Upper San Joaquin River Basin Storage Investigation

Dinkey Creek Reservoir

Surface Storage Option Technical Appendix to the Phase 1 Investigation Report

A Joint Study by:

Bureau of Reclamation
Mid-Pacific Region

California Department of Water Resources

In Coordination with:

The California Bay-Delta Authority

October 2003

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Dinkey Creek in the Vicinity of the Potential Dam Site

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Prepared by:

MWH

October 2003

SURFACE WATER STORAGE OPTION
TECHNICAL MEMORANDUM

DINKEY CREEK RESERVOIR
UPPER SAN JOAQUIN RIVER BASIN STORAGE INVESTIGATION

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Acronyms and Abbreviations List

CEQA	California Environmental Quality Act
cfs	cubic feet per second
CNDDB	California Natural Diversity Database
Corps	United States Army Corps of Engineers
elevation	number of feet above mean sea level
HEP	Habitat Evaluation Procedure
Investigation	Upper San Joaquin River Basin Storage Investigation
IECO	International Engineering Company, Inc.
KRCD	Kings River Conservation District
kV	kilovolt
kW	kilowatt
kWh	kilowatt hours
MW	megawatt
NEPA	National Environmental Policy Act
PCB	polychlorinated biphenyl
PG&E	Pacific Gas and Electric
PHABSIM	Physical Habitat Analysis Program
RCC	roller-compacted concrete
Reclamation	Bureau of Reclamation
ROD	Record of Decision
SNTEMP	Water Temperature Model
TM	Technical Memorandum
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

EXECUTIVE SUMMARY

The Upper San Joaquin River Basin Storage Investigation (Investigation) considered several potential storage options in the eastern San Joaquin Valley. This document describes a potential dam at Dinkey Creek, within the upper watershed of the North Fork of the Kings River. A dam at Dinkey Creek would be located within the Sierra National Forest at an elevation of approximately 5,425 feet above mean sea level (elevation 5,425). It would be constructed as a zoned rockfill dam, approximately 340 feet high and 1,600 feet long. Full reservoir capacity would be approximately 90 thousand acre-feet (TAF). This option would also include a spillway, two power plants, a second diversion dam, connecting tunnels, penstocks, and surge tanks.

Water stored in a new reservoir at Dinkey Creek would be released to Dinkey Creek, which flows into the North Fork of the Kings River. Dinkey Creek discharges would offset releases from Millerton Lake to the San Joaquin River through exchange.

Site conditions appear suitable for construction. The dam would be founded on hard granite. Pervious raw materials are available, though not quantified or tested. Although deposits of impervious materials containing a high percentage of fines were not noted in the vicinity of the dam site, they may be found in nearby meadow areas. Paved county roads are within 1 mile of the dam site and graded roads pass both the right and left abutments. A staging area could be situated 1.5 miles upstream of the potential dam site where the canyon widens.

Adverse environmental impacts would be expected in all categories assessed – botany, wildlife, aquatic biology and water quality, recreation, and land use. In particular, a reservoir at Dinkey Creek would fundamentally alter the existing recreation-based community. Potential exists for adverse impacts to fisheries and fishing-oriented recreation resources. A reduction in flow, particularly during spring and summer when rainbow trout are spawning and the young are growing, could affect physical habitat availability. Changes in water temperature below the dam could adversely impact trout and the dam would impede migration.

Dinkey Creek is a popular recreation area and trout fishing destination. Several campgrounds and residences are located near the stream. The area that would be inundated includes two organization camps, recreation residences, and paved and unpaved roads that provide access on both sides of the stream to recreational resources in the Sierra National Forest. Adverse regional land use impacts could also be expected. The community of Dinkey Creek and nearby resorts provide lodging and other recreation-oriented services. The area surrounding the potential inundation pool contains an organization camp, a public cabin complex, numerous recreation residences, developed campgrounds, picnic areas, trails, and parking areas. Inundation of roads and recreational resources they serve would adversely impact an entire established community and may be unmitigable. This option was dropped from further consideration in the Investigation.

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CHAPTER 1. INTRODUCTION

The Bureau of Reclamation, in cooperation with the California Department of Water Resources, is completing the Upper San Joaquin River Basin Storage Investigation (Investigation) consistent with the CALFED Bay-Delta Program Record of Decision (ROD), August 2000. The Investigation will consider opportunities to develop water supplies to contribute to water quality improvements in and restoration of the San Joaquin River, and to enhance conjunctive management and exchanges to provide high-quality water to urban areas. The ROD indicated that the Investigation should consider enlarging Friant Dam or developing an equivalent storage program to meet Investigation objectives.

The Investigation identified several potential surface storage sites to be initially considered through prefeasibility-level studies of engineering and environmental issues. This Technical Memorandum (TM), prepared as an appendix to the Phase 1 Investigation Report, presents findings from a prefeasibility-level review of the potential Dinkey Creek Dam and Reservoir.

OPTION SUMMARY

Dinkey Creek Dam would be located in Fresno County, near Shaver Lake, about 40 miles northeast of Fresno. The dam site is located on Dinkey Creek, about 11 miles above its confluence with the North Fork of the Kings River at Balch Camp. The site location is shown in Figure 1-1. A map of the Dinkey Creek site and vicinity is shown in Figure 1-2.

The dam would create a reservoir with a capacity of 90,000 thousand acre-feet (TAF). This primarily hydroelectric option would develop a 4,400-foot head between Dinkey Creek Meadow and its confluence with the North Fork. The average annual energy production of the option has been estimated at 272 gigawatt hours (IECO, 1974).

Water stored in Dinkey Creek Reservoir would be released further downstream to Dinkey Creek, which would then contribute to flow in the North Fork of the Kings River. Releases from Dinkey Creek Reservoir would be exchanged for water diverted from Millerton Lake or offset Millerton releases to the San Joaquin River.

EXISTING FACILITIES

No water storage facility presently exists at the site. There is a gaging station within the potential reservoir area.

SUMMARY OF PREVIOUS INVESTIGATIONS

In 1974, International Engineering Company, Inc. (IECO), prepared a Master Plan of the Kings River Service Area on behalf of the Kings River Conservation District (KRCD). The Master Plan recommended a course of action that would 1) provide a balanced water supply; 2) minimize flood damage; and 3) conserve and develop water andpower resources. One of the alternatives evaluated consisted of the potential development of Dinkey Creek.

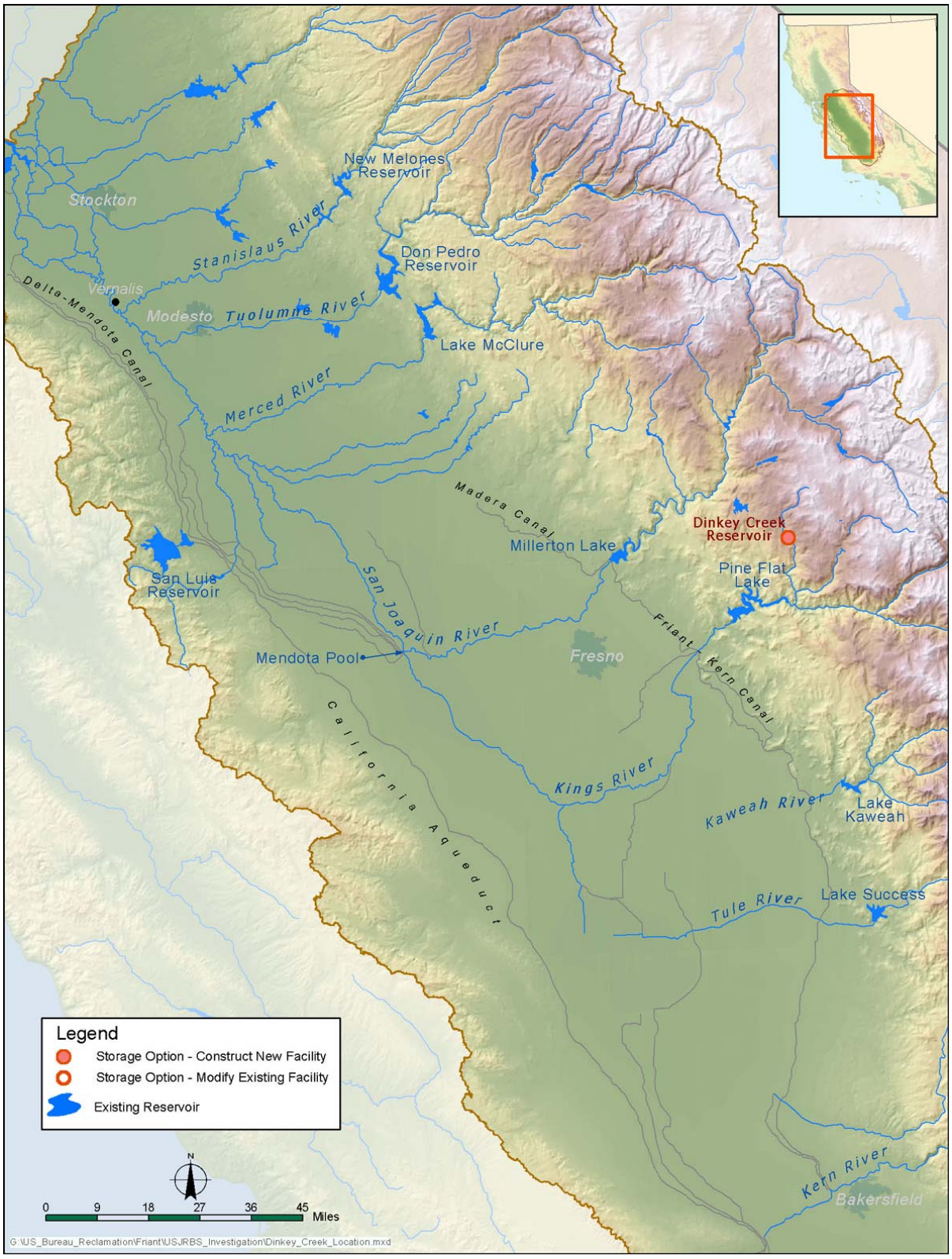

FIGURE 1-1. OPTION LOCATION MAP

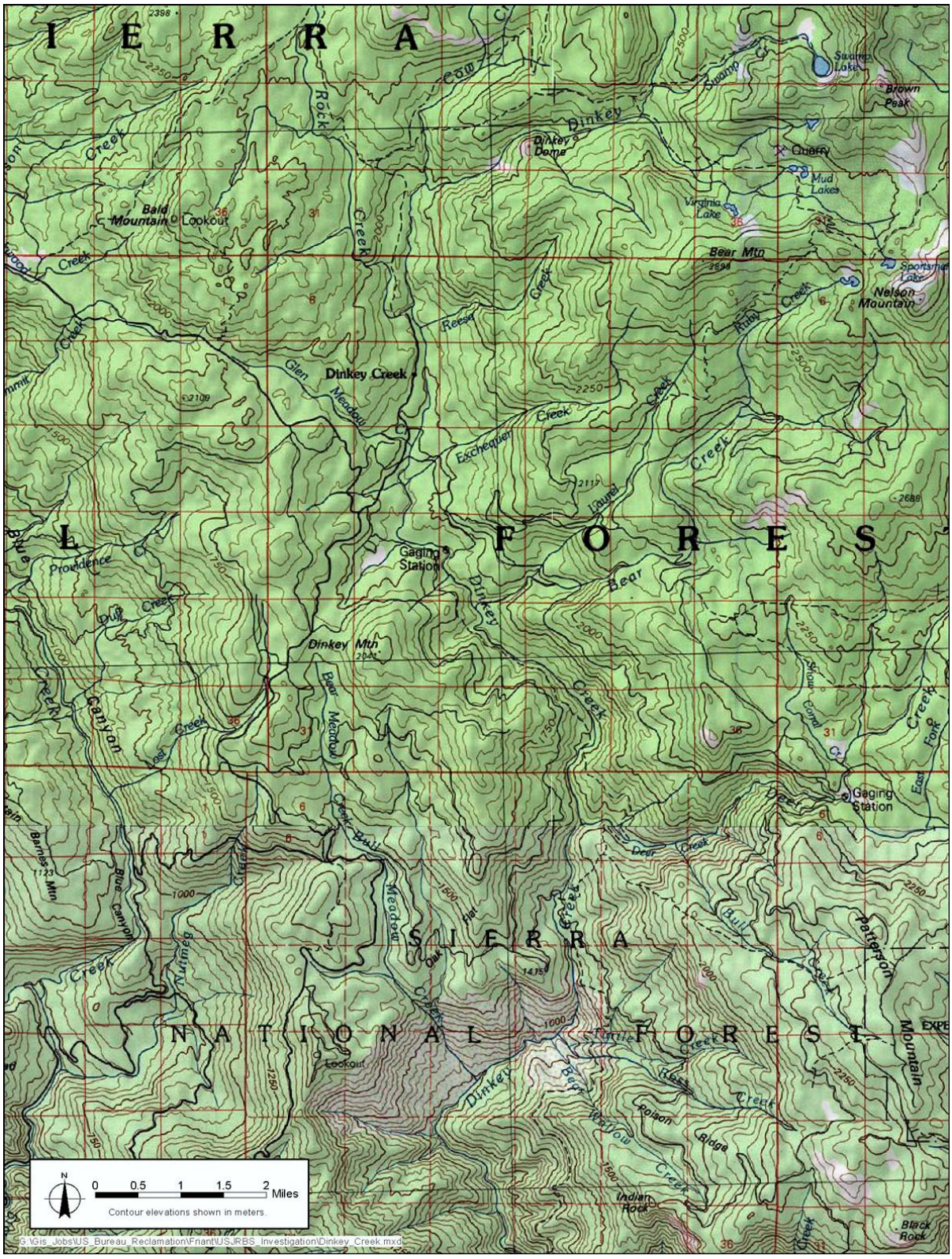

FIGURE 1-2. DINKEY CREEK AND VICINITY

The report concluded that the KRCD service area was deficient in water, and that unless additional water supplies were obtained, groundwater would be overdrafted to the point where a large segment of the agricultural service area would ultimately have to revert to dry farming. The IECO report concluded that a staged development of the recommended alternatives be pursued. Dinkey Creek Dam and Reservoir were found to be economically feasible and were retained as an alternative.

