Puget Sound Wastewater Service Affordability Analysis: Implications for Implementation Strategies

2022 CRITICAL ANALYSIS SUMMARY REPORT

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EXECUTIVE SUMMARY

Background and Objectives

In 2018, regional nutrient management efforts were initiated in response to monitoring data that revealed worrisome trends in Puget Sound's water quality. Wastewater treatment plants (WWTPs) are the largest anthropogenic source of nutrients to Puget Sound and were therefore an early focus of both nutrient management efforts. Puget Sound National Estuary Program Marine Water Quality Implementation Strategy (MWQ IS) planning efforts identified current funding levels as a barrier to reducing wastewater nutrient loads and recommended development of a funding pathway to identify new/expanded sources of local, state, and federal funding. In 2021, the Department of Ecology issued a Puget Sound Nutrient General Permit (PSNGP) requiring operators of facilities that discharge into Puget Sound marine waters to begin long-term planning for upgrades that would be needed to comply with total inorganic nitrogen (TIN) numeric effluent limits expected in future PSNGP cycles.

This analysis was initiated because participants in the MWQ IS development process expressed concerns about the impact of costly upgrades on their ratepayers. Since nutrient reduction upgrades have the potential to exacerbate existing affordability issues, additional data collection/analysis was recommended.

Research Questions

This report answers the following research questions as to whether current and PSNGP-adjusted sewer service costs:

1. Raise affordability concerns for Puget Sound households that are connected to sewer utilities? Affordability is measured using two indices, sewer bills as a percent of median household income (%MHI) and sewer bills as a percent of lowest quintile income (%LQI).
2. Contribute to equity and efficiency concerns of the MWQ IS if current and future sewer bills constitute a larger percentage of income of low-income households than high-income households?

And if the answer to these questions is yes, then can the data for this study help:

- Calculate the amount of federal and state monies needed to maintain %MHI or %LQI indices below a specified affordability threshold for individual Puget Sound utilities.
- Improve the equity outcomes when prioritizing the distribution of grant funds.

Study Methods

This analysis utilizes publicly available data to estimate the current annual household sewer bills and potential future nutrient-adjusted sewer bills for 80 Puget Sound regional sewer

utilities.[1] Data compilation and analysis steps are listed below. The full database is available open access via UW libraries (Barber et al. 2022).

- Current sewer rates were obtained from utilities web pages to estimate current (2022) sewer bills.
- Nutrient-adjusted sewer bills were estimated for two different nutrient removal objectives; total inorganic nitrogen (TIN) < 8 mg/L seasonally and TIN < 3 mg/L and total phosphorus (TP) < 0.1mg/L year-round. These two objectives bookend the estimated costs of regulatory standards that were reported by the Washington Department of Ecology (Ecology) and Tetra Tech in the June 2011, *Technical Evaluation of Nitrogen and Phosphorus Removal at Municipal Wastewater Treatment Facilities*.
- Household income data was obtained from the U.S. Census Bureau American Community Survey (ACS). The lowest geographic unit for which household income by quintile and population data is available is the Census Tract.
- Census tracts were corresponded to sewer district boundaries or city boundaries where utilities are operated by municipalities. This allowed us to estimate a population-weighted income for each of the 80 local wastewater service providers in the study.

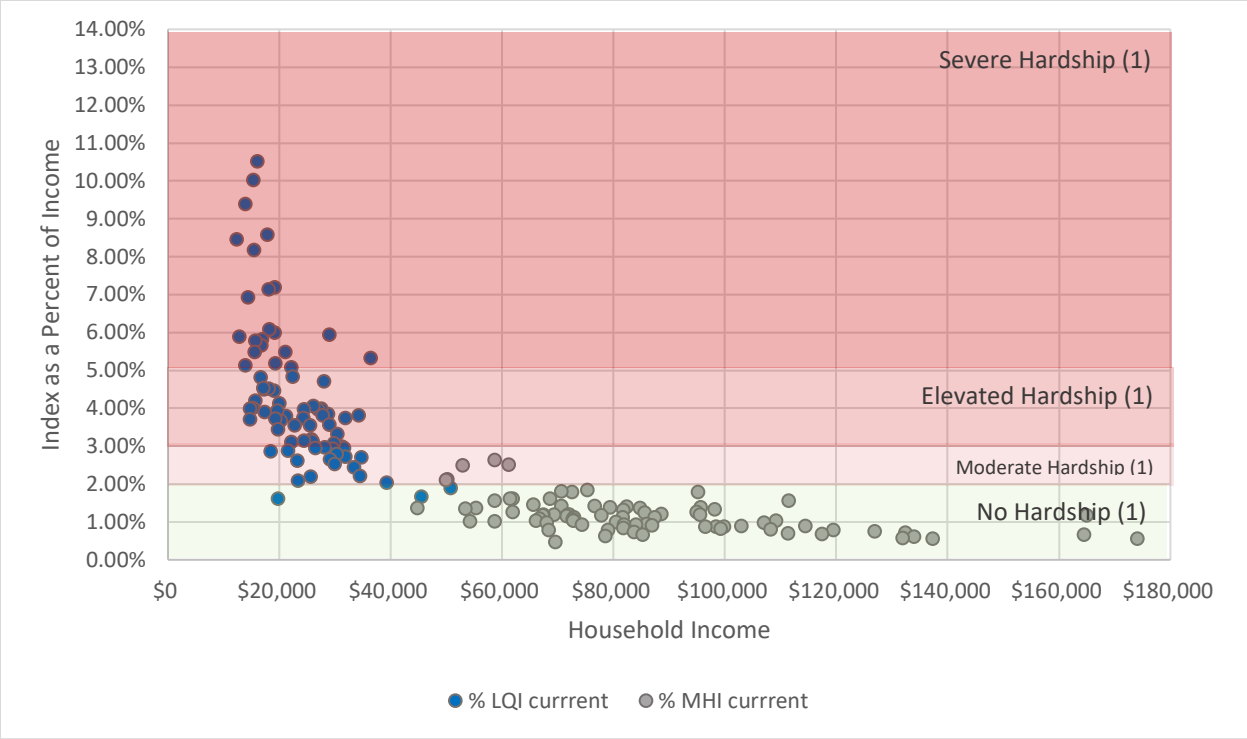
Summary Results

Current monthly sewer bills range from $27 to $161. Estimated PSNGP-adjusted monthly sewer bills ranged from $44 to $196, depending on the utility and the nutrient-reduction scenario. Estimated household income ranges widely across the region. MHI ranges from $174,078 to $44,844. LQI ranges from $50,831 to $12,425 and is, on average, 28% of MHI.

As shown in Figure ES-1, affordability metric results indicate that current sewer rates are likely:

- Not creating affordability concerns for households earning the median household income (MHI). Sewer bills were generally below 2 percent of MHI (%MHI).
- **Creating affordability concerns for households earning the lowest quintile income (LQI).** Sewer bills were often above 2 percent of LQI (%LQI), ranging between 1.61 percent of lowest quintile income (LQI) to 10.5 percent of LQI, with an average of 4.38 percent of LQI. For reference, the US Economic Research Service reports that in 2021, U.S. households spent an average of 10.3 percent of their disposable personal income on food, so on average sewer bills are a little less than half a lower quintile households' food budget.

[1] Wastewater/sewage services in the region are provided by a mix of county or municipal governments, Special Purpose Districts, and Public Utility Districts. For simplicity, we call all these local wastewater service providers utilities. Some of these utilities operate WWTPs and are PSNGP permittees, and the others are wholesale customers of those WWTP operators.

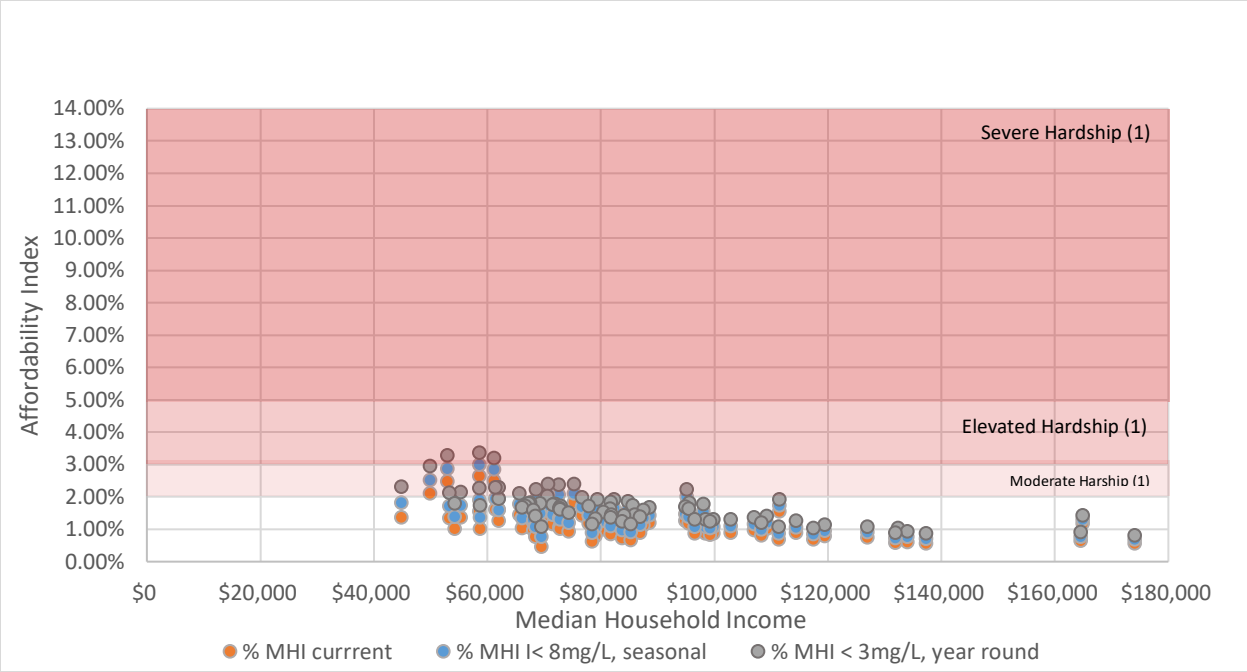


(1) Hardship categories taken from WAC 173-98-300 and apply to MHI% but not LQI%.

Figure ES-1. %MHI and %LQI Values of Estimated Current Sewer Rates for 80 Puget Sound Sewer Utilities, 2020 dollars

However, as shown in Figure ES-2, the estimated PSNGP-adjusted rates could result in sewer bills that:

- **Create affordability concerns for households earning the MHI and served by between 7 and 17** of the utilities in the study, depending on the nutrient-removal objective, e.g., %MHI values greater than 2 percent (Figure ES-2).
- **Continue to create hardship for households earning the lowest quintile income (LQI),** e.g., above 2 percent of LQI (%LQI), %LQI values greater than 2 percent for all 80 utilities ranging from 2.1 percent of LQI to 13.14 percent of LQI (Figure ES-3).



(1) Hardship categories taken from WAC 173-98-300.

Figure ES-2. Estimated current and nutrient-adjusted utility-district specific %MHI

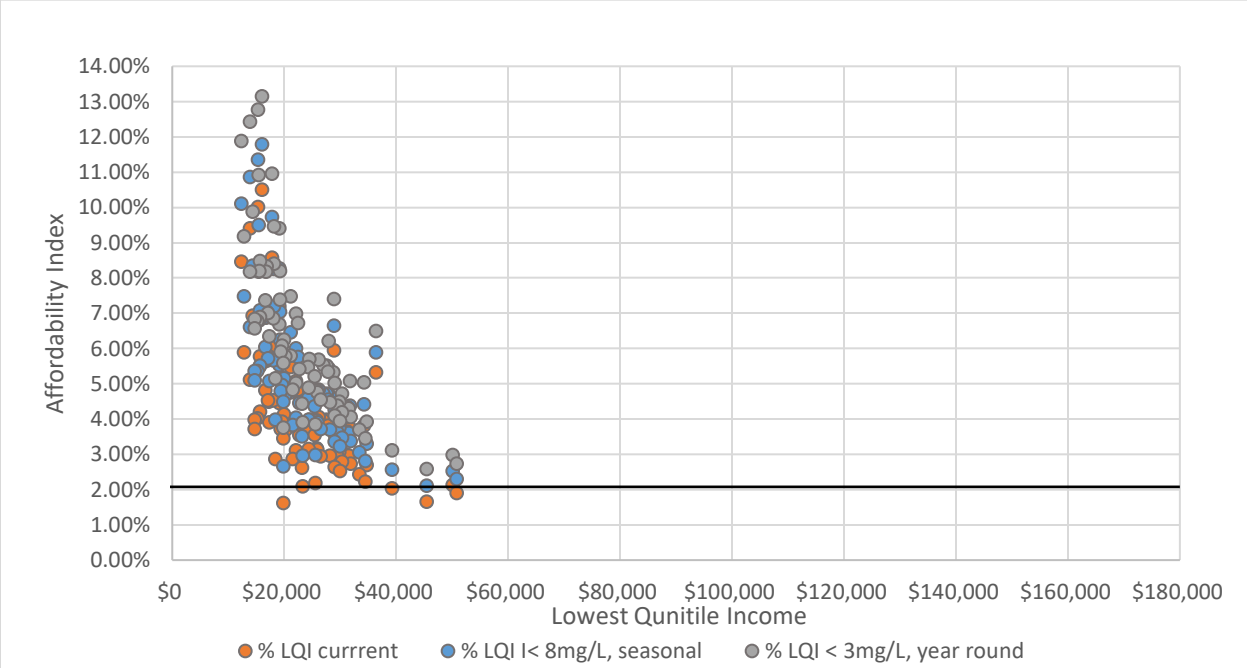


Figure ES-3. Estimated current and nutrient-adjusted utility-district specific %LQI

The range of the index values for both MHI and LQI vary widely in part because both income levels and sewer rates vary widely among the 80 utilities in the study.

With a high degree of variability in incomes and sewer bills, neither relatively high sewer bills, nor relatively low income alone predict the districts that have the highest impact index values. Rather, the %MHI and/or %LQI provides more information about the greatest need for grant funds than simply looking at the MHI levels (Figure ES-6). The correlation of both %MHI index value and %LHI index value to MHI is relatively low (R^2 of 0.2746 for %MHI and R^2 of 0.205 for %LQI). This low correlation suggests that MHI does predict the utilities that have the highest index values and therefore potentially households with the greatest need.

