CALFED Analytical Variables and Relationships
April 23, 1996

Response Variables for CALFED Programmatic EIR/EIS	Primary Variables	Secondary Variables	Supporting Variables	Supporting Variables	Control Variables	CALFED Actions
WATER QUALITY						
1 Delta Ag EC (South, Central, Western)	EC @ Vernalis	EC Ag Load	Ag Acres		X	Land Retirement, Land Fallowing, Drainage Controls
		Flow @ Vernalis	Trib Flows		Flows	
	EC @ Freeport	EC Ag Load			X	Land Retirement, Land Fallowing, Drainage Controls
		Flow @ Freeport	Trib Flows		Flows	
	EC @ Drains	Applied EC			Feedback	
		Drainage Flow	Ag Acres		X	Delta Land Conversion, Delta Drainage Control
			Rainfall		Input	
	EC @ Jersey	Outflow			Flows	
		Exports			Flows	
2 Export Cl	Location				X	Relocate Diversions
	Cl @ Vernalis	Cl Ag Load	Ag Acres		X	Land Retirement, Land Fallowing, Drainage Controls
		Flow @ Vernalis	Trib Flows		Flows	
	Cl @ Freeport	Cl Ag Load			X	Land Retirement, Land Fallowing, Drainage Controls
		Flow @ Freeport	Trib Flows		Flows	
	Cl @ Drains	Applied Cl			Feedback	
		Drainage Flow	Ag Acres		X	Delta Land Conversion, Delta Drainage Control
			Rainfall		Input	
	Cl @ Jersey	Outflow			Flows	
		Exports			Flows	
3 Export DOC	DOC @ Vernalis	DOC Ag Load	Ag Acres		X	Land Retirement, Land Fallowing, Drainage Controls
		Flow @ Vernalis	Trib Flows		Flows	
	DOC @ Freeport	DOC Ag Load			X	Land Retirement, Land Fallowing, Drainage Controls
		Flow @ Freeport	Trib Flows		Flows	
	Delta DOC load	Applied DOC			Feedback	
		Ag Drainage DOC	Ag Peat Soils		X	Delta Land Conversion, Delta Drainage Control
			Vegetation		X	Wetland restoration, Riparian restoration
			Rainfall		Input	
		Primary production			Response	
4 Disinfection-by-products in treated drinking water	Export DOC				Response	
	Export Br	Export Cl			Response	
	Treatment Process				Fixed	

KEY:
X = Direct Control
Flows = Water Management Control
Fixed = relationship is assumed to not change
Input = Monthly hydrologic or meteorologic conditions
Feedback = depends on another calculated variable
Response = depends on another response variable

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ECOSYSTEM

1 Species Populations (20+ Species)	Anadromous Fish (Winter, Spring, Fa San Joaquin Fall, steelhead,sturgeon striped bass, shad)	Riverine habitat Estuarine Habitat Transport Conditions Hatchery Production Fishing Harvest Ocean Conditions			Shallow water habitat restoration
	Resident Fish (splittail,delta smelt longfin smelt)	Estuarine Habitat Entrainment			
	Wildlife species	Wetland Habitat Riparian Habitat			
	Rare Plant species	Wetland Habitat Riparian Habitat			
2 Primary Production	Habitat Area	X2 Location hydrography	Outflow	Flows X	 Shallow water habitat restoration
	Chlorophyll	nutrient supply (N,P,C)	Concentration Inflows Exports	X Flows Flows	Nutrient Load Management
		light	Solar radiation suspended solids	Input X	Watershed Erosion Protection
		grazing residence time	Inflows Exports	Feedback Flows Flows	
	macrophytes	hydrography velocity			
3 Food Web Production	Habitat Area	X2 Location hydrography	Outflow	Flows X	 Shallow water habitat restoration
	Zooplankton	primary production predation residence time	Inflows Exports	Feedback Feedback Flows Flows	
	Organic detritus	primary production decomposition			
	Benthic Organisms	substrate salinity	suspended solids	X	Dredging management
4 Delta Entrainment	PGE Pumping Delta Ag Direct Exports Inflows			X X Flows Flows	Cooling Towers, Reduced Generation Screened Diversions, Relocate Diversions, Alternative Supply, Groundwat
5 Estuarine Habitat	Shallow Area Salinity	Hydrography X2 Location	 Outflow		
6 Toxicity & Low DO	Sources	Ag Drainage M & I Discharges		X X	Ag Drainage Controls Source Controls, Treatment
	Flows			Flows	
7 Wetland Habitat	Tidal Wetlands	Tidal Flows Salinity		X Feedback	Tidal wetland Restoration

