Assessing the Affordability of Water and Sewer Utility Costs in New Jersey

Phase 2 Report:
Conceptual Issues for a New Jersey
Affordability Assessment Methodology

A Project of New Jersey Future for Jersey Water Works

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Purpose of The Report

This report builds upon an earlier report (Van Abs and Evans, 2018, Assessing the Affordability of Water and Sewer Utility Costs in New Jersey: Phase 1 Report: Methodology Review and Preliminary Assessment), which was developed on behalf of Jersey Water Works by Rutgers University and New Jersey Future researchers. This Phase 2 report uses the assessment methodologies reviewed in the Phase 1 report to suggest:

- Criteria for effective assessments of the affordability of water utility services for households, and
- Recommendations for affordability assessment in New Jersey.

This report supports development by Jersey Water Works of a consensus assessment method and threshold(s) for household affordability,[1] as guidance for municipal, utility authority, utility and State efforts to understand and track household affordability issues and to improve affordability assistance at any appropriate level (e.g., utility, municipal or State). The Phase 1 report and this report provide the basis and background for a separate white paper that recommends a methodology and thresholds for use in estimating the number of households potentially burdened by water and sewer rates. The methodology will be considered by the Jersey Water Works Asset Management & Finance Committee and others, with the objective of developing a consensus. Phase 2 of the project will be complete when the methodology is used to provide a baseline assessment of household affordability in New Jersey. **Note: Thresholds within this draft are not recommendations, but examples.**

This issue is timely, as the New Jersey Legislature has recently indicated strong interest in the affordability issue. In the 2018-2019 session, legislation (S-276, companion bill A-3864) passed the New Jersey Senate and was considered by the New Jersey Assembly to permit "certain local units, authorities, and utilities to reduce water and sewerage rates for low-income persons."[2] The bill would authorize programs at the utility level, but would not establish a statewide program for affordability. Similar legislation may be considered in the current session.

Criteria for Effective Household Affordability Assessments

Household affordability is not a straightforward analytical or policy issue. As noted in the Phase 1 report:

> Affordability is a topic often discussed but lacking an adequately rigorous definition. Affordability addresses the question of whether a household can afford to pay for specific necessities (i.e., fixed costs that are not discretionary without substantial loss of quality of life), not whether it is willing to pay. Public policy addresses issues of household affordability regarding housing, energy, medical care, food, education and many other purposes, including

[1] This effort does not address affordability assessments relative to the ability of a utility to finance capital expenditures, operations, maintenance and major repairs. Utility-level assessments are used by state and federal agencies to determine compliance schedules for system upgrades and can be used to target utility finance subsidies such as grants, loan forgiveness and low-interest loans.

[2] The bill would authorize government-owned utilities to provide rate and fee reductions for owners or tenants of one or two-family dwellings for whom household income is below a percentage (set by the utility) of the federal poverty guidelines.

> the focus of this report on water and sewer utilities. … The problem is that affordability for any single cost category is inseparable from all other cost categories. Affordability in a correct sense involves a comparison of household income (including aid) to the costs of all necessary expenditures, including long-term costs such as retirement and unanticipated expenditures such as medical emergencies.

In the absence of a general program of affordability that includes water and sewer utilities rates as part of a comprehensive package, water and sewer affordability programs must necessarily make do with a piecemeal approach. The National Academy of Public Administration[3] in 2017 suggested that all water utility costs (drinking water, sewer, stormwater) should be considered together. In New Jersey a majority of residents are served by water utility systems under separate ownership, making coordinated assessment of rate affordability difficult, and coordinated implementation of affordability programs even more difficult.

Following the Phase 1 report, four major documents were released on this topic.

AWWA, NACWA and WEF (Raucher et al.)

The American Water Works Association, the National Association of Clean Water Agencies and the Water Environment Federation convened an expert panel in 2018 to draft criteria for establishing a revised affordability assessment framework, aimed at replacing the USEPA thresholds discussed in the Phase 1 report. The organizations endorsed to USEPA a consultant's report proposing a new approach to measuring household affordability and utility financial capacity, and how the approach could be used in regulatory programs.[4] The criteria for a customer (household) affordability framework are:

- Reflect all/combined water service costs
- Reflect the households that are most economically challenged
- Reflect local essential costs of living
- Be straightforward, transparent, and support consistent application.
- Use valid and defensible measures that rely upon readily available data from relevant verifiable sources.
- Be defensible in determining relative burdens.

Based on this set of criteria, the report recommends an alternative to USEPA's Residential Indicator:

1. The Household Burden Indicator (HBI), defined as basic water service costs[5] (combined) as a percent of the 20th percentile household income (i.e., the Lowest Quintile of Household Income (LQI) for the Service Area); plus

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[3] National Academy of Public Administration. 2017. Developing a New Framework for Community Affordability of Clean Water Services. Washington, DC. https://www.napawash.org/uploads/Academy_Studies/NAPA_EPA_FINAL_REPORT_110117.pdf

[4] Raucher, et al. 2019. Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector. Prepared for AWWA, NACWA, WEF. See also, Mastracchio et al., 2020, Affordability Assessments: Policy Recommendations for USEPA. Journal AWWA, June 2020, pp. 20-27.

[5] Basic water service costs reflect a level of service necessary for indoor household functions (i.e., non-discretionary). Raucher et al. (2019) suggest 50 gpcd (18,250 gallons per year per person) as a basic level of water demand. This demand level is also used by Teodoro (2018).

2. The Poverty Prevalence Indicator (PPI), defined as the percentage of community households at or below 200% of Federal Poverty Level (FPL).

In explanation of how the two indicators would be used, the report states (p. E-3):

> "It is recommended that a matrix approach be used to allow the results of both the HBI and PPI to be jointly interpreted. The rationale for the above paired metrics is several fold. The HBI measures the economic burden that relatively low-income households in that community face in paying their water services bills (including water, wastewater, and stormwater bills), and the PPI measures the degree to which poverty is prevalent in the community. Thus, in combination, the metrics indicate both a household-level burden and a community-based level of prevalence of the affordability challenge posed by water sector costs."

Later in the report, they note that the use of the FPL "does not reflect local or regional cost of living" and recommend consideration of an alternative to the 200% multiplier of FPL, or a third metric reflecting local cost of living (p. 3-14). Examples of a third metric include the MIT Living Wage index, the Low Income Housing Burden from the U.S. Census Bureau's American Community Survey, the United Way ALICE project, and the Teodoro Affordability Ratio.

The report provides the following table (p. E-6) showing potential benchmarks for the two indicators:

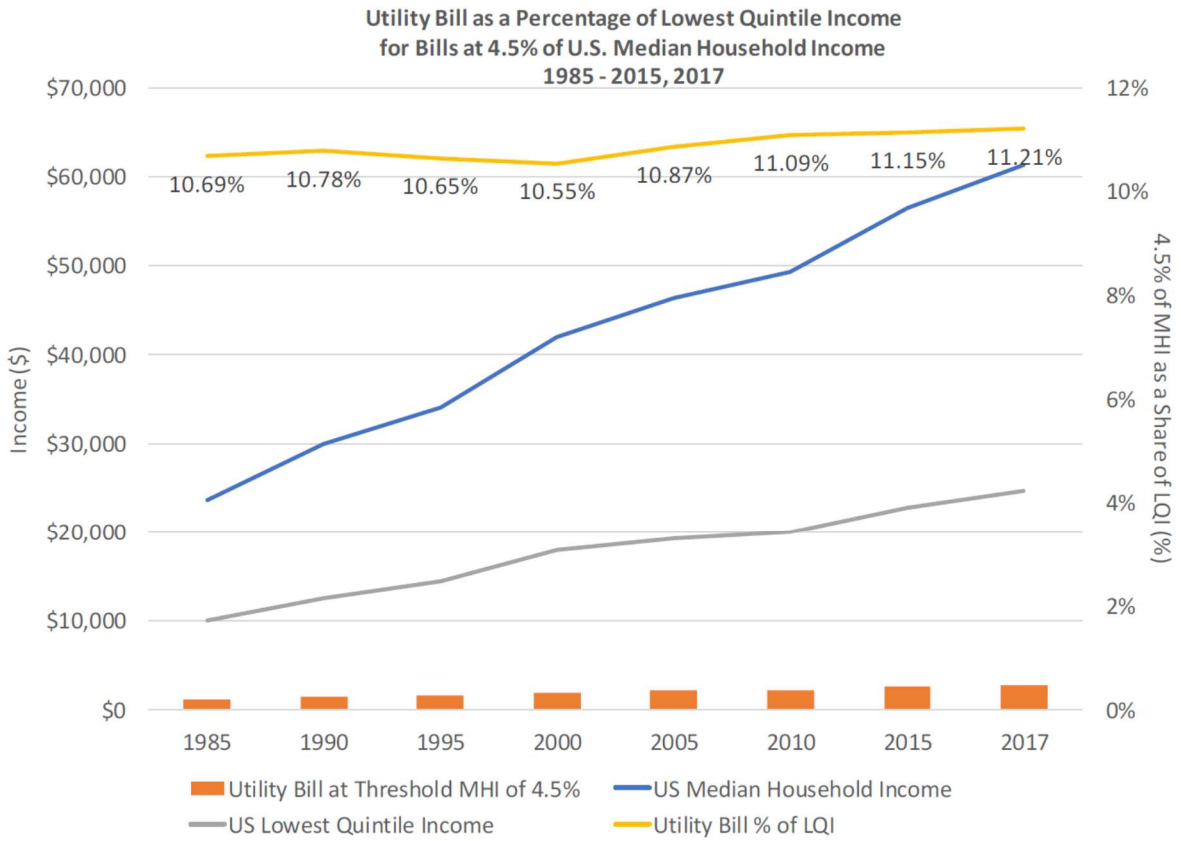
HBI - Water Costs as a Percent of Income at LQI	PPI - Percent of Households Below 200% of FPL		
	>=35%	20% to 35%	<20%
>=10%	Very High Burden	High Burden	Moderate-High Burden
7% to 10%	High Burden	Moderate-High Burden	Moderate-Low Burden
< 7%	Moderate-High Burden	Moderate-Low Burden	Low Burden

The thresholds for Percent of Income at LQI (lowest quintile income, or 20th percentile income) were derived from the USEPA's implied 4.5% threshold of MHI for water and sewer. A combined bill at 4.5% of national MHI is equivalent to 11% of national LQI, and 4% MHI is equivalent to 10% LQI (pp. 3-20,21). Figure 3-2 from the report (next page) shows the changes in MHI and LQI over time, and how a utility bill at 4.5% of MHI translates to a percentage of LQI.

