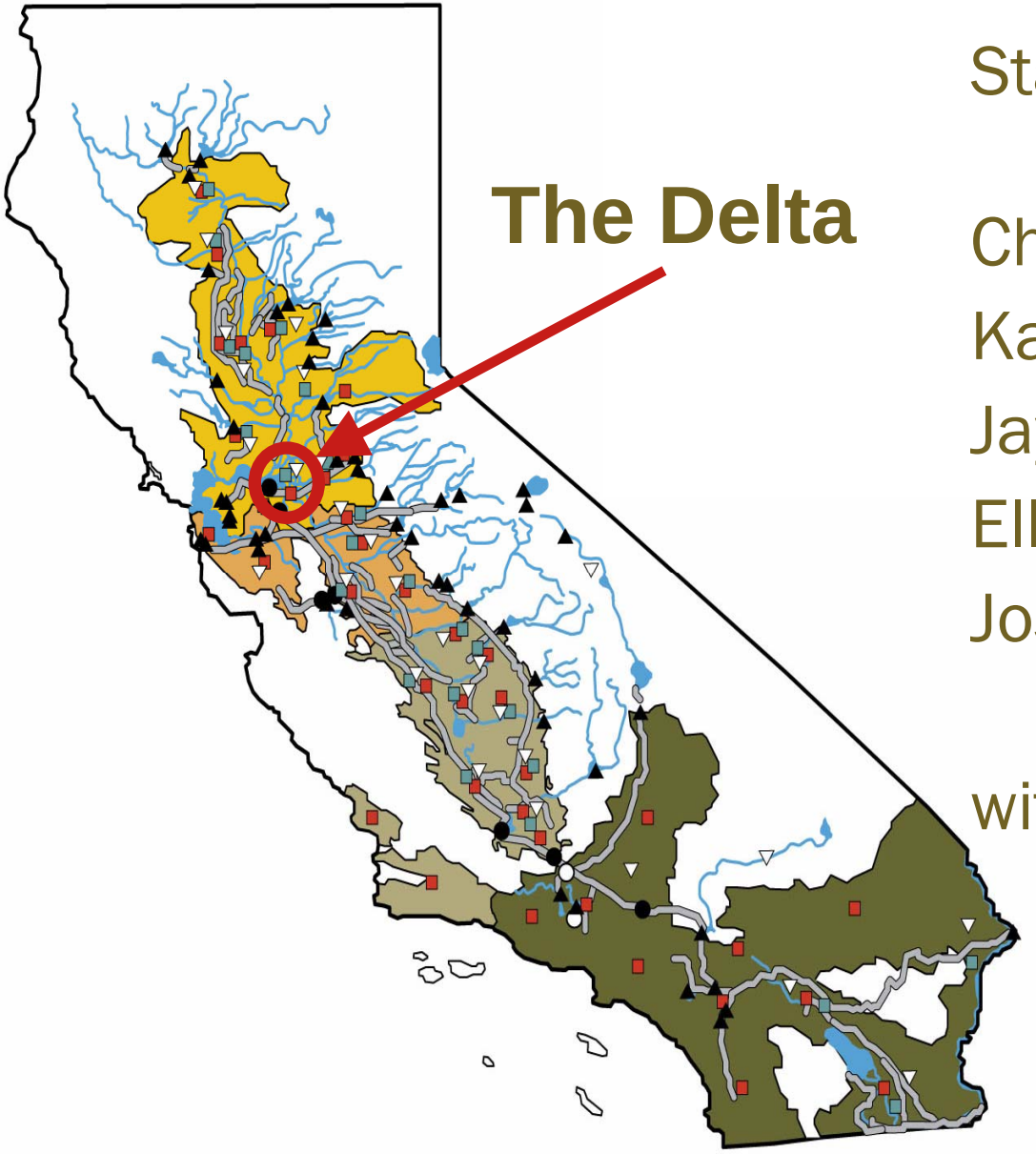
Economic Costs & Adaptations for Alternative Delta Regulations: Appendix F



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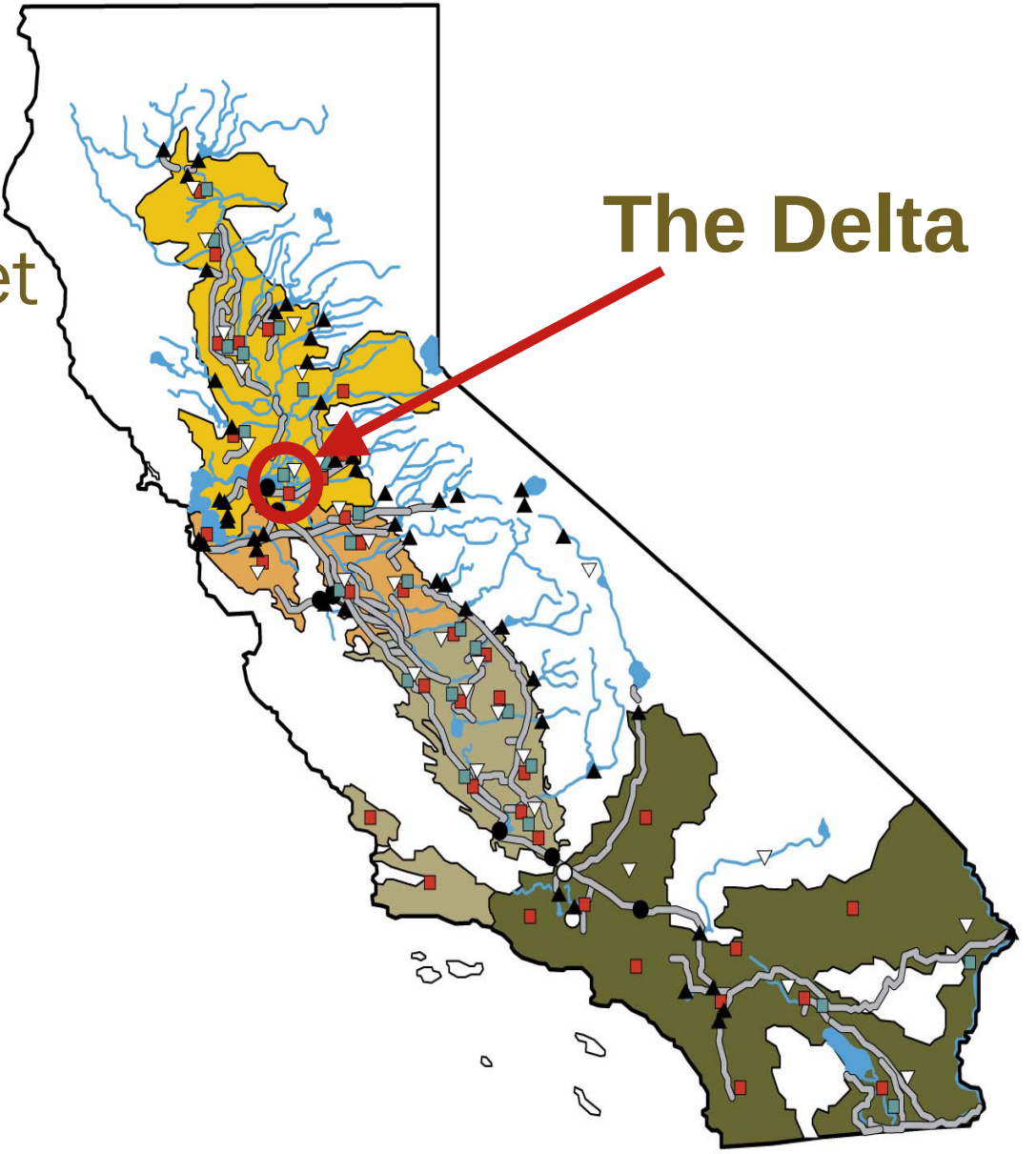
Delta and California's Water System

