Long Beach Water Department

Cost-of-Service Update for Water, Reclaimed Water, and Sewer Rates

Report / September 29, 2022

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September 29, 2022

Mr. Brandon Walker
Director of Finance
Long Beach Water Department
1800 E Wardlow Rd,
Long Beach, CA 90807

Subject: Report for the Cost-of-Service Update for Water, Reclaimed Water, and Sewer Rates

Dear Mr. Walker,

Raftelis is pleased to provide the Long Beach Water Department (Department) with this report which describes our work on the Cost-of-Service Update of the Department's Water, Reclaimed Water, and Sewer Rates (COS Update). The overarching purpose of the COS Update was to compare the actual FY 2021 rates implemented by the Department to FY 2021 rates recalculated by Raftelis using actual revenue, cost, and demand inputs. This comparison allows for a high-level determination of whether the Department's FY 2021 rates, and by inference its current FY 2022 rates, reflect the proportional demands and associated costs imposed by each customer class. To accomplish this objective, Raftelis completed two primary tasks:

- **Completion of an FY 2021 COS Study Using Actual Demands and Costs**. Raftelis completed a comprehensive COS study for FY 2021. This study was based on the actual revenues, costs, and demands experienced by the Department's water, reclaimed water, and sewer utilities during the period of October 1, 2020 – September 30, 2021. The outcome of this study was the "recalculation" of FY 2021 rates.

- **Comparison of the Recalculated FY 2021 Rates to Actual FY 2021 Rates**. Raftelis compared the actual FY 2021 water, reclaimed water, and sewer rates charged by the Department to the recalculated FY 2021 rates. The results of this comparison demonstrate that the FY 2021 rates charged by the Department fully recovered the operating and capital costs incurred to provide service. Except as noted in this report, these rates were generally reflective of the proportional demands and associated costs imposed by each customer class. By inference, Raftelis concludes this is also the case with Department's current FY 2022 rates.

In addition to the primary tasks discussed above, Raftelis also completed research on financial and operational policy issues related to water rate design and developed a new rate model for the use of the Department's staff. The report provides a detailed discussion of our key findings and recommendations. It has been a pleasure working with you and other members of the Department's staff. Thank you for the support you provided during this study.

Sincerely,

John Wright
Senior Manager

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Associate Consultant

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1. Executive Summary

1.1. Study Objectives

The Long Beach Municipal Water Department (Department) retained the services of Raftelis to complete a Cost-of-Service Update of the Department's water, reclaimed water, and sewer rates (COS Update). The overarching purpose of the COS Update was to compare the actual FY 2021 rates charged by the Department to the FY 2021 rates recalculated by Raftelis using actual revenue, cost, and demand inputs. This comparison allows for a high-level determination of whether the Department's FY 2021 rates, and by inference its current FY 2022 rates, reflect the proportional demands and associated costs incurred to serve each customer class. Rates that meet this criterion are believed to align with industry-standard principles of cost-of-service (COS) equity and the requirements of California Proposition 218.

At the request of the Department, Raftelis also analyzed the following items:

- The appropriateness of the Tier 1 residential water rate structure which currently features a consumption width of 0 – 6 ccf
- Changes in residential consumption characteristics during the period FY 2016 to FY 2021
- The quantification of pre- and post-COVID demands on the Department's potable water system
- Potential uses of water consumption data recorded by the Department's advanced metering infrastructure in future COS studies and potential future rate designs

Raftelis also created a new Microsoft Excel financial planning and COS model for use by Department staff.

1.2. Importance of Routine Cost-of-Service Updates

There is no Proposition 218 requirement that agencies providing municipal utility services complete a COS study on a specific schedule. However, the completion of routine COS studies can enhance the probability that the rates paid by customers are aligned with both industry-standard COS principles and the requirements of Proposition 218 (See Section 3.2). Some California utility agencies complete forward-looking COS studies approximately every four to five years. The outcome of these studies is a projection of rates and charges that are intended to comply with the requirements of Proposition 218.

Other utility agencies, including the Department, complete COS studies less frequently. Instead, they adjust rates using across-the-board increases correlated to the annual required percentage increase in rate revenues developed during their annual budgeting/financial planning process. The Department completed its last comprehensive COS study in FY 2016. Prior to FY 2016, rates were developed using the across-the-board approach.

In addition to enhancing the probability that rates reflect principles of COS equity, routine COS studies are beneficial in two other ways. First, they help utility staff, governing bodies, and customers understand the process used to calculate utility rates. Transparency in this regard provides stakeholders with a better understanding of the costs that municipal utilities incur to provide service. It also enhances stakeholder confidence in the process used to calculate utility rates for each customer class.

Second, the completion of routine COS studies can also serve as an important management information tool. COS studies require staff to acquire a detailed understanding of revenue, cost, and demand relationships that form the basis for utility rates. They also assist utility staff in assessing the effectiveness of their rate structure(s) in achieving

specific financial, cost-based water use efficiency, and public policy objectives as determined by the utility governing body.

1.3. Department Determination of FY 2021 Rates

As noted previously, the foundation for the Department's actual FY 2021 water, reclaimed water, and sewer rates was a comprehensive COS study completed by Raftelis in FY 2016. Several water rate structure alternatives were considered during the FY 2016 COS Study process and public workshops were conducted to solicit input from the Board and other stakeholders on each alternative. An outcome of the FY 2016 COS Study was the Department's adoption of its current Residential rate structure which was specifically designed to enhance customer bill affordability through the creation of Tier 1A (no volumetric rates paid by qualifying customers) and the allocation of low-cost water supplies to Tier 1B.

The FY 2016 COS Study was "forward-looking" in its rate calculation approach. Specifically, the FY 2017 rates calculated in the study were based on projected FY 2017 revenue, cost, and demand relationships. These FY 2017 rates were adopted by the Board and became effective on October 1, 2016.

The rates adopted and implemented by the Department during the period FY 2018 - FY 2021 were ***not*** calculated as part of a COS study. Instead, as has been customary for the Department, rates were adjusted using across-the-board increases correlated to the annual required percentage increase in rate revenues developed during the annual budgeting/financial planning process.

1.4. Process Used to Make the FY 2021 Rate Comparison

The rate comparison completed by Raftelis reflects ex-ante and ex-post methods for calculating the Department's FY 2021 rates. The ex-ante method is the approach used by the Department to determine the rates it charged in FY 2021 (discussed in Section 1.3 above). The ex-post method is the approach used by Raftelis to re-calculate FY 2021 rates based on actual FY 2021 revenue, cost, and demand relationships. Table 1-1 summarizes the differences between these two approaches.

Table 1-1: Comparison of FY 2021 Rate Methodologies

Actual FY 2021 Rates (Ex-Ante Approach)	Raftelis Recalculated FY 2021 Rates (Ex-Post Approach)
• FY 2021 rates were based on annual across-the-board increases applied to FY 2017 rates during the years FY 2018 – FY 2021. • The original FY 2017 rates were developed in the FY 2016 COS Study were based on projected FY 2017 demand, revenue, and cost relationships.	• Recalculated FY 2021 rates were based on actual FY 2021 revenue, cost, and demand inputs as recorded in the Department's financial accounting and billing systems. • As required, the cost allocations originally used in the FY 2016 COS Study were, as required, updated to reflect changes in the Department's operating characteristics and financial accounting system.

Raftelis used a two-step process to complete a comparison of actual versus recalculated FY 2021 rates.

Step 1: Completion of an FY 2021 COS Study Using Actual Demands and Costs. Raftelis completed a comprehensive COS study for FY 2021. This study featured the actual revenues, costs, and demands experienced by the Department's water, reclaimed water, and sewer utilities during the period of October 1, 2020 – September 30, 2021. The outcome of this study was the "recalculation" of FY 2021 rates that are based on actual experience.

Step 2: Comparison of the Recalculated FY 2021 Rates to Actual FY 2021 Rates. Raftelis compared the actual FY 2021 water, reclaimed water, and sewer rates charged by the Department to the recalculated FY 2021 rates. The results of this comparison demonstrate that the FY 2021 rates charged by the Department were generally reflective of the actual FY 2021 demands and associated costs incurred to serve customers. By inference, Raftelis concludes that the Department's current FY 2022 rates are also aligned with underlying principles of COS equity.

1.5. Summary Conclusions

The results of the comparison of recalculated FY 2021 rates to the Department's actual FY 2021 rates indicate the following:

- Actual FY 2021 water, reclaimed water, and sewer rates fully recovered the operating expenses and rate-funded capital expenditures incurred to provide service.
- The proportionate share of fixed and variable revenues earned by the Department in FY 2021 were aligned with the targets established in the FY 2016 COS Study. These same proportionate fixed and variable revenue contributions were replicated in the FY 2021 COS Update.
- The FY 2021 rates charged by the Department were generally aligned with the actual demands and the associated costs imposed by each customer class. The key exceptions, as fully explained later in this report, were Tier 1B and Tier 3 Residential rates and reclaimed water rates. These exceptions are explained by changes in the Department's water supply cost profile and changes in customer demand characteristics since the completion of the 2016 COS Study.
- Based on our analysis, the Department's existing water, reclaimed water, or sewer rate structures do not require modification.
- The Department's current Residential water rate structure which features a Tier 1 consumption allowance of 0 – 6 ccf remains appropriate from two perspectives. First, it complies with State of California requirements for indoor water usage. Second, it provides an amount of water that is adequate for basic human needs.
- Water usage during FY 2020 and FY 2021 was minimally impacted by the COVID pandemic.
- The detailed customer water consumption information recorded by the Department's advanced meter reading (AMR) infrastructure can produce data useful to make incremental improvements in the Residential water rate structure. However, the primary benefit of AMR will be from a customer service and management information perspective.

1.6. Summary Financial and Rate Comparisons

1.6.1. VALIDATION OF FY 2021 RATE REVENUES

As an initial step in the FY 2021 COS process, Raftelis validated the rate revenues reported in the Department's financial accounting system. The validation required Raftelis to independently calculate FY 2021 rate revenues based on actual customer billing data obtained from the Department's customer information system (CIS). As

shown on line 4 of Table 1-2, the Raftelis calculation of water and reclaimed water rate revenues was within 0.6% of the revenue reported in the Department's financial accounting system. As shown on line 9, the Raftelis calculation of sewer rate revenues is within 1.4% of the Department's reported total. Both of these calculated variances are within a reasonable range of accuracy and require no further investigation.

Table 1-2: FY 2021 Rate Revenue Validation

Line	Water and Reclaimed Water	FY 2021 Reported Rate Revenue	FY 2021 Rate Revenue Calculated by Raftelis	$ Difference	% Difference
1	Fixed Revenue (1)	$34,900,811	$36,251,570	$1,350,759	3.9%
2	Water Variable Revenue (2)	$74,435,459	$74,380,998	($54,461)	-0.1%
3	Reclaimed Variable Revenue (3)	$4,887,556	$4,239,053	($648,503)	-13.3%
4	Total	$114,223,826	$114,871,621	$647,795	0.6%
5					
6	Sewer	FY 2021 Reported Rate Revenue	FY 2021 Rate Revenue Calculated by Raftelis	$ Difference	% Difference
7	Fixed Revenue (4)	$11,162,309	$11,047,754	($114,556)	1.0%
8	Sewer Variable Revenue (5)	$5,793,225	$6,150,008	$356,783	-5.8%
9	Total	$16,955,534	$17,197,762	$242,228	1.4%
10					
11	(1) Fixed Revenue = Revenue from Daily Service Charges + Fire Line Daily Service Charges				
12	(2) Water Variable Revenue = Revenue from Potable Water Volumetric Rates				
13	(3) Reclaimed Variable Revenue = Revenue from Reclaimed Volumetric Rates				
14	(4) Fixed Revenue = Revenue from Sewer Daily Service Charges				
15	(5) Sewer Variable Revenue = Revenue from Sewer Volumetric Rates				

1.6.2. ADEQUACY OF FY 2021 COST RECOVERY

A second critical question in assessing the Department's FY 2021 rates is whether rate revenues were adequate to recover the actual operating and capital costs incurred to provide service. Table 1-3 shows the analysis completed by Raftelis which verifies the adequacy of FY 2021 cost recovery.

The FY 2021 rate revenues shown on lines 1 - 3 of Table 1-3 were calculated by Raftelis based on billing data obtained from the Department's CIS. The revenue requirement components (i.e., costs) shown in lines 7 - 15 are the actual costs recorded in the Department's financial accounting system. Except for water supply costs, Raftelis did not audit the Department's reported FY 2021 operating or capital costs.

In FY 2021, approximately $114.8 million in rate revenues were collected from water and reclaimed water customers (line 4). After the inclusion of a Measure M transfer to the General Fund of $10.6 million (line 10) and an increase of cash reserves of $7.9 million (line 11), the final net revenue requirement incurred to provide water and reclaimed water service was also $114.8 million (line 15). On annual basis, municipal utilities routinely experience increases or decreases in cash reserves. These changes can be intentional (i.e., budgeted) or the result of normal actual-to-budget variances. From the perspective of Raftelis, the actual FY 2021 increase in cash reserves of $7.9 million was reasonable.

In FY 2021, approximately $17.2 million in rate revenues was collected from sewer customers (line 4). After the inclusion of a Measure M transfer to the General Fund of $2.1 million (line 10) and a decrease in cash reserves of $155K (line 11), the final net revenue requirement (net costs) incurred to provide sewer service was also $17.2 million (line 15).

Table 1-3: FY 2021 Revenue Adequacy (Rate Revenues vs Costs)

Line	Rate Revenues (Calculated by Raftelis)	Water & Reclaimed	Sewer
1	Daily Service Charges	$31,995,332	$11,490,180
2	Volumetric Rates	$80,841,731	$5,707,582
3	Fire Service Charge	$2,034,558	$0
4	Total Revenues	$114,871,621	$17,197,762
5			
6	**Revenue Requirement (Costs Reported by the Department)**	**Water & Reclaimed**	**Sewer**
7	O&M Expenses	$86,927,049	$10,784,292
8	Existing Debt Service	$6,221,000	$729,000
9	Rate Funded Capital Projects	$15,616,814	$6,885,645
10	Transfer to the General Fund	$10,575,042	$2,118,236
11	Change in Cash Reserves	$7,856,441	($154,789)
12	Gross Revenue Requirement (Gross Costs)	$127,196,347	$20,362,384
13			
14	Less: Revenue Offsets	$12,324,725	$3,164,622
15	Total Net Revenue Requirement (Net Costs)	$114,871,621	$17,197,762
16			
17	Unexplained Difference (Line 4 – Line 15)	$0	$0

1.6.3. FY 2021 FIXED AND VARIABLE REVENUE RECOVERY

An outcome of the COS process is the identification of fixed and variable costs and the determination of the proportion of rate revenue that should be recovered from fixed versus variable rates. In the FY 2016 COS Study, rates were designed to ensure that approximately 30% of water and reclaimed revenues were earned from fixed sources (daily service charges and fire line daily service charges) and that approximately 70% of revenues were earned from variable sources (volumetric rates). Similarly, sewer rates were designed to achieve approximately 65% revenue recovery (sewer daily service charges) and 35% variable revenue recovery (volumetric rates).

To determine if the Department's FY 2021 revenue recovery profile remains aligned with the targets established in the FY 2016 COS Study, Raftelis completed the analysis shown in Table 1-4. Column A of Table 1-4 shows the actual proportion of FY 2021 fixed and variable rate revenue recovery as reported in the Department's financial accounting system. Column B of Table 1-4 shows the Raftelis calculated level of fixed and variable rate revenue recovery as determined in the FY 2021 COS Update. Both the Department's actual FY 2021 revenue recovery profile and the Raftelis calculated revenue recovery profile are closely aligned with the targets established in the FY 2016 COS Study.

Table 1-4: FY 2021 Fixed and Variable Revenue Recovery vs. Costs

Line	Water and Reclaimed Water	Column A FY 21 Reported Rate Revenue	Column B FY 2021 Raftelis COS	Column C $ Difference Reported vs COS	Column D % Difference Reported vs COS
1	Fixed Revenue (Daily Service Charge + Fire Line Charges)	$34,900,811	$36,251,570	$1,350,759	3.9%
2	Water Variable Revenue (Volumetric Rates)	$74,435,459	$74,380,998	($54,461)	-0.1%
3	Reclaimed Water Variable Revenue (Volumetric Rates)	$4,887,556	$4,239,053	($648,503)	-13.3%
4	Total	$114,223,826	$114,871,621	$647,795	0.6%
5					
6	Fixed Revenue (Daily Service Charge + Fire Line Daily Service Charges)	30.6%	31.6%		
7	Water Variable Revenue (Volumetric Rates)	65.2%	64.8%		
8	Reclaimed Water Variable Revenue (Volumetric Rates)	4.3%	3.7%		
9	Total	100%	100%		
10					
11		Column A	Column B	Column C	Column D
12	**Sewer**	FY 21 Reported Rate Revenue	FY 2021 Raftelis COS	$ Difference Reported vs COS	% Difference Reported vs COS
13	Fixed Revenue (Sewer Daily Service Charge)	$11,162,309	$11,047,842	($114,467)	1.0%
14	Sewer Variable Revenue (Volumetric Rates)	$5,793,225	$6,149,920	$356,695	-5.8%
15	Total	$16,955,534	$17,197,762	$242,228	-1.4%
16					
17	Fixed Revenue (Daily Service Charge)	65.8%	64.2%		
18	Sewer Variable Revenue (Volumetric Rates)	34.2%	35.8%		
19	Total	100.0%	100.0%		

1.6.4. COMPARISON OF FY 2021 WATER AND RECLAIMED WATER VOLUMETRIC RATES

When recalculating the rates for any past historical year it is virtually impossible to match the rates actually charged. This is because the actual revenue, cost, and demand data used to recalculate past rates will invariably differ from the assumptions used in the original rate calculation. Thus, the key objective of the FY 2021 rate comparisons made by Raftelis is not to achieve perfection. Instead, it is to determine if the recalculated FY 2021 rates are reasonably correlated to the actual FY 2021 rates charged by the Department. The concept of "reasonableness" in this context is qualitative in nature rather than quantitative in nature. This is because there is no specific industry standard that indicates that recalculated rates must fall within a certain percentage range of the actual rates charged in the past.

Table 1-5 shows a comparison of the Department's actual FY 2021 water and reclaimed water volumetric rates vs. the FY 2021 rates recalculated by Raftelis. As discussed in Section 6.7.2 of this report, the differences shown for Residential rates in Tier 1B (line 4) and Tier 3 (line 6) are due to changes in the profile of water supply costs and customer usage characteristics when compared to the assumptions used in the FY 2016 COS Study. The differences shown for reclaimed water (lines 12 – 14) are due to changes in the profile of customer usage characteristics compared to the assumptions used in the FY 2016 COS Study. Notwithstanding these two exceptions, Raftelis concludes that the FY 2021 water and reclaimed water volumetric rates charged by the Department were generally aligned with the actual demands and associated costs imposed by each customer class. Raftelis recommends no change to the water or reclaimed water volumetric rate structure.

Table 1-5: Recalculated FY 2021 Water and Reclaimed Water Volumetric Rates vs. Actual

Line	Customer Class	Actual FY 2021 Rates	Recalculated FY 2021 Rates	$ Difference	% Difference
1	Water				
2	Residential				
3	Tier 1A	$0.00	$0.00	$0.00	0.0%
4	Tier 1B	$2.44	$2.74	$0.31	12.5%
5	Tier 2	$4.66	$4.50	($0.16)	-3.5%
6	Tier 3	$6.81	$6.35	($0.45)	-6.6%
7	Commercial	$3.62	$3.39	($0.23)	-6.5%
8	Industrial	$3.62	$3.45	($0.17)	-4.7%
9	Irrigation	$3.62	$3.57	($0.05)	-1.5%
10					
11	Reclaimed Water				
12	Peaking	$2.36	$2.39	$0.03	1.3%
13	Non-Peaking	$2.00	$1.77	($0.23)	-11.3%
14	Interruptible	$2.00	$1.77	($0.23)	-11.3%

1.6.5. COMPARISON OF FY 2021 WATER AND RECLAIMED WATER DAILY SERVICE CHARGES

Table 1-6 shows a comparison of the Department's actual FY 2021 water and reclaimed water daily service charges vs. the FY 2021 daily service charges recalculated by Raftelis. We conclude that the Department's FY 2021 water and reclaimed water daily service charges were generally aligned with the actual demands and associated costs imposed at each meter size. Raftelis recommends no change to the structure of the Department's water and reclaimed water daily service charge structure.

