



# Pennsylvania Public School Employees' Retirement System

Actuarial Valuation Report  
June 30, 2018





May 31, 2019

Board of Trustees  
Pennsylvania Public School Employees'  
Retirement System  
5 North 5th Street  
Harrisburg, PA 17101

Ladies and Gentlemen:

This report presents the results of the annual actuarial valuation of the Pennsylvania Public School Employees' Retirement System (Retirement System or PSERS) as of June 30, 2018.

The valuation takes into account all of the promised benefits to which members are entitled as of June 30, 2018, including pension and survivor benefits, and as required by the Public School Employees' Retirement Code, 24 Pa. C.S. §8101 et. seq. (Retirement Code) is the basis for the contribution rate for fiscal year 2019/2020. In addition, the contribution rate indicated in the report includes a rate for anticipated employer contributions to the Pennsylvania Employees' Defined Contribution plan ("DC Plan") for future Class T-G, Class T-H and Class DC participants who become participants on or after July 1, 2019 and prior to July 1, 2020.

As required under Section 8502(j) of the Retirement Code, experience studies are performed once in every five-year period. This valuation was prepared on the basis of the demographic and economic assumptions that were recommended on the basis of an Experience Review covering the period from July 1, 2010 to June 30, 2015 and adopted by the Board of Trustees at their June 10, 2016 meeting. As mandated by the Retirement Code, these assumptions will remain in effect for valuation purposes until such time as the Board of Trustees adopts revised assumptions.

Reporting requirements of GASB Statements No. 67 and No. 68 took effect for PSERS at the June 30, 2014 and June 30, 2015 reporting dates, respectively. Also, reporting requirements of GASB Statements No. 74 and No. 75 took effect for PSERS at the June 30, 2017 and June 30, 2018 reporting dates, respectively. These requirements are addressed in separate reports.

### **Assets and Membership Data**

The Retirement System provided the individual data for members used in the valuation. While we did not verify the data at their source, we did perform tests for internal consistency and reasonableness. The amount of assets in the trust fund taken into account in the valuation was based on statements prepared for us by the Retirement System. The accuracy of the results presented in this report is dependent on the accuracy of the data.

### **Funding Adequacy**

The valuation results indicate that the employer contribution rate for fiscal year 2019/2020 is 34.29%. This rate includes a rate of .09% for employer contributions to the DC Plan. As of June 30, 2018, the total funded ratio of the plan (for Pensions and Health Insurance combined) is 56.5%, based on the accrued liability and actuarial value of assets calculated under the funding requirements of Section 8328 of the Retirement Code.

For the fourth consecutive year, the PSERS Board has certified the full employer contribution rate calculated by the actuary after 15 previous years of underfunding the actuarially required amount. This is an essential step to bring PSERS back to fully funded status. Full actuarial funding from employers, along with members contributions and investment income, are all necessary sources of funds that will pay down the unfunded liability of the System.

Unless stated otherwise, references to "funded ratio" and "unfunded accrued liability" are measured on an actuarial value of assets basis. It should be noted that if the same measurements were made using the market value of assets, different funded ratios and unfunded accrued liabilities would result. Moreover, the funded ratio presented is appropriate for evaluating the need and level of future contributions but makes no assessment regarding the funded status of the Retirement System if the Retirement System were to settle (i.e., purchase annuities to cover) a portion or all of its liabilities. Assuming contributions are made at the level indicated in the actuarial valuation and no future expected gains or losses, future expected plan contributions are expected to remain relatively level as a percent of payroll and the funded status is expected to increase.

### Financial Results and Membership Data

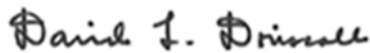
Detailed summaries of the financial results of the valuation and membership data used in preparing the valuation are shown in the valuation report. The actuaries prepared supporting schedules included in the Actuarial and Statistical Section of the PSERS Comprehensive Annual Financial Report (CAFR) and also provided historical data schedules included in the Financial Section of the CAFR.

Future actuarial measurements may differ significantly from current measurements due to Retirement System experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in Retirement System provisions or applicable law. Liability models necessarily rely on the use of approximations and estimates and are sensitive to changes in these approximations and estimates. Small variations in these approximations and estimates may lead to significant changes in actuarial measurements. An analysis of the potential range of such future differences is beyond the scope of this valuation.

Use of this report for any other purpose, or by anyone other than the Board of Trustees or the staff of PSERS or employers or its auditors, may not be appropriate and may result in mistaken conclusions because of failure to understand applicable assumptions, methods, or inapplicability of the report for that purpose. Buck should be asked to review any statement to be made on the basis of the results contained in this report. Buck will accept no liability for any such statement made without prior review by Buck.

David L. Driscoll is a Fellow of the Society of Actuaries and a Member of the American Academy of Actuaries. Edward Quinn and Salvador Nakar are Members of the American Academy of Actuaries. We meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and we are available to answer questions concerning it.

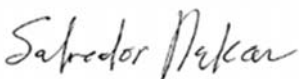
Buck Global, LLC



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# Pennsylvania Public School Employees' Retirement System

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## Executive Summary

This report presents the actuarial valuation as of June 30, 2018 for the Pennsylvania Public School Employees' Retirement System.

The principal valuation results include:

- The employer contribution rate for fiscal year 2019/2020, which is 34.29% (33.36% Pension plus 0.84% Premium Assistance plus 0.09% Act 5 DC contribution).
- The total funded ratio of the Retirement System determined as of June 30, 2018 under the funding requirements of Section 8328 of the Retirement Code is 56.5%, which is based on the accrued liability and the actuarial value of assets for Pensions and Health Insurance as of that date.
- The determination and analysis of actuarial experience in the year ending June 30, 2018, which consisted of a net experience loss of \$349 million.
- The Act 120 minimum employer pension rate is the normal cost rate of 7.49%.
- For the fourth consecutive year, the PSERS Board has certified the full employer contribution rate calculated by the actuary after 15 previous years of underfunding the actuarially required amount. This is an essential step to bring PSERS back to fully funded status. Full actuarial funding from employers, along with members contributions and investment income, are all necessary sources of funds that will pay down the unfunded liability of the System.
- The next Class T-E and Class T-F shared-risk valuation is to be performed for the nine-year period ending June 30, 2020. The Act 5-2017 member shared-risk contribution rates are discussed on page 12.
- Annual disclosures as of June 30, 2018 in accordance with the Governmental Accounting Standards Board (GASB) Statements No. 67 and 68 for Pensions and Statements No. 74 and 75 for the Health Insurance Premium Assistance Program have been provided in separate reports.

The valuation was completed based upon membership and financial data submitted by the Retirement System. Detailed summaries of the financial results of the valuation and membership data used in preparing the valuation are included in the valuation report. The actuaries prepared supporting schedules included in the Actuarial and Statistical Section of the PSERS Comprehensive Annual Financial Report (CAFR) and also provided historical data schedules included in the Financial Section of the CAFR.

## Changes Since Last Year

### Legislative and Administrative Changes

The benefit provisions and contribution provisions are summarized in Table 13. Act 5 of 2017 was passed in June of 2017. Under this legislation, any employee who becomes a member of the Retirement System on or after July 1, 2019 will have the option of electing Class T-G membership, Class T-H membership or Class DC participation within 90 days of becoming a member. Current active members and former PSERS members returning to active service will also be eligible to elect Class T-G or Class T-H membership or Class DC participation. In addition, Act 5 of 2017 establishes a defined contribution plan for future new members effective July 1, 2019. The "Hybrid Plan" benefit provisions are summarized as follows:

### Employees who become a member of the System on or after July 1, 2019

#### 1. Class T-G Membership - Hybrid Plan – Default Plan

##### a. Defined Benefit Plan Provisions

- Members will contribute 5.50% of pay.
- The annual benefit at retirement will be 1.25% of the highest five-year average pay multiplied by years of service. Eligibility for superannuation will be reached at the earlier of (1) attainment of age 67 with three years of service or (2) satisfaction of the Rule of 97 (i.e., the sum of the participant's age and service is greater than or equal to 97) and completion of at least 35 years of service.
- Members will vest after ten years of service and will be eligible to apply for immediate commencement of benefits. Benefits of members with less than 25 years of service electing to commence payment at or after age 62 but prior to superannuation eligibility will be reduced by the PSERS' actuarial equivalence factors based on an interest rate of 4.0%. Benefits of members electing to commence prior to age 62 will be reduced from superannuation to age 62 using the PSERS' actuarial equivalence factors based on an interest rate of 4.0% and further reduced from age 62 to commencement age using the PSERS' actuarial equivalence factors based on an interest rate equal to the expected rate of return on assets assumption as adopted by the Board.
- Members who terminate on or after attaining at least 25 years of service will be able to commence benefits immediately. Benefits commencing prior to eligibility for superannuation and on or after age 57 will be reduced by 3% for each year by which commencement occurs prior to superannuation eligibility. Benefits commencing prior to age 57 will be reduced by the PSERS' actuarial equivalence factors based on an interest rate of 4.0%.
- Members with five years of service will be eligible for disability benefits based on a 2.0% accrual rate.
- Members will be eligible to elect a cost-neutral Option 4 partial or full lump-sum distribution of accumulated deductions at benefit commencement.
- Members will be subject to a shared risk/gain provision, under which the member contribution rate will be no more than 3% below or 3% above the member's basic contribution rate, with rate increases or decreases made in increments of 0.75%.

- Members will be eligible for the Health Care Premium assistance program.
- b. Defined Contribution (DC) Plan Provisions
- DC plan mandatory participant contributions will be 2.75% of pay. Mandatory participant contributions are intended to be pre-tax “pickup” contributions.
  - The DC plan employer contribution will be 2.25% of pay.
  - A participant shall earn one eligibility point for each fiscal year in which the participant contributes to the DC plan.
  - Participant contributions to the DC plan will vest immediately. Employer contributions will vest upon accruing three eligibility points in the DC plan.
  - Each DC participant will have an individual investment account where all participant and employer contributions are accumulated and investment experience, fees and cost are credited or charged.

## 2. Class T-H Membership - Hybrid Plan

### a. Defined Benefit Plan Provisions

- Members will contribute 4.50% of pay.
- The annual benefit at retirement will be 1.00% of the highest five-year average pay multiplied by the number of years of service.
- Eligibility for superannuation will be reached at attainment of age 67 with three years of service.
- Members will vest after ten years of service and will be eligible to apply for immediate commencement of benefits. Benefits of members with less than 25 years of service electing to commence payment at or after age 62 but prior to superannuation eligibility will be reduced by the PSERS’ actuarial equivalence factors based on an interest rate of 4.0%. Benefits of members electing to commence prior to age 62 will be reduced from superannuation to age 62 using the PSERS’ actuarial equivalence factors based on an interest rate of 4.0% and further reduced from age 62 to commencement age using the PSERS’ actuarial equivalence factors based on an interest rate equal to the expected rate of return on assets assumption as adopted by the Board.
- Members who terminate on or after attaining at least 25 years of service will be able to commence benefits immediately. Benefits commencing prior to eligibility for superannuation and on or after age 55 will be reduced by 3% for each year by which commencement occurs prior to superannuation eligibility. Benefits commencing prior to age 55 will be reduced by the PSERS’ actuarial equivalence factors based on an interest rate of 4.0%.
- Members with five years of service will be eligible for disability benefits based on a 2.0% accrual rate.
- Members will be eligible to elect a cost-neutral Option 4 partial or full lump-sum distribution of accumulated deductions at benefit commencement.



- Members will be subject to a shared risk/gain provision, under which the member contribution rate will be no more than 3% below or 3% above the member's basic contribution rate, with increases or decreases in the rate in increments of 0.75%.
  - Members will be eligible for the Health Care Premium assistance program.
- b. Defined Contribution (DC) Plan Provisions
- DC plan mandatory participant contributions will be 3.00% of pay. Mandatory participant contributions are intended to be pre-tax "pickup" contributions.
  - The DC plan employer contribution will be 2.00% of pay.
  - A participant shall earn one eligibility point for each fiscal year in which the participant contributes to the DC plan.
  - Participant contributions to the DC plan will vest immediately. Employer contributions will vest upon accruing three eligibility points in the DC plan.
  - Each DC participant will have an individual investment account where all participant and employer contributions are accumulated and investment experience, fees and cost are credited or charged.

### 3. Class Defined Contribution (DC) Participant - DC Only Plan

- DC plan mandatory participant contributions will be 7.50% of pay. Mandatory participant contributions are intended to be pre-tax "pickup" contributions.
- The DC plan employer contribution will be 2.00% of pay.
- A participant shall earn one eligibility point for each fiscal year in which the participant contributes to the DC plan.
- Participant contributions to the DC plan will vest immediately. Employer contributions will vest upon accruing three eligibility points in the DC plan.
- Each DC participant will have an individual investment account where all participant and employer contributions are accumulated and investment experience, fees and cost are credited or charged.
- Members will be eligible for the Health Care Premium assistance program.

In accordance with Act 5 – 2017, the benefits for Class T-G members and Class T-H members who commence their benefits prior to age 62 and have less than 25 years of service are to be reduced from age 62 based on the mortality tables adopted by the Board and an interest rate as calculated by the System's actuary. The interest rate to be used for this purpose is the expected long term rate of return on assets assumption as adopted by the Board, which is currently 7.25% per annum. This interest rate provides true actuarially equivalent benefits for those Class T-G and T-H members with less than 25 years of service who elect to commence their benefits prior to age 62. We believe this is a reasonable interest rate to be used in determining the reduction in benefits for Class T-G and Class T-H members who commence their benefits prior to age 62 and have less than 25 years of service.

There were no other legislative or administrative changes since the prior valuation.

#### Actuarial Assumptions and Methods

The actuarial assumptions and methods are outlined in Table 12. As required under Section 8502(j) of the Retirement Code, experience studies are performed once in every five-year period. This valuation was prepared using demographic and economic assumptions that were recommended on the basis of the Experience Review covering the period from July 1, 2010 to June 30, 2015 and adopted by the Board at their June 10, 2016 meeting. These are the same assumptions used for the prior valuation.

The valuation reflects the funding provisions under Act 5 of 2017 and are summarized as follows:

- The accrued liability contribution is an amortization of the System's unfunded accrued liability (UAL). In accordance with Act 120, the UAL is amortized using a "layered" approach and was first effective with the June 30, 2010 valuation. The UAL as of June 30, 2010, was re-amortized as a level percentage of compensation using a closed (i.e., in each subsequent valuation, the remaining amortization period decreases by one year) amortization period of 24 years. Subsequent changes in the UAL due to actuarial gains/losses or assumption changes are separately financed by establishing amortization bases and payments, as a level percentage of compensation, over closed 24-year periods. Increases in the UAL resulting from legislation increasing benefits are to be funded as a level percentage of compensation using a closed 10-year amortization period. The accrued liability contribution is the sum of the payments for each of the amortization bases.
- The accrued liability contribution rate will be computed as a level percentage of total compensation of all active PSERS members and active DC participants of the accrued liability contribution.
- The normal contribution rate will be determined as a level percentage of total compensation of active PSERS members. In no event would the normal contribution rate be less than 0.00%.
- DC Only Plan participant employers will be surcharged the PSERS accrued liability contribution rate in addition to the employer defined-contribution payments made to the DC plan.
- The amount of the total employer contributions shall be computed as a percentage of the total compensation of all active members and active participants. The total employer contribution rate shall be the sum of the following divided by the total compensation of all active members and active participants:
  - the final contribution amount;
  - the premium assistance contribution amount; and
  - the employer defined contribution amount.

