



Napa Sanitation District
Cost of Service Rate and Capacity Charge Study

Technical Memorandum #3
COST OF SERVICE ANALYSIS AND RESULTS

DRAFT

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Abbreviations

2016 SSC Study	FYE 2016 Sewer Service Charge Rate Study
AF	Acre-feet
Carollo	Carollo Engineers, Inc.
City	City of Napa, CA
County	Napa County, CA
EDU	Equivalent Dwelling Unit
gpd	gallons per day
kgal	thousand gallons
MG	million gallons
MGD	million gallons per day
NapaSan	Napa Sanitation District
SFR	Single Family Residential
SSC	Sewer Service Charge
TM	Technical Memorandum

1 Introduction

1.1 Project Background

Napa Sanitation District (NapaSan) retained Carollo Engineers, Inc. (Carollo) to conduct a study regarding its sewer service charge (SSC) and capacity charge methodologies, among other financial analyses. As outlined in the project scope, Carollo will deliver a series of six technical memoranda (TM) outlining the analysis and recommendation for each individual topic covered by the study. Those topics are as follows:

- TM #1 – Residential Customer Data Analysis and Recommendations
- TM #2 – Financial Plan Review and Forecast
- TM #3 – Cost of Service Analysis and Results
- TM #4 – Billing Procedures Review and Recommendations
- TM #5 – Capacity Charge Analysis and Recommendations
- TM #6 – Sewer Service Charge Analysis and Recommendations

The final project deliverable will be presented to NapaSan as a compilation of the six TMs outlining Carollo's methodologies, results, and recommendations.

1.1.1 About NapaSan

NapaSan provides wastewater collection and treatment for approximately 82,000 residents, primarily in the City of Napa, California. NapaSan treats 10 million gallons per day (MGD), with a total treatment capacity of 15.4 MGD. NapaSan is able to reclaim a portion of its wastewater flows for recycled water usage, producing approximately 650 million gallons per year.

1.1.2 Cost of Service Allocation

As part of the study, NapaSan requested that Carollo calculate the percentage of costs that are variable, based on the volume of wastewater flow and constituent solids that are conveyed to and treated at the plant, and develop new rate structure. Carollo developed a cost of service based allocation of costs between fixed and variable categories, and between the residential, commercial, and industrial categories.

1.1.2.1 Allocation of Recycled Water Costs

In 2012, NapaSan engaged Raftelis Financial Consultants to conduct a full cost of service rate study for NapaSan's recycled water system. That analysis developed rates intended to cover the operating costs associated with recycled water service.

As part of that analysis, any costs and projects associated with NapaSan's treatment process up to and including secondary treatment were assumed to be part of the wastewater customers' revenue requirement. Remaining tertiary treatment and recycled water distribution system costs were allocated to recycled water customers.

For this analysis, two assumptions were made with respect to recycled water costs.

1. The rates developed in the 2012 study are self-sustaining for the recycled water system. Rate revenue is assumed to fully cover recycled water operating costs, and that no additional revenue will be needed.
2. The allocation of costs between fixed and variable categories is approximately equal between the wastewater and recycled water systems, and the recycled water costs are not deducted from the line item expenditures in order to allocate costs to fixed and variable categories.

2 Current Class Allocation Approach

NapaSan's current rate structure is based on an equivalent dwelling unit (EDU) approach. The EDU is a common method of comparing wastewater demand from a given customer with that of a typical single-family residence (SFR), where 1 EDU is intended to represent the demand of that SFR customer. This allows the wastewater agency to bill its customers in standardized units, despite a lack of metered wastewater flows.

2.1 Residential Rate Allocation

NapaSan's current residential rate structure is 100 percent fixed for residential customers. Residential customers pay a flat annual sewer service charge depending on the residential dwelling type. Each dwelling type has a corresponding EDU assumption, ranging from 0.4 to 1.0 EDU. The annual SFR sewer service charge (\$638.10 as of July 1, 2017) is adjusted by this factor.

