WATER QUALITY IN THE YOLO BYPASS

California Nonpoint Source Conference

November 8th, 2005

by

Armand Ruby, Armand Ruby Consulting

and Stephen McCord, Larry Walker Assoc.

Funding/Organization

- CALFED GRANT # WSP01-FP-0073 to City of Woodland
- DWR AGREEMENT # 4600001691
- City contracted with Larry Walker Assoc., Yolo Basin Foundation
- Additional funds from City of Woodland, City of Davis
- Stakeholders Advisory Group - oversight

Key Personnel

Name	Agency or Company
Stefan Lorenzato	CalFed Contract Manager, CA Dept. Water Resources
William Ray	QA Officer, State Water Resources Control Board
Casey Walsh Cady	CalFed Liaison, CA Dept. of Food and Agriculture
Gary Wegener	City of Woodland
Christine Engel	City of Woodland
Armand Ruby	Consultant Project Manager, Larry Walker Associates
Claus Suverkropp	QA Manager, Larry Walker Associates
Chris Erichsen	Field Coordinator, Larry Walker Associates
Todd Albertson	Caltest Analytical Laboratories
Frank Colich	Frontier Geosciences Inc.
Richard Danielson	BioVir Laboratories Inc.
Jeff Miller	Aqua Science, Inc.
Robin Kulakow	Yolo Basin Foundation

Stakeholder Process

- Local municipalities
- Agricultural interests
- Local environmental and resource conservation groups
- State agencies
- Federal agencies

Pollutant Sources/ Water Quality Issues

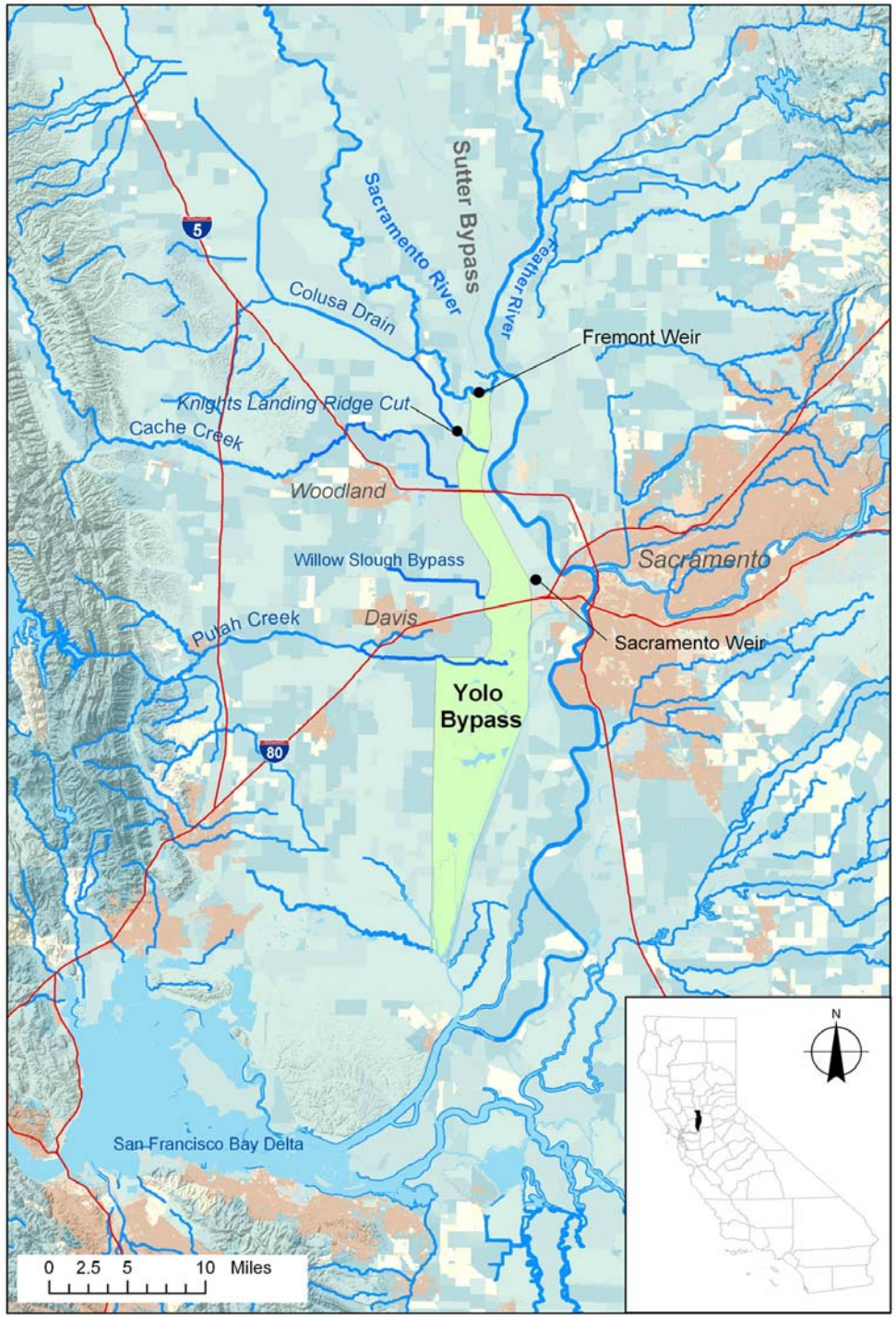
Sources:

