



# 2020 AMI COST-BENEFIT ANALYSIS

October 20, 2020



## Highlights of Cost-Benefit Analysis

- WSSC Water's Advanced Metering Infrastructure (AMI) project will pay for itself in 11 years – six years after the project completion in summer 2026.
- WSSC Water will achieve significant cost savings with more accurate meters and redeploying existing meter readers. No jobs will be lost.
- Over a 20-year period, the project savings will exceed the cost by more than \$286 million, which will have a long-term positive impact on customer rates while significantly improving customer service.
- WSSC Water estimates AMI project cost at \$208 million. The program was originally programmed at \$103 million for planning purposes. Please see Table 1 on page 3 for details on the basis for revised project cost estimate.
- WSSC Water's AMI installation cost is in line with comparably sized water utilities.
- The primary driver of cost is complete replacement of all 492,000 meters.
- Note: All costs and related benefits in this analysis are current estimates and subject to change based on vendor bids; contract negotiations; market conditions; operational issues and other factors.

## Executive Summary

In 2011, WSSC Water retained R.W. Beck, Inc. to provide an assessment of the costs and benefits for investment in Advanced Metering Infrastructure (AMI). The analysis was done in collaboration with WSSC Water staff, who participated in group workshops and individual interviews, and provided operations and management information. The project was found to pay for itself in 7 years.

Since the original business case, many factors have changed. The meter population has continued to age, labor and material costs have increased, and there have been significant advancements to AMI technology since 2011. The primary option at the time was a fixed network system, which would incorporate hundreds of data collection devices spread across the service area and would require operation and maintenance by the WSSC Water staff. Today there are more options available requiring various levels of support from WSSC Water. The deployment options have expanded from the traditional software to include managed services. Network-as-a-Service and Meter-as-a-Service options are now available to further reduce the burden on the utility's operations staff. Table 1 illustrates several of these key differences between the 2011 and 2020 Studies. The number of meters to be replaced increased drastically since all meters will be replaced due to their age and the benefits to be gained from improved accuracy of new meters and standardizing for the AMI system. Salaries have increased since 2011, and costs to operate an AMI network have increased.

**Table 1 Sample Comparison of Factors from 2011 to 2020 Studies**

FACTORS	2011 STUDY	2020 STUDY	PERCENT INCREASE
Number of Meters to be Replaced	152,186	492,805	+324%
Average Meter Age	12 years	17 years	+42%
Total Meter Population	456,000	492,805	+8%
Meter Reader II Annual Salary	\$38,463	\$46,303	+20%
Network Operating Cost Estimate	\$516,000	\$1,908,000	+370%

The AMI procurement was initiated in 2018, and a Needs Assessment was developed, followed by the development of procurement documents. The project was paused in March 2020 due to COVID-19, and in September 2020, the analysis was revisited. Conservative assumptions were made regarding the benefits and increased revenue from greater meter accuracy. The project is estimated to pay for itself in 11 years.

Updates to the cost-benefit analysis (CBA) included review and updates to assumptions, costs, benefits, and impacts of changes in the AMI industry.

## Methodology and Key Assumptions

The following approach was used for the analysis:

- Identify costs related to the project.
- Identify sources of tangible benefits, as generally recognized for AMI systems, also considering specifics about WSSC Water. Estimate the monetary value of the potential tangible benefits.
- Estimate project economics, including Internal Rate of Return (IRR), Modified IRR (MIRR), Simple Payback Period, Net Present Value, and Benefit/Cost ratio.
- Identify intangible benefits. Intangible benefits are defined as net positive outcomes and provide value to WSSC Water and customers, but which cannot be easily monetized and presented on a cost basis.

All costs and potential tangible benefits were estimated on a lifecycle basis using a 20-year period, with in-house replacements beginning in Year 16. The net present value (NPV) of the costs and potential

tangible benefits were then compared, using the annual discount rate provided by WSSC Water at 4%.<sup>1</sup> This discount rate represents an assumed weighted average cost of capital. A 2% inflation rate was used.<sup>2</sup>

In the 2011 study, the analysis was based on both meter replacements and retrofitting existing meters. In the 2020 update, the model estimated costs strictly on full replacement to maximize the benefits of AMI to all customers and reduce ongoing maintenance costs to WSSC Water.

The detailed tables supporting this analysis are in Attachment A and B included in this report.

- Attachment A – Cash Flow Tables Years 1-10 and 11-20 provides the detailed 20-year cash flow model.
- Attachment B – Supplemental Information contains a detailed description of the assumptions used for each cost and benefit category.

## AMI Adoption As Current Meter Reading Technology

Many large metropolitan public water utilities comparable to WSSC Water have implemented AMI to modernize meter reading and provide greater customer service benefits than prior options. Table 2 lists a sample of utilities locally and nationally who have radio frequency (RF)-based AMI, or are in the process of deploying the technology.

**Table 2 – AMI Implementation Status for Several Public Water Utilities**

Water Utility	AMI Status
City of Baltimore	Complete
DC Water	Complete
Loudoun Water	Complete
NYC DEP	Complete
Boston	Complete
Toronto	Complete
Cleveland	Complete
Detroit	Complete
Austin Water	In Progress
Columbia (SC)	In Progress
Akron	In Progress

Total project costs from Baltimore, Cleveland, and Detroit as well as recent awards for Austin, Texas, Columbia, SC, and Akron, Ohio are shown in Table 3 for comparison.

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<sup>1</sup> The 4% discount rate is used for all WSSC Water Asset Management Business Plans.

<sup>2</sup> World Bank – Average U.S. Inflation Rate 2010-2019.

<https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=US>

**Table 3 – Comparison of AMI Acquisition Project Costs and Meter Populations  
(WSSC Water estimate = \$423/meter)**

Water Utility	AMI Status	Acquisition Cost	Meter Population
City of Baltimore	Complete (2017) <sup>3</sup>	\$180M (\$439/mtr)	410,000
Detroit	Complete (2012)	\$150M (\$750/mtr)	200,000
Cleveland	Complete (2016)	\$86M (\$203/mtr)	425,000
Austin Water	In Progress	\$95M (\$358/mtr)	265,000
Columbia SC	In Progress	\$49M (\$350/mtr)	140,000
Akron	In Progress	\$35M (\$437/mtr)	80,000

## Cost Analysis

Table 4 lists a summary of estimated acquisition and operating costs for WSSC Water's AMI system. Each of these is described below:

### Acquisition Costs

- **Capital Project Cost for AMI Vendor** – The capital project cost for the AMI vendor is the total estimated acquisition cost including meters, Meter Interface Units (MIUs), installation costs, a network configuration, software, and the customer web portal. A 10% contingency was identified for the project based on the size, complexity, and unique nature of the AMI project.
- **Project Management** – This is the project management contract cost for the firm overseeing the AMI implementation
- **System Integration** – These are the system integration costs to connect AMI data to existing WSSC Water IT systems
- **Salvage Value** – This is the estimated credit that WSSC Water will receive from the contractor for the salvage value of meters that are replaced
- **Opt-Out Related Costs** – Finally, the impact of customers who opt-out of AMI is estimated. For this analysis, this cost is estimated based on 1% of customers with inside meters opting out of an AMI installation in their home and relocating the meter to the outside away from the home at the property line. This option aligns with the peer utility survey that was conducted with utilities across the U.S. and Canada earlier this year. It is expected that the relocations would happen toward the end of the project; therefore an inflation rate is applied to the cost in the cashflow table. For the analysis, the opt-out fee assumed is \$25 per month in the initial year to recover a portion of the meter relocation costs. For more detail on another opt-out option please refer to Cost C-5 in Attachment B.

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<sup>3</sup> City of Baltimore was a mix of 250,000 AMI installations and 160,000 AMR installations. The AMR installations are in Baltimore County.

## Operating Costs

- **Network Operating Costs** – WSSC Water will request a network-as-a-service option, which reduces the burden of maintaining the system and transfers that risk to the vendor.
- **Meter and MIU Maintenance Costs** – These are the annual meter and MIU maintenance costs once the system is installed.
- **Integration Post-Production Support** – This is the operating cost to support the system integration between AMI and other systems at WSSC Water after they are in production.
- **Monthly Billing Operating Costs** – This is the estimated increase in operating costs for bill production, postage, and related costs. Monthly billing is expected to be phased in over FYs 2029 and 2030.

