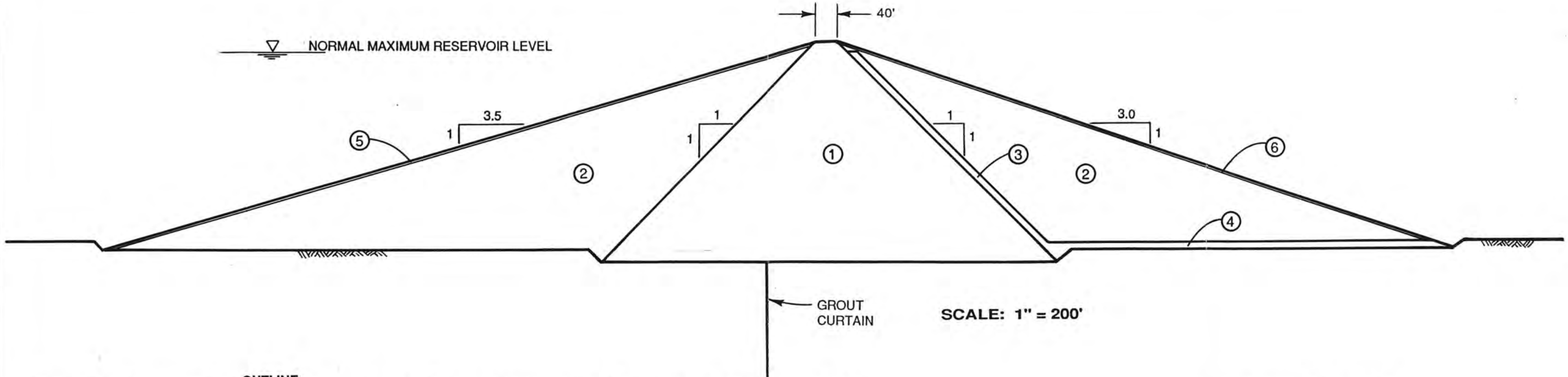
A summary of estimated total costs of the various-sized reservoirs is presented in Table V-1, and a cost curve showing total cost per acre-foot of storage versus reservoir size is shown on Figure V-18.

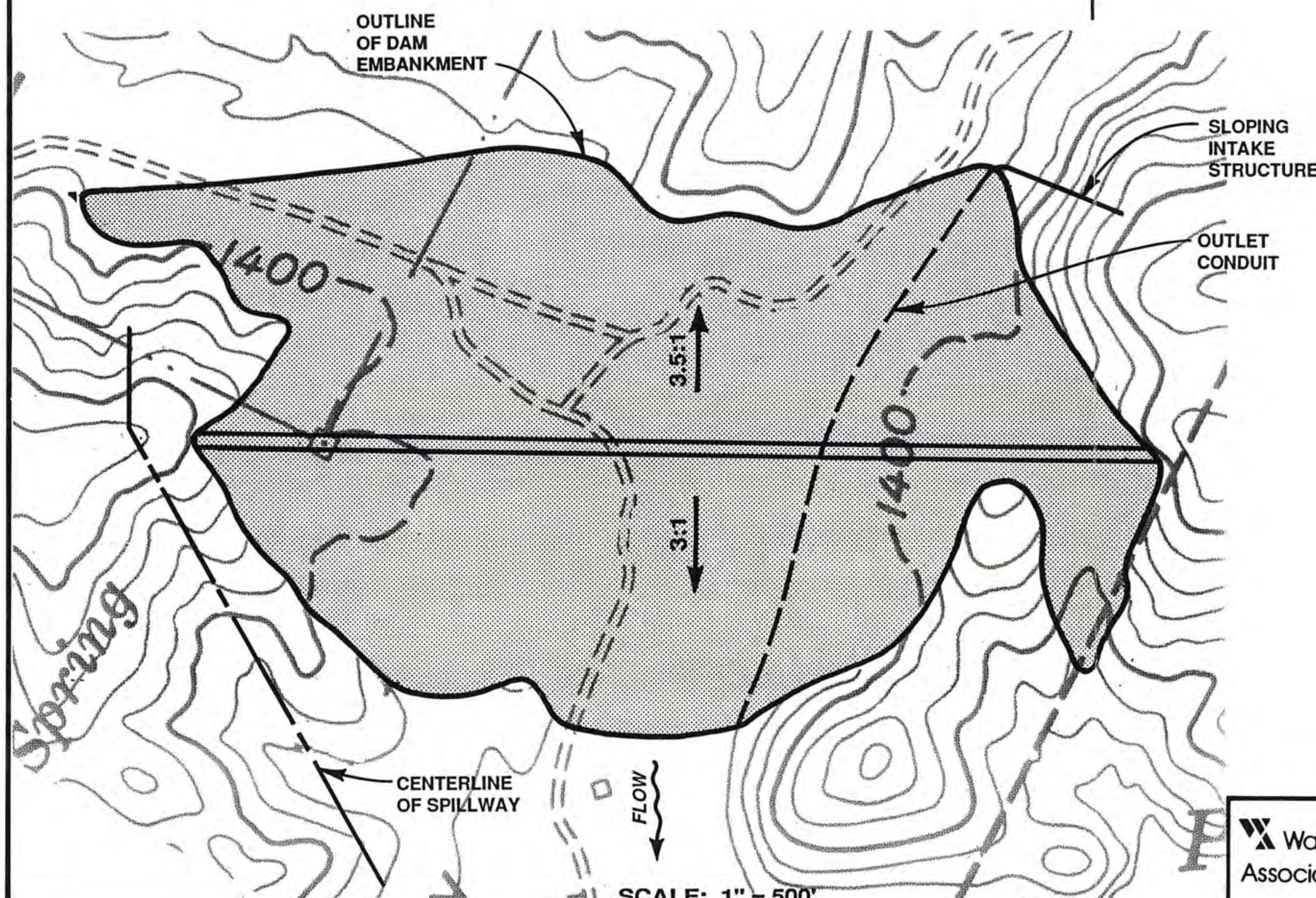
TABLE V-1

SUMMARY OF TOTAL COSTS OF RESERVOIR ALTERNATIVES

Reservoir Alternative	Dam Crest Elevation (feet M.S.L.)	Reservoir Elevation (feet M.S.L.)	Reservoir Storage (acre-feet)	Total Cost[1] ($)	Unit Storage Cost ($/acre-foot)
Packwood	1,530	1,510	80,000	269,559,000	3,369
	1,590	1,570	140,000	374,260,000	2,673
	1,640	1,620	200,000	554,240,000	2,771
Coe	1,435	1,415	100,000	181,705,000	1,817
	1,500	1,480	200,000	212,461,000	1,062
	1,540	1,520	300,000	251,342,000	838
Los Osos	1,045	1,025	150,000	169,802,000	1,132
	1,090	1,070	250,000	206,213,000	825
	1,125	1,105	350,000	245,514,000	701
	1,140	1,120	400,000	262,497,000	656
Cedar Creek	650	630	67,000	177,398,000	2,648
	730	710	124,000	274,033,000	2,210
	785	765	177,000	380,883,000	2,152
Pacheco B	740	720	150,000	200,560,000	1,337
	790	770	250,000	255,432,000	1,022
	830	810	350,000	302,302,000	864
	845	825	400,000	327,509,000	819
Upper Pacheco	820	800	150,000	186,670,000	1,244
	880	860	250,000	242,740,000	971
	930	910	350,000	304,180,000	869

[1]Includes construction cost, engineering, administration and legal costs, rights-of-way and acquisition costs, and contingencies (see Appendix 3 for detailed cost data).





EMBANKMENT ZONES

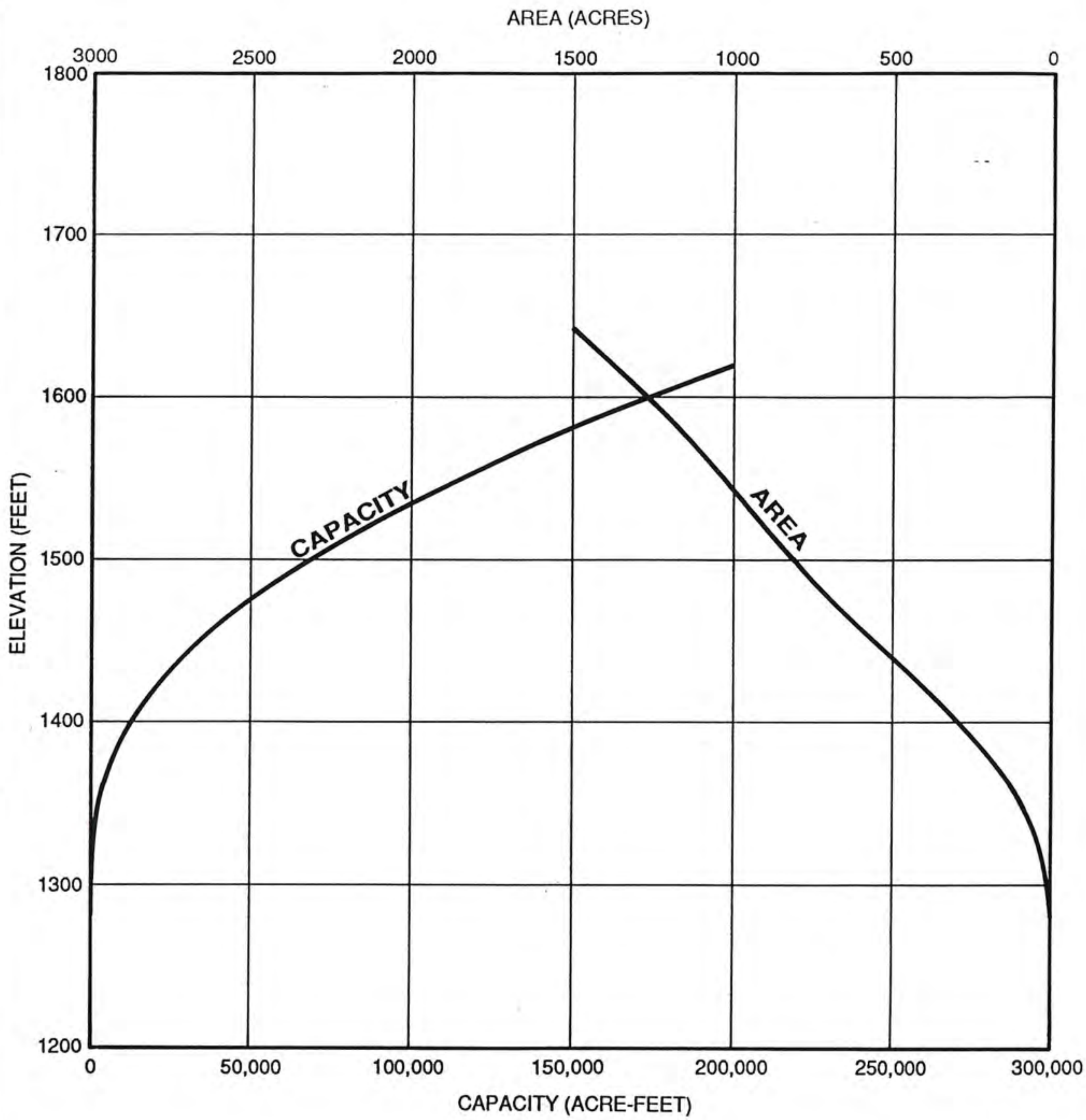
① IMPERVIOUS MATERIAL
② RANDOM MATERIAL
③ CHIMNEY DRAIN
④ BLANKET DRAIN
⑤ RIPRAP
⑥ SLOPE PROTECTION

SCALES

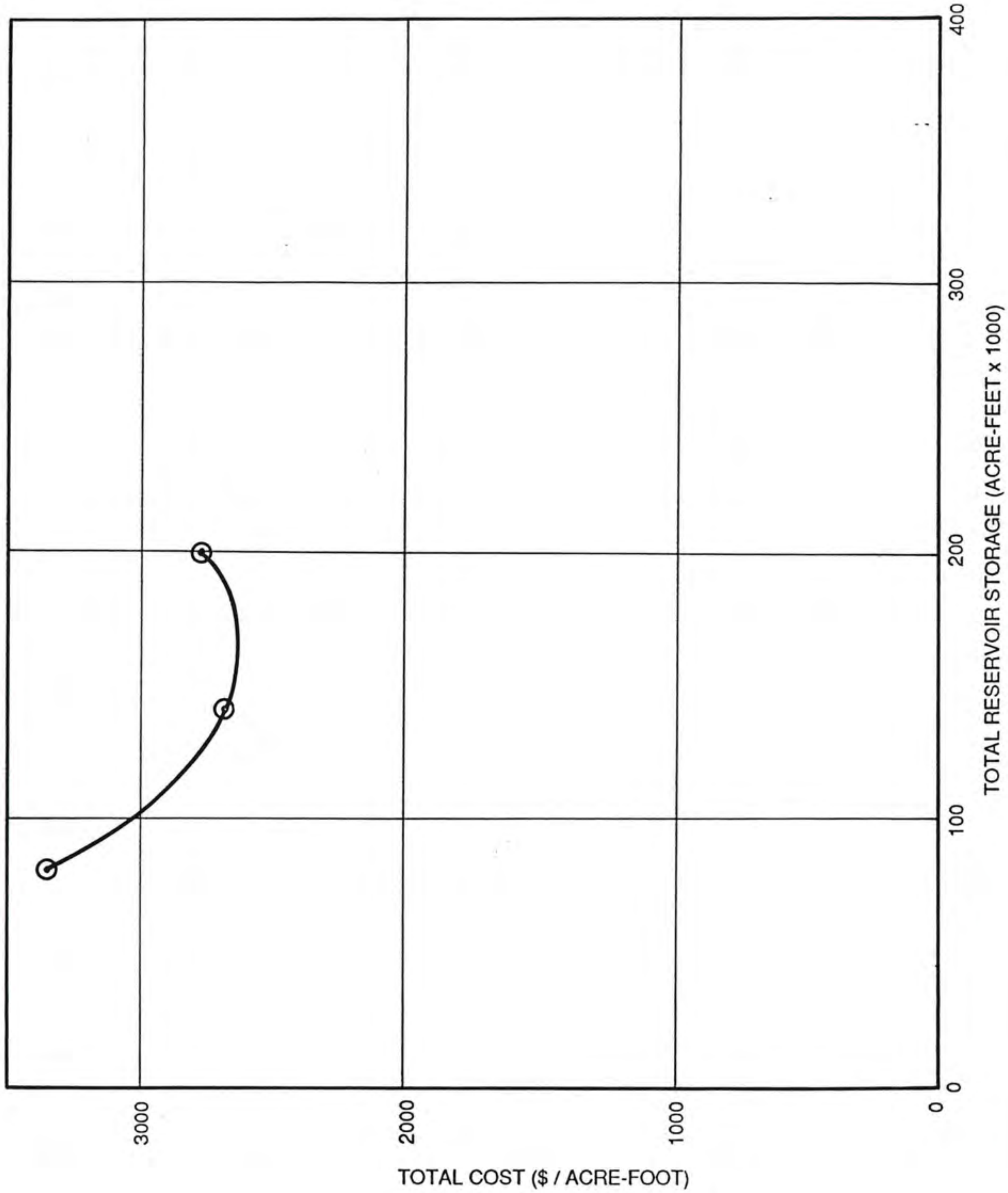
200 0 200 FEET
SECTION

500 0 500 FEET
PLAN

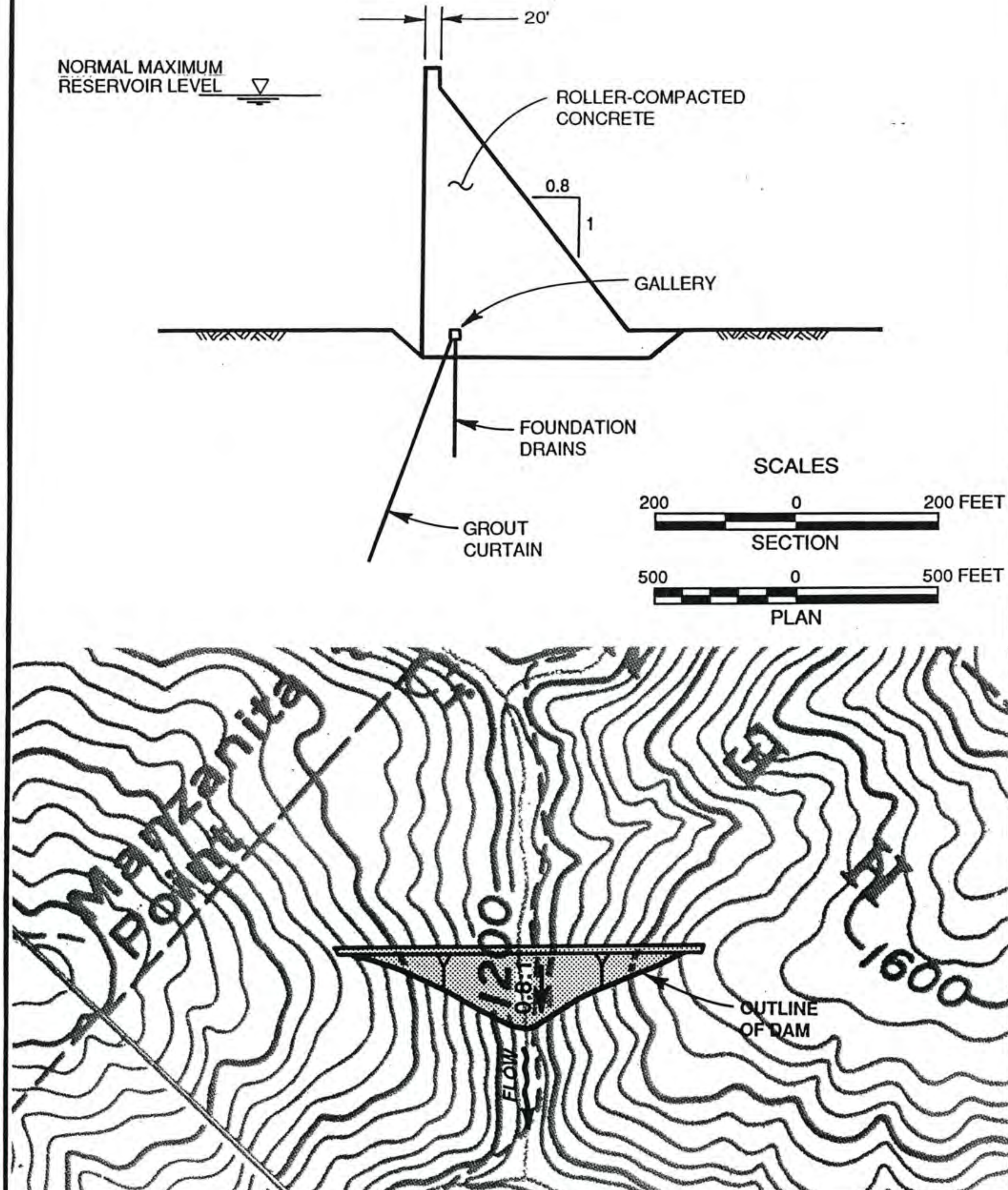
Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	TYPICAL PLAN AND CROSS SECTION PACKWOOD SITE		
		PROJECT NO.	DATE	FIGURE NO.
	PALO ALTO • CALIFORNIA	SCV-145A	FEBRUARY 1993	V-1



Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	RESERVOIR AREA-CAPACITY CURVES PACKWOOD SITE		
	PALO ALTO • CALIFORNIA	PROJECT NO.	DATE	FIGURE NO.
		SCV-145A	FEBRUARY 1993	V-2

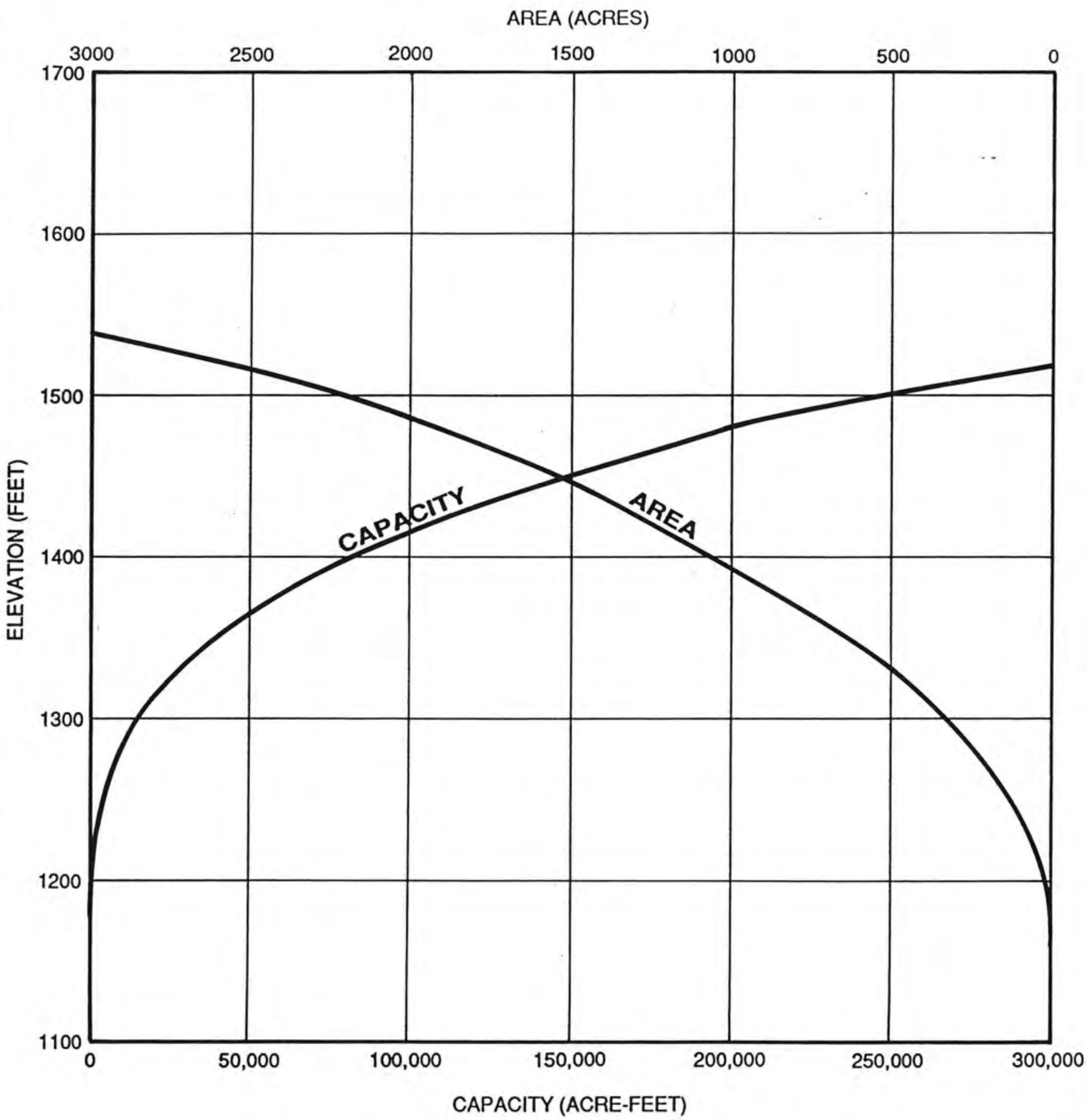


Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	COST CURVE PACKWOOD SITE		
		PROJECT NO.	DATE	FIGURE NO.
	PALO ALTO • CALIFORNIA	SCV-145A	FEBRUARY 1993	V-3

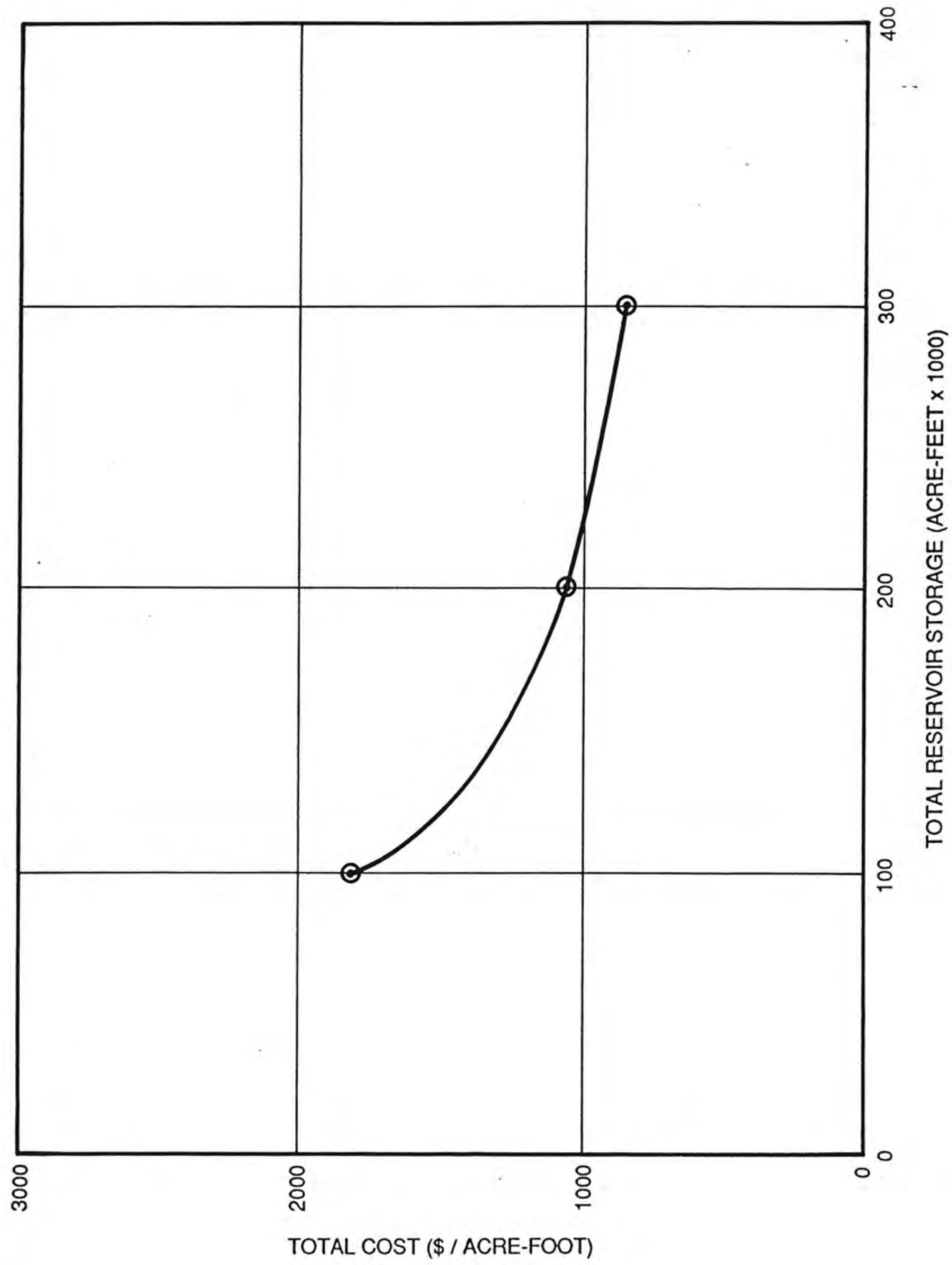


Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	TYPICAL PLAN AND CROSS SECTION COE SITE	
		PROJECT NO.	DATE	FIGURE NO.
	PALO ALTO • CALIFORNIA	SCV-145A	FEBRUARY 1993	V-4

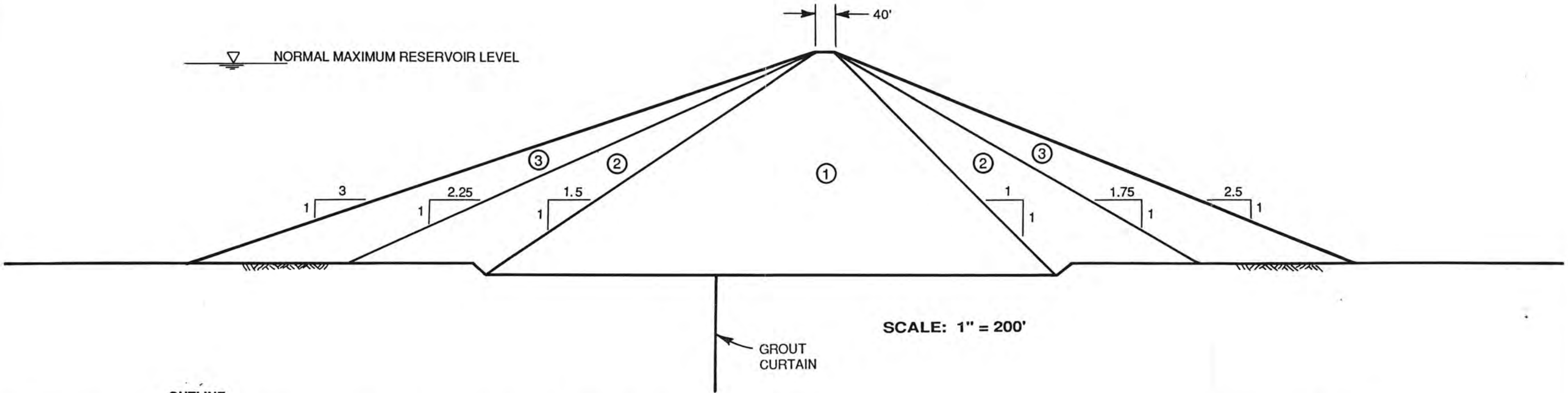
134729

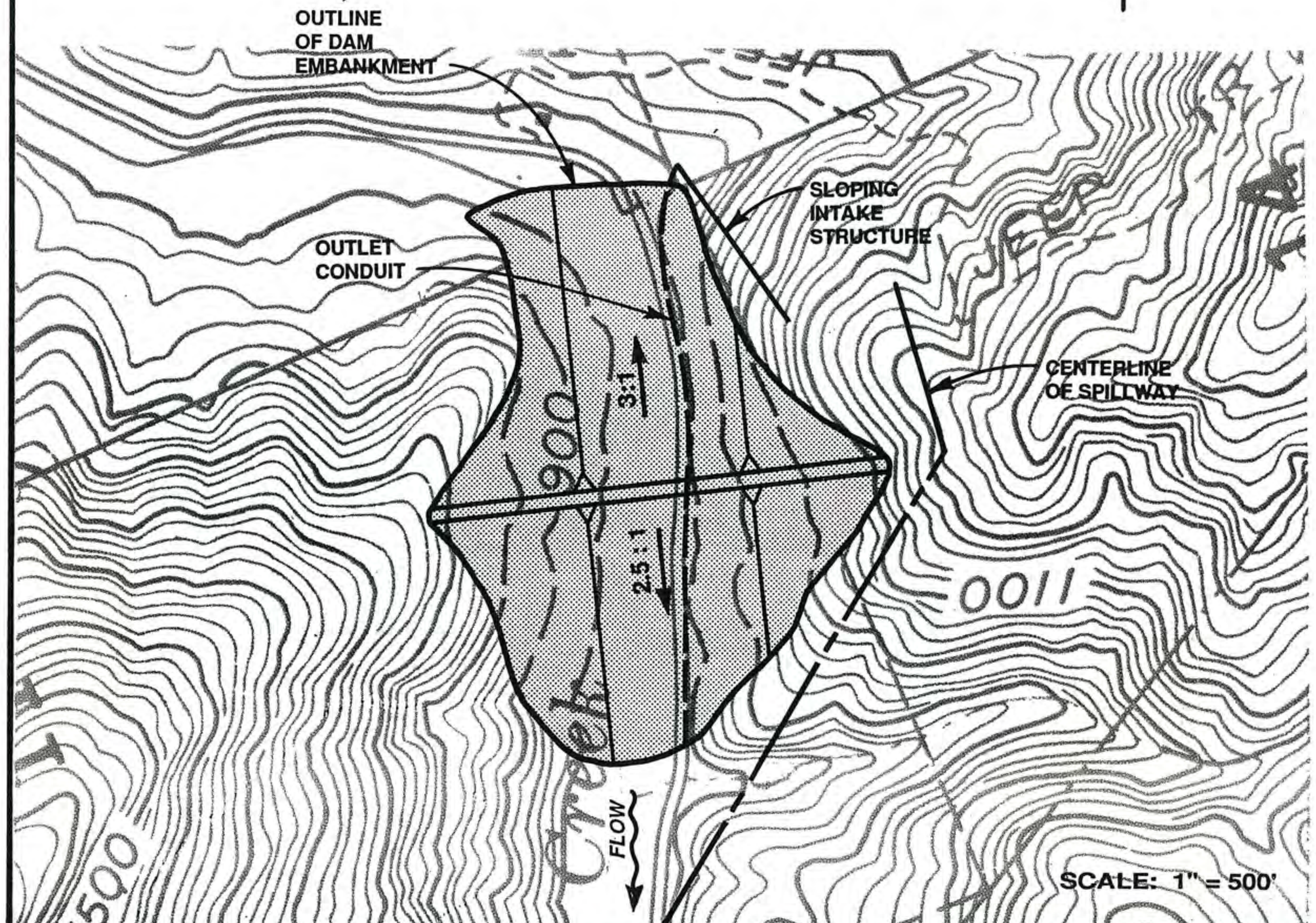


Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	RESERVOIR AREA-CAPACITY CURVES COE SITE		
		PROJECT NO.	DATE	FIGURE NO.
	PALO ALTO • CALIFORNIA	SCV-145A	FEBRUARY 1993	V-5



Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	COST CURVE COE SITE		
	PALO ALTO • CALIFORNIA	PROJECT NO. SCV-145A	DATE FEBRUARY 1993	FIGURE NO. V-6





EMBANKMENT ZONES

① IMPERVIOUS MATERIAL

② SAND AND GRAVEL

③ ROCKFILL

SCALES

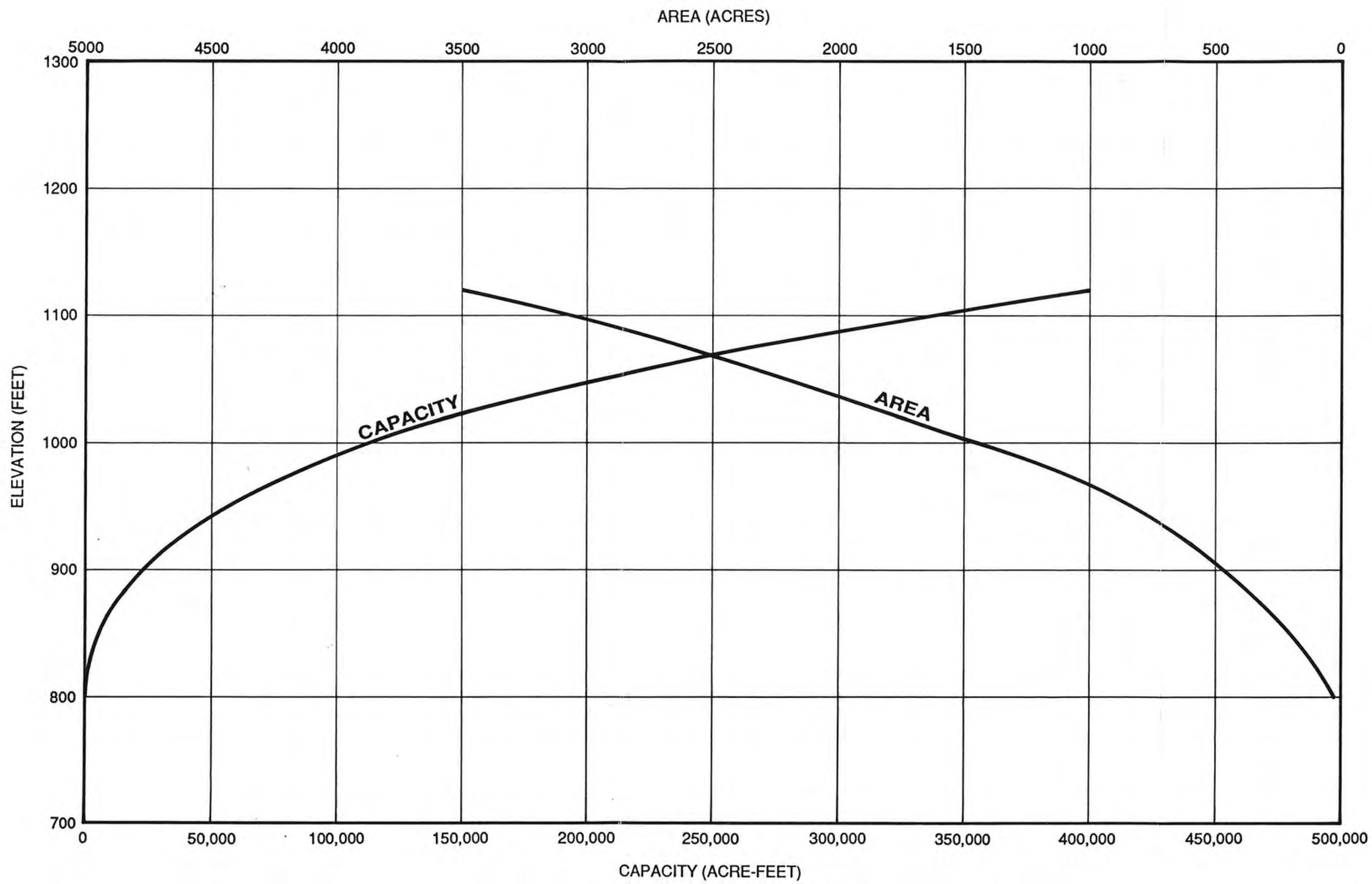
200 0 200 FEET

SECTION

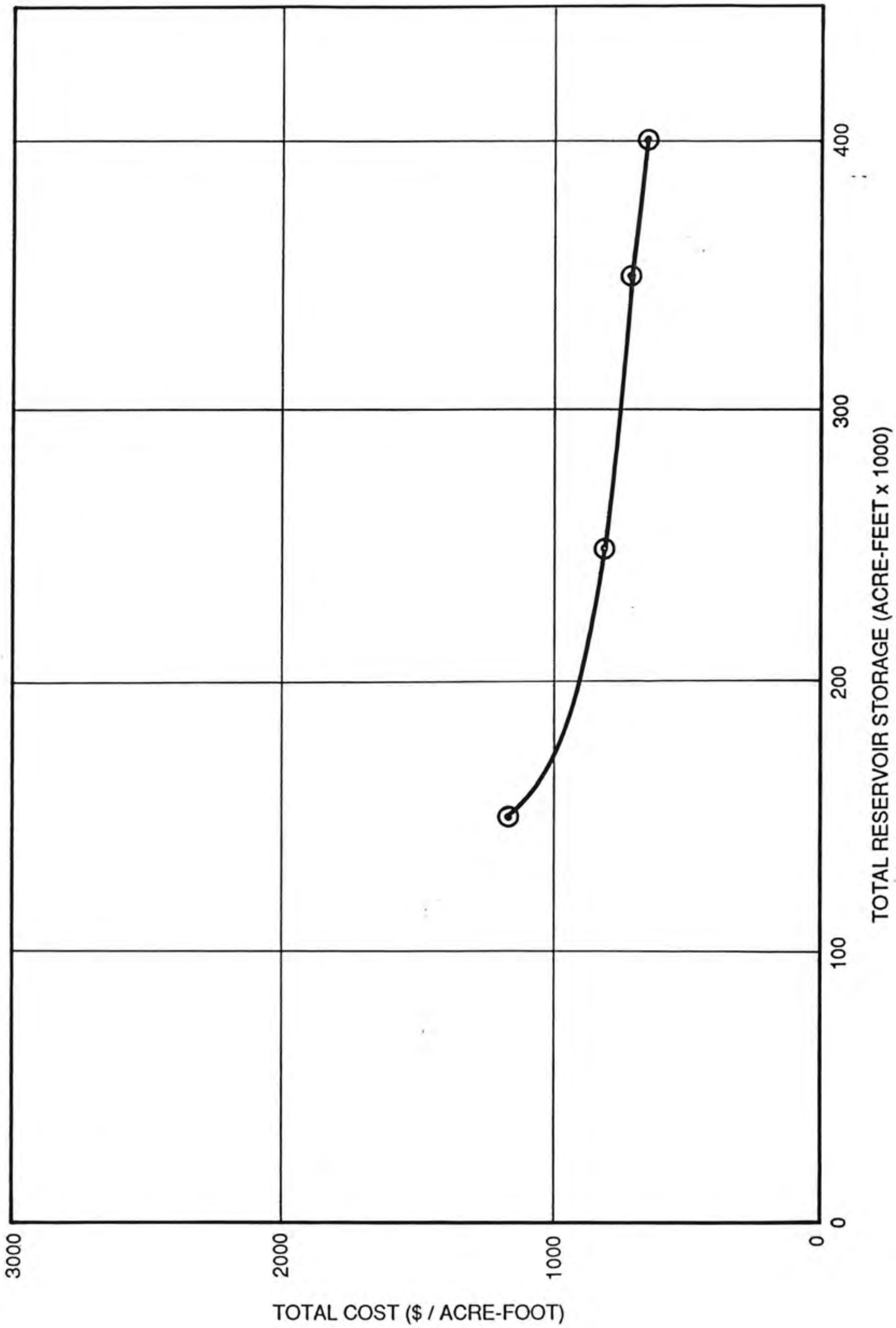
500 0 500 FEET

PLAN

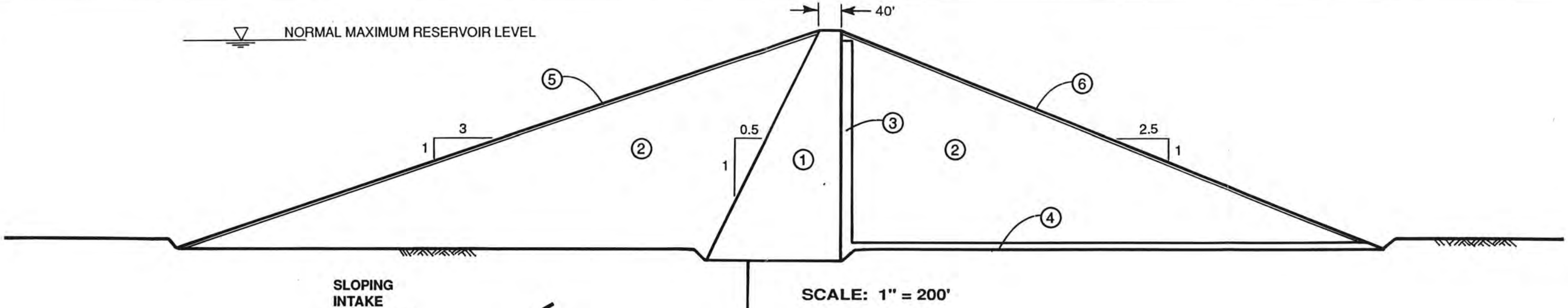
Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	TYPICAL PLAN AND CROSS SECTION LOS OSOS SITE		
		PROJECT NO.	DATE	FIGURE NO.
	PALO ALTO • CALIFORNIA	SCV-145A	FEBRUARY 1993	V-7

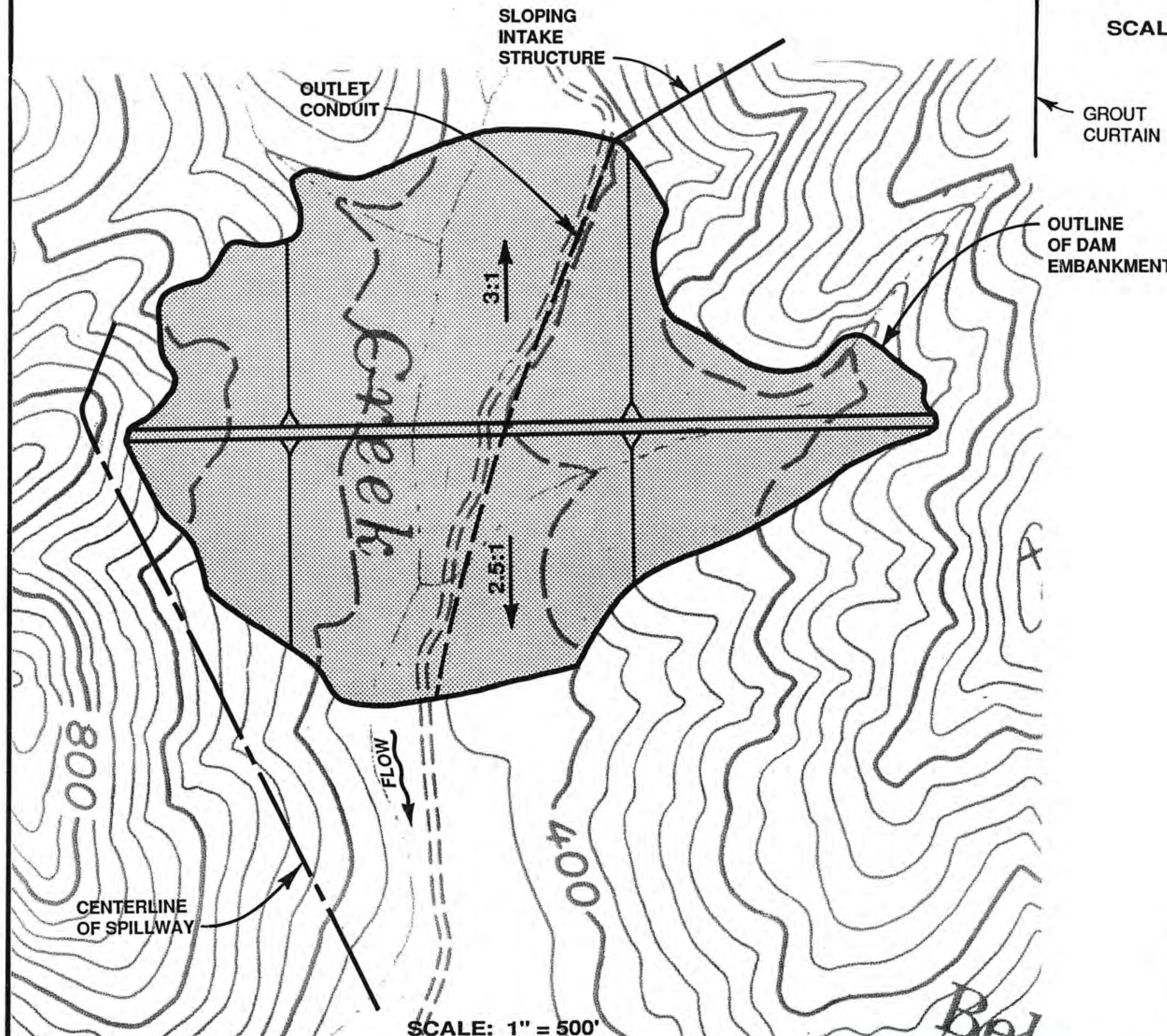


Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	RESERVOIR AREA-CAPACITY CURVES LOS OSOS SITE		
	PALO ALTO • CALIFORNIA	PROJECT NO.	DATE	FIGURE NO.
		SCV-145A	FEBRUARY 1993	V-8



Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	COST CURVE LOS OSOS SITE		
		PROJECT NO.	DATE	FIGURE NO.
	PALO ALTO • CALIFORNIA	SCV-145A	FEBRUARY 1993	V-9





EMBANKMENT ZONES

1. IMPERVIOUS MATERIAL
2. RANDOM MATERIAL
3. CHIMNEY DRAIN
4. BLANKET DRAIN
5. RIPRAP
6. SLOPE PROTECTION

SCALES

200 0 200 FEET

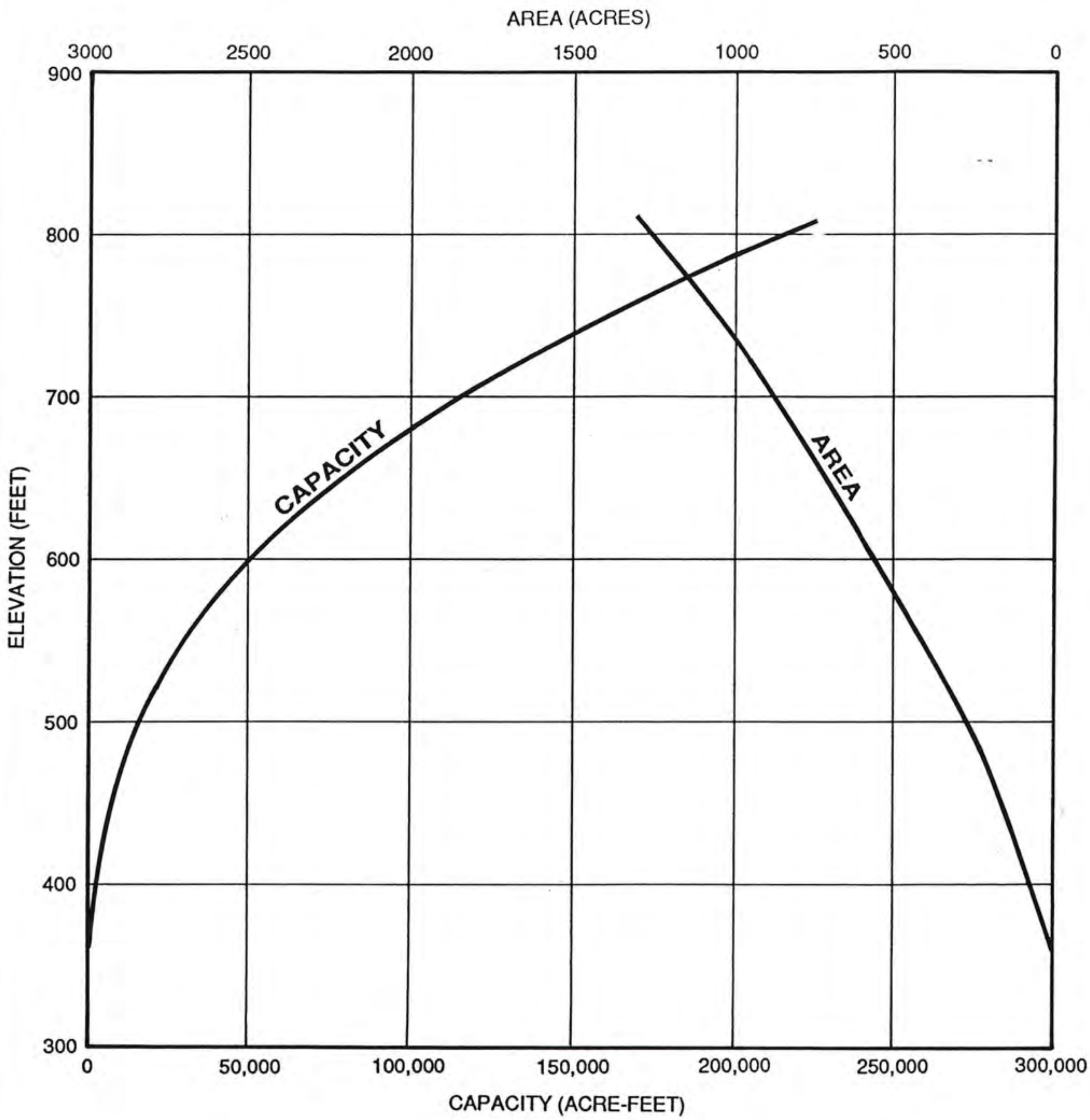
SECTION

500 0 500 FEET

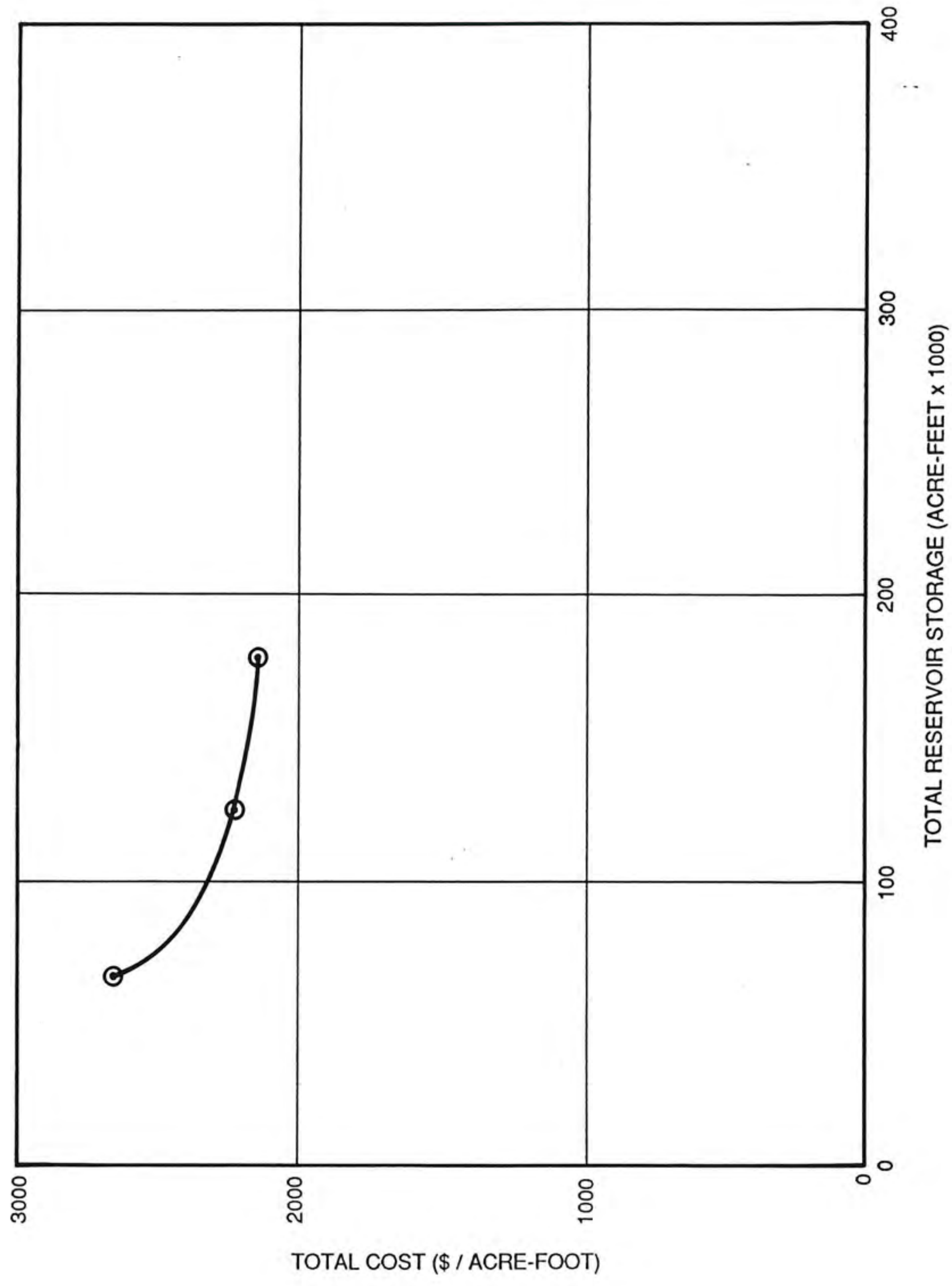
PLAN

Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	TYPICAL PLAN AND CROSS SECTION CEDAR CREEK SITE		
	PALO ALTO • CALIFORNIA	PROJECT NO. SCV-145A	DATE FEBRUARY 1993	FIGURE NO. V-10

