How to Estimate Relative Flow Benefits?

1 Select resource assessment variable (e.g. habitat condition or species lifestage)

2 Select flow (or Diversion) location

3 Determine monthly weighting factors (e.g. based on life stage occurrence or no-action hydrology)

4 Estimate magnitude of resource assessment variable as a function of flow (e.g. based on hydraulic geometry, salinity, or temperature calculations)

5 Combine monthly weights and calculated flow function to obtain relative flow benefits matrix for selected assessment variable

Available Methods For Estimating Relative Benefits Of Flow

A. Rivers

1. Unimpaired flows
2. Hydraulic geometry (depth, width, velocity, surface area, volume, residence time)
3. Temperature (release T, equilibrium T, surface area)
4. Fish habitat studies (IFIM, AFRP)
5. Fish life-stage occurrence

B. Delta

1. Historic flows
2. Channel geometry (net & tidal velocity, surface area, volume, residence time)
3. Salinity & Temperature
4. Fish habitat studies (IEP)
5. Fish life-stage occurrence (sampling and salvage records)

TIME VALUE OF WATER
LIST OF LOCATIONS AND KEY RESOURCES

I. BAY/DELTA

- *A. SACRAMENTO RIVER - FREEPORT/HOOD*
- *B. CHIPPS ISLAND - DELTA OUTFLOW*
- *C. SAN JOAQUIN RIVER - VERNALIS*
- *D. SAN JOAQUIN RIVER - STOCKTON*
- *E. EXPORTS*
- *F. HOOD DIVERSIONS*
- *G. DCC-GS-TMS*
- *H. MONTEZUMA SLOUGH*

II. SACRAMENTO DRAINAGE

- *A. UPPER SACRAMENTO RIVER - KESWICK*
- *B. UPPER SACRAMENTO RIVER - RED BLUFF*
- *C. UPPER SACRAMENTO RIVER - CHICO LANDING*
- *D. BATTLE CREEK*
- *E. FEATHER RIVER - ABOVE YUBA*
- *F. YUBA RIVER - BELOW DAGUERE*
- *G. BUTTE CREEK*
- *H. SPRING CREEK*
- *I. STONY CREEK*
- *J. YOLO BYPASS*
- *K. AMERICAN RIVER*

III. SAN JOAQUIN DRAINAGE

- *A. SAN JOAQUIN - VERNALIS*
- *B. MERCED RIVER*
- *C. TOULUMNE RIVER*
- *D. STANISLAUS RIVER*
- *E. MOKELUMNE RIVER*
- *F. CALAVERAS RIVER*

TIME VALUE OF WATER
LIST OF LOCATIONS AND KEY RESOURCES

I. BAY/DELTA

A. SACRAMENTO RIVER - FREEPORT/HOOD

1. CHINOOK SALMON - spring, fall, late fall, and winter runs
2. STEELHEAD
3. AMERICAN SHAD
4. STURGEON
5. STRIPED BASS
6. DELTA SMELT
7. SPLITTAIL
8. PRIMARY PRODUCTIVITY

B. CHIPPS ISLAND - DELTA OUTFLOW

1. CHINOOK SALMON - spring, fall, late fall, and winter runs
2. STEELHEAD
3. AMERICAN SHAD
4. STURGEON
5. STRIPED BASS
6. DELTA SMELT
7. SPLITTAIL
8. PRIMARY PRODUCTIVITY

C. SAN JOAQUIN RIVER - VERNALIS

1. CHINOOK SALMON - fall run
2. STEELHEAD
3. AMERICAN SHAD
4. STURGEON
5. STRIPED BASS
6. DELTA SMELT
7. SPLITTAIL
8. PRIMARY PRODUCTIVITY
9. SALINITY INTRUSION
10. TOXICS DILUTION

D. SAN JOAQUIN RIVER - STOCKTON

1. CHINOOK SALMON - fall run
2. STEELHEAD
3. AMERICAN SHAD
4. STURGEON
5. STRIPED BASS
6. DELTA SMELT
7. SPLITTAIL
8. DISSOLVED OXYGEN

E. SOUTH DELTA EXPORTS

1. CHINOOK SALMON - spring, fall, late fall, and winter runs
2. STEELHEAD
3. AMERICAN SHAD
4. STURGEON
5. STRIPED BASS
6. DELTA SMELT
7. SPLITTAIL
8. PRIMARY PRODUCTIVITY

F. HOOD DIVERSIONS

1. CHINOOK SALMON - spring, fall, late fall, and winter runs
2. STEELHEAD
3. AMERICAN SHAD
4. STURGEON
5. STRIPED BASS
6. DELTA SMELT
7. SPLITTAIL
8. PRIMARY PRODUCTIVITY

G. DCC-GS-TMS

1. CHINOOK SALMON - spring, fall, late fall, and winter runs
2. STEELHEAD
3. AMERICAN SHAD
4. STURGEON
5. STRIPED BASS
6. DELTA SMELT
7. SPLITTAIL
8. PRIMARY PRODUCTIVITY

H. *MONTEZUMA SLOUGH*

1. CHINOOK SALMON - spring, fall, late fall, and winter runs
2. STEELHEAD
3. AMERICAN SHAD
4. STURGEON
5. STRIPED BASS
6. DELTA SMELT
7. SPLITTAIL
8. PRIMARY PRODUCTIVITY
9. WATERFOWL FOOD PRODUCTION

II. SACRAMENTO DRAINAGE

A. *UPPER SACRAMENTO RIVER - KESWICK*

1. CHINOOK SALMON - fall, late fall, and winter runs
2. STEELHEAD

B. *UPPER SACRAMENTO RIVER - RED BLUFF*

1. CHINOOK SALMON - fall, late fall, and winter runs
2. STEELHEAD
3. STURGEON - GREEN & WHITE
4. STRIPED BASS
5. AMERICAN SHAD
6. RIPARIAN/MEANDER BELT FUNCTION

C. *UPPER SACRAMENTO RIVER - CHICO LANDING*

1. CHINOOK SALMON - spring, fall, late fall, and winter runs
2. STEELHEAD
3. STURGEON - GREEN & WHITE
4. STRIPED BASS
5. AMERICAN SHAD
6. SPLITTAIL

D. *BATTLE CREEK*

1. CHINOOK SALMON - spring, fall, late fall, and winter runs
2. STEELHEAD

E. *FEATHER RIVER - ABOVE YUBA*

1. CHINOOK SALMON - spring, fall runs
2. STEELHEAD
3. AMERICAN SHAD
4. SPLITTAIL

F. YUBA RIVER - ABOVE & BELOW DAGUERE

1. CHINOOK SALMON - spring, fall runs
2. STEELHEAD
3. AMERICAN SHAD

G. SUTTER & YOLO BYPASSES

1. CHINOOK SALMON - spring, fall, late fall, and winter runs
2. STEELHEAD
3. SPLITTAIL
4. DELTA SMELT

H. AMERICAN RIVER

1. CHINOOK SALMON - fall run
2. STEELHEAD
3. AMERICAN SHAD

III. SAN JOAQUIN DRAINAGE

A. SAN JOAQUIN - VERNALIS

1. CHINOOK SALMON - fall run
2. AMERICAN SHAD
3. SPLITTAIL
4. RIPARIAN/MEANDER CONDITIONS

B. MERCED RIVER

1. CHINOOK SALMON - fall run

C. TOULUMNE RIVER

1. CHINOOK SALMON - fall run

D. STANISLAUS RIVER

1. CHINOOK SALMON - fall run

E. MOKELUMNE RIVER

1. CHINOOK SALMON - fall run

F. CALAVERAS RIVER

IV. CHINOOK SALMON - winter run

American River Examples

Chinook Salmon and Steelhead Benefits of American River Flow

Basis: American River AFRP Flow Recommendations (Working Paper)

Wet	2500	2500	2500	2500	2500	4500	4500	4500	4500	2500	2500	2500
Normal	2000	2000	2000	2000	2000	3000	3000	3000	3000	2500	2000	1500
Dry	1750	1750	1750	1750	1750	2000	2000	2000	2000	1500	1000	500
Critical	800	1200	1200	1200	1200	1500	1500	1500	500	500	500	500
Weights based on Wet Year AFRP Flows	0.56	0.56	0.56	0.56	0.56	1.00	1.00	1.00	1.00	0.56	0.56	0.56

A. Estimated benefit of flow in each month without weighting between months

Flow (cfs)	October	November	December	January	February	March	April	May	June	July	August	September
5000	110	110	110	110	110	102	102	102	102	110	110	110
4750	109	109	109	109	109	101	101	101	101	109	109	109
4500	108	108	108	108	108	**100**	**100**	**100**	**100**	108	108	108
4250	107	107	107	107	107	98	98	98	98	107	107	107
4000	106	106	106	106	106	95	95	95	95	106	106	106
3750	105	105	105	105	105	90	90	90	90	105	105	105
3500	104	104	104	104	104	85	85	85	85	104	104	104
3250	103	103	103	103	103	80	80	80	80	103	103	103
3000	102	102	102	102	102	**75**	**75**	**75**	**75**	102	102	102
2750	101	101	101	101	101	65	65	65	65	101	101	101
2500	**100**	**100**	**100**	**100**	**100**	60	60	60	60	**100**	**100**	**100**
2250	90	90	90	90	90	55	55	55	55	90	90	95
2000	**75**	**75**	**75**	**75**	**75**	**50**	**50**	**50**	**50**	**75**	**75**	90
1750	**50**	**50**	**50**	**50**	**50**	35	35	35	45	60	70	85
1500	40	40	40	40	40	**25**	**25**	**25**	40	**50**	65	**75**
1250	35	**25**	**25**	**25**	**25**	20	20	20	35	45	60	60
1000	30	20	20	20	20	15	15	15	30	40	**50**	**50**
750	**25**	15	15	15	15	10	10	10	27	35	40	40
500	15	10	10	10	10	5	5	5	**25**	**25**	**25**	**25**
250	5	5	5	5	5	0	0	0	10	10	10	10

Benefits assumed to follow AFRP flow recommendations:

100 AFRP Flow Recommendations for Wet years
75 AFRP Flow Recommendations for Normal years
50 AFRP Flow Recommendations for Dry years
25 AFRP Flow Recommendations for Critical years

Each monthly block of flow requires a volume of 15 TAF (250 cfs * 30 days * 2 AF/dsf). Given an allocation of available water at the beginning of a month, allocate the water to maximize the fishery benefit for the remainder of the months

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Fall Run Chinook	0.75	1.20	0.55	0.35	0.50	0.45	0.65	0.80	0.65	0.00	0.00	0.10
Adult Migration	0.50	0.30	0.10									0.10
Spawning	0.20	0.65	0.15									
Incubation	0.05	0.25	0.30	0.25	0.10	0.05						
Fry Rearing				0.10	0.40	0.40	0.10					
Juvenile Rearing							0.35	0.35	0.30			
Juvenile Migration							0.20	0.45	0.35			
Steelhead	0.18	0.18	0.43	0.83	0.98	1.08	0.88	0.63	0.43	0.08	0.13	0.13
Adult Migration	0.10	0.10	0.15	0.35	0.15	0.05					0.05	0.05
Spawning			0.10	0.25	0.30	0.25	0.10					
Incubation			0.05	0.10	0.25	0.30	0.20	0.10				
Fry Rearing						0.10	0.20	0.35	0.35			
Juvenile Rearing	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Juvenile Migration			0.05	0.05	0.20	0.30	0.30	0.10				

B. Weighted benefit of flow in each month — Sum of monthly weight 8.44

Selected weights:	0.56	0.56	0.56	0.56	0.56	1.00	1.00	1.00	1.00	0.56	0.56	0.56
Flow (cfs)	October	November	December	January	February	March	April	May	June	July	August	September
5000	61.1	61.1	61.1	61.1	61.1	102.0	102.0	102.0	102.0	61.1	61.1	61.1
4750	60.6	60.6	60.6	60.6	60.6	101.0	101.0	101.0	101.0	60.6	60.6	60.6
4500	60.0	60.0	60.0	60.0	60.0	100.0	100.0	100.0	100.0	60.0	60.0	60.0
4250	59.4	59.4	59.4	59.4	59.4	98.0	98.0	98.0	98.0	59.4	59.4	59.4
4000	58.9	58.9	58.9	58.9	58.9	95.0	95.0	95.0	95.0	58.9	58.9	58.9
3750	58.3	58.3	58.3	58.3	58.3	90.0	90.0	90.0	90.0	58.3	58.3	58.3
3500	57.8	57.8	57.8	57.8	57.8	85.0	85.0	85.0	85.0	57.8	57.8	57.8
3250	57.2	57.2	57.2	57.2	57.2	80.0	80.0	80.0	80.0	57.2	57.2	57.2
3000	56.7	56.7	56.7	56.7	56.7	75.0	75.0	75.0	75.0	56.7	56.7	56.7
2750	56.1	56.1	56.1	56.1	56.1	65.0	65.0	65.0	65.0	56.1	56.1	56.1
2500	55.6	55.6	55.6	55.6	55.6	60.0	60.0	60.0	60.0	55.6	55.6	55.6
2250	50.0	50.0	50.0	50.0	50.0	55.0	55.0	55.0	55.0	50.0	50.0	52.8
2000	41.7	41.7	41.7	41.7	41.7	50.0	50.0	50.0	50.0	41.7	41.7	50.0
1750	27.8	27.8	27.8	27.8	27.8	35.0	35.0	35.0	45.0	33.3	38.9	47.2
1500	22.2	22.2	22.2	22.2	22.2	25.0	25.0	25.0	40.0	27.8	36.1	41.7
1250	19.4	13.9	13.9	13.9	13.9	20.0	20.0	20.0	35.0	25.0	33.3	33.3
1000	16.7	11.1	11.1	11.1	11.1	15.0	15.0	15.0	30.0	22.2	27.8	27.8
750	13.9	8.3	8.3	8.3	8.3	10.0	10.0	10.0	27.0	19.4	22.2	22.2
500	8.3	5.6	5.6	5.6	5.6	5.0	5.0	5.0	25.0	13.9	13.9	13.9
250	2.8	2.8	2.8	2.8	2.8	0.0	0.0	0.0	10.0	5.6	5.6	5.6

