

Pennsylvania Municipal Retirement System

**Actuarial Valuation
as of January 1, 2019**

Produced by Cheiron

May 2020

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May 14, 2020

Pennsylvania Municipal Retirement Board of the
Pennsylvania Municipal Retirement System
c/o Stephen W. Vaughn, Secretary
1721 North Front Street
Harrisburg, Pennsylvania 17102-2315

Re: PMRS 2019 Actuarial Valuation Report

Dear Members of the Board:

At your request, we have conducted the annual actuarial valuation of the Pennsylvania Municipal Retirement System (System) as of January 1, 2019. The purpose of this report is to provide the aggregate valuation results of the participating employer's plans for the System and the analyses of the combined asset and liability performance and projections. The report provides statistics on the participating employer contribution levels for all plans participating in the system as of the valuation date and incorporates the aggregated results from the individual Governmental Accounting Statements No. 67 and 68 (GASB 67/68) results for each plan.

Our report reflects the actuarial liabilities for the municipal and authority employers' traditional defined benefit plans, which are explicitly calculated as of January 1, 2019. The liabilities for the cash balance plans are based on the member and municipal account balances, as provided by PMRS, as well as the explicit liabilities associated with retirees for these plans. The liabilities for the county plans utilize the January 1, 2018 actuarial liabilities rolled-forward to January 1, 2019. The explicit retiree liabilities for these plans have been calculated as of January 1, 2019. .

This report has been prepared for the Board for the purposes described herein and for the use by the plan auditor in completing an audit related to the matters herein. Other users of this report are not intended users as defined in the Actuarial Standards of Practice, and Cheiron assumes no duty or liability to such other users.

In preparing the report we analyze combined asset and liability performance and projections. PMRS is an agent multiple-employer retirement system (as defined under Governmental Accounting Standards Board Statements No. 67 and 68) for participating municipalities and counties. Assets and liabilities are separately accounted for and reported to the Pennsylvania Department of the Auditor General through the Municipal Pension Reporting Program. We refer you to the Foreword and Board Summary which presents the general approach used in the preparation of this report, a big picture view of the System, historical trends developed by Cheiron, and future stress testing of the System. We also comment on the sources and reliability of both the data and the actuarial assumptions on which our findings are based. These comments support the information presented throughout our report.

Pennsylvania Municipal Retirement Board of the
Pennsylvania Municipal Retirement System
May 14, 2020

This report and its contents have been prepared in accordance with generally recognized and accepted actuarial principles and practices and our understanding of the Code of Professional Conduct and applicable Actuarial Standards of Practice (ASOP) set out by the Actuarial Standards Board as well as applicable laws and regulations. Furthermore, as credentialed actuaries, we meet the Qualification Standards of the American Academy of Actuaries to render the opinion contained in this report. This report does not address any contractual or legal issues. We are not attorneys and our firm does not provide any legal services or advice.

Sincerely,
Cheiron

Kenneth A. Kent, FSA, FCA, MAAA
Principal Consulting Actuary

Karen M. Zangara, FSA, MAAA
Principal Consulting Actuary

Anthony Bucci, FCA, MAAA
Consulting Actuary

cc: Charity D. Rosenberry, CPA
Bonnie Rightnour, FSA
Eric Hwang, ASA

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

FOREWORD

Cheiron performed the actuarial valuation of the Pennsylvania Municipal Retirement System (System) as of January 1, 2019. The purpose of this report is to:

- 1) **Measure and disclose**, as of the valuation date, the financial condition of the System;
- 2) **Indicate trends** in the financial progress of the System;
- 3) **Provide specific information** and documentation required by the Governmental Accounting Standards Board (GASB).

An actuarial valuation establishes and analyzes System assets and liabilities on a consistent basis and traces the progress of both from one year to the next. It includes measurement of the System's investment performance as well as an analysis of actuarial liability gains and losses.

Section I presents a summary containing our findings, disclosing important trends experienced by the System in recent years, and risks for consideration.

Section II contains details on various asset measures, together with pertinent performance measurements.

Section III shows similar information on System liabilities, measured for actuarial, accounting, and government reporting purposes.

Section IV shows the distribution of the traditional defined benefit plans' contribution rates by component.

Section V includes the required disclosures under GASB as well as additional information provided for the System's Comprehensive Annual Financial Report (CAFR) based on the Government Finance Officers Association (GFOA) guidance.

The appendices to this report contain a summary of the System's membership at the valuation date, and the actuarial methods and assumptions used in the valuations.

As this System is an agent multiple-employer retirement system in which each of the participating municipalities are entitled to define and submit to the Board the benefit provisions for their respective employees, the actual plan provisions are not included in this report. In preparing this valuation, we relied on the plan provisions defined and submitted to the State under the 2018 Act 293 filings and 2019 Act 205 filings in preparing this valuation as provided by the System.

We have rolled forward the liabilities for all county plans from January 1, 2018 to January 1, 2019. These liabilities reflect the assumption changes and material changes (such as plan changes) if applicable. These liabilities are incorporated into all of the 2019 liability calculations to provide a reasonable estimate for the aggregate System results. Further information on these techniques can be found in Appendix B under "Method to Estimate Rolled Forward Liabilities".

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

FOREWORD

For municipalities with cash balance plans, the active and vested terminated liabilities as of January 1, 2019 reflect the financial data as of this date, as provided by the System. Liabilities associated with all participants in pay status, are also determined as of January 1, 2019.

In preparing our report, we relied on information (some oral and some written) supplied by the System's staff. This information includes, but is not limited to, plan provisions, employee data, and financial information. We performed an informal examination of the obvious characteristics of the data by plan for each of the traditional defined benefit plans and in aggregate for the cash balance plans for reasonableness and consistency in accordance with Actuarial Standard of Practice No. 23 (Data Quality).

The actuarial assumptions were adopted by the Board along with the interest rate assumption which is formally reviewed each year. The assumptions represent the best estimate for the future experience of the System. They reflect the experience analysis and our presentation of appropriate assumptions in accordance with the Actuarial Standards of Practice No. 27 (Selection of Economic Assumptions for Measuring Pension Obligations) and No. 35 (Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations) in performing actuarial valuations of retirement systems. To the extent the laws of the Commonwealth of Pennsylvania and/or the administrative practices of the System differ from Actuarial Standards of Practice, we have identified such deviations within the assumption and methods section of this report.

The results of this report are dependent on future experience conforming to these assumptions. To the extent that plan experience differs from that anticipated by the assumptions, there are changes in the assumptions or plan provisions, or changes to the applicable law, the true cost for each of the plans could vary from our results. Future valuation reports may differ significantly from the current report presented in this document due to such factors as: plan experience differing from that anticipated by the assumptions, changes in assumptions, and changes in plan provisions or applicable law.

Finally, in preparing this report, we have conformed to generally accepted actuarial principles and practices which are consistent with the Code of Professional Conduct, and applicable Actuarial Standards of Practice set out by the Actuarial Standards Board.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION I – BOARD SUMMARY

General Comments

The primary purpose of the actuarial valuation and this report is to disclose the following as of the valuation date:

- the overall financial condition of the Pennsylvania Municipal Retirement System,
- biennial valuation of the non-county plans participating in the System and the full valuation of the cash balance plans,
- roll-forward of county defined benefit plans,
- past trends and expected future trends in the System’s financial condition,
- potential risks to the System and individual plans, and
- information required by the Governmental Accounting Standards Board (GASB) and the System’s Financial Statements.

In this Section, we present a summary of the principal valuation results. This includes the basis on which the January 1, 2019 valuation was completed and an examination of the current financial condition of the System. In addition, we present a review of the key historical trends followed by the System’s projected financial outlook.

The municipal plans are valued every odd year. Throughout our report, our discussion will address changes from January 1, 2017, the last time the municipal plans were valued, to January 1, 2019. In other parts of the discussion, we address the overall status of the System. In this case, we compare results from January 1, 2018 to January 1, 2019 to identify the changes in the overall System’s funded status. The January 1, 2018 valuation results reflect the explicit valuation of the cash balance and county pension plans, and a roll-forward of the liabilities for all municipal defined benefit based on the January 1, 2017 results. The January 1, 2019 valuation results reflect the explicit valuation of the cash balance and municipal pension plans, and a roll-forward of the liabilities for all county defined benefit plans based upon the January 1, 2018 results.

A. Valuation Basis

The January 1, 2019 valuation results are based on the same actuarial assumptions approved by the Board for the January 1, 2016 valuation following the last experience study and a 5.25% interest rate assumption, as adopted by the Board in November 2016, effective as of January 1, 2017. No assumption changes have been implemented since then.

Below we identify the following key results of this valuation.

- *2018 Asset Surplus and Excess Interest Distribution:* In 2018, for the first time since 2008, the System’s market value of assets (MVA) exceeded the reserves, which are used to define the actuarial asset value (AVA). This created a surplus, as defined in the Board Policy 05-2. Based on this policy, the Board awarded \$25.85 million in Excess Interest to the member plans to offset unfunded liabilities or provide for the opportunity to improve benefits (based on applicable law and funded status). This excess interest distribution occurred as of December 31, 2018. The liabilities associated with the additional benefits offered under the Excess Interest distribution are reflected in the January 1, 2019 valuation.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

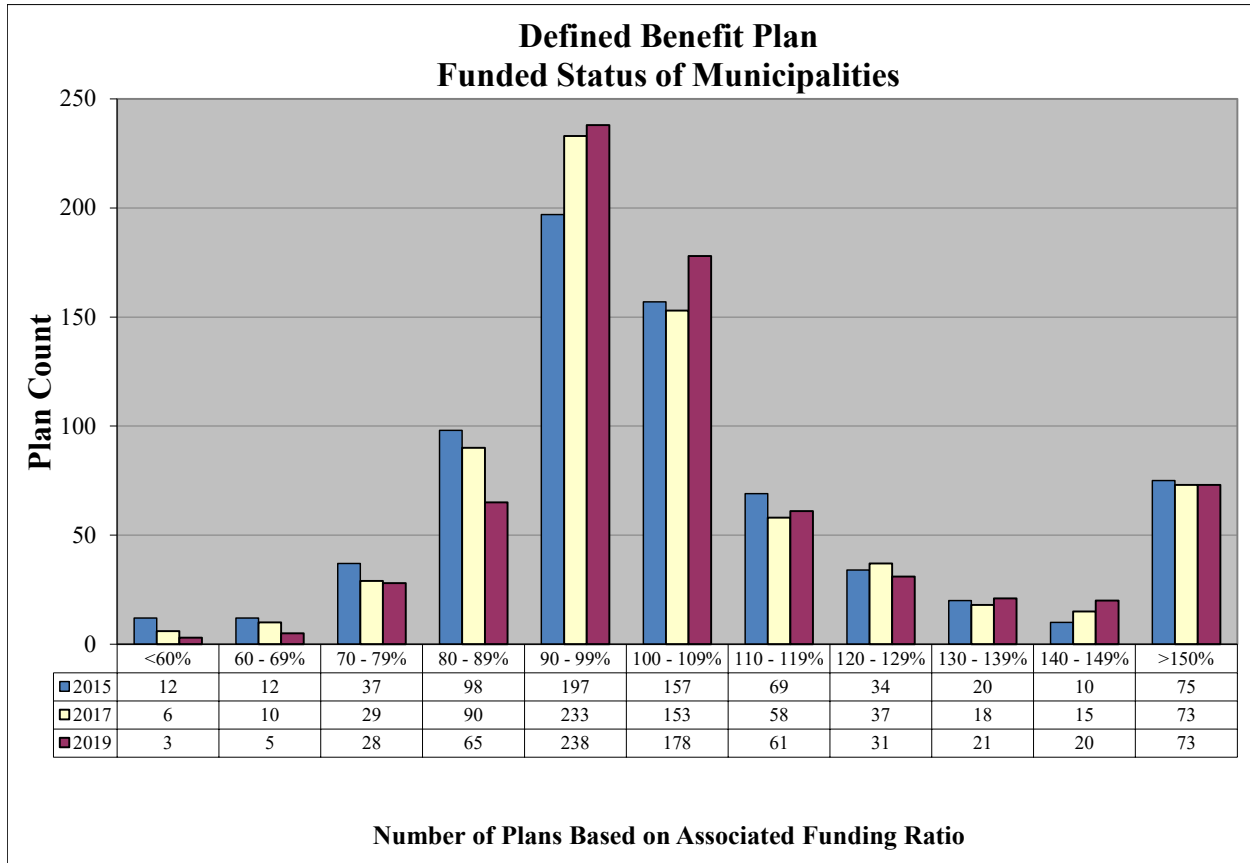
SECTION I – BOARD SUMMARY

- *Market Value of Assets:* On a Market Value of Assets basis, the average investment return for the year ending December 31, 2018 resulted in a money-weighted return rate of -4.6% used to measure the System’s experience for valuation purposes. The negative investment return for the year is the primary reason the results associated with the MVA in this valuation declined compared to the prior year’s report.
- *Actuarial Value of Assets:* On an Actuarial Value of Assets basis, the return is 5.25% based on the Regular Interest Rate determined by PMRS for the plan year ending December 31, 2018. The Actuarial Value of Assets equals the sum of the reserve information provided in the System’s December 31, 2018 CAFR. The AVA in this valuation reflects the \$25.85 million excess interest distribution effective as of December 31, 2018.
- *Asset Deficit:* As of January 1, 2019, the System’s MVA is less than the System’s AVA as defined in the Board Policy 05-2. Therefore, there is no excess interest distribution during the year.
- *Actuarial Liabilities:* The January 1, 2019 Actuarial Liabilities (AL) represent the explicit valuation of the cash balance and non-county (municipal and authority) defined benefit plans, and a roll-forward of the liabilities for county plans based on the January 1, 2018 results. The System’s AL increased by \$119.2 million, from \$2,400.9 million to \$2,520.1 million, primarily due to additional accruals during the past year with interest and the excess interest benefit improvements. These increases were offset by benefit payments paid to retirees. There was an actuarial loss of \$23.6 million (about 0.9% of the current AL) attributable primarily to new entrants, rehires new retirees, and general deviation from the assumptions. Because the valuations are biennial, this loss reflects a two-year period for the municipal defined benefit plans.
- *Unfunded Actuarial Liability (UAL)/Surplus Assets (SA):* The System is made up of many different retirement plans. Some plans have UAL, which occurs when the Actuarial Liability (AL) exceeds the Actuarial Value of Assets (AVA). Other plans have SA, which occurs when the AVA is greater than the AL. In aggregate, the System is in a surplus position of \$8.8 million as of January 1, 2019 compared to a net surplus of \$3.6 million as of January 1, 2018 based on the assets and liabilities after reduction by the \$25.9 million excess interest.
- *Funding Ratio on Actuarial Asset Value:* This is the ratio of the System’s Actuarial Value of Assets to Actuarial Liability. The funding ratio increased from 100.2% as of January 1, 2018 to 100.4% as of January 1, 2019.
- *Market Value of Assets vs. Actuarial Liabilities:* On a snapshot basis, comparing the MVA to AL provides information of the progress of the System’s funding status on the valuation date. As of January 1, 2019 the Actuarial Liability exceeded the Market Value of Assets resulting in an unfunded liability of \$170.8 million as shown in Table I-3. Compared to the surplus of \$90.7 million as of January 1, 2018, this was a \$261.5 million reduction due primarily to market losses during the past year, as previously indicated.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION I – BOARD SUMMARY

The following chart shows a distribution of the individual employer plan funded status using actuarial value of assets of the plans covered by the System assets in 2015, 2017 and 2019. The assumption change that occurred for the January 1, 2017 actuarial valuation is reflected in the chart below by the yellow bars for 2017 which still appear to exhibit continued overall funded progress since the last valuation.