- Nonpoint sources: agriculture, urban
- Point sources: 3 POTWs
- Designated floodway (wet season)

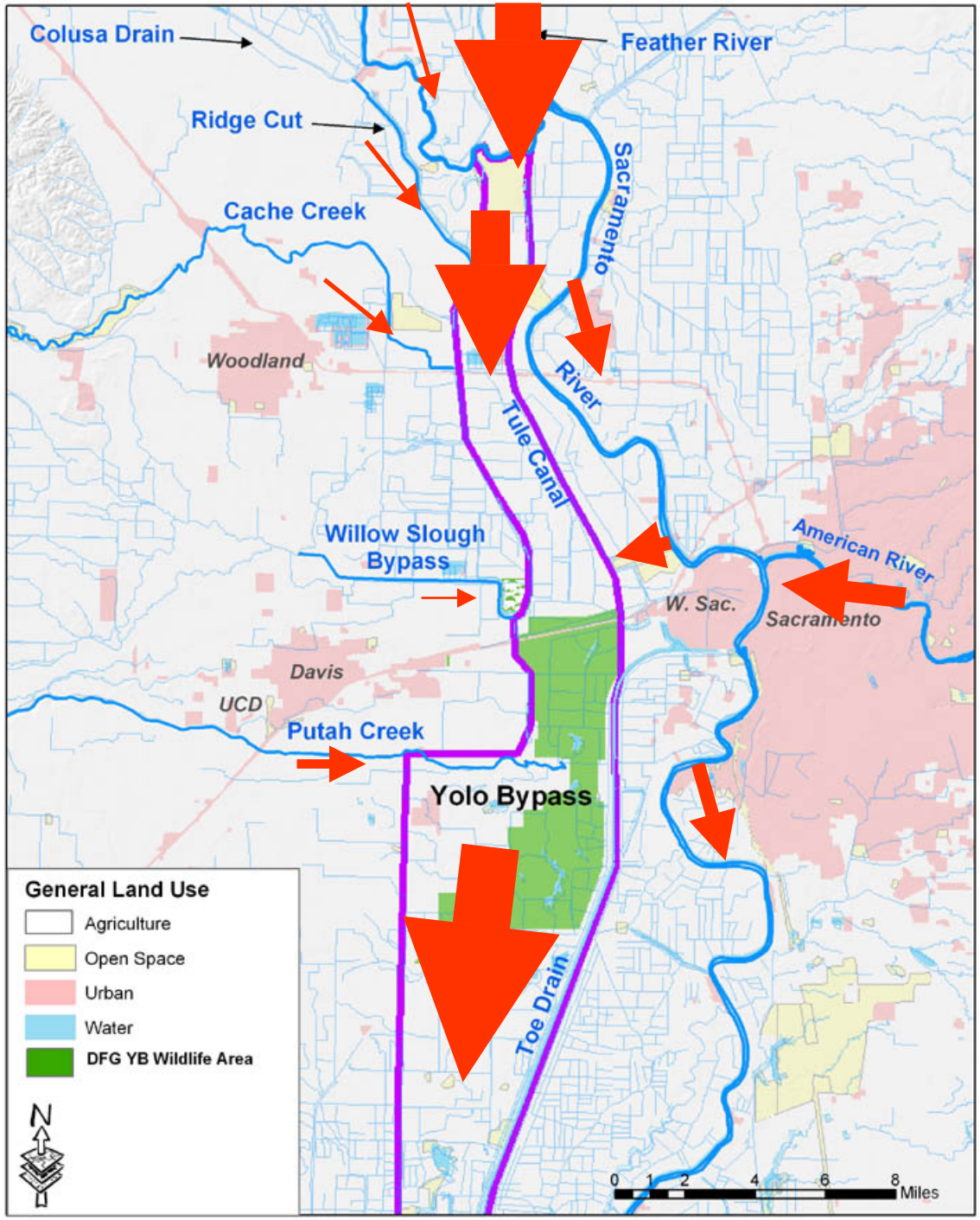
Water Quality Issues:

- Salinity (Conductivity) – water supply (ag?, Delta)
- Mercury – wildlife, human health
- Bacteria – human health
- Pesticides – wildlife, human health

