PUBLIC SERVICE COMMISSION OF WISCONSIN

INVESTIGATION INTO THE METHODS USED BY WISCONSIN'S WATER UTILITIES IN ALLOCATING PUBLIC FIRE PROTECTION (PFP) COSTS

Draft Staff Report

Docket 5-WI-104

September 23, 2015

Commented [PP1]: Comments provided by Patrick Planton, member of PFP eview team

Division of Water, Telecommunications, and Consumer Affairs

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Appendices

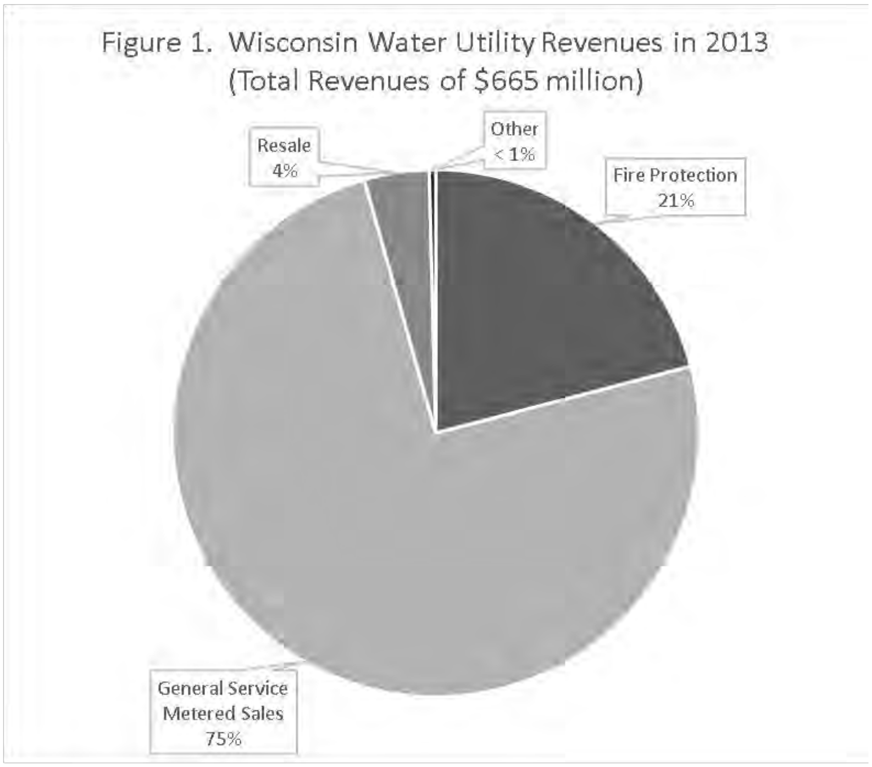
1. Purpose of Investigation

On October 30, 2014, the Public Service Commission of Wisconsin (Commission) presented its Final Decision in Docket 3720-WR-108, the "Application of Milwaukee Water Works, Milwaukee County, Wisconsin, for Authority to Increase Water Rates". Order Point No. 14 of that decision included two parts. Part A stated that "the Commission shall open a generic investigation to study the methods of all water utilities in allocating public fire protection costs." Part B stated that "MWW and the Wholesale Customers shall work with Commission staff to further evaluate alternative methods for allocating fire protection costs for use in MWW's next rate case." (PSC REF#: 223601)

The following report addresses Part A by describing how the Commission currently computes the PFP charge, comparing that method with best practices used by other states, identifying the assumptions that underlie the Commission's cost-of-service model (PSC model), and determining if those assumptions are reasonable or not. The goal of this study is to make improvements to the PSC model to make sure that the Commission's methods reflect reasonable assumptions and produce accurate PFP cost allocations. Also, it is hoped that this study will reduce the number of contested issues encountered in water rate cases. Part B will be addressed in a subsequent study.

2. Rationale for the Public Fire Protection Charge

The Commission regulates 582 water utilities in Wisconsin. All but five of them are municipally owned. These 582 water utilities earned a total of $665 million in revenues in 2013, as shown in Figure 1. Approximately $140 million (21%) of those revenues were earned from fire protection charges. Since the PFP charge provides such a significant share of water utility revenues, it is important to make sure that these charges are computed using the best methods available.



2.1 Definition of the PFP Charge

The PFP charge is ~~essentially~~ a ~~standby~~ charge that covers the costs to oversize the utility's water system to provide the high flows and pressures needed to fight fires. These costs include a portion of the operation and maintenance expenses, depreciation expenses, taxes, and return on net investment rate base attributable to the relevant water plant. The oversized water plant that impacts the PFP charge includes: wells, water treatment equipment, pumps, storage facilities, water mains, and hydrants. Please note that the cost of the water used to fight fires is relatively insignificant compared to the cost of the related plant.

In many cases, if a water system didn't have to provide the ~~high~~ higher flows and required minimum system pressure needed to fight fires, then its ~~components~~ supply, storage and distribution infrastructure would be smaller and less costly to build, operate and maintain. Such a water system might need less ~~well~~ supply capacity, less pumping capacity, smaller storage facilities, smaller diameter water mains, and very few if any hydrants. For many water systems, the addition of fire flow capacity results in an additional cost to build and operate the water system. For example, Wis. Admin Code NR 811.70(5) states, "The minimum diameter of water mains to provide water for fire protection and to serve fire hydrants is 6 inches. Larger mains are required if necessary to allow the required fire flow while maintaining a minimum residual pressure of 20 psi at ground level at all points in the distribution system. (6) FIRE PROTECTION. The minimum flow requirement for water mains serving fire hydrants is 500 gallons per minute (gpm) at 20 pounds per square inch (psi) residual pressure at ground level at all points in the distribution system." Many small communities could get by with 4-inch diameter mains or smaller if they did not provide the ~~high pressures and~~higher flows needed to fight fires. But since they do serve hydrants, then the WDNR requires minimum 6-inch diameter mains.

Commented [PP2]: Even a larger one. I did a water system study of the Superior Water Utility (investor-owned) in 1999. It had numerous locations served by long, dead-end 4-inch diameter mains – that provided the bare minimum DNR code required 500 gpm at 20 psi. No incentive to provide more even if required by ISO for an investor-owned water utility.

The Commission has traditionally designed water rates to assign the cost to the cost-causer. Therefore, it has been the Commission's standard of practice to identify the PFP cost-of-service, compute corresponding PFP rates, and bill those rates to the appropriate users. The PFP charge is not simply a "hydrant rental" fee. The cost of the fire hydrants is only a small portion of the total cost of providing PFP service. Also, the PFP charge has no relationship with funding the fire department.

If the PFP water is discharged through an unmetered hydrant, then the water used is paid through Schedule F-1, Public Fire Protection Service. If the water is discharged through an unmetered private fire protection service (sprinkler system), then the water used is paid through Schedule Upf-1, Private Fire Protection Service – Unmetered (see Section 7).

From a rate making perspective, the PFP cost-of-service should be the difference between the cost of the system with fire protection and the cost of the system without fire protection. Unfortunately, community water systems are typically designed piecemeal over time. As water capacity needs arise, communities hire engineering consultants to evaluate their water system and make recommendations for infrastructure improvements. As a result it can be difficult to assign assets to the correct category.

2.2 Sizing a Water System Based on Demand and Reliability

When evaluating the capacity of a water system, engineers consider the water system's ability to meet demand and its ability to provide reliable service. Typically, they will make sure that the water system's firm ~~well~~ supply capacity (~~well~~ supply capacity with largest ~~well~~ pumping unit out of service) is greater or equal to the communities' (current or future) maximum day demand. Also, the engineer will make sure that the firm ~~well~~ supply capacity plus effective storage meets the maximum day demand plus fire demand, ~~(~~or the maximum hour demand~~)~~. Then the engineer will evaluate the reliability of the water system. This entails evaluating how the water system performs under various operating scenarios including: ~~well~~ supply source or pump failure, maintenance of supply or storage facilities~~reservoir~~, drought, etc.

Commented [PP3]: Suggest change to supply and delete "well" – surface water utilities don't have wells.

Since~~Unfortunately,~~ there is no universally accepted definition of water system reliability, water system e~~. E~~ngineers use ~~are left to follow~~ their engineering judgement, state code requirements and standard industry engineering practice. Over the life of a water system, infrastructure is being added and changed based on each engineer's best efforts at meeting current or future water system demand and reliability. The result is that many systems may have added~~excess~~ capacity that was designed to meet future system demand, fire demand, or reliability of general service~~, or both~~. (PSC REF# 232974) See Appendix A for an example of a water system capacity analysis.

The PSC cost-of-service model assumes that the extra capacity not required to meet the demand of the general service customers is needed to fight fires. In reality, a water system's supply capacity is just as important in providing redundancy/reliability to the water system should a ~~well~~ supply source fail, a storage ~~an elevated~~ storage tank need repair or routine maintenance, or some other unusual event occur. The PSC cost-of-service model does not take into account these complexities when allocating costs to the PFP charge.

Often, the size of the utility impacts whether fire demand controls the design of the water system. Wisconsin's 582 regulated water utilities are classified by size into Class AB (serving more than 4,000 customers), Class C (serving from 1,000 to 4,000 customers), and Class D (serving fewer than 1,000 customers). Figure 2 shows the number of utilities in each class.

Commented [PP4]: Master planning for water utilities use a 20-year planning horizon. Supply, treatment and storage projects can take years to implement, and facilities have useful lives in excess of 50 years. Engineers need to take future demands and water supply needs into account. A current "excess" supply capacity might be needed to serve projected 2025 or 2035 demand. Example, as water demand grows incrementally over years, a utility needs to increase supply in large increments (e.g., new supply well that produces 1,000 gpm).

Commented [PP5]: Could be supply capacity to serve future demand projections (see comment above)

Commented [PP6]: Should changes be made so the model can?

Commented [PP7]: It always should – but in Superior it did not for cost/profit reasons.

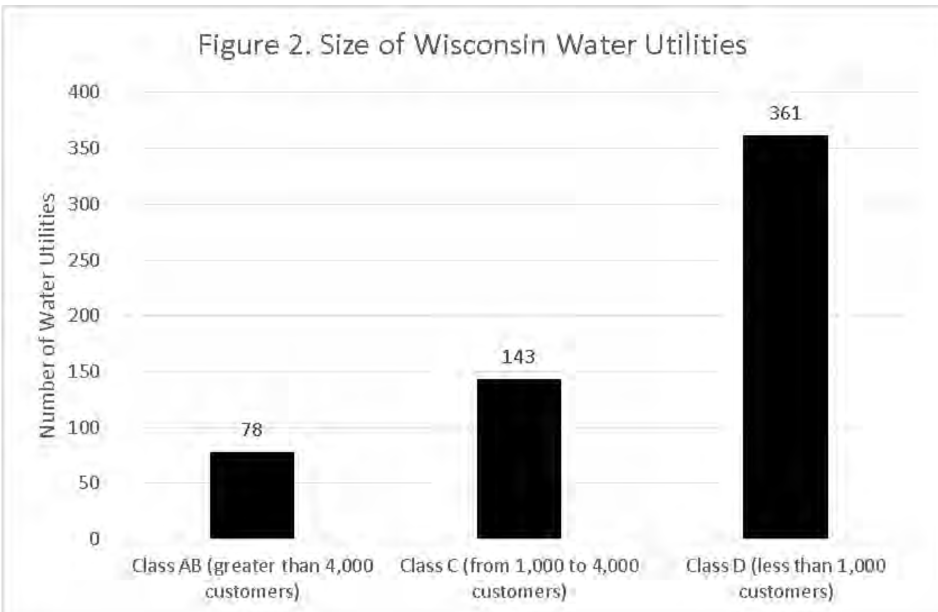


Figure 2. Size of Wisconsin Water Utilities

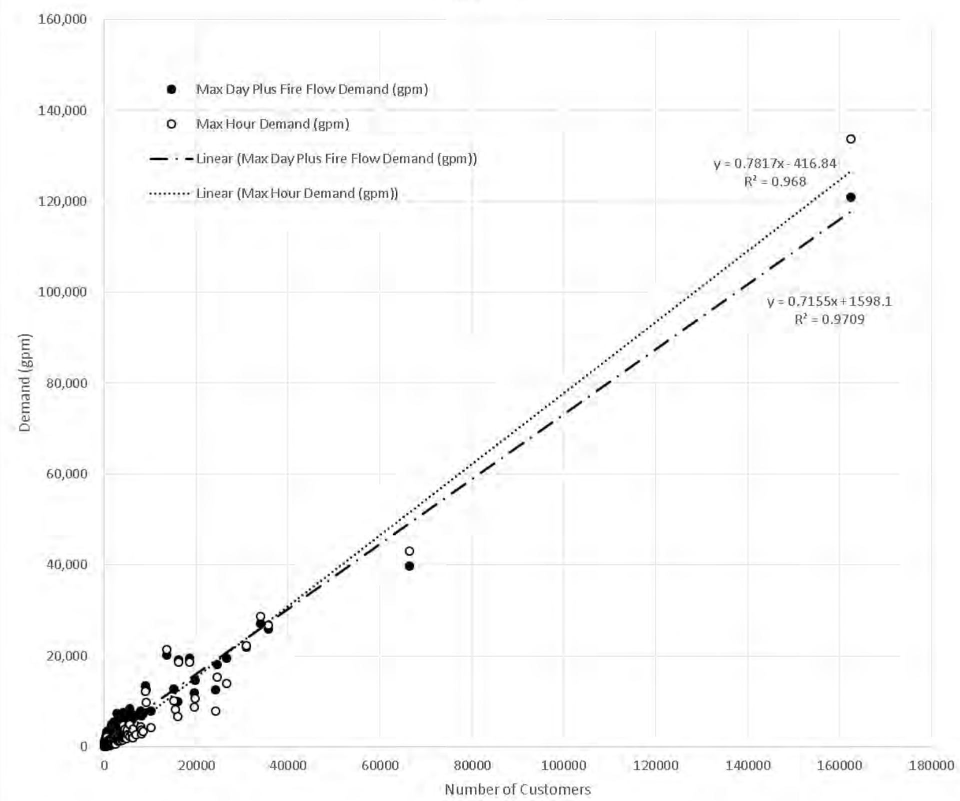
In smaller water systems (Class D), the fire flow typically represents the largest potential demand on the system. In larger systems (Class AB), the maximum hour demand for general service may be larger than the fire flow requirements and therefore control the overall design and operation of the water system. For example, the Orfordville Municipal Water Utility (Class D) has a maximum day plus fire flow demand of 1,178 gpm (178 gpm + 1,000 gpm). The maximum hour demand is 250 gpm, which is much less than the maximum day plus fire flow condition. So in this case, the maximum day plus fire flow demand is the controlling ~~the~~ design condition of the water system. In contrast, the Milwaukee Water Works has a current max day plus fire flow demand of 120,982 gpm (103,020 gpm plus 17,962 gpm). The max hour demand is 133,814 gpm. So in this case, the max hour demand for general service would be the controlling condition for ~~controls~~ the design and operation of the Milwaukee water system.

Commented [PP8]: General comment – suggest spell out "maximum"

~~Unfortunately, ~~T~~t~~he PSC cost-of-service model uses the same methodology to compute PFP costs, regardless of whether the fire flow demand controls the design of the water system or not. Figure 3 shows a plot of the max day plus PSC fire flow demand versus number of customers and also a plot of the max hour demand versus number of customers. This graph is based on 218 water utilities in Wisconsin that have received a full rate case since 2006. The data used to make the graph is included in Appendix B.

Linear trend lines were computed and are also shown on the graph. Figure 4 shows a detail of the same plot where the trend lines cross. Based on this analysis, the intersection of the two trend lines is at 30,437 customers. Therefore, when PSC assumptions on a utility's fire flow demand are used, it appears that the max hour demand is the controlling demand condition for water systems with more than 30,000 customers (rounded to nearest 1,000 customers). There are five water utilities in Wisconsin that have more than 30,000 customers: Kenosha Water Utility (30,962 customers), Racine Water Works Commission (33,981 customers), Green Bay Water Utility (35,728 customers), Madison Water Utility (66,416 customers), and Milwaukee Water Works (162,373 customers). Possible applications of this analysis will be discussed further in Section 4.

Figure 3. Comparison of Max Day Plus Fire Flow Demand and Max Hour Demand (n=218)



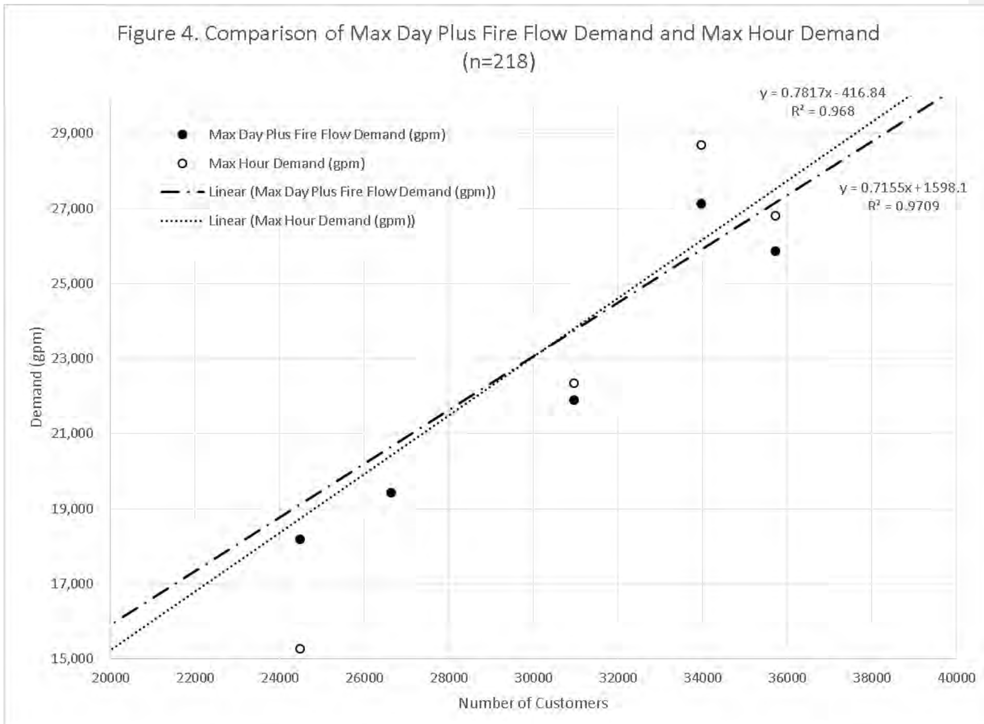


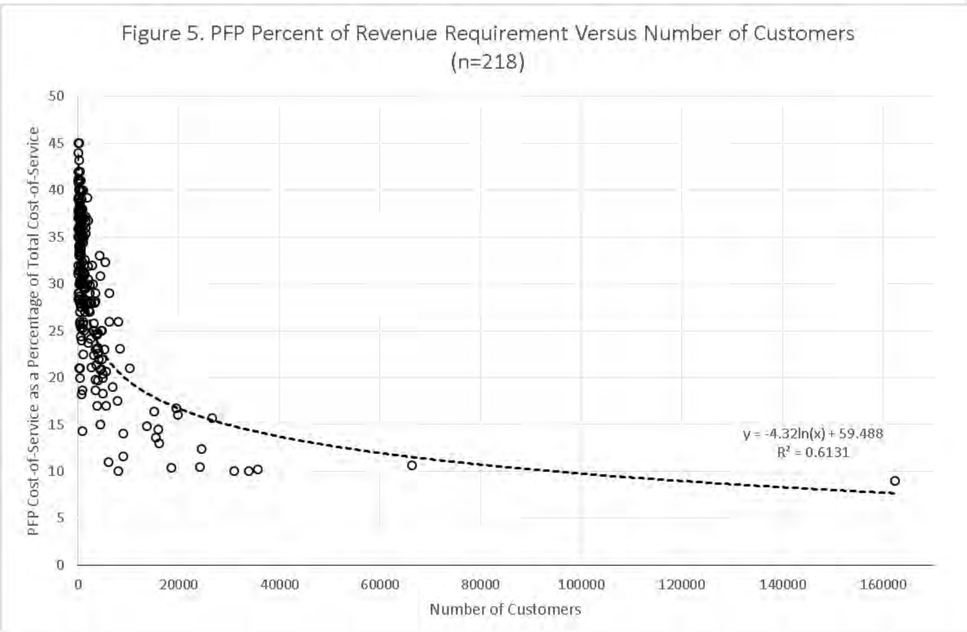
Figure 4. Comparison of Max Day Plus Fire Flow Demand and Max Hour Demand (n=218)
y = 0.7817x - 416.84
R² = 0.968
y = 0.7155x + 1598.1
R² = 0.9709
Max Day Plus Fire Flow Demand (gpm)
Max Hour Demand (gpm)
Linear (Max Day Plus Fire Flow Demand (gpm))
Linear (Max Hour Demand (gpm))
Demand (gpm)
29,000
27,000
25,000
23,000
21,000
19,000
17,000
15,000
20000
22000
24000
26000
28000
30000
32000
34000
36000
38000
40000
Number of Customers

3. Overview of the Public Fire Protection Charge

The Commission uses the base extra capacity cost-of-service and rate design model as shown in the American Water Works Association (AWWA) Manual M1, 6th Edition. The cost-of-service is based on the "base extra capacity" model. Once the model computes the cost-of-service for the PFP customer class, that amount is recovered through PFP rates. Characteristics of the resulting PFP cost-of-service are discussed in the following paragraphs.