Under Act 205 as amended by Act 44, plans may be considered distressed if they are less than 90% funded. As of January 1, 2019, **14% of the traditional defined benefit plans for the municipalities were less than 90% funded, which is a decrease compared to 19% and 22% as of January 1, 2017 and January 1, 2015, respectively.**

As of January 1, 2019, **53% of the traditional defined benefit plans for the municipalities were 100% funded or more, which is a slight increase compared to 49% and 51% as of January 1, 2017 and January 1, 2015, respectively.** These overfunded plans can apply 10% of the excess assets (assets that exceed the liabilities) to reduce their MMO. On this basis, it is not uncommon for the number of plans in surplus to decline as that surplus is used to fund the plans.

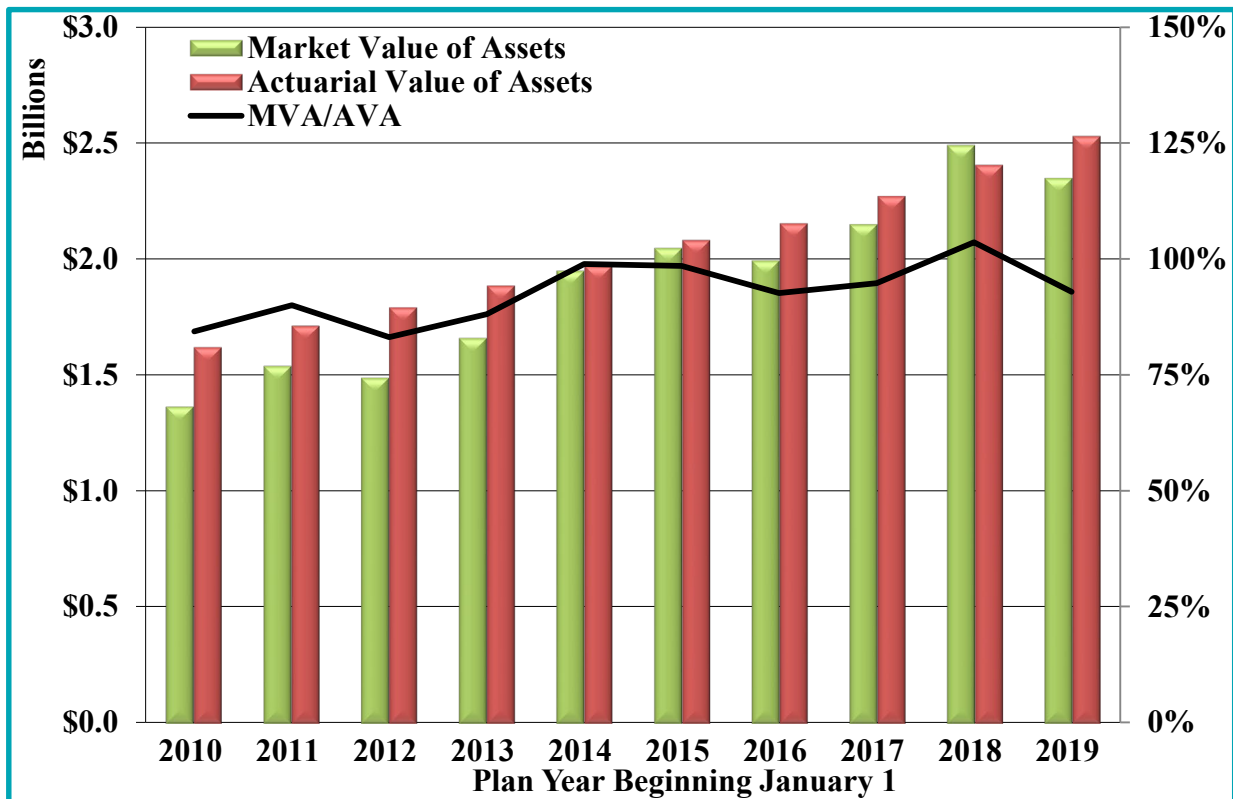
In addition to the historical funded status ranges, another important relationship to review is the history of the Actuarial Value of Assets and Market Value of Assets. The Actuarial Value of Assets is defined as the reserves being held for all benefits of the participating employers and reflects the crediting of the Regular Interest Rate and actual cash flows without regard to the actual investment return of the System.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION I – BOARD SUMMARY

The Market Value of Assets is the actual amount of money the system has as reported on the CAFR. The money-weighted returns for the plan years ended 2017 and 2018 were 17.8% and -4.6%, respectively. Comparing the Actuarial Value of Assets to the Market Value of Assets provides a representation of System assets to the aggregate individual plan assets. The Market Value exceeded the Actuarial Value of Assets last year by \$87.1 million, but this year due to the investment losses, the Market Value of Assets is \$179.6 million less than the Actuarial Value of Assets.

The following table shows the historic relationship between the Market Value of Assets (MVA; green bars) and the Actuarial Value of Assets (AVA; red bars) along with the ratio of the MVA to the AVA (represented by the line associated with the right vertical axis) demonstrating the underlying risk of the System as addressed later in this report. Over this time period, the only year the MVA exceeded the AVA was in 2018, when the line is above 100%.



In all years shown except 2018, when the ratio of MVA to AVA is less than 100%, any shortfall between the AVA and MVA must come from future investment earnings in excess of the Regular Interest Rate.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION I – BOARD SUMMARY

B. Current Financial Condition

On the following pages, we summarize the key results of the January 1, 2019 valuation and how they compare to the results from the January 1, 2018 valuation.

1. System Membership:

Table I-1 shows total membership in the Retirement System increased by 3.1% from 2018 to 2019. The active participant counts reported for the Traditional Defined Benefit Plans increased by 1.0% while the active cash balance plan participation increased by 4.3%.

Table I-1 Membership Total			
	January 1, 2019	January 1, 2018	% Change
Traditional Defined Benefit Actives	7,949	7,868	1.0%
Cash Balance Benefit Actives	1,446	1,387	4.3%
Terminated Vesteds	1,168	1,090	7.2%
Participants Receiving Benefit Payments	5,550	5,307	4.6%
Inactive Nonvested Participants with accounts	40	35	14.3%
Beneficiaries	639	599	6.7%
Total System Members	16,792	16,286	3.1%
Annual Salaries*	\$518,655,085	\$494,567,532	4.9%
Average Salary per Active Member	\$55,205	\$53,438	3.3%

* Annualized salary paid during the prior plan year for Traditional Defined Benefit plan participants and actual salary for active cash balance participants

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION I – BOARD SUMMARY

Table I-2 is a summary of the demographic make-up of the traditional defined benefit and cash balance plans in the System.

Table I-2 Demographic Make-up of the System				
Category	Valuation as of		Percent Change	
	January 1, 2019	January 1, 2018		
Number of plans:				
Traditional Defined Benefit Plans	723	730	-0.96%	
Cash Balance Plans	323	314	2.87%	
Total	1,046	1,044	0.19%	
Active Employees in Traditional Defined Benefit Plans:				
Count	7,949	7,868	1.03%	
Average Age	47.8	48.0	-0.36%	
Average Service	11.8	12.2	-2.90%	
Total Payroll*	\$ 455,352,355	\$ 434,554,380	4.79%	
Average Pay	\$ 57,284	\$ 55,231	3.72%	
Active Employees in Cash Balance Plans:				
Count	1,446	1,387	4.25%	
Average Age	49.8	50.2	-0.71%	
Average Service	11.1	11.5	-3.50%	
Total Payroll*	\$ 63,302,730	\$ 60,013,152	5.48%	
Average Pay*	\$ 43,778	\$ 43,268	1.18%	
Total Active PMRS Participants	9,395	9,255	1.51%	
Inactive Nonvested Participants with account balances:	40	35	14.29%	
Deferred Vested Participants:				
Traditional Defined Benefit Plans	853	797	7.03%	
Cash Balance Plans	315	293	7.51%	
Pensioners:				
Count	5,550	5,307	4.58%	
Average Age	70.1	69.9	0.22%	
Average Monthly Benefit	\$ 1,406	\$ 1,367	2.92%	
Number of New Awards	429	383	12.01%	
Average New Monthly Benefit	\$ 1,631	\$ 1,576	3.49%	
Number Receiving Legislated COLA	284	192	47.92%	
Survivor Beneficiaries:				
Count	639	599	6.68%	
Average Age	74.4	74.3	0.19%	
Average Monthly Benefit	\$ 1,008	\$ 980	2.78%	
Total Inactive Participants Count	7,397	7,031	5.21%	

* Annualized salary paid during the prior plan year for Traditional Defined Benefit plan participants and actual salary for active cash balance participants.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION I – BOARD SUMMARY

2. System Assets and Liabilities:

Table I-3 presents a comparison between the January 1, 2018 and January 1, 2019 System assets, liabilities, unfunded actuarial liability, and funding ratios for traditional defined benefit non-county, traditional defined benefit county, and non-county cash balance plans. While this valuation was prepared based on the explicit valuation of the municipal and cash balance plans, we have rolled forward county participant active and vested terminated liabilities from the 2018 valuation. Retiree liabilities are recalculated annually based on actual data. Liabilities for the cash balance plans are based on the member and municipal accounts, as provided by PMRS, and the explicit retiree liabilities.

On an Actuarial Value of Asset basis, the total funding ratio increased from 100.2% as of January 1, 2018 to 100.4% as of January 1, 2019. However, the overall funding ratio on a market value basis decreased from 103.8% as of January 1, 2018 to 93.2% on January 1, 2019.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION I – BOARD SUMMARY

Table I-3 Total Plan Assets and Liabilities (\$ thousands)			
	January 1, 2019	January 1, 2018	% Change to Baseline
Traditional Defined Benefit (Non-county) Plans:			
Actives	\$ 1,102,156	\$ 1,073,517	2.7%
Terminated Vesteds	86,138	81,108	6.2%
In Pay Status	1,056,279	988,595	6.8%
Total Actuarial Liability ¹	\$ 2,244,573	\$ 2,143,220	4.7%
Actuarial Value of Assets ²	2,253,907	2,139,585	5.3%
Unfunded/(Surplus) of Actuarial Liability	\$ (9,334)	\$ 3,635	
Traditional Defined Benefit (County) Plans:			
Actives	\$ 72,098	\$ 68,295	5.6%
Terminated Vesteds	12,883	12,584	2.4%
In Pay Status	49,562	46,569	6.4%
Total Actuarial Liability ¹	\$ 134,543	\$ 127,447	5.6%
Actuarial Value of Assets ²	133,858	126,210	6.1%
Unfunded/(Surplus) of Actuarial Liability	\$ 685	\$ 1,237	
Cash Balance Plans:			
Actives	\$ 87,345	\$ 83,386	4.7%
Terminated Vesteds	16,734	16,526	1.3%
In Pay Status	36,950	30,332	21.8%
Total Actuarial Liability	\$ 141,029	\$ 130,244	8.3%
Actuarial Value of Assets ²	141,882	131,571	7.8%
Unfunded/(Surplus) of Actuarial Liability	\$ (853)	\$ (1,327)	-35.7%
Total of All Plans			
Actives	\$ 1,261,599	\$ 1,225,198	3.0%
Terminated Vesteds	115,755	110,218	5.0%
In Pay Status	1,142,791	1,065,496	7.3%
Total Actuarial Liability	\$ 2,520,144	\$ 2,400,912	5.0%
Market Value of Assets	\$ 2,349,380	\$ 2,491,620	-5.7%
Actuarial Value of Assets (summation of above) ²	\$ 2,529,647	\$ 2,397,366	5.5%
Expenses in Excess of Assessment	5,513	5,458	1.0%
Actuarial Value of Asset Adjustment ³	(6,220)	1,675	-471.3%
Actuarial Value of Assets ⁴	2,528,940	2,404,499	
Excess Interest Distribution	0	25,851	
Actuarial Value of Assets Reflecting Excess Interest ⁵	\$ 2,528,940	\$ 2,430,350	4.1%
Unfunded/(Surplus) using Actuarial Value	\$ (8,796)	\$ (3,587)	
Funding Ratio on Actuarial Asset Value	100.4%	100.2%	0.2%
Unfunded/(Surplus) using Market Asset Value	\$ 170,764	\$ (90,708)	-288.3%
Funding Ratio on Market Asset Value	93.2%	103.8%	-10.6%

1 County plan liabilities are estimated in odd years and municipal (non-county) defined benefit liabilities are estimated in even years based upon a roll-forward of the prior year's liabilities; Liabilities associated with participants in non-operational plans are included in the non-county plan liabilities; numbers may not add due to rounding.

2 The assets shown above are attributable to the cash balance and traditional defined benefit non-county and county plans based on updated data and information provided. The cash balance assets reflect un-distributable forfeitures associated with terminated plan participants.

3 The Actuarial Value of Asset Adjustment reflects the total difference between the retiree reserve and the retiree liabilities as well as differences from plans entering and exiting the System as of plan year end.

4 The Actuarial Value of Assets reflects the asset value based on member, municipal, retiree, disability & DROP reserve accounts as approved by the Board along with the \$45.5 million transfer to the Retiree Reserve for the 2018 assets and provided by PMRS in the 2017 and 2018 CAFR.

5 The January 1, 2018 "Actuarial Value of Assets Reflecting the Excess Interest" includes the excess interest award, but because the liabilities associated with this award were not available until 2019, this asset value is not used for the 2018 results.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION I – BOARD SUMMARY

Table I-4 presents a summary of the January 1, 2019 municipal traditional defined benefit plans that are in a surplus or underfunded position compared to the last full valuation for these plans.