Hydrologic Context for the Yolo Bypass



Bypass Hydrology - Flow Capacities



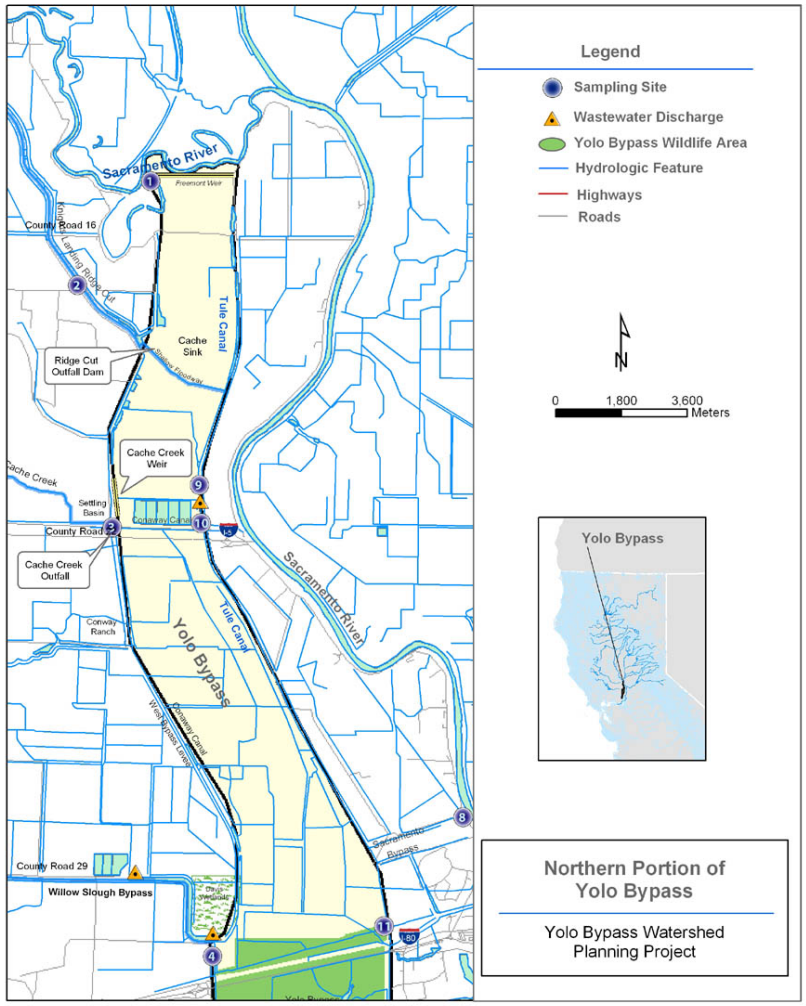
Pollutants of Concern

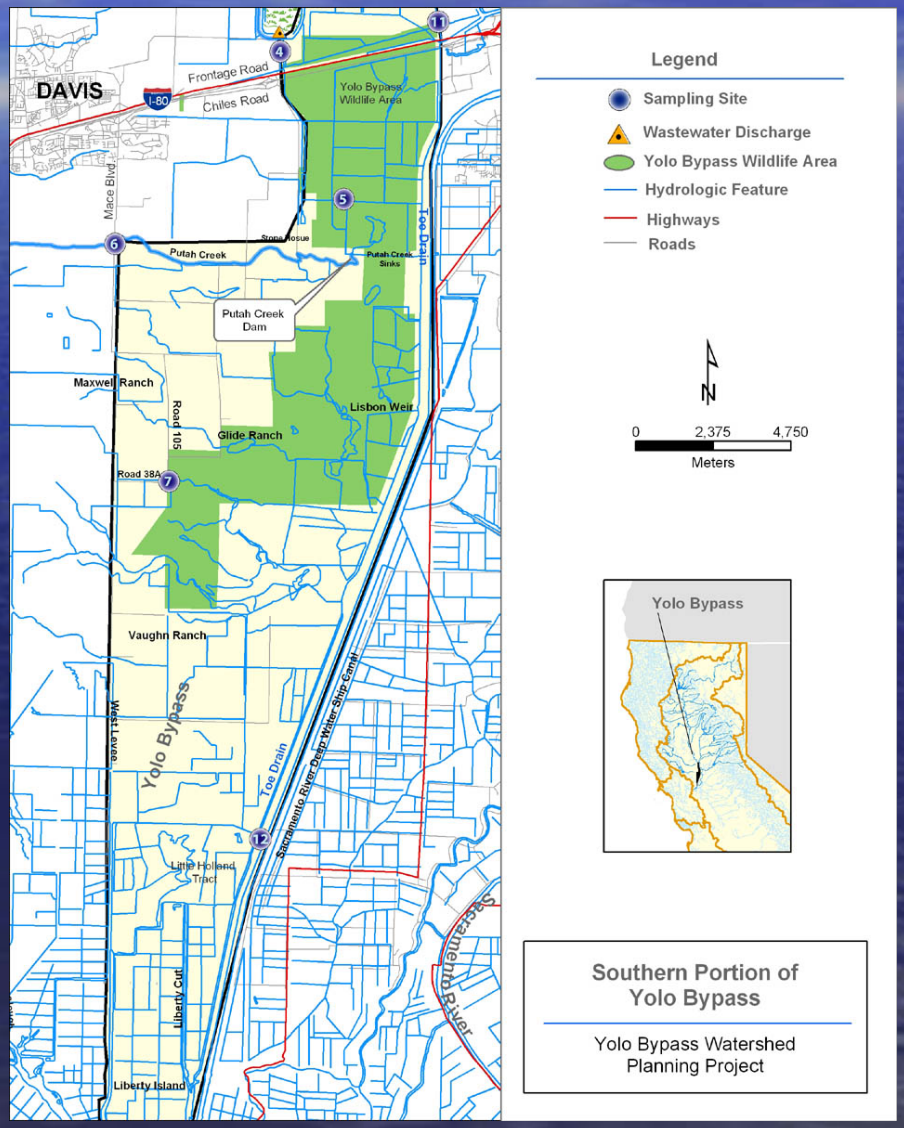
- Metals (Total & Dissolved):