As part of this analysis, Carollo analyzed potable water demand patterns and made recommendations for adjusted EDU figures. Both the current and adjusted EDU figures along with the underlying analysis are outlined in Technical Memorandum #1.

2.2 Commercial Rate Allocation

2.2.1 Wastewater Flow Assumptions

Commercial charges are calculated based on total annual usage and EDUs. NapaSan assumes that a typical single-family residence uses 76,650 gallons per year, or 210 gallons per day. NapaSan therefore sets 1 equivalent dwelling unit at 76,650 gallons per year. At the end of the year, NapaSan reviews potable water billing data from the City of Napa, and determines the number of flow EDUs based on that volume of demand. Accounts are adjusted based on data from subtraction meters for irrigation water usage, when available. Additional adjustments are made when calculating sewer service charges for some commercial facilities with significant landscape irrigation.

2.2.2 Wastewater Loading Assumptions

In addition to flow, NapaSan also treats loadings of constituents, namely biochemical oxygen demand (BOD) and total suspended solids (TSS). These two constituents are a major target of the treatment processes used by NapaSan, and vary significantly across customer classes.

NapaSan's EDU calculation also must take into account this variance in loadings. The flow basis previously discussed is then adjusted based on a flow strength factor for each commercial use type. The commercial use type factors from the California State Water Resources Control Board

Revenue Program Guides. This guide calculates the typical strength generated by various business types. These factors are outlined in Table 7 in the appendix. No changes to these factors are recommended at this time.

2.3 Industrial Rate Allocation

NapaSan has a significant number of industrial wastewater customers, primarily wineries and related operations. These customers require a permit in order to discharge waste to NapaSan's collection and treatment systems. These customers are billed on a monthly basis for sewer service that also stems from the EDU methodology.

Unlike commercial customers, most industrial customers have sampling data available for BOD and TSS. This data is used in the calculation of the monthly sewer service charge. Flow data comes from either flow meters, or from meter readings of the City's potable meters with adjustments made for any irrigation sub-meters and assumed domestic use. The calculation used is as follows:

Equation 1 Industrial Monthly Sewer Service Charge Calculation

$$\text{Industrial Flow Factor} = \frac{\text{Average Daily Flow (gallons)}}{210 \text{ gallons per day}}$$

$$\text{Industrial Strength Factor} = 0.5 + 0.25 \times \left(\frac{\text{BOD} \left(\frac{\text{mg}}{\text{L}} \right)}{175 \frac{\text{mg}}{\text{L}}} + \frac{\text{TSS} \left(\frac{\text{mg}}{\text{L}} \right)}{200 \frac{\text{mg}}{\text{L}}} \right)$$

$$\text{Industrial Monthly Sewer Use Fee} = \text{Flow Factor} \times \text{Strength Factor} \times \frac{\text{Rate per EDU}}{12 \text{ months}}$$

where the 210 gallons per day, 175 mg/L BOD, and 200 mg/L TSS are assumed SFR flows and concentrations.

3 Cost Allocation Review

3.1 Fixed / Variable Line Item Review

NapaSan requested that Carollo conduct a cost of service review of NapaSan's current operations and maintenance budget. The analysis consisted of a line item review and an allocation to fixed and variable categories. NapaSan is interested in understanding how much of its costs are driven by the volume of water treated, as well as the pounds of BOD and TSS that also must be treated. In practice, many of NapaSan's costs can be considered "variable" due to year-over-year fluctuations. However, this analysis is only focused on those costs that correlate with a change in flows, loadings, or both.

3.1.1 Expense Categories

3.1.1.1 Salaries and Benefits

All of NapaSan's labor costs were determined to be fixed in nature, or at a minimum "sticky," where changes are slow and based on long-planned changes. While labor costs may change due

to a change in plant flow and loadings, these changes take many years to manifest, and typically do not correlate with plant flows on a year-to-year basis.