Table I-4		
Funded Status of Municipalities		
	January 1, 2019	January 1, 2017
A. Municipal Plans in a surplus position		
1. Number of plans with a surplus	382	354
2. Actuarial Value of Assets in plans with a surplus	\$841,035,536	\$733,627,708
3. Actuarial Liability in plans with a surplus	<u>723,667,659</u>	<u>620,805,414</u>
4. Amount of surplus (2. – 3.)	\$117,367,877	\$112,822,294
B. Municipal Plans in an underfunded position		
1. Number of underfunded plans	337	364
2. Actuarial Value of Assets in underfunded plans	\$1,412,871,761	\$1,334,508,645
3. Actuarial Liability in underfunded plans	<u>1,520,905,003</u>	<u>1,456,032,055</u>
4. Amount of (unfunded) liability (2. – 3.)	(\$108,033,242)	(\$121,523,410)

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION I – BOARD SUMMARY

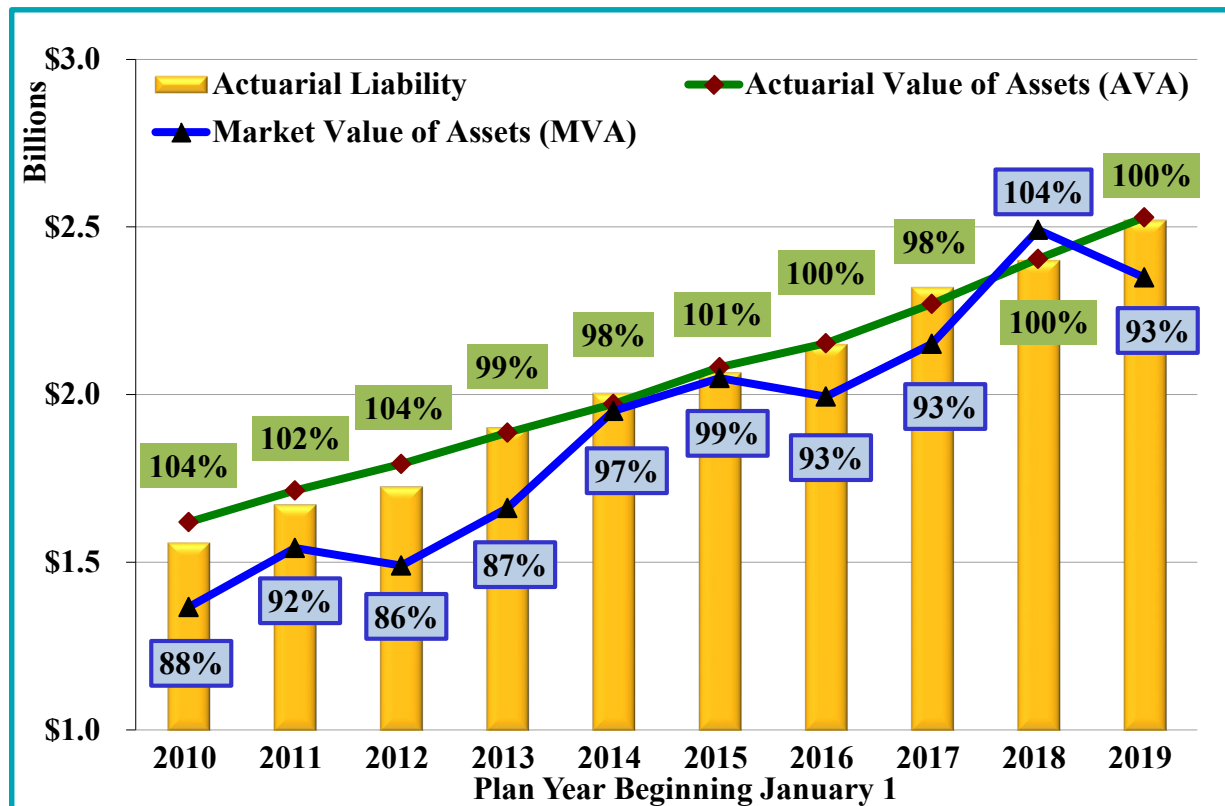
C. Historical Trends

Even though the attention given to the valuation reflects the most recently computed actuarial liability and funding ratio, it is important to remember that each valuation is merely a snapshot of the long-term progress of the System. It is equally important to judge a current year’s valuation result relative to historical trends, as well as trends expected into the future.

In the chart below, we present the historical trends for the total System (i.e. traditional defined benefit, cash balance, county and non-county) market and actuarial value of assets (blue and green lines) compared to the total System actuarial liabilities (yellow bars). We have included the funding ratio (Actuarial Value of Assets divided by the Actuarial Liability) across the top of each bar in green boxes to show the progress of the System since 2010. For 2019, this funding ratio is 100%. The Actuarial Value of Assets are based on the reserve accounts for the System. Due to the growth of the reserves as outlined with the Pennsylvania Municipal Retirement Law, the Actuarial Value of Assets do not fluctuate materially from year to year.

In addition, the funding ratio on a Market Value of Assets basis is important to understand the underlying System’s risks addressed later in this report. The market value funding ratios (Market Value of Assets divided by the Actuarial Liability) are provided within each bar in blue boxes. The 2019 Market Value of Assets is less than the Actuarial Liability with a funding ratio of 93%. Due to the volatility of the market value of assets, this ratio ranges from 86% up to 104% compared to the funding ratio based on the Actuarial Value of Assets, which ranges from 98% to 104%.

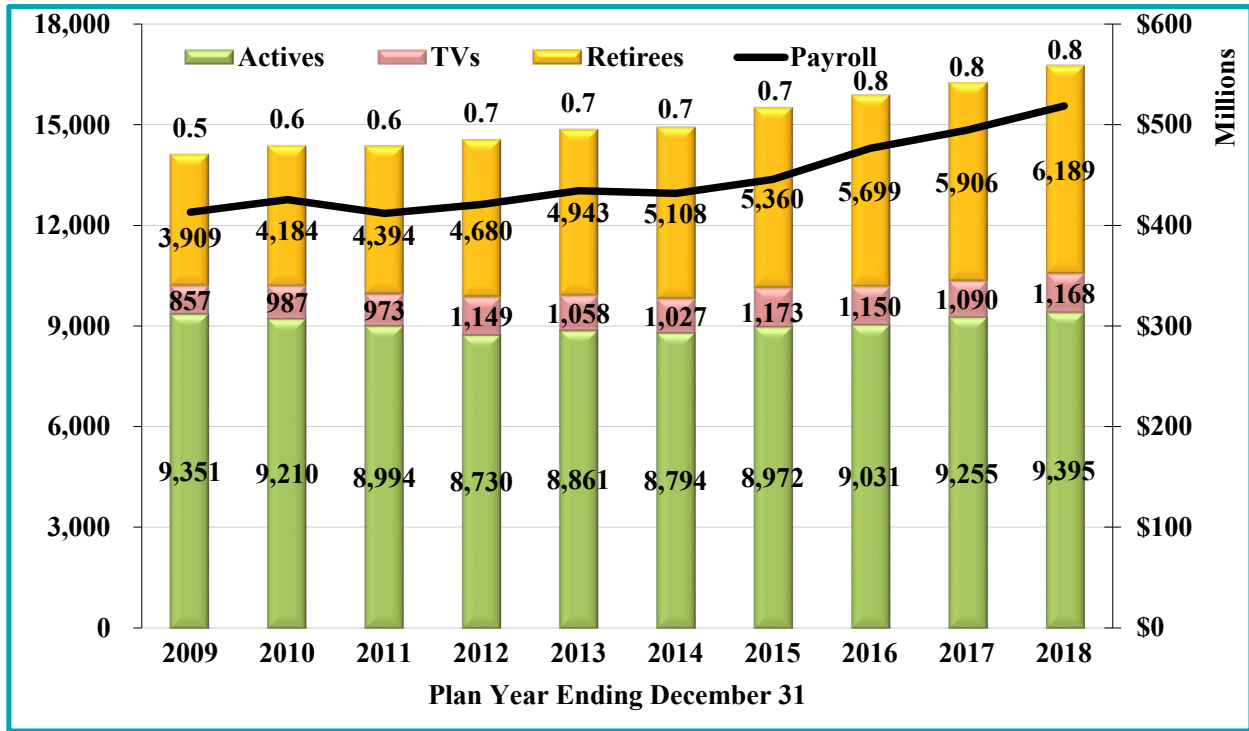
Pennsylvania Municipal Retirement System Assets and Liabilities – 2010 to 2019



**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION I – BOARD SUMMARY

Pennsylvania Municipal Retirement System Participant Counts – end of year 2009 to 2018



The chart above shows a comparison of the demographic makeup of the System over the last ten years. The black line represents the active payroll and corresponds to the right-hand axis. The number above the bars represents the support ratio of inactive to active participants which is increasing steadily.

A retirement system has a life cycle, reaching maturity when there are more covered participants in inactive (retirees and terminated vested participants) status than those who are actively employed. When this occurs, the support ratio of inactive to active participants moves closer to and sometimes above 1.0. The System is maturing as indicated by the steadily increasing ratio of inactive to active participants. The nature of the risk factors of a maturing fund is such that investment recovery takes more time and can be difficult to achieve without additional steps such as additional contributions. Prolonged investment recovery is impacted by the net negative cash flows occurring when benefit payments and expenses exceed contributions. This is a function of the support ratio. This is discussed in more detail in the risk section of this report.

D. Projected Financial Trends

Our analysis of the Pennsylvania Municipal Retirement System’s projected financial trends is an important part of this valuation. In this section, we present our assessment of the implications of the January 1, 2019 valuation results on the future outlook in terms of benefit security (assets sufficient to cover liabilities) and the System’s expected funding progression.

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In the charts that follow, we project the Retirement System’s resources and obligations. We assume the Act 205 contributions are made each year. The projections in this section only consider what was known as of January 1, 2019. The projections are provided under four different investment return assumption scenarios:

- 1) Assuming 5.25% investment returns each and every year,
- 2) Assuming a 7.00% (net of investment fees) for each and every year based on the long-term expected return information provided by the investment consultant and reviewed by the Board,
- 3) Assuming average investment returns over 20 years equals 5.25% but vary annually based on the returns provided in Table I-5. We do this to demonstrate a more realistic projection because the System’s return will never be level from year to year,
- 4) Assuming 20 years of varied returns equal to an overall average 7.00% investment return based on Table I-6.

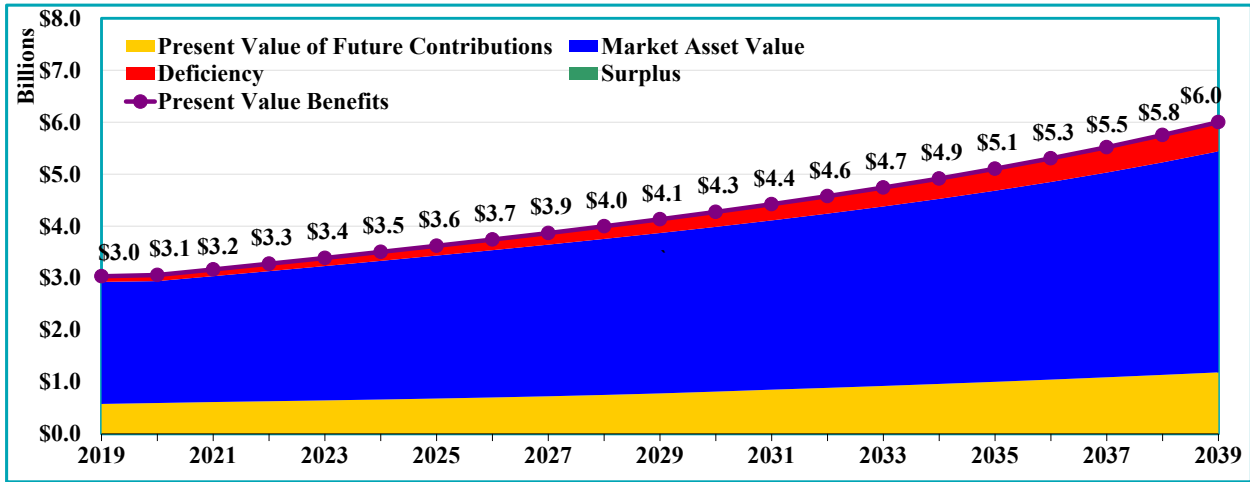
The projections that follow show how the total obligations (shown by the purple line) of the System, assuming the current active population, consistently increases. This is an open group projection which means when an active participant is expected to change status, they are assumed to be replaced. The area under the purple line represents the *Present Value of Benefits*. This amount takes into account the value of all benefits earned up to that point in time (Actuarial Liability) plus benefits assumed to be earned into the future. This amount represents the System’s total obligation over time.

To meet these obligations, the System has resources which include the Market Value of Assets (in blue) and the present value of future contributions (in gold). To the extent these two sources are insufficient to meet the obligations today or in the future, the result will be a deficit (in red). If the System’s resources exceed the obligations, the result will be a surplus (green). For this System, given that the investment Regular Interest Rate for all municipalities is currently 5.25%, the key resource initially to cover a deficit or create a surplus is through average future investment returns at a System level that exceed the 5.25% rate. The Board can reduce future crediting rates which in turn should increase the likelihood that returns will exceed this rate. This would also result in increased future contributions.

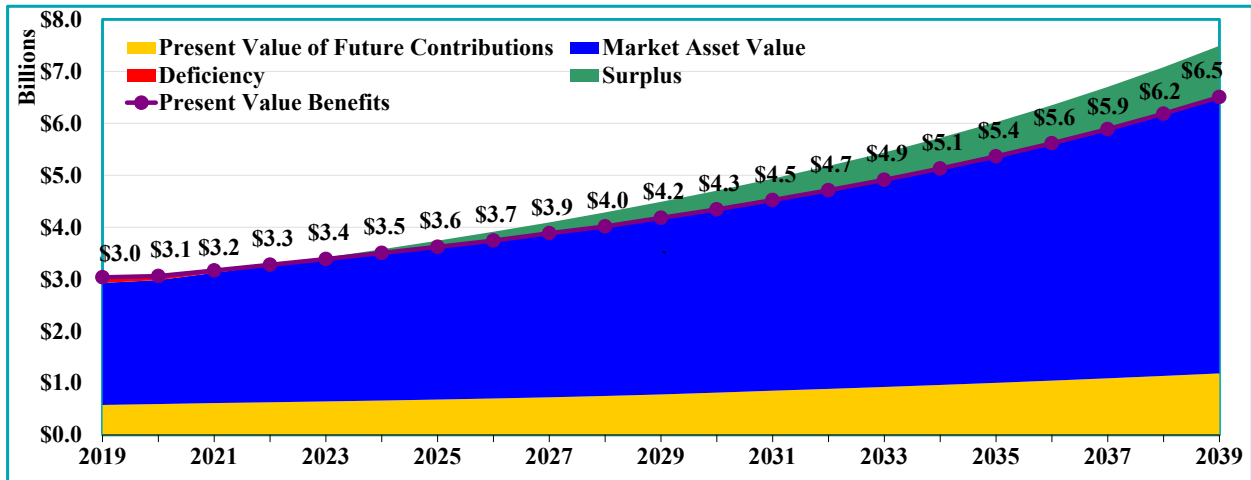
Under the following projections the gap between the assets and the System’s obligations gradually increases throughout the projection period. This occurs primarily because the MVA is originally less than the obligation and the AVA, and contributions are based on the underfunded AL when compared to the AVA, not the MVA. Therefore, without earnings in excess of the Regular Interest Rate, the gap between the MVA and the obligations will grow over time.

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This next graph shows the implications if the assets are projected to grow at the rate of 7.00%.