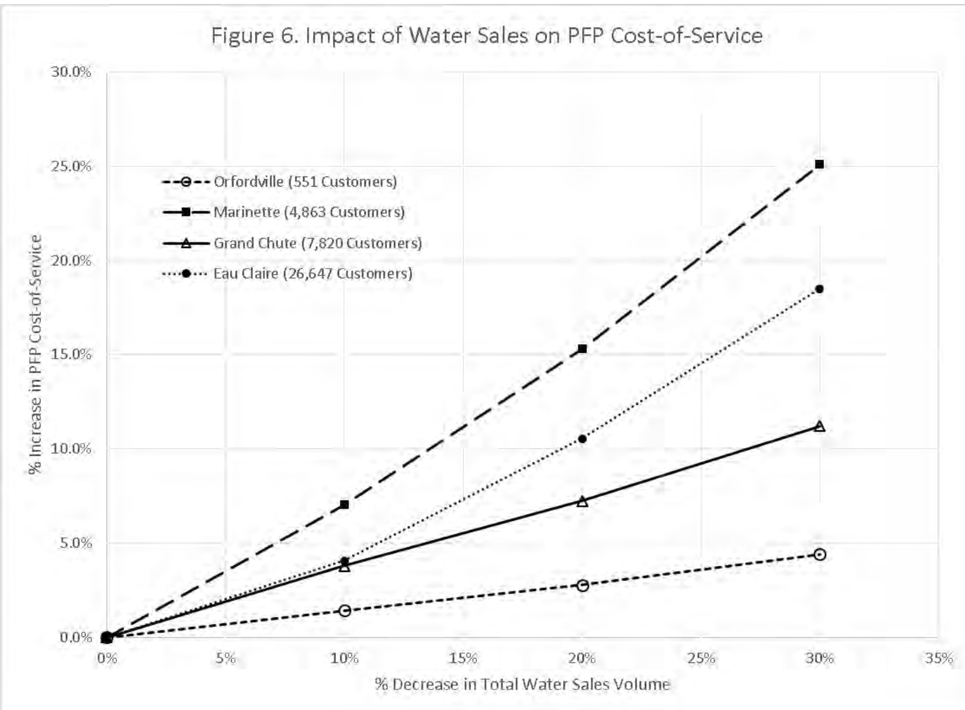
3.1 Relationship of Utility Size to the PFP Cost-of-Service

Based on the PSC cost-of-service model, the smaller the water utility (the fewer ~~the~~ number of customers), the higher the cost of PFP as a percentage of the total cost-of-service. As shown in Figure 5, the PFP charge ~~cost-of-service~~ ranges from 9% of a~~the~~ water utility~~ies~~'s total annual cost of service~~budget~~ (Milwaukee Water Works) to as high as 45% of ~~the~~ a water utility's service costs~~budget~~ (Tony Municipal Water Utility). ~~The plot below~~Figure 5 is based on cost-of-service data from March 2006 to the present. This included data from 218 of Wisconsin's 582 regulated water utilities. The data is included in Appendix C.



3.2 Relationship of Water Sales to the PFP Cost-of-Service

It is interesting to note that based on the Commission's cost-of-service model, the PFP cost increases as the general service consumption decreases. From 2007 to 2014, there has been a decline in average residential water use in Wisconsin of almost 13% (2014 Wisconsin Water Fact Sheet, Public Service Commission of Wisconsin). As ~~communities~~ utility customers reduce water usage over time (through increased use of water saving appliances, industrial water reuse, and other conservation efforts), the PFP cost-of-service increases. This occurs due to the way that the PFP customer class is calculated in the PSC cost-of-service model. To illustrate this relationship, Commission staff ran the cost-of-service model for four sample utilities of various sizes. The PSC cost-of-service model for each utility was run with incrementally lower water sales while all other parameters were held constant. The resulting plot of the percent increase in the PFP cost-of-service versus the percent decrease in total water sales is shown below in Figure 6. The data is found in Appendix D.



As total water sales decrease, the resulting reduction in demand causes incremental increases in available water supply capacity~~usage results in a water system that is over designed~~. The unused extra capacity in the system represents a stranded asset. As the general service use decreases then the PSC model allocates a portion of the ~~stranded asset~~excess supply capacity costs to the PFP cost-of-service. Is it reasonable to allocate ~~stranded asset~~excess supply capacity

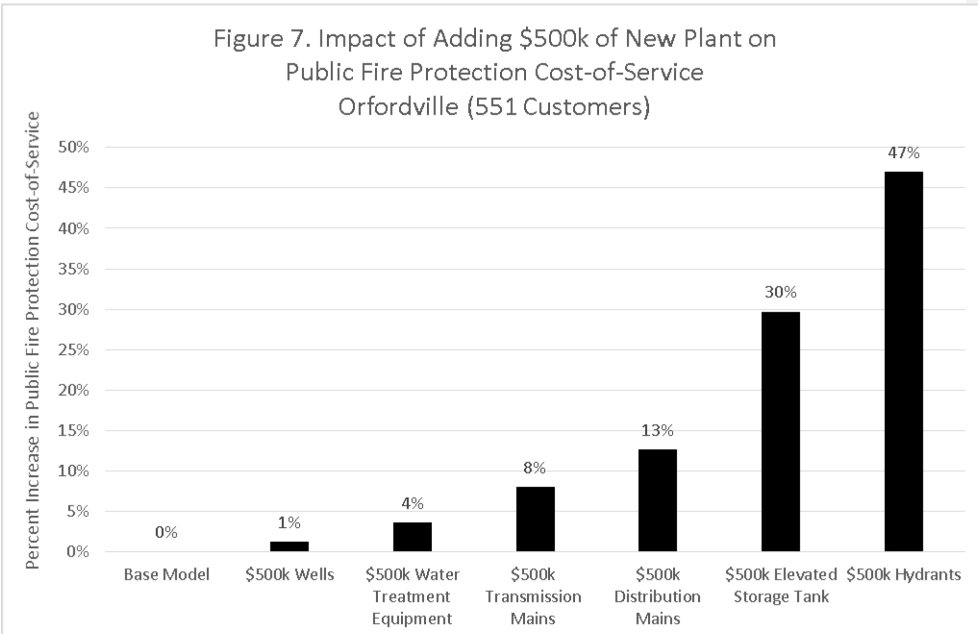
Commented [PP9]: Also defrays costs of future new supplies needed. Think of peak shaving in electric industry. Reduced peak demand can delay cost of $500 million new generating capacity.

costs to the PFP customer class, or should it only be allocated to the general service customers? This question will be discussed in more detail in Section 4.

3.3 Relationship of New Plant Additions to PFP Cost-of-Service

The PFP cost-of-service for a particular water utility can increase due to the additions of new plant. Wells, water treatment technology, booster pumping equipment, transmission mains, distribution mains, elevated storage tanks/standpipes/reservoirs, and hydrants all have some role to play in meeting fire demand. The relative importance of each of these components in meeting fire demand depends on the design of the particular water system.

Figure 7 shows how the addition of different types of new plant can increase the PFP cost-of-service for a small water utility. By adding $500,000 in new wells to the PSC model, the PFP cost-of-service increased by 1% compared to the base model. By adding $500,000 in new hydrants, the PFP cost-of-service increased by 47% compared to the base model.

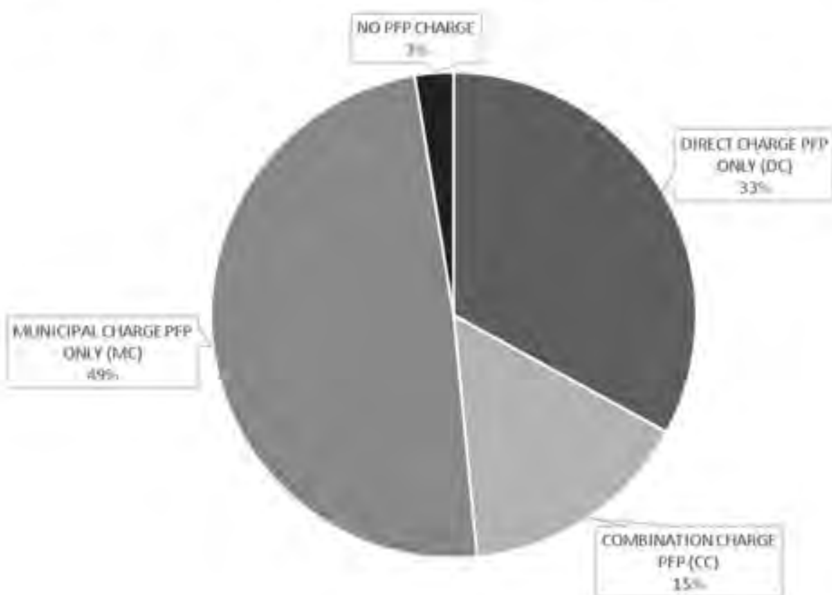


3.4 Types of PFP Charges

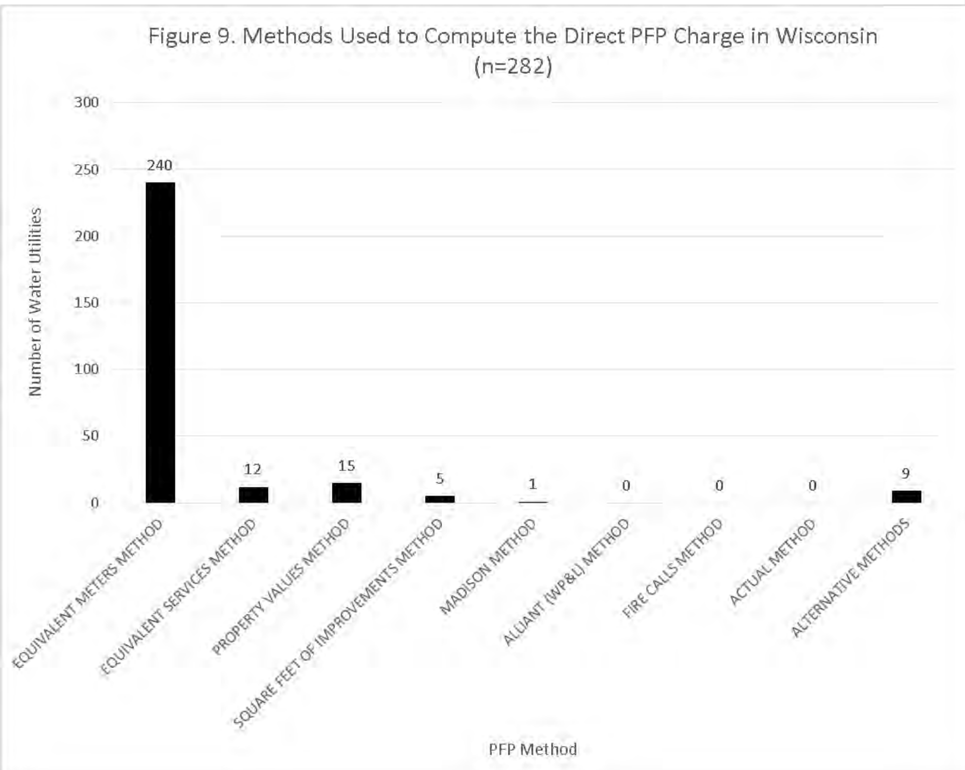
Prior to 1988, the water utility collected the PFP cost-of-service from the local government through the "municipal charge." The local government then recovered the municipal charge through the tax levy. In 1988, legislation was enacted that gave the governing body of any city, village, or town the option of collecting the PFP charge either through the tax levy ("municipal charge") or as a "direct charge" on general service water customer bills or through a combination of the two.

Figure 8 shows the distribution of various types of PFP charges among Wisconsin's 582 regulated water utilities. There are 285 water utilities that only use the municipal PFP charge (MC), 192 that only use the direct PFP charge (DC), 90 utilities that use a combination of the municipal and direct charges (CC), and 15 utilities that have no PFP charge. A list of the regulated water utilities in Wisconsin and the type of PFP charge that they employ is found in Appendix E.

Figure 8. Type of PFP Charges for Wisconsin Water Utilities (n=582)



The Commission permits water utilities to choose between eight preapproved methods for billing direct PFP charges: equivalent meters method, equivalent services method, property values method, square feet of improvements method, Madison method, Alliant Method, fire calls method, and the Actual method. The last three methods are not currently being used. Also, the Commission allows utilities to propose their own "alternative methods" for computing direct PFP charges. Any alternative methods must be approved by the Commission. Figure 9 shows each preapproved method and its frequency of use. This analysis is based on the 282 water utilities in Wisconsin that recover their PFP cost either by using a direct PFP charge (DC) where all of their PFP cost is collected directly through the water bills, or a combination PFP charge (CC) where some of the PFP cost is collected through a municipal charge and the remainder is collected through a direct charge on the water bills. The equivalent meters method is far more popular than any of the other preapproved methods.



3.5 Statutes, Administrative Code, and Policies for the PFP Charge

The PSC's authority to regulate water utilities was created in 1907 by the Railroad Commission and reinforced in 1931 when the PSC came into existence. Prior to 1988, the water

Commented [PP10]: 1905?

Commented [PP11]: I did a presentation on the history of Wisconsin water law in 2005. This info came from my research – please verify though.

utilities collected the cost of PFP by charging a “municipal charge” to the town, village, or city. The municipality then recovered this money through property taxes. In 1988, the Wisconsin State Legislature passed Wis. Stat. § 196.03(3)(b), authorizing direct charges and combination charges for public fire protection. Subsequently, the Commission filed an order for Docket 05-WI-100 that provided water utilities with a list of preapproved methods for directly charging the PFP cost. Since 1988, approximately one half of Wisconsin’s 582 regulated water utilities have shifted all or a portion of the PFP cost to direct charges on the water bill. Some utilities did this to provide more room under the property tax levy limit. Others did this to offset the fact that as their communities used less water, more of the ~~stranded asset~~excess supply capacity cost was being allocated to the PFP charge. So, even though they were not building any new plant that would serve the PFP customer class, they were still seeing an increase in the municipal PFP charge.

In 1994, the Court of Appeals of Wisconsin ruled that a charge for fire protection services under 196.03(3)(b) is a fee and not a tax. Therefore the charging of a PFP fee against a church is constitutional (City of River Falls v. St. Bridget’s Catholic Church 182 Wis. 2d 436, 513 N.W.2d 673 (Ct. App. 1994).

In 2013, the Wisconsin State Legislature passed Wis. Stats. § 66.0602(2m)(b). This statute states that if a municipality adopts a new fee or a fee increase, on or after July 2, 2013, for covered services which were partly or wholly funded in 2013 by property tax levy, that municipality must reduce its levy limit in the current year by the amount of the new fee or fee increase, less any previous reductions. A municipality is not required to adjust (reduce) its levy limit due to a fee increase if the municipality adopts a resolution which is approved in a referendum. This statute effectively eliminated the shifting of the PFP cost from a municipal charge to a direct charge. As a result, about 64% of Wisconsin's water utilities (that rely on a municipal charge or a combination charge can expect to see a steady increase in their municipal PFP charges over the coming years. This increase in the municipal charge will continually apply pressure on their levy limits, forcing them to reduce spending from other municipal services in order to pay the PFP charge. The effect of this legislation has a particularly big impact on smaller communities. Approximately 29% of Class AB utilities rely on the municipal charge or combination charge, while 82% of Class D utilities rely on the municipal charge or combination charge.

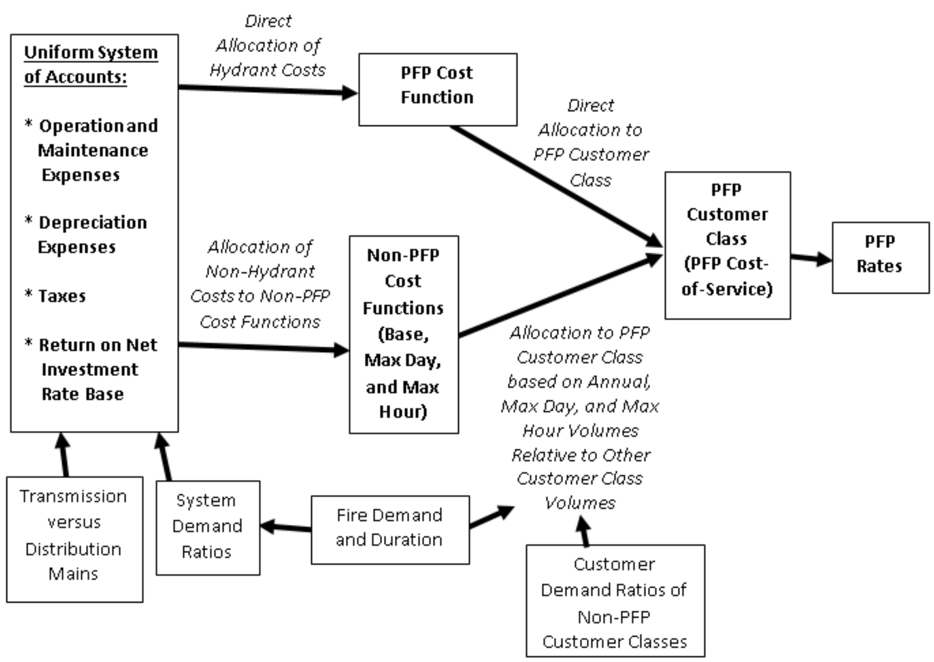
4. Public Service Commission of Wisconsin's Cost-of-Service and Rate Design Model

4.1 Overview of the PSC Model

The Commission uses the base extra capacity cost-of-service model as presented in the AWWA Manual M1, 6th Edition. The PSC model relies on the PSC's uniform system of accounts to categorize utility plant and expenses. Each plant and expense account pertains to one of the following operating costs: operation and maintenance expenses, depreciation expenses, taxes, and return on the net investment rate base (NIRB). These accounts are estimated for the test year, and then their totals are allocated to the following service cost functions: base system, base distribution, max day system, max hour distribution, max hour storage, billing, equivalent meter, equivalent services, and public fire protection.

The hydrant accounts are allocated directly to the PFP cost function, which is then directly allocated to the PFP customer class. The non-hydrant accounts are allocated to the non-PFP cost functions. The total amounts for the base system, base distribution, max day system, max hour distribution, and max hour storage cost functions are then allocated to the PFP customer class based on the relative annual, max day, and max hour volumes of the PFP customer class as compared to the other customer classes. The max day and max hour PFP volume is a function of the utility's fire demand and duration. The total PFP customer class is then used to compute the PFP rates. Note that the non-PFP cost functions are impacted by the system demand ratios and the relative length of transmission versus distribution mains. Figure 10 summarizes the PSC cost-of-service model.

Figure 10. Public Service Commission Cost-of-Service Model



4. 2 Comparison of the PSC Model with AWWA M1 Manual Model

The AWWA M1 Manual differs slightly from PSC cost-of-service model in how it allocates base and max hour costs to the PFP customer class. The PSC model allocates 1% of the total annual sales volume to the PFP customer class. This is a nominal amount that estimates the volume of water used to fight fires in the community. The AWWA M1 Manual does not allocate any base volume or cost to the PFP customer class. The PSC and AWWA Manual M1 models also differ in the way that they compute the PFP customer class max hour volume. The AWWA M1 Manual computes the max hour volume based on the fire demand over 24 hours. The PSC method computes the max hour volume over a one hour period. See Figure 11 to identify the differences between the two models.

Figure 11. Comparison of AWWA Manual M1 and Public Service Commission of Wisconsin Base Extra Capacity Models

Table III.2-1 **M1 Manual Model (Source: AWWA Manual M1, 6th Edition, p. 79)**

		Base Units		Maximum-Day Units			Maximum-Hour Units			Customer Units	
Line No.	Customer Class	Annual Use, 1,000 gal	Average Rate, 1,000 gpd	Peaking Factor, %	Total Capacity, 1,000 gpd	Extra Capacity, 1,000 gpd	Peaking Factor, %	Total Capacity, 1,000 gpd	Extra Capacity, 1,000 gpd	Equivalent Meters & Services	Bills
	Inside-City:										
	Retail Service										
1	Residential	968,000	2,652	250	6,630	3,978	400	10,608	3,978	15,652	185,760
2	Commercial	473,000	1,296	200	2,592	1,296	325	4,212	1,620	1,758	14,640
3	Industrial	1,095,000	3,000	150	4,500	1,500	200	6,000	1,500	251	420
4	Fire Protection		$\boxed{0}$		$\boxed{840}$	840		$\boxed{5,040}$	4,200		
5	Total Inside City	2,536,000	6,948		14,562	7,614		25,860	11,298	17,661	200,820

M1 Manual does not allocate any base flow to PFP (0%), while PSC model allocates 1% of annual sales to PFP base flow

M1 Manual computes Max Day PFP Allocator as:
=3,500 gpm x 60 min x 4 hours
= 840,000 gpd
While PSC model computes Max Day PFP Allocator as:
=3,500 gpm x 60 min x 4 hours
= 840,000 gallons

M1 Manual computes Max Hour PFP Allocator as:
=3,500 gpm x 60 min x 24 hours
= 5,040,000 gpd
While PSC model computes Max Hour PFP Allocator as:
=3,500 gpm x 60 min x 1 hours
= 210,000 gallons

Fire Demand
3,500 gpm at 4 hours

PSC Model – Schedule 9

PSC SCHEDULE 9 - CUSTOMER CLASS DEMAND RATIOS

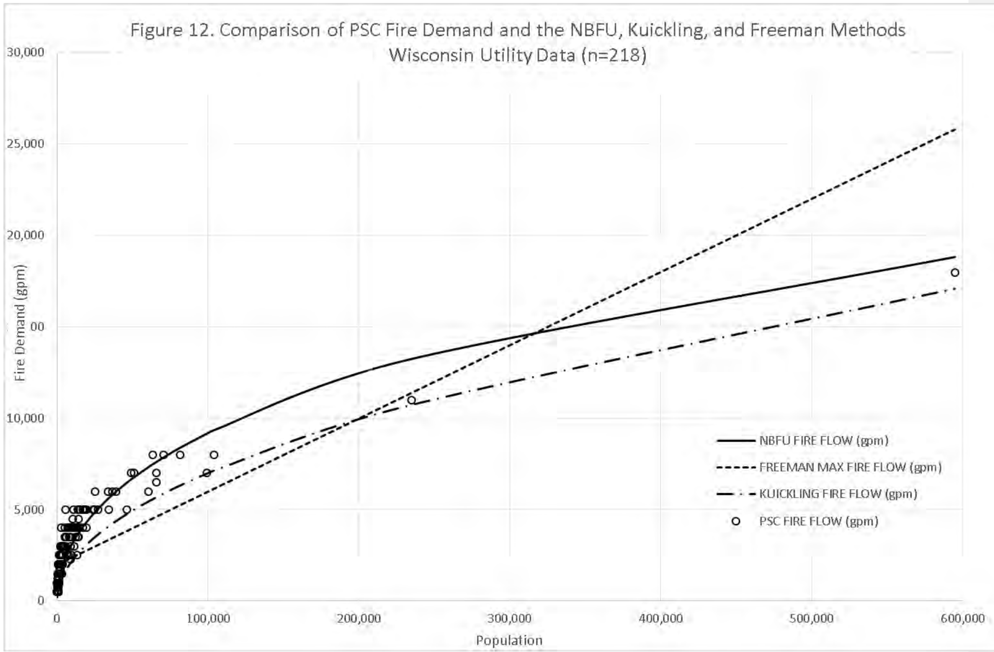
		BASE COSTS					EXTRA-CAPACITY MAX DAY DEMAND					EXTRA-CAPACITY MAX HOUR DEMAND				
CUSTOMER CLASS	Annual Volume 1,000 Mgal	Average Day Volume Mgal	Percent (%)	System Adjusted Percent (%)	Distribution Adjusted Percent (%)	Extra Capacity Ratio	Volume Rate Mgal Per Day	Percent (%)	System Adjusted Percent (%)	Distribution Adjusted Percent (%)	Extra Capacity Ratio	Volume Rate Mgal Per Hour	Percent (%)	System Adjusted Percent (%)	Distribution Adjusted Percent (%)	Storage Adjusted Percent (%)
Residential	968,000	2,652,055	37.79%	37.79%	37.79%	1.50	3,978,083	52.25%	52.25%	52.25%	3.00	331,507	42.07%	42.07%	42.07%	42.07%
Multifamily Residential	0	0	0.00%	0.00%	0.00%	0.00	0	0.00%	0.00%	0.00%	0.00	0	0.00%	0.00%	0.00%	0.00%
Commercial	473,000	1,295,890	18.46%	18.46%	18.46%	1.00	1,295,890	17.02%	17.02%	17.02%	2.25	121,490	15.42%	15.42%	15.42%	15.42%
Industrial	1,095,000	3,000,000	42.75%	42.75%	42.75%	0.50	1,500,000	19.70%	19.70%	19.70%	1.00	125,000	15.86%	15.86%	15.86%	15.86%
Public Authority	0	0	0.00%	0.00%	0.00%	0.00	0	0.00%	0.00%	0.00%	0.00	0	0.00%	0.00%	0.00%	0.00%
Public Fire Protection	25,614	70,174	1.00%	$\boxed{1.00\%}$	1.00%		$\boxed{840,000}$	11.03%	11.03%	11.03%		$\boxed{210,000}$	26.65%	26.65%	26.65%	26.65%
TOTALS	2,561,614	7,018,119	100%	100%	100%		7,613,973	100%	100%	100%		787,997	100%	100%	100%	100%

4.3 PSC Computation of Fire Demand

Each of the 582 regulated water utilities in Wisconsin has had its fire demand (PSC fire demand method) computed when its rates were first established. The fire demand was then passed down from rate case to rate case. During a water rate case, Commission staff compares the community's fire demand with several population based equations: the National Board of

Fire Underwriters (NBFU), the Freeman equation, and the Kuickling equation. Commission staff also estimates the water systems capacity to fight fires based on the capacity of existing wells and the effective storage volumes of reservoirs and elevated storage tanks. Usually, the fire demand used in the previous rate case carried through to the new rate case. It is only changed if the community's population has changed dramatically, the capacity of the water system is less than the community's estimated fire demand, or for some other compelling reason. The duration is usually the fire flow from the above formulas divided by 1000 (i.e., 8,000 gpm for 8 hours). These three formulas have been around for over 70 years. The Kuickling formula was first published in 1911, and the NBFU method is the most recent and dates from the 1940's using data of actual fires between 1906 and 1911 (Carl, K., Young, R., and Gordon Anderson, "Guidelines for Determining Fire-Flow Requirements", May 1973, AWWA Water Technology/Distribution Journal).

