Functional Assignment of Metropolitan's Demand Management Costs

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DEMAND MANAGEMENT

Table of Contents

1. Executive Summary

This report focuses on a single aspect of water service, Metropolitan's demand management programs, and a single aspect of Metropolitan's four step cost of service process – Step 2 Functionalize Costs. This report proposes a new approach Metropolitan can use to functionally assign the real costs for its demand management programs to the appropriate cost components, in the appropriate relative share.

The Metropolitan Water District of Southern California (Metropolitan) currently budgets for and spends approximately $90 - $100 million per year on programs to reduce regional water demand and to incentivize the development of local recycled and groundwater resources. Water conservation, incentives for local recycling and groundwater recharge programs (LRP), and the comparatively small Future Supply Actions Program together comprise the demand management line item in Metropolitan's annual budget. Collectively these programs are referred to as Metropolitan's "demand management" programs throughout this report.

For Metropolitan, demand management is both preferred and legislated. The Metropolitan's 1996 Integrated Water Resources Plan (IRP) included water conservation as an "essential element" in all three future resource mixes considered.[1] The 1996 IRP and its periodic updates integrate both conservation and local water supply impacts into forecast goals and the IRP's 25-year planning and forecasting window ends in 2020. Since 1996 many of the projected impacts of demand management programs have been realized and are now relied upon. Metropolitan also pursues conservation and local water resource development because it has been uniquely directed to do so by the California State Legislature. In 1999, then Governor Davis signed SB 60 (Hayden) into law. SB 60 amended the Metropolitan Water District Act to direct Metropolitan to increase conservation and local resource development. Metropolitan's demand management programs also support the region's compliance with the requirements of SB X7-7.

For Metropolitan, demand management increases reliability and reduces the region's reliance on imported water supplies to meet future demands. It decreases the burden on Metropolitan's infrastructure, reduces system costs, and frees up conveyance capacity to the benefit of all system users. The 2019 Water Tomorrow report concluded that since 1990, Metropolitan's demand management programs have produced cumulative savings and LRP production of more than 5.4 million AF.[2] The overall cost-savings of Metropolitan's demand management programs has been established through analysis reported in 2016 and 2018 in which Metropolitan documented approximately $3.0 billion in avoided costs related to transportation infrastructure due to its demand management efforts.[3]

To recover the annual revenue requirements of demand management (e.g. the $90 - $100 million currently spent annually), Metropolitan bills its 26 member agencies that purchase from and move water through Metropolitan's water system. In 2018, Metropolitan hired WaterDM to prepare this functional assignment report to develop a reasonable, updatable, objective method to ensure that the revenue requirements of Metropolitan's demand management programs are recovered from the

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[1] Metropolitan Water District of Southern California. 1996 Integrated Water Resources Plan Vols. 1, 2, and 3. Metropolitan Water District of Southern California, Los Angeles, CA.

[2] Metropolitan Water District of Southern California. 2019. Achievements in Conservation, Recycling, and Groundwater Recharge. Water Tomorrow Annual Report to the California Legislature. February 2019.

[3] Metropolitan Water District of Southern California. 2018. 2018 Review of Conveyance and Distribution Capital Projects Avoided or Deferred Regionally Due to Demand Management Programs. Office of the Chief Financial Officer. February 2018.

functional rate categories where impacts are realized and in the proper relative share, to be used from 2021 forward.

The specific task of functionalization within Metropolitan's cost of service ratemaking assigns costs to functional rate categories using a logical nexus between actual costs and impacts to establish a reasonable relative share, for the purpose of setting rates into the future. In this report, WaterDM presents a recommended avoided cost methodology for updating Metropolitan's functional assignment of demand management program costs. The approach of avoided cost analysis recognizes that in the absence of demand management more water must be delivered, and Metropolitan's system would necessarily need to be expanded in certain areas or across specific impacted functional categories to meet that additional demand. The approach of avoided cost analysis is a widely accepted method for evaluating the impacts of demand management on rates in the water industry and also the most applicable given Metropolitan's history of functional assignment.

The recommended approach starts with Metropolitan's functional categories which each represent a specific area of the system potentially impacted by demand management. Using the methods of avoided cost analysis, the approach recognizes that in the absence of demand management more water must be delivered, and Metropolitan's system would necessarily need to be expanded across specific impacted functional categories. Because the ratemaking process has the forward-looking goal of formulating the rates to be charged in the coming years, the amount of money budgeted to be spent in the future for each category offers forward-looking data points that can be used in comparison with each other to determine the relative share of impact.

During Metropolitan's biennial budget process, the revenue requirement – which is the amount budgeted to be spent over each of the two upcoming years – is determined for each functional category in the Metropolitan system. The relative share of revenue requirements for the upcoming two-year period *to each other* provides a reasonable and updatable way to estimate of the relative share of incremental avoided costs – the impacts of demand management – across Metropolitan's system. The relative share will be different for each biennial budget cycle. These budgeted revenue requirements are prepared independently and provide an objective measure of system costs (supply, transportation, etc.) and are the best available data to estimate the relative share of Metropolitan's marginal cost on which the functional assignment for demand management is based. Over time these revenue requirements represent the changing realities of providing water service and in the future the results of the functional assignment using the revenue requirements will change to reflect Metropolitan's changing system.

With this understanding, WaterDM concluded that a reasonable and appropriate method to estimate the relative share of impact of demand management into the foreseeable future for the purpose of setting rates is to calculate the relative share of each impacted category's budgeted revenue requirements. WaterDM's recommendation for Metropolitan is:

> *To estimate the relative share of impact of demand management into the foreseeable future for the purpose of setting rates, WaterDM recommends an incremental cost approach to estimate the relative share of avoided marginal costs using Metropolitan's categorized budgeted revenue requirements.*

Specifically, WaterDM prepared a two step process that provides Metropolitan a clear procedure it can use during its biennial rate cycle to reasonably estimate the relative share of impact of demand management. The two step functional assignment process is outlined in Figure 1.

In the first step, Metropolitan must determine which functional rate categories are impacted by demand management. In the second step, Metropolitan calculates the relative share of impact using its budgeted revenue requirements for each identified functional rate category. The functional assignment calculation is made by dividing each impacted category revenue requirement by the total of all impacted categories to produce the percent of the total for each identified functional category. It is recommended that the relative share is calculated using an average of the two budget years within the biennial cycle. The specific step by step process for the calculation of the relative share of Metropolitan's budgeted revenue requirements is shown in Figure 2.

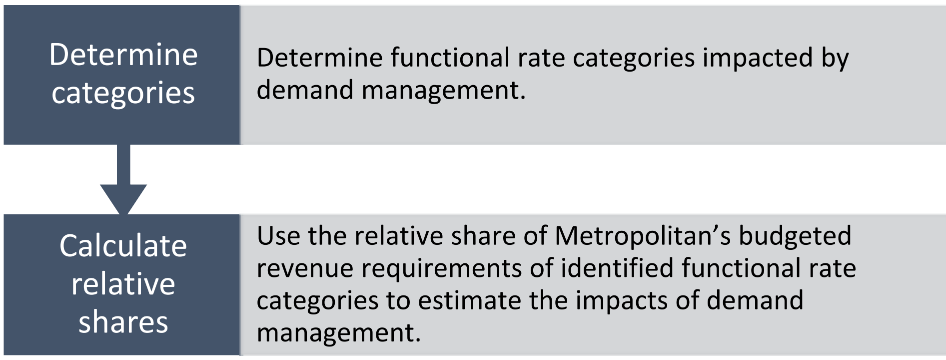

Figure 1: Recommended approach to functionalization of demand management

The resulting percentages reasonably estimate the relative share of impact if, in the absence of demand management, Metropolitan were required to deliver more water and thus incur more expenditures in each of these categories and can be used in the cost of service ratemaking process.

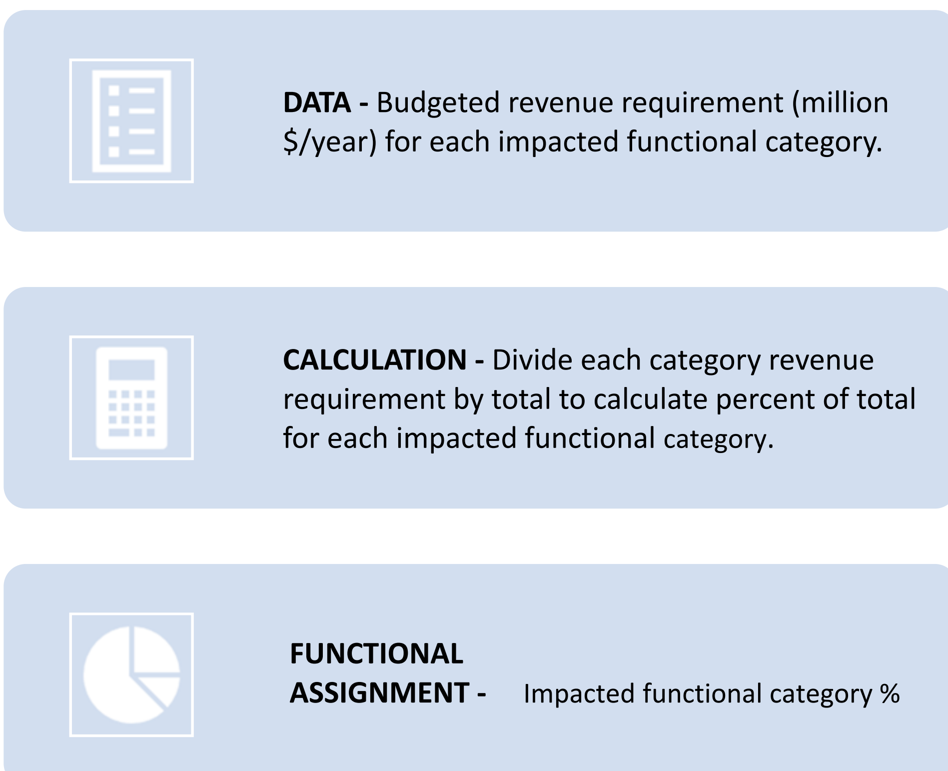

Figure 2: Calculation of relative shares for functional assignment of demand management

The method is transparent, it uses objective input data, and it is updatable into the future. The input data - Metropolitan's budgeted revenue requirements - are prepared independently as part of Metropolitan's biennial budget and ratemaking process.