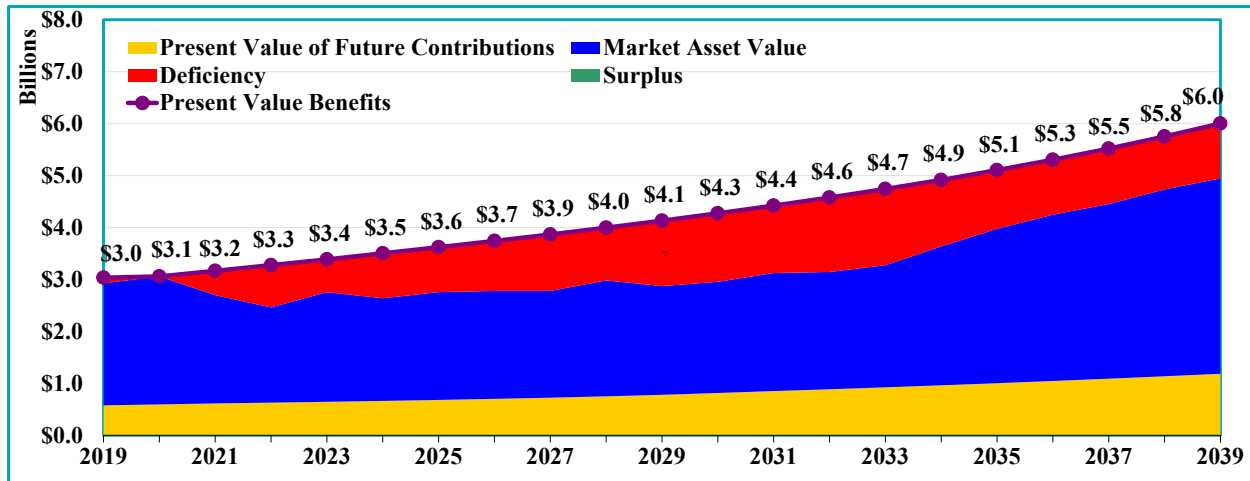
The surplus, shown by the green area in the second chart, displays the assets outpacing the obligations over the 20 year projection because of the assumption the annual investment return will be 1.75% larger than the Regular Interest Rate. In addition, the projected present value of benefits increases under this scenario because excess interest is assumed to occur and increase benefits offered under individual pension plans. Excess interest can be distributed to pay down unfunded liabilities instead of providing cost of living increases or benefit improvements based upon Pennsylvania Municipal Retirement Law until an individual municipality’s funded status is at least 95% funded.

The System’s return on assets each year is assumed to be the Regular Interest Rate of 5.25% but will, over time, be volatile with returns above and below the assumption Based on the hypothetical future return rates in Table I-5 on the next page, which yields an average 5.25% rate of return over the projection period. The projected funded status will show higher and lower levels of funding based on the market value of assets.

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Table I-5 Projected Returns Equal to the Valuation Rate										
Fiscal Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Return	12.00%	-15.00%	-10.00%	18.00%	-4.00%	8.00%	3.00%	2.00%	12.00%	-3.00%
Fiscal Year	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Return	6.00%	10.00%	2.60%	7.50%	17.00%	14.00%	10.00%	7.00%	8.70%	6.00%



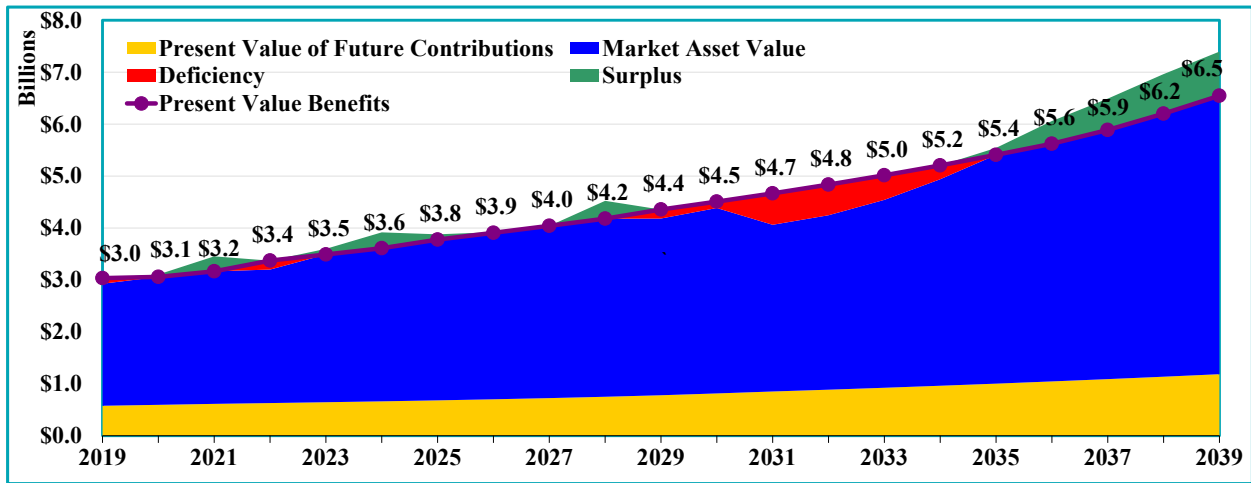
Based on this illustration, the negative net cash flow in conjunction with negative markets results in a worse funding position over time than the flat 5.25% projection.

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The potential volatility is equally apparent when we project investment returns that vary but now are expected to produce an average return over time of 7.00% as summarized in Table I-6. The fund could come out of deficit position at the end of the period with some additional years of investment returns in excess of the Regular Interest Rate.

Table I-6 Projected Returns Equal to 7.00%											
Fiscal Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
Return	12.50%	15.00%	-8.00%	17.00%	12.00%	0.00%	2.50%	5.00%	16.00%	-8.00%	
Fiscal Year	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	
Return	7.25%	-8.00%	7.00%	10.00%	12.00%	16.00%	12.00%	9.00%	9.00%	7.50%	



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E. Actuary’s Assessment of Risk

Actuarial Standards of Practice (ASOP) No. 51 is a new requirement for actuarial pension valuations completed after November 1, 2018. Actuarial valuations are based on a set of assumptions regarding future economic and demographic experience. These assumptions represent a reasonable estimate of long-term future experience, but actual future experience will undoubtedly be different. The purpose of this section of the actuarial report is to identify, in the actuaries’ professional judgment, the primary risks to the System, provide some background information about those risks, and provide an assessment of those risks in accordance with ASOP No. 51. According to the ASOP, the actuary should identify risks that, in the actuary’s professional judgment, may reasonably be anticipated to significantly affect the plan’s future financial condition.

The identification of risks for PMRS can be viewed in aggregate at a System level or at the individual plan level (Plan Risk). The individual plan level risks can vary greatly from plan to plan. The fundamental risk to the System is that the market value of assets could become insufficient to meet the benefit obligations of the individual plans, which could require increased contributions making the plans unaffordable. This section will attempt to address this fundamental risk by reviewing the Plan and System level risks for the following:

- 1) Investment Risk
- 2) Longevity and Other Demographic Risks
- 3) Withdrawal Risk

1) **Investment Risk** represents the risk associated with asset volatility (particularly asset losses) and exists for nearly all pension plans. Because the Pennsylvania Municipal Retirement Law defines the Regular Interest used in the funding valuation, the risk associated with the investment return for PMRS is unique.

Plan Level:

Participating plans within PMRS are not exposed to the same investment risk as typical pension plans. PMRS credits the municipal and member accounts at the Regular Interest Rate each year, regardless of the actual investment return on the market value of assets. These the aggregation of these plan accounts represent the Actuarial Value of Assets (AVA) and are used to determine the required plan contributions also known as the Minimum Municipal Obligation (MMO). In addition, if the system-wide MVA exceeds the plans’ AVA, then individual plans may receive a distribution of the surplus called Excess Interest. Therefore, plans participating in PMRS are not subject to the down-side risk of asset volatility but they do have the opportunity to share up-side potential.

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System Level:

When the actual investment returns are less than the Regular Interest Rate (currently 5.25%), the Market Value of Assets (MVA) drops below the system-wide reserve accounts (in essence the Actuarial Value of Assets or AVA). This is the current scenario for the System with the AVA exceeding the MVA by \$180 million. This gap is closed by the accumulation of returns in excess of the Regular Interest Rate in the future assuming the Regular Interest Rate remains at the current 5.25%. The System's asset allocation is selected such that the long-term return on assets is expected to exceed the Regular Interest Rate, which helps to reduce this System risk. The current long-term expected return is 7.00% (net of investment expenses) based on information provided by the investment consultant and reviewed by the Board.

If the actual investment returns are greater than the Regular Interest Rate and the system-wide reserve accounts are less than the market value of assets, then there is a surplus as defined in PMRS Policy Statement 05-2. This surplus can increase the Retired Reserve Account to ensure that the System level retiree liabilities (discussed more below) are fully funded. Also, this surplus may be shared with the municipalities through excess interest distributions in accordance with the Pennsylvania Municipal Retirement Law (PMRL) and PMRS Policy Statement 05-2. This scenario was in effect with the January 1, 2018 valuation. However, fully funding the Retired Reserve Account may cause a delay in when the MVA will exceed the AVA.

The System level investment risk can be explored in more detail by reviewing the Net Cash Flow and the Maturity Level.

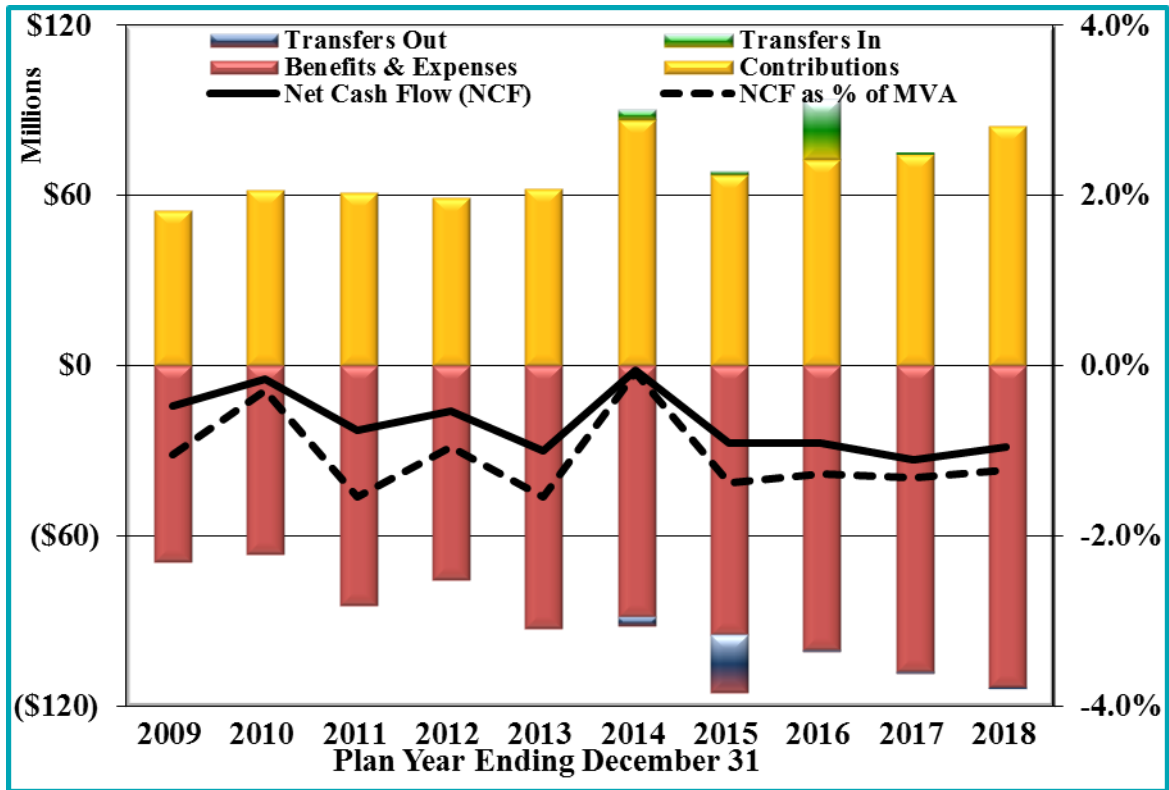
Net Cash Flow: Net cash flow (NCF) during a year equals the contributions into the System minus the benefit payments and expenses representing money flowing out of the System. If the level of benefit payments plus expenses exceeds expected contributions, then the system has negative NCF. Mature plans generally have a negative NCF as the number of retirees increase. Additional cash from existing assets are then needed to pay the pension benefits if a system has negative NCF. Historical NCF since 2009 is displayed in the next graph. The NCF is represented by the black line. The dashed black line (which corresponds to the right-hand axis) provides the net cash flow as a percent of the Market Value of Assets (MVA). As of December 31, 2018, this resulted in a \$29 million negative NCF, excluding transfers into and out of the System. This represents about -1.2% of the MVA. The negative net cash flow falls within the range of 0.1% to 2.0% of total assets, averaging -1.0% over the ten-year period. This implies that along with proceeds from contributions, an additional amount of cash generated from current plan assets must be used to pay benefits. Another way to consider this is that for the total value of assets to grow, the fund needs a minimum investment return at least equal to the negative NCF. Negative NCF can become less negative or even positive by decreasing the Regular Interest Rate (which results in an increase in contributions).

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The volatility of the NCF is largely a function of contributions and benefit payments. Beginning in 2014, the transfer of funds into and out of the System from new participating municipalities and exiting municipalities is excluded from the calculation of the NCF. The incorporation of transfers into and out of the System can be found in Table II-2 for the past year and is shown below in the shaded bars dating back to 2014, the first year this information was available.

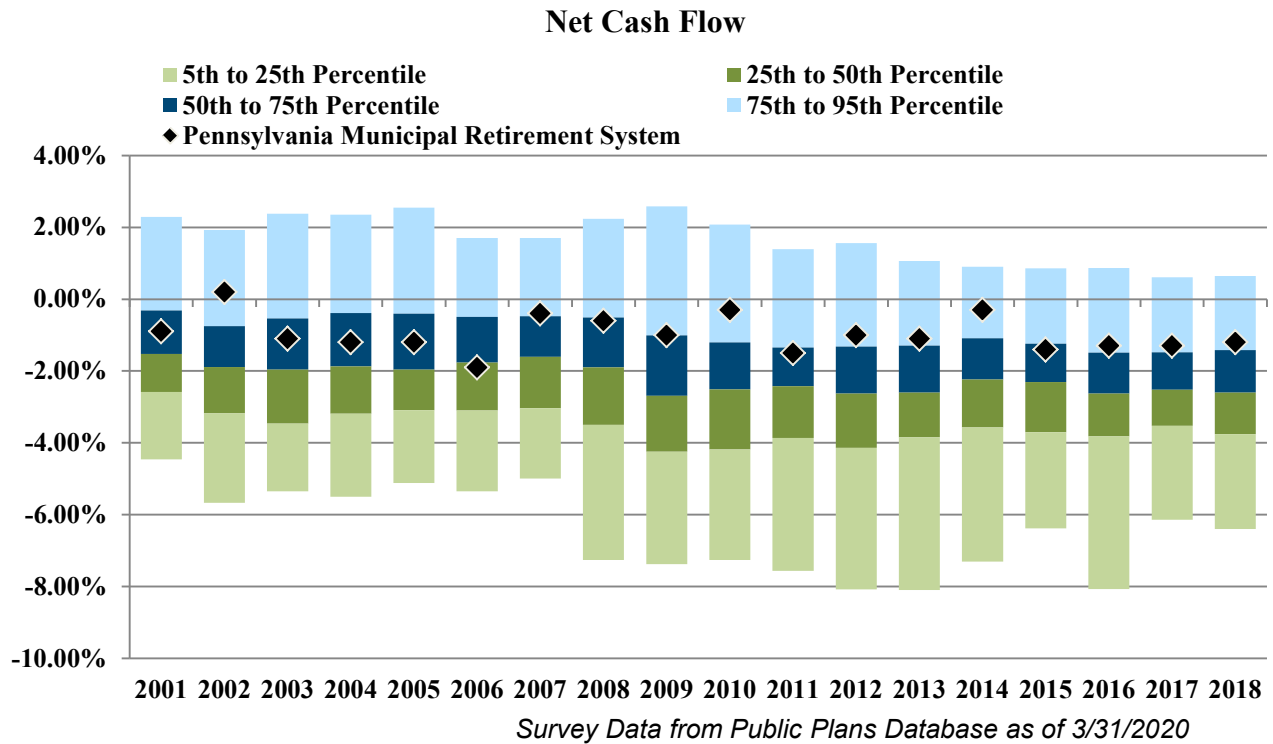
Pennsylvania Municipal Retirement System Cash Flows – 2009 through 2018



The chart below shows the distribution from the 5th to 95th percentile of net cash flow for the plans in the Public Plans Database. The black diamond shows how the System compares. Relative to the universe of plans, PMRS is a younger plan, found in the top quartile of this group in recent years.

