WATERSHED EXAMPLE - INLAND SURFACE WATER PLAN

PATTERSON AREA, SAN JOAQUIN VALLEY

This report has been prepared as an example of a typical drainage basin in the Central Valley of California. The information on the basin was laid out following the "informational needs" outline in our 16 March 1992 letter and is intended to give the user an idea of the detail and format expected in reports submitted to the Central Valley Regional Water Quality Control Board.

This report has been prepared as an *example* and does not represent an established water agency nor, necessarily, the current field conditions.

The area was chosen as it encompasses a portion of several water agencies, as well as private lands, contained within a discrete drainage boundary. The format demonstrates methods of estimating unknown parameters but also lists when no information is available. The bulk of the data for this report is contained in the following tables, figures, and appendix.

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Prepared by the Central Valley Regional Water Quality Control Board
Agricultural Unit

March 1992

I. GENERAL

1. Patterson Watershed Agency (Example)
   100 Any Main Street
   Patterson, CA 91234
   123/456-7890

2. Jan Doe, Manager

3. 17,675 acres

4. Attached (Map 1)

5. Water sources are varied for the portion of each separate water district contained within this watershed (shown on Map 1). The overall supply for the watershed area includes Federal Contract water delivered through the Delta Mendota Canal, surface water diversion from the San Joaquin River, and groundwater supply from three district wells and an unknown number of private facilities. Recycling occurs within the watershed as tailwater drains into downslope supply laterals. Supplies from selected fields may consist entirely of tailwater from upslope fields. The water sources can be divided as follows.

Section	Water Source
Del Puerto Water District	--direct turn outs from the Delta Mendota Canal
West Stanislaus Irrigation District	--diversion from the Delta Mendota Canal --groundwater (1 well)
Patterson Water District	--diversion from the Delta Mendota Canal --groundwater (two wells) --diversion from the San Joaquin River
Private	--private wells --riparian rights to the San Joaquin River --tailwater

II. WATER SUPPLY SOURCES

1(a) Attached (Map 2)

1(b) Four groundwater supply wells are located within the watershed; Well 101, Well 83, WSID-1W, and PWD-1W (Map 2). PWD-1W was completed in 1991 and has not yet been used as a supply source.

1(c) Attached (Map 2)

All drainage from the watershed, including operational spills, eventually flows into the San Joaquin River.

1(d) Attached (Map 2; Table 1)

2. Annual water supply volume was estimated based on the total annual supply for each water district within the watershed boundary, *adjusted by the percent of that district within the boundary*. For example, 30% of West Stanislaus Irrigation District is contained within the boundary. Therefore, since the total annual supply for the district is 102,299 AF, 30% of that supply or 30,690 AF is assumed to flow into Patterson Watershed Agency. The same type of calculation was used for the areas within Del Puerto Water District and Patterson Water District.

   For area's designated as private ownership, the average acre-foot (AF) per acre water supply for the surrounding districts (3 AF/acre/year) was assumed to apply to the total acreage designated as private (1,245 acres). Therefore, the total annual supply was calculated as follows:

   3 AF/acre/year x 1,245 acres = 3,734 AF/year

   Monthly distributions were estimated by using the known distribution for one district, calculating the monthly percentage of the annual flow, and applying that percentage to areas without a known distribution (ie. the private lands).

   A summary of the information is presented in Table 2.

3. Attached (Table 1)

   All supply canals may intercept tailwater runoff from upslope fields and thereby recycle the water as it progresses downslope (west to east) within the watershed boundaries.

III. LAYOUT OF SURFACE DRAINAGE SYSTEM

1. The surface drainage system runs perpendicular to the supply lines, running from west to east--downslope from the edge of the Coast Range to the San Joaquin River. The majority of the drains are underground pipes with the exception of Del Puerto Creek which is a natural stream channel whose flow consists entirely of agricultural drainage during the irrigation season.

   Runoff from the coastal range enters the west side of the district in Salado, Black Gultch, and Del Puerto Creeks. Only natural flows from Del Puerto Creek reach the San Joaquin River. Natural flow in Del Puerto Creek ceases soon after the rainy season. Natural flows from Salado and Black Gultch Creeks enter the area in only the wettest years and then for only short periods of time.

