Affordability Indicator Write-Up
October 31st 2018

This indicator helps estimate whether the user fees of rural Alaskan water and wastewater utilities are affordable. User fees are affordable if low-income homes can pay the fees without giving up paying for other important items and services, like food, electricity and heating fuel.

Rural Alaskan communities mostly have mixed-economies which are a mix of subsistence and cash-generating activities. Rural communities have different expenditure patterns and living costs than their urban counterparts. This unique Alaskan context shaped the development of this indicator, which was adapted from the US EPA's indicator in the 1997 "Combined Sewer Overflows - Guidance for Financial Capability Assessment and Schedule Development" publication. This indicator is still being refined and this is a prototype version.

The new indicator, shown below, is a matrix composed of a Residential Income indicator (RII) and a Financial Capability Index (FCI). The RII provides a measure of the household's finances while the FCI accounts for factors which could impact the household's disposable income. The affordability is determined by finding the intersection of the RII value and FCI score on the indicator. The indicator runs from right to left and from down to up. The most affordable combination of RII and FCI is in the upper left corner and the least affordable in the right bottom corner. The lighter the color, the more affordable the user fee is.

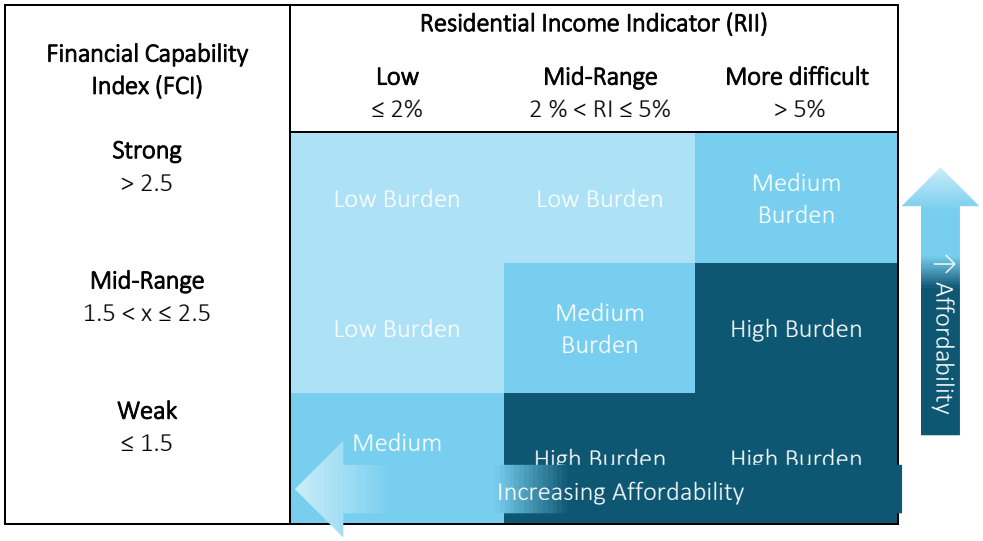

Table 1. Income quintiles

The RII is obtained by dividing the community's annual user fee by each income quintile value. A quintile is a group equal in size to four other groups. An income quintile is one of five groups a community is divided into based on income level. As shown below in Figure 1, income quintiles are found by collecting data on households' income and then ordering income from lowest to highest. In the example shown below, the community has 10 households whose annual income ranges between $0 to over $140,000. The income range, also called income distribution, is divided into five groups, and each group contains the same number of households. Because we are dividing the range by 5, each quintile contains 1 in 5 households, or 20% of the households in the community. The lowest income quintiles have the lowest income. So, the two households in income quintile 1 in the example below are the poorest in the community and have an annual income between $0 and $20,000.

