NCAR

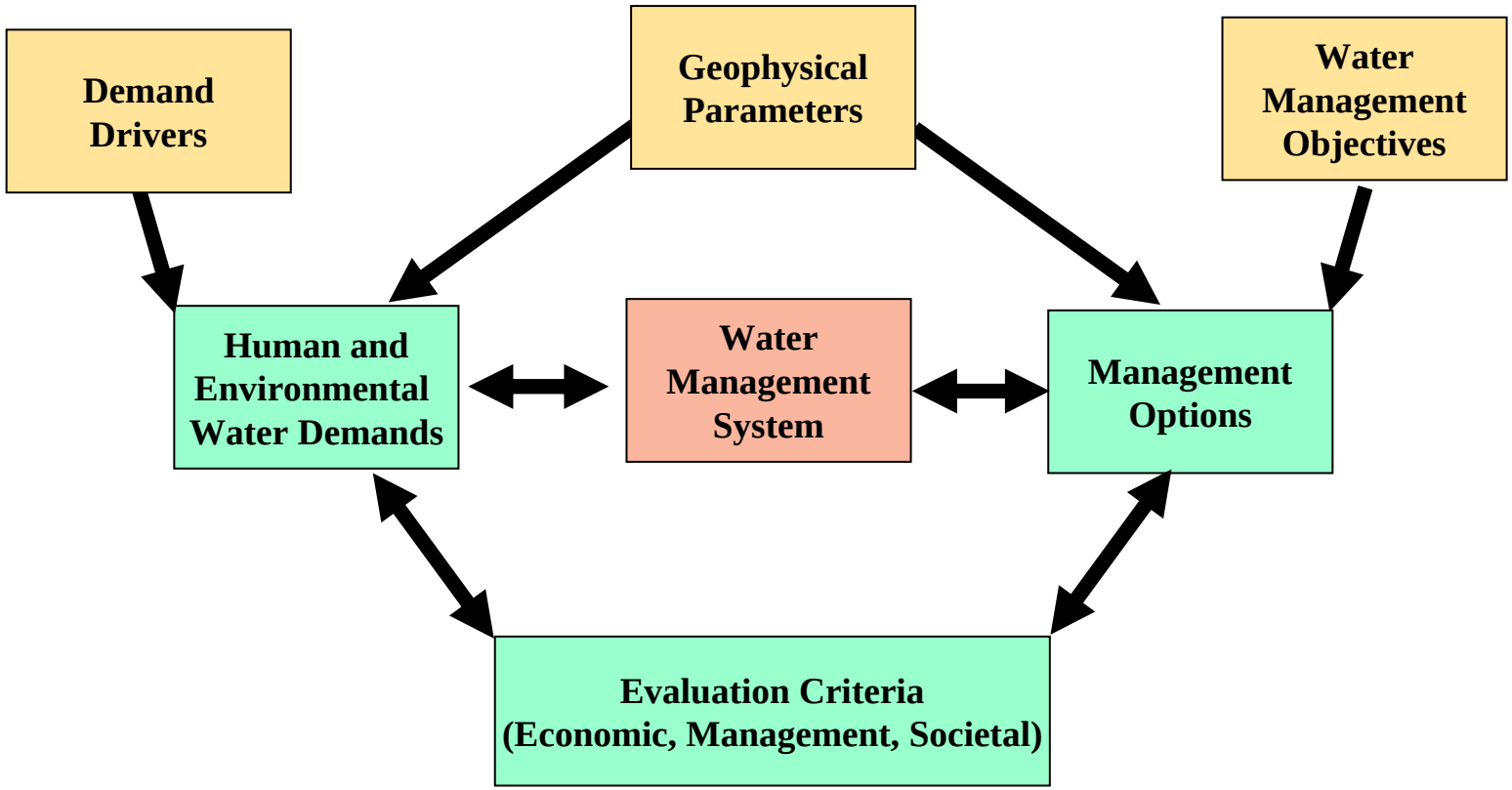
SEI STOCKHOLM ENVIRONMENT INSTITUTE US Center