   (a) Attached (Map 3)

   (b) Attached (Map 3)

   (c) Attached (Table 3)

(d) Attached (Map 3)

(e) Attached (Map 4)

(f) Attached (Map 3)

The City of Patterson is contained within the watershed boundaries. Municipal wastewater is pumped to the Sewage Treatment Plant (STP) adjacent to the San Joaquin River. The STP is currently operating at 60% capacity. Although the STP has a permit to discharge to the San Joaquin River, no discharge has occurred in the past nor is expected to occur in the near future.

Storm water is released at two locations--north of the city into the Olive Ave. Drain and east of the city into the Walnut Ave. Drain. The Olive Ave. Drain discharges into Salado Creek and eventually the San Joaquin River. The Walnut Ave. Drain discharges into a dead end slough adjacent to the San Joaquin River. The slough only flows into the river during major storm events when the water is able to breach a natural sand bar dam.

(g) Attached (Map 3)

2. The southeast corner of the watershed contains 520 acres of tiled land. All the subsurface drainage discharges at one point into the Patterson Main Drain and eventually the San Joaquin River. Additional subsurface flow from land south of the watershed boundary is also discharged at a separate point into the Patterson Main Drain. The volume of subsurface flow is not monitored.

(a) Attached (Maps 3 and 4)

(b) Attached (Maps 3 and 4)

(c) Attached (Maps 3 and 4)

(d) Attached (Maps 3 and 4)

IV. OPERATION OF THE SURFACE DRAINAGE SYSTEM

1(a) Attached (Table 3)

1(b) Attached (Map 4; Table 3)

1(c) There are no estimates for drain water entering the watershed.

Drainage water volumes within the watershed have not been measured directly. Some estimated flow volumes are available for selected drains into the San Joaquin River; however, these flows contain storm runoff and groundwater seepage in addition to agricultural return flows. To estimate drainage flows, 17% of the applied water is expected to be lost, half to evaporation and

seepage and half as runoff. Using that assumption, drainage volume for the watershed was calculated using 8.5% of the supply volumes. Results are presented in Table 4.

1(d) Attached (Table 3)

All drains primarily carry agricultural tailwater. The Patterson Main Drain may carry a mixture of subsurface drainage water while both the Olive Ave. Drain and the Walnut Ave. Drain may contain storm water runoff from the City of Patterson. Municipal wastewater is contained at the STP adjacent to the San Joaquin River.

1(e) Attached (Table 3)

Flow in the drains is primarily restricted to periods of irrigation. Pre-irrigation begins in February with final irrigation occurring in October. The drains remain dry during November to January unless a major storm event causes natural runoff. This pattern may change as more winter vegetables are included in the cropping pattern, thereby causing agricultural flow in the drains to continue year round.

1(f) Attached (Table 3)

The supply laterals, which carry a combination of freshwater and tailwater, are cleared of six inches of silt on an annual basis. The underground drainage lines were constructed to preclude maintenance.

1(g) Attached (Table 3)

V. WATER QUALITY MONITORING PROGRAM

Water quality monitoring has been conducted on a limited basis. Current monitoring is restricted to supply water. Past monitoring was conducted by a number of different agencies [the U.S. Soil Conservation Service (SCS), the U.S. Geological Survey (USGS), and the Central Valley Regional Water Quality Control Board (RWQCB)] and included information on drainage water reaching the San Joaquin River.

1(a) Attached (Map 2)

Supply lines are spot checked for electrical conductivity during the irrigation season. The only consistent monitoring is for flow diversions from the Delta Mendota Canal (DMC), San Joaquin River, and estimates of flows from supply wells. Private wells which pump into the DMC, are monitored for total volume discharged and annually for arsenic, boron, selenium, and mercury. The private wells are not depicted on Map 2 but serve the area along the DMC north of diversion point 38.15.

1(b) Not currently monitored. Past monitoring sites of subsurface drainage shown on Map 3.