Commission staff has developed a plot of the PSC fire demand versus population for a sample of regulated water utilities in Wisconsin. Figure 12 includes the data from 218 water utilities that have undergone a cost-of-service study between 2006 and the present. The figure also plots the computed fire demand based on population using the NBFU, Freeman Max, and Kuickling fire flow equations. The plot shows that the PSC fire demand closely follows the NBFU method up to a population of about 80,000 persons. The four data points representing Wisconsin's four largest water utilities more closely follow the Kuickling method. The data tables used to create this figure are found in Appendix F.



The population based estimates of fire flow can lead to some extreme fire flow estimates. For example, the last Milwaukee rate case used a fire flow requirement of 17,962 gpm for 18 hours; an estimate which is far outside any but the most extreme fires. On the other hand, the population estimates may underrate the fire flow requirements for a small system. A small village with a few hundred residents may have a large industrial plant in the town that requires a much larger fire flow requirement than one might expect based on the size of the community. An example is Boyceville, a village with only 1,000 residents, but it has a large ethanol plant located within the village limits.

Commented [PP12]: Milwaukee had 3,306 fire calls in 2014 (from City annual report) – averaged about 9 per day for an entire year. For a City the size of Milwaukee with multiple fire events occurring coincidentally, there could be many different 3,500 gpm fire flows occurring for hours throughout a given day. So maybe this number is not so unrealistic as thought.

Commented [PP13]: Patrick Cudahy plant fire a few years ago would be one of these extreme events – MWW provided water to Cudahy for this event.

Commented [PP14]: Very much agree!

4.4 Impact of Fire Demand on the PFP Cost-of-Service

In the PSC cost-of-service model, the utility's fire demand (gpm) and duration (hours) do not impact the computation of the PFP cost function (hydrant costs). However, the fire demand and duration do impact the calculation of the PFP customer class (costs associated with hydrants and oversized infrastructure needed to generate fire flow). First, an increase in the fire demand and duration increases the Max Day and Max Hour system demand ratios. These in turn increase the allocation of O&M, Depreciation Expenses, Taxes, and Return on NIRB to the Max Day and Max Hour extra capacity cost functions as shown in Figure 13 below).

Figure 13. Impact of Fire Demand on Allocation of Operating Costs to Cost Functions

Fire Demand (gpm)	Revenue Requirement ($)	Base Cost - System($)	Base Cost - Distribution ($)	Max Day -System($)	Max Day - Distribution ($)	Max Hour - System ($)	Max Hour (Distribution)	Max Hour (Storage)	Customer Costs	Fire Protection
↑	No Change	↓	↓	↑	No Change	No Change	↑	↑	No Change	No Change

Second, an increase in the fire demand increases the volume rate per day and volume rate per hour that is used to allocate the non-PFP cost functions to the PFP customer class. See Figure 14 below.

Figure 14. Impact of Fire Demand on Volume Allocators Used to Allocate Cost Function Totals to the PFP Customer Class

CUSTOMER CLASS DEMAND RATIOS

		BASE COSTS					EXTRA-CAPACITY MAX DAY DEMAND					EXTRA-CAPACITY MAX HOUR DEMAND				
CUSTOMER CLAS	Annual Volume 1,000 Mgal	Average Day Volume Mgal	Percent (%)	System Adjusted Percent (%)	Distribution Adjusted Percent (%)	Extra Capacity Ratio	Volume Rate Mgal Per Day	Percent (%)	System Adjusted Percent (%)	Distribution Adjusted Percent (%)	Extra Capacity Ratio	Volume Rate Mgal Per Hour	Percent (%)	System Adjusted Percent (%)	Distribution Adjusted Percent (%)	Storage Adjusted Percent (%)
Residential	22,874	62,668	75.71%	75.71%	75.71%	2.50	156,671	60.07%	60.07%	60.07%	5.00	13,056	17.05%	39.41%	39.41%	17.05%
Multifamily Residen	1,091	2,989	3.61%	3.61%	3.61%	2.50	7,473	2.87%	2.87%	2.87%	5.00	623	0.81%	1.88%	1.88%	0.81%
Commercial	4,053	11,104	13.41%	13.41%	13.41%	2.25	24,984	9.58%	9.58%	9.58%	4.25	1,966	2.57%	5.94%	5.94%	2.57%
Industrial	0	0	0.00%	0.00%	0.00%	1.25	0	0.00%	0.00%	0.00%	2.50	0	0.00%	0.00%	0.00%	0.00%
Public Authority	1,893	5,186	6.27%	6.27%	6.27%	2.25	11,669	4.47%	4.47%	4.47%	4.25	918	1.20%	2.77%	2.77%	1.20%
Public Fire Protectio	302	828	1.00%	1.00%	1.00%		60,000	23.01%	23.01%	23.01%		60,000	78.37%	50.00%	50.00%	78.37%
TOTALS	30,213	82,776	100%	100%	100%		260,797	100%	100%	100%		76,563	100%	100%	100%	100%

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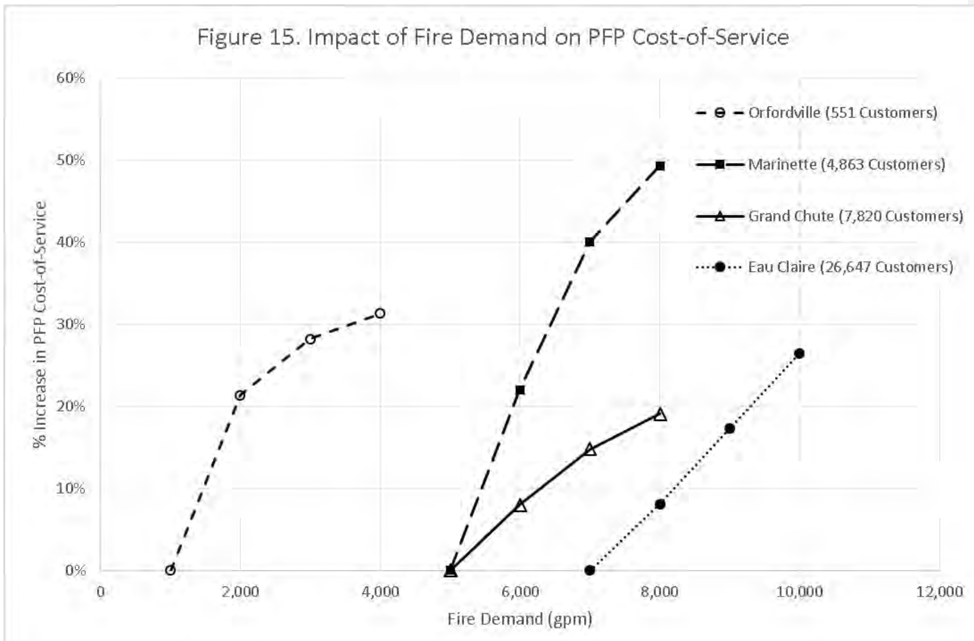
An increase in **Fire Demand** increases the "Volume Rate Per Day" and the "Volume Rate Per Hour". These in turn increase the "System Adjusted Percent", "Distribution Adjusted Percent", and "Storage Adjusted Percent" values. These values are then used to allocate costs to the PFP Customer Class.

Next, the non-billing cost function totals (base system, base distribution, max day system, max hour distribution, and max hour storage cost function) are allocated to the public fire protection customer class based on the PFP customer class' relative volume percentage. The bottom line is that an increase in the fire demand results in an increase in costs allocated to the PFP customer class. As shown in Figure 15, Commission staff plotted the impact of increasing fire demand on four different sized water utilities. Holding other factors constant, as the fire demand increased so did the percent increase in the PFP cost-of-service.



4.5 Impact of System Demand Ratios on the PFP Cost-of-Service

The PSC cost-of-service model uses system demand ratios to allocate operating costs to the base, max day, and max hour cost functions. The max day system demand ratio represents the ratio of the extra capacity max day volume divided by the max day volume. The max hour system demand ratio represents the extra capacity max hour volume divided by the max hour volume (use average hour plus one hour fire flow, if greater). System demand ratios are used as allocators to compare the extra capacity cost (costs associated with meeting peak demand) with base cost (costs to provide average rate of water use). Some factors that may impact the system demand ratios include: the loss or addition of a customer that has a high peak demand (power plant or canning company), or the change in the utility's fire demand. Figure 16 shows a plot of

Wisconsin water utilities that have had a rate case from 2006 to the present (the two largest utilities have been removed from the figure for clarity purposes). The figure shows that as utilities increase in size, their peak demands decrease in relation to their base demand. Please note that the system demand ratios do not impact the PFP cost function. The data used to produce Figure 16 is found in Appendix G. Figure 17 shows how the system demand ratios are calculated in the PSC cost-of-service model.

Figure 16. Population versus Max Day and Max Hour System Demand Ratios (n=216)

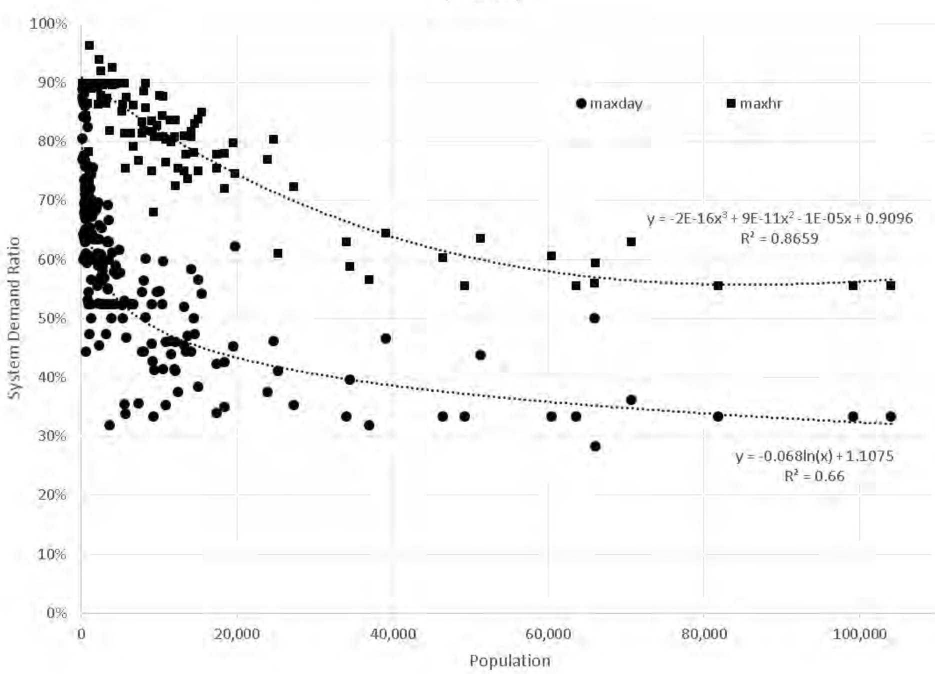


Figure 17. Impact of System Demand Ratios on Non-PFP Cost Functions

Docket 4450-WR-103					**Schedule 4**
		ORFORDVILLE MUNICIPAL WATER UTILITY			
		SYSTEM DEMAND RATIOS			
MAXIMUM DAY SYSTEM DEMAND					
TOTAL ANNUAL PUMPAGE	37,505,723	Gallons			
AVERAGE DAILY PUMPAGE	102,755	Gallons			
MAXIMUM DAY PUMPAGE	256,889	Gallons			
FIRE FLOW:					
GAL/MIN	1,000				
DURATION (HOURS)	1				
TOTAL FLOW	60,000	Gallons			
AVERAGE DAY PLUS FIRE FLOW	162,755	Gallons			
RATIO:	BASE =	102,755 / 256,889		40.00%	
	MAX DAY =	100-BASE		60.00%	
MAXIMUM HOUR SYSTEM DEMAND					
AVERAGE HOUR ON MAX DAY	10,704	Gallons			
MAXIMUM HOUR PUMPAGE	14,985	Gallons			
AVERAGE HOUR PLUS ONE HOUR FIRE FLOW	64,281	Gallons			
RATIO:	BASE =	102,755 / 1,542,755		6.66%	Use 10.00%
	MAX HOUR =	100-BASE		93.34%	Use 90.00%

Fire Demand impacts the system demand ratios below. Fire demand also impacts the allocation of the max day and max hour cost functions to the PFP customer class.

System Demand Ratios impact how operating expenses are allocated to the non-PFP cost functions.

4.6 Impact of Transmission and Distribution Mains on the PFP Cost-of-Service

The PSC classifies water mains into two categories: transmission mains and distribution mains. Generally speaking, water mains larger than 12 inches in diameter are transmission mains, and water mains less than 12 inches in diameter are classified as distribution mains. The PSC model typically classifies 12-inch diameter mains as transmission mains for Class C and D utilities, and as distribution mains for Class AB utilities. The reason for this classification is that the PSC model assumes that transmission mains are designed largely to meet max day demand, while distribution mains are designed to meet max hour demand. Therefore, transmission main costs are typically allocated to the base and max day cost functions, while distribution main costs are allocated to the base and max hour cost functions. The apportioning of transmission and distribution mains does not impact the PFP cost function, but it does impact the allocation of water main costs to the base, max day, and max hour cost functions, and ultimately it impacts the PFP customer class. Figure 18 shows how the PSC cost-of-service model uses the proportion of transmission mains to distribution mains to allocate main costs to non-PFP cost functions.

Figure 18. Length and Diameter of Transmission Versus Distribution Mains Impacts Non-PFP Cost Functions

4450-WR-103 ORFORDVILLE MUNICIPAL WATER UTILITY

Transmission Mains (12-inch and larger)

Diameter in Inches	Feet of Main	Diameter x Length
60	0	0
54	0	0
48	0	0
42	0	0
36	0	0
30	0	0
24	0	0
20	0	0
18	0	0
16	0	0
12	1,059	12,708
10	6,571	65,710
Total	7,630	78,418

Distribution Mains (smaller than 12-inch)

Diameter in Inches	Feet of Main	Diameter x Length
14		0
12	0	0
10	0	0
8	16,684	133,472
6	28,804	172,824
4	0	0
3	0	0
2	0	0
1.5	0	0
1.25	0	0
1	0	0
		0
Total	45,488	306,296

	Main Length	Percent of Total	D x L Diameter x Length	D x L Percent of Total	Utility Financed Dia x Length or Dollars	Utility Financed Percent of Total
Transmission M	7,630	14.36%	78,418	20.38%	387,794	36.67%
Distribution M	45,488	85.64%	306,296	79.62%	669,619	63.33%
Total	53,118	100%	384,714	100%	$ 1,057,413	100%

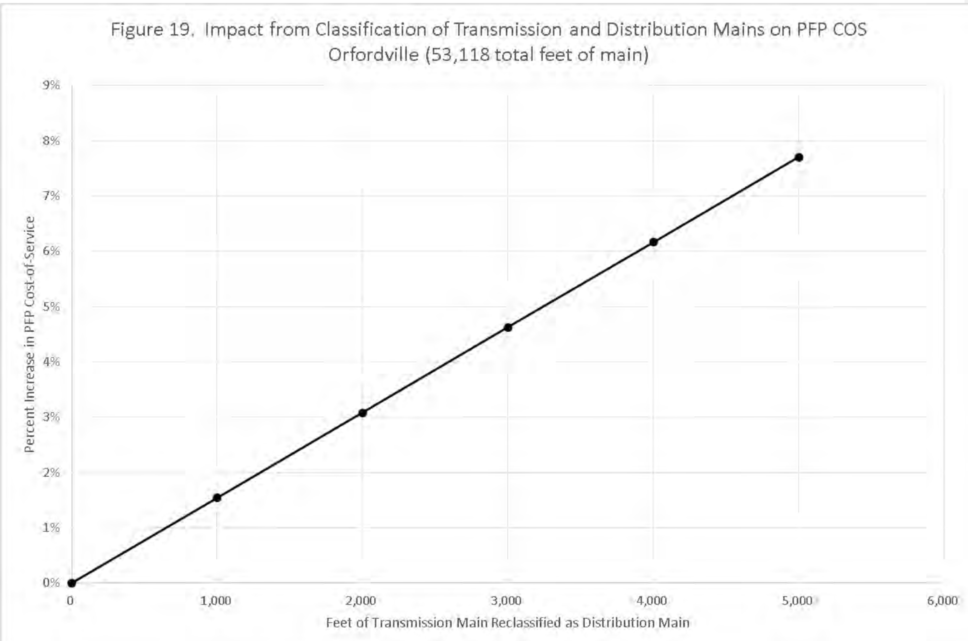
Percentage Transmission Versus Distribution Mains Impacts Allocation of Main Accts 343 to Non-PFP Cost Functions in Sch 7

Percentage Transmission Versus Distribution Mains Impacts Allocation of Main Accts 343 to Non-PFP Cost Functions in Sch 5A

Percentage Transmission Versus Distribution Mains Impacts Allocation of Main Accts 343 to Non-PFP Cost Functions in Sch 6

Percentage Transmission Versus Distribution Mains Impacts Allocation of Main Accts 343 to Non-PFP Cost Functions in Sch 5

Figure 19 shows the impact on the PFP cost-of-service model for the Orfordville Municipal Water Utility with the reclassification of 1,000, 2,000, and 3,000 feet of main from transmission main to distribution main.

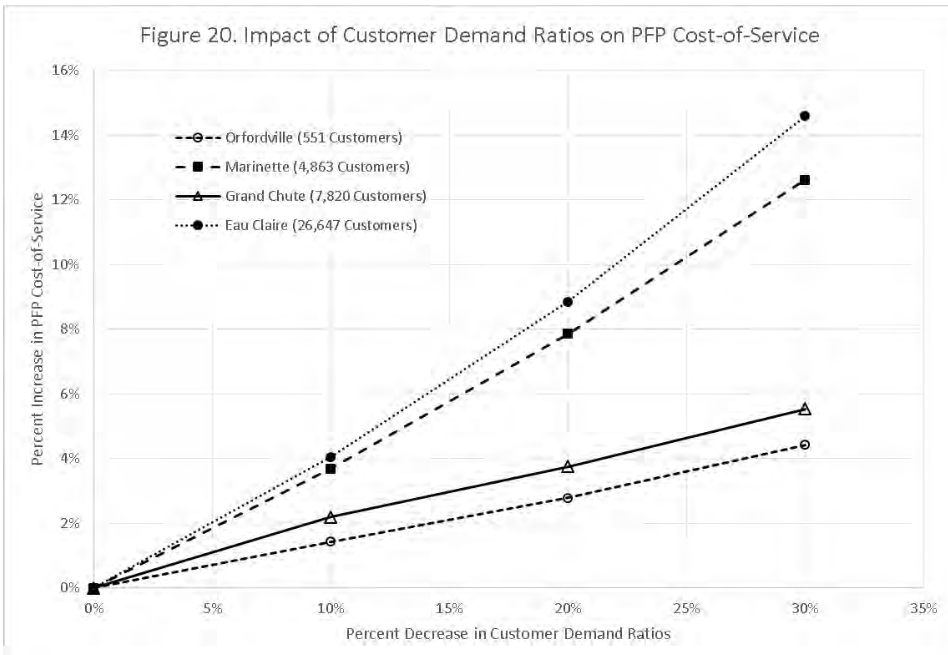


4.7 Impact of the Customer Demand Ratios on the PFP Cost-of-Service

The max day (hour) customer demand ratios are the difference between total max day (hour) capacity of a particular customer class and the average day rate of use of that same customer class. Before the advent of smart meters, water utilities rarely collected customer class max day and max hour water use data. As a result, Commission staff developed estimates of the customer demand ratios for each customer class. These customer demand ratios were handed down from rate case to rate case. Now that some utilities are actually collecting max day and max hour customer class data, Commission staff will be able to refine these customer demand ratios accordingly. The residential class tends to be more demand oriented than the industrial class. The residential class tends to use water more heavily in the evenings and on weekends than during a weekday. This non-uniform usage causes the utility to construct plant of a larger scale than would be needed if usage were uniform. As such, other factors aside, if demand related costs are going up significantly in a rate case, classes with higher demand ratios like the residential and public fire protection classes will typically receive a higher percentage increase in rates than good load factor classes like the industrial customer class.

Customer demand ratios are used to compute max day and max hour demand volumes for the non-PFP customer classes including: residential, multifamily residential, commercial, industrial, and public authority customer classes. These volumes are then used (along with the fire demand) to compute the relative max day and max hour volumes of the PFP customer class. The PFP volumes are then used to allocate the total base, max day, and max hour cost functions to the PFP customer class.

