

**Sacramento River Flood Control System Evaluation
Initial Appraisal Report - Lower Sacramento Area**

Attachment D

Economic Evaluation

October 1993

ECONOMIC EVALUATION
SACRAMENTO RIVER FLOOD CONTROL SYSTEM EVALUATION
INITIAL APPRAISAL REPORT

LOWER SACRAMENTO AREA, PHASE IV

September 1993

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**SACRAMENTO RIVER FLOOD CONTROL SYSTEM EVALUATION
INITIAL APPRAISAL REPORT - LOWER SACRAMENTO AREA
PHASE IV**

ECONOMIC EVALUATION

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**SACRAMENTO RIVER FLOOD CONTROL SYSTEM EVALUATION
INITIAL APPRAISAL REPORT - LOWER SACRAMENTO AREA
PHASE IV**

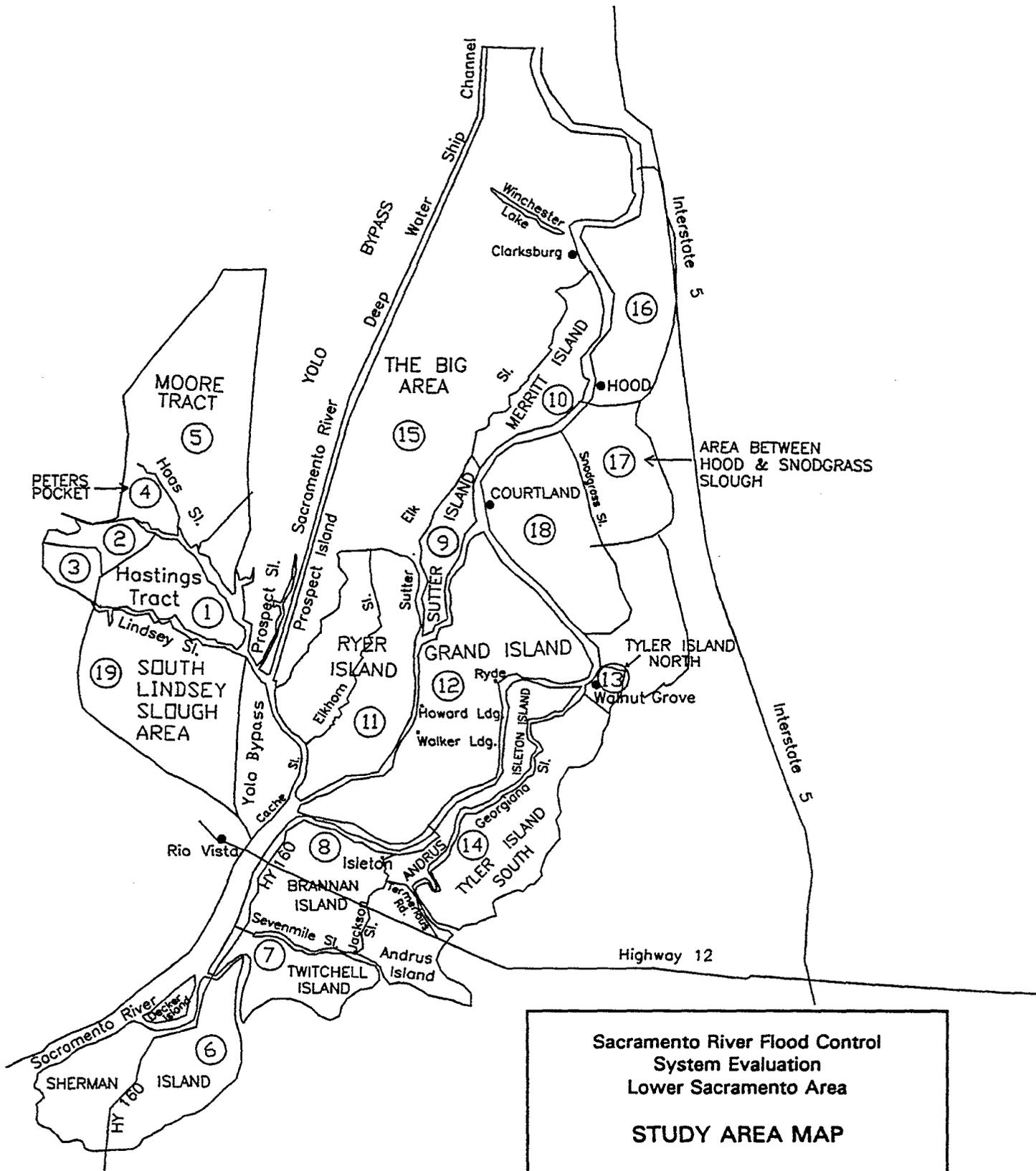
ECONOMIC EVALUATION

INTRODUCTION

The intent of this report is to document the results of field investigations for the "Sacramento River Flood Control System Evaluation, Initial Appraisal Report, Lower Sacramento Area," Phase IV study. See Figure 1 for a map of the study area. The study area has been divided into 19 individual areas for purposes of economic analysis. Assumptions and methodology used in the estimation of damages are described in the following paragraphs. Damages were estimated in accordance with ER 1105-2-100.

FLOOD PLAIN DESCRIPTION

All the individual areas in this study are protected by levees, either local levee or project levees or both. Each area was analyzed based upon the entire area being flooded to a maximum depth of flooding once a levee break occurred. This was done for the following 19 areas: (1) Hastings Tract "A", (Reclamation District) RD 2060; (2) Hastings Tract "B," RD 2060; (3) Hastings Tract "C," RD 2060; (4) Peters Pocket, RD 2104; (5) Moore Tract, RD 2098; (6) Sherman Island, RD 341; (7) Twitchell Island, RD 1601; (8) Brannan/Andrus Island, RDs 317, 407, 556, 2067; (9) Sutter Island, RD 349; (10) Merritt Island, RD 150; (11) Ryer Island, RD 501; (12) Grand Island, RD 3; (13) Tyler Island, RD 554; (14) Tyler Island south of J11, RD 563; (15) The Big Area, RDs 307, 765, 999; (16) Hood, MA (maintenance area) 9; (17) the area between Hood and Snodgrass Slough, MA (maintenance area) 9; and (18) Courtland, RD 551; and (19) South Lindsey Area RD 536. Table 1 shows the estimated population and acres analyzed in each area. Land use within these areas is predominantly agricultural.



**Sacramento River Flood Control
 System Evaluation
 Lower Sacramento Area**

STUDY AREA MAP

 Sacramento District, Corps of Engineers
 September 1993

FIGURE 1

Table 1
Population and Acreage Estimates

Area	Population _{1/}	Total Acreage
Hastings Tract "A"	41	4,350
Hastings Tract "B"	3	668
Hastings Tract "C"	12	1,440
Peters Pocket	0	1,390
Moore Tract	41	11,050
Sherman Island	208	10,100
Twitchell Island	42	3,539
Brannan/Andrus Island	2,064	14,957
Sutter Island	143	2,515
Merritt Island	234	4,720
Ryer Island	218	11,750
Grand Island	845	16,520
Tyler Island	286	469
Tyler Island South of J11	78	8,750
The Big Island	1,264	32,907
Hood	300	3,249
Area Between		
Hood & Snodgrass Slough	42 _{2/}	2,366
Courtland	400	9,209
South Lindsey Slough Area	87 _{2/}	7,436

1/ California Department of Finance Census Data Center

2/ Estimated at three persons per household

FLOOD PLAIN DAMAGE CATEGORIES

An area inventory conducted in 1991 identified the location, value, and number of structures within the flood plain. For every structure information was obtained on size (square feet), floor correction (the difference between ground elevation and the finished floor elevation), type of construction, location within the flood plain, and structural quality.

The value of each structure was estimated at replacement cost less depreciation. Replacement cost is the cost of physically replacing (reconstructing) the structure. Depreciation is that portion of the structural value that is diminished due to wear and age. Estimates of replacement cost were obtained from realtors, the county assessor's office, and the Marshall and Swift appraisal handbook. Estimates of

depreciation were obtained from Sacramento, Solano, and Yolo County appraisers.

Residential structural damage is physical damage to the residence (single-family, multi-family, and mobile homes) itself. Residential content damage is damage to the property contained within these homes (household items and personal property). Based upon discussions with local insurance agents, the value of residential contents is equal to 50 percent of the value (replacement cost less depreciation) of the structure.

Commercial damages are estimated using the structure value and content value. Contents include equipment and furniture, supplies, merchandise, and other items used in conducting business. Commercial structural damage is loss of value of the building due to flooding.

Farm building damages were estimated for losses to farm buildings and their contents. This category includes farm buildings, such as barns, equipment sheds, and silos.

Generally, the area investigated was primarily agricultural, so agricultural damages to crops were estimated since substantial acreage is in crop production. Crops harvested in the study area include wheat, barley, sugar beets, tomatoes, melons, peaches, prunes, kiwi, pears, walnuts, pistachios, almonds, corn, and rice. Most of these crops are planted annually in mid- to late spring (end of March and April and the beginning of May). Damages to agricultural crops were estimated from historical flood damage information. Historical agricultural crop damage information from the 1950, 1955, 1964, and 1965 flood events in the vicinity of the study area was accumulated, updated to current price levels using the Commodity Price Index, and divided by the total number of acres inundated to establish a damage-per-acre value. This average damage amounts to \$500 per acre.

Public damages are those damages associated with the inundation of schools, churches, governmental offices and facilities, roads, parks, and bridges. Again, both structural and content damage curves were used.

Emergency damages are the additional costs that were incurred during flood emergencies for evacuation and reoccupation, flood fighting, disaster relief, and increased police and fire protection. For purposes of this analysis, a cost of \$35 per person per day was assumed.

Automobile damages were also considered. Published data from the "Motor Vehicle Manufacturers Association of the United States Facts and Figures '88," suggests that the number of vehicles per household is approximately 1.7. It was assumed that 50 percent of the vehicles would be moved in time to avoid damage.

The levee repair damage category consisted of cost estimates for restoring the levee to its pre-flood state.

Dewatering costs were the required costs for pumping floodwaters from the flooded lands.

In addition, damages also occurred as a result of traffic (highway, railroad, etc.) disruptions, levee breaks, and erosion of railroad embankments. A representative of the Union Pacific railroad indicated that extensive damages were sustained along its tracks during the 1986 flood. These damages totaled approximately \$2 million and are for repair of the roadbed as well as for the extra costs of rerouting rail traffic either through Reno, Nevada, or Salt Lake City, Utah, into the Sacramento Area. This rerouting of rail traffic included the leasing of trackage rights from the Southern Pacific Railroad.

DEPTH-DAMAGE RELATIONSHIPS

Once the value of property is found, damage can be estimated by utilizing depth-damage curves. A depth-damage curve represents the amount of property destruction encountered for known depths of flooding. Flood damages were estimated based on depths and duration of flooding. The primary damage categories included , residential, commercial, public, farm building properties, and automobiles. Table 2 shows the depth-damage relationships used in this evaluation.

The 1988 Federal Insurance Administration depth-damage relationships were used for most residential and public properties. The 1988 Holbrook Study was chosen most representative of mobile home damages. Damage surveys conducted immediately after the February 1986 rainstorms of flood damaged structures along Dry Creek in Roseville, California, confirmed the reasonableness of the 1988 Flood Insurance Administration depth-damage relationships. Depth-damage curves for the automobiles associated with the residential structures were taken from the 1983 Lower Silver Creek Watershed study. The depth-damage relationships developed by the Tennessee Valley Authority for the Department of Housing and Urban Development in December 1969, Small Business Research for Flood Insurance Rate-setting, were used in estimating damages to commercial structures. The similarity in the types of construction between structures in this study area and those encountered in previous district studies was the basis for using these depth-damage curves. Lastly, Fort Worth District's STDMA depth-damage curves for farm buildings were chosen because of their reasonableness and applicability to the damage area studied. After consultation with various industry personnel, it was determined that all the above curves would be adjusted upward by 25 percent to reflect the assumed 60-day duration of standing water and area specific conditions.

Table 2
Depth-Damage Curves
(percent damage)

Depth of Flooding (feet)	Residential				MH'		Multi- Family*		Autos#	Commercial@			Public*		Farm Buildings"	
	SF-1*		SF-2*		Str	Con	Str	Con	Str	Str	Con	Con	Str	Con	Str	Con
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	10	14	7	10	10	4	7	10	12.5	6	13	45	10	14	10	10
2	16	29	11	14	54	34	11	14	45.8	11	38	66	16	29	16	16
3	25	39	18	23	78	61	16	23	80	18	68	80	25	39	23	23
4	34	44	23	29	91	80	23	29		23	85	89	34	44	31	31
5	36	46	28	35	98	98	25	35		28	94	98	36	46	44	44
6	38	51	33	41	100	100	28	41		33	98	100	38	51	56	56
7	51	56	39	49			30	49		39	100		51	56	69	69
8	54	63	44	55			33	55		44			54	63	81	81
9	55	69	50	63			38	63		50		55	69	90	90	
10	56	75	54	68			43	68		55			56	75	98	98
11	58	75	57	71			48	71		61			58	75	100	100
12	59	75	61	76			53	76		66		59	75			
13	60	75	65	81			58	81		75			60	75		
14	100	100	100	100			100	100		100			100	100		

Notes:

* 1988 FEMA Depth Percent Damage Curves.

' Damage curve based upon the 1988 Holbrook Study.

Lower Silver Creek Watershed, Soil Conservation Service, 1983; maximum damage is 80% of vehicle.

@ 1969 Tennessee Valley Authority Study; contents for "S" and "U"-shaped curves, respectively.

" Ft. Worth District 1990 STDMA Depth-Damage Curves.

After consultation with industry representatives, and based upon professional experience, all of the above mentioned curves were adjusted upward by 25% to reflect flood duration and area conditions.

AREA CONFIGURATIONS

This section of the report discusses the following items for each area: levee crest elevations, island levee boundaries, population estimates, acres per elevation, an inventory of the damageable property, and total damages.

HASTINGS TRACT "A" (RD 2060 - Area 1)

There were three Hastings Tract islands analyzed. The first was Hastings Tract "A." This island is located within Solano County. This island was the largest of the three Hastings Tract islands, comprising some 4,350 acres. See Table 3a for a description of affected acres at specific elevations.

Table 3a

Acres Flooded on Hastings Tract "A"

Ground Elevation	Cumulative Area Flooded (acres)
0	1,209
5	4,193
>5	4,350

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is made up of Lindsey Slough and Hastings Cut, the left bank is the Yolo Bypass and Cache Slough. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 16 feet m.s.l. This elevation exists at Yolo Bypass and Lindsey Slough.

AREA INVENTORY

There were approximately 11 single-family one-story homes, 37 mobile homes, 15 barn/garages, one public structure, and 1 commercial structure on Hastings Tract "A." As stated earlier, island population was estimated to be 41 people. Agriculture is the pervasive land use on this island. The

property value and total without-project damages are presented in tables 4a and 5a.

Table 4a

**Inventoried Property Value
for Hastings Tract "A"**

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	2,073
Farm Buildings/Garages	523
Public	166
Commercial	35
Automobiles	<u>215</u>
TOTAL	3,012

Table 5a

**Total Damages by Category
for Hastings Tract "A"**

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & ConTs)	2,014
Farm Buildings (Struc & ConTs)	523
Public (Struc & ConTs)	94
Commercial (Struc & ConTs)	35
Automobiles	55
Emergency Costs	88
Roads	126
Agriculture	2,262
Levee Repair	530
Dewatering	<u>530</u>
TOTAL	6,257

HASTINGS TRACT "B" (RD 2060 - Area 2)

This island, Hastings Tract "B", is located within Solano County. This island was the third largest of the three Hastings Tract islands, comprising some 668 acres. See Table 3b for a description of affected acres at specific elevations.

Table 3b

**Acres Flooded on
Hastings Tract "B"**

Ground Elevation	Cumulative Area Flooded (acres)
5	523
10	662
>10	668

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is Hastings Cut, and the left bank is Cache Slough. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 18.5 feet m.s.l. This elevation exists at Cache Slough and at Hastings Cut.

AREA INVENTORY

There were approximately one mobile home, three farm buildings/garages, and one public structure on Hastings Tract "B." As stated earlier, the population was estimated to be three people. The property value and total without-project damages are presented in tables 4b and 5b.

Table 4b

Inventoried Property Value
for Hastings Tract "B"

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	43
Farm Buildings/garages	445
Public	220
Automobiles	5
TOTAL	713

Table 5b

Total Damages by Category
for Hastings Tract "B"

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & Conts)	43
Farm Buildings/garages (Struc & Conts)	419
Public (Struc & Conts)	28
Automobiles	4
Emergency Costs	6
Roads	4
Agriculture	347
Levee Repair	424
Dewatering	212
TOTAL	1,487

HASTINGS TRACT "C" (RD 2060 - Area 3)

This island, Hastings Tract "C," is located within Solano County. This island was the second largest of the three Hastings Tract islands, comprising some 1,440 acres. See Table 3c for a description of affected acres per elevation.

Table 3c

**Acres Flooded on
Hastings Tract "C"**

Ground Elevation	Cumulative Area Flooded (acres)
5	568
10	1,295
>10	1,440

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is made up of Lindsey Slough and Barker Slough, and the left bank is Hastings Cut. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 17.5 feet m.s.l. This elevation exists on Lindsey Slough.

AREA INVENTORY

There were approximately three single-family one-story houses, one mobile home, and two farm buildings/garages on Hastings Tract "C." As stated earlier, population was estimated to be 12 people. The property value and total without-project damages are presented in tables 4c and 5c.

Table 4c

**Inventoried Property Value
for Hastings Tract "C"**

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	227
Farm Buildings/Garages	247
Automobiles	<u>21</u>
TOTAL	495

Table 5c

Total Damages by Category
for Hastings Tract "C"

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & Conds)	118
Farm Buildings/garages (Struc & Conds)	155
Automobiles	16
Emergency Costs	26
Roads	4
Agriculture	749
Levee Repair	424
Dewatering	<u>212</u>
TOTAL	1,704

PETERS POCKET (RD 2104 - Area 4)

Peters Pocket is located within Solano County. This area encompasses some 1,390 acres. See Table 3d for a description of affected acres at specific elevations.