Integrated water management scenarios for the Sacramento Hydrologic Region

National Center for Atmospheric Research

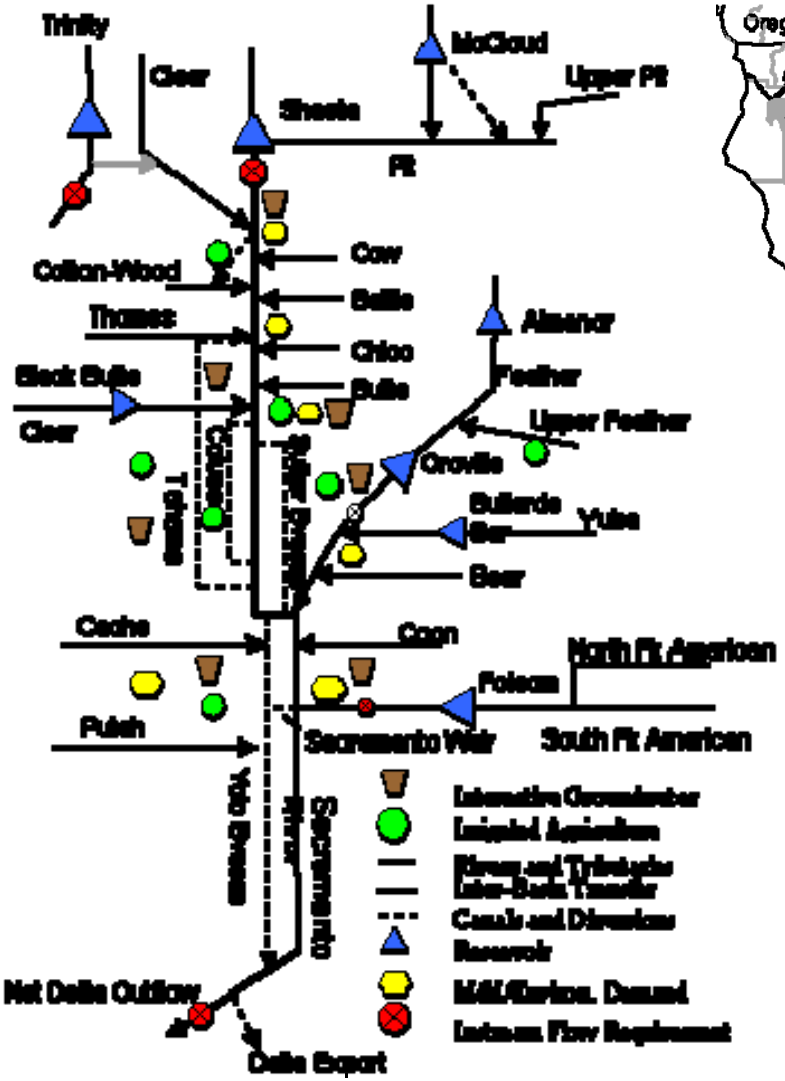
David Yates and David Purkey

DWR's Scenario Framework

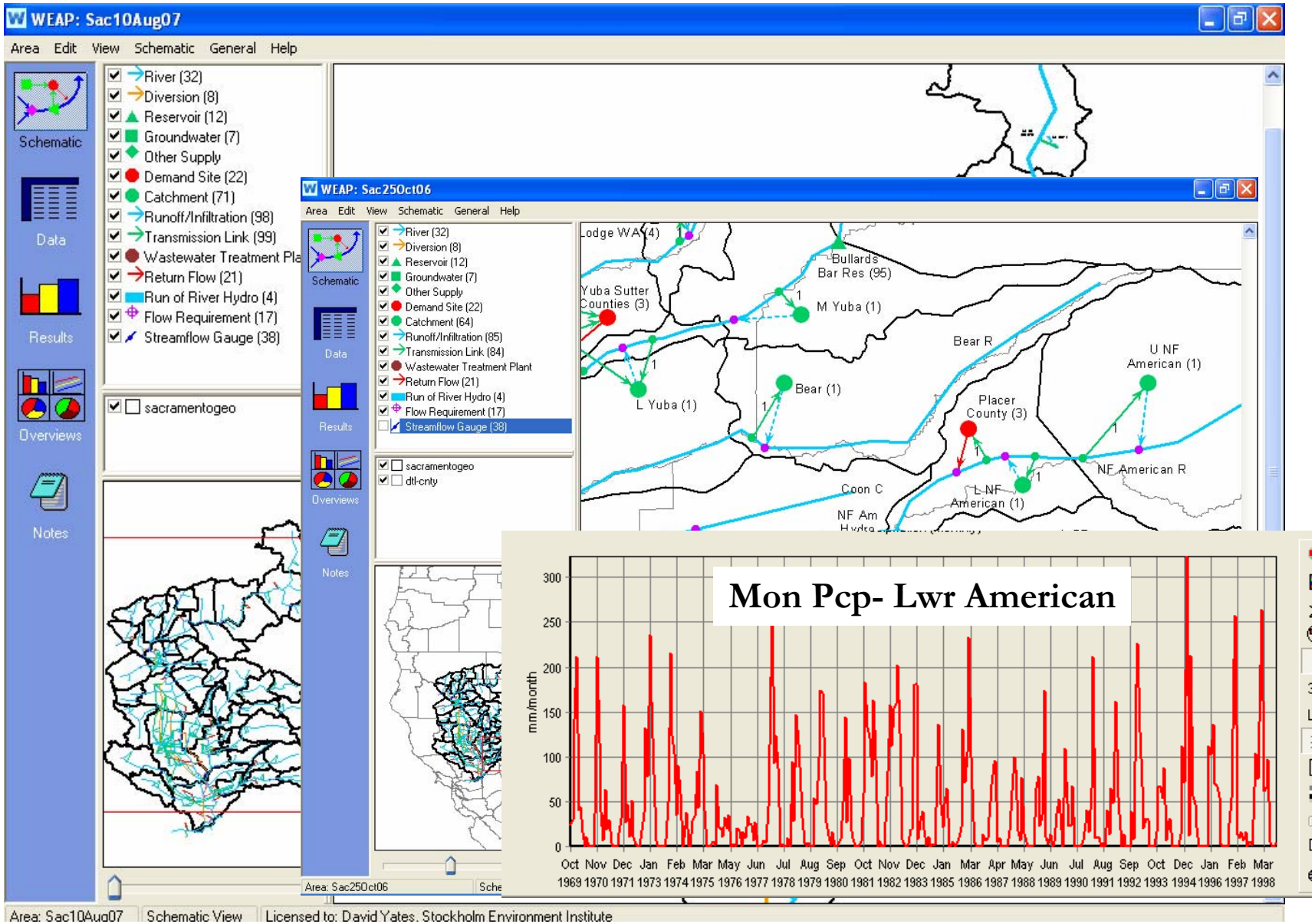


Water Management System

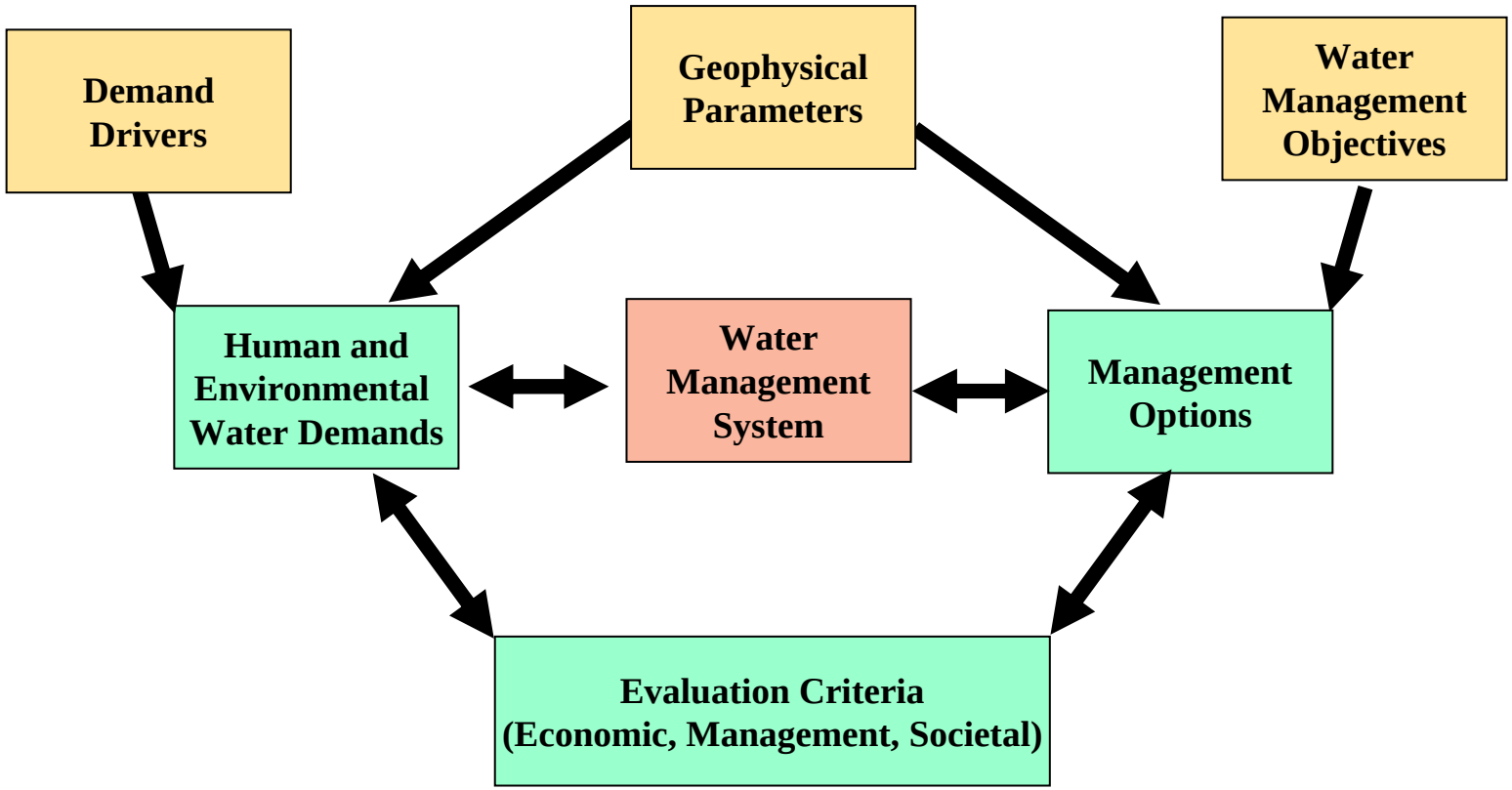
- **Comprehensive Representation of SAC**
  - 71 Catchments
  - 32 Rivers
  - 9 Surface Reservoirs
  - 7 Groundwater Basins
  - 8 Diversions (e.g. Yolo)
  - 30 Urban/Ag Demands
  - 6 Ag Crop types
  - Rice Ponding/Storage
  - Instream flow Requirements
  - Delta Salinity Dynamics