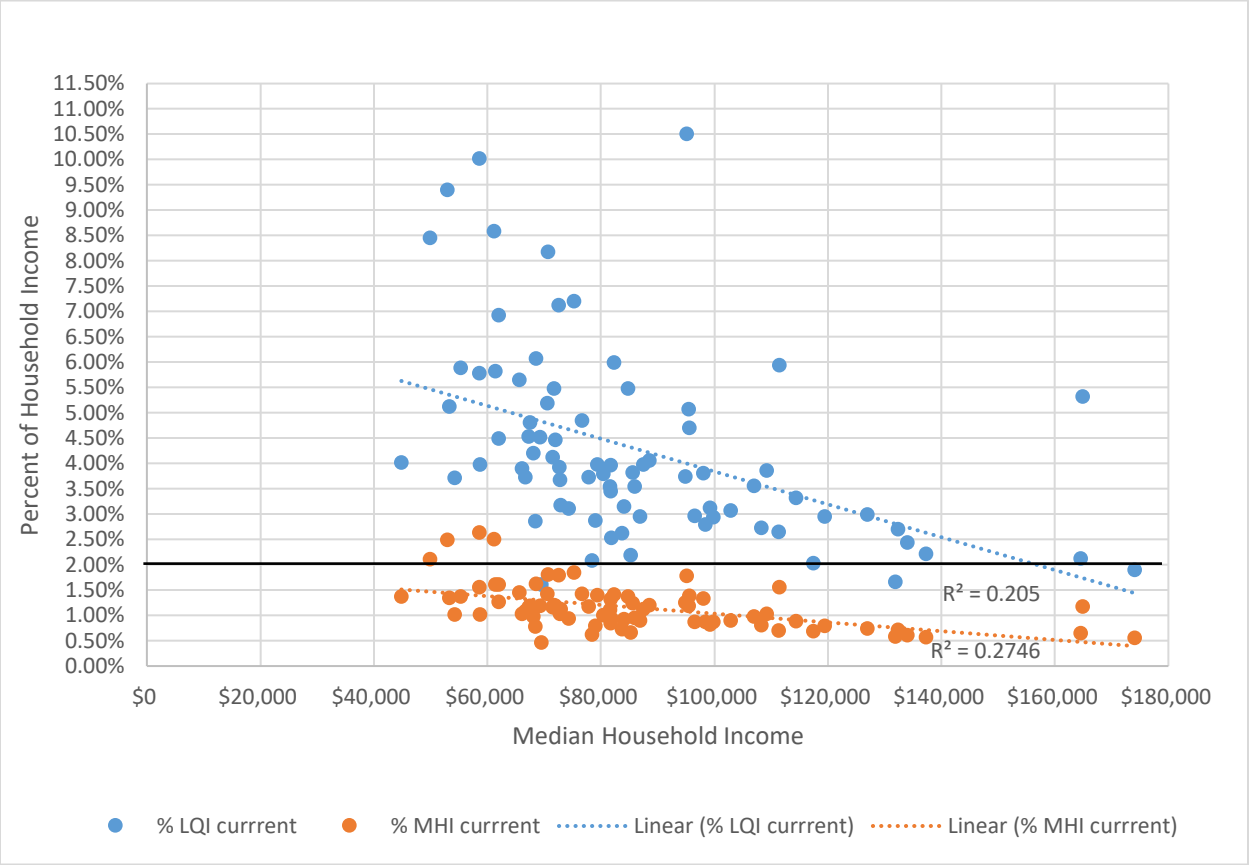


Figure ES-4. Correlation of %MHI and %LQI values to MHI

Recommendations

Our recommendations focus on identifying steps to take toward an equitable and efficient funding pathway for the MWQ IS reduce wastewater nutrient loads strategy. Non-utility public funding can contribute to the provision of a public good, in this case clean water, and help keep utility %MHI values within Ecology's "no hardship" range (below 2 percent of MHI). As funding is limited, this research helps direct available funding towards the places where it is needed most and may be used as efficiently as possible.

Four recommendations that might improve both efficiency and equity outcomes for the available grant and loans monies are:

- Utilize the data from this study to estimate the amount of federal and state capital grant monies would be needed to maintain %MHI or %LQI indices below a specified affordability threshold for individual Puget Sound utilities.
- Investigate the possibility of using the %MHI or %LQI metric in addition to other metrics used to determine financial hardship in Ecology's Grants and Loans Programs.
- Study the feasibility of a regional or state-wide low-income assistance program to aid those with the greatest need. In contrast to providing federal and state monies to pay for nutrient-related capital improvements, which could lower rates for all rate payers, a low-income assistance program would target funds to those households in greatest need of assistance.
- Consider funding a feasibility study to assess the potential benefits of restructuring rates following the model developed by the US Water Alliance's report, *A Promising Water Pricing Model for Equity and Financial Resilience* (Hara and Take 2022).

CONTENTS

TABLES AND FIGURES

LIST OF ABBREVIATIONS

CCWP	Centennial Clean Water Program
CWSRF	Clean Water State Revolving Fund
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FCA	EPA's Financial Capability Assessment
HEAL Act	Healthy Environments for All Act
IS	Implementation Strategy
LQI	Lowest Quintile Household Income
MHI	Median Household Income
MSRC	Municipal Research and Services Center
MWQ	Marine Water Quality
NPDES	National Pollutant Discharge Elimination System
PSNGP	Puget Sound Nutrient General Permit
PSP	Puget Sound Partnership
TIN	Total Inorganic Nitrogen
WAC	Washington Administrative Code
WWTP	Wastewater Treatment Plant

1. INTRODUCTION

This summary report describes methods, reports results, and discusses implications of a wastewater service affordability analysis conducted in support of Puget Sound National Estuary Program Marine Water Quality Implementation Strategy planning efforts. Associated data files and a data description with detailed metadata can be viewed in the companion *Puget Sound Wastewater Service Affordability Analysis Data Collection* (Barber et al. 2022), available at https://digital.lib.washington.edu/researchworks/handle/1773/49467.

Eutrophication is a process that occurs when anthropogenic nutrient inputs promote excessive growth of phytoplankton and macroalgae in water bodies, which can then cascade into other physical, chemical, and biological changes. Symptoms of eutrophication—low dissolved oxygen, loss of submerged aquatic vegetation, changes in nutrient ratios that alter planktonic species composition, and blooms of algae that produce harmful biotoxins—can intensify as the process progresses (Bricker et al. 2007).

In 2018, two regional nutrient management efforts were initiated in response to monitoring data that revealed worrisome trends in Puget Sound's water quality:

- Reporting for the Puget Sound Partnership's (PSP) "Marine Water Quality Vital Sign" implied a progression of eutrophication symptoms.[2] These findings led to development of a Marine Water Quality Implementation Strategy (MWQ IS) to provide a ***non-regulatory*** road map intended to align nutrient management efforts across agencies and programs. It was created using a collaborative process developed by PSP and is being implemented by the Stormwater Strategic Initiative.

- The Washington Department of Ecology's (Ecology) Water Quality Assessment identified 102 waterbody segments in Puget Sound that don't meet marine dissolved oxygen Water Quality Standards (i.e., they were placed on the 303(d) list of impaired waterbodies). As a result, Ecology began the Puget Sound Nutrient Reduction Project as a ***regulatory*** process to quantify needed pollutant reductions and identify management actions necessary to bring impaired waters back into compliance with the state's legally enforceable water quality standards.

Wastewater treatment plants (WWTPs) are the largest anthropogenic source of nutrients to Puget Sound and were therefore an early focus of both nutrient management efforts. Since most WWTPs in the region do not currently utilize advanced nutrient removal technologies, without facility upgrades nitrogen loading will continue to increase as the region's population grows. In 2021, Ecology issued a Puget Sound Nutrient General Permit (PSNGP) requiring operators of facilities that discharge into Puget Sound marine waters to begin long-term planning for upgrades that would be needed to comply with total inorganic nitrogen (TIN) numeric effluent limits expected in future PSNGP cycles.

[2] See PSP (2020) for the latest update on this recently replaced set of metrics.

WWTP upgrades needed to reduce TIN loading as population grows will be expensive. Capital costs associated with adding advanced nutrient removal technologies to all the municipal WWTPs subject to the PSNGP are likely to exceed $2 billion, based on a preliminary economic evaluation of potential nutrient limits by Ecology and Tetra Tech (2011) escalated to 2022 dollars. The MWQ IS identified current funding levels as a barrier to WWTP upgrades and recommended development of a funding pathway strategy to encourage alignment of federal, state, and local funding sources.

1.1 Critical Analysis Purpose

Critical analyses are a component of the Puget Sound National Estuary Program's implementation strategies (IS) framework. During development of these strategies, participants identify uncertainties that limit understanding of problems and potential solutions related to regional recovery targets. These uncertainties are catalogued by Puget Sound Institute. Each year some Environmental Protection Agency (EPA) and PSP implementation strategy assistance agreement funding is allocated for "critical analysis" to answer key questions with a targeted data collection and analysis effort.

This critical analysis was initiated because participants in the IS development process expressed concerns about the impact of costly upgrades on ratepayers. Northern Economics (2019) similarly raised questions about equitable distribution of nutrient reduction costs, and potential political implications if a subset of the region's population is to bear a disproportionate share of costs needed to achieve public benefits enjoyed by all residents. In addition, Kinney et al. (2021) and Kinney et al. (2023) had documented existing water utility service affordability challenges in the region. Since nutrient reduction upgrades have the potential to exacerbate existing affordability issues, additional data collection/analysis was recommended.

Results of this analysis are intended to inform and contribute to the discussion of how to "develop a funding pathway" strategy in the MWQ IS. Choices made about how the region is to pay for WWTP upgrades may have implications for growth management as well as equity outcomes receiving greater attention due to the White House's Justice40 Initiative and Washington's Healthy Environment for All (HEAL) Act. We hope this analysis can support development of funding strategies that improve water quality while minimizing unintended consequences for other elements of Puget Sound's socioecological system.

1.2 Critical Analysis Approach

We approach the analysis in two steps. First, we estimate and analyze the financial impact that sewer bills have on Puget Sound communities and households with municipal sewer service. Second, we discuss ways the impact analysis results could be used to develop a funding pathway strategy for the MWQ IS, specifically focused on the potential to improve economic efficiency and equity outcomes.

Sewer Bill Impact Analysis

The impact analysis answers two questions:

- How affordable are current sewer service costs in the Puget Sound region?
- How does affordability change when projected rate increases attributable to PSNGP-required upgrades are added to current service costs?

We assessed **"affordability"** by calculating sewer service costs for single family residential households as a percentage of Median Household Income (MHI) and Lowest Quintile Income (LQI). There is no single universally accepted threshold for water utility affordability, but consistent with existing literature and practice we flag results above 2% as relatively less affordable. **A %MHI value exceeding 2% begins to raise concerns at the utility/community scale and a %LQI value exceeding 2% is a potential red flag for individual households.** These generalizations were derived from two sources:

- EPA Financial Capability Assessment Guidance considers %MHI in combination with other factors when determining implementation schedules for control measures needed to meet Clean Water Act regulatory obligations.[3] Past EPA (2014) guidance suggested that wastewater costs exceeding 2% of MHI have a **"high impact"** on residents. Reliance on MHI as a measure of affordability was criticized because it understates financial impacts to low-income households (Congressional Research Service 2017, Teodoro 2018). EPA (2022a) responded by proposing new indicator metrics that incorporate LQI in their revised financial capability assessment guidance.
- WAC 173-98-300 4(b) and WAC 173-98-320 delineate three categories of **"hardship"** for Ecology to use when determining interest rates and forgivable principal eligibility for clean water loans. Moderate hardship occurs when %MHI is above <2% but less than 3%; elevated hardship is defined as %MHI between 3% and 5%; and severe hardship occurs when %MHI is above 5%.

Funding Strategy Discussion

Next, we discuss how the sewer bill impact analysis data and results could contribute to the development of a funding strategy for the MWQ IS. There is little debate that the needed nutrient-related capital infrastructure upgrades are costly and the demands for capital funds, whether from local, state, or federal sources, are limited. We focus our discussion on how the results of the impact analysis could help maximize the efficiency of state grant and loan

[3] EPA points out that their Financial Capability Assessment "is not a methodology for defining water affordability." **In this report we use the umbrella term "affordability" to encompass the general idea that water rates may be a financial burden on some households and utilities may face hardship when some of their ratepayers are unable to pay their bills.** As EPA points out, we do not intend to infer that the rates are unreasonable for the level of environmental protection that they offer.

spending, where efficiency is measured as prioritizing financial assistance to utilities and/or households with the greatest need.

The funding strategy discussion includes a brief background on the history of federal investment in water infrastructure and continues with a description of the state's grant and loan programs, specifically focused on prioritization methods. The prioritization discussion provides a basis to consider using the results of this study to improve the efficiency and equity of future grant funding.

Specifically, two potential equity issues are:

- Concerns over a subset of the region's population incurring a large portion of the expenditures needed to achieve broad public benefits.
- Whether increasing sewer rates cause lower income households to pay a disproportionate share of their incomes on sewer bills.

At the conclusion of the funding strategy discussion, we list recommendations and potential next steps.

2. SEWER BILL IMPACT ANALYSIS

The impact analysis describes the methods used to estimate the utility-specific %MHI and %LQI metrics for current and potential PSNGP-related sewer bills as well as data limitations we encountered during the analysis. We conclude the impact analysis with a description of the results. Additional information about data sources and analysis methodology can be found in the study's data collection (Barber et al. 2022).

2.1 Methods

Here we summarize the data compilation and analysis steps taken to estimate current and PSNGP-adjusted annual sewer service costs and income metrics used to calculate %MHI and %LQI.

2.1.1 Utilities Impacted by Puget Sound Nutrient General Permit

The first step was to identify all utilities[4] directly and indirectly affected by PSNGP requirements. The list of WWTP operators covered by the permit (the permittees) was obtained from Ecology (2021a and 2021b). Forty utilities operate 58 municipal WWTPs that discharge directly to Puget Sound marine waters. These utilities are directly impacted by the PSGNP because they operate the facilities that will need to be upgraded to comply with expected future TIN effluent limits.

Several permittees are wholesale providers of treatment services to neighboring utilities that do not own and operate a WWTP. The permittee charges wholesale customers a uniform rate to cover treatment costs (capital, operations, maintenance). The wholesale customer is also a retailer that bills their customers for the wholesaler's services plus the cost to operate their local collection systems (e.g., pipelines and pump stations) and convey wastewater to the wholesaler's system. These 43 utilities are impacted indirectly by the PSNGP, as they do not have to invest in treatment options, however the contract rates they pay for treatment services will likely increase. The total number of utilities that will be affected by the PSNGP is nearly twice the number of permittees.

King County is an example of a regional entity that owns/operates WWTPs and contracts treatment services to 29 local utilities. King County does not bill individual property owners; each of the 29 local utilities that King County provides services are the entities that bill individual customers. Because each of these local utilities have a unique rate structure and set their individual rates, this study calculated %MHI and %LQI for each of the local utilities.

[4] Wastewater/sewage services in the region are provided by a mix of county or municipal governments, Special Purpose Districts, and Public Utility Districts. For simplicity, we call all these different types of service providers sewer utilities.

In total this study estimated sewer bills and utility-specific household incomes for 80 Puget Sound municipal sewer utilities.[5] State agency permittees (Department of Corrections, Washington State Parks) and non-municipal customers (Washington State Ferries, Puget Sound Naval Shipyard, Ft. Warden, Manchester Naval Fuel Depot, and Tribes) were excluded from the study. Appendix A lists the permitee and the utility district to which they provide treatment services.

2.1.2 Monthly Sewer Service Cost

CURRENT COST

We estimated monthly sewer bills for 80 utilities in Puget Sound. Rate data was obtained from the utilities' webpages. Two assumptions were used to estimate the monthly sewer bills for each utility. First, the rates are based on a ¾" residential pipe size. Second, where a variable rate was charged based on water usage, the usage was assumed to be a constant 5.5 ccf per household per month across all utilities. Assuming a constant usage rate allows for comparisons across rates that are solely based on the variable rate and not a difference in water usage. For a detailed description of the calculations see Barber et al. (2022).

The project team emailed utilities that utilize a variable rate structure, where bills are based entirely or partially on the volume of water used, to verify the estimated rates. Of 26 utilities contacted, we received responses from 12 (46% response rate). Minor corrections to our initial estimates were made where errors were identified by utilities.

PSNGP-ADJUSTED COST

In addition to estimating the current sewer bills, we also estimated potential sewer rates once PSNGP-required upgrades are added to current sewer rates. We added estimates of the nutrient-related increase in sewer rates (Table 1), published in *Technical and Economic Evaluation of Nitrogen and Phosphorus Removal at Municipal Wastewater Treatment Facilities,* (Ecology and Tetra Tech 2011) to our estimates of current sewer rates to arrive at these PSNGP-adjusted sewer costs.

Ecology and Tetra Tech (2011) show the estimated increase in monthly sewer rates for 4 different potential nitrogen effluent limits in 2010 dollars, which are displayed in Table 1. We choose to project costs for the most (<3 mg/L TIN year-round) and least (<8mg/L dry-season) stringent limits, which coincide with the most and least expensive upgrade scenarios, to provide an idea of the full range of potential impacts on sewer bills. We adjusted the estimates to 2022 dollars using the US Producer Price Index for Construction Materials.[6]

[5] We identified 89 municipal sewer utilities the discharge into Puget Sound marine waters, however only 80 are included in the study because we were unable to find service area maps or sewer rates for 9 utilities.

[6] Federal Reserve Bank of St. Louis, Economic Research, PPI by Commodity: Special Indexes: Construction Materials.