Table 1-6: Recalculated FY 2021 Water and Reclaimed Water Daily Service Charges vs. Actual

Line	Meter Size	Actual FY 2021 Daily Service Charges	Recalculated FY 2021 Daily Service Charges	$ Difference	% Difference
1	5/8" or 3/4"	$0.70	$0.72	$0.02	3.3%
2	1"	$1.03	$1.10	$0.07	6.9%
3	1-1/2"	$1.87	$2.07	$0.19	10.3%
4	2"	$2.88	$3.22	$0.34	11.7%
5	3"	$6.08	$6.87	$0.80	13.1%
6	4"	$10.27	$11.68	$1.41	13.7%
7	6"	$22.87	$26.11	$3.23	14.1%
8	8"	$47.23	$53.99	$6.76	14.3%
9	10"	$70.76	$80.92	$10.16	14.4%
10	12"	$89.23	$102.07	$12.84	14.4%
11	16"	$131.23	$150.16	$18.92	14.4%

1.6.6. COMPARISON OF FY 2021 FIRE LINE DAILY SERVICE CHARGES

Table 1-7 shows a comparison of the Department's actual FY 2021 water fire line daily service charges vs. the FY 2021 charges calculated by Raftelis. We conclude that the Department's FY 2021 water fire line charges were generally aligned with the actual demands and associated costs imposed at each fire line diameter. Raftelis recommends no change to the structure of the Department's water fire line charges.

Table 1-7: Recalculated FY 2021 Fire Line Daily Service Charges vs. Actual

Line	Fire Line Size	Actual FY 2021 Daily Fire Line Charges	Recalculated FY 2021 Daily Fire Line Charges	$ Difference	% Difference
1	2”	$0.41	$0.37	($0.04)	-9.28%
2	3”	$0.83	$0.82	($0.01)	-1.67%
3	4”	$1.55	$1.58	$0.03	1.71%
4	6”	$4.13	$4.31	$0.18	4.36%
5	8”	$8.58	$9.02	$0.44	5.16%
6	10”	$15.28	$16.11	$0.84	5.47%
7	12”	$24.56	$25.94	$1.38	5.63%
8	16”	$52.11	$55.11	$3.00	5.77%

1.6.7. COMPARISON OF FY 2021 SEWER VOLUMETRIC RATES

Table 1-8 shows a comparison of the Department’s actual FY 2021 sewer volumetric rates vs. the FY 2021 volumetric rates recalculated by Raftelis. Raftelis concludes that the FY 2021 sewer volumetric rates charged by the Department were generally aligned with the actual demands and associated costs incurred to serve customers. Raftelis recommends no change to the sewer rate structure.

Table 1-8: Recalculated FY 2021 Sewer Volumetric Rates vs. Actual

Line	Billed Usage	Actual FY 2021 Rates	Recalculated FY 2021 Rates	$ Difference	Actual FY 2021 Rates
1	All	$0.36	$0.38	$0.03	7.8%

1.6.8. COMPARISON OF FY 2021 SEWER DAILY SERVICE CHARGES

Table 1-9 shows a comparison of the Department’s actual FY 2021 sewer daily service charges vs. the FY 2021 daily service charges calculated by Raftelis. As explained in Section 9.5 of this report, the differentials shown in Table 1-9 (e.g., lines 8, 9, and 10) are due to changes in the average daily winter water usage of customers with large meter sizes. Despite these differences, Raftelis concludes that the Department’s FY 2021 sewer daily service charges were generally aligned with the actual demands and associated costs imposed at each meter size. Raftelis recommends no change to the structure of the Department’s sewer daily service charges.

Table 1-9: Recalculated FY 2021 Sewer Daily Service Charge vs. Actual

Line	Meter Size	Actual FY 2021 Daily Service Charges	Recalculated FY 2021 Daily Service Charges	$ Difference	% Difference
1	5/8” or 3/4”	$0.23	$0.21	($0.02)	-8.0%
2	1”	$0.33	$0.32	($0.01)	-3.9%
3	1-1/2”	$0.87	$0.84	($0.04)	-4.2%
4	2”	$1.51	$1.33	($0.18)	-12.0%
5	3”	$3.51	$3.98	$0.47	13.3%
6	4”	$5.08	$4.14	($0.94)	-18.5%
7	6”	$14.15	$14.39	$0.24	1.7%
8	8”	$15.00	$22.79	$7.79	51.9%
9	10”	$23.22	$54.43	$31.21	134.4%
10	12”	$29.28	$54.43	$25.14	85.9%
11	16”	$43.07	$54.43	$11.36	26.4%

2. Department Description

2.1. History

During the early years of the twentieth century, Long Beach seemed destined to someday become a large city. To sustain the expected growth anticipated to occur in future years, it was critical that the City identify and secure a reliable source of water. In recognizing the importance of this, on June 27, 1911, Long Beach voters approved the purchase of two private water companies that had been providing water supplies to the Long Beach population. On June 30, 1911, the Long Beach city council approved an emergency ordinance creating the Long Beach Water Department, giving the City its own municipal water agency to control the use, sale, and distribution of water owned or controlled by the City.

In 1931, two additional milestones took place for the Department. The first was the creation of the Long Beach Board of Water Commissioners (Board), which governs the Department and is comprised of five members appointed by the Mayor, subject to confirmation by the City Council. Members of the Board serve overlapping five-year terms to provide continuity of operations. That same year, the City also became one of the original 13 founding members of the Metropolitan Water District of Southern California (MWD). Joining MWD allowed the Department to eventually acquire imported water as a supplement to the City's groundwater supplies.

In February 1988, the Department assumed responsibility for the various functions of the City's sanitary sewer system, including operations and maintenance. In April 1990, the citizens of Long Beach passed a City Charter amendment that allowed greater autonomy for the Department in administering the City's sanitary sewer operations.

2.2. Service Territory

The Department's service area encompasses the boundaries of the City of Long Beach, the seventh largest city in the State, with an area of approximately 50 square miles (32.000 acres) and a population of approximately 500,000 with some customers outside the City limits. Customers include a range of residential properties, commercial and downtown high-rise buildings, and large industrial areas. The City is also home to different types of regionally important facilities, such as The Port of Long Beach, Long Beach Airport, California State University of Long Beach, major healthcare facilities, and large energy production facilities. The City is almost fully built-out and future development is expected to be focused on redevelopment in the downtown and urban areas along major highways or along major arterial roads.

2.3. Potable Water System

2.3.1. WATER SUPPLY

The Department obtains its potable water supply from groundwater wells located in the Central Basin Aquifer and imported water from MWD. As discussed in the Department's Water Distribution System Master Plan dated September 2020 (Water Master Plan), the average production from the Central Basin was 29,930 AFY (26.7 MGD) during the period 2001 to 2019. The total amount of imported water purchased for the potable water system during this same period averaged 19,978 AFY (17.8 MGD).

Two groundwater basins underlie the Department's service area, the Central Basin, and the West Coast Basin. Both groundwater basins are managed by the Water Replenishment District of Southern California. As described in the Water Master Plan, the Department has an allowable pumping allocation of 32,692 AFY from the Central Basin and currently pumps all its groundwater supply from this source. The Department has an allowable pumping allocation of 0.7 AFY from the West Coast Basin but currently does not exercise its right to pump from this basin.

MWD is the purveyor of imported water for most of Southern California, providing supplemental water to 26 public agencies, including the Department through a regional distribution network of canals, pipelines, reservoirs, treatment plants, pump stations, hydropower plants, and other appurtenances.

2.3.2. HISTORICAL POTABLE WATER DEMAND AND PEAKING FACTORS

As discussed in the Water Master Plan, a water system is designed to meet the maximum demands placed on it. Maximum month and maximum day demands are important factors in sizing a system's supply capability. Maximum day demands usually dictate the design criteria for both system transmission and storage needs. Maximum hour peak demands measure the adequacy of transmission, distribution, and operational storage capacity. Table 2-1 shows the potable water system demand and peaking factors for the period 2016-2019 as they appear in the Department's Water Master Plan.

Table 2-1: Water System Demand and Peaking Factors (2016-2019)

Demand Description	Millions of Gallons per Day	Acre-Feet per Year
Minimum Day (1)	31,200,000	34,910
Minimum Month (2)	36,500,000	40,910
Average Day (3)	48,700,000	54,910
Maximum Month (2)	58,400,000	65,456
Maximum Day (1)	65,300,000	73,002
Peak Hour (4)	117,000,000	130,993
(1) Peaking factor based on 2016-2019 daily flow demands		
(2) Peaking factor based on 2016 - 2019 monthly flow demands		
(3) Average demand based on 2016 - 2019 total flow demand average		
(4) Based on the hydraulic model maximum day scenario, which includes diurnal use patterns for all water uses		

2.3.3. WATER SYSTEM INFRASTRUCTURE

As described in the Water Master Plan, the Department's existing potable water system consists of the following key components:

- Two primary pressure zones
- Approximately 4.8 million linear feet of (916 miles) of transmission and distribution mains with pipe diameters ranging from 2" through 54"
- 2 water storage tank farms
    - Alamitos Tank Farm with 21 potable water tanks (69.3 MG total storage)
    - JW Johnson Tank Farm with 12 potable water tanks (39.6 MG total storage)
- 3 pumping booster stations
- 24 active groundwater wells
- 11 imported water connections
- 7,010 fire hydrants
- 93,414 customer service connections

Pressure Zones

To accommodate the Department's service area elevations, the potable system consists of two (2) primary pressure zones. The Main Zone covers 30,956 acres. It is an open pressure zone with 69.3 MG of storage at the Alamitos Tank Farm and 39.6 MG of storage at the JW Johnson Tank Farm. The tank farms have a high-water level in each tank of 203.75 feet. The Boosted Zone is supplied by the 32nd Street Booster Pump Station. The Boosted Zone elevations range from 20 feet to 130 feet.

Transmission and Distribution System

Of the Department's 916 miles of transmission and distribution mains, approximately 41% percent are 6" in diameter and 27% are 8" in diameter. The majority of the Department's water mains were constructed from 1940 to 1990. Approximately 20% of the Department's transmission and distribution mains have been replaced in the past 20 years as part of the Department's ongoing pipe replacement program.

Groundwater Wells

The Department owns and operates 24 active wells. The wells pump into a pipeline collection system that conveys groundwater to the Department's Groundwater Treatment Plant. The total capacity of the groundwater wells is approximately 52.6 MGD. In addition, the Department also has an 8" permanent interconnection with the City of Lakewood. Well water from the City of Lakewood is also conveyed to the Groundwater Treatment Plant. The current average capacity of the City of Lakewood interconnection is 2.2 MGD.

Groundwater Treatment Plant

The Department has one Groundwater Treatment Plant with a capacity of 62.5 MGD. The treatment process includes coagulation, sedimentation, chlorine disinfection, filtration through fine coal and silicate sand, chloramine disinfectant, and fluoride. At the end of the treatment process, the treated water is stored in a 13 MG cistern (covered reservoir). The potable water is then pumped into the water distribution system via two booster pump stations.

Storage Tanks

The Department's potable water system includes two tank farms with multiple storage tanks at each facility. There is about 3.3 MGD of storage in each tank. The Alamitos Tank Farm includes 21 potable water storage tanks (total capacity of 69.3 MG) and 3 recycled water storage tanks. The JW Johnson Tank Farm (JWJ Tank Farm) includes 12 potable water storage tanks (total capacity of 39.6 MG).

Booster Pump Stations

The Department's water distribution system includes three booster pump stations, two at the Groundwater Treatment Plant and the 32nd Street Booster Station. The pump stations at the Groundwater Treatment Plant pump treated groundwater into the distribution system and up to the storage tanks at the Alamitos Tank Farm. The 32nd Street Booster Station 2.5 to 7 MGD of water to the Boosted Zone pressure zone.

Imported Water Connections

The Department has eleven (11) imported water connections with MWD.

2.4. Sewer System

The Department operates and maintains over 700 miles of sanitary sewer lines that deliver up to 40 million gallons of wastewater per day to the Sanitation Districts of Los Angeles County (LACSD) for treatment. Most of the wastewater delivered to the LACSD is directed to the Joint Water Pollution Control Plant in Carson located to the

northwest of the City of Long Beach. The remaining portion of the customer wastewater discharges is delivered to the Long Beach Water Reclamation Plant (LBWRP).

2.5. Reclaimed Water System

2.5.1. LONG BEACH WATER RECLAMATION PLANT

LACSD owns and operates the LBWRP. The LBWRP treats wastewater collected from the cities of Long Beach, Lakewood, Cerritos, and other parts of Los Angeles County. However, the Department has exclusive rights to the full amount of tertiary effluent discharged from the LBWRP. The LBWRP has a maximum treatment capacity of about 25 million gallons per day. On an annual basis, the plant produces an average of 17,300 acre-feet of reclaimed water.

2.5.2. RECLAIMED WATER CUSTOMER BASE

In FY 2021, there were a total of 151 reclaimed water customers served by the Department. As described in the Department's Water Resources Plan dated September 2019 (Water Resources Plan), irrigation customers (golf courses and landscape) account for the majority of reclaimed water service connections within the Department's service area. The next largest single user of reclaimed water is THUMS Long Beach Company (THUMS), a consortium of oil companies. THUMS extracts oil from the eastern offshore section of California's Wilmington oil field beneath Long Beach Harbor and uses reclaimed water for groundwater injection to re-pressurize offshore oil-bearing strata to prevent land subsidence. The remainder of reclaimed water generated within the Department's service area is projected to be for further treatment and injection into the Alamitos Seawater Barrier to prevent seawater from traveling into and degrading the groundwater in the Central Basin aquifer.

The Department has three (3) three 3.3 MGD reclaimed water storage tanks at Alamitos Reservoir and two pressure zones: a North Branch System, which flows to Virginia Lake, and a South Branch System which terminates at the intersection of Obispo Avenue and Second Street.

3. Regulatory Environment

3.1. Legal and Statutory Considerations

3.1.1. COMPLIANCE WITH PROPOSITION 218

Utility rates charged by California government agencies must comply with the requirements of Proposition 218. Raftelis does not take a position as to the Department's compliance with the requirements of Proposition 218 in FY 2021, and by extension, FY 2022. Instead, as noted throughout this report, we believe that the FY 2021 water, reclaimed water, and sewer rates charged by the Department were generally aligned with the actual demands and associated costs incurred to serve each customer class. Rates that meet this criterion are generally considered to align with industry-standard COS principles and the requirements of California Proposition 218.

3.1.2. OVERVIEW OF PROPOSITION 218

In November 1996, California voters approved Proposition 218, which amended the California Constitution by adding Article XIII C and Article XIII D. Article XIII D placed substantive limitations on the use of the revenue collected from property-related fees and on the amount of the fee that may be imposed on each parcel. Additionally, it established procedural requirements for imposing new, or increasing existing, property-related fees. The California Supreme Court has determined that water and sewer service fees are property-related fees. These provisions require that a property-related fee must meet all the following requirements:

- Revenues derived from the fee must not exceed the funds required to provide the property-related service.
- Revenues from the fee must not be used for any purpose other than that for which the fee is imposed.
- The amount of a fee imposed upon any parcel or person as an incident of property ownership must not exceed the proportional cost of the service attributable to the parcel.
- The fee may not be imposed for a service, unless the service is used by, or immediately available to, the owner of the property subject to the fee. A fee based on potential or future use of a service is not permitted and stand-by charges must be classified as assessments subject to the ballot protest and proportionality requirements for assessments.
- No fee may be imposed for general governmental services, such as police, fire, ambulance, or libraries, where the service is available to the public in substantially the same manner as it is to property owners.

The five substantive requirements in Article XIII D are structured to place limitations on (1) the use of the revenue collected from property-related fees and (2) the allocation of costs recovered by such fees to ensure that they are proportionate to the cost of providing the service attributable to each parcel.

As stated in the American Water Works publication, *Manual of Water Supply Practice M1, Principles of Water Rates, Fees, and Charges*, 7th Edition (AWWA Manual M1), "water rates and charges should be recovered from classes of customers in proportion to the cost of serving those customers." Similarly, the Water Environment Federation (WEF) publication, *Financing and Charges for Sewer Systems, WEF Manual of Practice No. 27*, 4th Edition (WEF Manual 27), states, "the process of identifying the service characteristics of the utility's customers and distributing costs in proportion to their service demands are critical steps in the development of equitable rates and charges."

Proposition 218 requires that water rates cannot be "arbitrary and capricious," meaning that the rate-setting methodology must be sound and that there must be a nexus between the costs and the rates charged in addition to meeting the substantive requirements set forth therein. California Courts have also made clear that, while agencies are authorized to use industry-standard rate-setting methodologies as set forth in AWWA Manual M1 and WEF Manual 27, rates for water and sewer service must meet the substantive requirements of Proposition 218. This study demonstrates that such requirements have been met for the Department's water and sewer fees.

3.1.3. CALIFORNIA CONSTITUTION – ARTICLE X, SECTION 2

Article X, Section 2 of the California Constitution (established in 1976) states the following:

> "It is hereby declared that because of the conditions prevailing in this State the general welfare requires that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare."

Article X, Section 2 institutes the need to preserve the State's water supplies and to discourage the wasteful or unreasonable use of water by encouraging conservation. As such, public agencies are constitutionally mandated to maximize the beneficial use of water, prevent waste, and encourage conservation.

3.2. The Rate-Setting Process and Proposition 218

The probability of compliance with both industry-standard principles of COS equity and Proposition 218 can be enhanced through a thoughtful and comprehensive rate-setting process that includes the following key steps:

- **Revenue Requirement Determination**: The rate-setting process starts by determining the "test-year" (rate-setting year) revenue requirement from rates. The revenue requirement should sufficiently fund the utility's O&M, debt service, capital expenses, and other identified costs with funding to reserves (positive cash) or using reserves (negative cash), all based on a long-term financial plan.

- **COS Analysis**: The annual cost of providing water and sewer service is distributed among customer classes in proportion to their service requirements. A COS analysis involves the following key steps:

  - **Assignment of Costs to Functions**: Examples of water system functions include storage, treatment, and distribution. Examples of sewer system functions include collection, conveyance, and treatment.

  - **Allocation of Costs to Cost Causation Components:** Examples of water cost components include base demand, maximum day demand, and maximum hour demand. Examples of sewer cost causation components include flow, biochemical oxygen demand, and suspended solids.

  - **Distribution of Costs to Customer Classes:** Costs are distributed to customer classes in proportion to the demands they place on the water and sewer systems.

- **Rate Design/Rate Calculations**: Rates do more than simply recover costs. Properly designed rates should support and optimize a blend of various utility objectives, such as promoting cost-based water use efficiency, affordability for essential needs, and revenue stability, among other objectives.

4. Water Revenue Requirement

4.1. Validation of FY 2021 Water Rate Revenues

As an initial step in the FY 2021 water COS process, Raftelis validated the rate revenues reported in the Department's financial accounting system. The validation required Raftelis to independently calculate FY 2021 rate revenues based on actual customer billing data obtained from the Department's CIS. As shown on line 4 of Table 4-1, the Raftelis calculation of water and reclaimed water rate revenues was within 0.6% of the revenue reported in the Department's financial accounting system. This calculated variance is within a reasonable range of accuracy and requires no further investigation.

Table 4-1: FY 2021 Water Rate Revenue Validation

Line	Water and Reclaimed Water	FY 2021 Reported Rate Revenue	FY 2021 Rate Revenue Calculated by Raftelis	$ Difference	% Difference
1	Fixed Revenue				
2	Potable Daily Service Charge	$32,357,899	$31,488,702	($869,197)	-2.7%
3	Reclaimed Daily Service Charge	$508,353	$506,631	($1,723)	-0.3%
4	Fire Line Charges	$2,034,558	$2,034,558	$0	0.0%
5	Total Fixed Revenue	$34,900,811	$34,029,891	($870,920)	-2.5%
6					
7	Volumetric Revenue				
8	Potable	$74,435,459	$75,942,316	$1,506,857	2.0%
9	Reclaimed	$4,887,556	$4,899,414	$11,858	0.2%
10	Total Volumetric Revenue	$79,323,015	$80,841,731	$1,518,715	1.9%
11					
12	Total Rate Revenue	$114,223,826	$114,871,621	$647,795	0.6%

4.2. Adequacy of FY 2021 Water Cost Recovery

A second question that must be answered when assessing the Department's FY 2021 rates is whether rate revenues were adequate to recover the actual operating and capital costs incurred to provide service. Table 4-2 shows the analysis completed by Raftelis which verifies the adequacy of FY 2021 cost recovery. Highlights of Table 4-2 include:

- The FY 2021 rate revenues shown on lines 1 - 12 of Table 4-2 were calculated based on billing data obtained from the Department's CIS.
- The revenue requirement components (i.e., costs) shown in lines 15 - 25 are the actual costs recorded in the Department's financial accounting system. Except for water supply costs, Raftelis did not audit the Department's reported FY 2021 operating or capital costs.
- The revenue offsets shown in lines 30 – 38 were recorded in the Department's financial accounting system.
- In FY 2021, approximately $114.9 million in rate revenues were collected from water and reclaimed water customers (line 12). After the inclusion of a Measure M transfer to the General Fund of $10.6 million (line 27) and an increase of cash reserves of $7.9 million (line 42), the final net revenue requirement incurred to provide water and reclaimed water service was also $114.9 million (line 43). From the perspective of Raftelis, the actual FY 2021 increase in cash reserves of $7.9 million was reasonable.

