Environmental Impact Planning Corporation
319 Eleventh Street • San Francisco, California 94103

Telephone (415) 864-2311

8/15 RH.

TRANSMITTAL

To: Jim McKevitt
Field Supervisor
U.S. Fish & Wildlife Service
Division of Ecological Services
2800 Cottage Way, Room E-1803
Sacramento, Cal. 95825

Date: 8/13/85

Job Name: Kirkwood

Job Number: 82038

We Are Sending You:
☒ Attached ☐ Under Separate Cover

Via:
☐ Messenger ☐ Air Mail ☒ First Class Mail
☐ United Parcel ☐ Air Freight ☐ _____

The Following: One copy of the Environmental Assessment for the Kirkwood project (July 9, 1985)

FISH AND WILDLIFE SERVICE
RECEIVED
AUG 15 1985
SACRAMENTO
DIVISION OF ECOLOGICAL SERVICES

Remarks: As requested by Roger Guinee

Transmitted:
☐ As Requested ☒ For Your Use ☐ For Review & Comment

By: Sue Villaseñor

ENVIRONMENTAL ASSESSMENT
ON THE PROPOSED
THIRD POWER GENERATOR UNIT
AT KIRKWOOD POWERHOUSE

DATE: July 9, 1985

Prepared for

STANISLAUS NATIONAL FOREST, TUOLUMNE COUNTY

Prepared by

EIP ASSOCIATES

San Francisco County
for the
San Francisco City and County Public
Utilities Commission

TABLE OF CONTENTS

FIGURE LIST

LIST OF TABLES

1 INTRODUCTION

In June 1981 a systemwide study of the Hetch Hetchy Water and Power System[1] was completed for the City and County of San Francisco, Public Utilities Commission. This study concluded, in part, that an additional 36 MW generating unit should be installed at the existing Kirkwood Powerhouse to utilize a portion of the spillwater from Hetch Hetchy Reservoir. The report also concluded that the Canyon Power Tunnel and existing penstock were capable of conveying the quantity of water capable of operating the three units, if necessary. The suggested project configuration was for the additional unit to be installed at the northwest wall of the existing powerhouse (referred to as Alternative B in this report, see Figures 5 and 6). In April 1983 an administrative copy of the Negative Declaration was prepared for the City of San Francisco Planning Department. This draft document was sent out to public agencies and special interest groups for comment. In 1984 the City hired Tudor Engineering Company to conduct in-depth studies; to investigate various alternatives; recommend the optimum project configuration; and to proceed with final design of the selected alternative. In September 1984 Tudor Engineering completed their studies and submitted a report,[2] recommending a different project configuration (referred to in this report as the proposed action, see Figures 2 and 3). In January 1985 the City authorized further study and preparation of the environmental documentation on the proposed action alternative.

In April 1983 the Stanislaus National Forest notified the City that an Environmental Assessment on the project was required prior to issuance of a Decision Notice. This document has been prepared in conformance with the content and format requirements of the 40CFR1508.9 1978 CEQ Regulations by EIP for the Stanislaus National Forest.

[1]Sverdrup & Parcel and Associates, Inc., Hetch Hetchy Water and Power Systemwide Power Study, June 1981.

[2]Tudor Engineering Company, Hetch Hetchy Water and Power Kirkwood Powerhouse Addition Preliminary Project Report, September 1984.

2 THE PURPOSE AND NEED FOR ACTION AND PUBLIC INVOLVEMENT

2.1 PURPOSE OF AND THE NEED FOR ACTION

The purpose and need for the proposed action -- the addition of a third generator unit to the existing Kirkwood Powerhouse -- is to increase the electrical energy generating capacity, the operation efficiency and flexibility of the Hetch Hetchy system by making use of spillwater from the Hetch Hetchy Reservoir in excess of the fish, wildlife and recreational needs of the Tuolumne River. The addition of this third generator would provide an additional average annual energy production of approximately 86,000,000 kilowatt-hours (kWh), which is equivalent to 147,000 barrels of oil per year. The addition of a third unit also would allow the operation of all three units below their rated capacity at peak-power generating times and thus extend the life of the generator units and increase the efficiency of the system. Presently, during portions of peak times, the existing two generators are operated at or above their rated capacity. The third generator would also provide more flexibility in the operation of the system by allowing one generator to be shutdown for repair and maintenance without substantially reducing the electricity generated during non-peak periods.

2.2 PUBLIC INVOLVEMENT PROGRAM

Comments on the proposed project were solicited from a number of special interest groups and agencies. Representatives of these groups and agencies were contacted by letter and phone. See Appendix A for copies of letters received. Comments received by EIP Associates concerning the environmental issues of proposed project have been considered and addressed in this document. Comments regarding other issues associated with the project have been responded to in letters directly to the respected commentors. Please refer to Chapter 5 for a list of agencies and individuals contacted.

The issues, concerns and opportunities considered and discussed during meetings with Forest Service personnel and during the analysis of the proposed action are presented in

the following summary. Additional issues and concerns expressed by public agencies and private interest groups during the public involvement program were also considered in the analysis and are included below:

- The Multiple Use Plans for the Groveland Ranger Districts of the Stanislaus National Forest, November 29, 1979, identifies the proposed action site within the Special Zone (S-2) Raker Act area.
- Activities should not significantly alter the characteristics of the Tuolumne River corridor, which is a designated Wild and Scenic River.
- Identify the direct impacts of the proposed action to the natural resources in the immediate surroundings of each site.
- Identify the indirect impacts (i.e., noise and visual quality) of the proposed action on recreational resources in the Tuolumne River Canyon.
- The effect on an important deer range during the winter.
- The effect on an archaeological site, known to occur near one of the spoils sites.
- The effect on prairie falcons, golden eagles and bald eagles that have been sighted in and around the river canyon.
- The effect on rare plants; although no rare plants have been sighted in the past, potential habitats do occur in the canyon.
- The effects on and compliance with the approved Fish Flow Release Agreement between the City and County of San Francisco and the U.S. Department of Interior.
- The effects of increased flows on the Kirkwood penstock.

3 ALTERNATIVES INCLUDING PROPOSED ACTION

3.1 INTRODUCTION

The City and County of San Francisco authorized a study[1] to determine opportunities for additional power generation facilities within and adjacent to the Hetch Hetchy system. A total of 17 potential projects were considered in terms of cost and compatibility with the Hetch Hetch System and are listed below.

*	Project No. 1	Kirkwood Powerhouse Addition
*	Project No. 2	Raising O'Shaughnessy Dam with Kirkwood Powerhouse Addition
	Project No. 3	Early Intake Powerhouse Replacement
*	Project No. 4	South Fork Tuolumne Dam and Power Plant
	Project No. 5	Tawonga Camp Project
*	Project No. 6	Harden Flat Dam and Power Plant
	Project No. 7	Lower Moccasin Creek Power Plant
	Project no. 8	Holm Pumping Plant and Lower Moccasin Creek Power Plant
*	Project No. 9	Additional Moccasin Power Plant
	Project No. 10	Marshs Flat Pumped-Storage Scheme
	Project No. 11	Additional Kirkwood Powerhouse
	Project No. 12	Additional Unit at Holm Powerhouse
	Project No. 13	Tap Lake Eleanor
	Project No. 14	Additional Unit at Moccasin Powerhouse
	Project No. 15	Powerhouse at Early Intake Dam
	Project No. 16	Dam and Powerhouse at Jackass Creek
	Project No. 17	Constructing New Priest Dam

Projects 11-17 were determined to be infeasible and eliminated from further study in the initial stages of the study. Of the remaining ten projects, five were determined to be most cost efficient and compatible with the existing Hetch Hetchy system (indicated with an asterisk (*) in the above list).

The Public Utilities Commission has decided to pursue the Kirkwood Powerhouse Addition project because it was determined to be the most cost efficient and compatible with the existing system and the least environmentally disruptive. The raising of O'Shaughnessy

Dam (Project No. 2) was considered to be politically vulnerable at this time and could have potentially significant impacts to visual resources. There is also a question whether this project would be compatible with the management goals and policies of the National Park Service and the Wild and Scenic designation of the Tuolumne River.

The South Fork and Harden Flat Dam projects (Nos. 4 & 6) are not feasible at this time because the Modesto and Turlock Irrigation District have secured the Federal Energy Regulatory Commission (FERC) preliminary permits that give them priority status on these projects.

The additional power plant at Moccasin (Project No. 9) is not favored at this time because this project could significantly reduce river flows between Holm Powerhouse and Moccasin. Such an impact could significantly affect the rafting/recreational use on the Tuolumne River and could be in direct conflict with the Wild and Scenic status of this stretch of the river.

In September 1984, Tudor engineering produced a report[2] evaluating five different configuration alternatives and variations of these configurations on the Kirkwood Powerhouse Addition Project. The five basic alternatives considered are defined as follows:

1. Alternative A uses the existing bypass penstock branch and a new 22,000-kW impulse turbine-generator unit.

2. Alternative B is based on a new penstock branch with a new 36,000-kW impulse turbine-generator unit.

3. Alternative C does not alter the existing bypass capability, access road and parking area by locating the new 36,000-kW impulse turbine-generator unit in an addition to the existing building projecting an additional 40 feet toward the river.

4. Alternative D would construct a new, separate powerhouse structure immediately downstream of the existing building and in the existing tailrace channel. It would use the existing bypass penstock branch and a new 36,000-kW impulse turbine-generator unit.

5. Alternative E is similar to Alternative A but provides a new 36,000-kW impulse turbine-generator unit that would rotate in the opposite direction of the existing unit because of space constraints.

Installation of a Francis turbine generator unit was investigated in lieu of the impulse type. With the present tunnel-penstock waterway configuration, the hydraulic transient problems render this option economically unattractive and the scheme was discarded.

Alternative A was found not to leave a benefit/cost ratio advantage and was thus not considered further.

Those alternatives using the existing branch-off of the bypass energy dissipator (Alternatives A, D and E) were dismissed when undesirable pressure fluctuations within the penstock were discovered in the Waterway Capacity Study.

The proposed action (Alternative C) was concluded to be the most cost efficient and to require the least ground disturbance of the five alternative configurations. Alternative B was considered to be the next most feasible project alternative and is evaluated along with the no-project alternative in this report.

3.2 PROPOSED ACTION

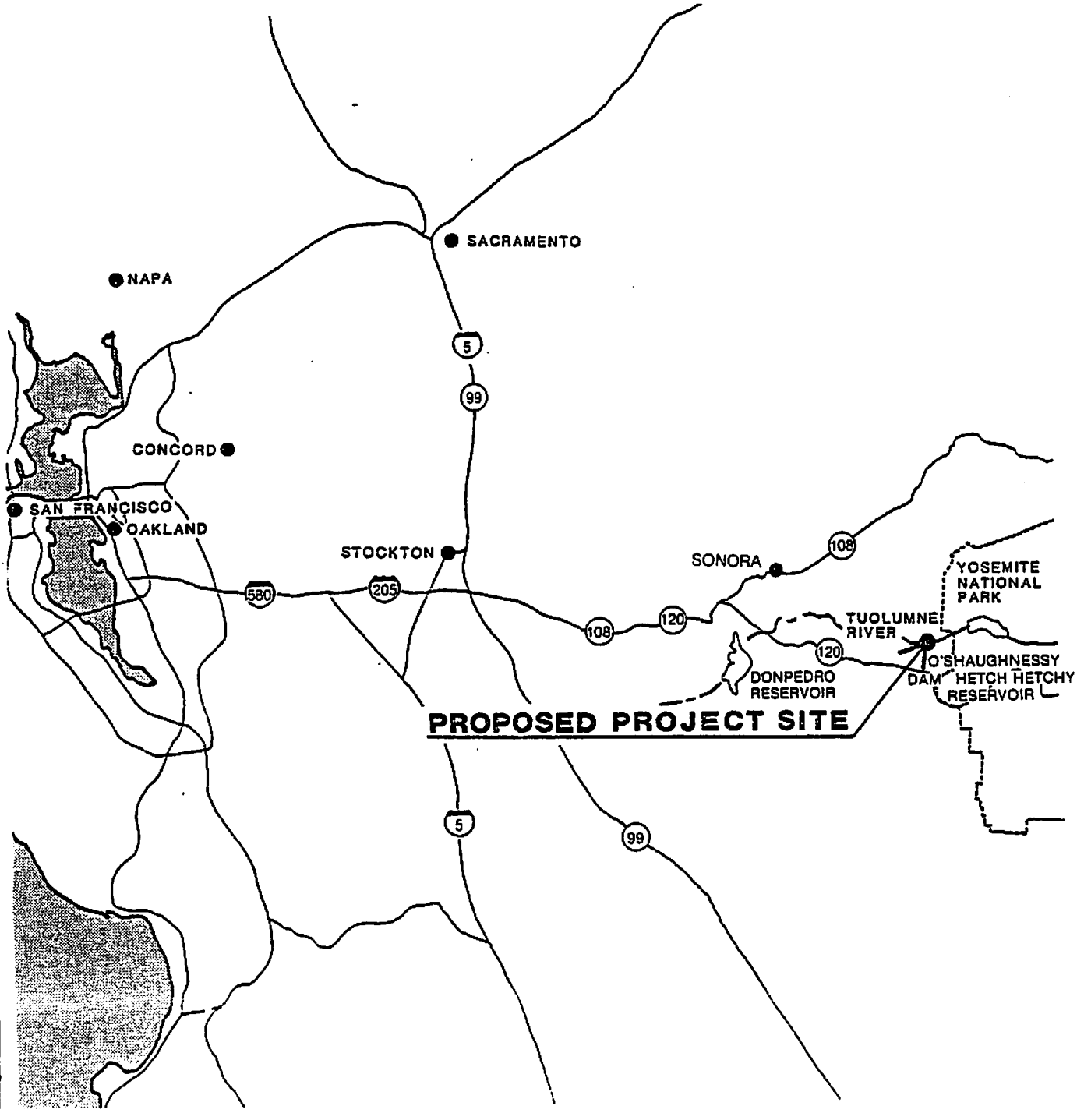
3.2.1 PROJECT CONFIGURATION

The proposed project is the addition of a third turbine-generator unit, approximately 36 MW, and associated powerhouse and transmission facility modifications to the Kirkwood Powerhouse on the Tuolumne River, at Early Intake Reservoir, Tuolumne County California (see Figures 1 and 2). The existing two turbine-generator units and the energy dissipator bypass would be unaltered.