It bears mentioning that the PSNGP-adjusted sewer rates assume utilities will pay the full amount of the necessary upgrades without state or federal grants.[7] Thus, the nutrient adjusted sewer rates may be overstated if significant grant funding is made available. At the same time, the estimated upgrade costs may be understated. The expected accuracy range of the estimated monthly rate increases was +100 percent to – 50 Percent (Tetra Tech, 2011). Additionally, our PSNGP-adjusted sewer rates do not account for any other increases in service costs required for any other type of planned upgrades, for example to replace aging infrastructure. Actual future sewer costs will be even higher than our PSNGP-adjusted rates. A reminder that this analysis, the first of its kind, is intended to estimate the potential magnitude of impacts the PSNGP may have on Puget Sound utilities and households in the absence of significant new sources of state or federal funding.

Table 1. Estimated Monthly Household Sewer Rate Increase For Nutrient Removal of Puget Sound Water Resource Inventory Areas, Adjusted to 2022 dollars.

	TIN <8mg/L year-round	TIN <3 mg/L year-round	TIN <8 mg/L dry season	TIN <3 mg/L dry season
2010 (a)	$ 16.00	$ 19.48	$ 9.43	$ 11.41
2022 (b)	$ 29.05	$ 35.36	$ 17.12	$ 20.71

Sources: (a) Table ES-3 in *Technical and Economic Evaluation of Nitrogen and Phosphorus Removal at Municipal Wastewater Treatment Facilities* (Ecology and Tetra Tech 2011) (b) Costs adjusted by factor of 182 percent based on PPI by Commodity: Special Indexes, Construction Materials.

2.1.3 Household Income

Household income and population data was obtained from the 2019 U.S. Census Bureau American Community Survey (ACS). The lowest geographic unit for which household income by quintile and population data is available is the Census Tract. We downloaded data associated with 941 unique census tracts for the twelve Puget Sound counties.

Census tracts were corresponded to sewer district boundaries or city boundaries where utilities are operated by municipalities. This allowed us to estimate a population-weighted income for each of the 80 local wastewater service providers in the study. The full database is available open access via UW libraries (see Barber et al. 2022).

[7] This assumption is based on the methodology described in Tetra Tech and Ecology's 2010 report entitled Technical Evaluation of Nitrogen and Phosphorus Removal at Municipal Wastewater Treatment Facilities, 2011. See Section 17.2 that describes how the weighted average monthly household sewer rate increase for nutrient removal upgrades was calculated.

2.1.4 Affordability Metrics

Using the numerators (estimated sewer bills) and denominators (estimated utility-specific household income) generated in the previous steps, we calculated six affordability metrics for each of the 80 utilities in the study:

- Current annual sewer service cost as a percent of MHI
- Current annual sewer service cost as a percent of LQI
- Annual cost of sewer service with a year-round 3 mg/L TIN limit as a percent of MHI
- Annual cost of sewer service with a year-round 3 mg/L TIN limit as a percent of LQI
- Annual cost of sewer service with a seasonal 8 mg/L TIN limit as a percent of MHI
- Annual cost of sewer service with a seasonal 8 mg/L TIN limit as a percent of LQI

Results were evaluated based on their value relative to the commonly applied 2% benchmark.

2.2 Data Limitations

The geographic scale of this evaluation is broader than an individual utility would undertake for a financial capability assessment. Results represent a snapshot in time and are intended to inform development of a regional-scale funding strategy. Here we provide a list of potential sources of error that should be considered when using this data and/or our analysis results. A more detailed description of the assumptions and the impacts that these assumptions had on our estimates can be found in Barber et al. (2022).

- Not all Puget Sound region households are included in the study. PSNGP-impacted utilities discharge directly to Puget Sound marine waters. WWTPs that discharge to rivers that flow into Puget Sound are not included. Likewise, on-site sewage treatment (septic systems) and utilities that discharge via groundwater are not included. Multifamily households were excluded from the analysis due to the differences in the ways utilities and building managers sub-meter and bill individual units.
- Corresponding the census tracts to utility district service areas required several assumptions that resulted in a lower level of confidence about than we would have liked.
- Households that use on-site sewage treatment (septic systems) but are located within the service area boundaries of a wastewater utilities were not excluded when calculating the Median Household Income and Lowest Quintile Income for those utilities.
- Our 5.5 ccf/month (4,114 gallons) water usage assumption does not explicitly include consideration of household size and seasonal variation. We decided to calculate service costs based on a standardized usage, rather that collecting data on actual usage, so that cost estimates were normalized to enable direct comparison. The standardized usage we

selected is based on a commonly applied estimate of average winter quarter usage in the region (D. Thompson, City of Tacoma Wastewater Operations Division Manager, pers. comm.). Using a rainy season average excludes outdoor/irrigation use thereby more closely approximating the generally accepted "basic use" estimate of 50 gallons per capita per day (gpcd) (approximately 6.6 ccf). Several utilities contacted to verify our service cost calculations responded that their actual annual average household usage volume was higher than 5.5 ccf/month.

- Some service providers incorporate state and local utility taxes into their rates, and some do not. We used published rates and did not account for inclusion/exclusion of taxes.
- More recent estimates of potential PSNGP compliance costs (e.g., Brown and Caldwell 2020) indicate that cost estimates provided in Ecology and Tetra Tech (2011) are very low, even adjusted to 2022 dollars.

2.3 Results

2.3.1 Utilities Impacted by the PSNGP

See Appendix A for a list of the sewer utilities included in the study. The list includes 85 utilities, 80 of which were included in the study. Five utilities were excluded because we were unable to locate a detailed map of the provider's service area or the district's web page did not report sewer rates. Two utilities, King County and LOTT, are exclusively wholesalers that do not bill any households for sewer treatment services.

2.3.2 Monthly Sewer Service Cost

Figure 1 shows our estimates for current monthly sewer bills of 80 local sewer providers. Current estimated monthly sewer cost ranges from $26.55 per month to $161.21 per month. The average across all 80 utilities was $78.36 per month with a standard deviation of $23.91. As discussed in Section 2.1.2, these costs assume 5.5 ccf of water usage for the 25 utilities with rates based on volume of water used. The remaining 55 utilities utilize a flat rate structure.

Figure 2 shows our estimates for potential future PSNGP-related sewer bills of 80 local sewer districts. The two PSNGP-related sewer bills were calculated by adding $17.12 (8mg/L seasonal scenario) and $35.36 (3mg/L year-round scenario) to estimated current sewer bills. Potential future PSNGP-adjusted monthly sewer bills associated with the 8mg/L seasonal scenario range from $43.76 per month to $178.33 per month. Potential future PSNGP-adjusted monthly sewer bills associated with the 3mg/L year-round scenario range from $62.01 per month to $196.57 per month.

This large range of estimated monthly sewer bills was curious but beyond the scope of this study to attempt to explain. A possible future study could attempt to correlate costs to factors such as number of connections, topography, underlying geology, length of pipes, number of pump stations, location (e.g., island), existing removal nutrient technology, etc.

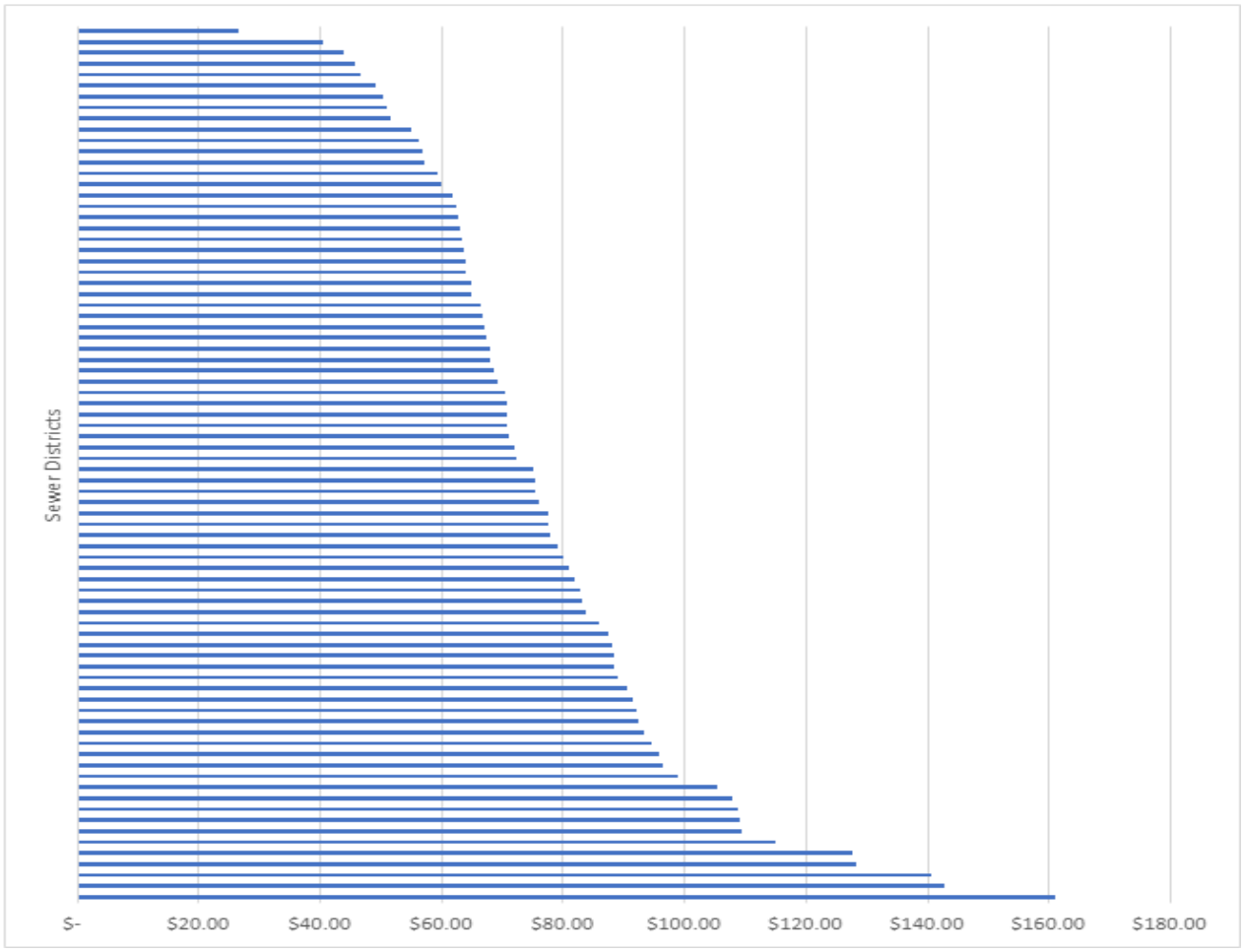


Figure 1. Estimated Current Monthly Sewer Service Costs, 80 Puget Sound Utilities

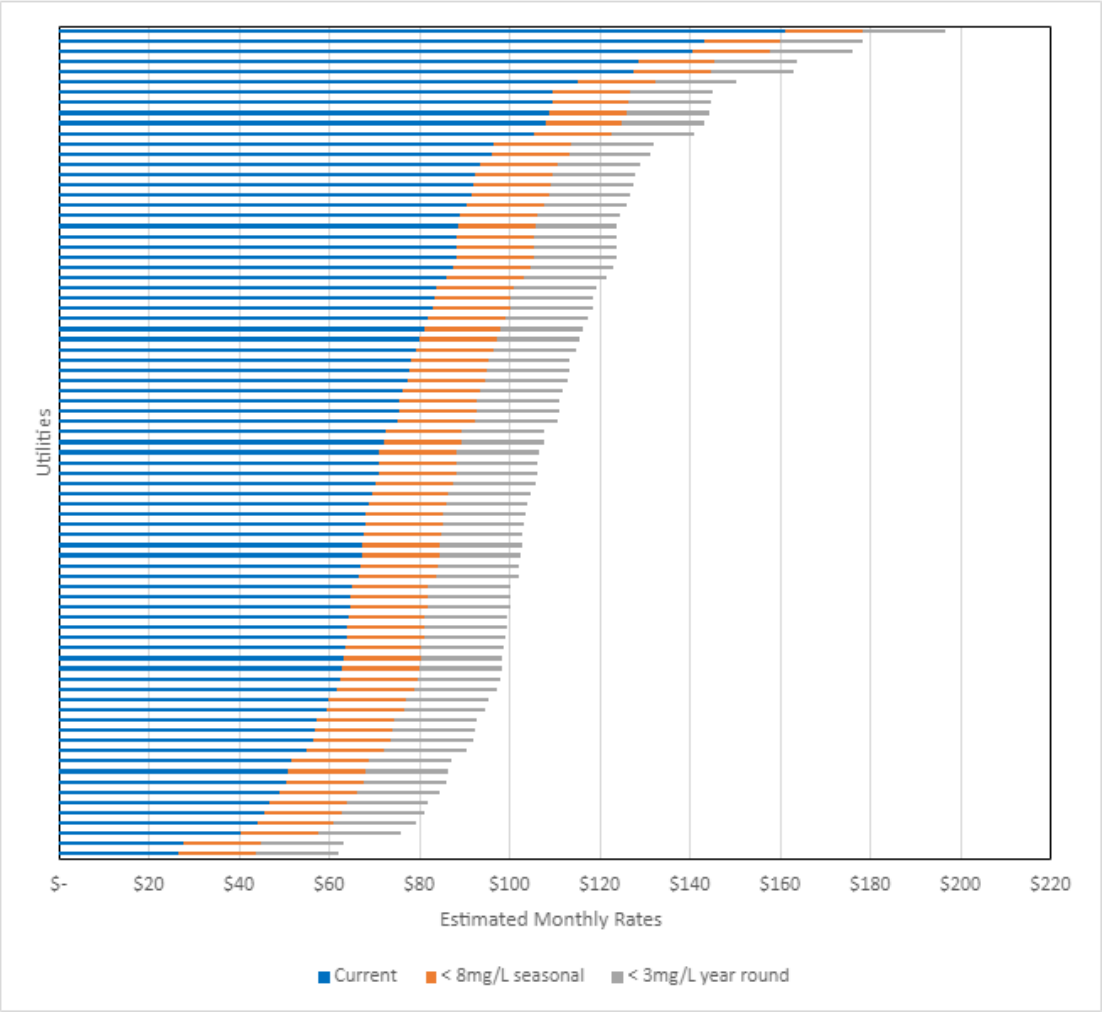


Figure 2. Estimated PSNGP-Related Monthly Sewer Service Costs, 80 Puget Sound Utilities

2.3.3 Household Income

Figure 3 shows estimated MHI and LQI in the service areas of 80 local wastewater providers. MHI ranges from a low of $44,844/year to a high of $174,078/year, with an average of $86,323/year. The estimated LQI ranges from a low of $12,425/year to a high of $50,831/year, with an average of $23,953/year. In general, the LQI is approximately 30 percent of the MHI, illustrating the extent of income disparity in the Puget Sound region (Figure 4).

