



August 23, 2020

VIA Email

Dan Denham
Deputy General Manager
San Diego County Water Authority
4677 Overland Avenue
San Diego, CA 92123

Dear Mr. Denham:

RE: DLM Engineering/Gillingham Review of SDCWA Regional Conveyance System Feasibility Review (July 2020)

The San Diego County Water Authority (“Water Authority”) asked *Stratecon Inc* to review the above captioned report (hereinafter cited as “DLM&G Review”).¹ Based on Stratecon’s experience and expertise, while I identify many deficiencies in the analytic methods, assumptions and lack of data in the DLM&G Review, the review identifies relevant issues (especially in Appendix A, *Comments from Member Agency Chief Financial Officers*) that *Stratecon* recommends be part of ongoing comprehensive review of the *Regional Conveyance System* (“RCS”).

Executive Summary

The DLM&G Review includes many deficiencies in economic analysis, analytic methods and lack of publicly available substantive data that provide a context for the economic analysis and risk assessment for the Regional Conveyance System (“RCS”). I find the Water Authority staff escalation assumptions reasonable and the alternative advanced by the DLM&G Review not reasonable. While additional economic analysis and risk assessment is warranted in Phase B, Stratecon does not find troubling that a financial plan was not developed in Phase A. The additional analysis in Phase B will provide the foundation for determination of an optimal finance plan. The key findings are provided below.

¹ The Review was commissioned by a group of Water Authority members identified as “participating member agencies” at p. ii.

Long-Term Projects Require A Long-Term Perspective

Proper economic assessment must match the timing of estimated costs with the timing of estimated benefits. Water infrastructure generally has useful lives in excess of the term of initial project financing. I disagree with the DLM&G assertion that the Water Authority staff favors a “non-standard” approach. The selected time horizon, 2112, runs through the term of the agreement for Canal Lining water. As staff indicate that an acceptable extension of agreement with IID to 2112 is one of the conditions for a successful project, a project life cycle analysis based on a time horizon through 2112 is reasonable.

The DLM&G Review of future uncertainty is puzzling. Understanding the uncertainty of future predictions is inherent to proper economic analysis and risk assessment of long-term infrastructure projects. Their statements, as discussed below, are at odds with the use of risk assessment by the Bureau of Reclamation, California Department of Water Resources, economics, business and finance over the past thirty years.

Future Rate Predictions Should be Grounded by History and Economic Analysis

Any prediction, of course, can be wrong. Learning occurs from understanding the reasons for success or failure of a prediction. Rather than looking at the actual dynamics on the Colorado River and other drivers of Metropolitan’s water rates, the DLM&G Review presumes that the failure of the prediction from a 2008 study about climate change was due to “adaptations and adjustments”. What were the adaptations and adjustments? The DLM&G Review mentions none. The DLM&G discussion of the New York Times article evidences a lack of understanding of uncertainty.

The escalation issue is one of the most critical issues for assessment of the economic viability of RCS, yet the DLM&G use of an alternative escalation assumption is without any analytical or factual foundation. Stratecon presents factual, public information on the various drivers of Metropolitan water rates. As shown by the historic record, Metropolitan water rates increase substantially faster than inflation, except for the time period 1985-2007.

The year 2003 was transformative. The era of a full Colorado River Aqueduct ended. Water allocations from the State Water Project have plummeted. A diminished water supply portfolio prompted Metropolitan spending trying to meet demands for Metropolitan water. This ushered in another era of Metropolitan water rates increasing substantially faster than inflation. To date, Metropolitan spending on new water resources has been unsuccessful.

Below, I outline how Phase B can provide the economic analysis and risk assessment to inform decision-makers.

Relying on Negotiations of the Exchange Agreement is not Prudent

The DLM&G Review stated “detailed consideration of the future of MWD rate structures is beyond our scope of work.” Stratecon finds the DLM&G Review recommendation of a renegotiated exchange agreement incomplete and not cognizant of actual negotiations. The Water Authority has been trying to negotiate a fair wheeling agreement with Metropolitan for two decades, and there is no new information, insight or strategy provided by the DLM&G review.

Additionally, Metropolitan’s valuation of its offer notes that “Metropolitan’s annual transportation rate increases, which reflect increasing costs to Metropolitan, have averaged 4.6 percent.” Metropolitan’s financial valuation of its offer assumes that these rate increases will continue through 2112. Water Authority staff and Metropolitan staff have common expectations about Metropolitan’s future.

The discussion addresses the following:

- Stratecon’s experience and expertise related to the proper economic analysis and risk assessment of a long-term infrastructure project
- Assessment of the DLM&G Review
- Identification of additional issues not addressed by the DLM&G Review
- Recommendations for further economic due diligence and risk assessment of the RCS

Stratecon Expertise and Experience

Stratecon Inc. (www.stratwater.com) is a strategic planning and economics consulting firm specializing in the economics, finance, and policy of water resources. I am involved as an advisor in the acquisition of water rights throughout the western United States and in the sale and leasing of water rights and water supplies to public and private sector water users. This first-hand experience in the decades-long development of water markets provides industry expertise to identify the best candidates and navigate related public policy issues.

I advise public and private sector clients, including high net worth investors, on business and public policy issues concerning water resources, including California’s Drought Water Bank, the government of New South Wales, Australia’s effort to privatize irrigation organizations, and the economic, financial, legal, and political dimensions of water transactions in many western states. I worked on the IID/San Diego County Water Authority Agreement, the settlement of Colorado River disputes on behalf of the Imperial Irrigation District, and the acquisition of 42,000 acres from the United States Filter Corporation, an unit of Veolia Environment. I am routinely involved in economic valuation of water rights, water investments, and negotiation of water acquisition and transportation agreements. I also perform studies on the economic risk of water shortages and valuation of surface water and groundwater storage. I also serve as an expert witness in the economic valuation of groundwater resources, disputes over the economic interpretation of water contracts, economics of water conservation and water use practices, rate-setting of municipal water systems and the socio-economic impacts of land fallowing.

I received a Ph.D. in Economics from the University of Chicago and a Bachelor of Arts in Economics from the University of California at Los Angeles. Prior to making a full time commitment to the private sector, I was a professor of economics at Claremont McKenna College for fifteen years, Director of the *Lowe Institute of Political Economy*, and a member of the editorial board of *Economic Inquiry*, the professional economics research journal of the *Western Economics Association*. In 1989, I was the John M. Olin Visiting Professor of Law and Economics at Columbia Law School. In the late 1970s and early 1980s, I was a visiting assistant professor of economics at the Graduate School of Business, University of Chicago, where I also served as the Associate Director of the *Center for the Study of the Economy and the State*, founded by the late Nobel Prize winner in economics, George Stigler. I started my career after graduate school as an economist at the RAND Corporation, where I participated in a study commissioned by the California Legislature on the role of markets to address California's water problems.

Assessment of DLM&G Review

The discussion focuses on Section 2 (“Economic Analysis”), Section 3.3 (“Risk Review”) and Appendix A (“Comments from Member Agency Chief Financial Officers”).

Section 2.1: DLM&G Review suggests that Water Authority staff used “unusually long evaluation timeframes” and price escalation assumptions “that are highly implausible.” Disagree.

Project life cycle analysis is the starting point for economic analysis and risk assessment. For example, California Department of Water Resources’ analysis of the various renditions of a twin tunnel project combined a 10 to 15-year development period with a 50-year period of operations. The recent analysis of the single tunnel project uses a 100-year period of operations.

In Texas, the San Antonio Water System (“SAWS”) entered into a 30-year agreement with a private party to develop a regional water pipeline that secured groundwater through 3,200 leases of groundwater rights from landowners.² At the end of the 30-year period, debt is retired and equity owners sell the infrastructure and interest in project groundwater leases for \$1. Recognizing that the useful life of project infrastructure extended beyond the term of project financing, SAWS entered follow-on negotiations with groundwater right owners to extend their leases beyond 30 years. SAWS time horizon extended far beyond the term of initial project financing or the agreement with the private project consortium.

Stratecon routinely uses life cycle project models for public and private sector clients. As a negotiator for IID, I developed (in consultation with IID board and staff and public input) a proprietary economic and risk assessment model of the economics of its historic agreement with the Water Authority. The “time horizon” of the model extended through the longest term under negotiation. (75 years of operations following five years of negotiations and regulatory approvals).

² For background, see “Vista Ridge Regional Supply Project”, *Journal of Water*, February 16, 2015, <https://journalofwater.com/jow/vista-ridge-regional-supply-project/>.

There were two components: (1) contract structure entertaining up to 78 different pricing structures and (2) a life cycle project cost model that combined alternative scenarios for IID system conservation investments and twenty cohorts of on-farm conservation programs. Both components required addressing the uncertainty of projections about future economic conditions.

As general partner for *Southwest Texas Water Resources, LLC* (“STWR”), I proposed in 2011 a \$300 million regional pipeline system backed by leases of groundwater rights to meet SAWS water demands. In response to a competitive solicitation by SAWS, STWR proposed a lease with an initial term of 50 years of operation and renewal provisions. Working with a major international investment bank responsible for project financing, the time horizon of the proprietary financial model extended beyond the term of initial project financing. The model addressed the uncertainty of future economic conditions through the design of contractual provisions and the use of hedging instruments during the planning and negotiation period as well as operations.

During the past two years, Stratecon has participated in negotiations and arbitrations involving the development of groundwater in west Texas for the oil and gas industry. In all instances, private parties are interested in life cycle project analysis. Assessing the useful life of assets is essential for decision-making. A proper analysis, of course, considers investment requirements beyond initial capital investment. Determining the time profile of replacement and renewals over a project’s useful life is an important component of project life cycle analysis.

Water infrastructure generally has useful lives in excess of the term of initial project financings. Consider, for example, the Colorado River Aqueduct. Built in the 1930s, water first flowed in 1939.³ Eighty-one years later, the aqueduct remains the backbone of the Metropolitan Water District of Southern California’s (“Metropolitan”) water system. Project operations and further investments have continued for decades beyond the retirement of debt financing for initial construction. This has enabled Metropolitan to move available Colorado River water for decades and into the foreseeable future.

I address the DLM&G Review’s discussion of price escalation below in Section 2.5.

The takeaway, long-term projects require a long-term perspective.

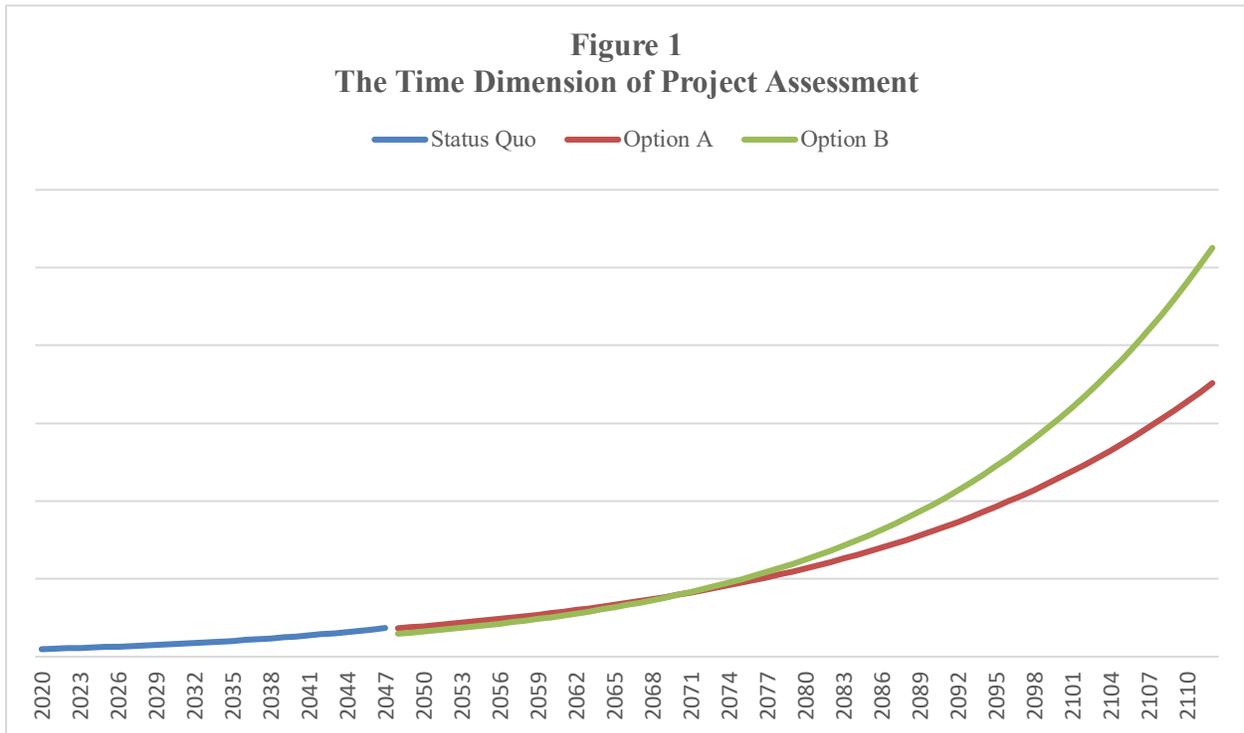
Section 2.2: Disagree with the assertion that the Water Authority staff favors a “non-standard” approach. The selected time horizon, 2112, runs through the term of the agreement for Canal Lining water. Water Authority staff indicate that an acceptable extension of Water Authority’s agreement with IID to 2112 is one of the conditions for a successful project. A project life cycle analysis based on a time horizon through 2112 is reasonable.

DLM&G Review’s “standard first-year unit cost analysis” (summarized in DLM&G’s Figure 2-1) is flawed. It compares the price of a Metropolitan exchange in the year 2020 with the

³ https://en.wikipedia.org/wiki/Colorado_River_Aqueduct.

estimated annualized capital and operating cost (including replacement and renewals) for conveyance starting twenty-five years later (2045). The calculation compares conveyance in the year 2020 (“apples”) with conveyance in the year 2045 (“oranges”).

Figure 1 shows the time dimension of proper project assessment. The status quo continues through 2047.⁴ In this figure there are two options: A and B. One option is the RCS. The other option a negotiated extension of the exchange agreement. The key point is that what matters is what the options look like in 2047 and thereafter. Comparing one option for conveyance in the future versus the cost of the other option conveying water in the year 2020 makes no economic sense.



An economically meaningful comparison matches the timing of benefits (conveyance) versus the timing of costs. Under the Water Authority staff’s assumption about the escalation of Metropolitan rates, the cost of the Metropolitan water exchange in 2045 is \$1,449 per acre foot, or about \$100/AF greater than the estimated annualized cost for the RCS, not \$1,088 per acre foot stated in DLM&G’s Figure 2-2.⁵ (See discussion below regarding price escalation assumption.) The relative economic attractiveness of the options will also depend on their respective dynamics after the first year of project operations.

The DLM&G Review of future uncertainty is puzzling. It states:

⁴ The prospect for a renegotiated exchange agreement before 2045 is addressed below.

⁵ $\$1,449/\text{AF} = \$482/\text{AF} (1+.045)^{25}$

“Predictions about the future are uncertain and become more so with longer periods of forecast. Economic analysis typically discounts future costs and benefits in part to account for this uncertainty.”

Returning to Figure 1, the status quo as well as the decision to select Option A or Option B involves predictions about the future. As discussed more extensively below, the statement that uncertainty about future costs and benefits are properly addressed by discount rates is at odds with the use of risk assessment by the Bureau of Reclamation, California Department of Water Resources, economics, business and finance over the past thirty years (see below).

The takeaways, (1) proper economic assessment must match the timing of estimated costs with the timing of estimated benefits, and (2) understanding the uncertainty of future predictions is inherent to proper economic analysis and risk assessment of long-term infrastructure projects.