POTENTIAL IMPROVEMENTS CONSIDERED

The 1974 KRCD Master Plan for the Kings River Service Area recommended a 340-foot-high rockfill dam, a diversion dam, two power plants, tunnels, access roads, and other works.

The upper structure, Dinkey Storage Dam, would create a reservoir with a capacity of 90 TAF. The crest of the upper dam would be approximately 20 feet wide and 1,600 feet long at an elevation of 5,700 feet above mean sea level (elevation 5,700). The gross pool would be at elevation 5,686.

The spillway would be located on the right abutment and would be approximately 70 feet wide, designed to pass a maximum discharge of 13,000 cubic feet per second (cfs). It would consist of a short excavated approach channel, an ungated crest section, a concrete-lined chute, and a discharge bucket that would direct the water a safe distance away from the spillway chute.

An intake structure at the main dam would lead to an unlined, 17,000-foot-long, 10-foot-diameter tunnel that would in turn lead to a surge tank excavated in bedrock. The concrete-lined surge tank would have an inside diameter of 21.5 feet and height of 263 feet. A second tunnel, 8 feet in diameter and steel-lined, would lead for about 2,000 feet from the surge tank to a 6-foot-diameter steel penstock, 2,000 feet in length, connecting to Power Plant No. 1 (see Figure 1-3).

Power Plant No. 1, a single-unit, 26 megawatt (MW) plant, would discharge back to Dinkey Creek about 4 miles below the main upper dam. Dinkey Diversion Dam would then recapture the discharge and create 5 acre-feet of additional storage. The diversion dam, a 30-foot-high concrete structure, would divert the discharge from Power Plant No. 1 into another tunnel, which would extend to Power Plant No. 2, located near Balch Camp at the North Fork of the Kings River. The diversion dam capacity would be more than 350 cfs. Intervening flow from the drainage area between the main storage dam and the diversion dam would also be diverted.

The intake to the diversion tunnel would be located on the left abutment of the diversion dam. The selected 32,500-foot tunnel route would proceed through the left bank of Dinkey Creek. The unlined 10-foot-diameter tunnel would be 24,000 feet long. A surge tank, 21.5 feet in diameter and 263 feet high, would be excavated near the end of the tunnel.

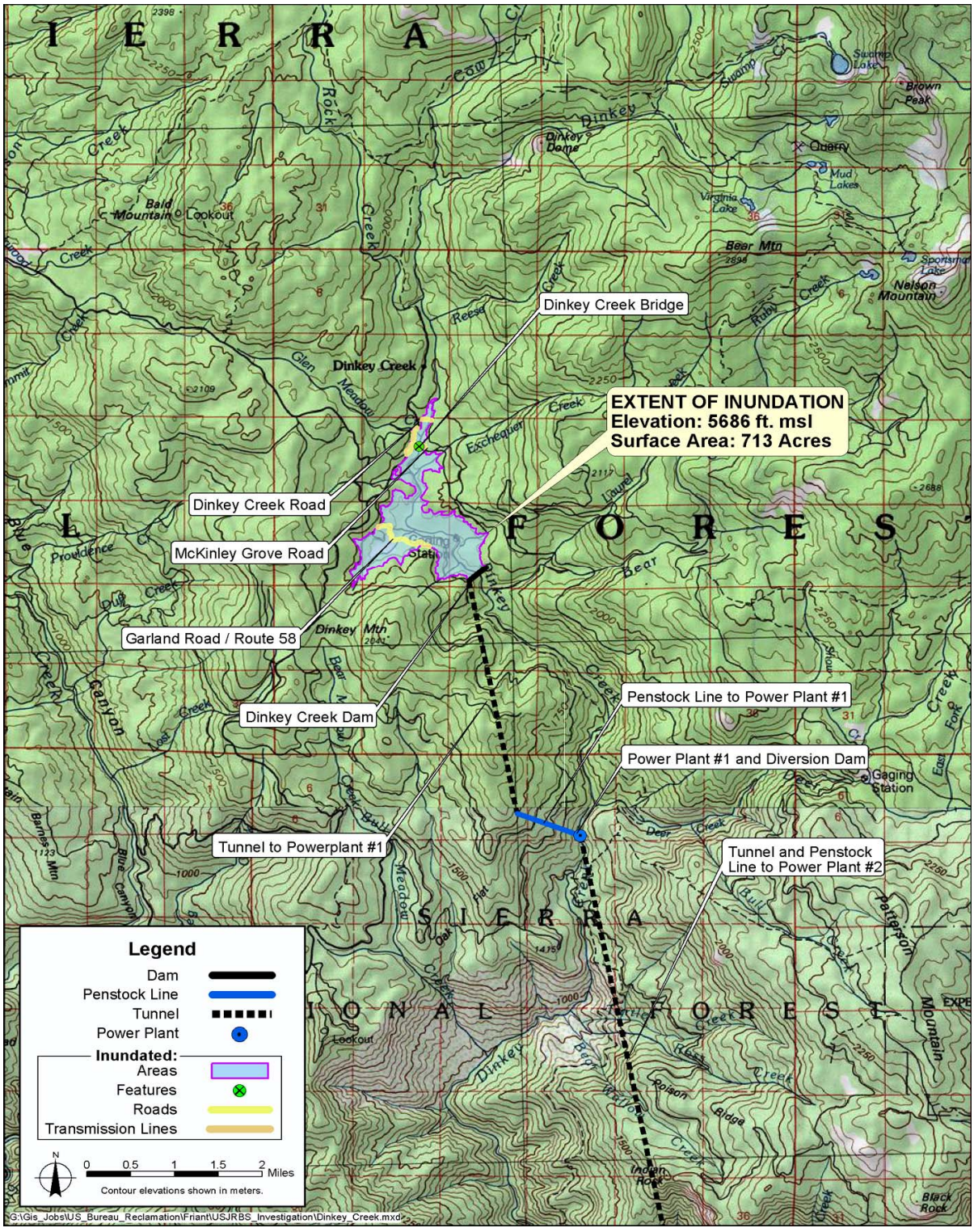

FIGURE 1-3. POTENTIAL STRUCTURES AND INUNDATED AREA

A transition section (about 4,000 feet) would connect the surge tank to a 6-foot-diameter, 7,000-foot-long steel penstock leading to Power Plant No. 2.

Power Plant No. 2 would also be a single-unit plant, rated at 63 MW. The plant would be of the conventional outdoor type, constructed of reinforced concrete. The switchyard, located adjacent to the powerhouse, would contain the necessary switching gear to handle the incoming 138-kilovolt transmission line. It would connect with the existing Pacific Gas and Electric Company (PG&E) transmission line located at the Kings River Power Plant.

APPROACH AND METHODOLOGY

This TM was prepared from a review of the prior study listed above, an engineering field reconnaissance on 13 June 2002 (Appendix A), and an environmental field reconnaissance of the dam and reservoir on 29 May 2002 (Appendix B).

During the June 2002 field trip, engineers and geologists examined the site under consideration. Locations of existing and potential structures were visually assessed. Topography, geology, geotechnical conditions, and utilities were noted. Access routes and possible borrow, staging, and lay-down areas were considered.

During the environmental field review, specialists in botany, wildlife, aquatic biology, recreational resources, and cultural resources visually assessed existing environmental resources. Additional research was conducted, making use of prior studies and available literature, the California Natural Diversity Database (CNDDB), topographic maps, and aerial photographs. This information was used to preliminarily identify the extent to which potential environmental impacts might constrain storage options under consideration. Where evident, opportunities for improving environmental resources or mitigating adverse effects were also noted. Surveys and consultations with external resource management or environmental agencies were not conducted.

The seismotectonic evaluation conducted by Reclamation (2002) for this study was based on readily available information and is considered appropriate for prefeasibility-level designs only. Detailed, site-specific seismotectonic investigations were not conducted for this preliminary analysis. Aerial/remotely sensed imagery was not evaluated for this prefeasibility-level assessment. More detailed, site-specific studies will be required for higher-level designs.

For prefeasibility-level studies, designs and analyses are typically quite general. Extensive efforts to optimize the design have not been carried out, and only limited value engineering techniques have been used.

CHAPTER 2. TOPOGRAPHIC SETTING

Regional topography consists of the nearly level floor of the San Joaquin Valley rising abruptly to moderately steep, northwest-trending foothills with rounded canyons. Farther east, and in the area of the potential dam site, the terrain steepens and the canyons become more incised. The canyons of the watershed have been cut by southwest- to west-flowing rivers and associated large tributaries. The Kings River is the main river in the area. The topography of the Kings River basin is the most rugged in the entire Sierra Nevada mountain range, rising to over elevation 14,000 in the upper watershed.

Elevations in the immediate area range from about elevation 5,360 in the streambed of the potential dam site to over elevation 7,000 in the surrounding mountains. The potential dam is located in a section of river that passes through a narrow, southeast trending bedrock canyon. The ground at the right abutment rises steeply from the riverbed, then flattens at a 3.5:1 horizontal-to-vertical slope until it encounters a ridge at an elevation of nearly 6,700 feet. Similarly, the left abutment slope rises steeply adjacent to the river, but flattens to an overall 5.5H:1V slope.

AVAILABLE TOPOGRAPHIC MAPPING

Topographic mapping of the study area from the United States Geological Survey (USGS) maps are publicly available. It is presumed that topographic maps of the dam and reservoir site are available from KRCD at an unknown scale and contour interval.

AVAILABLE AERIAL PHOTOGRAPHY

Aerial photography of various scales and imagery is available from the archive files of the USGS. Additional aerial imagery may also be available from the United States Department of Agriculture, Reclamation, KRCD, and United States Army Corps of Engineers (Corps). A specific search of the available photography was not conducted for this TM, nor was any preexisting aerial photography reviewed.

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CHAPTER 3. GEOLOGIC AND SEISMIC SETTING

The Kings River basin is located within a complex geologic area containing pre-Cretaceous meta-sedimentary and meta-volcanic rocks that have been folded, faulted, and intruded by granitic rocks of three different ages. Volcanism, followed by glaciation and recent stream-down cutting, modified the topography to essentially the present day landscape. Major geologic structures trend to the northwest. Bedding and foliation of the rock units typically strike northerly and dip steeply west. Degree of weathering and jointing is variable, depending on rock type.

Overall, seismic hazard potential at the site is low. Preliminary earthquake loading parameters evaluated as part of this study considered two types of potential earthquake sources: fault sources and areal/background sources (Reclamation, 2002).

Twenty-two potential fault sources for the site were identified, including those associated with the San Andreas fault, seven western Great Valley faults, seven eastern Sierra Nevada faults, the White Wolf fault of the southern San Joaquin Valley, and six faults of the Sierra Nevada foothills system. No major through-going or shear zones have been identified in this area of the Sierra Nevada and historic seismicity rates are low.