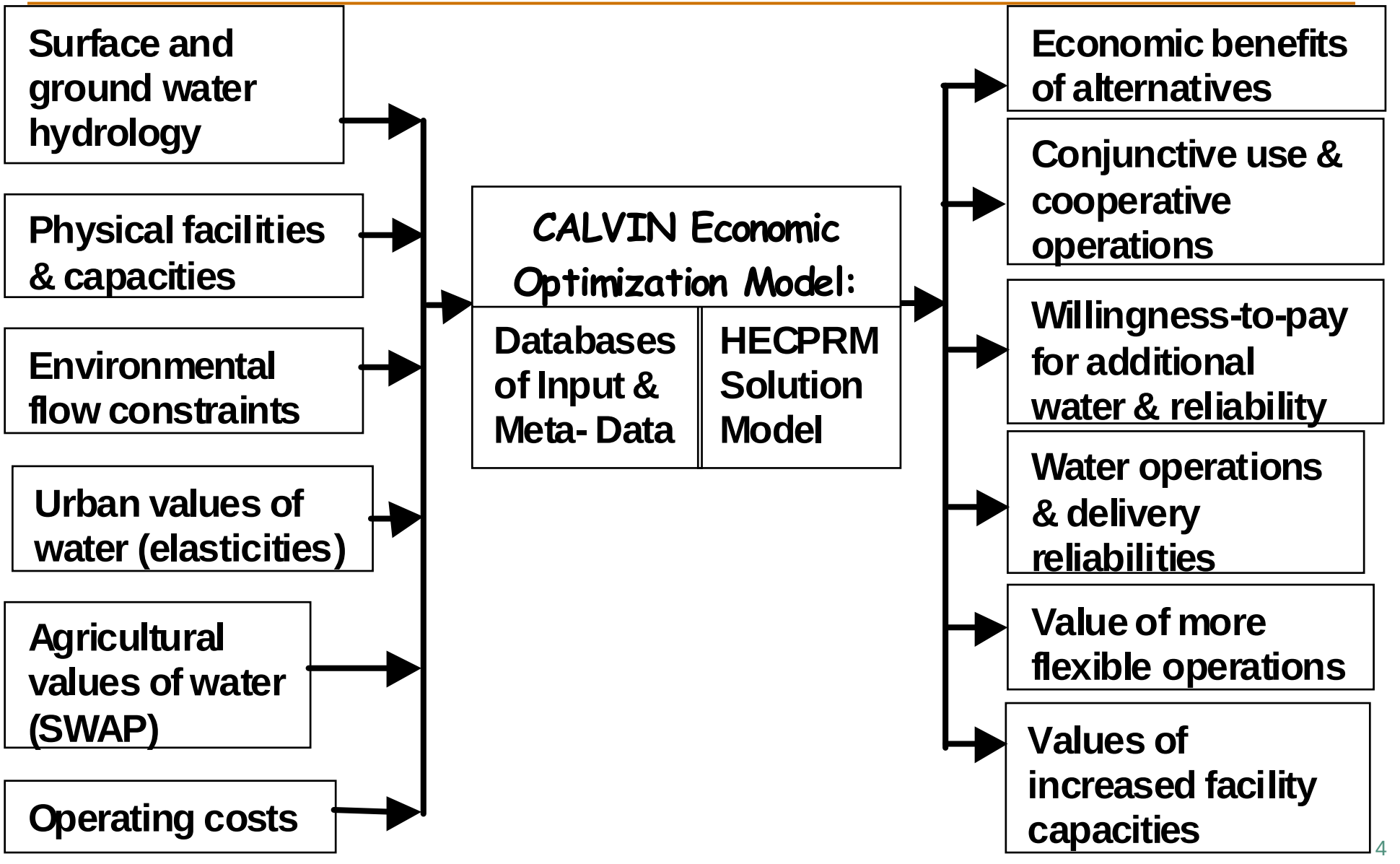
- Economic effects of reducing water exports
- Effects of increasing net Delta outflows
- Comparisons of Delta regulations
- Employment impacts
- Conclusions



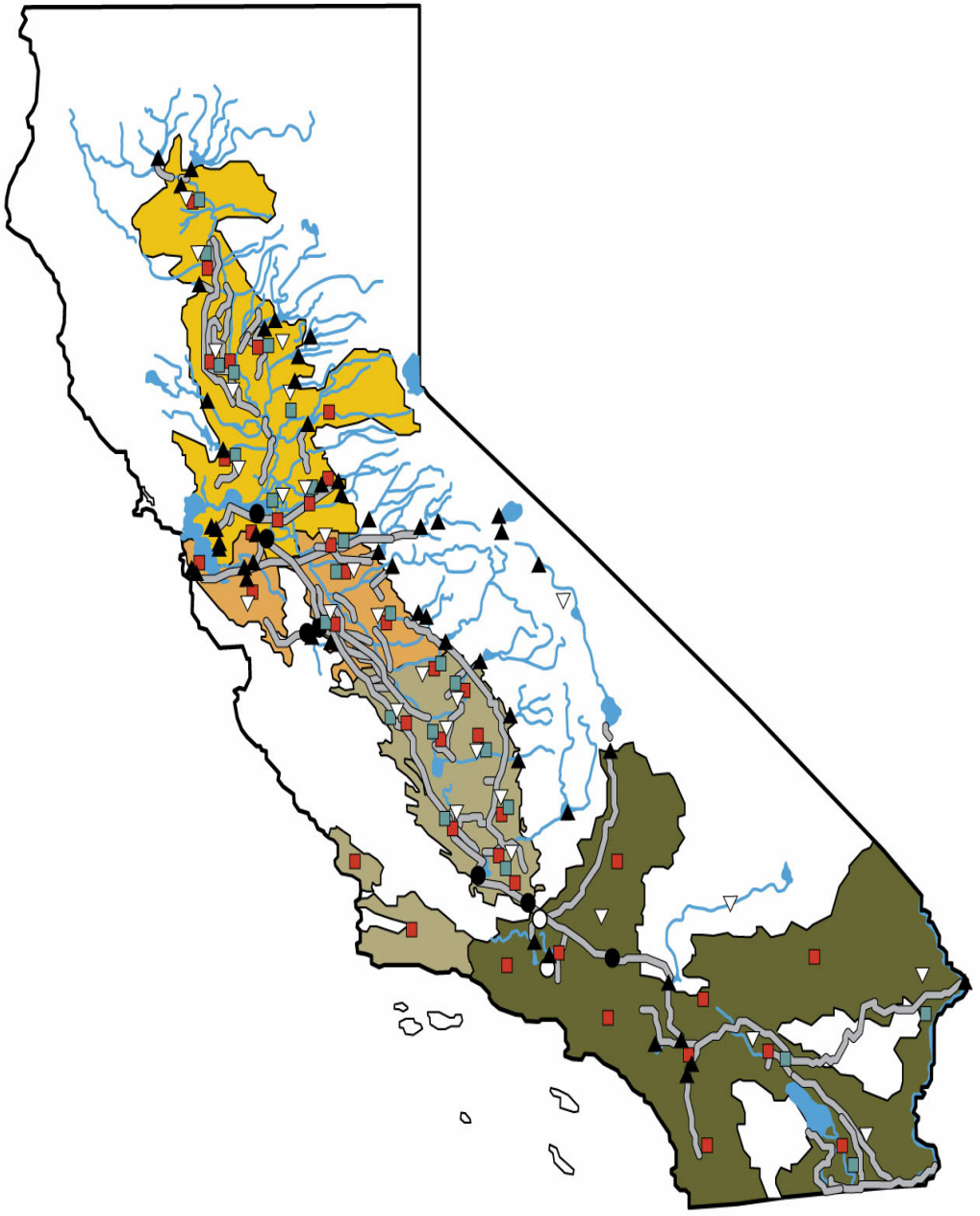
CALVIN Model

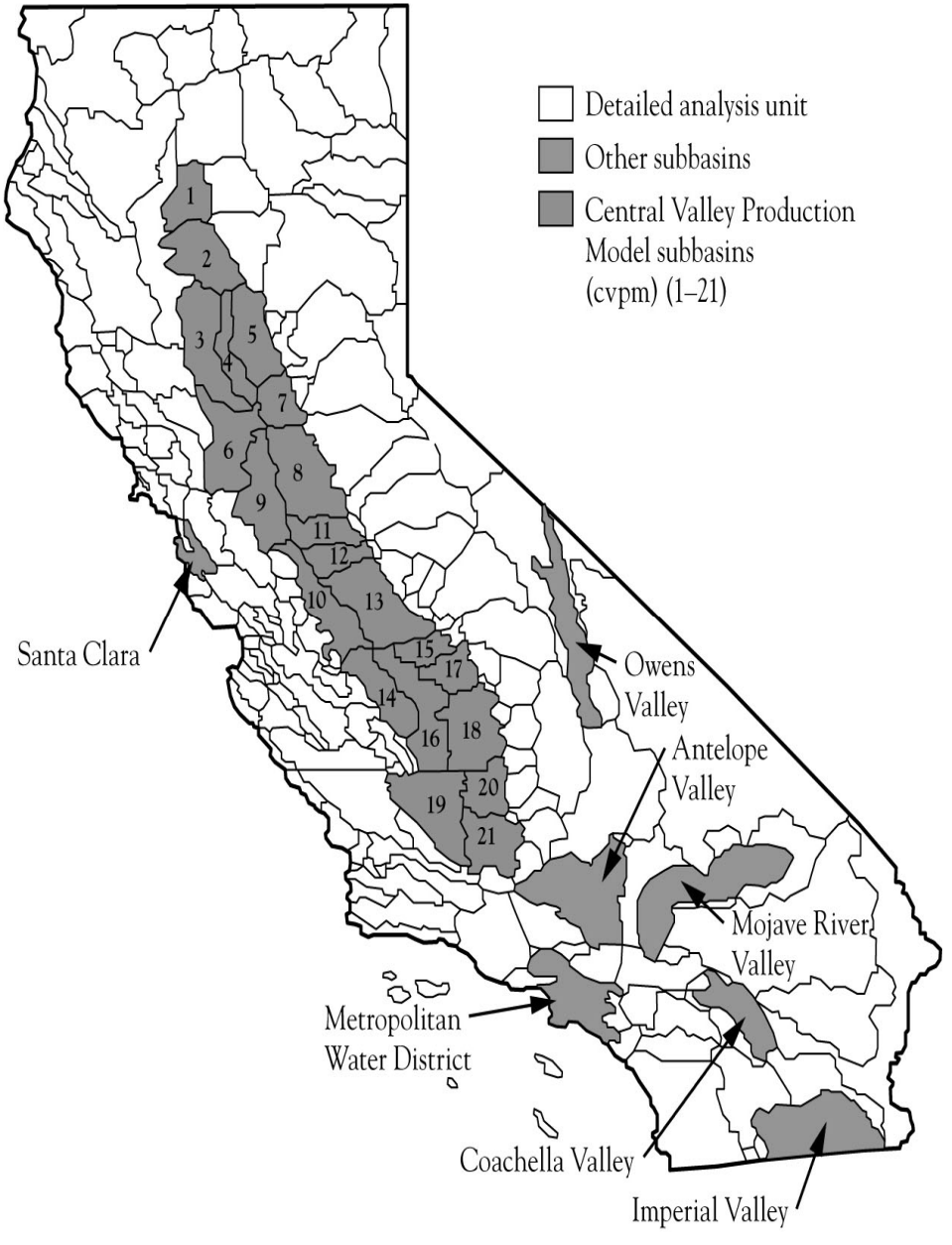
- Statewide intertied water system
- Integrated water management:
  - Reservoir reoperation
  - Groundwater & conjunctive use
  - Water conservation
  - Wastewater reuse
  - Seawater desalination
  - Water markets
- <u>Optimized</u> for statewide economic benefits
- Highly reviewed models and applications