Section 2.3: In this section, DLM&G Review acknowledges the need for “extended period analysis”. It opines that the Water Authority staff use of the 2112 time-horizon, while tied to term of contractual commitments, “otherwise has no significance to economic theory or analysis.”

Disagree. It is common to link conveyance projects to the resources transported. Oil and natural gas pipelines are built based on contractual commitments by future users. California’s State Water Project did the same. Contractual commitments provide the collateral for project financing. In the petroleum industry, pipeline projects may proceed without 100% contractual commitments. The project proponents often see “option value” from uncommitted capacity. By linking a 100% committed supply to a conveyance investment, the Water Authority staff is taking a conservative approach relative to the business practices in other industries.

Stratecon does agree with the DLM&G Review that transparency is required. In representing IID, my economic analysis was vetted in public workshops, presentations before the local Farm Bureau, banking institutions financing Imperial Valley agriculture, and individual farmers. Recommendations for a continued vetting process are provided below.

The takeaways, (1) economic analysis and commercial practices support the Water Authority staff use of the 2112 time-horizon, and (2) given the inevitable uncertainty of any long-term infrastructure project, the nature of project risks should be fully vetted and understood ahead of decision-making.

Section 2.4: DLM&G Review argues that the RCS entails generational transfers of costs and benefits. The time profiles in DLM&G’s Figures 2.5 and 2.6 depend on the project’s finance plan. The greater the role of PAYGO financing, the longer and more severe the “red bars” in these figures. For project financing, finance structure matters in both the terms of financial tranches and whether interest payments are based on fixed or indexed rates.

Regarding the latter, US treasury notes with fixed nominal and inflation-protected yields (Treasury Inflation Protected Securities, “TIPS”) are informative. The capital market sets pricing so that nominal and inflation-protected securities of the same term are financially equivalent. Relative to the use of the fixed nominal structure, inflation-protected financial instruments will “flatten the curve” in Figures 2.5 and 2.6.

The Water Authority is familiar with an indexed financial structure. The financial terms of the Carlsbad desalination plant escalated debt and equity returns by 2.5% annually.⁶ By escalating debt and equity payments for long-lived projects, a finance plan that matches the term of debt structure to the project’s useful life and makes both debt and equity payments subject to inflationary adjustments and deferred payments at the end of the payment period provides the best economic incentives for water conservation and project developers to full-fill their contractual obligations.⁷

Stratecon does not find it troubling that a financial plan has not been fully investigated during Phase A. It makes sense to develop first a project definition, prepare a cost analysis and perform preliminary economic analysis. As discussed below, significant economic analysis and risk assessment remains for Phase B of the study. Development of a meaningful finance plan builds on a fully vetted economic analysis. As they say on Wall Street, need to know all aspects of the deal before turning to financial engineering.

The takeaway, the RCS finance plan will determine the timing of project costs relative to the timing of project benefits.

Section 2.5: The DLM&G Review believes that Water Authority staff used “highly implausible” assumption in projecting future Metropolitan water rates.

The foundation of DLM&G Review’s position is two-fold. First, a methodological point of view stated as follows:

“Accurate forecasting of long term water rates is difficult. Many factors drive the price of water, including capital costs, increased operating cost, and changing sales volumes. A standard assumption on rate forecasting is that the further out the forecast horizon, the more inaccurate the future projection, because it is impossible to anticipate with any accuracy future conditions and their effect on rates. When forecasting future water rates, most projections will trend back to assumptions on underlying inflation or some small increment above inflation so as not to overstate the compounding effect of escalation factors. This is also reflected in the more

⁶ See “Economic Perspective on San Diego County Water Authority’s Carlsbad Desalination Project,” *Journal of Water*, January 15, 2015 <https://journalofwater.com/jow/economic-perspective-on-san-diego-county-water-authoritys-carlsbad-desalination-project/>

⁷ See “Thoughts on the Financial Structure of Water Projects,” *Hydrowonk Blog*, <https://hydrowonk.com/blog/2015/03/02/thoughts-on-the-financial-structure-of-water-projects/>.

standard approach to the length of an economic analysis so as not to skew the results based on diminishing accuracy of forecasted key variables and cost drivers.”

The second point is that “systems adapt and adjust.”

The methodological point of view is incoherent. The DLM&G Review is correct that there are many factors driving the price of water. Longer forecast horizons are often accompanied by more uncertainty in forecasts about the future. The following two sentences are problematic:

- “When forecasting future water rates, most projections will trend back to assumptions on underlying inflation or some small increment above inflation so as not to overstate the compounding effect of escalation factors.”
- “This is also reflected in the more standard approach to the length of an economic analysis so as not to skew the results based on diminishing accuracy of forecasted key variables and cost drivers.”

The first sentence is, at best, a conjecture about the many factors impacting future water prices. The DLM&G Review offers no facts or analysis in support of the conjecture. The second sentence reflects a retreat from the job at hand—understanding the uncertainty of future predictions is inherent to proper economic analysis and risk assessment of long-term infrastructure projects.

The DLM&G Review discussion of the New York Times article evidences a lack of understanding of uncertainty. The key point in the selected quote from a 2008 study is “a 50 percent chance of (Lake Mead) becoming unusable by 2021 . . . if demands remain unchanged and if human-induced climate change (quote truncated).”⁸ Presumably, the study concluded there was a 50% probability that Lake Mead will remain useable by 2021.

A one-time toss of a coin yielding “tails” does not mean the coin is not perfectly balanced providing “heads” 50% of the time and “tails” 50% of the time. A meaningful test of the accuracy of the study’s prediction would have been to compare the actual elevations of Lake Mead since 2008 with the trajectory of Lake Mead elevations forecasted by the study, assessing whether actual runoff in the Colorado River Basin reflected the predicted impact of “human-induced climate change” and the extent to which demands for Colorado River remained unchanged.

Any prediction, of course, can be wrong. Learning occurs from understanding the reasons for success or failure of any prediction. Rather than looking at the actual dynamics on the Colorado River and other drivers of Metropolitan’s water rates, the DLM&G Review presumes that the failure of the prediction from a 2008 study about climate change was due to “adaptations and adjustments”. What were the adaptations and adjustments? The DLM&G Review mentions none.

⁸ Emphasis added.

The DLM&G Review uses an alternative escalation assumption: use the Water Authority staff assumption for 20 years (5.1% for Tier 1 water rates and 4.5% for exchange rate) and drop the escalation rate to 3.7% thereafter.

The DLM&G Review offers the following as justification:

“Rather than basing economic analysis on such an unlikely occurrence (Water Authority escalation assumption), it seems prudent to us, and much more plausible, to assume MWD will make adaptations and adjustments to prevent rates from increasing to the point where they drive away most or all of their water sales. Whether those adjustments entail reductions in the costs driving the price increases, shifting costs to unavoidable fixed charges or other measures is beyond the scope of our review. Nevertheless, the finding holds that rates are highly unlikely to increase at these levels relative to other supply options for the simple reason they cannot.”

The economic analysis behind this narrative is missing. What are the adaptations and adjustments? None are discussed. What are the price points that “drive away most or all” water sales? Economic analysis would look at the relative trends of all factors driving demand for Metropolitan water (see below). DLM&G Review is silent. What is the levels of “other supply options”. DLM&G Review is silent.

The escalation issue is one of the most critical issues for assessment of the economic viability of RCS. Public information on the various drivers of Metropolitan water rates are presented below. The purpose is two-fold: (1) provide a factual framework for assessing the reasonableness of Water Authority staff’s escalation assumptions, and (2) identify key issues confronting predictions of future conditions.

History of Metropolitan Water Rates

Metropolitan’s real (inflation-adjusted) water price has been on an increasing trend since 1960 (see Figure 2).⁹ The real water price was increasing through the mid-1980s, then remained unchanged through 2007, and has been on a sharp upward trend thereafter (see Table 2). There is a stubborn dynamic of Metropolitan water rates increasing faster than inflation.

⁹ Data compiled from Metropolitan annual reports and resolutions. Water rate is for untreated full service until 2003 and Tier 1 rate for untreated water service thereafter. Readiness-to-Serve (“RTS”) charge equals RTS revenue requirement divided by the RTS Base (Metropolitan’s 10-Year running average of total firm deliveries). Real Water Rate equals sum of the Water Rate and the RTS Charge adjusted by the Consumer Price Index where 2020\$ = 1.0.

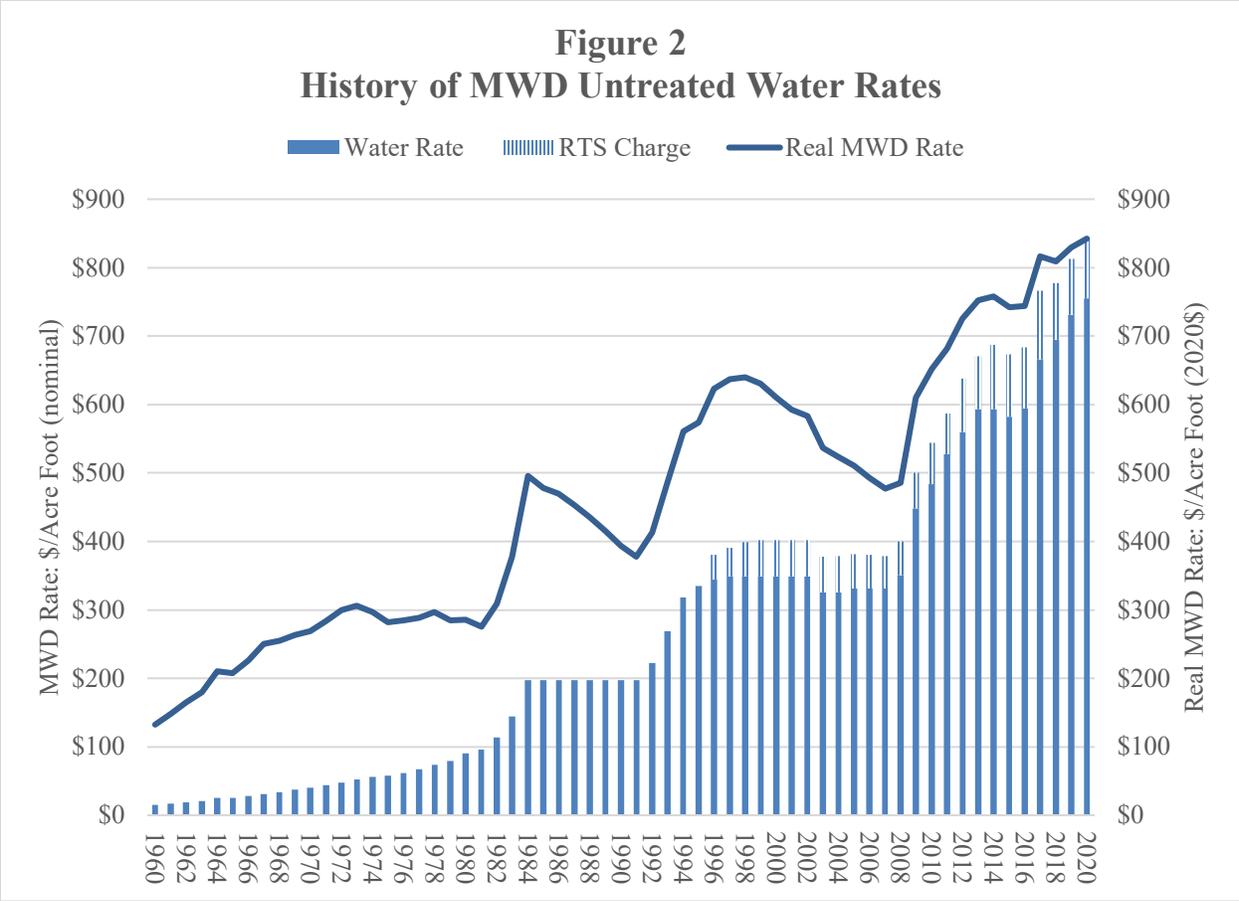


Table 2
Annual Increases in Metropolitan’s Water Rate by Eras

<i>Cumulative Annual Growth Rate</i>	<i>1960-1984</i>	<i>1985-2007</i>	<i>2008-2020</i>	<i>1960-2020</i>
Metropolitan Water Rate	11.3%	3.0%	6.4%	6.9%
Inflation	5.4%	3.0%	1.6%	3.7%
Real Metropolitan Water Rate	5.7%	0.0%	4.7%	3.1%

The drivers during these time periods provide a context for predicting Metropolitan’s future. The first period (1960-1984) was a transition from property taxes to water rates as well as phasing in payments for the State Water Project. The second period (1985-2007) was a period of rising water sales from the ramp up of deliveries from the State Water Project and continuation of a full Colorado River Aqueduct (see below). Third period (2008-2020) reflects Metropolitan’s need to develop new water supplies to back-stop declines in Colorado River water supplies and declining allocations from the State Water Project (see below). Recommendations about developing a framework for predicting future Metropolitan prices are made below.

Metropolitan’s rate for full water service is now based on components for water supply, system access, water stewardship and system power (see Table 3). The largest component is

system access followed by the Tier 2 and Tier 1 rates for water supply. Since 2008, the System Access rate and the Tier 1 supply has increased, respectively, by almost 6% per year and 7.4% per year faster than inflation.

**Table 3
Composition of Metropolitan’s Full-Service Rate for Untreated Water***

<i>Time Period</i>	<i>Tier 1 Supply</i>	<i>Tier 2 Supply</i>	<i>System Access</i>	<i>Water Stewardship</i>	<i>System Power</i>	<i>Tier 1 Full Service</i>	<i>Tier 2 Full Service</i>	<i>Readiness-to-Serve Charge</i>
CAGR								
2003-2020	6.4%	3.9%	5.4%	6.3%	2.5%	5.1%	4.4%	3.1%
2008-2020	9.1%	4.6%	7.6%	8.3%	1.8%	6.6%	5.4%	4.9%
2020 Rate	\$208	\$295	\$346	\$65	\$136	\$755	\$842	\$87
Real CAGR								
2003-2020	4.2%	1.8%	3.3%	4.1%	0.4%	2.9%	2.2%	1.0%
2008-2020	7.4%	3.0%	5.9%	6.6%	0.2%	4.9%	3.7%	3.3%

*CAGR (cumulative average growth rate)

As a Ph.D. economist, best practices distinguish between general inflation and changes in inflation-adjusted prices (“real prices”). From an economic perspective, real prices measure how Metropolitan’s water rates change relative to the general price level. If the real price were constant over time, price projections are driven solely by expected inflation.¹⁰ If the real prices are not constant, then price projections involve expected inflation plus adjustments for projected changes in real prices.

As shown by the historic record, Metropolitan water rates increase substantially faster than inflation, except for the time period 1985-2007. Since then, all components of Metropolitan’s rate structure (other than System Power) has increased substantially faster than inflation. To understand what has driven Metropolitan’s water rates historically and going forward, one must look at Metropolitan’s water supply sources and demands for Metropolitan water.

