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Water Resources Planning and Management

Date: September 13, 2012
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To: Hossein Parandvash
Cc: Lorna Stickel, Tom Chesnutt
Re: Task C Technical Memorandum

Task C calls for an evaluation of the degree to which the current Portland Water Bureau (PWB) retail rate structure meets local objectives and needs. A key question to be addressed by this study is the extent to which alternative rate structures might provide a greater conservation incentive than the existing structure. One of the determinants (but not necessarily the only determinant) of the need for additional conservation is the degree to which future demands are projected to outstrip available supplies. The analysis thus begins with a comparison of projected future water demands and supplies.

In addition, the analysis addresses:

- Anticipated economic costs and benefits;
- Impacts on low and fixed-income customers;
- Provision of appropriate economic signals to customers; and
- Risks of revenue instability.

Comparison of Projected Demands and Supplies

Available Supplies

The PWB has two significant municipal water supplies which can be utilized either singly or in conjunction with each other within the transmission system. The groundwater supplies consist of the Columbia South Shore Well Field (CSSWF), which has a listed capacity in the Water Management and Conservation Plan of 82.8 MGD, and the developed Powell Valley Well System of 7.36 MGD. Currently the City only utilizes the CSSWF and has not yet connected the Powell Valley wells into the primary transmission/distribution system.

The other primary source of water is from the Bull Run watershed. This surface water system is utilized year round, and relies on both storage within the reservoirs (9.9 BG) and the inflow of the Bull Run River during the peak season drawdown period. The Bureau has evaluated the historical record to provide a low estimate (5th percentile or below) of the average capacity over the drawdown period. In 1987, (the longest peak season period in the Bureau's 70 year record), drawdown started on June 10 and ended on November 12, for a duration of 155 days. During that time, the total volume of inflow to the reservoirs was 10.3 BG. Adding 9.9 BG from the reservoir storage at the beginning of drawdown yields a total volume of 20.2 BG, or an average of 130 MGD of available capacity over the 155 day drawdown period.

Adding this to the groundwater capacity results in a low-end estimate of total system capacity of approximately 220 MGD.

Customer Demands

The Bureau’s 2010 Water Management and Conservation Plan forecasts peak-season demands to 2030 for both normal weather and for the 1967 weather year.¹ Table 1 shows the higher forecast, based on 1967 weather, at 5-year intervals.

Table 1. Peak-Season Demand Forecast Assuming 1967 Weather

Year	Average Peak-Season Daily Demand (mgd)
2010	160.1
2015	168.1
2020	175.7
2025	182.5
2030	188.8

Even the 2030 peak-season demand forecast is well below the 220 mgd peak-season supply availability. Additional water conservation is not needed to help balance future water supply and demand. The forecasts indicate that, for the foreseeable future, there will be sufficient available water supply.

Rate Structure Economic Costs and Benefits

One of the conclusions of the Task A Technical Memorandum (June 4, 2012) was that “it is safe to assume that a more complex rate structure such as an increasing block rate is at least as expensive to administer as the Bureau’s current uniform rate, and would likely be more expensive.” To the degree that there is any variation at all in the costs to administer different rate structures, it is likely that the current uniform structure would be among the least costly.

The question therefore is whether the current structure or a more complex and presumably administratively more expensive structure that is intended to incentivize conservation is economically more viable for PWB. While it is impossible to provide a quantitative answer to this question, the following observations are relevant:

- As discussed in the Task A memo, there is little evidence in the literature that a change in rate structure results in significant water use reductions. It should be noted that the studies cited focus on the impact of increasing block rates. It is possible that another rate structure could yield more significant demand reductions.²

¹ 1967 weather results in the highest per-capita demands during the peak season.

² For example, account-specific budget-based rates have been used more in recent years. Anecdotal evidence points to the possibility of more significant water savings. Of course, the costs to implement and administer such a structure are much higher than other rate designs.

- The cost avoided per unit of water savings (the marginal supply cost) is likely to be small. Given the long-term sufficiency of the water supply discussed above, there are no capital costs avoided due to demand reductions. The only costs avoided are the variable operating costs. These are estimated to be approximately \$41 per million gallons for water provided from the Bull Run system, which serves the vast majority of demand, and \$465/mg for groundwater.³
- The economic benefits to PWB and its ratepayers of an alternative rate structure can therefore expected to be small. This small benefit may or may not exceed the incremental administrative costs of this new rate structure. Even if the benefits do exceed the costs, the net benefit is likely to be small.

Thus, the economic viabilities of the current rate structure and of any rate structure alternative are likely not to differ significantly.

Impacts on Low and Fixed Income Customers

The impacts of the current rate structure on PWB low and fixed income customers are mitigated by the Bureau's discount program for low income customers. The following discussion will first address the rate structure itself and then will address the discount program for low-income customers.

Rate Structure

There are two indicators that are often used to assess how a particular utility rate structure affects low and fixed-income customers:

- The volumetric rate charged for uses that are deemed essential.
- The magnitude of fixed vs. variable charges.

