AN ASSESSMENT OF

Water Affordability & Conservation Potential

Houston TEXAS

Alliance for Water Efficiency

PROMOTING
THE EFFICIENT
& SUSTAINABLE
USE OF WATER

May 2023

About the Project

Alliance for Water Efficiency

The Alliance for Water Efficiency (AWE) is a nonprofit dedicated to the efficient and sustainable use of water across North America. Based in Chicago, AWE advocates for water efficient products and programs, and provides information and assistance on water conservation efforts. AWE works with more than 500 member organizations, providing benefit to water utilities, business and industry, government agencies, environmental and energy advocates, universities, and consumers.

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Houston Public Works Partners

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HOUSTON PUBLIC WORKS

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Executive Summary

The Alliance for Water Efficiency (AWE) envisions a future with reliable, affordable, and equitable water resources, healthy ecosystems, and vibrant, economically strong communities. When water service is unaffordable, it undermines this future. Affordability is a growing concern as water and sewer rates rise to account for increasing costs due to aging infrastructure, extreme weather events, climate change, regulations, and inflation, to name a few. Investing in water conservation and efficiency is one strategy that can help keep water and sewer bills affordable.

Affordability Metrics Used in the Assessment

Household Burden Indicator (HBI)

The HBI assess the costs of water service as a percentage of the 20th percentile of household income in a community, or another geographic unit, like the Census tracts which are used in this assessment.

Poverty Prevalence Indicator (PPI)

The PPI is the percentage of households below 200 percent of the federal poverty line.

AWE is conducting research in multiple communities to better understand the economic impact of water and sewer services and how water conservation and efficiency can help lower water bills for low-income customers. This assessment presents a comprehensive water affordability assessment of water and sewer services provided by Houston Public Works in the City of Houston, Texas. The City of Houston has been particularly challenged by severe weather conditions, which are expected to be exacerbated and more frequent with a changing climate, and the City of Houston is committed to building a more resilient community. Houston Public Works is working to achieve a more resilient system, which requires significant investment. These investments have led to significant rate increases for a community with a wide range of incomes.

This assessment demonstrates in the City of Houston served by Houston Public Works:

How much income low-income households are spending on water and sewer bills, as a metric of affordability for the most vulnerable households:

- For households with incomes in the lowest 20th percentile, water and sewer bill expenses are about four percent of household income, on average, and that figure is projected to increase to 6.6 percent by 2025.
- By 2025, it is estimated that households in nine percent of census tracts, about 40,000 people, will spend at least ten percent of their annual income on water and sewer bills.
- For some households, water and sewer costs are a higher percentage of household income and are projected to be as high as 21 percent by 2025.

Low-income households use less water than other households, but water use is still higher than the conservation credit threshold used in the Houston Public Works' rate structure, which provides a lower water rate if, and only if, a customer uses less than 3,000 gallons per month.

Houston Public Works offers services to help with high bills, but relatively few households take advantage of the offerings.

Water efficiency and conservation strategies can lower ongoing water use and bills and improve affordability for customers. The measures assessed are estimated to achieve an average of 15 percent bill savings, though some strategies could save up to 34 percent.

Introduction

The Alliance for Water Efficiency (AWE) envisions a future with reliable, affordable, and equitable water resources, healthy ecosystems, and vibrant, economically strong communities.

When water service is unaffordable, it undermines this future. Affordability is a growing concern as water and sewer rates rise to account for the increasing costs due to aging infrastructure, extreme weather events, climate change, regulations, and inflation, to name a few. Investing in water conservation and efficiency is one strategy that can help keep water and sewer bills affordable.

As part of AWE's mission to promote the efficient and sustainable use of water, AWE is conducting research to better understand how water conservation and efficiency can help lower water bills for low-income customers. Most recently, AWE released in January 2022: *An Assessment of Water Affordability and Conservation Potential in Long Beach, California*. This case study demonstrates that water and sewer services are a financial burden for many customers and that there is a large potential for water conservation to save water and provide meaningful bill reductions for customers.[1]

Further, investing in strategies that achieve sustained water use reductions can help a utility avoid, delay, or downsize expensive capital investments in new supplies, infrastructure, and facilities. Water conservation and efficiency strategies are also often more cost-effective than supply-side strategies. AWE conducted a series of studies showing that utilities avoided significant expenses and kept customer water bills lower by investing in water efficiency and conservation.[2]

AWE is pleased to continue its ongoing research related to affordability in partnership with the City of Houston and Houston Public Works (HPW) with the release of *An Assessment of Water Affordability and Conservation Potential in Houston, Texas*. AWE continues to explore the variety of ways that households can lower water consumption and reduce costs, such as changing their water using habits, installing more efficient fixtures and appliances, and reducing outdoor water use, among other water saving strategies. Water affordability is far from a one dimensional or single-faceted issue. Opportunities and optimal strategies will vary from community to community.[3]

1 Alliance for Water Efficiency. 2022. *An Assessment of Water Affordability and Conservation Potential in Long Beach, California.* https://www.allianceforwaterefficiency.org/impact/our-work/assessment-water-affordability-conservation-potential-long-beach-california

2 https://www.financingsustainablewater.org/water-efficiency/when-everyone-conserves-everyone-saves and the more recent analysis for LADWP in 2018 https://www.allianceforwaterefficiency.org/impact/our-work/study-demonstrates-water-conservation-pay-ratepayers

3 Additional resources: https://www.nrdc.org/resources/water-affordability-advocacy-toolkit

Related Efforts in the City of Houston, Texas

The City of Houston is located in Southeast Texas near the Gulf of Mexico. It is the largest city in Texas spanning over 630 square miles and is home to 2.3 million people as of 2020. Houston Public Works (HPW) serves the City of Houston and an additional 2.4 million contract and wholesale customers outside the city limits. HPW is the largest water/wastewater utility in Texas. The City of Houston is focused on many issues that affect quality of life for their residents and the overall resiliency of their community, including issues that directly or indirectly affect the affordability of water and service. Here are some recent related efforts:

RESILIENT HOUSTON: The City of Houston experienced widespread damage and flooding in 2017 when Hurricane Harvey made landfall. The City of Houston took the opportunity to not only focus on recovery, but also to think about how to rebuild and grow resiliently. The Resilient Houston report provides a framework for all to work collectively to protect the City of Houston against future disasters.[4]

CLIMATE ACTION PLAN: In 2020 the City of Houston launched the Houston Climate Action Plan to reduce greenhouse gas emissions and meet the Paris Agreement goal of carbon neutrality by 2050. This plan and its implementation will help the City of Houston develop strategies to minimize its carbon footprint, save money, and improve the quality of life for residents.[5]

COMPLETE COMMUNITIES: This initiative promotes and facilitates implementation of innovative, community-identified projects and programs that address the needs for residents and businesses in the ten most under-resourced neighborhoods.[6]

ONE WATER PLAN: HPW is launching a One Water planning effort to develop a One Water Master Plan that will result in the sustainable, resilient, equitable and environmentally responsible management of drinking water, wastewater, and stormwater utilities. This effort includes a first phase to engage stakeholders and the community, develop a Water Equity Roadmap for utilities to consider how decisions and projects impact vulnerable communities, and prioritize projects that deliver equitable outcomes. This Affordability Assessment will contribute to this effort.

Alliance for Water Efficiency Affordability Assessment

This assessment is focused on understanding water and sewer service affordability for single-family households. This assessment does not address wholesale regions of HPW's water service area or any of the municipal utility districts in the HPW area.

The assessment includes:

- A review of HPW's affordability efforts.
- An assessment of water affordability at the census tract level using single-family customer consumption data.
- An assessment of the tiered rate structure and water usage.
- An estimate of how water conservation strategies can impact water affordability.
- Recommendations throughout for HPW to consider as potential ways to improve water and sewer service affordability for low-income residents.

4 https://www.houstontx.gov/mayor/Resilient-Houston-20200518-single-page.pdf

5 http://greenhoustontx.gov/climateactionplan/

6 https://www.houstoncc.org/

Houston Water Affordability Efforts

HPW is motivated to better understand and address water and sewer service affordability. HPW has a customer assistance program called the Water Aid to Elderly Residents (W.A.T.E.R) Fund, additional financial relief programs and policies, water conservation programs, and recently underwent a rate restructure.

Utility Bill Assistance

W.A.T.E.R Fund: The W.A.T.E.R. Fund provides financial assistance to senior citizens and others who struggle to pay their utility bills.[7] It is currently funded through voluntary donations. Customers must reside in a single-family home and be either older than sixty or disabled and meet income guidelines. Limited assistance is also available to other low-income customers. Customers who successfully apply can receive up to $100 every six months to use toward their utility bills, after which they can re-apply for further assistance. **Table 1** shows the participation for recent years.

RECOMMENDATION 1 ▸ Identify ways to enhance marketing to increase donations, reduce barriers to participation, and increase awareness of program to target households. For reference, the American Community Survey estimates that there are around 40,000 people in the City of Houston who are both over 65 years old and in poverty.[8] The W.A.T.E.R. Fund only serves a small subset of these of households each year. Challenges related to this program may include customers having to reapply, the form is only available in English, significant paperwork is required to prove income qualification, and there is a lack of services to address high uses that contribute to high bills (e.g., leak repair services).

RECOMMENDATION 2 ▸ Explore utility revenue streams that could be utilized for the W.A.T.E.R. Fund or other customer assistance programs. Depending on legal limitations, the City of Houston could start by identifying availability of non-ratepayer revenue sources for customer assistance programs.[9]

Temporary Assistance: HPW leverages a variety of temporary Federal funds for customer utility bill relief. The Houston-based non-profit organization BakerRipley, which has a focus on improving financial well-being and stability in Houston, Texas, is responsible for marketing, qualifying customers, and dispersing funds. It is valuable to have a partnership with a local non-profit that is trusted in the community. These funds are limited. As of the end of September 2022, 424 customers had been assisted through this program and a total of $179,656.69 disbursed.

Bill Adjustments: HPW provides bill adjustments for a set of distinct situations; **Table 2** shows the participation and associated payments.

Leak: Any customer who discovers and repairs private-side leaks. A customer can apply for two leaks per 12 months. If this adjustment is provided, the customer pays the established average consumption plus only one half of the excess charges resulting from the leak. The adjustment is limited to a maximum of three consecutive months and must be requested within six months of the repair.[10]

Unusually large bill: A single-family residential customer whose bill is inexplicably more than 200% greater than average usage in a single month. A customer can apply once per 12 months. If this adjustment is provided, the customer only pays 150% of their average consumption.

Exceptional circumstance adjustment: Any residential or commercial customer whose bill is inexplicably more than 500% greater than average usage. A customer can apply once per 24 months. The credit may not exceed $4,000.

There is also a Water Adjustment Board and a customer can dispute the amount of an adjustment through an administrative review process.

7 This program also allows payment relief related to drainage (stormwater) costs.

8 https://www.census.gov/programs-surveys/acs

9 https://efc.sog.unc.edu/resource/navigating-legal-pathways-rate-funded-customer-assistance-programs-guide-water-and/ and https://www.epa.gov/waterfinancecenter/compendium-drinking-water-and-wastewater-customer-assistance-programs

10 The Leak Adjustment credit is only allowed due to loss of water through an "excusable defect" in the customer's water line. An excusable defect means a rupture or leakage of the customer's water lines caused by city personnel, a city contractor, freezing weather, settlement, corrosion, or accidental occurrence not caused by customer negligence or disregard of waterline or fixture maintenance. The term does not apply to any defective or out-of-repair plumbing fixtures that are exchangeable devices or components attached to the plumbing system to deliver or drain water.

Table 1

W.A.T.E.R. Fund Support Levels

Year	Number of Applications Received	Number of Participating Customers	Funds Distributed
2019	1,191	546	$42,554
2020	674	422	$21,161
2021	434	289	$14,960
2022	446	70	$12,896

Table 2

Houston Public Works Water Bill Adjustments

Year Approved	Leak Adjustments	Total Leak Amount	Unusually Large Bill Adjustments	Total Unusually Large Bill Amount	Exceptional Circumstance Adjustments	Total Exceptional Circumstance Amount	Total
2019	7,188	$3.6M	2,016	$777.6K	256	$210.5K	$4.59M
2020	8,249	$4.6M	1,946	$680.0K	213	$149.9K	$5.43M
2021	6,607	$3.3M	1,779	$419.4K	246	$175.2K	$3.89M
2022* (YTD as of end of Oct 2022)	3,437	$2.5M	2,723	$995.8K	318	$317.1K	$3.81M

RECOMMENDATION 3 ▸ Explore which types of customers are benefiting from these programs. Consider strategies to improve awareness of these programs and payment plans for low-income customers. Discuss priorities for funds between these bill adjustment programs and alternative customer assistance programs and/or water conservation programs designed for low-income customers.

Payment Plans: HPW offers interest-free payment agreements, which prevents late fees and service interruptions, as long as the agreed upon payments are received by the due date each month. HPW also does not interrupt service if a customer is appealing a high bill as long as the customer continues to pay non-disputed bills.

RECOMMENDATION 4 ▸ HPW should improve tracking of payment plan information, service shut-offs, non-payment patterns, participation in assistance programs, and other measures in order to develop a richer set of affordability metrics and better track and understand the challenges facing customers across the economic spectrum.

