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The End of Abundance: How Water Bureaucrats Created and Destroyed the Southern California Oasis

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ABSTRACT: This paper describes how water bureaucrats shaped Southern California's urban development and put the region on a path of unsustainable growth. This path was popular and successful until the supply shocks of the 1960s, 1970s and 1980s made shortage increasingly likely. The drought of 1987-1991 revealed that the norms and institutions of abundance were ineffective in scarcity. Ever since then, Southern California has teetered on the edge of shortage and economic and social disruption. Despite the risks of business as usual, water bureaucrats, politicians and developers continue to defend a status quo management strategy that serves their interests but not those of citizens. Professional norms, control of the discourse, and insulation from outside pressure slow or inhibit the adoption of management techniques suitable to scarcity. Pressure from increasing population and politically and environmentally destabilised supplies promise to make rupture more likely and more costly.

KEYWORDS: Metropolitan Water District of Southern California, abundance, scarcity, institutions, California

INTRODUCTION

This paper[1] reviews how water bureaucrats have shaped the Metropolitan Water District of Southern California (MET) – from the period before its foundation in 1928 to its explosive growth in the early 50s, to the contraction in supply in the 1960s, and paradigm-changing drought of 1987-1991. This history helps us understand how and why bureaucrats made MET into an expansionist organisation, and how their policies destabilise MET today. This story is important not just because MET is the largest water utility in the US but because its policies are widely admired and copied worldwide. Although MET's managers should be proud of their role in creating one of the most prosperous regions in the world – the population of Los Angeles county grew from 170,000 in 1900 to 8.8 million in 1990 (Forstall, 1995) – their legacy is threatened by the unsustainable institutions that they built to facilitate this growth. In this essay, I argue that water managers' discourse – supply-driven growth – continues to dominate in an era that calls for a different discourse, i.e. one of sustainable demand.

For simplicity, think of a story in two acts: a pre-1960 era of growth and post-1960 era of scarcity. These eras did not result from exogenous factors: MET policies created excess supply in the early years; MET's solutions to those problems created excess demand that continues to affect MET today. Thus, institutions created in a time of abundance exacerbate problems in a time of scarcity.

To understand how it is possible for some institutions to persist when others should replace them, it is useful to consider the incentives of those with power. For simplicity, I will assume that there are four sets of actors: water bureaucrats, politicians, developers and citizens (or voters). These actors relate to each other within a principal-agent-beneficiary framework, with politicians as principals, managers as agents, and voters/developers as beneficiaries. This framework extends the traditional principal-agent framework (Stiglitz, 2001) by splitting the principal role into two parts: that of the politician who

[1] This paper is a heavily-revised version of chapter 3 of the author's dissertation thesis – Conflict and Cooperation within an organization: A case study of the Metropolitan Water District of Southern California – in Agricultural and Resource Economics at UC Davis in 2008.

monitors the bureaucrat for performance and that of the voter or developer whose benefits depend on the bureaucrat. Because this split leaves the costs of monitoring with the politician and reassigns the benefits from monitoring ('good' performance) to the beneficiaries, it weakens the politicians' incentive to monitor. If we begin with the example of an unmonitored bureaucrat, we can assume that he will act as he pleases, choosing to follow norms within his professional discourse that may suit neither his principal nor his beneficiary. If the politician monitors the bureaucrat, then the bureaucrat may expand the water system in accordance with the politician's wishes. Although developers will always favour expansion, the citizen will not support it if they bear the costs of benefits that accrue elsewhere.

Thus, we can see (in this stylised framework), how all four groups may have supported development and growth fuelled by water projects while water was abundant but may disagree on growth once water became scarce. In other words, citizens' support for growth would fade if they did not benefit from it. Unfortunately, citizens (*qua* beneficiaries) may not have the power to stop growth if their only contact with bureaucrats is via politicians. That is because these same politicians may choose to ignore citizens, paying attention to their own welfare (growth is good for votes) and the welfare of developers (growth is good for business). Given bureaucrats' instinctive desire to continue with business as usual (Wilson, 1989), it would be very easy for developers, politicians and bureaucrats to form an 'iron triangle' that would support growth inconsistent with maximised social welfare (e.g. sustainability) because they would enjoy the benefits of growth while leaving the costs to fall on citizens.

Before we begin, let us learn a little more about MET, a "public corporation" governed as a cooperative by its 26 member agencies. Fourteen members are municipally owned, retail water utilities, and 12 members are Municipal Water Districts (MWDs) that wholesale water to about 230 retail agencies within their service areas. Table 1 describes them. MET is the largest water utility in the United States by population served (18 million) and treated water delivery (1.6 million acre-feet per year [Mafy]).[2] Most of MET's water comes from the Colorado river (via the Colorado River Aqueduct, or CRA) and the Sacramento-San Joaquin delta (via the California aqueduct of the State Water Project, or SWP). Figure 1 shows the physical location of MET and these sources. For most of its member agencies, MET is the sole supplier of imported water.[3]

This paper describes how MET was founded, evolved, and now copes with shortages. It shows how MET's current problems reflect past actions and how the continued use of past policies make it difficult for MET to face today's problems. The paper is organised chronologically, from MET's foundation to its current and future challenges.

Two elements from this story reappear in the story of MET: the combination of economically valuable electricity and politically valuable water and growth driven by cheap water supplies. Even more interesting, perhaps, is how cities threatened by Los Angeles' aggressive tactics joined Los Angeles in founding MET and then benefited from Los Angeles' generous subsidies of MET's operations.

MET's origin can be traced to Los Angeles' desire for more electricity. After the defeat of its plan for a high dam on the Colorado river – a dam that would have generated power for export – Los Angeles changed tactics. In 1923 – one year after proclaiming Los Angeles had four times its water requirements – Mulholland proposed that a Colorado river aqueduct (CRA) bring water from the Colorado river to 'parched' southern California (Milliman, 1956a).[4] Mulholland's announcement was misleading but not totally unfounded: although Los Angeles had plenty of water, other communities that relied on groundwater were running short. Instead of selling excess LAA water or allowing them to solve their

[2] An acre-foot (af) is the volume of water sufficient to cover one acre (approximately 0.4 ha) of area to one foot deep (0.3 m). One acre-foot of water contains 325,851 gallons (1,234 m^3). In California, 4 or 5 people might use one acre-foot per year. Taf(y) and Maf(y) refer, respectively, to thousands or millions of acre-feet per year.

[3] The important exception to this monopoly is the Los Angeles aqueduct, which has brought water to Los Angeles since 1913.

[4] Surplus water dumped from the LAA was already damaging crop roots in the San Fernando valley. Milliman says that Mulholland either lied or exaggerated when arguing for the CRA. Mulholland did not announce an extension of the LAA to Mono lake (a cheaper source of additional water) until 1930 – *after* the CRA was approved.

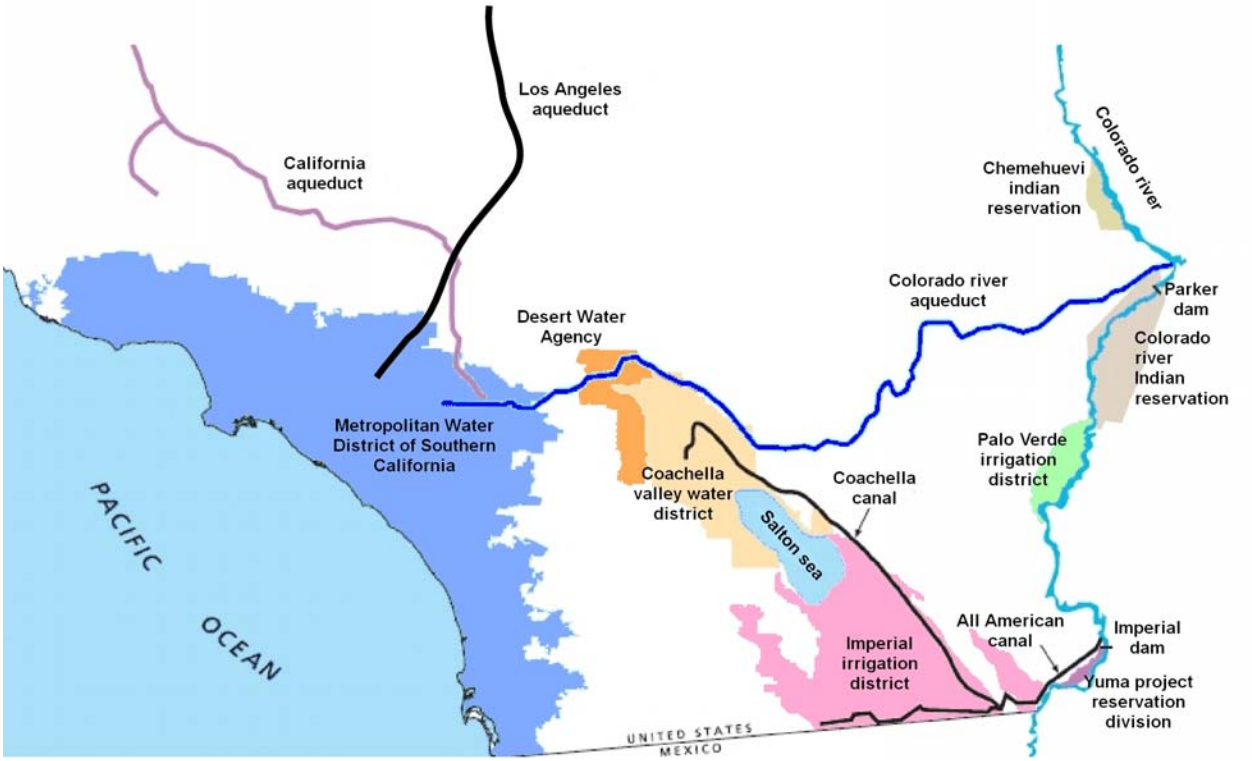
own problems, Mulholland instead proposed a regional water organisation that would share the water and the costs of bringing the water. That organisation was MET.

