

California State Lands Commission

Sacramento River Marina
Carrying Capacity Study

Contract C8462

Developed by

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In Association with

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Mr. Gary Horn
California State Lands Commission
1807 13th Street
Sacramento, California 95814

Subject: Sacramento River Marina Carrying Capacity Study C8462
(fiscal limit \$114,094.00) plus Amendment #1 (\$29,445.00)

Dear Gary,

The Riparian Systems/Meyer Resources team is please to submit our final report on the Sacramento River Carrying Capacity. We wish to thank you and the State Lands Commission staff who worked with us and reviewed our draft materials. We especially appreciate the contributions of Executive Director Claire Dedrick, Jim Trout, Gary Horn, Dan Gorfain, Diana Jacobs and Kirk Walker.

We also acknowledge the cooperation and valuable comments we received from Toke Masuda and Steve Dee of the City of Sacramento. Their coordination of responses from various City departments was invaluable. Walt Ueda and Suzanne Taylor from Sacramento County and Ben Hulse and Harry Gibson from Yolo County are thanked for their comments from the regional perspective. The county Sheriffs and City Police were especially helpful.

Numerous state and federal agency personnel were cooperative in our obtaining data for our analysis as well as providing comments on draft material. In particular, we wish to thank Ralph Hinton from Cal. DWR, Roger Hagen from Cal. DMV, Ron Schlorff, Earl Cummings and Fred Meyer from Cal. Fish and Game, Jim Matsueda from Cal. Boating and Waterways, Bob Manning from the State Reclamation Board, Walter Pettit from the State Water Resources Control Board, Cay Goude from

the U.S. Fish and Wildlife Service, Jim Bybee and Paget Leh-Lenarz from National Marine Fisheries Service, James Blodgett from U.S.G.S. and Bob Clark from the Army Corps of Engineers.

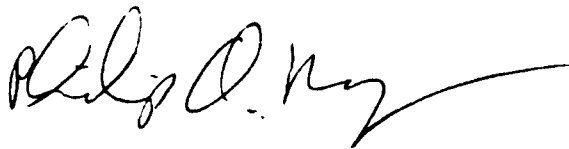
Our marina surveys were successful largely due to the active involvement and cooperation of Larry McConnell, Executive Director of the Marina and Recreation Association. The marina owners and operators and all the boaters and Garden Highway residents who participated in our surveys are thanked for their willingness to assist us in developing user data for the study area.

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We especially appreciate the comments and public interest shown by Kip Skidmore from River Bank Holding Company, Vickie Lee from the Mother Lode Chapter of Sierra Club, Jim Potter of the Sacramento River Preservation Trust, Daniel Taylor from the National Audubon Society, Richard Spotts from Defenders of Wildlife, and Daniel Yamshon attorney-at-law.

While the strengths of our report are due to the help of those just acknowledged, all errors and omissions are the authors' responsibility.

Very Truly Yours,



Philip A. Meyer
Meyer Resources, Inc.



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Sacramento River Marina Carrying Capacity Analysis

Executive Summary

The purpose of this analysis is to assess the marina carrying capacity of the Sacramento River from River Mile (RM) 44.8, approximately 1 1/2 miles below Freeport, upriver to RM 76.0, just above the Sacramento/Sutter county line. Carrying capacity is defined as "the extent to which the Sacramento River and its adjacent banks can carry marina development without significant negative impact on other human, ecological or water quality benefits associated with the river system." This analysis further divides the river study area into 5 reaches. These reaches are described in Executive Table 1 and illustrated in Figure 1 (following page 4 of the main report).

There are presently 21 operating marinas on the river. In general, they have a 95+ percent occupancy rate in the May through August/ September peak period, with an approximate 75 percent occupancy rate in winter months. It appears clear that demand for moorage exceeds supply during the peak use period, particularly for vessels in larger size classes. For boaters who moor at marinas, slip rental is estimated to account for a relatively small portion of average boating costs, and industry-wide rental charges do not widely affect demand for moorage. Considerable price competition exists between individual facilities, however, particularly from public agency marinas which characteristically charge less for slip rentals. This practice is considered economically destabilizing by private marina operators. Tie up facilities not offering permanent moorage are treated separately in our report.

Executive Table 1

River Reaches in the Study Area

<u>Reach No.</u>	<u>River Mile Reference</u>	<u>Reach Description</u>
1	RM 44.8 to 53.5	This reach begins just below the proposed Sacramento County marina, and includes Cliff's, Freeport, Dock Holiday, Light 29, Garcia Bend and Stan's Marinas.
2	RM 53.5 to 55.5	This reach begins downstream of the Four Seasons Marina, and extends upriver two miles to include Sherwood Marina, Sacramento Yacht Club and Captain's Table.
3	RM 55.5 to 57.5	This reach extends upriver from the Sacramento Yacht Club to the Sacramento Deep Water Ship Channel.
4	RM 57.5 to 62.0	This reach extends from the Sacramento Deep Water Ship Channel upstream to the gaging station near Bryte Yard. It includes the Sacramento Yacht Harbor at Miller Park, Ramos Oil, Raley's, Discovery Park, the Broderick boat ramp, Chart Room, Viewpoint, River Galley, Village, Riverbank, Virgin Sturgeon, Riverview, and Dwyer's Landing marinas, and proposed facilities at Sacramento and Broderick.
5	RM 62.0 to 76.0	This reach extends from Bryte Yard to the upstream end of the study area just downstream from Rio Ramaza. It includes Metro and Alamar marinas, a proposed marina at Sand Cove and boat ramps at Elkhorn Regional Park (Yolo), and at the Elkhorn Ferry Site (Sacramento).

The majority of boat owners in Sacramento and Yolo counties reach the river via launching ramps. However, during peak weekend days, launching ramp congestion constrains access by these boaters. It appears that traffic generated from launching ramps exceeds that from marinas in Reach 5 during peak summer periods. Marina generated traffic slightly exceeds that from launching ramps in Reach 4, and considerably exceeds it in Reaches 3, 2 and 1. The greatest apparent need for expanded launching ramp capacity is at the upriver and downriver extremities of the study area. Boater activity during peak periods is relatively intense in the urban Sacramento area (Reach 4). Crowding will also occur on a spot basis in other reaches during such peak periods. On an annual basis, boat fishing accounts for almost 60 percent of boater activity in the study area. General cruising accounts for about 36 percent. Water and jet skiing account for less than 5 percent of total activity.

Strongest constraints to further marina expansion on the river relate to ability of boats to maintain a reasonable speed while traveling, and to the need to protect remnant riparian vegetation, fish and wildlife. The Sacramento River is relatively narrow, and traveling craft must slow to 5 MPH when within 200 feet of moored vessels. In Reach 4 from Dwyer's Landing downstream to Miller Park, existing marinas now largely constrain river travel to the 5 MPH limit. Unmanaged future marina development in the study area could progressively reduce the ability of both recreation and commercial boats to maintain a reasonable traveling speed.

Riparian vegetation along the Sacramento River has been reduced to a remnant 5 percent of its pre-development abundance. Remaining trees, shrubs and associated vegetation are vitally

important to human enjoyment of the river corridor and to birds and animals. In this report, we propose a "no further net loss" policy for riparian vegetation, together with a strategy to make that objective compatible with further marina expansion. Maintenance of water quality and management of user conflicts on the river, particularly respecting water and jet skiing and impact of boating on bankside residents, are also significant concerns. A full display of the marina related issues and effects we have examined, with associated recommendations, is provided in Executive Table 2. Jurisdictional issues associated with our conclusions and recommendations are discussed in Section VIII (pg. 145 ff.)

The Sacramento River provides a diverse array of human, ecological, water quality and recreation benefits to citizens of Sacramento and Yolo counties. Left to random development, the river corridor is rapidly reaching carrying capacity limitations in several areas. With proper management, we believe these limitations can be overcome, and that marina patrons and other river users can enjoy the river for many years into the future.

Executive Table 2-1A Summary of Conclusions and Recommendations Concerning
Marina Development and its Effects on Other River -
Related Benefits

<u>Study Conclusions</u>	<u>Recommendations</u>	<u>Report Page References</u>
<u>HUMAN USE AND BENEFITS</u>		
<u>1. Traveling Conditions for Boats on the River</u>		
1a. Traveling at speed is now largely pre-empted in Reach 4.	1.1 Restrict new instream marina development to Reach 4. Apply a 5 MPH boating speed limit from the I-80 overpass at (approx.) RM 62.5 downstream to the lower limit of Reach 4.	1-12, 20-22, 157-158, 183-188, 202-205
1b. Traveling boats are now generally required to reduce speed or go to the far side of the channel when passing instream marinas in other river reaches	1.2 Do not allow new marinas in Reach 4 to intrude further into the river than existing marinas.	
1c. New instream marina development in Reaches 1, 2, 3, & 5 will eventually limit traveling speeds in these reaches, as it has in Reach 4.	1.3 Expansion of existing marinas could be a permitted use in all river reaches, subject to meeting other criteria specified in this report (including Rec. 1.2 above).	
1d. Boats traveling at speed too close to marinas and private docks create damage and inconvenience with their wakes.	1.4 Do not allow new instream marinas to be constructed directly opposite an existing marina. 1.5 Develop stable funding to ensure continued operation of the accessing lock to the Sacramento Deep Water Ship Channel. 1.6 Encourage a cooperative speed signing program on the river. 1.7 Establish a more effective standard to assess and remove inebriated/irresponsible boaters from the river.	

Executive Table 2-2

<u>Study Conclusions</u>	<u>Recommendations</u>	<u>Report Page References</u>
	1.8 Encourage a cooperative review of enforcement and safety capabilities on the river.	
<u>2. Multiple Use Conflicts and Crowding on the River</u>		
2a. Generally, river user densities in the study area have not reached levels that would constrain further marina development.	2.1 Prohibit water/jet skiing in Reach 4.	22-65, 182-183, 188-192, 202-205
	2.2 Prohibit water/jet skiing between RM 46 and 50 during fishing seasons.	
2b. Development of further launch ramp capacity is most needed at upriver and downriver extremities of the study area.	2.3 Consider prohibition of water/jet skiing opposite all study area instream marinas	
	2.4 Consider prohibition of water/jet skiing in areas adjacent to private docks (primarily RM 62-68) during the off-peak season (September-May).	
2c. Sport fishing hot spots at the mouth of the American River and between Garcia Bend and Freeport (approx. RM 46 to 50) can be adversely affected by other river users during periods of intense fishing.	2.5 Post other areas for water/jet skiing, with private dock development proceeding at owner's risk.	
	2.6 Do not encourage further launch ramp development between Elkhorn - Sacramento and Miller Park.	
2d. Conflicts between water/jet skiers and other users are among those potentially most severe on the river.	2.7 Sign all marinas and launch ramps, re. boater responsibilities- ie. wave wash.	
2e. Impact of boat noise upon shore bank residents and shoreline users and other boaters is a locally severe problem.	2.8 Post speed signs at fishing hot spots during fishing season.	

Executive Table 2-3

<u>Study Conclusions</u>	<u>Recommendations</u>	<u>Report Page References</u>
	2.9 Post warning signs where there are extensive private docks along the river, re. transitting craft keeping to center of channel and passing port to port.	
	2.10 Allow no marina development on the Sacramento side to intrude into the waters in front of the American River Parkway.	
	2.11 Adopt noise regulations for the river study area.	
	2.12 Prohibit dry stacks & unmuffled boats in the study area.	
<u>3. Economic Viability of Marinas</u>		
3a. A healthy demand appears to exist for some expansion of marina facilities in the study area.	3.1 Other things being equal, the Commission should give priority to marinas that propose, or are expanding toward a diverse array of enterprise centers. (We do not consider condominiums, office buildings or residential developments to be marina enterprise centers).	1-19, 192
3b. The economic viability of individual marinas depends on the skills and perspectives of their management and on the degree to which each marina has also diversified into non-moorage enterprise centers (i.e., fuel stations, restaurants/bar, shops).		
3c. All private marinas complain of price undercutting from public facilities.		
3d. A financially sound private marina is better able to meet its non-revenue public obligations.		

Executive Table 2-4

<u>Study Conclusions</u>	<u>Recommendations</u>	<u>Report Page References</u>
<u>4. Public Access to the River</u>		
4a. In general, Sacramento and Yolo counties, and the City of Sacramento emphasize public access to the river as a policy. No coordinated plan to provide such access is in place, however.	4.1 The Commission should participate with the City and the 2 counties to develop a joint urban riverfront linear access policy, and a Sacramento River Corridor Plan.	79-80, 175-176, 193-194
	4-2 Alternatively, the Commission should encourage the 3 local planning agencies to jointly develop a Sacramento River Corridor element of their General Plans.	

ECOLOGICAL USES AND BENEFITS5. General Ecological Wellbeing

5a. Riparian vegetation provides important benefits to human, wildlife and fishery populations-and is a useful indication of ecological wellbeing in the study area.	5.1 To the extent possible, combine avoidance and restorative strategies to ensure no net loss of riparian habitat within each marina development/expansion site.	86-114, 155-157, 194-196
5b. Remaining riparian vegetation along the Sacramento River amounts to less than 5 percent of its pre-development abundance.	5.2 Where 5.1 is not fully effective, the marina developer should use acquisition and planting techniques to ensure restoration of productively equivalent riparian habitat elsewhere in the same river reach.	
5c. On the basis of 5a and 5b, above, we conclude that residents, wildlife and fish of the Sacramento River study area can afford no further net loss of riparian habitat.	5.3 Where 5.1 and 5.2 are not fully effective, the marina developer should extend strategy 5.2 to the full study area.	

Executive Table 2-5

<u>Study Conclusions</u>	<u>Recommendations</u>	<u>Report Page References</u>
	<p>5.4 Replacement through acquisition or restoration of riparian habitat outside the study area is not recommended, because it does not respond to the loss of local habitat productivity. Strong emphasis should be placed on exhausting possibilities under strategy 5.1, before strategies 5.2 and 5.3 are considered.</p> <p>5.5 Experts from the California Department of Fish and Game and the U.S. Fish and Wildlife Service should be consulted with respect to equivalent riparian habitat productivity.</p>	
<u>6. Threatened or Endangered Species</u>		
6a. Three threatened species, the Swainson's Hawk, the California Yellow Billed Cuckoo and the Valley Elderberry Longhorned Beetle have been reported to use the study area, and require special treatment in any policy governing marina expansion.	<p>6.1 The California Department of Fish and Game and the U.S. Fish and Wildlife Service should be closely consulted with respect to avoidance and protection of threatened species and their habitats.</p> <p>6.2 Where riparian habitats or threatened species may be significantly impacted by a proposed marina development, an EIR should be required.</p>	101-108, 112-114

Executive Table 2-6Study
ConclusionsRecommendationsReport Page
ReferencesWATER QUALITY USES AND BENEFITS7. Waste Control

- | | | |
|--|--|---|
| 7a. The greatest portion of human sewage from boats is presently being discharged directly into the river. To the best of our knowledge, only one pumpout station is presently operational on the river. This situation is not acceptable in a river frequented by fishermen and swimmers. | 7.1 The Commission should require adequate and <u>operational</u> pumpout stations and holding tank facilities at all marinas, as a condition of development, expansion or lease renewal. Boat hookups should be placed on the in-channel side of marinas, and in all instances should be accessible to boaters. | 117-118,
120-121,
159-161,
197-198 |
| | 7.2 The need for similar facilities at launching ramps should be closely examined, and if a need is confirmed, similar requirements instituted there. | |
| | 7.3 All marinas should be required to place litter disposal bins on their docks, at locations convenient to boaters. | |
| | 7.4 The Commission should encourage local jurisdictions to conduct a joint assessment of the adequacy of public washrooms in the study area, and to provide for any facility needs that are identified. | |
| | 7.5 The Commission should consider standards for mooring, waste holding and shore service umbilicals for all live-aboard vessels during their ongoing staff study of residential use of tidal and submerged state lands. | |

Executive Table 2-7

<u>Study Conclusions</u>	<u>Recommendations</u>	<u>Report Page References</u>
8. <u>Toxins</u>		
8a. Early evidence suggests that tributyltin-oxide, now widely used in bottom paints for boats, may be extremely toxic to fish, with possible deleterious effects for humans as well.	8.1 The Commission should request an immediate determination from appropriate State authority as to whether use of paints containing tributyltin-oxide is hazardous.	141-144, 160-162, 198-199
8b. Off-stream marina basins can become toxic sinks, if marina design and systems for water circulation are not adequate.	8.2 An expert workshop should be considered to focus available knowledge on the problem identified in 8a.	
	8.3 An interim advisory notice concerning the possible consequences of use of paints containing tributyltin-oxide should be issued and posted at all marinas and launching ramps.	
	8.4 An approved "best wood preservative" list should be developed and distributed to marina owners and boaters.	
	8.5 Boat maintenance facilities should be monitored for their handling of hull paint residues.	
	8.6 Engine and hull washing detergents should be certified as safe for use on the Sacramento River.	
	8.7 Control measures and safe disposal standards should be established for boat maintenance and haul-out facilities.	

Executive Table 2-8

<u>Study Conclusions</u>	<u>Recommendations</u>	<u>Report Page References</u>
	8.8 Off stream marina sites should be engineered to provide adequate water circulation, and maintenance dredge spoil should be monitored for toxins.	
9. <u>Fuel Spills</u>		
9a. Fuel spills are possible at marina facilities, but are avoidable through installation and proper maintenance of adequate equipment.	9.1 Highest quality automatic shut-offs on all fueling hoses, and EPA approved fuel storage tanks should be a minimum requirement for any new boat fueling facilities.	122-123, 161, 199
10. <u>Other Water Quality Issues</u>		
10a. Bilge water and similar drainage discharge is often dumped back into the river when boats are taken out at launching ramps.	10.1 Consider installation of grated transverse drains across launching ramps to collect bilge discharges and convey them to a dump or buried tank for eventual safe disposal.	119-120, 141-142, 162, 199-200
10b. Urban runoff in areas ancillary to marinas can also pose a problem.	10.2 New ancillary areas should consider porous pavement designs, grading to direct drainage away from the river and periodic mechanical sweeps of parking areas.	

Executive Table 2-9

<u>Study Conclusions</u>	<u>Recommendations</u>	<u>Report Page References</u>
<u>MARINAS AND RIVER LEVEES</u>		
<u>11. River Levees</u>		
11a. Boats/skiiers traveling at speed can erode levees in the study area during higher water periods (where the river flows against the levee, not the berm). This will generally occur in the non-summer period.	11.1 Levee integrity must be an overriding factor during any marina development, on or off-stream.	97-100, 111-114, 123-126, 200
11b. The presence of marinas, by reducing boat speed to 5 MPH, will reduce levee erosion in adjacent areas.	11.2 Procedures for preserving both levee safety and ecological productivity along the river bank are available from the State Reclamation Board, the California Department of Fish and Game and the California Department of Water Resources - and should be utilized during marina development or expansion.	
11c. Where marina development is coupled with levee improvement work, flood control objectives will be enhanced.	11.3 Non-essential vessel travel should be prohibited in the study area during high water periods when levee safety is threatened.	
11d. Multiple use levee management is a preferred objective in the study area. Reference to documents from the State Reclamation Board, DWR and CF&G dealing with joint management to provide flood control and protect ecological values suggests that this objective is attainable.	11.4 The Commission should consider convening an inter-agency task force on multiple use management of levees in the study area.	
	11.5 Conduct study of erosive factors on East bank of the River between RM 63 and RM 76.	
	11.6 See Rec. 2.9.	

Executive Table 2-10

<u>Study Conclusions</u>	<u>Recommendations</u>	<u>Report Page References</u>
<u>OTHER ISSUES</u>		
<u>12. Tie-Up Facilities</u>		
12a. Tie-up facilities designed to provide temporary moorage so boaters may go to a restaurant, shop, etc. likely do not preempt traveling capabilities in adjacent river areas, to the extent which marians would.	12.1 Tie-up facilities may be permitted in all river reaches, as long as they don't extend more than 60-70 feet into the river.	1, 201
	12.2 Tie-up facilities must meet all ecological and water quality criteria advanced in this report.	
	12.3 New facilities should <u>not</u> be allowed to expand to marina status after initial designation as tie-up facilities.	
<u>13. Off-Stream Marinas</u>		
13a. Off-stream marinas do not impede traveling craft, but involve most of the other issues raised here.	13.1 Off-stream marinas <u>may</u> be considered <u>in</u> all river reaches.	86-114, 115-144, 194-205
	13.2 Off-stream marinas should meet all ecological and water quality criteria advanced in this report.	
13b. Offstream marinas may contribute to boat traffic.		
<u>14. Historic/Archeological Concerns</u>		
14a. Sensitivity for Historic and archeologic sites in the marina study area is estimated to be quite high.	14.1 Historic and archeological concerns should be met on a project specific basis through the EIR/EIS process and with site investigations.	80-83
14b. Historic and archeologic resources seem to be dispersed throughout the study area.		

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I. The Existing Marina Situation on the Sacramento River bordering Sacramento and Yolo Counties

1. Existing Marinas

The study area for this report consists of the Sacramento River bordered by Sacramento and Yolo counties between river miles 44.8 and 76.0. There are presently 21 operating marinas on the Sacramento River in the study area between Alamar Marina upriver and Cliff's Marina downriver (see Figure 1 following page 4). Marinas may be categorized by whether provision of permanent moorage on an annual or monthly basis is a central facility purpose, or whether only limited moorage is provided for day or overnight use, primarily to service trade to restaurants, bars, and other commercial facilities. We will term the former marinas, and the latter tie up facilities in our analysis. Over time the designation between existing marinas and tie-up facilities has blurred, as the latter acquire permanent moorage clients and/or expand toward marina status. The distinction is useful, however, in considering new facility development, and will be applied, as appropriate in this analysis.

Current marina capacity and occupancy along the study section of the Sacramento River is shown in Table 1. Occupancy rates are for the January period and understate peak period usage. There are actually three distinct mooring groups along the Sacramento River. Power boats in excess of 26 feet are moored at the marinas year round. Fishermen with boats in the 14 foot to 26 foot range begin to moor in mid-February and stay into May. In May, waterskiiers with similarly sized boats begin to arrive, replacing some of the fishermen, and staying through October.

Table 1

Existing Marina Capacity and Present Usage
along the Sacramento River

<u>Marinas</u>	<u>Design Capacity</u> ^(1,2)	<u>Vessels Moored</u>		
		<u><25'</u>	<u>25-40'</u>	<u>>40'</u>
Alamar 5999 Garden Hwy.	38 slips at 25' 28 slips at 32'	0	43	7
Metro 5891 Garden Hwy.	13 slips at 30' 9 slips at 32'	6	8	0
Dwyers Landing 1951 Garden Hwy.	12 slips at 32'	0	9	2
Riverview 1801 Garden Hwy.	23 slips at 28' 38 slips at 32' 14 slips at 36' 14 slips at 40' 14 slips at 44' <u>103</u> total slips	7	67	24
Virgin Sturgeon 1577 Garden Hwy.	21 slips at 32'	2	11	1
Riverbank Holding 1361 Garden Hwy.	62 slips at 24' 76 slips at 30' 21 slips at 40' <u>159</u> total slips	46	85	18
Village Marina 1331 Garden Hwy.	25 slips at 32'	3	7	2
River Galley County Rd. 136	31 slips at 32'	1	17	3
Viewpoint Marina Broderick	28 slips at 30' 16 slips at 32'	3	27	0
Chart Room ⁽³⁾ County Rd. 136	50 slips at 32'	4	12	0
Sacramento Yacht Club W. Sacramento	62 slips at 32'	8	21	14
Captain's Table 4350 Riverside Blvd.	54 slips at 24' 12 slips at 32' <u>66</u> total slips	0	50	4
Sherwood Harbor 1045 S. River Rd.	45 slips at 32'	25	12	10

Table 1 Continued

<u>Marinas</u>	<u>Design Capacity</u>	<u>Vessels Moored</u>		
		<u><25'</u>	<u>25-40'</u>	<u>>40'</u>
Four Seasons - S. River Rd.	15 slips at 20' 16 slips at 30' 38 slips at 32' 7 slips at 40' <u>76</u> total slips	12	40	7
Garcia Bend	16 slips at 32'	4	14	1
Stan's Yolo	19 slips at 32'	0	2	3
Freeport 8250 Freeport Blvd.	175 slips between 18' and 36'	-	70 boats	-
Cliff's 8651 River Rd.	61 slips at 18' 47 slips at 26' 41 slips at 32' <u>149</u> total slips	20	67	4
Sacramento Boat Hbr. Miller Park 2701 Harbor View Dr.	13 slips at 14' 3 slips at 16' 11 slips at 18' 72 slips at 20' 117 slips at 25' 62 slips at 30' 9 slips at 40' <u>287</u> total slips	102	174	10
Dock Holiday	8 slips at 32'	6	2	1
Marina Inn	- day slips -	--	--	--

All Marinas	- < 25' - 376 slips	284	--	--
	- 25-40' - 994 slips	--	703	--
	- > 40' - <u>66 slips</u>	--	--	111
Total, all size classes	1,436 slips			

- (1) Design capacity includes linear wharf space, assuming 32 ft. of wharfage equals 1 slip.
- (2) It should be noted that where vessels are smaller than designated slip size, more boats can be accommodated.
- (3) Damaged in 2/86 storms. Boats currently in dry storage.

These data, while generalized, suggest that in the present off-peak period, usership at Sacramento river marinas in the study area stands at about 75 percent of capacity for vessels below 40 feet. As anticipated, capacity for vessels over 40 feet is fully utilized*. Based on conversations with marina operators, it is expected that increased moorage by vessels under 40 feet will raise occupancy rates to 95 percent or more during the peak season (May through August/September).

Three (3) percent of boats moored at marinas during September, 1985, appeared to be definite live aboards, with curtains in the windows, flower boxes, and other signs of current habitation. A further 12 percent were of the houseboat variety, often used as rentals on the river, and could be lived in. We thus observed a 15 percent potential live aboard capability in existing marinas. Distribution of live aboards was apparently randomly distributed between marinas. A further unknown number of live aboards moor or anchor in the river at undetermined locations.

* Because we broke out wharf berthage in 32 foot intervals, the 66 slips figure for boats over 40 feet is likely low, and may need to be adjusted upward to cover the number of vessels in that size category that are actually moored.

2. Demand for Marina Space in Sacramento and Yolo Counties

a) Present Boating Demand in Sacramento and Yolo Counties

Economists define "demand" as the amount of a commodity (such as mooring space) that will be purchased at each of a series of possible prices. Thus, future demand for moorage in Sacramento and Yolo counties will be jointly determined by the number of persons who own boats and the price they are willing to pay for moorage. Actual mooring slips rented will also be affected by the quantity and price of moorage available. This issue is further complicated by the fact that vessels above approximately 25 feet in length are difficult to trailer, and may consequently have few alternatives for accessing the river, while boats below that size are trailerable, and can access the river via launching ramps. In this section, we will first examine the demand for boating in Sacramento and Yolo counties, and its likely progression to the year 2000. Particular attention will be paid to anticipated growth in vessel registration by size class. Then, utilizing data from a recent survey by the Cal. Dep't. of Water Resources (DWR, 1982), the implications for regional moorage of increased boating demand are identified.

State Department of Motor Vehicles (DMV) data indicate the following resident boat owner population in Sacramento and Yolo Counties (Table 2). These data are based on registrations as of January 31, 1986. At that time of year, some boat users are slow in re-registration, and comparison with 1985 total registration for June 30th suggest these data are likely low by at least 11 percent. We have adjusted our data upward by 11 percent accordingly.

Table 2

Present Boater Population of Sacramento
and Yolo Counties

Referent Area	Vessel Size				Total
	<16'	16' to 19'11"	20' to 39'11"	>40'	
Sacramento County	17,254	9,257	3,679	298	30,488
Yolo County	2,276	1,152	424	38	3,890
2-County Total	19,530	10,409	4,103	336	34,378
2-County Adjusted Total	21,678	11,554	4,554	373	38,159
Percentage of Total Vessels	56.8	30.3	11.9	1.0	100.0

Combining these data with those from Table 1, it is estimated that marina facilities in Sacramento and Yolo counties can accommodate approximately 4 percent of the registered boats in the two counties. In the most heavily pressured "over 40 foot" category, and equating the present number of vessels moored (111 boats) with total capacity, it would appear that present facilities can accommodate 27 percent of the 2-county vessel population for that size class. Other large vessels presumably moor outside the study area--while the vast majority of smaller vessels are trailered.

These data may also be compared, by size class, with DMV data developed by Arthur Young and Company in 1973 (Table 3). Data from 1973 is for "Sacramento Basin". Data for 1986 is for Sacramento and Yolo counties.

Table 3
Comparison of Boats by Size Class
1973 and 1986

Boat Size (feet)	Percent of Total Boats			
	1973 Data		1986 Data	
	<u>size class</u> <u>percent</u>	<u>cumulative</u> <u>percent</u>	<u>size class</u> <u>percent</u>	<u>cumulative</u> <u>percent</u>
< 14	42.0	42.0	--	--
14-< 16	29.5	71.5	56.8	56.8
16-< 18	17.5	89.0	--	--
16-< 20	--	--	30.3	87.1
18-< 21	6.1	95.1	--	--
21-< 26	2.8	97.9	--	--
26-< 31	1.0	98.9	--	--
31 & over	1.1	100.0	--	--
20-< 40	--	--	11.9	99.0
40 & over	--	--	1.0	100.0

Source: California Department of Motor Vehicles

Data classes from 1973 and 1986 are not strictly comparable. However, examination of the cumulative percent data suggests that there has been a small but discernable annual shift from vessels under approximately 20 feet, in favor of vessels in the 20' to 39'11" size class. Considering intervening improvements in trailer technology, we consider comparison of the 1973 cumulative percentage of 95.1 percent for vessels under 21 feet with the 1986 cumulative figure of 87.1 percent for vessels under 20 feet indicative. Proportionately more boats may also appear in the over 40 foot class today--but trends within this group, representing only 1 percent of the total boat owner population, will have little impact upon our subsequent total analysis.*

* The over 40 foot boat size class does, however, require specific treatment in our analysis of future marina requirements.

b) Estimated Future Demand for Boating in Sacramento and Yolo Counties

In this section, potential growth in pleasure boating in Sacramento and Yolo counties through the year 2020 is considered via two methods. First, average growth in DMV pleasure boat registrations, 1980-1985 (at June end), are used to project future growth in pleasure vessel registration. Second, 1985 per capita boating populations, developed from DMV and Department of Finance data, are applied to Department of Finance bicentennial population projections. Results are presented in Table 4.

Table 4

Projected Vessel Registration in Sacramento and Yolo Counties - 1986 to 2020

	Year							
	<u>1986</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>	<u>2005</u>	<u>2010</u>	<u>2015</u>	<u>2020</u>
	-----'000 boats-----							
<u>Projection A</u> ⁽¹⁾								
Sacramento Co.	33.8	37.9	43.7	50.4	58.1	67.0	77.3	89.2
Yolo Co.	4.3	4.8	5.5	6.3	7.3	8.4	9.7	11.2
2-County Total	<u>38.1</u>	<u>42.7</u>	<u>49.2</u>	<u>56.7</u>	<u>65.4</u>	<u>75.4</u>	<u>87.0</u>	<u>100.4</u>
<u>Projection B</u> ⁽²⁾								
Sacramento Co.	33.8	36.0	39.3	42.7	45.7	48.7	51.6	54.3
Yolo Co.	4.3	4.7	5.0	5.4	5.7	6.0	6.3	6.5
2-County Total	<u>38.1</u>	<u>40.7</u>	<u>44.3</u>	<u>48.1</u>	<u>51.4</u>	<u>54.7</u>	<u>57.9</u>	<u>60.8</u>

(1) Based on an average growth rate of 2.9 percent per year in boater registrations, 1980-85.

(2) Based on a per capita vessel registration rate of .036 in Sacramento county and .034 in Yolo County.

From these data, it can be observed that 2-county vessel registration is expected to reach between 48 and 57 thousand by the year 2000, and between 61 and 100 thousand by the year 2020. These projections diverge increasingly over future years, reflecting the different assumptions used. It is likely, however, that they encompass the range of possibility for the future 2-county boater population. Actual future boater populations attained will depend upon a variety of events, not precisely predictable at present. Those will include realized growth patterns in Sacramento and Yolo counties, relative shifts in real wealth among residents of the two-county population, boating costs including especially fuel and insurance, and policies developed by government which affect recreational boaters.

It is also important to consider likely increases in vessel registration by size class. As noted previously, vessels below approximately 25 feet may be trailerable--and consequently have alternatives to mooring on the river. Vessels above approximately 25 feet have no such options. Consequently, in Table 5, we estimate projected future vessel registrations by size class. To do this, we make use of the data from Table 3, and the following assumptions:

- i) Use cumulative 1986 data from Table 3 to indicate that 87.1 percent of registered vessels are below 20 feet in length;

- ii) Consider 1973 data from the 21 to 26 foot class. Note that these vessels equalled 57 percent of all vessels over 20 feet in 1973. Estimate that $.57 (100.0 - 87.1) = 7.4$ percent of present vessels are in the 21 to 26 foot class.

- iii) Estimate that the remainder of vessels ($100.0 - 87.1 - 7.4 = 5.5$ percent) are over 26 feet in length.

Vessels under 21 feet can clearly be trailered. While these vessel owners may desire moorage, they are not dependent on it. Vessels over 26 feet are not easily trailered, and are largely dependent upon moorage. Vessels in the 21 to 26 foot category can likely be either trailered or moored.

Table 5
Projected Boater Population in Sacramento
and Yolo County by Size Class

<u>Year</u>	<u>Projection A</u>			<u>Projection B</u>		
	<u><21'</u>	<u>21'-26'</u>	<u>>26'</u>	<u><21'</u>	<u>21'-26'</u>	<u>>26'</u>
	-----'000 vessels-----					
1986	33.2	2.8	2.1	33.2	2.8	2.1
1990	37.2	3.2	2.3	35.4	3.0	2.2
1995	42.9	3.6	2.7	38.6	3.3	2.4
2000	49.4	4.2	3.1	41.9	3.6	2.6
2005	57.0	4.8	3.6	44.8	3.8	2.8
2010	65.7	5.6	4.1	47.6	4.0	3.0
2015	75.8	6.4	4.8	50.4	4.3	3.2
2020	87.4	7.4	5.5	53.0	4.5	3.3

Considering these data, and Table 1, it can be concluded that present marina capacity in Sacramento and Yolo counties for boats in the 40 foot category is significantly less than 2-county vessel registration--and that existing space is fully subscribed. Registration of vessels between 26 feet and 39 feet also considerably exceeds capacity; but that capacity is presently underused in the off peak period. On this basis, it is our conclusion that if the factors affecting usership do not change radically, a sufficient market exists, or will shortly exist, to support further expansion in marina capability to handle larger size classes of boats.

3. Proposed New Marina Development in Sacramento and Yolo Counties

Additional marina space has been proposed over the past several years for both Sacramento and Yolo counties. These potential additions represent both expansion at existing sites and construction of new marinas. Table 6 lists some of the more easily identifiable of these proposals. No claim is made that this list is exhaustive, or that all projects listed here are still under active consideration. When directly asked during this analysis, 25 percent of marina owners/operators expressed interest in expansion.

Table 6

A Listing of Selected Proposals to Expand
Marina Capacity in Sacramento and Yolo Counties

<u>Proposed Additional Capacity</u>	<u>Expansion(E) or New Marina (N)</u>	<u>Estimated⁽¹⁾ New Berths</u>
Captain's Table	E	172
Cliff's Marina	E	50
River View Marina	E	35
Sherwood Hbr.	E	62
Tower Bridge	E	25
Four Seasons	E	7
Sand Cove Marina	N	50
Village Marina	E	200
Sacramento County (Freeport)	N	700
City of Sacramento (Miller Park)	E	282
Sacramento Redevelopment Agency	N	80 ⁽²⁾
Ahlstrom Marina	N	80
Lighthouse Marina	N	800

(1) Wharfage estimated at 32' per berth.

(2) Temporary tie up berths only.

4. The Economics of Marina Development and Operation

The foregoing analyses provide a picture of the potential market for moorage on the Sacramento river bordering Sacramento and Yolo counties. These data tell little about the financial viability of present and future marinas operating on the River, however. Marina viability depends on being able to sell moorage and other services at a sufficient combination of volume and price to remain profitable. Profitability in the modern marina does not depend exclusively on berthing charges. Other enterprise centers, notably restaurants, bars, chandleries, fuel sales, marina and grocery stores, bait, pumpout stations, automatic tellers and so on, assist the contemporary marina to remain viable. Where these enterprise centers return a profit, they become profit centers. Enterprise centers for present marinas are identified in Table 7.

In Table 8, revenue data from Dana Harbor in Orange County (1977) is presented. These data are for a larger facility than exists on the Sacramento river, and are somewhat dated. Revenues will also obviously vary with the mix of enterprise centers provided. The data are useful, however, to illustrate the relative role that revenue from moorage rental and other enterprise centers can play in marina financial viability.

Table 7
Marina Enterprise Centers in
the Sacramento River Study Area

<u>Marina</u>	<u>Enterprise Centers</u>							
	<u>Restaurant</u>	<u>Bar</u>	<u>Fuel</u>	<u>Boat Repairs</u>	<u>Pumpout</u> ⁽¹⁾	<u>Stores</u>	<u>Other Services</u>	<u>Moorage</u>
Alamar	X	X	X					X
Metro						X		X
Dwyer's Landing								X
Riverview					X	X	X	X
Virgin Sturgeon	X	X						X
Riverbank	X	X			X		X	X
Village		X						X
River Galley	X	X						X
Viewpoint								X
Chart Room	X			X				X
Sacramento Yacht Club		X					X	X
Captain's Table								X
Sherwood Hbr.			X			X		X
Four Seasons	X	X			X	X		X
Garcia Bend						X		X
Stan's Yolo								X
Freeport			X				X	X
Cliff's					X	X		X
Sacramento Boat Hbr.			X			X		X
Dock Holiday	X					X	X	X
Marina Inn	X							X

(1) Discussions with boaters active on the river suggest that only 1 pumpout facility may presently be operational.

Table 8

Gross Revenue Received at Dana Point Harbor
Various Enterprise Centers - 1977

<u>Enterprise Center</u>	<u>Revenue Received</u>	<u>Percent of Total Revenue</u>
	--\$'000--	%
Boat slips	4,570	31.6
Boat storage	<u>281</u>	<u>1.9</u>
Total Boat Moorage & Storage	4,851	33.6
Boat Launching	187	1.3
Marine Fueling	430	3.0
Sport Fishing	3,076	21.3
Boat Repair	170	1.2
Retail Shops	4,499	31.1
Restaurants	691	4.8
Motel	543	3.7
Other	<u>6</u>	<u>--</u>
Totals	14,453	100.0

The viable marina not only turns a profit, but is better able to meet costs associated with services/obligations that do not produce revenue. Principal among these latter may be bank rip-rapping, dredging, provision of public areas and provision of environmental compensation and mitigation. Logic would suggest that development be financially responsible for services/ obligations necessitated by its actions, but not for other ongoing service requirements. Actual practice has fallen on both sides of this mark, depending on policy circumstances of the day. This issue will be further discussed in subsequent sections.

5. Slip Rental Charges and How They Affect Demand for Moorage

Little explicit data are available on boater expenditures in California. Drawing on two studies concerning pleasure boat expenditures from British Columbia, it is possible, however, to draw reasonable inferences about the role that moorage price plays in total boater costs. Data from Shaffer et al. (1977) and Harrison (1979) are combined to provide the following general apportionment of boating expenditures between categories (Table 9).

Table 9A General Distribution of Pleasure Boating Expenditures Between Cost Components

<u>Item of Expenditure</u>	<u>Percent of Total Annual Costs</u> %
Moorage	12.4
Capital costs	53.7
Insurance	9.0
Maintenance & Repairs	11.4
Fuel	12.8
Boating Club Fees	<u>0.7</u>
Total	100.0

These data are generalized and inferential. Even should they vary somewhat, however, they indicate that a 10 percent change in the price of moorage can be expected to increase a pleasure boater's overall costs by less than 2 percent. This suggests that the demand for moorage faced by the marina industry as a whole is not particularly elastic* with respect to price. In fact, this is reflected by moorage prices in California and elsewhere, which have risen steadily over the past decade.

* Price elasticity refers to the sensitivity of total demand for moorage as price rises.

While price elasticity facing the marina industry is likely to be low, elasticity facing the individual marina is likely to be higher. At any point in time, boat owners will "shop" for a low price--subject to the general area and type of facility they require. This means, other things being equal, that price competition will be an effective strategy to secure higher user rates for the individual marina. However, because marinas must cover costs and earn a reasonable return to remain viable, prices cannot be altered capriciously. Further, the individual marina's ability to meet a given competitive price for moorage will vary from one marina to the next. In general, ability to meet price will be affected by:

- ability to compete on price,
- the number of enterprise centers in the marina,
- percent of marina capacity utilized,
- capital cost of the marina facility,
- operating cost of the marina facility, and
- the magnitude of services/obligations the marina must meet that do not produce revenue.

Government policy can affect several of these factors. Where public marinas compete with private operators under a moorage price subsidy, the private marina will either have to drop price--narrowing profit and viability--or maintain price and see its usership rate decrease. Where the magnitude of non-revenue services/ obligations is substantial, marinas must either raise

moorage prices or see profits fall. Capital and operating costs of the marina, together with diversity of enterprise centers, are more related to the perspective and skill of the operator, although enterprise centers may be limited by land use policies affecting the marina complex. It should again be recalled that the marina industry can better tolerate industry-wide costs than inconsistent price subsidies or non-revenue obligations affecting one marina differently than the next. The need for consistent regulations, capital loan policies and rental fee policies between public and private marinas was a major issue raised by marina representatives interviewed during this study. In fact, where moorage prices are driven down by public competition, the ability of the private marina operator to meet its non-revenue public obligations is impaired.

Actual prices charged for moorage in the Sacramento river study area reflect the age and sophistication of facilities offered, whether slips are covered or open, relative slip location in the marina and whether the facility is public or private. Different moorage rates may also apply on and off peak periods. Foot/month charges at the newest and best equipped marinas in the study area are now ranging from about \$4.30 to \$6.00. At Sacramento City's Miller Park, prices start at \$2.40 per foot/month, and range upward to \$3.85. These two data sets indicate the price differential between private and public marinas on the river. Older private facilities generally charge out between these upper and lower bounds--perhaps from a level of \$3.25 per foot/month on up.

II. Marinas and Traveling Space on the River

The Sacramento River bordered by Sacramento and Yolo counties varies in width between approximately 400 feet and 725 feet under median water depth conditions (approx. 17 ft.). At extreme low water (approx. 4 ft.), its narrowest width at river mile 66 is reduced to 300 feet, while at high water (approx. 29 ft.), it can expand to about 920 feet at river mile 60.7. Data, by river mile, are provided in Appendix 1.

These data are important because wave wash from passing boats creates difficulties for marinas, and vessels are required to reduce speed to five miles per hour* when they are within 200 feet of a marina facility. Where the river is relatively narrow, and marinas extend into the river, this can effectively require that all transitting craft be governed by the 5 MPH restriction. In Table 10, we attempt to estimate the distance that existing marinas project into the river, and to assess the availability of a travelling channel on that basis. Column 1 provides the general location for each estimate. Column 2 indicates the exact mileage point at which the estimate was taken.

* This speed is measured relative to the stationary river bottom.

Table 10
Assessment of Available Traveling Channel
on the Sacramento River

<u>Location</u>	<u>River Mile</u>	<u>Median River Width</u>	<u>Estimated Marina Incursion</u>	<u>Available Transit Channel</u>	<u>Available Traveling Channel if Similar Marina on Opposite Bank</u>
-----ft.-----					
<u>CLARKSBURG TO FREEPORT</u>					
Cliff's Marina	42.3	650	150	300	0
Freeport Marina/Dock Holliday	46.2	650	160	290	0
<u>ABOVE FREEPORT TO SACRAMENTO YACHT CLUB</u>					
Stan's Marina	50.1	650	75	375	100
Four Seasons	53.6	400	90	110	0
Sacramento Yacht Club	55.3	600	200	0 ⁽¹⁾	0
<u>MILLER PARK TO DWYER'S LANDING</u>					
Viewpont Marina	60.4	475	125	150	0
Riverview Marina	61.8	600	200	200	0
<u>UPSTREAM FROM DWYER'S LANDING</u>					
Alamar/Metro	70.6	450	150	100	0

(1) Captain's Table is across from the Sacramento Yacht Club. Traveling craft are consequently limited to 5 MPH between these two facilities.

Two general conclusions are evident from these data. First, few areas in the Sacramento river study area are wide enough to permit 2-sided development of marinas in-river and maintenance of a higher speed

vessel traveling zone. In fact, the data from Table 10 may overestimate the available transitting channel, as it measures shore to shore, and does not subtract out shallows on the non-marina side of the river. Second, data for the area between Miller Park and Dwyer's Landing overstates ease of transit, as marinas commence down-river on the Yolo side, and then cross over further upriver to the Sacramento side. As a result, we consider this reach unavailable to higher speed boat travel, as a practical matter.

Finally, the level of compatability between marinas and higher speed boat travel will be affected by the nature of river currents at various flow stages. Inventory of these flow stage characteristics of the river go beyond the requirements for this policy analysis. Current velocities at various flow stages will, however, be an important feature of any site specific analysis.

III. The Relationship Between Marinas and Boating Activity in the Sacramento River Study Area

1. Marinas, Launching Ramps and Boating Activity

In this section, we will consider user activity data to estimate the expected contribution of marinas and launching ramps, respectively, to overall boating patterns in the study area. In sections III.2 and III.3, following, we will provide further data on general boater characteristics. In sections III.4 and III.5, we develop specific user and perceptions data for boaters with vessels moored at marinas in the study area. Section III.6 develops limited data on launching ramps in the study area. Finally, in Section III.7, general conclusions concerning peak boater use on the river are developed, and

facility constraints at existing marinas and launching ramps applied to these peak user data to draw inferences concerning the relative contribution of marinas and launching ramps to peak period traffic congestion.

It has already been observed that, over a full year, the majority of pleasure boat owners in Sacramento and Yolo counties do not moor their boats, accessing the river via trailer and launching ramps instead. This conclusion is confirmed in 1980 data developed by DWR (DWR, 1982a). That study employed extensive bank-side surveying of active boaters at marinas, launching ramps and other river areas where boaters congregated. It developed data for three reaches useful to this study:

<u>DWR Reach</u>	<u>Description</u>
11	- Feather River downstream to Discovery Park
12	- Discovery Park downstream to the south end of Miller Park
13	- South end of Miller Park downstream to the Paintersville Bridge below Courtland

While DWR Reaches 11 and 13 extend beyond the upper and lower boundaries of our study area, these data are considered representative. Table 11 indicates the type of access used by boaters encountered in each river reach and in the study area as a whole.

Table 11Estimated Boater Recreation in the Sacramento Study Area, by Type of Access to the River

<u>Boating Area</u>	<u>Trailered Boat</u>	<u>Moored Boat</u>	<u>Rental Boat</u>	<u>Not Specified</u>	<u>Total</u>
	-----percent of boaters-----				
Upriver from Discovery Park	95.7	0.7	0.7	2.9	100.0
Discovery Park to Miller Park	90.6	0.5	1.0	7.9	100.0
Downstream of Miller Park	95.1	--	--	4.9	100.0
Total Study Area	93.4	0.4	0.6	5.6	100.0

The study method employed by DWR prevented full sampling of larger vessels in transit, and likely understates moored access. However, even if the data for "percent moored" were increased several-fold, they still corroborate information from Table 2. This suggests that, on an annual basis, the greatest portion of boaters in Sacramento and Yolo county do not access the river via moorage at marinas. The DWR study also identifies that 29 percent of total boating upstream from Courtland, by residents of Sacramento and Yolo County, takes place above our study area.

2. General Recreational Boating Characteristics in the Study Area

This section provides further insight into boating recreation in the study area. The DWR data (1982) are again of use in that regard. Table 12 indicates the number of recreation hours spent on each DWR reach, by type of activity. Figures in brackets for boating identify relative importance in percent, and relate to the boating subtotal.

Table 12

Recreation Hours Spent in the Sacramento River Study Area, by Type of Activity

<u>Activity</u>	<u>Upriver from Discovery Park</u>	<u>Discovery Park To Miller Park</u>	<u>Downstream from Miller Park</u>	<u>Total</u>
	-----'000 hrs.-----			
Boat Fishing	135 (54.9)	122 (48.6)	289 (66.4)	546 (58.6)
Water Skiing	20 (8.1)	7 (2.8)	13 (3.0)	40 (4.3)
General Pleasure Boating	90 (36.6)	118 (47.0)	132 (30.3)	340 (36.5)
Jet Skiing/Sailing	1 (0.4)	4 (1.6)	1 (0.3)	6 (0.6)
Total Boating	<u>246</u> (100.0)	<u>251</u> (100.0)	<u>435</u> (100.0)	<u>932</u> (100.0)
Shore Fishing	45	105	199	349
General Relaxing	30	280	32	342
Swimming & Beach Use	45	112	40	197
Total Hours ⁽¹⁾	400	940	740	2,080

(1) Individual activities do not add to total, as some less important activities are not specifically listed.

These data overestimate activity for our study area alone in the upriver and downriver reaches (DWR 11 & 13). They nevertheless produce conclusions that are helpful to the present policy analysis. First, it appears that boating intensity is greatest downstream from Miller Park. In the urban area from Discovery Park to Miller Park, general shore-based recreation, shore fishing, swimming and beach use account for almost 75 percent of river recreation. Boating is significant in that reach, however, and accounts for about 60 percent of total recreation in the less urbanized upper and lower sectors of our study area. Most water skiing takes place above or below urban Sacramento (DWR Reaches 11 & 13), with water skiing accounting for less than 5 percent of total recreational activity in the study area. Jet skiing appears of negligible overall significance in these 1980 data. Because of higher speeds required by their sports, the impact of water and jet skiers on other river recreation is understated by these data.

In Table 13, estimates of boater recreational activity by county of residence are presented.

Table 13Estimated Boater Recreation, By County of Origin:
Sacramento River Study Area

<u>Boating Area</u>	<u>County of Origin</u>			<u>Total</u>
	<u>Sacramento County</u>	<u>Yolo County</u>	<u>Other Counties</u>	
	-----percent of boaters-----			
Upriver from Discovery Park	62.3	9.9	27.8	100.0
Discovery Park to Miller Park	78.8	2.4	18.8	100.0
Downstream from Miller Park	82.8	3.4	13.8	100.0
Total Study Area	75.0	4.9	20.1	100.0

These data indicate that boaters from Sacramento County predominate in the river reaches of our study area from Discovery Park downstream. Sacramento County residents are also the most numerous boaters upstream from Discovery Park. More Yolo County boaters use the river upstream from Discovery Park than downstream of the park. Overall, 80 percent of boaters in the study area appear to come from the 2-county area.