Metropolitan’s Colorado River Water Supplies

Under a 1931 Agreement among California parties, Metropolitan has a Priority 4 right for 550,000 acre feet (“AF”) per year and Priority 5 right of 662,000 AF per year of the total

¹⁰ The pricing of nominal and inflation protected U.S. treasury notes provide a market estimate of expected inflation.

consumptive use of Colorado River water available to California.¹¹ These priorities are junior to 3.85 million AF of Colorado River water for Priorities 1, 2 and 3.¹² Given that California's total annual entitlement to Colorado River water equals 4.4 million AF, Metropolitan will receive water under its Priority 5 right only when there is unused entitlement water from Arizona or Nevada or when there is surplus Colorado River water in the Lower Basin.¹³

The historic record of Colorado River water deliveries can be divided into two periods: pre-2003 versus 2003 and thereafter (see Figure 3).¹⁴ Before 2003, Metropolitan routinely received water under its Priority 5 right. In 29 of the 39 years for the period 1964-2002, Metropolitan's Colorado River water supplies ranged between 1.1 million AF and 1.3 million AF per year.¹⁵ During the last decade of the 20th Century, Arizona and Nevada's use of Colorado River water was rapidly approaching their Colorado River water entitlements. As a result, the availability of water under Metropolitan's Priority 5 right to keep Metropolitan's Colorado River Aqueduct full had come to an end. The loss of this Colorado River water would have been even more devastating to Metropolitan and its member agencies absent the execution of the Quantification Settlement Agreement ("QSA") and related agreements in 2003.

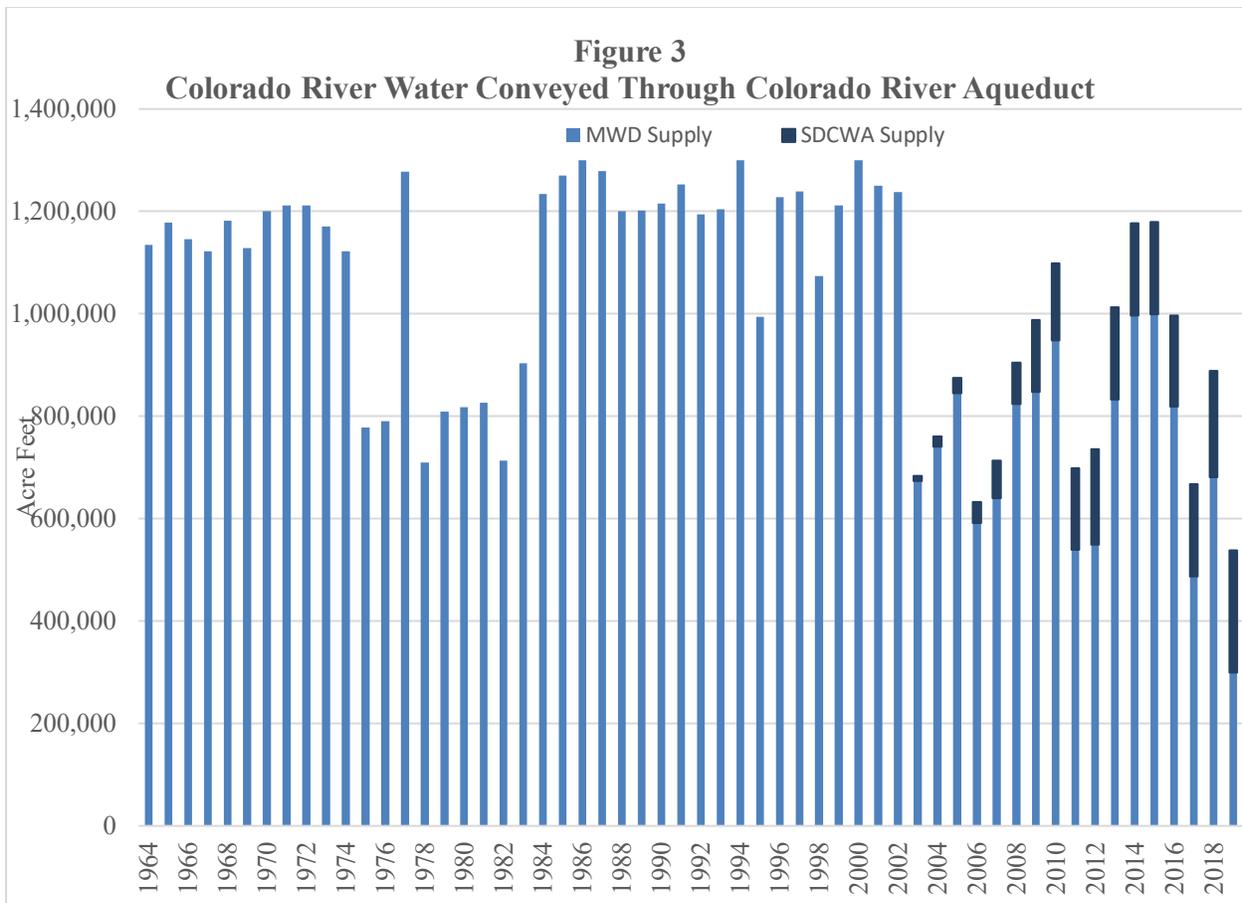
¹¹ Boulder Canyon Project Agreement, Requesting Apportionment of California's Share of the Waters of the Colorado River Among the Applicants in the State, August 18, 1931, Sections 4 and 5.

¹² *Ibid*, Section 3.

¹³ The text ignores Metropolitan's liability for a cutback in its Priority 4 right when the use of Colorado River water by California Indian Tribes and miscellaneous Present Perfected Rights exceeds 14,500 AF per year.

¹⁴ Compiled from Decree Accounting Reports 1964-2018, *Arizona v. California*, U.S. Bureau of Reclamation, <https://www.usbr.gov/lc/region/g4000/wtracct.html#decree> (hereinafter cited as "Decree Accounting Reports").

¹⁵ The Colorado River water in excess of Metropolitan's Priority 4 right was unused entitlement water from Arizona and Nevada during this time period. Starting in 1989, Metropolitan's water conservation agreement with the Imperial Irrigation District generated about 100,000 AF per year of conserved Colorado River water, although 20,000 AF of this amount was available to the Coachella Valley Water District. Therefore, the amount of Colorado River water available to Metropolitan under its agreement with the Imperial Irrigation District accounted for a minor share of the water available to Metropolitan above its Priority 4 right.



Since 2003, there have been two sources of Colorado River water conveyed through Metropolitan’s Colorado River Aqueduct: (i) Metropolitan water available under its Priority 4 right, own transfer agreements and programs and (ii) the Water Authority’s Colorado River water acquired under its long-term water and conservation agreement with the Imperial Irrigation District (“IID”) and the lining of the All American Canal and the Coachella Canal. For the 2003-2019 time period, the annual amount of Colorado River water conveyed through the Colorado River Aqueduct averaged 855,895 AF, of which 724,374 AF were Metropolitan’s Colorado River water supplies and 131,521 AF were the Water Authority’s Colorado River water supplies (see Table 4).¹⁶ Concerning future Colorado River water supplies, San Diego’s supply situation is firm—set in contract. Metropolitan’s Colorado River water situation is complex and nuanced.

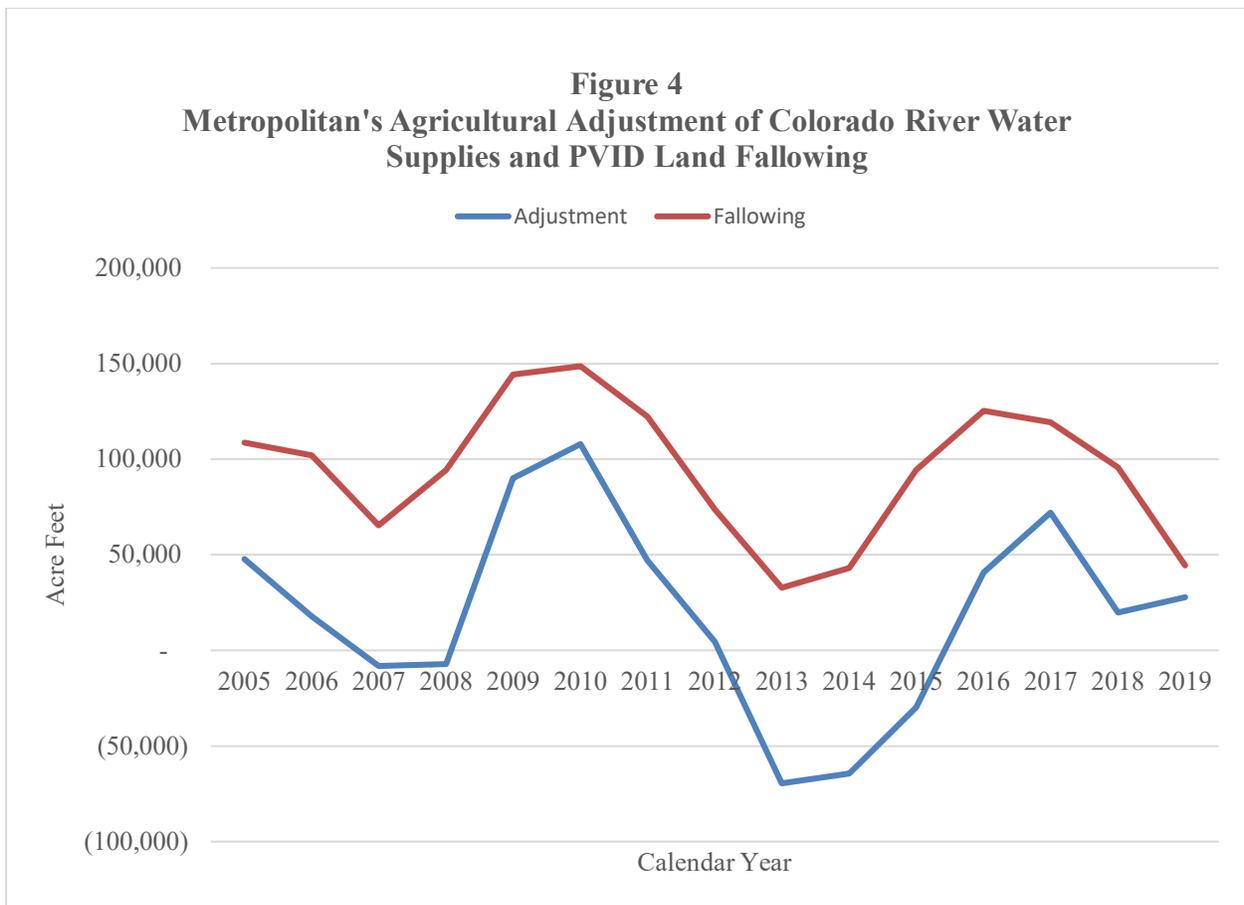
Table 4
Average Annual Colorado River Water Supplies (AF): 2003-2018

<i>Metropolitan</i>	<i>Water Authority</i>	<i>Total</i>
724,374	131,521	855,895

¹⁶ Compiled from Decree Accounting Reports.

Metropolitan has entered into long-term water conservation agreements with IID and the Palo Verde Irrigation District (“PVID”). Metropolitan recently purchased land in PVID and is now the largest landowner in PVID. Metropolitan also has access to unused Priority 3 water, Intentionally Created Surplus credits, engages in interstate banking arrangements and related transfers with the Southern Nevada Water Authority and participates in system efficiency projects in the Lower Basin.

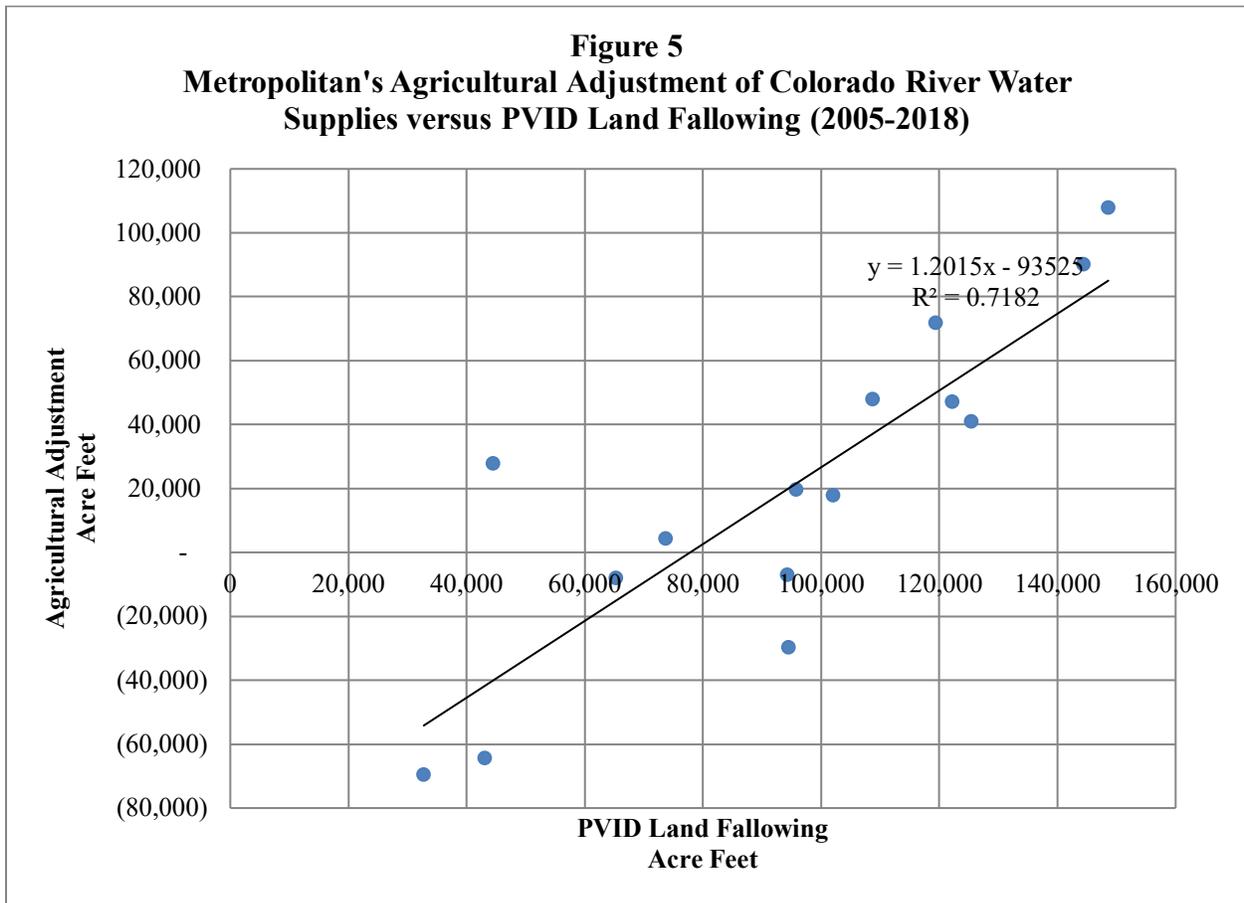
Under the QSA, Metropolitan’s available Colorado River water is adjusted annually depending on whether the consumptive use of Colorado River water under Priority 1, 2 and 3b is below or above 420,000 AF.¹⁷ Priority 1, 2 and 3b are, respectively, the consumptive use of Colorado River water by PVID, the Reservation Division of the Yuma Project and the Lower Palo Verde Mesa.¹⁸ By reducing PVID’s use of Colorado River water, PVID land fallowing increases the amount of Colorado River water available to Metropolitan (see Figure 4).



¹⁷ Colorado River Water Delivery Agreement: Federal Quantification Settlement Agreement”, October 10, 2003, Section 4d <http://www.usbr.gov/lc/region/g4000/crwda/crwda.pdf>

¹⁸ The Bureau of Reclamation also includes the use of Colorado River water on Yuma Island in the calculation.