Los Angeles' decision to go for water was politically astute. If Los Angeles wanted to get power, it needed a dam. Although money was not available for dams, it was available for water. MET joined the interests of Los Angeles and neighbouring cities: Los Angeles got political support for a high dam in exchange for helping cities pay for the CRA (Parsons, 1990). And thus we see how Hoover dam was part of a plan to bring power and water to southern California.

After a political tussle that limited Los Angeles' voting power to 50% and prohibited MET from seizing local water supplies, the California Legislature approved the MET Act, and Los Angeles and 12 other cities joined MET as founding member agencies in 1928 (CA Legislature, 1927; Milliman, 1956a). At the federal level, MET's plan to use Hoover dam power to bring water to the people dramatically increased the popularity of the Boulder Canyon Project that Congress approved in 1928. The BCP Act authorised the construction of Hoover dam, Imperial dam and the All-American canal (see figure 1).[5]

MET now needed $220 million to build the CRA and its member agencies distributed over 500,000 pamphlets in voters' utility bills. These pamphlets gave four reasons to vote for the largest bond issue in southern California's history. Milliman argues that three of these reasons were untrue. I repeat them here because they have been used many times, in many places, to justify water infrastructural spending (Milliman, 1956a):

Figure 1. MET's service area and water sources.



[5] As noted by Fradkin (1981) and Wehr (2004), the BCP put the Colorado river to man's need; unfortunately, it also sowed the seeds of future problems (political, environmental) by failing to limit those needs within sustainable bounds.

Table 1. Characteristics of MET's 26 member agencies.

	Area (mi^2)	Population (000s)	Year joined	Board % votes	Share of sales (1979-2005)	Water use Urban/Ag (%)	Water source Local/MET (%)
Anaheim	50	340	1928	1.7	1.3	100/0	75/25
Beverly Hills	6	41	1928	0.9	1.7	100/0	14/86
Burbank	17	105	1928	0.9	1.0	100/0	50/50
Calleguas MWD	395	517	1960	4.0	5.4	84/16	24/76
Central Basin MWD	227	1,400	1954	5.5	5.7	100/0	65/35
Compton	8	93	1931	0.2	0.2	100/0	47/53
Eastern MWD	555	105	1951	2.8	2.9	74/26	20/80
Foothill MWD	22	80	1953	0.6	0.6	100/0	40/60
Fullerton	22	134	1931	0.7	0.7	100/0	66/34
Glendale	31	200	1928	1.1	1.4	100/0	15/85
Inland Empire MWD	242	700	1951	3.8	3.0	100/0	70/30
Las Virgenes MWD	122	65	1960	0.9	1.0	99/1	0/100
Long Beach	50	487	1931	1.8	2.5	100/0	51/49
Los Angeles (LADWP)	465	3,849	1928	19.0	10.3	100/0	70/30
MWD of Orange County	600	2,000	1951	17.1	14.8	97/3	50/50
Pasadena	26	160	1928	0.9	1.2	100/0	40/60
San Fernando	2	24	1971	0.1	0.0	100/0	100/0
San Marino	4	13	1928	0.2	0.0	100/0	90/10
Santa Ana	27	347	1928	1.1	0.8	100/0	66/34
Santa Monica	8	90	1928	1.1	0.6	100/0	18/82
SDCWA	1,457	2,840	1946	18.3	26.6	85/15	15/85
Three Valleys MWD	133	600	1950	2.5	3.5	100/0	40/60
Torrance	20	112	1931	1.1	1.1	100/0	8/92
Upr. San Gabriel MWD	144	900	1960	3.5	2.3	100/0	20/80
West Basin MWD	185	900	1948	6.6	8.7	100/0	20/80
Western MWD	509	600	1954	3.6	3.7	68/32	76/24
Totals/Averages	5,327	16,702		100.0	100.0	93/7	38/62

1. "A water shortage is imminent". *False:* the district had surplus water when LAA supplies were included.
2. "The project can be financed with a small increase in property taxes". *False:* property taxes were not 0.10% (as promised). Due to cost overruns and demand shortfalls (see below) they varied from 0.25 to 0.50% between 1937 and 1954.
3. "The CRA will provide jobs for district citizens". *True:* 10,000 persons (1.2% of all workers in the area) were employed for 6 years.
4. "The CRA will 'perfect' southern California's water-rights on the Colorado River". *False:* under the 1931 Seven Party Agreement among California water users, MET had an entitlement of 1.1 Mafy out of a total of 5.2 Mafy allocated to California, but the federal government only recognised 4.4 Maf of rights under the 1928 BCP Act. These conflicting numbers were reconciled to MET's disadvantage in 1963, when the Supreme Court affirmed the 4.4 Maf limit.

THE AGE OF ABUNDANCE

MET's CRA came online in 1941 with a capacity of 1.3 Mafy. Unfortunately, MET's demand projections were wildly inaccurate, and demand did not exist at planned price levels. MET dropped its prices below the cost for member agencies' local supplies to increase sales and covered operating losses with higher property taxes (Milliman, 1956a). Since Los Angeles had most of MET's assessed value, it paid more taxes (Milliman, 1957). Los Angeles and MET's other member agencies decided that these losses could be reduced with growth, which would increase demand, spread out fixed costs, and bring MET closer to profitability – allowing property taxes to fall.

Low demand and subsidies

MET based its demand calculation on the "habitable [not inhabited] area of the South Coastal Basin" and made no provision for the effect of prices on demand (Milliman, 1956a, 1957). Milliman claims that MET engineers started with a CRA capacity of 1,500 cubic feet per second (cfs) and projected a demand that would require that much water. After building the CRA, MET set prices to cover the cost of building and operating the CRA but ignored the possibility that demand would not exist at those prices. Given "the average cost of Colorado River water, even on the basis of full capacity operation, is roughly three to five times the cost of existing water supplies" and a reduction in demand due to high rainfall, actual sales were 5% of projections in MET's first years (Milliman, 1957; Kahrl, 1979).

Facing a flood of unsold water, MET lowered its prices below the cost of local water to increase sales and covered operating losses with higher property taxes. This financing structure transferred wealth from high-tax areas to high-demand areas (Ostrom, 1953). The duration and magnitude of these subsidies ended up being quite large: by 1954, Los Angeles (with nearly 70% of MET's tax base) had paid 61% of MET's costs in exchange for 8% of its water (Milliman, 1956a). A second subsidy came at annexation to MET's service area. Although MET 'penalised' later annexation with penalty fees and back taxes, those fees were calculated to minimise the cost of growth. Further subsidies came from outsiders: besides the benefit of access to cheap power from Hoover dam, MET received cheap government financing on the CRA.[6]

[6] In the 1931 bond prospectus, MET claimed that debt would be paid by service charges, not taxes. When MET did collect taxes, it claimed they were "ownership charges" for potential access to MET water. In 1932, MET qualified as a "self-liquidating project without resort to taxation", which allowed it to swap its 1931 bonds for cheap loans from the Federal Reconstruction Finance Corporation (Milliman, 1956a, 1957).

Expansion

Although MET sold water below the cost of delivery and covered losses with property taxes, existing MET members favoured expansion. They may have reasoned that short-run losses would increase, but the absorption of excess capacity would support higher prices and reduce the burden in the long run (Milliman, 1956a; Erie, 2006).[7] The annexation of the San Diego County Water Authority (SDCWA) was MET's biggest and most important expansion. MET had surplus supply, and San Diego county had a big demand, but the county's 'natural' annexation to MET was hindered by the City of San Diego's historic rivalry with Los Angeles, its location outside the South Coast basin (MET's service area), and the large agriculture sector (Erie, 2006). After some jostling, SDCWA joined MET in December 1946 and received its first deliveries in November 1947 (SDCWA, 2004). By 1949, SDCWA was buying half of MET's water.

SDCWA's annexation heralded a new era in which MET – pushed by scarce revenues and abundant water and pulled by local drought – expanded more, and on more favourable terms, than predicted in the 1930s (Oshio, 1992). The eight member agencies that annexed with SDCWA between 1946 and 1955 were big and vacant: they increased MET's area by over 200%, and its population by 75%.

Nobody embodied expansionary spirit like Joseph Jensen (former oilman and chair of the Los Angeles Chamber of Commerce committee on water), who was elected Chairman of MET's Board of Directors in 1949. He and others vowed to "maintain the momentum of the boom in southern California" (Oshio, 1992). Opposed to these boosters were those who worried that over-expansion would strain Colorado river supplies without lowering taxes. In 1948, the slow-growth group (led by Los Angeles but not Jensen) blocked the annexation of thirsty, poor Pomona MWD (later Three Valleys MWD). Politicians in the California Legislature retaliated with a motion to replace block voting with individual voting on the Board of Directors, which threatened Los Angeles' hegemony. In a compromise, Pomona agreed to pay higher annexation charges; the reform disappeared and Pomona annexed to MET (Oshio, 1992).