**Table 4 - Summary of Estimated Lifecycle Costs for Project, (20 Year Lifecycle)**

COSTS	NET PRESENT VALUE	CASH VALUE
Capital Project Cost	\$ 146,589,746	\$ 165,285,507
10% Project Contingency	\$ 14,658,975	\$ 16,528,551
Total Plus 10% Contingency	\$ 161,248,721	\$ 181,814,058
Project Management	\$ 7,687,530	\$ 8,667,982
System Integration	\$ 8,529,684	\$ 9,291,800
Salvage Value of Meters	\$ (1,040,586)	\$ (1,173,300)
Opt-Out Related Costs	\$ 8,068,174	\$ 9,816,168
<b>Total Acquisition Cost</b>	<b>\$ 184,493,524</b>	<b>\$ 208,416,707</b>
Network Operating Costs	\$ 28,160,727	\$ 46,896,273
Meter/MIU Maintenance Costs	\$ 14,389,883	\$ 24,049,392
Integration Post-Production Support	\$ 4,327,952	\$ 4,960,000
Monthly Billing Operating Costs	\$ 25,453,600	\$ 44,721,194
<b>20-Year Lifecycle Cost</b>	<b>\$ 256,825,686</b>	<b>\$ 329,043,566</b>

COVID-19 has had a major impact on which priorities come first at WSSC Water, like many utilities across the country and the globe. The delay in the project's requisition and procurement will push out the schedule so that project implementation will not begin until Fiscal Year 2022. Table 5 below outlines the project's phases and their timing:

**Table 5 – Project Phases**

Project Phase	Fiscal Year	Phase Cost
Procurement	FY 2021	\$0.4M
Integration and Proof of Concept	FY 2022	\$9.2M
Deployment	FY 2023-2026	\$198.6M
Project Closeout	FY 2027	\$0.2M

## Benefits

### Tangible Benefits

Table 6 lists the potential tangible benefits of the project, which are described below:

- **Savings on Normal Meter Turnover** – This is the savings on the normal meter turnover which is currently performed by WSSC Water staff. Given that the AMI project will change out all meters, this in-house meter replacement program can cease until the new meters start reaching the end of their useful life, expected at Year 16. Full replacement warranties are expected to be a minimum of 15 years.
- **Labor Savings** – Labor savings are expected based on the ability of staff to work less on tasks related to conventional meter reading and more on other activities needed, such as analyzing the AMI data to plan field activities. This is shown as a cost savings. It is estimated that 29 of the existing 37 meter reader positions can be eliminated, and any remaining incumbent employees are redeployed to other WSSC Water operations. In addition, it is expected that six new meter mechanic positions will be created to maintain the new meters and four training positions will be created to provide WSSC Water staff with the required professional development to adapt to the AMI system.

- **Carbon Footprint Reduction** – WSSC Water Fleet Management estimates a reduction of the carbon footprint by 130 Metric tons per year through the reduction of truck rolls from meter reading activities and 14,720 fewer miles driven per year.
- **Reduction in Workers' Compensation Claims** – As the amount of field work by meter readers declines over the course of the AMI project, employee safety is improved and fewer workers compensation claims are expected. The savings is based on an assumption that the labor force for field meter reading activity will decline during the project and remain consistent in years 6-20.
- **Domestic Leak Detection** – Domestic leak detection is the impact of the customer's ability to identify leaks through the AMI system ahead of when they typically would from viewing their quarterly bill. While this leads to a decline in revenue because the leak stops sooner than without AMI, it is viewed as a customer benefit.
- **Revenue Gain from Meter Accuracy** – Improved registration can increase meter accuracy compared to aged, under-registering meters. For this analysis, a conservative 3% assumption was used for the estimated rate of improvement. This compares to the actual 8% improvement experienced by Cleveland after their AMI implementation.<sup>4</sup>

**Table 6 - Summary of Tangible Benefits for Project, (20 Year Lifecycle)**

BENEFITS	NET PRESENT VALUE		CASH VALUE	
Savings on Normal Meter Turnover	\$	35,663,289	\$	48,814,535
Labor Savings	\$	17,991,615	\$	30,036,274
Carbon Footprint Reduction	\$	1,607,438	\$	2,525,288
Reduction in Workers' Comp. Claims	\$	1,508,039	\$	2,365,932
Domestic Leak Detection	\$	(34,601,136)	\$	(56,501,126)
Revenue Gain from Meter Accuracy	\$	371,096,064	\$	588,407,479
<b>Total Benefits</b>	<b>\$</b>	<b>393,265,309</b>	<b>\$</b>	<b>615,648,382</b>

<sup>4</sup> Cleveland used AMI technology for their implementation, but chose to use the term Automated Meter Reading or AMR because they believed it improved public understanding of the new technology.



## Summary of AMI Project Economics

Table 7 summarizes the economic value of the AMI project based on the costs and benefits shown above.

**Table 7 - Summary of AMI Project Economics**

Summary Statistic	Value
Simple Payback (Years)	11
Present Value Costs	\$ 256,825,686
Present Value Benefits	\$ 393,265,309
Net Present Value	\$ 136,439,623
Internal Rate of Return <sup>5</sup>	13.3%
Modified Internal Rate of Return <sup>6</sup>	4.6%
Benefit/Cost Ratio	1.53

### Intangible Benefits

Intangible benefits represent outcomes from the project that are positive, but for which an economic value (in dollars) cannot be easily estimated. The following are the potential intangible benefits:

- **Safer Working Environment for WSSC Water Employees** – This benefit is quantified to the extent of reduction in workers' compensation claims, but the overall improvement of safety and reduced risk to WSSC Water from the reduction in meter reading field activities is an intangible benefit.
- **Positive Environmental Impacts including Water & Energy Conservation** – Beyond the tangible benefit represented by the Carbon Footprint Reduction calculation, AMI is expected to lead to better water management by customers. This is expected to lead to improved water conservation, which in turn reduces the energy used to pump water to customers.

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<sup>5</sup> The internal rate of return (IRR) is the discount rate that makes the net present value of future cash flows equal to zero, or the expected compound rate of return on a project or investment.

<sup>6</sup> Another approach to determining the rate of return on an investment is the calculation of the modified internal rate of return (MIRR). While the IRR calculation applies the IRR rate to all cash flows of a project, the MIRR calculation applies the expected rate of return (4%) to the positive cash flows and the expected financing rate (4%) to the negative cashflows.

- **Identification of Meter Tampering and Potential Water Theft** – The AMI system will provide reports on suspected tampering based on alterations to the wired connection between the meter register and the MIU. Addressing these issues quickly can add lead to additional savings.
- **Provides Customers With More Usage Information** – Some customers will value the ability to access interval meter reading. This is especially true for larger commercial customers.
- **Improved Planning and Recovery of System Water Losses** – Interval meter read data can be very useful for planning and non-revenue water reduction. It will help pinpoint sources of water loss so that they may be addressed as part of the capital program, reducing waste, and adding to the lifecycle benefits of AMI.
- **Monthly Billing Benefits** – Monthly billing provides improvements to customer service by replacing large quarterly bills with smaller, more manageable monthly bills, as well as improved collections and more consistent revenue streams compared to quarterly billing for WSSC Water. The increased operating costs may be offset by an increase in customers that move to e-billing.

## Conclusion

The benefits of the AMI project were found to significantly outweigh the cost primarily due to:

- **Net Present Value Benefit** – The estimated net present value benefit is \$136,439,623 over the 20-year period.
- **Addressing Obsolete Infrastructure and Aging Systems** – Many of the meters across the system are at or beyond their useful life, with consumption going unmetered due to the decreased accuracy of older meters.
- **Operational Efficiency Gains** – With AMI, approximately 74% all current truck rolls related to meter reads are no longer needed, saving significant labor by Meters, Customer Service, and Billing, which can be redeployed to other operations.
- **Payback Period** – Based on this analysis, the project will pay for itself in 11 years, well ahead of the system lifecycle estimate of 20 years.