Consumption Awareness Program: Customers can sign up for the Consumption Awareness Program (CAP). Through CAP customers have access via a computer or mobile device to view active readings, track current billing cycle, monthly, daily, hourly usage, receive weekly summary emails, receive alerts and notifications, have access to a water usage calculator, and their projected upcoming water bill. The website describes how to determine if there is a leak and provides tips on how to find leaks. Not all customers have meters that enable this service. HPW estimates that about 28% of customers are eligible for this service, and approximately 15,818 customers are enrolled (as of February 1, 2023).

In March of 2021, the Houston City Council unanimously passed a one-time ordinance implementing a utility relief program that adjusted affected water bills, suspended fees for late payments, and suspended utility disconnections for households with unexpectedly high water and wastewater consumption related to the intense storm in February of 2021, Winter Storm Uri. An estimated 25 percent of customers experienced a leak as a result of freezing temperatures, power outages, freezing pipes, and varying pressure issues. Typically, customers need to demonstrate proof of repairs for the regular leak adjustment program, but in this situation, they granted automatic adjustment for single-family residential customers and allowed multi-family and commercial customers to apply for the adjustment.

Water Conservation Programs

HPW has a five-year Water Conservation Plan, last updated in 2019 and due to be updated in 2024.[11] The Texas State Water Plan, which details how Texas will address the state's growing water needs, calls for significant statewide conservation efforts to meet 25 percent of Texas's future water needs. The region that includes the City of Houston calls for nearly ten percent of future supplies to be met through municipal conservation.[12]

HPW also has a drought response plan and works to reduce distribution system water loss, including recently starting an internal water loss audit task force which is working to determine priorities and break down silos across the organization. HPW's water loss baseline (2014-2019) for the system is 19 percent.[13] Working towards reducing both real and apparent water loss can help reduce costs and impacts to customers; AWE recommends focusing on performance indicators beyond percentage indicators.

And although this affordability assessment focuses on single-family retail customers only, HPW is also focusing on programming to support wise water use across their other sectors, including their wholesale water conservation program.[14]

Current Single-family Retail Customer Programs: The HPW Swap-A-Showerhead program allows residents to trade in old inefficient showerheads for high efficiency WaterSense showerheads, limited to two per household. If customers do not have an old showerhead to exchange, they can receive a new WaterSense showerhead by pledging to install the new showerhead within 48 hours.

HPW has a bi-annual Rain Barrel Sale where customers can buy significantly discounted rain barrels. At a typical event, HPW sells 50-gallon rain barrels at a 40% discount to roughly 1,500 customers.

Rate Restructure

HPW employs an inclining block rate structure using units of 1,000 gallons or 1 kilogallon (kgal) to bill its residential customers on a monthly basis. From 2017 to 2021, the water rates for a 5/8" or 3/4" meter, which comprise the majority of all single-family connections, increased by an average of about 2.66 percent every year.

In September of 2021, HPW instituted a rate change to reflect the findings of its latest Cost of Service Rate Study, completed in June 2021. This study incorporated the Resilient Houston goals to protect the City of Houston against future disasters and to build a more resilient Houston. For the water and sewer systems, the study recognized significant needs to address aging infrastructure, add redundancy to water and wastewater treatment plants, and address vulnerabilities in the system. HPW approved a rate increase of nine percent for water and 20 percent for wastewater to be effective immediately and additional increases over a five-year period. Despite the significant revenue requirements to meet resiliency goals, the new rate structure also had a goal to improve equity, make rates easier for customers to understand, and incorporate a stronger conservation signal. Details on rates can be found in **Appendix A**.

Conservation Credit: The rate restructure included a lower volumetric per unit price for usage up to 3,000 gallons per billing period (roughly a month). In the rates enacted in September 2021, the volumetric rate for the conservation credit was only $1.00 per thousand gallons, with modest increases each year such that in 2025 it will be $1.65 per 1,000 gallons. There is a steep increase in the total bill for households who use beyond the 3,000 gallons conservation credit threshold. Above 3,000 gallons customers no longer receive the conservation credit and all water up to 6,000 gallons is charged at a higher rate, which was $5.50 per 1,000 gallons in September 2021 and will be $7.50 per 1,000 gallons by 2025. For comparison, under the September 2021 rate schedule, the monthly water bill for a household using 3,000 gallons is $9.46 but a household using 4,000 gallons faces a bill of $28.46. The rate structure also includes additional jumps at higher tiers. Most households do not have smart meters or access to information about how their water use is tracking during a billing period, making it hard to manage water use to this conservation credit level.

This new rate structure provides a strong financial incentive to conserve water. In the short term, however, the overall rate increases still resulted in significant bill impacts to customers. Further, the lower rates associated with the conservation credit were counteracted by the significant sewer rate increases. **Table 3** shows the rates in 2019 and the new rates effective September 2021 after the rate restructure. **Figure 1** shows the combined water and sewer bill at different levels of consumption over time.

11 Texas water providers who serve at least 3,300 connections must adopt a water conservation plan meeting certain minimum requirements and update it every five years.

12 https://regionhwater.org/index.asp

13 While percentage indicators have been used for many years and are still part of the required reporting metric ins some states, AWWA stopped using percentage indicators in 2020 in favor of other performance indicators.

14 Visit this website to learn more: https://www.houstonpublicworks.org/waterconservation

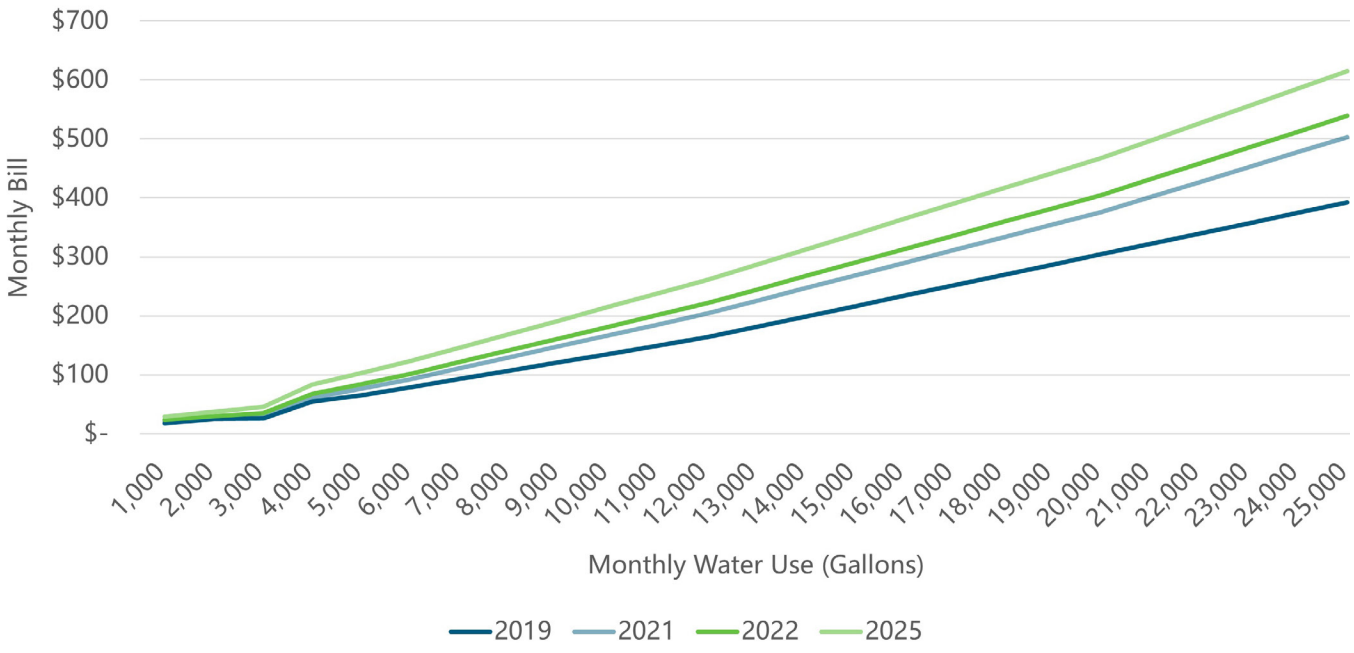
Table 3

Changes in Water and Sewer Bills after Rate Restructure

Water Use	Water			Sewer		
5/8" or ¾" Meter	2019	2021	% Change	2019	2021	% Change
Fixed Charge	$5.54	$6.25	13%	$11.77	$10.00	-15%
1 kgal	$5.69	$7.25	27%	$11.96	$14.00	17%
2 kgal	$12.97	$8.25	-36%	$12.35	$18.00	46%
3 kgal	$13.41	$9.25	-31%	$12.67	$22.00	74%
4 kgal	$25.36	$28.25	11%	$29.04	$32.50	12%
5 kgal	$30.39	$33.75	11%	$34.96	$43.00	23%
6 kgal	$35.43	$39.25	11%	$43.57	$54.50	25%
7-12 kgal	$35.43 + $5.47 per kgal	$39.25 + $6.00 per kgal	10%	$43.57 + $8.61 per kgal	$54.50 + $10.50 per kgal	24%
12-20 kgal	$68.25 + $5.47 per kgal	$75.25 + $11.00 per kgal	17%			
Over 20 kgal	$112.01 + $5.47 per kgal	$163.25 + $15.00 per kgal	51%			

Figure 1

Monthly Combined Water and Sewer Bills by Water Use and Year



Water Use Analysis

Billing data from 2019, 2020, 2021, and a subset of 2022 was used for this assessment. Data cleaning was required to remove incomplete and anomalous data. More information about his can be found in **Appendix B**. The subset of single-family households used for this analysis used an average of around or just over 5,000 gallons per month in years 2019-2021. **Figure 2** shows the distribution of average monthly water use across households in the analysis by year of analysis.

Water use patterns often exhibit a "long tail" where a small percentage of households use high amounts of water compared to most households. Water use increased in 2020, a common pandemic trend while many people were spending more time at home. Water use in 2021 returned to a distribution similar to 2019, though with slightly more households in the lower portion of the distribution.

A common question when addressing affordability is to assess if water usage is systematically different for lower income households. **Table 4** shows differences in annual water use for different segments of the single-family households in the analysis.[15] The first comparison looks at households in census tracts with fewer than 50 percent of the households with incomes at or below the Federal Poverty Level (FPL) versus households in tracts with 50 percent or more of the households with incomes at or below the FPL. Across all years, the average annual water use of households is lower in tracts with higher incidence of poverty, although the gap is lower in 2021. All differences are statistically significant.

The second comparison looks at households in census tracts with a 20th percentile income level greater than $25,000 versus households in census tracts with a 20th percentile income level less than $25,000. This second approach has a similar conclusion, demonstrating that areas of the community with lower incomes use less water.

15 All differences are statically significant, p<0.01.

Figure 2

Histogram: Annual Water Use Breakdown by Year

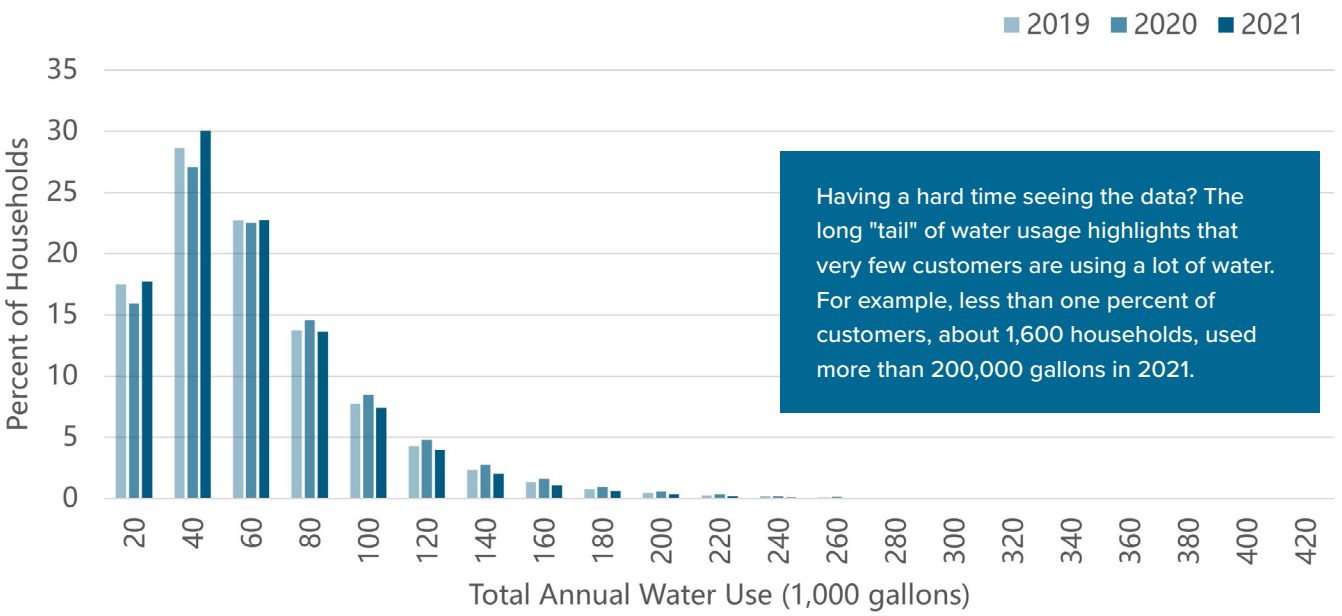


Table 4

Annual Water Use Differences for Higher vs. Lower Incomes Census Tracts*

Annual Water Use Differences Across Households (1,000 gallons)				
Year	Fewer than 50% of households at FPL	50% or more of households at FPL	Difference in Average Water Use	% Difference
2019	65.6	55.5	10.1	15%
2020	69.2	57.7	11.5	17%
2021	63	55.4	7.6	12%

Year	Tract's 20th percentile income is greater than $25,000	Tract's 20th percentile income is $25,000 or less	Difference in Average Water Use	% Difference
2019	67.4	56	11.4	17%
2020	71.1	58.3	12.7	18%
2021	64.4	55.6	8.8	14%

* All differences are statically significant, p<0.01.