1(c) Not currently monitored. Past monitoring sites presented on Map 3.

1(d) Not currently monitored. Past monitoring site presented on Map 3.

1(e) Not currently monitored. Past monitoring site presented on Map 3.

2. See 1(a) above

3. Attached (Table 5)

4. Still being developed. See 6 below.

5. Since 1988, the RWQCB has been conducting the U.S. EPA's three species bioassay test within the San Joaquin River watershed. Although no samples were collected within the watershed boundaries, samples taken at the San Joaquin River at Crows Landing and the San Joaquin River at Laird Park, represent upstream and downstream water quality, respectively, of the watershed drainage. A report published by the RWQCB (Foe et al., 1991) concluded that a 43 mile river reach which encompasses the portion of the river this watershed drains into, displays chronic toxicity. The toxicity is attributed to pesticides entering the river in tailwater from orchard and row crops. Diazinon, parathion, carbaryl, and carbofuran were pesticides detected in the water column at concentrations in excess of those reported in the literature to be toxic to invertebrates.

6. The primary water quality concerns within the watershed boundary include:

   a) Excess sediment in tailwater

   b) Potential offsite movement of agricultural chemicals in tailwater

      --organochlorines attached to the sediment
      --soluble organophosphates and carbamates in the water column
      --nutrient loading from fertilizers

   The area has initiated several programs to address the water quality concerns. Most work has focussed on excess sedimentation and included a demonstration project in the Spanish-Grant area to evaluate Best Management Practices (BMP's) for reducing sediment load. A sediment control plan developed by the SCS has been adopted by the districts contained within the watershed boundary in which the area growers will attempt to reduce suspended sediment in tailwater to 300 mg/L using BMP's. These BMP's include, but are not limited to:

      --sediment basins
      --pre-irrigation improvement
      --improved water delivery systems
      --recycling drainwater

   The watershed is also part of the Federal Hydrologic Unit Area program which is providing cost

share opportunities for local growers to install BMP's to control tailwater runoff. A monitoring program will be developed to assess improvements in water quality as the two programs are further developed.

VI COST

1. Unknown

2. Unknown

3. Dependent on final agreements under the recently adopted Sediment Reduction Plan and Hydrologic Unit Area Program.

APPENDIX FOR WATER QUALITY MONITORING IN THE VICINITY OF THE PATTERSON WATERSHED AGENCY

Bailey, R., J. McClung, and D. Faulkner, 1989. Non-Point Source Pollution and Planning for Water Quality Improvements in Western Stanislaus County. U.S. Soil Conservation Service, Patterson Field Office.

Clifton, D.G. and R.J. Gilliom, 1989. Trace Elements in Bed Sediments of the San Joaquin River and Its Tributary Streams, California, 1985. U.S. Geological Survey, Water-Resources Investigations Report 88-4169.

Gilliom, R.J. and D.G. Clifton, 1987. Organochlorine Pesticide Residues in Bed Sediments of the San Joaquin River and its Tributary Streams, California. U.S. Geological Survey, Open-File Report 87-531.

Westcot D.W., E.W. James, R. Waters, and R.R. Thomasson, 1989. Quality of Agricultural Drainage Discharging to the San Joaquin River from the Western Portion of Stanislaus County, California--April 1985 to October 1988. Central Valley Regional Water Quality Control Board.

Table 1. Water Supply Points and Canals for the Patterson Watershed Agency
(As depicted on Map 2)