The salaries and benefits category includes costs from the following cost accounts:

- Salaries and Wages
- Overtime
- Holiday Pay
- Vacation Payout
- 457B Employer Contribution
- Cell Phone Allowance
- Director Pay
- Medicare
- F.I.C.A. / Social Security
- Employee Insurance - Premiums
- Workers Compensation
- Retirement
- Other Post-Employment Benefits
- Other Employee Benefits

None of these accounts were determined to have costs that could be considered variable and correlated with flow and loadings.

3.1.1.2 Services and Supplies

Costs from services and supplies form the other primary expense category tracked in NapaSan's budget process in addition to labor costs. These costs include routine administrative expenses such as printing, janitorial services, landscaping, and training fees. It also includes major operational and supply costs, such as equipment and vehicle maintenance, chemical purchases, and energy and other utilities.

Nearly all of the costs in this category were determined to be fixed in nature, with the exception of the following items:

- Waste Disposal Services
- Hazardous Waste Disposal Services
- Gas, Electric, and Water Utilities
- Chemical Purchases

None of these categories are expected to be completely variable. NapaSan will always need some baseline level of chemicals or electricity for instance. However, for the purposes of this analysis, they are assumed as 100 percent variable for alternative rate modeling. That is, they would be allocated to a variable rate approach.

3.1.1.3 Other Expenses

Other expenses include debt service payments, administrative costs on bond issuances, and taxes and assessments paid by NapaSan. All of these costs are assumed to be fixed because they are set for a long period of time, and do not correlate with the flow or loadings received in each year. Capital projects that address flow and load needs may be funded with these debt service payments, but NapaSan would not implement a project to address those needs based on one year of data.

This analysis did not consider Intrafund Transfers, which NapaSan tracks in this category as part of its annual budget process.

3.1.2 Allocation Results

The analysis resulted in the following split of expenses between what could be recouped from the current fixed charge, and what could be allocated to a variable rate. Looking only at the operating expenses (salaries and benefits, and services and supplies), approximately 87 percent

of NapaSan's expenses could be considered fixed in nature. This is in keeping with data from other sewer agencies, where fixed costs are typically between 80 to 90 percent of total expenses. After including debt service and other non-operating expenses, the share of costs categorized as fixed increases to approximately 90 percent. The results of this analysis are found in Table 1.

Table 1 Cost Allocation Results

Expense Category	Fixed	Variable	Total
Operating Expenses			
Salaries and Benefits	\$9,600	\$0	\$9,600
Services and Supplies	3,800	2,000	5,800
Total Operating Expenses	\$13,400	\$2,000	\$15,400
<i>Percent Split</i>	<i>87%</i>	<i>13%</i>	
Other Expenses	4,800	-	4,800
Total Expenses	\$18,200	\$2,000	\$20,200
<i>Percent Split</i>	<i>90%</i>	<i>10%</i>	
(1) All figures in thousands of dollars.			

3.2 Class Allocation Review

3.2.1 Baseline EDU Levels

NapaSan's EDU billing approach aims to assess each customer based on their level of wastewater system usage relative to a typical SFR household. Based on fiscal year ending (FYE) 2017 water usage data from commercial and industrial customers, the current EDU amounts are outlined in Table 2.

Table 2 Baseline EDU Levels for FYE 2018

Customer Class	FYE 2018 EDUs
Residential	23,344
Commercial	1,412
Industrial	14,410
Other Non-Residential ⁽²⁾	1,409
Total ⁽¹⁾	40,575
(1) EDU estimates are at beginning of fiscal year and do not include any projected development, or changes in commercial and industrial usage.	
(2) Includes use types such as schools, local and state government facilities, open spaces, and utilities.	

3.2.2 Water Usage Estimates

NapaSan bills its commercial and industrial customers based on sewer flow meters and metered potable water demand from the cities of Napa and American Canyon. NapaSan assumes that a typical SFR household uses 210 gallons per day (gpd), or 76,650 gallons annually. Therefore, NapaSan assigns one EDU for every 76,650 gallons used each year by commercial and industrial customers. This volume is then adjusted by a strength factor to account for BOD and TSS loadings.