Importantly, the report uses combined costs for all water utilities, rather than individual utilities, to provide a more comprehensive assessment. However, the authors recognize the additional complexity where households receive water, sewer and stormwater service from different entities.

The report also notes that the proposed indicators do not directly incorporate cost of living, as with the Teodoro (2018) Affordability Ratio method, due to difficulties in assessing cost of living, living wage or other similar measures at a level appropriate for specific utilities. They highly recommend consideration of such information as supplemental measures, where feasible, and specifically mention the Household Survival Budgets developed by the United Way ALICE project (Raucher, et al., p. 1-5).

Figure 3-2: Utility Bill as a Percentage of Lowest Quintile Income for Bills at 4.5% of U.S. Median Household Income 1985-2017, 2017[12]



Raucher, et al. 2019.

Commentary: Jersey Water Works intends to assess household affordability for all households, which is the focus of the proposed Household Burden Indicator. The Poverty Prevalence Indicator is more indicative of a community's ability to support a Customer Assistance Program or other affordability program – the higher the PPI value, the less likely that the community (or utility) will be able to support all of its stressed households. These are two separate issues that provide independent information, each valuable in its own way.

The use of ranges has value for determining the extent of household stress. Use of a single threshold doesn't differentiate between households that are just barely over the threshold and those that are far over the threshold. The thresholds themselves are based on comparison to 4% of MHI (the USEPA guidance), but they can be modified, such as to incorporate cost of living measures. As a point of comparison, the United Nations has stated that "The costs for water and sanitation services should not exceed 5% of a household's income, meaning services must not affect peoples' capacity to acquire other essential goods and services, including food, housing, health services and education."[6] This threshold is

[6] UN-Water Decade Programme on Advocacy and Communication and Water Supply and Sanitation Collaborative Council. n.d. The Human Right to Water and Sanitation: Media Brief. https://www.un.org/waterforlifedecade/pdf/human_right_to_water_and_sanitation_media_brief.pdf

different from most used in the United States, as it applies to all households regardless of income, not at a specific household income such as the median or 20th percentile.

California Water Resources Control Board

California adopted the Human Right to Water Act (Assembly Bill 685) in 2012, declaring that access to clean, safe, affordable and accessible water for human consumption and sanitary purposes was a human right. In 2019, the California Environmental Protection Agency (in support of the California Water Resources Control Board) released a draft framework[7] including an affordability objective: "Water to meet household needs should be affordable, taking into consideration the amount of the household water bill, after accounting for other demands on income, and the direct and indirect costs associated with obtaining access to the water." Three indicators would be used in combination: (CAEPA, p. 4,5).

- Affordability ratio at median household income
- Affordability ratio at county poverty income threshold
- Affordability ratio at deep poverty income threshold (50% of county poverty income threshold)

The affordability ratio is based on the water and sewer utility costs of an assumed household water demand of 150 gallons per day (50 gallons per person per day) (CAEPA, p. 25). The draft framework recognizes the limitations of thresholds based on total household income, saying: "Ideally, the figure used for household income should represent total household income minus other essential expenditures (such as housing and food), so that basic expenditures are not in conflict with one another. Indeed, improved affordability ratios specify the water cost for a particular volume of water, and aim to measure disposable income minus other essential expenditures." (CAEPA, p. 24). The California framework is intended to support statewide assessments of water quality, water access and water affordability, and is not directly associated with an affordability program.

The California Water Resources Control Board released a white paper in 2019, suggesting legislative approval of a statewide ratepayer assistance program, to address statutory limitations on the ability of government-owned utilities to provide assistance to low-income households, and the fact that numerous utilities have high percentages of customers with household incomes less than 200% of the federal poverty levels (a threshold specified in law).[8] They estimate that 34% of Californians, roughly 13 million people, live in households that are below that income threshold (5.8 million households); the percentage is roughly equivalent to the national average of 35% (p.8). The Board proposed graduated benefit levels, reflecting in part the average California water bill of $60 per month per household:

- **Tier 1**: 20% discount to all households that have incomes below 200% of the federal poverty level (FPL) in water systems where monthly water expenditures (at 12 CCF) are below $90,
- **Tier 2**: 35% discount to all households that have incomes below 200% of the FPL in water systems where monthly water expenditures (at 12 CCF) are between $90 and $120, and

[7] California Environmental Protection Agency (CAEPA). 2019. A Framework and Tool for Evaluating California's Progress in Achieving the Human Right to Water – January 2019 Draft. Office of Environmental Health Hazard Assessment. https://oehha.ca.gov/media/downloads/water/report/hr2wframeworkpublicreviewdraft010319.pdf

[8] California State Water Resources Control Board. 2019. Options for Implementation of a Statewide Low-Income Water Rate Assistance Program. https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/assistance/docs/2019/draft_report_ab401.pdf

- **Tier 3**: 50% discount to all households that have incomes below 200% of the FPL in water systems where monthly water costs (at 12 CCF) are above $120.

Commentary: The California Environmental Protection Agency focused on the assessment of affordability, while the California Water Resources Control Board approach is directly focused on customer assistance linked to specified discounts, not affordability analysis. As with Raucher et al. (2019), both reports recommend use of multiple thresholds. Note that California's statutory threshold of 200% of Federal Poverty Level is the same as recommended by Raucher et al.

California Public Utilities Commission

Staff of the California PUC released a report[9] addressing affordability metrics across all utilities regulated by the PUC – water and sewer (water), electricity and natural gas (power) and telecommunications.[10] The report proposes definitions and quantifications of "essential services" for these utilities, and a framework for assessing affordability. They define affordability as "the degree to which a household can regularly pay for essential service of each public utility type on a full and timely basis without substantial hardship." They propose three metrics of affordability: Hours at Minimum Wage (HM); Affordability Ratio (AR); and a composite socioeconomic vulnerability index (SEVI), The report does not recommend thresholds for affordability. Their focus is on methods to understand the relative affordability of utility costs and how the affordability would change given rate change requests.

The first two metrics are from Teodoro (2018), with the AR approach modified for California using the Census Bureau's Public Use Microdata Samples (PUMS) dataset from the American Community Survey.[11] Rather than using the Teodoro definition of discretionary household income, they use a simpler approach of household income minus housing costs.

SEVI is "a composite of five socioeconomic indicators: educational attainment, housing burden, linguistic isolation, poverty, and unemployment."[12] It is focused on socioeconomic vulnerability of the communities, averaging the percentiles of the five indicators, on a scale from 0 (least vulnerable) to 100 (most vulnerable). SEVI was developed to be independent of utility costs, but it is strongly correlated with ability to pay.

For water, "essential services" is defined as 600 cubic feet (4488.31169 gallons) per month per household for indoor demands (53,860 gallons per year). This demand level is also proposed for use by other California agencies as an essential service use.

Commentary: As with the Poverty Prevalence Indicator from Raucher, et al. (2019), the California PUC report's Ability to Pay Index is more indicative of a community's ability to support a Customer Assistance Program or other affordability program – the higher the API value, the less likely that the community (or utility) will be able to support all stressed households. Again, these are two separate issues that provide independent information, each valuable in its own way. As the California PUC staff are measuring

[9] Hancock, et al. 2020. Staff Proposal on Essential Service and Affordability Metrics, R.18-07-006. California Public Utilities Commission.
[10] The CA PUC staff report is used as the basis for a proposed Rulemaking 18-07-006, filed 4 June 2020. As of the time of this writing, the rulemaking is not adopted.
[11] Each Public Use Microdata Area (PUMA) has a population of at least 100,000 and is composed of groups of census tracts. On that basis, New Jersey should have many PUMA, though far fewer than California's 265.
[12] Hancock, et al., p. 32.

changes in affordability, they propose no thresholds, making this approach less directly useful for New Jersey.

Metropolitan Planning Council (Northeast Illinois)

The MPC, which serves the Chicago metropolitan area, evaluated affordability issues within the region. The results included a final report, a literature review, and a national evaluation of water affordability programs and policies.[13]

On average, residential drinking water rates grew 5.94% per year from 2008 to 2018, at constant dollars, with considerable variation within the community. In nominal dollars, water bills increased by 4% per year in the same period. Many communities in the region experienced water rate increases that exceed increases in household incomes. MPC developed a dashboard tool to show the results, which is available at: http://metroplanning.org/WaterAffordability. MPC defined water affordability using three methods, for water and sewer rates combined.

1. **4.5% of Lowest Quintile Household Income (LQI):** This approach using the USEPA thresholds, combined, but compared to the 20th percentile household income instead of median household income. Using this threshold and a household water demand of 5,000 gallons per month, a third of all census tracts in the region had average water and sewer bills that exceeded the LQI. The results are shown below in Figure 4 from the report.
2. **Hours of Work Needed to Pay the Water Bill:** This approach is adapted from Teodoro (2018). However, the region has considerable variations in the minimum wage, and so the MPC "converted representative water bills into hours worked by converting mean annual income for the lowest quintile into hourly income." The result on average was 6.6 hours.
3. **Cost Burden versus Income:** This approach evaluated combined water and sewer bills as a percent of household income, relative to the percent of households earning below 80% of the area median income. The results provide a geographic sense of an affordability gradient, in five graduated levels from low burden to high burden, as shown below in Figure 8 from the report. The purpose is to show "the distribution of water affordability challenges across the region."