The approach also includes a regular opportunity where categories can be included or excluded in the functional assignment based upon changing circumstances. Significantly, the approach meets all the goals of the project.

This report reviews the history and importance of demand management for Metropolitan and how the costs for implementation of demand management have been historically functionally assigned. Section 4 of this report explains the proposed new method and presents a hypothetical example to show how Metropolitan can implement the approach for functional assignment of demand management revenue requirements as part of the biennial cost of service process.

2. Water Service and Demand Management

"Water management is multidimensional."[4]

"As urban societies strive for genuine sustainability, it is essential to recognize realistically what wise demand management requires and avoids." – Gilbert F. White[5]

2.1 Functional Categories

The provision of reliable water service is a complex task requiring utilities to engage in a wide range of activities, each of which is essential, for the delivery of the service to the customer. For the purposes of ratemaking, these activities may be divided into specific functional categories so that costs can be accounted for and revenue collected to fund these components.

For Metropolitan, providing reliable water service includes these functional categories:

- Supply
- Conveyance and aqueduct
- Storage
- Treatment
- Distribution
- Demand management
- Hydroelectric
- Administrative and General

Each of these functional categories is a part of Metropolitan's provision of reliable water service to its member agencies. Each functional category carries with it annual revenue requirements (e.g. real annual costs) that Metropolitan spends to provide reliable water service. These revenue requirements are recovered through rates and charges paid by Metropolitan's member agencies. These rates and charges are regularly reviewed and developed through Metropolitan's cost of service ratemaking process.

This report focuses on a single aspect of water service, Metropolitan's demand management programs, and a single aspect of Metropolitan's four step cost of service process – Step 2 Functionalize Costs. This report proposes a new approach Metropolitan can use to allocate the real costs for its demand management programs to the appropriate cost components, in the appropriate relative share.

2.2 Demand Management: An Essential Component of Reliable Water Service

Managing the demand for water through measures such as rates, metering, and customer side efficiency programs is standard utility practice. Public water providers across the US (and around the globe) implement a wide variety of demand management programs. These programs are implemented because demand management programs are generally recognized at the least-cost management option.

[4] Viessman, W. and M.J. Hammer. 1993. Water Supply and Pollution Control, 5th Edition, HarperCollins College Publishers, NY.

[5] Bauman, D.D., J.J. Boland, W.M. Hanemann. With Foreword by G.F. White. 1998. *Urban Water Demand Management Planning.* McGraw-Hill, Inc. New York.

This history and development of urban water demand management parallels the growth and development of water supply systems themselves. Unconstrained water use in the public supply context was known to be unsustainable in ancient times as it is today and thus water providers through history have managed demand along with supply to ensure the ability to provide their service. The most fundamental concepts of water demand management include flow regulation, measurement, and pricing. These components of water demand management have been employed since the earliest days of public water supply.

The physical concept of managing demand by regulating flow capacity with pipes, connections, and fixtures of different diameter is a foundational demand management principle practiced in all public water systems. The Romans understood that the provision of public water supply involved not just bringing the water to the city, but also the management of the demand for the water. Two-thousand years ago, Roman engineer Frontinus carefully described the provision of public water supply to include the management of demands through the proper sizing of pipes and plumbing connections and fixtures and the complimentary concept of assessing fees based on flow capacity and volumetric use.[6]

Ancient Romans and modern economists understand volumetric pricing to be another foundational demand management practice. Utility economists have always recognized "demand-control" as one of the single most important functions of utility rates because it is the function that is "demand-inhibiting" and designed "to restrict or influence demand".[7] The combination of flow regulation and water pricing are fundamental forms of demand management that have been practiced world-wide since the very beginning of public supply.

Early demand management approaches and technologies developed out of necessity in the United States when from 1830 – 1920 public water service expanded to cities and towns across the country. The water closet (e.g. toilet) gained wide acceptance in US during the 1840s and 1850s and the growing installation of fixtures like baths, sinks, and showers contributed to an increase in per capita usage.[8]

During this time metering water usage became a powerful management tool in administering the water supply in public systems. Between 1870 and 1910 more than 400 patents were issued on liquid meters.[9] Meters were installed for two primary purposes: revenue and demand management. "Ostensibly employed as a way to set rates, the use of water meters was equally important as a means to check waste and to anticipate future expansions of the system."[10] For example, an 1860 investigation in Boston revealed excessive water use in two popular downtown hotels and over the bitter protest of the managers, water meters were installed so that the hotels could pay for their actual usage.[11]

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[6] Frontinus, Sextus Julius. The Stratagems and the Aqueducts of Rome, with an English Translation. New York: G.P. Putnam's Sons, 1925.
[7] Bonbright, J.C. A.L. Danielsen, and D.R. Kamerschen. 1988. *Principles of Public Utility Rates. Second Ed.,* Public Utilities Reports Inc., Arlington, VA.
[8] Blake, N.M. 1956. Water for the Cities: A History of the Urban Water Supply Problem in the United States. Syracuse: Syracuse University Press.
[9] Crainic, Monica S. 2012. "A Short History of Residential Water Meters Part 1 Mechanical Meters With Moving Parts". Proc. Installation for Buildings and Ambiental Comfort Conference XXI- edition. Timisoara, Romania. April 2012.
[10] Melosi, M.V. 2010. "Full Circle? Public Responsibility and the Privatization of Water Supplies in the United States." In Pragmatic Sustainability: Theoretical and Practical Tools, edited by Steven A. Moore, 1st. ed. Milton Park, Abingdon, Oxon; New York; Routledge.
[11] Blake, N.M. 1956.

Seventy years later in 1936, one of the first articles on water meter sizing to be published in the Journal of the American Water Works Association, noted that meters are used for managing demand as well as collecting revenue, "One of the prime purposes of meterization of the public water supply is to eliminate waste, not only from carelessness, but by leaky fixtures and plumbing."[12] Managing water demand via flow regulation and pricing has long been recognized as essential to providing reliable public water service.

The concept of managing demand through systematically reduced usage at the customer level has become a core utility function over the past 50 years as the process of urbanization and development lead to the conclusion that many of the "cheapest sites for water storage and conveyance have been developed."[13] Drought in the 1970s forced urban water managers in California to implement mandatory restrictions on outdoor irrigation and to begin other demand management programs focused on end user water conservation and efficiency.

Today there are approximately 55,000 water utilities in the US and all 55,000 practice some form of demand management. All modern water systems manage demand through:

- Water loss control practices on the distribution system to prevent leakage
- Requirement for metered customer service
- Implementation of consumption-based rates and fees
- When necessary the implementation of voluntary and/or mandatory demand restrictions during drought or other supply emergency

Thousands of wholesale and retail utilities across North America (including Metropolitan and all its member agencies) also manage demand using:

- End user demand management programs such as education, information, incentives, rebates, leak detection, etc.
- Peak management and load shifting (less common)

Demand management programs in the modern utility context include everything from utility water loss control to non-promotional water rates to metering and regular billing to incentive programs designed to reduce consumption at the end user level. The specific components of demand management programs may vary across water providers, but the underlying rationale for program implementation is usually similar – demand management represents the lowest cost option for providing reliable water service into the future.

[12] Niemeyer, Howard W. "METER SIZING." Journal (American Water Works Association) 28, no. 7 (1936): 882-84. http://www.jstor.org/stable/41226592
[13] Bauman, D.D., J.J. Boland, W.M. Hanemann. 1998.

The impact of water efficiency programs and reductions in water use are well documented from reduced toilet flush and clothes washer volumes at the end user level[14] all the way to documented reduced public supply withdrawals nationally.[15]

Thus, the provision of reliable public water service has always required the management of both supply and demand. As urban water management has acquired a scientific basis in the United States and has learned to take advantage of technology like meters, it has also "transcended its former supply-only orientation and now encompasses all aspects of supply and demand" including technology, institutions, laws, regulations, incentive structure and financial practices.[16] Put succinctly: "The water supply problem is one of balancing supply and demand."[17]

[14] DeOreo, W.B., P. Mayer, J. Kiefer, and B. Dziegielewski. 2016. Residential End Uses of Water, Version 2. Water Research Foundation. Denver, CO.
[15] Dieter, C.A., Maupin, M.A., Caldwell, R.R., Harris, M.A., Ivahnenko, T.I., Lovelace, J.K., Barber, N.L., and Linsey, K.S., 2018, Estimated use of water in the United States in 2015: U.S. Geological Survey Circular 1441, 65 p., https://doi.org/10.3133/cir1441.
[16] Bauman, D.D., J.J. Boland, W.M. Hanemann. 1998. *Urban Water Demand Management Planning.* McGraw-Hill, Inc. New York.
[17] Viessman, W. and M.J. Hammer. 1993.