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C. Weighted incremental benefit of adding 250 cfs in a month

Flow (cfs)	October	November	December	January	February	March	April	May	June	July	August	September
Weights	0.56	0.56	0.56	0.56	0.56	1.00	1.00	1.00	1.00	0.56	0.56	0.56
5000	0.56	0.56	0.56	0.56	0.56	1.00	1.00	1.00	1.00	0.56	0.56	0.56
4750	0.56	0.56	0.56	0.56	0.56	1.00	1.00	1.00	1.00	0.56	0.56	0.56
4500	0.56	0.56	0.56	0.56	0.56	2.00	2.00	2.00	2.00	0.56	0.56	0.56
4250	0.56	0.56	0.56	0.56	0.56	3.00	3.00	3.00	3.00	0.56	0.56	0.56
4000	0.56	0.56	0.56	0.56	0.56	5	5	5	5.00	0.56	0.56	0.56
3750	0.56	0.56	0.56	0.56	0.56	5	5	5	5.00	0.56	0.56	0.56
3500	0.56	0.56	0.56	0.56	0.56	5	5	5	5.00	0.56	0.56	0.56
3250	0.56	0.56	0.56	0.56	0.56	5	5	5	5.00	0.56	0.56	0.56
3000	0.56	0.56	0.56	0.56	0.56	10.00	10.00	10.00	10.00	0.56	0.56	0.56
2750	0.56	0.56	0.56	0.56	0.56	5.00	5.00	5.00	5.00	0.56	0.56	0.56
2500	5.56	5.56	5.56	5.56	5.56	5.00	5.00	5.00	5.00	5.56	5.56	2.78
2250	8.33	8.33	8.33	8.33	8.33	5.00	5.00	5.00	5.00	8.33	8.33	2.78
2000 (Added Flow)	13.89	13.89	13.89	13.89	13.89	15.00	15.00	15.00	5.00	8.33	2.78	2.78
1750	5.56	5.56	5.56	5.56	5.56	10.00	10.00	10.00	5.00	5.56	2.78	5.56
1500	2.78	8.33	8.33	8.33	8.33	5.00	5.00	5.00	5.00	2.78	2.78	8.33
1250	2.78	2.78	2.78	2.78	2.78	5.00	5.00	5.00	5.00	2.78	5.56	5.56
1000	2.78	2.78	2.78	2.78	2.78	5.00	5.00	5.00	3.00	2.78	5.56	5.56
750 (Minimum Flow)	5.56	2.78	2.78	2.78	2.78	5.00	5.00	5.00	2.00	5.56	8.33	8.33
500	5.56	2.78	2.78	2.78	2.78	5.00	5.00	5.00	15.00	8.33	8.33	8.33
250	2.78	2.78	2.78	2.78	2.78	0.00	0.00	0.00	10.00	5.56	5.56	5.56
Blocks Added	47	0	5	5	5	5	6	6	6	0	1	3	5

1 Assume that the minimum instream flow allocation corresponds to the Critical year AFRP flows.
This corresponds to the 25% benefit flow in each month of Table A. This requires about 50 monthly blocks of water (750 TAF).

2 Now suppose that an additional 750 TAF (50 monthly blocks) was allocated for instream flows.
The allocation procedure would add blocks of water with the highest incremental benefits, as shown in Table C.
All blocks with a value of greater than 5 units are added in each month.

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Folsom Reservoir & American River Temperature Effects

Basis: CVPIA No-Action Simulated Folsom Release Temperatures

	October	November	December	January	February	March	April	May	June	July	August	September
Min Release T (F)	53	54.7	46.7	43.3	43.3	48.8	51.3	56.3	57.4	64.9	64.9	65.7
Avg Release T (F)	61.2	58.3	50.8	46.9	48.6	52.6	55.7	57.4	58.2	66.3	66.2	67.2
Max Release T (F)	69	63.1	56.8	52.1	54.3	58	58.2	59	60.4	69.3	71.4	71
Equilibrium T (F)	63.3	52.7	44.9	44.0	51.5	55.4	61.5	67.9	73.3	76.5	75.5	71.4
Potential T Change	2.1	-5.6	-5.9	-2.9	2.9	2.8	5.8	10.5	15.1	10.2	9.3	4.2
Assumed T Benefits	Eggs	Eggs	Eggs	Eggs	Eggs	Eggs	Eggs	Eggs	Rearing	Rearing	Rearing	Rearing
100%	50	50	50	50	50	50	50	50	50	50	50	50
80%	56	56	56	56	56	56	56	56	56	56	56	56
60%	57	57	57	57	57	57	57	57	60	60	60	60
40%	58	58	58	58	58	58	58	58	64	64	64	64
20%	59	59	59	59	59	59	59	59	68	68	68	68
0%	60	60	60	60	60	60	60	60	72	72	72	72
Heat Transfer Rate (K)	107	84	79	87	101	118	132	148	183	169	162	139

American River Temperature at H Street

Basis: Release T + (Equil T-Release T)]* (1 - exp [- K * 0.0081 * 1000 acres / Flow(cfs)])

	October	November	December	January	February	March	April	May	June	July	August	September
Assumed Release T	61.2	58.3	50.8	46.9	48.6	52.6	55.7	57.4	58.2	66.3	66.2	67.2
Flow (cfs)												
5000	61.5	57.6	50.1	46.5	49.0	53.1	56.8	59.6	62.1	68.8	68.3	68.1
4750	61.6	57.6	50.1	46.5	49.1	53.1	56.8	59.7	62.3	68.9	68.4	68.1
4500	61.6	57.6	50.0	46.4	49.1	53.1	56.9	59.8	62.5	69.0	68.6	68.2
4250	61.6	57.5	50.0	46.4	49.1	53.2	57.0	59.9	62.7	69.1	68.7	68.2
4000	61.6	57.5	49.9	46.4	49.1	53.2	57.0	60.1	62.9	69.3	68.8	68.3
3750	61.6	57.4	49.9	46.4	49.2	53.2	57.1	60.2	63.1	69.5	68.9	68.3
3500	61.7	57.3	49.8	46.3	49.2	53.3	57.2	60.4	63.4	69.6	69.1	68.4
3250	61.7	57.3	49.8	46.3	49.2	53.3	57.3	60.6	63.7	69.8	69.3	68.5
3000	61.7	57.2	49.7	46.3	49.3	53.4	57.4	60.8	64.1	70.1	69.5	68.5
2750	61.8	57.1	49.6	46.2	49.3	53.4	57.5	61.1	64.5	70.3	69.7	68.6
2500	61.8	57.0	49.5	46.2	49.4	53.5	57.7	61.4	65.0	70.6	70.0	68.7
2250	61.9	56.9	49.3	46.1	49.5	53.6	57.9	61.7	65.5	71.0	70.3	68.9
2000	61.9	56.7	49.2	46.0	49.6	53.7	58.1	62.1	66.1	71.4	70.7	69.0
1750	62.0	56.5	49.0	45.9	49.7	53.8	58.3	62.6	66.8	71.9	71.1	69.2
1500	62.1	56.3	48.8	45.8	49.8	53.9	58.6	63.2	67.7	72.4	71.6	69.4
1250	62.3	56.0	48.4	45.6	50.0	54.1	59.0	63.9	68.7	73.1	72.2	69.7
1000	62.4	55.6	48.0	45.4	50.2	54.3	59.5	64.7	69.9	73.9	73.0	70.1
750	62.6	55.0	47.4	45.1	50.5	54.6	60.1	65.8	71.2	74.9	73.9	70.5
500	62.9	54.1	46.5	44.7	50.9	55.0	60.8	66.9	72.5	75.8	74.8	71.0
250	63.2	53.1	45.4	44.2	51.4	55.3	61.4	67.8	73.3	76.5	75.5	71.4
Assumed Equilibrium	63.3	52.7	44.9	44.0	51.5	55.4	61.5	67.9	73.3	76.5	75.5	71.4

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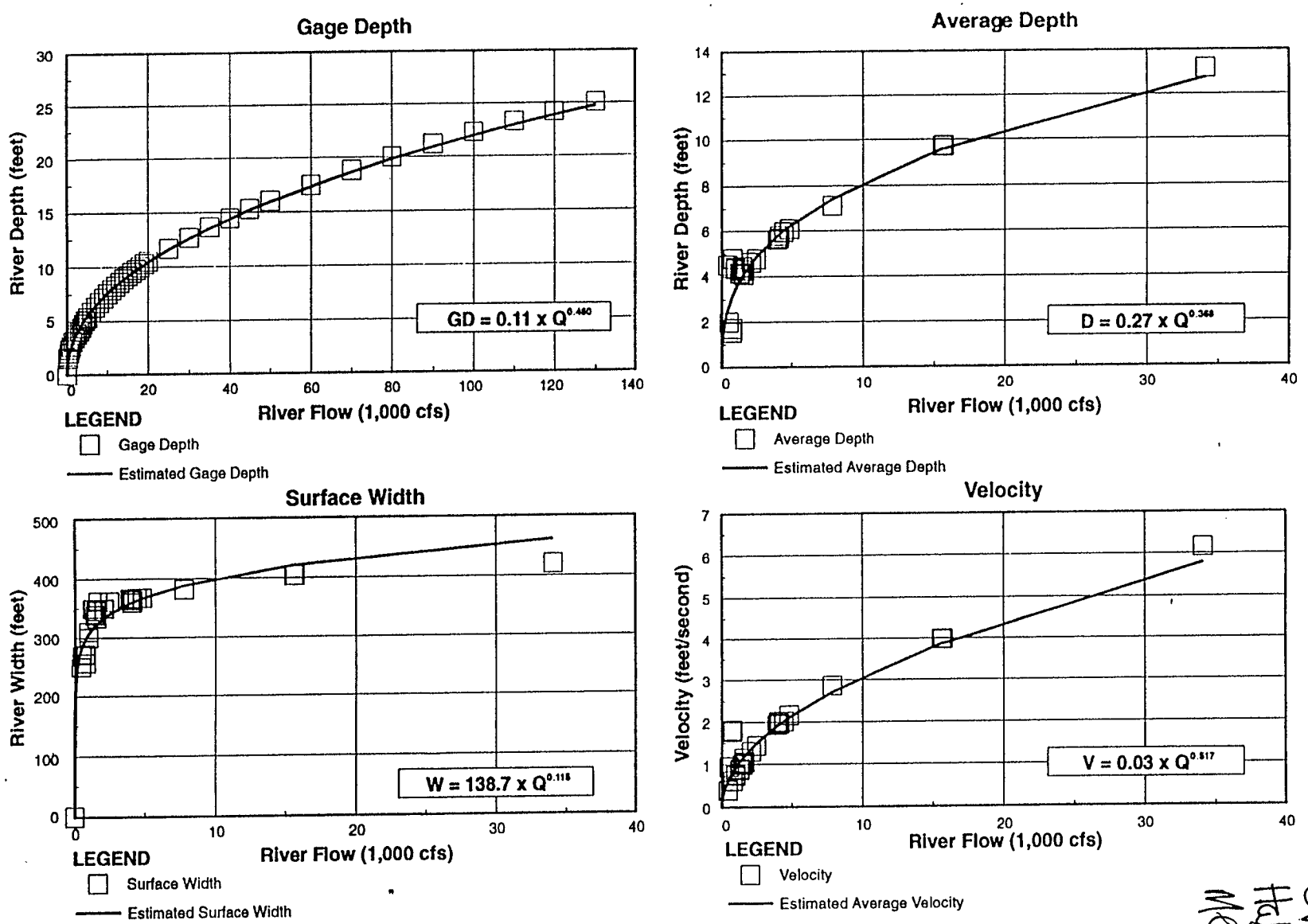

FIGURE II-7
STREAM HYDRAULICS FOR THE AMERICAN RIVER AT FAIR OAKS
(1967-1991 MEAN FLOW = 3,830 cfs)

