



DESIGN MEMORANDUM NO. 2

OCTOBER 1981

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MERCED COUNTY STREAMS  
CALIFORNIA

GENERAL DESIGN  
MEMORANDUM

PHASE II

PROJECT DESIGN

DEPARTMENT OF THE ARMY  
SACRAMENTO DISTRICT, CORPS OF ENGINEERS  
SACRAMENTO, CALIFORNIA

MERCED COUNTY STREAMS,  
CALIFORNIA

GENERAL DESIGN MEMORANDUM

PHASE II

PROJECT DESIGN

U.S. ARMY CORPS OF ENGINEERS  
SACRAMENTO DISTRICT  
SACRAMENTO, CALIFORNIA



DEPARTMENT OF THE ARMY  
SACRAMENTO DISTRICT, CORPS OF ENGINEERS  
650 CAPITOL MALL  
SACRAMENTO, CALIFORNIA 95814

REPLY TO  
ATTENTION OF  
SPKED-D

29 March 1982

SUBJECT: Merced County Streams, California - Revisions to Final Design  
Memorandum No. 2, Phase II GDM

Commander, South Pacific Division

1. References:

- a. SPKED-D Letter dated 20 October 1981, Subject: "Merced County Streams, California - Design Memorandum No. 2, Phase II GDM".
- b. SPDED-TC (20 Oct 81) 1st Ind dated 19 Jan 1982, Subject: "Merced County Streams, California - Design Memorandum No. 2, Phase II GDM".
- c. SPKED-D (20 Oct 81) 2d Ind dated 3 March 1982, Subject: "Merced County Streams, California - Design Memorandum No. 2 Phase II GDM".
- d. DAEN-CWP-W Letter dated 3 February 1982, Subject: "Merced County Streams, California".
- e. SPDPD-S (3 Feb 82) 1st Ind dated 12 Feb 1982, Subject: "Merced County Streams, California".

2. The final Phase II General Design Memorandum (GDM), transmitted by reference 1.a., has been revised in accordance with comments and responses presented in references 1.b. and 1.c. Twenty (20) copies of the revised pages and plates are inclosed for insertion into the previously submitted copies of the subject GDM.

3. Inclosed revisions also comply with the requirements of references 1.d. and 1.e., and include a summary of the complete results of the intensive cultural resources survey. Formal coordination with the State Historic Preservation Office (SHPO) and other appropriate agencies has been completed.

4. Recommend approval of the final Phase II GDM, including revised pages and plates.

1 Incl (20 cys)  
as

  
PAUL F. KAVANAUGH  
Colonel, CE  
Commanding

MERCED COUNTY STREAMS, CALIFORNIA  
GDM PHASE II-PROJECT DESIGN

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DESIGN MEMORANDUM NO. 2  
MERCED COUNTY STREAMS

PERTINENT DATA

General

Name	Merced County Streams, California
Streams	Bear Creek Burns Creek Black Rascal Creek Canal Creek Black Rascal Slough Fahrens Creek Cottonwood Creek El Capitan Canal
Counties and State	Merced and Mariposa; California
Purpose	Flood control and minor recreation.

* Cost (Oct 81 Price Level)	<u>Burns Incl.</u>	<u>Burns Deferred</u>
Federal first cost	\$74,400,000	\$65,100,000
Non-Federal first cost	\$18,100,000	\$18,100,000
Total project first cost	\$92,500,000	\$83,200,000
Total annual cost	\$ 7,590,000	\$ 6,830,000

Benefits - annual (Oct 81 Price Level)		
Flood control	\$ 7,762,000	\$ 7,204,000
Recreation	\$ 228,000	\$ 228,000
Employment	\$ 657,000	\$ 589,000
Total	\$ 8,647,000	\$ 8,021,000

Benefit/cost ratio	1.1 to 1.0	1.2 to 1.0	*
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Drainage areas

Bear Reservoir	72.1 sq.mi.
Burns Reservoir	72.2 sq.mi.
Haystack Reservoir	18.3 sq.mi.
Castle Reservoir	28.2 sq.mi.
Lower Bear Cr. Channel	254.0 sq.mi.
Bear Creek above W. 16th St.	204.0 sq.mi.
Fahrens Creek and tributaries	40.4 sq.mi.