The results presented in this report are based on the assumption that the Hybrid Plan will cover only employees hired on or after July 1, 2019, and do not take into consideration elections by current PSERS members or former PSERS members returning to active service of membership in the Hybrid Plan.

Also, it has been assumed that, among new school employees hired on or after July 1, 2019, 65% will become Class T-G members, 30% will elect Class T-H membership, and 5% will elect Class DC participation. These are the same assumptions used in the development of the Cost Note (published May 23, 2017) for the passage of Act 5 of 2017.

There have been no other changes in the actuarial assumptions and methods from those used in the prior valuation.

We have reviewed the assumptions and methods used in completing the June 30, 2018 actuarial valuation and believe that they are reasonable and in compliance with the applicable standards.

### **Contribution Rates**

The results of the valuation as of June 30, 2018 determine the employer contribution rate for fiscal year 2019/2020. The calculated employer contribution rate for the 2019/2020 fiscal year is 34.29% and the Board of Trustees certified this rate at their December 7, 2018 meeting.

The average contribution rate payable by the members is 7.59%. The average member contribution rate of 7.59% is a pay-weighted average of member rates that vary based on date of hire and Class membership. Effective January 1, 2002, the employee contribution rate for members who elected to have prior school service and intervening military service converted to Class T-D service increased by 1.25% to 7.50%. Anyone who enrolled after July 1, 2001 and before July 1, 2011 is a member of Class T-D. Any employee who becomes a member after June 30, 2011 is a Class T-E member or, alternatively, may elect to become a Class T-F member. The base contribution rate for Class T-E members is 7.50% of compensation. The base contribution rate for Class T-F members is 10.30% of compensation. The base contribution rate for Class T-G members is 5.5% and for Class T-H members is 4.5%. Class T-E, Class T-F, Class T-G and Class T-H members are subject to a "shared-risk" employee contribution rate, as discussed on page 12.

### Reasons for Change in the Rate Calculated by the Actuary

The employer contribution rate calculated by the actuary increased from 33.43% for fiscal year 2018/2019 to 34.29% for fiscal year 2019/2020. The reconciliation of the employer contribution rates by source is as follows:

• FY 2018/2019 employer contribution rate	33.43%
• Decrease due to change in normal rate	(0.10)
• Net decrease due to total employer payroll growth and liability experience <sup>1</sup>	(0.12)
• Increase due to actuarial loss on assets	0.98
• Act 5 DC employer contribution rate	0.09
• Change in health insurance contribution rate	<u>0.01</u>
• FY 2019/2020 employer contribution rate	34.29%

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<sup>1</sup> Reflects increase in total employer payroll and liability gains.

## Summary of Principal Results

Summarized below are the principal financial results for the Public School Employees' Retirement System based upon the actuarial valuation as of June 30, 2018. Comparable results from the June 30, 2017 valuation are also shown.

Item	June 30, 2018	June 30, 2017
<b>Demographics</b>		
Active Members		
• Number	256,362	255,945
• Average Annual Pay	\$ 52,188	\$ 50,924
Annuitants		
• Number <sup>1</sup>	233,288	230,014
• Average Annual Benefit Payment	\$ 25,405	\$ 25,287
<b>Contribution Rates (as a Percentage of Payroll)</b>		
	(Fiscal Year 2019/2020)	(Fiscal Year 2018/2019)
Employer Contribution Rate:		
• Total Pension Rate Calculated by Actuary <sup>2</sup>	33.36%	32.60%
• Health Insurance Contribution Rate	0.84	0.83
• Act 5 DC Employer Contribution Rate <sup>3</sup>	<u>0.09</u>	<u>N/A</u>
• Total Contribution Rate	34.29%	33.43%
• Total Contribution Rate Certified by Board	34.29%	33.43%
• Member Average Contribution Rate	<u>7.59</u>	<u>7.57</u>
• Total Rate	41.88%	41.00%
<b>Funded Status<sup>4</sup></b>		
• Accrued Liability	\$ 103,113.6 Mil	\$ 101,972.6 Mil
• Actuarial Value of Assets	58,258.3	57,460.6
• Market Value of Assets	56,486.4	53,279.1
• Unfunded Accrued Liability		
• Actuarial Value of Assets	\$ 44,855.3	\$ 44,512.0
• Market Value of Assets	46,627.2	48,693.5
• Funded Ratio		
• Actuarial Value of Assets	56.5%	56.3%
• Market Value of Assets	54.8%	52.2%

1. Excludes 1,752 and 2,141 beneficiaries as of June 30, 2018 and June 30, 2017, respectively, who are only entitled to a pending lump sum distribution.
2. The Act 120 minimum pension rate for the June 30, 2018 valuation is 7.49% and for the June 30, 2017 valuation is 7.59%.
3. Average DC contribution rate. Actual rate will vary by employer.
4. Pensions and Health Insurance combined.

## Five-Year History of Principal Financial Results

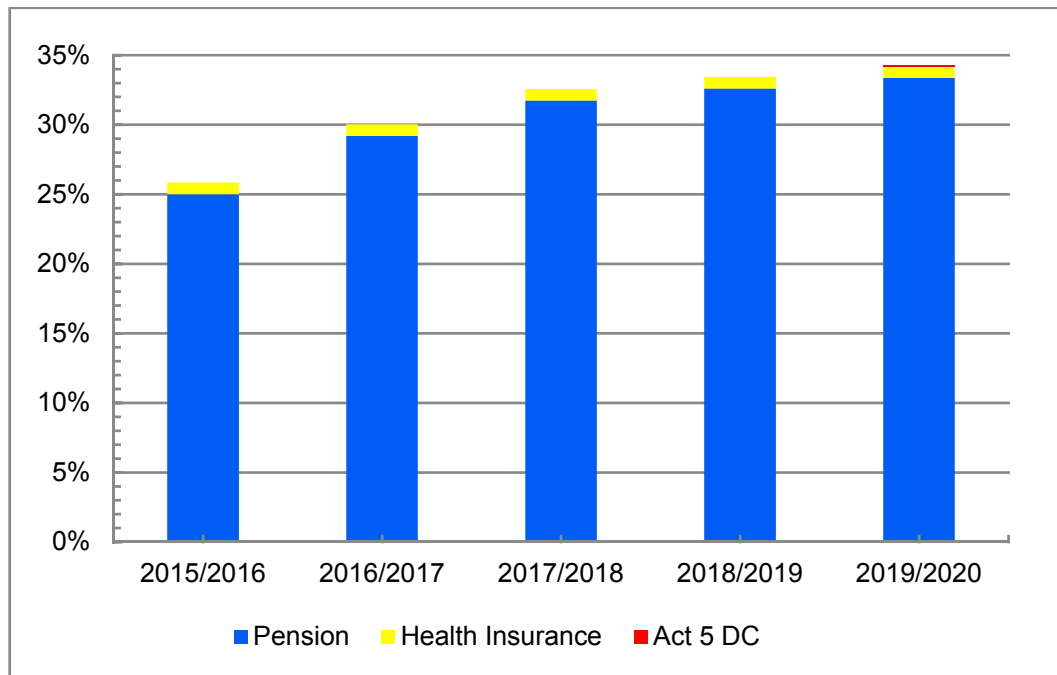
### Five-Year History of Contribution Rates (As a % of Payroll)

Fiscal Year	Member Contributions	Employer Contributions					
		Normal Cost	Unfunded Accrued Liability	Health Insurance	Act 5 DC Employer Rate <sup>1</sup>	Preliminary Employer Contribution	Final Employer Contribution <sup>2</sup>
2019/2020	7.59%	7.49%	25.87%	0.84%	0.09%	34.29%	34.29%
2018/2019	7.57	7.59	25.01	0.83	N/A	33.43	33.43
2017/2018	7.54	7.70	24.04	0.83	N/A	32.57	32.57
2016/2017	7.52	8.31	20.89	0.83	N/A	30.03	30.03
2015/2016	7.49	8.38	19.44	0.84	N/A	28.66	25.84 <sup>3</sup>

1. Average DC contribution rate. Actual rate will vary by employer.
2. Certified by the Board.
3. Reflects Act 120 Pension Collar.

The following chart shows a five-year history of employer contribution rates:

### Five-Year History of Employer Contribution Rates



## Funded Ratio

The financing objective of the Retirement System is to:

- Fully fund all current costs based on the normal contribution rate determined under the funding method; and
- Liquidate the unfunded accrued liability based on level-percent-of-pay amortization schedules required by the Retirement Code as amended by 2010-120, i.e., a schedule of 24 years for the unfunded accrued liability as of June 30, 2010 and each change in the unfunded accrued liability due to actuarial experience after the June 30, 2010 valuation. Any legislation after June 30, 2010 that increases the liability due to benefit enhancements will be funded over 10 years based on level-percent-of-pay amortization.
- Fully fund the employer contribution to the Defined Contribution Plan
- As directed by Act 2010-120, the minimum employer pension contribution rate will be the normal cost rate.

The total contribution rate of 34.29% of payroll payable by employers, when taken together with the contributions payable by the members, current assets, and expected future asset returns, is sufficient to achieve the financing objective.

The Retirement System's total funded ratio on this funding basis is measured by comparing the actuarial value of assets (based on a phased-in, 10-year moving average market value) to the accrued liability. The accrued liability for pensions is the present value of benefits accumulated to date under the Retirement System's funding method and reflects future pay increases for active employees. The accrued liability for Health Insurance equals the assets in the Health Insurance account.

On this basis, the Retirement System's total funded ratio (for Pensions and Health Insurance combined) is 56.5% as of June 30, 2018. This funded ratio is based on an actuarial value of assets of \$58.26 billion and an accrued liability of \$103.11 billion. The funded ratio for Pensions alone is 56.4% as of June 30, 2018, based on an actuarial value of assets of \$58.14 billion, and an accrued liability of \$102.99 billion.

### Reasons for Change in the Total Funded Ratio

The total funded ratio increased from 56.3% as of June 30, 2017 to 56.5% as of June 30, 2018. This increase is due to a net actuarial gain on demographic experience, which offset the loss incurred due to investment returns below expected levels on assets measured at actuarial value, which is a 10-year moving average of the market value. Table 6 provides an analysis of the change in the unfunded accrued liability as of June 30, 2018.

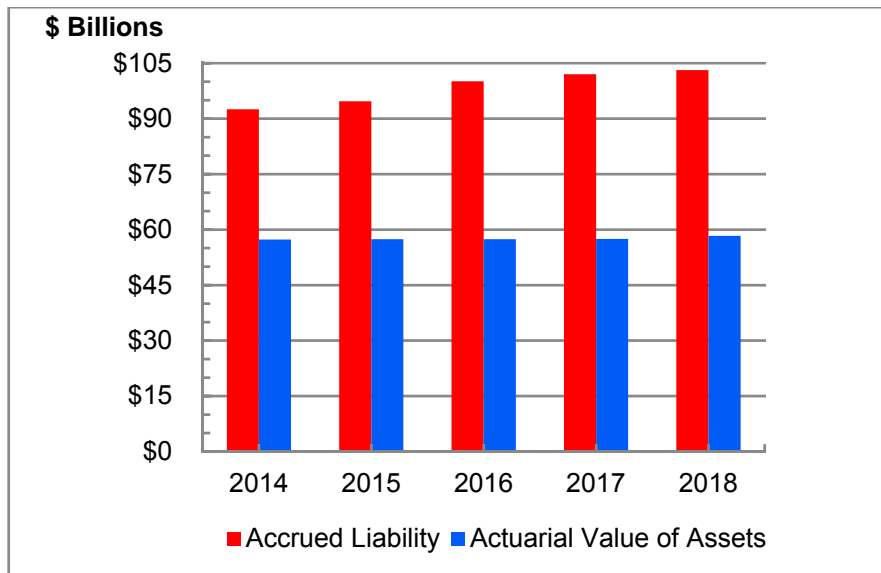
**Five-Year History of Total Funded Ratio<sup>1</sup>**  
(\$ Amounts in Millions)

Valuation as of June 30	Accrued Liability	Actuarial Value of Assets	Unfunded Accrued Liability	Funded Ratio
2018	\$ 103,113.6	\$ 58,258.3	\$ 44,855.3	56.5%
2017	101,972.6	57,460.6	44,512.0	56.3
2016	100,114.0	57,390.1	42,723.9	57.3
2015	94,697.4	57,361.6	37,335.8	60.6
2014	92,465.0	57,343.9	35,121.1	62.0

1. For Pensions and Health Insurance (under the funding provisions of the Retirement Code).

The following chart shows a five-year history of the accrued liability and the actuarial value of assets:

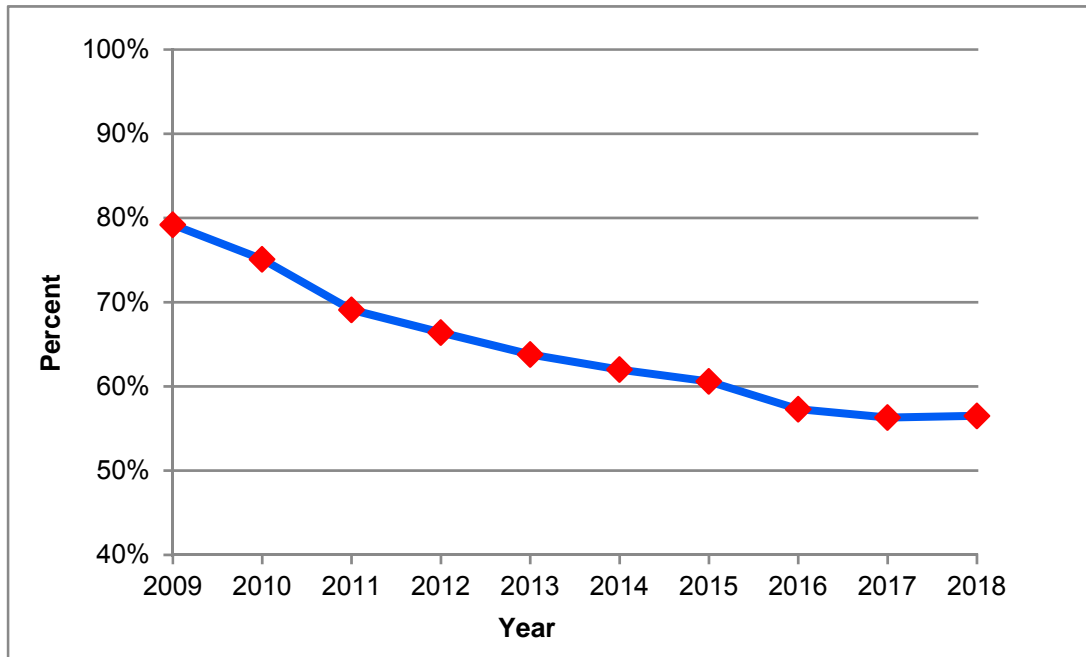
**Five-Year History of Accrued Liability and Actuarial Value of Assets**





The following chart shows a ten-year history of the total funded ratio based on actuarial value of assets for Pensions and Health Insurance:

**Ten-Year History of Total Funded Ratio (2009 – 2018)**



**Act 5-2017 Class T-E, Class T-F, Class T-G and Class T-H shared risk contributions**

Commencing with the annual actuarial valuation for the period ending June 30, 2014, and every three years thereafter, the Board compares the actual investment rate of return, net of fees, to the annual interest rate adopted by the Board for the calculation of the normal contribution rate, based on the market value of assets, for the prior ten-year period. Until the Retirement System has accumulated a ten-year period of investment rate of return experience following June 30, 2011, the look-back period used in this calculation will begin not earlier than June 30, 2011.