Figure 20 shows the impact of the customer demand ratios on the PFP cost-of-service. For each of the four utilities shown in the graph, if the max day and max hour customer demand ratios for the non-PFP customer classes are lowered, the PFP cost-of-service increases proportionately. This is due to the fact that the PFP customer class depends on the relative volume of each customer class, which in turn depends on the customer demand ratios. The smaller the customer demand ratios, the smaller the relative base, max day, and max hour volumes for each non-PFP customer class. As a result, the PFP base, max day, and max hour volumes increase, and the PFP cost-of-service increases. Note that Marinette has a higher PFP cost-of-service than does Grand Chute, and that is why it plots higher up on the graph. Generally, the larger the number of customers, the larger the PFP cost-of-service, but sometimes the cost of new plant can result in a smaller utility (Marinette) having a larger PFP cost-of-service than a larger utility (Grand Chute). Also note that while the customer demand ratios impact the PFP customer class, they do not impact the PFP cost function.



4.8 Allocating Costs to the PFP Cost Function

Within the PSC cost-of-service model, the PFP cost function essentially identifies the operating costs associated with fire hydrants. The hydrant costs are included in the following accounting schedules: operation and maintenance expenses, depreciation expenses, taxes, and return on net investment rate base. Then, the hydrant costs from each accounting schedule are added together to compute the total PFP cost function. Figure 21 shows the PFP cost function amount compared to the number of hydrants for four selected utilities. The strong linear relationship shows that the PFP cost function is highly correlated with the number of hydrants.

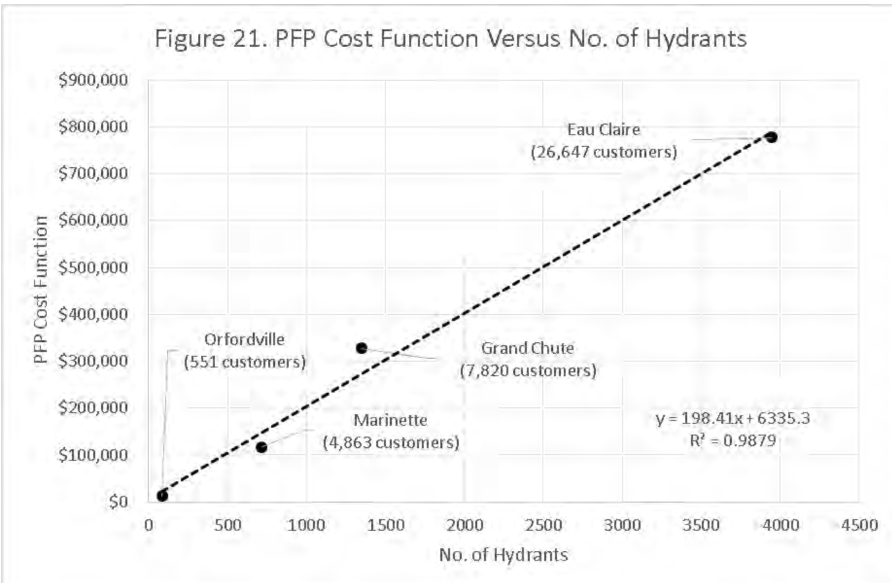


Figure 22 shows how the PSC model allocates the depreciation expense accounts to the PFP cost function (same for Utility Financed Plant and Total Plant schedules). Figure 23 illustrates how the operation and maintenance expense accounts are allocated to the PFP cost function. Figure 24 displays how the PFP cost function total from each accounting schedule is then totaled in the PFP cost function column. The PFP cost function is then directly allocated to the PFP customer class. One should remember that the total PFP cost function is not effected by the fire demand, the system demand ratios, or the amount of transmission mains versus distribution mains. It is neither impacted by the water usage of the other customer classes.

Figure 22. Allocation of Depreciation Expenses to PFP Cost Function (same for Utility Financed Plant and Total Plant Schedules - Class AB, C, and D Utilities)

For Accts 340 thru 341 the PFP cost function= (Acct "Total") x (Sum of PFP cost function for Dep Exp Accts 342 thru 349) / (Sum of Total Dep Exp for Accts 342 thru 349)
= (Acct "Total") x ($1,968) / ($27,439)
= (Acct "Total") x (0.0496)

ALLOCATION OF DEPRECIATION EXPENSE
TO SERVICE COST FUNCTIONS
(continued)

			BASE COSTS		EXTRA-CAPACITY: MAX DAY		EXTRA-CAPACITY: MAX HOUR			CUSTOMER COSTS			
ACCT NO.	ACCOUNT DESCRIPTION	TOTAL ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	Storage ($)	Billing ($)	Equivalent Meter ($)	Equivalent Service ($)	Fire Protection ($)
	TRANSMISSION & DISTRIBUTION PLANT												
340	Land and land rights	0	0	0	0	0	0	0	0	0	0	0	0
341	Structures and improvements	0	0	0	0	0	0	0	0	0	0	0	0
342	Distribution reservoirs and standpipes	2,086	209						1,877				
343	Transmission mains	5,041	2,016		3,025								
343	Distribution mains	8,705		870				7,834					
345	Services	6,967										6,967	
346	Meters	2,672									2,672		
348	Hydrants	1,968											1,968
349	Other transmission and distr. plant	0	0	0	0	0	0	0	0	0	0	0	0
	GENERAL PLANT												
389	Land and land rights	0	0	0	0	0	0	0	0	0	0	0	0
390	Structures and improvements	0	0	0	0	0	0	0	0	0	0	0	0
391	Office furniture and equipment	14	2	0	3	0	0	3	1	0	1	3	1
391	Office furniture & equip - Computers	771	132	18	192	0	0	158	38	0	54	140	40
392	Transportation equipment	8,007	1,372	182	1,993	0	0	1,639	393	0	559	1,458	412
393	Stores equipment	0	0	0	0	0	0	0	0	0	0	0	0
394	Tools, shop and garage equipment	0	0	0	0	0	0	0	0	0	0	0	0
395	Laboratory equipment	0	0	0	0	0	0	0	0	0	0	0	0
396	Power operated equipment	0	0	0	0	0	0	0	0	0	0	0	0
397	Communication equipment	0	0	0	0	0	0	0	0	0	0	0	0
397	SCADA equipment	0	0	0	0	0	0	0	0	0	0	0	0
398	Miscellaneous equipment	1,939	332	44	483	0	0	397	95	0	135	353	100
	TOTAL	49,001	8,396	1,115	12,194	0	0	10,031	2,404	0	3,421	8,921	2,520

Schedule 6

To Sch 8

For Accts 389 thru 398 the PFP cost function= (Acct "Total") x (Sum of PFP cost function for Dep Exp Accts 310 thru 349) / (Sum of Total Dep Exp for Accts 310 thru 349)
= (Acct "Total") x ($1,968) / ($38,270)
= (Acct "Total") x (0.0514)

Figure 23. Allocation of O&M Expenses to PFP Cost Function (Class D Utilities)

For Accts 600 thru 680 the PFP cost function = (Acct "Total") x (Total Plant PFP cost function from Sch 5A) / (Total Plant from Sch 5A)
= (Acct "Total") x ($172,287) / ($3,472,183)
= (Acct "Total") x (0.0496)

ALLOCATION OF OPERATION AND MAINTENANCE EXPENSES
TO SERVICE COST FUNCTIONS

			BASE COSTS		EXTRA-CAPACITY					CUSTOMER COSTS			
					MAX DAY		MAX HOUR						
ACCT NO.	ACCOUNT DESCRIPTION	TOTAL ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	Storage ($)	Billing ($)	Equivalent Meter ($)	Equivalent Service ($)	Fire Protection ($)
	PLANT OPERATION AND MAINTENANCE												
600	Salaries and wages	24,000	2,442	921	3,510	0	0	8,289	1,101	3,600	591	2,515	1,012
610	Purchased water	0	0										0
620	Fuel or power purchased for pumping	13,000	13,000										
630	Chemicals	800	800										
640	Supplies and expenses	11,000	1,328	497	1,892	0	0	4,470	594	0	319	1,356	544
650	Repairs of water plant	21,700	2,619	980	3,733	0	0	8,817	1,171	0	628	2,675	1,077
660	Transportation expenses	2,000	241	90	344	0	0	813	108	0	58	247	99
	GENERAL OPERATING EXPENSES												
680	Administrative and general salaries	27,000	2,770	1,036	3,948	0	0	9,325	1,239	4,050	665	2,829	1,139
681	Office supplies and expenses	4,000	440	164	627	0	0	1,480	197	357	105	449	181
682	Outside services employed	6,000	659	247	940	0	0	2,220	295	536	158	674	271
684	Insurance Expense	7,400	813	304	1,159	0	0	2,738	364	661	195	831	334
686	Employee pensions and benefits	22,000	2,418	905	3,447	0	0	8,141	1,081	1,964	580	2,470	994
688	Regulatory commission expenses	1,000	110	41	157	0	0	370	49	89	26	112	45
689	Miscellaneous general expenses	3,000	330	123	470	0	0	1,110	147	268	79	337	136
690	Uncollectible accounts	0								0			
691	Customer service and informational expenses	0								0			
	TOTAL OPERATION & MAINTENANCE EXPENSES	142,900	27,990	5,308	20,228	0	0	47,773	6,345	11,524	3,405	14,493	5,834

Docket 4450-WR-103 Schedule 7

To Sch 8

For Accts 681 thru 689 the PFP cost function = (Acct "Total") x (Sum of PFP cost function for O&M Accts 600, 640, 650, 660, and 680) / (Total O&M for Accts 600, 640, 660, and 680)
= (Acct "Total") x ($3,873) / ($85,700)
= (Acct "Total") x (0.0452)

Figure 24. Cost Allocation to PFP Cost Function

Schedule 8 – PFP Cost Function

SUMMARY OF ALLOCATION OF OPERATING COSTS TO SERVICE COST FUNCTIONS

		BASE COSTS		EXTRA-CAPACITY					CUSTOMER COSTS			
				MAX DAY		MAX HOUR						
OPERATING COST	TOTAL ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	Storage ($)	Billing ($)	Equivalent Meter ($)	Equivalent Service ($)	Fire Protection ($)
OPERATION AND MAINTENANCE	142,900	27,990	5,308	20,228	0	0	47,773	6,345	11,524	3,405	14,493	5,834
DEPRECIATION EXPENSE	49,001	8,396	1,115	12,194	0	0	10,031	2,404	0	3,421	8,921	2,520
AMORTIZATION EXPENSE	0	0	0	0	0	0	0	0	0	0	0	0
TAXES AND TAX EQUIVALENT	76,981	9,291	3,475	13,244	0	0	31,279	4,154	0	2,229	9,489	3,820
RETURN ON NET INVESTMENT RATE BASE	14,675	2,260	513	3,264	0	0	4,614	756	0	744	1,839	685
TOTAL	283,557	47,937	10,411	48,929	0	0	93,697	13,660	11,524	9,799	34,742	12,859

Docket 4450-WR-103 Schedule 8

PFP Cost of Service from Schedule 7, O&M Expenses =$5,834 (see Figure 1A)

PFP Cost of Service from Schedule 6, Depreciation Expenses =$2,520 (see Figure 1B)

PFP Cost of Service = (Taxes Schedule 1) x (Total Plant PFP Cost Function Schedule 5A) / (Total Plant Schedule 5A)

= ($76,981) x ($172,287)/ ($3,472,183) = $3,820 (same allocation as Fig. 1B)

PFP Cost of Service = (NIRB from Schedule 2) x (Rate of Return from Schedule 2) x (Utility Financed Plant PFP Cost Function) / (Total Utility Financed Plant Schedule 5)

= ($1,467,508) x (1.00%) x ($94,931)/($2,033,952) = $684 (same allocation as Fig. 1B)

Revenue Requirement

Total PFP Cost Function = $12,859

4.9 Allocating Costs to the PFP Customer Class

The PFP customer class represents the total PFP cost-of-service. It includes hydrant costs (PFP cost function), and it also includes the costs associated with oversized infrastructure (e.g. wells, mains, elevated storage tanks, etc.) needed to generate the high flows ~~and pressures~~ used to fight fires. A portion of the base, max day, and max hour cost functions capture the costs of these oversized facilities. The PSC cost-of-service model allocates operating expenses (including operation and maintenance expenses, depreciation expenses, taxes, and return on net investment rate base) to the base, max day, and max hour cost functions based on the system demand ratios and the amount of transmission main to distribution main. Figures 25 and 26 demonstrate how the PSC model allocates the depreciation expense accounts to the base, max day, and max hour cost functions. Figure 27 shows how the operation and maintenance expenses are allocated to the base, max day, and max hour cost functions.

Figure 25. Allocation of Depreciation Expense to Non-PFP Cost Functions (same for Utility Financed Plant and Total Plant Schedules- Class AB, C, and D Utilities)

ALLOCATION OF DEPRECIATION EXPENSE
TO SERVICE COST FUNCTIONS

For Accts 301 thru 303 the cost function amount= (Acct Row Total) x (Column Total for Accts 310 thru 349) / (Grand Total for Accts 310 thru 349)

For Accts 310 thru 334 the cost function amount= (Acct Row Total) x Base/MD or Base/MH System Demand Ratios

			BASE COSTS		EXTRA CAPACITY					CUSTOMER COSTS			
					MAX DAY		MAX HOUR						
ACCT NO.	ACCOUNT DESCRIPTION	TOTAL ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	Storage ($)	Billing ($)	Equivalent Meter ($)	Equivalent Service ($)	Fire Protection ($)
	INTANGIBLE PLANT												
301	Organization	0	0	0	0	0	0	0	0	0	0	0	0
302	Franchises and consents	0	0	0	0	0	0	0	0	0	0	0	0
303	Miscellaneous intangible plant	0	0	0	0	0	0	0	0	0	0	0	0
	SOURCE OF SUPPLY												
310	Land and land rights	0	0		0								
311	Structures and improvements	0	0		0								
312	Collecting and impounding reservoirs	0	0		0								
313	Lake, river, and other intakes	0	0		0								
314	Wells and springs	4,823	1,929		2,894								
316	Supply mains	0	0		0								
317	Other water source plant	0	0		0								
	PUMPING PLANT												
320	Land and land rights	0	0		0								
321	Structures and improvements	2,555	1,022		1,533								
323	Other power production equipment	0	0		0								
325	Electric pumping equipment	3,131	1,252		1,879								
326	Diesel pumping equipment	0	0		0								
328	Other pumping equipment	150	60		90								
	WATER TREATMENT PLANT												
330	Land and land rights	0	0		0								
331	Structures and improvements	0	0		0								
332	Sand or Other Media Filtration Equip	172	69		103								
333	Membrane Filtration Equipment	0	0		0								
334	Other Water Treatment Equipment	0	0		0								

Figure 26. Allocation of Depreciation Expense to Non-PFP Cost Functions (same for Utility Financed Plant and Total Plant Schedules – Class AB, C, and D Utilities)

ALLOCATION OF DEPRECIATION EXPENSE TO SERVICE COST FUNCTIONS (continued)

ACCT NO.	ACCOUNT DESCRIPTION	TOTAL ($)	BASE COSTS System ($)	BASE COSTS Distribution ($)	EXTRA CAPACITY MAX DAY System ($)	EXTRA CAPACITY MAX DAY Distribution ($)	EXTRA CAPACITY MAX HOUR System ($)	EXTRA CAPACITY MAX HOUR Distribution ($)	EXTRA CAPACITY MAX HOUR Storage ($)	CUSTOMER COSTS Billing ($)	CUSTOMER COSTS Equivalent Meter ($)	CUSTOMER COSTS Equivalent Service ($)	Fire Protection ($)
	TRANSMISSION & DISTRIBUTION PLANT												
340	Land and land rights	0	0	0	0	0	0	0	0	0	0	0	0
341	Structures and improvements	0	0	0	0	0	0	0	0	0	0	0	0
342	Distribution reservoirs and standpipes	2,086	209						1877				
343	Transmission mains	5,041	2,016		3,025								
343	Distribution mains	8,705		870				7,834					
345	Services	6,967										6,967	
346	Meters	2,672									2,672		
348	Hydrants	1,968											1,968
349	Other transmission and distr. plant	0	0	0	0	0	0	0	0	0	0	0	0
	GENERAL PLANT												
389	Land and land rights	0	0	0	0	0	0	0	0	0	0	0	0
390	Structures and improvements	0	0	0	0	0	0	0	0	0	0	0	0
391	Office furniture and equipment	14	2	0	3	0	0	3	1	0	1	3	1
391	Office furniture & equip - Computers	771	132	18	192	0	0	158	38	0	54	140	40
392	Transportation equipment	8,007	1,372	182	1,993	0	0	1,639	393	0	559	1,458	412
393	Stores equipment	0	0	0	0	0	0	0	0	0	0	0	0
394	Tools, shop and garage equipment	0	0	0	0	0	0	0	0	0	0	0	0
395	Laboratory equipment	0	0	0	0	0	0	0	0	0	0	0	0
396	Power operated equipment	0	0	0	0	0	0	0	0	0	0	0	0
397	Communication equipment	0	0	0	0	0	0	0	0	0	0	0	0
397	SCADA equipment	0	0	0	0	0	0	0	0	0	0	0	0
398	Miscellaneous equipment	1,939	332	44	483	0	0	397	95	0	135	353	100
	TOTAL	49,001	8,396	1,115	12,194	0	0	10,031	2,404	0	3,421	8,921	2,520

For Acct 342 the cost function amount = (Acct Row Total) x Base/MD or Base/MH System Demand Ratios

For Accts 341 thru 342 the cost function amount = (Acct Row Total) x (Column Total for Accts 342 thru 349) / (Grand Total for Accts 342 thru 349)

For Acct 349 the cost function amount = (Acct Row Total) x (Column Total for Accts 342 thru 348) / (Grand Total for Accts 342 thru 348)

For Accts 343 the cost function amount = (Acct Row Total) x Trans/Dist Main Ratios

For Accts 389 thru 398 the cost function amount = (Acct Row Total) x (Column Total for Accts 310 thru 349) / (Grand Total for Accts 310 thru 349)

Accts 345, 346 and 348 directly allocated to cost functions as shown

Figure 27. Allocation of O&M Expenses to Non-PFP Cost Function (Class D Utilities)

For Accts 600, 640 thru 660 the cost function amount = (Acct Row Total) x (Same Cost Function Column Total from Total Plant Schedule) / (Grand Total from Total Plant Schedule)

Direct Allocation to Base System cost function

ALLOCATION OF OPERATION AND MAINTENANCE EXPENSES
TO SERVICE COST FUNCTIONS

			BASE COSTS		EXTRA-CAPACITY					CUSTOMER COSTS			
					MAX DAY		MAX HOUR						
ACCT NO.	ACCOUNT DESCRIPTION	TOTAL ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	Storage ($)	Billing ($)	Equivalent Meter ($)	Equivalent Service ($)	Fire Protection ($)
	PLANT OPERATION AND MAINTENANCE												
600	Salaries and wages	24,000	2,462	921	3,310	0	0	8,289	1,101	3,600	591	2,51[illegible]	1,012
610	Purchased water	0	0										0
620	Fuel or power purchased for pumping	13,000	13,000										
630	Chemicals	800	800										
640	Supplies and expenses	11,000	1,328	497	1,892	0	0	4,470	594	0	319	1,356	546
650	Repairs of water plant	21,700	2,619	980	3,733	0	0	8,817	1,171	0	628	2,675	1,077
660	Transportation expenses	2,000	241	90	344	0	0	813	108	0	58	247	99
	GENERAL OPERATING EXPENSES												
680	Administrative and general salaries	27,000	2,770	1,036	3,948	0	0	9,325	1,239	4,050	665	2,829	1,139
681	Office supplies and expenses	4,000	440	164	627	0	0	1,480	197	357	105	449	181
682	Outside services employed	6,000	659	247	940	0	0	2,220	295	536	158	674	271
684	Insurance Expense	7,400	813	304	1,159	0	0	2,738	364	661	195	831	334
686	Employee pensions and benefits	22,000	2,418	905	3,447	0	0	8,141	1,081	1,964	580	2,470	994
688	Regulatory commission expenses	1,000	110	41	157	0	0	370	49	89	26	112	45
689	Miscellaneous general expenses	3,000	330	123	470	0	0	1,110	147	268	79	337	136
690	Uncollectible accounts	0								0			
691	Customer service and informational expense	0								0			
	TOTAL OPERATION & MAINTENANCE EXPENSES	142,900	27,990	5,308	20,226	0	0	47,773	6,345	11,524	3,405	14,493	5,834

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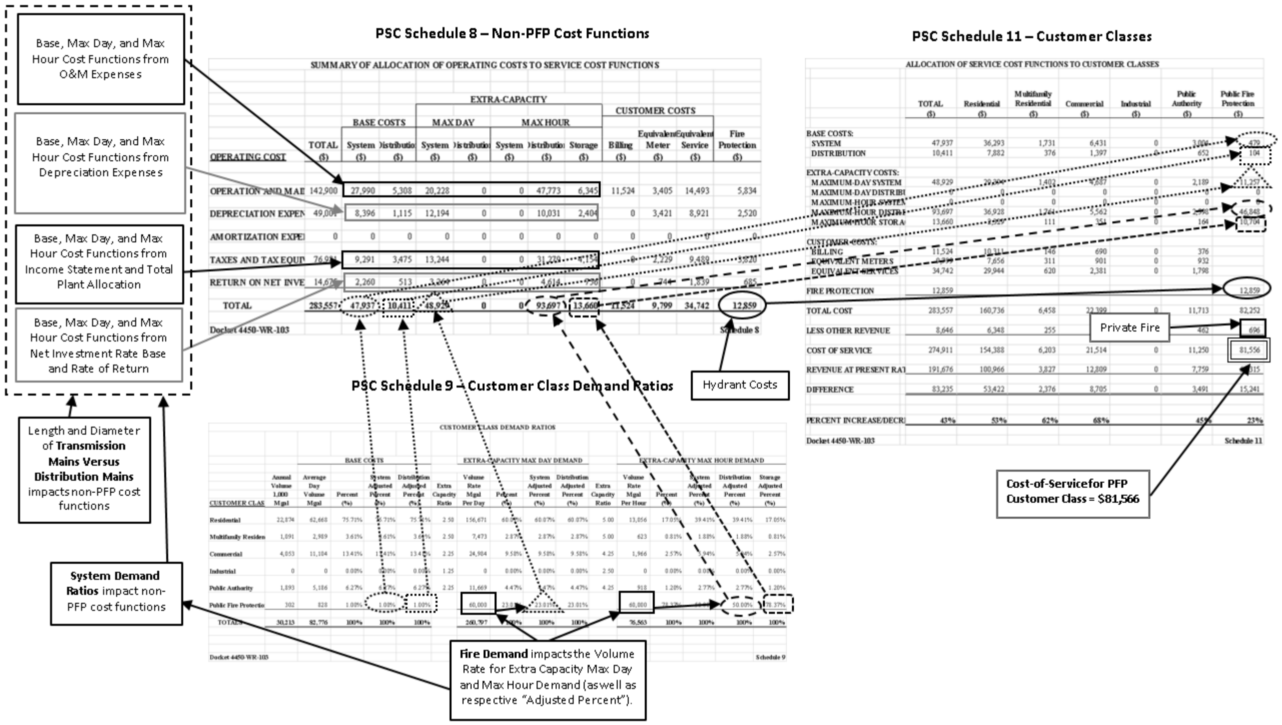
For Accts 681 thru 689 the PFP cost function= (Acct Row Total) x (Column Total for Accts 600, 640, 650, 660, and 680)/ (Grand Total for Accts 600, 640, 660, and 680)

The total amounts of the base, max day, and max hour cost functions are then allocated to the PFP customer class based on the volume of the PFP customer class (annual, max day, and max hour volumes) as compared to the volumes from the other customer classes (residential, commercial, industrial, and public authority customer classes). The annual PFP volume is defined as one percent of the utility's total annual sales volume. The max day and max hour PFP volumes are a function of the utility's fire demand and duration. The relative volumes of each customer class are a function of their respective annual sales volume and their customer demand ratios. Figure 28 shows how the base, max day, and max hour cost functions are allocated to the PFP customer class.

