

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY  
REGIONAL WATER QUALITY CONTROL BOARD  
CENTRAL VALLEY REGION

Amendments to the Water Quality Control Plan  
For the Sacramento River and  
San Joaquin River Basins

For

The Control of Diazinon and Chlorpyrifos  
Runoff into the Sacramento-San Joaquin Delta

*June 2006 Final Staff Report*

**Appendix A**

**Waterways of the Sacramento-San Joaquin  
Delta**

This Appendix lists the Sacramento-San Joaquin Delta Waterways (Delta Waterways)(1) to which the site-specific diazinon and chlorpyrifos water quality objectives and implementation and monitoring provisions apply. The following are distinct, readily identifiable waterbodies within the boundaries of the “Legal” Delta that are hydrologically connected by surface water flows (not including pumping) to the Sacramento and/or San Joaquin rivers. Figures A-1 and A-2 show the locations of the Delta Waterways.

- |     |  |     |                                       |
|-----|--|-----|---------------------------------------|
| 1.  | Alamo Creek                              | 37. | Elkhorn Slough                        |
| 2.  | Babel Slough                             | 38. | Emerson Slough                        |
| 3.  | Barker Slough                            | 39. | Empire Cut                            |
| 4.  | Bear Creek                               | 40. | Fabian and Bell Canal                 |
| 5.  | Bear Slough                              | 41. | False River                           |
| 6.  | Beaver Slough                            | 42. | Fisherman's Cut                       |
| 7.  | Big Break                                | 43. | Fivemile creek                        |
| 8.  | Bishop Cut                               | 44. | Fivemile Slough                       |
| 9.  | Black Slough                             | 45. | Fourteenmile Slough                   |
| 10. | Broad Slough                             | 46. | Franks Tract                          |
| 11. | Brushy Creek                             | 47. | French Camp Slough                    |
| 12. | Burns Cutoff                             | 48. | Georgiana Slough                      |
| 13. | Cabin Slough                             | 49. | Grant Line Canal                      |
| 14. | Cache Slough                             | 50. | Grizzly Slough                        |
| 15. | Calaveras River                          | 51. | Haas Slough                           |
| 16. | Calhoun Cut                              | 52. | Hastings Cut                          |
| 17. | Clifton Court Forebay                    | 53. | Highline Canal                        |
| 18. | Columbia Cut                             | 54. | Hog Slough                            |
| 19. | Connection Slough                        | 55. | Holland Cut                           |
| 20. | Cosumnes River                           | 56. | Honker Cut                            |
| 21. | Crocker Cut                              | 57. | Horseshoe Bend                        |
| 22. | Dead Dog Slough                          | 58. | Indian Slough                         |
| 23. | Dead Horse Cut                           | 59. | Italian Slough                        |
| 24. | Deer Creek<br>(Tributary to Marsh Creek) | 60. | Jackson Slough                        |
| 25. | Delta Cross Channel                      | 61. | Kellogg Creek                         |
| 26. | Deuel Drain                              | 62. | Latham Slough                         |
| 27. | Disappointment Slough                    | 63. | Liberty Cut                           |
| 28. | Discovery Bay                            | 64. | Lindsey Slough                        |
| 29. | Donlon Island                            | 65. | Little Connection Slough              |
| 30. | Doughty Cut                              | 66. | Little Franks Tract                   |
| 31. | Dredger Cut                              | 67. | Little Mandeville Cut                 |
| 32. | Dry Creek<br>(Marsh Creek tributary)     | 68. | Little Potato Slough                  |
| 33. | Dry Creek<br>(Mokelumne River tributary) | 69. | Little Venice Island                  |
| 34. | Duck Slough                              | 70. | Livermore Yacht Club                  |
| 35. | Dutch Slough                             | 71. | Lookout Slough                        |
| 36. | Elk Slough                               | 72. | Lost Slough                           |
|     |  | 73. | Main Canal<br>(Duck Slough tributary) |

74.	Main Canal (Indian Slough tributary)	117.	Sutter Slough
75.	Marsh Creek	118.	Sweany Creek
76.	Mayberry Cut	119.	Sycamore Slough
77.	Mayberry Slough	120.	Taylor Slough (Elkhorn Slough tributary)
78.	Middle River	121.	Taylor Slough (near Franks Tract)
79.	Mildred Island	122.	Telephone Cut
80.	Miner Slough	123.	The Big Ditch
81.	Mokelumne River	124.	The Meadows Slough
82.	Mormon Slough	125.	Three River Reach
83.	Morrison Creek	126.	Threemile Slough
84.	Mosher Slough	127.	Toe Drain
85.	Mountain House Creek	128.	Tom Paine Slough
86.	North Canal	129.	Tomato Slough
87.	North Fork Mokelumne River	130.	Trapper Slough
88.	North Victoria Canal	131.	Turner Cut
89.	Old River	132.	Ulatis Creek
90.	Paradise Cut	133.	Upland Canal (Sycamore Slough Tributary)
91.	Piper Slough	134.	Victoria Canal
92.	Pixley Slough	135.	Walker Slough
93.	Potato Slough	136.	Walthall Slough
94.	Prospect Slough	137.	Washington Cut
95.	Red Bridge Slough	138.	Werner Dredger Cut
96.	Rhode Island	139.	West Canal
97.	Rock Slough	140.	Whiskey Slough
98.	Sacramento Deep Water Channel	141.	White Slough
99.	Sacramento River	142.	Winchester Lake
100.	Salmon Slough	143.	Woodward Canal
101.	San Joaquin River	144.	Wright Cut
102.	Sand Creek	145.	Yosemite Lake
103.	Sand Mound Slough	146.	Yolo Bypass (not labeled)(2)
104.	Santa Fe Cut		
105.	Sevenmile Slough		
106.	Shag Slough		
107.	Sheep Slough		
108.	Sherman Lake		
109.	Short Slough		
110.	Smith Canal		
111.	Snodgrass Slough		
112.	South Fork Mokelumne River		
113.	Steamboat Slough		
114.	Stockton Deep Water Channel		
115.	Stone Lakes		
116.	Sugar Cut		