With a new growth path (out of the basin to SDCWA, to non-urban areas like Pomona), MET's Colorado river rights suddenly looked inadequate. Chairman Jensen believed that MET could buy enough water to maintain reliability while growing (Ostrom, 1953). On December 16, 1952, MET issued the Laguna Declaration guaranteeing southern California's water supply:[8]

> The district is prepared, with its existing governmental powers and its present and projected distribution facilities, to provide its service area with adequate supplies of water to meet expanding and increasing needs in the years ahead. When and as additional water resources are required to meet increasing needs for domestic, industrial and municipal water, the district will be prepared to deliver such supplies.
>
> Taxpayers and water users residing within the district have already obligated themselves for the construction of an aqueduct supply and distribution system. This system has been designed and constructed in a manner that permits orderly and economic extensions and enlargements to deliver the district's full share of Colorado river water **and State Project water** as well as water from other sources as required in the years ahead. Establishment of overlapping and paralleling governmental authorities and water distribution facilities to service southern Californian areas would place a wasteful and unnecessary financial burden on all of the people of California, and particularly the residents of southern California.

According to Ostrom (1953), the Laguna Declaration gave others notice that MET intended to control the Feather River Project (later renamed as the State Water Project) – extending its self-proclaimed monopoly on imports to the region.

[7] Robert Skinner (MET's General Manager from 1962 to 1967) said that MET's "effort of the early 40s is to actually encourage annexations to expand the tax base as an ameliorating measure on the economic side" (Oshio, 1992).

[8] Bold face text was added to the original Declaration, which is now Section 4202 of MET's Administrative Code.

Irrational Los Angeles?

Under Jensen's leadership (1949-1974), MET's service area grew from 900 to 4,900 mi^2, and much of the cost of that expansion fell on Los Angeles. Although LADWP had 50% of the vote until 1953 and a substantial plurality until the 1970s, it did not veto expansion.[9] Why did Los Angeles pay so much? Looking more deeply, why did Los Angeles even support MET's formation if it was pretty clear that it would subsidise everyone else?

The answer to this question depends on how monolithic 'Los Angeles' is. If we treat Los Angeles as a 'being', then we have to consider costs and benefits in aggregate. If we make the more realistic assumption that 'Los Angeles' is really composed of multiple parties with diverging interests (e.g. politicians, developers, water managers, taxpayers, et al.), then it is easier to explain an outcome that does not favour the city in aggregate.

Consider the monolithic perspective: first, Los Angeles supported MET to get power from Hoover dam. That decision did not look so smart when MET's sales fell short of expectations and Los Angeles' property taxes increased, but then it was too late – the CRA was built and it made sense to expand. Second, Los Angeles may have wanted MET water for its own growth or as an insurance policy against failure of the Los Angeles aqueduct (Erie, 2006). Third, Los Angeles may have wanted to contribute to social welfare – acting out of progressive ideals. Ostrom quotes MET Chairman Whitsett (1929-1947), who said "whatever is done should be done for the benefit of the whole and whatever is done for the benefit of the whole should be shared by all the parts" (Ostrom, 1953). Whitsett led a Los Angeles delegation that kept the peace, sought unanimous decisions, never opposed a united opposition, and voted last to either support the consensus or ask for reconsideration if consensus is not clear. Fourth, 'the small' may have exploited the large (Los Angeles).[10] When MET was founded by 13 cities in 1928, Los Angeles represented 82% of assessed land value but was politically weak from the fallout over its aggressive management of LAA water. In later years, less powerful entities (e.g. SDCWA and Pomona) used political pressure to force their way into MET.

The Iron Triangle

It is also possible to explain the actions of 'Los Angeles' from the perspective of interest groups within the Los Angeles decision-making unit. For example, an 'iron triangle' of bureaucrat-politician-developer interests could unite to push for an expansion of water supplies beneficial to their interests but funded by taxpayers. This exploitation of the 'ignorant' majority by the 'knowledgable' minority (à la Olson [1971]) is common in the water sector of the western US and facilitated by the opacity of water planning and operations. As we saw earlier with Mulholland's volte-face on water scarcity, water managers play a critical role in defining the issues and controlling the discourse in water development (Worster, 1986; Gottlieb, 1988; Gottlieb and FitzSimmons, 1991). As a high priesthood, it is easy to see how they may (with good or bad intentions) promote water systems that give them more work and prestige, increase the value of previously dry land, and increase the power of local politicians (Waller, 1994; Pisani, 2002).[11] Water bureaucrats have little incentive to limit development and risk alienating powerful economic and political actors. Even today, managers and politicians claim that development is not only sustainable but necessary (Ladd, 2009; Lippert and Efstathiou Jr., 2009). For their part, Los Angeles' politicians may have wanted expansion as regional boosters and/or direct beneficiaries of growth (Parsons, 1990; Gottlieb and FitzSimmons, 1991; Hundley Jr., 1992; Erie, 2006).

This pro-growth perspective will persist for as long as its costs are negligible (in the case of abundant water or financing for projects) or hidden (in the case of a shortage it can be blamed on the weather,

[9] The MET Act of 1928 limited Los Angeles' votes to 50% of the total. In 1947, Los Angeles had 69% of total assessed value.

[10] Skaperdas (2003) demonstrates how the poorer (less productive) opponent has a comparative advantage in grabbing from a common pool – a concept resembling the exploitation of LADWP by poorer member agencies.

[11] LADWP claimed its operations placed "no burden on Los Angeles taxpayers" in the 1950s, but general tax assessments funded LADWP projects – including MET (Milliman, 1956a).

politics or bureaucrats). If costs grow so large that shortage or rationing is necessary, it is still possible that managers will use their elite status to maintain control over the discourse and the responses to shortage. It is thus that managers may be charged with fixing a problem (shortage) of their own making (setting prices too low) and propose a solution (dams, desalination, etc) that may not be as cheap or efficient as other solutions (prices, markets) that they either do not understand or favour.

INSTITUTIONS OF ABUNDANCE – NOT ECONOMICS

During the Glory Years, abundant and cheap water was the norm. Because there was plenty to go around, members did not have to worry about shortages. Because Los Angeles covered most costs, members did not have to worry about high prices. When water became scarce, problems-in-waiting became real problems (rationing, conflict, etc), but MET did not have the institutions to cope with these. This section explains the economics underlying those problems, and the following recounts how MET and its member agencies tried to adjust as water supplies changed from abundant to scarce.

MET's problems originate in the way it sets prices. Because prices are set in advance, they are likely to be too high or too low when demand and supply are realised. The resulting shortages/surpluses create uncertainty for MET as a seller and its member agencies as buyers. Because prices set to recover costs are low, they encourage demand on the extensive margin (sprawling new communities) and intensive margin (higher water use within existing communities). Because fixed costs are covered in variable revenues (price), they are difficult to monitor, and this opacity encourages cost inflation.

Guesstimate prices

MET estimates demand and supply in March and sets prices for the next calendar year. During that year, members buy as 'much water as they want' at those fixed prices – regardless of actual quantity available, says Tim Quinn, MET's [former] VP of State Water Project Resources (Quinn, 2006). Because prices are based on estimated supply (Ω_S) and demand (Ω_D) instead of actual supply and demand (Q_S and Q_D), supply/demand imbalances are likely, i.e.:

- *High Supply*. If $Q_S>\Omega_S$, MET sells or stores surplus water, and profits are zero. Social surplus is not maximised because additional quantity is not sold at a lower price on the demand curve but as surplus water to infra-marginal users.
- *Low Supply*. If $Q_S<\Omega_S$, price is too low, member agencies fight over supply, and MET loses money. ($Q_S<\Omega_S$ results in lower variable costs, but unfunded fixed costs are much bigger.) MET fills the gap with stored water and financial reserves.
- *High Demand*. If $Q_D>\Omega_D$, price is too low, and member agencies fight over supply – destroying surplus. MET does not lose money because it sells $Q_S=\Omega_S$
- *Low Demand*. If $Q_D<\Omega_D$, Price is too high, and MET cannot sell enough water. Because revenues are lower than total costs, MET draws on financial reserves.

Besides these effects, *all* cases of imbalance involve misallocation of water among users, which reduces efficiency. MET tries to reduce harm from disequilibrium by managing shortages and surpluses on an ad hoc basis with large buffers of water (e.g. the two billion dollar Diamond valley lake) and cash – MET keeps an average of $440 million in buffer and stabilisation reserves.[12]

Sprawling prices

MET's most inefficient policy is postage stamp pricing (PSP), i.e. selling water at the same price for all delivery locations. PSP is inefficient in four ways: PSP does not sort member agencies by willingness to

[12] This number is the 2000-2004 average of water [Revenue Remainder/Rate Stabilisation/Transfer] funds.

pay; PSP bundles water and conveyance; PSP bundles fixed and variable costs; and PSP averages costs across member agencies. Overall, PSP is inefficient in the typical way that average cost pricing is inefficient. Although some would argue that PSP is useful because it is simple to calculate and understand, the distortions resulting from weak or non-existent forces at the margin means that PSP increases inefficiency.[13] Although PSP is the industry-standard, its (known) problems with efficiency increase as the service area grows and the number of customers falls. The former because it implies greater customer-heterogeneity, which increases the magnitude of subsidies; the latter because the impact of a single miscalculation on shortage is larger. Because MET has a large service area and only 26 member agencies, it is likely to experience greater distortions from PSP.