  Aluminum, Boron, Chromium, Copper, Lead, and Selenium
- Mercury, Methylmercury
- Field Measurements: EC, DO, pH, Temp, Turbidity, Flow
- TOC / DOC
- TSS / TDS
- Color & Nitrate
- Total & Fecal Coliform, E. coli
- Pesticides:

  Organophosphate, Chlorinated, and Carbamates
- Acute & Chronic 3 Species Toxicity

Monitoring Sites

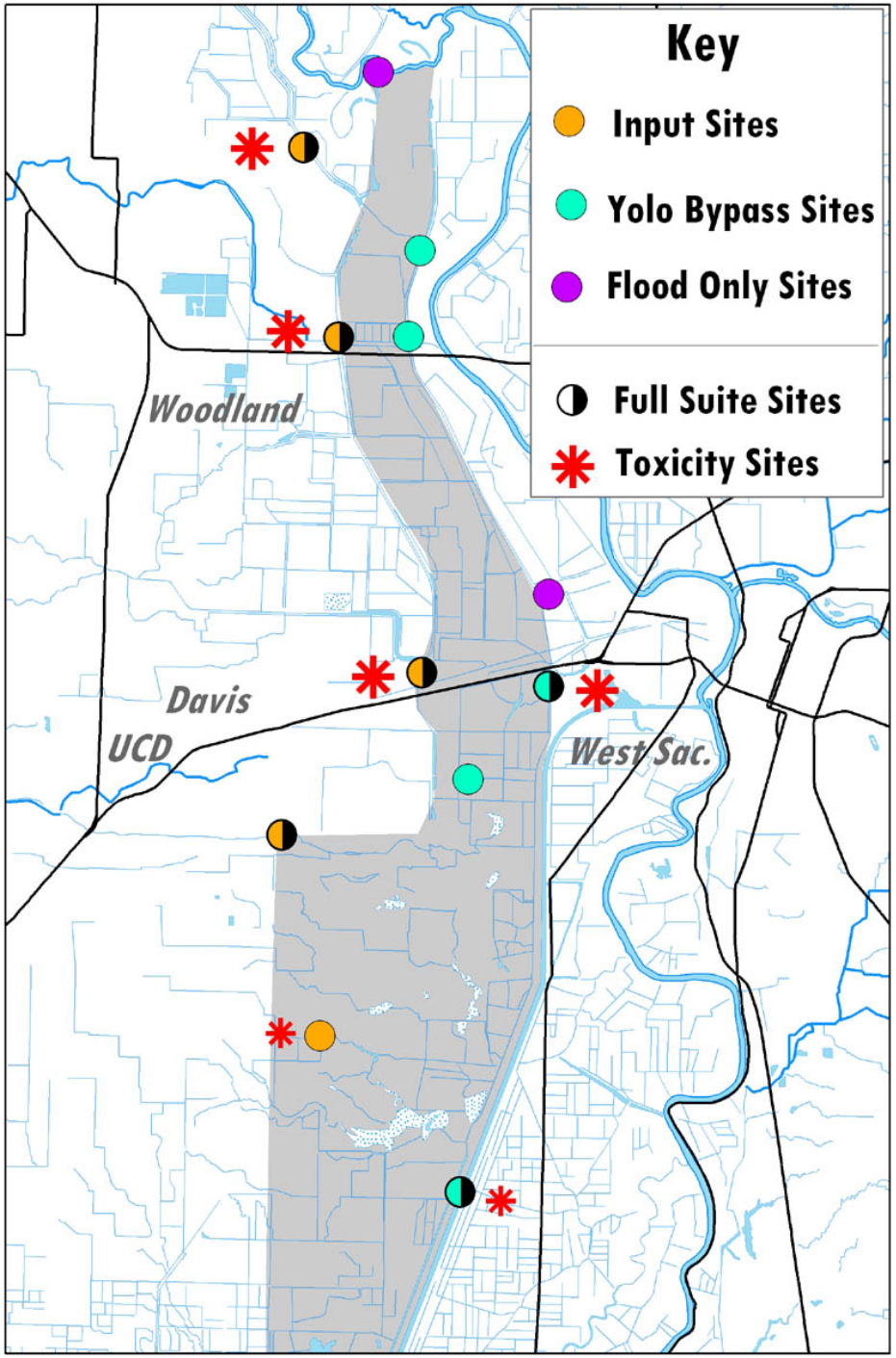




Monitoring Sites

Site description	Site ID	Site Type
Sacramento River Overflow/Fremont Weir	1	Input – Sac R overflow
Knight's Landing Ridge Cut	2	Input channel
Cache Creek	3	Input creek
Willow Slough Bypass	4	Input channel
Yolo Bypass Wildlife Area – lift pump	5	Input – pumped
Putah Creek	6	Input creek
Z Drain – Dixon RCD	7	Input channel
Sacramento River Overflow/Sacramento Weir	8	Input – Sac R overflow
Tule Canal – Woodland R1	9	East side drain channel
Tule Canal – Woodland R2	10	East side drain channel
Tule Canal at north-east corner of I-80	11	East side drain channel
Toe Drain at north-east corner of Little Holland	12	East side drain channel

Sampling Site Locations/ Types



Monitoring Summary

- 12 Sites
- 12 Events (2003-2004):
  - 1 Flood Event
  - 4 Toxicity Events
  - 6 Full Suite Events
  - 12 Hg/Bacteria Events

QA/QC ISSUES

- No Fathead Minnow toxicity test in Jan
- Detection Limits for Pesticides too high in Jan – changed labs
- Could not access Toe Drain in Dec or Feb
- No Access to YBWA in Feb & March
- Missed Bacteria sample for YBWA in Sept

Freemont Weir

Cache Creek Settling Basin Weir

Sampling Sacramento Weir Discharge, Feb. 2004

Monitoring Results