Figure 8. Water Affordability Matrix

			Percent of households in area earning below 80% AMI		
			>=50%	25-49%	<25%
			High	Medium	Low
Percent household income for lowest quintile	Greater than 4.5%	High	High	Medium-High	Medium-High
	2.25-4.5%	Medium	Medium-High	Medium	Medium-Low
	Less than 2.25%	Low	Medium-High	Medium-Low	Low

[13] Metropolitan Planning Council. 2019. Water Affordability in Northeastern Illinois: Addressing Water Equity in a Time of Rising Costs. Available from: https://www.metroplanning.org/uploads/cms/documents/mpc_water_affordability_report_web.pdf. Schneemann, Margaret. 2019. Defining & Measuring Water Affordability: A Literature Review. University of Illinois Extension. Available from: https://iiseagrant.org/wp-content/uploads/2019/08/DMWA_FINAL.pdf. Schneemann, Margaret, and Louis Tello. 2019. Water Affordability Programs & Policies: A National Review. University of Illinois Extension. Available from: https://iiseagrant.org/wp-content/uploads/2019/08/WAPP_FINAL.pdf

Figure 4. A Widespread Issue: Municipalities with at Least One High Water Burden Tract for Lowest Income Earners

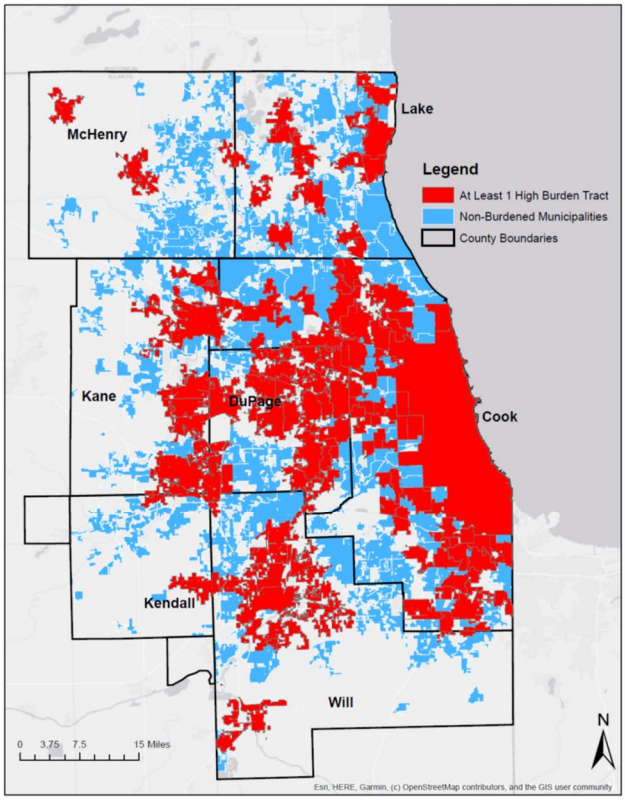
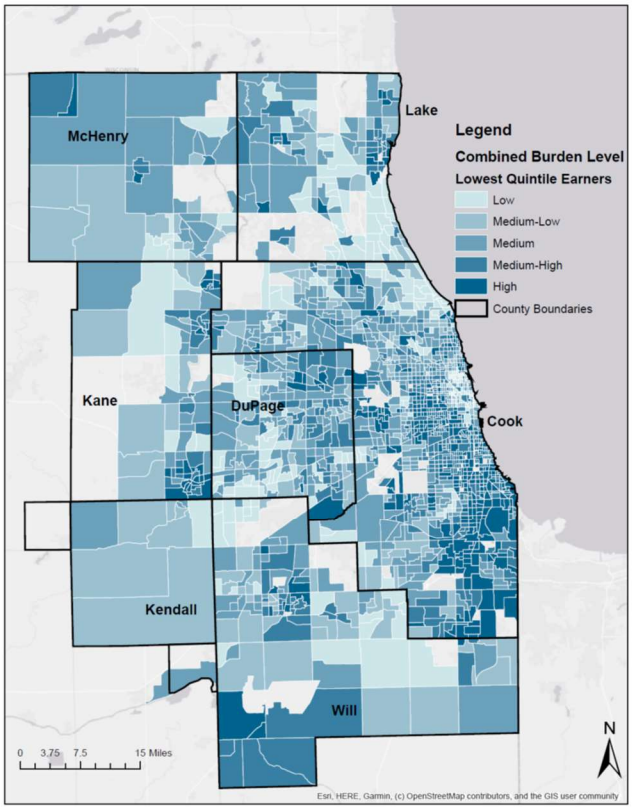


Figure 9. An Issue Across the Region: Map of Water Burden Levels by Census Tract



Metropolitan Planning Council (2019).

The MPC also evaluated affordability relative to race. A municipal dashboard tool provides this information in an accessible format.

Finally, the report provides strategies to equitably address water affordability issues:

- Reduce utility net costs through asset management, subsidies such as State Revolving Funds, partnerships, and regionalized management.
- Promote water conservation, including both utility and customer approaches
- Design and implement equitable rates, including lifeline rates and adjustments to fixed charges
- Strengthen customer assistance programs
- Target the hard to reach

Commentary: The MPC evaluation of LQI to the USEPA threshold of 4.5% is similar to analyses provided in the Phase 1 report. The hours worked approach is a modification of Teodoro's method. The final method is more relevant to understand the extent to which affordability concerns may exceed the ability of an individual utility or municipal to address the issue without outside assistance.

Proposed New Jersey Criteria

New Jersey needs to know the answers to two major questions regarding household affordability assessments. Ideally, the affordability assessment method would address both needs, with the first being addressed through a general assessment and the second being addressed through a household-specific assessment.

1. What is the geographic distribution and approximate number of households potentially facing affordability issues from water and sewer costs in the absence of ratepayer assistance programs?
2. What specific households would be eligible for assistance and to what level?

A critical part of any methodology development is identification of the most important criteria that the method should address. The following six criteria are proposed as important for a New Jersey method.

1. Focus on **households with legitimate affordability issues.** This criterion comes with a caveat that there are factors that make a comprehensive estimate infeasible, including:
    - *Costs of living vary among sub-state geographic areas*. At the same income level and family size, the costs of housing and transportation vary considerably among the counties and municipalities of New Jersey. Therefore, equal utility costs will have different financial impacts on households depending on the local costs of living.
    - *Household size and composition affects affordability relative to a specific income*. Increased household size translates to increased costs, and children will have different household costs than adults.
    - *Financial flexibility increases as household income increases*. Given a specific household size and composition, and the same area costs of living, increased household income reduces the financial stress of utility rates relative to other costs; more choices are available for balancing costs. For example, a household at the state poverty level is more stressed by utility costs equivalent to 3 percent of their income than a household at twice the poverty level with utility costs at the same 3 percent level.
    - *Many households (especially most renters and some in non-rental multi-family units) do not directly pay water and sewer costs*. With the addition of an intermediary that pays the direct utility costs (e.g., landlord, housing agency), along with rent regulation and subsidization of various sorts that applies to some low-income housing, it is difficult to determine what portion of the utility costs are passed to the households through rent, what portion is effectively paid by a rental assistance program, and what portion is absorbed by the building owner as reduced profit or investment.
    - *Financial assistance programs not associated with water and sewer utilities (e.g., energy, housing, transportation, Earned Income Credit Program) can directly or indirectly reduce household financial stress*. Financial programs can greatly affect net household income, and in some cases (e.g., Section 8 housing certificates) that assistance will pay utility costs, including energy, water and sewer. However, these programs are not uniformly available across jurisdictions or for specific household income levels. Appropriations are often insufficient to address total needs, leading to the use of lotteries or waiting lists to determine who receives assistance. Therefore, similar

households can have significantly different exposures to water and sewer costs. Tracking these different effects is very difficult.

2. **Useable at the utility and larger (e.g., statewide) levels**, with the ability to compare results and understand how rate design, utility costs, income, costs of living and other relevant factors interrelate across jurisdictions.
3. **Sufficient data are available** for deriving the affordability assessments at relatively low cost. Critical data needs would include the utility rate structure, household water demand (or proxy), household income (e.g., neighborhood level[14] income distributions), and the impacts of other assistance programs (or proxy). Additional information needs would include cost of living, poverty thresholds or other similar metrics, depending on the assessment method selected. Implementation of affordability assistance programs would require income information for the specific households, provided by program applicants.
4. **Affordability benchmarks can be developed** using the method. The purpose of benchmarks is to provide a clear sense of "what is", which will help the public, decision-makers and program providers understand the relative impact of utility rates on affordability, in comparison to other utilities, based on current conditions.
5. **Affordability can be tracked over time** using the method. The purpose of tracking is to determine whether affordability (pre- and post-assistance) is changing. For example, Census Bureau reports, utility rate schedules, customer water demands, and specific household income are or can be updated over time. The United Way ALICE method has no guarantee of periodic updates, though biennial updates have been developed since 2014.
6. **Realistic results** come from the method, such that programs to improve affordability can be implemented for appropriate households in a manner that is administratively feasible and will result in costs that are not unacceptably high.

Assessment of Methods Relative to Proposed Criteria

Table 1 (next page) provides a general understanding of how the various methods reviewed in the Phase 1 report[15] address the first five criteria. The last criterion is assessed at a later point.

These methods focus on various purposes:

- **Relative affordability of utility rates within a geographic area**, either comparing utilities or comparing areas within utility service districts: Census Tracts Exceeding X% of MHI; Teodoro Affordability Ratio Method; Teodoro Minimum Wage Method; Comparison to Poverty Income Thresholds.
- **Potential number of households facing affordability issues:** Households Exceeding X% of HHI
- **Broad-spectrum affordability** not specifically addressing water and sewer utility costs: United Way ALICE budgets

[14] Income distribution data are available to the Census Block Groups, defined by the US Census Bureau as "statistical divisions of census tracts, are generally defined to contain between 600 and 3,000 people". Each Census Tract is comprised of multiple Block Groups.