Let us look at each of these distortions in more detail. First, PSP is de facto inefficient: if member agencies' willingness to pay for reliability (i.e. outbid others to buy a certain quantity) differs, they should be allowed to pay for the reliability they want and the accompanying conveyance. Since they cannot and face the same price, marginal benefit-cost ratios vary and inefficiency results (Brewer, 1964; Staatz, 1983).[14] Inefficiency from reduced reliability is very costly to member agencies.

Second, PSP combines different conveyances and water into one good – a distortional practice with a long tradition at MET: in the 1940s, MET averaged the cost of local and CRA water to make CRA water look cheaper (Milliman, 1956a). In the 1960s, it blended the cost of (now cheap) CRA water with SWP water to make SWP water look cheaper (Brooks, 1964). More recently, the bundled price of different conveyance facilities (e.g. SWP versus CRA) has dampened – if not halted – demand for water trades that would have low marginal conveyance costs.[15]

Third, PSP mixes fixed and variable costs.[16] Efficiency requires that the marginal benefit of a unit be greater than or equal to its marginal costs; equity suggests that fixed costs be allocated in proportion to surplus. It is not easy to match costs and benefits e.g. Sexton (1986) finds that allocation in proportion to purchases does not guarantee efficiency, but that does not rule out some sort of two-part tariff (Coase, 1946).

Because MET's fixed costs are so significant, and PSP pays them, decreased sales volumes require higher prices (Sofaer, 1997). Although it may make sense that prices should fall when MET has plenty of water (and rise when it does not), this relationship does not always hold. Member agencies use a combination of local water and MET water to meet demand. If local supplies are scarce, members increase their relative demand for MET water. Since MET sets its prices according to PSP (not demand), member agencies' diversification into MET water occurs at prices that are relatively 'low', which means that signals to conserve (within districts facing low local water supplies) are dampened. Weakened scarcity signals also create a false sense of reliability that can increase 'hardened' demand. Further, MET may benefit from *dependent* member agencies or higher sales volume (in prestige, cheaper bond financing, etc). If so, MET may have a perverse incentive to encourage unreliable member agency supplies.

Finally, PSP do not vary by delivery distance – often due to an explicit pro-growth policy (Tarlock and van de Wetering, 2008). Under PSP, members who use a lot of infrastructure or require new infrastructure do not pay the marginal cost of system expansion (Brewer, 1964; Dixon et al., 1998).[17]

[13] Water managers claim that PSP are politically efficient because they are "fair" and easy to understand. While this may be true when thousands or millions of different efficient prices are possible, it is not at MET. Its 26 member agencies are "sophisticated" enough to understand the need for different prices.

[14] Note also that without quantity rationing, ratios vary from MET's perspective because MET's marginal cost of delivery varies. With quantity rationing, they vary for member agencies and MET because, now, members do not choose how much water to buy.

[15] MET charges SDCWA $258/af to "wheel" (move) water it buys from Imperial Irrigation district through MET's facilities, a cost that represents the average cost of MET's entire system. If it only represented the fixed and variable costs of the CRA (the conveyance SDCWA actually uses), the wheeling charge would only be $116/af (MET, 1997).

[16] Of MET's revenues 80% are from sales, and 80% of MET's costs are fixed.

[17] Bjornlund and O'Callaghan (2005) show that both water and water infrastructure impact agricultural land values. If they are both subsidised, value is twice-inflated.

When supplies are variable (increasingly true in southern California), PSP create a subsidy from consistent water buyers to occasional (e.g. drought) buyers – regardless of the quantity of infrastructure used. Following Coase (1946), Faulhaber (1975) argues that organisations with significant fixed costs can avoid cross-subsidies only if consumers pay different prices and generate marginal revenues in excess of marginal costs. Although MET's variable revenue exceeds its variable costs, PSP ensures that member agencies do not contribute marginal revenue in proportion to marginal costs, making cross-subsidies likely.

Inflated prices

Water managers want a quiet life, and water shortages make them look incompetent and attract attention from customers, politicians and the press (Lach et al., 2005a; SDCWA, 2006). In shortage, should MET sell additional water to meet current demand or hold back in case the shortage gets worse? If somebody else (the customer) is going to pay the cost of avoiding that decision (e.g. by building storage to prevent shortage), then water managers will create overcapacity (or slack) "to ensure the right quantity and quality of water was available to all users at all times" (Lach et al., 2005b).[18] This problem is common in the water industry: Timmins (2002) calculates that the marginal benefit of water utilities' last dollar of investment is worth 45 cents.

MET management and staff also have incentives to shirk – e.g. not trying to optimise water or cost management practices – because prices *will* rise to cover costs, e.g. MET has *already* projected annual price increases of 3-5% between 2004 and 2014 (Alchian and Demsetz, 1972; Hansmann, 1980; MET, 2004a). Cost control is weak because of free-riding incentives, i.e. because all member agencies benefit when one agency expends effort to reduce MET's costs, each member wants another to exert that costly effort. The result is that all members are worse off than they would have been had they been able to coordinate efforts to reduce costs.

The irrelevance of economics

Although economists criticized water management policies for many years (Ostrom, 1953; DeHaven and Hirshleifer, 1957; Milliman, 1957), their perspectives were trumped by political and cultural considerations that supported growth, subsidies and so on. Why are weaknesses ignored, despite their increasing economic and environmental costs? They are ignored because either those costs are too small (or too hard) to notice or change is too difficult. Taking some combination as given, it is also important to note that those in a position to promote change have little incentive to challenge the status quo. After all, politicians and water managers face little risk of financial or career ruin due to shortage. They can blame drought, politics or accountants for rising costs and lower reliability. Even if they are blamed, it is unlikely that they are penalised. They are monopolists until re-election, and most elections merely reaffirm their incumbency.

Further, they (water managers and the politicians who appoint them) view the world through a different lens. Their discourse gives more weight to growth and development than efficiency, equity or sustainability. Earlier in this essay, I explained how the actions of an 'iron triangle' of bureaucrats, politicians and developers would explain Los Angeles' 'irrational' subsidy of neighbouring regions in the way that MET was founded and operated. That example can be generalised: the members of these three groups would support projects that are 'uneconomic' in terms of aggregate social welfare because they gather the benefits and leave the costs to citizens.

[18] Slack is the extra reserve or operational capacity managers use to reduce internal conflict and/or cushion the organisation while adjusting to external shocks (Cyert and March, 1963).

THE END OF ABUNDANCE

With hindsight, we can see that MET started down an unsustainable path in the 1940s and discovered it was on that path in the 1960s. Policies that may have been efficient in the years of abundance became inefficient when conditions changed. Although MET responded to these changes, the responses (reduced subsidies, changed price structures) were not economic as much as administrative, reflecting the dominant discourses of engineering and politics. Because these changes did not address the main problems (supply and demand imbalance, cross subsidies), tension among MET's member agencies increased and conflict reduced MET's efficiency. These pressures and outcomes were most obvious during the 1987-1991 drought (see 'The big drought,' below). Contemporaneous to these changes in external conditions and policies were internal changes that influenced and were affected by outside conditions. Although these internal changes were important, they neither ended conflict within MET nor restored its efficiency in managing water.

Changes in supplies

MET's founders estimated that CRA water would support demand growing at the rates of the 1920s until 1980 (Milliman, 1957).[19] The 1952 Laguna Declaration that MET would provide 'adequate' supplies seemed reasonable at the time – MET was only selling one-third of its supply by 1956. Unfortunately, MET's plans did not consider competing demands: soon after the Declaration, Arizona decided to contest California's allocation of Colorado river water (Ostrom, 1953). Since MET held junior rights in California's allocation, this attack pushed MET to look for other supplies. By 1960, MET had become the biggest contractor of the unbuilt State Water Project (SWP), but SWP supplies also turned out to be vulnerable: ten years after SWP deliveries began in 1972, voters limited the SWP's total size and MET's contracts. MET, a supply-centric organisation, responded by seeking more supplies, not by addressing demand.

The Colorado river

MET was founded to import water from the Colorado river, via the CRA. Although the CRA has a capacity of 1.3 Maf and MET has rights to 1.212 Maf of Colorado water, these firm rights were reduced to 0.55 Maf in the 1963 *Arizona vs. California* decision of the US Supreme Court (SDCWA, 2002). Facing these reductions, MET set out to purchase water from agricultural entities with senior rights, making deals with the Imperial Irrigation District in 1988 and Palo Verde Irrigation District in 1992 (Haddad, 1999).[20]

Figure 2 shows the fluctuations in MET's entitlements to, and supply of, water from the Colorado river. Although MET took more water than its rights as recently as 2002, its access to surplus falls when lake Mead's surface elevation drops below 1,145 feet, the threshold that allows the Bureau of Reclamation to declare an unrestricted surplus. Today, MET gets about 30-40% of its water from the CRA.