3. Metropolitan Demand Management

Metropolitan currently budgets for and spends approximately $90 - $100 million per year on programs to reduce regional water demand and to incentivize the development of local recycled and groundwater resources, collectively known as "demand management". For Metropolitan, the functional category of "demand management" includes these major components:

- Water conservation program
- Local Resources Program
- Future Supply Actions Program

Whenever Metropolitan's demand management program or category is referenced in this report, it refers to this suite of programs.

Metropolitan's demand management programs are implemented at the local level and its regional approaches have been proven effective and benefit all water users. This is consistent with the practices of water agencies currently and through history as discussed in chapter 2. Metropolitan implements demand management for various reasons and avoiding future costs is the particular reason analyzed for the purpose of ratemaking. Demand management programs help to increase reliability and reduce the region's reliance on imported water supplies to meet future demands. They decrease the burden on Metropolitan's infrastructure, reduce system costs, and free up conveyance capacity to the benefit of all system users.[18] Demand management programs also advance the legislative intent that Metropolitan increase "sustainable, environmentally sound and cost-effective water conservation, recycling, and groundwater storage and replenishment measures."[19]

3.1 For Metropolitan, Demand Management is Preferred and Legislated

3.1.1 1996 IRP and the Preferred Resource Mix

Metropolitan increased its emphasis on demand management programs after the devastating drought of the early 1990's. Metropolitan's 1996 Integrated Resources Plan identified the Preferred Resource Mix as the resource plan that achieved the region's reliability goal of providing the full capability to meet all retail-level demands during foreseeable hydrologic events, represented the least-cost sustainable resources plan, met the region's water quality objectives, was balanced and diversified and minimized risks, and was flexible, allowing for adjustments should future conditions change.

The Preferred Resource Mix included locally developed water supplies and conservation and recognized that regional participation was important to achieve their development. Additional imported supplies frequently have relatively lower development costs but can create a large cost commitment for regional infrastructure to transport and store those imported supplies. On the other hand, local projects, like those designed to recycle water or increase groundwater production, may have higher development costs but require little or no additional infrastructure to distribute water supplies to customers. This trade-off between relatively lower-cost imported supplies requiring large regional infrastructure investments and relatively higher-cost local supply development requiring less additional infrastructure

[18] Metropolitan Water District of Southern California. 2019. Achievements in Conservation, Recycling, and Groundwater Recharge. Water Tomorrow Annual Report to the California Legislature. February 2019.
[19] Senate Bill 60

was an important consideration in the development of the Preferred Resource Mix. A strategy of aggressively investing in importing water would lead to higher costs for the region because of the larger investments required in infrastructure.

Metropolitan's 1996 Integrated Resource Plan included an analysis of future demand scenarios and their effect on infrastructure requirements. A comparison of capital infrastructure costs with and without demand management programs showed a difference of around $2 billion through 2020. In other words, the ability to meet demand through demand management programs resulted in what was back in 1996 an anticipated $2 billion in capital cost savings. A sensitivity analysis further showed that a 5% increase or decrease in demand had a correlative effect on when Metropolitan would need to incur capital infrastructure costs.[20]

Since 1996, Metropolitan has successfully avoided the assets identified in the IRP. For example, Metropolitan has been able to avoid or defer the need to build additional transportation infrastructure such as the Central Pool Augmentation Project tunnel and pipeline, completion of San Diego Pipeline No. 6, the West Valley Interconnection, and the completion of the SWP East Branch expansion. Overall, the decrease in regional demands from implementing demand management is estimated to have avoided or deferred the need for projects between four and twenty-five years at a capital infrastructure savings of approximately $2.9 billion in 2017 dollars, even more than was forecast in 1996.[21]

Since 1996, the Integrated Resources Plan has been updated three times, in 2004, 2010, and 2015, reaffirming long-term sustainability of the region's water supply through implementation of conservation and local resource development. Demand management remains an important part of Metropolitan's resource management efforts.

Demand management costs also support the Strategic Plan Policy Principles approved by Metropolitan's Board on December 14, 1999. These principles represent the Board's vision that Metropolitan is a regional provider of wholesale water services.

3.1.2 Clear Legislative Directive

Metropolitan also pursues conservation and local water resource development because it has been uniquely directed to do so by the California State Legislature. In 1999, then Governor Davis signed SB 60 (Hayden) into law. SB 60 amended the Metropolitan Water District Act to direct Metropolitan to increase conservation and local resource development. No other water utility in California, public or private, has been specifically identified by the state Legislature and directed to pursue water conservation and local water resource development.

Metropolitan's demand management programs also support the region's compliance with the requirements of SB X7-7. In 2009, the state Legislature passed SB X7-7, which was enacted to reduce urban per capita water use by 20 percent by December 31, 2020. Urban retail water suppliers are not eligible for state water grants or loans unless they comply with the water conservation requirements of

[20] Metropolitan Water District of Southern California. 1996 Integrated Water Resources Plan Vols. 1, 2, and 3. Metropolitan Water District of Southern California, Los Angeles, CA.

[21] Metropolitan Water District of Southern California. 2018. 2018 Review of Conveyance and Distribution Capital Projects Avoided or Deferred Regionally Due to Demand Management Programs. Office of the Chief Financial Officer. February 2018.

the legislation. Demand management programs help the region achieve urban per capita water use reductions.

3.2 Real Costs

Metropolitan currently budgets for and spends approximately $90 - $100 million per year on programs to reduce regional water demand and to incentivize the development of local recycled and groundwater resources. Water conservation, incentives for local recycling and groundwater recharge programs, and the comparatively small Future Supply Actions Program together comprise the demand management line item in Metropolitan's annual budget.

The $90 - $100 million Metropolitan currently spends on these programs goes directly to fund programs to reduce end user consumptions such as turf conversion rebates and to incentivize the development of local groundwater and recycled water. In the LRP program, Metropolitan enters into long-term (15 – 25 year) contracts with member agencies and retail agencies to provide incentives for approved local recycled and groundwater production.

These revenue requirements and expenditures are documented in Metropolitan's biennial cost of service reports[22] as well as the annual Water Tomorrow report to the State Legislature.[23]

3.3 Documented Impacts

Metropolitan annually evaluates and documents the impacts of its water demand management programs. The most recent 2019 Water Tomorrow annual report submitted to the State Legislature documented 426,000 AF of conservation savings and LRP production in FY2017/18, as shown in Table 1.

Table 1: Demand management program impacts for FY2017/18[24]

Demand Management Program	Category	Annual Savings/Production in FY2017/18 (AF)
Conservation	Water saved from Metropolitan Conservation Credits Program	223,000
LRP - Recycled Water	Water produced from projects receiving Metropolitan incentives	165,000
LRP - Groundwater Recovery	Water produced from projects receiving Metropolitan incentives	48,000
Total	**Conservation + LRP**	**426,000**

[22] Metropolitan Water District of Southern California. 2018. Fiscal Years 2018/19 and 2019/20 Cost of Service Report For Proposed Water Rates and Charges. February 2018.
[23] Metropolitan Water District of Southern California. 2019. Achievements in Conservation, Recycling, and Groundwater Recharge. Water Tomorrow Annual Report to the California Legislature. February 2019.
[24] IBID

The 2019 Water Tomorrow report concluded that since 1990, Metropolitan's demand management programs have produced cumulative savings and LRP production of more than 5.4 million AF.[25] This is a substantial volume of water that Metropolitan has not had to acquire, move, store, or treat. The overall cost-effectiveness of Metropolitan's demand management programs and its role in the preferred resources mix was established through recent analysis when in 2016 and 2018, Metropolitan documented approximately $3.0 billion in avoided costs related to transportation infrastructure due to its demand management efforts.[26]

Demand management impacts on infrastructure were also found during the early implementation of the 1996 IRP. The US Environmental Protection Agency (EPA) reported on the impact of demand management on infrastructure costs for water agencies across the US. The report recognized the impact of Metropolitan's demand management efforts on infrastructure in 2002 stating, "Conservation efforts have considerably reduced the cost estimate of Metropolitan's capital-improvement."[27]

3.4 Annual Costs of Demand Management Recovered Through Rates

As noted earlier, Metropolitan currently budgets for and spends approximately $90 - $100 million per year on programs to reduce regional water demand and to incentivize the development of local recycled and groundwater resources. Metropolitan's annual expenditures for demand management programs are a preferred and legislated expense for the provision of water service across the region and Metropolitan, like its peers, recovers the costs of implementing demand management through its water rates and changes.

Metropolitan delivers water across a 5,200 square mile service area and owns and operates an interconnected regional conveyance and distribution system that can deliver water from both the State Water Project and Colorado River Aqueduct to every member agency. Metropolitan's flexible, interconnected system benefits all member agencies.

Accordingly, Metropolitan considers the impact of demand management in aggregate across the entire wholesale water system and recovers the annual costs of these programs though its rate structure. Conservation and resource development take place at the local level, and regional approaches have proven to be effective and benefit all Metropolitan member agencies. These programs help to increase reliability and reduce the region's reliance on imported water supplies to meet future demands. They decrease the burden on Metropolitan's infrastructure, reduce system costs, and free up conveyance capacity to the benefit of all system users. The programs advance the legislative intent that Metropolitan increase "sustainable, environmentally sound and cost-effective water conservation, recycling, and groundwater storage and replenishment measures."[28]

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[25] Metropolitan Water District of Southern California. 2019. Achievements in Conservation, Recycling, and Groundwater Recharge. Water Tomorrow Annual Report to the California Legislature. February 2019.

[26] Metropolitan Water District of Southern California. 2018. 2018 Review of Conveyance and Distribution Capital Projects Avoided or Deferred Regionally Due to Demand Management Programs. Office of the Chief Financial Officer. February 2018.