Figure 5 plots Metropolitan’s Agricultural Adjustment (on the vertical axis) versus the amount of water conserved by PVID land fallowing (on the horizontal axis) to illustrate how land fallowing under Metropolitan’s agreement with PVID is a key driver of Metropolitan’s Agricultural Adjustment. The annual variation of the amount of water conserved by land fallowing explains 72% of the annual variation in Metropolitan’s Agricultural Adjustment for available Colorado River supplies from the consumptive use of Priority 1, 2 and 3b. For the period 2005-2019, “Metropolitan Agricultural Adjustment” has averaged 19,768 AF. Even though PVID land fallowing averaged 94,293 AF, there has been sustained overruns by Priority 1, 2 and 3b relative to the 420,000 AF benchmark.¹⁹



Metropolitan must engage in significant land fallowing to offset its liability for underwriting the risk that the consumptive use of Colorado River water by Priority 1, 2 and 3b (plus Yuma Island) exceeds 420,000 AF per year. Metropolitan must conserve about 77,800 AF of water by land fallowing for Metropolitan to avoid its liability for Priority 1, 2 and 3b overruns (see Figure 5).²⁰ Metropolitan’s average net increase in annual Colorado River water supplies

¹⁹ Without land fallowing, the estimated value of Metropolitan adjustment is -93,525 (the intercept in the equation in Figure 3).

²⁰ The value of “x” that yields an estimated Metropolitan Adjustment of zero using the equation in Figure 5.

after accounting for the liability of Priority 1, 2 and 3b overruns (19,768 AF) is about 21% of the average annual amount of 94,293 AF of land fallowing.²¹

Table 5 compares Metropolitan’s Colorado River water supplies before and after 2003. For the ten years before 2003, Metropolitan’s Colorado River water supplies averaged 1,203,822 AF. From 2003 and thereafter Metropolitan’s supplies from its Priority 4 rights and transfer agreements with IID and PVID averaged 664,061 AF. When combined with the average amount of unused Priority 3 water available, Metropolitan’s Colorado River water supplies averaged 752,990 AF. Therefore, the end of the era of unused entitlement water and surplus water means that, despite its programs over the past eighteen years, Metropolitan has 450,832 AF per year less Colorado River water. San Diego’s independent Colorado River supplies offset 237,711 AF of Metropolitan’s reduced Colorado River water supplies in 2019 and will offset 277,000 AF per year of Metropolitan’s reduced Colorado River water supplies over the long-term.

Table 5
Comparison of Metropolitan’s Annual Colorado River Water Supplies Pre and Post 2003

<i>Item</i>	<i>AF</i>	<i>Comment</i>
Pre-2003	1,203,822	Mostly Priority 4 and Priority 5 water
Post-2003		
Priority 4	550,000	Exclusive of liability for Indian/Misc. PPRs
IID	94,293	Per-2003 agreement
PVID	19,768	Inclusive of liability for Priority 1, 2 3b overruns
Sub-Total	664,061	
Unused Priority 3	88,929	In excess of Priority 4 right pre-2003 agreement
Total	752,990	
Lost Supply	450,837	

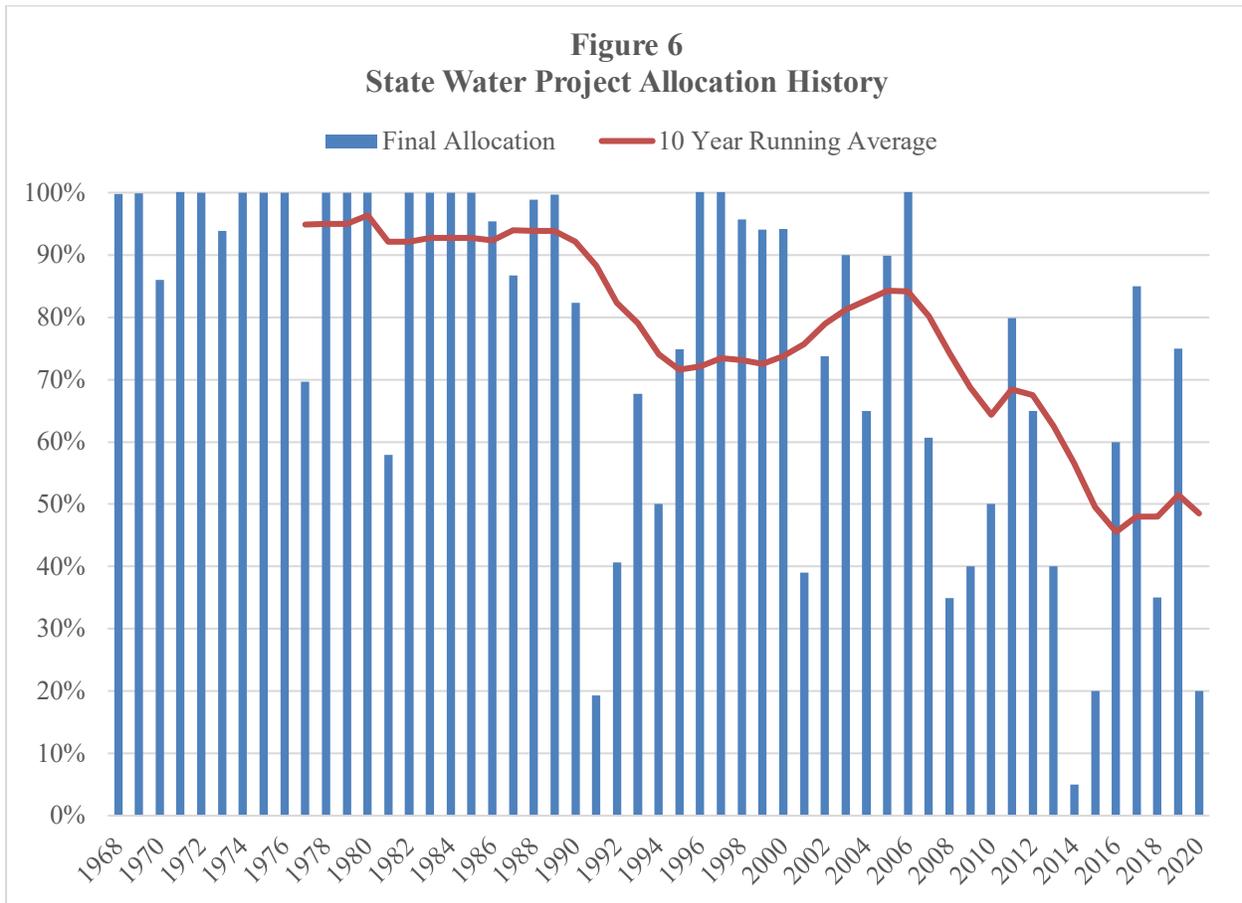
State Water Project

The history of SWP allocations has three distinct time periods (see Figure 6). Between 1968 through 1989, SWP allocations averaged 95%.²² Spurred by the 1991 drought, SWP allocations dropped and averaged 73% through the 1990s. There was a brief recovery in SWP allocations, increasing by 10 percentage points until the early 2000s as environmental problems in the Delta mounted. Since then, average SWP allocations have been declining. The final SWP Allocation for 2014 was only 5% (most of the year the declared SWP Allocation was zero). The

²¹ 19,193 AF equals the projected Metropolitan Agricultural Adjustment from Figure 3 when PVID land fallowing equals 94,293 AF.

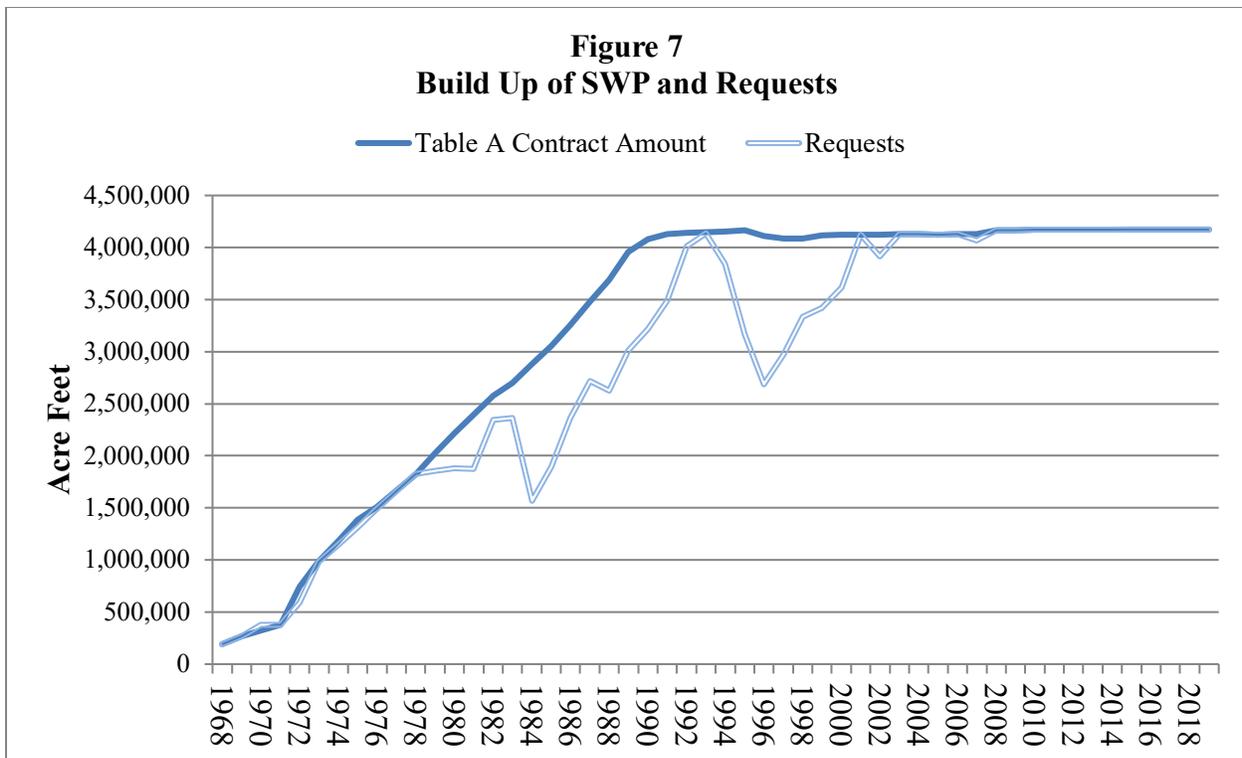
²² Before the 1994 Monterey Amendment, agencies submitted water requests reflecting their actual water demands. With the Monterey Amendment, available water was pro-rated in accordance with requests. This provided an incentive for agencies to request their full entitlement amounts (see Figure 7).

Final Allocation for 2015 was 20%. Final Allocations increased in 2016 and 2017, plummeted in 2018, increased to 75% for 2019 and fell again to 20% in 2020.



The period of 90%+ SWP Allocations corresponded to the scheduled build-up of the SWP (see Figure 7). SWP Contract Amounts grew until 1990. Therefore, the relevant historical period for SWP Allocations going forward is the post-1989 record. After the Monterey Amendments to SWP contracts, SWP contractors now request their full contract amounts each year.

The legendary disputes over water exports from northern California to Southern California have been ongoing for over 40 years when the State Water Resources Control Board initiated hearings to revise water quality standards in the Bay Delta. Since 2003, the loss of Colorado River water supplies created a shift to increase the reliance on the State Water Project. With the continued collapse of the delta ecosystem, the 2009 Delta Reform Act included the state policy to reduce Delta reliance. Consistent with that policy directive, the 10-year running average of State Water Project allocations fell from 65% to 50% by 2020.



Conclusions Regarding Metropolitan’s Water Sources

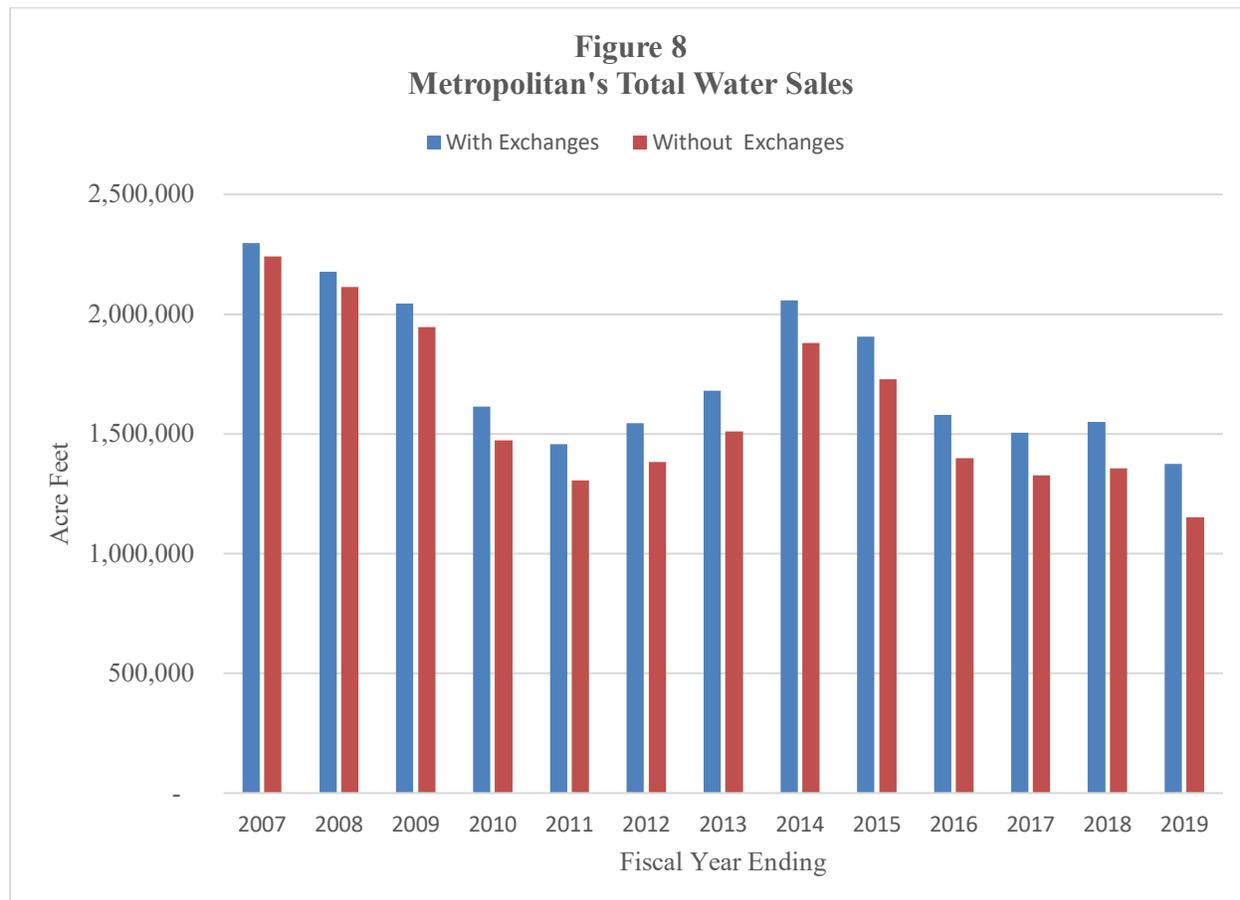
The year 2003 represents a turning point for Metropolitan’s water sources. On the Colorado River, the era of large volumes of Priority 5 Colorado River water ended. On the positive side, the QSA paved the way for Metropolitan’s long-term fallowing program that has conserved, on average, 94,293 AF per year. On the downside, Metropolitan assumed the risk for overruns by Priority 1, 2 and 3b. The net effect has been that its PVID venture has yielded, on average, 19,768 AF per year of Colorado River water. The year 2003 was also a turning point for Metropolitan with respect to SWP supplies with the emergence of a decreasing trend in SWP Table A Allocations.