*Footnotes:*

*(1) The Delta Waterways include only those reaches that are located within the "Legal" Delta, as defined in Section 12220 of the California Water Code.*

*(2) When flooded, the entire Yolo Bypass is a Delta Waterway. When the Yolo Bypass is not flooded, the Toe Drain is the only Delta Waterway within the Yolo Bypass.*

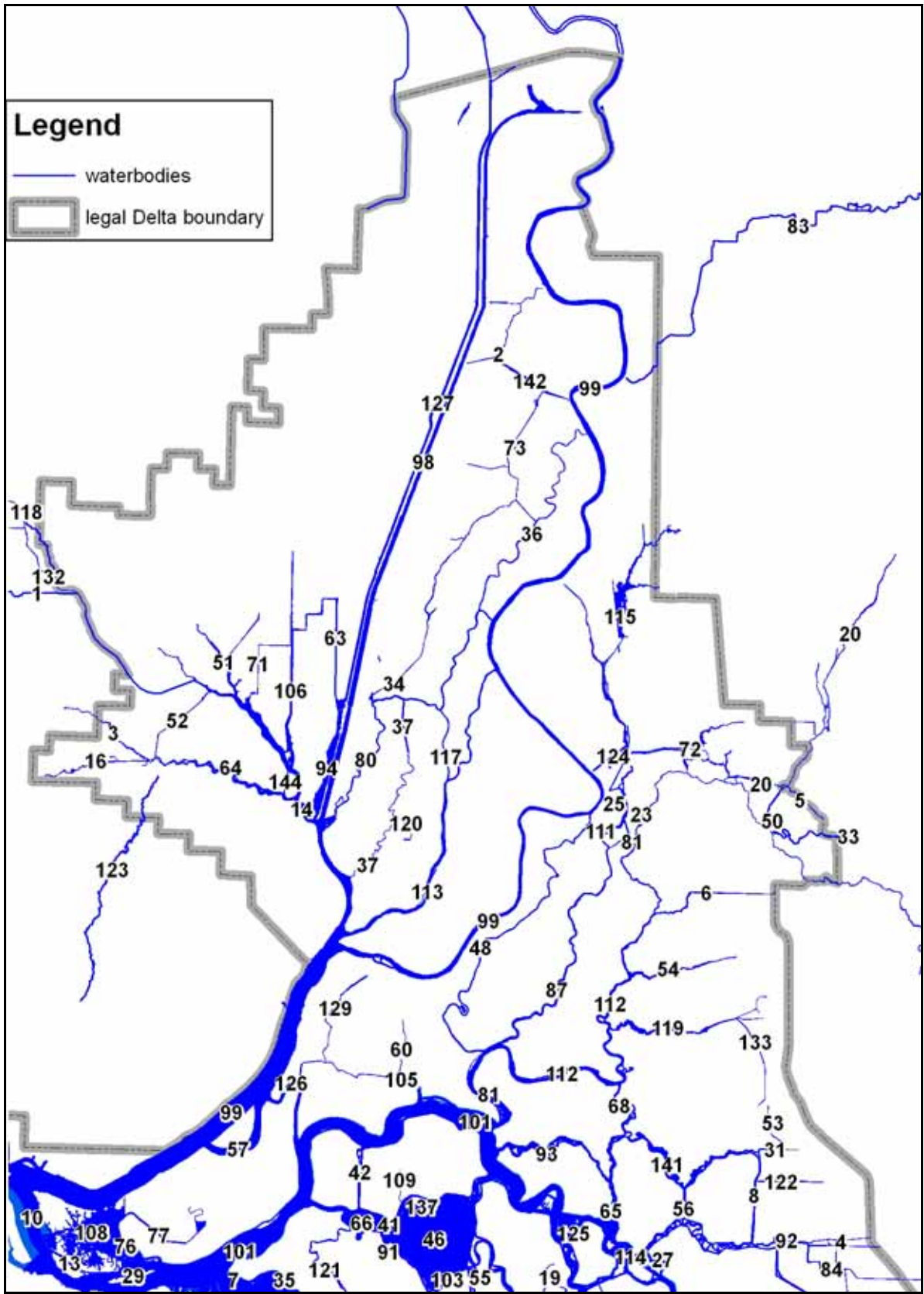


Figure A-1. Delta Waterways (Northern Panel)