[27] U.S. EPA (2002) Cases in Water Conservation: How Efficiency Programs Help Water Utilities Save Water and Avoid Costs. Environmental Protection Agency. Washington, D.C.

[28] Senate Bill 60

3.4.1 Demand Management Within the Utility Budget

Costs to implement public water utility demand management programs are usually included as a component of an agency's operating expenses budget. Operating expenses include all costs applicable to the furnishing of water utility services, and this includes demand management.

> "*Operation expenses* for a water utility include…customer account expenses. Customer account expense also include customer service costs related to supervision, labor, and providing customer service and informational activities to encourage the safe and efficient use of a utility's service, to promote conservation of water, and to assist customer in answering specific questions regarding the proper and economical use of a utility's service and of customer's equipment that uses the service." (Bui, A.T., editor. 2012. *Financial Management for Water Utilities: Principles of Finance, Accounting, and Management Controls*. American Water Works Association. Denver, CO.)

Wholesale and retail water utilities across the US from New York to California include demand management activities as operating expenses which are as standard practice recovered through user charges paid by all customers. These particular operating expenses are incurred annually to reduce demand and avoid future capital and other costs. Examples of water utilities that include demand management as an operating expense recovered through user charges include: New York City Department of Environmental Protection, San Diego County Water Authority, Los Angeles Department of Water and Power, East Bay Municipal Utility District, and many more.

Including demand management as an operating expense means that the revenue requirements can be functionally assigned using applicable approaches applied to other types of operating expenses. Because a major impact of demand management is cost savings from avoiding capital and operation and maintenance costs associated with not providing more capacity, avoided cost analysis provides an appropriate approach and establishes the required logical nexus for the functional assignment of these costs.

4. Functional Assignment of Demand Management Costs

4.1 Within Metropolitan's Cost of Service Rate Making Process

The purpose of the functional assignment task within the cost of service ratemaking process is to establish the assignment of the revenue requirement for demand management to the appropriate cost components, in the appropriate relative share. The central focus of this project was to prepare a reasonable and reproducible method for establishing these relative shares.

Metropolitan follows a four-step cost of service ratemaking process that includes the following steps:

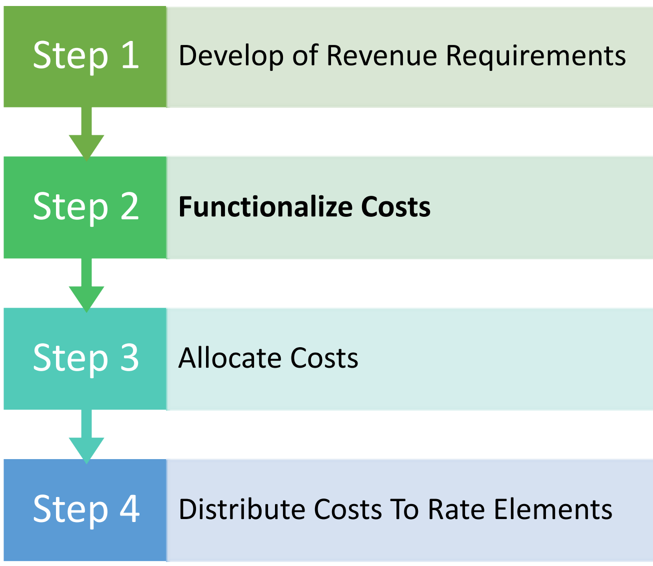

Figure 3: Metropolitan's four step cost of services process

The focus of this project is limited to the second step of cost functionalization. The allocation of the revenue requirement for demand management to the appropriate cost components falls squarely within step 2 of this process.

Within Metropolitan's functional categories, there are six possible areas where demand management could hypothetically be functionally assigned as shown in Table 2.

Table 2: Metropolitan categories available for demand management functional assignment

Functional Category	**% of Functionalized Dollars**
Supply	**?**
Conveyance and Aqueduct	**?**
Storage	**?**
Distribution	**?**
Treatment	**?**
Hydroelectric	**?**
Total	**100%**

4.2 Metropolitan's History of Functional Assignment for Demand Management

Metropolitan's history of functional assignment for demand management (Figure 4) goes back to the 1996 IRP which established demand management as a core component of the preferred resources mix and runs through the current project to update the functional assignment methodology. The 1996 IRP forecasted future demand out 25 years to the year 2020 and specifically identified demand management measures to be implemented and infrastructure projects that might be avoided or deferred through the plan implementation.

Soon after the 1996 IRP was completed, Metropolitan unbundled its water rates and through this process demand management was established as a distinct functional cost category and the rate was included in transportation based on identified avoided future infrastructure costs. Metropolitan's Board approved the unbundled rate structure in 2001 and it went into effect in 2003. In 2016 and 2018, Metropolitan retrospectively documented approximately $3.0 billion in avoided transportation infrastructure due to demand management.[29] These avoided and deferred projects are described in Appendix A and include the West Valley Project, the Central Pool Augmentation Tunnel and Pipeline, San Diego Pipeline No. 6, and SWP East Branch expansion completion.

Much has changed over the years since the 1996 IRP was completed. Metropolitan's 2015 IRP Update presents an evolving utility focused on adaptive management and with a different perspective on the future than it had 1996. The 2015 IRP Update makes it clear that "climate change may prove to be the most significant challenge to water supply in Southern California" along with other challenges such as supply uncertainty.[30] In 1996, Metropolitan was just starting down the road of implementing demand management and identified specific infrastructure projects that could be avoided over the next 25 years. By 2015, Metropolitan has documented approximately 5.4 million AF of water savings and local production from its demand management programs[31] and billions in avoided transportation infrastructure. Going forward, Metropolitan's additional future demands are expected to be met in part by additional demand management while Metropolitan continues to avoid and defer infrastructure investment as a result.

As the 1996 IRP forecast window ends in 2020, it is an appropriate time to update the functional assignment of demand management. WaterDM's project to update the functional assignment approach was initiated in 2018.

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[29] Metropolitan Water District of Southern California. 2018. 2018 Review of Conveyance and Distribution Capital Projects Avoided or Deferred Regionally Due to Demand Management Programs. Office of the Chief Financial Officer. February 2018.

[30] Metropolitan Water District of Southern California. 2016. Integrated Water Resources Plan 2015 Update. Report No. 1518. January 2016.

[31] Metropolitan Water District of Southern California. 2019. Achievements in Conservation, Recycling, and Groundwater Recharge. Water Tomorrow Annual Report to the California Legislature. February 2019.

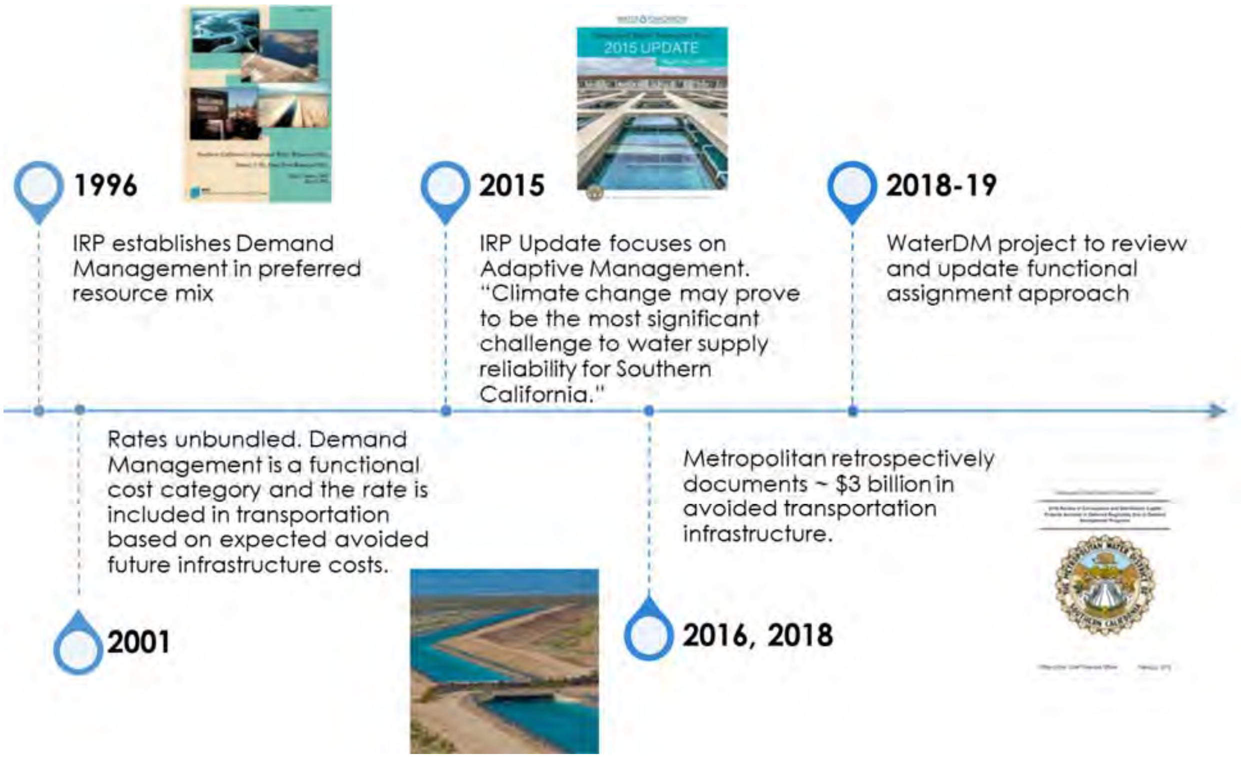

Figure 4: History of demand management functional assignment

4.3 Functional Assignment Methods and Demand Management

The primary goal of the WaterDM project was to prepare a clear, objective, repeatable method Metropolitan can use regularly and update in the cost of service ratemaking process and which conforms with industry understanding of the impacts of demand management.