In Table 14 estimates of seasonal activity, again from the 1982 DWR study, are displayed.

Table 14Estimates of Seasonal Boater Activity
in the Sacramento River Study Area

<u>Month</u>	<u>Boat Fishing</u>	<u>Water Skiing</u>	<u>Cruising/ General Boating</u>
	-----percent of boaters-----		
January	--	--	--
February	--	--	0.6
March	5.6	0.8	4.4
April	27.9	1.6	5.0
May	16.8	1.6	6.1
June	7.5	23.8	25.0
July	7.1	21.3	22.2
August	8.4	41.8	30.0
September	7.1	6.6	3.9
October	12.0	2.5	2.2
November	6.0	--	0.6
December	<u>1.6</u>	<u>--</u>	<u>--</u>
Total year	100.0	100.0	100.0

These data corroborate the information provided by marina operators during our 1985-1986 study. Fishing activity provides peak usage in April/May and again in September/October. Waterskiing is popular in the intervening June through August period. General pleasure boating is more pronounced in the holiday months of June, July and August. These data underestimate downstream trips, as vessels proceeding to the Delta and San Francisco Bay are not included.

3. Sport Fishing Activity in the Sacramento River Study Area

Discussion with California Department of Fish and Game* provides further insight into fishing activity on the river. This information is summarized in Table 15.

Table 15

Information on Sport Fishing in the
Sacramento River Study Area

<u>Time of Year</u>	<u>Primary Species Targetted</u>	<u>Location(s)</u>	<u>Time of Day</u>	<u>Fishermen Concentration Information</u>
January	Steelhead	Freeport bridge	dawn to noon	- 2-3 boat clusters
Late March/early April	Shad	above & below Freeport	mid-day	- 10-12 boat clusters
End of April/early May	Shad	mouth of American River	mid-day	- 30-50 boat clusters - later decline to 5-10 boat clusters
May	Striped bass	- Freeport bridge - Garcia Bend - Brickyard - mouth of American River - general study area	early morning; late evening early morning; late evening	- 30-50 boat clusters - 30-50 boat clusters - 30-50 boat clusters - 30-50 boat clusters - boat every 300 yds.
July	Early fall chinook	mouth of American River	dawn to 11:00 am	- 40-50 boat clusters
Mid-Sept.	Fall chinook	mouth of American River	dawn to 11:00 am	- 10-15 boat clusters
October	Fall chinook	mouth of American River	dawn to 11:00 am	- 50-100 boat clusters

* Fred Meyer, California Department of Fish and Game, personal communication.

From these data it can be observed that there are recognizable boat fishing hot spots in the study area, identifiable by time of year and time of day. Fishing effort is most intensive in April and May, with concentrated effort at the mouth of the American River, at the Freeport Bridge, at the Brickyard and at Garcia Bend--and in October, at the mouth of the American River. The mouth of the American River also receives significant early morning fishing pressure in July.

4. Recreational Activity of Vessels Moored in the Sacramento River Study Area

Data were also developed via a questionnaire for boaters who now moor in the Sacramento river study area. This questionnaire was non-random, but it was circulated to owners of most of the estimated 1,100 vessels that moor on the river. Replies were received from 340 boat owners, although "n," the number of usable answers, varied by question. We consider these data to be useful in the present policy analysis.

Some of the data obtained simply corroborated activity patterns developed earlier in this report. However, data classifying moored boater outings added an important dimension to our discussion (Table 16).

Table 16

Classification of Outings by Boats Moored
at Marinas: Sacramento River Study Area

<u>Purpose</u>	<u>Vessel Size</u>				<u>Total Boats</u>
	<u><16'</u>	<u>16'-19'11"</u>	<u>20'-39'11"</u>	<u>40'+</u>	
	-----% of total outings-----				
Relax at the dock	23.8	10.7	7.4	61.5	17.9
Boat in the metro area of the river	76.2	60.7	70.4	28.2	60.7
Cruise downstream to the Delta & San Francisco Bay	--	17.9	14.8	7.7	14.3
Cruise up- stream above the Sacramento metro area	--	10.7	7.4	2.6	7.1
Totals	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

These data suggest that, for vessels currently using marinas, boats less than 16 feet recreate exclusively in the Sacramento River study area. Boats greater than 16 feet and less than 40 feet use the study area between 60 and 70 percent of the time, and cruise downstream about twice as often as upstream. Boats greater than 40 feet spend significant recreational dock time (61.5 percent of recreational usage) and cruise to the Delta/Bay area about 3 times as often as they cruise upstream. These data will vary by marina, but are believed to provide representative statistics for moored boaters as a whole in the study area.

The same data provide estimates of trips per moored vessel to the destinations specified, by size class of vessels. These estimates are provided in Table 17.

Table 17

Number of Outings Per Year by Boats Moored
at Marinas: Sacramento River Study Area

<u>Purpose</u>	<u>Vessel Size Class</u>				<u>All Boats</u>
	<u><16'</u>	<u>16'-19'11"</u>	<u>20'-39'11"</u>	<u>40'+</u>	
	-----outings per boat per year-----				
Relax at the dock	12	4	4	52	9
Boat in the metro area of the river	35	26	36	24	32
Cruise downstream to the Delta & San Francisco Bay	1	8	7	7	7
Cruise up- stream above the Sacramento metro area	--	5	4	3	4
Totals	<u>48</u>	<u>43</u>	<u>51</u>	<u>86</u>	<u>52</u>

Survey data also distribute moored boater outings by month and between weekdays and weekends. Combining these data, we were able to provide the following estimated distribution of effort (Table 18).

Table 18

Distribution of Outings by Boats Moored at Marinas:
Sacramento River Study Area, by Time Period

<u>Time Period</u>	<u>Vessel Size Class</u>				<u>All Moored Boats</u>
	<u><16'</u>	<u>16'-19'11"</u>	<u>20'-39'11"</u>	<u>40'+</u>	
	-----percent of total outings-----				
January					
-weekdays	--	0.2	0.6	1.0	0.6
-weekends	--	0.6	1.5	2.0	1.5
February					
-weekdays	--	0.2	0.6	1.4	0.7
-weekends	--	0.6	1.5	3.1	1.6
March					
-weekdays	2.9	1.0	1.1	1.4	1.2
-weekends	4.7	2.4	2.8	3.1	2.8
April					
-weekdays	8.7	3.0	1.9	1.8	2.1
-weekends	14.4	7.1	4.8	3.5	5.2
May					
-weekdays	5.7	2.0	2.5	2.5	2.5
-weekends	9.9	4.7	6.5	5.0	6.0
June					
-weekdays	8.6	5.3	4.3	5.5	4.7
-weekends	14.4	12.3	11.0	11.0	11.3
July					
-weekdays	2.9	7.9	5.9	6.8	6.3
-weekends	4.7	18.3	15.6	13.5	15.4
August					
-weekdays	8.7	5.8	4.9	5.8	5.3
-weekends	14.4	13.6	12.9	11.5	12.8
September					
-weekdays	--	2.8	2.6	2.5	2.6
-weekends	--	6.4	6.9	5.0	6.3
October					
-weekdays	--	1.3	1.5	2.0	1.5
-weekends	--	2.9	3.9	4.0	3.7
November					
-weekdays	--	0.2	1.2	1.3	1.1
-weekends	--	0.6	3.1	2.5	2.5
December					
-weekdays	--	0.2	0.7	1.3	0.7
-weekends	--	0.6	1.7	2.5	1.6
Total					
-weekdays	37.5	29.9	27.8	33.3	29.3
-weekends	62.5	70.1	72.2	66.7	70.7
Total-all days	100.0	100.0	100.0	100.0	100.0

We are now in a position to estimate the average number of outings taken per week day and per weekend day, for each month of the year, for each size class of boat, via the following formulæ.

$$(1) \text{WDO}_{ij} = B_M \times P_j \times O_j \times \frac{\text{WD}_{ij}}{21.7}$$

$$(2) \text{WEO}_{ij} = B_M \times P_j \times O_j \times \frac{\text{WE}_{ij}}{8.7}$$

where,

WDO_{ij} = the number of average outings on a weekday in month i , for boat size class j .

WEO_{ij} = the number of average outings on a weekend day in month i , for boat size class j .

B_M = the total of boats estimated moored in the study area. As questionnaire respondents (who were both presently moored and moor in the May through October higher use season), answered, B_M was calculated from Table 1 as 95 percent of available slips = 1,364 boats.

P_j = the percent of total boats in class size j .

O_j = the average number of outings per year for boat size class j , from Table 17.

WD_{ij} = the percent of monthly trips taken on week days in month i , by a vessel in size class j , from Table 18, expressed as a proportion.

21.7 = the average number of weekdays per month in a year.

WE_{ij} = the percent of monthly trips taken on weekends in month i , by a vessel in size class j , from Table 18, expressed as a proportion.

8.7 = the average number of weekend days per month in a year.

To obtain P_j , data from our moored boater questionnaire were used to allocate total moored vessels by size class. Results are reported in Table 19.

Table 19

Estimated Distribution of Moored Boats in
the Sacramento River Study Area by Size Class

	<u>Vessel Size Class</u>				<u>All Moored Boats</u>
	<u><16'</u>	<u>16'-19'11"</u>	<u>20'-39'11"</u>	<u>40'+</u>	
Percentage of total boats moored	2.9	22.2	65.5	9.4	100.0
Estimated number of vessels (1)	40	303	893	128	1,364

(1) Based on an estimated total moored population of 1,364 vessels.

These data are compatible with our estimates of available moorage in Table 1, although implying that several larger vessels will need to be "squeezed in" during the summer moorage period. Our calculations may also underestimate outings on "special" holidays. In general, however, we believe they provide a reliable outings profile for boats moored in the study area. Results are presented in Tables 20 and 21.

Table 20

Estimated Outings by Moored Boats in the
Sacramento River Study Area on an Average
Weekday - By Month

<u>Time Period</u>	<u>Vessel Size Class</u>				<u>All Moored Boats</u>
	<u><16'</u>	<u>16'-19'11"</u>	<u>20'-39'11"</u>	<u>40'+</u>	
	-----number of outings per weekday-----				
January	--	1	12	3	16
February	--	1	12	4	17
March	3	6	23	4	36
April	8	18	39	9	74
May	5	12	53	12	82
June	8	31	90	27	156
July	3	47	123	34	207
August	8	34	102	29	173
September	--	17	55	12	84
October	--	8	31	10	49
November	--	1	25	6	32
December	--	1	14	6	21

Table 21

Estimated Outings by Moored Boats in the
Sacramento River Study Area on an Average
Weekend Day - By Month

<u>Time Period</u>	<u>Vessel Size Class</u>				<u>All Moored Boats</u>
	<u><16'</u>	<u>16'-19'11"</u>	<u>20'-39'11"</u>	<u>40'+⁽¹⁾</u>	
	-----number of outings per weekend day-----				
January	--	9	78	25	112
February	--	9	78	39	126
March	10	35	145	39	229
April	31	106	250	44	431
May	22	70	338	63	493
June	32	183	585	126	926
July	10	273	846	126	1,255
August	32	202	691	126	1,051
September	--	95	360	63	518
October	--	43	203	51	297
November	--	9	162	31	202
December	--	9	89	31	129

(1) Theoretical calculations for the 40'+ class slightly exceeded estimated total vessels (126) for June, July and August. These averages were added to the 20'-39'11" column for appropriate months.

As these estimates are based on self-reported data, they may slightly overestimate actual outings. As noted, however, they seem adequate for the policy purposes of this report.

Tables 20 and 21 clarify the likely intensity of outings by vessels moored in the study area, but do not indicate how such outings impact particular river reaches. To do this, the

river was first subdivided into reaches, as follows (Table 22). Reach numbers assigned here should not be confused with those in DWR (1982) and referenced earlier in this document. Reaches are identified in Figure 1.

Table 22

River Reaches in the Study Area

<u>Reach No.</u>	<u>River Mile Reference</u>	<u>Reach Description</u>
1	RM 44.8 to 53.5	This reach begins just below the proposed Sacramento County marina, and includes Cliff's, Freeport, Dock Holiday, Light 29, Garcia Bend and Stan's Marinas.
2	RM 53.5 to 55.5	This reach begins downstream of the Four Seasons Marina, and extends upriver two miles to include Sherwood Marina, Sacramento Yacht Club and Captain's Table.
3	RM 55.5 to 57.5	This reach extends upriver from the Sacramento Yacht Club to the Sacramento Deep Water Ship Channel.
4	RM 57.5 to 62.0	This reach extends from the Sacramento Deep Water Ship Channel upstream to the gaging station near Bryte Yard. It includes the Sacramento Yacht Harbor at Miller Park, Ramos Oil, Raley's, Discovery Park, the Broderick boat ramp, Chart Room, Viewpoint, River Galley, Village, Riverbank, Virgin Sturgeon, Riverview, and Dwyer's Landing marinas, and proposed facilities at Sacramento and Broderick.
5	RM 62.0 to 76.0	This reach extends from Bryte Yard to the upstream end of the study area just downstream from Rio Ramaza. It includes Metro and Alamar marinas, a proposed marina at Sand Cove and boat ramps at Elkhorn Regional Park (Yolo), and at the Elkhorn Ferry Site (Sacramento).

Establishment of these reaches was based on our judgment of meaningful divisions in the study area from marina facility, traffic, general recreation and environmental perspectives. Specification of reaches is of assistance in considering policy options available to the State Lands Commission, and they will be further discussed in subsequent sections of this report.

Data from Table 21 were reworked to develop an estimate of total boat traffic generated from marinas in the study area on a weekend day for each reach. Calculations underlying these estimates are provided in Appendix 2. Results are presented in Table 23.

Table 23Estimated Traffic on a Weekend Day
in Each Study Reach, by Boaters who Moor at Marinas

<u>Month</u>	<u>Reach 1</u>	<u>Reach 2</u>	<u>Reach 3</u>	<u>Reach 4</u>	<u>Reach 5</u>
	-----total moored boats per weekend day ⁽¹⁾ -----				
January	64	77	111	127	38
February	65	83	125	142	40
March	131	158	230	267	63
April	253	293	428	493	107
May	271	327	491	568	123
June	511	608	917	1,065	220
July	709	832	1,244	1,446	297
August	582	691	1,040	1,210	248
September	283	337	511	590	123
October	158	190	283	335	73
November	107	133	204	232	55
December	71	87	131	149	40

(1) A boat is counted in each reach it enters on both its outgoing and return trip.

These data are inferential. To the extent that boats from Reaches 1 and 2 do not travel the full metropolitan area into Reach 4, they may somewhat overstate traffic in that reach. They provide useful insight for this policy review, however. It should also be again emphasized that these data refer to vessels moored at marinas in the study area only--not to total boating activity in the study area. With those notations, it can be observed from Table 23 that traffic generated by boats moored in the study area is heaviest in Reach 4, the so-called "marina

alley", followed by Reaches 3, 2 and 1. It is notable that Reach 3 is estimated to receive fairly significant levels of traffic, even though no marinas are located in it. Reach 5 receives lower levels of traffic, relative to other study sub-areas.

5. Perceptions of Boaters Who Moor in the Study Area

Our questionnaire to owners of moored boats in the study area also developed data on motivations and perceptions. These data are presented in Tables 24 through 27.

Table 24

Motivational Profile for Boaters who Moor
at Marinas in the Study Area

<u>Activity</u>	<u>Percent of total Usage⁽¹⁾</u> %
Cruising	82.6
Anchoring & Relaxing	47.9
Fishing	46.8
Sightseeing	27.9
Visiting	25.6
Touring the river	20.6
Waterskiing	14.7
Other	2.0

(1) Respondents supplied multiple answers so percentages add to more than 100 percent.

Table 25Attributes of the Sacramento River
Enjoyed by Boaters who Moor at Marinas

<u>Attribute</u>	<u>Percent of Total Features</u> ⁽¹⁾ %
Opportunity to fish	48.0
Scenic value	41.1
Quiet of the river	40.8
Nearness to the city they live in	34.4

(1) Respondents supplied multiple answers, so percentages add to more than 100 percent.

Table 26Principal Features of the Sacramento River
Disliked by Boaters who Moor at Marinas

<u>Feature</u>	<u>Percent of Total</u> ⁽¹⁾ <u>Respondents</u> %
Boat wakes	54.2
Crowded water	37.5
Required reduced speed	28.9
Water quality	24.9
Noise	20.0

(1) Respondents supplied multiple answers, so percentages add to more than 100 percent.

Table 27Facilities Most Desired by Boaters who Moor at Marinas

<u>Facility</u>	<u>Percent of⁽¹⁾ Respondents</u> %
Restaurants	71.3
Temporary Tie-up for shopping, etc.	49.4
Separate areas on the river for higher speed boating	45.9
More covered slips	42.6
More dockage	34.0
More open slips	13.6

(1) Respondents supplied multiple answers, so percentages add to more than 100 percent.

Several inferences can be drawn from these data. Tables 24 and 25 confirm the predominant importance of cruising and fishing for the boating public on the river. In Table 26, boat wakes are identified as the primary concern among moored boaters. Crowding is a concern for 37.5 percent of respondents. Seventy percent of respondents indicated they did not plan to adjust their future boating habits because of crowding on the river, however. Fifty-five percent of respondents indicated that increased future usage of the river would diminish their own enjoyment. This somewhat mixed picture may be further clarified by the fact that, during discussion, boaters indicated that they were still able to get away from boat congestion quickly on the Sacramento River, and that this feature was important to them.

6. The Role of Launching Ramps

a. Present Facilities

As noted in Section 1, annual data suggest that the majority of traffic on the Sacramento river is not generated by vessels moored at marinas, but from launching ramps. The location, hours of operation, capacity and peak day usage of these ramps play an important role with respect to patterns of boater activity and potential congestion on the river. In Table 28, existing launching ramps in the study area are identified.

Table 28

Launching Ramps in the Sacramento
River Study Area

<u>Ramp</u>	<u>Location</u>	<u>Number of Lanes</u>
Elkhorn Boating facility	RM 70.5, Sacramento side.	1
Elkhorn Regional Park	RM 69.5, Yolo side	1
Discovery Park	RM 60.3, Sacramento side	5
Broderick	RM 59.3, Yolo side	1
Miller Park	RM 57.2, Sacramento side	3
Garcia Bend	RM 49.3, Sacramento side	2
Total		<hr/> 13

b. Peak Period Launching and Impact on Traffic in the Study Area

In order to determine the contribution of launching ramps to river traffic, an on-site survey was conducted at the six listed facilities, over the weekend of June 28 and June 29, 1986, during the afternoon and evening of Thursday, July 3, and on Friday, July 4, 1986. June 28-29 and July 4 were selected as peak user days. The afternoon/evening of July 3 was selected because of a major fireworks display in Reach 4 that evening, which attracts a maximum number of boaters to the river stretch. Surveying was via personal interview as boaters arrived at each launch area, and continued from dawn to dusk on June 28-29 and July 4, and from 12:01 pm to dusk on July 3. Data were also collected as vessels returned to the ramps. Data for July 3 are considered most appropriate to site crowding issues, but would distort general river use patterns. They are consequently included or excluded as appropriate. A copy of the launch ramp questionnaire is included as Appendix 3. Data on boat launches are included in Tables 29 through 36.

Table 29

Number of Launches from Public Ramps⁽¹⁾
in the Study Area

<u>Ramps</u>	<u>Saturday,</u> <u>June 28</u>	<u>Sunday,</u> <u>June 29</u>	<u>Thursday,</u> <u>July 3</u>	<u>Friday,</u> <u>July 4</u>
	-----number of launches-----			
Elkhorn - Sacramento	39	56	27	43
Elkhorn - Yolo	21	24	7	19
Discovery Park	182	273	183	174
Broderick	34	40 ⁽²⁾	41	38
Miller Park	58	84	63	81
Garcia Bend	<u>55</u>	<u>84</u>	<u>42</u>	<u>72</u>
Total launches	389	561	363	427

(1) Based on survey from 5:00 am to 9:00 pm for June 28, June 29 and July 4. Based on 12:01 pm to 9:00 pm survey on July 3.

(2) Ramp closed for several hours due to discovery of corpse.

Table 30
Boat Launches from Elkhorn - Sacramento
by Time of Day

<u>Time of Day</u>	<u>Saturday,</u>	<u>Sunday,</u>	<u>Thursday, Friday,</u>		<u>Three</u> ⁽¹⁾	<u>Percent of</u> ⁽²⁾ <u>Total Launches</u>
	<u>June 28</u>	<u>July 29</u>	<u>July 3</u>	<u>July 4</u>	<u>Day</u> <u>Total</u>	
	-----#-----					%
5-7 am	0	2	*	3	5	3.6
7-8 am	1	1	*	7	9	6.5
8-9 am	4	6	*	6	16	11.6
9-10 am	5	1	*	7	13	9.4
10-11 am	3	8	*	4	15	10.9
11-12 am	5	5	*	1	11	8.0
12-1 pm	1	14	5	4	19	13.8
1-2 pm	4	4	5	4	12	8.7
2-3 pm	6	7	4	1	14	10.1
3-4 pm	2	4	3	1	7	5.1
4-5 pm	3	1	3	2	6	4.3
5-6 pm	2	3	7	1	6	4.3
6-7 pm	2	0	0	1	3	2.2
7-8 pm	0	0	0	1	1	0.7
8-9 pm	0	0	0	0	0	--
Total launches	<u>39</u>	<u>56</u>	<u>27</u>	<u>43</u>	<u>138</u>	

(1) Totals exclude July 3 data.

(2) Based on previous column.

* Not surveyed.

Table 31
Boat Launches from Elkhorn - Yolo
by Time of Day

<u>Time of Day</u>	<u>Saturday, June 28</u>	<u>Sunday, July 29</u>	<u>Thursday, Friday,</u>		<u>Three⁽¹⁾ Day Total</u>	<u>Percent of⁽²⁾ Total Launches</u>
			<u>July 3</u>	<u>July 4</u>		
	-----#-----					%
5-7 am	1	0	*	0	1	1.6
7-8 am	0	0	*	0	0	0
8-9 am	1	0	*	2	3	4.7
9-10 am	3	0	*	2	5	7.8
10-11 am	2	5	*	4	11	17.2
11-12 am	2	4	*	2	8	12.5
12-1 pm	3	7	2	1	11	17.2
1-2 pm	4	4	0	1	9	14.1
2-3 pm	2	3	2	3	8	12.5
3-4 pm	1	1	1	3	5	7.8
4-5 pm	1	0	0	0	1	1.6
5-6 pm	1	0	2	1	2	3.1
6-7 pm	0	0	0	0	0	0
7-8 pm	0	0	0	0	0	0
8-9 pm	0	0	0	0	0	0
Total launches	<u>21</u>	<u>24</u>	<u>7</u>	<u>19</u>	<u>64</u>	

(1) Totals exclude July 3 data.

(2) Based on previous column.

* Not surveyed.

Table 32
Boat Launches from Discovery Park
by Time of Day

<u>Time of Day</u>	<u>Saturday, June 28</u>	<u>Sunday, July 29</u>	<u>Thursday, July 3</u>	<u>Friday, July 4</u>	<u>Three⁽¹⁾ Day Total</u>	<u>Percent of⁽²⁾ Total Launches</u>
	-----#-----					%
5-7 am	26	27	*	14	67	10.7
7-8 am	3	7	*	4	14	2.2
8-9 am	10	17	*	5	32	5.1
9-10 am	10	11	*	15	36	5.8
10-11 am	11	37	*	22	70	11.2
11-12 am	14	38	*	23	75	12.0
12-1 pm	19	34	4	19	72	11.5
1-2 pm	23	31	10	20	74	11.9
2-3 pm	17	19	11	15	51	8.2
3-4 pm	16	15	11	9	40	6.4
4-5 pm	16	17	13	6	39	6.2
5-6 pm	5	7	30	7	19	3.0
6-7 pm	1	7	43	8	16	2.6
7-8 pm	9	6	42	2	17	2.7
8-9 pm	2	0	19	0	2	0.3
Total launches	<u>182</u>	<u>273</u>	<u>183</u>	<u>169</u>	<u>624</u>	

(1) Totals exclude July 3 data.

(2) Based on previous column.

* Not surveyed.

Table 33
Boat Launches from Broderick
by Time of Day

<u>Time of Day</u>	<u>Saturday, June 28</u>	<u>Sunday, July 29</u>	<u>Thursday, Friday,</u>		<u>Three⁽¹⁾ Day Total</u>	<u>Percent of⁽²⁾ Total Launches</u>
			<u>July 3</u>	<u>July 4</u>		
	-----#-----					%
5-7 am	7	1	*	6	14	12.4
7-8 am	1	0	*	1	2	1.8
8-9 am	0	1	*	1	2	1.8
9-10 am	0	5	*	1	6	5.3
10-11 am	1	3	*	4	8	7.1
11-12 am	2	2	*	4	8	7.1
12-1 pm	5	0	2	4	9	8.0
1-2 pm	2	3	2	4	9	8.0
2-3 pm	5	2	1	5	12	10.6
3-4 pm	3	(3)**	5	3	9	8.0
4-5 pm	2	4	3	2	8	7.1
5-6 pm	3	7	8	1	11	9.7
6-7 pm	0	4	9	2	6	5.3
7-8 pm	1	5	6	0	6	5.3
8-9 pm	1	2	4	0	3	2.7
Total launches	<u>33</u>	<u>42</u>	<u>40</u>	<u>38</u>	<u>113</u>	

(1) Totals exclude July 3 data.

(2) Based on previous column.

* Not surveyed.

** Ramp closed due to corpse. Data for closed period prorated from data for 6/28 and 7/4.

Table 34
Boat Launches from Miller Park
by Time of Day

<u>Time of Day</u>	<u>Saturday, June 28</u>	<u>Sunday, July 29</u>	<u>Thursday, July 3</u>	<u>Friday, July 4</u>	<u>Three⁽¹⁾ Day Total</u>	<u>Percent of⁽²⁾ Total Launches</u>
	-----#-----					%
5-7 am	3	6	*	1	10	4.5
7-8 am	3	3	*	2	8	3.6
8-9 am	2	5	*	0	7	3.1
9-10 am	2	3	*	7	12	5.4
10-11 am	5	11	*	10	26	11.7
11-12 am	9	12	*	9	30	13.5
12-1 pm	7	12	7	12	31	13.9
1-2 pm	8	13	3	8	29	13.0
2-3 pm	9	6	4	6	21	9.4
3-4 pm	6	4	5	3	13	5.8
4-5 pm	3	5	8	3	11	4.9
5-6 pm	0	3	8	5	8	3.6
6-7 pm	1	1	12	5	7	3.1
7-8 pm	0	0	6	6	6	2.7
8-9 pm	0	0	5	4	4	1.8
Total launches	<u>58</u>	<u>84</u>	<u>58</u>	<u>81</u>	<u>223</u>	

(1) Totals exclude July 3 data.

(2) Based on previous column.

* Not surveyed.

Table 35
Boat Launches from Garcia Bend
by Time of Day

<u>Time of Day</u>	<u>Saturday, June 28</u>	<u>Sunday, July 29</u>	<u>Thursday, July 3</u>	<u>Friday, July 4</u>	<u>Three⁽¹⁾ Day Total</u>	<u>Percent of⁽²⁾ Total Launches</u>
5-7 am	1	0	*	0	1	0.5
7-8 am	1	0	*	0	1	0.5
8-9 am	2	1	*	2	5	2.4
9-10 am	2	4	*	5	11	5.2
10-11 am	2	16	*	10	28	13.3
11-12 am	8	17	*	9	34	16.1
12-1 pm	8	8	1	12	28	13.3
1-2 pm	9	18	4	15	42	19.9
2-3 pm	5	7	4	9	21	10.0
3-4 pm	4	8	1	4	16	7.6
4-5 pm	7	5	4	5	17	8.1
5-6 pm	5	0	5	1	6	2.8
6-7 pm	1	0	11	0	1	0.5
7-8 pm	0	0	11	0	0	0
8-9 pm	0	0	1	0	0	0
Total launches	<u>55</u>	<u>84</u>	<u>42</u>	<u>72</u>	<u>211</u>	

(1) Totals exclude July 3 data.

(2) Based on previous column.

* Not surveyed.

Table 36
Total Boat Launches in the Study Area, (1)
By Time of Day

<u>Time of Day</u>	<u>Elkhorn - Sac.</u>	<u>Elkhorn - Yolo</u>	<u>Discovery Park</u>	<u>Broderick</u>	<u>Miller Park</u>	<u>Garcia Bend</u>	<u>Total-all Facilities</u>	<u>Percent of Total Launches</u>
	-----#-----							%
5-7 am	5	1	67	14	10	1	98	7.1
7-8 am	9	0	14	2	8	1	34	2.5
8-9 am	16	3	32	2	7	5	65	4.7
9-10 am	13	5	36	6	12	11	83	6.0
10-11 am	15	11	70	8	26	28	158	11.5
11-12 am	11	8	75	8	30	34	166	12.1
12-1 pm	19	11	72	9	31	28	170	12.4
1-2 pm	12	9	74	9	29	42	175	12.7
2-3 pm	14	8	51	12	21	21	127	9.2
3-4 pm	7	5	40	9	13	16	90	6.6
4-5 pm	6	1	39	8	11	17	82	6.0
5-6 pm	6	2	19	11	8	6	52	3.8
6-7 pm	3	0	16	6	7	1	33	2.4
7-8 pm	1	0	17	6	6	0	30	2.2
8-9 pm	0	0	2	3	4	0	9	0.7
Total launches	<u>138</u>	<u>64</u>	<u>624</u>	<u>113</u>	<u>223</u>	<u>211</u>	<u>1,373</u>	
Percent of Total Launches (%)	10.1	4.7	45.4	8.2	16.2	15.4		

(1) Based on data from June 28, June 29, and July 4.

In interpreting these data, it should be recalled that they are for the peak summer period, when cruising and water skiing are at their activity heights and while fishing may be less intense save in localized areas. With this qualification, we note that launches reach a peak in the study area between 10:00 am and 2:00 pm - although early morning launching for fishing was significant at Discovery Park, Broderick, and to a lesser extent, at Miller Park. Launching ramps in Reach 4 provide the largest portion of traffic to the river (69.8 percent), with Discovery Park alone accomodating 45.4 percent of launched traffic. On the most intensely surveyed day, Sunday, June 29, five hundred and sixty-one (561) vessels were launched to the river. River destinations, by launching site, are presented in Table 37.

Table 37

River Destination by Launching Ramp⁽¹⁾

<u>Launching Ramp</u>	<u>Reach 1</u>	<u>Reach 2</u>	<u>Reach 3</u>	<u>Reach 4</u>	<u>Reach 5</u>
	-----Percent of boats launched-----				
Elkhorn - Sac.	--	--	--	17.4	100.0
Elkhorn - Yolo	--	--	--	7.9	100.0
Discovery Park	4.4	4.4	10.1	100.0	43.7
Broderick	5.6	5.6	16.7	100.0	48.2
Miller Park	6.7	8.5	16.1	100.0	7.6
Garcia Bend	100.0	26.5	21.3	9.5	1.9

(1) Based on data from June 28, June 29 and July 4.

Table 37 indicates that the major pressure from the two Elkhorn facilities occurs in Reach 5, and northward. Discovery Park and Broderick ramps also make significant contributions to upriver traffic. Applying these data to the peak Sunday, June 29 data from Table 29, and again counting each vessel in each reach as it enters both on its outgoing and return trip, estimated traffic generated by launched craft in each reach on a peak weekend day is identified in Table 38.

Table 38

Estimated Traffic on a Peak Weekend Day Generated
by Launched Vessels in Each Study Reach

<u>Launching Ramp</u>	<u>Traffic Impact by Reach</u>				
	<u>Reach 1</u>	<u>Reach 2</u>	<u>Reach 3</u>	<u>Reach 4</u>	<u>Reach 5</u>
	-----# of vessels-----				
Elkhorn - Sac.	--	--	--	20	112
Elkhorn - Yolo	--	--	--	4	48
Discovery Park	24	24	56	546	238
Broderick	4	4	14	80	38
Miller Park	12	14	28	168	12
Garcia Bend	168	44	36	16	4
Total traffic	<u>208</u>	<u>86</u>	<u>134</u>	<u>834</u>	<u>452</u>

Finally, we can integrate the results of Table 38 with those for traffic generated by boats that moor in the river (Table 23). In Table 39, estimated vessel traffic from both moored and launched sources is presented.

Table 39

Estimated Traffic Generated on a Peak Weekend
Day by All Vessels in the Study Area

<u>Reach</u>	<u>Total Traffic</u>			<u>Percent of Traffic</u> <u>by Vessels that</u> <u>Moored in the</u> <u>Study Area (1)</u>
	<u>Moored</u> <u>Vessels</u>	<u>Launched</u> <u>Vessels</u>	<u>All</u> <u>Vessels</u>	
	-----# of vessels-----			%
1	709	208	917	77.3
2	832	86	918	90.6
3	1,244	134	1,378	90.3
4	1,446	834	2,280	63.4
5	297	452	749	39.7

(1) These estimates are high to the extent that traffic not generated from study area moorage or launching ramps is found on the river.

These data suggest that vessels with study area moorage may account for approximately 60 percent of traffic in Reach 4 during peak periods. In Reach 5, contribution by vessels that moor likely falls below 40 percent. The proportion of marina to launched boats is relatively high in Reaches 2 and 3, and declines, but still appears dominant in Reach 1.

c. Waiting Times at the Launch Site

Tables 40 and 41 identify waiting times associated with launching and returning boats at each study area ramp. These data indicate that waiting times are longest at Garcia Bend where put-in waits average 35 minutes during peak periods, with take out waiting of a similar duration. Elkhorn-Sacramento also has significant waiting during peak periods (a 24 minute average wait to put in, and 18 minutes to take a boat out). Peak period waits at Elkhorn-Yolo, Discovery Park and Miller Park are in the range of 10-15 minutes to put in, and up to 20 minutes to take out. The Broderick ramp does not appear crowded under even peak conditions.

Table 40

Average Waiting Time at Study Area Launching Ramps (1)

<u>Launching Ramp</u>	<u>Putting Boats In</u>		<u>Taking Boats Out</u>	
	<u>Expected Wait</u>	<u>Actual Wait</u>	<u>Expected Wait</u>	<u>Actual Wait</u>
	-----minutes-----			
Elkhorn - Sac.	5 (3.8)	12 (5.4)	10 (4.0)	12 (4.1)
Elkhorn - Yolo	6 (4.2)	8 (3.8)	7 (4.1)	9 (5.1)
Discovery Park	5 (9.5)	5 (6.6)	6 (9.6)	10 (10.3)
Broderick	3 (3.8)	<1	4 (4.2)	1 (1.2)
Miller Park	6 (6.3)	5 (5.8)	12 (10.0)	8 (7.5)
Garcia Bend	16 (16.1)	11 (9.5)	25 (27.5)	17 (9.5)

(1) Based on data from June 28, June 29, July 3 and July 4.

* Data in parenthesis are standard deviations.

Table 41Peak Period Average Waiting Time - By Launch Ramp

<u>Launch Ramp</u>	<u>Peak Period Wait to Put Boat In</u>		<u>Peak Period Wait to Take Boat Out</u>	
	<u>Time</u>	<u>Wait</u>	<u>Time</u>	<u>Wait</u>
		(min.)		(min.)
Elkhorn - Sac.	8-9	24	6-7	18
Elkhorn - Yolo	1-2 5-6	15 15	4-5	20
Discovery Park	11-12	14	6-7	20
Broderick	5-6	5	4-5	5
Miller Park	2-3	10	12-1	17
Garcia Bend	2-3	35	6-7	36

d. Perceptions and Motivations of Launchers

Table 42 identifies principal motives of boaters who use launching ramps in the study area. It can be observed that the two Elkhorn ramps and the one at Garcia Bend service a proportionately higher percentage of water skiers than those in Reach 4.

Table 42

Principle Boating Activity for Launched Boats⁽¹⁾

<u>Launching Ramp</u>	<u>Cruising</u>	<u>Fishing</u>	<u>Skiing Jet/skiing</u>	<u>Other</u>	<u>Total</u>
Elkhorn - Sac.	48 (31.2)	15 (9.7)	85 (55.2)	6	154
Elkhorn - Yolo	16 (25.0)	3 (4.7)	38 (59.4)	7	64
Discovery Park	284 (44.4)	131 (20.5)	201 (31.5)	23	639
Broderick	44 (31.9)	33 (23.9)	34 (23.9)	27	138
Miller Park	117 (45.7)	25 (9.8)	97 (37.9)	17	256
Garcia Bend	81 (35.5)	21 (9.2)	118 (51.8)	8	228
Totals	590 (39.9)	228 (15.4)	573 (38.7)	88 (5.9)	1,479

(1) Based on data from June 28, June 29 and July 4.

* Numbers in parenthesis represent percent of launches targetting each principal activity at each launch ramp.

Table 43 identifies the facilities that boat launchers believe are needed at each ramp. Concern for ramp expansion is greatest at Garcia Bend, followed by Elkhorn - Sacramento. Primary concerns at Discovery and Miller parks seem associated with dredging and silt removal.

Table 43

Facilities Needed, By Launch Ramp⁽¹⁾

<u>Facility</u>	<u>Elkhorn - Sac.</u>	<u>Elkhorn - Yolo</u>	<u>Discovery Park</u>	<u>Broderick</u>	<u>Miller Park</u>	<u>Garcia Bend</u>
	-----% of launchers-----					
Facilities are O.K.	23.0	49.3	63.2	64.7	17.8	16.2
Dredging/Silt removal	2.4	16.9	11.9	--	31.8	9.9
More Parking	29.7	--	7.9	--	47.2	12.6
More ramp/ launch space	30.9	--	3.3	20.9	9.4	57.7
Better/more restrooms	6.1	8.5	3.2	3.9	28.3	9.1
Snack Bar/ store	4.2	2.8	2.2	2.6	7.7	2.4
Bigger picnic area	3.0	1.4	--	1.3	--	1.2
Drinking water	1.2	5.6	0.2	--	0.7	--
Moorage/docks	7.3	2.8	4.4	0.7	15.4	14.2
Security	0.6	5.6	2.5	6.5	6.6	10.3
Gas facilities	--	2.8	1.6	--	--	0.8
Traffic control	--	1.4	1.1	0.7	3.5	2.4
Telephone	--	1.4	1.8	--	5.2	0.4
Other	3.0	8.5	1.2	2.0	7.3	18.6

(1) Based on data from June 28, June 29, July 3 and July 4.

Other data obtained in our questionnaire, and of possible interest to readers, are included in Appendix 4.

e. Conclusions

Data provided in this section suggest that in Reach 5 river traffic is primarily generated by launching ramps. As one moves downriver, the proportion of marina-based boats on the river during peak periods increases; however. In Reach 4, a 60-40 split between marina based and launched boats may obtain during peak periods. The proportion of marina based boats is much higher than for launched boats in Reaches 1-3. Using waiting times as an indicator, expanded launching facilities seem most needed at the upriver and downriver extremes of the study area - notably at Elkhorn-Sacramento and at Garcia Bend. These facilities also register the highest proportions of clientele targetting water skiing during peak periods. Launching facilities at Broderick and at Elkhorn-Yolo do not presently seem pressed to capacity.

7. Marinas, Launching Ramps and Congestion on the River

Congestion is a time and location specific phenomenon that will vary with the perception of river users and with the technical requirements of the boating activity. Boaters looking for a passive experience will seek greater separation from other users than those engaged in more active recreational boating. Fishing boats with lines in the water require more space than pleasure boats that are not fishing,

for example. Further, boaters tend to select river areas that will meet their desired conditions of user density. Hinton (1982) has suggested that, at minimum, a fishing boat in moving water requires four acres of surface area for uncongested recreation--an area just over 400 ft. by 400 ft. square. Clearly, fishing hot spots on the Sacramento River experience far greater congestion at peak usage. In general, we consider measures of boat/day/reach of little direct use in measuring an instantaneous variable such as congestion. Rather, we believe that congestion can most effectively be considered in terms of conditions at river access points during peak periods, at boat use hot spots, or at locations where users are in close proximity to one another.* This draws our attention to marina and launching ramp usage during the peak summer months, to conditions in the adjacent river during peak periods and to fishing hot spots.

Previous analysis leads us to conclude that both marinas and launching ramps on the Sacramento shore are likely to be congested during peak demand periods. Fishing activity, such as that we observed in late June at the mouth of the American River, can be intense, and can preempt rapid boat travel. Further, Reach 4 assumes a generally crowded condition on peak weekend afternoons.

Field inspection suggests that Sand Cove Beach, about 1/4 mile above Dwyer's Landing and just below the I 880 overpass, poses particular conflicts during summer months. The beach

* It would be technically possible to establish spatial requirements for categories of boating use, and to estimate the frequency of negative encounters at peak period. This would require an analysis more extensive than the scope of this study.

supports significant levels of recreational swimming, and water skiers sometimes jump start from the beach--proceeding at right angles to transiting traffic. At the same time, downstream traffic is still traveling at speed, while upstream traffic is accelerating after passing Dwyer's Landing. Finally, currents opposite the beach area are as difficult as any in the study area.

The general perception of boaters is that the entire study area is "somewhat crowded" during peak weekends, although negative reaction to problems of crowding did not appear strong. The capability to leave crowded areas quickly by boat was noted as important, however.

While it is difficult to directly apply data on user density per year, per month or per day to achieve useful results, it may be helpful to establish peak user density benchmarks against which to assess relative crowding in subsequent years. These data are developed for the July peak month and provided in Table 44. Data on moored vessels are developed from Tables 21 and 23. Data on peak use of launched craft are from Table 29. Ten percent of total traffic is assumed to originate outside the area*.

* This is reduced from the DWR 20 percent figure due to capture of some non-residents in our boat launch survey.

Table 44Benchmark Estimates of Peak Boater Densities
in July in the Sacramento River Study Area

	<u>Estimated Area acres</u>	<u>Boats per Day per Acre boats/acre</u>
Study area acres	1,816	--
Estimated density of boats from study area marinas	--	1.1
Estimated density of launched boats	--	.3
Estimated density of all boats	--	1.5

Densities in Reach 4 will be far higher. Further, the relative contribution to overall crowding of launched boats will increase in upriver areas.

IV. Other Issues Affecting Marinas in the Study Area

1. The Sacramento Deep Water Ship Channel

The Sacramento Deep Water Ship Channel is accessed on the Yolo side of the Sacramento River across from Miller Park. It provides high speed access for 2-county boaters to the lower Delta and San Francisco Bay, bypassing speed controls and reducing user conflict and congestion along the main Sacramento River downstream. Discussion with boaters suggests that the Channel reduces traveling time to the Delta by about 3 hours, with associated reductions in fuel costs. This estimate will vary with vessel configuration.

The lock providing access is presently operated by the City of Sacramento, under a contract with the U.S. Army Corps of Engineers. However, a stable source of funding for its continued operation is lacking. Stabilization of the operation of this lock facility offers major potential for management of congestion related conflict in Reaches 1, 2 and 3.

2. Impact of Boats on Residents of Garden Highway

A significant study concern has been the potential impact of boater traffic generated by marinas on residents living along the river-side of Garden Highway. To address this issue, a survey was conducted on a door to door basis, targetting all residents on the river-side of the highway. The survey form is included as Appendix 5. Response rates for the survey are provided in Table 45.

Table 45

Response Rates - Garden Highway Resident Survey

	<u>Frequency</u>	<u>Percent</u>
Number of homes in Garden Highway study stretch	171	100.0
Number of homes contacted	125	73.1
Not at home	46	26.9
Refusals	8	4.7
Successful Interviews	117	68.4
Rate of Response (based on homes contacted)	--	93.6

To avoid bias, the survey was administered at three progressively more specific levels of enquiry. First, residents were asked what was good and bad about living along the river, but boat traffic was not identified. This initial line of question was used to identify whether boat traffic was considered a major problem for residents. Second, the issue of boat traffic was specifically raised, and residents were asked specifically whether the traffic caused problems. Finally, where problems with boat traffic were identified, residents were asked to specify the problem(s) in more detail. Results of the first open-ended line of questioning are presented in Tables 46 and 47.

Table 46

Benefits of Living Along Garden Highway

<u>Benefit</u>	<u>Frequency</u>	<u>Percent of Respondents</u>
	#	%
Being by the river	72	61.5
Rural living and Privacy	57	48.7
Quiet and Peaceful	49	41.9
View/Open Space	35	29.9
Cool in Summer	24	20.5
Close to the City	17	14.5
Wildlife	16	13.7
Other	16	13.7
Total n	117*	--

* Individual responses add to more than 117 due to multiple answers by several respondents.

Table 47

Major Problems or Annoyances Living Along
the Garden Highway

<u>Problem/Annoyance</u>	<u>Frequency</u>	<u>Percent of Respondents</u>
<u>A. Noise Related</u>		
1. Noise from boats on river	53	43.0
2. Highway traffic noise	31	26.5
3. Airport/airplane noise	29	24.8
4. Noise from other side of river.	3	2.6
Total Noise Related	<u>116</u>	<u>99.1</u>
<u>B. Flooding/High Water</u>		
5. Flooding/high water	44	37.6
<u>C. Erosion of River Banks/Boat Wave Wash</u>		
6. Erosion of river banks	5	4.3
7. Boaters don't know rules	5	4.3
8. Wave damage	4	3.4
9. Uncontrolled river traffic	3	2.6
10. Water skiers	1	0.9
Total Erosion/Wave Wash	<u>18</u>	<u>15.4</u>
<u>D. Other Responses</u>		
11. Insects	11	9.4
12. Too far from city	5	4.3
13. Theft	4	3.4
14. Other - general	<u>34</u>	<u>29.1</u>
<u>E. Total Respondents, n</u>	117	--

From Table 47, it can be observed that noise, including that from boats, is far and away the most significant concern of Garden Highway residents. Understandably, concern over flooding is also significant. Only 15.4 percent of residents identified problems of wave wash during this initial inquiry.

Residents were then asked if they owned a boat and/or a private dock. Results of these questions are presented in Table 48.

Table 48
Boat and Private Dock Ownership of Garden
Highway Residents

<u>Characteristics</u>	<u>Frequency</u>		<u>Percent</u>	
	<u>Yes</u>	<u>No</u>	<u>Yes</u>	<u>No</u>
	-----#-----		-----%------	
Own a boat	83	34	70.9	29.1
Own a private dock	64	53	54.7	45.3

Residents were then asked to estimate the number of vessels passing their residence in a peak hour and peak day respectively. These data, which may serve as useful reference points for future analysis of boat traffic densities, are presented in Table 49. Time intervals over which peak traffic is noticeable are reported in Table 50.

Table 49Estimated Peak Traffic Passing the Average
Garden Highway Residence Per Peak Weekend Hour and Day

<u>Traffic Measure</u>	<u>Average Boats</u>	<u>Standard Deviation</u>	<u>Number of Respondents (n)</u>
Boats per peak hour	56	45	109
Boats per peak day	335	293	106

Table 50Interval for Boat Traffic on The River

	<u>Average Hour of the Day</u>	<u>Number of Respondents (n)</u>
Starting time	9:00 am	112
Ending time	9:00 pm	112

Respondents were next asked to specifically list any boat traffic-related problems that affected them. Results are presented in Table 51.

Table 51
Boat-Related Problems Noted by Residents
of Garden Highway

<u>Problem</u>	<u>Frequency</u>	<u>Percent of Respondents</u>
		(n = 116)
1. Loud boat noise	59	50.9
2. Wave wash/wakes	39	33.6
3. Erosion	7	6.0
4. Damage to moored boat(s) and dock	4	3.4
5. Speeding	16	13.8
6. Traveling too close to dock	9	7.8
7. Boaters don't know rules of waterway	7	6.0
8. Boating laws not enforced	4	3.4
9. Jet boats/skiers	4	3.4
10. Inconsiderate people	4	3.4
11. Other	15	12.9
Sub-total-potentially noise related	67	57.8
Sub-total-potentially related to wave wash	94	81.0
Noise related (from Q. 10)	45	38.8
Wave wash related (from Q. 11)	63	54.3

Boat noise was again identified as a significant issue. However, in this second level questioning, effects of wave wash on the integrity of river banks, on docks and on moored vessels, was identified by 81 percent of those interviewed. This leads us to conclude that wave wash is a significant, although not overriding, problem for Garden Highway residents - and that it is likely the source of continuing annoyance and incremental expense over time.

Our third level of questioning attempted to specify the exact nature of boat wave and noise problems. Results with respect to wave wash from boats are presented in Tables 52 through 55.

Table 52Causes of Wave Wash Problems - Residents
of Garden Highway

<u>Cause</u>	<u>Frequency</u>	<u>Percent of Respondents</u> (n = 45)
Speeding	19	42.2
Big waves/wakes	18	40.0
Boats too close to property/docks	11	24.4
Plowing	6	13.3
Not obeying rules	5	11.1
Other	3	6.7

Table 53Estimate of Boat Distances Relative to
Wave Wash Problems

<u>Boater Category</u>	<u>Average Distance</u> ft.	<u>Standard Deviation</u>	<u>Number of Respondents (n)</u>
Boats that are too close to property/ docks	22	21	28
Boats that are far enough away from property/docks	64	62	24

Table 54Estimate of Boat Speeds Relative to
Wave Wash Problems

<u>Boater Category</u>	<u>Average Speed</u>	<u>Standard Deviation</u>	<u>Number of Respondents (n)</u>
	MPH		
Boats traveling too fast	43	9	16

Table 55Specific Damages Associated With Boat Wakes

<u>Type of Damage</u>	<u>Frequency</u>	<u>Percent of Respondents</u>
	#	(n = 47)
Erosion	40	85.1
Dock damage	27	57.4
Boat damage	15	31.9

These data suggest that the erosion effects of boat waves are the major concern of residents, although concern over damage to boats and docks is also significant. Not surprisingly, boats traveling too fast and/or coming too close are perceived as the primary causes of damage.

Finally, the perceived causes of adverse noise impacts from boats are displayed in Table 56. Boats operating without mufflers, jet boats and boats using dry stacks are identified as the primary problem group.