Name	Type	Construction	Length (miles)	Water Type*	Water Quality Concerns†
Flows Entering Boundaries:					
WS-1 (Lateral 4 South)	constructed	concrete lined	-	DMC & Ag Tail water	1
WS-2 (Lateral 5 South)	constructed	concrete lined	-	DMC & Ag Tail water	1
WS-3 (Lateral 6 South)	constructed	concrete lined	-	DMC & Ag Tail water	1
Del Puerto Creek	natural	channel	-	storm runoff	unknown
Black Gultch Creek	natural	channel	-	storm runoff	unknown
Salado Creek	natural	channel	-	storm runoff	unknown
Supply Points:					
DMC-1	constructed	pipe	0.5	DMC	unknown
DMC-2	constructed	pipe	0.4	DMC	unknown
41.53	constructed	diversion	-	DMC	unknown
41.03	constructed	diversion	-	DMC	unknown
40.45	constructed	diversion	-	DMC	unknown
39.78	constructed	diversion	-	DMC	unknown
39.22	constructed	diversion	-	DMC	unknown
38.08	constructed	diversion	-	DMC	unknown
38.15	constructed	diversion	-	DMC	unknown
37.58	constructed	diversion	-	DMC	unknown
37.32	constructed	diversion	-	DMC	unknown
Well 101	constructed	well	-	groundwater	unknown
Well 83	constructed	well	-	groundwater	unknown
WSID-1W	constructed	well	-	groundwater	unknown
PWD-1W	constructed	well	-	groundwater	unknown
SJR-1	constructed	pump	-	San Joaquin River	1, 2, 3, 4
Supply Canals:					
Main Lift Canal	constructed	concrete lined	3.3	San Joaquin River	1, 2, 3, 4
Lateral A	constructed	concrete lined	3.0	SJR & Ag Tail	1, 2, 3, 4
Lateral B	constructed	concrete lined	4.3	SJR & Ag Tail	1, 2, 3, 4
Lateral 3 North	constructed	concrete lined	4.9	SJR & Ag Tail	1, 2, 3, 4
Lateral 4 North	constructed	concrete lined	3.8	SJR & Ag Tail	1, 2, 3, 4
Lateral M	constructed	concrete lined	6.1	SJR & Ag Tail	1, 2, 3, 4
Ward Avenue	constructed	pipe	1.0	DMC	unknown
Bortch Road	constructed	pipe	0.7	DMC	unknown
1st Lift	constructed	concrete lined	1.5	DMC	unknown
2D Lift	constructed	concrete lined	0.8	DMC	unknown
Vineyard Avenue	constructed	concrete lined	1.0	DMC & Ag Tail	1
Lateral 4 South	constructed	concrete lined	3.9	DMC & Ag Tail	1
Lateral 5 South	constructed	concrete lined	5.0	DMC & Ag Tail	1
Lateral 6 South	constructed	concrete lined	5.3	DMC & Ag Tail	1

*DMC = Delta Mendota Canal
SJR = San Joaquin River
Ag Tail = Agricultural tail water

† 1 = excess sediment in tailwater
2 = elevated TDS concentrations
3 = elevated boron concentrations
4 = pesticide residue

Table 2. Estimated Water Supply Volumn for Patterson Watershed Agency

Time Period	DMC Supply (AF)†		Mixed (AF)*		Wells	Total
	DPWD	WSID	PWD	Private		
January	58	134	-	-	unknown	192
February	116	153	-	-	unknown	269
March	174	1638	2475	373	unknown	4660
April	870	5606	4455	672	unknown	11348
May	1392	5304	4455	672	unknown	11348
June	1450	4736	3710	560	unknown	11348
July	1450	6434	3710	560	unknown	11348
August	1160	4505	3710	560	unknown	11348
September	580	1520	1980	336	unknown	11348
October	174	166	-	-	unknown	340
November	87	102	-	-	unknown	189
December	29	389	-	-	unknown	418
Total:	7540	30687	24750	3734	unknown	66711

DPWD = Del Puerto Water District (58% in watershed)
WSID = West Stanislaus Irrigation District (30% in watershed)
PWD = Patterson Water District (55% in watershed)

†AF = acre feet
* Mixed may be a combination of groundwater, San Joaquin River riparian rights, and tail water from upslope drainers. PWD receives approximately 45% from the San Joaquin River, 45% from the DMC, and 10% from groundwater.