Metropolitan Water Sales

Metropolitan’s water sales have been declining (see Figure 8).²³ Metropolitan’s water sales including Water Authority exchanges fell by 921,850 acre-feet per year from Fiscal Year Ending 2007 to Fiscal Year Ending 2019. Metropolitan’s water sales excluding Water Authority

²³ Data compiled from Annual Reports of the Metropolitan Water District of Southern California, Table “Water Use by Metropolitan’s Member Agencies” Table 1-2 in the 2019 Annual Report and comparable tables in earlier annual reports. Metropolitan includes San Diego’s Colorado River water supplies from its IID Agreement and Canal Lining projects in San Diego’s local water supplies in its estimate of firm supply. The data Water Sales with exchanges is the data provided in Metropolitan’s annual reports. The data Water Sales without exchanges subtracts San Diego’s Colorado River water from its IID Agreement and Canal Lining projects.

exchanges fell by 1,088,829,486 acre-feet per year from Fiscal Year Ending 2007 to Fiscal Year Ending 2019.



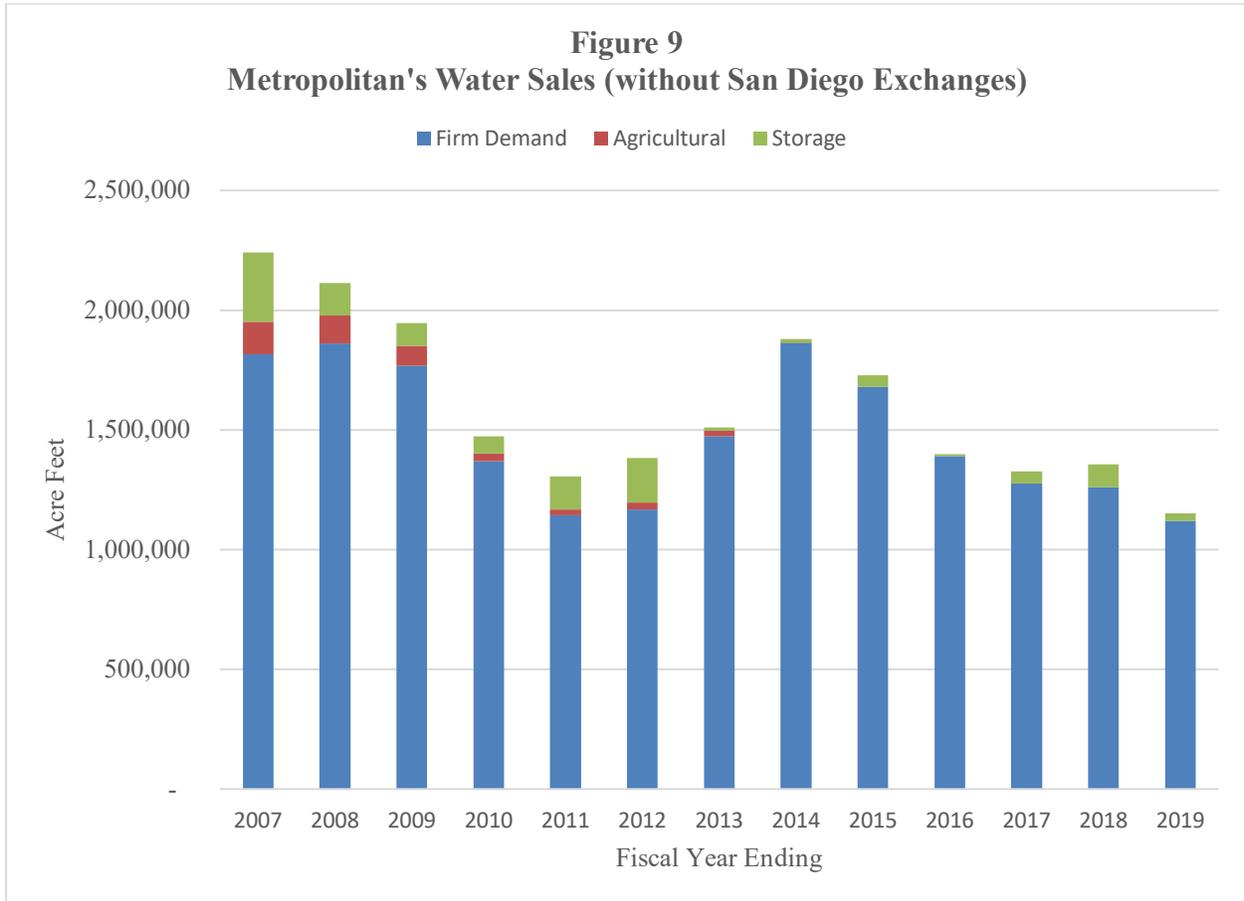
Metropolitan’s water sales decline with increased local rainfall and Metropolitan’s real water price and increases with real (inflation-adjusted) personal income in the six counties within Metropolitan’s service area.²⁴ Two significant factors regarding member agency local supplies also have an impact on Metropolitan’s water sales.²⁵ First, the greater the water available from the Los Angeles Aqueduct, the lower Metropolitan’s water sales. Second, with the initiation of the Water Authority’s significant acquisitions of Colorado River water and Canal Lining water in 2003, there is now an independent declining trend in Metropolitan’s water sales.

The composition of Metropolitan’s water sales has also shifted (see Figure 9). Starting in 2013, Metropolitan eliminated separate pricing for agricultural water and replenishment relative to firm water service. All water sales are now at full-service pricing. Sales to agricultural water

²⁴ *Metropolitan Water District of Southern California Water Supply Assessment and Use Among Its 26 Member Agencies*, Rodney T. Smith, Ph.D., Stratecon Inc., April 9, 2016, prepared for the San Diego County CWA (hereinafter cited as “Stratecon 2015 Study”), p. 36.

²⁵ *Ibid.*

users has been eliminated. Metropolitan water sales to its member agencies for storage are substantially lower as well.



Understanding Metropolitan's Past and Predicting Its Future

The year 2003 was transformative for Metropolitan. The era of a full Colorado River Aqueduct ended. Water allocations from the State Water Project have plummeted. A diminished water supply portfolio prompted Metropolitan spending trying to meet demands for Metropolitan water. Where Metropolitan water rates only increased with inflation for about 20 years through 2007, there has been another era of Metropolitan water rates increasing substantially faster than inflation. To date, Metropolitan spending on new water resources has been unsuccessful. Its PVID land fallowing program has been a tool to manage its risk from Priority 1&2 overruns, rather than producing a significant new water supply. With increasing water rates, the demand for Metropolitan water has been declining.

Continuation of Metropolitan's efforts to develop new water sources requires additional investments. Will new water supply ventures finally prove successful? Will they become cheaper or more expensive over time? Recommendations for further vetting of projections of Metropolitan's future are provided below.

Based on the Stratecon 2015 Study, there are three trends at work for the future demand for Metropolitan water: (1) increased real personal income of its service area, (2) changing real price for Metropolitan water, and (3) declining demand due to member agency local projects. The trend annual growth of real personal income in Metropolitan’s service area is 2.6%. Therefore, Metropolitan’s real water rate can increase by 5.6% annually to offset the impact of real personal income growth on Metropolitan’s water demand.²⁶ With expected inflation currently running at 1.28%,²⁷ the annual increase in Metropolitan’s nominal water price when the real water rate is increasing by 5.6% is 7.0%.²⁸ In other words, Metropolitan water rates would have to increase by 200 basis points faster than the Water Authority staff assumption to offset trend growth in real personal income.

The takeaways: (1) Within the context of Metropolitan’s past and current circumstances, I find the Water Authority staff escalation assumptions reasonable and the alternative advanced by the DLM&G Review not reasonable as based on assumptions rather than data and analysis, and (2) further due diligence on Metropolitan’s plan for meeting future water demands in Southern California can improve the economic foundation of predictions and risk assessment.

Section 2.6: The DLM&G Review considers Metropolitan’s offer for a renegotiated exchange agreement. Under their assumptions, the review calculates a potential benefit from a renegotiated exchange agreement. A key point is made about the benefit:

“A shift by METROPOLITAN of costs from volumetric charges to fixed charges . . . could reduced (sic). . . the economic advantage of a Negotiated Exchange Option.”

The DLM&G Review does not recognize the substance of the Water Authority-Metropolitan negotiations as reported in public 998 Offer negotiations. In its counterproposal, the Water Authority accepted Metropolitan’s proposed price terms and proposed the following “reset”:²⁹

“As of 2019, the price under the Exchange Agreement is \$453 AF, which consists of a \$326 System Access Rate and a \$127 AF System Power Rate (the “2019 Price Components”). The Water Authority shall be protected against any changes in the

²⁶ Metropolitan water sales increased at 0.95 of the annual increase in real personal income in Metropolitan’s six county service area. Metropolitan’s water sales decreased by -0.44 of the annual increase in Metropolitan’s real water rate. Stratecon 2015 Study, p. 36. The growth of Metropolitan water demand at trend growth in real personal income and an increasing real Metropolitan water rate of 5.6% is zero: $.95*2.6\% - .44*5.6\% \sim 0\%$

²⁷ Expected inflation implied by the yield of nominal 10-year Treasury notes (0.73%) and yield on 10-year TIPS (-0.54%).

²⁸ Estimate of nominal growth uses the Fisher equation: $(1 + n) = (1 + r)*(1 + \pi)$, where n = growth in nominal price, r = growth in real price, and π expected inflation

²⁹ Letter from Jim Madaffer (Chair of San Diego County Board of Directors) to Gloria Gray (Chairwoman; METROPOLITAN Board of Directors), “Settlement Offers”, dated December 19, 2019, p. 2.

recovery of costs that are currently included in either of the 2019 Price Components as follows: Should at any point in time during the term of the Exchange Agreement METROPOLITAN in any manner move any of the costs in either of the 2019 Price Components to any other cost recovery mechanism (such as a fixed charges, or property taxes), the Water Authority's Fixed Price shall be reduced commensurately. For example, the System Access Rate is currently about 72% of the overall 2019 Price Components. Should METROPOLITAN move 50% of cost recovery of the System Access Rate to another form of cost recovery, the Fixed Price would receive a credit of about 36% (half of the 72% portion of the overall 2019 Price Components). Also, if there is a material reduction or elimination of costs that are currently in the 2019 Price Components, the Water Authority will similarly receive a commensurate reduction in the Fixed Price."

This was rejected by Metropolitan.

The Water Authority's position on a renegotiated Exchange rate is not only reasonable, but essential to securing benefits from a renegotiated price term. After all, the Water Authority is familiar with the risks associated with a restructuring of Metropolitan water rates. Its 1998 agreement with IID addresses this issue as a "Fundamental Change".³⁰ The 1998 agreement outlined a calculation of a "financially-equivalent" Replacement Rate after any Metropolitan restructuring.

The DLM&G Review stated "detailed consideration of the future of METROPOLITAN rate structures is beyond our scope of work." The DLM&G Review recommendation of a renegotiated exchange agreement is incomplete and is not cognizant of actual negotiations that have occurred. The Water Authority has been trying to negotiate a fair wheeling agreement with Metropolitan for two decades, and there is no new information, insight or strategy provided by the DLM&G review.

Interestingly, Metropolitan's valuation of its offer notes that "Metropolitan's annual transportation rate increases, which reflect increasing costs to Metropolitan, have averaged 4.6 percent." Its financial valuation of its offer assumes that these rate increases will continue through 2112.³¹ Water Authority staff and Metropolitan staff have common expectations about Metropolitan's future. In addition, Metropolitan proposes to include the cost of any new Delta conveyance into the Exchange fee. In which case, there is a substantial "upside" in the Exchange fee proposed by Metropolitan.

³⁰ See "Agreement for Transfer of Conserved Water between Imperial Irrigation District and the San Diego County Water Authority, dated April 29, 1998, for definition of Fundamental Change (p. 28), for definition of Replacement Rate (p. 31), and impact of Fundamental Change on Contract Price (p. 36).

³¹ Letter from Barry Lee (counsel for Metropolitan) to John Keeker (counsel for the Water Authority), titled "San Diego County Water Authority v. Metropolitan Water District of Southern California", dated November 15, 2019, p. 6.

The Takeaways, (1) a renegotiated exchange agreement with Metropolitan must address the financial consequences of potential Metropolitan rate restructuring, and (2) Metropolitan’s projections of its annual transportation rate charges conform with the projections by Water Authority staff.

Section 2.7: The DLM&G Review raises questions about the post-2034 contract prices for IID water. The proper analysis of this issue should be conducted within the context of the actual contractual provisions of the transfer agreement.

The Base Contract price is defined as follows:³²

Base Contract Price = [METROPOLITAN Full Water Rate – Base Wheeling Rate] x [1 – Applicable

Discount Rate] + 50% x [Base Wheeling Rate – lessor of the Actual Wheeling Rate or 115% of the Base Wheeling Rate]

The Metropolitan Full Water Rate is a combination of volumetric and non-volumetric Metropolitan charges.³³ The Base Wheeling Rate reflects IID and the Water Authority’s interpretation of the Katz wheeling bill, which is substantially below Metropolitan’s exchange fee.³⁴ The Applicable Discount Rate is now 5%.³⁵ The change in the Base Contract price is related to the change in its components as follows:³⁶

Change Base Contract Price = 95%*Change in METROPOLITAN Full Rate %
– 102.5%*Change in Base Wheeling Rate

That is, the Base Contract Price changes by less than the Change in Metropolitan charges as measured by the contractually defined Metropolitan Full Water Rate and declines with increases in the Base Wheeling Rate. Projecting changes in the Base Contract Price should be based on projections of the underlying components.

³² Revised Fourth Amendment to Agreement between Imperial Irrigation District and the San Diego County Water Authority for Transfer of Conserved Water, October 10, 2003, §5.1(d), pp. 11-12. See Exhibit A for discussion of contractual definition of Full METROPOLITAN Water Rate and Base Wheeling Rate are calculated.

³³ See Exhibit A of the 1998 Agreement for discussion of contractual definition of Full METROPOLITAN Water Rate and Base Wheeling Rate are calculated.

³⁴ Statement based on my participation in the negotiation and drafting of the 1998 transfer agreement.

³⁵ See definition of Applicable Discount Rate in 1998 Agreement, p. 25. After 2020, the Applicable Discount Rate is 5%.

³⁶ The term for the Change in the Base Wheeling Rate collects the term (1- Applicable Discount Rate), or 95%, with the term 50% x [Base Wheeling Rate – lessor of the Actual Wheeling Rate or 115% of the Base Wheeling Rate]. Since the Actual Wheeling Rate is greater than the Base Wheeling Rate, the second term is 50% of 100% less 115% of the Change in the Base Wheeling Rate. Collecting these two terms, 95% - 50%*15% = 102.5%.

The Base Contract Price will also be subject to a shortage premium after 2034.³⁷ As with projecting changes in the Base Contract Price, projecting the timing and magnitude of shortage premium payments requires analysis of the contractual triggers and contractual calculations.

The Base Contract Price is subject to a price redetermination starting in 2035. Whether or not the IID Contract price will be subject to a price redetermination depends on the development of a water transfer market with enough “eligible” and “qualifying” transactions to trigger the contractual conditions for a price redetermination.³⁸ The nature of any price adjustment, in turn, will depend on the underlying economics driving the transfer market in California.

In sum, the price provisions of the transfer agreement were heavily negotiated to capture the underlying economics of water and water markets in California. The DLM&G Review’s discussion of future IID contract prices is detached from contractual provisions and the related underlying economics. Their assumptions lack analytic foundation.

The takeaway, projections of future IID contract prices should be based on the underlying contractual provisions.

Section 2.8: The DLM&G Review notes that grant funding would reduce the cost of the RCS. A complete analysis would address any terms and conditions tied to grant funding.

The takeaway, a comprehensive analysis of grant funding should include an analysis of the economic cost, if any, of terms and conditions.