The areal/background seismic source considered was the South Sierran Source Block, the region surrounding the potential dam and reservoir site. This region possesses relatively uniform seismotectonic characteristics.

Probabilistic seismic hazard analysis performed shows that the peak horizontal accelerations to be expected at the site are 0.13g with a 2,500-year return period, 0.18g with a 5,000-year return period, and 0.23g with a 10,000-year return period.

SITE GEOLOGY

Mesozoic granitic bedrock underlies most of the region in the vicinity of the potential Dinkey Creek dam site. Narrow aplite stringers and felsic dikes intrude the bedrock locally and scattered, small roof pedants of meta-sedimentary rocks are found within a mile of the site (IECO, 1974). In the nearby higher elevations, scattered deposits of glacial material cover much of the land surface.

Dinkey Creek has cut a narrow gorge, nearly 150 feet deep in places. As such, the final dam site location could vary over a distance of a few hundred feet. Bedrock is covered in a few scattered locations by thin talus deposits and large blocks of loose rock.

No significant through-going faults are known to exist in the area of the site.

SITE GEOTECHNICAL CONDITIONS

According to the IECO 1974 report, and as observed during the field reconnaissance, the steep lower portions of both dam abutments expose fresh, very hard granite that varies from slightly fractured to massive. Higher up the canyon walls, the rock is slightly weathered and somewhat more fractured, with exfoliation and stress relief fractures becoming more evident. Slightly fractured bedrock, locally obscured by talus and slope wash, is exposed over much of the reservoir area. No large existing or potential landslides have been identified; consequently, only minor slumps from steeper slopes are expected upon reservoir filling.

In the left abutment, a three-dimensional joint pattern is evident. Most fractures appear to be tight. Higher up on the left abutment, a small gully filled with talus/slope wash traverses the center of the abutment. Downstream of the abutment, alluvium has accumulated near the confluence with Laurel Creek.

On the right abutment, a greater number of large loose granitic blocks is present than on the left abutment. Near the downstream end of the rock mass is a large (10 feet by 20 by 50 feet) block of loose, exfoliated granite and farther on is a steep ravine containing slope wash and talus. The potential spillway is located on the right abutment. Excavation in this location would be in fresh, slightly fractured granite. Because a relatively deep cut is anticipated, rock bolting of the excavation should be anticipated.

Alluvial deposits occur within Dinkey Meadow Creek and downstream of its confluence with Dinkey Creek. The creek channel is filled with large scattered boulders within the narrow gorge. Competent, hard granitic bedrock is expected to underlie the streambed. Potholes up to 10 feet in diameter are found locally.

The areas traversed by tunnels and appurtenant structures downstream of Dinkey Creek are composed essentially of granitic rock. On the whole, it is expected that the granitic rock will be relatively unweathered and only slightly fractured, and tunnel support is not expected to be necessary. However, there appear to be four different granitic rock types. Contact zones between these granitic plutons may be quite fractured and tunnel support may be required in such intervals. Furthermore, some meta-sedimentary and basic intrusive rocks are found in the area. Portions of the tunnels may penetrate these units, depending on selection of the final alignment, and support may be required. Moderate water flow should be anticipated in the more closely fractured zones. Methane and toxic gases are not expected.

CHAPTER 4. HYDROLOGIC SETTING

The Kings River watershed upstream of the potential Dinkey Creek Dam covers approximately 51 square miles, with elevations ranging from about elevation 5,600 at the potential dam site to elevation 14,000.

RAINFALL

Rainfall in this Mediterranean climate region varies from about 8 or 9 inches per year in the Central Valley to about 60 inches per year in the Sierra Nevada. About 90 percent of runoff-producing precipitation occurs from November through April.

Precipitation usually occurs as rain below elevation 4,000 and as snow at higher elevations. However, snow has occurred in the San Joaquin Valley, and rain sometimes occurs above elevation 10,000. The snow pack accumulates during the winter and early spring and generally starts melting in April.

EROSION, RUNOFF, AND RECHARGE

Specific erosion potential information for the site was not identified. However, some information on soils is available. IECO reported in 1974 that the upland soils of intermediate elevations in the Sierra Nevada, where developed, are moderately deep to deep, medium to moderately fine-textured, medium to strongly acidic, and based on basic igneous and meta-sedimentary rocks.

Discharge records are available for water years 1922 to 1935 for Dinkey Creek at Dinkey Meadow. Gage No. 2170 is located just upstream of the potential Dinkey Creek Dam. Average annual flow at Dinkey Creek is 104 cfs, with a maximum average flow of 315 cfs, and a minimum annual average of 26 cfs (IECO, 1974).

AVAILABLE FLOOD DATA

Detailed flood data were not identified in the documents reviewed.

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CHAPTER 5. STORAGE STRUCTURES AND APPURTENANT FEATURES

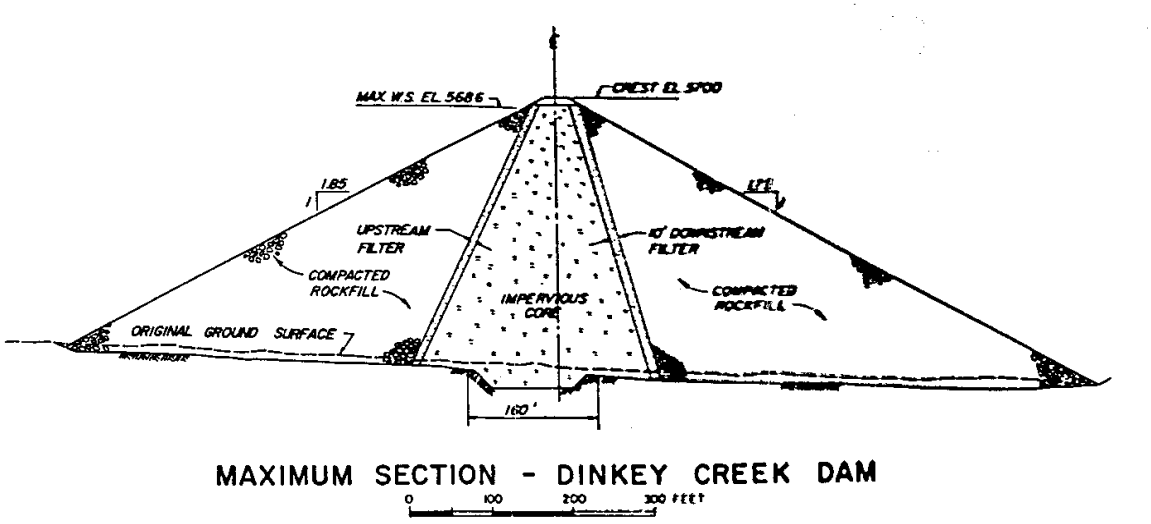
This chapter describes the recommended storage structure and appurtenant peatures for the Dinkey Creek dam site, and the constructibility, cost, and systems operations for this option.

STORAGE STRUCTURE

In its 1974 study, IECO adopted a zoned embankment design as the most suitable for the site, since impervious fill material is available locally. However, future studies could also consider roller-compacted concrete (RCC), gravity, or concrete-faced rockfill (CFRF) dam designs.

The IECO study established the main dam crest at elevation 5,700, resulting in a dam height of approximately 340 feet above the riverbed. At this elevation, the crest length would be about 1,600 feet, and the gross pool elevation would be at about elevation 5,686. The crest width would be approximately 20 feet.

The zoned rockfill embankment, as conceived by IECO in its study, would consist of an impervious core flanked upstream and downstream by filters; transition zones of disintegrated granitic rock from required excavations; and rockfill shells on both the upstream and downstream sides. A filter blanket and a chimney drain of coarse material would be provided downstream of the impervious core. The upstream face of the dam would slope at 1.85:1 (horizontal to vertical) and 1.75H:1V on the downstream side. Figure 5-1 is a cross section from the 1974 IECO study.



Source: IECO, 1974

FIGURE 5-1. CROSS SECTION OF A ROCKFILL EMBANKMENT DAM

RESERVOIR CAPACITY CURVE

A reservoir storage volume versus elevation curve is shown in Figure 5-2. The data used to generate the curve were taken from the 1974 IECO report.

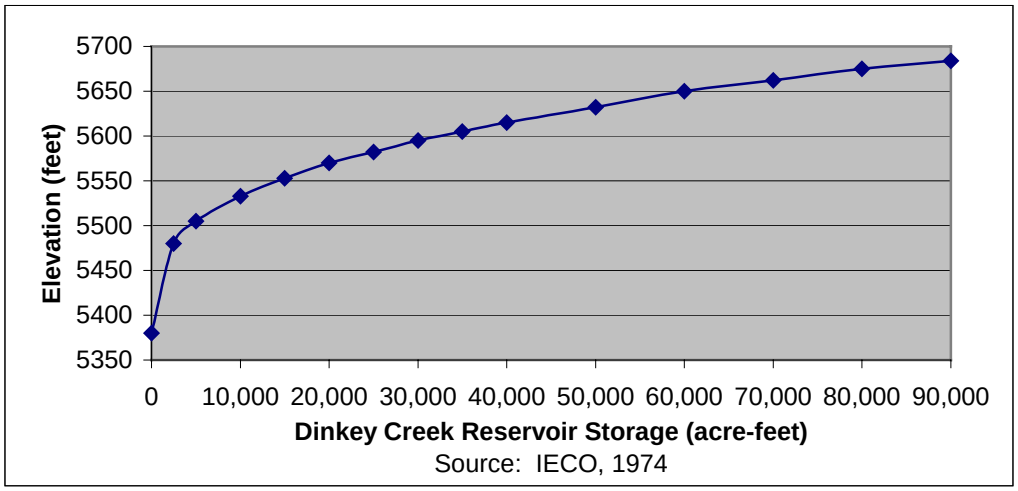


FIGURE 5-2. RESERVOIR AREA VS. STORAGE RELATIONSHIP

APPURTENANT FEATURES This section discusses other features that would be needed for the potential option.

Conveyance

The intake structure at the main dam would lead to an unlined, 17,000-foot-long, 10-foot-diameter tunnel (slope at 0.008), emptying into a surge tank excavated in bedrock. The concrete-lined surge tank would be about 21.5 feet in diameter and 263 feet high. An 8-foot-diameter steel-lined tunnel would lead for about 2,000 feet from the surge tank to a 6-foot-diameter steel penstock, 2,000 feet in length, connecting to Power Plant No. 1.

A 30-foot-high concrete diversion dam, located approximately 4 miles downstream from the main dam, would divert discharge from Power Plant No. 1 into another tunnel, which would extend to Power Plant No. 2. The diversion capacity would be more than 350 cfs. Intervening flow from the drainage area between the main storage dam and the diversion dam would also be diverted.

The intake to the 10-foot-diameter, unlined tunnel would be located on the left abutment of the diversion dam. This tunnel would be 24,000 feet long and have a slope of 0.008. The selected 32,500-foot tunnel route would proceed through the left bank of Dinkey Creek. A surge tank 21.5 feet in diameter and 263 feet high would be excavated near the end of the tunnel. A transition section (about 4,000 feet) would connect the surge tank to a 6-foot-diameter, 7,000-foot-long steel penstock leading to Power Plant No. 2.

Pumping Plants

Water would be conveyed by gravity; therefore, no pumping plants would be required.

CONSTRUCTIBILITY

This section discusses issues of concern related to modifying the dam, reservoir, and appurtenant features.

Land, Rights-of-Way, Access, and Easements

Paved county roads pass within 1 mile of the potential dam axis. Access to the dam site is afforded on both the right and left abutments by graded roads passable in four-wheel drive vehicles.

Borrow Sources/Materials

IECO did not carry out a formal construction materials investigation, but potential borrow deposits were noted in its report. Deposits of impervious materials containing a high percentage of fines were not noted in the vicinity of the dam site; however, the report recommended exploring some of the nearby, relatively flat meadow areas that might contain such suitable material.

Pervious materials could be obtained from alluvial deposits occurring along Dinkey Creek about 1 mile upstream of the potential dam site. Pervious materials were also reported to occur along Dinkey Meadow Creek. Exploration and testing would be necessary to evaluate the extent and suitability of such materials.

Decomposed granite suitable for use in transition zones between the filters and rockfill zones would likely be generated from required excavations for the dam and spillway. Ample quantities of hard, granitic rock suitable for quarrying of riprap, rockfill, and concrete aggregate is exposed near the potential dam site.