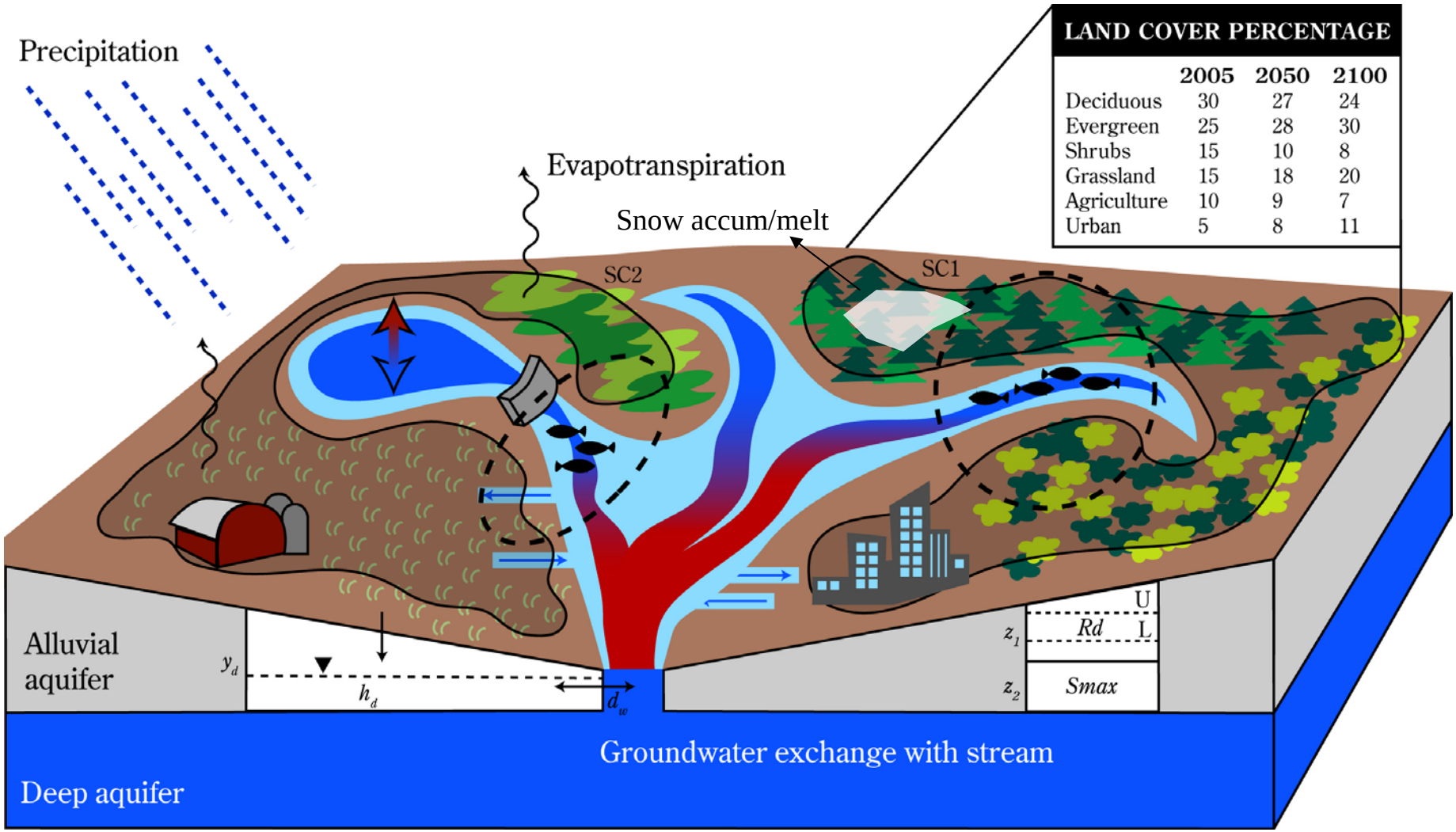
WEAP Water Management System



Scenario Framework



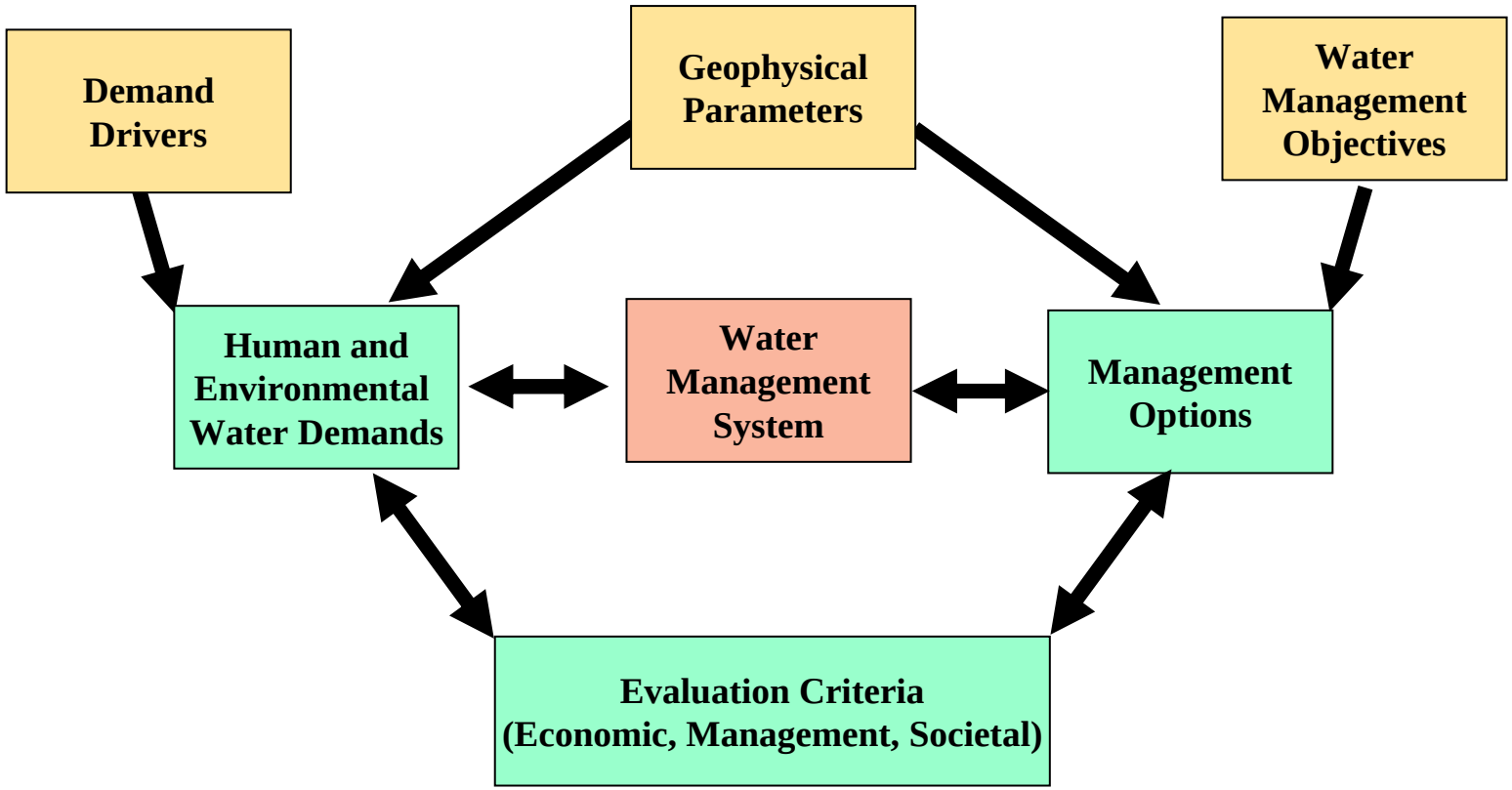
Geophysical Parameters



LAND COVER PERCENTAGE

	2005	2050	2100
Deciduous	30	27	24
Evergreen	25	28	30
Shrubs	15	10	8
Grassland	15	18	20