The State Water Project

In 1960, California's Department of Water Resources (DWR) began signing contracts for a State Water Project (SWP) to bring water from the Sacramento delta to southern California. MET was DWR's first and biggest contractor, with entitlement to 2.01 Mafy – 48% of the SWP's *planned* capacity (Hundley Jr.,

[19] Although early plans discuss moving water from Northern California to the San Joaquin valley via the SWP, they pay almost no attention to the idea of pumping water over the Tehachapi mountains to MET's service area (CA Department of Water Resources, 1930; Commonwealth Club of CA, 1931).

[20] The Palo Verde Irrigation District (PVID) deal was not a success at the time – MET lost water it gained from PVID fallowing when the Bureau of Reclamation spilled it to make room for flood flows into lake Mead in 1997 – but it set the stage for a successful 2005 fallowing deal.

1992; SDCWA, 2002). After SWP deliveries began in 1972, MET increased its deliveries (as high as 800 Tafy) until 1982, when voters rejected a Peripheral Canal project in the Sacramento delta that would have 'completed' the SWP (Rossman, 2005). The Peripheral Canal defeat signalled a shift in power from water agencies to environmentalists that would only grow stronger (McDermott, 1998; Erie, 2006). More recent rulings have limited exports of water from the delta to protect endangered fish (Weiser, 2007).[21]

Figure 2. MET's CRA entitlement rises and falls.

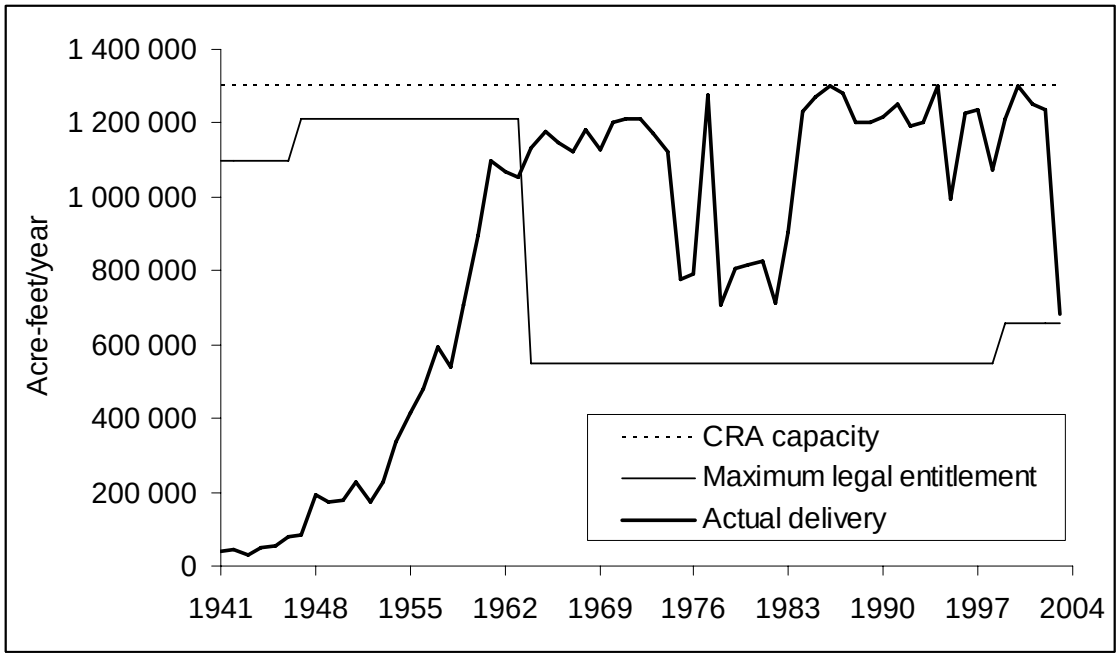


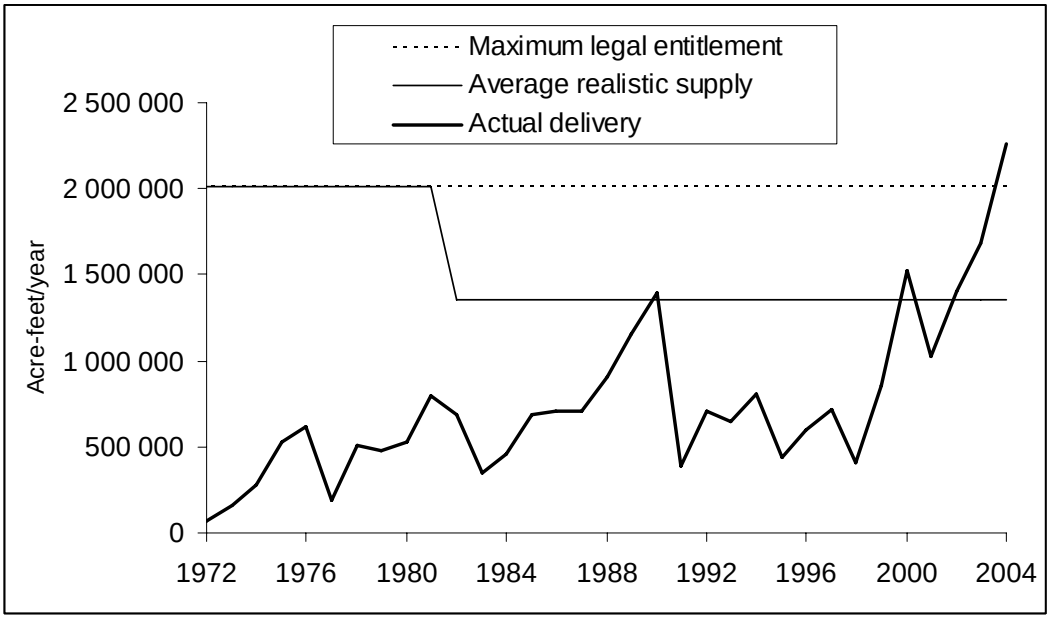
Figure 3 shows MET's rights and deliveries over the years. In the 20 years until 2004, MET's median SWP purchase was 700 Taf, and MET estimates its SWP supply to be 0.6 Maf in a dry year and 1.35 Maf in an average year (SDCWA, 2002). Present SWP deliveries to MET are approximately 1.35-1.5 Mafy or 60-70% of its total supply (MET, 2004b).

Changes in demand

In MET's early years, low prices encouraged existing consumers to replace groundwater with MET water and new consumers to annex to MWD – increasing intensive and extensive demand, respectively. Although per capita demand peaked in the 1960s – probably due to exogenous factors such as greater population density, lifestyle changes and/or environmental 'awareness' – aggregate demand grew under the twin influences of higher population and a larger service area: 97% of the increase in MET's service area in the 50 years until 1993 came from member agencies that joined MET after it was founded by the original 13 cities. Aggregate water deliveries by MET and its member agencies were between 2 and 3 Maf during the 1960s and 1970s, between 3 and 4 Maf during the 1980s and 1990s, and over 4 Maf after 2000.

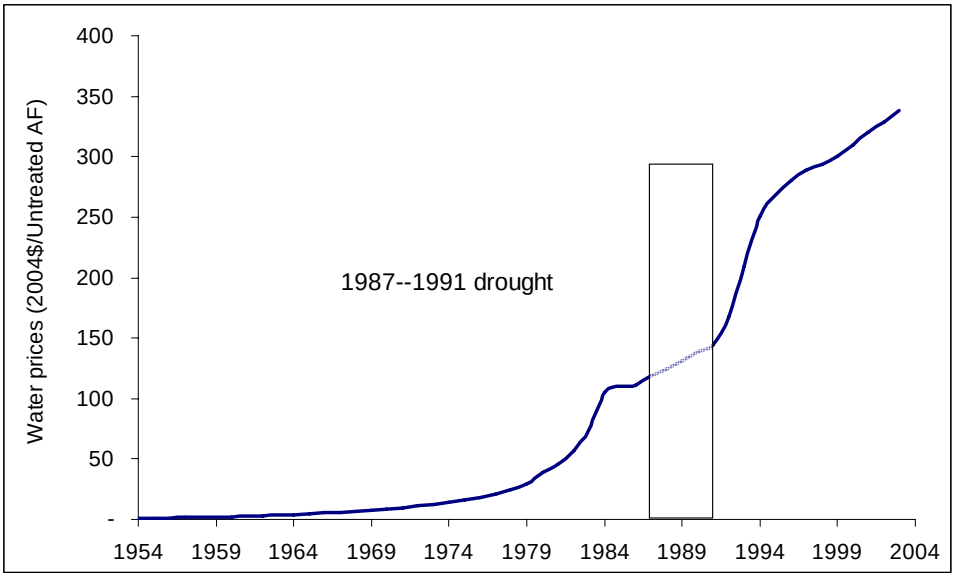
[21] Ironically, the Peripheral canal is again being considered, except that it is now proposed as a means of restoring fish habitat while maintaining "sustainable" water exports (Lund et al., 2008). Although the Peripheral Canal is likely to be built (perhaps after 2015), it will – at best – sustain historic exports in the face of challenges to water supply from climate change and environmental constraints. It will not bring *additional* water to Southern California or allow MET to receive its 2.01 maf entitlement.