REGIONAL LOCATION MAP

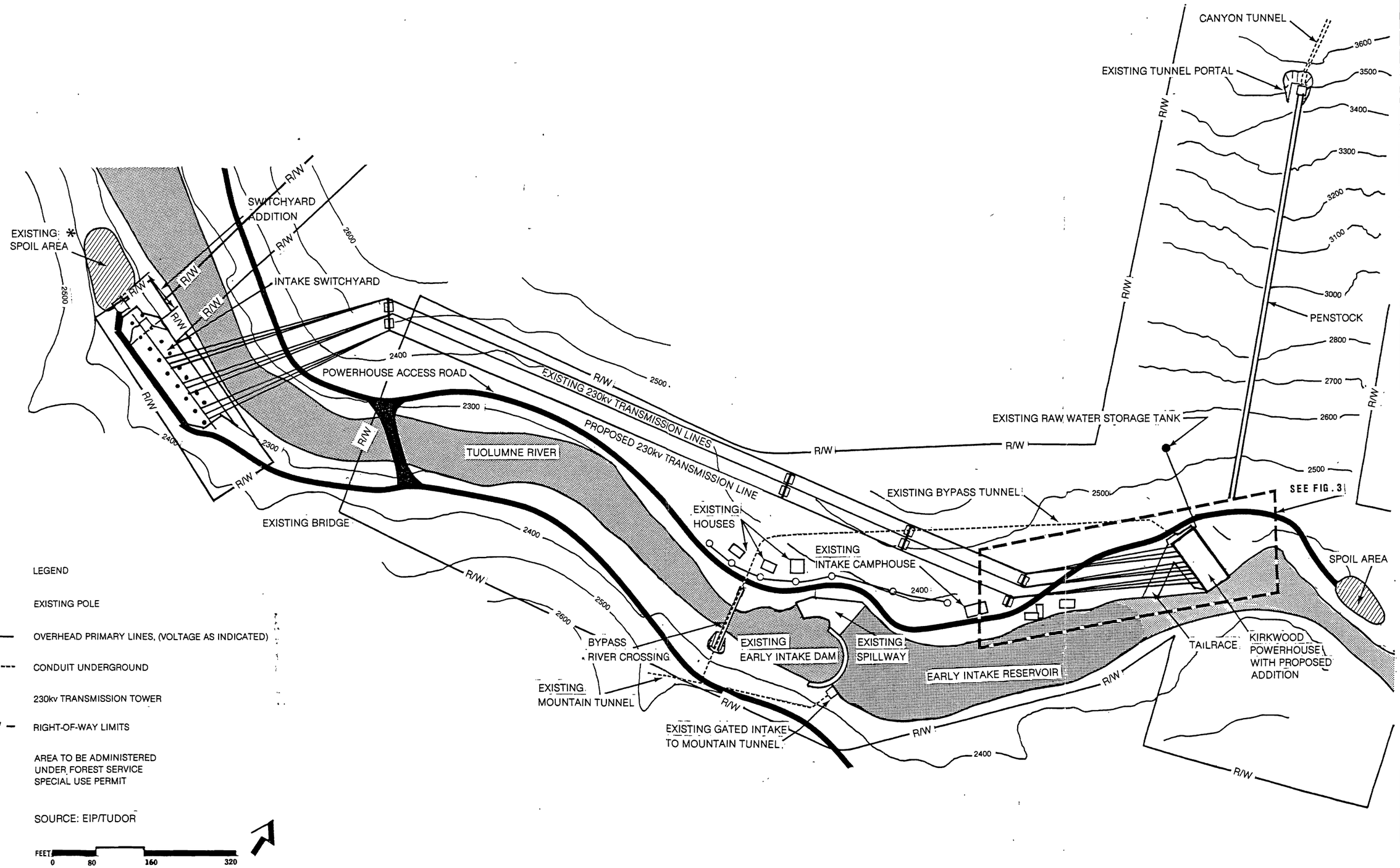
FIGURE 1

SOURCE: EIP CORPORATION



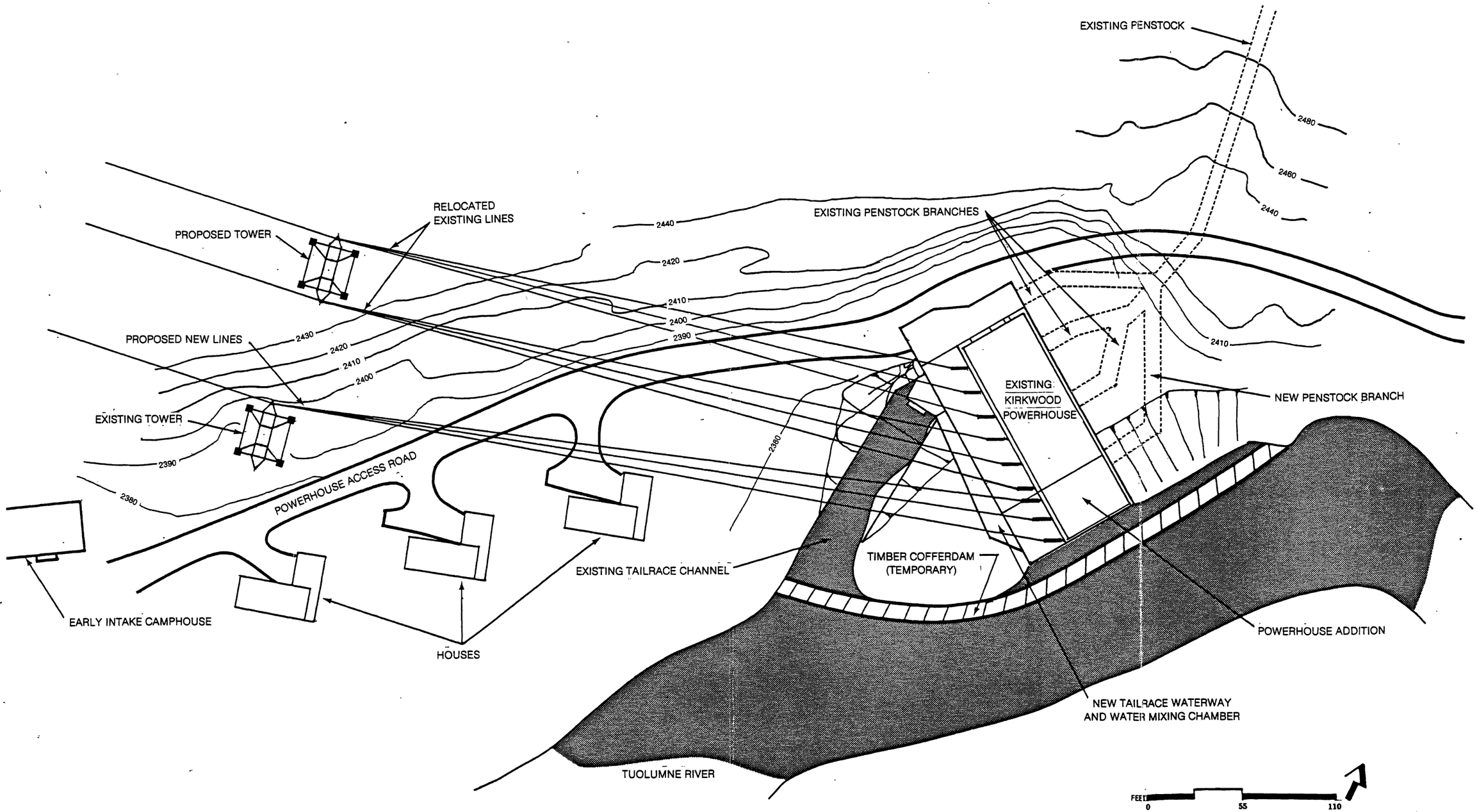
PROPOSED ACTION SITE MAP

FIGURE 2



DETAILED PROPOSED POWERHOUSE ADDITION AND TRANSMISSION LINE

FIGURE 3



SOURCE: EIP/TUDOR

The proposed project would allow 1,300 cubic square feet (cfs) to pass through the Canyon Power tunnel, which is approximately 400 cfs more than that which currently passes through when O'Shaughnessy Dam is spilling water from the Canyon Power Tunnel into the penstock[5] and down to the Kirkwood Powerhouse. The penstock currently splits into three branches on the upstream side of the powerhouse; two branches convey water into the two existing turbine-generator units and a third branch into a conduit that bypasses the two generating units. A fourth penstock branch would be installed, extending to the proposed new third unit, with the same water-carrying capacity of the existing two branches (see Figure 3).

The new turbine generator would be located within an addition to the powerhouse at the southeasterly end of the existing powerhouse, extending approximately 40 feet toward the Tuolumne River (see Figures 2 and 3). The powerhouse addition would not encroach on the normal flow channel. At flood levels the river flow channel would rise and the base of the new building addition would be in contact with the water.

A new tailrace waterway[4] would be required for the third unit and would be built along the downstream wall of the existing powerhouse (see Figures 2 and 3).

A single-circuit 230 kilovolt (kV) transmission line would be built on the immediate downhill side and within the easement of the existing double circuit power line (see Figure 2). The new transmission line would be connected at the Intake Switchyard located approximately one-half mile downstream of the powerhouse. To accommodate the new transmission line, the switchyard would have to be extended on spoils fill approximately 80 feet to the downstream side. The existing access roadway approaching the powerhouse would remain, and the access road continuing upstream of the powerhouse would be relocated with improved alignment.

3.2.2 PROJECT CONSTRUCTION

Construction of the project is expected to last for approximately 20 months and is scheduled to begin in September 1985. The concrete substructure for the powerhouse addition would be attached to the existing powerhouse on the riverside. The superstructure of the powerhouse addition would be completed before the existing powerhouse end

wall would be removed. After all concrete work outside the existing powerhouse would be completed, the existing end wall would then be removed. The run of the 100-ton crane within the existing building would be extended into the powerhouse addition and used to install the new equipment. Additional concrete for the embedment of equipment would then be placed.

The powerhouse addition superstructure would be built behind a wooden cofferdam. The cofferdam would be constructed of wooden cribs and a waterproof plastic membrane applied to the wooden structure. The cofferdam would be placed approximately ten feet from the end wall of the proposed powerhouse addition and extend from a point upstream of the powerhouse and downstream in the area of the tailrace (see Figure 3). The cofferdam would be designed to hold back the river waters at a design flood of 9,300 cfs. It is estimated that approximately two verticle feet of loose rock, alluvial sands and gravel on the river bottom would be removed in the area (approximately 12 feet wide) where the cofferdam would be placed on top of the bedrock. The cofferdam would be dismantled and removed from the site once construction is completed. The riverbed rock and rip-rap would be placed back onto the existing slope. No additional rip-rap would be added to the building's river side.

In the downstream wall area of the powerhouse, where the existing tailrace discharge gate[5] is located, an additional water mixing chamber would be added (see Figures 2 and 3). Water passing through the three generator units would be discharged into this new chamber and mixed prior to passing through the tailrace. The existing tailrace discharge gate would be relocated approximately 10-15 feet south of its present location on the downstream wall on the powerhouse addition.

All construction spoils would be deposited at two locations, an existing spoils site just upstream of the powerhouse and an existing spoils site immediately downstream of the switchyard (see Figure 2). The spoils deposited at the intake switchyard site would serve as fill to extend the yard area and foundations would be placed for the additional bay superstructure and equipment. All concrete spoils would be buried at the identified spoils areas and both spoils areas would be recontoured and spoils deposited in accordance with Forest Service requirements.

3.2.3 PROJECT OPERATIONS

Water flows to the Kirkwood Powerhouse via the ten-mile Canyon Power Tunnel from O'Shaughnessy Dam in Yosemite National Park. Water leaves the powerhouse either through a diversion tunnel that connects to the Mountain Tunnel, the major water supply to San Francisco, or directly into the Tuolumne River at Early Intake Reservoir (Figure 3).

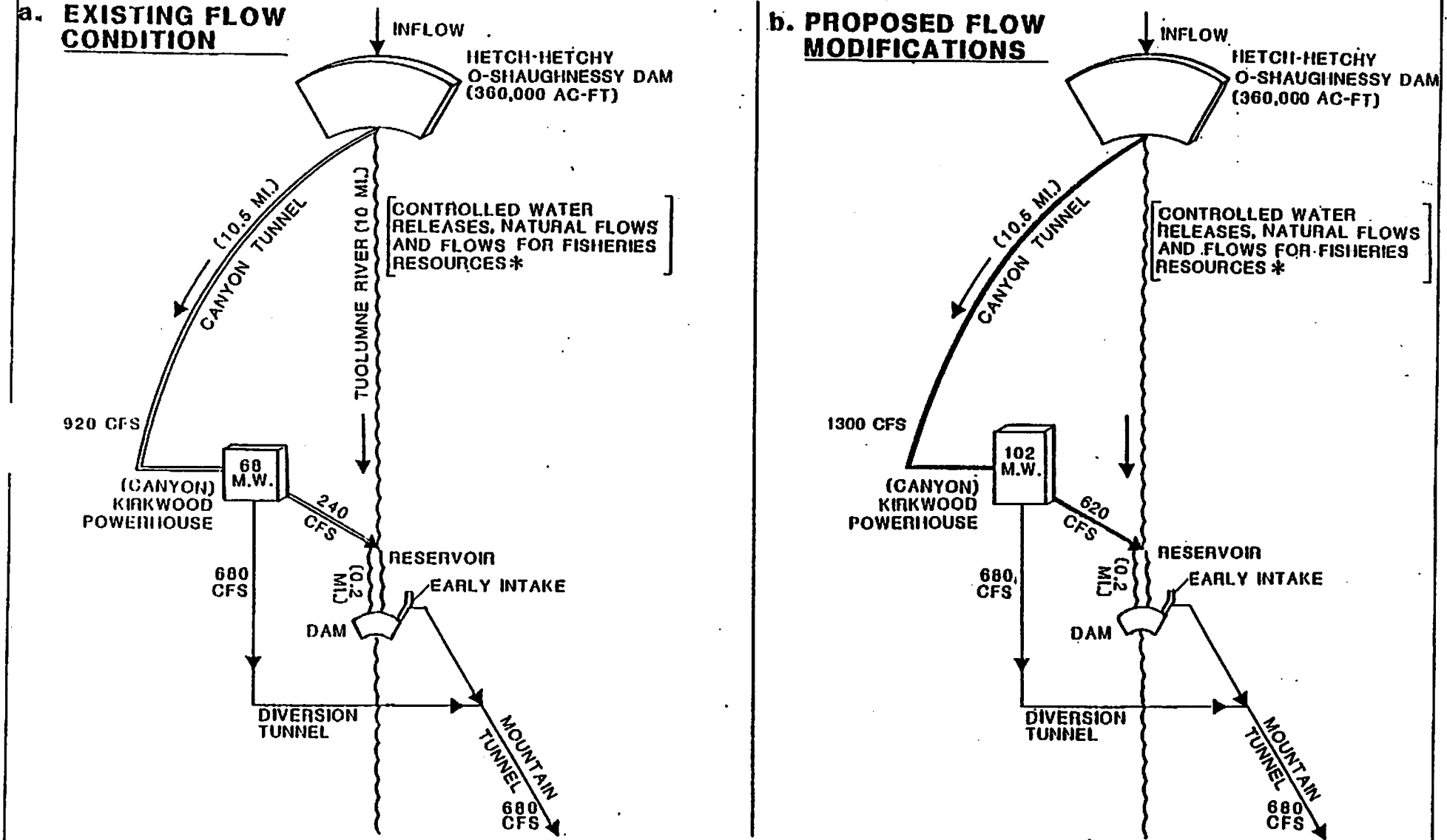
Depending on the level of Hetch Hetchy Reservoir, past records indicate that the Canyon Power Tunnel and penstock are capable of transporting up to 1,300 cubic feet per second (cfs) of water, or about 400 cfs more than the 900 cfs that is currently carried at peak times (see Figure 4).[6] This additional 400 cfs of water would allow the operation of three generator units and would provide more flexibility for the operation of all three units; in addition, the useful life of the generators would be extended by operating the three generators at or below their rated capacity. An increase in electrical generation of 86 million kWh could be achieved annually, and the addition of a third generator would allowfor maintaining full flow to Moccasin Powerhouse without having to forego power generation due to utilization of the bypass when one generator is to be shut down for repair and maintenance. The third unit would also provide a backup in the event of a prolonged shutdown of one of the existing two units.

Usage of the third unit depends on water conditions; all three units generally would be used during the spring runoff period of normal and wet years, which typically occurs between March through June. In very wet years, all three units may be operated beginning in February or March. During the remainder of the year, only two units would be operated simultaneously, unless the year were extremely wet. During below normal or dry years, the three units would not be operated simultaneously. Any discharges for the purpose of operating three units at Kirkwood would be determined after all instream (fish flow) release requirements had been met in accordance with the negotiated agreement in January 1985 between the City and County of San Francisco and the U.S. Department of Interior (see Appendix B). The monitoring of the flows is done daily by the City, several hundred yards downstream from the base of O'Shaughnessy Dam.

KIRKWOOD POWERHOUSE: EXISTING AND PROPOSED FLOW CONDITIONS

FIGURE 4

SOURCE: PBQ AND D/EIP CORPORATION

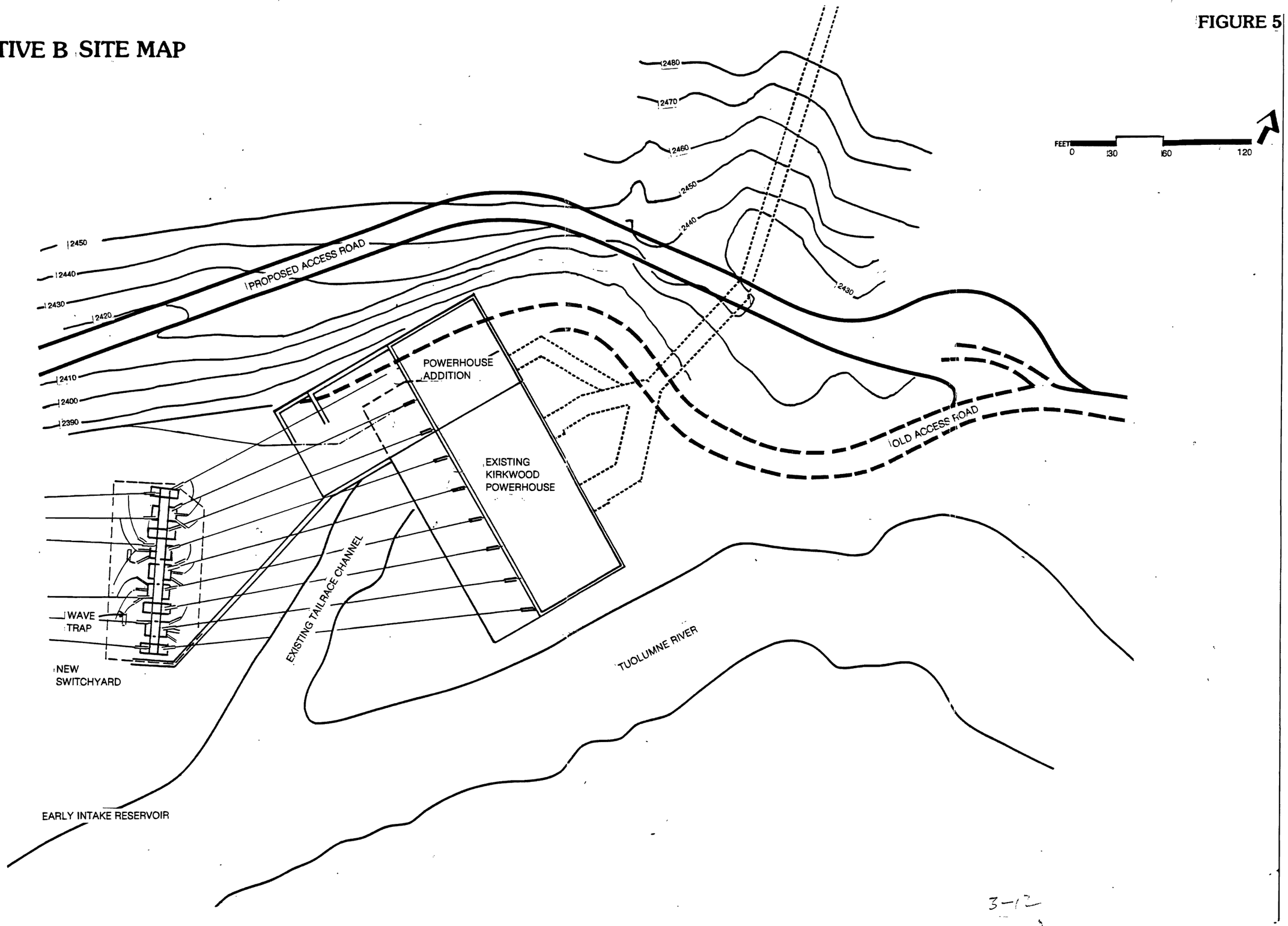


*VARIES WITH TIME OF THE YEAR AND DEGREE OF SNOW MELT/RAIN FALL.