Agriculture	10	9	7
Urban	5	8	11

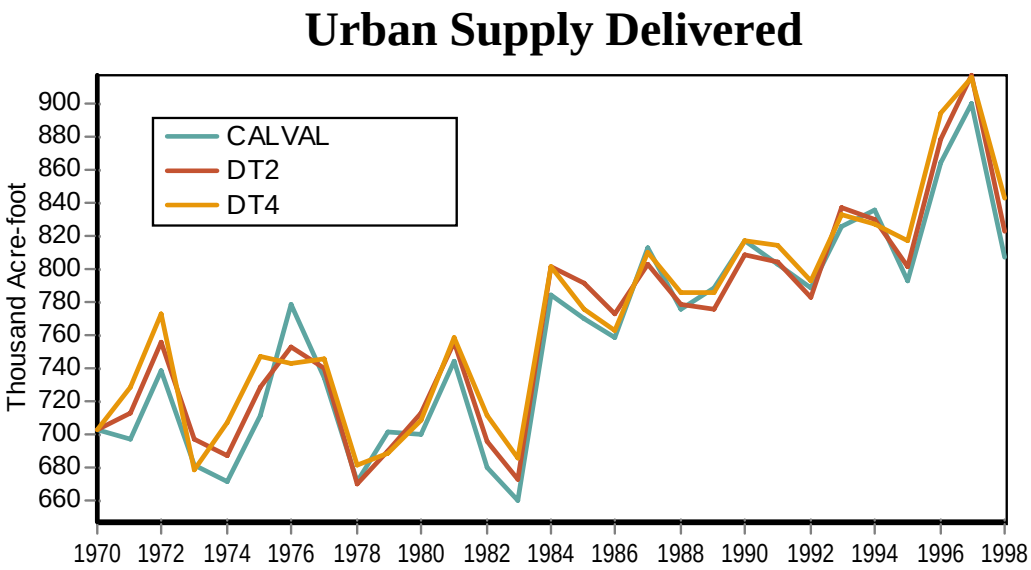
Scenario Framework



Demand Drivers/Scenarios

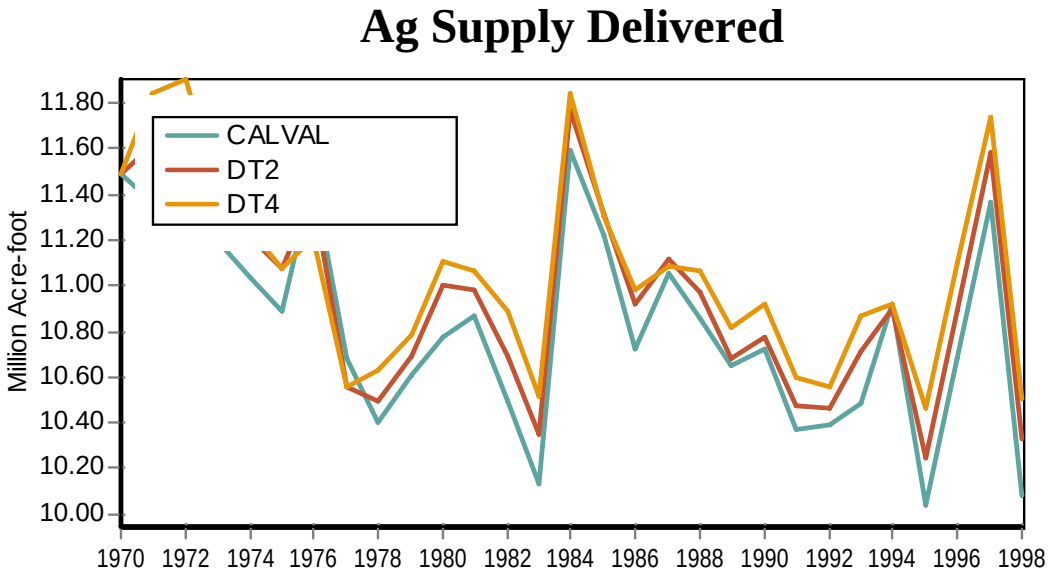
Urban Water Drivers

- Population projections
- Urban water use rates
- Indoor/Outdoor disaggregation
- Conservation Measures



