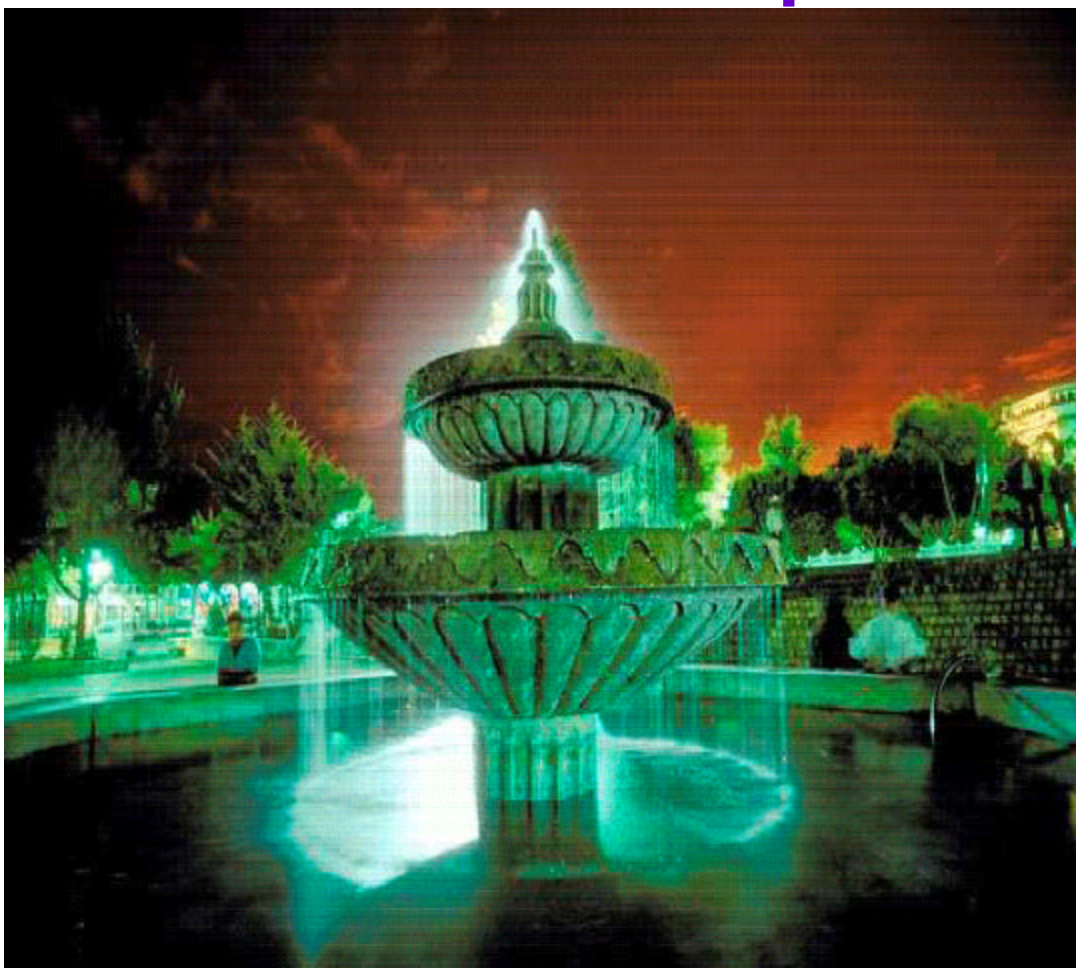
Water-Energy Relationships



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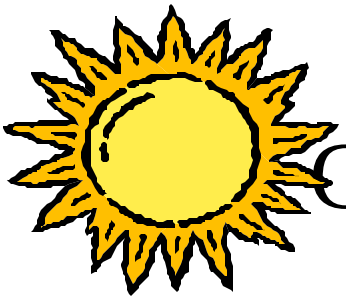
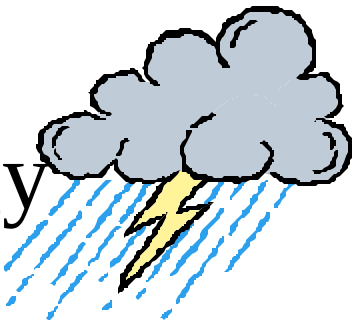
Docket 04-IEP-1H