Table 3d

Acres Flooded on
Peters Pocket

Ground Elevation	Cumulative Area Flooded (acres)
5	759
10	1,339
>10	1,390

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is made up of Cache Slough, and the left bank is Haas Slough. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 16.5 feet m.s.l. This elevation exists at Cache Slough and Haas Slough.

AREA INVENTORY

There were approximately two mobile homes, one multi-family one-story structure, and two farm buildings/garages on Peters Pocket. Even though there were residential structures on the island, they did not appear to be inhabited. The property value and total without-project damages are presented in tables 4d and 5d.

Table 4d

**Inventoried Property Value
for Peters Pocket**

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	39
Farm Buildings/Garages	<u>361</u>
TOTAL	400

Table 5d

**Total Damages by Category
for Peters Pocket**

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & Conats)	39
Farm Buildings/garages (Struc & Conats)	361
Roads	16
Agriculture	723
Levee Repair	530
Dewatering	<u>424</u>
TOTAL	2,093

MOORE TRACT (RD 2098 - Area 5)

Moore Tract is located within Solano County. This area encompasses some 11,050 acres. See Table 3e for a description.

Table 3e

**Acres Flooded on
Moore Tract**

Ground Elevation	Cumulative Area Flooded (acres)
0	294
5	3,950
10	7,040
15	9,230
20	11,050

AREA BOUNDARIES

The area levee boundaries are as follows: Looking downstream, the right bank is made up of Cache Slough and Haas Slough, and the left bank is Shag Slough. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 16.5 feet m.s.l. This elevation exists at Cache Slough.

AREA INVENTORY

There were approximately 14 single-family one-story homes, 3 single-family two-story structures, 1 public structure, and 13 farm buildings/garages on Moore Tract. As stated earlier, population was estimated to be forty-one people. The property value and total without-project damages are presented in tables 4e and 5e.

Table 4e
Inventoried Property Value
for Moore Tract

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	883
Farm Buildings/Garages	1,261
Automobiles	73
Public	<u>25</u>
TOTAL	2,242

Table 5e
Total Damages by Category
for Moore Tract

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & Conats)	247
Farm Buildings/garages (Struc & Conats)	1,052
Public	4
Automobiles	25
Emergency Costs	88
Roads	269
Agriculture	4,888
Levee Repair	530
Dewatering	<u>1,061</u>
TOTAL	8,164

SHERMAN ISLAND (RD 341 - Area 6)

Sherman Island is located within Sacramento County. This area encompasses some 10,100 acres. See Table 3f for a description of affected acres at specific elevations.

Table 3f
Acres Flooded on
Sherman Island

Ground Elevation	Cumulative Area Flooded (acres)
-15	1,743
-10	7,169
-5	9,214
0	10,041
>0	10,100

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is the Sacramento River, and the left bank consists of the San Joaquin River and Threemile Slough. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 11.5 feet m.s.l. This elevation exists at the Sacramento River and Threemile Slough.

AREA INVENTORY

There were approximately 32 single-family one-story homes, 12 single-family two-story structures, 36 mobile homes, and 13 farm buildings/garages on Sherman Island. As stated earlier, population was estimated to be 208. The property value and total without-project damages are presented in tables 4f and 5f.

Table 4f
Inventoried Property Value
for Sherman Island

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	6,610
Farm Buildings/Garages	916
Automobiles	357
Recreational Vehicles	<u>787</u>
TOTAL	8,670

Table 5f

**Total Damages by Category
for Sherman Island**

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & Conts)	4,971
Farm Buildings/garages (Struc & Conts)	916
Automobiles	290
Recreational Vehicles	630
Emergency Costs	427
Roads	177
Traffic Rerouting	2,264
Agriculture	5,252
Levee Repair	1,061
Dewatering	<u>3,183</u>
TOTAL	19,171

TWITCHELL ISLAND (RD 1601 - Area 7)

Twitchell Island is located within Sacramento County. This area encompasses some 3,539 acres. See Table 3g for a description of affected acres at specific elevations.

Table 3g

**Acres Flooded on
Twitchell Island**

Ground Elevation	Cumulative Area Flooded (acres)
-15	1,450
-10	2,588
-5	3,315
0	3,539

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is made up of Threemile Slough, and the left bank consisted of the San Joaquin River and Sevenmile Slough. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 9 feet m.s.l. This elevation exists at Threemile Slough.

AREA INVENTORY

There were approximately 12 single-family one-story homes, 2 single-family two-story structures, 2 mobile homes, and 6 farm buildings/garages on Twitchell Island. As stated earlier, population was estimated to be 42 people. The property value and total without-project damages are presented in tables 4g and 5g.

Table 4g

**Inventoried Property Value
for Twitchell Island**

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	969
Farm Buildings/garages	602
Automobiles	<u>73</u>
TOTAL	1,644

Table 5g

**Total Damages by Category
for Twitchell Island**

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & Conts)	724
Farm Buildings/garages (Struc & Conts)	587
Automobiles	63
Emergency Costs	88
Roads	73
Agriculture	1,841
Levee Repair	849
Dewatering	<u>1,061</u>
TOTAL	5,286

BRANNAN/ANDRUS ISLAND (RD 317, 407, 556, 2607 - Area 8)

Brannan/Andrus Island is located within Sacramento County. This island encompasses some 14,957 acres. See Table 3h for a description of affected acres at specific elevations.

This island actually consists of two islands which are geographically joined. The island also contains a rather large city, Isleton, by delta island standards. With a population estimated at 983 people, Isleton accounts for approximately 50 percent of the damageable property on the island. Isleton is situated on the south bank of the Sacramento River on Andrus Island. Again, all data were aggregated so that Brannan/Andrus Island could be handled as one island.

Table 3h

**Acres Flooded on
Brannan/Andrus Island**

Ground Elevation	Cumulative Area Flooded (acres)
-20	1,290
-15	3,606
-10	8,486
-5	11,467
0	13,283
5	14,407
>5	14,957

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is made up of the Sacramento River and Sevenmile Slough, with the left bank consisting of the San Joaquin River, Georgiana Slough and the Mokelumne River. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 8 feet m.s.l. This elevation exists at Georgiana Slough.

AREA INVENTORY

There were approximately 440 single-family one-story homes, 62 single-family two-story structures, 785 mobile homes, 90 commercial structures, 53 farm buildings/garages, and 6 public buildings on Brannan/Andrus Island. As stated earlier, island population was estimated to be 2,064 people. The property value and total without-project damages are presented in tables 4h and 5h.

Table 4h

Inventoried Property Value
for Brannan/Andrus Island

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	60,046
Commercial	14,512
Public	6,020
Farm Barns/Garages	5,362
Automobiles	5,747
Recreational Vehicles	<u>2,995</u>
TOTAL	94,682

Table 5h

Total Damages by Category
for Brannan/Andrus Island

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & Conts)	40,067
Farm Buildings/garages (Struc & Conts)	4,009
Commercial (Struc & Conts)	7,660
Public (Struc & Conts)	3,267
Automobiles	2,841
Recreational Vehicles	2,395
Traffic Rerouting	2,264
Emergency Costs	4,241
Roads	812
Agriculture	7,562
Levee Repair	1,061
Dewatering	<u>4,244</u>
TOTAL	80,423

SUTTER ISLAND (RD 349 - Area 9)

Sutter Island is located within Sacramento County. This island encompasses some 2,515 acres. See Table 3i for a description of affected acres at specific elevations.

Table 3i

**Acres Flooded on
Sutter Island**

Ground Elevation	Cumulative Area Flooded (acres)
-5	72
0	1,376
5	2,117
>5	2,515

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is made up of Sutter Slough, and the left bank consists of Steamboat Slough and the Sacramento River. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 21 feet m.s.l. This elevation exists at Steamboat Slough.

AREA INVENTORY

There were approximately 27 single-family one-story homes, 20 single-family two-story structures, 8 mobile homes, and 39 farm buildings/garages on Sutter Island. As stated earlier, population was estimated to be one hundred forty-three people. The property value and total without-project damages are presented in tables 4i and 5i.

Table 4i

**Inventoried Property Value
for Sutter Island**

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	8,830
Farm Buildings/Garages	2,657
Automobiles	<u>247</u>
TOTAL	11,734

Table 5i

Total Damages by Category
for Sutter Island

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & Conts)	8,393
Farm Buildings (Struc & Conts)	2,638
Automobiles	180
Emergency Costs	292
Roads	22
Traffic Rerouting	66
Agriculture	1,308
Levee Repair	1,050
Dewatering	1,050
TOTAL	14,999

MERRITT ISLAND (RD 150 - Area 10)

Merritt Island is located within Yolo County. This island encompasses some 4,720 acres. See Table 3j for a description of affected acres at specific elevations.

Table 3j

Acres Flooded on
Merritt Island

Ground Elevation	Cumulative Area Flooded (acres)
0	306
5	2,949
10	4,360
>10	4,720

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is made up of Elk Slough, and the left bank consists of the Sacramento River. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 21.5 feet m.s.l. This elevation exists on Elk Slough.

AREA INVENTORY

There were approximately 50 single-family one-story homes, 29 single-family two-story structures, 1 single-family three story home, 10 mobile homes, and 68 farm barn/garages on Merritt Island. As stated earlier, island population was estimated to be 234. The property value and total without-project damages are presented in tables 4j and 5j.

Table 4j

**Inventoried Property Value
for Merritt Island**

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	13,972
Farm Buildings/Garages	4,390
Automobiles	<u>405</u>
TOTAL	18,767

Table 5j

**Total Damages by Category
for Merritt Island**

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & ConTs)	10,090
Farm Buildings/garages (Struc & ConTs)	4,390
Automobiles	327
Emergency Costs	517
Roads	80
Agriculture	2,454
Levee Repair	1,061
Dewatering	<u>2,122</u>
TOTAL	21,041

RYER ISLAND (RD 501 - Area 11)

Ryer Island is located within Solano County. This island encompasses some 11,750 acres. See Table 3k for a description of affected acres at specific elevations.

Table 3k
Acres Flooded on
Ryer Island

Ground Elevation	Cumulative Area Flooded (acres)
-10	487
-5	8,546
0	11,150
5	11,670
>5	11,750

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is composed of Miner Slough and Cache Slough, and the left bank consists of Steamboat Slough and Sutter Slough. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 16 feet m.s.l. This elevation exists on Cache Slough.

AREA INVENTORY

There were approximately 55 single-family one-story homes, 14 single-family two-story structures, 7 mobile homes, and 51 farm buildings/garages on Ryer Island. As stated earlier, population was estimated to be 218. The property value and total without-project damages are presented in tables 4k and 5k.

Table 4k

Inventoried Property Value
for Ryer Island

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices- in \$1,000)
Residential	7,488
Farm Buildings/Garages	5,248
Automobiles	<u>342</u>
TOTAL	13,078

Table 5k

Total Damages by Category
for Ryer Island

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & ConTs)	6,131
Farm Buildings/garages (Struc & ConTs)	5,248
Automobiles	269
Traffic Rerouting	21
Emergency Costs	461
Roads	107
Agriculture	6,110
Levee Repair	1,061
Dewatering	<u>3,183</u>
TOTAL	22,591

GRAND ISLAND (RD 3 - Area 12)

Grand Island is located within Sacramento County. This island encompasses some 16,520 acres. See Table 31 for a description of affected acres at specific elevations.

Table 31
Acres Flooded on
Grand Island

Ground Elevation	Cumulative Area Flooded (acres)
-10	2,527
-5	11,165
0	14,298
5	15,775
>5	16,520

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is composed of Steamboat Slough, and the left bank the Sacramento River. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 17 feet m.s.l. This elevation exists on the Steamboat Slough.

AREA INVENTORY

There were approximately two hundred 44 single-family one-story homes, 59 single-family two-story structures, 23 mobile homes, and 72 farm buildings/garages on Grand Island. As stated earlier, population was estimated to be 845 people. The property value and total without-project damages are presented in tables 41 and 51.

Table 41
Inventoried Property Value
for Grand Island

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	70,954
Farm Buildings/Garages	4,396
Automobiles	<u>1,455</u>
TOTAL	76,805

Table 51

**Total Damages by Category
for Grand Island**

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & Conts)	58,204
Farm Buildings (Struc & Conts)	4,396
Automobiles	1,157
Traffic Rerouting	34
Emergency Costs	1,736
Roads	186
Agriculture	8,480
Levee Repair	1,061
Dewatering	4,244
TOTAL	79,498

TYLER ISLAND (RD 554 - Area 13)

Tyler Island is located within Sacramento County. This island encompasses 469 acres. See Table 3m for a description of affected acres at specific elevations.

Table 3m

**Acres Flooded on
Tyler Island**

Ground Elevation	Cumulative Area Flooded (acres)
0	315
5	383
>5	469

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is composed of Georgiana Slough and the Sacramento River, and the left bank consists of Snodgrass Slough. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 19.5 feet m.s.l. This elevation exists on the Sacramento River and Georgiana Slough. Tyler Island consists of two regions bisected by Route J11: Tyler Island, and Tyler

Island South of Route J11. Tyler Island basically consists of the town of Walnut Grove.

AREA INVENTORY

There were approximately 90 single-family one-story homes, 17 single-family two-story structures, 2 mobile homes, 1 multi-family unit, 50 commercial structures, 8 public structures, and 3 farm buildings/garages on Tyler Island. As stated earlier, population was estimated to be 286 people. The property value and total without-project damages are presented in tables 4m and 5m.

Table 4m

**Inventoried Property Value
for Tyler Island**

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	12,410
Commercial	17,198
Public	7,740
Farm Buildings/Garages	<u>265</u>
TOTAL	37,613

Table 5m

**Total Damages by Category
for Tyler Island**

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & ConTs)	12,308
Commercial (Struc & ConTs)	13,054
Public (Struc & ConTs)	7,740
Farm Buildings/Garages (Struc & ConTs)	265
Automobiles	395
Emergency Costs	587
Roads	38
Levee Repair	1,061
Dewatering	<u>1,061</u>
TOTAL	36,509

TYLER ISLAND SOUTH OF ROUTE J11 (RD 563 - Area 14)

Tyler Island south of Route J11 is located within Sacramento County. This island encompasses 8,750 acres. See Table 3n for a description of affected acres at specific elevations.

Table 3n

**Acres Flooded on
Tyler Island South of Route J11**

Ground Elevation	Cumulative Area Flooded (acres)
-15	433
-10	5,104
-5	7,128
0	8,292
5	8,701
>5	8,750

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is Georgiana Slough, and the left bank consists of the North Mokelumne River. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 9.5 feet m.s.l. This elevation exists on Georgiana Slough.

AREA INVENTORY

There were approximately 14 single-family one-story homes, 9 single-family two-story structures, 7 mobile homes, 20 commercial structures, and 15 farm buildings/garages on Tyler Island south of Route J11. As stated earlier, island population was estimated to be 78 people. The property value and total without-project damages are presented in tables 4n and 5n.

Table 4n

Inventoried Property Value
for Tyler Island South of Route J11

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	3,453
Commercial	4,034
Farm Buildings/Garages	1,201
Automobiles	<u>137</u>
TOTAL	8,825

Table 5n

Total Damages by Category
for Tyler Island South of Route J11

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & ConTs)	1,863
Commercial (Struc & ConTs)	2,597
Farm Buildings (Struc & ConTs)	1,201
Automobiles	109
Emergency Costs	161
Roads	144
Traffic Rerouting	27
Agriculture	4,549
Levee Repair	1,061
Dewatering	<u>2,652</u>
TOTAL	14,364

THE BIG AREA (RD 307, 765, 999 - Area 15)

The Big Area is located primarily within Yolo County. This island encompasses 32,907 acres. See Table 3o for a description of affected acres at specific elevations.

The little town of Clarksburg is contained in this areas boundaries. Clarksburg is located on the Sacramento River just south of Winchester Lake.

Table 3o
Acres Flooded on
the Big Area

Ground Elevation	Cumulative Area Flooded (acres)
0	2,313
5	26,253
10	30,979
15	32,773
>15	32,907

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream, the right bank is composed of the Sacramento River Deep Ship Channel, the left bank consists of the Sacramento River, Elk Slough, Sutter Slough, and Miner Slough. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 19 feet m.s.l. This elevation exists on Miner Slough.

AREA INVENTORY

There were approximately 408 single-family one-story homes, 56 single-family two-story structures, 28 mobile homes, 28 commercial structures, 8 public structures, and 248 farm buildings/garages on the Big Area. As stated earlier, island population was estimated to be 1,264 people. The property value and total without-project damages are presented in tables 4o and 5o.

Table 4o
Inventoried Property Value
for the Big Area

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	77,183
Commercial	10,077
Public	4,610
Farm Buildings/Garages	14,120
Automobiles	<u>2,196</u>
TOTAL	108,186

Table 5o
Total Damages by Category
for the Big Area

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & ConTs)	54,096
Commercial (Struc & ConTs)	6,782
Public (Struc & ConTs)	2,077
Farm Buildings/Garages (Struc & ConTs)	6,787
Automobiles	1,752
Emergency Costs	2,175
Roads	1,134
Traffic Rerouting	23
Agriculture	17,098
Levee Repair	1,061
Dewatering	<u>8,487</u>
TOTAL	101,472

HOOD AREA (M.A. # 9 - Area 16)

The Hood Area is located in Sacramento County. This island encompasses approximately 3,249 acres. See Table 3p for a description of affected acres at specific elevations.

The small town of Hood is contained in this area's boundaries. Hood is a small municipality along the Sacramento River. The types of structures and quality of structures vary in quality from average to poor. Structures present in the area include one- and two-story residential, mobile homes, commercial (restaurant, market, and garage), public (fire station), and farm buildings (barns and stables).

Table 3p

**Acres Flooded on
Hood Area**

Ground Elevation	Cumulative Area Flooded (acres)
0	271
5	1,260
10	3,249

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream the right boundary is composed of Interstate 5 and the left boundary is the Sacramento River. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 23 feet m.s.l. This elevation exists on the Sacramento River.

AREA INVENTORY

There were approximately 204 structures in the flood plain: 93 single-family one-story homes, 18 single-family two-story structures, 47 mobile homes, 6 commercial structures, 2 public structures, and 38 barns/garages in this area. Population for the town of Hood was estimated at 300 people in 1989. The property value and total without-project damages are presented in tables 4p and 5p.