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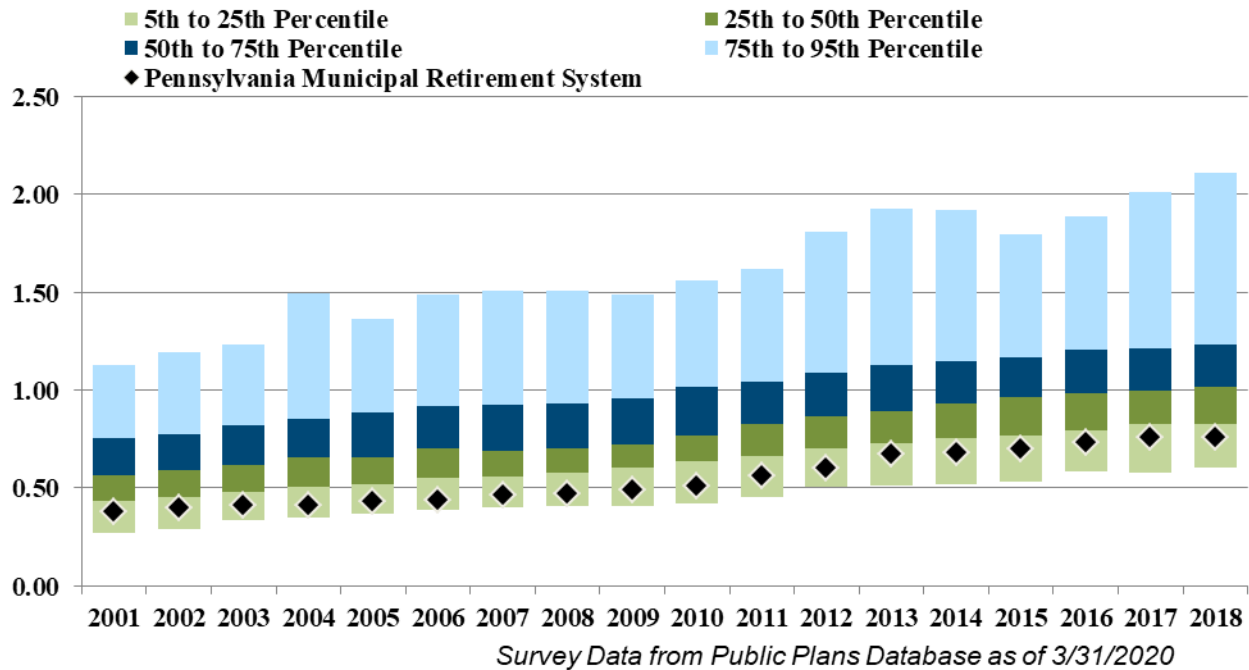


Maturity Level: Mature pension plans are plans that have more retirees than active participants. These plans tend to have negative NCF and be more sensitive to investment risks. Plan maturity can be measured in a variety of ways, but one simple measure of plan maturity is the ratio of the number of inactive participants (those receiving benefits or entitled to a deferred benefit) to the number of active participants. We refer to this as the support ratio. The revenue base supporting the plan is usually proportional to the number of active participants. A relatively high number of inactive participants compared to active participants may indicate a larger plan relative to its revenue base.

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Support Ratio



The chart above shows the distribution from the 5th to 95th percentile of support ratios for the plans in the Public Plans Database. The lower a system is on this chart the lower the maturity impact risk. The black diamond shows how the System compares. This shows that while the System is maturing, it is doing so at a very similar rate to the universe of plans and still remains relatively young. This may be due to the number of new plans that continue to join the System.

For additional review of the risk of the System associated with the investment returns, please refer to the prior section to review the deterministic projections.

- 2) **Longevity and Other Demographic Risk** is the potential for retirees to live longer than expected, resulting in more benefits being paid from the assets or other actual demographic experience to differ from the assumptions. This creates a financial risk that the plan will cost more than originally anticipated.

Plan Level:

PMRS is designed to transfer the longevity risk from individual plans to the system when participants retire. This is managed via a transfer of the expected present value of benefit payments from the member and municipal accounts to the Retired Reserve. Once this transfer occurs, the plan no longer has risk associated with the retiree outliving their expected lifetime assumption as long as the plan remains in the System.

Plans in PMRS range in plan participant counts from 1 to nearly 1,000. There is always a risk that actual demographic experience will vary from the assumptions, but this is magnified

SECTION I – BOARD SUMMARY

when plans with smaller counts deviate from assumptions. This deviation can cause volatility in the liabilities and the associated MMO. The demographic experience of the System is reviewed every 5 years to ensure that assumptions reflect the experience of the plans of the System as a whole.

System Level:

All retirees are paid from the Retired Reserve Account which is funded through transfers of retirees from the individual plans. In this way, mortality risk is pooled among all individual plans, thereby decreasing the overall risk associated with mortality. As long as plans do not withdraw from PMRS, this retiree longevity risk stays within the System. Assumption changes that occur after the transfer to the Retired Reserve Account that increase the retiree liabilities (such as mortality assumption changes or reduction in the discount rate) can cause a gap between the Retired Reserve Account and the System's retiree liabilities. If the retiree liabilities are not fully funded by the Retired Reserve Account and there are surplus assets available under PMRS Policy Statement 05-2, then the Board may transfer undistributed excess earnings to the Retired Reserve Account to ensure these liabilities are fully funded.

3) **Withdrawal Risk** is the risk that plans withdraw from the System.

Plan Level:

If an individual plan withdraws from the System, then all future risks associated with longevity and market fluctuations will be recognized, because the assets that are distributed to the plan on withdrawal are marked to the market value of assets of the System.

System Level:

If a significant number of plans withdraw from the System, there could be risk to the System because the economies of scale for services provided may be more difficult to provide and the depletion in assets may greatly change the System's exposure to investment risk, longevity risk, and managing expenses. Historically, there have been relatively few plans that have withdrawn from PMRS in the past 10 years. In fact, the number of pension plans in total has increased from 696 defined benefit plans and 203 cash balance plans as of January 1, 2009 to 723 defined benefit plans and 323 cash balance plans as of January 1, 2019. The active participant count over that same time period has grown from 3,909 to 6,189 participants. When plans withdraw from PMRS, the Pennsylvania Municipal Retirement Law states that the asset refund provided to the withdrawing plan is not to exceed the pro rata portion of the market value assets "as of the date of receipt of the application for permission to withdraw to prevent plans from leaving with higher reserve accounts". This provision protects the System from anti-selection risk when participating employer requests a withdrawal..

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SECTION II – ASSETS

The System’s assets play a key role in the financial operation and in the decisions the Board may make with respect to future deployments. The level of assets, the allocation of assets among asset classes, and the methodology used to measure assets can impact benefit levels, Municipal and County contributions, and the ultimate security of participants’ benefits.

In this section, we present detailed information on total (county & non-county) System assets including:

- **Disclosure** of System assets at December 31, 2018 and December 31, 2017;
- Statement of the **changes** in market values during the year;
- Development of the **actuarial value of assets**; and
- Allocation of **excess interest**.

Disclosure

The market value of assets represents a “snap-shot” or “cash-out” value, which provides the principal basis for measuring financial performance from one year to the next. Market values, however, can fluctuate widely with corresponding swings in the market.

The actuarial values are a reflection of the market values and the aggregate reserves being credited to each participating employer. They are used for evaluating the System’s ongoing liability to meet its obligations to pay benefits when due.

Table II-1 summarizes the market value of assets by asset class as provided in the December 31, 2018 PMRS CAFR.

Table II-1		
Statement of Assets at Market Value December 31 (\$ Thousands)		
	2018	2017
Assets		
Equity Investments	\$ 1,459,723	\$ 1,658,662
Accounts Receivable	4,243	5,599
Fixed Income Investments	416,101	408,219
Real Estate Investments	486,313	438,583
Fixed Assets	383	442
Accounts Payable	(4,810)	(4,815)
Net Pension Liability	(3,938)	(4,475)
Net OPEB Obligation Liability	(5,197)	(6,768)
Investment Purchases Payable	(1,860)	(4,155)
Net Deferred Outflow of Resources	(1,578)	328
Total Market Value of Assets	\$ 2,349,380	\$ 2,491,620

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Table II-2 summarizes the transaction of the assets during the year leading up to our valuation.

Table II-2 Changes in Market Value in (\$ Thousands)		
Market Value of Assets – January 1, 2018		\$ 2,491,620
<u>Additions</u>		
Contributions:		
Municipal Employers	\$ 61,289	
Plan Members	23,008	
Assessments	258	
Total Contributions		\$ 84,555
Investment Income:		
Net Appreciation In Fair Value Of Investments	\$ (142,496)	
Short-Term And Other Investments	1,038	
Common And Preferred Stock	13,642	
Real Estate Equity	19,927	
International Equities	6,974	
Less Investment Expenses	(12,306)	
Net Investment Income		\$ (113,221)
Total Additions		(28,666)
<u>Deductions</u>		
Annuity Benefits	\$ (107,644)	
Transfers to other plan administrators	(160)	
Administrative Expenses	(5,771)	
Total Deductions		\$ (113,575)
Market Value of Assets – January 1, 2019		\$ 2,349,380

From Table II-2 the benefit payments, transfers out of the system, and administrative expenses of \$113.6 million exceeds contribution income and transfers into the system of \$84.6 million resulting in a net negative cash flow of \$29.0 million, which is approximately 1.2% of the end of year Market Value of Assets.

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SECTION II – ASSETS

Actuarial Value of Assets

The Actuarial Value of Assets is based on the individual municipal account balances maintained by PMRS, also referred to as reserves.

This asset valuation method also takes into account the calculation of *excess interest* which is derived from income in excess of the long-term investment return assumption and when the Market Value of Assets exceeds the Actuarial Value of Assets. The steps in the determination of the Actuarial Value of Assets as of December 31, 2018 are shown below. When the Market Value of Assets exceeds the Actuarial Value of Assets there is a surplus. However, the Market Value of Assets is less than the Actuarial Value of Assets by \$179.5 million as of December 31, 2018, and after adjusting for the prior year’s surplus of \$61.3 million, the new deficit this year is \$240.8 million. This deficit represents 10.25% of the Market Value of Assets. Based on the funding structure of the System, it is currently anticipated that this difference will be made up by future investment returns in excess of the current crediting rate assumption of 5.25%.

Table II-3 Development of Actuarial Value of Assets (\$ Thousands)	
1. Prior Year Actuarial Value Reflecting Excess Interest:	\$ 2,430,350
2. Total Audited Reserve Accounts:	\$ 2,523,427
3. Expected Administrative Expenses:	<u>5,513</u>
4. Preliminary Actuarial Value (2. + 3.):	\$ 2,528,940
5. Current Year Market Value of Assets:	2,349,380
6. Prior Year Market Value of Assets:	2,491,620
7. New Surplus {Minimum of [(5. - 4.) & (5. - 4.) - (6. - 1.)]}:	(240,830)
8. Percentage of New Surplus Credited as Excess Interest: ^a	0.000%
9. Excess Interest (Maximum of 0 and (7. x 8.)) available:	\$ 0
10. Excess Interest awarded	\$ 0
11. Current Year Actuarial Value of Assets (4. + 10.):	\$ 2,528,940

^a See Table II-4b

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SECTION II – ASSETS

Excess Interest Allocation

Each year, municipalities may be eligible to receive a supplemental allocation of investment monies beyond the regular 5.25% interest rate. This “excess interest” award is derived as a portion of “new surplus” created during the year. “Surplus” refers to the excess of Market Value of Assets over the Actuarial Value of Assets. Once the preliminary actuarial asset value has been determined, a formula is used to determine the new surplus. Depending on the relative size of surplus to market value “margin,” between 10% and 90% of new surplus will be designated as “excess interest.”

For the year ended December 31, 2018, there was no surplus because the Market Value of Assets is less than the Actuarial Value of Assets. The calculation in Table II-4a details the calculation that leads to no excess interest for this year.

Table II-4a	
Determination of Excess Interest (\$ Thousands)	
1. Assets	
a. Market value	\$ 2,349,380
b. Preliminary Actuarial Value	<u>2,528,940</u>
c. Available Surplus (1a. - 1b.)	\$ (179,560)
2. Reserves	
a. Members	\$ 474,931
b. Municipal	911,884
c. Disability	359
d. Retired	1,134,709
e. DROP Participant Reserve Account	<u>1,544</u>
f. Total (2a. + 2b. + 2c. + 2d. + 2e.)	\$ 2,523,427
3. Last year's surplus	\$ 61,270
4. New surplus (1c. - 3.)	\$ (240,830)
5. Excess percent of New Surplus (see Table II-4b)	0.000%
6. Excess Interest Awarded	\$ 0
7. Percent of reserve {6. / (2f. - 2c.)}	0.00%
8. Trial Surplus (1c. - 6.)	\$ (179,560)
9. Trial margin percent (8. / 1a.)	0.00%

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SECTION II – ASSETS

1. Market Value of Assets	\$ 2,349,380
2. Available Surplus	\$ 0
3. Margin (2. / 1.)	0.00%
4. New Surplus	\$ 0
5. New Margin (4. / 1.)	0.00%
6. Excess Percent (10% + 800% x 3.) / (100% + 800% x 5.)	0.00%

As of the valuation date, the System has a no surplus in assets. Therefore, no excess interest is awarded to participating municipalities and counties.

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SECTION III – LIABILITIES

Disclosure

The present value of all benefits is the measure of the total expected obligations of the System reflecting the expected future benefit accruals of active participants and the payout stream of all benefits. When compared to the sum of the Market Value of Assets and present value of future contributions the balance (surplus)/deficit, which for the deficit position can only be filled with excess returns increasing the asset value.

The Actuarial Liability is used for funding calculations. The Actuarial Liability is calculated taking the present value of benefits less the present value of future normal costs under the **Entry Age Normal** funding method.

The following table presents the different liability measurements reflecting actual municipal liabilities and a roll-forward of county plan liabilities for the 2019 valuation. The Present Value of Future Contributions is based upon the Present Value of Future Normal Cost and future amortization of unfunded/(surplus) as of the January 1, 2019 valuation for the municipal defined benefit plans. This information for the county plans is based upon the prior year valuation results rolled forward one year. For the analysis of the deficit/surplus of the Present Value of Benefits (PVB) outlined below, the PVB of the cash balance plans equals the AL because for funding purposes these plans are by definition currently set to be fully funded due to their plan design.