January 14, 2005



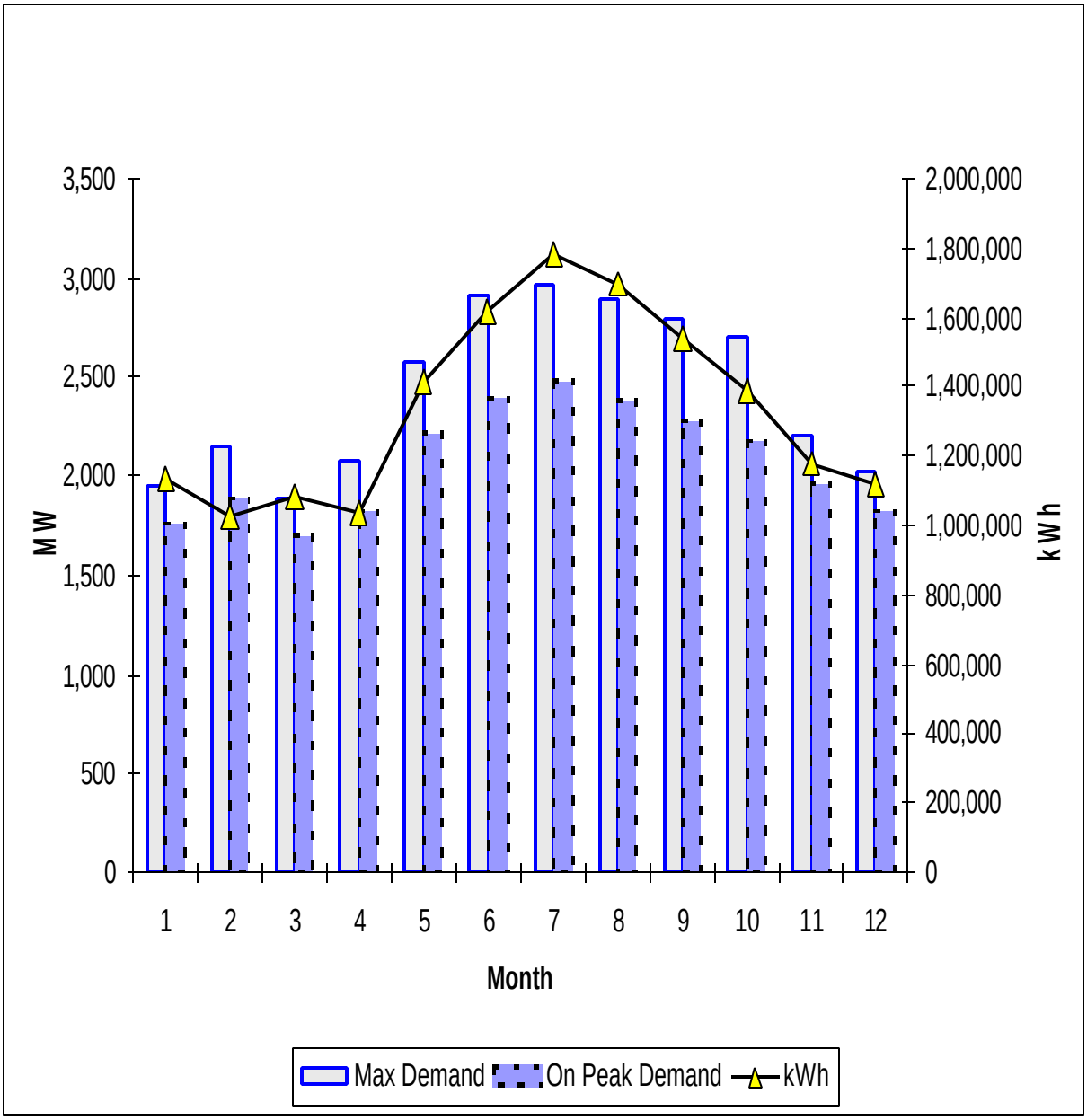
California Hydrology



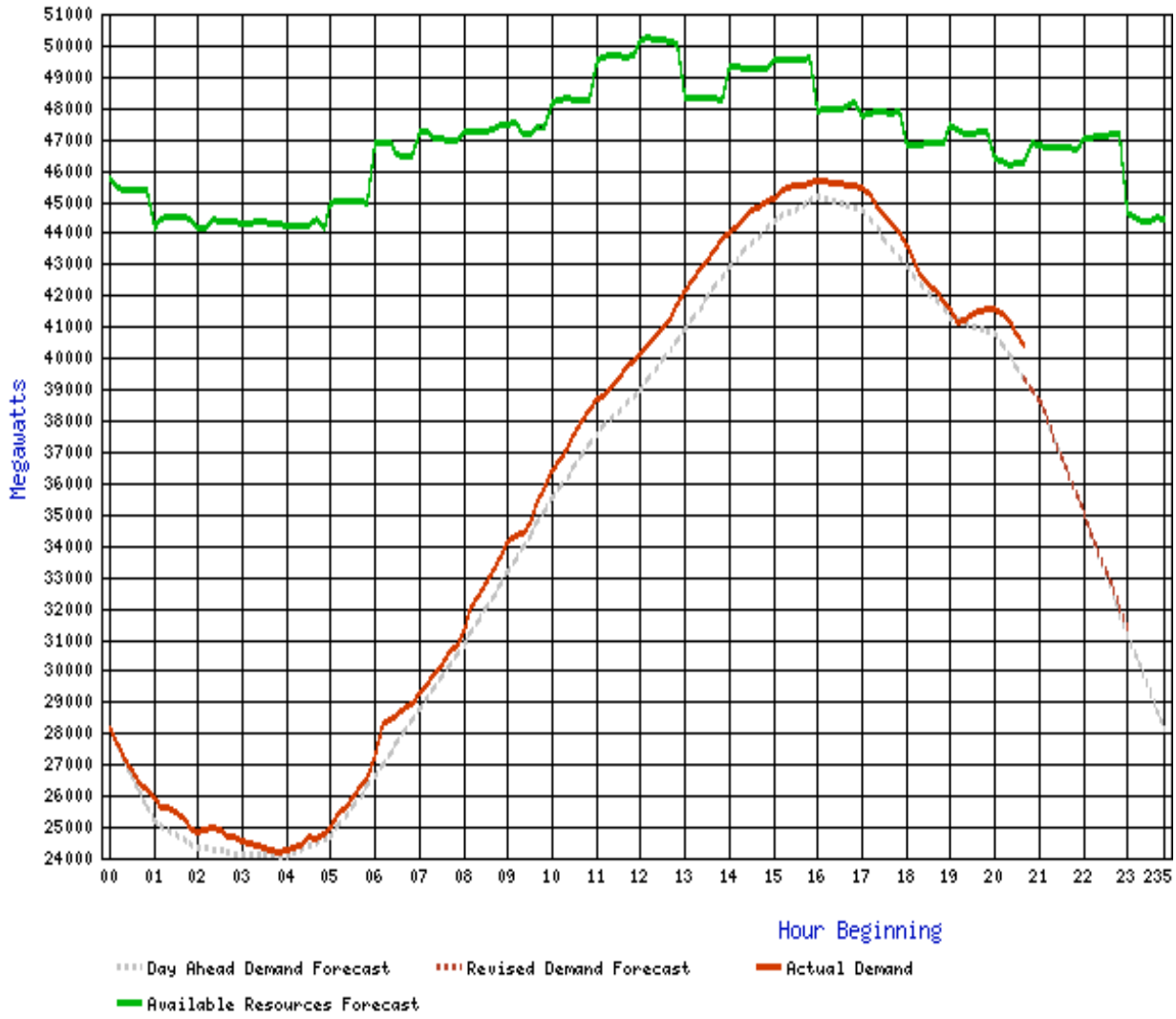
- 75% of rainfall occurs north of Sacramento
- 80% of use of water occurs south of Sacramento
- Mediterranean climate: 80% of the precipitation occurs from November to March. Most as snow, melts through August/September.
- Majority of water use is in summer
- About 71,000,000 acre-feet of water per year is runoff
  - flows to ocean - 36%
  - environmental flows - 28%
  - agriculture - 28%
  - urban/industrial - 7%
  - other - 1%