Table 4p
Inventoried Property Value
for the Hood Area

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	8,769
Commercial	357
Public	116
Industrial	2,125
Farm buildings	1,300
Automobiles	<u>1,214</u>
TOTAL	13,881

Table 5p
Total Damages by Category
for the Hood Area

Damage Category	Total Damage (Oct 93 prices in \$1,000)
Residential (Struc & ConTs)	6,122
Commercial (Struc & ConTs)	276
Public (Struc & ConTs)	73
Industrial (Struc & ConTs)	1,247
Farm Buildings (Struc & ConTs)	1,300
Automobiles	590
Emergency Costs	422
Roads	1,644
Agriculture	1,690
Levee Repair	530
Dewatering	<u>530</u>
TOTAL	14,424

AREA BETWEEN HOOD & SNODGRASS SLOUGH (M.A. # 9 - AREA 17)

The area between Hood and Snodgrass Slough is located in Sacramento County. This area encompasses approximately 2,366 acres. See Table 3q for acres affected at specific elevations.

The area is comprised of residential homes, mobile homes, barns, and agriculture.

Table 3q

**Acres Flooded on
the Area Between Hood and Snodgrass Slough**

Ground Elevation	Cumulative Area Flooded (acres)
0	418
5	1,400
10	2,366

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream the right boundary is Interstate 5, and the left boundaries are the Sacramento River and Snodgrass Slough. The lowest levee crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 23 feet m.s.l. This elevation exists on the Sacramento River.

AREA INVENTORY

There were approximately 31 structures in the area comprised of 4 single-family one-story structures, 6 single-family two-story homes, 1 three-story, 3 mobile homes, and 17 barns. The property value and the total without-project damages are presented in tables 4q and 5q.

Table 4q

Inventoried Property Value
the Area Between Hood and Snodgrass Slough

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	1,542
Farm Buildings	276
Automobiles	<u>126</u>
TOTAL	1,944

Table 5q

Total Damages by Category
the Area Between Hood and Snodgrass Slough

Damage Category	Total Damage (in Oct 93 prices in \$1,000)
Residential (Struc & Conats)	918
Farm Buildings (Struc & Conats)	276
Automobiles	63
Emergency Costs	45
Roads	743
Agriculture	1,230
Levee Repair	530
Dewatering	<u>424</u>
TOTAL	4,229

COURTLAND AREA (RD 551 - AREA 18)

The Courtland Area is located within Sacramento County. This island encompasses 9,209 acres. See Table 3r for a description of affected acres at specific elevations.

The town of Courtland with a population of 400 (1989) is in this area. Structures present in the area are single-family residential, mobile homes, commercial, public, and farm buildings.

Table 3r
Acres Flooded on
Courtland

Ground Elevation	Cumulative Area Flooded (acres)
0	5,700
5	8,060
10	9,209

AREA BOUNDARIES

The levee boundaries are as follows: Looking downstream the right bank is Snodgrass Slough, the left bank is the Sacramento River. The lowest crest elevation (the point at which floodwater would be expected to exit a completely inundated levee) is 23 feet m.s.l. This elevation exists on Sacramento River.

AREA INVENTORY

There were approximately 331 structures: 156 single-family one-story homes, 60 single-family two-story structures, 10 mobile homes, 12 commercial structures, 7 public structures, and 86 farm barn/garages in the area. As stated earlier, the population was estimated to be 400 in the town of Courtland. The property value and total without-project damages are presented in tables 4r and 5r.

Table 4r
Inventoried Property Value
Courtland

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	21,489
Commercial	2,960
Public	2,814
Farm Buildings/Garages	4,078
Automobiles	2,019
TOTAL	33,360

Table 5r

Total Damages by Category
Courtland

Damage Category	Total Damage (in Oct 93 prices in \$1,000)
Residential (Struc & Conts)	10,098
Commercial (Struc & Conts)	2,289
Public (Struc & Conts)	1,754
Farm Buildings (Struc & Conts)	4,078
Automobiles	979
Emergency Costs	701
Roads	3,697
Agriculture	4,788
Levee Repair	530
Dewatering	<u>1,379</u>
TOTAL	30,293

SOUTH LINDSEY SLOUGH AREA (RD 536 - AREA 19)

The South Lindsey Slough Area is located within Solano County. This area encompasses 7,400 acres. See Table 3s for a description of affected acres at specific elevations.

The town of South Lindsey Slough Area has an estimated population of 87 people. Structures present in the area are single-family residential, mobile homes, and farm buildings.

Table 3s

Acres Flooded on
South Lindsey Slough

Ground Elevation	Cumulative Area Flooded (acres)
0	1,787
10	4,914
15	7,400

AREA BOUNDARIES

The levee boundaries are as follows: The north levee embankment is South Lindsey Slough, the east levee embankment is the West Levee of the Yolo Bypass, and there are levee embankments to the west and south. The lowest crest elevation (the point at which floodwater would be expected to exit and completely inundated levee) is 15 feet m.s.l.

AREA INVENTORY

There were approximately 74 structures: 22 single-family one-story homes, 4 single-family two-story structures, 3 mobile homes, and 45 farm buildings in the area. As stated earlier, the population was estimated to be 87. The property value and total without-project damages are presented in tables 4s and 5s.

Table 4s

Inventoried Property Value South Lindsey Slough

Inventoried Category (structure & contents)	Total Value of Property (in Oct 93 prices in \$1,000)
Residential	3,200
Farm Buildings/Garages	973
Automobiles	<u>198</u>
TOTAL	4,371

Table 5s

Total Damages by Category South Lindsey Slough

Damage Category	Total Damage (in Oct 93 prices in \$1,000)
Residential (Struc & Conats)	878
Farm Buildings (Struc & Conats)	366
Automobiles	198
Emergency Costs	16
Roads	570
Agriculture	513
Levee Repair	530
Dewatering	<u>700</u>
TOTAL	3,771

ELEVATION-DAMAGE RELATIONSHIPS

Due to the uncertainty of when, where, and how many levee breaks will occur within, adjacent to, and upstream of the study area for a particular flood event, a generalized methodology was developed to estimate the flood damages and flood inundation reduction benefits attributable to the proposed levee reconstruction. An elevation-damage relationship was developed for each area. Each elevation-damage relationship is based upon reservoir-type flooding. It was assumed that for any levee break, floodwater would move into the area and flow by gravity in the direction of local drainage and pond behind the southernmost levee embankments of each flooded area. As flood depths in those inundated areas increased, flood damages were determined for specific water surface elevations as if each elevation represented a lake with a horizontal water surface. For those areas completely encircled by levee embankments, the maximum elevation of flooding was the lowest levee crown elevation at which sedentary floodwater could begin to flow back out of the flooded area. At this elevation, additional levee failures were probable due to the high potential for loss of levee embankment material from wave action, scouring, and overflowing of floodwater. Elevation-damage relationships were estimated for each area and damageable property in the flood plain (residential, commercial, and public structures, etc.) by relating depths of inundation and ground elevation to its corresponding depth-percent damage relationship. Damages were estimated for various depths of inundation in the flood plain. The resulting elevation-damage relationships are shown in figures 3 - 21. The damages shown in these relationships are also based on flood durations of 60 days, except for the areas of Hood and the area between Hood and Snodgrass Slough where the duration was set at 30 days, and for the South Lindsey Slough (21 days duration). Although longer durations of flooding are possible, particularly if pumping is stipulated for removing floodwater from a given flooded area, durations longer than 60 days did not significantly impact estimated flood damages.

The elevation-damage relationships shown in figures 3 -21 indicate the maximum potential flood damages for each of the areas. Figure 3 indicates the maximum potential flood damages for area 1 (Hastings Tract "A") of \$6.2 million at a water surface elevation of 16 feet. Maximum flood damages were determined for each area.

After determining total maximum damages for the 19 areas, an initial screening process eliminated 9 areas. Areas 2, 3, 13, 17, and 18 were eliminated because they are capable of passing design flows with no apparent design deficiencies. Areas 6, 7, 14, and 16 were eliminated because they have non-Federal levees that are known to have levels of flood protection lower than the Federal levees, such that

reconstructing the Federal levees will not increase the level of flood protection. Average annual damages and benefits, discussed below, were computed for the remaining 10 areas (Figure 2) which include Hastings Tract "A" (area 1), Peters Pocket (area 4), Moore Tract (area 5), Brannan-Andrus Island (area 8), Sutter Island (area 9), Merritt Island (area 10), Ryer Island (area 11), Grand Island (area 12), The Big Area (area 15) and South Lindsey Slough (area 19).

AVERAGE ANNUAL DAMAGES AND BENEFITS

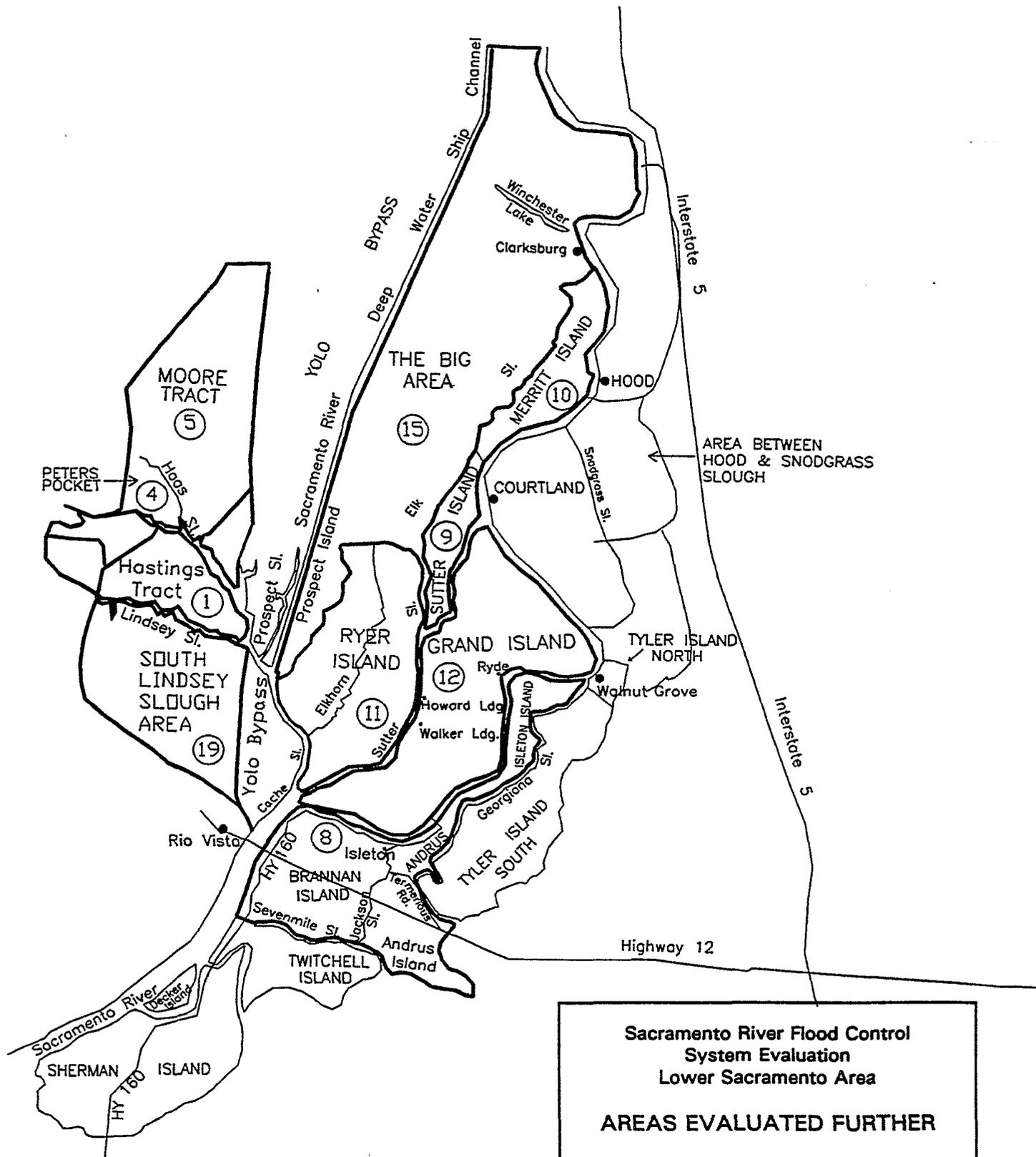
The proposed project is based on a 50-year project life, October 1993 prices, 8-1/4 percent interest rate, and existing conditions. Average annual damages were estimated under without and with-project conditions. Probable average annual damages were estimated for the present year and annually throughout the study period. The potential levee failure recurrence intervals varied for each area and are presented in Table 6. The average annual with project damages are those damages which the project does not eliminate. The with-project design levels for each of the areas are shown below.

TABLE 6

Levee Failure Recurrence Intervals

Area	Non-damaging Frequency	Design Frequency
Hastings Tract "A" (1)	50-year	60-year
Peters Pocket (4)	40-year	50-year
Moore Tract (5)	50-year	100-year
Brannan-Andrus Island (8)	40-year	50-year
Sutter Island (9)	45-year	55-year
Merritt Island (10)	70-year	80-year
Ryer Island (11)	50-year	60-year ✓
Grand Island (12)	35-year	45-year
The Big Area (15)	45-year	50-year
South Lindsey Slough	35-year	50-year ✓

Flood damage reduction benefits are the difference between equivalent average annual flood losses without the project and the residual annual losses with the project. The average annual without-project damages, with-project damages, and benefits for the proposed project are presented in Table 7.



**Sacramento River Flood Control
 System Evaluation
 Lower Sacramento Area**

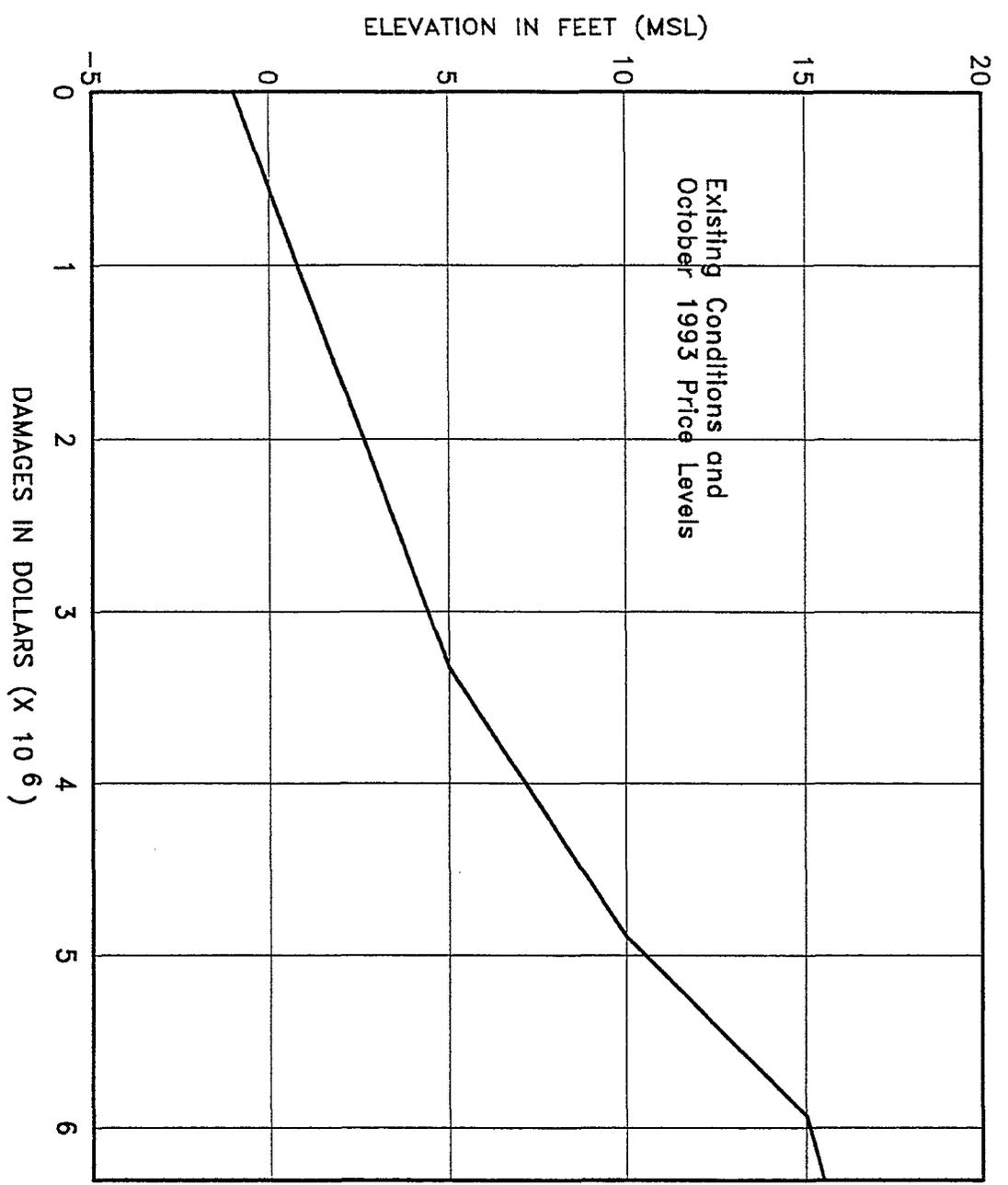
AREAS EVALUATED FURTHER

 Sacramento District, Corps of Engineers
 September 1993

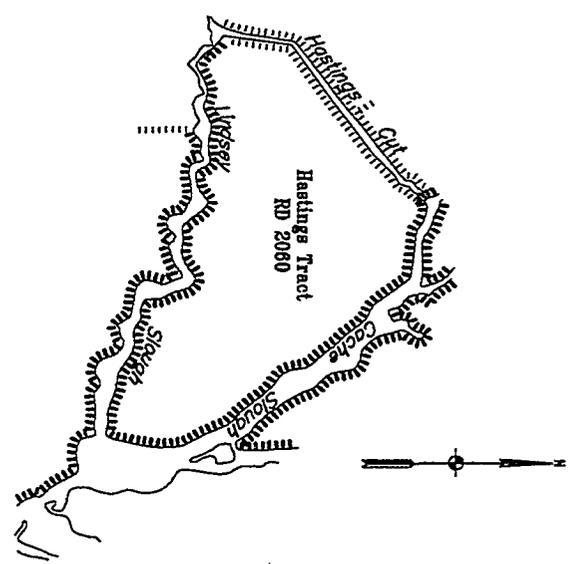
FIGURE 2

TABLE 7
 SACRAMENTO RIVER FLOOD CONTROL SYSTEMS EVALUATION PHASE IV
 AVERAGE ANNUAL EQUIVALENT BENEFITS
 OCTOBER 1993 PRICES, 8 1/4 % INTEREST RATE
 (IN \$1,000)

AREA	NON-DAMAGING	DESIGN LEVEL	AVERAGE ANNUAL WITHOUT PROJECT DAMAGES	AVERAGE ANNUAL WITH PROJECT DAMAGES	BENEFITS
HASTINGS TRACT "A" (1)	50 YEAR	60 YEAR	\$125.2	\$104.2	\$21.0
PETERS POCKET (4)	40 YEAR	50 YEAR	52.2	41.9	10.3
MOORE TRACT (5)	50 YEAR	100 YEAR	163.2	81.6	81.6
BRANNAN/ANDRUS ISLAND (8)	40 YEAR	50 YEAR	1,961.9	1,608.1	353.8
SUTTER ISLAND (9)	45 YEAR	55 YEAR	326.4	273.1	53.3
MERRITT ISLAND (10)	70 YEAR	80 YEAR	296.4	263.1	33.3
RYER ISLAND (11)	50 YEAR	60 YEAR	447.2	376.3	70.9
GRAND ISLAND (12)	35 YEAR	45 YEAR	2,208.1	1,760.9	447.2
THE BIG AREA (15)	45 YEAR	50 YEAR	1984.5	1,825.9	158.6
SOUTH LINDSEY SLOUGH (19)	35 YEAR	50 YEAR	104.7	75.5	29.2
TOTAL			\$7,669.8	\$6,410.6	\$1,259.2



NOTE: Damages include the cost of repairing one levee break and dewatering.