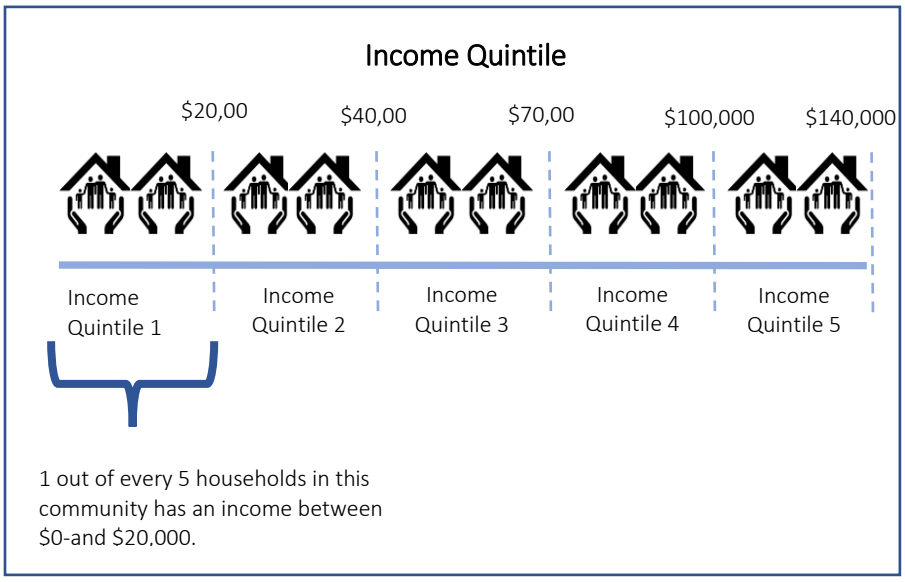

Figure 2. Illustration of Income Quintiles in a community of 10 households

The RII is calculated by dividing the annual user fees by each income quintile value. In the example show in Figure 3, the RII for income quintile 1 is calculated by dividing the annual user fees of $1,000 by $20,000 and multiplying it by 100, to obtain the percentage value. The RII value for income quintile 1 (RII(IQ1)) in the example is 5%. Hence, in this example the user fees account for 5% of the income of the households of income quintile 1, and 2.5% and 1.4$ of the households in income quintile 2 and 3, respectively. If user fees are affordable for lower income quintiles, the households with the higher income will also be able to afford the fees. Since affordability is defined as the ability of the lowest-income households to pay their bills without having to give up other essentials, the RII score for each community is calculated by averaging the RII score income quintiles 1-3.

Residential Income Indicator Calculation

Income quintile	IQ1	IQ2	IQ3	IQ4	IQ5
Annual income	$ 20,000	$ 40,000	$ 70,000	$ 100,000	$ 140,000

Annual user fees: $1,000

RII Value:	RII (IQ1)	RII (IQ2)	RII (IQ3)	RII (IQ4)	RII (IQ5)
% annual cost: $\left(\frac{\text{User Fee}}{\text{Income Quintile}}\right) \text{x } 100$	5.0%	2.5%	1.4%	1.0%	0.57%

Average RII (IQ1-IQ3): 2.96%

Figure 3 - Example of how the Residential Income Indicator is calculated using an imaginary community

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The affordability of the RII community scores are determined using the pre-set thresholds show in Table 1. An RII percentage of 2% or lower indicate that the user fees are a low burden for the community. Scores between 2% and up to and including 5% are a medium burden. Any user fees that result in an RII above 5% are a high burden.

Table 1- RII Thresholds

% cost to quintile	≤ 2%	2% < x ≤ 5%	> 5%
Affordability value	Low Burden	Medium Burden	High Burden

The FCI value is obtained by calculating the average of score assigned to the indicators based on pre-established thresholds. FCI is composed of socioeconomic indicators chosen for their ability to detail the situation in rural Alaska. The socio-economic indicators used are the:

1) percentage of households which are Supplemental Nutrition Assistance Program (SNAP) recipients;
2) percentage of households living under the poverty level;
3) percentage of people over the age of 16 with full time jobs.