For Detailed Results Go To:
http://www.lwa.com/public/YoloBypass/

May 2005
Yolo Bypass Water Quality Management Plan Report

Prepared under CALFED Watershed Grant,
Agreement # 4600001691
For the City of Woodland
Prepared by:
Larry Walker Associates

[and Appendices]

Electrical Conductivity

Electrical Conductivity (uS/cm)

UN Report = 700 uS

Site #	Sampling Site	Results											
		NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT
1	Fremont Weir				158								
2	Ridge Cut	491	491	569	319	826	731	923	985	1,109	964	888	688
3	Cache Creek	562	570	585	334	602	741	470	280	675	555	802	570
4	Willow Slough Bypass	1,596	1,352	1,120	608	1,107	890	640	812	925	1,267	917	775
5	YB Wildlife Area	760	615	560			603	664	592	361	732	920	830
6	Putah Creek	611	522	514	359	365	853	504	480	472	541	651	421
7	Z Drain	610	764	797	790	1,087	996	447	411	415	540	595	538
8	Sacramento Weir				81								
9	Woodland R1	513	520	578	80	916	498	564	668	634	545	541	665
10	Woodland R2	896	485	560	158	789	603	770	817	842	614	640	878
11	Tule Canal @ 80	686	530	620	210	615	702	895	760	823	840	827	752
12	Toe Drain	827		590		479	514	310	210	193	278	1,013	260

Boron
(almost all present as dissolved)

TOTAL BORON (ug/L)

EPA Drinking Water Health Advis = 600 ug/l

Site #	Sampling Site	Results					
		NOV	JAN	APR	JUN	AUG	SEPT
2	Ridge Cut	250	200	910	2,700	2,400	1,000
3	Cache Creek	1,700	1,400	1,700	550	1,200	2,300
4	Willow Slough Bypass	1,300	1,700	1,400	1,400	1,400	1,500
6	Putah Creek	350	400	390	1,400	840	510
11	Tule Canal @ 80	1,100	800	550	1,700	1,100	1,000
12	Toe Drain	1,700	700	550	140	170	1,700