# ATTACHMENT A – CASH FLOW TABLES

## YEARS 1-5

WSSC Water AMI Program Cost Benefit Cash Flow Table 20-Year Lifecycle Analysis				Fiscal Year Project Time Horizon		2022	2023	2024	2025	2026
October 2020				% Installs Per Year Cumulative Installs		1	2	3	4	5
LINE	COSTS	NPV	CASH VALUE			3%	30%	30%	30%	7%
						3%	33%	63%	93%	100%
1	Vendor Capital Project Cost	\$ 146,589,746	\$ 165,285,507			\$ 4,958,565	\$ 49,585,652	\$ 49,585,652	\$ 49,585,652	\$ 11,569,986
2	10% Project Contingency	\$ 14,658,975	\$ 16,528,551			\$ 495,857	\$ 4,958,565	\$ 4,958,565	\$ 4,958,565	\$ 1,156,999
3	Total Plus 10% Contingency	\$ 161,248,721	\$ 181,814,058			\$ 5,454,422	\$ 54,544,217	\$ 54,544,217	\$ 54,544,217	\$ 12,726,984
4	Project Management	\$ 7,687,530	\$ 8,667,982			\$ 260,039	\$ 2,600,395	\$ 2,600,395	\$ 2,600,395	\$ 606,759
5	System Integration	\$ 8,529,684	\$ 9,291,800			\$ 3,582,600	\$ 3,822,800	\$ -	\$ -	\$ 1,886,400
6	Salvage Value of Meters	\$ (1,040,586)	\$ (1,173,300)			\$ (35,199)	\$ (351,990)	\$ (351,990)	\$ (351,990)	\$ (82,131)
7	Opt-Out Related Costs (1% Relocation)	\$ 8,068,174	\$ 9,816,168			\$ -	\$ -	\$ -	\$ -	\$ 9,816,168
8	Total Acquisition Cost (CIP)	\$ 184,493,524	\$ 208,416,707			\$ 9,261,862	\$ 60,615,422	\$ 56,792,622	\$ 56,792,622	\$ 24,954,179
9	Network Operating Costs	\$ 28,160,727	\$ 46,896,273			\$ -	\$ -	\$ -	\$ -	\$ -
10	Meter/MIU Maintenance Costs	\$ 14,389,883	\$ 24,049,392			\$ -	\$ -	\$ -	\$ -	\$ -
11	Integration Post-Production Support	\$ 4,327,952	\$ 4,960,000			\$ -	\$ 1,240,000	\$ 1,240,000	\$ 1,240,000	\$ 1,240,000
12	Monthly Billing Operating Costs	\$ 25,453,600	\$ 44,721,194			\$ -	\$ -	\$ -	\$ -	\$ -
13	20-Year Lifecycle Cost	\$ 256,825,686	\$ 329,043,566			\$ 9,261,862	\$ 61,855,422	\$ 58,032,622	\$ 58,032,622	\$ 26,194,179
BENEFITS										
14	Savings on Normal Meter Turnover	\$ 35,663,289	\$ 48,814,535			\$ 2,822,724	\$ 2,879,178	\$ 2,936,762	\$ 2,995,497	\$ 3,055,407
15	Labor Savings	\$ 17,991,615	\$ 30,036,274			\$ (580,201)	\$ (453,607)	\$ 4,706	\$ 1,255,587	\$ 1,312,089
16	Carbon Footprint Reduction	\$ 1,607,438	\$ 2,525,288			\$ 3,415	\$ 38,315	\$ 74,610	\$ 112,341	\$ 123,213
17	Reduction in Workers Comp Claims	\$ 1,508,039	\$ 2,365,932			\$ 22,022	\$ 29,950	\$ 53,462	\$ 112,957	\$ 115,216
18	Domestic Leak Detection	\$ (34,601,136)	\$ (56,501,126)			\$ (50,049)	\$ (594,582)	\$ (1,225,920)	\$ (1,936,370)	\$ (2,052,552)
19	Revenue Gain from Meter Accuracy	\$ 371,096,064	\$ 588,407,479			\$ 593,061	\$ 7,045,562	\$ 14,526,668	\$ 22,945,218	\$ 24,321,931
20	Total Benefits	\$ 393,265,309	\$ 615,648,382			\$ 2,810,972	\$ 8,944,817	\$ 16,370,287	\$ 25,485,230	\$ 26,875,304
21	Annual Benefits Minus Costs:					\$ (6,450,890)	\$ (52,910,605)	\$ (41,662,335)	\$ (32,547,392)	\$ 681,124
Assumptions:										
22	Inflation Rate	2%								
23	Discount Rate	4%								
24	Cumulative Costs	\$ 256,825,686	\$ 329,043,566			\$ 9,261,862	\$ 71,117,284	\$ 129,149,906	\$ 187,182,528	\$ 213,376,707
25	Cumulative Benefits	\$ 393,265,309	\$ 615,648,382			\$ 2,810,972	\$ 11,755,789	\$ 28,126,076	\$ 53,611,307	\$ 80,486,610
26	Cumulative Benefits minus Costs	\$ 136,439,623	\$ 286,604,816			\$ (6,450,890)	\$ (59,361,495)	\$ (101,023,830)	\$ (133,571,221)	\$ (132,890,097)

# ATTACHMENT A – CASH FLOW TABLES (CON'T)

## YEARS 6-10

WSSC Water AMI Program Cost Benefit Cash Flow Table 20-Year Lifecycle Analysis				Fiscal Year Project Time Horizon		2027 6	2028 7	2029 8	2030 9	2031 10
October 2020				% Installs Per Year Cumulative Installs		0% 100%	100%	100%	100%	100%
LINE	COSTS	NPV	CASH VALUE							
1	Vendor Capital Project Cost	\$ 146,589,746	\$ 165,285,507	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2	10% Project Contingency	\$ 14,658,975	\$ 16,528,551	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
3	Total Plus 10% Contingency	\$ 161,248,721	\$ 181,814,058	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
4	Project Management	\$ 7,687,530	\$ 8,667,982	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
5	System Integration	\$ 8,529,684	\$ 9,291,800	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
6	Salvage Value of Meters	\$ (1,040,586)	\$ (1,173,300)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
7	Opt-Out Related Costs (1% Relocation)	\$ 8,068,174	\$ 9,816,168	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
8	Total Acquisition Cost (CIP)	\$ 184,493,524	\$ 208,416,707	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
9	Network Operating Costs	\$ 28,160,727	\$ 46,896,273	\$ 2,711,799	\$ 2,766,035	\$ 2,821,356	\$ 2,877,783	\$ 2,935,339		
10	Meter/MIU Maintenance Costs	\$ 14,389,883	\$ 24,049,392	\$ 1,341,149	\$ 1,374,678	\$ 1,409,045	\$ 1,444,271	\$ 1,480,378		
11	Integration Post-Production Support	\$ 4,327,952	\$ 4,960,000	\$ -	\$ -	\$ -	\$ -	\$ -		
12	Monthly Billing Operating Costs	\$ 25,453,600	\$ 44,721,194	\$ -	\$ -	\$ 802,587	\$ 3,274,554	\$ 3,340,045		
13	20-Year Lifecycle Cost	\$ 256,825,686	\$ 329,043,566	\$ 4,052,948	\$ 4,140,713	\$ 5,032,988	\$ 7,596,608	\$ 7,755,761		
BENEFITS										
14	Savings on Normal Meter Turnover	\$ 35,663,289	\$ 48,814,535	\$ 3,116,515	\$ 3,178,845	\$ 3,242,422	\$ 3,307,270	\$ 3,373,416		
15	Labor Savings	\$ 17,991,615	\$ 30,036,274	\$ 1,371,133	\$ 1,432,834	\$ 1,497,311	\$ 1,564,690	\$ 1,635,101		
16	Carbon Footprint Reduction	\$ 1,607,438	\$ 2,525,288	\$ 125,677	\$ 128,191	\$ 130,755	\$ 133,370	\$ 136,037		
17	Reduction in Workers Comp Claims	\$ 1,508,039	\$ 2,365,932	\$ 117,520	\$ 119,871	\$ 122,268	\$ 124,713	\$ 127,208		
18	Domestic Leak Detection	\$ (34,601,136)	\$ (56,501,126)	\$ (2,175,705)	\$ (2,306,248)	\$ (2,444,623)	\$ (2,591,300)	\$ (2,746,778)		
19	Revenue Gain from Meter Accuracy	\$ 371,096,064	\$ 588,407,479	\$ 25,781,247	\$ 27,328,122	\$ 28,967,809	\$ 30,705,878	\$ 32,548,230		
20	Total Benefits	\$ 393,265,309	\$ 615,648,382	\$ 28,336,387	\$ 29,881,615	\$ 31,515,943	\$ 33,244,622	\$ 35,073,215		
21	Annual Benefits Minus Costs:			\$ 24,283,439	\$ 25,740,902	\$ 26,482,955	\$ 25,648,014	\$ 27,317,454		
Assumptions:										
22	Inflation Rate	2%								
23	Discount Rate	4%								
24	Cumulative Costs	\$ 256,825,686	\$ 329,043,566	\$ 217,429,656	\$ 221,570,369	\$ 226,603,357	\$ 234,199,964	\$ 241,955,726		
25	Cumulative Benefits	\$ 393,265,309	\$ 615,648,382	\$ 108,822,997	\$ 138,704,612	\$ 170,220,555	\$ 203,465,177	\$ 238,538,392		
26	Cumulative Benefits minus Costs	\$ 136,439,623	\$ 286,604,816	\$ (108,606,659)	\$ (82,865,757)	\$ (56,382,802)	\$ (30,734,787)	\$ (3,417,334)		