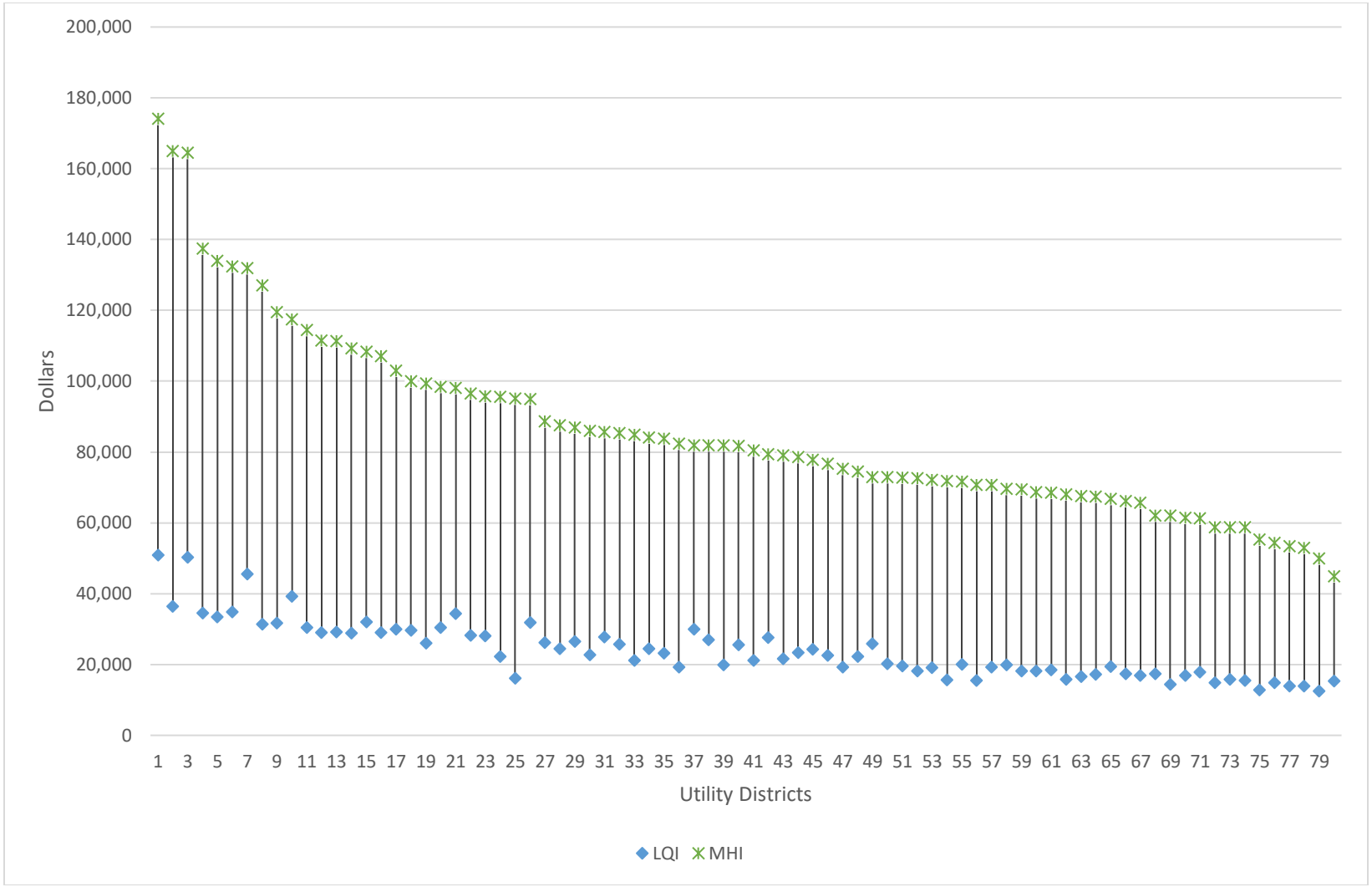


Figure 3. Estimated Household Income for 80 Puget Sound Sewer Utilities, 2020 dollars

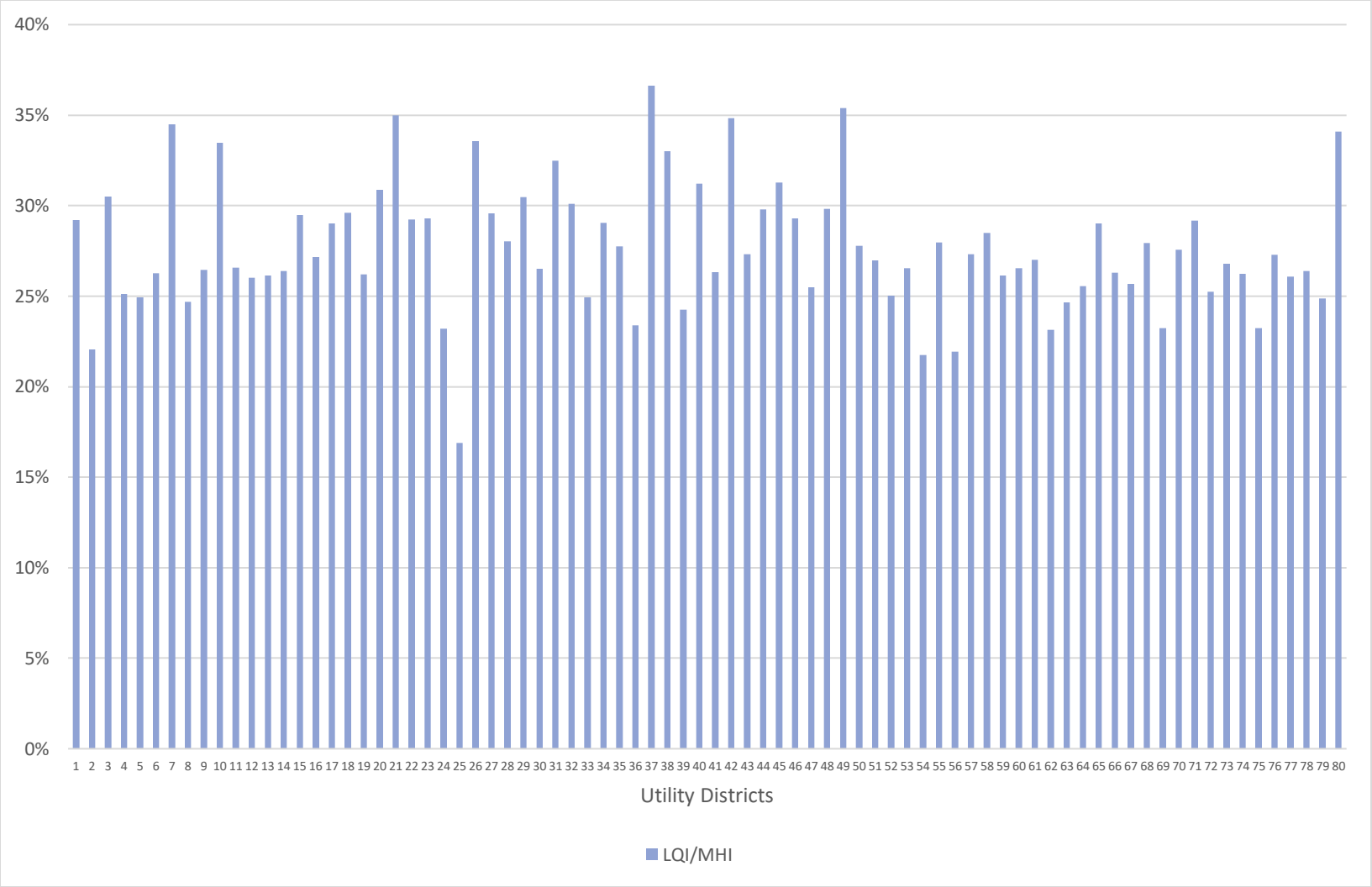


Figure 4. Lowest Quintile Income as a Percent of Median Household Income for 80 Puget Sound Sewer Utilities, 2020 dollars

2.3.4 Indicators of "Affordability"

The %MHI and %LQI results were calculated by dividing the estimated sewer costs by the utility specific MHI and LQI, respectively. Two sets of %MHI values and %LQI values were estimated, one set for current sewer costs and a second set for PSNGP-adjusted sewer costs.

Estimated %MHI and %LQI results for current sewer costs are shown in Figure 5. Values range from 0.5 %MHI to 2.6 %MHI, averaging 1.2 %MHI. These values suggest current rates are reasonably affordable when calculated using MHI. However, the %LQI results indicate sewer service costs are burdening low-income households. %LQI values range from 1.6 %LQI to 10.5 %LQI. This wide disparity in index values demonstrates one reason EPA's FCA guidance document includes utilizing LQI in some metrics. For reference, the US Economic Research Service reports that in 2021, U.S. consumers spent an average of 10.3 percent of their disposable personal income on food.

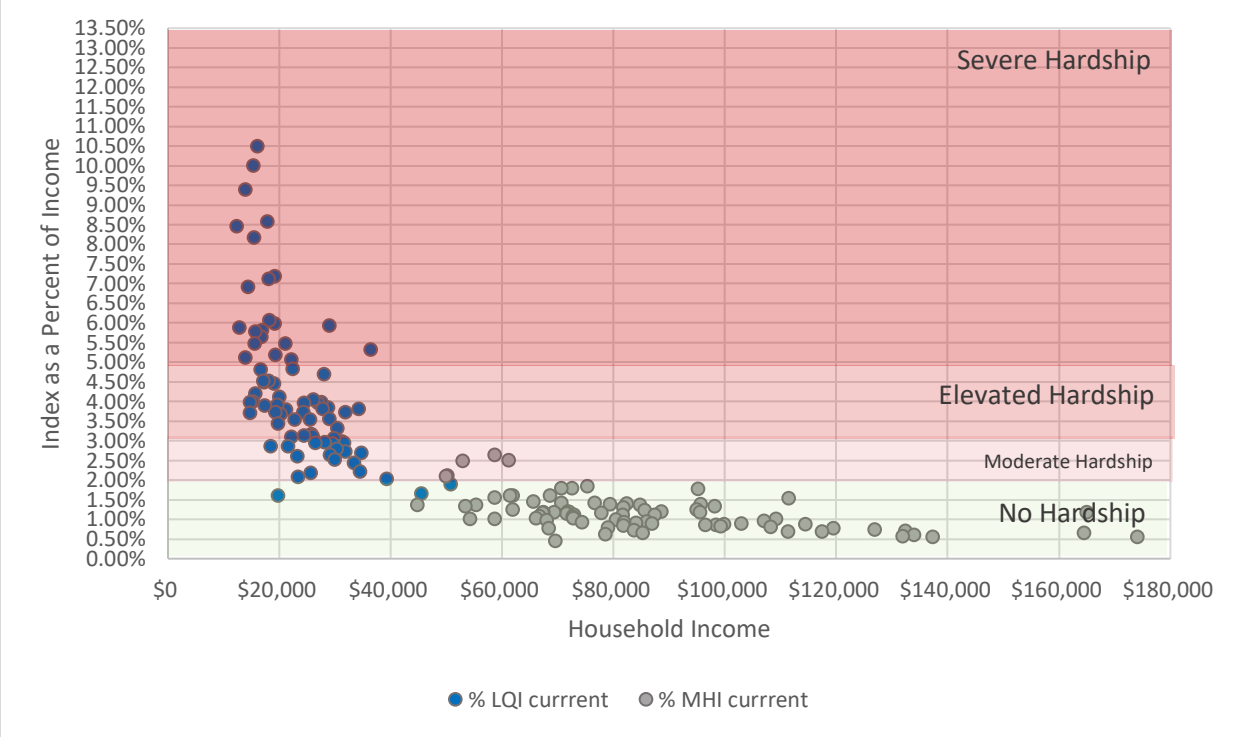


Figure 5. %MHI and %LQI Values Using Estimated Current Sewer Costs for 80 Puget Sound Sewer Utilities, 2020 dollars

The summary information presented in Figure 5 demonstrates several areas of potential concern. First, the scatter plot demonstrates the income disparity in Puget Sound, even between MHI and LQI. Where MHI ranges from approximately $40,000 to a high of $180,000. Whereas LQI range is much narrower, with the majority of households around $20,000 LQI. Second, current sewer rates may not have a high impact on Puget Sounds' household's budget using MHI, however sewer bills do have a relatively high impact, or create hardship, on low-

income households. The next question to address is how might PSNGP-adjusted sewer rates impact households? This question and a detailed description of the both sets of indices (the %MHI and the %LQI) using both current and nutrient-adjusted sewer rates are discussed below.

CURRENT AND PSNGP-ADJUSTED COSTS AS A PERCENT OF MHI

The utility-specific %MHI values using current sewer rates are less than two percent in 76 of the 80 Puget Sound sewer utilities included in the analysis (Table 2). The %MHI values range between 0.46 percent of MHI and 2.63 percent of MHI, with an average of 1.16 percent of MHI, and a standard deviation of 0.44. These results indicate that for most utilities in the region current sewer costs are not high impact or causing hardship as defined by EPA and Washington State, respectively.

However, estimated %MHI values using PSNGP-adjusted sewer rates suggest that over 20 percent of Puget Sound utilities' sewer bills would cause hardship to their rate payers, absent federal or state investment in nutrient reduction upgrades (Table 2). %MHI values were estimated for two potential regulatory scenarios: <8.0mg/L TIN during dry season-only, and <3.0mg/L TIN year-round. These two scenarios bookend the potential sewer rates increases, representing both the least expensive (<8.0mg/L TIN) and most (<3.0mg/L TIN) expensive approaches to nutrient reduction.

Under the 8.0mg/L TIN scenario, 8 utilities (10%) have %MHI values greater than two percent and less than 3 percent of MHI. This %MHI range is defined by Ecology as "moderate hardship." EPA considers %MHI above 2.0 percent as high impact. The %MHI values range from 0.67 percent of MHI to 2.98 percent of MHI.

Under the 3.0mg/L effluent limit scenario, 18 utilities (23%) exceed the 2% affordability benchmark. Three of those utilities have %MHI values in the "elevated hardship" range. The %MHI values range from 0.80 %MHI to 3.35 %MHI.

In summary, the range of %MHI values indicate that current sewer bills cause moderate hardship on households served by 4 (5% of the total) Puget Sound utilities. Absent additional state or federal funding, PSNGP-required upgrades could cause moderate to severe hardship for 18 of the 80 Puget Sound sewer utilities.

Table 2. Summary of Current and PSNGP-Adjusted %MHI Values

Metric	Current	PSNGP-Adjusted (a)	
		< 8.0mg/L TIN dry season	< 3.0mg/L TIN year round
Total number of districts/utilities	80	80	80
Moderate Hardship, (e.g. index > 2.0 % and < 3%)			
Number of utilities	4	8	15
Percent of utilities	5.0%	10%	19%
Elevated Hardship, (e.g. index > 3.0 % and < 5%)			
Number of utilities	0	0	3
Percent of utilities	0.0%	0.0%	4.0%
Severe Hardship, (e.g. index > 5.0 %)			
Number of utilities	0	0	0
Percent of utilities	0.0%	0.0%	0.0%
Minimum %MHI value	0.46%	0.67%	0.80%
Maximum %MHI value	2.63%	2.98%	3.35%
Average %MHI value	1.16%	1.41%	1.69%
Std Deviation	0.44%	0.49%	0.54%

(a) **Nutrient-adjusted rates estimated using data from Technical and Economic Evaluation of Nitrogen and Phosphorus Removal at Municipal Wastewater Treatment Facilities. Publication 11-10-060, WA Dept of Ecology and Tetra Tech, 2011.**

(b) **See the Data Limitations section of the analysis for a discussion on the limitations of the population data**

Source: Barber, A., K. Bogue, S. Burke, N. Jo, and A. Kinney. 2022. Puget Sound Wastewater Service Affordability Analysis Data Collection [Data files]. 1st Version. Prepared by College of Business and Economics, Western Washington University; ECO Resources Group; and Puget Sound Institute, University of Washington Tacoma. Distributed by ResearchWorks, University of Washington Libraries.

Figure 6. presents a scatter plot of current and estimated nutrient-adjusted %MHI values and delineates the 2.0 percent benchmark for EPA's high impact and Ecology's hardship metric. The %MHI values are plotted against household income for all 80 utilities in the study, showing a correlation between higher income households and lower %MHI values (i.e., there are more utilities with higher %MHI at the low end of the MHI axis). However, the correlation is not as strong as might have been expected. For example, there are utility districts below $60,000 MHI and that still have %MHI values below 2.0% and there are utility districts above $60,000 MHI that have %MHI values above 2.0 percent. This suggests that using an MHI metric to prioritize grant funds may provide money to districts that need it less than another district with a higher %MHI value. This finding is addressed in more depth in Section 5, Implications for MWQ IS.