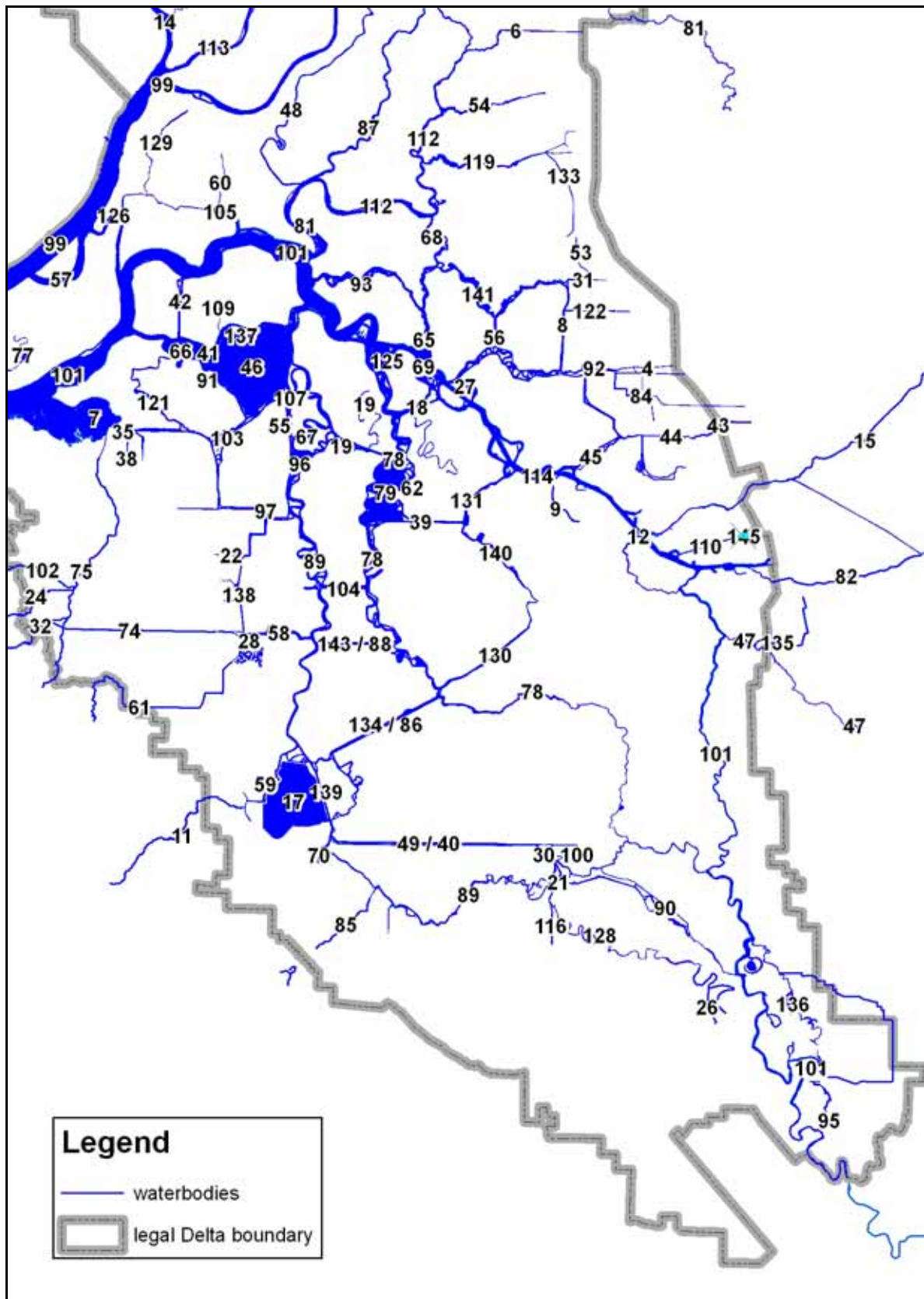


Figure A-2. Delta Waterways (Southern Panel)

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**Appendix B**

**Summary of Water Quality Monitoring  
Programs, Studies, and Databases Used as  
Sources of Delta and Delta Tributary Diazinon  
and Chlorpyrifos Concentration Data**

## INTRODUCTION

This appendix summarizes the sources of water quality data used in this report. The table summarizes the data sources in chronological order of when sample collection started, and is followed by the list of full citations in alphabetical order.

<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
MacCoy et al., 1995	USGS	Dissolved Pesticide Data for the San Joaquin River at Vernalis and the Sacramento River at Sacramento, California, 1991-1994. USGS Open File Report 95-110	Jan 1991 – April 1994	Samples collected approximately 3 times per week, year round	San Joaquin River at Vernalis, Sacramento River at Sacramento
Foe, 1995	CRWQCB-CVR	Insecticide concentrations and invertebrate bioassay mortality in agricultural return water from the San Joaquin basin	Feb 1991 – June 1992		San Joaquin River nr Vernalis



Reference Citation	Agency	Title	Monitoring Time Period	Sample Frequency and Timing	Monitoring Sites in the Delta Watershed
Ross et al., 1996 ; Ross et al., 1999	DPR	Distribution and mass loading of insecticides in the San Joaquin River, California: spring 1991 and 1992. DPR report EH 99-01 Distribution and mass loading of insecticides in the San Joaquin River, California: winter 1991-92 and 1992-93. DPR report EH 96-06 Four memoranda by L. Ross (DPR) Six memoranda by R. Fujumura (DFG)	March 1991 – February 1993		San Joaquin River nr Vernalis
Foe and Sheipline, 1993	CRWQCB-CVR	Pesticides in Surface Water From Application on Orchards and Alfalfa During the Winter and Spring of 1991-1992	Orchard: Jan – Feb 1992 Alfalfa: Mar – April 1992	Orchard: weekly Alfalfa: weekly (water samples that tested toxic were submitted for pesticide analysis; five non-toxic water samples were also submitted)	Orchard: Mokelumne R at New Hope Rd, French Camp Sl at Manthey Rd, Old R at Cohen Rd, San Joaquin R at Bowman Rd, Lone Tree Ck at Austin Rd, Marsh Ck at Cypress Rd, Alfalfa: Old R at Tracy Rd, Paradise Cut at Paradise Rd, Bishop Cut at 8 Mile Rd, Ulatis Ck at Salem Rd, Bishop Tract Main Drain

<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
USGS NWIS, 2005	USGS	USGS NWIS web water quality data. <a href="http://waterdata.usgs.gov/nwis/">http://waterdata.usgs.gov/nwis/</a>	Apr 1992 - Sept 2001	various	French Camp Slough at Airport Way, Middle River at Middle River, Sacramento River at Freeport, Sacramento River at Rio Vista, Sacramento River at Tower Bridge, San Joaquin River at Vernalis, Yolo Bypass at I-80 nr West Sacramento
Kuivila and Foe, 1995	USGS, CRWQCB-CVR	Concentrations, Transport and Biological Effects of Dormant Spray Pesticides in the San Francisco Estuary, California	January – February 1993	Samples collected daily (twice a day at Vernalis)	Sacramento River at Sacramento, Sacramento River at Rio Vista, Chipps Island (Suisun Bay), Martinez (Suisun Bay), San Joaquin River at Vernalis, San Joaquin River at Stockton, Old River, Middle River, Grant Line Canal
Deanovic et al, 1996	CRWQCB-CVR, UC Davis Aquatic Toxicology Laboratory, SWRCB	Sacramento-San Joaquin Delta Bioassay Monitoring Report 1993-1994	May 1993 – May 1994	Samples were collected monthly, during low tide. When pesticides were identified in the TIE process as primary toxicants, their concentrations were then determined	Sacramento River at Greene's Landing, , San Joaquin River at Vernalis, Pierson Tract Main Drain, Ulatis Creek, Prospect Slough, Paradise Cut, Duck Slough, French Camp Slough, Lake McLeod (downtown Stockton), Old River at Hwy 4