# ATTACHMENT A – CASH FLOW TABLES (CON'T)

## YEARS 11-15

WSSC Water AMI Program Cost Benefit Cash Flow Table 20-Year Lifecycle Analysis				Fiscal Year Project Time Horizon	2032 11	2033 12	2034 13	2035 14	2036 15
October 2020				% Installs Per Year Cumulative Installs	100%	100%	100%	100%	100%
LINE	COSTS	NPV	CASH VALUE						
1	Vendor Capital Project Cost	\$ 146,589,746	\$ 165,285,507		\$ -	\$ -	\$ -	\$ -	\$ -
2	10% Project Contingency	\$ 14,658,975	\$ 16,528,551		\$ -	\$ -	\$ -	\$ -	\$ -
3	Total Plus 10% Contingency	\$ 161,248,721	\$ 181,814,058		\$ -	\$ -	\$ -	\$ -	\$ -
4	Project Management	\$ 7,687,530	\$ 8,667,982		\$ -	\$ -	\$ -	\$ -	\$ -
5	System Integration	\$ 8,529,684	\$ 9,291,800		\$ -	\$ -	\$ -	\$ -	\$ -
6	Salvage Value of Meters	\$ (1,040,586)	\$ (1,173,300)		\$ -	\$ -	\$ -	\$ -	\$ -
7	Opt-Out Related Costs (1% Relocation)	\$ 8,068,174	\$ 9,816,168		\$ -	\$ -	\$ -	\$ -	\$ -
8	Total Acquisition Cost (CIP)	\$ 184,493,524	\$ 208,416,707		\$ -	\$ -	\$ -	\$ -	\$ -
9	Network Operating Costs	\$ 28,160,727	\$ 46,896,273		\$ 2,994,045	\$ 3,053,926	\$ 3,115,005	\$ 3,177,305	\$ 3,240,851
10	Meter/MIU Maintenance Costs	\$ 14,389,883	\$ 24,049,392		\$ 1,517,387	\$ 1,555,322	\$ 1,594,205	\$ 1,634,060	\$ 1,674,912
11	Integration Post-Production Support	\$ 4,327,952	\$ 4,960,000		\$ -	\$ -	\$ -	\$ -	\$ -
12	Monthly Billing Operating Costs	\$ 25,453,600	\$ 44,721,194		\$ 3,406,846	\$ 3,474,983	\$ 3,544,482	\$ 3,615,372	\$ 3,687,679
13	20-Year Lifecycle Cost	\$ 256,825,686	\$ 329,043,566		\$ 7,918,278	\$ 8,084,231	\$ 8,253,692	\$ 8,426,737	\$ 8,603,442
BENEFITS									
14	Savings on Normal Meter Turnover	\$ 35,663,289	\$ 48,814,535		\$ 3,440,884	\$ 3,509,702	\$ 3,579,896	\$ 3,651,494	\$ 3,724,524
15	Labor Savings	\$ 17,991,615	\$ 30,036,274		\$ 1,708,681	\$ 1,785,572	\$ 1,865,922	\$ 1,949,889	\$ 2,037,634
16	Carbon Footprint Reduction	\$ 1,607,438	\$ 2,525,288		\$ 138,758	\$ 141,533	\$ 144,364	\$ 147,251	\$ 150,196
17	Reduction in Workers Comp Claims	\$ 1,508,039	\$ 2,365,932		\$ 129,752	\$ 132,347	\$ 134,994	\$ 137,694	\$ 140,447
18	Domestic Leak Detection	\$ (34,601,136)	\$ (56,501,126)		\$ (2,911,585)	\$ (3,086,280)	\$ (3,271,456)	\$ (3,467,744)	\$ (3,675,808)
19	Revenue Gain from Meter Accuracy	\$ 371,096,064	\$ 588,407,479		\$ 34,501,124	\$ 36,571,192	\$ 38,765,463	\$ 41,091,391	\$ 43,556,875
20	Total Benefits	\$ 393,265,309	\$ 615,648,382		\$ 37,007,615	\$ 39,054,066	\$ 41,219,183	\$ 43,509,975	\$ 45,933,867
21	Annual Benefits Minus Costs:				\$ 29,089,336	\$ 30,969,835	\$ 32,965,491	\$ 35,083,238	\$ 37,330,425
Assumptions:									
22	Inflation Rate	2%							
23	Discount Rate	4%							
24	Cumulative Costs	\$ 256,825,686	\$ 329,043,566		\$ 249,874,004	\$ 257,958,235	\$ 266,211,927	\$ 274,638,664	\$ 283,242,106
25	Cumulative Benefits	\$ 393,265,309	\$ 615,648,382		\$ 275,546,007	\$ 314,600,072	\$ 355,819,255	\$ 399,329,230	\$ 445,263,097
26	Cumulative Benefits minus Costs	\$ 136,439,623	\$ 286,604,816		\$ 25,672,003	\$ 56,641,837	\$ 89,607,328	\$ 124,690,566	\$ 162,020,991