CALVIN Model



Model Coverage





Applications of CALVIN

- Regional and statewide water markets & values of new facilities (2001)
- Conjunctive use in S. California (2002)
- Restoring Hetch Hetchy (2003)
- Climate warming & adaptation (2003, 2005, now)
- Paleodrought (2005)
- Groundwater overdraft (2006)
- Baja California & Colorado R. Delta (2006 - now)
- Delta water supply impacts (2002, 2007- now)
- Sacramento Valley Conjunctive Use (2008)

Does it work? 2001 Predictions

1. Water market transfers
   - IID – San Diego transfers
   - Kern–Castaic transfers
   - Sacramento Valley to South transfers
2. CCWD-EBMUD inter-tie
3. No major new surface storage
4. More conjunctive use development
5. CRA conjunctive use fails (2003)

Only a model, “wrong, but sometimes useful.”

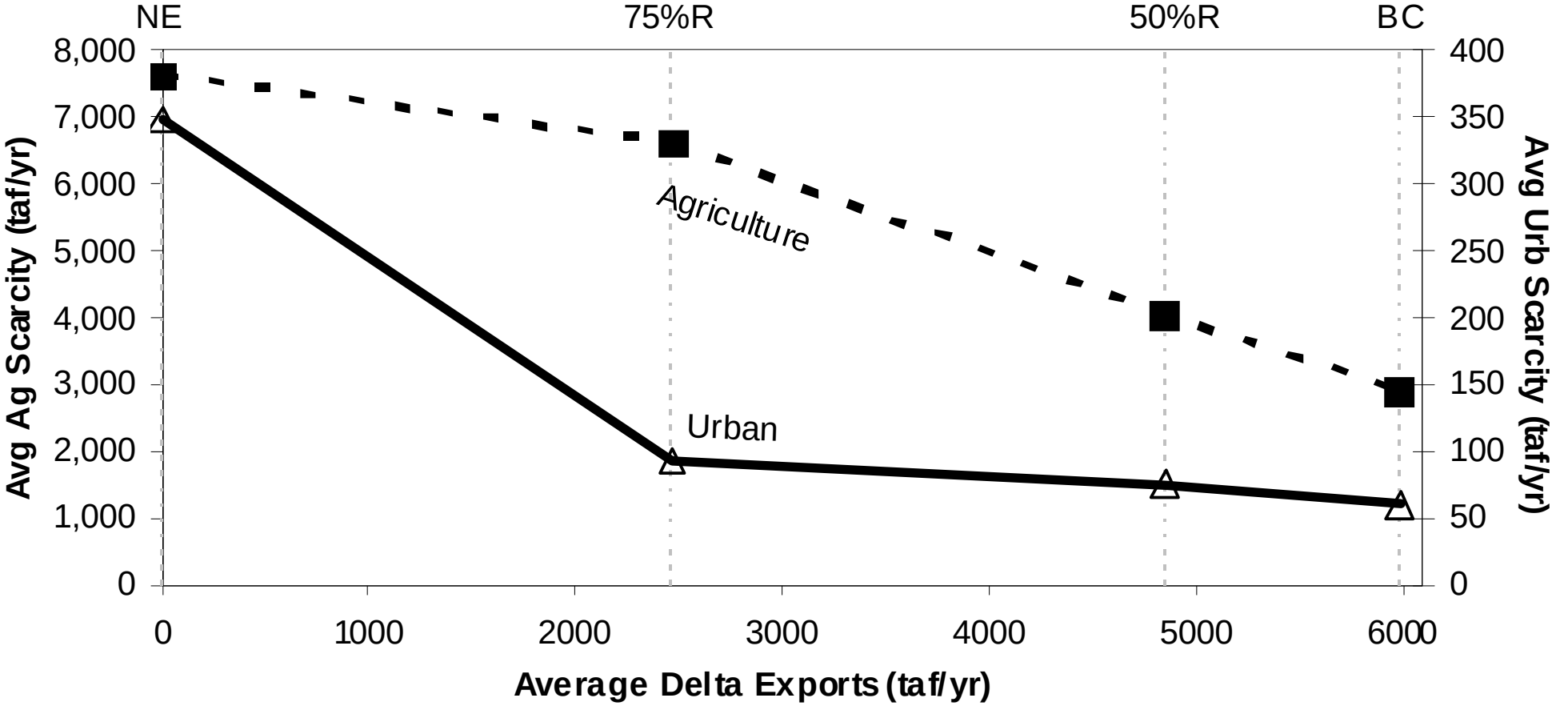
Delta Model Runs

- What is the problem?
  - Exports from the Delta
  - Reductions in net Delta outflow

- Runs reducing and ending water exports
- Runs increasing net Delta outflows, but not necessarily reducing exports
- Model results for 2050 conditions:
  - Water deliveries and shortages
  - Water scarcity costs
  - Operating costs
  - Mix of water management decisions

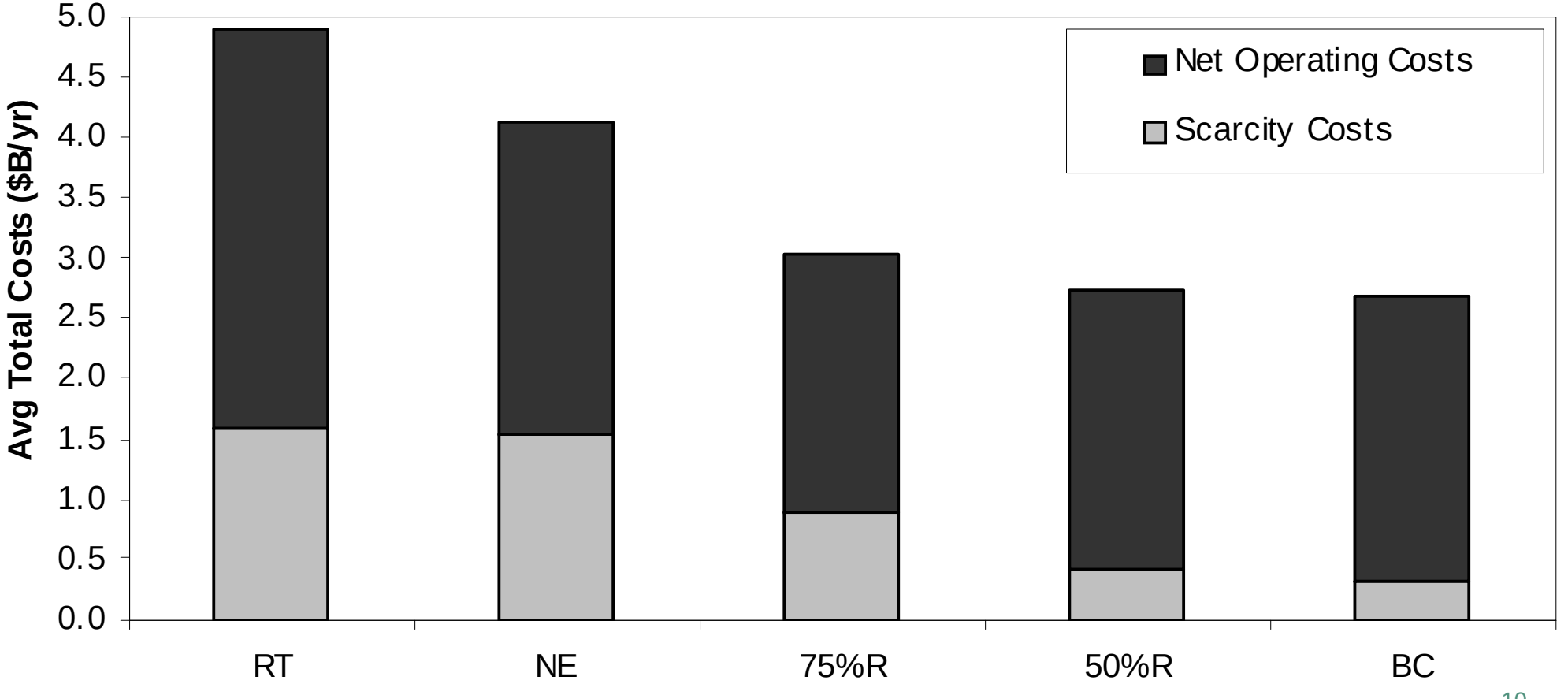
Reducing Water Exports

- Responds to problems with in-Delta intakes
- Reduce physical export capacity, to zero