California Water System

Water Agency Electricity Requirements in California



September 8, 2004



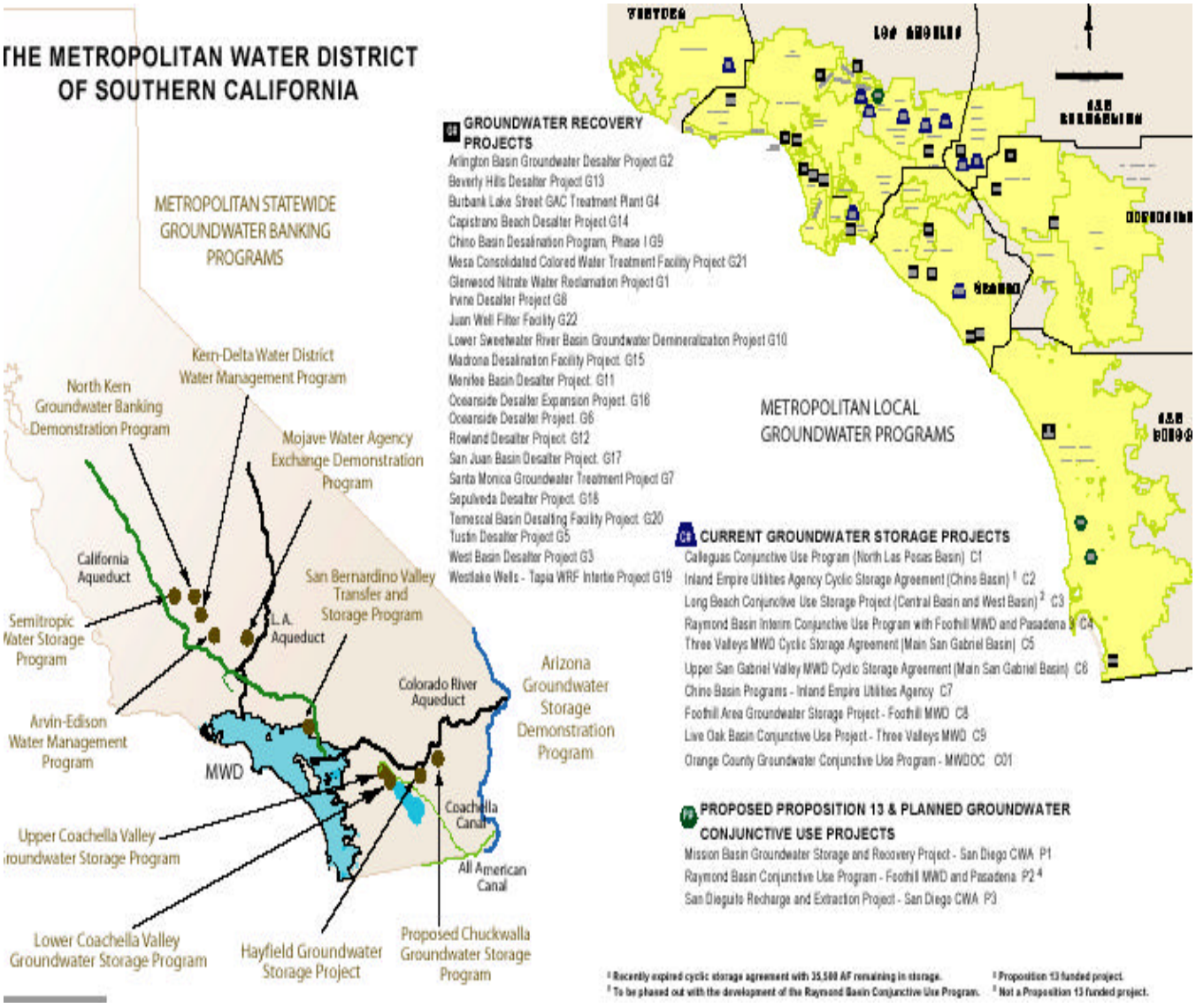
Previous energy use record of 43,609 MW, set in July 1999.

July 19 - 44,042 MW; July 20 - 44,330 MW; July 21 - 44,360 MW; August 10 - 44,497 MW; August 11 - 44,872 MW; September 7 - 45,165 MW; September 8 - 45,597 MW.

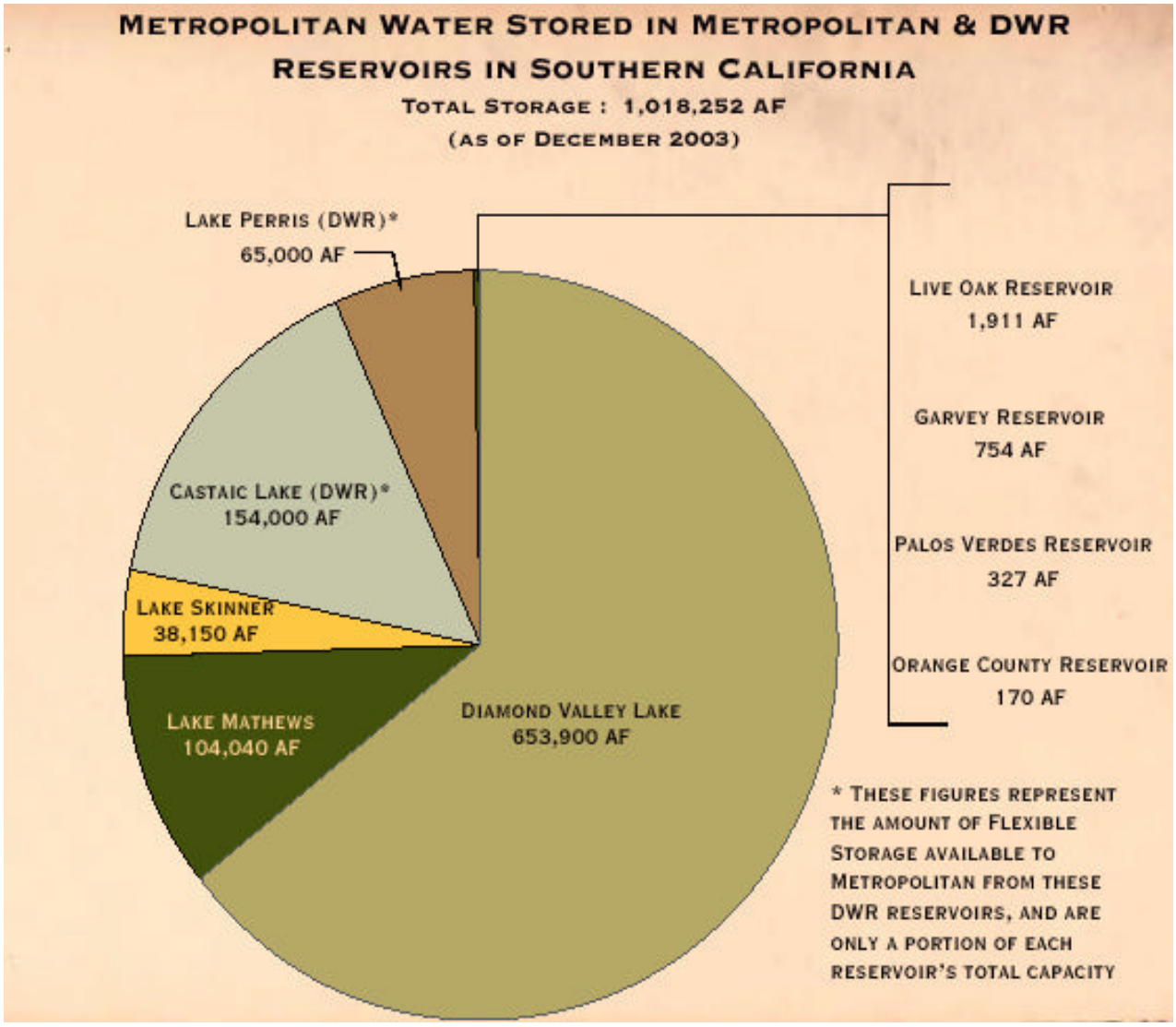
New Water Electricity Requirements

- Conjunctive Use Development
- Desalinization
- Drought/Climate Change
- Increased Treatment Requirements
- Increased Population