CONFIDENTIAL
CVPIA PEIS
Habitat Water Quality
Methodology

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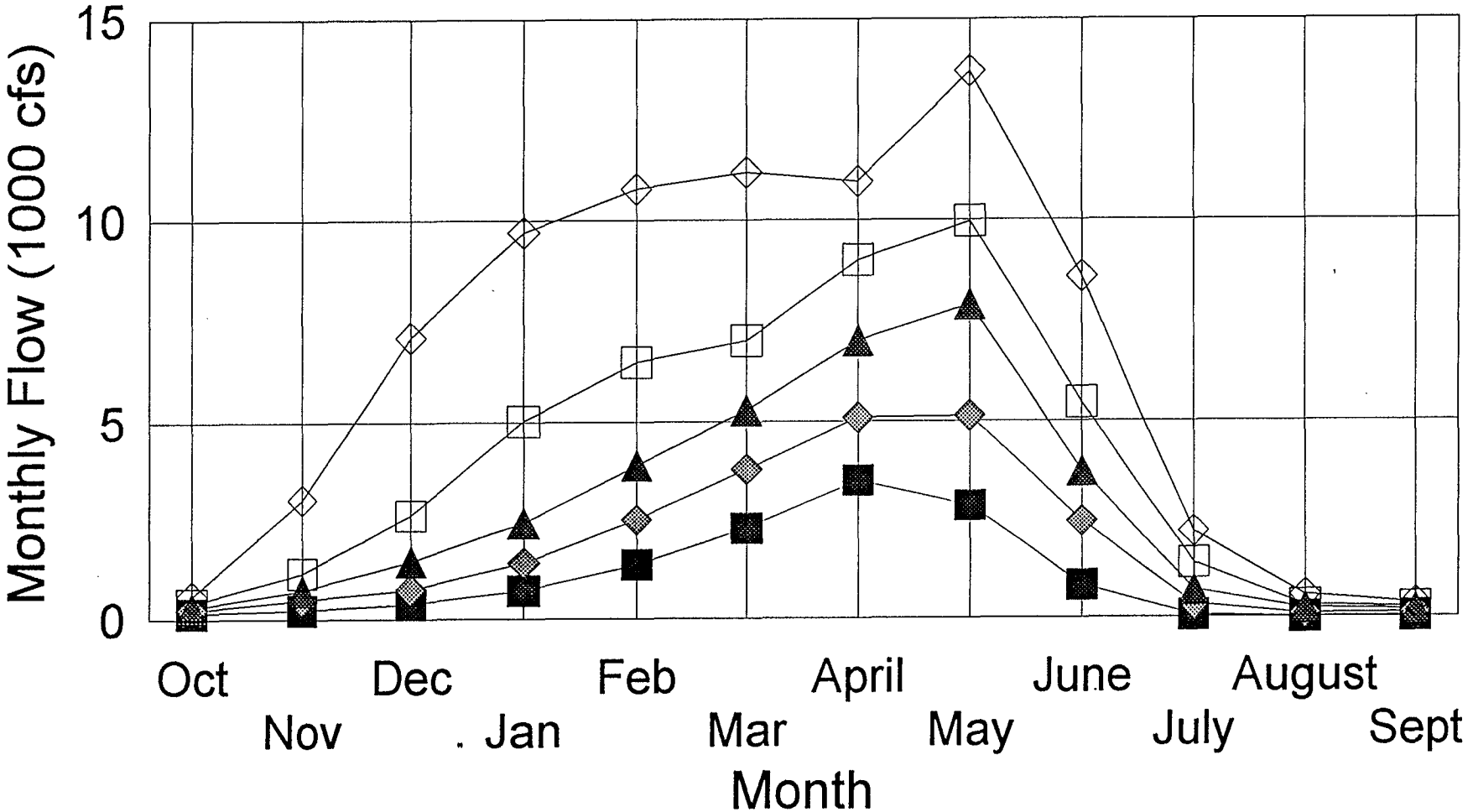
D-025859

American River Unimpaired Flows



■ 10% ◆ 30% ▲ 50% □ 70% ◇ 90%

D-025860
D—025860

Sacramento River Examples

D-025861

Sacramento River Downstream of Chico Landing
Habitat Value for Sacramento Splittail and Chinook Salmon

Monthly Weighting Factors

Chinook Salmon												
fall run	0.0	0.0	0.1	0.2	0.6	1.0	0.7	0.3	0.0	0.0	0.0	0.0
late fall run	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
winter run	1.0	0.9	0.8	0.7	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0
spring run	0	0.32	0.66	1	0.75	0.43	0.27	0.11	0.00	0.00	0.00	0.00
Splittail	0.00	0.00	0.00	0.00	0.29	1	1	0.43	0.14	0.00	0.00	0.00

Flow (cfs)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
90000	100	100	100	100	100	100	100	100	100	100	100	100
88000	98	98	98	98	98	98	98	98	98	98	98	98
86000	96	96	96	96	96	96	96	96	96	96	96	96
84000	94	94	94	94	94	94	94	94	94	94	94	94
82000	92	92	92	92	92	92	92	92	92	92	92	92
80000	90	90	90	90	90	90	90	90	90	90	90	90
78000	88	88	88	88	88	88	88	88	88	88	88	88
76000	86	86	86	86	86	86	86	86	86	86	86	86
74000	84	84	84	84	84	84	84	84	84	84	84	84
72000	82	82	82	82	82	82	82	82	82	82	82	82
70000	80	80	80	80	80	80	80	80	80	80	80	80
68000	78	78	78	78	78	78	78	78	78	78	78	78
66000	76	76	76	76	76	76	76	76	76	76	76	76
64000	73	73	73	73	73	73	73	73	73	73	73	73
62000	71	71	71	71	71	71	71	71	71	71	71	71
60000	69	69	69	69	69	69	69	69	69	69	69	69
58000	67	67	67	67	67	67	67	67	67	67	67	67
56000	64	64	64	64	64	64	64	64	64	64	64	64
54000	62	62	62	62	62	62	62	62	62	62	62	62
52000	59	59	59	59	59	59	59	59	59	59	59	59
50000	57	57	57	57	57	57	57	57	57	57	57	57
48000	54	54	54	54	54	54	54	54	54	54	54	54
46000	52	52	52	52	52	52	52	52	52	52	52	52
44000	49	49	49	49	49	49	49	49	49	49	49	49
42000	46	46	46	46	46	46	46	46	46	46	46	46
40000	43	43	43	43	43	43	43	43	43	43	43	43
38000	40	40	40	40	40	40	40	40	40	40	40	40
36000	37	37	37	37	37	37	37	37	37	37	37	37
34000	34	34	34	34	34	34	34	34	34	34	34	34
32000	31	31	31	31	31	31	31	31	31	31	31	31
30000	27	27	27	27	27	27	27	27	27	27	27	27
28000	24	24	24	24	24	24	24	24	24	24	24	24
26000	19	19	19	19	19	19	19	19	19	19	19	19
24000	15	15	15	15	15	15	15	15	15	15	15	15
22000	9	9	9	9	9	9	9	9	9	9	9	9
20000	0	0	0	0	0	0	0	0	0	0	0	0
18000	0	0	0	0	0	0	0	0	0	0	0	0
16000	0	0	0	0	0	0	0	0	0	0	0	0
14000	0	0	0	0	0	0	0	0	0	0	0	0
12000	0	0	0	0	0	0	0	0	0	0	0	0
10000	0	0	0	0	0	0	0	0	0	0	0	0
8000	0	0	0	0	0	0	0	0	0	0	0	0
6000	0	0	0	0	0	0	0	0	0	0	0	0

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Sacramento River Downstream of Chico Landing
Flow-Temperature-Survival Value for Chinook Salmon

Monthly Weighting Factors

Chinook Salmon												
fall run	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.0	0.5	0.0	0.0	0.0
late fall run	0.9	1.0	0.6	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.0	0.0
winter run	0.1	0.2	0.4	0.5	1.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0
spring run	0.0	0.0	0.0	0.5	0.8	1.0	0.8	0.2	0.0	0.0	0.0	0.0

Flow (cfs)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
56000	100	100	100	100	100	100	100	90	75	0	0	0
54000	100	100	100	100	100	100	100	88	73	0	0	0
52000	100	100	100	100	100	100	100	87	71	0	0	0
50000	100	100	100	100	100	100	100	86	70	0	0	0
48000	100	100	100	100	100	100	100	85	68	0	0	0
46000	100	100	100	100	100	100	100	83	66	0	0	0
44000	100	100	100	100	100	100	100	82	64	0	0	0
42000	100	100	100	100	100	100	100	80	62	0	0	0
40000	97	100	100	100	100	100	100	78	60	0	0	0
38000	96	100	100	100	100	100	100	77	58	0	0	0
36000	94	100	100	100	100	100	100	75	56	0	0	0
34000	93	100	100	100	100	100	100	73	53	0	0	0
32000	91	100	100	100	100	100	100	71	51	0	0	0
30000	89	100	100	100	100	100	100	69	48	0	0	0
28000	87	100	100	100	100	100	100	67	45	0	0	0
26000	85	100	100	100	100	100	100	64	42	0	0	0
24000	83	100	100	100	100	100	98	61	38	0	0	0
22000	81	100	100	100	100	100	95	59	35	0	0	0
20000	78	100	100	100	100	100	92	55	31	0	0	0
18000	75	100	100	100	100	100	88	52	26	0	0	0
16000	72	100	100	100	100	100	84	48	21	0	0	0
14000	68	100	100	100	100	100	80	44	15	0	0	0
12000	64	100	100	100	100	100	75	38	0	0	0	0
10000	59	100	100	100	100	100	69	32	0	0	0	0
8000	52	100	100	100	100	100	61	25	0	0	0	0
6000	44	100	100	100	100	100	52	15	0	0	0	0
4000	33	73	73	73	73	73	39	0	0	0	0	0
2000	14	36	36	36	36	36	16	0	0	0	0	0

D-025863

D—025863

Sacramento River Downstream of Chico Landing
Transport Value for Striped Bass

Striped Bass

Flow (cfs)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	WEIGHTING (Spawn Distr MAY	JUN
40000	0	0	0	0	0	0	0	100	100	0	0	0	0.74	0.26
38000	0	0	0	0	0	0	0	98	98	0	0	0	0.75	0.25
36000	0	0	0	0	0	0	0	95	95	0	0	0	0.76	0.24
34000	0	0	0	0	0	0	0	92	92	0	0	0	0.77	0.23
32000	0	0	0	0	0	0	0	89	89	0	0	0	0.78	0.22
30000	0	0	0	0	0	0	0	86	86	0	0	0	0.8	0.2
28000	0	0	0	0	0	0	0	82	82	0	0	0	0.81	0.19
26000	0	0	0	0	0	0	0	78	78	0	0	0	0.82	0.18
24000	0	0	0	0	0	0	0	74	74	0	0	0	0.83	0.17
22000	0	0	0	0	0	0	0	69	69	0	0	0	0.84	0.16
20000	0	0	0	0	0	0	0	64	64	0	0	0	0.85	0.15
18000	0	0	0	0	0	0	0	59	59	0	0	0	0.86	0.14
16000	0	0	0	0	0	0	0	53	53	0	0	0	0.88	0.12
14000	0	0	0	0	0	0	0	46	46	0	0	0	0.89	0.11
12000	0	0	0	0	0	0	0	38	38	0	0	0	0.9	0.1
10000	0	0	0	0	0	0	0	28	28	0	0	0	0.91	0.09
8000	0	0	0	0	0	0	0	17	17	0	0	0	0.93	0.07
6000	0	0	0	0	0	0	0	1	1	0	0	0	0.94	0.06

D-025864

D-025864

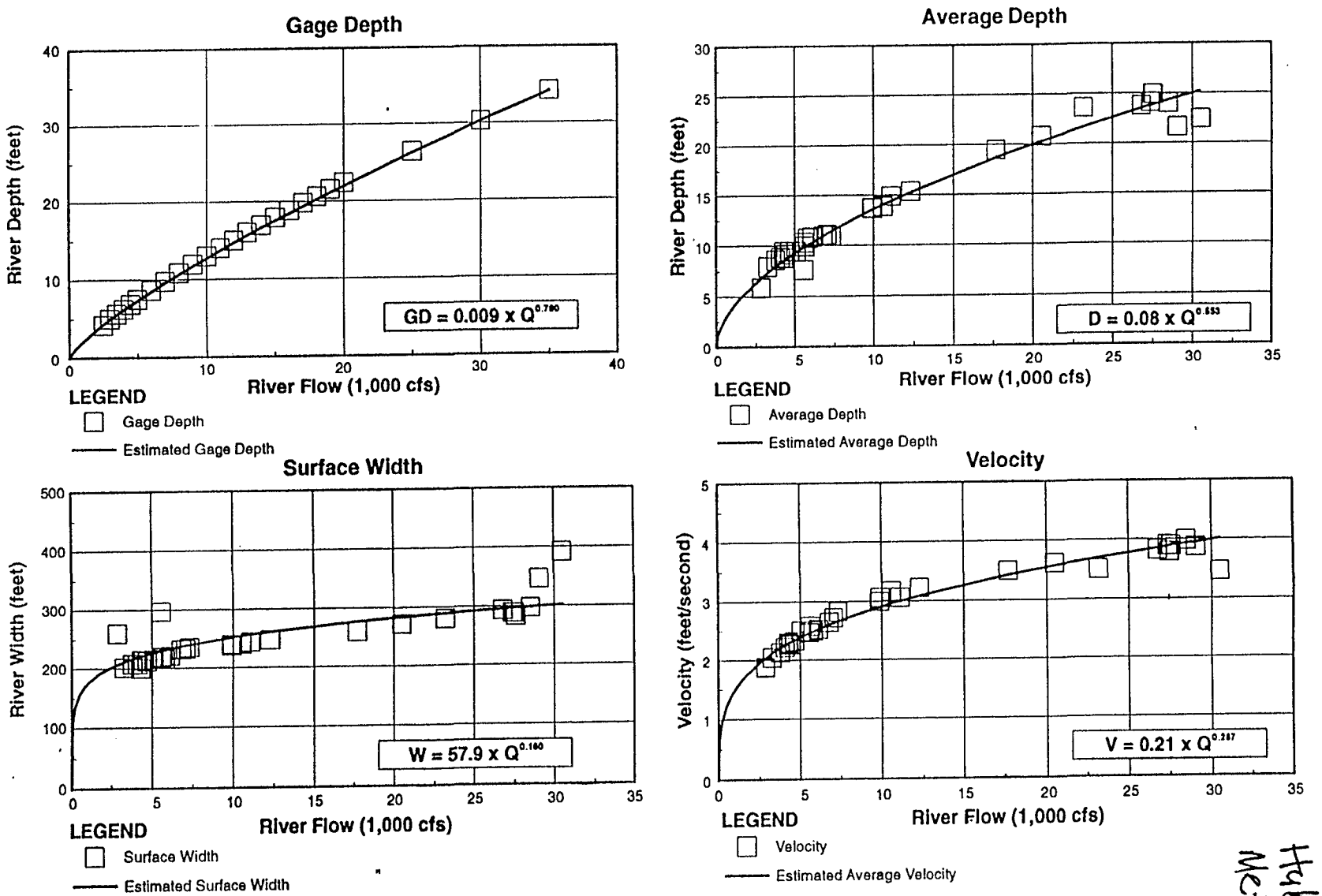

FIGURE II-11
STREAM HYDRAULICS FOR THE SACRAMENTO RIVER BELOW WILKINS SLOUGH NEAR GRIMES (1967-1991 MEAN FLOW = 10,892 cfs)