Rate structures like the one currently employed by HPW attempt to select a level of usage that reflects an efficient level of indoor water use, so that essential water use is more affordable. **HPW selected 3,000 gallons, but how many households regularly achieve this level of water use?**

A common way to identify indoor or essential water use is to assess water use during winter months, which makes sense for most climates in the United States, including the City of Houston, as outdoor water use is expected to be zero or minimal. Households should not be irrigating landscapes or using significant amounts of water outdoors during the winter months. December, January, and February were selected for the winter water use analysis, where the winter water average is defined as the average water use across these three months. **Table 5** shows the average winter water usage and the percentage of households whose average water use is at or below 3,000 gallons.

After the rate restructure in 2021, more households have water use below the conservation credit threshold of 3,000 gallons during the winter months, but one cannot readily determine if the rate structure caused this shift or if it was due to other reasons. The majority of households, however, have average monthly water use higher than 3,000 gallons. This may be due to inefficient behaviors, appliances, or fixtures in the home. Some households may have larger household sizes which make it harder to reduce essential water use compared to homes with fewer people, even if the home and behaviors are efficient.

Table 5

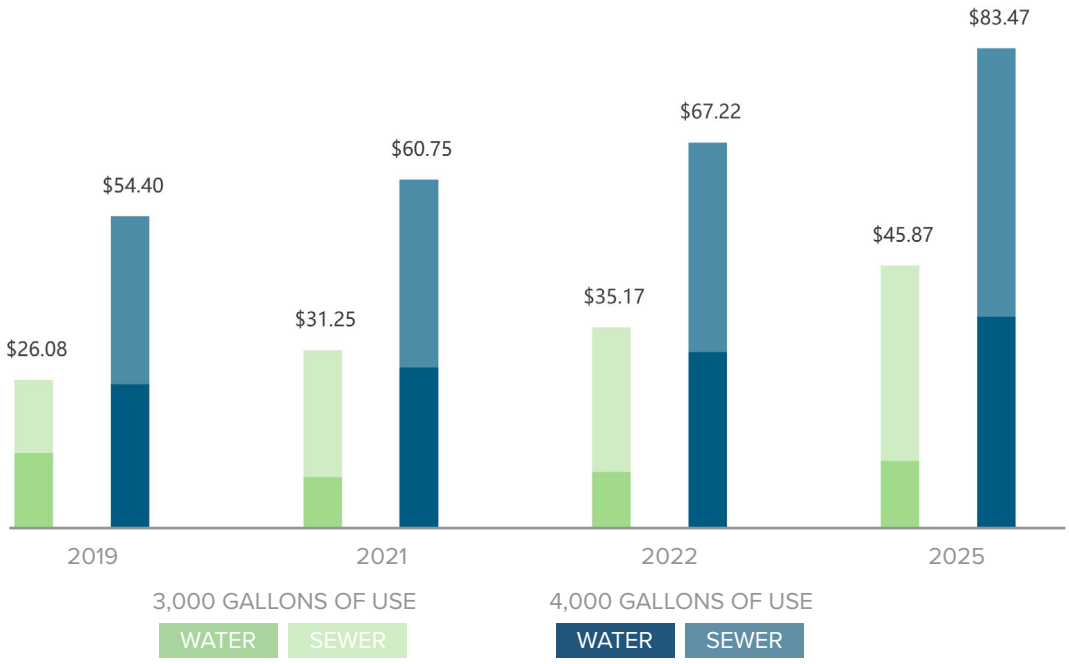
Winter Water Use Analysis

Year	Average monthly winter water use (kgal)	% of households with winter average monthly water use ≤ 3 kgal
2019	4.6	33.5%
2020	5.0	30.0%
2021	4.7	31.8%
2022	4.5	38.7%

The HPW rate structure is unique compared to a traditional tiered rate structures. The conservation credit is such that when a household uses more than 3,000 gallons, they no longer are billed using the lower rate for the first 3,000 gallons, and instead all water usage is at a higher rate, including the first 3,000 gallons. **Figure 3** demonstrates the sharp increase in monthly bills if customers use more than 3,000 gallons. Unless a customer is monitoring their own meter or is enrolled in the Consumption Awareness Program, which is not available to all customers, it is challenging to know how closely their usage is to the conservation credit level.

Figure 3

Monthly Combined Water and Sewer Bill by Year: 3,000 vs. 4,000 Gallons



RECOMMENDATION 5 ▸ Track the number of households who are benefiting from the conservation credit over time. Conduct a study of a representative set of households to understand the relevant contribution of inefficient water use versus household size in driving use levels. If inefficient water use is the dominant factor, consider targeting conservation messaging and programs to help households benefit from the conservation credit. If household size, explore increasing the conservation credit level to 4,000 or 5,000 gallons, setting individual household budgets, or adjusting the tiered structure to provide the lower rate for the first 3,000 gallons regardless of total usage.

RECOMMENDATION 6 ▸ Explore water use levels of participants of the Consumption Awareness Program (CAP) to assess if this program helps households benefit from the conservation credit. Ensure the program offers advanced notification of usage compared to the conservation credit threshold. Another observation about single-family water use was identified. A small proportion of single-family households have larger meter sizes than is common in a single-family setting. Water use was compared based on meter size and revealed that there is a statistically significant difference in water usage which may warrant further exploration of a separate customer class category. **Table 6** shows that customers with larger meters (1.5" and above) use around 40 percent more water per year, on average, than households with smaller meter sizes.[16]

RECOMMENDATION 7 ▸ Consider different rates for single-family customers with larger meter sizes. All single-family residential customers face the same water and sewer rates, yet water usage varies considerably between the smaller and larger meter sizes.

Table 6

Small vs. Large Meter Size Water Use

Average Annual Water Use Per Year by Meter Size (kgal)				
Year	5/8" and 1" Meters	1.5" and Larger Meters	Difference	Percent Difference
2019	61.6	85.6	24	39%
2020	64.6	91.2	26.6	41%
2021	59.8	83.6	23.8	40%

16 All differences are statically significant, $p<0.01$.

Water Affordability Assessment

Water affordability for low-income households was calculated using a modified version of the indicators developed by Raucher, et al. in the 2019 report, *Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector*.[17] This assessment calculates a Household Burden Indicator (HBI) and Poverty Prevalence Indicator (PPI) and assigns affordability descriptors that combine the HBI, and PPI to contextualize water affordability for low-income households. These indicators and descriptors are calculated for 555 census tracts.

Data and Methods

HPW provided AWE with monthly water consumption data associated with the bills for all single-family accounts from January 2019 through August 2022. Since we did not have the full 2022 data, it was only used for some aspects of consumption analysis. Several data cleaning steps were taken to remove incomplete and anomalous data. About 300,000 households were used for the assessment. Additional information about the data and cleaning steps can be found in **Appendix B**.

The water and sewer bills were calculated for each of the single-family accounts for each year of analysis. The 2021 consumption data was used in conjunction with the proposed 2025 rates to calculate potential bills in 2025. The water and sewer bills each have a fixed service charge and volumetric component. The steps for calculating the bills are outlined below. After calculating the monthly bills, the results were summed to a total annual water and sewer bill for each account. The rates used can be found in **Appendix A**.

1. Monthly Water Bill = Water Service Charge + Volumetric Water Charge

- Fixed Charge: The water service charge for an account's specific meter size.
- Volumetric Charge: Calculated based on the account's monthly water use (in 1,000 gallons) and the HPW tiered water rate structure in effect for the given year.[18]

2. Monthly Sewer Bill = Sewer Service Charge + Volumetric Sewer Charge

- Fixed Charge: The sewer service charge for an account's specific meter size.
- Volumetric Charge: Calculated based on the account's monthly water use (in 1,000 gallons) and the Houston tiered sewer rate structure in effect for the given year.[19]

3. Monthly Water and Sewer Bill = Monthly Water Bill + Monthly Sewer Bill

4. Annual Combined Water and Sewer Bill = Monthly Water Bills + Monthly Sewer Bills

- After the water and sewer bills were calculated for each individual account for a given year, an average annual water and sewer bill was calculated for each census tract. These values were used to calculate the Household Burden Indicator.

Household Burden Indicator

Historically, affordability was measured based on a median level of household income, which would mask the impacts utility bills had on the most vulnerable households in a community. The updated Household Burden Indicator (HBI) described by Raucher, et al., 2019 is a metric that provides insight into water affordability for lower-income households. The HBI is defined as the basic water service costs as a percent of the 20th percentile household income (i.e., the lowest 20% of households based on household income).

$$HBI = \frac{\textit{Average Total Household Annual Water Cost}}{\textit{Upper Boundary of the Lowest Quintile Income}}$$

17 Raucher, R., Clements, J., Rothstein, E., Mastracchio, J., & Green, Z. (2019). *Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector*. American Water Works Association, National Association of Clean Water Agencies, and Water Environment Federation.

18 In HPW, rates change in April each year rather than at the start of a calendar year. For ease of analysis calculations were done on a calendar year basis using one of the rate structures in effect that year. See **Appendix A** for more detail.

19 In HPW, sewer bills are determined by the volume of water registered by the account's water meter. If a household has a separate irrigation-only meter, that water usage is not included in the sewer bill calculation.

For this analysis, the HBI formula was modified to use an average annual combined water and sewer bill derived from billing data. That is, the average annual combined water and sewer bill for a given census tract was used instead of the total annual basic water sector household cost, which is a less specific calculation that relies on estimates for consumption (50 gallons per person per day) instead of precise utility billing and consumption data. The upper boundary of the lowest quintile income was obtained for each census tract from the Household Income Quintile Upper Limits table from United States Census Bureau 2021 American Community Survey 5-Year Estimates.[20] The HBI formula used specifically for this assessment is defined below. Each census tract had its own unique average water and sewer bill calculated from the HPW water consumption data and a unique value for the upper boundary of the lowest income quintile.

$$HBI = \frac{\textit{Average Annual Combined Water and Sewer Bill}}{\textit{Upper Boundary of the Lowest Quintile Income}}$$

The Poverty Prevalence Indicator (PPI) is a measure of poverty within a given geography. This indicator is a measure of the percentage of households below 200% of the Federal Poverty Level, see **Table 7** for reference. The PPI as described by Raucher, et al., 2019 is calculated with publicly available data from the U.S. Census Bureau using the formula below:

$$PPI = \frac{\textit{Population Below 200\% of Federal Poverty Level}}{\textit{Population for Whom Poverty Status is Determined}}$$

Affordability Descriptors

In addition to the HBI and PPI, the Raucher, et al., 2019 report includes a way of combining the quantitative levels of HBI and PPI to generate qualitative descriptors. These descriptors place quantitative data into qualitative terms that are easy to understand and communicate. There are five descriptors based on the combination of HBI and PPI:

- Low Burden
- Moderate-Low Burden
- Moderate-High Burden
- High Burden
- Very High Burden

Table 8 contains the matrix which was adapted from the report, *Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector*. This table signifies values from the color-coded maps in Figures 13-15.

Table 7

200% of Federal Poverty Level

200% of Federal Poverty Level - 2020	
Household Size	Annual Income
1	$25,520
2	$34,480
3	$43,440
4	$52,400
5	$61,360
6	$70,320

Table 8

Qualitative Descriptors of Household Affordability

HBI: Water Costs as a Percent of Income at LQI	PPI: Percent of Households Below 200% of FPL		
	≥ 35%	20-35%	< 20%
≥ 10%	Very High Burden	High Burden	Moderate-High Burden
7-10%	High Burden	Moderate-High Burden	Moderate-Low Burden
< 7%	Moderate-High Burden	Moderate-Low Burden	Low Burden

20 Income data from the American Community Survey combine single-family and multi-family households. Disaggregated data are not available. The average cost of water and sewer reflects single-family customers.

Results and Discussion

The analysis was conducted for three time periods: 2019, 2021, and a future year, 2025, to demonstrate the estimated trend based on projected rate increases. The 2025 analysis was based on water use in 2021.

Incomes and Poverty: Like many growing metropolitan areas, the City of Houston has a wide distribution of income levels. The median household income as measured in the 2020 Census was $53,600. By contrast, the median of the 20th percentile of household incomes in census tracts was only $24,131 as shown in **Table 9**. Further, **Table 10** shows that a large portion of census tracts have more than 50% of people living at or below 200% of the Federal Poverty Level.

Figure 4 is a map of the Poverty Prevalence Indicator by census tract, which shows the percentage of households in the census tract with incomes 200% of the Federal Poverty Level.