FISHERIES RELEASES WILL BE ACCORDING TO THE 1984 AGREEMENT WITH THE U.S. DEPARTMENT OF INTERIOR

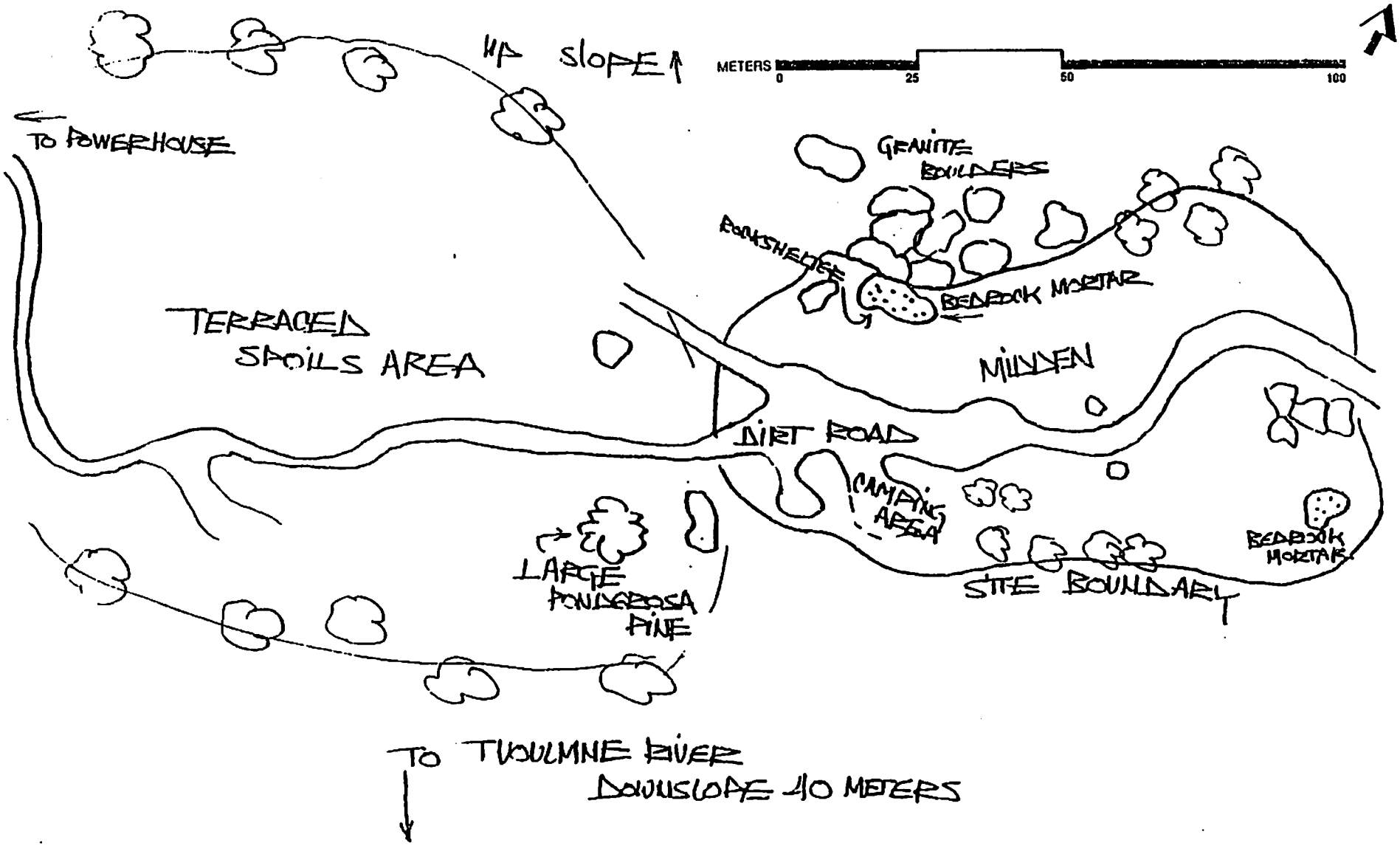
FIGURE 5

ALTERNATIVE B SITE MAP



ARCHAEOLOGICAL SITE MAP

FIGURE 10



The primary management goal for Hetch Hetchy is to have as much water in storage in July as possible for delivery to San Francisco and other Bay Area customers. Runoff normally decreases in July, depending on weather conditions, so reservoir levels must be managed during late winter and spring to ensure an optimum reservoir supply in July. The projected spills from O'Shaughnessy Dam are based on:

- existing level (maximum capacity 360,400 acre feet[7])
- snowpack conditions (variables include the wetness or dryness of the snow, presence of ice, the depth and area of coverage, cloud cover, temperatures and soil conditions)
- actual precipitation onto the Hetch Hetchy watershed after the forecast date

Projections are made monthly by the City, beginning in February when the first State Department of Water Resources snow pack data are available for analysis. If all three of the above criteria are normal[8] or above average for March, April and May, then all three units at Kirkwood Powerhouse may be operated. The amount of anticipated spill is what would determine whether water is released to Kirkwood to operate all three units.[9] These power spills for operating all three units would not interfere with the fish release schedule agreed upon between the City and the U.S. Department of Interior in January 1985.

Water years that are less than 75% of normal would not support operation of all three units simultaneously.[10] Therefore, in dry years or years below 75% of normal, only two units would be in operation. In years that are 75% of normal, there would be a 50-50 chance of full operation, and the decision would be postponed until April, when the certainty of the water supply is about 90%. All three units could typically be used through June in normal and above normal water years. The only time all three units would be in operation beyond June would be in years when heavy snowpacks remain into the summer.

During any year that all three units are operating and using more than 900 cfs, the City and County of San Francisco is prepared to release an additional 10,000 acre-feet of water at O'Shaughnessy Dam, in addition to the required level of release for maintenance of fisheries resources. The need for additional flow releases at O'Shaughnessy Dam above the negotiated fish releases may not be necessary in most years. The diversion of an

additional maximum 400 cfs for the third unit would not prevent spills over O'Shaughnessy Dam from occuring in normal to very wet years. These spills may be augmented by the proposed additional 10,000 acre-feet. The timing and rates of these releases would be managed in cooperation with the appropriate agencies to benefit the fish, wildlife and recreational values of the Tuolumne River below O'Shaughnessy Dam.

3.2.4 MANAGEMENT REQUIREMENTS

Prior to the construction and operation of the additional generating unit at Kirkwood, the following management plans would be generated and adhered to to ensure specific actions do not result in significant environmental impacts. These management plans would be reviewed and approved by the U.S. Forest Service prior to project implementation

- o Fire Management Plan
- o Erosion Control Plan
- o Spoils Disposal Plan
- o Construction Staging and Hazardous Materials Storage/Contingency Plan

3.3 ALTERNATIVES

3.3.1 ALTERNATIVE B

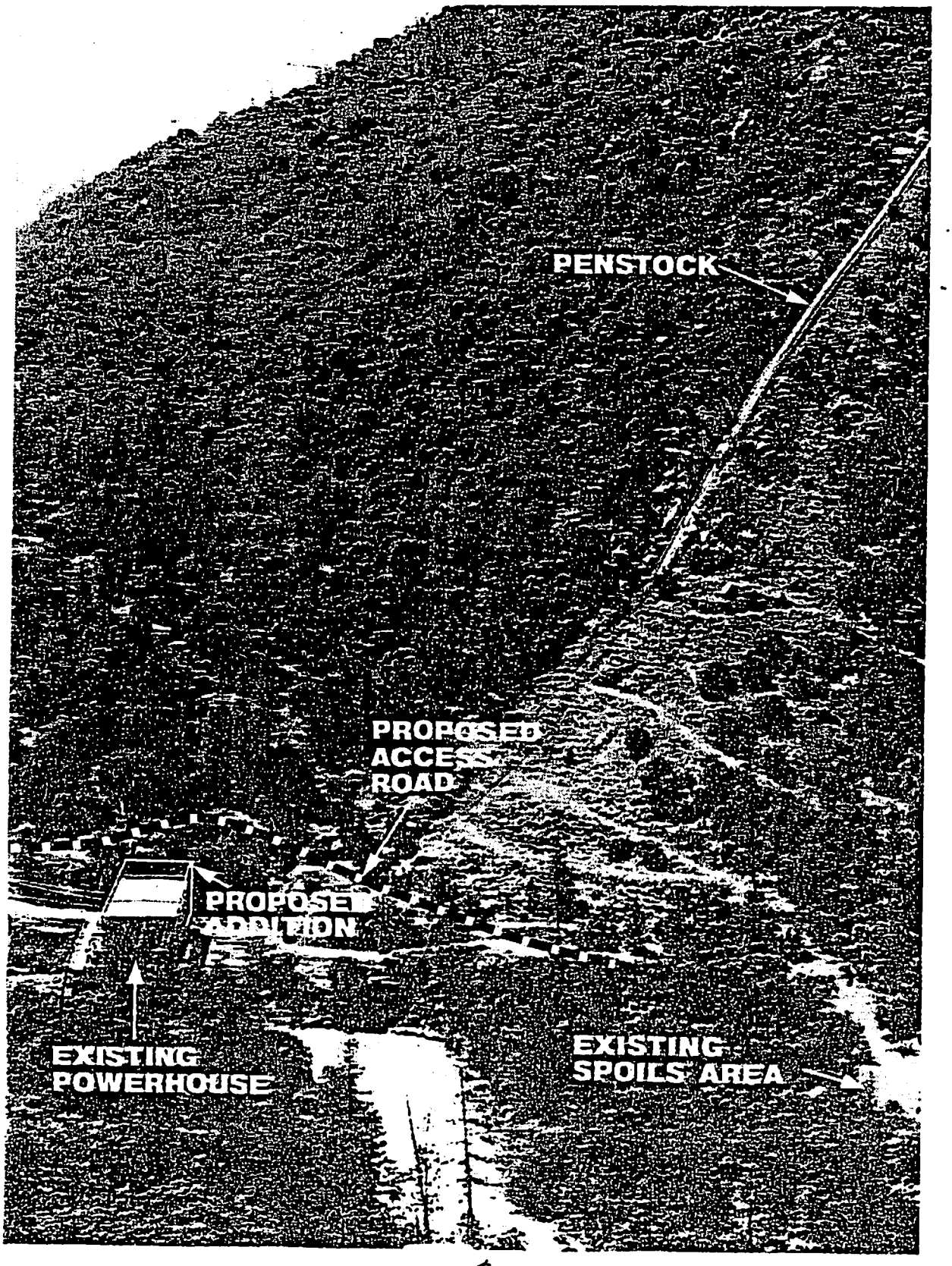
PROJECT CONFIGURATION

The new 36 MW turbine-generator set for Alternative B would be located in the area of the existing energy dissipation system. The powerhouse would be extended in a northwesterly direction over the existing roadway into the hillside (see Figures 5 and 6).

The energy dissipation system is removed and replaced with a turbine-generator of a capacity equivalent to the existing units. This new turbine-generator set has approximately a 7% higher capacity, but has physical dimensions similar to the existing turbine-generator sets. To provide adequate water inflow capacity, it would be necessary to replace the existing penstock branch to the energy dissipator with a larger penstock branch and install a new 42-inch diameter turbine shutoff valve of the same type as the existing ones. The existing penstock branch to the present energy dissipator would be capped.

ALTERNATIVE B: PROJECT AREA PHOTOGRAPH

FIGURE 6



As an energy transmission option, a new switchyard would be built downstream of the powerhouse (see Figure 5). The existing double-circuit 230kV transmission line and existing switchyard would remain as they are. A third transmission option would be to replace the existing switchgear and transformers with larger units. These options were dismissed as too expensive and disruptive to the operations of the system.

Because the existing access roadway bypassing the Kirkwood powerhouse would be interrupted by the powerhouse addition, a new bypass road would be built on the steep slope north of the powerhouse, starting near the existing bunkhouse and connecting to the existing road after passing over the penstock.

PROJECT CONSTRUCTION

The excavation, concrete placement and spoils disposal would be conducted in the same manner as in the proposed action. Differences in the construction process would be related to the differences in the configuration of the alternatives.

Additional fill would be placed along the tailrace retaining wall to create a Kirkwood Switchyard platform at el 2384.0 between the existing first operator residence fence and the new tailrace retaining wall. On this platform the new gas-insulated switchyard would be erected.

Relocation of the access road to the north would require far more grading and fill to construct than the relocation of the access road for the proposed action. A cofferdam would not be needed for this alternative.

PROJECT OPERATIONS

Operations of this alternative would be the same as for the proposed action.

3.3.2 NO-PROJECT ALTERNATIVE

This is the no-project alternative and serves as the basis against which the proposed action and Alternative B are compared. This alternative would involve none of the proposed activities defined in the proposed action and Alternative B descriptions.

[1]Sverdrup & Parcel and Associates, Inc., Hetch Hetchy Water and Power Systemwide Power Study, June 1981.

[2]Tudor Engineering Company, Hetch Hetchy Water and Power Kirkwood Powerhouse Addition Predesign Investigation Executive Summary, March 1985.

[3]Penstock = A large 84-92-inch, 1,900-foot-long exposed pipe conveying water from the portal of the Canyon Power Tunnel down the 1,000-foot vertical drop to the Kirkwood Powerhouse.

[4]Tailrace = The constructed channel that carries the water away from the powerhouse and back into the natural waterway after it has been sent through the power turbines.

[5]Tailrace Discharge Gate = This is a tailrace overflow and flood water regulating gate that is designed to prevent water from backing up into the turbine generators.

[6]The penstock is capable of carrying additional cfs within safe limits. In the past year, leakage was discovered at the Number 4 coupling, which was replaced with a larger expansion coupling to allow for slight movement. The Hetch Hetchy Water and Power Department is in process of a detailed investigation of the subsurface under the coupling and has provided additional monitoring of the penstock to ensure that the Kirkwood Powerhouse continues to operate safely at all times. (See Appendix C for further discussion.)

[7]Acre Foot = 325,851 gallons.
Cubic feet per second - 1 acre-ft/1.98/number of days.

[8]Normal reservoir level on February 1 = 160,00 acre-ft
Average precipitation and snowpack on April 1 - July - 605,000 acre-ft

[9]The specific amount and time for spills is difficult to project. The process of determining the time and amount of releases or spills is based on a detailed analysis form used by the City, which considers all of the controlling variables (see Appendix D). For example, the reservoir level is a function of precipitation and snowpack from the previous year(s). Early in the normal spill season (February - April) the amount of water to be released is evaluated for the entire projected spill period. For example, assuming the reservoir is at a normal level, the following are estimate projections of the amount of water that should be released through the normal spill period in a normal or average year. These also are estimates of threshold levels for the operation of the proposed third unit:

February 1	220,000	acre-ft
March 1	150,000	acre-ft
April 1	60,000	acre-ft
May 1	30,000	acre-ft

The amount and timing of spills must always meet the fish release conditions and stipulations of the agreement between the City and U.S. Department of Interior (See Appendix B).

As the season progresses the release schedule is monitored and updated on a weekly to daily basis. It is during this projection period that the actual weekly or daily releases would be determined based on the various weather conditions. The actual spills in terms of cubic feet per second (cfs) would be determined on the basis of how long a spill period is required. Depending on the time of season, the release schedule may extend over ten days of 100 cfs, for example, or 1,000 for one day.

[10] For the purposes of comparison this year (1985) is approximately 69% of average or a dry water year.

4 SETTING

The setting for each issue is the same for the proposed action and each alternative.

4.1 TRANSPORTATION

The project site is directly accessible (via a site access road) from Cherry Oil Road, a Forest Service route (IN07). Cherry Oil Road is two lanes wide, extending from Cherry Valley Dam (about 15 miles north of the site) to State Highway 120 (about 10 miles south of the site). State Highway 120 is also a two-lane rural road extending east to Yosemite National Park and west through various small communities to Highway 99 and Interstate 5.

Traffic volume data have been obtained from Caltrans and Forest Service records.[1,2] As shown in Table 1, the existing volumes tend to vary considerably, depending on the season. The higher daily volumes on Highway 120 reflect summer conditions. On Cherry Oil Road, higher traffic volumes are experienced during the deer hunting season (September to November).

TABLE 1

EXISTING TRAFFIC VOLUMES

Road	Average Daily Volume	Peak Season Daily Volume
Cherry Oil Road north of Highway 120	65	135
Highway 120 at Cherry Oil Road	1,600	3,150

4.2 BIOLOGY

VEGETATION AND WILDLIFE

Vegetation cover on the upper slopes of the river canyon is relatively sparse; the bottom of the canyon supports more dense stands of vegetation. Principal woody species are ponderosa pine, incense cedar, California black oak, California buckeye, willow, alder, Ceonothus, birchleaf mahogany, manzanita, elderberry, wild grape and poison oak.

Wildlife species common to the Tuolumne River drainage include black-tailed deer, California mule deer, black bear, black-tailed jackrabbit, gray squirrel, coyote, beaver, mink, muskrat, raccoon, striped skunk, California quail, mountain quail, blue grouse, band-tailed pigeon and mourning dove. The U.S. Forest Service and California Fish and Game have identified areas south of the river as important winter range habitat for the Yosemite deer herd.