Indicator data is obtained form the American Community Survey 2016 5-year estimates, which can be found on the American Factfinder portal. The relevant ACS tables are listed below in Table 2.

Table 2- Data Source for socio-economic indicators

Indicator	American FactFinder Table
SNAP	S2201
Poverty Levels	B17012
% population > 16 with full time jobs	S1701

The FCI scores are assigned scores which range from 1, which indicates socio-economic weakness, to 3, which represents a strong socio-economic situation. The scores are set based on the thresholds shown in Table 3 below. The FCI value is calculated by averaging the 3 scores.

Table 3- Threshold levels of the FCI scores

Indicator:	FCI Score Thresholds		
	1	2	3
% of households which are SNAP recipients	>20%	10% < x ≤ 20%	≤ 10%
% households under the poverty level	> 20%	10% < x ≤ 20%	≤ 10%
% over the age of 16 employed full time	≤ 30%	30% < x ≤ 50%	> 50%

MHI Indicator

This indicator replaces the MHI indicator. With the MHI indicator, if the total user fees paid by a home in a year accounted for 5% or less of the community's median household income (MHI), then the fee levels were considered affordable. The MHI indicator was found to be unreliable in the rural Alaskan context as it:

1. Failed to account for the distribution of income within communities;
2. Failed to account for the cost burden experienced by households making less than the median household income;
3. Median household income figures are a static snapshot of income in time;
4. Differences in costs of living expenses are unaccounted for.

Median household income is the half-way point of household's income distribution in a community. Pretend that there is a list of the income of every household in a community, and that list is sorted from smallest to largest. As shown in Figure 4, the median household income is the point at which half of the households have an income above and half below.

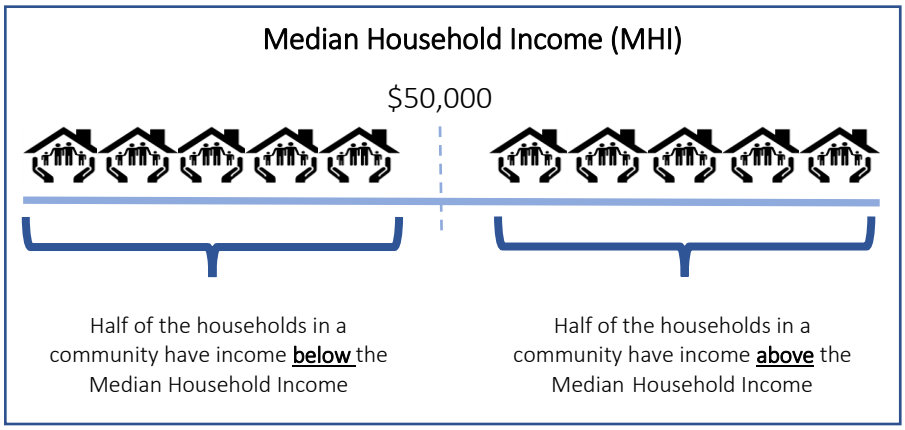

Figure 4- Median Household Income

One of the problems with the MHI indicator is its failure to account for the distribution of income within a community. The median household income figure means that half of the households in a community have an income below that level. However, as shown in Figure 5, the distribution could be very different. In the top panel, three of the households make $10,000 while one makes $45,000. In the bottom panel, the households' income level is much closer to the median, as even the poorer households make $40,000.