The functional assignment process can be accomplished through several different approaches, but the avoided cost approach is most frequently associated with water reuse and conservation which specifically negate or avoid the need for future supply and capacity. The avoided cost approach focuses on the capital and O&M costs associated with "not providing" one more unit of capacity, exactly the function demand management accomplish. The American Water Works Association Manual of Practice, M1 further discusses use of "Avoided cost approach" as one of four accepted approaches to marginal cost allocation specifically useful for programs associated with the delay or elimination of supply and infrastructure expansion.[32]

4.3.1 Avoided Costs, Marginal Costs, and Incremental Costs

The economic benefits of deferring or downsizing water infrastructure and supply projects are frequently referred to as *avoided costs.* Avoided costs are expenses that Metropolitan and thus the member agencies would incur annually, if water were not saved and if LRP supplies were not produced. Avoided costs are essentially the marginal costs that Metropolitan could have incurred to produce and deliver the water that was instead conserved and recycled.

[32] AWWA Manual M1, 7th ed., pp. 246-247

An avoided cost is a cost saving, but the savings anticipates future spending.[33] An example of an avoided cost would be spending money for preventative maintenance on a car—such as regular oil changes—to avoid the future cost of replacing an engine. Similarly, Metropolitan's current annual $90 – 100 million demand management expenditures across the Southern California region— has avoided billions that would be associated with providing more water including capital and operations and maintenance costs.[34]

The M1 manual states "Avoided Cost is the marginal cost avoided or saved by choosing one option over another to achieve the same goal."[35] Experts have noted that avoided costs are marginal costs which are synonymous with incremental costs when considering the impacts of demand management. "Marginal cost is synonymous with avoided cost – the cost that would be saved (avoided) by reducing output by a small amount…it is synonymous with incremental cost – the added cost of a small amount of additional output."[36]

4.3.2 Avoided Cost Studies

Four recent published studies from Westminster, CO, Tucson, AZ, Gilbert, AZ, and LADWP utilized avoided cost analysis to evaluate the impact of water efficiency on customer water rates. While these studies differed from Metropolitan's goal to functionalize budgeted expenditures in relative share to the costs avoided, the underlying methodology of employing a marginal cost allocation using an avoided cost approach to establish the impacts of demand management was the same. These four studies show how the water industry uses the analysis of avoided marginal costs to evaluate the impact of conservation programs.

These four recent avoided cost studies evaluated the impact of water efficiency on customer water rates. This study for Metropolitan was undertaken for the purpose of recommending a methodology to be used in ratemaking, an important difference. To assess the impact on customer water rates in LADWP, Colorado, and Arizona, the approach applied in the four studies required the research team to reasonably estimate the total value of the system expansion costs that were avoided by water efficiency. Metropolitan seeks to reasonably estimate the relative share of costs that are avoided by demand management into the future. To do this it is not necessary to estimate the total value of system expansion costs, only the relative share of acquiring, treating, and delivering must be estimated. These differing objectives led WaterDM to develop a separate avoided cost approach for Metropolitan than was implemented in these four earlier studies, using forward-looking data to estimate the relative share of impact.

Westminster, CO

Westminster, Colorado is a suburb of Denver with a population of about 112,000 people. To examine the impact of conservation on rates, the City of Westminster evaluated the marginal costs due to the buildout requirements by removing conservation from the equation. The research, conducted in 2013

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[33] Avoided Cost, Opportunity Cost, Savings - How to Legitimize Avoided Cost and Opportunity in the Business Case. Building the Business Case website. https://www.business-case-analysis.com/avoided-cost.html

[34] Metropolitan Water District of Southern California. 2018. 2018 Review of Conveyance and Distribution Capital Projects Avoided or Deferred Regionally Due to Demand Management Programs. Office of the Chief Financial Officer. February 2018.

[35] AWWA Manual M1, 7th ed., p. 188.

[36] Bauman, D.D., J.J. Boland, W.M. Hanemann with Foreword by G.F. White. 1998. Urban Water Demand Management Planning. McGraw-Hill, Inc. New York.

by Westminster staff and WaterDM, found that reduced water use in Westminster since 1980 has resulted in approximately $590 million in capital and operating savings by avoiding expenses related to water resources, water treatment, wastewater treatment, debt service, and operating expenses. The study found that increased water efficiency has saved Westminster residents and businesses 80% in tap fees and 91% in rates compared to what they would have been in the absence of demand reductions. This avoided cost analysis was published by both the Alliance for Water Efficiency (November 2013) and the American Water Works Association Journal (April 2014).[37]

LADWP

Lower Water Bills: The City of Los Angeles Shows How Water Conservation and Efficient Water Rates Produce Affordable and Sustainable Use (2018) is an avoided cost analysis conducted by Dr. Thomas Chesnutt of A&N Technical Services for the Los Angeles Department of Water and Power (LADWP) and published in 2018 by the California Water Efficiency Partnership and the Alliance for Water Efficiency. This study set out to answer the question, "What would have been the economic impact on bills in the City of Los Angeles if none of these activities occurred?"- that is, if conservation had never happened.

The authors explain that the use of marginal cost of service is a progressive methodology (Boiteux, 1949; Kahn, 1991) in water planning and rate design in "contra-distinction to the sole use of average embedded methods." They also note that both avoided cost and average embedded methods are allowed under American rate design standards (AWWA 2017).[38]

The analysis found LADWP's summed avoided water supply costs (resources, conveyance, and treatment) amounted to $11 billion (2016 US$) and this is a low estimate because the LA wastewater was not considered in this study. Increased water efficiency resulting in avoided expenditures reduced customer water bills in Los Angeles by 26.7%, improved the long-term water sustainability, and constituted a "meaningful sustainability payoff from two and a half decades of water conservation efforts and efficient water rates."

Tucson and Gilbert, AZ

In 2017, the Alliance for Water Efficiency published two avoided cost studies prepared for Tucson and Gilbert Arizona by WaterDM. Both Arizona studies used the same approach as the Westminster and LADWP studies, employing a marginal cost of service analysis which first assessed water savings and the resulting avoided expenditures, and then assessed the financial impacts of reduced demand on customer rates.[39]

The Tucson study included avoided cost savings from both water and wastewater infrastructure. The avoided Tucson water infrastructure included the $140 million Avra Valley Transmission Main Capital Improvement Project that has been postponed indefinitely (and may never be built) because conservation resulted in reductions in annual and peak daily demands. Conveyance projects represented

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[37] Feinglas, S., C. Gray, and P. Mayer. 2014 Conservation efforts limit rate increases for Colorado utility. Journal of the American Water Works Association, April 2014, 106:4.

[38] Chesnutt T., D. Pekelney, and J. Spacht. 2018. Lower Water Bills: The City of Los Angeles Shows How Water Conservation and Efficient Water Rates Produce Affordable and Sustainable Use. California Water Efficiency Partnership. Sacramento, CA and Alliance for Water Efficiency. Chicago, IL.

[39] Mayer, P. 2017 Water Conservation Keeps Rates Low in Gilbert, Arizona. Alliance for Water Efficiency. Chicago, IL.;Mayer, P. 2017 Water Conservation Keeps Rates Low in Tucson, Arizona. Alliance for Water Efficiency. Chicago, IL.

13.5% of the total avoided costs for Tucson. The study concluded that Tucson water and wastewater rates were at least 13.3% lower than they would have been if Tucson residents had not decreased per capita water use and lowered overall demand.

Gilbert, Arizona is one of the fastest growing communities in America starting with about 2,000 residents in 1990 and expanding to 220,000 in 2009. Gilbert's primary source of drinking water is a limited surface water supplied to two water treatment plants by an extensive canal network from the Salt River Project (SRP) and the Central Arizona Project (CAP). Gilbert's utility-sponsored water conservation program was formally launched in 2001 and is focused on community outreach campaigns and a tiered rate structure. Per capita demands were also reduced by policies promoting smaller lot sizes with reduced turf grass area, as well as national plumbing code changes and technology improvements.

The Gilbert avoided cost analysis showed that system development fees and connection charges to new customers were 45% lower than if per capita water demand had not been reduced. The study also found that water and wastewater rates and charges to customers were 5.8% lower than if Gilbert customers had not decreased their per capita water use. Essentially, through conservation Gilbert has avoided the costs of acquiring, delivering and treating additional water supplies that would have been necessary to provide a reliable water supply to a growing population.

4.4 Recommended Functional Assignment Methodology for Demand Management

To prepare a recommended functional assignment approach for demand management which is reasonable, objective, repeatable, and can be readily implemented by Metropolitan's Finance Department staff in the biennial cost of service ratemaking process, Peter Mayer, Principal of WaterDM conducted research and worked closely with Metropolitan staff to understand the ratemaking process and the impacts of demand management.