SENSITIVE SPECIES

During a field survey no rare or endangered plant species were located at any of the construction sites. Candidate plant species targeted and looked for during the field survey are listed in Table 2. Young Clarkia plants in bud were observed in and around the area of proposed Tower 6AE. Positive identification of this plant is not possible until the plant blooms in June-July. The only Clarkia with legal status as a rare or endangered plant is Clarkia lingulata, a plant listed as "rare" under the California Native Plant Protection Act (1981). A recent Sensitive Plant Survey Report[3] concluded that "it is very unlikely that Clarkia lingulata occurs in the [Stanislaus National] Forest, due to habitat and geographic factors." A subsequent survey of the site in July 1985 was inconclusive due to the unusually dry and warm weather the plants had already bloomed and set seed. Based on the seed and capsule characteristics, it appears that the plants were Clarkia unguiculata, a common species in this region.

Rare, endangered or threatened wildlife species whose geographical range of distribution includes the project study area are listed in Table 3.

TABLE 2
CANDIDATE SPECIES FOR RARE PLANT SURVEY

Species	Status			
	Federal	State	USFS	CNPS
Carex paucifructa	*		S	1
Carex whitneyi				1
Chloroglum grandlflorum	*			1
Clarkia australis			S	1
C. lingulata	*	R	S	1
C. rostrata	*		S	1
Dowisnngia humilus	*			1
Eriophyllum congoonii	*	R	S	1
Lewisia congdonii	*	R	S	1
Pygmaea	*			1
Lomatium congdonii	*			1
Lomatium stebbinsii	*		S	1
Lupinus dalesae	*			1
L. spectabilis	*			1
Plagiobothrys scriptus	*			1
Pseudobahia bahiaefolia	*	E		1
Arctostaphylos nissenana				2
Carex congdonii				2
C. davyi				2
Ceanothus fresnensis				2
Clarkia biloba ssp. australis	*			2
C. virgata				2
Cryptantha crymophilia				2
C. mariposa				2
Cypripedium californicum	*			2
Eryngium pinnatisectum	*		S	2
Erythronium tuolumnense	*		S	2
Hackelia longituba				2
Hulsea brevifolia				2
Iris hartwegii ssp. columbiana				2
Ivesia unguiculata				2
Mimulus biolettii				2
M. filicaulis				2
M. gracilipes				2
M. grayi				2
M. inconspicuus				2
M. lanciniatus				2
M. pulchellus				2
M. whipplei	*		S	3
Ophioglossum lusitanicum ssp. californicum				2
Perideridia bacigalupii	*			2
Phacelia platyloba				2
P. vallicola				2
Podistera nevadensis				2
Polystichum kruckeburgii				2

TABLE 2

CANDIDATE SPECIES FOR RARE PLANT SURVEY

(continued)

Species	Status			
	Federal	State	USFS	CNPS
Scirpus clementis				2
Silene invisa	*		S	2
Trichostema rubisepalum				2
Trifolium bolanderi	*			2
Wyethia elata				2

R = Rare
E = Endangered
S = Sensitive Species
* = Plant taxa currently under Federal review
1 = Plants considered to be rare and endangered by the California Native Plant Society (CNPS)
2 = Taxa rare but not endangered according to CNPS
3 = Taxa believed to be extinct by CNPS

The limestone salamander is found in the nearby Merced River Canyon. As its name implies, this species is associated with limestone outcrops. No limestone outcrops are located in the reach of the Tuolumne River associated with the Kirkwood Powerhouse project area.

Bald eagles have been sighted in the project area and peregrine falcons are known in the area of O'Shaughnessy Dam. Either a peregrine or a prairie falcon has been sighted near the rock outcrop on the south side of the Tuolumne River, directly across from the Early Intake Reservoir.

FISHERIES

Rainbow and brown trout inhabit the 12-mile stretch of river between O'Shaughnessy Dam and Early Intake. The range of these species extends as far downstream as Don Pedro Reservoir. Non-salmonid fishes in the area include suckers, riffle sculpin and minnows.

TABLE 3

POTENTIAL RARE OR SENSITIVE ANIMALS IN THE KIRKWOOD ADDITION PROJECT AREA

	Mammals	USFS Concern	Federal Listed	State Listed
1.	Sierra Nevada Red Fox (Vulpes vulpes necator)	X		Rare
	Birds			
1.	Harlequin Duck (Histrionicus histrionicus)	X		
2.	Bald Eagle (Haliaectus leucocephlaus)	X	Endangered	Endangered
3.	Northern Goshawk (Accipiter gentilis)	X		
4.	Golden Eagle (Aquila chrysaetos)	X		
5.	American Peregrine Falcon (Falco peregrimus anatum)	X	Endangered	Endangered
6.	Prairie Falcon (Falco mexicanus)	X		
7.	Spotted Owl (Strix occidentalis)	X		
8.	Great Gray Owl (Strix nevulosa)	X		Endangered
9.	Pileated woodpecker (Dryocopus pileatus)	X		
10.	Willow Flycatcher (Epidonax traillii)	X		
	Reptiles			
No sensitive species in the area.				
	Amphibians			
1.	Limestone Salamander (Hydromantes brunus)	X		Rare
	Invertebrates			
1.	Tuolumne Land Snail (Monadenia circumcarinata)	X		

A condition of Kirkwood Powerhouse approval in 1967 was an interim flow requirement established by the Secretary of the Interior to protect the Tuolumne River fisheries and recreational resources between O'Shaughnessy and Early Intake. The flow schedule established minimum flows during the period May 1 through September 15 of 75 cfs and between September 16 through April 30 of 35 cfs.

As stipulated in the terms of the conditions of approval, the Fish & Wildlife Service, U.S. Forest Service, National Park Service, and the California Department of Fish & Game conducted an interagency fishery and recreation study in 1968 and 1970 to determine the adequacy of the interim flow schedule for the protection of fisheries and recreational interests.

The interagency group concluded from the studies that the interim flow schedule was inadequate and recommended a revised schedule of minimum flows.

Subsequent negotiations between the City and the resource agencies resulted in a fish flow release schedule that incorporates factors of preciptitation and runoff in its implementation (see Appendix B).

4.3 VISUAL QUALITY

The project site is not within the Wild and Scenic area of the Tuolumne River. The Tuolumne River's steep slopes, vegetative variety and contrasts between rock and free-flowing water contribute to the river's high aesthetic rating that ultimately leads to wild and scenic status for most of the river under the Wild and Scenic River Act. The designated portions of the river are thus protected under the Act to be preserved in a natural condition. The Kirkwood project site is not within the Wild and Scenic designated area of the Tuolumne River. The Wild and Scenic River Act, passed by Congress on October 2, 1968, defined wild river areas or portions of rivers as those that are free of impoundments, with shorelines that are primitive and undeveloped, but accessible. Because the Kirkwood project site consists of a penstock mounted on a canyon wall, a powerhouse at the river edge, an 81-foot-high concrete arch dam, electrical transmission lines, electrical switchyard, accessory facilities and a small residential community, the

area was considered ineligible by the Forest Service for Wild and Scenic status.[4] In addition, it was noted by the Forest Service that there is extensive rip-rapping (the placement of rockfill) of the Tuolumne's streambed to prevent erosion and protect the residences and switchyard facility. The Forest Service concluded, "Including the diversion dam, this one-mile segment of the Tuolumne, centered at Early Intake and extending to the Cherry Creek confluence, is considered ineligible for designation."[4]

4.4 CULTURAL RESOURCES

Prior to conducting a field reconnaissance of the project area, maps and records that indicate the location of known cultural resources in that general area were reviewed. A similar literature review was accomplished at the U.S. Forest Service Office in Sonora and existing site information was verified with the California Archaeological Inventory Central Information Center at Stanislaus State University. In addition, the National Register of Historic Places[6] and the California Inventory of Historic Resources[7] were also consulted. The records indicate that one prehistoric archaeological site (USFS No. 05-16-54-183) is located in the immediate vicinity of the proposed staging/spoils area. The site was recorded during the Tuolumne Wild and Scenic River Studies.[8,9] The site is described as a very large (105 meters N-S x 80 meters E-W), deep midden site with several probable rock shelters, two bedrock outcroppings with 38 mortars, abundant obsidian debitage, cobble pestles and mano (grinding stone) fragments. This large habitation and milling site is presumed to have been the location of a permanent prehistoric settlement and can be regarded as potentially eligible for nomination to the National Register of Historic Places.

4.5 WATER QUALITY

A limited amount of published water quality data for the Tuolumne River is available from the California Department of Water Resources. Although brief, the information gives a general idea of the quality of water in the river system.[10]

Nutrient analyses at Early Intake and at Wards Ferry Bridge indicate very minor amounts of nutrients; in most tests the amounts are so low that they could not be measured.

Mineral analyses from Early Intake, Wards Ferry Bridge and New Don Pedro Reservoir indicate that the hydrogen ion concentration of the water is neutral to slightly acidic (as nearly optimum as possible) and that the water is so free of dissolved minerals that its electrical conductivity ranges from 10 to 60 micromhos. A conductivity of 200 micromhos is necessary for good aquatic habitat. Ammonia and organic nitrogen is below 0.02 milligrams (mg) per 100 milliliters (ml). Inorganic nitrogen is below 0.002 mg/100 ml. When there is a measurable amount, total phosphate is below 0.002 mg/100 ml.

Because of the constant aerating action normal in a whitewater river, the dissolved oxygen content is high, whereas biological oxygen and total suspended solids are very low, indicating very pure water with almost no turbidity.

4.6 RECREATION

Recreation has been and will continue to be the most popular use of the Tuolumne River. The river is accessible to a large number of recreationists. The nearly five and one-half million residents of the San Francisco Bay Area are within a four- to five-hour drive of the river, and the Sacramento Metropolitan Area is within about a two-hour drive of the river. Fishing, hiking and camping are popular recreational activities along the river within the Stanislaus National Forest and Yosemite National Park, although the river environment is not well developed for recreational use because of the rugged terrain and few access points. Whitewater rafting is a major recreational use of the lower Tuolumne, beginning at a point about two to three miles downstream of the Kirkwood Powerhouse; this sport has become very popular in recent years.

The Preston Falls trailhead is located within the immediate area of the Kirkwood Powerhouse, adjacent to the powerhouse spoils area. The trail is about four miles long and ends at Preston Falls. The trailhead area is used occasionally by campers, but visitation statistics are not available. It has not been documented whether there is swimming in the river that flows along the trail, but wading by hikers cannot be ruled out. Some fishing along the river by trail hikers is also a possibility, but there is no statistical data on this activity. It is estimated that two or three people hike the trail each day during the spring and early summer months.[11]

The Poopenaut Valley trailhead is off the paved road to O'Shaughnessy Dam. The trail is approximately 1.5 miles to the Valley. ~~There are~~ fire pits provided and camping is permitted. The most popular recreational activities in the Valley are fishing and swimming.

4.7 UTILITIES/PUBLIC SERVICES

The operation of the Kirkwood Powerhouse is essentially self-contained with respect to use of public utilities and services. All water, power and sanitation services are provided to the powerhouse and the Early Intake/Kirkwood Village from sources exclusive to the Hetch Hetchy System.

4.8 GEOLOGY/TOPOGRAPHY

The Tuolumne River Canyon has the same general rock and soil types as the Merced River Canyon (to the south), the Stanislaus River Canyon (to the north) and other major river canyons in the Western Sierra Uplands. The major geologic units are steeply dipping metamorphosed sedimentary rocks in the lower section of the river, weathered granitic rocks in the middle and upper sections of the river, and small scattered areas of glacial deposits and alluvial flats in the upper section of the river. At the proposed project site, on the north shore of Early Intake Reservoir, the bedrock is granitic, usually deeply weathered and overlain by 13-22 feet of sand and gravel.[12] This thin veneer of glacial deposit occurs on the canyon walls above Early Intake. These deposits probably represent the most recent glacial events in the area; earlier deposits have been removed by erosion. Upstream from the project site, the bedrock is also granitic. It is not deeply weathered and was generally cleared of soil and weathering products by glacial erosion.[13]

At the project site, the canyon is steep-walled with a narrow bottom that is completely filled by the river channel. The existing powerhouse is at approximately 2,400 feet above sea level, which is approximately 100 feet above the canyon floor at the base of Early Intake Dam and about 1,800 feet below the crest of the ridge through which the canyon was cut.

Soils in the project vicinity are classified by bedrock geology, vegetation type and slope class. Chawanakee and Tollhouse soils occur at the project site on weathered granitic bedrock slopes that range in steepness from 50-100%. They are stony and coarse-textured and very easily eroded and gullied. Bare rock forms between 10-50% of the mapped areas of these soils. These soils are considered marginal to very poor for timber production. A small area of glacial deposits on the south wall above Early Intake contains Dinkey/Ducey-like soils. These soils are coarse-grained and very unstable when disturbed by tree removal or road construction. A large slide in these soils was triggered by road construction.[14]

The Melones Fault Zone is about three miles southwest of the project site. Most rupture traces within this zone are approximately located or well located. A few traces are inferred or hidden by younger rocks. These faults do not show evidence of recent movement, but numerous earthquakes associated with the fault zone have been reported in the last 150 years. Reported earthquakes range between Richter magnitude 3.1 and 4.0 (modified Mercalli Intensity III to V).[13] Earthquakes of these Richter magnitudes are too small to register on the San Francisco Groundshaking Intensity Scale, which begins with Richter magnitude 5.5 (modified Mercalli Intensity IV). The Kirkwood structure would be designed to resist damage from seismic groundshaking.

4.9 AIR QUALITY AND CLIMATE

The climate of the proposed project site is influenced by its altitude and the relationship between the mountainous areas to the northeast and south and the Central Valley to the west. Winds are strongly influenced by the thermal differences between the Valley and the mountain areas. The complex topography makes wind speed and direction difficult to predict in the vicinity of the project site. However, during winter storms, wind speeds may exceed 100 mph.

Air quality measurements are not available in the immediate vicinity of the project. Estimates of existing air quality were based on data collected in other areas in the Sierra Nevada. It would appear that potential air quality problems would be limited to ozone and particulate matter. Ozone is the result of upwind emissions of hydrocarbons and nitrogen

oxides that undergo photochemical reactions. The major sources of particulate matter in the project vicinity are natural rather than created by human activity and would not be affected significantly by the proposed project.

4.10 LAND USE ZONING AND PLANS

The proposed Kirkwood Third Unit project is located in Stanislaus National Forest and Tuolumne County. The actual site of the project is on land used by the City and County of San Francisco under the terms of the Raker Act of 1913.

In 1979, the U.S. Forest Service, National Park Service and Bureau of Land Management, at the direction of Congress, completed a study of the Tuolumne River for possible Federal Wild and Scenic River designation. The study resulted in the recommendation to Congress that 83 of the 92 miles originally designated for study be made part of the National Wild and Scenic River System. That portion of the Tuolumne River around the Early Intake/Kirkwood Village (approximately one mile) was determined to be ineligible for Wild and Scenic status. A 12-mile stretch of the river upstream of the project site to O'Shaughnessy Dam was designated as "scenic," and a 13-mile stretch of the river downstream of the project site to the Clavey River confluence was designated as "recreational." The final designation of the eligible stretches of the Tuolumne River as Wild and Scenic was made by Congress and signed by President Reagan in September 1984.

The Tuolumne River from O'Shaughnessy Dam to Lake Don Pedro was listed in the 1974 California Recreational Trails Act as a potential priority Boating Trail. Official designation of a river requires a request for designation and a management plan to preserve, manage and enhance the river from the local agency with jurisdiction over the river corridor. To date, no such request has been made by the Forest Service or Bureau of Land Management for that portion of the Tuolumne River that crosses federal land, and none of the priority streams has been so designated, although the California Department of Boating and Waterways uses the list of priority streams in reviewing proposed projects that could conflict with river boating.

The Multiple Use Management Plan of the Stanislaus National Forest designates the project site within the "Special Zone (S-2) Raker Act Area."[16] The Forest Service Objectives and Management Decisions for this zone are presented in the following paragraphs.

MANAGEMENT OBJECTIVES

Management objectives of the Raker Act are:

- Safeguard the public interest by completely exercising the authorities granted to the Forest Service by the Raker Act, the Stipulations for Relocation and Amendment filed October 2, 1958, and authorities acquired through precedence.
- At each opportunity ensure that an optimum water flow is achieved and guaranteed, which will provide recreation use and fishery production and not damage the stream channel and banks.
- Will request maximum measures to be used in order that all practical slope stabilization is performed.

MANAGEMENT DECISIONS

Management Decisions of the Raker Act are:

- Improvements in this unit will be limited to those necessary in connection with water-power developments and in connection with recreation use.
- Require adequate soil stabilization practices in all CCSF projects in the Raker Area.
- All roads located in this unit will be located to prevent side cast from entering live stream channels.
- Recreation sites will be developed to provide facilities for day use fishing and picnic sites only.
- Work with CCSF on CCSF development and maintenance of a picnic and rest area at Early Intake.
- CCSF to provide public access to streams in the Unit.
- Work with CCSF to make spoil areas aesthetically pleasing as possible.

- o Protect existing scattered timber stand from damage or reduction by CCSF projects.
- o Check water releases to assure that stream flow agreements are followed and fishery is not damaged. Coordinate protection and improvement of fishery habitat with water yield objectives.
- o Eliminate livestock grazing from this unit.
- o Provide for withdrawals when needed to protect recreation, water production.
- o Maintain land under national forest ownership and minimize encumberances upon the land.

The spoils generated by the construction of the road and demolition of part of the existing powerhouse would be disposed of at the existing staging/spoils area. As part of the construction, measures would be implemented to ensure that the additional spoils would be placed completely clear of all trees, shrubs and riparian vegetation and not allowed to wash into the Tuolumne River.