Table III-1		
Obligation Deficit/(Surplus) Analysis of All PMRS Plans*		
	January 1, 2019	January 1, 2018
<u>Present Value of All Benefits - Total Obligation</u>		
Active Participant Benefits	\$ 1,777,076,100	\$ 1,740,624,198
Retiree and Inactive Benefits	<u>1,258,545,895</u>	<u>1,175,715,217</u>
Present Value of Benefits (PVB)	\$ 3,035,621,995	\$ 2,916,339,416
Present Value of Future Contributions (PVFC)	(569,229,134)	(592,052,494)
Municipal Market Value of Assets (MVA)	<u>(2,349,379,775)</u>	<u>(2,491,619,728)</u>
Net (Surplus)/Deficit of Resources to Obligation (PVB + PVFC + MVA)	\$ 117,013,086	\$ (167,332,806)
<u>Actuarial Liability</u>		
Present Value of Benefits (PVB)	\$ 3,035,621,995	\$ 2,916,339,416
Present Value of Future Normal Cost Contributions (PVFNC)	<u>(515,477,681)</u>	<u>(515,427,496)</u>
Actuarial Liability (AL = PVB + PVFNC)	\$ 2,520,144,314	\$ 2,400,911,920
Municipal Actuarial Value of Assets (AVA)	<u>(2,528,939,742)</u>	<u>(2,404,498,404)</u>
Net Unfunded/(Surplus) (AL + AVA)	\$ (8,795,428)	\$ (3,586,484)

*Unrounded values may differ from the rounded values in other sections of report

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SECTION III – LIABILITIES

Changes in Liabilities

The Actuarial Liabilities shown in the following table change with each valuation based on the experience of the Plan. The majority of the liabilities are associated with the municipal defined benefit plans, which were last valued as of January 1, 2017, so the gains/losses reflected below reflect a two year period. The liability may change for any of several reasons, including:

- New hires since the last full valuation
- Benefits accrued (normal cost) since the last valuation
- Plan amendments (benefit changes) including excess interest benefit improvements
- Interest on Actuarial Liability
- Benefits paid (benefit payments) to retirees and beneficiaries
- Participants leaving employment at rates different than expected (gains/losses)
- Participants transferring to other Plans within the System
- Plans transferring into and out of the System
- Changes in actuarial assumptions
- Changes in actuarial methods

The following table shows the sources of the Actuarial Liability changes since the last valuation based on the individual GASB results. .

Table III-2 Actuarial Liability Reconciliation	
Actuarial Liability as of 1/1/2018	\$ 2,400,911,920
Actuarial Liability as of 1/1/2019	2,520,144,314
Liability Increase/(Decrease)	119,232,394
Changes due to	
Normal Cost	\$ 65,593,756
Interest	126,186,495
Benefit Changes	12,267,276
(Gains)/Losses	23,628,781
Benefit Payments	(107,225,508)
Transfers	(1,218,406)
Total	\$ 119,232,394

PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019

SECTION IV – CONTRIBUTIONS

In the process of evaluating the financial condition of any pension plan, the actuary analyzes the assets and liabilities to determine the contributions needed based upon the funding policy established for the plan. Typically, the actuarial process will use a funding technique that will result in a pattern of contributions that are both stable and predictable.

For each of the plans covered by the System, the funding cost method as stipulated by law to be applied in the determination of the liability is the **Entry Age Normal Actuarial Cost Method**. This method is also relevant for accounting standards, as it is an acceptable cost method for GASB 67/68. Incorporating this cost method results in four components used to determine the total contribution: the **normal cost**, the amortization of **initial unfunded actuarial liability**, any subsequent amortizations of **increases/decreases in the unfunded actuarial liability/or adjustment for surplus**, and **expenses** applied at the rate of \$20 per participant.

The statutory funding method requires that increases/decreases resulting from experience gains or losses by plan get amortized over the lesser of 20 years or the future working life of the active participants. Increases/decreases from assumption changes by the System are amortized over 15 years or the future working life of the active participants. Changes in liabilities as a result of changes in benefits by plan are amortized over 20 years if state mandated, otherwise over 10 years for active employees and 1 year for inactive employees. There are exceptions to some of these rules for plans in differing levels of “distress” as defined by under Act 205.

For benefit improvements related to excess interest distributions, the impacted plans receive funds through their excess interest distribution to fully fund the excess interest benefit improvement. Therefore, there is no impact on the unfunded liabilities as a result of the excess interest benefit improvements.

For plans with a surplus, the contribution rate is the normal cost offset by 10% of the surplus. This report provides an analysis of the aggregate assets and liabilities but not the aggregation of the Minimum Municipal Obligations (MMO) required for each participating municipality covered by the 2019 Act 205 forms for 2021 and 2022 MMO contributions. The combination of underfunded and surplus plans would not necessarily be informative in reviewing the overall funded status of the System.

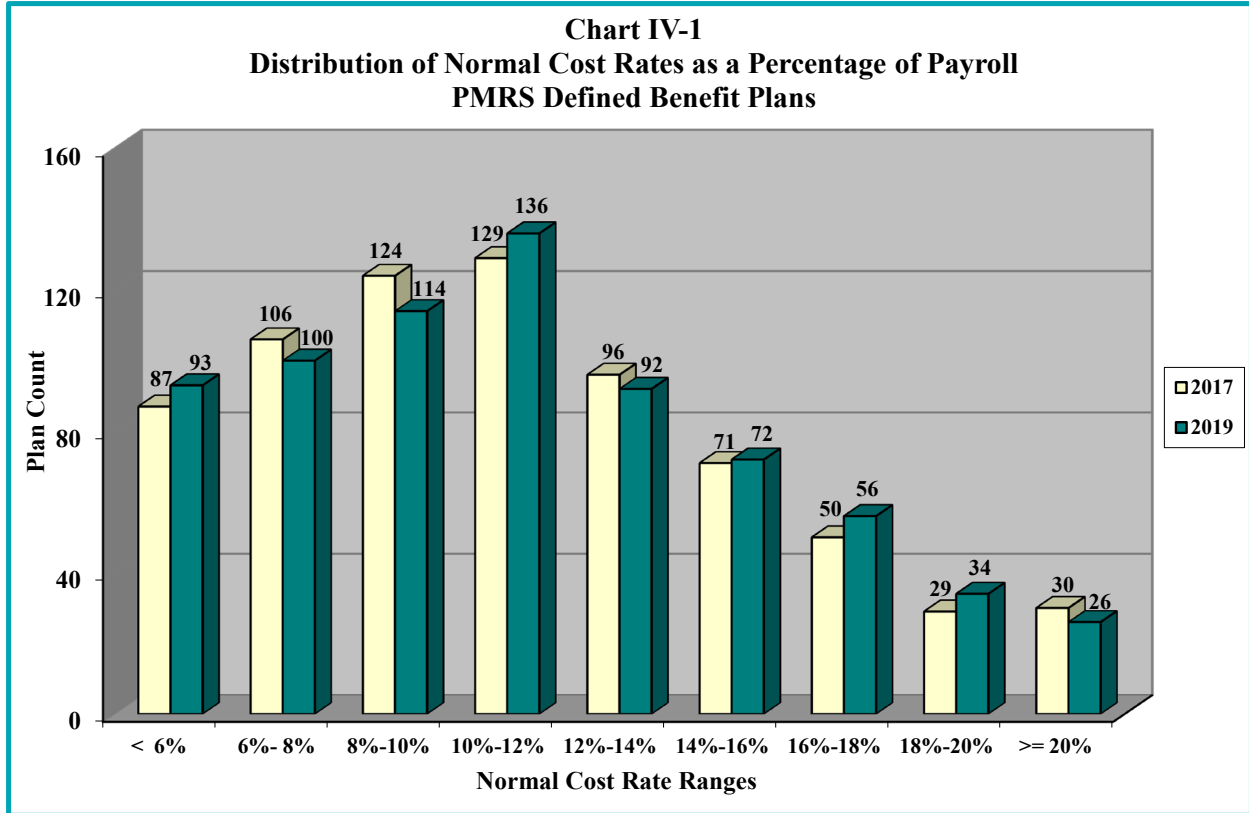
On the following pages, we describe the cost components and provide graphically the distribution of costs among the participating municipalities.

The normal cost rate (i.e., normal cost as a percent of payroll) is determined in the following steps. For a typical new entrant, an individual normal cost rate is determined by taking the present value of future normal costs as of entry age into the plan divided by that member’s present value of expected future salary during their working lifetime. The total normal cost rate is reduced by the member contribution rate to produce the employer normal cost rate. If a plan provides for a Separate Member Annuity through required member contributions, this contribution rate is then added to the total normal cost rate to determine the final total normal cost rate.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION IV – CONTRIBUTIONS

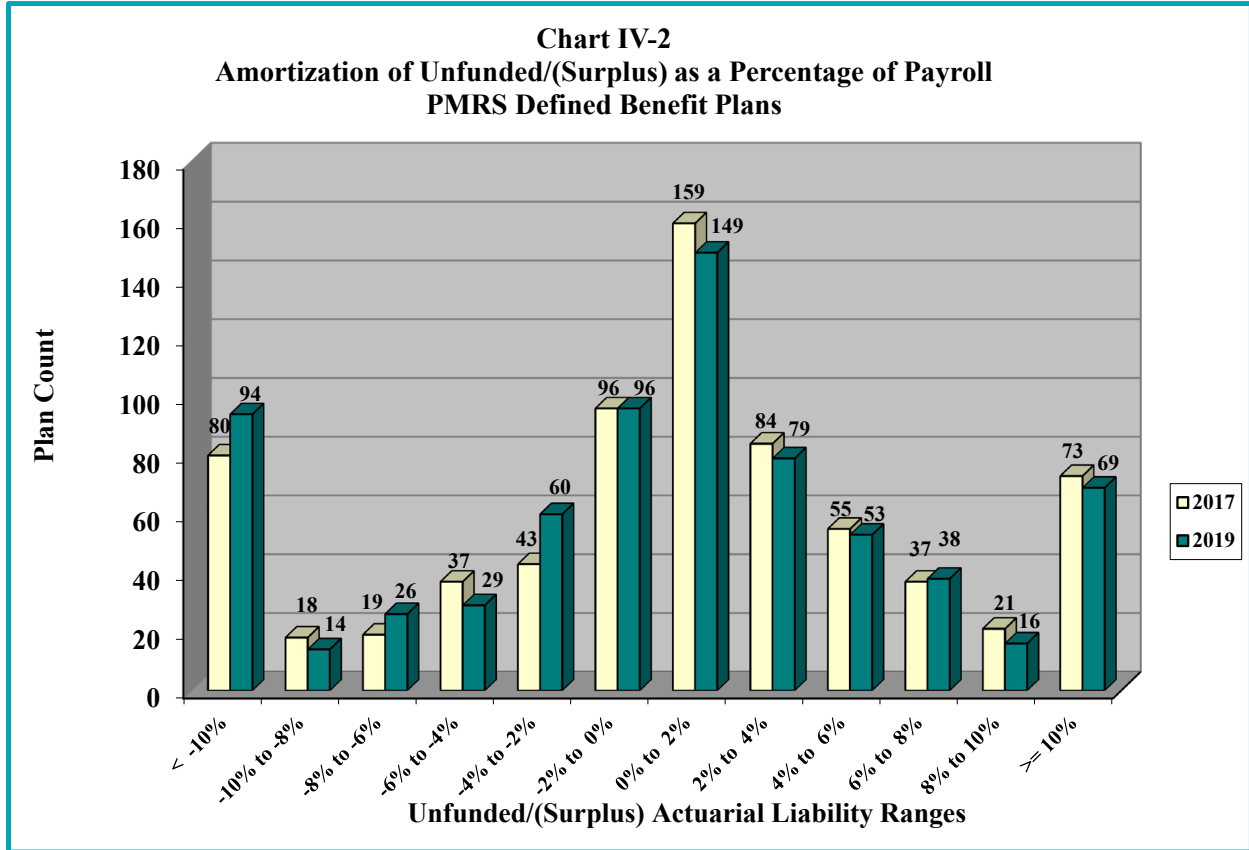
The following chart is a summary of the normal cost rates, which is the normal cost as a percentage of payroll, determined for the traditional defined benefit plans as of January 1, 2017 and January 1, 2019.



**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION IV – CONTRIBUTIONS

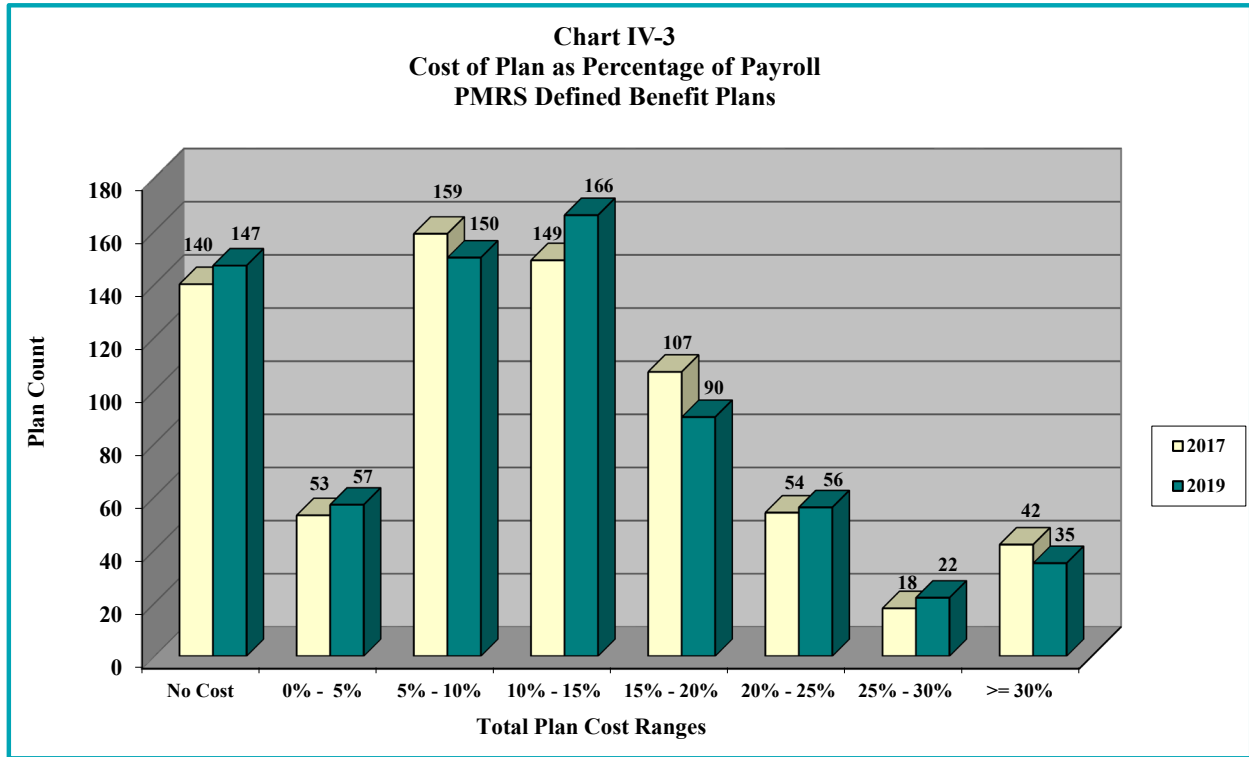
Chart IV-2 below is a summary of the unfunded/(surplus) actuarial liability amortization costs defined as a percentage of covered payroll of each plan’s active members, determined for the traditional defined benefit plans as of January 1, 2017 and January 1, 2019.



**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION IV – CONTRIBUTIONS

Chart IV-3 below is a summary of the total costs as a percentage of covered payroll, representing the sum of the normal cost and amortization of unfunded/(surplus) offset determined for the traditional defined benefit plans as of January 1, 2017 and January 1, 2019.