- Line 46 shows that the difference between total rate revenues (line 12) and the total net revenue requirement (line 43) is $0. This verifies the adequacy of the Department's FY 2021 rates to pay for the costs incurred to provide water and reclaimed water service.

Table 4-2: FY 2021 Water Revenue Adequacy

Line	Rate Revenue	Amount	Percentage of Total
1	Fixed Revenue		
2	Potable Daily Service Charge	$31,488,702	27.4%
3	Reclaimed Daily Service Charge	$506,631	0.4%
4	Fire Line Charges	$2,034,558	1.8%
5	Total Fixed Revenue	$34,029,891	29.6%
6			
7	Volumetric Revenue		
8	Potable	$75,942,316	66.1%
9	Reclaimed	$4,899,414	4.3%
10	Total Volumetric Revenue	$80,841,731	70.4%
11			
12	Total Rate Revenue	$114,871,621	100.0%
13			
14	**Revenue Requirement (Costs Paid for by Rates)**	**Amount**	**Percentage of Total**
15	O&M Expenses		
16	Potable	$86,138,887	67.5%
17	Recycled	$788,162	0.6%
18	Total O&M Expenses	$86,927,049	68.2%
19			
20	Capital Costs		
21	Debt Service	$6,221,000	4.9%
22	Rate Funded Capital Projects	$23,828,647	18.7%
23	Total Capital Costs	$30,049,647	23.6%
24			
25	Subtotal	$116,976,696	91.7%
26			
27	Transfer to the General Fund	$10,575,042	8.3%
28	Total Gross Revenue Requirement	$127,551,738	100.0%
29			
30	Less: Revenue Offsets		
31	Water Other Unallocated Operating Revenue		
32	Reclaimed Operating Revenue	$9,093,359	72.5%
33	Water Accounting Revenue	$1,100,508	8.8%
34	Water Development Revenue	$1,088,710	8.7%
35	Conservation Revenue	$48,044	0.4%
36	Existing Debt Proceeds	$220,000	1.8%
37	Interest	$187,187	1.5%
38	Total Revenue Offsets	$545,858	4.4%
39		$12,545,922	100.0%
40	Total Costs Before Change in Cash Reserves		
41			
42	Change in Cash Reserves	($134,195)	
43	Total Net Revenue Requirement	$114,871,621	
44			
46	Difference (Line 12 Rate Revenues – Line 43 Net Revenue Requirement)	$0	

4.3. O&M Costs in the FY 2021 Revenue Requirement

As obtained from the Department's financial accounting system, the actual costs incurred to provide water service in FY 2021 included $86.9 million of operations and maintenance (O&M) expenses (line 18 in Table 4-2). This amount is 68.2% of the total FY 2021 gross revenue requirement of $127.5 million (line 28 of Table 4-2). Table 4-3 shows an itemized detail of actual FY 2021 O&M expenses.

Table 4-3: Detail of the FY 2021 Water O&M Revenue Requirement

Line	Service	Amount	Percentage of Total
1	Potable O&M		
2	Undefined Expenses	$993,519	1.1%
3	Executive Admin Expenses	$1,116,425	1.3%
4	Commission Expenses	$51,809	0.1%
5	Business Admin Expenses	$1,173,074	1.3%
6	MIS Expenses	$2,796,794	3.2%
7	Safety Expenses	$336,225	0.4%
8	Security Expenses	$894,080	1.0%
9	Accounting Expenses	$916,686	1.1%
10	Budget Expenses	$257,095	0.3%
11	Unallocated Expenses	$4,579,690	5.3%
12	Legislation Expenses	$366,971	0.4%
13	Public Affairs Expenses	$457,010	0.5%
14	Eng. Admin Expenses	$2,322,146	2.7%
15	Development Expenses	$150	0.0%
16	GIS Expenses	$693,715	0.8%
17	Inspection Expenses	$239,719	0.3%
18	Pipelines Expenses	$31,332	0.0%
19	Facilities Expenses	$17,043	0.0%
20	Treatment Ops Admin Expenses	$4,382	0.0%
21	Treatment Ops Expenses (Includes All Water Supply Costs)	$48,830,646	56.2%
22	Water Quality Expenses	$1,605,681	1.8%
23	Telemetry Expenses	$458,724	0.5%
24	Conservation Expenses	$2,091,995	2.4%
25	Water Ops Admin Expenses	$702,030	0.8%
26	Support Admin Expenses	($7,701)	0.0%
27	Communications Expenses	$579,574	0.7%
28	Fleet Services Expenses	$1,411,864	1.6%
29	Warehouse Expenses	$857,583	1.0%
30	Facilities Mgmt. Expenses	$2,097,883	2.4%
31	Main Construction Expenses	$5,906,177	6.8%
32	Meter Expenses	$1,236,921	1.4%
33	Valve Ops Expenses	$1,534,562	1.8%
34	Backflow Expenses	$84,088	0.1%
35	Water Emergency Breaks Expenses	$1,482,464	1.7%
36	Water Service Const Expenses	$18,531	0.0%
37	Total Potable O&M	$86,138,887	99.1%
38			
39	Reclaimed O&M		
40	Reclaimed Unallocated Expenses	$37	0.0%
41	Eng. Admin Expenses	$11,687	0.0%
42	Reclaimed Distribution	$715,738	0.8%
43	Meter Expenses	$60,700	0.1%
44	Total Reclaimed O&M	$788,162	0.9%
45			
46	Total O&M	$86,927,049	100.0%

4.4. Validation of FY 2021 Water Supply Costs

Water supply costs are the largest single cost component incurred by the Department. In FY 2021, the Department reported water supply costs of $40.1 million which is equivalent to 31.4% of the FY 2021 gross revenue requirement of $127.5 million (line 28 of Table 4-2) and 34.9% of the net revenue requirement of $114.9 million (line 43 of Table 4-2). Table 4-4 shows the Raftelis validation of water supply costs which resulted in a water supply cost estimate within 0.2% of that reported by the Department. No additional analysis is required.

Table 4-4: Validation of FY 2021 Water Supply Costs

Line	Description	FY 2021
1	**Actual Potable Water Sales (AF)**	49,558 AF
2	Water Loss	4.0%
3	Potable Water Demand w/ Loss	51,541 AF
4		
5	**Available Annual Domestic Supply**	
6	Groundwater (WRD)	32,692 AF
7	Lakewood Interconnect	900 AF
8	MWD Tier 1	57,560 AF
9		
10	**Water Supply Used to Meet Demand**	
11	Groundwater (WRD)	32,692 AF
12	Lakewood Interconnect	900 AF
13	MWD Tier 1	17,949 AF
14	Total	51,541 AF
15		
16	**Water Supply Costs**	
17	Groundwater (WRD) Pumped Quantity (%)	32,692 AF
18	Oct-Jun	60.0%
19	Jul -Sep	40.0%
20	Groundwater Assessment ($/AF)	
21	Oct-Jun	$382 / AF
22	Jul -Sep	$394 / AF
23	Total Groundwater Supply Cost	**$12,645,266**
24		
25	Lakewood Interconnect	900 AF
26	Lakewood Interconnect ($/AF)	$662 / AF
27	Total Lakewood Interconnect Costs	**$595,800**
28		
29	MWD Variable Costs	
30	MWD Purchased Before Jan 1 (%)	20.0%
31	MWD Purchased After Jan 1 (%)	80.0%
32	MWD Tier 1	17,949 AF
33	MWD Rate Increase	2.7%
34	Oct – Dec	$1,078 / AF
35	Jan – Sep	$1,104 / AF
36	MWD Tier 2	
37	Oct – Dec	$1,165 / AF
38	Jan – Sep	$1,193 / AF
39	MWD Purchased Variable Costs	$19,721,997
40		
41	MWD Fixed Costs	
42	MWD RTS	$1,733,220
43	MWD Capacity Reservation Charge	$783,900
44	Total Fixed	$2,517,120
45		
46	MWD LB07A Purchase	
47	Tier 1 MWD Purchases for LB07A	4,150 AF
48	% Purchased before January 1	50%
49	% Purchased after January 1	50%
50	Total MWD LB07A Purchase	$4,548,400
51		
52	Total MWD Costs	**$26,787,517**
53		
54	Total Water Supply Costs Calculated by Raftelis	**$40,028,583**
55		
56	Reported Actuals	$40,107,131
57	Difference	-0.2%

4.5. Rate Funded Capital Costs in the FY 2021 Revenue Requirement

Table 4-5 provides a detail of the rate funded capital improvement expenditures included in the FY 2021 water revenue requirement. The expenditures for each project were provided by Department staff.

Table 4-5: Detail of FY 2021 Water Rate Funded Capital Expenditures

Line	CIP Category	Cost
1	In-House Water Main Replacement	$2,500,000
2	Meter Replacement Program	$50,000
3	Large Valve Replacement	$0
4	Water Developer Projects	$0
5	Water Pipeline Emergency Repair	$0
6	Water Pipeline Improvement	$2,520,000
7	Water Pipeline Replace/Install	$4,680,973
8	Alamitos Reservoir Improvements	$2,116,880
9	Water SCADA Improvements	$295,351
10	Treatment Plant Improvements	$819,682
11	New Well Development/Equipment	$0
12	Water Desalination	$0
13	Water Supply Improvements	$650,900
14	Well Rehabilitation	$8,211,833
15	Reclaimed Water Emergency Repairs	$0
16	Reclaimed Water Improvements	$207,400
17	Reclaimed Water Pipe Replace/Install	$0
18	Reclaimed Developer Projects	$0
19	Water Facility Improvements	$1,962,815
20	Subtotal	$24,015,834
21		
22	Less: Available Proceeds from Debt	$187,187
23	Total Rate Funded Capital Expenditures	$23,828,647

5. Water Customer Units of Service

The FY 2021 COS Update features actual FY 2021 customer class demand information. This section of the report highlights key demand information used in the allocation of costs and the development of customer class rates as discussed in Section 6.

5.1. FY 2021 Customer Class Peaking Factors

Water utility systems must be designed, constructed, and operated to meet the peak demands imposed by customers. Because water utilities incur higher costs to serve customer class peak volumetric demands, customer classes that impose higher peak demands are allocated more volumetric costs in the COS process and ultimately pay higher rates. For this reason, estimating the peaking factors of each customer class is a critical component of the COS analysis.

Table 5-1 shows the customer class peaking factors used in the FY 2021 COS Update. The peaking factors are based on actual FY 2021 customer billed consumption. The maximum day peaking factors for each customer class are determined by dividing maximum month demand by average month demand. Maximum hour peaking factors were not used to allocate costs to customer classes due to the lack of actual hourly demand data from the Department's customer billing system.

Table 5-1: Water Customer Class Peaking Factors

Line	Customer Class	FY 2021 Total Usage	Maximum Month Usage	Average Month Usage	Peaking Factor (Maximum Month/Average Month
1	Potable				
2	Residential				
3	Tier 1	9,161,210	812,564	763,434	1.06
4	Tier 2	4,970,154	483,422	414,180	1.17
5	Tier 3	1,128,699	135,970	94,058	1.45
6					
7	Non-Residential	6,327,548	635,108	527,296	1.20
8	Commercial	5,304,634	517,553	442,053	1.17
9	Industrial	127,133	13,369	10,594	1.26
10	Irrigation	895,781	106,502	74,648	1.43
11					
12	Reclaimed				
13	Peaking	428,973	55,272	35,748	1.55
14	Non-Peaking (1)	854,007			1.00
15	Interruptible (2)	959,242			1.00
16	(1) Non-Peaking is not charged based on peaking factors since they aren't using during peak				
17	(2) Interruptible is not charged based on peaking factors since they can be interrupted during peak				

5.2. FY 2021 Customer Accounts

The actual number of FY 2021 customer accounts was calculated using data obtained from the Department's CIS. As shown in Table 5-2 there were a total of 87,841 potable water customer accounts and 151 reclaimed water customer accounts service by the Department at the end of FY 2021.

Table 5-2: FY 2021 Water Accounts by Meter Size and Customer Class

Line	Meter Size (inches)	Potable Water							Reclaimed Water
		Single Family	Multi Family	Duplex	Commercial	Industrial	Irrigation	Total Potable	
1	5/8" or 3/4"	53,559	5,922	7,133	2,187	100	119	69,020	1
2	1"	5,889	2,653	1,148	1,234	57	226	11,207	5
3	1 1/2"	379	2,586	63	900	33	242	4,203	12
4	2"	52	738	7	1,345	36	410	2,588	65
5	3"	2	119	0	288	5	69	483	20
6	4"	0	33	0	115	1	15	164	23
7	6"	0	28	0	55	2	5	90	16
8	8"	0	10	0	50	2	1	63	8
9	10"	0	1	0	19	0	0	20	1
10	12"	0	0	0	3	0	0	3	0
11	16"	0	0	0	0	0	0	0	0
12	Total	59,881	12,090	8,351	6,196	236	1,087	87,841	151

5.3. FY 2021 Equivalent Meters

To allocate non-volumetric meter-related costs appropriately, the number of 3/4" equivalent meters that existed in FY 2021 must be estimated. By using equivalent meters instead of the actual meter count, the COS analysis reflects the fact that larger meters impose greater demands on the system and thus are more expensive to install, maintain, and replace. The number of equivalent meters is based on the maximum hydraulic capacity at each meter size (gallons per minute of maximum flow). Equivalent meters represent the potential demand on a water system expressed in terms of the smallest commonly used meter size on the system. For example, if a 3/4" meter has a maximum capacity of 30 gallons per minute and a 3" meter has a maximum capacity of 350 gallons per minute, the number of equivalent 3/4" meters represented by a single 3" meter would be 11.7 (350/30 = 11.7).

As shown in Table 5-3 there were a total of 137,686 equivalent 3/4" equivalent connections (potable and reclaimed) at the end of FY 2021. The meter types and flow rate equivalencies are shown in Table 5-3. Note that the flow equivalencies used to estimate the number of equivalent 3/4" meters were obtained from AWWA Manual M1 and are the same as those used in the FY 2016 Study.

Table 5-3: FY 2021 Water Accounts and Equivalent 3/4" Meters

Line	Meter Size (inches)	Meter Type	Accounts	Flow Equivalency	Flow Equivalency Ratio	Billing & Customer Service Flow Equivalency Ratio	Total Equivalent Meters
1	5/8" or 3/4"	Displacement	69,020	30	1.00	1.00	69,020
2	1"	Displacement	11,207	50	1.67	1.00	18,678
3	1 1/2"	Displacement	4,203	100	3.33	1.00	14,010
4	2"	Displacement	2,588	160	5.33	1.00	13,803
5	3"	Compound	483	350	11.67	1.00	5,635
6	4"	Compound	164	600	20.00	1.00	3,280
7	6"	Compound	90	1,350	45.00	1.00	4,050
8	8"	Class 2 Turbine	63	2,800	93.33	1.00	5,880
9	10"	Class 2 Turbine	20	4,200	140.00	1.00	2,800
10	12"	Class 2 Turbine	3	5,300	176.67	1.00	530
11	16"	Class 2 Turbine	0	7,800	260.00	1.00	0
12	Total		87,841				137,686

5.4. FY 2021 Water Private Fire Lines

To allocate non-volumetric fire protection costs appropriately, the actual number of private fire lines must be estimated. Table 5-4 provides FY 2021 data for private fire lines, public fire hydrants, and private fire lines.

Table 5-4: FY 2021 Water Private Fire Lines and Public Hydrants

Line	Fire Service Size	Public Hydrants	Private Hydrants	Private Fire Lines
1	2"			61
2	3"			52
3	4"			356
4	6"	7,054	65	425
5	8"			256
6	10"			54
7	12"			3
8	16"			2
9	Total	7,054	65	1,209

6. Water Cost Allocations

6.1. COS Methodology

Demonstrating proportionality when calculating rates is a critical component of ensuring compliance with Proposition 218. Similar to the 2016 COS Study, the FY 2021 update recovers fixed costs through the Department's fixed daily service charge. Fixed costs are spread over all accounts or by meter size depending on the type of expense. As such, actual customer usage was not considered nor is it necessary for calculating each customer's fixed daily service charge.

Conversely, costs that are variable in nature are allocated among customer classes based on the proportionate demands they impose on the Department's water utility system. AWWA Manual M1 agrees with Proposition 218 that "the costs of water rates and charges should be recovered from customer classes in proportion to the cost of serving those customers." The Department's revenue requirements are, by definition, the cost of providing service. This cost is then used as the basis to develop unit costs for each water cost causation component and to allocate costs to the various customer classes in proportion to the level of volumetric water service rendered.

Individual customer demands vary depending on the nature of the use at the location where service is provided. For example, water service demand for a family residing in a typical single-family home is different than the water service demand for a commercial, primarily due to peak use behavior which drives the costs incurred to size infrastructure to meet this demand. The concept of proportionality requires that cost allocations consider both the average quantity of water consumed (base fixed demand) and the peak rate (maximum day demand) at which it is consumed. As noted previously, a water system is designed to meet peak demands. The additional costs associated with designing, constructing, and maintaining facilities to meet these peak demands must be allocated to those customers whose usage requires facilities to upsize in response to peak demand.

In allocating the cost-of-service, the industry standard discussed in AWWA M1 Manual is to group customers with similar demand characteristics into customer classes. Rates are then developed for each customer class, with each individual customer paying the average allocated customer class average cost.

Generally speaking, customers place the following demands on the water system and water supplies:

- The system capacity[1] (for treatment, storage, and distribution) that must be maintained to provide reliable service to all customers at all times
- The level of water efficiency as a collective group
- The number of customers requiring customer services such as bill processing, customer service support, and other administrative services

Joint costs are proportionately shared among all customers in the system based on their service requirements; some specific costs, such as pumping charges, are borne by a subgroup of customers based on the characteristics of that group alone (i.e., elevation zone).

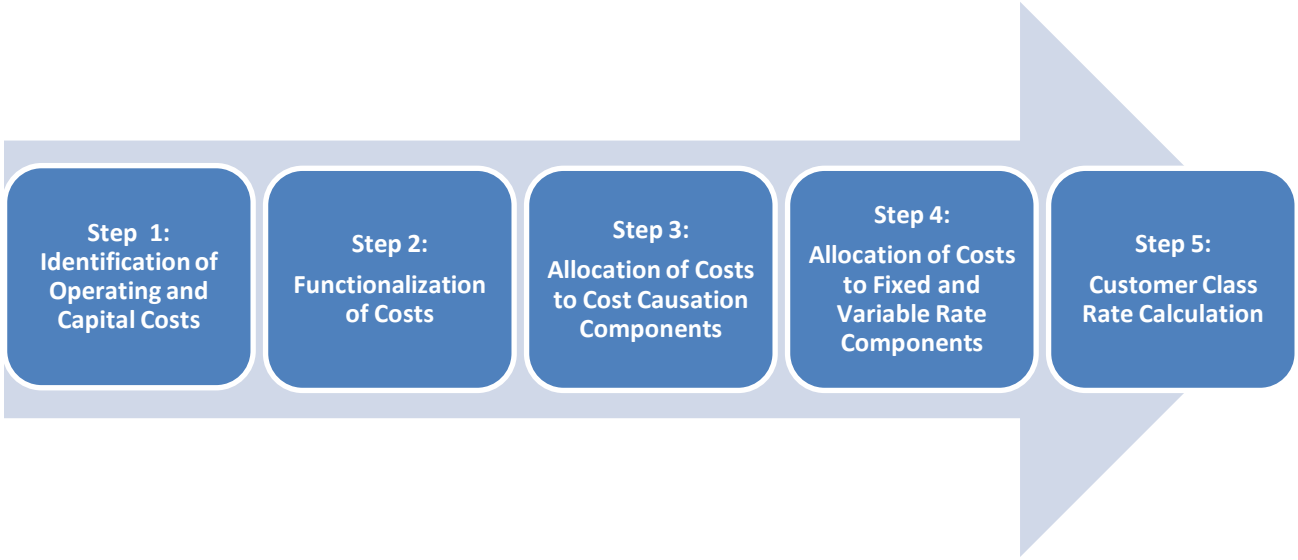
[1] System capacity is the system's ability to supply water to all delivery points at the time when demanded. The time of greatest demand is known as peak demand.