Foundations

The dam would be founded on hard granite. A core trench would be excavated a minimum of 5 feet into the rock under the impervious core, after stripping approximately 10 feet of highly weathered surface material.

Power Sources

Power is available in the Dinkey Creek area that could be accessed.

Staging and Lay-Down Area

A contractor staging and lay-down area is available in Dinkey Meadow 1.5 miles upstream of the potential dam site where the canyon widens.

Contractor Availability and Resources

There are several regional general contractors capable of performing the work necessary to construct the dam.

Construction Schedule and Seasonal Constraints

At the site elevation, construction would more than likely have to be interrupted during winter. Therefore, the main dam would probably be built over a period of 3 years. This assumes that excavation of the diversion tunnel could be conducted during the first spring and summer, with river diversion in mid-summer. Excavation and foundation treatment would follow in late summer and fall. Placement of the dam embankment would begin in the spring of the second construction season, and would be topped out in the third construction season.

Flood Routing During Construction

The diversion works would consist of an upstream cofferdam, a temporary downstream cofferdam, and a 1,000-foot-long, 10-foot-diameter horseshoe-shaped diversion tunnel that would pass through the ridge of the left abutment. The upstream cofferdam would be incorporated into the main dam.

Environmental Impacts During Construction

Environmental impacts during construction could be mitigated with proper planning and implementation of best management practices. Noise and visual impacts would be significant to the inhabitants of Dinkey Creek. Air quality issues during construction could be mitigated by dust control measures. Blasting that would be required for abutment excavation, and quarries would require both noise and vibration monitoring on the dam. A cultural survey would have to be conducted to identify any ancestral American Indian or historic artifacts and construction activities would be restricted in those areas. Importing cement and concrete aggregate from distant plants could cause traffic impacts but with proper planning and coordination with Caltrans, major impacts could be mitigated. All construction equipment should have spark arresters and fire control equipment should be kept readily accessible during construction. Construction water would have to be controlled and provisions made for runoff and erosion control. A spill control plan would be needed to control any construction-related fuels, lubricants, and other materials.

Permits

Both Federal and non-Federal entities would sponsor construction of the dam. This joint sponsorship could complicate the permitting process as Federal projects are not subjected to the same level of permitting required for non-Federal projects.

Given the probable duality of sponsorship, and potential environmental and cultural impacts identified, at a minimum, certain permits could be required from the permitting agencies listed in Table 5-1.

TABLE 5-1. POSSIBLE REQUIRED PERMITS

Permit	Permitting Agency
Permit to Construct	DSOD, Fresno County
Encroachment	Caltrans, Fresno County
Air Quality	CARB, Fresno County
Low/No Threat NPDES	RWQCB
Waste Discharge	RWQCB
401 Certification	SWRCB
Blasting	Fresno County
Stream Bed Alteration	CDFG
Fire/Burn	CDF, Fresno County

Key:

CARB	California Air Resources Board
CDF	California Department of Forestry
CDFG	California Department of Fish and Game
DSOD	Department of Safety of Dams
NPDES	National Pollutant Discharge Elimination System
RWQCB	Regional Water Quality Control Board
SWRCB	State Water Resources Control Board

In addition, the following agencies could be involved in reviewing permit conditions:

- Bureau of Land Management
- State Historic Preservation Office
- Advisory Council on Historic Preservation
- United States Fish and Wildlife Service (USFWS)

In obtaining these various permits, several plans would have to be prepared and submitted to the responsible agencies for review and approval:

- Construction Plan and Summary Documents
- Quality Control Inspection Plan
- Highway Notification Plan
- Blasting Plan
- Noise Monitoring Plan
- Water Quality Monitoring Plan
- Noxious Weed Control Plan
- Bat Protection Plan
- Management Plan for Avoidance and Protection of Historic and Cultural Properties
- Storm Water Pollution Prevention Plan
- Spill Prevention/Containment Plan
- Visual Quality Control Plan
- Dust Control and Air Quality Plan

Another important regulatory requirement involves compensation/mitigation for habitat loss. In October 1998, USFWS issued its draft Coordination Act Report and Habitat Evaluation Procedure (HEP Analysis). The HEP Analysis delineates how compensation for adversely affected baseline habitat and wildlife conditions is to be determined.

In addition, if power generation is included in a project or is modified for an existing project, the Federal Energy Regulatory Commission may become involved in the permitting process.

COSTS

Updated construction costs for this storage option are discussed below.

Initial Construction Costs

Based on the 1974 IECO cost estimate, the cost estimate for the potential Dinkey Creek Dam hydropower option was updated to April 2002 unit costs using Reclamation Construction Cost Trends. Costs were also evaluated by MWH dam cost estimators and modified to reflect current material costs and standards of practice, especially with respect to seismic requirements. Costs for the storage-only option were estimated by subtracting the estimated costs for the power generation portions from the original estimate.

Hydropower Option - The estimated total construction cost for the potential Dinkey Creek hydropower option is approximately $423 million.

Storage-Only Option - The estimated total construction cost for storage only at Dinkey Creek is approximately $122 million.

Estimated cost components are presented below in Table 5-2 and in Appendix C. Field costs represent the estimated cost to construct identified features, plus provisions for unlisted items (15 percent), contingencies (25 percent), and mitigation (5 percent). Land costs are excluded from this prefeasibility-level estimate. Additional study of land requirements would be needed to determine their cost. Total option costs include field costs plus estimated costs for future analyses and planning documentation, development of designs, and construction management (15 percent).

Operations and Maintenance Costs

Operations and maintenance costs were not evaluated in any of the previous studies of the potential Dinkey Creek option and were not estimated for this report.

SYSTEMS OPERATIONS

Water stored in Dinkey Creek Reservoir would be released to Dinkey Creek, which would then contribute to flow in the North Fork of the Kings River. Releases from Dinkey Creek Reservoir would be exchanged for water diverted from Millerton Lake or would offset Millerton releases to the San Joaquin River. Hydropower aspects of this option are addressed in Chapter 6.

TABLE 5-2.
SUMMARY OF FIRST COSTS

Dinkey Creek Dam and Reservoir	**Estimated Cost ($Million)**	
Cost Component	Hydropower	No Hydropower
Main Dam	68.4	68.4
Spillway	2.3	2.3
Diversion Dam	1.5	
Power Intake, Tunnels, Penstocks	155.5	
Powerplants and Generating Equipment	11.5	
Transmission Facilities	4.2	
Unlisted Items	36.5	10.6
Contingency	70	20
Mitigation	18	5
Total Field Cost	**368**	**106**
Investigation/Design/CM	55	16
Total First Cost	**423**	**122**

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CHAPTER 6. HYDROELECTRIC POWER OPTIONS

Various hydroelectric power options were considered for each surface storage site, including Dinkey Creek.

PUMPED STORAGE CONSIDERATIONS

The potential Dinkey Creek option would not result in a pumped storage option.

ADDED HYDROELECTRIC POWER TO EXISTING STRUCTURES

No hydroelectric facilities currently exist at the site.

NEW HYDROELECTRIC POWER

The Dinkey Creek option has the potential to generate up to 89 MW of firm hydroelectric energy through developing 4,400 feet of head between Dinkey Meadow and the confluence of Dinkey Creek and the North Fork of the Kings River.

Power Plant No. 1 would be a single-unit, 26 MW plant. Power Plant No. 2 would also be a single-unit plant, rated at 63 MW. The vertical-shaft, impulse-type turbine at Plant No. 2 would be rated at 94,000 horsepower at a net head of 3,055 feet.

Table 6-1 summarizes results of reservoir operation and power studies (IECO, 1974). It was assumed that intervening flow between the storage dam and the diversion dam would provide additional water for power generation at Power Plant No. 2. It also assumed that the project would operate at a plant factor of 0.25 (i.e., for 6 hours per day only 25 percent of the intervening flow would be diverted). Average annual energy production is estimated at 72,110,000 kilowatt-hours (kWh) for Power Plant No. 1 and 200,100,000 kWh for Power Plant No. 2, for a total of 272,210,000 kWh (IECO, 1974).

TRANSMISSION AND DISTRIBUTION

It is expected that transmission lines from the two powerhouses would tie into the existing 138 kilovolt (kV) line at the PG&E Balch Camp powerhouse.

The switchyard, located adjacent to the powerhouse, would contain the necessary switching gear to handle the incoming 138 kV transmission line. It would connect with the existing PG&E transmission line located at the Kings River Power Plant.

TABLE 6-1.
ESTIMATED ENERGY PRODUCTION

	Dinkey Storage Dam & Power Plant No. 1	Dinkey Diversion Dam & Power Plant No. 2
Full Reservoir Capacity (acre-feet)	90,000	5
Full Reservoir Elevation (feet)	5,686	4,400
Minimum Reservoir Capacity (acre-feet)	0	0
Minimum Reservoir Elevation (feet)	5,380	4,370
Installed Capacity (MW)	26	63
Average Annual Turbine Discharge (cfs)	101	117
Maximum Gross Head (feet)	1,286	3,120
Firm Power/0.25 PF (MW)	25.4	62.5
Average Annual Energy (kWh)	72,110,000	200,100,000

CHAPTER 7. ENVIRONMENTAL CONSIDERATIONS

This chapter describes existing environmental resources at the site and qualitatively describes potential effects of the potential surface storage option, indicating the extent to which expected or potential environmental effects might pose a constraint to its development. Where evident, opportunities for improving environmental resources or mitigating adverse effects have been noted. Analysis focuses on botany, terrestrial wildlife, aquatic biology, water quality, recreational resources, cultural resources, and existing land uses. Mining and other known past activities that might affect site conditions are also briefly discussed, along with the potential presence of hazardous or toxic materials. Temporary construction-related disruptions and impacts are discussed in Chapter 5.

Identification of constraints was conducted at a preliminary, prefeasibility-level of planning, consistent with the current phase of the Investigation. Criteria considered were based, in part, on criteria commonly used to evaluate environmental impacts of projects under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The application of criteria that may be used for NEPA or CEQA evaluation does not imply that the analysis is at a level necessary to support an Environmental Impact Statement or Environmental Impact Report. Considerations included presence of special status species (e.g., Federally listed endangered species), species of concern, or sensitive habitats; relative amounts of affected riparian or wetland habitat; effects on native or game fish; conflict with established recreational uses or land uses; presence of nationally registered historic places, sacred Native American sites, or Traditional Cultural Properties; permanent disruption or division of established communities; and any loss of energy production facilities.

The environmental setting descriptions provided in this chapter pertain principally to the potential inundation area of the potential main dam on Dinkey Creek.

BOTANY

The primary habitat is mixed Sierran forest (yellow pine forest). Meadows and riparian habitats have also been identified in the area. Chaparral and oak woodland occur in areas affected by roads and spoil sites. Giant sequoia groves are located in areas that could be affected by the diversion tunnel. Soils and geologic conditions are granitic.

Two special-status species are known to occur in the area: orange lupine and tree anemone. Only the tree anemone is listed. None of the locations identified in the CNDDB as sites where it occurs are in the immediate proximity of the potential dam and reservoir, but there is abundant suitable habitat for this species present. Populations of *Carex whitneyi* and *Pityopus californicus* have been reported in the area affected by the potential reservoir. *Carex whitneyi* is no longer considered a special-status species and *Pityopus californicus* is a California Native Plant Society List 4 species.

Constraints

The loss of wetlands and riparian habitat would be a constraint to construction. Loss of mixed Sierran forest would affect timber harvest in the area. New locations of the tree anemone that would be affected by construction of the reservoir, roads, and other facilities would be an additional constraint. A 1980 Environmental Impact Statement indicated that the diversion tunnel could affect giant sequoias in the McKinley Grove. This would be considered a serious adverse impact.

Opportunities

Several State and Federal agencies have been apparently assessing measures to mitigate impacts from this potential storage option. It is unclear whether mitigation could occur within the Dinkey Creek watershed.

WILDLIFE

The Dinkey Creek area hosts a relatively diverse wildlife community with an abundance of deer, bear, and mountain quail. While the area has only limited development, few sensitive wildlife species are recorded for the area. The Mt. Lyle salamander has been recorded, as well as the willow flycatcher. The salamander is not Federally or State-listed as threatened or endangered. The threatened willow flycatcher has been recorded within a few miles of Dinkey Creek. However, the area does not appear to currently support the riparian woodlands this species requires for nesting.

Constraints

A reservoir in this relatively remote area would considerably alter the biological setting. The damming of a free flowing mountain stream would likely be a concern to resource agencies. Development of this measure would appear to destroy habitat for the willow flycatcher; this would be an important constraint if the flycatcher is still presently inhabiting and nesting in the area.