Table 3 Baseline Weighted Flow Estimates

Customer Class	Weighted Usage ⁽²⁾
Residential	2,061
Commercial	684
Industrial	1,105
Total ⁽¹⁾	3,850
(1) EDU estimates are at beginning of fiscal year and do not include any projected development, or changes in commercial and industrial usage. (2) Weighted using the strength factors for each customer class, as outlined in the appendix of this TM for commercial, and by measured/assumed BOD and TSS concentrations for industrial customers.	

3.2.2.1 Adjusted Water Usage and Loadings Estimates

NapaSan's current residential usage assumption of 210 gpd is under review, with flow measurements and meter data indicating that a flow assumption closer to 120-150 gpd is more appropriate. If the 210 gpd figure is adjusted downward to reflect this data, the other customer classes would need to be adjusted, or else the allocation of costs would be misaligned.

Furthermore, data on BOD and TSS shows different concentrations from the current 175 and 200 mg/L for BOD and TSS, respectively. Concentrations have gone up considerably. However, total pounds of each constituent have either remained constant or increased more modestly. This would also need to be reconciled with the non-residential strength factors.

Prior to making any changes to the underlying flow and strength assumptions, additional data on commercial loadings, similar to that obtained for SFR customers, should be collected. This would help determine if the change in concentrations is unique to residential customers, or if all customers have demonstrated this trend.

4 Alternative Rate Structure Analysis

4.1 Revenue Requirement Allocation

This analysis developed an alternative hybrid rate structure by taking the allocations from above, and allocating the revenue requirements outlined in TM #2 by the percentages in Table 1. The resulting shares of revenue requirements allocated to fixed and variable are outlined in Table 4.

Table 4 Cost Allocation Results

	Allocation Percentage	Resulting Allocation
Revenue Requirement		\$26,163
Fixed	90%	\$23,572
Variable	10%	\$2,590

(1) All figures in thousands of dollars.

4.2 Calculating Alternative Rates

4.2.1 Fixed Rate Portion

The calculation of the fixed rate portion is unchanged from the previous methodology. However, the share of costs allocated to this category is lower, and therefore the fixed fee will be lower than the current sewer service charge as a result. To illustrate the impact of this allocation, Table 5 outlines the current and alternative fee calculation methods.

Table 5 Fixed Rate Calculation

	Current Methodology	Alternative Methodology
Revenue Requirement ⁽¹⁾	\$26,163	\$23,572
EDUs	41,000	41,000
Annual Fixed Charge ⁽²⁾	\$638.10	\$574.94

(1) Figures in thousands of dollars.

(2) Revenue requirement divided by EDUs. Rate has been rounded to nearest \$0.01.

The alternative allocation approach reduces the fixed charge by approximately \$63 per year, or approximately 10 percent, as predicted by the allocation percentages.

4.2.2 Variable Rate Portion

Part of NapaSan's current rate structure is based on a variable basis currently. The commercial sewer service charge is calculated based on the volume of water used in the year, which is then matched against an assumed annual demand for a SFR customer. However, the rate is not directly tied to metered water usage on a bi-monthly basis. It is only used to determine the number of EDUs for the annual sewer service charge. Furthermore, residential customers do not have any variable portion to their bill at present.

A true variable approach would use a rate for each thousand gallons of water metered by either the cities of Napa or American Canyon. This would then show up on the customers' bills as a volumetric charge for usage.

4.2.2.1 Calculation Approach

Like potable water rate development, the volumetric rate is simply the division of allocated costs by the number of units anticipated in the year. Unlike potable water rate calculation however, the number of units for a sewer rate is not dependent solely on the volume of flow. Loadings of

BOD and TSS must also be taken into account. Weighting each unit of flow by customer class is an appropriate method to accomplish this.