CONFIDENTIAL
CVPIA-PEIS
Habitat Water Quality
Methodology

D-025865

D—025865

CVPIA No Action
Wilkins Slough

Sacramento River Above Feather River: High flows result in Sutter Bypass Flows

	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	August	Sept
Minimum	3999	3999	4107	5433	5330	4214	3999	3999	3999	3999	3999	3999
	3999	3999	5121	5474	5457	4495	3999	3999	3999	3999	3999	3999
	3999	3999	5194	5948	5595	5232	3999	3999	3999	3999	3999	3999
	3999	3999	5215	5949	5782	5428	3999	3999	3999	4214	3999	3999
	3999	4083	5286	5953	5802	5667	3999	3999	3999	4336	3999	3999
	3999	4219	5433	6072	5802	5801	3999	3999	3999	4731	3999	4042
10%	3999	4243	5598	6452	6320	6187	4024	3999	3999	4999	3999	4214
	3999	4386	5717	6461	7054	6349	4047	3999	3999	5236	3999	4318
	3999	4452	5833	6718	7244	6978	4163	3999	3999	5329	3999	4358
	3999	4473	6106	6859	7514	7380	4285	3999	3999	5398	3999	4514
	3999	4485	6439	7144	8105	7479	4364	3999	3999	5457	3999	4540
	3999	4496	6666	7420	8288	7559	4479	3999	3999	5467	3999	4556
	3999	4999	6691	7733	8335	7745	4486	3999	3999	5589	3999	4560
20%	3999	5078	6840	7775	8926	7897	4528	3999	3999	5611	3999	4956
	3999	5124	6900	7776	9008	8141	4613	3999	3999	5623	3999	4999
	4034	5251	7220	8068	9401	8211	4949	3999	3999	5628	3999	4999
	4060	5590	7373	8247	9556	8434	5010	3999	3999	5698	3999	5033
	4071	5705	7495	8377	9621	8948	5194	3999	4085	5716	3999	5099
	4079	5740	7834	8383	9904	8958	5320	3999	4114	5948	3999	5114
	4263	5965	7867	8574	10823	9068	5406	3999	4115	5968	3999	5180
30%	4369	5969	7979	9218	10855	9123	5599	3999	4172	5979	3999	5189
	4661	6081	8096	9242	10860	9495	5984	3999	4174	5997	3999	5196
	4990	6159	8172	9275	11783	10006	6379	3999	4358	6141	3999	5299
	4999	6210	8249	9380	12410	10252	6606	3999	4359	6169	3999	5427
	5179	6232	8271	9479	12661	10265	6610	3999	4438	6380	4167	5504
	5226	6456	8645	9829	13134	10293	6631	4000	4491	6778	4193	5561
	5379	6589	8930	10030	13492	11142	6653	4487	4605	6780	4680	5578
40%	5474	6746	9110	10374	13583	11299	6836	4490	4689	6797	4705	5582
	5880	6751	9153	10553	13694	12100	6906	4535	4962	6866	4839	5627
	5948	7138	9222	10776	13952	12115	7249	4704	4994	6866	4968	5646
	6103	7138	9510	10891	14776	12721	7609	4780	4999	6943	4972	5657
	6482	7350	9909	10990	15124	12723	7673	4999	4999	6955	4985	5711
	6523	7443	10167	11739	15725	12773	7679	4999	4999	7009	4999	5763
	6532	7510	10296	11874	16270	12845	7754	5147	4999	7011	4999	5891
50%	6549	7596	10446	12072	16828	15012	7895	5220	5034	7067	5014	5897
	6550	7708	10611	12490	17241	15486	7907	5517	5110	7124	5058	5907
	6610	7818	10912	12771	19178	15618	7978	5562	5163	7161	5080	5931
	6726	7883	10955	13771	19808	15671	8116	5897	5175	7212	5203	5999
	6892	7892	11008	13882	19999	15731	8491	6046	5179	7382	5262	6067
	6898	7927	11105	14842	23369	15861	8491	6270	5183	7387	5320	6140
	6933	7938	11145	16219	24633	16206	8532	6524	5186	7411	5462	6161
60%	6991	7996	11499	17150	25060	17030	9161	6551	5528	7514	5891	6192
	7195	8094	13727	17253	26226	17532	9216	6709	5581	7662	6006	6236
	7224	8469	14729	17608	26440	17767	9680	6832	5649	7768	6287	6284
	7291	8649	14943	18156	27220	18154	9702	7125	5652	7821	6531	6367
	7445	8816	14974	18303	27395	18762	10169	7511	5702	8030	6690	6426
	7452	8819	15750	19330	27406	18899	10795	7862	5866	8065	6785	6541
	7499	9484	16015	20171	30414	19736	12324	7924	6222	8167	6793	6568
70%	7609	9495	16801	20626	31158	22499	13165	8130	6432	8204	6823	6804
	7634	9951	16983	23356	33205	22935	13306	8157	6679	8321	7019	6926
	7661	10090	17034	25669	33744	23844	14569	8653	7169	8331	7120	6990
	7719	10219	18715	26921	35043	25682	19379	8870	7263	8521	7339	7142
	7958	10362	18907	26964	35337	25937	20895	9001	7690	8730	7349	7283
	7985	10565	24403	27181	37484	26554	21163	9479	8052	8768	7517	7337
	8018	11795	25605	32479	40103	27649	21372	9664	8738	8841	7668	7359
80%	8080	11878	26555	33702	40777	28125	23221	10192	8755	8866	7808	7591
	8311	12160	31104	36710	41231	28409	23979	12180	8915	8889	8009	7614
	8351	12260	31144	39393	43816	29502	25038	12470	9056	9212	8086	7622
	8386	12568	31290	40520	44160	30279	25111	12504	9150	9257	8284	7677
	8460	12647	34082	40665	44256	36772	25799	12711	9365	9463	8528	7683
	8510	13299	34285	44058	55094	41117	26300	13338	9393	9526	8529	7829
	8639	13823	36067	45607	60026	44898	26789	13880	9414	9632	8595	8048
90%	8649	16803	37504	49008	62295	45815	29823	14371	10154	9806	8621	8061
	8945	16854	39860	57083	68679	46127	30052	15131	10711	10016	8621	8068
	9073	16870	42700	61810	71812	52677	32962	16970	10909	10482	8625	8075
	9247	20024	43082	65358	73288	53470	38254	18129	11587	10504	8927	8413
	9265	29885	44965	74771	80239	53653	47334	18141	13290	10638	9212	8441
	12641	34552	56357	76056	94323	80807	50008	19442	13683	10980	9773	8559
100%	13357	41904	64536	98244	132749	109165	51996	22239	16064	11556	10174	9587

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Delta Outflow Examples

D-025867

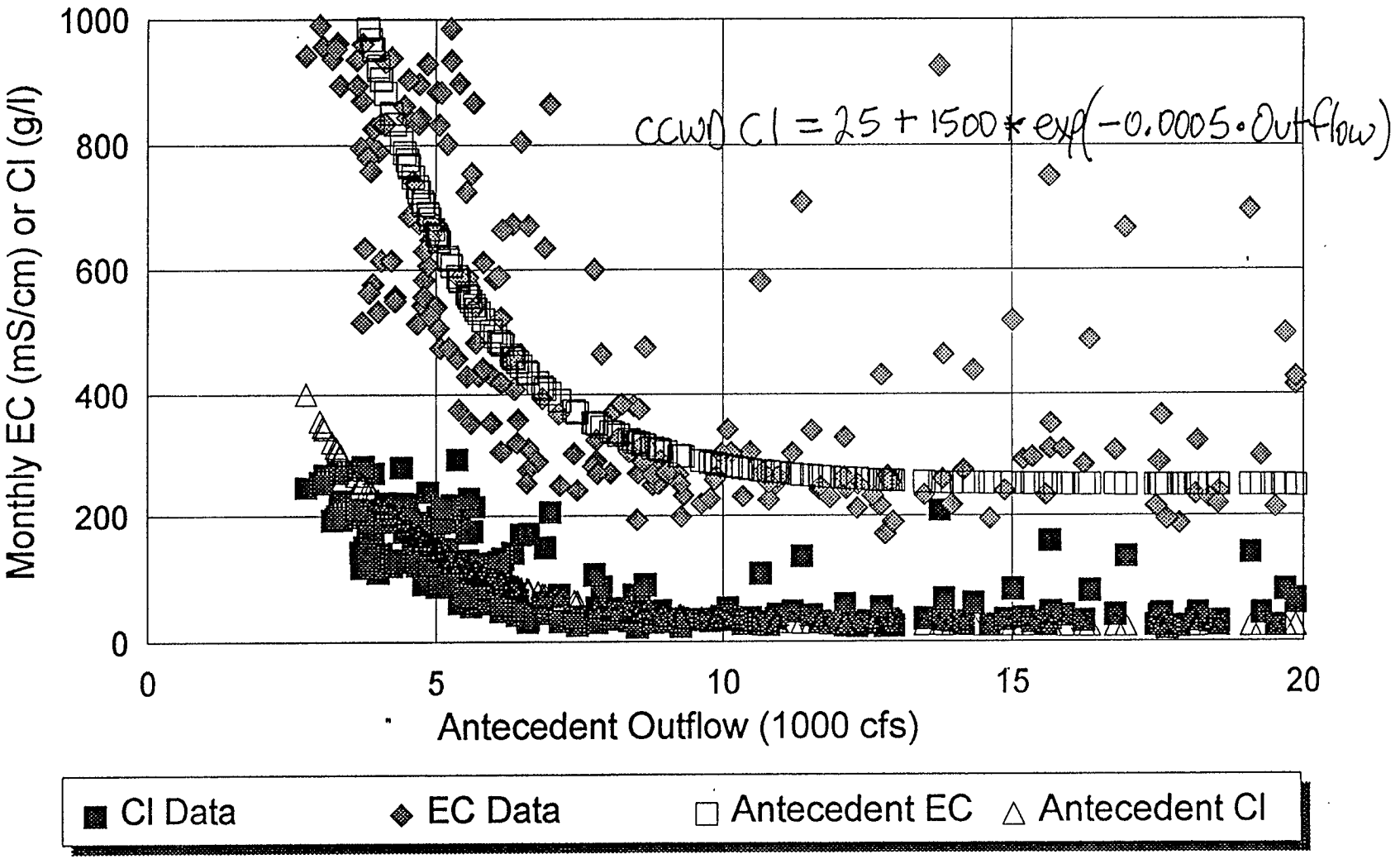
Multiple Effects of Delta Outflow

Outflow (cfs)	Water Supply (TAF)	Export Chloride (mg/l)	Outflow Toxicant (ppb)	Collinsville Chlorophyll (ug/L)	Habitat Upstream of X2 (km2)	Confluence Entrained 10,000 export (%)	Confluence Entrained 5,000 export (%)	Information X2 (km)	Travel Time (days)	Export Ratio 5000
		Good	Good		Good	Good	Good			
20000	1200	0.1	5.0	7.8	83.0	9.6	4.6	68.4	6.9	0.20
19000	1140	0.1	5.3	8.2	81.0	10.2	4.9	69.0	7.2	0.21
18000	1080	0.2	5.6	8.7	79.0	10.8	5.2	69.7	7.6	0.22
17000	1020	0.3	5.9	9.2	77.0	11.5	5.5	70.4	8.1	0.23
16000	960	0.5	6.3	9.7	75.0	12.2	5.8	71.1	8.6	0.24
15000	900	0.8	6.7	10.4	72.5	13.1	6.3	71.8	9.2	0.25
14000	840	1.4	7.1	11.1	70.0	14.1	6.7	72.6	9.8	0.26
13000	780	2.3	7.7	11.9	66.0	15.3	7.3	73.5	10.6	0.28
12000	720	3.7	8.3	13.0	62.0	16.6	7.9	74.4	11.5	0.29
11000	660	6.1	9.1	14.2	60.0	18.2	8.7	75.5	12.5	0.31
10000	600	10.1	10.0	15.6	59.0	20.0	9.6	76.6	13.8	0.33
9000	540	16.7	11.1	17.3	57.5	22.2	10.8	77.8	15.3	0.36
8000	480	27.5	12.5	19.5	55.0	24.8	12.2	79.2	17.2	0.38
7000	420	45.3	14.3	22.3	52.5	28.0	14.1	80.8	19.6	0.42
6000	360	74.7	16.7	26.0	47.0	32.0	16.6	82.6	22.9	0.45
5000	300	123.1	20.0	31.0	41.0	37.0	20.0	84.7	27.5	0.50
4000	240	203.0	25.0	39.0	36.0	43.4	24.8	87.3	34.4	0.56
3000	180	334.7	33.3	52.0	28.0	51.8	32.0	90.7	45.8	0.63
2000	120	551.8	50.0	78.0	16.0	63.0	43.4	95.6	68.8	0.71
1000	60	909.8	100.0	156.0	0.0	78.3	63.0	103.6	137.5	0.83
	Good			Good						