[15] See the Phase 1 report for detailed descriptions of these methods.

Table 1. Evaluation of Affordability Assessment Methods

Criteria \ Methods	Census Tracts Exceeding X% of MHI* (modified from USEPA)	Households Exceeding X% of HHI* (modified from USEPA)	Teodoro Affordability Ratio Method	Teodoro Minimum Wage Method	Comparison to Poverty Income Thresholds	United Way ALICE Household Survival Budget by County
1. Focus on households with legitimate affordability issues	**Low** Poor indicator of income distribution	**Good** HHI statistics directly used, but HH* size not addressed	**Moderate** Single threshold; HHI and HH size not addressed	**Moderate** Single threshold; HHI and HH size not addressed	**Moderate** Multiple levels can be used; HHI and HH size not addressed	**Good** Varies by HH size and county, but utility component not identified
2. **Useable at the utility and statewide levels**	**Good** Easy to use with GIS expertise; can use census block group HHI statistics	**Good** Easy to use with GIS expertise; can use census block group HHI statistics	**Good** Easy to use; can use census block group HHI statistics	**Moderate** Easy to use; no differentiation for census block groups	**Moderate** Easy to use; no differentiation for census block groups	**Moderate** Easy to use; no differentiation for census block groups
3. **Sufficient data are available**	**Moderate** Need utility rates/costs	**Moderate** Need utility rates/costs	**Moderate** Need utility rates/costs, sub-state disposable income levels	**Moderate** Need utility rates/costs	**Moderate** Need utility rates/costs	**Moderate** Need utility rates/costs, updated ALICE budgets
4. **Affordability benchmarks can be developed**	**Moderate** MHI not a robust threshold income	**Good** HHI directly applicable; need to reflect HH size	**Good** Single threshold; need to reflect HH size, income	**Good** Single threshold; need to reflect HH size, income	**Good** Single threshold; need to reflect HH size, income	**Good** Multi-threshold; need to reflect HH income
5. **Affordability can be tracked over time**	**Good** Easy to replicate, but unknown if HH pay utilities or are subsidized	**Good** Easy to replicate, but unknown if HH pay utilities or are subsidized	**Moderate** Easy to replicate, but unknown if HH pay utilities or are subsidized; special metric	**Good** Easy to replicate, but unknown if HH pay utilities or are subsidized	**Good** Easy to replicate, but unknown if HH pay utilities or are subsidized	**Moderate** Easy to replicate, but unknown if HH pay utilities or are subsidized; special 3rd party metric

* MHI = Median Household Income. HHI = Household Income. HH = Households

There are some disadvantages to all the methods. Costs of living can vary significantly within larger areas such as counties or even large utility service areas, and so any comparison of utility costs to a common threshold will not address the fact that two similar households served by the same utilities but in nearby municipalities could face significantly different housing and transportation costs, and therefore have different affordability issues. Realistically, though, a program can only include a limited level of administrative complexity before it becomes unworkable. Therefore, the use of thresholds is inevitable, and those thresholds will require some level of regional or statewide approach that aggregates households with similar, but not necessarily the same, costs of living.

Given that the United Way ALICE budgets are developed at the county level for multiple household types (i.e., 2-person and 4-person), they provide the greatest specificity regarding intrastate differences in costs of living. The disposable income estimates used by the Teodoro Affordability Ratio Method might be (but have not been) derived for regions of New Jersey, if sufficient data points are available within these regions through the American Community Survey. The other methods are all statewide thresholds (e.g., there are no sub-state regional poverty level estimates, though California is considering use of county poverty levels). Further, all the methods require data and analyses that are periodic, not continuous. Therefore, we must accept that any method will have increasing uncertainty as the data and analyses age, until they are renewed.

Based on the discussion and table above, three major issues must be resolved.

The first issue is how to structure an assessment approach. A three-tiered approach to affordability assessments may be the most appropriate approach.

- The first level is statewide aggregate assessments that would be used to determine whether there is sufficient need for state-level action (e.g., legislation) for new or modified efforts (currently or based on projected rate increases) and to track affordability over time. If a statewide affordability program is created (similar to the household energy program), household assessments would use the criteria for eligibility and level of assistance.
- At the second level, utility-level assessment will be needed for utility-level programs in the absence of statewide efforts. Utilities could also be involved in the implementation of a statewide affordability program, but the household energy assistance model indicates that use of a statewide agency is preferable.
- The third level is household assessments, which would need to determine the eligibility and benefit amounts of any assistance programs for renters and owners, and should reflect the effects of household financial assistance that is already reducing water and sewer utility costs. This level would be needed for programs involving direct assistance to households, such as for water conservation assistance or long-term rate reductions. Affordability efforts that are utility-wide, such as alternative rate designs, state subsidies and management efficiencies that reduce utility costs would not require household-level assessments.

The second major issue for all assessment levels is that no bright line exists between affordability and non-affordability, but most existing methods use bright lines such as a single income threshold. While a bright-line approach may be useful when comparing utilities, determining roughly how many households may need assistance, and tracking relative progress over time, it does not reflect the reality that financial stress is a continuum, not a cliff. The statewide question is not just how many households

face affordability issues, but how severe the affordability issues are for various households. For households, that ideally would mean financial assistance on a sliding scale, reducing as income grows. Again, though, realistic administration may require a program with a small number of graduated thresholds, similar to that of Philadelphia.

The third major issue is that water and sewer utility costs are part of broader household costs that are generally not incorporated in affordability methods, with the exception of the Teodoro Affordability Ratio method (which uses total household costs in deriving Estimated Disposable Income) and the United Water ALICE Budgets (which are specifically developed to reflect a minimum budget to sustain a specific household size). To the extent that water and sewer utility costs are compared to incomes, they should be addressed together but most utilities in New Jersey do not operate both systems. Therefore, a utility-specific approach will encounter difficulties in assessing financial stress.

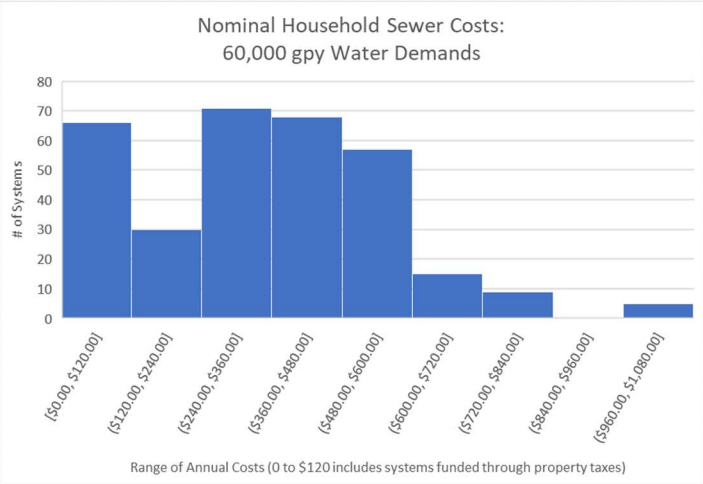
Current Water and Sewer Costs for New Jersey Households

The Phase 1 report provides information regarding current (2017 or early 2018) household costs for water and sewer utilities, using nominal annual water demands of 60,000 gallons. This section is a brief overview of those costs, to help provide context for the following discussions of method and thresholds.

Sewer Utility Costs

Information was gathered from 321 sewer utilities, of which 62 reported that households were not charged separate sewer utility bills; instead, the sewer costs are within the municipal budget, funded through property taxes. For the remaining 259 utilities, the following statistics (table) and distribution (graph) apply:

Annual Sewer Costs	
MAXIMUM	$1,076
MINIMUM	$35
MEDIAN	$400
AVERAGE	$426

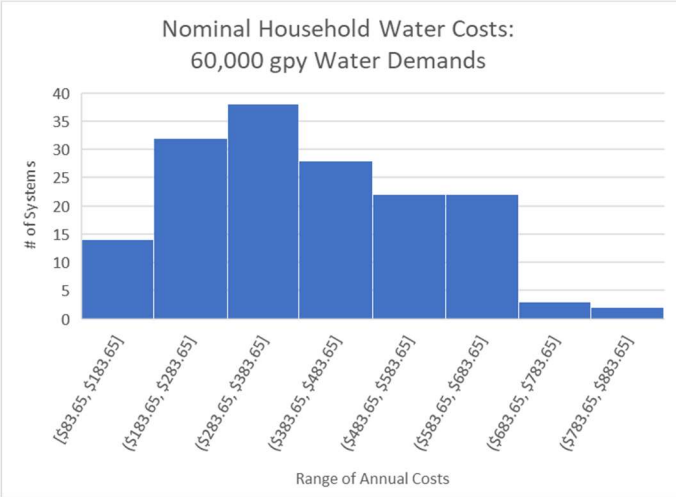


It is important to note that these costs are per system and are not sorted by population. Very small systems may have very high costs but affect few households.

Water Utility Costs

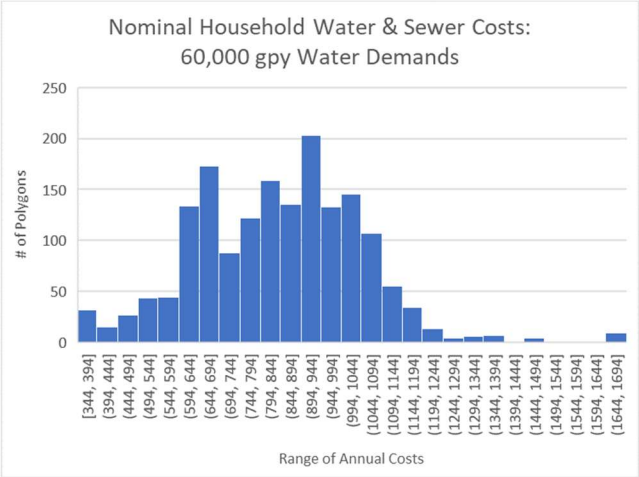
Information was gathered from 161 public community water systems. The results are shown in the table and graph, with the same caveats regarding cost versus system size.