Table 56

Identification of Boats Causing Noise Problems

<u>Boat Characteristic</u>	<u>Frequency</u>	<u>Percent of Respondents</u>
		(n = 63)
No mufflers	54	85.7
Jet boats	31	49.2
Dry stacks	22	34.9
Hot rods	6	9.5
Speeding	4	6.3
Other	3	4.8

3. Levee Road Capacities

The capacity of adjacent levee roads can be a limiting factor in marina expansion. Therefore we surveyed present road capacities along the levee. The data we were able to obtain are summarized in Table 57. This indicates the need to properly plan for increased traffic that might be generated by additional marina development activities.

Discussion with traffic experts from the State and from Sacramento County suggests that roads adjacent to the river in the City of Sacramento are being used "at capacity", while present traffic in the two counties is well within design limits.

Table 57
Data on Present Road Capability
in the Study Area

<u>Area</u>	<u>Design Capability</u>	<u>Traffic Counts</u>	<u>Date of Counts</u>
<u>Sacramento County</u>			
Freeport Bridge Rd.	- 10,000-15,000 vehicles/day (1)	- 4,500 vehicles per day	1983
	- (1)	- 490/peak hr.	1983
Meadowview	- (1)	- 650/peak hr.	1983
W. of Powerline Rd.	- 1,000 vehicles/ lane/hr. (2)	- 360 vehicles per day for 2 lanes	1985
<u>Sacramento City</u>			
Pocket Rd. (near Greenhaven)		- 2,000 vehicles/day	1980
Garden Hwy.	- (2)	- 4,110 vehicles/day	1984
Broadway at 3rd. St.	- (2)	- 6,293 vehicles day	1984
<u>Yolo County</u>			
Riverbank Rd.	- 1,000 vehicles per lane day (3)	- 573 vehicles/day	1983
S. River Rd., N. of Babel Slough Rd.	- "	- 396 vehicles/day	1985
S. River Rd., S. of Babel Slough Rd.	- "	- 258 vehicles/day	1985
N. of Davis Rd.	- "	- 199 vehicles/day	1985
S. of Davis Rd.	- "	- 262 vehicles/day	1985
N. of Linden Rd.	- "	- 602 vehicles/day	1985
S. of Linden Rd.	- "	- 524 vehicles/day	1985

(1) Personal communication, State of California traffic experts.

(2) Personal communication, County of Sacramento traffic experts.

(3) Manual of Instructions, Caltrans.

Other important services such as public utilities and fire protection are not discussed in this document. These concerns are more appropriately considered during evaluation of specific projects.

4. Marinas and the Issue of Public Access

Public access is an important issue for waterside planning. Access may be linear, providing an opportunity to walk, run or ride along a given stretch of river bank without interference. Access may also be location specific, providing an opportunity to reach a given location on the river. Location specific access is most often obtained via park purchase of river front property, or through easement requirements placed on marina operators and other private entrepreneurs. Linear access involves continuity of bank-side access, with frequent direct access to the river itself. Continuity can be obtained via pathways, jogging trails, bicycle trails, or via sidewalk access in urban areas.

No existing specific plan delineates comprehensive access requirements in any of the 3 local jurisdictions in the study area. Sacramento City comes the closest in a 1975 planning document extending linear access from approximately the mouth of the American River through Old Sacramento to the city's downriver boundary on the Sacramento River. Yolo County also has embodied planning concern for preservation of open space and access along its urban river area and in that sense shows a similar concern to that expressed by Sacramento City

(Gibson, 1986). In non-urban areas, Yolo County sees public access to the river as a less important priority. Rural access to the river on the Yolo County side is provided at Elkhorn Regional Park (RM 69.5) and Broderick (RM 59.3). Rural access on the Sacramento side of the river has been provided at Elkhorn (RM 70.5) and at Garcia Bend (City of Sacramento, RM 49.3).

It should be noted that where linear access is planned for heavily vegetated areas within urban locations, provision for service vehicle access and public safety become important components of a linear plan. This is particularly true for so-called "hobo jungle" areas along the present urban river bank.

5. Historic and Archeologic Resources of the Sacramento River Marina Study Area

i) Sacramento County (East Bank)

Fifteen historic/archeologic studies have been conducted along the Sacramento River between Freeport and the Sutter County line. Many of these surveys have resulted in identification of cultural resources (Holman, 1984; Johnson, 1974; Peak, 1985; Russo, 1978; Werner, 1985; Wiant, 1976). The area along the Sacramento River has an exceptionally high number of prehistoric and historic sites, according to the Northwest Information Center, Department of Anthropology at Sonoma State University. A list of these resources is included in Appendix 6.

The banks of the Sacramento River were intensively utilized in the historic past. Since most of the project area has not been field surveyed, there is a high possibility for discovery of additional cultural resources. Many prehistoric villages were located on the natural levees of the Sacramento River, often across the river from one another or in small clusters. It is generally acknowledged that heavy siltation is likely to have buried prehistoric resources (Johnson and Johnson 1974). Historic settlements were also located along the river, including Freeport, Fremont, Washington/Broderick, and Sacramento. The Sacramento River was developed into a major transportation and trade route until introduction of the railroads.

ii) Yolo County (West Bank)

Thirteen recorded prehistoric archeological sites are known to be located within or immediately adjacent to the study area along the west bank of the Sacramento River from Freeport to the Sutter County Line. According to the Department of Anthropology at California State University in Sacramento, these sites represent the majority of known archeological remains in this reach. Only a few sites are recorded outside the river corridor, and these are mostly along the American River or on high ground within the City of Sacramento. Twenty-three survey reports are on file at the California State University of Sacramento for properties included or nearby (within 1 mile) of the study area.

There are numerous referenced historic landmarks and other features within or adjacent to the study area including Old Sacramento, the I Street and Tower Bridges, and five other properties listed in the National Register of Historic Places. Appendix 3 includes references for the historic and archeological sites located along the Yolo County (west) bank of the study area.

iii) Sensitivity of the Study Area for Historic/
Archeological Impact

Based upon the existing records for historic and archeological sites, and upon local topography, sensitivity for the study area is estimated to be quite high. It is considered, however, that the greatest extent of historic and archeological resources may yet be undiscovered. Further, these resources seem to be randomly dispersed over the study area. Consequently, no data are available to lead us to policy level recommendations for the study area as a whole. Rather, we believe it most effective to deal with historic/archeological concerns on a site-specific impact basis.

The departments of anthropology at both Sonoma and Sacramento State Universities recommend that updated record searches and on-the-ground archeological surveys be done for each new proposed development. They recommend updated record searches because several years may pass before some of the proposed marinas are built. During this time new information may be discovered which could affect the

quality and completeness of work undertaken to identify cultural resources. Appendix 3 contains a Survey Recommendation Advisory which should guide future survey work in the marina study area. This advisory should also be applied to the river bed, if the possibility of significant historical/archeological impact on submerged resources is suspected.

V. The Existing Marina Situation in the Study Area - A Summary

On the basis of previous analysis, the following conclusions appear appropriate respecting marinas and associated recreational boating on the Sacramento River bordering Sacramento and Yolo Counties.

1. Present moorage for vessels approaching 40 feet or longer is strained to capacity.
2. For remaining boat size classes, marinas likely operate at 95+ percent capacity from May through October, and then drop back to about 75 percent for the remainder of the year. During peak periods, sport fishing and waterskiing boats replace each other to some extent, with waterskiing activities most notable in June, July and August.

3. Overall, boats moored at marinas account for less than 10 percent of total 2-county registrations; this is also likely to indicate relative annual activity. Chief boat-related recreational activities on the river are fishing and pleasure cruising. Waterskiing accounts for less than five percent of total boating activity on an annual basis, with jet skiing accounting for a negligible percent of total activity.
4. Boaters from marinas in the study area contribute a relatively small portion of total boating activity on a year round basis. At peak summer periods, the relative role of marinas in generating river traffic increases due to accessing constraints at launching ramps. On peak summer weekends, a higher portion of traffic in Reach 5 is generated by launched craft than by marina-based craft. This has particular relevance for the noise and wave wash concerns of Garden Highway residents. Marina-based traffic is somewhat more numerous than launched craft in Reach 4 during summer peak weekends, and is clearly more numerous in Reaches 1 through 3. We estimate that about 20 percent of boating activity in the study area is generated from outside the two counties.
5. Boating activity generated by boats from marinas in the study area is heaviest adjacent to urban Sacramento (Reach 4), and can also be relatively significant in other Reaches at fishing hotspots or during particular peak summer periods.

6. In terms of conflicts, noise, wave wash problems and associated need for speed reduction on the river are most acute during summer months, when boater traffic is most intense and when river elevation is low. Other conflicts occur when boating and/or fishing activities are at a peak, and will involve both access to the river and activity on it. Congestion problems are most likely at or adjacent to marinas and launch ramps, at fishing hot spots and in other areas such as Garden Highway, where high speed boating activity conflicts with more passive river and bank-side pursuits.

7. Future demand for marina moorage will expand with population. With peak use presently constrained by existing marinas and launch ramps, steady expansion in accessing needs and attendant pressure on river resources can be anticipated.

8. While growth in demand for access is anticipated, the economic viability of all present and future marina operators is not assured. Viability of private operators is presently most threatened by price competition from public marinas and by the failure of some operators to horizontally expand their facilities to encompass a variety of enterprise centers.

VI. Ecological Issues and Impacts

1. The Importance of Riparian Vegetation and Wildlife

i) Importance to Society

Sacramento Valley riparian forests are highly productive habitats found along most of the major rivers and tributaries wherever there is an abundant water supply, high nutrients and coarse textured, well aerated and well drained soils. These forests provide cool retreats for wildlife and man during the summer as well as abundant food and nesting sites for a wide variety of wildlife species. They have been described as "gallery forests", reminiscent of tropical jungles, especially during the summer when vines of wild grape and clematis hang in profusion from tall cottonwoods. The undergrowth in riparian areas is often so dense that it is nearly impossible to pass through these jungles.

Riparian forests of the Sacramento River are characterized by the presence of an overstory of Fremont's cottonwood with some California sycamores and a varied midstory composed of box elder, Oregon ash, elderberry, alder, buckeye, walnut, valley oak and numerous species of willow. The understory layer is comprised of young shrubs and trees plus a large assortment of wildflowers and grasses. Growing over all these plants are vines, including clematis, poison oak, honeysuckle, Dutchman's pipe vine, wild cucumber and California rose, along with native and introduced blackberries. The resulting forest is multi-layered, with many different heights and sizes of plants. It is very similar to the tropical forests of South America in its appearance, and presents an attractive backdrop for people enjoying the river.

Riparian forests do more than support wildlife and provide restful areas for man. They play an important role in stabilizing the river banks and moderating flood flows. The roots of all the forest plants form a mass which anchors soil in place and allows recharging of ground water during and after storms. When these forests are cut down, or the understory and midstory cleared away, the ecosystem is weakened and the root mass is less able to hold the soil. The result is erosion of topsoil and of banks, and increased siltation of the river. This can impact water quality and contribute to costs of water purification. As banks begin to fail, costs will be incurred to apply physical protection to reduce further erosion and prevent flooding.

Well known recreational values of the Sacramento River riparian forests include bank fishing, bird watching, boating and simply enjoying a peaceful quiet place. Other social benefits are derived from these areas in the forms of open space, outdoor education, aesthetics and scientific study. Even in a narrow band of riparian vegetation which still has its complex stratification of under-, mid-, and overstory plants, one can experience solitude and relief from the pressures of urban life. The atmosphere within a complete Sacramento River forest is restful, refreshing and a pleasant contrast from the surrounding urban noise and activity. The recreational value of riparian areas is well exemplified by the nearby Lower American Parkway, a thirty mile urban riparian corridor which supports a variety of successional stages of riparian forests and valley oak groves in the City

and County of Sacramento (Meyer Resources, Inc. 1985; Sacramento County, 1985). As California's human population in the Central Valley continues to expand, the unique riparian corridors of the American and Sacramento rivers will become even more important as open space and recreation sites.

Just as riparian forests on public lands are valued for their contributions to parks and open space areas, the presence of a riparian forest is also an aesthetic asset to private property. In the Sacramento area, the home sites along the Garden Highway are attractive because of their native riparian vegetation. This vegetation serves as visual screening between homes, as well as providing ready-made landscaping. The overall appearance of the Sacramento River waterfront is enhanced wherever riparian trees, shrubs and understory plants remain. Marinas and other waterside developments can take advantage of this aesthetic complement to their property by saving the riparian vegetation. The riparian vegetation, including the under- and mid-story plants as well as the tall shrubs and trees, can be retained as natural landscaping, and thus becomes both a visual and an economic asset to a development. In fact, the Marina and Recreation Association support enhancement of natural wildlife in the river corridor, as they feel "wildlife enhancement adds to the ambiance and quality of the river experience" (Marina and Recreation Association, 1986).

ii) Importance to Wildlife

The importance of Sacramento Valley riparian forests to wildlife is well documented. They are vitally important to the survival of over 100 species of birds, 39 species of mammals, 19 species of reptiles and amphibians, 27 species of fish, and numerous invertebrates (Roberts, et al. 1977). Studies have shown that approximately 70 species of birds nest in Sacramento Valley riparian zones, more than in any other habitat type in California. Because the remaining riparian woodlands along the urbanized reaches of the Sacramento River are narrow and scattered, compared with their original extent, they are now of more critical importance to wildlife. Even a small stand of a few acres will be used by a variety of birds, mammals, reptiles, amphibians and invertebrates. Any further removal of riparian woodlands, therefore, must be addressed in the context of their extremely limited and reduced extent.

Several species of special concern have been recorded for the riparian woodlands of the study area and are given special emphasis in our report. They include the California yellow billed cuckoo, the Swainson's hawk and the valley elderberry longhorned beetle. Examples of other species of interest which occur in the study area are the river otter, the great blue heron, and the yellow warbler. These species and many others are declining in numbers due to loss of riparian woodland habitats. Emphasis on these animals does not underestimate the importance of the other species which

utilize riparian forests. All the wildlife and vegetation which constitute the riparian community are interrelated and important to the functioning of the ecosystem.

No matter how rare or common a species might be, there are several features of riparian woodlands which are of critical importance to wildlife. The dense undergrowth provides protection from predators, and quiet places to rest. The forest canopy creates shade and cools the air, while the vegetation itself creates higher humidity than the surrounding environment. Tall trees are used as nesting sites and perches by predatory birds, and mid and understory shrubs serve as nesting sites for smaller birds and mammals. The linear nature of a riparian woodland acts as a migratory corridor for birds, mammals and other wildlife. In fact, if a riparian corridor is fragmented, certain creatures have great difficulty crossing the newly opened breach in the forest. This can create problems for young animals which must move out of established territories to find their own new feeding and breeding grounds.

The stratified nature of riparian forests allows a diverse wildlife population to use them. They are like high rise apartments, offering many sizes and floor plans to their tenants. The variety of vegetation types provides abundant food in the form of leaves, flowers, fruits, berries and seeds. Insects of many kinds play important roles in pollination of riparian plants, and the variety and abundance of insects are a critical food supply for nesting birds during the raising of their young.

Even the river's instream life benefits from the riparian woodlands (Baltz and Moyle, 1984). Underwater roots of riparian trees and shrubs growing along the riverbank are used by fish as shelter from river currents and hiding places from predators. Snags which occur along the banks or in shallow areas also provide resting places for fish. Contributions of riparian vegetation in terms of shade and instream nutrient input into the Sacramento River occur along sidesloughs and backwaters, rather than in the main channel. Probably the most important functions of riparian vegetation relative to instream habitats are stabilization of riverbanks and reduction of sediment loads.

iii) Historical Impacts

Prior to human settlement of the Sacramento area, riparian woodlands occurred along all the major rivers and their tributaries and formed nearly impenetrable jungles of lush vegetation. Diaries and field notes of early explorers described forests of tropical luxuriance growing in bands several miles wide along both banks of the Sacramento River. These forests supported astounding numbers of wildlife species, including elk, grizzly bear and bald eagles. The productivity of the forests and adjacent river systems also resulted in substantial populations of both resident and anadromous fishes. By the 1850's, the vast forests along the Sacramento River and its tributaries had been reduced to about 775,000 acres. By 1952, the figure had dropped to 27,000 acres, and a 1972 survey estimated there were less

than 18,000 acres of riparian woodland remaining in the Sacramento Valley. Current estimates indicate this figure has dropped further, to about 12,000 acres (Sands, 1977).

These losses of riparian vegetation have occurred for numerous reasons including clearing of land for agriculture, timber production, bank protection and river stabilization projects, livestock grazing, water development and urbanization. Through a combination of these actions, we have lost over 95 percent of the riparian woodlands which once thrived along the Sacramento and its tributaries.

2. Existing Condition of the Riparian Forests of the Sacramento River Marina Study Area

In order to understand the impacts of marinas on riparian vegetation and wildlife along the Sacramento River between river miles 44 and 76, it is necessary to assess the existing condition of this resource. Field surveys were conducted in the fall of 1985 and January, 1986 to characterize the river bank vegetation along both banks of the river and to locate those areas where bank protection works were in place. Aerial photographs (USACE, 1984) were used to develop acreage estimates of the vegetation types identified in the field and to determine the location and extent of potential riparian vegetation restoration sites. Eight vegetation cover types were used to characterize the river banks. Cover types were based upon the vertical structure of the vegetation and upon the means and extent of artificial bank stabilization. The types ranged from rock rip-rap to mature riparian woodland, with herbaceous and

riparian brush intermediates. Habitat was assessed from the river's edge to the top of the levee on the river side. The width of this riparian corridor varied between about 50 and 500 feet, depending on the presence or absence of berms. Table 58 describes the eight vegetation cover types. Table 59 shows total acres of riparian woodland and potential restoration areas by study reach. Field data showing the cover type, condition and extent of riparian vegetation, the nature of any disturbances to the vegetation and recommendations for revegetation potential on both banks by river mile are presented in Appendix 7.

Table 58

Riparian Vegetation Cover Types
Sacramento River Marina Study

- RW = Riparian Woodland
 Mature riparian trees (cottonwoods, sycamores, box elder and oaks) with an understory of willow trees and brush species. This cover may range from mid-slope to the top of the levee. Generally there are little if any artificial bank stabilization areas except in specific localized areas.
- RW₂ = Riparian Woodland with Urban Development Within
 These areas support a mature riparian cover with small areas of underbrush and tree clearings around homes within the woodland. Very little bank stabilization except in localized areas around homes. Revegetation is generally not needed.
- RB = Riparian Brush Cover
 Rock rip-rap areas which are reverting back to Riparian Woodlands. They may be a seral stage of riparian succession. Areas are dominated by tall grasses, willow and blackberry thickets and scattered trees. Revegetation potential for these areas is high with some enhancement plantings of trees.
- RB₂ = Mosaic of Riparian Brush Cover with Stands of Mature Riparian Woodlands
 Areas with small stands of mature riparian tree cover with a limited understory of grass and forbs. Revegetation potential is high with plantings of brush understory species.
- RR = Rip-Rap Areas
 These are newly or freshly rip-rapped areas with little or no vegetation cover except for some annual grass species in between rocks. Revegetation potential is high if an extensive planting program is initiated.
- RR₂ = Rip-Rap Areas with Various Levels of Herbaceous Cover
 These areas have exposed rock rip-rap with a vegetation cover dominated by herbaceous species. This revegetation potential is high involving an extensive planting program of woody species.
- D = Developed Areas
 These areas have extensive developments such as marinas, restaurants, etc., eliminating much of the native vegetation. The developments extend to the base of the river bank and out into the river in some cases. Revegetation potential is low for these areas due to the lack of available river bank for planting.
- P = Pavement
 Vegetation cover is limited to grass and forbs growing between cracks in the pavement apron. The revegetation potential is low unless the pavement is removed.

Table 59

Riparian Woodland and Potential Revegetation Areas
In Acres, by Study Reach, Sacramento River Marina Study

<u>Reach</u>	<u>River Miles</u>	<u>Riparian Woodland¹</u>	<u>Potential Revegetation Areas²</u>
		-----acres-----	
1	44.0 - 53.5	63	94
2	53.5 - 55.5	70	17
3	55.5 - 57.5	37	32
4	57.5 - 62.0	115	4
5	62.0 - 76.0	<u>429</u>	<u>71</u>
Totals	32 miles	714 acres	218 acres

¹ Consists of RW and RW₂ habitat.

² Consists of RB, RB₂, RR and RR₂ habitat.

There are approximately 714 acres of riparian woodland and 218 acres of rip-rap and disturbed areas along the banks of the Sacramento River in the study area between river miles 44 and 76. Riparian woodland is categorized as having mature riparian trees, such as cottonwood, sycamore, box elder, and oak with an understory including willow, button-willow, wild rose, grape, poison oak, and mugwort (Roberts, et.al. 1977). In the study area, this plant cover may range from midslope to the top of the levee. Some of the existing riparian woodlands extend 500-600 feet back from the steep river banks; others grow on 100-150 foot wide berms between the levee and the river. In the study area, there are about three times more riparian woodland acres than rip-rapped acres because the woodland areas are generally wider than the rip-rap placements. In general, an average acre available for potential revegetation is expected to be less productive than an average acre now in riparian production due to marginal soil conditions.

North of I Street Bridge (river mile 59.5), the river banks support far more riparian woodlands than south of this bridge, especially along the eastern bank. About 544 acres of riparian woodland exist along the Sacramento River north of the City of Sacramento, compared with 170 acres south of the City. Except for private home sites and marinas, which usually result in complete removal of riparian vegetation, very few bank stabilization efforts have been made north of the City. The existing native riparian vegetation appears to be effectively slowing bank erosion while providing valuable wildlife habitat and presenting an aesthetic view corridor. On river banks north of the City, riparian woodlands are approximately seven times greater in extent than the disturbed rip-rapped areas.

South of the I Street Bridge, the riparian woodlands are more disjunct and the overall impression is one of remnant stands of vegetation separated by narrow stringers of scattered trees and long stretches of rip-rapped banks, some with isolated willows, patches of vines and grasses. Some healthy stands of riparian woodland occur on the west bank at Babel Slough, along the east bank at river miles 52 and 54, along the east and west banks at Sherwood and the Sacramento Yacht Club, and along portions of the east and west banks from river mile 56 to Miller Park. However, the dominant cover types south of Sacramento are riparian brush, small stands of trees without an understory, and rip-rapped areas. Rock rip-rap covers 143 acres in the southern portion of the study area below I Street Bridge, compared with 75 acres in the northern portion about I Street Bridge.

3. Riparian Restoration Potential

The ecological productivity of the study area can be increased by restoring riparian woodlands in areas which have been disturbed. The existing condition of the riverbanks indicates that rock rip-rap is the dominant method of bank stabilization used, especially south of Highway 80. Rock rip-rap was observed to extend from the water's edge up to one half to two thirds the slope of the bank. In some localized spots it extended to the top of the bank. Above the rip-rap the banks are generally grass covered, and, judging from the sharp line of demarcation between the grass and the rip-rap, these grass areas are presumed to be maintained to allow easy access and view of the levees. Vegetation within the rock rip-rap zone varied from low herbaceous growth of grasses and forbs to wooded thickets of brush and small trees at about the high water mark of the river. These cover types (indicated by RB, RB₂, RR and RR₂) were considered to have the greatest revegetation potential, and amounted to approximately 218 acres in the study reach. It would appear that those areas of brush and willow thickets represent a stage in the successional development of a climax riparian community. If left undisturbed these areas are expected to revert to a riparian woodland type. It is not clear if they would return to a woodland of tall, mature trees and a dense brush understory as currently exists in other portions of the river; however, it is reasonable to assume that over time more elements of native riparian habitat would reappear in these areas. It is likely that the rock rip-rap is slowing down the natural successional process; however, without the rip-rap the

banks would be susceptible to soil erosion. A revegetation program in these areas should (1) allow the natural process of succession to continue without disturbance, such as brush and tree clearing, and (2) enhance the recovery process in selected areas with plantings of native trees and brush species. It should be noted that a diversity of successional stages, from grass and forb cover to mature woodlands, is beneficial to the overall wildlife diversity of the river.

Other forms of artificial bank stabilization observed in the study area included the use of concrete blocks and cement aprons at localized sites. The revegetation potential in these areas is considered to be low because these cement features would have to be removed, which would be expensive with a limited return due to the small extent of these apron and cement block areas. However, depending upon the size of the area, removing the concrete block debris and replacing it with smaller rock rip-rap, which is more conducive to vegetation establishment, may be possible.

The restoration potential of riparian woodlands in the 32 mile study area is best in the southern half, below I street bridge. A total of 218 acres (143 below I street and 75 above I street) of rip-rapped and semi-vegetated banks could be restored by planting native riparian brush and tree species and by encouraging the natural recovery of vegetation now present.

Recognizing the need for levee maintenance, it is still feasible to have some riparian vegetation on levees (Carter and Anderson, 1984; Daar, et. al. 1984). Guidelines have been

established by the State Reclamation Board and the California Department of Water Resources for the planting and management of levee vegetation (State Rec. Bd., 1967; Cal. DWR, 1982b).

These guidelines point out several assets of levee vegetation, including:

- protecting soil from wind and water erosion;
- drying out saturated embankments;
- reducing damage from humans, vehicles and burrowing rodents;
- providing food and habitat to desirable wildlife (such as insect-eating birds and rodent-eating hawks); and
- enhancing the aesthetics of the riparian environment.

The trend in flood management is toward an acceptance of vegetation and a recognition of its values as long as it demonstrates no threat to the levee system (Reclamation Board, 1981). In the Marina study area, the levees are generally capable of supporting some riparian vegetation without posing a threat to their integrity. Therefore, an active riparian revegetation program which (1) encourages existing vegetation to colonize and (2) allows for planting of native riparian brush and trees is recommended. The details of such a program would require separate study, but program development could be based on the existing D.W.R. and State Reclamation Board guidelines. Revegetation could be accomplished on both public and private lands. Revegetation plans would have to be approved by the local Reclamation Districts and the State Reclamation Board.

Table 60 shows the recent usage of the 32 mile linear study area by threatened Swainson's hawks, and projects the maximum potential use if habitat is improved to the level seen in Yolo County at Willow Slough (i.e., one pair every 0.2 mile). Total existing nesting rates in the study area range from 2 to 5 nesting pairs of hawks per year. With ideal maximum riparian habitat restoration, 160 pairs of Swainson's hawks could use the 32 mile linear study area.

These data conclude that the existing nesting rate is at or below potential. With revegetation, it is highly likely that an increase in Swainson's hawk nesting will be seen over time. These hawks prefer cottonwoods and oaks from 20 to 100 feet in height. Therefore, immediate increases in hawk nesting should not be expected. However, it would be expected that, as riparian vegetation becomes denser and more productive over time, these habitats will become more attractive to hawks and many other species of birds and wildlife. If existing young cottonwoods and oaks are allowed to grow to maturity, the nesting Swainson's hawk population could begin to increase within 5-10 years. Section VI.4, i. (p. 103) discusses the Swainson's hawk and recent California Department of Fish and Game findings in detail.

Table 60

Swainson's Hawk Records 1983-1985 and
Potential Use by Reach (Nests/Mile/Year)

Reach	Actual Sightings/ Nests			Actual Ave. nests/ year/reach	Min. Potential* 1 pair/8.5 miles DFG Estimate	Max. Potential* 1 pair/0.2 miles DFG Estimate
	1983	1984	1985			
1 44-53.5 (9.5 mi.)	1/0	4/1	3/2	1.0	1.1	47.5
2 53.5-55.5 (2 mi.)		1/1	1/1	0.7	0.2	10.0
3 55.5-57.5 (2 mi.)			1/0	0	0.2	10.0
4 57.5-62.0 (4.5 mi.)	2/0	1/0	2/1	0.3	0.5	22.5
5 62.0-76.0 (14 mi.)	7/2	5/3	6/1	2.0	1.6	70.0
Total					3.6	160.0

* Schlorff & Bloom, 1984

4. Threatened and Endangered Wildlife and Other Species of Concern

The state and federal endangered species laws recognize that certain animals and plants are in danger of becoming extinct, primarily due to human activities. These species are protected, not only for their own right to exist, but also because they symbolize our state and nation's ability to support a healthy and diverse set of ecosystems.

Threatened species are frequently used as indicators of the health of an ecosystem, monitoring our environment in much of the same way as canaries did for the coal miners. Legal protection is based on an overall premise that the protection of genetic diversity in wildlife communities is essential for the ongoing existence of those communities. Additional justification is based on the potential usefulness of certain species of animals and plants to human society. Examples include the development of disease resistant strains of edible crops, biological pest controls, and development of medicines and vaccines.

The endangered species acts are discussed in Section VIII and Appendix 8 under Analysis of Agencies/Institutions. These acts preempt and/or condition any activities which would destroy the habitat of endangered or threatened species. The California Department of Fish and Game and the U.S. Fish and Wildlife Service are both responsible for commenting on projects which would affect endangered or threatened species in the Sacramento River riparian corridor. Projects which could affect federally protected species, such as the valley elderberry longhorned beetle, must comply with conditions established during consultation with the U.S. Fish and Wildlife Service.

Three threatened species are known to use the riparian woodlands of the Sacramento River within the marina study area. As riparian forests in the Sacramento Valley have declined, these species have also been reduced in number. Their distribution in the remaining riparian woodlands within the marina study area is a good indication of the overall

condition of the woodlands themselves. Their presence places direct constraints on the location and nature of developments in and near the riparian vegetation along the Sacramento River. The following discussions identify these threatened species.

i) Swainson's Hawk (Buteo swainsoni), California
Threatened Species, Federal Candidate Species

The California Department of Fish and Game continues to be greatly concerned over the status of the Swainson's hawk. Historic estimates range from about 4,000 to 17,000 pairs, while the current known population is 110 pairs with an estimated 375 pairs. This raptor population has suffered a 90 percent decline statewide since 1900. Results of a statewide 1979 DFG study and subsequent monitoring show that California's central valley supports the greatest concentration of breeding Swainson's hawks. These hawks are most numerous in the Davis, Woodland, Sacramento and Stockton areas (Bloom, 1979).

Additional studies conducted in 1980 and 1981 showed that a majority of all central valley Swainson's hawk nests and territories were close to or within riparian woodlands (Schlorff and Bloom, 1984). Subsequent monitoring sustains this finding. The nests were found most often in cottonwoods and oaks with heights ranging from 20-100 feet, with a mean of 41 feet. Occasional nests were found a mile or more away from a riparian zone, but most nests were within streamside vegetation. Nest surveys showed a frequency of one breeding pair per 8.5 river miles. The greatest nesting frequency was

recorded when three active territories were located along 0.7 mile of Willow Slough in Yolo County--indicating that, if abundant suitable habitat was available, nesting Swainson's hawks would co-exist as closely as 0.2 mile from each other. It was pointed out by DFG that adequate foraging areas must also be available to the hawks. These are primarily certain agricultural fields such as cereal grain, alfalfa, and livestock grazing lands. Grasslands and weedy areas are also very important hunting grounds.

The conclusion was drawn that Swainson's hawks in California are in serious trouble statewide. One key to the drop in Swainson's hawk numbers is the loss of tall nest trees, such as the cottonwoods of riparian forests and the oaks of the grasslands and fields. The remaining riparian areas are now vital because they are the best source of tall nest trees left in the central valley. Swainson's hawks apparently depend upon riparian woodlands for their migratory routes to and from South America as well as for their nesting sites. It is suggested that a vigorous program to maintain and enhance existing riparian woodlands would help to re-establish a healthy population of Swainson's hawks which could then migrate out and re-populate other areas of the state (Schlorff and Bloom, 1984).

At 27 separate locations in the 32 mile marina study area, a total of 34 sightings of Swainson's hawks were made by DFG during a three year period from 1983 to 1985 (Schlorff, 1985). Eleven of these were in the southern half of the study area (downstream of I Street Bridge) and 23 in the northern half. Two nests were seen in 1983, and 5 each in 1984 and

1985. The 1979 DFG data collected for the central valley indicated that one nesting pair of Swainson's hawks might need an 8.5 mile riparian territory. One might consequently expect about 5 pairs of Swainson's hawks nesting in the 40 mile study area each year.

The 1983-1985 data indicate that actual use is from 2 to 5 pairs per year. This is very encouraging, and shows that, with active restoration and protection of existing and new riparian woodland, the study area has great potential for sustaining more pairs of Swainson's hawks. This is especially true for woodlands adjacent to open fields, as noted above.

ii) California Yellow Billed Cuckoo (*Coccyzus americanus occidentalis*), California Threatened Species, Federal Candidate Species

The California yellow billed cuckoo once occurred throughout California's coast range and central valleys. Presently, its numbers are limited to a few pairs which migrate from South America to the upper Sacramento River to nest in some large stands (20 acres or more each) of riparian woodlands between Colusa and Red Bluff. The last sighting of a nesting cuckoo in the Sacramento river marina study area was in 1960 near the Sacramento Bypass northwest of the Lighthouse Marina site. A 1980 DFG study conducted in Glenn County along Sacramento River indicated that cuckoos were found to be limited by food availability, and that they used riparian woodlands for 88 percent of their foraging activities. Nests were in riparian willows (Laymon, 1980).

Few species better illustrate the potentially catastrophic impacts from losses of riparian woodlands than the California yellow billed cuckoo. Since cuckoos use the riparian corridors of the central valley to migrate from their South American wintering areas to their nesting sites, protection and enhancement of the riparian woodlands of the Sacramento River will directly benefit this bird.

Whether it is possible to re-establish nesting yellow billed cuckoo in the marina study area is unclear at this time. The bird is very shy and sensitive to human interference. It appears to prefer dense willows and large stand of riparian woodlands dominated by cottonwoods. In the DFG study mentioned above, cuckoos were utilizing a 20 acre riparian forest dominated by 60-90 foot tall cottonwoods (95 percent) with willows being next most abundant. Although it would be feasible to restore cottonwoods and willows in the marina study area, it may not be realistic to expect cuckoos to choose nesting sites so close to human activity centers. Their critical migratory corridor, however, would certainly be improved by revegetation of cleared areas.

iii) Valley Elderberry Longhorned Beetle (Desmocerus californicus dimorphus), Federal Threatened Species

The valley elderberry longhorned beetle is only known from riparian forests of Sacramento, Yolo, Solano and Merced counties. Elderberry plants (Sambucus spp.) found in riparian woodlands are essential to the reproductive success of the beetle. The female lays her eggs in cracks in the

bark of living elderberry plants; the larvae hatch and bore into the pith of stems where they pupate. Adult beetles emerge in the spring when the plants are blooming. Elderberry beetle exit holes have been found in both stressed and healthy shrubs, though some beetles appear to be attracted to stressed plants (Kellner, 1986).

Exit holes of the beetle have been found within the marina study area on the west bank near the I 880 overpass (river mile 62.5) and at the Lighthouse Marina site (river mile 60.0). Suitable elderberry beetle habitat exists in other portions of the study area, such as at Bable Slough (river mile 49.5), and nearby along the Lower American River Parkway near Discovery Park (river mile 60.5).

Field studies of the elderberry longhorned beetle indicate that its survival is linked to the extent and distribution of elderberry shrubs associated with riparian woodlands. The continued survival of this species depends on maintaining self sustaining clumps of elderberry plants from which the beetle can disperse to new clumps of elderberries (Kellner, 1986).

iv) Other Wildlife Species of Concern

Other species which occur in the study area also indicate the condition of riparian woodlands. Their presence adds a dimension of diversity to the landscape and provides an element of wildness to the urban river corridor. One such mammal is the river otter (Lutra canadensis). This otter

has nearly vanished through most of its historic range, due to habitat alteration and trapping. The river otter occurs within the study area along the banks of the river and in riparian sloughs.

Great blue herons (Ardea herodias) are frequently seen along the Sacramento River wading in the shallows, roosting in tall cottonwoods, or flying low over the water. Nesting rookeries of these majestic birds are of species concern to DFG. With the removal of riparian woodlands, suitable nesting locations have become scarce. Restoration and protection of tall stands of cottonwoods may encourage herons to use the study area for nesting.

Yellow warblers (Dendroica petechia) and other small perching birds may not be as obvious as the great blue heron, but their songs and flashing colors add to the visual aesthetics of the riparian woodland. As the vegetation is thinned and cleared, these birds no longer find the food, cover and nesting sites on which they depend for survival. Yellow warblers are now considered uncommon, while at one time they were frequently seen.

5. Conclusions Regarding Riparian Vegetation and Wildlife

Removal of riparian forests has resulted in major reductions of wildlife, increased soil erosion, bank instability, accelerated river meandering and flooding. Remnant riparian vegetation has become highly important to society, especially in areas such as the Sacramento Valley which have undergone nearly complete conversion from their

natural state to uses such as agriculture, industry, transportation corridors, and urban development. In such developed regions, the scattered riparian woodlands which occur along rivers and streams are often the only greenbelts and wildlife habitats remaining. Continued loss of riparian forests along the Sacramento River would have serious consequences for the water quality, bank stability, recreational wellbeing, aesthetics, and wildlife of the region.

Planning for the future of Sacramento and its urban waterway should include a careful evaluation of the importance of riparian vegetation to the community in terms of bank stability, water quality, aesthetics, recreation, wildlife habitat and economics. The cumulative impacts on this unique natural resource from future marina proposals and other waterside developments must be recognized. Avoidance of impacts, combined with restoration and protection of riparian areas should become requirements for further planning.

6. Fish and Fishery Resources

Fish habitats of the Sacramento River marina study area are enhanced by the diversity of conditions at the interface of land and water. Roots of riparian plants help stabilize the riverbank and slow bank erosion and sedimentation. Submerged roots also provide resting and hiding places for all age classes of fishes as they migrate up and down the river. Branches which hang low into the water are used by fish for escape cover from predators.

Submerged logs and root wads provide a stable surface for attachment of aquatic fish food organisms and shelter from swift currents (Baltz and Moyle, 1984; Bybee, 1986).

The Sacramento River and its tributaries support important commercial and recreational fisheries. The anadromous fishes include chinook salmon (a candidate species for threatened status), steelhead, striped bass, American shad and white sturgeon. It is estimated that 300,000 to 500,000 chinook salmon, 40,000 to 50,000 steelhead, 2 million striped bass, and 2 million American shad enter the Sacramento River annually to spawn. Virtually all of California's white sturgeon, American shad and approximately two-thirds of the striped bass are believed to spawn in the Sacramento River system. The Sacramento River also supports a large warm water fishery, including small and large mouth bass, channel catfish, yellow bullhead, bluegill, green sunfish and various non-game species (Sacramento County, 1984).

The highest use of the marina study area by anadromous fishes is for migration of all age classes. The Freeport area (Reach 1) supports a small steelhead fishery immediately above and below the Freeport Bridge during January. This same area has a shad run in late March to early April. The shad move upstream and cluster at the mouth of the American River before going to spawn in that tributary. The end of April and through May finds striped bass in the river at Freeport, Garcia Bend and up to the American River and beyond. The early fall chinook salmon run concentrates at the American River and Verona (north of the study area) in July. By mid-september the largest chinook runs are occurring at the mouth of the American. A significant

trolling area occurs just downstream of the confluence of the American River with the Sacramento River. This portion of Reach 4 is not recommended for further marina development.

Juvenile salmon and steelhead may be found throughout the study area all year, as they migrate down stream. These juveniles tend to move toward the shorelines in the day time, where they find cover, food and shelter from predatory fishes. These same fish will move away from the shores at night. Most young migrating fishes use the outside bends of rivers (Bybee, 1986).

Clearly, the Sacramento River marina study area is a critical migration route for significant numbers of anadromous fishes, as well as an important habitat for resident species. The contributions of the riparian vegetation to the success of migrating and resident fishes is critical to their continued survival in the Sacramento River.

7. Impacts of Marina Construction and Operation on Riparian Vegetation and Wildlife

Ecological impacts from marina development may occur both on land and in the river. Terrestrial habitats are impacted when riparian vegetation is removed or disturbed in order to construct docks and secondary buildings such as grocery stores, restaurants, condominiums and offices. Instream habitats are impacted when driving pilings for floating docks. Water quality may be impaired during and after construction by sedimentation and run-off waters containing oil residues from construction equipment. The placement of rip-rap or other bank protection

materials to control erosion usually results in the permanent loss of riparian vegetation and its habitat productivity, for both terrestrial and instream wildlife.

The impacts of new marinas and marina expansions on the remaining riparian vegetation and its wildlife can include:

- removal of vegetation, grading and construction
- compaction of roots of remaining vegetation
- disruption of banks and placement of bank protection
- alteration or removal of understory plants
- fragmentation of migratory corridors for terrestrial wildlife
- introduction of human activities, noise, night lighting
- isolation, reduction or destruction of threatened and rare species and their habitats
- disruption of shoreline, instream fish habitats
- disruption from activities of adjacent developments

8. Recommendations for Mitigation of Marina Construction Impacts

Protection of existing riparian habitat and/or equivalent restoration of riparian vegetation should be required as mitigation for any expanding and all new marinas. Replacement should occur as close to the construction site as possible, and within the marina study area. Off site mitigation on other rivers or on distant reaches of the same river does not address the loss of local riparian resources in Sacramento and Yolo counties.

Mitigation plans will differ from site to site, but the following general guidelines should be applied to all marina construction and expansion projects:

- i) The project should be designed to avoid environmentally sensitive areas to the maximum extent; such areas would include habitat for threatened and endangered species and riparian vegetation.
- ii) The project should incorporate all feasible modifications and construction techniques to eliminate or minimize adverse impacts on ecological resources of land and water.
- iii) Replacement of riparian vegetation should be planned by experts familiar with native riparian plants and their requirements, and monitoring programs should be established to ensure the satisfactory completion and maintenance of revegetation programs.
- iv) The overall goal of mitigation should be that post-project habitat productivity be at least equal to pre-project habitat productivity. Determinations of habitat productivity should be made by a panel of qualified biologists using habitat analysis methods acceptable to the U.S. Fish and Wildlife Service and the California Department of Fish and Game.

- v) The project should comply with conditions set forth by regulatory agencies acting under the authority of state and federal laws protecting endangered and threatened species, water quality, historic and archeologic sites, and other environmental elements as defined by the California Environmental Quality Act and the National Environmental Policy Act.

Site-specific mitigation measures will be determined during the Environmental Impact Report process.

9. Summary of Ecological Issues

Ecological wellbeing in the marina study area is closely aligned with abundance of available riparian habitat--which serves as a good indicator for abundance of a broad range of species. Riparian habitat now stands at less than 5 percent of historic levels, and at less than 50 percent of levels of the 1950's. Recent evidence suggests it is still declining. At present, we estimate that 714 acres of riparian habitat remain in the study area, and that restoration programs could increase that figure to 932 acres, albeit with expected lower ecological productivity on marginal acreage.

VII. Water Use and Water Quality

1. Identification of Impact Issues

Marina and boating activities can influence river water quality, particularly where boats and/or facilities are concentrated. Table 61 summarizes the potential for marina/boat-induced water quality degradation by sub-category. Each of the identified water quality elements in Table 61, to which marinas and recreational boating can be related, will be discussed in subsequent subsections of the report.

Table 61

Marina, Recreational Boating and Moored Houseboat Induced Water Quality Degradation Potential (Direct and Indirect)

<u>Source</u>	<u>Pollutant/ Contaminant</u>	<u>Contemporary Controls</u>	<u>Bibliographic Reference</u>
Sanitary waste	Pathogens, algal nutrients	MSD's, holding tanks, dump stations	84, 85, 91
Bilge water	Petroleum residues, detergents	Dump stations	85
Internal combustion engine exhaust	Organic hydro- ⁽¹⁾ carbon residues, carbon monoxide and lead, CO ₂	Unleaded fuel, optimum air/fuel mixes, closed cycle crankcase drainage	22, 87, 88
Litter/Solid Waste	Food and beverage container residues (glass, metal, paper, plastic)	Waterborne garbage boats for peak days, serviced, on-shore refuse containers	52, 77
Accidental fuel and other spills	Gasoline, diesel fuel, detergent oils and lubricants, engine coolants	Title 33 CFR, Part 1-199 Subchapter "0", Part 15.1	55, 83

Table 61 (cont.)

<u>Source</u>	<u>Pollutant/ Contaminant</u>	<u>Contemporary Controls</u>	<u>Bibliographic Reference</u>
Wave action, turbidity and levee erosion	Inorganic sediment placed in suspen- sion by boat in- duced wave action and resuspension by prop and jet wash	Levee protection, reduced boat speeds	1, 2, 14, 21, 28, 33, 48, 50, 51, 55, 69, 97, 100
Antifouling paint	Copper and tri- butyltin oxides, chromium zinc, lead, PCB's	None; Needed on commercial, military and pleasure craft to control marine growth on hulls	54, 66, 94
Boat maintenance functions (misc.-- including chipping and painting)	Paint residues, fuel/lube products, battery electro- lytes, detergents	Title 33, CFR, Part 1-199 sub- chapter "0", Part 15.1. Special care in handling of paint residues	17
Permanently moored live- aboards (houseboats)	Domestic animal litter/waste, other litter (plastic, paper metal and glass)	Title 33, CFR, Part 1-199 sub- chapter "0", Part 15.1	86
Urban runoff (2)	Auto. residues, animal waste, litter, dust, BOD/COD, algal nutrients, bio- degradable organics.	Federal Waste Pollution Control Act (p. 192-500) as amended. 33 USC. 1251 et seq.	35, 69
Marine structures (wood pre- servatives)	Creosote, copper arsenate, other copper and zinc salts	None	16, 38
Off-river marinas as pollutant sinks	Dredging, turbidity and dredge spoil disposal	Natural or artificial circulation	27

(1) NO₂ released to the air is not included here. Recent studies suggest its negative affect in the context of boating and marinas is limited.

(2) Urban runoff primarily represents an indirect impact, associated with parking lots and paved areas connected to marinas.

2. Sanitary Waste from Recreational Boats

In 1966 the then Federal Water Pollution Control Administration (now the Environmental Protection Agency (EPA)) identified the magnitude and extent of inland and estuarial pollution from military, commercial and recreational vessels. The federal studies of watercraft waste eventually produced the requirement that no vessel had the right to discharge untreated sewage into the waters of the U.S. including territorial seas (Federal Water Pollution Control Act, 1972). So-called Marine Sanitation Devices (MSD) were developed for retrofitting on old vessels and for installation on all new vessels after January 30, 1977 (GSA, 1984). Many of the devices employ chlorine as a disinfectant along with maceration of solids before discharge of the partially treated waste overboard. No one will dispute the fact that fecal material in waters used for swimming, drinking and waterskiing constitutes a human health hazard. The effectiveness of these devices (sometimes bypassed by creative plumbing) and the potential hazard to aquatic organisms from the formaldehyde-based waste stabilizers and chlorine, as a result of accidental or deliberate discharge of holding tanks to confined waterways, has been questioned by the pleasure boating public (Clark, 1982).

Within the study area boundaries there is apparently only one (1) operational water-craft sewage pumpout station (or dump station as they are called by boaters). This lack of pumping facilities forces even the conscientious boater, who is limited by the volume of his or her vessel's holding tank to discharge stabilized but untreated waste to the river. Likewise small boats

without an MSD sometimes discharge untreated wastes into the water. Public restroom facilities in the study area are also at a premium, and are grossly over-taxed on peak use days. Discovery Park and the restaurant/fuel dock restrooms cannot be expected to accommodate holiday toilet traffic.

3. Boat Exhaust and Hydrocarbon Pollutants

This potential source of water pollution has been studied in small lake systems with high seasonal densities of small, outboard motor-powered boats (Chmura and Ross, 1978; National Envir. Resource Ctr. 1980; Envir. Eng. Inc. 1969). Elemental lead from leaded gasolines was not considered in any of the published studies because of the natural high background levels of lead found in dried plant tissue in the Florida lakes that were studied. The phase-out of lead additive fuels by EPA to an eventual minimum of 0.1gm lead per gallon virtually eliminates the toxic metal in engine exhaust as a future threat to beneficial water uses affected by increase boat density on the Sacramento River (Koslow, 1986). Of some concern in the several study conclusions was the "raw-fuel drainage" to exhaust systems that some older inboard engines produced. Outboard engines with internal crankcase drainage that were analyzed (all new outboard motors have a "drainless" system and are virtually pollution-free from that source) did produce raw-fuel drainage to exhaust systems at various rates depending upon engine revolutions per minute (RPM) and motor manufacturer (Envir. Eng. Inc. 1969). Motor exhaust products do not appear to be a significant pollution factor for water quality, given present and expected future boat and marina densities on the Sacramento River.

4. Bilge Water

Drainage and leakage of rainwater and wave wash in heavy weather, condensation, and engine leakage (cooling water, fuel lubricants) can accumulate in the lower sections of a ship's hull, known as the bilge. In small boats, it is the water and boating activity residuals that slosh around under the floor boards, which are eventually bailed-out, if boat buoyancy is endangered, or drained at the launching ramp, if the boat is removed from the water for trailer transport. The constituency of pleasure boat bilge water is estimated to be highly variable and its discharge to navigable waters is prohibited by current federal laws (U.S. Coast Guard, 1979). Bilge pumps on larger recreational boats (electric and hand powered) are usually plumbed and valved so that, in an emergency situation when the boat sustains a hull puncture or takes on water in heavy weather, buoyancy can be maintained with pumping of bilge excess overboard. For routine non-emergency conditions, the boat operator can shut off the overboard discharge and connect a hose to a shore-connected waste dump station for sanitary waste. From a practical standpoint, the policing and enforcement of bilge water discharge from small outboard vessels is an almost impossible task. In the final analysis it will be the boater's own perception of the importance of water quality and his role as a member of the boating community that governs his or her actions in protecting water resources.

A possible physical solution to launching ramp bilge water dumping would be the installation of a grated, transverse drain across the ramp which could collect bilge discharge and convey

it to a dump or buried tank for eventual safe disposal at a municipal waste treatment facility. The transverse drains could be retrofitted for existing boat ramps and made a requirement for new installations on the Sacramento River. One thousand trailered boats might produce 2000 gallons of bilge water, only two thirds of one commercial septic tank truck capacity.