<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
Kratzer, 1997	USGS	Transport of Diazinon in San Joaquin River Basin, California. U.S. Geological Survey Open File Report 97-411.	Jan – Feb 1994	Samples collected throughout the storm hydrograph	San Joaquin River at Vernalis
Holmes, et al. 2000	CRWQCB-CVR, UC Davis Aquatic Toxicology Laboratory	Monitoring of Diazinon Concentrations and Loadings, and Identification of Geographic Origins Consequent to Stormwater Runoff From Orchards in the Sacramento River Watershed, U.S.A.	Jan – March 1994	Daily following storm events, with some interval sampling	Sacramento River at Tower Bridge, Colusa Basin Drain
Bailey et al., 2000	UC Davis, CRWQCB-CVR	Diazinon and Chlorpyrifos in Urban Waterways in Northern California, USA	1994 – 1995	Most samples collected Oct – May, generally associated with runoff events, some dry-weather samples. Samples collected during rising limb of hydrograph	Mosher Slough, Five Mile Slough, Mormon Slough, Smith Canal, Walker Slough, Calaveras River

<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
Deanovic et al., 1998	CRWQCB-CVR, UC Davis Aquatic Toxicology Laboratory, SWRCB	Sacramento-San Joaquin Delta Bioassay Monitoring Report: 1994-95	June 1994 – July 1995	Samples collected once per sampling event; Pesticide analysis only when a sample was determined to be toxic	Sacramento River at Greene's Landing, San Joaquin R at Vernalis, Ryer Island, Middle Roberts Tract, Duck Slough, French Camp Slough, Ulati Creek, Haas Slough, Mosher Slough, Paradise Cut, Sycamore Slough, Old River at Tracy Blvd
Lee and Jones-Lee, 1999	DeltaKeeper, CRWQCB-CVR, City of Stockton, UC Davis Aquatic Toxicology Laboratory	Conclusions from review of the City of Stockton urban stormwater runoff aquatic life toxicity studies conducted by the Central Valley Regional Water Quality Control Board, DeltaKeeper, City of Stockton, and the University of California, Davis Aquatic Toxicology Laboratory between 1994 and 1999	1994 – 1999		Calaveras River at Pacific Avenue, Duck Creek at El Dorado Street, Five Mile Slough at Plymouth, Mosher Slough at Mariners Drive, Smith Canal at Pershing, Walker Slough at Manthey
SFEI, 2005	San Francisco Estuary Institute Regional Monitoring Program	San Francisco Estuary Institute Regional Monitoring Program, Dissolved Pesticide Concentrations in Water Samples	1994 – 1997		Sacramento River near Sherman Island, San Joaquin River near Antioch

<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
Kratzer, 1998	USGS	Pesticides in storm runoff from agricultural and urban areas in the Tuolumne River basin in the vicinity of Modesto, California	1994-1995	Daily during storm events	San Joaquin River at Vernalis
City of Stockton / Kamp Dresser and McKee, 1996	City of Stockton, Department of Municipal Utilities	City of Stockton: 1995-96 National Pollution Discharge Elimination System Storm Water Monitoring Program Data.	1995-1996		Calaveras River at Sutter Street, Calaveras River at West Lane, Duck Creek at West Pacific Industrial Park, Mosher Slough at Kelley Drive, Mosher Slough at Thorton Road
Domagalski, 2000	USGS	Pesticides in Surface Water Measured at Select Sites in the Sacramento River Basin, California, 1996-1998 (Water-Resources Investigations Report 00-4203)	Nov 1996 to April 1998	Monthly and bi-monthly	Sacramento River at Freeport, Yolo Bypass at Hwy 80, Colusa Basin Drain Near Knights Landing
Bennett, et al., 1998	DPR	Occurrence of aquatic toxicity and dormant-spray pesticide detections in the San Joaquin River watershed, winter 1996-97. (SWDB study 32)	Winter 1996-1997	Daily during storm events	San Joaquin River nr Vernalis

<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
Larry Walker Associates, 2005	Maintained by Larry Walker Associates for Sacramento Regional County Sanitation District	Sacramento Coordinated Monitoring Program (CMP) Database	Jan 1997 - Feb 2005		Sacramento River at Freeport, Sacramento River at Mile 44
Reyes et al., 2000	UC Davis, CRWQCB-CVR	Orchard In-Season Spray Toxicity Monitoring Results, 1997	April 1997 – September 1997	biweekly	Calaveras River at Solari Ranch Rd, French Camp Slough at El Dorado St.
Ganapathy, 1999a	DPR	Preliminary results of acute and chronic toxicity testing of surface water monitored in San Joaquin River watershed, winter 1997-98	December 1997 – March 1998		San Joaquin River nr Vernalis
Ganapathy, 1999b	DPR	Preliminary results of acute and chronic toxicity testing of surface water monitored in the San Joaquin River watershed, winter 1998-99	Dec 1998 – Mar 1999		San Joaquin River nr Vernalis