6.2. Steps in the COS Process

After the determination of the net revenue requirement from rates as discussed in Section 4 of this report, a COS analysis distributes the revenue requirement to each customer class based on their proportionate share of total system water demands and associated costs. To accomplish this objective, the FY 2016 COS study and the FY 2021 COS Update required Raftelis to complete a multi-step cost allocation process using industry-standard cost allocation principles as presented in AWWA Manual M1. Whenever possible, the same general cost allocation procedures used in the FY 2016 COS Study were also used in the FY 2021 Update.

The key steps in the water COS process completed for the Department, in both the FY 2021 COS Update and the FY 2016 COS are shown in Figure 6-1 and described below.

Figure 6-1: The COS Process



Step 1: Identification of Revenue Requirement Components: The overall FY 2021 revenue requirement of $114.9 million shown in line 43 of Table 4-1 consists of both operating costs (e.g., O&M expenses) and capital costs (e.g., debt service, rate funded capital expenditures, or changes in cash reserve balances). In Step 1, each individual cost and revenue offset is identified as being either operating or capital in nature to facilitate the allocation of costs described in Steps 2 -5 below.

Step 2: Cost Functionalization: Utilities incur O&M and capital costs to perform specific functional activities such as obtaining water supplies, storage, treatment, pumping, transmission, distribution, meters maintenance, billing, and customer service. The cost functionalization process assigns the costs reflected in the annual net revenue requirement to the specific functions they were incurred to perform.

Step 3: Allocation to Cost Causation Components: Each utility function is designed to meet one or more different types of customer demands. For example, the water treatment function may be designed to meet base fixed demand (i.e., average day) and maximum day demands. Similarly, the distribution function may be designed to meet a combination of maximum day and maximum hour demands. The different types of customer demands that must be met by the utility system are called cost causation components. Cost causation components include variable demands such as base fixed, maximum day, and maximum hour demands. They also include fixed demands that do not vary with the volume of water used, such as billing and customer service or meter

maintenance. The cost allocation process assigns the functionalized costs reflected in the annual revenue requirements to cost causation components.

Step 4: Determination of Customer Class Units of Service: In this step of the COS analysis, the total system units of service for each cost causation component are determined. This allows for the calculation of a total system unit COS for each of the components (e.g., $/ccf cost of service base demand or the $/bill of proving billing and customer service functions to each customer).

Step 5: Customer Class Rate Calculation: The final step in the COS process is the distribution of costs to customer classes and the calculation of customer class volumetric rates and daily service charges. This is accomplished by multiplying the total system unit cost-of-service for each cost causation component as developed in Step 4 by the specific customer class units of service for each cost causation component. The summation of the costs across all cost causation component results in the distribution of the proportionate share of the annual total system revenue requirement to each customer class.

6.3. Step 1: Identification of Operating and Capital Costs

The starting point of the water COS analysis is to identify the operating and capital cost components of the annual revenue requirement from rates. Table 6-1 on the next page shows this for the Department's actual FY 2021 revenue requirement. The information shown in Table 6-1 was provided in earlier tables presented in this report. For example:

- See Table 4-2 for the derivation of the gross revenue and net revenue requirements from rates shown in lines 53 and 73 of Table 6-1
- See Table 4-3 for a detail of O&M expenses as shown in lines 1 - 46 of Table 6-1
- See Table 4-5 for a detail of rate funded CIP expenditures as shown in line 51 of Table 6-1

The revenue offsets in shown Table 6-1 include operating revenues from unmetered construction water sales and the reimbursement of imported water purchases for the Vander Lans facility[2]. Non-operating revenues include interest income, rental income, service connection, grants, other reimbursements, and non-operating revenues from other miscellaneous sources. Other reimbursements include those received from MWD for the Department's Lawn-to-Garden Conservation Incentive Program and the reimbursement of the O&M costs at the Vander Lans facility[3]. Grants are non-recurring cash receipts from qualifying federal programs. As shown in line 68 of Table 6-1 (and also line 48 of Table 4-2) the Department had $12.1 million of revenue offsets in FY 2021 which reduced

[2] Since Oct 1, 2005, the Department, through a contract with WRD has operated the Leo J. Vander Lans Advanced Water Treatment Facility, which enables WRD to use recycled water from the Long Beach Water Reclamation Plant to replace imported MWD water previously supplied to the Alamitos Barrier. In 2015, the Vander Lans facility expansion was completed, providing the operation flexibility to meet the needs of the barrier almost completely with recycled water and minimize imported water needs. The Alamitos Barrier is an engineered freshwater pressure ridge and seawater trough constructed to prevent seawater instruction into the Central Groundwater Basin of Los Angeles County and neighboring Orange County Groundwater Basin.

[3] Includes 100% of labor costs, 75% of Power, chemical and other treatment reclaimed distribution costs incurred in the Department's Treatment Reclaimed Distribution cost center along with reimbursement from WRD of recycled raw water used at the Vander Lans facility at $100/AF.

the number of rate revenues that were collected from customers from $97.5 million (line 53) to $84.5 million (line 73).

Table 6-1: FY 2023 Water Revenue Requirement Operating and Capital Cost Components

Line	Revenue Requirement Component	Operating	Capital	Total
1	Potable O&M			
2	Undefined Expenses	$993,519	$0	$993,519
3	Executive Admin Expenses	$1,116,425	$0	$1,116,425
4	Commission Expenses	$51,809	$0	$51,809
5	Business Admin Expenses	$1,173,074	$0	$1,173,074
6	MIS Expenses	$2,796,794	$0	$2,796,794
7	Safety Expenses	$336,225	$0	$336,225
8	Security Expenses	$894,080	$0	$894,080
9	Accounting Expenses	$916,686	$0	$916,686
10	Budget Expenses	$257,095	$0	$257,095
11	Unallocated Expenses	$4,579,690	$0	$4,579,690
12	Legislation Expenses	$366,971	$0	$366,971
13	Public Affairs Expenses	$457,010	$0	$457,010
14	Eng. Admin Expenses	$2,322,146	$0	$2,322,146
15	Development Expenses	$150	$0	$150
16	GIS Expenses	$693,715	$0	$693,715
17	Inspection Expenses	$239,719	$0	$239,719
18	Pipelines Expenses	$31,332	$0	$31,332
19	Facilities Expenses	$17,043	$0	$17,043
20	Treatment Ops Admin Expenses	$4,382	$0	$4,382
21	Treatment Ops Expenses (Includes All Water Supply Costs)	$48,830,646	$0	$48,830,646
22	Water Quality Expenses	$1,605,681	$0	$1,605,681
23	Telemetry Expenses	$458,724	$0	$458,724
24	Conservation Expenses	$2,091,995	$0	$2,091,995
25	Water Ops Admin Expenses	$702,030	$0	$702,030
26	Support Admin Expenses	($7,701)	$0	($7,701)
27	Communications Expenses	$579,574	$0	$579,574
28	Fleet Services Expenses	$1,411,864	$0	$1,411,864
29	Warehouse Expenses	$857,583	$0	$857,583
30	Facilities Mgmt. Expenses	$2,097,883	$0	$2,097,883
31	Main Construction Expenses	$5,906,177	$0	$5,906,177
32	Meter Expenses	$1,236,921	$0	$1,236,921
33	Valve Ops Expenses	$1,534,562	$0	$1,534,562
34	Backflow Expenses	$84,088	$0	$84,088
35	Water Emergency Breaks Expenses	$1,482,464	$0	$1,482,464
36	Water Service Const Expenses	$18,531	$0	$18,531
37	Total Potable O&M	$86,138,887	$0	$86,138,887
38				
39	Reclaimed O&M	$0	$0	$0
40	Reclaimed Unallocated Expenses	$37	$0	$37
41	Eng. Admin Expenses	$11,687	$0	$11,687
42	Reclaimed Distribution	$715,738	$0	$715,738
43	Meter Expenses	$60,700	$0	$60,700
44	Total Reclaimed O&M	$788,162	$0	$788,162
45				
46	Total O&M Costs	$86,927,049	$0	$86,927,049
47				
48	Other Costs			
49	Existing Debt Service	$0	$6,221,000	$6,221,000
50	Proposed Debt Service	$0	$0	$0
51	Rate Funded Capital Projects	$0	$23,828,647	$23,828,647
52	Water Fund Transfer	$10,575,042	$0	$10,575,042
53	Total Gross Revenue Requirement	$97,502,091	$30,049,647	$127,551,738
54				
55	Less: Revenue Offsets			
56	Other Operating Revenues			
57	Water Other Unallocated Operating Revenue	$9,093,359	$0	$9,093,359
58	Reclaimed Operating Revenue	$1,100,508	$0	$1,100,508
59	Water Accounting Revenue	$1,088,710	$0	$1,088,710
60	Water Development Revenue	$48,044	$0	$48,044
61	Reclaimed Distribution Revenue	$0	$0	$0
62	Conservation Revenue	$220,000	$0	$220,000
63	Warehouse Revenue	$0	$0	$0
64	Existing Debt Proceeds	$0	$187,187	$187,187
65	Non-Operating Revenues	$0	$0	$0
66	Interest	$545,858	$0	$545,858
67	Other Non-Operating Revenues	$0	$0	$0
68	Total Revenue Offsets	$12,358,735	$187,187	$12,545,922
69				
70	Adjustment for Change in Cash Reserves	$0	($134,195)	($134,195)
73	Net Revenue Requirement from Rates	$85,143,356	$29,996,656	$114,871,621

6.4. Step 2: Cost Functionalization

After determining the FY 2021 operating and capital cost revenue requirement components based on actual cost data, the next step in the COS process is to assign the revenue requirement from rates to specific functional categories and then allocate these functionalized costs to specific cost causation components. The assignment of costs to functional categories answers the question: What water utility functions are supported by (i.e., paid for) the rate revenue provided by customers? Cost causation components reflect the types of demands the water utility must have the ability to serve. Table 6-2 shows the functional categories and the cost causation components used in the FY 2021 COS update. These are the same functional categories and cost causation components used in FY 2016 COS Study.

Table 6-2: Water Utility Functions

Line	Functions	Costs Associated with Each Function
1	**Potable Water**	
2	Potable Supply	Direct water supply costs to produce potable water before distributing to customers, including power costs for treatment, and pumping from groundwater wells, chemical costs, and costs of purchasing water from the City of Lakewood and MWD
3	Production Plant / Wells	Operating and capital costs associated with production facilities to produce water
4	Storage	Costs associated with water storage within the distribution or transmission systems
5	Pumping	Costs associated with pumping water from the treatment facilities to the transmission and distribution systems
6	Treatment	Costs associated with treating water to potable water standards, excluding power and chemical costs
7	Transmission	Costs associated with transporting water from the point of treatment through a major trunk to locations within the distribution systems
8	Distribution	Costs associated with the smaller local service distribution mains transporting water to specific locations within the service area
9	Transmission and Distribution	Joint transmission and distribution costs
10	Fire Protection	Costs associated with installing and maintaining fire hydrants
11	Meter Services	Costs associated with providing customer water meters and associated testing and replacements
12	General and Administrative	Represents all other costs that do not serve a specific function
13	Water Replenishment District	Water Replenishment District costs allocated to potable water supply
14	Billing	Billing costs including meter reading, billing, and collection costs associated with preparing a water customer bill and processing funds received from water users
15	Customer Service	Costs include costs associated with customer accounts such as processing complaints, responding to customer inquiries, performing rereads, etc.
16	Conservation	Costs associated with conservation programs and services offered to Department customers
17	Revenue Offsets	Miscellaneous revenue sources such as reimbursements and grants that offset the revenue requirement from rates
18	Water Rights	Costs to acquire and maintain water rights
19	**Reclaimed Water**	
20	Reclaimed Water Average Demand	Costs associated with meeting reclaimed water average day demand
21	Reclaimed Water Storage	Costs associated with reclaimed water storage within the reclaimed water distribution system
22	Reclaimed Water Pumping	Costs associated with pumping within the reclaimed water distribution system
23	Reclaimed Water Distribution	Costs associated with the reclaimed water distribution mains transporting water to specific locations within the service area
24	Water Replenishment District	Water Replenishment District costs allocated to reclaimed water supply
25	**Capital Costs Allocations**	
26	Capital Costs	Capital-related costs such as debt service, rate funded capital expenditures, changes in cash reserves, or facilities-related expenses allocated based on assets

Raftelis reviewed and functionalized the Department's O&M expenses and assets for the water and reclaimed water systems. Table 6-3 summarizes the functionalized actual O&M costs for FY 2021.

Table 6-3: Functionalized FY 2021 Water O&M Costs

Line	Type of Costs	Cost
1	Potable Water	$27,383,317
2	Potable Supply	$27,383,317
3	Production Plant	$8,305,519
4	Treatment	$10,412,126
5	Distribution	$2,874,622
6	Transmission and Distribution	$7,490,602
7	Meter Services	$1,381,709
8	Gen & Admin	$9,652,623
9	Billing	$517,147
10	Customer Service	$3,427,655
11	Conservation	$2,091,995
12	Total Potable Water O&M Costs	$73,537,315
13		
14	Reclaimed Water	
15	Reclaimed Water Average Demand	$11,687
16	Reclaimed Water Distribution	$715,738
17	Water Replenishment District	$12,645,266
18	Total Reclaimed Water O&M Costs	$13,372,691
19		
20	Capital Costs Allocations	
21	Capital Costs Identified as O&M	$17,043
22	Total Capital Costs	$17,043
23		
24	Total O&M Costs	$86,927,049

Table 6-4 shows FY 2021 functionalized water utility fixed asset values expressed on a replacement cost basis. To reduce rate variability from year-to-year, the allocation of fixed assets to functions and cost causation components is used as a basis for allocating the capital cost revenue requirement. The FY 2021 asset values were escalated from their original acquisition cost to current dollars using the Engineering News Record – Construction Cost Index (ENR CCI) for Los Angeles.

Table 6-4: FY 2021 Functionalized Water Asset Values

Line	Type of Asset	Value
1	Potable Water	
2	Wells	$56,250,232
3	Storage	$115,901,615
4	Pumping	$19,184,737
5	Treatment	$163,200,809
6	Transmission	$150,048,989
7	Distribution	$476,077,508
8	Transmission & Distribution	$580,054
9	Fire Protection	$26,375,164
10	Meter Services	$7,152,898
11	General and Administrative	$39,702,751
12	Customer Service	$562,744
13	Water Rights	$17,093,039
14	Total Potable Water Assets	$1,072,130,539
15		
16	Reclaimed Water	
17	Reclaimed Water Storage	$4,856,281
18	Reclaimed Water Pumping	$1,987,723
19	Reclaimed Water Distribution	$107,289,096
20	Total Reclaimed Water Assets	$114,133,100
21		
22	Total Assets	$1,186,263,639

6.5. Step 3: Allocation to Cost Causation Components

The allocation of costs to cost causation components answers the question: What types of customer demands are met by (i.e., paid for) by each function of the water utility system? Raftelis used the Base-Extra Capacity method of cost allocations, as described in the AWWA M1 Manual. These cost causation components include:

- **Water Supply Costs** are direct costs incurred to produce or purchase water.

- **Base Costs** are the operating and capital costs of the water system associated with serving customers at a constant, or average, rate of use.

- **Extra Capacity Costs** or peaking costs represent the costs incurred to meet customer peak demands for water in excess of average day usage. Total extra capacity costs are subdivided into costs associated with maximum day and maximum hour demands. The maximum day demand is the maximum amount of water used in a single day in a year. The maximum hour demand is the maximum usage in an hour on the maximum usage day. Various facilities are designed to meet customer peaking needs. For example, transmission lines or reservoirs (storage) are designed to meet maximum day requirements. Both have to be designed larger than they would be if the same amount of water were being used at a constant rate throughout the year.

  The cost associated with constructing a larger line or reservoir is based on system-wide peaking factors. For example, if the maximum day peaking factor is 2.0, then certain system facilities have to be designed at least twice as large as required to meet average daily demand. In this case, half of the cost would be allocated to base fixed (or average day demand) and the other half allocated to maximum day. The calculation of the maximum hour and maximum day peaking factors is explained below. Different facilities, such as distribution and storage facilities, and the O&M costs associated with those facilities are designed to meet the peaking demands of customers. Therefore, extra capacity[4] costs include the O&M and capital costs associated with meeting peak customer demand. This method is consistent with the AWWA M1 Manual and is widely used in the water industry to perform COS analyses.

- **Customer Service Costs** include such costs as meter reading, billing, collecting, and customer accounting.

- **Meter Costs** or meter service costs include maintenance and capital costs associated with servicing meters. These costs are assigned based on meter size or equivalent meter capacity.

- **Fire Protection** includes proportional costs to provide fire protection capacity.

- **Conservation** includes costs associated with conservation programs and services offered for Department customers.

- **Revenue Offsets** includes non-rate revenues that can be used to provide affordability for essential use and other affordability programs.

[4] The terms extra capacity, peaking, and capacity costs are used interchangeably.

6.5.1. SYSTEM PEAKING FACTORS AND DEMAND RATIOS

After establishing the functions and cost causation components to be used in the cost allocation process, system demand ratios must be calculated to accurately allocate the functionalized costs to each cost causation component. Table 6-5 shows the system peaking factors and demand ratios used to allocate variable costs in the FY 2021 COS update. The potable water demand ratios shown in Table 6-5 were taken from the Water Master Plan and reflect data from the period 2016 – 2019. The reclaimed water demand ratios were calculated by Raftelis based on data provided by Department staff.

Table 6-5: Water System Peaking Factors and Demand Ratios

				System Demand Ratios		
Line	Type of Demand	Demand (MGD)	System Peaking Factors	Base Fixed Demand	Maximum Day Demand	Maximum Hour Demand
1	Potable Water					
2	Average Day (Based Fixed)	48.70	1.00	100.0%		
3	Maximum Day	65.30	1.34	74.6% (1)	25.4% (2)	
4	Maximum Hour	117.00	2.40	41.6% (3)	14.2% (4)	44.2% (5)
5						
6	Reclaimed Water					
7	Average Day (Based Fixed)	6.19	1.00	100.0%		
8	Maximum Day	11.58	1.87	53.5% (6)	46.5% (7)	
9	Maximum Hour	19.44	3.14	31.8% (8)	27.7% (9)	40.4% (10)
	Derivation of System Demand Ratios: 74.6% = 1.00 Base Peaking Factor /1.34 Max Day Peaking Factor 25.4% = 100% - 74.6% 41.6% = 1.00 Base Peaking Factor /2.40 Max Hour Peaking Factor 14.2% = (1.34 Max Day Peaking Factor – 1.00 Base Peaking Factor) / 2.40 Max Hour Peaking Factor 44.2% = 100% - (41.6% + 14.2%) 53.5% = 1.00 Reclaimed Base Peaking Factor /1.87 Reclaimed Max Day Peaking Factor 46.5% = 10% - 53.5% 31.8% = 1.00 Reclaimed Base Peaking Factor /3.14 Reclaimed Max Hour Peaking Factor 27,7% = (1.87 Reclaimed Max Day Peaking Factor – 1.00 Reclaimed Peaking Factor)/3.14 Reclaimed Max Hour Peaking 40.4% = 100% - (31.8% + 27.7%)					

Water system infrastructure is designed to meet peak demand plus fire protection. To appropriately allocate costs associated with the fire protection function to causation components the amount of system capacity required for protection must be estimated. Based on fire demand estimates provided by Department staff, as shown in Table 6-6, 21.6% of the water system capacity is reserved for fire protection demand. Therefore, storage, transmission, and distribution costs will have 21.6% allocated to fire protection cost categories.

Table 6-6: Water Fire Protection Capacity Requirements

Line	Potable Water	Demand (MGD)	Notes
1	Fire Demand	17.93[5]	*Estimated population of 500,000*
2	Max Day Demand	65.30	*Table 6-4*
3	Fire Protection %	21.5%	*Line 1 / Line 2*

Table 6-7 summarizes the percentage allocation of functionalized water costs to cost causation components. All treated groundwater (65.6%) and purchased water (34.4%) are blended in storage tanks to be used for all water needs including fire protection. Groundwater requires pumping, whereas purchased water does not incur any pumping costs. Thus 65.6% of the water in storage tanks has pumping costs, which is also used for fire protection. Fire protection makes up 21.5% of the system costs (line 3 in Table 6-6). Thus, 14.1% of pumping costs are allocated to fire protection (65.6%*21.5%=14.1%).