Figure 28. Cost Allocation to PFP Customer Class



4.10 Rate Design

The PSC rate design method strives to follow several important criteria identified by James Bonbright in his book, "Principles of Public Utility Rates" (Columbia University Press, 1961). Bonbright claims that well designed utility rates will meet the following criteria:

- Practical, simple, and easily understandable.
- Clear, having only one interpretation.
- Achieve proper revenue requirement.
- Provide relatively stable revenues.
- Avoid unnecessary rate shock.
- Based on the cost of providing service.
- Not be unduly discriminatory.
- Promote justified applications and discourage wasteful use.

Keeping these criteria in mind, ~~let's go through~~ the mechanics of how the PSC model computes PFP rates is summarized below. The total amount allocated to the PFP customer class is the PFP cost-of-service. This is the amount that the PFP rates must recover if the water utility is to remain sustainable. As discussed in Section 3 of this report, there are three types of PFP charges, the "municipal charge" (PFP cost-of-service billed to local government and collected through property taxes), the "direct charge" (PFP cost-of-service collected through water bills), and a combination of the two.

The municipal charge is simply that portion of the PFP cost-of-service that the utility and municipality have agreed should be paid for through property taxes. This charge is directly billed to the municipality. A sample tariff is shown in Figure 29.

Figure 29. Sample Tariff for Municipal PFP Charge.

Public Fire Protection Service

Public fire protection service includes the use of hydrants for fire protection service only and such quantities of water as may be demanded for the purpose of extinguishing fires within the service area. This service shall also include water used for testing equipment and training personnel. For all other purposes, the metered or other rates set forth, or as may be filed with the Public Service Commission, shall apply.

The annual charge for public fire protection service to the Village of Birnamwood shall be $32,140. The utility may bill for this amount in equal bimonthly installments.

Billing: Same as Schedule Mg-1.

The four most popular preapproved methods for computing the direct PFP charge are: the equivalent meters method, the equivalent services method, the property values method, and the square feet of improvements method.

The equivalent meters method is used by 240 of Wisconsin's 582 regulated water utilities. It computes charges based on ratios of meter size. Figure 30 shows how the equivalent meter ratios are used to compute the PFP rates. First, the PSC rate model divides the PFP cost-of-service by the number of billing periods per year and by the total equivalent meters for the particular utility. The resulting value is the "Charge per billing period per equivalent meter" which is $14.38 as shown in the figure. Then, this value is used to compute the equivalent charges for each meter size. For each meter size, the equivalent charge is equal to the charge per billing period per equivalent meter times the appropriate equivalent meter ratio. So, a 6-inch meter should be charged $719 per month ($14.38 x 50). Then, the proposed charges are entered by hand by rounding up or down the equivalent charges. The PFP cost-of-service is then compared to the total calculated PFP revenue using the proposed charges. The proposed charges are adjusted until the difference is deemed immaterial.

Figure 30. Equivalent Meter Ratios Used to Compute the PFP Rates.

Choose Method ("M" for equivalent meters, "S" for equivalent services) M Equivalent Meter

MARINETTE MUNICIPAL WATER UTILITY 3370-WR-105 2014 **07/02/15**
Public Fire Protection

Equivalent Meter Ratio Method **Inside Retail**

Cost of Public Fire Protection Service - Inside Retail	$1,120,132
Proposed Municipal Charge Revenue	**$0**
Direct Charge Revenue Required	$1,120,132
Noncustomer bts charged fire protection: Charge per Billing Period per Equivalent Meter	$14.38
	$1,120,201
Difference Between Proposed and Req'd Revenue	$69

= $1,120,132 / (12 billing periods x 6,494 eq. meters)

Eq. Charges = $14.38 x Eq. Meter Ratio

Meter Size Decimal	Meter Size	Old Rates	Equivalent Charges	Proposed Charges	Percent Change
0.625	5/8	$9.55	$14.38	14.37	50%
0.750	3/4	$14.32	$14.38	21.60	51%
1.000	1	$23.90	$35.94	36.00	51%
1.250	1 1/4	$35.33	$53.19	53.00	50%
1.500	1 1/2	$47.79	$71.88	72.00	51%
2.000	2	$76.43	$115.00	115.00	50%
3.000	3	$144.20	$215.63	216.00	50%
4.000	4	$238.96	$359.38	360.00	51%
6.000	6	$477.92	$718.75	719.00	50%
8.000	8	$764.26	$1,150.00	1150.00	50%
10.000	10	$1,146.39	$1,725.01	1725.00	50%
12.000	12	$1,528.52	$2,300.01	2300.00	50%

Inside Retail Revenues at Proposed Rates

Meter Size	Residential	Multifamily Residential	Commercial	Industrial	Public Authority	Non Customers	Total
5/8	731,146	2,931	52,767	862	3,966		791,672
3/4	3,629	259	10,109	518	2,074		16,589
1			20,304	3,888	3,024		27,216
1 1/4							0
1 1/2			24,192	6,048	2,592		32,832
2			45,540	33,120	8,280		86,940
3			41,472	23,328	15,552		80,352
4			12,960	25,920	4,320		43,200
6							0
8			13,800	27,600			41,400
10							0
12							0
	734,774	3,191	221,143	121,285	39,808	0	1,120,201

6	8	10	12	TOTAL METERS	PERCENT
0	0	0	0	4,254	87%
0	0	0	0	18	0%
				473	10%
				64	1%
0	0	0	0	54	1%
0	**3**	**0**	**0**	**4,863**	**100%**

6 .0	8 80.0	10 120.0	12 160.0	TOTAL EQUIV. METERS	PERCENT
0	0	0	0	4,261	66%
0	0	0	0	19	0%
0	80	0	0	1,281	20%
0	160	0	0	703	11%
0	0	0	0	231	4%
0	**240**	**0**	**0**	**6,494**	**100%**

This method is popular because it is relatively easy to administer. Unfortunately, it is not perfectly equitable. For example, a warehouse with a 5/8-inch meter will pay the same PFP charge as a town home with the same size meter, even though the warehouse requires larger flows and higher pressures to fight a future fire than does the town home. Figure 31 shows an example of a typical PFP tariff sheet using the equivalent meters method.

Figure 31. Sample Tariff for Direct PFP Charge Using the Equivalent Meters Method.

Public Fire Protection Service

Public fire protection service includes the use of hydrants for fire protection service only and such quantities of water as may be demanded for the purpose of extinguishing fires within the service area. This service shall also include water used for testing equipment and training personnel. For all other purposes, the metered or other rates set forth, or as may be filed with the Public Service Commission, shall apply.

Under Wis. Stat. § 196.03(3)(b), the municipality has chosen to have the utility bill the retail general service customers for public fire protection service.

Monthly Public Fire Protection Service Charges:

⅝ -inch meter - $	14.37	3 -inch meter - $	216.00
¾ -inch meter - $	21.60	4 -inch meter - $	360.00
1 -inch meter - $	36.00	6 -inch meter - $	719.00
1¼ -inch meter - $	53.00	8 -inch meter - $	1,150.00
1½ -inch meter - $	72.00	10 -inch meter - $	1,725.00
2 -inch meter - $	115.00	12 -inch meter - $	2,300.00

Customers who are provided service under Schedules Mg-1, Ug-1, or Sg-1 shall be subject to the charges in this schedule according to the size of their primary meter.

Billing: Same as Schedule Mg-1.

The equivalent services method is used by 12 water utilities. The equivalent services method is virtually identical to the equivalent meters method. The only difference is that the charges are based on different ratios using the service size. This method has the same benefits and shortcomings as the equivalent meters method. Compared to the equivalent meters method, this method results in relatively higher charges to small meters and lower charges to large meters. Figure 32 shows an example of a typical PFP tariff sheet using the equivalent services method.

Figure 32. Sample Tariff for Direct PFP Charge Using the Equivalent Services Method.

Public Fire Protection Service

Under Wis. Stat. § 196.03(3)(b), the municipality has chosen to have the utility bill the retail general service customers for public fire protection service.

This service shall include the use of hydrants for fire protection service only and such quantities of water as may be demanded for the purpose of extinguishing fires within the service area. This service shall also include water used for testing equipment and training personnel. For all other purposes, the metered or other rates set forth, or as may be filed with the Public Service Commission, shall apply.

Monthly Public Fire Protection Service Charges:

⅝ -inch meter - $	4.18	3 -inch meter - $	16.80
¾ -inch meter - $	4.18	4 -inch meter - $	21.00
1 -inch meter - $	5.50	6 -inch meter - $	26.00
1¼ -inch meter - $	7.20	8 -inch meter - $	30.00
1½ -inch meter - $	8.40	10 -inch meter - $	34.00
2 -inch meter - $	13.50	12 -inch meter - $	38.00

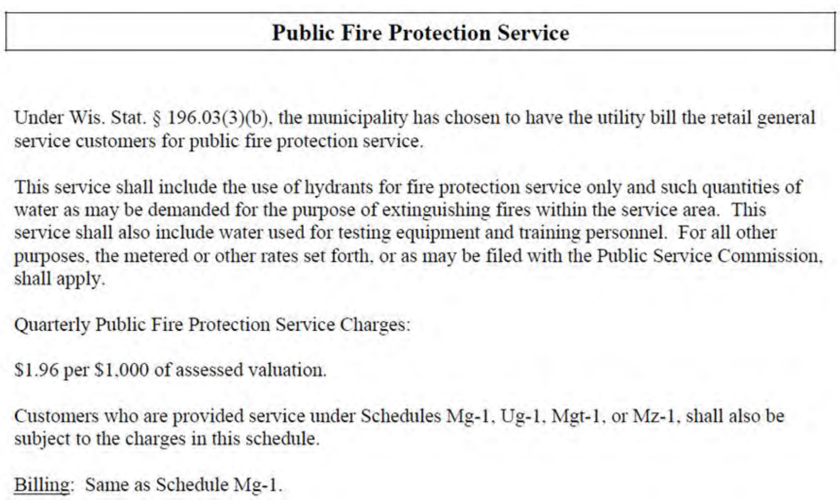
Customers who are provided service under Schedules Mg-1, Ug-1, Mgt-1, or Mz-1, shall also be subject to the charges in this schedule.

Billing: Same as Schedule Mg-1.

The property values method is used by 15 water utilities. This method requires that the utility compute the assessed value of all of the municipality's taxable parcels. The utility then must also identify and estimate the value of parcels that are tax-exempt (tax-exempt properties must pay the direct PFP charge). The sum of these two amounts is the total property value. Then, the PFP cost-of-service is divided by the total property value amount to obtain a PFP rate of so many dollars in PFP charge per 100,000 dollars of assessed valuation. Each property owner is then directly billed a direct PFP charge based on their property's assessed value (or their estimated assessed value in the case of tax-exempt properties). This method is equitable in that the PFP charge closely reflects the benefits received. Also, it closely mimics how property owners would be charged if the PFP was collected as municipal charge using property taxes.

The downside is that it takes significant effort for utility staff to develop an accurate property value table and correlate that table with their list of water customers (not an issue if the utility chooses to bill PFP charge to non-general service customers as well). Figure 33 shows an example of a typical PFP tariff sheet using the property values method.

Figure 33. Sample Tariff for Direct PFP Charge Using the Property Values Method.



Public Fire Protection Service

Under Wis. Stat. § 196.03(3)(b), the municipality has chosen to have the utility bill the retail general service customers for public fire protection service.

This service shall include the use of hydrants for fire protection service only and such quantities of water as may be demanded for the purpose of extinguishing fires within the service area. This service shall also include water used for testing equipment and training personnel. For all other purposes, the metered or other rates set forth, or as may be filed with the Public Service Commission, shall apply.

Quarterly Public Fire Protection Service Charges:

$1.96 per $1,000 of assessed valuation.

Customers who are provided service under Schedules Mg-1, Ug-1, Mgt-1, or Mz-1, shall also be subject to the charges in this schedule.

Billing: Same as Schedule Mg-1.

The square feet of improvements method is used by five water utilities. This method is similar to the property values method, except that the square feet of improvements of each parcel is substituted for the assessed value. In this case, the PFP cost-of-service is divided by the total square feet of improvements of all the municipality’s parcels. This generates a PFP rate of so many dollars in PFP charge per square foot of improvements. This method correlates PFP charge with size of structure. Also, it does not bill a PFP charge to vacant lot owners. This method may also be difficult to administer. Figure 34 shows an example of a typical PFP tariff sheet using the square feet of improvements method.

Figure 34. Sample Tariff for Direct PFP Charge Using the Square Feet of Improvements Method.

Public Fire Protection Service

Public fire protection service includes the use of hydrants for fire protection service only and such quantities of water as may be demanded for the purpose of extinguishing fires within the service area. This service shall also include water used for testing equipment and training personnel. For all other purposes, the metered or other rates set forth, or as may be filed with the Public Service Commission, shall apply.

Under Wis. Stat. § 196.03(3)(b), the municipality has chosen to have the utility bill the retail general service customers for public fire protection service.

Quarterly Public Fire Protection Service Charges:

$0.0113 per square foot of improvements.

Customers who are provided service under Schedules Mg-1, Ug-1, or Sg-1 shall be subject to the charges in this schedule.

Billing: Same as Schedule Mg-1.

4.11 Allocating PFP Costs to Wholesale Customers

There are 28 regulated water utilities in Wisconsin that provide wholesale water service. These wholesale providers serve 53 water utilities that act as wholesale customers. The largest wholesale provider in the state is Milwaukee Water Works. Appendix H contains a table of these wholesale providers along with the communities that they serve.

The existing PSC cost-of-service and rate design model was created to ensure ~~tries to make sure~~ that the wholesale customer pays the appropriate cost for any PFP benefits that it receives. PFP benefits include the ~~standby~~ cost to provide higher flows at sufficient pressures and duration needed to fight fires in the wholesale customer community. If needed, a~~The~~

wholesale customer may rely on the wholesale provider's excess supply~~well~~ capacity, transmission mains, and water storage volume~~capacity~~ to meet the wholesale customer's PFP needs.

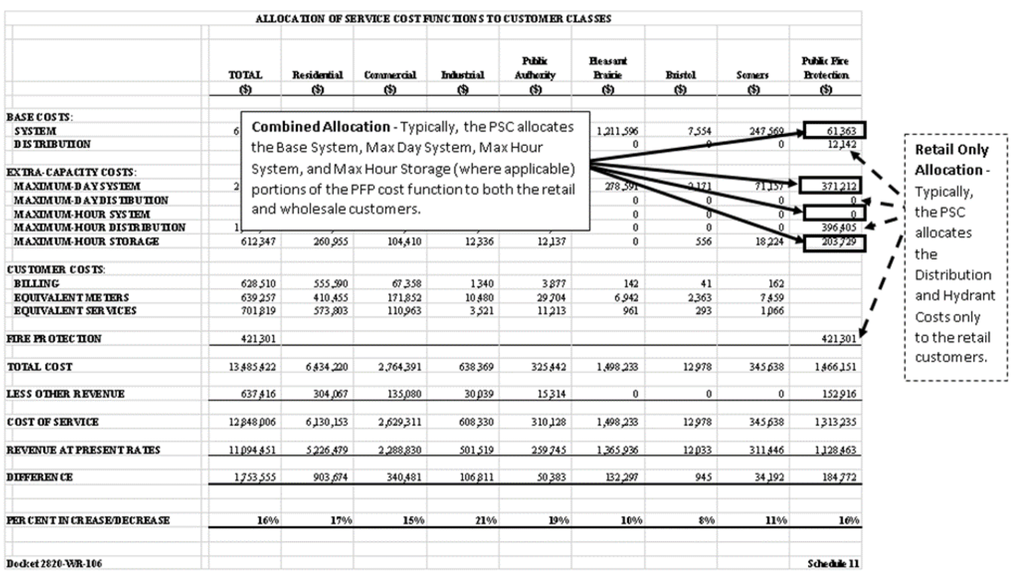
PFP charges to wholesale customers are often contentious issues in water rate cases. Ideally, the wholesale provider and the wholesale customer would have a contract that clearly ~~spells out~~defines ~~what kind of~~the water service ~~is~~ being provided (max day, max day plus fire flow, etc.). If so, then the cost-of-service and rate model should reflect the requirements of the contract. If the wholesale contract is not clear, or if the actual wholesale supplier's system hydraulics cannot meet ~~don't reflect~~ the minimum contract requirements, then an analysis is performed to determine what level of service the wholesale customer actually receives. In the final decision for the latest Milwaukee Water Works rate case (Docket 3720-WR-108) the Commission ruled that the "Oak Creek criteria" (Docket 4310-WR-104, p. 32) should be used to determine what PFP charge the wholesale ~~community~~ customer should be allocated. Those criteria are:

- The wholesale customer has the capability to meet its maximum day plus fire flow based on its own distribution storage.
- The wholesale supplier cannot provide max day plus fire flow to the wholesale customer.
- There exists contractual limitations to the wholesale supplier's ability to provide maximum day plus fire flow.
- There exists technical limitations (i.e. flow control devices) to the wholesale supplier's ability to provide maximum day plus fire flow.

When performing a cost-of-service study for a wholesale provider, the PSC model first allocates a portion of the PFP cost-of-service (Base Distribution, Max Day Distribution, Max

Hour Distribution, and the hydrants costs) solely to the retail customers (Retail Only Allocation). Then, the PSC model allocates the remaining portion of the PFP cost-of-service (Base System, Max Day System, Max Hour System, and Max Hour Storage, where applicable) to both the wholesale and retail customers (Combined Allocation). The cost functions included in each of these two PFP allocations is shown in Figure 35.

Figure 35. PFP Cost Allocation to Retail and Wholesale Customers



ALLOCATION OF SERVICE COST FUNCTIONS TO CUSTOMER CLASSES

	TOTAL ($)	Residential ($)	Commercial ($)	Industrial ($)	Public Authority ($)	Pleasant Prairie ($)	Bristol ($)	Somers ($)	Public Fire Protection ($)
BASE COSTS:									
SYSTEM	6[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,211,596	7,554	247,569	61,363
DISTRIBUTION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	12,142
EXTRA-CAPACITY COSTS:									
MAXIMUM-DAY SYSTEM	2[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	278,591	2,171	71,157	371,212
MAXIMUM-DAY DISTIBUTION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0
MAXIMUM-HOUR SYSTEM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0
MAXIMUM-HOUR DISTRIBUTION	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	396,405
MAXIMUM-HOUR STORAGE	612,347	260,955	104,410	12,336	12,137	0	556	18,224	203,729
CUSTOMER COSTS:									
BILLING	628,510	555,590	67,358	1,340	3,877	142	41	162	
EQUIVALENT METERS	639,257	410,455	171,852	10,480	29,704	6,942	2,363	7,459	
EQUIVALENT SERVICES	701,819	573,803	110,963	3,521	11,213	961	293	1,066	
FIRE PROTECTION	421,301								421,301
TOTAL COST	13,485,422	6,434,220	2,764,391	638,369	325,442	1,498,233	12,978	345,638	1,466,151
LESS OTHER REVENUE	637,416	304,067	135,080	30,039	15,314	0	0	0	152,916
COST OF SERVICE	12,848,006	6,130,153	2,629,311	608,330	310,128	1,498,233	12,978	345,638	1,313,235
REVENUE AT PRESENT RATES	11,094,451	5,226,479	2,288,830	501,519	259,745	1,365,936	12,033	311,446	1,128,463
DIFFERENCE	1,753,555	903,674	340,481	106,811	50,383	132,297	945	34,192	184,772
PERCENT INCREASE/DECREASE	16%	17%	15%	21%	19%	10%	8%	11%	16%

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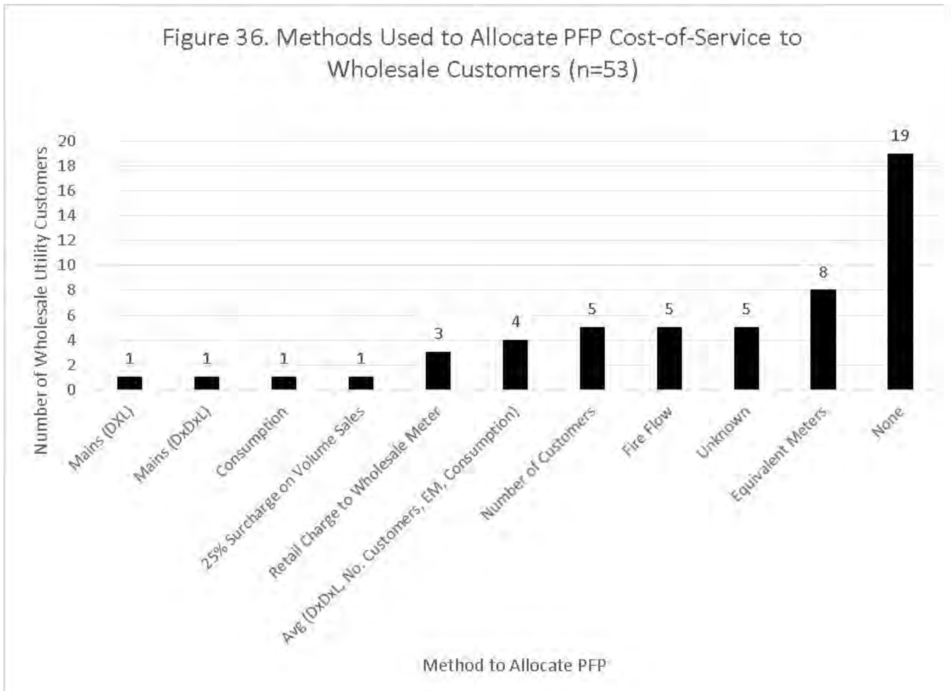
The “Combined Allocation” of the PFP customer class (Base System, Max Day System, Max Hour System and Max Hour Storage) is then allocated between the retail and wholesale customers using one of the following methods:

- Population-based methods – relative populations

- Milwaukee Method – average of Freeman's Formula max and min, NBFU Method, and Kuickling Method
- Equivalent meters
- Feet of main / D x L / D x D x L
- Number of customers
- Consumption
- Fire flows totals – flow rate x duration
- Elevated storage
- Number of hydrants
- Wholesaler's retail PFP charge to wholesale meter
- Combination of various methods

Appendix H also lists the methods used to allocate the PFP cost to the wholesale customers. Figure 36 shows how frequently each allocation method is used to allocate PFP costs to Wisconsin's 53 wholesale customers.