D-025868

D—025868

CCWD EC and Cl and Outflow



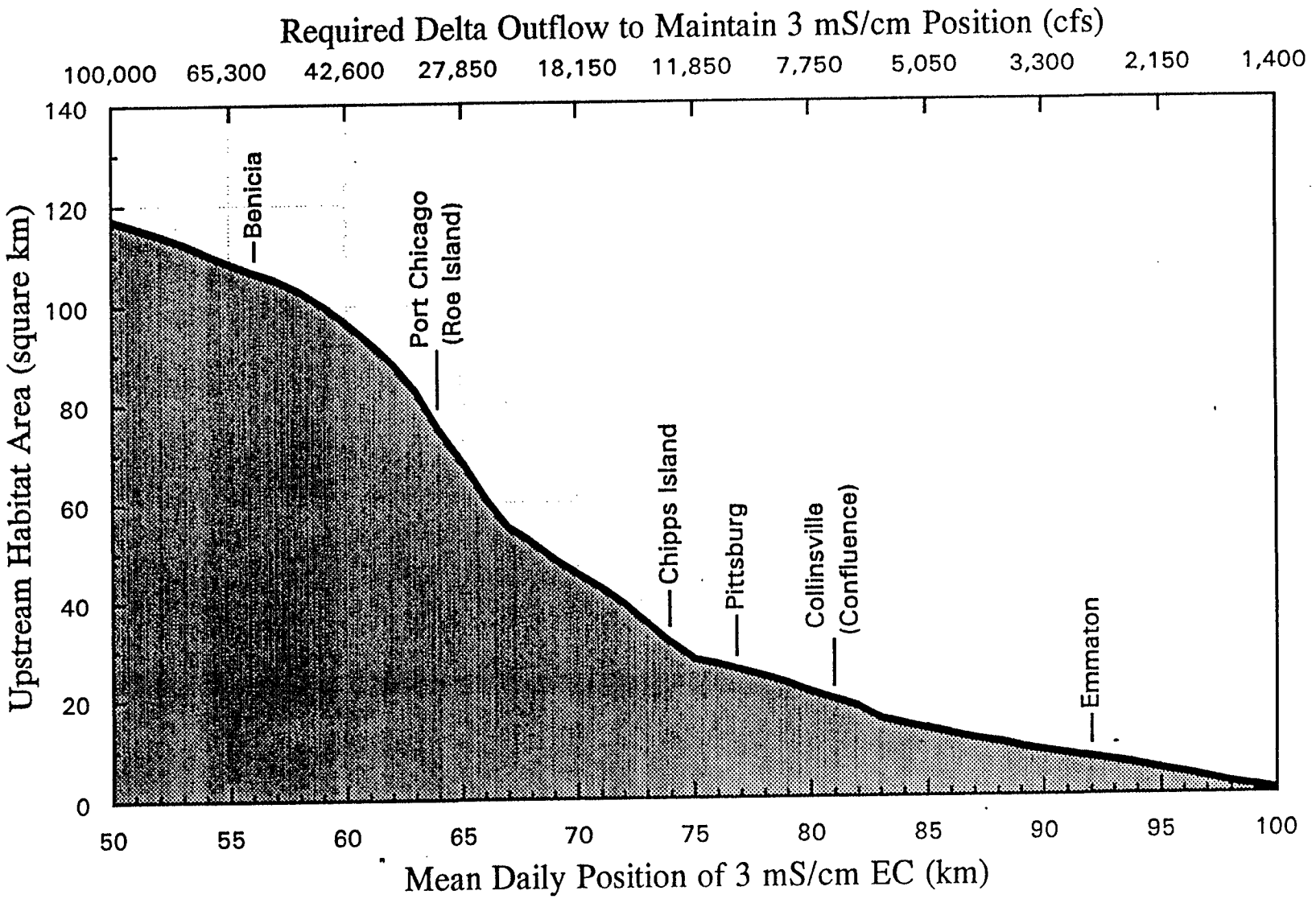
D-025869

D-025869

Estimated Estuarine Habitat Area Upstream of Mean Daily Position of 3 mS/cm EC

Position of 3 mS/cm (km)	Estimated Habitat Width (km)	Estimated Upstream Habitat (km^2)	Estimated Delta Outflow to Maintain Position[1] (cfs)
50	1.50	117.25	100,000
51	1.50	115.75	91,825
52	1.75	114.25	84,319
53	2.00	112.50	77,426
54	2.00	110.50	71,097
55	1.75	108.50	65,285
56	1.50	106.75	59,948
57	2.25	105.25	55,048
58	3.00	103.00	50,548
59	3.50	100.00	46,416
60	4.00	96.50	42,622
61	4.25	92.50	39,137
62	5.50	88.25	35,938
63	8.00	82.75	33,000
64	6.50	74.75	30,303
65	7.25	68.25	27,826
66	6.00	61.00	25,551
67	3.00	55.00	23,462
68	3.50	52.00	21,544
69	3.00	48.50	19,783
70	3.00	45.50	18,166
71	3.25	42.50	16,681
72	4.00	39.25	15,317
73	4.00	35.25	14,065
74	3.50	31.25	12,915
75	1.00	27.75	11,860
76	1.25	26.75	10,890
77	1.25	25.50	10,000
78	1.50	24.25	9,183
79	1.75	22.75	8,432
80	1.50	21.00	7,743
81	1.50	19.50	7,110
82	2.50	18.00	6,529
83	1.00	15.50	5,995
84	1.00	14.50	5,505
85	1.00	13.50	5,055
86	1.00	12.50	4,642
87	0.75	11.50	4,262
88	1.00	10.75	3,914
89	0.75	9.75	3,594
90	0.75	9.00	3,300
91	0.75	8.25	3,030
92	0.75	7.50	2,783
93	0.75	6.75	2,555
94	1.00	6.00	2,346
95	0.75	5.00	2,154
96	1.00	4.25	1,978
97	1.00	3.25	1,817
98	0.75	2.25	1,668
99	0.75	1.50	1,532
100	0.75	0.75	1,407

[1]Using Kimmerer and Monismith Steady State X2 equation.



ESTUARINE HABITAT AREA UPSTREAM OF MEAN DAILY POSITION OF 3 mS/cm EC

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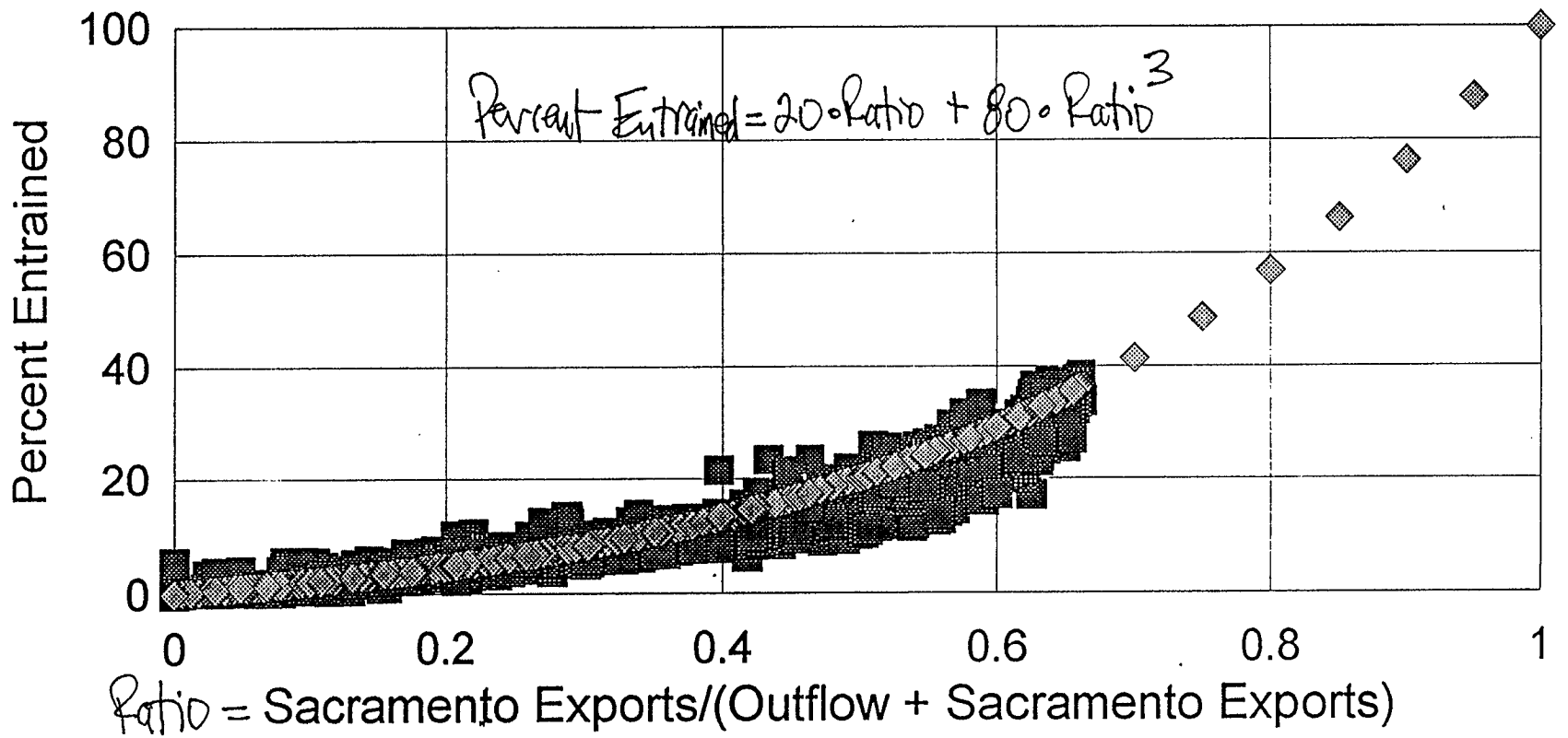
Entrainment of Confluence Water

CVPIA No-Action 1922-1990



Delta Outflow Benefits

Basis: Recommended Delta Outflow for Striped Bass Population of 2 million
Basis: Delta Outflow AFRP REcommendations (Working Paper, May 1995)

Delta Exports Limited to 1,200 cfs

													Approximate Total (TAF)
Wet	11,500	29,500	80,500	100,500	103,000	101,000	96,500	99,500	67,500	27,000	11,000	8,000	44,314
Above	7,500	24,000	36,000	85,500	85,500	89,500	73,000	77,500	44,500	16,000	7,000	6,500	33,288
Below	6,500	13,000	24,500	36,500	57,500	51,000	68,000	65,500	36,000	12,000	6,000	5,500	23,016
Dry	7,500	13,500	19,500	20,000	40,000	50,500	49,500	46,500	24,000	8,500	5,000	4,500	17,412
Critical	7,000	8,000	12,500	18,000	18,000	24,500	25,500	27,000	16,500	6,000	3,500	3,500	10,243

Wet year flows are assumed to provide 100% of the monthly benefits; Above Normal flows are assumed to provide 80%;
Below Normal flows are assumed to provide 60%; Dry year flows are assumed to provide 40%; and Critical year flows provide 20%.