Figure 3. MET's SWP rights are stable but deliveries vary.



Except for penalty pricing during the 1987-1991 drought (analysed in the next section), there is little evidence to show that MET has ever used prices to reduce per capita or aggregate demand. Although MET's prices rose faster than their historic trend in the 1980s, that increase was based on cost recovery, not restraint of demand. Even those penalty prices were suspect, since they were connected to historic use. MET's everyday prices during the drought did not rise to restrict demand across the board. Instead, they rose *after* the drought, when MET needed to recover costs (due to lower sales volumes), not restrain demand; see Figure 4.

Figure 4. Water prices rise steeply after the 1987-1991 drought.



Internal changes

As MET faced challenges from falling and volatile supplies and growing demand, its responses were affected by internal changes in political power and culture. These internal changes were not entirely accidental; they were affected by, and influenced, MET's 'external' changes. Overall, internal changes gave MET more flexibility, but that flexibility was neither cost-minimising nor efficiency-maximising. In other words, they reflected the desires of competing interests more than the region as a whole.

Changes in votes

MET's Board of Directors makes its policies, and each member agency's vote on the Board depends on its share of total assessed value within MET's service area. Thus, voting power matters, and members' relative power has shifted over time. At MET's foundation Los Angeles had the largest share of assessed value and the most political power. Los Angeles' veto over MET policies ended in 1949 when its share of votes dropped below 50%, but it was not until 1973 that the combined shares of the second and third largest member agencies (SDCWA and MWDOC, or MWD of Orange County) passed that of LADWP. In 2005, LADWP had 23% of the votes, with 18% for MWDOC and 15% for SDCWA. As Los Angeles' relative power declined, Board decisions became more democratic – and unpredictable.[22]

The power shift from Los Angeles to other agencies was accompanied by a parallel shift from the Board of Directors to MET's staff: after Chairman Jensen died in 1974, director terms were limited, and staff authority grew relatively stronger (McDermott, 1998). Also because of term limits, directors were less likely to be retired 'water buffaloes' and more likely to be aspiring politicians on their way to higher offices. Because they see their districts – not the region – as their clients, Board decisions have become more contentious. Jeff Kightlinger's 2006 election as General Manager – against the wishes of LADWP and SDCWA – set a historic precedent because it was the first time that an alliance of MET's two most powerful member agencies was defeated.

These changes in relative power and perspectives were further magnified by a growing misalignment between political and economic power within MET. As MET shifted its revenue base from taxes to sales (sales revenue surpassed tax revenue in 1973), it failed to realign votes from the share of assessed value to the share of revenues. The result was that water buyers were paying a larger share of MET's expenses without gaining more control over how that revenue was spent, i.e. taxation without representation (SDCWA, 2001; Atwater and Blomquist, 2002). This mismatch worsened disputes because it was easier for member agencies to cry foul, e.g. members with less than 51% of assessed value (votes) might still be compelled to pay more than 51% of a project's costs. This is important because conflict dissipates the benefits that MET generates (Mehlum and Moene, 2002).

Changes in culture

Along with these changes in political power (or perhaps because of them), the culture of MET changed over the years.[23] MET's first General Manager, F.E. Weymouth, held a joint appointment as Engineer of Dams at the Los Angeles Bureau of Water Works and Supply (Milliman, 1956a). Weymouth brought many employees from the Bureau and a culture of engineering to MET. Until the 1980s, executives at MET and member agencies came from a homogenous group of male engineers who worked together for years (Milliman, 1956a; McDermott, 1998). More recently, leaders' gender, training, tenure and prior experience have diversified. Although diversity improves community representation, cooperation is more difficult when common knowledge, language and goals diverge (Wilson, 1989; Ostrom et al., 1994). It has become more difficult to agree on how to solve problems at MET.

[22] Despite these shifts, the top three agencies were usually united in promoting growth – LADWP to keep the peace; SDCWA and MWDOC for their own interests – so their interests became MET's interests, even as growth harmed their constituents.

[23] *Culture* is a function of "generally accepted norms of behaviour, the level of common understanding about action areas, the extent to which the preferences are homogenous, and distribution of resources among members" (Ostrom et al., 1994).

At risk of overgeneralisation, engineering culture rewards problem-solving and treats costs as an outcome rather than a constraint. When engineers face a shortage, they ration with a formula. Note that MET and other water agencies *did* try to avoid shortages but only within their traditional, supply-side discourse (Wilson, 1989; Gottlieb and FitzSimmons, 1991), strongly backing the 1982 ballot initiative for a Peripheral canal that would bring more water to southern California. When that initiative was defeated, MET's managers had no Plan B – as we saw in their ad-hoc response to the 1987-1991 drought described in later. They were pursuing solutions within a professional discourse that did not include economic tools. This is not surprising, since their engineering careers began in an era of abundance.

As MET's situation changed, and shortages and costs became more important, the reallocation of existing rights and renegotiation of policies gave lawyers a comparative advantage, and most recent general managers have been lawyers.[24] Why a shift to lawyers instead of to economists? It is because MET – like nearly every water agency in the world – is a monopoly that operates within bureaucratic, not market, norms. Because MET faced no market pressure or competition, it only changed as a result of internal negotiation. Given this paradigm, lawyers skilled in bargaining have the advantage over economists skilled in promoting efficiency. Although bargaining can be quite costly in terms of inefficiency, MET's monopoly status allows this cost to be ignored – for a time.

If economists had been in charge, it is likely that subsidies would have been smaller and/or projects (e.g. Hoover dam or the CRA) would have been delayed until the benefit/cost ratio improved. This result would be driven by a professional creed of 'user pays', which gives little weight to the common (and often flawed) argument that 'uneconomic' projects should be approved because they include some unquantified 'public benefit'. It is more often the case that these projects subsidise a special-interest group. Since economists put a heavy weight on opportunity cost and the option value of delay, they are more likely to wait and see than engineers trained to build and operate projects. Furthermore, economists would hesitate to issue a Laguna Declaration (guaranteeing an 'adequate' supply of water to MET's member agencies) that did not include some means of limiting the level and/or growth in demand.

THE BIG DROUGHT

Over the years, MET adapted to falling supply, growing demand, realignment of political power and changes in culture. From an outside perspective, everything seemed fine: water was reasonably cheap and nearly always available. It was only when the 1987-1991 drought hit that outsiders discovered everything was not fine: MET's excess supply was gone, and it had no policies for managing demand or rationing supply. In the resulting conflict over ad hoc solutions MET adopted, relations among member agencies grew so strained that analysts studied how to break MET apart (MET-RAND, 1998; O'Connor, 1998). This section describes those ad hoc solutions.

In the early years of the 1987-1991 drought, MET maintained or increased deliveries to member agencies losing local supplies, but deliveries fell as the drought continued. MET's 1952 Laguna Declaration, a pledge to provide 'adequate supplies', was no longer credible. MET also tried to reduce demand. In November 1990, MET's Board approved an "Incremental Interruption and Conservation Plan" (IICP) and implemented Stage 1 (voluntary reductions) immediately. Stage 2 was implemented in February 1991. Just one month later, the IICP jumped to Stage 5, which cut urban deliveries by 20% and agricultural deliveries by 50%. MET stayed in Stage 5 until April 1992.

MET used prices to reduce demand toward targeted "rights" for a base year allocation (Base) that varied by member agency and depended on historic use, conservation programmes and local supplies.

[24] The value of negotiation is demonstrated in the non-uniformity of "uniform cuts" implemented during the 1987–1991 drought. Note that Wodraska (the exception to the lawyer trend) spent most of his 5 years "trying to regain control of the staff" (McDermott, 1998). Insiders add that conflict among member agencies led him to resign in frustration.

Base did not determine who got water but how much water would cost: members buying more than Base paid a penalty rate of $394/af (double the normal price of $197/af); those that bought less than 95% of Base received $99 for each acre-foot they did not buy (Boronkay, 1990). The IICP appeared to favour some member agencies over others and had unintended effects,[25] but it worked: in 1992, member agencies demanded 77% of the 1989-1991 average.

Although successful in aggregate, the IICP's negotiated formula created winners and losers. Because LADWP lost 'local supplies' from the LAA, it got a higher Base and could increase its purchases without surcharges (Hundley Jr., 1992). LADWP's 1992 delivery was 350% of its 1986 delivery. SDCWA – despite (or because of) being MET's biggest customer, accounting for 26% of MET's demand – got no such adjustment, and its 1992 delivery was 92% of its 1986 delivery. According to SDCWA, the "region's economy suffers loss of millions of dollars in economic activity and thousands of jobs are imperilled. Economic development in the region suffers a major blow" (SDCWA, 2004).[26]

This outcome weakened MET because it highlighted SDCWA's reliance on MET (the source of 83% of its water) and drove SDCWA to reduce its dependency – breaking many taboos in the process. First, SDCWA circumvented MET's informal monopoly on imported supplies (*contra* the Laguna Declaration): in 1995, SDCWA signed an agreement to buy water from the Imperial Irrigation District (IID). That agreement led to 8 years of negotiation and lawsuits between MET and SDCWA over how to deliver the water through MET's CRA. Second, SDCWA sued MET, MET's Board of Directors and LADWP, asking that the Laguna Declaration be confirmed, i.e. that MET guarantee supplies to SDCWA (SDCWA, 2001).[27] Third, SDCWA (and its member agencies) began building substitute infrastructure to reduce dependence on MET: in 2004, a few of SDCWA's member agencies signed contracts to buy water from a $300 million, 56 Tafy sea water desalination plant (construction will begin soon). In 2006, SDCWA approved a $4.3 billion capital improvement budget "to guarantee that the region would have a reliable water supply" (Conaughton, 2006). Since some of that budget was devoted to duplicate infrastructure, SDCWA's actions signalled a lack of faith in MET's function as an organisation of collective action as well as increasing costs for customers in the region.