# ATTACHMENT A – CASH FLOW TABLES (CON'T)

## YEARS 16-20

WSSC Water AMI Program Cost Benefit Cash Flow Table 20-Year Lifecycle Analysis				Fiscal Year Project Time Horizon	2037 16	2038 17	2039 18	2040 19	2041 20
October 2020				% Installs Per Year Cumulative Installs	100%	100%	100%	100%	100%
LINE	COSTS	NPV	CASH VALUE						
1	Vendor Capital Project Cost	\$ 146,589,746	\$ 165,285,507		\$ -	\$ -	\$ -	\$ -	\$ -
2	10% Project Contingency	\$ 14,658,975	\$ 16,528,551		\$ -	\$ -	\$ -	\$ -	\$ -
3	Total Plus 10% Contingency	\$ 161,248,721	\$ 181,814,058		\$ -	\$ -	\$ -	\$ -	\$ -
4	Project Management	\$ 7,687,530	\$ 8,667,982		\$ -	\$ -	\$ -	\$ -	\$ -
5	System Integration	\$ 8,529,684	\$ 9,291,800		\$ -	\$ -	\$ -	\$ -	\$ -
6	Salvage Value of Meters	\$ (1,040,586)	\$ (1,173,300)		\$ -	\$ -	\$ -	\$ -	\$ -
7	Opt-Out Related Costs (1% Relocation)	\$ 8,068,174	\$ 9,816,168		\$ -	\$ -	\$ -	\$ -	\$ -
8	Total Acquisition Cost (CIP)	\$ 184,493,524	\$ 208,416,707		\$ -	\$ -	\$ -	\$ -	\$ -
9	Network Operating Costs	\$ 28,160,727	\$ 46,896,273		\$ 3,305,668	\$ 3,371,781	\$ 3,439,217	\$ 3,508,001	\$ 3,578,161
10	Meter/MIU Maintenance Costs	\$ 14,389,883	\$ 24,049,392		\$ 1,716,785	\$ 1,759,704	\$ 1,803,697	\$ 1,848,789	\$ 1,895,009
11	Integration Post-Production Support	\$ 4,327,952	\$ 4,960,000		\$ -	\$ -	\$ -	\$ -	\$ -
12	Monthly Billing Operating Costs	\$ 25,453,600	\$ 44,721,194		\$ 3,761,433	\$ 3,836,661	\$ 3,913,395	\$ 3,991,663	\$ 4,071,496
13	20-Year Lifecycle Cost	\$ 256,825,686	\$ 329,043,566		\$ 8,783,885	\$ 8,968,147	\$ 9,156,308	\$ 9,348,453	\$ 9,544,666
BENEFITS									
14	Savings on Normal Meter Turnover	\$ 35,663,289	\$ 48,814,535		\$ -	\$ -	\$ -	\$ -	\$ -
15	Labor Savings	\$ 17,991,615	\$ 30,036,274		\$ 2,129,327	\$ 2,225,147	\$ 2,325,279	\$ 2,429,916	\$ 2,539,262
16	Carbon Footprint Reduction	\$ 1,607,438	\$ 2,525,288		\$ 153,200	\$ 156,264	\$ 159,389	\$ 162,577	\$ 165,829
17	Reduction in Workers Comp Claims	\$ 1,508,039	\$ 2,365,932		\$ 143,256	\$ 146,122	\$ 149,044	\$ 152,025	\$ 155,065
18	Domestic Leak Detection	\$ (34,601,136)	\$ (56,501,126)		\$ (3,896,357)	\$ (4,130,138)	\$ (4,377,947)	\$ (4,640,623)	\$ (4,919,061)
19	Revenue Gain from Meter Accuracy	\$ 371,096,064	\$ 588,407,479		\$ 41,553,258	\$ 39,152,403	\$ 36,313,854	\$ 32,993,730	\$ 29,144,462
20	Total Benefits	\$ 393,265,309	\$ 615,648,382		\$ 40,082,685	\$ 37,549,798	\$ 34,569,620	\$ 31,097,625	\$ 27,085,557
21	Annual Benefits Minus Costs:				\$ 31,298,800	\$ 28,581,651	\$ 25,413,311	\$ 21,749,172	\$ 17,540,891
Assumptions:									
22	Inflation Rate	2%							
23	Discount Rate	4%							
24	Cumulative Costs	\$ 256,825,686	\$ 329,043,566		\$ 292,025,991	\$ 300,994,138	\$ 310,150,447	\$ 319,498,900	\$ 329,043,566
25	Cumulative Benefits	\$ 393,265,309	\$ 615,648,382		\$ 485,345,782	\$ 522,895,580	\$ 557,465,199	\$ 588,562,825	\$ 615,648,382
26	Cumulative Benefits minus Costs	\$ 136,439,623	\$ 286,604,816		\$ 193,319,791	\$ 221,901,442	\$ 247,314,753	\$ 269,063,925	\$ 286,604,816

## ATTACHMENT B – SUPPLEMENTAL INFORMATION

### COST C-1: Capital Project Cost

Costs are based on bids on recent projects in the industry. This includes a lump sum estimate for meters, MIUs, installation costs, configuration of the network, software, and the network.

Acquisition Cost Category	Cost
Meters, MIUs, Installation, Software, and Network	\$ 165,285,507
Contingency 10% above Estimate	\$ 16,528,551
<b>Total including 10% Contingency</b>	<b>\$ 181,814,058</b>
<b>Total NPV Cost</b>	<b>\$ 161,248,721</b>

Source: Arcadis

Assumptions: Minimal price fluctuation due to COVID-19

### COST C-2: Project Management

This is the professional services costs for the AMI project manager, based on the existing contract.

Acquisition Cost Category	Cost
Project Management	\$ 8,667,982
<b>Total</b>	<b>\$ 8,667,982</b>
<b>Total NPV Cost</b>	<b>\$ 7,687,530</b>

Source: Arcadis

Assumptions: None

## COST C-3: Integration and Software

Software integration costs have been updated based on the results of the needs assessment and estimates developed in early 2020. The implementation costs are based on the use of the Oracle Smart Grid Gateway (SGG) and available APIs. The implementation of a new customer portal has been included. Post-Production Support for the integration is captured as a non-capitalized operating cost.

Acquisition Cost Category	Cost
System Integration between AMI, Billing, and other systems	\$ 9,291,800
<b>Total</b>	<b>\$ 9,291,800</b>
<b>Total NPV Cost</b>	<b>\$ 8,529,684</b>

Source: Arcadis, WSSC Water

Assumptions: Pricing estimate aligns well with proposals



## COST C-4: Salvage of Old Meters

The existing bronze water meter has a salvage value for recycling meters which keeps them out of the waste stream and is provided as a credit by the installation contractor. The salvage value is carried on the cost side as a negative cost. The table below shows the calculation of expected salvage value by the typical weight of the meters.

Meter Size	Type	Count	Weight Per Meter (lbs.)	Salvage Value @ \$0.75 per pound
5/8 in	Displacement	138,110	3	\$ 310,748
3/4 in	Displacement	269,876	3	\$ 607,221
1 in	Displacement	71,208	5	\$ 267,030
1.5 in	Displacement	5,477	10	\$ 41,078
2 in	Displacement	3,950	15	\$ 44,438
3 in	Compound	1,001	31	\$ 23,273
4 in	Compound	561	40	\$ 16,830
6 in	Compound	171	77	\$ 9,875
10 in	Compound	7	210	\$ 1,103
2 in	Fire	236	15	\$ 2,655
4 in	Fire	170	40	\$ 5,100
6 in	Fire	1,168	77	\$ 67,452
8 in	Fire	740	120	\$ 66,600
10 in	Fire	127	210	\$ 20,003
12 in	Fire	3	286	\$ 644
<b>Total</b>		<b>492,805</b>		<b>(\$ 1,173,300)</b>
<b>Total NPV Cost</b>				<b>(\$ 1,040,586)</b>

Source: WSSC Water and Meter Manufacturer Specification Sheets

Assumptions: \$0.75 salvage value per pound, Detector Check meters will not be removed by the AMI vendor

## COST C-5: Opt-Out Related Costs

### OPT-OUT WITH MANUAL TOUCH READ DEVICE

It is anticipated that a number of customers may opt-out of the AMI technology. One option to address this is to install a touchpad at their location and manually read the meter going forward. The tables below show anticipated costs to set up touchpads and read the meters manually for 1% opting out, 2.5%, and 5%. These totals show the cost estimates without an opt-out fee implemented, however Maryland Public Service Commission (PSC) has ordered that all electric and gas companies implementing AMI must assess a fee for customers choosing to opt out to comply with rate making principles. Case 9208, Order 85294

#### 1% OPT OUT

Estimated Cost of Monthly AMI Opt-Out Meter Readings (cost per read)	
Meter Reading Labor Cost	\$ 7.06
Vehicle Cost	0.92
Annual Maintenance & Maintenance Cost	0.24
Indirect Service Cost for Billing System Set-Up	0.59
<b>Total Estimated Cost of AMI Opt-Out Monthly Readings</b>	<b>\$ 8.81</b>
<b>Annual Cost to WSSC Water for AMI Opt-Out Monthly Readings</b>	<b>\$ 524,542</b>

Estimated Cost of Touchread Set-Up (per set-up) - Includes Removal of AMI	
Meter Set-Up Labor Cost	\$ 163.76
Vehicle Cost	9.78
System Set-Up (cost of touch read components)	16.43
Indirect Service Cost for Billing System Set-Up	19.12
<b>Total Estimated Cost of Touch Read Installation</b>	<b>\$ 209.08</b>
<b>Total Estimated Costs for all AMI Opt-Out Touch Read Installs</b>	<b>\$ 62,724</b>