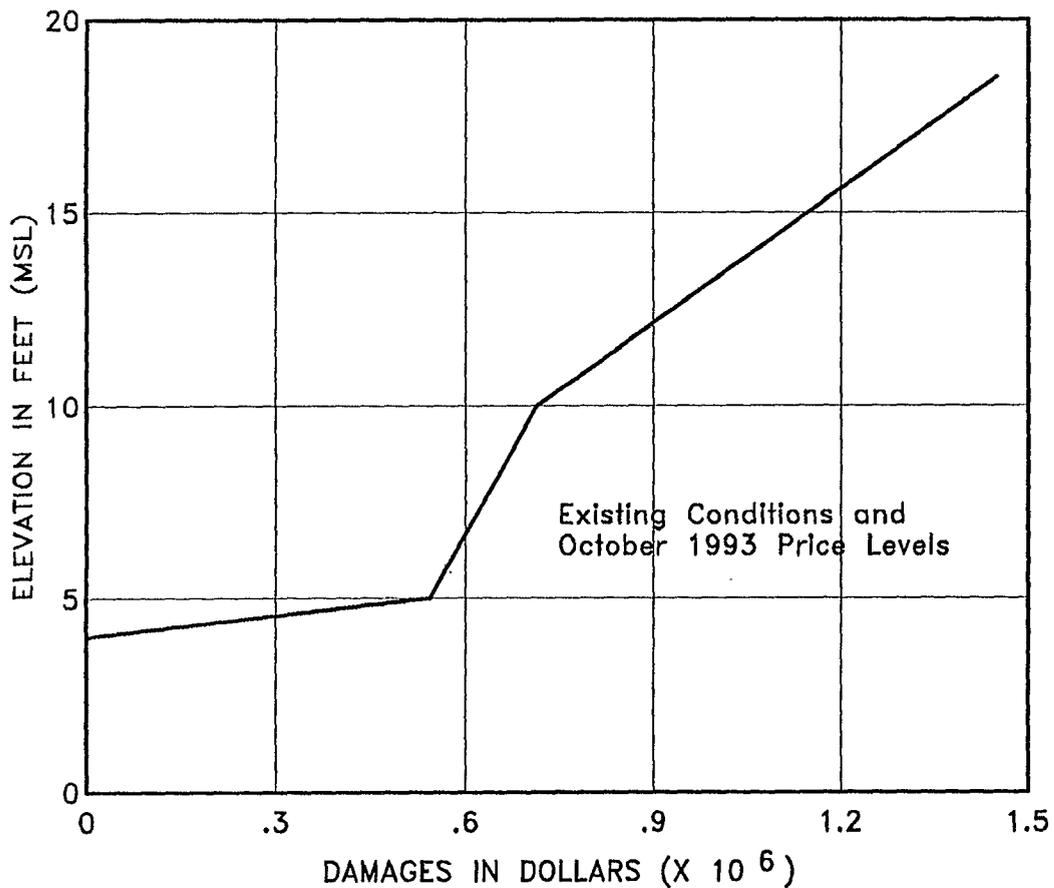
GENERAL LOCATION MAP

SACRAMENTO RIVER FLOOD CONTROL
 SYSTEM EVALUATION
 LOWER SACRAMENTO AREA

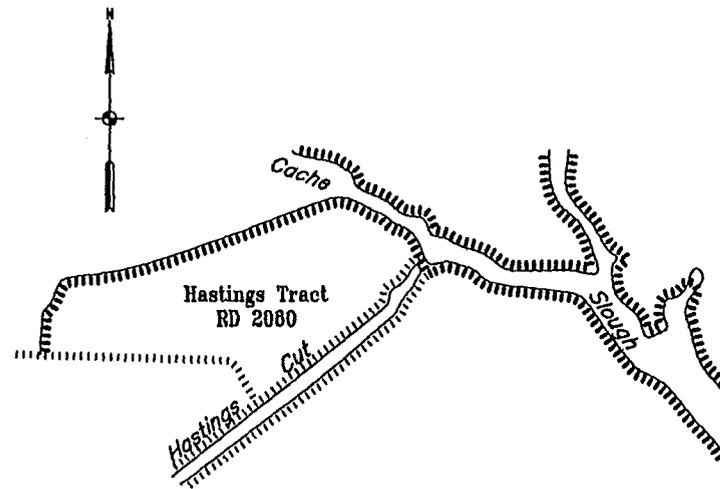
DAMAGES VERSUS ELEVATION
 RD 2060 (HASTINGS TRACT)
 (SOUTHEAST OF HASTINGS CUT)

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
 SEPTEMBER 1993

FIGURE 3



NOTE: Damages include the cost of repairing one levee break and dewatering.



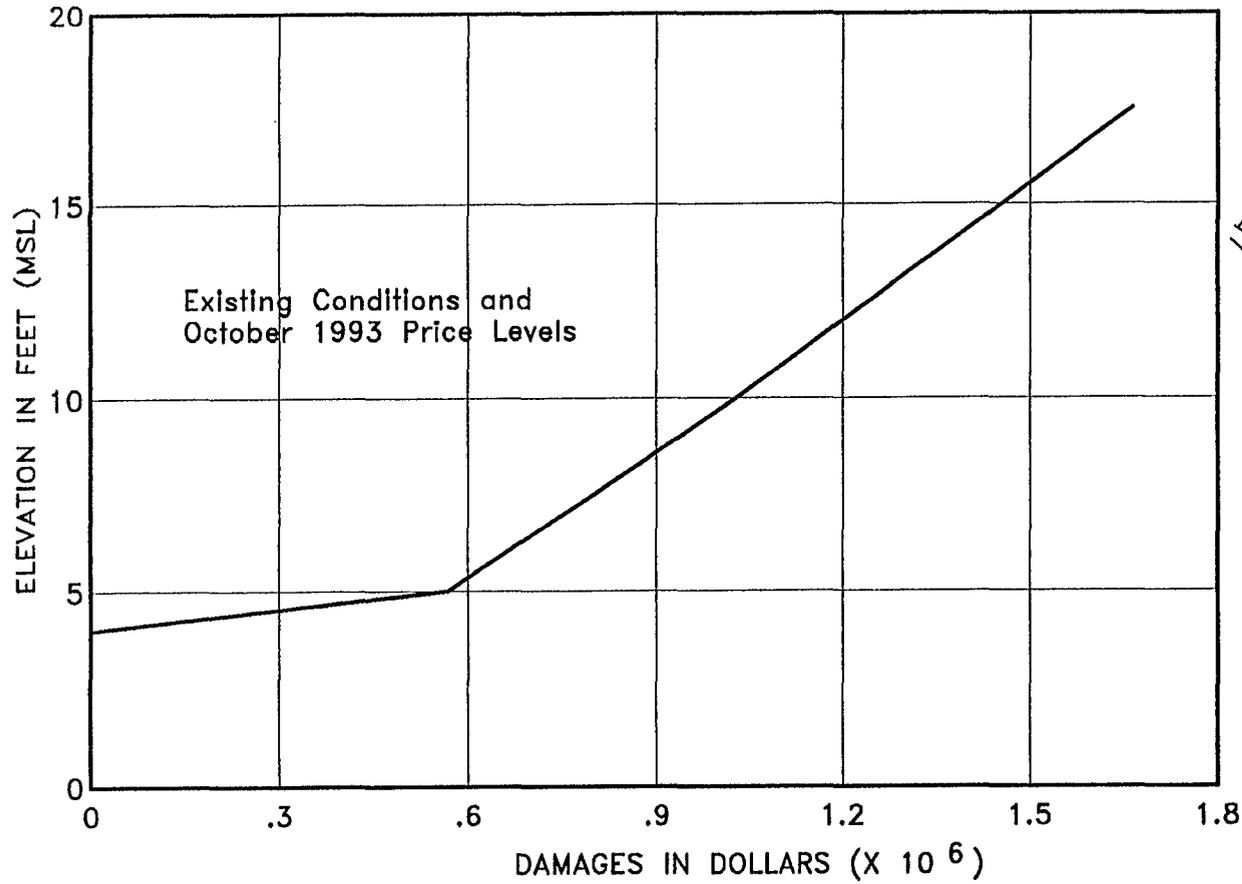
GENERAL LOCATION MAP

SACRAMENTO RIVER FLOOD CONTROL
SYSTEM EVALUATION
LOWER SACRAMENTO AREA

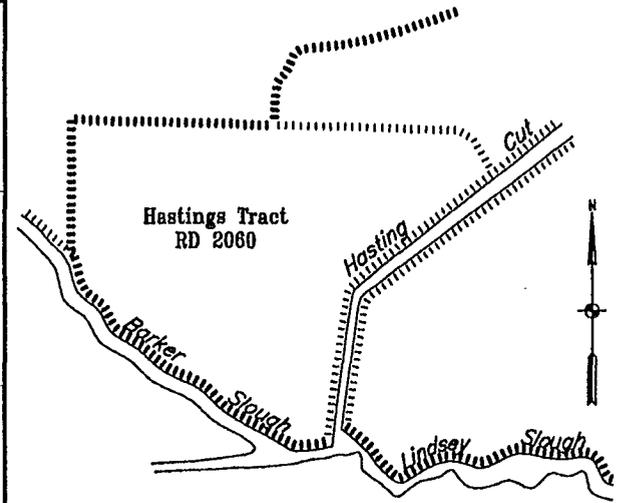
DAMAGES VERSUS ELEVATION
RD 2060 (HASTINGS TRACT)
(NORTHWEST OF HASTINGS CUT)

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SEPTEMBER 1993

FIGURE 4



NOTE: Damages include the cost of repairing one levee break and dewatering.



GENERAL LOCATION MAP

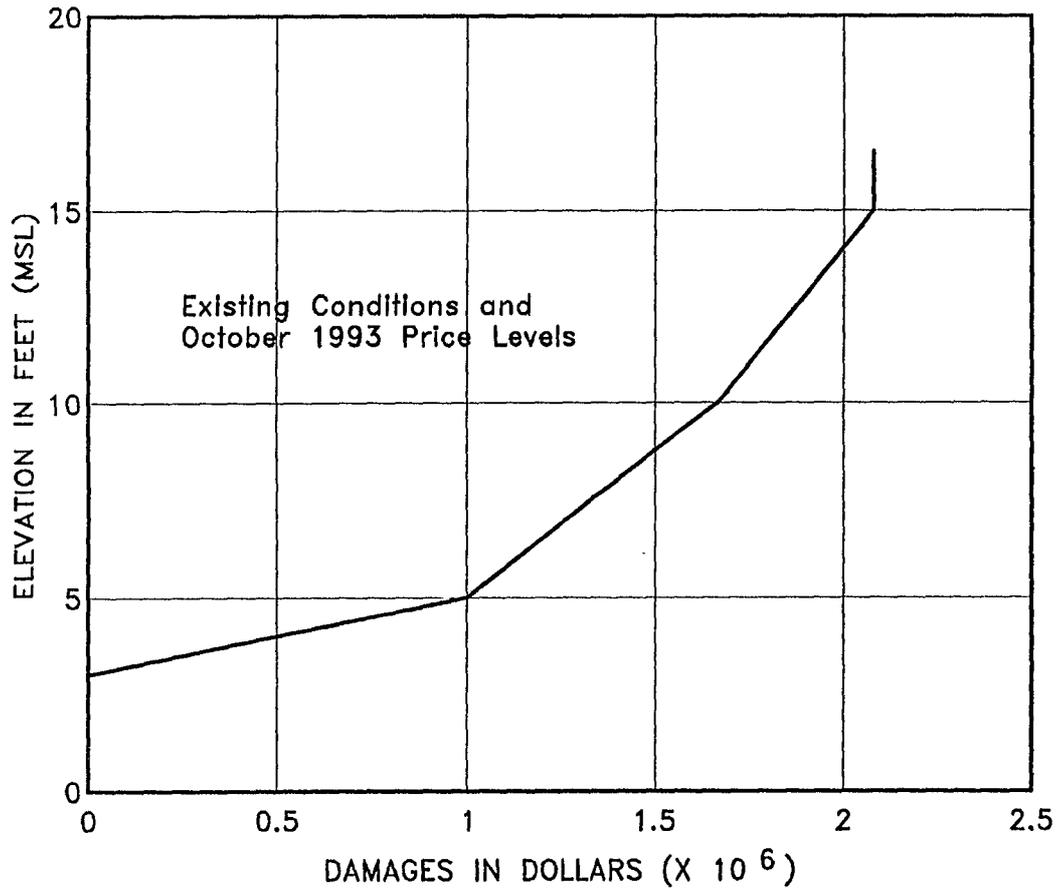
SACRAMENTO RIVER FLOOD CONTROL
SYSTEM EVALUATION
LOWER SACRAMENTO AREA

**DAMAGES VERSUS ELEVATION
RD 2060 (HASTINGS TRACT)
(WEST OF HASTINGS CUT)**

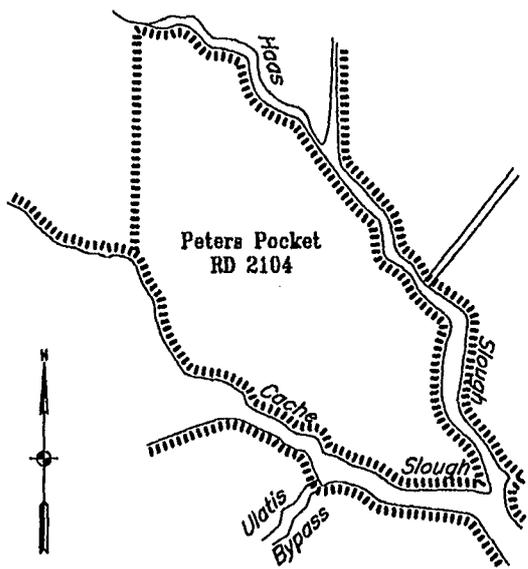
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SEPTEMBER 1993

FIGURE 5

-47-



Existing Conditions and
October 1993 Price Levels



GENERAL LOCATION MAP

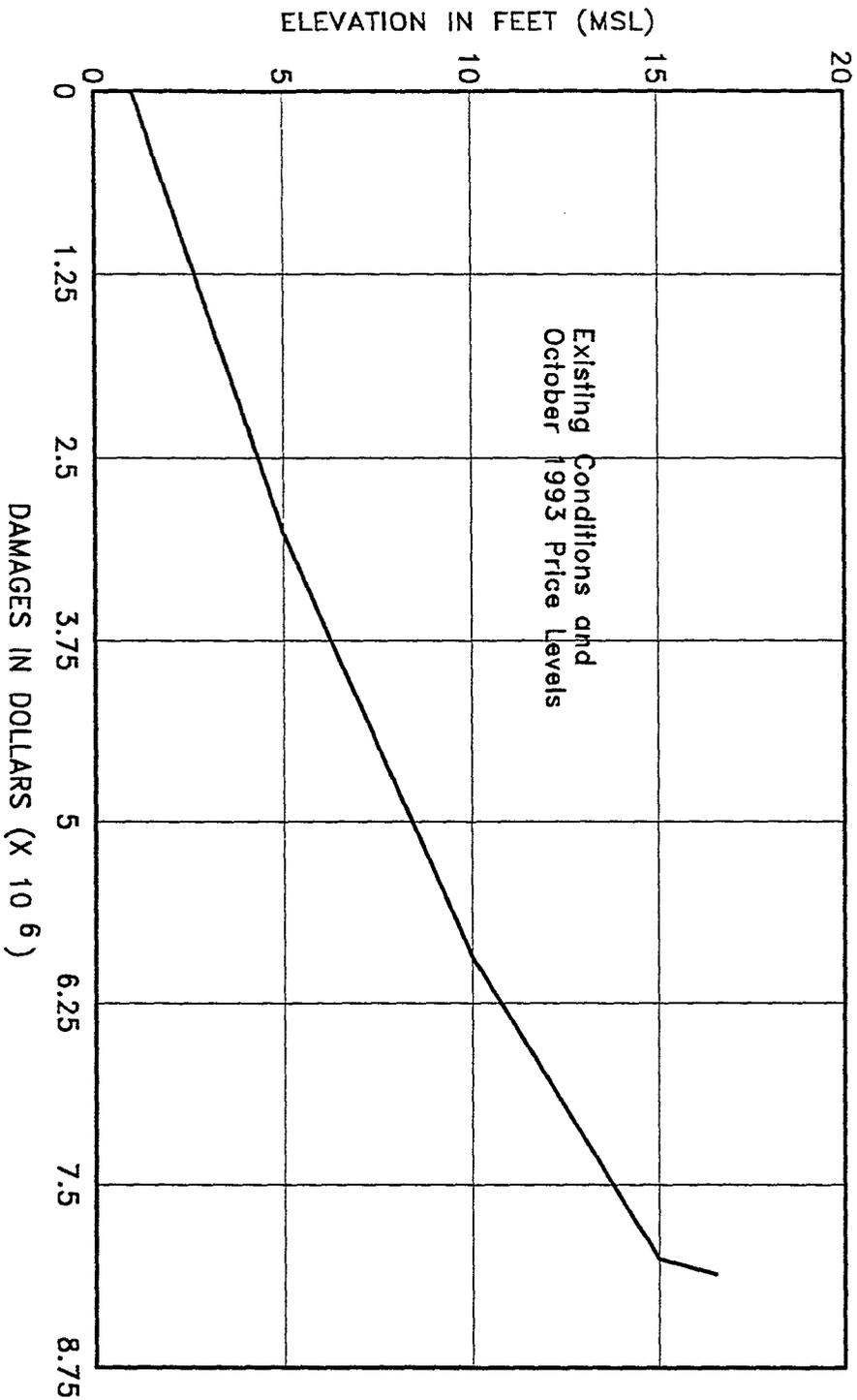
NOTE: Damages include the cost of repairing one levee break and dewatering.