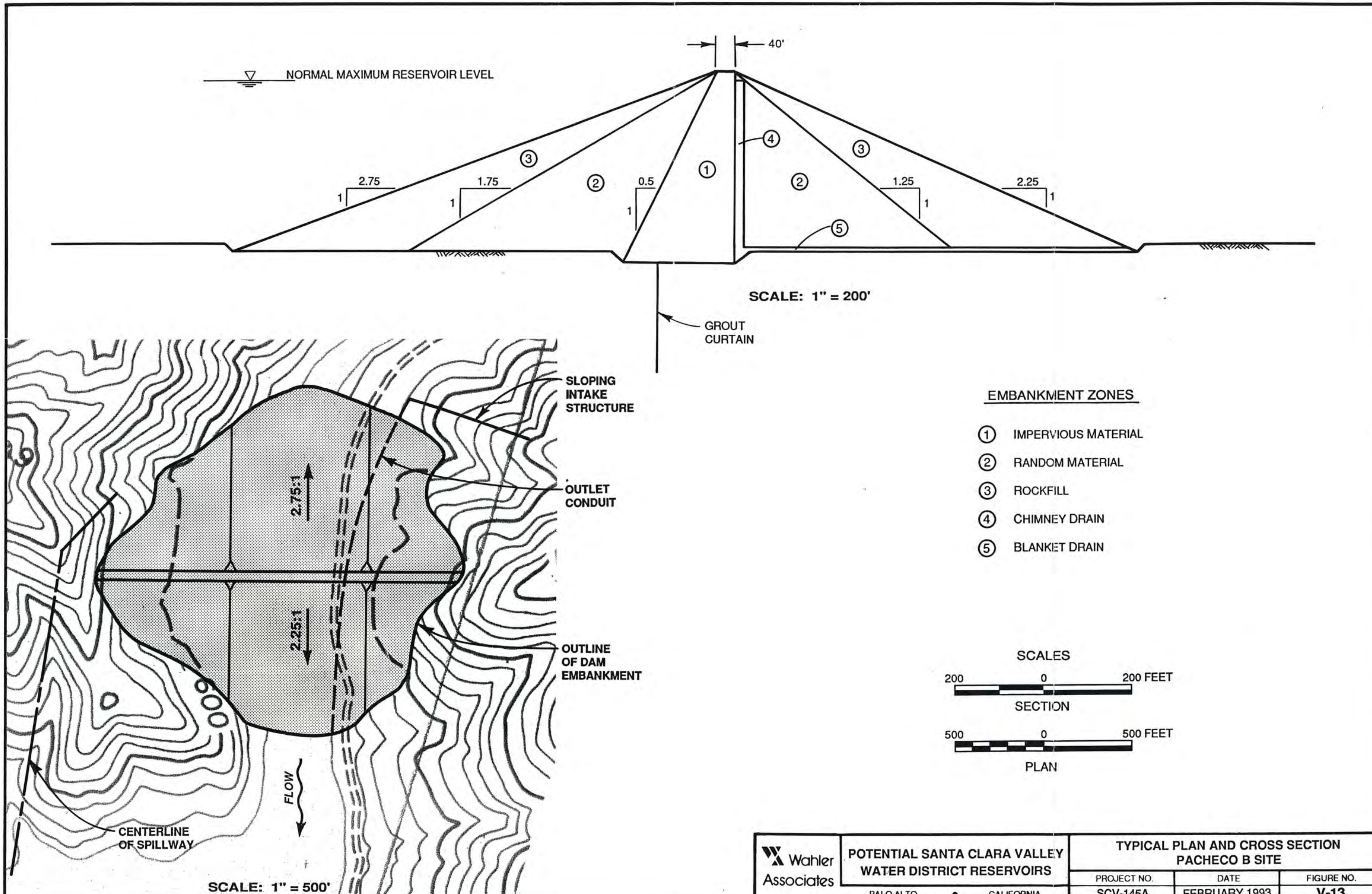
134729



Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	RESERVOIR AREA-CAPACITY CURVES CEDAR CREEK SITE		
		PROJECT NO.	DATE	FIGURE NO.
	PALO ALTO • CALIFORNIA	SCV-145A	FEBRUARY 1993	V-11



Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	COST CURVE CEDAR CREEK SITE		
		PROJECT NO.	DATE	FIGURE NO.
	PALO ALTO • CALIFORNIA	SCV-145A	FEBRUARY 1993	V-12



Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS PALO ALTO • CALIFORNIA	TYPICAL PLAN AND CROSS SECTION PACHECO B SITE		
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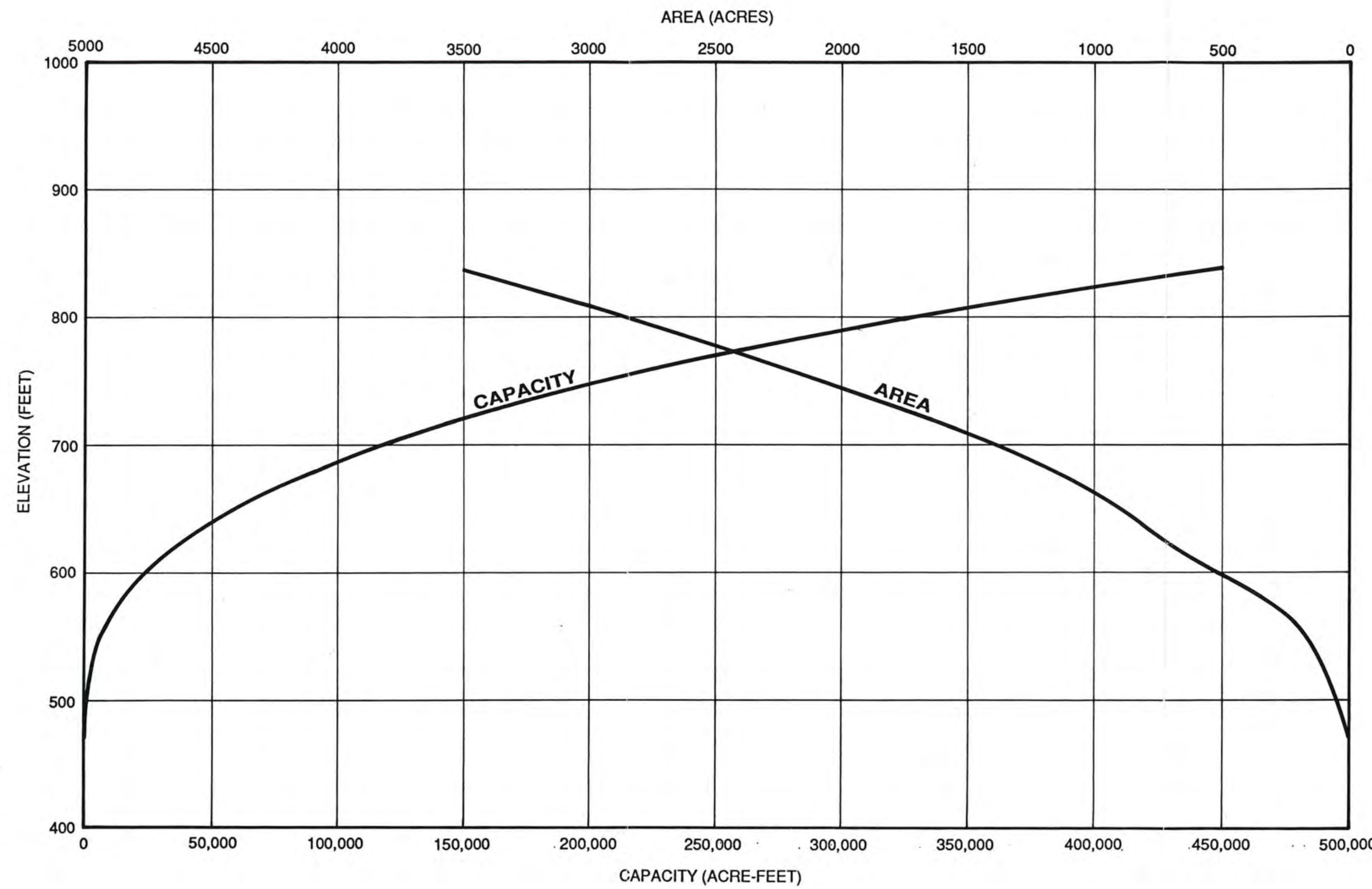
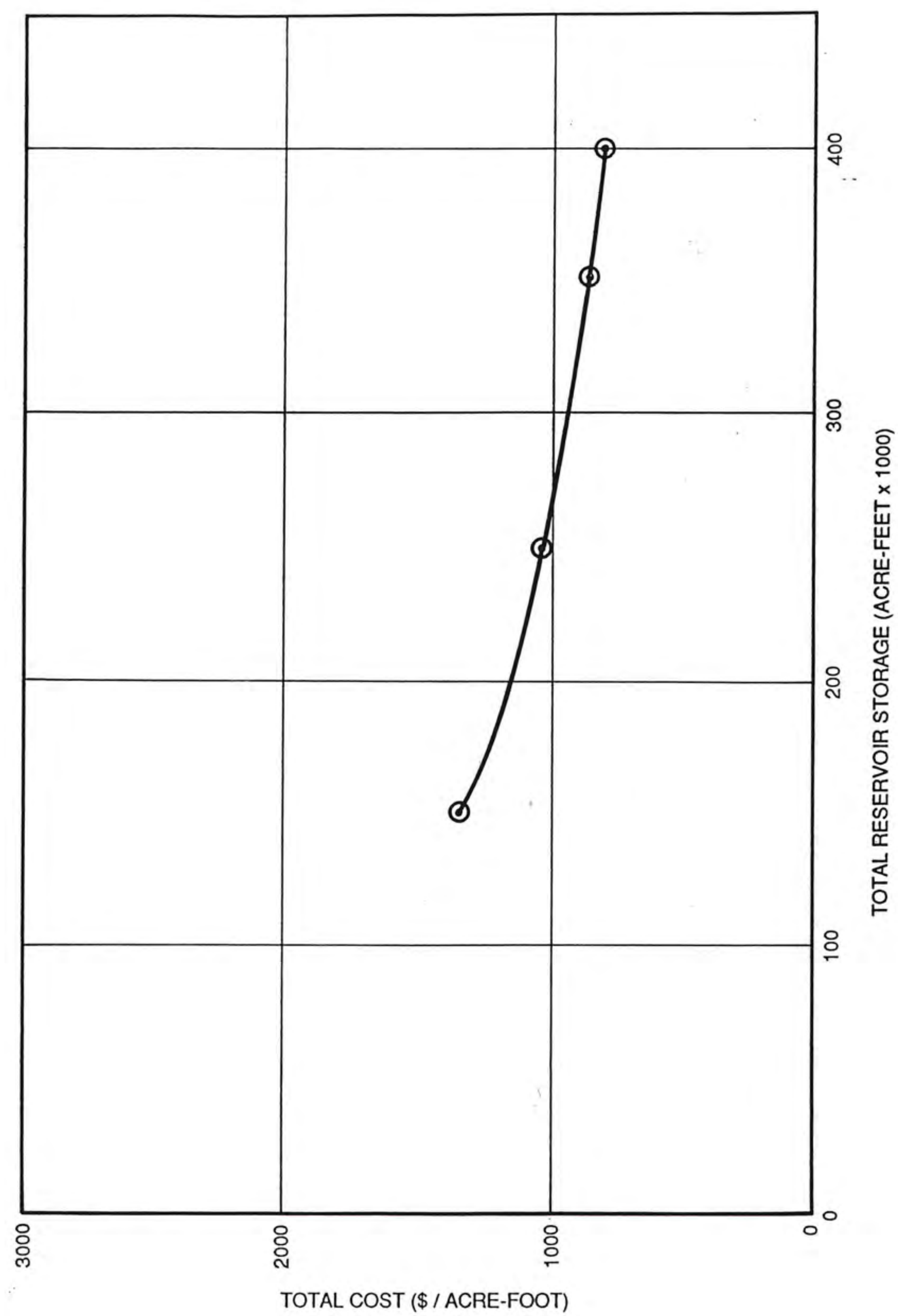
		SCV-145A	FEBRUARY 1993	V-13



Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS PALO ALTO • CALIFORNIA	RESERVOIR AREA-CAPACITY CURVES PACHECO B SITE PROJECT NO. SCV-145A · DATE FEBRUARY 1993 · FIGURE NO. V-14



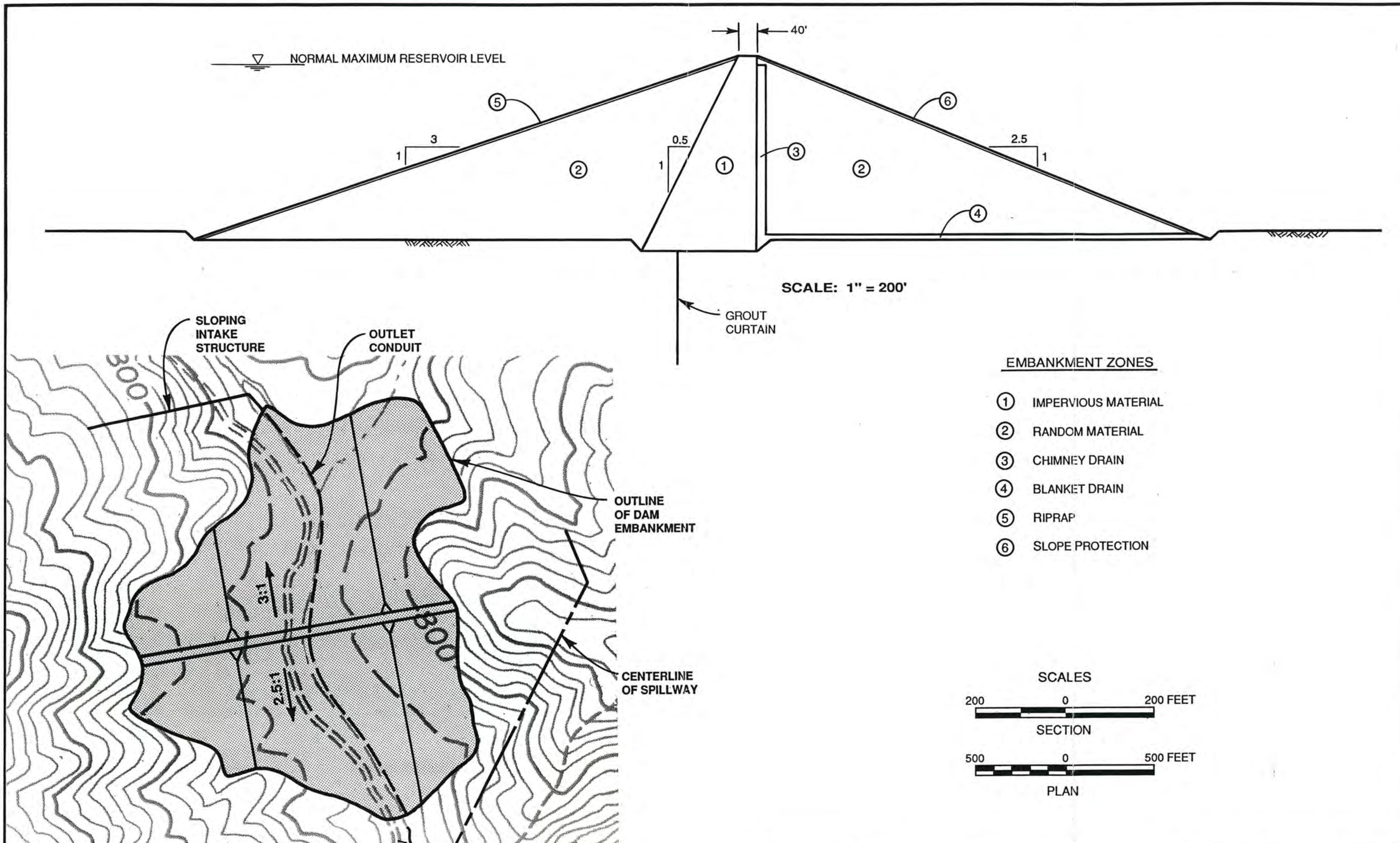
Wahler Associates

POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS

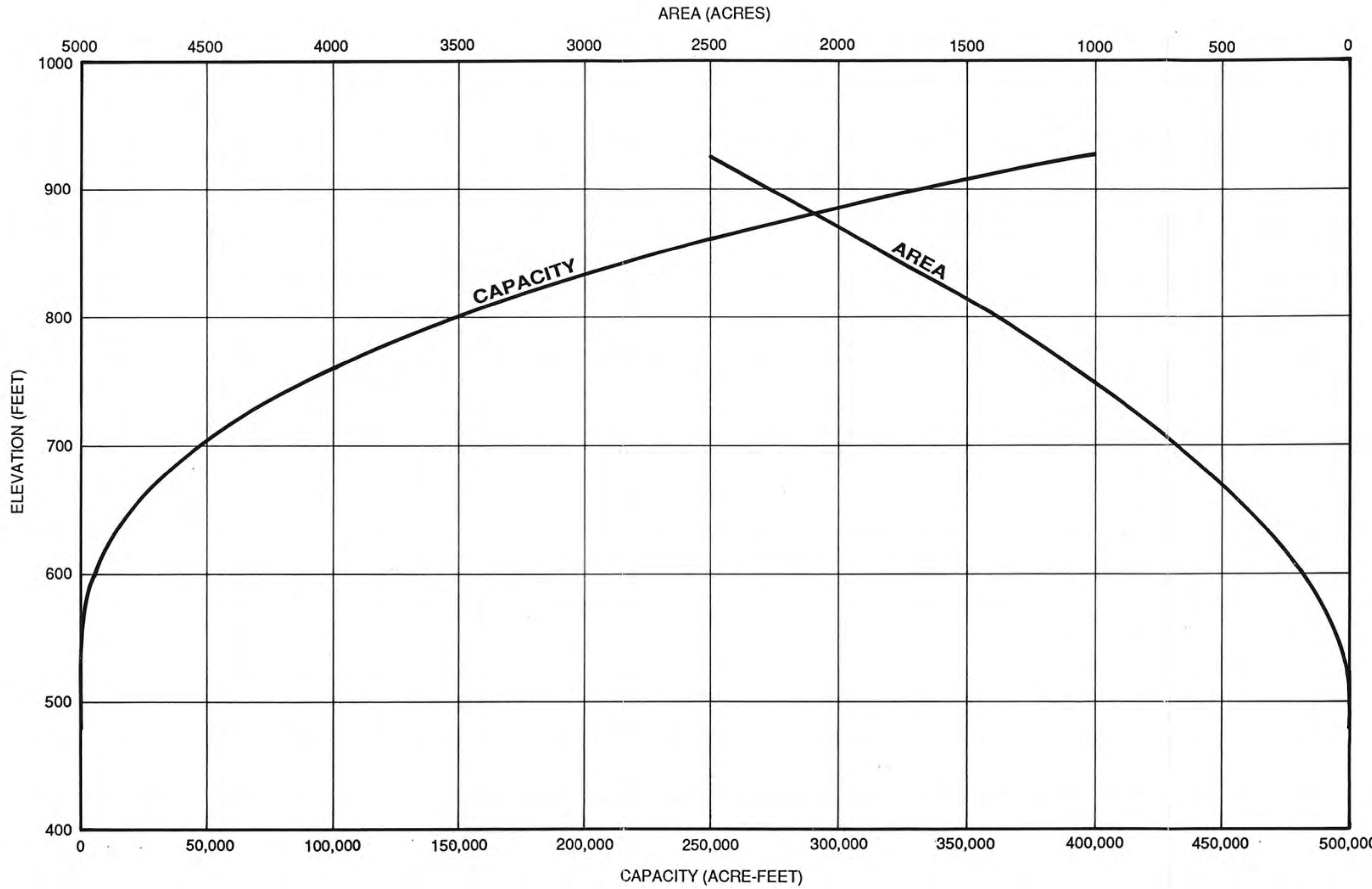
PALO ALTO • CALIFORNIA

COST CURVE
PACHECO B SITE

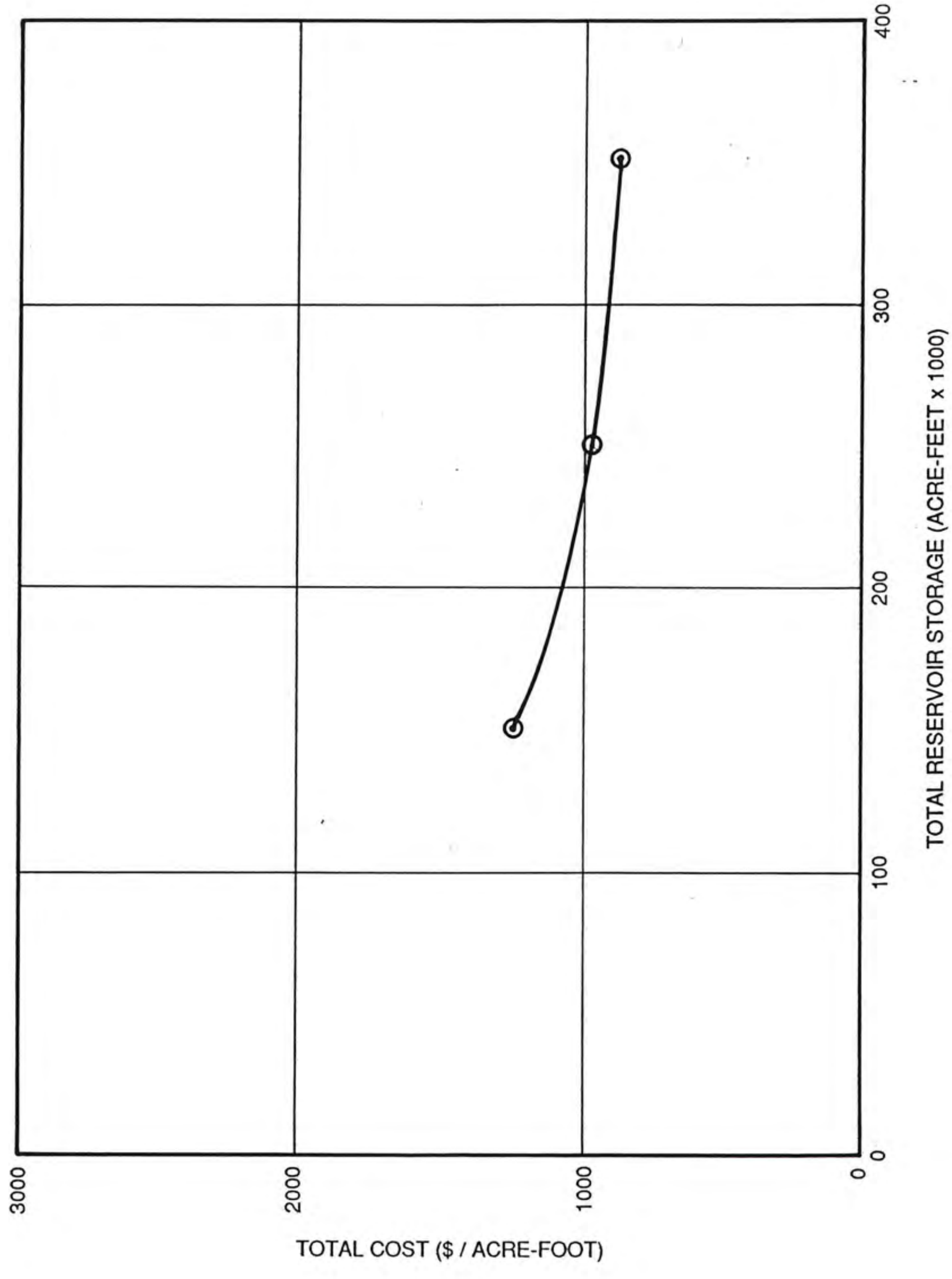
PROJECT NO.	DATE	FIGURE NO.
SCV-145A	FEBRUARY 1993	V-15



Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	TYPICAL PLAN AND CROSS SECTION UPPER PACHECO SITE		
		PROJECT NO.	DATE	FIGURE NO.
	PALO ALTO • CALIFORNIA	SCV-145A	FEBRUARY 1993	V-16



Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	RESERVOIR AREA-CAPACITY CURVES UPPER PACHECO SITE		
	PALO ALTO • CALIFORNIA	PROJECT NO. SCV-145A	DATE FEBRUARY 1993	FIGURE NO. V-17



Wahler Associates	POTENTIAL SANTA CLARA VALLEY WATER DISTRICT RESERVOIRS	COST CURVE UPPER PACHECO SITE	
		PROJECT NO.	DATE	FIGURE NO.
	PALO ALTO • CALIFORNIA	SCV-145A	FEBRUARY 1993	V-18

CHAPTER VI

CHAPTER VI
CONCLUSIONS AND RECOMMENDATIONS

A. GENERAL

At this time, it is possible to draw a number of conclusions about the sites and approximately rank them in terms of technical and cost factors. However, until certain detailed environmental studies are completed, it is not yet possible to rank the sites from the environmental standpoint. It is also not yet advisable to select a specific site. There are several reasons for this. To date, required storage has not been fully determined because of the uncertainty of imported supplies; yet a site which may be suitable to impound a reservoir up to a certain capacity may not be suitable for larger reservoirs. Detailed environmental impact studies still have to be accomplished, and it is always possible that some environmental constraint will be discovered that would be fatal to construction of a dam and reservoir at one or more of the sites. Subsurface geotechnical investigations have not yet been conducted. Although we believe the reconnaissance-level studies have afforded a reasonable general assessment of the major geotechnical issues at the candidate sites, there is always a possibility that feasibility-level investigations might uncover unexpected geotechnical conditions that would adversely impact technical or economic feasibility of the site.

For the above reasons, the conclusions presented below are tentative and possibly subject to revision as further studies are completed.

B. CONCLUSIONS

The Cedar Creek and Packwood sites are topographically inefficient, requiring very large dams to provide moderate storage capacity. Consequently, projects at these sites would be extremely expensive, as reflected in the cost estimates presented in this report. At the Packwood site, narrow ridges form the extensions of both abutments, a factor which would probably limit storage capacity to about 150,000 to 200,000 acre-feet. The Packwood site is situated less than a mile from the active Calaveras Fault, and could therefore be subjected to very strong shaking in the event of a major earthquake on that fault. The Cedar Creek site suffers from a serious deficiency of construction materials, particularly materials with which to construct an impervious core of the dam. In the least, production of suitable impervious material would be a very difficult and expensive process. It is distinctly possible that, as a practical matter, it cannot effectively be done at all. For the above reasons, the Cedar Creek and Packwood sites are by far the least desirable from a technical and economic standpoint.

The Coe site is topographically an efficient one, so that from the standpoint of reservoir cost alone, a project here would probably cost less than at any other site. However, a very long pipeline would be required to import water to the reservoir. In addition, the reservoir would be at a considerably higher elevation than many of the other alternatives. Consequently, pipeline and pumping station costs offset the reservoir cost, bringing the Coe project costs into about the same range as the Pacheco sites and making it more expensive than a Los Osos project. Storage capacity at the Coe site may be limited by dam safety concerns associated with narrow upper abutments at higher dams. This would need to be investigated in any feasibility study, but there appears to be a strong possibility that abutment configurations may limit storage capacity to something on the order of 200,000 acre-feet.

The Los Osos site is topographically a very efficient site, and it appears that a project here would be the cheapest of all alternatives. However, a major public road relocation would be required to restore access to the recently approved Gilroy Hot Springs Resort and Henry Coe State Park from the southwest. A study of the cost of such a road relocation was not included in the scope of work, because it would require special feasibility-level studies. Given the steepness and ruggedness of the terrain surrounding the proposed reservoir, it would be difficult and costly to provide a suitable replacement access road. The Los Osos site is situated just over a mile from the active Calaveras Fault, and could therefore be subjected to very strong shaking in the event of a major earthquake on that fault. Fortunately, sources of high-quality construction materials exist, which would permit zoning a dam to provide a significant degree of earthquake resistance. Thus, the impact of very strong shaking could be considerably mitigated. The old landslide on the right abutment downstream of the proposed dam alignment may be a constraint on reservoirs larger than about 350,000 to 400,000 acre-feet. Detailed geotechnical evaluations would be required at the feasibility level to assess this.

The Pacheco B and Upper Pacheco sites are topographically efficient and can provide large storage capacity with a dam of reasonable size. Because they are more distant from the Calaveras and San Andreas Faults than are the other sites, these two sites are the most favorable from the standpoint of potential earthquake shaking. From the standpoint of cost, they appear competitive with the Coe site and somewhat more expensive than Los Osos. No fatal technical deficiencies were noted during this study, but delineation of the best sources of construction materials would be an important task in any feasibility study. It appears that larger quantities of high quality rock would be available for construction of a dam at Pacheco B than at Upper Pacheco.

The Packwood, Coe and Los Osos alternatives would allow stored imported water to be released down natural water courses to Anderson Reservoir, and thence to the District's system. This would provide additional reliability to the District's water supply in the event of interruption of the Santa Clara Conduit by an earthquake on the Calaveras fault. The Cedar Creek, Pacheco B and Upper Pacheco damsites are located east of the Calaveras fault and releases to the District's system would have to be made through the Pacheco/Santa Clara Conduit. Thus, these alternatives would not offer the additional system reliability provided by Packwood, Coe and Los Osos.

C. RECOMMENDATIONS

The following discussion presents a general overview of the recommended approach to proceeding with investigation and development of a storage reservoir project. It provides only the salient highlights of a very complicated set of processes. As such, it is not intended to be exhaustive as to agencies involved, species impacted, issues of concern, or as to applicable statutes and compliance procedures. Compliance with Section 404 of the Clean Water Act (wetlands) and the federal Endangered Species Act involve critical legal considerations for which it would be most prudent to seek the advice of a well-qualified attorney.

1. NEPA/CEQA

Federal environmental documentation will be required under the National Environmental Policy Act (NEPA) in support of major federal permit actions under the Clean Water Act (filling of wetlands) as discussed below, and possibly the Endangered

Species Act (if federally listed species are subject to "take"). The federal document required will most likely be a full Environmental Impact Statement (EIS) given the magnitude of the project and the significance of the potential impacts.

In order to satisfy state environmental processing requirements under the California Environmental Quality Act (CEQA), the environmental document will likely be a "joint document" known as an EIR/EIS which will satisfy both state and federal requirements. It is possible that the federal agencies would accept only an EIR, providing it included NEPA-level discussions of alternatives, etc. (This is the approach used by DWR for the Los Banos Grandes EIR.) The lead agency for purposes of environmental processing will likely be the District, with close involvement from the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service on matters relating to wetlands and endangered species, respectively.

Given the extensive involvement by a number of state and federal agencies, and the likelihood of several revisions prior to public circulation, the time period allocated for environmental clearance should be a minimum of two years (after the project has been sufficiently defined for extensive environmental evaluation). This time-frame could easily double if the chronic understaffing situation at the Corps' San Francisco District office continues.

2. Corps of Engineers Permit

The filling of wetlands by the proposed dam and reservoir will require a permit from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. Given the large acreage of wetlands involved under any of the alternatives, several complex legal questions will need to be addressed concerning the availability of practicable alternatives, the issue of avoidance versus mitigation, and so on. These issues are further complicated by the fact that there are three federal agencies with major involvement in wetlands regulation, including: EPA (which has oversight authority for Section 404 permits), the Corps (which administers the regulatory program), and the U.S. Fish and Wildlife Service (which must be consulted on 404 permits by law). All three agencies have different positions and approaches to the wetlands issue, which must be reconciled before a permit is issued in each case.

Since the 404 permit process is integrated with the EIR/EIS process, the time allocated should be two to four years, at least.

3. Endangered Species Act

There is a strong possibility that at least one candidate species for listing under the federal Endangered Species Act (i.e., the California tiger salamander) is present at all of the alternative sites under investigation. While it is fairly certain that the federally threatened Bay checkerspot butterfly is absent from all sites, the federally endangered San Joaquin kit fox has been sighted in the immediate vicinity of the Pacheco sites.

The U.S. Fish and Wildlife Service is responsible for administering the Act. In theory, a permit is required for any proposed "take" of a listed species (e.g., kit fox) or its habitat, which must include provision of suitable replacement habitat at several times the acreage to be removed. In practice, it would be almost impossible to get such permission if there is any other way to achieve the objectives of the project, and/or unless there is a great deal of political impetus behind the project (e.g., Los Banos Grandes).

In cases involving candidate species (e.g., tiger salamander), the Act is unclear, although the service has been vigorous in its "informal" protection of these species. Additionally, there is a continuing risk that a candidate species will be "uplisted" to threatened or endangered.

The timing question is difficult to predict at this time due to the uncertainties surrounding the two species in question. With regard to the kit fox, whether the Pacheco sites constitute habitat for this species can only be determined through extensive field surveys and consultations with the Service. The situation with the tiger salamander is currently in flux with the Service, which has proposed uplisting of this species to threatened, but that was before this year's more normal rainfall which appears to have caused the population to rebound.

4. California Department of Fish and Game

The Department of Fish and Game's (DFG) principal authority here is for issuance of Streambed Alteration Agreements which are primarily aimed at preventing siltation and mitigating loss of riparian habitat. Procedures and requirements for compliance are well established and the permit process can be completed in a matter of a few months.

The DFG also has responsibility as a coordinating agency for Corps' permits and Endangered Species matters. It is also responsible for commenting on environmental documents, although it is entirely up to the lead agency whether to adopt DFG's CEQA-related recommendations. This could become important in instances where DFG's concerns extend beyond the mandate of the USF and WS under the federal Endangered Species Act (e.g., protection of valley oak woodland, riparian woodland, pronghorn and tule elk).

5. Engineering Studies

The next step in project development, from the engineering standpoint, would be a feasibility study for the purposes of defining the project. Because they are mutually supportive, environmental and feasibility studies should in general be proceeding more or less concurrently.

In defining the project, the feasibility study would culminate in: (1) selection of all major components (reservoir, dam, conveyances, pump stations, etc.); (2) sizing the project; (3) sizing all features (dams, spillways, outlet works, conveyances, pump stations, etc.); (4) updating the project cost estimate; and (5) preparing a detailed schedule for project development.

The feasibility study would embrace the following broad tasks:

- Exploration at remaining candidate sites to firm up technical feasibility and project costs. Particular emphasis would be placed on resolving those issues that would have significant impact on cost and feasibility (other detailed issues would be reserved until final design-level studies of the selected project). The investigations would normally include: (1) damsite drilling and testing; (2)

exploration and testing to confirm availability and general character of construction materials; (3) exploration, where necessary, for conveyance alignments and pump stations; and (4) exploration, where necessary, to assess other major concerns (such as potential landslides, suspected faulting, etc.)

- In conjunction with environmental impact studies, development of proposed mitigation measures and their costs.
- Comparison of the remaining candidate projects by refining layouts, designs and cost estimates.
- Selection of a project.
- Performance of a feasibility-level design for the selected project (including engineering analyses as required to demonstrate project safety).
- Development of a feasibility-level cost estimate.
- Preparation of a feasibility study report.

The length of time required to complete such a study would depend on the number of alternatives being studied and the general size of the proposed project. However, it would not be unusual for a feasibility study of a project of this scope to require about two years.

After a project is selected and sized, the next step from an engineering standpoint would comprise development of the final design. This process would include all remaining field and laboratory investigations required to detail the project, extensive engineering analyses of the dam and appurtenant structures, coordination and negotiation with the State Division of Safety of Dams and other applicable agencies to facilitate review and acceptance of the project, preparation of required investigation and design reports, development of an Engineer's Estimate, and preparation of plans and specifications suitable for construction.

The length of time required for this process would depend on the size of the project and the nature of the remaining problems to be resolved. However, it would not be unusual for this process to require between two and three years.

APPENDIX 1

ENVIRONMENTAL AND LAND USE FACTORS

FINAL REPORT

PRELIMINARY EVALUATION

OF SIX PROPOSED

DAM AND RESERVOIR SITES

IN THE MOUNT HAMILTON RANGE

ENVIRONMENTAL AND LAND USE FACTORS

Prepared for the
Santa Clara Valley Water District

Prepared by
Nolte and Associates

In Association with
Wahler Associates

February 1993

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I. INTRODUCTION

A. STUDY OBJECTIVES

The intent of this report is to provide a preliminary appraisal of environmental and land use factors for six potential dam and reservoir sites selected for study by the Water District in the Mount Hamilton Range.

The primary purpose of this initial study was to identify potentially environmental and land use constraints to the development of the candidate sites. The secondary purpose of this study was to characterize the nature and significance of such constraints present at each site to enable a preliminary comparison, and perhaps to assist in eliminating sites from further study. In order to provide an overview reference for the site evaluations, the discussion is followed by an Environmental Sensitivity Matrix, which summarizes the findings and conclusions for each site under the various categories.

This preliminary assessment was also intended to identify those factors for which sufficient data was not available, and for which additional study would be required at a subsequent study phase in the program. Some preliminary suggestions for further study are provided at the end of this report.

To provide a more complete discussion of environmental factors, a brief explanation of general mitigation requirements is included after the site evaluations.

B. STUDY METHODS

This preliminary assessment of environmental and land use factors is based entirely upon existing published sources, aerial photographs, and aerial and ground reconnaissance. The details of the study approach are described below.

1. Land Use

a. **Existing Land Use** - Principal source materials included USGS Quadrangle maps, County land use mapping, and aerial photos, augmented by aerial and ground reconnaissance.

b. **Pending Development** - This information was gathered from the files of the Santa Clara County Planning Department, as verified by Planning staff.

c. **Plans/Policies** - The sources here included the County of Santa Clara General Plan, the County's Open Space Program, and the Henry W. Coe State Park General Plan.

2. Flora and Fauna

a. Sensitive Habitat and Species - A report on biological constraints was prepared by H.T. Harvey and Associates based on previous inventories, published sources, aerial photographs and extensive staff knowledge of the area. (No biological field reconnaissance was undertaken.)

b. Wetlands - A crude estimate of Corps of Engineers jurisdictional wetlands was derived for each site by measuring the length of "blueline streams" on the USGS quad maps and assuming an average channel width of 50 feet throughout. While this method could not take into account the presence of isolated off-channel wetlands, or account for variations in habitat quality, it was a sufficient basis for initial comparison among the proposed dam and reservoir sites.

3. Cultural Resources

a. Archaeological and Historic Sites - A cultural resources constraints analysis was prepared by Basin Research Associates based on published sources. (No archaeological field reconnaissance was undertaken.) The potential importance of each recorded cultural resources site was qualitatively estimated to provide a preliminary indication of the level of mitigation anticipated for each site.

b. Scenic Resources - This qualitative assessment was based on review of topo sheets and aerial photos, as well as aerial and ground reconnaissance.

C. STUDY LIMITATIONS

An inherent characteristic of this preliminary appraisal is that several important questions will be left unanswered until detailed follow-up studies and surveys can be conducted. An important example is whether certain sensitive wildlife species exist at any or all of the sites. The answer to that question may dictate the direction of further studies and decisions on reservoir siting. To a lesser extent, it would be desirable to conduct archaeological field reconnaissances at sites for which no information currently exists, but which have a high potential to contain significant cultural deposits (e.g. Packwood, Cedar Creek). However, the outcomes of such archaeological surveys would not be critical due to the general mitigability of archaeological sites. Nevertheless, such finds could add considerably to the cost of developing a given site.

Also important is the filling of wetlands which would occur at all of the reservoir sites, an activity which is subject to the permit jurisdiction of the U.S. Army Corps of Engineers under Section 404 of the federal Clean Water Act of 1972. Prior to approving the issuance of any permit for the filling of wetlands, the Corps must make findings regarding the existence of "practicable alternatives to meet the basic project objective" and selection of the "least environmentally damaging alternatives" and to show "maximum avoidance" in the proposed project concept. These are legal questions which go to the "permittability" of a given project. Thus, while the site evaluations discuss wetland mitigation, such discussion is predicated on the implicit assumption that a given project is "permittable" under Section 404. It is beyond the scope of this initial study to address the issue of "permittability" as it may apply to a future reservoir site.

To a minor degree, this initial study is limited by the lack of detailed project descriptions for the alternative sites. For example, it has not yet be determined where borrow sites and construction staging areas might be located at each site. Accordingly, this evaluation did not address potential impacts at such sites. Likewise, the potential for traffic generation along haul/access routes and attendant noise, dust and safety concerns are not addressed here, since these are in the nature of incidental impacts which would be common to all sites, and do not represent constraints which help to distinguish one site from another.

II. SITE EVALUATIONS

1. PACKWOOD

The Packwood site is about 2 miles east of Anderson Reservoir and would inundate about 900 acres, which includes approximately 4 miles in the Packwood, Vance and Hoover Valleys.

A. SITE CONDITIONS AND INFLUENCES

1. Land Use

a. Existing Land Use

- The site contains one ranch complex with several dwellings on west side of Packwood Valley (Los Huecos Ranch).
- Southern and central portions of Packwood Valley are in cultivation. Upper Packwood and Hoover Valley are used for grazing.
- There are no public roads or major utilities within the site boundaries.

b. Pending Development

- There are no development applications pending or proposed.

c. Plans/Policies

- The County General Plan designation covering this site is "Ranchland", which permits very limited land division only.
- The site is not located within any existing or proposed parks, open space preserves, trail corridors or scenic routes.

2. Flora and Fauna

a. General

- Packwood Valley floor is in cultivation or pasture, with a well developed riparian corridor along central and lower Packwood Creek.

- The Hoover Valley arm is in pasture with a narrow strip of riparian along creek.

- The lower slopes of surrounding hills are covered with dense woodland, while savanna woodland occupies higher slopes and ridges.

b. Sensitive Habitat

- The Packwood site contains 6.5 miles of riparian woodland (of which 5 miles is considered to be high quality riparian habitat), which is a habitat type of concern to the California Department of Fish and Game. This site ranks sixth in importance among the six sites under study, in terms of potential loss of high quality riparian woodland. (See the biological constraints report by H. T. Harvey and Associates, which is included as Appendix A.)

- The site ranks fifth in terms of potential loss of valley oak woodland, which is also a habitat type of concern to the Department of Fish and Game.

c. Sensitive Species

- The site contains no plant or animal species currently on State or Federal lists of threatened or endangered species. However, there is some potential for the occurrence of the red-legged frog, a Federal Candidate species for listing. This amphibian is currently being actively proposed for uplisting to Threatened or Endangered by the U.S. Fish and Wildlife Service, and it is anticipated that this uplisting will occur within the next year. If this species is found to be present at the site, the Service would be strongly opposed to any proposal for a dam and reservoir here. The Service would also be concerned if other candidate species for listing such as the tiger salamander and southwest pond turtle were found at that site. (The degree of concern would be lower, however, since these latter two species are not currently proposed for immediate uplisting.)

- The Packwood site contains suitable habitat for the Tule elk and pronghorn, both of which have been reintroduced to the Mount Hamilton Range since 1980. Field surveys would likely indicate that the site is used by both of these species, with the probability of occurrence here higher than at any of the other proposed reservoir sites. While neither of these species is threatened or endangered, the loss of this habitat would be considered a significant impact to the California Department of Fish and Game (CDFG).

- There is some possibility that Golden Eagles may nest in one of the larger trees on the valley floor. If so, this would be of concern to both the State and Federal resource agencies.

d. Wetlands

- The site contains approximately 9 miles of creek channel (including tributaries) defined as "Waters of the U.S." subject to permit authority of U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. Assuming an average channel width of 50 feet, this yields approximately 55 acres of Corps jurisdictional channel. The final acreage figure could be higher or lower depending on actual site conditions, and could also be higher if any seasonal wetlands, seeps or agricultural ponds are present off-channel.

3. <u>Cultural Resources</u>

a. Archaeological Sites

- No prehistoric sites have been recorded in the vicinity of Packwood Valley to date. However, the topographic and ecological setting of the valley floor would have been very favorable for Native American habitation; so it is highly likely that field surveys would result in the discovery of previously unrecorded sites. (See the cultural resources constraints report by Basin Research Associates, which is included as Appendix B.)

b. Historically Significant Sites

- No sites have been recorded in the vicinity. The ranch structures are unlikely to be considered historically significant.

c. Scenic Resources

- The Packwood Valley is a pristine agricultural valley. However, due to its isolation and inaccessibility, the aesthetic value of this site has limited public importance as a visual resource. The valley contains no particularly unique or outstanding visual features which would be lost due to the creation of a reservoir here.

B. POTENTIALLY SIGNIFICANT ENVIRONMENTAL AND LAND USE IMPACTS

- Displacement of one large ranch complex and agricultural land, requiring compensation.

- Reduction of high quality elk and pronghorn habitat, which cannot be mitigated.

- Loss of approximately 6.5 miles of riparian habitat, requiring replacement at a 3 to 1 ratio (minimum, by acreage) as specified by the CDFG.

- Loss of valley oak woodland requiring replacement at a 3 to 1 ratio by acreage, as specified by the CDFG.

- "Filling" of approximately 55 acres of Corps' jurisdictional channel and wetlands requiring replacement mitigation as specified by Corps and the Service (assuming a project here is "permittable"). Note: Wetland mitigation area would overlap substantially with riparian mitigation acreage required by CDFG.

- There is a high probability for the occurrence of one or more archaeological sites here, which could, in the worst-case, require high levels of study/mitigation. (See the cultural resources constraints report by Basin Research Associates, in Appendix B, for further explanation of possible mitigation requirements.)

C. SUMMARY AND CONCLUSIONS

There do not appear to be any insurmountable environmental or land use constraints which would potentially be fatal to the construction of a dam and reservoir here. (This conclusion assumes that the red-legged frog is not found here, and that the Corps would deem a project here to be "permittable" under Section 404 of the Clean Water Act.)

A comparison with other potential reservoir sites indicates that Packwood is one of the least sensitive sites in terms of potential impacts to environmental resources. This is generally a reflection of its relatively small size which also limits the quantity of riparian and valley oak woodland, as well as wetlands found on the site.

The site's greatest environmental value is that it provides suitable habitat for the reintroduced Tule elk and pronghorn, both of which are known to use the site. Since Packwood is the only potential reservoir site known to provide habitat for both of these sensitive species, the Department of Fish and Game would likely be opposed to a dam and reservoir at this site.

2. COE

The Coe site falls entirely within the boundaries of Henry W. Coe State Park, with the proposed dam situated at the confluence of the East and Middle Fork of Coyote Creek, approximately 11 miles east of Anderson Reservoir. This proposed reservoir would inundate about 2,250 acres which includes 2 miles of the Middle Fork, 5 miles of the East Fork, and about 3 miles of Kelly Cabin Canyon.

A. SITE CONDITIONS AND INFLUENCES

1. Land Use

a. Existing Land Use

- The proposed dam and reservoir lie within an area of the Park which is developed for non-intensive recreational uses such as hiking/backpacking, mountain biking and horse packing. The reservoir would inundate portions of the extensive trail system as well as several designated backcountry camping areas.

- The northeasterly reaches of the reservoir would occupy portions of several private in-holdings within the State Park.

- There are no structures, roads or utilities within the dam and reservoir area.

- There is no cultivation or grazing within the Park boundaries.

b. Pending Development

- None (see below).

c. Plans and Policies

- The area of the proposed reservoir site is designated as "Special Management Area" in the Henry Coe State Park General Plan (1985), where the intent is to retain the existing wilderness character for the area, and where detailed planning is deferred to the future. However, it is clearly the intent of the Park Plan that the wilderness character of this area be preserved by the prohibition of man-made elements, and even enhanced by the removal of the few existing man-made elements which are present. Under the current Park General Plan, there are no roads or visitor serving structures planned for this part of the State Park.

2. Flora and Fauna

a. General

- Vegetation within the proposed reservoir area consists predominantly of savanna and dense woodland, with riparian woodland occurring along the creek channels.

b. Sensitive Habitats

- The Coe site contains approximately 21 miles of riparian woodland (of which 12 miles is considered to be high quality riparian habitat), ranking it second behind Los Osos in terms of importance for this habitat type. (See the biological constraints report by H. T. Harvey and Associates, which is included as Appendix A.)

- The site ranks second after Los Osos in terms of potential loss of valley oak woodland.

c. Sensitive Species

- As with all the other potential reservoir sites, the red-legged frog, a federal candidate species proposed for uplisting, could be present on the Coe site. If this species is found to be present, the U.S. Fish and Wildlife Service would be likely to strongly object to any proposal for a dam and reservoir here. (The literature available on the Park indicates that the red-legged frog is present here.) The Service would also be concerned if candidate species such as the tiger salamander and southwest pond turtle were found at this site. (The degree of concern would be lower, however, since these latter two species are not currently proposed for immediate uplisting.)

- There is some potential that this site supports pronghorn. If so, the California Department of Fish and Game would likely consider the loss of this habitat a significant impact.

d. Wetlands

- Defined channels subject to Corps wetland jurisdiction (including tributaries) extend approximately 16 lineal miles within the proposed dam and reservoir area. Assuming an average channel width of 50 feet, this yields approximately 97 acres of Corps jurisdictional channel. The final acreage figure could be higher or lower depending on actual site conditions, and could also be higher if any seasonal wetlands, seeps or agricultural ponds are present off-channel.

3. Cultural Resources

a. Archaeological Sites

- Four recorded archaeological sites exist within the proposed dam and reservoir area. Three of these sites include midden deposits which would require low to moderate levels of study/mitigation. The fourth site contains human burials and would require a high level of study/mitigation. The Coe site is ranked third in significance for known on-site prehistoric resources (after Upper and Lower Pacheco) among the potential reservoir sites under consideration. (See the cultural resources constraints report by Basin Research Associates, which is included as Appendix B.)

b. Historically Significant Sites

- One recorded site of historic importance is present within the reservoir area, and would require a moderate level of study/mitigation.

c. Scenic Resources

- The interior of Coe Park is generally very scenic, particularly along the forks of Coyote Creek. A band of scenic rock outcrops ("Rock House Ridge") crosses the northeast arm of the reservoir site creating additional visual interest.

- Due to its rugged terrain, variety of landscape, and virtually pristine natural condition, the interior of Coe State Park is considered to be scenically valuable as a large expanse of wilderness area.

B. POTENTIALLY SIGNIFICANT ENVIRONMENTAL AND LAND USE IMPACTS

- "Filling" of approximately 97 acres jurisdictional channel and wetlands requiring replacement as specified by the Corps and the U.S. Fish and Wildlife Service (assuming a project here would be deemed "permittable" under Section 404).

- Loss of approximately 21 miles of riparian vegetation, requiring replacement at a 3 to 1 ratio (minimum, by acreage), as specified by the California Department of Fish and Game. (Such riparian mitigation acreage would overlap substantially with the wetlands mitigation area required by the Corps.)

- Significant loss of valley oak woodland requiring replacement as specified by California Department of Fish and Game.

- Potential reduction of pronghorn and Tule elk habitat, which would be considered a significant impact which cannot be mitigated.

- Loss of archaeological and historic resources, which can be mitigated by excavation, retrieval and cataloging of artifacts or by photographing historic features. However, archaeological mitigation could become extremely expensive at the site containing known human burial. (For further explanation of these mitigation requirements see the cultural resources report by Basin Research Associates, included as Appendix B.)

- Disruption or destruction of existing recreational facilities within Henry Coe State Park, such as the extensive trail network and several camping sites along Coyote Creek.

- Introduction of man-made elements into the interior of Coe State Park, contrary to the policies of the Park General Plan which call for the prohibition of such elements from this area of the park.

- Loss of scenic wilderness resources. This is a particularly significant impact at this site, since one of the principal values to be protected and preserved within this State Park is the natural aesthetic value essential to the wilderness experience. (This impact probably cannot be mitigated from the point of view of the State Parks Department. Creation of a recreational lake to replace wilderness, for example, would likely be considered contrary to the goal of providing for very low intensity recreational opportunities, as indicated in the Park's General Plan. It is also highly likely that the donation of the ranch to the State by the Coe family was made on condition that it be preserved in its natural state in perpetuity).

C. SUMMARY AND CONCLUSIONS

It is doubtful that the proposed dam and reservoir would be deemed to be consistent with the goals of the State Parks Department which call for largely preserving Coe State Park as a wilderness area. It does not appear that this inconsistency could be reconciled without a major change in State policy with respect to Coe State Park, and such a change may be precluded in any event by conditions stipulated in the original land bequest. This issue may warrant some further investigation, but it appears to be an insurmountable constraint which would almost certainly be fatal to a proposed dam and reservoir at this site.

A comparison with the other potential reservoir sites indicates that the Coe site is one of the most environmentally sensitive sites overall, if not the most sensitive site, under consideration. It has among the largest quantities of high quality valley oak woodland and wetland present on-site. While this is generally a reflection of its relatively large size, these factors nonetheless would lend added weight to arguments for the continued preservation of the site as a wilderness area.

3. LOS OSOS

The Los Osos site is about one mile east of Coyote Reservoir. The proposed reservoir would inundate about 3,500 acres which includes approximately 7 miles of Coyote Creek, about 3 miles of Canada de Los Osos Creek, and about 2 miles of Hunting Hollow.

A. SITE CONDITIONS AND INFLUENCES

1. Land Use

a. Existing Land Use

- There are two existing ranch complexes, a disused CDF station, and one new house within the proposed dam and reservoir area. There is also another ranch complex in close proximity to the southern abutment of the main dam.

- Approximately 10 miles of public road within reservoir area (portions of Gilroy Hot Springs Road, Canada Road, and Jamieson Road), along with appurtent utilities. Gilroy Hot Springs Road is particularly important because it will provide access to the recently approved Gilroy Hot Springs Resort, as well as a new entrance planned there for Henry Coe State Park (see below).

- Agricultural activities include the cultivation of hay and grazing in Canada de los Osos, and grazing in Hunting Hollow.

- In the northern-most two-mile reach of the proposed reservoir, the eastern bank of Coyote Creek, opposite Gilroy Hot Springs, lies within the boundaries of Henry Coe State Park.

b. Pending Development

- The County of Santa Clara Board of Supervisors recently approved a General Plan amendment to allow a new resort development at the site of the old Gilroy Hot Springs Resort on the northerly arm of the proposed reservoir on Coyote Creek. The new resort was approved for 70 rooms, recreational and eating facilities, plus a package plant for wastewater treatment. Most of the resort would be outside the proposed reservoir area (i.e., above 1,120 foot elevation), except for the package treatment plant, much of the parking area, and the main access road.

- A future entrance to Henry Coe State Park is planned to be located at the terminus of Gilroy Hot Springs Road, on the east side of Coyote Creek.

c. Plans and Policies

- The County General Plan - Land Use Element designates the major portion of the dam and reservoir area as "Ranchlands", which would permit very limited land divisions, with the exception of the recently approved General Plan Amendment for the Gilroy Hot Springs Resort, as discussed above. A small area at the confluence of Coyote Creek and Canada de los Osos is designated as a site of a future flood control reservoir.