Variable Rate Calculation

In order to calculate the variable rate, the flow must be gathered from the available potable water records and then weighted to reflect the appropriate customer class. The commercial and industrial data was taken from NapaSan's existing usage records, and then weighted for the appropriate customer class.

The residential records were taken from the City of Napa's potable water meter reads. Because the City's dataset did not include customer class designations that match NapaSan's, the commercial records from NapaSan's records described above were used to filter out commercial records from the City's dataset. The remaining records are assumed to be residential customers, however, there may be some inaccuracies in that data.

The resulting weighted flow figures are shown in Table 6 below. The resulting variable rate is \$0.68 per thousand gallons using the revenue requirement for FYE 2018.

Table 6 Volumetric Rate Calculation

	Calculation
Revenue Requirement⁽¹⁾	\$2,590
Residential Flow (million gallons)	2,061
Weighted Commercial Flow	675
Weighted Industrial Flow	1,105
Total Weighted Flow	3,840
Variable Rate (\$ / thousand gallons) ⁽²⁾	\$0.68
(1) Figure in thousands of dollars	
(2) Revenue requirement divided by total weighted flow. Rate has been rounded to nearest \$0.01.	

4.2.2.2 Challenges

Data Needs

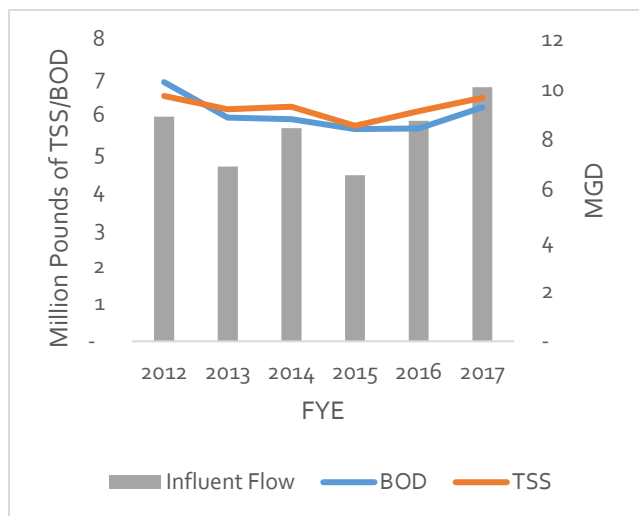
This approach is far more data intensive than NapaSan's current approach. Rather than only documenting and billing for usage for its approximately 1,500 commercial and industrial customers, NapaSan would need to record usage for approximately 16,000 residential parcels, which include many multi-family residences that would bring the number of connections much higher. Some of the challenges already faced by NapaSan with billing commercial customers based on flow would only expand if residential customers were included. For instance, NapaSan staff routinely needs to make field inspections of commercial parcels to verify address recordings. This is a time-consuming process that could draw on NapaSan's resources, which brings costs that should be considered when evaluating the benefits of this approach.

Furthermore, it is important to point out some of the challenges because it impacts the calculation of these rates. This process requires collecting data from both the cities of Napa and

American Canyon. These entities use different billing structures from NapaSan. This makes creating a complete dataset difficult, and without complete data available for all parcels, the rate calculation may be inaccurate. For that reason, the rates shown here are illustrative and would need a thorough review for accuracy prior to adoption.

Revenue Volatility

The other major challenge with a variable wastewater rate structure is revenue volatility from year to year. Throughout California,



potable water demands have decreased substantially in recent years due to the state's historic drought. These decreases—often in excess of 30 percent for some agencies—can have significant impacts on agency revenues. Given that such a large percentage of NapaSan's costs are fixed in nature, this type of revenue volatility may be undesirable when planning rates. Looking at NapaSan's plant influent flows over the last several years shows substantial volatility, with no year over year changes of less than 15 percent.