**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION V – ACCOUNTING AND FINANCIAL STATEMENT INFORMATION

GASB Statements No. 67 (GASB 67) and No. 68 (GASB 68) established standards for disclosure of pension information by public employee retirement systems and governmental employers in notes to financial statements and supplementary information. The System is defined as an agent multiple-employer plan system under GASB 67. The assets of an agent multiple-employer plan system are pooled for investment purposes but separate accounts are maintained for each individual participating employer. As a result, each participating employer's share of the pooled assets is legally available to pay the pensions of only its retirees.

The actuarial liability is determined assuming that the System is on-going and participants continue to terminate employment, retire, etc., in accordance with the actuarial assumptions. Liabilities are discounted at the assumed valuation interest rate of 5.25% per annum.

Tables V-1 through V-6 provide the exhibits to be used with the System's Comprehensive Annual Financial Report based upon review of GASB 67 and input from PMRS:

- Table V-1 is the Note to Required Supplementary Information;
- Table V-2 is the Solvency Test which shows the portion of Actuarial Liability covered by Assets;
- Table V-3 is the Funded Status of Actuarial Liabilities;
- Table V-4 is the Schedule of Retirees and Beneficiaries;
- Table V-5 is the Schedule of Total Membership by Status with Six Year Trend; and
- Table V-6 is the Schedule of Total Membership and Salary.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION V – ACCOUNTING AND FINANCIAL STATEMENT INFORMATION

**Table V-1
NOTE TO REQUIRED SUPPLEMENTARY INFORMATION**

The information presented in the required supplementary schedules was determined as part of the actuarial valuation at the date indicated. Additional information as of the latest actuarial valuation follows.

Valuation date	January 1, 2018 – County Plans January 1, 2019 – Cash Balance (CB) and Municipal plans that are not CB
Measurement date	January 1, 2019
Actuarial cost method	Entry Age Normal
Amortization method	Level dollar for Plan Bases and an average for Aggregate Gain/Loss, 10% of surplus is credited against aggregate cost where applicable
Actuarial assumptions:	
Investment rate of return*	5.25%
Projected salary increases*	2.8%-7.05%
*Includes inflation at	2.8%
Cost-of-living adjustments	ad hoc

The actuarial assumptions used have been adopted by the System’s Board based on the most recent review of the System’s experience for the period January 1, 2009 through December 31, 2013 and completed in 2015 and the updated investment rate of return assumption of 5.25% as of January 1, 2017.

The rate of employer contributions to the System is composed of the normal cost, amortization of the unfunded actuarial liability and an allowance for administrative expenses. The normal cost is a level percent of payroll cost which, along with member contributions, will pay for projected benefits at retirement for the average plan participant. The actuarial liability is that portion of the present value of projected benefits that will not be paid by future employer normal costs or member contributions. The difference between this liability and the funds accumulated as of the same date is the unfunded actuarial liability (or surplus if funds exceed the liabilities). The allowance for administrative expenses is based on the System’s actual administrative expenses.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION V – ACCOUNTING AND FINANCIAL STATEMENT INFORMATION

**Table V-2
SOLVENCY TEST
Aggregate Accrued Liabilities for**

Valuation Date January 1,	Active Member Contributions (1)*	Retirees, Beneficiaries & Vested Terminated (2)	Active Member Employer Financed Contributions (3)	Actuarial Value of Reported Assets	Portion of Accrued Covered by Reported		
					(1)	(2)	(3)
2019	\$474,930,885	\$1,258,545,895	\$786,667,534	\$2,528,939,742	100%	100%	101%
2018	460,805,568	1,175,715,217	764,391,135	2,404,498,404	100%	100%	100%
2017	451,613,188	1,114,835,472	754,316,724	2,270,278,691	100%	100%	93%
2016	435,834,498	999,866,637	715,640,331	2,153,625,821	100%	100%	100%
2015	427,736,008	938,380,470	701,148,372	2,081,439,591	100%	100%	102%
2014	416,472,872	881,502,593	707,246,642	1,972,273,674	100%	100%	95%

*Includes the sum of the active member employee contribution balances, the member separate annuity account balances, the municipal for member separate annuity account balances, and the excess interest allocations as provided in the CAFR.

**Table V-3
Funded Status of Actuarial Liabilities**

Valuation Date January 1,	Actuarial Value of Assets (A)	Actuarial Liability (AL) Entry Age (B)	Unfunded AL (Surplus) (B-A)	Funded Ratio (A/B)	Discount Rate
2019	\$2,528,939,742	\$2,520,144,314	\$(8,795,428)	100.4%	5.25%
2018	2,404,498,404	2,400,911,920	(3,586,484)	100.1%	5.25%
2017	2,270,278,691	2,320,765,384	50,486,693	97.8%	5.25%
2016	2,153,625,821	2,151,341,466	(2,284,355)	100.1%	5.50%
2015	2,081,439,591	2,067,264,850	(14,174,741)	100.7%	5.50%
2014	1,972,273,674	2,005,222,107	32,948,433	98.4%	5.50%

The actuarial assumptions as of January 1, 2019 are shown in the assumptions and methods section which are used, along with the participant data and plan provisions provided by PMRS, to determine the liabilities above. The following table shows the number of pension plans valued each year, and which plans have liabilities rolled-forward from the prior year.

Valuation of Liabilities – Number of Plans Includes

Valuation Date	Complete Valuation	Roll-Forward	Cash Balance Plans
January 1, 2019	719	4	323
January 1, 2018	4	726	314
January 1, 2017	718	4	311
January 1, 2016	4	718	294
January 1, 2015	717	4	286
January 1, 2014	4	712	268

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION V – ACCOUNTING AND FINANCIAL STATEMENT INFORMATION

The table below is a schedule of the changes to the retiree and beneficiary rolls over the last six years.

Valuation Date	Average Added	Average		Average Deleted	Annual Annuities Removed	Number on roll	Annual Annuities	Percentage Increase in Annuities	Average Annual Annuities	Percent Increase in Average Annuities
		Annual Annuities Added	Annual Benefit Increase							
January 1, 2019	429	\$ 19,572	\$ 419	146	\$ 8,147	6,189	\$ 101,399,088	7.8%	\$ 16,384	2.9%
2018	383	18,912	575	176	9,325	5,906	94,073,168	6.5%	15,928	2.7%
2017	447	18,744	490	108	8,174	5,699	88,360,677	9.5%	15,505	2.9%
2016	339	18,888	161	87	18,915	5,360	80,729,221	6.3%	15,061	1.3%
2015	392	17,908	185	227	10,494	5,108	75,936,364	6.6%	14,866	3.1%
2014	431	20,472	430	168	16,043	4,943	71,257,797	9.5%	14,416	3.7%

The table below is a summary of the total membership over the last six years.

Valuation Date	Active Members:		Deferred Pensions	Inactive Members*	Total		
	Active Defined Benefit	Cash Balance					
January 1, 2019	7,949	1,446	5,550	639	1,168	40	16,792
2018	7,868	1,387	5,307	599	1,090	35	16,286
2017	7,728	1,303	5,099	600	1,150	28	15,908
2016	7,698	1,274	4,784	576	1,173	7	15,512
2015	7,580	1,214	4,566	542	1,027	8	14,937
2014	7,676	1,185	4,423	520	1,044	14	14,862

* Inactive members represent inactive non-vested participants with employee contribution account balances.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

SECTION V – ACCOUNTING AND FINANCIAL STATEMENT INFORMATION

The table below is a schedule of the total membership over the last four years.

Table V-6 Schedule of Total Membership and Salary				
	2019	As of January 1^a		2016
		2018	2017	
a. Retirees currently receiving benefits	5,550	5,307	5,099	4,784
b. Beneficiaries currently receiving benefits	639	599	600	576
c. Terminated vested employees entitled to future benefits from Defined Benefit Plans	853	797	834	872
d. Terminated non-vested employees entitled to contribution refunds from Defined Benefit Plan:	40	35	28	7
e. Active employees in defined benefit plans	7,949	7,868	7,728	7,698
i. Aggregate Salary ^b	\$455,352,355	\$434,554,380	\$422,621,214	\$394,133,120
ii. Vested ^c	4,470	4,553	4,573	4,676
iii. Non-vested	3,479	3,315	3,156	3,022
f. Non-Retired Participants in cash balance plans	1,761	1,680	1,619	1,575
i. Aggregate Salary	\$63,302,730	\$60,013,152	\$53,998,354	\$51,642,049
ii. Active	1,446	1,387	1,303	1,274
iii. Inactive	315	293	316	301

a Includes traditional defined benefit non-county plans, traditional defined benefit county plans, and cash balance plans

b Annualized salary paid during the prior plan year for Traditional Defined Benefit plan participants and actual salary for active cash balance participants

c Count of vested participants estimated based on service as of the valuation date

PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
 ACTUARIAL VALUATION AS OF JANUARY 1, 2019

APPENDIX A – MEMBERSHIP INFORMATION

**Distribution of All Active Members
 by Age and Service as of January 1, 2019**

COUNTS BY AGE/SERVICE

Age	Service										Total
	1 year or less	1 to 2	2 to 3	3 to 5	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 & up	
Under 20	7	0	0	0	0	0	0	0	0	0	7
20 to 24	125	70	37	37	2	0	0	0	0	0	271
25 to 29	153	142	106	144	82	5	0	0	0	0	632
30 to 34	165	107	88	148	198	85	4	0	0	0	795
35 to 39	117	101	76	148	202	182	80	1	0	0	907
40 to 44	90	66	61	134	171	162	183	40	4	0	911
45 to 49	95	87	77	122	187	197	215	152	76	8	1,216
50 to 54	98	66	74	121	206	221	237	200	142	79	1,444
55 to 59	71	59	68	110	192	231	231	160	166	221	1,509
60 to 64	47	43	39	71	160	182	170	157	124	215	1,208
65 & up	10	14	26	22	77	83	75	50	51	87	495
Total	978	755	652	1,057	1,477	1,348	1,195	760	563	610	9,395

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

APPENDIX A – MEMBERSHIP INFORMATION

**Distribution of Active Defined Benefit Members
by Age and Service as of January 1, 2019**

COUNTS BY AGE/SERVICE

Age	Service										Total
	1 year or less	1 to 2	2 to 3	3 to 5	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 & up	
Under 20	6	0	0	0	0	0	0	0	0	0	6
20 to 24	104	56	27	30	2	0	0	0	0	0	219
25 to 29	131	128	92	116	72	5	0	0	0	0	544
30 to 34	135	97	77	137	183	72	4	0	0	0	705
35 to 39	98	86	63	133	183	164	72	1	0	0	800
40 to 44	77	56	51	114	148	145	166	38	4	0	799
45 to 49	79	63	60	94	151	176	187	131	68	7	1,016
50 to 54	73	56	62	102	163	187	206	181	130	67	1,227
55 to 59	58	45	53	92	152	197	201	130	146	199	1,273
60 to 64	35	34	32	54	122	157	143	121	100	183	981
65 & up	8	10	23	16	56	64	61	41	40	60	379
Total	804	631	540	888	1,232	1,167	1,040	643	488	516	7,949

PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
 ACTUARIAL VALUATION AS OF JANUARY 1, 2019

APPENDIX A – MEMBERSHIP INFORMATION

**Distribution of Active Cash Balance Members
 by Age and Service as of January 1, 2019**

COUNTS BY AGE/SERVICE

Age	Service										Total
	1 year or less	1 to 2	2 to 3	3 to 5	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 & up	
Under 20	1	0	0	0	0	0	0	0	0	0	1
20 to 24	21	14	10	7	0	0	0	0	0	0	52
25 to 29	22	14	14	28	10	0	0	0	0	0	88
30 to 34	30	10	11	11	15	13	0	0	0	0	90
35 to 39	19	15	13	15	19	18	8	0	0	0	107
40 to 44	13	10	10	20	23	17	17	2	0	0	112
45 to 49	16	24	17	28	36	21	28	21	8	1	200
50 to 54	25	10	12	19	43	34	31	19	12	12	217
55 to 59	13	14	15	18	40	34	30	30	20	22	236
60 to 64	12	9	7	17	38	25	27	36	24	32	227
65 & up	2	4	3	6	21	19	14	9	11	27	116
Total	174	124	112	169	245	181	155	117	75	94	1,446

PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019

APPENDIX A – MEMBERSHIP INFORMATION

**Pennsylvania Municipal Retirement System Distribution of All Active Members
by Age and Service as of January 1, 2019**

AVERAGE SALARY BY AGE/SERVICE

Age	Service										Total
	1 year or less	1 to 2	2 to 3	3 to 5	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 & up	
Under 20	\$23,867	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$23,867
20 to 24	\$35,040	\$40,092	\$43,715	\$48,357	\$92,717	\$0	\$0	\$0	\$0	\$0	\$39,773
25 to 29	\$36,461	\$42,338	\$47,167	\$51,589	\$56,166	\$57,972	\$0	\$0	\$0	\$0	\$45,751
30 to 34	\$39,161	\$47,965	\$49,340	\$55,130	\$55,879	\$59,360	\$65,843	\$0	\$0	\$0	\$50,903
35 to 39	\$41,403	\$46,894	\$52,407	\$54,911	\$58,030	\$64,380	\$67,680	\$82,823	\$0	\$0	\$55,818
40 to 44	\$41,272	\$46,324	\$50,673	\$48,673	\$56,222	\$64,165	\$71,604	\$68,139	\$52,236	\$0	\$57,554
45 to 49	\$42,732	\$44,527	\$49,849	\$50,463	\$54,253	\$61,123	\$67,528	\$69,725	\$73,252	\$61,679	\$58,629
50 to 54	\$34,724	\$50,815	\$46,480	\$52,421	\$53,279	\$56,522	\$59,747	\$65,579	\$73,063	\$71,362	\$57,683
55 to 59	\$40,673	\$49,799	\$53,373	\$52,693	\$53,628	\$55,324	\$58,368	\$60,937	\$66,614	\$66,732	\$57,897
60 to 64	\$36,998	\$42,501	\$54,966	\$54,103	\$54,018	\$52,185	\$57,940	\$58,078	\$60,881	\$63,283	\$56,138
65 & up	\$42,524	\$39,294	\$47,892	\$46,396	\$49,030	\$47,407	\$52,043	\$55,266	\$52,876	\$59,608	\$51,516
Total	\$38,508	\$45,414	\$49,585	\$52,208	\$54,859	\$58,006	\$62,507	\$63,360	\$66,527	\$65,034	\$55,205

PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019

APPENDIX A – MEMBERSHIP INFORMATION

**Inactive Benefit Payment Distribution
as of January 1, 2019**

COUNTS BY BENEFIT/AGE: RECEIVING PAYMENTS

Age	Monthly Benefit	Count
x < 30	\$3,548	5
30 <= x < 35	\$5,503	5
35 <= x < 40	\$8,502	9
40 <= x < 45	\$12,427	21
45 <= x < 50	\$35,871	45
50 <= x < 55	\$192,099	136
55 <= x < 60	\$656,415	363
60 <= x < 65	\$1,783,115	1,067
65 <= x < 70	\$2,404,940	1,506
70 <= x < 75	\$1,637,626	1,282
75 <= x < 80	\$884,441	807
80 <= x < 85	\$478,500	498
85 <= x	\$346,939	445
<Total>	\$8,449,924	6,189