- The Regional Parks, Trails and Scenic Highways Element of the County General Plan designates the entire Coyote Creek corridor from Coe State Park to Coyote Reservoir as a proposed Park, including a proposed trail corridor along the banks of the creek. All of the public roads within the reservoir area are designated as "Local Roads Needing Scenic Protection."

- The County's Open Space Preservation Program document identifies Canada de los Osos as an additional site for a proposed park.

- The Henry Coe State Park General Plan designates Gilroy Hot Springs as a planned future park entrance, with the visitor support facilities to be located on the easterly bank of Coyote Creek opposite the Gilroy Hot Springs Resort site.

2. <u>Flora and Fauna</u>

a. General

- Much of the dam and reservoir area consists of level or sloping valley which is being cultivated for hay or being grazed. Woodlands of varying densities occur on the lower slopes of the adjacent ridges.

- A corridor of high quality riparian woodland occurs along Coyote Creek in the vicinity of Gilroy Hot Springs.

b. Sensitive Habitats

- The Los Osos site contains 24 miles of riparian woodland (including 15 miles of high quality riparian habitat), ranking it by far the highest in terms of importance for this habitat type. (See the biological constraints report by H. T. Harvey Associates, which is included as Appendix A.)

- The site ranks highest in terms of potential loss of valley oak woodland, mainly due to its large size.

c. Sensitive Species

- There is a band of serpentine bedrock which passes through the site north-to-south near the mouth of Hunting Hollow, and just off-site to the west at Gilroy Hot Springs. This may indicate the presence of several rare plant and invertebrate animal species which are endemic to serpentinite-based habitats. While it is highly unlikely that any listed threatened or endangered species are present (e.g., the Bay checkerspot butterfly), it is quite possible that other species of concern to the U.S. Fish and Wildlife Service, which are currently candidates for listing (e.g., serpentine phalangid, micro-blind harvestman, Opler's longhorn moth), may be present. There are several serpentine-endemic plant species which are scheduled for uplisting by the U.S. Fish and Wildlife Service; however, it is not expected that any of these plants (e.g., Coyote ceanothus) occur at the Los Osos site.

- As with all the other potential reservoir sites, the red-legged frog is potentially present at this site. If this species is found to be present, the U.S. Fish and Wildlife Service would be likely to vigorously oppose a proposed dam and reservoir here. The Service would also be concerned if candidate species such as the tiger salamander or southwest pond turtle were found. The degree of concern would be lower, however, since these later two species are not currently proposed for immediate uplisting.

- There is a strong possibility that the Los Osos site supports pronghorn, and to a lessor extent Tule elk. If so, the California Department of Fish and Game would likely consider the loss of this habitat as a significant impact.

- There is some possibility that Golden Eagles may nest in one of the larger trees found on the valley floor. If so, this would be of concern to both the state and federal resource agencies.

d. Wetlands

- Defined channels (including tributaries) subject to Corps' jurisdiction comprise approximately 28 lineal miles within the proposed dam and reservoir area. Assuming an average channel width of 50 feet, this yields approximately 170 acres of Corps jurisdictional channel. The final figure could be higher or lower depending on actual site conditions, and could also be higher if any seasonal wetlands, seeps or agricultural ponds are present off-channel.

3. Cultural Resources

a. Archaeological Sites

- There is one recorded archaeological site within the proposed dam and reservoir area. This site contains bedrock mortars and would require a low level of study/mitigation. (See the cultural resources constraints report by Basin Research Associates, which is included as Appendix B.)

b. Historically Significant Sites

- There are eight recorded sites of historic significance within or in the immediate vicinity of the proposed dam and reservoir area, including the old Gilroy Hot Springs site. It is anticipated that three of these sites would require moderate levels of study/mitigation, while the remaining five sites would require only low levels of study/mitigation.

c. Scenic Resources

- The Los Osos site offers a variety of rural scenery. The upper arm along Coyote Creek is characterized by enclosed woodland along the creek. While the views along Canada Road consist of longer roadside views over rolling pasture and savanna woodland.

- This area is considered to have scenic value by the County, as indicated by the designation of all the public roads as "Local Roads Needing Scenic Protection." It is an important consideration that this is one of the very few areas where public roadway access is available into the interior of the Mount Hamilton Range.

4. Environmental Hazards

As mentioned above, a narrow band of serpentine bedrock runs through the Los Osos site from north to south along the Madrone fault, just west of Coyote Creek. Serpentine rock contains a small percentage of chrysotile, a form of asbestos which poses potential health hazards when its fibers are inhaled. The potential health hazard only arises when the serpentine rock and soil is disturbed by earthmoving or excavation activity causing the airborne release of chrysotile fibers. The band of serpentine rock is only found within the reservoir area proposed to be inundated, and not in the vicinity of the main dam site or the proposed saddle dam site where earthwork would take place. Therefore, the potential health hazard posed by the on-site chrysotile would be minimal or non-existent.

B. POTENTIALLY SIGNIFICANT ENVIRONMENTAL AND LAND USE IMPACTS

- The displacement of the existing ranch complexes, residences and farmlands would require compensation.

- The potential displacement of portions of the approved Gilroy Hot Springs Resort would require relocation of the planned package treatment plant, parking areas and the public access road.

- The proposed reservoir would inundate the area of Henry Coe State Park which is planned to be developed as a visitor serving facility at the new Park entrance at the northern terminus of Gilroy Hot Springs Road. A suitable replacement location for this facility would be required, assuming the State Parks and Recreation Department would be willing to cooperate. (As mentioned previously, inundation of any portion of the State Park may be precluded if there is a condition in the original land bequest stipulating the preservation of the land in its natural state in perpetuity).

- The proposed reservoir would inundate much of Gilroy Hot Springs Road, which will provide access to the new Gilroy Hot Springs Resort, as well as the new entrance planned for Henry Coe State Park. A new roadway would be required to restore access to these facilities.

- "Filling" of approximately 170 acres of Corps jurisdictional channel and wetlands, requiring replacement as specified by the Corps and the U.S. Fish and Wildlife Service (assuming a project here would be deemed permittable under Section 404).

- Loss of approximately 24 miles of riparian woodland, requiring replacement at a ratio of 3 to 1 (minimum, by acreage), as specified by the California Department of Fish and Game. (This mitigation acreage would overlap substantially with wetland mitigation area required by the Corps).

- Significant loss of valley oak woodlands, requiring replacement at a 3 to 1 ratio by acreage, as specified by the California Department of Fish and Game.

- Potential impacts to sensitive species endemic to serpentinite-based habitat (e.g., Bay checkerspot butterfly), requiring field studies at a minimum, and potentially involving a lengthy and expensive process of identifying and securing an adequate mitigation site.

- Loss of archaeological and historic resources, which can be mitigated by excavation, retrieval and cataloging of artifacts, or by photographing and preparing measured drawings of historic features. (The absence of known human burials indicates a relatively low expense level for mitigation.)

- Loss of County-designated scenic resources along existing roadways. This may be somewhat mitigated, from the County's point of view, by the creation of a recreational lake.

- The inundation of the exposed serpentine bedrock would not pose a health hazard since there are no health risks associated with the ingestion of chrysotile. However, if the serpentine area is disturbed by earthmoving (e.g., for roadway relocation), the potential release of airborne chrysotile could pose a health risk from inhalation of fibers. If construction is required in such an area of exposed serpentine, health risks would be reduced to an acceptable level through standard mitigations such as keeping exposed surfaces watered down.

C. SUMMARY AND CONCLUSIONS

The most significant potential impact associated with the Los Osos site would be cutting off public roadway access to the recently approved Gilroy Hot Springs Resort and Henry Coe State Park from the southwest. Given the steepness and ruggedness of the surrounding terrain, it would be difficult and costly to provide a suitable replacement access road, particularly one which involves a minimum amount of grading and environmental impact.

A comparison with the other potential reservoir sites indicates that the Los Osos site is one of the most environmentally sensitive sites under consideration. It has by far the most high quality riparian woodland and wetland present, as well as the largest woodland acreage overall. This is mainly due to its relatively large size. The Los Osos site may also provide habitat for the pronghorn and Golden Eagle, which would increase its sensitivity relative to most other sites, particularly when compared with the three sites to the southeast. The Los Osos site also carries the second greatest land use impacts (after the Coe site), while archaeological impacts are not as significant as at some other sites.

While none of these considerations would necessarily be insurmountable or prove fatal to the Los Osos site, the provision of adequate mitigation and compensation could become very costly. (This conclusion assumes that the red-legged frog is not present here, and that the Corps of Engineers would deem a project here to be "permittable" under Section 404.)

4. <u>CEDAR CREEK</u>

The Cedar Creek site is located just north of Highway 152 and about one-half mile west of Bell Station. The site would inundate about 800 acres, which includes approximately 2.5 miles of Hagerman Canyon and about 1.5 miles of Hurricane Canyon.

A. SITE CONDITIONS AND INFLUENCES

1. <u>Land Use</u>

a. Existing Land Use

- There are no structures, roads or utilities within the proposed dam and reservoir area.

- Agricultural activity consists solely of cattle grazing on the valley floor and lower surrounding slopes.

b. Pending Development

- There are no known development applications pending or proposed for the site.

c. Plans and Policies

- The County General Plan designates the site as "Ranchland", where only very limited land divisions are allowed.

- The site is not within any existing or proposed parks, open space preserves or trail corridors. However, the proposed dam site is within view of State Route 152, which is an officially designated State Scenic Route. The County also designates the Highway 152 corridor as a trail connection to other Regional Trail Systems to the east.

2. Flora and Fauna

a. General

- The proposed dam and reservoir site is vegetated with continuous riparian woodland along the creek channels, and the adjacent hillside is covered with a balanced mixture of dense woodland and savanna woodland.

b. Sensitive Habitats

- The Cedar Creek site contains approximately 8 miles of high quality riparian woodland, ranking it fourth in importance after Los Osos, Coe and Upper Pacheco.

- The site ranks sixth in terms of potential loss of valley oak woodland, mainly due to its relatively small size. (See the biological constraints report by H. T. Harvey Associates, which is included as Appendix A.)

c. Sensitive Species

- As with all the other potential reservoir sites, the proposed-for-listing red-legged frog is potentially present at this site. If this species is found to be present here, the U.S. Fish and Wildlife Service would be likely to strenuously resist any proposal for a dam and reservoir at this site. The Service would also be concerned if candidate species such as the tiger salamander or southwest pond turtle were found. The degree of concern would be lower, however, for these latter two species since they are not currently being proposed for immediate uplisting.

d. Wetlands

- The site contains approximately 7.5 miles of creek channel (including tributaries) subject to Corps jurisdiction. Assuming an average channel width of 50 feet, this yields approximately 45 acres of Corps jurisdictional channel. The final acreage figure may be higher or lower depending on actual site conditions, and could be higher if any seasonal wetlands, seeps or cattle ponds are present off-channel.

3. Cultural Resources

a. Archaeological Sites

- There are no recorded archaeological sites within the proposed dam and reservoir site. However, the topographic and ecological settings of the valley would have been very favorable for Native American habitation; so it is highly likely that field surveys would result in the discovery of previously undiscovered sites. (See the cultural resources constraints report by Basin Research Associates, which is included as Appendix B.)

b. Historically Significant Sites

- There are no known sites of historic importance within the proposed dam and reservoir site.

c. Scenic Resources

- The proposed dam site is within view of State Route 152, a designated State Scenic Highway.

- The proposed dam and reservoir site is largely obscured from view of the highway by the oak savanna woodland covering the valley floor.

B. POTENTIALLY SIGNIFICANT ENVIRONMENTAL AND LAND USE IMPACTS

- Loss of approximately 8 miles of riparian woodland, requiring replacement at a ratio of 3 to 1 (minimum, by acreage), as specified by the Department of Fish and Game.

- "Filling" of approximately 45 acres of jurisdictional channel and wetlands, requiring replacement as specified by the Corps and the U.S. Fish and Wildlife Service. (The mitigation acreage for wetlands would overlap substantially with riparian mitigation area required by CDFG.)

- Significant loss of valley oak woodland, requiring replacement at a 3 to 1 ratio by acreage, as specified by the California Department of Fish and Game.

- Introduction of an earthen dam approximately one-quarter mile from Route 152 within the viewshed of the designated scenic highway. However, the overall visual impact would be minimized due to the screening effect of the hillsides adjacent to the valley, which extend right up to the highway and block all but adjacent views into the valley.

- There is a high probability for the occurrence of one or more archaeological sites here, which could, in the worst case, require high levels of study/mitigation. (See the cultural resources constraints report by Basin Research Associates, in Appendix B, for further explanation of possible mitigation requirements.)

C. SUMMARY AND CONCLUSIONS

There do not appear to be any insurmountable environmental or land use constraints which would potentially be fatal to the construction of a dam and reservoir here. (This conclusion assumes that the red-legged frog is not present, and that the Corps of Engineers would deem a project here to be"permittable" under Section 404.)

A comparison with other potential reservoir sites indicates that the Cedar Creek site is one of the least sensitive sites in terms of potential impacts to environmental resources. This is generally a reflection of its relatively small size which also limits the quantity of riparian and valley oak woodland, as well as wetlands found on the site.

5. UPPER PACHECO (CHIMNEY ROCK DAM SITE)

The proposed "Chimney Rock" dam and reservoir site is situated two miles upstream from the existing Pacheco Reservoir dam. This reservoir would inundate about 2,250 acres which includes approximately 5 miles of the North Fork Pacheco Creek, as well as portions of Chimney Canyon, Pine Springs Canyon, Cow Canyon, Bullhead Canyon, and Coon Creek.

A. SITE CONDITIONS AND INFLUENCES

1. Land Use

a. Existing Land Use

- There are no public roads or utilities within the proposed dam and reservoir area.
- The O'Connor Ranch is the only inhabited site within the reservoir area.
- Grazing of cattle and horses currently takes place within the site.
- The upper reaches of the proposed reservoir along Pacheco Creek would extend into Henry Coe State Park by about 2 miles.

b. Pending or Planned Development

- There are no applications for private development pending or proposed for the site.
- The State Parks and Recreation Department plans to construct a southern entrance road to Coe State Park, commencing from Highway 152 at Bell Station, and following the existing gravel road along the ridgeline northward into the Park at Dowdie Ranch. The northward extension of this road further into the Park, as planned, would cross Pacheco Creek at approximately the 760 foot elevation, well under the proposed 900 foot elevation of the water surface of the proposed reservoir.

c. Plans and Policies

- The entire site is designated as "Ranchlands" in the County General Plan, which would allow only very limited land division.

- The Henry Coe State Park General Plan designates a large portion of the park as wilderness; however, that designation does not extend as far south as the upper reaches of the reservoir on Pacheco Creek which would lie within the park boundaries. Nevertheless, since the entire park is intended for a very low intensity of recreational use, it is uncertain whether the partial encroachment of a reservoir into a remote corner of the park would be considered to be consistent with this general intent.

2. Flora and Fauna

a. General

- The vegetation cover of the Upper Pacheco site and surrounding area consists predominantly of savanna/woodland, reflecting the dryness of this easternmost site. The riparian vegetation along the creeks consists mainly of sparse and thin woodland corridors.

b. Sensitive Habitats

- The Upper Pacheco site contains 22 miles of riparian woodland (of which 11 miles consists of high quality riparian habitat), ranking it third in importance for this habitat type after Los Osos and Coe. (See the biological constraints report by H. T. Harvey Associates, which is included as Appendix A.)

- The site ranks third, after Los Osos and Coe, in terms of potential loss of valley oak woodland.

c. Sensitive Species

- The San Joaquin kit fox, a federally Endangered species, may use portions of Upper Pacheco site occasionally, since the site is located at the western margin of the known range for the kit fox.

- As with all the other potential reservoir sites, the red-legged frog is potentially present at this site. If this species is found to be present here, the U.S. Fish and Wildlife Service would be likely to vigorously oppose any proposal for a dam and reservoir at this site. The Service would also be concerned if candidate species such as the tiger salamander or southwest pond turtle were found. (However, the degree of concern would be lower for these latter two species since they are not currently being, proposed for uplisting.)

d. Wetlands

- The site contains approximately 14 miles of creek channel subject to Corps jurisdiction. Assuming an average channel width of 50 feet, this yields approximately 85 acres of Corps jurisdictional channel. The final acreage figure could be higher or lower depending on actual site conditions, and could also be higher if any seasonal wetlands, seeps or off-channel ponds are present.

3. Cultural Resources

a. Archaeological Sites

- There are seven recorded archaeological sites within the proposed dam and reservoir site. It is anticipated that one of these sites will require low levels of study/mitigation, three will require moderate levels, and the remaining three sites will require high levels of study/mitigation due to the potential presence of human skeletal remains. The Upper Pacheco site clearly is the most archaeologically sensitive of all the sites under consideration since it contains the largest number and most important known prehistoric sites. (See the cultural resources constraints report by Basin Research Associates, which is included as Appendix B.)

b. Historically Significant Sites

- There are no known sites of historic importance within the proposed dam and reservoir site.

c. Scenic Resources

- This site has scenic quality, but the lack of public access reduces its importance as an aesthetic and visual resource.

- The flooding of the upper reaches of Pacheco Creek, within the boundaries of Coe State Park, may be considered inconsistent with the general intent to preserve the natural wilderness and exclude man-made elements. (It may also violate a condition of the original land donation for the Park, if it specified that the Ranch be preserved in its natural state.)

B. POTENTIALLY SIGNIFICANT ENVIRONMENTAL AND LAND USE IMPACTS

- Loss of approximately 22 miles of riparian woodland, requiring replacement at a minimum ratio of 3 to 1, on an acreage basis, as specified by the California Department of Fish and Game.

- "Filling" of approximately 85 acres of jurisdictional channel and wetlands, requiring replacement as specified by the Corps and the U.S. Fish and Wildlife Service. (Such wetland mitigation acreage would overlap substantially with mitigation area required for riparian woodland by CDFG.)

- Significant loss of valley oak woodland, requiring replacement at a 3 to 1 ratio by acreage, as specified by CDFG.

- Potential loss of an area of marginal kit fox habitat, requiring replacement of the habitat elsewhere, assuming the U.S. Fish and Wildlife Service would permit the "take".

- Flooding of the upper reaches of Pacheco Creek, within the boundaries of Coe State Park, resulting in inundation of the planned creek crossing for the main park entrance road from Bell Station, and potentially resulting in a conflict with the land use policies applicable to the park.

- Potential loss of significant cultural resources, which can be mitigated by excavation, retrieval and cataloging of artifacts for archaeological sites. However, the presence of three known sites with human burials indicates that archaeological mitigation for this site could be very expensive. (See the cultural resources constraints report by Basin Research Associates, in Appendix B, for further explanation of possible mitigation requirements.)

C. SUMMARY AND CONCLUSIONS

There do not appear to be any insurmountable environmental or land use constraints which would potentially be fatal to the construction of a dam and reservoir here. (This conclusion assumes that the red-legged frog is not found here, and that the Corps of Engineers would deem a project here to be "permittable" under Section 404 of the Clean Water Act). However, the abundance of major archaeological sites could prove very costly to mitigate. The expense of archaeological mitigation is somewhat balanced by the relative inexpensiveness expected for land use mitigation, since no public roads or utilities would require relocation, and one small ranch complex would be affected.

A comparison with other sites indicates that the Upper Pacheco site is among the most sensitive in some environmental aspects (e.g., archaeological resources potential presence of kit foxes), but one of the least sensitive sites for other factors (e.g., high quality riparian woodland), and somewhere in the middle in other respects (e.g., wetlands).

The one problematic aspect of this alternative is that, at the proposed water surface elevation of 900 feet, it would encroach upon Henry Coe State Park for a distance of about 2 miles and would inundate a portion of the planned southern entrance road to the Park. Whether this poses an insurmountable obstacle to development can only be determined through further exploration of this issue with the California Department of Parks and Recreation.

6. LOWER PACHECO (EXISTING DAM & RESERVOIR SITE)

The proposed Lower Pacheco site, located about 2 miles east of Bell Station and just north of Highway 152, would raise the level of the existing dam at Pacheco Reservoir by approximately 230 feet. The new reservoir would inundate about 1,575 acres which includes Pacheco Reservoir, and approximately 4 miles upstream on the North Fork of Pacheco Creek, as well as portions of Cow Creek, Pine Springs Canyon, and Chimney Canyon.

A. SITE CONDITIONS AND INFLUENCES

1. Land Use

a. Existing Land Use

- There are no public roads or utilities, apart from the existing dam, reservoir and spillway, and the O'Connor Ranch, located within the inundation area for this proposed reservoir. A second ranch complex (El Toro Ranch) is located east of the eastern abutment, and could also be affected.

b. Pending Development

- There are no development applications pending or proposed for this site.

c. Plans/Policies

- The major portion of the site is designated as "Ranchlands" in the County General Plan. The eastern margins of the existing downstream reservoir are designated "Public Open Space" on the Land Use Element.

- The Regional Parks, Trails and Scenic Highways Element of the County General Plan shows the area surrounding the existing downstream reservoir as a Proposed Park containing a proposed trail corridor around the reservoir.

2. Flora and Fauna

a. General

The setting of the site is dominated by the water surface of the existing reservoir, with oak woodland and savanna occurring on the side slopes, and relatively sparse riparian woodland occurring along the upstream channels.

b. Sensitive Habitats

- The Lower Pacheco site contains 14 miles of riparian woodland (of which 5 miles consists of high quality riparian habitat), ranking it sixth in importance for this habitat type. (See the biological constraints report by H. T. Harvey Associates, which is included as Appendix A.)

- The site ranks fourth in terms of potential loss of valley oak woodland.

c. Sensitive Species

- The San Joaquin kit fox, a federally Endangered species, may use portions of the Lower Pacheco site occasionally, since the site is located at the western margin of the known range for the kit fox.

- As with all the other potential reservoir sites, the red-legged frog is potentially present at this site. If this species is found to be present here, the U.S. Fish and Wildlife Service would strenuously resist any proposal for raising the existing dam and increasing the reservoir size. The Service would also be concerned if candidate species such as the tiger salamander or southwest pond turtle were found. However, the degree of concern would be lower since these latter two species are not being currently proposed for immediate uplisting.

d. Wetlands

- The site includes approximately 11 miles of creek channel (located upstream of the existing reservoir) subject to the Corps' jurisdiction. Assuming an average channel width of 50 feet, this yields approximately 67 acres of Corps jurisdictional channel, which would rank this site fourth in magnitude of potential wetland loss. The final acreage figure could be higher or lower depending on actual field conditions, and could also be higher if any seasonal wetlands, seeps, or off-channel ponds are present.

3. Cultural Resources

a. Archaeological Sites

- There are six recorded archaeological sites within the proposed dam and reservoir site. (These sites are also within the inundation area of the Upper Pacheco site discussed above.) It is anticipated that one of these sites will require low levels of study/mitigation, two will require moderate levels, and the remaining three will require high levels of study/mitigation due to the potential presence of human skeletal remains. The Lower Pacheco site is the second most archaeologically sensitive site after Upper Pacheco. (See the cultural resources constraints report by Basin Research Associates, which is included as Appendix B.)

b. Historically Significant Sites

- There are no structures or other known sites of historic importance within the proposed dam and reservoir site.

c. Scenic Resources

- The existing and proposed dam site is partially within view of Route 152, a designated State Scenic Highway. The site is not directly visible to eastbound motorists due to the screening effect of mature riparian woodland between the roadway and the dam face. However, due to the curvature of the roadway, westbound motorists have a direct view of the dam site traveling downgrade from the east.

B. POTENTIALLY SIGNIFICANT ENVIRONMENTAL AND LAND USE IMPACTS

- Loss of approximately 14 miles of riparian woodland requiring replacement at a ratio of 3 to 1 (minimum, by acreage) as specified by the Department of Fish and Game.

- "Filling" of approximately 67 acres of jurisdictional channel and wetlands, requiring replacement as specified by the Corps and the U.S. Fish and Wildlife Service (assuming the project is deemed permittable). Note: Wetland mitigation acreage would overlap substantially with the riparian mitigation area required by CDFG.

- Significant loss of valley oak woodland requiring replacement at a 3 to 1 ratio by acreage, as specified by the California Department of Fish and Game.

- Potential loss of an area of marginal kit fox habitat, requiring replacement of the habitat elsewhere, assuming the U.S. Fish and Wildlife Service would permit the "take".
- Raising of the existing dam by 230 feet, within the direct line of sight of Route 152, thereby introducing a large structural element into the scenic viewshed. This would be considered a significant visual impact along this designated state scenic highway.

C. SUMMARY AND CONCLUSIONS

There do not appear to be any insurmountable environmental or land use constraints which would potentially be fatal to the construction of a dam and reservoir here. (This assumes that the red-legged frog is not found here, and that the Corps of Engineers would deem a project here to be "permittable" under Section 404 of the Clean Water Act).

A comparison with other potential reservoir sites indicates that the Lower Pacheco site is probably in the mid-range of environmental sensitivity among the sites under consideration. This is due in part to the fact that it is already largely inundated by the existing reservoir. Thus, it has among the smallest areas of riparian woodland and wetlands. However, this site still contains the second largest area of high quality valley oak woodland, after Upper Pacheco, and also contains abundant archaeological resources. Additionally, the dam would create significant visual impacts. However, there are few if any land use impacts, and the proposed reservoir would not encroach upon Henry Coe State Park, thus avoiding potential conflict there.

III. ENVIRONMENTAL SENSITIVITY/IMPACT MATRIX[1]

SITE / FACTOR	PACK-WOOD	COE	LOS OSOS	CEDAR CREEK	UPPER PACHECO	LOWER PACHECO
Land Use/Public Facilities Impacts	m	h	h	l	m	m
Scenic/Visual Impacts	l	h	m	m	l	h
Archaeol./Historic	m[2]	m	l	m[2]	h	h
Riparian Woodland	m	h	h	m	h	m
Valley Oak Woodland	m	h	h	m	h	m
Wetlands Impacts	m	m	h	l	m	l
Sensitive Species[3]	h	m	h	l	m	l
OVERALL	m	m/h	m/h	l/m	m	m

NOTES:

1. All sites were assigned sensitivity values of high (h), moderate (m), or low (l) for each factor. These value assignments reflect subjective judgements based on available data discussed in the preceeding site evaluations.

2. These sites were assigned a medium value for archaeology because although no artifacts have been found (due to the absence of studies) there is a high likelihood that important archaeological deposits exist at both sites.

3. The values assigned to each site for sensitive species are based on the following assumptions: there are no listed or potentially listed amphibians (e.g., red-legged frog, tiger salamander) at any of the sites; pronghorn are likely to regularly use the Packwood and Los Osos sites, and to a lesser extent the Coe site; Tule elk are likely to use the Packwood site, and to a lesser extent the Coe and Los Osos sites; the Bay checkerspot butterfly and other listed or potentially listed serpentine-endemic species are not present at the Los Osos site or any other site; San Joaquin kit foxes are likely to make marginal use of the Upper Pacheco site, and to a lesser extent the Lower Pacheco site; Golden Eagles are not present within the potential impact areas of any of the six sites.

IV. GENERAL MITIGATION REQUIREMENTS

The following is a brief description of mitigation measures which would be required for the various environmental and land use impacts discussed in the preceding site evaluations.

1. Land Use

a. Displacement of ranches, residences, agricultural land - Financial compensation or physical relocation if feasible.

b. Displacement of public roadways and utilities - Relocation if necessary (i.e., if the end users have not also been displaced).

2. Flora and Fauna

a. Riparian Woodland Habitat - For each acre lost, the provision of three new acres of riparian woodland elsewhere, often accomplished by replacement planting within a degraded riparian corridor elsewhere in order to enhance its habitat value. Typical planting ratios required are 5 stems for every stem removed.

b. Valley Oak Woodland - Creation of new oak woodland elsewhere, at a ratio of 3 acres to 1, with propagation, planting and monitoring to ensure success.

c. Wetlands - Creation of new wetlands or enhancement of degraded wetland elsewhere at varying ratios, up to about 3 to 1 by acreage depending on the habitat value of the wetlands to be filled (assuming the Corps deems the dam and reservoir project to be "permittable" under Section 404 of the Clean Water Act). Note: The mitigation acreage required for wetlands would overlap substantially with the habitat replacement area required by the California Department of Fish and Game for riparian woodland.

d. Protected Species - Creation of suitable replacement habitat elsewhere (assuming the resource agencies would allow the impact to take place). This applies to the red-legged frog and the California tiger salamander, if they are found on the proposed sites (and if they become listed under the Endangered Species Act), as well as the Bay checkerspot butterfly, the Golden Eagle and San Joaquin kit fox if they are found within any of the proposed reservoir sites.

There is no available mitigation for reduction of habitat area for the pronghorn or Tule elk.

3. Cultural Resources

a. **Archaeological Sites** - Level of study/mitigation can vary greatly depending on the nature and importance of the site. A typical midden (refuse) site would require a low level of study/mitigation (i.e., minimal excavation to verify non-significance) which could cost up to $10,000 per archaeological site. A moderate level of mitigation which may be required for an important intact midden could cost as much as $50,000. An important village site which was occupied for many centuries and contains human remains could cost hundreds of thousands of dollars to study and mitigate properly (e.g., careful retrieval and cataloging; ceremonial reburial of human skeletal remains elsewhere). It should be noted that CEQA places an upper limit on the cost of archaeological mitigation equivalent to no more than one percent of the estimated construction cost.

b. **Historic Sites** - Where only foundations and buried trash are present, a low level of mitigation would apply (i.e., up to $10,000). For standing structures, appropriate mitigation consists of record photography and the preparation of measured drawings (with associated costs as high as $50,000). Preservation in place or intact removal (i.e., high levels of study/mitigation) would only be required in rare cases involving very high profile structures.

c. **Scenic Resources** - Large scale alteration of a scenic valley cannot be mitigated, but it might be partially compensated by the introduction of a new water element with its own scenic value (except where the proposed site is being actively preserved and protected for its intrinsic natural qualities, e.g., Henry Coe State Park). Relatively smaller scale impacts such as the introduction of an earthen dam within the viewshed of a scenic highway may be somewhat mitigated by foreground landscaping to screen and visually soften the new structural elements in the landscape.

V. RECOMMENDATIONS FOR FURTHER STUDY

It is recommended that the following studies be conducted in order to provide critical additional information which will be essential for selection of an appropriate dam and reservoir site.

Biological Field Studies

California red-legged frog - Immediate field studies are recommended to determine the presence/absence of the red-legged frog which is a candidate species currently being proposed for immediate listing as threatened or endangered under the federal Endangered Species Act. The U.S. Fish and Wildlife Service is actively proposing this uplisting, which is expected to take effect within the next year. If this species is found to occur at any site, it will be virtually impossible to obtain permission from the U.S. Fish and Wildlife Service to develop that site if another suitable alternative site is available which does not have this species present. Thus the determination of the presence/absence of this amphibian at the proposed dam and reservoir sites will be essential for eliminating continuing uncertainty on this issue, and will thus enable planning to continue with a higher degree of confidence. Any such field surveys should also check for the presence of California tiger salamanders and southwestern pond turtles, since both of these species are also being proposed for uplisting, albeit not as actively as the red-legged frog.

Golden Eagle - As mentioned in the site evaluations, there is some potential that Golden Eagle nests may be found in tall trees on the valley floors of the Packwood and Los Osos sites. It is recommended that focused raptor surveys be conducted in these areas to determine the presence/absence of any such active nests. Since the Golden Eagle is protected under the Bald Eagle Protection Act, its presence within any of the dam and reservoir sites could be problematic in terms of agency approvals from (both U.S. Fish and Wildlife Service and California Department of Fish and Game).

Bay checkerspot butterfly - While the narrow band of serpentine running through the Los Osos site is highly unlikely to support the federally threatened Bay checkerspot butterfly, or any other sensitive insect, arachnid or plant species associated with serpentine-based soils, it is recommended that a brief site survey be conducted to verify this preliminary conclusion.

San Joaquin kit fox - It is possible that marginally suitable habitat for the kit fox may exist on the Upper Pacheco site, and to a lesser extent on the Lower Pacheco site. Such a determination could not be made from a review of aerial photos and will require a brief ground survey. If potentially suitable habitat exists, then intensive survey methods, including night-lighting would be recommended.

Henry Coe State Park

Prior to undertaking any feasibility studies for the Coe site, some investigation should be conducted into the question of whether any or all of the lands donated for the park were conditioned upon the State's preservation of these lands in their natural state in perpetuity, thereby precluding a dam and reservoir.

If the Los Osos site is carried forward for further study, an investigation should be made into the question of whether a planned southwestern entrance to Henry Coe State Park, opposite Gilroy Hot Springs, is still being pursued. If not, this may remove one obstacle from the Los Osos site.

VI. REFERENCES

Basin Research Associates, Preliminary Constraint Analysis: Cultural Resources - Santa Clara Valley Water District Reservoir Sites, April 1992.

County of Santa Clara, General Plan of Santa Clara County, October 1982, as amended.

County of Santa Clara, Gilroy Hot Springs Resort Project - Draft Environmental Impact Report, August 1991.

County of Santa Clara, Open Space Preservation: A Program for Santa Clara County, April 1987.

H.T. Harvey and Associates, Mount Hamilton Range Reservoir Sites - Biological Constraints Analysis, April 1992.

Santa Clara Valley Water District, Water Supply Master Plan Report: Preliminary Evaluation of Alternative Dam and Reservoir Sites, August 1991.

State of California, Department of Parks and Recreation. Henry W. Coe State Park General Plan, Volume 1, October 1985.

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APPENDIX A

BIOLOGICAL CONSTRAINTS ANALYSIS

Prepared by

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April 1992

PR0115-G

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MOUNT HAMILTON RANGE
RESERVOIR SITES
BIOLOGICAL CONSTRAINTS ANALYSIS

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INTRODUCTION

The Santa Clara Valley Water District is reviewing six potential sites (Packwood, Coe, Los Osos, Cedar Creek, Lower Pacheco, and Chimney Rock) for the construction of a reservoir in the Mount Hamilton Range. The objective of this review was to assess the potential biotic constraints of each potential site. This included assessing the potential presence of special status plants and animals (e.g., federally or state threatened or endangered, federal candidate species, and state species of special concern), high profile species (e.g., Wild Turkey, *Meleagris gallopavo*; black-tailed deer, *Odocoileus hemionus columbianus*; and puma, *Puma concolor*), native fish, valley oak woodlands, and riparian habitat.

SITE DESCRIPTION

All six reservoir sites are located in the Mount Hamilton area of the Diablo Range. The Mount Hamilton area is bounded by Niles Canyon on the north, Santa Clara Valley on the west, Pacheco Pass on the south, and San Joaquin Valley on the east (Sharsmith 1982). Elevations vary from 300 m to over 1280 m with the majority of the land mass above 600 m. The major ridges lie parallel to the longitudinal axis of the Diablo Range in a northwest-southeast direction. Shallow but moderately steep subsidiary drainages flow into the main creek systems resulting in a complex, rolling topography. The creeks and streams are intermittent, but water is available year-round for wildlife from the numerous cattle ponds and springs scattered throughout the area. A Mediterranean climate results in cool, wet winters and warm dry summers; snowfall is intermittent and uncommon.

Vegetation within the Mount Hamilton area can be generalized into several broad categories: chaparral, oak woodland, north slope woodland, oak-bigberry manzanita woodland, annual grassland, oak savanna, and riparian woodland communities (Barbour and Major 1977, Simmons et al. 1984, Dunne 1987). Isolated stands of ponderosa pine (*Pinus ponderosa*) exist on some of the higher ridges (e.g., Pine, Bollinger, and Blue Ridges). Several prescribed burns, generally smaller than 8 km^2, have occurred on private and public lands between 1983 and the present.

The Packwood, Coe, and Los Osos sites are within the Coyote Creek watershed while the Cedar Creek, Lower Pacheco, and Chimney Rock sites are part of the Pacheco Creek system. The Packwood site is about 2-3 km east of Anderson Reservoir and would inundate about 900 acres which includes a majority of Packwood, Vance, and Hoover Valleys.

The Coe site falls entirely within Henry W. Coe State Park with the proposed dam situated at the confluences of the East and Middle Fork of Coyote Creek. This reservoir would inundate about 2250 acres which includes 3-4 km of the Middle Fork, 7-8 km of the East Fork, and about 3-5 km of Kelly Cabin Canyon.

The Los Osos site is about 3-4 km east of Coyote Reservoir. The proposed reservoir would inundate about 3500 acres which includes Coyote Creek upstream from Gilroy Hot Springs, about 5 km of Canada de Los Osos Creek, and about 4 km of Hunting Hollow.

The Cedar Creek site is just north of Highway 152 and about 1 km west of Bell Station. The site would inundate about 800 acres which include portions of Hagerman and Hurricane Canyons.

The proposed Lower Pacheco site, about 3 km east of Bell Station and just north of Highway 152, would raise the level of the existing dam at Pacheco Reservoir. The new reservoir would inundate about 1575 acres which includes Pacheco Reservoir, and portions of the North Fork of Pacheco Creek, Cow Creek, Pine Springs Canyon, and Chimney Canyon.

The proposed Chimney Rock reservoir is situated just upstream from the existing Pacheco Reservoir. This reservoir would inundate about 2250 acres which includes portions of the North Fork Pacheco Creek, Chimney Canyon, Pine Springs Canyon, Cow Canyon, Bullhead Canyon, and Coon Creek.

METHODS

Information about possible threatened, endangered, and other special status plant or animal species was collected from several published and unpublished sources for the six potential reservoir sites. Information on the locations and habitat types of these species was gathered by searching within the Gilroy, Gilroy Hot Springs, Mississippi Creek, San Felipe, Mt. Sizer, Mt. Stakes, Isabel Valley, Morgan Hill, Lick Observatory, Mustang Peak, Pacheco Pass, and Three Sisters Quads (USGS Topographical Quadrangle Map) using California Natural Diversity Data Base Reports (California Department of Fish and Game), the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Vascular Plants of California (1989), Flora of the Mt. Hamilton Range of California (Sharsmith, 1982), Plants of Henry W. Coe State Park, California (Dittmann, unpublished), California Native Plant Society (Santa Clara Chapter) Field Survey Forms, Santa Clara County Sensitive Natural Resource Maps (H. T. Harvey and Assoc.), the California Wildlife Habitat Relationships species notes (1988, 1990), and miscellaneous information available through the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), California Department of Parks and Recreation, and technical publications. This review of the presence of potential special status species did not include field surveys.

THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

Plant Species

Plant species listed below have been given special status under state and/or federal endangered species legislation, or are species of special local concern, and are known to occur in habitats similar to those occurring on the proposed project sites. They have been separated into two distinct groups, the serpentine and non-serpentine groups for purposes of discussion.

Non-serpentine species

The following non-serpentine species potentially occur on the proposed projects sites (Table 1). They all are on the Federal Category 2 and CNPS 1B lists (explanations of legal classifications occur at the end of Table 1). Additionally, the rock sanicle (*Sanicula saxatilis*) is state listed as rare. This group includes the Mt. Hamilton jewelflower (*Streptanthus callistus*), rock sanicle, Mt. Hamilton coreopsis (*Coreopsis hamiltonii*), Mt. Diablo phacelia (*Phacelia phaceliodes*), and Gairdner's Yampah (*Perideridia gairdneri ssp. gairdneri*).

All known populations of all of these species except Gairdner's Yampah, occur at slightly higher elevations than those of the proposed reservoirs. However, substrate, and not elevation, is believed to be the key factor in determining their distribution (T. Corelli pers. comm.). Therefore, their potential presence cannot be ruled out solely on the basis of elevation. Each of these species occurs on rocky outcrops (talus) slopes, and some have fairly specific rock type preferences. All are found in chaparral and/or foothill woodland communities. Preliminary assessments of the Soil Survey maps (SCS 1974) and USGS aerial photography indicates that suitable habitats are likely to occur at each site.

Gairdner's Yampah occurs at elevations below 11,000 ft. in many communities including chaparral, broadleaved upland forest. It is "fairly common" in Henry Coe State Park in meadows and on shaded banks (Dittman, unpublished), and is potentially present at all sites.

Table 1. Sensitive species their status, and potential occurrence at the six proposed reservoir sites: Packwood (PA), Coe Park (CO), Los Osos (LO), Cedar Creek (CC), Lower Pacheco (LP), Chimney Rock (CR).

SPECIES	LEGAL STATUS	POTENTIAL FOR OCCURRENCE IN RANGE	POTENTIAL AT PROPOSED RESERVOIR SITES
PLANTS			
CNPS List, State Protected, or Federal Candidate Species			
Mount Hamilton Jewelflower	FC2, CNPS 1B	Potential occurrence	PA, CO, LO, CC, LP, CR
Rock Sanicle	FC2, CNPS 1B	Potential occurrence	PA, CO, LO, CC, LP, CR
Mount Hamilton Coreopsis	FC2, CNPS 1B	Potential occurrence	PA, CO, LO, CC, LP, CR
Mount Diablo Phacelia	FC2, CNPS 1B	Potential occurrence	PA, CO, LO, CC, LP, CR
Gairdner's Yampah	FC2, CNPS 1B	Potential occurrence	PA, CO, LO, CC, LP, CR
Santa Clara Thornmint	CNPS list 4	Potential occurrence	PA, CO, LO, CC, LP, CR
Brewer's Clarkia	CNPS list 4	Potential occurrence	PA, CO, LO, CC, LP, CR
Chaparral Campanula	CNPS list 4	Potential occurrence	PA, CO, LO, CC, LP, CR
Oakland Star Tulip	CNPS list 4	Serpentine endemic, occurrence unlikely	LO
Hall's Bush Mallow	CNPS list 4	Serpentine endemic, occurrence unlikely	LO
Santa Clara Thornmint	CNPS list 4	Serpentine endemic, occurrence unlikely	LO
Coyote Ceanothus	FC1, 1B	Serpentine endemic, occurrence unlikely	LO
Showy Indian Clover	FC2, 1A	Highly Improbable	Unlikely to occur
Brandegee's Eriastrum	FC2, 1B	Highly Improbable	Unlikely to occur
Contra Costa Goldfields	FC1, 1B	Highly Improbable	Unlikely to occur
ANIMALS			
State or Federally Endangered			
Bay Checkerspot Butterfly	FT	Potentially present	LO
Bald Eagle	FE, CE, CP	Occassional winter bird	LO, LP, CR
American Peregrine Falcon	FE, CE, CP	Likely transient	PA, CO, LO, CC, LP, CR
San Joaquin Kit Fox	FE, CT	Potentially present, 2 sightings near Bell Station	CC, LP, CR
California Species of Special Concern, State Protected, or Federal Candidate Species			
Edgewood Blind Harvestman	FC2	Potential occurrence	LO
Hom's Blind Harvestman	FC2	Potential occurrence	LO
Silver Creek Blind Harvestman	FC2	Potential occurrence	LO
Opler's Longhorn Moth	FC2	Potential occurrence	LO
California Tiger Salamander	FC2, S	Likely occurrence	PA, CO, LO, CC, LP, CR
Western Spadefoot Toad	FC2R, S	Likely occurrence	PA, CO, LO, CC, LP, CR

Table 1. Continued.

SPECIES	LEGAL STATUS	POTENTIAL FOR OCCURRENCE IN RANGE	POTENTIAL AT PROPOSED RESERVOIR SITES
California Red-legged Frog	FC1, S, CP	Likely occurrence	PA, CO, LO, CC, LP, CR
Foothill Yellow-legged Frog	S	Likely occurrence	PA, CO, LO, CC, LP, CR
Southwestern Pond Turtle	FC2, S	Likely occurrence	PA, CO, LO, CC, LP, CR
Common Loon	S	Likely transient	LP, CR
Western Grebe	C	Likely transient	LP, CR
American White Pelican	S	Likely transient	LP, CR
Double-crested Cormorant	S	Likely transient	LP, CR
Great Blue Heron	C	Likely transient, potential breeder	LP, CR
Great Egret	C	Likely transient, potential breeder	LP, CR
Snowy Egret	C	Likely transient, potential breeder	LP, CR
Black-crowned Night Heron	C	Likely transient	LP, CR
Osprey	S	Potential transient and breeder	LP, CR
Black-shouldered Kite	CP	Likely breeder	PA, CO, LO, CC, LP, CR
Northern Harrier	S	Likely breeder	PA, CO, LO, CC, LP, CR
Sharp-shinned Hawk	S	Likely breeder	PA, CO, LO, CC, LP, CR
Cooper's Hawk	S	Likely breeder	PA, CO, LO, CC, LP, CR
Swainson's Hawk	CT, FC3	Rare transient	PA, CO, LO, CC, LP, CR
Ferruginous Hawk	FC2	Likely transient	PA, CO, LO, CC, LP, CR
Golden Eagle	FP, CP, S	Likely breeder	PA, CO, LO, CC, LP, CR
Merlin	S	Migrant, likely transients	PA, CO, LO, CC, LP, CR
Prairie Falcon	S	Has breed in Coe Park	CO, LO, LP, CR
California Gull	S	Likely transient	LP
Burrowing Owl	S	Potential occurrence	PA, LO, CR
Short-eared Owl	S	Unlikely transient	PA, LO
Bank Swallow	CT	Potential breeder	PA, CO, LO, CC, LP, CR
Willow Flycatcher	CE	Likely transient	PA, CO, LO, CC, LP, CR
Purple Martin	S	Potential breeder	PA, CO, LO, CC, LP, CR
Yellow Warbler	S2	Potential breeder	PA, CO, LO, CC, LP, CR
Yellow-breasted Chat	S	Potential breeder	PA, CO, LO, CC, LP, CR
Tri-colored Blackbird	FC2	Unlikely breeder, potential transient	PA, CO, LO, CC, LP, CR
Townsend's Big-eared Bat	FC2, S	Likely resident	PA, CO, LO, CC, LP, CR
California Mastif Bat	FC2, S	Likely resident	PA, CO, LO, CC, LP, CR

Table 1. Continued.

SPECIES	LEGAL STATUS	POTENTIAL FOR OCCURRENCE IN RANGE	POTENTIAL AT PROPOSED RESERVOIR SITES
Badger	S3	Likely resident	PA, CO, LO, CC, LP, CR
Ringtail	SP	Likely resident	PA, CO, LO, CC, LP, CR
High Profile Species			
Wild Turkey	Game	Likely resident	PA, CO, LO, CC, LP, CR
California Quail	Game	Likely resident	PA, CO, LO, CC, LP, CR
Band-tailed Pigeon	Game	Likely resident	PA, CO, LO, CC, LP, CR
Pronghorn	Game	Likely resident	PA, CO, LO
Tule Elk	Game	Likely resident	PA, CO, LO
Black-tailed Deer	Game	Likely resident	PA, CO, LO, CC, LP, CR
Wild Pigs	Game	Likely resident	PA, CO, LO, CC, LP, CR
Bobcat	Nongame	Likely resident	PA, CO, LO, CC, LP, CR
Puma	Spec. Protected	Likely resident	PA, CO, LO, CC, LP, CR
Native Fish			
Rainbow Trout	Game Fish	Likely resident	CO, LO, CC
Sacramento Squawfish	Nongame Fish	Likely resident	CO, LO
Sacramento Sucker	Nongame Fish	Likely resident	CO, LO, CC, LP, CR
California Roach	Nongame Fish	Likely resident	CO, LO, CC, LP, CR
Riffle Sculpin	Nongame Fish	Likely resident	CO, LO
Prickly Sculpin	Nongame Fish	Likely resident	CO, LO, LP, CR

CNPS 1A = California Native Plant Society List 1A, Plants presumed extinct in California
CNPS 1B = California Native Plant Society's List 1B, plants that are rare, threatened, or endangered in California and elsewhere.
CNPS List 4 = California Native Plant Society List 4, plants of limited distribution; a watch list.
FE = Designated as an endangered species by the federal government.
CE = Designated as an endangered species by the California Fish and Game Commission.
FT = Designated as a threatened species by the federal government.
FC1 = Designated as a candidate species by the federal government. FC1 species have relatively high potential for uplisting to endangered or threatened.
FC2 = Designated as a candidate species by the federal government. Occurrence on list 2 indicates that US Fish and Wildlife Service has potential information for upgrading listing to endangered or threatened, but conculsive data on the biological vulnerability and threat are not currently available to support proposed listing.

Table 1. Continued.

FC2R = Recommended for candidate 2 listing.
S = Species of special concern in the state of California, including species whose breeding populations in the state have declined severely or are otherwise so low that extirpation is a real possibility. There are no special legal statutes governing the protection of this group.
CP = Fully protected species in the state of California under the CDFG code.
C = Taxa considered endangered or rare under section 153 80(d) of CEQA guidelines.
Spec. Protected = Specially Protected Mammal, sport hunting is prohibited and the protection of the puma is legislated by Proposition 117.
Game = Those species for which sport hunting is permitted.
FP = Federal protection under the Bald Eagle Protection Act and the Migratory Bird Treaty Act.
Nongame = All species occurring naturally in California which are not game species, fully protected, or fur–bearing mammals are non–game species.

Three CNPS list 4 species that may occur are the Santa Clara thornmint (*Acanthomentha lanceolata*), Brewer's clarkia (*Clarkia breweri*), and Chaparral campanula (*Campanula exigua*). Like most of the previously discussed species, these tend to occur on rocky chaparral or woodland slopes, usually at elevations that are somewhat higher than those of the project sites. However, these elevational differences do not necessarily preclude their presence.

All of the species listed above could potentially occur at all of the proposed sites but some are far less likely to be found at Packwood. The Packwood site differs from all the others in that it occurs to the west of the major ridge system of the range. Therefore, those species with a more interior and eastern distribution are not likely to be found at the Packwood site; these species are the Mt. Hamilton Jewelflower, rock sanicle, Santa Clara thornmint, and Brewer's Clarkia.

The flora of Coe Park is reasonably well documented and populations of the Mt. Hamilton Jewelflower, rock sanicle, Mt. Hamilton coreopsis, Gairdner's Yampah, Santa Clara thornmint, Brewer's clarkia, and chaparral campanula are known to occur there. None of these plants have been reported at the Coe reservoir site. Nonetheless, until detailed surveys are conducted, they should be presumed present at the Coe site.

The probability of occurrence for three other listed species is considered too low to warrant further consideration. Showy Indian clover (*Trifolium amoenum*), a Federal Category 2 and CNPS list 1A plant, occurs in rich fields and grasslands. It was last seen in 1969. Brandegee's eriastrum (*Eriastrum brandegeae*), Federal Category 2 and CNPS list 1B, is extremely uncommon in the Mount Hamilton Range, and is known from only one location in this area, at 2500 ft in the Isabel Valley quad. Contra Costa Goldfields (*Lasthenia conjugens*), Federal Category 1, CNPS list 1B, grows on low flats in grasslands and vernal pool borders. Appropriate habitat for this species is not likely to occur on these sites. Known populations in Santa Clara County have been west of the Mount Hamilton Range.

Serpentine species

The soil assessment by the U.S Geologic Survey reported a wedge of serpentine soil on the west side of Coyote Creek near Gilroy Hot Springs (USGS 1973). In addition, the geological survey preformed at the six reservoir sites found no other serpentine outcrops.

According to the Draft EIR for Gilroy Hot Springs (Reid and Assoc. 1991), this area is serpentine-based chaparral that could potentially support four sensitive plant species: Oakland star tulip (*Calochortus umbellatus*), CNPS list 4; Hall's bush mallow (*Malacot-*

hamnus hallii), CNPS list 4; Santa Clara thornmint (*Acanthomintha lanceolata*), CNPS list 4; and coyote ceanothus (*Ceanothus ferrisae*), Federal Category 1, CNPS list 1B. Several federal candidate species are proposed to be uplisted to either threatened or endangered status during the next five years as the result of a settlement agreement between the USFWS and the California Native Plant Society (CNPS). None of these species were found during site surveys at Gilroy Hot Springs in 1990 and 1991 (Reid and Assoc. 1991).

The CNDDB considers the serpentine chaparral community to be rare enough to merit the highest inventory priority. The draft EIR describes the community at the Los Osos site as dominated by manzanita (*Arctostaphyllos sp.*) and chamise (*Adenostoma fasciculatum*). Understory plants include two species of star tulip, California fescue, brodiaea, and monkey flower. A patch of California plantain (*Plantago erecta*) was also reported on the Gilroy Hot Springs Area.

Wildlife Species

Table 1 lists special status wildlife species that are known to occur or could occur in the Mount Hamilton Range. The Bay checkerspot butterfly (*Euphydryas editha bayensis*) is a federally threatened serpentine endemic. Larvae are host specific on two plant species (*Plantago erecta* and *Orthocarpus densiflorus*) that are found only on serpentine soils. Populations of this serpentine obligate have declined to low numbers following the destruction of serpentine habitats within Santa Clara Valley. Therefore, the presence of plantago at Gilroy Hot Springs would necessitate detailed surveys at the Los Osos site for Bay checkerspots. However, the serpentine habitat on site is considered unsuitable for Bay checkerspots due to its isolation, small size, and lack of diverse slope and aspect (A. Launer, pers. comm.).

Several Bald Eagles (*Haliaeetus leucocephalus*) are reported wintering around some of the larger reservoirs in the Mount Hamilton area each year. Wintering Bald Eagles had been observed prior to the draining of Pacheco Reservoir in 1987 (P. Andresen pers. comm.). Eagles may also use Coyote Reservoir during the winter. Therefore, Los Osos, Lower Pacheco, and Chimney Rock are the only potential sites that would effect Bald Eagles. Increasing the size of the existing Pacheco Reservoir or building the Chimney Rock Reservoir would likely increase the value of this area to wintering Bald Eagles.

Peregrine Falcons (*Falco peregrinus anatum*) are likely transients but unlikely breeders at all of the potential sites and hence no impacts would be expected for these falcons. These falcons prefer to nest along relatively large cliff faces and no breeding pairs have been reported in the Mount Hamilton Range.

Two sightings of San Joaquin kit fox (*Vulpes macrotis mutica*) have been reported just north of Bell Station within the southern tip of Henry Coe Park. Potential impacts could occur to this federally endangered fox at the Cedar Creek, Lower Pacheco, and Chimney Rock sites if suitable habitat (i.e., grasslands and flat to rolling hills) is found to exist. Very little is known about the distribution and abundance of the kit fox in southern Santa Clara County because it is on the marginal extreme of the kit fox's range. Generally, the habitat at Cedar Creek, Lower Pacheco, and Chimney Rock appear to be of marginal value for the kit fox. However, more formal surveys will need to be conducted to assess the suitability of these three sites for the kit fox.

Golden Eagles are considered a species of special concern and along with their nests and eggs are fully protected in the state of California by the CDFG (CDFG Code 355, 3503.5, and 3511). Also, Golden Eagles and their nests are federally protected under the Bald Eagle Protection Act (16 U.S.C. 668-6686) and the Migratory Bird Treaty Act (16 U.S.C. 703-711). Golden Eagles are likely to forage and potentially breed at all sites.