SACRAMENTO RIVER FLOOD CONTROL
SYSTEM EVALUATION
LOWER SACRAMENTO AREA

DAMAGES VERSUS ELEVATION
RD 2104 (PETERS POCKET)

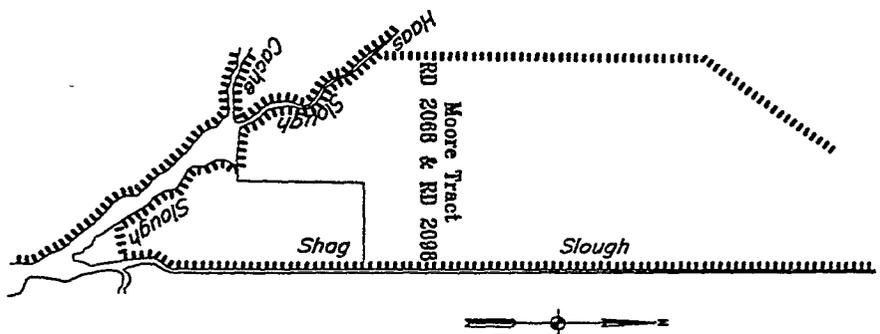
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SEPTEMBER 1993

FIGURE 6



NOTE: Damages include the cost of repairing one levee break and dewatering.

GENERAL LOCATION MAP



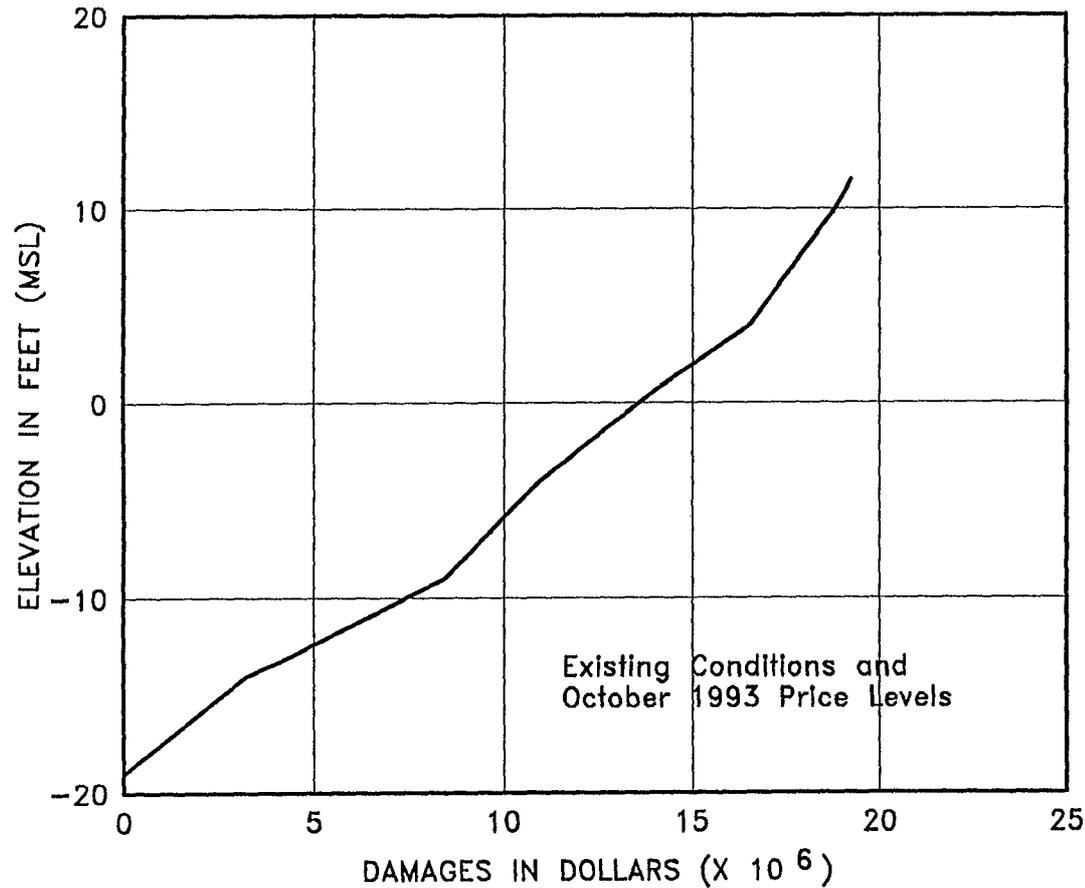
GENERAL LOCATION MAP

SACRAMENTO RIVER FLOOD CONTROL
SYSTEM EVALUATION
LOWER SACRAMENTO AREA

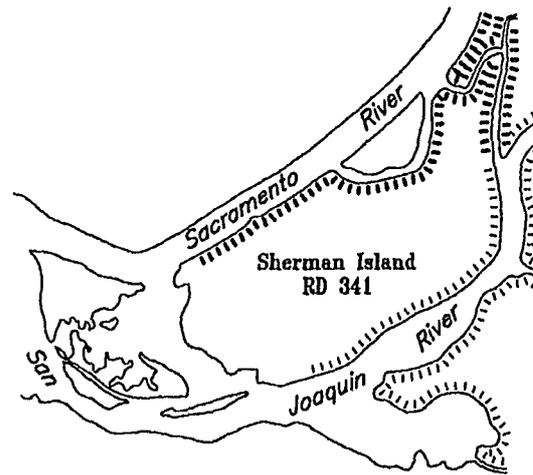
DAMAGES VERSUS ELEVATION
RD 2068 & RD 2098
(MOORE TRACT)

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SEPTEMBER 1993

FIGURE 7



NOTE: Damages include the cost of repairing one levee break and dewatering.



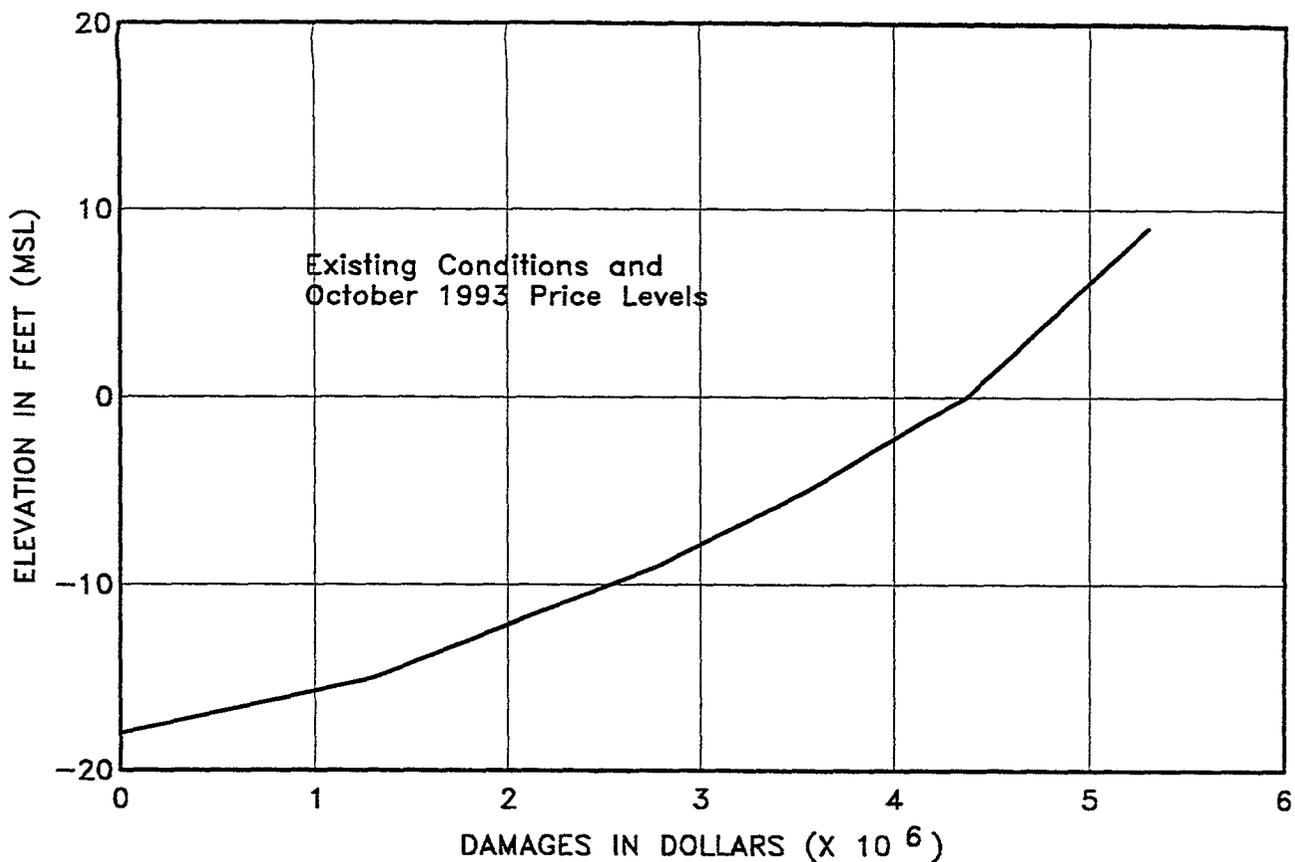
GENERAL LOCATION MAP

SACRAMENTO RIVER FLOOD CONTROL
SYSTEM EVALUATION
LOWER SACRAMENTO AREA

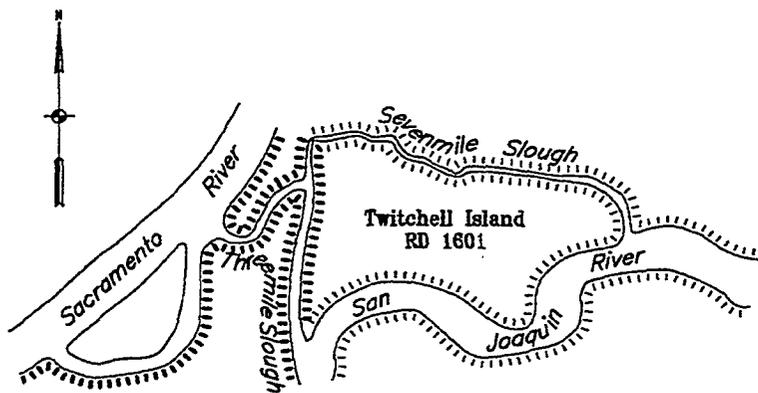
**DAMAGES VERSUS ELEVATION
RD 341 (SHERMAN ISLAND)**

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 1993

FIGURE 8



NOTE: Damages include the cost of repairing one levee break and dewatering.



GENERAL LOCATION MAP

SACRAMENTO RIVER FLOOD CONTROL
SYSTEM EVALUATION
LOWER SACRAMENTO AREA

DAMAGES VERSUS ELEVATION
RD 1601 (TWITCHELL ISLAND)

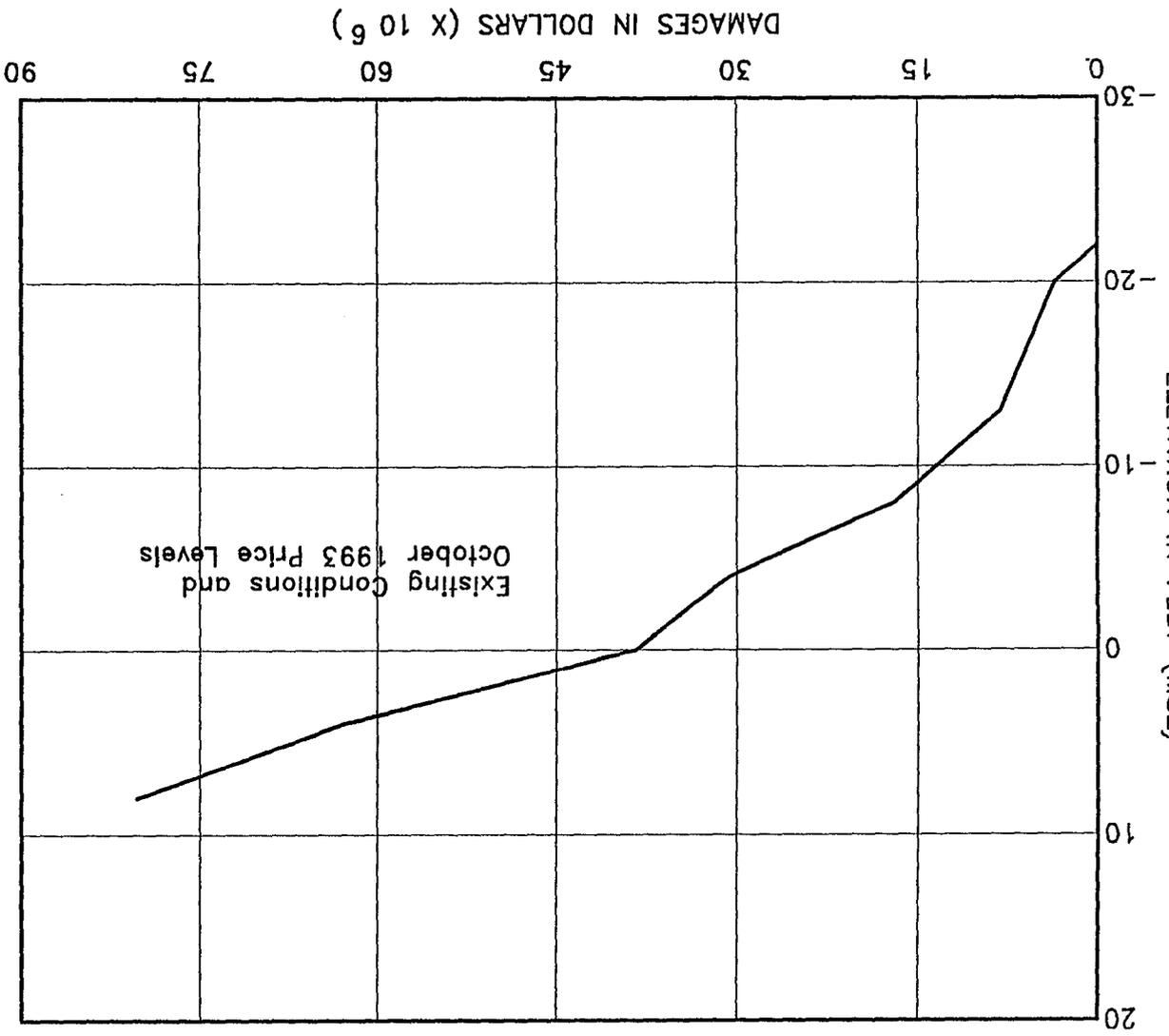
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SEPTEMBER 1993

FIGURE 9

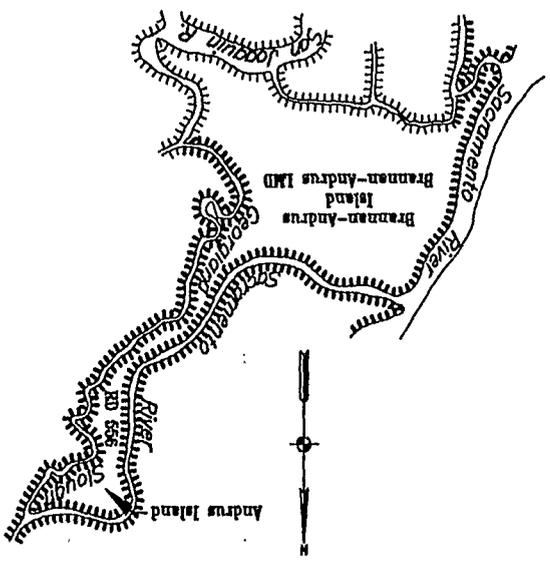
SACRAMENTO RIVER FLOOD CONTROL
 SYSTEM EVALUATION
 LOWER SACRAMENTO AREA
 DAMAGES VERSUS ELEVATION
 BRANNAN-ANDRUS LEVEE
 MAINTENANCE DIST. & RD 556
 (BRANNAN-ANDRUS AND
 ANDRUS ISLAND)
 SACRAMENTO DISTRICT, CORPS OF ENGINEERS
 SEPTEMBER 1993