<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
Jones, 1999	DPR	Protocol for monitoring acute and chronic toxicity in the San Joaquin River watershed, winter 1999-2000. Document Review and Approval, Environmental Monitoring and Pest Management, Department of Pesticide Regulation, Sacramento, California	Dec 1999 – Mar 2000		San Joaquin River nr Vernalis
Larry Walker Associates, 2002	Sacramento River Watershed Program	Sacramento River Watershed Program Water Quality Database	Feb 2000, May 2000	Storm event and interval	Sacramento River at Freeport, Cache Slough nr Ryer Island
Bacey, 2002	DPR	Preliminary Results of Pesticide Residue Analysis Acute and Chronic Toxicity Testing of Surface Water Monitored in the San Joaquin River Watershed, Winter 2000-2001.	Dec 2000 - Mar 2001		San Joaquin River at Vernalis

<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
Menconi, 2001	CRWQCB-CVR	Unpublished data from Delta Waterways Study in 2001.	April – May 2001		Georgiana Sl at the south end of Tyler Island, Steamboat Slough at Hogback Park, Mosher Slough at Mariners Dr, Fivemile Slough at Plymouth, Calaveras River at Ijams Rd, McCleod Lake in Stockton, Walker Slough west of Manthey Dr, Mid-Roberts Island Drain at Woodbro, Paradise Cut at Paradise Rd, Whiskey Slough at Whiskey Slough Harbor, Tom Paine Slough south of Paradise Cut, Sutter Slough 1.5 mi. south of Sutter Island Cross Road
Lu, 2004	CRWQCB-CVR	Sacramento and San Joaquin Delta Pesticides Monitoring Report 2002 and 2003	2002 - 2003	monthly	Mokelumne River at New Hope Rd, Mosher Slough at Mariners Dr, Fivemile Slough at Plymouth, Calaveras River at Ijams Rd, Mid-Roberts Is Drain at Woodbro, French Camp Slough at Carolyn Weston Blvd, Paradise Cut at Paradise Rd, Old R at Tracy Rd, Marsh Creek at Cypress Rd, Ulati Creek at Brown Rd, Duck Slough nr Five Point, Steamboat Slough at Hogback Park, Cache Slough at Real McCoy, Sacramento River at Rio Vista



<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
Starner, 2003	DPR	Monitoring Surface Waters of the San Joaquin River Basin for Selected Summer-Use Pesticides.	July – September 2002		San Joaquin River at Vernalis
Kuivila and Moon, 2004	USGS	Kuivila, K.M. and G.E. Moon. 2004. Potential Exposure of Larval and Juvenile Delta Smelt to Dissolved Pesticides in the Sacramento-San Joaquin Delta, California.	Apr 1998 – July 2000	Interval Sampling	Barker Slough, Cache Slough at Hastings, Frank's Tract, Indian Slough at Discovery Bay Marina Boat Ramp near Discovery Bay, Lindsey Slough, Middle River at Empire Cut, along east arm of River, Middle River at Middle River, Old River at Mouth of Holland Cut, Old River at Santa Fe Cut, Old River Northwest of Coney Island, Old River, western arm at Railroad Bridge, Sacramento River at Tower Bridge, San Joaquin River at Jersey Point, San Joaquin River at mouth of Calaveras River at Light 41, San Joaquin River at Stockton, San Joaquin River at Vernalis, San Joaquin River between Hog Slough and Turner Cut At Light 21

<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
DWR, 2005	DWR	Bay Delta and Tributaries Project	May 1998 - May 2002	various	Barker Slough at Cook Road, Barker Slough at North Bay Pumping Plant, Calhoun Cut at Hwy 113, Colusa Basin Drain above Knights Landing, Lindsey Slough at Hastings Island Bridge, Shag Slough at Liberty Island Bridge, San Joaquin River at Vernalis, Big Break near Oakley, Frank's Tract near Russo's Landing, Old River at Rancho Del Rio, Sacramento River at Greene's Landing, Sacramento River above Point Sacramento, Sherman Lake near Antioch, San Joaquin River at Antioch, San Joaquin River at Mossdale Bridge, San Joaquin River at Buckley Cove
Dileanis et al., 2002.	USGS	Occurrence and Transport of Diazinon in the Sacramento River, California, and Selected Tributaries During Three Winter Storms, January – February 2000. USGS Water-Resources Investigations Report 02-4101	Jan – Feb 2000	Daily samples following Jan-Feb Storm Events	Sacramento River at Tower Bridge, Colusa Basin Drain at Road 99E near Knights Landing

<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
Dileanis et al., 2003	USGS and DPR	Occurrence and Transport of Diazinon in the Sacramento River and Selected Tributaries, California, during Two Winter Storms, January-February 2001.	Jan-Feb 2001	Daily samples following Jan-Feb Storm Events	Sacramento River at Sacramento
Dileanis, 2003	USGS and DPR	Data from 2002 Dormant Spray Season Water Quality Monitoring Performed by U.S. Geological Survey and CVRWQCB.	Jan-Feb 2002	Daily samples following January and February Storm Events	Sacramento River at Sacramento
Dileanis, 2003	USGS	Data from 2003 dormant spray season water quality monitoring performed by the US Geological Survey.	Jan-Feb 2003	Daily samples following January and February Storm Events	Sacramento River at Sacramento
Calanchini et. al., 2003	UC Davis	Presence of Diazinon and Chlorpyrifos in California's Central Valley Waterways, January-March 2003	Jan-March 2003	Daily samples following Jan-Feb Storm Events	Sacramento River at Sacramento, San Joaquin River at Vernails
Calanchini and Johnson, 2005a	UC Davis	A Summary of the 2003 TMDL Monitoring for Diazinon and Chlorpyrifos in the Northern San Joaquin Basin, California March - August 2003	March - August 2003	Inerval Sampling	San Joaquin River at Vernalis