5. Methods Used by Other States to Compute and Recover the Public Fire Protection Cost

The PSC created a survey comprised of 20 questions to find out how other public utility commissions of each state in the United States computes public fire protection costs, allocates them to the cost functions and customer classes, and then develops appropriate rates. The survey was sent via email to all 50 public utility commissions. The first email was sent on April 14, 2015. As needed, follow-up emails were sent in May, June, and July 2015. The results of the survey are included in Appendix I. All 50 public utility commissions responded to the survey. The quality of the responses varied. The answers to Questions 1 and 2 are discussed below. The remaining answers are discussed in Section 4 of this report.

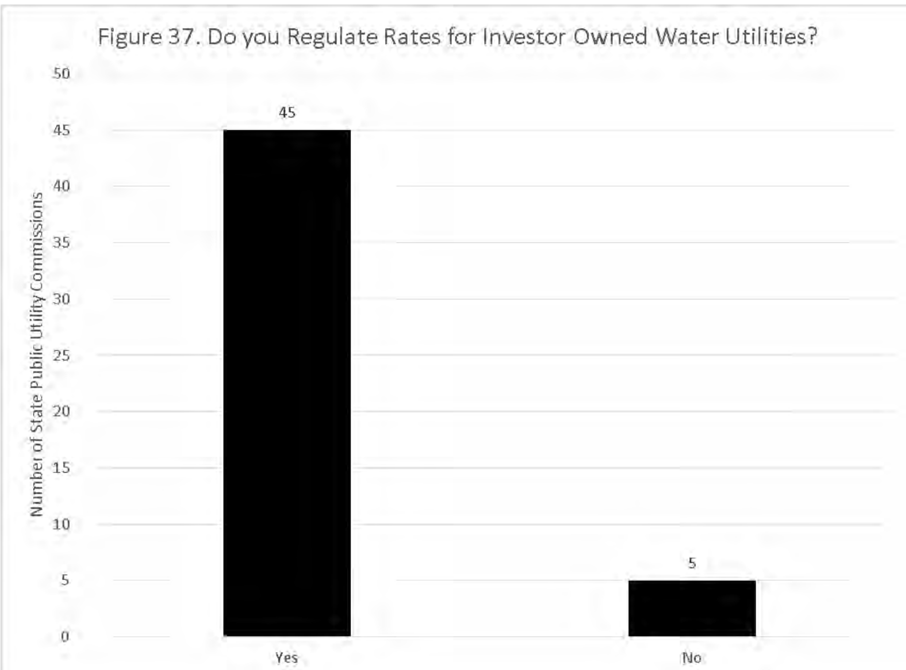
The first question of the survey asked, “Do you regulate rates for municipal water utilities?” As seen in Table 1, there were 10 states that responded that they do regulate municipal water utilities, at least under certain circumstances. Only Wisconsin regulates municipal water utilities under all circumstances.

Table 1. “Do you Regulate Rates for Municipal Water Utilities?”

	Number of Public Utility Commissions	States
Yes, Regulate Rates for All Municipal Water Utilities	1	WI
Yes, Regulate Rates for Certain Types of Municipal Water Utilities and/or Under Certain Conditions	9	AK, IN, ME, MD, MS, NJ, PA, RI, WV
No, Does Not Regulate Rates for Municipal Water Utilities	40	Remaining States

Commented [PP15]: Why is the state of Wisconsin so unique compared to the other 49 states in the union? Should some sort of public water utility de-regulation be considered?

The second question of the survey asked, “Do you regulate rates for investor owned water utilities? The response is summarized in Figure 37 shown below. The five public utility commissions that do not regulate rates for investor-owned water utilities are: Georgia, Michigan, Minnesota, North Dakota, and South Dakota.



6. Discussion of Options for Computing and Allocating the Public Fire Protection Charge

Section 4 of this report describes how the PSC model currently computes PFP cost-of-service and rates. The following paragraphs discuss possible improvements to the PSC model.

6.1 Computation of Fire Demand

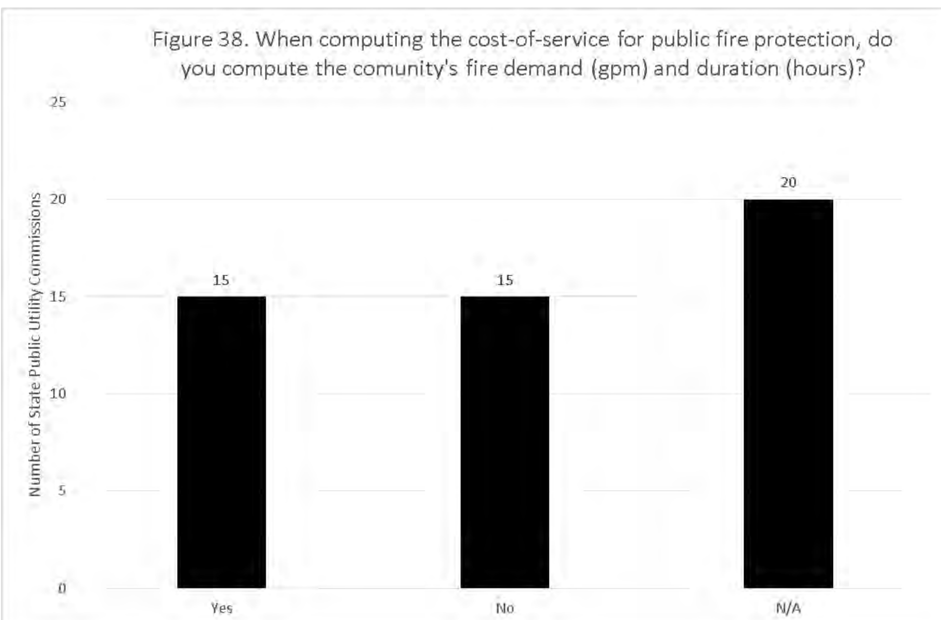
As discussed in Section 4 of this report, the PSC model uses the community's estimated fire demand as one factor in computing the non-PFP cost functions. When performing a cost-of-service study, the PSC model relies on the previous estimate of fire demand from the former rate case, unless there is a reason to change it. In general, PSC fire demands closely follow the NBFU method up to a population of about 80,000 persons. The four largest water utilities in the state that serve populations of greater than 80,000 persons have computed fire demands that more closely follow the Kuickling method. These population based equations have the advantage of being consistent with prior practice. Unfortunately, they may be overestimating the fire demand for large systems because fire demand actually tops out at the largest building fire, regardless of the size of the population being served. Also, these equations are based on data that is over 70 years old, and they do not reflect the current state of fire science.

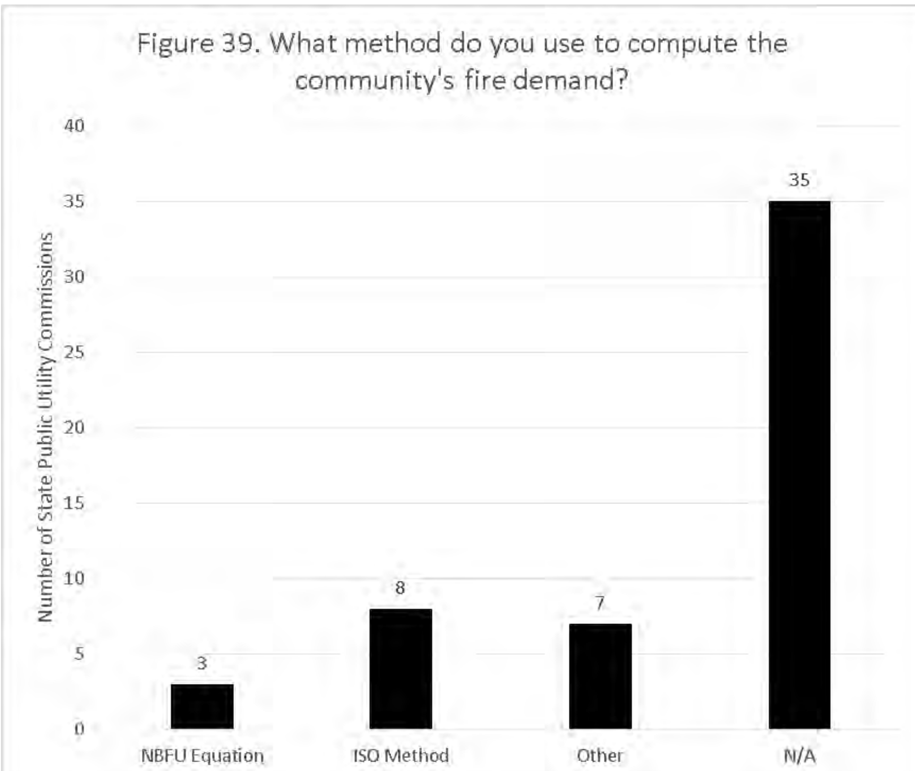
Today, the Insurance Services Office (ISO) has replaced the NBFU as the national standard for computing a community's fire demand. ISO gives each community a rating between 1 and 10 that describes its firefighting ability. This rating system is a national standard used by insurance companies to calculate property and homeowners insurance premiums. To determine a community's rating, ISO conducts on-the-ground surveys of the structures in a community and calculates a "needed fire flow" (NFF) for each building. When computing each NFF, ISO takes into account the building area, occupancy, construction type, building use, and exposures, and the presence of sprinklers. ISO also performs actual capacity tests on the water distribution system to rate the effectiveness of the distribution system to provide water for firefighting. As part of the rating process, ISO takes the fifth-highest NFF for the buildings they survey and sets that as the Basic Fire Flow (BFF). The BFF is, essentially, the minimum fire flow that the water system should be able to support at ~~any~~ the highest needed fire flow locations. Unlike the population based formulas, the BFF is not an estimate. It is calculated directly from the buildings in the community and, therefore, reflects the unique character of each community. Also, ISO puts a cap on the BFF. The maximum amount that a community needs to have available is 3,500 gpm for 3 hours. The rationale behind this is that fire control for larger buildings is largely the responsibility of the property owner by using fire retardant building

Commented [PP16]: Not "any" location. No need to design distribution system in a residential area for 3,500 gpm.

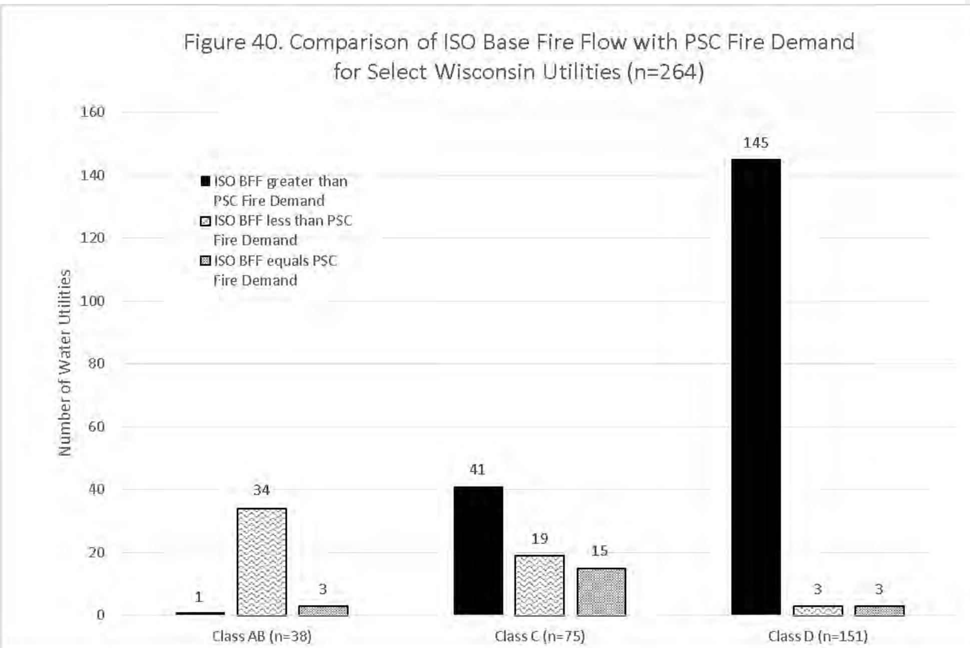
materials and installing sprinkler systems and automatic smoke alarms. This philosophy is often reflected in more stringent building codes for these larger structures, as discussed in Rebuttal-PSC-Shannon-2-4. (PSC REF# 206290)

Figure 38 shows that, based on the survey of the 50 public utility commissions, there were 15 states that stated that when they compute the PFP cost-of-service, they compute the community's fire demand and duration. Figure 39 shows that 8 of those 15 utilities use the ISO method to compute fire demand, while three use the population based equations.





Commission staff obtained BFF data from the Insurance Services Office for 264 of Wisconsin's 582 regulated water utilities. The sample consists of 38 Class AB utilities, 75 Class C utilities, and 151 Class D utilities. The data is shown in Appendix J. Commission staff compared the ISO base fire flow (BFF) with the PSC fire demand to see how they differ. The results are shown in Figure 40. Virtually all of the Class AB utilities (34 of 38 utilities) have BFFs less than the PSC fire demand. As a result, one could expect that if the ISO base fire flows were used in the PSC's cost-of-service study, then the PFP cost-of-service for those 34 utilities would decrease. Figure 40 shows that for 41 of the 75 Class C utilities sampled, the ISO base fire flow was greater than the PSC fire demand. The adoption of the ISO base fire flow in the PSC cost-of-service study would result in an increase in the PFP cost-of-service for these 41 utilities. Another 19 Class C utilities from the same sample had ISO base fire flows less than the PSC fire demand. The remaining 15 Class C utilities from the same sample had ISO base fire flows equal to the PSC fire demand. Among the 151 Class D utilities sampled, 145 had an ISO base fire flow greater than the PSC fire demand. Only three Class D utilities had ISO base fire flows less than the PSC fire demand, and another three utilities had ISO base fire flows equal to the PSC fire demand. Assuming that the 264 utilities sampled are statistically representative of the entire population of the 582 regulated water utilities in Wisconsin, the use of the ISO base fire flows would decrease the PFP cost-of-service for 90% of the Class AB utilities. Approximately 55% of the Class C utilities would experience an increase in the PFP cost-of-service, while 25% would see a decrease in the PFP cost-of-service, and 20% would not see any change. For Class D utilities, about 96% of the utilities would experience an increase in the PFP cost-of-service.



Commission staff chose four utilities from each utility class to compute the actual change in the PFP cost-of-service that results from using the ISO base fire flow. These sample utilities include the ones with the biggest difference between the ISO base fire flow and the PSC fire demand. Table 2 summarizes the results. Based on the results shown below, it is estimated that if the ISO base fire flow is substituted for the PSC fire demand, the ~~PSC~~ PFP cost-of-service for Class AB utilities will decrease from 0% to 41%. Similarly, for Class C utilities the PFP cost-of-service may change from -28% to +32%. Class D utilities would experience a PFP cost-of-service increase from 0% to 20%.

Table 2. Comparison of the Impact Using the PSC Fire Demand Versus the ISO Base Fire Flow on the PFP Cost-of-Service.

Utility Name	Utility ID	No. Customers	Class	PSC Fire Demand (gpm)	PSC PFP Cost-of-Service ($)	ISO Base Fire Flow (gpm)	ISO PFP Cost-of-Service ($)	Percent Difference Between PSC PFP COS and ISO PFP COS (%)
Milwaukee Water Works	3720	162,369	AB	17,962	$8,126,970	3,500	$4,760,230	-41.4%
Sheboygan Water Utility	5370	18,815	AB	7,000	$784,832	3,500	$479,848	-38.9%
Marinette Municipal Water Utility	3370	4,766	AB	5,000	$1,120,132	3,500	$785,373	-29.9%
Sussex Public Water Utility	5835	3,380	C	4,500	$487,293	3,000	$350,333	-28.1%
Eau Claire Municipal Water Utility	1740	26,769	AB	7,000	$1,487,464	3,500	$1,081,088	-27.3%
Grand Chute Sanitary District No. 1	2310	8,332	AB	5,000	$567,876	3,500	$482,461	-15.0%
Verona Water Utility	6100	4,549	AB	4,000	$464,096	3,500	$445,542	-4.0%
Fredonia Municipal Water Utility	2130	1,612	D	1,750	$139,504	2,500	$147,344	5.6%
Sauk City Municipal Water & Light Utility	5260	1,451	C	2,500	$139,388	3,000	$147,514	5.8%
Mineral Point Municipal Water Utility	3740	1,423	C	1,500	$137,471	3,000	$154,966	12.7%
Cambridge Municipal Water Utility	920	709	D	1,500	$155,871	3,500	$185,257	18.9%
Bayfield Water & Sewer Utility	385	490	D	1,000	$94,428	2,000	$113,227	19.9%
Poynette Municipal Water Utility	4810	997	C	2,000	$122,904	3,000	$162,672	32.4%

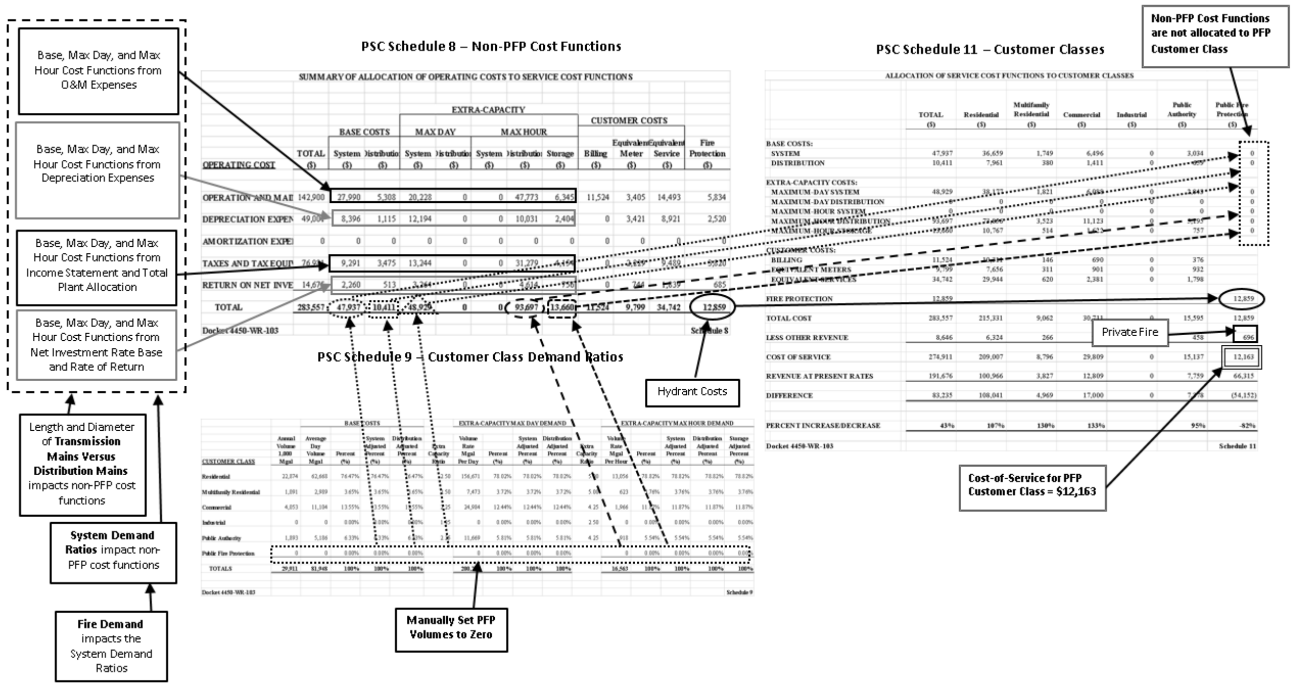
In summary, the ISO method for computing fire demand can be seen as ~~is~~ superior to the current PSC method that relies on population based equations like the NBFU or Kuickling equations. The ISO method is based on a rigorous analysis by a neutral party that results in a calculation of fire demand that can be more easily defended in a contested rate case. The use of the ISO base fire flow would significantly decrease the PFP cost-of-service for Class AB utilities and significantly increase the PFP cost-of-service for Class D utilities. Some Class C utilities would see an increase and others a decrease in the PFP cost-of-service.

6.2 Allocation of Costs to the PFP Cost Function and PFP Customer Class

The existing PSC cost-of-service model allocates hydrant costs to the PFP cost function, which makes the PFP cost function simple to understand and to predict. In contrast, the PFP customer class is calculated as a function of the hydrant costs, the fire demand, the system demand ratios, the length of transmission main versus distribution main, the customer demand ratios, and the water sales from each customer class. As shown in Figure 6, as general water service sales decrease, the PFP cost-of-service increases. This occurs because the cost of created ~~the~~ excess supply capacity ~~resulting stranded assets~~ is~~are~~ assigned not only to the general service customer classes, but also to the PFP customer class, even though the number of hydrants and the community's PFP demand may not have changed. ~~The PFP charge is supposed to be a "standby charge." Standby charges should be fixed and not vary with other customer class usage. This represents a fundamental problem with the PSC cost-of-service method (and its source, the AWWA Manual M1).~~ To address this issue of increases in PFP charges with decreasing sales volume, the PSC COSS model could be modified to separate customer water sales volumes from the PFP customer class~~In order to avoid this problem~~.~~,~~ Commission staff describes the following three options for revising the PFP cost-of-service model with the goal of separating customer class sales volumes from the final PFP customer class (aka PFP cost-of-service).