Estimate of annual distribution for both PWD and Private:

Month	Annual Flow Distribution
March	10%
April	18%
May	18%
June	15%
July	15%
August	15%
September	9%

Table 3. Agricultural Drainage System for Patterson Watershed Agency (As depicted on Map 3)

Name	Type	Length (miles)	Construction	Drained Acreage	Water Type	Flow Period	Maintenance	Water Quality Concerns†
Del Puerto Creek	main	6.3	natural	6400	storm runoff	Nov - Jan		1,2,3,4
"	"	"	natural	"	ag tail	Feb - Oct		1,2,3,4
Cox Rd. Drain	lateral	0.2	concrete lined	-	ag tail	Feb - Oct		1,2,3,4
Vineyard Ave. Drain	lateral	1.2	pipe	-	ag tail	Feb - Oct		1,2,3,4
Sequoia Ave. Drain	lateral	0.75	pipe	-	ag tail	Feb - Oct		1,2,3,4
V-1	lateral	0.3	pipe	-	ag tail	Feb - Oct		1,2,3,4
Lateral 4 South*	supply	[1.05]	concrete lined	-	DMC & ag tail	Feb - Oct	annual	1,2,3,4
Needham Rd. Drain	lateral	0.65	earthlined	-	ag tail	Feb - Oct		1,2,3,4
Rogers Rd. Drain	lateral	0.7	pipe	-	ag tail	Feb - Oct		1,2,3,4
N-1	lateral	0.3	pipe	-	ag tail	Feb - Oct		1,2,3,4
Lateral 5 South*	supply	[5.0]	concrete lined	-	DMC & ag tail	Feb - Oct	annual	1,2,3,4
Lateral 6 South*	supply	[5.3]	concrete lined	-	DMC & ag tail	Feb - Oct	annual	1,2,3,4
DPC-5	supply	[3.8]	concrete lined	-	SJR & ag tail	Feb - Oct	annual	1,2,3,4
DPC-4	lateral	1.1	pipe	-	ag tail	Feb - Oct		1,2,3,4
DPC-4a	lateral	0.25	pipe	-	ag tail	Feb - Oct		1,2,3,4
DPC-4b	lateral	0.5	pipe	-	ag tail	Feb - Oct		1,2,3,4
DPC-1	supply	[6.1]	concrete lined	-	SJR & ag tail	Feb - Oct	annual	1,2,3,4
DPC-2	supply	[4.9]	concrete lined	-	SJR & ag tail	Feb - Oct	annual	1,2,3,4
DPC-3	supply	[4.3]	concrete lined	-	SJR & ag tail	Feb - Oct	annual	1,2,3,4
Fruit Ave Drain	main	0.65	pipe	288	ag tail	Feb - Oct		1,2,3,4
Magnolia Ave. Drain	main	1.1	pipe	530	ag tail	Feb - Oct		1,2,3,4
SJR-1	point	-	-	-	ag tail	Feb - Oct		1,2,3,4
SJR-2	point	-	-	-	ag tail	Feb - Oct		1,2,3,4
Eucalyptus Ave. Drain	main	1.7	pipe	390	ag tail	Feb - Oct		1,2,3,4
Salado Creek	main	6.1	natural/pipe	-	storm & ag tail	Jan - Dec		1,2,3,4
Sperry Ave. Drain	lateral	0.55	pipe	-	ag tail	Feb - Oct		1,2,3,4
Olive Ave. Drain	main	2.5	pipe	4710	city storm & ag tail	Jan - Dec		1,2,3,4
Baldwin A	lateral	1.1	concrete	-	ag tail	Feb - Oct		1,2,3,4
Baldwin B	lateral	0.7	pipe	-	ag tail	Feb - Oct		1,2,3,4
Black Gultch	lateral	2.9	pipe	-	storm & ag tail	Feb - Oct		1,2,3,4
Walnut Ave. Drain	main	0.7	pipe	451	city storm & ag tail	Feb - Oct		1,2,3,4
Patterson Main Drain	main	3.35	pipe/earth	230(surface)	ag tail and tile	Feb - Oct		1,2,3,4
Richie Slough	main	outside area	pipe/earth	1200	ag tail	Feb - Oct		1,2,3,4
total drains:		33.6		14200				
total mixed supply/drains:		30.5						

* supply lines which receive agricultural tailwater from upslope fields

[ ] = canals which contain both supply and ag tail water

† 1 = excess sediment in tailwater
2 = elevated TDS concentrations
3 = pesticide residue in sediment
4 = pesticide residue in water column

Table 4. Estimated Monthly and Annual Drainage Water Volumn Leaving the Watershed Agency Boundaries.