<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
San Joaquin County and Delta Water Quality Coalition, 2005	San Joaquin County and Delta Water Quality Coalition	San Joaquin County and Delta Water Quality Coalition data collected for the Conditional Irrigated Lands Waiver Program. Data. Submitted in Annual Monitoring Report (May-Sep) and Storm data (Nov-April) still in draft form.	2004-2005	Interval Sampling	Calaveras River at Bellota Intake, Delta Drain- Terminous Tract off Glascock Rd, Duck Creek at Hwy 4, French Camp Slough at Airport Way, Grant Line Canal at Arnando, Grant Line Canal near Calpack Rd, Kellogg Creek at Hwy 4, Littlejohns Creek at Jacktone Rd, Lone Tree Creek at Jacktone Rd, Marsh Creek at Balfour Ave, Mokelumne River at Bruella Rd, Potato Slough at Hwy 12, Terminous Tract Drain at Hwy 12
Calanchini and Johnson, 2005c	UC Davis	A Summary of the 2004 TMDL Monitoring for Selected Pesticides in the Northern San Joaquin Basin, California February 2004, 286 KB, PDF (PDF info)	February 04	Daily following storm events	San Joaquin River at Vernalis
Calanchini et al., 2004	UC Davis	A Brief Summary of the 2004 TMDL monitoring for Diazinon in California's Sacramento Valley Waterways January-March 2004	January - March 2004	Daily following storm events	Sacramento River at Sacramento, Colusa Basin Drain

<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
Calanchini and Johnson, 2005b	UC Davis	A Summary of the 2004 TMDL Monitoring for Selected Pesticides in the Sacramento-San Joaquin Delta, January - February 2004	March - April 2004	Interval Sampling	Cache Slough nr Outltet, Sac R. at Rio Vista, Calaveras River ds of Stockton Diverting Canal, Duck Slough, Five Mile Slough, French Camp Slough, Marsh Creek, Middle Roberts Island Drain, Mokelumne River nr Delta Boundary, Mosher Slough, Old River at Tracy Road, Ulatis Creek
Calanchini and Johnson, 2005d	UC Davis	A Summary of the 2004 TMDL Monitoring for Selected Pesticides in the Sacramento-San Joaquin Delta, California, March - April 2004	March-April 2004	Daily following storm events and Interval Sampling	San Joaquin River at Vernalis Cache Slough nr Outltet, Sac R. at Rio Vista, Calaveras River ds of Stockton Diverting Canal, Duck Slough, Five Mile Slough, French Camp Slough, Marsh Creek, Middle Roberts Island Drain, Mokelumne River nr Delta Boundary, Mosher Slough, Old River at Tracy Road, Ulatis Creek
Calanchini and Johnson, 2005e	UC Davis	A Summary of the 2004 TMDL Monitoring for Selected Pesticides in the Northern San Joaquin Basin, California March - August 2004	March - August 2004	Interval Sampling	San Joaquin River at Vernalis

<b>Reference Citation</b>	<b>Agency</b>	<b>Title</b>	<b>Monitoring Time Period</b>	<b>Sample Frequency and Timing</b>	<b>Monitoring Sites in the Delta Watershed</b>
Calanchini and Johnson, 2005f	UC Davis	In Progress. Results of the 2005 TMDL monitoring for Diazinon and Chlorpyrifos in California's Central Valley Waterways January - February 2005.	January-February 2005	Daily following storm events	Sacramento River at Sacramento, Colusa Basin Drain, San Joaquin River at Vernalis

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CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY  
REGIONAL WATER QUALITY CONTROL BOARD  
CENTRAL VALLEY REGION

Amendments to the Water Quality Control Plan  
For the Sacramento River and  
San Joaquin River Basins

For

The Control of Diazinon and Chlorpyrifos  
Runoff into the Sacramento-San Joaquin Delta

*June 2006 Final Staff Report*

**Appendix C**

**Comparison of Existing Concentrations to the  
Proposed Loading Capacity**

## INTRODUCTION

Appendix C compares measured diazinon and chlorpyrifos concentrations to the proposed Loading Capacity (LC) for the Delta Waterways. The number of samples, number exceedances of the proposed Loading Capacity, and the average and maximum percent reductions that would be needed to meet the proposed loading capacity during exceedances are summarized for each water year in which data are available at each location. The data sources are listed in Appendix B. As discussed in the main body of the report the Loading Capacity is determined using Equation 1:

$$\frac{C_1}{O_1} + \frac{C_2}{O_2} = S, S \leq 1 \quad [\text{Equation 1}]$$

Where:

C = The concentration of each pesticide.

O = The proposed acute toxicity water quality objective for diazinon to protect invertebrates (0.16 µg/L) and the proposed acute water quality objective for chlorpyrifos (0.025 µg/L).

S = The sum. A sum greater than one (1.0) indicates an exceedance of the Loading Capacity.

For each exceedance of the Loading Capacity, the percent reduction that would be necessary to meet the Loading Capacity was calculated using the following formula:

$$\text{Percent reduction needed to meet the Loading Capacity} = \frac{S - 1}{S} * 100$$

Where:

S = The sum from Equation 1.

For the observed exceedances at each location, the average (mean) and maximum percent reduction needed to meet the Loading Capacity were determined.