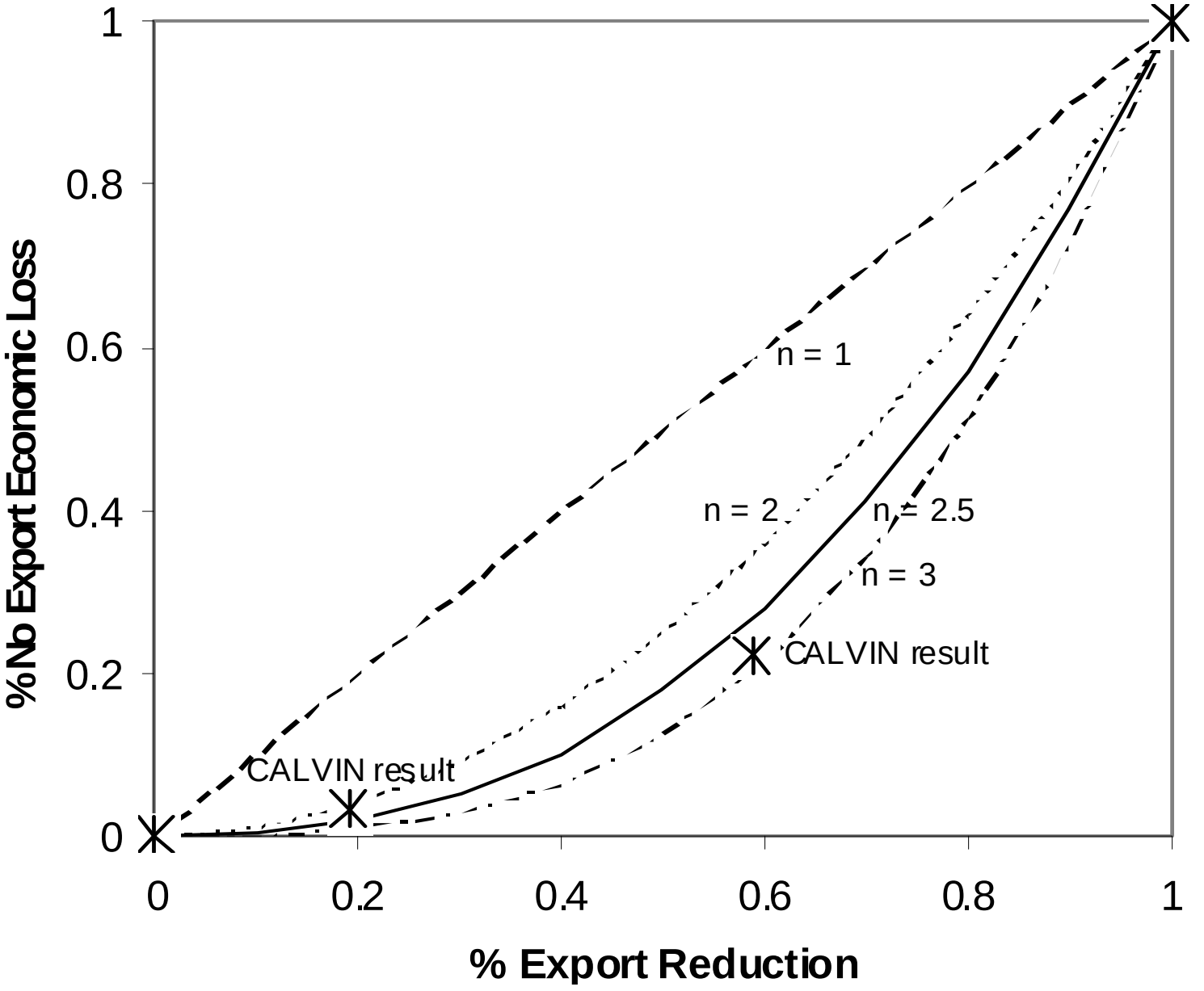
Reducing Water Exports

- Economic costs: $1.5 - $2.2+ billion/year (2050)
- RT = restricted transfers



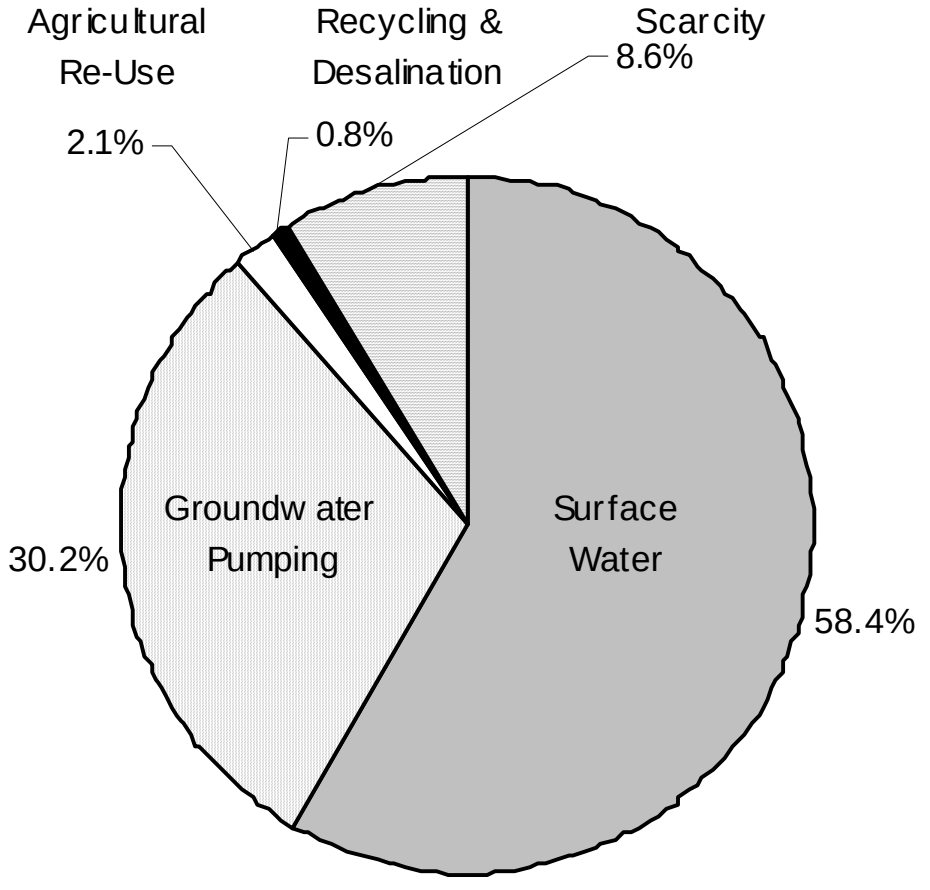
Reducing Water Exports

- Statewide costs of partial reductions in exports

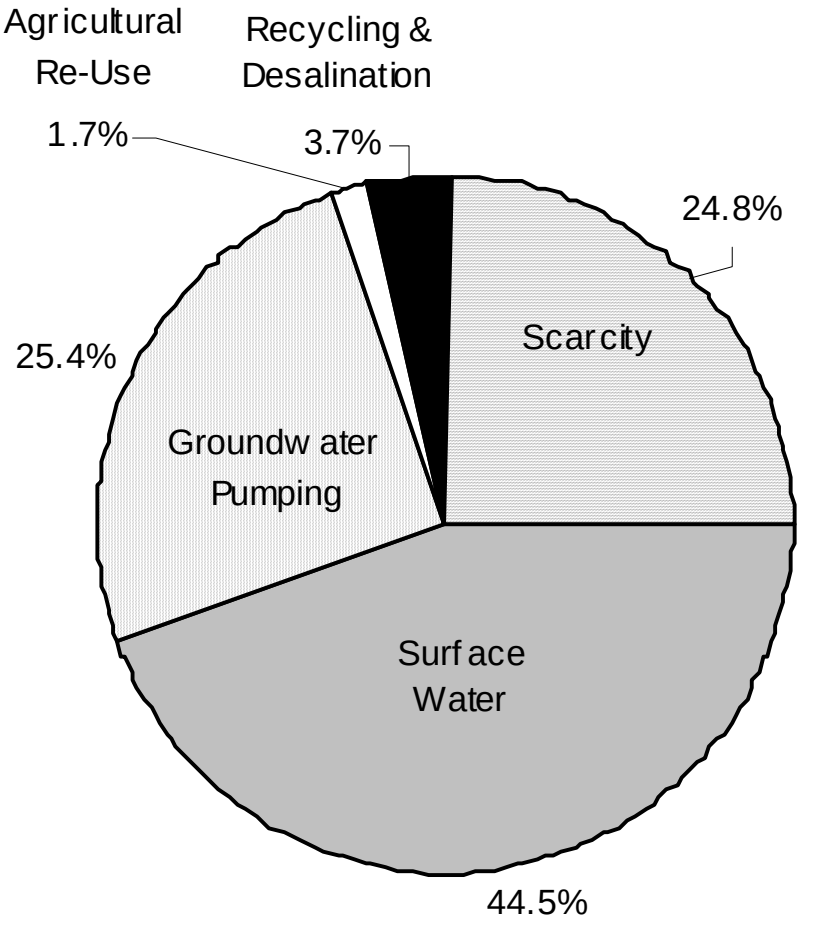


Ending Water Exports

- Water management adaptation
- Unfettered water market



South of Delta –Base Case



South Delta – No Exports

Ending Water Exports

- Employment and regional income effects in southern Central Valley

	Southern Central Valley Crop Losses with No Delta Exports*		
	Base	No Exports	Reduction
Water Delivery (maf)	15.0	10.1	4.9 (29%)
Irrigated Crop Acres (million acres)	3.399	2.522	0.877 (26%)
Agricultural Crop revenue ($billion)	19.0	15.7	3.3
Water Scarcity Costs# ($billion)	-	-	0.814
Valley Crop Income ($billion)	25.5	21.1	4.4
Valley Crop Agricultural Jobs	598,000	495,000	103,000