#### 2.5% OPT OUT

Estimated Cost of Monthly AMI Opt-Out Meter Readings (cost per read)	
Meter Reading Labor Cost	\$ 3.77
Vehicle Cost	0.37
Annual Maintenance & Maintenance Cost	0.12
Indirect Service Cost for Billing System Set-up	0.32
<b>Total Estimated Cost of AMI Opt-Out Monthly Readings</b>	<b>\$ 4.58</b>
<b>Annual Cost to WSSC Water for AMI Opt-Out Monthly Readings</b>	<b>\$ 1,311,254</b>

<b>Estimated Cost of Touchread Set-Up (per set-up) – Includes Removal of AMI</b>		
Meter Set-Up Labor Cost	\$	163.76
Vehicle Cost		9.78
System Set-Up (cost of touch read components)		16.43
Indirect Service Cost for Billing System Set-Up		19.12
<b>Total Estimated Cost of Touch Read Installation</b>	<b>\$</b>	<b>209.08</b>
<b>Total Estimated Costs for all AMI Opt-Out Touch Read Installs</b>	<b>\$</b>	<b>156,810</b>

### 5% OPT OUT

<b>Estimated Cost of Monthly AMI Opt-Out Meter Readings (cost per read)</b>		
Meter Reading Labor Cost	\$	3.06
Vehicle Cost		0.19
Annual Maintenance & Maintenance Cost		0.09
Indirect Service Cost for Billing System Set-Up		0.26
<b>Total Estimated Cost of AMI Opt-Out Monthly Readings</b>	<b>\$</b>	<b>3.60</b>
<b>Annual Cost to WSSC Water for AMI Opt-Out Monthly Readings</b>	<b>\$</b>	<b>2,622,708</b>

<b>Estimated Cost of Touchread Set-Up (per set-up) – Includes Removal of AMI</b>		
Meter Set-Up Labor Cost	\$	163.76
Vehicle Cost		9.78
System Set-Up (cost of touch read components)		16.43
Indirect Service Cost for Billing System Set-Up		19.12
<b>Total Estimated Cost of Touch Read Installation</b>	<b>\$</b>	<b>209.08</b>
<b>Total Estimated Costs for all AMI Opt-Out Touch Read Installs</b>	<b>\$</b>	<b>313,621</b>

## METER RELOCATION

Another option is to relocate the meter from the inside to a meter pit near the property line. Pricing was provided from multiple contractors and the midpoint cost estimate was \$2,992.

<b>Estimated Cost of Meter Relocation</b>		
Midpoint Relocation Cost Estimate from Contractor	\$	2,992

## OPT-OUT OPTION SUMMARY WITH FEE IMPLEMENTATION

Below are the 20-year lifecycle cost estimates for 1%, 2.5%, and 5% opt-out for meter relocation assuming monthly billing and an Opt-Out-Fee is implemented. The Opt-Out Fee will cover a portion of the installation and manual meter reading costs. The Opt-Out Fee is assumed to be collected as \$25 per month in the first year to offset a portion of the meter relocation costs.

<b>1% Relocation - Total 20-year lifecycle cost:</b>	<b>\$9,816,168</b>
<b>1% Relocation - Total 20-year NPV cost:</b>	<b>\$8,068,174</b>
<b>2.5% Relocation - Total 20-year lifecycle cost:</b>	<b>\$24,540,419</b>
<b>2.5% Relocation - Total 20-year NPV cost:</b>	<b>\$20,170,436</b>
<b>5% Relocation - Total 20-year lifecycle cost:</b>	<b>\$49,080,838</b>
<b>5% Relocation - Total 20-year NPV cost:</b>	<b>\$40,340,871</b>
<b>Breakeven Meter Location Opt-Out Percentage to off-set Net Present Benefit Value</b>	<b>20%</b>

Maryland PSC has ordered that all electric and gas companies implementing AMI must assess a fee for customers choosing to opt out to comply with rate making principles. Case 9208, Order 85294

Below are the 20-year lifecycle cost estimates for 1%, 2.5%, and 5% opt-out using touchpads and assuming monthly billing and if an Opt-Out Fee was implemented. A \$26/month fee would be charged for the initial year and a \$9/month continuing charge to offset the cost of installing the touchread meter and monthly manual meter reads.

<b>1% Touchpad - Total 20-year lifecycle cost:</b>	<b>\$2,247,292</b>
<b>1% Touchpad - Total 20-year NPV cost:</b>	<b>\$1,348,817</b>
<b>2.5% Touchpad - Total 20-year lifecycle cost:</b>	<b>\$5,618,230</b>
<b>2.5% Touchpad - Total 20-year NPV cost:</b>	<b>\$3,372,043</b>
<b>5% Touchpad - Total 20-year lifecycle cost:</b>	<b>\$11,236,460</b>
<b>5% Touchpad - Total 20-year NPV cost:</b>	<b>\$6,744,086</b>
<b>Breakeven with Touchpad Opt-Out Percentage to off-set Net Present Benefit Value</b>	<b>70%</b>

Maryland PSC has ordered that all electric and gas companies implementing AMI must assess a fee for customers choosing to opt out to comply with rate making principles. Case 9208, Order 85294

Source: Arcadis, WSSC Water

Assumptions: Opt-out customers will be uniformly spread across the service area, drive time, and setup installation time will be consistent. Opt-Out Fee Implemented.

## **COST C-6: Network-as-a-Service Reoccurring Operating Cost**

The costs were compared to a Network-as-a-Service (NaaS) alternative based on industry pricing, and annual costs were estimated to be \$1,908,000 for the Naas option compared to \$1,960,026 for in-house maintenance costs. The NaaS option was used for the analysis. Oracle licensing was also included under this category as there is a cost for importing the meter read data into the Oracle C2M billing system. WSSC Water's network operating cost would start at conclusion of the AMI implementation in Year 6 as the cost for the term of the project is expected to be included in the capital cost.

<b>Operating Cost Category</b>	<b>Cost</b>
Reoccurring Network-as-a-Service Fee	\$ 1,908,000
Annual Oracle Licensing for Interval Meter Reads	\$ 500,000
<b>Total annual cost</b>	<b>\$ 2,408,000</b>
<b>Total 20-year lifecycle cost</b>	<b>\$ 46,896,273</b>
<b>Total 20-year NPV lifecycle cost</b>	<b>\$ 28,160,727</b>

Source: Arcadis, WSSC Water

Assumptions: Network operating cost for duration of implementation is included in capital project cost and reoccurring operating cost will start in year 6.

Note: Impact of annual inflation is reflected on Attachment A

## COST C-7: Annual Meter and MIU Maintenance Costs

A fraction of the meters and MIUs that are installed will fail year-to-year. This accounts for the labor and materials associated with these repairs. Since these are expected to increase over time, the inflation rate was increased to 2.5% for the lifecycle calculations.

Operating Cost Category	Cost
Labor Cost for Replacing/Repairing Devices	\$ 578,240
Transportation Cost for Replacing/Repairing Devices	\$ 52,984
Material Cost for Replacing/Repairing Devices	\$ 525,245
<b>Total annual cost</b>	<b>\$ 1,156,469</b>
<b>Total 20-year lifecycle cost</b>	<b>\$ 24,049,392</b>
<b>Total 20-year NPV cost</b>	<b>\$ 14,389,883</b>

Source: Arcadis, WSSC Water

Assumptions: Initial annual failure rate of 0.5% of Meters and wiring, and 1% of MIUs

Note: Impact of annual inflation is reflected on Attachment A

## COST C-8: Integration Post-Production Support

After the system integration development and testing is complete, post-production support is needed to address any changes that may impact the AMI solution. When one system has an upgrade, patch, or configuration change, it is common to impact the existing integration between the systems. Post-production support addresses those issues. The post-production support related to the AMI solution is expected to be needed through FY 2026.