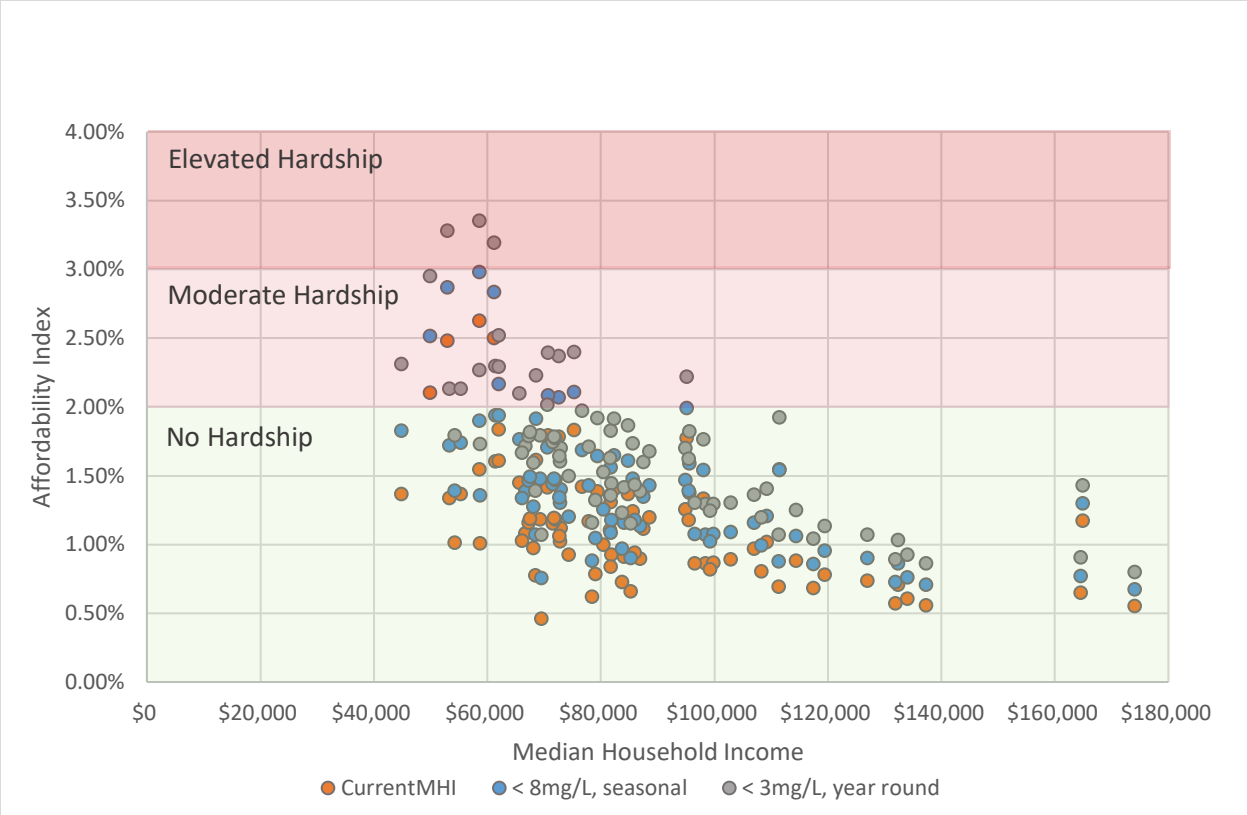


Figure 6. Estimated current and nutrient-adjusted utility-district specific %MHI

CURRENT AND PSNGP-ADJUSTED COSTS AS A PERCENT OF LQI

77 of the 80 Puget Sound sewer utilities had values exceeding 2%LQI (Table 3). 19 utilities' %LQI values were between 2% and 3%; 35 utilities' %LQI values were between 3% and 5%; and 23 utilities' %LQI values were above 5%. Current %LQI values range from 1.97% LQI to a high of 10.5% LQI, with an average of 4.4%LQI and a standard deviation of 1.97.

These estimated %LQI values suggest that approximately twenty percent of Puget Sound households served by a sewer utility are paying on average approximately 4.4% of their income on sewer bills. The lowest quintile of households in this study may spend almost half of a households' estimated food budget (per ERS 2021) on sewer bills.

Table 3. Summary of Current and PSNGP-Adjusted %LQI Values

Metric	Current	PSNGP-Adjusted (a)	
		< 8.0mg/L TIN dry season	< 3.0mg/L TIN year round
Total number of districts/utilities	80	80	80
Index > 2.0 % and < 3%			
Number of utilities	19	8	3
Percent of utilities	24.0%	10%	4%
Index > 3.0 % and < 5%			
Number of utilities	35	37	23
Percent of utilities	44.0%	46.0%	29.0%
Index > 5.0 %			
Number of utilities	23	35	54
Percent of utilities	29.0%	44.0%	68.0%
Minimum %LQI value	1.61%	2.80%	3.44%
Maximum %LQI value	10.50%	11.78%	13.14%
Average %LQI value	4.38%	5.47%	6.52%
Std Deviation	1.86%	2.05%	2.27%

(a) **Nutrient-adjusted rates estimated using data from Technical and Economic Evaluation of Nitrogen and Phosphorus Removal at Municipal Wastewater Treatment Facilities. Publication 11-10-060, WA Dept of Ecology and Tetra Tech, 2011.**

(b) **See the Data Limitations section of the analysis for a discussion on the limitations of the population data**

Source: Barber, A., K. Bogue, S. Burke, N. Jo, and A. Kinney. 2022. Puget Sound Wastewater Service Affordability Analysis Data Collection [Data files]. 1st Version. Prepared by College of Business and Economics, Western Washington University; ECO Resources Group; and Puget Sound Institute, University of Washington Tacoma. Distributed by ResearchWorks, University of Washington Libraries.

All PSNGP-adjusted costs had %LQI values above 2.0%. Under the 8.0 mg/L scenario, 8 utilities' %LQI values are between 2 percent and 3 percent of LQI; 37 utilities' %LQI values are between 3 percent and 5 percent; and 35 utilities' %LQI values are above 5 percent of LQI. Under the 3.0mg/L scenario, 3 utilities' %LQI values are between 2 percent and 3 percent of LQI; 37 utilities' %LQI values are between 3 percent and 5 percent; and 54 utilities' %LQI values are above 5 percent of LQI.

For the 8.0mg/L scenario, %LQI values range between 2.8 percent of LQI and 11.8 percent of LQI with an average of 5.47 percent of LQI. Under the 3.0mg/L scenario, %LQI values range from 3.4 percent of LQI to 13.1 percent of LQI, with an average %LQI of 6.5 percent of LQI.

Figure 7 presents a scatter plot of current and PSNGP-adjusted %LQI values. The %LQI values are plotted against household income for all 80 utilities in the study, showing a correlation between higher income households and lower %LQIs, e.g. there are more utilities with higher %LQIs at the low end of the LQI axis.

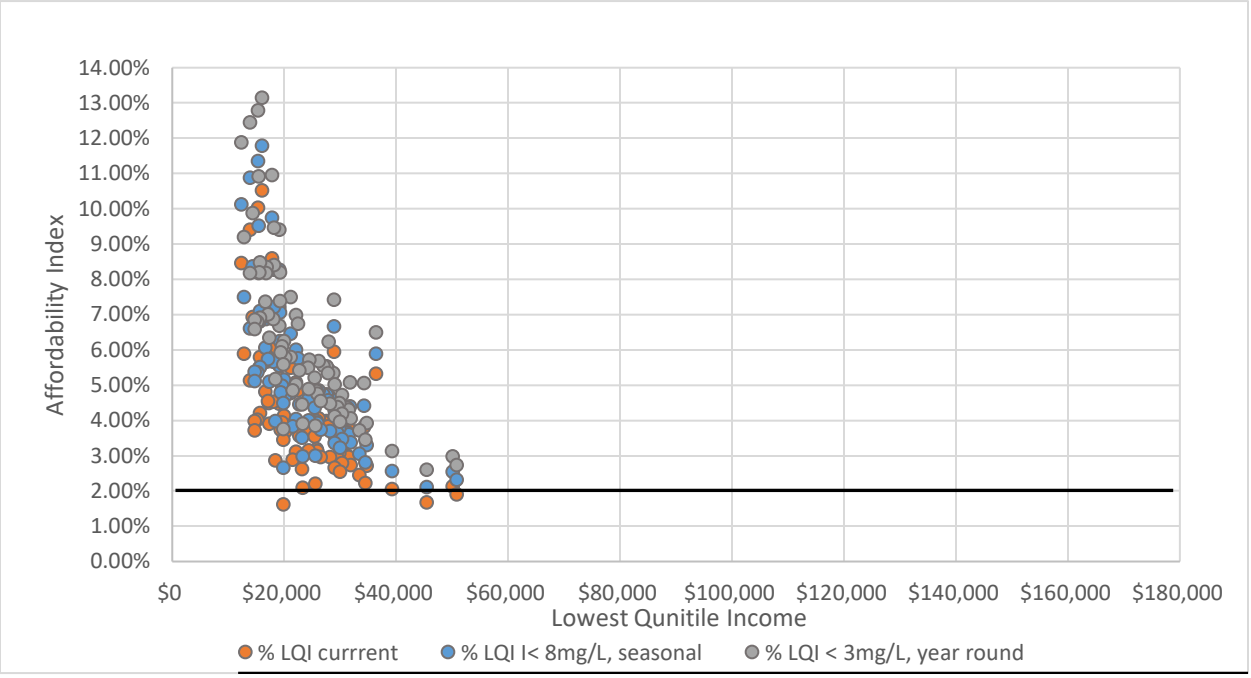


Figure 7. PSNGP-adjusted service cost as %LQI

3. FUNDING STRATEGY DISCUSSION

The findings of the impact analysis may help inform policy in in two areas:

- **Funding of public benefits**: Some industry experts and resource managers argue that sewer services provide a public benefit. We discuss this concept and the potential concern over a subset of the region's population incurring a large portion of the expenditures needed to achieve those public benefits.

- **Environmental justice/equity consequences**: Utility bills are regressive in nature and cause lower income households to pay a disproportionate share of their incomes on sewer bills. We discuss this issue using the findings of the impact analysis.

Both potential concerns are well described by the US Water Alliance in a recent publication (Hara and Take 2022) which states (emphasis added):

> For every community in our country, the availability of **wastewater services is a precondition for public health and prosperity. It is in our collective national interest** that everyone has access to clean water and sanitation. Yet, the reality is that maintaining and operating water systems is incredibly costly, **and both people who cannot pay water bills and utilities who cannot cover costs** can face severe consequences…

Lastly, we close with a discussion of implications this study has for the MWQ IS funding strategy and potentially for the Land Development and Cover IS.

3.1 Funding the Public Benefit of Sewer Services

Sewer Services as a Public Good

Some categories of public goods, like public education systems are funded in ways that aim to accrue and distribute the benefits of those goods to all people. For example, higher education, for which the student pays a portion of the cost, is subsidized through student loans, acknowledging the benefit to society of a well-educated population. To the extent that some of the benefits of wastewater services accrue to the public, an argument can be made for public funding for a portion of the costs of providing those services.

When public benefits do not receive appropriate levels of public funding the consequences can be under production of the public good, in this case clean water. And public funding for water infrastructure has been complicated by the fact that the federal government's funding has not kept pace with the need. The US Water Alliance estimates that, at the national level, in 2019 the gap between spending from all sources and investment needs as $81 billion (US Water Alliance, undated). This gap in federal funding places added pressure on local and state governments to bridge the gap and increases the urgency to distribute available funds to utilities with the greatest need and equity concerns (see Box 1). And the standard locally reliant utility revenue model is a precarious way to fund essential public goods that benefits more than just rate payers (Beecher, 2020).

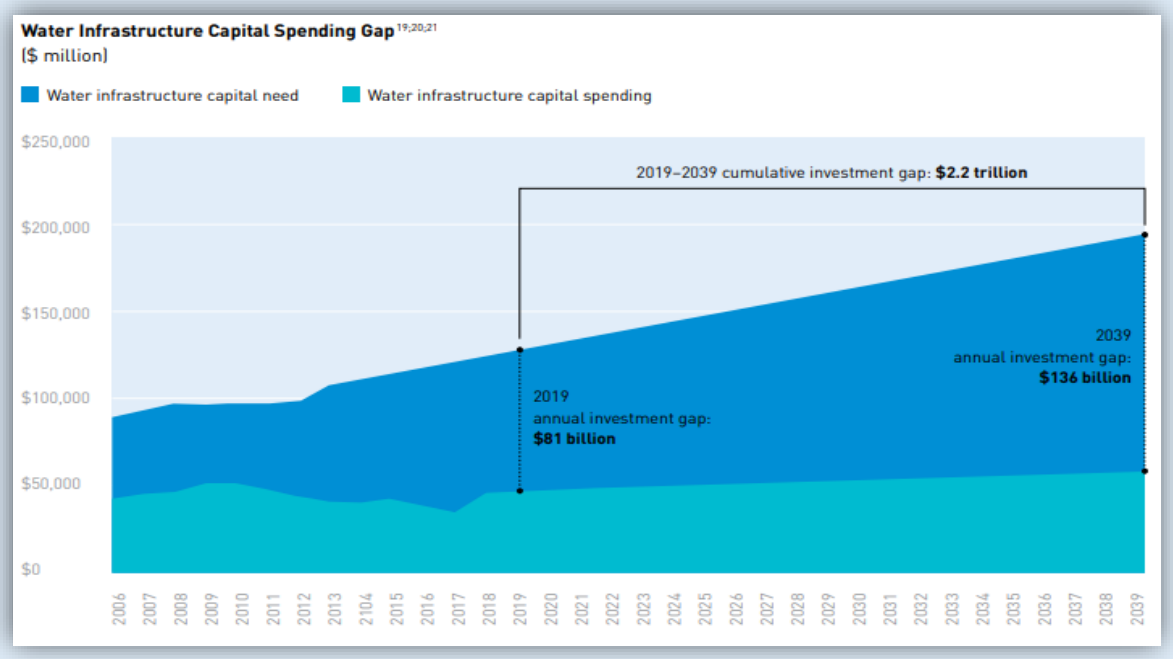
Another consequence of a gap of public funding is the negative equity outcomes that occur if a subset of the region's households bears the greatest responsibility for paying for nutrient-related infrastructure investments. Questions have been raised about the equitable cost distribution associated with a subset of the region's population incurring a large portion of the expenditures needed to achieve public benefits (Northern Economics, 2019). Those expenditures come from households when they pay their sewer bills. Households with on-site sewage systems (septic) do not pay monthly sewage bills.

Box 1

The Economic Benefits of Investing in Water infrastructure

US Water Alliance National Water Infrastructure Spending Gap

"Meeting the drinking water and wastewater capital needs for communities across the United States will require coordinated investment at the federal, state, and local levels. Despite the growing need for water infrastructure, the federal government's share of capital investment has fallen from 31 percent in 1977 to a mere four percent in 2017. ... As federal support for water infrastructure capital needs has declined, local and state spending has provided a much greater share. Across the country, water rates are climbing to meet the costs of upgrading, expanding, and replacing water infrastructure. As costs, however, continue to rise, many communities will struggle to cover them through local rates and fees." (Page 14)



Source: US Water Alliance, The Economic Benefits of Investing in Water infrastructure, undated.

Ability to Pay

A second potential unintended equity outcome of over-reliance on sewer ratepayers to fund wastewater treatment involves the potential for lower income households to either pay a disproportionate share of their income on sewer bills or be unable to pay those bills. Utility bills are regressive—they take a relatively larger share of low-income households' budgets compared to middle- and high-income households' budgets—and are therefore a form of structural inequity (Beecher 2020).

Our findings suggest that currently only three Puget Sound utilities' sewer rates result in sewer bills less than 2.0 percent of LQI. PSNGP-adjusted rates resulted in %LQI values ranging between 2.64 percent of LQI and 12.76 percent of LQI. These relatively high values indicate that sewer bills exacerbate the already regressive nature of Washington State's tax structure.

Although customer assistance programs for low-income households exist in Washington,[8] utility managers note that these programs are undersubscribed in their districts (see Box 2). This result is borne out in research on low-income assistance programs nationwide (Pierce, et.al, 2021 and Teodoro, 2021). Multiple challenges to administering these programs include: imprecise eligibility rules, extensive time and effort required for customers to apply, and a lack of trust to share income information.

Box 2. Sewer Utilities' Income-Based Assistance Programs

Discounted utilities rates for low-income senior citizens or disabled residents are offered by many Puget Sound utilities districts. However, utility-based programs that offer low-income households - other than seniors or disabled citizens - have not been widely adopted. Furthermore, previous studies indicates that enrollment levels tend to be low compared to eligible populations (Kinney, 2022). Multiple challenges administering these programs, such as imprecise eligibility rules; extensive time and effort required for customers to apply; and a lack of trust to share income information are common (Pierce et al. 2021, Teodoro 2021).