Castle Reservoir

DAM

Type - Impervious core with transition zones and random fill  
upstream and downstream

Top of dam elevation	220.0 feet
Freeboard above spillway flood pool	5.0 feet
Maximum height (bottom of core trench to crest)	52.5 feet
Side slopes	
Upstream	1V on 3.25 H
Downstream	1V on 2.5 H

#### SPILLWAY

Type - concrete, low ogee perched spillway	
Spillway crest elevation	211.5 feet
Spillway crest width	180.0 feet
Maximum spillway discharge	3,900 cfs
Spillway Design Flood pool	215.0 feet

#### OUTLET WORKS

Type - ungated riser intake with irrigation flow intake, cut and cover conduit, conventional stilling basin

##### Riser -

Height	28.5 feet
Crest Elevation	210.0 feet
Crest Length	16.25 feet
Width	7.25 feet
2.33' W x 2.33'H Port at invert elevation	186.0 feet
3.1' W x 3.1'H Port at invert elevation	195.0 feet
7.25' W x 9.5'H irrigation intake (and bulkhead) at invert elevation	183.0 feet

##### Conduit

Diameter	7.25 feet
Invert elevation	183.0 feet
Slope	0.01

\*

Stilling basin	171.6 feet	
Apron elevation	14.0 feet	
Width	14.0 feet	
Length	48.0 feet	
Stilling basin design discharge at TD/d <sub>2</sub> ratio of .85, min. losses		1,500 cfs
Maximum allowable design parameters		
Conduit (and irrigation intake) open channel flow		500 cfs
Maximum combined port discharge during 50-year flood		300 cfs
Maximum combined port and riser crest discharge during SPF flood		500 cfs *

#### FLOWS

Mean annual at damsite	5 cfs
50-year maximum inflow	2,700 cfs
50-year maximum outflow	290 cfs

* SPF maximum inflow	4,100 cfs	
SPF maximum outflow	490 cfs	*
SDF maximum inflow (SDF = PMF)	9,050 cfs	
SDF maximum outflow (SDF = PMP)	5,300 cfs	

#### STORAGE

* 50-year flood pool elevation	206.5 feet	4,100 AF *
SPF flood pool elevation	210.8 feet	6,400 AF
SDF flood pool elevation	215.0 feet	10,400 AF

#### Haystack Reservoir

##### DAM

Type - Homogeneous fill with interior filter zones to control seepage.

Top of dam elevation	313.0 feet
Freeboard above spillway flood pool	5.0 feet
Maximum height (bottom of core trench to crest)	78.0 feet
Side slopes	
Upstream	1V on 3.0 H
Downstream	1V on 2.5 H

##### SPILLWAY

Type - concrete, low ogee perched spillway

Spillway crest elevation	304.0 feet
Spillway crest width	200.0 feet
Maximum spillway discharge	4,600 cfs
Spillway Design Flood pool	308.0 feet

##### OUTLET WORKS

Type - ungated riser intake, cut and cover conduit, conventional stilling basin

##### Riser -

Height	37.5 feet
Crest elevation	296.5 feet
Crest length	13.5 feet
Width	5.75 feet
3.9' W x 1.0' h Port at invert elevation	265.0 feet

##### Conduit -

Diameter	5.75 feet
Invert elevation	259.0 feet
Slope	.0039

##### Stilling Basin -

Apron elevation	252.2 feet
Width	17.75 feet
Length	37.0 feet

Stilling basin design discharge at TW/d<sub>2</sub> ratio of .85, min. losses

1,150 cfs \*

*	Maximum allowable design parameters -		
	Maximum port discharge during 50-year flood		100 cfs
	Maximum combined port and riser crest discharge during SPF		1,000 cfs *

#### FLOWS

Mean annual at damsite	3 cfs
50-year maximum inflow	2,200 cfs
50-year maximum outflow	115 cfs
SPF maximum inflow	3,400 cfs
SPF maximum outflow	960 cfs
SDF maximum inflow	12,200 cfs
SDF maximum outflow	5,640 cfs