The approach of avoided cost analysis is the most widely accepted method for evaluating the impacts of demand management on rates in the water industry. It also is the most applicable approach given Metropolitan's history of functional assignment since the early 2000s when rates were unbundled and demand management was included in transportation based on expected avoided future infrastructure costs. As noted earlier, "Marginal cost is synonymous with avoided cost – the cost that would be saved (avoided) by reducing output by a small amount…it is synonymous with incremental cost – the added cost of a small amount of additional output."[40]

Avoided cost analysis recognizes that in the absence of demand management more water must be delivered, and Metropolitan's system would need to be expanded in certain areas or across specific impacted functional categories, as shown earlier in Table 2. The relative share of incremental avoided system expansion costs across the functional categories impacted by demand management forms the logical nexus between costs and impacts required for a reasonable functional assignment. Since 2003 Metropolitan used identified avoided and deferred transportation projects to functionalize demand management costs. Demand management has worked and continues to work and as a result Metropolitan no longer lists avoidable projects in its 2015 IRP Update. Metropolitan's system is large and complex and in the absence of demand management, additional demand could be met in a variety of ways. Rather than speculate about potential avoidable projects and the cost of those projects,

[40] Bauman, D.D., J.J. Boland, W.M. Hanemann with Foreword by G.F. White. 1998. Urban Water Demand Management Planning. McGraw-Hill, Inc. New York.

WaterDM, working with Metropolitan staff, developed an approach to estimate the relative share of avoided future system expansion costs, using the best available data on current system costs.

The recommended approach starts with Metropolitan's functional categories which each represent a specific area of the system potentially impacted by demand management. Using the methods of avoided cost analysis, the approach recognizes that in the absence of demand management more water must be delivered, and Metropolitan's system would necessarily need to be expanded across specific impacted functional categories. The ratemaking process has the forward-looking goal of formulating the rates to be charged in the coming years. The amount of money budgeted to be spent in the future for each category offers objective, forward-looking data points that can be used in comparison with each other to approximate the relative share of incremental system expansion costs. This leads to a reasonable two step approach to assign the relative share of impact of demand management across Metropolitan's functional categories.

The recommended approach uses Metropolitan's best available data for estimating the relative share of system expansion costs (supply, transportation, etc.) into the future. The relative share of revenue requirements for the upcoming two-year period *to each other* provides a reasonable and updatable way to estimate the relative share of incremental avoided costs – the impacts of demand management – across Metropolitan's system. The relative share will be different for each biennial budget cycle.

Metropolitan's budgeted revenue requirements are prepared separately during step 1 of the cost of service process and provide an objective measure of system expansion costs for estimating the relative share of avoided future expansion costs, which then forms the basis for the functional assignment for demand management. As noted, the calculated relative share will be different for each biennial budget cycle and over time these revenue requirements represent the changing realities of providing regional water service across Southern California. When Metropolitan implements this approach in 2021 and into the future, the results of the functional assignment using the revenue requirements will change to reflect Metropolitan's changing system.

WaterDM's recommendation for Metropolitan is:

> *To estimate the relative share of impact of demand management into the foreseeable future for the purpose of setting rates, WaterDM recommends an incremental cost approach to estimate the relative share of avoided marginal costs using Metropolitan's categorized budgeted revenue requirements.*

4.4.1 Two Step Approach for Functional Assignment

Specifically, WaterDM is proposing a two step process that provides Metropolitan a procedure it can use during its biennial rate cycle to simply and reasonably estimate the relative share of impact of demand management.

In the first step, Metropolitan must determine which functional rate categories are impacted by demand management. In the second step, Metropolitan calculates the relative share of impact using its budgeted revenue requirements for each identified functional rate category. The functional assignment calculation is made by dividing each impacted category revenue requirement by the total of all impacted categories to produce the percent of the total for each identified functional category. The resulting percentages reasonably estimate the relative share of impact if, in the absence of demand management, Metropolitan were required to deliver more water and thus incur more expenditures in each of these categories.

WaterDM's recommended two step approach is outlined in Figures 5 and 6. A hypothetical example following the process through is presented in section 4.5. This recommendation was arrived at after extensive research by WaterDM and discussions with Metropolitan staff, and based on Peter Mayer's 25 years of experience working with water utilities on demand management issues.

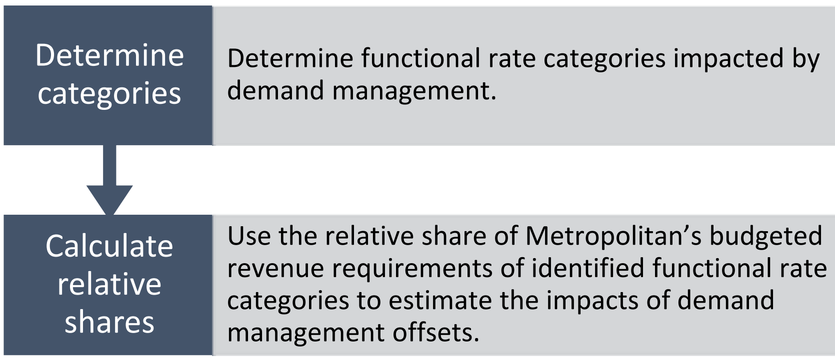

Figure 5: Recommended approach to functionalization of demand management

In the first step, the functional rate categories which could be impacted by demand management are considered. Under Metropolitan's current categorization, there are six possible functional categories that could be impacted.

- Supply
- Conveyance and Aqueduct
- Storage
- Distribution
- Treatment
- Hydroelectric

In the second step, described in more detail in Figure 6, the functional assignment for demand management is calculated as the relative share of Metropolitan's averaged biennial budgeted revenue requirements of identified functional rate categories. In practice, the input data can be formulated by averaging the revenue requirement for each impacted functional category for each year in the biennial cycle. To be broadly inclusive of impact across Metropolitan's system, the budgeted revenue requirements should be inclusive of operations and maintenance, administrative and general, and long-term investments and planning, while excluding revenue requirements of demand management itself.

The functional assignment calculation is made by dividing each impacted category revenue requirement by the total of all impacted categories to produce the percent of the total for each identified functional category. The resulting percentages reasonably estimate the relative share of impact if, in the absence of demand management, Metropolitan were required to deliver more water and thus incur more expenditures in each of these categories.

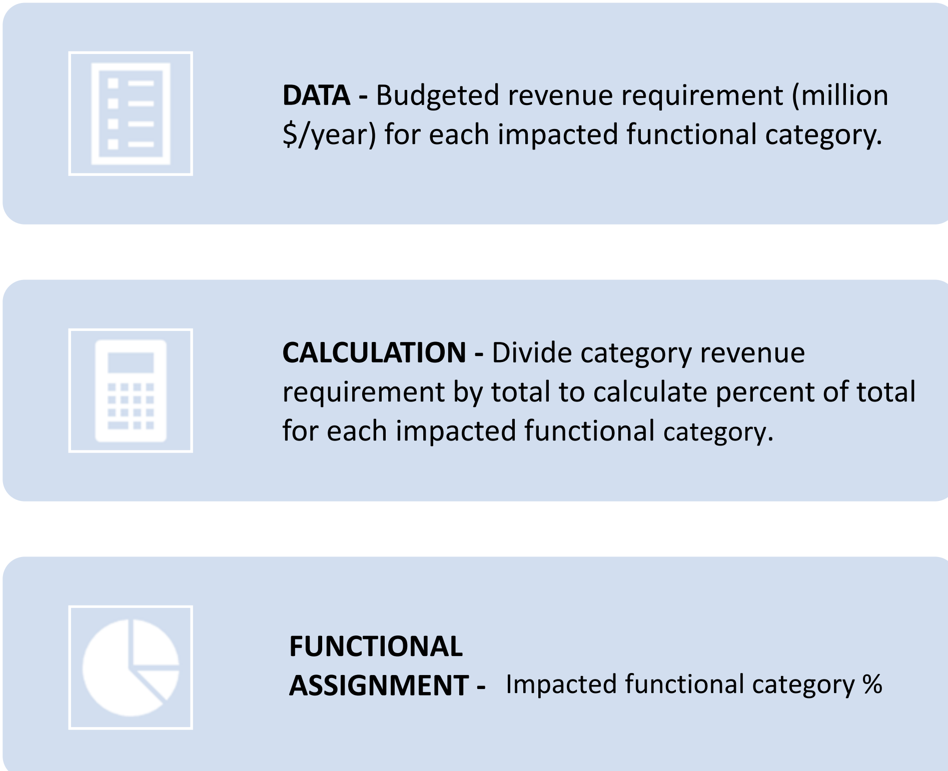

Figure 6: Calculation of relative shares for functional assignment of demand management

4.4.2 Transparent, Objective, Updatable

The advantages of the proposed functional assignment approach for demand management are clear. The method is transparent, it uses objective input data, and it is updatable into the future. The recommended method does not require speculative analysis of avoided projects and costs as would other approaches.

The input data for the recommended approach - Metropolitan's budgeted revenue requirements - are regularly and independently formulated as part of Metropolitan's biennial budget and rate setting process. Over time these revenue requirements represent the changing realities of providing water service and in the future the results of the functional assignment using the revenue requirements will change to reflect Metropolitan's changing system. The relative share will be different for each biennial budget cycle.

The approach also includes a regular opportunity where categories can be included or excluded in the functional assignment based upon changing circumstances.

Significantly, the approach meets all the requirements set out by Metropolitan at the outset of this project.

4.5 Hypothetical Example of Functional Assignment Using the Recommended Method

To illustrate the recommended method for the functional assignment of Metropolitan's demand management revenue requirements, a hypothetical example was prepared. The example steps through the process using hypothetical revenue requirements which are not based on any particular Metropolitan budget.[41]

4.5.1 Example - Determine Functional Rate Categories Impacted by Demand Management

In the first step, the functional rate categories which could be impacted by demand management are considered. Under Metropolitan's current categorization, there are six possible functional categories that could be impacted, and the goal of the functional assignment is to determine the relative share of impact across relevant categories.