Table 2 compares Portland's current volumetric rate to the rate charged to residential customers by our comparison utilities. Five of the six comparison utilities have increasing block rates. In those cases, the rate for the first tier is shown. Portland's volumetric rate is third-highest among the 7 utilities, and significantly exceeds the average. It is one of only two utilities that do not have an increasing-block structure. Such a rate structure allows a utility to charge a lower volumetric rate for more essential less-discretionary uses.⁴

³ Personal communication from Cecelia Huynh, Acting Finance Director, Portland Water Bureau.

⁴ Of course, the degree to which the lower charges for these uses benefit low-income customers depend on the details of the rate structure.

Table 2. Minimum Volumetric Rate Charged to Residential Customers

Utility	Minimum Volumetric Rate (\$/ccf)
Portland	\$3.32
Seattle	\$4.34 ^{a, b}
Tacoma	\$1.37 ^{a, c}
Denver	\$1.90 ^a
Mesa	\$3.00
Tucson	\$1.69 ^a
San Francisco	\$3.90 ^a
Average	\$2.79

- a. First tier of increasing-block structure.
- b. \$4.04 uniform rate in winter.
- c. \$1.37 uniform rate in winter.

Table 3 compares the percentage of single-family revenues collected through the fixed charge.⁵ In general, higher fixed charges are more onerous to low- and fixed-income customers. Portland ranks fourth among the seven utilities. Its percentage of total single-family revenues that are collected through the fixed charge is slightly above the average of the seven utilities.

Table 3. Fixed Revenue as Percentage of Total Revenue for Single-Family Customers

Utility	Single-Family Fixed Revenue as % of Total
Portland	37%
Seattle	38%
Tacoma	58%
Denver	16%
Mesa	45%
Tucson	24%
San Francisco	23%
Average	34%

Low-Income (LINC) Assistance Program

The Bureau's low income discount is available to single family residential customers with incomes below 50% of the statewide median income. As of June 30, 2012, there were 9,350 households receiving the discount. Each of these customers receives a fixed quarterly discount of \$37.15 on its water bill and \$78.77 on its sewer bill for a total quarterly discount of \$115.92 (just under \$39 per month).

⁵ For each utility, these figures are for the most recent fiscal year for which data is available. These percentages are likely to vary from year to year due to differences in weather and economic conditions.

It is instructive to compare Portland’s low income assistance program to those of our comparison utilities. Table 4 compares key parameters of those programs.⁶ Two of the six comparison utilities do not have such a program. The program of one (Tacoma) only applies to low income customers who are elderly or disabled. Portland’s and Seattle’s programs define their income threshold as a percentage of statewide median income. The definitions of the other three programs’ thresholds are based on the federal poverty guidelines. For comparison purposes, all thresholds are expressed as a percent of statewide median income.

Table 4. Comparison of Utility Low-Income Assistance Programs

Utility	Income Threshold		Percent Bill Discount
	Stated Criterion	Percent of State Median Income	
Portland	50% Med ^b	50%	41% ^d
Seattle	70% Med ^b	70%	50%
Tacoma^a	150% Pov ^c	42%	30%
Denver	N/A		
Mesa	N/A		
Tucson	100% Pov ^c	33%	30%
San Francisco	200% Pov ^c	59%	15%
Average	--	51%	33%

- a. Tacoma program applies only to low income elderly or disabled.
- b. Income criterion expressed as percentage of state median income.
- c. Income criterion expressed as percentage of federal poverty guidelines.
- d. Portland percent discount based on current fixed quarterly discount of \$37.15 and 74 ccf average annual usage of participating customers.

Portland’s income threshold ranks third of the five programs and is also close to the average across the five programs. The magnitude of the Portland discount ranks second and is significantly above the average of the other programs.

Provision of Appropriate Economic Signals

Economic theory tells us that customers receive the ‘appropriate’ economic signal if the charge for each increment of a commodity equals its marginal cost. If the incremental charge exceeds the marginal cost, the result will be that customers will consume less than the economically efficient quantity. Conversely, if the incremental charge is less than the marginal cost, excess consumption will occur.

As is typically the case for water utilities, the vast majority of the Bureau’s costs are fixed. Rates must be set to collect the revenue requirements associated with those fixed costs, as well as the Bureau’s variable costs. The current commodity charge for all customers is \$3.32 per ccf, or in excess of \$4,000 per million gallons. As discussed above, the marginal supply cost, even from the most expensive source, is less than \$500 per million gallons.

⁶ The table reflects discounts only on water bills. Discounts for sewer and other utilities are excluded.

The foregoing only considers the costs incurred by the Water Bureau. There could also be other (e.g. environmental) costs imposed by water usage. Some would argue that such 'external' costs should also be considered in setting prices to provide the societally-efficient economic signal. These external costs are much more difficult to estimate, but given the gap between the Bureau's marginal costs and the variable rate, it is highly unlikely that the total (internal and external) marginal cost will approach \$4,000/mg.

As pointed out in the Task A memo, despite the fact that economic theory tells us that an informed customer will base his/her consumption decisions on the marginal price, it is not clear whether water customer price response is primarily driven by marginal or by average price. In Portland, the average price currently facing a residential customer is even higher than the marginal price.⁷

In summary, it can be argued that the current rate structure is not transmitting the proper economic signal to customers; rather, it is encouraging customers to consume at a level that is below that which is economically efficient. This is largely due to a combination of high fixed costs, low production costs, and projected demands that are significantly less than current supplies.