* 2050 crop projections (in 2008 dollars). #Estimated from SWAP post-processing

Ending Water Exports

- Reduced agricultural water deliveries

	Region	Base Case (% target delivery)	No Export (% target delivery)	No Export % of Base Case
Sacramento Valley & Delta	CVPM 1	95.8	95.8	-0.1
	CVPM 2	92.6	97.5	5.3
	CVPM 3	100	100	0
	CVPM 4	98.7	100	1.3
	CVPM 5	94.7	99.5	5.1
	CVPM 6	100	100	0
	CVPM 7	94.6	95.7	1.1
	CVPM 8	98.4	97.9	-0.5
	CVPM 9	93.1	95.8	2.9
Exchange contractors	CVPM 10	91.9	45.4	-50.6
E. San Joaquin Valley	CVPM 11	97.9	97.4	-0.5
	CVPM 12	85.5	84.9	-0.7
	CVPM 13	87.7	76.2	-13.2
Westlands	CVPM 14	90	39.2	-56.5
E. Tulare Basin	CVPM 15	90.9	75	-17.5
	CVPM 16	95.2	85.3	-10.4
	CVPM 17	81.8	72.2	-11.7
W. & S. Tulare Basin	CVPM 18	90.1	45	-50.1
	CVPM 19	91.9	52.9	-42.4
	CVPM 20	90.4	63	-30.3
	CVPM 21	91.3	21.4	-76.6
	Total	92.5	74.3	-19.7

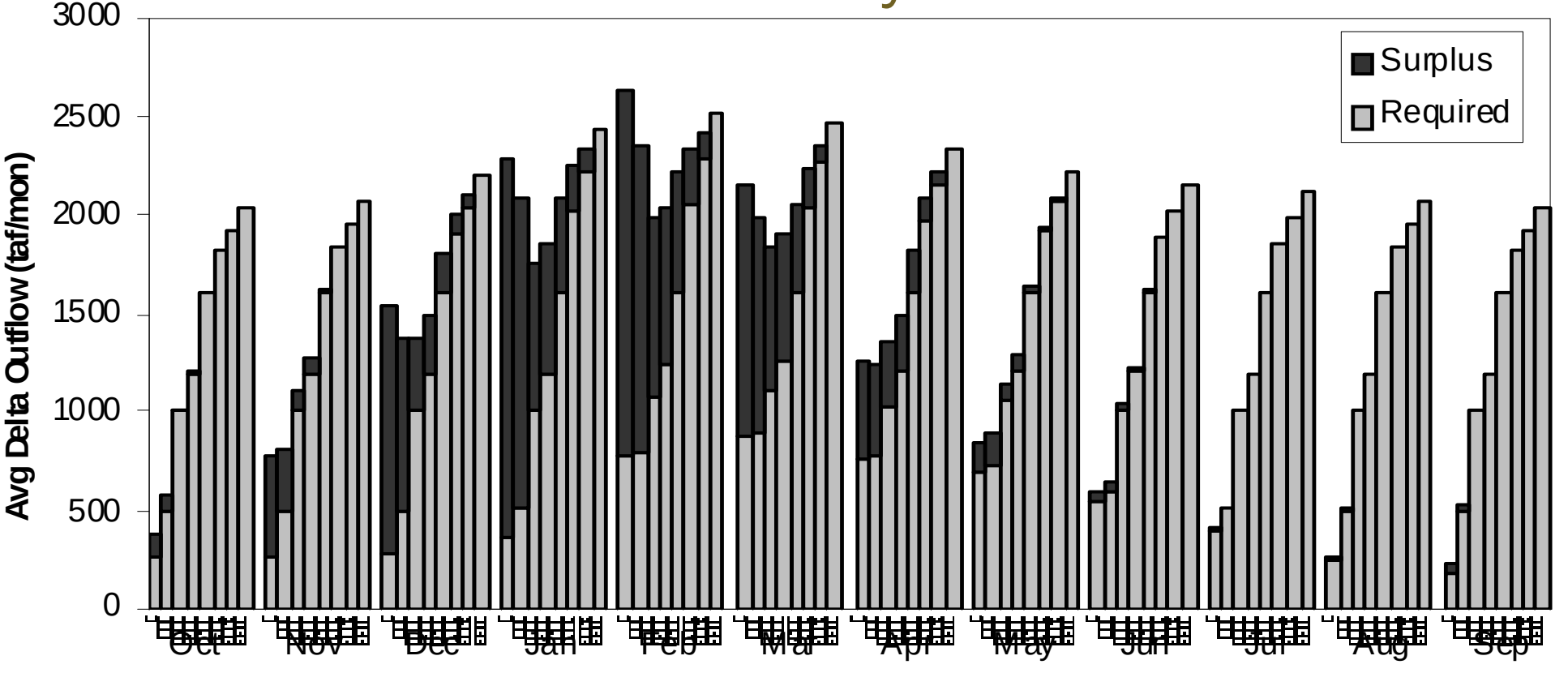
Ending Water Exports

- Reduced agricultural acreages (SWAP results)

	San Joaquin Valley			Statewide
Crop	Base Case	No Export	No Export (% of Base Case)	No Export (% of Base Case)
Alfalfa	380,413	262,442	-31.0	-18.4
Citrus	222,135	215,610	-2.9	-2.6
Cotton	589,463	373,434	-36.7	-36.7
Field Crops	294,990	128,843	-56.3	-25.8
Grains	144,921	34,271	-76.4	-39.8
Orchards	766,653	713,414	-6.9	-3.8
Pasture	179,452	133,541	-25.6	-12.8
Raisins	26,287	25,293	-3.8	-3.8
Rice	6,278	5,184	-17.4	0.3
Sugar Beet	36,485	28,919	-20.7	-15.6
Table Grapes	17,184	17,021	-1.0	-1.0
Tomato	245,225	144,664	-41.0	-23.6
Truck Crops	398,661	356,093	-10.7	-8.3
Wine Grapes	91,451	83,671	-8.5	-4.4
Total	3,399,598	2,522,400	-25.8	-15.3

Increasing Net Delta Outflows

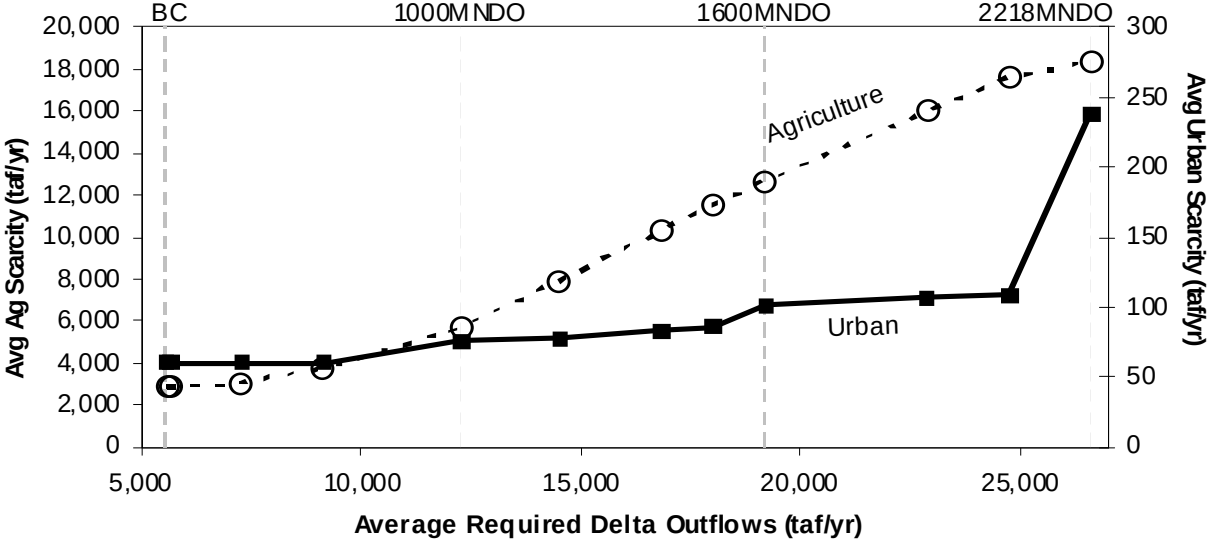
- Allows exports to continue with water purchased upstream
- Increase minimum monthly Delta outflow