FIGURE 10

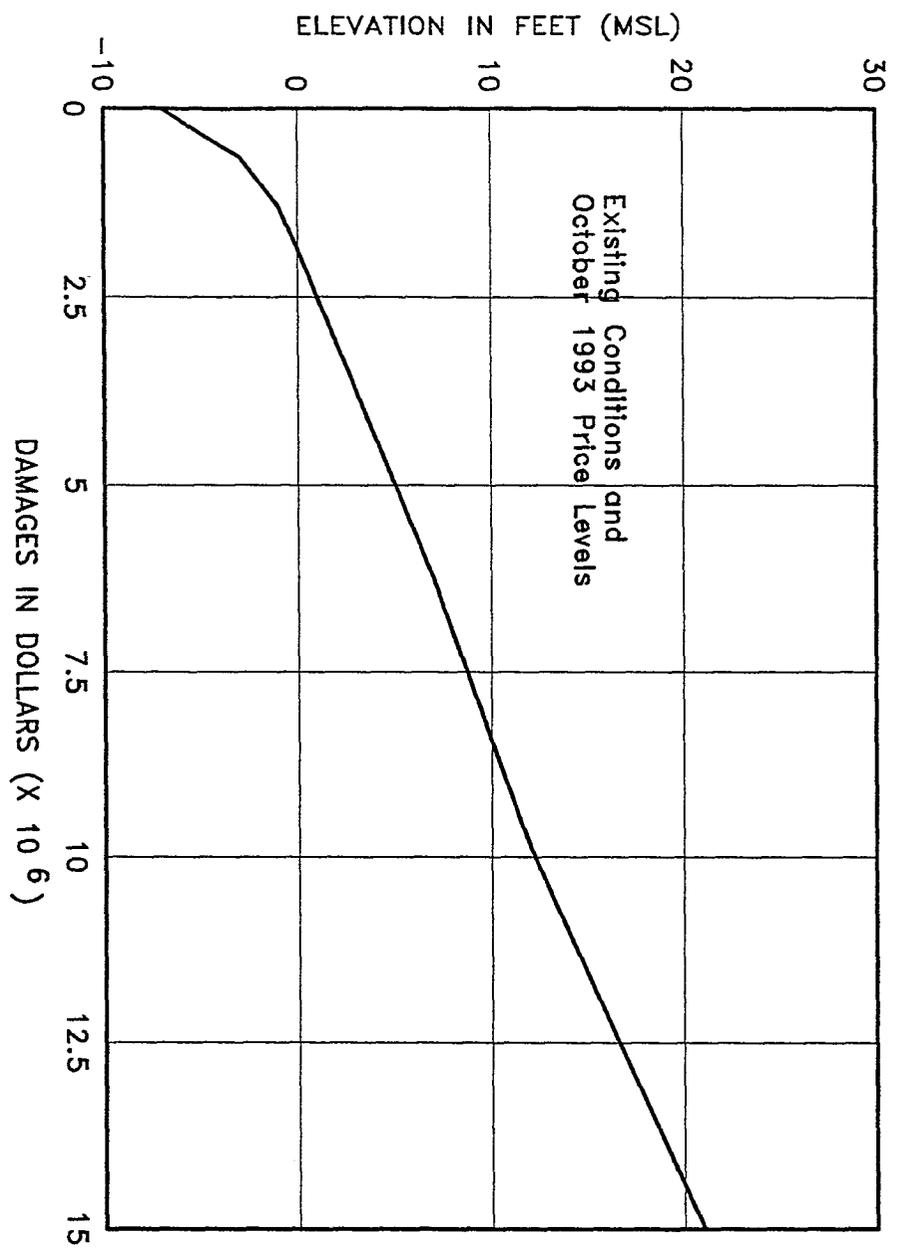
NOTE: Damages include the cost of repairing one levee break and dewatering.



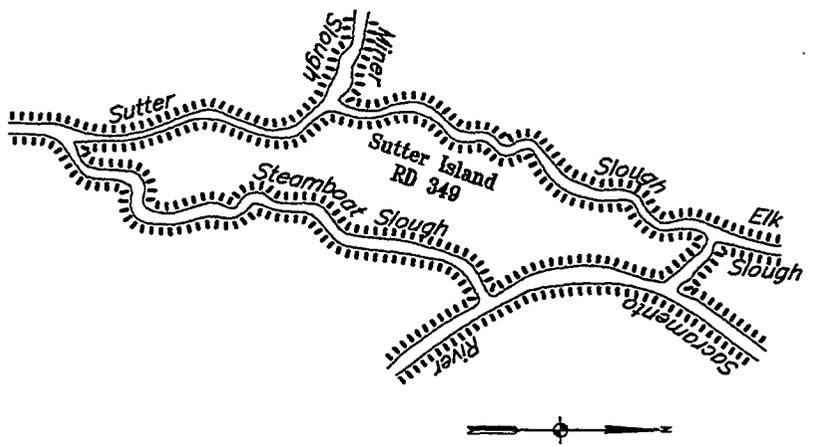
GENERAL LOCATION MAP



C-103719



NOTE: Damages include the cost of repairing one levee break and dewatering.



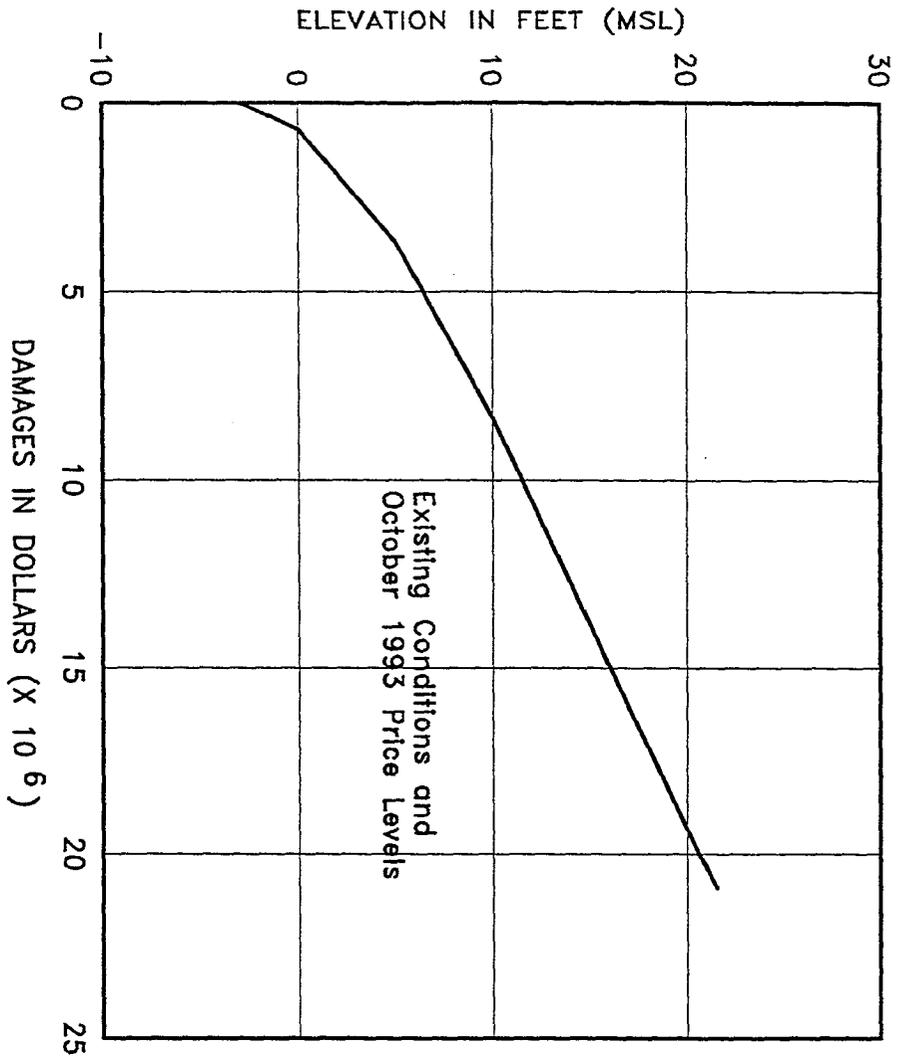
GENERAL LOCATION MAP

SACRAMENTO RIVER FLOOD CONTROL
 SYSTEM EVALUATION
 LOWER SACRAMENTO AREA

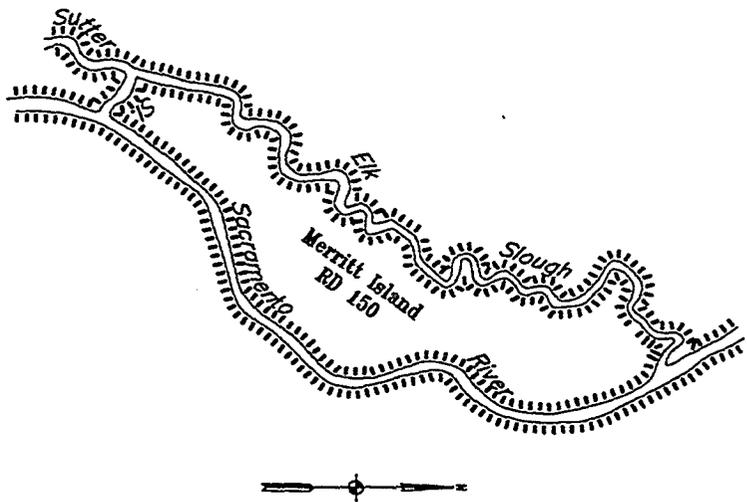
**DAMAGES VERSUS ELEVATION
 RD 349 (SUTTER ISLAND)**

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
 SEPTEMBER 1993

FIGURE 11



NOTE: Damages include the cost of repairing one levee break and dewatering.



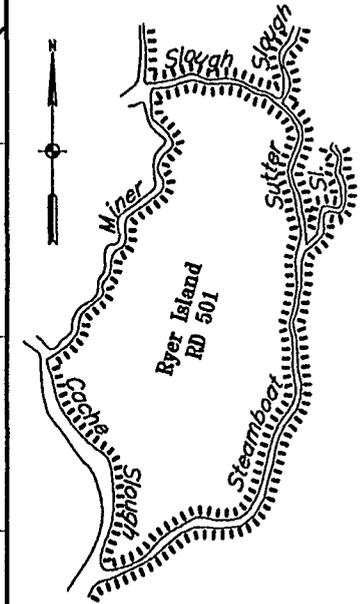
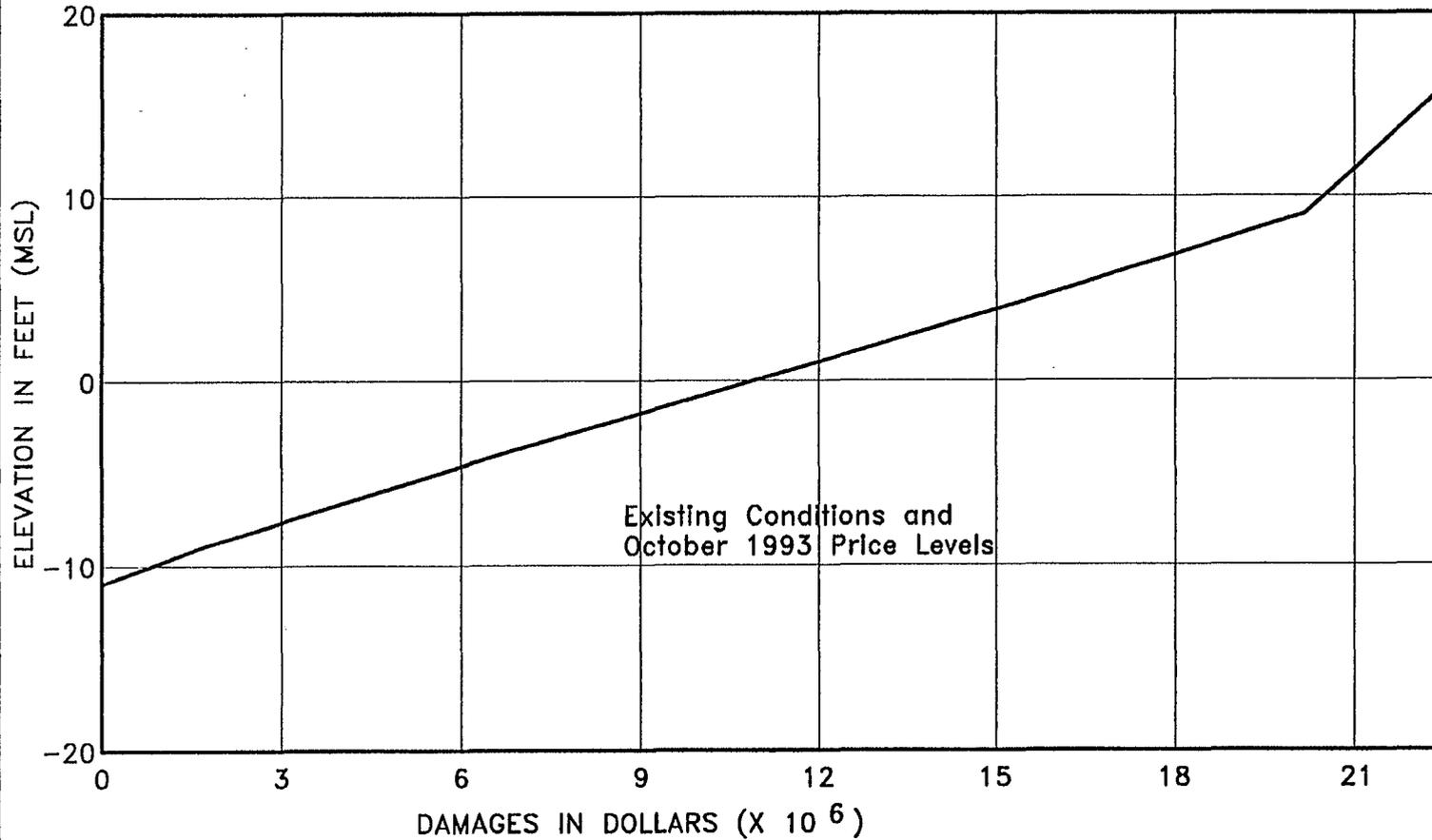
GENERAL LOCATION MAP

SACRAMENTO RIVER FLOOD CONTROL
SYSTEM EVALUATION
LOWER SACRAMENTO AREA

DAMAGES VERSUS ELEVATION
RD 150 (MERRITT ISLAND)

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SEPTEMBER 1993

FIGURE 12



GENERAL LOCATION MAP

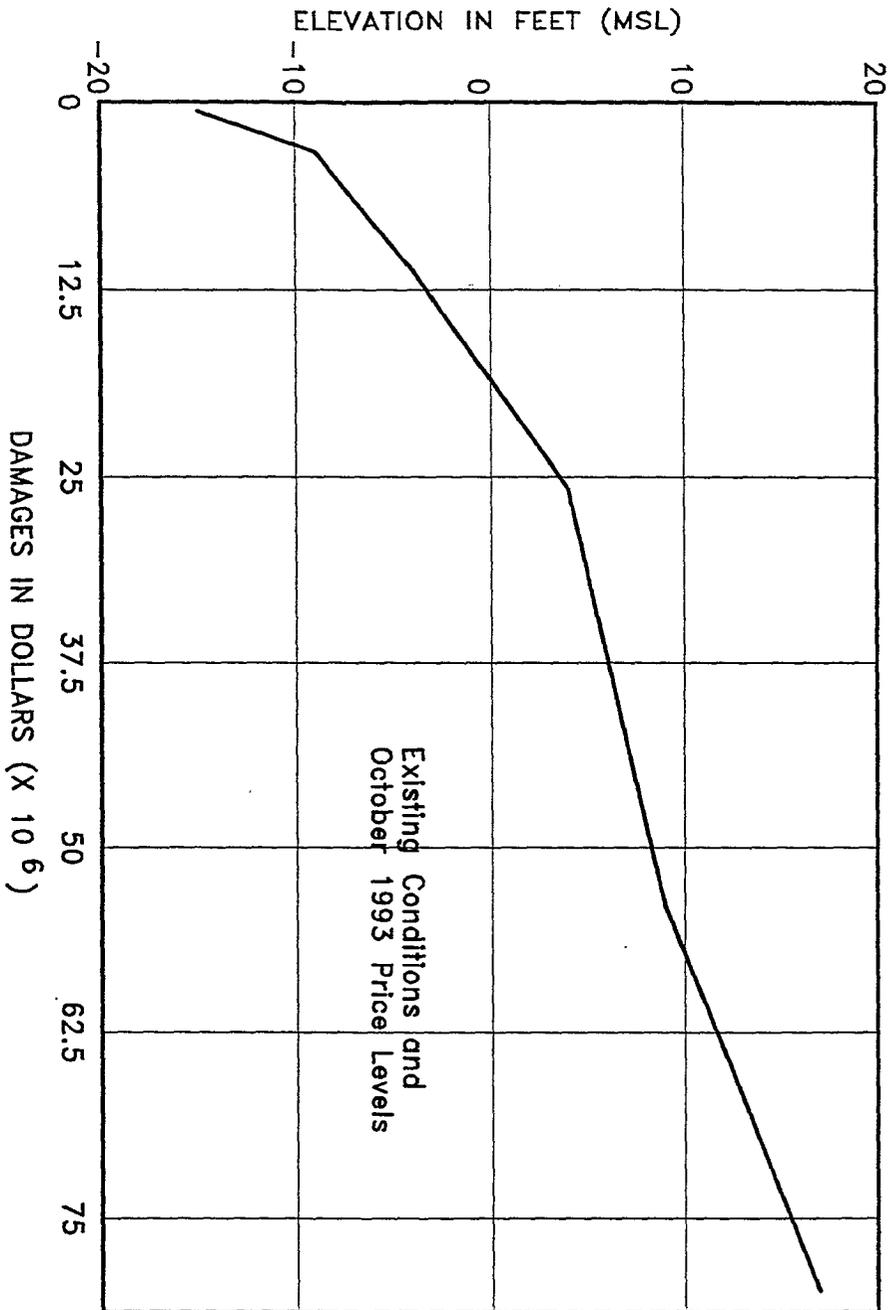
NOTE: Damages include the cost of repairing one levee break and dewatering.

SACRAMENTO RIVER FLOOD CONTROL
SYSTEM EVALUATION
LOWER SACRAMENTO AREA

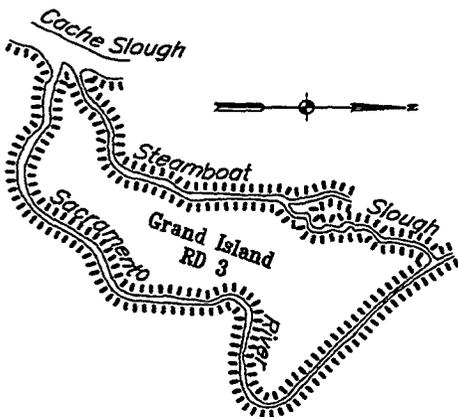
**DAMAGES VERSUS ELEVATION
RD 501 (RYER ISLAND)**

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SEPTEMBER 1993

FIGURE 13



NOTE: Damages include the cost of repairing one levee break and dewatering.