#### STORAGE

*	50-year flood pool elevation	296.5 feet	3,500 AF	*
	SPF flood pool elevation	301.4 feet	5,300 AF	
	SDF flood pool elevation	308.0 feet	8,800 AF	

#### Burns Reservoir

##### DAM

Type - Extension and expansion of existing impervious earthfill dam by use of random fill	
Top of dam elevation	328.5 feet
Freeboard above spillway flood pool	3.2 feet
Maximum height (bottom of core trench to crest)	78.0 feet
Side slopes -	
Upstream	1V on 3H
Downstream	1V on 3H

##### SPILLWAY

Type - concrete, log ogee perched spillway	
Spillway crest elevation	322.0 feet
Spillway crest width	925.0 feet
Maximum spillway discharge	22,000 cfs
Spillway Design Flood pool	325.3 feet

##### OUTLET WORKS

Type - ungated riser intake, existing cut and cover conduit, and existing stilling basin

Riser -	
Height	49.8 feet
Crest elevation	316.0 feet
Crest length	12.5 feet

Width	10.5 feet	
3.0' W x 3.75' H port at invert elevation	270.0 feet	
Conduit -		
Double-box existing conduit	4.75' W x 6.0' H per box	
Invert elevation	266.2 feet	
Slope	.00369	
Stilling basin - existing		
Apron elevation	258.0 feet	
Width	20.0 feet	
Length	44.0 feet	
* Maximum allowable design parameters -		*
Maximum port discharge during 50-year flood		350 cfs
Maximum combined port and riser crest discharge during SPF		1,820 cfs

#### FLOWS

Mean annual at damsite	18 cfs
50-year maximum inflow	9,900 cfs
50-year maximum outflow	350 cfs
SPF maximum inflow	15,000 cfs
SPF maximum outflow	1,820 cfs
SDF maximum inflow	29,000 cfs
SDF maximum outflow	24,300 cfs

#### STORAGE

* 50-year flood pool elevation	313.5 feet	20,400 AF *
SPF flood pool elevation	322.0 feet	34,700 AF
SDF flood pool elevation	325.3 feet	42,000 AF

#### Bear Reservoir

#### DAM

Type - Extension and expansion of existing dam by use of random fill	
Top of dam elevation	481.5 feet
Freeboard above spillway flood pool	3.0 feet
Maximum height (bottom of core trench to crest)	150.0 feet
Side Slopes -	
Upstream	1V on 2H
Downstream	1V on 2H

#### SPILLWAY

Type - Ungated side channel spillway with stilling basin	
Spillway crest elevation	466.5 feet
Spillway crest width	200.0 feet
Maximum Spillway discharge	31,600 cfs
Spillway Design Flood pool	478.5 feet

Stilling Basin -	
Width	45.0 feet
Length	170.0 feet
Apron elevation	343.7 cfs
Design discharge for TW/d <sub>2</sub> ratio of .85	31,600 cfs

OUTLET WORKS

Type - Existing cut and cover conduit with upstream and downstream extension and conventional stilling basin

Conduit -

Diameter	7.0 feet
Invert elevation	344.4 feet
Slope	.003205

Stilling Basin -

Apron elevation	330.0 feet
Width	17.87 feet
Length	41.0 feet

\* Stilling basin design discharge at TW/d<sub>2</sub> ratio of .85, min. losses 1,000 cfs

Maximum allowable design parameters - \*

Maximum releases below spillway crest elevation 1,000 cfs

Discharge is restricted at intake by a fixed position steel gate leaf with an opening 7.0' x x 2.2' h

FLOWS

Mean annual at damsite	26 cfs	
50-year maximum inflow	12,500 cfs	
* 50-year maximum outflow	900 cfs	*
SPF maximum inflow	19,000 cfs	
* SPF maximum outflow	4,400 cfs	*
SDF maximum inflow	38,800 cfs	
SDF maximum outflow	32,600 cfs	

STORAGE

* 50-year flood pool elevation	448.5	20,000 AF	*
SPF flood pool elevation	469.53	32,500 AF	
SDF flood pool elevation	478.5	38,500 AF	