Table 9

20th Percentile Incomes

20th percentile of income across City of Houston Census tracts (2020 Census data)	
Average	**$29,208**
Minimum	$2,500
Median	$24,131
Maximum	$133,907

Table 10

Poverty Prevalence Levels - Based on Federal Poverty Levels

FPL = Federal Poverty Level in 2020	
Tracts with more than 50% people below 200% of FPL	215
Percent of census tracts with more than 50% people below 200% of FPL	38.7%
Tracts with more than 75% people below 200% of FPL	18
Percent of census tracts with more than 75% people below 200% of FPL	3.2%

Water Use and Annual Water and Sewer Bills: Household bills are likely to increase as a result of the new rate structure and projected rate increases over time. **Table 11** shows the average monthly and annual water use by year, as well as average water and sewer bill. **Figure 5**, **Figure 6** and **Figure 7** map the average annual water and sewer bills by census tract across the City of Houston, color coded into five groupings. A darker color indicates a higher average annual water and sewer bill.

Higher bills are concentrated in the northeastern suburban area as well as the central and areas west of central Houston. By 2021, very few tracts have an average annual bill less than $720 and by 2025, no tract is projected to have an average annual water and sewer bill less than $720.

Table 11

Average Water Use and Bills by Year

Year	Average Monthly Water Use (kgal)	Average Annual Water Use (kgal)	Average Water and Sewer Bill
2019	5.1	61.9	$820
2021	5	60.1	$951
2025	5	60.1	$1,338

Figure 4

Poverty Prevalence Indicator Map

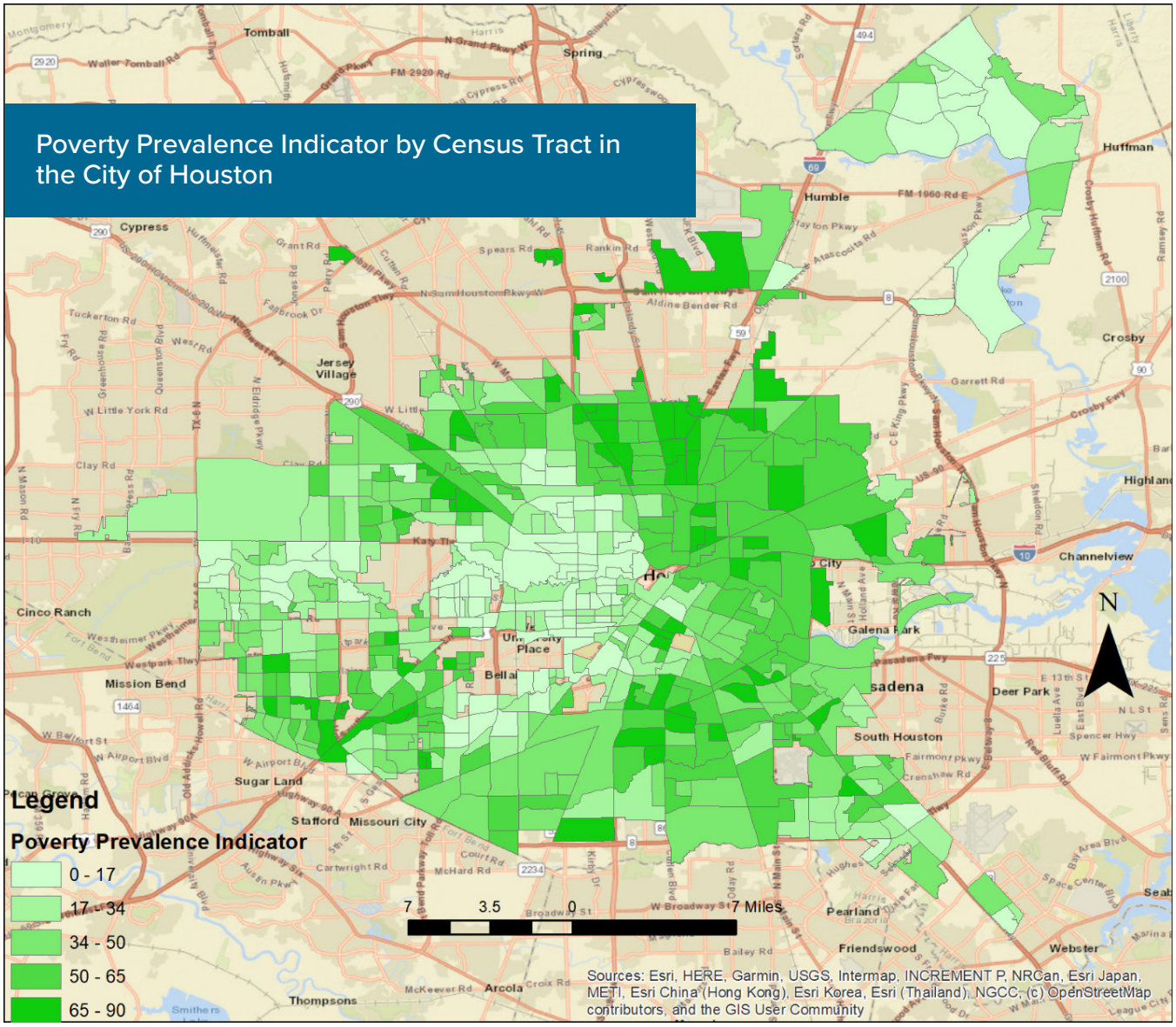


Figure 5

2019 Average Water and Sewer Bills Map

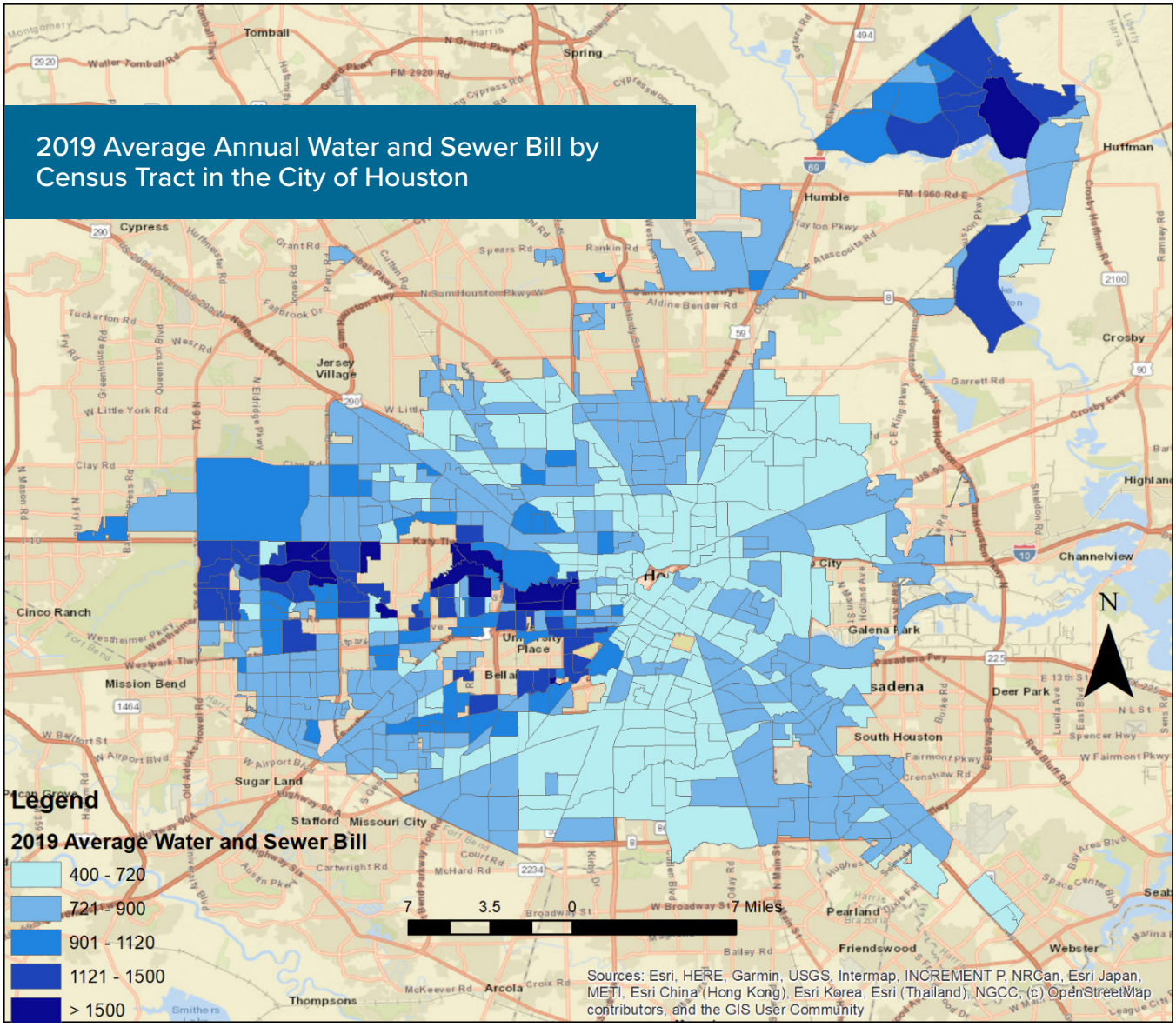


Figure 6

2021 Average Water and Sewer Bills Map

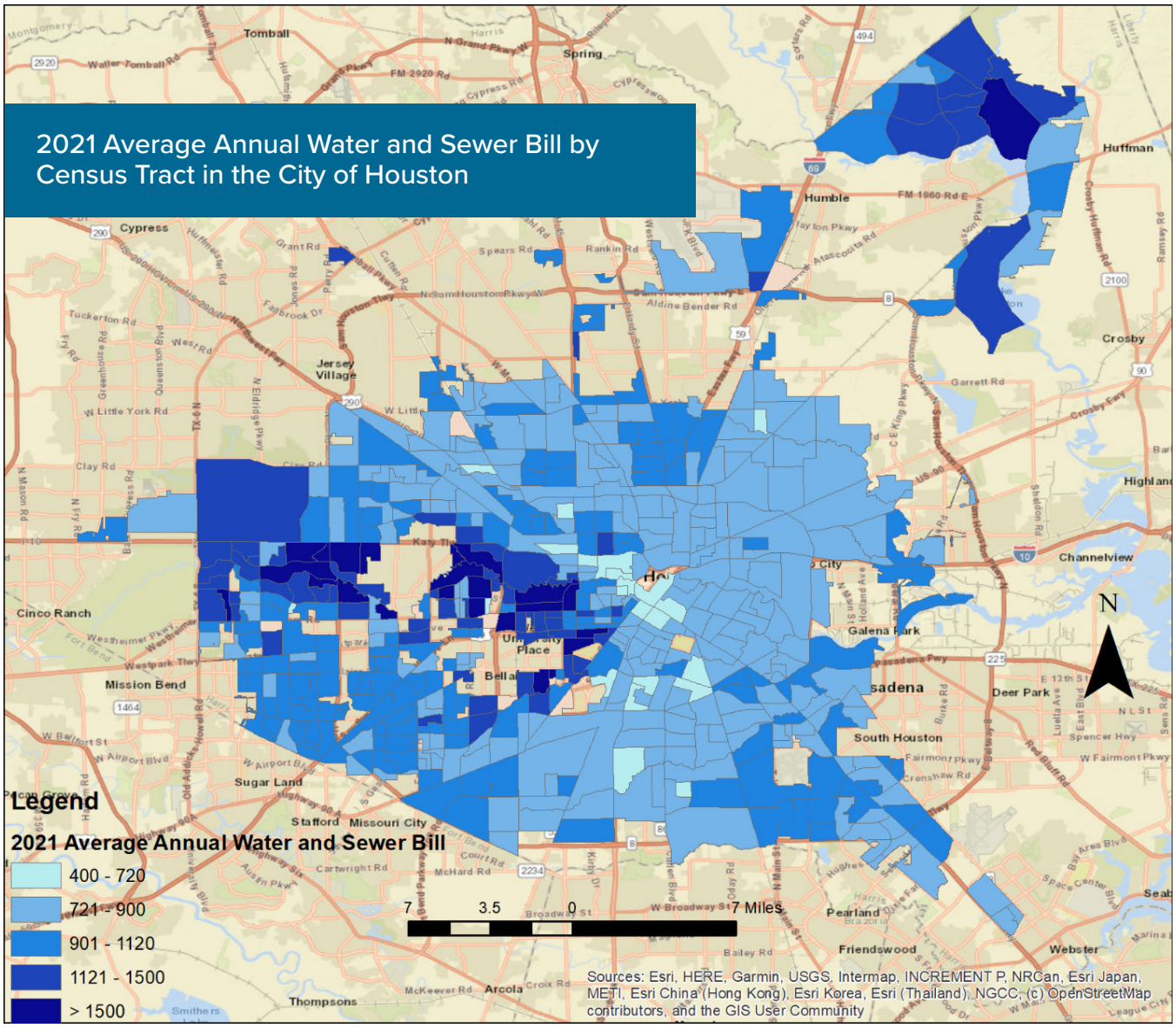
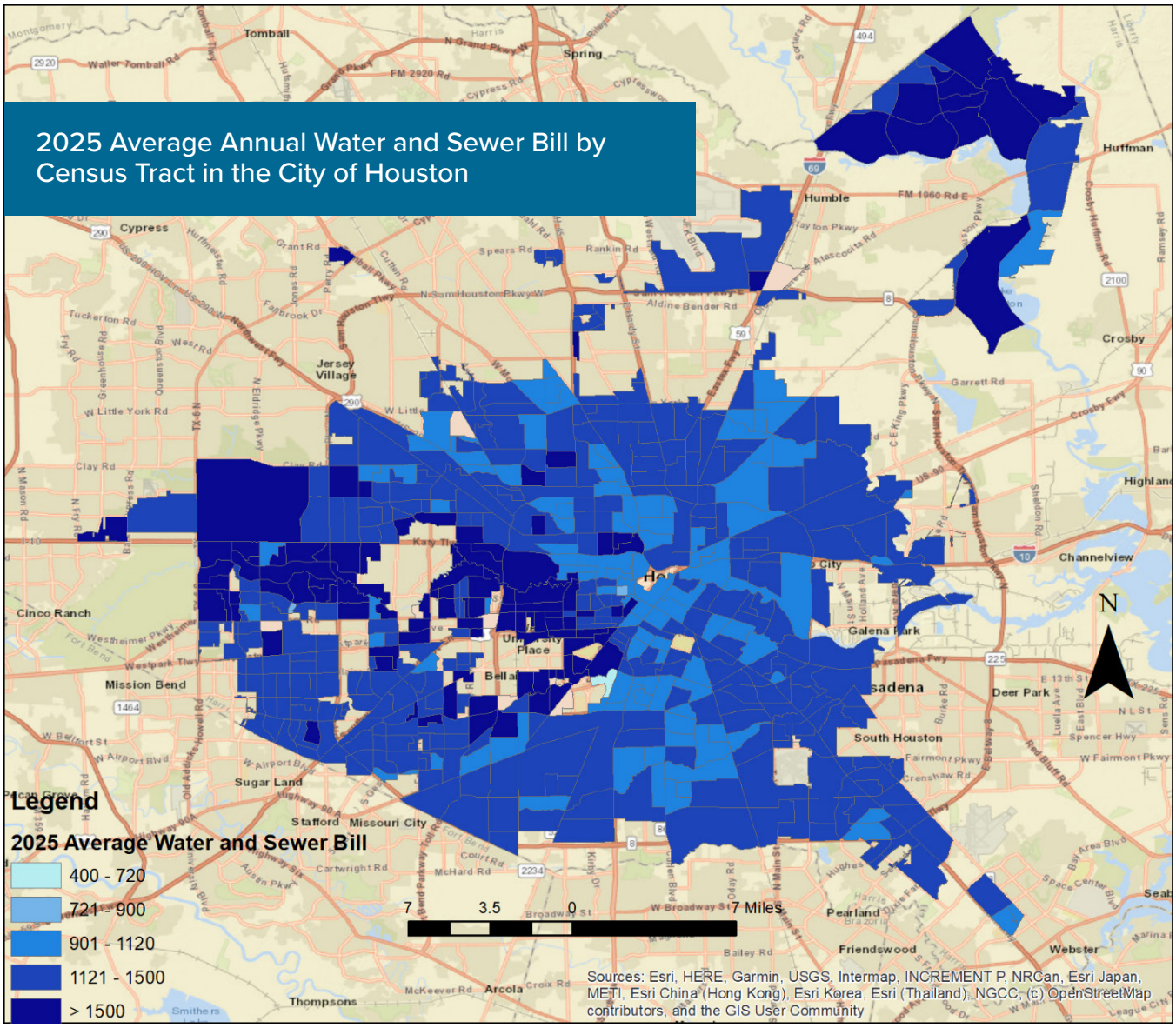