Wet Year Flow Weight	0.11	0.29	0.78	0.98	1.00	0.98	0.94	0.97	0.66	0.26	0.11	0.08

A. Benefit of outflow in each month without weighting between months

Outflow (cf	October	November	December	January	February	March	April	May	June	July	August	September	Outflow (cfs)
100000	100.0	100.0	100.0	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	100.0	100.0	100.0	100.0	100000
95000	100.0	100.0	100.0	95.0	94.0	90.0	96.0	96.0	100.0	100.0	100.0	100.0	95000
90000	100.0	100.0	100.0	90.0	87.0	**80.0**	92.0	92.0	100.0	100.0	100.0	100.0	90000
85000	100.0	100.0	100.0	85.0	**80.0**	78.0	88.0	88.0	100.0	100.0	100.0	100.0	85000
80000	100.0	100.0	**100.0**	**80.0**	75.0	75.0	84.0	84.0	100.0	100.0	100.0	100.0	80000
75000	100.0	100.0	96.0	78.0	70.0	72.0	**80.0**	**80.0**	100.0	100.0	100.0	100.0	75000
70000	100.0	100.0	94.0	76.0	65.0	69.0	70.0	70.0	100.0	100.0	100.0	100.0	70000
65000	100.0	100.0	92.0	74.0	**60.0**	66.0	**60.0**	**60.0**	**100.0**	100.0	100.0	100.0	65000
60000	100.0	100.0	90.0	72.0	56.0	63.0	54.0	55.0	95.0	100.0	100.0	100.0	60000
55000	100.0	100.0	88.0	70.0	52.0	**60.0**	47.0	50.0	90.0	100.0	100.0	100.0	55000
50000	100.0	100.0	86.0	68.0	48.0	**40.0**	**40.0**	45.0	85.0	100.0	100.0	100.0	50000
45000	100.0	100.0	84.0	66.0	44.0	36.0	36.0	**40.0**	**80.0**	100.0	100.0	100.0	45000
40000	100.0	100.0	82.0	63.0	**40.0**	32.0	32.0	35.0	70.0	100.0	100.0	100.0	40000
35000	100.0	100.0	**80.0**	**60.0**	35.0	28.0	28.0	27.0	**60.0**	100.0	100.0	100.0	35000
30000	100.0	**100.0**	70.0	54.0	30.0	24.0	24.0	**20.0**	50.0	**100.0**	100.0	100.0	30000
25000	100.0	**80.0**	**60.0**	47.0	25.0	**20.0**	**20.0**	16.0	**40.0**	90.0	100.0	100.0	25000
20000	100.0	70.0	**40.0**	**40.0**	**20.0**	16.0	16.0	13.0	30.0	**80.0**	100.0	100.0	20000
15000	100.0	**60.0**	**20.0**	**20.0**	15.0	12.0	12.0	10.0	**20.0**	**60.0**	100.0	100.0	15000
10000	**100.0**	**40.0**	13.0	13.0	10.0	8.0	8.0	7.0	14.0	**40.0**	**100.0**	**100.0**	10000
5000	**20.0**	**20.0**	7.0	7.0	5.0	4.0	4.0	4.0	7.0	**20.0**	**40.0**	**40.0**	5000

Each block in this table represents a 300 TAF volume of water.
Therefore, the ability to shift water within this table requires considerable reservoir storage.

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Striped Bass Life Stage Occurance Weights												
Spawn-Sacramento								0.8	0.2			
Spawn-San Joaquin							0.8	0.2				
Salinity Habitat							0.12	0.52	0.34	0.02		
Salvage/Screen	0.01	0.02	0.04	0.01			0.03	0.1	0.44	0.29	0.05	0.01
Sum of Weights	0.01	0.02	0.04	0.01	0	0	0.95	1.62	0.98	0.31	0.05	0.01
Delta Smelt Life Stage Occurance Weights												
Spawning					0.1	0.25	0.35	0.25	0.05			
Salinity Habitat					0.05	0.1	0.2	0.3	0.2	0.1	0.05	
Salvage/Screen		0.01	0.02	0.05	0.06	0.06	0.05	0.08	0.38	0.23	0.04	0.01
Sum of weights	0	0.01	0.02	0.05	0.21	0.41	0.6	0.63	0.63	0.33	0.09	0.01
Longfin Smelt Life Stage Occurance Weights												
Spawning				0.1	0.45	0.35	0.1					
Salinity Habitat				0.04	0.44	0.42	0.09	0.01				
Salvage/Screen		0.06	0.03	0.09	0.04	0.01	0.26	0.35	0.15	0.01		
Sum of weights	0	0.06	0.03	0.23	0.93	0.78	0.45	0.36	0.15	0.01	0	0

B. Benefit of outflow with assumed weighting between months using: Sum of weights for striped bass

Assumed Weights (SB	0.01	0.01	0.02	0.01	0.00	0.00	0.59	1.00	0.60	0.19	0.03	0.01
Outflow (cf	October	November	December	January	February	March	April	May	June	July	August	September
100000	0.6	1.2	2.5	0.6	0.0	0.0	58.6	100.0	60.5	19.1	3.1	0.6
95000	0.6	1.2	2.5	0.6	0.0	0.0	56.3	96.0	60.5	19.1	3.1	0.6
90000	0.6	1.2	2.5	0.6	0.0	0.0	54.0	92.0	60.5	19.1	3.1	0.6
85000	0.6	1.2	2.5	0.5	0.0	0.0	51.6	88.0	60.5	19.1	3.1	0.6
80000	0.6	1.2	2.5	0.5	0.0	0.0	49.3	84.0	60.5	19.1	3.1	0.6
75000	0.6	1.2	2.4	0.5	0.0	0.0	46.9	80.0	60.5	19.1	3.1	0.6
70000	0.6	1.2	2.3	0.5	0.0	0.0	41.0	70.0	60.5	19.1	3.1	0.6
65000	0.6	1.2	2.3	0.5	0.0	0.0	35.2	60.0	60.5	19.1	3.1	0.6
60000	0.6	1.2	2.2	0.4	0.0	0.0	31.7	55.0	57.5	19.1	3.1	0.6
55000	0.6	1.2	2.2	0.4	0.0	0.0	27.6	50.0	54.4	19.1	3.1	0.6
50000	0.6	1.2	2.1	0.4	0.0	0.0	23.5	45.0	51.4	19.1	3.1	0.6
45000	0.6	1.2	2.1	0.4	0.0	0.0	21.1	40.0	48.4	19.1	3.1	0.6
40000	0.6	1.2	2.0	0.4	0.0	0.0	18.8	35.0	42.3	19.1	3.1	0.6
35000	0.6	1.2	2.0	0.4	0.0	0.0	16.4	27.0	36.3	19.1	3.1	0.6
30000	0.6	1.2	1.7	0.3	0.0	0.0	14.1	20.0	30.2	19.1	3.1	0.6
25000	0.6	1.0	1.5	0.3	0.0	0.0	11.7	16.0	24.2	17.2	3.1	0.6
20000	0.6	0.9	1.0	0.2	0.0	0.0	9.4	13.0	18.1	15.3	3.1	0.6
15000	0.6	0.7	0.5	0.1	0.0	0.0	7.0	10.0	12.1	11.5	3.1	0.6
10000	0.6	0.5	0.3	0.1	0.0	0.0	4.7	7.0	8.5	7.7	3.1	0.6
5000	0.1	0.2	0.2	0.0	0.0	0.0	2.3	4.0	4.2	3.8	1.2	0.2

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C. Incremental Benefit of Augmenting Delta Outflow by 5000 cfs in a month

Assumed Weights: (SB Sum)	0.01	0.01	0.02	0.01	0.00	0.00	0.59	1.00	0.60	0.19	0.03	0.01
Outflow(cfs)	October	November	December	January	February	March	April	May	June	July	August	September
100000	0.00	0.00	0.00	0.03	0.00	0.00	2.35	4.00	0.00	0.00	0.00	0.00
95000	0.00	0.00	0.00	0.03	0.00	0.00	2.35	4.00	0.00	0.00	0.00	0.00
90000	0.00	0.00	0.00	0.03	0.00	0.00	2.35	4.00	0.00	0.00	0.00	0.00
85000	0.00	0.00	0.00	0.03	0.00	0.00	2.35	4.00	0.00	0.00	0.00	0.00
80000	0.00	0.00	0.10	0.01	0.00	0.00	2.35	4.00	0.00	0.00	0.00	0.00
75000	0.00	0.00	0.05	0.01	0.00	0.00	5.86	10.00	0.00	0.00	0.00	0.00
70000	0.00	0.00	0.05	0.01	0.00	0.00	5.86	10.00	0.00	0.00	0.00	0.00
65000	0.00	0.00	0.05	0.01	0.00	0.00	3.52	5.00	3.02	0.00	0.00	0.00
60000	0.00	0.00	0.05	0.01	0.00	0.00	4.10	5.00	3.02	0.00	0.00	0.00
55000	0.00	0.00	0.05	0.01	0.00	0.00	4.10	5.00	3.02	0.00	0.00	0.00
50000	0.00	0.00	0.05	0.01	0.00	0.00	2.35	5.00	3.02	0.00	0.00	0.00
45000	0.00	0.00	0.05	0.02	0.00	0.00	2.35	5.00	6.05	0.00	0.00	0.00
40000	0.00	0.00	0.05	0.02	0.00	0.00	2.35	8.00	6.05	0.00	0.00	0.00
35000	0.00	0.00	0.25	0.04	0.00	0.00	2.35	7.00	6.05	0.00	0.00	0.00
30000	0.00	0.25	0.25	0.04	0.00	0.00	2.35	4.00	6.05	1.91	0.00	0.00
25000	0.00	0.12	0.49	0.04	0.00	0.00	2.35	3.00	6.05	1.91	0.00	0.00
20000	0.00	0.12	0.49	0.12	0.00	0.00	2.35	3.00	6.05	3.83	0.00	0.00
15000	0.00	0.25	0.17	0.04	0.00	0.00	2.35	3.00	3.63	3.83	0.00	0.00
10000	0.49	0.25	0.15	0.04	0.00	0.00	2.35	3.00	4.23	3.83	1.85	0.37
5000	0.12	0.25	0.17	0.04	0.00	0.00	2.35	4.00	4.23	3.83	1.23	0.25

The assumed value of incremental flows depends on:
1) the assumed benefits at each flow for each month (Table A)
2) the relative weighting of the months which is dependent on life stage occurance of multiple species (Table B)

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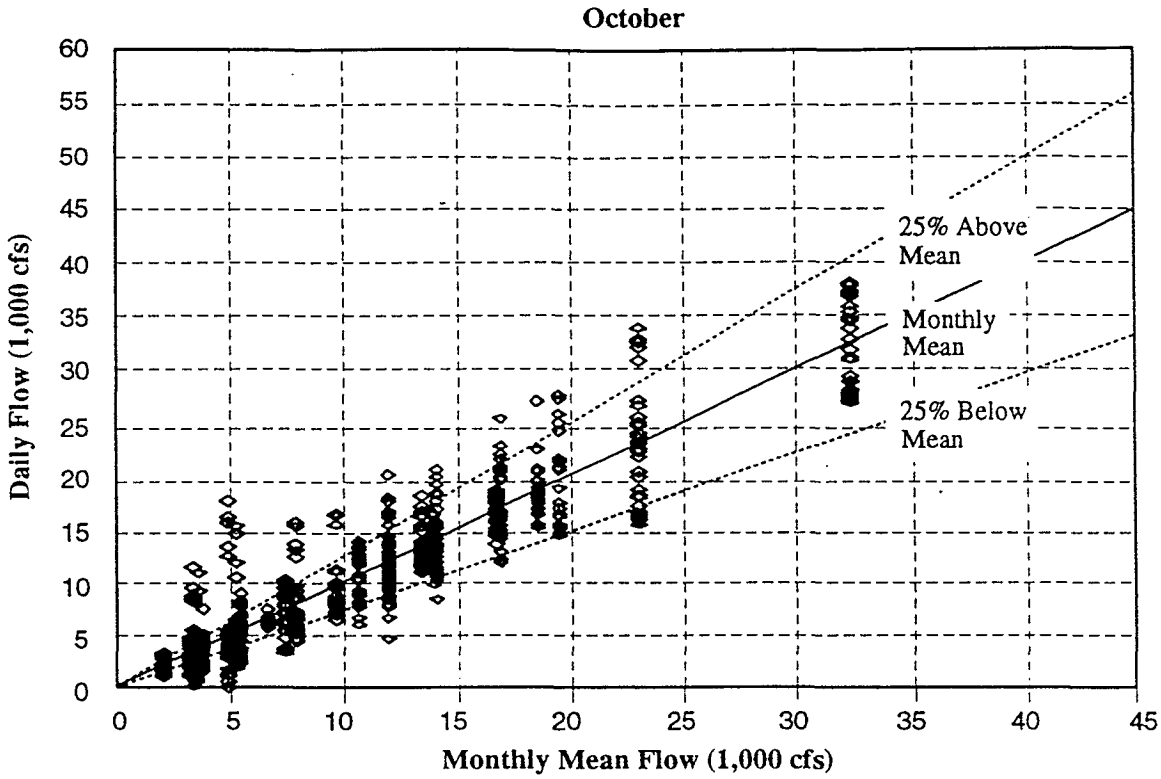
Delta Outflow
Sorted