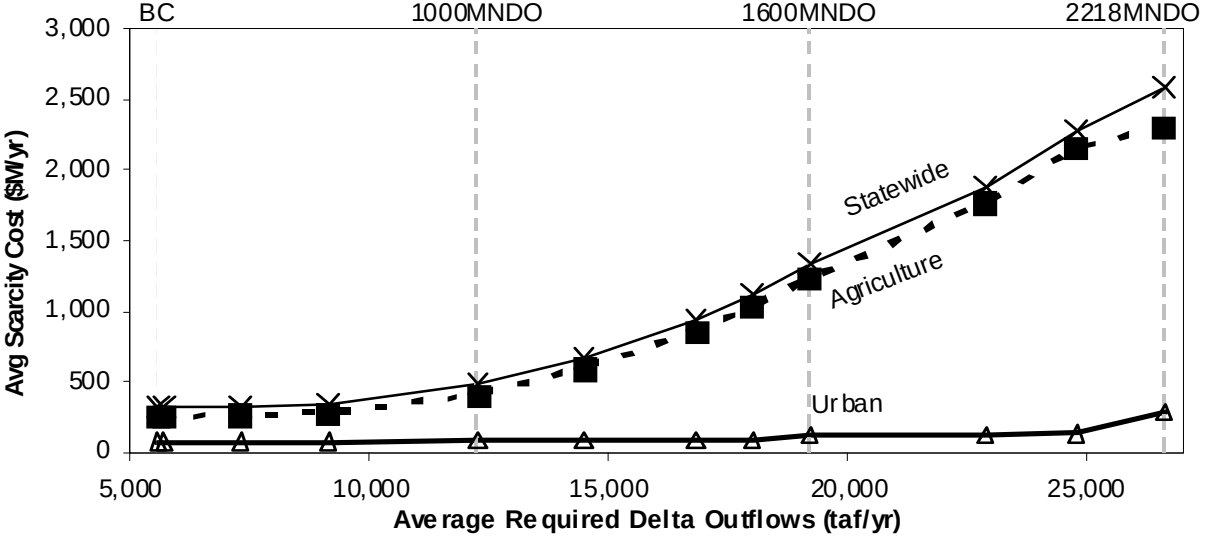


Monthly required flows increase with each run

Increasing Net Delta Outflows

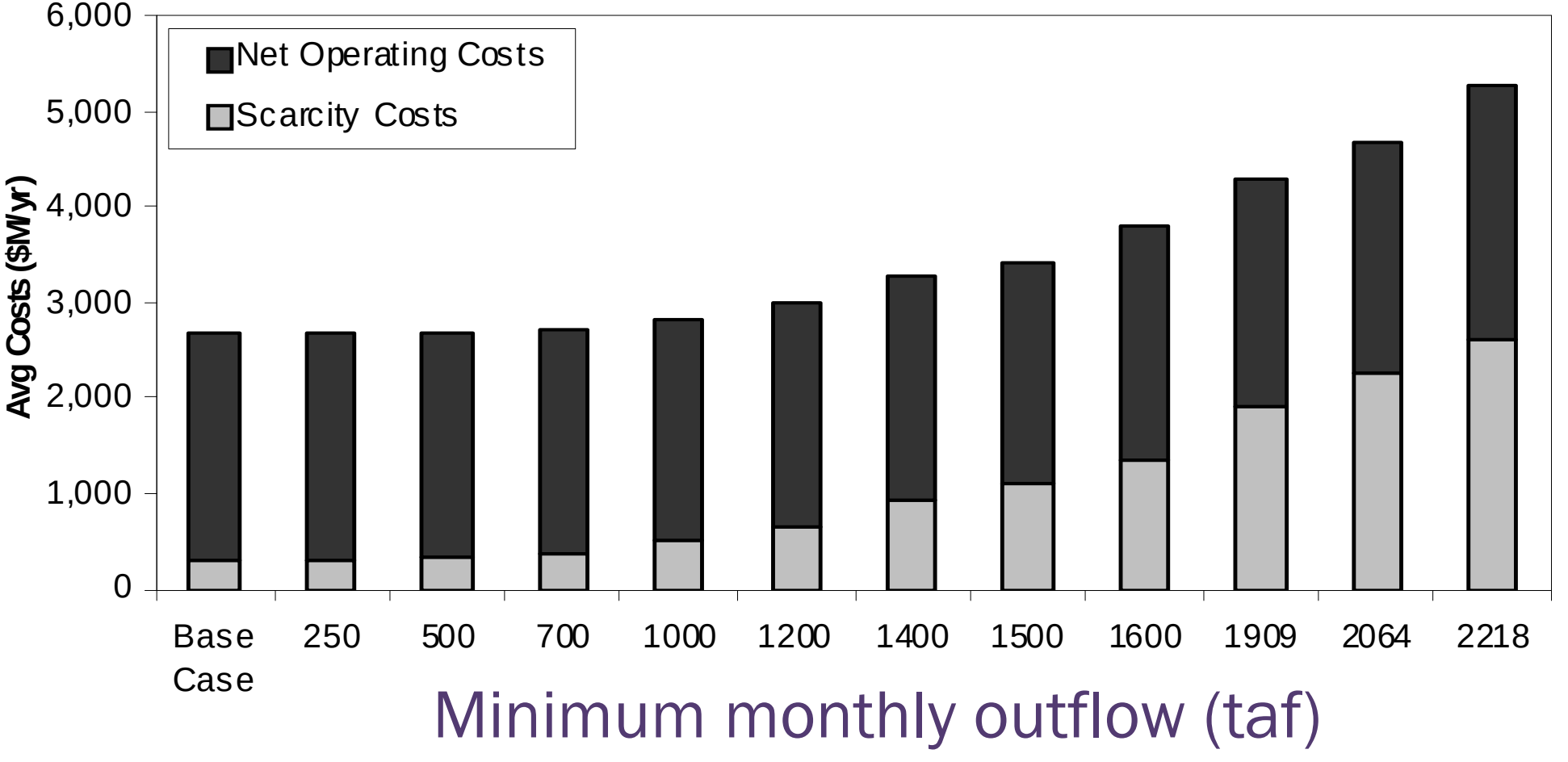
- Water Scarcity and scarcity costs





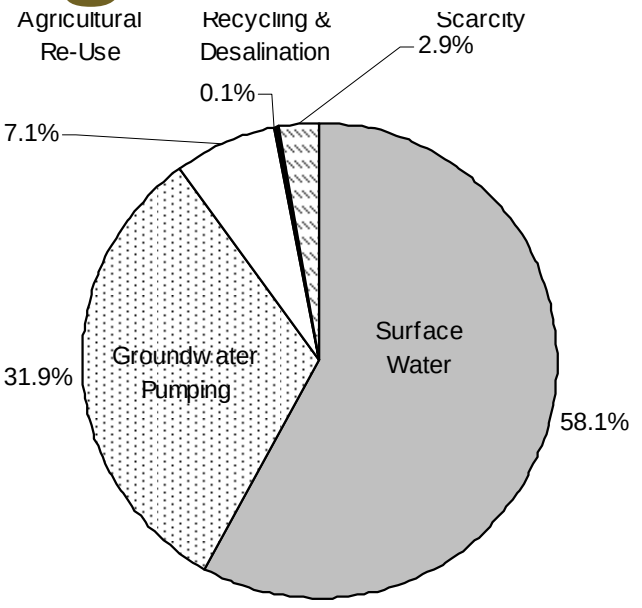
Increasing Net Delta Outflows

- Total economic costs

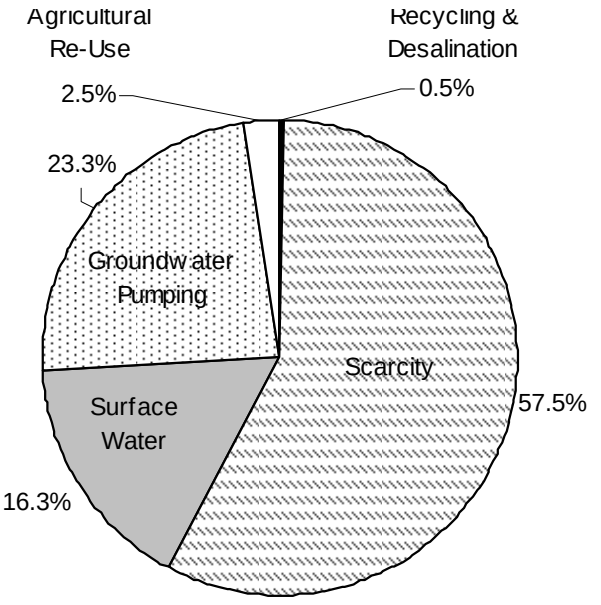


Increasing Net Delta Outflows

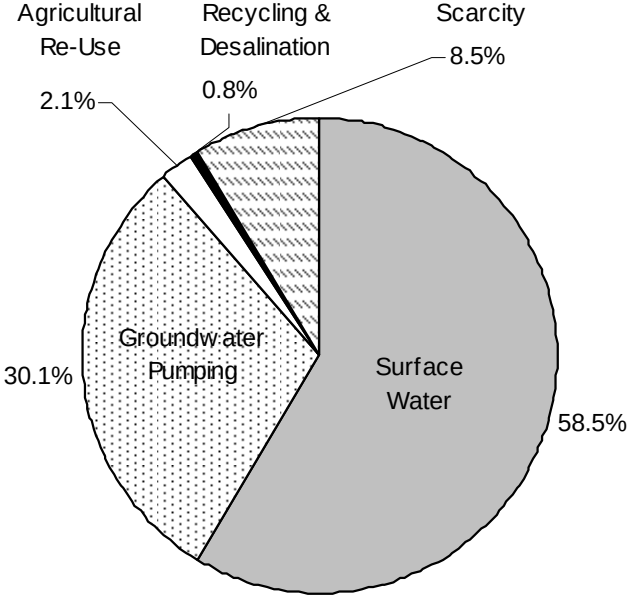