The shared risk contribution rates of Class T-E, T-F, T-G, and T-H members are determined as follows:

- If the actual time-weighted investment rate of return, net of fees, is less than the annual interest rate adopted by the Board by an amount of 1% or more, the shared risk contribution rate of Class T-E and T-F members will increase by 0.5% and the shared risk contribution rate for Class T-G and Class T-H members will increase by .75%.

If the actual time-weighted investment rate of return, net of fees, is equal to or exceeds the annual interest rate adopted by the Board by less than 1%, the shared risk contribution rate of Class T-E and T-F members will decrease by 0.5% and the shared risk contribution rate for Class T-G and Class T-H members will decrease by .75% provided the total member contribution rate on the date of the actuarial valuation is above the member's basic contribution rate.

- If the actual time-weighted investment rate of return, net of fees, is more than the annual interest rate adopted by the Board by an amount of 1% or more, the shared risk contribution rate of Class T-E and T-F members will decrease by 0.5% and the shared risk contribution rate for Class T-G and Class T-H members will decrease by .75%.

If the actual time-weighted investment rate of return, net of fees, is equal to or below the annual interest rate adopted by the Board by less than 1%, the shared risk contribution rate of Class T-E and T-F members will increase by 0.5% and the shared risk contribution rate for Class T-G and Class T-H members will increase by .75% provided the total member contribution rate on the date of the actuarial valuation is below the member's basic contribution rate.

The total member contribution rate for Class T-E members shall not be less than 5.5%, nor more than 9.5%. The total member contribution rate for Class T-F members shall not be less than 8.3%, nor more than 12.3%. The total member contribution rate for Class T-G members shall not be less than 2.5% nor more than 8.5% and the total member contribution rate for class T-H members shall not be less than 1.5% nor more than 7.5%.

If the Retirement System's total funded ratio based on the actuarial value of assets is at least 100% as of the measurement date, the shared risk contribution rate shall not be greater than zero. If the annual interest rate adopted by the Board for the calculation of the normal contribution rate is changed during the period used to determine the shared risk contribution rate, the Board, with the advice of the actuary, shall determine the applicable rate during the entire period, expressed as an annual rate. For any fiscal year in which the employer contribution rate is lower than the final contribution rate under section 8328(h), the total member contribution rate for Class T-E, T-F, T-G and T-H members shall be prospectively reset to the basic contribution rate provided the total member contribution rate is at or above the basic contribution rate. There shall be no increase in the member contribution rate if there has not been an equivalent increase to the employer contribution rate over the previous three-year period.

The time-weighted market rates of return net of fees, for the six-year period ending June 30, 2017 were as follows:

Valuation as of June 30	Time-Weighted Rate of Return (Market Value) <sup>1</sup>
2017	10.14%
2016	1.29
2015	3.04
2014	14.91
2013	7.96
2012	3.43
Six-Year Average	6.69%

1. As provided by the Retirement System's investment consultant.

The time-weighted rate of return, net of fees, for the six-year period ending June 30, 2017 is 6.69%, as calculated by Aon. Since the time-weighted rate of return exceeded 6.46% (the average of the annual interest rate adopted by the Board over the six-year period less 1.00%), the contribution rates for Class T-E and Class T-F members shall remain at 7.50% and 10.30%, respectively, for the period July 1, 2018 to June 30, 2021.

The next Class T-E, Class T-F, Class T-G and Class T-H "shared-risk" valuation is to be performed for the nine-year period ending June 30, 2021.

## Rate of Return

The investment return of the trust fund (i.e., total return including both realized and unrealized gains and losses) for fiscal years 2008/2009 through 2017/2018 is shown in the table below.

The rate of return on market value reflects the investment earnings on the market value of assets from the beginning of the fiscal year to the end of the fiscal year.

Fiscal Year	Rate of Return Based on Market Value <sup>1</sup>
2017/2018	9.3%
2016/2017	10.1
2015/2016	1.3
2014/2015	3.0
2013/2014	14.9
2012/2013	8.0
2011/2012	3.4
2010/2011	20.4
2009/2010	14.6
2008/2009	(26.5)

1. Provided by PSERS' investment consultants (Aon for fiscal years 2013/2014 - 2017/2018 and Wilshire Associates for prior years).

Table 1

**Summary of Results of Actuarial Valuation as of June 30, 2018**  
(\$ Amounts in Thousands)

Item	June 30, 2018	June 30, 2017
<b>Member Data</b>		
1. Number of Members		
a) Active Members	256,362	255,945
b) Vestees <sup>1</sup>	25,117	24,515
c) Annuitants, Beneficiaries and Survivor Annuitants <sup>2</sup>	233,288	230,014
d) Total	<u>514,767</u>	<u>510,474</u>
2. Annualized Salaries (\$ Amounts in Thousands) <sup>3</sup>	\$ 13,379,041	\$ 13,033,919
3. Annual Annuities (\$ Amounts in Thousands)	\$ 5,926,658	\$ 5,816,388
<b>Valuation Results</b>		
4. Present Value of Future Pension Benefits		
a) Active Members	\$ 63,249,952	\$ 62,725,773
b) Inactive Members and Vestees	2,092,376	1,944,846
c) Annuitants, Beneficiaries and Survivor Annuitants	<u>56,742,925</u>	<u>56,184,146</u>
d) Total	\$ 122,085,253	\$ 120,854,765
5. Present Value of Future Pension Normal Cost		
a) Active Members	\$ 10,008,621	\$ 9,849,017
b) Employer	<u>9,085,724</u>	<u>9,156,931</u>
c) Total	\$ 19,094,345	\$ 19,005,948
6. Pension Accrued Liability		
a) Active Members (4a) - (5c)	\$ 44,155,607	\$ 43,719,825
b) Inactive Members and Vestees	2,092,376	1,944,846
c) Annuitants, Beneficiaries and Survivor Annuitants	<u>56,742,925</u>	<u>56,184,146</u>
d) Total	\$ 102,990,908	\$ 101,848,817
7. Health Insurance Assets for Premium Assistance	\$ 122,734	\$ 123,743
8. Total Accrued Liability for Funding (6) + (7)	\$ 103,113,642	\$ 101,972,560
9. Actuarial Value of Assets	\$ 58,258,273	\$ 57,460,599
10. Funded Status (9) / (8)	56.5 %	56.3 %
11. Unfunded Accrued Liability (8) - (9)	\$ 44,855,369	\$ 44,511,961
12. Total Normal Cost Rate	15.08 %	15.16 %
13. Member Contribution Rate	7.59 %	7.57 %
14. Employer Normal Cost Rate (12) - (13)	7.49 %	7.59 %
<b>Employer Annual Funding Requirement</b>		
15. Employer Contribution Rate Calculated by Actuary	<b>Fiscal 2019/2020</b>	<b>Fiscal 2018/2019</b>
a) Normal Cost	7.49 %	7.59 %
b) Unfunded Accrued Liability	<u>25.87</u>	<u>25.01</u>
c) Preliminary Pension Rate	33.36 %	32.60 %
d) Health Insurance	0.84	0.83
e) Act 5 DC <sup>4</sup>	<u>0.09</u>	<u>N/A</u>
f) Total Rate <sup>5</sup> = (15c) + (15d) + (15e)	34.29 %	33.43 %

1. Excludes 127,136 and 123,574 inactive members and non-members as of June 30, 2018 and June 30, 2017, respectively, who are no longer participating and are valued for their accumulated deductions only.

2. Excludes 1,752 and 2,141 beneficiaries as of June 30, 2018 and June 30, 2017, respectively, who are only entitled to a pending lump sum distribution.

3. The salaries shown represent an annual rate of pay for members who were in active service on the valuation date.

4. Average DC contribution rate. Actual rate will vary by employer.

5. The Act 120 minimum pension rate for the June 30, 2018 valuation is 7.49% and for the June 30, 2017 valuation is 7.59%.

Table 2

Summary of Sources of Employer Contribution Rate as of June 30, 2018  
(\$ Amounts in Thousands)

	Funding Period (Years)	Beginning July 1	Initial Liability	6/30/2018 Outstanding Balance	Annual Payment	
					Amount	Percent <sup>1</sup>
1. Amortization of:						
a) Act 120 Fresh Start Unfunded Accrued Liability and Asset Method Change	24	2011	\$ 16,279,283	\$ 17,925,169	\$ 1,532,591	11.04 %
b) 2010 Experience	24	2011	3,419,297	3,750,547	320,669	2.31 %
c) 2011 Experience	24	2012	564,642	617,176	50,638	0.36 %
d) 2011 Assumption Changes	24	2012	4,592,397	5,019,675	411,857	2.97 %
e) 2012 Experience	24	2013	2,372,550	2,600,873	205,398	1.48 %
f) 2013 Experience	24	2014	2,707,494	2,968,826	226,269	1.63 %
g) 2014 Experience	24	2015	2,170,432	2,374,872	175,101	1.26 %
h) 2015 Experience	24	2016	1,941,277	2,115,062	151,189	1.09 %
i) 2016 Experience	24	2017	2,666,236	2,880,158	199,994	1.44 %
j) 2016 Assumption Changes	24	2017	2,521,326	2,723,621	189,124	1.36 %
k) 2017 Experience	24	2018	1,433,915	1,537,874	103,921	0.75 %
l) 2017 Act 5	24	2018	(6,867)	(7,365)	(498)	0.00 %
m) 2018 Experience	24	2019	348,881	<u>348,881</u>	<u>24,430</u>	<u>0.18 %</u>
Total Amortization Payments				\$ 44,855,369	\$ 3,590,683	25.87 %
2. Employer Normal Cost Rate						<u>7.49 %</u>
3. Pension Rate (1) + (2) <sup>2</sup>						33.36 %
4. Health Insurance Rate						0.84 %
5. Act 5 DC Rate <sup>3</sup>						<u>0.09 %</u>
6. Final Total Employer Contribution Rate Calculated by Actuary: (3) + (4) + (5)						34.29 %

1. Based on Estimated Employer Payroll for Fiscal Year Ending 2020 of \$ 13,880,000.

2. Cannot be less than the Act 120 Fiscal Year 2020 Minimum Employer Pension Rate (Employer Normal Cost Rate) of 7.49%.

3. Average DC contribution rate. Actual rate will vary by employer.

Table 3

Determination of Health Insurance Contribution Rate for Fiscal Year 2019/2020  
(\$ Amounts in Thousands)

Item			
1. June 30, 2018 Balance in Health Insurance Account			\$ 122,734
2. Estimated Fiscal 2018/2019 Contribution			
(a) Contribution Rate Certified in 2017 Valuation			0.83%
(b) Estimated Fiscal 2018/2019 payroll			\$ 13,775,000
(c) Estimated Contribution = (a) x (b)			\$ 114,333
3. Estimated Number of Annuitants who:			
	Are Eligible	Elect Coverage	
(a) Fiscal 2018/2019	150,900	95,067	
(b) Fiscal 2019/2020	152,900	96,327	
(c) Fiscal 2020/2021	154,800	97,524	
4. Estimated Disbursements:	Administration	Assistance	Total
(a) Fiscal 2018/2019	\$ 1,954	\$ 114,080	\$ 116,034
(b) Fiscal 2019/2020	1,967	115,592	117,559
(c) Fiscal 2020/2021	2,065	117,029	119,094
(d) Total	\$ 5,986	\$ 346,701	\$ 352,687
5. Required Fiscal 2019/2020 Contribution (4d) – (1) – (2c)			\$ 115,620
6. Required Health Insurance Contribution Rate			
(a) Estimated 2019/2020 Payroll			\$ 13,880,000
(b) Required Health Insurance Contribution Rate (5) / (6a) (rounded up)			0.84%

Notes:

1. Current estimates of fiscal 2018/2019 membership payroll and all administrative expenses were provided by PSERS staff.
2. 63% of eligible annuitants are assumed to elect coverage. This is the same coverage election rate used in the prior valuation.
3. Premium Assistance payments equal \$100 per month per eligible annuitant who elected coverage.

Table 4

Summary of Market Value of Plan Assets as of June 30, 2018  
(\$ Amounts in Thousands)

<b>Market Value</b>	
1. Market Value of Assets as of June 30, 2017	
a) Market Value of Assets as of June 30, 2017	\$ 53,279,079
b) Effect of change in accounting principle	<u>(80,076)</u>
c) Adjusted Market Value of Assets as of June 30, 2017 (a) + (b)	\$ 53,199,003
2. Contributions During Fiscal 2017/2018	5,387,972
3. Disbursements During Fiscal 2017/2018	6,766,993
4. Investment Return During Fiscal 2017/2018	
a) Investment Return (Net of Investment Expenses)	\$ 4,715,613
b) Administrative Expenses	<u>49,147</u>
c) Investment Return After Expenses (a) - (b)	\$ 4,666,466
5. Market Value of Assets as of June 30, 2018 (1c) + (2) - (3) + (4c)	\$ 56,486,448
6. Rate of Return (per Aon)	9.27 %
<b>Asset Allocation by Account</b>	
1. Members' Savings Account	\$ 16,120,538
2. Annuity Reserve Account	56,742,925
3. State Accumulation Account	(16,499,749)
4. Health Insurance Account	<u>122,734</u>
5. Total (1) + (2) + (3) + (4)	\$ 56,486,448



**Table 5**

**Derivation of Actuarial Value of Assets as of June 30, 2018  
(\$ Amounts in Thousands)**

1. Market Value of Assets as of June 30, 2018							\$ 56,486,448
2. Determination of Deferred Gain (Loss)							
		Return on Assets					
Fiscal Year	Actual	Expected	Difference	Recognized Amount	% Deferred <sup>3</sup>	Deferred Amount	
2017/2018	\$ 4,666,466	\$ 4,115,904	\$ 550,562	\$ 55,056	90.00%	\$ 495,506	
2016/2017	4,948,659	4,101,830	846,829	84,683	80.00%	677,463	
2015/2016	426,974	4,220,500	(3,793,526)	(379,353)	70.00%	(2,655,468)	
2014/2015	1,284,258	4,202,212	(2,917,954)	(291,795)	60.00%	(1,750,773)	
2013/2014	7,057,089	4,193,490	2,863,599	286,360	50.00%	1,431,800	
2012/2013	4,086,520	4,239,172	(152,652)	(15,265)	40.00%	(61,061)	
2011/2012	1,057,435	4,303,637	(3,246,202)	(324,620)	30.00%	(973,860)	
2010/2011	9,207,766	4,609,422	4,598,344	459,834	20.00%	919,669	
2009/2010	6,100,499	4,651,504	1,448,995	144,900	10.00%	144,899	
2008/2009	(16,237,298)	4,900,688	(21,137,986)	(1,878,933)	0.00%	0	
			\$ (20,939,991)	\$ (1,859,133)		\$ (1,771,825)	
3. Preliminary Actuarial Value of Assets <sup>1,2</sup> (1) - (2)							\$ 58,258,273
4. 70% of the Market Value of Assets (1) x 70%							\$ 39,540,514
5. 130% of the Market Value of Assets (1) x 130%							\$ 73,432,382
6. Actuarial Value of Assets: (3) not less than (4) and not greater than (5)							\$ 58,258,273

1. The amounts reported include assets for both Pension and Health Insurance.
2. The rate of return on the actuarial value of assets was 3.83%. This investment return is based on the change in the actuarial value of assets from the June 30, 2017 valuation to the June 30, 2018 valuation. The actuarial value of assets developed above is a rolling ten-year average. The impact of investment gains and losses is not fully realized in the year the gain or loss arose but is smoothed in over a ten-year period.
3. The percentage amounts shown are rounded. The corresponding Deferred Amounts reflect the use of unrounded percentages.