Indicator Bacteria

E. Coli (MPN/100ml)

RWQCB Pending Basin Plan criteria = 235 MPN/100ml

Site #	Sampling Site	Results											
		NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT
1	Fremont Weir				300								
2	Ridge Cut	20	2	2	280	2	20	3,000	1,300	50	30	60	50
3	Cache Creek	70	40	17	34	20	20	3,000	22	1,300	50	1,700	5,000
4	Willow Slough Bypass	1,400	50,000	1,700	400	40	70	1,400	1,700	8,000	3,000	8,000	11,000
5	YB Wildlife Area	20	20	50			40	20	80	60	17		30
6	Putah Creek	20	20	30	70	110	40	1,700	30	50	13	8	23
7	Z Drain	80	5,000	21	240	20	11,000	6,000	5,000	5,000	30,000	9,000	50
8	Sacramento Weir				500								
9	Woodland R1	1,300	20	30	160	40	20	5,000	22	50	27	1,700	50
10	Woodland R2	1,700	20	50	170	70	20	1,700	70	80	17	1,000	80
11	Tule Canal @ 80	80	20	11	300	900	20	2,200	80	30	80	50	1,100
12	Toe Drain	40		1,100			2	40	23	50	30	50	2,200

Pesticides

Event Date	Site	Chemical	Result	Unit
NOV	-	Not Detected	-	-
JAN	CACHE CREEK	Diazinon	0.035	ug/L
	RIDGE CUT	Diazinon	0.032	ug/L
APRIL	CACHE CREEK	Methomyl	0.07	ug/L
	RIDGE CUT	Chlorpyrifos	43	ug/L
	RIDGE CUT	Diuron	0.30	ug/L
	TOE DRAIN	Diuron	0.50	ug/L
	TULE CANAL	Diuron	0.30	ug/L
	WILLOW SLOUGH	Diuron	0.80	ug/L
JUNE	PUTAH CREEK	Chlorpyrifos	17.6	ug/L
	RIDGE CUT	4,4-DDE	0.02	ug/L
	RIDGE CUT	Chlorpyrifos	10.7	ug/L
	RIDGE CUT	Diuron	0.20	ug/L
	TULE CANAL	Diuron	0.10	ug/L
	WILLOW SLOUGH	Diuron	0.20	ug/L
AUG	RIDGE CUT	4,4'-DDE	0.01	ug/L
	WILLOW SLOUGH	4,4'-DDE	0.01	ug/L
	WILLOW SLOUGH	Diuron	0.4	ug/l
SEPT	WILLOW SLOUGH	Chlorpyrifos	0.01	ug/L

Chlorpyrifos = Ca DFG Hazard Assessment criteria of 0.014 ug/l
Diazinon = Ca DFG Hazard Assessment criteria of 0.05 ug/l
Diuron = EPA lifetime health advisory, 10 ug/l
4’4’ DDE = CTR Human Health of 0.0005 ug/l

Toxicity

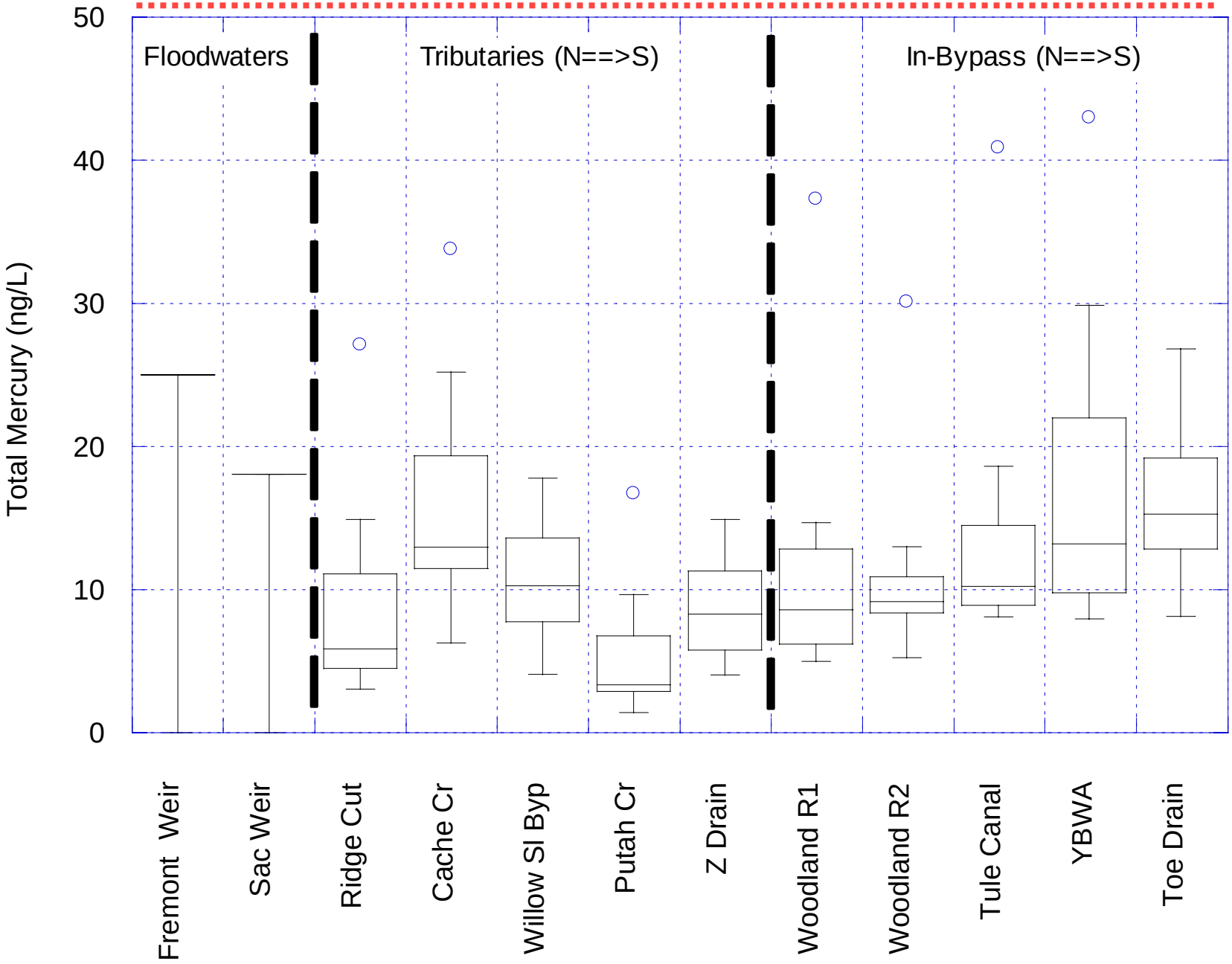
Ceriodaphnia (% Survival)					
Site #	Sampling Site	JAN	APRIL	AUG	SEPT
	Lab Control	90	100	100	100
2	Ridge Cut	100	100	100	100
3	Cache Creek	100	80	100	100
4	Willow Slough Bypass	100	100	100	100
11	Tule Canal @ 80	100	90	100	100