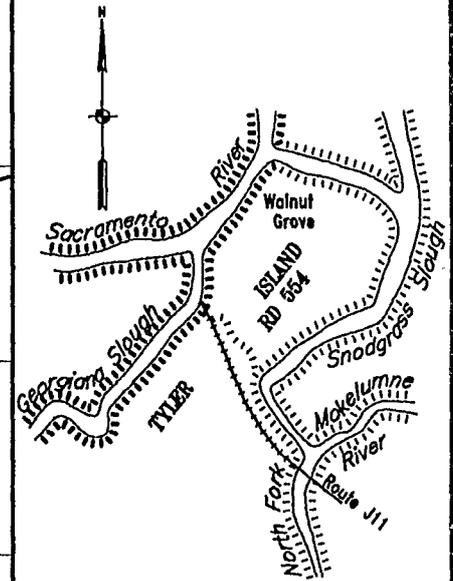
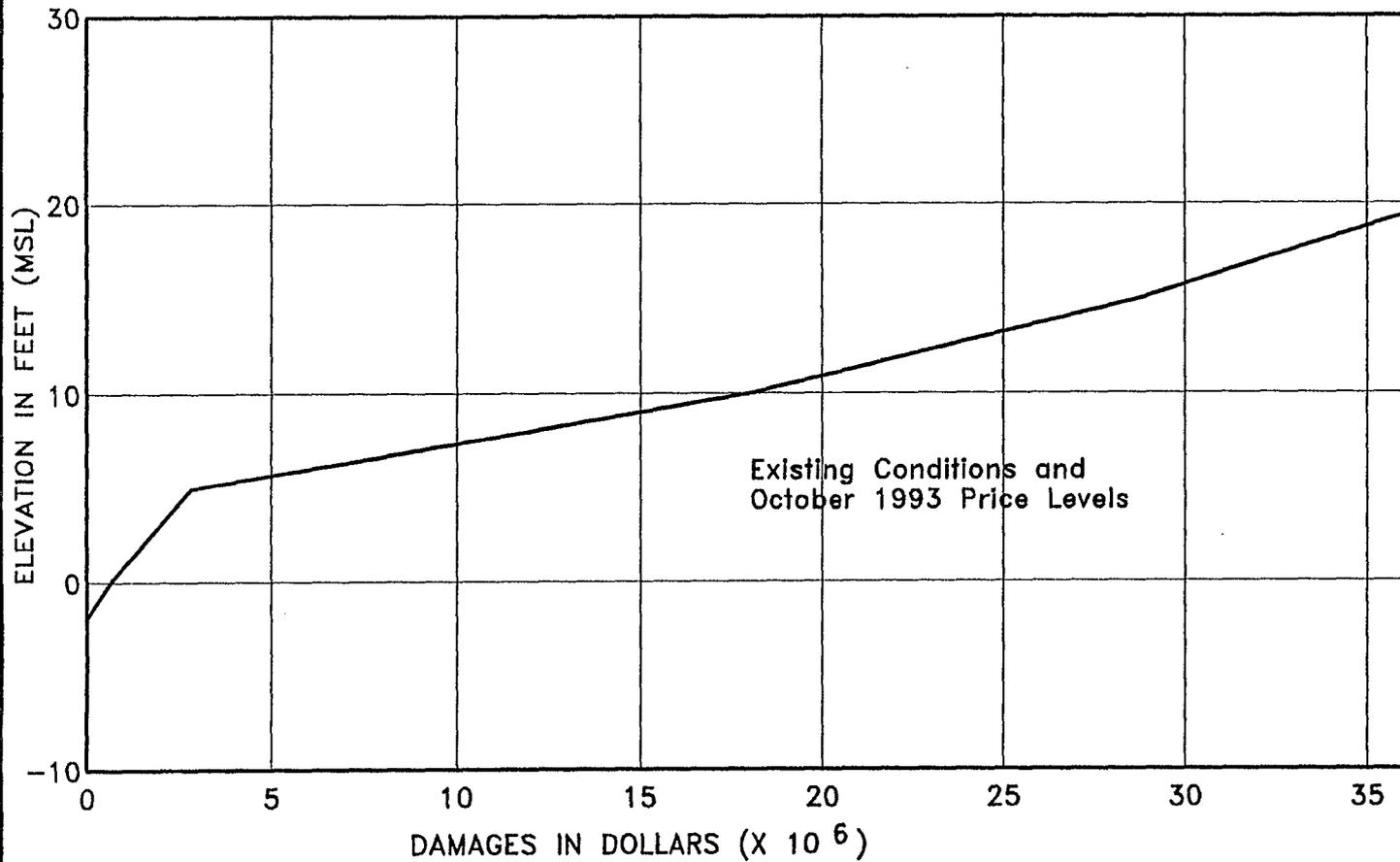
GENERAL LOCATION MAP

SACRAMENTO RIVER FLOOD CONTROL
SYSTEM EVALUATION
LOWER SACRAMENTO AREA

DAMAGES VERSUS ELEVATION
RD 3 (GRAND ISLAND)

SACRAMENTO DISTRICT CORPS OF ENGINEERS
SEPTEMBER 1983

FIGURE 14



GENERAL LOCATION MAP

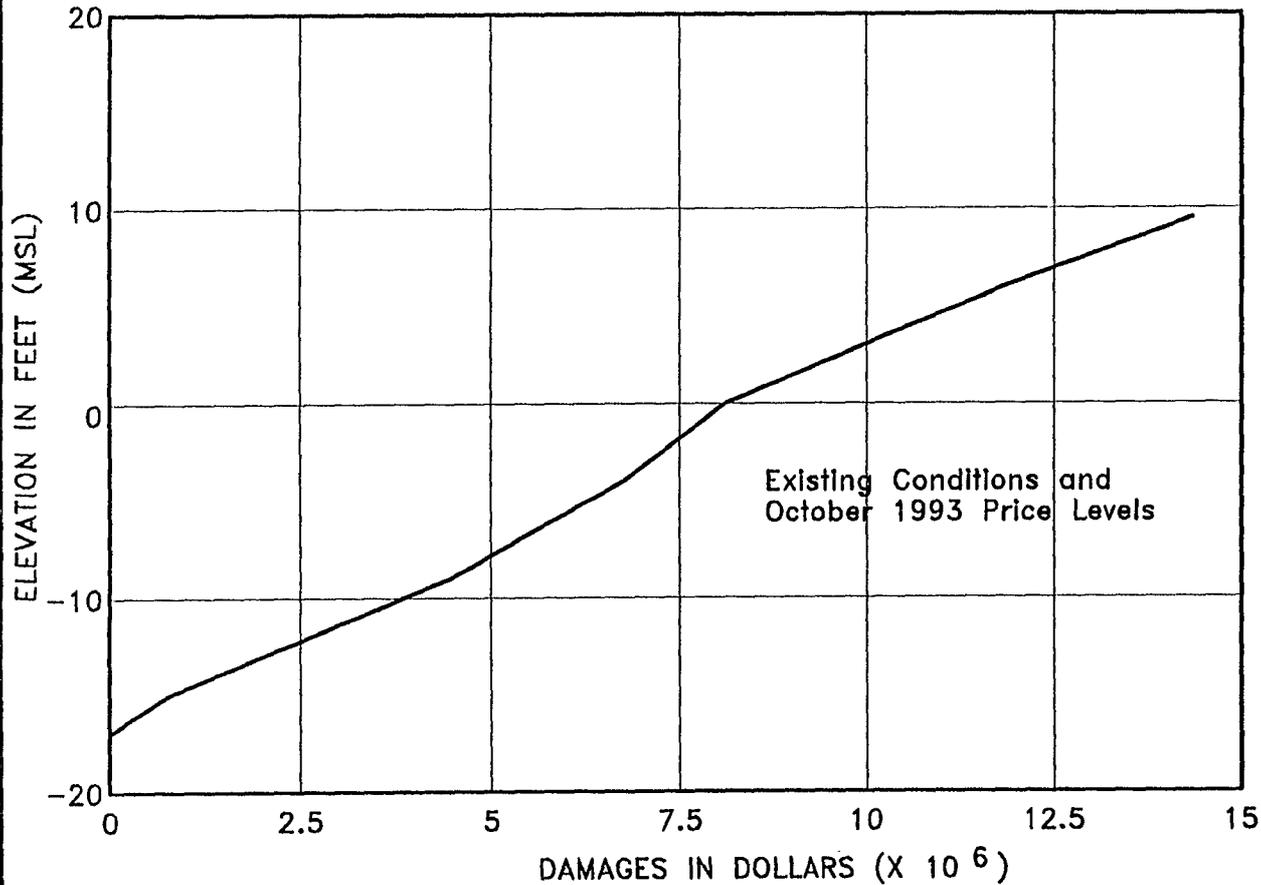
NOTE: Damages include the cost of repairing one levee break and dewatering.

SACRAMENTO RIVER FLOOD CONTROL SYSTEM EVALUATION LOWER SACRAMENTO AREA

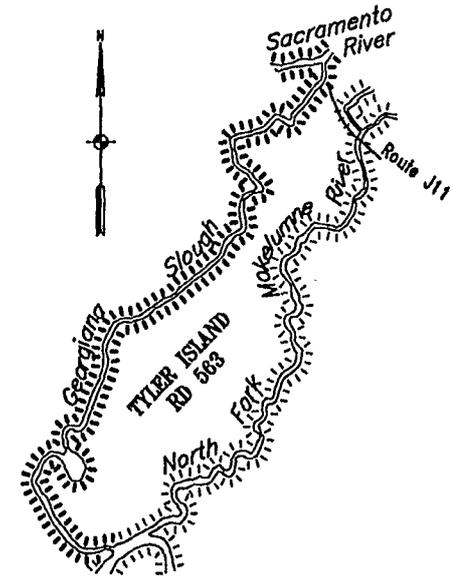
DAMAGES VERSUS ELEVATION RD 554 (TYLER ISLAND) NORTH OF ROUTE J11

SACRAMENTO DISTRICT, CORPS OF ENGINEERS SEPTEMBER 1993

FIGURE 15



NOTE: Damages include the cost of repairing one levee break and dewatering.



GENERAL LOCATION MAP

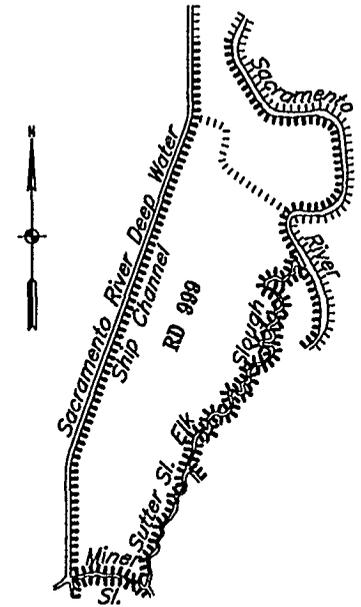
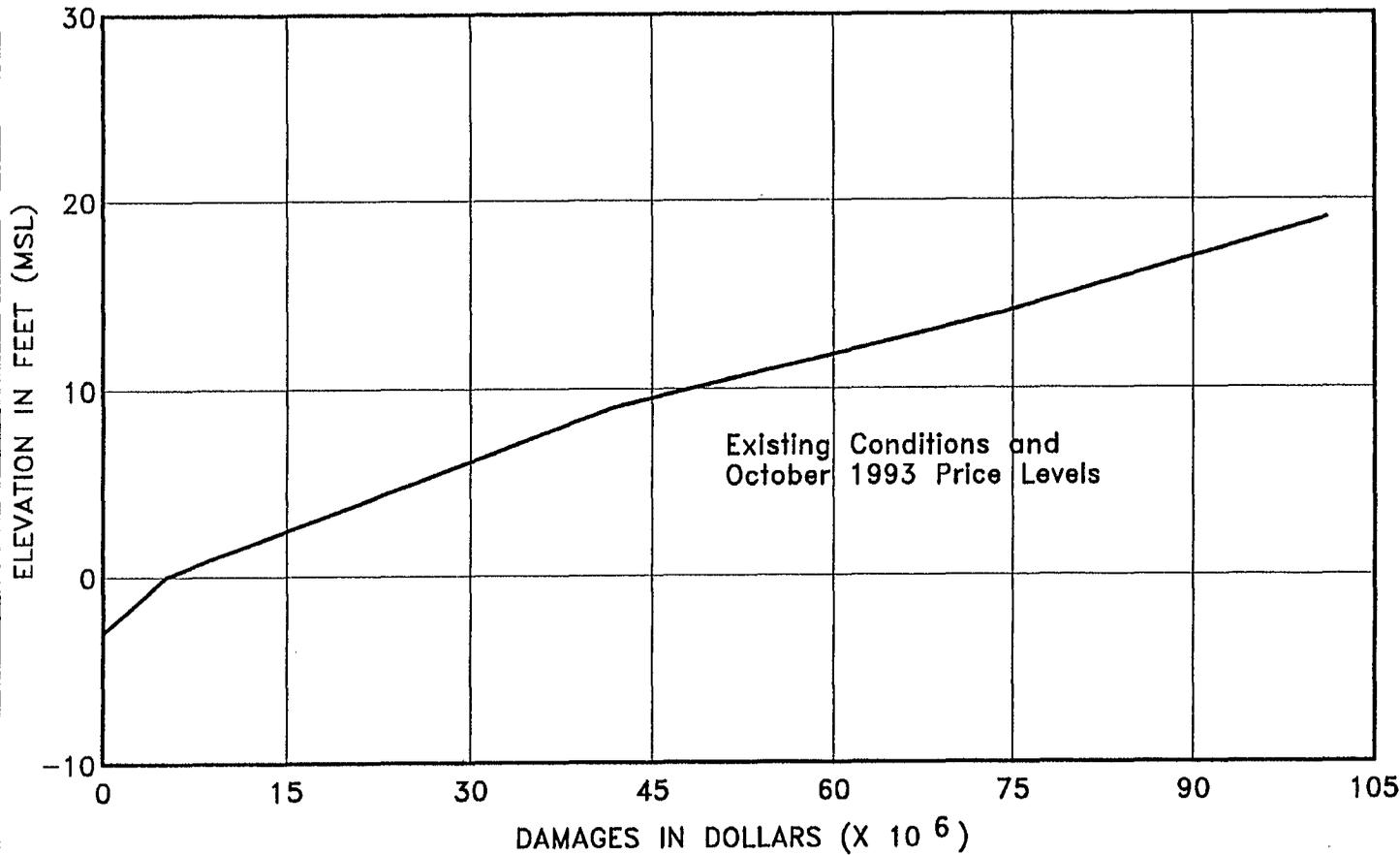
SACRAMENTO RIVER FLOOD CONTROL
 SYSTEM EVALUATION
 LOWER SACRAMENTO AREA

DAMAGES VERSUS ELEVATION
 RD 563 (TYLER ISLAND)
 SOUTH OF ROUTE J11

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
 SEPTEMBER 1993

FIGURE 16

C-103725



GENERAL LOCATION MAP

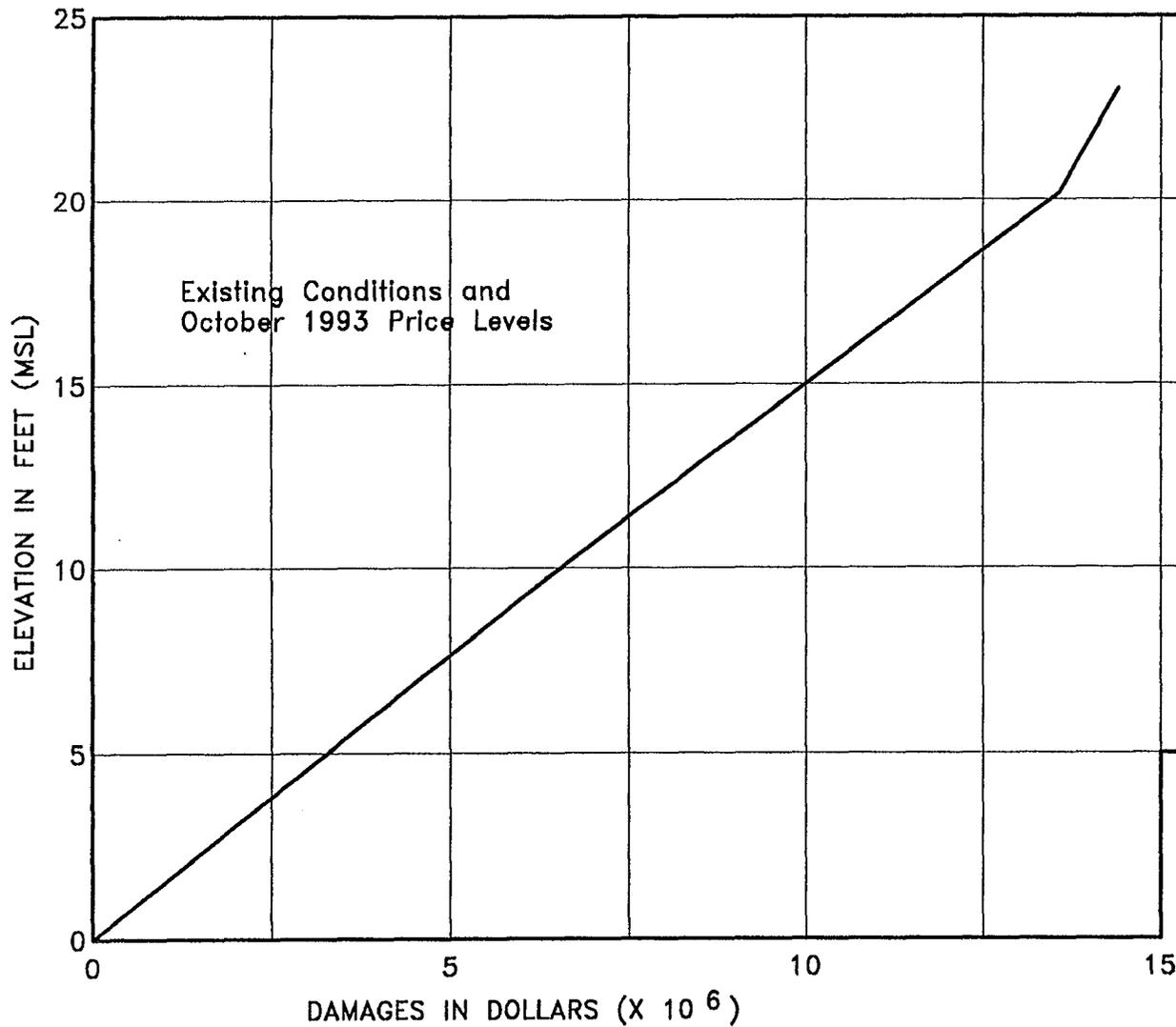
NOTE: Damages include the cost of repairing one levee break and dewatering.