Time Period	Calculated Drainage Volume in Acre-Feet (8.5% of the Supply) DPWD	WSID	PWD	Private	Wells	Total
January	5	11	-	-	unknown	16
February	10	13	-	-	unknown	23
March	15	139	210	32	unknown	396
April	74	477	379	57	unknown	986
May	118	451	379	57	unknown	1005
June	123	403	315	48	unknown	889
July	123	547	315	48	unknown	1033
August	99	383	315	48	unknown	844
September	49	129	168	29	unknown	375
October	15	14	-	-	unknown	29
November	7	9	-	-	unknown	16
December	2	33	-	-	unknown	36
Total:	641	2608	2082	317	unknown	5649

DPWD = Del Puerto Water District (58% in watershed)
WSID = West Stanislaus Irrigation District (30% in watershed)
PWD = Patterson Water District (55% in watershed)

Table 5. Water Quality Data for the Patterson Watershed Area

Agency	Analyses	Frequency	Location	Concentration Ranges		
				EC (umhos/cm)	Suspended Sed. (mg/L)	B(mg/L)
SCS	Flow, EC, Susp. Sed	weekly, 1988 irrigation season	Del Puerto Ck.		12 - 626	
			Eucalyptus		20 - 1556	
RWQCB	EC, pH, B, Se, Mo, Cu, Cr, Ni, Pb, Zn	monthly: 1985-87 weekly: 1988 irrigation season	Del Puerto Ck.	350 - 1250	-	.1 - .74
			Magnolia	350 - 1800	-	.18 - 1.4
			Eucalyptus	400 - 1750	-	.33 - 1.3
			Olive	400 - 2200	-	.14 - 1.0
			Patterson Drain	550 - 3000	-	0.2 - 1.7
			tile drains: D17		-	1.9
			D18		-	2.0

Agency	Analyses	Frequency	Location	Concentration Ranges in ug/L							
				Se	Mo	Cu	Cr	Ni	Pb	Zn	Hg
RWQCB	EC, pH, B, Se, Mo, Cu, Cr, Ni, Pb, Zn	monthly: 1985-87 weekly: 1988 irrigation season	Del Puerto Ck.	0.3 - 4	<5	<1 - 24	<1 - 17	<5 - 90	<5	<1 - 80	<0.5
			Magnolia	0.2 - 8.8	<5	3.0 - 60	2.0 - 75	5.0 - 430	<5 - 23	7.0 - 270	<0.5
			Eucalyptus	0.8 - 7	<5	15 - 38	9.0 - 39	59 - 230	5.0 - 11	35 - 130	<0.5
			Olive	0.7 - 7.8	<5	<1 - 24	<1 - 23	<5 - 51	<5 - 14	<1 - 165	<0.5
			Patterson Drain	0.4 - 6.8	<5 - 11	<1 - 13	<1 - 9	<5 - 15	<5	3.0 - 20	<0.5
			tile drains: D17	3.3 - 4.0	<5 - 9	2.0 - 6	15 - 17	12.0	<5	-	<0.5
			D18	4.0 - 8	<5 - 24	1.0 - 8	2.0 - 9	8.0 - 12	<5 - 7	1.0 - 61	<0.5 - 1.2

Agency	Analyses	Frequency	Location	Sediment Concentrations in mg/kg							
				Se	Mo	Cu	Cr	Ni	Pb	Zn	Hg
USGS	sediment: pesticides trace elements	1985 (one time)	Del Puerto Ck.	0.2	<2	23	52	27	17	67	0.12

Agency	Analyses	Frequency	Location	Pesticide Concentrations in ug/L			
				DDD	DDE	Dieldrin	Toxaphene
USGS	sediment: pesticides trace elements	1985 (one time)	Del Puerto Ck.	29	73	1.4	250