Operating Cost Category	Cost
Total Cost for Integration Post-Production Support	\$ 4,960,000
<b>Total 20-year lifecycle cost</b>	<b>\$ 4,960,000</b>
<b>Total 20-year NPV cost</b>	<b>\$ 4,327,952</b>

Source: Arcadis, WSSC Water

Assumptions: Post-Production Support needed through the end of FY 2026

## COST C-9: Monthly Billing Operating Costs

The transition from quarterly to monthly billing is expected to phase in one quarter at a time starting in the second half of Fiscal Year 2029. This results in the following assumed operating cost increases.

Operating Cost Category	Cost
Bill Printing and Postage (\$178k increase x 12 months)	\$ 2,136,000
Bill Production Support (\$12k increase x 12 months)	\$ 144,000
Payment Processing (\$30k increase x 12 months)	\$ 360,000
Revenue Division Additional Processing Effort	\$ 100,000
<b>Total Annual Cost Before 2% Inflation</b>	<b>\$ 2,740,000</b>
<b>Total 20-year lifecycle cost</b>	<b>\$ 44,721,194</b>
<b>Total 20-year NPV cost</b>	<b>\$ 25,453,600</b>

Source: WSSC Water

Assumptions: Monthly billing costs increase at 2% inflation rate and phase in starting in FY 2029

## BENEFIT B-1: SAVINGS ON NORMAL METER TURNOVER

This benefit is the deferred cost of the normal and on-going meter replacements, which will be superseded by the AMI replacement program. The value of the existing meter replacements was estimated as part of the 2011 business case and was updated as part of the needs assessment to reflect updated meter unit costs. The replacement program is conservatively expected to resume at Year 16 in the analysis.

Meter Size	Annual Number Replaced	Unit Cost	Unit Install Cost	Total Annual Cost
5/8" Meter and Wall Pad	2000	\$ 79.69	\$ 52.85	\$ 265,080
5/8" Meter and Pit Pad	3500	\$ 62.22	\$ 52.85	\$ 402,745
5/8" x 3/4" Meter and Wall Pad	300	\$ 56.77	\$ 52.85	\$ 32,886
3/4" Meter and Wall Pad	6000	\$ 82.44	\$ 52.85	\$ 811,740
3/4" Meter and Pit Pad	4000	\$ 85.16	\$ 52.85	\$ 552,040
1" Meter and Wall Pad	3500	\$ 122.27	\$ 52.85	\$ 612,920
1" Meter and Pit Pad	500	\$ 127.08	\$ 52.85	\$ 89,965
<b>Total annual benefit</b>				<b>\$ 2,767,376</b>
<b>Total 20-year lifecycle benefit</b>				<b>\$ 48,814,535</b>
<b>Total 20-year NPV lifecycle benefit</b>				<b>\$ 35,663,289</b>

Source: Arcadis, WSSC Water

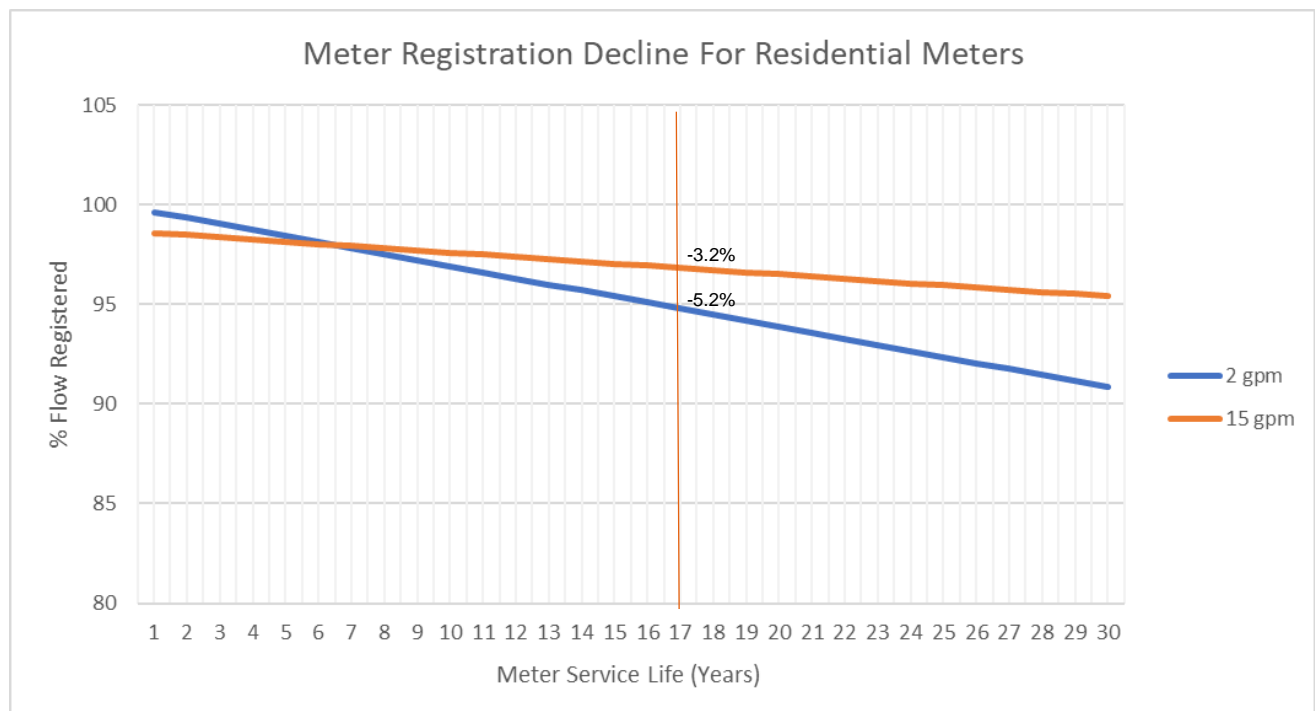
Assumptions: Installation Cost at \$52.85



## BENEFIT B-2: Annual Meter Registry Recovery

The revenue to be gained from the accuracy of new meters is a significant project benefit. A 2011 Water Research Foundation study published curve fit equations for registration loss estimates over time. 595 meters were pulled from service and provided for the study from 12 utilities across the United States.

The graph and table below demonstrate the results for residential meters, the predominate source of revenue for WSSC Water. For a 17 year old residential meter, the average age of a meter at WSSC Water, losses at a normal flow rate for a faucet or shower of 2 gallons per minute are estimated at 5.2%. At a higher flow rate of 15 gallons per minute, the loss is expected to be 3.2%.



Source: *Accuracy of In-Service Water Meters at Low and High Flow Rates*, Water Research Foundation, Report #4028, 2011.

Flow Rate	Flow Rate Description	Estimated % Registered for 17 Year Old Residential Meter	Estimated % Under-registration
2 gpm	Flow through Faucet/Shower	94.8%	5.2%
15 gpm	Flow through Garden Hose	96.8%	3.2%

For this analysis, a conservative value of 3% was applied. WSSC Water provided annual inflation values for this analysis based on the current financial forecast of 6.6% starting in 2022, then 8.0%, 8.0%, 7.0%, 6.5%, and 6% for all subsequent years. An assumption included is that the accuracy declines starting in Year 16 as the age impacts the meter.

Factor	Value	Description/Calculation
Consumption-based revenues FY2020	\$ 618,158,000	WSSC Water FY2020 annual consumption-based revenue
Percent Recovery from Accuracy of New Meters	3%	Expected percent increase from the accuracy of new meters
<b>Expected annual revenue gain</b>	<b>\$ 18,544,740</b>	
<b>Total 20-year lifecycle benefit</b>	<b>\$588,407,479</b>	
<b>Total 20-year NPV lifecycle benefit</b>	<b>\$371,096,064</b>	

Source: Arcadis, WSSC Water

Assumptions: 3% gained revenue from improved accuracy. Accuracy declines starting in Year 16.

## BENEFIT B-3: Domestic Leak Detection

The AMI allows WSSC Water to offer customer leak monitoring. Reductions in leaks are a benefit significant benefit to the customer in the form of avoided high bills. The leak estimates were developed as part of the 2011 AMI Study. This benefit to the customer is considered to have a negative financial impact on WSSC Water as it results in a revenue reduction. Only the variable cost portion of the revenue is considered.