Table C-1. Comparison of Concentration data with the proposed Loading Capacity

<b>Location</b>	<b>Water Year<sup>i</sup></b>	<b># of samples</b>	<b># of samples &gt; LC</b>	<b>% of samples &gt; LC</b>	<b>avg % reduction needed to meet LC during exceedances</b>	<b>max % reduction needed to meet LC</b>
Barker Slough	1996	2	0	0%	-	-
	1997	4	0	0%	-	-
	1998	5	0	0%	-	-
Bishop Cut	1992	1	0	0%	-	-
Bishop Tract	1992	2	0	0%	-	-
Cache Slough at Hastings	1998	6	0	0%	-	-
	2000	7	0	0%	-	-
Cache Slough nr Outlet	2000	1	0	0%	-	-
	2002	3	0	0%	-	-
	2003	27	1	4%	31%	31%
	2004	18	0	0%	-	-
Calaveras River at Bellota Intake	2004	2	0	0%	-	-
Calaveras River ds Stockton Diverting Channel	1996	6	4	67%	79%	93%
	1997	1	0	0%	-	-
	2001	5	2	40%	32%	51%
	2002	4	0	0%	-	-
	2003	12	3	25%	38%	63%
	2004	15	6	40%	44%	83%
	Calhoun Cut	1996	1	0	0%	-
1997		5	0	0%	-	-
Colusa Basin Drain nr Knights Landing	1999	5	0	0%	-	-
	2000	10	0	0%	-	-

Table C-1. Comparison of Concentration data with the proposed Loading Capacity

<b>Location</b>	<b>Water Year<sup>i</sup></b>	<b># of samples</b>	<b># of samples &gt; LC</b>	<b>% of samples &gt; LC</b>	<b>avg % reduction needed to meet LC during exceedances</b>	<b>max % reduction needed to meet LC</b>
	2001	8	1	13%	96%	96%
	2002	4	0	0%	-	-
	2003	18	0	0%	-	-
	2004	18	3	17%	9%	11%
	2005	11	0	0%	-	-
Delta Drain on Terminous Tract	2005	4	0	0%	-	-
Delta Outflow at Chipps Island	1993	1	0	0%	-	-
Duck Creek	1996	3	2	67%	86%	94%
	1997	1	1	100%	57%	57%
	2004	2	0	0%	-	-
Duck Slough	1993	1	0	0%	-	-
	1994	1	0	0%	-	-
	1995	2	2	100%	96%	96%
	2002	4	0	0%	-	-
	2003	23	0	0%	-	-
	2004	16	10	63%	71%	95%
Five-Mile Slough	1996	2	2	100%	78%	80%
	1997	1	1	100%	78%	78%
	1998	2	1	50%	84%	84%
	2001	4	0	0%	-	-
	2002	4	0	0%	-	-
	2003	25	5	20%	34%	71%
	2004	19	8	42%	46%	73%
French Camp Slough	1992	4	3	75%	62%	86%
	1994	5	4	80%	75%	95%
	1995	1	0	0%	-	-
	1996	1	1	100%	21%	21%
	1999	1	1	100%	31%	31%
	2002	4	0	0%	-	-
	2003	21	1	5%	62%	62%
	2004	19	7	37%	55%	89%
	2005	2	0	0%	-	-
Georgiana Slough	2001	6	0	0%	-	-
Grant Line Canal	1993	13	5	38%	34%	77%

Table C-1. Comparison of Concentration data with the proposed Loading Capacity

<b>Location</b>	<b>Water Year<sup>i</sup></b>	<b># of samples</b>	<b># of samples &gt; LC</b>	<b>% of samples &gt; LC</b>	<b>avg % reduction needed to meet LC during exceedances</b>	<b>max % reduction needed to meet LC</b>
	2003	4	0	0%	-	-
	2005	4	1	25%	67%	67%
Haas Slough	1995	1	0	0%	-	-
Indian Slough	2000	7	0	0%	-	-
Kellogg Creek	2005	1	1	100%	86%	86%
Lindsey Slough	1996	1	0	0%	-	-
	1997	4	0	0%	-	-
	1998	12	0	0%	-	-
	1999	10	0	0%	-	-
Littlejohns Creek	2004	2	0	0%	-	-
	2005	2	0	0%	-	-
Lone Tree Creek	1992	5	4	80%	78%	94%
	2004	2	0	0%	-	-
	2005	2	1	50%	10%	10%
Marsh Creek	1992	1	1	100%	43%	43%
	2002	4	0	0%	-	-
	2003	29	3	10%	31%	63%
	2004	16	0	0%	-	-
	2005	2	0	0%	-	-
McLeod Lake	2001	4	0	0%	-	-
Middle River at Tracy Blvd	2003	4	0	0%	-	-
Middle River near Middle River, CA	1993	47	0	0%	-	-
	1998	6	0	0%	-	-
	1999	5	0	0%	-	-
	2000	7	0	0%	-	-
Middle Roberts Island Drain	1995	2	1	50%	43%	43%
	2001	5	0	0%	-	-
	2002	4	0	0%	-	-
	2003	21	6	29%	52%	93%
	2004	13	4	31%	57%	90%
Mokelumne River near Delta Boundary	1992	2	0	0%	-	-

Table C-1. Comparison of Concentration data with the proposed Loading Capacity

<b>Location</b>	<b>Water Year<sup>i</sup></b>	<b># of samples</b>	<b># of samples &gt; LC</b>	<b>% of samples &gt; LC</b>	<b>avg % reduction needed to meet LC during exceedances</b>	<b>max % reduction needed to meet LC</b>
Mokelumne River near Delta Boundary	2002	4	0	0%	-	-
Mokelumne River near Delta Boundary	2003	21	1	5%	29%	29%
Mokelumne River near Delta Boundary	2004	15	1	7%	52%	52%
Mokelumne River u/s of Lodi	2004	2	0	0%	-	-
Mokelumne River u/s of Lodi	2005	2	0	0%	-	-
Mosher Slough	1995	2	2	100%	86%	86%
	1996	6	6	100%	87%	94%
	1997	1	1	100%	86%	86%
	1998	2	2	100%	87%	87%
	2001	5	0	0%	-	-
	2002	4	0	0%	-	-
	2003	24	9	38%	33%	59%
Old River at Highway 4	1993	1	0	0%	-	-
	1994	1	0	0%	-	-
Old River at Tracy Rd	1992	1	0	0%	-	-
	1994	1	0	0%	-	-
	2002	4	0	0%	-	-
	2003	17	1	6%	32%	32%
	2004	10	0	0%	-	-
Old River Northwest of Coney Island	1999	5	0	0%	-	-
Old River nr Bacon Island	1993	19	0	0%	-	-
	1998	6	0	0%	-	-
	1999	10	0	0%	-	-
Old River off Cohen Road	1992	2	1	50%	55%	55%
Paradise Cut	1994	7	3	43%	84%	96%
	1995	3	3	100%	81%	85%
	2001	5	0	0%	-	-
	2002	4	0	0%	-	-
	2003	17	0	0%	-	-
Pierson District Main Drain	1994	1	0	0%	-	-
Potato Slough	2004	2	0	0%	-	-
	2005	2	0	0%	-	-
Prospect Slough	1993	1	0	0%	-	-