Table 6

Analysis of Change in Unfunded Accrued as of June 30, 2018<sup>1</sup>  
(\$ Amounts in Thousands)

Item	Amount
1. Unfunded Accrued Liability at June 30, 2017	\$ 44,511,961
2. Interest Credit to June 30, 2018	3,227,117
3. Expected Contributions Toward Unfunded Accrued Liability	<u>3,232,590</u>
4. Expected Unfunded Accrued Liability at June 30, 2018 (1) + (2) - (3)	\$ 44,506,488
5. Actual Unfunded Accrued Liability at June 30, 2018	<u>44,855,369</u>
6. Increase (Decrease) from Expected (5) - (4)	\$ 348,881
7. Reasons for Increase (Decrease)	
(a) Experience Losses (Gains)	
(i) Loss from Investment Return on Actuarial Value of Assets	\$ 1,939,209
(ii) Loss from New Entrants and Pickups	273,060
(iii) Gain from Salary Increases Less than Expected	(547,032)
(iv) Gain from Mortality Experience	(46,558)
(v) Gain Terminations (retirement/disability/terminations) Experience	(121,453)
(vi) Data – active expected future service update	(976,906)
(vii) Gain from Data/Miscellaneous	<u>(171,439)</u>
Total	\$ 348,881

1. The amounts reported include assets and liabilities for Pensions only.

**Table 7**

**Schedule of Funding Progress for Pensions<sup>1</sup>**  
 (\$ Amounts in Thousands)

Valuation as of June 30	Actuarial Value of Assets	Actuarial Accrued Liability	Unfunded Actuarial Accrued Liability	Funded Ratio	Covered Payroll <sup>2</sup>	Unfunded Accrued Liability as a Percentage of Covered Payroll
2018	\$ 58,135,539	\$ 102,990,908	\$ 44,855,369	56.4 %	\$ 13,379,041	335.3 %
2017	57,336,856	101,848,817	44,511,961	56.3	13,033,919	341.5
2016	57,265,506	99,989,401	42,723,895	57.3	12,851,289	332.4
2015	57,240,946	94,576,710	37,335,764	60.5	12,678,213	294.5
2014	57,231,799	92,352,983	35,121,184	62.0	12,620,862	278.3
2013	57,353,262	89,951,816	32,598,554	63.8	12,577,105	259.2

1. The amounts reported above include assets and liabilities for Pensions.
2. The salaries shown represent an annual rate of pay for the year ended June 30<sup>th</sup> for members who were in active service on June 30<sup>th</sup>.

The above schedule is not required by current GASB standards for pension plans. The information is provided for historical perspective as PSERS has transitioned to GASB Statement No. 67.

**Table 8**

**Solvency Test for Pensions**  
**Comparative Summary of Accrued Liability and Actuarial Value of Assets**  
 (\$ Amounts in Thousands)

Valuation as of June 30	(1) Active Member Contributions	(2) Retirees and Beneficiaries	(3) Active Member Employer Financed	Actuarial Value of Assets	Portion of Accrued Liability Covered by Valuation Assets		
					(1)	(2)	(3)
2018	\$ 16,120,538	\$ 56,742,925	\$ 30,127,445	\$ 58,135,539	100 %	74 %	0 %
2017	15,500,215	56,184,146	30,164,456	57,336,856	100	74	0
2016	14,907,731	55,314,858	29,766,812	57,265,506	100	77	0
2015	14,079,658	52,739,489	27,757,563	57,240,946	100	82	0
2014	13,554,229	51,425,295	27,373,459	57,231,799	100	85	0
2013	13,089,342	49,979,444	26,883,030	57,353,262	100	89	0

**Table 9**

**Schedule of Employer Contributions For Pensions**  
(\$ Amounts in Thousands)

Fiscal Year Ended June 30	Actuarially Determined Contribution	Actual Contributions Related to the Actuarially Determined Contribution	Contribution Deficiency (Excess)	Percentage Contributed
2018	\$ 4,243,328	\$ 4,243,328	\$ 0	100.0%
2017	3,824,908	3,824,908	0	100.0%
2016	3,540,304	3,181,438	358,866	89.9%
2015	3,289,615	2,596,731	692,884	78.9%
2014	2,965,715	1,992,084	973,631	67.2%

Valuation date: Actuarially determined contributions are calculated as of the June 30 preceding the fiscal year in which contributions are made. That is, the contribution calculated as of the June 30, 2018 actuarial valuation will be made during the fiscal year ended June 30, 2020.

**Schedule of Employer Contributions For Postemployment Benefits Other Than Pensions**  
(\$ Amounts in Thousands)

Fiscal Year Ended June 30	Actuarially Determined Contribution	Actual Contributions Related to the Actuarially Determined Contribution	Contribution Deficiency (Excess)	Percentage Contributed
2018	\$ 134,607	\$ 111,724	\$ 22,883	83.0%
2017	125,694	110,985	14,709	88.3%
2016	129,494	113,307	16,187	87.5%

Valuation date: Actuarially determined contributions are calculated as of the June 30 preceding the fiscal year in which contributions are made. That is, the contribution calculated as of the June 30, 2018 actuarial valuation will be made during the fiscal year ended June 30, 2020.

The Actuarially Determined Contribution is based on the Entry Age Normal Accrued Liability and assets as of the valuation date and a 30-year amortization of the unfunded accrued liability. See the Information Required Under Governmental Accounting Standards Board Statement No. 74 as of June 30, 2018 (published September 19, 2018) for additional information.

Table 10

History of Contribution Rates and Funded Ratios

Fiscal Year Ending June	Budgeted Total Employer Payroll (thousands)	Contribution Rates <sup>1</sup>								Funded Ratio
		Employee	Employer Normal Cost	Employer Unfunded Liability	Preliminary Employer Pension	Final Employer Pension <sup>2</sup>	Act 5 Employer DC <sup>7</sup>	Employer Health Insurance	Total Employer	
2009	\$ 12,500,000	7.29 %	6.68 %	(3.37) %	3.31 %	4.00 %		0.76 %	4.76 %	79.2 %
2010 <sup>3</sup>	12,899,000	7.32	7.35	(3.72)	3.63	4.00		0.78	4.78	75.1
2011 <sup>3,4</sup>	13,510,000	7.34	8.08	(0.50)	7.58	5.00		0.64	5.64	69.1
2012	14,112,000	7.37	8.12	10.15	18.27	8.00		0.65	8.65	66.4
2013 <sup>5</sup>	14,297,000	7.40	8.66	12.99	21.65	11.50		0.86	12.36	63.8
2014	13,720,000	7.43	8.57	15.25	23.82	16.00		0.93	16.93	62.0
2015	13,482,000	7.46	8.46	17.51	25.97	20.50		0.90	21.40	60.6
2016	13,375,000	7.49	8.38	19.44	27.82	25.00		0.84	25.84	57.3
2017	13,549,000	7.52	8.31	20.89	29.20	29.20		0.83	30.03	56.3
2018 <sup>6</sup>	13,449,000	7.54	7.70	24.04	31.74	31.74		0.83	32.57	<b>56.5</b>
2019	13,775,000	7.57	7.59	25.01	32.60	32.60		0.83	33.43	
<b>2020</b>	<b>13,880,000</b>	<b>7.59</b>	<b>7.49</b>	<b>25.87</b>	<b>33.36</b>	<b>33.36</b>	<b>0.09 %</b>	<b>0.84</b>	<b>34.29</b>	

1. In general, the Preliminary Employer Pension Rate equals the sum of the rates for the Employer Normal Cost and the Unfunded Liability; and the Final Employer Pension Rate is the greater of the Preliminary Pension Rate and any Pension Rate Floor or Collar stated in the Retirement Code. The Total Employer Rate is the sum of the Final Employer Pension Rate, Act 5 Employer DC Rate and the Employer Health Insurance Rate.
2. The Final Employer Pension rate is limited by the Act 2010-120 pension rate collars for fiscal years 2012 through 2016.
3. At its January 2009 meeting, the Board voted to reduce the interest rate from 8.50% to 8.25% for the June 30, 2008 valuation and to 8.00% for subsequent valuations.
4. Act 2010-46 recertified the fiscal year ended June 30, 2011 pension rate from 7.58% to 5.00%.
5. Revised actuarial assumptions based on a five-year experience review ended June 30, 2010 were used to determine the contributions for the fiscal year ending June 30, 2013 and thereafter, which include an interest rate of 7.50%.
6. Revised actuarial assumptions based on a five-year experience review ended June 30, 2015 were used to determine the contributions for the fiscal year ending June 30, 2018 and thereafter, which include an interest rate of 7.25%.
7. It is assumed that new members through June 30, 2019 are Class T-E members and after June 30, 2019, it is assumed that 65% of new members elect Class T-G membership, 30% elect Class T-H membership and 5% elect DC Only participation under Act 5. In addition, the above rate is an average DC contribution rate. Actual rate will vary by employer.

**Table 11**

**History of Annuitants, Beneficiaries, Survivor Annuitants and Active Members**

Valuation as of June 30	Annuitants at End of Year	Beneficiaries and Survivor Annuitants at End of Year	Total Annuitants, Beneficiaries and Survivor Annuitants	Active Members
2009	169,919	8,044	177,963	279,701
2010	176,210	8,724	184,934	282,041
2011	183,665	10,957	194,622	279,152
2012	190,560	11,455	202,015	273,504
2013	197,735	11,469	209,204	267,428
2014	203,756	10,144	213,900	263,312
2015	209,266	10,509	219,775	259,868
2016	214,019	10,809	224,828	257,080
2017	218,886	11,128	230,014	255,945
<b>2018</b>	<b>221,879</b>	<b>11,409</b>	<b>233,288</b>	<b>256,362</b>

Table 12

Description of Actuarial Assumptions and Methods

Assumptions

**Interest Rate:** 7.25% per annum, compounded annually (adopted as of June 30, 2016). The components are 2.75% for inflation and 4.50% for the real rate of return. Actuarial equivalent benefits are determined based on an interest rate of 4% per year (since 1960) except, in accordance with Act 5-2017, an interest rate of 7.25% per year is used for Class-TE and Class T-F members' Option 4 partial withdrawal of accumulated member contributions.

**Separation from Service:** Illustrative rates of assumed separation from service are shown in the following table (adopted as of June 30, 2016).

Age	Annual Rate of:						
	Withdrawal less than 5 Years of Service	Withdrawal		Death <sup>1</sup>	Disability	Early Retirement <sup>2</sup>	Superannuation Retirement
		Between 5 and 10 Years of Service	10 or More Years of Service				
<b>Males</b>							
25	14.85%	5.70%	2.57%	.041%	.020%		
30	12.74	3.37	2.57	.039	.020		
35	13.39	3.21	1.50	.044	.058		
40	14.49	3.97	1.34	.050	.116		
45	14.42	4.53	1.37	.084	.160		19.16%
50	14.31	4.45	1.92	.138	.284		19.16
55	12.17	4.43	3.38	.233	.442	18.57%	26.59
60	12.43	5.58	5.57	.379	.582	14.42	30.87
65				.700	.087		21.39
69				1.067	.135		19.34
<b>Females</b>							
25	13.41%	7.47%	5.02%	.013%	.018%		
30	13.81	6.05	4.02	.017	.023		
35	14.22	5.53	2.85	.024	.055		
40	11.79	4.87	1.60	.032	.096		
45	11.54	4.51	1.65	.051	.135		15.00%
50	11.66	4.43	2.06	.088	.229		15.00
55	11.75	4.38	3.11	.133	.368	18.59%	10.02
60	12.25	5.97	6.40	.196	.360	17.05	35.77
65				.327	.082		22.23
69				.443	.115		22.79

1. These base mortality tables will then be projected on a generational basis using the Buck Modified 2015 projection scale from 2013 to the valuation date and thereafter.
2. Early Retirement – Age 55 with 25 years of service, but not eligible for Superannuation retirement.

**Death after Retirement:**

Male annuitants: RP-2014 male mortality table adjusted backward to 2006 with the MP-2014 improvement scale and projected to the valuation date with the Buck Modified 2015 projection scale.

Female Annuitants: RP-2014 female mortality table adjusted backward to 2006 with the MP-2014 mortality improvement scale, projected to 2013 with the Buck Modified 2015 projection scale adjusted for credibility. This base mortality table will then be projected on a generational basis using the Buck Modified 2015 projection scale from 2013 to the valuation date.

Disabled annuitants: RP-2014 male and female disabled mortality tables adjusted backward to 2006 with the MP-2014 mortality improvement scale and projected from 2013 to the valuation date with the Buck Modified 2015 projection scale.

The above base mortality tables are projected on a fully generational basis using the Buck Modified 2015 projection scale from the valuation date.

For determination of actuarial equivalence, a unisex table based on the above base tables, with weightings of 25% of male and 75% of female mortality probabilities, is utilized. This table is then projected on a generational basis to 2020 using the Buck Modified 2015 projection scale.

**Salary Increase:** Effective average of 5.00% per annum, compounded annually (adopted as of June 30, 2016). The components are 2.75% for inflation, and 2.25% for real wage growth and merit or seniority increases. Representative values are as follows:

Age	Annual Rate of Salary Increase
20	10.25%
30	7.75
40	5.75
50	3.75
55	3.25
60	3.25
65	3.25
70	3.25

**Payroll Growth:** A 3.50% per annum payroll growth assumption is used to liquidate the unfunded accrued liability based on level-percent-of-pay amortization schedules required by the Retirement Code as amended by Act 2010-120 and Act 2017-5, i.e., a schedule of 24 years for the unfunded accrued liability as of June 30, 2010 and each change in the unfunded accrued liability due to actuarial experience after the June 30, 2010 valuation. Any legislation after June 30, 2010 that increases the liability due to benefit enhancements will be funded over 10 years based on level-percent-of-pay amortization.



**Miscellaneous:**

Annuity Optional Forms Assumption for Retiring Active Members:

- 50% will elect Maximum Straight Life Annuity (MSLA)
- 20% will elect OPTION 1 (Straight life annuity with guaranteed payments equal to present value of MSLA)
- 20% will elect OPTION 2 (100% Joint and Survivor with males 3 years older than females)
- 10% will elect OPTION 3 (50% Joint and Survivor with males 3 years older than females)
- 0% will elect OPTION 4 annuity

Option 4 Lump Sum Elections: 80% of Class T-C, Class T-D, Class T-E and Class T-F members are assumed to elect a refund of contributions and a reduced annuity.

Withdrawal Annuity: 90% of members are assumed to commence payment immediately and 10% are assumed to defer payment to superannuation age.

**Health Insurance:**

Elections: 63% of eligible retirees are assumed to elect premium assistance.

Administrative Expenses: Assumed equal to \$1,954,000 for fiscal year 2018/2019, \$1,967,000 for fiscal year 2019/2020 and \$2,065,000 for Fiscal year 2020/2021.

**Summary of Changes since the June 30, 2017 Valuation:**

It has been assumed that, among new school employees hired on or after July 1, 2019, 65% will become Class T-G members, 30% will elect Class T-H membership, and 5% will elect Class DC participation. These are the same assumptions used in the development of the Cost Note (published May 23, 2017) for the passage of Act 5 of 2017.

Assumed administrative expenses for the Premium Assistance Plan changed from 2% of the contributions made to the trust for premium assistance to the amounts shown above for fiscal years 2018/2019 to 2020/2021.