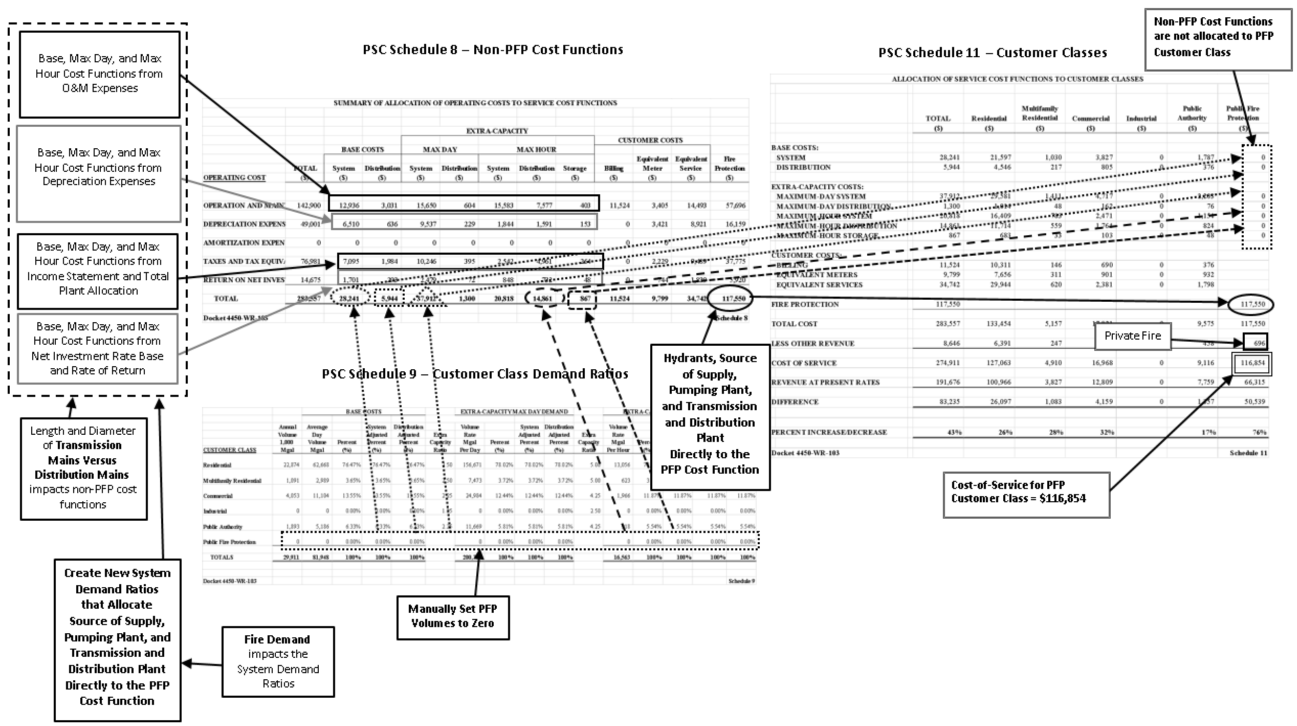
Option #1 eliminates the allocation of non-PFP cost functions to the PFP customer class. The result is that the PFP customer class represents hydrant costs only. This is accomplished by taking the standard PSC cost-of-service model and assigning zero volumes to the PFP customer class in the worksheet titled, "Customer Class Demand Ratios" (Schedule 9). Then, the PFP cost function (hydrant costs) is the sole amount allocated to the PFP customer class, as shown in Figure 41. The actual model results are shown in Appendix K.

Figure 41. Option #1 - Cost Allocation to PFP Customer Class



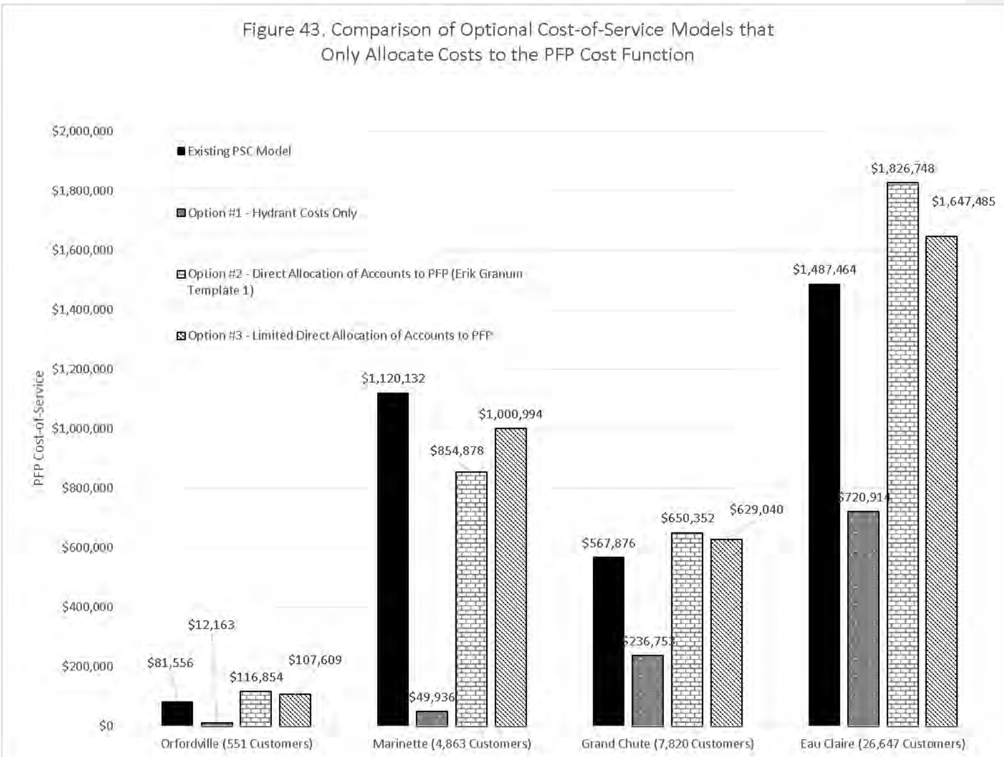
Option #2 allocates additional accounts to the PFP cost function by using additional system demand ratios that include fire demand. This option was developed by Erik Granum of Trilogy Consulting, LLC, as one of several possible methods to improve the PSC model for computing the PFP cost-of-service, as discussed in PSC REF# 237301. Option #2 is the same as Erik Granum's Template #1. It expands the type of facilities and costs directly allocated to the PFP cost function. The resulting PFP cost function includes contributions from hydrants as well as source of supply, pumping plant, distribution reservoirs and standpipes, and distribution main costs. The total PFP cost function amount then becomes the sole allocation to the PFP customer class, as shown in Figure 42. The actual model results are shown in Appendix L.

Figure 42. Option #2 - Cost Allocation to PFP Customer Class



Option #3 is similar to Option #2, but it allocates fewer accounts to the PFP cost function. The resulting PFP cost function includes hydrants as wells as contributions from the distribution reservoirs and standpipes account and the distribution main account. The total PFP cost function amount then becomes the sole allocation to the PFP customer class per Option #2. The actual model results are shown in Appendix M.

Four sample utilities (Orfordville, Marinette, Grand Chute, and Eau Claire) were used to compare the resulting PFP cost-of-service using the existing PSC cost-of-service model and the three options. All three options use the PSC fire demand. The results are shown in Figure 43. Options #1, #2, and #3 produce a PFP cost-of-service that does not change with decreasing utility sales volume. Option #1 is the simplest of the three options because only the hydrant costs are allocated to the final PFP cost-of-service. Option #2 is the most thorough allocation of costs to the PFP cost-of-service. Option #3 produced results closest to the existing PSC model.



Based on the survey of the 50 public utility commissions, there were 18 states that require regulated water utilities to include a separate cost allocation for public fire protection. The survey found that 17 states require that cost-of-service studies treat public fire protection as a separate cost function. Sixteen states identified which assets are directly allocated to the PFP cost function. These assets are shown in Figure 44. The same 16 states identified how costs are allocated to the PFP cost function, as shown in Figure 45.

Figure 44. Assets Directly Allocated to PFP Cost Function
(16 states responded other than N/A)

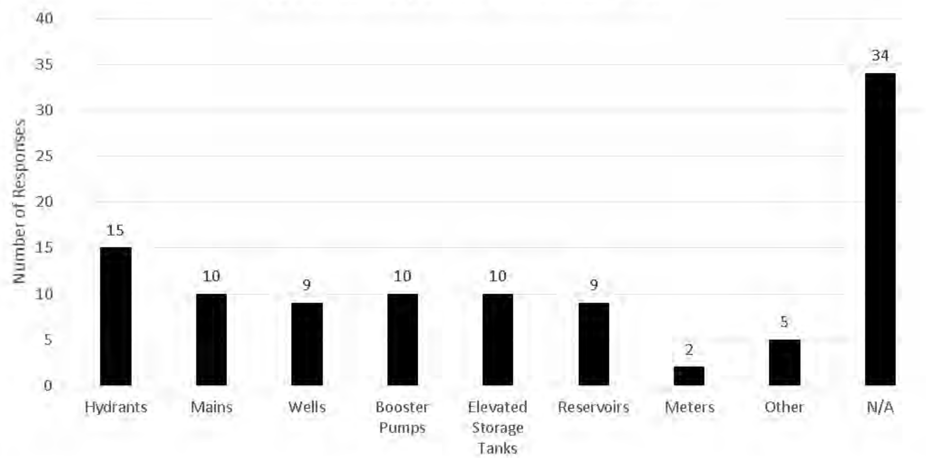
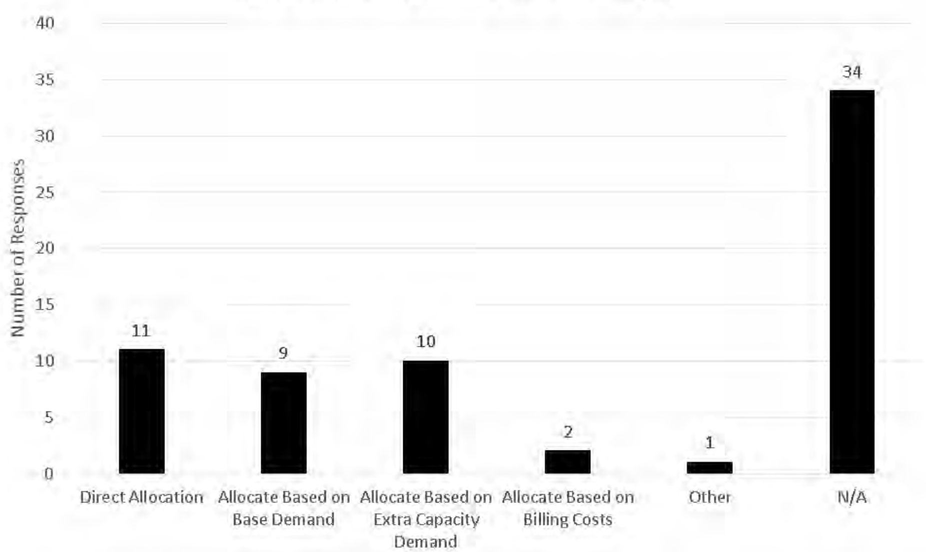
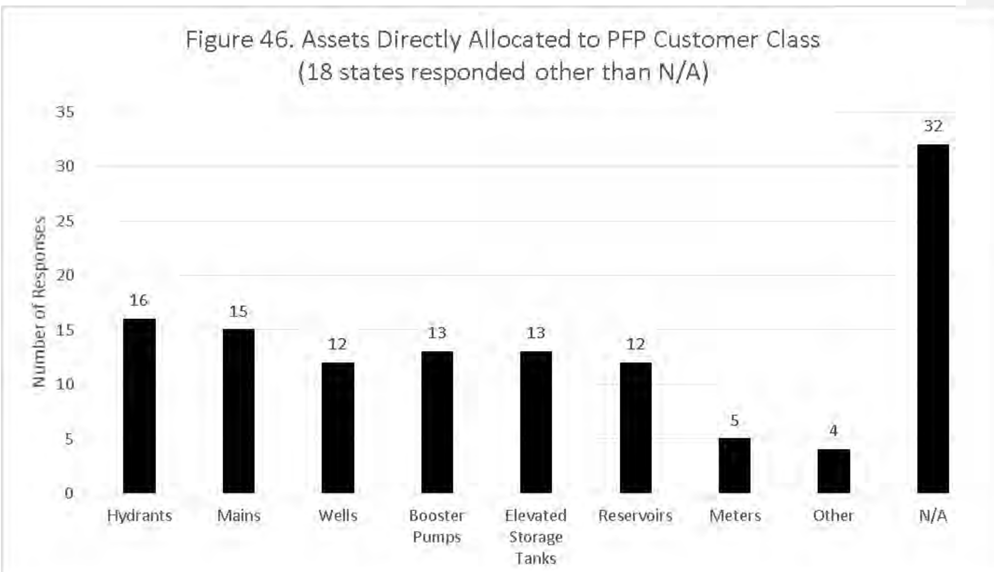
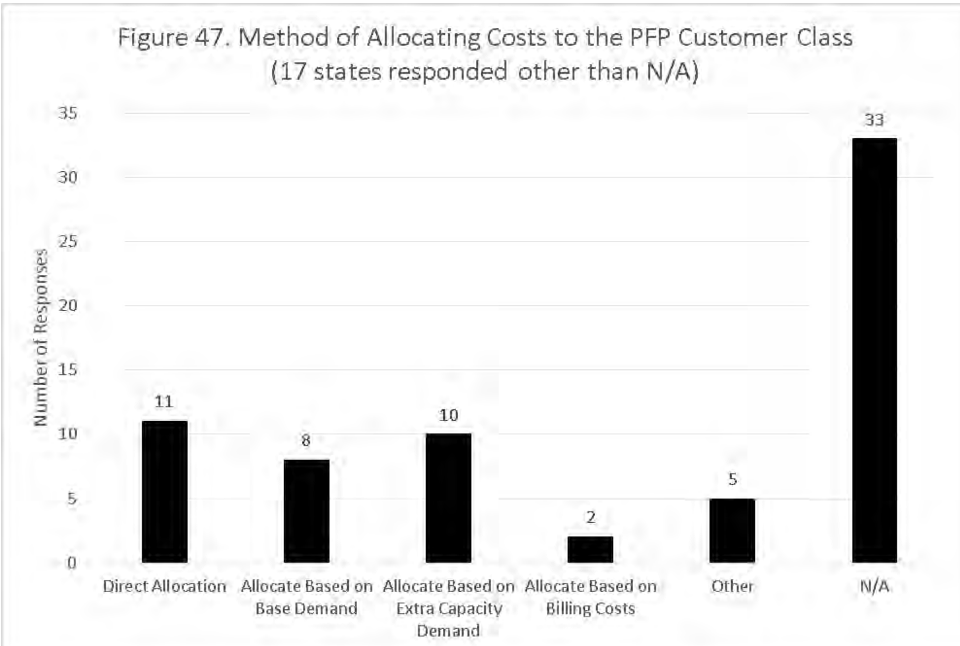


Figure 45. Method of Allocating Costs to the PFP Cost Function
(16 states responded other than N/A)



The survey found that 18 states require that cost-of-service studies treat public fire protection as a separate customer class. Sixteen states identified which assets are directly allocated to the PFP cost function. These assets are shown in Figure 46. Seventeen states identified how costs are allocated to the PFP customer class as shown in Figure 47.





6.3 Limit Maximum PFP Cost-of-Service

Another option for dealing with the issue of the increase in the PFP cost-of-service as general water service sales decrease is to place a cap or maximum limit on the PFP cost-of-service. This could be a maximum percentage of the total cost-of-service. Based on the survey of the 50 public utility commissions, there were two states that reported specific methods for capping the maximum allowable public fire protection cost. The Maine Public Utilities Commission does not allow the PFP cost-of-service to exceed 30% of the total cost-of-service (revenue requirement). The Pennsylvania Public Utility Commission limits the PFP cost-of-service in some cases. For companies that are required to provide a cost of service study, the rate charged for PFP is limited to 25% of the PFP cost-of-service (with some exceptions).

The advantages of implementing a cap on the PFP cost-of-service is that if general service consumption decreases, the cap reduces the allocation of ~~stranded asset~~excess capacity costs to the PFP cost-of-service. The disadvantage of a cap is that it appears to be subjective. Unless it is codified in statute or administrative code, it may become a contested issue.

Among Wisconsin's regulated water utilities, the PFP cost-of-service ranges from 9% of the water utilities total cost-of-service (Milwaukee Water Works) to as high as 45% of the water utility's total cost-of-service (Tony Municipal Water Utility). As shown in Figure 5, as the number of customers increases, the PFP cost-of-service as a percentage of the total cost-of-service decreases. Based on the same data set, Commission staff computed the average value for the "PFP cost-of-service as a percentage of total cost-of-service" for each customer class. The values are shown in Table 3 below. Perhaps these average values could be used as a cap for each utility class. If such a cap were adopted, those utilities that would experience a decrease in their PFP cost-of-service would see a proportionate increase in the cost-of-service for their residential, commercial, industrial, and public authority customers.

Table 3. Average PFP Cost-of-Service as a Percentage of Total Cost-of-Service (n=218)

Utility Class	Averge PFP Cost-of-Service as Percentage of Total Cost-of-Service
AB	18%
C	29%
D	34%

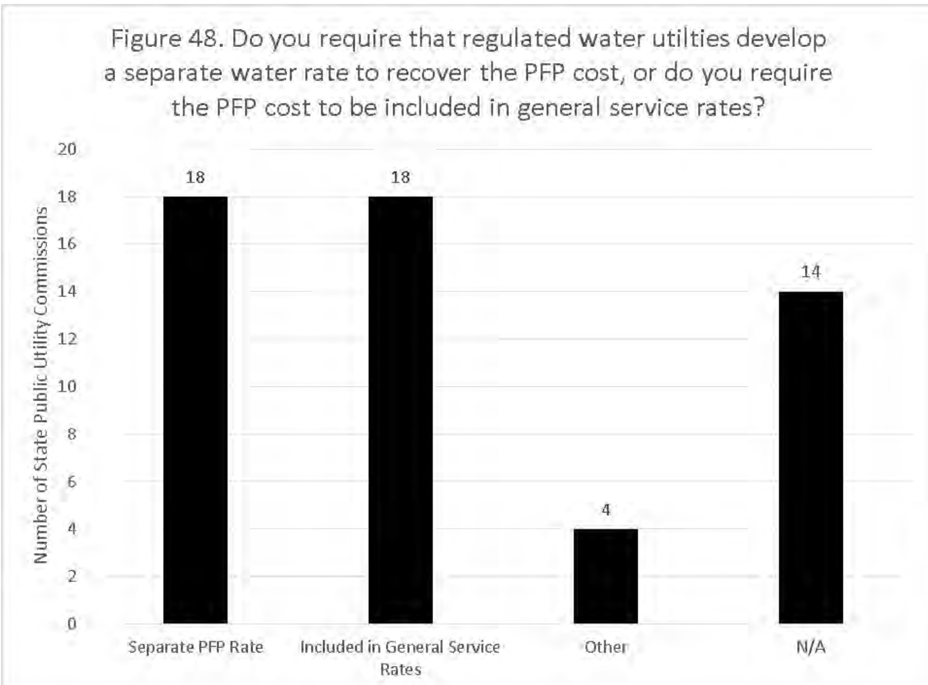
6.4 Class Absorption Method

In 1988, John Mayer, a utility rate consultant, proposed the "Class Absorption" method in his testimony submitted in Docket 05-WI-100. (PSC REF# 230968) The Class Absorption method eliminates the PFP customer class. All PFP costs are absorbed into the other customer classes and recovered through general service rates. This has been accomplished in this study by using the PSC cost-of-service model and by allocating the hydrant costs in Account 348 (Utility Financed Plant, Total Plant, and Depreciation Expenses schedules) to the cost functions of Base Distribution and Max Hour Distribution. The allocation is accomplished using Account 343, Distribution Mains. For Class AB utilities, the Maintenance of Hydrants cost in Account 677 of the Operation and Maintenance Expenses schedule is also allocated to the same cost functions by prorating the costs shown in Account 673, Maintenance of Distribution Mains. Then, the PFP volume is set to zero in the Customer Class Demand Ratio schedule. An explanation of this method is found in Appendix N. Table 4 summarizes how the Class Absorption method impacts the cost-of-service amount for the non-PFP customer classes for a select sample of utilities. Keep in mind that these results are the same whether the model uses the PSC fire demand or the ISO fire demand.

Table 4. Comparison of PSC COS Model and Class Absorption COS Model

Orfordville (551 Customers)							
	Residential Cost-of-Service	Multi-Family Cost-of-Service	Commercial Cost-of-Service	Industrial Cost-of-Service	Public Authority Cost-of-Service	PFP Cost-of-Service	Total Cost-of-Serivce
PSC Standard Model	$154,388	$6,203	$21,514	$0	$11,250	$81,556	$274,911
Class Absorption Method	$218,561	$9,253	$31,276	$0	$15,821	$0	$274,911
% Difference	42%	49%	45%	0%	41%	-100%	0%
Marinette (4,863 Customers)							
	Residential Cost-of-Service	Multi-Family Cost-of-Service	Commercial Cost-of-Service	Industrial Cost-of-Service	Public Authority Cost-of-Service	PFP Cost-of-Service	Total Cost-of-Serivce
PSC Standard Model	$1,582,988	$13,525	$567,130	$1,405,641	$194,275	$1,120,132	$4,883,691
Class Absorption Method	$2,082,754	$18,616	$758,638	$1,758,131	$265,552	$0	$4,883,691
% Difference	32%	38%	34%	25%	37%	-100%	0%
Grand Chute (7,820 Customers)							
	Residential Cost-of-Service	Multi-Family Cost-of-Service	Commercial Cost-of-Service	Industrial Cost-of-Service	Public Authority Cost-of-Service	PFP Cost-of-Service	Total Cost-of-Serivce
PSC Standard Model	$2,264,420	$0	$2,132,788	$404,601	$112,762	$567,876	$5,482,447
Class Absorption Method	$2,543,180	$0	$2,379,253	$434,184	$125,830	$0	$5,482,447
% Difference	12%	0%	12%	7%	12%	-100%	0%
Eau Claire (26,647 Customers)							
	Residential Cost-of-Service	Multi-Family Cost-of-Service	Commercial Cost-of-Service	Industrial Cost-of-Service	Public Authority Cost-of-Service	PFP Cost-of-Service	Total Cost-of-Serivce
PSC Standard Model	$4,711,735	$348,402	$1,446,411	$1,030,616	$447,495	$1,487,464	$9,472,123
Class Absorption Method	$5,507,622	$423,762	$1,740,365	$1,223,566	$576,808	$0	$9,472,123
% Difference	17%	22%	20%	19%	29%	-100%	0%

Based on the survey of the 50 public utility commissions, there were 18 states that required utilities to roll the cost of public fire protection into general service rates. The results are shown in Figure 48 below.



It is noteworthy that in 1989, the PSC allowed the Jefferson Water and Electric Department to adopt the Class Absorption method as a test case. The resulting cost-of-service design removed the PFP customer class and rolled that cost into the general service rates. In that case, the standard PSC cost-of-service model was used, and the total for the PFP customer class was distributed to the other customer classes. In 2005, Jefferson decided to adopt direct PFP charges based on the equivalent meters method.

One benefit of the Class Absorption Method is that it addresses the issue discussed in Section 2 of this report, namely, how to fairly allocate costs for very large community water systems, where the max hour demand for general service is larger than the fire demand. For these large utilities the general service max hour demand controls the design of the water system.

Therefore, it does not make sense to allocate costs to the PFP customer class, since it represents a redundant demand that is already covered by the infrastructure needed to meet the general service max hour demand. The Class Absorption Method is a cost-of-service model that properly assigns all system costs to the non-PFP cost functions for large utilities. As discussed in Section 2, there are five water utilities in Wisconsin where the max hour general service demand controls the design and costs of the water system (based on the PSC fire demand). Those utilities are: Kenosha Water Utility, Racine Water Works Commission, Green Bay Water Utility, Madison Water Utility, and Milwaukee Water Works.

