

# City of Phoenix Employees' Retirement System

ACTUARIAL VALUATION REPORT AS OF  
June 30, 2018



October 4, 2018

Mr. Scott Steventon  
Acting Retirement Program Administrator  
**City of Phoenix Employees' Retirement System**  
200 W. Washington Street, 10<sup>th</sup> Floor  
Phoenix, Arizona 85003

**Re: Actuarial Valuation of the City of Phoenix Employees' Retirement System as of June 30, 2018**

Dear Scott:

We are pleased to present the Report on the actuarial valuation of the City of Phoenix Employees' Retirement System ("COPERS") as of June 30, 2018.

This Report presents the results of the June 30, 2018 actuarial valuation of COPERS. The Report describes the current actuarial condition of COPERS, determines annual employer contribution rates, and analyzes changes in these rates. In addition, the Report provides various summaries of the data. This report should not be relied on for any purpose other than the purpose described in the primary communication. Accounting information for purposes of complying with Governmental Accounting Standards Board (GASB) Statements Nos. 67 and 68 is provided in a separate report.

We certify that the information included herein and contained in the June 30, 2018 Actuarial Valuation Report is accurate and fairly presents the actuarial position of COPERS as of the valuation date.

***Financing Objectives***

The Actuarially Determined Contribution is determined by taking the sum of the normal cost, a component to amortize the unfunded liability and a component to cover administrative expenses. The Board's current funding policy is to contribute an amount each year based on the most recently calculated Actuarially Determined Contribution.

The unfunded accrued liability is comprised of experience gains and losses, assumption changes and benefit changes. A base is established in each year for changes in the unfunded accrued liability arising from these sources. In September 2013, the Board adopted amortization payment methods that amortize the pre-assumption changes of July 1, 2013 over a closed 25-year period as a level percentage of payroll; amortizes the assumption change liability as of July 1, 2013 over a closed 25-year period as a level percentage of payroll with a four-year phase in, and amortizes future gains and losses over a closed 20 year period. Future gains cannot be amortized over a period shorter than the period remaining on the 25-year amortization schedule. The actuarially determined contribution has increased from 37.99% of pay to 38.51% of pay. The increase is primarily due to the phase-in of the July 1, 2015 assumption change liability.

Mr. Scott Steventon

October 4, 2018

Page 2

Assuming all actuarial assumptions are met, this method of payment of the unfunded liability will result in full funding in 20 years. Actual results can and almost certainly will differ, as actual experience deviates from the assumptions. A schedule of each year's initial base and remaining outstanding balance is illustrated in Exhibit B.5.

### ***Progress Toward Realization of Financing Objectives***

The unfunded actuarial accrued liability and the funded ratio (ratio of the actuarial value of assets to the actuarial accrued liability) illustrate the progress toward the realization of certain financing objectives.

Based on the actuarial valuation as of June 30, 2018, COPERS has an unfunded liability of \$1,663.2 million and a funded ratio of 60.6%.

Although there were losses on the actuarial value of assets, the funded ratio on an actuarial value of assets basis increased from 58.2% to 60.6%. The funded ratio on a market value of assets basis increased from 57.0% to 60.5%. This increase was due primarily to liability and contribution gains created by contributions made during the year that were in excess of the actuarially determined contribution. A funded ratio less than 100% indicates an actuarially determined contribution that will require a normal cost and an amortization payment. If the contributions equal the ADC, and if all assumptions are met, the funded ratio should improve over time.

### ***Benefit Provisions***

All of the benefit provisions reflected in this valuation are those which were in effect on June 30, 2018. The benefit provisions are summarized in Section D of this Report.