Wildlife species of special concern, state protected, or federal candidate species that could be resident or breed at all sites include the California tiger salamander (*Ambystoma tigrinum californiense*), western spadefoot (*Scaphiopus hammondi*), California red-legged frog (*Rana aurora draytonii*), foothill yellow-legged frog (*Rana boylii*), southwestern pond turtle (*Clemmys marmorata pallida*), Black-shouldered Kite (*Elanus caeruleus*), Northern Harrier (*Circus cyaneus*), Sharp-shinned Hawk (*Accipiter striatus*), Cooper's Hawk (*Accipiter coorperii*), Golden Eagle (*Aquila chrysaetos*), Bank Swallow (*Riparia riparia*), Purple Martin (*Progne subis*), Yellow Warbler (*Dendroica petechia brewsteri*), Yellow-breasted Chat (*Icteria virens*), Townsend's big eared bat (*Plecotus townsendii*), California mastif bat (*Eumops perotis californicus*), badger (*Taxidea taxus*), and ringtail (*Bassariscus astutus*). Hence, development of any of these sites could potentially effect the abundance or distribution of any of the above species within the Mount Hamilton Range. Site specific surveys would be necessary to determine the presence or absence of any of these special status species at each potential site. Burrowing Owls have been relocated to the Chimney Rock area by CDFG as part of a mitigation program (P. Andresen pers. comm.).

A number of waterbirds such as the Great Blue Heron (*Ardea herodias*), Great Egret (*Casmerodius albus*), and Snowy Egret (*Egretta thula*) could potentially breed at Pacheco Reservoir and the Common Loon (*Gavia immer*), Western Grebe (*Aechmophorus occidentalis*), American White Pelican (*Pelecanus erythrorhynchos*), and Double-crested Cormorant (*Phalacrocorax auritus*) are likely transients. Hence, development of the Lower Pacheco or Chimney Rock site could possibly effect these birds. Site specific surveys could discern the presence or absence of breeding colonies of these birds adjacent to Pacheco Reservoir.

The remaining special status species in Table 1 could occur as winter transients or as migrants. Development of a reservoir might have only a transitory effect on these species.

HIGH PROFILE WILDLIFE SPECIES

The California Department of Fish and Game is likely to express concern over the potential impacts of a reservoir project to several game and non-game species (see Table 1). All of these species, except the pronghorn (*Antilocapra americana*), and the Tule elk (*Cervus elaphus nannodes*), are likely common to abundant residents at all sites.

The Wild Turkey is an non-native introduced game bird in California and CDFG is actively managing their populations in the Mount Hamilton Range. Wild Turkeys prefer the oak woodland and riparian communities of the Mount Hamilton Range. Turkeys are locally abundant and are known to occur in the vicinity of all six reservoir sites.

The black-tailed deer is a non-migratory and relatively common large mammal that inhabits virtually all habitats of the Mount Hamilton range. The Mount Hamilton deer herd varies from about 6 to 15 deer/km2 on the eastern and western side of the Range, respectively (Schauss 1984, Hopkins 1990, Klinger et al. 1989). The black-tailed deer is one of the more easily and frequently observed large mammals of Mount Hamilton. Additionally, the deer is one of the most popular game animals in the state. However, hunting is not allowed in Coe Park and occurs at a low to moderate level in the rest of the range since hunting is restricted on the private lands.

The wild pig (*Sus scrofa*) is an exotic species that elicits great public response because of its negative effect on the native flora and fauna of an area. The extent of influence on the environment depends greatly upon the size of the pig population and the relative sensitivity of the ecosystem (Singer 1981). The wild pig uses a variety of habitats and its populations can fluctuate widely depending upon forage availability and water. The negative effects of wild pigs is the result of predation and competition for food (Wood and Barrett 1979). Throughout California wild pigs prey heavily on fall mast or acorn crop, directly competing with many native animals and undoubtedly influence the distribution and abundance oak woodlands (Barrett 1990). However, the extent to which pigs out compete native wildlife and influence oak woodlands is poorly understood.

Wild pigs in the Mount Hamilton Range can be found in virtually all habitats. They tend, however, to be associated with the more mesic or wet habitats in the summer, but their movements expand to the upper ridges during the wet season (Schauss 1980). Schauss (1980) estimated wild pig densities of 3.6/km^2 for Grant County Park in the northwestern part of the range.

The Tule elk was once an abundant resident of the Santa Clara Valley, but due primarily to market hunting their numbers were decimated and it was even thought to be extinct in the early 1900's. A small herd was discovered in the 1930's in the Owens Valley. Through an active management program of reintroducing herds throughout its historic range their numbers have increased to well over 2,000 elk statewide (Phillips 1985).

Several reintroductions have occurred in the Mount Hamilton range since the early 1980's. Tule elk were sighted throughout the range after the early reintroduction efforts. However, it now appears the present distribution of the 50-70 elk is primarily the Isabel Valley, Horse Valley, Sizer Flat, and Packwood Valley areas of the Mount Hamilton Range. Tule elk prefer open canopied oak woodlands, oak savannas, and grassland communities. Elk are most likely to occur at the Packwood site and to a lesser extent the Los Osos and the Coe site.

The pronghorn was also an abundant ungulate in the Santa Clara Valley during pre-European times. A herd of about 60 individuals was reintroduced into the Mount Hamilton Range in the fall of 1990. Pronghorn are primarily a grassland/savanna species and their current distribution includes the west side of the range from Pacheco Pass to Grant Park. The Packwood and Los Osos sites have suitable open habitats to attract these reintroduced ungulates. The Coe site is less likely to support pronghorn due to the lack of open habitats, but it may function as a movement corridor.

The puma has long evoked strong emotion because of its predatory skills, inherently low population density, and secretive nature. This highly skilled and rarely seen large carnivore has evolved a mystique that contributes to the significant polarization surrounding its management. The puma has become a standard bearer for wildness in the state by environmentalists (e.g., the Mountain Lion Foundation) and has been protected from sport hunting since 1972 by legislative action, litigation, and the passage of Proposition 117.

The population of pumas in the Mount Hamilton Range is one of the best studied (Smith 1981, Hopkins et al. 1986, Hopkins 1990). These studies estimated the density of adult pumas in the Mount Hamilton Range to be about 4/100 km^2 with home ranges for female and male pumas averaging 61 and 135 km^2, respectively. The diet of the puma in this area consist primarily of black-tailed deer and to a lesser extent wild pig. The puma is found in all habitats of Mount Hamilton and would be relatively common at all potential sites.

California Quail (*Callipepla californica*), Band-tailed Pigeons (*Columba fasciata*), and bobcats (*Lynx rufus*) are relatively common in the Mount Hamilton Range. The quail and Band-tailed Pigeons are considered prized game birds in the state while the bobcat is classified as a nongame mammal.

NATIVE FISH

Several native fish species are likely to occur at all of the sites except for the Packwood site (Table 1). The Sacramento sucker (*Catostomus occidentalis*) and the California roach (*Hesperoleucus symmetricus*) are the most widely distributed native fish probably occurring at five of the sites. The roach is a small minnow adapted to fluctuating stream flows and temperature (H. T. Harvey and Assoc. 1977). The Sacramento Squawfish (*Ptychocheilus grandis*) and the riffle sculpin (*Cottus gulosus*), however, are believed to occur in the Coyote Creek system and not the Pacheco system. Hence, they are likely to be found only at the Coe and Los Osos sites. The Sacramento squawfish and Sacramento sucker are restricted to the deeper pools in late summer and early fall. Rainbow trout (*Salmo gairdneri*), the only native game fish in these creek systems, can be expected to occur at the Coe, Los Osos, and Cedar Creek sites. Rainbow trout may only be found at the Los Osos site in the spring of wet years, and either move upstream from Coyote Reservoir or are washed downstream from Henry Coe Park (H. T. Harvey and Assoc 1977). The current Pacheco dam acts as an effective barrier in prohibiting movement of trout past Pacheco Reservoir (J. Smith, pers. comm.).

VALLEY OAK WOODLAND

The valley oak (*Quercus lobata*) is considered a special status habitat and is on the CNPS List 4 or watch list. This large oak generally grows on rich loamy soils of valleys and slopes below 2000 ft. and is relatively common throughout the Mount Hamilton Range (Munz 1968, Sharsmith 1982). It is most often found in grassland and savanna habitats which frequently occur in valleys and their adjacent slopes, particularly in the interior of the range. The same areas also support blue oak (*Quercus douglasii*) which is also common across the range. Valley oak woodlands intergrade with blue oak woodlands on drier slopes (Holland, 1986). In the Los Osos and Henry Coe areas, valley oaks are a component of the dense woodlands and are found mostly on north and east facing slopes and in narrow ravines. It is assumed that this distribution holds true for all sites of interest in this study. Coast live oak (*Quercus agrifolia*), California bay (*Umbellularia californica*), gray pine (*Pinus sabiniana*), and blue oak are common species of these dense woodlands.

USGS aerial photographs and topographic maps (both 1:24,000 scale) were used to map potential valley oak woodland at a minimum resolution of one hectare. These are gross estimates due to the large scale of both the topographic maps and the photographs and therefore, should only be used for comparative purposes. The categorization of vegetation into community types is general because of the inability to positively identify species from available photographs. Plant communities were mapped based upon the overall appearance and location of the vegetation type. The savanna and woodland habitats may contain significant but indistinguishable patches of scrub and chaparral habitat. Personal knowledge of the Packwood, Los Osos, and Coe site along with color 4" X 6" prints (oblique photos, scale unknown) of portions of each reservoir site were useful in classifying community types.

The following community types were mapped and are listed in the order of decreasing predicted valley oak abundance: savanna/woodland, dense woodland, valley floor, riparian valley floor, and scrub. The savanna/woodland has extremely open to moderately open canopies, mostly consisting of mature, large sized blue oak and valley oak. The dense woodlands have relatively closed canopies, mostly on north and east facing slopes. Mixed composition includes coast live oak, California bay, blue oak, gray pine, and valley oak.

The valley floor habitat is generally found in flat valley bottoms, mostly agricultural, and occurs only at the Packwood and Los Osos sites. There are numerous scattered trees at the Packwood site that could be valley oaks. The valley floor habitat at the Los Osos site supports few trees. The riparian valley floor habitat is found in flat valley bottoms and contains riparian species and is considered poor valley oak habitat. The scrub habitat type may be either chaparral or scrub with no trees present.

The acreage estimates for communities that contain valley oaks are listed in Table 2. Approximately 100 acres at both Coe and Chimney Rock, and 150 acres at Los Osos were not covered by the aerial photographs and were not included in mapping.

RIPARIAN WOODLANDS

Riparian woodlands are exceptionally productive habitats for wildlife in that they function as escape cover, thermal cover, migration corridors, and nesting and foraging habitat for a diverse wildlife community. Through time this habitat has been steadily eliminated over much of the Santa Clara Valley. The loss of riparian habitat would be viewed as significant by the various resource agencies.

Table 2. Acreage estimates and relative importance for valley oak woodlands at the six proposed reservoir sites in the Mount Hamilton Range. The Rank of Importance estimates the relative value of each site for supporting valley oaks. This ranking was based on the predicted decrease in valley oak abundance within the Savanna/Woodland, Dense Woodland, and Valley Floor communities. Hence, Los Osos was ranked first because of the relatively high acreage estimates in both the Savanna/Woodland and Dense Woodland categories. Conversely, Cedar Creek was ranked last because of the relatively low acreage estimates for the Savanna/Woodland and Dense Woodland communities.

Site	Savanna/ Woodland	Dense Woodland	Valley Floor	Rank of Importance
Los Osos	1128	992	877	1
Coe	816	1103	0	2
Chimney Rock	270	1681	0	3
Lower Pacheco	224	1250	0	4
Packwood	240	414	250	5
Cedar Creek	295	378	0	6

Perennial streams throughout the Mount Hamilton Range support riparian forests that have moderately closed to thick canopies. Common species include White Alder (*Alnus rhombifolia*), Big leaf Maple (*Acer macrophyllum*), California Sycamore (*Platanus racemosa*), California Bay (*Umbellularia californica*), and Coast Live Oak (*Quercus agrifolia*). The riparian vegetation surrounding intermittent drainages has a more open aspect and consists of scattered trees of Fremont Cottonwood (*Populus fremontii*), California Sycamore, and Red Willow (*Salix laevagata*). Understory and subsidiary tree species include some which are typically riparian, such as numerous shrub willows, as well as many grasses and shrubs that are common to but not exclusive to riparian areas. Species distribution is variable across the range, especially from east to west and is highly dependent on local site factors (Sharsmith 1982, Holland 1986, Dittman unpub.).

The Riparian Inventory of Santa Clara County (Harvey and Associates, 1989) was used as the main resource in determining the presence of potential riparian vegetation along drainages in the proposed project areas. The Inventory used 1986 aerial photographs at a scale of 1"=500' (provided by the Santa Clara County Planning Department) to map both qualitative and quantitative characteristics of streamside vegetation throughout the county. Due to the limitations of this methodology, no detailed identification of plant associations was possible. The term "riparian vegetation" as used here, denotes any woody or herbaceous vegetation which is closely associated with any watercourse. The riparian vegetation comprises typical riparian habitats (such as cottonwood-sycamore woodland) as well as more mesic (wet but not saturated) vegetation such as oak woodland. In drier portions of the Mount Hamilton Range, such stream-associated mesic vegetation often provides a striking contrast to that of neighboring areas.

The total linear extent of the drainages supporting the vegetation categories identified by the Riparian Inventory was determined by using mylar overlay maps of the proposed dam sites (Table 3). The Riparian Inventory maps were then used to determine the linear extent of each vegetation category at each site.

Due to the scale of the photographs and maps provided, the characterization of the vegetation types and the determination of linear feet of riparian woodlands are crude estimates and should be used for comparative purposes only.

Riparian vegetation was subdivided into dense vegetation, narrow vegetation, sparse vegetation, and agricultural or grazing habitat. Dense vegetation generally includes more than 50-feet of dense vegetation extending out from the toe of both banks of the stream. Narrow vegetation, on the other hand, includes the vegetation which extends less than 50-feet from the toe of both banks.

Table 3. Linear feet and the relative importance of riparian vegetation at the six potential reservoir sites in the Mount Hamilton Area.

	Dense	Narrow	Sparse	Agric.	Total	Rank
Los Osos	46,839	34,468	20,386	24,307	126,000	1
Coe.	38,538	26,848	44,614	0	110,000	2
Chimney Rock	19,500	39,270	44,500	13,090	116,360	3
Cedar Creek	36,000	6,000	0	0	42,000	4
Lower Pacheco	7,909	27,728	26,636	14,727	77,000	5
Packwood	20,459	4,924	0	8,617	34,000	6

Sparse vegetation is relatively sparse, but there is no evidence of impact by farming. These areas are common in the drier interior drainages and in washes where rivers widen into gravelly flats. Agricultural or grazing vegetation is effected by farming or grazing. These areas have little woody vegetation, although a very narrow strip of trees is often associated with watercourses. This is the lowest quality riparian vegetation category. The Coe, Los Osos, and Cedar Creek sites support the greatest number of linear feet of dense riparian vegetation (Table 3). The Los Osos site also supports the greatest number of linear feet of agricultural or grazing habitat.

CONCLUSIONS

SPECIAL STATUS SPECIES

Plants

All proposed sites, except Packwood, have the potential to support all eight of the non-serpentine plant species of concern. Packwood is far less likely to support two of the five Federal Candidate 1-CNPS list 1B species, and two of the three CNPS list 4 species. The only site known to have any serpentine soil is Los Osos. The serpentine chaparral community on this site is considered rare, but no rare plant species were found during field surveys.

Animals

The serpentine soils located adjacent to Gilroy Hot Springs would be considered as potential habitat for the Bay checkerspot butterfly, the three harvestmen, and the Opler's longhorn moth. Hence, these rare invertebrates may occur at the Los Osos site. However, this serpentine habitat is considered unsuitable for Bay checkerspots due to its isolation, small size, and lack of diverse slope and aspect (A. Launer, pers. comm.)

The kit fox is potentially present at the Cedar Creek, Lower Pacheco, and Chimney Rock sites. However, the likelihood of their presence is dependent upon the availability of grasslands and oak savanna woodlands. Generally, the habitats at these sites appear to be of marginal value for the kit fox. Surveys will need to be conducted to assess the availability of suitable kit fox habitat at these three sites. Detailed kit fox surveys (based on CDFG and USFWS guidelines) will be required if any of these sites are found to contain suitable habitat.

The loss of habitats due to reservoir construction would not likely be interpreted as significant for wintering or migrating birds. These birds would likely move to similar habitats nearby. In fact, the construction of a large reservoir might attract such wintering birds as the Common Loon, Western Grebe, American White Pelican, Double-crested Cormorant, and Bald Eagle.

Breeding or resident species would most likely be adversely impacted by construction of a reservoir. Most potential breeders or resident wildlife species are likely to occur at all potential sites (Table 1). Only those birds associated with water (e.g., Great Blue Heron and Great Egret) and the Prairie Falcon are not likely to occur at all sites (Table 1).

HIGH PROFILE SPECIES

All of the high profile species (Table 1) are relatively common, except for the Tule elk and pronghorn, but CDFG and environmental organizations would likely view the loss of any habitat due to reservoir constructions as a significant impact. Loss of habitat and habitat fragmentation is considered a significant problem for many game species throughout the state. For example, the Mount Hamilton Deer Herd Plan targets loss of habitat as a potential problem for this deer herd (Schauss 1984).

Regardless of the potential negative affects of the wild pig, CDFG views it as a valuable game species. Therefore, CDFG would view the loss of pig habitat as significant. Depending on the specific design of the reservoir, it is possible that wild pigs would be attracted to the reservoir during the drier months of the year.

It is likely that Tule elk would only be impacted by development of the Packwood site. The pronghorn is likely to be effected by development of the Packwood and Los Osos sites, and to a lesser extent the Coe site. CDFG would likely consider the loss of habitat for these two reintroduced ungulates as significant.

Proposition 117 classified the puma as a specially protected mammal, which prohibits its "take". "Take", with respect to the puma, has traditionally been interpreted within the context of sport hunting and not related to "take" of habitat. However, CDFG and many environmental organizations will express concern over the loss of puma habitat. To what extent the issue of "take" would be pursued by these organizations is unknown.

NATIVE FISH POPULATIONS

None of the native fish that occur in the creek systems in question are considered special status species. However, with the exception of the Lower Pacheco and Chimney Rock sites, the construction of a reservoir would likely be considered as a significant impact due to loss of stream habitat and possibly impede movement of fish within the creek systems. The Packwood site is the only site that does not likely support native fish species.

VALLEY OAKS

Valley oaks are common across the Mount Hamilton Range in the types of habitats which occur on all of the proposed sites. All of the sites are likely to support large numbers of valley oaks. The acreage estimates of the community types vary with size, topography and location of the sites. This crude assessment suggests that the three sites that support the greatest number of valley oaks are the Los Osos, Coe, and Chimney Rock sites. At the more southeastern Cedar Creek, Lower Pacheco, and Chimney Rock sites the amount of dense woodland decreases in relation to the amount of savanna/woodland. The savanna/woodland community is excellent valley oak habitat, usually consisting of large, mature blue and valley oak trees. The valley oak is a component, but not a dominant species of the dense woodland community. The valley floor at the Packwood site, although largely agricultural, may have numerous valley oaks. The valley floor at the Los Osos site is mostly treeless.

RIPARIAN WOODLANDS

All of the proposed sites potentially support significant amounts of riparian vegetation. The dense, narrow, and sparse vegetation categories probably each represent good mature vegetation. The categories differ mostly in either the width of the corridor or the quantity of trees per unit area. The agricultural riparian category is the most effected and is therefore likely to be the lowest quality riparian vegetation type.

The Los Osos, Coe, and Chimney Rock areas appear to support the greatest extent of riparian habitat of the six potential sites (Table 3). The linear footage estimates derived from the Riparian Inventory of Santa Clara County (Harvey and Associates, 1989) indicate some major differences between project sites. The Lower Pacheco site contains only about 8,000 linear feet of dense riparian, while the other sites range from about 20,000 to 46,000 linear feet. The two smallest sites, Packwood and Cedar Creek, have no sparse riparian, while the other sites have between approximately 20,000 to 45,000 linear feet. Both of these sites also have much less narrow riparian (about 5000-6000 ft.) than all other sites which vary from about 27,000 to 41,000 linear feet. The Coe and Cedar Creek sites are the only ones which do not have any agricultural riparian areas.

LITERATURE CITED

Barbour, M., and J. Major. 1977. Terrestrial vegetation of California. John Wiley and Sons, New York. 1002pp.

Barrett, R. H. 1990. Pigs and Oaks. Fremontia, 18:82.

California Department of Fish and Game. 1988. California's Wildlife, Amphibians and Reptiles. Vol. I. Sacramento, California.

California Department of Fish and Game. 1990. California's Wildlife, Birds. Vol. II. Sacramento, California.

California Department of Fish and Game. 1990. California's Wildlife, Vol. III, Mammals. Sacramento, California.

California Native Plant Society. 1988. California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California. CNPS Special Publication No. 1, Fourth Edition. CNPS Sacramento, California.

California Native Plant Society. unpublished. Santa Clara Valley Chapter field survey forms.

Dittmann, L. unpublished. Plants of Henry W. Coe State Park, California: an annotated catalog of the vascular plants. 45pp.

Dunne, J. F. 1987. Response of vegetation and wildlife to prescribed burning in Central California's Inner Coast Range. M.A. Thesis. University of California, Berkeley. 221pp.

Harvey and Associates. unpublished. Natural resource sensitivity areas base maps, Santa Clara County. Project # 80-01.

Harvey and Associates. 1977. Biological resources survey of Coyote Creek from Hwy 17 to Metcalf Road and of the proposed Canada de Los Osos reservoir site, Santa Clara County. Project No. 42-01, 60 pp.

Harvey and Associates. 1989. Riparian inventory of Santa Clara County: Preliminary report. Project No. 382-01, 5 pp.

Holland, R. F. 1986. Preliminary descriptions of the terrestrial natural communities of California. Department of Fish and Game. 155 pp.

Hopkins, R. A. 1990. Ecology of the Puma in the Diablo Range, California. Ph.D. Dissertation. Department of Forestry and Resource Management, Univ. of California Berkeley. 262pp.

Klinger, R. C., M. J. Kutilek, and H. S. Shellhammer. 1989. Population responses of black-tailed deer to prescribed burning. J. Wildl Manage. 53:863-871.

Munz, P. A. 1968. A California flora. University of California Press, Berkeley.

Phillips, J. A. 1985. Acclimation of reintroduced tule elk in the Diablo Range, California. M.A. Thesis, San Jose State University, San Jose. 106pp.

Reid and Associates. 1991. Gilroy Hot Springs Resort, Draft EIR.

Schauss, M. E. 1980. Population dynamics and movements of wild pigs in Grant Park. M.A. Thesis, San Jose State University, San Jose. 75pp.

Schauss, M. E. 1984. The Mount Hamilton deer Herd management plan. California Fish and Game, Sacramento. 62pp.

Sharsmith, H. K. 1982. Flora of the Mount Hamilton range of California. California Native Plant Society: special publication number 6. 382 pp.

Simmons, C., A. Dennis, and J. W. Bartolome. 1984. A progress report on a study of the large-mammal community in the Diablo Range of California. Dept. Forestry and Resource Managment, Univ. California, Berkeley. 56pp.

Singer, F. J. 1981. Wild pig populations in the National Parks. Environmental Management 5:263-270.

Soil Conservation Service. 1974. Soil survey of eastern Santa Clara area, California.

Smith, J. P. and K. B. Berg. 1986. Inventory of rare and endangered vascular plants of California. California Native Plant society. 168 pp.

USGS. 1973. Open file soils map.

Wood, G. W., and R. H. Barrett. 1979. Status of wild pigs in the United States. Wildl. Soc. Bull. 7:237-246.

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APPENDIX B

CULTURAL RESOURCES CONSTRAINTS ANALYSIS

Prepared by

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April 1992

PR0115-G

April 16, 1992

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RE: Preliminary Constraint Analysis: Cultural Resources
Santa Clara Valley Water District Reservoir Sites

Dear Bert,

This letter presents of the results of a preliminary cultural resources constraint analysis of the proposed Coe, Cedar Creek, Upper and Lower Pacheco, Los Osos and Packwood reservoir sites located in southern Santa Clara County, California. This analysis is limited to a brief examination of in-house archaeological site location information and checking certain standard references and sources. A formal archive and records search was not undertaken.

Specialized listings consulted for this preliminary analysis include the *National Register of Historic Places* (National Conference of State Historic Preservation Officers, National Park Service and American Association for State and Local History (NCSHPO) 1989); United States National Park Service (USNPS) 1991a-b); *California Historical Landmarks* (CAL/OHP 1990d) and updates (CAL/OHP 1989a-b; 1990a-c; 1991a-b); the *California History Plan* (CAL/OHP 1973 a-b); *California Inventory of Historic Resources* (CAL/OHP 1976), *Five Views: An Ethnic Sites Survey for California* (CAL/OHP 1988), as well as local inventories and lists (Butler 1975; Pace 1975; Santa Clara County Historical Heritage Commission 1979, 1980, 1981, 1982a,b, 1984, 1985, 1987, 1988, 1989, 1991).

The available in-house cultural resource site record forms were briefly reviewed. For each site, a subjective determination was made of the level of possible study/mitigation that might be required should the sites be endangered from construction and/or inundation. The sites were ranked as possibly needing *low, moderate* or *high* levels of study/mitigation. Sites ranked *low* might be studied/mitigated for levels of funding up to $10,000. *Moderate* ranked sites might require funding above $10,000 but less than $50,000. Sites thought to require *high* levels of study/mitigation might involve costs of $50,000 into several hundreds of thousands of dollars.

Cedar Creek Reservoir Site

Eastern portions of the Cedar Creek Reservoir site fall within the boundaries of Rancho San Louis Gonzaga, however, no historic Mexican Period structures are located within this rancho. Available information indicates that no cultural resource sites are recorded within the Cedar Creek Reservoir site. However two (2) prehistoric archaeological sites are located within one mile of the proposed dam site but do not appear to be close enough to be in any direct danger from proposed reservoir construction operations.

Coe Reservoir Site

Coe Reservoir site is not located within the boundaries of a rancho. Five (5) cultural resource sites are located within the proposed Coe Reservoir site. These include four (4) prehistoric archaeological sites and one (1) historic site. One of the sites might require *low* levels of study or mitigation, one will require ***high*** levels of study and three might require *moderate* study or mitigation.

CA-SCl-73 and SCl-75 are prehistoric archaeological sites where midden deposits are present. The presence of midden suggests the sites will require *moderate* levels of study or mitigation. CA-SCl-74 is a prehistoric archaeological site where midden deposits may be present. *Low* levels of study or mitigation are anticipated.

CA-SCl-353, the Poverty Flat Site, is a prehistoric archaeological site with artifacts present on the surface and obvious midden deposits. Human skeletal remains are present as well. The Poverty Flat Site is listed in the California History Plan as significant on the state level. It was also listed on the National Register of Historic Places (No. 72000254) on February 23, 1972. This site will require *high* levels of study or mitigation.

The Coyote Creek Archaeological District is located within Henry W. Coe State Park. Without consultation with the Northwest Information Center at Sonoma State University, the identity and location of the sites which compose the District cannot be determined. The District was listed on the National Register of Historic Places (No. 71000192) on October 14, 1971 and is also listed in the California History Plan as having significance on the state level. It is *possible* that sites CA-SCl-73, -74 and -75 are the sites which compose the District.

CA-SCl-543H is a historic site with foundations, ruins or features. It is possible that this site might require *moderate* levels of study or mitigation.

Los Osos Reservoir Site

Los Osos Reservoir site is not located within the boundaries of any ranchos but is located just west of Rancho La Polka. Late American Period structures are located along the southern and western boundaries of the reservoir site.

Gilroy Hot Springs, which appears to be located just outside the inundation zone, is listed as a Point of Historical Interest (from the American Era) in the California History Plan. However, the size and extent of the Gilroy Hot Springs site and/or complex has not been investigated at this time.

Nine (9) cultural resource sites are located within the proposed Los Osos Reservoir site. These include one (1) prehistoric archaeological site and eight (8) historic sites. Six of the sites might require *low* levels of study or mitigation and three will require *moderate* levels of study/mitigation.

CA-SCl-55 is a prehistoric archaeological site with bedrock mortars present. It is anticipated that this site might require only *low* levels of study/mitigation.

CA-SCl-344H and SCl-346H are historic sites with both standing structures and foundations/ruins/features present. *Moderate* levels of study/mitigation may be required. Both SCl-344H and SCl-346H correspond to late American Period structures depicted by Thompson and West (1876:56).

CA-SCl-345H is a historic site with standing structures present. A *low* level of study/mitigation is anticipated. SCl-345H appears to correspond to a late American Period structure depicted by Thompson and West (1876:56).

CA-SCl-408H is a multi-component site. The site record form indicates that (prehistoric) bedrock mortars (possibly moved from their original location/setting) are present in addition to historic foundations/ruins/features. A *moderate* level of study/mitigation should be anticipated. SCl-408H appears to correspond to a late American Period structure depicted by Thompson and West (1876:56).

CA-SCl-479H is a historic site with artifacts present on the surface and foundations/ruins/features present. A *low* level of study/mitigation is anticipated. CA-SCl-480H is a historic site with standing structures present. A *low* level of study/mitigation is anticipated.

CA-SCl-544H is a historic site with artifacts present on the surface and foundations/ruins/features present as well. A *low* level of study/mitigation is anticipated. CA-SCl-549H is a historic site with standing structures - a *low* level of study/mitigation is anticipated.

Upper and Lower Pacheco Reservoir Sites

The southern portion of the Upper Pacheco Reservoir site is located within the boundaries of Rancho San Louis Gonzaga. No Mexican Period structures are located within this rancho. Seven (7) cultural resource sites are located within the proposed Upper and Lower Pacheco Reservoir sites. . All seven are prehistoric archaeological sites. One of the sites might require *low* levels of study/mitigation, three will require *moderate* levels and three will require *high* levels of study/mitigation.

All of the sites are located at elevations of 700 feet or lower. Site CA-SCl-520, situated on a slope, may extend as high as the 800 foot contour. Given that the maximum pool elevation of the proposed Lower Pacheco Reservoir will be at the 700 foot contour and the maximum pool of the Upper reservoir will be at the 900 foot contour, all seven sites appear to be at risk of inundation regardless of which reservoir alternative is constructed.

CA-SCl-520 is a prehistoric archaeological site with surface artifacts and bedrock mortars. The site might require *moderate* levels of study/mitigation.

CA-SCl-682, SCl-683, and SCl-684 are prehistoric archaeological sites with artifacts on the surface, obvious midden deposits and human skeletal remains. A *high* level of study/mitigation will be required for these three sites.

CA-SCl-685 is a prehistoric archaeological site with bedrock mortars present. The site will probably require a *moderate* level of study/mitigation. CA-SCl-686 is a prehistoric archaeological site with bedrock mortars present. The site will probably require a *low* level of study/mitigation. CA-SCl-687 is a prehistoric archaeological site with artifacts present on the surface, obvious midden deposits and bedrock mortars present. A *moderate* level of study/mitigation is anticipated.

No archaeological or historic sites appear to be present within the (existing) Lower Pacheco Reservoir site.

Packwood Reservoir Site

The Packwood Reservoir site is located within Rancho Los Huecos and Cañada de San Felipe y las Animas. No historic Mexican Period structures are located on these ranchos. Available information indicates that no cultural resource sites are recorded within the Packwood Reservoir site.

Discussion

The Packwood and Cedar Creek reservoir sites appear to have no significant cultural resource sites present. This may be due to any number of factors including their relatively remote location and lack of previous archaeological reconnaissance in the area. In the case of Cedar Creek reservoir site, two archaeological sites are located within a mile of the proposed dam site.

Los Osos, Coe and Upper Lower Pacheco reservoir sites are located in areas which have received some archaeological investigation in the past. The Los Osos Reservoir site could be considered the least sensitive of the three, having 6 of its 9 cultural resource sites designated as *low* (study/mitigation needed) and 3 of the 9 designated *moderate*. The Coe site appears to be more sensitive with 1 of its 5 cultural resources designated as *low*, 3 as *moderate* and 1 as *high*. Both the Upper and Lower Pacheco are clearly the most sensitive reservoir sites with 1 of their cultural resources designated *low*, 3 as *moderate* and 3 as *high*. Cultural resources in the two Pacheco reservoir alternatives include a number of prehistoric archaeological sites with known midden deposits and/or human skeletal remains/cemeteries.

Due to the preliminary nature of this constraints analysis, the rankings of relative sensitivity must be considered with great caution. Intensive archaeological survey of these reservoir sites would undoubtedly result in the discovery of many additional prehistoric and historic cultural resources. The Cedar Creek and Packwood areas, for example, are topographic and ecological settings which would have been favorable for Native American occupation. With better reconnaissance data, Cedar Creek and Packwood might be as sensitive or more sensitive than the Upper and Lower Pacheco sites.

If you have any questions, or if we can be of further assistance, please to not hesitate to contact us. Thanks again for retaining BASIN for this preliminary study.

Sincerely yours,
BASIN RESEARCH ASSOCIATES, INC.

James C. Bard, Principal

JCB/c

REFERENCES CITED

California, State of

1973a The California History Plan, Volume One - Comprehensive Preservation Program. State of California, The Resources Agency, Department of Parks and Recreation, Sacramento.

1973b The California History Plan, Volume Two - Inventory of Historic Features. State of California, The Resources Agency, Department of Parks and Recreation, Sacramento.

1976 California Inventory of Historic Resources. Resources Agency, Department of Parks and Recreation, Sacramento.

1982 California Historical Landmarks. Resources Agency, Department of Parks and Recreation, Sacramento [1979, revised].

1988 Five Views: An Ethnic Sites Survey for California. State of California, The Resources Agency, Department of Parks and Recreation, Sacramento.

Hendry, G.W. and J.N. Bowman

1940 The Spanish and Mexican Adobe and Other Buildings in the Nine San Francisco Bay Counties, 1776 to about 1850. MS on file, Bancroft Library, University of California, Berkeley.

National Conference of State Historic Preservation Officers, National Park Service and American Association for State and Local History [NCSHPO]

1989 National Register of Historic Places 1966-1988. American Association for State and Local History, Nashville, Tennessee.

Ogilvie, A.L.

1982 Heritage Tree Appendix to the 1981 Additions to the Santa Clara County Heritage Resources Inventory. Adopted by the Board of Supervisors April 20, 1982. Planning Department, County of Santa Clara, San Jose.

Pace, P. (compiler and editor)

1975 Santa Clara County Heritage Resource Inventory. Santa Clara County Historical Heritage Commission, San Jose.

Santa Clara County Historical Heritage Commission

1979 Santa Clara County Heritage Resource Inventory. Santa Clara County Historical Heritage Commission, San Jose.

1980 Additions to the Santa Clara County Heritage Resource Inventory. Fall 1980. Adopted 1/27/81 by the Board of Supervisors, San Jose.

1981 Additions to the Santa Clara County Heritage Resource Inventory. Adopted 1/81 by the Board of Supervisors. n.p.

1982a Additions to the 1981 Santa Clara County Heritage Resource Inventory. Adopted 4/20/82 by the Board of Supervisors. Planning Department, Santa Clara County, San Jose.

1982b Additions to the 1982 Santa Clara County Heritage Resource Inventory. Adopted 12/14/82 by the Board of Supervisors, Santa Clara Planning Department, San Jose.

1984 Additions to the 1983 Santa Clara County Heritage Resource Inventory. Adopted 1/31/84 by the Board of Supervisors, Santa Clara County Planning Department, San Jose.

1985 Additions to the 1985 Santa Clara County Heritage Resource Inventory. Adopted 11/19/85 by the Board of Supervisors, Santa Clara County Planning Department, San Jose.

1987 Additions to the 1986 Santa Clara County Heritage Resource Inventory. Adopted 6/9/87 by the Board of Supervisors, Santa Clara County Planning Department, San Jose.

1988 [No Additions approved; D.M. Garaventa w/Nancy Phillips, Librarian Santa Clara County Board of Supervisors, personal communication 3/27/90.]

1989 Additions to the 1989 Santa Clara County Heritage Resource Inventory. Adopted 10/17/89 by the Board of Supervisors, Santa Clara County Planning Department, San Jose.

1991 [No Additions approved; A.M. Banet w/ Nancy Phillips, Librarian Santa Clara County Board of Supervisors, personal communication 9/4/91.]

Thompson and West

1876 Historical Atlas of Santa Clara County, California. Thompson and West, San Francisco (reprinted Smith and McKay, San Jose, 1973).

United States Department of the Interior, National Register of Historic Places, National Park Service [USNPS]

1991a National Register of Historic Places Index by Property Location. Properties in California. Computer Printout from National Register of Historic Places, National Park Service, Washington, D.C. Copy on file, Basin Research Associates, San Leandro.

1991b National Register of Historic Places Index by Property Location. Determined Eligible Properties. Properties in California. Computer Printout from National Register of Historic Places, National Park Service, Washington, D.C. Copy on file, Basin Research Associates, San Leandro.

APPENDIX 2

SEISMICITY AND GEOTECHNICAL CONSIDERATIONS

APPENDIX 2
SEISMICITY AND GEOTECHNICAL CONSIDERATIONS
RECONNAISSANCE-LEVEL STUDY

PACKWOOD DAMSITE

A. SEISMICITY

The active Calaveras Fault is located 0.7-mile southwest of damsite and is the controlling fault for seismic design (Figure 2-1). See Table 2-1 for MCE probable maximum bedrock acceleration.

B. DAMSITE

1. Topography and Vegetation

Right abutment is slight sloping to locally 2:1 (horizontal to vertical), uniform rounded slope; grass covered with occasional oak trees. Left abutment is steeply sloping (2-½:1 to 1-½:1); abundant trees. Channel is about 650 feet wide at the dam axis and about 1,600 feet wide at the upstream toe. Damsite straddles the confluence of Packwood and Hoover Creeks. Elevation at the channel is about 1,270 feet.

2. Geology

Damsite entirely underlain by bedrock units of the Berryessa Formation consisting of interbedded sandstone, siltstone and shale (Figure 2-1). General strike of beds is northwest (parallel to dam axis) with moderate to steep dips to northeast (upstream). Outcrops are rare and where present are mostly sandstone. Some fine-grained terrace deposits are noted on lower right abutment, but appear to be localized and shallow. Broad alluvial valley appears to be underlain by soft, gravelly clay to clayey gravel, as exposed on creek banks. Estimated depth of alluvium 10 to 30 feet. Available geologic maps show no faults at the damsite.

3. Foundation Conditions

A stripping depth ranging from 3 to 10 feet and averaging 6 feet is estimated in the right abutment to reach competent formation, and about 15 feet in the core trench. In the left abutment 5 to 20 feet stripping depth (average about 10 feet, 15 feet beneath core zone). Channel estimate average stripping depth of 20 feet, 30 feet beneath core zone.

Excavation appears possible with heavy excavation equipment. Excavated material probably usable as core (channel alluvium) and random zone (abutment stripping).

Seepage potential - low in Berryessa shale; moderate in sandstone. Overall seepage potential probably lower because of upstream dips of beds and interbedded shale. Grouting requirement probably localized (in sandstone).

C. APPURTENANT STRUCTURES

1. Spillway

Potential spillway locations on either right or left abutments. Long alignments required, on the order of 1,500 to 2,000 feet. Stilling basin will be required prior to reentering Packwood Creek. Geology consists of Berryessa Formation (interbedded shale, siltstone, sandstone). Competent formation material; however, lining will probably be required. Material from required excavation appears usable for random zone of embankment. Excavation possible with heavy excavation equipment.

2. Outlet Works

Potential outlet conduit location at base of left abutment and possible sloping intake on left steep slope located about 500 feet upstream on left side of reservoir. Geologic materials mapped as Berryessa Formation (interbedded shale, siltstone, sandstone) Dibblee's geologic map shows ribs of sandstone in this area.

D. RESERVOIR CONDITIONS

Reservoir geology mostly in Berryessa Formation (interbedded shales and sandstones). Upper end of Packwood Creek arm of reservoir in Franciscan Complex (chert and sandstones). General structural trend is northwest -southeast.

The Berryessa Formation and Franciscan Complex are separated by the northwest trending Madrone Springs Fault that passes through the upper end of Packwood Creek arm of the reservoir (Figure 2-1).

As shown on the California Division of Mines and Geology Map showing Recency of Faulting, San Francisco-San Jose Quadrangle California (1991), the Madrone Springs Fault is classified as pre-Quaternary (that is, older than 2 million years) and does not show evidence of Quaternary displacement.

Landslides mapped on upper end of Packwood Creek in bedrock units of the Franciscan Complex as shown on Dibblee's geologic map, but are remote from damsite (Figure 2-1).

Reservoir leakage potential - probably low; there are no narrow ridges around the reservoir rim that would constitute short seepage paths.

E. CONSTRUCTION MATERIALS

1. Impervious Clay

Potential clay source is the alluvial valley of Packwood Creek and upper Hoover Valley upstream of damsite. The material is a gravelly clay as exposed in creek banks. Estimated average thickness is 12 feet. Estimated volume of borrow area shown on map (Figure 2-1) is 8.5 million cubic yards, with haul distances ranging from 0 to 2 miles.

2. Random Material

Potential source is bedrock material (Berryessa Formation) that forms the ridges and slopes below maximum reservoir level. One source is the ridge separating Packwood and Hoover Creeks immediately upstream of damsite. Other sources are the sideslopes in the reservoir immediately upstream of the dam.

Material anticipated is mixed shale, siltstone and sandstone that will probably generate a clayey sandy gravel. Thick beds of hard sandstone may be encountered that can probably be selectively sorted as rock material. Beds of resistant sandstone were mapped by Dibblee and follow an alignment parallel to the regional northwest trends (Figure 2-1). Estimated volume of random materials source shown on map below the proposed maximum reservoir level, excluding rock portion, is 4.0 million cubic yards. An unlimited supply of random material is possible if the ridges above the maximum reservoir were to be considered as potential sources.

3. Rock Materials

Possibly selective sorting of thick, hard sandstone beds of the Berryessa Formation in conjunction with excavating for random source materials. Assuming 10 percent of random zone source is sandstone beds, estimated volume is 400,000 cubic yards.

4. Filter, Drain Materials, and Concrete Aggregate

No apparent on-site materials; will probably be obtained from commercial sources.

COE DAMSITE

A. SEISMICITY

The active Calaveras Fault is 4.3 miles southwest of damsite and is apparently the controlling fault for seismic design. See Table 2-1 for MCE/ probable maximum bedrock accelerations.

B. DAMSITE

1. Topography and Vegetation

The damsite is located immediately downstream of the confluence of the Middle Fork and East Fork of Coyote Creek (Figure 2-2). Abutment slopes are steep, ranging from 1½:1 (horizontal to vertical) to 2:1, locally 1:1. Abundant trees occur on both abutments, more on left than on the right. Channel is about 100 to 150 feet wide with little riparian vegetation. Elevation at the channel is about 1150 feet.

2. Geology

The damsite is entirely underlain by Franciscan Complex bedrock units - mainly graywacke, interbedded shale, siltstone, and sheared shale. Geologic structure (mainly bedding) is apparent in the layered rocks; however, the rocks have locally been deformed (contorted bedding and intense shearing of shale). Bedrock is exposed in the channel with locally shallow alluvial cover. In the abutment, outcrops are sporadically scattered and consist predominantly of resistant sandstone graywacke.

General attitude of bedding is N20°W with vertical dips to very steep dips to southwest.

3. Foundation Conditions

The scarcity of impervious clay and the presence of potential rock aggregate source impacts the type of dam to be considered at this site. The rock foundation (with proper treatment) appears to be strong enough for a roller compacted concrete (RCC) dam. The following discussion on foundation conditions is based on consideration of an RCC type dam.

In the channel, strong, competent, fresh bedrock is exposed at or near surface. An average 5-foot foundation excavation depth is estimated in the channel area. In the abutments, stripping depths ranging from 20 to 50 feet (average stripping depth of 35 feet) will probably be required.

Weak zones in the form of sheared, soft, soil-like shale may be encountered in the foundation and will require special treatment (overexcavation and dental concrete work). These shear zones appear as linear narrow surface structures (up to 5 feet wide). About 10 to 15 percent of the foundation is anticipated to be comprised of this weak material.

Published geologic map of Santa Clara County shows a probable fault passing through the damsite (Figure 2-2). This probable fault appears to be part of the Madrone Springs Fault zone. Any feasibility level study should investigate this fault and other geologic structures and their impact on foundation conditions, specifically relative to foundation stability.

Mass excavation appears possible with very heavy excavation equipment. Localized blasting will probably be required in the fractured massive sandstone.

Seepage potential is probably low in fresh Franciscan Complex rocks as exposed in channel. Grouting requirements probably localized in fractured graywacke sandstone.

C. APPURTENANT STRUCTURES

1. Spillway

For an RCC dam, the spillway is incorporated by overtopping the dam. Rock in the spillway impact area is similar to the dam foundation; strong, competent, interbedded sandstone, siltstone and shale. Interbedded, weak, sheared shale will require special treatment.

2. Outlet Works

Incorporated in RCC dam structure.

D. RESERVOIR CONDITIONS

Reservoir geology comprised entirely of Franciscan Complex. Extensive mapped landslides on reservoir slopes on Middle Fork Coyote Creek arm of reservoir (Figure 2-2). Possible reactivation could contribute to siltation. The possible landslide deposits need to be further assessed in terms of mass movement. The irregular slopes of the reservoir suggest that the effect of seiche or wave action from massive landsliding is most likely insignificant.

Reservoir leakage potential probably low; no narrow ridges along reservoir rim.

E. CONSTRUCTION MATERIALS

There is no readily identified source of an adequate supply of suitable impervious clay. Impervious clay materials appear to be limited to shallow surficial soil (2 to 3 feet thick) and possibly the fine grained portions (shale, sheared shale, gouge) of the Franciscan Complex melange.

A potential rock quarry site exists just upstream of the damsite (Figure 2-3). Several other scattered sources occur in the reservoir area immediately upstream of the dam. The hard cobbles and boulders in the alluvium of Coyote Creek could provide supplemental sources of rock aggregate, but may be somewhat limited. The bedrock unit in these potential rock quarry sources consists mostly of graywacke and siltstone, with some shale. Based on an average of 10 to 15 feet of stripping in the quarry areas, and about 10 percent waste due to the shaley materials, about 1.6 million cubic yards is estimated.

LOS OSOS DAMSITE

A. SEISMICITY

The active Calaveras Fault is located 1.1 miles southwest of the Los Osos damsite and is the controlling fault for seismic design. See Table 2-1 for MCE/ probable maximum bedrock accelerations.

B. DAMSITE

1. Topography and Vegetation

Damsite located in constriction of Coyote Creek channel upstream of existing Coyote Reservoir (Figure 2-4). Abutment slopes range in inclination from 1:1 (horizontal to vertical) to 2:1; locally, some relatively flat, narrow benches. Thickly vegetated with trees on left abutment; some trees and thick brush on right abutment. Channel is about 200 feet wide and covered with granular alluvium. Elevation at channel is about 800 feet.

2. Geology

Preliminary geologic map of Gilroy and Gilroy Hot Springs Quadrangle by T.W. Dibblee, Jr. (1973) indicates that entire damsite is underlain by marine sedimentary rocks of Cretaceous-Tertiary age (Figure 2-5). Dibblee's geologic map suggests that the beds are folded in the damsite vicinity, possibly indicating a southeast-plunging anticline with beds dipping upstream. Dibblee maps a resistant bed of sandstone that forms the backbone of the right abutment ridge and extends to the left abutment in a warped manner consistent with the folding of the sediments. The remainder of the formation at the damsite consists of interbedded, closely fractured, folded shale, siltstone and sandstone.

Dibblee maps an old landslide on the right abutment ridge slope. The old landslide is indicated by hummocky topography. The southeastern portion of this slide could encroach into the damsite area for very large dams.

3. Foundation Conditions

There appear to be two types of bedrock foundation material; the massive sandstone in the upstream dam footprint (abutment and channel area) and interbedded shale, siltstone and sandstone in most of the dam footprint area. Both should provide strong competent foundation for an embankment dam. Alluvium in the channel is estimated to be on the order of up to 30 feet thick. Average excavation depths of 20 feet and 30 feet are estimated for the abutments and channel, respectively. An additional 10 feet of excavation is estimated for the cut-off core trench. Excavation appears possible with heavy excavation equipment.

The old landslide in the right abutment represents a constraint in siting the dam. It is possible that the dam could be sited far enough upstream to avoid the landslide; however this may limit the size and height of the structure. The old landslide should be investigated during feasibility level study to assess its impact on dam-siting (specifically reactivation during foundation excavation).

Seepage potential is probably low in the interbedded shale, siltstone and sandstone. Overall seepage potential probably low because of general upstream dips of beds and interbedded tight shale beds. Grouting requirement probably localized in fractured sandstone.

C. APPURTENANT STRUCTURES

1. Spillway

A spillway site on the right abutment will be impacted by the extensive old landslide deposit; therefore, a preferred location is on the left abutment. Because of the ground topography, a spillway alignment on the left abutment will require massive, high cuts to accommodate a spillway channel. The required excavation (anticipated to be a clayey, silty gravel) could be utilized in a random zone of the embankment. Excavation should be possible with conventional heavy excavation equipment, although thicker sandstone beds may require some blasting.

An alternative to an open-cut spillway is a morning glory hole and tunnel through the left abutment. Materials anticipated include massive sandstone on the upstream portion which may not require lining and interbedded shale, siltstone and sandstone, which may requiring lining.

2. Outlet Works

The outlet works could be sited at the base of either the left or right abutments for both the conduit and a sloping intake. The massive sandstone bed mapped on the upstream portion of both abutments could provide a strong foundation for a sloping intake but this will require confirmation during feasibility level studies.

D. RESERVOIR CONDITIONS

The entire reservoir is underlain by bedrock units of the unnamed sedimentary rocks of Cretaceous-Tertiary age and the Franciscan Complex. These two geologic formations are separated by the Madrone Springs Fault which bisects the reservoir area in a northwest to southeast direction (Figure 2-5). Serpentine is associated with the Madrone Springs Fault and occurs in relatively narrow lenses bounded by fault traces.

The Franciscan Complex rocks are generally confined to the Coyote Creek and Hunting Hollow area of the proposed reservoir. Landslides are more prevalent in the Franciscan Complex but are mapped at higher elevations (generally above maximum reservoir), and are therefore outside reservoir influence.

The Madrone Springs Fault is classified as pre-Quaternary, that is, older than 2 million years and does not show evidence of Quaternary displacement (CDMG 1991), therefore, the fault is not considered active.

Although a few landslides have been mapped in the reservoir area, they appear to be remote and would not impact reservoir operation.

Seepage potential appears to be low based on the generally tight nature and structural trend of the bedrock units and the absence of narrow ridges.

E. CONSTRUCTION MATERIALS

1. Impervious Clay

Potential source of clay for the impervious zone of the dam is the fine grained gravelly sandy clay to clayey sandy gravel alluvium in the extensive alluvial valley of Canada de Los Osos located about 3 to 6 miles from the damsite. Based on an estimated thickness of 12 feet, about 9 million cubic yards is available in the area outlined in Figure 2-5.

2. Transition Zones - Sand and Gravel

Sand and gravel occur in the alluvium of Coyote Creek from the damsite up to 3.5 miles upstream. Based on an estimated thickness of 12 feet, about 4 million cubic yards is available.

3. Rock Material

Rock for outer shells could probably be obtained by developing a rock quarry in the sandstone ridge upstream of the right side of the dam. The sandstone is gray, hard, massive and appears durable. In order to generate adequate quantities, it will be necessary to quarry beyond maximum reservoir elevation. About 30 percent waste is anticipated.

CEDAR CREEK DAMSITE

A. SEISMICITY

The active Calaveras and San Andreas Faults are located 8.2 miles and 17.5 miles, respectively, southwest of the Cedar Creek site. See Table 2-1 for MCE/probable maximum bedrock accelerations.

B. DAMSITE

1. Topography and Vegetation

The abutment slopes are dissected by local drainage swales. Slope inclinations range from 2:1 to 4:1 (horizontal to vertical), with localized steep (1½:1) slopes. The creek channel and flood plain is about 100 to 200 feet wide; however, the valley floor is up to 500 feet wide.

Vegetation consists of scattered oak trees, with relatively more trees on the right (south) abutment than the north abutment.

2. Geology

The damsite is underlain entirely by bedrock of the Franciscan Complex, portions of which appear to be melange bedrock materials. The pervasively sheared melange consists of dark gray siltstone or shale matrix containing abundant hard, resistant masses of graywacke, schist, chert and greenstone. Associated with the melange are interbedded sandstone, siltstone and shale. Bedding is variable because of folding and faulting.

A landslide was mapped by Cotton (1972) on the left (east) abutment area of the damsite (Figure 2-6). This was confirmed during the reconnaissance mapping. The landslide area exhibits a hummocky topography with associated occurrences of seepage. It appears to be shallow and confined to the Franciscan melange. It is possible to site the dam further upstream to avoid most of the slide area.

3. Foundation Conditions

The bedrock units of the Franciscan Complex should provide adequate foundation for an earthfill type embankment. Weak, sheared clay shale zones may occur in the foundation and require special treatment such as overexcavation. For the abutment areas, an estimated average stripping depth of 10 feet is estimated. In the channel, stripping depths are estimated to range from 10 to 30 feet and average 20 feet. An additional 10 feet of excavation is estimated for the core trench.

C. APPURTENANT STRUCTURES

1. Spillway

A spillway alignment could be located on the right (west) abutment; however, this will require extensive grading because of the relatively steep topography. Lining will most likely be required. The material from the required excavation can be incorporated in the dam embankment.

2. Outlet Works

Because of the landslide on the east abutment, it would be preferable (although not essential) to site the outlet conduit at the base of the right (west) abutment. The bedrock material is anticipated to be comprised of interbedded sandstone, siltstone and shale of the Franciscan Complex.

D. RESERVOIR CONDITIONS

The reservoir is underlain entirely by bedrock units of the Franciscan Complex. Cotton (1972) maps a few landslide deposits in the reservoir area which could be reactivated during reservoir operation (Figure 2-6). Landsliding in the reservoir is not anticipated to affect dam safety, but can contribute to reservoir siltation.

E. CONSTRUCTION MATERIALS

The availability of suitable construction material is a key issue at this site. There are no readily identifiable sources of clay for the impervious zone. Any clay material would have to be derived from the bedrock formation materials. However, because of the heterogeneous mixture of the Franciscan Complex, it would be difficult to define and isolate substantial areas of "clay" source. This selection would probably have to be done during construction, which would require a complex and expensive excavation operation.

The relatively small and narrow reservoir basin and the relatively steep reservoir slopes restrict the amount of bedrock materials available within the limits of the reservoir. It will be necessary to borrow materials well above maximum reservoir in order to produce adequate quantities.

The bedrock materials are anticipated to consist of interbedded sandstone, siltstone and shale, possibly with included larger masses of hard rock. The shale and siltstone could provide the finer grained components of the impervious zone.

The bulk of the material is anticipated to be a sandy gravel to clayey sandy gravel, which can be utilized in the outer (random) zone of the dam. Rock materials could be obtained by selectively sorting rock masses within the bedrock formation materials. Rock for filter and drain materials and aggregates would be obtained from off-site commercial sources.