LEVEE AND CHANNEL MODIFICATION

	: Drainage Channel	: Bear Creek Bypass	: Bear Creek	: Black Rascal Sl.	: Bear Creek
	: E.S. Bypass to	: E.S. Canal to	: Diversion Structure	: Above	: Above
	: E.S. Canal	: Diversion Structure	: to Crocker Dam	: Crocker Dam	: Crocker Dam
Length (miles)	3.4	4.0	9.6	7.4	0.8
Levee improvements					
Length (stream miles)	3.4	4.0	2.7	7.4	0.6
Avg. height of levees (feet)	9	8	6	2	2
Crown width of levees (feet)	12	12	12	12	12
Landside slope	1V on 2H	1V on 2H	1V on 2H	1V on 2H	1V on 2H
Waterside slope	1V on 3H	1V on 3H	1V on 3H	1V on 3H	1V on 3H
Riprap length (feet)	150	-	600	2,400	-
Road resurfacing on existing levees					
Length (stream miles)	-	-	7.0	-	-
New Channel excavation					
Length (stream miles)	3.4	4.0	2.7	7.4	0.8
Avg. bottom width (feet)	185	145	100	80	270
Avg. depth (feet)	4	5	8	11	11
Project design flows (cfs)					
	9,000	6,500	2,000	4,500	7,000

\*

\*

LEVEE AND CHANNEL MODIFICATION

STREAM	Fahrens Creek	Fahrens Creek	Black Rascal Creek	Cottonwood Creek	El Capitan Canal
REACH	Bear Creek to Cottonwood Creek	Above Cottonwood Creek	to G. Street		
Length (miles)	3.2	0.9	1.7	1.5	0.9
Levee improvements					
Length (stream miles)	3.2	0.9	1.5	1.5	0.9
Avg. height of levees (feet)	7	6	4	4	6
Width of levees (feet)	12	12	12	12	12
Landside slope	1V on 2H	1V on 2H	1V on 2H	1V on 2H	1V on 2H
Waterside slope	1V on 3H	1V on 3H	1V on 3H	1V on 3H	1V on 3H
Riprap length (feet)	2,300	-	150	-	-
New Channel excavation					
Length (stream miles)	2.0 <u>1/</u>	0.9	1.7 <u>2/</u>	0.8	-
Avg. bottom width (feet)	105	75	40	40	-
Avg. depth (feet)	8	7	8	8	-
Project design flows (cfs)	7,000	6,300	1,800	1,900	negligible

1/ Includes 0.1 miles of concrete lined channel

2/ Includes 0.3 miles of concrete lined channel

RELOCATIONS AND MODIFICATIONS

Item	Castle Reservoir	Haystack Mt. Reservoir	Burns Reservoir	Bear Reservoir	Fahrens & Tributaries	Bear Creek	Drain Channel
State highway bridges replaced	-	-	-	-	1	-	-
Local road bridges replaced	-	-	-	-	9	3	-
New local road bridges	-	-	-	-	-	-	-
New private road bridge	-	-	-	-	-	1	1
Private road bridges modified	-	-	-	-	1	-	-
Railway bridges replaced	-	-	-	-	3	-	-
Abandoned railway bridge removed	-	-	-	-	1	-	-
Residential homes	2	-	-	-	-	-	-
Barns & associated structures	-	1	1	1	-	-	-
Powerline (mi)	0.5	-	0.6	-	0.8	0.8	-
Telephone lines (mi)	-	-	-	-	0.9	0.6	-
Television cable (ft)	-	-	-	-	400	350	-
R.R. Tel & Tel Signal Line (ft)	-	-	-	-	500	-	-
Waterlines (mi)	-	-	-	-	.5	-	-
Sewerlines (mi)	-	-	-	-	.4	-	-
Gaslines (mi)	-	-	-	-	.5	-	-
Irrigation lines and canals (mi)	-	-	-	-	1.2	8.3	-
Fencing (mi)	-	-	-	-	11.4	39.4	-
Roads (mi)	0.3	-	1.5	-	-	-	-
Storm Drain (mi)	-	-	-	-	0.9	-	-
30" x 30" Concrete drain strgs (ea)	-	-	-	-	4	14	-
Concrete spillways (ea)	-	-	-	-	-	9	-
Drag gates (Barbed wire) (ea)	-	-	-	-	-	74	-
Wire mesh gates (ea)	-	-	-	-	42	59	2
42" Irrigation siphons (ea)	-	-	-	-	2	-	-
Inverted siphons (ea)	-	-	-	-	-	6	1
Drainage pump modification (Job)	-	-	-	-	1	-	-
Relocate pump structure (Job)	-	-	-	-	-	1	-
New Drainage Pumping Stations	-	-	-	-	2	-	-