COUNTS BY BENEFIT/AGE: DEFERRED PAYMENTS

Age	Monthly Benefit	Count
x < 30	\$850	9
30 <= x < 35	\$10,253	43
35 <= x < 40	\$29,896	71
40 <= x < 45	\$76,912	113
45 <= x < 50	\$165,926	222
50 <= x < 55	\$188,811	276
55 <= x < 60	\$207,149	282
60 <= x < 65	\$80,924	138
65 <= x < 70	\$3,908	11
70 <= x < 75	\$394	3
75 <= x < 80	\$0	0
80 <= x < 85	\$0	0
85 <= x	\$0	0
<Total>	\$765,022	1,168

Deferred payments listed above are attributable to the non-cash balance defined benefit plans only. Deferred payments to the 315 cash balance participants will be determined upon their retirement.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

APPENDIX A – MEMBERSHIP INFORMATION

Pensions in Payment on January 1, 2019 by Type and Amount						
Monthly Amount	Total	Normal	Involuntary early	Pension Type Voluntary early	Service disability	Non-service disability
Total	6,189	5,212	223	632	53	69
Under \$100	279	244	18	15	1	1
\$ 100 - \$199	338	276	28	33	1	0
200 - 299	323	259	26	38	0	0
300 - 399	330	267	24	34	3	2
400 - 499	331	271	25	31	2	2
500 - 599	322	265	9	40	2	6
600 - 699	272	217	18	33	3	1
700 - 799	272	223	12	34	1	2
800 - 899	267	213	11	32	2	9
900 - 999	250	198	6	31	6	9
1,000 - 1,199	505	404	15	67	5	14
1,200 - 1,399	382	300	11	60	5	6
1,400 - 1,599	352	295	4	38	8	7
1,600 - 1,799	252	220	5	24	1	2
1,800 - 1,999	248	208	4	30	5	1
2,000 - 2,199	212	187	3	18	2	2
2,200 - 2,399	201	179	3	18	1	0
2,400 - 2,599	160	144	0	14	1	1
2,600 - 2,799	132	118	0	11	1	2
2,800 - 2,999	108	103	0	3	0	2
3,000 - 3,499	254	237	1	14	2	0
3,500 - 3,999	171	163	0	8	0	0
4,000 and over	228	221	0	6	1	0

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2019**

APPENDIX A – MEMBERSHIP INFORMATION

Pensions Awarded in Prior Ten Years, by Type and Monthly Amount											
Year Ended December 31:	Total		Normal		Involuntary early		Voluntary early		Disability		
	Number	Average Monthly Amount	Number	Average Monthly Amount	Number	Average Monthly Amount	Number	Average Monthly Amount	Number*	Average Monthly Amount	
2009	296	1,336	249	1,412	17	339	26	1,300	4	(0)	1,067
2010	396	1,552	341	1,632	13	364	37	1,250	5	(0)	1,407
2011	438	1,367	352	1,496	37	459	40	1,180	9	(3)	888
2012	390	1,370	341	1,421	20	520	22	1,614	7	(2)	709
2013	431	1,706	364	1,800	17	905	34	1,280	16	(2)	1,319
2014	392	1,492	341	1,524	14	825	29	1,575	8	(2)	1,022
2015	339	1,574	309	1,593	4	562	22	1,569	4	(2)	1,113
2016	447	1,562	397	1,600	11	627	28	1,428	11	(3)	1,485
2017	383	1,576	342	1,616	8	822	29	1,350	4	(1)	1,311
2018	429	1,631	382	1,651	9	963	33	1,475	5	(4)	2,277

*Number of service-related disability pensions are shown in parentheses

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APPENDIX B – ACTUARIAL ASSUMPTIONS AND METHODS

Actuarial Assumptions:

The PMRS demographic actuarial assumptions were revised by the Board effective January 1, 2016, while the Regular Interest Rate (investment return assumption) was approved by the Board effective January 1, 2017:

A. Healthy Life Mortality:

Rates of Pre-Retirement Mortality

Males: RP 2000 Non-Annuitant Male table projected 15 years with Scale AA
Females: RP 2000 Non-Annuitant Female table projected 15 years with Scale AA, setback five years

Rates of Post-Retirement Mortality

Males: RP2000 Annuitant Male table projected 5 years with Scale AA
Females: RP2000 Annuitant Female table projected 10 years with Scale AA

Based on the information provided by PMRS and review of the actual mortality experience over a five-year period, these mortality tables provide projected mortality improvements for the future. Given that experience analysis is required to be performed every four years the projection periods are sufficient to reflect anticipated improvements until the next study is performed.

Service Related Mortality: 15% for municipal plans and 50% for uniform plans

B. Disabled Life Mortality Rates:

Males and females: RP 2000 with 10 year set forward

C. Termination Rates Before Retirement

Rates based on the number of active members in the pension plan, years of service, and the type of plan participants (non-uniform or uniform).

Municipal Participants (Non-Uniform) Number of Active Members in Plan		
Service	<25	25+
<1	15.0%	18.0%
1	15.0%	18.0%
2	11.0%	14.0%
3	8.0%	12.0%
4	7.0%	9.0%
5	6.0%	9.0%
6	5.5%	8.0%
7	5.5%	7.5%
8	5.5%	6.5%
9	4.0%	5.0%
10+	2.5%	4.0%

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Uniform Participants Number of Active Members in Plan		
Service	<25	25+
<1	12.0%	13.0%
1	12.0%	10.0%
2	12.0%	7.0%
3	9.0%	7.0%
4	7.0%	6.0%
5	5.0%	5.0%
6	5.0%	4.0%
7	5.0%	3.0%
8	4.5%	3.0%
9	4.0%	3.0%
10+	3.0%	3.0%

D. Disability Incidence Rates:

Municipal - 40% of 1964 OASDI (Social Security) Experience for Males with adjustments. Sample rates are:

Age	Rate
25	0.014%
35	0.029%
45	0.064%
55	0.134%
65	0.658%

Uniformed plans – 60% of 1964 OASDI (Social Security) Experience for Males with adjustments. Sample rates are:

Age	Rate
25	0.031%
35	0.058%
45	0.136%
55	0.335%
65	1.123%

Type of Disability:

- (a) 15% of disablements are assumed to be service related for municipal plans, and
- (b) 50% of disablements are assumed to be service related for uniform plans.

E. Workers Compensation: Service-related disability benefits payable from municipal plans are offset by 25% of final average salary.

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F. Salary Scale:

Age	Total Rate ¹ (including inflation)
25	7.05%
30	5.44%
35	4.55%
40	4.26%
45	3.97%
50	3.72%
55	3.44%
60	3.28%
65	2.80%

¹Add 2% for each of the first three years of service and additional 6% increase in year prior to normal retirement age

G. Rates of Retirement:

Municipal Members:

Members are assumed to retire over a range of ages as shown below.

Age	Rate ¹
<45	2%
45	8%
46	10%
47 – 50	15%
51 – 54	17%
55	22%
56 – 59	14%
60 – 64	18%
65	25%
66 – 74	20%
75	100%

¹ Rates indicated are adjusted by adding 5% (and 10% for ages 60-62 under current rate assumptions) for the year in which the member is first eligible for normal retirement.

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Uniform Members:

Members are assumed to retire over a range of ages as shown below.

Age	Rate
<49	0%
50	30%
51 – 54	10%
55	25%
56 – 58	20%
59 – 60	15%
61	20%
62	30%
63 – 64	20%
65	30%
66+	100%

H. Marital Status and Spouse’s Age (if applicable):

80% of active members are assumed to be married for retirees with the 50% Joint and Survivor form of payment. Male spouses are assumed to be three years older than female spouses.

I. Social Security Projections (if applicable):

- (a) The Social Security Taxable Wage Base will increase by 3.3% compounded annually;
- (b) The Consumer Price Index will increase 2.8% compounded annually; and
- (c) The Average Total Wages of All Workers will increase by 3.3% compounded annually.

J. Post-Retirement Cost of Living Increases (if applicable)/Inflation: 2.8% per year, subject to plan limitations.

K. Investment Return Assumption for municipal assets (Regular Interest Rate):

5.25% compounded annually (net of investment and certain administration expenses) for funding purposes.

L. Administrative Expenses

System-wide Actuarial Value of Assets: The expense assumption is based on the previous year’s actual expenses

Municipalities: The expense assumption is based on the expected expenses for the current year, as reported on the Act 205 forms.

Rationale for Assumptions: An experience study is completed every five years for the System. The assumptions outlined above were reviewed and adopted by the Board based on the most recent experience study for the period covering January 1, 2009 – December 31, 2013.

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APPENDIX B – ACTUARIAL ASSUMPTIONS AND METHODS

Actuarial Methods:

Contribution requirements are individually determined for each participating municipality, on an actuarial basis as described below in the Funding of the Unfunded Actuarial Liability section, at least biennially. The frequency of the actuarial valuation is determined by applicable Commonwealth statute (Act 205 of 1984 and Act 293 of 1972). The following actuarial methods were adopted effective January 1, 1985, unless indicated otherwise.

Actuarial Value of Assets:

The System's Actuarial Value of Assets equal the sum of all audited reserve accounts as of the valuation date, including Member, Municipal, Retired, Disability, and DROP Reserves, and a one-year administration expense reserve, plus the portion of any additional investment income to be distributed as "excess interest", based on the PMRS Policy Statement 05-2.

Each year, municipalities may receive an excess interest allocation derived as a portion of new surplus created during the prior year based on the current financial standing of the System. "Surplus" refers to the excess of fair market value over the actuarial value of assets. Once the preliminary actuarial value of assets has been determined, a formula is used to allocate the new surplus. Generally, depending on the relative size of surplus to fair market value, between 10 percent and 90 percent of the new surplus will become excess interest.

The Actuarial Value of Assets are set equal to reserves under the System based on the unique legislative structure of PMRS, which are increased annually at a rate agreed on by the Board named "Regular Interest" as defined under the Pennsylvania Municipal Retirement Law. Therefore, these assets do not necessarily relate directly or indirectly with the current market value of assets as required under Actuarial Standard of Practice Statement No. 44 which states under Section 3.3:

"...the actuary should select an asset valuation method that is designed to produce actuarial values of assets that bear a reasonable relationship to the corresponding market values. The qualities of such an asset valuation method include the following:

- a. The asset valuation method is likely to produce actuarial values of assets that are sometimes greater than and sometimes less than the corresponding market values.*
- b. The asset valuation method is likely to produce actuarial values of assets that, in the actuary's professional judgment, satisfy both of the following:*
 - 1. The asset values fall within a reasonable range around the corresponding market values. For example, there might be a corridor centered at market value, outside of which the actuarial value of assets may not fall, in order to assure that the difference from market value is not greater than the actuary deems reasonable.*
 - 2. Any differences between the actuarial value of assets and the market value are recognized within a reasonable period of time. For example, the actuary might use a method where the actuarial value of assets converges toward market value at a pace that the actuary deems reasonable, if the investment return assumption is realized in future periods.*

APPENDIX B – ACTUARIAL ASSUMPTIONS AND METHODS

In lieu of satisfying both (1) and (2) above, an asset valuation method could satisfy section 3.3(b) if, in the actuary's professional judgment, the asset valuation method either (i) produces values within a sufficiently narrow range around market value or (ii) recognizes differences from market value in a sufficiently short period."

The administrative rules adopted by the PMRS Board in conjunction with Pennsylvania Municipal Retirement Law, which are not subject to comply with Actuarial Standards of Practice (ASOP), when defining the Actuarial Value of Assets, does not necessarily meet the requirement of ASOP 44 Selection and Use of Asset Valuation Methods for Pension Valuations. The Actuarial Value of Assets provided within this report follow the Pennsylvania Municipal Retirement Law and the PMRS policy statement.

Actuarial Cost Method: Entry Age Normal Actuarial Cost Method.

The Entry Age Normal Actuarial Cost Method was used for active employees, whereby the normal cost is computed as the level annual percentage of pay required to fund the retirement benefits between each member's date of hire and assumed retirement. Entry age is defined as attained age less credited service. The normal cost is based on taking the value, as of entry age into the plan, of each member's projected future benefits. This value is then divided by the value, also at entry age, of each member's expected future salary producing a normal cost rate as a percent of salary. The normal cost rate is multiplied by current salary to determine each member's normal cost. If a plan provides for a Separate Member Annuity through required member contributions, this contribution rate is then added to the total normal cost rate to determine the final total normal cost rate. Within the MMO calculation, the normal cost is reduced by the member contribution to produce the employer normal cost to be paid.

The actuarial liability is the difference between the present value of future benefits and the present value of future normal cost. The unfunded actuarial liability is the difference between the actuarial liability and the actuarial value of assets.

Funding of the Unfunded Actuarial Liability:

Actuarial gains (or losses), including the effect of contributions greater or lesser than the previously determined actuarial level, are reflected by decreases (or increases) in the unfunded actuarial liability. Under Act 205 of 1984, and updated by Act 44, the unfunded actuarial liability for each plan is amortized as a level dollar amount over the lesser of:

- (a) (i) 30 years, with respect to the initial liability as of 1/1/85 (or first valuation);
- (ii) 20 years, with respect to actuarial gains and losses;
- (iii) 15 years, with respect to changes due to actuarial assumptions;
- (iv) 20 years, with respect to changes due to plan provisions (if state mandated);
- (v) 10 years, with respect to changes in benefits for currently active members and 1 year for retired members (if local benefit changes); or

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- (b) The average assumed working lifetime of active employees as of the date the liability was established. If there are no active employees, the unfunded liability is amortized one year after the liability was established.

With the two exceptions which follow, the funding method is applied individually with respect to each municipality:

- 1) Retired and disabled members are paid monthly benefits from the System's Retired Reserve account, which at the time of retirement receives a transfer from the municipal and member accounts in an amount actuarially determined to be sufficient to pay all future benefits for the member (and, if applicable, a surviving beneficiary). Thus, post-retirement experience is pooled with the System.
- 2) A disabled member's pension is met in part from the amount that can be provided by the value of that portion of the member's accrued benefit attributable to municipal contributions, with the balance of the pension being provided by the appropriate transfer from the Disability Reserve Account. The amount of annual transfer from the accumulated municipal contributions to the Disability Reserve Account is determined on the one year term cost basis, i.e., the expected cost of disabilities in the coming year.

If a plan is in a surplus position, then 10% of the surplus is credited against the aggregate cost of the plan.

Method to Estimate Rolled Forward Liabilities:

The defined benefit pension plans for municipalities are valued explicitly every odd calendar year. However, the liabilities for the County plans are explicitly valued every even calendar year. For the odd calendar years, we estimate the County Plan liabilities by rolling forward the prior year's liabilities. With the implementation of GASB 68, which required an individual report to be issued for each pension plan, the liabilities for the County defined benefit plans were rolled forward based on the actual benefit payments. These liabilities reflect the assumption changes and any material changes to the liabilities that may have occurred since the prior actuarial valuation. These rolled forward liabilities have been reflected in this report. The liabilities for all participants in pay status for these municipal pension plans are explicitly valued every year. The roll forward active and deferred vested liabilities were proportionally adjusted based on the prior year liabilities net of in pay status liabilities.

All other liabilities for the municipal and cash balance plans were explicitly valued as of January 1, 2019 based on the data, plan provisions, methods and assumptions.

Changes in Actuarial Assumptions and Methods:

None.