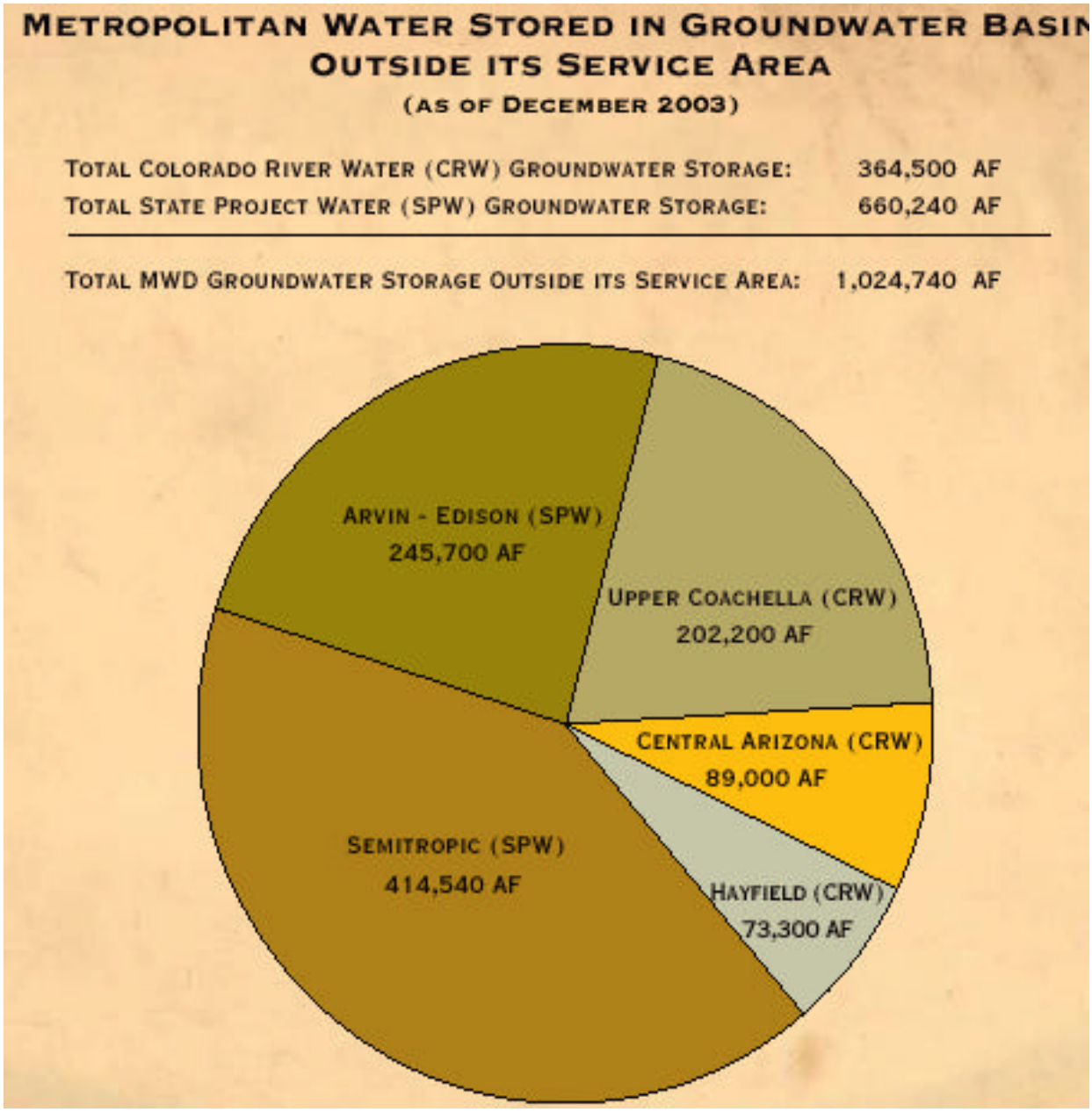
Conjunctive Use
Southern California



MWD Above Ground Storage



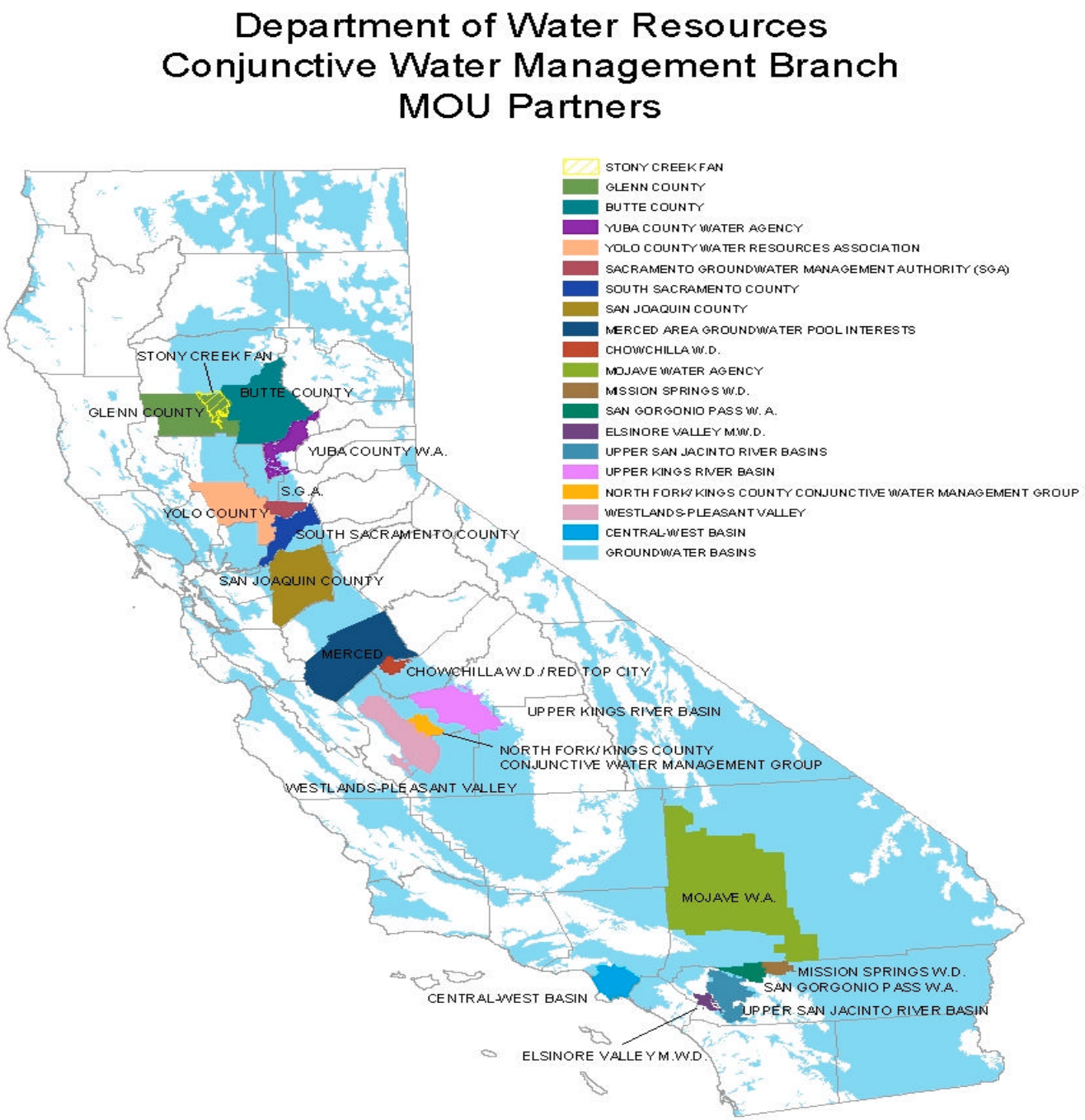
MWD Groundwater Conjunctive Use



New Met Groundwater Storage Projects

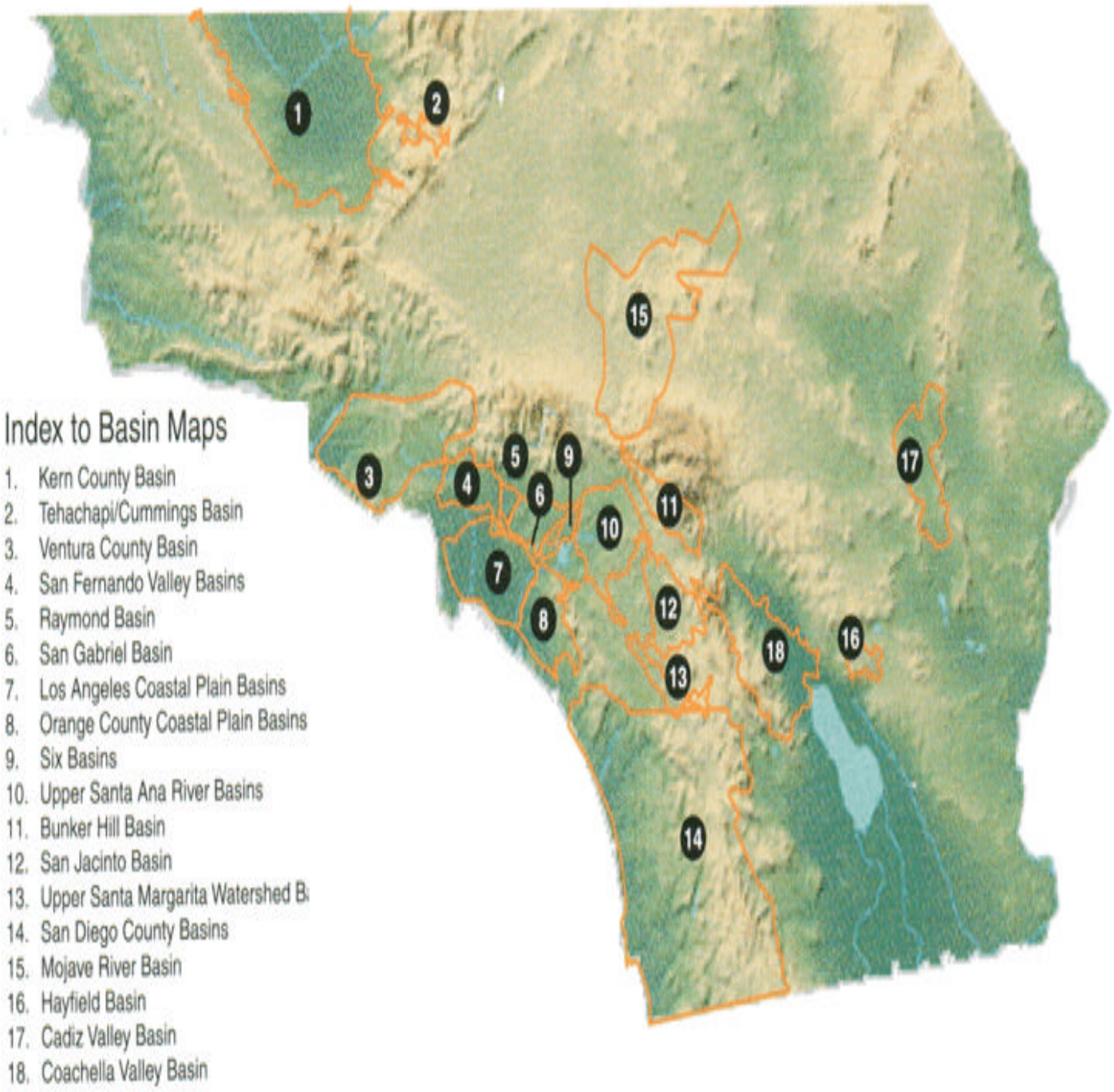
- 5 New agreements for 192,000 acre-feet
  - Three Valleys Municipal Water District and the City of La Verne - Live Oak Basin
  - The City of Long Beach and Central and West Basin Municipal Water District
  - Central Basin
  - Foothill Municipal Water District - Monkhill Sub-basin of the Raymond Basin
  - Inland Empire Utilities Agency, Three Valleys MWD, and the Watermaster - Chino Basin
  - Municipal Water District of Orange County and Orange County Water District
  - Orange County Basin
- San Diego County Water Authority in the Raymond Basin for up to 75,000 acre-feet of storage.