Section 2.9: The DLM&G Review posits that the economics of Water Authority local projects may differ from the economics of Member Agency local supply projects. Project specific analysis would be helpful. In my experience, many analyses do not properly cost, for example the creation of new supplies from recycling. Many urban water management plans discuss the cost of recycled water at the plant but exclude the cost of recycled water distribution systems.

The Water Authority’s analysis of the Carlsbad project is an example of a complete analysis. Project cost analysis included the cost of conveying water from the desalination plant to a delivery point in the Water Authority’s water distribution system.

The takeaway, economic analysis of local supply projects must include the cost of creating and moving water to relevant distribution systems.

Section 2.10: The DLM&G Review discusses ascertaining the water rate impacts of the RCS. A complete analysis should identify the impact on forecasted rate structures. Until a proper economic assessment is completed, including a completed RCS Finance Plan, discussion of rate impacts at this time prior to Phase B of the RCS study is unduly speculative.

³⁷ See Exhibit D of the 1998 Agreement for discussion of the Shortage Premium,

³⁸ See Section 5 and Exhibit E of the 1998 Agreement.

The takeaway, the economic analysis and risk assessment discussed above provides the foundation for structuring a finance plan that provides the foundation for determination of water rates.

Section 3.3 (Risk Review): The DLM&G Review discusses the need for consideration of the risk of underlying water demands. Both the demand for Metropolitan water and Water Authority water should be investigated.

As with all aspects of project analysis, factual accuracy is essential. Stratecon notes that projections of future projects are inherently risky. Expectations about the timing, volume and terms of the availability of future water supplies may prove inaccurate. For example, in its 2010 Urban Water Management Plan, Los Angeles Department of Water & Power projected that the use of recycled water in FY 2014-2015 would reach 49,990 acre-feet.³⁹ Actual use was 36,738 acre-feet, or 70% below LADWP’s projections.⁴⁰ Track records of past projections should be part of assessments of the viability of currently planned projects.

The takeaways, (1) risk assessment of demand for Water Authority water is as appropriate as is a risk assessment of demand for Metropolitan water, and (2) predicting potential projects is an ongoing process.

Appendix A: Comments from Member Agency Chief Financial Officers:

Many of the comments are useful and worthy of further consideration. The table below provides my observation on each comment. Each comment is paraphrased rather than extensively quoted.

<i>Member Agency CFO Comment</i>	<i>Stratecon Response</i>
<ul style="list-style-type: none"> • Finds Water Authority escalation assumption unrealistic • METROPOLITAN may change its rate structure in the next 100 years 	<ul style="list-style-type: none"> • See discussion above • Prudent long-term planning by the Water Authority should consider the prospect of Metropolitan changing its rate structure
<ul style="list-style-type: none"> • The Water Authority’s cost of debt may be as high as 6.5%. 	<ul style="list-style-type: none"> • The relevant cost of debt will be at market conditions at the time of financing. Municipal interest rates generally follow U.S. treasury yields and inversely related to the strength of the economy

³⁹ Los Angeles Water & Power *Urban Water Management Plan*, 2015, p. 4-25, Exhibit 4N.

⁴⁰ *Ibid.*

<i>Member Agency CFO Comment</i>	<i>Stratecon Response</i>
	<ul style="list-style-type: none"> • Like all aspects of a long-term infrastructure project, this involves projections of future market conditions
<ul style="list-style-type: none"> • What is the cost of stranded assets? • What is Water Authority's share of Metropolitan's cost to operate, maintain, repair and replacement their facilities? • Metropolitan will change rate structure to impose costs on the Water Authority 	<ul style="list-style-type: none"> • The prospect as well as costs of stranded assets, considering salvage values, should be considered. • The Water Authority's share of Metropolitan costs should be investigated and is an important consideration about Metropolitan as a water provider as well as the RCS. • The prospect that Metropolitan may change its rate structure should be part of the Water Authority's long-term strategic planning separate and apart from as well as in conjunction with the RCS.
<ul style="list-style-type: none"> • Consider link between IID contract price and Metropolitan rates • Need to have a term sheet with IID for contract extension before project is started 	<ul style="list-style-type: none"> • Analysis should be based on the analysis of contractual provisions (see above). • A stated condition by Water Authority staff.
<ul style="list-style-type: none"> • RCS should be financed by property tax or like the Water Authority's Infrastructure Access Rate 	<ul style="list-style-type: none"> • Should be considered as an alternative in the finance plan.
<ul style="list-style-type: none"> • The time profile of benefits and costs should be discussed by the Water Authority Board • An analysis beyond 30 to 40 years should be included 	<ul style="list-style-type: none"> • Agree. • The appropriate analysis is the project's useful life which exceeds 40 years (see above).
<ul style="list-style-type: none"> • Water Authority should explain basis for all their assumptions and complete sensitivity analysis and perform probability analysis. 	<ul style="list-style-type: none"> • All assumptions should be grounded on specific economic analysis of all factors and subject to risk assessment.
<ul style="list-style-type: none"> • Water Authority should break down the transportation costs by capital and operation and maintenance 	<ul style="list-style-type: none"> • Suggest including the cost of replacement and renewals.

<i>Member Agency CFO Comment</i>	<i>Stratecon Response</i>
<ul style="list-style-type: none"> As member agency reduce demands on Water Authority, what impact does it have on RCS? 	<ul style="list-style-type: none"> RCS should be assessed within the context of expectations about future conditions, including member agency demands for Metropolitan water and Water Authority water.
<ul style="list-style-type: none"> Water Authority should treat local supply alternative as a project. 	<ul style="list-style-type: none"> Economic analysis of alternatives benefits from consideration of specific projects.
<ul style="list-style-type: none"> RCS repair and replacement costs may be underestimated. 	<ul style="list-style-type: none"> Repair and replacements costs should be included in project life cycle analysis.
<ul style="list-style-type: none"> Is there a benefit to pursuing long-term debt? 	<ul style="list-style-type: none"> Yes. The role, structure and amount of debt should be determined as part of an optimal financing plan developed in Phase B of the RCS study.
<ul style="list-style-type: none"> Review assumptions and provide off ramps before issuing debt. 	<ul style="list-style-type: none"> Assessment of a long-term infrastructure project should be subject to continued testing of underlying assumptions.
<ul style="list-style-type: none"> Is there an opportunity to connect member agency reservoirs in South County 	<ul style="list-style-type: none"> Defer to Water Authority staff and member agencies.
<ul style="list-style-type: none"> Could Water Authority monetize the value of IID water to another entity? 	<ul style="list-style-type: none"> Always recommend considering trading opportunities.
<ul style="list-style-type: none"> Identify quantifiable and non-quantifiable project and environmental risks. 	<ul style="list-style-type: none"> Agree.
<ul style="list-style-type: none"> Is there a value to a local water supply that is long-term and drought proof? 	<ul style="list-style-type: none"> Yes. DWR assessment of Bay Delta projects provides a reasonable economic model to quantify benefits (see below). The method requires fundamental economic and hydrological analysis discussed below.

<i>Member Agency CFO Comment</i>	<i>Stratecon Response</i>
<ul style="list-style-type: none"> Water Authority should review “IC modifications” to identify any improvements. 	<ul style="list-style-type: none"> Any proposed improvements should be considered on the merits.

Identification of additional issues not addressed by the DLM&G Review

There are additional issues that should be considered in the economic assessment of the RCS: water supply reliability, climate change, and COVID-19.

Water Supply Reliability: As emphasized by California’s Department of Water Resources (“DWR”), water shortages have economic consequences. In 2013, DWR estimated the annual economic cost of municipal water shortages borne by water users at \$812/AF for 5% water shortages increasing to \$2,504/AF for 25% shortages (see Figure 10).⁴¹ Assuming that the real cost of water shortages has not changed since 2013, the economic cost of water shortages in 2020 dollars is 12% higher than in 2013.⁴² In other words, the annual economic cost of 5% or 25% water shortages, respectively, are now \$909/AF and \$2,804/AF.

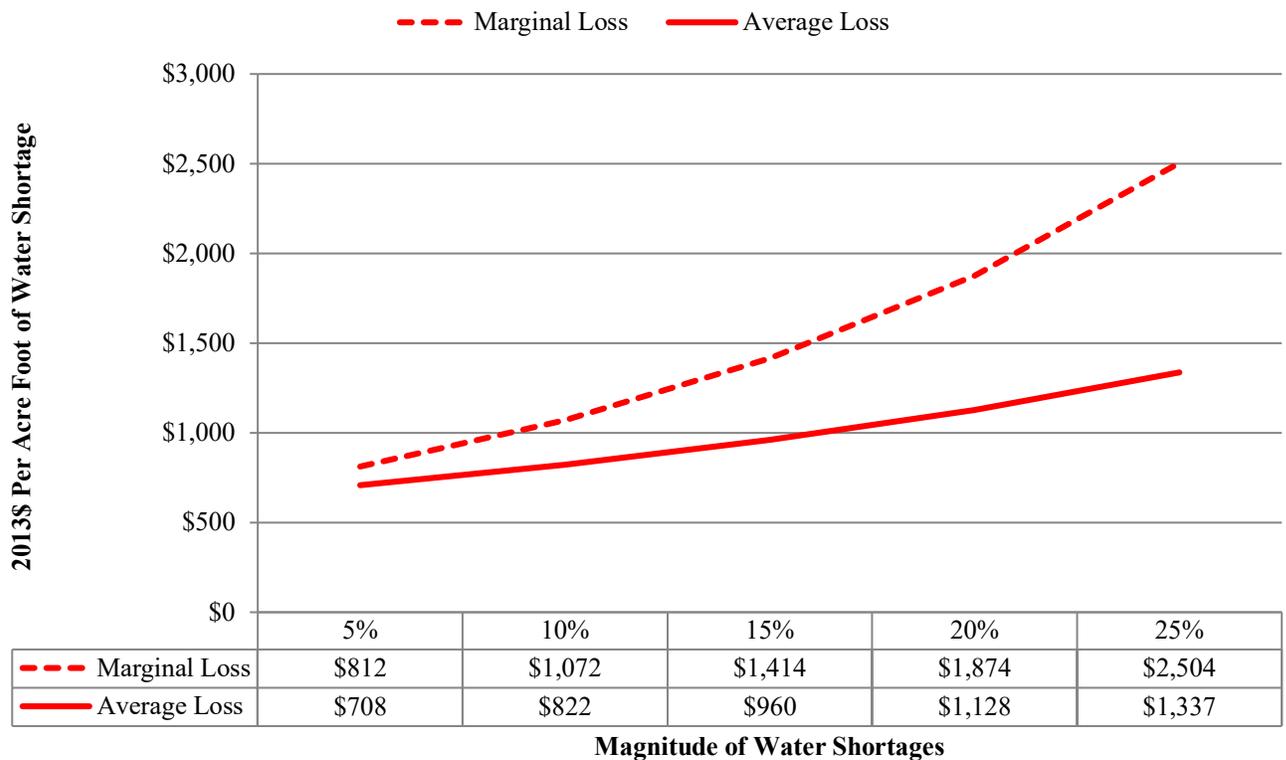
Water shortages also impact the finances of water providers. The loss of water sales means less revenue is available to meet (especially the fixed) cost of water providers. Water systems based on less reliable water supplies requires higher financial reserves than water systems based on more reliable supplies.

The frequency, magnitude and duration of water shortages depend on the reliability of water supplies. Both of Metropolitan’s major supply sources face future challenges. Metropolitan also faces the need for further investments to repair its deteriorating water supply portfolio.

⁴¹ “Is Bay Delta Conservation Plan a Doable Deal?”, presentation by Rodney T. Smith to Special Imported Water Committee Meeting, Bay Delta Conservation Plan, Economic Analysis, San Diego County Water Authority, September 12, 2013, slide 19.

⁴² Estimate based on Bureau of Labor Statistics “CPI Inflation Calculator”, https://www.bls.gov/data/inflation_calculator.htm. The assumption that the real economic cost of shortages has remained unchanged is probably wrong. Recommendations on how to investigate this issue are made below.

Figure 10
Annual Economic Cost of Municipal Water Supply Shortages

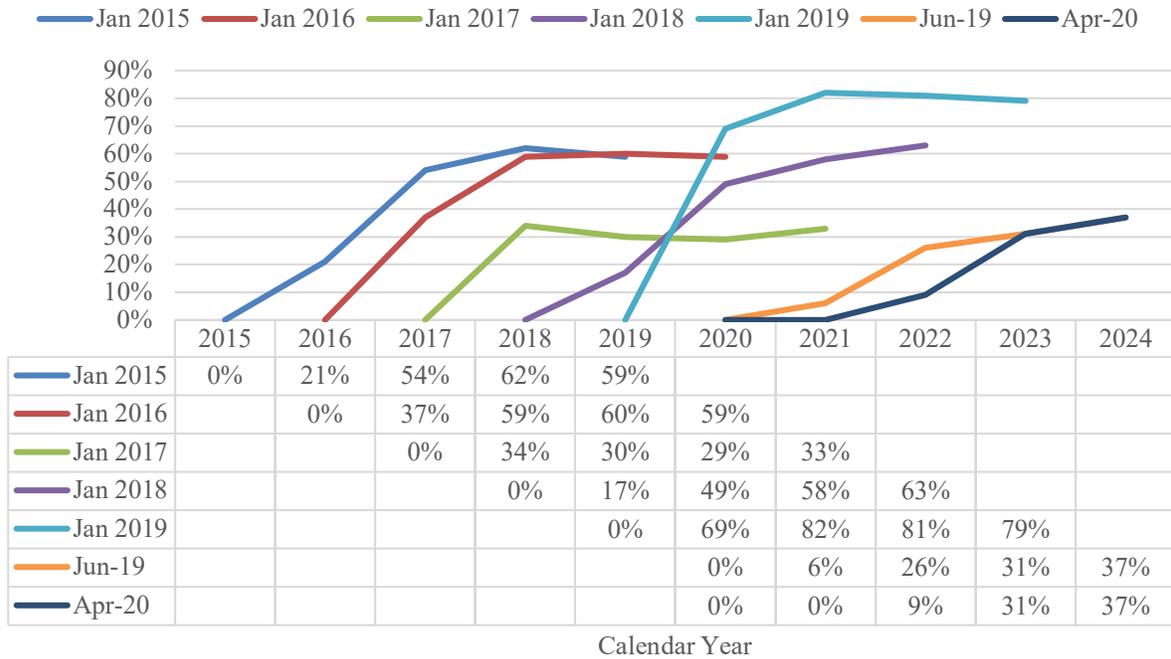


Colorado River

The risk of Colorado River water shortages is becoming material (see Figure 11).⁴³ In successive forecasts starting in 2015, the prospect of a shortage of Colorado River water was looming “next year” with increasing risk in subsequent years (although the January 1, 2017 forecast backed off from earlier forecasts due to high runoff). The January 1, 2019 forecast was the most alarming with shortage becoming virtually unavoidable in the early 2020s. Due to a high runoff in the Colorado River Basin, the June 2019 forecast stretched out shortage risk into the mid-2020s. The April 2020 forecast has the risk of shortages returning to earlier projections by 2023.

⁴³ Compiled from Reclamation’s Five-Year Projections of risk of water shortages.