**Methods**

**Calculations:** The actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures, based on the current provisions of the retirement system, and on actuarial assumptions that are internally consistent and reasonable based on the actual experience of the System.

**Asset Valuation Method:** A ten-year moving market average (five-year moving market average prior to June 30, 2010) value of assets that recognizes the 7.25% (7.50% prior to June 30, 2016, 8.25% prior to June 30, 2009, and 8.50% prior to June 30, 2008) actuarial expected investment return immediately and spreads the difference between the actual return on the market value of assets and the expected return on the actuarial value of assets over a period of ten years. The actuarial value of assets can be no less than 70% and no more than 130% of the market value of assets.

**Actuarial Cost Method for Pension Funding:** Entry Age Normal Cost Method (modified slightly as of June 30, 2005 to use a pay-weighted average normal contribution rate). The results of each June 30 valuation normally determine the employer contribution rate for the second succeeding fiscal year. Act 120 revised the funding method effective with the June 30, 2010 valuation. Act 120 mandated that the outstanding balance of the unfunded accrued liability as of June 30, 2010, including changes in the unfunded accrued liability due to the funding reforms of Act 120, be amortized over a 24-year period, as a level percent of pay, beginning July 1, 2011. Future valuation gains and losses, and changes in the unfunded accrued liability resulting from changes in actuarial assumptions and methods, are amortized over a 24-year period, as a level percent of pay. As provided by Act 5-2017, future increases in the unfunded accrued liability due to benefit enhancement legislation will be amortized over 10-year periods, as a level percent of pay. Act 120 also modified the employer pension contribution requirements by imposing collars on the rate for fiscal years ending June 30, 2012, June 30, 2013, and on or after June 30, 2014; the pension contribution rate was limited to 3%, 3.5% and 4.5%, respectively, of total compensation of all active members, greater than the prior year's final contribution rate. Beginning with the fiscal year ending June 30, 2017, the actuarially required contribution rate was less than the collared rate and the final contribution rate was the actuarially determined contribution rate. However, as provided by Act 120-2010, the final contribution rate cannot be less than the employer normal contribution rate.

**Actuarial Cost Method for Health Insurance Funding:** The actuarial liability equals the assets in the health insurance account, and the results of the June 30 valuation determine the contribution rate for the second succeeding fiscal year. The rate so determined is the rate necessary to establish reserves sufficient to cover administrative expenses and provide premium assistance payments for all participating eligible annuitants during the third fiscal year that follows the valuation date.

#### Data

**Census and Assets:** The valuation was based on members of the Retirement System as of June 30, 2018 and does not take into account future members. All census data was supplied by the Retirement System and was subject to reasonable consistency checks. The actuaries adjust the data to account for service and pay earned by members on or before the valuation that is not reported by the Retirement System until after the actuarial valuation is performed. Asset data was supplied by the Retirement System.

**Table 13**

**Summary of Benefit and Contribution Provisions**

**Membership**

For valuation purposes, all employees are considered to be full coverage members. All employees who become members on and after January 1, 1966 are members of the dual coverage group. Dual coverage members contribute to both PSERS and to Social Security.

**Benefits**

**Superannuation Annuity**

Eligibility Age 62, or age 60 with 30 years of service, or 35 years of service regardless of age. For Class T-E and Class T-F members, age 65 with a minimum of three years of service credit, or any combination of age and service that totals 92 with at least 35 years of credited service. For Class T-G members, age 67 with a minimum of three years of service, or any combination of age and service that totals 97 with at least 35 years of credited service. For Class T-H members, age 67 with a minimum of three years of service credit.

Amount

Class	Accrual	Final Average Salary
T-C	2.00%	For any 3 years of service
T-D	2.50%	For any 3 years of service
T-E	2.00%	For any 3 years of service
T-F	2.50%	For any 3 years of service
T-G	1.25%	For any 5 years of service
T-H	1.00%	For any 5 years of service

Based on the above table, Accrual Rate times the Final Average Salary times years of school service and intervening military service. Minimum of \$100 per year of service. The "final average salary" means the highest average annual salary.

Annual salary is subject to a limit of \$200,000, as adjusted under Section 401(a)(17) of the Internal

Revenue Code. As of June 30, 2018, the adjusted limit is \$275,000.

For members who elect coverage under Class T-D, the maximum benefit is equal to the limit established by Section 415 of the Internal Revenue Code.

For Class T-E, Class T-F, Class T-G and Class T-H members, the maximum benefit is equal to the lesser of the limit established by Section 415 of the Internal Revenue Code or 100% of final average salary.

### **Early Retirement Annuity**

Eligibility

Age 55 with 25 years of service. For Class T-G members, age 57 with 25 years of service.

Amount

Accrued benefit as of date of retirement, reduced 1/4% for each month by which commencement of payments precedes Superannuation Age.

For members who elect coverage under Class T-D, the maximum benefit is equal to the limit established by Section 415 of the Internal Revenue Code.

For Class T-E, Class T-F, Class T-G and Class T-H members, the maximum benefit is equal to the lesser of the limit established by Section 415 of the Internal Revenue Code or 100% of final average salary.

### **Withdrawal Annuity**

Eligibility

5 years of service. For Class T-E, Class T-F, Class T-G and Class T-H members, ten years of service.

Amount

Accrued benefit deferred to superannuation retirement age or an actuarially reduced benefit payable immediately. For Class T-C, Class T-D, Class T-E and Class T-F members, PSERS early retirement factors are based on the statutory interest rate of 4%. For Class T-G and T-H members, PSERS early retirement factors from age 62 to superannuation are based on the statutory interest rate of 4%. From commencement age to age 62, PSERS early retirement factors are based on the assumed long term return on plan assets as adopted by the Board.

### **Disability Annuity**

Eligibility

5 years of service.

Amount

The standard single life annuity if the total number of years of credited service is greater than 16.667,

otherwise the standard single life annuity multiplied by the lesser of the following ratios:  $(Y^*/Y)$  or  $(16.667/Y)$  where Y is the number of years of credited service and Y\* is the total years of credited service if the member were to continue as a school employee until superannuation retirement age (or at current age, if later). For Class T-G and Class T-H members, the standard single life annuity for this provision is based on a 2.0% accrual rate. Minimum of \$100 per year of service.

### **Return of Contributions**

Eligibility	Death or separation from service and member does not qualify for other benefits.
Amount	Refund of accumulated deductions includes interest (less annuity payments received prior to death in the case of a retired member).

### **Death Benefit**

Eligibility	Death of an active member or vestee who was eligible to receive an annuity.
Amount	The present value of the annuity that would have been effective if the member retired on the day before death. Option 1 assumed payable if no other option elected.

### **Normal and Optional Forms of Benefits**

Normal Form (Maximum):	Life annuity with a guaranteed payment equal to member contributions with interest.
Option 1:	Reduced benefit with refund of balance of present value of annuity at retirement over payments received. If balance is less than \$5,000, benefit is paid in lump sum; otherwise, beneficiary may elect annuity and/or lump sum.
Option 2:	Joint and 100% survivorship annuity.
Option 3:	Joint and 50% survivorship annuity.
Option 4:	Benefit of equivalent actuarial value, including lump sum payment of member contributions.

### **Health Care Premium Assistance**

Eligibility	Retired members who: (a) have 24½ or more years of service, or (b) are disability annuitants, or
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- (c) have 15 or more years of service and who both terminated school service and retired after attaining superannuation age and
- (d) participate in the PSERS health options program or in an employer-sponsored health insurance program.

DC Only participants who terminate employment, are eligible for Medicare, have received all or part of their individual investment account and who:

- (a) have 24½ or more eligibility points, or
- (b) have 15 or more eligibility points and who both terminated school service and retired after attaining age 67 and
- (c) participate in the PSERS health options program or in an employer-sponsored health insurance program.

Amount

Participating eligible annuitants receive health insurance premium assistance payments from the Health Insurance Account equal to the lesser of \$100 per month or the actual monthly premium. All administrative expenses necessary to operate the health insurance premium assistance program are to be funded by the Health Insurance Account. The Health Insurance Account is credited with contributions of the Commonwealth and the employers.

**Contributions**

By Members

Regular member contribution:

Class	Enrollment	Contribution Rate
Members who did not elect Class T-D	Prior to July 22, 1983	5.25%
Members who did not elect Class T-D	After to July 21, 1983 but prior to July 1, 2001	6.25%
T-D	Prior to July 22, 1983	6.50%
T-D	After to July 21, 1983	7.50%
T-E		7.50%
T-F		10.30%
T-G		5.50%
T-H		4.50%

Shared-Risk contribution:

Class T-E, Class T-F, Class T-G and Class T-H members are subject to a “shared-risk” employee contribution rate. Members benefit when investments of the fund are doing well and share some of the risk when investments underperform. The member contribution rate will stay within the specified range allotted for Class T-E, Class T-F, Class T-G or Class T-H members, but could increase or decrease every three years starting July 1, 2015 depending on investment performance.

1. If the investment rate of return (less investment fees) is equal to or exceeds the assumed rate of return by more than 1.0% based on the prior ten-year period:

Class	Decrease in Contribution Rate	Minimum Contribution Rate
T-E	0.50%	5.50%
T-F	0.50%	8.30%
T-G	0.75%	2.5%
T-H	0.75%	1.5%

Provided the total member contribution rate is less than the member’s basic contribution rate, if the investment rate of return (less investment fees) is less than the assumed rate of return by less than 1.0% based on the prior ten-year period:

Class	Increase in Contribution Rate
T-E	0.50%
T-F	0.50%
T-G	0.75%
T-H	0.75%

2. If the investment rate of return (less investment fees) is less than assumed rate of return by more than 1.0% based on the prior ten-year period:

Class	Increase in Contribution Rate	Maximum Contribution Rate
T-E	0.50%	9.50%
T-F	0.50%	12.30%
T-G	0.75%	8.5%
T-H	0.75%	7.5%

Provided the total member contribution rate is greater than the member's basic contribution rate, if the investment rate of return (less investment fees) is equal to or exceeds the assumed rate of return by less than 1.0% based on the prior ten-year period:

Class	Decrease in Contribution Rate
T-E	0.50%
T-F	0.50%
T-G	0.75%
T-H	0.75%

If the Retirement System is fully funded at the time of the comparison, the increase in member contribution rate shall not be greater than zero. There shall be no increase in the member contribution rate if there has not been an equivalent increase in the employer contribution rate over the previous three-year period.

Until a full ten-year look back period is available, the investment return measurement period will begin on July 1, 2011.

By Commonwealth and School Districts

Balance of required contribution determined as normal contribution, accrued liability contribution, supplemental annuity contribution, experience adjustment factor and premium assistance contribution and the DC Plan contribution, is funded by the Commonwealth and the School District.



**Table 14**

**Summary of Membership Data as of June 30, 2018**  
 (\$ Amounts in Thousands)

**Total Active Members<sup>1</sup>**

Item	Male	Female	Total
Number of Members	69,862	186,500	256,362
Total Annual Salaries <sup>6</sup>	\$ 4,032,577	\$ 9,346,464	\$ 13,379,041
Average Age <sup>7</sup>	45.2	45.4	45.3
Average Service <sup>7</sup>	11.8	11.4	11.5

<sup>1.</sup> Excludes 152,253 inactive members, non-members and vestees.

**Class T-C Members<sup>2</sup>**

Item	Male	Female	Total
Number of Members	786	2,430	3,216
Total Annual Salaries <sup>6</sup>	\$ 52,677	\$ 121,257	\$ 173,934
Average Age <sup>7</sup>	50.9	53.5	52.8
Average Service <sup>7</sup>	21.9	19.9	20.4

<sup>2.</sup> Excludes 28,534 inactive members, non-members and vestees.

**Class T-D Members<sup>3</sup>**

Item	Male	Female	Total
Number of Members	47,085	128,890	175,975
Total Annual Salaries <sup>6</sup>	\$ 3,255,621	\$ 7,497,278	\$ 10,752,899
Average Age <sup>7</sup>	47.6	48.2	48.0
Average Service <sup>7</sup>	16.1	15.1	15.4

<sup>3.</sup> Excludes 79,600 inactive members, non-members and vestees.

<sup>6.</sup> The salaries shown in the table above represent an annual rate of pay for the year ended June 30, 2018 for members who were in active service on June 30, 2018.

<sup>7.</sup> Average completed years of age and service.

**Table 14**  
(Continued)

**Summary of Membership Data as of June 30, 2018**  
(\$ Amounts in Thousands)

**Class T-E Members<sup>4</sup>**

Item	Male	Female	Total
Number of Members	18,159	45,721	63,880
Total Annual Salaries <sup>6</sup>	\$ 555,399	\$ 1,356,235	\$ 1,911,634
Average Age <sup>7</sup>	40.0	38.6	39.0
Average Service <sup>7</sup>	2.3	2.4	2.4

<sup>4</sup>. Excludes 41,984 inactive members and non-members.

**Class T-F Members<sup>5</sup>**

Item	Male	Female	Total
Number of Members	3,832	9,459	13,291
Total Annual Salaries <sup>6</sup>	\$ 168,880	\$ 371,694	\$ 540,574
Average Age <sup>7</sup>	39.7	37.4	38.0
Average Service <sup>7</sup>	2.9	2.8	2.8

<sup>5</sup>. Excludes 2,135 inactive members and non-members.

<sup>6</sup>. The salaries shown in the table above represent an annual rate of pay for the year ended June 30, 2018 for members who were in active service on June 30, 2018.

<sup>7</sup>. Average completed years of age and service.

**Table 14  
(Continued)**

**Summary of Membership Data as of June 30, 2018  
(\$ Amounts in Thousands)**

**Total Annuitants and Beneficiaries<sup>1</sup>**

Item	Number	Annual Annuities <sup>2</sup>	Average Annuities	Average Age
Annuitants (Normal, Early and Withdrawal)	212,712	\$ 5,578,345	\$ 26,225	71.1
Survivors and Beneficiaries	11,409	164,356	\$ 14,406	75.8
Disabled Annuitants	<u>9,167</u>	<u>183,957</u>	\$ 20,067	65.1
Total	233,288	\$ 5,926,658	\$ 25,405	71.1

**New Annuitants and Beneficiaries  
Who Retired Between July 1, 2017 and June 30, 2018**

Item	Number <sup>3</sup>	Annual Annuities <sup>2</sup>	Average Annuities	Average Age
Annuitants (Normal, Early and Withdrawal)	8,345	\$ 212,435	\$ 25,457	61.4
Survivors and Beneficiaries	2,646	14,815	\$ 5,599	66.8
Disabled Annuitants	<u>280</u>	<u>7,758</u>	\$ 27,709	54.3
Total	11,271	\$ 235,009	\$ 20,851	62.5

1. The median annual benefit payable to all annuitants and beneficiaries is \$20,538.
2. The annuities shown in the tables above represent the annual amount payable as of July 1, 2018 for participants who were in payment on June 30, 2018.
3. Excludes 2,171 newly reported annuitants who retired prior to June 30, 2017 and 115 members who retired after June 30, 2017 but died prior to June 30, 2018.

