Water Affordability

Lauren Patterson • December 2021

The Nicholas Institute for Environmental Policy Solutions' Water Policy Program has developed a water affordability dashboard that allows users to assess affordability across different water utilities using flexible, self-selected parameters.

WHY WATER AFFORDABILITY? WHY NOW?

Everyone needs water, but many Americans are struggling to pay the rising costs of water services. The COVID-19 pandemic is amplifying existing water affordability and equity challenges throughout the US. As widespread unemployment and shutdowns disrupted Americans' lives water affordability became an urgent public health issue and the focus of many national policy discussions.

> ***"The COVID-19 pandemic is amplifying existing water affordability and equity challenges throughout the US."***

In California, 1 in 8 households had water debt as of January 2021.[1] That's at least 1.6 million households across the state of California. Utilities generate the revenue they need to pay for operations, maintenance, and infrastructure from their customers—including households. When households cannot pay their bills, the utility experiences financial distress as well. In California, water systems are absorbing an estimated $1 billion of unpaid household bills.[2] This same story is playing out for water systems across the nation, highlighting the integral link between the financial health of a utility and the financial health of their customers (Figure 1).

1 Botts. 2021. `The most basic form of PPE`: 1.6 million households face water shutoffs.
2 Ibid.

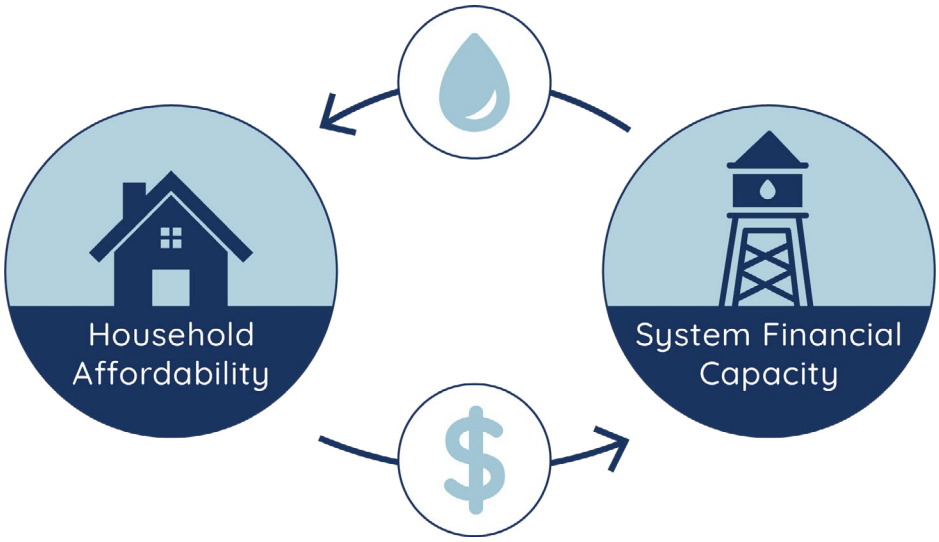

Figure 1: The majority of a utility's revenue to operate, maintain, and invest in infrastructure comes from their customers, including households. Therefore, the ability for a utility to generate sufficient revenue to cover costs is tied to the financial health of the community it serves.[3]

The pandemic is also highlighting the challenge of financing infrastructure that lasts 30 to 100 years for populations and businesses that are far more mobile. Cities in the Rust Belt have been wrestling with this challenge for the past several decades. The out-migration of water-intensive industries and their workforces has left many utilities with customer bases that are too small to cover the costs of operating water systems that were built for much greater demand.[4] Here it is important to distinguish between the financial capacity of a system and household affordability. Financial capacity refers to the ability of a system to generate the revenue needed to cover costs. This revenue often comes from the system's customers (e.g. industrial, government, commercial, and residential). The rest of this blog will focus on household affordability.

WHY A WATER AFFORDABILITY DASHBOARD?

The definition of water affordability is values-based and hard to quantify

Household affordability is the ability for a household to pay for the **basic water services** needed for drinking, cooking, cleaning, and sanitation without **undue hardship.** The subjective terms used in this definition (shown in bold) make it difficult to determine when water is unaffordable.