Agricultural Water Drivers

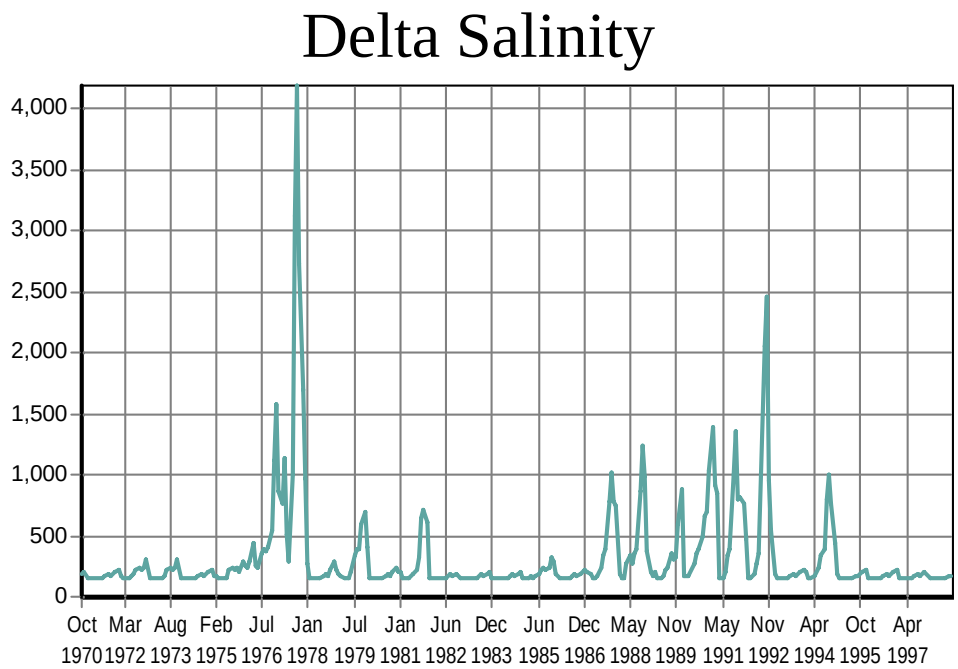
- Crop type
- Irrigation Technology
- Evaporative Demand
- Cropping Schedule



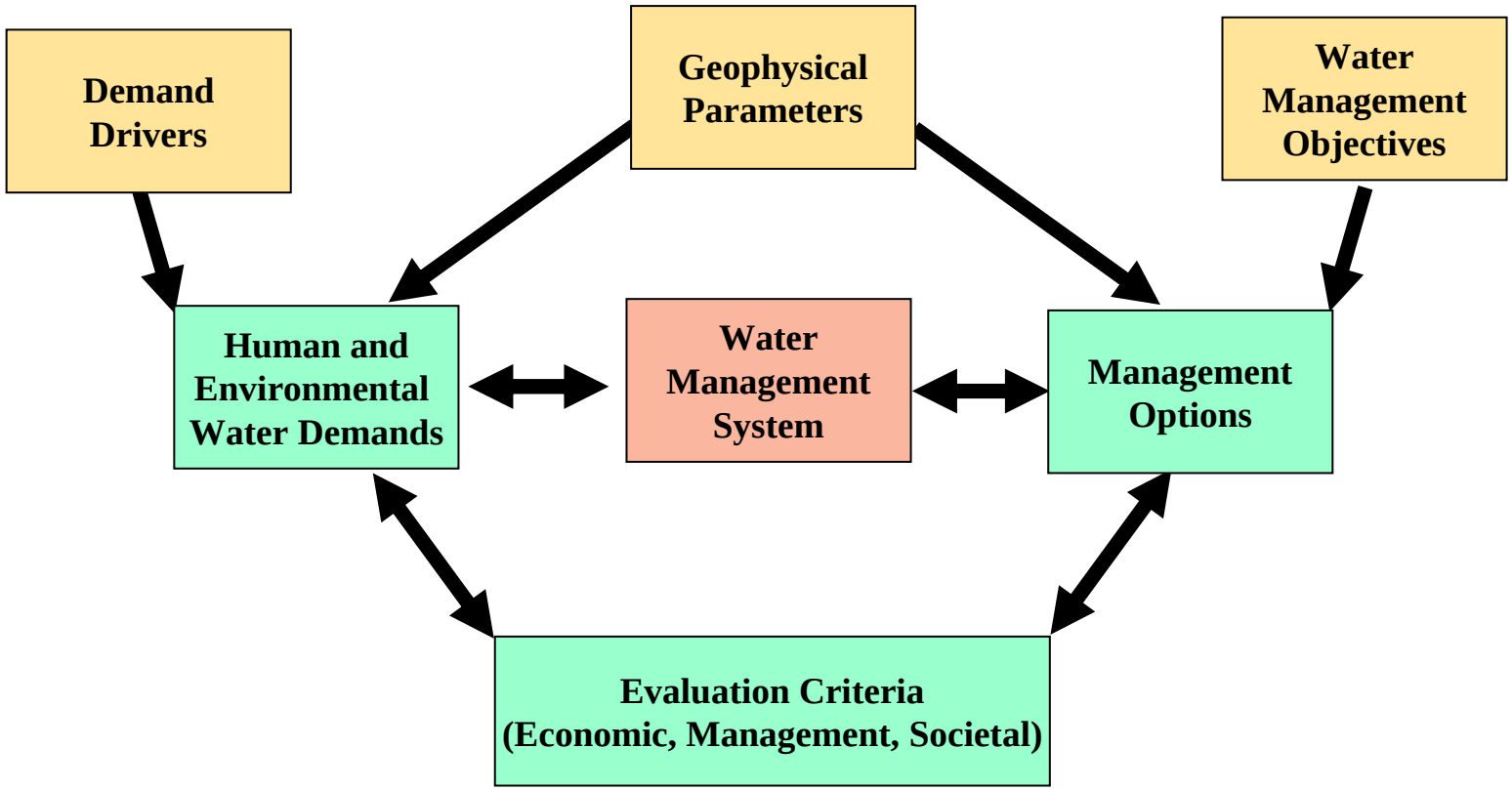
Human/Environmental Demands

Instream Flow Requirements

- Delta Salinity
- Sacramento River Requirements
- Wildlife Refuges
- Temperature Targets on Sacramento