Risks of Revenue Instability

Rates are typically set to recover utility fixed and variable costs. The rates are usually based on a forecast of test year demands and are set to recover utility revenue requirements if actual demands equal the forecast. Of course, water demands are inherently uncertain. Actual demands can vary substantially from forecasts.

The degree to which demand variability translates into revenue uncertainty defines the "revenue instability" of a rate structure. As an extreme case, revenues under a rate structure under which each customer pays only a fixed charge, regardless of how much water is consumed, would be extremely stable. On the other hand, a rate structure which generates all of its revenues based on consumption and in which many customers pay a high marginal charge would be very unstable.

Generally speaking, a higher fixed charge means that a smaller fraction of revenue requirements are collected through variable charges, which in turn means that the average variable charge is lower. In a uniform rate structure such as that currently in use in Portland, this average variable charge is in fact the charge for each unit consumed. With this structure, it can therefore be stated unambiguously that more revenue collected through the fixed charge results in revenues less subject to variations in demand.

Thus, a useful summary measure of revenue stability is the overall percentage of total water revenue that is collected through the fixed charge. All else being equal, a higher fraction of revenue collected through fixed charges implies more stable revenue. Table 5 compares this measure in Portland to the six comparison utilities.⁸

⁷ The average price reflects the quarterly fixed charge.

⁸ Note that these figures differ from those in Table 3 in that here we are interested in the fixed vs. variable revenue breakdown across all classes. In Table 3, the focus is on residential customers. Recall also that Portland's combined water/sewer bill contains a single fixed charge. Arguably, if the fixed charge were split between separate water and sewer bills, the water portion would be a smaller fraction of total water revenue.

Table 5. Total Retail Fixed Revenue as Percentage of Total Revenue

Utility	Total Retail Fixed Revenue as % of Total
Portland	26%
Seattle ^a	24%
Tacoma ^a	53%
Denver ^a	10%
Mesa	45%
Tucson ^a	19%
San Francisco ^a	14%
Average	25%

a. Utility has an Increasing-block rate structure for at least a portion of the year.

In recent years, water utilities across the country, including Portland, have faced unexpectedly-sharp declines in sales. This has made revenues less predictable and more unstable. The desire to stabilize revenues has therefore become a more prominent concern which, of course, needs to be balanced against other objectives. It is possible, for example, that the high fixed revenue percentages in Tacoma and Mesa were instituted specifically to stabilize revenues. Likewise, it is possible that other utilities are considering such a move for that reason.

Portland's percentage of total revenues that are collected through the fixed charges is the third highest of the seven utilities and is right at the seven-utility average. So by this measure, the revenue stability characteristics of Portland's rate structure seem to be in line with the other utilities.

However, Portland is one of only two of our sample that does not have an increasing-block rate structure. For utilities with increasing blocks, the water consumed in the higher blocks is likely to be of a more discretionary nature than usage in the lower blocks. Thus, depending on how many customers are consuming in those block(s), and the degree that the rates in these blocks exceed the average variable charge, such a rate design will tend to increase revenue instability relative to a uniform rate design.

Summary

This memorandum has assessed the degree to which the current rate structure meets key local needs. The key conclusions are as follows:

- For the foreseeable future, available water supply is more than sufficient to meet projected retail and wholesale demands. While, for some water utilities, conservation is needed as a component of a resource strategy to balance future demands and supplies, that is not the case in Portland.
- A corollary of the sufficiency of future supplies is that the economic benefit of conservation to the Bureau and its ratepayers is small. Thus, the economic benefit of any alternative rate structure that may encourage conservation is small and these benefits may or may not exceed the incremental administrative costs of this new rate structure. Even if the benefits do exceed the costs, the net benefit is likely to be small.

- One measure of the burden that water charges place on low- or fixed-income customers is the commodity charge for the first (less discretionary) units of usage. When Portland's current commodity charge is compared to the minimum volumetric rate of our comparison utilities, it is third highest and exceeds the average. It is one of only two of the seven utilities that does not have an increasing block rate, which gives it less flexibility to charge less for non-discretionary uses.
- Another measure of the burden on low- and fixed-income customers is the fraction of single-family revenue that comes from fixed charges. On this measure, Portland is about average.
- Like most of our other comparison utilities, Portland has a discount program to assist low-income customers. Both the income criteria and the magnitude of the discount of Portland's program are in line with our comparison utilities. As a percentage of average bill, Portland's discount exceeds all but one of our comparison utilities.
- Both the marginal and average prices of the current Portland rate structure exceed the marginal cost of supply. It can therefore be argued that the current rate structure is not transmitting the proper economic signal to customers; rather, it is encouraging customers to consume at a level that is below that which is economically efficient.
- An important concern for Portland as well as for other water utilities is revenue stability. A key indicator of revenue stability is the fraction of total revenue coming from fixed charges. For its retail customers, about one-fourth of Portland's revenue is fixed. This is about equal to the average across our seven utilities.