Additional research on the effectiveness of customer assistance programs, as well as legal constraints related to such programs in Washington may be warranted (see footnote 6). For a thorough exposition of Washington State's grant, loan and assistance programs see the Marine Water Quality Base Program Analysis (Kinney and Wright, 2022). For examples of how utilities in other states are approaching these equity-based challenges see the US Water Alliance's recent study, A Promising Water Pricing Model for Equity and Financial Resilience (Hara and Take, 2023).

This concern—overburdening disadvantaged or low-income households—is addressed in the Washington State Environmental Justice (EJ) Task Force Recommendations for Prioritizing EJ in Washington State Government. The recommendations of the task force resulted in the adoption of Chapter 70A.02 RCW which states, "an equitable distribution means a fair and just, but not necessarily equal, allocation intended to mitigate disparities in benefits and burdens". Washington State's concern over these equity issues is well justified, as the State ranks highest

[8] RCW 35.92.020 and RCW 35.67.020 confer authority to construct systems and *fix rates and charges* to Counties and Cities, respectively stating "the rates charged shall be uniform for the same class of customers or service" where the "factors" used to classify customers do not include low-income households. However, both RCWs do allow *assistance to aid* low-income persons in connection with services. RCW 57.08.014 provides authority to adjust or delay rates for low-income persons provided that "information on cost shifts caused by establishment of the special rates or charges shall be included in the notification of same." RCW 74.38.070 further discusses reducing rates for low-income senior citizens and other low-income citizens provided that the definitions of same are defined by appropriate ordinance or resolution adopted by the governing body of the county, city, town, public utility district or other municipal corporation. For example, Edmonds has adopted rate reductions for low-income citizens utilizing the definition of low-income established in RCW 84.36.381(5)(b)(i), Property tax exemptions, which includes a statement that to qualify individuals must be 61 years or older or disabled.

in the Tax Inequality Index (ITEP, 2018), which measures the regressive nature of states' tax structures.

Demonstrating similar concern about overburdening low-income households, EPA (2022b) instructed states to review, refine and improve as necessary their CWSRF affordability criteria to ensure that criteria are reflective of current affordability issues in the state. This instruction is an opportunity to incorporate newer thinking regarding use of LQI versus MHI in prioritizing funding decisions. These affordability metrics influence a utilities' access to grants and loans.

In addition to federal and State concerns of overburdening low-income households the industry also writes about these concerns. The US Water Alliance recently commented on the impact that the user-fee based funding structure has more broadly on communities and the environment, noting:

> *"This type of funding model exposes both individuals and communities to health and economic risks. Households that cannot pay their water bills face consequences like service shutoffs, property tax liens, and additional penalties and fees. This can push struggling customers into deeper debt, making it even harder to get current on bills. Meanwhile, utilities that cannot collect adequate revenue from rates run the risk of financial instability, putting vital operations and system maintenance at risk. Utilities that struggle financially may not be able to secure loans with favorable terms, which raises costs, leads to deferred maintenance, and drives the need for further rate increases to maintain quality levels of service. Utilities' financial dependence on customers makes them highly vulnerable to economic crises and growing income inequality." (Hara, 2022 for the US Water Alliance)*

3.2 Implications for the Land Development and Cover Implementation Strategy

The work is also relevant to the Land Cover and Development Implementation Strategy and 2022-2026 Action Agenda Strategy #1 (Advance smart development and protect intact habitats and processes by channeling population growth into attractive, transit-oriented centers with easy access to natural spaces). The high cost of living in urban centers, relative to rural communities, has been identified as a barrier to the regional goal of directing population growth into urban centers. Residents of these urban areas fund clean water services through Stormwater Utility Fees and sewer bills, while rural residents on septic systems in areas without NPDES Municipal Stormwater Permit coverage do not. This is likely one component of the "rural cost subsidy" described in the Land Cover and Development Implementation Strategy.

4. RECOMMENDATIONS

Our recommendations combine the findings of the impact analysis with the funding strategy discussion to help identify steps to take toward an efficient funding pathway for the MWQ IS. Public (i.e., non-utility) funding is required if resource managers agree that sewer services provide a public good. Additional public funding would also be required if resource managers

set a target to keep utilities' %MHI values within Ecology's "no hardship" range (below 2 percent of MHI). The %MHI values of between 8 and 18 individual utilities were in either the moderate hardship range or the elevated hardship range when using the PSNGP-adjusted sewer rates. And over half the %LQI values exceeded 5%, indicating a significant impact on low-income households.

Demand for public funding, whether state or federal, frequently exceeds the supply of funding. Public funding is a finite resource. As such, developing a plan to utilize the available funding as efficiently as possible is an admirable goal. In the following four subsections, we provide recommendations that might improve both efficiency and equity outcomes for the available grant and loans monies. They are:

- Use the data collected for this study, plus newer estimates of PSNGP-related capital costs currently being developed as a PSNGP requirement, to calculate a Capital Investment Gap metric. The gap would be the amount of state/federal funding needed to maintain %MHI indices values below a specified percentage and/or the funding needed for low-income assistance programs to ensure households don't pay more for sewer service than a specified percentage of their income (Section 4.1).
- Investigate the possibility of using the %MHI or %LQI metric in addition to other metrics used to determine financial hardship in Ecology's Grants and Loans Programs (Section 4.2).
- Consider development of a regional or state-wide low-income assistance program for sewer utilities (Section 4.3).
- Consider funding a study to assess the potential equity benefits of restructuring wastewater rates using the Resilient Rate Structure model developed by the US Water Alliance (Section 4.4).

4.1 Estimate the Capital Investment Gap to maintain index values below target levels

Ecology and Tetra Tech's (2011) initial estimates of the total capital investment required to upgrade all Puget Sound WWTP for nitrogen and phosphorus removal was estimated to be between $1.4 billion and $5.9 billion depending on the level of nitrogen removal required.[9] Current estimates being completed by individual utilities are higher, but the exact amount of capital investment required to meet regulatory requirements cannot be known until nutrient effluent limits are determined by Ecology. While the final capital cost estimates are being completed by each utility, we recommend developing a methodological approach for distributing federal or state grant funds (assuming such grant funding is available) to maximize the equity outcomes and efficiency of those investments.

[9] See Tables ES-3 and Table ES-4 of the 2011 Technical and Economic Evaluation of Nitrogen and Phosphorus Removal at Municipal Wastewater Treatment Facilities, WA Dept of Ecology and Tetra Tech, adjusted for 2022 dollars.

We propose developing a Capital Investment Gap metric as shown in green on the bar chart in Figure 8. Assume for this hypothetical example that the State and/or Puget Sound regional recovery partners set a target of a 2%MHI for all Puget Sound utilities and endeavors to provide grant funds to utilities that would exceed that target due to PSNGP-required upgrades. The first bar shows a current (before nutrient removal upgrades are implemented) index value. The second bar shows how the index value would change assuming that the utility receives no state or federal grant funding and increases rates to pay for all PSNGP-required upgrade costs. The third bar shows a local share up to 2 percent, with the green stripped area above 2 percent indicating the hypothetical state or federal contribution needed to keep the %MHI index below the 2 percent threshold.

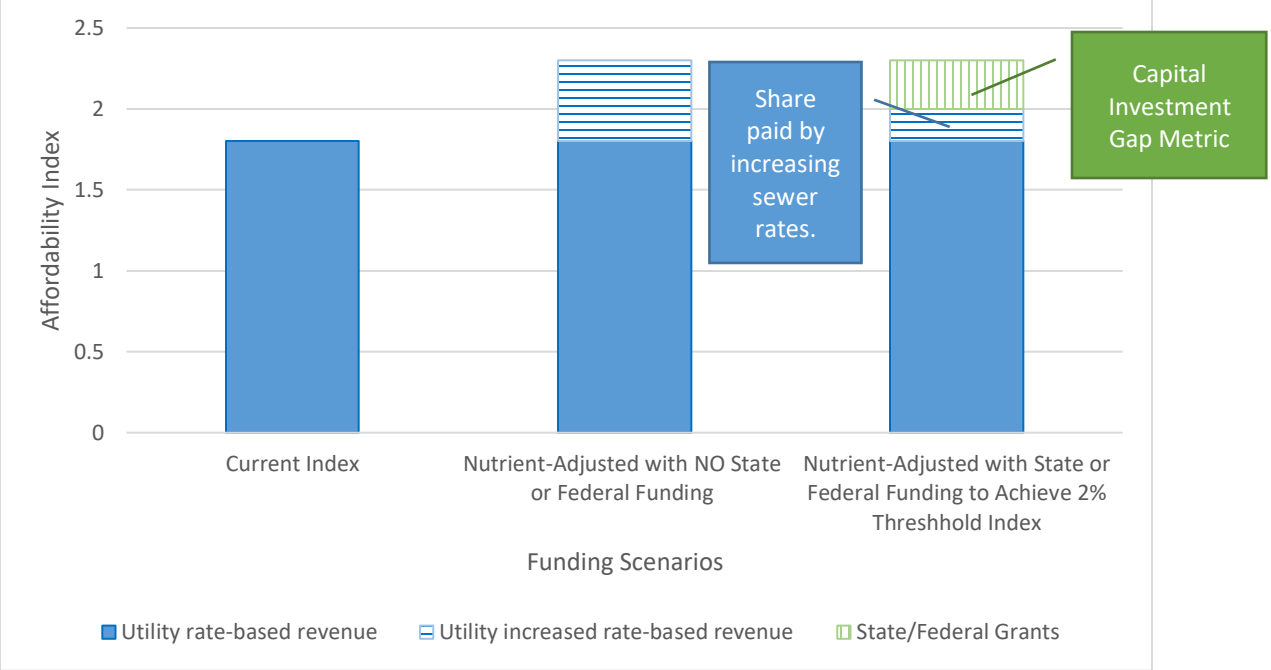


Figure 8. Proposed method to derive a Capital Investment Gap metric for quantifying state and federal funding requests to support PSNGP-required upgrades

This method would help estimate the amount of state/federal funding that could keep sewer bills below a target threshold. In this example the threshold was 2% but results could be calculated for other thresholds, such as other state hardship benchmarks like 3% and 5%. Note that this method assumes that utilities raise rates to pay for the difference between the index value under current rates and the rates up to the selected threshold. The funding need above that threshold would provide a target for state and federal funding requests.

Using utility-specific index thresholds to prioritize grant funding would help increase the economic efficiency of grant distribution. Additionally using utility specific index thresholds would help estimate how much grant money might be needed to fill the gap between what utilities can pay at a 2 percent index threshold and how much grant money might be needed to keep indices below that threshold level. In other words, utilities that have index values below 2

percent, even after the nutrient upgrades would receive a lower priority for grant funds. Instead, scarce grant funds would be prioritized to those utilities to close a gap and maintain a 2 percent index threshold.

Applying this same method using %LQI instead of %MHI could be used to estimate the annual budget needed to implement a regional low-income assistance program. Ideally, a customer assistance program would be sufficiently funded to ensure households don't pay more for sewer service than a specified percentage of their income.

Using this method to estimate the gap in capital spending, the annual budget for a low-income assistance program, or a combination of the two would help the advance the MWQ IS funding pathway strategy and increase understanding of the magnitude of the funding challenge associated with adding advanced nutrient reduction technologies to WWTPs in the region.

4.2 Utilize %MHI or %LQI in place of MHI when allocating grant/loan funding

Ecology manages grants and loans under both the Water Quality Combined Funding Programs[10] as well as the Puget Sound nutrient reduction grants program. Each of the funding programs described in Table 4 uses either %MHI or MHI as part of the prioritization process. The Ecology Water Combined Funding program, which oversees the Centennial Clean Water Program (CCWP) and the Clean Water State Revolving Fund (CWSRF), utilizes %MHI for its hardship determination. The 2022 Puget Sound Nutrient Reduction Grant Program (PSNRGP) included consideration for the average MHI of permitees.

If one of goals of a grants and loan program includes reducing hardship on those households most affected, incorporating %LQI in the hardship determination could potentially increase the efficiency and equity of the programs. However, if MHI (used for the PSNGP grant program) and %MHI (used for the CWSRF and the CCWP) values are close proxies for %LQI values then a program change would not be warranted.

[10] See Ecology's Grants and Loans web page.

Table 4. Washington State Grant and Loan Programs Available for Wastewater Infrastructure Improvements in Puget Sound

Program Name	Phase	Eligible Utilities	Current Hardship/Prioritization Metrics
Clean Water State Revolving Fund (a)	Pre-construction	All	• The existing residential population of the service area for the proposed project is 25,000 or less at the time of application. • The MHI for the proposed service area is less than 80 percent of the state MHI.
	Construction	All	• The existing residential population of the service area for the proposed project is 25,000 or less at the time of application. • Financing the project without subsidy would cause existing residential sewer fees to be two percent or more of the MHI for the service area. Hardship categories: Moderate 2% < RI < 3%; elevated 3% < RI < 5%; severe RI >5%
Centennial Clean Water Program (a)	Pre-construction & construction	All	• Managed in accordance to Chapter 70A.135RCW and Chapter 173-95A WAC where: • 70A.135 RCW give preference to Puget Sound partners (defined in 90.71.010 RCW as an entity that has been recognized by the partnership as having consistently achieved outstanding progress in implementing the 2020 action agenda • 173-95A WAC define hardship (in WAC 173-98-300) as MHI > 2%, categories as listed above under CWSRF.
Puget Sound Nutrient Reduction Grant Program (b)	Planning	43 utilities that own and operate the 58 WWTPs discharging to Puget Sound	From page 1, from legislative language for the $9M of the 2021-23 biennium: • Location of wastewater treatment facility, prioritizing facilities that are not located within a city with a population of 760,000 or more, • Age of wastewater treatment facility, prioritizing the oldest eligible facilities; and • Immediacy of need for grant funding to avoid system failure and higher magnitude of contamination. From page 3, under prioritization factors all of the above and: • Economic Status: Facilities serving populations with lower Median Household Incomes receiving higher priority.

Sources: (a) Washington State Department of Ecology, 2022. State Fiscal Year 2024 Funding Guidelines Water Quality Combined Funding Program, Pub 22-10-016 (b) Washington State Department of Ecology, 2021. 2021-2023 Puget Sound Nutrient Reduction Program Funding Guidelines, Pub 21-10-042

Figure 9 shows the correlation between MHI and %MHI values and %LQI values. The correlation between either index and MHI is moderate at best. Meaning, MHI may not be a good proxy for hardship. This demonstrates that the MHI does not identify the utilities with the highest %MHI values or %LQI values. The reason that MHI is not strongly correlated with hardship is due to the wide variability of sewer rates (Figure 1). The information suggests that, at a minimum incorporating the %MHI index into the hardship determination for the PSNRGP would increase equity outcomes significantly.