Figure 11
Probability of Any Lower Colorado River Water Shortage
by Forecast Date

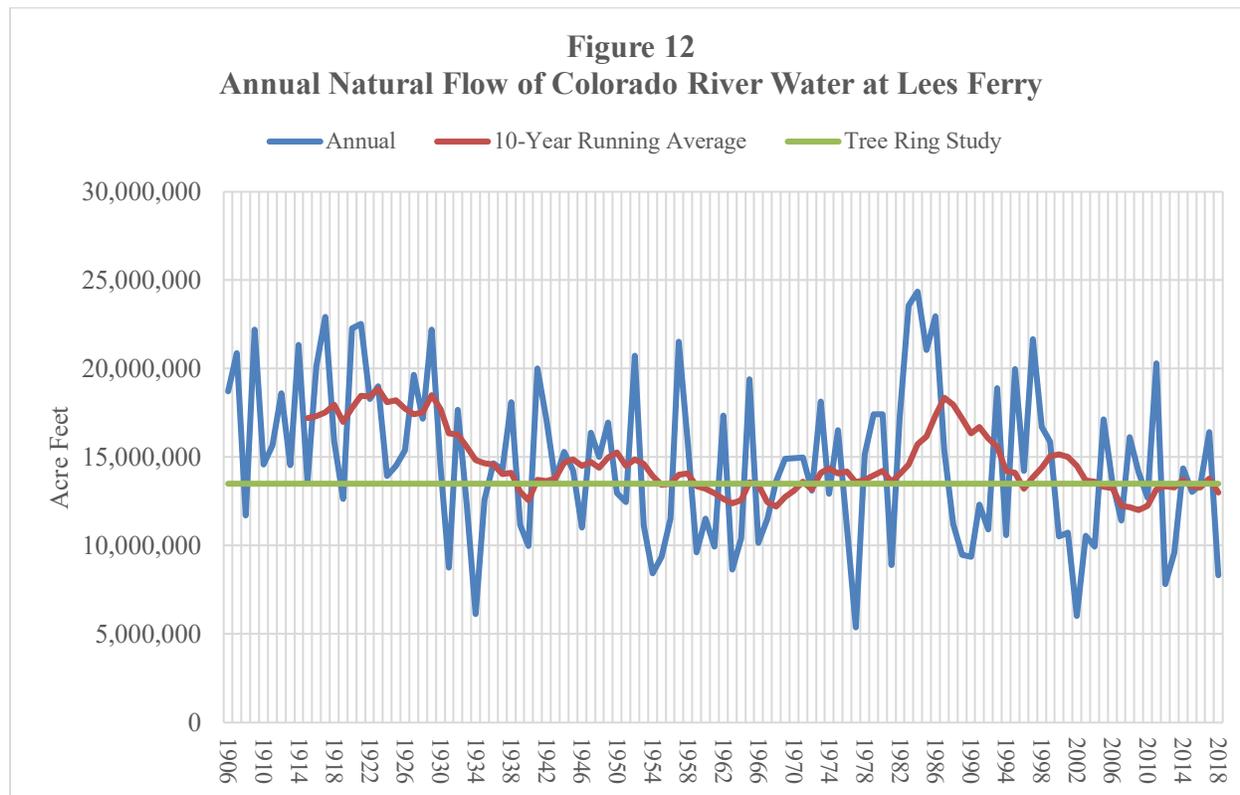


The Drought Contingency Plan (“DCP”) calls for California to make 200,000 AF to 350,000 AF available through conservation to increase Lake Mead storage when the elevation of Lake Mead drops to and below 1,045 feet.⁴⁴ IID has opted out of the DCP. Metropolitan backstops California’s obligation. The DCP continues through 2026 as a bridge to an anticipated longer-term agreement among Colorado River Basin parties (including Mexico). With California agreeing to obligations under the DCP, should one anticipate that the anticipated long-term agreement have a smaller, larger, or same obligation?

The future for the Colorado River depends on which road we are traveling. Have we been in a prolonged drought, or are the unusually wet hydrologic conditions in the early 20th century giving way to the long-term average calculated by tree-ring studies (see Figure 12)? Under the former belief, the last decade was a drought. Under the latter belief, a drought in the first decade of the 21st century was broken by the year 2011 until returning in 2018. Have we been experiencing

⁴⁴ See “What the Drought Contingency Plan Mean for California”, [https://www.ppic.org/blog/what-does-the-colorado-river-drought-plan-mean-for-california/#:~:text=What%20Does%20the%20Colorado%20River%20Drought%20Plan%20Mean%20for%20California%3F,-Gokce%20Sencan%20May&text=This%20drought%20contingency%20plan%20\(DCP,water%20shortages%20in%20the%20basin.](https://www.ppic.org/blog/what-does-the-colorado-river-drought-plan-mean-for-california/#:~:text=What%20Does%20the%20Colorado%20River%20Drought%20Plan%20Mean%20for%20California%3F,-Gokce%20Sencan%20May&text=This%20drought%20contingency%20plan%20(DCP,water%20shortages%20in%20the%20basin.)

the “long-term” new normal? The nature of the risks we are managing depends on which world we are inhabiting. The value of seniority of Colorado River water will increase over time.



State Water Project

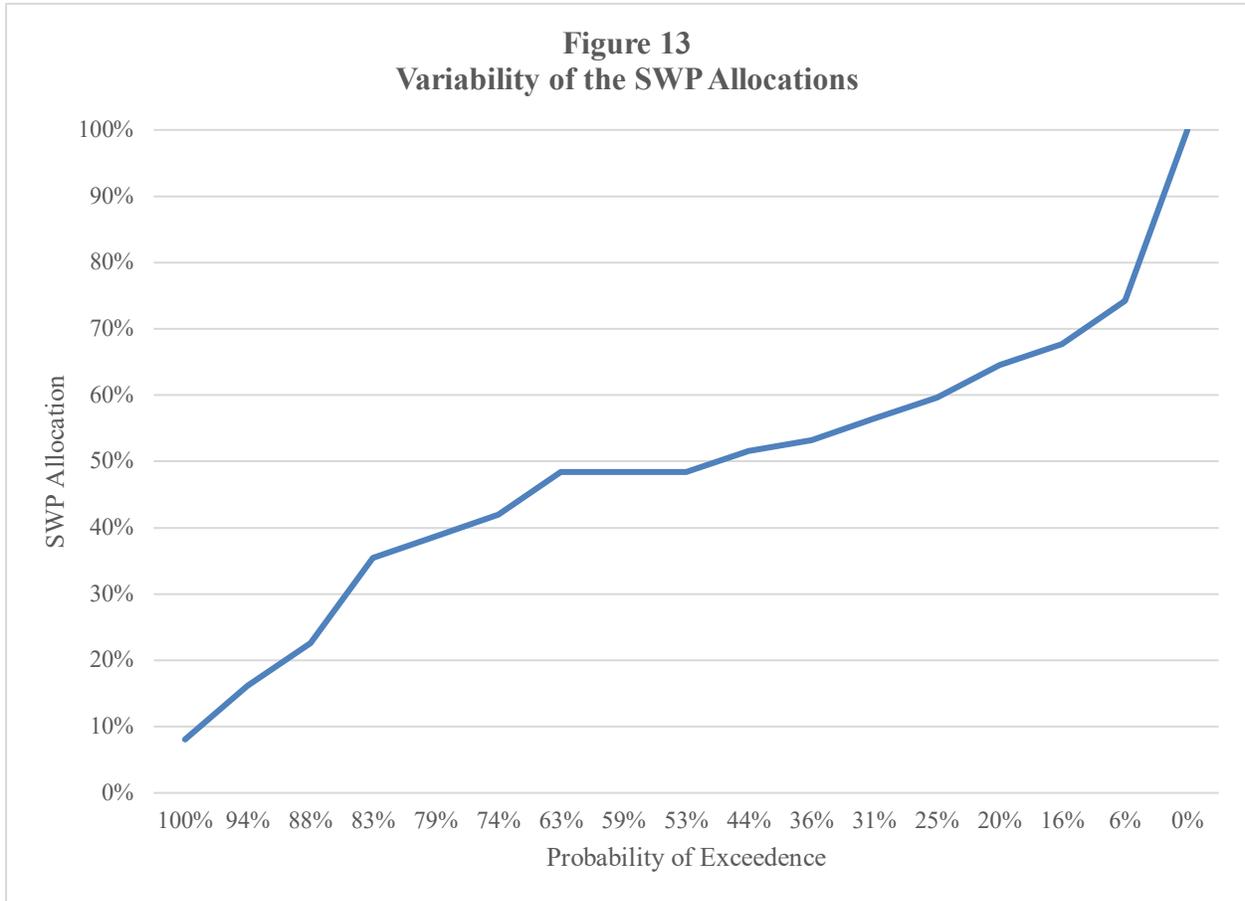
The California WaterFix had been a central focus of Metropolitan’s multi-year effort to secure new water supplies for its member agencies. Governor Newsom replaced the twin tunnels project with the single tunnel project under development. The design, cost and timing are under investigation.

It is difficult to foresee any project commencing operations before 2040 at the earliest. On the eve of the cancellation of WaterFix, project operations were not anticipated to start until 2035. How long will Governor Newsom new venture take to complete environmental review, litigation and negotiation of contractual arrangements? What happens before then?

In the “interim”, California water users are stuck with the delivery problems of the current State Water Project. Figure 13 illustrates the variability in SWP water supplies for urban water users under the existing SWP.⁴⁵ The “probability of exceedance” gives the forecasted probability that available annual water supplies will exceed the amount shown on the vertical axis. For

⁴⁵ Figure 14 plots the data points read from Figure 1 “Total SWP Deliveries” in *Economic Analysis of the California WaterFix*, Prepared for California Department of Water Resources by David L. Sunding, Ph.D. The Brattle Group September 20, 2018, p.12.

example, there is a 63% probability that annual available water supplies will exceed 48%; and a 37% probability that annual available water supplies will be less than 48%.⁴⁶ The average allocation is 49%, the 10-year running average of actual SWP allocations since 2016 (see Figure 6).



There are significant risks confronting the State Water Project apart from the environmental challenges in the Bay Delta. Land subsidence in the Central Valley threatens the delivery capacity of the California Aqueduct that will increase SWP project costs.⁴⁷

Climate Change: Climate change is another factor affecting future water supplies. By the last quarter of this century, climate change is estimated to reduce runoff on the Colorado River by 10%.⁴⁸ California is also to lose “much of spring snowpack.”⁴⁹

⁴⁶ Figures in text from curves plotted in Figure 14.

⁴⁷ See *Update on California Aqueduct Subsidence*, Metropolitan Water District of Southern California, Member Agency Managers Meeting, January 17, 2020.

⁴⁸ See “San Diego’s Future—Warmer, Drier and Wetter,” by Dan Cayan and David Pierce, Board of Directors Meeting of the San Diego County Water Authority, July 23, 2020, p. 14.

⁴⁹ *Ibid*, p. 15.

Monitoring the accuracy of such projections is essential for Water Authority planning. The reduction in runoff on the Colorado River will increase the frequency, magnitude and duration of Colorado River water shortages. This should further increase the value of senior priority claims on Colorado River water. Loss of spring snowpack will also prove significant. Depending on the location of lost snowpack, this would reduce SWP allocations with or without a new Delta conveyance facility. If the lost snowpack reduces the yield of the Los Angeles Aqueduct, this would increase the demand for Metropolitan water, putting further stress on Northern California and increased dependence on the over-appropriated Colorado River.

COVID-19 Pandemic: The COVID-19 pandemic is (hopefully) once in a lifetime disrupter of our lives. The public health establishment has been shattered and is being rebuilt on the fly. The economy is in shambles. We are learning about supply chains and interconnectedness of economic activity. Rapid joblessness and burgeoning food lines bring back visions of the Great Depression, where the U.S. economy (measured by inflation-adjusted Gross Domestic Product) contracted by 26% over four years. The U.S. economy did not fully recover to pre-Depression levels until the end of the 1930s. Economic historians believe it took World War II to put our country's economy back on its feet.

As in other states, shutdown of the economy has generated widespread unemployment in California (see Figure 14).⁵⁰ Before mid-March, weekly initial unemployment claims averaged 45,828 claims. Initial unemployment claims increased 4-fold in the third week of March and 23-fold in the fourth week. Initial claims peaked at 1,058,325 by the end of March. While initial unemployment claims have declined, they still average about 200,000 claims per week, or almost 5-fold the weekly rate before mid-March. The new initial unemployment claims have matured into increased continuing claims. California's insured unemployment rate stood at 2% in mid-March and peaked at 27.8% in the first week of May. By mid-July, California's insured unemployment rate stands at 15.6%.

The economy is on the road to credit defaults and bankruptcy. Will laid-off workers be rapidly integrated back into their previous jobs? With businesses closing, millions of the unemployed will be chasing job opportunities disappearing into bankruptcy. The water industry is not immune to the economic fallout from COVID-19.⁵¹

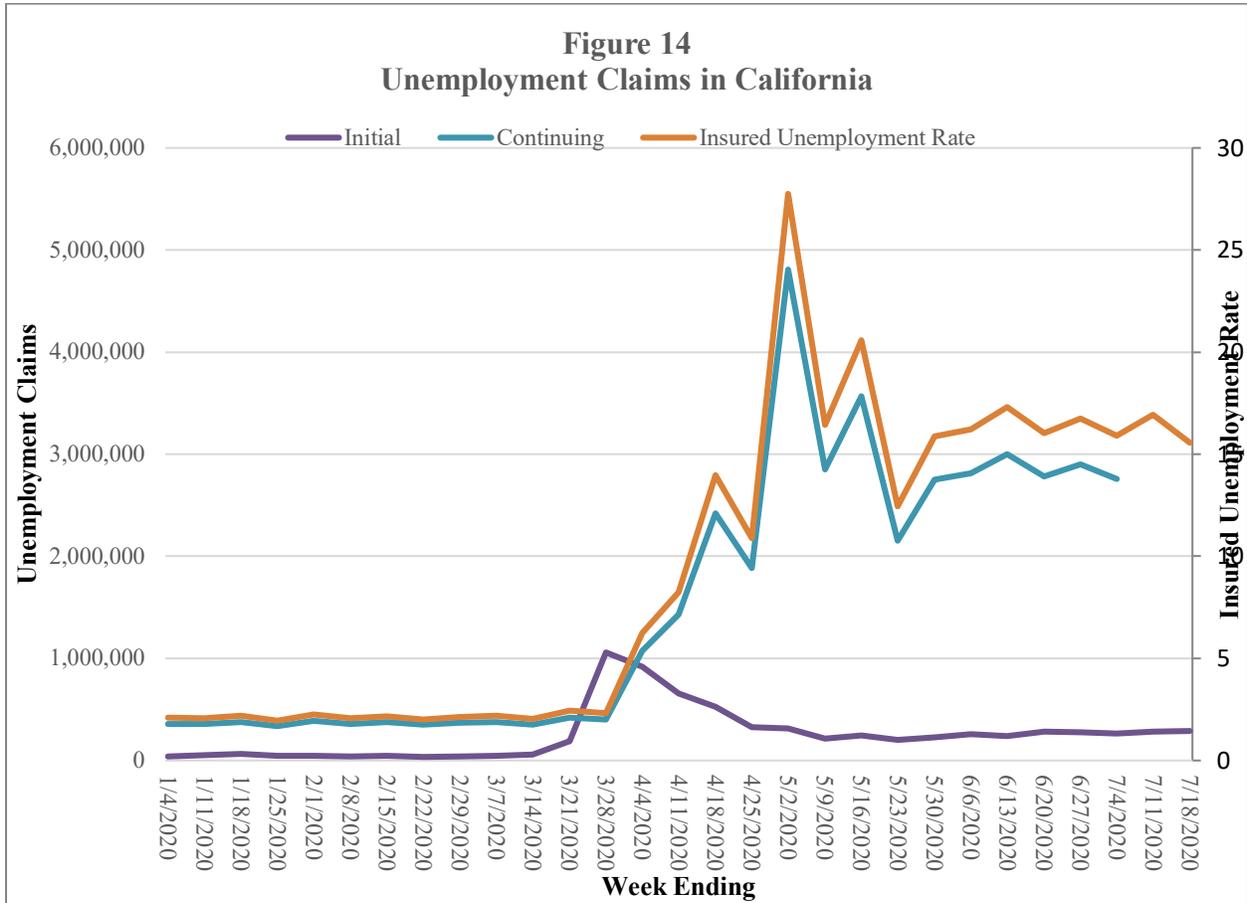
Associations of public agencies and private water utilities estimate the annualized nationwide impact of COVID-19 on drinking water utilities at \$13.9 billion.⁵² Declining water

⁵⁰ From Department of Labor, "State Weekly Claims for Unemployment Insurance, Data Not Seasonally Adjusted", <https://oui.doleta.gov/unemploy/claims.asp>

⁵¹ See "COVID-19 Will Change the Water Industry", (hereinafter cited as "COVID-1) <https://hydrowonk.com/blog/2020/04/20/covid-19-will-change-the-water-industry-a-trilogy-the-industrys-economic-model-is-dead>

⁵² "Financial Impact of the COVID-19 Crisis on Drinking Water Utilities," American Water Works Association and Association of Metropolitan Water Agencies, April 14, 2020.