Scenario Framework



Management/Response Options

- Agricultural lands stewardship
- Agricultural water use efficiency
- Conjunctive management and groundwater storage
- Conveyance
- Desalination
- Drinking water treatment and distribution
- Economic incentives (Loans, Grants, and Water Pricing)
- **Ecosystem Restoration**
- Floodplain management
- Groundwater remediation/Aquifer remediation
- Matching water quality to water use
- Pollution prevention
- Precipitation enhancement
- Recharge areas protection
- Recycled municipal water
- Surface storage-CALFED
- Surface storage-regional/local
- System reoperation
- Urban land use management
- Urban runoff management
- Urban water use efficiency
- Water-dependent recreation
- Watershed management
- Water transfers

Other resource management strategies (includes crop idling for water transfers, dewvaporation, fog collection, irrigated land retirement, rainfed agriculture and water bag transport/storage technology)

WEAP: EID

Area Edit View General Tree Help

Schematic
Data
Results
Overviews
Notes

- dpf
- dtf
- MeltSeason
- WatershedTemp
- WaterYear
- pulse
- Demand Sites and Catchments
- Hydrology
- Supply and Resources
  - Linking Demands and Supply
  - River
    - Camp C Tunnel
    - Caples C
      - Reservoirs
      - Flow Requirements
        - Caples Creek IFR
        - Pulse IFR
      - Reaches
    - Pyramid C
    - Camp Creek
    - Echo Lake Conduit
    - Sly Park
    - Echo
    - EID Canal
    - SF American
    - Silver Fork Amer R
    - Sly Park C
  - Other Supply
  - Return Flows
- Water Quality

Data for: base (1982-1985) | Manage Scenarios... | Data Report...

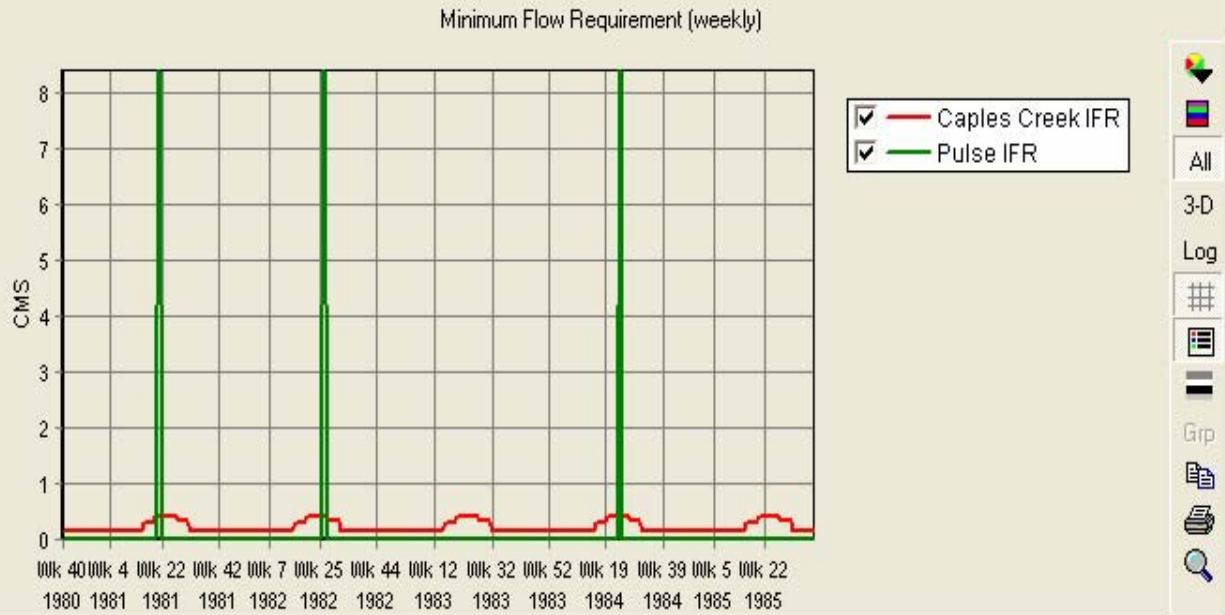
Minimum Flow Requirement | Priority

Minimum average weekly instream flow required for social or environmental purposes. Help

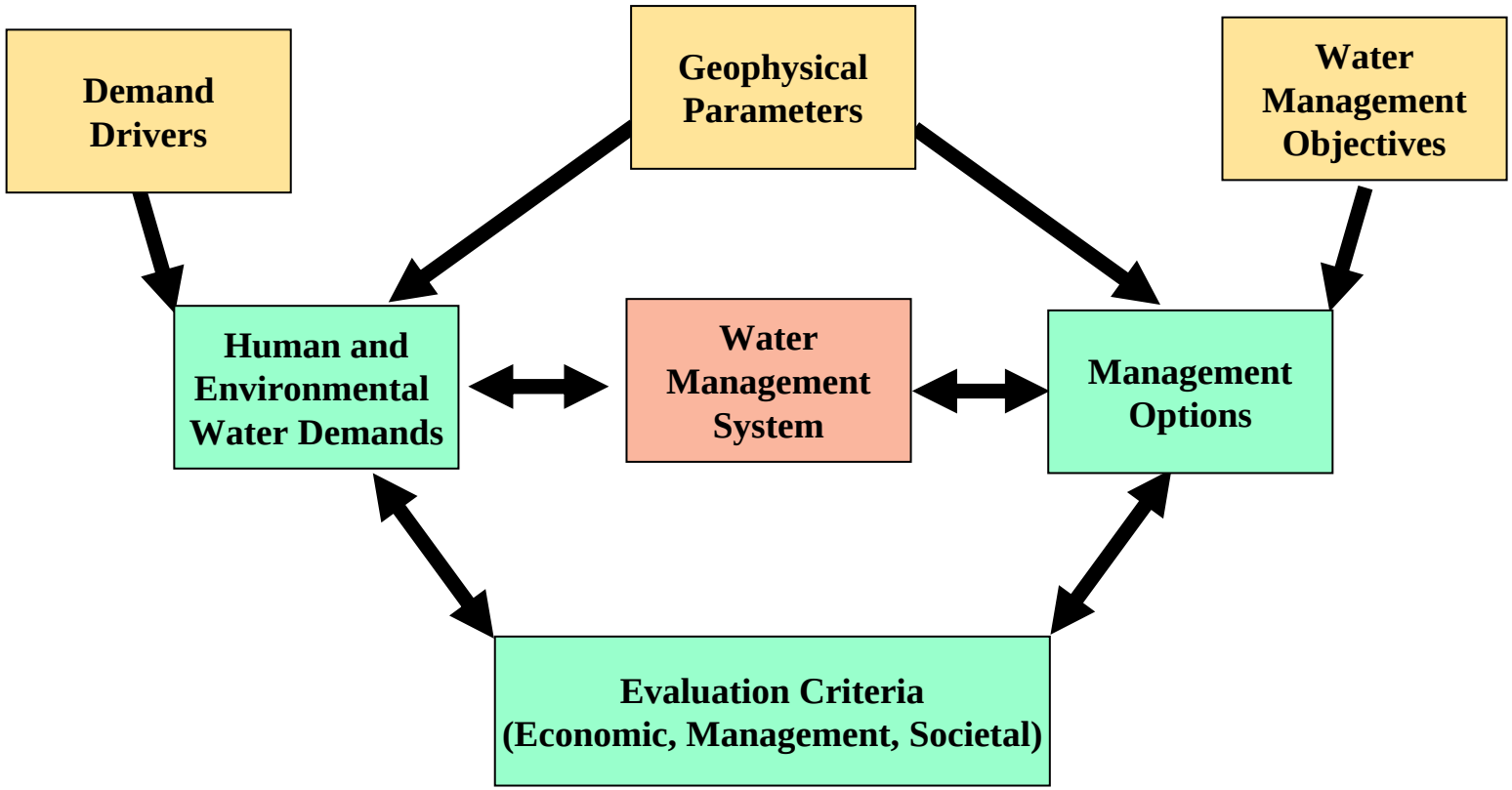
Flow Requirement	1981	1982-1985	Scale	Unit
Caples Creek IFR	Weekly...	WeeklyValues(Wk 1, 5, Wk 15, 5, Wk 16, 10, Wk 19, 10, Wk 20, 14, W		CMS
Pulse IFR	If(And(Pr...	If(And(PrevTSValue(Supply and Resources\River\Caples C\Reaches\Below ...		CMS