5. Litter and Solid Waste

With higher boating densities and marina development projects, the quantity of unspecified litter left in or near the river can be expected to increase in a direct proportion to the additional boaters and other recreators that will utilize the waters and shoreline of the study area. The solid waste component, classified as litter for recreational developments, is on the average 0.33 to 0.5 pounds per person per recreation day (Tschbanoglous and Theissen, 1981). Soft drink containers (metal and disposable glass), bottle caps, beer containers (metal and disposable glass), food wrappers, unclassified paper, plastic and metal, tobacco product residuals, facial tissue and domestic animal waste are each elements of recreational activity litter mass. Incremental volumes of litter can be partially controlled by the availability of refuse containers at the points of critical litter generation "on-shore", but "on-water" source control must be the boater's responsibility. Historically, anti-litter legislation with \$500 single event fines has only been marginally effective in controlling litter on California's highways (Mounts, 1986). The enactment of boating rules that would require the carrying of plastic litter

bags on pleasure boats of all sizes, would not guarantee their use as receptacles for boat generated litter, but for many boaters it could become as routine a piece of boating equipment as life-preservers. Increased boating densities associated with new marinas or ramp launched boats in the study area, and the projected increment of litter must be planned for and dealt with in a positive and boater-directed manner.

While the potential for litter generation from houseboats/live-aboards might be greater, it is assumed that permanent residents of the river are more likely to have a "special stewardship" attitude toward the river and its amenities, than river users who return to their terrestrial residences after a day of boating activity.

The impact of litter on the river crosses all lines of activity from the most passive sightseeing or nature enjoyment to the most active water skier, and in all cases the ugliness of litter decreases the recreational experience. Using data from this section, and from section I, it is estimated that more than 3,000 pounds of litter are distributed over the study area by boaters on a peak July weekend day.

6. Fuel and Other Spills

Since 1974, the U.S. Coast Guard has published reports on polluting incidents in U.S. waters (U.S. Coast Guard, 1974-83). While the 10 year trend nationally in the number of non-oil substance reported incidents has increased from some 42 in 1974 to 175 in 1983, the reasons for the upward trend are not clear nor are they explained (Ibid.). On a quantity or gallonage basis

the trend is entirely opposite for the same period, except for 1982 when only two (2) incidents out of the total 175 reported, accounted for 92 percent of the 8 million pounds of spill substances reported (Ibid.). In 1982-83, in excess of 80 percent of all pollution incidents occurred in inland waters. Focusing on a sub-category of areas, "river channels" accounted for about 35 percent of all reported spill in 1982-83 (Ibid.).

Oil/fuel spill incidents are reported as a separate category. The trend analysis indicates a decrease in the number of incidents reported, 14,500 in 1974 to some 10,600 reported nationally for 1983; and a median level of about 18 million gallons of oil and other substances with a 10 year high of 36 million gallons in 1976 (Ibid.). An average of 33 percent of all spills occurred in river channels for 1982-83 (8612 and 9208 incidents respectively). Unfortunately, data for the Sacramento River alone were not available, as those incidents are reported by the 12th Coast Guard District as a single number. Future data processing capability will permit the U.S. Coast Guard to subdivide spill data by water body and region (Kelly, 1985). Spill data for the 12th Coast Guard District, which include the Sacramento River study area, were obtained from the San Francisco Marine Safety Office. For January-September 1985, 402 spill incidents were reported with 53 attributed to "marinas" (U.S. Coast Guard, 1985).

7. Wave Action, Turbidity and Levee Erosion

a. Statement of the Problem

As noted earlier, erosion of bank-side property has been a continuing source of annoyance and expense for Garden Highway residents. In general, erosion and transport of inorganic sediment and bedload materials is a natural river process that proceeds with and without the influence of man's boating activities. However, it is important to separate, if possible, the man-induced, incremental effects of marinas and boating on soil erosion and sediment suspension and transport processes.

b. Variables Important to Analysis of Erosion

Erosion of soil by water is a function of the erosive force of the water (shear forces tending to move soil particles) and the physical/chemical nature of the soil particles. Large particles, such as rocks and boulders are capable of movement and transport along the Sacramento River bottom. Much of the material finds its way eventually to San Francisco Bay and thence is transported under tidal influence to the outer marine shelf, where the material is deposited in a "bar" --eg., the San Francisco Bar. Smaller particles of the river's sediment load are suspended by boat wave and propeller/jet action (Chmura and Ross, 1978).

The erosive shear forces associated with current, and tending to erode the confining levees of the Sacramento River have an energy potential that occurs 365 day per year, 24 hours per day. Also at work, tending to erode unarmoured levees, are wind and boat induced waves. These latter erosion

producers interact with only a portion of the levee, generally at the water surface-soil interface, plus a levee section about 1 to 1.5 feet above river elevation, where wave "run up" occurs (Ahrens, 1981).

While there are areas between the levees where both accretion (addition) and reliction (loss) of bank materials are occurring, the net change in levee section will be negative under almost all conditions. The U.S. Geological Survey has estimated that in the 66 year period between 1849 and 1914, the river transported 1,820,000,000 cubic yards of hydraulic mining debris or an average of 28,000,000 cubic yards per year (Gilbert, 1917). The USGS estimated that approximately 30 percent of the annual total was from non-mining activity/sources (Ibid.). More recent data have shown the total sediment load (bed load and suspended sediment) at Sacramento to be on the average 30,000 cubic yards per month (Anion, 1955). Ranges in total sediment load as a function of river discharge are reported in Table 62.

Table 62Average Velocity, River Stage & Total Sediment Load vs. Discharge

<u>River Discharge at Sacramento</u> (Cubic Ft. Per Second)	<u>Approximate River Stage</u> (ft.)	<u>Estimated River Cross Sectional Area</u> (sq. ft.)	<u>Approximate Average Velocity</u> (ft./sec.)	<u>Total Sediment Load</u> (Cubic Yards/Month)
8,000	2.5	1,038	7.71	47,000
15,000	4.7	3,768	3.98	135,000
20,000	6.6	5,075	3.94	227,000
50,000	15.3	9,523	5.25	836,000
80,000	23.5	16,182*	4.95	1,383,000

While much of the transported material has its origins in major and minor watersheds and tributaries of the Sacramento River, there is still an amount of in-river erosion that must be reckoned with in any accounting of source materials.

c. River Velocity and Erosion

Distribution of stream velocity transverse to flow direction and in a vertical direction from water surface to bottom would give a typical developed velocity distribution that, in a solid geometry sense, would resemble the rounded stern of a boat. This results in lowest velocities near the banks and bottom with the highest velocities near the middle and at about 0.8 of the depth of the active water prism. Erosion from surface wave action (wind and boats) is almost entirely a surface phenomenon.

* Based upon cross-sectional data taken from Figure 4 for River Mile 67.9

While the principal focus of this study is on boat induced waves, the subject cannot be adequately treated unless all of the components of the river erosion equation are identified and explained. The erosive force of the river can be described mathematically and the shearing forces and stream velocity required to initiate the motion of a soil particle can be quite accurately predicted (Rubey, 1948; Menard, 1950). It is believed that the erosive forces working throughout the entire "wetted section" of the river are predominant in the loss of large volumes of levee material. Other independent variables such as rapid drawdown and slope failure (slumping), burrowing animals, loss of large tree species from the waterside of the levee and access trails which are kept in a constant state of soil instability all contribute to the complexity of levee stability and soil loss relationships.

The principal variables contributing to erosion of the wetted cross-section are:

- a) particle size (grain size) and specific gravity.
- b) stream velocity.
- c) stream turbulence and mixing potential.

While practical considerations suggest that the degree of armouring or resistance to the initiation of erosion must also be a factor, the three variables shown above are the only parameters used in a rigorous mathematical approach to the problem (Leliavsky, 1966).

d. River Stage

River stage (or level) is highly variable in the reach of river within the study boundaries. Fluctuations in water stage for the unarmoured sections of levee permit a full range of vertical "river only" erosive shear forces to come into play against the face of the levee at various seasons of the year. A qualitative assessment of boating activity by season and associated river stage is shown in Table 63.

Table 63

<u>Period</u>	<u>Sacramento River Hydraulic Status</u>	<u>Remarks</u>
Jan-Mar	High river stages associated with winter flows (rainfall).	Boating limited to fishing and incidental other closed-vessel recreational trips.
Apr-May	Snowmelt. High to medium river stages.	Fishing boats and beginning of open boat recreational period (water skiing, etc.).
Jun-Sept	Regulated flows from CVP and State Water Project.	Maximum boating activity.
Oct-Dec	Regulated flows from CVP and early winter rainfall events.	Fishing boats and other closed-vessel recreational boating.

The period January-March is typically represented by high river stages and boating on the river is predominantly for fishing and cruising in closed vessels. Boat wave damage during this period is considered negligible when compared to the erosive forces produced by high river discharge. During April-May the river is on a recession regime with discharges at the end of May only slightly affected by snowmelt. The irrigation season in the Central Valley generally begins in April requiring both the CVP and State Water Project to begin regulated releases from their respective reservoirs. Memorial Day signals the beginning of a high level boating use period on the river which is sustained through September and possibly early October.

June-September are the active boating months with river stages generally stabilized at between 6 and 10 feet MSL, as measured at the I Street Bridge. During this four month period, any boat or wind induced wave energy would be directed at that same section of levee, and the 6 to 11 1/2 foot levee section consequently has the greatest potential for erosion from wave wash*. Figure 2 identifies the percentage of time the Sacramento river remains at various river stages, measured at the I Street Bridge, for dry, wet and average water years. Also shown are key reference elevations such as approximate elevation of the pre-levee river bank; berm** elevation at

* Recall the 1 1/2 ft. margin for wave run up, discussed earlier.

** The berm is the horizontal top section of the levee.

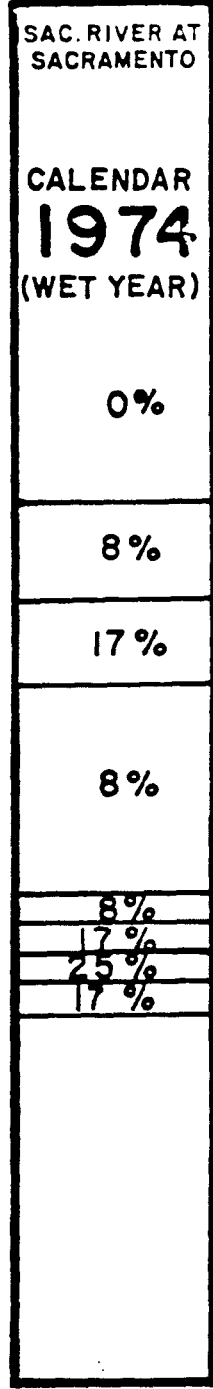
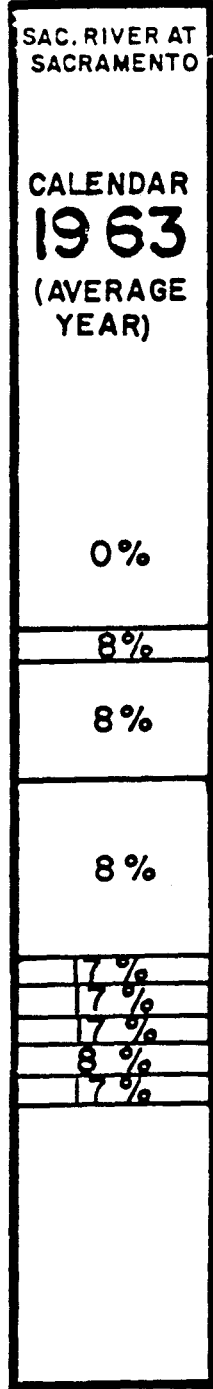
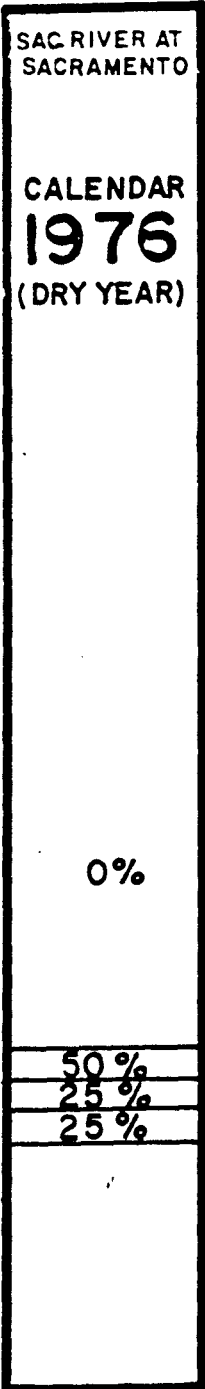
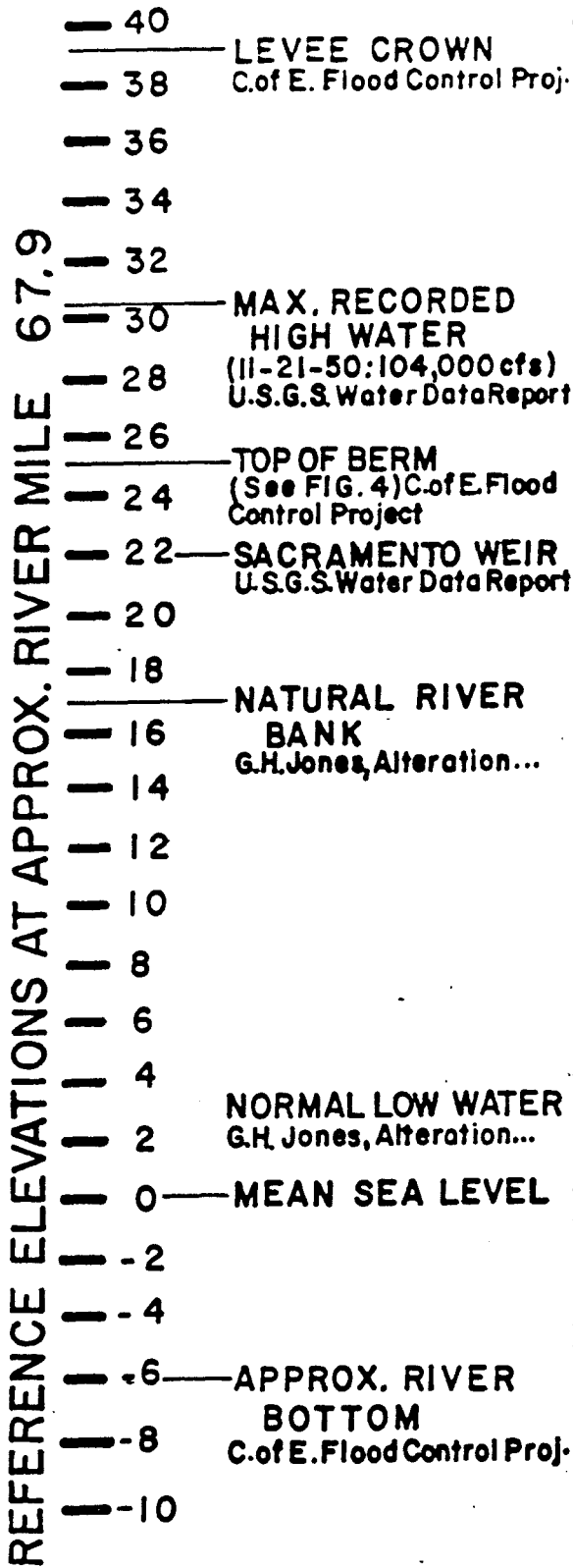
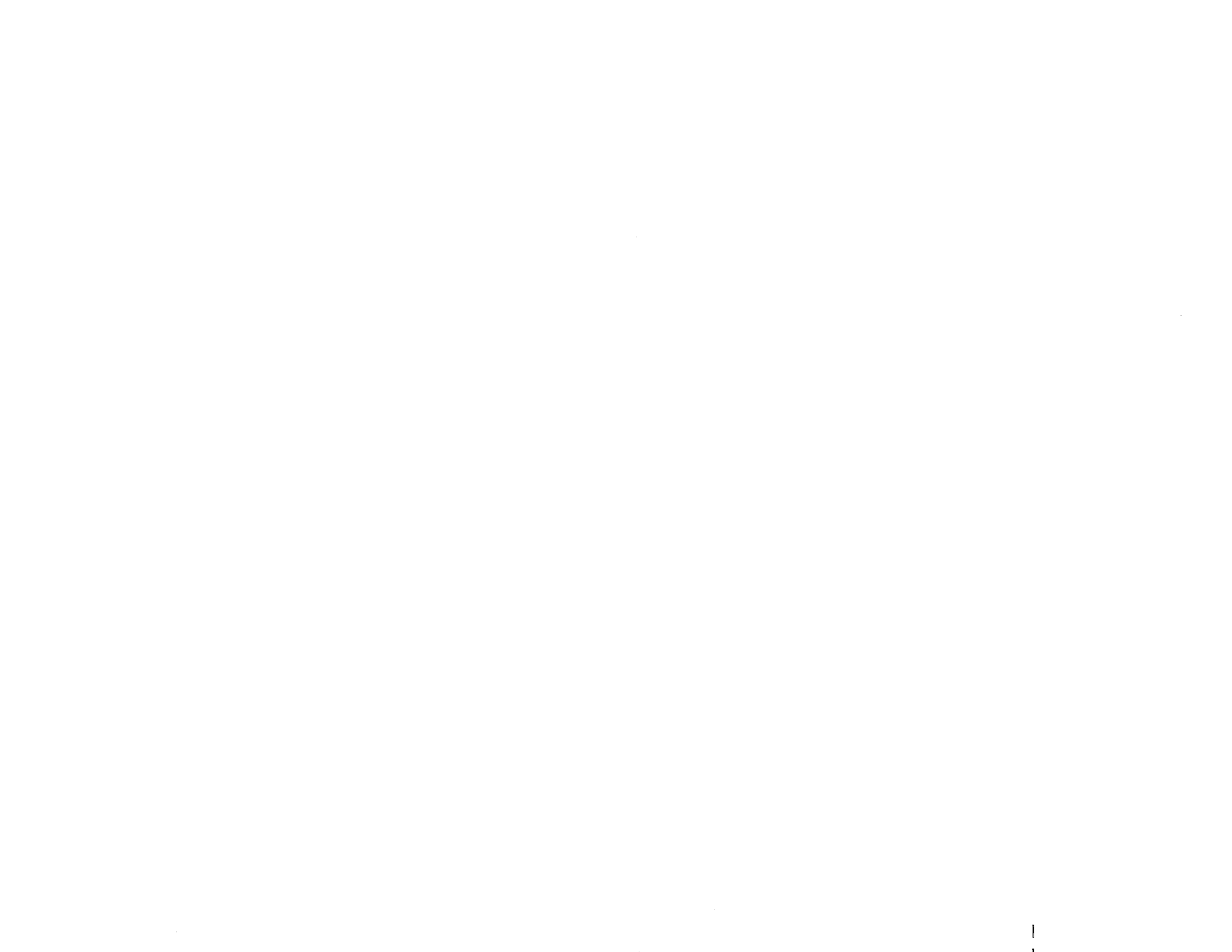


FIGURE 2

**PERCENTAGE
TIME RIVER IS AT
GIVEN STAGE
SACRAMENTO RIVER
AT SACRAMENTO**

● MEAN SEA LEVEL DATUM ●

SOURCES: (1) GERALD H. JONES, ALTERATION OF THE REGIMEN OF SACRAMENTO RIVER AND TRIBUTARY STREAMS ATTRIBUTABLE TO ENGINEERING ACTIVITIES DURING THE PAST 116 YEARS, JAN. 1967.
 (2) U.S.G.S. WATER DATA REPORT, WATER RESOURCES OF CALIFORNIA, 1963, 64, 74, 75, 76, 77, MEAN MONTHLY DISCHARGE.
 (3) CORPS OF ENGINEERS, FLOOD CONTROL PROJECT, LEVEE CONSTRUCTION AS CON-



River Mile 67.9 and the Sacramento weir overflow elevation. For example, in an average year (1963) 76 percent of the time the river stage fluctuated only 5 feet (between 3 and 8 feet of elevation), making that particular sector of the river bank vulnerable to boat and wind wave action for the period April through September. For a very dry year, such as 1976, the potential boat-wind wave erosion band is only 3 feet (between 2 and 5 feet of elevation) and that zone is vulnerable 100 percent of the time.

e. Anatomy of a Levee

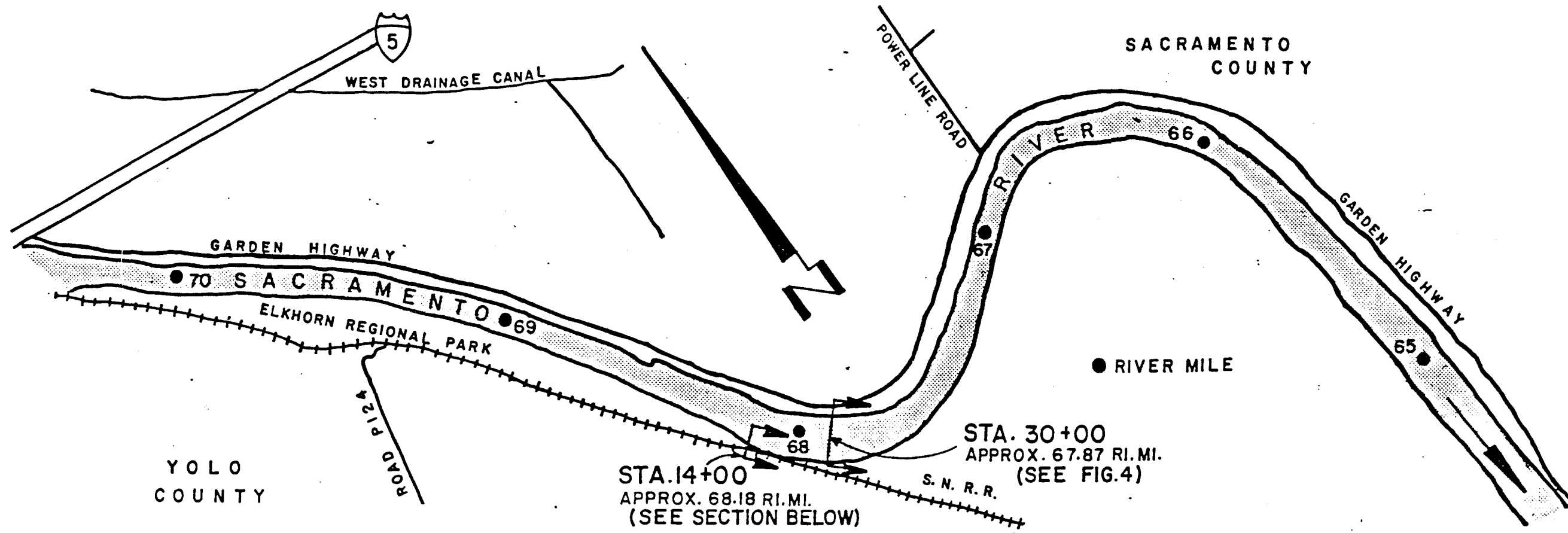
Figure 3 is included to illustrate a levee section on the river bank (west bank) at River Mile 68.1 some 3 miles downstream from the I-5 bridge crossing. Of importance is the pre-levee rehabilitation and armouring profile (original ground line) that fixes the approximate elevation of the top of the historical natural overflow levee (about El 7.17) and the steeper slopes associated with the first generation flood control project levees.

Cross-sectional data for the left (east) bank of the river above the I-880 Bridge (now I-80) are only available from the Corps of Engineer map archives for surveys completed as early as 1932 and 1952. Figure 4 is a "composite" cross section of the Sacramento River at about River Mile 67.9, and is composed of data from three (3) separate surveys at different times at the same locale. The 1932 and 1952 surveys do not register perfectly, but for purposes of illustration are adequate. As no levee rehabilitation activity or "official" bank armouring

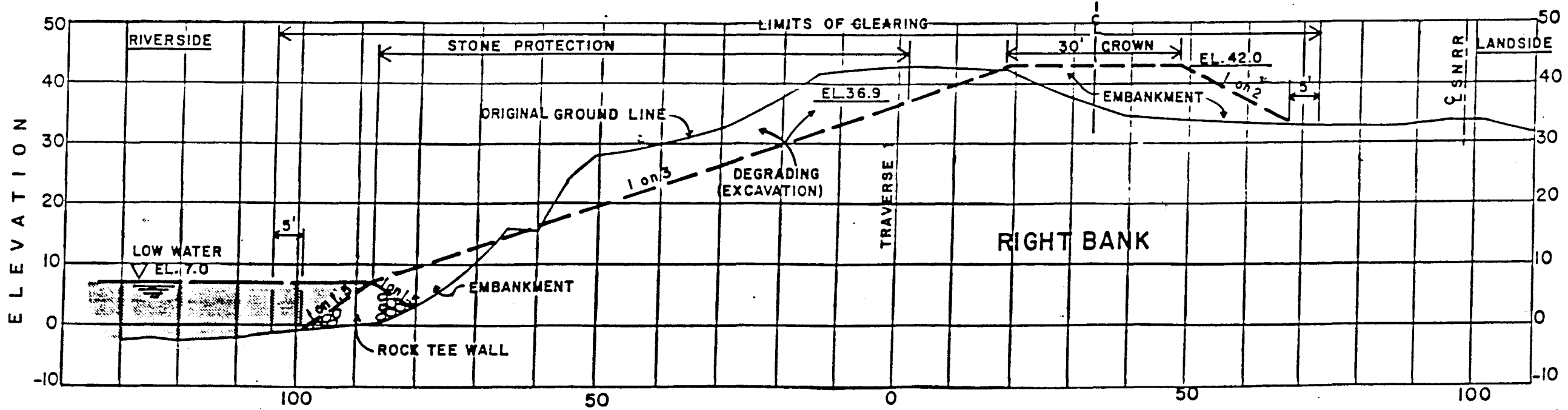
has taken place at this left bank location since the 1930's, the bank profile composite is believed to be the best data available on the levee geometry for that side of the river. Of interest is the berm elevation difference between the east and west bank of about 4 feet, which means that at flood stage the river is impinging on the old east levee section some 4 feet lower than on the newly constructed (1957) west side where berm elevation is at or near maximum high river stage of 30.2 feet, mean sea level datum.

f. Boat and Wind Waves

Limerinos and Smith (1975), in their study of Delta levees, concluded that, for their chosen test sites in Georgiana Slough and False River and for the test period December 1972 through March 1973, all the erosion which occurred could be attributable to tractive shear forces (winter fresh water discharge and tidal flood and ebb). On the other hand, they also concluded that from April through September 1973, tractive shear forces were negligible, and wind and boat generated waves were responsible for all erosion. As these conclusions were based upon wave meter measurements and energy conversions, they also concluded that wind waves were of generally low amplitude and of hours in duration, while the boat waves had greater amplitude but occurred at random intervals and were of short duration. By assuming a linear relationship between wave energy and erosion it was concluded that, during the boating season, two-thirds of the April-September erosion could be attributable to boat waves



PLAN
SCALE: 1" = 2500'

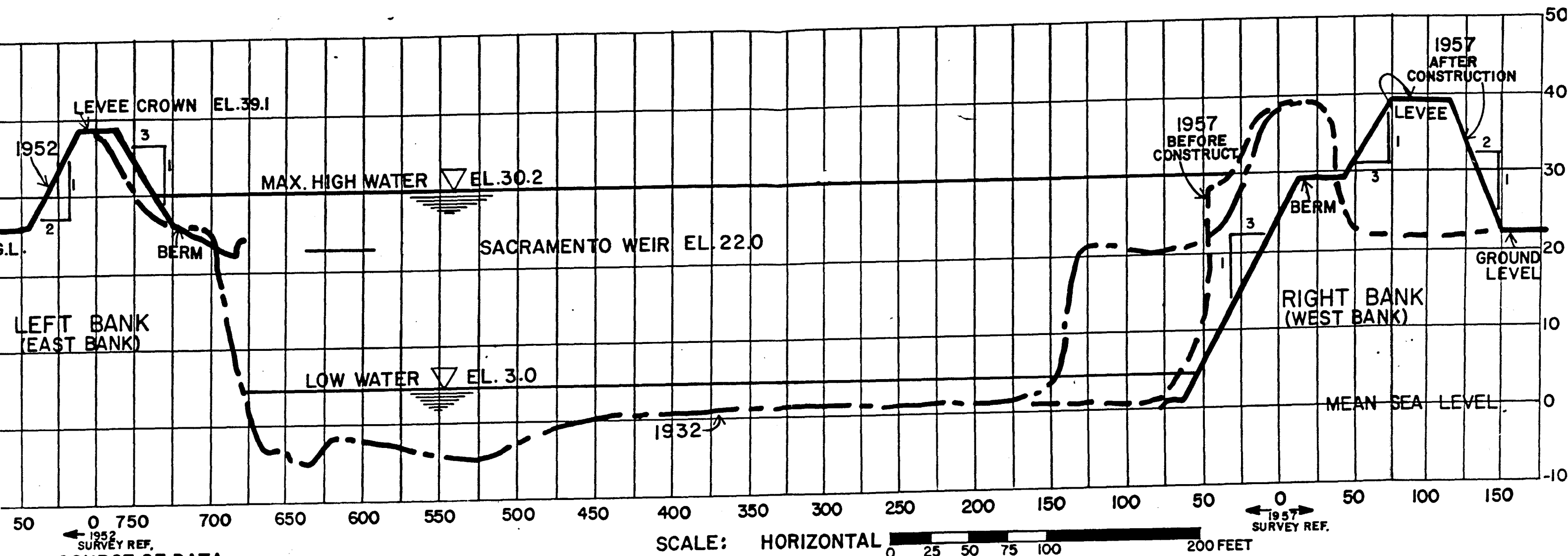


SECTION STA. 14+00
SCALE: 1" = 20' HORIZ. & VERT.

NOTE: ALL ELEVATIONS ARE REFERRED TO C.O.F.E.
 DATUM: MEAN LOWER LOW WATER SUISUN BAY = 3.0 FT. BELOW MEAN SEA LEVEL.
 SOURCES: U.S. ARMY CORPS OF ENGINEERS, SAC.
 RIVER FLOOD CONTROL PROJECT, LEVEE
 CONSTRUCTION AS BUILT, FILE: 50-4-3295,
 SHEET: 3295/6, MAY 1957,
 (2) U.S. ARMY CORPS OF ENGINEERS, SAC, RIVER
 AERIAL ATLAS, PLATE II, MAY 1951

**TYPICAL PROJECT LEVEE CROSS-SECTION
 (AS-BUILT), RIGHT BANK R.M. 68.18 AND
 PRE-EXISTING GROUND PROFILE**

FIGURE 3



SOURCE OF DATA:

- CORPS OF ENGINEERS, SACRAMENTO RIVER FROM SACRAMENTO TO VERNON, FILE 6, DIV. 13, SHEET 573, AUGUST 8, 1932.
- CORPS OF ENGINEERS, SACRAMENTO RIVER FLOOD CONTROL PROJECT AS CONSTRUCTED, TYPICAL CROSS SECTION, FILE NO. 50-4-2936, SHEET 293621, MARCH 1952.
- CORPS OF ENGINEERS, FLOOD CONTROL PROJECT, LEVEE CONSTRUCTION AS CONSTRUCTED, FILE 50-4-3295, SHEET 3295-16, MAY 1957.
- ALL ELEVATION CALLS ARE FOR MEAN SEA LEVEL DATUM. CONVERSION IS: MSL = C.O.F. E. DATUM - 3 FEET.
- SEE FIG. 2 "PLAN" FOR LOCATION OF R.M. 67.87 (STA. 30+00).

SCALE: HORIZONTAL 0 25 50 75 100 200 FEET
 VERTICAL 0 10 20 30 FEET

FIGURE 4

**TYPICAL CROSS SECTION
 RIVER MILE 67.87, LEFT &
 RIGHT BANKS (COMPOSITE
 FROM 3 SEPARATE SURVEYS)**

only (Ibid). Limerinos also studied boat waves as a function of boat length and found that houseboats (26-42 feet) produced nearly one logarithm less (10^3 vice 10^4) wave energy (in ft.-lbs./foot per boat passage) than a comparable conventional boat of the same length.

Comparing these findings to the Sacramento River experience, the following differences in the slough and river prototype are observed:

- (1) Both north and south traversing boats in the river section above the I-880 bridge generally take the 200 foot, rather than the 5 mph option when passing moored boats. This puts a high level of potential boat wave impact on the west side levee and the least on the east side, as the greater distance allows more energy dissipation from currents and other boat waves.

- (2) Figure 5 suggests that the river current can have a wave energy suppressing effect on boats proceeding upstream, but an additive effect for boats moving in a downstream direction (Crapper, 1984; Herchenroder, 1981). Likewise the inside port and starboard waves generated by passing boats tend to cancel each other as each wave is propagating in a direction counter to the other. Observations made on the river on June 28, 1986 showed that counter propagating waves produced a zone of "chop" at point of coincidence. The two outside bow waves of the two boats, however, proceeded to the

river bank, unimpeded. Also the presence of multiple boats produced a "confused" surface even when the boats were proceeding at a 5 mph minimum speed.

- (3) The Delta test reach prototypes (Georgiana Slough and False River) are much narrower than the Sacramento River above the I-880 bridge. Georgiana Slough has an average width of about 150 feet, while False River, lying to the north of Franks Tract in the western Delta, is made up of several narrow channels separated by islands. The width in False River varies from 130 feet to 250 feet throughout the two mile boat wave test section. The Sacramento River on the other hand is some 400-600 feet in width from the I-880 bridge to the upper end of the study area.

The significance of this difference in stream geometry is that the same boat waves that generated a given energy level in Georgiana Slough and False River would have a greater distance to dissipate energy in the Sacramento River before impinging on the river bank.

- (4) The materials used to construct the Delta levees and the Sacramento River project levees in our study area are vastly different. The Georgiana Slough levees were built principally by clam shell dredging of channel deposits, while the False River levees are almost entirely constructed from organic peat soils. The

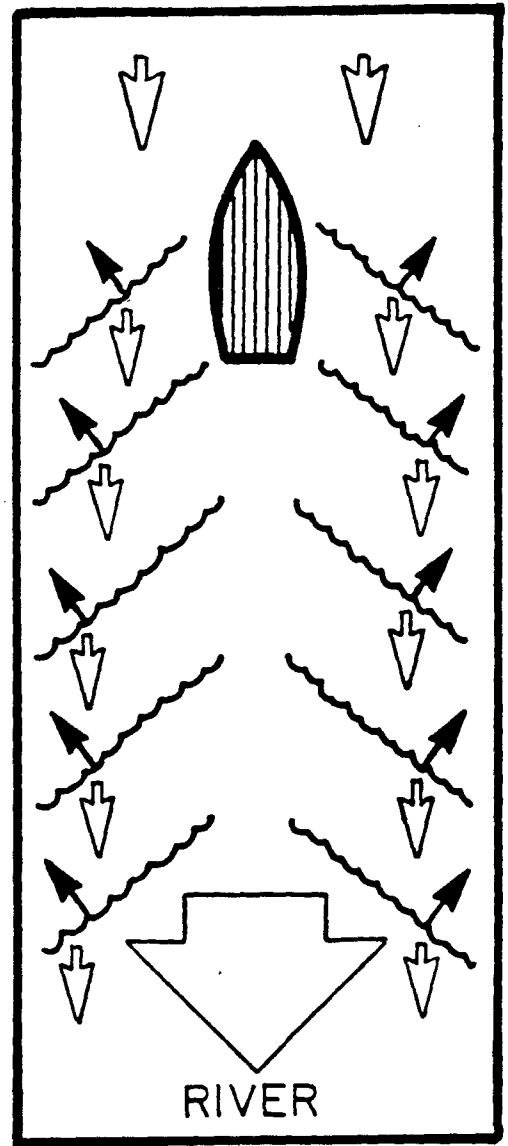
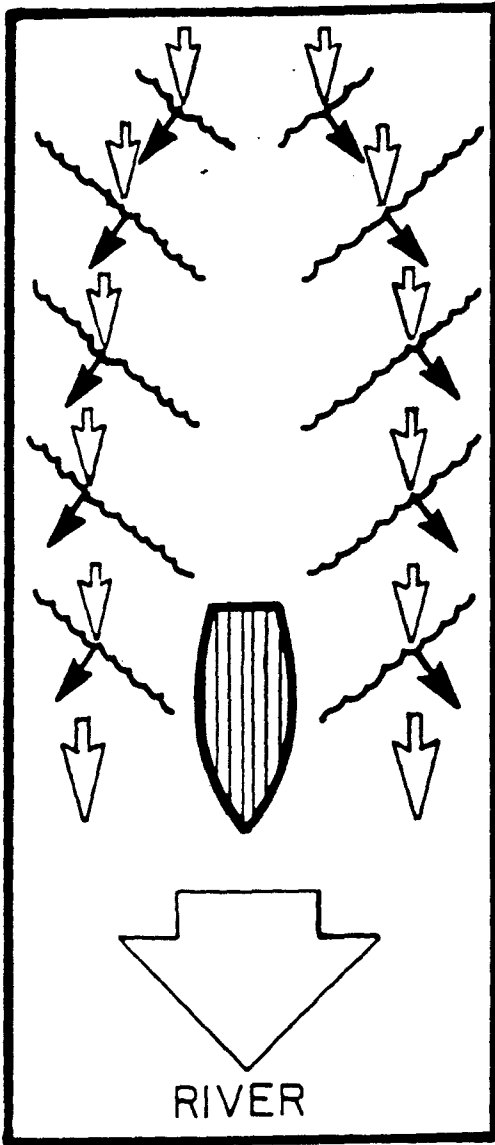


FIGURE 5

**SCHEMATIC REPRESENTATION OF
BOAT WAVES AS INFLUENCED
BY RIVER CURRENT**

Sacramento River levees in our study area were built using landward soils, such as the silty loams of the Yolo Loam Agricultural Soils series.

After considering these factors, it is our opinion that, while the Delta boat wave study is a significant contribution to an understanding of the boat, wind and tractive force elements at work on the erosion of levees, their conclusions, in terms of allocations of levee loss among principal erosion components, cannot be correlated to the Sacramento River situation. Wave studies, structured in the same mode as the Delta wave studies, could be undertaken to verify the actual distribution of erosive forces in the Sacramento River above the I-880 bridge.

g. Boat Waves and Turbidity

To further examine the impact of boat wash on levee erosion in the study area, weekend river turbidity was examined. The test hypothesis was that, for weekends of high boating activity, the river might exhibit heightened background turbidity/suspended sediment measurements. USGS reported suspended sediment data for the I Street Bridge location was utilized for this analysis.

These data are reported in Table 64 and are for the same calendar years as those used to study the range in river stage for dry, average and wet years. Climatological data were also studied to assist in correlating sediment increases with summer rain events. It was assumed that rainfall coincident with weekends and/or holidays might also be a contributing factor for increases in turbidity.

Table 64

Suspended Sediment for Weekends and Holidays
Sacramento River at Sacramento 1976 (Dry Year)

<u>Month/Day</u>				<u>Suspended Sediment (mg/l)</u>				<u>Monthly Average Susp. Sediment</u>	<u>Remarks</u>
<u>Sat</u>	<u>Sun</u>	<u>Mon</u>	<u>Tues</u>	<u>Sat</u>	<u>Sun</u>	<u>Mon</u>	<u>Tues</u>		
5-1,	5-2,	5-3		42,	45,	42		39.6	
5-8,	4-9,	5-10		37,	31,	27		"	
5-15,	5-16,	5-17		50,	49,	46		"	
5-22,	5-23,	5-24		38,	34,	33		"	
5-29,	5-30,	5-31*, 6-1		43,	46,	48*, 50		"	
6-5,	6-6,	6-7		37,	37,	37		42.2	
6-12,	6-13,	6-14		49,	55,	61			0.04" rain in Sacto, 6-9
6-19,	6-20,	6-21		39,	38,	37		"	
6-26,	6-27,	6-28		39,	41,	44		"	
7-3,	7-4*, 7-5			44,	41,	38		35.5	
7-10,	7-11,	7-12		40,	42,	43		"	
7-17,	7-18,	7-19		32,	35,	37		"	
7-24,	7-25,	7-26		27,	29,	34		"	
7-31,	8-1,	8-2		36,	42,	49		43.7	
8-7,	8-8,	8-9		32,	31,	30		"	
8-14,	8-15,	8-16		32,	39,	48		"	0.21" rain 8-14
8-21,	8-22,	8-23		60,	60,	60		"	0.28" rain 8-15
8-28,	8-29,	8-30		46,	41,	35		"	0.10" rain 8-17
								"	0.03" rain 8-18
								"	0.01" rain 8-22
9-4,	9-5,	9-6*, 9-7		34,	37,	46,	56	44.1	
9-11,	9-12,	9-13		56,	56,	56		"	0.07" rain 9-10
								"	0.31" rain 9-11

* Holiday and/or holiday weekend. Rainfall is for Climatological Station at Sacramento Airport #7630.

Table 64

1976 (Dry Year) Continued

<u>Month/Day</u>				<u>Suspended Sediment (mg/l)</u>				<u>Monthly Average Susp. Sediment</u>	<u>Remarks</u>
<u>Sat</u>	<u>Sun</u>	<u>Mon</u>	<u>Tues</u>	<u>Sat</u>	<u>Sun</u>	<u>Mon</u>	<u>Tues</u>		
9-18,	9-19,	9-20		46,	66,	62		"	
9-25,	9-26,	9-27		25,	24,	28		"	
<u>1974 (Wet Year)</u>									
5-4,	5-5,	5-6		75,	75,	73		>8.9	
5-11,	5-12,	5-13		105,	105,	100		"	
5-18,	5-19,	5-20		95,	88,	68		"	0.01" rain 5-17
5-25,	5-26,	5-27		51,	53,	54		"	
5-31*,	6-1,	6-2,	6-3	66,	61,	60,	54	"	
6-8,	6-9,	6-10		52,	53,	54		50.0	
6-15,	6-16,	6-17		49,	49,	48		"	0.05" rain 5-17
6-22,	6-23,	6-24		50,	49,	47		"	
6-29,	6-30,	7-1		44,	46,	53		"	
7-4*,	7-5,	7-6,	7-7	45,	42,	39,	38	48.8	
7-13,	7-14,	7-15		61,	62,	57		"	
7-20,	7-21,	7-22		49,	48,	44		"	
7-27,	7-28,	7-29		40,	38,	36		"	
8-3,	8-4,	8-5		39,	38,	38		45.3	
8-10,	8-11,	8-12		40,	42,	47		"	
8-17,	8-18,	8-19		50,	50,	50		"	
8-24,	8-25,	8-26		50,	47,	44		"	
8-31,	9-1,	9-2*,	9-3	53,	54,	55,	56	"	

* Holiday and/or holiday weekend. Rainfall is for Climatological Station at Sacramento Airport #7630.

Table 64

1974 (Wet Year) Continued

<u>Month/Day</u>				<u>Suspended Sediment (mg/l)</u>				<u>Monthly Average Susp. Sediment</u>	<u>Remarks</u>
<u>Sat</u>	<u>Sun</u>	<u>Mon</u>	<u>Tues</u>	<u>Sat</u>	<u>Sun</u>	<u>Mon</u>	<u>Tues</u>		
9-7,	9-8,	9-9		54,	52,	56		46.4	
9-14,	9-15,	9-16		50,	50,	54		"	
9-21,	9-22,	9-23		40,	38,	37		"	
9-28,	9-29,	9-30		34,	34,	34		"	
<u>1963 (Avg. Year)</u>									
5-4,	5-5,	5-6		133,	104,	73		87.4	0.32" rain 5-8
5-11,	5-12,	5-13		95,	106,	95		"	0.30" rain 5-10 0.02" rain 5-11
5-18,	5-19,	5-20		107,	93,	76		"	
5-25,	5-26,	5-27		76,	67,	77		"	
5-31*,	6-1,	6-2,	6-3	70,	96,	96,	93	62.7	
6-8,	6-9,	6-10		69,	77,	69		"	Trace rain 6-10
6-15,	6-15,	6-17		40,	45,	52		"	
6-22,	6-23,	6-24		45,	49,	52		"	
6-29,	6-30,	7-1		48,	45,	40		"	
7-4*,	7-5,	7-6	7-7	36,	34,	38,	33	33.3	
7-13,	7-14,	7-15		36,	32,	34		"	
7-20,	7-21,	7-22		32,	32,	34		"	
7-27,	7-28,	7-29		28,	22,	26		"	
8-3,	8-4,	8-5		24,	25,	22		31.9	
8-10,	8-11,	8-12		41,	35,	32		"	Trace rain 8-7 Trace rain 8-8
8-17,	8-18,	8-19		29,	27,	28		"	
8-24,	8-25,	8-26		30,	35,	47			

* Holiday and/or holiday weekend. Rainfall is for Climatological Station at Sacramento Airport #7630.

Table 641963 (Avg. Year) Continued

<u>Month/Day</u>				<u>Suspended Sediment (mg/l)</u>				<u>Monthly Average Susp. Sediment</u>	<u>Remarks</u>
<u>Sat</u>	<u>Sun</u>	<u>Mon</u>	<u>Tues</u>	<u>Sat</u>	<u>Sun</u>	<u>Mon</u>	<u>Tues</u>		
8-31,	9-1,	9-2*	9-3	43,	49,	41,	40	95.6	
9-7,	9-8,	9-9		53,	61,	74		"	
9-14,	9-15,	9-16		117,	112,	103		"	0.47" rain 9-12
9-21,	9-22,	9-23		172,	100,	92		"	
9-28,	9-29,	9-30		108,	65,	65		"	

* Holiday and/or holiday weekend. Rainfall is for Climatological Station at Sacramento Airport #7630.

In 1976, the Monday following Labor Day showed an increase of about 22 mg/l occurring over the four day period and producing an approximate weekend movement above the monthly average of 12 mg/l. For comparison, one (1) milligram per liter increase in sediment concentration is roughly equivalent to an increase in mass of sediment of about 30-40 tons per day for summer flows of about 12,000 to 35,000 cfs.

In addition to early rainfall events affecting river sediment concentration, other factors such as the dewatering of thousands of acres of rice prior to October harvest can have a significant impact on the river's turbidity. Recalling the data presented in Table 62, an average monthly sediment discharge for 15,000 cfs of river flow was reported as 135,000 cubic yards (or an approximate mass equivalent of 164,025 tons per month at 1.22 tons per cubic yard). If the 9-6-76 weekend

increase in sediment discharge could all be attributed to boat wave action the net increment in sediment load to the river would have been about 700 tons per day. On a proportional basis, the 700 tons would represent only about a 10 percent increase in the average monthly predicted sediment load for that day at the I Street Bridge location. The sediment increase on the river for that particular weekend was also probably influenced by the extreme drought of the late 1976 summer, as the anomaly did not present itself for the wet or average year. Further, the data from Table 64 are uneven. They do not present a clear pattern of sediment increases following summer weekends, and, where increases do occur, they seem often related more to rainfall than to increased boating.

We conclude, based upon an analysis of two years of hydrologic extremes and an average year for all weekends and holidays, that boat traffic on the river above the I Street Bridge does not appear to significantly affect turbidity/suspended sediment concentrations at the I Street Bridge location.

h. Balanced River Management

From a river management standpoint a balance must be achieved between total loss of berm and bankside vegetation and protective rip-rap, from lowest river stage to maximum flood elevation throughout the entire study area. Although levee integrity and flood protection on reclaimed lands must have the highest river management priority, achieving a balance between levee safety and ecological protection is both desirable and feasible, as was discussed in Section VI of this

report. Several studies have been made in this regard (California DWR, 1967; State Reclamation Board, 1967; Madrone Assoc. for DFG/USFWS, 1980), and others are ongoing. It is our general conclusion that enough work has now been done to develop joint solutions in this area, and to avoid the polar alternatives of collapsing levees on the one hand, and totally denuded river banks on the other.

i) Conclusions and Recommendations

The analysis of this section leads to the following conclusions.

- (1) Boat generated waves impinging on the east side project levees above the I-880 bridge have the potential to dissipate some of their erosive energy if boats respect the 200 foot distance or 5 mph "no wake" boat operating criteria.
- (2) There is an exchange of energy between boat induced waves and river current which is either positive or negative depending upon the boat's direction (downstream or upstream). Wind shear can also add or subtract energy from waves.
- (3) For boats passing port to port, respective port bow waves tend to cancel each other and create a confused water surface or "chop". Starboard waves propagate undiminished to the shoreline.
- (4) Marinas and moored boats can act as boat wave and wind wave suppressants.

- (5) Dry years, such as 1976, produce the worst case scenario for boat wave induced levee erosion because of the nearly constant low river stage conditions during the five most active boating months.
- (6) The best available scientific data on boat wave, wind wave, and stream tractive forces used relatively narrow Sacramento-San Joaquin Delta prototype channels for study. The data and conclusions do not appear applicable to the relatively wide Sacramento River situation between project levees.
- (7) Houseboats have only one tenth the potential for wave damage in foot-pounds per foot per boat passage as conventional boats.
- (8) An analysis of turbidity records for the Sacramento River at Sacramento for weekends and holidays for typical dry, average and wet hydrologic years does not demonstrate that intense boating activity can produce a significant increase in suspended sediment in the river. Very minor local summer rainfall event, correlated to the weekend/holiday dates did not show a direct response of rainfall to an increase in turbidity.

In sum, wave wash clearly causes erosion, particularly during the summer boating season. While it is our impression that the major erosive threat to levees in the study area is associated with current velocity and changes in river stage, a continuing wave related impact on levees does occur during boating season, causing annoyance and requiring localized remedial action. Our recommendations in this regard will be contained in concluding sections.

Finally, it is not clear that marinas are directly adverse to levee safety. Marina installation is often coupled with levee improvement. Where this is so, improved flood control conditions will result.

8. Anti-fouling Hull Paints

Most boat hulls that are left in the water (not trailer transported and ramp launched) are painted to discourage the growth of so-called "fouling organisms". Periphyton (attached algae), submerged grass species and some invertebrate species attach themselves to boat hulls and interfere with the boat's performance, handling and fuel consumption.

In practice, the antifouling paint continually exposes a toxic surface to the colonizing organism, by "leaching" the toxic material from the paint surface (Leviorsen and Spindel, 1969; Burns and Bradley, 1967). Copper-based paints were used for many years by commercial, military and recreational vessels; but, since about 1979, anti-fouling paints containing tributyltin-oxide have been in widespread use. During 1985, the

U.S. Navy completed research that convinced many ship maintenance experts that tributyltin bottom paints were a serious threat to the environment (Salazar and Salazar, 1982; Newton, Thurm and Seligman, 1985; Valkirs et al. 1985; Salazar, 1985; Valkirs, Davidson and Seligman, 1985). Concentrations in the water of as little as 1 part tributyltin per trillion parts of water, proved to be toxic to mollusks (Ibid). The effects of this compound on other marine species and its ability to concentrate in cell tissue are still under study. Canadian investigators have found tributyltin-oxide to be very toxic to juvenile salmon (Maguire, 1984). Another negative feature of tributyltin-oxide paint is its ability to resist chemical or biological breakdown in sediment or water, although its bioavailability appears to be reduced when absorbed in silt and clay size particles (Salazar and Salazar, 1982). As a result of these concerns, the U.S. Navy has moved to prohibit use of tributyltin-oxide by their craft in Chesapeake Bay until recertification by EPA. Immediate action on this issue in California seems warranted, and will be addressed in our recommendations.