AQUATIC BIOLOGY/WATER QUALITY

Although remote, Dinkey Creek is a popular recreation area and trout fishing destination. A number of campgrounds and residences are located near the stream.

Dinkey Creek is a major tributary of the North Fork Kings River. Flow at the potential dam site typically varies from about 5 cfs in late summer and fall to about 500 cfs in April through June. In wet years, May and June flows often exceed 1,000 cfs. The creek is a high-gradient stream with a bedrock-controlled channel, and with some alluvial sections as well.

The Dinkey Creek elevation places it in the Rainbow Trout Fish Zone. Rainbow trout and brown trout are currently the principal species in the stream.

Constraints

The reservoir of a 340-foot dam would inundate a little less than 3 miles of the stream. Principal effects on aquatic biological resources result from replacement of stream habitat with lacustrine habitat and altering the instream flow regime downstream of the potential reservoir. Populations of fish and other organisms adapted to a stream environment could be reduced or eliminated from inundated areas, while those of species adapted to lacustrine conditions would be enhanced. Trout are well adapted to both types of environments and would probably survive well in the new reservoir.

Storage and releases from the new reservoir would alter the timing of flows in Dinkey Creek, and diversions would reduce flow. The proposal for a Dinkey Creek option with a 340-foot dam includes diversions that would reduce average flows from December through June to as little as one tenth of pre-dam levels. This reduction in flow, particularly during spring and summer, when rainbow trout are spawning and the young are growing, could affect physical habitat availability. Adult trout generally require much higher flow velocities than juvenile trout, so reduction in flows could impair production of older trout but benefit younger life stages. Physical habitat analysis (e.g., PHABSIM) would be needed to determine the net effect of changes in flow.

The reservoir created by damming Dinkey Creek would likely stratify during summer months. Therefore, assuming water was released from the lower reservoir depths (hypolimnion), the reservoir would result in colder water temperatures below the discharge point. Trout require relatively cold water, but at the elevation of Dinkey Creek, unimpaired water temperatures are generally ideal. Water released from the reservoir would likely be so cold as to reduce growth and development of the trout, and thus inhibit production. However, because of reduction in flow, summer water temperatures in Dinkey Creek would rapidly warm with distance downstream from the dam and could therefore exceed temperatures required by trout further upstream than under pre-dam conditions. Water temperature modeling (i.e., SNTEMP) would be required to resolve this issue. Water diverted from the new Dinkey Creek Reservoir, particularly if conveyed in tunnels and sheltered from the sun, would remain cold for a considerable distance and would likely cool the water temperatures of its receiving stream or reservoir.

Resident stream rainbow trout seasonally migrate to varying degrees but construction of Dinkey Creek Dam would impose a barrier to trout migrations. The significance of trout migrations in streams is poorly understood, but they may be important, particularly for spawning.

Entrainment of fish into diversion structures and powerhouses could result in substantial mortality. However, this mortality would likely be offset by increased fish production due to new fish habitat created by the reservoir.

Opportunities

The principal opportunity afforded by this measure is the substantial new fish habitat that would be created by the reservoir. This reservoir would provide excellent conditions for a trout fishery. Rainbow and or brown trout populations would probably be successfully self-sustaining, but regular stocking could increase production.

If existing vegetation in the new Dinkey Creek Reservoir inundation area were not removed prior to building the new dam, it would be inundated, providing a short-term increase in nutrient levels in the reservoir and enhancing habitat structure. Both effects would likely benefit fish production.

Providing adequate minimum instream flow releases from Dinkey Creek Reservoir would help protect fish populations downstream. An instream flow study would be needed to determine suitable flow levels for releases.

RECREATION

This new dam site and reservoir would be situated mainly on public lands of the Sierra National Forest, managed by the United States Forest Service. The Dinkey Creek area provides a variety of recreation opportunities, based mainly around Dinkey Creek. The community of Dinkey Creek, the Trails End Resort, and Dinkey Creek Inn, located just upstream of the potential inundation area, provide lodging and other recreation-oriented services.

The area that would be inundated is relatively developed and includes two organization camps (Camp Mary-Y-Mac and Camp El-O-Win), recreation residences, and paved and unpaved access roads. In the area surrounding the potential inundation pool is another organization camp (Fresno Junior), a public cabin complex (Camp Fresno), numerous recreation residences, developed campgrounds, picnic areas, trails, and parking areas.

Constraints

Constructing a dam and creating a reservoir on Dinkey Creek would inundate two organization camps, several recreation residences, and paved and unpaved access roads. Loss of these developed facilities and the opportunities and activities they support would be considered substantial adverse impacts. These facilities would have to be reconstructed elsewhere to avoid displacing recreation visitors, along with suitable access routes.

Over the long term, Dinkey Creek Reservoir would probably provide as many or more recreation opportunities as are currently present. The reservoir would provide a large body of water that would increase opportunities for fishing, swimming, and boating. River-oriented recreation activities would continue to be present along Dinkey Creek upstream and downstream of the reservoir. Increased use at the reservoir would create demand for new facilities that should be considered part of the option.

Outlying organization camps, campgrounds, picnic areas, nearby towns, and commercial developments would probably benefit from a reservoir over the long term. However, these would be adversely affected by noise, dust, and air pollution during the construction period. Mitigation measures should be included to abate dust, noise, and air pollution to the extent possible. Overall recreation use in the area would probably decrease during the construction period, so commercial businesses that depend on recreation income might have to be compensated.

Opportunities

PG&E considered the possibility of constructing a similar reservoir for hydropower. As part of its studies, PG&E conducted recreation visitor surveys to evaluate appropriate types of recreation improvements. According to PG&E, survey respondents indicated an overwhelming desire to limit development that might otherwise detract from the existing recreation environment. Respondents also indicated that 1) a commercial complex like Dinkey Inn should be retained; 2) power boating on the reservoir should be limited or restricted; and 3) recreation development should be limited to a low-density level. A similar survey should be undertaken to determine whether these views have changed.

CULTURAL RESOURCES

The lower reaches of Dinkey Creek were traditional territory of the Wobonuch people, Numic-speaking relatives of the Northfork Mono along the San Joaquin River. The Wobonuch lived in small settlements along larger watercourses. It is likely that Wobonuch people traveled to the headwaters of Dinkey Creek for summer fishing and deer hunting, and for traveling across the Sierra Nevada via Piute Pass.

The Dinkey Creek area has been surveyed for cultural resources in connection with a potential reservoir development by KRCD. In 1981, testing of 18 potentially impacted sites in the area demonstrated substantial occupation of the area as early as B.C. 4000.

Specific information is presently unavailable regarding the history of the Dinkey Creek area. A variety of sites is likely to be present associated with mining, logging, grazing, recreation, and other activities. In 1863, hunters reportedly named the creek for their dog Dinkey who was injured in a fight with a grizzly bear. In 1878, John Muir mentioned the presence of a grove of giant sequoias named Dinkey Grove on Dinkey Creek.

Constraints

Numerous cultural resources are known to be present. Inundation of archaeological sites (prehistoric or historic) could result in loss of important scientific data. As many as 18 or more archaeological sites could be adversely affected by construction of Dinkey Creek Dam. Smaller dam configurations would presumably inundate fewer sites.

Some sites tested by Kipps were recommended as eligible for the National Register of Historic Places, but specific information regarding their status is not presently available and it is likely that the sites would require re-evaluation under an updated research design. No Native American sacred sites or Traditional Cultural Properties are known to occur, but Wobonuch Mono concerns are expected.

Opportunities

Inundation damage to archaeological sites can be mitigated with scientific data recovery programs. Reservoir projects also provide an opportunity for public interpretation of the past. For ancillary facilities, such as roads, power lines, or other structures, impacts to archaeological sites might be avoided through design or facility placement.

LAND USE

Ranchettes and other private homes are abundant in this popular recreation area. Private residences and roads, public lands, and timber reserves may be located in the areas of inundation (Figure 1-3). Major facilities that would be inundated below elevation 5,686 include the following:

- McKinley Grove Road
- Dinkey Creek Road
- Connecting road crossing Dinkey Creek Bridge and Garland Road
- Route 58

Constraints

Dinkey Creek represents a well-developed recreation-based community with many residences located in this area because of the proximity to recreation opportunities. This interrelationship between recreational and residential uses is well described in the recreation section. This measure would have significant land use constraints because of its impact on an existing vital community.

Opportunities

No land use opportunities have been identified for this measure. Mitigation of impacts to the existing recreation based community would be difficult.

MINING AND OTHER PAST ACTIVITIES

The community of Dinkey Creek is located in the central Sierra Nevada, away from tectonic structures that typically create concentrations of valuable minerals, and lacks in large alluvial deposits suitable as aggregate.

As evidenced in USGS topographic maps, a sawmill once existed, above the potential inundation line in the Dinkey Creek community (west of the Ranger Station), indicating that logging was once conducted in the area. The USGS maps also show a prospect, or mining claim, on the right bank of Dinkey Creek, just upstream of the potential dam. No indication exists that the prospect is, or ever was, active.

Constraints

Since the sawmill appears to be closed and removed and the prospect or mining claim does not appear significant, no constraints were identified.

HAZARDOUS AND TOXIC MATERIALS

The community of Dinkey Creek may possess, or may have once contained, underground or aboveground petroleum hydrocarbon storage tanks. The sawmill may have used underground fuel and lubricant storage tanks, or electrical transformers containing polychlorinated biphenyls (PCBs). While the mineral(s) of interest at the mining prospect is not known, fuel, lubricants, or extraction chemicals might have been used at the site.

Constraints

While the former sawmill appears to have been demolished and removed, potential impacts to the site from fuel and lubricant hydrocarbons and from electrical transformers may exist on the site. If so, remediation would be required. Similarly, although the prospect shows no significant evidence of activity, mining-associated chemicals could be present.

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CHAPTER 8. FINDINGS AND CONCLUSIONS

This TM evaluated a potential new dam and reservoir on Dinkey Creek, in the upper watershed of the North Fork of the Kings River. A dam at Dinkey Creek would be located within the Sierra National Forest at approximately elevation 5,425. It would be constructed as a zoned rockfill dam, approximately 340 feet high and 1,600 feet long. Full reservoir capacity would be approximately 90 TAF. This option would include a 70-foot wide spillway on the right abutment with a discharge bucket, two power plants, a second diversion dam, connecting tunnels, penstocks, and surge tanks. The diversion tunnels together would total 46,000 feet in length. The two power plants would each consist of a single generating unit, 26,000 kW and 63,000 kW, respectively.

Water stored in a new reservoir at Dinkey Creek would be released to Dinkey Creek, which flows into the North Fork of the Kings River. Dinkey Creek discharges would offset releases from Millerton Lake to the San Joaquin River through exchange.

Site conditions appear suitable for construction. The dam would be founded on hard granite. Pervious raw materials are available, though not quantified or tested. Although deposits of impervious materials containing a high percentage of fines were not noted in the vicinity of the dam site, they may be found in nearby meadow areas. Paved county roads are within 1 mile of the dam site and graded roads pass both the right and left abutments. A staging area could be situated 1.5 miles upstream of the potential dam site where the canyon widens.

Adverse environmental impacts would be expected in all categories assessed – botany, wildlife, aquatic biology and water quality, recreation, and land use. In particular, a reservoir at Dinkey Creek would fundamentally alter the existing recreation-based community. Potential exists for adverse impacts to fisheries and fishing-oriented recreation resources. A reduction in flow, particularly during spring and summer when rainbow trout are spawning and the young are growing, could affect physical habitat availability. Changes in water temperature below the dam could adversely impact trout and the dam would impede migration.

Dinkey Creek is a popular recreation area and trout fishing destination. Several campgrounds and residences are located near the stream. The potentially inundated area includes two organization camps, recreation residences, and paved and unpaved roads that provide access on both sides of the stream to recreational resources in the Sierra National Forest. Adverse regional land use impacts could also be expected. The community of Dinkey Creek and nearby resorts provide lodging and other recreation-oriented services. The area surrounding the potential inundation pool contains an organization camp, a public cabin complex, numerous recreation residences, developed campgrounds, picnic areas, trails, and parking areas. Inundation of roads and recreational resources they serve would adversely impact an entire established community and may be unmitigable. This option was dropped from further consideration in the Investigation.