- Calleguas Municipal Water District storage and extraction in the North Las Posas Basin in Ventura County. This program has been phased; phases 1 and 2 are scheduled to come online by 2005. Completion of facilities necessary for management of a 210,000 acre-foot storage program in this basin should be operational by 2010.

Conjunctive Use Sites
Northern California



Potential Southern California Sites

21 million acre-feet dry year storage



Last DWR Supply Update

California Water Budget with Existing Facilities and Programs (maf)

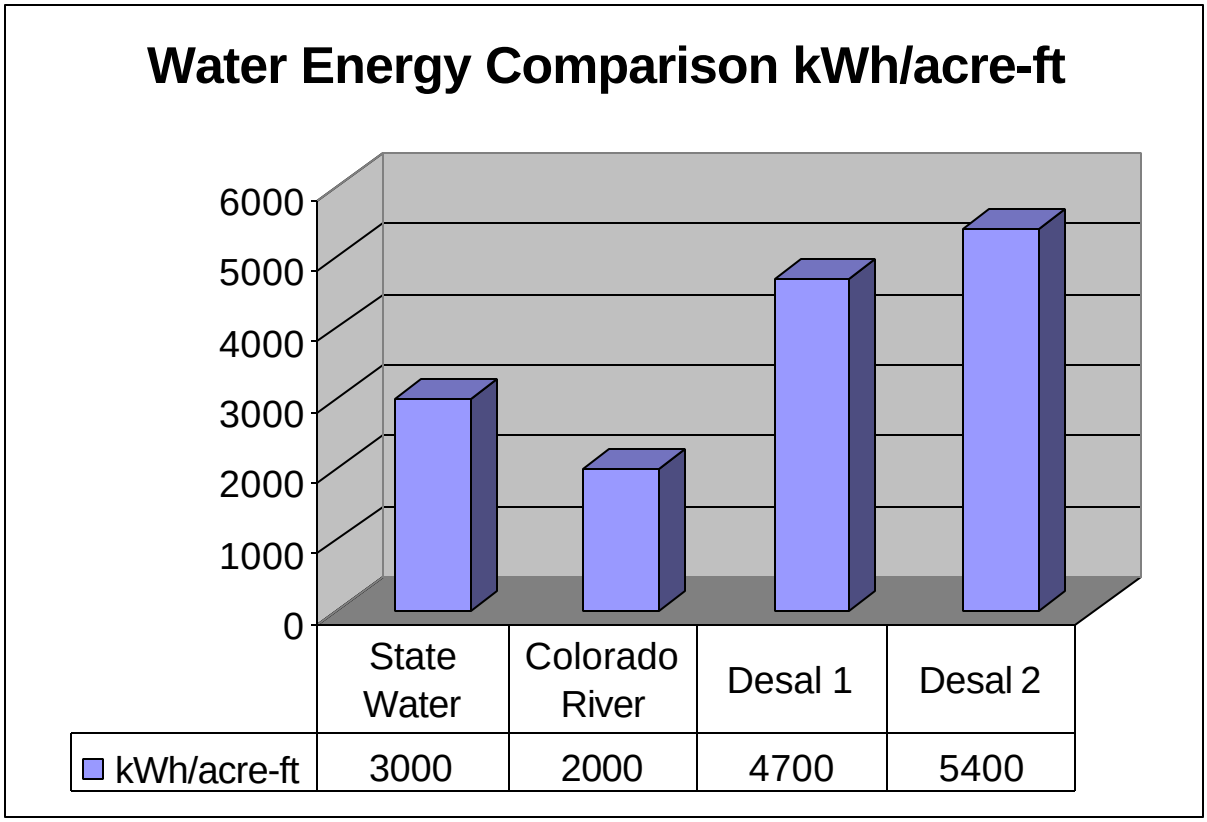
	1995		*2020*	
	Average	***Drought***	***Average***	***Drought***
	Water Use			
Urban	8.8	9.0	12.0	12.4
Agricultural	33.8	34.5	31.5	32.3
Environmental	36.9	21.2	37.0	21.3
Total	**79.5**	**64.7**	**80.5**	**66.0**
	Supplies			
Surface Water	65.1	43.5	65.0	43.4
Groundwater	12.5	15.8	12.7	16.0
Recycled and Desalted	0.3	0.3	0.4	0.4
Total	**77.9**	**59.6**	**78.1**	**59.8**
	Shortage			
	1.6	**5.1**	**2.4**	**6.2**