### ***Assumptions and Methods***

The assumptions were adopted by the City of Phoenix Employees' Retirement System primarily upon the prior actuary's analysis. The most recent experience study had covered the period of July 1, 2009 through June 30, 2014. The new assumptions were adopted in August of 2015. Updated mortality assumptions were adopted in October of 2015. In 2017 the Board accepted GRS's recommendation in the economic assumption analysis and directed GRS to use a 7.25% discount rate, a 2.50% inflation assumption and a 3.0% payroll growth assumption. These assumptions and methods are detailed in Section F of this Report. The Board has sole authority to determine the actuarial assumptions used for COPERS. In our opinion, the actuarial assumptions used are reasonable.

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on COPERS's funded status); and changes in plan provisions or applicable law. The actuarial calculations presented in this report are intended to provide



Mr. Scott Steventon

October 4, 2018

Page 3

information for rational decision making.

**Data**

The valuation was based upon information as of June 30, 2018, furnished by City of Phoenix Employees' Retirement System staff, concerning Plan benefits, financial transactions, plan provisions and active members, terminated members, retirees and beneficiaries. We checked for internal and year-to-year consistency, but did not otherwise audit the data. We are not responsible for the accuracy or completeness of the information provided by City of Phoenix Employees' Retirement System staff.

**Certification**

All of our work conforms with generally accepted actuarial principles and practices, and to the Actuarial Standards of Practice issued by the Actuarial Standards Board. In our opinion, our calculations also comply with the requirements of, where applicable, the Internal Revenue Code, and ERISA.

The signing actuaries are independent of COPERS sponsor. Leslie Thompson is an Enrolled Actuary. All signing actuaries are Members of the American Academy of Actuaries, and meet the Qualification Standards of the American Academy of Actuaries. Finally, all of the undersigned are experienced in performing valuations for large public retirement systems.

Respectfully submitted,

**Gabriel, Roeder, Smith & Company**



Leslie Thompson, FSA, FCA, EA, MAAA  
Senior Consultant



Paul Wood, ASA, FCA, MAAA  
Consultant



*TABLE OF CONTENTS*

<b>Section</b>	
	<b>COVER LETTER</b>
<b>A</b>	<b>EXECUTIVE SUMMARY</b>
<b>B</b>	<b>VALUATION RESULTS</b>
<b>C</b>	<b>PLAN ASSETS</b>
<b>D</b>	<b>PROJECTIONS</b>
<b>E</b>	<b>SUMMARY OF BENEFIT PROVISIONS</b>
<b>F</b>	<b>SUMMARY OF PARTICIPANT DATA</b>
<b>G</b>	<b>ACTUARIAL ASSUMPTIONS AND METHODS</b>

## SECTION A

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### EXECUTIVE SUMMARY

## **Actuarial Valuation**

Valuations are prepared annually, as of June 30 of each year. The primary purposes of the valuation report are to measure the plan's liabilities, to determine the contribution rate and to analyze changes in the City of Phoenix Employees' Retirement System actuarial position.

In addition, the report provides summaries of the member data, financial data, plan provisions, and actuarial assumptions and methods.

## **Financing Objectives**

The employer contributions are intended to be sufficient to pay the normal cost and administrative expenses and to amortize the Unfunded Actuarial Accrued Liability (UAAL) as described on page B-6 of this report.

The contribution rate shown on pages B-4 and B-5 may be considered as a minimum contribution rate that complies with the Board's funding policy. Users of this report should be aware that contributions made at that rate do not guarantee benefit security. Given the importance of benefit security to any retirement system, we suggest that contributions to COPERS in excess of those presented in this report be considered.

The contribution rate in this report is determined using the actuarial assumptions and methods disclosed in Section F of this report. This report does not include a more robust assessment of the risks of future experience not meeting the actuarial assumptions. Assessment of risks was outside the scope of this assignment. We encourage a review and assessment of investment and other significant risks that may have a material effect on the plan's financial condition.

## **Assumption Changes**

There were no changes to assumptions since the prior valuation. The assumptions are summarized in Section F of the report.

## **Experience During the Year**

The plan experienced a contribution gain of \$77.7 million and a liability gain of \$42.8 million during fiscal year 2018.