Other than the above considerations -- Wild and Scenic River status, Boating Trail designations and the Multiple Use Management Plan -- there are no plans or goals that would affect the proposed project.

---

[1]Caltrans, 1982 Traffic Volumes on State Highways, 1983.

[2]Barton, Charles, U.S. Forest Service Traffic Engineer, Sonora Office, telephone conversation, November 18, 1983.

[3]Taylor, Dean, Summary of: A Sensitive Plant Survey for the Stanislaus National Forest California, October 1982.

[4]United States Department of Agriculture, Forest Service, Draft, Tuolumme Wild and Scenic River Study and Environmental Impact Statement, 05-16-78-09, page 31.

[5]United States Geological Survey, Lake Eleanor NW, California, 7.5 minute quadrangle series.

[6]U.S. Department of the Interior, National Park Service, National Register of Historic Places, 1979, Federal Register, 44:26; Federal Register Updates, February 6, 1979; March 18, 1980; February 3, 1981; and February 2, 1982.

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

[8]Colston, D. and B. Balen, Cultural Resources Inventory: Wild and Scenic River Study, Report on file with the Stanislaus National Forest, Sonora, California, 1976.

[9]Joratto, Michael J., Tuolumne Wild and Scenic River Study: Archaeology, Department of Anthropology, California State University, San Francisco, 1973.

[10]Information in the following four paragraphs was collated by Earl Ruby, Hydrologist, Stanislaus National Forest, for Water Quality Report, Tuolumne Wild River Sutdy, June 1, 1976.

[11]Lane, Bill, , U.S. Forest Service Groveland District, Recreation Officer, telephone conversation, May 3, 1985.

[12]Parsons Brinkerhoff Quade & Douglas, Inc., Hetch Hetchy Water Supply, Kirkwood Powerhouse Project, Access Road Relocations, Sacramento, California, November 1983, Figure 2.

[13]Delapp, J., Forest Soil Scientist, Stanislaus National Forest, Geology - Soils -Vegetation of the Tuolumne River Study Area, May 1976, pages 2 and 3.

[14]Delapp, op.cit., pages 6 to 8.

[15]Kojan, E., Project Engineer, USDA Forest Service, Identification and Evaluation of Geotechnical Hazards, Tuolumne River Study, July 1976, scale 1:250,000.

[16]U.S. Forest Service, "Chapter 300 - Special Zone (S-2) Raker Act Area," Multiple Use Management Plan of the Stanislaus National Forest, June 7, 1978, page 44.1.

5 ENVIRONMENTAL CONSEQUENCES

5.1 IMPACTS: PROPOSED ACTION

5.1.1 TRANSPORTATION

The proposed action would generate traffic during construction. The completed project would not have a measurable effect on the total powerhouse operating staff. It is not anticipated that project operation would result in traffic increases. Project construction traffic would reflect delivery of equipment and materials. (All excavated materials would be disposed of onsite.)

Based on the project cost and schedule, an average of 30 construction employees would work during the peak construction period of 17 months.[1] The remaining three months of project construction would have an average of 10-15 employees. It is not known whether the employees would live onsite or commute from other housing locations. Assuming all employees commuted from offsite, an estimated 20-30 daily trips would be added to the highways during the peak construction period (assuming two to three employees per vehicle). On Cherry Oil Road, the traffic increase would be recognized, but traffic would remain free flowing. On Highway 120, construction employee traffic would add at most 1-2% to existing volumes. An increase of this amount would not be measurable in typical daily traffic-volume fluctuations.

The most intense construction phase would involve concrete placement. The total concrete placement is estimated at about 7,000 cubic yards over a six-month period.[1] With delivery of materials (e.g., aggregate, sand, steel), truck traffic would average five to ten daily vehicles over the six-month period. With temporary surges in delivery activity (to stockpile materials), peak truck traffic could approach 10-20 vehicles on

certain days (20-40 one-way trips). The truck traffic would reduce Highway 120 capacity by 5-10%, but flows would remain stable.[2] While the effects would be more pronounced on Cherry Oil Road, the low total volume would remain stable. Truck traffic on Cherry Oil Road would be limited to nonholiday weekdays, except in emergency situations.

The added traffic volumes would be visible from positions of the Tuolumne Wild and Scenic River corridor upstream of the site. It is possible that some of the larger trucks could be heard from the nearest portions of the Wild and Scenic River corridor upstream.

ACCESS TO STAGING/SPOILS AREA AND RELOCATION OF EXISTING ROAD

A preliminary engineering study was conducted for a new access road north of the powerhouse (see Figure 7). The new access road alignment is fixed at both ends by the existing access roadway and by the required ten-foot fill over the penstock. The new roadway alignment would be supported by concrete crib retention walls on both the upslope and downslope cut areas.

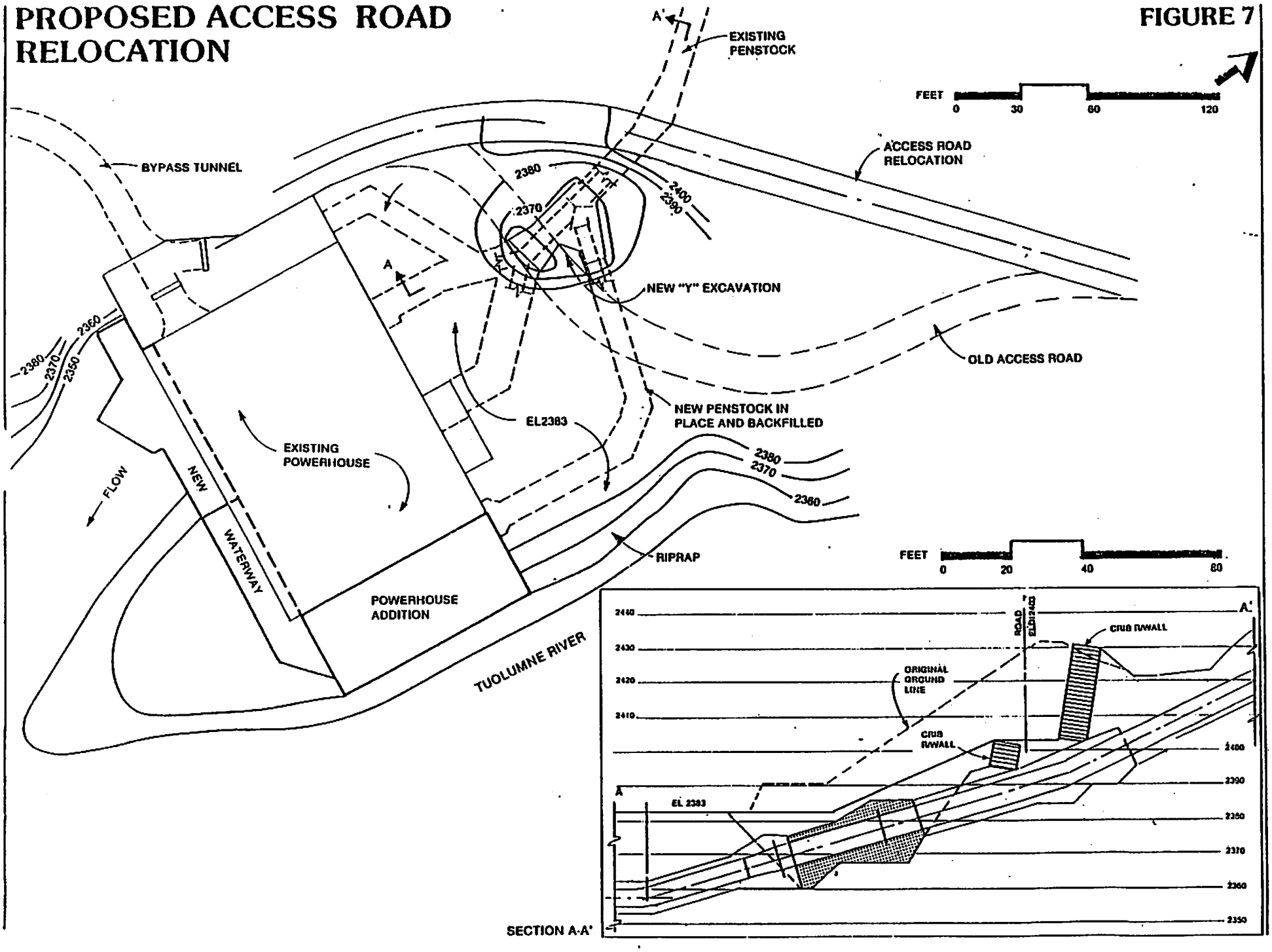
The proposed access road alignment would have a maximum grade of 15% and a roadway width of 15 feet. The grade cannot change without increasing the road construction area to the west and east, thus increasing the area of impact.

The amount of excavation and fill material for the new access road is shown in Table 4, with the total estimated at 3,500 cubic yards. In addition to excavation, provisions for surfacing the access road would be necessary. This may be two inches of bituminous surfacing over six inches of aggregate base. There would also be a need for drainage crossings. It can be expected that the uphill, in-cut side of the access road would have seepage water that must be channeled as well as surface runoff (from rainfall and snowmelt) that must be collected and transported.

Because of the elevation drop, guard rail barriers would border the south side of the roadway.

PROPOSED ACCESS ROAD RELOCATION

FIGURE 7



SECTION A-A'

Table 4 also summarizes the estimated quantities and costs involved in the construction of a new access road. The construction costs estimated for the new access road are based on unit prices and lump sum estimates derived from recent experience on similar jobs.

TABLE 4
CONSTRUCTION VOLUMES AND COST FOR ROADWAY ALIGNMENT

Item	Unit	Quantity	Unit Cost $	Cost $
Clearing and Grubbing	Lump sum	--	--	2,000
Unclassified Excavation	cu yd	2,500	5	12,500
Rock Excavation	cu yd	1,000	20	20,000
Backfill from Excavation	cu yd	100	5	500
Reinforced Concrete Crib Walls	Lump sum	--	--	80,000
Gravel Surfacing	Lump sum	--	--	12,000
Surface Drainage	Lump sum	--	--	2,000
Asphalt Pavement	Lump sum	--	--	4,000
Remedial Work and Landscaping	Lump sum	--	--	2,000
			Total Cost	135,000

Approximate length of relocation = 700 feet. Unit cost per foot of length = $193 ft.

None of the access roadway relocation work would occur within the Wild and Scenic River corridor. The spoils area is outside of the Wild and Scenic River corridor and none of the spoils materials is expected to enter the river and thus impact downstream areas.

5.1.2 BIOLOGY

VEGETATION

The proposed action would result in some limited vegetation removal in the areas of the added transmission towers, and the relocated access roadway east of the powerhouse. In the areas of the transmission towers, some brush and a few small oak trees (Quercus weslezenii and Q. kelloggii) would have to be removed to place the tower footings. There are about 21 Ponderosa pine trees (Pinus ponderosa) and 3 California black oak trees (Quercus kelloggii) occuring along the powerline alignment. These trees grow to 100-150 feet in height at maturity. Many, if not all, of these trees would be removed to prevent them from conflicting with the overhead powerhouse. Most of these trees are located near the proposed tower 3AE, are about 50-75 feet tall with a diameter at breast height (dbh) of one-half to one foot. No significant vegetation removal at the proposed powerhouse additions, switchyard addition or spoils sites is expected because these areas are essentially devoid of vegetation. Consequently, the proposed action would not result in loss of habitat for wildlife or native vegetation.

None of the proposed actions would remove or disturb vegetation within the Wild and Scenic River corridor. The changes in flow volumes in the river are not expected to be great enough to significantly affect riparian vegetation along the river. Spills are still expected to occur from O'Shaughnessy Dam in volume great and often enough to support any regeneration of riparian plant species.

WILDLIFE

The opposite side of the canyon (south side) is an important winter range for the Yosemite mule deer herd. The proposed action should not significantly interfere with deer migrations. Most of the construction-related traffic would be limited to daylight hours when most deer migrations do not occur. Consequently, the potential for construction vehicles killing deer would be limited and not significant.

The implementation of the Third Unit is not expected to significantly affect fish habitat or interfere substantially with the movement of any resident or migratory fish species within the stretch of the Tuolumne River between O'Shaughnessy Dam and Early Intake.

The pre-project negotiated fish flow release schedule is to remain in effect during construction and after project completion.

Construction of the cofferdam would be scheduled to avoid disturbing the substrate or mobilizing silt during the spawning and incubation period (April-May) for rainbow trout. The cofferdam would be removed in mid-November; however, this activity is not expected to create enough downstream siltation to disturb the brown trout spawning and incubation.

Dynamite blasting and heavy equipment operation may generate noise conditions that may affect rare bird species, such as bald eagles and peregrine falcons, particularly during the breeding season. Blasting would be limited to March-June to avoid disruption during the nesting season.

No rare or endangered plant species are located or are believed to occur on the site.

The fish, bird and mammal wildlife within the Wild and Scenic River corridor is not expected to be significantly impeded by the proposed action. None of the wildlife habitat within the corridor would be significantly reduced or disturbed. The reductions in flows between O'Shaughnessy and Early Intake are not expected to significantly reduce fish habitat on the river (See Appendix E).

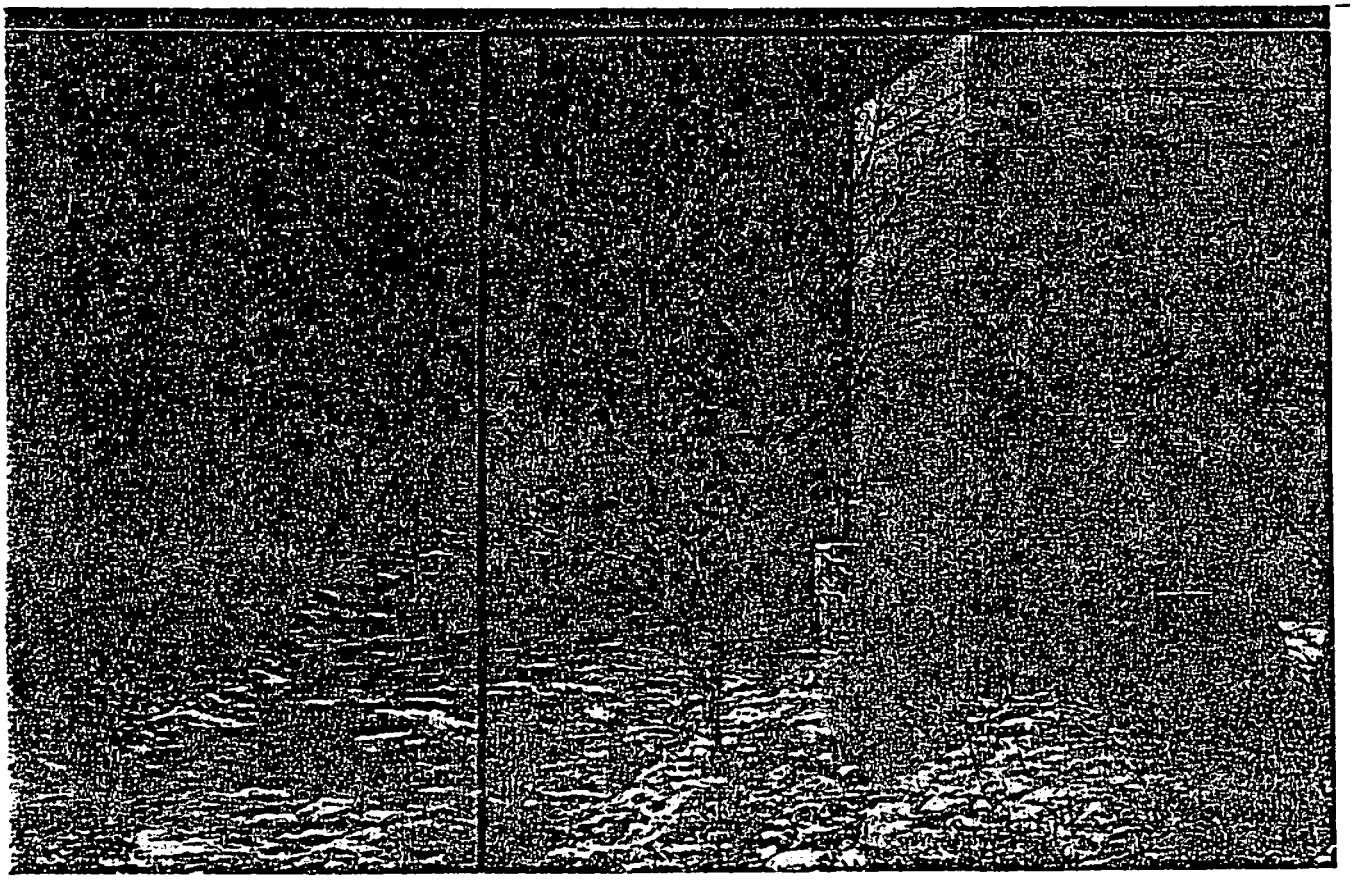
5.1.3 VISUAL QUALITY

The proposed action would include the construction of a 40-foot-long, 63-foot-wide powerhouse structure adjacent to the river. The structure would be built as an extension to the existing powerhouse building, protruding toward the Tuolumne River (Figures 8 and 9). The building addition would be 78 feet high, which is about the same height as the existing powerhouse structure. In following the design of the existing powerhouse, the building addition would be constructed of reinforced concrete with a flat roof. The new powerhouse addition would add to the perceived mass and bulk of the existing powerhouse, increasing structural volume of the visible superstructure by 30%.