Figure 7

Projected 2025 Average Water and Sewer Bills Map



Household Burden Indicator: **Table 12** shows the Household Burden Indicator (HBI) results by year. The average HBI for 2019 was just under four, meaning that annual total water and sewer bills were just under four percent of the 20th percentile of household annual income level. However, some census tracts have a very high HBI. The HBIs for 2021 and projected for 2025 demonstrate the impact of the rate increases, with water and sewer bills reflecting over six percent of income. **Figure 8** illustrates the percentage of census tracts for different levels of HBI, showing how prevalent higher HBIs are projected by 2025. **Figure 9**, **Figure 10**, and **Figure 11** illustrate these results across the community and highlights, that some census tracts have a very high HBI. The HBI trends over time do not match the trends in the average annual water and sewer bills. Bringing together both water use levels and income levels demonstrates a more nuanced story and that census tracts with the highest HBIs are scattered throughout the community.

By 2025, nearly 20 percent of census tracts are projected to have an HBI greater than 7 and 9 percent of tracts with an HBI greater than 10.

Table 12

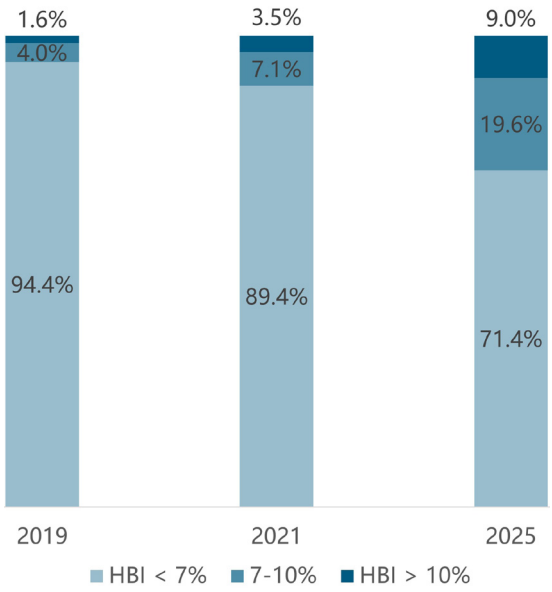
Household Burden Indictor Results by Year

	2019	2021	2025
Average HBI	3.81	4.45	6.27
Minimum HBI	0.48	0.59	0.83
Median HBI	3.29	3.81	5.39
99th Percentile HBI	13.01	15.21	21.51
Maximum HBI	28.02	35.20	54.56

Figure 8

Percent of Census Tracts by HBI level over time

HBI = Water and Sewer Costs as a Percent of Lowest Quintile of Income



Although a relatively small percentage of tracts have an average HBI greater than ten, meaning those households on average pay more than ten percent of their income on water and sewer bills, these tracts are home to thousands of households as shown in **Table 13**. Further, the number of tracts with an HBI greater than ten are projected to grow over time as rates continue to rise.

Table 13

Population in Tracts with HBI greater than 10

	2019	2021	2025
Number of HBI Tracts with an HBI above 10	9	19	49
Total population of tracts with HBI above 10	21,081	32,483	39,089
Total # of people below 200% FPL of tracts with HBI above 10	12,399	13,698	18,606