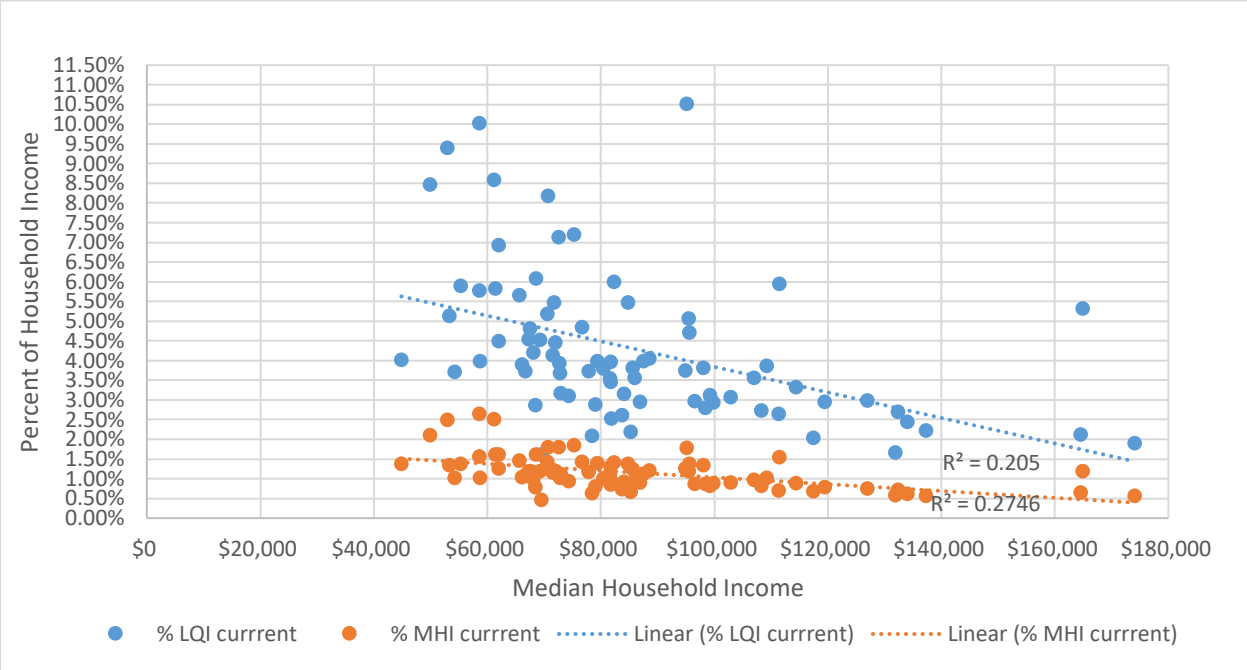


Figure 9. Correlation of %MHI and %LQI values to MHI

Figure 10 shows the correlation between %LQI values and %MHI values. Here the correlation is strong. Meaning, %MHI value may be a good proxy for hardship. There would be room for an equity improvement if %LQI was used in place of %MHI in determining hardship, but the improvement may be relatively small. The reason that %MHI values are correlated with hardship is because %MHI incorporates variability in sewer rates. The information suggests that, incorporating the %LQI value into the hardship determination for the CWSRF and CCWP may increase equity outcomes slightly.

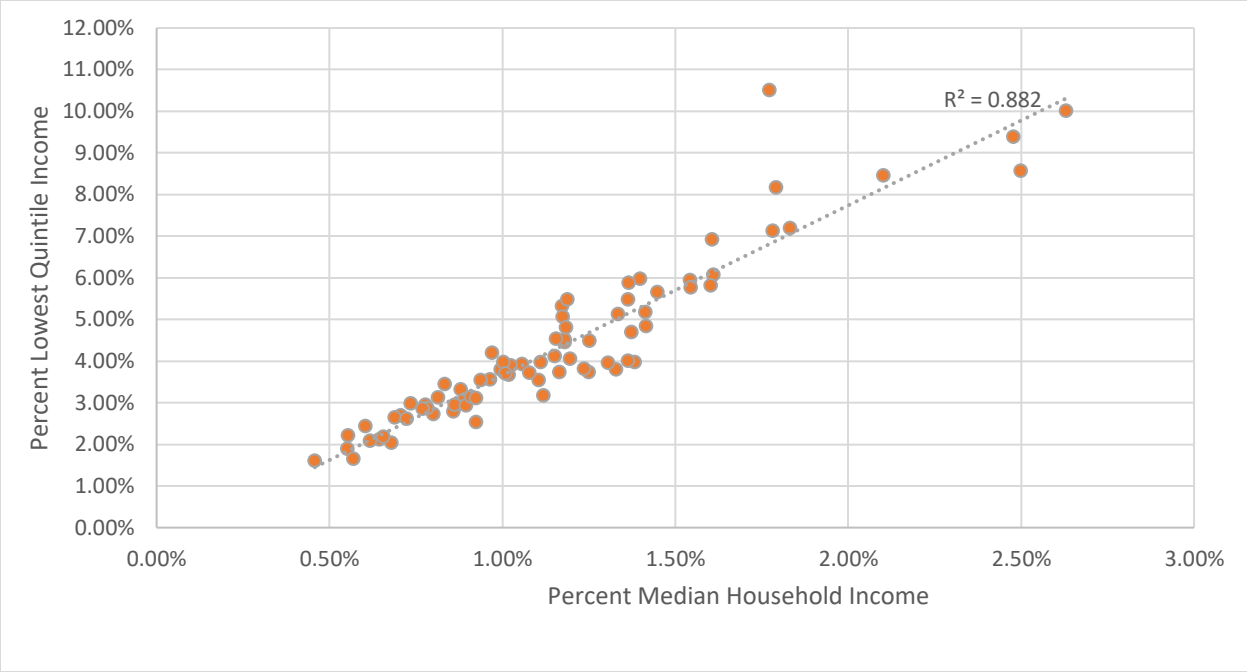


Figure 10. Correlation of %LQI to %MHI

4.3 Consider developing a regional or statewide low-income assistance program

The results of this study show that our conservatively low PSNGP-adjusted sewer service cost estimates would exceed 2% LQI for 76 of the utilities included in the study and pose a financial risk to both people who cannot pay water bills and utilities who cannot cover costs if bills are not paid. One possible improvement to equity outcomes of state grant programs would be development of a statewide or region wide low-income assistance program. Developing this program at a state or region level would lower the financial risk and administrative burden that utilities face in developing a low-income assistance program. In addition, a state-wide or region-wide program may reduce some impacts of Washington State's regressive tax system.

Several of Washington's codes provide authority for utilities to develop low-income assistance programs/rates (see footnote 6). However low-income assistance programs have not been widely adopted by utilities, except for programs for seniors and disabled individuals (see Box 2). The US Water Alliance observes this phenomenon among utilities nationwide. Utilities facing administrative burdens and legal ambiguities have errored on the side of caution with regard to low-income rates. The Municipal Research and Services Center (MRSC) describes how utilities could define eligibility on a utility-by-utility basis, emphasis added:[11]

> *Eligibility requirements for low-income and senior **low-income assistance are not defined by statute,** so agencies are free to define these as they see fit. Some only*

[11] MRSC's website at: https://mrsc.org/explore-topics/public-works/general-utility-topics/senior-and-low-income-utility-rate-discounts.

provide these assistance programs to low-income seniors, while others include persons with disabilities as well, generally defining people with disabilities to be those people who qualify for special parking privileges under chapter 46.19 RCW (formerly RCW 46.16.381) and people who are blind as defined in RCW 74.18.020.

*However, **there are a range of definitions**. Some jurisdictions may include individuals with developmental disabilities and mental illnesses, while others require proof of disability from the Social Security Administration. Some may even exempt all low-income individuals.*

*In some cases, the utility requires that qualified persons be the head of household, while in other cases there may be a restriction on the income level of any co-tenant. To ensure that **eligibility determinations are made fairly and uniformly**, the utility's legislative body should establish, by ordinance or resolution, policies or programs for utility staff to follow.*

This description provides an example of some of the administrative challenges that an individual utility may face in developing a low-income rate. Seeing similar challenges nationwide the US Water Alliance recommends:

- Establish affordability criteria to better target state funding.
- Remove legal barriers to affordability solutions.
- Create a statewide program for water bill assistance for low-income residents, citing California's programs.

A program to aid low-income sewer rate payers could be modeled after existing programs like Washington Low Income Home Energy Assistance Program (LIHEAP) (See Box 3). Additionally, a program may be able to be created with a modification to the existing Low Income Household Water Assistance Program (LIHWAP). The LIHWAP provides assistance to low-income households with water and wastewater bills that are disconnected or are in imminent threat of disconnection. A modification to the program that includes payment of monthly sewer bills may want to be considered in order to offset unintended equity outcomes that may arise from the needed investment in nutrient reduction infrastructure.

Box 3. Low Income Assistance Programs

Washington Low Income Home Energy Assistance Program (LIHEAP) (see https://www.benefits.gov/benefit/1586) Washington Low Income Home Energy Assistance Program (LIHEAP) services are provided to the public through a network of 26 local community-based nonprofit organizations and local municipalities. Services include energy assistance, client conservation education, furnace repair and replacement, and weatherization. Energy assistance benefits are paid directly to energy providers and are based on a portion of a household's annual home heating costs.

Low Income Household Water Assistance Program (LIHWAP) (see https://www.commerce.wa.gov/growing-the-economy/energy/low-income-home-energy-assistance/lihwap/) LIHWAP provides emergency assistance to low-income households who are disconnected or are in imminent threat of disconnection. LIHWAP provides water assistance to households in Washington through the same network of community action agencies and local partners that provide the Low-Income Home Energy Assistance Program (LIHEAP). These local organizations will help you determine if you're eligible and how much assistance you might receive. If you qualify, your local agency will send a payment directly to your water utility on behalf of your household. Households eligible for water assistance are also qualified for the Low-Income Home Energy Assistance Program.

4.4 Consider the feasibility of the Resilient Rate Structure

The US Water Alliance's recent publication, *Pricing Water for Public Health and Financial Resilience: An Applied Modeling Pilot, Project Description* (US Water Alliance, 2021) proposes an alternative type of rate structure to address shortcomings of a usage-only based rate structures, enhance revenue stability, and integrate equity considerations. Models of this Resilient Rate Structure are already being developed in Minnesota and Cincinnati for water bills. From the paper:

> *The water sector and community advocates need to reimagine the utility revenue model and available pricing structures to reflect water's fundamental role in a thriving society and the true costs and value of providing safe, reliable water and wastewater service. Of course, federal funding is crucial and should contribute a larger share of utility revenue than it presently does. However, utilities can use the tools at hand to begin* ***billing for water in a more sensible, equitable way while advocating for change at the federal level****. The time is right to develop innovative new ways to price and fund water that supports system sustainability, equity, and public health.*

The outcome of the feasibility study would suggest whether innovative pricing models could make sewer bills more affordable and equitable while preserving utility revenue. The resilient rate structure model would seek to allow certain amounts of costs and an associated level of

sewer service for all residents to be paid for by property taxes or some other similar property-based cost recovery mechanism.

5. NEXT STEPS

When developing a funding strategy for WWTP upgrades, we encourage policy makers to consider tradeoffs between water quality and other regional recovery goals. Choices made about how the region is to pay for WWTP upgrades may have implications for growth management as well as equity outcomes receiving greater attention due to the White House's Justice40 Initiative and Washington's Healthy Environment for All (HEAL) Act. We hope this analysis can support development of funding strategies that improve water quality while minimizing unintended consequences of Puget Sound's socioecological system.

Possible next steps for this research beyond the recommendations described in the preceding section could include:

- **Addressing know data gaps and challenges**. For example: improve the accuracy of the correspondence table that links the income data (at the census tract level) with the utility district boundaries. Improving the correspondence table would not only increase the certainty of the individual utilities' households' MHI and LQI but also increase our confidence about stating the number of households effected within each income quintile. Another known data challenge is the method with which we averaged LQI. We utilized a population weighting, which does not accurately estimate the median value of the lowest quintile income. For a complete list of know data challenges see Barber et.al (2022).

- **Explore the usefulness of making the household income data easily available to Puget Sound utilities and Ecology**. While this study was done at a relatively coarse scale, the data is useful in identifying potential hardships faced by utility providers. However, this data can become quickly outdated as data on incomes is updated at least annually. Should utilities and Ecology find this data useful it could be updated annually for very little cost. If the database proved useful, updating it could become an annual exercise for student interns under the supervision of a senior researcher. For example, the income data that was gathered for this study was collected using student interns located at the Center for Business and Economic Research at Western Washington University. The cost of data collection was low and the students received invaluable work experience, that ultimately lead to permanent employment in the consulting and public sectors.

- **Explore implications of the extremely wide variation in what Puget Sound residents pay to treat a gallon of sewage**. More research is needed to characterize the distribution of clean water costs and benefits across the region's population. This effort could include analyzing the proportionality of costs among utility ratepayers in neighboring jurisdictions as well as compared to on-site sewage system users who incur sewage treatment costs on a different timeframe (i.e., system maintenance or replacement costs are usually not paid monthly).

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APPENDIX: DATA TABLES

Table A-1 lists all 89 local wastewater service providers directly and indirectly affected by the PSNGP. Those on the left are directly impacted by the PSNGP because they operate WWTPs covered by the permit. Those on the right include additional utilities indirectly impacted by the permit because they retail wastewater treatment services provided by permittees.

Table A-2 provides individual sewer cost, MHI, LQI, %MHI, and %LQI results for the 80 service providers included in the study.

Table A-3 provides summary statistics for the 80 service providers included in the study.

All data is from Barber et al. (2022).

Table A-1. Local Wastewater Service Providers Direct and Indirectly Affected by the PSNGP

WWTP Operator / PSNGP Permittee	Utility District Billing Individual Property Owners	Included in study?
Alderwood Water District	Alderwood Water District	Yes
	Silver Lake Water & Sewer District	Yes
Anacortes, City Of	Anacortes, City of	Yes
Bainbridge Island City of	Bainbridge Island City of	Yes
Bellingham-Water Division City of	Bellingham-Water Division City of	Yes
	Lake Whatcom Water and Sewer District	Yes
Birch Bay Water & Sewer District	Birch Bay Water & Sewer District	Yes
Blaine City of	Blaine City of	Yes
Bremerton City of	Bremerton City of	Yes
Clallam Bay Sekiu (Clallam County PUD)	Clallam Bay Sekiu (Clallam County PUD)	Yes
Coupeville Town of	Coupeville Town of	Yes
Eastsound Sewer and Water District	Eastsound Sewer and Water District	Yes
Edmonds, City of	Edmonds, City of	Yes
	Mountlake Terrace, City of	Yes
Everett Public Works Dept. City of	Everett Public Works Dept. City of	Yes
Fisherman Bay Water Association	Fisherman Bay Water Association	Yes
Friday Harbor Town of	Friday Harbor Town of	Yes
Gig Harbor Sanitary Sewer	Gig Harbor Sanitary Sewer	Yes
King County	King County Does Not Bill Individual Property Owners	No (1)
	Algona Water Dept	Yes
	Auburn, City of	Yes
	Bellevue City of	Yes
	Black Diamond Water Dept	Yes
	Bothell Water City of	Yes

WWTP Operator / PSNGP Permittee	Utility District Billing Individual Property Owners	Included in study?
	Brier, City of	Yes
	Cedar River Water & Sewer District	Yes
	Coal Creek Utility District	Yes
	Cross Valley Water District	Yes
	Issaquah Water System	Yes
	Kent Water Department	Yes
	Kirkland, City of	Yes
	Lake Forest Park Water District	Yes
	Lakehaven Water and Sewer District	Yes
	Mercer Island City of	Yes
	NE Sammamish Sewer & Water District	Yes
	Northshore Utility District	Yes
	Olympic View Water & Sewer District	Yes
	Pacific, City of	Yes
	Redmond Water System City of	Yes
	Renton City of	Yes
	Sammamish Plateau Water & Sewer	Yes
	Seattle Public Utilities	Yes
	Shoreline Waste Water, City of	Yes
	Skyway Water & Sewer	Yes
	Soos Creek Water & Sewer District	Yes
	Tukwila Water Department	Yes
	Valley View Sewer District	Yes
	Woodinville Water District	Yes
	Highlands Sewer District	No (2)
	Vashon Sewer District	No (2)
Kitsap County	Kitsap County	Yes
	Poulsbo City of	Yes
Kitsap County Sewer District #7	Kitsap County Sewer District #7	Yes
La Conner Water Dept	La Conner Water Dept	Yes
Lake Stevens Sewer District	Lake Stevens Sewer District	Yes
Langley City of	Langley City of	Yes
LOTT	LOTT Does Not Bill Individual Property Owners	No (1)
	Lacey Water Department	Yes
	Olympia City of	Yes
	Tumwater City of	Yes
Lynnwood, City of	Lynnwood, City of	Yes
Marysville Utilities	Marysville Utilities	Yes
Mason County	Mason County	Yes
Midway Sewer District	Midway Sewer District	Yes