- Water management adaptation



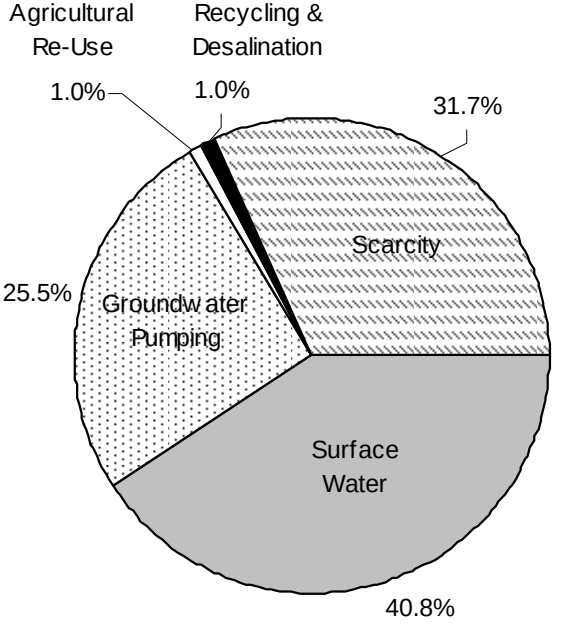
North of Delta – Base Case



North of Delta – 1909 taf per month MNDO



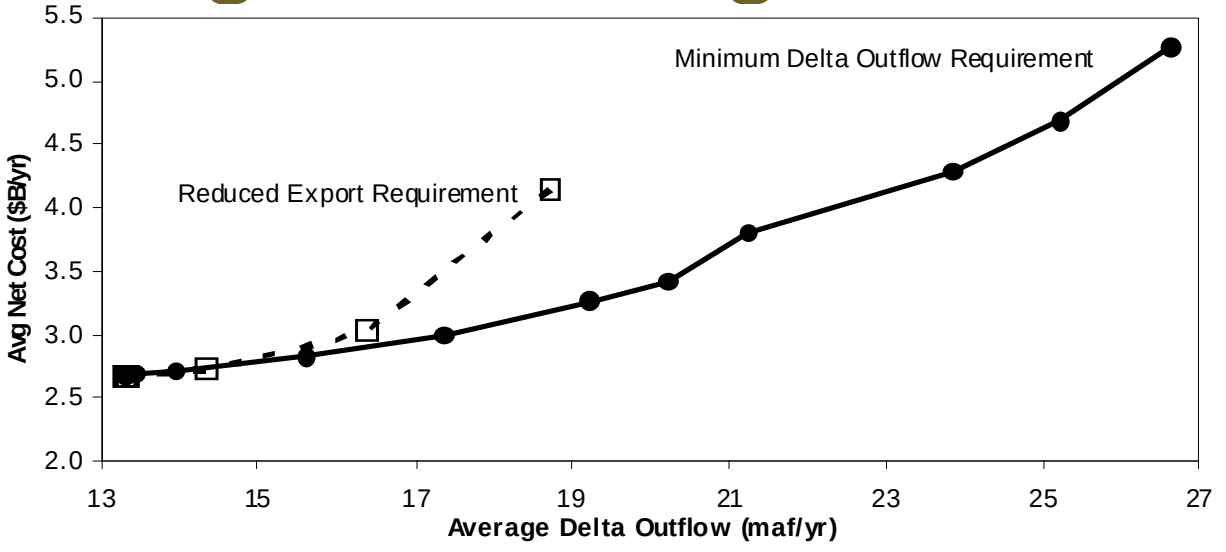
South of Delta – Base Case

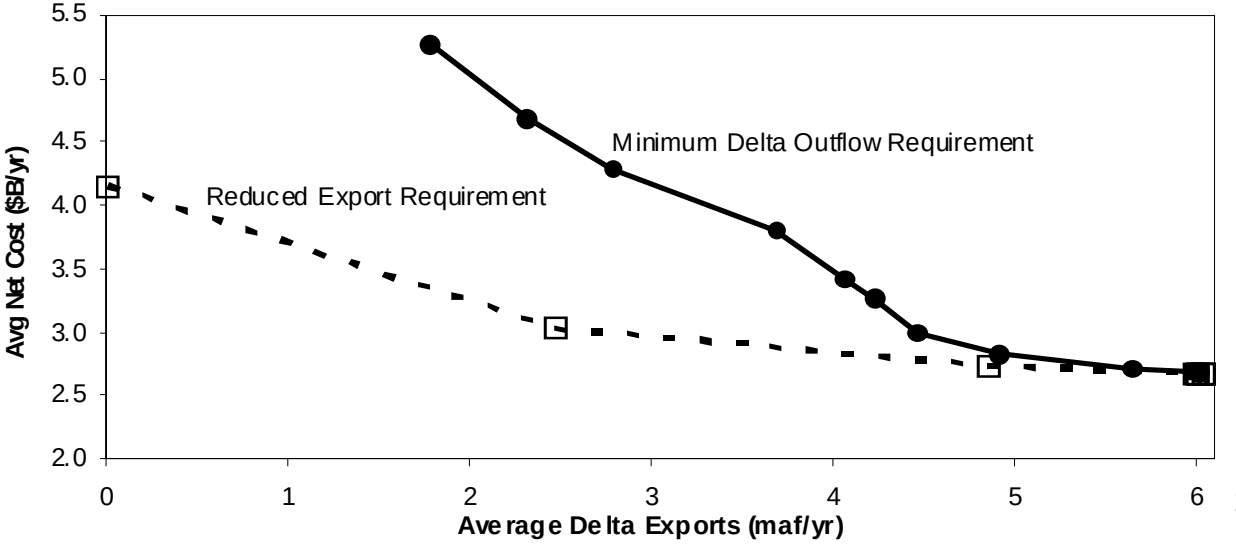


South of Delta – 1909 taf per month MNDO

Comparing Delta Regulation Strategies

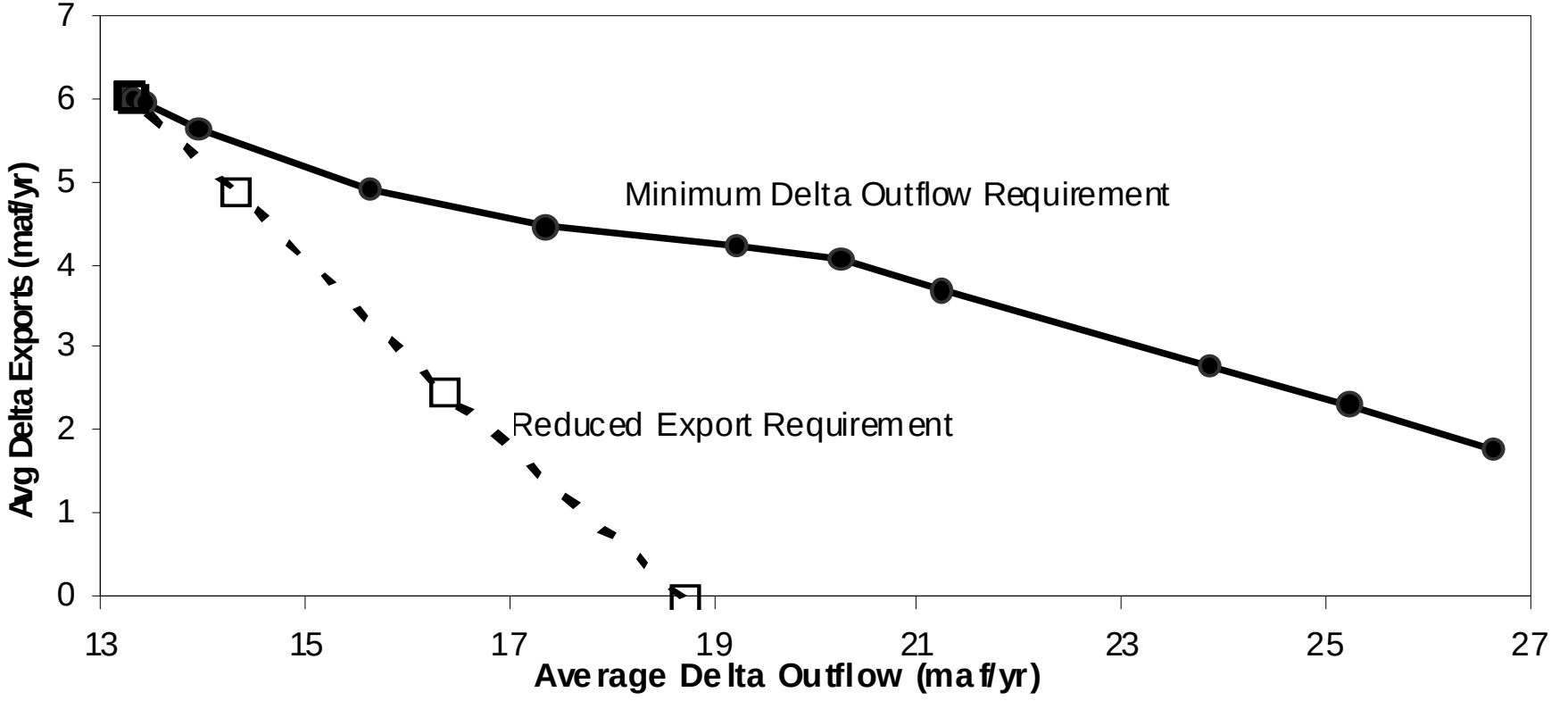
- Regulation strategies have different costs & effects