3 Figure from Aspen Roundtable Briefing Document (not for distribution).
4 Doyle, M.W. *et al. 2020.* Growing options for shrinking cities. *JAWWA 112 (12): 56-66.*

1. **Basic water services** refer to the amount of water needed to meet the basic needs of a household. Quantifying this term is challenging because even if someone decides that 50 gallons per person per day is enough to live on, the translation of that amount to a household is dependent on how many people live in the household. A single person would use ~1,500 gallons in a month while a four-person household would use 6,000 gallons a month (Figure 2). There are additional complications such as medical needs that require the use of additional water and inequity in the age and efficiency of household fixtures and appliances. For example, households with lower incomes are more likely to have older or leaking fixtures that use more water than a household that could afford to fix leaks or install water-efficient toilets. Lower income households are also more likely to rent rather than own their homes. Since landlords do not typically pay water bills, there is little incentive for them to install new water-efficient fixtures and appliances. If a utility has to make decisions about a single rate structure they will apply to the entire community, how much water is set aside for basic services?

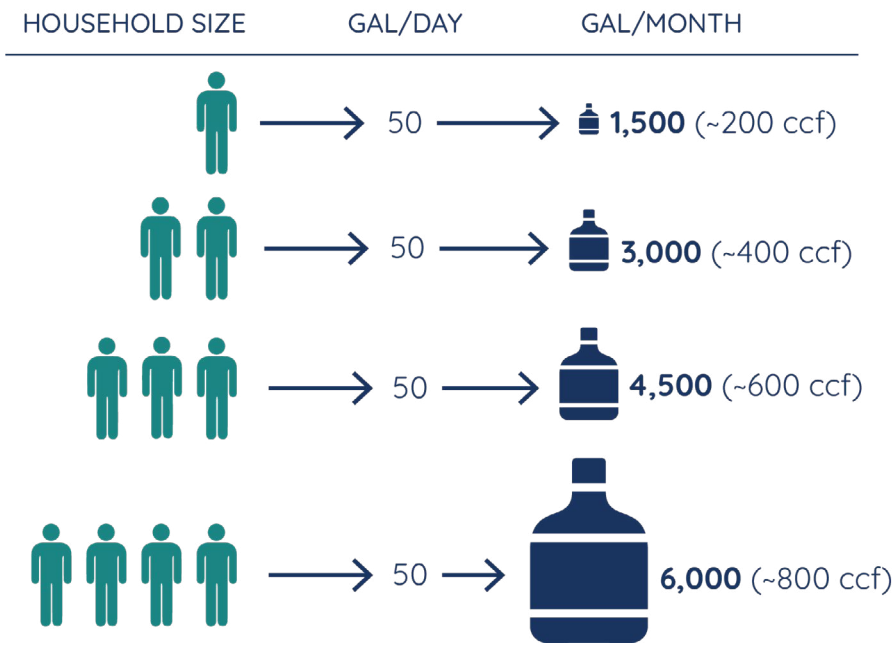

Figure 2: The volume of water a household would use depending on how many gallons are used per person per day and how many persons live in a household.

2. **Undue hardship** refers to the point when costs become unaffordable. This is a values-based judgment – when do services become unaffordable for a household? Hardship is often described in terms of the percentage of income or days of labor required to pay for basic water services. For example, is it acceptable for a household to spend 1 day of labor each month to pay for basic water services?

3. **Which household** is something utilities wrestle with when setting rates. Many local or state regulations require a utility to set the same rates for all customers in a class (e.g. residential customers) to be fair. Historically, the Environmental Protection Agency used the median household income (50th percentile) as a proxy because it was an easy metric to estimate in the 1990s. In other words, how much of the median household's income is spent on water services using the average utility bill. In recent years, other slices of the community, specifically minimum wage earners and low-income (20th percentile) households, have been proposed as a better representative for affordability. For each of these slices of the community, the percent of income going to pay for the exact same water bill will vary dramatically. For example, the minimum wage earner might spend 10% of their income, the low-income household might spend 6% of their income, and the median household might spend 2% of their income to pay for the same water bill. The cost of water might be fair but the financial impact on households is not equitable.