9. Urban Runoff

Parking areas, walkways and other paved features are a part of most marina developments. Runoff from urban streets has been thoroughly studied by a host of investigators because of its potential for water quality degradation (Sartor and Boyd, 1972, Journal of Envir. Eng. Feb. 1975). Uncontrolled surface drainage from paved areas in new marinas should be controlled through the use of:

- (1) porous pavements;
- (2) grading for drainage away from the river; and
- (3) periodic mechanical sweeps or "controlled" washdowns of the parking lot to reduce the potential pollution load to the river.

Employment of sumps or drywells is also possible, but seems less practical on operational levels.

10. Marina Structures (Piers, Docks and Wharves)

The wood components of many river structures are often pressure-treated with a preservative such as creosote, copper arsenate, copper naphthenate or various other copper and zinc compound combinations (Chmura and Ross, 1978). The Koppers Company, a manufacturer of wood preservatives, found that creosote was only moderately toxic to non-target aquatic organisms. Lethal Dose₅₀ for bluegills and rainbow trout were 990 parts per billion and 880 parts per billion, respectively (Koppers, 1979). Planning and design criteria concerning use of wood preservatives at marinas on the Sacramento River should be developed by appropriate state agencies, such as the Department of Water Resources and the California Department of Fish and Game. Said criteria should identify wood preservatives which perform effectively, but present the least threat to aquatic organisms and water quality over the life of structures.

11. In Stream Flood Control Structures and Recreational Boating

Rock wing dams placed at right angles to protect levees at non-uniform intervals present a hazard to boaters on the Sacramento River at certain river stages. In the study area, the wing dams or groins all seem to be concentrated in the section between Sand Cove and Rio Ramaza Marina. The function of these dams is to protect levees from undercutting by eddy erosion at certain river stages. Soil accretion or shoaling generally occurs on the downstream side of the dam. Marking of these boating hazards by the Corps of Engineers and/or the U.S. Coast Guard would be a simple and expeditious solution.

12. Off-River Marinas and Circulation

Off-river marinas can become "sinks" for pollutants and require periodic dredging to maintain navigability for resident boats. Dredging and disposal of dredge spoils can produce significant negative water quality and terrestrial impacts. Future off-river marina development plans should be thoroughly reviewed to ensure that natural or artificial circulation is provided. Also, the breaching of flood control project levees is not necessarily looked upon favorably by the responsible state and federal flood control agencies. One exception might be the coincidental siting of an off-river marina parcel with a section of "problem" levee that would benefit from replacement.

VIII. Analysis of Agencies/Institutions Involved With Marinas in the Sacramento River Study Area

1. Agencies and Institutions

This section provides background information concerning the authorities, regulations and policies of the public agencies which have permit authority over marinas or which may otherwise influence the scope and direction of marina development in the study reach of the Sacramento River. The sections which follow will provide a description of the constraints which existing laws and policies of these agencies impose upon marina development.

A large number of local, state and federal agencies play a role in marina development. Four or five major permits will usually be required for a marina project to proceed. In addition, many other agencies, as well as private interest groups and landowners, may influence the decisions of the permitting agencies and the nature of marina development generally.

The primary permitting agencies include the local land use authority--either the City of Sacramento, or Yolo or Sacramento County, depending upon project location; the State Lands Commission and Reclamation Board; interested respectively in the management of state-owned lands and protection of the river levee system--and the U.S. Army Corps of Engineers which is responsible for dredge and fill permits. Generally, the state and federal agencies will be more concerned with in-river and near-river effects of marina developments while the local land use authorities will deal not only with marina developments but also with associated shoreward developments such as condominiums, offices and parking facilities. Other permits will also be

involved with most marina developments, such as building permits, but generally these will condition the development rather than involve questions relating to whether the project may be built at all.

Numerous other agencies have an interest in marina development apart from direct regulatory responsibilities. They may have their own marina projects which they are seeking to develop, such as the Freeport and Miller Park proposals. Or they may have a general institutional mission, such as river safety, which may be affected by location or scale of marina developments.

A list of all agencies with a regulatory or other interest in marina developments is set forth in Table 35, a summary of the principal permitting requirements is contained in Table 36. A summary of the principal concerns of other interested agencies is presented in Table 37.

Table 65List of Agencies Having Regulatory Authority or
Interest Concerning Sacramento River Marina DevelopmentPermitting AgenciesLocal

Sacramento County
Yolo County
City of Sacramento

State

State Lands Commission
Reclamation Board
Department of Fish and Game*
Central Valley Regional Water Quality Control Board

Federal

U.S. Army Corps of Engineers

Reviewing or Interested AgenciesLocal

Sacramento County Sheriff
Yolo County Sheriff
City of Sacramento Housing and Redevelopment Agency
City of Sacramento Parks and Community Services
Sacramento County Parks and Recreation
Reclamation Districts 811, 900 & 1000

State

Boating and Waterways
Department of Water Resources
Coastal Conservancy
State Department of Parks and Recreation
Office of Planning and Research
Resources Agency
Wildlife Conservation Board

Federal

Coast Guard
Fish and Wildlife Service
National Marine Fisheries Service
Bureau of Reclamation
Environmental Protection Agency

* The Department of Fish and Game does not issue a permit but does enter into stream alteration agreements.

Table 66

Permitting Agencies

<u>Agency</u>	<u>Principal Responsibilities</u>	<u>Geographical Jurisdiction</u>	<u>Statutes and Regulations</u>	<u>Applicable Plans and Policies</u>	<u>Summary of Regulatory Constraints</u>
State Lands Commission	Leasing of state-owned lands used for marina development. Broad discretion to condition leases in the public interest.	Submerged lands (river bottom) and tidelands to the ordinary high tideline (historical natural shoreline is controlling limit of jurisdiction).	Public Resources Code Sec. 6000 et seq.; Title 2 California Admin. Code Sections 1900-2954.	Environmentally Significant Lands Inventory; moratorium on new marina leasing.	Water dependent uses only; public access size of marina; extent of occupancy of river; cumulative effects of multiple marina projects.
Reclamation Board	Protection of floodways for public safety. Upon consultation with DWR & Corps of Engineers, issues permits for any construction, alteration, improvement of structures or removal of vegetation waterward of levees.	<p><u>In general:</u> Central Valley Drainage Basin. Includes Sacramento & San Joaquin Rivers and connecting streams & tributaries.</p> <p><u>Rec. Dist. 1000:</u> from American River to Natomas Cross Canal (Sac. Side).</p> <p><u>Rec. Dist. 811:</u> Broderick north (Yolo side).</p> <p><u>Rec. Dist. 900:</u> Broderick south (Yolo side).</p>	Water Code Sec. 8532-8723; Title 23 California Administrative Code sections 16-152.	Standards for Encroachments; Standards for Rec. Dist. 1000. Bank Protection guide; guide for vegetation on project levees; Riparian Vegetation Management Policy.	<p>Except for Rec. Dist. 1000, structure for human habitation not permitted waterward of levee; No building on levee itself; No parking on levee; generally no significant impeding or alteration of flows; bank protection requirements.</p> <p>Broad public interest decision criteria; Limitation or extent marinas extend into river; maintenance of</p>

Table 66 (continued)

Permitting Agencies

<u>Agency</u>	<u>Principal Responsibilities</u>	<u>Geographical Jurisdiction</u>	<u>Statutes and Regulations</u>	<u>Applicable Plans and Policies</u>	<u>Summary of Regulatory Constraints</u>
					navigational channels; may regulate effects of "dependent facilities" on upland areas.
U.S. Army Corps of Engineers	Issues permits for obstruction or alteration of navigable waters or dredge and fill activities in waters of the U.S.	Ordinary high water.	Sec. 10 Rivers & Harbors Act, (33 U.S.C. sec. 401); Sec. 404 Clean Water Act, 33 U.S.C. sec. 1244; 33 CFR Parts 320-384; 40 CFR Part 230	U.S. Corps of Eng. Regulatory Program (EP 1145-2-1, May, 1985)	
City of Sacramento	Land use planning, zoning, permitting of uses and construction.	River shoreline within City limits; jurisdiction extends to middle of river.	Comprehensive Zoning Ordinance (Ordinance 2550); Sub-division Ordinance (dedication of access); watercourse obstruction.	General Plan (1974); Sacramento River Parkway Plan (1975); South Natomas Community Plan (1978); Pocket Area Plan (1978); Docks Specific Plan.	Public access; bank protection; elevation of structures above 100 year flood plane; discourages non-water dependent uses; some limits on vegetation removal.
Sacramento County	Land use planning, zoning and permitting of uses and construction.	East Side; N. from El Centro Rd. to Sutter Line; S. from point 1/2 mi. north of town of Freeport.	Zoning Ordinance (secs. 235-90; 235-140) Garden Highway Special Planning Area Ordinance S2C78-142B.	General Plan (1982); Delta Community Area Plan (1983).	Public access; protection of mature oaks; favor water-dependent uses; 35' height limit; provide pump

Table 66 (continued)

Permitting Agencies

<u>Agency</u>	<u>Principal Responsibilities</u>	<u>Geographical Jurisdiction</u>	<u>Statutes and Regulations</u>	<u>Applicable Plans and Policies</u>	<u>Summary of Regulatory Constraints</u>
Yolo County	Land use planning, zoning and permitting of uses and construction.	West Side, Sacramento River (entire study area).	Yolo County Zoning Code.	County Master Plan (1983); East Yolo General Plan (1976); Southport Area Plan (1982).	out facilities; N. of City commercial development limited to certain individual parcels. OS-1 overlay zone limits development of most riverfront area; structures elevated above 100 yr. flood plain; agricultural uses emphasized except for few locations designated for parks and recreational use.
Department of Fish and Game	Minimize adverse impacts upon fish and wildlife habitat caused by marina development; Stream Alteration Agreements; Suction Dredging Permits; Comments upon CEQA and NEPA documents; enforces fishing regulations.	River bed and bank.	Fish and Game Code Secs. 1601, 1603; 5650, 5653 12002. 14 Cal. Admin. Code Secs. 12; Art 1, Sec. 25, State Constitution.	Mitigation sought for destruction of fish and wildlife habitat; disturbance of stream bed and bank to be minimized.	Minimum vegetation removed, mature vegetation to be re-established; bank protection only where vegetation cannot be re-established.

Table 66 (continued)Permitting Agencies

<u>Agency</u>	<u>Principal Responsibilities</u>	<u>Geographical Jurisdiction</u>	<u>Statutes and Regulations</u>	<u>Applicable Plans and Policies</u>	<u>Summary of Regulatory Constraints</u>
Central Valley Regional Water Quality Control Board.	Regulation of discharges harmful to surface or groundwater quality; issuance of waste discharge requirements; certification to federal permitting agencies of water quality compliance.	Waters of the state.	Porter-Cologne Water Quality Control Act (Water Code Secs. 13000 et seq.); Sec. 401 Clean Water Act (33 U.S.C. Sec. 1341).	Sacramento-San Joaquin Delta Basin Plan; compliance with water quality standards.	Chemical analysis of bottom sediments for large dredging operations in sensitive fish habitats; limitations on turbidity; effluent limitations on any direct discharge of treated sewage effluent.

Table 67Other Agencies with an Interest or Concern
in Marina Development

<u>Agency</u>	<u>Interest or Concern</u>
<u>Local</u>	
Sacramento County Sheriff	River patrol; search and rescue
Yolo County Sheriff	River patrol; search and rescue
Sacramento City Police	River patrol; search and rescue
Sacramento City Housing Re- development Agency	Old Sacramento Wharf development
Sacramento City Parks and and Community Services	Miller Park Marina expansion
Sacramento County Parks and Recreation	Freeport Marina development
<u>State</u>	
Boating and Waterways	Grants for marina development and boat ramps; loans for marina development; boating safety; review of Federal and local ordinances regulating boating
Department of Water Resources	Levee system integrity; flood management
Coastal Conservancy	Urban Waterfront Bond Act - review of proposals
State Department of Parks and Recreation	Office of Historic Preservation concern with archaeological issues; effects of increased boat traffic on other state park facilities
Office of Planning and Research	State Clearinghouse for environmental documents requiring state agency review; Office of Permit Assistance coordination of state agency review of major projects (e.g., Lighthouse)
Resources Agency	Coordinates CEQA and NEPA comments of Resources Agency departments upon proposed projects
Wildlife Conservation Board	Acquisition of areas for habitat and recreation access values.

Table 67 (continued)Other Agencies with an Interest or Concern
in Marina Development

<u>Agency</u>	<u>Interest or Concern</u>
<u>Federal:</u>	
Bureau of Reclamation	Levee system integrity
Fish and Wildlife Service	Listing of species as threatened or endangered; review of the effects of projects upon threatened and endangered species and wildlife generally
Coast Guard	Oil and hazardous material spill regulations; regulation of safety equipment specifications; navigation rules in federal navigable waters
National Marine Fisheries Service	Effect of marina development upon anadromous fishery habitat
Environmental Protection Agency	Promulgation of regulations concerning marine sanitation devices, oil and hazardous material spills, and regulations relating to Corps of Engineers dredge and fill permits

In addition to the specific requirements imposed by particular agencies, several general statutory requirements, to be followed by all agencies, may affect marina developments. These include the National Environmental Policy Act (NEPA), the California Environmental Quality Act (CEQA), both federal and state Endangered Species Acts, and the Fish and Wildlife Coordination Act and a number of statutes relating to water quality control. These statutes, particularly CEQA, contain requirements which can constrain the actions of a number of agencies. At the very least they will influence the agenda of issues which will be considered in the regulatory process. These laws and the legal authorities and policies of the principal permitting agencies are summarized in sections which follow. Appendix 5 provides more detail on the same subjects.

2. Summary of Authorities and Policies of Principal Permitting Agencies

i) Laws Generally Applicable to Marina Construction and Boating

a) The California Environmental Quality Act (CEQA)

CEQA requires the lead permitting agency, usually the local government permitting authority, to conduct an analysis of the environmental effects of proposed projects. If the agency finds that the project may have a significant effect on the environment, then an environmental impact report (EIR) must be prepared. CEQA states that it does not grant new powers to agencies independent of the powers granted to that agency by other laws. However, where another law does grant discretionary power to an agency, then CEQA authorizes that agency to use its discretionary powers to mitigate or avoid significant environmental effects. Lead agencies may apply this power to any aspect of the project, while responsible agencies are limited to requiring mitigation only with respect to that part of the project which they are called upon to approve (CEQA Guidelines sec. 15041).

For a lead or responsible agency to approve a marina project, it must find either that there are measures to mitigate the significant environmental effects or that there are overriding economic or social factors making mitigation measures or alternatives impractical. CEQA will at least set the agenda for agency consideration of the project, though it may not dictate the result.

Though courts will defer to the judgment of the permitting agency, the agency must make a written finding concerning the disposition of significant environmental effects and have some rational basis for such findings.

The effect of these requirements is likely to be to generally constrain the design of marina projects to reduce environmental impacts though rarely to prevent the construction or expansion of a marina altogether. Whether or not a responsible or a lead Agency is legally required to impose mitigation measures and alternatives identified in an EIR or Negative Declaration, the CEQA process usually raises issues and considerations that would not have otherwise been discovered or considered.

b) California and Federal Endangered Species Acts

Some 175 plants and 65 species of fish and wildlife have been listed by the state Fish and Game Commission as threatened or endangered (14 Cal. Ad. Code secs. 670.2 and 670.5). The status of efforts to protect listed fish and wildlife is reported periodically by Fish and Game in updates of its publication "At the Crossroads." The principal state-listed animal species within the study reach are the California yellow-billed cuckoo, and the Swainson's hawk. The giant garter snake occurs in the vicinity of the study area, but outside the riparian corridor. All are considered threatened species. The greater sandhill crane (threatened) also

occurs within the Sacramento River corridor, though its principal habitat is not within the immediate area of the study reach.

The principal species listed under the federal system which is present within the study reach is the valley elderberry longhorn beetle ("VELB" for short) which is listed as a threatened species (50 CFR sec. 17.11). A formal consultation between the Fish and Wildlife Service and the Corps of Engineers has been going on since early 1984 concerning the possible effects of upper Sacramento River bank protection projects on the VELB. In November 1985, Fish and Wildlife issued its opinion finding that the Chico Landing to Red Bluff portion of the Corps project would jeopardize the beetle. It further found that certain additional bank protection work south of Chico Landing would not jeopardize the beetle because habitat in this area was already largely disturbed by previous levee construction and bank protection. Elderberry bushes are located on the site of the proposed Lighthouse Marina and probably on the sites of other projects in the study area as well. (The U.S. Fish and Wildlife Service is participating in the review of the Lighthouse project; this review was still in process at the time this report was completed.)

Though there is some flexibility provided in both state and federal acts, the net effect of a finding of jeopardy of a threatened or endangered species by a

particular project is at least to delay it and require changes in project design. Depending on the effect of the project and availability of mitigation measures, a jeopardy finding may prevent permit issuance or make the project economically infeasible. If the Department of Fish and Game determines that a "take" of a threatened or endangered species would occur as a result of a project, it may issue a permit or memorandum of understanding for "incidental take" as part of a management plan to benefit the species. Otherwise, "take" of a listed species is prohibited.

c) Boat Speed Laws

Laws controlling the operation of boats in the Sacramento River are established by federal, state and local regulations. General criteria for safe boating speeds are contained in the federal Inland Navigational Rules Act of 1980 and in state regulations (33 U.S.C. sec. 2006; 14 Cal. Adm. Code sec. 6615). In addition to the general authority to limit speed according to river conditions (e.g. visibility, traffic density, navigational hazards), California has also adopted specific five mile an hour speed zones. Boats may not operate at more than five miles an hour within 100 feet of bathers and within 200 feet of docks to which boats are made fast or upon which people are standing. Boat wakes are not directly regulated in the study area, though Sacramento County has established restricted wake

zones in sections of the river south of the study area. In these areas wakes may not show a whitewater break when striking the shore, levee or a moored vessel.

Enforcement of boating laws in the study area is the primary responsibility of the Sheriff's officers in Sacramento and Yolo Counties, and of the City Police in the City of Sacramento. Eight patrol vessels are available to the river, 4 from Sacramento County and two each from Yolo County and the City of Sacramento. Not all of these boats are necessarily operational at the same time. In Sacramento City and County, enforcement and safety activities are funded almost totally by the appropriate local government--with occasional grant monies used to purchase capital equipment. Yolo County receives the greatest part of its operating funds via a grant from the California Department of Boating and Waterways. This grant is based on estimated days of boater use, and requires that the County first spend a specified portion of the boat taxes it collects on safety and enforcement activity, before receiving federal funds. This formula is updated periodically.

While boaters seem strongly supportive of greater enforcement and safety effort, we were able to find no clear empirical evidence on this point. There seems agreement that on peak weekends there is not enough policing to go around. However, our findings do not allow us to go beyond that generalized conclusion.

d) Water Quality

The water quality effects of marina development may be divided roughly into three categories: effects of marina construction; effects of marina operation; and effects of boat operation. The principal agency concerned with water quality protection in the Sacramento River is the Central Valley Regional Water Quality Board. Local health departments generally take the lead with regard to sewage disposal issues.

A system of water quality standards and pollution discharge permitting is established in California under a combined federal and state set of laws and regulations--the federal Clean Water Act (33 U.S.C. sec. 1252 et seq.) and the Porter-Cologne Water Quality Control Act (Water Code secs. 13000 et seq.). The principal activities of concern associated with marina development and operation are dredging and sewage disposal.

Dredging is also regulated by the Corps of Engineers under section 404 of the Clean Water Act and possibly section 10 of the River and Harbors Act (see below). The Clean Water Act gives state water pollution control agencies the opportunity to either certify or waive certification that a federal permit for an activity which may result in a discharge to navigable waters will not violate applicable water quality standards. In addition, the Porter-Cologne Act requires any person proposing to discharge waste that could affect waters of

the state to file a report of discharge with the Central Valley Board. The Board can then either issue waste discharge requirements or choose to waive such requirements (Water Code sec. 13260, 13269).

In practice, if sewage is disposed of other than through a direct discharge of treated effluent to surface waters and only minor water quality impacts from dredging are foreseen, the Board will waive certification of Corps permits and will also waive discharge requirements. The process of securing this waiver, however, does give the Board an opportunity to review the project and negotiate conditions with the proponent with regard to water quality protection. When a major amount of dredging is involved, the Board will issue requirements. Standard conditions include prohibitions on redepositing dredged materials into the river and limiting increases in turbidity to less than 150 turbidity units 300 feet downstream of the dredging. Significant dredging may also raise concerns about resuspending metals or toxic materials in bottom sediments. No certifications or waste discharge requirements have recently been required for marina developments in the study reach.

Other concerns with marina construction include chemically treated pilings and possible deteriorated water quality and contaminating of bottom sediments in off stream marinas caused by poor water circulation. These effects might not be considered "discharges" subject to permitting, but could be regulated through

the local government land use approval, through a State Lands Commission lease condition or through a Corps permit condition.

Marina operation issues center on sewage disposal, fuel storage and fuel spills. Sewage disposal is generally regulated by local engineering, health department and water and sewer authorities. Additional requirements may be imposed through conditions in local land use permits covering such matters as dockside pump out facilities for vessel sewage wastes, waste oils and bilge wastes. Fuel spills are subject to state and federal spill reporting requirements though the amounts involved may be below set minimums. The state minimum for reporting oil or petroleum product spills is 42 gallons (Water Code sec. 13272). Petroleum product fuel storage is required to be underground under the Uniform Fire Code (Article 19). Fuel tanks must meet state and local reporting and design requirements to prevent leakage (e.g., Water code sec. 13170.5; Sacramento County Code, Ch. 6.34).

Water quality issues related to boat operations include vessel sewage disposal systems, oil or fuel discharges from vessel engines and the use of toxic anti-fouling hull bottom paints. The Clean Water Act mandated EPA to promulgate regulations for marine sanitation devices (sec. 312; 33 U.S.C. sec. 1322). EPA regulations permit the use in waterways, such as the Sacramento River, of Coast Guard certified devices meeting certain design criteria. Devices on boats built

after 1980 must limit fecal coliform bacteria to 200 parts per 100 ml and limit suspended solids to 150 mg/ml. Older boats need only limit coliform bacteria to 1,000 parts per 100 ml with no visible solids.

Petroleum discharges from a "properly functioning vessel engine" are not deemed to be harmful under EPA regulations, but oil accumulated in a vessel's bilge is not considered to be exempt. Bilge pumping would violate the Clean Water Act if it could be shown to violate water quality standards or cause a film or sheen on the water surface (40 CFR Part 110). Enforcement against individually small and difficult to detect discharges is another matter.

Regulation of hull bottom paints again raises the question of whether a "discharge" has occurred for purposes of state or federal water quality regulation. A more likely regulatory mechanism may be either of two federal statutes which apply to the production and sale of potentially harmful products. These are the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) and the Toxics Substance Control Act. Both are administered by EPA and require registration and testing of hazardous materials. If currently used products are harmful to water quality, they could be restricted or prohibited under these statutes. State or local regulation might also be feasible, but could raise questions of federal preemption.

ii) Principal Agency Permit Requirements and Policies
Applicable to Marinas

a) City of Sacramento

Marina development is not significantly limited to provisions of the General Plan, specific area plans or the City zoning ordinance. There are a number of policies, particularly in the General Plan, which encourage protection of the natural values of open space areas along the river, but with adequate project-specific attention to these values, water related uses such as marinas are consistent with applicable plans and ordinances. There is no explicit consideration in plans or ordinances of the amount of marina development, extent of appropriate development of areas in or along the river, or the effect of increased boating use upon recreational or other use of the river. The Sacramento River Parkway Plan appears to encourage some additional commercial recreational development, including marinas, without specifying exactly where or how much. It does include designations of nine locations on the river (south of Sacramento) where additional development is more appropriate. No such specific areas are identified north of the Central City.

Non-water dependent uses are inconsistent with existing plans. The Sacramento shoreline waterward of the levee is zoned "F" - Flood Zone. Developments within this zone require a special use permit issued by the Planning Commission. Uses which may be permitted include

marinas and restaurants, and outdoor recreation facilities. Other uses may also be permitted on a case-by-case basis provided that the development will enhance the appearance and use of the river and will not have an adverse effect of any natural resource. Any permitted use must be consistent with applicable land use plans. Proposed office space uses and condominiums have been permitted, through plan amendments for both Riverbank and Riverview marinas. Structures permitted to be constructed within the F flood zone must be above the 100 year flood level. Height and area restrictions are specified. Plan policies and use permits include provisions requiring public access to riverfront developments. Permits also typically include detailed requirements concerning parking, aesthetics, docking and pump out facilities developed on case-by-case as deemed necessary by the Planning Commission to promote the most appropriate site design.

b) Sacramento County

The location and extent of marina development are not explicitly treated in the Sacramento County General Plan. Areas along the river north of the city limits are zoned "SPA(F)". SPA is the designation for a special planning area subject to a separate ordinance. The ordinance for the Garden Highway area is designated 78-142B. Areas adjacent to the river south of Freeport are zoned "DW". Marina developments may be allowable use

under both the SPA (F) and DW zones in areas under Sacramento County jurisdiction. The Freeport area is designated as appropriate for further marina development and certain specific parcels in the Garden Highway area are designated as appropriate for commercial recreation development. Water-dependent uses are generally favored for riverside development, but condominiums have also been permitted, though not yet constructed, for the Sand Cove project on the Garden Highway. County policy appears to be favorable to additional condominium development in specific locations. This may be considered an extension of the history of residential use of areas waterward of the levee in the Garden Highway area. In the area south of Freeport the question of non-water-dependent uses has been less pressing in proposed developments. These uses do not appear to be within the permitted uses under the Delta Waterways zoning ordinance. Height and setback requirements are similar to those provided under the City rules. Riparian vegetation receives protection in the Garden Highway area primarily on parcels that are designated as undeveloped open space and on which no vegetation is to be removed. In the Delta area, riparian vegetation protection is primarily related to designation of areas as either natural or scenic, which limits development in those areas. Use permits set forth detailed conditions similar to those noted in City permits to protect riparian resources and water quality.

c) Yolo County

There are few specific policies in Yolo County plans and ordinances directed at marina development. Certain areas within the study reach have been designated as appropriate for parks and recreation uses including boat docking, fueling and minor service. Except for the urbanized portion of the Yolo County Sacramento River shoreline in the Bryte-Broderick-West Sacramento area, most of the areas adjacent to the river are zoned either Agricultural General ("A-I") or Agricultural Preserve ("A-P"). Marina development is severely limited in these areas. The southern portion of the Lighthouse marina project, the Sacramento Yacht Club and the Sherwood marina are all within "PR", Parks and Recreation designated areas. The purpose of the PR zone is to preserve lands of natural beauty or lands containing natural or potential park and recreation features for uses in the public interest. Permitted uses in the PR zone include boat docking, fueling and minor service. Private recreational facilities, restaurants and other uses may be issued conditional use permits if they are considered by the County Planning Commission to be consistent with the PR zone. Except for these areas, virtually the entire balance of the riverfront area on the Yolo County side is subject to the OS-1 overlay land use designation. Within this designation the policy is to preserve natural vegetation and wildlife habitats and also to ensure that community vistas remain open to the river.

These policies and land use restrictions, if maintained, will limit marina development to a few locations on the river. However, while the East Yolo plan notes that the community's prime open space resource is the Sacramento River, it also encourages development in areas where proposed development would improve existing unbalanced socioeconomic characteristics. The plan also notes the lack of public recreation facilities in the Bryte-Broderick area and the potential value of the riverfront for park and recreation purposes. Thus, policies encouraging protection of the natural character of riparian areas are competing with other planning policies aimed at improving the local economy and providing more opportunities for public recreational uses of the river.

d) State Lands Commission

The State Lands Commission has broad discretionary latitude concerning the approval or expansion of additional marinas in the study reach. Greater marina capacity may be seen as enhancing navigation consistent with the public trust. On the other hand, as evidenced by the Commission moratorium and this study, too much development may impair navigation, at least in a qualitative sense of user facility and enjoyment, and may also conflict with additional trust values such as other recreation uses and ecological quality.

The principal restrictions likely to be imposed under a Commission lease, in addition to basic record keeping, insurance and other requirements, will concern overall size of the marina, public access, permitted facilities, and extent of occupancy of the river. The Commission is likely to reject non-water dependent uses proposed to be located within tide and submerged lands. However, these uses have been proposed for upland areas which are beyond the Commission's direct authority (unless the development site happens to be land which was created above the former natural shoreline through artificial means). The counties and City are responsible for issues relating to such uses. While there is not a gap in agency jurisdiction concerning these developments, there appears to be a risk of disjointed review of facilities located in each of the two shoreline and upland jurisdictional areas rather than coordinated consideration of the effects of what is in fact an integrated project. The Commission typically acts as a responsible agency in the CEQA process. As such, it is somewhat limited in the scope of mitigation measures which may be required as a condition of lease issuance. Should the Commission act as a lead agency, its discretion in this regard would be greater. An argument might also be made that the Commission must deal to some extent with upland uses in order to effectively exercise its public trust responsibilities. This would likely be challenged as beyond Commission authority, however, and

thus far the Commission has generally limited conditions in leases to construction of the marina and other facilities within sovereign ownership or subject to public trust.

e) U.S. Army Corps of Engineers

The Corps will have jurisdiction over most marina developments in the Sacramento River since the river is clearly within the scope of federal jurisdiction over "navigable waters" (Sec. 10 Rivers and Harbors Act) and "waters of the United States" (Sec. 404 Clean Water Act). Most projects will involve either or both an obstruction of or deposition into the waterway subject to permitting under these statutes. Though the scope of factors taken into consideration by the Corps in the "public interest" analysis it applies to permit decisions is extremely broad, the agency's jurisdiction is still triggered by actions occurring in the river; and most of the conditions in Corps permits are related solely to conditions in the waterway, such as navigation or pollution.

Permit conditions limit the extent to which marina structures may extend into the river. Given the broad criteria applicable to Corps decisions under section 10 and section 404, it could probably limit its issuance of permits based upon an analysis of overall effects of multiple marinas upon river use and resource values, much like the State Lands Commission. The extent of land

jurisdiction, if any, is a question here as well. The Corps sometimes imposes conditions that require protection or replacement of riparian vegetation. Though conditions of permits are usually oriented to water management, the Corps would appear to be authorized by NEPA, the Endangered Species Act, and Executive Order No. 11988 concerning flood plain management to take shoreward impacts into consideration when permitting a marina with associated upland facilities. Corps policy is to review the effects of the entire project, including upland developments, if the latter are deemed to be "dependent" on proposed activities within direct Corps jurisdiction. The Corps may include conditions in its section 10 or 404 permit which address adverse effects identified during NEPA review which may be caused by such dependent upland activities.

f) Reclamation Board

The State Reclamation Board's permit authority covers all of the land areas, from the crown of the levee waterward, that are likely to be involved in any marina proposal. The Board has very broad authority, though it may only be exercised for the limited purpose of protecting the integrity and adequate operation of the flood control system. There is very little explicit treatment of marina development issues in Reclamation Board statutory provisions or in formal guidance documents. The Board appears likely to favor offstream

as opposed to instream marina developments, since the latter may involve greater potential obstruction of the floodway. However, the Board would undoubtedly have concerns with offstream marinas regarding levee breaching and the adequacy of flood protection surrounding an offstream boat basin.

There are detailed Reclamation Board guidelines with regard to construction of structures within floodway areas. Generally, structures for human habitation are not permitted, though a large exception to this rule has been made for the Garden Highway areas north of the American River on the east side of the Sacramento River. The Lighthouse marina proposal may require extension of this policy to the west side as well.

Board policy favors retention of vegetation, but the Board would probably not prohibit construction activities, otherwise consistent with Board requirements, solely on this basis. Board policies designed to protect the flood control project or the safety of structures in the floodway--such as prohibition of parking on the levee crown, minimum structure elevation requirements, and bank protection--necessarily conflict with preservation of habitat and visual amenities. Board regulations concerning uses permitted in designated floodways require consideration of the affect of the combination of such uses in the specific reach of the stream on flood heights or river velocity. It is unclear whether this sort of cumulative

analysis has been undertaken in connection with permitted or proposed marina projects in the study reach.

g) Department of Fish and Game

The Department of Fish and Game influences the development of marinas and management of activities in the Sacramento River in a number of ways. The Department must approve a stream alteration "agreement" (similar to, but technically not a permit) for construction activities which substantially change the flow of the river or the river bed or bank. The Department must also issue a permit if any suction dredging is associated with marina construction. Through these authorities the department is able to reduce, though not eliminate, the adverse affects upon water quality and fish habitat which can occur as a result of marina construction. Disturbance of the river bed and banks is to be minimized and stream side vegetation is generally required to be restored if feasible.

The department also influences marina development indirectly through its comments upon proposed permits and environmental documents prepared by other agencies. Given the department's expertise and statutory responsibilities concerning fish and wildlife protection, its comments carry great weight. Under NEPA, CEQA, and the Fish and Wildlife Coordination Act such comments must be fully addressed in final environmental

documents. The department has commented negatively on some proposed marina developments because of destruction of riparian habitat and growth inducement of additional construction in riparian areas.

Finally, the Department of Fish and Game and the Fish and Game Commission set and enforce regulations concerning fishing hours and seasons. Fishing is permitted year round for trout and salmon and fishing may occur during daylight or nighttime hours.

iii) Conclusions

A number of conclusions may be drawn from the preceding analysis of applicable laws and agency policies:

- At least one agency, and sometimes more, already has adequate authority to regulate with respect to shoreline effects of marina development.

- Regulatory authority to control in-river boating and recreational activity is also adequate, but presents problems of policy coordination between local jurisdictions; and, more importantly, adequate enforcement is limited by available budget and personnel.

- A large number of agencies and laws apply to marina development and boating. Their authorities sometimes overlap--the Corps, State Lands Commission, Central Valley Regional Water Quality Board, Fish and Game and local government may all be concerned with aspects of water quality; local government, the Reclamation Board and the Corps are all concerned with land use waterward of the levee.

- Few instances of policy conflict were noted. The state and federal agencies generally leave upland land use regulation up to local government which in turn leaves details concerning work in and immediately adjacent to the river to the state and federal process.

- Marina permits contain considerable detail concerning resource protection, flood control and land use issues. However, there is a gap in local government plans concerning explicit policies regarding marina development and overall river management. The CEQA requirement for cumulative effects analysis does not seem to be filling this gap.

- Water dependent uses in areas adjacent to the river are generally favored by both local government policies and those of state and federal governments. Marina development appears often to be directly linked to more intensive development of upland areas. This development may be beyond the regulatory reach of the state and

federal agencies, though a case might be made for some additional consideration of upland development by these agencies in the course of their review of in-river uses.

- Once a marina is considered an appropriate use, some disturbance of riparian areas and change in aesthetic aspects of river use is inevitable in order to meet other regulatory and public policy requirements relating to flood control, land use and public safety (e.g., structures must be high enough to be above the 100 year flood elevation; river banks must be protected to avoid flood damage to new structures; off-levee parking must be provided for public safety and to permit levee inspection).
- Policies for riparian protection may compete with those for economic development and greater public access to river areas. Additional explicit policies in local land use plans would be helpful to help resolve this conflict with regard to marina development.
- Minimum navigation channel width policies of the Corps and local government (e.g., Sacramento County) may already practically limit in-stream marina development to one side of the river in many locations.
- Public access, in some form, is a firmly established policy but is sometimes difficult to square with management of condominium developments frequently associated with new marinas.

- A Sacramento River Corridor Plan should be prepared to address the overall management of the urban river and its adjacent land uses. General authority to do this exists within local general planning laws. Government Code Sections 65302 regarding General Plans and 65560 regarding Open Space contain language allowing for the preparation of a comprehensive river corridor management plan. Section 65301(b) permits the combination of General Plan elements to form an Area Plan for a specific region, and this could be done for the Sacramento River. This plan could be composed of existing General Plan elements referencing land use, natural resource conservation, protection of land use in stream channels, and preservation of ecologic and scientific values.

- The preparation of such a plan might be handled by one agency taking the lead and establishing a joint policy committee which would review and work out differences of policy among the three agencies. A less formal process could involve informal consultation among the planners of the agencies, with one agency preparing a draft general plan element. In any case, the goal would be for each agency to adopt the river management plan language as part of its General Plan.

IX. Conclusions and Recommendations Concerning Marina Carrying Capacity of the Sacramento River Study Area

1. Introduction

In this section, conclusions developed from our data are summarized, and options available to protect and preserve the capacity of the Sacramento River study area to support marinas and related boating are identified. Not all options identified here fall within the direct control of the State Lands Commission. We believe, however, that our conclusions and recommendations should be as comprehensive as possible if they are to be of practical use. In this sense, some identified options may involve action by the Commission alone, some may suggest cooperative action with other agencies/institutions and some may involve encouragement of actions by affected third parties.

2. Definition of Carrying Capacity

We define carrying capacity as "the extent to which the Sacramento River and its adjacent banks can carry marina development without significant negative impact on other human, ecological or water quality benefits associated with the river system." The geographic focus of the analysis can be relatively broad, dealing with the study area as a whole, or more specific, dealing with river reaches within the study area. At its most focused level, the marina carrying capacity analysis can be location and time specific, dealing with effects on particular user groups and/or resources.

3. Establishment of River Reaches

As noted earlier, we have divided the study area into 5 river reaches, to aid in policy analysis (See Table 22). To recall, Reach 1 begins at the southernmost boundary of our study area (Route Mile 44.8) and proceeds upstream through Garcia Bend, encompassing Cliff's, Freeport, Dock Holiday, Garcia Bend and Stan's marinas and the Garcia Bend Recreation Area to Rm 53.5. Reach 2 proceeds from there upstream to RM 55.5, encompassing Four Seasons and Sherwood marinas, Captain's Table and the Sacramento Yacht Club. Reach 3 lies between the Sacramento Yacht Club and the lock for the Sacramento Deep Water Ship Channel (RM 57.5), and contains no marinas. Reach 4 encompasses so-called "marina alley". It starts at the Sacramento Boat Harbor at Miller Park and proceeds upstream to RM 62.0 encompassing the Chart Room, Viewpoint, River Galley, Village, Riverbank, Virgin Sturgeon, Riverview and Dwyer's Landing marinas. Reach 5 starts at River Mile 62.0 and proceeds northward to the upstream study boundary (RM 76.0). It encompasses Metro and Alamar marinas, and the launching ramps at Elkhorn.

4. Principal Focus of Marina Policy Analysis

i) Effects of Marina Development on Human Benefits Associated with the River

While all effects discussed in this report ultimately involve human values and perceptions, a number of issues result from relatively direct interaction between marinas, their clientele and other human use. Of these, we consider the major relevant issues that could delimit the Sacramento river's capacity to carry future marina development to be:

- crowding in the river study area;
- capabilities for vessels traveling on the river;
- location-specific conflict caused when vessels operate in close proximity to each other or to persons/facilities near the riverbank;
- the economic viability of marina enterprise on the river; and,
- public access to the river.

ii) Effects of Marina Development on Ecological Benefits Associated with the River

Principal ecological concerns in the study area focus on the riparian vegetation along river banks that supports over 100 species of birds and animals. Among these are familiar birds and animals, such as the river otter, the great blue heron and the yellow warbler. Species of particular concern include the yellow billed cuckoo, the Swainson's hawk and the valley elderberry longhorned beetle. Riparian vegetation is an excellent indicator of the health of virtually all species in the study area.* It has consequently been selected as our indicator for ecological analysis.

* Water quality and river flows also impact species. Water quality is discussed subsequently.

iii) Effects of Marina Development on Water Quality Benefits Associated with the River

It is our impression that water quality in the Sacramento River at the study area or reach level of aggregation is not impaired by marina development. Consequently, our water quality discussion will focus on effects at specific times and locations. Our concluding discussion here will pay particular attention to:

- sanitary disposal of sewage from vessels;
- litter on the river;
- toxins, with immediate attention to tributyltin-oxide;
- fuel spills;
- urban runoff.

iv) Effect of Marina Development on River Levees

River levees provide essential flood control protection for study area communities. It is important that the protection standards that allowed levees to withstand recent record high water be maintained. In our concluding analysis, we take this objective as a given requirement for the levee system, and will discuss ways in which it can be made compatible, to the fullest extent possible, with other human and ecological beneficial uses of the river.

v) Other Issues on the River

The above issues are, we believe, the driving forces in limiting the Sacramento River's capacity to carry further marina development within the study area. By this, we mean that they have the greatest potential to constrain future marina development--by indicating when additional marina capacity can only be reached at significant cost to other benefits generated by the river system. Other issues are also important. For example, we understand that only a portion of the historical and archeological sites along the river have yet been discovered. We have been unable, however, in this analysis, to discover evidence that would support study-wide policy action beyond that already required by the EIR/EIS process. Nothing that we discuss here is intended to weaken that process, or to imply that issues left unaddressed in this carrying capacity policy document should not be addressed during specific analysis of particular development proposals. For the purposes of this document, however, it appears appropriate to concentrate on those river conditions and attributes that are expected to be most influential in the Sacramento River's ability to carry future marina development.

In the following sub-sections, each area of principal concern will be discussed, and recommendations made. Conclusions from human and ecological benefit sections are convergent, and will consequently be integrated in a final set of recommendations.

5. Conclusions Concerning Effects on Human Benefits

In this section, our conclusions respecting conditions in the river and associated marina policy options for the State Lands Commission will be arrayed.

i) General Crowding in the Study Area

As noted in our analysis, crowding is a subjective issue, and recreators tend to pre-select those sites where crowding expectations are aligned with their own preferences. Further, the Sacramento River, as it passes through the central study area (Reach 4) is an urban river. Consequently, user densities encountered and accepted as "normal" will exceed those for more rural areas. We have provided baseline estimates of peak user densities for the study area--2.8 boats per acre on a peak day, of which we estimate 40 percent are generated by vessels moored in the Sacramento River study area. We estimate that peak period crowding is greatest in Reach 4, with crowding in other reaches also significant on a time specific basis. Boat owners consider the river "somewhat crowded", but show little present evidence of altering their recreational habits as a result.

Our conclusion respecting general crowding is that river user densities in the full study area have not yet reached levels that would constrain the river's ability to carry further marina development. Progression of boater densities over future years should be monitored, together with user perceptions as to what that increasing density

means for recreational quality. No policy action to control overall boater density in the study area is presently recommended, however. The key to control of densities during peak periods is access--and there, both marinas and launching ramps play an important role. This role is further discussed in following sub-sections.

ii) Traveling Conditions for Boats in the Study Area

The major problem identified by present boaters in the study area is wave wash. Wave wash becomes a problem when vessels traveling at speed generate waves that cause damage to vessels or facilities at bankside marinas and docks, or when they inconvenience other recreators on the river. We will deal with the damage issue here--and inconvenience to other recreators in a subsequent section.

The Sacramento River serves a vital function as a transit corridor for vessels, both commercial and recreational. At the same time, vessels are legally required to slow to 5 MPH when within 200 feet of a marina or dock where vessels are moored. Further, the river in the study area is not particularly wide--and it can be generalized that, in most locations, a marina intruding some 150 to 200 feet into the river (a not unusual distance) automatically constrains the width of channel available to transiting craft, and in some areas may force those craft toward shallower water close to the opposite bank. Our calculations show that, in almost all river locations, siting of in-river marinas opposite each other would remove a viable high speed transiting corridor entirely.

In-river marina locations tend to be particularly affected by water skiing and jet skiing, as those activities generally involve broader stretches of river than do transiting craft. Conflict is also intensified by boaters who are unaware of their obligations when near moored vessels or who are operating boats while under the influence of alcohol or controlled substances.

Several positive policy options are available to the Commission. At the study area level, we recommend that the Commission provide strong encouragement to the three local governments to develop a cooperative speed signing program for the river. Such a program would post large visible signs at key river locations, together with "information" signs at all marinas and launching ramps. A program of this type has been successful down-river, and would likely act to reduce conflicts between moored and traveling vessels in the study area.

Similarly, several bills are now before the legislature to introduce an "implied consent provision" into recreational boating law and to establish a more effective standard to assess and remove inebriated and/or potentially irresponsible boaters from the state's waterways (i.e., SB 1484). This type of legislation is being pursued with the cooperation of marina and boater organizations and, we believe, deserves the Commission's support*.

* A Bill of this type was approved by the State Legislature in June, 1986.

Finally, we believe the Commission should encourage the three local governments and the Department of Boating and Waterways to conduct a review of present and future capabilities and requirements for cooperative provision of enforcement and safety services on the river. This review should consider required levels of service in waters abutting the City and the two Counties, consequent requirements for vessels and personnel, and associated sources and formulas for financing. We have not identified any clear evidence of deficiency, but encountered significant concern among boaters that enforcement be adequate. With river use steadily increasing, we consequently believe that such a review would be timely, and could very well lead to action that would minimize conflict and hence increase the river's capacity to carry marinas and associated boaters.

On a reach by reach basis, we consider that only in Reach 4, has the river's capacity to carry both marinas and rapidly traveling craft been reached. In this reach, often referred to as "marina alley", speed limits are now effectively reduced to 5 MPH. A 5 MPH provision applies between I street and Tower Bridges, and opposite Discovery Park, leaving (theoretically) about 1 3/4 mile of unrestricted transit water from the Sacramento Boat Harbor upstream to Tower Bridge; about 1 mile between I Street Bridge and Discovery Park; and about 1 mile upstream of Discovery Park. However, the 1 mile length between I Street bridge and Discovery Park has 3 instream marinas on the Yolo side, while the mile above Discovery Park has 5 marinas on the Sacramento side--

providing high potential for conflict with rapidly traveling craft in these stretches of river. Further, development of the "Docks" project by the City of Sacramento Redevelopment Agency will increase potential conflicts with transiting craft downstream from Tower Bridge. In considering this situation, it is our conclusion that the portion of Reach 4 from Tower Bridge to Dwyer's Landing plus the short portion of Reach 5 from Dwyer's to I 880 overpass, a distance of approximately 3 miles, has already exceeded its capacity to jointly support marinas and rapidly traveling boat traffic.

We believe that this situation offers the Commission, the Counties and the City of Sacramento two fundamental choices--depending on the type of recreational river they would like to see in the future in the study area. The study team's preferred choice would see a river management strategy designed to maximize the range of recreational and other uses available on the river in the future, while minimizing conflict between them. Such a strategy is identified below.

- a) Concentrate Further In-Stream Marina Development in Reach 4, Restricting Marina Development in other Reaches.

This strategy suggests that because effective boat travel at speed is already preempted in Reach 4, marina expansion can take place there with little further impact on traveling craft. By concentrating in-stream marina expansion in Reach 4, other areas of the river would be left freer in future years for vessel travel and recreation. Coupled with designation of river user areas, to follow in discussion, this strategy would facilitate a more varied future river for recreational use.

Alternatively, closing Reach 4 to further marina development and letting other reaches "fill up" with marinas over time is a second alternative.

b) Halt Further In-Stream Marina Development in Reach 4, and Allow Development in other Reaches until they are also "filled up."

This option suggests a strategy that reacts to achievement of full capacity, or over capacity, in each reach. It would allow further marina development throughout Reaches 1, 2, 3 and 5, subject to normal permit controls, and only halt development when capacity was reached. Over future years, it can be predicted that the study area would gradually fill up with marinas, reach by reach, under this strategy--until other stretches of river approximated the conditions now prevailing in Reach 4. At that time rapid boat travel in the river study area would be largely preempted, and use of the river for certain more active pursuits such as water or jet skiing would be difficult, if not impossible.

As noted, based on our evaluation, the first option appears preferred.

iii) Location Specific Conflict Between Vessels, or With Other River Users/Facilities

We here discuss the principal location and time specific conflicts on the river. These conflicts are:

- conflicts between traveling vessels and vessels moored at marinas (discussed previously);
- conflicts between water skiers/jet skiers and vessels moored at marinas or private docks;
- conflicts between moving vessels and boat fishermen;
- conflicts between moving vessels and shore residents/recreators;
- conflicts between moving vessels and commercial craft;
- conflicts between moving vessels and in-river groins, etc.

Our analysis suggests that conflicts between water skiers/jet skiers and other boaters, undue noise impacting residential areas due to boat operation, and the impact of wave wash from boats may be most significant among issues listed. Sport fishing hot spots in the study area are primarily at the mouth of the American River (RM 60-61), and in the section of the river between Garcia Bend and Freeport (approximately RM 46 to 50). These areas are consequently vulnerable, particularly during fishing peaks in April/May and September/October, to irresponsible actions by other boaters. Where conflicts of the type described in this section are encountered regularly throughout the study area, it can be concluded that river carrying capability to support

a diversity of use has been reached. Where conflicts occur less regularly or less comprehensively, an opposite conclusion can hold.

In conclusion, the Sacramento River's capability to carry divergent types of vessel and other use is variable, depending on the consideration that recreators offer one another, and on the way use in the river is managed. Left unmanaged, and if a high level of user irresponsibility prevailed, it could be concluded that the study area has currently exceeded its capability to support multiple use. We believe, however, that with appropriate education and management initiatives, boater use on the river, whether generated from marinas or launch ramps, can be held well within the present study area's capabilities. The following initiatives are identified as particularly useful for cooperative effort by the Commission and other local, state and federal jurisdictions.

a) Education/Information

- Sign all restricted speed areas including areas of sport fishing concentration.
- Sign marinas and launching ramps, providing information on boater responsibilities, particularly for wave wash.
- Sign areas where there are extensive private docks to warn transitting vessels to keep to the center of the channel, and to pass oncoming boats port to port.
- Consider other cooperative education programs.

b) Adopt noise regulations in the river study area that are consistent with the decibel standards and time periods in adjacent upland areas. Where standards vary between jurisdictions, the stricter one should be applied to the river. Further, dry stack boats and all other unmuffled boats should be prohibited in the study area. Provision of a muffler system for the average boat is minimally expensive, and this enactment would provide substantial relief to other boaters, Garden Highway residences, and other users of the river.

c) Consider adoption of specific water-skiing/jet skiing zones on the river. Implementation of such measures would require cooperative action by local jurisdictions and appropriate state agencies (See Section VII). Our analysis leads us to conclude that no water skiing or jet skiing should be allowed in Reach 4 upstream of Tower Bridge (or, if in-stream marinas subsequently are built downstream of Tower Bridge, in an expanded area designated to encompass those additional marinas). The Commission may wish to consider the following further measures:

- prohibition of water/jet skiing opposite instream marinas in other reaches;
- prohibition of water/jet skiing in posted boat fishing areas (RM 60-61, 46-50) during fishing seasons;

- prohibition of water/jet skiing in areas adjacent to private docks (i.e. RM 62-68) during the off-peak season (September-May).