PHOTOMONTAGE

FIGURE 8

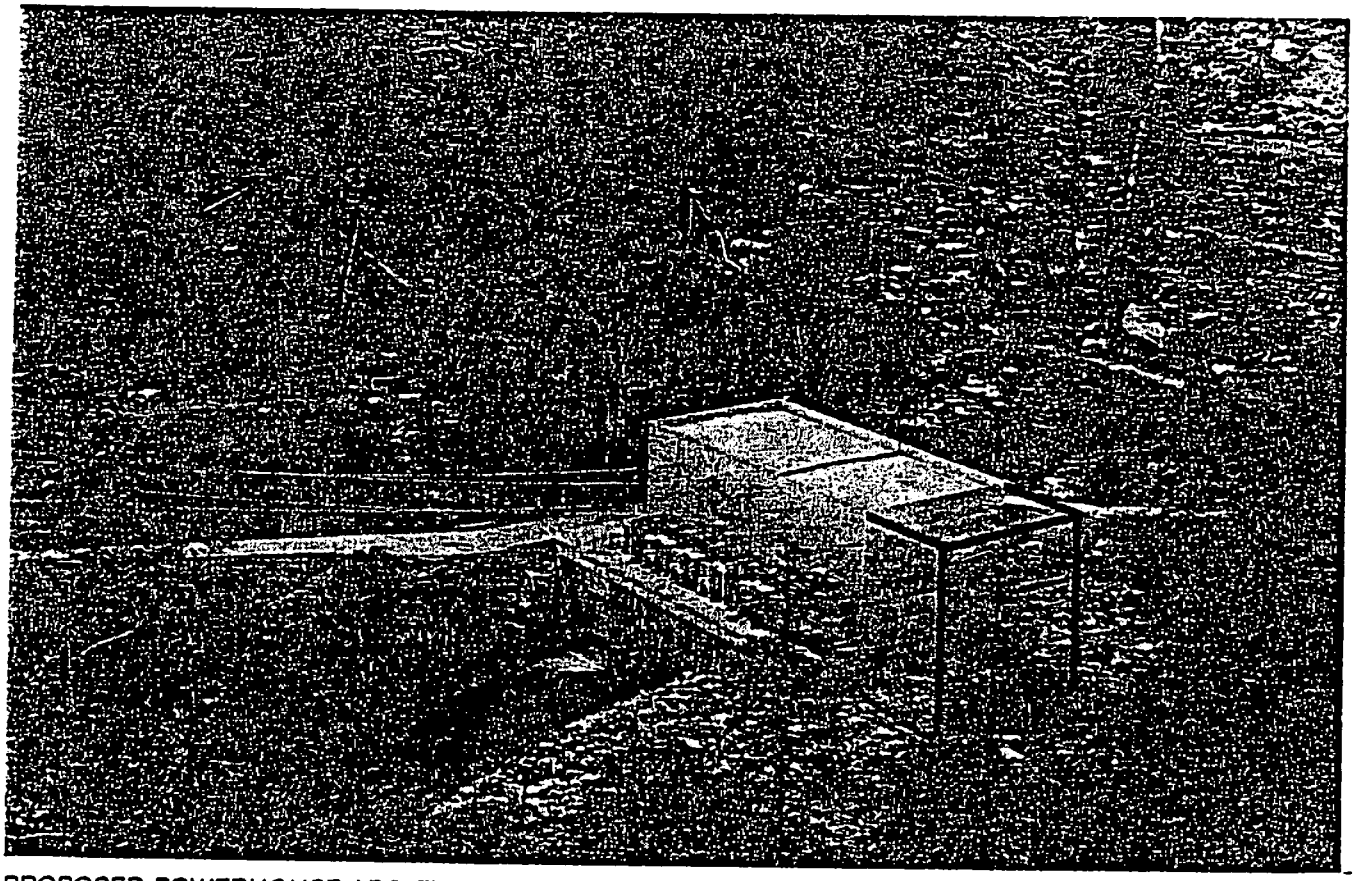
PROPOSED POWERHOUSE ADDITION



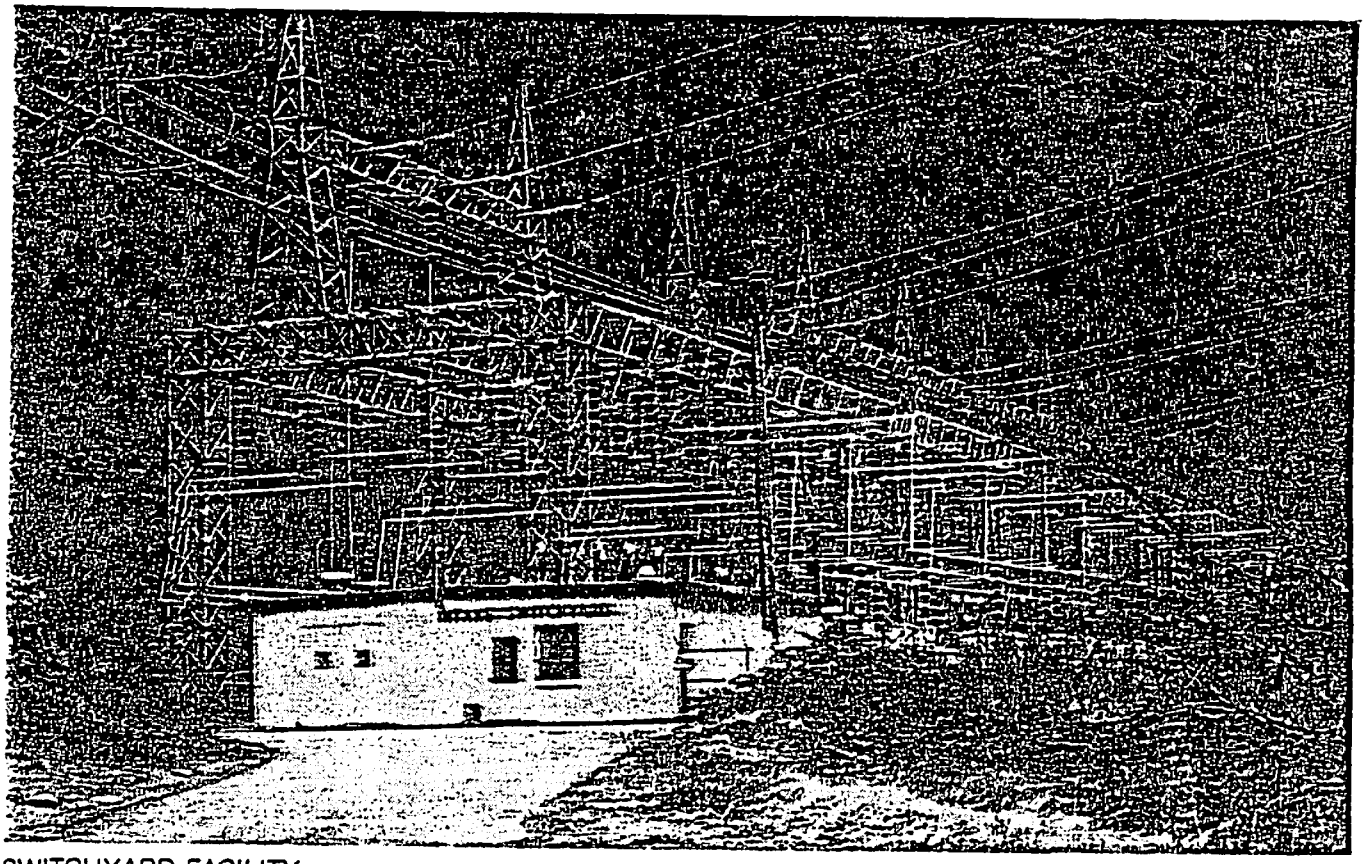
PROPOSED POWEREHOUSE ADDITION

PHOTOMONTAGE

FIGURE 9



PROPOSED POWERHOUSE ADDITION; (VIEW IS FROM ACCESS ROAD 1N07)



SWITCHYARD FACILITY

Approximately 180 linear feet of unpaved access road around the west end of the powerhouse would be relocated a maximum of 85 feet north on the adjacent slopes where the new penstock branch would be constructed. Constructing the penstock branch and realigned access road would require excavation, surface grading and approximately 150 feet of retaining wall. Several pine trees would be removed to accommodate road relocation.

Four new lattice-design transmission line tower structures would be constructed adjacent to the existing tower structures along the south canyon wall above the river. Approximately 1,800 feet west of the powerhouse, a single-circuit 230 kV transmisison line would be added to the transmission line right-of-way, providing an electrical connection between the powerhouse addition and switchyard. Facilities and electrical equipment added at the west end of the switchyard would increase the overall 400-foot length of the switchyard by about 80 feet.

To persons familiar with the existing facilites, the proposed additions would be noted as an expansion of transmission line facilities and to the existing powerhouse structure. The powerhouse and transmission line additions would not be apparent as new facilities at the Kirkwood site to those persons who are unfamiliar with the site because the new structures would appear contiguous with and match the design of the existing structures. The powerhouse and transmission line additions would be seen by occupants of the nearby residences, particularly the three residences about 300 feet west of the powerhouse site.

The Kirkwood powerhouse and transmission line additions would not be in view of the designated wild and scenic portions of the Tuolumne River because of the curvature in the river, intervening canyon walls, riverbanks and vegetation, all of which obstruct views to the Kirkwood site from the upstream and downstream areas. The powerhouse addition would be seen from portions of access road 1NO7 on the south canyon wall where views are not obstructed by vegetation.

Night lighting provided along the existing access road adjacent to the powerhouse would be maintained for security.

During construction, the disposal of spoils at the site of the staging/spoils area east of the powerhouse would contrast with the existing visual conditions of the area and would be noticed by those passing through the area to hike the Preston Falls trail. After construction, spoils disposed of at the staging/spoils area would be leveled, compacted and designated as a parking area for approximately 30 cars at the trailhead to Preston Falls, improving the visual appearance of the area. The spoils area adjacent to the switchyard would be recontoured after construction to blend into the existing terrain.

The construction of four new tower structures on the canyon wall would require the removal of some trees (see Section 5.1.2). Tree removal is not considered to be a significant impact on visual resources, however, additional trees may need to be cleared or topped under the power lines to allow the necessary clearance.

Initially, the tower structure would be more conspicuous because of the polished sheen on the metal. As a condition of approval the metal should be etched or painted to remove or reduce the polished metal surface.

5.1.4 CULTURAL RESOURCES

FIELD INVESTIGATIONS

The field reconnaissance of the project area was conducted on foot. The powerhouse extension location, transmission towers, proposed access road alignment and proposed staging/spoils area were all inspected, as was some of the surrounding area terrain. The recorded archaeological site (USFS No. 05-16-54-183) was located in relation to the project area and found to be situated adjacent to the eastern boundary of the proposed staging/spoils area (see Figure 10).[3]

It was observed that the proposed staging/spoils area is in the same location as the existing spoils area, which was utilized during the construction of the existing Kirkwood Powerhouse facility. The location is easily defined as a sparsely vegetated area that has been artificially developed, in relation to the archaeological site area. It is conceivable that the archaeological site extends under the existing spoils area and was covered over by the original Kirkwood spoils deposition. Further spoils deposition is of no consequence because no subsurface construction activities are proposed in that specific area.

CONCLUSIONS AND RECOMMENDATIONS

It is concluded that the proposed construction activities at the Kirkwood Powerhouse would have no direct adverse impacts on the recorded archaeological site in that area. This conclusion is based on the assumption that the proposed activities would be restricted to the disturbance areas previously identified and depicted in Figure 8. To avoid and protect the archaeological resource, the following procedures are recommended:

- Prior to construction startup, a qualified archaeologist would be retained to stake and flag a line of archaeological sensitivity; that line should be placed approximately 100 feet west of the boundary of the archaeological site, within the eastern end of the existing spoils area. It should be a condition of the construction contract that no construction-related activities take place east of the flagged line. This would include vehicular traffic and parking, and equipment laydown.

- Prior to construction, an orientation meeting would be held so that the archaeologist can inform the construction personnel of the archaeological sensitivity of the area.

- The archaeologist would periodically monitor the construction to ensure that the archaeological site is being protected.

The implementation of these procedures would protect the known archaeological resources in the area; this does not, however, preclude the possibility that archaeological remains exist below the ground surface and could be encountered during land alteration activities associated with the proposed project. In the event that archaeological remains are encountered during subsurface construction, land alteration work in the general

vicinity of the find should be halted and a qualified archaeologist should be consulted. Prompt evaluations could then be made regarding the finds, local Native American organizations consulted and a course of action acceptable to all concerned parties could be adopted.

The proposed action would not impact any cultural resources within the Wild and Scenic River corridor.

5.1.5 WATER QUALITY

At the Kirkwood Powerhouse, water passing through the turbines and entering Early Intake Reservoir may have a slightly depressed oxygen level. The turbulence of water flow leaving the reservoir could be expected to rapidly restore dissolved oxygen content to saturation level. The potential of the Third Unit to negatively affect the dissolved oxygen content is limited.

The only potential for water quality alteration due to the project would be the addition of solids (turbidity) or vehicle/equipment-related petroleum products and heavy metals during the construction period. The vehicle and equipment staging area would be used as a spoils area to store soil, rock and concrete excavated from the project site and access road relocation. This area is upstream from all the facilities at Early Intake and above the inundation zone of the river. Compaction of material would reduce or eliminate the movement of particles to the river by stormwater runoff.

Some minimal downstream siltation could extend to the Wild and Scenic corridor during the placement and removal of the cofferdam. It is expected that the majority of the suspended materials would be trapped in Early Intake Reservoir or settle out before it reaches the Wild and Scenic River corridor approximately one mile downstream.

5.1.6 RECREATIONAL USE

Construction of the powerhouse addition would entail a temporary shutdown of the penstock for a period of approximately 13 days in October. Water that would normally enter the existing bypass tunnel via the penstock and Canyon Tunnel, would be shut off. The water would either be released into the Tuolumne River and enter the Mountain Tunnel at the Early Intake Dam, or remain stored in Hetch Hetchy Reservoir.

As noted in Section 4.1.7, recreational use of the river in the project area is limited, with the major recreational activity being occasional hiking along the Preston Falls and Poopenaut Valley trails. The Preston Falls trail basically parallels the river, and thus a hiker may access the river anywhere along the trail to fish or swim. Users fish and swim in the river throughout the Poopenaut Valley. Hikers or anglers may wade in the river upstream of Early Intake. The existing swimming and wading use in the river do not have significant effects on the water quality, and it is doubtful that the extent of swimming or wading activities would affect water quality during the 13-day period when the domestic water supply may be routed along the river to the Mountain Tunnel intake. Routing the domestic water supply along the river to the intake at the Mountain Tunnel in lieu of through the Canyon Tunnel, penstock and bypass tunnel would not affect whitewater rafting flows or fishing farther downstream, and have minimal, if any, impacts on the Poopenaut Valley recreation activities. Storage of the water in Hetch Hetchy Reservoir during a 13-day period in October would not significantly affect river rafting downstream because this is not the busy season for river rafting. The only time the project would affect use of the scenic segment of the Tuolumne River would be while the access road is being rerouted east of the powerhouse. Grading and penstock construction activities would disrupt vehicular and pedestrian traffic access to the Preston Falls trailhead for short periods (less than one hour at any one time) during construction. It would not be necessary to close the area to the public for an extended period of time. Sanitation facilities (public toilet and garbage cans) and telephones would be available at the highway bridge south of Early Intake Village. Signs clearly designating Early Intake Village and the Preston Falls trailhead will be posted for travelers (hikers, anglers and picnickers).

5.1.7 UTILITIES/PUBLIC SERVICES

Construction of the Third Unit would not involve the relocation of the Early Intake/Kirkwood Village water supply line or the electrical power line.

5.1.8 GEOLOGY/TOPOGRAPHY

About 4,500 cubic yards of concrete and rock would be excavated from the existing powerhouse site. An additional 2,000 cubic yards of soil would be excavated during relocation of the access road. The proposed alignment has been selected to minimize the

amount of material to be excavated. All site spoils would be stored at a staging/spoils area upstream from the project site. The staging/spoils area is within the Dinkey/Ducey soils, but not within the inundation area of Early Intake Reservoir. The staging/spoils area and the proposed relocation of the powerhouse access road are on previously disturbed ground that has been stabilized and maintained by the Hetch Hetchy System. The system would continue to maintain slopes and roads after completion of the proposed project. The spoils would be graded and compacted as a parking area for trail users. During construction all spoils would be handled in compliance with an erosion control plan to be developed in consultation with the forest service.

Implementation of the erosion control plan should prevent erosion into the river and thus any downstream impacts in the Wild and Scenic River corridor.

5.1.9 AIR QUALITY AND CLIMATE

The proposed action would temporarily degrade air quality in the vicinity of the project site during construction because of the dust raised by excavation, site preparation and creation of the access road. Construction vehicles and equipment would release emissions from combusion of fossil fuel, largely gasoline and diesel.

Construction equipment and vehicle exhaust emisions would not be expected to result in any violation of air quality standards in the area, including the portions of the river in the Wild and Scenic River corridor. Construction equipment would also cause dust to be resuspended during travel, particularly in unpaved areas. Violations of the air quality standard governing 24-hour averages of total suspended particulate matter could occur in the immediate vicinity of the project and within the Wild and Scenic corridor during periods of project construction. This impact could be reduced by watering exposed earth surfaces and replanting exposed areas as soon as practical after construction is finished.

The proposed action would result in an increase in electrical generation of 50 million kWh annually. About 90,000 barrels of oil would be required to generate this quantity of electricity in a fossil fuel-fired power plant (minus a small amount for the transmission losses in the distribution of hydroelectrically generated power).