Based on discussions with staff and a review of recent planning documents including the 2015 IRP Update, it was determined that four functional categories are currently impacted by demand management and two are not (Table 3). In this analysis, the functional categories where cost savings are realized through demand management are: supply, conveyance and aqueduct, distribution, and storage. The functional categories where cost savings are not realized through demand management are: treatment and hydroelectric generation. A brief discussion of the connection of demand management with each functional category follows.

Table 3: Functional cost categories impacted by demand management

Existing Metropolitan Functional Categories	Currently Impacted by Demand Management?	Comment
Supply	Yes	DM avoids annual purchases and infrastructure costs.
Conveyance and Aqueduct	Yes	DM avoids annual O&M and infrastructure costs.[42]
Distribution	Yes	DM avoids annual O&M and infrastructure costs.
Storage	Yes	DM avoids annual O&M and infrastructure costs.
Treatment	No	Treatment capacity is being downsized. DM does not provide benefit.[43]
Hydroelectric	No	DM does not benefit power generation.

Supply – As a large regional wholesale water provider, reducing consumption through conservation and producing new local supplies both have the impact of reducing Metropolitan's required deliveries from imported water including annual spot-market purchases and long-term contracts. In the absence of demand management, meeting higher demands would require additional supply through annual water

[41] This hypothetical example should not be construed or interpreted as a representation of the actual functional assignment which would take place in 2020 as part of the cost of service ratemaking process, and will yield a different, distinct result.
[42] Appendix A documents Metropolitan's avoided conveyance projects.
[43] Feb. 13, 2017 Engineering and Operation Committee Item 6a, Review of Water Treatment Operating Capacities

transfers and long-term supply investments. Demand management avoids associated O&M and capital expenses.

Conveyance and Aqueduct – For Metropolitan, reducing consumption through conservation and producing new local supplies both have the impact of reducing the need to import water. This in turn reduces conveyance costs and will continue to have this impact into the future. There can be times during a year when Metropolitan may use its full conveyance capacity in different parts of its system. Demand management helps Metropolitan continue to avoid and defer conveyance projects into the future.

Distribution – Metropolitan's Distribution System facilities are distinguished from Conveyance and Aqueduct facilities at the point of connection to the SWP, Lake Mathews (CRA), and other major turnouts along the CRA facilities. Examples include the Rialto Pipeline; the Etiwanda Pipeline; the Foothill Feeder; the Sepulveda Feeder; the Santa Monica Feeder; the Upper, Middle, and Lower Feeders; and the San Diego Pipelines No. 1, No. 2, No. 3, No. 4, and No. 5. There can be times during a year when Metropolitan may use its full distribution system capacity in different parts of its system. Demand management reduces the volume of water Metropolitan must move within the service area and as a result reduces capital, operating, maintenance and overhead costs related to this extensive system.

Storage – For Metropolitan, storage includes emergency, dry year, and regulatory storage. In the absence of demand management, meeting higher demands would require additional storage in all categories. If Metropolitan imported more water, additional regulatory storage would be required. Higher annual demands would necessitate higher volumes of emergency storage and firm demand must be met in a dry year; thus, increased demands would require additional dry year storage. Demand management reduces Metropolitan's storage requirements and associated costs, including the capital financing, operating, maintenance, and overhead costs.

Treatment – While treatment would be an assigned category for many water utilities in America, Metropolitan is in a different situation. Metropolitan is currently in the process of downsizing its treatment capacity and thus demand management does not reduce either the capital or operating and maintenance costs of the treatment system.[44]

Hydroelectric – Metropolitan earns money by producing hydroelectric energy at numerous points in its water system. Water conservation and producing new local supplies could potentially *reduce* hydroelectric generation which is not considered a positive impact. Consequently, this category was excluded from the functional assignment.

With the first step complete, the method then proceeds to the next step with four impacted functional categories: Supply, Conveyance and Aqueduct, Transportation, and Storage.

4.5.2 Example - Functional Assignment Calculation

In the second step, the functional assignment is calculated as the percent share of the annual revenue requirements for the four impacted functional categories. The input data, budgeted revenue requirements, are entered as dollars per year of anticipated spending. In practice these input data can be formulated by averaging the revenue requirement for each impacted functional category for each year in the biennial cycle.

[44] Feb. 13, 2017 Engineering and Operation Committee Item 6a, Review of Water Treatment Operating Capacities

The functional assignment calculation is made by dividing each impacted category revenue requirement by the total of all impacted categories to produce the percent of the total for each identified functional category. The resulting percentages reasonably estimate the relative share of impact if, in the absence of demand management, Metropolitan were required to deliver more water and thus incur more expenditures in each of these categories.

Table 4 presents the hypothetical example calculation using revenue requirements not intended to represent any particular year.

Table 4: Hypothetical example of the functional assignment calculation

Relevant Functional Category	Hypothetical Revenue Requirements[45] (M$/year)	Demand Management Functional Assignment %
Supply	$ 240	**20%**
Conveyance and Aqueduct	$ 600	**51%**
Storage	$ 140	**12%**
Distribution	$ 200	**17%**
Total Category	**$ 1,180**	**100%**

These are the hypothetical functional assignment percentages for demand management across the four relevant categories for the biennial cycle for which the analysis was conducted. The results are presented as a pie chart in Figure 7. The functional assignment percentages represent to Metropolitan, the relative share of avoided marginal costs of not producing and delivering the next increment of supply.

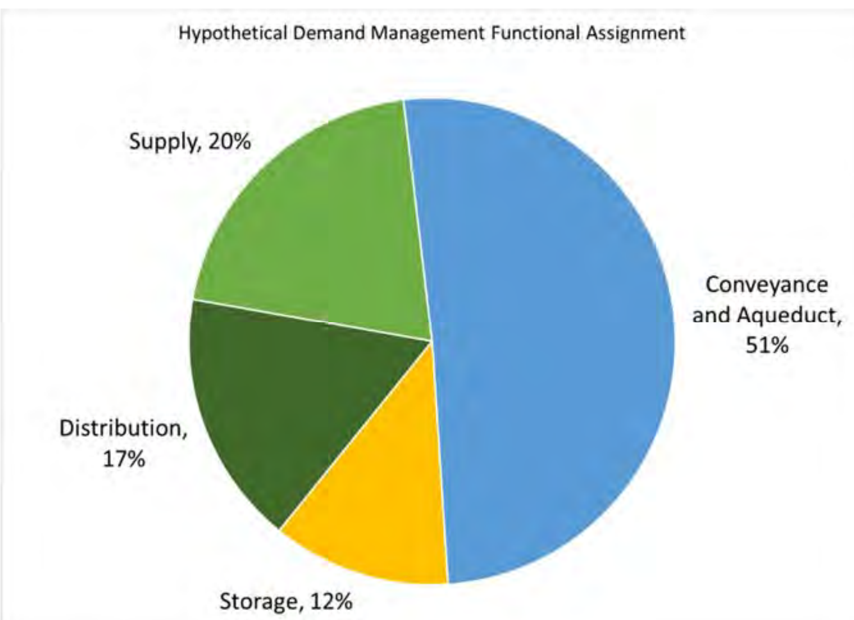

Figure 7: Hypothetical example of demand management functional assignment

[45] Example includes: Operations and maintenance, administrative and general, and long-term investments and planning, while excluding revenue requirements of demand management itself.

As demonstrated through the hypothetical example, the methodology described provides a reasonable, straight-forward approach for Metropolitan to properly apportion the impacts of demand management using consistent and readily available data on a regular basis.

Once calculated, the functional assignment percentages are intended be used in the cost of service ratemaking process so that Metropolitan can recover the revenue requirements of implementing demand management programs. This two step methodology for marginal cost analysis and functional assignment provides a clear, sound, reproducible basis for assigning Metropolitan's annual demand management revenue requirements by the relative share of expenditures they avoid. The method can be implemented by Metropolitan staff or designated consultants on a regular basis or whenever needed to determine the functional assignment of demand management costs as part of the regular cost of service process.

Refinements to this basic methodology presented here are anticipated and expected as Metropolitan implements and re-implements the functional assignment methodology for each cost of service rate cycle. The ratemaking process is iterative and adaptive, and the methodology described in this report should be considered a basic recipe to be used as a general guide and to be refined as needed in the future. For example, when implementing this method in the future Metropolitan has the potential to make adjustments as appropriate such as excluding categories which would not be impacted by demand management.

5. Summary

In this report, WaterDM presented a recommended methodology for updating Metropolitan's functional assignment of demand management program costs. The proposed method is clear, understandable, and updatable so that Metropolitan can use it regularly in the cost of service ratemaking process. Furthermore, the approach is based on careful research and conforms with industry understanding of the impacts of demand management on water utilities.

Metropolitan implements demand management for various reasons and avoiding future costs is the particular reason analyzed for the purpose of ratemaking. Demand management decreases the burden on Metropolitan's infrastructure, reduces system costs, and frees up conveyance capacity to the benefit of all system users. Demand management programs also advance the legislative intent that Metropolitan increase "sustainable, environmentally sound and cost-effective water conservation, recycling, and groundwater storage and replenishment measures."

The specific task of functionalization within Metropolitan's cost of service ratemaking assigns costs to functional rate categories using a logical nexus to establish a reasonable relative share, for the purpose of setting rates into the future. The approach of avoided cost analysis recognizes that in the absence of demand management more water must be delivered, and Metropolitan's system would necessarily need to be expanded in certain areas or across specific impacted functional categories to meet that additional demand.