CVPIA No Action Alternative

	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	August	Sept
Minimum	3708	4010	4817	5333	8237	7445	5913	5248	4000	4001	3415	3029
	3710	4239	4823	5828	8391	7613	6516	5477	4000	4001	3415	3331
	3735	4298	4868	6001	8466	7983	7236	5580	4000	4001	3415	3380
	3950	4504	4955	6132	8468	8657	7579	6238	6117	4001	3415	3390
	4001	4509	5391	6427	8679	8765	7712	6355	6117	4001	3415	3444
	4001	4727	5441	6604	9008	8833	7759	6479	6117	4001	3415	3609
10%	4001	4838	5477	6605	10003	9966	7780	6592	6117	4001	3415	3972
	4001	4865	6006	6684	10096	10061	7844	7463	6189	4993	3567	3984
	4001	4878	6548	6696	10145	10177	8076	7579	6190	4993	3806	4137
	4001	4906	6574	6701	11001	10430	8318	7579	6258	4993	3806	4459
	4001	4959	6592	6832	11400	11177	9377	7579	6287	4993	3806	4635
	4001	5072	6599	7146	11400	11246	9397	7579	6400	4993	3806	4639
	4001	5103	6599	7265	11400	11400	9739	7579	6419	4993	3806	4659
20%	4001	5172	6690	7504	11400	11400	9821	7579	6539	4993	3806	4774
	4001	5272	6744	7597	11400	11826	9861	7579	6630	4993	3806	4815
	4001	5272	6965	7615	11645	13003	10184	7579	6687	4993	3806	4852
	4001	5318	7141	7634	12137	14501	10367	7681	6840	5163	3806	4870
	4042	5397	7161	7693	12142	14538	10374	7752	6840	5235	3806	4911
	4098	5406	7185	7809	12600	14698	10380	7768	6840	5252	3909	4945
	4134	5495	7217	7862	12836	14807	10411	7843	6840	5369	3941	4980
30%	4271	5521	7228	8744	14254	15750	10461	7894	6840	5405	4005	4987
	4291	5569	7233	9261	16869	15755	10461	8262	6897	5434	4112	5074
	4309	5622	7294	9711	17327	16539	10660	8272	6897	5534	4310	5137
	4340	5651	7332	10146	19307	16812	11109	9310	7004	5580	4394	5140
	4351	5742	7360	10318	19759	16860	11220	9430	7078	6227	4860	5231
	4360	5754	7403	11418	21296	17691	11259	9618	7364	6505	6286	5299
	4393	5818	7449	11821	21350	19533	11259	10012	7579	6505	6444	5418
40%	4457	5902	7508	11827	22053	20279	11259	10120	7579	6525	6476	5452
	4470	5903	7534	12079	22274	21174	11400	10368	7579	6727	6510	5552
	4485	6004	7861	13754	22998	21762	12715	10686	7579	7178	6527	5557
	4489	6041	8002	14996	23660	22575	14245	10765	7579	7273	6535	5584
	4525	6141	8282	15708	24404	23017	14626	11020	7579	7393	6661	5589
	4529	6289	8746	17896	26918	25238	15830	11130	8098	7428	6666	5591
	4573	6294	9141	18233	28725	26390	16482	11167	8100	7459	6685	5592
50%	4581	6302	9153	18991	32028	26904	16533	11234	8237	7561	6771	5621
	4601	6772	9262	19169	34021	26904	17203	11334	8318	7590	6824	5636
	4618	6802	9495	19409	35855	28685	17391	11400	8322	7651	6825	5645
	4635	6834	10423	21293	37944	30914	17500	11843	8331	7675	7014	5650
	4637	6851	10428	22733	38007	31681	18263	12281	8594	7685	7049	5655
	4640	6963	10479	22750	42703	32119	18287	13104	8721	8002	7072	5657
	4710	6966	11247	23437	43434	32350	18901	13158	8763	8002	7388	5718
60%	4790	7007	11914	24080	46738	33252	19204	13994	8873	8002	7423	5718
	4824	7015	12749	24181	48454	34478	19432	14423	9135	8002	7428	5747
	4867	7093	13371	26308	53540	36821	21057	15221	9346	8002	7433	5749
	4883	7107	14066	26747	53928	38011	21656	15346	9353	8002	7465	5750
	4922	7122	14348	27322	54410	39532	21860	15535	9580	8002	7500	5781
	4969	7230	16226	27390	54921	41032	22506	16573	9651	8002	7552	5785
	4989	7333	16532	30497	56514	41419	22726	18075	9734	8002	7611	5797
70%	4993	7830	17353	31740	58452	42620	24480	19116	9789	8002	7651	5804
	5093	8033	17681	43636	60471	44228	25608	19508	10335	8002	7685	5806
	5184	8270	19021	45523	64766	46697	30406	20307	10577	8134	7699	5827
	5428	8642	21851	46644	66720	46897	31957	21067	10843	8176	7710	5831
	5480	9531	29299	64311	69730	62906	38256	22034	10970	8454	7714	5838
	5626	9691	31111	68876	74295	64134	39148	25564	13825	8627	7725	5840
	5697	9760	37842	71712	77553	66853	46409	26293	15093	8662	7743	5840
80%	6169	13072	40319	72842	79150	73649	48741	26804	15133	8665	7762	5879
	6503	13573	44510	81482	88306	74665	49423	26866	16063	8678	7773	5916
	6557	14122	50197	82015	90916	80394	51857	28043	16476	8793	7842	5983
	6580	14419	53547	83902	94336	92422	57463	34650	16631	9073	7843	6334
	6627	16072	58337	86767	106973	93075	64311	37509	17649	9108	8117	8204
	6634	16829	62002	96918	122337	93872	64366	39085	22147	9109	8149	8615
	8403	18242	63949	100055	130712	94226	70514	39344	22998	9205	8160	8647
90%	8474	18857	66947	100238	134935	94588	71551	45520	26766	9262	8205	8923
	8546	23268	82510	108875	135086	107372	76241	45562	29852	9343	8232	9205
	9513	39827	83211	116068	141466	110158	82605	55975	35208	9359	8274	9715
	10183	39833	84876	119959	142553	113274	91364	56855	36011	9413	8337	10481
	13331	43088	94056	126631	173080	152073	97134	67368	38528	12265	8616	11416
	16854	50549	95320	165882	185931	177874	101542	72656	40249	16007	9921	15898
100%	23820	83133	154443	206675	243886	264903	144893	80593	68211	27726	15795	17355

30



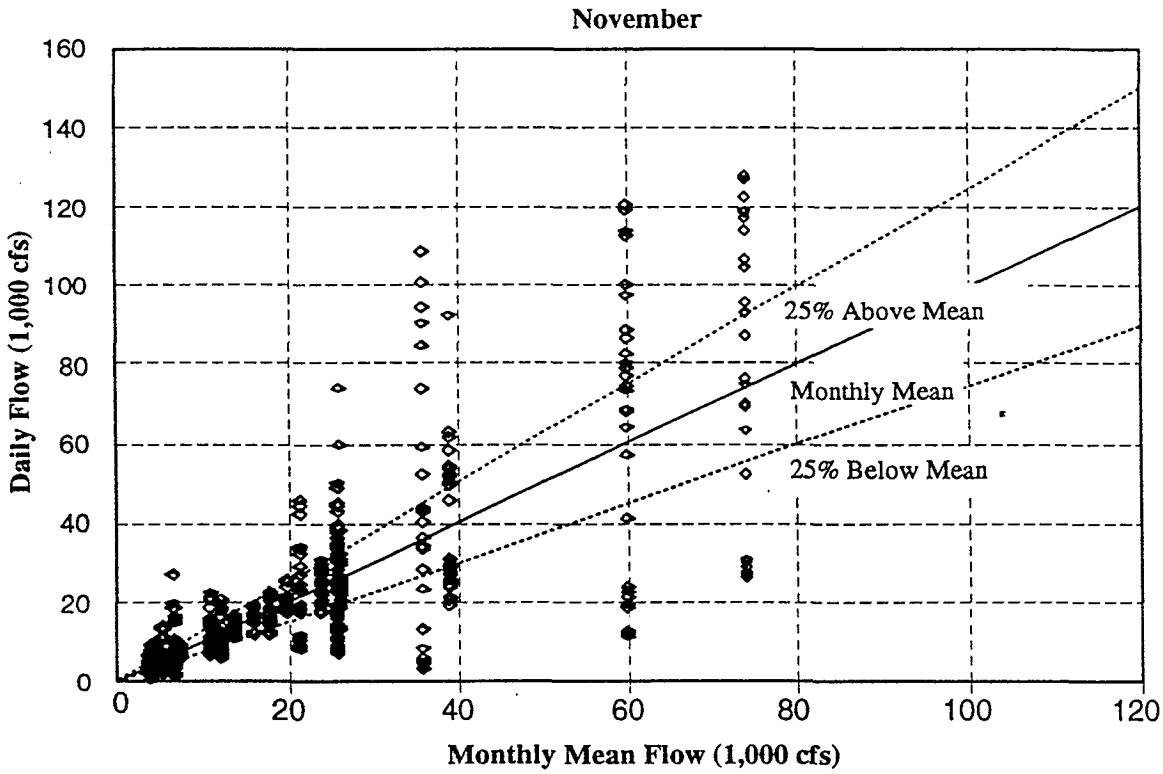


Figure A4-9.
Daily versus Mean Monthly Delta Outflow

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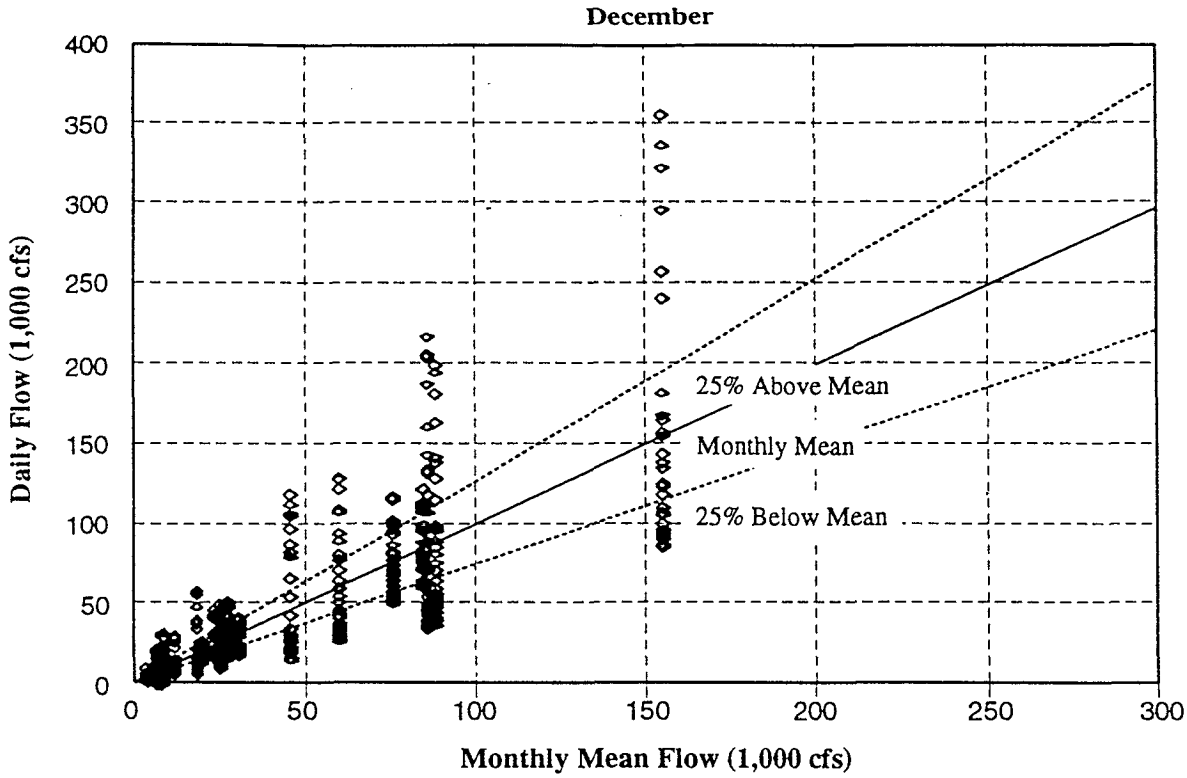