PACHECO "B" DAMSITE

A. SEISMICITY

Significant faults that could subject the site to strong shaking include the active Calaveras and San Andreas, 11 and 20 miles, respectively, to the southwest, and the potentially active Ortigalita Fault, 8.7 miles to the northeast. Probable maximum bedrock accelerations produced by maximum credible earthquakes on these faults range from 0.35 to 0.40g (Table 2-1).

B. DAMSITE

1. Topography and Vegetation

The Pacheco B damsite is located across a relatively narrow constriction of the existing Lake Pacheco, about 1.5 miles upstream of the existing North Fork Dam (Figure 2-7). The estimated channel elevation is 440 feet. Maximum reservoir water surface elevation at Lake Pacheco is 472 feet.

Both abutments are relatively steep, with slopes averaging 1½:1. The lower portions of the abutments are relatively flat in what appear to be topographic benches. The channel section is on the order of 300 feet wide. Vegetation consists of scattered trees, and local concentrations of trees and brush.

2. Geology

Published geologic maps (Cotton, 1972; Rogers and Williams, 1974) indicate that the entire damsite is underlain by bedrock units of the Franciscan Complex (Figure 2-6). These rocks consist of interbedded graywacke sandstone, siltstone and shale, and are anticipated to be typically folded and sheared. Bedding observed in isolated outcrops on the left (east) abutment indicates a N30°W strike and 45°NE dip. There are no mapped landslides at this damsite, although several relatively extensive landslides have been mapped downstream along the existing Lake Pacheco rim and on the east (left) abutment of the existing North Fork Dam.

3. Foundation Conditions

In the upper, steeper abutments, an average excavation depth of 15 feet is estimated, with an additional 10 feet in the core trench. In the bench area at the base of the abutments, an average excavation depth of 20 feet is estimated because of a probable thick deposit of slopewash material. A similar depth is estimated in the channel area, mostly to remove reservoir sediments and shallow alluvium in the channel. As in the abutment, an additional 10 feet of excavation is estimated in the core trench in the channel area.

Foundation seepage potential is probably low to moderate. Grouting will probably be required in localized areas of fractured graywacke sandstone.

It is anticipated that foundation excavation is possible with heavy excavation equipment. However, the typical Franciscan Complex will probably contain included hard masses of sandstone, greenstone, chert or schist, which may require some localized blasting.

C. APPURTENANT STRUCTURES

1. Spillway

A spillway could be sited on either abutment and will involve extensive excavations. A possible landslide deposit or thick slopewash occurs on the downstream left (east) abutment and could impact spillway siting. Therefore, it would be preferable to locate the spillway on the right (west) abutment where it could be routed to an adjoining drainage remote from the downstream toe of the dam. Lining will most likely be required. Material from the required excavation can be incorporated into the random zone of the dam embankment.

2. Outlet Works

The outlet works can be sited along the base of either abutment; however, the possible landslide or thick slopewash deposit on the downstream left abutment will have to be investigated. The right abutment area appears to be stable and would be a preferable location for the outlet conduit. It would be possible to site the intake structure in the borrow excavation of the bedrock finger ridge located upstream of the right abutment.

D. RESERVOIR CONDITIONS

Published geologic maps (Cotton, 1972) show extensive areas of landslide deposits within the reservoir area (Figure 2-6). One important impact of landslide reactivation related to reservoir operation, is accelerated siltation of the reservoir. It is unlikely that massive, rapid landslide movement would occur in these types of landslides that could impact dam safety (by wave action and dam overtopping). Potential for reservoir seepage is probably low because of the general tightness of the Franciscan Complex bedrock materials.

E. CONSTRUCTION MATERIALS

1. Impervious Clay

There are no readily identifiable sources of substantial amounts of clay for the impervious zone of the dam, such as the extensive alluvial areas at the Los Osos or Packwood sites. Alluvial deposits are very limited at this site and are generally granular. Potential sources of clay are landslide deposits in the reservoir, which are generally derived from the Franciscan melange consisting of mixed sheared shale and clay and various types of rock components. These materials are typically heterogeneous and will require sorting of rockier, less clayey zones, which would entail a complex and difficult excavation plan. The landslide deposits are generally found in areas of slightly to moderately sloping hummocky ground. In order to obtain substantial quantities, it will be necessary to extend the excavation limits well above maximum reservoir level. Potential sources of impervious material are shown on Figure 2-8 at distances of 2 to 5 miles from the damsite, and elevations of up to 1,000 feet. Assuming a 30-foot thickness, and 30 percent rock material, a total volume of about 7 million cubic yards of impervious material is estimated. The availability of suitable clay material is an important geotechnical issue and will require extensive investigation during the feasibility study.

2. Random Material

Potential sources of random material are the bedrock ridges and bedrock slopes within the reservoir. These materials are anticipated to be comprised of interbedded sandstone, siltstone and shale, with included masses of sandstone, chert, and greenstone. These bedrock units will probably generate semi-pervious clayey, sandy gravel. Included masses of abundant boulder-size hard rock will require sorting. A likely source of this material is the finger ridge, immediately upstream of the right (west) abutment, which is estimated to generate about 7 million cubic yards, if the excavation were confined to the reservoir. Substantially more material is available if the borrow operations extend above the maximum reservoir elevation.

3. Rock Materials

A potential source of rockfill is the bedrock which outcrops at Chimney Rock located about 1 mile upstream of the damsite. Assuming an average depth of 40 feet and 25 percent waste, about 2.3 million cubic yards is estimated for an area within the limits of the reservoir. There is a potential for doubling this quantity if the excavation would extend beyond the maximum reservoir; however, this will require confirmation during feasibility level study.

Other supplemental sources are scattered outcrops of sandstone graywacke or greenstone within the reservoir. Because of their occurrence, it is likely that these sources will produce limited quantities, possibly in the range of 50,000 to 200,000 cubic yards per individual source. Waste of up to 25 percent may be anticipated. For this study, we have estimated a cumulative volume of about 2 million cubic yards from several sources ranging in distance 2 to 7 miles from the damsite. The availability of critical rock materials is an equally important issue that needs to be investigated during feasibility level study.

4. Filter, Drain Material and Aggregate

Aggregate could be processed from the rock material sources described above, or obtained from commercial sources. Filter and drain materials will probably be obtained from commercial sources.

UPPER PACHECO DAMSITE

A. SEISMICITY

Significant faults that could subject the site to strong shaking include the Calaveras and San Andreas, 12.0 and 21.4 miles, respectively to the southwest, and the Ortigalita Fault, 7.7 miles to the northeast. Probable maximum bedrock accelerations produced by maximum credible earthquakes on these faults range from 0.34 to 0.41g (Table 2-1).

B. DAMSITE

1. Topography and Vegetation

The Upper Pacheco damsite is located across a relatively narrow constriction of the North Fork of Pacheco Creek, immediately downstream of its confluence with the East Fork of Pacheco Creek (Figure 2-9). The area is identified as "Chimney Rock" in the U.S. Geological Survey topographic map of the Pacheco Peak quadrangle. Channel elevation is estimated at 500 feet.

Both abutments are relatively steep, with slopes averaging 1½:1 (horizontal to vertical). The lower portions of the abutment are relatively flat, with slopes of about 5:1. The right abutment is dissected by several drainage swales while the left abutment is generally a uniform rounded slope. The creek channel is about 50 to 100 feet wide.

Vegetation consists of brush and scattered trees.

2. Geology

The damsite is underlain entirely by bedrock units of the Franciscan Complex (Figure 2-6). Exposures of graywacke, thinly bedded chert, interbedded sandstone, siltstone and shale, were observed along the creek channel. Shear zones (dark gray clay gouge) and sheared shale typical of the Franciscan melange were also noted. Large boulders, as well as resistant outcrops of in-place chert and graywacke, occur along and near the creek channel. The general strike of bedding is N60-80°W with moderate dips to the northeast (upstream); however, widespread variations in bedding attitudes are anticipated because of the folding and deformation of the Franciscan Complex.

3. Foundation Conditions

Fresh, competent rock occurs at or near the surface along the channel, with local areas of alluvium and large boulders. An average stripping depth of 10 feet is estimated with an additional 10 feet for the core trench.

In the abutments, an average stripping depth of 15 feet is estimated to obtain competent foundation, with an additional 10 feet for a core trench.

Excavation is generally possible with heavy excavation equipment; however, hard masses of graywacke and chert are anticipated and may require blasting.

Seepage potential is probably low to moderate overall in the Franciscan Complex; however, the extent of the openly fractured, contorted chert in the foundation should be carefully studied because of its potentially high fracture permeability.

C. APPURTENANT STRUCTURES

1. Spillway

A potential open cut spillway could be sited on the left (east) abutment, which will require extensive excavations. A spillway site on the right abutment may be difficult because of the several incised drainage swales that dissect the abutment slope.

The left abutment spillway location is anticipated to be in the heterogeneous bedrock units of the Franciscan Complex, from weak, sheared shale to hard, strong, massive graywacke sandstone. Lining will probably be required. Materials from required excavation of the spillway (and the dam foundation) can be used as random fill material in the embankment.

2. Outlet Works

The outlet conduit can be sited along either the base of the left or right abutments. A significant amount of blasting may be required along the alignment because of the widespread occurrence of massive rock along the channel.

D. RESERVOIR CONDITIONS

Published geologic maps (Cotton, 1972) show extensive areas of landslide deposits within the reservoir area. One important impact of landslide reactivation related to reservoir operation, is accelerated siltation of the reservoir. It is unlikely that massive, rapid landslide movement would occur in these types of landslides that could impact dam safety (by wave action and dam overtopping). Potential for reservoir seepage is probably low because of the general tightness of the Franciscan Complex bedrock materials.

E. CONSTRUCTION MATERIALS

1. Impervious Clay

There are no readily identifiable sources of substantial amounts of clay for the impervious zone of the dam, such as the extensive alluvial areas at the Los Osos or Packwood sites. Alluvial deposits are very limited at this site and are generally granular. Potential sources of clay are landslide deposits in the reservoir area, which are generally derived from the Franciscan melange consisting of mixed sheared shale and clay and various types of rock components. These materials are typically heterogeneous and will require sorting of rockier, less clayey zones, which would entail a complex and difficult excavation operation. The landslide deposits are generally found in areas of slightly to moderately sloping hummocky ground. In order to obtain substantial quantities, it will be necessary to extend the excavation limits well above maximum reservoir level. Potential sources of impervious material are shown on Figure 2-8 at distances of 1 to 3 miles from the damsite, and at elevations of up to 1,000 feet. Assuming a 30-foot thickness, and 30 percent rock material, a total volume of about 7 million cubic yards of impervious material is estimated. The availability of suitable clay material is an important element in the geotechnical consideration and will require extensive investigation during the feasibility study.

2. Random Material

Potential sources of random material for the outer zones of the dam are the bedrock ridges and bedrock slopes within the reservoir. These materials are anticipated to be comprised of interbedded sandstone, siltstone and shale, with included masses of sandstone, chert, and greenstone. These bedrock units will probably generate semi-pervious clayey, sandy gravel. Included masses of abundant boulder-size hard rock will require sorting. A likely source of these materials is the ridge immediately upstream of the dam and the confluence of the North Fork and East Fork of Pacheco Creek, as well as other bedrock ridges that jut into the reservoir. In order to generate large volumes of material, it will be necessary to extend the borrowing beyond the limits of the maximum reservoir.

3. Rock Materials

Sources of rock are the scattered outcrops of sandstone graywacke or greenstone within the reservoir. Because of their occurrence, it is likely that these sources will produce limited quantities, possibly in the range of 50,000 to 200,000 cubic yards per individual source. Waste of up to 25 percent may be anticipated. For this study, we have estimated a cumulative volume of about 2 million cubic yards from several sources ranging in distances 2 to 7 miles from the damsite. The random material source may also generate rock materials which will require sorting. The availability of suitable rock materials is an equally important issue that needs to be investigated during feasibility level study.

4. Filter, Drain Materials and Aggregate

Aggregate could be processed from the rock material sources described above, or obtained from commercial sources. Aggregate for filter and drain materials will probably be obtained from commercial sources.

REFERENCES

California Division of Mines and Geology, 1991, *Map Showing Recency of Faulting, San Francisco-San Jose Quadrangle, California*, scale 1:250,000, Regional Geologic Map Series - Map No. 5A (Geology), sheet 5 of 5.

Cotton, William R., 1972, *Preliminary Geologic Map of the Franciscan Rocks in the Central Part of the Diablo Range, Santa Clara and Alameda Counties, California* U.S. Geological Survey Miscellaneous Field Studies Map MF-343.

Dibblee, Thomas W., Jr., 1973a, *Preliminary Geologic Map of the Gilroy Quadrangle, Santa Clara County, California*, U.S. Geological Survey Open File Map 73-59.

Dibblee, Thomas W. Jr., 1973b, *Preliminary Geologic Map of the Gilroy Hot Springs Quadrangle, Santa Clara County, California*, U.S. Geological Survey Open File Map 73-59.

Dibblee, Thomas W. Jr., 1973c, *Preliminary Geologic Map of the Mt. Sizer Quadrangle, Santa Clara County, California*, U.S. Geological Survey Open File Map 73-59.

Nilsen, Tor H., 1972, *Preliminary Photointerpretation Map of Landslide and other Surficial Deposits of Parts of the Los Gatos, Morgan Hill, Gilroy Hot Springs, Pacheco Pass, Quien Sabe and Hollister 15-Minute Quadrangles, Santa Clara County, California*, U.S. Geological Survey Miscellaneous Field Studies Map MF-416.

Rogers, Thomas H., and Williams, John W., 1974, *Potential Seismic Hazards in Santa Clara County, California*, California Division of Mines and Geology Special Report 107.

Seed, Bolton, H. and Idriss, I.M., 1982, *Ground Motions and Liquefaction During Earthquakes*, Earthquake Engineering Institute, Berkeley, California.

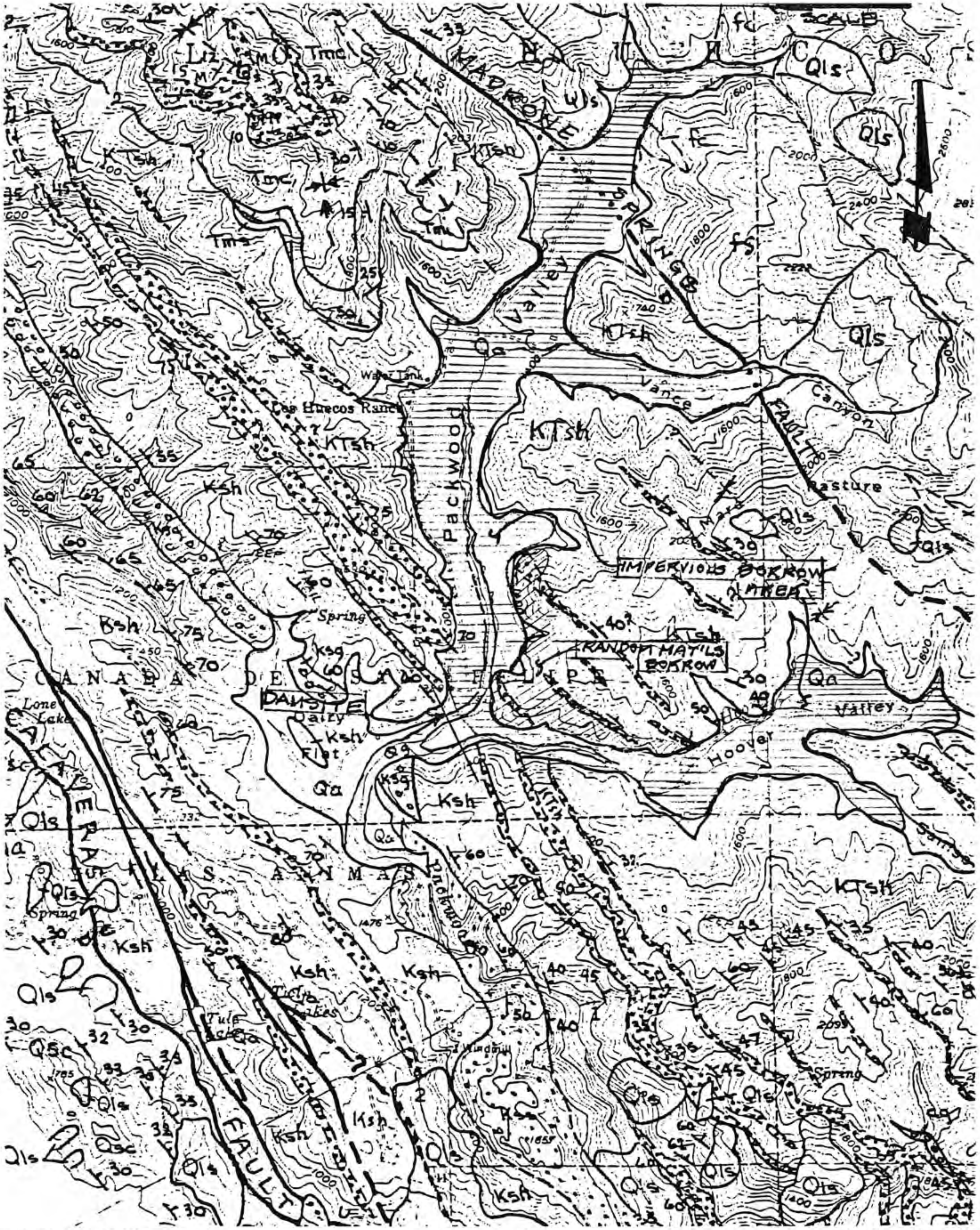
TABLE 2-1

SANTA CLARA VALLEY WATER DISTRICT STORAGE RESERVOIR SITES
REGIONAL SEISMICITY - SIGNIFICANT FAULTS

DAM SITE	ACTIVE OR POTENTIALLY ACTIVE FAULT	DISTANCE AND DIRECTION FROM DAMSITE (MILES)	MAXIMUM CREDIBLE EARTHQUAKE (MAGNITUDE)	PROBABLE MAXIMUM BEDROCK ACCELERATIONS [2]
PACHECO B	CALAVERAS	11.0 SOUTHWEST	7.5	0.40 g
	SAN ANDREAS	20.0 SOUTHWEST	8.5	0.35 g
	OCTIGALITA [1]	8.7 NORTHEAST	7.0	0.40 g
UPPER PACHECO	CALAVERAS	12.0 SOUTHWEST	7.5	0.39 g
	SAN ANDREAS	21.4 SOUTHWEST	8.5	0.34 g
	OCTIGALITA	7.7 NORTHEAST	7.0	0.41 g
CEDAR CREEK	CALAVERAS	8.2 SOUTHWEST	7.5	0.42 g
	SAN ANDREAS	17.5 SOUTHWEST	8.5	0.37 g
	OCTIGALITA	11.2 NORTHEAST	7.0	0.33 g
LOS OSOS	CALAVERAS	1.1 SOUTHWEST	7.5	0.71 g
	SAN ANDREAS	13.0 SOUTHWEST	8.5	0.43 g
	OCTIGALITA	17.3 NORTHEAST	7.0	0.24 g
COE	CALAVERAS	4.3 SOUTHWEST	7.5	0.56 g
	SAN ANDREAS	18.0 SOUTHWEST	8.5	0.37 g
	OCTIGALITA	13.7 NORTHEAST	7.0	0.30 g
PACKWOOD	CALAVERAS	0.7 SOUTHWEST	7.5	0.71 g
	SAN ANDREAS	14.7 SOUTHWEST	8.5	0.41 g
	OCTIGALITA	18.0 NORTHEAST	7.0	0.24 g

[1] ORTIGALITA MAPPED AS HOLOCENE FAULT IN CDMG MAP SHOWING RECENCY OF FAULTING OF SAN FRANCISCO - SAN JOSE QUADRANGLE, CALIFORNIA. PUBLISHED 1991

[2] FROM SEED AND IDRISS, 1982.



EXPLANATION: Qa - alluvium
Ksh - clay shale (Berryessa)
KTsh - unnamed marine sedimentary rocks.
(sandstone symbol) - sandstone

Qls - landslide

Geologic map from Dibblee (1973c) Mt. Sizer Quadrangle.

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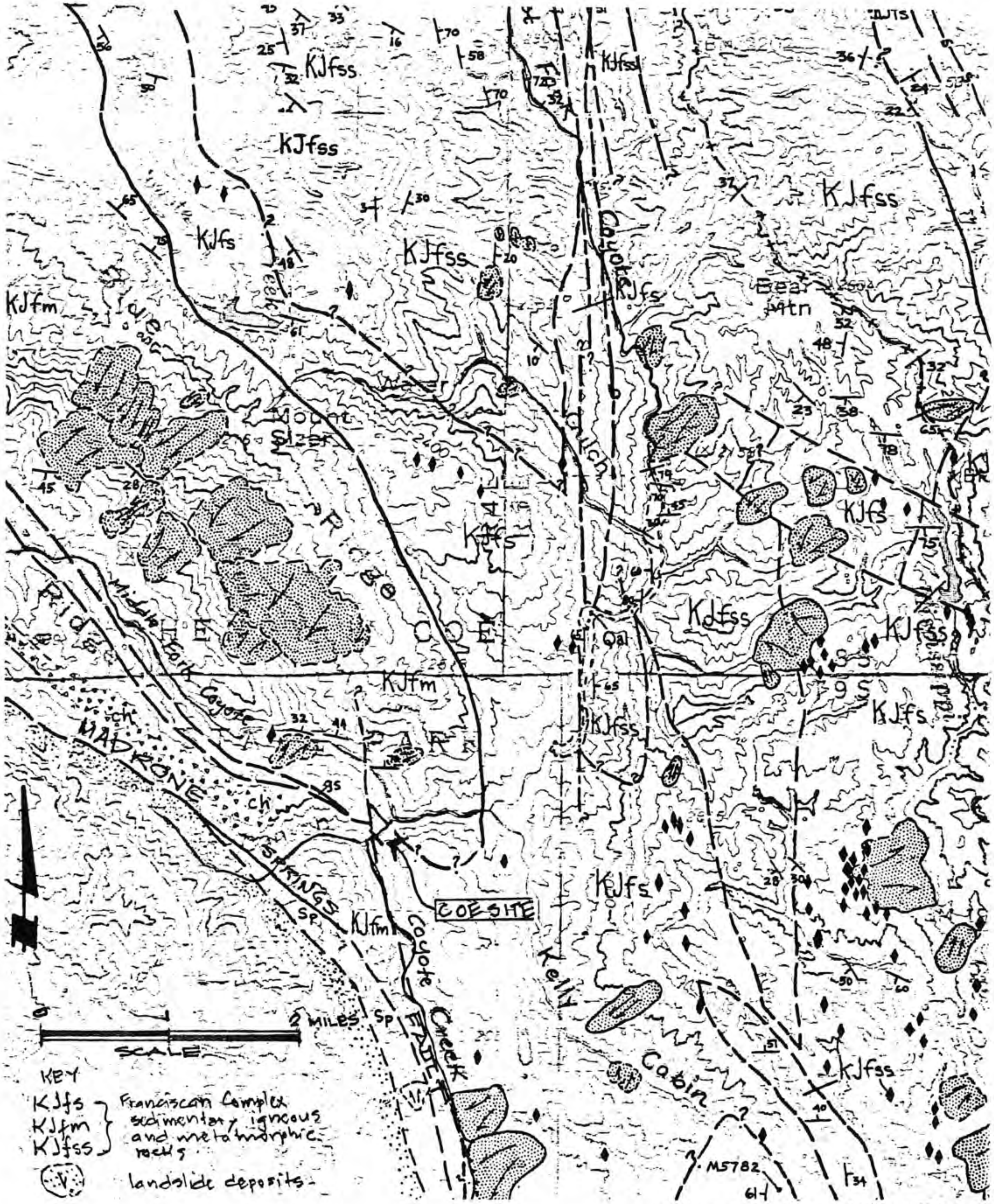
GEOLOGIC MAP AND GENERAL LOCATION OF BORROW AREAS PACKWOOD DAMSITE
FIGURE 2-1



Geologic map from Cotton, 1973.

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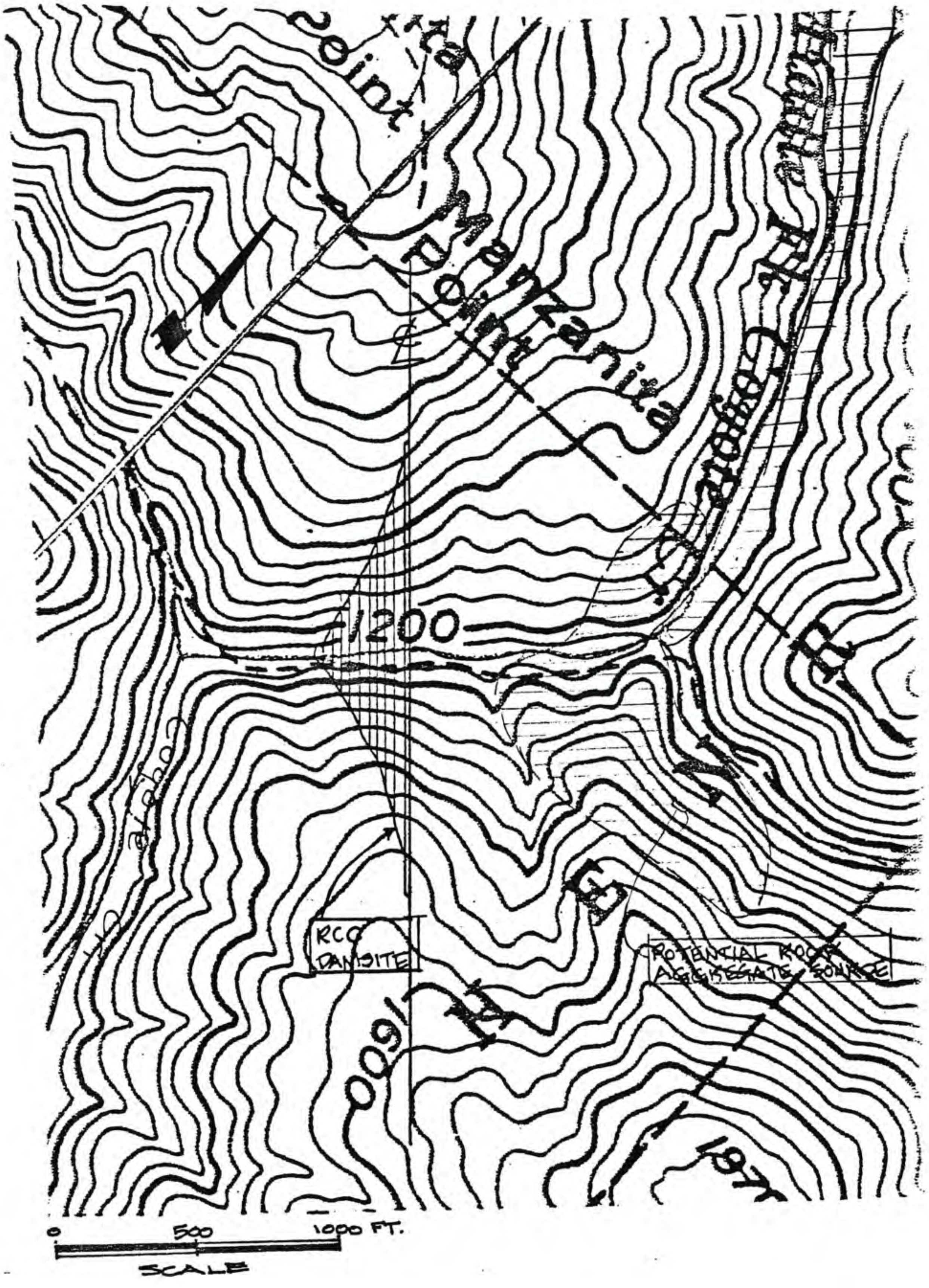
GENERAL GEOLOGIC MAP
COE DAMSITE

FIGURE 2-2



COE DAMSITE AND ROCK AGGREGATE SOURCE

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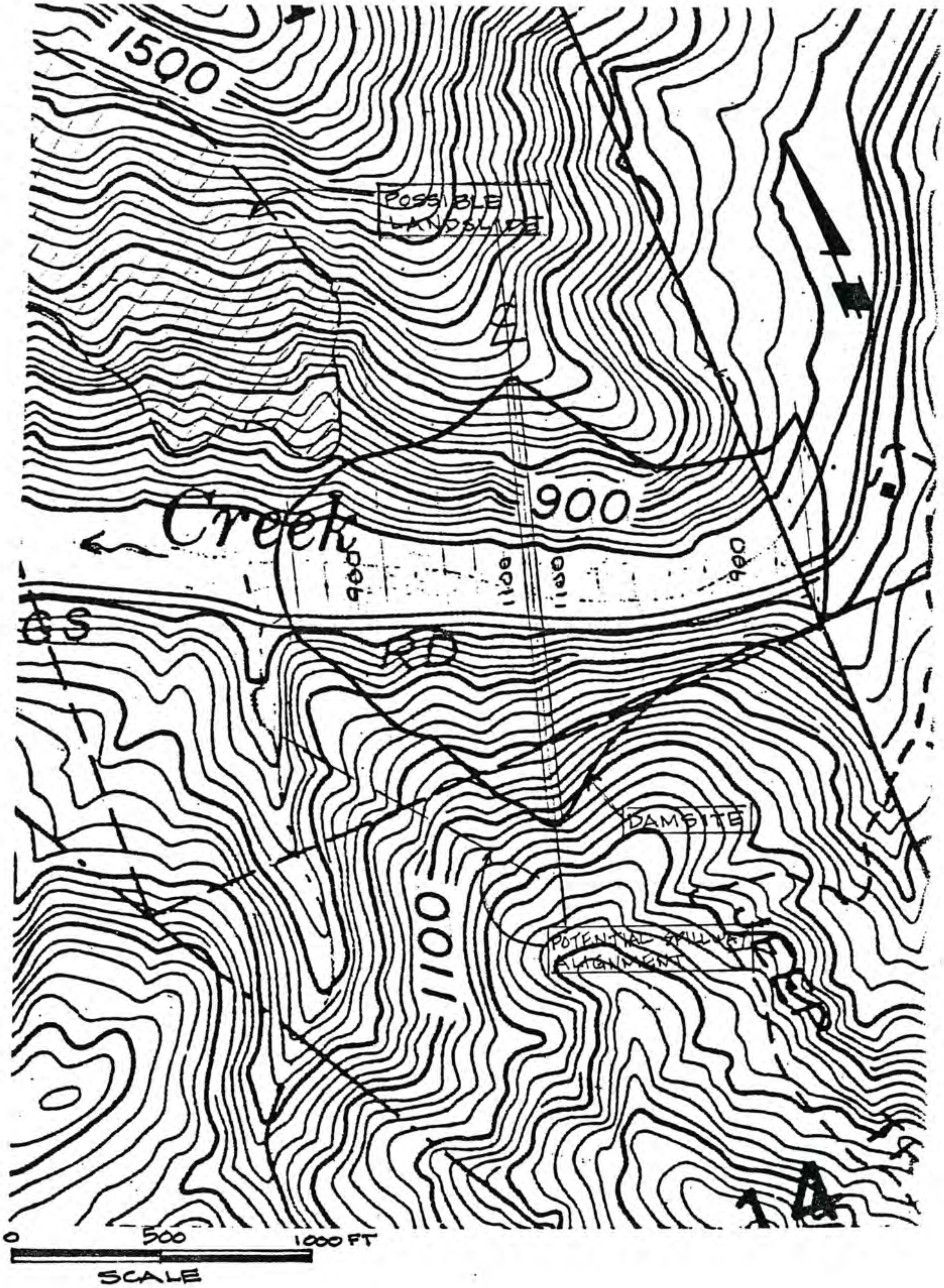
FIGURE 2-3



LOS OSOS DAMSITE

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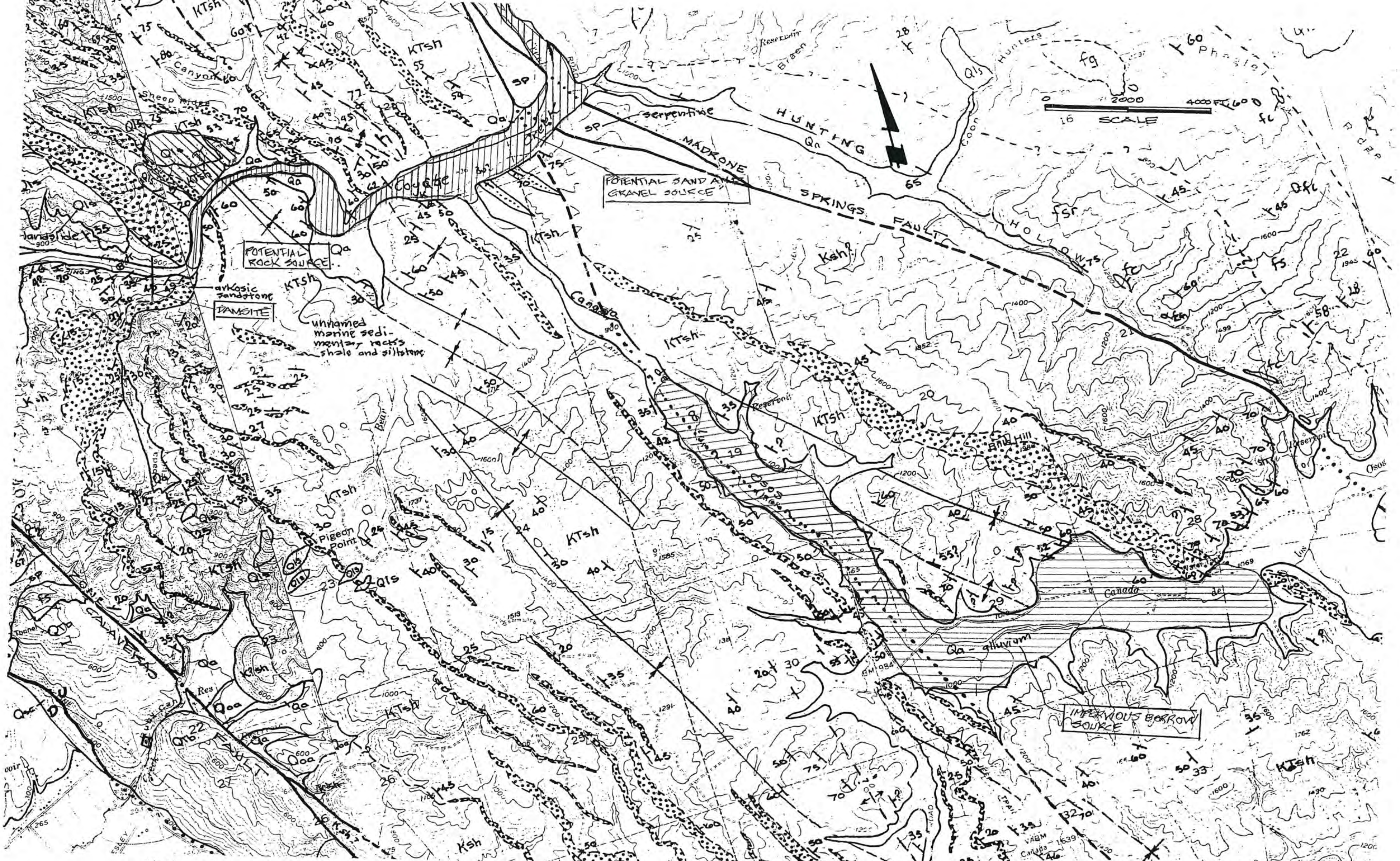
FIGURE 2-4



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Geologic Map from Dibblee 1973
Gilroy and Gilroy Hot Springs
Quadrangle.

GEOLOGIC AND GENERAL BORROW
LOCATION MAP- LOS OSOS DAMSITE
FIGURE 2-

Geologic map from Cotton, 1973.

REGIONAL GEOLOGIC MAP
CEDAR CREEK AND PACHECO
DAM SITES

WAHLER ASSOCIATES
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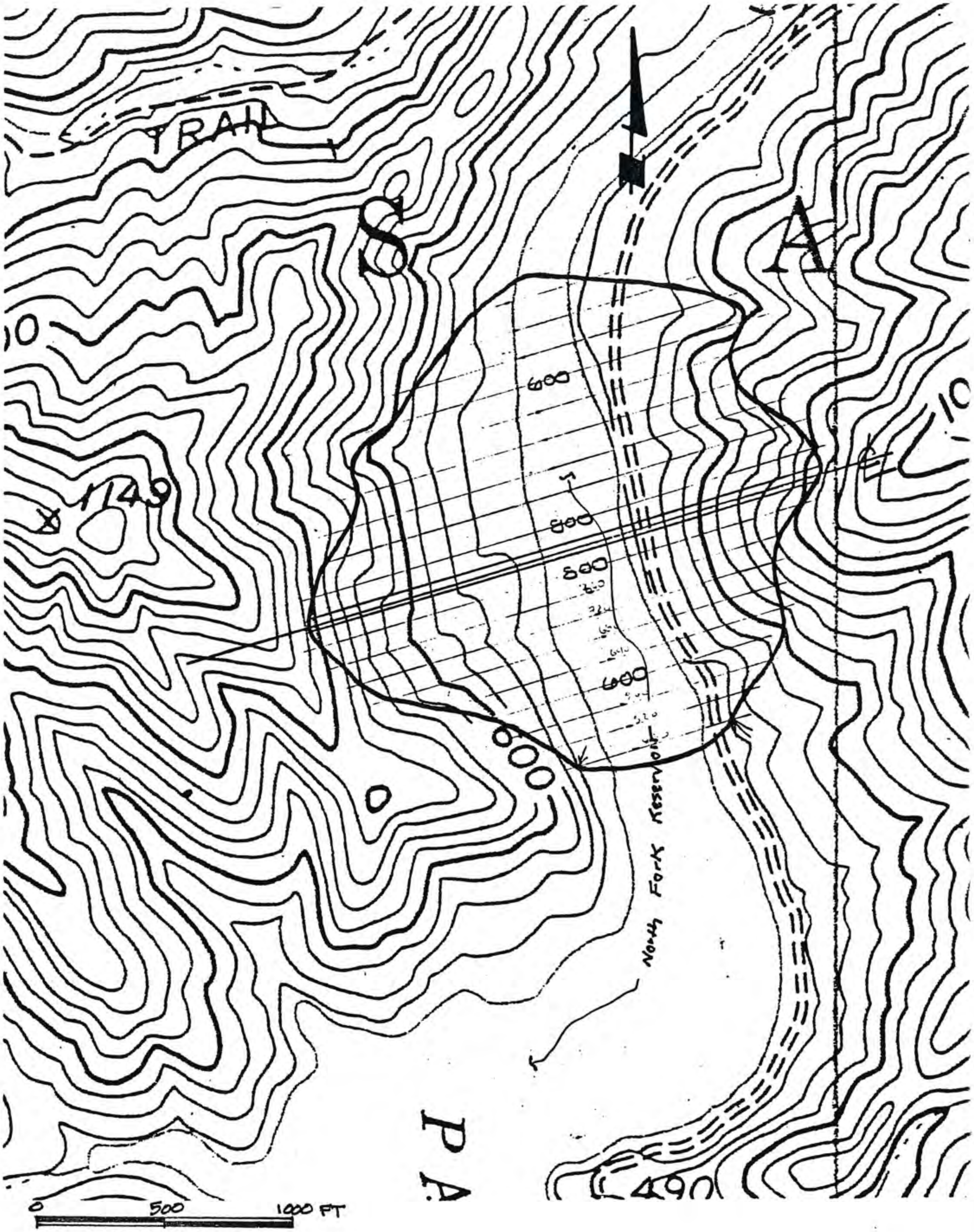
FIGURE 2-6



PACHECO "B" DAMSITE

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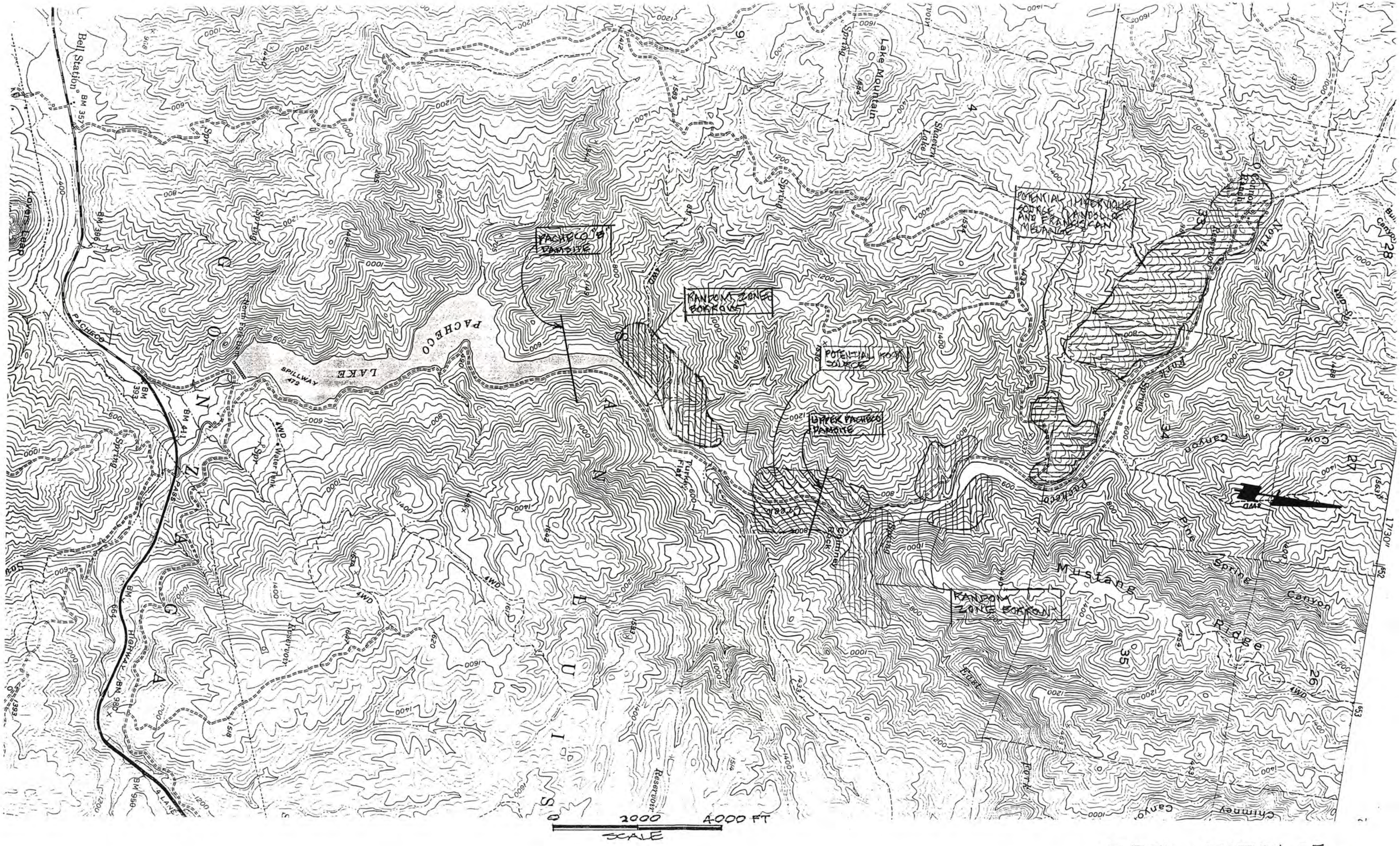
FIGURE 2-7



GENERAL LOCATION OF BORROW AREAS, PACHECO DAMSITES

FIGURE ?-8

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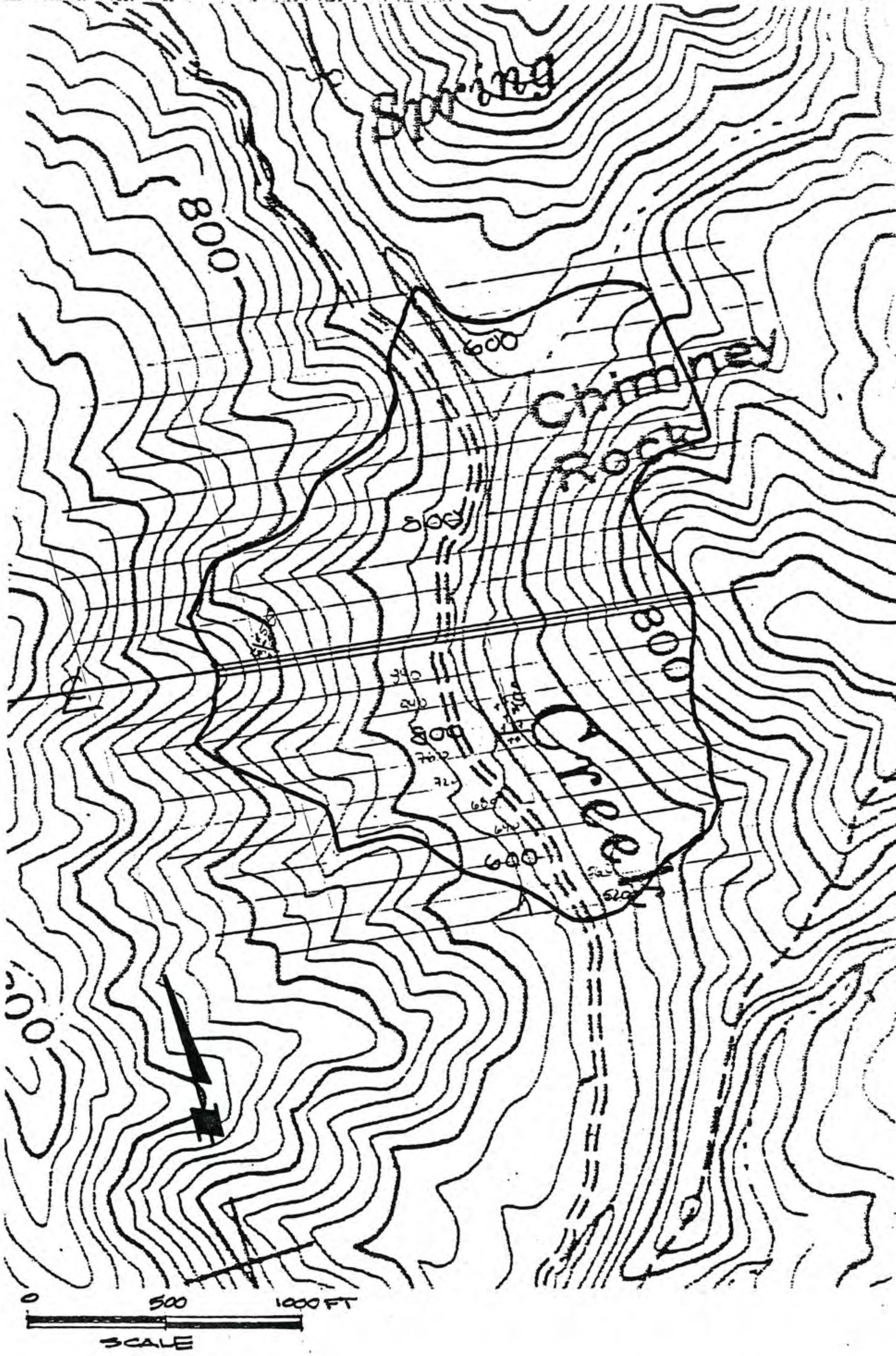

UPPER PACHECO DAMSITE

WAHLER ASSOCIATES
PROJ SCV 145A

FIGURE 2-9

APPENDIX 3

PROJECT COST ESTIMATES

COST ESTIMATE
PACKWOOD - DAM CREST ELEVATION 1,640
(200,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 12,000,000
Care of Water	1	Job	L.S.	1,000,000
Reservoir Clearing	1,500	Acres	$2,000.00	3,000,000
Foundation Excavation	4,134,000	C.Y.	3.00	12,402,000
Grout Curtain	130,000	C.Y.	25.00	3,250,000
Impervious Fill	10,316,000	C.Y.	5.00	51,580,000
Random Fill	23,631,000	C.Y.	6.00	141,786,000
Filter/Drain	1,650,000	C.Y.	26.50	43,725,000
Riprap/Bedding	984,000	C.Y.	46.00	45,264,000
Downstream Slope Protection	370,000	C.Y.	36.00	13,320,000
Spillway	1	Job	L.S.	6,850,000
Outlet Works	1	Job	L.S.	2,850,000
Pipelines	1	Job	L.S.	21,830,000
Pumping Stations	1	Job	L.S.	33,000,000
Access Roads	1	Job	L.S.	2,035,000
Allowance for Unlisted Items	1	Job	L.S.	4,000,000
		Estimated Construction Cost (1992 Dollars)		$397,892,000
		Contingencies @ 20%		79,578,000
		Engineering, Administration, Legal @ 15%		59,684,000
		Subtotal, Construction		537,154,000
		Rights-of-Way		12,204,000
		Acquisition Costs		2,441,000
		Contingencies @ 20%		2,441,000
		Subtotal, Rights-of-Way		17,086,000
		Total Cost		$554,240,000

COST ESTIMATE
PACKWOOD - DAM CREST ELEVATION 1,590
(140,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 12,000,000
Care of Water	1	Job	L.S.	1,000,000
Reservoir Clearing	1,200	Acres	$2,000.00	2,400,000
Foundation Excavation	3,078,000	C.Y.	3.00	9,234,000
Grout Curtain	104,000	C.Y.	25.00	2,600,000
Impervious Fill	6,780,000	C.Y.	5.00	33,900,000
Random Fill	15,257,000	C.Y.	6.00	91,542,000
Filter/Drain	1,279,000	C.Y.	26.50	33,894,000
Riprap/Bedding	199,000	C.Y.	46.00	9,154,000
Downstream Slope Protection	84,000	C.Y.	36.00	3,024,000
Spillway	1	Job	L.S.	6,850,000
Outlet Works	1	Job	L.S.	2,850,000
Pipelines	1	Job	L.S.	21,830,000
Pumping Stations	1	Job	L.S.	31,500,000
Access Roads	1	Job	L.S.	2,035,000
Allowance for Unlisted Items	1	Job	L.S.	3,000,000
			Estimated Construction Cost (1992 Dollars)	$266,813,000
			Contingencies @ 20%	53,363,000
			Engineering, Administration, Legal @ 15%	40,022,000
			Subtotal, Construction	360,198,000
			Rights-of-Way	10,044,000
			Acquisition Costs	2,009,000
			Contingencies @ 20%	2,009,000
			Subtotal, Rights-of-Way	14,062,000
			Total Cost	$374,260,000

COST ESTIMATE
PACKWOOD - DAM CREST ELEVATION 1,530
(80,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 12,000,000
Care of Water	1	Job	L.S.	1,000,000
Reservoir Clearing	1,000	Acres	$2,000.00	2,000,000
Foundation Excavation	2,129,000	C.Y.	3.00	6,387,000
Grout Curtain	63,000	C.Y.	25.00	1,575,000
Impervious Fill	3,908,000	C.Y.	5.00	19,540,000
Random Fill	8,587,000	C.Y.	6.00	51,522,000
Filter/Drain	866,000	C.Y.	26.50	22,949,000
Riprap/Bedding	131,000	C.Y.	46.00	6,026,000
Downstream Slope Protection	56,000	C.Y.	36.00	2,016,000
Spillway	1	Job	L.S.	6,850,000
Outlet Works	1	Job	L.S.	2,850,000
Pipelines	1	Job	L.S.	21,830,000
Pumping Stations	1	Job	L.S.	31,000,000
Access Roads	1	Job	L.S.	2,035,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
		Estimated Construction Cost (1992 Dollars)		$191,580,000
		Contingencies @ 20%		38,316,000
		Engineering, Administration, Legal @ 15%		28,737,000
		Subtotal, Construction		258,633,000
		Rights-of-Way		7,804,000
		Acquisition Costs		1,561,000
		Contingencies @ 20%		1,561,000
		Subtotal, Rights-of-Way		10,926,000
		Total Cost		$269,559,000

COST ESTIMATE
COE - DAM CREST ELEVATION 1,540
(300,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 5,000,000
Care of Water	1	Job	L.S.	2,000,000
Reservoir Clearing	3,000	Acres	$2,000.00	6,000,000
Foundation Excavation	227,000	C.Y.	10.00	2,270,000
Foundation Cleanup	23,000	C.Y.	40.00	920,000
Consolidation Grouting	103,000	L.F.	25.00	2,575,000
Grout Curtain	62,000	L.F.	50.00	3,100,000
Drain Holes	31,000	L.F.	40.00	1,240,000
RCC	1,292,000	C.Y.	35.00	45,220,000
Upstream Facing	351,000	S.F.	15.00	5,265,000
Drainage Gallery	1,600	L.F.	2,000.00	3,200,000
Spillway and Outlet Works	1	Job	L.S.	2,000,000
Pipelines	1	Job	L.S.	43,070,000
Pumping Stations	1	Job	L.S.	33,000,000
Access Roads	1	Job	L.S.	4,015,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
			Estimated Construction Cost (1992 Dollars)	$160,875,000
			Contingencies @ 20%	32,175,000
			Engineering, Administration, Legal @ 15%	24,131,000
			Subtotal, Construction	217,181,000
			Rights-of-Way	24,401,000
			Acquisition Costs	4,880,000
			Contingencies @ 20%	4,880,000
			Subtotal, Rights-of-Way	34,161,000
			Total Cost	$251,342,000

COST ESTIMATE
COE - DAM CREST ELEVATION 1,500
(200,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 5,000,000
Care of Water	1	Job	L.S.	2,000,000
Reservoir Clearing	2,200	Acres	$2,000.00	4,400,000
Foundation Excavation	175,000	C.Y.	10.00	1,750,000
Foundation Cleanup	18,000	C.Y.	40.00	720,000
Consolidation Grouting	81,000	L.F.	25.00	2,025,000
Grout Curtain	46,000	L.F.	50.00	2,300,000
Drain Holes	23,000	L.F.	40.00	920,000
RCC	869,000	C.Y.	35.00	30,415,000
Upstream Facing	262,000	S.F.	15.00	3,930,000
Drainage Gallery	1,000	L.F.	2,000.00	2,000,000
Spillway and Outlet Works	1	Job	L.S.	2,000,000
Pipelines	1	Job	L.S.	43,070,000
Pumping Stations	1	Job	L.S.	32,000,000
Access Roads	1	Job	L.S.	4,015,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
			Estimated Construction Cost (1992 Dollars)	$138,545,000
			Contingencies @ 20%	27,709,000
			Engineering, Administration, Legal @ 15%	20,782,000
			Subtotal, Construction	187,036,000
			Rights-of-Way	18,161,000
			Acquisition Costs	3,632,000
			Contingencies @ 20%	3,632,000
			Subtotal, Rights-of-Way	25,425,000
			Total Cost	$212,461,000