[5] Using formulas by American Insurance Association

Table 6-7: Allocation of Functionalized Potable Water Costs to Cost Causation Components

Line	Functions	Water Supply	Base Fixed	Maximum Day	Maximum Hour	Billing & Customer Service	Meters & Services	Conservation	General	Fire Protection	Water Rights
1	Potable Supply	100.0%									
2	Production Plant		100.0%								
3	Storage		58.5%	19.9%						21.5%	
4	Pumping		64.0%	21.8%						14.1%	
5	Treatment		74.6%	25.4%						0.0%	
6	Transmission (T)		58.5%	19.9%						21.5%	
7	Distribution (D)		32.7%	11.1%	34.7%					21.5%	
8	T&D		38.9%	13.2%	26.4%					21.5%	
9	Source of Supply		100.0%								
10	Fire Protection									100.0%	
11	Meter Services						100.0%				
12	Gen & Admin								100.0%		
13	Billing					100.0%					
14	Customer Service					100.0%					
15	Conservation							100.0%			
16	Revenue Offset										
17	Wells		100.0%								
18	Water Rights										100.0%
19	WRD Allocations	84.3%									

Table 6-8 summarizes the percentages allocation of functionalized reclaimed water costs to cost causation components.

Table 6-8: Allocation of Functionalized Reclaimed Water Costs to Cost Causation Components

Line	Functions	Reclaimed Base Fixed	Reclaimed Max Day	Reclaimed Max Hour
1	Reclaimed Average Demand	100.0%		
2	Reclaimed Storage	53.5%	46.5%	
3	Reclaimed Pumping	31.8%	27.7%	40.4%
4	Reclaimed Treatment	53.5%	46.5%	
5	Reclaimed Distribution	31.8%	27.7%	40.4%
6	Water Replenishment District Allocations	15.7%		

Using the allocation factors from Table 6-7 and the functionalized O&M costs from Table 6-3, Table 6-9 summarizes the allocation of FY 2021 O&M expenses to cost causation components. Similarly, Table 6-10 uses the allocation factors from Table 6-7 and the functional costs from Table 6-4, summarizes the allocation of Water Fund fixed asset values (by replacement costs as of September 30, 2021) to cost categories and allocation percentage for capital related costs.

Table 6-9: Results of the Water O&M Cost Allocations

Line	Cost Component	FY 2021 O&M	Allocation Factors
1	Water Supply	$38,037,555	43.8%
2	Base Fixed Demand	$19,926,843	22.9%
3	Maximum Day Demand	$3,960,997	4.6%
4	Maximum Hour Demand	$2,973,350	3.4%
5	Billing & Customer Service	$3,944,811	4.5%
6	Meters & Services	$1,381,812	1.6%
7	Conservation	$2,091,995	2.4%
8	General & Administrative	$9,653,194	11.1%
9	Fire Protection	$2,236,155	2.6%
10	Water Rights	$246	0.0%
11	Total	$86,927,049	100.0%

Table 6-10: Results of the Water Asset Value Allocations

Line	Cost Component	FY 2021 O&M	Allocation Factors
1	Water Supply	$0	0.0%
2	Base Fixed Demand	$501,542,476	42.3%
3	Maximum Day Demand	$151,783,393	12.8%
4	Max Hour	$165,193,034	13.9%
5	Billing & Customer Service	$562,744	0.0%
6	Meters & Services	$7,152,898	0.6%
7	Conservation	$0	0.0%
8	General & Administrative	$39,702,751	3.3%
9	Fire Protection	$189,100,203	15.9%
10	Water Rights	$17,093,039	1.4%
11	Total	$1,186,263,639	100.0%

6.5.2. REVENUE REQUIREMENT ALLOCATIONS

Table 6-11 shows the total revenue requirement for each major revenue requirement component detailed in Table 6-1. As noted previously, debt service, capital replacement, reserve funding, and certain non-operating revenues are considered capital revenue requirements. It is important to note that the amounts shown in Table 6-11 do not reflect the final allocation of General & Administrative costs or the final allocation of Public Fire Protection costs.

Table 6-11: Water Revenue Requirement and Allocation Factors

Line	Description	FY 2021	Allocation Basis
1	Revenue Requirements		
2	O&M Expenses	$86,927,049	O&M Allocation
3	Debt Service	$6,221,000	Asset Allocation
4	Capital Improvement Projects	$15,616,814	Asset Allocation
5	Adjustment for Change in Cash Reserves	$8,118,697	Asset Allocation
6	General Fund Transfer (Measure M)	$10,575,042	Based on lines 2-6
7	Gross Revenue Requirement	$127,458,602	
8			
9	Less: Revenue Offsets		
10	Other Operating Revenues		
11	Water Other Unallocated Operating Revenue	$9,093,359	100% to General & Administrative
12	Reclaimed Operating Revenue	$1,100,508	100% to General & Administrative
13	Water Accounting Revenue	$1,088,710	100% to General & Administrative
14	Water Development Revenue	$48,044	100% to General & Administrative
15	Conservation Revenue	$220,000	100% to Conservation
16	Interest	$586,917	Asset Allocation
17	Existing Debt Proceeds	$187,187	Asset Allocation
18	Reclaimed Contract Rate Revenue	$262,256	Asset Allocation
19	Subtotal Revenue Offsets	$12,586,981	
20			
21	Net Revenue Requirement from Rates	$114,871,621	

Table 6-12 summarizes the result of allocating the components of the revenue requirement from rates shown in Table 6-7 and Table 6-8.

Table 6-12: Water Net Revenue Requirement Allocated to Cost Causation Components

Line	Cost Causation Component	FY 2021 Revenue Requirement
1	Water Supply	$38,037,555
2	Base Fixed Demand	$38,030,182
3	Maximum Day Demand	$9,066,548
4	Maximum Hour Demand	$8,288,804
5	Billing & Customer Service	$4,672,313
6	Meters & Services	$1,837,890
7	Reclaimed Water Base Fixed Demand	$3,715,224
8	Reclaimed Water Maximum Day Demand	$1,176,774
9	Reclaimed Water Maximum Hour Demand	$1,620,616
10	Conservation	$1,871,995
11	General	-$709,507
12	Fire Protection	$6,846,266
13	Water Rights	$416,960
14	Total	$114,871,621

General and Administrative costs are reallocated to all cost causation components, excluding water supply, conservation, and revenue offsets. The allocation of General and Administrative costs is shown in Table 6-13.

Table 6-13: Water General & Administrative Cost Allocation

			General and Administrative Cost Reallocation		
		A	B	C=B/B14	D=A Line 11 x C
Line	Cost Causation Components	FY 2021 Revenue Requirement	Cost Basis for the Allocation Percentage	Allocation %	General & Administrative Allocation
1	Water Supply	$38,037,555	N/A		
2	Base Fixed Demand	$38,030,182	$38,030,182	55.6%	($394,435)
3	Maximum Day Demand	$9,066,548	$9,066,548	13.3%	($94,035)
4	Maximum Hour Demand	$8,288,804	$8,288,804	12.1%	($85,968)
5	Billing & Customer Service	$4,672,313	$4,672,313	6.8%	($48,460)
6	Meters & Services	$1,837,890	$1,837,890	2.7%	($19,062)
7	Reclaimed Water Base Fixed Demand	$3,715,224	$3,715,224	5.4%	($38,533)
8	Reclaimed Water Maximum Day Demand	$1,176,774	$1,176,774	1.7%	($12,205)
9	Reclaimed Water Maximum Hour Demand	$1,620,616	$1,620,616	2.4%	($16,808)
10	Conservation	$1,871,995	N/A		
11	General	($709,507)	N/A		
12	Fire Protection	$6,846,266	N/A		
13	Water Rights	$416,960	N/A		
14	Total	$114,871,621	$68,408,351	100.0%	($709,507)

Table 6-14 shows the calculation of fire capacity units of service for public and private fire protection. AWWA Manual M1 states that fire capacity is equal to the port size increased by the exponent 2.63. Fire hydrants with 6" connections include two 2" ports and one 4" port with an equivalent fire capacity of 50.70. The Department's FY 2021 fire protection system included 7,054 public fire hydrants with a 6" connection, 65 private fire hydrants with a 6" connection, and 1,209 private fire line services of various pipe diameters.

Total public fire protection capacity was equal to 357,637 equivalent units and private fire protection capacity was equal to 154,321 equivalent units as shown in Table 6-14. Approximately 69.9% of fire protection for the Department's water system is reserved for public fire protection, which is reallocated to all benefiting customers within the service area (shown in Table 6-15) and the remaining 30.1% of fire protection costs represents the private fire protection costs to be paid for by customers who have a private fire service meter. Public fire protection (i.e.,

hydrants) costs are related to the capacity of the water system that is allocated to providing fire protection, not the actual costs of extinguishing fires.

Table 6-14: FY 2021 Water Fire Protection Units of Service

Line	A Port Size (inch)	B Fire Capacity by Port Size (1) (2 x 2-in + 1x4-in)	C 6" Fire Hydrant (2 x 2" + 1 x 4")	D # of Private Fireline	F = B x D Private Fireline Fire Capacity
1	2"	6.19	12.38	61	378
2	3"	17.98		52	935
3	4"	38.32	38.32	356	13,642
4	6"	111.31		425	47,307
5	8"	237.21		256	60,725
6	10"	426.58		54	23,035
7	12"	689.04		3	2,067
8	16"	1,468.37		2	2,937
9		Fire Capacity	50.70	1,209	151,026
10		Public Fire Hydrants	7054		
11		Public Fire Demand	357,637		
12		Private Fire Hydrants	65		
13		Private Fire Capacity	3,295		151,026
14		Total Fire Capacity (11+13)	360,932		151,026
15					
16	(1) AWWA M1 Manual, Fire Demand = Port Size ^2.63				

Table 6-15 shows the calculation of FY 2021 public and private fire protection capacity based on the data presented in Table 6-14.

Table 6-15: FY 2021 Water Public and Private Fire Protection Capacity

Line	Type of Fire Service	Fire Capacity (Table 6-14)	% of Total Fire Capacity	Notes
1	Public Fire	357,637	69.9%	
2	Private Fire	154,321	30.1%	Based on Line 13 of Table 5-14
3	Total	511,958		

Table 6-16 shows the final reallocation of FY 2021 public fire protection costs to the base fixed demand and meters and services cost causation components.

Table 6-16: FY 2021 Water Public Fire Protection Reallocation

Line	Cost Causation Components	FY 2021 Revenue Requirement	Public Protection Cost Reallocation Cost Basis for the Allocation Percentage	Allocation %	Allocated Public Fire Protection Costs
		A	B	C=B/B15	D=69.9% x Column A Line 12 x C
1	Water Supply	$38,037,555	N/A		
2	Base Fixed Demand	$37,635,747	$37,635,747	95.4%	$4,564,930
3	Maximum Day Demand	$8,972,513	N/A		
4	Maximum Hour Demand	$8,202,835	N/A		
5	Billing & Customer Service	$4,623,853	N/A		
6	Meters & Services	$1,818,829	$1,818,829	4.6%	$220,610
7	Reclaimed Water Base Fixed Demand	$3,676,691	N/A		
8	Reclaimed Water Maximum Day Demand	$1,164,569	N/A		
9	Reclaimed Water Maximum Hour Demand	$1,603,807	N/A		
10	Conservation	$1,871,995	N/A		
11	General	$0	N/A		
12	Fire Protection	$6,846,266	N/A		
13	Water Rights	$416,960	N/A		
14	Total	$114,871,621	$39,454,575		$4,785,540

Table 6-17 summarizes the results from Table 6-11, Table 6-13, and Table 6-16 to show the revenues from rates after general and public fire protection cost reallocation.

Table 6-17: Reallocated Water FY 2021 Revenue Requirements

Line	Cost Causation Components	FY 2021 Revenue Requirement	General & Administrative Reallocation	Public Fire Protection Reallocation	Reallocated Revenue Requirement
		A	B	C	D=A+B+C
1	Water Supply	$38,037,555			$38,037,555
2	Base Fixed Demand	$38,030,182	($394,435)	$4,564,930	$42,200,677
3	Maximum Day Demand	$9,066,548	($94,035)		$8,972,513
4	Maximum Hour Demand	$8,288,804	($85,968)		$8,202,835
5	Billing & Customer Service	$4,672,313	($48,460)		$4,623,853
6	Meters & Services	$1,837,890	($19,062)	$220,610	$2,039,439
7	Reclaimed Water Base Fixed Demand	$3,715,224	($38,533)		$3,676,691
8	Reclaimed Water Maximum Day Demand	$1,176,774	($12,205)		$1,164,569
9	Reclaimed Water Maximum Hour Demand	$1,620,616	($16,808)		$1,603,807
10	Conservation	$1,871,995			$1,871,995
11	General	($709,507)	$709,507		$0
12	Fire Protection	$6,846,266		($4,785,540)	$2,060,726
13	Water Rights	$416,960			$416,960
14	Total	$114,871,621			$114,871,621

Table 6-18 shows the summary of revenue requirements by cost categories to be recovered from water and reclaimed water rates.

Table 6-18: FY 2021 Water Revenue Requirement by Cost Causation Components

Line	Cost Categories	FY 2021
1	Water Supply	$38,037,555
2	Base Fixed Demand	$42,197,848
3	Maximum Day Demand	$3,676,691
4	Maximum Hour Demand	$17,175,348
5	Billing & Customer Service	$2,768,377
6	Meters & Services	$4,623,853
7	Reclaimed Water Base Fixed Demand	$2,039,302
8	Reclaimed Water Maximum Day Demand	$1,871,995
9	Reclaimed Water Maximum Hour Demand	$416,960
10	Conservation	$2,063,691
11	General	$114,871,621

6.6. Step 4: Allocation of Costs to Fixed and Variable Rate Components

As discussed in AWWA Manual M1 the COS approach to setting water rates results in the proportionate distribution of costs to each customer class based on demands and associated costs that each customer class imposes on the water utility system. A dual set of rates and charges —fixed and variable—is an extension of this cost causation theory.

The components of water system costs shown in Table 6-18 are recovered through either daily service charges, water volumetric rates, reclaimed water volumetric rates, or a combination of the three. As shown in Table 6-19, the entirety of water supply costs, water peaking costs, and water conservation program costs are recovered

through water volumetric rates. Reclaimed water peaking costs are recovered through reclaimed water volumetric rates. Billing and customer service costs, along with the cost of meters and services, are fixed in nature and do not vary with water consumption. Thus, they are recovered via the Department's daily service charge. Private fire services costs are paid by customers who have a private fire service meter through the Department's private fire line daily service charge.

To provide revenue stability for the Department, Raftelis allocated 40% of potable and reclaimed water base fixed demand costs to daily service charge cost recovery. This was also done in the FY 2016 COS Study to achieve the Department's fixed revenue recovery target of 30%. The remaining FY 2021 potable and reclaimed water costs are collected via water and reclaimed water volumetric rates. Table 6-20, Table 6-21, and Table 6-22 are derived from Table 6-19 based on the rate components for fixed charges, water volumetric rates, and reclaimed water volumetric rates.

Table 6-19: FY 2021 Water Cost Allocations to Rate Components

Line	Cost Categories	FY 2021 Revenue Requirement	Fixed Charges	Water Volumetric Rates	Reclaimed Volumetric Rates
1	Water Supply	$38,037,555		$38,037,555	
2	Potable Base Fixed	$42,197,848	$25,318,709	$16,879,139	
3	RW Base Fixed	$3,676,691	$2,206,015		$1,470,677
4	Potable Peaking (Max Day + Max Hour)	$17,175,348		$17,175,348	
5	RW Peaking (RW Max Day + RW Max Hour)	$2,768,377			$2,768,377
6	Billing & Customer Service	$4,623,853	$4,623,853		
7	Meters & Services	$2,039,302	$2,039,302		
8	Conservation	$1,871,995		$1,871,995	
9	Water Rights	$416,960		$416,960	
10	Private Fire Services	$2,063,691	$2,063,691		
11	Total	$114,871,621	$36,251,570	$74,380,998	$4,239,053

The Department's fixed charge revenue requirement consists of three components: billing and customer service, meter services and capacity, and private fire lines. As shown in line 11 of Table 6-19 and line 6 of Table 6-20, the FY 2021 fixed revenue requirement calculated by Raftelis was $36.3 million.

Table 6-20: Water FY 2021 Fixed Revenue Requirement

	Rate Components	Cost Categories	FY 2021	
Line	A	B	C (Table 6-19)	D
1	Billing & Customer Service	Billing & Customer Service	$4,623,853	$4,623,853
2	Meter Services & Capacity	Potable Base Fixed Demand	$25,318,709	$29,564,025
3		Reclaimed Water Base Fixed Demand	$2,206,015	
4		Meters & Services	$2,039,302	
5	Private Fire	Private Fire Services	$2,063,691	$2,063,691
6	Total Raftelis Calculated FY 2021 Fixed Revenue Recovery	31.6% Fixed	$36,251,570	$36,251,570
7	Actual FY 2021 Fixed Revenue Recovery Reported by the Department	30.6% Fixed	$34,900,811	

As shown in Table 6-21, variable water volumetric rates are composed of water supply costs, delivery, peaking, conservation, and revenue offset rate components. The FY 2021 variable water revenue requirement was $74.4 million (line 11 of Table 6-19). The water supply rate recovers direct water supply costs. The delivery rate collects the remaining water system fixed cost to deliver water to end users. The peaking rate collects the peaking costs of the potable water system. The conservation rate reflects the conservation program costs from the upper tiers to promote conservation from large users. The revenue offset rate is used to provide affordability for essential use. As more water system costs are recovered through fixed charges less revenue is collected through water volumetric rates.

Table 6-21: FY 2021 Water Variable Revenue Requirement

Line	Rate Components A	Cost Categories B	FY 2021 C
1	Water Supply	Water Supply	$38,037,555
2	Delivery	Potable Base Fixed	$16,879,139
3	Peaking	Potable Peaking	$17,175,348
4	Conservation	Conservation	$1,871,995
5	Water Rights	Water Rights	$416,960
6	Total Raftelis Calculated FY 2021 Water Variable Revenue Recovery	64.8%	$74,380,998
7	Actual FY 2021 Water Variable Revenue Recovery Reported by the Department	65.2%	$74,435,459

Table 6-22 shows the FY 2021 reclaimed water variable revenue requirement.

Table 6-22: FY 2021 Reclaimed Water Variable Revenue Requirement

Line	Rate Components A	Cost Categories B	FY 2021 C
1	Delivery	Reclaimed Base Fixed	$1,470,677
2	Peaking	Reclaimed Peaking	$2,768,377
3	Total Raftelis Calculated FY 2021 Reclaimed Water Variable Revenue Recovery	3.7%	$4,239,053
4	Actual FY 2021 Reclaimed Water Variable Revenue Recovery Reported by the Department	4.3%	$4,887,556

6.7. Step 5: Customer Class Rate Calculation

In Step 5, daily service charges and water volumetric rates for each customer class are developed using the cost allocation results shown in Table 6-20 and Table 6-21.

6.7.1. RECALCULATION OF FY 2021 DAILY SERVICE CHARGES

There are three cost components recovered by the Department's daily service charges: billing and customer service costs, meter services and capacity costs, and private fire line service costs. The daily service charge recognizes that even when a customer does not use any water, the Department incurs fixed costs in connection with the maintenance of meters, the ability or readiness to serve each connection, and/or the billing services provided to each connection.

The meter services and capacity component of the daily service charge collects capacity-related costs. Capacity costs are allocated to the daily service charge by meter size. This reflects the fact that larger meters have the potential to demand more capacity compared to smaller meters. The capacity demanded is proportional to the potential maximum flow through each meter size as established by the AWWA hydraulic capacity ratios which are shown in the "AWWA Meter Ratio" column D of Table 6-23. The ratios depict the potential flow through each meter size compared to the flow through a 5/8" or 3/4" meter, which is the base meter size used in the study For example, the flow through a 2" meter is approximately 5.33 times that of a 3/4" meter. Similarly, according to AWWA M1 Manual, a 3" fire line has 2.90 times more fire capacity than a 2" fire line, as derived and noted in Table 6-24.

Table 6-25 summarizes the projected number of water and reclaimed water accounts and private fire line services in FY 2017 and illustrates the calculations for equivalent units of service for each fixed service charge component. The Department bills customer on monthly basis, thus 89,201 (87,841 +151+ 1,209) accounts are equivalent to 1,070,412 monthly bills. The billing and customer service component recovers costs associated with meter reading,

customer billing and collection, and customer service costs. These costs are the same for all meter sizes as it costs the same to provide billing and customer services to a small meter as it does for a larger meter.