Annual Water Costs	
MAXIMUM	$880
MINIMUM	$84
MEDIAN	$345
AVERAGE	$376



Combined Water and Sewer Utility Costs

Maximum, minimum, median or average combined costs are not a simple combination of the two tables above. In some areas, one utility or the other existed, but not both. In some areas where both utilities exist, the Phase 1 project procured rate information for one utility or the other, but not both. In areas where property taxes are used to address residential sewer costs, both utilities exist but only the water utility charges households directly. However, for the areas where both water and sewer utilities exist and rates are known for both, the following statistics (table) and distribution (graph) apply. In this case, the analysis was based on the number of geographic areas (polygons) with unique combinations of water and sewer utilities.



Annual Water and Sewer Costs	
MAXIMUM	$1674
MINIMUM	$344
MEDIAN	$850
AVERAGE	$839

Methodology Concepts

Based on experience and proposals in other jurisdictions (e.g., Philadelphia, California) and consideration of the available literature and methodologies as discussed above and in the Phase 1 report, the best approach is one that recognizes, first, that affordability has gradations (i.e., it is not an issue with a bright line between affordable and not affordable) and, second, that a single method is desirable for assessing affordability at the statewide, utility and household levels (with the addition of more detailed information when addressing individual households).

This section provides a general discussion in support of the separate white paper recommendation for consideration and use by Jersey Water Works, state agencies, and local governments and utilities in the near future. Its use for individual households would only be applicable through financial assistance programs.

NOTE: The various thresholds discussed in this section have either been mentioned in the literature (e.g., Teodoro Affordability Ratio method), are embodied in law (e.g., Low-Income Household Energy Affordability Program), or are used in comparison with such thresholds. **Thresholds mentioned below are not recommendations, but examples.** The focus of this section is on the general methodology. The separate white paper proposes a specific methodology with appropriate thresholds.

Summary of the Approach

While an infinite number of options are theoretically available, New Jersey needs to assess relative affordability of water and sewer service for households within a jurisdiction (e.g., state, county, municipality, utility service area). The intent is to evaluate the general level of need for affordability assistance in the target jurisdiction(s), using multiple thresholds to identify the number of households facing various levels of affordability problems (i.e., from stressed to highly stressed). Rate information compiled for the Phase 1 report (and adjusted as new information is provided) would be used for the statewide analysis. Census block group information on household income (HHI) would be used as a comparison to utility costs within that census block group. Statewide results will be useful for assessing the general need for assistance; the results would be provided statewide and for local areas, as the affordability issues of some utilities may be limited while for others the needs may be widespread.

The method would be used to determine the number and percentage of customer households for which water and sewer utility costs for a nominal water demand would exceed a series of cost thresholds, absent any mitigating factors (e.g., rent subsidies).

This approach requires knowing the distribution of disposable household income for the targeted geographic area, the costs for a nominal demand (using the basic service level concept discussed above) per nominal household (using average occupancy rates from the Census Bureau), and the relevant utility rate schedules. Two or three thresholds should be used, as more thresholds would make the assessment process too complex.

For household assistance programs, the method could be used to determine the level of assistance required to ensure that that the actual water and sewer utility costs (i.e., costs for the actual water demands, up to a volume limit per household member) do not exceed the cost thresholds. Households eligible for financial assistance would be those that have utility costs (adjusted as necessary to reflect good conservation habits) exceeding the thresholds, where the household does not otherwise receive

sufficient financial assistance for these costs through other programs (to avoid overlapping subsidies). Through the use of graduated thresholds, households with the highest ratio of utility costs to household income would receive more assistance. The assumption here is that discretionary income drops as utility costs consume an increasing share of income, placing a higher stress on the household and therefore a greater need for assistance.[16]

Derivation of an Initial Threshold

The initial threshold would establish the highest disposable and gross incomes for which the nominal water demand would create affordability issues at the target income. The income and the threshold would in turn identify a maximum utility cost for that geographic area that would not result in threshold exceedance. Actual utility costs would then be compared to that maximum.

Bright-line thresholds are necessarily somewhat arbitrary, as there will still be some level of stress above that income. The question is how to derive a threshold using a reasonable justification. Two possible approaches are considered for establishing the initial threshold - a modification of the Teodoro Affordability Ratio method and use of a NJ Poverty Level. **(Percentages used in this section are for illustration only.**)

Basic Household Service Levels

Several national approaches (e.g., Teodoro, Raucher et al., California PUC) recommend the use of 50 gpcd (18,250 gallons per year) as a basic service level of indoor water demand.[17] A family of four would then need 73,000 gallons per year at this basic service level. New Jersey has an average population per household of 2.71 (ranging from 2.52 to 3.03),[18] rounding up to 3 people per household would yield a basic service level of 54,750 gallons per year. However, the 50 gpcd value includes many different climates, some of which drive higher water demands due to their arid nature.

New Jersey could use the same value, or a lower value representing a more humid climate. Van Abs et al. (2018) determined that actual water demands in urban areas (which are nearly all indoor uses) are roughly 50-60 gpcd. As noted in the Phase 1 report, others such as Chenoweth (2008), recommend 135 liters (35.66 gallons) per capita per day for basic water services (e.g., for a four-person household, the result would be roughly 52,000 gallons per year, and 39,000 for a three-person household).

Again, the use of a single benchmark level of water demand reduces the accuracy of an affordability assessment. However, there is no available method to link actual household size with actual water rates. The best that can be done is to examine population statistics, including household size distributions, for a Census block group.

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[16] The method for providing financial assistance is not addressed here. For owner households, financial assistance could be directly to the household or as a bill credit. For renters, the financial assistance could be to the renter directly, serving as a rent offset. The assumption here is that rental rates would not change if the financial assistance was paid to the landlord, providing an increase in profit rather than assistance to the household. By comparison, energy assistance programs such as LIHEAP, discussed later, provide bill credits.

[17] Outdoor uses are deemed non-essential.

[18] Index Mundi, New Jersey Average household size by County, https://www.indexmundi.com/facts/united-states/quick-facts/new-jersey/average-household-size#table

Affordability Methods

This section uses a statewide 20th percentile household income of $32,900, which is derived from an average of values from the Census Bureau American Community Survey (ACS) for the years 2016 through 2018. Those years are used because they correspond to the years used in deriving the essential expenditures, from Consumer Expenditure Survey (CEX) data from the U.S. Bureau of Labor Statistics. It should be noted that household incomes were rising through 2019, but that in 2020 the pandemic rapidly shifted household income patterns and the expectation is that 2021 will also see significant shifts. Therefore, the discussion here should be viewed as examples to show how the methods would work, not final answers regarding current affordability issues.

Water and sewer utility cost as a percentage of statewide or regional net disposable income for the 20th percentile household income.

Teodoro (2018) suggests a preliminary threshold for the Affordability Ratio at the 20th percentile household income (AR_{20}), where the combined water and sewer utility costs should be less than 10% of net disposable household income, but recognizes that this threshold is debatable. The example below uses a 10% threshold. Net disposable income is 20th percentile household income minus essential expenditures.[19] Of the two metrics used, household income is routinely reported. Essential expenditures must be derived periodically using Consumer Expenditure Survey (CEX) data from the U.S. Bureau of Labor Statistics.

(1) Gross Household LQI – Non-Discretionary Household Costs = Disposable Income

Example: $32,900 - $24,865 = $8,035

(2) Disposable Income X Threshold % = Maximum "Affordable" Utility Bill at LQI

Example: $8,035 X 10% = $803

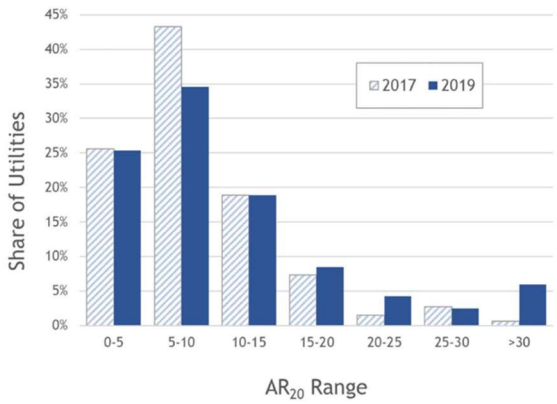
(3) Threshold % X Disposable Income/Gross Household LQI = Maximum % of Gross Household LQI

Example: 10% X $8,035/$32,900 = 2.44%

The California PUC report indicates that disposable income can be derived to smaller geographic levels using the PUMS dataset. Given that the vast majority of utility customers live in urban and suburban areas, the Teodoro approach would provide the most useful results using net disposable incomes for the smallest regional areas for which sufficient CEX data are available.

Teodoro (2019) reports that the average AR_{20} for the nation has jumped from 9.7 to 12.4 in just two years, from 2017 to 2019.[20] From the example provided here, the much higher cost of living in New Jersey results in a lower disposable income, and therefore would result in a higher average AR_{20}.

[19] Derived by Kimberly Irby of New Jersey Future using the general methodology discussed in Teodoro (2018) but also including transportation costs, which is not part of the Teodoro AR approach. The results were checked with Manuel Teodoro in November 2020 for confirmation that the results appropriately reflected the methodology.
[20] Teodoro, Manuel. 2019.11.25. Water & Sewer Affordability in America, 2019. Blog by email.