Seawater Desalination Facilities in California

- **Existing:**
  - About a dozen small facilities along coast.
  - Total production about 2.7 mgd.
  - Generally for drought-relief, emergencies, industrial processes.
- **Proposed:**
  - Over 20 new facilities; including largest in U.S.
  - Total production about 250 mgd.
  - To provide baseline water supply.

Desal Electricity Requirements

Each facility ~30-50MW



Drought Climate Impacts

- Climate change - snowpack reduction in Sierra could result in loss of 2.6 - 4.0 million acre-feet of water storage
- Drought in Southwest could seriously deplete the Colorado River, and California's share
- Drought/climate change will reduce quantity, availability, and timing of hydroelectric generation
- All remedies will require significantly more electricity use

River Characteristics

River	Water Agency	Generation	Generation (in MW) Utility	Runoff 1000 Ave. AF	Dry % Ave	County	Min cfs
Pit/Fall			768	5,896	42%	Shasta	120
Feather River			738	4,526	21%	Butte/Plumas	50
Feather -South Fork							
	Oroville-Wyandotte	118	291	291	11%	Butte	
Yuba	Yuba CWA	396	12	2337	16%	Yuba	5
Bear River	Nevada ID	80	208			Nevada/Placer	7
American - North/Middle							
	Placer CWA	200	245			Placer	
South Fork							
	El Dorado ID	21	7	2,674	13%	El Dorado	
Mokelumne	East Bay MUD	39	209	736	31%	Amador	
Stanislaus	TriDam	96	100	1,131	14%	Tuolumne	38
Merced	Merced ID	99	4	952	16%	Merced	
San Joaquin	Friant Power	25	221	1,753	21%	Fresno/Madera	23
			1,014				
Kings	Kings River	165	345	1,647	23%	Fresno	4
			1,200	Helms Pumped Storage		Fresno	
Kern River			12	694	25%	Kern	22
Tule River			6	135	12%	Tulare	

Water Agency Peak Demand Reductions

- More Effective Use of Storage
- Add More Storage
- Get Customers to Shift Water Demand