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CHAPTER 9. LIST OF PREPARERS

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APPENDIX A

Engineering Trip Report

Dinkey Creek Reservoir

Field Trip Log			
Trip Log Number:	15	**Project No.:**	1003032.01180502
Dates:	6/13/02	**Times:**	1520-1615
Site Name:	New Dinkey Creek	**Location:**	Dinkey Creek
Prepared By:	DKR/JMH/WAM	**Reviewed By:**	
Date:	6/13/02	**Date:**	

Attendees/Visitors Name	Organization/Phone/Email
DKR	MWH, 925.685.6275 x125, david.k.rogers@mwhglobal.com
JMH	MWH, 925.685.6275 x143, james.m.herbert@mwhglobal.com
WAM	MWH, 425.602.4025 x1060, william.a.moler@mwhglobal.com

Weather Conditions:

Clear, warm (low 80s), light breeze

Access Route (attach map):

Highway 99, Shaw Av / State highway 168 (E) through north Fresno, to Shaver Lake and Dinkey Creek Rd

Attachments:	Yes	No
Photo Log	✔	
Photos	✔	
Video Log (available)	✔	
Dictation Log (available)	✔	
Topographic Map	✔	

Purpose:

Review potential location of new damsite.

Field Observations:

Existing Structures/Cultural Features:

A U.S. Forest Service Ranger Station, scattered residences, group and individual campgrounds, a historic bridge (National Register of Historic Places) were observed or reported in the area upstream of the potential new dam.

The historic bridge is a redwood truss structure that may be the only one of its kind in California. It was among the first bridges in America to utilize steel, split-ring timber-connecting devices, and it was one of the first bowstring arch truss bridges in California. The Civilian Conservation Corps assembled the bridge over Dinkey Creek in 1938, using redwood cut on the coast and fabricated into trusses in Monterey.

Right of Way/Access Restrictions:

Public and Forest Service roads lead to the new Dinkey Creek Dam and Reservoir area.

Overhead/Buried Utilities:

Overhead / underground utilities provide some service to the area.

Description of Potential Structures (attached a field sketch or sketch on a topo map):

Per URS, the potential dam at Dinkey Creek would be located in Sierra National Forest at an elevation of ~5,425 ft. The dam would be a concrete-faced rockfill embankment having a height of up to 395 feet above streambed level, that would store up to 200,000 ac-ft of water, and spillway and outlet works. Water would come from natural run-off from the ~22,000 ac watershed (URS, 2000).

An earlier IECO alternative at the same general location consisted of an ~340-ft high, 1,600-ft long, zoned rockfill dam with the spillway located n the right abutment. Full reservoir capacity was estimated at 90,000 ac-ft (IECO, 1974).

Description of Appurtenant Features (spillways, tunnels, pumping plants, flood routing/coffer dams/dewatering during construction, outlet works, switch yards, transformer yards, transmission lines, conveyance pipelines/canals, access roads, security, operation/maintenance):

The dam summarized in the IECO report would consist of a zoned rockfill embankment structure, 70-ft wide right abutment spillway with discharge bucket, two power plants, diversion dam and connecting tunnels and penstock. A 22,000-ft, 10-ft wide, horseshoe-shaped tunnel and penstock would extend from the main storage reservoir along the right side of Dinkey Creek to a 21.5-ft diameter by 263-ft high surge tank and Power Plant No. 1 (IECO, 1974).

A small (30-ft high. 5 ac-ft storage) diversion dam located downstream of Power Plat No. 1 would divert the water from tunnel No. 1, as well as the runoff from the watershed between the main reservoir and the diversion dam, into a second, 24,000-ft long, 10-ft diameter tunnel. The tunnel would direct water to a 28.5-ft diameter by 265-ft high surge tank that leads to Power Plant No. 2 via a penstock near Balch Camp on the North Fork of the Kings River (IECO, 1974).

Power Plant No. 1 would consist of a single 26,000kW unit, while Power Plant No. 2 would consist of a single 63,000 kW unit (IECO, 1974).

Briefly Describe Geologic/Geotechnical Site Conditions:

The New Dinkey Creek option would be located relatively high in the Sierra Nevada. The state geologic map shows that Mesozoic granitics with scattered small exposures of Mesozoic basic intrusive rocks and pre-Cretaceous meta-sedimentary rocks. Quaternary glacial deposits are found farther up the Dinkey Creek drainage and in surrounding areas (CDMG, 1965 and 1967).

The IECO report states that Lower Cretaceous granitics underlie a considerable area in the Dinkey Creek damsite area. Narrow basic stringers of aplite and felsic dikes intrude the bedrock locally, and scattered, small roof pedants of metasedimentary rocks are found within a mile of the site. A small thrust fault has been identified about 6 miles northeast of the site, in the Huntington Lake Quadrangle (IECO, 1974).

Dinkey Creek has cut a deep, narrow gorge that is near 150 feet deep in places. As such, the final damsite could vary over a distance of a few hundred feet. In general, the steep lower portions of both dam abutments expose fresh, very hard granite that varies from slightly fractured to massive. Higher up the canyon walls, the rock is slightly weathered and somewhat more fractured, with exfoliation and stress relief fractures becoming more evident. Bedrock is covered in a few scattered locations by

thin talus deposits and large blocks of loose rock. Some angular granitic blocks exceed 20 feet in their maximum dimension (IECO, 1974).

The creek channel is filled by Dinkey Creek. Large scattered boulders within the narrow gorge are presumably underlain by hard, competent granitic bedrock. Potholes are found locally up to 10 feet in diameter (IECO, 1974).
In the left abutment, a three-dimensional joint pattern is evident. Most fractures appear to be tight. Higher up, a small talus/slope wash filled gully traverses the center of the abutment. Downstream of the abutment, alluvium has accumulated near the confluence with Laurel Creek (IECO, 1974).

On the right abutment, there are a greater number of large, loose granitic blocks than on the left abutment. Near the downstream end of the rock mass, is a large (10' x 20' x 50') block of loose, exfoliated granite and farther on is a steep ravine containing slope wash and talus (IECO, 1974). The potential spillway is located on the right abutment. Excavation in this location will be in fresh, slightly fractures granite. Because a relatively deep cut is anticipated, rock bolting of the excavation should be anticipated (IECO, 1974).

Water in the designed reservoir would be impounded up to level near a bridge across Dinkey Creek and close to the Ranger Station. Slightly fractured bedrock, locally obscured by talus and slope wash, is exposed over much of the reservoir area. Alluvial deposits occur within Dinky Meadow Creek and downstream of its confluence with Dinkey Creek. Reservoir leakage is expected to be minimal. Large existing or potential landslides have not been identified; therefore, only minor slumps from steeper slopes are expected upon reservoir filling (IECO, 1974).

The areas traversed by tunnels and appurtenant structures downstream of Dinkey Creek are composed essentially of granitic rock. In general, it is expected that the granitic rock is relatively unweathered and only slightly fractured, and tunnel support is not expected. However, there appears to be four different granitic rock types. Contact zones between these granitic plutons may be quite fractured and tunnel support may be required in these intervals. Furthermore, some metasedimentary and basic intrusive rocks are found in the area, and as such, portions of the tunnels may penetrate these units, depending upon selection of the final alignment and support may be required. Moderate water flow should be anticipated in the more closely fractured zones. Methane and toxic gases are not expected (IECO, 1974).

As with most sites in the region, studies indicate that there are no faults in the area capable of producing ground motions greater than those generated by four known regional sources that include the San Andreas fault system, the Sierra Frontal fault system, the White Wolf fault, and the Garlock fault (USCOE, 1990).

Location/Description of Nearest Borrow Areas (attach map or show on topo map):

Construction material studies have not been conducted; however, potential borrow areas were noted. Impervious material deposits were not noted, but exploration of some relatively level meadow areas may reveal suitable materials in sufficient quantities. Pervious materials occur in alluvial deposits along Dinkey Creek about 1 mile upstream of the damsite and along Dinkey Meadow Creek. The quantity and quality of these deposits warrant investigation. Numerous potential quarry sites for riprap, rockfill, and concrete aggregate are found within the damsite vicinity (IECO, 1974).

Location/Description of Equipment/Material Staging and Lay Down Areas (attach map or show on topo map):

Potential staging and laydown areas may be found in the Dinkey Meadow area upstream of the proposed dam site.

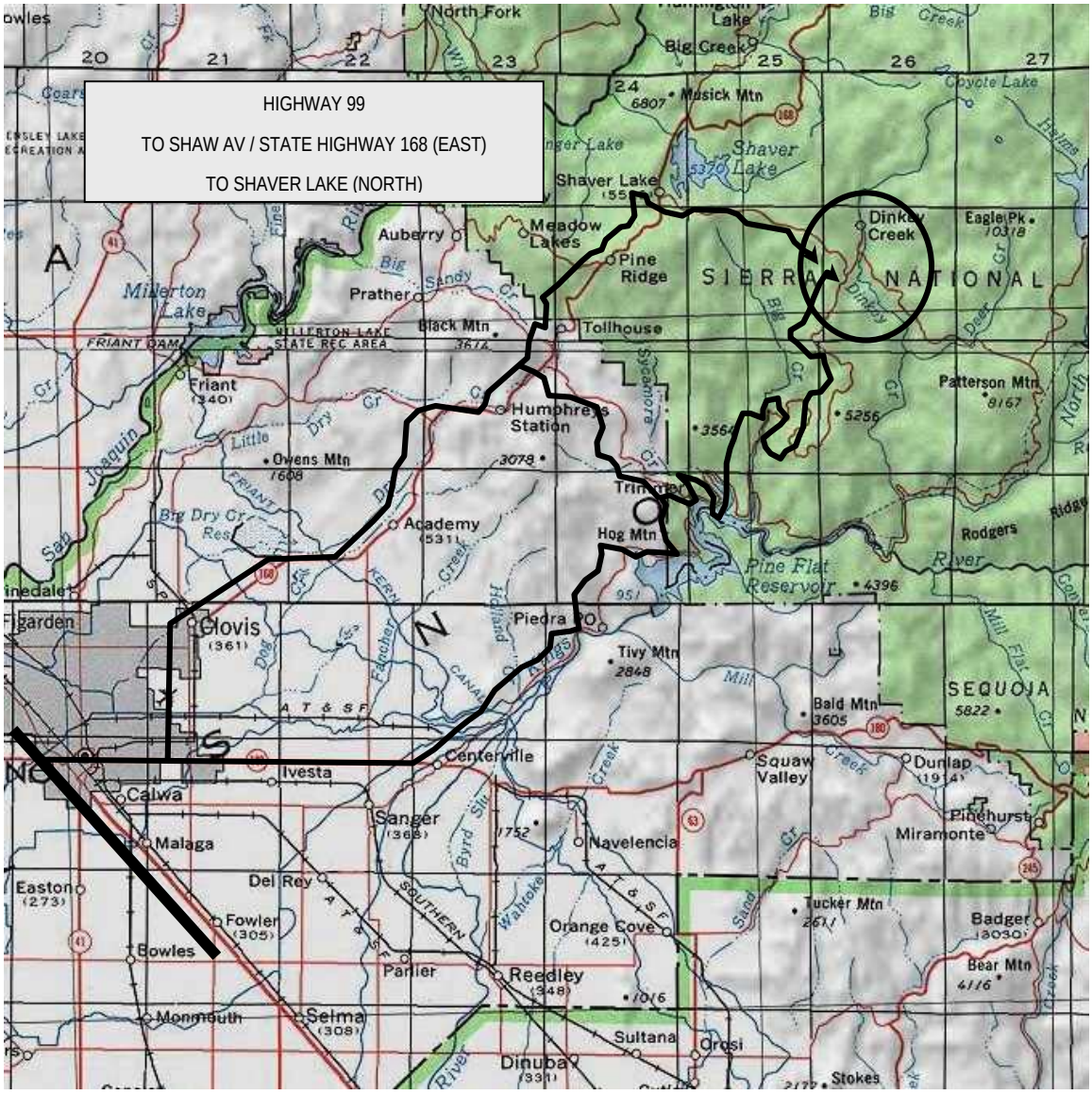
Identification of Environmental Sensitive Areas (wetlands, springs, rivers, streams, endangered/threatened species habitats, etc.):

Riparian, wetland, and aquatic habitats are found along Dinkey Creek. Pine forest habitats are found above the creek.