Selenastrum (Cell Growth)					
Site #	Sampling Site	JAN	APRIL	AUG	SEPT
	Lab Control	100	100	-	-
2	Ridge Cut	100	100	<100	100
3	Cache Creek	100	100	<100	<100
4	Willow Slough Bypass	100	100	<100	100
11	Tule Canal @ 80	100	100	<100	100

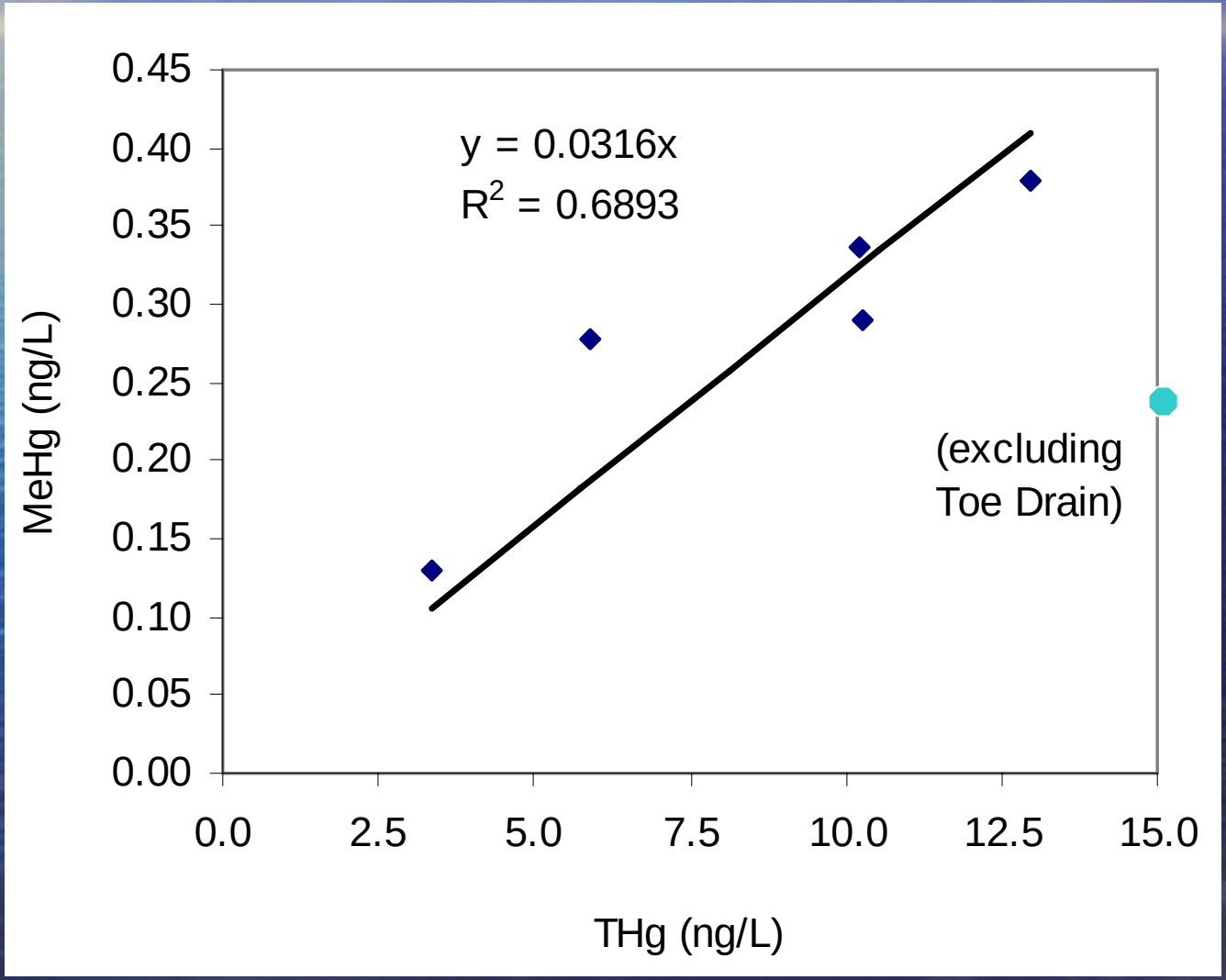
Fathead Minnow (% Survival)					
Site #	Sampling Site	JAN	APRIL	AUG	SEPT
	Lab Control		100	100	92.5
2	Ridge Cut		72.5	100	83
3	Cache Creek		100	100	93
4	Willow Slough Bypass		77.5	100	80
11	Tule Canal @ 80		97.5	100	85