THE CURRENT DROUGHT AND CLIMATE CHANGE

Unfortunately, the 'big drought' was not MET's last. In recent years, three developments have made shortage more likely. The first is traditional drought. As of this writing, California is in its third year of below-average precipitation. The drought has produced shortages from two directions: a reduction in supply from smaller snow-pack, reduced run-off and falling reservoir levels and an increase in demand from human and environmental sectors experiencing higher temperatures and drier landscaping. MET's supplies from the Colorado river are not in much better shape. Although 2008 and 2009 precipitation in the watershed was near average, 8 years of below-average precipitation (1999-2007) mean that on-river reservoirs are severely depleted. Although El Niño may soak California in the 2009-2010 water year, that temporary bump in supplies will not change the long-term trend.

Second is the 'regulatory' drought that has affected MET's access to SWP flows. The 2007 Wanger decision and subsequent decisions have resulted in restrictions on SWP exports from Northern to southern California. These restrictions are unlikely to ease in the near future and may grow worse.

[25] First, agencies that overdrafted groundwater (and bought less MET water) received conservation payments. Because overdrafting reduced local supply, Base increased – allowing them to buy more MET water at normal prices. Second, some agencies lost money when customers cut demand (reducing revenue) faster than conservation payments increased (Young, 1998).

[26] According to Erie, SDCWA dramatised the drought's impact by cutting "supplies by 31 percent across-the-board, not by a weighted average of 31 percent [20 percent cuts to urban users and 50 percent cuts to agricultural users] (Erie, 2006). This protected agriculture in San Diego county at the expense of urban customers and bolstered SDCWA's claim to urban customers that they were vulnerable to MET".

[27] SDCWA lost that case in 2004.

Finally, there is the end of *stationarity*, i.e. the probability that climate change will permanently change precipitation patterns for the worse. According to California's Department of Water Resources, climate change will result in a permanent 25-40% decrease in Sierra-Nevada snow-pack, earlier and 'flashier' run-off, higher evapotranspiration, and so on (DWR, 2009). As California approaches a new state of aridity, even the concept of drought will change. (As the old saying goes, "Nobody ever said that the Sahara was in drought".)

Unfortunately, MET is responding to these supply-side challenges with its traditional tool of supply augmentation (via purchases of agricultural water, pursuit of a Peripheral canal in the SWP, and formulaic rationing among member agencies). Although MET and its member agencies learned a lot about conservation during the big drought, the lessons of desperate circumstances did not appear to sink in. The water bureaucrats at MET continue to pursue a discourse of hard infrastructural and cost-accounting prices that is ill-suited to contemporary supply issues, the need to ration demand with prices, and the problems of inefficiency and inequity that are growing under outdated institutions. In short, it appears that things will get worse before MET's managers are forced to change their ways.

SUMMARY

MET's history helps us understand its current institutional form, i.e. the policies, norms and behaviour that shape its operations. In the beginning, Los Angeles supported (and subsidised) the CRA to get access to Hoover power. When the CRA brought excess, expensive water, MET used Los Angeles' tax payments to lower its water prices below local prices and expand – growing by 200%. MET considered these actions prudent and sustainable: the 1952 Laguna Declaration guaranteed water to member agencies, new and old.

But events conspired to threaten the Laguna Declaration: new members wanted a lot of water, various complications lowered MET's supply, and Los Angeles cut its subsidies. Formerly abundant water became scarce, but MET had no policies to allocate in scarcity. Although its bureaucrats were skilled in growth and abundance, they did not possess the perspective or tools for dealing with shortage and scarcity. Instead of adopting a new discourse (of scarcity, sustainability and efficiency), they adopted formulas for rationing, increasing the relative importance of lawyers and the discourse of conflict and negotiation.

Although negotiating skills were useful in a static environment, they were too unwieldy for a fast-changing, dynamic environment where many actors with many interests were forced to work together. It was therefore not surprising when a big shock (the 1987-1991 drought) exposed the weaknesses of the status quo. Faced with rapidly deteriorating conditions, MET's Board of Directors imposed dramatic changes with little notice on member agencies accustomed to multi-year lead times. Although these changes hurt all of MET's member agencies, they were particularly painful for SDCWA, and SDCWA's dramatic efforts to reduce its dependence on MET caused conflict and disruption at MET. Today, MET's function as an organisation of collective action is weakened: water supplies are stressed, cost allocation is controversial, and member agencies have a hard time agreeing on policies to address these problems.

MET's weaknesses have been known to economists for over 50 years (Ostrom, 1953; Milliman, 1956b, 1957), but suggestions for improvement or reform have rarely been implemented. Why not? First, MET – as a government bureaucracy – can resist outside pressure for change. Second, MET may believe it can 'overcome' problems by purchasing agricultural water.[28] But trade is not that easy. Even after years of study and negotiation, agricultural areas only transfer 300-400 Tafy to MET's area

[28] IID and two other Southern California agricultural areas control 3.85 maf of California's allocation from the Colorado river – nearly double MET's total supply of water. Newlin et al. (2002) estimate that market-based transfer of 13% of Southern California's agricultural water would decrease MET's scarcity costs by 84%. Unfortunately, Newlin's estimate is based on an engineering simulation that fails to consider institutional or cultural constraints.

(Haddad, 1999). Why so little? Farmers want other farmers' 'surplus' for themselves; environmentalists want 'surplus' to flow down the rivers.

Third is a failure to change MET's dominant discourse from one of abundance to one of scarcity and efficient resource management. This failure increases MET's costs from internal friction and weakens its external position, making it harder for MET to import more water (Quinn, 1983; Harris, 1990). Is there any sign that MET is changing? Unfortunately, no. MET's response to the current drought – formulas to allocate a shrinking water supply among member agencies are both traditional and inefficient (compared to prices or markets, for example). Some member agencies have sued MET, challenging the equity and efficiency of these formulas (Saltzgaver, 2008; Schoch, 2008a, 2008b). This situation – a mere recycling of ideas that made sense 40 years ago – persists because water managers continue to operate within a discourse from long ago, are trusted by citizens who have no way of knowing whether their expert managers are right or wrong, and have little incentive to put in costly effort to create benefits that will go to others. And this situation will persist until a crisis forces change or outside interests take up the unrewarding task of pushing 'public servants' to serve the public.

REFERENCES

Alchian, A.A. and Demsetz, H. 1972. Production, information costs, and economic organization. *American Economic Review* 62(5): 777-795.

Atwater, R. and Blomquist, W. 2002. Rates, rights, and regional planning in the Metropolitan Water District of Southern California. *Journal of the American Water Resources Association* 38(5): 1195-1205.

Bjornlund, H. and O'Callaghan, B. 2005. A comparison of implicit values and explicit prices of water. *Pacific Rim Property Research Journal* 11(3): 316-331.

Boronkay, C. 1990. Incremental interruption and conservation plan. Letter from GM to Board of Directors, Metropolitan Water District of Southern California.

Brewer, M.F. 1964. Economics of public water pricing: The California case. In Smith, S.C. and Castle, E.N. (Eds), *Economics and public policy in water resource development*, chapter 14, pp. 222-247. Ames: Iowa State University Press.

Brooks, D.C. 1964. *Pricing and marketing of imported water in southern California*. Los Angeles: Metropolitan Water District of Southern California.

CA Department of Water Resources. 1930. Report to the Legislature of 1931 on the State Water Plan. Bulletin No. 25. Sacramento: California Department of Public Works, Division of Water Resources.

CA Legislature. 1927. Metropolitan Water District Act. In *General laws, amendments to codes, resolutions, constitutional amendments passed at the regular session of the forty-seventh legislature*, chapter 429, pp. 694-714. Sacramento: California State Printing Office. Approved by the Governor 10 May 1927. Enacted 29 July 1927.

Coase, R.H. 1946. The marginal cost controversy. *Economica* (New Series) 13(51): 169-182.

Commonwealth Club of CA. 1931. Commonwealth Club of California on the State Water Plan. *The Commonwealth-Part Two* 7(22): 51-132.

Conaughton, G. 2006. Water project costs soar. *North County Times*, 1 December.

Cyert, R.M. and March, J.G., 1963. *A behavioral theory of the firm*. Englewood Cliffs, New York: Prentice Hall.

DeHaven, J.C. and Hirshleifer, J. 1957. Feather river water for southern California. *Land Economics* 33(3): 198-209.

Dixon, L.; Dewar, J.; Pint, E.; Reichardt, R. and Edelman, E. 1998. Building a new vision for the Metropolitan Water District of Southern California: Options for key policy decisions. Draft DRU-1931-MWD, RAND, Santa Monica, CA.