More Effective Use of Existing Storage

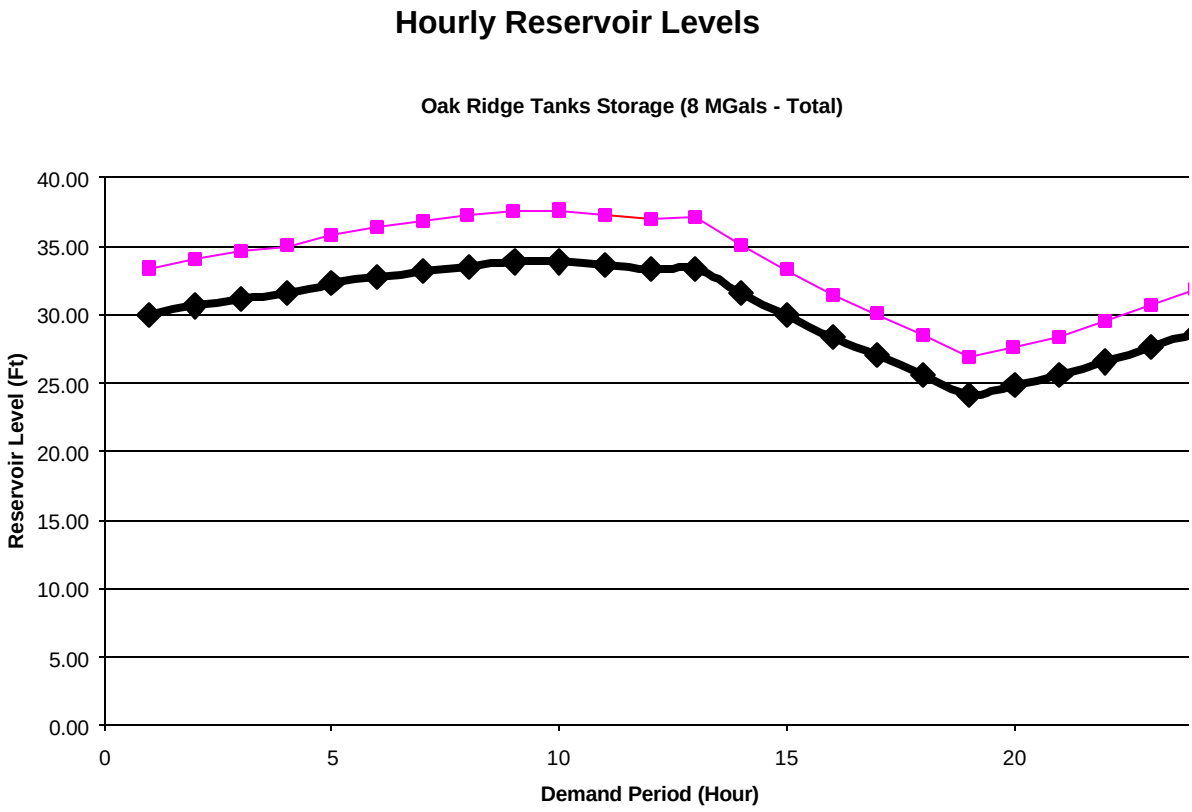
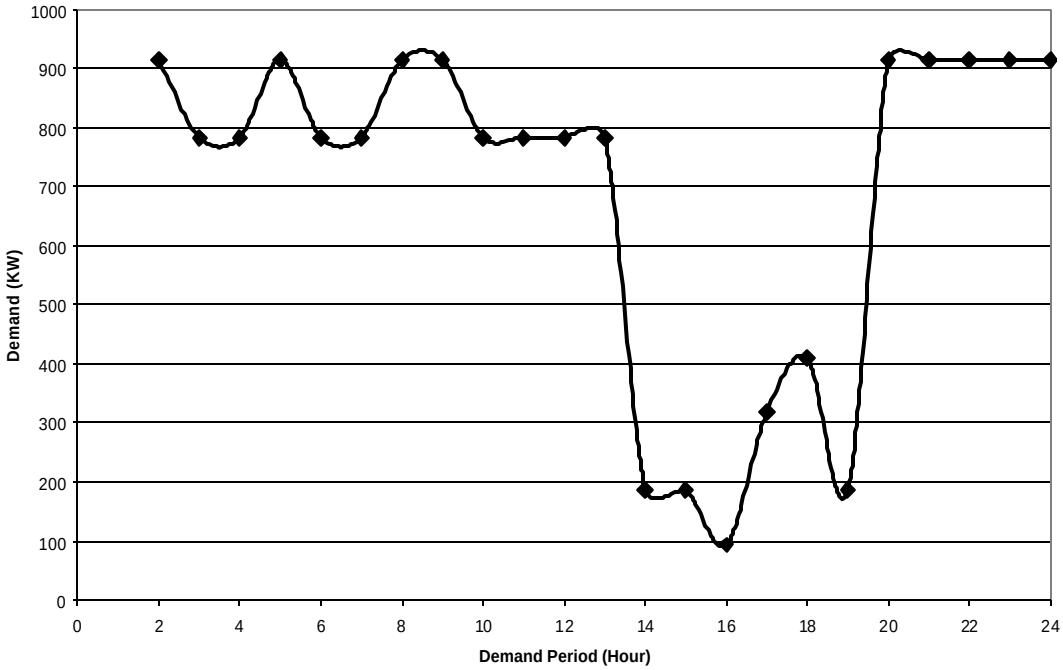
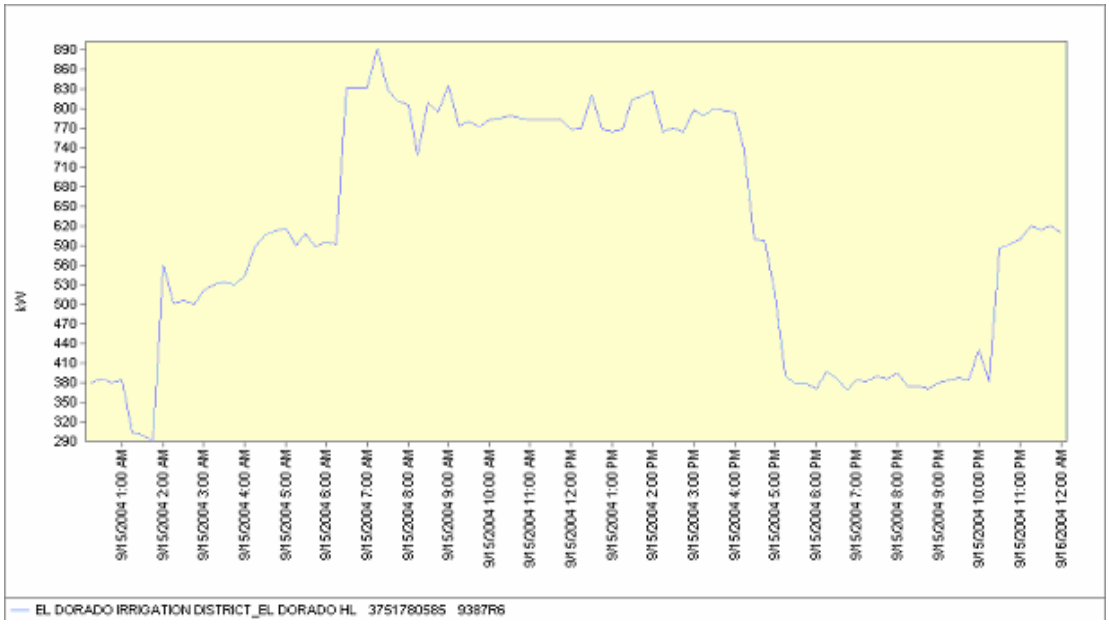


Figure 5. Treatment Plant Hourly Electrical Demands
Demand Response Profile (14.5 MGal Demand)

PG&E ID #3751780585
EID EDH WTP & Treated Water Pumping Facilities

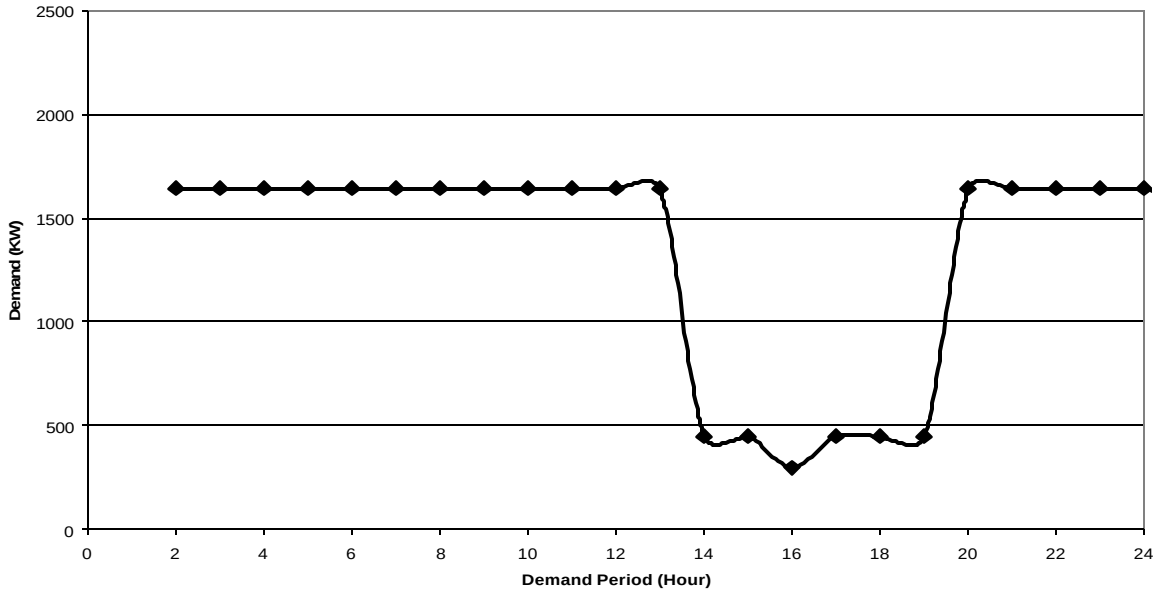


Recorded Electrical Use – September 15, 2004



Folsom Lake Raw Water Pumping Station Hourly Electrical Demands
Demand Response Profile (14.5 MGal Demand)