**Table 14  
(Continued)**

**Distribution of Annuitants, Beneficiaries, and Survivors by Annual Pension Amount  
As of June 30, 2018**

1. All annuitants, beneficiaries, and survivors

Annual Pension Amount	Number	Average Years of Service
Under \$10,000	82,564	12
\$10,000 - \$19,999	32,645	21
\$20,000 - \$29,999	26,368	26
\$30,000 - \$39,999	28,847	30
\$40,000 - \$49,999	27,930	32
\$50,000 - \$59,999	18,563	34
\$60,000 - \$69,999	9,215	35
\$70,000 - \$79,999	4,091	36
\$80,000 - \$89,999	1,540	37
\$90,000 - \$99,999	720	37
\$100,000 or more	805	38
Total	233,288	23

2. Excludes annuitants, beneficiaries, and survivors with no service on file

Annual Pension Amount	Number	Average Years of Service
Under \$10,000	79,352	13
\$10,000 - \$19,999	30,643	22
\$20,000 - \$29,999	25,325	27
\$30,000 - \$39,999	28,357	30
\$40,000 - \$49,999	27,636	33
\$50,000 - \$59,999	18,407	34
\$60,000 - \$69,999	9,143	35
\$70,000 - \$79,999	4,068	36
\$80,000 - \$89,999	1,532	37
\$90,000 - \$99,999	715	37
\$100,000 or more	797	38
Total	225,975	24

**Exhibit I**

**Active Membership Data as of June 30, 2018  
Number and Average Annual Salary**

Age	Service									Total	
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40+		
Under 25	6,371 \$25,119	46 \$34,251									6,417 \$25,184
25-29	15,388 \$37,042	4,053 \$51,570	49 \$42,352								19,490 \$40,076
30-34	8,926 \$35,466	12,380 \$56,312	6,047 \$64,033	25 \$60,991							27,378 \$51,226
35-39	7,555 \$29,322	5,936 \$53,681	15,721 \$68,228	4,395 \$76,698	21 \$54,951						33,628 \$58,018
40-44	7,609 \$25,168	4,190 \$45,662	6,866 \$65,321	11,819 \$80,378	2,830 \$86,987	19 \$67,084					33,333 \$60,863
45-49	7,803 \$23,157	5,075 \$38,289	5,972 \$55,050	7,232 \$74,925	9,559 \$87,400	2,279 \$87,068	33 \$55,014				37,953 \$60,109
50-54	6,275 \$22,572	4,774 \$33,988	6,236 \$45,382	5,489 \$59,675	4,539 \$78,056	5,588 \$85,360	1,755 \$83,448	36 \$62,161			34,692 \$54,607
55-59	4,837 \$21,461	3,970 \$30,939	5,996 \$41,251	6,443 \$50,167	4,312 \$62,996	2,967 \$75,081	3,048 \$84,709	518 \$72,130	20 \$50,217		32,111 \$49,458
60-64	3,405 \$19,527	2,639 \$30,194	3,594 \$39,130	4,505 \$47,468	3,567 \$56,466	2,185 \$62,848	1,082 \$69,957	618 \$81,410	193 \$73,448		21,788 \$44,959
Over 64	2,783 \$14,702	1,596 \$22,735	1,467 \$32,093	1,292 \$41,214	944 \$48,580	710 \$51,657	393 \$56,906	157 \$61,927	230 \$80,263		9,572 \$32,450
<b>Total</b>	70,952 \$28,092	44,659 \$45,077	51,948 \$56,926	41,200 \$66,707	25,772 \$75,896	13,748 \$78,081	6,311 \$79,942	1,329 \$74,970	443 \$75,937		256,362 \$52,188

**Exhibit II**

**The Number of Average Annual Annuity as of June 30, 2018**

**Retired on Account of Superannuation, Early Retirement and Those  
in Receipt of Withdrawal Annuities**

Age	Years of Service									Total
	0-4 <sup>1</sup>	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40+	
Under 50		4,787	1,556	440	119	24	1			6,927
		\$906	\$2,706	\$7,013	\$13,499	\$22,212	\$8,382			\$1,989
50-54		1,718	1,054	461	243	167	45	12	1	3,701
		\$1,144	\$2,824	\$6,695	\$14,016	\$23,838	\$34,785	\$45,032	\$9,498	\$4,737
55-59		1,760	1,597	931	588	895	1,585	630	12	7,998
		\$1,607	\$3,322	\$7,889	\$14,667	\$32,894	\$47,723	\$55,275	\$49,985	\$20,575
60-64	75	2,493	3,188	2,805	2,548	3,290	5,670	4,317	239	24,625
	\$11,315	\$2,881	\$5,551	\$12,065	\$21,198	\$34,131	\$48,639	\$58,983	\$57,308	\$31,265
65-69	605	3,422	5,808	5,223	5,508	6,555	11,927	11,105	1,118	51,271
	\$1,937	\$3,757	\$6,258	\$13,378	\$22,491	\$32,799	\$45,654	\$58,304	\$68,121	\$33,689
70-74	1,278	2,863	5,339	4,518	4,417	5,412	12,714	9,907	1,264	47,712
	\$1,277	\$3,637	\$5,144	\$11,222	\$19,153	\$28,891	\$39,587	\$53,808	\$67,378	\$30,445
75-79	1,212	1,840	3,303	3,275	3,103	3,650	7,736	5,397	935	30,451
	\$984	\$2,941	\$4,713	\$9,221	\$15,460	\$23,733	\$33,809	\$44,028	\$58,989	\$24,343
80-84	728	1,103	2,319	2,143	2,541	2,789	3,871	2,740	875	19,109
	\$768	\$2,367	\$3,835	\$7,183	\$12,053	\$19,698	\$29,241	\$37,217	\$45,867	\$19,275
85-89	407	654	1,588	1,636	1,874	2,044	2,152	1,547	707	12,609
	\$707	\$1,872	\$3,448	\$6,220	\$11,185	\$17,601	\$25,331	\$35,444	\$41,692	\$16,886
Over 89	329	455	1,195	1,355	1,439	1,325	988	841	382	8,309
	\$1,019	\$1,702	\$3,378	\$6,419	\$10,801	\$16,054	\$21,800	\$27,746	\$38,430	\$13,264
Total	4,634	21,095	26,947	22,787	22,380	26,151	46,689	36,496	5,533	212,712
	\$1,301	\$2,351	\$4,749	\$10,197	\$17,480	\$27,395	\$39,656	\$51,738	\$56,943	\$26,225

1. Includes 17 annuitant records with no service information provided.

Exhibit III

The Number and Average Annual Annuity as of June 30, 2018

Beneficiaries and Survivor Annuitants

Age	Years of Service								Total
	0-9 <sup>1</sup>	10-14	15-19	20-24	25-29	30-34	35-39	40+	
Under 50	221 \$11,036	21 \$3,902	15 \$5,318	14 \$4,536	19 \$8,598	10 \$14,631	8 \$16,349	1 \$23,464	309 \$7,362
50-54	156 \$24,161	11 \$2,040	15 \$4,613	14 \$7,320	9 \$8,002	8 \$10,159	3 \$14,631	6 \$13,791	222 \$8,660
55-59	300 \$27,022	14 \$2,666	15 \$7,415	18 \$8,969	14 \$13,875	14 \$12,017	8 \$23,943	7 \$11,270	390 \$11,276
60-64	623 \$21,657	30 \$7,258	37 \$5,159	43 \$7,753	30 \$12,721	20 \$20,117	19 \$18,758	10 \$15,690	812 \$15,662
65-69	1,107 \$25,903	37 \$4,447	36 \$5,610	39 \$8,906	49 \$13,490	89 \$15,547	61 \$21,519	12 \$18,061	1,430 \$19,436
70-74	1,261 \$28,187	38 \$2,730	36 \$5,582	52 \$8,598	58 \$13,672	159 \$17,939	132 \$22,334	20 \$14,190	1,756 \$18,978
75-79	1,147 \$19,117	70 \$3,418	76 \$6,753	64 \$9,009	71 \$13,303	164 \$17,954	153 \$21,494	43 \$18,652	1,788 \$15,829
80-84	1,054 \$14,833	89 \$3,183	82 \$4,676	80 \$7,399	82 \$11,771	156 \$14,043	129 \$18,562	71 \$21,756	1,743 \$12,729
85-89	858 \$13,936	79 \$3,394	94 \$4,457	84 \$7,753	87 \$9,159	144 \$12,708	123 \$15,090	87 \$20,237	1,556 \$11,750
Over 89	590 \$12,173	107 \$2,618	92 \$4,064	112 \$6,249	114 \$8,571	131 \$10,103	173 \$12,050	84 \$16,762	1,403 \$9,374
<b>Total<sup>2</sup></b>	7,317 \$15,840	496 \$3,424	498 \$5,107	520 \$7,644	533 \$11,161	895 \$14,886	809 \$18,056	341 \$18,645	11,409 \$14,406

1. Includes 7,200 beneficiary or survivor annuitant records with no service information provided.

2. In addition, there are 1,752 beneficiaries who are only entitled to a pending lump sum distribution.

**Exhibit IV**

**The Number and Average Annual Annuity as of June 30, 2018  
Retired on Account of Disability**

Age	Years of Service								Total	
	0-4	5-9 <sup>1</sup>	10-14	15-19	20-24	25-29	30-34	35-39		40+
Under 50		176	168	109	54	3				510
		\$15,517	\$20,850	\$25,884	\$38,999	\$51,751				\$22,189
50-54		160	166	140	109	76	7			658
		\$13,144	\$16,557	\$23,302	\$34,029	\$46,467	\$55,733			\$23,928
55-59		274	328	273	209	164	65	2		1,315
		\$11,062	\$13,783	\$19,617	\$29,969	\$42,145	\$47,919	\$44,804		\$22,271
60-64		388	447	377	367	246	105	1	1	1,932
		\$10,078	\$13,649	\$18,330	\$26,560	\$37,601	\$46,802	\$39,632	\$39,130	\$21,157
65-69		341	407	307	331	374	189	3	2	1,954
		\$8,330	\$12,062	\$16,519	\$24,662	\$35,779	\$47,515	\$45,223	\$22,352	\$22,268
70-74		201	256	228	230	271	137	7	4	1,334
		\$7,023	\$9,731	\$13,366	\$21,606	\$30,303	\$40,358	\$34,807	\$42,990	\$19,548
75-79		119	182	154	157	105	30		1	748
		\$5,481	\$8,090	\$10,450	\$17,243	\$25,342	\$29,977		\$10,189	\$13,383
80-84		66	110	92	66	52	9	3		398
		\$5,009	\$6,963	\$8,591	\$14,399	\$20,101	\$29,826	\$43,058		\$10,754
85-89		35	60	43	42	22	4		1	207
		\$3,495	\$6,000	\$8,193	\$11,641	\$20,377	\$20,587		\$54,601	\$9,221
Over 89		21	39	21	12	13	5			111
		\$3,861	\$6,018	\$8,410	\$10,815	\$16,994	\$20,401			\$8,515
Total		1,781	2,163	1,744	1,577	1,326	551	16	9	9,167
		\$9,665	\$12,532	\$16,856	\$24,863	\$34,553	\$44,067	\$39,858	\$35,620	\$20,067

1. Includes 3 annuitant records with no service information provided.



Exhibit V

Annuitant and Beneficiary Membership Data as of June 30, 2018

Number and Average Annual Benefit  
Excludes Partial Lump Sum Payments

Age Last Birthday	Number	Annual Benefit (Thousands)	Average Annual Benefit
<b>Annuitants (Normal, Early and Withdrawal)</b>			
Under 60	18,626	\$ 195,865	\$ 10,516
60 - 64	24,625	769,901	31,265
65 - 69	51,271	1,727,244	33,689
70 - 74	47,712	1,452,613	30,445
75 - 79	30,451	741,274	24,343
Over 79	40,027	691,448	17,275
Total	212,712	\$ 5,578,345	\$ 26,225
<b>Survivors and Beneficiaries</b>			
Under 60	921	\$ 8,595	\$ 9,332
60 - 64	812	12,717	15,661
65 - 69	1,430	27,793	19,436
70 - 74	1,756	33,326	18,978
75 - 79	1,788	28,303	15,829
Over 79	4,702	53,622	11,404
Total	11,409	\$ 164,356	\$ 14,406
<b>Disabled Annuitants</b>			
Under 60	2,483	\$ 56,348	\$ 22,694
60 - 64	1,932	40,875	21,157
65 - 69	1,954	43,512	22,268
70 - 74	1,334	26,076	19,547
75 - 79	748	10,012	13,385
Over 79	716	7,134	9,964
Total	9,167	\$ 183,957	\$ 20,067
<b>Grand Total Average Annual Benefit</b>			
	233,288	\$ 5,926,658	\$ 25,405

**Exhibit VI**

**10-Year History of Membership Data**

**Active Members**

Valuation as of June 30	Number of Active Members	Percentage Change in Membership	Total Annualized Payroll (Thousands) <sup>1</sup>	Percentage Change in Payroll
2018	256,362	0.16%	\$ 13,379,041	2.65%
2017	255,945	(0.44%)	13,033,919	1.42%
2016	257,080	(1.07%)	12,851,289	1.37%
2015	259,868	(1.31%)	12,678,213	0.45%
2014	263,312	(1.54%)	12,620,862	0.35%
2013	267,428	(2.22%)	12,577,105	(1.08%)
2012	273,504	(2.02%)	12,714,371	(1.52%)
2011	279,152	(1.02%)	12,910,043	0.95%
2010	282,041	0.84%	12,788,847	2.11%
2009	279,701	2.57%	12,524,593	5.06%

1. The salaries shown represent an annual rate of pay for the year ending June 30<sup>th</sup> for members who were in active service on June 30<sup>th</sup>.

**Exhibit VI**  
(Continued)

**10-Year History of Membership Data**

**The Number and Annual Annuities of Annuitant and Survivor Annuitant Members**

Year Ended June 30	Number	Annual Annuities <sup>1</sup> (Millions)	Average Annual Annuities	Additions	Annual Annuities (Millions)	Deletions	Annual Annuities (Millions)	Percentage Change in Membership	Percentage Change in Annuities
2018	233,288	\$ 5,926.7	\$ 25,405	11,806	\$ 274.2	8,532	\$ 98.6	1.42%	1.90%
2017	230,014	5,816.4	25,287	12,876	274.2	7,690	102.1	2.31%	2.65%
2016	224,828	5,666.4	25,203	12,686	267.1	7,633	93.5	2.30%	2.64%
2015	219,775	5,520.6	25,119	15,017	297.3	9,142	91.7	2.75%	3.39%
2014	213,900	5,339.5	24,962	15,225	300.5	8,878	84.9	3.06%	3.74%
2013	207,553	5,147.1	24,800	16,404	377.6	10,866	83.7	2.74%	5.63%
2012	202,015	4,872.9	24,121	14,579	332.7	7,186	66.6	3.80%	4.78%
2011	194,622	4,650.8	23,897	16,228	453.7	6,540	76.4	5.24%	7.17%
2010	184,934	4,339.6	23,466	12,649	372.8	5,678	77.6	3.92%	8.59%
2009	177,963	3,996.3	22,456	9,651	314.9	5,228	74.4	2.55%	4.85%

1. The annual annuities added and deleted are for the annuitants and survivor annuitants who were added and deleted. Changes in annuities for continuing payees may also occur due to finalization of benefit calculations and due to the commencement of supplemental annuity payments.