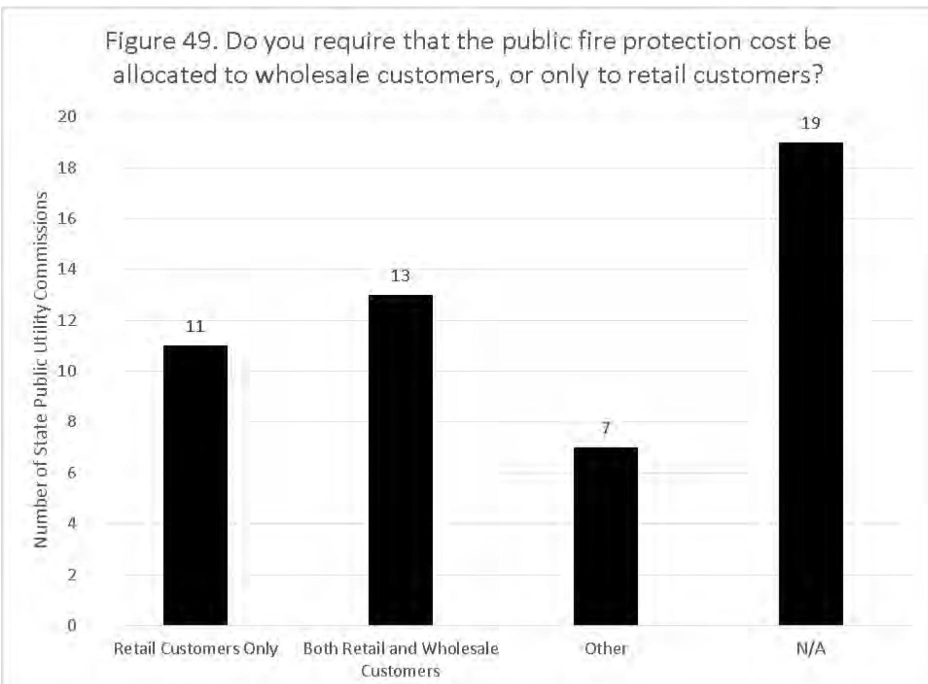
It is worth noting that if the ISO fire demand (rather than the PSC fire demand) is used to perform the same analysis as in Section 2 of this report, then the max hour demand is the controlling demand for water systems with more than 16,000 customers (rounded to nearest 1,000 customers). There are 14 water utilities in Wisconsin that have more than 16,000 customers. They are as follows: Wausau Water Utility, La Crosse Water Utility, Sheboygan Water Utility, West Allis Municipal Water Utility, Waukesha Water Utility, Oshkosh Water Utility, Janesville Water Utility, Eau Claire Municipal Water Utility, Appleton Water Department, Kenosha Water Utility, Racine Water Works Commission, Green Bay Water Utility, Madison Water Utility, and Milwaukee Water Works. The calculations using the ISO fire demand values are found in Appendix O.

<u>6.5 Impact of Options on the PFP Cost-of-Service Allocated to Wholesale Customers</u>

As discussed in Section 4 of this report, the PSC regulates 28 water utilities that provide wholesale service to another 53 utilities that act as wholesale customers. Wisconsin requires that wholesale providers identify their PFP costs and allocate them appropriately to their wholesale

Commented [PP17]: State statute or admin law?

customers. This typically results in the establishment of PFP rates for the wholesale customers. It is interesting to note that based on the survey of the 50 public utility commissions, there were 11 states that require the PFP cost-of-service be allocated only to retail customers. Another 13 states require that the PFP cost-of-service be allocated to both retail and wholesale customers (where applicable). The results are shown in Figure 49 below.



Commission staff used the most recent cost-of-service model for Milwaukee Water Works in Docket 3720-WR-108 to estimate how the use of the ISO Base Fire Flow would impact the general service and PFP charges billed to its wholesale customers. (PSC REF# 222194) The current fire demand used in the Milwaukee Water Works model is 17,962 gpm for 18 hours.

This value was changed to ~~the~~ an ISO Base Fire Flow value of 3,500 gpm for 3 hours. The result of changing the fire demand was a 0.42% decrease in the total cost-of-service amount for retail customers. The wholesale customers experienced a change ranging from a 2.82% decrease to a 5.99% increase in their total wholesale cost-of-service as shown in Table 5.

Table 5. Impact of the ISO Base Fire Flow on the Cost-of-Service Allocated to Milwaukee Water Work's Wholesale Customers

	Gen Service Existing COS	PFP Existing COS	Total Existing COS	Gen Service ISO BFF COS	PFP ISO BFF COS	Total ISO BFF COS	Percent Difference Total COS
			Retail				
Retail Total	$ 70,809,856	$ 7,990,659	$ 78,800,515	$ 73,737,465	$ 4,734,921	$ 78,472,386	-0.42%
			Wholesale				
Brown Deer	$ 721,571	$ -	$ 721,571	$ 751,012	$ -	$ 751,012	4.08%
Butler	$ 165,550	$ -	$ 165,550	$ 170,286	$ -	$ 170,286	2.86%
Greendale	$ 729,359	$ -	$ 729,359	$ 773,062	$ -	$ 773,062	5.99%
Menomonee Falls	$ 1,604,903	$ -	$ 1,604,903	$ 1,664,809	$ -	$ 1,664,809	3.73%
Mequon	$ 542,431	$ 3,339	$ 545,770	$ 571,269	$ 619	$ 571,888	4.79%
New Berlin	$ 1,328,844	$ -	$ 1,328,844	$ 1,380,955	$ -	$ 1,380,955	3.92%
Shorewood	$ 717,632	$ 63,047	$ 780,679	$ 746,968	$ 11,731	$ 758,698	-2.82%
Wauwatosa	$ 2,462,185	$ -	$ 2,462,185	$ 2,559,988	$ -	$ 2,559,988	3.97%
West Allis	$ 2,622,493	$ 69,926	$ 2,692,419	$ 2,695,805	$ 12,959	$ 2,708,764	0.61%
County Institutions	$ 433,823	$ -	$ 433,823	$ 453,770	$ -	$ 453,770	4.60%
Wholesale Total	$ 11,328,791	$ 136,312	$ 11,465,103	$ 11,767,923	$ 25,309	$ 11,793,232	2.86%
Grand Total			$ 90,265,617			$ 90,265,617	0.00%

Commission staff then used Milwaukee Water Works most recent cost-of-service model (with the ISO Base Fire Flow) to determine what impact the Class Absorption Method would have on the general service and PFP charges billed to Milwaukee's wholesale customers. By rolling the PFP cost into the general service rates, the total cost-of-service for retail customers decreased by 0.54%. The wholesale customers experienced a change ranging from a 3.33% decrease to a 7.05% increase in their total wholesale cost-of-service as shown in Table 6.

Commented [PP18]: Allocation of storage costs needs to be evaluated here. 56% allocated to base, 44% to maximum hour. MWW's storage facilities do not serve the wholesale customers (with exception for Shorewood, Mequon (partial) and West Allis (partial). Storage related service costs should be allocated 100% to maximum hour storage (similar to hydrant costs allocated 100% to PFP cost function).

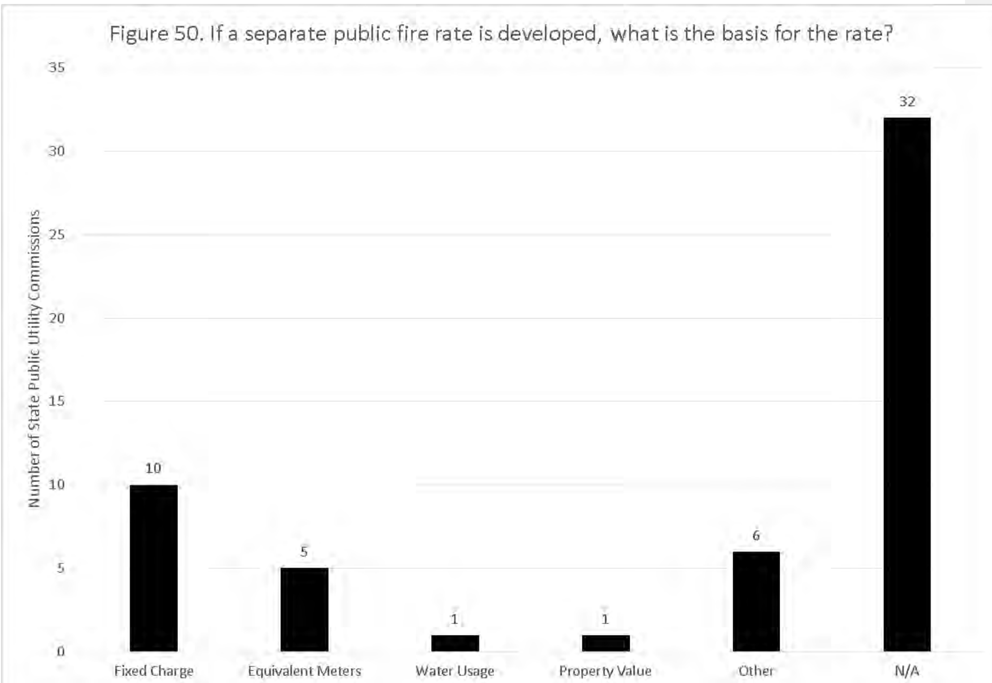
Commented [PP19]: Commission decision in 2014 MWW rate case eliminated PFP charges for most of the wholesale customers (except Shorewod, part of Mequon and part of West Allis). Class Absorption method appears to shift PFP costs to wholesale customers, most of which do not need this PFP service from MWW. Not sure I understand why.

Table 6. Impact of the Class Absorption Method and ISO Base Fire Flow on the Cost-of-Service Allocated to Milwaukee Water Work's Wholesale Customers

	Gen Service Existing COS	PFP Existing COS	Total Existing COS	Gen Service Class Absorption COS	PFP Class Absorption COS	Total Class Absorption COS	Percent Difference Total COS
			Retail				
Retail Total	$ 70,809,856	$ 7,990,659	$ 78,800,515	$ 78,378,085	$ -	$ 78,378,085	-0.54%
			Wholesale				
Brown Deer	$ 721,571	$ -	$ 721,571	$ 758,796	$ -	$ 758,796	5.16%
Butler	$ 165,550	$ -	$ 165,550	$ 172,077	$ -	$ 172,077	3.94%
Greendale	$ 729,359	$ -	$ 729,359	$ 780,806	$ -	$ 780,806	7.05%
Menomonee Falls	$ 1,604,903	$ -	$ 1,604,903	$ 1,681,727	$ -	$ 1,681,727	4.79%
Mequon	$ 542,431	$ 3,339	$ 545,770	$ 576,934	$ -	$ 576,934	5.71%
New Berlin	$ 1,328,844	$ -	$ 1,328,844	$ 1,394,587	$ -	$ 1,394,587	4.95%
Shorewood	$ 717,632	$ 63,047	$ 780,679	$ 754,659	$ -	$ 754,659	-3.33%
Wauwatosa	$ 2,462,185	$ -	$ 2,462,185	$ 2,586,068	$ -	$ 2,586,068	5.03%
West Allis	$ 2,622,493	$ 69,926	$ 2,692,419	$ 2,723,527	$ -	$ 2,723,527	1.16%
County Institutions	$ 433,823	$ -	$ 433,823	$ 458,351	$ -	$ 458,351	5.65%
Wholesale Total	$ 11,328,791	$ 136,312	$ 11,465,103	$ 11,887,532	$ -	$ 11,887,532	3.68%
Grand Total			$ 90,265,617			$ 90,265,617	0.00%

6.6 Rate Design Options

Based on the survey of the 50 public utility commissions, there were 18 states that identified a method for computing separate PFP rates. The results of the survey are shown in Figure 50.



As discussed in Section 4 of this report, the equivalent meters method is the most popular with Wisconsin water utilities, probably because it is relatively easy to administer. Some have argued that the ease to administer this charge is not enough to offset its inherent inequity. They argue that the size of a water meter has very little correlation with the fire demand of the property. Many of these critics argue that the property values method is the most equitable because PFP charges are proportional to the value of the property.

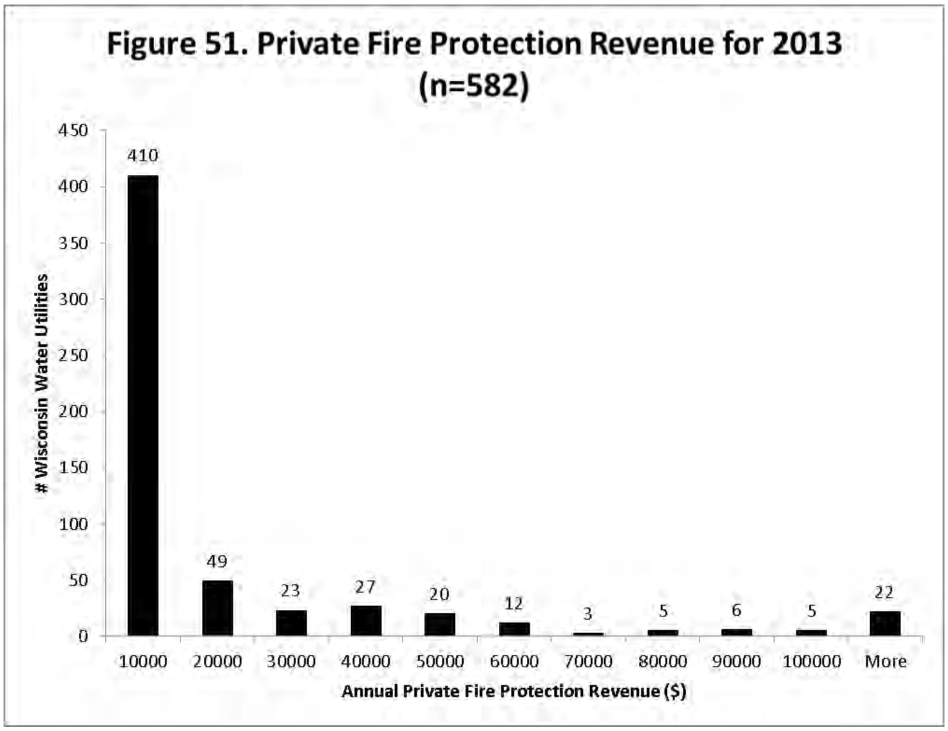
7. Private Fire Protection

The private fire protection charge represents the extra capacity of the water system needed to provide the high pressures and flows to fight fires through private fire suppression equipment, such as sprinkler systems. The private fire protection charge is a standby service, and the actual cost of the water used in fighting fires is considered immaterial. The charge is used to recover the extra cost to oversize the wells, pumps, storage tanks, and water mains in the water system. This charge includes a portion of the operation and maintenance expenses, depreciation expenses, taxes, and return on net investment rate base attributable to the facilities available to supply fire protection. Charges for private fire protection are computed on a parallel basis with the public fire protection charge. As such, it is a measure of the cost of providing the service. It is neither a measure of the value of the service nor of the benefits received from the service.

The charge for an unmetered private fire protection connection is based on the potential demand which could be placed on the system because of that connection. Accordingly, the size of the connection to the utility's water main is used as the basis for the private fire protection service charge. For example, if a commercial property installs a 4-inch lateral to serve an unmetered private fire suppression system, the water customer is charged an unmetered private fire protection fee in Schedule Upf-1 of the respective water tariff. This is appropriate because the connection to the main and the utility's portion of the service lateral from the main to the shutoff valve at the curb stop or property line are the utility's only control points with respect to this service. The utility has little, if any, control over the sizing of and changes to the customer's piping within the building. A detailed explanation of how the private fire protection charge is computed is found in Appendix P.

The Commission has traditionally identified unmetered private fire protection as an additional service, above and beyond the public fire protection service. That is why the Commission allows utilities to charge a private fire protection fee. The Commission, however, does not require any utility to charge a private fire protection fee. The decision is left up to each utility.

For most of Wisconsin's water utilities, the private fire protection revenues are not a significant portion of their respective revenue requirements. In fact, 230 of Wisconsin's 582 regulated water utilities (40%) do not report any Private Fire Protection revenues for 2013. This lack of revenue may be due to water utilities choosing not to have a private fire protection tariff, or it may be that water utilities have a private fire protection tariff, but they don't have any private fire protection customers. The Private Fire Protection revenues account for only 0% to 8% of the total water utility revenues for Wisconsin's 582 regulated water utilities. The median amount of private fire protection annual revenue is only $1,700, based on 2013 annual report data. The histogram below shows the number of utilities and the private fire protection annual revenue for 2013. There are 410 Wisconsin water utilities (70%) that have total annual private fire protection revenue below $10,000, based on 2013 annual report data. Milwaukee Water Works has the largest private fire protection revenue at $705,000 (1% of total operating revenues) for 2013. The data used to develop the histogram shown in Figure 51 is found in Appendix Q.



The Wisconsin State Fire Chiefs Association would like the state's water utilities to structure rates to encourage residential and small commercial customers to install sprinkler systems. They argue that today's building code requirements for sprinkler systems have reduced the fire demand for sprinklered structures and, therefore, have reduced the community's overall fire demand. Many argue that sprinklered buildings put out fires quicker with less water and, therefore, reduce the community's overall fire demand. From a design standpoint, if fire flow has been reduced for one of the five largest fire flows (NFFs) in the municipality, the utility's fire demand has also been reduced. Therefore, that building should not have to pay a private fire protection charge, since it has reduced the community's overall fire demand. Such a customer may even deserve a discount from the public fire protection charge.

In their 2012 report, "Fire Flow Water Consumption in Sprinklered and Unsprinklered Buildings: An Assessment of Community Impacts," Code Consultants Inc. states, "The required fire flow for a building protected with a sprinkler system is typically permitted to be reduced by 50% for one and two-family dwellings and 75% for buildings other than one- and two-family dwellings. Available studies of fire water usage in sprinklered and unsprinklered residential buildings show the volume of water to be conservative and indicate a reduction of water used in a sprinklered home to be approximately 90% less than that of an unsprinklered home." So, this report states that the fire demand is 50% to 75% lower for sprinklered buildings as compared to unsprinklered buildings. Based on these claims, it appears that fire flow needs are significantly reduced for sprinklered buildings.

Others argue that sprinklered buildings do not lower the community-wide fire demand because it is computed by the NBFU equation. If the community-wide fire demand is computed using the ISO equation (5th largest NFF is the BFF) then sprinklered buildings may not be one of the five largest fire flows (NFFs) and would not impact the computed fire demand. If that is the case, sprinkled buildings should not get a break. Fire demand is set by the population at large or by the BFF (which is impacted by the largest five buildings (NFFs) in the community). A few residential sprinklered buildings are not going to lower the community-wide fire demand. Therefore, since they are receiving standby services not offered to others, they should pay for this additional service. Also, keep in mind that the owners of sprinklered buildings are likely receiving discounts on their property insurance. So, they are already receiving a benefit from their sprinkler system. Since 1988, the PSC has permitted water utilities to shift from a municipal PFP charge (based on property values) to a direct PFP charge placed on the water bills. If the direct PFP allocation method is not based on property value, then many feel that large commercial customers are not paying their fair share (large structure and fire hazard, but small fee due to ¾-inch meter for bathroom). They see the private PFP charge as a way to even the playing field.

Please note that Wisconsin's water utilities do not have to implement the private fire protection charge. If a community wants to encourage residential sprinkler systems, it may request that the Commission remove Schedule Upf-1 from its water tariff.

8. Recommendations

The Final Decision in Docket 3720-WR-108, the "Application of Milwaukee Water Works, Milwaukee County, Wisconsin, for Authority to Increase Water Rates" directed Commission staff to open a generic investigation to study the methods of all water utilities in allocating public fire protection (PFP) costs. The following paragraphs list Commission staff's suggested improvements to ~~recommendations for improving~~ the methods used to compute the PFP cost-of-service and resulting rates for Wisconsin's 582 regulated water utilities.

1. ~~Commission staff recommends that~~ W~~w~~ater utilities that have a general service max hour demand greater than the sum of the max day demand plus the ISO Base Fire Flow, c~~sh~~ould eliminate their PFP customer class and use the Class Absorption Method to roll PFP costs into the retail and wholesale general service rates. For these water utilities, the water system design is controlled by the general service max hour demand and reliability issues. Based on the ISO Base Fire Flow data that is currently available, Commission staff estimates there are about 14 of Wisconsin's largest water utilities (those utilities

Commented [PP20]: Allocation of storage costs between retail and wholesale customers needs further discussion.

with more than 16,000 customers) that fall into this category. This estimate may change as more ISO Base Fire Flow data becomes available. These 14 utilities are: Wausau Water Utility, La Crosse Water Utility, Sheboygan Water Utility, West Allis Municipal Water Utility, Waukesha Water Utility, Oshkosh Water Utility, Janesville Water Utility, Eau Claire Municipal Water Utility, Appleton Water Department, Kenosha Water Utility, Racine Water Works Commission, Green Bay Water Utility, Madison Water Utility, and Milwaukee Water Works.

2. For the remaining 568 regulated water utilities, the water system capacity is ~~partly~~ typically sized to meet max day plus fire demand. Therefore, it is appropriate that a PFP cost-of-service is computed. ~~Unfortunately,~~ Under the existing PSC cost-of-service model, ~~does not accurately estimate~~ the PFP cost-of-service for communities that experience declining sales volumes increases disproportionately~~,~~ because the PSC cost-of-service model allocates any created excess supply capacity~~stranded asset~~ costs to the PFP customer class. Commission staff believes that it would be more equitable if the cost of excess supply capacity~~stranded assets~~ resulting from reduced water sales was allocated in greater proportion to the general service customers that such system capacity was originally designed to serve. ~~Therefore,~~ Commission staff suggests~~recommends~~ that the non-PFP cost functions no longer be allocated to the PFP customer class based on the fire demand volume as compared to the other customer class volumes. ~~Commission staff recommends the adoption of Option #3.~~ Option #3 allocates costs from the hydrants account, the distribution reservoir account, and the distribution main account directly to the PFP cost function. The PFP cost function then becomes the sole allocation to the PFP customer class.

3. Use the ISO method to compute each utility's fire demand. Although fire demand will no longer impact the PFP cost-of-service (see recommendations #1 and 2 above), it will still impact the allocation of water main accounts to the non-PFP customer classes. The ISO method uses on-the-ground surveys of the structures in each community, which is more accurate than the older population based equations currently used in the PSC cost-of-service model.
4. The investigation of the wholesale PFP will further be addressed in Part B of this study. If a large wholesale provider, like Milwaukee Water Works, rolls the PFP cost into general service rates, then wholesale customers will pay any wholesale related PFP costs through those general service rates.
5. It is apparent that sprinkler systems reduce community fire demand. The Commission currently allows each water utility to choose whether or not they want to include a private fire protection charge in their water tariff. It is Commission staff's opinion that the private fire protection charge be eliminated.

Commented [PP21]: Still not sure if appropriate to very large utilities. What does ISO say is MWW's BFF?