Figure 9

2019 Household Burden Indicator Map

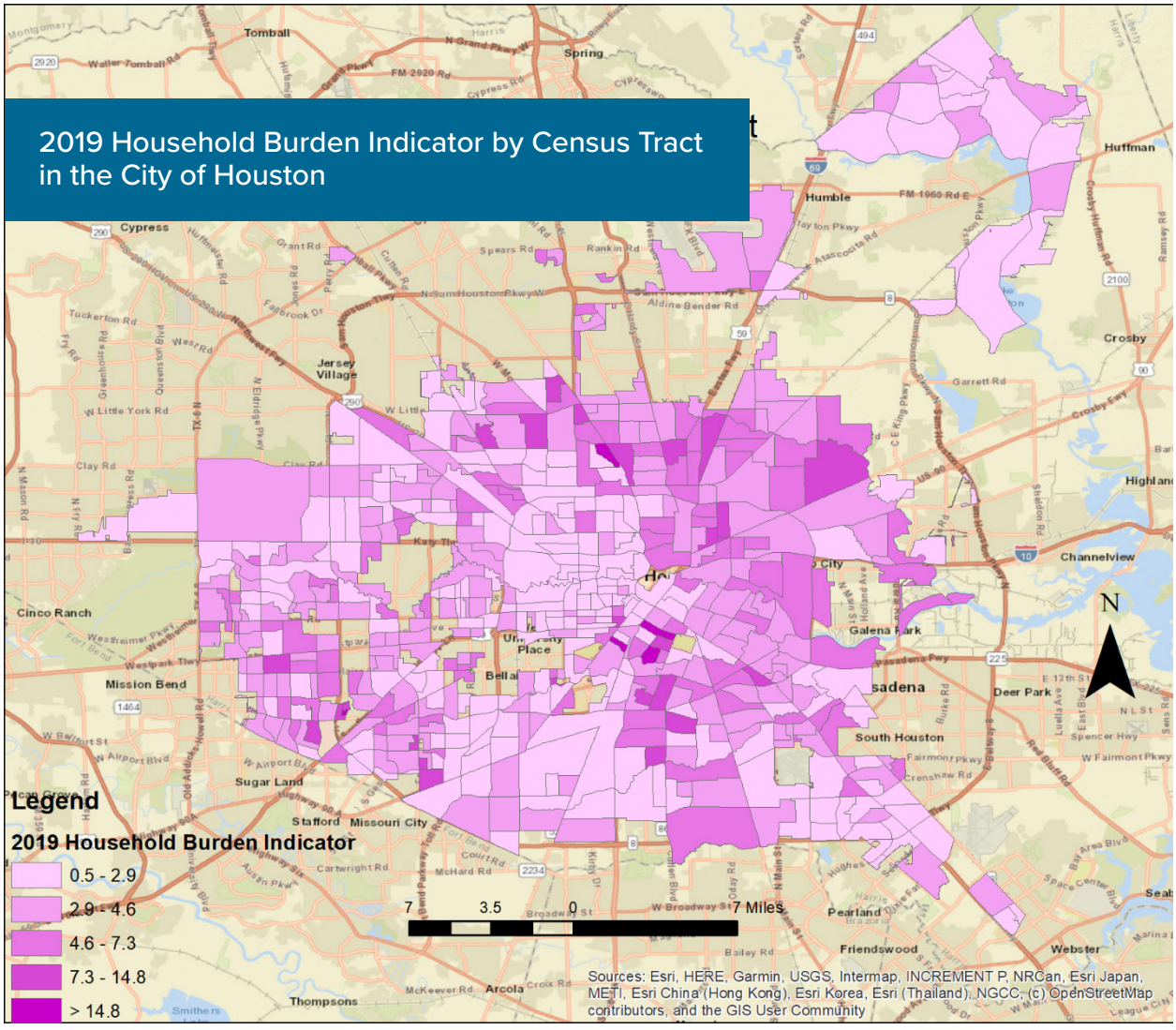


Figure 10

2021 Household Burden Indicator Map

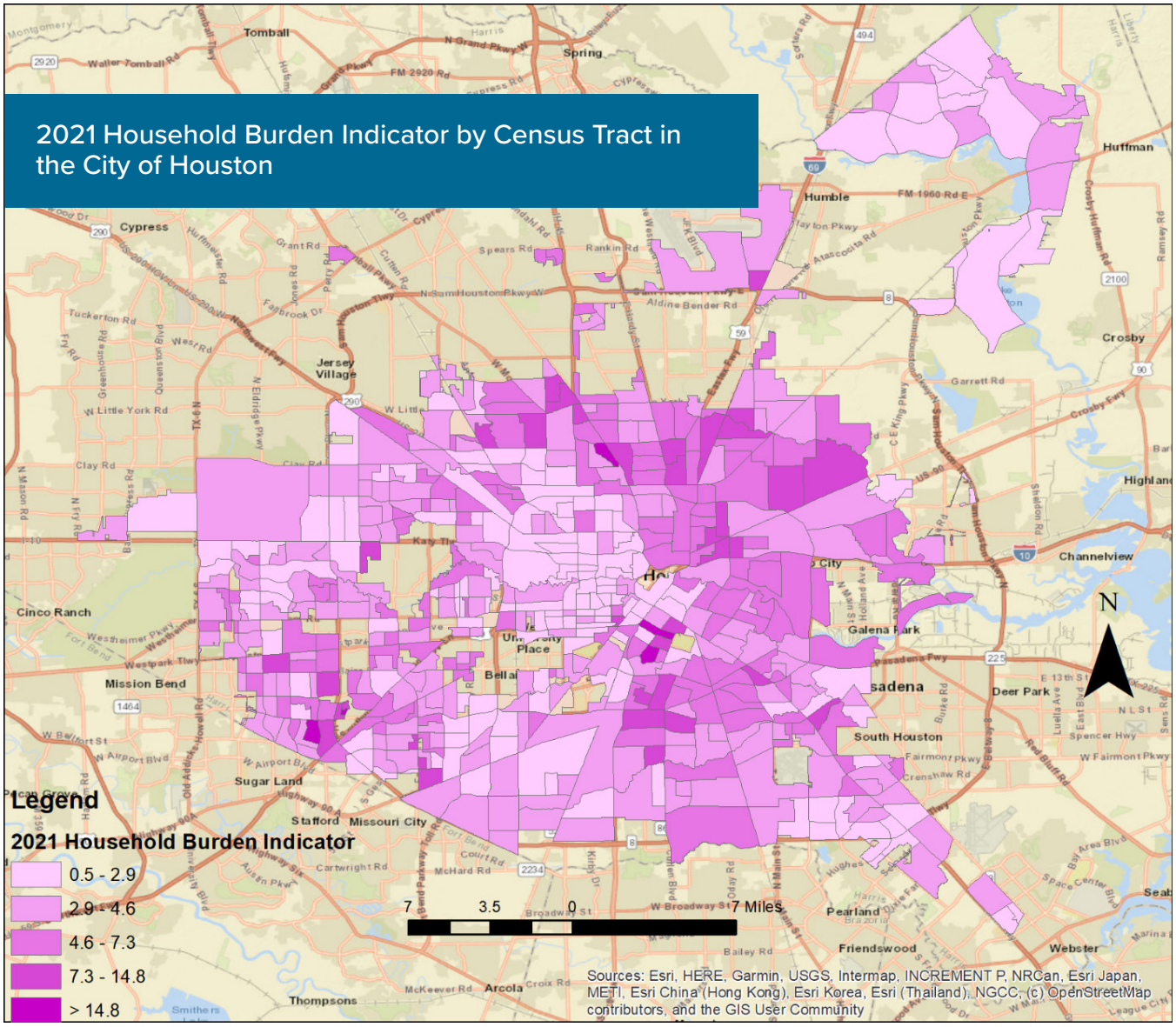


Figure 11

2025 Household Burden Indicator Map

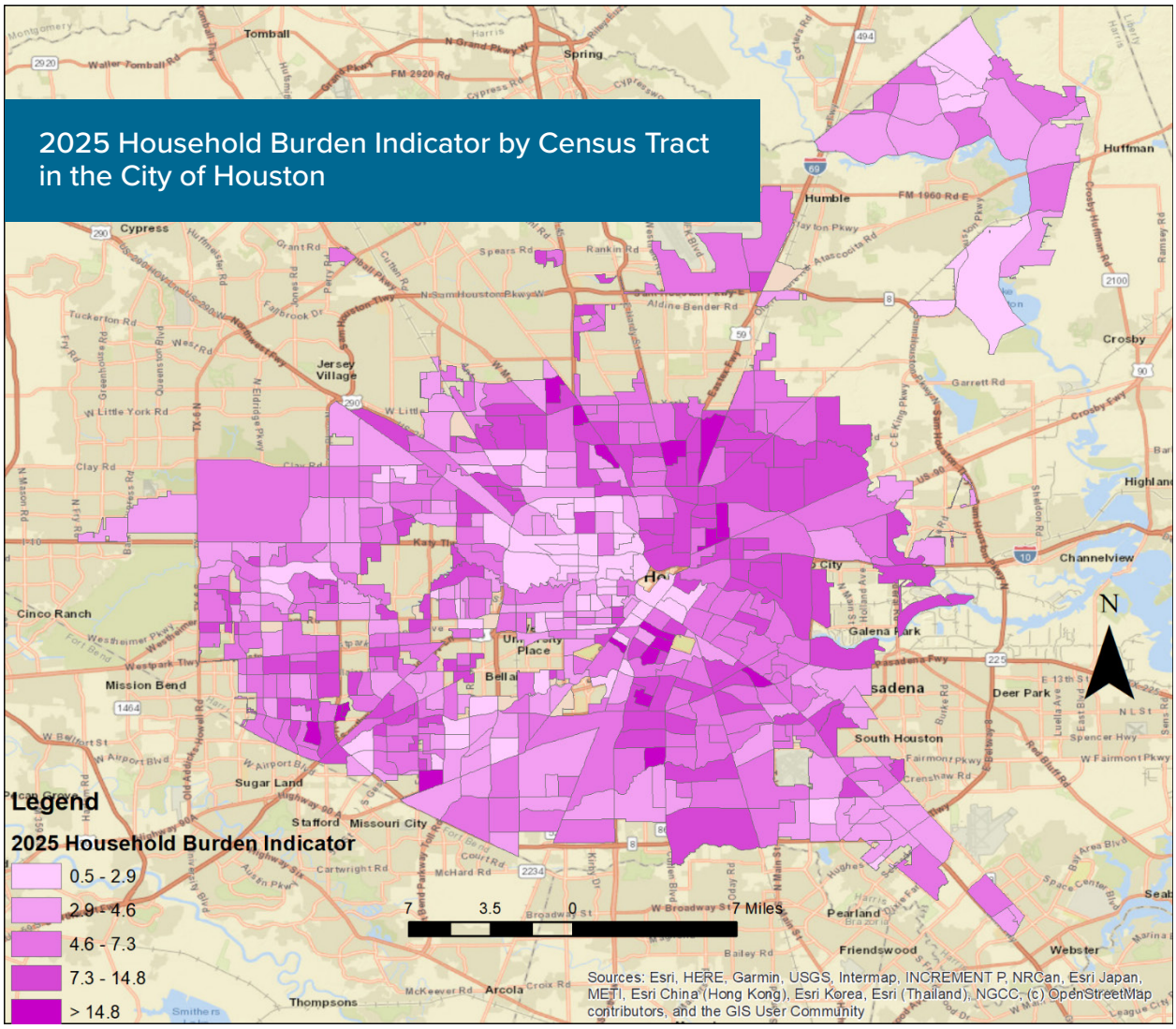


Figure 12

Percent of Census Tracts by Descriptor Category

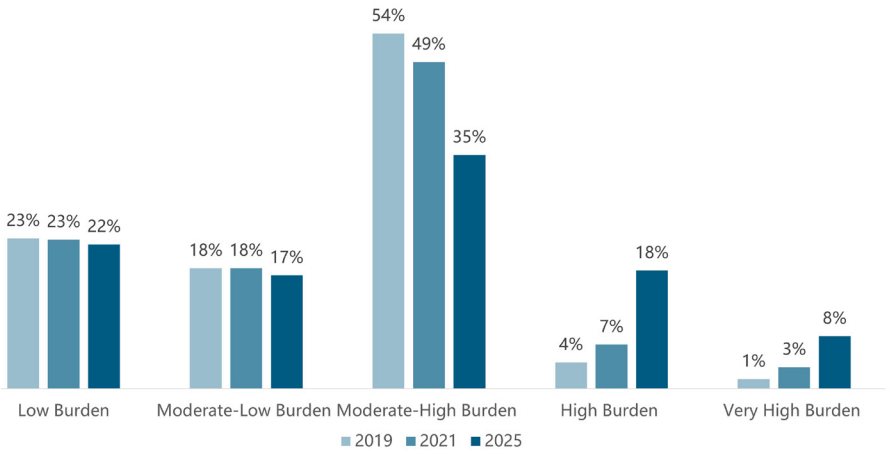


Figure 12 shows the percentage of census tracts by each analysis year that fall into each of the qualitative affordability descriptor categories. While the proportion of low and moderate-low burden households stay fairly consistent over time, many census tracts shift from having a moderate-high burden to a high or very high burden by 2025. **Figure 13**, **Figure 14**, and **Figure 15** map the affordability descriptors by census tract.