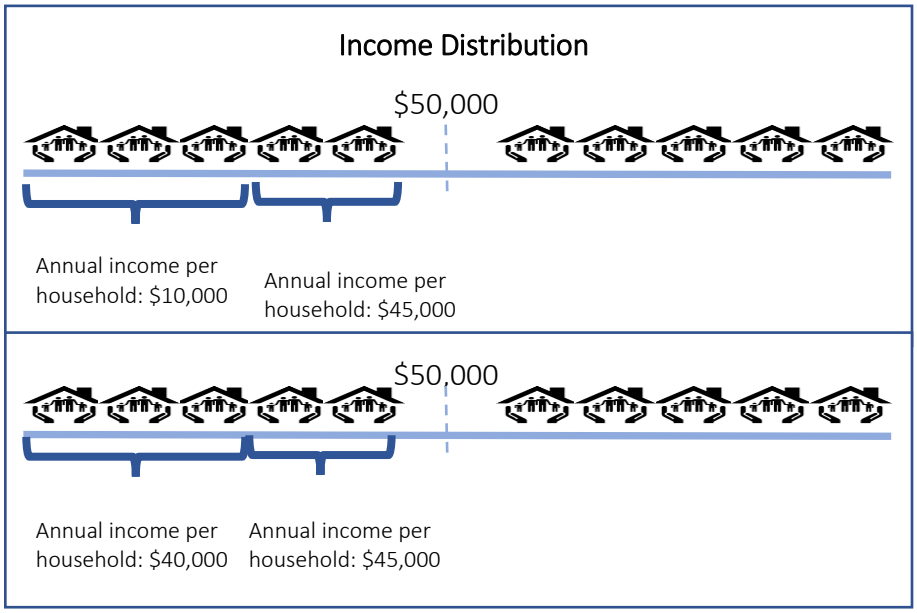

Figure 5- Difference in income distribution in two communities with the same median household income

Figure 6 shows why income distribution is important. In this example, the median household income is $50,000 and so monthly user fee of up to $208 are considered affordable. While a household making $50,000 will spend 5% of its income paying the user fees, a household with an income of $10,000 will have to spend 25% of its income to pay the user fees.

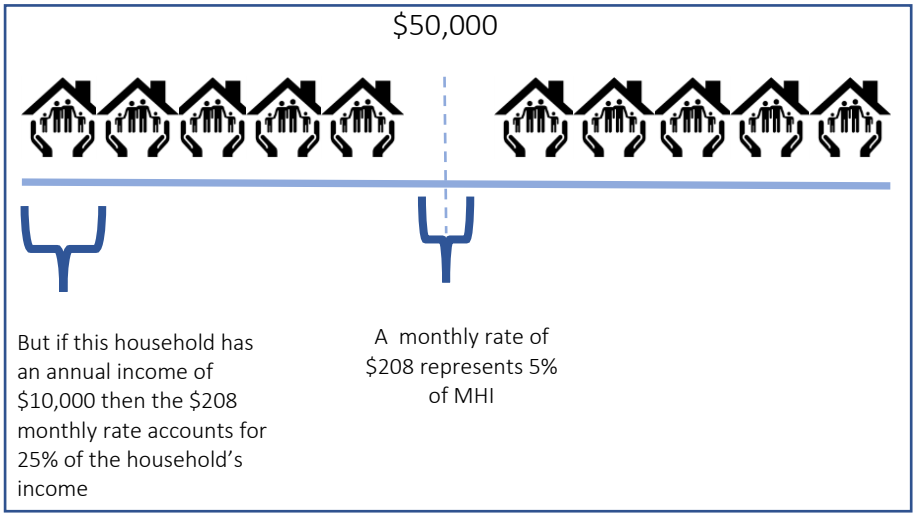

Figure 6 - The MHI Indicator cannot account for the income distribution within a community

Another problem stemmed from the fact that data on median household income in rural communities are only collected every 5 years. The availability of cash-generating opportunities varies between seasons and years, and so if the data was collected in a year with a higher than usual number of cash paying jobs the median household figure would overestimate the community's income. Conversely if the data was captured in a bad year, the median household would be underestimated.

The MHI indicator also failed to account for differences in cost of living between communities. Cost of living vary significantly across rural Alaska, and depend on many factors, such as whether communities are on the road system or PCE eligible. In communities with higher costs of living, the 5% threshold may in fact be unaffordable.