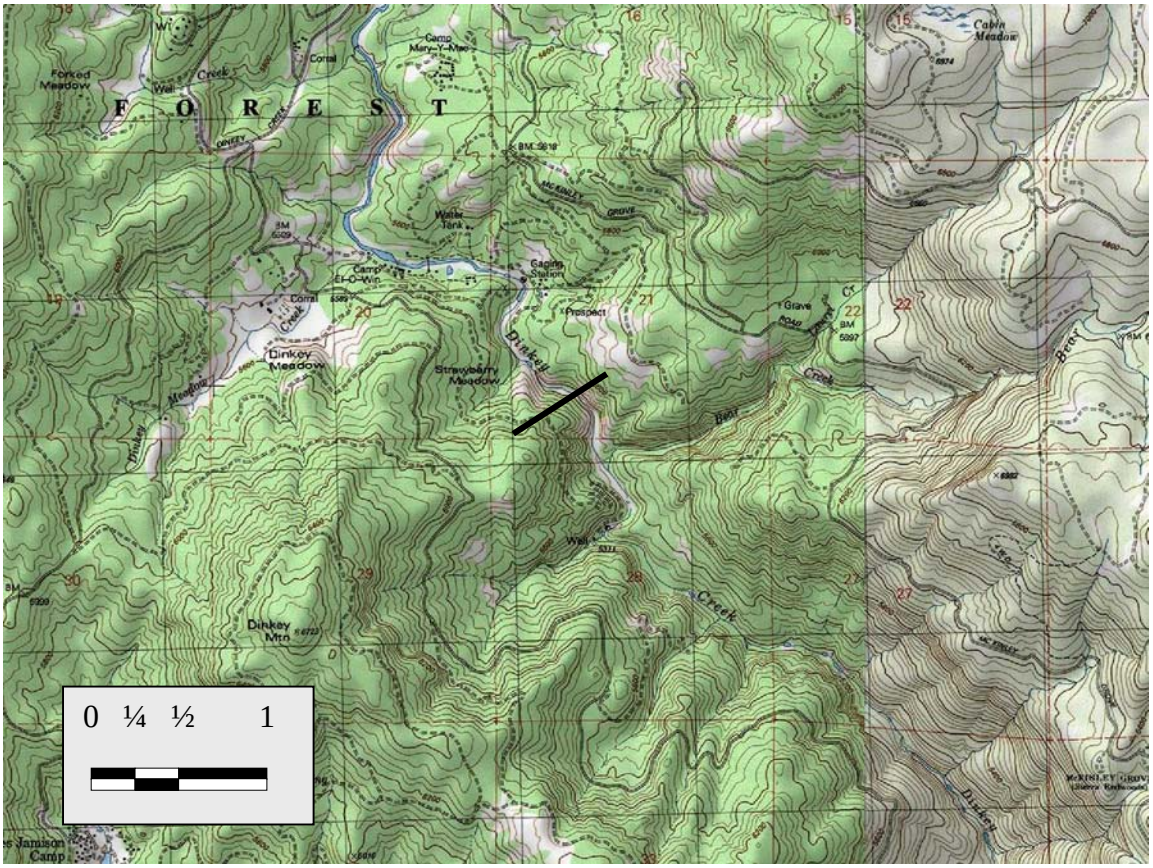
The Kings River in this area has been designated as Wild and Scenic, and is actively used by a number of river rafting enterprises. As such, this option would be extremely difficult to permit (URS, 2000).

Description of Mining or Other Anthropologic Activities:

None were noted.



VICINITY MAP



LOCATION OF POTENTIAL DAM

Dinkey Creek – Downstream view toward potential dam site.

View down into stream canyon from near right abutment of potential dam.

APPENDIX B

Environmental Trip Report

Dinkey Creek Reservoir

ENVIRONMENTAL TRIP REPORT – DINKEY CREEK RESERVOIR

A team of environmental specialists completed an initial field trip to the potential Dinkey Creek Reservoir site on May 29, 2002. The field trip was the first task in the environmental study of several potential surface storage options identified for initial review during the Upper San Joaquin River Basin Storage Investigation. For initial consideration, the environmental review focused mainly on construction and potential upstream impacts associated with surface storage sites. The site visit provided an opportunity to conduct preliminary reconnaissance of existing resources at the various locations for the following resource areas: terrestrial biology; aquatic biology and water quality; recreation; cultural resources, and land use.

This appendix includes a brief overview of the resource specialists' observations, trip logs prepared by team members, photographs taken during the field trip, and maps used to identify and review existing resources. Environmental team view of the Dinkey Creek Reserovoir site was made remotely from airplane. Observations are concomitant with this viewing limitation.

SUMMARY OF FIELD OBSERVATIONS

This option would involve constructing a new dam on Dinkey Creek, which is a tributary to the North Fork of the Kings River. The new dam site and reservoir would be situated mainly on public lands managed by the Sierra National Forest. This area is a popular recreation destination and includes numerous developed recreation facilities as described below. The area also includes a heliport, a ranger station, a sawmill, and paved and unpaved roads. The town of Dinkey Creek is located just upstream.

Botany

- This area is a rather remote and pristine western slope forest biotic community and consists of mid-elevation Sierra Nevadan mixed coniferous forest.
- Dinkey Creek is a large stream with high current flows.
- Mountain meadows, chaparral, rock outcroppings are present within the area.
- Highly varied habitats are present that would be affected.
- Possible presence of special status species.
- Would almost certainly affect wetlands and riparian habitat.

Wildlife

- This area appears to be an important area for summer deer range.

- The area is remote, there is a low level of existing human intrusion, a natural stream, and limited access.
- Loss of deer summer range and habitat fragmentation are likely with implementation of the management measure.

Aquatic Biology/Water Quality

- Much of the reach of Dinky Creek appears to be steep with bedrock-controlled channel and sparse riparian vegetation, but alluvial sections with riparian vegetation were also noted.
- Dinkey Creek is a popular trout fishing destination.
- Need information on fish species in the stream.
- Construction of a reservoir would replace a stream fishery with a lake fishery.
- Reservoir would likely affect downstream water temperatures with possible adverse effects on fisheries.
- Inundation of abandoned mines, if any are present, could result in water quality degradation.

Recreation

- The reservoir would inundate a major recreation area which includes three recreation camps, numerous (potentially hundreds) of recreation residences, campgrounds, day use areas, trails and roads which provide access to other recreation areas.
- The reservoir would also displace a variety of dispersed users such as fisherman, hikers and campers.

Cultural Resources

- This area is within the coniferous forest zone. There is a moderate probability of prehistoric archaeological sites, including hunting and fishing camps.
- Historic sites are likely, associated with mining, logging, recreation and other activities.

Land Use

- Ranchettes and other private homes are abundant in this popular recreation area.
- Private residences and roads, public lands, and timber reserves may be located in the areas of inundation.

Field Trip Log - Botany		
Trip Log Number:	S9	**Project No.** 8004094
Dates:	May 29, 2002	
Site Name:	Dinkey Creek Dam	
Location:	Dinkey Creek, tributary to the Kings River	
Prepared By:	Jeff Glazner/Barry Anderson/David Stevens	
Date:	June 3, 2002	

Weather Conditions:	Hot and dry
Areas Covered (attach map with notations	
Attachments	
Photo Log	Yes
Photos	Yes
Topographic Map(s)	No

Field Observations:

Existing Facilities:

None.

Existing Environmental Features as Appropriate to Discipline (hydrology; aquatic-water quality; terrestrial—plants; wildlife; recreation; cultural resources; land use; aesthetic)

This area is a rather remote and pristine western slope forest biotic community and consists of mid-elevation Sierra Nevadan mixed coniferous forest. Dinkey Creek is a large stream with high current flows and supports riparian habitat. Mountain meadows, chaparral, rock outcroppings are present within the area. Dominated by mixed conifer forest, with some chaparral. Rock outcrops are habitat for some southern Sierra Nevada special status species. Seeps and springs, especially around outcrops are likely.

Need for additional (engineering/hydrological, or other) information on measures

- Geology maps
- Spillway elevation
- Location of diversion structures and tunnel
- Location of power tunnels and generators
- Locations of new work pads, roads, and other construction areas
- Location of realigned existing roads
- Location of work pads, access roads, and other construction areas

Additional data needs (within each specific discipline)

- CNDDB report
- CNPS report
- Ceres report
- Field surveys for wetlands and special status species and habitats

Field Trip Log - Wildlife		
Trip Log Number:	S9	**Project No.** 8004094
Dates:	May 29, 2002	
Site Name:	Dinkey Creek Dam	
Location:	Dinkey Creek, tributary to the Kings River	
Prepared By:	Dave Stevens, Stephanie Murphy	
Date:	June 5, 2002	

Weather Conditions:	Hot and dry
Areas Covered (attach map with notations	
Attachments	
Photo Log	
Photos	
Topographic Map(s)	

Field Observations:

Existing Facilities:

Potential concrete faced rockfill dam.

Existing Environmental Features as Appropriate to Discipline (hydrology; aquatic-water quality; terrestrial—plants; wildlife; recreation; cultural resources; land use; aesthetic)

This area is a rather remote and pristine western slope forest biotic community and consists of mid-elevation Sierra Nevadan mixed coniferous forest. Dinkey Creek is a large stream with high current flows. Mountain meadows, chaparral, rock outcroppings

are present within the area. This area was viewed from the air and appears to be an important area for summer deer range. There are several constraints with this area, it is remote, low level of existing human intrusion, natural stream, limited access, loss of deer summer range, and habitat fragmentation.

Need for additional (engineering/hydrological, or other) information on measures

- Hydrologic models, dam, inundation zones
- Potential features in addition to dam, size and location, etc.

Additional data needs (within each specific discipline)

a. Need to coordinate with resource agency biologists and agency files on known distribution of sensitive species for this area.
b. Further studies and field visits will be necessary to determine the extent of wildlife impacts that may occur due to this alternative.

Field Trip Log – Fish and Water Quality		
Trip Log Number:	S9	**Project No.** 8004094
Dates:	May 29, 2002	
Site Name:	Dinkey Creek Dam	
Location:	Dinkey Creek, tributary to the Kings River	
Prepared By:	Philip Unger	
Date:	June 10, 2002	

Weather Conditions:	Hot and dry
Areas Covered (attach map with notations	Dinkey Creek and vicinity
Attachments	
Photo Log	No
Photos	No
Topographic Map(s)	Yes

Field Observations:

Existing Facilities:

Dinkey Creek is a tributary to the North Fork of the Kings River. The new dam site and reservoir would be situated mainly on public lands managed by the Sierra National Forest.

Existing Environmental Features as Appropriate to Discipline (hydrology; aquatic-water quality; terrestrial—plants; wildlife; recreation; cultural resources; land use; aesthetic)

Much of the site area reach of Dinky Creek appears to be steep with a bedrock controlled channel and sparse riparian vegetation. However, alluvial sections with riparian vegetation were also noted. Dinkey Creek is a popular trout fishing destination.

Need for additional (engineering/hydrological, or other) information on measures

Need information on range of seasonal flow conditions in Dinkey Creek.
Need information on exact area that would be submerged by a dam on Dinkey Creek.
Need the following estimates for potential reservoir:

- Mean depth for each month, April – October.
- Mean surface area of shallow water habitat (less than 15 feet deep) in each month, April – October.
- Mean rate of water level fluctuation for each month, April – October.

Additional data needs (within each specific discipline)

Need information on summer water temperatures in Dinkey Creek and list of fish species likely to be present in the creek. Also, any existing water quality information and information on the location and types of active and abandoned mines in the inundation zone of the potential reservoir.

Field Trip Log - Recreation		
Trip Log Number:	S9	**Project No.** 8004094
Dates:	May 29, 2002	
Site Name:	Dinkey Creek Dam	
Location:	Dinkey Creek, tributary to the Kings River	
Prepared By:	Sandra Perry	
Date:	June 3, 2002	

Weather Conditions:	Hot and dry
Areas Covered (attach map with notations	Dinkey Creek and vicinity
Attachments	
Photo Log	No
Photos	No
Topographic Map(s)	Yes

Field Observations:

Existing Facilities:

This option would involve constructing a new dam on Dinkey Creek, which is a tributary to the North Fork of the Kings River. The new dam site and reservoir would be situated mainly on public lands managed by the Sierra National Forest. This area is a popular recreation destination and includes numerous developed recreation facilities as described below. The area also includes a heliport, a ranger station, a sawmill, and paved and unpaved roads. The town of Dinkey Creek is located just upstream.