The Clean Air Act, as amended in 1977, divides parts of the nation into three categories of air quality. Type I areas are those that are pristine with regard to air quality (e.g., national parks, national seashores and natural wilderness areas). These areas are protected from further significant amounts of air pollution by federal law. In California there are a number of such areas designated, including Yosemite National Park and Emigrant Wilderness. Class II areas are areas where moderate deterioration is allowed and Class III areas are specifically designated as heavy industrial.

The U.S. Environmental Protection Agency has promulgated regulations for Prevention of Significant Deterioration (PSD) of air quality in areas where air pollutant concentrations are currently in compliance with federal air quality standards. These standards apply to any source or major modification of an existing source that would result in annual emissions of more than 100 tons of any regulated pollutant.

Because the proposed project would not result in pollutant emissions of this magnitude, these regulations would not apply. It is also noteworthy that the regulations do not apply to emissions from project construction, but only to emissions generated by the operation of the project.

The operation of the proposed project would have negligible impacts on the nearest Class I area (Yosemite National Park, about five miles east of the project site) because no significant pollutant emissions are predicted to occur. Construction activities would generate some dust and exhaust emissions. These would be temporary and unlikely to result in measurable increases in pollutant concentrations in Yosemite even under worst-case conditions.

No significant air quality impact would result from operation of the proposed project.

5.1.10 LAND USE ZONING AND PLANS

The proposed action would conform to the Raker Act and the multiple use management plan of the Stanislaus National Forest and not conflict with the Tuolumne River nor its potential priority as a boating trail. The proposed action would not conflict with river boating opportunities on the river.

The 12-mile stretch of river above Early Intake to O'Shaughnessy Dam in classified as Scenic under the evaluation criteria used in the Wild and Scenic designation. The scenic classification is defined as "Those rivers or sections of rivers that are free of impoundments with shorelines or watersheds still largely primitive and shorelines largely undevelopd but accessible."

The stipulation agreement with the U.S. Department of Interior (See Appendix B) established adequate fisheries, recreational and aesthetic flows for this stretch of river. The proposed action would not add impoundments nor alter the shoreline of the river. The diversion of a maximum of 400 cfs to Early Intake is not expected to significantly reduce the fish habitat in the rivier nor the aesthetic or recreational opportunities on this stretch of the river. The proposed project would comply with the agreed to stipulation and thus preserve the maximum flows for fish, recreation and aesthetic resources on this section of the river.

5.2 IMPACTS: ALTERNATIVE B

Many of the impacts associated with the proposed action would occur in this alternative. However, Alternative B would have greater land-disturbing impacts associated with the powerhouse addition and relocated access roadway. Approximately 9,200 cubic yards (cy) of additional rock and surface materials would be excavated for the placement of the powerhouse addition and tailrace modifications in Alternative B than in the proposed action. Most of this additional excavation would occur in the powerhouse addition area where an existing rock face and slope would be cut back. Existing vegetation, including a wet seep area on the rock face, would be removed.

The access road relocation for Alternative B would be approximately 750 linear feet longer and require approximately 1,700 more cubic yards of fill and cut than for the proposed action. The additional roadway construction would result in larger cut and fill scars; therefore, it would represent a greater visual impact than the proposed action until the slopes have revegetated.

Although it would not be necessary to place a cofferdam in the river, the impacts associated with the dam are not considered to be significant (see Section 4.2, Impacts).

5.3 IMPACTS: NO ACTION ALTERNATIVE

With the No-Action Alternative, the effects identified for the proposed action and other alternatives would not occur. However, without the proposed third unit the existing two generating units would continue operating above their rated capacity during peak periods, thereby effectively reducing the operating lifetime of these units. In addition, the opportunities for additional energy production in the Hetch Hetchy System without significantly reducing fisheries habitat on the river would be lost.

---

[1]Biederman, Jack, Tudor Engineering Company. Project Engineer. Meeting on December 20, 1984.

[2]National Academy of Sciences, Highway Capacity Manual Special Report 87, 1965.

[3]Certain information concerning the locations and nature of archaeological sites, which is included in this report, is not for public distribution. Uncontrolled access to this information can result in unauthorized excavation and/or vandalism to nonrenewable cultural resources.

6 AGENCIES AND PERSONS CONTACTED

The following list of agencies and people were contacted by telephone and mail by EIP. Concerns and issues expressed by these people are addressed in this report. A request for written comments was made to each of these people.

Agency/Group	Name	Phone
US Fish and Wildlife Service	Jody Hoffman	(916) 484-4731
Yosemite National Park	Steve Botti	(209) 372-4461
Groveland Ranger District	Kit Perlee Bill Lane	(209) 962-7825
US Forest Service	Ed Stewart	(209) 532-3671
California Fish and Game	Bob Ehlers	(209) 222-3761
Tuolumne County	Jim Nuzum Dominic Salluce	(209) 533-5611 (209) 533-5515
Sierra Club	Alvin Greenberg Bob Hackamack	(415) 927-0566 (209) 523-7612
Tuolumne River Pres. Trust	John Amodio	(415) 441-8778
Tuolumne River Exped. Inc.	Mike Remy Bill Center	(916) 443-2745 (916) 622-8672
Citizens to Preserve Tuolumne River	Noreen Parks	(209) 928-3680
Friends of the River	Betty Andrews	(916) 442-3155
Planning and Conservation League	Jerry Meral	(916) 444-8726
Environmental Defense Fund	Tom Graff	(415) 548-8906
National Audubon Society	Dan Taylor	(916) 481-5332
Wilderness Society	Patty Hedge	(415) 771-2020
Stanislaus County LCV	Gordon Hollingsworth	(209) 526-5734
Cal. Sport Fishing Protection Alliance	Don Moyer	(209) 465-0831
Save Our Streams	Jerry Bishop	(209) 877-2978

APPENDICES

APPENDIX A

LETTERS OF COMMENT RECEIVED DURING THE PUBLIC INVOLVEMENT PROGRAM

RECEIVED
MAY 06 1985
EIP

THE PLANNING AND
CONSERVATION LEAGUE

PCL

909 12TH ST., SUITE 203 • SACRAMENTO, CA 95814 • (916) 444-8726

May 2, 1985

Stu During
EIP Associates

RE: Kirkwood Powerhouse

Dear Mr. During:

We recommend that as part ofthe environmental review of the proposed third powerhouse at Kirkwood you consider better overall management of the Hetch-Hetchy power system to optimize flows in the Tuolumne River for river recreation. At the present time Holm Powerhouse makes releases at various odd hours, including late at night and very early in the morning. We suggest an operations study to consider whether more daytime releases could be made, especially to augment flows on Staurdays and Sundays.

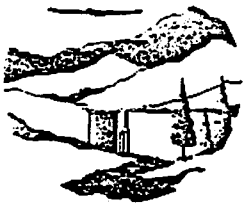
We believe that such a study would be appropriate in conjunction with the studies associated with the Third Kirkwood Powerhouse, since Hetch-Hetchy clearly stands to benefit from the third powerhouse, and therefore should at least examine ways in which the River operation could be benefitted as well. We also suggest you take into account the views of the Tuolumne Trust on the fish release below Hetch-Hetchy, in addition to other issues raised by the Trust.

We would be happy to discuss this matter with you at your convenience.

sincerely,

Gerald H. Meral

Gerald H. Meral
Executive Director



S.O.S.

May 28, 1985

Mr. Stu During
EIP Associates
319 Eleventh St.
San Francisco, California 94103

Re: Kirkwood Expansion

Dear Mr. During:

Our group shares the opinion of the Sierra Club that O'Shaughnessy Dam should be razed and Hetch Hetchy Valley restored. The instant proposal will tend to preclude that alternative.

What will be done with the 50 GWh increased power output? If it will be sold to MID-TID, it will tend to stimulate their growth and demands for more hard hydro development, an undesirable indirect impact.

If the third AC line is added to the Pacific Intertie, the instant project may preclude buying Pacific Northwest dump surplus power during the run-off.

The California Energy Commission has specified an unfilled need of 300 MW in hydro over the next 12 years. Can you advise whether the Kirkwood expansion was considered before this figure?

Spring flooding plays a poorly understood role in riparian ecosystems. For example, destruction of old vegetation seems to induce sprouting of willows to yield desirable new deer browse. Reductions of this reset mechanism may lead to altered vegetation patterns with unknown impacts on terrestial, avian and aquatic species. We would very much like to see these impacts addressed. The proposed compensatory release of less than 14 cfs appears trivial in in comparison to natural flows.

I am enclosing our matrix checklist and bibliography on hydro projects.

Your firm is highly regarded by the Planning and Conservation League. You may be pleased to know that we nominated your firm to Trinity County to do environmental studies there, based on PCL's recommendation.

Save Our Streams P.O. Box 56 North Fork, Calif. 93643 (209) 877-2978

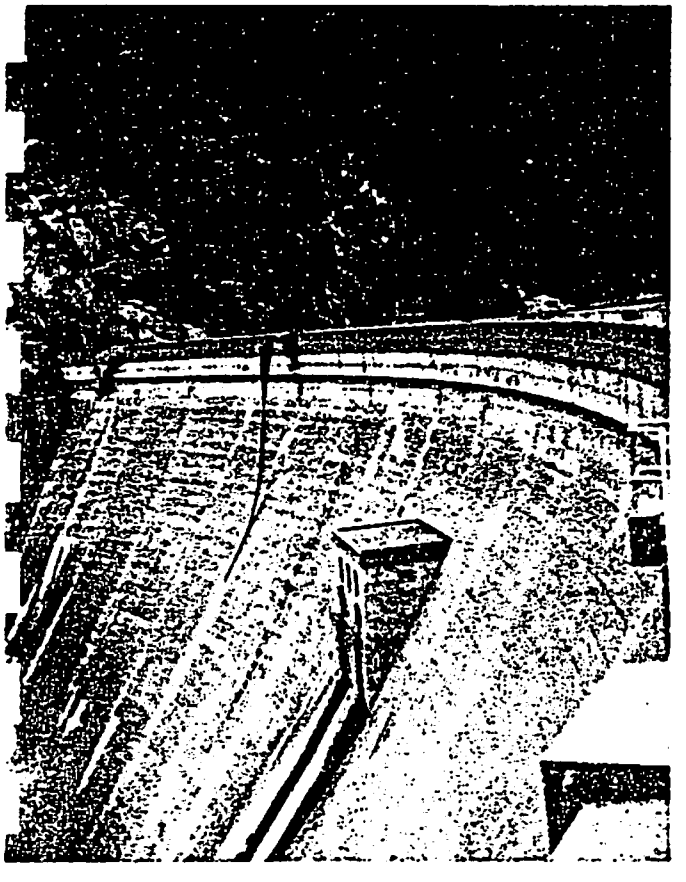
O'Shaughnessy Dam is an abomination. I am enclosing for your archives a couple of photographs taken at a 1982 ceremony dedicating the dam for destruction and symbolocally cracking it. John Muir was right!!

Sincerely,

J. V. Henry
Agency Affairs
California Save Our Streams Council

JVH:md

Encl.



SIERRA CLUB
CALIFORNIA
6014 COLLEGE AVENUE, OAKLAND, CALIFORNIA 94618 (415) 658-7106

Please reply to
5100 Parker Road
Modesto, CA 95355
May 26, 1985

Stu During
EIP Associates
319 Eleventh Street
San Francisco, CA 94103

Subject: Kirkwood Project Description

Dear Mr. During:

I reviewed this undated project description that was accompanied with a cover letter from Anne Sands suggesting that comments be sent to you.

I don't think the City will be pleased with this document because of the lack of specific information. For example, what is the turbine design? Is it the same as the others or different, what would it likely cost and what countries might offer bids for it? Likewise for the generator and transformer. What spare parts would be necessary and are they different from those presently serving the generators, turbines and transformers at this and other City powerhouses? Would the workforce at Kirkwood need to be increased for a third generator? What would the whole project cost?

What are the potential dollar benefits and who would likely be the cutomers? At 3¢/kWh above cost of operation, 50 million kWh/y would be available to pay for the cost of construction and interest. Simple math will show how large a bond issue would be possible to cover costs. If, for argument, 20 years repayment is chosen with 9% interest, a bond issue of 13.7 million $ could be supported. Every reader will want B/C information.

Then we come to environmental concerns, such as why the penstock is not painted tan to match the slope or why the whole powerhouse is not a darker color. What would be the impacts on fish from the coffer dam and how long will it be in the river? What might be the impacts and preventive and mitigation measures at the two spoil sites? Why is the generator on the river side less harmfull than the previous design on the uphill side or vice versa? How long will the road to the trailhead area upstream be blocked by penstock construction and relocation and improved alignment of the road?

And most important, when will the flow release study begin

as called for in stipulation 6 of the agreement signed by the City on December 13, 1984? We believe the proper minimum release is 211 cfs. There is no connection between 900 cfs diversion and the needs of the stream, especially since the City has a federal permit to divert no more than 700. We urge the Department of the Interior not to approve any work at Kirkwood until that next fish release schedule is approved by the Secretaries and is put into effect! Past implementations have been very hard on the fishery because of the slowness of agencies.

Another part that we feel is important for inclusion in any project is the O'Shaughnessy Toe Generator. That feature is not addressed at all in the description.

Yours truly,

Robert W. Hackamack

Robert W. Hackamack
Chair, Tuolumne River Conference

copy to Fish and Wildlife Service
Department of Fish and Game
National Park Service
Forest Service
Alvin Greenberg
John Amadio

P. S. While waiting for internal approvals of this letter, the Corps of Engineers public notice number 8987 arrived. The fact the Corps shows water diversion will be 66 % above your description (66 % increase in generation) does nothing for the credibility of the City PUC, your firm or the Army. We believe it wishful thinking "that the [coffer]dam is scheduled to be placed in September of 1985". We request a written explanation of these points.

STATE OF CALIFORNIA—THE RESOURCES AGENCY

GEORGE DEUKMEJIAN, Governor

DEPARTMENT OF FISH AND GAME

REGION 4
1234 E. Shaw Avenue
Fresno, CA 93710
(209) 222-3761

May 16, 1985

Stu During
EIP Associates
319 Eleventh Street
San Francisco, CA 94103

Subject: Kirkwood Powerhouse Third Unit Addition

Dear Mr. During:

In speaking with Anne Sands on Monday, May 13, 1985, regarding the proposed powerhouse expansion project, she asked that I contact you. I had several questions that were not provided in the Project Description we received.

We have several concerns with project construction timing and public access at the powerhouse. As you know, access for recreationists above the powerhouse site was provided during your earlier construction. It is important to visitors to have access for fishing, hiking, etc., at this time also. We understand the present parking area will be used as a laydown-spoil area. What provisions will be made to accommodate visitor parking and access trail(s) during construction? This should be addressed and provided for in your planning. Second, the Description did not reveal how long, nor during what period(s) of the year, the construction would be ongoing. Our concern here is with disurbance to migratory deer and other wildlife caused by people, noise, heavy equipment impacts. Operation of heavy equipment, trucking (cement, materials, etc.) during the period from mid-October to mid-May would be particularly stressful to deer. We will need to meet with you and develop provisions and criteria for their protection depending on when construction occurs.

As for the physical facilities to be installed and site location, we have no problems with the powerhouse. The only requirement we have involves modification of the stream bank or channel. At the appropriate time (within 30

days before construction) you should file a notification form for stream alteration with this office. Our staff biologist will meet with the on-site manager to develop any necessary water quality control methods for preventing downstream pollution problems.

At a later time our comments on streamflow and fishery subjects will be provided. Our people are working on these matters now.

Sincerely,

Robert R. Ehlers
Environmental Services Supervisor

RRE:mt

cc: Jody Hoffman, USFWS

APPENDIX B

FISH FLOW STIPULATION AGREEMENT BETWEEN THE CITY AND COUNTY OF SAN FRANCISCO AND THE U.S. DEPARTMENT OF INTERIOR

Stipulation for Amendment of
Rights-of-Way for
Canyon Power Project
Approved by
Secretary of the Interior
on May 26, 1961
to fulfill the conditions
set forth in Provision 6 of
said Amended Permit

Pursuant to the Act of December 19, 1913 (38 Stat. 242), and in consideration of relocation and installation of its facilities and the granting to it by the United States of amended rights-of-way applied for, the City and County of San Francisco, a municipal corporation of the State of California, on May 23, 1961 stipulated and agreed and did bind itself, its successors and assigns to the terms, conditions and obligations set forth in the amended rights-of-way approved May 26, 1961 and amendments or modifications subsequent thereto.

Condition number 6 of said amended rights-of-way provided, among other things, that the interim stream flow releases would be subject to a study for a recommended flow schedule. The study, with recommendations, was completed August 23, 1976. Following the City's objections to certain aspects of the study's recommendations, the City now hereby agrees, amends and/or supplements said rights-of-way and binds itself, its successors and assigns, to each of the following terms, conditions, and obligations, consisting of six provisions, including the water release schedule set forth on Exhibit A:

1. That the minimum amount of water released from Hetch Hetchy Reservoir to the Tuolumne River at O'Shaughnessy Dam be in accordance with the schedule attached hereto as Exhibit A.

2. That the allowable rate of change in the magnitude of water releases from Hetch Hetchy Reservoir to the river at O'Shaughnessy Dam be changed from the present stipulation of "... not more than double nor less than one-half the previous release over a one-hour period ..." to "not more than double nor less than one-half the previous release over a four-hour period except when the previous release is 200 cfs or less, in which case the rate of change shall not exceed 50 cfs over a four-hour period."

3. That, insofar as the storage capacity at Hetch Hetch Reservoir and emergency situations allow, releases to the Tuolumne River shall be managed to prevent sudden or short-term high magnitude releases or spills at O'Shaughnessy Dam.