COST ESTIMATE
COE - DAM CREST ELEVATION 1,435
(100,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 5,000,000
Care of Water	1	Job	L.S.	2,000,000
Reservoir Clearing	1,400	Acres	$2,000.00	2,800,000
Foundation Excavation	128,000	C.Y.	10.00	1,280,000
Foundation Cleanup	14,000	C.Y.	40.00	560,000
Consolidation Grouting	61,000	L.F.	25.00	1,525,000
Grout Curtain	29,000	L.F.	50.00	1,450,000
Drain Holes	14,000	L.F.	40.00	560,000
RCC	582,000	C.Y.	35.00	20,370,000
Upstream Facing	179,000	S.F.	15.00	2,685,000
Drainage Gallery	1,000	L.F.	2,000.00	2,000,000
Spillway and Outlet Works	1	Job	L.S.	2,000,000
Pipelines	1	Job	L.S.	43,070,000
Pumping Stations	1	Job	L.S.	31,500,000
Access Roads	1	Job	L.S.	4,015,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
		Estimated Construction Cost (1992 Dollars)		$122,815,000
		Contingencies @ 20%		24,563,000
		Engineering, Administration, Legal @ 15%		18,422,000
		Subtotal, Construction		165,800,000
		Rights-of-Way		11,361,000
		Acquisition Costs		2,272,000
		Contingencies @ 20%		2,272,000
		Subtotal, Rights-of-Way		15,905,000
		Total Cost		$181,705,000

COST ESTIMATE
LOS OSOS - DAM CREST ELEVATION 1,140
(400,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 5,000,000
Care of Water	1	Job	L.S.	2,000,000
Reservoir Clearing	4,100	Acres	$2,000.00	8,200,000
Foundation Excavation	1,840,000	C.Y.	5.00	9,200,000
Grout Curtain	54,000	L.F.	25.00	1,350,000
Impervious Fill	4,871,000	C.Y.	6.00	29,226,000
Sand/Gravel Transition	2,486,000	C.Y.	10.00	24,860,000
Rockfill	2,486,000	C.Y.	8.00	19,888,000
Spillway	1	Job	L.S.	17,500,000
Outlet Works	1	Job	L.S.	3,000,000
Pipelines	1	Job	L.S.	12,390,000
Pumping Stations	1	Job	L.S.	24,500,000
Access Roads	1	Job	L.S.	1,265,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
			Estimated Construction Cost (1992 Dollars)	160,379,000
			Contingencies @ 20%	32,076,000
			Engineering, Administration, Legal @ 15%	24,057,000
			Subtotal, Construction	216,512,000
			Rights-of-Way	32,847,000
			Acquisition Costs	6,569,000
			Contingencies @ 20%	6,569,000
			Subtotal, Rights-of-Way	45,985,000
			Total Cost	$262,497,000

COST ESTIMATE
LOS OSOS - DAM CREST ELEVATION 1,125
(350,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 5,000,000
Care of Water	1	Job	L.S.	2,000,000
Reservoir Clearing	3,600	Acres	$2,000.00	7,200,000
Foundation Excavation	1,673,000	C.Y.	5.00	8,365,000
Grout Curtain	50,000	L.F.	25.00	1,250,000
Impervious Fill	4,445,000	C.Y.	6.00	26,670,000
Sand/Gravel Transition	2,281,000	C.Y.	10.00	22,810,000
Rockfill	2,281,000	C.Y.	8.00	18,248,000
Spillway	1	Job	L.S.	17,500,000
Outlet Works	1	Job	L.S.	3,000,000
Pipelines	1	Job	L.S.	12,390,000
Pumping Stations	1	Job	L.S.	24,000,000
Access Roads	1	Job	L.S.	1,265,000
Allowance for Unlimited Items	1	Job	L.S.	2,,000,000
		Estimated Construction Cost (1992 Dollars)		151,698,000
		Contingencies @ 20%		30,340,000
		Engineering, Administration, Legal @ 15%		22,755,000
		Subtotal, Construction		204,793,000
		Rights-of-Way		29,087,000
		Acquisition Costs		5,817,000
		Contingencies @ 20%		5,817,000
		Subtotal, Rights-of-Way		40,721,000
		Total Cost		$245,514,000

COST ESTIMATE
LOS OSOS - DAM CREST ELEVATION 1,090
(250,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 5,000,000
Care of Water	1	Job	L.S.	2,000,000
Reservoir Clearing	2,800	Acres	$2,000.00	5,600,000
Foundation Excavation	1,297,000	C.Y.	5.00	6,485,000
Grout Curtain	39,000	L.F.	25.00	975,000
Impervious Fill	3,276,000	C.Y.	6.00	19,656,000
Sand/Gravel Transition	1,691,000	C.Y.	10.00	16,910,000
Rockfill	1,691,000	C.Y.	8.00	13,528,000
Spillway	1	Job	L.S.	17,500,000
Outlet Works	1	Job	L.S.	3,000,000
Pipelines	1	Job	L.S.	12,390,000
Pumping Stations	1	Job	L.S.	22,500,000
Access Roads	1	Job	L.S.	1,265,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
			Estimated Construction Cost (1992 Dollars)	128,809,000
			Contingencies @ 20%	25,762,000
			Engineering, Administration, Legal @ 15%	19,321,000
			Subtotal, Construction	173,892,000
			Rights-of-Way	23,087,000
			Acquisition Costs	4,617,000
			Contingencies @ 20%	4,617,000
			Subtotals, Rights-of-Way	32,321,000
			Total Cost	$206,213,000

COST ESTIMATE
LOS OSOS - DAM CREST ELEVATION 1,045
(150,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 5,000,000
Care of Water	1	Job	L.S.	2,000,000
Reservoir Clearing	2,200	Acres	$2,000.00	4,400,000
Foundation Excavation	993,000	C.Y.	5.00	4,965,000
Grout Curtain	29,000	L.F.	25.00	725,000
Impervious Fill	2,148,000	C.Y.	6.00	12,888,000
Sand/Gravel Transition	1,121,000	C.Y.	10.00	11,210,000
Rockfill	1,121,000	C.Y.	8.00	8,968,000
Spillway	1	Job	L.S.	17,500,000
Outlet Works	1	Job	L.S.	3,000,000
Pipelines	1	Job	L.S.	12,390,000
Pumping Stations	1	Job	L.S.	21,500,000
Access Roads	1	Job	L.S.	1,265,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
			Estimated Construction Cost (1992 Dollars)	107,811,000
			Contingencies @ 20%	21,562,000
			Engineering, Administration, Legal @ 15%	16,172,000
			Subtotal, Construction	145,545,000
			Rights-of-Way	17,327,000
			Acquisition Costs	3,465,000
			Contingencies @ 20%	3,465,000
			Subtotal, Rights-of-Way	24,257,000
			Total Cost	$169,802,000

COST ESTIMATE
CEDAR CREEK- DAM CREST ELEVATION 785
(177,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 8,000,000
Care of Water	1	Job	L.S.	1,000,000
Reservoir Clearing	1,200	Acres	$2,000.00	2,400,000
Foundation Excavation	3,871,000	C.Y.	3.00	11,613,000
Grout Curtain	134,000	L.F.	25.00	3,350,000
Impervious Fill	4,950,000	C.Y.	7.00	34,650,000
Random Fill	23,784,000	C.Y.	6.00	142,704,000
Filter/Drain	884,000	C.Y.	25.50	22,542,000
Riprap/Bedding	184,000	C.Y.	46.00	8,464,000
Downstream Slope Protection	83,000	C.Y.	35.00	2,905,000
Spillway	1	Job	L.S.	8,450,000
Outlet Works	1	Job	L.S.	3,150,000
Pipelines	1	Job	L.S.	1,770,000
Pumping Stations	1	Job	L.S.	18,000,000
Access Roads	1	Job	L.S.	165,000
Allowance for Unlisted Items	1	Job	L.S.	3,000,000
		Estimated Construction Cost (1992 Dollars)		272,163,000
		Contingencies @ 20%		54,433,000
		Engineering, Administration, Legal @ 15%		40,824,000
		Subtotal, Construction		367,420,000
		Rights-of-Way		9,617,000
		Acquisition Costs		1,923,000
		Contingencies @ 20%		1,923,000
		Subtotal, Rights-of-Way		13,463,000
		Total Cost		$380,883,000

COST ESTIMATE
CEDAR CREEK - DAM CREST ELEVATION 730
(124,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 8,000,000
Care of Water	1	Job	L.S.	1,000,000
Reservoir Clearing	1,000	Acres	$2,000.00	2,000,000
Foundation Excavation	1,969,000	C.Y.	3.00	5,907,000
Grout Curtain	104,000	L.F.	25.00	2,600,000
Impervious Fill	2,499,000	C.Y.	7.00	17,493,000
Random Fill	16,346,000	C.Y.	6.00	98,076,000
Filter/Drain	787,000	C.Y.	25.50	20,069,000
Riprap/Bedding	137,000	C.Y.	46.00	6,302,000
Downstream Slope Protection	65,000	C.Y.	35.00	2,275,000
Spillway	1	Job	L.S.	8,450,000
Outlet Works	1	Job	L.S.	3,150,000
Pipelines	1	Job	L.S.	1,770,000
Pumping Stations	1	Job	L.S.	15,500,000
Access Roads	1	Job	L.S.	165,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
		Estimated Construction Cost (1992 Dollars)		194,757,000
		Contingencies @ 20%		38,951,000
		Engineering, Administration, Legal @ 15%		29,214,000
		Subtotal, Construction		262,922,000
		Rights-of-Way		7,937,000
		Acquisition Costs		1,587,000
		Contingencies @ 20%		1,587,000
		Subtotal, Rights-of-Way		11,111,000
		Total Cost		$274,033,000

COST ESTIMATE
CEDAR CREEK - DAM CREST ELEVATION 650
(67,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 8,000,000
Care of Water	1	Job	L.S.	1,000,000
Reservoir Clearing	700	Acres	$2,000.00	1,400,000
Foundation Excavation	1,304,000	C.Y.	3.00	3,912,000
Grout Curtain	73,000	L.F.	25.00	1,825,000
Impervious Fill	1,335,000	C.Y.	7.00	9,345,000
Random Fill	8,602,000	C.Y.	6.00	51,612,000
Filter/Drain	551,000	C.Y.	25.50	14,051,000
Riprap/Bedding	87,000	C.Y.	46.00	4,002,000
Downstream Slope Protection	40,000	C.Y.	35.00	1,400,000
Spillway	1	Job	L.S.	8,450,000
Outlet Works	1	Job	L.S.	3,150,000
Pipelines	1	Job	L.S.	1,770,000
Pumping Stations	1	Job	L.S.	13,500,000
Access Roads	1	Job	L.S.	165,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
		Estimated Construction Cost (1992 Dollars)		125,582,000
		Contingencies @ 20%		25,116,000
		Engineering, Administration, Legal @ 15%		18,837,000
		Subtotal, Construction		169,535,000
		Rights-of-Way		5,617,000
		Acquisition Costs		1,123,000
		Contingencies @ 20%		1,123,000
		Subtotal, Rights-of-Way		7,863,000
		Total Cost		$177,398,000

COST ESTIMATE
PACHECO B - DAM CREST ELEVATION 845
(400,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 6,000,000
Care of Water	1	Job	L.S.	3,000,000
Reservoir Clearing	3,700	Acre	$2,000.00	7,400,000
Foundation Excavation	1,852,000	C.Y.	5.00	9,260,000
Grout Curtain	87,000	L.F.	25.00	2,175,000
Impervious Fill	2,971,000	C.Y.	7.00	20,797,000
Random Fill	8,146,000	C.Y.	6.00	48,876,000
Rockfill	6,633,000	C.Y.	8.00	53,064,000
Filter/Drain	576,000	C.Y.	25.50	14,688,000
Spillway	1	Job	L.S.	14,500,000
Outlet Works	1	Job	L.S.	3,400,000
Pipelines	1	Job	L.S.	6,490,000
Pumping Stations	1	Job	L.S.	19,000,000
Access Roads	1	Job	L.S.	605,000
Demolition	1	Job	L.S.	1,000,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
		Estimated Construction Cost (1992 Dollars)		212,255,000
		Contingencies @ 20%		42,451,000
		Engineering, Administration, Legal @ 15%		31,838,000
		Subtotal, Construction		286,544,000
		Rights-of-Way		29,261,000
		Acquisition Costs		5,852,000
		Contingencies @ 20%		5,852,000
		Subtotal, Rights-of-Way		40,965,000
		Total Cost		$327,509,000

COST ESTIMATE
PACHECO B - DAM CREST ELEVATION 830
(350,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 6,000,000
Care of Water	1	Job	L.S.	3,000,000
Reservoir Clearing	3,400	Acres	$2,000.00	6,800,000
Foundation Excavation	1,790,000	C.Y.	5.00	8,950,000
Grout Curtain	82,000	L.F.	25.00	2,050,000
Impervious Fill	2,646,000	C.Y.	7.00	18,522,000
Random Fill	7,120,000	C.Y.	6.00	42,720,000
Rockfill	5,890,000	C.Y.	8.00	47,120,000
Filter/Drain	549,000	C.Y.	25.50	14,000,000
Spillway	1	Job	L.S.	14,500,000
Outlet Works	1	Job	L.S.	3,400,000
Pipelines	1	Job	L.S.	6,490,000
Pumping Stations	1	Job	L.S.	18,500,000
Access Roads	1	Job	L.S.	605,000
Demolition	1	Job	L.S.	1,000,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
			Estimated Construction Cost (1992 Dollars)	195,657,000
			Contingencies @ 20%	34,131,000
			Engineering, Administration, Legal @ 15%	29,349,000
			Subtotal, Construction	264,137,000
			Rights-of-Way	27,261,000
			Acquisition Costs	5,452,000
			Contingencies @ 20%	5,452,000
			Subtotal, Rights-of-Way	38,165,000
			Total Cost	$302,302,000

COST ESTIMATE
PACHECO B - DAM CREST ELEVATION 790
(250,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 6,000,000
Care of Water	1	Job	L.S.	3,000,000
Reservoir Clearing	2,700	Job	$2,000.000	5,400,000
Foundation Excavation	1,495,000	C.Y.	5.00	7,475,000
Grout Curtain	68,000	L.F.	25.00	1,700,000
Impervious Fill	2,101,000	C.Y.	7.00	14,707,000
Random Fill	5,690,000	C.Y.	6.00	34,140,000
Rockfill	4,668,000	C.Y.	8.00	37,344,000
Filter/Drain	470,000	C.Y.	25.50	11,985,000
Spillway	1	Job	L.S.	14,500,000
Outlet Works	1	Job	L.S.	3,400,000
Pipelines	1	Job	L.S.	6,490,000
Pumping Stations	1	Job	L.S.	17,000,000
Access Roads	1	Job	L.S.	605,000
Demolition	1	Job	L.S.	1,000,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
		Estimated Construction Cost (1992 Dollars)		166,746,000
		Contingencies @ 20%		33,349,000
		Engineering, Administration, Legal @ 15%		25,012,000
		Subtotal, Construction		225,107,000
		Rights-of-Way		21,661,000
		Acquisition Costs		4,332,000
		Contingencies @ 20%		4,332,000
		Subtotal, Rights-of-Way		30,325,000
		Total Cost		$255,432,000

COST ESTIMATE
PACHECO B - DAM CREST ELEVATION 740
(150,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 6,000,000
Care of Water	1	Job	L.S.	3,000,000
Reservoir Clearing	1,900	Acres	$2,000.00	3,800,000
Foundation Excavation	1,182,000	C.Y.	5.00	5,910,000
Grout Curtain	54,000	L.F.	25.00	1,350,000
Impervious Fill	1,442,000	C.Y.	7.00	10,094,000
Random Fill	3,840,000	C.Y.	6.00	23,040,000
Rockfill	3,186,000	C.Y.	8.00	25,488,000
Filter/Drain	388,000	C.Y.	25.50	9,894,000
Spillway	1	Job	L.S.	14,500,000
Outlet Works	1	Job	L.S.	3,400,000
Pipelines	1	Job	L.S.	6,490,000
Pumping Stations	1	Job	L.S.	16,000,000
Access Roads	1	Job	L.S.	605,000
Demolition	1	Job	L.S.	1,000,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
		Estimated Construction Cost (1992 Dollars)		132,571,000
		Contingencies @ 20%		26,514,000
		Engineering, Administration, Legal @ 15%		19,886,000
		Subtotal, Construction		178,971,000
		Rights-of-Way		15,421,000
		Acquisition Costs		3,084,000
		Contingencies @ 20%		3,084,000
		Subtotal, Rights-of-Way		21,589,000
		Total Cost		$200,560,000

COST ESTIMATE
UPPER PACHECO - DAM CREST ELEVATION 930
(350,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 6,000,000
Care of Water	1	Job	L.S.	2,000,000
Reservoir Clearing	2,600	Acres	$2,000.00	5,200,000
Foundation Excavation	1,544,000	C.Y.	5.00	7,720,000
Grout Curtain	72,000	L.F.	25.00	1,800,000
Impervious Fill	1,731,000	C.Y.	7.00	12,117,000
Random Fill	15,106,000	C.Y.	6.00	90,636,000
Filter/Drain	652,000	C.Y.	25.50	16,626,000
Riprap/Bedding	118,000	C.Y.	46.00	5,428,000
Downstream Slope Protection	54,000	C.Y	35.00	1,890,000
Spillway	1	Job	L.S.	16,150,000
Outlet Works	1	Job	L.S.	3,800,000
Pipelines	1	Job	L.S.	10,620,000
Pumping Stations	1	Job	L.S.	21,000,000
Access Roads	1	Job	L.S.	990,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
		Estimated Construction Cost (1992 Dollars)		203,977,000
		Contingencies @ 20%		40,795,000
		Engineering, Administration, Legal @ 15%		30,597,000
		Subtotal, Construction		275,369,000
		Rights-of-Way		20,579,000
		Acquisition Costs		4,116,000
		Contingencies @ 20%		4,116,000
		Subtotal, Rights-of-Way		28,811,000
		Total Cost		$304,180,000

COST ESTIMATE
UPPER PACHECO - DAM CREST ELEVATION 880
(250,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	$ 6,000,000
Care of Water	1	Job	L.S.	2,000,000
Reservoir Clearing	2,100	Acres	$2,000.00	4,200,000
Foundation Excavation	1,190,000	C.Y.	5.00	5,950,000
Grout Curtain	58,000	L.F.	25.00	1,450,000
Impervious Fill	1,213,000	C.Y.	7.00	8,491,000
Random Fill	10,420,000	C.Y.	6.00	62,520,000
Filter/Drain	535,000	C.Y.	25.50	13,643,000
Riprap/Bedding	89,000	C.Y.	46.00	4,094,000
Downstream Slope Protection	44,000	C.Y	35.00	1,540,000
Spillway	1	Job	L.S.	16,150,000
Outlet Works	1	Job	L.S.	3,800,000
Pipelines	1	Job	L.S.	10,620,000
Pumping Stations	1	Job	L.S.	19,000,000
Access Roads	1	Job	L.S.	990,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
		Estimated Construction Cost (1992 Dollars)		162,448,000
		Contingencies @ 20%		32,490,000
		Engineering, Administration, Legal @ 15%		24,367,000
		Subtotal, Construction		219,305,000
		Rights-of-Way		16,739,000
		Acquisition Costs		3,348,000
		Contingencies @ 20%		3,348,000
		Subtotal, Rights-of-Way		23,435,000
		Total Cost		$242,740,000

COST ESTIMATE
UPPER PACHECO - DAM CREST ELEVATION 820
(150,000 ACRE-FEET)

Item	Estimated Quantity	Unit	Unit Price	Estimated Cost
Mobilization	1	Job	L.S.	6,000,000
Care of Water	1	Job	L.S.	2,000,000
Reservoir Clearing	1,600	Acres	$2,000.00	3,200,000
Foundation Excavation	846,000	C.Y.	5.00	4,230,000
Grout Curtain	42,000	L.F.	25.00	1,050,000
Impervious Fill	746,000	C.Y.	7.00	5,222,000
Random Fill	6,233,000	C.Y.	6.00	37,398,000
Filter/Drain	417,000	C.Y.	25.50	10,634,000
Riprap/Bedding	63,000	C.Y.	46.00	2,898,000
Downstream Slope Protection	32,000	C.Y	35.00	1,120,000
Spillway	1	Job	L.S.	16,150,000
Outlet Works	1	Job	L.S.	3,800,000
Pipelines	1	Job	L.S.	10,620,000
Pumping Stations	1	Job	L.S.	18,000,000
Access Roads	1	Job	L.S.	990,000
Allowance for Unlisted Items	1	Job	L.S.	2,000,000
		Estimated Construction Cost (1992 Dollars)		125,312,000
		Contingencies @ 20%		25,062,000
		Engineering, Administration, Legal @ 15%		18,797,000
		Subtotal, Construction		169,171,000
		Rights-of-Way		12,499,000
		Acquisition Costs		2,500,000
		Contingencies @ 20%		2,500,000
		Subtotal, Rights-of-Way		17,499,000
		Total Cost		$186,670,000

APPENDIX 4

CONVEYANCE FACILITIES, SPILLWAYS, AND ACCESS ROAD COST BACKUP

APPENDIX 4

CONVEYANCE FACILITIES, SPILLWAYS, and ACCESS ROAD COST BACK-UP

SANTA CLARA VALLEY WATER DISTRICT

PRELIMINARY RESERVOIR STUDY

I. INTRODUCTION

A. STUDY OBJECTIVES

The intent of this appendix is to provide a preliminary appraisal of the conveyance facilities, spillways, and access roads needed for six potential dam and reservoir sites selected for study by the Santa Clara Valley Water District (SCVWD) in the Mount Hamilton Range. This appendix does NOT address the cost of the dams themselves. The six potential dam sites were selected from a preliminary screening process performed by SCVWD, as reported in Water Supply Master Plan Report, Preliminary Evaluation of Alternative Dam and Reservoir Sites, August 1991. The new reservoirs would be used to store excess imported water from the Pacheco/Santa Clara Conduit which would be available during "wet years" to supplement SCVWD supplies during "dry years."

Accompanying the project descriptions for each site in Section II, are preliminary gross cost estimates for these facilities. The costs for the major pumping and pipeline components, however, are also presented in the form of curves in Section I, as the size of these facilities will be dictated, in part, by the method of operation which will ultimately be selected by SCVWD. The curves will provide preliminary cost data that can be used by SCVWD to help shape the method of operation.

B. STUDY METHODS

1. Size and Cost Curves for Pumping Facilities

There are several variables which will affect the size and cost of the pumping and pipeline facilities required at each of the six reservoir sites. As shown on TABLE 1, each of the six dam sites is being evaluated for three or four different maximum reservoir elevations. Thus, each site has at least three different sets of conditions under which water must be delivered from the Pacheco/Santa Clara Conduit to the reservoir. In addition, for the Los Osos site, an alternative alignment for the pipeline supplying the reservoir was evaluated. The third major variable which will affect the size of facilities is the ultimate method of operation (e.g. peaking capacity). For example, based upon projections of excess water available, would it be more desirable to be able to fill the reservoir over one, two or more years?

Since there are so many variables for each of the potential dam sites and uncertainties associated with the operation of the facilities, this appendix provides curves and tables which cover the expected limits of size and operation. These tools will assist SCVWD staff in determining the most desirable method of operation for the proposed facilities, and thus the size and cost of those facilities.

The following is a summary of the table and curves provided in this appendix to assist in evaluating the size and cost of facilities:

a. **TABLE 1:** This table provides a summary of the alternatives evaluated for each of the six reservoir sites. Information on the table includes: maximum water surface elevation and/or high point of proposed pipeline route; reservoir invert; pipeline invert at point of proposed turnout from the Pacheco/Santa Clara Conduit; expected maximum and minimum values for the hydraulic grade line in the conduit at the proposed turnout; and length of proposed pipeline. This table can be used to determine the range of required pump station lift for each of the proposed alternatives.

b. **CURVE 1:** This curve provides optimum pipe size for a given flow rate. For preliminary cost estimating, an optimal head loss criterion of one foot per 1,000 feet of pipeline has been established to size pipe diameter based on peak flow rate. This criterion is established by totaling the present worth cost of pipe, pump station capacity and energy to overcome head loss due to pipe friction.

c. **CURVE 2:** This curve provides the required horsepower to deliver a given flow rate against the total head required. The total head can be determined by adding the required lift for a particular alternative given in TABLE 1, to the head loss produced by the desired flow rate in the optimum sized pipe. The pipeline curve (CURVE 1) is based upon a head loss of 1-foot per 1,000 feet of pipeline. Due to the wide range of possible operating criteria, this data is actually presented in three curves (2a, 2b, and 2c).

d. **CURVE 3:** This curve provides a unit cost for pipeline ($/foot of pipe) based upon the diameter determined from CURVE 1. In addition, the average annual maintenance costs in $ per foot of pipe is given.

e. **CURVE 4:** This curve provides a gross capital cost estimate for pumping facilities and power supply based upon the horsepower requirements determined from CURVE 2. The average annual maintenance costs are also presented. Again, as with Curve 2, Curve 4 is presented in multiple curves (4a and 4b) in order to cover the potential operating range of the various alternatives. (NOTE: Capital costs for pump/turbines would be higher than those supplied in these curves.)

f. **CURVE 5:** This curve presents the expected average annual energy costs, which are dependent upon the total annual pumping volume and the total head requirement. The unit power cost used in Curve 5 is $0.12 per kw-hr.

2. Size and Cost of Spillways

The required spillway size for each alternative was determined using rough estimates for spillway design flow based on nearby existing dams with drainage areas over one square-mile. TABLE 2 provides the spillway design flow and width, along with the estimated cost for each alternative. The costs will vary only slightly with reservoir elevations, thus only one set of estimates is presented.

3. Size and Cost of Outlet Works

The size and configuration of a dam's outlet works is dependent upon many variables, including: downstream fish flow requirements; water supply requirements; releases for hydro-electric power generation; and regulation of reservoir level for flood control purposes. At the present time, there are many uncertainties as to the release requirements for any of the alternatives being considered. Therefore, at the direction of SCVWD, a conservative estimate for outlet works requirements was made for this preliminary study.

The recently constructed multiple level intake and outlet works for Anderson Reservoir was used as a guide for estimating the needs for the various dam alternatives. The quantities and configuration for the Anderson project were adjusted for each of the six dam sites in the current study. In addition, the costs shown for the outlet works include an allowance for a solar / propane generator unit at the dam site. These units would provide power at the dam site for telemetry devices and for operation of the outlet valves and gates. Table 5 presents a summary of the Intake/Outlet Works costs for each of the dam sites.

4. Costs for Other Features Associated with Each Alternative

Table 3 provides costs for access road construction and right-of-way for each of the alternatives. A unit cost of $8,000 per acre, provided by SCVWD, was used to estimate right-of-way costs.

II. PROJECT DESCRIPTIONS and COST COMPARISONS

A. Packwood

The proposed turn-out from the Pacheco/Santa Clara Conduit for this alternative is at East Dunne Avenue near Morgan Hill. From the turn-out, the pipeline would run northeast along East Dunne Avenue, across Coyote Creek, continuing on East Dunne along Anderson Reservoir, over a ridge to the Packwood Creek Canyon. From this point the pipeline would follow the canyon up to the reservoir site.

Imported water stored under this alternative could be released either back through the conveyance pipeline or down Packwood Creek, which is a tributary to Anderson Reservoir. The fact that Packwood Creek is tributary to Anderson Reservoir provides additional reliability to the District's water supply in the event of failure of the Santa Clara Conduit at the Calaveras Fault during an earthquake. Water released downstream to Anderson Reservoir can be used to generate power at the existing hydro-electric plant, and can also be diverted through the Coyote Pumping Plant and Cross Valley Pipeline to Calero Reservoir. With the proposed pump station properly equipped, water released back through the pipeline could be used to generate supplemental peaking power for sale to P.G.& E. Water released through the pipeline could also be diverted through the Coyote Pumping plant and Cross Valley Pipeline to Calero Reservoir.

B. Coe

There are two turn-out and pipeline/access road alignments for this reservoir site.

1. Canyon Route: The proposed turn-out from the Pacheco/Santa Clara Conduit for this alternative is at Roop Road near the City of Gilroy. From the turn-out, the pipeline would follow Roop Road eastward to the upstream end of Coyote Reservoir, where it would turn and follow Gilroy Hot Springs Road up the Coyote Creek canyon to the proposed dam site.

Imported water stored under this alternative could be released either back through the conveyance pipeline or down Coyote Creek to Anderson Reservoir. The fact that the proposed Coe Reservoir would be on Coyote Creek, the major tributary to Anderson Reservoir, provides additional reliability to the District's water supply in the event of failure of the Santa Clara Conduit at the Calaveras Fault during an earthquake. Water released downstream to Anderson Reservoir can be used to generate power at the existing hydro-electric plant, and can also be diverted through the Coyote Pumping Plant and Cross Valley Pipeline to Calero Reservoir. With the proposed pump station properly equipped, water released back through the pipeline could be used to generate supplemental peaking power for sale to P.G.& E. Water released through the pipeline could also be diverted through the Coyote Pumping plant and Cross Valley Pipeline to Calero Reservoir.

2. Ridge Route: The proposed turn-out from the Pacheco/Santa Clara Conduit for this alternative is at East Dunne Avenue near Morgan Hill. From the turn-out, the pipeline would run northeast along East Dunne Avenue, across Coyote Creek near the upstream end of Anderson Reservoir. From this point, the pipeline would turn and follow Coyote Creek canyon upstream to Otis Canyon, running up Otis Canyon, over the ridge (Elev. 2,530 feet) to Rough Gulch Canyon. The pipe would follow Rough Gulch Canyon downstream to its confluence with Coyote Creek, where it would turn and follow the creek upstream to the proposed dam site.

Imported water stored under this alternative could only be released down Coyote Creek to Anderson Reservoir as the ridge elevation of 2,530 feet is higher than the maximum proposed reservoir elevation. Due to this constraint, and the enormous pumping station that would be required, this alternative has been eliminated from further consideration.

C. Los Osos

There are two turn-out and pipeline/access road alignments for this reservoir site. In addition, there is a third alternative for this site that would not require a conveyance system.

1. Canyon Route: The proposed turn-out from the Pacheco/Santa Clara Conduit for this alternative is at Roop Road near the City of Gilroy. From the turn-out, the pipeline would follow Roop Road eastward to the upstream end of Coyote Reservoir, where it would turn and follow Gilroy Hot Springs Road up the Coyote Creek canyon to the proposed dam site.

Imported water stored under this alternative could be released either back through the conveyance pipeline or down Coyote Creek to Anderson Reservoir. The fact that Los Osos Canyon is tributary to Anderson Reservoir provides additional reliability to the District's water supply in the event of failure of the Santa Clara Conduit at the Calaveras Fault during an earthquake. Water released downstream to Anderson Reservoir can be used to generate power at the existing hydro-electric plant, and can also be diverted through the Coyote Pumping Plant and Cross Valley Pipeline to Calero Reservoir. With the proposed pump station properly equipped, water released back through the pipeline could be used to generate supplemental peaking power for sale to P.G.& E. Water released through the pipeline could also be diverted through the Coyote Pumping plant and Cross Valley Pipeline to Calero Reservoir.

2. Ridge (Back) Route: The proposed turn-out from the Pacheco/Santa Clara Conduit for this alternative is approximately 10,000 feet west of the Pacheco Ranger Station along Highway 152. From the turn-out the pipeline and access road would follow an unnamed canyon over a ridge (Elev. 1,250 feet) to Cañada de Los Osos, which is a tributary to Coyote Creek and the proposed reservoir site.

Imported water stored under this alternative could be released down Coyote Creek to Anderson Reservoir. The fact that Los Osos Canyon is tributary to Anderson Reservoir provides additional reliability to the District's water supply in the event of failure of the Santa Clara Conduit at the Calaveras Fault during an earthquake. Water released downstream to Anderson Reservoir can be used to generate power at the existing hydro-electric plant, and can also be diverted through the Coyote Pumping Plant and Cross Valley Pipeline to Calero Reservoir. This alternative is unique from all of the others which are tributary to Anderson Reservoir in that it would provide a link between the Pacheco/Santa Clara Conduit and the SCVWD system *upstream* of the Conduit's crossing of the Calaveras Fault. This would provide an *additional* level of protection for the valley's water supply in the event of a major earthquake, since pumping from the conduit may still be possible.

3. No Conveyance Alternative: This alternative would involve the construction of the dam only at the Los Osos site, without a conveyance connection to the Pacheco/Santa Clara Conduit. The water stored at Los Osos under this alternative would be the locally generated flows from the upper Coyote Creek watershed. Preliminary calculations indicate that the average annual runoff for this watershed, upstream of the proposed Los Osos site would range between 12,000 and 15,000 acre-feet. Thus, between 12,000 and 15,000 acre-feet of additional volume would be available in Anderson Reservoir for the storage of excess imported water (through the Coyote Pumping Plant) on an average annual basis. The fact that Los Osos Canyon is tributary to Anderson Reservoir provides additional reliability to the District's water supply in the event of failure of the Santa Clara Conduit at the Calaveras Fault during an earthquake. Water released downstream to Anderson Reservoir can be used to generate power at the existing hydro-electric plant, and can also be diverted through the Coyote Pumping Plant and Cross Valley Pipeline to Calero Reservoir.

D. Cedar Creek

The proposed turn-out from the Pacheco/Santa Clara Conduit for this alternative is approximately 3,500 feet west of Bell Station. From the turn-out, the pipeline would cross under Highway 152, and then the pipeline and access road would follow the Cedar Creek Canyon up to the proposed dam site.

Imported water stored under this alternative would be released back through the conveyance pipeline. With the pump station properly equipped, water released back through the pipeline could be used to generate supplemental peaking power for sale to P.G.& E. Water released through the pipeline could also be diverted through the Coyote Pumping plant and Cross Valley Pipeline to Calero Reservoir.

E. Pacheco 'B'

The proposed turn-out from the Pacheco/Santa Clara Conduit for this alternative is directly opposite Pacheco Canyon, approximately 500 feet south of Highway 152. From the turn-out, the pipeline would head toward Pacheco Canyon, under the highway. The access road and pipeline would then run up the canyon to the proposed dam site.

Imported water stored under this alternative would be released back through the conveyance pipeline. With the pump station properly equipped, water released back through the pipeline could be used to generate supplemental peaking power for sale to P.G.& E. Water released through the pipeline could also be diverted through the Coyote Pumping plant and Cross Valley Pipeline to Calero Reservoir.

F. Upper Pacheco (Chimney Rock)

The proposed turn-out from the Pacheco/Santa Clara Conduit for this alternative is directly opposite Pacheco Canyon, approximately 500 feet south of Highway 152. From the turn-out, the pipeline would head toward Pacheco Canyon, under the highway. The access road and pipeline would then run up the canyon to the proposed dam site.

Imported water stored under this alternative would be released back through the conveyance pipeline. With the pump station properly equipped, water released back through the pipeline could be used to generate supplemental peaking power for sale to P.G.& E. Water released through the pipeline could also be diverted through the Coyote Pumping plant and Cross Valley Pipeline to Calero Reservoir.

G. Spillways

1. General

As stated above, the required spillway size for each alternative was based on available data for nearby existing dams. At this preliminary study level, spillway design flow rates for existing nearby dams were obtained from the California Division of Safety of Dams (DSOD) and the Santa Clara Valley Water District.

Table 2 presents a summary of the flow rates, widths, and preliminary estimated costs for the various spillways.

2. Packwood

The proposed spillway for this site is located on the right (looking downstream) dam abutment. Starting from the crest, the main spillway chute would extend downslope for about 1,500', transitioning into a 600' long stilling basin, ending at the main creek channel.

3. Coe

Since a roller compacted concrete (RCC) dam is being proposed for this site, the spillway would be incorporated into the dam.

4. Los Osos

Due to a slide area identified on the right abutment, the spillway for this site is proposed to be on the left abutment. Starting from the crest, the main spillway chute would extend downslope around the embankment fill for about 1,850', where it would transition to a 600' long stilling basin back toward the creek.

5. Cedar Creek

Topographically, the left abutment would be the best location for a spillway at this site. However, due to a slide area identified on the left abutment, the spillway for this site is proposed to be on the right abutment. Beginning at the crest, the main spillway would extend 2,300' back toward the creek, ending in a 300' long stilling basin. Due to the close proximity of Highway 152 to the spillway terminus, if this site is selected, a careful hydraulic analysis will be crucial.

6. Pacheco 'B'

The proposed spillway for this site would begin on the right abutment. Beginning at the crest, the main spillway chute would extend about 1,900' downslope, terminating at a 300' long stilling basin, which enters the creek about 2,000' downstream of the embankment toe.

7. Upper Pacheco (Chimney Rock)

Since there are rock outcrops on the right abutment, the spillway proposed for this site is on the left embankment. Beginning at the crest, the main spillway chute would extend downslope for about 2,200 feet back toward the creek. The spillway would terminate in a 350' long stilling basin.

H. Conveyance System Costs

The cost associated with the conveyance system required to import water from the Pacheco/Santa Clara Conduit ranges from being a minor part of the total cost to being the major component of the total cost, depending upon the alternative. The major variables which impact the cost of the conveyance facilities are:

- **Total Head:** This consists of the head difference between the lowest expected head in the Conduit and the highest expected head in the reservoir (or the highest ridge elevation that the pipeline must cross, whichever is higher) plus the head-loss expected in the conveyance pipeline. The total head requirement and flow rate determine the size of the pumping facilities.

- **Flow rate:** The flow rate assumed will determine the pipe size of the conveyance facilities, as well as the head loss component of the Total Head.

- **Length of Pipeline:** The length of pipeline will also effect the head loss component of the Total Head.

For the purposes of the cost comparisons presented in this report, it has been assumed that the conveyance facilities would be sized for 270 cubic-feet-per-second (cfs). This flow rate corresponds to the maximum amount of excess water expected to be available from the Pacheco/Santa Clara Conduit during the winter months (16,473 acre-feet in December). This assumed flow rate, combined with the required head and pipeline lengths for each alternative provide the necessary information to size and estimate capital costs of the conveyance facilities. The annual energy costs were based upon pumping 45,513 acre-feet of water per year, which is the expected average annual excess volume.

TABLE 4 presents a cost comparison of the seven basic alternatives using the above stated assumptions. Values are provided for each of the proposed reservoir elevations.

NOTE: All costs contained in this Appendix have been adjusted to the June 1992 ENR Index level of 6262.

I. Drainage Basin Yield

The table below presents the *estimated* values for the drainage area, probable maximum flood (PMF) flow rate, as well as the annual yield for the tributary sub-basins to each reservoir alternative. The PMF values were used to size the spillways. The watershed yields can be used to estimate the amount of storage that will be needed to store the local basin runoff on an average annual basis.

RESERVOIR	ESTIMATED DRAINAGE AREA (sq.mi.)	ESTIMATED PMF (cfs)	ESTIMATED ANNUAL YIELD (ac-ft)
Packwood	7	5,000	1,500
Coe	26	15,000	6,000
Los Osos	46	30,000	12,000
Cedar Creek	13	10,000	3,000
Pacheco 'B'	63	30,000	15,000
Upper Pacheco	67	30,000	16,000

TABLE 1 SCVWD RESERVOIR STUDY ---- PIPELINE PARAMETERS

RESERVOIR	WSEL (ft)	RESERVOIR INVERT (ft)	PIPELINE INVERT (ft)	PIPELINE HGL (ft) HIGH	LOW	PIPELINE LENGTH (ft)
PACKWOOD	1510	1280	380.0	710	685	37,000
	1570	1280	380.0	710	685	37,000
	1620	1280	380.0	710	685	37,000
COE	1415	1150	315.3	478	469	73,000
(Canyon Route)	1480	1150	315.3	478	469	73,000
	1520	1150	315.3	478	469	73,000
LOS OSOS	1025	790	315.3	478	469	21,000
	1070	790	315.3	478	469	21,000
	1105	790	315.3	478	469	21,000
	1120	790	315.3	478	469	21,000
LOS OSOS (back)	(Ridge Elev. = 1,200')		260.1	598	570	23,000
CEDAR CREEK	630	360	260.3	610	587	3,000
	710	360	260.3	610	587	3,000
	765	360	260.3	610	587	3,000
PACHECO 'B'	720	440	260.5	612	598	11,000
	770	440	260.5	612	598	11,000
	810	440	260.5	612	598	11,000
	825	440	260.5	612	598	11,000
UPPER PACHECO	800	520	260.5	612	598	18,000
(Chimney Rock)	860	520	260.5	612	598	18,000
	910	520	260.5	612	598	18,000

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TABLE 2
SANTA CLARA VALLEY WATER DISTRICT RESERVOIR STUDY
COMPARISON OF SPILLWAY COSTS

Rev. 3 – 08/05/92
ENR = 6262

RESERVOIR ALTERNATIVE	EXCAVATION (cu.yds.)	EXCAVATION (1992 $)	CONCRETE (cu.yds.)	CONCRETE (1992 $)	TOTAL (1992 $)	SPILLWAY WIDTH	ESTIMATED DESIGN FLOW (cfs)
Packwood	200,000	$3,000,000	7,000	$3,850,000	$6,850,000	20–30'	5,000
Coe Canyon Route	SPILLWAY COSTS INCLUDED IN COST OF DAM						15,000
Los Osos Canyon	800,000	$12,000,000	10,000	$5,500,000	$17,500,000	100'	30,000
Cedar Creek	270,000	$4,050,000	8,000	$4,400,000	$8,450,000	30'	10,000
Pacheco 'B'	600,000	$9,000,000	10,000	$5,500,000	$14,500,000	100'	30,000
Upper Pacheco (Chimney Rock)	600,000	$9,000,000	13,000	$7,150,000	$16,150,000	100'	30,000

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TABLE 3
SANTA CLARA VALLEY WATER DISTRICT RESERVOIR STUDY
COMPARISON OF ACCESS ROAD COSTS

Rev. 07/27/92
ENR = 6262

RESERVOIR ALTERNATIVE	ACCESS ROAD LENGTH (feet)	CONSTRUCTION COST (June 1992 $)	RIGHT-OF-WAY COST (June 1992 $)	TOTAL COST (June 1992 $)
Packwood	37,000	$2,035,000	$203,500	$2,238,500
Coe Canyon Route	73,000	$4,015,000	$401,500	$4,416,500
Los Osos Canyon	21,000	$1,155,000	$115,500	$1,270,500
Los Osos (back)	23,000	$1,265,000	$126,500	$1,391,500
Cedar Creek	3,000	$165,000	$16,500	$181,500
Pacheco 'B'	11,000	$605,000	$60,500	$665,500
Upper Pacheco (Chimney Rock)	18,000	$990,000	$99,000	$1,089,000

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TABLE 4
SANTA CLARA VALLEY WATER DISTRICT RESERVOIR STUDY
PIPELINE AND PUMPING COSTS

Rev. 8/12/92
ENR = 6262

		Packwood	COE Canyon Rte	Los Osos	Los Osos (back)	Cedar Creek	Pacheco 'B'	Upper Pacheco (Chimney Rock)
Reservoir WSEL		1510	1415	1025	1,200	630	720	800
Turnout Elevation		380	315.3	315.3	260	260.3	260.5	260.5
Lift (feet)		1130	1099.7	709.7	939.9	369.7	459.5	539.5
Pipeline Length (feet)		37,000	73,000	21,000	23,000	3,000	11,000	18,000
Peak Flowrate (cfs)		270	270	270	270	270	270	270
Annual Pumpage (ac–ft)		45,513	45,513	45,513	45,513	45,513	45,513	45,513
Pipe Diameter (in)	curve 1	84	84	84	84	84	84	84
Total Head (feet)		1167	1173	731	963	373	471	558
Horsepower	curve 2	47,500	48,000	29,500	39,000	16,000	19,000	23,000
CAPITAL COSTS								
Pipeline	curve 3	$21,830,000	$43,070,000	$12,390,000	$13,570,000	$1,770,000	$6,490,000	$10,620,000
Pumping Station	curve 4	31,000,000	31,500,000	21,500,000	28,000,000	13,500,000	16,000,000	18,000,000
Total		$52,830,000	$74,570,000	$33,890,000	$41,570,000	$15,270,000	$22,490,000	$28,620,000
ANNUAL O&M COSTS								
Pipeline	curve 3	$109,150	$215,350	$61,950	$67,850	$8,850	$32,450	$53,100
Pump Station	curve 4	1,550,000	1,575,000	1,075,000	1,400,000	675,000	800,000	900,000
Power	curve 5	8,000,000	8,100,000	5,200,000	6,700,000	2,400,000	3,200,000	3,800,000
Total		$9,659,150	$9,890,350	$6,336,950	$8,167,850	$3,083,850	$4,032,450	$4,753,100
Storage Capacity		80k	100k	150k		67k	150k	150k

TABLE 4 (continued)
SANTA CLARA VALLEY WATER DISTRICT RESERVOIR STUDY
PIPELINE AND PUMPING COSTS

Rev. 8/12/92
ENR = 6262

		Packwood	COE Canyon Rte	Los Osos	Los Osos (back)	Cedar Creek	Pacheco 'B'	Upper Pacheco (Chimney Rock)
Reservoir WSEL		1570	1480	1070		710	770	860
Turnout Elevation		380	315.3	315.3		260.3	260.5	260.5
Lift (feet)		1190	1164.7	754.7		449.7	509.5	599.5
Pipeline Length (feet)		37,000	73,000	21,000		3,000	11,000	18,000
Peak Flowrate (cfs)		270	270	270		270	270	270
Annual Pumpage (ac-ft)		45,513	45,513	45,513		45,513	45,513	45,513
Pipe Diameter (in)	curve 1	84	84	84		84	84	84
Total Head (feet)		1227	1238	776		453	521	618
Horsepower	curve 2	49,500	50,000	31,000		18,500	21,500	25,000
CAPITAL COSTS								
Pipeline	curve 3	$21,830,000	$43,070,000	$12,390,000		$1,770,000	$6,490,000	$10,620,000
Pumping Station	curve 4	31,500,000	32,000,000	22,500,000		15,500,000	17,000,000	19,000,000
Total		$53,330,000	$75,070,000	$34,890,000		$17,270,000	$23,490,000	$29,620,000
ANNUAL O&M COSTS								
Pipeline	curve 3	$109,150	$215,350	$61,950		$8,850	$32,450	$53,100
Pump Station	curve 4	1,575,000	1,600,000	1,125,000		775,000	850,000	950,000
Power	curve 5	8,500,000	8,600,000	5,300,000		3,100,000	3,600,000	4,300,000
Total		$10,184,150	$10,415,350	$6,486,950		$3,883,850	$4,482,450	$5,303,100
		140k	200k	250k		124k	250k	250k

TABLE 4 (continued)
SANTA CLARA VALLEY WATER DISTRICT RESERVOIR STUDY
PIPELINE AND PUMPING COSTS

Rev. 8/12/92
ENR = 6262

		Packwood	COE Canyon Rte	Los Osos	Los Osos (back)	Cedar Creek	Pacheco 'B'	Upper Pacheco (Chimney Rock)
Reservoir WSEL		1620	1520	1105		765	810	910
Turnout Elevation		380	315.3	315.3		260.3	260.5	260.5
Lift (feet)		1240	1204.7	789.7		504.7	549.5	649.5
Pipeline Length (feet)		37,000	73,000	21,000		3,000	11,000	18,000
Peak Flowrate (cfs)		270	270	270		270	270	270
Annual Pumpage (ac-ft)		45,513	45,513	45,513		45,513	45,513	45,513
Pipe Diameter (in)	curve 1	84	84	84		84	84	84
Total Head (feet)		1277	1278	811		508	561	668
Horsepower	curve 2	53,000	53,000	34,000		22,000	24,000	28,000
CAPITAL COSTS								
Pipeline	curve 3	$21,830,000	$43,070,000	$12,390,000		$1,770,000	$6,490,000	$10,620,000
Pumping Station	curve 4	33,000,000	33,000,000	24,000,000		18,000,000	18,500,000	21,000,000
Total		$54,830,000	$76,070,000	$36,390,000		$19,770,000	$24,990,000	$31,620,000
ANNUAL O&M COSTS								
Pipeline	curve 3	$109,150	$215,350	$61,950		$8,850	$32,450	$53,100
Pump Station	curve 4	1,650,000	1,650,000	1,200,000		900,000	925,000	1,050,000
Power	curve 5	9,000,000	9,100,000	5,700,000		3,600,000	3,900,000	4,600,000
Total		$10,759,150	$10,965,350	$6,961,950		$4,508,850	$4,857,450	$5,703,100
		200k	300k	350k		177k	350k	350k

TABLE 4 (continued)
SANTA CLARA VALLEY WATER DISTRICT RESERVOIR STUDY
PIPELINE AND PUMPING COSTS

Rev. 8/12/92
ENR = 6262

		Packwood	COE Canyon Rte	Los Osos	Los Osos (back)	Cedar Creek	Pacheco 'B'	Upper Pacheco (Chimney Rock)
Reservoir WSEL				1120			825	
Turnout Elevation				315.3			260.5	
Lift (feet)				804.7			564.5	
Pipeline Length (feet)				21,000			11,000	
Peak Flowrate (cfs)				270			270	
Annual Pumpage (ac–ft)				45,513			45,513	
Pipe Diameter (in)	curve 1			84			84	
Total Head (feet)				826			576	
Horsepower	curve 2			34,500			24,500	
CAPITAL COSTS								
Pipeline	curve 3			$12,390,000			$6,490,000	
Pumping Station	curve 4			24,500,000			19,000,000	
Total				$36,890,000			$25,490,000	
ANNUAL O&M COSTS								
Pipeline	curve 3			$61,950			$32,450	
Pump Station	curve 4			1,225,000			950,000	
Power	curve 5			5,800,000			4,000,000	
Total				$7,086,950			$4,982,450	

TABLE 5
SANTA CLARA VALLEY WATER DISTRICT RESERVOIR STUDY
COMPARISON OF OUTLET WORKS COSTS

Rev: 08/05/92
ENR = 6262

RESERVOIR ALTERNATIVE	CONDUIT LENGTH (feet)	CONDUIT COST (1992 $)	CONCRETE VOLUME (cu. yds.)	CONCRETE COST (1992 $)	MISCELLANEOUS* COSTS (1992 $)	TOTAL COSTS (1992 $)
Packwood	2,700	$1,350,000	1,000	$500,000	$1,000,000	$2,850,000
Coe Canyon Route	1,000	$500,000	2,000	$1,000,000	$1,000,000	$2,500,000
Los Osos Canyon	2,500	$1,250,000	1,500	$750,000	$1,000,000	$3,000,000
Cedar Creek	2,800	$1,400,000	1,500	$750,000	$1,000,000	$3,150,000
Pacheco 'B'	2,800	$1,400,000	2,000	$1,000,000	$1,000,000	$3,400,000
Upper Pacheco (Chimney Rock)	3,600	$1,800,000	2,000	$1,000,000	$1,000,000	$3,800,000

* Miscellaneous Costs include trashracks, sluicegates, and other appurtenances.