Existing Environmental Features as Appropriate to Discipline (hydrology; aquatic-water quality; terrestrial—plants; wildlife; recreation; cultural resources; land use; aesthetic)

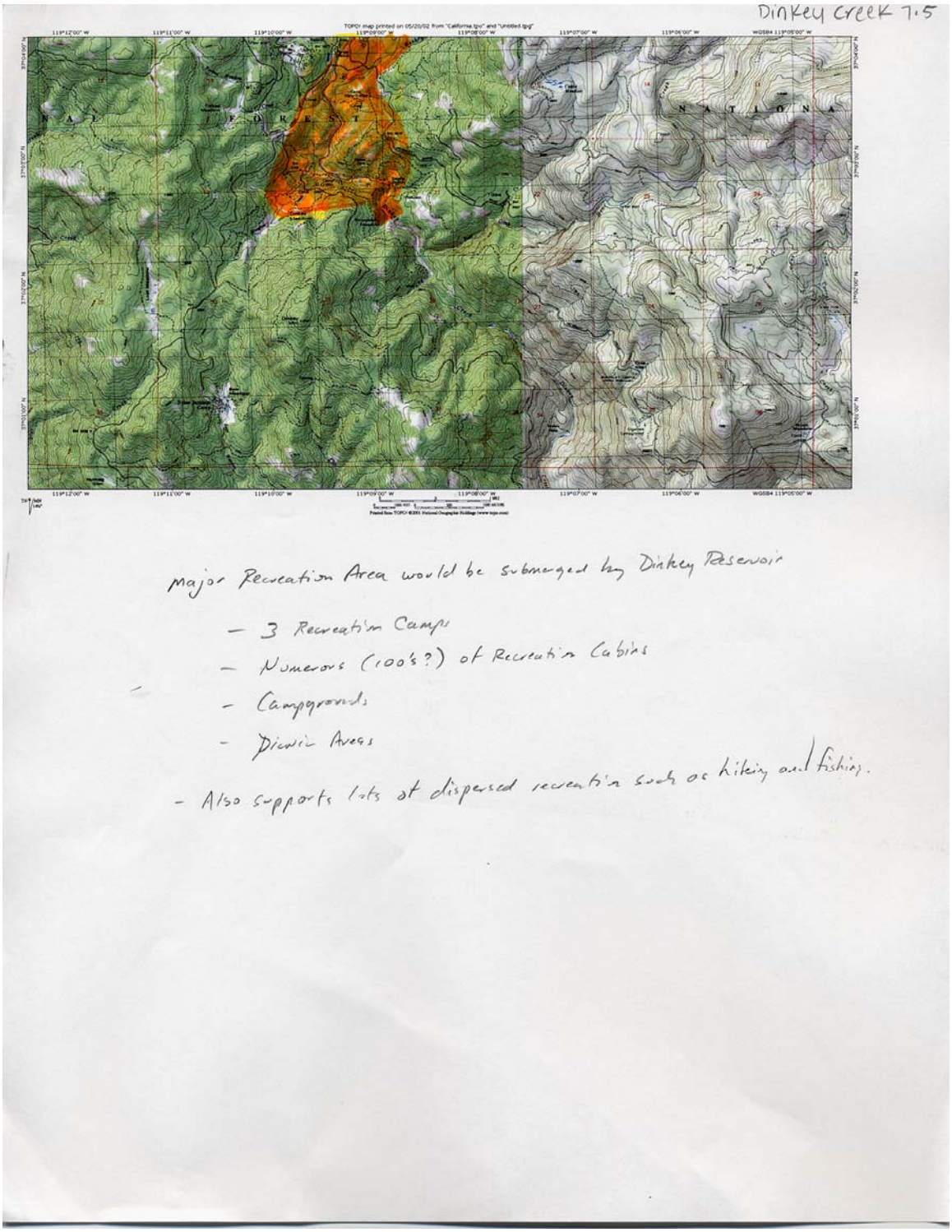
This area is a major recreation destination and includes numerous developed recreation facilities including three recreation camps (Camp Fresno, Camp Mary-Y-Mac, Camp El-O-Win), numerous recreation residences, developed campgrounds and picnic areas, and trails and trailheads. The area provides a variety of recreation opportunities including, hiking, picnicking, horseback riding, and camping. Dinkey Creek is a popular fishing destination.

Need for additional (engineering/hydrological, or other) information on measures

Need information on exact area that would be submerged by a dam on Dinkey Creek.
Need information on how Dinkey Reservoir would be operated.

Additional data needs (within each specific discipline)

Need information on the recreation residences in the area including the number of residences, type of residence (eg. Forest Service lease or private), season of use and use estimates.
Need information on the three recreation camps in the area, including estimates on annual visitation and season of use.
Need information on the developed campgrounds and picnic areas in the area, including use estimates and season of use.
Need to describe how the area is used for dispersed recreation and estimate use by activity along Dinkey Creek and surrounding area.
Need to determine status of potential nearby Wilderness Area (Marble Point)
Need to determine how roads in the area are used to access other recreation areas in the Forest


Dinkey Creek 7.5
NATIONA
Major Recreation Area would be submerged by Dinkey Reservoir
- 3 Recreation Camps
- Numerous (100's?) of Recreation Cabins
- Campgrounds
- Picnic Areas
- Also supports lots of dispersed recreation such as hiking and fishing.

Field Trip Log – Land Use		
Trip Log Number:	S9	**Project No.** 8004094
Dates:	May 29, 2002	
Site Name:	Dinkey Creek Dam	
Location:	Dinkey Creek, tributary to the Kings River	
Prepared By:	Irina Torrey	
Date:	June 12, 2002	

Weather Conditions:	Hot and dry
Areas Covered (attach map with notations	Dinkey Creek and vicinity
Attachments	
Photo Log	Yes
Photos	Yes
Topographic Map(s)	No

Field Observations:

Existing Facilities:

This option would involve constructing a new dam on Dinkey Creek, which is a tributary to the North Fork of the Kings River. The new dam site and reservoir would be situated mainly on public lands managed by the Sierra National Forest. This area is a popular recreation destination and includes numerous developed recreation facilities as described below. The area also includes a heliport, a ranger station, a sawmill, and paved and unpaved roads. The town of Dinkey Creek is located upstream.

Existing Environmental Features as Appropriate to Discipline (hydrology; aquatic-water quality; terrestrial—plants; wildlife; recreation; cultural resources; land use; aesthetic)

This area is a major recreation destination and includes numerous recreation residences (ranchettes). Private residences and roads may be located in areas of inundation.

Need for additional (engineering/hydrological, or other) information on measures

Need information on exact area that would be submerged by a dam on Dinkey Creek.

Additional data needs (within each specific discipline)

Need information on residences in the area including the number of residences, type of residence (eg., Forest Service lease or private), season of use and use estimates.
Need to determine how roads in the area are used and how they would be affected by development of the reservoir.

Field Trip Log – Cultural Resources		
Trip Log Number:	S9	**Project No.** 8004094
Dates:	May 29, 2002	
Site Name:	Dinkey Creek Dam	
Location:	Dinkey Creek, tributary to the Kings River	
Prepared By:	David White	
Date:	May 29 2002	

Weather Conditions:	Hot & dry
Areas Covered (attach map with notations)	Aerial reconnaissance May 29.
Attachments	
Photo Log	Yes – MWH 0205
Photos	Yes – nos. 23-25
Topographic Map(s)	Dinkey Creek quad

Field Observations:

Existing Facilities:

No existing dam; there are recreational facilities in Dinkey Creek drainage.

Existing Environmental Features as Appropriate to Discipline (hydrology; aquatic-water quality; terrestrial—plants; wildlife; recreation; cultural resources; land use; aesthetic)

Cultural resources:
Prehistoric: coniferous forest zone. Moderate probability of prehistoric archaeological sites including hunting & fishing camps.
Historic: Various sites likely, associated with mining, logging, recreation and other activities.

Need for additional (engineering/hydrological, or other) information on measures

Need precisely mapped footprint of reservoir, with various potential dam levels; also need footprint of all associated ground disturbance areas, to include but not be limited to offices and maintenance buildings, construction set-up and lay-down areas, access roads, electric transmission lines, water conveyance structures, and all other facilities.

Additional data needs (within each specific discipline)

Need archaeological records search with California Historic Resources Inventory System (CHRIS) information center. Clearinghouse: Southern San Joaquin Valley Info Center, CSU-Bakersfield.
Need consultation with USFS cultural resource specialists (Sierra National Forest) regarding sites that may not be recorded with the CHRIS information center.
Also need brief review of archaeological and ethnographic literature pertaining to the area. Minimal level of effort: (1) to identify types of archaeological remains expected, time periods represented; and (2) to identify Native American tribes historically occupying the area, along with published information on major named villages or other ethnographic sites.

Picture: P5290034 Dinkey Creek area, May 29, 2002, afternoon

Picture: P5290035 Dinkey Creek area, May 29, 2002, afternoon

Picture: P5290036 Dinkey Creek area, May 29, 2002, afternoon

Confluence of Dinkey Creek (upper left corner of photo) and North Fork Kings River AND confluence mainstem Kings River (left to right in photo) and North Fork Kings River

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APPENDIX C

Cost Estimate Summary

Dinkey Creek Dam and Reservoir

Upper San Joaquin River Basin Storage Investigation

Cost Estimate

Dinkey Creek Dam and Reservoir			
	Hydropower Option		
	340' Rock Fill Dam (max gross pool el. 5686)		
	diversion dam, ~4 mi. tunnels, 2 power plants		
FIRST COST ITEMS			**Cost (2002 dollars)**
DAMS	Diversion Dam	$	1,500,000
	Diversion Works/Tunnel	$	-
	Main Dam	$	68,425,000
	Spillway	$	2,250,000
	Outlet Works	$	-
SUBTOTAL		**$**	**72,175,000**
CONVEYANCE FACILITIES			
	Power intake, tunnels & penstocks	$	155,475,000
	Diversion Tunnel	$	-
	Tunnel	$	-
	Canals/Pipelines	$	-
	Pumping Stations	$	-
	Regulating Reservoirs	$	-
SUBTOTAL		**$**	**155,475,000**
PERMANENT OPERATING EQUIPMENT			
	Powerplants, generators & turbines	$	11,500,000
	Transmission Lines, switchyards, & substns.	$	4,150,000
SUBTOTAL		**$**	**15,650,000**
TOTAL, LISTED ITEMS (rounded)		**$**	**243,300,000**
UNLISTED ITEMS (15%; rounded)		**$**	**36,500,000**
TOTAL, CONSTRUCTION ITEMS (rounded)		**$**	**280,000,000**
CONTINGENCIES ON CONSTRUCTION (25%; rounded)		**$**	**70,000,000**
TOTAL, CONSTRUCTION COST		**$**	**350,000,000**
MITIGATION (5%; rounded)		**$**	**18,000,000**
TOTAL FIELD COSTS		**$**	**368,000,000**
INVESTIGATION, DESIGN, & CONSTRUCTION MNGMT (15%; round		**$**	**55,000,000**
TOTAL FIRST COST		**$**	**423,000,000**

Upper San Joaquin River Basin Storage Investigation

Cost Estimate

Dinkey Creek Dam and Reservoir		
Storage Only Option (No Hydropower) 340' Rock Fill Dam (max gross pool el. 5686)		
FIRST COST ITEMS		**Cost (2002 dollars)**
DAMS	Diversion Dam	$ -
	Diversion Works/Tunnel	$ -
	Main Dam	$ 68,425,000
	Spillway	$ 2,250,000
	Outlet Works	$ -
SUBTOTAL		**$ 70,675,000**
CONVEYANCE FACILITIES		
	Power intake, tunnels & penstocks	$ -
	Diversion Tunnel	$ -
	Tunnel	$ -
	Canals/Pipelines	$ -
	Pumping Stations	$ -
	Regulating Reservoirs	$ -
SUBTOTAL		**$ -**
PERMANENT OPERATING EQUIPMENT		
	Powerplants, generators & turbines	$ -
	Transmission Lines, switchyards, & substns.	$ -
SUBTOTAL		**$ -**
TOTAL, LISTED ITEMS (rounded)		**$ 70,700,000**
UNLISTED ITEMS (15%; rounded)		**$ 10,600,000**
TOTAL, CONSTRUCTION ITEMS (rounded)		**$ 81,000,000**
CONTINGENCIES ON CONSTRUCTION (25%; rounded)		**$ 20,000,000**
TOTAL, CONSTRUCTION COST		**$ 101,000,000**
MITIGATION (5%; rounded)		**$ 5,000,000**
TOTAL FIELD COSTS		**$ 106,000,000**
INVESTIGATION, DESIGN, & CONSTRUCTION MNGMT (15%; round		**$ 16,000,000**
TOTAL FIRST COST		**$ 122,000,000**