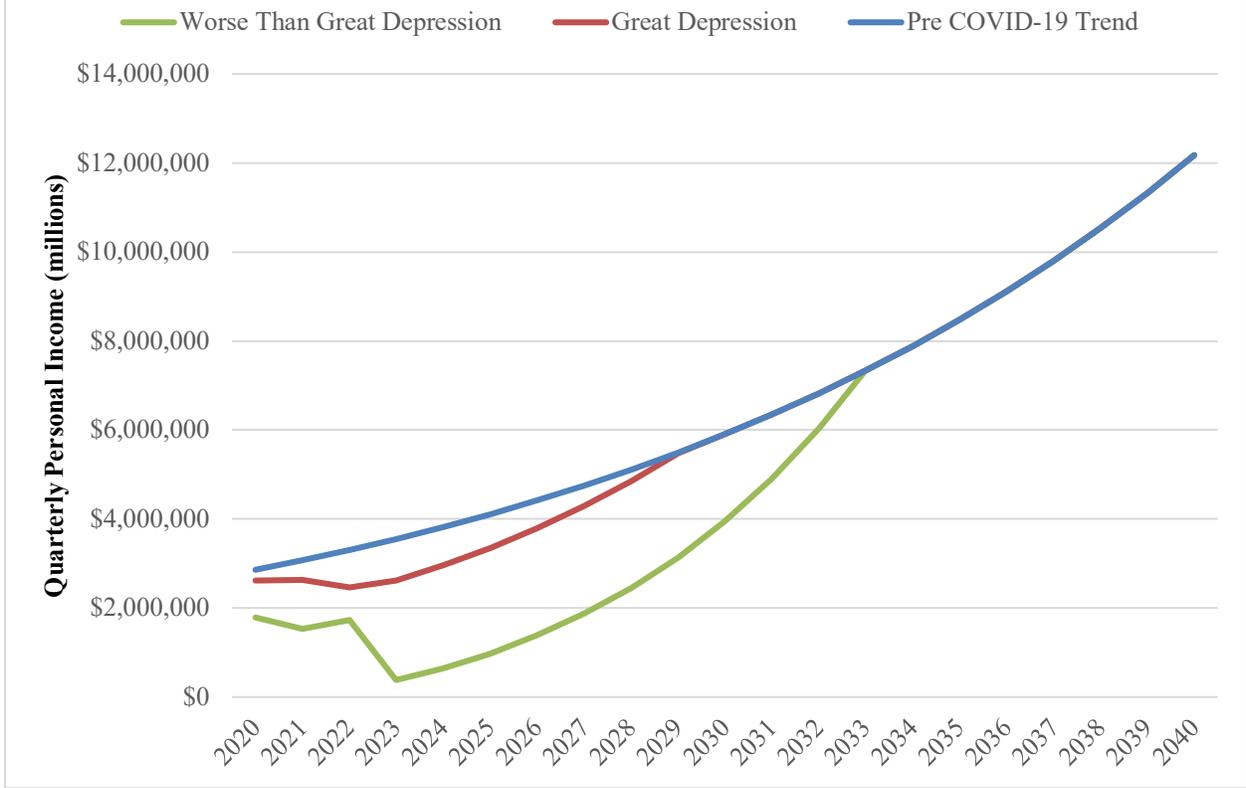
sales and increased payment delinquencies will stress the industry’s finances. Many water agencies in California have reduced or even suspended planned rate increases and are monitoring operational COVID-19 impacts for potentially further cutbacks.



The shutdown of the economy was admittedly essential for public health but will be consequential for the long-term health of the U.S. economy (see Figure 15).⁵³ Consider two scenarios. The COVID-19 disruption will be twice as severe and “only” take one-more year to reach bottom than the Great Depression, but the economy will not recover to the pre-COVID-19 trend until the mid-2030s. Even if the COVID-19 disruption “just proves” to be another Great Depression, California’s economic future is a great departure from the pre-pandemic trend.

⁵³ COVID-1

**Figure 15
California's Economic Future**



The immediate economic disruption from COVID-19 is painful and severe. Examining how the economy unfolds will prove essential for planning by water agencies. Having said that, even if the COVID-19 pandemic proves worse than the Great Depression, the California economy has a quarter of century to recover from the pandemic.

The impact of COVID-19 on the economics of water projects will be the greatest on projects initiating operations within the next decade. Longer-term projects, such as the RCS, may find that, because their underlying economics are based on long-term economic conditions, COVID-19 pandemic may prove less challenging.

Recommendations for further economic due diligence and risk assessment of the RCS

Economic assessment of any long-term project, including RCS, needs to be based on projections of the future that are inevitably subject to uncertainty. Innovation in information technology has increased exponentially the ability to develop and assess projections about the future for decision-making.⁵⁴

⁵⁴ For background, see *Risk Assessment Framework: Navigating Uncertainty*, 2019

Since the 1990s, the Bureau of Reclamation has been developing simulation models of the availability of Colorado River in the face of unknown hydrologic conditions and assumptions about water demands and policy. This analytic tool supported negotiations of interim surplus guidelines in 2003, interim guidelines for shortage sharing on the Colorado River in 2007 and the Drought Contingency Plan in 2019.

Starting in 2002, California's Department of Water Resources has been conducting simulation studies of the deliverability of SWP water under unknown hydrologic conditions and assumptions about water demands and policy. This analytic tool supported assessment of the twin tunnel projects and now the single tunnel project.

In the private sector, the use of quantitative risk assessment models has exploded. Investments in the petroleum sector, development of structured finance products and many other sectors now use quantitative risk assessment. Stratecon routinely uses quantitative risk assessment for analyzing proposed water investments and transactions.

The discussion below presents questions for economic analysis and risk assessment in Phase B, scope of analytic tools, the need for learning during the period of RCS assessment before decision-making, potential strategic alliances, and a framework for collaboration going forward.

Questions for Phase B: The lists provided below identify substantive issues identified above for inclusion in Phase B of the RCS study.

Metropolitan Issues

Objective: Provide sound analytic and factual foundation for projecting future Metropolitan water rates and charges and reliability of Metropolitan water service.

1. Forensic analysis of the causes, planning assumptions behind the historic increases in Metropolitan's water rates and charges.
2. Identify and handicap the "bets" behind relying on Metropolitan water supplies going forward as evidenced by its current Integrated Resources Plan.
3. Develop, assess and update forecast tool for analyzing the reliability of Metropolitan's current and proposed future water supplies.
4. Review true costs and water yield of Metropolitan's proposed and planned projects and assess impact on Metropolitan water rates and charges and their contribution to the reliability of Metropolitan future water supplies.
5. Project the source and amount of future demand for Metropolitan's water service.
6. Develop, assess and update forecast tool of Metropolitan's water rates and charges.

Long-Term Strategic Planning Issues

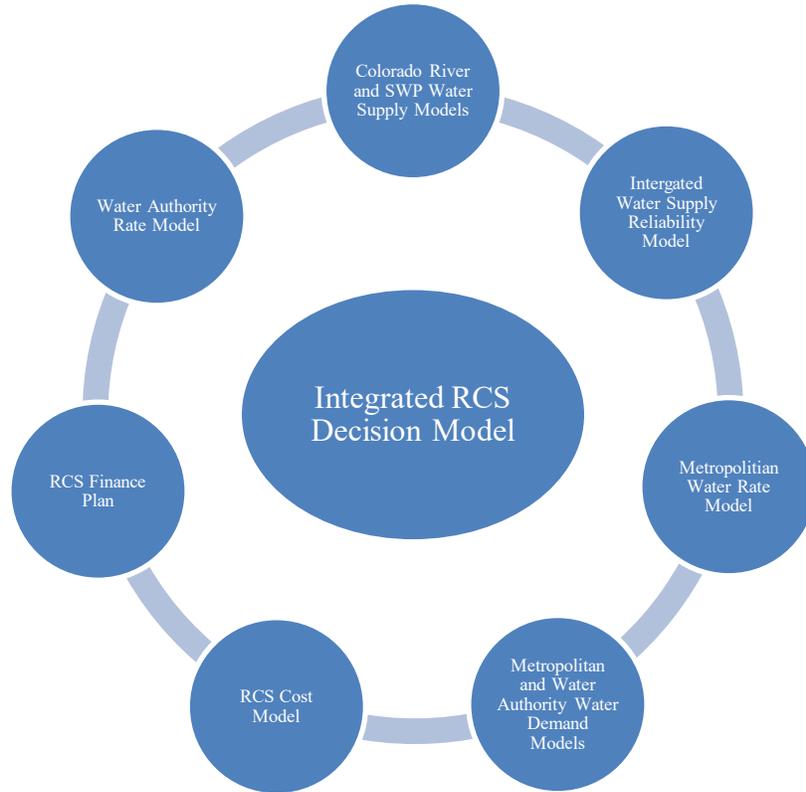
Objective. Assure that analytic and factual foundation of RCS conforms with analysis and facts employed on Metropolitan issues.

1. Develop an analysis of the reliability of the Water Authority's water supplies based on composition of Water Authority's water supply portfolio (preferential rights within Metropolitan, additional purchases from Metropolitan, Colorado River water supplies, Carlsbad Desalination Project and other current and proposed Water Authority or member agency projects).
2. Develop an analysis of future demand for Water Authority water service.
3. Assure that assessments of the Water Authority's future projects conform with methods used to assess Metropolitan projects (address timing of investments versus water yields, cost escalation, project risk assessment).
4. Develop an optimal RCS financial plan.
5. Assure that projections of Water Authority's rates and charges conforms with methods used to project Metropolitan's rates and charges.

Scope of Analytic Tools: The Economic Model developed by Water Authority staff and adapted by DLM&G are financial projections under different scenarios based on stated assumptions. As discussed above, the issues raised by the DLM&G Review need further investigation into the underlying economics and risk factors facing the Water Authority and Metropolitan.

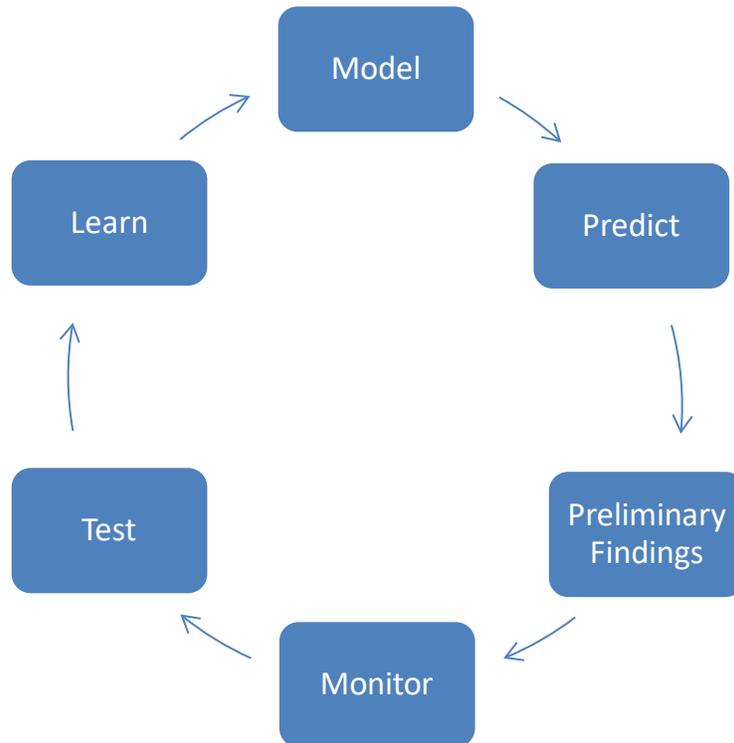
Figure 16 sketches the various components of a follow-on assessment. Colorado River and SWP water supply models should be based on the Bureau of Reclamation and DWR models adjusted for risk analysis of climate change and other issues. The findings become input for an integrated water supply reliability models for Metropolitan and the Water Authority. The Metropolitan issues identified above would be the basis for a Metropolitan rate model. Metropolitan and Water Authority water demand models should be based on statistical models identifying the factors driving historical adjusted for projections of local water projects and the feedback between water pricing and water demand. The RCS cost model from Phase A could be updated to assure consistency between the analysis of future economic conditions throughout the "circle" in Figure 16. This information then feeds into the development of an optimal RCS finance plan. As discussed above, with the RCS finance plan and the other findings, one has the inputs for the Integrated RCS Decision Model. The economic analysis and risk assessment discussed above is driven by the findings of investigating the underlying economics and risks assessments and identifying the "bets" under project alternatives.

Figure 16
Analytic Components of RCS Decision Model



Learning During Risk Assessment in Preparation for Decision-Making: Predicting the future is difficult. Some fundamental premises may prove correct. Others incorrect. It is essential to continue to test underlying premises (see Figure 17).

Figure 18
The Critical Role of Learning



Initial models are constructed, and predictions made. Preliminary findings are advanced. Given the lengthy period of project development for the RCS, there will be the opportunity to monitor how the world unfolds relative to predictions. Is the world unfolding as predicted, or not? This testing provides the opportunity to learn and ultimately improve the tools for decision-making.

Potential Strategic Alliances: Potential strategic alliances can change the economics of the RCS. The opportunities to enter into power agreements with local third parties may prove beneficial. Potential partners include the Imperial Irrigation District and geothermal producers in the Imperial Valley. Binational opportunities may also exist. The State of Baja has long-term plans to build natural gas-powered power plants in the Mexicali Valley.

Strategic opportunities may also exist in water. Water Authority staff assume that water must be purchased from Metropolitan to offset the loss of water from water treatment. Local water supplies opportunities may prove attractive.

Finally, it is common for regional conveyance projects to look for partnership opportunities along its pipeline route. The RCS may provide a link to a regional system for local communities who especially face severe water problems with few, if any, alternatives.

Collaboration Going Forward: Multi-billion, long-term capital investments involve the future. The RCS or any other water project is no exception. The more extensive the information and analysis of the underlying economics and risks of a project and its alternatives, the better the prospect for prudent decision-making. Critical judgments must be made with incomplete information. What next decade looks like may or may not conform with today's expectations.

Decision-making in the face of uncertainty is an art as well as a science. Achieving consensus among decision-makers is facilitated through understanding of underlying economics and risk assessments. Common understandings are most likely to occur through exchange of information and analysis.

Conclusion

Thank you for the opportunity to consider the questions being raised about the RCS. There are really few bad questions. There is a pathway for finding the most informative answers for Water Authority decision-making.

A handwritten signature in black ink, appearing to read 'Rodney T. Smith', with a large, stylized initial 'R' and a long horizontal stroke extending to the right.

Rodney T. Smith
President