Other areas could be posted for water/jet skiing, with subsequent bank-side dock development proceeding at owner's risk. Water and jet skiing comprise about 5 percent of total boating effort on the river, but are much more significant in Reaches 5 and 1 during summer peak periods. Because of the spatial demands of the sport, they can precipitate some of the most volatile interactions between river users. If all of the zoning measures identified here were implemented, it is estimated that water/jet skiers would still have access to approximately 24 of the 32 miles in the study area during peak summer skiing periods (June-August) and to approximately 18 miles in other months. Adoption of only some of these measures would leave a larger portion of the study area available for water and jet skiing. We consider that such measures offer potential for retaining multiple recreational uses on the river for the future in a manner that would lie well within the river's capability to carry them.

d) Place proper navigation warnings visible by day and night at groins and other navigation hazards in the river.

e) Consider provision of further launch ramp capacity only from Elkhorn-Sacramento northward, and downriver from Miller Park (especially in the Garcia Bend area).

Do not expand launching capacity in Reach 4. This would provide further launch capacity where it is most needed, while minimizing transiting impact in Reach 4 and on Garden Highway residents living south of Elkhorn-Sacramento.

iv) Economic Viability of Marina Operation

While it is perhaps inappropriate for government entities to intervene directly in the economics of marina operation, their actions and policies will nonetheless impact marina economic viability. Principally three types of effects are relevant to this policy perspective. First, to the extent that government policy severely delineates the range of enterprise centers available to a marina operator, economic viability will be impaired. Second, to the degree that public marinas compete with private marinas via moorage price reductions, the economic viability of the private operator will be impaired. Third, to the degree that marina economic viability is impaired, the marina operator's ability to provide and maintain non-revenue service/easement obligations as part of his ongoing responsibility will be impaired. Consequently, at a policy level, marinas that propose full service facilities, including multiple enterprise centers, or expansion of enterprise centers/moorage are preferable on the river to new marinas that offer only moorage, or that

destabilize price for existing operations. The Commission should keep these concerns in mind when considering alternative proposals for marina development.

v) Public Access to the River

As noted, public access may be location specific, primarily in the form of parks or right of way easements; or linear, providing the ability to walk, jog, or bike along the river with appropriate (and in some places continuing) access to the river bank. Recent analysis concerning the American River (Meyer Resources, Inc. 1985; City of Sacramento, 1985) has indicated the substantial benefits that urban rivers generate for the urban public. We consequently believe it important that the Commission and local jurisdictions enunciate a river accessing policy for the study area, and develop a cooperative access plan. We do not believe that every private land owner need allow the public to walk through his property to the river. However, the idea of providing linear access on the river with appropriate periodic river bank opportunities seems beneficial, particularly in the urban study area. Such access appears consistent with the earlier City of Sacramento plan to link up access from Discovery Park, through Old Sacramento and Miller Park to the southern boundary of the city, and with principles outlined by Yolo County in considering development proposals for Raley's and the Lighthouse Marina project. Cooperative planning by the City of Sacramento and Yolo County could enhance the level and diversity of river side

experiences made available to the general public. We consequently recommend that the Commission participate with the City of Sacramento, Yolo County and Sacramento County as appropriate to develop a joint urban riverfront linear access policy and plan. Authority to prepare such a plan exists within General Plan law (p. 176). This plan would facilitate review of riverbank developmental activities. Safety provisions should be an important element of such a plan.

6. Conclusions Concerning Effects on Ecological Benefits

Using riparian vegetation as the key indicator for ecological wellbeing on the river, and observing that only remnant riparian resources remain in the study area, it is our conclusion that the river corridor's capability to support both marinas and the significant benefits derived from ecological resources by area residents, boaters, birds and animals has been reached. We consequently do not believe that further net destruction of viable riparian habitat in the study area can be permitted. This conclusion need not preempt further expansion/development of marinas. It simply recommends that marinas be developed so that no further net loss of riparian habitat be incurred. Siting marinas to avoid bank areas of high riparian productivity is an obvious strategy in that regard. Where productive riparian areas cannot be entirely avoided, we recommend the following procedure to the Commission and cooperating agencies.

- i) To the extent possible use a combination of avoidance and restorative strategies to ensure no net loss of riparian habitat within the marina development/expansion site;

- ii) Where (i) above is not totally effective in protecting remaining riparian habitat, the marina developer should use acquisition and replanting techniques to ensure restoration of productively equivalent riparian habitat elsewhere in the same river reach;
- iii) Where (i) and (ii) together do not fully protect riparian habitat from net reduction, the marina developer should use acquisition and replanting techniques to ensure restoration of productively equivalent riparian habitat elsewhere in the river study area.

Appropriate incentives should be applied to fully utilize remedies available in Step (i) before proceeding to Step (ii), and to utilize remedies from Steps (i) and (ii) before employing Step (iii). This is required because linear continuity of habitat along river reaches is important to the human, animal, bird and fish populations it benefits. Alternatively, concentration of riparian vegetation in a few widely separated areas will produce a second best result. Where riparian habitat is restored as part of the no net loss strategy, equivalency should be assumed on the basis of area provided, productivity of the replacement habitat provided, and the ability of that habitat to support equivalent levels and diversity of species. The Commission and cooperating agencies should consult experts in the California Department of Fish and Game and the U.S. Fish and Wildlife Service in that regard. Replacement credit should only be applied for restored habitat. Purchase of existing riparian habitat in exchange for habitat destroyed at site

diminishes total riparian resources available in the study area--and does not address the policy outlined here. Finally, replacement with riparian vegetation outside the Sacramento River corridor would likewise further diminish the scope of remaining riparian habitat along the river, and is not recommended as appropriate mitigation for Sacramento River losses.

This recommendation addresses the need to protect remaining riparian habitat, while providing flexibility to expand existing marinas and provide new marina facilities, at least through the near future. It should be noted, however, that of the estimated 218 acres of bank area that could be revegetated, perhaps half or more would be only marginally productive. In essence, these 218 acres represent "the bank" that the Commission and cooperating agencies can use to ensure that needs for marina expansion and for no further loss of riparian habitat can both be served. This "bank" is exhaustible, however. Consequently, we believe that the Commission and cooperating agencies should place strong emphasis on on-site protection or restoration of existing riparian habitat, and develop clear priorities concerning utilization of the remaining "banked" potential riparian habitat with respect to existing and future marina proposals.

Finally, destruction of riparian habitat in the study area has not been either solely or principally the result of marina expansion. We consequently recommend that the Commission work with other appropriate agencies to extend the principal of "no further net loss of riparian habitat" to other jurisdictions and interests on the river.

7. Conclusions Concerning Water Quality

i) Waste Control

We conclude that it is no longer acceptable in the Sacramento River study area to continue to permit wholesale discharge of human sewage from boats, live-aboards and/or marinas into waters frequented by boaters, fishermen and swimmers. The Commission and cooperating agencies, should require adequate and operational pumpout stations and holding tank facilities at all marinas, as a condition of development, expansion or lease renewal. Boat hookups should ideally be placed on the in-channel side of marinas, and in all instances should be accessible to vessels. Further, because a majority of boats in the two counties are trailered, cooperating agencies should also closely examine the need for pumpout facilities at all launching ramps--and establish such facilities where required. We also recommend that all marinas be required to place litter disposal bins on their docks at locations convenient to boaters. These pumpout and litter facilities should be periodically inspected to see that they are operational.

We also recommend that either as part of a linear public access study, or separately, the Commission encourage a joint assessment by local jurisdictions of the adequacy of washroom facilities for the general public. It is unreasonable to expect private marinas to bear the brunt of public use in this area. Public needs should consequently be reviewed, and any required facilities provided. The Commission may also wish to encourage a regulation requiring that litter bags be carried on all vessels.

Finally, the Commission should encourage development of standards for mooring, waste holding and shore service umbilicals for all live-aboard vessels.

ii) Toxins

Evidence from the U.S. Navy suggests that tributyltin-oxide may have serious negative toxic effects in-river. This chemical is contained in paints presently in widespread use for anti-fouling. The Commission should request an immediate determination from appropriate State authorities as to whether use of such paint is hazardous. If data are limited, a workshop involving those experts doing work in the field, or preparing regulations, should be quickly convened. In the interim, an advisory notice of the possible consequences of use of tributyltin-oxide based paints should be issued--and posted at all marinas and launching ramps. Any dredged materials from the river should be analyzed for tributyltin-oxide before dredge spoil disposal is approved.

An approved "best wood preservative" list should be prepared to provide developers with wood preservative options for waterside structures that present the least threat to the aquatic environment. Existing and planned boat maintenance facilities should be monitored for their handling of hull paint residues. Engine and hull washing detergents should be certified as safe for use on the Sacramento River. Control and safe disposal standards should be established for each boat maintenance and haul-out facility.

Off-stream marinas pose few problems for in-stream traffic, but, without proper water circulation, they can become sinks for toxins and can encounter significant dredging costs. Future off-river marina proposals should include natural or artificial circulation systems to preclude such problems, and maintenance dredge spoils should be monitored for toxins.

iii) Fuel Spills

Prevention of major fuel spills must begin with the enforcement of stringent fuel transfer system construction, operation and maintenance standards. Highest quality automatic shut-offs on all fueling hoses, and EPA approved fuel storage tanks should be minimum requirements for new or expanding marinas with boat fueling capability.

A phase out of open cycle crankcase drainage outboard motors should be encouraged on the river, in favor of engines with "drainless" features.

iv) Rock Groins and Other In-Stream Structures

Existing Corps of Engineers wing dams (rock groins) from Sand Cove to Rio Ramaza Marina should be suitably marked as potential boating hazards.

v) Urban Runoff

Urban runoff from paved ancillary areas of marinas should be directed shoreward if possible. New marina developments should consider provisions in surface drainage for paved areas that might include:

- a. porous pavement designs;
- b. grading for drainage away from the river; and
- c. periodic mechanical sweeps of parking areas if neither feature (a) or (b) can be incorporated into the design.

8. Conclusions Concerning River Levees

Protection of levee reliability and of the river's remaining ecological integrity and scenic beauty are essential objectives of this carrying capacity analysis. Procedures for achieving these joint goals have been considered by the State Reclamation Board and DWR (St. Rec. Bd., 1967; DWR, 1982b.), and are under further development by the California Department of Fish and Game and the U.S. Army Corps of Engineers (U.S.ACE, 1986). Full use should be made of these findings, and further research should be supported where required. An inter-agency approach to levee and habitat management similar to the one proposed for Delta levees should also be considered (Madrone Assoc. for DFG/USFWS, 1980). Off-stream marinas must also be designed in a manner fully consistent with levee security.

With respect to erosion from wave wash, boats traveling at speed and/or too close to levees are a chronic annoyance and problem. The following recommendations will act to reduce impact levels in this area.

- a) Incorporate in the signing program at marinas, launching ramps and along river banks the provision that transiting boats must pass port to port, each keeping to the center of the channel. This will place vessels travelling downstream and generating the most destruction outside waves at some distance from the Garden Highway shore.
- b) Increase enforcement of distance requirements and the 5 MPH rule adjacent to docks and properties.
- c) Conduct a seasonal wave study for the east bank of the river (RM 63 to RM 76) to permit better determination of levee erosion processes due to boat waves, wind waves and tractive forces. This would require the placement of wave recorders at several secure locations.

9. Tie Up Facilities

Tie up facilities were initially typified as providing temporary tie-up to service commercial enterprise along the river bank. Proposed dockage at Old Sacramento and at "The Docks" would likely be so categorized. Tie up facilities may have an effect on traveling traffic, due to the 5 mph speed control. We recommend that such facilities do not intrude into the river more than 60 to 70 feet, and that all recommendations in ecological and water quality sections of this report apply to them. We also recommend that tie up facilities not be allowed to automatically expand into full marina status.

10. The Sacramento Deep Water Ship Channel

Continued effective access to the Sacramento Deep Water Ship Channel appears to offer an outstanding opportunity to enhance the recreational capacity of the study area. The operating future of the lock that provides access is presently uncertain. The Commission should join with the Department of Boating and Waterways and appropriate local jurisdictions to explore all options for assuring continued effective access by boaters to the channel.

11. A Summary of Recommendations Concerning Marinas and their Effects on Human and Ecological Benefits Associated with the River

In reviewing the conclusions and recommendations of human and ecological benefits sections, several areas of consistency emerge. Our consideration of the interface between marinas and transitting vessels, boater conflicts on the river, concerns about marina economic viability (and associated responsibility) and concerns over safeguarding remaining riparian habitat seem to converge to a single recommendation. That recommendation is summarized as follows:

i) Restrict development of new in-stream marinas to Reach 4, where the opportunity for continued higher speed transit is already largely preempted. Apply a 5 MPH speed zone to that reach, from the I 880 overpass (just above Reach 4) at least as far downstream as Tower Bridge*. Prevent development on the Sacramento side at the mouth of the American river. Do not allow new marinas in Reach 4 to intrude further into the river than existing marinas.

ii) Allow expansion of existing marinas in all river reaches, subject to not intruding further into the river than existing marinas in each reach, and subject to all other recommendations of this report.

iii) Do not allow new instream marinas to be constructed directly opposite an existing instream marina.

iv) Do not encourage construction of further launching ramp capacity from Elkhorn-Sacramento downstream to Miller Park.

v) Prohibit water and jet skiing in Reach 4, and in the fishing area between RM 46 and RM 50 during fishing seasons. At the option of the Commission and cooperating agencies, further control water/jet skiing between RM 62 and RM 68 in the September through May period. Post other areas as open for water and jet skiing, and adopt a policy where subsequent development of dock facilities in such posted areas would be at the dock owner's risk.

* This recommendation exempts the annual July 4th power boat races.

As noted, these recommendations integrate concern for marina development and viability, recreational use on the river and ecological protection. By allowing new in-stream marina development in Reach 4, the Commission would provide opportunity for new enterprise in the area where future pressure may be greatest, but where rapid through-transit for vessels has already been preempted. By permitting expansion of existing marinas in all reaches (subject to appropriate environmental controls and restrictions), the Commission allows marina operators to move toward greater enterprise diversity and financial viability, and consequently, toward more responsible servicing of non-revenue requirements and commitments. This policy also guides utilization of those resources left in the riparian habitat restorative "bank" to these existing facilities and expansions, rendering it less likely that "banked" capability to restore riparian communities will be exhausted in a random and unplanned manner across the study area. Further, a move to separate marinas and key sport fishing areas from high speed skiing and jet ski uses, via a zoning strategy, will enhance the capability of the Sacramento River to carry all three interests into the future, rather than see water skiing preempted, one reach at a time.

It is proposed that off-stream and tie-up facilities may be permitted throughout the study area, subject to the recommendations concerning public access, protection of riparian habitat, water quality and levee integrity contained in our report.

This integrated recommendation designating appropriate areas for in-stream marina development and boating use should be read in concert with our other recommendations directed at achieving the Sacramento River's full potential to provide a diverse array of human, ecological, water quality and protection benefits to citizens. Left to random development, the river is rapidly reaching carrying capacity limitations in several areas. With proper management, we believe these limitations can be overcome, and that marina patrons and other river users can jointly enjoy the river for many years into the future.

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APPENDICES

- Appendix 1 - Estimated River Widths at Alternative Flow Stages: Sacramento River between Sacramento and Yolo Counties
- Appendix 2 - Calculations Supporting Estimates of Boat Traffic per Weekend Day from Marinas, By Reach
- Appendix 3 - Launch Ramp Survey
- Appendix 4 - Additional Data from Launch Ramp Survey
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- Appendix 6 - Detailed Archaeological and Historic Reference Information
- Appendix 7 - Detailed Analysis of Conditions and Restorative Potential of Riparian Habitat, By River Mile
- Appendix 8 - Additional Background on Legal Authority, Jurisdictions, Requirements and Decision Criteria of Permitting Agencies

Appendix 1

Estimated River Widths at Alternative Flow
Stages: Sacramento River between Sacramento and
Yolo Counties

Appendix 1 - Estimated River Widths at Alternative Flow Stages: Sacramento River between Sacramento and Yolo Counties

These data are developed from Department of Water Resources Channel Capacity Maps for the upper river (river miles 60.7 to 79.0), and from the U.S. Army Corps of Engineer's Aerial Atlas (1984) for the lower river (river miles 45 to 60). The U.S. Army Corps of Engineers reference provides an estimating basis for median water only.

Table A-1

River Widths - Sacramento River Study Area

<u>River Mile</u>	<u>Extreme Low Water</u>	<u>Median Water</u>	<u>Extreme High Water</u>
	-----width in feet-----		
	(approx. 4 ft.)	(approx. 17 ft.)	(approx. 29 ft.)
45		500	
45.25		650	
46		650	
46.1		650	
47		500	
48		675	
49		600	
50		625	
50.1		650	
51		600	
52		600	
53		500	
53.6		400	
54		600	
55		400	
55.4		600	
56		475	
57		600	
58		625	
59		575	

Table A-1 (continued)

<u>River Mile</u>	<u>Extreme</u>	<u>Median Water</u>	<u>Extreme</u>
	<u>Low Water</u>	<u>width in feet</u>	<u>High Water</u>
60		525	
60.4		475	
60.7	520		920
61		400	
61.2	440		760
61.5		600	
62		625	
62.25	440		840
62.5	680		880
62.6	680		880
63		525	
63.05	520		760
63.5	520		800
64		625	
64.7	560		880
65		625	
65.9	300		680
66		450	
66.7	300		720
67		450	
67.7	320		680
68		500	
68.15	580		860
69		550	
70		575	
70.5	400		520
70.6		450	
70.8	460		560
71		600	
71.4	460		720
71.8	380		520
72		500	
72.5	500		720
73		650	
74		500	
74.2	340		420
75	520	575	640
76		575	
76.4	420		520
77	400		500
78.45	440		680
79	400		840

* Median data are from the U.S. Army Corps of Engineers. High and low water data are from DWR.

Appendix 2

Calculations Supporting Estimates of Boat
Traffic per Weekend Day from Marinas, By Reach

Appendix 2 - Calculations Supporting Estimates
of Boat Traffic per Weekend Day from Marinas, By Reach

Data from Table 21 were reworked to separate the outings patterns for marinas located in each river reach. The results of these recalculations are presented in Table A-2. No marinas are located in Reach 3. Insufficient returns were received from Reach 5 to have any confidence in results.

Table A-2

Estimated Distribution of Outings for
Boats Moored in Study Area Reaches

	Reach		
	<u>1</u>	<u>2</u>	<u>4</u>
	-----% of outings-----		
Relax at the dock	27.1	48.6	34.2
Boat in the metro area of the river	57.2	30.1	49.6
Cruise downstream to the Delta and San Francisco Bay	12.4	17.7	7.9
Cruise upstream above the Sacramento metro area	3.3	3.5	8.3

Applying the results of previous calculations in Section III-4, an estimate of average weekend day traffic generated by boats moored in the study area, by month, was developed for each study reach, according to the following procedure.

(i) The 1,364 boats estimated moored in the study area were distributed between reaches 1,2,4 and 5* on the basis of actual available moorage, and a percentage weighting of total study area moorage developed for each reach from that data from Tables 1 and 19.

(ii) These percentage weightings were then applied to the estimated outings per weekend day developed in Table 21, to develop estimated outings, by month, for each reach.

(iii) Data from Table A-2 were applied to the results of (ii) above to develop estimates of actual traffic in each reach. For Reach 5, average destination data over the total study area were employed.

a) Outings "relaxing at dock" were eliminated from analysis.

b) For traffic originating in Reach 1:

- Metro area traffic was assumed to impact Reaches 1, 2, 3 and 4.

* Study reach 3 has no marinas in it.

- Upstream traffic was assumed to impact Reaches 1, 2, 3, 4 and 5.
- Downstream traffic was assumed to impact Reach 1.

c) For Traffic originating in Reach 2

- Metro traffic was assumed to impact Reaches 2, 3, and 4.
- Upstream traffic was assumed to impact Reaches 2, 3, 4 and 5.
- Downstream traffic from vessels up to 39'11" in length was assumed to impact Reaches 1 and 2. One-half of downstream traffic for 40'+ vessels was assumed to use the Sacramento Deep Water Ship Channel, and was counted in Reaches 2 and 3. The other half of 40'+ traffic was assumed to impact Reaches 1 and 2.

d) For traffic originating in Reach 4

- Metro traffic was assumed to impact Reaches 3, 4 and 5.
- Upstream traffic was assumed to impact Reaches 4 and 5.

- Downstream traffic from vessels up to 39'11" was assumed to impact Reaches 1, 2, 3 and 4. Downstream traffic for boats of 40'+ was divided: fifty percent in Reach 4, and then to the Sacramento Deep Water Ship Channel, and 50 percent through Reaches 1, 2, 3 and 4.

e) For traffic originating in Reach 5

- Metro traffic was assumed to impact Reach 4 and 5.
- Upstream traffic was assumed to impact Reach 5.
- Downstream traffic from vessels up to 39'11" was assumed to impact Reaches 1, 2, 3, 4 and 5.
- Downstream traffic of 40'+ was assigned half to Reaches 1, 2, 3, 4 and 5, and half in Reaches 4 and 5 and then to the Sacramento Deep Water Ship Channel.

(iv) Traffic counts were developed in (iii) above for each reach. They were then multiplied by 2, as we assume that vessels will both depart and return through the designated reaches, to obtain a total moored boat traffic estimate per weekend day for each reach. Results are presented in Table 23.

Appendix 3

Launch Ramp Survey

RAMP _____

BOAT REGISTRATION NO. (0)

County

1. What county do you live in? _____

Miles

2. How many miles did you drive today from your house to this launching ramp? _____

Feet

No. of persons

3. Boat Length _____

4. No. in boating group _____

Minutes

5. How many minutes, on average, do you wait to launch at this ramp at this time of year? _____

6. How many minutes, on average, do you wait in the river to take your boat out at this time of year? _____

7. Time of arrival (0) _____

Arrived Back (0) _____

Time of launch (0) _____

Out on ramp (0) _____

Time expected back _____

8. Principal destination on the river _____

9. Chief boating activity (reason) _____

10. No. of launches in last 12 months:

- This launch ramp _____ June _____

- Other Sacramento or Yolo County ramps _____ July _____

- Other ramps not Sacramento or Yolo County _____ August _____

- Total launches (0) _____ Other _____

11. Are there any facilities needed at this launching ramp?

Appendix 4

Additional Data from
Launch Ramp Survey

Table 4-1
Residence of Launchers, By County⁽¹⁾

<u>County</u>	<u>Elkhorn - Sac.</u>	<u>Elkhorn - Yolo</u>	<u>Discovery Park</u>	<u>Broderick</u>	<u>Miller Park</u>	<u>Garcia Bend</u>	<u>Total-all Facilities</u>	<u>Percent of Total Launches</u>
-----#-----								
Sacramento	135 (97.1)	21 (33.9)	528 (85.0)	53 (47.3)	186 (84.5)	196 (93.3)	1,119	82.1
Yolo	2 (0.1)	41 (66.1)	15 (2.4)	52 (46.4)	18 (8.2)	3 (1.4)	131	9.6
Placer	--	--	35	1	4	3	43	3.2
El Dorado	1	--	15	1	8	--	25	1.8
Solano	--	--	5	1	1	--	7	0.5
Nevada	--	--	2	--	--	--	2	0.1
Fresno	--	--	1	1	--	--	2	0.1
Sutter	--	--	4	--	--	--	4	0.3
S.F. Bay Area	--	--	8	3	2	6	19	1.4
Northern Calif.	--	--	4	--	1	2	7	0.5
Southern Calif.	--	--	2	--	--	--	2	0.1
Outside Calif.	--	--	2	--	--	--	2	0.1
Total launches	<u>139</u>	<u>62</u>	<u>621</u>	<u>112</u>	<u>220</u>	<u>210</u>	<u>1,363</u>	
Percent of Total Launches (%)	10.1	4.7	45.4	8.2	16.2	15.4		

(1) Based on data from June 28, June 29, and July 4.

* Numbers in parenthesis indicate percent of launches from Sacramento and Yolo counties at each facility.

Table 4-2Average Mileage Driven to Each Launching Ramp⁽¹⁾

<u>Launching Ramp</u>	<u>Average Miles Driven</u>	<u>Standard Deviation</u>
Elkhorn - Sac.	17.6	5.8
Elkhorn - Yolo	14.4	8.9
Discovery Park	18.8	36.4
Broderick	10.6	13.2
Miller Park	12.0	12.0
Garcia Bend	11.3	16.0

(1) Based on data from June 28, June 29, and July 4.

Table 4-3

Length of Boats Launched from Study Area Ramps⁽¹⁾

<u>Launch Ramp</u>	<u><16'</u>	<u>16' - 21'</u>	<u>21<</u>	<u>Average Length All Vessels</u>
	-----%-----			ft.
Elkhorn - Sac.	46.7	52.7	0.6	16
Elkhorn - Yolo	14.1	84.5	1.4	17
Discovery Park	22.0	71.7	6.3	18
Broderick	28.8	62.1	9.1	16
Miller Park	12.9	78.0	9.1	18
Garcia Bend	11.9	85.0	3.2	17

(1) Based on data from June 28, June 29, July 3 and July 4.

Table 4-4Number of Persons per Boat, by Launching Ramp⁽¹⁾

<u>Launch Ramp</u>	<u>Average Number of Persons</u> #
Elkhorn - Sac.	4
Elkhorn - Yolo	3.5
Discovery Park	4
Broderick	3
Miller Park	3
Garcia Bend	4

(1) Based on data from June 28, June 29 and July 4.

Table 4-5

Amount of Time Spent on the River⁽¹⁾
By Launching Ramp

<u>Launching Ramp</u>	<u>Average Expected Time</u>	<u>Average Actual Time</u>
	-----hours-----	
Elkhorn - Sac.	5.3	5.1
Elkhorn - Yolo	4.4	4.2
Discovery Park	4.8	4.5
Broderick	4.4	4.0
Miller Park	4.4	4.5
Garcia Bend	3.8	3.7

(1) Based on data from June 28, June 29, and July 4.

Appendix 5
Garden Highway Residence Survey

Household Survey of River-Front Residences Along
the Garden Highway

1. What would you say are the three major good things about living on the Sacramento River along the Garden Highway?

i) _____

ii) _____

iii) _____

2. What would you say are the three major problems or annoyances you have living along the river?

i) _____

ii) _____

iii) _____

NOW we'd like to ask you about boating on the river, and its effect on you.

3. Do you own a boat? Yes _____

No _____

4. Do you have your own private dock here? Yes _____

No _____

5a. On an average peak weekend in July or August, how many boats would you estimate go by your property (on the river) per peak hour? No. of boats

No. of boats

5b. How many per day? _____

6. At what time of day does boat traffic usually begin? Time

7. At what time does boat traffic usually end? Time

8. Do you have any problems or annoyances with boat traffic on the river? Yes _____
No _____

If No, then thank them and good-bye.

If Yes,

9. Would you please list these problems or annoyances?

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____

10. If Wave Wash Problems

a) What percentage of passing boats do you estimate create wave wash problems?

Percent

(May need to correct or help - See Q.5)

b) What are these problem boats doing that is different than other boats?

If "coming too close"

Feet

i) Estimate how close

Feet

ii) Estimate distance of boats not causing problems.

If "going too fast"

MPH

iii) Estimate how fast

c) What specific damage or annoyance does this wave wash cause (please be as specific as possible)?

No. of times per year each damage type occurs

1. _____

2. _____

3. _____

11. If "too noisy"

Percent

a. What percentage of passing boats do you estimate create noise problems?

b. How do these boats differ from other boats?

If "time of day"

Time

i) What time(s) of day is noise annoying?

Time

ii) What time of day would be more reasonable?

12a. FOR OTHER LISTED ANNOYANCES/PROBLEMS

i) Type of problem.

Percent

ii) What percentage of boats?

iii) Describe specific damage, if any.

12b.

i) Type of damage.

Percent

ii) What percentage of boats?

iii) Describe specific damage, if any.

Appendix 6

Detailed Archaeological and Historic Reference
Information

Appendix 3 - Detailed Archaeological and Historic
Reference Information

Archaeological and Historic Elements

The North Central Information Center at California State University, Sacramento conducted a record search for the Sacramento River from RM 44-RM 76 (USGS Clarksburg 7.5', Florin 7.5', Grays Bend 7.5', Sacramento West 7.5', and Taylor Monument 7.5' quads. T7N R4E Sec. 4, 9, 10, 11, 13 and 14; T8N R4E Sec. 32 and Unsectioned area; T9N R3E Sec. 1, 2 and 12; T9N R4E Sec. 7, 8, 17, 20, 21, 26, 27, 28, 29 and 35; T10N R3E Sec. 12, 13, 23, 24, 26 and 35) revealing the following information for the Sacramento County side of the river:

Prehistoric Resources: Thirteen recorded prehistoric archaeological sites are shown to be located within or immediately adjacent to the 1/4 mile corridor study area along the Sacramento River from Freeport north to the Sutter County line. These include CA-SAC-15, 16, 17, 28, 30, 41, 42, 43, 44, 46, 160, 164 and 268. These sites represent the majority of known archaeological remains in the Sacramento County river region from Sutter Co. line to Freeport. Only a few sites are recorded outside the river corridor and those are mostly along the American River or on high ground within the City of Sacramento.

Historic Resources: There are numerous referenced historic landmarks and other features within or adjacent to the study area including Old Sacramento (National Register and State Landmark), the I St. and Tower Bridges (both on the National Register) and five other properties also listed on the National Register of Historic Places. In addition to the above mentioned Old Sacramento landmarks there are twenty-two separate buildings or other features such as

the First Transcontinental Railroad which are registered as State Landmarks. A review of Place Names mentions Freeport (1862), the Sacramento River (1808), Sacramento City (1848) and the American River and American Basin. The early Sacramento Trail (late 1820's) and the "Paper City" of Boston (1849) are mentioned in Historic Spots in California.

Previous Archaeological Investigations: There are twenty-three survey reports on file for properties included or nearby the study area (within 1 mile) .

Sensitivity and Recommendations: The sensitivity for the study area is estimated to be quite high for both prehistoric and historic resources. It is recommended that prior to any proposed development an updated record search be done, followed by an on-the-ground archaeological survey. Additional record searches are recommended because several months or even years will probably pass before some of the possible marinas will be proposed and additional survey reports and site information will undoubtedly be added to the research center files and could easily affect the quality and completeness of any work undertaken concerning cultural resources.

Literature Search: Reviewed were the official maps and record for archaeological sites in Sacramento County, the National Register of Historic Places (1985), California Inventory of Historic Resources (1976), California Historical Landmarks (1979), Gold Districts of California (1979), California Gold Camps (1975), California Place Names (1969) and Historic Spots in California (1966).

Review of the Northwest Information Center's files at Sonoma State University also indicates that fifteen studies with cultural/historic components have been conducted along the Sacramento River between Freeport and Verona on the Yolo County side of the river. These surveys resulted in identification of a number of cultural resources (Wiant 1976; Russo 1978; Johnson 1974; Peak 1985; Werner 1985; Holman 1984). The area along the Sacramento river has an exceptionally high number of prehistoric and historic resources. Listed below are those cultural resources within the area of concern, which are listed with the National Register of Historic Places and the California Inventory of Historic Resources, or assigned a trinomial by this office of the California Archaeological Inventory.

National Register of Historic Places:

Tower Bridge CA 275, Broderick/Sacramento
 First Pacific Coast Salmon Cannery Site, Broderick

California Inventory of Historic Resources:

First Pacific Coast Salmon Cannery Site
 Fremont (old town site across from Verona)
 Russian Orthodox Catholic Church, Bryte
 Washington (Broderick) Riverfront
 Yolo County Court House
 Yolo Plank Road and Turn Pike, Yolo County

Archaeological Sites

Ca-Yol-12	Ca-Yol-59	Ca-Yol-82
Ca-Yol-21	Ca-Yol-19	Ca-Yol-22
Ca-Yol-23	Ca-Yol-20	Ca-Yol-24
Ca-Yol-25	Ca-Yol-27	Ca-Yol-132
Ca-Yol-45	Ca-Yol-46	

The following cultural resources have also been identified.

Camillus Nelson Farm (Johnson and Johnson 1974)
 Washington (Broderick) - town (Johnson and Johnson 1974)
 Fremont - town's location (Hoover et al. 1966)
 Nawe - Nisenan village region at confluence of Feather and
 Sacramento Rivers (Wilson and Towne, 1978).

The above is not an exhaustive listing and inventories and listings other than those included in the bibliography were not reviewed.

The bank of the Sacramento River has been intensively utilized and since most of the project area has not been field surveyed there is a high possibility of discovery of additional cultural resources. Prehistorically, many large villages were situated on natural levees along the Sacramento River, often across from one another, or in small clusters. Due to heavy silting by the river the possibility of buried prehistoric cultural resources is high (Johnson and Johnson 1974). Historically, this area was utilized in the 1820's by Spanish explorers; in the 1830's by fur trappers; and was settled by the Mexicans in 1843 (Rancho Rio de Jesus Maria) and later in the mid-1800's by the Europeans and Americans, resulting in such settlements as Freeport 1862, Verona 1849, Fremont 1849, Washington/Broderick 1850, Sacramento 1848 (Gudde 1969, Hoover et al. 1966). The Sacramento River area continued to develop and served as the major transportation and trade route until the introduction of the railroad.

Prior to any ground disturbance, construction or other activity that could adversely affect cultural resources, an archival and field study should be done to identify prehistoric and historic archaeological cultural resources.

An Archaeological/Historic Survey Recommendation Advisory for Site Specific EIR's

The survey field work and cultural resources evaluation should be performed by a qualified professional archeologist who can demonstrate that he/she has a record of full cooperation with the Information Center Program and has an acceptable report review record with the State Office of Historic Preservation and/or other governmental agencies which must comply with NEPA or CEQA. The resulting report should include at a minimum, a description of the project and background of the history and archaeology of the area, results of the field survey, complete records of any remains found (eligible for State Trinomial designations), an analysis of the significance of those remains if they do occur and recommendations for their preservation and/or mitigation.

Appendix 7

Detailed Analysis of Conditions and
Restorative Potential of Riparian Habitat,
By River Mile

Appendix 4 - Detailed Analysis of Conditions and
Restorative Potential of Riparian Habitat, By River Mile

Sacramento River Riparian Vegetation Survey

River Miles 44 - 76

Sacramento River Marina Study

River Mi. (W = West Bank) (E = East Bank)	Vegetation Type	Disturbance	Revegetation Potential And Notes + = Yes - = No
<u>Reach 1 (44.5 - 53.5)</u>			
W 44.1 - 44.5	RB2 Riparian brush w/ scattered trees.	Rock Rip-Rap lower 2/3 of bank	+ Area is reverting to Riparian Woodland.
W 44.5 - 44.8	RW Riparian Woodland.	Very little. Appear to be one of the healthiest stands seen thus far.	Protect in existing condition.
E 44.5 - 44.9	RR2 Grass on upper 1/3 of slope. Scattered tree or bush on lower 2/3 of bank.	Rip-Rap on lower 2/3 w/very limited amount of veg. cove. Tree now and then - upper bank grass covered.	+ May be reverting on its own. However, could be enhanced.
E 44.9 - 45.3 (just down river from Cliff's Marina)	P Grass covered 1/3 of bank, occasional bush or tree on cracks of pavement.	Pavement slope. Looks to be very old with some areas rip-rapped.	- Very little opportunity unless pavement is removed.
W 44.8 - 44.9	RR Scattered grass on upper bank.	Fresh Rock Rip-Rap which is now devoid of veg.	+ Brush and tree plantings would improve wildlife values.
W 44.9 - 45.3	RB Some oaks on upper bank and brush below. Other Rip. trees of med. age & size - box elder cottonwoods.	Rip-Rap	+ Area is reverting to riparian woodland.
E 45.3 -45.4	RB Riparian brush with some remnant trees.	Very little other than removal of trees at some time. Bank appears stable w/ a little rip-rap at toe.	+ Tree plantings would improve wildlife values.

River Mi. (W = West Bank) (E = East Bank)	Vegetation Type	Disturbance	Revegetation Potential And Notes + = Yes - = No
W 45.3 - 45.4	RR Grass cover on upper 1/3 of bank.	Fresh Rip-Rap on lower 2/3 of bank, devoid of veg. cover.	+ Brush and tree planting would improve wildlife values.
W 45.4 - 45.8	RR ₂ Grass & brush w/ a few scattered trees. The trees become more dense up river before mature stand- thickets of bamboo & willows.	Rip-Rap on lower 2/3 of bank.	+ Brush and tree plantings would improve wildlife values.
E 45.4 -46.8 (Just up river from Cliff's Marina)-(To where power lines cross river.)	RR ₂ Brush covered with small trees.	Rip-Rap	+ Brush and tree plantings would improve wildlife values.
W 45.8 - 47.6	RB Grass and forbs mid way up bank, Rip-Rap on lower 1/3 of bank with no cover. Mix of willows, blackberries, mature oaks, box elder, and bare bank.	Rip-Rap up 2/3 of bank.	+ Brush and tree plantings on bare patches to improve wildlife values.
E 46.8 - 47.1	RW Mature cottonwood trees with little understory.	Some Rip-Rap. Trees are prevent- ing a large erosion problem.	+ Good candidate area because trees are established. With more shrubs, the erosion control would be more effective. Plant under- story.
E 47.1 -48.3	RR ₂ Mostly grass & herb cover throughout the bank from near the water to the top.	Rip-Rap	+ Brush and tree plantings would improve wildlife values.

River Mi. (W = West Bank) (E = East Bank)	Vegetation Type	Disturbance	Revegetation Potential And Notes + = Yes - = No
W 47.6 - 47.7	RR Grasses on upper bank.	Fresh Rip-Rap	+ Brush and tree plantings would improve wildlife values.
W 47.7 - 50	RW Riparian Woodland - Evidence of beaver, pheasant & ducks observed. Mature box elder & cottonwoods.	Little or none	No revegetation needed.
E 48.3 - 48.8	RW Riparian woodland - grass covered tops of bank with large mature trees (cottonwoods) along the shore.	Little or none	No revegetation needed.
E 48.8 - 49.0	RR Sparse - a few scattered trees and herb cover.	Cement block and rock rip-rap.	+ Replace cement block with rip-rap and plant with brush and trees.
E 49 - 49.4	RW Riparian Woodland like 48.3-48.8. Interrupted by a pumping station north of Garcia Bend.	Little or none.	No revegetation needed.
W 50 - 50.1	D Void except for a couple of trees.	Stan's Yolo Marina- Boat docks, cement slab, cleared areas.	- Little or no space available for revegetation.
E 49.4 - 50.7	RB Riparian brush and scattered trees, grass on upper bank.	Rip-Rap with localized cement pieces.	No revegetation needed.
W 50.1 - 50.2	RW Riparian Woodland	Little or none.	No revegetation needed.
W 50.2 - 50.3	RR Grass on upper bank, none below.	Rip-Rap fresh.	+ Brush and tree planting would improve wildlife values.

River Mi. (W = West Bank) (E = East Bank)	Vegetation Type	Disturbance	Revegetation Potential And Notes + = Yes - = No
W 50.3 - 51	RW Riparian Woodland	Rip-Rap at shore- line and up slope.	No revegetation needed.
E 50.7 - 51.3	RW Riparian Woodland - discontinuous due to rip-rap.	Rip-Rap	+ Plant an understory and revegetate rip- rapped area.
W 51 - 54.7 (at the Sherwood Marina.)	RR ₂ Primarily herb. growth with a few willow thickets.	Rip-Rap	+ Plant brush and trees to improve wildlife values.
E 51.3 - 52	RW Riparian Woodland - grassland on top of the bank.	Little or none.	No revegetation required.
E 52 - 52.2	RR Little veg. on bottom 2/3 of bank. Grass on upper 1/3.	Rip-Rap (Rock)	+ Brush and tree plantings would improve wildlife values.
E 52.2 - 52.8	RW Riparian Woodland - grass on upper slope (1/3).	Little or none.	No revegetation required.
<u>Reach 2 (53.5 - 55.5)</u>			
E 52.3 - 53.9	RB Brush and herb. growth with scattered small trees.	Old cobble Rip-Rap which is now over- grown for most part & cement chunks which are bare.	+ Tree plantings; replace the cement chunks with rip-rap.
E 53.9 - 55.4 (Captains Table)	RW Riparian Woodland - grass on upper bank.	Little or none with some minor bank erosion.	No revegetation needed.
<u>Reach 3 (55.5 - 57.5)</u>			
W 54.7 - 55.9	RW Riparian Woodland	Little except for marina areas and they have minimized their impacts.	No revegetation needed.

River Mi. (W = West Bank) (E = East Bank)	Vegetation Type	Disturbance	Revegetation Potential And Notes + = Yes - = No
E 55.4 - 55.9	RR Very limited grass on upper bank, very little growth on lower bank - few scattered trees.	Rip-Rap looks rather recent.	+ Brush and tree plantings would improve wildlife values.
W 55.9 - 57.6	RB ₂ Brush and small trees, herb. growth & grass. In portions this area appears to be woodland like.	Limited to localized spots. Trash has been dumped at the far north end next to the Ports prop.	No major revegetation necessary except for a few tree plantings - should continue to revert on its own.
E 55.9 - 56	P Virtually none - some grass in cracks.	Pavement.	- Would have to remove the pavement in order to revegetate.
<u>Reach 4 (47.5 - 62.0)</u>			
E 56 - 57 (to the County boat ramp).	RW Riparian Woodland - lower portions of bank have dense vegetation behind which is a Rip-Rap slope with grass covered top. This bank may have been put there for the railroad.	Little to none on the river bank but railroad slope is rock Rip-Rap (blueish). Some Rip-Rap (cement chunks & rock) at the North end. Boat ramp is pavement. Cement chunks along bank north of entrance to the Sacramento Boat Harbor.	No revegetation really required except to remove debris.
E 57 - 58 (Miller Park)	D Much of the river-side vegetation has been cleared to present a park-like appearance and to allow public access.	The banks have been secured with cobble Rip-Rap and seeded with grass in other areas.	- Considering the existing use, revegetation may not be appropriate.
E 58 - 58.1 (Pioneer Mem. Bridge)	RW Riparian Woodland - Dense veg. cover.	No Rip-Rap, however, the area is littered with trash.	No revegetation required. Trash removal would improve chances for vegetation to spread.

River Mi. (W = West Bank) (E = East Bank)	Vegetation Type	Disturbance	Revegetation Potential And Notes + = Yes - = No
E 58.1 - 58.8	RR Little or none, scattered trees and grass on top.	Rip-Rap with concrete chunks and rock.	+ Remove concrete and revegetate with brush and trees.
E 58.8 - 59 (Tower Bridge)	D/P None to speak of - scattered trees, however, there is very little of the river bank left.	A concrete wall and pilings at the north end encroach upon the river bank. Asphalt and concrete trash scattered about.	+ Reconstruct the bank, - remainder could be cleaned up and planted.
W 57.6 - 59.5 (Pioneer Mem. Bridge to Tower Bridge.)	RW ₂ Mature Rip. trees (cottonwood) and some willows with grass.	Public access trails, trash; no Rip-Rap however.	+ Could be developed into a park with brush understory. Maintenance costs due to high public access could be prohibitive. Could turn out to be a "bum haven".
E 59.5 - 60.7 (Discovery Park and American River)	RW Mature riparian trees (cottonwoods); some understory. Large stand of undisturbed riparian woodland along East Main Canal.	Parking lot and landscaped vegetation. Boat launch facilities.	- Revegetation not necessary, given existing uses and presence of riparian woodland nearby.
E 60.7 - 61.6 (Village Marina to RiverView Marina.)	D Essentially no riparian vegetation remaining along banks. Some large trees remaining.	Clearing for development of marinas.	- Revegetation not likely, given existing uses. Protection of remaining trees would maintain some wildlife values.
E 61.6 - 62	D Remnants of Riparian vegetation in among landscaping for homes.	Homes and associated clearing. RiverView Marina has cleared all veg. as has the River Bank Marina.	- Revegetation not likely, given existing uses. Protection of existing vegetation would maintain wild- life values.

River Mi. (W = West Bank) (E = East Bank)	Vegetation Type	Disturbance	Revegetation Potential And Notes + = Yes - = No
<u>Reach 5 (62.0 - 76.0)</u>			
W 61.9 -	RW Riparian Woodland	None	No revegetation required.
W 61.9 - 62.2	RB ₂ Lower 1/2 of slope with native Rip. growth & upper half with ice plant and landscape sp.	No Rip-Rap, some erosion taking place.	+ Brush and tree plantings would improve wildlife values.
E 62 - 62.6	RW Riparian Woodland with understory.	Some trash dumping.	+ Remove the trash.
W 62.2 - 63	RR ₂ Herb. low growth with willow thickets, grass on upper 1/4, little or no growth on lower 3/4.	Cement slabs near the bypass, rock Rip-Rap on lower 3/4 and garbage on upper 1/4 of slope.	+ Revegetation possible if cement slabs removed. Revegetate bare areas.
W 63 - 63.4 (Sacramento Weir)	RB Low annual growth, forbs & grass, scattered willow thickets.	Large cement block Rip-Rap at center of stretch along waters edge.	- Revegetation not desirable due to flood control uses.
W 63.4 - 63.5 (North bank of the Sacto. bypass).	P/RR Riparian brush on lower half. Little to none on upper half.	Paved slabs on upper half. Rip-Rap (rock) on lower half.	- Would have to remove cement slabs to revegetate.
W 63.5 - 63.8	RR ₂ Very little vegetation, some scattered willows.	Rip-Rap (rock) to top of bank.	+ Brush and tree plantings would improve wildlife values.
W 63.8 - 66	RB ₂ Upper half of bank in grass, lower half with Riparian brush.	Rip-Rap on lower half.	+ Brush and tree plantings would improve wildlife values.
E 62.6 - 66	RW ₂ MoSaic of lots with with homes, some of which have cleared the underbrush and others which have allowed the veg. to remain.	Clearing for homes.	- Revegetation not likely under existing uses.

River Mi. (W = West Bank) (E = East Bank)	Vegetation Type	Disturbance	Revegetation Potential And Notes + = Yes - = No
E 66 - 66.2	RW Riparian Woodland with homes within - much like previous areas.	Homes and associated clearing.	No revegetation required.
W 66 - 66.8	RR ₂ Mosaic of brush and bare or rock covered areas.	Rock Rip-Rap to top of bank.	+ Brush and tree plantings would improve wildlife values.
E 66.2 - 66.8	RW Underbrush removed around home lots. Mature trees remain.	Vegetation removal around home.	- Revegetation not likely under existing uses.
E 66.8 - 67	RW ₂ Riparian Woodland - dense understory much like that which exists north of the walnut grove.	Some homes and and associated clearing.	No revegetation required.
E 67 - 67.5	RW ₂ Understory is cleared - mature trees & walnut tree orchard is all that remains - savanna looking.	Urban clearing for yards.	- Revegetation not likely due to existing uses.
W 66.8 - 68.1	RB Riparian brush, willows, grass on upper 1/3. Most of slope has veg. cover except for narrow zone along the toe of the slope.	Very little - Rip- Rap is not exposed.	No revegetation required - it is reverting back to Riparian Woodland.
W 68.1 - 68.3	RW Riparian Woodland from bottom to top of bank.	None	No revegetation required.
W 68.3 - 68.5	RR Little to none.	Fresh rock Rip-Rap from bottom to top	+ Brush and tree plantings would improve wildlife values.

River Mi. (W = West Bank) (E = East Bank)	Vegetation Type	Disturbance	Revegetation Potential And Notes + = Yes - = No
W 68.5 - 70.2 (Elkhorn Regional Park)	RW Dense Riparian Woodland to top of the bank.	Development of boat ramp and parking lot.	No revegetation needed for most of site, protect existing vegetation.
W 70.2 - 70.5	RR Little to none in some areas.	Rock Rip-Rap to top of bank under freeway and down to river.	+ Revegetation possible, - depending on maintenance policy of CalTrans.
W 70.5 - 72	RW Riparian Woodland on lower 2/3 and grass on upper 1/3.	None. No Rip-Rap. Lots of Rip-Rap with no veg. under the I-5 overpass.	None required.
W 72 - 72.2	RB Riparian brush with areas devoid of veg. except for herb. cover.	Rock Rip-Rap on lower 2/3 of bank.	+ Like similar areas.
W 72.2 - 74.5	RW Riparian Woodland on lower 2/3, grass on upper 1/3. In some short stretches the mature trees drop out and willows & brush dominate.	No Rip-Rap.	Not required.
W 74.5 - 75.2	RB Low brush and willow thickets on lower 2/3 and grass on upper 1/3.	Rip-Rap (rock) exposed in some areas.	+ Plantings
W 75.2 - 75.5	RW Riparian Woodland on lower 2/3 of bank, grassland above.	Very little - some erosion.	No revegetation required.
W 75.5 - 76	RB Riparian brush, willows, black- berries, etc.	Rip-Rap (rock) exposed in many areas on lower 2/3 of bank.	+ It appears to be returning. However, it may be enhanced by additional plantings.

River Mi. (W = West Bank) (E = East Bank)	Vegetation Type	Disturbance	Revegetation Potential And Notes + = Yes - = No
RW E 67.5 - 77.3	Riparian Woodland - differs from West side in that there is a wide alluvial plane behind the low "river bank" then grass slope up to the roadway. The homes are in the alluvial plane.	Mostly undisturbed except in areas of houses where the vegetation has been cleared or cement blocks were placed on lower portion of bank.	No revegetation required except in areas of disturbance.

Appendix 8

Additional Background on Legal Authority,
Jurisdictions, Requirements and Decision
Criteria of Permitting Agencies

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GENERAL STATUTORY REQUIREMENTS

1. The California Environmental Quality Act (CEQA) and the Permit Review Process

Before making a decision on whether to approve a permit, public agencies must comply with the California Environmental Quality Act (CEQA) when: 1) The permitting decision is discretionary; 2) approval of the permit will have a "significant effect" upon the environment; 3) and where the permit approval constitutes a "project" within the meaning of CEQA. If CEQA applies, it may impose a number of legal constraints which may limit the scope of the project. For example, CEQA requires that public agencies consider the possible environmental effects of the proposed project, any alternatives to the project and measures to mitigate potentially adverse environmental effects.