DATA ARE AVAILABLE FOR SOME STATES AND UTILITIES

There are three types of data required to calculate household affordability (Figure 3):

- **Census data** – These data provide information about who lives in a given area, specifically the number of households in each income bracket. This data is open and freely available from the U.S. Census Bureau.
- **Rates data** – These data are used to calculate estimated water bills based on the volume of water used. There was no single rates database to draw from, so the Water Policy Program team began to build this database by searching for rates on the water utilities' websites.
- **Service area boundaries** – These data demarcate the physical boundaries of a utility's service area. They are used to intersect the rates for a utility with the incomes of the people living in the service area boundaries. The Water Policy Program team found statewide service area boundaries available for drinking water utilities for 10 states.

Together these three types of data answer the question: **how affordable are water services given the costs and the demographic makeup of the community that lives in my utility's service area.**

Several water affordability metrics have been developed that calculate the amount of time a household needs to work to pay for water services each month. Essentially, for the same water bill, what is the burden experienced by different members of the community?

- **Traditional** – what percent of income is spent by the median income household to pay for water services?
- **Household Burden** – what percent of income is spent by low-income households to pay for water services, where low-income refers to the 20th quintile?
- **Minimum Wage** – how many hours must a minimum wage earner work to pay for water services?

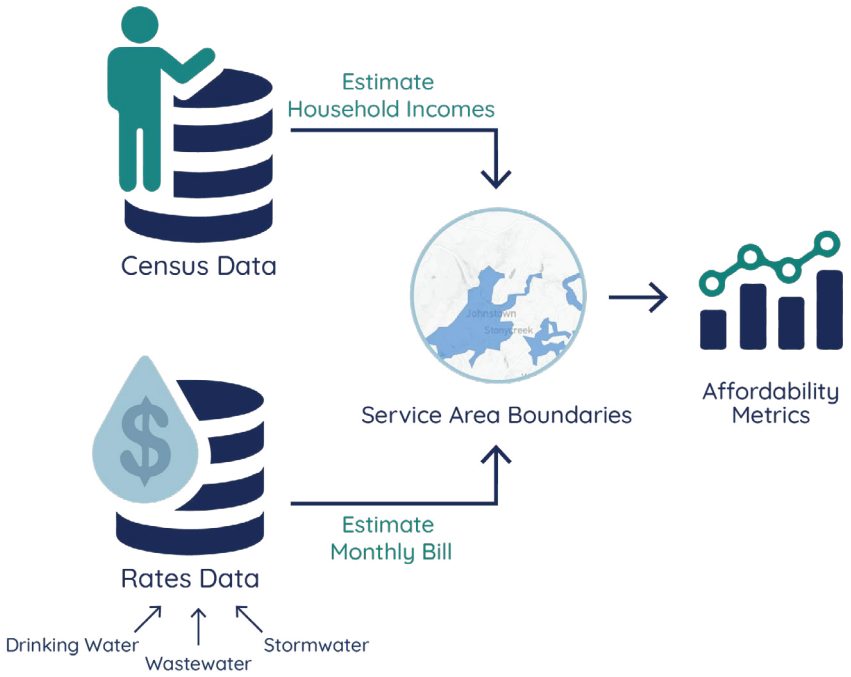

Figure 3: The data needed to calculate affordability metrics in an open, repeatable way.

In a month, a day of labor is equivalent to 4.6% of the income earned that month, which allows these three slices of the community to be explored together using days of labor. In fact, if you have the right data, many affordability metrics could be calculated and viewed together in an automated, repeatable fashion.

The Nicholas Institute's Water Policy Program developed a new metric that looks at how many households within the community spend a similar amount of their income on water services. This metric is called the **Income Dedicated to Water Services** metric (Figure 4). Essentially, it takes the costs of water in a year and back calculates the amount of income a household would need for those costs to account for 1%, 2%, 3%, etc. of the household's income. Then, using the census data, you can estimate the percent of households that earn less than that income. The result is that rather than saying low-income households spend 4% of their income on water services, you can say that 20% of households are spending more than 4% of their income on water services. This metric accounts for not only the hardship (percent income) but also the prevalence of hardship (percent of households).