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	Flooded Wetlands	Location Water management			X Flows	Wetland Restoration
8 Riverine Habitat	Spawn & Rear	Gravel Area Temperature Channel Geometry Shaded-Riparian Entrainment	Reservoir Storage Flows Flows Diversions Flows		X Flows Flows X X Flows X Flows	Gravel Restoration Channel Restoration Riparian Restoration Demand management, Conjunctive Use
9 Riparian Habitat						
10 Reservoir Habitat	Surface Area				Flows	
WATER SUPPLY						
1 GW Storage (21 subregions)	Recharge Pumping	River Recharge Subsurface Inflow Rainfall Irrigation Diversion Deficits Pumping Cost	River Flows Foothills Runoff Ag Acres Diversions Ag Demand GW Elevation	Crop Acres	Flows Input Input X Flows X Feedback	Land Retirement, Land Fallowing, Crop Shifting Land Retirement, Land Fallowing, Crop Shifting, Transfers
2 Reservoir Storage (10-20 locations)	Runoff Flood Control Demands Instream Targets	Flood Storage Channel Capacity			Inputs Fixed Fixed X X	Demand Management, Conjunctive Use, Transfers IFIM Requirements, Pulse Flows
3 Deliveries (10-20 locations)	Runoff Demands Diversions Storage				Input	
4 Instream Flows (10-20 locations)	Instream Targets Runoff Storage Demands					
5 Drainage Flow (10-20 locations)	Rainfall Irrigation Soils Drainage Facilities	Crop Acres Applied EC			Input X Feedback Fixed Fixed	Land Retirement, Ag Conservation
SYSTEM INTEGRITY						
1 Levee Stability	Flood Risk Seismic Risk Subsidence Risk					
2 Land Subsidence from GW Pumping	GW elevation	GW Storage			Feedback	

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3 Water supply integrity	aqueduct integrity emergency storage					
4 Ecosystem integrity	extreme conditions introduced species diversity	 habitats niches species				
ECONOMICS						
1 Cost of Alternative	Cost of Action Matching Funds	Capitol Investment Costs Maintenance Costs				
2 Value of Recreation	Expenditures & User-days	Fishing success Reservoir surface area River Flows Refugee or habitat area	Fish population Reservoir storage	Riverine habitat	Response Flows Flows X	 Habitat restoration
3 Value of Commercial	Harvest	Fish Population Regulations			Response Feedback	
Fishery Harvest	Market Price					
4 Net Value of Flood Damage Protection	Flood Risk Property Value Levee expenditure					
5 Net Farm Income	Crop Acres Irrigation Efficiency Water supply Crop Market Price Land Values Labor & materials Subsidees	 Surface water supply Ground water supply	 Contracts Delivery Costs Pumping Costs	 GW elevation	X Flows Feedback Feedback	Land retirement, fallowing, crop shifting Ag water conservation
6 Value of Urban Water Supply	Urban Supply Urban Supply Cost					
7 Regional Income & Employment					Feedback	
8 Hydropower Value	Reservoir Storage Reservoir Releases Export Pumping GW Pumping Power Cost				Flows Flows Flows Response	

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