**10-Year History of Membership Data**

**The Number and Annual Annuities of Annuitant Members**

Year Ended June 30	Number	Annual Annuities <sup>2</sup> (Millions)	Average Annual Annuities	Additions	Annual Annuities (Millions)	Deletions	Annual Annuities (Millions)	Percentage Change in Membership	Percentage Change in Annuities
2018	221,879	\$ 5,762.3	\$ 25,970	10,911	\$ 220.2	7,918	\$ 93.0	1.37%	1.80%
2017	218,886	5,660.4	25,860	11,942	257.9	7,075	95.8	2.27%	2.54%
2016	214,019	5,520.0	25,792	11,807	249.8	7,054	88.1	2.27%	2.54%
2015	209,266	5,383.3	25,725	12,624	279.2	7,114	86.5	2.70%	3.30%
2014	203,756	5,211.4	25,577	12,915	283.9	6,894	80.0		

2. The annual annuities added and deleted are for the annuitants who were added and deleted. Changes in annuities for continuing payees may also occur due to finalization of benefit calculations and due to the commencement of supplemental annuity payments.

**Exhibit VII**

**Detailed Tabulations of the Data**

Table 1

The Number and Annual Salaries of Members in Active Service Distributed  
by Age as of June 30, 2018

Age	Male		Female		Total	
	Number	Salaries	Number	Salaries	Number	Salaries
17	25	\$ 154,643	11	\$ 144,402	36	\$ 299,045
18	51	380,213	29	245,281	80	625,494
19	127	1,493,559	102	988,149	229	2,481,708
20	194	2,511,989	175	1,938,505	369	4,450,494
21	233	3,504,549	238	3,111,652	471	6,616,201
22	300	4,773,690	533	10,536,513	833	15,310,203
23	577	13,711,236	1,321	36,813,353	1,898	50,524,589
24	715	20,934,601	1,786	60,365,956	2,501	81,300,557
25	917	27,567,923	2,241	81,214,939	3,158	108,782,862
26	966	33,120,197	2,608	101,982,393	3,574	135,102,590
27	1,060	39,623,048	2,923	119,625,014	3,983	159,248,062
28	1,160	46,992,313	3,169	135,957,196	4,329	182,949,509
29	1,172	48,736,279	3,274	146,270,774	4,446	195,007,053
30	1,220	55,517,744	3,403	160,485,683	4,623	216,003,427
31	1,392	69,086,974	3,798	187,764,743	5,190	256,851,717
32	1,523	78,314,677	4,101	207,608,788	5,624	285,923,465
33	1,651	89,573,034	4,252	224,708,189	5,903	314,281,223
34	1,622	92,115,472	4,416	237,277,270	6,038	329,392,742
35	1,677	96,596,937	4,646	254,933,673	6,323	351,530,610
36	1,878	113,529,315	4,859	272,420,201	6,737	385,949,516
37	1,893	117,120,171	4,951	279,993,571	6,844	397,113,742
38	1,895	123,321,481	4,962	285,861,330	6,857	409,182,811
39	1,944	125,783,770	4,923	281,479,106	6,867	407,262,876
40	1,855	124,866,833	4,772	273,976,680	6,627	398,843,513
41	1,969	131,755,851	4,844	279,916,901	6,813	411,672,752
42	1,906	133,257,868	4,689	269,897,124	6,595	403,154,992
43	1,879	130,731,070	4,745	276,352,700	6,624	407,083,770
44	1,889	134,662,829	4,785	273,341,734	6,674	408,004,563
45	1,954	139,223,044	4,943	281,654,854	6,897	420,877,898
46	2,086	148,653,391	5,426	305,661,937	7,512	454,315,328
47	2,236	158,327,052	5,990	338,203,715	8,226	496,530,767
48	2,010	142,450,399	5,828	329,406,201	7,838	471,856,600
49	1,971	138,161,991	5,509	299,587,269	7,480	437,749,260
50	1,844	129,183,250	5,192	275,490,865	7,036	404,674,115
51	1,781	119,657,910	5,147	267,355,153	6,928	387,013,063
52	1,852	122,302,950	4,902	250,166,648	6,754	372,469,598
53	1,726	110,390,957	5,228	254,925,394	6,954	365,316,351
54	1,803	115,164,790	5,217	249,785,685	7,020	364,950,475
55	1,655	101,227,536	4,967	238,022,983	6,622	339,250,519
56	1,601	94,683,690	4,990	236,745,688	6,591	331,429,378

**Table 1**  
(Continued)

**The Number and Annual Salaries off Members in Active Service Distributed  
by Age as of June 30, 2018**

Age	Male		Female		Total	
	Number	Salaries	Number	Salaries	Number	Salaries
57	1,624	\$ 96,002,726	5,102	\$ 238,288,246	6,726	\$ 334,290,972
58	1,473	83,220,297	4,702	212,492,883	6,175	295,713,180
59	1,493	80,228,183	4,504	207,248,013	5,997	287,476,196
60	1,403	73,735,433	4,341	193,776,852	5,744	267,512,285
61	1,299	68,522,403	4,031	177,637,524	5,330	246,159,927
62	1,057	51,262,073	3,091	133,993,645	4,148	185,255,718
63	997	46,606,726	2,611	108,129,153	3,608	154,735,879
64	837	37,637,893	2,121	88,262,867	2,958	125,900,760
65	613	27,310,712	1,443	58,351,291	2,056	85,662,003
66	498	18,525,533	1,030	37,458,028	1,528	55,983,561
67	389	14,422,737	775	26,337,198	1,164	40,759,935
68	346	12,461,453	612	19,119,211	958	31,580,664
69	291	8,798,357	471	12,697,630	762	21,495,987
70	256	7,243,049	403	10,520,824	659	17,763,873
71	230	6,589,740	349	8,809,709	579	15,399,449
72	144	3,661,951	171	4,249,510	315	7,911,461
73	136	3,908,966	161	3,726,562	297	7,635,528
74	123	2,807,670	158	3,205,847	281	6,013,517
75	109	2,743,014	127	2,703,385	236	5,446,399
76	82	2,127,049	112	2,077,181	194	4,204,230
77	58	1,100,941	84	1,582,444	142	2,683,385
78	53	1,094,871	46	926,717	99	2,021,588
79	33	821,460	31	551,762	64	1,373,222
80	29	639,566	40	680,621	69	1,320,187
81	24	529,406	26	313,804	50	843,210
82	17	429,839	21	303,257	38	733,096
83	14	294,459	12	186,055	26	480,514
84	10	354,094	13	249,799	23	603,893
85	8	172,361	9	193,130	17	365,491
86	3	74,082	2	16,057	5	90,139
87	4	84,324	6	157,014	10	241,338
<b>Total</b>	<b>69,862</b>	<b>\$ 4,032,576,594</b>	<b>186,500</b>	<b>\$ 9,346,464,431</b>	<b>256,362</b>	<b>\$ 13,379,041,025</b>

Table 2

**The Number and Annual Salaries of Members in Active Service Distributed by  
Years of Credited Service as of June 30, 2018**

Service	Male		Female		Total	
	Number	Salaries	Number	Salaries	Number	Salaries
0	5,005	\$ 65,811,447	8,516	\$ 121,045,134	13,521	\$ 186,856,581
1	5,616	147,921,587	14,186	362,325,002	19,802	510,246,589
2	3,833	127,483,021	10,698	325,353,660	14,531	452,836,681
3	3,053	115,653,771	9,292	314,636,887	12,345	430,290,658
4	2,747	115,409,258	8,006	297,541,718	10,753	412,950,976
5	2,510	113,575,373	7,109	281,017,598	9,619	394,592,971
6	2,029	95,450,486	6,242	254,986,377	8,271	350,436,863
7	1,973	97,924,318	6,039	258,567,993	8,012	356,492,311
8	2,219	116,710,622	6,832	311,331,178	9,051	428,041,800
9	2,343	130,255,254	7,363	353,258,628	9,706	483,513,882
10	2,547	148,577,321	8,046	406,151,072	10,593	554,728,393
11	2,556	158,239,258	8,170	425,852,125	10,726	584,091,383
12	2,480	157,831,668	7,898	431,938,427	10,378	589,770,095
13	2,533	170,668,088	7,728	439,763,176	10,261	610,431,264
14	2,621	183,356,586	7,369	434,831,709	9,990	618,188,295
15	2,179	156,789,139	6,387	385,583,204	8,566	542,372,343
16	2,151	159,765,637	6,341	389,552,232	8,492	549,317,869
17	2,085	157,462,423	6,056	382,480,265	8,141	539,942,688
18	1,951	152,660,406	6,109	394,852,035	8,060	547,512,441
19	2,349	192,902,164	5,592	376,285,180	7,941	569,187,344
20	1,989	163,495,972	4,619	321,069,950	6,608	484,565,922
21	1,883	161,695,604	4,075	289,645,478	5,958	451,341,082
22	1,493	127,314,149	3,412	248,118,625	4,905	375,432,774
23	1,325	114,128,524	3,097	227,277,406	4,422	341,405,930
24	1,143	97,717,871	2,736	205,526,203	3,879	303,244,074
25	1,334	115,914,447	2,499	186,251,794	3,833	302,166,241
26	856	71,966,560	1,873	142,778,519	2,729	214,745,079
27	749	61,379,334	1,778	132,490,544	2,527	193,869,878
28	778	63,640,650	1,622	122,498,603	2,400	186,139,253
29	754	62,029,143	1,505	114,508,059	2,259	176,537,202
30	575	49,246,808	1,272	98,264,948	1,847	147,511,756
31	517	43,366,470	1,035	80,657,913	1,552	124,024,383
32	431	36,030,133	849	66,544,841	1,280	102,574,974
33	328	27,198,554	619	48,950,840	947	76,149,394
34	255	21,044,874	430	33,211,524	685	54,256,398
35	155	11,497,651	209	15,961,281	364	27,458,932
36	118	8,587,908	165	12,322,190	283	20,910,098
37	104	7,913,564	153	11,928,647	257	19,842,211
38	82	6,316,411	141	10,386,615	223	16,703,026
39	70	5,498,002	132	9,222,728	202	14,720,730

**Table 2  
(Continued)**

**The Number and Annual Salaries of Members in Active Service Distributed by  
Years of Credited Service as of June 30, 2018**

Service	Male		Female		Total	
	Number	Salaries	Number	Salaries	Number	Salaries
40	35	\$ 2,922,640	81	\$ 6,010,765	116	\$ 8,933,405
41	28	2,353,492	42	2,904,394	70	5,257,886
42	27	2,162,859	37	2,797,693	64	4,960,552
43	7	612,932	39	2,402,170	46	3,015,102
44	13	1,079,672	25	1,964,343	38	3,044,015
45	11	1,051,655	22	1,810,465	33	2,862,120
46	9	807,781	12	879,630	21	1,687,411
47	4	355,819	9	667,017	13	1,022,836
48	2	152,408	9	440,932	11	593,340
49	2	137,551	9	598,442	11	735,993
50			4	311,018	4	311,018
51	1	41,974	3	182,547	4	224,521
52	1	96,748	2	81,709	3	178,457
53	1	146,650	4	295,373	5	442,023
54						
55						
56						
57	1	114,895	1	47,983	2	162,878
58						
59	1	109,062			1	109,062
60						
61						
62			1	99,642	1	99,642
<b>Total</b>	<b>69,862</b>	<b>\$4,032,576,594</b>	<b>186,500</b>	<b>\$9,346,464,431</b>	<b>256,362</b>	<b>\$ 13,379,041,025</b>



Table 3

**The Number and Annual Annuities of Annuitants on the Retired List  
as of June 30, 2018**

**Retired on Account of Superannuation, Early Retirement and  
Those in Receipt of Withdrawal Annuities**

Age	Male		Female		Total	
	Number	Annunities	Number	Annunities	Number	Annunities
26			1	\$ 253	1	\$ 253
27	1	\$ 267	4	7,277	5	7,544
28	12	6,822	7	1,871	19	8,693
29	15	7,857	5	3,575	20	11,432
30	20	16,518	26	19,848	46	36,366
31	23	24,172	38	21,977	61	46,149
32	47	38,959	69	52,230	116	91,189
33	64	60,388	90	61,752	154	122,140
34	56	54,928	99	85,068	155	139,996
35	62	60,235	156	142,076	218	202,311
36	105	116,944	155	152,921	260	269,865
37	98	123,254	171	198,713	269	321,967
38	126	189,418	171	215,119	297	404,537
39	121	197,147	239	301,936	360	499,083
40	146	252,814	235	317,399	381	570,213
41	135	272,562	241	390,723	376	663,285
42	133	248,778	280	423,820	413	672,598
43	128	248,035	290	441,114	418	689,149
44	127	262,191	327	556,665	454	818,856
45	144	411,303	341	736,070	485	1,147,373
46	171	513,604	327	728,433	498	1,242,037
47	180	558,542	433	976,707	613	1,535,249
48	195	757,066	453	1,054,756	648	1,811,822
49	201	948,944	459	1,514,580	660	2,463,524
50	164	723,436	458	1,626,691	622	2,350,127
51	201	981,116	492	1,808,765	693	2,789,881
52	229	1,364,011	515	1,932,654	744	3,296,665
53	212	1,507,741	557	2,423,729	769	3,931,470
54	236	2,278,845	637	2,883,400	873	5,162,245
55	309	4,571,427	763	8,371,667	1,072	12,943,094
56	374	7,781,078	952	14,056,942	1,326	21,838,020
57	457	11,328,031	1,102	19,589,260	1,559	30,917,291
58	566	15,727,162	1,291	26,342,923	1,857	42,070,085
59	661	20,842,373	1,523	35,948,371	2,184	56,790,744
60	846	28,461,337	1,978	53,511,343	2,824	81,972,680
61	1,026	37,967,200	2,591	79,595,470	3,617	117,562,670
62	1,275	46,450,133	3,628	108,176,915	4,903	154,627,048
63	1,543	55,665,416	4,589	135,844,245	6,132	191,509,661
64	1,798	62,861,583	5,351	161,366,862	7,149	224,228,445
65	2,203	82,931,946	6,395	202,753,743	8,598	285,685,689
66	2,625	96,812,247	7,489	243,817,715	10,114	340,629,962
67	3,058	115,513,615	8,049	259,664,871	11,107	375,178,486
68	2,998	115,467,791	7,632	247,475,793	10,630	362,943,584
69	3,357	128,760,588	7,465	234,046,002	10,822	362,806,590
70	3,597	133,631,943	7,263	223,534,825	10,860	357,166,768
71	4,177	148,543,823	7,803	228,013,194	11,980	376,557,017
72	3,613	123,294,593	6,220	170,647,057	9,833	293,941,650