Figure 13

2019 Affordability Descriptors Map

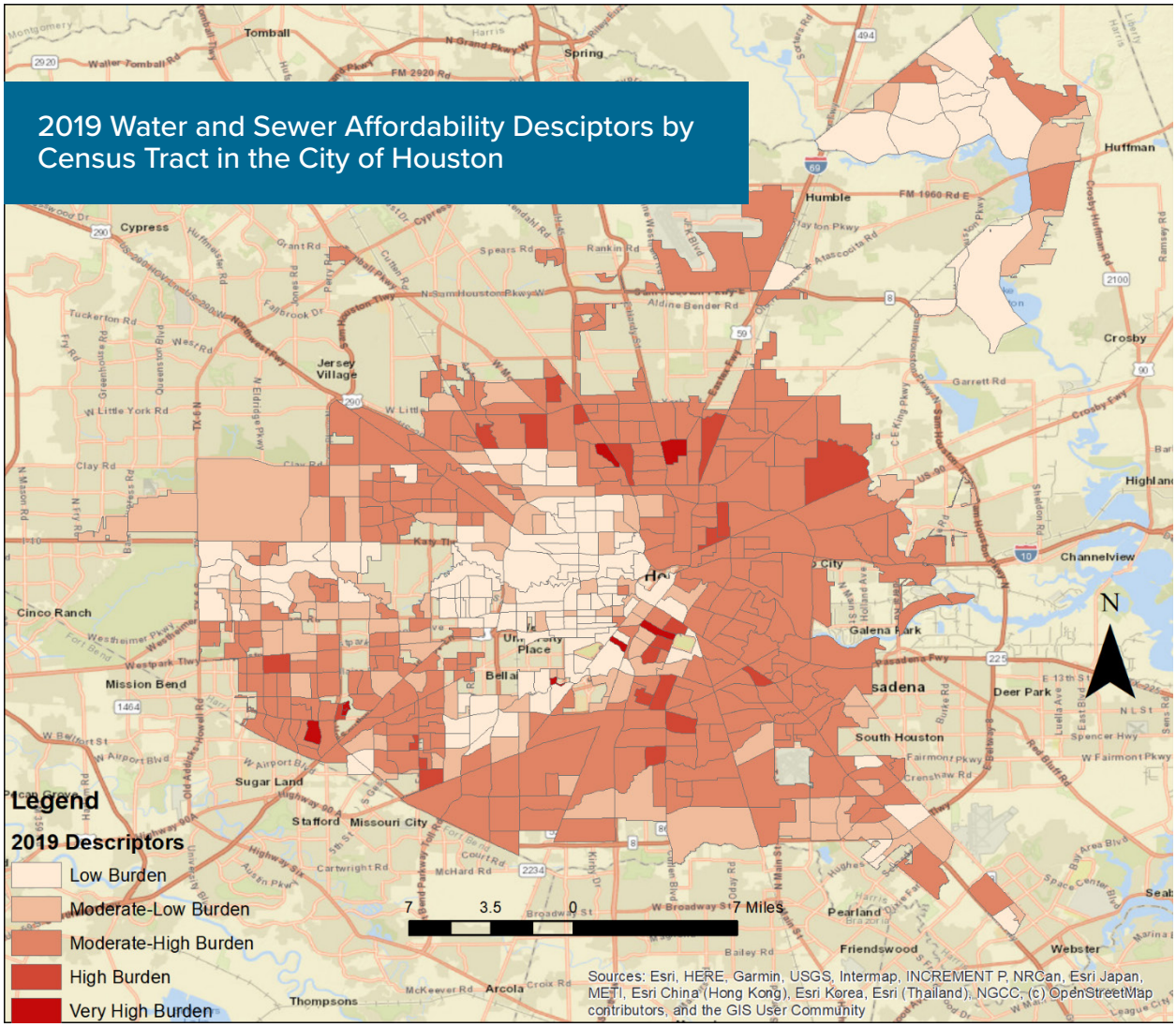


Figure 14

2021 Affordability Descriptors Map

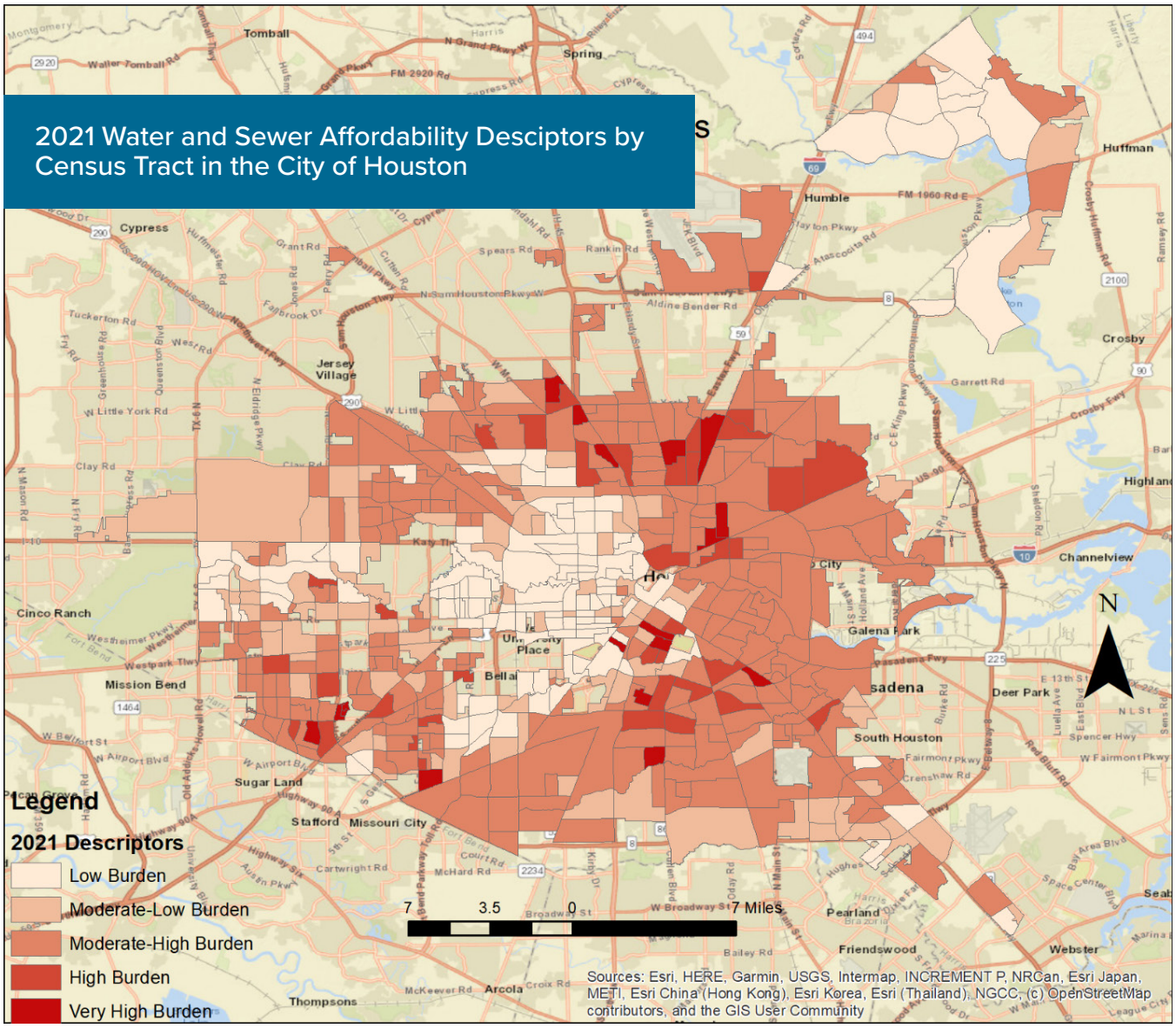
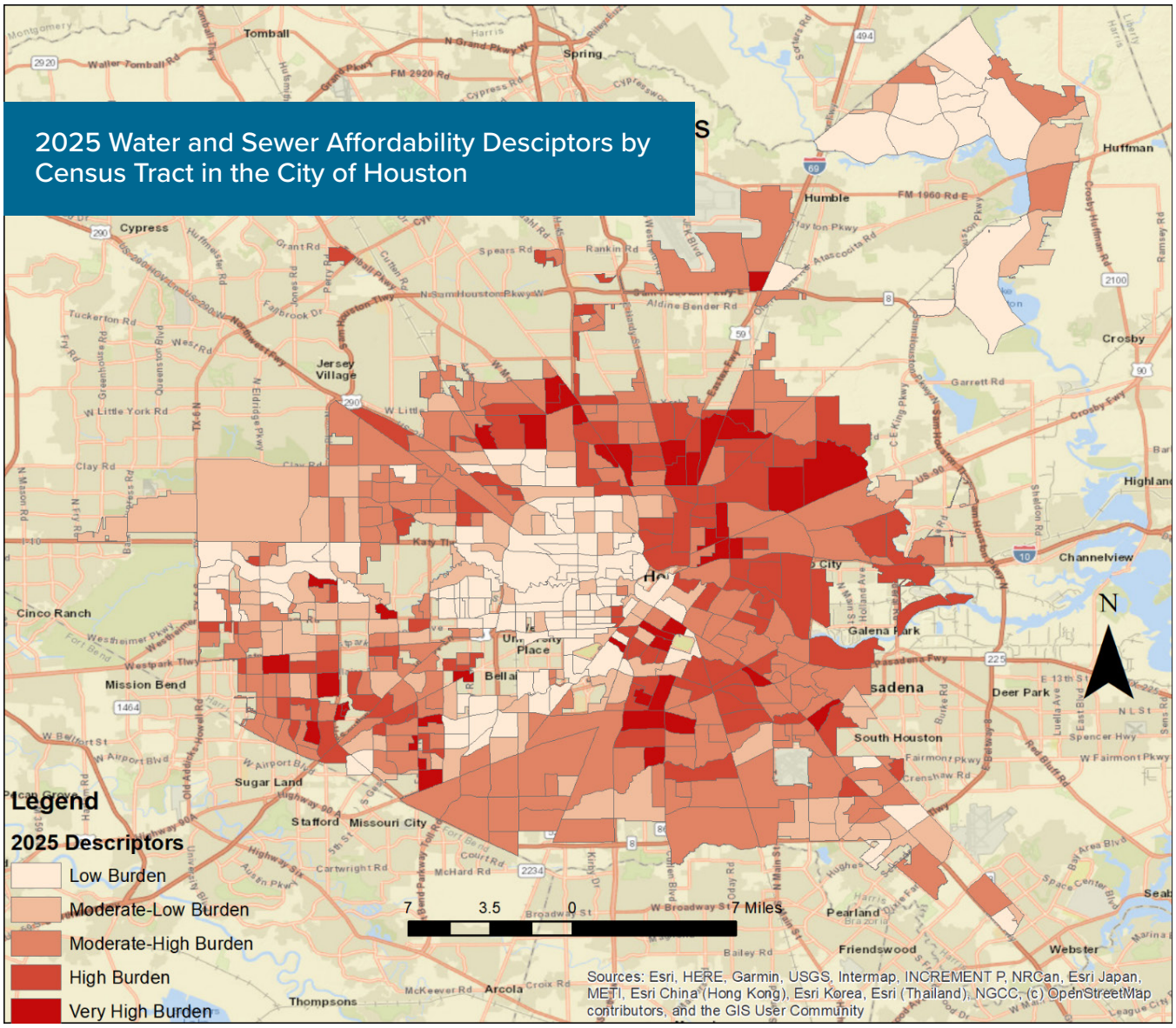


Figure 15

Projected 2025 Affordability Descriptors Map



Impact of Water Conservation and Efficiency Strategies

HPW has not historically offered many conservation programs for single-family customers. There is significant potential to achieve water savings and help households reduce their water use as a strategy to mitigate affordability issues. This section provides potential water savings and estimates of bill impacts for various water conservation and efficiency strategies. To estimate bill impacts, water consumption from 2021 was used paired with the water and sewer rates effective as of April 2022 since we did not have a complete dataset for 2022. See **Appendix A** for rates.

There are many conservation programs that HPW could offer single-family customers to reduce household water consumption. By replacing a combination of old, inefficient toilets, showerheads and clothes washers with high-efficiency models, customers can save a meaningful amount of water and money every month.

The impacts of water saving strategies are presented for two different types of customers:

- Households with relatively consistent water use throughout the year, primarily indoor water use, and
- Households with a moderate level of outdoor water use.

The true individual impact of each strategy will vary by household. Results are presented in **Table 14**. Savings estimates range from $30 per year to over $300 per year, representing between three and 34 percent savings on annual bills. If conservation programs focused on households with a high HBI, the conservation measures could have a large impact on utility bill affordability. Water savings estimates were generated using AWE's Water Conservation Tracking Tool for the replacement of inefficient toilets, clothes washers, and showerheads.[21] Note that the same water-saving strategy will save a high-water-use household more money than a low-water-use household because of the inclining block rate structure.

Indoor Strategies

Toilet flushing is the largest indoor water user and is estimated to save 14-15 percent on annual bills. Based on the current housing stock, there is ample opportunity for water conservation savings via toilet replacements. Using U.S. Census data on housing age and American Housing Survey data, it was estimated that there are over 600,000 inefficient toilets remaining in the single-family homes in the City of Houston in the Census tracts analyzed for this assessment. This calculation incorporated a couple of factors: The state of Texas adopted standards in 2009 that took effect in 2014 requiring that any toilet sold in Texas be a high efficiency toilet (1.28 gallons per flush), so presumably all homes built after this date already have a high efficiency toilet.

Behavioral Strategies

There are a variety of behavioral actions that HPW recommends consumers take to reduce their water consumption. For example, checking for and fixing toilet leaks, taking shorter showers, washing only full loads of dishes or clothes, and turning off the faucet while brushing teeth and washing hands.[22] If the typical City of Houston single-family household could reduce their monthly consumption by 500 gallons per month through behavioral water-saving strategies, they could save approximately three to eight percent on their water and sewer bills each year.

Outdoor Strategies

Households who use water outdoors could save by using a smart irrigation controller and/or replacing some high-water-use landscape with more waterwise landscaping. Each of these strategies could save an average household about 14 to 15 percent on annual water and sewer bills. The AWE Landscape Transformation study was used for the landscape transformation estimates.[23] The results were calculated based on a project transforming 1,000 square feet of high-water use landscape to a lower water use landscape.

21 Alliance for Water Efficiency. 2021. Water Conservation Tracking Tool, Version 4. https://www.allianceforwaterefficiency.org/resources/topic/water-conservation-tracking-tool

22 https://www.houstonpublicworks.org/indoor-water-conservation-tips

23 Estimates were based on the results for a Texas utility participated in this study. https://www.allianceforwaterefficiency.org/impact/our-work/landscape-transformation-assessment-water-utility-programs-and-market-readiness

Table 14

Impact of Conservation and Efficiency Strategies on Water and Sewer Bills

Water Conservation or Efficiency Strategy	Annual Water Savings (gallons)	Annual Water and Sewer Bill Savings	Percent Reduction from Average Bill
Households with primarily indoor water use. Average annual use is 58,100 gallons, $909 annual bill			
Toilet Replacement	10,100	$135.84	-15%
Indoor Retrofit (Toilets, showerheads, and clothes washer)	18,000	$310.14	-34%
Behavioral Actions	6,000	$31.09	-3%
Households with moderate outdoor use. Average use is 73,500 gallons, $1,215 annual bill			
Toilet Replacement	10,100	$170.04	-14%
Indoor Retrofit (Toilets, showerheads, and clothes washer)	18,000	$267.04	-22%
Behavioral Actions	6,000	$92.54	-8%
Smart Irrigation Controller	9,500	$175.32	-14%
Landscape Transformation	11,500	$178.69	-15%

RECOMMENDATION 8 ▸ Explore conservation strategies that reduce barriers and improve accessibility for more vulnerable households. This may include reducing language barriers, working with community-based partners, offering no or low-cost direct install programs, offering no or low-cost home and irrigation water use assessments, offering leak detection and repair services, and more.

Multi-family and Commercial Sector Opportunities: About 87 percent of connections in HPW retail service area are single-family connections and much of historical conservation efforts have been focused on this set of customers. The other two sectors, however, multi-family and ICI (Industrial, Commercial and Institutional) each represent more total annual water usage than the single-family sector. In 2018 they used 33 percent and 38 percent of all retail water use, leaving the single-family sector only using about 29 percent.[24]

RECOMMENDATION 9 ▸ Consider water conservation programs that address water use in the multi-family and ICI sectors. There are likely affordability challenges among these customers and HPW could enhance the equity of their efforts by designing and implementing programs to serve low-income multi-family communities and small businesses.

Exploring the Scale of Outdoor Water Savings Opportunities: A peak ratio was calculated to compare average summer water use to winter water use to assess how many households have significantly higher water use during the summer season.[25] This analysis can also help identify which households may be good candidates for outdoor water conservation and efficiency programs.

$$\textit{Peak Ratio} = \frac{\textit{Average (June water use, July water use, August water use)}}{\textit{Average (December water use, January water use, February water use)}}$$

24 Found in the 2019 Houston Public Works Water Conservation Plan. https://www.houstonpublicworks.org/waterconservation

25 For 2022, the ratio is only calculated using an average of January and February water use for the winter estimate since the dataset only goes through August 2022.

Table 15 provides the results. Not all data was available for 2022, so annual-scale metrics are not reported for 2022. A peak ratio of around one means that water use is consistent throughout the year. If the ratio is greater than one, more water is used during the summer months than winter months. A relatively small proportion of households in the analysis use a considerable amount of water in the summer. In 2019, only 13 percent of the customers in the analysis had a peak ratio greater than or equal to two, meaning they use at least twice as much water in the summer months than winter months, and yet they represent over 23 percent of the total water use in summer months. 2022 was considerably hotter and drier than the other years represented in this analysis, which is reflected in the greater proportion of customers who have higher summer water use relative to their winter water use.

RECOMMENDATION 10 ▶ Consider developing conservation programs to address outdoor water use. Incorporate analysis to tailor the outreach for residents with high peak ratios, especially those who are in census tracts with higher burdens as calculated in this assessment. Customers with lower peak ratios may not benefit as much from a program focused on reducing outdoor water use.

Table 15

Outdoor Water Use Analysis

		2019	2020	2021	2022 (Jan-Aug only)
All Households	Count of Households in Analysis	296,829	308,699	273,545	289,716
	Average Annual Water and Sewer Bill	$820	$871	$951	
	Average Annual Water Use (kgal)	61.9	65	60.1	
	Average Monthly Water Use (kgal)	5.1	5.4	5.0	
Households with a Peak Ratio<2	Percent of Households	87%	90.6%	93.6%	83.1%
	Average Annual Water and Sewer Bill	$773	$844	$931	N/A
	Average Annual Water Use (kgal)	58.8	63.4	59.2	
	Average Monthly Water Use (kgal)	4.9	5.3	4.9	--
	Average Summer Monthly Water Use (kgal)	5.2	5.6	5.0	5.1
Households with a Peak Ratio ≥2 and <4	Percent of Households	11%	8.4%	5.7%	13.4%
	Average Annual Water and Sewer Bill	$1,112	$1,116	$1,225	N/A
	Average Annual Water Use (kgal)	80.6	80.2	73.4	
	Average Monthly Water Use (kgal)	6.7	6.7	6.1	--
	Average Summer Monthly Water Use (kgal)	10.1	9.6	8.6	9.4
Households with a Peak Ratio ≥4	Percent of Households	2%	1%	0.7%	3.4%
	Average Annual Water and Sewer Bill	$1,291	$1,248	$1,387	--
	Average Annual Water Use (kgal)	90.9	86.5	79.5	--
	Average Monthly Water Use (kgal)	7.6	7.2	6.6	--
	Average Summer Monthly Water Use (kgal)	13.8	12.6	11.7	11.6

Summary & Conclusion

Water conservation and efficiency strategies can mitigate affordability challenges by reducing household water use and lowering water and sewer bills. Sustained water conservation at a large scale can help utilities avoid, defer, or downsize capital investments in facilities and infrastructure. Affordability is a challenge that requires a multi-pronged approach and must be incorporated into all strategic, financial, and operational planning efforts.

In HPW, the projected outcomes based on the adopted rate increases between 2019 to 2025 are:

Increase in the average HBI, or the water and sewer costs and a percentage of income at the lowest 20th percentile, from just under four percent to over six percent.
The percentage of census tracts with a high or very high burden, based on a combination of the HBI and the prevalence of poverty, will jump from only five percent to 26 percent.
The number of households living in census tracts that spend ten percent or more of their yearly income on water and sewer bill will double.
The most impacted households will go from paying about 13 percent of yearly income on water and sewer bills to over 21 percent.