An expression editor is used to define and view rules like IFRs

Chart | Table | Notes

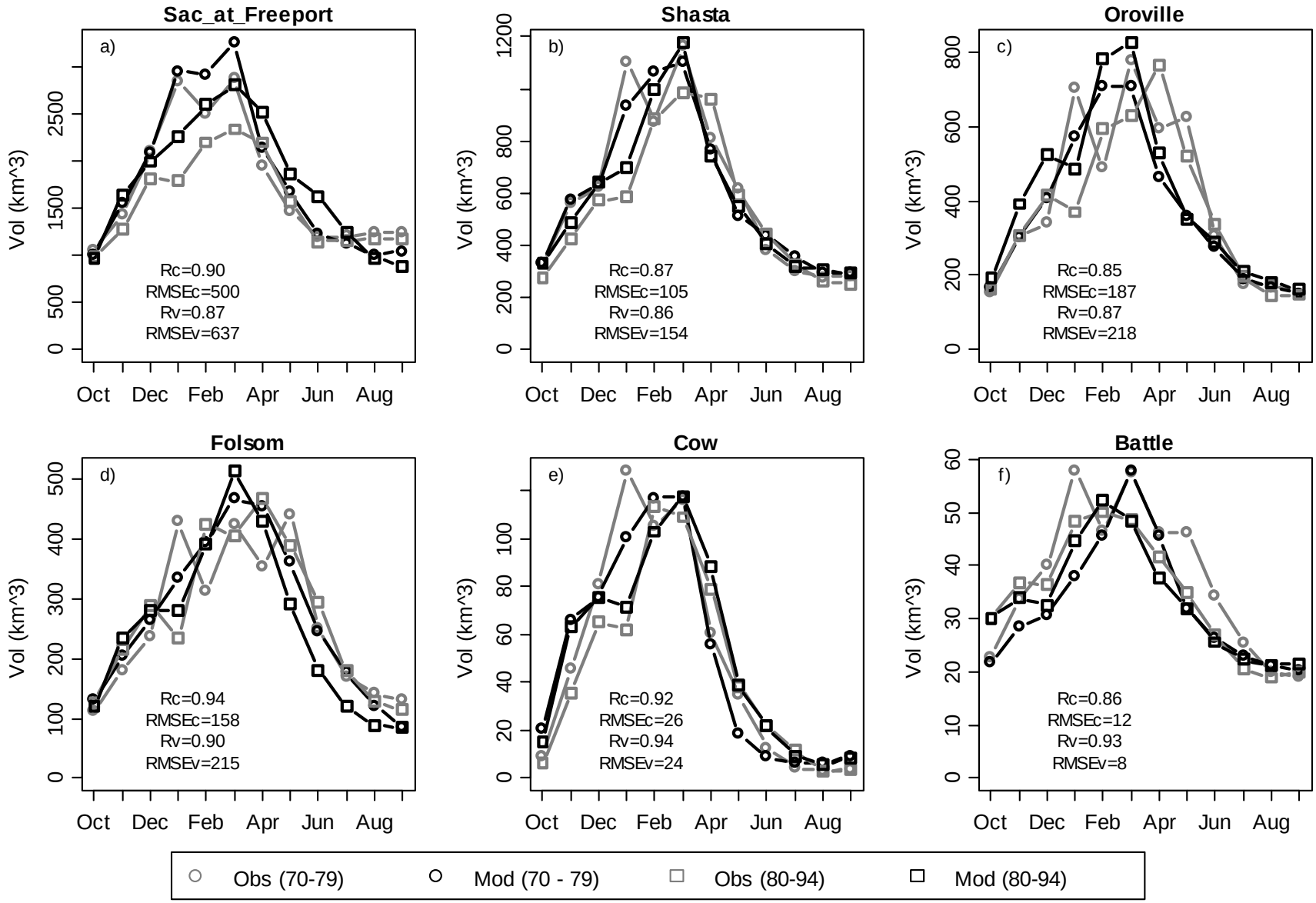


Scenario Framework

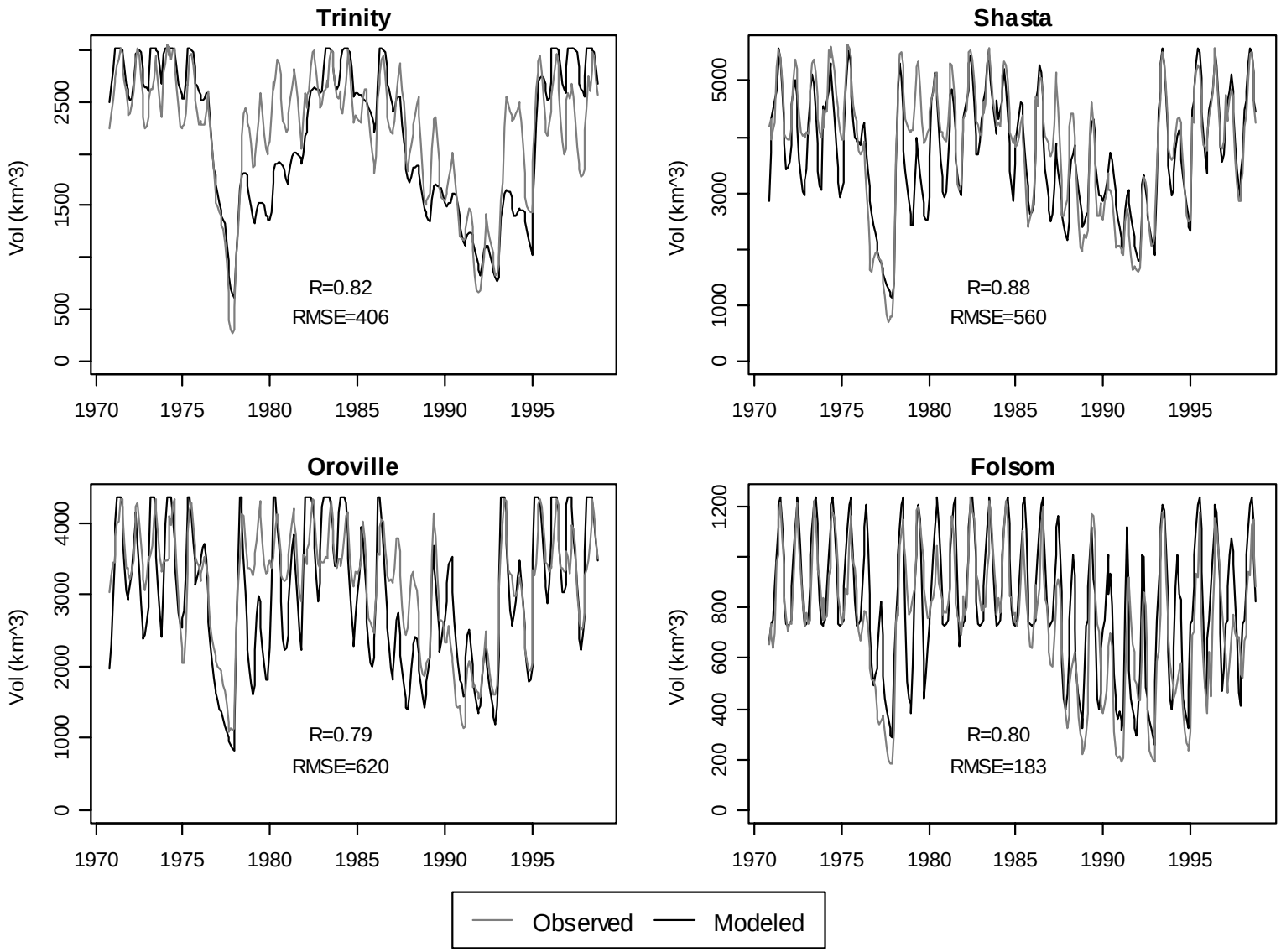


Calibration/validation

Evaluation Criteria
(Calibration and Validation)



Reservoir Storage throughout Sacramento



Bulletin 160-98: Applied Water Use

TABLE ES4-11

California Average Year Water Use by Hydrologic Region (taf)

Region	1995 Urban	1995 Agricultural	1995 Environmental	1995 Total (rounded)	2020 Urban	2020 Agricultural	2020 Environmental	2020 Total (rounded)
North Coast	169	894	19,544	20,610	201	927	19,544	20,670
San Francisco Bay	1,255	98	5,762	7,110	1,317	98	5,762	7,180
Central Coast	286	1,192	118	1,600	379	1,127	118	1,620
South Coast	4,349	784	100	5,229	5,519	462	104	6,080
Sacramento River	766	8,065	5,833	14,660	1,139	7,939	5,839	14,920
San Joaquin River	574	7,027	3,396	11,000	954	6,450	3,411	10,820
Tulare Lake	690	10,736	1,672	13,100	1,099	10,123	1,676	12,900
North Lahontan	39	530	374	940	50	536	374	960
South Lahontan	238	332	107	680	619	257	107	980
Colorado River	418	4,118	39	4,570	740	3,583	44	4,370
Total (rounded)	**8,770**	**33,780**	**36,940**	**79,490**	**12,020**	**31,500**	**36,980**	**80,500**

TABLE ES4-12

California Drought Year Water Use by Hydrologic Region (taf)