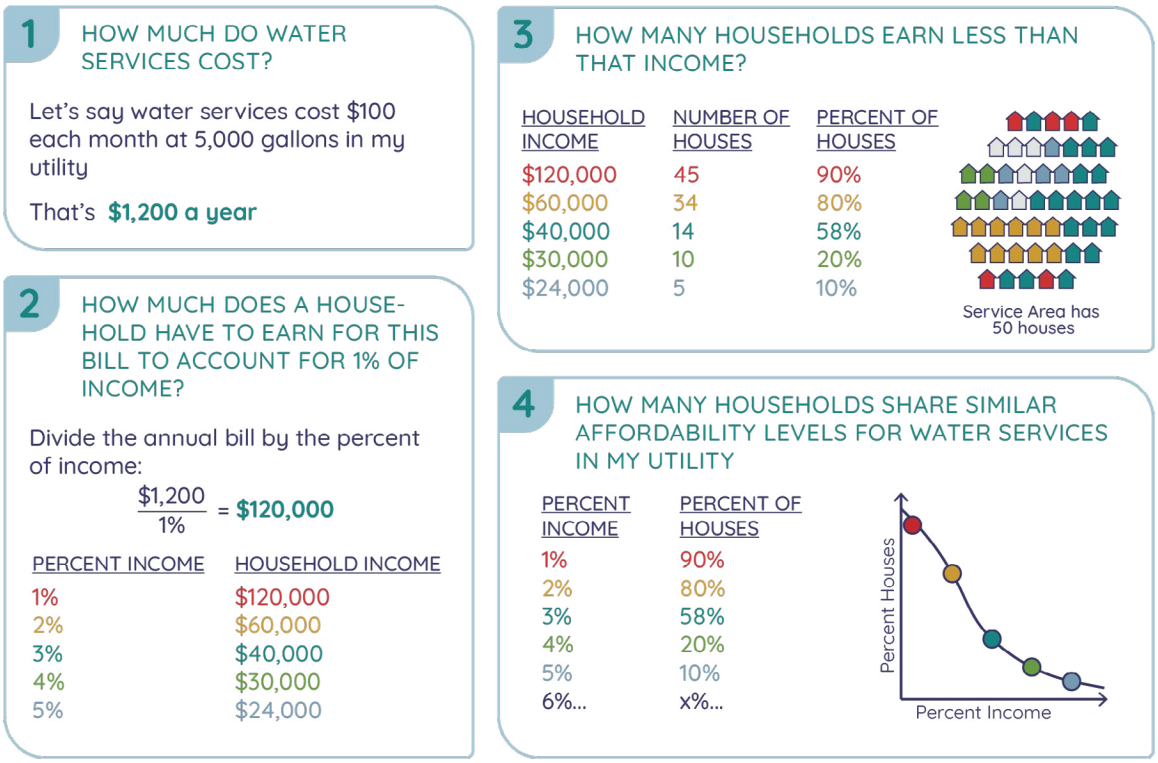

Figure 4: Calculating the Income Dedicated to Water Services metric.

DESIGNING THE DASHBOARD

The Water Policy Program team designed the dashboard to maximize flexibility when exploring affordability. The dashboard does this in three ways. First, the user can select the volume of water that best matches what they decide accounts for basic needs (between 0 and 16,000 gallons a month). Second, the dashboard provides information about (a) who lives in the utility, (b) the costs of service, (c) multiple affordability metrics for all utilities in the database, and (d) how affordability changes with water usage. This approach provides more transparency and allows users to compare their utility with others nearby. Remember, the utility could charge the exact same amount for water but have very different affordability metrics depending on the community being served. Third, the dashboard shows the full spectrum of affordability results and provides markers showing how many days of labor are needed to pay for services. This allows the user to determine when an undue hardship is reached.