4. That the San Francisco Public Utilities Commission provide the appropriate field offices of the U.S. Forest Service, the National Park Service, the U.S. Fish and Wildlife Service, and the California Department of Fish and Game with periodic reports of releases from Hetch Hetchy Reservoir to the Tuolumne River at O'Shaughnessy Dam. The reports should (1) be furnished on a monthly basis by the 10th workday of the month following that reported on, (2) indicate the magnitude of the release at any given time during the report period, and (3) contain an explanation of any circumstances preventing compliance with the schedule of minimum reservoir releases specified in Recommendation No. 1.

5. That the San Francisco Public Utilities Commission notify the appropriate field office of the U.S. Forest Service, the National Park Service, the U.S. Fish and Wildlife Service, and the California Department of Fish and Game at least 7 days in advance of any anticipated noncompliance with the schedule of minimum reservoir releases specified in Recommendation No. 1.

6. That the foregoing conditions are imposed for the Tuolumne River from O'Shaughnessy Dam to Early Intake with respect to the existing Hetch Hetchy facilities and capacities along the Tuolumne River. San Francisco agrees that any proposed expansion, alteration, or other modification of the water and power supply facilities which could alter flows along that stretch of river will be subject to review by the Department of the Interior for the purpose of determining what change, if any, should be made in the flow release schedule stipulated in Condition 1. San Francisco further agrees that it will provide to the Department of the Interior advance information concerning any such proposed projects and will assist

the Department of the Interior in making its review by undertaking as part of San Francisco's environmental review a study of any such project's impact on fish, wildlife, recreational, and aesthetic values due to changes in river flow. The plan of study will be formulated in coordination with the U.S. Fish and Wildlife Service, National Park Service, U.S. Forest Service and the California Department of Fish and Game, and approved by the Department of the Interior, to insure that all aspects of the proposed projects that could impact river flow are adequately investigated. At the conclusion of the study and based upon such study, the U.S. Fish and Wildlife Service will recommend to the Secretary of the Interior such changes in the flow releases schedule as may be necessary to protect fish, wildlife, recreational, and aesthetic values. Such recommendations, shall become part of these conditions, unless San Francisco, within 30 days from receipt of notice of the recommendations, shall file with the Secretary of the Interior, its objections thereto. In such event, at its request, San Francisco shall be afforded a hearing regarding these objections before a special hearing officer who will render proposed findings of fact. The Secretary, after considering the proposed findings of fact and the record, shall determine what additional flows, if any, shall be required over those specified above.

The City further agrees that said conditions, and release schedule, are hereby made a part of and included in said rights-of-way and its stipulations.

IN WITNESS WHEREOF, the said City and County of San Francisco has caused this instrument to be executed in the City of San Francisco, California, this 13th day of December, 1984.

General Manager of Public Utilities Commission, City and County of San Francisco

Subscribed and sworn to before me this 13th day of December, 1984

FORM APPROVED:

Thomas M. Berliner
City Attorney
City and County of San Francisco

DATE: 12/14/84

Secretary, Public Utilities Com.
City and County of San Francisco

DATE: December 13, 1984

Assistant Secretary for Fish and Wildlife and Parks

DATE: JAN 31 1985

2528p

Exhibit A

That the minimum amounts of water to be released from Hetch Hetchy Reservoir to the Tuolumne River at O'Shaughnessy Dam shall be in accordance with the following schedules:

	Minimum Release Schedules (cfs)			Cumulative Precip. (inches)/runoff (acre-feet)		
	A	B	C	A Equal to or greater than:	B Less than Col. A but equal to or greater than:	C Less than Col. B:
January	50	40	35	8.8	6.1	---
February	60	50	35	14.0	9.5	---
March	60	50	35	18.6	14.2	---
April	75	65	35	23.0	18.0	---
May	100	80	50	26.6	19.5	---
June	125	110	75	28.5	21.3	---
July	125	110	75	575,000	390,000	---
August	125	110	75	640,000	400,000	---
September 1-15	100	80	75	---	---	---
September 16-30	80	65	50	---	---	---
October	60	50	35	---	---	---
November	60	50	35	---	---	---
December	50	40	35	---	---	---
Minimum amount of Water (acre-feet)	59,235	50,019	35,215			
Frequency (percent)[1/]	60	32	8			

Determination of applicable schedule (A, B or C) is to be made on the first of each month during January through August. Determinations for January through June are to be based on cumulative precipitation at Hetch Hetchy since October 1 of the preceding year. Determinations for July and August are to be made based on calculated cumulative runoff into Hetch Hetchy since October 1 of the preceding year. The release schedule which is in effect on August 1 of each year shall remain in effect until the following January.

1/ The frequency of each schedule is based on precipitation and runoff data which have been collected over the past 58 years at Hetch Hetchy. During the first three months Schedule B is adjusted to be in effect an average of 25% of the time and Schedule C 15% of the time.

APPENDIX C

BACKGROUND INFORMATION ON THE KIRKWOOD PENSTOCK

BACKGROUND INFORMATION ON THE KIRKWOOD PENSTOCK

The penstock in its original design condition is considered suitable by Tudor Engineers for the addition of the third unit both during construction and startup as well as under normal operating conditions. This evaluation is based on the determination that although velocities would increase, there would be no increase in pressures under normal operating conditions above that previously permitted by the design criteria. Similarly there would be no increase beyond previously permitted design pressure criteria under hydraulic transient conditions after the new governor for Unit 3 has been installed and the existing governors for Units 1 and 2 have been modified and readjusted. Extreme care would be required during the startup period to avoid testing or operational errors which might result in excessive hydraulic transient pressures.

Under the above conditions, the only major change to the penstock would be in the penstock anchor force due to bend in pipe with water flowing at greater velocity. A review of this effect has established that overall forces under 3-unit operation as now being designed would be equal to or less than those under the existing units operation, both under normal operations and under hydraulic transient conditions.

TUDOR ENGINEERING COMPANY

MEMORANDUM

To: Jack Biederman Date: April 26, 1985

From: E.R. Floodeen File:

Subject: Kirkwood Penstock - Change in Hydraulic Thrust at Achorage Outside of Tunnel

Make comparison of hydraulic loads at first anchor block for (1) Full reservoir, no flow, (2) Existing condition of 2 units full flow of 845 cfs, and (3) Changed condition of flow after unit No. 3 is installed, 1,340 cfs.

Compare loads using pressure head at anchor block based on pressure gradient (static head minus friction), plus dynamic load due to flow in pipe. For comparison, use only direct loads in horizontal direction and not the resultant of the loads due to change in direction (the resultant load will be proportional). Also, do not consider weight of anchor, unless total hydraulic forces in condition (2) and (3) are greater than condition (1).

	Pressure hd	Q
Condition (1)	351'	0 cfs
Condition (2)	*351' - 70 = 281'	845 cfs 2 units
Condition (3)	*351' - 250 = 101'	1,340 cfs 3 units

*See attached sheet for friction loss in ft. of head.

Condition (1) No Flow

Reservoir Elev. - 3,806 -
El at Bend - 3,455
Head - 351 ft., p = (152.3 psi)

Hydrostatic Force at first anchor block equals

Stat. F = PA (144) A = area in sq. ft.
ID pipe = 92"00 - 2(5/8")
ID = 90.75 inches
A = 6,468 sq. inches (44.9 sq. ft.)
F = 152.3 x 6,468
F = 985,076 lbs. ----> No flow. Cond. (1)

Condition (2)

Hydrostatic head at first anchor block at Q = 845 cfs is 281 ft. (122 psi)

Stat. F = 122 x 6,468 sq. inches
= 788,798 lbs. static

Dyn. F = QwV/g w/g = 1.94

$$F = (845)\ 1.94\ \left(\frac{845}{44.9}\right)$$

F = 30,851 lb. dynamic

$\sum F$ condition (2) = 788,798 + 30,851
= 819,649 lbs. <---- Cond. (2)

Condition (3)

Hydrostatic hd at first anchor block at Q = 1,340 cfs is 101 ft. (44 psi)

Stat. F = 44 x 6,468 sq. inches
= 284,592 lbs. static

$$\text{Dyn. } F = 1{,}340 \times 1.94\ \left(\frac{1{,}340}{44.9}\right)$$

= 77,583 lbs. dynamic

$\sum F$ condition (3) = 284,592 + 77,583
= 362,174 lbs. <---- Cond. (3)

Summary

Condition (1)

No Flow Condition - (for Cond. (2) or (3) w/o flow) (Static Only) F = 985,076 lbs.

Condition (2)

Flow Condition (2) - Total Static + Dyn. F = 819,649 lbs.

Condition (3)

Flow Condition (3) - Total Static + Dyn. F = 362,174 lbs.

A review of transient load conditions during load acceptance indicates that pressures at load acceptance in condition (2) or (3) would be lower than normal operations, at Anchor block 1. Therefore normal operations govern.

Pressures due to transient or water hammer conditions with 3 units will not exceed those transient conditions for 2 units. This has been controlled by change in governor times for the 3 units.

JCB:04261068a*

APPENDIX D

FORM USED IN ESTIMATING RUNOFF OF THE TUOLUMNE RIVER AT HETCH HETCHY

ESTIMATED RUNOFF OF THE TUOLUMNE RIVER AT HETCH HETCHY

19 - 19

Acre Feet

	WATER RESOURCES FORECAST		RUNOFF BASED ON PRECIPITATION		REMARKS
	100% NORMAL AFTER	50% NORMAL AFTER	100% NORMAL AFTER	50% NORMAL AFTER	
FORECAST OF RUNOFF FOR PERIOD OCT. 1,19 TO JULY 1,19					PRECIPITATION:-
NATURAL RUNOFF AT HETCH HETCHY OCT. 1,19 TO ,19					100% NORMAL:-
FORECAST RUNOFF FOR PERIOD ,19 TO JULY 1,19					
ESTIMATED FISH RELEASE ,19 TO JULY 1,19					50% NORMAL:-
ESTIMATED KIRKWOOD POWERHOUSE DRAFT ,19 TO JULY 1,19 (c.f.s.)					
AVAILABLE FOR STORAGE ,19 TO JULY 1,19					RUNOFF:-
ACTUAL STORAGE IN HETCH HETCHY RESERVOIR ,19					
ESTIMATED THEORETICAL STORAGE IN HETCH HETCHY RESERVOIR JULY 1,19					
CAPACITY OF HETCH HETCHY RESERVOIR	360,000	360,000	360,000	360,000	
AVAILABLE FOR SPILLING ,19 TO JULY 1,19					
AMOUNT SHORT OF SPILLING ,19 TO JULY 1,19					

* JAN 1, TO MAY 1, 35 c.f.s. MAY 1, TO JULY 1, 75 c.f.s.

APPENDIX E

LETTERS FROM FISHERIES EXPERTS

Dr. Don Baltz
Dr. Richard Ridenhour

Donald M. Baltz, Ph.D.
Fishery Consultant
206 Huerta Place
Davis, California 95616

May 9, 1985

Mr. Stuart During
Environmental Impact Associates
319 Eleventh Street
San Francisco, California 94103

Dear Mr. During:

After a review of existing information relevant to the Kirkwood Powerhouse Third Unit Addition Project proposed by the City and County of San Francisco, it is my considered opinion that environmental impacts would be very minimal and that the mitigations proposed by the City would enhance the fishery above existing conditions.

The major mitigation proposed by the City would be to make an additional 10,000 acre feet of water available for fish flow releases during years in which the three Kirkwood units were operated above two thirds capacity. This would occur in normal to wet years, but not during dry years. The additional 10,000 acre feet could be used to augment existing fish water releases or as flushing flows, and the manner of use could be determined and reviewed on an annual basis by concerned public agencies.

An evaluation of the effects of reducing the magnitude and duration of spills from O'Shaughnessy Dam requires knowledge of the stream flow versus habitat area relationship in the Tuolumne River between Early Intake and O'Shaughnessy Dam. Previous instream flow studies conducted by the U. S. Fish and Wildlife Service were limited by the then current state of the art; therefore, the stream flow versus habitat area relationship was not and should not be extrapolated beyond the highest stream flow measured, which was 211 cfs. Habitat area generally increases to a maximum with increasing flows and then declines. Above Early Intake, maximum habitat may be obtained with as little as 500 cfs (personal communication, Jody Hoffman, Instream Flow Specialist, USFWS, Sacramento, California). If this figure is accurate, then spills greater than 500 cfs would degrade habitat compared to the optimum while spills less than 500 cfs would enhance habitat compared to the existing fish water release schedule. Regardless of the exact level of optimum flow, three impact conditions would exist while the third unit was operating. If the third unit is operated while O'Shaughnessy is:

1. Spilling
   Then the only impact would be in the reach above Early Intake and may be positive or negative depending or the magnitude of the spill.
   a) The impact would be negative when low magnitude spills (<

500 cfs) which enhance trout habitat are diverted to the third unit.

b) The impact would be positive when large magnitude spills (> 500 cfs) which degrade trout habitat are reduced by diversion to the third unit.

2. Not Spilling

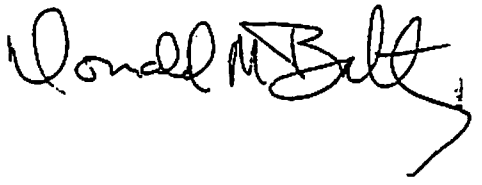
Then there could be a positive impact downstream of Early Intake due to the release of Kirkwood Powerhouse discharge in excess of Mountain Tunnel's capacity (700 cfs) over Early Intake Dam.

Negative impacts under condition 1a which occur while the third unit is operating should be at least partially off set by positive impacts under condition 1b. Any remaining negative impacts due to operation of the third unit would be completely off set by the release of 10,000 acre feet of fish water. Since the City intends to operate the third unit only while O'Shaughnessy is spilling, positive impacts under condition 2 should not occur.

An additionbal mitigation I would propose is the provision by the City of a small sum annually to do fishery inventory and management work on the Tuolumne River. The funds would be used to monitor fish population levels and gather data relevant to allocating the additional 10,000 acre feet of water during wet years.

In 1981, Hetch Hetchy began making fish water releases at O'Shaughnessy Dam under the new flow agreement which was not formalized until 1984. However, the status of trout populations above Early Intake has not been evaluated since the 1977 surveys conducted by the USFWS. Since the system has been operating under the new flow regime for several years, it would be timely and useful to the USFWS and other public agencies for the City to immediately conduct new population surveys for comparison with the 1977 data to evaluate the existing flow schedule.

Sincerely,



2736 Sunny Grove Ave.
McKinleyville, CA 95521

9 May 1985

Mr. Ric Villasenor
Environmental Impact Planning
319 11th Street
San Francisco, CA 94103

Dear Mr. Villasenor:

I have reviewed the project description for the proposed installation and operation of a third generating unit at the Kirkwood Powerhouse which is part of the Hetch Hetchy Water and Power Project of the City of San Francisco. I am generally familiar with the project since I was directly involved as a fisheries consultant to the City of San Francisco during the determination of the minimum flows to be required in the Tuolumne River between O'Shaughnessy Dam and Early Intake as a condition for operation of the Canyon Power Project.

It is understood that this project would result in the diversion of additional water (in excess of 900 cfs) through Canyon Tunnel to operate three generating units only during certain periods of abundant water supply. Generally, the simultaneous operation of the three units would be limited to the heavy runoff periods of normal and wet years as defined in the minimum flow release schedule. It is not clear from the project description that operation of the three generating units would be limited only to periods when there would otherwise be water passing over the spillway of O'Shaughnessy Dam (or water in excess of the minimum flow requirements would need to be discharged through the dam to prevent spilling water).

I understand that 10,000 acre-feet of water is to be provided to the river below O'Shaughnessy Dam in years that water is diverted in excess of 900 cfs which is the capacity of the existing two generating units. This 10,000 acre-feet is to be in addition to the required minimum flows. However, it is not clear whether or not water which is spilled or discharged to the river because of the inability of the reservoir to contain the runoff would be considered as contributing to the 10,000 acre-feet obligation.

I have considered the potential impacts on the fish populations in the river that could result from the operation of the proposed third generating unit at Kirkwood Powerhouse. Though some aspects of the operation are not entirely clear to me,

I would not anticipate appreciable impacts, either negative or positive, on the fish populations between O'Shaughnessy Dam and Early Intake. Water temperatures suitable for trout were a primary concern when the minimum flow schedule was established. The increased diversion of water from O'Shaughnessy should not appreciably affect water temperatures in the river so long as the minimum flow schedule is maintained and the spill of surface water from the reservoir is minimized. The availability of cover for fish should not be affected by the project. Spawning habitat and food production could be adversely affected if excessive fines are permitted to accumulate in the river but the sources of such material are limited and the effect is not considered to be significant. Periodic high runoff periods when uncontrollable spills occur should suffice to flush any undesirable accumulation of fines.

It is not clear to me what will be the fate of the water when it leaves Kirkwood Powerhouse. If it is to be returned to the river, there should be no net effect on the flows below Early Intake. However, if the water in excess of 900 cfs is also diverted through Mountain Tunnel, there could be adverse effects on fishlife below Early Intake resulting from the net reduction in flows to that reach of the river.

In summary, although there are operational details that are not entirely clear to me, I do not believe the addition and operation of a third generating unit at Kirkwood Powerhouse should significantly affect the production of fish between O'Shaughnessy Dam and Early Intake. Care to avoid the release of warm surface water from O'Shaughnessy Dam would eliminate the only potential for significant negative effects that I can perceive at this time. I do have some concern for the potential negative effects on fish production below Early Intake but this concern would be without basis if no more than 900 cfs continues to be diverted through Mountain Tunnel.

Sincerely,

Richard L. Ridenhour
Consulting Fishery Biologist