The first analytical step in determining whether CEQA applies to the permit approval decision is whether the project falls under a statutory or categorical exemption. Marina projects could be found exempt only in two possible situations: one, where a marina project approval involves a ministerial decision (Guidelines Sec. 15268); or two, where a project involves an alteration or addition to an already existing facility (Guidelines Sec. 15300.4 - 15304). Neither of these conditions will be fulfilled for any of the major pending marina development proposals.

CEQA defines a "project" to include activities involving the issuance of a permit or license by a public agency (Guidelines,

Sec. 15378), so that element of CEQA's triggering provisions is also clearly satisfied. The more important inquiry is whether the "project" could have a "significant effect" upon the environment (Public Resources Code Sec. 21083; Guidelines Sec. 15064, 15070). Where more than one public agency is involved in approving a project, the "lead agency" has exclusive authority in determining whether project approval will have a significant environmental effect (Guidelines Sec. 15064 & 15065). If the lead agency finds that the project has no potentially significant effect upon the environment, then it prepares a Negative Declaration documenting its decision. (Guidelines Sec. 15070, 15071). If, however, based upon substantial scientific and factual evidence, the lead agency finds that the project may have a significant effect on the environment, then the lead agency must prepare and Environmental Impact Report (EIR) (Guidelines sec. 15064).

"Responsible Agencies" are public agencies other than the Lead Agency having discretionary approval power over the project (CEQA Guidelines sec. 15050). Responsible agencies assist the Lead Agency by recommending whether the Lead Agency should prepare an EIR or Negative Declaration; however, the Lead Agency is not bound by these comments. (Guidelines Sec. 15096). The EIR or negative declaration prepared by the lead agency is relied upon by responsible agencies when they consider the project for approval. In most cases, the city or county will serve as the Lead Agency with regard to marina developments.

The National Environmental Policy Act (NEPA) applies to projects approved by federal agencies. Marina projects will

probably be subject to NEPA as well as CEQA review, possibly requiring preparation of an Environmental Impact Statement (EIS), because the U. S. Army Corps of Engineers will usually be involved in permit approval of marina projects. The requirements of NEPA and CEQA are very similar, so NEPA will not be treated separately in this report. Both NEPA and CEQA regulations provide for the option of a single environmental analysis, a joint EIR/EIS, to avoid unnecessary duplication.

CEQA provides Responsible and Trustee Agencies an opportunity to comment on the environmental document prepared by the Lead Agency. Trustee agencies are state agencies having jurisdiction by law over natural resources affected by the project. Both Fish and Game and the State Lands Commission are considered trustee agencies. (Guidelines Sec. 15386). For EIR's, commenting agencies have an opportunity early in the process of advising the lead agency concerning the appropriate scope and content of the draft EIR. Upon completion of the draft EIR or the Negative Declaration, Responsible Agencies may reach their own conclusions on whether and how to approve the project, but they must consider the environmental effects of the project as shown by the EIR when reaching their decisions. (Guidelines Sec. 15096).

The Lead Agency must consider comments received in response to a Draft EIR. It is obligated to respond in writing to the issues raised and give reasons justifying nonacceptance of specific comments and suggestions. (Guidelines Sec. 15088). The Lead Agency has the power to impose all measures necessary to mitigate

significant environmental effects involved in the project provided the agency is otherwise given discretionary authority over the project. (Guidelines Sec. 15040 - 15042). Given the broad land use powers of local government, discussed subsequently below, the lead agencies for marina projects will probably have adequate authority to deny or condition projects based upon effects identified in EIRs.

Unlike Lead Agencies, Responsible Agencies may disapprove a project only to avoid direct or indirect environmental effects of that part of the project which it is called on to carry out or approve. (Guidelines 15041 (b)). A Responsible Agency has no authority to require the Lead Agency to follow its comments regarding mitigation or alternatives not within the domain of the responsible agency. Where a project is one of several similar projects, as is the case with proposed development of marinas on the Sacramento River, the lead agency is required to comment upon the cumulative effect several marina projects will have. (Guidelines Sec. 15126(g) and 15165). "Cumulative impact" is defined as the change in the environment which results from the incremental impact of a marina project when added to other closely related past, present, and reasonably foreseeable probable future marina projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time. (Guidelines Sec. 15355).

CEQA will limit the universe of potential marina projects only if in making permit decisions, the Lead Agency and the Responsible Agencies must mitigate the impacts identified in environmental impact reports. Does CEQA require the mitigation

or merely the disclosure of significant environmental effects?

The answer to this question is ultimately determined on a case-by-case basis by the permitting agencies. CEQA requires public agencies not to approve a project as proposed if there are feasible alternatives to substantially lessen significant environmental effects of the project as identified in the EIR. However, the statute and guidelines also give the permitting agency the option of finding that specific economic, social or other considerations make infeasible the mitigation or alternatives identified in the EIR to reduce environmental impacts. (PRC Secs. 21002, 21002.1, 21081; Guidelines Secs. 15043, 15091-93). CEQA case law suggests that the permitting agency may, if it chooses, rely on the EIR to justify imposition of constraints upon a project, but that a court will be hesitant to substitute its judgment for the public agency as to whether it is "feasible" to mitigate particular impacts identified in the EIR [see *Burger v County of Mendocino*, 45 Cal App 3d 322 (1975) and *Laurel Hills Homeowners Ass'n v City Council of City of Los Angeles*, 83 Cal App 3d 515 (1981)].

In summary, for an agency to approve a marina project, it must find either that there are measures to mitigate the significant environmental effects or that there are overriding economic or social factors making mitigation measures or alternatives impractical. CEQA will at least set the agenda for agency consideration of the project, though it may not dictate the result. And, though courts will defer to the judgment of the permitting agency, that agency must make a written finding concerning the

disposition of significant environmental effects and have some rational basis for such findings. The effect of these requirements is likely to be to generally constrain the design of marina projects to reduce environmental impacts though probably not to prohibit the construction or expansion of a marina altogether. Whether or not a Responsible or a Lead Agency is legally required to adhere to mitigation measures and alternatives raised in an EIR or Negative Declaration, CEQA usually raises issues and considerations that would not have been discovered or considered absent the CEQA process.

2. The California and Federal Endangered Species Acts

A. The California Act

The California Endangered Species Act (Fish and Game Code Section 2050 et seq.) is designed to conserve and protect endangered and threatened species and their habitats. An endangered species is defined as a "native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat...." (Fish and Game Code Sec. 2062). A threatened species is a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future" in the absence of special protection (Fish and Game Code Sec. 2067). The criteria for designation of endangered and threatened species under Federal Endangered Species Act (16 USCS 1531 et seq.) are quite similar to the California Act. One difference is that plants may be classified as rare as well as threatened or endangered under the state system but are included only as threatened or endangered under the federal act. California's act does provide for invertebrates, and thus insects. Where endangered or threatened species or their habitats are put in "jeopardy" because of approval of a marina project, the protection provisions (prohibition against "take") of the California Act are invoked.

When a project may affect fish and wildlife or designated rare or endangered native plants, the lead agency must include

the California Department of Fish and Game (DFG) in the CEQA consultation process as a "trustee agency" (see the discussion of CEQA above for a further description of the consultation process). (CEQA Sec. 21080.3 and Guidelines Section 15386). As part of this consultation, DFG is required to issue a written finding indicating whether the proposed project would "jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habit essential to the continued existence of the species." (California Fish and Game Code Sec. 2090.)

If the Department finds "jeopardy" then it is required to develop, together with the project proponent and Lead Agency, "reasonable and prudent alternatives" designed to conserve the species or critical habitat. Alternatives with respect to plants must be consistent with provisions of the Native Plant Protection Act (Fish and Game Code Secs. 1900 et seq.). The lead agency may not approve the project unless feasible reasonable and prudent alternatives are adopted. (Fish and Game Code Secs. 2053 and 2091).

Where the reasonable and prudent alternatives are found to be "infeasible", the Lead Agency may, through a finding of overriding considerations, approve a marina project if it at least requires "reasonable mitigation and enhancement measures as are necessary and appropriate to minimize the adverse impacts" causing jeopardy, and determines that the benefits of the project as proposed clearly outweigh the benefits of the project if approved with the alternatives which would otherwise prevent jeopardy. (Fish and Game Code Sec. 2092(b)(1)). Finally, a state Lead

Agency is flatly prohibited from approving a project if it concludes that it would likely cause the extinction of any endangered or threatened species. (Fish and Game Code Sec. 2092(c)).

Where a particular marina project may affect species listed under both the state and federal endangered species acts, the CDFG is required to participate to the "greatest extent practicable" in federal consultation--a process similar to the state consultation process. (Fish & Game Code Sec. 2095.) DFG policy is to adopt the federal opinion as its own unless DFG finds the federal opinion would not adequately protect the listed species in which case it will recommend more protection.

Some 175 plants and 65 species of fish and wildlife have been listed by the state Fish and Game Commission as threatened or endangered (14 Cal. Ad. Code secs. 670.2 and 670.5). The status of efforts to protect listed fish and wildlife is reported periodically by Fish and Game in updates of its publication "At the Crossroads." The principal state listed animal species within the study reach are the giant garter snake, the California yellow-billed cuckoo, and the Swainson's hawk. All are considered threatened species. The greater Sandhill crane (threatened) also occurs within the Sacramento River corridor, though its principal habitat is not within the immediate area of the study reach.

B. The Federal Act

The Federal Endangered Species Act (16 U.S.C. sec. 1531 et

seq.) imposes on all federal agencies a mandate to insure "that any action authorized" by that agency does not" jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of the habitat of such species." (16 USCS Sec. 1536(a)(2)). Since the Army Corps of Engineers will be involved in approving federal permits for a proposed marina project (see discussion of Corps permits below), its permit approval decision will be subject to the provisions of the Federal Endangered Species Act. Endangered and threatened species are listed in 50 CFR secs. 17.11 and 17.12. Procedures and criteria for listing particular species are outlined in 50 CFR Part 424.

The Corps of Engineers is required to consult with the Secretary of the Interior and DFG to determine in fact whether its permit approval will cause "jeopardy" as defined above. (16 USCS Sec. 1536(a)(2)). (Regulations concerning the consultation process are set forth in 50 CFR Part 402). The focus of the consultation is not to be limited just to the particular marina project under consideration, but must also consider past and present impacts of human activities including all state, federal, and private projects. Cumulative impacts of other proposed future federal projects in the vicinity which have undergone consultation and have received favorable biological opinions must also be considered. Finally, consultation must also consider the impacts of proposed state or private actions reasonably certain to occur prior to the completion of the federal project under consideration. These provisions thus require consideration of the

cumulative impact not only of marina construction but also of construction of associated condominium and restaurant and parking facilities.

The Secretary of the Interior is required to issue a written opinion indicating whether jeopardy of the species or adverse modification of critical habitat is found. If the opinion determines that jeopardy or adverse modification will in fact result upon permit approval, the Secretary is to suggest reasonable and prudent alternatives to be followed by the Army Corps of Engineers in granting its approval. (16 USCS Section 1536(b)(3)(A)). According to National Wildlife Federation v. Coleman (1976), 529 F2d 359, the final decision on whether to approve the permit still lies with the Corps, not with the Secretary of the Interior. Nevertheless, in making its decision, the Corps is under a substantive mandate to use "all methods and procedures which are necessary to prevent the loss of any endangered species regardless of the cost." TVA v. Hill 437 U.S. 153, 185, (1978)(the famous snail darter case). In the wake of TVA v. Hill, Congress amended the Endangered Species Act to provide an elaborate exemption process to permit a project to proceed even if it threatens the loss of an endangered species. 16 USCS 1536 (h)(1). (The so-called "God Committee").

Though there is some "wiggle room" provided in both state and federal acts, the net effect of a finding of jeopardy of a threatened or endangered species by a particular project is at least to delay it and require changes in project design. Depending on the effect of the project and availability of mitigation measures, a jeopardy finding may prevent permit issuance or make

the project economically infeasible. If DFG determines that "take" of a listed species would occur, it may issue a permit or memorandum of understanding for incidental take as a part of a management plan to benefit the species. Take of a listed species is otherwise prohibited.

The principal species listed under the federal system which may be present within the study reach is the Valley Elderberry Longhorn Beetle ("VELB" for short) which is listed as a threatened species. (50 CFR sec. 17.11). A formal consultation between the Fish and Wildlife Service and the Corps of Engineers has been going on since early 1984 concerning the possible effects of upper Sacramento River bank protection projects on the VELB. In November 1985, Fish and Wildlife issued its opinion finding that the Chico Landing to Red Bluff portion of the Corps project would jeopardize the beetle. It further found that certain additional bank protection work south of Chico Landing would not jeopardize the beetle because habitat in this area was already largely disturbed by previous levee construction and bank protection. Elderberry bushes are located on the site of the proposed Lighthouse project and probably on the sites of other projects as well. Fish and Wildlife is participating in the review of this project but this review is still at an early stage.

Laws Affecting Boating Activities

Laws controlling the operation of boats in the Sacramento River are established by federal, state and local regulations which are enforced primarily by the local Sheriff and Police Departments. The speed, wake and noise of boats using marinas require special attention.

A. Speed

Safe speeds in boating areas are determined by the federal government based on the following considerations: the visibility of the area; the traffic density; the amount of room for stopping and turning; the lighting at night; and the navigational hazards present in a given area (33 USC Sec. 2006). The state has incorporated these criteria also (Title 14, California Administrative Code, Section 6615) and citations may be based on their violation.

Beyond this general authority to limit speed according to river conditions, California has also adopted specific five mile per hour speed zones. Boats may not operate at more than five miles per hour 1) within 100 feet of bathers (not including water skiers actively engaged in the sport), and 2) within 200 feet of sunbathing beaches, swimming floats, diving platforms, lifelines, or mooring areas for access to and from boats (Harbors and Navigation Code, Section 655.2).

Enforcement of these five mile per hour speed zones may be undertaken by the City and County of Sacramento and the County of Yolo (Harbors and Navigation Code, Section 663). In practice, each of the three jurisdictions enforces one another's local ordinances as well as their own. This enforcement, however, pertains only to

violations occurring in the river (regardless of which side of the river centerline). Shore activities are patrolled by the local agency responsible for the area. Local entities may also adopt more specific provisions for regulation of waterways (Harbors and Navigation Code, Section 660, subsection a). Sacramento County, for instance, has established the following restricted areas in sections of the river south of the study area: Limited Speed Zones (where boats may only travel at five miles per hour); Restricted Wake Zones (where boats may not create wakes which show a whitewater break when striking the shore); No Ski Zones (where boats may proceed at more than five miles per hour but because of hazards must proceed with caution); Nature Study Preserve (where "idle speed" is the limit); and Boat Anchorage Areas (where caution is required). These areas are to be marked conspicuously by signs recommended by the County Sheriff (Sacramento County Code, Section 13.08.050). The City of Sacramento limits speed to 5 mph between I Street Bridge and Tower Street Bridge (Sacramento City Code, Section 27.361). This portion of the river borders Old Sacramento.

B. Wakes

Very little regulation of wakes exists at any level of government. Only Sacramento County, as discussed above, has set aside Restricted Wake Zones. Wakes which show a whitewater break when striking the shore, levee or moored vessel are prohibited in these areas (Sacramento County Code, Section 13.08.050, Subsection B).

C. Noise

Virtually no federal regulation of noise exists. The state and local entities require, however, that all exhaust of internal combustion engines of boats be effectively muffled at all times (Harbors and Navigation Code, Section 654; Sacramento County Code, Section 13.08.060; Sacramento City Code Section 66.302, subsection G). The State also limits the noise of boat engines according to their year of manufacture. For instance, from a distance of 50 feet, noise must be effectively muffled to the following levels: for pre-1976 engines, no more than 86 decibels; for engines manufactured after January 1, 1976 and before January 1, 1978, no more than 84 decibels; and for all engines manufactured after January 1, 1978, no more than 82 decibels. (Harbors and Navigation Code, Section 654.05). Three-day exemptions from these noise levels may be granted by a permit from a local entity. (Harbors and Navigation Code, Section 654; Sacramento County Code, Section 6.68.190; Sacramento City Code, Section 66.404).

Local entities can impose more restrictive controls on noise. In residential and agricultural areas of Sacramento City and County, for instance, 55 decibels are allowed during the day between 7:00 a.m. and 10:00 p.m. Fifty decibels are allowed at night between 10:00 p.m. and 7:00 a.m. Intermittent sounds in excess of these levels may not exceed 20 decibels at any time (Sacramento County Code, Section 6.68.070; Sacramento City Code, Section 66.201). State Department of Health guidelines call for a limit of 60 decibels in residential areas. Noise in nature study preserves, as designated by Sacramento County, is restricted to 55 decibels (Sacramento County Code, Section 13.08.060).

4. Water Quality

The water quality effects of marina development may be divided roughly into three categories: effects of marina construction; effects of marina operation; and effects of boat operation. The principal agency concerned with water quality protection in the Sacramento river is the Central Valley Regional Water Quality Board. Local health departments generally take the lead with regard to sewage disposal issues.

A system of water quality standards and pollution discharge permitting is established in California under a combined federal and state set of laws and regulations -- the federal Clean Water Act (33 U.S.C. sec. 1251 et seq.) and the Porter-Cologne Water Quality Control Act (Water Code secs. 13000 et seq.). The principal activities of concern associated with marina development and operation are dredging and sewage disposal.

Dredging is also regulated by the Corps of Engineers under section 404 of the Clean Water Act and possibly under section 10 of the River and Harbors Act (see below). The Clean Water Act gives state water pollution control agencies the opportunity to either certify or waive certification that a federal permit for an activity which may result in a discharge to navigable waters that the discharge will not violate applicable water quality standards. In addition, the Porter-Cologne Act requires any person proposing to discharge waste that could affect waters of the state to file a report of discharge with the Central Valley Board. The Board can then either issue waste discharge requirements or choose to waive such requirements. (Water Code sec. 13260, 13269).

In practice, if sewage is disposed of other than through a direct discharge of treated effluent to surface waters and minor water quality impacts from dredging are foreseen, the Board will waive certification of Corps permits and will also waive discharge requirements. The process of securing this waiver, however, does give the Board an opportunity to review the project and negotiate conditions with the proponent with regard to water quality protection. When a major amount of dredging is involved, the Board will issue requirements. Standard conditions include prohibitions on redepositing dredged materials into the river and limiting increases in turbidity to less than 150 turbidity units 300 feet downstream of the dredging. Significant dredging may also raise concerns about resuspending metals or toxic materials in bottom sediments. No certifications or waste discharge requirements have recently been required for marina developments in the study reach.

Other concerns with marina construction include chemically treated pilings and possible deteriorated water quality and contaminating of bottom sediments in off stream marinas caused by poor water circulation. These effects might not be considered "discharges" subject to permitting, but could be regulated through the local government land use approval, through a State Lands Commission lease condition or through a Corps permit condition.

Marina operation issues center on sewage disposal, fuel storage and fuel spills. Sewage disposal is generally regulated by local engineering, health department and water and sewer

authorities. Additional requirements may be imposed through conditions in local land use permits covering such matters as dockside pump out facilities for vessel sewage wastes, waste oils and bilge wastes. Fuel spills are subject to state and federal spill reporting requirements though the amounts involved may be below set minimums. The state minimum for oil or petroleum products is 42 gallons (Water Code sec. 13272). Petroleum product fuel storage is required be underground under the Uniform Fire Code (Article 19). Fuel tanks must meet state and local reporting and design requirements to prevent leakage (e.g., Water Code sec. 13170.5; Sacramento County Code, Ch. 6.34).

Water quality issues related to boat operations include vessel sewage disposal systems, oil or fuel discharges from vessel engines and the use of toxic anti-fouling hull bottom paints. The Clean Water Act mandated EPA to promulgate regulations for marine sanitation devices (sec. 312; 33 U.S.C. sec. 1322). EPA regulations permit the use in waterways such as the Sacramento River of Coast Guard certified devices meeting certain design criteria. Devices on boats built after 1980 must limit fecal coliform bacteria to 200 parts per 100 ml and limit suspended solids to 150 mg/ml. Older boats need only limit coliform bacteria to 1,000 parts per 100 ml with no visible solids.

Petroleum discharges from a "properly functioning vessel engine" are not deemed to be harmful under EPA regulations, but oil accumulated in a vessels bilge is not considered to be exempt. Bilge pumping would violate the Clean Water Act if it could be shown to violate water quality standards or cause a film or sheen on the water surface (40 CFR Part 110). Enforcement

against individually small and difficult to detect discharges is another matter.

Regulation of hull bottom paints again raises the question of whether a "discharge" has occurred for purposes of state or federal water quality regulation. A more likely regulatory mechanism may be either of two federal statutes which apply to the production and sale of potentially harmful products. These are the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) and the Toxics Substance Control Act. Both are administered by EPA and require registration and testing of hazardous materials. If currently used products are harmful to water quality, they could be restricted or prohibited under these statutes. State or local regulation might also be feasible, but could raise questions of federal pre-emption.

PRINCIPAL PERMITTING AGENCIES

City of Sacramento (Planning Commission)

1. General Role

Within its borders the City of Sacramento, through the Planning Commission and City Council, has the responsibility for land use regulation effecting marinas. The principal proposals within the City include the Riverview, Riverbank, Miller Park, Captain's Table and the Old Sacramento wharf developments. The City exercises this authority primarily through the planning process--the General Plan and area plans covering smaller areas within the City--through zoning and special permit requirements. The City acts as the lead agency under CEQA for the projects which are proposed in its jurisdiction.

2. Basic Regulatory Requirements

a. Authority

Local government is empowered under the State Constitution and the Government Code to exercise broad land use authority to protect the public health and welfare (see Gov't. Code Sec. 65102; Cal. Const. XI, Sec. 7). Local government is required under the State Government Code to adopt general plans covering certain minimum topics including open space preservation and conservation. Cities are also required to regulate subdivision of parcels under the Subdivision Map Act (see Gov't Code Sec. 66452).

b. Geographical Jurisdiction

The City of Sacramento has land use regulatory authority over all land within the city limits. The city limits currently extend from north of Freeport northward to El Centro Road. The northernmost

portion of the City's jurisdiction along the Sacramento River now includes the Riverview Marina site which was recently annexed into the City. The River View project was previously permitted by the County of Sacramento. The City jurisdiction extends to the middle of the Sacramento River. Thus, the City and the State Lands Commission and Corps of Engineers have overlapping jurisdiction over that portion of the marina project which extends from the ordinary high tide line waterward into the submerged lands which are state-owned. In this area, a State Lands lease will be required, and probably a Corps of Engineers permit, and in addition, special use and building permits will be required from the City.

3. Decision Criteria

a. Discretionary Authority

Marina projects may require rezoning, general or specific plan amendments and special permits. Additional review may also be required with regard to design after the special permits are issued. Rezoning and plan amendment applications are decided by the City Council. Special permits are issued by the Planning Commission. Any follow-up design review is conducted by the City's Design Review Board. The existing zoning and plans do constrain the decision of the land use authority, but these can and have been amended to permit marina developments with associated

non-water related uses, such as condominiums and offices, to be constructed. Ultimately, the local land use authority--City or County--has broad legislative type authority to regulate land use in a manner which in the judgement of the authority promotes the public health and welfare.

b. Applicable General and Area Plans

The General Plan for the City of Sacramento was last adopted in 1974. In addition to the General Plan, there are four area or specific plans which are relevant to marina development on the Sacramento River. These include: the South Natomas Community Plan, the Docks Specific Plan, North and South Pocket Area Plans, and the Sacramento River Parkway Plan. These plans generally do not constrain, and in some respects encourage, marina development on the Sacramento river. However, they do contain provisions which limit the construction with marinas, such as condominiums and office space and perhaps restaurants. The provisions of these plans relative to marina development will be briefly summarized.

(1) General Plan

The General Plan contains ten elements covering a variety of planning issues for land use in Sacramento. Of these ten, four are most relevant to marina development: the land use,

public facilities and services, open space, and conservation elements. The General Plan discusses land use in four broad categories--residential, commercial, industrial and open space. Commercial and open space categories are of most importance to marina development in the Sacramento River corridor.

The General Plan contains some policies which are of importance to marina development, but these are stated in broad and general terms. Specific constraints upon development must come through either zoning or special permit conditions, discussed subsequently. General Plan policies which should influence the nature of these more specific restrictions include the following:

- The City should prevent "incompatible commercial development" adjacent to the American and Sacramento River Parkways (General Plan, page 2-11)
- Passive recreation areas such as trail system along waterways and nature preserves should be protected from use as active recreation areas and enhance where appropriate with significant natural vegetation (page 4-²).
- In open space areas along the Sacramento River: encourage the preservation of riparian habitats, ensure adequate public access in newly developed areas, safeguard visual amenities potentially impacted by development, protect Sacramento river lands, particularly Chicory Bend, that have unique riparian habitats, leave floodplains of the Sacramento River free of most buildings and other improvements, control possible visual obstructions within the floodplains of the Sacramento River (pages 6-8, 6-9, 6-10, 6-14, 6-16, 6-17).
- Control the intensity of recreational use along the Sacramento River to avoid impacts upon fish and wildlife dependent upon the limited natural areas along the river's embankments (page 7-16).
- Limit marina development on both the Sacramento and American Rivers which would have an adverse impact on anadromous fish (page 7-17).

(2) Sacramento River Parkway Master Plan (1975)

This plan covers the area from the American River south to the town of Freeport on the Sacramento side. The Master Plan was adopted by the City Council on July 20, 1976. The plan's orientation is to develop a parkway for the Sacramento River similar to that developed for the American River. Thus, it is not a river use plan but rather a linear park and trail plan. It is nevertheless useful because it evaluates the existing conditions and potential for development in some detail along the Sacramento River from the American River to the town of Freeport. It identifies specific areas that are appropriate for low, medium and high intensity uses and notes areas south of the American River that should remain natural and others that may be developed (pages 75, 87-94). The plan states that the policy is to retain the majority of the proposed parkway in a natural state for passive recreational use (page 73), but it also states that development of river-oriented commercial facilities which will positively effect the parkway should be encouraged at "appropriate and compatible points" along the river. This may include public marinas (page 96). In addition to implementation of the plan through acquisition of fee interests or commercial interests in land, the plan relies upon implementation through zoning (most of the area is zoned either floodway or agricultural open space) or through dedications required under the State Subdivisions Map Acts and City Subdivision Ordinance.

(3) South Natomas Community Plan (1978)

The plan developed for the South Natomas Area extending from the American River-Sacramento River confluence upriver to the City limits was adopted in 1978. Recent amendments to the Plan have not changed plan provisions relating to the "riverfront district" along the Sacramento River.

The specific provisions of the community plan for the Riverfront District include the following points:

- Land use permitted within the district should complement the open space and natural character of the embankment and water.
- Natural riparian areas and mature trees should be preserved.
- New or replacement uses should be restricted to single family detached residential dwellings on lots of one acre or more, private boat docks and "water-oriented commercial uses."
- Commercial gas and boat service facilities should be allowed only at existing marinas.
- Work with the County of Sacramento to retain the 26 acres of riverfront known as Ski Beach (location of the proposed Sand Cover Marina project) as a regional park (pages 41-42, 60).

The requirements and standards of the County's Waterway Use Program are "supported" in the South Natomas Community Plan (P. 41), but does not appear to have been considered explicitly in recent use permit proceedings. The County Program includes specific provisions for the Garden Highway area extending from the Sacramento city limits to the Sutter County line and including the land between the Garden Highway and the river. The Garden Highway section of the county program (page 29)

applies the restrictions listed under "Water-Side Projects Regulations and Standards" (pages 16-21). The Water-Side Projects Regulations include prohibitions on new in-channel marinas and also prohibit commercial projects such as marinas, piers and docks in "natural areas" and nonwater-dependent facilities "scenic areas." The study reach of the river does not appear to include any such areas. The regulations also restrict the distance structures may extend into the river (various limits are imposed depending on the nature of the area; a rule of thumb is no greater than 1/3 of the horizontal distance across the waterway).

(4) Dock Specific Plan

Planning has been underway since the mid-1970's for the development of the riverside area south of Capitol Mall/Tower Bridge extending to the extension of S Street in central Sacramento. The docks specific plan was adopted in 1977 and a more detailed planning study was completed by City consultants in 1984. The consultant's plan calls for the development of about 80 transient boat slips by 1990. The plan recommends deferring any development of permanent slips because physical conditions at the site make it difficult to offer a competitive site of permanent moorage.

(5) South Pocket Area Plan (1979)

The Pocket Area Community Plan, published in 1979, is a compilation of two other specific plans adopted in 1976 for the North and South Pocket Areas respectively. The two plans cover

the area from 35th Avenue on the north to just north of Freeport on the south. They contain little detail concerning marina development. Several references appear to the Sacramento River Parkway Master Plan, and the plans are presented as consistent with the Parkway Plan. Both community plans designate the riverfront area as park and open space. They include a total of nine areas which are designated as appropriate for recreation development ("recreation nodes"). For the North Pocket Area these three areas are: (1) the area between 35th Avenue and Seymour Park, (2) the area adjacent to the terminous of Arabella Way, and (3) an area adjacent to the Elks Club location. For the South Pocket Are three major and three minor areas are identified. The major "nodes" are: (1) an area immediately south of River Bend Estates, (2) Garcia Bend Park, and (3) the Meadowview Wastewater Treatment Plant (to be phased out). The intermediate areas are: (1) the extension of Florin Road, (2) the main canal-parkway, and (3) the area near Light 29. These locations have been identified as able to withstand more intensive development; however, the plan appears to contemplate the improvement of these areas as public parks rather than as private facilities such as additional private marinas. The plan also includes a resolution by the City Council for design standards applicable to development adjacent to the river levee. These requirements include the provision that in dedications of land adjacent to the levee shall be as a condition of subdivision map approval in order to assure access to the river and to promote the development of the Sacramento River Parkway.

(6) Zoning Ordinance

Most, if not all, of the Sacramento River shoreline waterward of the levees is zoned "F" - Flood Zone within the City limits. (There is currently no master zoning map available, so individual parcels must be checked for zoning). One of two additional "overlay zones" will apply: FW - Floodway, or FF - Floodway Fringe. The Flood Zone is also considered an open space zone (Zoning Ordinance, p. 1-4, section 23-B), and developments within this zone require a special permit issued by the Planning Commission. Uses which may be permitted include private boat docks, marinas, outdoor recreation facilities, and restaurants (section 23-C-2). In addition, any other use may be permitted if the Planning Commission makes a number of findings. Included among these are findings that:

- the development will enhance the appearance and public use of the river;
- the development will not have an adverse effect on any natural resource; and
- adequate parking is provided on the landward side of the levee.

Any permitted use must be consistent with applicable plans as well as the zoning ordinance. (Thus, inconsistency of the Riverbank marina project with the south Natomas Community Plan limitations on residential development and non-water dependent uses required a plan amendment as well as a special permit).

No building is to be constructed within the F zone unless it either floats or is above the 100 year flood line. (Section 23-E). Variances from open space regulations are to be granted only in "extreme circumstances". The zoning ordinance does not require consideration of the effect of marina developments upon boating and other recreational use of the river. Nor does the ordinance specifically require limitations upon the extent to which marinas extend along or into the river, though the restrictions included in Sacramento County's Waterway Use Program may be deemed to apply since they are incorporated in the South Natomas Plan (see discussion above under South Natomas Community Plan).

In addition to these requirements, the Flood Zone overlay regulations also apply. Within the FW floodway zone, no structure shall be constructed which increases the level of the base flood. In the FF fringe zone (the 100 year flood area), no permit shall be issued if the cumulative effect of such developments would raise the flood level by one foot. In addition, residential structures must be above the base flood level and non-residential structures must either be above the flood level or be flood proofed.

No specific height and area regulations apply in the F zone, though the regulations concerning elevating structures above the flood level will tend to increase the visual impacts of developments. Similarly, parking space requirements will tend to increase the removal of riparian vegetation for approved developments (section 6, Zoning Ordinance; the Riverbank project include some 400 parking spaces.)

4. Specific Permit Provisions Noted

The following uses were permitted or restrictions imposed were noted in reviews of previously issued special permits for marinas (for Riverbank and Riverview). These conditions are listed only as examples. The City in its comments on this report emphasized that the conditions listed might not be appropriate for other sites (e.g., Miller Park).

- a. Proposed office space uses were permitted by the City Council.
- b. Access to include pedestrian areas for river overlook; vehicle use restricted in this area.
- c. Restriction of guest dockage to percent of permanent marina berths (no specific percentage stated).
- d. No boat sales, repair facilities, fuel sale or storage.
- e. No fish cleaning facilities.
- f. All other state and federal approvals to be obtained before building permit issued.
- g. Detailed site plans to be submitted and review by Design Review Board before building permits issued.
- h. Parking areas to be screened from view from river.
- i. Building foundations to accomodate pressures from debris and high velocity river flows.
- j. Exposed riverbanks and levees to be revegetated and erosion control features to be approved by City Planning; rip-rap to be approved by Reclamation Board.
- k. Excavations to take place during low water period to avoid excessive sediment discharge.
- l. Oak trees to be removed only with approval of Planning Director and City Arborist. Cottonwoods subject to 5 year removal and replacement plan.
- m. Dripline area of preserved trees to be protected from construction disturbance, filling or paving.

- n. Construction within 50 meters of "potential" archeological find prohibited.
- o. Adequate pump out facilities to be provided.

5. Summary of Agency Position

Marina development is not significantly limited by provisions of the General Plan, specific area plans or the City Zoning Ordinance. There are a number of policies, particularly in the General Plan, which encourage protection of the natural values of open space areas along the river, but with adequate project specific attention to these values, water related uses such as marina are consistent with applicable plans and ordinances. There is no explicit consideration in plans or ordinances of the amount of marina development, extent of appropriate development of areas in or along the river, or the effect of increased boating use upon recreational or other use of the river. The Sacramento River Parkway Plan appears to encourage some additional commercial recreational development, including marinas, without specifying exactly where or how much. It does include designations of nine locations on the river (south of Sacramento) where additional development is more appropriate. No such specific areas are identified north of the Central City.

Non-water dependent uses are inconsistent with existing plans. Proposed office space uses and condominiums have been permitted, through plan amendments for both Riverbank and Riverview marinas. Structures permitted to be constructed within the F flood zone must be above the 100 year flood level. Height and area restrictions are decided on a case-by-case basis. Specific parking requirements are specific. Plan policies and use permits include provisions requiring public access to riverfront developments.

Sacramento County

1. General role

Sacramento County, acting primarily through the Department of Planning and Community Development, Planning Commission, and Board of Supervisors, exercises land use authority over marina developments in areas outside of the Sacramento city limits on the east side of the Sacramento River. Like the City and Yolo County, Sacramento County policies and its land use authority are described and exercised through its general plan, community plan, and zoning ordinances. Pending marina proposals or projects within Sacramento County's authority include the Sand Cove Project located just south of the Interstate 80 bridge, Cliff's Marina expansion, about 1/2 mile south of Freeport and the proposed Freeport Marina being planned by the County Department of Parks and Recreation.

2. Basic Regulatory Requirements

a. Authority

See discussion and references in the Sacramento City section concerning general authority of local government with regard to land use planning and regulation.

b. Geographic Jurisdiction

The county's jurisdiction extends northward from El Centro Road to the Sutter County line (about 1/2 mile north of the Interstate 5 bridge) and from a point about 1/2 mile north of the town of Freeport downriver to a point near Collinsville. As the local land use authority, the county authority to approve, deny

or condition marina proposals is quite broad. Some general constraints on the scope of the county's discretionary authority are imposed by policies in the General Plan and the Delta Community Plan/Garden Highways portions of the zoning ordinance, but marinas are generally consistent with those policies and ordinances.

Review authority is exercised primarily through the Planning and Community Development staff. In most cases, use permits are required before marinas can be developed. Public hearings on marina use permits are held by the Zoning Administrator, the Project Planning Commission and Board of Supervisors.

3. Decision Criteria

a. General Plan

A major update of the County General Plan was completed in 1982. A Waterways Use Program for Sacramento River and other waterways in the county was adopted in 1977. Some of the policies and requirements of this plan have since been adopted in portions of the county's zoning ordinance. These include the Delta waterways land use zone for the southern portion of the county (Zoning Code section 235-140) and the Garden Highway Special Planning area (zoning code 235-90; County Ordinance SZC 78-142B). The Waterways Use Program contained a prohibition on new in-channel marinas and prohibited structures for human habitation within floodway areas except for single family homes on existing lots and floating structures moored in approved marina.

Also, expansions of existing marinas, though permitted under the Program, are limited to a maximum extension along and within the waterway of 350 feet unless an exemption is made when necessary for commercial feasibility. These restrictions do not appear to have been carried over to the more specific zoning ordinances for the Garden Highway and Delta areas.

The general plan of Sacramento County contains eleven elements. Five of these have some relevancy to marina development: the land use element; the open space, conservation and resource management element; the public service and facilities element; the noise element; and the scenic highways element. The plan identifies four major types of land use; residential, commercial and industrial, public and quasi-public, and open space. The frontage of the Sacramento River is classified as open space, recreational use. Some of the General Plan policies, goals or objectives that are pertinent to marina land use decisions are as follows:

- a. General
 - o Maintain a "harmoniously balanced ecological system" and continue development without harming the environment (General Plan, page 7)
 - o Preserve diverse and valuable resources for present and future generations (page 16)
- b. Land Use - Recreation
 - o Develop recreational activities for an expanding population with increasing amounts of leisure time (page 16)
 - o Maintain the narrow strip of land along the riverside of Sacramento rivers as access for fishing, picnicking and swimming (page 78)
 - o Provide for compatible multipurpose use of recreational areas for all age groups, special use facili-

ties such as marinas must meet specific conditions. They must be: self supporting, compatible with other uses and adjacent property owners, non-destructive of designated areas, easy to maintain and control and attractive to spectators (page 79)

c. Open Space - Water Resources

- o Manage and protect ground water and surface water resources and their quality (page 119)
- o Acquire parks and public access in portions of flood plains for visual and recreational enjoyment (page 120)

d. Vegetation and Wildlife

- o Use flood and open space zoning for protection of the natural environment (page 126)
- o Maintain vegetation for repairing habitats along rivers (page 126)

e. Noise

- o For open space water and recreational areas activity noise levels greater than 60 decibels require study and possible mitigation and levels greater than 75 decibels should be discouraged (noise element, pg 9)

f. Flood Zones

- o Promote the improvement of natural drainage ways in urbanizing portions of the county in a manner to balance protection of uses with consideration of environmental, recreational and open space needs.
- o Encourage joint study with DWR, the Reclamation Board and the Corps of Engineers to determine how levee maintenance can be revised to better take account of aesthetic and environmental considerations including possible replanting of levees (pages 34 and 35, Safety element)

g. Scenic Highways

(Garden Highway on the north and Highway 160 on the south)

- o Preserve and enhance the scenic qualities of Garden Highway (Scenic Highway element, page 2)
- o Preserve scenic corridor open space for hiking, driving, walking, bicycling and boating (General Plan page 127)

No specific references to boating needs and effects or marina development were located in the General Plan. The Delta Community Plan gives some attention to these issues, but the area covered by the plan is south of the study reach.

b. Zoning Ordinance - General Provisions

Areas along the river north of the city limits are zoned SPA (F). SPA is the designation for special planning area. In such areas the zoning ordinance (section 235-90) applies the terms of specific "sub-ordinances" that have been passed for numerous individual areas in the county. The ordinance for the Garden Highway area is designated SZC 78-142B and was enacted in October, 1978 and amended in July, 1982. The F zone is a combining zone that (section 235-10) applies the floor elevation and other requirements of the Sacramento County Water Agency Drainage Ordinance. This ordinance requires a permit from the Agency Engineer of the Sacramento Water Agency for construction of structures in areas subject to flooding. Habitable structures must be constructed one foot above the 100 year flood level. In addition the Agency Engineer may impose other conditions to protect the structure or avoid impeding or changing the direction of flood flows.

Areas adjacent to the river south of Freeport are zoned DW and sometimes have a sub-designation of S (scenic), N (natural), or R (restricted). These designations will be discussed subsequently. The area along the river is also designated as a scenic corridor and thus is subject to the General Plan policies noted earlier with regard to protection of the visual qualities of the area. Specific requirements of the county sign ordinance (zoning

code, III, Chapter 35) also apply.

Conditional Use permits are required for marina developments in the SPA and DW zones. The County Park and Recreation Commission is given an opportunity to review all proposed marinas or expansions. The commission has adopted general policy criteria for this purpose. (Revised July 22, 1982). These criteria do not include policies concerning preferred marina location, size, type or the scale of upland development. They do require adequate public access, pollution control and mitigation for loss of wetlands.

c. Garden Highway Special Planning Ordinance (SZC 78-142B)

The Garden Highway Ordinance recognizes both the flood prone character of the land waterward of the levee and also the fact that the Garden Highway areas has previously been divided into numerous parcels, many of which are developed with residential and other uses. The ordinance sets forth a number of categories of permitted uses and legalizes numerous pre-existing non-conforming uses. Most germane to marina development are the categories for developed commercial recreation uses, undeveloped commercial and undeveloped open space parcels. Marina and associated developments on either previously developed or undeveloped commercial lots will require use permits issued pursuant to the requirements of section 8 of the ordinance. (These requirements have been applied to the Sand Cove Project). Nine parcels are listed as developed commercial recreation parcels and another 8 parcels are listed in the undeveloped commercial recreation category. (The specific locations of these parcels has not been

determined).

Development of commercial recreation lots must be for commercial facilities oriented to water recreation. Uses permitted, subject to a use permit, include boat launches, water recreation equipment rental and sales, yacht brokerage, boat rentals, sales and repair, marinas and condominiums and townhouses if public access to and along the river is provided. Building heights are to be limited to 30 feet above the elevation of the nearest levee and the first floor elevation is to comply with the county's drainage ordinance. In addition to other conditions which might be imposed under a conditional use permit, special consideration is to be given to a number of factors which are listed in the ordinance. Included among these are Health Department approval of pump-out facilities and other sewage facilities, availability of public access to waterways, protection from flood hazards, and measures to reduce the impact of any loss of vegetation and for fowl or animal habitats.

Some 70 to 80 undeveloped open space parcels are listed in exhibit G to the ordinance. Restrictions on developments in these areas are set forth in section 9 of the ordinance. Less intensive development is permitted and uses are limited to either agriculture or low intensity uses oriented to providing riverside recreation or access. No removal of perennial vegetation is permitted and no approval of open space uses is allowed without first receiving a report on this use from the director of the County Parks and Recreation Department.

Any use permitted under the ordinance is to maintain an unrestricted navigation channel on the river adjacent to the

parcel. More specifically no facility structure or dock is to extend into the river more than 1/3 of the distance across the river or 300 feet between the facility and the opposite undeveloped bank whichever is less.

d. Delta Waterways

Zoning regulations for the area from Freeport south are set forth in sections 235-140 and following of the zoning code. The shoreline within this area is either zoned DW or can also be zoned with a suffix following the DW as noted previously. The area near Freeport is zoned DW-R (restricted area). In these areas the waterways are already restricted for through-navigation by existing docks or other development or are adjacent to existing delta urban communities. In such areas additional water oriented facilities are considered to be compatible with existing uses. By contrast, no marinas may be located in areas designated as natural areas (N) and no non-water uses may be located in scenic areas (S) (section 235-144 zoning code).

Boat launches, water recreation equipment rental and sales, restaurants, boat harbors, marinas, commercial docks and piers and other "similar water dependent uses" are permitted within the DW zone upon issuance of a conditional use permit by the county zoning administrator. Condominiums do not appear to be an allowable use unless they might be considered to be an "incidental accessory use" to a marina (see section 235-143)k). In restricted areas (R) extensions into the river must not exceed 1/3 of the horizontal distance across the river and an unrestricted navigation channel of not less than 100 feet must be maintained.

In all other areas a 100 foot navigation channel must be maintained. In addition the project must meet the most restrictive of a number of other distance restrictions which are listed and apply to a variety of river conditions and use types (see section 235-147(a)-(F)). Private docks and fishing piers may be permitted if they do not extend more than 40 feet into the river or occupy greater than 50 feet along the bank. In most cases, such docks must be located where the waterway width exceeds 500 feet.

No conditional use permit is to be approved if the granting authority finds that the new facility will not create a number of problems such as: limiting the diversity of public uses; substantial environmental impacts to natural habitats; impeding the natural flow of the channel; adversely affecting the stability of levees or adjacent lands; creating safety or navigation hazards; reducing ecological values of ecological preserves or wildlife management areas; or causing excessive disturbance of shoreline areas incompatible with existing natural and man-made features.

4. Specific Permit Provisions Noted

The following conditions were noted in permits for the Sand Cove and Cliff's Marina projects:

- a. Provide separate public access to marina and recreation facilities.
- b. Height of buildings limited to 35 feet.
- c. Extensive mitigation measures to protect existing large oak trees.
- d. Provide a sewage pump-out station for boaters.
- e. Use of all soil material excavated for the yacht as on-site fill.

- f. Construction of off-stream harbor in phases to minimize erosion and turbidity impacts on the river.
- g. Install upstream bank erosion protection measures to prevent erosion.
- h. Prohibition of fish cleaning in yacht harbor waters.
- i. Connection of any fish cleaning stations to the public sewer system.
- j. Prohibition on boat launching facilities, gas pump-out facilities and boat service and repair facilities.
- k. Requirements for installation of facilities for clean-up of oil and gas spillage to prevent its escaping the harbor area into the main river. This is to include a foaming station and string buoy system.

A requirement for public access was originally included in the Sand Cove permit providing for access from the Garden Highway to the river bank. This was eventually eliminated on the grounds that it would lead to trespass and other nuisance problems that would be incompatible with the use of the side for private residential development. Public use of the beach area for boaters with access from the river itself is, however, to continue.

5. Summary of Agency Position

Questions related to the location and extent of marina development are not explicitly treated in the General Plan. Marina developments may be an allowable use under both the SPA (F) and DW zones in areas under Sacramento County jurisdiction, depending on the specific zoning of the parcel. Conditional use permits are required. The Freeport area is designated as appropriate for further marina development and certain specific parcels in the Garden Highway area are designated as appropriate for commercial recreation development. Water-dependent uses are generally favored for riverside development, but condominiums

have also been permitted in the Garden Highway, Sand Cove project, and county policy appears to be favorable to additional condominium development in specified locations. This may be considered an extension of the history of residential use of areas waterward of the levee in the Garden Highway area. In the area south of Freeport the question of non-water-dependent uses has been less pressing in proposed developments. These uses do not appear to be within the permitted uses under the Delta Waterways zoning ordinance. Height and setback requirements are similar to those provided under the City rules. Riparian vegetation receives protection in the Garden Highway area primarily on parcels that are designated as undeveloped open space and on which no vegetation is to be removed. In the Delta area, riparian vegetation protection is primarily related to designation of areas as either natural or scenic which limits development in those areas.

Yolo County

1. General Role

Yolo County exercises land use authority on the west side of the Sacramento River within the study reach. Projects within this area include the proposed Lighthouse Marina and the expansion of the Sherwood Marina located about three miles south of central Sacramento.

2. Basic Regulatory Requirements

a. Authority

As noted in discussion of the City of Sacramento and Sacramento County, Yolo County, as the local land use authority, has broad discretionary authority to determine what land uses shall occur along the river and elsewhere within the County. This authority is constrained to a degree by the General Plan for East Yolo County and requirements of the Yolo Zoning Ordinance. These, of course, may be amended by the county in its discretion, subject to the broad outlines of the state's planning laws (Government Code Section 65000 et seq.). Use permits and zoning variances are decided by the County Planning Commission (acting as the Board of Zoning Adjustment). Applications for rezoning and plan amendments are decided by the County Board of Supervisors after review and recommendations of the Planning Commission.

b. Geographical Jurisdiction

On the north, Yolo County's jurisdiction begins at a point substantially north of the Sacramento-Sutter County line on the other side of the river and extends southward to a point just

south of the town of Courtland. The County currently exercises land use authority in the Bryte, Broderick and Southport communities which lie across the river from the City of Sacramento. Consideration has been underway for several years of the incorporation of this area into a new city which would then exercise local land use authority. This is not anticipated to happen prior to the conclusion of this study, but once it occurs will add a fourth local land use authority to the three jurisdictions which currently exercise local permitting authority within the study area.

3. Decision Criteria

a. Discretionary Authority

As noted, Yolo County exercises broad discretionary authority regarding local land use decisions subject to the general confines of state planning law and constitutional constraints (see discussion under City of Sacramento).

b. Applicable Plans

There are three plans which may apply to particular marina proposals in Yolo County. They include the County's Master Plan, the East Yolo General Plan and the Southport Area Plan. These plans contain little or no explicit consideration of the propriety or preferred locations of marina development, or conditions which should be imposed on such development. They do contain, however, some general policies which should influence marina development decisions and management of the riverfront area. These provisions are summarized below.

1) Master Plan

The County Master Plan was adopted in July, 1983. More specific treatment of the riverfront area, particularly in the Bryte-Broderick area, is contained in the East Yolo Plan (described subsequently). The Master Plan does contain some policies which are germane. Some of those noted are:

- Commercial land use activities and facilities necessary to support recreation should be confined to existing urban areas, marinas, or make concessions in public parks (policy "LU 34").
- In areas designated for industry and commerce, the County shall encourage the initiation of growth with required environmental mitigations (LU 43).
- The Sacramento River from I-880 to I-5 is designated "A", Agriculture, except for certain designated parcels which are designated Residential or Commercial

2) East Yolo General Plan

The East Yolo General Plan was adopted in 1976. It has been amended several times since then, but generally these amendments did not affect the riverfront areas. Some amendments have more recently been proposed in connection with the Lighthouse Marina project and Riverbend residential development.

The East Yolo General Plan contains detailed analysis of land uses within the Bryte, Broderick and West Sacramento area. (Areas south of the barge canal are treated in the Southport Area Plan discussed next.) The elements of the East Yolo General Plan of

most concern to marina development are the Land Use, Open Space and Conservation, Parks and Recreation and Scenic Highway elements.