The Water Policy Program team went through several iterations of dashboard designs and engaged in focused discussions with a variety of audiences. The team found that different audiences prioritized different components of the dashboard. Utilities enjoyed the "who lives in my utility" tab with clear graphics showing

information about who lives in the utility in terms of numbers, income, age, race, ethnicity, and unemployment. Policy centers prioritized the detailed block group information and were interested in the diversity (or lack of diversity) of incomes within water service boundaries. Academics and consultants enjoyed the diversity of metrics provided and detailed rates data.

KEY FINDINGS

As of this blog post, the Water Policy Program has assessed the affordability of 2,349 utilities across 7 states. Here, the results are shown using 4,000 gallons of water a month.

WIDESPREAD POVERTY IS A KEY DRIVER OF AFFORDABILITY

The Water Policy Program's assessment includes a metric that does not look at household affordability but assesses the financial health of the community being serviced. This metric is the Poverty Prevalence Indicator, which is the percent of the community living below 200% of the Federal Poverty Level. The team found that the median utility serves a community where 30% of households are below 200% of the Federal Poverty Level (Figure 5). Remember that the financial health of the utility (and its capacity to help its customers afford their bills) is tied to the financial health of the community.

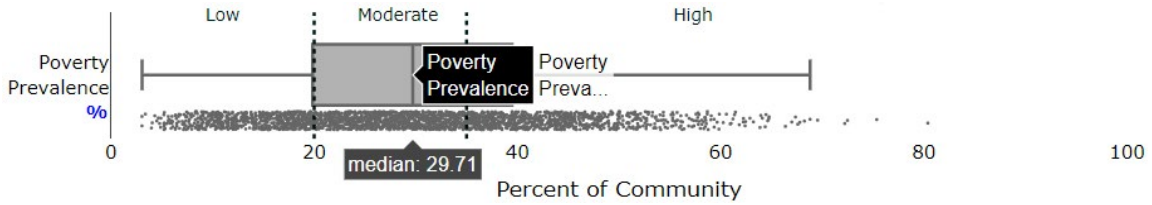

Figure 5: The percent of the community that is below 200% of the Federal Poverty Level.

DIFFERENT SLICES OF THE COMMUNITY HAVE DIFFERENT BURDEN LEVELS

Not surprisingly, the assessment showed that affordability metrics for different slices of the community showed different burden levels (Figure 6). Minimum wage earners were the most sensitive to water rates and affordability challenges. In the median utility, minimum wage earners spent 1-2 days of labor each month to pay for water services. In contrast, low-income earners tended to spend between half a day and a little over a day each month and median income earners usually spent less than a half-day of labor to pay for services.