Table C-1. Comparison of Concentration data with the proposed Loading Capacity

<b>Location</b>	<b>Water Year<sup>i</sup></b>	<b># of samples</b>	<b># of samples &gt; LC</b>	<b>% of samples &gt; LC</b>	<b>avg % reduction needed to meet LC during exceedances</b>	<b>max % reduction needed to meet LC</b>
Ryer Island Drain	1995	2	0	0%	-	-
Sacramento River at Freeport	1997	15	0	0%	-	-
	1998	11	0	0%	-	-
	1999	16	0	0%	-	-
	2000	17	0	0%	-	-
	2001	22	0	0%	-	-
	2002	3	0	0%	-	-
	2003	4	0	0%	-	-
	2004	5	0	0%	-	-
	2005	5	0	0%	-	-
Sacramento River at Greene's Landing	1994	1	1	100%	43%	43%
Sacramento River at Mile 44	1999	4	0	0%	-	-
	2000	2	0	0%	-	-
	2001	9	0	0%	-	-
	2002	3	0	0%	-	-
	2004	5	1	20%	60%	60%
	2005	3	0	0%	-	-
Sacramento River at Rio Vista	1993	39	4	10%	29%	48%
	2002	3	0	0%	-	-
	2003	28	2	7%	31%	31%
	2004	18	0	0%	-	-
Sacramento River at Sacramento	1992	141	0	0%	-	-
	1993	176	5	3%	26%	48%
	1994	98	3	3%	27%	37%
	1995	3	0	0%	-	-
	2000	30	0	0%	-	-
	2001	12	0	0%	-	-
	2003	27	0	0%	-	-
	2004	19	1	5%	31%	31%
2005	15	0	0%	-	-	
Sacramento River near Sherman Island	1994	2	0	0%	-	-
	1995	3	0	0%	-	-
	1996	2	0	0%	-	-
	1997	3	0	0%	-	-
	1998	2	0	0%	-	-
	1999	3	0	0%	-	-
Shag Slough	1997	1	0	0%	-	-
San Joaquin River at Antioch	1994	2	0	0%	-	-
	1995	2	0	0%	-	-
	1996	1	0	0%	-	-

Table C-1. Comparison of Concentration data with the proposed Loading Capacity

<b>Location</b>	<b>Water Year<sup>i</sup></b>	<b># of samples</b>	<b># of samples &gt; LC</b>	<b>% of samples &gt; LC</b>	<b>avg % reduction needed to meet LC during exceedances</b>	<b>max % reduction needed to meet LC</b>
	1997	3	0	0%	-	-
	1998	1	0	0%	-	-
	1999	2	0	0%	-	-
	2000	1	0	0%	-	-
	2003	4	0	0%	-	-
San Joaquin River at Bowman Rd	1992	3	2	67%	66%	72%
San Joaquin River at Jersey Point	1999	5	0	0%	-	-
San Joaquin River between Hog and Turner Cut	1999	5	0	0%	-	-
San Joaquin River near Stockton	1993	36	15	42%	37%	80%
	1998	5	0	0%	-	-
	1999	5	0	0%	-	-
	2003	4	0	0%	-	-
San Joaquin River near Vernalis	1991	35	0	0%	-	-
	1992	204	5	2%	26%	70%
	1993	290	50	17%	45%	89%
	1994	155	30	19%	46%	82%
	1995	17	4	24%	31%	59%
	1996	1	0	0%	-	-
	1997	45	0	0%	-	-
	1998	11	0	0%	-	-
	1999	41	0	0%	-	-
	2000	82	3	4%	13%	22%
	2001	109	12	11%	27%	40%
	2002	24	0	0%	-	-
	2003	33	0	0%	-	-
	2004	27	1	4%	11%	11%
2005	15	0	0%	-	-	
Smith Canal	1997	1	1	100%	62%	62%
Steamboat Slough	2001	6	0	0%	-	-
	2002	4	0	0%	-	-
	2003	25	1	4%	24%	24%
Sutter Slough	2001	2	0	0%	-	-
Sycamore Slough	1995	1	0	0%	-	-
Terminus Tract Drain	2005	2	0	0%	-	-
Tom Paine Slough	2001	5	0	0%	-	-
Ulatis Creek	1992	6	2	33%	33%	33%
	1993	2	2	100%	54%	55%

Table C-1. Comparison of Concentration data with the proposed Loading Capacity

<b>Location</b>	<b>Water Year<sup>i</sup></b>	<b># of samples</b>	<b># of samples &gt; LC</b>	<b>% of samples &gt; LC</b>	<b>avg % reduction needed to meet LC during exceedances</b>	<b>max % reduction needed to meet LC</b>
	1994	4	4	100%	48%	72%
	1995	7	4	57%	68%	86%
	2002	4	0	0%	-	-
	2003	30	10	33%	61%	81%
	2004	19	10	53%	64%	82%
Walker Slough	2001	5	1	20%	29%	29%
Whiskey Slough	2001	5	0	0%	-	-
Yolo Bypass at I-80	1997	2	0	0%	-	-
	1998	2	0	0%	-	-
	1999	1	0	0%	-	-
	2000	1	0	0%	-	-

<sup>i</sup> Water years span from October of the previous calendar year through September. For example, the 1997 water year was from October 1, 1996 through September 31, 1997.