WWTP Operator / PSNGP Permittee	Utility District Billing Individual Property Owners	Included in study?
Mount Vernon, City of	Mount Vernon, City of	No (2)
Mukilteo Water & Wastewater District	Mukilteo Water & Wastewater District	Yes
Oak Harbor City of	Oak Harbor City of	Yes
Penn Cove Water and Sewer District	Penn Cove Water and Sewer District	No (2)
Pierce County	Pierce County	Yes
	Steilacoom Town of	Yes
Port Angeles City of	Port Angeles City of	Yes
Port Townsend City of	Port Townsend City of	Yes
Sequim City of	Sequim City of	Yes
Shelton City of	Shelton City of	Yes
Skagit County Sewer District #2	Skagit County Sewer District #2	No (2)
Snohomish, City of	Snohomish, City of	Yes
Stanwood Water Dept City of	Stanwood Water Dept City of	Yes
SW Suburban Sewer District	SW Suburban Sewer District	Yes
Tacoma Water	Tacoma Water	Yes
	Fife Dept of Public Works	Yes
	Fircrest City of	Yes
	Ruston, City of	Yes
Thurston County	Thurston County Boston Harbor	Yes
	Thurston County Tamoshan	Yes
West Sound Utility District	West Sound Utility District	Yes

(1) King County and LOTT do not provide retail services to households, therefore do not have retail rates, and as such %MHI and %LQI cannot be calculated

(2) Barber et al. (2022) were unable to locate a detailed map of the provider's service area or the district's web page did not report sewer rates

Table A-2. Individual Results for 80 Puget Sound Wastewater Service Provider

Permitee Serving	Utility Name	Est Annual Sewer Bill	Est. Utility District Income Metric		%MHI Index			%LQI Index		
			MHI	LQI	Current	< 8mg/L, seasonal	< 3mg/L, year round	Current	< 8mg/L, seasonal	< 3mg/L, year round
Alderwood Water District	Alderwood Water District	$866	$99,925	$29,596	0.87%	1.07%	1.29%	2.93%	3.62%	4.36%
Alderwood Water District	Silver Lake Water & Sewer District	$797	$117,439	$39,324	0.68%	0.85%	1.04%	2.03%	2.55%	3.11%
Anacortes, City of	Anacortes, City of	$742	$72,862	$20,246	1.02%	1.30%	1.60%	3.67%	4.68%	5.76%
Bainbridge Island, City of	Bainbridge Island, City of	$1,007	$114,451	$30,415	0.88%	1.06%	1.25%	3.31%	3.99%	4.71%
Bellingham Water Division	Bellingham Water Division	$589	$58,703	$14,826	1.00%	1.35%	1.73%	3.97%	5.36%	6.84%
Bellingham Water Division	Lake Whatcom Water and Sewer District	$1,069	$81,832	$27,023	1.31%	1.56%	1.82%	3.95%	4.72%	5.53%
Birch Bay Sewage Treatment Plant (STP)	Birch Bay Water & Sewer District	$319	$69,617	$19,839	0.46%	0.75%	1.07%	1.61%	2.64%	3.74%
Blaine, City of	Blaine, City of	$1,381	$75,356	$19,208	1.83%	2.11%	2.40%	7.19%	8.26%	9.40%
Bremerton, City of	Bremerton, City of	$777	$62,011	$17,332	1.25%	1.58%	1.94%	4.48%	5.67%	6.93%
Clallam Bay PUD	Clallam Bay Sekiu (Clallam County PUD)	$612	$44,844	$15,291	1.36%	1.82%	2.31%	4.00%	5.35%	6.78%
Coupeville, Town of	Coupeville, Town of	$661	$68,102	$15,759	0.97%	1.27%	1.59%	4.19%	5.50%	6.89%
Eastsound Sewer and Water District	Eastsound Sewer and Water District	$756	$55,350	$12,858	1.37%	1.74%	2.13%	5.88%	7.48%	9.18%
Edmonds, City of	Edmonds, City of	$606	$83,751	$23,236	0.72%	0.97%	1.23%	2.61%	3.49%	4.44%
Edmonds, City of	Mountlake Terrace, City of	$766	$84,112	$24,426	0.91%	1.16%	1.42%	3.14%	3.98%	4.87%
Everett Public Works Dept., City of	Everett Public Works Dept., City of	$999	$70,649	$19,293	1.41%	1.70%	2.01%	5.18%	6.24%	7.38%
Fisherman Bay Water Assoc	Fisherman Bay Water Assoc	$996	$62,008	$14,400	1.61%	1.94%	2.29%	6.92%	8.34%	9.86%
Friday Harbor, Town of	Friday Harbor, Town of	$1,542	$58,690	$15,405	2.63%	2.98%	3.35%	10.01%	11.34%	12.76%
Gig Harbor Sanitary Sewer	Gig Harbor Sanitary Sewer	$810	$99,284	$26,004	0.82%	1.02%	1.24%	3.11%	3.90%	4.75%
King County	Algona Water Dept	$816	$72,942	$25,804	1.12%	1.40%	1.70%	3.16%	3.96%	4.81%
King County	Auburn, City of	$903	$81,719	$25,517	1.11%	1.36%	1.62%	3.54%	4.34%	5.20%

Permitee Serving	Utility Name	Est Annual Sewer Bill	Est. Utility District Income Metric		%MHI Index			%LQI Index		
			MHI	LQI	Current	< 8mg/L, seasonal	< 3mg/L, year round	Current	< 8mg/L, seasonal	< 3mg/L, year round
King County	Bellevue, City of	$934	$126,996	$31,343	0.74%	0.90%	1.07%	2.98%	3.64%	4.33%
King County	Black Diamond Water Dept	$868	$108,333	$31,932	0.80%	0.99%	1.19%	2.72%	3.36%	4.05%
King County	Bothell Water City of	$1,033	$107,072	$29,071	0.96%	1.16%	1.36%	3.55%	4.26%	5.01%
King County	Brier, City of	$683	$81,817	$19,841	0.83%	1.09%	1.35%	3.44%	4.48%	5.58%
King County	Cedar River Water & Sewer District	$915	$102,967	$29,889	0.89%	1.09%	1.30%	3.06%	3.75%	4.48%
King County	Coal Creek Utility District	$1,721	$111,493	$29,005	1.54%	1.54%	1.92%	5.93%	5.92%	7.40%
King County	Cross Valley Water District	$1,109	$109,257	$28,839	1.02%	1.20%	1.40%	3.85%	4.56%	5.32%
King County	Issaquah Water System	$812	$134,035	$33,442	0.61%	0.76%	0.92%	2.43%	3.04%	3.70%
King County	Kent Water Dept	$907	$77,856	$24,343	1.16%	1.43%	1.71%	3.73%	4.57%	5.47%
King County	Kirkland, City of	$931	$119,490	$31,621	0.78%	0.95%	1.13%	2.94%	3.59%	4.29%
King County	Lake Forest Park Water District	$833	$96,555	$28,221	0.86%	1.08%	1.30%	2.95%	3.68%	4.46%
King County	Lakehaven Water & Sewer District	$486	$78,554	$23,401	0.62%	0.88%	1.16%	2.08%	2.95%	3.89%
King County	Mercer Island, City of	$1,935	$165,001	$36,417	1.17%	1.30%	1.43%	5.31%	5.88%	6.48%
King County	NE Sammamish Sewer & Water District	$962	$174,078	$50,831	0.55%	0.67%	0.80%	1.89%	2.30%	2.73%
King County	Northshore Utility District	$768	$111,384	$29,127	0.69%	0.87%	1.07%	2.64%	3.34%	4.09%
King County	Olympic View Water & Sewer District	$1,061	$88,612	$26,206	1.20%	1.43%	1.68%	4.05%	4.83%	5.67%
King County	Pacific, City of	$1,099	$79,412	$27,652	1.38%	1.64%	1.92%	3.97%	4.72%	5.51%
King County	Redmond Water System, City of	$761	$137,373	$34,494	0.55%	0.70%	0.86%	2.21%	2.80%	3.44%
King County	Renton, City of	$972	$87,494	$24,511	1.11%	1.35%	1.60%	3.97%	4.80%	5.70%
King County	Sammamish Plateau Water & Sewer	$1,063	$164,576	$50,206	0.65%	0.77%	0.90%	2.12%	2.53%	2.96%
King County	Seattle Public Utilities	$1,123	$95,537	$22,177	1.18%	1.39%	1.62%	5.06%	5.99%	6.98%
King County	Shoreline Waste Water, City of	$807	$85,987	$22,798	0.94%	1.18%	1.43%	3.54%	4.44%	5.40%

Permitee Serving	Utility Name	Est Annual Sewer Bill	Est. Utility District Income Metric		%MHI Index			%LQI Index		
			MHI	LQI	Current	< 8mg/L, seasonal	< 3mg/L, year round	Current	< 8mg/L, seasonal	< 3mg/L, year round
King County	Skyway Water & Sewer	$1,295	$72,635	$18,186	1.78%	2.07%	2.37%	7.12%	8.25%	9.45%
King County	Soos Creek Water & Sewer District	$846	$98,460	$30,392	0.86%	1.07%	1.29%	2.78%	3.46%	4.18%
King County	Tukwila Water Dept	$951	$65,657	$16,851	1.45%	1.76%	2.10%	5.65%	6.86%	8.16%
King County	Valley View Sewer District	$984	$61,420	$16,922	1.60%	1.94%	2.29%	5.82%	7.03%	8.32%
King County	Woodinville Water District	$937	$132,419	$34,770	0.71%	0.86%	1.03%	2.69%	3.29%	3.91%
Kitsap County	Kitsap County	$1,059	$85,655	$27,823	1.24%	1.48%	1.73%	3.81%	4.55%	5.33%
Kitsap County Sewer Dist #7	Kitsap County Sewer Dist #7	$751	$131,979	$45,527	0.57%	0.72%	0.89%	1.65%	2.10%	2.58%
Kitsap County	Poulsbo, City of	$852	$72,083	$19,131	1.18%	1.47%	1.77%	4.45%	5.53%	6.67%
La Conner Water Dept	La Conner Water Dept	$800	$67,518	$16,657	1.19%	1.49%	1.81%	4.80%	6.04%	7.35%
Lake Stevens Sewer District	Lake Stevens Sewer District	$1,188	$94,973	$31,866	1.25%	1.47%	1.70%	3.73%	4.37%	5.06%
Langley, City of	Langley, City of	$854	$71,835	$15,624	1.19%	1.48%	1.78%	5.47%	6.78%	8.18%
LOTT	Lacey Water Dept	$825	$71,606	$20,026	1.15%	1.44%	1.74%	4.12%	5.14%	6.24%
LOTT	Olympia, City of	$819	$69,385	$18,139	1.18%	1.48%	1.79%	4.51%	5.65%	6.85%
LOTT	Thurston County Boston Harbor	$1,315	$95,664	$28,023	1.37%	1.59%	1.82%	4.69%	5.43%	6.21%
LOTT	Thurston County Olympic View	$1,266	$70,695	$15,502	1.79%	2.08%	2.39%	8.17%	9.49%	10.91%
LOTT	Tumwater City of	$770	$72,769	$19,640	1.06%	1.34%	1.64%	3.92%	4.96%	6.08%
Lynnwood, City of	Lynnwood, City of	$619	$79,032	$21,602	0.78%	1.04%	1.32%	2.87%	3.82%	4.83%
Marysville Utilities	Marysville Utilities	$560	$85,294	$25,673	0.66%	0.90%	1.15%	2.18%	2.98%	3.83%
Rustlewood, North Bay/Case Inlet, Belfair WR/Sewer	Mason County	$1,306	$98,169	$34,349	1.33%	1.54%	1.76%	3.80%	4.40%	5.04%
Midway Sewer District	Midway Sewer District	$720	$66,787	$19,372	1.08%	1.39%	1.71%	3.72%	4.78%	5.91%
Mukilteo Water & Wastewater Distr	Mukilteo Water & Wastewater Dist	$779	$86,968	$26,510	0.90%	1.13%	1.38%	2.94%	3.71%	4.54%
OAK HARBOR City of	Oak Harbor, City of	$1,532	$61,278	$17,872	2.50%	2.84%	3.19%	8.57%	9.72%	10.95%

Permitee Serving	Utility Name	Est Annual Sewer Bill	Est. Utility District Income Metric		%MHI Index			%LQI Index		
			MHI	LQI	Current	< 8mg/L, seasonal	< 3mg/L, year round	Current	< 8mg/L, seasonal	< 3mg/L, year round
Pierce County Chambers Creek Regional WWTP	Pierce County	$688	$74,435	$22,197	0.92%	1.20%	1.49%	3.10%	4.03%	5.01%
Pierce County Chambers Creek Regional WWTP	Steilacoom, Town of	$757	$81,915	$29,994	0.92%	1.18%	1.44%	2.52%	3.21%	3.94%
Port Angeles, City of	Port Angeles, City of	$1,050	$49,965	$12,425	2.10%	2.51%	2.95%	8.45%	10.10%	11.87%
Port Townsend, City of	Port Townsend, City of	$549	$54,320	$14,818	1.01%	1.39%	1.79%	3.70%	5.09%	6.57%
Sequim City of	Sequim City of	$713	$53,400	$13,928	1.33%	1.72%	2.13%	5.12%	6.59%	8.16%
Shelton City of	Shelton, City of	$1,312	$52,947	$13,978	2.48%	2.87%	3.28%	9.39%	10.86%	12.42%
Snohomish, City of	Snohomish, City of	$803	$80,539	$21,203	1.00%	1.25%	1.52%	3.79%	4.76%	5.79%
Stanwood Water Dept	Stanwood Water Dept	$1,152	$82,394	$19,269	1.40%	1.65%	1.91%	5.98%	7.04%	8.18%
SW Suburban Sewer District	SW Suburban Sewer District	$528	$68,471	$18,501	0.77%	1.07%	1.39%	2.85%	3.96%	5.15%
Tacoma Water	Fife Dept of Public Works	$1,087	$76,735	$22,490	1.42%	1.68%	1.97%	4.83%	5.75%	6.72%
Tacoma Water	Fircrest, City of	$907	$58,694	$15,722	1.55%	1.90%	2.27%	5.77%	7.08%	8.47%
Tacoma Water	Ruston, City of	$1,157	$84,868	$21,158	1.36%	1.61%	1.86%	5.47%	6.44%	7.47%
Tacoma Water	Tacoma Water	$678	$66,183	$17,410	1.02%	1.33%	1.67%	3.89%	5.07%	6.33%
Thurston County	Thurston County Ground Mound	$1,106	$68,631	$18,227	1.61%	1.91%	2.23%	6.07%	7.19%	8.39%
Thurston County	Thurston County Tamoshan	$1,688	$95,188	$16,074	1.77%	1.99%	2.22%	10.50%	11.78%	13.14%
West Sound Utility District (South Kitsap WRF)	West Sound Utility District	$779	$67,388	$17,211	1.16%	1.46%	1.79%	4.53%	5.72%	6.99%

Color Codes:

Income Metric
Lowest
Midpoint

Annual Sewer Bill
Highest
Midpoint
Lowest

Indices
Severe hardship (greater than 5%)
Elevated hardship (greater than 3% and less than 5%)
Moderate hardship (greater than 2% and less than 3%)
No hardship (less than 2%)

Table A-3. Summary Statistics for 80 Puget Sound Wastewater Service Providers

Summary Statistics:	Population weighted MHI	Population weighted LQI	%MHI Current	%MHI 8mg/L, seasonal	%MHI 3mg/L, year-round	%LQI Current	%LQI 8mg/L, seasonal	%LQI 3mg/L, year-round
Total number of utilities	80	80	80	80	80	80	80	80
utilities with index > 2% and < 3%, e.g., moderate hardship			4	7	14	19	8	3
% Utilities with index > 2% and < 3%			*5%*	*9%*	*18%*	*24%*	*10%*	*4%*
utilities with index > 3% and < 5% e.g., elevated hardship			0	0	3	35	37	23
% Utilities with index > 3% and < 5%			*0%*	*0%*	*4%*	*44%*	*46%*	*29%*
utilities with index > 5% e.g., severe hardship			0	0	0	22	35	54
% Utilities with index > 5			*0%*	*0%*	*0%*	*29%*	*44%*	*68%*
Total utilities with index > 2%						77	80	80
Minimum	$44,844	$12,425	0.46%	0.67%	0.80%	1.61%	2.10%	2.58%
Maximum	$174,078	$50,831	2.63%	2.98%	3.35%	10.50%	11.78%	13.14%
Average	$86,324	$23,953	1.16%	1.42%	1.69%	4.31%	5.25%	6.27%
Correlation to MHI			-0.5316			-0.4613		
Correlation to %MHI			NA			0.9399		