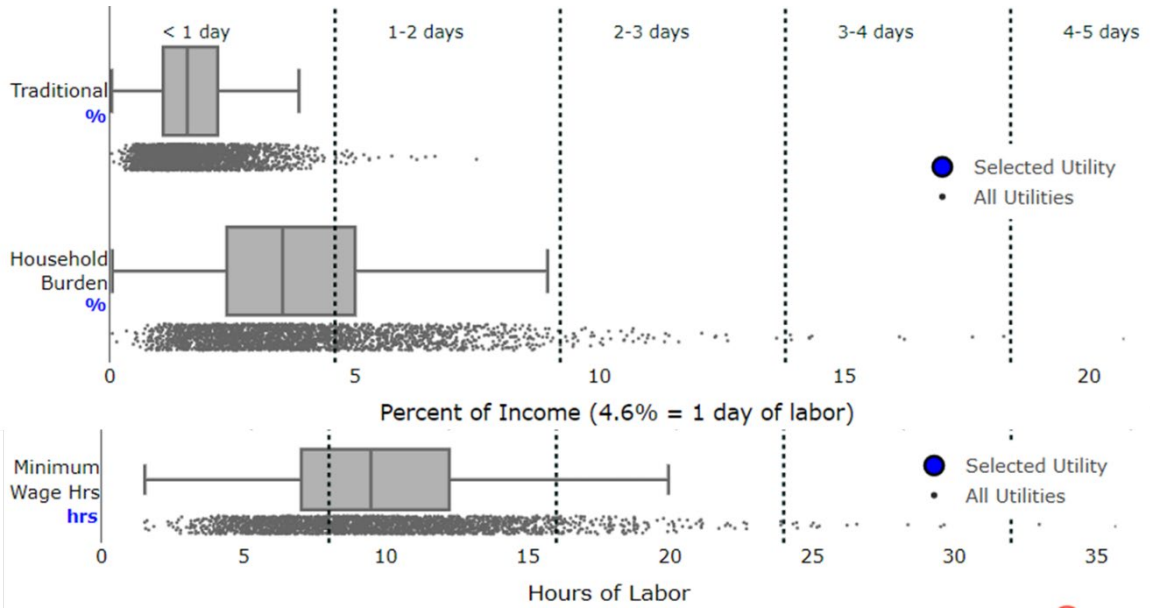

Figure 6: Comparing the burden level for different slices of the community at 4,000 gallons of water.

The Income Dedicated to Water Services metric indicated that 12% of households in the median utility spent 5% of their income (slightly more than a day of labor) paying for water services each month (Figure 7). The difference between states ranged from 7% in New Jersey to 16% in North Carolina. New Jersey had the highest median annual income of these states in 2019 ($87,726) while North Carolina ($61,159) and New Mexico ($53,113) had much lower median incomes. The median cost of water services in North Carolina ($81) was $17 higher than New Mexico ($64) at 4,000 gallons a month; highlighting that it is not just the cost of water but the financial health of the community that determines affordability.

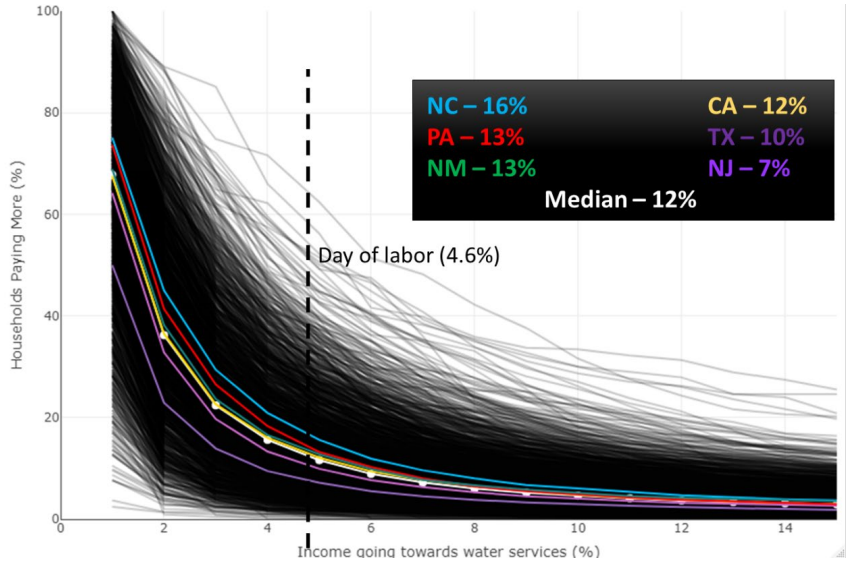

Figure 7: Income Dedicated to Water Services by state. Each gray line represents an individual utility. The dashed vertical line represents a day of labor (~4.6% of monthly income).

HOW WILL THE WATER AFFORDABILITY DASHBOARD BE SUPPORTED BY AN INTERNET OF WATER?

Service area boundaries, rates, and population all change over time. The dashboard captures a snapshot of who was living in service areas of the included utilities and the costs of water services between 2019 and 2021. The Internet of Water project is developing tools that can help expand and update the data in the dashboard.

A BOundary Update Tool for Utility Services (ABOUT-US) will provide an open-source online tool for utilities to create and update their service areas using a similar interface to Google Maps. Utilities who use the tool will not need any additional software to create or update digital service area boundaries. If states provide ABOUT-US to their utilities as a service, they can establish version control and create a process for quality control of boundaries.

The Internet of Water is also developing a rates survey to make it easier to standardize and update rates data. The rates survey data can be integrated into the dashboard. Additionally, the rates data will be linked to water utility information in Geoconnex. This will make it easy for users to enter a volume of water for a utility and see the estimated monthly bill for water services.

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