Figure 1 NapaSan Annual Flow and Loads

4.2.2.3 Additional Rate Structure Adjustments

There are several strategies often employed by wastewater agencies to smooth the bill impact for customers when a variable rate is introduced. For residential customers, a bill ceiling is often adopted to account for the fact that wastewater discharge does not increase linearly with potable water demand. Once a certain threshold is reached for residential consumption, much of the additional water usage goes to consumptive uses such as landscaping.

In order to account for the revenue volatility, some agencies will look at an entire year's worth of potable water bills for a customer, and then base the volumetric on the winter average. That usage is then set for the entire year. This helps smooth the revenue

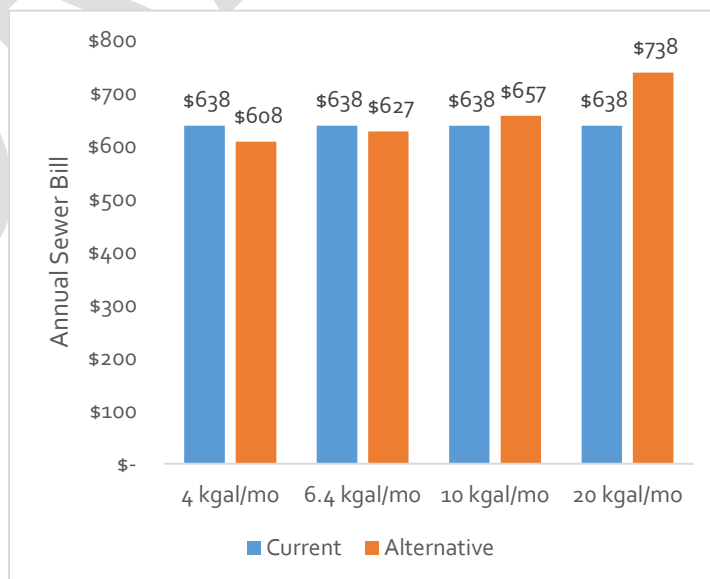


Figure 2 Residential Bill Impact

collection for the agency, while mitigating month-to-month fluctuations for the customer as well.

4.2.3 Bill Impact

The impact of the alternative rate calculation would decrease the typical SFR customer's annual bill by approximately \$11, from \$638.10 to \$627.06. It is expected that much of the decrease would be made up by higher demand users at the right tail end of the usage distribution. This assumes an annual usage of 76.6 thousand gallons, or approximately 6.4 thousand gallons per month. The bill impact of the alternative rate approach at various usage levels is depicted in Figure 2. Most residential customers would see a decrease in their annual bill because much of the costs would be reallocated to commercial and industrial customers that have higher usage volumes.

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Appendix

Table 7 Current Commercial Strength Factors

Residential Unit Type	Current Strength Factor
Automobile Sales & Service	1.0
Bakeries/Candy/Ice Cream Manufacturing	2.7
Banks/Business Offices	1.0
Bars/Nightclubs	1.0
Bed and Breakfast Inns	1.0
Car Wash	0.7
Carpet & Rug Cleaners	1.4
Churches	1.0
Convalescent/Care Homes/Hospitals	1.0
Daycare Facilities	0.8
Delicatessen (no cooking)	1.4
Delicatessen (cooking)	2.0
Dry Type Industries	1.0
Funeral Homes	2.6
Hotels/Motels (without restaurants)	1.0
Hotels/Motels (with restaurants)	2.0
Laundries-Commercial	1.4
Laundries-Self Service	0.9
Markets, with disposals	2.6
Markets, without disposals	1.4
Membership Organizations, with kitchens	2.7
Membership Organizations, without kitchens	1.0
Merchandising/Department/Retail Stores	1.0
Mixed Use (1 water meter)	1.6
Physicians/Medical/Dental Offices	1.0

Residential Unit Type	Current Strength Factor
Printers/Newspapers	1.0
Repair Shops/Service Stations	1.0
Restaurants and Caterers	2.7
Service Related Enterprises	1.0
Theaters	1.0

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