Table 6-23: Water Meter Capacity Ratios

Line	Meter Size A	Meter Types B	AWWA Max Capacity (gpm) C	Meter Flow Equivalency Ratios D=C/30 gpm
1	5/8" or 3/4"	Displacement	30	1.00
2	1"	Displacement	50	1.67
3	1 1/2"	Displacement	100	3.33
4	2"	Displacement	160	5.33
5	3"	Compound	350	11.67
6	4"	Compound	600	20.00
7	6"	Compound	1,350	45.00
8	8"	Class 2 Turbine	2,800	93.33
9	10"	Class 2 Turbine	4,200	140.00
10	12"	Class 2 Turbine	5,300	176.67
11	16"	Class 2 Turbine	7,800	260.00

Table 6-24: Water Fire Line Capacity Ratios

Line	Fire Protection Capacity by Port Size A	Fire Protection Capacity Ratio B	Fire Line Flow Equivalency Ratios C=B/6.19
1	2"	6.19	1.00
2	3"	17.98	2.90
3	4"	38.32	6.19
4	6"	111.31	17.98
5	8"	237.21	38.32
6	10"	426.58	68.91
7	12"	689.04	111.31
8	16"	1,468.37	237.21

Table 6-25: FY 2021 Water Units of Service for Daily Service Charge Component

					Meter Ratios			Units of Service (EMU / yr)		
Line	Meter Size	# of Water Accts A	# of Reclaimed Accounts B	# of Private Fireline C	Billing & Customer Service D	Services & Capacity E	Private Fire Capacity F	Billing & Customer Service G=(A+B+C) x D x 12	Services & Capacity H=(A+B) x E x 12	Private Fire Capacity I = C x F x 12
1	5/8" or 3/4"	69,020	1		1.00	1.00		828,252	828,252	
2	1"	11,207	5		1.00	1.67		134,544	224,240	
3	1 1/2"	4,203	12		1.00	3.33		50,580	168,600	
4	2"	2,588	65	61	1.00	5.33	1.00	32,568	169,792	732
5	3"	483	20	52	1.00	11.67	2.90	6,660	70,420	1,813
6	4"	164	23	356	1.00	20.00	6.19	6,516	44,880	26,445
7	6"	90	16	425	1.00	45.00	17.98	6,372	57,240	91,706
8	8"	63	8	256	1.00	93.33	38.32	3,924	79,520	117,717
9	10"	20	1	54	1.00	140.00	68.91	900	35,280	44,655
10	12"	3		3	1.00	176.67	111.31	72	6,360	4,007
11	16"			2	1.00	260.00	237.21	24		5,693
12	Total	87,841	151	1,209				1,070,412	1,684,584	292,767

Table 6-26 illustrates the development of the unit costs (line 4) for each daily service charge component. The revenue requirements from Table 6-20 are divided by the number of bills/equivalent meters per year (from Table 6-25).

Table 6-26: Development of FY 2021 Water Daily Service Charge Unit Costs

Line		Billing & Customer Service	Services & Capacity	Private Fire Capacity	Notes
1	Revenue Requirements	$4,623,853	$29,564,025	$2,063,691	Table 6-19 (Cost Allocation to Rate Components)
2	Units of Service	1,070,412	1,684,584	292,767	Table 6-25 (Units of Services for Daily Service Charge Components)
3	Units of Service Description	*Monthly bills per Year*	*Equivalent Meter Units per Year*	*Equivalent Fire Line Units per Year*	
4	Unit Cost of Service	$4.32	$17.55	$7.05	Line 1 / Line 2 rounded to $0.01

Table 6-27 shows a comparison of the FY 2021 daily service charges recalculated by Raftelis versus the actual FY 2021 daily service charges assessed by the Department. As shown in column G of Table 6-27, the recalculated daily service charges are up to approximately 14% higher at larger meter sizes. This does not reflect a fundamental flaw in the Department's daily service charge structure. Instead, it reflects the fact that no cost allocation methodology can result in the calculation of FY 2021 rates and charges that exactly match those actually assessed by the Department. From the Raftelis perspective, the variances shown in column G are within the bounds of reasonableness. This is especially true given that the vast majority of water and reclaimed water customers served by the Department have smaller meter sizes.

Table 6-27: Recalculated FY 2021 Water Daily Service Charges vs. Actual

Line	Meter Size	Meter Capacity Ratios A (Table 5-23)	Billing & Customer Service B	Services & Capacity C=A x 17.55	FY 2021 D = B + C	Calculated FY 2021 E= D x 12/365	Actual FY 2021 F	% Difference G=E/F-1
1	5/8" or 3/4"	1.00	$4.32	$17.55	$21.87	**$0.72**	**$0.70**	**3.3%**
2	1"	1.67	$4.32	$29.25	$33.57	**$1.10**	**$1.03**	**6.9%**
3	1 1/2"	3.33	$4.32	$58.50	$62.82	**$2.07**	**$1.87**	**10.3%**
4	2"	5.33	$4.32	$93.60	$97.92	**$3.22**	**$2.88**	**11.7%**
5	3"	11.67	$4.32	$204.75	$209.07	**$6.87**	**$6.08**	**13.1%**
6	4"	20.00	$4.32	$350.99	$355.31	**$11.68**	**$10.27**	**13.7%**
7	6"	45.00	$4.32	$789.74	$794.06	**$26.11**	**$22.87**	**14.1%**
8	8"	93.33	$4.32	$1,637.98	$1,642.30	**$53.99**	**$47.23**	**14.3%**
9	10"	140.00	$4.32	$2,456.96	$2,461.28	**$80.92**	**$70.76**	**14.4%**
10	12"	176.67	$4.32	$3,100.46	$3,104.78	**$102.07**	**$89.23**	**14.4%**
11	16"	260.00	$4.32	$4,562.93	$4,567.25	**$150.16**	**$131.23**	**14.4%**

Table 6-28 shows a comparison of the FY 2021 daily service charges for private fire line service recalculated by Raftelis versus the actual FY 2021 daily service charges for private line service assessed by the Department. As shown in column G of Table 6-28, the recalculated fire line daily service charges range from approximately 9% lower (line 1) and up to approximately 5.8% higher (line 8). This also does not reflect a fundamental flaw in the Department's daily service charge rate structure for private fire lines. Instead, as discussed previously, it reflects the fact that no cost allocation methodology can result in the calculation of FY 2021 rates and charges that exactly match those actually assessed by the Department. From the Raftelis perspective, the variances shown in column G are within the bounds of reasonableness.

Table 6-28: Recalculated FY 2021 Water Daily Service Charges for Fire Lines vs. Actual

Line	Fire Line Size	Fire Line Capacity Ratios A (Table 5-24)	Billing & Customer Service B	Services & Capacity C=A x 7.05	FY 2021 D=B+C	Calculated FY 2021 E= D x 12/365	Actual FY 2021 F	% Difference G=E/F-1
1	2"	1.00	$4.32	$7.05	$11.37	$0.37	$0.41	-9.3%
2	3"	2.90	$4.32	$20.48	$24.80	$0.82	$0.83	-1.7%
3	4"	6.19	$4.32	$43.63	$47.95	$1.58	$1.55	1.7%
4	6"	17.98	$4.32	$126.75	$131.07	$4.31	$4.13	4.4%
5	8"	38.32	$4.32	$270.11	$274.43	$9.02	$8.58	5.2%
6	10"	68.91	$4.32	$485.75	$490.07	$16.11	$15.28	5.5%
7	12"	111.31	$4.32	$784.62	$788.94	$25.94	$24.56	5.6%
8	16"	237.21	$4.32	$1,672.05	$1,676.37	$55.11	$52.11	5.8%

6.7.2. RECALCULATION OF FY 2021 POTABLE WATER VOLUMETRIC RATES

Water volumetric rates are comprised of water supply costs, delivery, peaking, conservation, and revenue offset rate components (Table 6-29).

Table 6-29: Water Volumetric Rate Component Descriptions

Line	Water Volumetric Rate Components	Descriptions
1	Water Supply	Recovering Water Supply Related Costs (Fixed & Variable)
2	Delivery	Recovering remaining fixed costs of delivering water to customers
3	Peaking	Recovering peaking costs
4	Conservation	Recovering conservation program related costs
5	Revenue Offset	Using Rental income (unrestricted revenues) to provide affordability for essential use

Proposition 218 does not specify the type of rate structure that must be used if the rates reflect the proportional cost of serving customers. Table 6-30 summarizes the framework used to justify the Department's water volumetric rates in the FY 2016 COS Study and the FY 2021 COS Update. Specifically, the lowest cost water supplies are allocated to Residential Tiers 1A and 1B. The delivery rate is a uniform cost recovery for all usage types. The peaking rate is allocated to customer classes and tier usage based on proportional peaking factors as discussed in Section 5.1. The conservation rate is allocated uniformly to all customer classes; however, residential classes have conservation costs collected in Tier 3 to promote cost-based water use efficiency.

Table 6-30: Water Volumetric Rate Component Framework

Line	Customer Class	Water Supply	Delivery	Peaking	Conservation	Revenue Offset
		Water Supply Source Allocation	Uniform for All Usage	Proportional to Peaking Factors	Usage Allocation	Offset for Affordable Essential Use
1	Residential					
2	Tier 1A	Groundwater	x	x		xxx
3	Tier 1B	Groundwater	x	x		
4	Tier 2	Blended Lakewood + MWD Tier 1	x	xx		
5	Tier 3	MWD Tier 2	x	xxx	xx	
6	Non-Residential	Blended GW + Lakewood + MWD	x	xxx	x	

6.7.2.1. FY 2021 Water Supply Unit Costs

Table 6-31 shows the FY 2021 availability of water supply sources and their associated variable unit costs. $387/AF or $0.925/ccf represents the water pump tax assessed by the Water Replenishment District for every unit of groundwater pumped from groundwater wells within the Department's service area. The blended Lakewood and MWD Tier 1 water supply unit cost is $2.612/ccf.

Table 6-31: FY 2021 Water Supply Sources - Quantity and Unit Cost Data

	Water Supply Purchase	Available for Purchase (AF)	Available for Sales (After 4% Water Loss)	Unit Cost (/AF)	Unit Rate (with 4% water loss) (/ccf)	Blended Unit Rate
Line		A	B	C	D=C/435.6/(1+4%)	
1	Groundwater	32,692	31,435	$387	$0.925	$0.925
2	Lakewood	900	865	$662	$1.583	$2.612
3	MWD Tier 1	57,560	55,346	$1,099	$2.628	
4	MWD Tier 2			$1,187	$2.840	$2.840

Table 6-32 shows the FY 2021 blended (i.e., weighted average) water supply unit cost of $1.381/ccf calculated for Non-Residential customers. The costs shown in Table 6-32 are based on calculated usage and the actual cost of water.

Table 6-32: FY 2021 Non-Residential Blended Water Supply Rate

Line	Description	Unit Rate	FY 2021 Sales	
1	Non-Residential Calculated Sales		6,327,548 ccf	14,526 AF
2	Groundwater	$0.925	4,531,708 ccf	10,403 AF
3	Lakewood	$1.583	162,302 ccf	373 AF
4	MWD Tier 1	$2.628	1,633,538 ccf	3,750 AF
5	Blended Rate (Weighted Average)	$1.381		

Other direct water supply costs include power for pumping and treatment, chemicals, and MWD fixed costs such as Readiness-to-Serve (RTS) and capacity charges. The costs shown in Table 6-33 are actual FY 2021 costs as documented in the Department's financial accounting system. The calculated FY 2021 uniform rate of $0.300/ccf was applied to the water supply rates for all customer usage.

Table 6-33: FY 2021 Other Water Supply Unit Costs

Line	Other Water Supply Costs	Cost
1	Power	$2,845,501
2	Chemical	$1,109,778
3	MWD Fixed Costs (RTS & Capacity Charges)	$2,517,120
4	Total Other Water Supply Costs	$6,472,399
5	Sales	21,587,611 ccf
6	Unit Rate	$0.300

Table 6-34 summarizes the actual calculated FY 2021 "all-in" water supply unit costs for all usage types. Residential Tier 1 demand is met by groundwater. Thus, the Tier 1 water supply unit cost ($1.225/ccf) reflects the groundwater variable unit cost ($0.925/ccf) plus the other water supply unit cost ($0.300/ccf). If all residential usage exceeds Tier 2, the Department must buy the next marginal water supply source which is MWD Tier 2 water at a unit cost of $2.912/ccf, plus the other water supply unit cost. The Non-Residential water supply unit cost is $1.681/ccf, which is derived from the $1.381/ccf blended variable unit cost and the other water supply unit cost.

Table 6-34: FY 2021 "All-In" Water Supply Unit Costs

Line	Customer Class	Water Supply Sources A	Water Supply Variable Rates B	Other Water Supply Rates C	All-in Water Supply Rates D= B + C	Calculated Sales (ccf) E
1	Residential					
2	Tier 1	Groundwater	$0.925	$0.300	$1.225	9,161,210
3	Tier 2	Lakewood & MWD Tier 1	$2.612	$0.300	$2.912	4,970,154
4	Tier 3	MWD Tier 2	$2.840	$0.300	$3.139	1,128,699
5	Non-Residential	Blended	$1.381	$0.300	$1.681	6,327,548

6.7.2.2. FY 2021 Water Delivery Unit Cost

Table 6-35 shows the calculation of the FY 2021 water delivery unit cost of $0.78/ccf which is uniformly charged to all customer usage to recover the remaining potable base fixed demand costs (see Table 6-20)

Table 6-35: FY 2021 Water Delivery Costs

Line	Description	Delivery Rate	Note
1	Revenue Requirements	$16,879,139	
2	Units of Service	21,587,611 ccf	
3	Unit Cost of Service	$0.78	Line 1 / Line 2 rounded to $0.01

6.7.2.3. FY 2021 Peaking Unit Costs

Peaking costs are recovered from customers based on their respective customer class peaking characteristics as determined in Table 5-1. Table 6-36 shows the equivalent peaking usage units for each usage type with respect to the corresponding peaking factors.

Table 6-36: FY 2021 Equivalent Peaking Usage Units

Line	Potable Sales	Peaking Factors A	FY 2021 Sales (ccf) B	Equivalent Peaking Usage (ccf) C = A x B
1	Residential	1.11	15,260,063	17,183,471
2	Tier 1A	1.06	63,925	68,038
3	Tier 1B	1.06	9,097,286	9,682,729
4	Tier 2	1.17	4,970,154	5,801,064
5	Tier 3	1.45	1,128,699	1,631,640
6	Non-Residential	1.20	6,327,548	7,593,058
7	Total (Line 1 + Line 6)		21,587,611	24,776,528

Table 6-37 illustrates the development of water peaking rates for each usage type. Peaking costs for the potable water system ($17.2 million from Table 6-21) are divided by equivalent peaking usage to derive $0.70/ccf for the peaking unit cost of service. The peaking unit cost is then multiplied by the peaking factors of each usage type to derive the respective peaking rates. The calculated rates are rounded up to the nearest $0.001/ccf.

Table 6-37: FY 2021 Peaking Unit Costs

Line	Description	Peaking Factors A	Peaking Rate B	Notes C
1	Revenue Requirements		$17,175,348	
2	Units of Service		24,531,727	
3	Unit Cost of Service		$0.70	Line 1 / Line 2 rounded to nearest $0.01
4				
5	Residential			
6	Tier 1A	1.06	$0.73	B3 x A6 rounded to nearest $0.01
7	Tier 1B	1.06	$0.73	B3 x A7 rounded to nearest $0.01
8	Tier 2	1.17	$0.81	B3 x A8 rounded to nearest $0.01
9	Tier 3	1.45	$1.00	B3 x A9 rounded to nearest $0.01
10	Non-Residential	1.20	$0.84	B3 x A10 rounded to nearest $0.01

6.7.2.4. FY 2021 Conservation Unit Costs

The development of actual FY 2021 conservation unit costs for residential and non-residential classes is shown in Table 6-38. Residential Tier 3 users are the focus of the conservation program, thus residential conservation program costs ($1.3 million) are recovered from Tier 3 users only.

Table 6-38: Development of FY 2021 Conservation Unit Costs

Line	Description	Sales A	Conservation Rate B	Notes
1	Revenue Requirements		$1,871,995	
2	Units of Service		21,587,611	
3	Unit Cost of Service		$0.09	Line 1 / Line 2 rounded to nearest $0.01
4				
5	Residential	15,260,063 (71%)	$1,329,117	71% x B1
6	Non-Residential	6,327,548 (29%)	$542,879	29% x B1
7	Unit Conservation Rate			
8	Residential	Tier 3 = 1,128,699	$1.17	B4 / A8 rounded to nearest $0.01
9	Non-Residential	All = 6,327,548	$0.09	B4 / A9 rounded to nearest $0.01

Table 6-39 summarizes the actual FY 2021 conservation unit costs.

Table 6-39: FY 2021 Conservation Unit Costs

Line	Customer Class	Conservation Rate
1	Residential	
2	Tier 1A	$0.00
3	Tier 1B	$0.00
4	Tier 2	$0.00
5	Tier 3	$1.17
6	Non-Residential	$0.09

6.7.2.5. FY 2021 Revenue Offset Unit Costs

The Department funds its Residential Tier 1A exemption program (Tier 1A = $0/ccf) though the application of rental income. As shown in Table 6-40, before any revenue offsets, the calculated FY 2021 cost of providing water service for Tier 1A usage is $2.74/ccf.

Table 6-40: True Cost of Tier 1A Water

Line	Components	Tier 1A Costs
1	Water Supply	$1.22
2	Delivery	$0.78
3	Peaking	$0.73
4	Conservation	$0.00
5	Water Rights	$0.00
6	Total	$2.74

Table 6-41 shows the calculation of the remaining rental income offsets that are applicable to Tier 1B usage after funding the exemption program (Tier 1A). The rental income offset applied to Tier 1B is intended to enhance affordability for basic and essential usage.

Table 6-41: FY 2021 Rental Revenue Applied to Tier 1B

Line	Description	Revenue Offset Rate	Notes
1	Rental Income	$291,569	
2	Offsetting all Tier 1A Costs	($227,767)	-$2.74 x 83,088 ccf (Tier 1A)
3	Remaining Rental Income	$63,801	Line 1 - Line 2

Table 6-42 shows the $/ccf revenue offset for each usage type.

Table 6-42: FY 2021 Revenue Offsets

Line	Customer Class	Revenue Offset
1	Residential	
2	Tier 1A	($2.74)
3	Tier 1B	$0.00
4	Tier 2	$0.00
5	Tier 3	$0.00
6	Non-Residential	$0.00

6.7.2.6. Recalculated FY 2021 Potable Water Volumetric Rates

Table 6-43 shows a comparison of the FY 2021 water volumetric rates recalculated by Raftelis versus the actual FY 2021 water volumetric rates charged by the Department. As shown in lines 2 - 4 of column G, the recalculated Residential Tier 1B rate is 12.5% higher than the rate charged by the Department. Correspondingly, the Tier 2 and Tier 3 rates are 3.5% and 6.6% lower, respectively. These residential variances are caused by two factors.

First, as shown in Table 6-44, there has been an increase in the cost of groundwater supplies since the completion of the FY 2016 COS study. As shown in line 1 of Table 6-44, there was a 31.5% increase in groundwater supply costs. Similarly, when viewed on a unit cost basis (line 6 of Table 6-44), there has been a 32.1% increase in groundwater costs.

Second, there has been a change in the intensity of peak water demands in the Residential tiers. As shown in line 5 of Table 6-45, the actual FY 2021 Tier 3 peaking factor was 24.8% lower than the projected FY 2017 Tier 3 peaking factor as developed in the FY 2016 COS Study. The change results in the allocation of more peaking costs to Tier 1B and less peaking costs to Tier 3.