Factor	Value	Description/Calculation
# Small accounts	479,194	Number of meters <= 1"
% with Leaks >.25 gpm during a year	1	% of customers with leaks >0.25 gpm
# with Leaks >.25 gpm during a year	4,792	Line 1 x Line 2
Average leak (gpm)	0.4	Typical leak rate (gpm)
Leak volume (1000gpd)	2,760	Line 3 x Line 4 x 1440 minutes per day / 1000
AMI-Based Reduced Leak Duration (days)	45	Reduction in time customer is alerted to high usage compared to currently
Reduced leak volume (1000gal)	124,207	Line 5 x Line 6
Marginal price of water & sewer (per 1000 gal)	\$ 12.60	WSSC Water rate for 1000 gallons of water usage
<b>Total reduced revenue</b>	<b>(\$ 1,565,009)</b>	
<b>Total 20-year lifecycle benefit</b>	<b>(\$56,501,126)</b>	
<b>Total 20-year NPV benefit</b>	<b>(\$34,601,136)</b>	

Source: Arcadis, WSSC Water

Assumptions: 0.4 gpm average leak rate, 45 days currently until the customer realizes leak

WSSC Water provided annual projected rate increases for this analysis based on the current financial forecast of 6.6% starting in 2022, then 8.0%, 8.0%, 7.0%, 6.5%, and 6% for all subsequent years.

## BENEFIT B-4: Carbon Footprint Reduction

Based on labor savings and 23 fewer vehicles expected to be needed, WSSC Fleet Management estimates 14,720 fewer miles driven per year, and a 130 metric ton reduction in carbon footprint. The cost savings are outlined below.

Factor	Value
Estimated reduction in gallons of fuel from 23 vehicles	14,720
Annual Cost Reduction from fewer gallons of fuel for 23 vehicles	\$23,110
Annual Reduction in vehicle maintenance costs from 23 vehicles	\$27,488
Annual Reduction in vehicle replacement costs from 23 vehicles	\$61,000
<b>Expected annual savings benefit</b>	<b>\$111,598</b>
<b>Total 20-year lifecycle benefit</b>	<b>\$2,525,288</b>
<b>Total 20-year NPV lifecycle benefit</b>	<b>\$1,607,438</b>

Source: WSSC Water

Assumptions: 14,720 annual miles driven reduction from 23 fewer vehicles needed

## BENEFIT B-5: Labor Savings

Several meetings were held with the Utility Services and Customer Care staff to discuss the possible impacts of AMI. While the full extent of the impact will be better understood after a solution is selected, the managers made their best estimate to what resources are expected to be needed over the course of the project and beyond. Within the Center of Excellence, 4 additional resources were identified as the organizational changes and new business processes are expected to require more training than currently. In the Meter Services Division, meter reading activities are expected to decline during the project as AMI is deployed, but 2 meter readers will remain for each service depot since the location of reads not collected by AMI may be spread across a large area. The reduction is expected to be from 37 full-time to 8 full-time. The staff will transition from meter reading to other work activities such as collections, field maintenance, and data analysis. Since the turnover of meters will involve the entire meter population, it is expected that there will be many more meter test requests from customers as well as quality control checks needed on new meters. 5 additional Meter Shop Mechanics are expected to be needed along with 1 additional Senior Meter Shop Mechanic.

Personnel Impact										
	2022		2023		2024		2025		2026	
	Current	WIAMI	Saved	WIAMI	WIAMI	WIAMI	WIAMI	WIAMI	WIAMI	Midpoint Salary
<b>Center of Excellence (78200)</b>										
Training Specialist	1	2	-1	2	2	2	2	2	2	\$ 90,230
Quality Management Specialist	1	2	-1	2	2	2	2	2	2	\$ 90,230
Workforce Management Planner	1	2	-1	2	2	2	2	2	2	\$ 90,230
Quality & Training Associate	1	2	-1	2	2	2	2	2	2	\$ 67,792
<b>Meter Services Division (76800)</b>										
Sr Shop Meter Mechanic	1	2	-1	2	2	2	2	2	2	\$ 56,077
Shop Meter Mechanic	4	9	-5	9	9	9	9	9	9	\$ 50,190
Meter Reader II	37	8	29	31	23	23	19	19	19	\$ 46,303
	<b>42</b>	<b>19</b>	<b>23</b>	<b>42</b>	<b>40</b>	<b>34</b>	<b>19</b>	<b>19</b>		
<b>Overhead % = 51.0%</b>										
<b>Annual Increase 4.5%</b>										

Current	2022	2023	2024	2025	2026	2022	2023	2024	2025	2026
Total Lbr	Total - No AMI	Total - No AMI	Total - No AMI	Total - No AMI	Total - No AMI	Total w/AMI	Total w/AMI	Total w/AMI	Total w/AMI	Total w/AMI
\$136,247	\$142,378	\$148,785	\$155,481	\$162,477	\$169,789	\$284,757	\$297,571	\$310,962	\$324,955	\$339,578
\$136,247	\$142,378	\$148,785	\$155,481	\$162,477	\$169,789	\$284,757	\$297,571	\$310,962	\$324,955	\$339,578
\$136,247	\$142,378	\$148,785	\$155,481	\$162,477	\$169,789	\$284,757	\$297,571	\$310,962	\$324,955	\$339,578
\$102,366	\$106,972	\$111,786	\$116,817	\$122,073	\$127,567	\$213,945	\$223,572	\$233,633	\$244,147	\$255,133
\$84,676	\$88,486	\$92,468	\$96,629	\$100,978	\$105,522	\$176,973	\$184,937	\$193,259	\$201,955	\$211,043
\$303,150	\$316,792	\$331,047	\$345,945	\$361,512	\$377,780	\$712,781	\$744,857	\$778,375	\$813,402	\$850,005
\$2,586,949	\$2,703,361	\$2,825,013	\$2,952,138	\$3,084,984	\$3,223,809	\$2,264,978	\$2,214,199	\$1,835,113	\$667,024	\$697,040
<b>\$3,485,882</b>	<b>\$3,642,747</b>	<b>\$3,806,671</b>	<b>\$3,977,971</b>	<b>\$4,156,980</b>	<b>\$4,344,044</b>	<b>\$4,222,948</b>	<b>\$4,260,277</b>	<b>\$3,973,265</b>	<b>\$2,901,392</b>	<b>\$3,031,955</b>
						Estimate of Labor Cost Difference with AMI:				
						\$580,201	\$453,607	(\$4,706)	(\$1,255,587)	(\$1,312,089)

<b>Total 20-year lifecycle benefit</b>	<b>\$30,036,274</b>
<b>Total 20-year NPV benefit</b>	<b>\$17,991,615</b>

Source: WSSC Water

Assumptions: Labor costs reflect salaries and fringe benefit rate = 51% and annual salary increases of 4.5%. The current estimate is based on expected impacts from the high volume of meter changes and conversion from quarterly to monthly billing. Actual staff needs will be more well-defined after the solution is selected and impacts on operations are more fully understood.

## BENEFIT B-6: Reduction in Workers' Compensation Claims

This table shows the impact of the percent reduction in field staff activities and expected savings from the decline in workers compensation claims.

Factor	Current	2022 w/AMI	2023 w/AMI	2024 w/AMI	2025 w/AMI	2026 w/AMI
Estimated Claim Value at 100% Staffing	\$ 133,142	\$135,804	\$138,520	\$141,291	\$144,117	\$147,000
Percent Reduction Compared to 2021 Meter Reading Field Staff Activities		16%	22%	38%	78%	78%
<b>Annual Savings from Reduction in Expected Worker's Comp Claims</b>		<b>\$ 22,022</b>	<b>\$ 29,950</b>	<b>\$ 53,462</b>	<b>\$112,957</b>	<b>\$115,216</b>

<b>Total 20-year lifecycle benefit</b>	<b>\$2,365,932</b>
<b>Total 20-year NPV benefit</b>	<b>\$1,508,039</b>

Source: WSSC Water

Assumptions: Labor estimate is accurate and 2026 level will continue 2027-2041.

Arcadis U.S., Inc.

1111 Superior E

Suite 1300

Cleveland, Ohio 44114

Tel 216 781 6177

Fax 216 781 6243

[www.arcadis.com](http://www.arcadis.com)