Mercury

Total Mercury (ng/l)				Basin Plan = 12 ng/l									
Site #	Sampling Site	Results											
		NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT
1	Fremont Weir				25								
2	Ridge Cut	4	3	5	10	6	6	15	27	12	10	4	6
3	Cache Creek	15	13	12	34	11	6	23	25	13	16	7	13
4	Willow Slough Bypass	9	3	4	11	7	8	15	11	12	16	18	10
5	YB Wildlife Area	8	11	12			10	30	43	18	22	14	8
6	Putah Creek	1	3	3	17	3	6	10	8	3	6	2	3
7	Z Drain	6	7	5	6	6	4	10	15	11	12	12	10
8	Sacramento Weir				18								
9	Woodland R1	5	5	7	37	6	9	12	11	9	9	15	6
10	Woodland R2	9	5	9	30	10	10	12	10	8	9	13	7
11	Tule Canal @ 80	8	8	12	41	12	10	19	17	10	10	9	8
12	Toe Drain	9		19		8	13	27	25	19	16	15	14


Total Mercury (ng/L)
50
40
30
20
10
0
Floodwaters
Tributaries (N==>S)
In-Bypass (N==>S)
Fremont Weir
Sac Weir
Ridge Cut
Cache Cr
Willow Sl Byp
Putah Cr
Z Drain
Woodland R1
Woodland R2
Tule Canal
YBWA
Toe Drain

Site=	Ridge Cut	Cache Creek	Willow Slough Bypass	Putah Creek	Tule Canal @ 80
THg=	5.9	13.0	10.3	3.4	10.2
MeHg=	0.28	0.38	0.29	0.13	0.34



Management Actions

- Assess monitoring data to determine:
  - Spatial and temporal patterns
  - Frequency of water quality criteria exceedance
  - Effects on beneficial uses
- Categorize as High/Medium/Low Priority
- Develop Implementation Plan for high priority pollutants

Priority Ranking Categories

- High Priority:
  - Exceed water quality criteria often and in multiple locations
    and/or are otherwise important to stakeholders
  - Address expeditiously via control measures and/or other means
- Medium Priority:
  - Occasionally exceed water quality criteria
  - Continue to list as POCs, develop implementation plan
    (but will not be the focus of near-term activities)
- Low Priority:
  - Do not exceed water quality criteria
  - No longer classify as POCs; no implementation plan

Prioritization

POC	Priority		
	High	Medium	Low
Bacteria	X		
Total coliform			
Fecal coliform			
E. coli			
Boron	X		
Metals			
Aluminum	X		
Chromium			X
Copper			X
Lead			X
Mercury	X		
Selenium			X
Nitrate			X
Organic Carbon		X	
Total organic carbon			
Dissolved organic carbon			
Pesticides and Herbicides			
OCs (DDE and DDT)		X	
OPs (Chlorpyrifos and Diazinon)		X	
Carbamates (Diuron and Methomyl)			X
Salinity	X		
Total Suspended Solids (TSS)			X

Suggestions for Similar Work, NPS Monitoring Projects

- Do your homework: identify pollutants of concern, understand the hydrology
- Characterize temporal (seasonal) and spatial variability
- Maximize data collection effort
- Use monitoring data to effectively focus management actions

Resources/Contacts

Yolo Bypass Water Quality Management Plan Report

May 2005:

http://www.lwa.com/public/YoloBypass/

CalFed: http://calwater.ca.gov/

Armand Ruby: armand@armandruby.com