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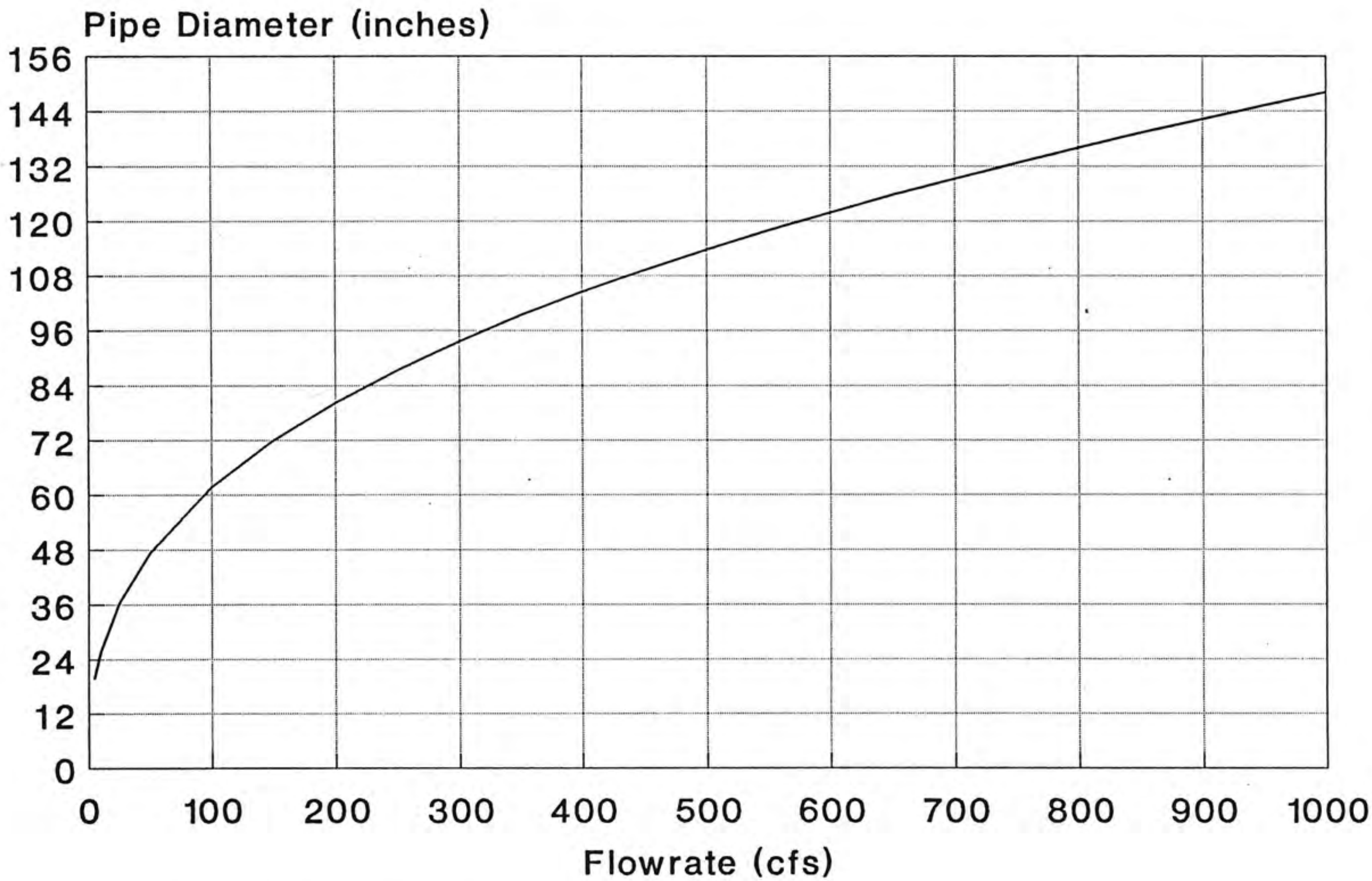
SCVWD Reservoir Study
PIPE SIZE

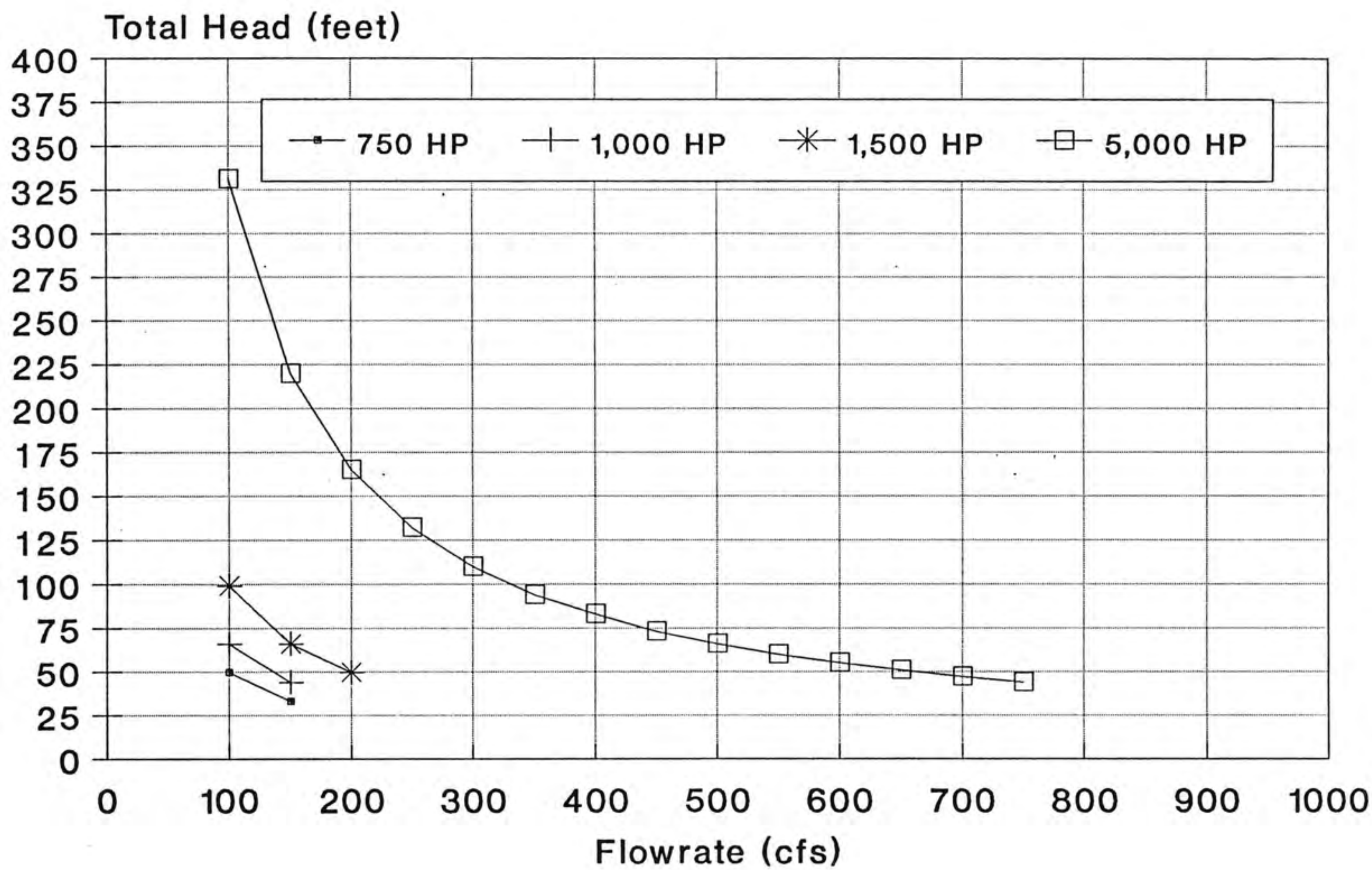
1



Note: Based on Head Loss of 1 ft/1000'

SCVWD Reservoir Study

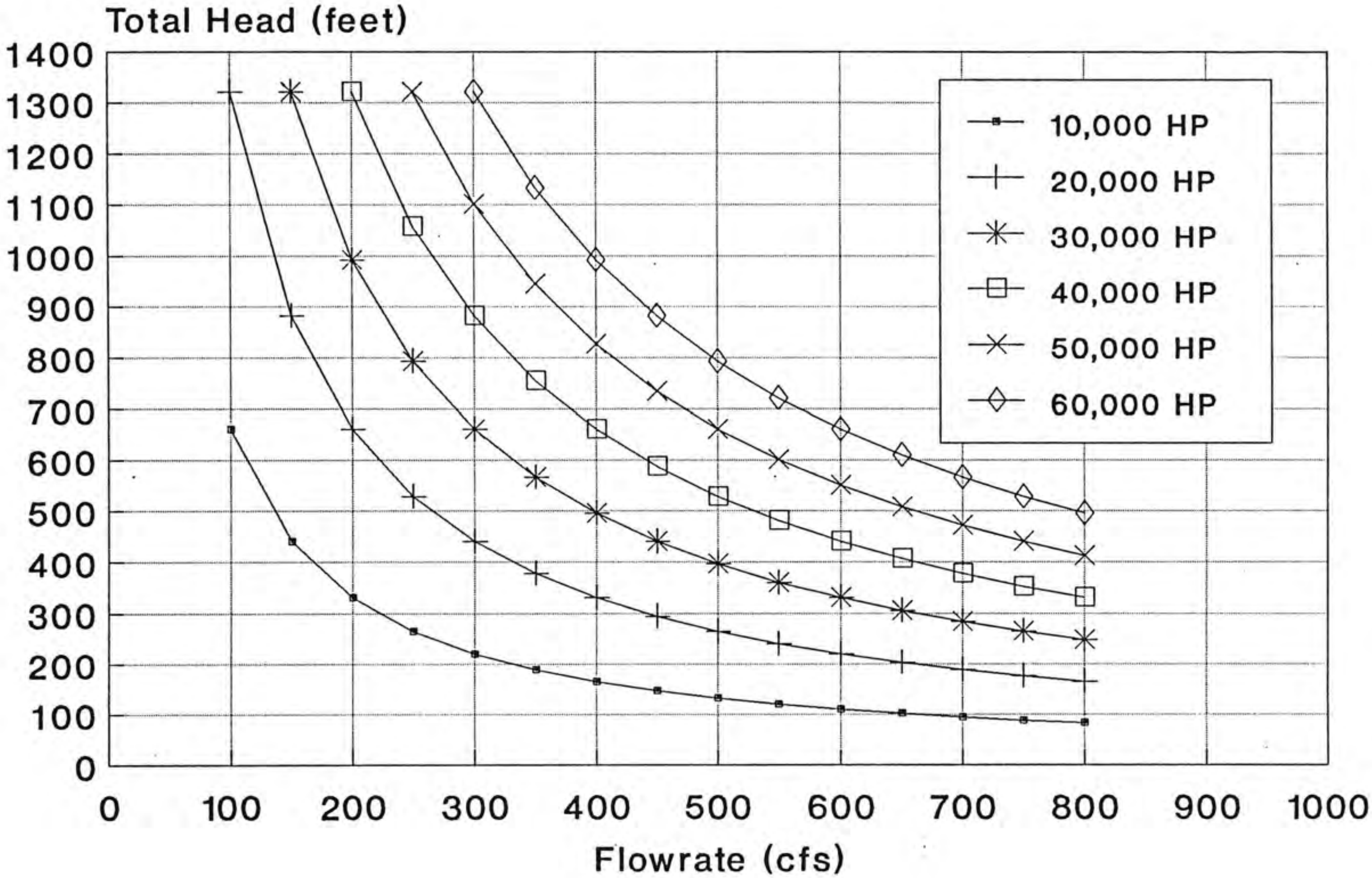
TOTAL HEAD VS. FLOWRATE



SCVWD Reservoir Study

TOTAL HEAD VS. FLOWRATE

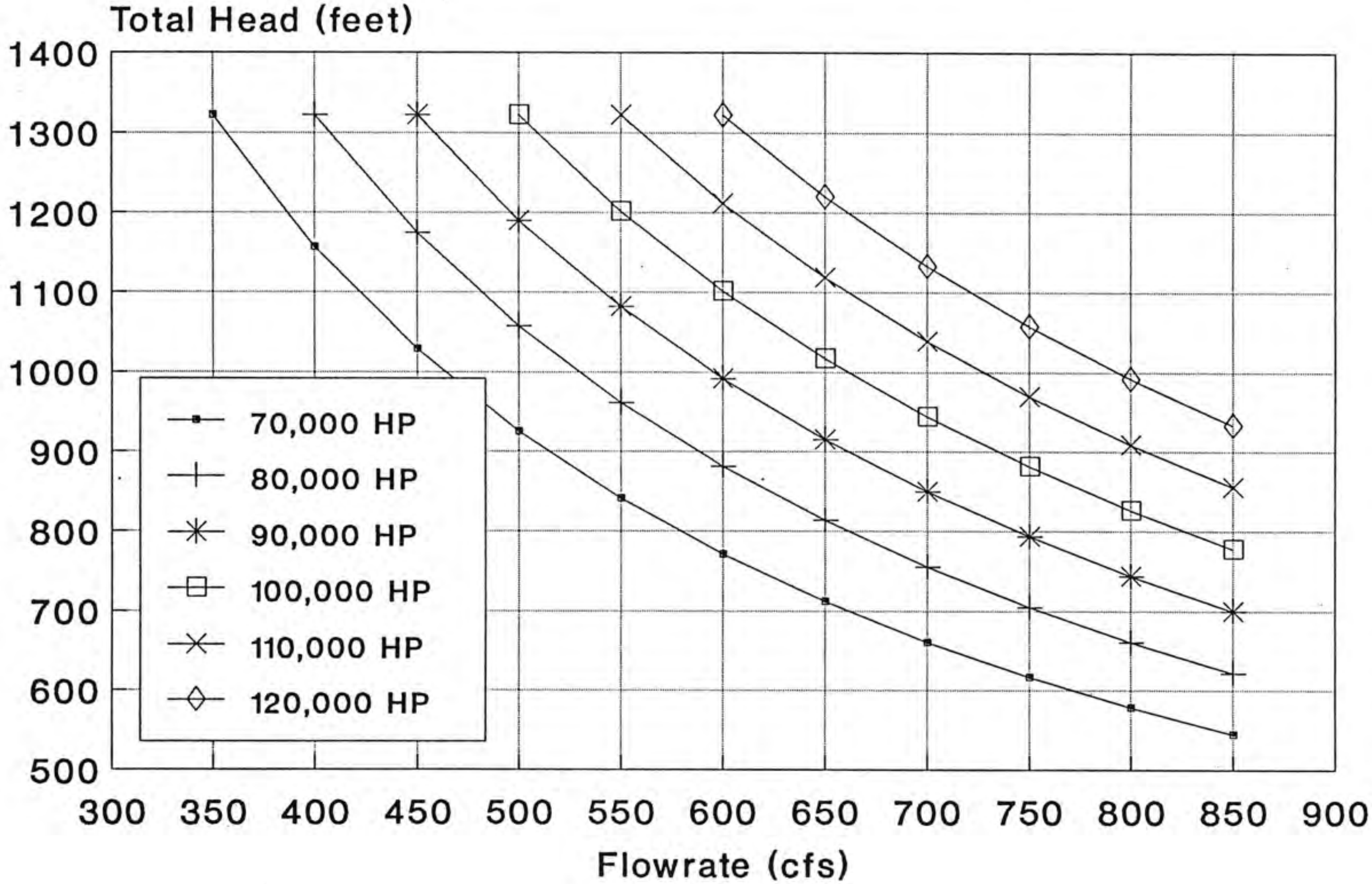
2B



SCVWD Reservoir Study

TOTAL HEAD VS. FLOWRATE

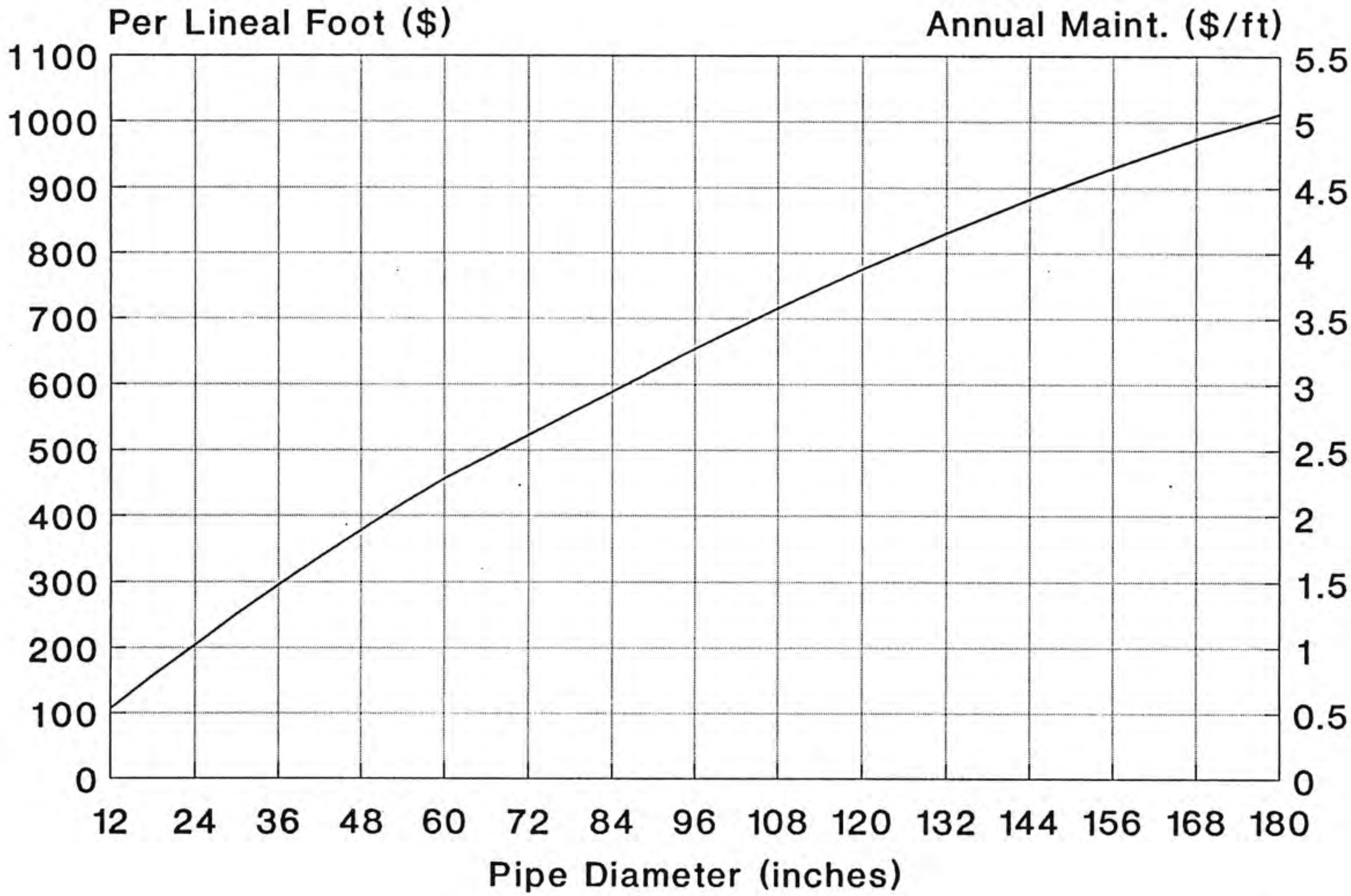
2C



SCVWD Reservoir Study

UNIT PIPE COST

3

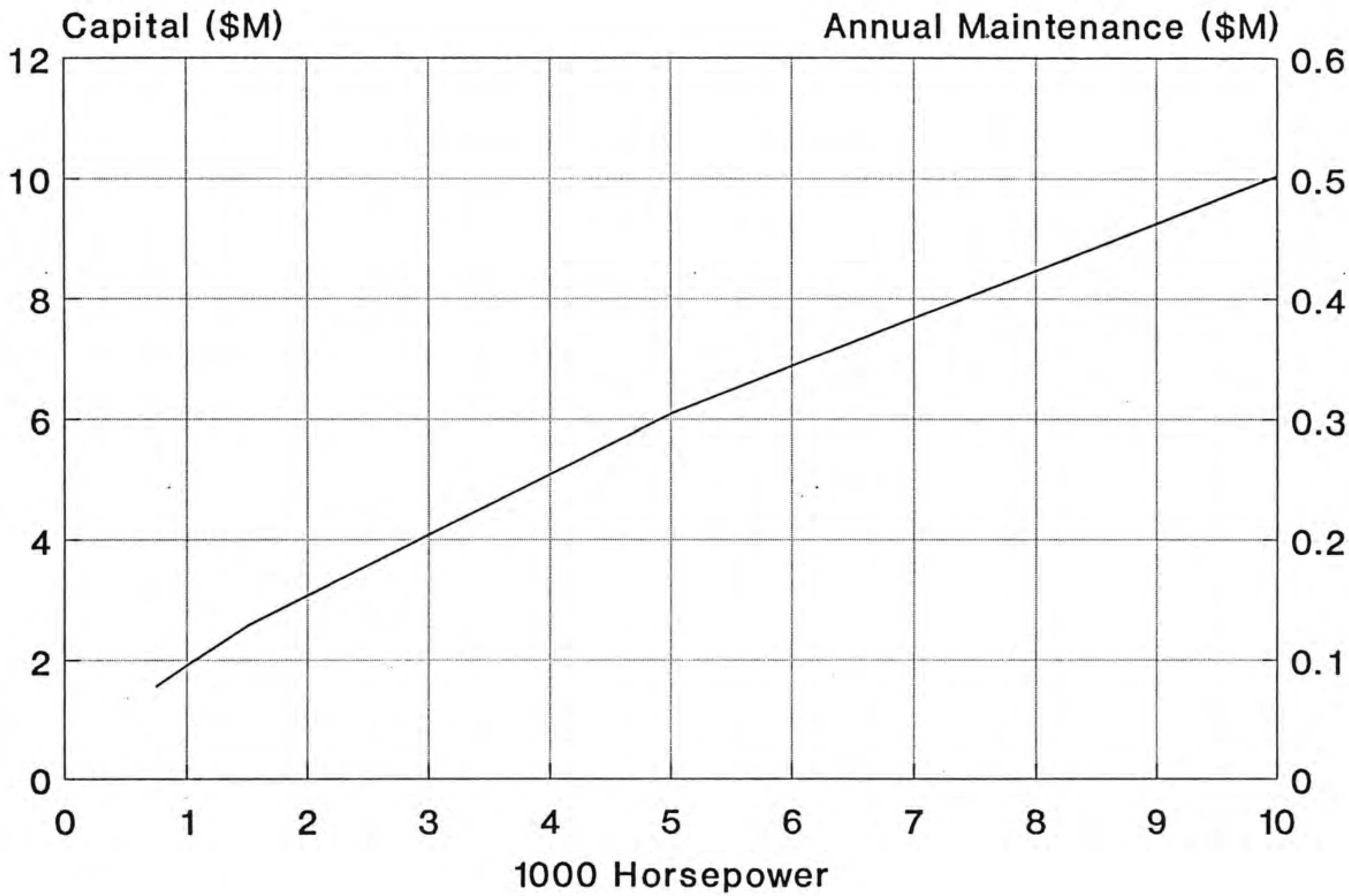


ENR - 6266

SCVWD Reservoir Study

PUMP STATION COST

4A

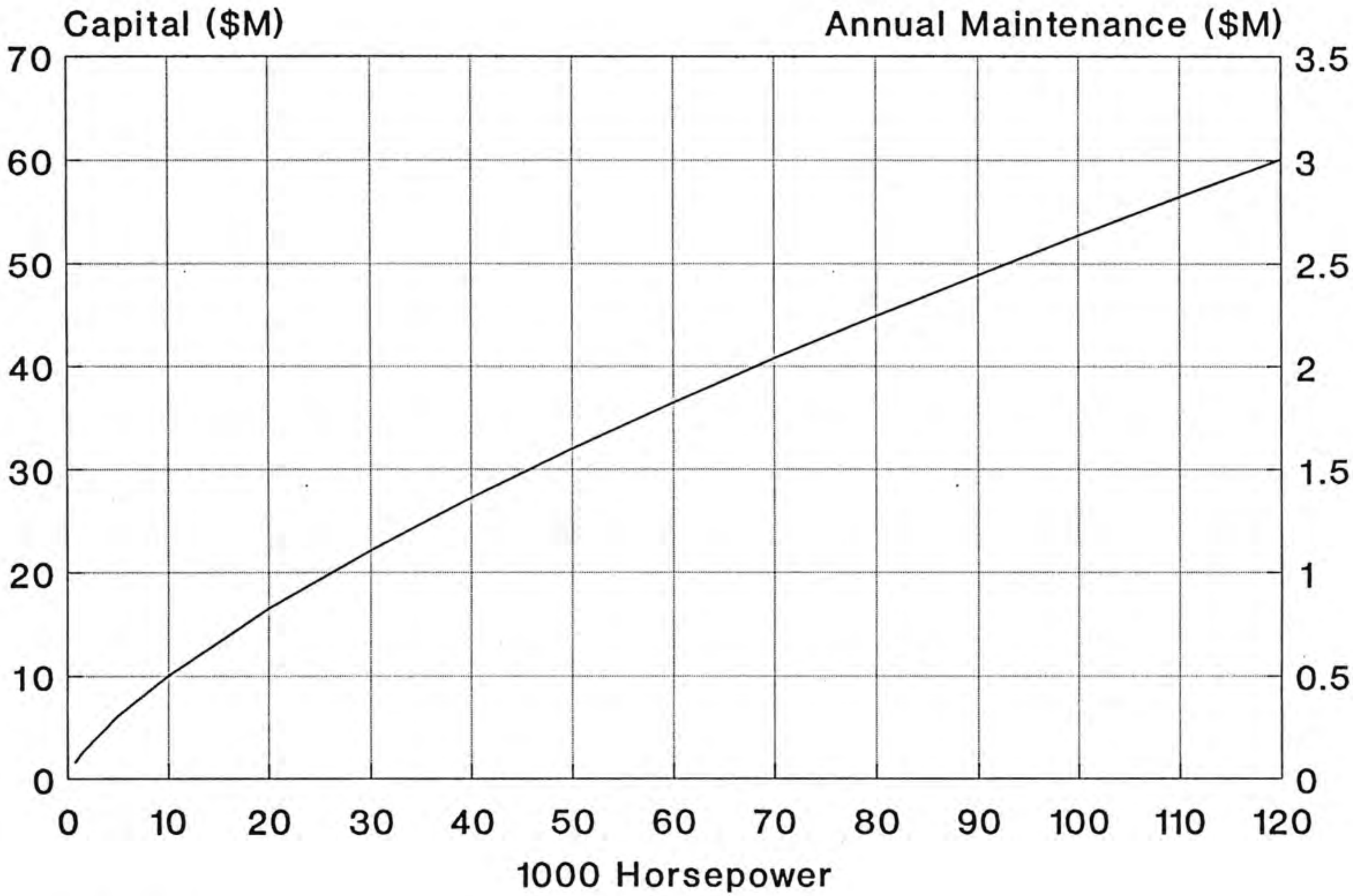


ENR = 6266

SCVWD Reservoir Study

PUMP STATION COST

4B



ENR - 6266

SCVWD Reservoir Study

ANNUAL PUMPING COSTS

$0.12 per kw-hr

5

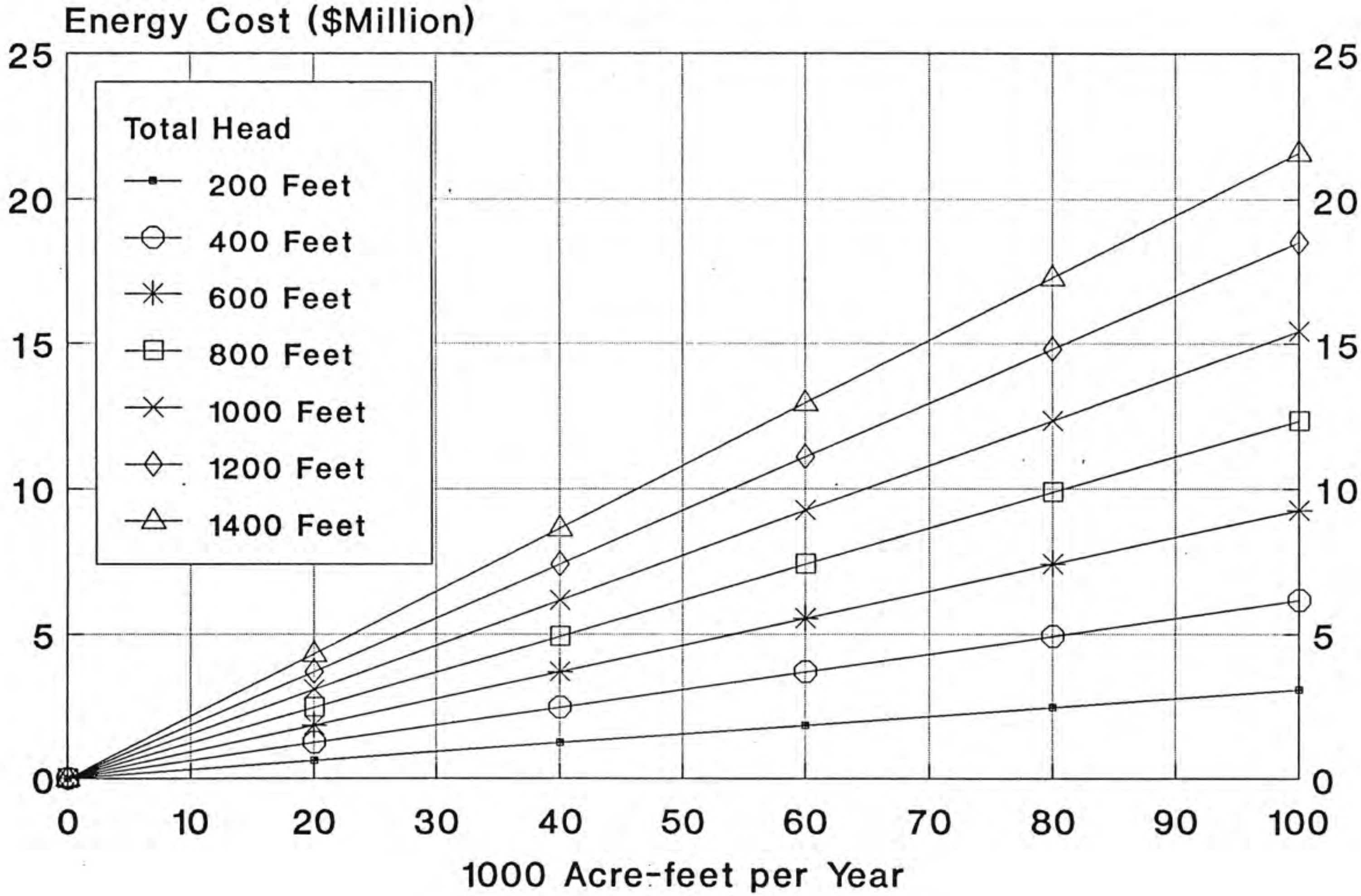


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Photo Source: Wahler Associates (1993)

Santa Clara Valley Water District
San Luis Reservoir
Low Point Improvement Project

Conceptual Alternative Summary:
Alternative #4C: New Dam and Reservoir at Pacheco Creek

DRAFT

August 2002

MWH
MONTGOMERY WATSON HARZA

Jones & Stokes

INTRODUCTION

This technical memorandum provides a description of Alternative #4C: New Dam and Reservoir at Pacheco Creek for the San Luis Reservoir Low Point Improvement Project. This description includes details about how the options address the low point problem and a summary of the advantages and disadvantages of the alternatives, including a brief analysis relative to the screening criteria.

General Alternative Description

Alternative 4C is a storage solution for the San Luis Reservoir low point problem. Contracted water could be pumped and stored in a new reservoir during wet seasons and released during dry seasons when the low point problem occurs.

Previous studies by the Santa Clara County Water District (District) have considered new reservoir options to capture more local flows, provide more storage capacity for existing contracted imported sources, or store future water transfers or recycled water. If a new reservoir is located near the San Felipe Project, additional surface storage could increase the District's ability to more efficiently utilize existing contract amounts of imported water.

In 1991 the District considered 13 sites for potential new in-county reservoirs. The sites were limited to southeast Santa Clara County because imported water from the San Felipe Project could be readily integrated with existing District reservoirs. This list was narrowed to 5 sites (Packwood, Coe, Los Osos, Cedar Creek, and Pacheco) because other sites lacked potential storage volume. At the time, these sites were considered "the only viable storage alternatives that might meet the District's needs". The District then commissioned a 1993 study by Wahler Associates to perform a reconnaissance-level study of the 5 alternative dam and reservoir sites selected by the District.

The 1993 Wahler study concluded that the Cedar Creek and Packwood sites are least desirable due to inefficient topography for reservoirs, near proximity of the Calaveras fault, and limited availability of construction materials. The Coe site was found to have efficient topography for a reservoir, but would require a long pipeline and the reservoir would be at higher elevation compared to other sites, requiring higher operations cost. For these reasons and the fact that the entire reservoir would be contained within Henry Coe State Park, the Coe site is considered technically infeasible.

The Los Osos site was considered to have, perhaps, the lowest cost of all alternatives for the dam itself and has some desirable features that enhance the overall reliability of the District's water delivery system. However, it would require major road relocation and is in close proximity to the Calaveras fault, which is somewhat mitigated by the availability of high quality construction materials.

The Pacheco A site (location of the existing North Fork Dam of Lake Pacheco) was eliminated from consideration due to geotechnical stability concerns of the left (south) abutment. The

Pacheco B and Upper Pacheco sites were found to be desirable sites due to efficient topography producing good storage capacity with reasonably sized dams, likely availability of good quality construction materials, and were the most distant sites from the Calaveras fault of all sites considered. Furthermore, the report stated that the Pacheco B site may have potentially better high quality rock than the Upper Pacheco site.

Given the reconnaissance level information provided in the Wahler (1993) report, the Cedar Creek, Packwood and Coe sites are not considered technically feasible (i.e., these sites do not advance past the pass/fail screening criteria). Therefore, only the Pacheco sites (Pacheco B and Upper Pacheco) and the Los Osos sites will be subjected to the concept level screening criteria. Because the Pacheco B site may have potentially better high quality rock than the Upper Pacheco site, the following discussions are based on consideration of a new dam and reservoir at the Pacheco B dam site. A separate technical memorandum addresses a new dam and reservoir on Coyote Creek at the Los Osos site.

Method of Addressing the Low Point Problem

Alternative 4C is a storage solution for the San Luis Reservoir low point problem. Contracted water could be pumped and stored in a new reservoir during wet seasons and released during dry seasons when the low point problem occurs, thereby bypassing San Luis Reservoir water containing high concentrations of algae.

Summary Preliminary Screening Criteria

The following table summarizes an analysis of this alternative relative to the preliminary screening criteria.

Criteria	Comments
Water Quality	Stores high quality water in a new reservoir, eliminating dependence on algae-laden water within San Luis Reservoir.
Water Supply Reliability	Provides a reliable high quality water source for the District and other San Felipe Division contractors.
Water Supply Flexibility	Frees up 200 thousand acre-feet (TAF) of storage in the San Luis Reservoir and provides additional operational flexibility to the Central Valley Project and the State Water Project. Also improves operational flexibility for the District's water allocation from the San Felipe Division.

Criteria	Comments
Environmental	Provides habitat for waterfowl, and may provide an additional water source to augment local stream flows and enhance aquatic resources.
Regional Benefits	Potential for expanding existing and creating new scenic and recreational benefits, including hiking, fishing, picnicking and boating. Creates opportunity for new hydropower generation facilities. Meets CALFED objectives and solves low point problem for all San Felipe Division contractors.
Economics	Present value capital cost is \$492 million Present value O&M cost is \$68 million Total present value cost is \$560 million
Schedule	Feasibility Studies, Pre-Design and EIR/EIS: 2002 - 2004 Design, Permitting and Associated Plans: 2004 - 2011 Construction: 2011 - 2014 Reservoir Filling and Start-Up: 2014 - 2016 On-Line: 2016
Project Risks	Geotechnical and permitting risks associated with building a new dam and reservoir in the Franciscan Assemblage in a seismically active region.

DESCRIPTION OF FACILITIES

Alternative 4C consists of construction of a new dam and reservoir in the Pacheco Creek valley, upstream of the existing North Fork Dam at the site referred to as "Pacheco B". The principal features of this alternative would include an embankment dam, spillway, outlet works, conveyance facilities, and a pumping-generating plant as described below. The general project layout is shown in Figures 1 through 3.

Water for the reservoir would be conveyed through a new pipeline connected to the existing Pacheco Conduit. A pumping-generating facility downstream of the dam would pump water from the existing Pacheco Conduit to the new reservoir in the wet season and would generate power when the water is released from the reservoir to the existing Pacheco Conduit in the dry season. Outlet works would serve to regulate releases of water impounded by the dam.

Storage Volume Required

The storage volume required to resolve the low point problem is currently estimated to be approximately 100 TAF. This volume is based upon a low point problem supply interruption for up to four months for the existing and future San Felipe Division contractors. This capacity will be refined through operational modeling to be conducted during the evaluation of the feasible alternatives. For a new storage reservoir, the total capacity required could be up to 150 TAF to allow for dead storage, local flood control, and other project purposes.

Dam, Inundation Area, and Watershed

The new Pacheco B Dam would be located about 1.5 miles upstream of the existing North Fork Dam near the upstream end of Lake Pacheco. The dam would be a zoned earthfill structure consisting of an impervious core, flanked by transition zones of random material and an outer shell of quarried rock fill. A vertical chimney drain at the downstream face of the core would be used to control seepage through the dam, connecting to a blanket drain beneath the downstream transition zone and outer shell materials. The rock fill outer shells would provide erosion protection.

Preliminary studies indicate that reservoir sizes ranging from 150 to 400 TAF are feasible at this site. The inundation area for a 150 TAF reservoir and watershed boundary are presented in Figure 2. The inundation map indicates that a reservoir with a total storage capacity of 150 TAF will have a maximum water surface area of approximately 1220 acres and a shoreline perimeter of approximately 32 miles. It is estimated that the upper reach of the proposed reservoir would extend into Henry Coe State Park approximately .25 mile along Pacheco Creek. The total watershed area is approximately 64 square miles, of which approximately 25 square miles are within the existing boundaries of Henry Coe State Park.

A plan view of the dam footprint and representative and cross section is shown in Figure 3. The dam embankment geometry is summarized in the table below.

Storage Capacity (TAF)	Maximum Water Surface Elevation (feet)	Dam Crest Elevation (feet)	Maximum Height of Structure[(a)] (feet)	Maximum Width of Structure[(b)] (feet)	Maximum Crest Length (feet)	Estimated Embankment Volume (Million cubic yards)
150	725	745	305	1670	1800	8.2

(a) Height of structure as referenced to bottom of existing Lake Pacheco channel at elevation 440 feet.
(b) Width of structure as measured along the existing Lake Pacheco channel axis.

Outlet Works

The outlet works for the dam would be located north of the left (east) abutment. During normal operations, the outlet works would divert water flow into a pipeline constructed between the proposed dam and the existing Pacheco Conduit. During emergency conditions, the outlet works would serve as an evacuation outlet for reservoir draw down. The outlet works would consist of an intake port system, discharge pipe, gatehouse, energy dissipation basin, and discharge channel.

A series of intake ports would be constructed along the reservoir bank at different depths to allow selective withdrawal of water at various depths within the reservoir. The ports would connect with an inclined pipe anchored to the reservoir bank that would lead to the discharge pipe. Each intake port would be equipped with a trash rack and isolation gate.

The discharge pipe would extend below the base of the dam. The upstream half of the discharge pipe would be a reinforced concrete pressurized pipe and the downstream half of the discharge pipe would include a steel liner. The gatehouse would be located at the downstream portal of the discharge pipe. The gatehouse would house a guard gate and a control gate. A steel pipe would branch from a square steel section between the guard gate and control gate. The normal reservoir release would be discharged through the branch pipe. This branch pipe would connect to a pump/powerhouse facility located downstream of the dam. This facility would pump water from the existing Pacheco Conduit to the reservoir and would generate power when water was released from the reservoir back to the Pacheco Conduit. Control valves would be installed in the branch line. A flow meter would also be installed in the branch line in order to measure normal reservoir releases.

A control gate would be installed downstream of the square steel section. The control gate would be closed during normal reservoir operation and would be opened to discharge water during emergency evacuation of the reservoir.

Several creeks deliver water into Pacheco Lake from the surrounding watershed. During dam construction, it would be necessary to divert the stream flow through the dam site. Implementation of a well-designed diversion plan will minimize serious potential flood damage to any work in progress. A temporary diversion conduit would be provided to join to the lower portion of the permanent outlet conduit. Permanent closure of the diversion inlet would be accomplished by placing a concrete plug immediately upstream of the junction between the diversion conduit and outlet conduit.

Spillway

Ample spillway capacity must be provided for earthfill dams to prevent overtopping. The designed spillway capacity is dependent upon the hazard classification of the dam. The hazard classification depends upon the reservoir storage and dam height, and the potential for downstream damage resulting from dam failure. When there is a risk for loss of life due to dam failure, the California Division of Safety of Dams (DSOD) and the Federal Energy Regulatory Commission (FERC) require that the highest hazard classification be assigned. While there is little development in Pacheco Canyon downstream of the proposed dam, State Route (SR) 152 is only about two miles downstream of the dam, and dam failure might result in the loss of life on SR 152. Consequently, the spillway for the proposed dam would most likely be designed to accommodate the probable maximum flood.

An uncontrolled ogee spillway would be excavated into the bedrock north of the right (west) abutment of the proposed dam. The spillway discharge would be aligned with the axis of Pacheco Creek where it discharges into the creek, approximately 1500 feet downstream of the dam. A reverse curve at the bottom of the spillway would turn the flow onto the apron of a stilling basin. The stilling basin would be located at the toe of the spillway to dissipate the energy during flood release. The flood release would discharge into the Pacheco Creek, which would be lined with riprap.

Conveyance Pipeline

A pipeline would be constructed to connect the existing Pacheco Conduit with a pumping-generating facility located downstream of the proposed Pacheco B Dam. The proposed pipeline would be approximately 10 feet in diameter and about 12,000 feet long with a design capacity of 490 cubic feet per second (cfs). This pipeline would deliver imported water from the Pacheco Conduit to the proposed reservoir for future release, and also would deliver the reservoir release to the Pacheco Conduit to increase the water deliveries to the Santa Clara Conduit during high water demand seasons. Figure 4 shows the hydraulic grade line (HGL) for this alternative.

A pump station would be required to pump the imported water from the Pacheco Conduit to the proposed reservoir for future release. Also, since the head difference between the proposed reservoir and the Pacheco Conduit is much larger than the friction losses in the proposed pipeline, an energy dissipation valve would be needed before the turnout to dissipate the extra head. Alternatively, a small hydropower unit could be installed to generate power during reservoir releases, as long as the reservoir water head exceeds the sum of the HGL at the turnout and pipeline friction losses.

LAND REQUIREMENTS

Land requirements for Alternative 4C were evaluated through review of aerial photographs, USGS topographic maps, and District GIS data. Review of the inundation area of the new reservoir (Figure 2) shows the water surface area to be approximately 1,220 acres for a 150 TAF reservoir. The watershed area is approximately 64 square miles, of which approximately 25 square miles is part of Henry Coe State Park. Therefore, approximately 39 square miles of rural ranch land would need to be purchased in order to restrict land use of the watershed area.

Downstream facilities (gatehouse, pipelines, energy dissipation basin, and discharge channel) will require land along the valley bottom below the proposed dam site, extending to the pipeline inter-tie with the USBR Pacheco Conduit. State, local municipal, and private lands that will be affected include, but are not necessarily limited to:

- The O'Connor Ranch;
- Henry W. Coe State Park;

- Pacheco Water District property containing the existing North Fork Dam and Pacheco Lake; and
- Miscellaneous features including off-road vehicle roads, ranch buildings and a water tank.

The feasibility of obtaining land and/or right-of-way agreements was evaluated based on the current site conditions. The District's ability to obtain land is for this alternative is favorable due to the following:

- The project area is rural and relatively uninhabited, being used largely as graze land
- There are few structures and utilities
- There are a limited number of property owners

However, some resistance from the property owners should be anticipated. Property owners may desire a higher than market property value or may want land replaced in a more desirable area. Nevertheless, land acquisition for this alternative is probable given the project location and current land use.

Outside of the dam and reservoir area, a permanent 50-foot easement would be required for pipelines. A 100-foot temporary easement would be required for construction.

CONSTRUCTABILITY

Key constructability issues include: 1) delineation of adequate borrow source(s) for construction of the low-permeability core for the dam; 2) assessment of the potential impact of existing landslides in reservoir inundation area; and 3) design, permitting, and construction of a new dam in the Franciscan Assemblage in a seismically active region. Additional discussion of constructability is provided in this section, including details of terrain, geologic and seismic conditions, and utilities.

Terrain

The Pacheco B dam site is located across a relatively narrow constriction of Lake Pacheco, about 1.5 miles upstream of the existing North Fork Dam. The estimated channel elevation at the proposed dam site is 440 feet and the channel section at the proposed dam site is approximately 300 feet wide. Both abutments of the planned dam are relatively steep, with slopes averaging 1.5:1 (horizontal to vertical), and both possess relatively level topographic benches near the base of each slope.. Vegetation consists primarily of annual grasses with scattered trees and local concentrations of trees and brush.

There is an existing dirt access along the east side of the Pacheco Creek and Lake area that provides a relatively accessible corridor to install a new pipeline to connect the Pacheco Conduit to the new Pacheco Reservoir.

Geology and Seismicity

Bedrock in the abutments consist of folded and sheared, somewhat metamorphosed interbedded greywacke sandstone, siltstone and shale of the Franciscan Assemblage. The need for foundation grouting is anticipated to seal fractures in the dam foundation prior to constructing the earthfill.

A few small landslides have been mapped in the dam site area, and numerous large landslides have been mapped on both sides of Pacheco Creek valley, upstream of the proposed dam site. Any landslides within the dam footprint or landslides that could slide into the new reservoir and cause a seiche that could overtop the dam will need to be excavated and removed prior to dam construction.

One of the major considerations that will determine the feasibility of a dam at this location is the local availability of fine-grained materials that may be used as the low-permeability core of the dam. The landslides in the area may provide the necessary fine-grained materials; however, these landslides will need to be investigated as part of feasibility studies to determine if adequate materials are available of the quality and quantity needed to construct a new dam.
There are no known active or significant inactive faults in proximity to the proposed dam site, although the Franciscan Assemblage is commonly much fractured and internally faulted. Active faults closest to the proposed dam site include the Ortigalita Fault (about 7 miles east), the Quien Sabe Fault (about 10 miles southwest), the Calaveras Fault (about 11 miles west-southwest), the Sargent Fault (about 16 miles southwest), and the San Andreas Fault (about 20 miles southwest). In general, ground shaking produced on the Calaveras Fault is expected to govern the seismic design of the dam. This fault is capable of producing a maximum credible earthquake of magnitude 7.0, which will produce strong ground shaking within the project area. The Pacheco B dam site is preferable to other dam sites considered in previous District studies from a seismic design standpoint because it is located furthest east from the Calaveras fault.

Utilities

Construction of pump stations and hydroelectric facilities will required installation of power transmission lines and a new substation.

ENVIRONMENTAL CONDITIONS, CONSTRAINTS, AND OPPORTUNITIES

The following sections present discussions of potential adverse environmental effects that could be causes by implementation of this alternative as well as discussion of mitigation measures to be considered.

Environmental Effects

This subsection provides a description of the potential environmental effect that may be anticipated as a result of construction and operation of Alternative 4C. In addition, a discussion of land use and sensitive resources is presented.

Construction. Potential effects associated with construction of the Pacheco Reservoir and associated infrastructure may include short-term increases in noise, ground-borne vibration, air emissions (e.g., particulate matter, NO_X, and CO), and energy consumption. It is anticipated that noise, ground-borne vibration, and emission effects would not be substantial because the construction footprint is located in an area that is largely undeveloped, and therefore does not support sensitive receptors.

Operations. Potential operations-related effects may include increases in noise, ground-borne vibration, air emissions (e.g., NO_X and CO), and energy consumption associated with operation of the dam and associated pumping facilities. It is anticipated that noise, ground-borne vibration, and emissions effects would not be substantial because the site is located in an area that is undeveloped, and therefore does not support sensitive receptors in close proximity to the construction footprint. Potential increases in noise, ground-borne vibration, and air emissions will vary based on the types of turbine pumps and motors (e.g., electrical or diesel) installed in the proposed pumping facilities. Energy consumption may be minimized by the installation of hydropower turbines in the proposed pumping facilities to generate electricity.

Land Use. The area proposed for the Pacheco Reservoir is designated by the Santa Clara County General Plan as Ranchlands and Existing Regional Park, and is generally used for cattle grazing. Construction of the reservoir would not result in a substantial conflict with the existing land use designations, and would not likely require an amendment to the Santa Clara County General Plan. However, the northern reach of the proposed reservoir is located within Henry Coe State Park. The proposed reservoir is inconsistent with the goals of the State Parks Department which calls for the preservation of the park as a wilderness area. Therefore, consultation with the State Parks Department during the reservoir planning and design process would be necessary to determine the feasibility of constructing a reservoir in this area.

Sensitive Resources. Implementation of this alternative may result in potential short-term adverse environmental effects on sensitive biological resources associated with construction of the reservoir and associated facilities, and potential long-term adverse environmental effects associated with operation of the dam and associated pumping facilities(Figures 5 and 6). The expanded reservoir would remove and/or degrade existing aquatic and oak woodland habitats that potentially support special-status species including California red-legged frog and California tiger salamander. Additionally, the upland habitats in the surrounding areas may support San Joaquin kit fox. Potential construction-related effects may include: temporary and/or permanent loss of habitat for plant and wildlife species; temporary disturbance (e.g., disruption of wildlife movement/migration, disruption of roosting, nesting, breeding, and foraging activities) of common and special-status wildlife species; direct mortality of common and special-status wildlife species; and temporary increase in erosion and runoff resulting in the degradation of water quality in adjacent waterways.

Potential operation-related effects on sensitive biological resources associated with this alternative include intermittent disturbance of wildlife roosting, nesting, foraging, breeding, and movement/migration activities associated with noise and ground-borne vibration. The level of disturbance will vary based on the types of turbine pumps and motors (e.g., electrical or diesel) installed in the proposed pumping facilities.

The proposed reservoir is located within an area that is known to support seven archeological sites. Additionally, construction of the proposed reservoir may degrade and/or disturb a number of ridges, knolls, drainages, ponds, and other physical features that are considered sensitive and likely to contain historical and/or archaeological resources. Therefore, construction of the proposed reservoir may disturb and/or degrade unknown archaeological and/or historical sites.

Mitigation Measures

A variety of best management practices (BMPs) and other measures may be incorporated into this alternative to avoid, minimize, and/or mitigate potential adverse effects. BMPs that may be incorporated to address construction-related effects may include:

- Siltation fences or other devices to control erosion,
- Construction activity timing to avoid key life history stages for wildlife,
- Pre-construction surveys for key species (e.g., San Joaquin kit fox, California red-legged frogs, and migratory birds),
- Wildlife exclusion fencing, and
- Pre-construction record searches and surveys for archaeological and historical sites.

Operation-related effects may be avoided and/or minimized by incorporating building materials and/or design features (e.g., trenches) that reduce noise, ground-borne vibration levels, and emissions on sensitive resources.

PERMITTING REQUIREMENTS

Permitting and compliance requirements for this alternative will be identified and refined through coordination with the following agencies:

- Environmental Protection Agency
- National Marine Fisheries Service
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- California Department of Fish and Game

- State Historic Preservation Office
- Regional Water Quality Control Board

At this time it is anticipated that implementation of this alternative may require compliance and/or permits associated with the following regulations:

- California Environmental Quality Act
- National Environmental Policy Act
- Clean Water Act Sections 401, 402, and 404
- National Historic Preservation Act 106
- National Pollutant Discharge Elimination System
- State and Federal Endangered Species Acts
- Migratory Bird Treaty Act
- Regional Water Quality Control Board Waste Discharge Permit
- Fish and Wildlife Service Coordination Act

INSTITUTIONAL

Implementation of this alternative would require reallocation of land use where the reservoir encroaches into a small portion of Henry Coe State Park.

PROJECT BENEFITS

This section presents a brief summary of proposed Alternative 4C as it applies to water quality, water supply reliability and flexibility, environmental enhancements, and regional benefits.

Water Quality

This alternative addresses the low point problem by storing high quality water in a new reservoir, eliminating dependence on algae-laden water within San Luis Reservoir during the period when the low point problem occurs.

Water Supply Reliability

This alternative solves the low point problem by providing a reliable source of water supply for the District and other San Felipe Division contractors. Water will be collected in the new reservoir during the winter months from: 1) pumping from San Luis Reservoir; and 2) runoff from the local watershed area. This water can then be released for use by the District and other San Felipe Division contractors, preventing interruption in the water supply to the San Felipe Division that is caused when the water level in the reservoir drops below the lower intake.

Water Supply Flexibility

Implementation of this alternative would free up 200 TAF of storage in the San Luis Reservoir, which may be used by SWP and CVP contractors south of the Delta. This alternative also provides additional operational flexibility to the District for use of allocated San Felipe Division water stored in the new reservoir.

Environmental Enhancement Opportunities

Implementation of this alternative would increase available habitat for waterfowl, and may provide an additional water source to augment local stream flows and enhance aquatic resources. The existing reservoir facility does not provide any recreational amenities. If the existing reservoir is retained, the project may provide both contact (e.g., swimming) and non-contact (e.g., boating) recreational opportunities. Additionally, other recreational opportunities may be provided on adjacent lands (e.g., hiking, nature viewing).

Regional Benefits

This alternative creates the potential for new scenic benefits of a new lake and new recreational benefits in the form of hiking trails, fishing, picnicking, and boating. These enhancements create opportunities for expanding the existing recreational benefits associated with Henry Coe State Park.

This alternative also develops the potential for hydropower generation from the reservoir releases, which may be sold on the open market in the dry season when power prices are high.

Finally, this alternative meets CALFED objectives and solves the low point problem for all San Felipe Division contractors.

COST ESTIMATES AND ECONOMICS

Capital costs are estimated at $694 million as shown on the attached table.

The present value capital and operation and maintenance (O&M) costs discounted to the base year (2002) are given below:

- Present value capital cost is $492 million
- Present value O&M cost is $68 million
- Total present value cost is $560 million

SCHEDULE

The design, permitting, land acquisition, environmental mitigation plans, and financial and institutional arrangements could require up to 7 years from 2004 to 2011. Construction is anticipated to take approximately 3 years from 2011 to 2014, and reservoir filling may take up to 2 years. Therefore, the estimated on-line date is 2016.

PROJECT RISKS

There are geotechnical risks associated with building a new dam and reservoir in the Franciscan Assemblage in a seismically active region, including existing landslides within the reservoir inundation area, lack of detailed knowledge at this time regarding the integrity of the dam foundation, and lack of knowledge at this time regarding availability of adequate fine-grained materials for construction of a low-permeability dam core. There are also risks associated with the complexity and probable legal challenges associated with permitting a new dam and reservoir in California.