Table 6-43: Recalculated FY 2021 Potable Water Volumetric Rates vs. Actual

Line	Customer Class	Water Supply A	Delivery B	Peaking C	Conservation D	Water Rights E	Revenue Offset F	Calculated FY 2021 G=A + B + C + D + E +F	Actual FY 2021 H	% Difference I = G / H - 1
1	Residential									
2	Tier 1A	$1.22	$0.78	$0.73	$0.00	$0.00	-$2.74	$0.00	$0.00	0.0%
3	Tier 1B	$1.22	$0.78	$0.73	$0.00	$0.00	$0.00	$2.74	$2.44	12.5%
4	Tier 2	$2.91	$0.78	$0.81	$0.00	$0.00	$0.00	$4.50	$4.66	-3.5%
5	Tier 3	$3.14	$0.78	$1.00	$1.17	$0.26	$0.00	$6.35	$6.81	-6.6%
6	Non-Residential	$1.68	$0.78	$0.84	$0.09	$0.02	$0.00	$3.41	$3.62	-5.9%

Table 6-44: Change in the Profile of Water Supply Costs (FY 2017 Projected vs. FY 2021 Actual)

Water Supply Costs						
Line No.	Water Source	Projected FY 2017 Water Cost (1)	Actual FY 2021 Water Cost (1)	$ Difference	% Difference	
1	Groundwater	$294.20	$386.80	$92.60	31.5%	
2	Lakewood	$573.00	$662.00	$89.00	15.5%	
3	MWD Tier 1	$970.28	$1,098.80	$128.52	13.2%	
4	MWD Tier 2	$1,073.71	$1,187.48	$113.77	10.6%	
5	(1) Water supply costs were obtained by taking proportion of the previous and test year's rates based on when rate adjustments would have occurred					
Water Supply Cost Rate Used for Rate Design						
Line No.	Water Source	Projected FY 2017 Variable Supply Rate Component	Actual FY 2021 Variable Supply Rate Component	$ Difference	% Difference	
6	Groundwater	$0.70	$0.92	$0.22	32.1%	
7	Lakewood	$1.36	$1.58	$0.22	16.2%	
8	MWD Tier 1	$2.31	$2.63	$0.32	13.9%	
9	MWD Tier 2	$2.55	$2.84	$0.29	11.3%	
Detailed Calculation of the FY 2021 Water Supply Unit Cost						
Line No.	Water Source	Actual CY 2020 Rate * % usage (AF)	Actual CY 2021 Rate * % usage (AF)	Sum of Rates	Conversion to ccf Rates	Adjustment for Water Loss
10	Groundwater	$229.20	$157.60	$386.80	$0.89	$0.92
11	Lakewood	$662.00	$0.00	$662.00	$1.52	$1.58
12	MWD Tier 1	$215.60	$883.20	$1,098.80	$2.52	$2.63
13	MWD Tier 2	$233.00	$954.48	$1,187.48	$2.73	$2.84

Table 6-45: Change in the Residential Peaking Factors (FY 2017 Projected vs. FY 2021 Actual)

Line	Customer Class	Projected FY 2017 Peaking Factors	Actual FY 2021 Peaking Factors	% Difference
1	Residential	1.22	1.11	-9.2%
2	Tier 1A	1.07	1.06	-0.2%
3	Tier 1B	1.07	1.06	-0.2%
4	Tier 2	1.34	1.17	-12.9%
5	Tier 3	1.92	1.45	-24.8%
6				
7	Non-Residential Combined	1.20	1.20	0.3%
8	Commercial	1.20	1.17	-2.2%
9	Industrial	1.20	1.26	5.4%
10	Irrigation	1.20	1.43	19.6%

6.7.3. RECALCULATION OF FY 2021 RECLAIMED WATER VOLUMETRIC RATES

As was the case for potable water volumetric rates, reclaimed water rates are calculated using the respective peaking factors for each different reclaimed water service: peaking, non-peaking, and interruptible rates. FY 2021 equivalent peaking usage for reclaimed water services are calculated in Table 6-46.

Table 6-46: Equivalent Peaking Usage Units

Line	Service	Reclaimed Water Sales (ccf) A	Peaking Factors B	Equivalent Peaking Usage (ccf) C = A x B
1	Peaking	428,973	1.55	664,908
2	Non-Peaking	854,007	1.00	854,007
3	Interruptible	959,242	1.00	959,242
4	Total Non-Contracted Sales	2,242,222		2,478,157

Table 6-47 illustrates the development of delivery and peaking unit costs for reclaimed water services.

Table 6-47: FY 2021 Reclaimed Water Volumetric Rates Revenue Requirements

Line	Rate Components A	Delivery B	Peaking C	Notes D
1	Revenue Requirements	$1,470,677	$2,768,377	
2	Units of Service	2,242,222 ccf	2,478,157 ccf	
3	Units Reclaimed Rates	$0.66	$1.12	Line 1 / Line 2 rounded to nearest $0.01
4				
5	Peaking	$0.66	$1.73	Peaking = Line 3 x 1.55
6	Non-Peaking / Interruptible	$0.66	$1.12	

6.7.3.1. Recalculated FY 2021 Reclaimed Water Volumetric Rates

Table 6-48 shows a comparison of the recalculated FY 2021 reclaimed water volumetric rates versus the actual FY 2021 volumetric rates charged by the Department. As shown in lines 1 and 3 of column G, the recalculated non-peaking and interruptible rates are 11.3% less than those charged by the Department. This variance is due to a significant change in reclaimed water demand patterns. As shown in Table 6-49, actual FY 2021 Peak service demand is approximately 60% less than what projected for FY 2017. Conversely, Non-Peaking and Interruptible service demands are significantly higher (lines 2 and 3). These demand shifts result in a marginally higher $/ccf rate for Peaking service and a significantly lower $/ccf rate for Non-Peaking and Interruptible service.

Table 6-48: FY 2021 Reclaimed Water Volumetric Rates Revenue Requirements

Line	Service	Delivery A	Peaking B	FY 2021 Recalculated Rates C = A + B	FY 2021 Actual Rates D	% Difference E = C / D - 1
1	Peaking	$0.66	$1.73	**$2.39**	**$2.36**	**1.3%**
2	Non-Peaking	$0.66	$1.12	**$1.77**	**$2.00**	**-11.3%**
3	Interruptible	$0.66	$1.12	**$1.77**	**$2.00**	**-11.3%**

Table 6-49: Reclaimed Demand (FY 2021 Actual vs. FY 2017 Projected)

Line	Service	Projected FY 2017 Demand A	Actual FY 2021 Demand B	Difference C = B - A	% Difference D = B / A -1
1	Peaking	1,071,512	428,973	(642,539)	-59.97%
2	Non-Peaking	414,249	854,007	439,758	106.16%
3	Interruptible	292,914	959,242	666,328	227.48%
4	Total	1,778,675	2,242,222	463,547	26.06%

7. Sewer Revenue Requirement

7.1. Validation of FY 2021 Sewer Rate Revenues

As an initial step in the sewer FY 2021 COS process, Raftelis validated the rate revenues reported in the Department's financial accounting system. The validation required Raftelis to independently calculate FY 2021 rate revenues based on actual customer billing data obtained from the Department's CIS. As shown on line 4 of Table 7-1, the Raftelis calculation of sewer rate revenues were within 1.4% of the revenue reported in the Department's financial accounting system. This calculated variance is within a reasonable range of accuracy and requires no further investigation.

Table 7-1: FY 2021 Sewer Rate Revenue Validation

Line	Sewer	FY 2021 Reported Rate Revenue	FY 2021 Rate Revenue Calculated by Raftelis	$ Difference	% Difference
1	Fixed Revenue (1)	$11,162,309	$11,490,180	$327,871	2.9%
2	Sewer Variable Revenue (2)	$5,793,225	$5,707,582	($85,643)	-1.5%
3	Total	$16,955,534	$17,197,762	$242,228	1.4%
4					
8	(1) Fixed Revenue = Revenue from Daily Service Charges				
9	(2) Sewer Variable Revenue = Revenue from Sewer Volumetric Rates				

7.2. Adequacy of FY 2021 Sewer Cost Recovery

A second question that must be answered when assessing the Department's FY 2021 rates is whether rate revenues were adequate to recover the actual operating and capital costs incurred to provide service. Table 7-2 shows the analysis completed by Raftelis which verifies the adequacy of FY 2021 cost recovery. Highlights of Table 7-2 include:

- The FY 2021 rate revenues shown on lines 1 - 7 of Table 7-2 were calculated by Raftelis based on billing data obtained from the Department's CIS.
- The revenue requirement components shown in lines 9 - 20 are the actual costs recorded the Department's financial accounting system.
- The revenue offsets shown in lines 22 – 32 were recorded in the Department's financial accounting system.
- In FY 2021, approximately $17.2 million in rate revenues were collected from sewer customers (line 7). After the inclusion of a Measure M transfer to the General Fund of $2.1 million (line 19) and a decrease of cash reserves of $153k (line 36), the final net revenue requirement (i.e., net costs) incurred to provide sewer service was also $17.2 million (line 37). From the perspective of Raftelis, the actual FY 2021 decrease in cash reserves of $153k million was reasonable.
- Line 39 shows that the difference between total rate revenues (line 7) and the total net revenue requirement (line 37) is $0. This verifies the adequacy of the Department's FY 2021 rates to pay for the costs incurred to provide sewer service.

Table 7-2: FY 2021 Sewer Revenue Adequacy (Rate Revenues vs Incurred Costs)

Line	Rate Revenues	Amount	% of Total
1	Fixed Revenue		
2	Daily Service Charge	$11,490,180	66.8%
3			
4	Volumetric Revenue		
5	Volumetric Rates	$5,707,582	33.2%
6			
7	Total Rate Revenues	$17,197,762	100.0%
8			
9	Revenue Requirement		
10	O&M Expenses	$10,784,292	52.6%
11			
12	Capital Costs		
13	Existing Debt Service	$729,000	3.6%
14	Rate Funded Capital Projects	$6,885,645	33.6%
15	Total Capital Costs	$7,614,645	37.1%
16			
17	Subtotal	$18,398,937	89.7%
18			
19	Transfer to the General Fund	$2,118,236	10.3%
20	Total Gross Revenue Requirement	$20,517,173	100.0%
21			
22	Less: Revenue Offsets		
23	Impact Fees - Sewer Capacity	$1,318,805	41.7%
24	Interest - Miscellaneous	$4	0.0%
25	Other Investment Income	$101	0.0%
26	Contributions in aid of Construction	$189,209	6.0%
27	Miscellaneous Funds & Reimbursements	$1,326,659	41.9%
28	OTH Dept SVC to Prop Funds Rev	$86,400	2.7%
29	Interest	$128,184	4.0%
30	Existing Debt Proceeds	$1,450	0.0%
31	Other Non-Operating Revenues	$115,260	3.6%
32	Total Revenue Offsets	$3,166,072	100.0%
33			
34	Total Costs Before Change in Cash Reserves	$17,351,101	
35			
36	Change in Cash Reserves	($153,339)	
37	Total Net Revenue Requirement	$17,197,762	
38			
39	Difference	$0	

7.3. O&M Costs in the FY 2021 Revenue Requirement

The actual costs incurred to provide sewer service in FY 2021, as obtained from the Department's financial accounting system, included $10.8 million of O&M expenses (line 10 in Table 7-2). This amount is 52.6% of the total FY 2021 sewer gross revenue requirement of $17.2 million (line 37 of Table 7-2). Table 7-3 shows an itemized detail of actual FY 2021 O&M expenses. Raftelis did not audit the Department's reported FY 2021 sewer O&M expenses.

Table 7-3: Detail of the FY 2021 O&M Revenue Requirement

Line	Expense	Amount	Percentage of Total
1	Undefined Expenses	$180,770	1.7%
2	MIS Expenses	$306,774	2.8%
3	Unallocated Expenses	$3,853,291	35.7%
4	Development Expenses	$604,945	5.6%
5	GIS Expenses	$15,774	0.1%
6	Inspection Expenses	$398	0.0%
7	Pipelines Expenses	$2,932	0.0%
8	Facilities Expenses	$222,996	2.1%
9	Sewer Pump Station Expenses	$958,675	8.9%
10	Water Ops Admin	$5,799	0.1%
11	Sewer Ops Admin Expenses	$146,619	1.4%
12	Facilities Management Expenses	$8,179	0.1%
13	Sewer Main Const Expenses	$4,425,437	41.0%
14	Sewer Emergency Breaks Expenses	$0	0.0%
15	Sewer Service Const Expenses	$48,255	0.4%
16	Sewer Debt Unallocated Expenses	$3,450	0.0%
17	Total O&M Expenses	$10,784,292	100.0%

7.4. Rate Funded Capital Costs in the FY 2021 Revenue Requirement

Table 7-4 provides a detail of the rate funded capital improvement expenditures included in the FY 2021 sewer revenue requirement ($6.9 million in line 11). The expenditures for each project by Department staff and have not been audited Raftelis staff.

Table 7-4: Detail of FY 2021 Sewer Rate Funded Capital Expenditures

Line	CIP Category	Cost
1	Sewer Pipeline Rehab	$2,150,000
2	Sewer Developer Projects	$0
3	Sewer Pipeline Emergency Repair	$0
4	Sewer Operations	$1,050,000
5	Sewer Pipeline Rehab/Install	$1,050,000
6	Sewer Lift Stations	$2,637,094
7	Subtotal	$6,887,094
8		
9	Less: Available Proceeds from Debt	$1,450
10		
11	Total Rate Funded Capital Expenditures	$6,885,645

8. Sewer Customer Units of Service

Sewer customers receive a monthly bill that includes a daily service charge based on their water meter size and a volumetric charge for billed usage. Billed usage is calculated based on average winter water consumption during the months of December – March. Column B of Table 8-1 shows the calculated FY 2021 billed sewer usage for all customers (15.987 ccf) based on billing data obtained from the Department's CIS. Column C shows the monthly average winter sewer usage on a per account basis. Column D shows the daily winter average usage for each meter size and Column E shows the ratio of daily winter average ratios which are calculated using the baseline of a 5/8" or 3/4" connection. As discussed in Section 7.1, the daily winter average ratios in Column E are used in the calculation of the winter daily service charge.

Table 8-1: Detail of FY 2021 Sewer Customer Units of Service

	Meter Size	Annual Use (All Accounts)	Monthly Average Winter Use Per Account	Daily Winter Average	Daily Winter Average Ratios
Line	A	B	C	D	E=D/0.35
1	5/8" or 3/4"	7,185,878	10.51	0.35	1.00
2	1"	1,924,252	17.20	0.57	1.64
3	1 1/2"	1,967,918	47.84	1.59	4.55
4	2"	1,928,287	76.82	2.56	7.31
5	3"	898,008	233.85	7.80	22.24
6	4"	450,536	243.39	8.11	23.15
7	6"	754,670	850.96	28.37	80.94
8	8"	431,240	1,348.36	44.95	128.25
9	10"	393,925	3,222.82	107.43	306.54
10	12"	52,909	3,222.82	107.43	306.54
11	16"			107.43	306.54
12	Total	15,987,624			

9. Sewer Cost Allocations

The sewer COS analysis follows the same basic steps as the water COS analysis process previously discussed in Section 6 of this report:

- Step 1: Identification of Revenue Requirement Components
- Step 2: Cost Functionalization
- Step 3: Allocation to Cost Causation Components
- Step 4: Determination of Customer Class Units of Service
- Step 5: Customer Class Rate Calculation

9.1. Step 1: Identification of Operating and Capital Costs

The starting point of the sewer COS analysis is to identify the operating and capital cost components of the annual revenue requirement from rates. Table 9-1 on the next page shows this for the Department's actual FY 2021 revenue requirement. The information shown in Table 9-1 was provided in in earlier tables presented in this report. For example:

- See Table 7-2 for the derivation of the gross revenue and net revenue requirements from rates shown in lines 26 and 47 of Table 9-1
- See Table 7-3 for a detail of O&M expenses shown in lines 1 - 18 of Table 9-1
- See Table 7-4 for a detail of rate funded CIP expenditures as shown in line 22 of Table 6-1

9.2. Step 2: Cost Functionalization

After determining the FY 2021 operating and capital cost revenue requirement components based on actual cost data, the next step in the COS process is to assign the revenue requirement from rates to specific functional categories. Table 9-2 shows the functional categories and the cost causation components used in the FY 2021 COS update. These are same functional categories and cost causation components used in FY 2016 COS Study

Table 9-1: FY 2021 Sewer Revenue Requirement Operating and Capital Cost Components

Line	Revenue Requirement Component	Operating	Capital	Total
1	O&M			
2	Undefined Expenses	$180,770	$0	$180,770
3	MIS Expenses	$306,774	$0	$306,774
4	Unallocated Expenses	$3,853,291	$0	$3,853,291
5	Development Expenses	$604,945	$0	$604,945
6	GIS Expenses	$15,774	$0	$15,774
7	Inspection Expenses	$398	$0	$398
8	Pipelines Expenses	$2,932	$0	$2,932
9	Facilities Expenses	$222,996	$0	$222,996
10	Sewer Pump Station Expenses	$958,675	$0	$958,675
11	Water Ops Admin	$5,799	$0	$5,799
12	Sewer Ops Admin Expenses	$146,619	$0	$146,619
13	Facilities Management Expenses	$8,179	$0	$8,179
14	Sewer Main Const Expenses	$4,425,437	$0	$4,425,437
15	Sewer Emergency Breaks Expenses	$0	$0	$0
16	Sewer Service Const Expenses	$48,255	$0	$48,255
17	Sewer Debt Unallocated Expenses	$3,450	$0	$3,450
18	Total O&M Expenses	$10,784,292	$0	$10,784,292
19				
20	Other Costs			
21	Debt Service	$0	$729,000	$729,000
22	Rate Funded CIP	$0	$6,885,645	$6,885,645
23	Sewer Fund Transfer	$2,118,236	$0	$2,118,236
24	Total Other Costs	$2,118,236	$7,614,645	$9,732,881
25				
26	Total Gross Revenue Requirement	$12,902,528	$7,614,645	$20,517,173
27				
28	Less: Revenue Offsets			
29	Other Operating Revenues			
30	Permits - Industrial Waste		$0	$0
31	Impact Fees - Sewer Capacity		$1,318,805	$1,318,805
32	Interest - Pooled Cash		$0	$0
33	Interest – Miscellaneous		$4	$4
34	Other Investment Income		$101	$101
35	Contributions in aid of Construction		$189,209	$189,209
36	Sale of Property/Equipment		$0	$0
37	Miscellaneous Funds & Reimbursements		$1,326,659	$1,326,659
38	Damage Claims Recoveries		$0	$0
39	OTH Dept SVC to Prop Funds Rev		$86,400	$86,400
40	Interest		$128,184	$128,184
41	Other Non-Operating Revenues		$115,260	$115,260
42	Existing Debt Proceeds		$1,450	$1,450
43	Total Revenue Offsets	$0	$3,166,072	$3,166,072
44				
45	Adjustment for Change in Cash Reserves	$0	($153,339)	($153,339)
46	Net Revenue Requirement from Rates	$12,902,528	$4,295,234	$17,197,762

Table 9-2: Sewer Utility Functions

Line	Functions	Costs Associated with Each Function
1	Flow	Costs incurred to transport customer sewer discharges to across the Department's sewer collection and conveyance system
2	Sewer Services	Costs incurred to provide customer connections to sewer mains. The Department's sewer daily service charge is based, in part, on the size of the customer's water meter
3	Billing & Customer Service	Billing costs including meter reading, billing and collection costs associated with preparing a sewer customer bill and processing funds received from sewer users. Customer service costs include costs associated with customer accounts such as processing complaints, responding to customer inquiries, performing rereads, etc.
4	General	Represents all other costs that do not serve a specific function
5	Revenue Offsets	Miscellaneous revenue sources such as reimbursements and grants that offset the revenue requirement from rates

Raftelis reviewed and functionalized the Department's sewer O&M expenses and assets. Table 9-3 summarizes the functionalized actual O&M costs for FY 2021.

Table 9-3: FY 2021 Functionalized Sewer O&M Costs

Line	Cost Component	FY 2021 O&M	Allocation Factors
1	Flow	$977,778	9.1%
2	Billing & Customer Service	$794,761	7.4%
3	Sewer Services	$4,473,692	41.5%
4	General	$4,538,061	42.1%
5	Total	$10,784,292	100.0%

Table 9-4 shows FY 2021 functionalized sewer utility fixed asset values expressed on replacement cost basis. The FY 2021 asset values were escalated from their original acquisition cost to current dollars using the Engineering News Record – Construction Cost Index (ENR CCI) for Los Angeles.

Table 9-4: FY 2021 Functionalized Sewer Asset Values

Line	Cost Component	FY 2021 O&M	Allocation Factors
1	Flow	$413,100,336	98.0%
2	Billing & Customer Service	$7,910,191	1.9%
3	Sewer Services	$259,210	0.1%
4	General	$220,882	0.1%
5	Total	$421,490,619	100.0%

9.3. Step 3: Allocation to Cost Causation Components

Table 9-5 summarizes the allocation of functionalized sewer costs to cost causation components.