A 2019 analysis of Ohio utilities by EJ Metrics reports a population-weighted average AR_{20} for a 4-person household of 10.6, and that "In about 45 percent of Ohio communities a household at the 20th income percentile must pay more than ten percent of disposable income for basic water and sewer service."[21]

Water and sewer utility cost as a percentage of New Jersey poverty level (or multiple thereof).

The national poverty level (NPL) is described as a typical "basket of goods and services" necessary for a minimal lifestyle; recent federal guidance indicates an NPL of $24,563 for a household of four people. The equivalent NJ poverty level would be a statewide value. New Jersey poverty level is variously reported as 12 to 26 percent higher than the national poverty level (NPL). Several methods recommend use of a multiple of the poverty level, such as 200%. A selected percentage would be used to determine a level of aggregate water and sewer utility costs that are barely "affordable" for this income level; this example uses 2% but other percentages are possible. Household income distributions by census block group can then be compared to actual utility costs to determine the number of households that exceed or don't exceed the same level of stress. It is not known whether sub-state poverty levels can be derived but they are not currently available.

(1) National Poverty Level X 1.2 = Estimated NJ Poverty Level (NJPL)

Example: $24,339 X 1.2 = $29,206

(2) NJPL X Threshold % = Maximum "Affordable" Utility Bill at 200% NJPL

Example: $29,206 X 2% = $584

Both the national and New Jersey poverty levels address cost of living issues, a critical criterion, but both suffer from a lack of regional variation in a state that has significant differences in costs of living.

Comparison of Income Metrics

The New Jersey 20th percentile household income ($32,900) is somewhat higher than the New Jersey poverty level ($27,511 assuming a 12% increase over the NPL, $29,206 assuming a 20% increase, or $30,949 assuming a 26% increase).

If Teodoro's suggested 10% threshold is applied to the net disposable income of $8,035 (for a household at the LQI), that would imply that a household at the LQI could afford no more than a combined annual

[21] EJ Metrics. 2019. Water & Sewer Service Affordability in Ohio: Assessment & Opportunities for State Policy. Prepared for the Alliance for the Great Lakes & Ohio Environmental Council.

water and sewer utility cost of $803. This is equivalent to 2.75% of a New Jersey poverty level of $29,206.

In must be noted that any approach using a single income level at the statewide level can be used to assess a statewide level and severity of affordability risks, but such an assessment is problematic. For example, the 20th percentile household income (or LQI) for Camden City is $9,359,[22] which is less than a third of the statewide value ($32,900) and far less than the calculated statewide essential expenditures of $24,865 (i.e., net disposable income for Camden is negative for households at this income level). Using this approach for Camden City, at the 20th percentile income, water and sewer services would be considered unaffordable for all households at the LQI no matter how low the rates might be. This result may be an appropriate finding, but it shows the problems inherent with any method that uses a statewide income threshold.

As a point of comparison, New Jersey's energy affordability programs through the Low-Income Household Energy Affordability Program/Universal Service Fund (LIHEAP/USF), provide assistance for eligible households[23] that spend more than 3% of actual household income for each of heating and non-heating electricity costs, or 6% for all-electric households.[24, 25, 26] California PUC staff, on the other hand, recommend use of utility costs at a basic service level, not actual costs (which can include inefficient or non-essential uses) as the basis for affordability assessments.

For further comparison, for a combined water utility cost of $803 (based on 10% of disposable income at the LQI) to not exceed 3% of total household income, the household income necessary would be $26,767; this level is similar to the statewide NJ Poverty Level of $29,206 and roughly 40% of the United Way ALICE Household Survival Budget of $64,176 (four-person household).

Graduated Thresholds

The initial threshold would be at the level necessary to trigger concerns about affordability. Additional thresholds would be used to identify more severe affordability concerns. For example, if a threshold of X% of net disposable income is selected as the initial threshold, then households where utility costs exceed 1.5 and 2.0 times the initial threshold could be considered in High and Severe stress. This approach would allow consideration of relative affordability needs, to help assess the total needs for

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[22] Statistical Atlas, https://statisticalatlas.com/county/New-Jersey/Camden-County/Household-Income, accessed 10 November 2020.

[23] Eligible households have total incomes of less than 200% of NPL for LIHEAP and 175% of NPL for USF, as adjusted for household size (recent NJDCA guidance for a household of four is $50,208 for LIHEAP, and therefore $43,932 for USF). The programs are run jointly by the NJ Department of Community Affairs. See https://www.nj.gov/dca/divisions/dhcr/offices/energy.html

[24] LIHEAP payments are capped at $1400 per year, and USF payments are capped at $1800 per year, regardless of total energy costs. Those receiving energy assistance through other programs such as Section 8 housing vouchers are not eligible. According to the State Auditor (2019), annual expenditures for LIHEAP alone average nearly $120 million for more than 105,000 recipient households.

[25] Use of the EPA threshold of 4.5% median household income (MHI) for combined water sewer, which is not recommended, translates into a much higher acceptable utility cost as a percentage of New Jersey's poverty level, 20th percentile income or Teodoro disposable income. New Jersey's MHI was roughly $80,000 in 2016. 4.5% of that MHI is $3600, which is 13% of the 20th percentile income, 11.6% to 13% of the two NJ Poverty Levels, and 21% of Teodoro's net disposal income.

[26] The Energy Information Agency estimates that the average household in New Jersey paid just over $3,000 per year in energy costs, though costs for low-income households may be lower due to smaller unit sizes.

financial assistance, water conservation programs, etc., and so that households with the worst stresses are provided priority access to affordability programs.

To provide an example of how the number work, **Table 2** compares the combined water and sewer cost statistics (discussed above), relative to the net disposable incomes at various household incomes (HHI) (assuming that non-discretionary costs are equal across all incomes). For example, if the average cost burden at LQI is roughly 10% (median utility cost) and that is selected as the initial threshold, then high and severe levels of stress might be 15% and 20%, respectively. This example uses an annual water demand of 60,000 gallons per household.

Table 2. Utility Costs as Percentage of Net Disposable Income
(60,000 gallons per year)

Household Income (HHI)	Net Disposable Income	Maximum Utility Cost ($1673.65)	Minimum Utility Cost ($343.66)	Median Utility Cost ($850.28)
$32,900*	$8,035	20.83%	4.28%	10.58%
$25,000	$135	1239.74%	254.56%	629.84%
$20,000	($4,865)	NA	NA	NA
$15,000	($9,865)	NA	NA	NA
$12,000	($12,865)	NA	NA	NA
$10,000	($14,865)	NA	NA	NA

*Statewide 20th Percentile Household Income

The graduated thresholds would be applied to combined water and sewer utility costs and household income data from the census block group level, to determine the total number of households for which costs would exceed each of the thresholds, assuming that they all paid direct rates and did not receive any other assistance. Further steps to better refine the estimates would be as follows:

- Assess the number of rental households to determine the potential split between those likely to pay directly (single-family owner households and some rental households in single-family dwellings) or indirectly (rental households in multi-family and some single-family buildings).
- Identify and assess information on subsidized housing (including those with utility subsidies), to the smallest possible geographic area, and abstract those households from the number of stressed households at that geographic level.
- The result will be an estimate of stressed households (total, total by housing/rental type, and by levels of stress) and net stressed households (total minus subsidized). The results would be at the statewide level and to the extent feasible at the sub-state level.

Modification for County-Level Analyses

There are two major ways for identifying county-level thresholds. One is to apply the Teodoro (2018) method at the county level. This method was implemented at the statewide level, as noted above, and also at the county level.[27] The detailed methodology is provided in Appendix A. The results are provided in Table 3.

[27] Kimberly Irby at New Jersey Future, August 2020

Table 3. Annual Household Disposable Income by County				
County	**20th Percentile Income ($)**	**Monthly Essential Expenditures ($)**	**Annual Essential Expenditures ($)**	**Annual Disposable Income ($)**
Atlantic	23,104	1,735	20,820	2,284
Bergen	37,211	2,278	27,336	9,875
Burlington	39,344	2,255	27,060	12,284
Camden	24,911	1,807	21,684	3,227
Cape May	28,461	1,999	23,988	4,473
Cumberland	18,782	1,440	17,280	1,502
Essex	20,389	1,527	18,324	2,065
Gloucester	35,788	2,172	26,064	9,724
Hudson	25,091	1,800	21,600	3,491
Hunterdon	50,005	2,728	32,736	17,269
Mercer	29,115	1,924	23,088	6,027
Middlesex	35,925	2,212	26,544	9,381
Monmouth	37,853	2,294	27,528	10,325
Morris	48,912	2,668	32,016	16,896
Ocean	28,577	1,969	23,628	4,949
Passaic	24,817	1,744	20,928	3,889
Salem	22,490	1,655	19,860	2,630
Somerset	47,381	2,632	31,584	15,797
Sussex	41,940	2,385	28,620	13,320
Union	31,951	1,998	23,976	7,975
Warren	32,699	2,074	24,888	7,811
Weighted Avg	**32,900**	**2,072**	**24,865**	**8,035**

As seen in the table, the annual disposable household income varies widely among the counties, with the wealthiest counties (Hunterdon, Morris and Somerset) having values over $15,000, and the least wealthy (Cumberland, Essex, Atlantic and Salem) having values near or below $2,000.

A second way is to use another method as a template for estimating how essential expenses would vary among the counties. United Way has published multiple cycles of the ALICE Household Survival Budgets. Assuming United Way commits to routine updates, the county-specific values would help understanding of financial stress at the sub-state level, and an initial threshold can be developed in combination with the Teodoro approach or a NJ poverty level. Essential expenses were assumed in **Table 2** to be stable throughout the state, but they could be adjusted using the United Water ALICE budgets (i.e., if the ALICE budget for a county is 5% less than the statewide ALICE budget, then the essential expenses or the poverty level would also be 5% less than the statewide level). **Table 4** shows how this adjustment could work. For each county, the revised essential expenses estimates would be subtracted from the county 20th percentile income to create comparable affordability thresholds to the statewide approach.