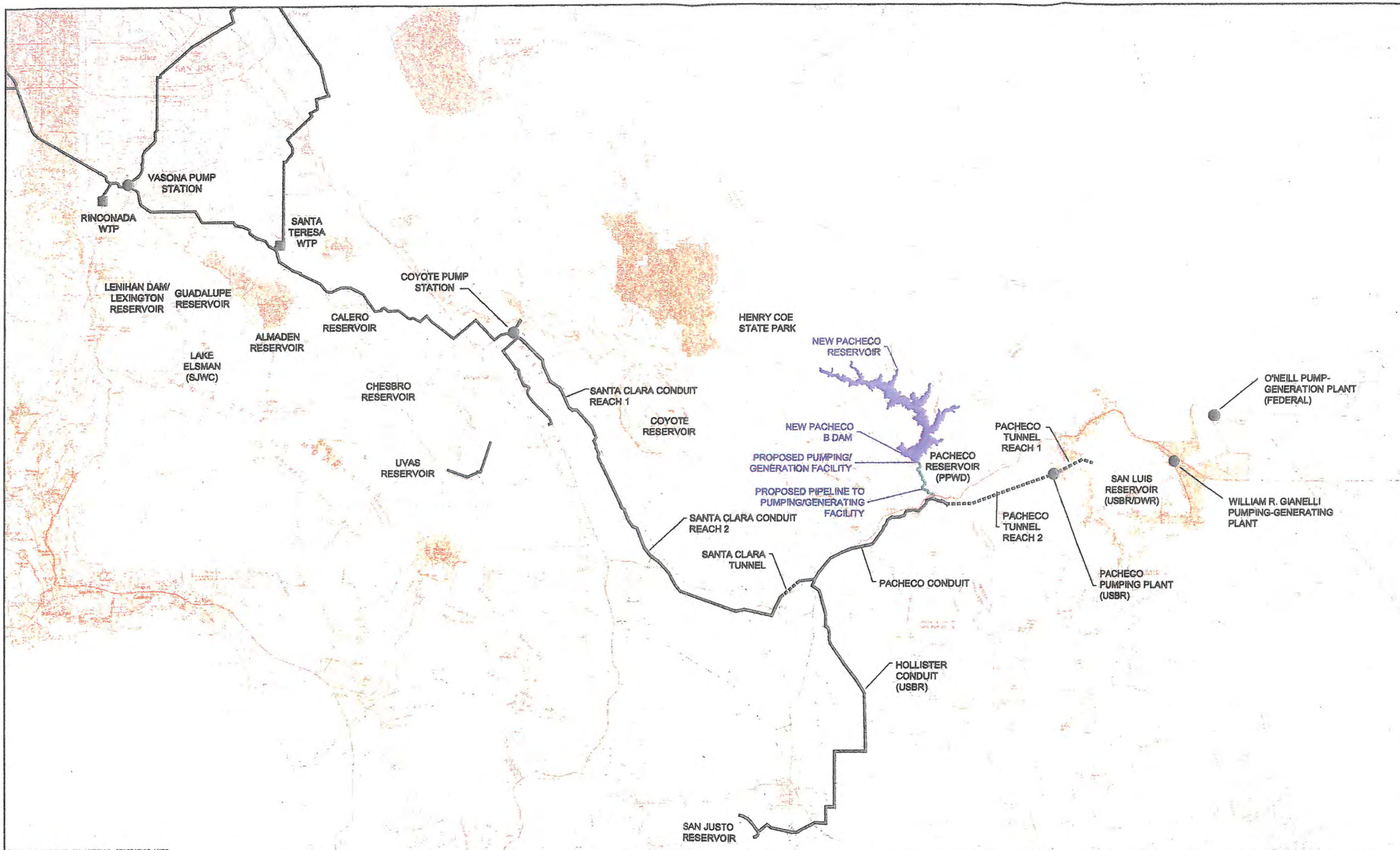
San Luis Reservoir Low Point Improvement Project
Acronyms & Abbreviations

CALFED	CALFED Bay-Delta Program
CCI	Construction Cost Index
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CVP	Central Valley Project
CY	cubic yard
°	degrees
District	Santa Clara Valley Water District
DO	dissolved oxygen
DSOD	California Division of Safety of Dams
DWR	California Department of Water Resources
EIR	environmental impact report
EIS	environmental impact study
El.	Elevation
FERC	Federal Energy Regulatory Commission
ft^2	square foot
GOX	gaseous oxygen
HGL	hydraulic grade line
IDF	inflow design flood
LOD	level of development
LOX	liquid oxygen
LPIP	San Luis Reservoir Low Point Improvement Project
MAF	million acre-feet
MGD	million gallons per day
mg/L	milligrams per liter
msl	mean sea level
NEPA	National Environmental Policy Act
O&M	operation and maintenance
PMF	probable maximum flood
RO	reverse osmosis
ROD	record of decision
SCVWD	Santa Clara Valley Water District
SR	state route
SWP	State Water Project
TAF	thousand acre-feet
TAF/yr	thousand acre-feet per year
USBR	The U.S. Bureau of Reclamation
WTP	Santa Teresa Water Treatment Plant

SCVWD SAN LUIS RESERVOIR LOW POINT IMPROVEMENT PROJECT
OPINION OF PROBABLE CAPITAL COSTS AT PLANNING LEVEL
ALTERNATIVE 4C - NEW DAM AND RESERVOIR AT PACHECO CREEK

Description	Quantity	Unit	Unit Cost	Total Cost
ESTIMATED CONSTRUCTION COSTS				
Pumping Plant ($/Hp = 2,583.5 * $Hp^{-0.0679}$)	17,500	Hp	$ 1,331	$ 23,288,646
Pipelines				
120 inches - standard construction	12,000	LF	$ 1,325	$ 15,900,000
New Dam and Reservoir				
Reservoir Clearing ($1,700/acre - $4,000/acre)	1,400	AC	$ 4,000	$ 5,600,000
Common Excavation/Stripping ($4/cy - $7/cy)	1,082,000	CY	$ 7	$ 7,574,000
Excavation for Spillway/ Stilling Basin ($7/cy)	1,049,000	CY	$ 7	$ 7,343,000
Impervious Core ($8/cy - $14/cy)	1,250,000	CY	$ 14	$ 17,500,000
Filter and Drain ($23/ton - $35/ton)	700,000	TON	$ 35	$ 24,500,000
Random Fill ($7/cy to $12/cy)	3,500,000	CY	$ 12	$ 42,000,000
Rock Fill ($7/cy to $12/cy)	3,100,000	CY	$ 12	$ 37,200,000
Concrete for Spillway and Inlet/Outlet Works ($350/cy - $700/cy)	13,700	CY	$ 700	$ 9,590,000
Other Dam Costs (foundation treatment, inlet/outlet works, etc.)	1	LS	$ 30,261,400	$ 30,261,400
Hydroelectric	7,800	kW	$ 1,800	$ 14,040,000
Substations				
Station ($350,000 - $1,000,000)	1	LS	$ 1,000,000	$ 1,000,000
Transmission Line	8	mile	$ 200,000	$ 1,600,000
Outlet Pipe Tie-in to Pacheco Conduit	1	LS	$ 10,000,000	$ 10,000,000
SUBTOTAL				$ 247,400,000
Mobilization/Demobilization (5%)			5%	12,370,000
SUBTOTAL				$ 259,770,000
Contingency (20% to 40%)			40%	$ 103,910,000
SUBTOTAL				$ 363,680,000
Land (purchase)	25,000	AC	$ 6,500	$ 162,500,000
Land (easements)	125	AC	$ 5,000	$ 625,000
Environmental Mitigation (1% to 5%)			3%	10,910,000
Recreational Facilities (1% to 5%)			3%	10,910,000
Program Costs (35%)			35%	127,290,000
Other Costs (Additional QA/QC, Geotechnical, etc.)			5%	18,180,000
TOTAL				$ 694,000,000

Revised 8/23/02



BASE MAP PROVIDED BY: NATIONAL GEOGRAPHIC MAPS

MWH
MONTGOMERY WATSON HARZA

N

SCALE
1" = 4 MILES
0 2 4

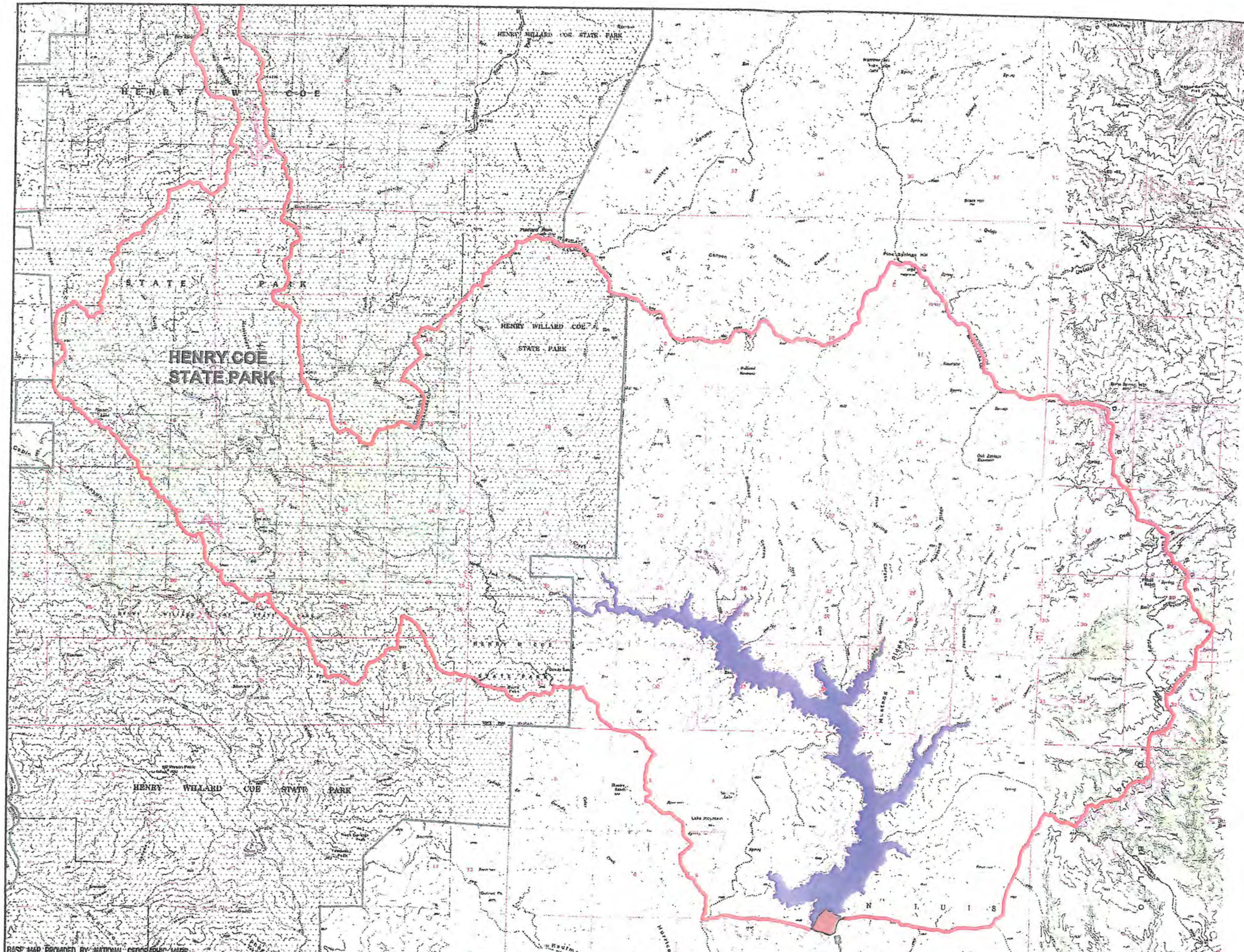
Santa Clara Valley Water District

EXISTING FACILITIES
EXISTING TUNNEL
EXISTING PIPELINE
WATER TREATMENT PLANT
PUMPING PLANT

PROPOSED FACILITIES
PROPOSED PIPELINE

FIGURE 1: ALTERNATIVE 4C

PROJECT AREA MAP
NEW DAM AND RESERVOIR AT PACHECO CREEK
SAN LUIS RESERVOIR
LOW POINT IMPROVEMENT PROJECT



150,000 ACRE-FEET STORAGE
MAXIMUM WATER SURFACE ELEVATION OF 725 FT

FOOTPRINT OF DAM WITH CREST
ELEVATION OF 745 FT.

MWH
MONTGOMERY WATSON HARZA

N

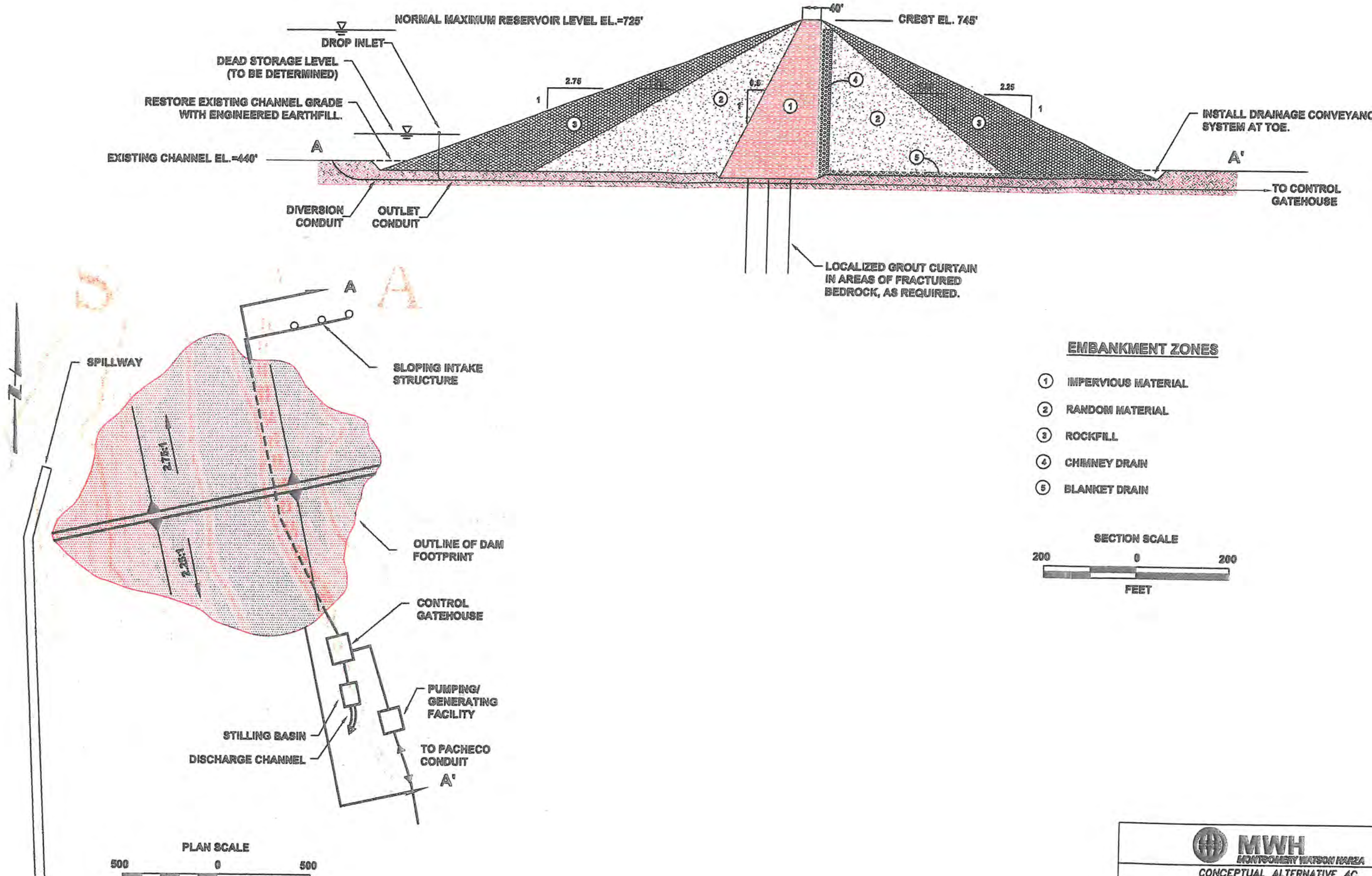
SCALE
0 3000 6000
1" = 6,000'

Santa Clara Valley Water District

LEGEND
WATERSHED BOUNDARY
PROPOSED PIPELINE

FIGURE 2: ALTERNATIVE 4C

INNUNDATION AND WATERSHED BOUNDARY MAP
NEW PACHECO RESERVOIR
SAN LUIS RESERVOIR
LOW POINT IMPROVEMENT PROJECT



EMBANKMENT ZONES

1. IMPERVIOUS MATERIAL
2. RANDOM MATERIAL
3. ROCKFILL
4. CHIMNEY DRAIN
5. BLANKET DRAIN

SECTION SCALE

200 0 200

FEET

MWH
MONTGOMERY WATSON HARZA

CONCEPTUAL ALTERNATIVE 4C

NEW 150,000 A-F PACHECO RESERVOIR
SAN LUIS RESERVOIR
LOW POINT IMPROVEMENT PROJECT

FIGURE

Figure 4 - Hydraulic Gradeline Along New Pacheco Pipeline

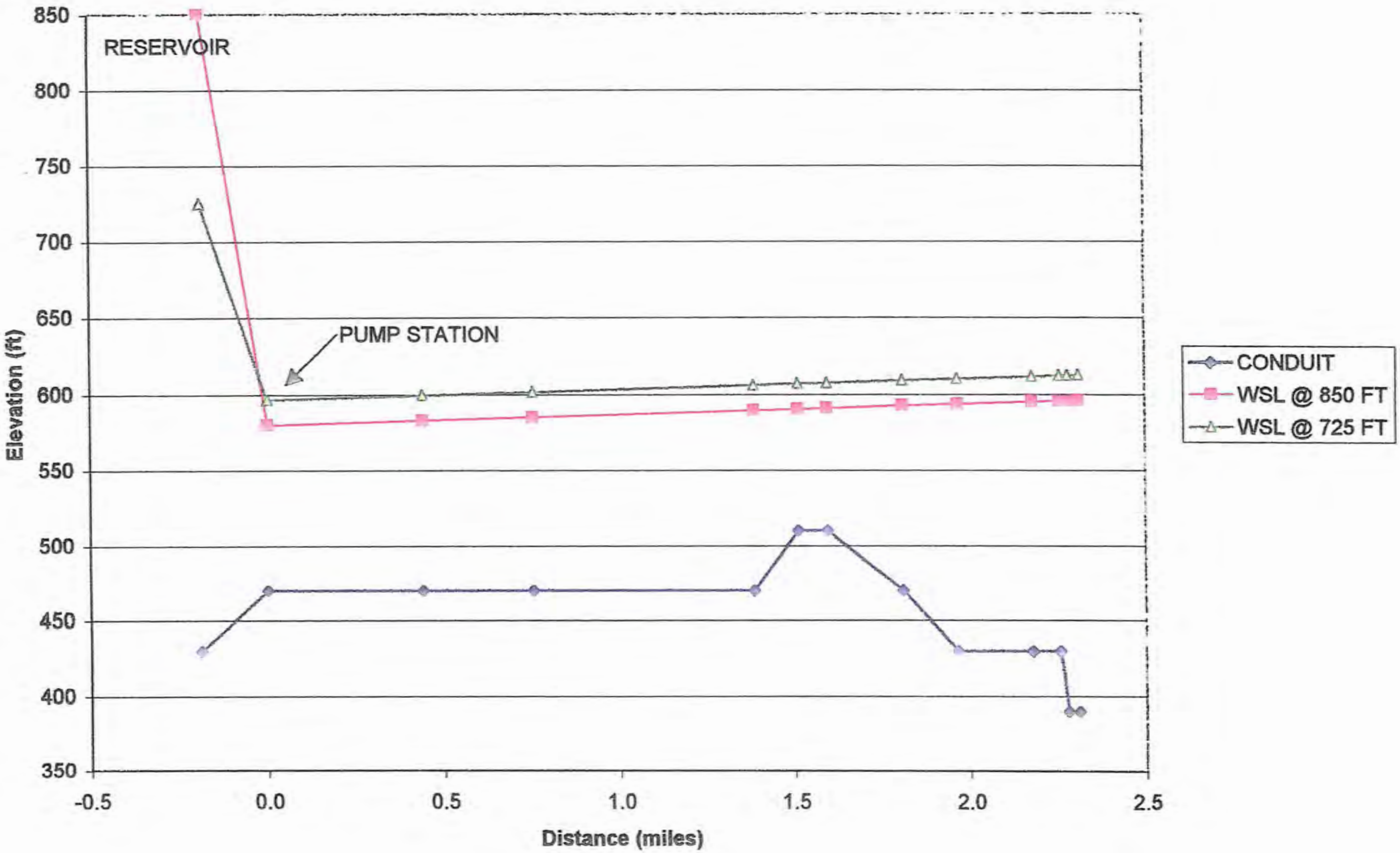


Figure 5 - Habitat Types within the San Luis Reservoir Low Point Improvement Project Area, Proposed Pacheco Reservoir

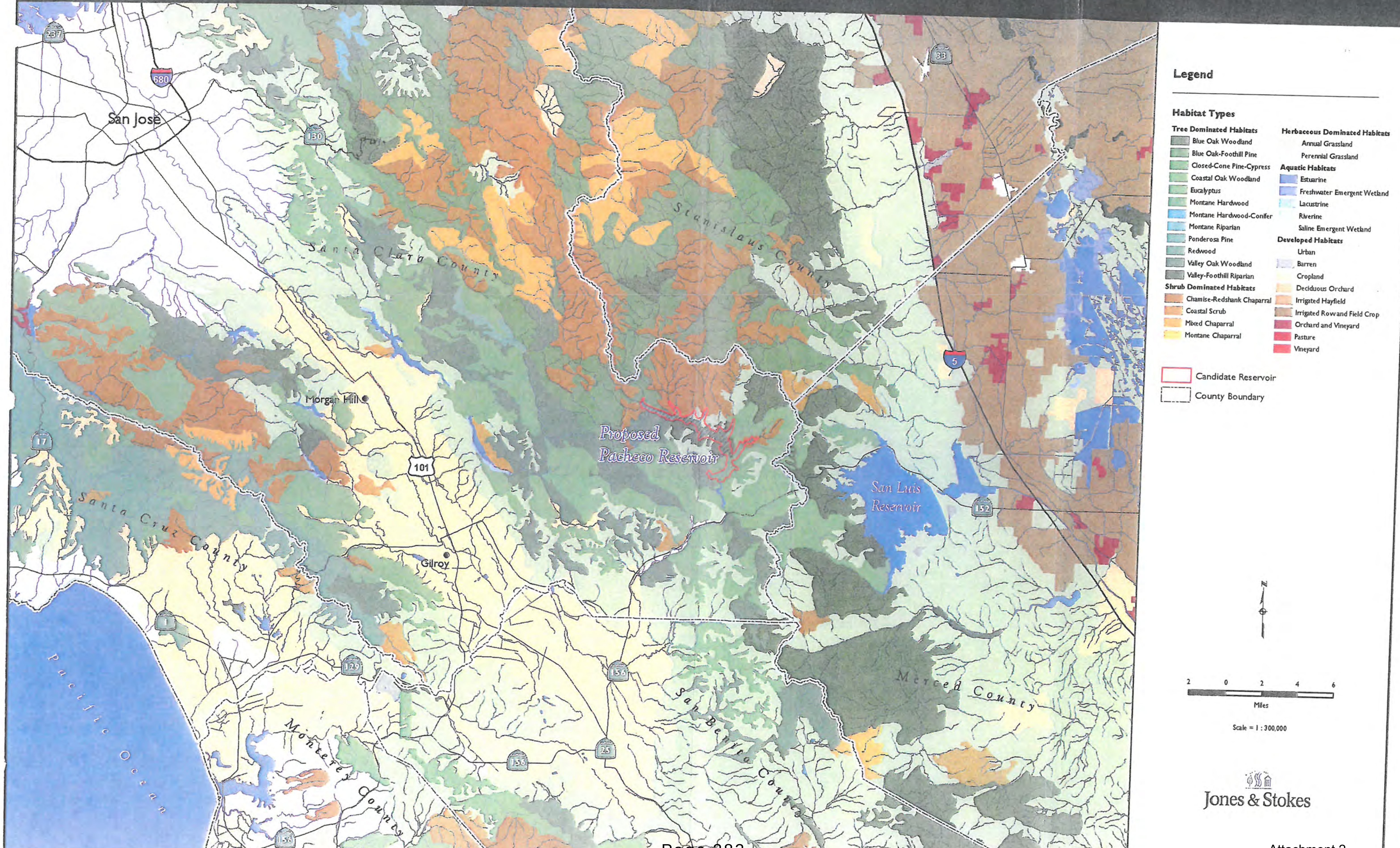
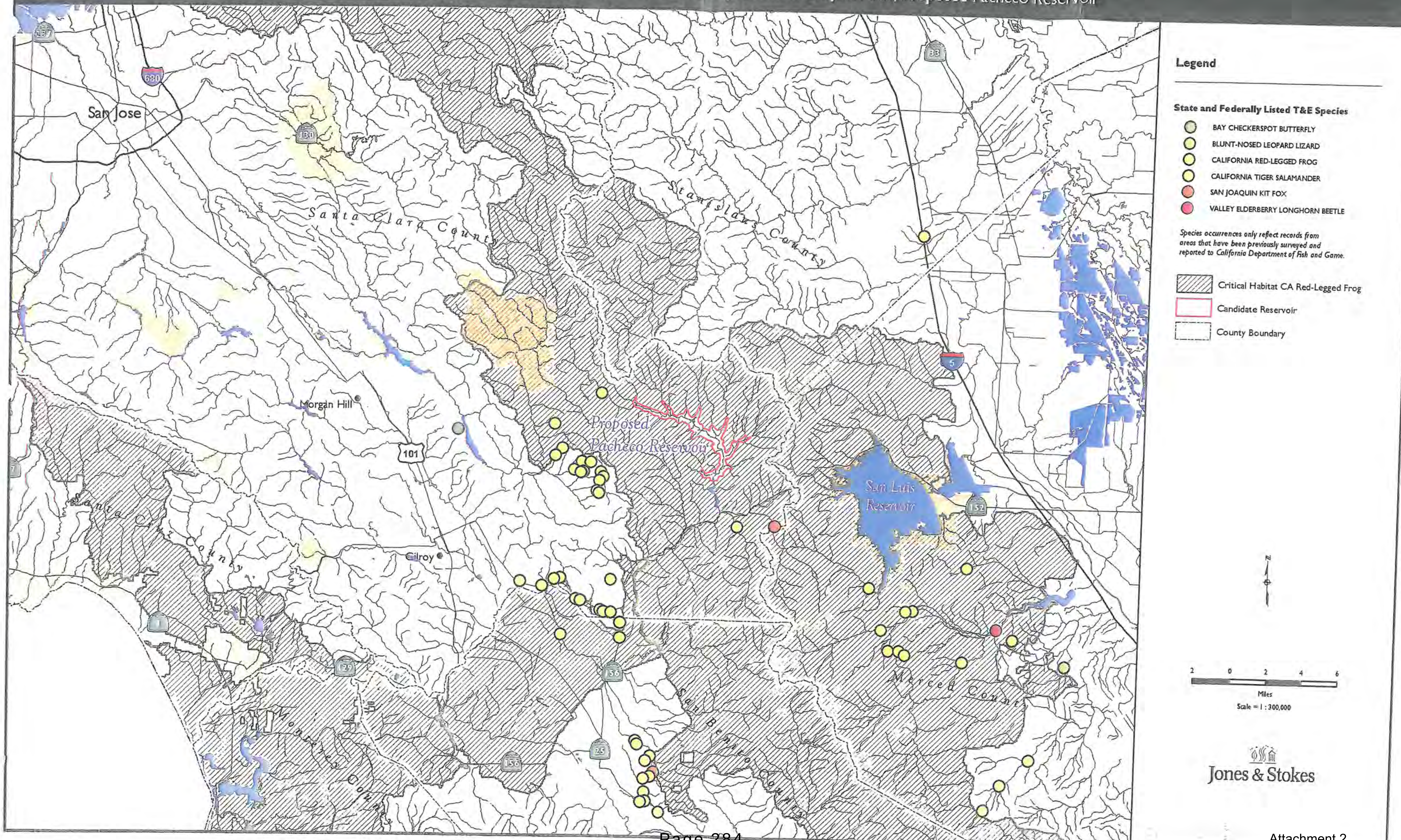


Figure 6 - Recorded Occurences of Special Status Species within the San Luis Reservoir Low Point Improvement Project Area, Proposed Pacheco Reservoir



Santa Clara Valley Water District

Meeting Date:	09/23/08
Agenda Item :	8.
Manager:	G. Zlotnick
Extension:	2081
Director:	All

BOARD AGENDA MEMO

☒ Discussion ☒ Action ☐ Consent ☐ Information

SUBJECT: Principles of Agreement for Joint Investigation of Future Alternatives for Pacheco Reservoir

RECOMMENDATION:

That the Board approve Principles of Agreement for a Joint Investigation of Future Alternatives for Pacheco Reservoir (Attachment 1) as the basis of negotiation for an agreement with Pacheco Pass Water District and San Benito County Water District.

RATIONALE:

The subject Principles of Agreement for a Joint Investigation of Future Alternatives for Pacheco Reservoir ("Principles of Agreement") would inform negotiations of an agreement that would;

(a) facilitate investigation of the Pacheco Reservoir alternative under consideration as part of the San Luis Low Point Improvement Project ("SLLPIP); and,

(b) provide information to support future water supply investment planning.

Approval of the Principles of Agreement would, therefore, support:

Policy E-2.1.2: There is a reliable supply of healthy, clean drinking water.
Policy E-2.1.3: The water supply is reliable to meet future demands in Santa Clara County, consistent with the County's and cities' General Plans and other appropriate regional and statewide projections.

In addition, Pacheco Reservoir has been identified as a site of interest in the Santa Clara Valley Habitat Conservation Plan ("Valley Habitat Plan") currently under development with District participation, as there may be a potential for re-operations to support a run of steelhead in Pacheco Creek and downstream in the Pajaro River. Other opportunities for environmental enhancement in the watershed could be identified through investigations contemplated by the Principles of Agreement. Consequently, approval of the Principles of Agreement would also support:

Policy E-3.2: Environmental enhancements are implemented to improve watersheds, streams and the natural resources therein.

APPROVED

SEP 23 2008

SUBJECT: Principles of Agreement for Joint Investigation of Future Alternatives for Pacheco Reservoir

Policy E-3.2.1: Potential environmental enhancement opportunities are identified to the Board.

EL-3.7 COMPLIANCE:

This is not a proposed consultant contract so EL-3.7 is not applicable.

SUMMARY:

In response to a request from the Pacheco Pass Water District ("Pacheco Pass"), representatives from San Benito County Water District ("San Benito") and the District met with Pacheco Pass on May 19, 2008, to explore collective interests in Pacheco Reservoir. The scope of the discussion included the watershed, operation of Pacheco Dam, flows in Pacheco Creek, existing facilities and potentially relocated or expanded facilities.

As a result of this meeting, staff drafted a set of principles for negotiation of an agreement that would give the parties three years to jointly investigate feasible alternatives for the future of Pacheco Reservoir. After completion of relevant studies, the agreement would also provide an option for the District and San Benito to purchase the existing Pacheco Reservoir and Pacheco Pass lands, subject to appropriate environmental review. Both Pacheco Pass and San Benito have reviewed the Principles of Agreement contained in Attachment 1 and confirmed that they reflect discussions held to date, and outline what the parties hope to achieve through a potential negotiated agreement.

Drivers for Investigation of Pacheco Reservoir

A. San Luis Low Point Improvement Project

The San Luis Low Point Improvement Project ("SLLPIP") is authorized by the CALFED Bay-Delta Authorization Act (October 25, 2004, 118 Stat. 1694). It specifically authorizes the Secretary of the Interior to "expend funds for feasibility studies, evaluation and implementation of the San Luis Low Point Improvement Project, except that Federal participation in any construction of the expanded Pacheco Reservoir shall be subject to future congressional authorization."

From the outset, an expanded Pacheco Reservoir was identified as a possible SLLPIP alternative. Providing a capability for San Felipe Division water to be stored during winter months in an enlarged Pacheco Reservoir would allow the San Luis Reservoir to be further drawn down during summer months, without reducing water quality or exacerbating water supply risks for the District and San Benito.

Central Valley Project (CVP) water supplies for the District and San Benito must be conveyed through San Luis Reservoir to the federal Pacheco Pumping Plant and San Felipe Division facilities. When storage in the reservoir drops below 300,000 acre-feet, increased turbidity and algae reduces water quality and causes problems at the District's treatment plants. CVP deliveries to the San Felipe Division may become limited by reduced pumping capacity at Pacheco Pumping Plant if the reservoir drops to a low enough level. Ultimately, if the drop is far enough or quality is so deteriorated, deliveries could be interrupted entirely. The SLLPIP seeks to resolve these problems, along with accomplishing other planning objectives that would benefit all south-of-Delta water contractors.

In August 2008, the U.S. Bureau of Reclamation (Reclamation) completed a Draft SLLPIP Plan Formulation Report. Alternatives carried forward and evaluated in that report include: (1) lowering the San Felipe (Pacheco Pumping Plant) intake facilities; (2) expanding Pacheco Reservoir; and, (3) implementing a combination of expanding the use of local groundwater, desalination, institutional measures, and re-operation of the District's and San Benito's existing facilities.

Reclamation conducted EIS/EIR scoping meetings in San Jose on September 10 and in Sacramento and Los Banos on September 11, 2008. The Draft Feasibility Report and EIS/EIR is currently scheduled to be completed by summer 2009, and the Final Feasibility Report and EIS/EIR is scheduled to be completed by the end of 2009 or early 2010.

However, this schedule is heavily dependent on obtaining sufficient access to Pacheco Reservoir and private lands in its watershed for further geologic and technical studies. Approval of the Principles of Agreement and successful negotiation of an agreement with Pacheco Pass and San Benito would aid a more timely completion of the SLLPIP, by, among other things, helping to facilitate the requisite access for investigations. It could also facilitate effective use of remaining State Proposition 13 funds that are currently available until March 9, 2009, for reimbursement of certain SLLPIP costs.

B. Valley Habitat Plan

The Valley Habitat Plan is a cooperative effort by six Santa Clara County government agencies to provide an effective framework to protect, enhance, and restore natural resources in Santa Clara County, while improving and streamlining the environmental permitting process related to mitigating impacts on threatened and endangered species. The Valley Habitat Plan will provide incidental take permits for a broad suite of public works and development. Pacheco Reservoir is being discussed in the development of the Valley Habitat Plan, both as a covered activity and as a potential conservation measure.

1.) The covered activity includes relocating Pacheco Dam and expanding Pacheco Reservoir as an alternative in the SLLPIP, or as a future activity that could be undertaken independently by the District to optimize local water storage in its integrated water management portfolio.

2.) The conservation measure would entail re-operation of either the existing Pacheco Reservoir or an expanded Pacheco Reservoir to improve fishery resources. Some participants in the Valley Habitat Plan, including the federal resource agencies, are interested in establishing a run of steelhead in Pacheco Creek and downstream in the Pajaro River. While the Principles of Agreement contemplate investigating the feasibility of Pacheco Reservoir re-operation for this purpose, any actual change in operations during the proposed agreement's three-year timeframe would be subject to the approval of Pacheco Pass, coordination with the Valley Habitat Plan, and appropriate environmental review. Other opportunities for environmental enhancements may also be identified through related investigations in the watershed.

C. Relationship To Future Water Supply Investment Decisions

The District's Integrated Water Resource Planning 2003 Report (IWRP 2003) recommended protecting existing water supplies and making modest near term investments in a "no regrets" portfolio of additional conservation, groundwater recharge, and water banking. For longer term investments, IWRP 2003 found that the District's water supply portfolio should include investments in all-weather supplies (i.e., recycling and conservation), storage, and dry-year transfers. Subsequently, in December 2005, the Board adopted Policy E-2.1.4.2, which states; "the District's water supply sources are further diversified by making new investments in a mix of all weather supplies, storage, and dry year transfers or option agreements."

The District needs to consider how best to balance all weather supplies and storage, as well as the type of storage, for future water supply reliability. These considerations will be better informed with additional information on different water supply alternatives. Improved understanding of the feasibility of Pacheco Reservoir as a potential future storage option will provide important perspective as the District undertakes analyses and considers decisions regarding the appropriate mix of future water supply investments.

Moreover, investigations related to Pacheco Reservoir as envisioned under the Principles of Agreement could also contribute significantly to the District's developing dam retrofit strategy to address pressing and increasing seismic requirements.

CEQA REQUIREMENTS:

Approval of the Principles of Agreement provides only a basis for negotiation and has no environmental impact; therefore, it is not a project, as defined by CEQA.

ADVISORY COMMITTEE INPUT:

The proposed Principles of Agreement have not been presented to any Advisory Committees.

PUBLIC OUTREACH:

Public outreach related to investigation of Pacheco Reservoir is, in part, achieved through the EIS/EIR process for the SLLPIP. Public scoping meetings were held in San Jose on September

10 and in Sacramento and Los Banos on September 11, 2008. The Valley Habitat Plan process also includes public meetings in which Pacheco Reservoir has been discussed.

FINANCIAL IMPACT:

Approval of the Principles of Agreement has no immediate financial impact.

Pacheco Pass would continue to own and operate Pacheco Dam and Reservoir during the term of the agreement. However, successful negotiation of an agreement based on these principles could lead to commitments and costs that are not currently included in the District's FY09 budget and long range forecast. Because discussions among the parties related to the subject Principles of Agreement did not commence until May of this year, it was not possible to include resources in the current year budget with any level of precision. Consequently, none were provided.

It is anticipated that certain investigations covered by a joint agreement would be conducted and paid for under the existing SLLPIP, including potential Proposition 13 funds referenced above, while others might be coordinated through the Valley Habitat Plan process. While there are no funds dedicated to such activities in the Valley Habitat Plan effort, it is possible that grants or other sources of funds might become accessible in the future for studies related to activities consistent with the Valley Habitat Plan, e.g. reservoir reoperation.

Should the Board authorize moving forward, an agreement subject to the proposed principles will provide for cost-sharing of additional investigations of mutual interest. Consistent with Board policy, any financial commitment that would exceed Executive Limitation EL-5.7 will be brought back to the Board for discussion and decision.

Principles of Agreement
for
Joint Investigation of Pacheco Reservoir
DRAFT #2 June 18, 2008

1. **Parties:**_ Pacheco Pass Water District (Pacheco Pass), San Benito County Water District (San Benito) and Santa Clara Valley Water District (Santa Clara).

2. **Interests of the Parties**
   a. San Benito and Santa Clara are seeking alternatives that will improve their ability to manage water supply, water quality, and operational risks related to federal water deliveries from San Luis Reservoir.
   b. As a participant in the Santa Clara County Habitat Conservation Plan, Santa Clara is seeking alternatives that will improve fish habitat and other environmental values in the watershed.
   c. Pacheco Pass is seeking to ensure the continuation of operational benefits from Pacheco Dam and Reservoir, including groundwater recharge in Pacheco Creek upstream of the Highway 156 crossing.

3. **Purpose of the Agreement**
   a. Establish a process and time period for Santa Clara and San Benito to investigate feasible alternatives for the future of Pacheco Dam and Reservoir.
   b. Establish an option for Santa Clara and San Benito jointly to acquire Pacheco Dam and Reservoir, or to enter into a long-term lease or other arrangement with Pacheco Pass that would provide long-term benefits.
   c. Establish a process to explore and potentially implement mutually agreed upon near-term operational changes.

4. **Term:** Three years from date of execution (expected July 2008).

5. **Work Plan to Investigate Feasible Alternatives**
   a. Santa Clara and San Benito will jointly develop and agree upon a work plan to be accomplished during the term of the Agreement, including a scope of work, schedule, resources and budget, project management, methods of communication and coordination.
   b. Santa Clara and San Benito will form a policy-level steering committee and a management committee to facilitate development and implementation of the work plan.

6. **Coordination**
   a. Santa Clara and San Benito will consult Pacheco Pass in the development of the work plan, keep them informed of progress and make work products available for their review prior to release to others.
   b. Santa Clara and San Benito will coordinate the investigations and analyses with the Bureau of Reclamation's ongoing San Luis Reservoir Low Point Improvement Project.
   c. Santa Clara and San Benito will seek input from partners in the Santa Clara County Habitat Conservation Plan on the range of issues that should be studied, participation in workgroups to carry out investigations, and review of work products.

7. **Alternatives to be Evaluated**
   a. Alternatives to be evaluated will include remediation and re-operation of the existing Pacheco Dam and Reservoir, reconstruction and enlargement, or other possibilities.
   b. Feasible alternatives must maintain operational benefits for Pacheco Pass, including groundwater recharge in Pacheco Creek upstream of the Highway 156 crossing, at least equal to those that would have existed absent implementation of the alternative.
   c. Feasible alternatives will have no unacceptable impact on Henry Coe State Park.

8. **Funding and Cost Sharing**
   a. Santa Clara will seek to utilize an appropriate share of State grant funding available for the San Luis Reservoir Low Point Improvement Project to carry out the work plan.
   b. Santa Clara will seek cost-share funding from the Santa Clara County Habitat Conservation Plan for interim operational changes or investigations related to improvement of Pacheco Creek fish habitat.
   c. Santa Clara and San Benito will share remaining costs of the work plan equally, provided that when the option decisions provided by the Agreement are exercised, these cost shares will be adjusted to reflect the districts' respective long-term benefits.

9. **Access for Investigations**
   a. Pacheco Pass will provide access to the existing Pacheco Dam and adjacent property that the district owns or has rights of entry, for the purpose of investigating structural, geologic, environmental and other aspects of proposed alternatives.
   b. Pacheco Pass will facilitate, to the extent they are able, access by Santa Clara and San Benito to property in the watershed owned by others, as necessary to carry out investigations.
   c. Pacheco Pass will provide access to any relevant records that may assist with the evaluation of alternatives, including records of Pacheco Dam operation and maintenance and diversions in the watershed.
   d. Santa Clara and San Benito will each provide any relevant records or previous studies that may assist with evaluation of alternatives, including records of San Felipe Division operation and maintenance and diversions in the watershed.

10. **Operations During the Term of the Agreement**
   a. Pacheco Pass will continue to own and operate Pacheco Dam and Reservoir during the term of the Agreement.
   b. The parties will explore and, subject to mutual agreement and appropriate environmental review, may implement near-term operational changes to achieve water management and/or environmental objectives.
   c. Santa Clara and/or San Benito may provide resources to accomplish near-term operational changes, subject to appropriate indemnification by Pacheco Pass.

11. Exercise of Option

a. Before the end of the Agreement, Santa Clara and San Benito may jointly exercise an option to acquire Pacheco Dam and Reservoir, or to enter into a long-term lease or other arrangement with Pacheco Pass that provides long-term benefits.
b. If either Santa Clara or San Benito decides that it does not want to participate in an acquisition, long-term lease or other arrangement with Pacheco Pass, then the other district may independently exercise the option.
c. Neither Santa Clara nor San Benito is obligated to exercise any option provided by the Agreement.

BOARD OF DIRECTORS MEETING

MINUTES

REGULAR BOARD MEETING
TUESDAY, SEPTEMBER 23, 2008
9:30 AM

(Paragraph numbers coincide with agenda item numbers)

IV. ENDS:

8. Principles of Agreement for Joint Investigation of Future Alternatives for Pacheco Reservoir. (Greg Zlotnick) (E-2.1.2, -2.1.3)

Recommendation:	Approve Principles of Agreement for a Joint Investigation of Future Alternatives for Pacheco Reservoir as the basis of negotiation for an agreement with Pacheco Pass Water District and San Benito County Water District.
Motion:	Approve Principles of Agreement for a Joint Investigation of Future Alternatives for Pacheco Reservoir as the basis of negotiation for an agreement with Pacheco Pass Water District and San Benito County Water District, amending the timeframe for drafting a work plan to investigate feasible alternatives from three years to two years, with an option to extend the agreement by one year.
Move to to Approve :	L. Wilson
Second:	T. Estremera

Yeas:	T. Estremera, R. Kamei, S. Sanchez, R. Santos, L. Wilson
Nays:	None
Abstains:	None
Recuses:	None
Absent:	J. Judge, P. Kwok
Summary:	5 Yeas; 0 Nays; 0 Abstains; 2 Absent.

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Principals of Agreement

Submittal of Proposition 1 Application

and

Joint Investigation of Pacheco Reservoir Expansion

Parties: The parties to this Principles of Agreement ("Agreement") are Pacheco Pass Water District (Pacheco Pass), San Benito County Water District (San Benito) and Santa Clara Valley Water District (Santa Clara), each referred to hereafter as "Party" or collectively as "Parties".

1) **Interests of the Parties**:
   a) San Benito and Santa Clara are seeking alternatives that will improve the reliability of their respective water supplies in dry years and the ability to manage their water supply, water quality, and operational risks.
   b) Pacheco Pass seeks to preserve the continued operational benefits it receives from Pacheco Dam and Reservoir, including groundwater recharge in Pacheco Creek upstream of the Highway 156 crossing.
   c) The Parties are interested in submitting a Proposition 1 Water Storage Investment Program grant funding application to the California Water Commission to help fund the potential expansion of Pacheco Dam and Reservoir (Proposition 1 Grant Application) that will allow achievement of their respective interests.

2) **Purposes of the Agreement**: The purposes of this Agreement are to (i) establish commitments for coordination and participation to evaluate the potential expansion of Pacheco Dam and Reservoir; (ii) coordinate efforts to prepare and submit a Proposition 1 Grant Application; (iii) establish options for Santa Clara (or Santa Clara and San Benito jointly) to acquire fee title to Pacheco Dam and Reservoir, or to acquire a possessory interest of Pacheco Dam and Reservoir via a long-term lease or other arrangement, which would enable the expansion of Pacheco Dam and Reservoir, and thereafter, its operation to meet the Parties' respective interests; and (iv) establish commitments to explore other mutually beneficial activities.

3) **Term and Termination of Agreement**: This Agreement becomes effective when signed by all the Parties, and expires three (3) years thereafter. Any Party may terminate this Agreement by providing at least thirty (30) days prior written notice.

4) **Coordination**:
   a) The Parties will: (i) coordinate efforts to develop and submit a Proposition 1 Grant Application; (ii) keep each other informed of progress; and iii) make their related work products available for each Party's review.
   b) The Parties will seek input from other potential partners and stakeholders on the range of issues that may be studied, on participation in workgroups to carry out investigations, and on review of work products.
   c) Pacheco Pass will provide a formal resolution from its board of directors and/or other assurances required by the California Water Commission to ensure that Pacheco Dam and Reservoir is available to support the Proposition 1 Grant Application.
   d) The Parties shall develop and execute a comprehensive cost sharing agreement that specifies each Party's rights, interests and obligations regarding any potential expansion of Pacheco Dam and Reservoir.
   e) The Parties agree that feasible alternatives to expand Pacheco Dam and Reservoir: (i) must maintain operational benefits for Pacheco Pass, including groundwater recharge in Pacheco Creek upstream of the Highway 156 crossing, at least equal to the magnitude of recharge that would have existed absent expansion of the Pacheco Dam and Reservoir; (ii) will provide water

supply benefits acceptable to Santa Clara and San Benito; (iii) will have no unacceptable impact on Henry Coe State Park; and (iv) will include operations to improve the ecosystem and/or fishery benefits in both the Sacramento-San Joaquin Delta and local creeks.

5) **Access for Investigations**:
   a) Pacheco Pass will provide access to the existing Pacheco Dam and Reservoir and adjacent property that it owns or has rights of entry for the purpose of investigating structural, geologic, environmental and other aspects of proposed alternatives.
   b) Pacheco Pass will facilitate, to the extent they are able, access to property in the watershed owned by others, as necessary to carry out investigations.
   c) Pacheco Pass will provide access to any relevant records that may assist with the evaluation of alternatives, including records of Pacheco Dam and Reservoir operations and maintenance and diversions in the watershed.
   d) Santa Clara and San Benito will each provide any relevant records or previous studies that may assist with evaluation of alternatives, including records of San Felipe Division operation and maintenance and diversions in the watershed.

PACHECO PASS WATER DISTRICT

By:______________________________________ Date:___________________

Name/Title:_________________________________

SAN BENITO COUNTY WATER DISTRICT

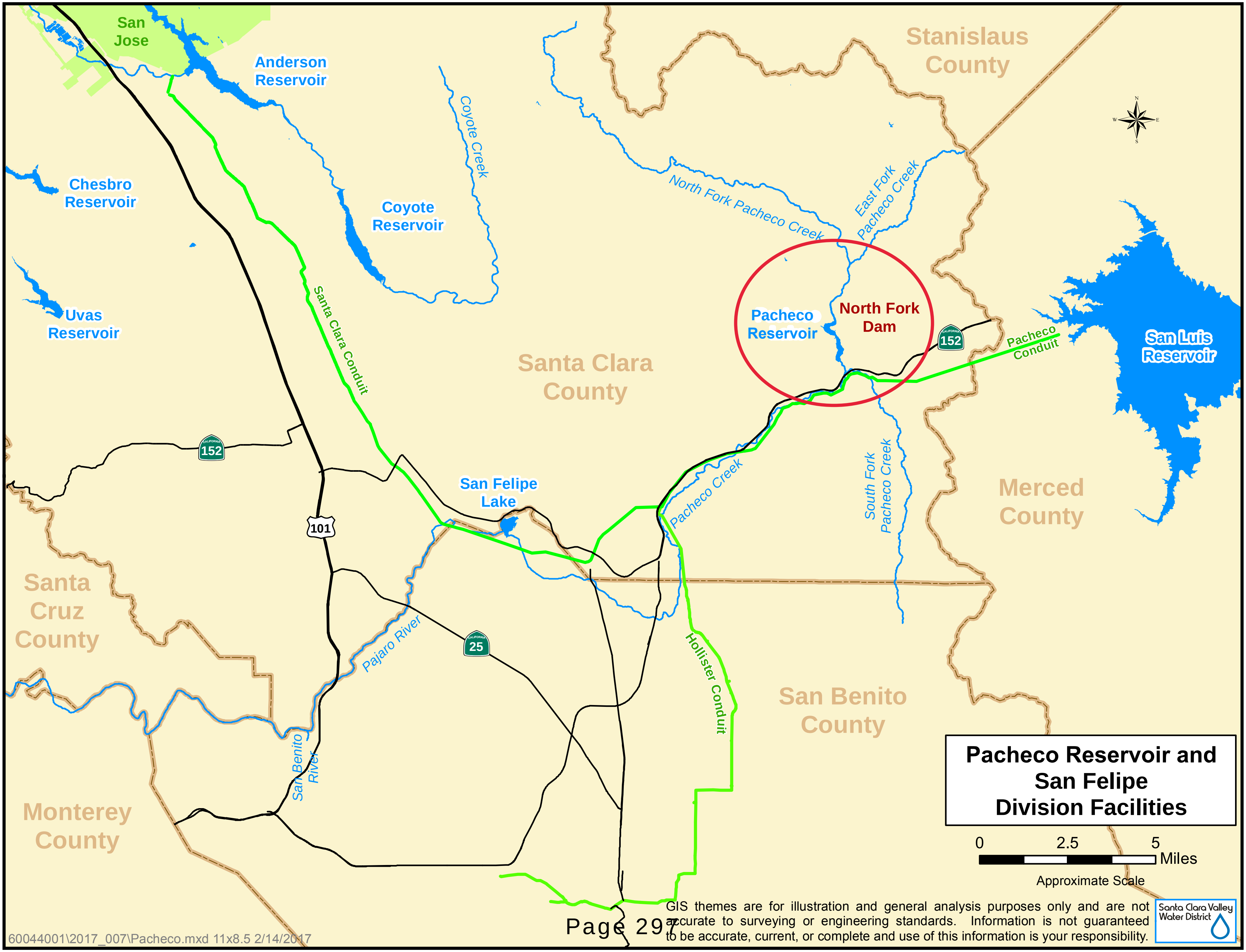
By:______________________________________ Date:___________________

Name/Title:_________________________________

SANTA CLARA VALLEY WATER DISTRICT

By:______________________________________ Date:___________________

Name/Title:_________________________________


San Jose
Anderson Reservoir
Chesbro Reservoir
Coyote Reservoir
Coyote Creek
Uvas Reservoir
Stanislaus County
North Fork Pacheco Creek
East Fork Pacheco Creek
Pacheco Reservoir
North Fork Dam
152
Pacheco Conduit
San Luis Reservoir
Santa Clara Conduit
Santa Clara County
San Felipe Lake
101
Pacheco Creek
South Fork Pacheco Creek
Merced County
Santa Cruz County
Pajaro River
25
Hollister Conduit
San Benito County
San Benito River
Monterey County
Pacheco Reservoir and San Felipe Division Facilities
0
2.5
5
Miles
Approximate Scale
GIS themes are for illustration and general analysis purposes only and are not accurate to surveying or engineering standards. Information is not guaranteed to be accurate, current, or complete and use of this information is your responsibility.
Santa Clara Valley Water District
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Preliminary Assessment of Enlarging Pacheco Reservoir and Potential Application for Proposition 1 Funding

Meeting of SCVWD Pacheco Reservoir Exploratory Ad Hoc Committee with San Benito County Water District and Pacheco Pass Water District Board representatives

February 23, 2017

Santa Clara Valley Water District

Key points

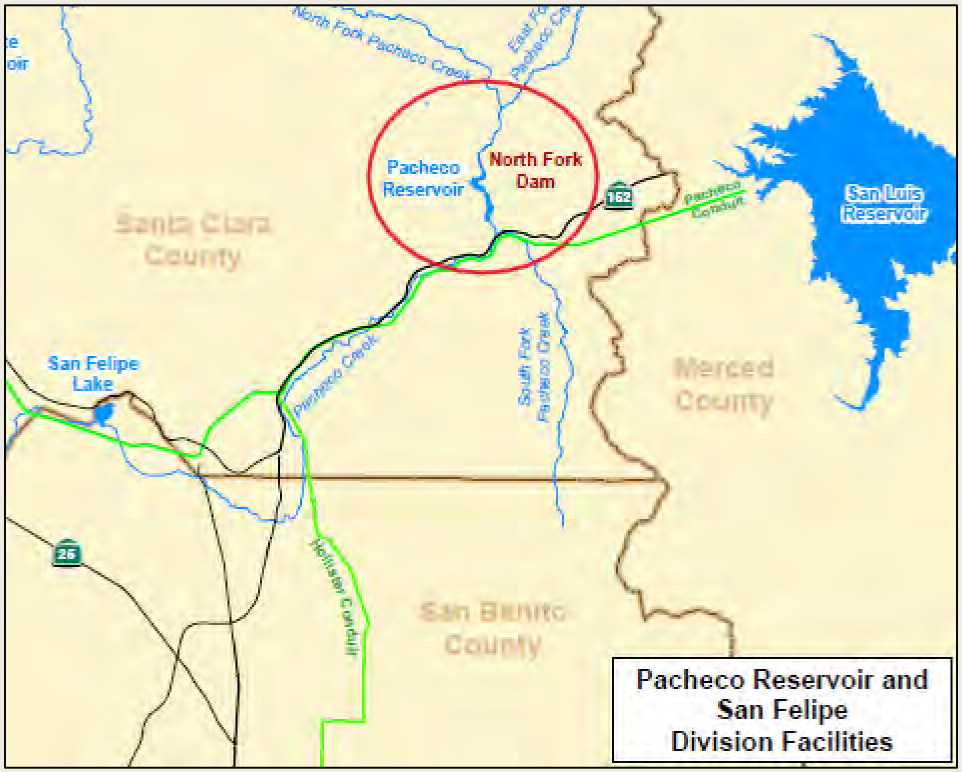
- An enlarged Pacheco Reservoir may have significant supply, water quality, and ecosystem benefits.
- Additional analyses are needed to determine if benefits justify costs.
- Upon Board approval, staff will prepare and submit an application for Proposition 1 funding provided benefit-cost and other analyses indicate the project is justified.
- SCVWD will work closely with Pacheco Pass Water District and San Benito County Water District.

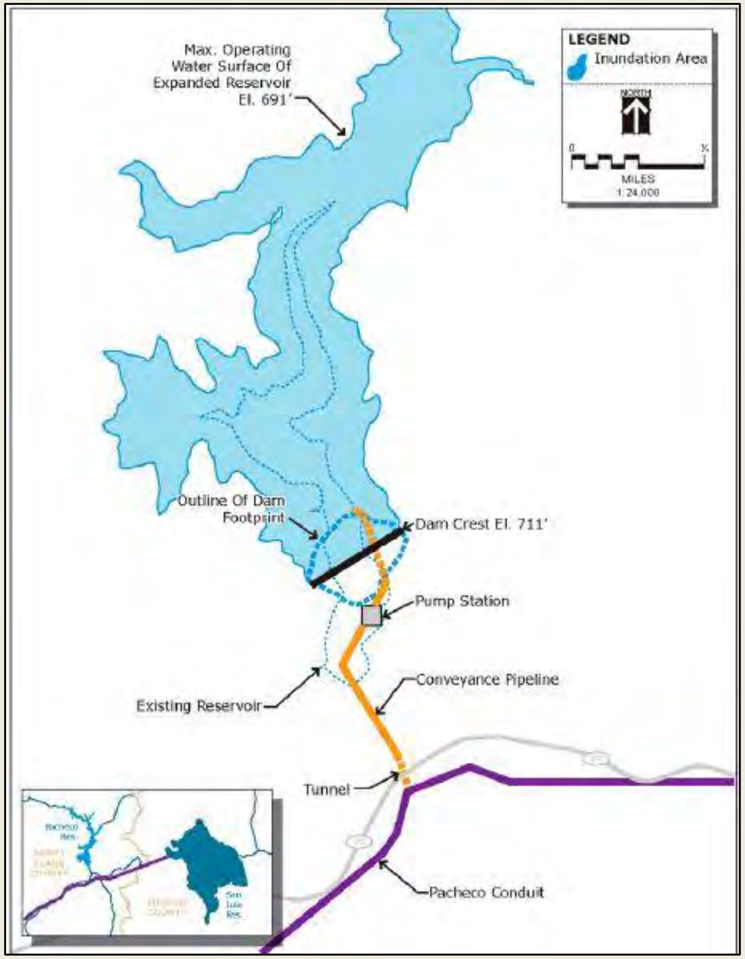
Potential benefits of local reservoir expansion

Expansion of a local reservoir could offer:

- Drought year supply
- Improved water quality
- Increased operational flexibility
- Local and Delta ecosystem enhancement
- Emergency supply
- Flood protection

An Enlarged Pacheco Reservoir may be eligible for Proposition 1 funding





Next Steps

- Finalize Principles of Agreement between the three Districts
- SCVWD to secure a consultant to:
  - Evaluate the dam site options
  - Evaluate project costs vs. benefits to determine qualification for Proposition 1 funding
  - Assist SCVWD in filing the Proposition 1 Application if determined feasible.

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