SACRAMENTO RIVER FLOOD CONTROL SYSTEM EVALUATION LOWER SACRAMENTO AREA

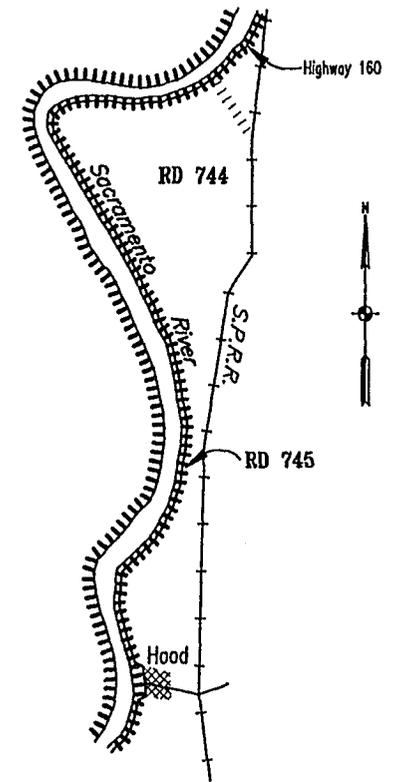
DAMAGES VERSUS ELEVATION RD 999

SACRAMENTO DISTRICT, CORPS OF ENGINEERS SEPTEMBER 1993

FIGURE 17



NOTE: Damages include the cost of repairing one levee break and dewatering.



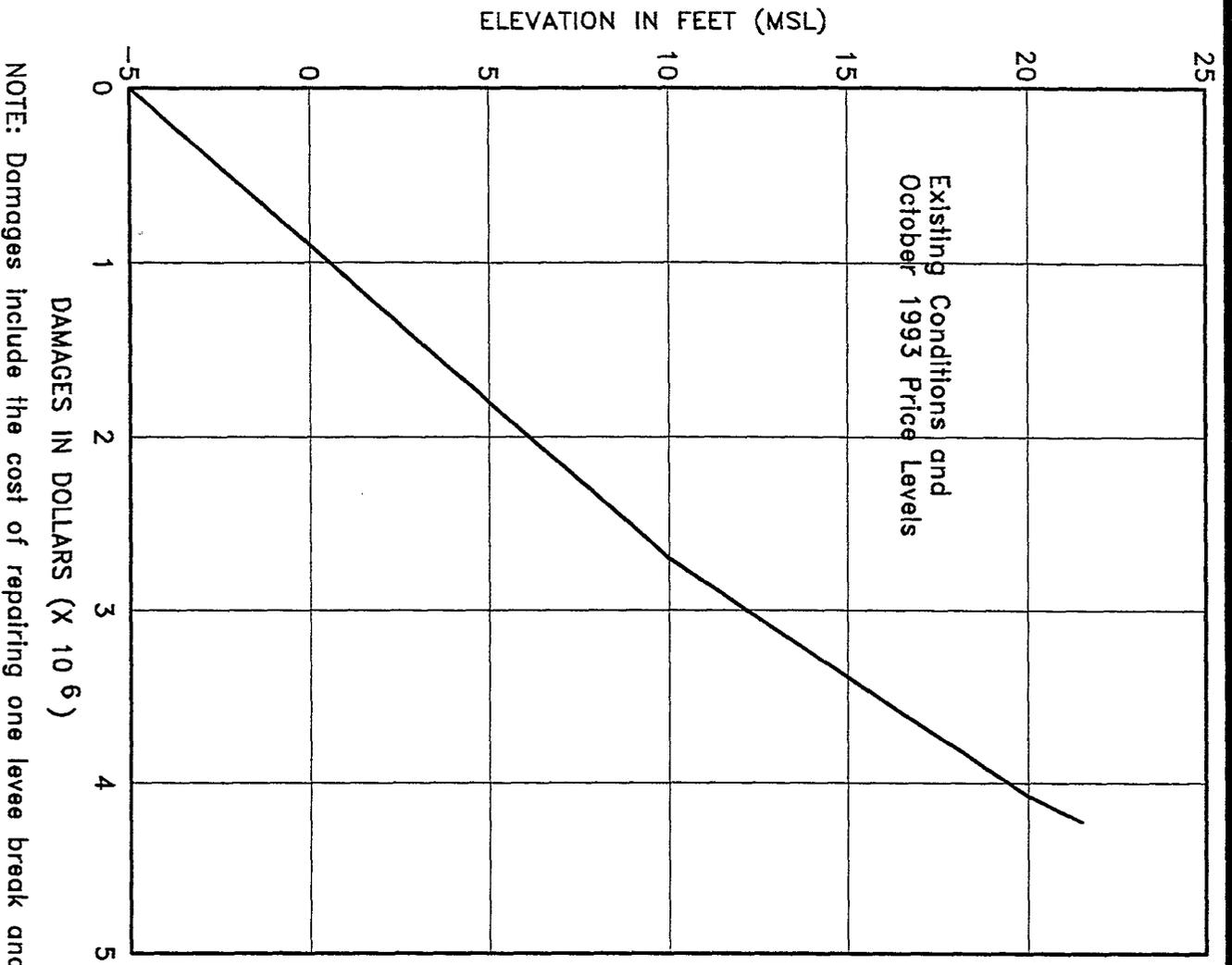
GENERAL LOCATION MAP

SACRAMENTO RIVER FLOOD CONTROL
SYSTEM EVALUATION
LOWER SACRAMENTO AREA

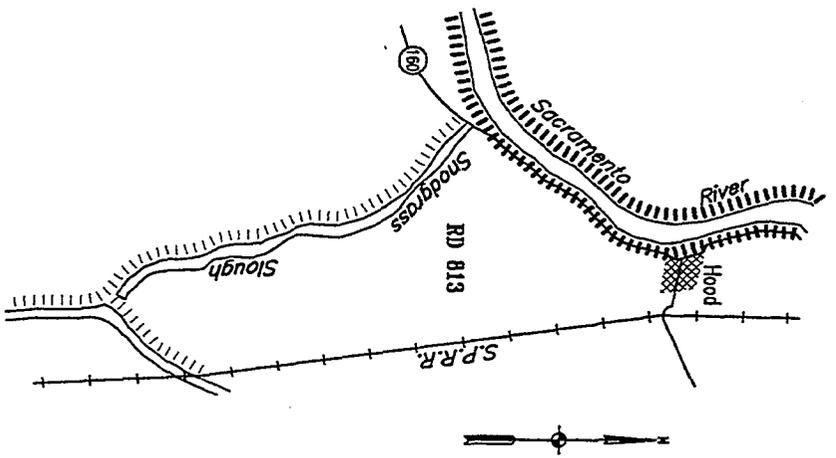
DAMAGES VERSUS ELEVATION
MA 9
(HOOD AREA)

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SEPTEMBER 1993

FIGURE 18

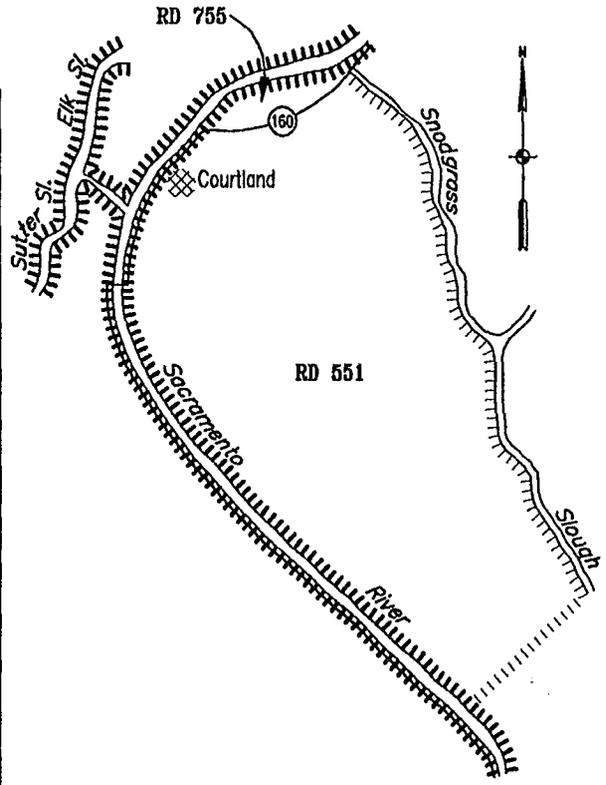
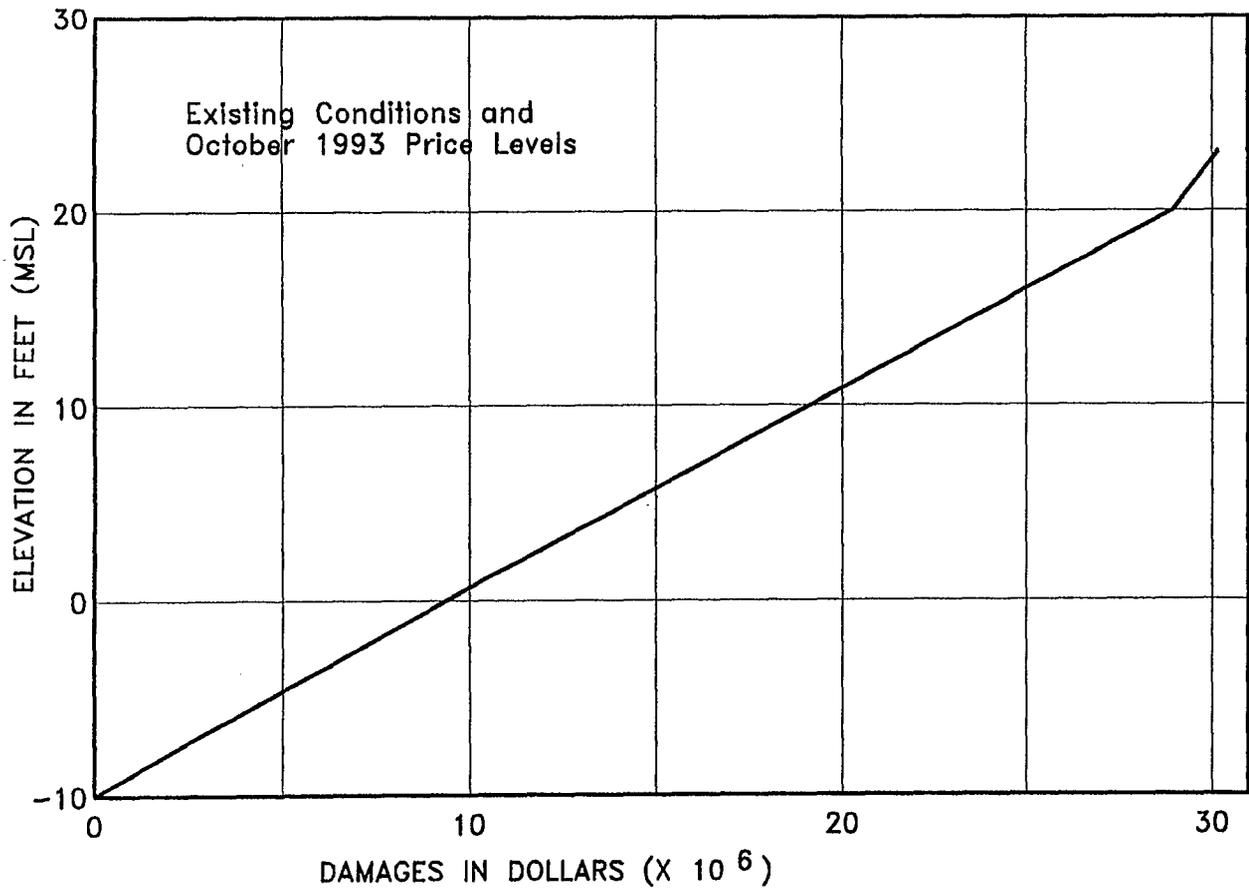


NOTE: Damages include the cost of repairing one levee break and dewatering.



GENERAL LOCATION MAP

SACRAMENTO RIVER FLOOD CONTROL
 SYSTEM EVALUATION
 LOWER SACRAMENTO AREA
 MA 9
 DAMAGES VERSUS ELEVATION
 (HOOD TO SNODGRASS SLOUGH)
 SACRAMENTO DISTRICT, CORPS OF ENGINEERS
 SEPTEMBER 1993
 FIGURE 19



GENERAL LOCATION MAP

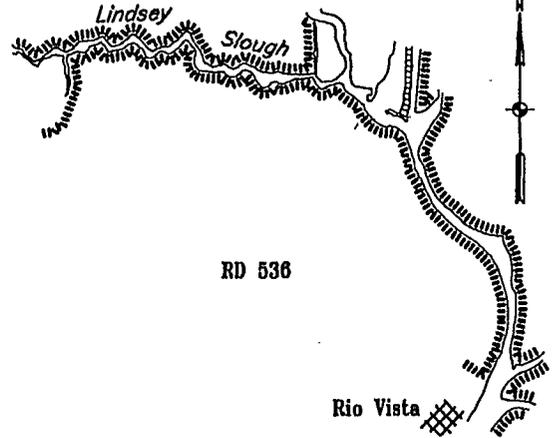
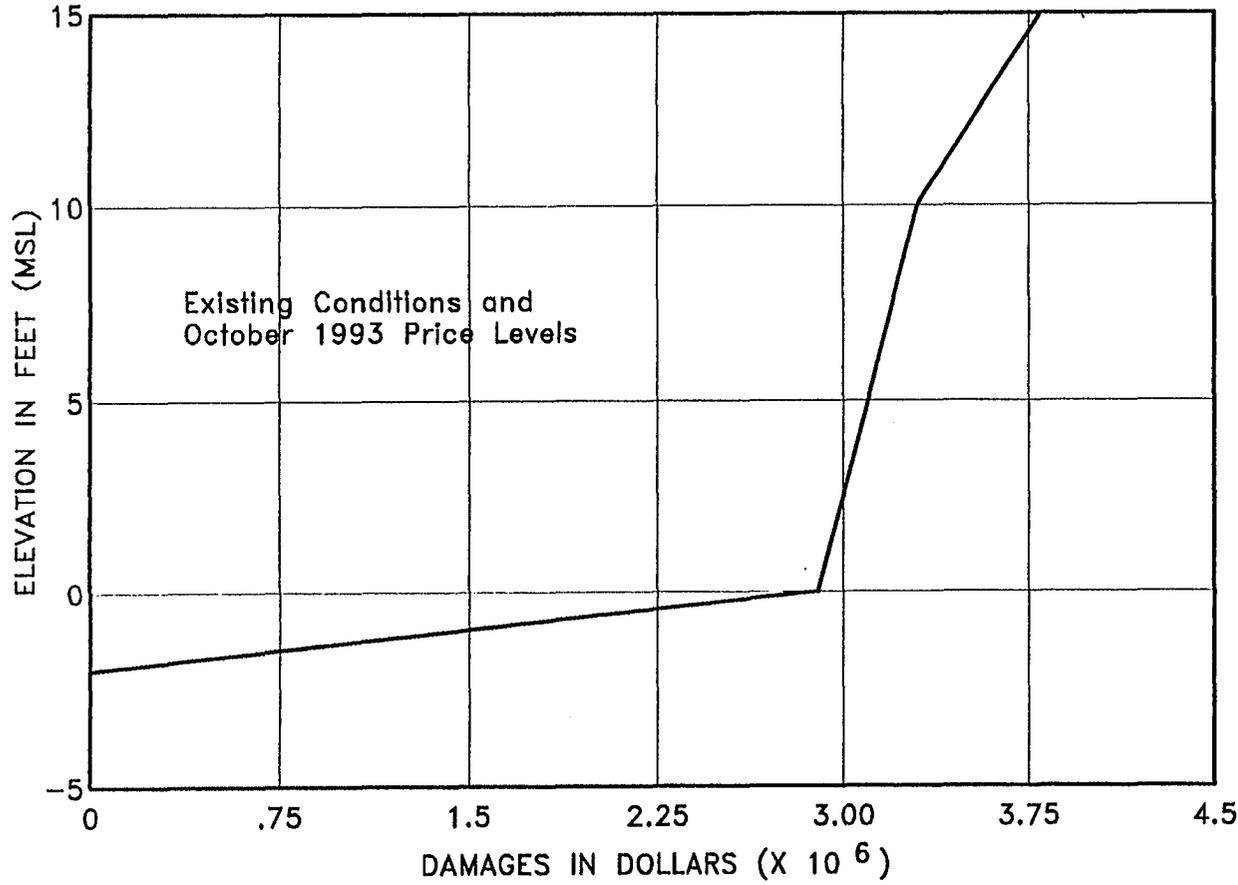
SACRAMENTO RIVER FLOOD CONTROL
SYSTEM EVALUATION
LOWER SACRAMENTO AREA

DAMAGES VERSUS ELEVATION
RD 551
(COURTLAND AREA)

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SEPTEMBER 1993

FIGURE 20

NOTE: Damages include the cost of repairing one levee break and dewatering.



GENERAL LOCATION MAP

NOTE: Damages include the cost of repairing one levee break and dewatering.

SACRAMENTO RIVER FLOOD CONTROL
 SYSTEM EVALUATION
 LOWER SACRAMENTO AREA

DAMAGES VERSUS ELEVATION
 RD 536
 (S. LINDSEY SLOUGH)

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
 SEPTEMBER 1993

FIGURE 21