Table 9-5: Allocation of Functionalized Sewer Costs to Cost Causation Components

Line	Function	Flow	Billing & Customer Service	Meters & Services	General	Total
1	Pumping	100.0%				100.0%
2	Collection	100.0%				100.0%
3	Gen & Admin				100.0%	100.0%
4	Billing		100.0%			100.0%
5	Customer Service		100.0%			100.0%
6	Sewer Services			100.0%		100.0%
7	Sewer O&M	9.1%	7.4%	41.5%	42.1%	100.0%
8	Sewer Capital (From Assets)	98.0%	1.9%	0.1%	0.1%	100.0%

9.3.1. REVENUE REQUIREMENT ALLOCATIONS

Table 9-6 shows the total revenue requirement for each major revenue requirement component detailed in Table 9-1. As noted previously, debt service, capital replacement, reserve funding, and certain non-operating revenues are considered capital cost requirement components and allocated based on functionalized asset values.

Table 9-6: FY 2021 Sewer Revenue Requirement and Allocation Factors

Line	Description	FY 2021	Allocation Factors
1	Revenue Requirements		
2	O&M Expenses	$10,784,292	O&M Allocations
3	Debt Service	$729,000	Asset Allocation
4	Rate Funded CIP	$6,885,645	Asset Allocation
5	Net Operating Cashflow (excl. Revenue Adjustments)	($153,339)	Asset Allocation
6	General Fund Transfer	$2,118,236	Based on Lines 2-5
7	Gross Revenue Requirement	$20,363,834	
8			
9	*Less Revenue Offsets*		
10	Other Operating Revenues	$2,921,179	Asset Allocation
11	Interest	$128,184	Asset Allocation
12	Other Non-Operating Revenues	$115,260	Asset Allocation
13	Proceeds from Existing Debt	$1,450	Asset Allocation
14	Subtotal Other Revenues	$3,166,072	
15			
16	Net Revenue Requirement from Rates	$17,197,762	

Table 9-7 summarizes the allocation of the revenue requirement from rates shown in Table 9-6 to cost causation components.

Table 9-7: FY 2021 Sewer Net Revenue Requirement Allocated to Cost Causation Components

Line	Cost Component	FY 2021 Net Revenue from Rates
1	Flow	$6,150,008
2	Billing & Customer Service	$983,896
3	Sewer Services	$4,996,243
4	General	$5,067,616
5	Total	$17,197,762

9.4. Step 4: Allocation of Costs to Fixed and Variable Rate Components

Table 9-8 summarizes the allocation of the FY 2021 revenue requirement to rate components: fixed (daily service charges) and variable (volumetric rates).

Table 9-8: FY 2021 Sewer Allocations to Rate Components

Line	Cost Categories	Daily Service Charges	Volumetric	FY 2021
1	Flow		$6,150,008	$6,150,008
2	Billing & Customer Service	$983,896		$983,896
3	Meters & Services	$4,996,243		$4,996,243
4	General & Admin	$5,067,616	$0	$5,067,616
5	Total	$11,047,754	$6,150,008	$17,197,762

As shown in line 5 of Table 9-8, the FY 2021 variable sewer revenue requirement was $6.1 million. Variable sewer rates are composed of costs in the flow cost causation component (line 1). As shown in Table 9-9, the total proportion of variable revenue recovery in FY 2021, as calculated by Raftelis, was 35.8%.

Table 9-9: FY 2021 Sewer Volumetric Rate Components

Line	Rate Components	Cost Categories	FY 2021
1	Flow Charges	Flow	$6,150,008
2	Total Raftelis Calculated FY 2021 Sewer Variable Revenue Recovery	35.8%	$6,150,008
3	Actual FY 2021 Sewer Variable Revenue Recovery Reported by the Department	34.2%	$5,793,225

As shown in Table 9-10, sewer daily service charges are composed of billing and customer service and sewer services costs. The FY 2021 sewer daily service charge revenue requirement was $11.0 million (line 5 of Table 9-8). As shown in Table 9-10, the total proportion of fixed revenue recovery in FY 2021, as calculated by Raftelis, was 64.2%.

Table 9-10: FY 2021 Sewer Daily Rate Components

Line	Rate Components	Cost Categories	FY 2021
1	Billing & Customer Service	Billing & Customer Service	$983,896
2	Sewer Services	Meters & Services, General & Administrative	$10,063,858
3	Total Raftelis Calculated FY 2021 Sewer Fixed Revenue Recovery	64.2%	$11,047,754
4	Actual FY 2021 Sewer Fixed Revenue Recovery Reported by the Department	65.8%	$11,162,309

9.5. Step 5: Calculation of Customer Class Rates

In Step 5, daily service charges and sewer volumetric rates are developed, for each customer class, using the cost allocation results shown in Table 9-8.

9.5.1. RECALCULATION OF FY 2021 DAILY SERVICE CHARGES

The sewer daily service charges is composed of two components: billing & customer service and meters & services. This charge recognizes the fact that even when a customer does not discharge any sewage, the Department incurs fixed costs due to the maintenance of the sewer systems, the ability or readiness to serve each connection, and/or the billing services provided to each connection.

Table 9-11 summarizes the number of sewer accounts in FY 2021 and illustrates the calculations for equivalent units of service for each daily service charge component. The Department bills its sewer customers monthly; thus 91,167 accounts are equivalent to 1,094,004 monthly bills. The billing and customer service component recovers costs associated with meter reading, customer billing and collection, and customer service costs. These costs are the same for all meter sizes as it costs the same to provide billing and customer services to a small meter as it does for a larger meter.

The services component recovers sewer service capacity related costs. Capacity related costs are allocated to and recovered through the daily service charge by meter size. This reflects the fact that larger meters have the potential to demand more capacity compared to smaller meters. The potential capacity demanded is proportional to the potential flow through each meter size as established by the daily winter average. The daily winter average is a proxy to estimate indoor usage and return flows to sewer system. The daily winter average is the average usage during the winter months of December 2021 to March 2022 for each meter size. The ratios depict the potential flow through each meter size compared to the flow through a 5/8" or 3/4" meter, which is the base meter size for this study. For example, the flow through a 2" meter is approximately 7.31 times that of a 3/4" meter.

It is important to note that the sewer services capacity ratio shown in Column C in Table 9-11, which is based on daily winter average water usage, differ significantly from the values estimated for FY 2017 in the FY 2016 COS Study. The values projected for FY 2017 were based on calculated daily winter average usage during the period December 2014 to March 2015. As noted previously, the values shown in Column C are based on calculated on daily winter average water usage during the period December 2021 to March 2022. The approximate 7-year time differential in these data points may account for the change in daily winter average usage. Table 8-1 provides a detail of the calculation of FY 2021 daily winter average water use.

Table 9-11: FY 2021 Sewer Units of Service for Daily Service Charge Components

				Meter Ratios		Units of Service (EMU/Year)	
Line	Meter Size	FY 2021 # of Sewer Accounts	Billing & Customer Service	Sewer Services Capacity Based on Actual FY 2021 Daily Winter Average Water Usage	Sewer Services Capacity Based on Estimated FY 2017 Daily Winter Average Water Usage from the FY 2016 COS Study	FY 2021 Billing & Customer Service	FY 2021 Sewer Services Capacity
		A	B	C	D	E = A x B x 12	F = A x C x 12
1	5/8" or 3/4"	72,687	1.00	1.00	1.00	872,244	872,244
2	1"	11,457	1.00	1.64	1.66	137,484	224,936
3	1 1/2"	4,117	1.00	4.55	4.92	49,404	224,789
4	2"	2,201	1.00	7.31	8.75	26,412	192,972
5	3"	413	1.00	22.24	20.06	4,956	110,235
6	4"	150	1.00	23.15	30.35	1,800	41,670
7	6"	82	1.00	80.94	85.17	984	79,643
8	8"	48	1.00	128.25	90.31	576	73,871
9	10"	8	1.00	306.54	140.00	96	29,427
10	12"	4	1.00	306.54	176.67	48	14,714
11	16"	0	1.00	306.54	260.00	0	0
12	Total	91,167				1,094,004	1,864,501

Table 9-12 illustrates the development of unit service charges for each daily service charge component. This calculation divides the revenue requirements from Table 9-10 by the number of equivalent bills/meters per year from Table 9-11.

Table 9-12: Development of FY 2021 Sewer Daily Service Charge Unit Costs

Line	Description	Billing & Customer Service	Sewer Services Capacity	Notes
1	Revenue Requirement	$983,896	$10,063,858	
2	Units of Service	1,094,004	1,864,501	
3		Monthly Bills /Year	Equivalent Meter Units/Year	
4	Unit Cost of Service	$ 0.90	$ 5.40	Line 1 / Line 2 rounded to $0.01
5	Daily Unit Service Cost	$ 0.03	$ 0.18	Line 4 * 12 / 365

Table 9-13 shows a comparison of the FY 2021 daily service charges recalculated by Raftelis using actual cost and demand data versus the actual FY 2021 daily service charges assessed by the Department. As shown in column G of Table 9-13, the recalculated daily service charges differ significantly for some meter sizes (e.g., 4", and 8" - 16"). Raftelis believes these variances are due to changes in the daily winter average water usage shown in Columns C and D of Table 9-11. This does not reflect a fundamental flaw in the Department's daily service charge rate structure. Similar to all of the cost and demand data used in this report for sewer, water, and reclaimed water, Raftelis recommends using updated daily winter average water usage information in the Department's next comprehensive COS analysis.

Table 9-13: Recalculated FY 2021 Sewer Daily Service Charge vs. Actual

		Daily Winter Average Ratio	Billing & Customer Service	Sewer Services	Daily FY 2021	Actual FY 2021	$ Difference	% Difference
Line	Meter Size	A	B	C = A * 0.18	D = B + C	E	F = D - E	G = D / E -1
1	5/8" or 3/4"	1.00	$0.03	$0.18	$0.21	$0.23	($0.02)	-8.0%
2	1"	1.64	$0.03	$0.29	$0.32	$0.33	($0.01)	-3.9%
3	1 1/2"	4.55	$0.03	$0.81	$0.84	$0.87	($0.04)	-4.2%
4	2"	7.31	$0.03	$1.30	$1.33	$1.51	($0.18)	-12.0%
5	3"	22.24	$0.03	$3.95	$3.98	$3.51	$0.47	13.3%
6	4"	23.15	$0.03	$4.11	$4.14	$5.08	($0.94)	-18.5%
7	6"	80.94	$0.03	$14.36	$14.39	$14.15	$0.24	1.7%
8	8"	128.25	$0.03	$22.76	$22.79	$15.00	$7.79	51.9%
9	10"	306.54	$0.03	$54.40	$54.43	$23.22	$31.21	134.4%
10	12"	306.54	$0.03	$54.40	$54.43	$29.28	$25.14	85.9%
11	16"	306.54	$0.03	$54.40	$54.43	$43.07	$11.36	26.4%

9.5.1. RECALCULATION OF FY 2021 VOLUMETRIC RATES

Table 9-14 shows a comparison of the FY 2021 sewer volumetric rates as recalculated by Raftelis using actual cost and demand data versus the actual FY 2021 daily service charges assessed by the Department. The $0.03/ccf differential (7.8%) is within the bounds of reasonableness.

Table 9-14: Recalculated FY 2021 Sewer Quantify Rates vs. Actual FY 2021

Line	Description	Flow	Note
1	Revenue Requirements	$6,150,008	
2	Units of Service	15,987,624 ccf	
3	Unit Cost of Service	$0.38	Line 1 / Line 2 rounded to nearest $0.01
4			
5	FY 2021 $/ccf Rate	$0.38	
6	Actual FY 2021	$0.36	
7	$ Difference	$0.03	
8	% Difference	7.8%	

10. Secondary Objectives

10.1. Basic Human Needs Water Consumption

The Department's current rate structure for the Residential customer class features a first tier (Tier 1A and Tier 1B) with a width of 0-6 ccf. As part of the FY 2021 COS Study, the Department sought an analysis of whether this current tier width provides an adequate level of water to satisfy the basic human needs of residential customers.

To answer this question, Raftelis conducted a review of industry literature with a focus on three studies. The first study was from Dr. Peter Gleick, a scientist from the Pacific Institute who has won awards for his work on water resources. Dr. Gleick studied basic human needs water usage by first estimating how much water the average person must drink each day with a range based on climate. After adding water usage for cooking, he produced an estimate of approximately 13 gallons per person per day. This estimate, which did not include water usage estimates for appliances or running toilets, results in a tier width of approximately 1.9 ccf per account per month for a three-person household. 1.9 ccf was the lowest basic human needs estimate identified in our literature review.

The second study reviewed by Raftelis was from the textbook "Data Statistics and Useful Numbers for Environmental Sustainability," written by Dr. Benoit Cushman-Roisin, a professor of engineering at Dartmouth University's Thayer School of Engineering. His text explores the average cost of water for appliances in addition to the drinking water required to survive. He calculates that, on average in America, people require 69.3 gallons per person per day or approximately 8.3 ccf per account per month for a three-person household. This calculation is based on a nationwide estimate, where water needs vary based on climate and socio-economic conditions. 9.3 ccf was the maximum basic human needs estimate identified in our literature review.

The final study reviewed was from the Water Research Foundation (WRF). In 2016, the WRF completed a "residential end use" study, which analyzed household water usage based on end uses such as bathing, cooking, clothes washing, irrigation, etc. The study was national in scope and separated indoor and outdoor water use and even considered appliance water use efficiency. The results indicated that a three-person household requires approximately 5.5 ccf per month which equates to approximately 46 gallons per person per day. 5.5 ccf was the midpoint basic human needs estimate identified in our literature review.

As a final test, Raftelis reviewed current and future California indoor water use standards. The current California indoor water usage standard is 55 gallons per person per day. For a three-person household, the Department's 0 - 6 ccf first tier equates to approximately 49.9 gallons per day. The 0 - 6 ccf first tier is also below the 50 gallons per person per day standard that will become effective in 2030. On April 14, 2022, the California Senate approved lowering the current standard of 55 gallons per person per day to 47 gallons per person per day in 2025. For a three-person household this equates to 5.6 ccf per month, slightly below the Department's current 0 - 6 ccf threshold. The legislation has not passed the full California State Assembly. Table 10-1 summarizes our findings on basic human needs water usage.

Table 10-1: Basic Human Needs Water Use Comparison

Line	Metric	Peter Gleick (1)	Benoit Cushman-Roisin (2)	Water Research Foundation (3)	Long Beach Current Tier 1
1	ccf per Account per Month	1.9	8.3	5.5	6
2	Gallons per Month per Household	1,188	6,237	4,140	4,488
3	Average Household Density	3	3	3	3
4	Monthly per Person	396	2,079	1,380	1,496
5	Days	30	30	30	30
6	Gallons per Capita per Day	13.2	69.3	46	49.9
7	(1) Based on international water usage data that included developing countries. Often cited by academic researchers				
8	(2) Author of "Data Statistics and Useful Numbers for Environmental Sustainability"				
9	(3) Water Research Foundation "Residential End Uses of Water Version 2 Executive Report", April 2016				

10.2. Pre- and Post- COVID Water Demands

In early 2020, the COVID-19 pandemic arrived in California. The Department asked Raftelis to examine the effects of COVID-19 on the usage characteristics Department customers. Table 10-2 shows the results of our analysis which indicate minimal COVID-19 impacts for residential customers (lines 2 – 5) and slightly more significant impacts for commercial customers (lines 14 – 19).

Table 10-2: Changes in Customer Demand During COVID-19 (ccf)

Line	Customer Class	Pre-COVID FY 2019	COVID-19 FY 2020	COVID-19 FY 2021
1	Residential			
2	Residential Use	14,544,821	14,962,815	15,260,063
3	Percentage Change in Use		3%	2%
4	Residential Accounts	79,017	79,266	80,322
5	Average Use per Account	184	189	190
6				
7	Non-Residential			
8	Non-Residential Use	6,475,785	6,219,935	6,327,548
9	Percentage Change in Use		-4%	2%
10	Non-Residential Accounts	7,575	7,647	7,519
11	Average Use per Account	855	813	842
12				
13	Commercial			
14	Commercial Use	5,636,873	5,340,251	5,304,634
15	Percentage Change in Use		-5%	-1%
16	Commercial Accounts	6,195	6,234	6,196
17	Average Use per Account	910	857	856
18				
19	Industrial			
20	Industrial Use	126,994	118,283	127,133
21	Percentage Change in Use		-7%	7%
22	Industrial Accounts	240	239	236
23	Average Use per Account	529	495	539
24				
25	Irrigation			
26	Irrigation Use	711,918	761,401	895,781
27	Percentage Change in Use		7%	18%
28	Irrigation Accounts	1,140	1,174	1,087
29	Average Use per Account	624	649	824
30				
31	Total			
32	Total Use	21,020,606	21,182,750	21,587,611
33	Percentage Change in Use		1%	2%
34	Total Accounts	86,592	86,913	87,841
35	Total Average Use Per Account	243	244	246

10.3. Changes in Residential Demands

Although COVID-19 had a minimal impact on residential customers, there have been significant shifts in residential demand characteristics since FY 2016 COS Study. Table 10-3 compares the FY 2017 demand projections used in the FY 2016 COS Study to actual FY 2021 water demand on the Department's system. During this period, residential usage in all three consumption tiers changed significantly (lines 2 – 5 in Table 10-3). The 28% reduction in Tier 3 demand (line 5) and the 32% increase in Tier 2 demand are particularly notable.

Table 10-3: Changes in Customer Demand FY 2016 to FY 2021 (ccf)

Line	Customer Class	FY 2017 Demand Estimate from the FY 2016 COS Study	Actual FY 2021 Demand	Difference	% Difference
1	Residential	15,171,032	15,260,063	89,031	1%
2	Tier 1A	82,306	63,925	(18,382)	-22%
3	Tier 1B	9,759,164	9,097,286	(661,878)	-7%
4	Tier 2	3,769,538	4,970,154	1,200,616	32%
5	Tier 3	1,560,024	1,128,699	(431,326)	-28%
6	Commercial	5,889,319	5,304,634	(584,685)	-10%
7	Industrial	102,548	127,133	24,585	24%
8	Irrigation	754,811	895,781	140,970	19%
9	Total	21,917,710	21,587,611	(330,099)	-2%

10.4. Advanced Metering Infrastructure

Advanced Metering Infrastructure (AMI) is a system of controls and communication technologies that automate typically manual tasks for water and electric utility meters. While new to many water utilities, AMI can be a valuable tool for water departments across the United States, from both a customer communication and water usage efficiency perspective. The Department called on Raftelis to investigate how its AMI infrastructure can be used for future rate-setting studies to continue providing equitable and affordable rates.

Part of our investigation involved looking into the electric utility industry where AMI has been successful. While not a one-to-one comparison, it does provide a good foundation for some future potential water utility uses. In electric utilities, AMI can be used to provide hourly usage data as it ties in directly to a power source and so can constantly update demand. This has allowed many electric utilities to implement time-of-use or peak hour rate structures. This is less feasible with water AMI. Water utilities do not have a direct power tie-in and instead rely on batteries. Therefore, water meters must balance remote meter reading frequency with battery life. As a result, AMI may not be entirely effective in developing time-of-use water rate structures.

Where AMI can be used most effectively by water utilities is analyzing customer usage characteristics for use in COS studies. For example, AMI data can be extremely useful in the determination of empirically based calculations of customer class maximum day and maximum hour peaking factors. This information will enhance the accuracy of the cost allocation process and the development of customer class water rates.

Since it can detect these unique demand characteristics on a more intense scale, AMI can also provide opportunities for examining areas of water loss in a utility system. Across the United States, utilities have used AMI to lower water loss in their own systems and thus improved water conservation efforts. This is something the Department can also take advantage of in their ongoing water conservation efforts.

An additional potential benefit of AMI in Department's service area is the opportunities for new and improved ways to provide customer service. If properly maintained and invested in, AMI can be used to smooth customer service calls by providing easy-to-access and understandable information to both customer service representatives and the customers themselves. Further, by training customer service representatives to understand AMI charts they can also quickly identify problems for customers and thereby reduce appointments to check meters. This also allows for the implementation of a remote turn-on or turn-off function, which reduces costs to the utility by decreasing the number of trips to meters.

In the case of the water utility in Kansas City, Missouri, it saved approximately $450,000 in reduced field orders and $2.25 million by monitoring vacant properties remotely. When integrated into online resources, AMI can also be used to send high-use alerts to customers so that customers may adjust their usage or investigate any leaks that may be occurring that would result in such high usage.

When properly invested in, AMI can be a valuable tool to increase transparency and encourage good water use habits, both of which are shown to increase customer satisfaction. When combined with efforts by the Department to serve low-cost water to residential tiers, meet basic human needs, and reduce water loss, AMI offers many options for the Department to meet its goals of affordability and conservation.