4x

## RECREATION FACILITIES

### Biketrails

10-foot-wide blacktop bikeway	6 mi
Location - on top of the levees along those sections of Black Rascal and Fahrens Creeks north of State Highway 99.	
Staging areas	
Quantity	2
Location - one at each end of Fahrens Creek.	
Facilities	
Graveled parking area for 10 cars	
4 picnic tables	
Potable water supply	
Chemical restrooms	
Access ramps	
Quantity	3
Location - strategic locations along the levee	
Bridge - would link the Fahrens and Black Rascal portions of the trail	
Activity mix	
·Bicycling	60%
Pedestrian activities	35%
Equestrian activities	5%

## FISH AND WILDLIFE PROJECT IMPACTS

Unavoidable detrimental impact	
Cultivated agriculture removed	316 acres
Grassland removed	905 acres
Riparian habitat removed	45 acres
Marshland	25 acres
Beneficial impacts	
Habitat preserved	
Freshwater marshland	2800 acres
Grassland	111 acres
Riparian	14 acres
Habitat created	
Freshwater marshland	25 acres
Riparian	45 acres

MERCED COUNTY STREAMS  
CALIFORNIA

DESIGN MEMORANDUMS

Date	D. M. No.	Title	Date of Approval
Mar 75	1.	Hydrology DM	11 Sep 75
* Mar 80	2.	Phase I GDM/EIS	3 Feb 82
Sep 81	4.	Real Estate DM - Castle and Bear Dams and Reservoirs	Submitted
Oct 81	2.	Phase II GDM	Submitted
Nov 81	5.	Feature DM - Castle Dam and Reservoir	Submitted
Jan 82	6.	Site Geology DM - Castle Dam and Reservoir	Submitted
Nov 81	3.	Concrete Materials DM	Submitted
	7.	Feature DM - Bear Dam and Reservoir	
	8.	Site Geology DM - Bear Dam and Reservoir	
	4A.	Real Estate DM - Haystack Mountain and Burns Dams and Reservoirs	
	9.	Feature DM - Haystack Mountain Dam and Reservoir	
	10.	Site Geology DM - Haystack Mountain Dam and Reservoir	
*	11.	Feature DM - Channel Improvements	*

DESIGN MEMORANDUM NO. 2  
 MERCED COUNTY STREAMS PROJECT  
 MERCED, CALIFORNIA  
 GENERAL DESIGN MEMORANDUM--PHASE II  
 PROJECT DESIGN

October 1981

REVISIONS

Date	New pages or drawings
Mar 1982	Revised Pages i, iv, v, vi, vii, viii, ix, x, xi, xii, xiii, 1, 2, 3, 4, 23, 26, 29, 31, 33-46, 48-51, 65, 78-84, 96, 99, 100, 105-107, 110-113, 117, 118, 120, 122, 124, 125, 129, 134, 135, 138, 142, 143, 147, 150, 152, 169-173, 180-183, 195, 196, 199-204, 207, 209, 214-217, 219, 221, and 222-225
Mar 1982	Added Pages 3a, 46a-46f, 219a, 225a
Mar 1982	Revised Plates XXVI, XXVIII, XXIX, XXX, XXXI (Sheets 2, 3, 5, 6, 7), XXXIII, XXXVI, XXXIX, XLI, and XLII
Mar 1982	Added Plate XXXa
Mar 1982	Added Appendix B
Sep 1982	Revised Pages v, 4, 5, 27, 28, 46e, 76, 78, 79, 220, 221, and 222
Sep 1982	Added Page 221a
Sep 1982	Revised Plates III, VI, VII, IX, X, XI, XXVI, XXVIII, XXIX, XXX, and XXXa