Table 4. Example Adjustment of 20th Percentile Household Income and Essential Expenditures Using United Way ALICE Household Survival Budgets (2016) and County-level Household Incomes						
County	**ALICE Budget (4-person household)**	**% of Statewide**	**20th Percentile HHI**	**Adjusted Essential Expenses**	**20th Percentile HH Net Disposable Income**	**Initial Threshold (10% Net Disposable Income)**
Statewide	**$64,176**	**100%**	**$32,900**	**$24,865**	**$8,035**	**$804**
Atlantic	$65,040	101.35%	$23,104	$25,201	**($2,097)**	($210)
Bergen	$63,672	99.21%	$37,211	$24,669	**$12,542**	$1,254
Burlington	$66,360	103.40%	$39,344	$25,710	**$13,634**	$1,363
Camden	$64,428	100.39%	$24,911	$24,962	**($51)**	($5)
Cape May	$66,324	103.35%	$28,461	$25,698	**$2,763**	$276
Cumberland	$65,604	102.23%	$18,782	$25,419	**($6,637)**	($664)
Essex	$55,788	86.93%	$20,389	$21,615	**($1,226)**	($123)
Gloucester	$66,276	103.27%	$35,788	$25,678	**$10,110**	$1,011
Hudson	$55,164	85.96%	$25,091	$21,374	**$3,717**	$372
Hunterdon	$81,168	126.48%	$50,005	$31,449	**$18,556**	$1,856
Mercer	$67,332	104.92%	$29,115	$26,088	**$3,027**	$303
Middlesex	$62,280	97.05%	$35,925	$24,131	**$11,793**	$1,179
Monmouth	$66,660	103.87%	$37,853	$25,827	**$12,026**	$1,203
Morris	$69,012	107.54%	$48,912	$26,740	**$22,172**	$2,217
Ocean	$72,192	112.49%	$28,577	$27,971	**$607**	$61
Passaic	$55,980	87.23%	$24,817	$21,690	**$3,127**	$313
Salem	$65,436	101.96%	$22,490	$25,352	**($2,862)**	($286)
Somerset	$80,088	124.79%	$47,381	$31,029	**$16,352**	$1,635
Sussex	$69,708	108.62%	$41,940	$27,008	**$14,932**	$1,493
Union	$56,400	87.88%	$31,951	$21,851	**$10,100**	$1,010
Warren	$63,420	98.82%	$32,699	$24,572	**$8,127**	$813

As shown in **Table 4**, the county ALICE budget results for a four-person household (second column) were compared to the statewide ALICE budget estimate (third column), and then used to modify the statewide estimates of essential expenses using the modified Teodoro (2018) method (fifth column). Estimates of the 20th percentile county household income (from **Table 3**, column 2) are provided in the fourth column, and the net disposable income (sixth column) is the 20th percentile income minus the essential expenses for each county. The final column is 10% of net disposable income. As can be seen, the "affordable costs" for the 20th percentile income household vary significantly from county to county at the 10% level, with a high of $2,217 (Morris) and a low of negative $664 (Cumberland). This variation raises significant concerns regarding the use of this method, as the variation in essential expenditures is much lower than those shown by the use of Consumer Expenditure Survey (CEX) data from the U.S. Bureau of Labor Statistics.

Another approach would be to vary the statewide estimate of affordable utility costs by the percentage difference in statewide versus county ALICE costs, as shown in **Table 5**.

Table 5. Example Adjustment of Affordable Utility Costs Using County-Level United Way ALICE Household Survival Budgets (2016)

County	ALICE Budget (4-person household)	% of Statewide	Adjusted Maximum Affordable Combined Water and Sewer Costs (Affordability Ratio of 10%)
Statewide	**$64,176**	**100%**	**$804**
Atlantic	$65,040	101.35%	$815
Bergen	$63,672	99.21%	$798
Burlington	$66,360	103.40%	$831
Camden	$64,428	100.39%	$807
Cape May	$66,324	103.35%	$831
Cumberland	$65,604	102.23%	$822
Essex	$55,788	86.93%	$699
Gloucester	$66,276	103.27%	$830
Hudson	$55,164	85.96%	$691
Hunterdon	$81,168	126.48%	$1,017
Mercer	$67,332	104.92%	$844
Middlesex	$62,280	97.05%	$780
Monmouth	$66,660	103.87%	$835
Morris	$69,012	107.54%	$865
Ocean	$72,192	112.49%	$904
Passaic	$55,980	87.23%	$701
Salem	$65,436	101.96%	$820
Somerset	$80,088	124.79%	$1,003
Sussex	$69,708	108.62%	$873
Union	$56,400	87.88%	$707
Warren	$63,420	98.82%	$795

The results for **Table 5** show a significantly narrower range of affordable utility costs, with a maximum of $1,017 and a minimum of $691 for 10% of disposable income. For both statewide and county thresholds, the method could be used to identify the number of households exceeding the threshold for affordability as a percentage of income, by Census block group and aggregated up to utility, municipal, county and statewide levels.

Conclusion

This report provides an overview of methodologies from the literature and practice that have been published since Van Abs and Evans, 2018, Assessing the Affordability of Water and Sewer Utility Costs in New Jersey: Phase 1 Report: Methodology Review and Preliminary Assessment. It also explores further the application of the Teodoro (2018) Affordability Ratio method, the use of poverty level estimates, and the use of the United ALICE project in developing a New Jersey methodology for assessing the

relative level of affordability problems for New Jersey households. The results of this report are then used in a final 2021 report for Jersey Water Works: **A New Jersey Affordability Methodology and Assessment for Water and Sewer Utility Costs**.

Appendix A: Methodology to Calculate Disposable Income by County

Overview

This analysis calculates monthly essential expenditures at the 20th percentile income level by county in New Jersey. These numbers are then used to calculate disposable income, which is compared against water/sewer rates and certain affordability thresholds to ultimately show how many households in New Jersey, for each combination of utilities and Census tract, are stressed by water and sewer bills in 2020. Generally, this analysis of essential expenditures entails running a regression analysis on Consumer Expenditure Survey data to estimate monthly essential expenditures as a function of household income, education, household size, race, ethnicity, home ownership (rent vs. own), and dwelling type (single family vs. multi-family). The coefficients for the aforementioned independent variables are then applied to corresponding American Community Survey data to determine estimated essential expenditures. This approach modifies for New Jersey purposes a national approach from Teodoro (2018) "Measuring Household Affordability for Water and Sewer Utilities."

Data Preparation

This analysis uses two sources of data for the years 2016-2018 (the most recent available for both sources): the public-use microdata (PUMD) from the Consumer Expenditure (CEX) Survey and three tables from the American Community Survey (ACS). From the CEX PUMD, the Interview files and New Jersey state weights were used. Note that Interview files were used and not Diary files because "the Interview [survey] generally tracks consumer units' large expenditures, such as major appliances and cars, while the Diary [survey] tracks smaller, everyday expenditures that might be easily forgotten even after a few days, such as a cup of coffee." From the ACS data, the following three tables were used:

- Demographic Characteristics for Occupied Housing Units (TableID: S2502)
- Physical Housing Characteristics for Occupied Housing Units (TableID: S2504)
- Household Income Quintile Upper Limits (TableID: B19080)

CEX Data

The table below shows the variables from the CEX PUMD that were used. Under the "Type" column, "DV" refers to Dependent Variable and "IV" refers to Independent Variable. The variables denoted DV were summed to calculate total essential expenditures. Largely, this includes food, healthcare, home energy use, transportation (a modification from Teodoro, 2018), and shelter (referring to essential costs for either rented or owned dwellings). Again, the independent variables are household income, education, household size, race, ethnicity, home ownership (rent vs. own), and dwelling (building) type (single-family vs. multi-family). Please refer to the CEX glossary for detailed explanations of what each variable entails.

Table 1. CEX PUMD variables used in the analysis

Variable	Type	Name	Category
NEWID	ID	Public use microdata identifier	ID
STATE	ID	State (NJ = 34)	State
FOODPQ	DV	Food last quarter	Food
HEALTHPQ	DV	Health care last quarter	Health care
ELCTRCPQ	DV	Electricity last quarter	Energy
NTLGASPQ	DV	Natural gas last quarter	Energy
ALLFULPQ	DV	Fuel oils and other fuels last quarter	Energy
TRANSPQ	DV	Transportation last quarter	Transportation
SHELTPQ	DV	Shelter last quarter	Housing
TOTXEST	DV	Estimated total taxes paid	Taxes
FINCBTXM	IV	Total amount of family income before taxes (imputed or collected data)	Income
CUTENURE	IV	Housing tenure	Own vs. Rent
BUILDING	IV	Building type	Single vs. Multi- Family
HISP_REF	IV	Hispanic or non-Hispanic	Ethnicity
REF_RACE	IV	Race of reference person	Race
FAM_SIZE	IV	Number of members in CU	Household size
EDUC_REF	IV	Education of reference person	Education

Table 2. CEX PUMD categorical variables and assignments for the analysis

Category	Assignments
Rent vs. Own	1 = Own 2 = Rent
Education - High School Graduate	1 = Less than high school graduate 2 = High school graduate and above
Education - College Graduate	1 = Less than college graduate 2 = College graduate and above
Single vs. Multi-Family*	1 = Single 2 = Multi-family
Race	1 = White 2 = Black 3 = Native American 4 = Asian / Pacific Islander 5 = Multi-racial / Other
Ethnicity	1 = Hispanic 2 = Non-Hispanic

*Single vs. multi-family was categorized to match the ACS definition as closely as possible. ACS defines “single family structures” as fully detached, semi-detached (semi-attached, side-by-side), row houses, duplexes, quadruplexes, and townhouses. “Multifamily” is defined as residential buildings containing units built one on top of another and those built side-by-side which do not have a ground-to-roof wall and/or have common facilities (i.e., attic, basement, heating plant, plumbing, etc.)