**Table 3  
(Continued)**

**The Number and Annual Annuities of Annuitants on the Retired List  
as of June 30, 2018**

**Retired on Account of Superannuation, Early Retirement and  
Those in Receipt of Withdrawal Annuities**

Age	Male		Female		Total	
	Number	Annuities	Number	Annuities	Number	Annuities
73	2,894	\$ 94,591,535	4,842	\$ 129,491,245	7,736	\$ 224,082,780
74	2,719	86,068,351	4,584	114,796,212	7,303	200,864,563
75	2,827	87,469,469	4,666	110,055,374	7,493	197,524,843
76	2,755	84,113,420	4,318	97,114,630	7,073	181,228,050
77	2,148	60,754,539	3,816	82,537,569	5,964	143,292,108
78	1,829	51,208,905	3,314	67,005,346	5,143	118,214,251
79	1,660	41,661,119	3,118	59,353,738	4,778	101,014,857
80	1,549	39,305,906	2,968	54,337,640	4,517	93,643,546
81	1,456	36,322,014	2,632	45,048,488	4,088	81,370,502
82	1,332	32,967,156	2,528	41,422,558	3,860	74,389,714
83	1,203	27,877,233	2,319	35,052,104	3,522	62,929,337
84	1,068	24,779,089	2,054	31,204,470	3,122	55,983,559
85	974	22,743,196	1,862	26,627,358	2,836	49,370,554
86	945	22,035,217	1,917	27,646,386	2,862	49,681,603
87	801	19,395,786	1,840	27,150,509	2,641	46,546,295
88	711	15,359,262	1,575	21,785,882	2,286	37,145,144
89	565	11,653,216	1,419	18,522,282	1,984	30,175,498
90	423	8,941,970	1,334	16,949,075	1,757	25,891,045
91	371	7,453,406	1,148	14,315,201	1,519	21,768,607
92	301	5,879,019	950	11,688,385	1,251	17,567,404
93	233	4,339,603	726	8,006,841	959	12,346,444
94	179	3,465,821	617	6,756,865	796	10,222,686
95	113	1,813,830	455	4,437,343	568	6,251,173
96	83	1,287,497	382	3,710,525	465	4,998,022
97	46	810,933	267	2,718,099	313	3,529,032
98	35	582,847	206	2,049,173	241	2,632,020
99	17	281,581	124	1,288,247	141	1,569,828
100	14	190,109	103	1,201,027	117	1,391,136
101	7	115,747	74	749,027	81	864,774
102	5	41,796	36	386,332	41	428,128
103	2	42,712	26	284,795	28	327,507
104	1	2,792	11	140,363	12	143,155
105			6	93,528	6	93,528
106			5	73,970	5	73,970
107	1	15,242	4	34,189	5	49,431
108			3	38,707	3	38,707
109			1	25,679	1	25,679
<b>Total</b>	<b>67,102</b>	<b>\$ 2,042,408,501</b>	<b>145,610</b>	<b>\$ 3,535,936,482</b>	<b>212,712</b>	<b>\$ 5,578,344,983</b>

**Table 3  
(Continued)**

**The Number and Annual Annuities of Annuitants on the Retired List  
as of June 30, 2018**

**Retired on Account of Superannuation, Early Retirement and  
Those in Receipt of Withdrawal Annuities**

<u>OPTION</u>	<u>MALE</u>		<u>FEMALE</u>	
Maximum	31,570	\$ 952,496,072	83,692	\$ 2,012,203,897
1	10,662	249,739,326	32,915	633,886,152
2	15,861	471,945,664	17,373	473,314,631
3	7,526	298,377,923	10,661	376,223,134
4	<u>1,483</u>	<u>69,849,516</u>	<u>969</u>	<u>40,308,668</u>
	67,102	\$ 2,042,408,501	145,610	\$ 3,535,936,482

**DEFINITIONS OF OPTIONS**

- Option 1 A life annuity to the member with a guaranteed payment to the beneficiary equal to the present value of the total maximum single life annuity less any amounts paid to the member prior to death.
- Option 2 A joint and one hundred percent (100%) survivor annuity payable during the lifetime of the member with the full amount of such annuity payable thereafter to the designated survivor annuitant, if living at the member's death.
- Option 3 A joint and fifty percent (50%) survivor annuity payable during the lifetime of the member with one-half of such annuity payable thereafter to the designated survivor annuitant, if living at the member's death.
- Option 4 A life annuity to the member with a special death benefit other than the normal option 1, 2, or 3 death benefit.

Note: The Option 4 totals above only reflect annuity elections that differ from the Maximum annuity or Options 1, 2 or 3. The Option 4 totals do not reflect Option 4 elections to withdraw accumulated deductions.

Table 4

**The Number and Annual Annuities of Beneficiaries and Survivor Annuitants  
as of June 30, 2018**

Age	Male		Female		Total	
	Number	Annuities	Number	Annuities	Number	Annuities
8	1	\$ 1,534			1	\$ 1,534
9						
10						
11						
12	1	3,741	1	\$ 1,534	2	5,275
13						
14						
15						
16						
17	2	4,036			2	4,036
18	1	1,898	2	10,923	3	12,821
19			2	4,388	2	4,388
20	2	11,957	1	9,605	3	21,562
21	2	3,275	1	8,672	3	11,947
22	1	9,869			1	9,869
23			2	4,814	2	4,814
24	2	17,708	1	9,942	3	27,650
25			2	9,620	2	9,620
26	2	2,899	3	30,329	5	33,228
27	3	19,923	2	18,704	5	38,627
28	2	118,597	4	19,051	6	137,648
29	5	24,013	4	22,733	9	46,746
30	2	5,832	1	3,484	3	9,316
31	9	96,008	3	25,735	12	121,743
32	2	2,839	1	5,316	3	8,155
33	2	21,891	7	87,104	9	108,995
34	5	22,393	3	20,253	8	42,646
35	3	18,257	3	42,716	6	60,973
36	5	59,285	4	25,667	9	84,952
37	5	29,161	4	16,443	9	45,604
38	6	35,469	2	9,340	8	44,809
39	3	3,031	8	66,359	11	69,390
40	12	93,089	7	28,882	19	121,971
41	7	64,651	7	26,832	14	91,483
42	3	9,392	11	70,030	14	79,422
43	7	102,070	10	86,220	17	188,290
44	7	27,200	10	63,437	17	90,637
45	6	23,376	10	35,330	16	58,706
46	5	37,238	8	66,087	13	103,325
47	3	3,945	17	127,787	20	131,732
48	8	43,860	12	110,971	20	154,831
49	8	61,580	24	226,568	32	288,148
50	13	65,232	21	151,093	34	216,325

Table 4  
(Continued)

The Number and Annual Annuities of Beneficiaries and Survivor Annuitants  
as of June 30, 2018

Age	Male		Female		Total	
	Number	Annuities	Number	Annuities	Number	Annuities
51	15	\$ 82,374	29	\$ 243,191	44	\$ 325,565
52	13	89,580	31	282,240	44	371,820
53	10	97,503	32	377,627	42	475,130
54	14	63,846	44	469,804	58	533,650
55	15	195,496	44	347,290	59	542,786
56	11	131,133	44	409,963	55	541,096
57	19	159,100	60	868,776	79	1,027,876
58	21	241,033	67	928,010	88	1,169,043
59	24	294,775	85	822,062	109	1,116,837
60	27	259,088	99	1,479,353	126	1,738,441
61	33	287,277	116	1,666,156	149	1,953,433
62	42	547,531	108	1,764,853	150	2,312,384
63	37	661,653	151	2,591,267	188	3,252,920
64	43	737,399	156	2,722,589	199	3,459,988
65	67	1,083,330	183	3,231,042	250	4,314,372
66	87	1,881,077	187	3,151,206	274	5,032,283
67	89	1,727,657	198	3,917,000	287	5,644,657
68	82	1,491,103	207	4,347,338	289	5,838,441
69	92	2,062,324	238	4,901,101	330	6,963,425
70	99	2,113,740	252	4,814,101	351	6,927,841
71	116	2,343,032	305	5,698,771	421	8,041,803
72	103	1,776,689	269	4,994,837	372	6,771,526
73	71	1,376,053	241	4,533,480	312	5,909,533
74	88	1,823,492	212	3,851,400	300	5,674,892
75	89	1,530,266	270	4,190,291	359	5,720,557
76	99	1,861,276	279	4,437,074	378	6,298,350
77	87	1,648,553	281	4,543,714	368	6,192,267
78	58	928,806	293	4,214,243	351	5,143,049
79	65	949,254	267	3,999,357	332	4,948,611
80	71	1,197,980	294	3,805,176	365	5,003,156
81	66	690,652	272	3,510,558	338	4,201,210
82	62	904,800	311	3,822,454	373	4,727,254
83	64	597,666	278	3,683,070	342	4,280,736
84	50	726,173	275	3,248,586	325	3,974,759
85	41	476,210	261	3,190,155	302	3,666,365
86	55	625,196	250	3,155,860	305	3,781,056
87	55	665,622	294	3,422,527	349	4,088,149
88	51	515,664	266	2,901,002	317	3,416,666
89	43	488,156	240	2,842,344	283	3,330,500
90	29	267,373	236	2,234,390	265	2,501,763
91	36	399,038	220	2,113,358	256	2,512,396
92	38	321,785	172	1,659,581	210	1,981,366
93	32	374,084	139	1,395,474	171	1,769,558
94	24	221,773	120	1,070,261	144	1,292,034
95	17	127,904	88	808,938	105	936,842
96	12	131,717	65	548,928	77	680,645

Table 4  
(Continued)

The Number and Annual Annuities of Beneficiaries and Survivor Annuitants  
as of June 30, 2018

Age	Male		Female		Total	
	Number	Annuities	Number	Annuities	Number	Annuities
97	8	\$ 115,569	48	\$ 463,541	56	\$ 579,110
98	4	43,254	35	299,828	39	343,082
99	3	25,847	19	127,386	22	153,233
100	4	32,004	17	124,548	21	156,552
101			12	78,002	12	78,002
102	3	17,693	9	60,184	12	77,877
103	1	10,411	4	33,141	5	43,552
104	1	11,358	5	17,169	6	28,527
107			1	16,032	1	16,032
109			1	1,838	1	1,838
<b>Total</b>	2,531	\$ 38,477,618	8,878	\$ 125,878,436	11,409	\$ 164,356,054

Table 5

The Number and Annual Annuities of Annuitants on the Retired List  
as of June 30, 2018

## Retired on Account of Disability

Age	Male		Female		Total	
	Number	Annuities	Number	Annuities	Number	Annuities
31			2	\$ 38,864	2	\$ 38,864
33			4	73,510	4	73,510
34			5	116,311	5	116,311
35	2	\$ 34,395	5	110,092	7	144,487
36	6	87,950	2	45,363	8	133,313
37	2	41,507	4	84,797	6	126,304
38	4	63,281	6	142,188	10	205,469
39	4	60,901	9	209,468	13	270,369
40	3	61,629	13	286,612	16	348,241
41	5	133,232	20	470,994	25	604,226
42	12	219,117	21	393,607	33	612,724
43	3	49,567	22	503,177	25	552,744
44	4	55,389	31	643,861	35	699,250
45	12	237,406	34	695,219	46	932,625
46	11	197,148	36	802,563	47	999,711
47	8	230,907	45	1,071,159	53	1,302,066
48	24	627,144	59	1,569,634	83	2,196,778
49	21	529,409	71	1,429,905	92	1,959,314
50	39	883,768	53	1,221,089	92	2,104,857
51	26	683,800	82	1,987,207	108	2,671,007
52	34	751,371	77	2,097,587	111	2,848,958
53	43	1,038,628	101	2,357,765	144	3,396,393
54	56	1,506,044	147	3,217,491	203	4,723,535
55	61	1,392,844	157	3,546,229	218	4,939,073
56	69	1,592,222	151	3,326,791	220	4,919,013
57	57	1,407,603	182	3,701,023	239	5,108,626
58	73	2,058,733	214	4,486,986	287	6,545,719
59	124	3,086,199	227	4,688,340	351	7,774,539
60	102	2,285,904	253	5,581,989	355	7,867,893
61	112	2,558,834	244	5,030,078	356	7,588,912
62	127	2,582,077	269	5,245,990	396	7,828,067
63	121	2,690,530	281	5,842,730	402	8,533,260
64	117	2,651,885	306	6,405,480	423	9,057,365
65	137	2,922,225	294	5,983,973	431	8,906,198
66	118	2,865,175	281	6,187,363	399	9,052,538
67	112	2,726,576	268	6,272,394	380	8,998,970
68	95	1,969,943	258	5,839,456	353	7,809,399
69	135	3,213,083	256	5,531,350	391	8,744,433
70	92	2,128,686	237	5,018,773	329	7,147,459
71	104	2,445,500	248	4,677,536	352	7,123,036
72	84	1,645,209	199	3,560,820	283	5,206,029
73	54	1,197,234	146	2,405,678	200	3,602,912
74	54	1,092,261	116	1,904,802	170	2,997,063
75	64	1,039,357	135	1,879,798	199	2,919,155

**Table 5**  
(Continued)

**The Number and Annual Annuities of Annuitants on the Retired List  
as of June 30, 2018**

**Retired on Account of Disability**

Age	Male		Female		Total	
	Number	Annuities	Number	Annuities	Number	Annuities
76	46	\$ 677,166	142	\$ 1,902,176	188	\$ 2,579,342
77	30	387,910	102	1,236,309	132	1,624,219
78	36	563,942	96	1,025,490	132	1,589,432
79	31	483,311	66	816,101	97	1,299,412
80	30	364,749	75	791,855	105	1,156,604
81	23	265,301	69	798,288	92	1,063,589
82	19	238,765	46	543,354	65	782,119
83	15	167,168	54	450,300	69	617,468
84	16	171,213	51	489,091	67	660,304
85	15	184,684	38	319,204	53	503,888
86	6	60,651	47	495,715	53	556,366
87	12	120,915	32	232,769	44	353,684
88	1	25,639	31	224,976	32	250,615
89	6	95,985	19	148,272	25	244,257
90	7	86,824	31	232,348	38	319,172
91	5	95,689	14	82,939	19	178,628
92	1	9,317	17	148,357	18	157,674
93	1	3,312	9	51,809	10	55,121
94	1	9,186	6	44,319	7	53,505
95			6	58,686	6	58,686
96			3	27,462	3	27,462
98	1	4,614	1	5,731	2	10,345
99			1	2,321	1	2,321
100			3	39,128	3	39,128
101			1	17,829	1	17,829
102			2	17,743	2	17,743
103			1	7,505	1	7,505
<b>Total</b>	<b>2,633</b>	<b>\$ 57,061,014</b>	<b>6,534</b>	<b>\$ 126,896,119</b>	<b>9,167</b>	<b>\$ 183,957,133</b>



## Exhibit VIII

### Glossary

<b>Accrued Liability</b>	The difference between (a) the present value of future plan benefits, and (b) the present value of future normal cost. It is the portion of the present value of future plan benefits attributable to service accrued as of the valuation date. Sometimes referred to as “actuarial accrued liability”.
<b>Accrued Service</b>	The service credited under the plan that was rendered before the date of the actuarial valuation.
<b>Actuarial Assumptions</b>	Estimates of future plan experience with respect to rates of mortality, disability, turnover, retirement, rate or rates of investment income and salary increases. Decrement assumptions (rates of mortality, disability, turnover and retirement) are generally based on past experience, often modified for projected changes in conditions. Economic assumptions (salary increases and investment income) consist of an underlying rate in an inflation-free environment plus a provision for a long-term average rate of inflation.
<b>Actuarial Cost Method</b>	A mathematical budgeting procedure for allocating the dollar amount of the “present value of future plan benefits” between the present value of future normal cost and the accrued liability. Sometimes referred to as the “actuarial funding method”.
<b>Actuarial Equivalent</b>	A series of payments is called an actuarial equivalent of another series of payments if the two series have the same actuarial present value.
<b>Actuarial Value of Assets</b>	The value of current plan assets recognized for valuation purposes. Based on a smoothed market value that recognizes investment gains and losses over a period of ten years.
<b>Amortization</b>	Paying off an interest-bearing liability by means of periodic payments of interest and principal, as opposed to paying it off with a lump sum payment.
<b>Experience Gain (Loss)</b>	A measure of the difference between actual experience and that expected based upon a set of actuarial assumptions during the period between two actuarial valuation dates, in accordance with the actuarial cost method being used.
<b>Normal Cost</b>	The annual cost assumed, under the actuarial funding method, for current and subsequent plan years. Sometimes referred to as “current service cost”.
<b>Present Value</b>	The amount of funds presently required to provide a payment or series of payments in the future. The present value is determined by discounting the future payments at a predetermined rate of interest, taking into account the probability of payment.
<b>Unfunded Accrued Liability</b>	The difference between the actuarial accrued liability and actuarial value of assets.