Metropolitan's functional categories represent the specific potential areas that would need to be expanded, in the absence of demand management. Because the process has the forward-looking goal of formulating the rates to be charged in the coming years, the amount of money budgeted to be spent in the future for each category offers forward-looking data points that could be used to determine the relative share of impact. During Metropolitan's budget process, the revenue requirement – which is the amount budgeted to be spent over the upcoming two years – is determined for each functional category in the Metropolitan system.

WaterDM concluded that the relative share of revenue requirements for the upcoming two years *to each other* provides a reasonable, objective, and updatable way to develop an estimate of the relative share of incremental avoided costs – the impacts of demand management – across Metropolitan's system. The relative share of revenue requirements into the future *to each other* offers the logical nexus required for functional assignment and provides a reasonable, objective, and updatable way to estimate the relative share of incremental avoided costs – the impacts of demand management – across Metropolitan's system. While the final recommended method is relatively simple to implement, the approach is carefully considered to meet the goals of being clear, objective, and updatable.

WaterDM's recommendation for Metropolitan is:

> *To estimate the relative share of impact of demand management into the foreseeable future for the purpose of setting rates, WaterDM recommends an incremental cost approach to estimate the relative share of avoided marginal costs using Metropolitan's categorized budgeted revenue requirements.*

Specifically, WaterDM proposed a two step process that provides Metropolitan a procedure it can use during its biennial rate cycle to reasonably estimate the relative share of impact of demand management.

In the first step, Metropolitan must determine which functional rate categories are impacted by demand management. In the second step, Metropolitan calculates the relative share of impact using its budgeted revenue requirements for each identified functional rate category. The functional assignment calculation is made by dividing each impacted category revenue requirement by the total of all impacted categories to produce the percent of the total for each identified functional category.

The advantages of the proposed functional assignment approach for demand management are clear. The method is transparent, it uses objective input data, and it is updatable into the future. The recommended method does not require speculative analysis of avoided projects and costs as would other approaches. The input data - Metropolitan's budgeted revenue requirements - are regularly formulated as part of Metropolitan's biennial budget and rate setting process. Over time these revenue requirements represent the changing realities of providing water service and in the future the results of the functional assignment using the revenue requirements will change to reflect Metropolitan's changing system. The relative share will be different for each biennial budget cycle.

The approach also includes a regular opportunity where categories can be included or excluded in the functional assignment based upon changing circumstances. For Metropolitan, the approach meets all the goals set out for this project and offers a reasonable, well-considered path forward.

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7. Appendix A.

Metropolitan Avoided Conveyance Project Summaries

West Valley Project

Project Name: West Valley Project

Program No.: 5-0229-21

Original Budget Year: FY 1995/96

Estimated Project Cost (2018 dollars): $532,215,370

Project Description:
The 1996 IRP noted that although ample treatment plant capacity exists to meet demands in the Jensen exclusive area, conveyance capacity constraints might limit the ability to deliver the treated water to the areas of need. For the Jensen exclusive area, a shortfall in conveyance capacity into the West Valley Area was anticipated. Peak demands in the West Valley area on West Valley Feeder No. 2 were estimated to increase from 275 cfs in 1995 to 368 cfs by 2020. These peak demands assumed full implementation of the North Las Posas Basin Conjunctive-Use Project, the first phase of the West Valley Improvement Program. The IRP stated, "even with full implementation of the North Las Posas Conjunctive-Use Project, demands in the West Valley area are anticipated to exceed existing conveyance capacities by the summer of 2007. To satisfy demands through 2020, about 60 cfs of additional conveyance is required." (1996 IRP vol.1, p. 4-27)

The *West Valley Area Study* (March 1993) outlined two general project alternatives to meet projected long-term shortfalls in conveyance capacity. The alternatives investigated included tunnel and pipeline conveyance systems that followed alignments either through the Santa Clara River area or through the San Fernando Valley area. Beyond meeting the water demands of the West Valley service area, these alternatives were proposed to increase the reliability of water deliveries and help support the increased local storage and conjunctive use in the North Las Posas groundwater basin.

By 1996, Metropolitan had revised downward demand projections. The 1996 IRP noted that, "since completion of the *West Valley Area Study* revised demand projections and local supply assumptions incorporating more emphasis on the use of local resources and development of conjunctive-use potential in the North Las Posas groundwater basin have reduced the need for new conveyance capacity to the West Valley area. As described in Section 4, about 60 cfs will be required by 2020." (1996 IRP vol. 2, p.256).

Several phases of construction were proposed, but never completed because they became unnecessary. Phase 2 proposed a West Valley Interconnection to connect West Valley Feeders No. 2 and No. 1 with a 54-inch diameter pipeline. Phase 3 proposed additional West Valley Conveyance to deliver water to Calleguas MWD service area.

Central Pool Augmentation Tunnel and Pipeline and Central Pool Augmentation and Water Quality Project - Study and Land

Project Name: Central Pool Augmentation Tunnel and Pipeline

Program No.: 5-0141-21

Original Budget Year: FY 1996/97

Estimated Project Cost (2018 dollars): $1,432,533,372

Project Name: Central Pool Augmentation and Water Quality Project - Study and Land

Program No.: 5-5560-71

Original Budget Year: FY 1996/97

Estimated Project Cost (2018 dollars): $78,853,665

Project Description:
The 1996 IRP stated:

> "In response to increasing needs for treated water in the Common Pool area, Metropolitan will need to construct new treatment and conveyance facilities. For the purposes of this report, it is proposed the Central Pool Augmentation (CPA) Project be built by 2013 to fulfill that need. However, because this project is very sensitive to percentage changes in demand and is needed over 15 years into the future, it will be re-evaluated regularly. Metropolitan has been studying the CPA Project to deliver additional treated water to the Orange County area, relieving demands on the Diemer plant and allowing it to convey more water into the Common Pool area. The CPA Project conveyance facilities will also strengthen the network of pipelines serving the Central Pool region." (Vol. 2, p. 250)

The proposed but never constructed CPA Project consisted of numerous infrastructure components including:[46]

A) New outlet structure to feed water from Lake Mathews to a new water treatment plant and an 18-mile-long tunnel and pipeline system to deliver water from a new treatment plant to the Orange County section of the Central Pool region.
B) New distribution facilities. From the CPA Project water *treatment* plant in Eagle Valley, water would be transported through a buried pipeline across Temescal Valley westerly along Bedford Canyon to a tunnel under the Santa Ana Mountains. A buried pipeline from the Orange County end of this tunnel will connect the project with the AMP and SCP northwest of the E1 Toro Marine Corps Air Station (MCAS). The proposed, but unconstructed pipeline varied in diameter from 114 inches at its beginning to 48 inches at its terminal delivery point.
C) CPA Conveyance Extension was proposed to complete the CPA conveyance system for long-term needs

[46] Source: 1996 IRP

Second Lower Cross Feeder

Project Name: Second Lower Cross Feeder

Program No.: 15428

Original Budget Year: FY 2005/06

Estimated Project Cost (2018 dollars): $76,699,238

Project Description:
The Second Lower Cross Feeder (SLCF) was a proposed new 84-inch diameter pipeline approximately 2.4 miles long and designed to convey up to 100 cfs of treated water into the Diemer service area.[47] The cross feeder was designed to be bi-directional in order to provide an additional future delivery route into the "Central Pool" (e.g. Los Angeles, Orange, and Ventura Counties) once the Central Pool Augmentation program was completed. The cross feeder connection would have improved operational flexibility and reliability by augmenting the Diemer water treatment plant service area through delivery of additional treated water from the Jensen water treatment plant.

The Central Pool Augmentation program was proposed but never constructed.

San Diego Pipeline No. 6 completion

Project Name: San Diego Pipeline No. 6 completion

Program No.: 5-5580-21

Original Budget Year: FY 2010/11

Estimated Project Cost (2018 dollars): $465,668,457 [48]

Project Description:
A joint project between Metropolitan and the San Diego County Water Authority, the proposed San Diego Pipeline No. 6 project would have consisted of an approximately 10 foot diameter pipeline/tunnel system from near Lake Skinner to a terminal delivery point near the San Luis Rey River. Metropolitan's portion consisted of approximately 6.5 miles of tunnel and 12.5 miles of buried pipeline construction.[49]

According to the 1996 IRP, the San Diego Pipeline No. 6 was proposed to increase raw water delivery capacity by 490 cfs to meet the projected increases in demand for both treated and untreated water in southwestern Riverside and San Diego counties through the year 2020. This proposed capacity expansion assumed that San Diego Pipeline No. 3 would be converted from raw water service to treated

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[47] Board Letter Item 8-2, January 2006 authorizing design

[48] Incudes a deduction of $117,913,800 for features that were completed.
[49] Source: Final EIR certified by MWD's Board in May 1993, Multiple Board items from March 2001 (Item 9-2) through March 2006 (Item 8-4) authorizing design, R/W acquisition, professional services agreements, and construction of the North Reach.

water conveyance when and if San Diego Pipeline No. 6 was completed, in order to avoid construction of another San Diego treated water supply pipeline.

State Water Project (SWP) East Branch expansion completion

Project Name: SWP East Branch expansion completion

Original Budget Year: FY 2007

Estimated Project Cost (2018 dollars): $417,395,031 [50]

Project Description: The East Branch expansion completion was a proposed combination of canal raise and hydraulic structure (including check structures and siphons) improvements to accommodate increasing flow in the East Branch of the California Aqueduct by more than 800 cfs to 2,876 cfs.
The cost estimate is based on Scenario 1 from DWR 2004 Report Conditions which included 16 check bays as part of the construction.[51]

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[50] Based on an 80% cost responsibility for Metropolitan

[51] Phase II Draft East Branch Enlargement Feasibility Report – April 29, 2008