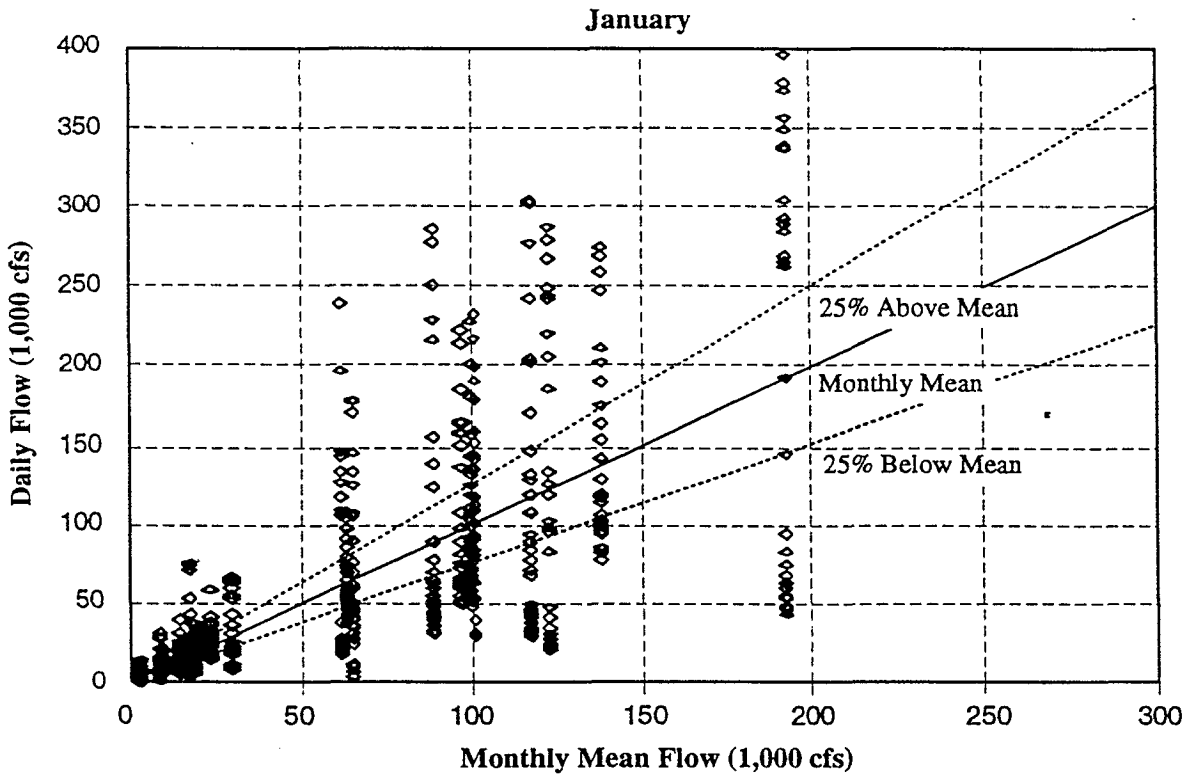

Figure A4-9.
Continued

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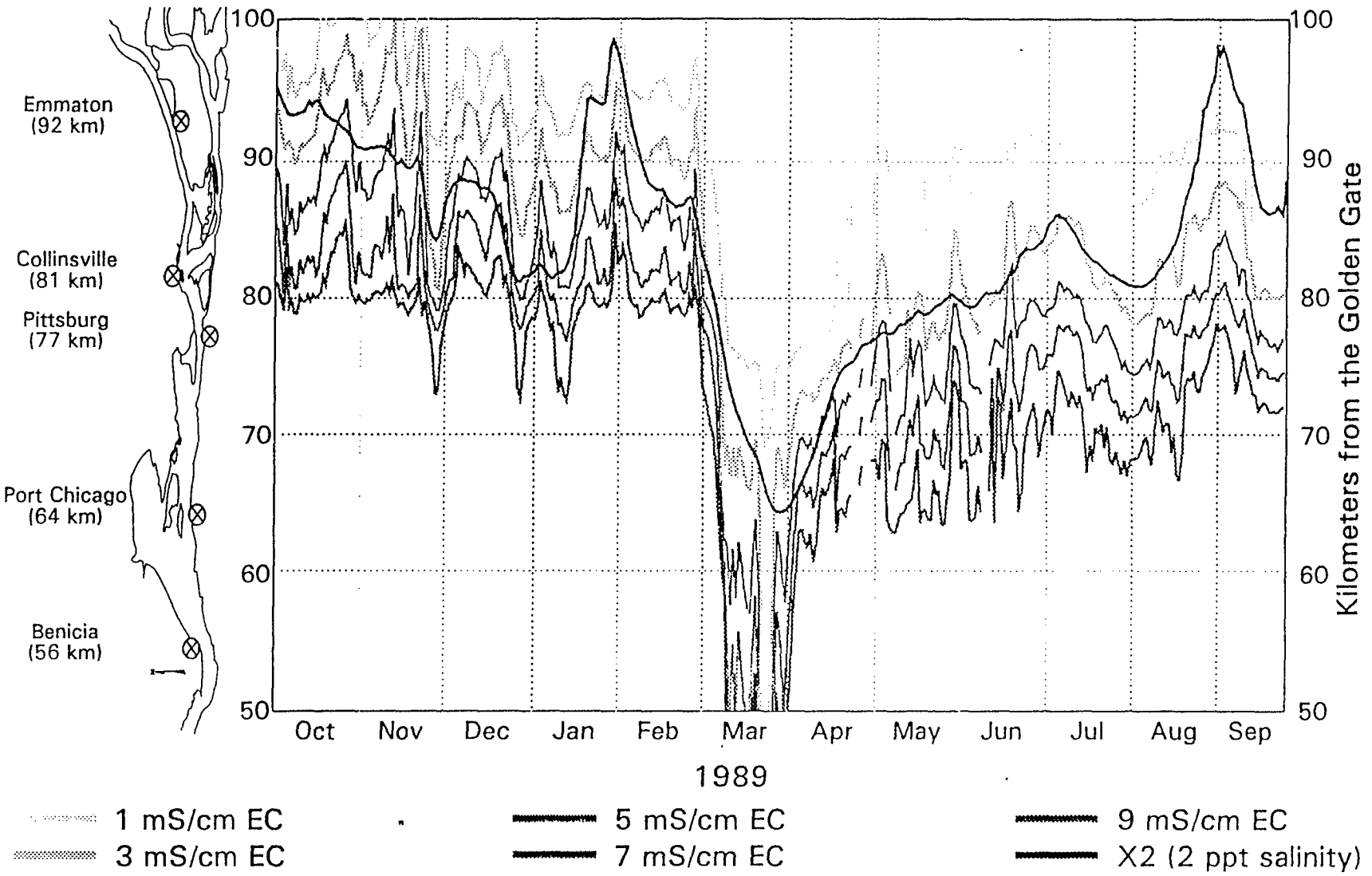

LOCATION OF SALINITY GRADIENT INTERPOLATED FROM DAILY AVERAGE EC MEASUREMENTS AND ESTIMATED X2 POSITION FOR 1989
FIGURE 89B

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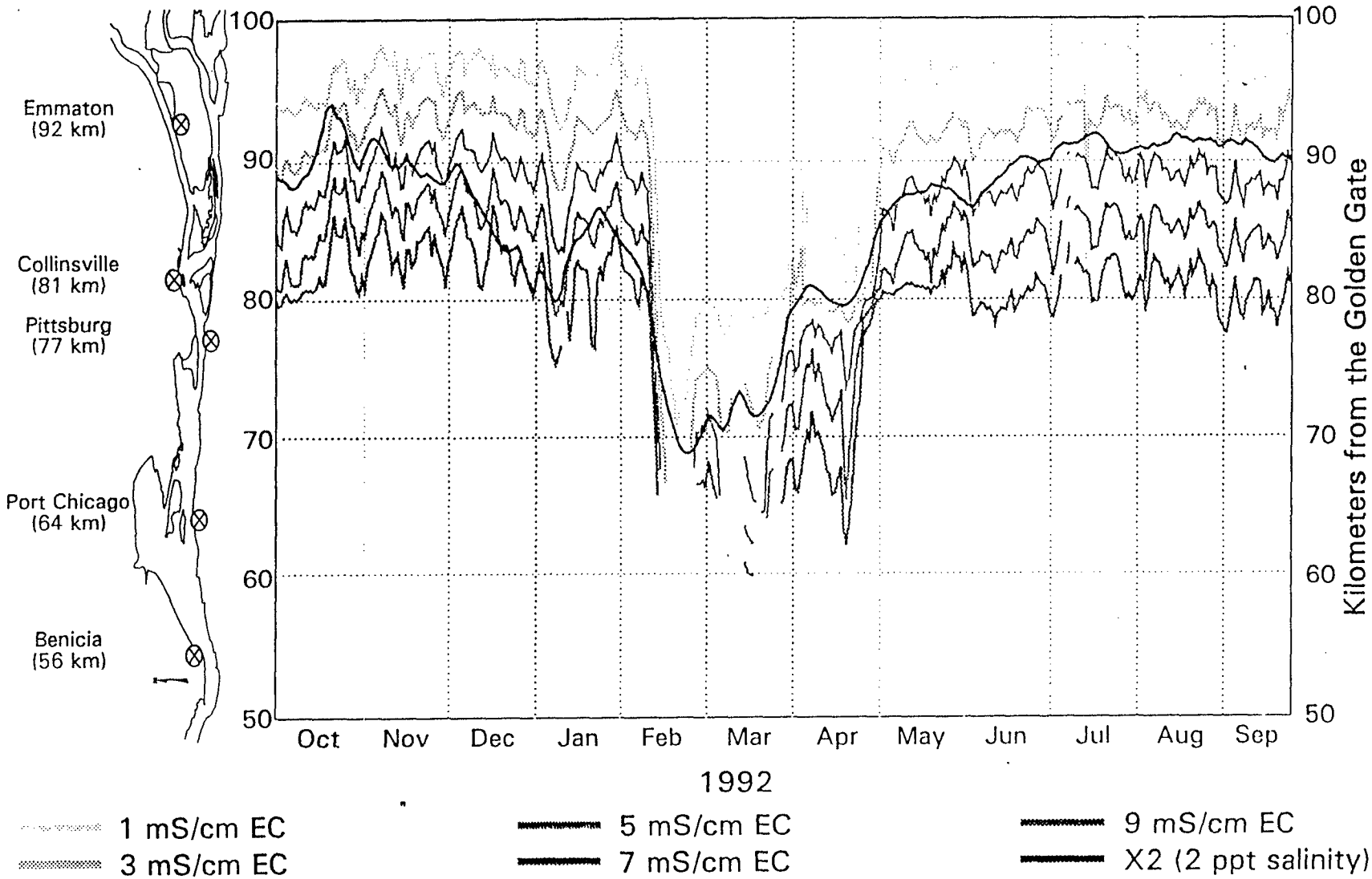

LOCATION OF SALINITY GRADIENT INTERPOLATED FROM DAILY AVERAGE EC MEASUREMENTS AND ESTIMATED X2 POSITION FOR 1992
FIGURE 92B

D—025880

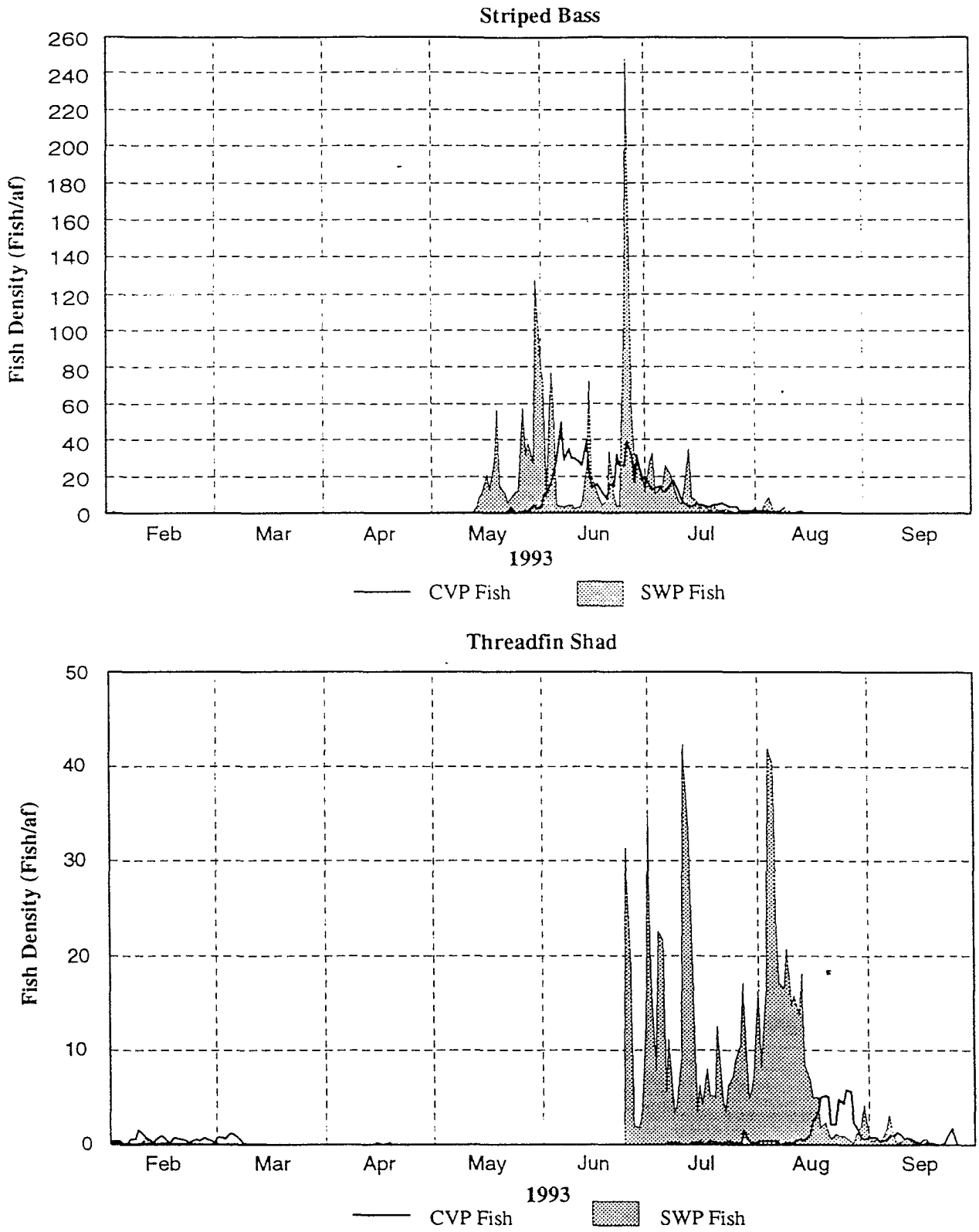

Figure A4-10.
Daily Estimates of Fish Density Obtained from SWP Banks and CVP Tracy Salvage Records for February-September 1993

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