Region	1995 Urban	1995 Agricultural	1995 Environmental	1995 Total (rounded)	2020 Urban	2020 Agricultural	2020 Environmental	2020 Total (rounded)
North Coast	177	973	9,518	10,670	212	1,011	9,518	10,740
San Francisco Bay	1,358	108	4,294	5,760	1,428	108	4,294	5,830
Central Coast	294	1,279	37	1,610	391	1,223	37	1,650
South Coast	4,382	820	82	5,280	5,612	484	86	6,180
Sacramento River	830	9,054	4,223	14,110	1,236	8,822	4,225	14,280
San Joaquin River	583	7,244	1,904	9,730	970	6,719	1,919	9,610
Tulare Lake	690	10,026	809	11,530	1,099	9,532	813	11,440
North Lahontan	40	584	256	880	51	594	256	900
South Lahontan	238	332	81	650	619	257	81	960
Colorado River	418	4,118	38	4,570	740	3,583	43	4,370
Total (rounded)	**9,010**	**34,540**	**21,240**	**64,790**	**12,360**	**32,330**	**21,270**	**65,960**

Mass Balance Comparison: B160-98

		DWR-B160	CALVAL		DT2	
		1995 Estimate	Wet Yr. Avg	Dry Yr. Avg	Wet Yr. Avg	Dry Yr. Avg
Sacramento Basin Runoff	A	52.2	51.5	22.6	50.5	21.9
Trinity Imports	B	1.1	0.84	0.76	0.85	0.75
Total Supply	C:A+B	53.3	52.3	23.4	51.4	22.7
Exported	D	6.90	6.90	6.90	6.90	6.90
Un-exported	E: C-D	46.4	45.4	16.5	44.5	15.8
Applied Urban Water Use*	F	0.95	1.04	1.05	1.06	1.05
Applied Agriculture Water Use	G	9.80	9.60	9.73	9.81	9.74
Applied Environmental Use**	H	8.00	7.66	7.60	7.60	7.48
Total Delivered	I:F+G+H	18.7	18.3	18.4	18.5	18.3
Unallocated	J:C-I	34.5	34.0	4.98	32.88	4.38
Ratio of Sacramento Runoff	K:J/A	66%	66%	22%	65%	20%