DWR (Department of Water Resources). 2009. Managing an uncertain future climate change adaptation strategies for California's water. White paper, Department of Water Resources.

Erie, S.P. 2006. *Beyond Chinatown: The Metropolitan Water District, growth, and the environment in southern California*. Stanford, CA: Stanford University Press.

Faulhaber, G.R. 1975. Cross-subsidization: Pricing in public enterprises. *American Economic Review* 65(5): 966-77.

Forstall, R.L. 1995. California population of counties by decennial census: 1900 to 1990 Compiled. Technical Report, US Bureau of the Census. www.census.gov/population/cencounts/ca190090.txt

Fradkin, P. 1981. *A river no more: The Colorado river and the West*. New York: Knopf.

Gottlieb, R. 1988. *A life of its own: The politics and power of water*. New York: Harcourt.

Gottlieb, R. and FitzSimmons, M. 1991. *Thirst for growth: Water agencies as hidden government in California*. Tucson: University of Arizona Press.

Haddad, B.M. 1999. *Rivers of gold: Designing markets to allocate water in California*. Washington, DC: Island Press.

Hansmann, H.B. 1980. The role of nonprofit enterprise. *Yale Law Journal* 89(5): 835-901.

Harris, R.W. 1990. Southern California's water resources: An assessment of supply and demand with projected drought effects. Masters thesis. University of California, Los Angeles (Civil Engineering).

Hundley, Jr. N. 1992. *The great thirst: Californians and water, 1770s-1990s*. Berkeley: University of California Press.

Kahrl, W. L. 1979. *The California Water Atlas*. Sacramento: State of California.

Lach, D.; Rayner, S. and Ingram, H. 2005a. Maintaining the status quo: How institutional norms and practices create conservative water organizations. *Texas Law Review* 83(7): 2027-2053.

Lach, D.; Rayner, S. and Ingram, H. 2005b. Taming the waters: Strategies to domesticate the wicked problems of water resource management. *International Journal of Water* 3(1): 1-17.

Ladd, W. 2009. The growth of the human population is bad. *San Diego News Network*, 16 July.

Libecap, G.D. 2004. Transaction costs: Valuation disputes, bi-lateral monopoly bargaining and third-party effects in water rights exchanges. The Owens Valley Transfer to Los Angeles. NBER Working Paper 10801. Cambridge, MA: National Bureau of Economic Research.

Lippert, J. and Efstathiou, Jr. J. 2009. Las Vegas running out of water means dimming Los Angeles lights. *Bloomberg News*, 26 February.

Lund, J.; Hanak, E.; Fleenor, W.; Bennett, W.; Howitt, R.; Mount, J. and Moyle, P. 2008. Comparing futures for the Sacramento-San Joaquin delta. Report. San Francisco: Public Policy Institute of California.

McDermott, T. 1998. Knee-deep disputes for "water buffaloes"; the power of the Metropolitan Water District long went unquestioned. Now it is mired in inertia, ineptitude. *Los Angeles Times*, 1 November 1998.

Mehlum, H. and Moene, K. 2002. Battlefields and marketplaces. *Defence and Peace Economics* 13(6): 485-496.

MET (Metropolitan Water District of Southern California). 1997. Resolution to adopt wheeling rates effective January 15, 1997. Board of Directors Resolution. Los Angeles: Metropolitan Water District of Southern California. Approved 14 Jan 1997.

MET. 2004a. 2004-5 Long range finance plan. Los Angeles: Metropolitan Water District of Southern California.

MET. 2004b. Integrated water resources plan-2003 update. Los Angeles: Metropolitan Water District of Southern California. Approved Jul 2004.

MET-RAND. 1998. MWD Strategic Visioning Project, Metropolitan Water District of Southern California. Presented to the MWD Board of Directors 8 December 1998.

Milliman, J.W. 1956a. *The history, organization and economic problems of the Metropolitan Water District of Southern California*. PhD thesis. Los Angeles: University of California (Economics).

Milliman, J.W. 1956b. Commonality, the price system, and use of water supplies. *Southern Economic Journal* 22(4): 426-437.

Milliman, J.W. 1957. Economic problems of the Metropolitan Water District of Southern California. *Proceedings of the 32nd Annual Conference of the Western Economic Association*, pp. 42-45. Western Economic Association.

Newlin, B.D.; Jenkins, M.W.; Lund, J.R. and Howitt, R.E. 2002. Southern California water markets: Potential and limitations. *Journal of Water Resources Planning and Management* 128(1): 21-32.

O'Connor, D.E. 1998. Governance of the Metropolitan Water District of Southern California: Options for Change. Legislative Analysis CRB-98-018. Sacramento: California State Library.

Olson, M. 1971. *The logic of collective action*. Cambridge, MA: Harvard University Press.

Oshio, K. 1992. *Urban water diplomacy: A policy history of the metropolitan water supply in the twentieth century southern California*. PhD thesis. Santa Barbara: University of California.

Ostrom, E.; Gardner, R. and Walker, J. 1994. *Rules, games, and common-pool resources*. Ann Arbor, MI: Ann Arbor Books.

Ostrom, V. 1953. *Water Supply*, volume VIII of *Metropolitan Los Angeles: A study in integration*. Los Angeles: Haynes Foundation.

Parsons, W.W. 1990. *The politics of water in the Southwest: Policy patterns of water elites in southern California and Arizona*. PhD thesis. University of Arizona (Political Science).

Pisani, D.J. 2002. *Water and American government: The Reclamation Bureau, national water policy, and the West, 1902-1935*. Berkeley: University of California Press.

Quinn, T.H. 1983. Groundwater management in California: An economist's view of the political pickle. In *Proceedings of the 14th Biennial Conference on Groundwater.* Davis, California. California Water Resources Center.

Quinn, T.H. 2006. Personal Communication. 28 April 2006.

Reisner, M. 1993. *Cadillac desert*. New York: Penguin Books.

Rossman, A. 2005. Can California make peace with its neighbors and itself? Working Paper. http://tinyurl.com/2xh7uj

Saltzgaver, H. 2008. Water allocations leave city thirsty. *Gazette Newspapers*, 24 January.

Schoch, D. 2008a. Southeast L.A. County water agency sues over MWD drought plan. *Los Angeles Times*, 18 April.

Schoch, D. 2008b. Water board approves drought plan. *Los Angeles Times*, 13 February.

SDCWA (San Diego County Water Authority). 2001. SDCWA vs. MWD, BoD of MWD, Los Angeles, and Does 1-100. Complaint for Declaratory Relief, Superior Court of the State of California for the County of San Diego. Case GIC 761526. 30 January.

SDCWA. 2002. Regional water facilities master plan: Chapter 4-Water Supply Analysis. Engineering Department Draft Report, San Diego County Water Authority.

SDCWA. 2004. Key milestones in the Water Authority's history. www.sdcwa.org/news/pdf/WaterAuthorityTimeline.pdf

SDCWA. 2006. Drought Management Plan Report. Draft, San Diego County Water Authority. 23 March.

Sexton, R. J. 1986. The formation of cooperatives: A game-theoretic approach with implications for cooperative finance, decision making, and stability. *American Journal of Agricultural Economics* 68(2): 214-225.

Skaperdas, S. 2003. Restraining the genuine *Homo Economicus*: Why the economy cannot be divorced from its governance. *Economics and Politics* 15(2): 135-162.

Sofaer, A.D. 1997. California and Colorado river water: Seize the opportunity. In Sanchez, R.; Woled, J. and Tilly, D. (Eds), *Proceedings of the First Biennial Rosenberg International Forum on Water Policy: Resolving Conflict in the Management of Water Resources*, No. 93 in Water Resources Center Report. University of California Centers for Water and Wildlife Resources.

Staatz, J.M. 1983. The cooperative as a coalition: A game-theoretic approach. *American Journal of Agricultural Economics* 65(5): 1084-1089.

Stiglitz, J.E. 2001. Principal and Agent (ii). In Eatwell, J.; Milgate, M. and Newman, P. (Eds), *New Palgrave: A dictionary of economics*, pp. 966-972. Basingstoke, England: Palgrave MacMillan.

Tarlock, A.D. and van de Wetering, S.B. 2008. Growth management and western water law: From oases to archipelagos. *Hastings West-Northwest Journal of Environmental Law and Policy* 983. (Winter)

Timmins, C. 2002. Measuring the dynamic efficiency costs of regulators' preferences: Municipal water utilities in the arid West. *Econometrica* 70(2): 603-629.

Waller, T. 1994. Expertise, elites, and resource management reform: Resisting agricultural water conservation in California's Imperial Valley. *Journal of Political Ecology* 1: 13-42.

Wehr, K. 2004. *America's fight over water: The environmental and political effects of large-scale water systems*. New York: Routledge.

Weiser, M. 2007. Delta water exports halved. *Sacramento Bee*, 29 December.

Wilson, J.Q. 1989. *Bureaucracy: What government agencies do and why they do it*. New York: Basic Books.

Worster, D. 1986. *Rivers of empire: Water, aridity, and the growth of the American West*. New York: Pantheon.

Young, M.B. 1998. Draft paper on events leading up to and chronology of the 1990-92 drought years and supply reliability improvements achieved as a result of the drought. Memo to member agency managers, Metropolitan Water District of Southern California. 25 August.