Thus, single family was made to include the following subtypes within the BUILDING variable:

- Single family detached (detached structure with only one primary residence, however, the structure could include a rental unit(s) in the basement, attic, etc.)
- Row or townhouse inner unit (2, 3 or 4 story structure with 2 walls in common with other units and a private ground level entrance; it may have a rental unit as part of structure)
- End row or end townhouse (one common wall)
- Duplex (detached two-unit structure with one common wall between the units)
- 3-plex or 4-plex (3- or 4-unit structure with all units occupying the same level or levels)
- Mobile home or trailer
- Other

Accordingly, multi-family was made to include the following subtypes:

- Garden (a multi-unit structure, usually wider than it is high, having 2, 3, or possibly 4 floors; characteristically the units not only have common walls but are also stacked on top of one another)
- High-rise (a multi-unit structure which has 4 or more floors)
- Apartment or flat (a unit not described above; could be located in the basement, attic, second floor or over the garage of one of the units)

ACS Data

Corresponding demographic and socioeconomic data from the ACS, along with 20th percentile income values, was downloaded for New Jersey, by county for the years 2016-2018. The values were averaged over three years (sometimes two years in the case of missing data, though there were only two instances of this - race data for Salem and Hunterdon counties).

Using the ACS data, single family was made to include:

- 1 unit, detached
- 1 unit, attached
- 2 units in structure
- 3 or 4 units in structure
- Mobile home or other type of housing

Using the ACS data, multifamily was made to include:

- 5 to 9 units in structure
- 10 or more units in structure

Data Analysis

The national CEX dataset was imported into R, which is a free software environment for statistical computing. Then, the data was pared down to the relevant variables for consumer units in New Jersey only. Then, the independent variables were re-categorized accordingly. A monthly essential expenditure variable was constructed by summing the quarterly housing, health care, food, home energy, transportation and taxes for each consumer unit in New Jersey and dividing by three. Then, an ordinary least squares regression was run to estimate monthly essential expenditures as a function of household income, education, household size, race, ethnicity, home ownership, and single- or multi-family home, applying the New Jersey state weights. Note that the regression was run on the log of monthly essential expenditures and the log of annual household income, which matches the methodology in Teodoro (2018).

Table 3. Regression results

Independent Variable	**Coefficient**
Family size	0.032
Single-family residence	-0.018
High school graduate	0.282
College graduate	0.341
Black	-0.232
Native American	0.199
Asian / Pacific Islander	0.117
Multi-racial / Other	0.551
Hispanic	-0.159
Log pre-tax HH income	0.397
Homeowner	0.185
Intercept	2.920

Table 4. Percentages associated with the relevant ACS variables, by county.
Note: Family size was set to three across all counties.

County	Single family	HS grad	CLG grad	Black	Nat. Amer.	Asian / PI	Multi / Other	Hispanic	Homeowner
Atlantic	82%	89%	30%	15%	0%	6%	8%	14%	67%
Bergen	79%	93%	51%	6%	0%	16%	4%	17%	64%
Burlington	88%	95%	41%	16%	0%	4%	4%	6%	75%
Camden	82%	90%	35%	19%	0%	5%	9%	14%	67%
Cape May	93%	94%	37%	3%	0%	1%	3%	6%	78%
Cumberland	89%	81%	18%	17%	1%	1%	6%	24%	65%
Essex	71%	87%	37%	41%	0%	5%	10%	20%	44%
Gloucester	89%	95%	36%	10%	0%	2%	3%	4%	80%
Hudson	50%	87%	46%	12%	0%	16%	14%	37%	32%
Hunterdon	91%	96%	57%	1%	0%	4%	1%	5%	83%
Mercer	80%	90%	45%	21%	0%	10%	3%	13%	63%
Middlesex	78%	92%	46%	10%	0%	22%	5%	17%	63%
Monmouth	83%	94%	48%	7%	0%	5%	3%	8%	74%
Morris	82%	95%	58%	3%	0%	9%	3%	11%	74%
Ocean	92%	93%	32%	3%	0%	2%	3%	7%	79%
Passaic	79%	84%	31%	12%	0%	5%	16%	35%	52%
Salem	88%	91%	22%	12%	0%	1%	3%	6%	68%
Somerset	84%	96%	58%	10%	0%	16%	3%	12%	76%
Sussex	92%	96%	39%	2%	0%	2%	2%	6%	83%
Union	81%	89%	39%	22%	0%	5%	14%	27%	58%
Warren	88%	93%	34%	4%	0%	2%	3%	7%	73%

Each of these values was multiplied by the relevant coefficient. The resulting number was summed across the rows to get the log of the monthly essential expenditures. The formula =EXP(x) was applied to get the actual value for monthly expenditures.

Table 5. 20th percentile income, essential expenditures (monthly and annual) and annual disposable income from the 20th percentile income, with maximum annual utility charge according to an affordability threshold of 6% of disposable income.

County	20th Percentile Income ($)	Monthly Essential Expenditures ($)	Annual Essential Expenditures ($)	Annual Disposable Income ($)	Max Annual Utility Charge - 6% of DI ($)
Atlantic	23,104	1,735	20,820	2,284	137
Bergen	37,211	2,278	27,336	9,875	593
Burlington	39,344	2,255	27,060	12,284	737
Camden	24,911	1,807	21,684	3,227	193
Cape May	28,461	1,999	23,988	4,473	269
Cumberland	18,782	1,440	17,280	1,502	90
Essex	20,389	1,527	18,324	2,065	124
Gloucester	35,788	2,172	26,064	9,724	584
Hudson	25,091	1,800	21,600	3,491	209
Hunterdon	50,005	2,728	32,736	17,269	1,036
Mercer	29,115	1,924	23,088	6,027	362
Middlesex	35,925	2,212	26,544	9,381	563
Monmouth	37,853	2,294	27,528	10,325	619
Morris	48,912	2,668	32,016	16,896	1,014
Ocean	28,577	1,969	23,628	4,949	297
Passaic	24,817	1,744	20,928	3,889	233
Salem	22,490	1,655	19,860	2,630	157
Somerset	47,381	2,632	31,584	15,797	948
Sussex	41,940	2,385	28,620	13,320	799
Union	31,951	1,998	23,976	7,975	479
Warren	32,699	2,074	24,888	7,811	469
Average*	**32,900**	**2,072**	**24,865**	**8,035**	**482**

*Weighted by population (average of ACS 1-year estimates, 2016-2018)

The average monthly essential expenditure of $2,072 may seem high for 20th percentile income. However, looking at the NJ table produced from the Consumer Expenditure data using NJ state weights, we see that the average annual expenditure (about $34K, which includes all forms of income including government support) is about twice as high as the average annual income for the average consumer unit within the 20th percentile (about $16K).

Report Responsibilities

Daniel J. Van Abs Ph.D. FACIP, PP

Dan is an Associate Professor of Professional Practice for Water, Society & Environment at Rutgers University's School of Environmental and Biological Sciences, where he focuses on planning and management policy for water infrastructure, water supply, wastewater and watershed protection. He joined the Rutgers faculty in 2012. Previously, he was senior director for planning and science with New Jersey's Highlands Water Protection and Planning Council, and he was director of watershed protection with the New Jersey Water Supply Authority. He served with the New Jersey Department of Environmental Protection for 12 years, six as manager for statewide water resources planning; and as technical director of the Passaic River Coalition for four years. Dan holds a Ph.D. in Environmental Science from SUNY-College of Environmental Science and Forestry. He is a member of the College of Fellows, American Institute of Certified Planners, a licensed Professional Planner in New Jersey and former chairman of the New Jersey Clean Water Council. Dan is co-editor with Karen O'Neill of the June 2016 Rutgers University Press book *Taking Chances: The Coast After Sandy*. Further information is available at www.danvanabs.com.

Chris Sturm, Managing Director for Policy and Water, New Jersey Future

Chris directs the New Jersey Future's water programs and policy. Her work focuses on efforts to upgrade water infrastructure to support healthy, just and prosperous communities, including managing the organization's work on green infrastructure, water financing, and community organizing and managing staff that provide backbone support the Jersey Water Works collaborative. She has built successful teams and collaborations to accomplish legislative, regulatory and programmatic innovations in areas including climate resilience, state and regional planning, land preservation, and compact, equitable growth. She is a member of the Clean Water Council of New Jersey and the U.S. Water Alliance. Chris served as project manager for this research study. She helped to shape the research questions and approach, and oversaw project progress.

Kimberly Irby, Policy Analyst, New Jersey Future

Kimberley provides research and analytical support to various programmatic areas, including the Jersey Water Works data dashboard, lead in drinking water, and combined sewer overflow communities. She provided the updated analysis of essential expenditures used in this report.

Jersey Water Works

Jersey Water Works is a collaborative effort of many diverse organizations and individuals who embrace the common purpose of transforming New Jersey's inadequate water infrastructure by investing in sustainable, cost-effective solutions that provide communities with clean water and waterways; healthier, safer neighborhoods; local jobs; flood and climate resilience; and economic growth. Jersey Water Works' shared goals are end states the collaborative aims to help achieve over the next three to five years. The 2018 Work Plan is executed by the collaborative's committees. The projects will advance best practices, better stakeholder engagement, and affordability for all ratepayers, among other goals. Jersey Water Works includes hundreds of members: water and sewer utilities, governments, businesses, non-governmental organizations, consultants, academics, individuals and others.

New Jersey Future

Founded in 1987, New Jersey Future is a nonprofit, nonpartisan organization that promotes sensible growth, redevelopment and infrastructure investments to foster vibrant cities and towns, protect natural lands and waterways, enhance transportation choices, provide access to safe, affordable and aging-friendly neighborhoods and fuel a strong economy. The organization does this through original research, innovative policy development, coalition-building, advocacy, and hands-on strategic assistance. New Jersey Future provides the backbone staff and serves as fiscal agent for Jersey Water Works.