PG&E ID#3751780690
Folsom Lake Raw Water Pumping Station



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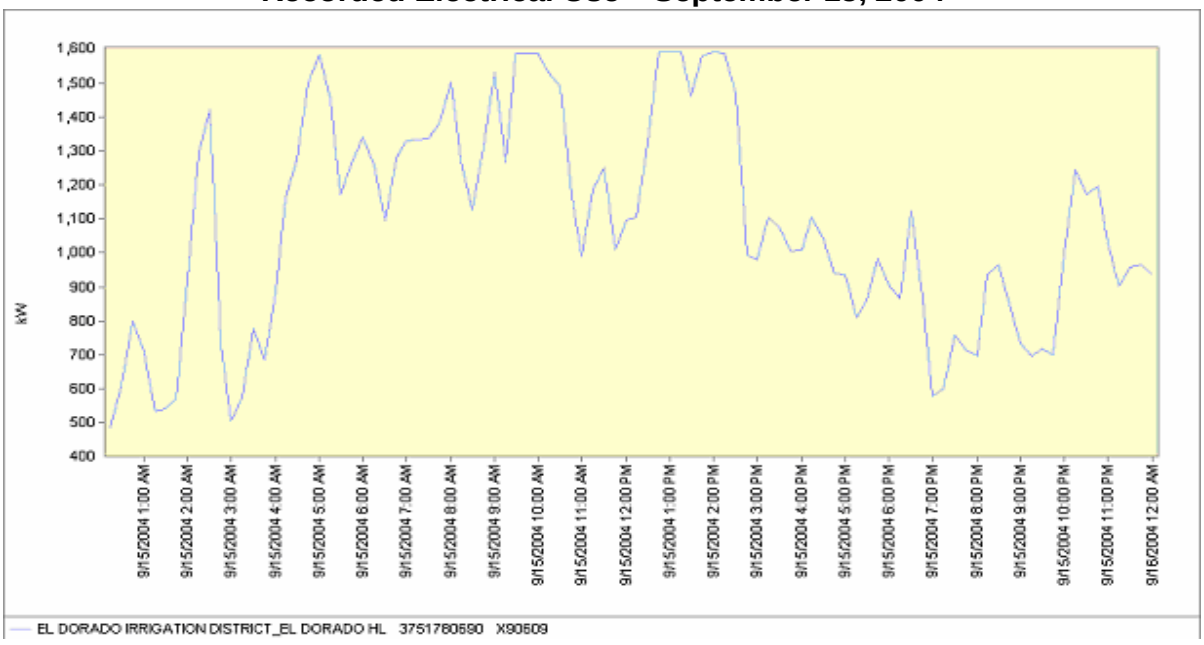
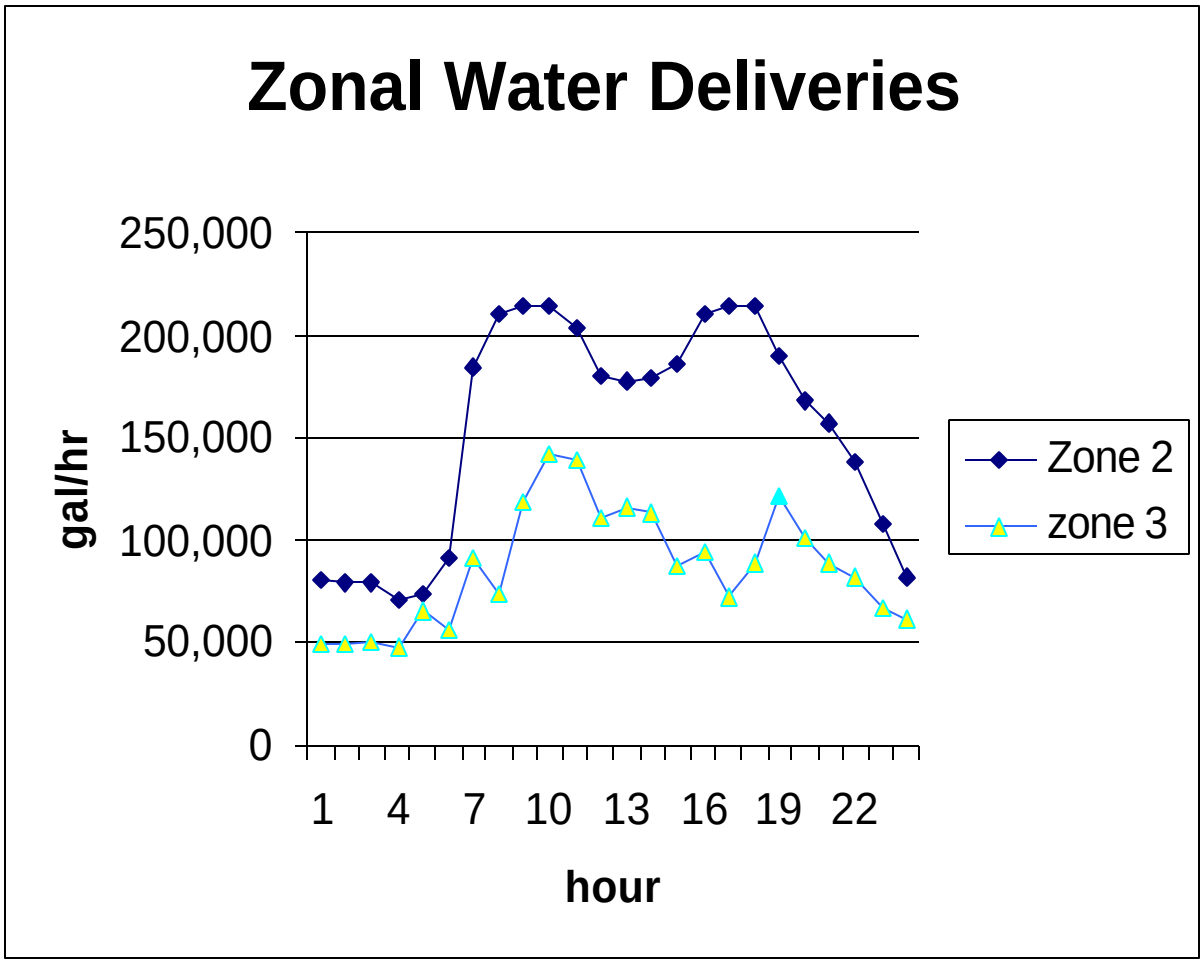


TOU Water Meter Proposal

- To CEC PIER Program
  - Inventory TOU water meter options
  - Develop TOU water tariffs
  - Install TOU meters on
    - Residential
    - Commercial / Industrial
  - Assess real-time meter changeout impact on wholesalers
  - Projected deployment by spring 2005
  - Interim report fall 2005
  - Final report fall 2006

If Water Agencies Can Get Customers To shift Demand, They Can Reduce Peak Usage



Water Agency Generation Opportunities

- Water agencies (exclusive of those selling retail electricity) already have about 1,500 MW of generation
- Water agencies are essential services, and have to have back up generation for critical loads
  - over 1/3 of all back up generation in the state is owned by water agencies
- Virtually all water treatment facilities are suitable for biogas generation
- Virtually all water agencies have potential for additional small hydro generation
- Institutional barriers have prevented development of this additional generation

Summary

- Water agencies are the single largest electricity end user in California
  - have the most potential to shift 1,000 MW+ of peak demands without disrupting service
  - have untapped generation potential of 1,000+ MW
- Drought significantly reduces hydro generation and increases pumping requirements
- Climate change may significantly reduce available water
- There is a lot of new water related electricity demand being developed that we haven’t seen yet, and may see only occasionally