Comparing Delta Regulation Strategies

- Regulate exports based on objectives

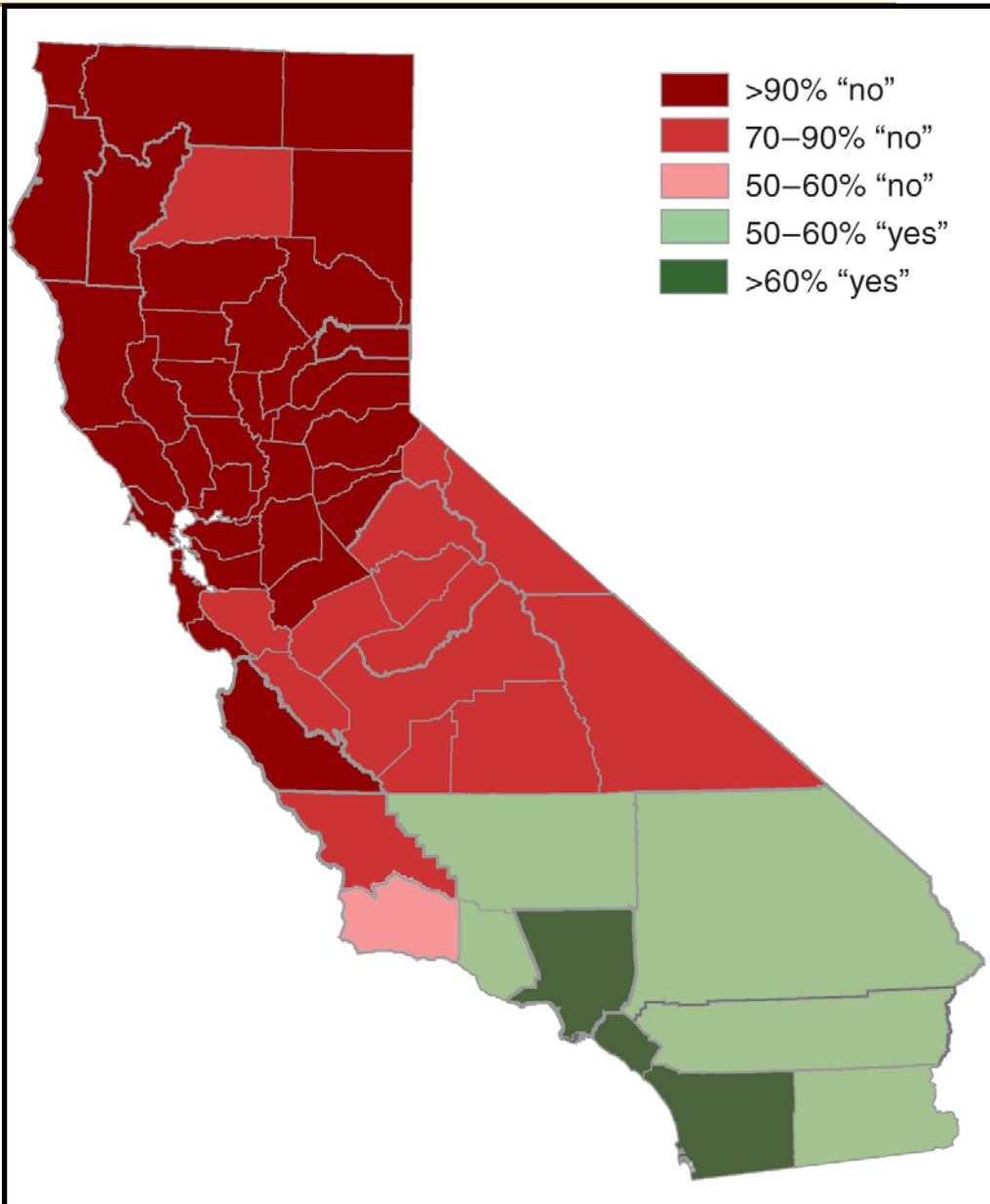


Conclusions

- Ending exports is possible, but costly $1.5 - 2.3+B/yr
- Ending exports not catastrophic statewide, but is for parts of southern Central Valley agricultural economy
- Shortages are felt more by agriculture, as cities buy all they can. Larger shortages get cities too
- Water conservation, wastewater reuse, and seawater desalination help some
- Reducing exports is an economically costly way to increase net Delta outflows
- Reduces economic surplus for other purposes

Questions?

- Research Brief, main report, technical appendices, animations, and spreadsheets available at: www.ppic.org



Value of Infrastructure Expansions

- Marginal value of infrastructure expansion ($/AF-yr – conveyance, $/AF – storage)
- Selected conveyance becomes much more valuable
- Some recharge become much more valuable
- Additional storage seems much less valuable

N. or S. of Delta	Name	No Exports	Base Case
	Conveyance Facilities		
North	Freeport Project	7	0
North	Mokelumne River Aqueduct	274	0
South	New Don Pedro Intertie	863	252
South	Hetch Hetchy Aqueduct	1365	480
South	EBMUD-CCWD Intertie	21	0
South	Hayward Intertie	766	161
South	Jones Pumping Plant	1880	0
South	Banks Pumping Plant	1885	3
South	Cross Valley Canal	224	1
South	Friant-Kern Canal	7	0
South	Coastal Aqueduct	0	1371
South	Colorado River Aqueduct	1011	362
	Surface Reservoirs		
North	Shasta Lake	8	8
North	Clair Engle Lake	3	3
North	Lake Oroville	12	15
North	Thermalito Afterbay	4	9
North	New Bullards Bar Res	17	18
North	Englebright Lake	44	44
North	Folsom Lake	10	13
South	New Melones Reservoir	9	9
South	New Don Pedro Reservoir	17	18
South	Hetch-Hetchy Reservoir	5	5
South	Millerton Lake	29	6
South	Lake Kaweah	166	51
South	Lake Success	148	46
South	Lake Skinner	27	522
	Artificial Recharge Facilities		
South	Santa Clara Valley	1873	31
South	Mojave	357	392
South	Antelope Valley	1715	1051

Economic Costs of Environmental Flows

- Marginal value of environmental flows ($/AF)
- Northern environmental flows become easier
- Southern environmental flows become much harder

N. or S. of Delta	Location	No Exports	Base Case
	Minimum Instream Flow		
North	Trinity River	47.0	51.5
North	Sacramento River	2.4	3.1
North	Clear Creek	24.1	24.6
North	Feather River	0.8	0.5
North	Yuba River	0.5	0.6
North	American River	1.2	0.9
North	Mokelumne River	8.2	5.7
North	Calaveras River	0	0
South	San Joaquin River	277.5	54.2
South	Stanislaus River	4.0	3.3
South	Tuolumne River	3.9	3.5
South	Merced River	60.5	29.7
	Refuges		
North	Sacramento East	1.3	4.3
North	Sacramento West	0.6	4.0
South	Pixley Nat'l Wildlife	168.8	50.6
South	Kern National Wildlife	756.5	56.7
South	San Joaquin Wildlife	601.3	35.6
	Other		
North	Req. Net Delta Outflow	0.4	3.8
South	Delta Mendota Pool	131.2	31.7
South	Owens Lake	1741.4	1101.7
South	Mono Lake	2104.7	1423.7

Uncertainty about No Export Cost Estimates

"All models are wrong, but some are useful."

Why might costs be too low?

- Optimization models tend to be optimistic:
  - Easy water marketing
  - No fights over water
  - Perfect foresight
- More agricultural land use
- Higher population growth
- Additional water quality costs

Why might costs be too high?

- Desalination costs
- Water scarcity/conservation costs (mostly urban)
- Lower population growth
- Agricultural land retirements

Could Ending Exports Cost Less than a Peripheral Canal?

- Seems unlikely, at this time.
- Modeled costs of ending exports seem more likely to be low than high, on balance.
- Market values of exports at $150/AF for 6 MAF/year, ending exports would cost California $900 M/yr - already exceeds estimated p.c. cost. What is Westlands paying this year?
- Why would exporters pursue a p.c. if ending exports were cheaper?