The various water conservation and efficiency measures assessed could each save a household an average of 15 percent on their annual water and sewer bills, with some measures or combination of measures estimated to save a household 34 percent, on average. The recent HPW rate restructure provides a significant financial incentive to reduce use below 3,000 gallons per month, however, many households consistently use more than 3,000 gallons. Only around a third of households stay below this threshold even in the winter months where usage would be expected to be lowest and largely consist of only indoor, essential usage. And while households in census tracts with greater poverty do demonstrate lower average water usage than higher income tracts, the average monthly use is still about 4,700 gallons per month.

Customers need clear and consistent education to understand the financial impact of exceeding 3,000 gallons per month, and customers need the tools to actively manage their water use. Additionally, conversation programs should focus on large households when possible, because of the greater potential water savings and return on investment and because these larger households are unlikely to be able to keep their use below 3,000 gallons per month even when using water efficiently.

Direct Install Pilot

A companion effort to this Affordability Assessment is a direct install pilot where a subset of homes will receive installation of high efficiency toilets, showerheads, faucets and clothes washing machines at no cost to the household. In 2023, HPW is partnering with the City of Houston Housing and Community Development Department, Single Family Division, to install high efficiency faucets, showerheads, toilets and clothes washers. This partnership will help rehabilitate low-income households in the City of Houston. This pilot will provide additional data to inform the next steps for HPW.

Full List of Recommendations

RECOMMENDATION 1 ▶ Identify ways to enhance marketing to increase donations, reduce barriers to participation, and increase awareness of program to target households. For reference, the American Community Survey estimates that there are around 40,000 people in the City of Houston who are both over 65 years old and in poverty. The W.A.T.E.R. Fund only serves a small subset of these of households each year. Challenges related to this program may include customers having to reapply, the form is only available in English, significant paperwork is required to prove income qualification, and there is a lack of services to address high uses that contribute to high bills (e.g., leak repair services).

RECOMMENDATION 2 ▶ Explore utility revenue streams that could be utilized for the W.A.T.E.R. Fund or other customer assistance programs. Depending on legal limitations, the City of Houston could start by identifying availability of non-ratepayer revenue sources for customer assistance programs.

RECOMMENDATION 3 ▶ Explore which types of customers are benefiting from these programs. Consider strategies to improve awareness of these programs and payment plans for low-income or otherwise vulnerable customers. Discuss priorities for funds between these bill adjustment programs and alternative customer assistance programs and/or water conservation programs designed for low-income customers.

RECOMMENDATION 4 ▶ HPW should improve tracking of payment plan information, service shut-offs, non-payment patterns, participation in assistance programs, and other measures in order to develop a richer set of affordability metrics and better track and understand the challenges facing customers across the economic spectrum.

RECOMMENDATION 5 ▶ Track the number of households who are benefiting from the conservation credit over time. Conduct a study of a representative set of households to understand the relevant contribution of inefficient water use versus household size in driving use levels. If inefficient water use is the dominant factor, consider targeting conservation messaging and programs to help households benefit from the conservation credit. If occupancy, explore increasing the conservation credit level to 4,000 or 5,000 gallons, setting individual household budgets, or adjusting the tiered structure to provide the lower rate for the first 3,000 gallons regardless of total usage.

RECOMMENDATION 6 ▶ Explore water use levels of participants of the Consumption Awareness Program to assess if this program helps households benefit from the conservation credit. Ensure the program offers advanced notification of usage compared to the conservation credit threshold.

RECOMMENDATION 7 ▶ Consider different rates for single-family customers with larger meter sizes. All single-family residential customers face the same water and sewer rates, yet water usage varies considerably between the smaller and larger meter sizes.

RECOMMENDATION 8 ▶ Explore conservation strategies that reduce barriers and improve accessibility for more vulnerable households. This may include reducing language barriers, working with community-based partners, offering no or low-cost direct install programs, offering no or low-cost home and irrigation water use assessments, offering leak detection and repair services, and more.

RECOMMENDATION 9 ▶ Consider water conservation programs that address water use in the multi-family and ICI sectors. There are likely affordability challenges among these customers and HPW could enhance the equity of their efforts by designing and implementing programs to serve low-income multi-family communities and small businesses.

RECOMMENDATION 10 ▶ Consider developing conservation programs to address outdoor water use. Incorporate analysis to tailor the outreach for residents with high peak ratios, especially those who are in census tracts with higher burdens as calculated in this assessment. Customers with lower peak ratios may not benefit as much from a program focused on reducing outdoor water use.

Appendix A:
Water and Sewer Rates Used for Assessment

HPW typically updates rates every April, though with the rate restructure an additional rate adjustment was made in September 2021. This appendix includes excerpts from the HPW published rate documents to show the rates used throughout this study. Note that the analysis did not incorporate the Texas Commission on Environmental Quality fee per connection, only the monthly service charge and the volumetric charges.

2019: The rates effective as of April 2019

Water Rates

	5/8 or ¾" meters	1 inch meter	1.5 inch meter	2 or 3 inch meter
Basic charge, per meter size	$ 5.54	$ 6.86	$ 10.40	$12.24
The numbers below this line include both Base and Volume charges				
1,000 gallons	$5.69	$7.01	$10.55	$12.39
2,000 gallons	$12.97	$14.29	$17.83	$19.67
3,000 gallons	$13.41	$14.73	$18.26	$20.10
4,000 gallons	$25.36	$26.68	$30.21	$32.06
5,000 gallons	$30.39	$31.71	$35.25	$37.09
6,000 gallons	$35.43	$36.75	$40.28	$42.12
7,000 to 12,000 gallons	The total charge for 6,000 gallons + $5.47 per 1,000 gallons			
Over 12,000 gallons	The total charge for 12,000 gallons + $9.00 per 1,000 gallons			

Sewer Rates

	5/8 or ¾" meters	1 inch meter	1.5 inch meter	2 inch meter	3 inch meter
Basic charge, per meter size	$11.77	$12.37	$14.34	$14.93	$26.75
The numbers below this line include both Base and Volume charges					
1,000 gallons	$11.96	$12.56	$14.53	$15.12	$26.94
2,000 gallons	$12.35	$12.95	$14.92	$15.51	$27.33
3,000 gallons	$12.67	$13.27	$15.24	$15.83	$27.65
4,000 gallons	$29.04	$29.64	$31.61	$32.20	$44.02
5,000 gallons	$34.96	$35.56	$37.53	$38.12	$49.94
6,000 gallons	$43.57	$44.17	$46.14	$46.73	$58.55
Over 6,000 gallons	The total charge for 6,000 gallons + $8.61 per 1,000 gallons				

The rates used throughout the study for analysis of data in years 2021, 2022 and projecting forward to 2025 are based on the information in the following tables. 2021 rates are effective as of September 2021, 2022 rates are effective as of April 2022, and 2025 rates are effective as of April 2025.

Table 1 - Water Monthly Service Charges and Future Adjustments

Meter Size	FYE 2022		FYE 2023	FYE 2024	FYE 2025	FYE 2026
Month of Increase	*Sept. 2021*	*April 2022*	*April 2023*	*April 2024*	*April 2025*	*April 2026*
	Charges	*Future Adjustments*				
5/8-inch	$6.25	+$0.32	+$0.19	+$0.17	+$0.14	+$0.03
3/4-inch	6.25	+0.32	+0.19	+0.17	+0.14	+0.03
1-inch	8.80	+0.40	+0.32	+0.28	+0.25	+0.05
1 1/2-inch	12.43	+0.52	+0.50	+0.45	+0.42	+0.06
2-inch	14.61	+0.59	+0.60	+0.56	+0.52	+0.07
3-inch	32.76	+1.20	+1.49	+1.40	+1.34	+0.17
4-inch	63.27	+2.21	+2.99	+2.81	+2.72	+0.32
6-inch	147.88	+5.02	+7.14	+6.72	+6.56	+0.75
8-inch	184.20	+6.21	+8.93	+8.41	+8.19	+0.95
10-inch	244.84	+8.23	+11.90	+11.22	+10.94	+1.26
12-inch	341.44	+11.43	+16.64	+15.69	+15.31	+1.76
TCEQ Fee per connection	0.21	+0.00	+0.00	+0.00	+0.00	+0.00

Table 3 - Single Family Residential Water Volume Rates and Future Adjustments

Rate Block	FYE 2022		FYE 2023	FYE 2024	FYE 2025	FYE 2026
Month of Increase	*Sept. 2021*	*April 2022*	*April 2023*	*April 2024*	*April 2025*	*April 2026*
	Rates	*Future Adjustments*				
Customers with usage up to 3,000 gallons per month:						
First 1 kgal	$1.00	+$0.20	+$0.10	+$0.20	+$0.15	+$0.10
Next 1 kgal						
Next 1 kgal						
** Single family residential customers who use 3,000 gallons or less per month receive a conservation credit.*						
Customers with Usage over 3,000 gallons per month:						
First 1 kgal	$5.50	+$0.60	+$0.40	+$0.50	+$0.50	+$0.50
Next 1 kgal						
Next 1 kgal						
Next 1 kgal						
Next 1 kgal						
Next 1 kgal						
Next 6 kgal	8.00	+0.65	+0.45	+0.65	+0.55	+0.70
Next 8 kgal	11.00	+0.65	+0.35	+0.80	+0.50	+0.70
Over 20 kgal	15.00	+0.65	+0.35	+0.65	+0.35	+0.50

Table 7 - Wastewater Monthly Service Charges and Future Adjustments						
Meter Size	**FYE 2022**		**FYE 2023**	**FYE 2024**	**FYE 2025**	**FYE 2026**
Month of Increase	*Sept. 2021*	*April 2022*	*April 2023*	*April 2024*	*April 2025*	*April 2026*
	Charges	*Future Adjustments*				
5/8-inch	$10.00	+$1.50	+$1.00	+$1.10	+$0.60	+$0.60
3/4-inch	10.00	+1.50	+1.00	+1.10	+0.60	+0.60
1-inch	12.45	+1.79	+2.15	+1.61	+0.96	+1.08
1 1/2-inch	15.93	+2.23	+3.78	+2.25	+1.57	+1.49
2-inch	18.03	+2.47	+4.76	+2.62	+1.96	+1.70
3-inch	35.46	+4.60	+12.60	+5.92	+4.63	+4.03
4-inch	64.76	+8.16	+25.37	+11.87	+9.09	+7.97
6-inch	146.02	+18.05	+60.80	+28.36	+21.47	+18.89
8-inch	180.90	+22.29	+76.01	+35.43	+26.79	+23.58
10-inch	239.14	+29.38	+101.40	+47.26	+35.66	+31.40
12-inch	331.92	+40.65	+141.85	+66.09	+49.79	+43.87
16-inch	805.89	+98.31	+348.49	+162.30	+122.00	+107.56

Table 9 - Single Family Residential Wastewater Volume Rates and Future Adjustments						
Rate Block	**FYE 2022**		**FYE 2023**	**FYE 2024**	**FYE 2025**	**FYE 2026**
Month of Increase	*Sept. 2021*	*April 2022*	*April 2023*	*April 2024*	*April 2025*	*April 2026*
	Rates	*Future Adjustments*				
First 1 kgal	$4.00	+$0.50	+$0.30	+$1.00	+$0.75	+$0.40
Next 1 kgal						
Next 1 kgal						
Next 1 kgal	10.50	+0.75	+0.25	+0.75	+0.30	+0.70
Next 1 kgal						
Over 5 kgal						

Appendix B:
Additional Data and Analysis Information

Billing data from 2019, 2020, 2021, and a subset of 2022 was used for this analysis. Data cleaning was required to remove incomplete andanomalous data. The following steps were taken to transform the raw billing data into the data used for the analysis:

- Kept only single-family residential accounts.
- Removed duplicates.
- Removed entries with negative water consumption value in any month.
- Removed entries with more than one zero consumption value in any month within a single year.
- Removed outliers to reduce outlier influence on analysis: the highest 99th percentile of water use across any given month used in the analysis was around 30,000 gallons. After ground-truthing with staff, a cutoff of 40,000 gallons per month was selected. Any entries with a greater value were removed.
- Removed bills without a census tract assignment or sufficient census data.
- Combined customer entries for household with a main meter and an irrigation-only meter
- When possible, combined customer entries for households where a meter replacement resulted in two different billing entries.
- Kept only households with both water and sewer service through the City of Houston.

The City of Houston is a growing community, and each year there are many new homes being built, lots of in- and out-migration in a given year, and tenants moving from one home to another. Some rental properties that regularly turnover were likely cleaned out of the data, as a result of the step that eliminated entries with no water use across more than one month. A proxy identify was assigned based on the account holder, not based on the property. If a home was renter-occupied, when the renter leaves, then the remainder of the year shows up as zero water use. For the new renter that moves in, the dataset shows zero water use in the previous year up to when they moved into the home. The City of Houston also attracts “snowbirds” which results in some households only having water use during the winter months and may show zero water use across the summer months.

Number of Households used in the Data Analysis			
2019	2020	2021	2022 (Jan – Aug only)
296,829	308,699	273,545	289,716

AN ASSESSMENT OF

Water Affordability & Conservation Potential

Houston TEXAS

May 2023

Alliance for Water Efficiency