Yolo County has a very strong policy of preserving the agricultural lands upon which its agricultural economy depends. Areas north of the northern boundary of Bryte and south of Bevan Avenue in the Southport area are generally designated for agricultural use. Areas within Bryte and Broderick and in the northern portion of Southport have been reevaluated within the last five years and generally slated for more intense urban development, either residential or planned developments. There is an existing heavy industrial area south of M Street to the barge canal in the northern portion of Southport, as well as other industrial facilities associated with the Port of Sacramento and deep water ship channel. The riverfront area, generally the area between the levee and the river edge, is subject to an overlay plan designation of Open Space which applies to all zones otherwise applicable to such areas. The Open Space overlay (OS-1) is to preserve the natural vegetation of the riparian areas. It is also to help ensure that community vistas remain open to the river. A long-range goal for the area is to provide pedestrian and bicycle paths along the river, while at the same time maintaining the natural beauty of riverfront lands.

In addition to the OS-1 overlay zone, other areas along the river (including the southerly portion of the Lighthouse Marina parcel, the parcel adjoining the southern side of the barge canal, and the Sacramento Yacht Club and Sherwood Marinas area) are designated Parks and Recreation (PR). This designation is also

south of the town of Courtland. The County currently exercises land use authority in the Bryte, Broderick and Southport communities which lie across the river from the City of Sacramento. Consideration has been underway for several years of the incorporation of this area into a new city which would then exercise local land use authority. This is not anticipated to happen prior to the conclusion of this study, but once it occurs will add a fourth local land use authority to the three jurisdictions which currently exercise local permitting authority within the study area.

3. Decision Criteria

a. Discretionary Authority

As noted, Yolo County exercises broad discretionary authority regarding local land use decisions subject to the general confines of state planning law and constitutional constraints (see discussion under City of Sacramento).

b. Applicable Plans

There are three plans which may apply to particular marina proposals in Yolo County. They include the County's Master Plan, the East Yolo General Plan and the Southport Area Plan. These plans contain little or no explicit consideration of the propriety or preferred locations of marina development, or conditions which should be imposed on such development. They do contain, however, some general policies which should influence marina development decisions and management of the riverfront area. These provisions are summarized below.

intended to support the preservation of the natural character of these areas. However, there is greater emphasis on more intensive recreational use including boating facilities and parks (East Yolo Plan, page 83).

Like the Master Plan, the East Yolo General Plan does not contain much specific policy discussion of marina development but it does contain some general policies of note:

- Allow for urban growth only if in accord with the natural environment of the area. Particular attention shall be paid to the river and adjacent lands (East Yolo General Plan, page 90).
- Develop the riverfront areas offering recreational facilities, visual aesthetics and open space amenities while ensuring access to the river for all residents (page 92).

- Encourage urban development:

In areas where the proposed development would improve existing unbalanced socioeconomic characteristics;

In areas where there is an absence of natural hazards or where the proposed development can offset such hazards;

In areas where there is an absence of significant natural resources or where the proposed development can ensure the preservation of such natural resources (page 99).

- The community's prime open space resource is identified as the Sacramento River which provides open space for the preservation of natural wildlife habitat and which provides areas of outstanding scenic value. The area is also particularly well-suited for park and recreation purposes (Open Space Element, East Yolo General Plan, page 3).
- Numerous policies aimed at protection of wildlife habitat and scenic areas including a policy to limit and redirect development along the river so as to preserve the natural resources along the riverfront (Open Space Element, pages 21-25, policies numbered 4.7, 1.3, 1.5, 2.1, 2.5, 3.5, 3.9 and 4.11).

- Encourage private enterprise to establish recreation facilities within the community (Parks and Recreation Element, page 16, policy number 2.16).
- Notes the absence of public recreation facilities in the Bryte and Broderick area other than school grounds and the Broderick Beach boatramp (East Yolo Plan, Section IV).
- Develop agreements with local reclamation districts for hiking, bicycle and horse trails on levees and rights-of-way (Parks and Recreation Element, page 18, item 4.1.10).
- Designation of an area south of the barge canal between the river and Jefferson Boulevard for a pleasure craft marina. Plans are tentative but the East Yolo Plan indicates that the area is capable of accommodating four hundred boat slips (Parks and Recreation Element, page 9).
- Scenic highway corridors are established north of Bryte to Elkhorn and from the barge canal to Babel Slough (Scenic Highway Element, pages 1-6).
- The Sacramento River is an area of great scenic value and the scenic view of the river from the scenic highway route should be preserved (Scenic Highway Element, page 6).

3) Southport Area Plan

An area plan for the Southport area was completed in 1982. The plan area extends from the barge canal south to Bevan Road. The study area extends further south to the county line. The plan is oriented to more intensive development of the plan area including more residential development from the river in a westerly direction and more industrial development adjacent to the deep water ship channel and the Port of Sacramento. The plan limits the southerly encroachment of urban development into agricultural areas with the line being drawn at Bevan Road.

The plan contains little specific policies on marinas. The plan continues the OS-1 designation for the riverfront area. It designates the area just south of the barge canal as public

recreation and also the area between Linden and Davis Roads (the location of the Sacramento Yacht Club and Sherwood Marinas). It also alludes to the possibility of development of a marina by private developers on a lease from the Port of Sacramento and the establishment of a regional park in the northeast corner of the plan area by the East Yolo Community Service District on lands to be provided by the U.S. Corps of Engineers (Southport Area Plan, page VI-19).

c. Zoning

Outside of the urbanized area from Bryte to Southport the riverfront is generally zoned Agricultural Preserve or Agricultural General. In the Bryte-Broderick area the zoning--starting at the upriver point and proceeding south--is residential, planned development (in the area adjacent to the Riverbend Golf Course), Parks and Recreation (PR) (in the area of the marina portion of the Lighthouse Marina project), commercial (between the Tower and I-80 bridges) and industrial (south to the barge canal). As noted in the discussion above of the East Yolo General Plan, the river frontage is subject to the overlay OS-1 land use designation to protect the natural and scenic values of riverfront open space. In addition to the requirements associated with applicable zones and the OS-1 overlay, projects located within the 100-year floodplain must meet the requirements of the County floodplain management regulations (Yolo County Code Section 8-3.101 et seq.).

The purpose of the Park and Recreation zone (PR) is to preserve lands of natural beauty or lands containing natural or potential park and recreation features for uses in the public interest (County Code Section 8-2.1901). Permitted uses in the PR zone include boat docking, fueling and minor service, publicly owned park and recreation facilities, swimming, hiking and fishing facilities. Conditional use permits may be issued within the PR zone for privately owned recreation facilities including boat sales, service and repair and restaurants as well as other uses which in the judgement of the Planning Commission are consistent with the purposes of the PR zones. The standard height requirement is 30 feet. Parking requirements are set within the discretion of the planning director (Section 8-2.2507(p)).

The purpose of the Agricultural General Zone (A-1) is to preserve lands in agricultural use and protect them from encroachment of urban uses at least until growth capacity in urban zones is exhausted (County Code Sec. 8-2.601). Permitted uses within the A-1 zone include parks and recreation areas, but only if they are publicly owned. Allowable accessory uses, not requiring a use permit, include private recreation areas such as county clubs, but do not apparently include marinas. Conditional uses in this zone include commercial recreation facilities but only if most of the activity is out-of-doors such as a driving range or a drive-in theater. It is questionable whether a marina could be built on a site zoned A-1 without a zoning change.

The purpose of the Agricultural Preserve zone (A-P) is of course to maintain high quality agricultural lands in agricultural use. The A-P zone is the zone used to designate lands for which

there are Williamson Act contracts in effect (County Code Sec. 8-2.401). The permitted uses in the A-P zone also include public parks and recreation areas, but there is no provision for conditional use permits for private recreation facilities of any kind. Rezoning cancellation of the Williamson Act contract would be required for marina development to occur in areas zoned A-P.

The upstream portion of the Lighthouse Marina project is located within a zone designated PD-1, a planned development zone. Planned development zones are established parcel by parcel and essentially are "tailor-made" zones with specific development and design requirements established on a case by case basis.

In addition to the requirements associated with the zones described, the provisions of the County's floodplain management regulations will likely apply to any marina development (County Code Sec. 8-3.101 et seq.). These regulations, intended to comply with requirements of the National Flood Insurance program, are similar to the requirements set forth in discussions of Sacramento County and City planning laws since all jurisdictions are responding to the same federal requirements. Any construction in flood hazard areas must obtain a development permit (issued by the Director of the Community Development Agency) in addition to the use permit required under the zoning provisions (Section 8-3.401). The principal requirements for issuance of a development permit are secure anchoring of all structures, and for residential structures, elevating them so that the lowest habitable floor is above the base flood elevation. Non-residential structures can be below the flood base elevation provided they are water-tight and secure. In areas beyond the 100-year floodplain which are

designated subject to shallow flooding, residential structures must also be above the level of the flood elevation or be above the crown of the nearest street. Again, non-residential structures may be flood-proofed rather than elevated above the flood level.

4. Specific Permit Provisions Noted

The following provisions were noted in the County use permit for the Sherwood Marina expansion. This permit was approved October 3, 1984. It calls for the addition of a new parallel dock at the marina 950 feet long with 130 berths. There is no change in the shore facilities other than additional parking.

The permit requires:

- a. expansion of the parking lot from the present 22 marked spaces to add 95 spaces;
- b. that there be no new "finger docks" extending into the Sacramento River (i.e., all fingers must be pointed towards the shoreline); and,
- c. that all applicable permits be obtained.

5. Summary

There are few specific policies in Yolo County plans and ordinances directed at marina development. Certain areas within the study reach have been designated as appropriate for parks and recreation uses including boat docking, fueling and minor service. The southern portion of the Lighthouse Marina project, the Sacramento Yacht Club and the Sherwood Marina are all within PR designated areas. Except for these areas, virtually the entire balance of the

The purpose of the Park and Recreation zone (PR) is to preserve lands of natural beauty or lands containing natural or potential park and recreation features for uses in the public interest (County Code Section 8-2.1901). Permitted uses in the PR zone include boat docking, fueling and minor service, publicly owned park and recreation facilities, swimming, hiking and fishing facilities. Conditional use permits may be issued within the PR zone for privately owned recreation facilities including boat sales, service and repair and restaurants as well as other uses which in the judgement of the Planning Commission are consistent with the purposes of the PR zones. The standard height requirement is 30 feet. Parking requirements are set within the discretion of the planning director (Section 8-2.2507(p)).

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The purpose of the Agricultural Preserve zone (A-P) is of course to maintain high quality agricultural lands in agricultural use. The A-P zone is the zone used to designate lands for which

riverfront area on the Yolo County side is subject to the OS-1 overlay land use designation. Within this designation the policy is to preserve natural vegetation and also to ensure that community vistas remain open to the river. Areas not zoned PR are generally zoned for agricultural uses (A-1 or A-P) which severely limit or exclude marina development uses.

These policies and land use restrictions, if maintained, will limit marina development to a few locations on the river. However, while the East Yolo plan notes that the community's prime open space resource is the Sacramento River, it also encourages development in areas where proposed development would improve existing unbalanced socio-economic characteristics. The plan also notes the lack of public recreation facilities in the Bryte-Broderick area and the potential value of the riverfront for park and recreation purposes. Thus, policies encouraging protection of the natural character of riparian areas are competing with other planning policies aimed at improving the local economy and providing more opportunities for public recreational uses of the river.

State Lands Commission

1. General Role

The State Lands Commission (SLC) manages certain state-owned lands, including lands which the state received upon admission of California to the Union in 1850. These are sometimes called "sovereign lands" and include tide and submerged lands and the beds of navigable inland streams and lakes. The principal responsibility of the Commission concerning marina development involves the leasing of sovereign lands along or on the bed of the Sacramento River for the construction of buildings, docks, piers, slips and other structures.

2. Basic Regulatory Requirements

a. Authority

The SLC's authorities and responsibilities concerning leasing of state owned lands are set forth in Public Resources Code Sections 6000 and following. The Commission's regulations on leasing are contained in Title 2 California Administrative Code Secs. 1900-2954.

b. Geographic Jurisdiction

The Commission has determined that the Sacramento River is subject to tidal influence as far upstream as Verona, north of the Sacramento County line. Commission jurisdiction extends to all "tide and submerged lands." (PRC secs. 6216(a); 6301). Tidelands are defined as the land lying between the ordinary high and low tide lines. Submerged lands lie below the ordinary low tide line and, along the coast, extend three miles seaward. The

Commission is empowered to establish the ordinary high or low water mark by agreement, arbitration or a court action to quiet title (PRC sec. 6357).

State sovereign ownership extends to last historic natural position of the ordinary high water mark. (PRC sec. 6331.5; 6332) Thus, construction of streamside levees or berms does not affect the shoreward limit of state ownership, even if the berm or levee effectively narrows the width of the river. If new shore areas are exposed through the gradual deposition of sediment, called accretion, then in California the ownership of the newly exposed shoreline depends upon whether the accretion was caused by a natural or artificial process. If the accretion was caused by the intervention of man, such as by construction of a new wharf or jetty, then the state retains ownership to the old shoreline. If the shift is natural, then the riparian landowner takes the new shore area.

The Legislature may grant state-owned lands to cities or counties for administration. In such a case, the leasing powers of the Commission are also transferred to the local government entity, subject to any public trust obligations imposed upon the state or other conditions in the legislative grant (PRC secs. 6305; 6324). The only known instance of a legislative grant which would affect a pending marina development proposal in the study area is the Miller Park marina which lies within the bounds of a legislative grant to the City of Sacramento. (Statutes of 1970, Chapter 1266).

c. Lease Provisions

Commission regulations provide for various types of leases

depending on the type of land and use involved. Marinas fall within the General Lease, Commercial Use category which covers income producing uses such as marinas, restaurants, recreation piers or facilities, docks, moorings, buoys or gas service facilities [2 CAC sec. 2002(a)]. The term of general leases can be as long as 49 years, but 20 to 30 years is more typical for marina leases. Rental may be based upon one or more of three factors according to Commission regulations: a percentage of annual gross income; 9% of the appraised value of the leased land; or the volume of commodities passing over the leased premises. (2 CAC 2003). A recent SLC lease for a 175 berth in-river marina provides for the following payments:

- 6 % of gross income from the rental of docks and moorings
- 3 % of gross income from restaurant and bar operations
- 25 % of gross income from the operation of coin operated vending and electronic game machines.
- 5 % of gross income from boat sales
- 10 % of gross income from anything else (limited to leased area; i.e., excluding revenues from any upland developments such as condominiums or office space).
- Minimum annual rental of \$15,000 per year

Rental amounts are subject to revision by the commission every five years after execution of the lease.

3. Decision Criteria

a. General Authority

The Commission exercises broad discretion as manager of the lands, including matters concerning the issuance of leases and the imposition of lease conditions. The statute governing Commission management of state owned land provides simply that the Commission shall exercise its authority in "the best interests of the State". (PRC sec. 6005). The 1984 State Permit Handbook

(published by the Office of Planning and Research, but presumably reflecting Commission policy) adds three other factors to this very general decision criteria. The proposed activity is to be evaluated according to its consistency with various trusts under which the land is held; its environmental effects; and its effects upon the value of state lands. Commission leasing regulations further state that it shall have broad discretion in all aspects of leasing, including leasing category, permitted use, rental, competitive bidding, term, bonding and insurance and whether a proposed lessee is "qualified" --- all based on what the commission deems to be the best interests of the state. [2 CAC 2000(b)].

b. Public Trust Doctrine

Tide and submerged lands are and have been subject to the common law public trust doctrine. Under this doctrine, which has its roots in the Magna Carta and Roman Civil Law and is largely established through court cases rather than legislation, the state acts as a public trustee of certain uses and values of sovereign lands. The doctrine began with the concern for public navigational use of waterways primarily for purposes of commerce and fisheries. More recently, the trust has been held to comprehend recreational and natural ecological values; to condition previously established water rights so as to protect public trust uses and values, and to apply between ordinary high and low water lines of inland navigable lakes and streams as well as to tide and submerged lands. Tide and submerged lands may not be sold, only leased, and leases must be consistent with public trust

purposes. These purposes are considered an easement which the State, acting through the Commission or the Legislature, is generally powerless to extinguish by grant or lease. The role of the trustee, be it the Legislature, the Commission, or local government, is to determine priorities among competing trust users.

Marinas may generally be considered to be consistent with trust purposes since they further interest of navigation. Aspects of proposed marinas, other than boat storage and servicing facilities, are more likely to be found inconsistent with the public trust. Offices and condominiums are generally not permitted to be located on tide and submerged lands. Restaurants appear to occupy a gray area in which particular proposals may be seen as visitor-serving facilities enhancing boating, recreation and public areas or instead an independent commercial use that need not occupy sovereign lands.

Even boating facilities may run afoul of the public trust in some instances since the doctrine now also includes the "preservation of lands in their natural state, so that they may serve as ecological units for scientific study, as open space and as environments that provide food and habitat for birds and marine life, and which favorably affect the scenery and climate of the area." [quoting from the California Supreme Court case of Marks v. Whitney, 6 Cal. 3d 251 (1971)]. Thus, the Commission may be called upon to balance conflicting trust purposes when reviewing particular marina project lease applications.

c. Public Access

Public access to sovereign lands is, of course, one of the fundamental interests protected by the public trust doctrine.

Right of access is also protected in the California Constitution (Article X, Section - use for public purposes; Article I, sec. 25 - use for fishing) and by statute (PRC sec. 6210.4). Depending upon the grant history of the parcel, a right of access to navigable waters across privately owned lands shoreward of the ordinary high water mark (called "uplands") could be claimed in some instances.

The standard SLC lease form provides that the state reserves to the public an easement for convenient access across leased lands to other State-owned lands (presumably including navigable waters). Commission policy when reviewing marina lease applications is that the operator shall not block public access to the water, though some areas of the dock facility may be reserved for private use (e.g., renters of boat slips).

d. CEQA

State lands leases, with exceptions for minor actions, are considered discretionary permits subject to CEQA. In most instances, the Commission will be a responsible rather than a lead agency (the city or county), and either a negative declaration or EIR will be prepared in connection with lead agency approvals. As noted in the general discussion of CEQA presented earlier in this report, the Commission, as a responsible agency, must condition its approval of a project upon adoption of feasible alternatives or mitigation measures which lessen adverse environmental impacts if the Commission otherwise has jurisdiction over this portion of the project.

The public trust doctrine and the basic statutory authoriza-

tion for Commission review of lease applications already give it broad authority without regard to CEQA. However, the CEQA process may serve to identify adverse effects of proposed projects which then require the Commission to exercise its broad authorities over sovereign lands in a manner which eliminates or lessens such effects.

e. Environmentally Significant Lands

In 1970 the Legislature directed the Commission to compile a list of unconveyed State-owned school lands and tide and submerged lands which possess significant environmental values. The Commission was further directed to adopt regulations to "assure permanent protection" of the lands identified. (PRC sec. 6370). The Commission submitted the required list and report to the Legislature in 1975. Environmentally significant lands are grouped into three classes: A (Restricted Use), B (Limited Use), and C (Multiple Use).

Commission regulations implementing the legislation require that projects located on environmentally significant lands must be designed to be consistent with their use classification. If this cannot be accomplished through project design or mitigation then the lease application for the project must be denied. The option given to decision makers under CEQA to find "overriding considerations" is explicitly excluded for environmentally significant lands.

The study reach does include an area listed in the Commission's inventory (parcel number 34-097-000). This parcel has a B classification. A recent amendment of an existing marina lease (Riverview) to permit rip-rapping and other shore protection work

was found to be consistent with the B classification.

4. Specific Lease Provisions Noted

A sample of existing leases was reviewed to determine what conditions were being imposed by the Commission in the exercise of its broad authority over sovereign lands. The following provisions were noted:

- a. Permitted improvements include specified number of berths, floating restaurant, a boat sales office, debris reflector, harbor master's office and "all appurtenant facilities related thereto."
- b. Marina is to be open and available to the general public consistent with the operators rules and procedures. (Riverbank)
- c. Berths to be available on a first-come, first-served basis. (Riverbank)
- d. No person to be refused use or rental of a slip because of non-membership in a club formed for the use of leased premises in conjunction with adjacent uplands (e.g., a condominium association).
- e. Lease issued subject to subsequent review and approval by SLC Executive Officer of operation plans and progress reports on work permitted under lease (e.g., shore protection).
- f. Concurrence in permit conditions of Corps of Engineers or Fish and Game (unclear to what extent such concurrence makes such conditions directly enforceable under SLC lease, particularly upland conditions).

5. Summary of Agency Position

The State Lands Commission has broad discretionary latitude concerning the approval or expansion of additional marinas in the study reach. Greater marina capacity may be seen as enhancing navigation consistent with the public trust. On the other hand, as evidenced by the Commission moratorium and this study, too much development may impair navigation, at least in a qualitative sense of user enjoyment, and may also conflict with other trust

values such as other recreation use and ecological quality.

The principal restrictions likely to be imposed under a Commission lease, in addition to basic record keeping, insurance and other requirements, will concern overall size of the marina, public access, permitted facilities, and extent of occupancy of the river. The Commission is likely to reject non-water dependent uses proposed to be located within tide and submerged lands. However, these uses have been proposed for upland areas which are beyond the Commission's direct authority (unless the development site happens to be land which was created above the former natural shoreline through artificial means). The county and City are responsible for issues relating to such uses. While there is not a gap in jurisdiction of some agency concerning these developments, there appears to be a risk of disjointed review of facilities located in each of the two jurisdictional areas rather than coordinated consideration of the effects of what is in fact an integrated project.

U. S. Army Corps of Engineers

1. General Role

The Army Corps of Engineers ("the Corps") has long been responsible for maintaining and protecting the navigability of the nation's waters. Since the 1960's the Corps role has expanded to comprehend broader values associated with waters under its jurisdiction including water quality and fish and wildlife values. The Corps regulates the alteration or modification of the course, condition, location, or capacity of the navigable waters of the United States. It is also authorized to regulate the discharges of dredge or fill materials into the waters of the United States. The principal responsibility of the Corps concerning marina development involves granting or denying permits to dredge and fill or to build docks, piers, slips and other structures that may obstruct navigability on the Sacramento River.

2. Basic Regulatory Requirements

a. Authority

The Corps's authorities and responsibilities concerning the granting of permits are set forth in the Rivers and Harbors Act, Section 10 (33 U.S.C. 403) and Section 404 of the Clean Water Act (33 U.S.C. 1344). The regulations interpreting these statutes are contained in 33 C.F.R. 320-384.13.

b. Jurisdiction under the Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act provides the Corps

with extensive power to regulate activities obstructing or interfering with the navigability of "navigable waters." The Corps is authorized to prohibit the building of wharfs, piers, booms, breakwaters, bulkheads, jetties or other structures obstructing any navigable river. Furthermore, the Corps may prohibit "excavation or filling or altering or modifying the course, location, condition or capacity of any port, ... harbor or the channel of any navigable water of the United States." Therefore, marina developers are required to obtain permits from the Corps before building any structures deemed to obstruct the navigability of the Sacramento River.

Corps regulations define navigable waters of the United States as waters that are subject to the ebb and flow of the tide and/or those waters that are, have been or may be used to transport interstate or foreign commerce (33 CFR sec. 329.4). The test boils down to two factors: presence of interstate commerce and capability of use for such commerce (so called "navigability in fact"). The nature of the commerce is unimportant. It is necessary only that goods be brought from or destined to go to another state.

The Sacramento River clearly meets these tests. The area of the study reach is subject to the ebb and flow of the tide. The river has been and is now used as a "highway" for interstate commerce. (Even though it is an intrastate body of water, entirely within the state, it is still viewed as an interstate waterway because it physically connects with the ocean. 33 CFR Section 329.7.) Since the Sacramento River also meets the physical navigability test, it is subject to permit jurisdiction under

Section 10 of the Rivers and Harbors Act.

c. Jurisdiction under Section 404 of the Clean Water Act

The jurisdictional reach as well as the substantive requirements of Section 404 (hereafter referred to as Section 404) of the Clean Water Act (33 U.S.C. 1344) are more extensive than Section 10 of the Rivers and Harbors Act. Under Section 404, the Secretary of the Army is authorized to issue permits for the discharge of dredged or filled materials into "waters of the United States." The regulation interpreting the Clean Water Act jurisdictional term "waters of the United States" expands the extent of federal jurisdiction beyond the traditional jurisdiction exercised by the Corp under section 10 (see 33 CFR sec. 323.2) It includes, for example, intrastate waters if they could merely "affect" interstate commerce. An interstate transportation connection is unnecessary; economic effect appears to be enough. Wetlands adjacent to "waters of the United States" are also included. Again, the Sacramento River clearly falls within the sweep of federal jurisdiction. Thus, and dredging and filling activities associated with marina development along the Sacramento River will be regulated by the Corps under Section 404. Usually, only a section 10 permit will be required unless the marina involves construction of a new bulkhead or deposition of other fill.

The shoreward extent of Corps jurisdiction is defined, similarly to the State Lands Commission, as the ordinary high water line.

3. Decision Criteria under Section 404 and Section 10 of the Rivers and Harbors Act

In determining whether to issue either a 404 or Section 10 permit, Corps regulations require it to engage in what is termed a "public interest review" -- a balancing of favorable against the detrimental impacts of issuing the permit. The Corps' regulations set out the following guidelines for determining whether a permit will be issued under the public interest review:

"The decision whether to issue a permit will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest....The benefits which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments...The decision whether to authorize a proposal, and if so the conditions under which it will be allowed to occur, are therefore determined by the outcome of the general balancing process. That decision should reflect the national concern for both protection and utilization of important resources.[Among the factors to be considered are:] conservation, economics, aesthetics, general environmental concerns, wetlands, cultural values, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber reproduction, mineral needs, considerations of property ownership, and in general the needs and welfare of the people." (33 C.F.R. 320.4).

In addition, Executive Order No. 11988 directs federal agencies to take flood risks into account when undertaking or permitting activities within flood zones.

a. EPA's substantive role under Section 404

In addition to the substantive criteria set out above, the Environmental Protection Agency has authority to adopt its own substantive standards for Section 404 permit issuance. It may designate geographical areas in which no permit may be granted. (Section 404(b) and (c)). Furthermore, after notice, hearing and

written findings of an "unacceptable adverse effect," the EPA may override the grant of a permit by the Corps. (Section 404(c)).

b. Role of the Fish and Wildlife Coordination Act in 404 and Section 10 permit issuance

The Fish and Wildlife Coordination Act [16 USC Section 661 et seq. (1958)] requires governmental agencies, including the Corps to consult with the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the California Department of Fish and Game. Through this process, the activities proposed in the permit application may be coordinated in order to minimize potential adverse impacts upon fish and wildlife. [16 U.S.C. Section 662(a) and 33 C.F.R. 320.4(c), and Zabel v. Tabb, 430 F.2d 199 (1970)]. Furthermore, pursuant to the consultation process, when deciding on the issuance, denial or conditioning of permits, the Corps is required to give full consideration to the views of these agencies concerning fish and wildlife. 33 C.F.R. 320.4(c).

c. The Corps may refuse or condition permits based on environmental concerns

According to Zabel v. Tabb 430 F.2d 199, 214 (1970), the Secretary of the Army Corps of Engineers may refuse on conservation grounds to grant a permit under the Rivers and Harbors Act. In that case, the Court reasoned that the legislative history of the Rivers and Harbors Act coupled with the substance of both the National Environmental Policy Act of 1969 and the Fish and Wildlife Coordination Act, allows the Secretary such discretion under the Rivers and Harbors Act. The Corps may also refuse or condition 404 permits based on environmental concerns,

U.S. v. King Fisher Marina, 640 F.2d, 522, 523 (1981). The Corps' policy is to review the effects of an entire project, including upland developments, if the latter are deemed to be "dependent" on proposed activities within direct Corps jurisdiction.

d. NEPA

The National Environmental Policy Act (NEPA) (42 U.S.C. 4331 et seq. requires the preparation of an Environmental Impact Statement (similar to the EIR discussed in the CEQA section) when permit approval of a private project constitutes a "major federal action." [Section 102 (2)(C) of NEPA and Public Information, Inc. v. Atomic Energy Commission 481 F.2d 1079, 1088 (1973).] Under certain circumstances, an Environmental Impact Statement may be required in lieu of an EIR, while in other circumstances preparation of a combined EIR-EIS document is necessary. (CEQA Guidelines Sections 15221 and 15222).

4. Specific Permit Provisions Noted

The decision criteria outlined above are so broad as to suggest virtually unlimited range of requirements which might be imposed in Corps permits. In practice, of course, the range is more limited. A review of permits issued for Sacramento area marinas (Riverbank, Riverview, Schultz, and Sherwood) turned up the following conditions:

- a. Approved structures must not be converted to residences;
- b. Landscaping plan must be submitted to Corps prior to construction.
- c. Sewage from floating structures must be discharged to an approved land-side septic system

- d. No boats to be moored on outside docks.
- e. No alterations or additions allowed without the approval of the Corps
- f. Permittee (in a particular case) was to maintain a navigational 200 foot navigational channel to a depth of 8 feet.
- g. Structures for small boats and boats moored to these structures must be protected from damage by wave wash. The permittee alone is liable for damages.
- h. When permits expire or are revoked, the permittee permittee must restore the waterway to its former condition.
- i. Any discharges of pollutants to waters of the United States must conform to water quality standards.
- j. Pollutants must not destroy threatened or endangered species or critical habitats of those species.

5. Summary of Agency Position

The Corps will have jurisdiction over most marina developments in the Sacramento River since the river is clearly within the scope of federal jurisdiction and most projects will involve either or both an obstruction of or deposition into the waterway. Though the scope of factors taken into consideration by the Corps when issuing permits is quite broad, the agency's jurisdiction is still triggered by actions occurring in the river and most of the conditions in permits relate solely to conditions in the waterway, such as navigation or pollution. The Corps sometimes imposes conditions that require protection or replacement of riparian vegetation. Though conditions of permits are oriented to water management, the Corps is authorized by NEPA, the Endangered Species Act and Executive Order No. 11988 to take shoreward impacts into consideration when permitting a marina with associated upland facilities.

Reclamation Board

1. General Role

The Reclamation Board is concerned with flood control in the Sacramento and San Joaquin Valleys. The Board cooperates with the U. S. Army Corps of Engineers, the Department of Water Resources (DWR) and local drainage districts in the construction and maintenance of levees, by-passes and other flood control works. The Board receives staff and administrative support from DWR which also has operational responsibility for maintenance of Sacramento Flood Control Project levees. The Reclamation Board has regulatory authority to review, approve or deny proposed construction activities along or near the Sacramento River to prevent interference with the flood control system. An "encroachment permit" from the Board must be obtained before commencing such construction. Board policy is to treat vegetation removal as an "encroachment" requiring a permit since, in some circumstances, removal of vegetation can adversely affect the integrity or flood carrying characteristics of a floodway.

2. Basic Regulatory Requirements

a. Authority

The responsibilities and authorities of the Reclamation Board are set forth in Water Code sections 8520-9577 with provisions concerning encroachment permits at sections 8710 to 8723. Board regulations are contained in 23 California Administrative Code secs. 16 to 152. The Board has also issued several guidance documents which further specify applicable requirements. These include: Standards for Encroachments, April 1976; Encroachment

Standards for Reclamation District 1000 (American River to North Natomas Cross Canal), July, 1985; Standards for Encroachments, Bank Protection Guide, June 1972; Guide for Vegetation on Project Levees, Dec., 1967; and Riparian Vegetation Management Policy, March, 1981.

b. Geographical Jurisdiction

The Board's jurisdiction extends to construction activities in the bed, along or near the banks of the Sacramento River banks. The board's jurisdiction also extends to adjacent lands or "any land susceptible to overflow." (Water Code sec. 8710) These general jurisdictional limits are made more specific by adoption of designated floodway maps for specific areas. A "designated floodway" is the stream channel and adjacent lands required to carry the "design flood" volume of water, or the floodway between existing project levees. Of course, work on the levee itself is also within the Board's jurisdiction (Water Code sec. 8712). In summary, the Board has jurisdiction of any construction activities from the levee (starting ten feet landward of the levee toe) waterward to the stream bed.

3. Decision Criteria

a. General Authority

The Board has broad general authority to enforce the protection and maintenance of such levees and other flood control works needed to protect lands adjacent to the Sacramento and San Joaquin Rivers from overflow. (Water Code secs. 8533, 8534). In 1970, the Legislature more specifically required the Board to establish and enforce standards for the maintenance and operation

of levees, channels and other flood control works including standards concerning construction, erosion control and vegetation. When adopting such standards, the Board is to give full consideration to fish and wildlife, recreation and environmental factors. (Water Code sec. 8608). With regard to encroachment permits, the Reclamation Board statute states that the Board may refuse to issue a permit if in the judgment of the Board the proposed encroachment would be injurious to flood control works or interfere with the "successful execution" of any adopted plan of flood control. (Water Code sec. 8723). Thus, while the Legislature has given the Board broad discretionary authority, all of the Board's decisions must be in furtherance of the single purpose of protection and effective operation of the flood control system.

b. More Specific Requirements

(1) Policies

The Board has provided additional guidance concerning its requirements and policies with regard to encroachment permits and regulations in guidance documents and in letters of comment concerning any particular projects. A letter from the Board commenting on the notice of preparation of a draft EIR on the Lighthouse Marina Project contains a helpful summary of the Board's policy approach. (Memorandum dated October 2, 1985 from Raymond E. Barsch, General Manager). Board policy is to not issue permits which would:

- o allow structures intended for human occupation waterward of the levee;

- o significantly affect the functional and structural integrity of the levee;
- o impede inspection and maintenance of the levee; or
- o significantly alter the direction, elevation and velocity of flood flows in the Sacramento River flood control project floodways

In the same letter of comment, the Board expresses support for offstream marinas since they generally do not obstruct flood flows to the same extent as instream marinas and also tend to sustain less damage during high flood flows. (The Board goes on to express some concerns, however, with regard to the effect of the Lighthouse Marina Project on possible displacement and increased velocity of flood waters at the project site, downstream and on the opposite bank.)

(2) Board Regulations

The Board in its regulations defines "encroachment" to mean the "use for any purpose" of flood control project works or the floodway [23 Cal. Adm. Code sec. 46 (h)]. In 1981, the Board announced that it regards removal of vegetation as an encroachment requiring a permit. The regulations further state that certain uses may be permitted in the designated floodway if a combinations of such uses in a specific reach of the stream will not materially increase the flood height or the velocity of the designed flood (23 CAC Sec. 75). Interestingly, this provision seems to envision a cumulative analysis of the effects of multiple projects. The permitted uses include open space uses, fences (providing they do not constitute an obstruction to debris), storage yards, railroads, streets, bridges and public utility wires and pipelines, commercial excavation of materials (provi-

ding there is no stockpiling which creates an obstruction to flood flows), and structures that are designed to have a minimum effect upon the flows of water and are firmly anchored to prevent the structure from floating. With regard to structures, the regulation provides that "normally" no structures for human habitation shall be permitted [23 CAC Sec. 76 (g)].

(3) Standards for Encroachments

In 1976 the Board issued a manual -- Standards for Encroachments -- which sets forth in more detail its requirements and policies regarding encroachments. This manual provides additional detail with regard to particular types of activities within the floodway and particular requirements in certain geographical areas. Part II, M of the manual (page 29) covers boat facilities. It provides that a permit must be obtained prior to the construction of wharves, docks, boathouses, ramps, and similar boating facilities. The manual also provides that boating facilities will not be constructed on the levee section and that the levee crown will not be used for parking. Boating facilities must be firmly anchored to prevent damage in times of flood. Buildings may not be constructed over the levee section. The manual further provides standards for erosion control of river banks and levees. The most economical and effective method is found to be riprap but applications for other methods will be given consideration by the Board (a variety of other less expensive methods are outlined in the Board's "Bank Protection Guide", 1972).

(4) Encroachment Standards for Reclamation District 1000

Reclamation District 1000 is a local reclamation district which covers the east bank of the Sacramento River from the North Natomas cross canal south to the American River. The Board has adopted special standards for this area. The general effect of these standards is to provide an exception from the normal policy discouraging structures for human habitation on the waterward side of the levee, providing certain requirements are met. This exception is justified by the Board on the grounds that this area receives additional flood control protection by a setback levee and that Sacramento flood flows and stages are further controlled by the operation of the Sacramento Weir upstream of the area.

Some of the more important requirements of the District 1000 standards are to permit construction of structures if they are greater than 65 feet waterward of the levee shoulder and the finished floor of the structure is not less than 2 feet above the project design flood plain. Fill is permitted up to 150 feet waterward of the center line of the levee crown roadway. Structures cannot be built closer than 30 feet from the top of the riverbank unless special bank protection measures are provided.

(5) Vegetation Standards

The Board recognizes the environmental values of vegetation within floodways and has the policy of encouraging the retention of riparian vegetation as long as it poses no threat to the flood control system. As noted, removal of vegetation does require an encroachment permit. However, the the Board has also found that vegetation can also increase flood control problems in certain circumstances and that certain species of vegetation can present

problems. Concerns include: inspection of the landward toe of the levee, adequate spacing of vegetation to permit passage of water in high water periods, susceptibility to wind throw, and attractiveness to burrowing species such as ground squirrels. Generally, the Board policy is to impose spacing requirements for vegetation on the landward and waterward sides of the levee and to impose little or no requirements on vegetation types, spacing or height in berm areas. Vegetation is also allowed within revetment (bank protection) areas unless it somehow threatens the integrity of the flood control system.

4. Review Process

The Department of Water Resources reviews and comments on all applications for encroachment permits and inspects the work during and after construction for compliance with the conditions of a Board order granting approval to the permit. The Corps of Engineers also reviews permit applications to assure that no encroachment will adversely affect efficient operation and maintenance of the flood control project. Applications must also be endorsed by the agency responsible for maintenance of the levee, such as a local reclamation district. There are three such districts in the study reach. District 1000 (American River north to the Natomas Cross Canal on the east side of the river); District 811 (from Broderick north on the west side); and District 900 (from Broderick south on the west side). Disapproval by the local districts is not technically binding on the Board or the Corps of Engineers, but it would likely be hard to convince the Reclamation Board that it should approve an application over

the objection of the other agencies responsible for levee maintenance and flood control.

5. Specific Permit Provisions Noted

The following specific conditions, in addition to the requirements described above, were noted in a review of encroachment permits issued for the Sand Cove, Riverview and Riverbank Projects:

- a. The top of driven timber pilings shall be a minimum distance of 2 feet above the design flood plain elevation of 34.5 feet;
- b. Detailed plans for the pump out stations shall be submitted and approved by the Board prior to start of construction;
- c. Details of design and installation of fencing shall be submitted;
- d. No structures other than walkways to be constructed on levee section;
- e. No construction except riprap, piles and bank sloping shall be done within 30 feet of the top of the riverbank;
- f. Detailed plans for erosion control are to be submitted to the Board before construction;
- g. State of California shall not be held liable for any damages that might be caused to condominiums or appurtenances by operation of the flood control project or from reservoir releases;
- h. In the event of damage to condominiums or appurtenances to the extent of more than 50% of their value, such structures cannot be reconstructed or replaced without the approval of the Board;
- i. Detailed plans for landscaping to be submitted;
- j. The channel, overflow area and levee sections shall be restored to at least the same condition that existed prior to commencement of work;
- k. Erosion control works shall not contain any reinforcing steel, floatable or "objectionable material";

6. Summary

The Reclamation Board's permit authority covers all of the land areas, from the crown of the levee waterward, that are likely to be involved in any marina proposal. The Board has very broad authority, though it only may be exercised for the limited purpose of protecting the integrity and adequate operation of the flood control system. There is very little explicit treatment of marina development issues in Reclamation Board statutory provisions or in formal guidance documents. The Board appears likely to favor offstream as opposed to instream marina developments, since the latter may involve greater potential obstruction of the floodway. However, the Board will undoubtedly also have concerns as well concerning offstream marinas with regard to levee breaching and the adequacy of flood protection surrounding an offstream boat basin.

There are detailed Reclamation Board guidelines with regard to construction of structures within floodway areas. Generally, structures for human habitation are not permitted, though a large exception to this rule has been made for the Garden Highway areas north of the American River on the east side of the Sacramento River. The Lighthouse marina proposal may require extension of this policy to the west side as well.

Board policy favors retention of vegetation, but the Board would probably not prohibit construction activities, otherwise consistent with Board requirements, solely on this basis. Board policies designed to protect the flood control project or the safety of structures in the floodway -- such as prohibition of parking on the levee crown, minimum structure elevation require-

ments, and bank protection -- necessarily conflict with preservation of habitat and visual amenities. Board regulations concerning uses permitted in designated floodways require consideration of the affect of the combination of such uses in the specific reach of the stream on flood heights or velocity. It is unclear whether this sort of cumulative analysis has been undertaken in connection with permitted or proposed marina projects in the study reach.

Department of Fish and Game

1. General Role

The Department of Fish and Game influences marina development in three principal ways. First, certain construction activities require departmental review. A Stream Alteration Agreement is required for any change of a river channel, and a Standard Suction Dredging Permit is needed for any removal of riverbed material by dredgers. Second, the department is generally responsible for the protection, conservation and enhancement of fish and wildlife and their habitats and for enforcing fish, wildlife, and related water quality protection laws in the State. Finally, the Fish and Game Commission and the Department enact and enforce hunting and fishing regulations. Overall, the role of the Department of Fish and Game is to monitor the river area to protect fish and wildlife and the public's enjoyment of these resources. The Department's specific regulatory authority regarding marina development is limited, however.

2. Geographic Jurisdiction

The Department's general fish and wildlife protection mission extends broadly to wherever wildlife and their habitat are located. The department's regulatory authority with regard to marina construction activities is limited to the river and the riverbed. In practice, the agreements include some conditions that apply to the immediate shoreline as well.

3. Authority Regarding Marina Construction or River Use

a. Stream Alteration Agreements

The purpose of a Stream Alteration Agreement is to protect fish and wildlife resources to the degree possible during and after any activity that will divert, obstruct or change the natural flow or bed of any river, stream or lake (Fish and Game Code Secs. 1601, 1603). Any governmental agency or public utility that plans to alter the natural state of any river, stream or lake in California must notify the department prior to undertaking construction and submit a fee and descriptive information concerning the activity to the department (Sec. 1601, F & G Code). Any private person proposing such activities must also notify the department (Sec. 1603, F & G Code). There are no administrative regulations concerning these requirements other than a provision which states that they apply streams with intermittent flows as well as to all other rivers, streams, lakes and stream beds in the state. (14 Cal. Adm. Code sec. 720). The department extends its review of project effects to fish and wildlife resources directly dependent on the waterway. Usually, this ends at the top of the stream bank, but it can extend potentially to the 100-year floodplain.

The process established under the Fish and Game Code is different from the permit authority exercised by other state, local and federal agencies. Plans to alter the river require "agreements" rather than "permits". The statute establishes a negotiation process leading to either mutual agreement between the department and the applicant or to binding arbitration. The

Department cannot dictate the terms of a permit, but can propose the terms of an "agreement" or argue its position before a panel of arbitrators jointly established by the Department and the applicant. Because of this structure, the Department takes the position that its review is not subject to CEQA on the grounds that it is a "ministerial" project exempt from review under the Act [14 Cal. Adm. Code sec. 757 (b)(3)]. (An alternative ground for exclusion might be that the 1601-1603 agreements are not "projects" subject to CEQA if they do not constitute a permit or other entitlement for use; see Public Resource Code sec. 21065.)

On the other hand, some aspects of the Stream Alteration process are similar to other permits. The Department must be notified prior to beginning construction. And once an agreement is reached, failure to comply with its terms constitutes a misdemeanor not merely a breach of contract [Fish and Game Code secs. 5650; 12002 (a)(b)]. Though technically the parties are coming to an agreement, the Department's status as steward of the state's fish and wildlife, and its expertise, may make its "proposals" appear to a project proponent as permit conditions rather than proposed terms of an agreement.

1) Decision Criteria--Objectives

The general objective applied by Fish and Game in its review of proposed projects under section 1601 and 1603 is stated in the first standard agreement "recommendation" included in the Fish and Game agreement form. This recommendation requires that disturbance of the stream bottom and vegetation removal be kept to a minimum and for the areas affected to be restored to as near their original condition as possible.

2) Specific Permit Provisions

The following provisions were noted in the standard form employed by the department and in the agreement reached on the Riverview and Sand Cove projects:

- A) Only the minimum amount of vegetation necessary to complete the project shall be removed.
- B) Stripped areas must be restored.
- C) Rock, riprap and other erosion protection materials only where vegetation cannot reasonably be re-established.
- D) No equipment in "live stream channels" is allowed, except that which is necessary for crossings or barriers and fills at channel changes.
- E) Temporary fills must be made of non-erodible material to avoid silt deposits.
- F) Muddy or silt-filled wash water shall not be allowed to enter streams.
- G) Basins for catching silt shall be constructed of gravel to avoid additional silt and shall be removed on completion.
- H) If equipment must be moved across a stream, it must be done without substantially increasing the stream's turbidity.
- I) The "low flow channel" of a stream shall be returned as nearly as possible to its natural state without creating future bank erosion problems.
- J) Structures vulnerable to high seasonal flows shall be moved above high water mark.
- K) To prevent material from entering stream with rainfall or run off waters, excess debris shall be removed from work area.
- L) Native vegetation shall be re-established along the stream side work area.
- M) No work is to occur during the high flow season.
- N) Float line to be used to catch debris removed from stream bank.

b. Vacuum or Suction Dredging Permits

A vacuum or suction dredging permit must be obtained from Fish & Game before any person uses vacuum or suction dredge equipment in any river, stream or lake (Sec. 5653(a), F & G Code). The purpose of this regulation is primarily to control recreational gold dredging with small suction dredges in salmon and trout streams. The department may also designate waters as open areas (dredging permitted) or closed areas (dredging prohibited). The size of the dredging equipment as well as the time of year in which it is used may also be regulated. Presently, no specific regulations exist for vacuum or suction dredges (section 5653(b), F & G Code). An on-site inspection of the dredging may be required if the dredging may potentially interfere with fish and wildlife (Section 5653(c), F & G Code).

Standard Permits are valid only for uses of dredges with intake diameters of 8 inches or less which are used in waters open to dredging. Dredges with wider intake diameters or dredging proposed in closed waters require special permits. The permit shall be issued if the department determines that the dredging will not be deleterious to fish. Fish and Game's CEQA regulations include dredge permits among those listed as "ministerial" and not subject to CEQA requirements. [14 CAC sec. 7579(b)(5)].

The department has established five zones with differing restrictions on the time of year when dredging may occur. One zone prohibits dredging at any time. The Sacramento River is open to dredging throughout the year. The American River is

closed to dredging from the mouth of the river to Nimbus Dam. A permittee cannot operate in any national, state, county or municipal park where another agency prohibits dredging or in violation of any other federal, state or local ordinance. The permit also reminds permittees that disposition in state waters of any substance dangerous to fish is prohibited (Sec. 5653, F & G Code). State Senate Resolution 28 (1982) establishes the goal of increasing California's wetland habitat by fifty percent by the year 2000. Based in part on this resolution, the Department takes the position, when reviewing projects, that there should be no net loss of wetland or riparian vegetation acreage or quality.

c. General Authorities

The Department of Fish and Game, in accordance with general policies set by the Fish and Game Commission, has broad responsibilities concerning the conservation and enhancement of fish and wildlife resources in California. It is responsible for enforcement of an extensive system of regulation concerning hunting and fishing and importing of fish and wildlife species. It operates a number of fish hatcheries and undertakes a limited amount of information gathering and research activities concerning game and non-game species in the State. The department is designated as a "trustee agency" under CEQA and has an opportunity to comment upon proposed negative declarations or draft EIR's. The department also comments upon proposed Corps of Engineers' Section 10 or section 404 permits (described in the Corps of Engineers' section of this report). The department's authority to comment on federal permits or federal water projects is found in the Fish

and Wildlife Coordination Act (see discussion under Corps of Engineers).

d. Fishing Regulations

1) Constitutional Protection

Article 1, Section 25 of the California Constitution guarantees fishing rights to the public. This provision of the constitution requires that any sale of state land which borders on or includes a public body of water contain a reservation of an absolute right to fish. This provision appears to apply to prior sales by the State of swamp and overflow lands bordering on the Sacramento River (although it was only adopted in 1910).

Right of access to the Sacramento River for fishing is not expressly guaranteed by the Constitution. It has been argued that a right of access must be implied to perfect the constitutional right to fish. (16 Davis Law Journal 661, 666 (1983).

2) Fishing Seasons -- Trout and Salmon

Fishing seasons are set by the Fish and Game Commission. On the Sacramento River within the study area, open season for trout and salmon continues throughout the year (14 CAC Secs. 12.03, 12.60). The Department is given a project veto power over certain spawning areas on the Sacramento River in Shasta County. There are no spawning areas designated for protection in Sacramento County (Sec. 1505, F & G Code). On the American River, however, certain stretches of river are protected. From the Hazel Avenue Bridge piers to the U.S. Geological Survey gauging station 300 yards below Nimbus Hatchery fish rack, the river is closed to salmon fishing from April 1 through September 14 (14

Sec. 12.06). For spawning purposes, the American River is closed also between the southwest border of Ancil Hoffmann Park to the Hazel Avenue Bridge below Nimbus Dam from November 1 through December 31 (14 CAC Sec. 12.07).

3) Restrictions on Fishing Hours

In the Valley District which includes both the American and the Sacramento Rivers in the vicinity of Sacramento, all fish except trout and salmon may be taken day or night north of Interstate 80 (which crosses both channels). Except on the American River between Business 80 and Nimbus Dam, all fish may be taken day or night south of Interstate 80 as well. Between Business 80 and Nimbus Dam on the American River fish may be taken only during daylight hours [14 CAC Sec. 3.00 (c)(4), subsections (A), (B), and (C)]

5. Summary of Agency Position

The Department of Fish and Game influences the development of marinas and management of activities in the Sacramento River in a number of ways. The Department must approve a stream alteration "agreement" (similar to, but technically not a permit) for construction activities which substantially change the flow of the river or the river bed or bank. The Department must also issue a permit if any suction dredging is associated with marina construction. Through these authorities the department is able to reduce, though not eliminate, the adverse affects upon water quality and fish habitat which can occur as a result of marina construction. Disturbance of the river bed and banks is to be

minimized and stream side vegetation is generally required to be restored if feasible.

The department also influences marina development indirectly through its comments upon proposed permits and environmental documents prepared by other agencies. Given the department's expertise and statutory responsibilities concerning fish and wildlife protection, its comments carry great weight. Under NEPA and CEQA, such comments must be fully addressed in final environmental documents. The department has commented negatively on some proposed marina developments because of destruction of riparian habitat and inducement of additional growth in riparian areas.

Finally, the Department of Fish and Game and the Fish and Game Commission set and enforce regulations concerning fishing hours and seasons. Fishing is permitted year round for trout and salmon and fishing may occur during daylight or nighttime hours.