The plan experienced an asset loss of \$49.7 million during fiscal year 2018. As of June 30, 2018, the amount of outstanding assets losses not yet recognized in the actuarial value of assets was \$8.3 million. If the Plan does not earn investment earnings in excess of the assumed 7.25% per year, these losses will need to be recognized in future valuations. This will put downward pressure on the funded ratio and upward pressure on the Actuarially Determined Contribution.

## **Benefit Provision Changes**

There were no changes to benefit provisions since the prior valuation. The benefit provisions are summarized in Section D of the report.



## Financial Position and Summary of Results

The funded ratio on an actuarial value of assets basis increased from June 30, 2017 to June 30, 2018. On a market value of assets basis, the funded ratio also increased from June 30, 2017 to June 30, 2018.

<b>Exhibit A.1 City of Phoenix Employees' Retirement System Executive Summary</b>		
	<b>June 30, 2018</b>	<b>June 30, 2017</b>
<b>1. Total Actuarially Determined Contribution</b>		
a. Dollar Amount	\$ 208,889,903	\$ 203,958,677
b. As a % of Payroll	38.51%	37.99%
<b>2. Funded Status</b>		
a. Actuarial Accrued Liability	\$ 4,226,045,811	\$ 4,129,452,386
b. Actuarial Value of Assets (AVA)	2,562,847,008	2,402,707,329
c. Unfunded Liability (AVA-basis)	1,663,198,803	1,726,745,057
d. Funded Ratio (AVA-basis)	60.64%	58.18%
e. Market Value of Assets (MVA)	\$ 2,554,513,709	\$ 2,353,607,330
f. Unfunded Liability (MVA-basis)	1,671,532,102	1,775,845,056
g. Funded Ratio (MVA-basis)	60.45%	57.00%
<b>3. Summary of Census Data</b>		
a. Actives		
i.(a) Tier 1 Count	5,638	6,030
i.(b) Tier 2 Count	737	823
i.(c) Tier 3 Count	1,602	1,177
i.(d) Total Active Count	7,977	8,030
ii. Total Annual Compensation	\$ 527,160,824	\$ 521,709,266
iii. Average Projected Compensation	66,085	64,970
iv. Average Age	46.6	46.5
v. Average Service	12.4	12.3
b. Deferred Vested Member Counts	943	925
c. Retiree Counts	5,813	5,661
d. Beneficiary and Alternate Payee Counts	1,076	1,072
e. Disability Counts	249	247
f. Total Members Included in Valuation	16,058	15,935

The funded ratio may not be appropriate for assessing the need for future contributions. The funded ratio is not appropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations.

## **SECTION B**

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### **VALUATION RESULTS**

**Exhibit B.1**  
**City of Phoenix Employees' Retirement System**  
**Actuarial Valuation Results**  
**Actuarial Accrued Liability**

	June 30, 2018				June 30, 2017
	Tier 1	Tier 2	Tier 3	Total	Total
<b>1. Active Members</b>					
a. Retirement Benefits	\$ 1,427,352,538	\$ 23,550,332	\$ 11,098,900	\$ 1,462,001,770	\$ 1,431,497,234
b. Withdrawal Benefits	25,108,651	1,926,726	1,435,789	28,471,166	29,183,095
c. Disability Benefits	14,793,448	453,937	173,642	15,421,027	15,450,895
d. Death Benefits	14,597,312	424,514	159,425	15,181,251	15,237,273
e. Total	<u>\$ 1,481,851,949</u>	<u>\$ 26,355,509</u>	<u>\$ 12,867,756</u>	<u>\$ 1,521,075,214</u>	<u>\$ 1,491,368,497</u>
<b>2. Members with Deferred Benefits</b>				\$ 70,812,660	\$ 68,936,162
<b>3. Members Receiving Benefits</b>				\$ 2,634,157,937	\$ 2,569,147,727
<b>4. Total</b>				\$ 4,226,045,811	\$ 4,129,452,386
<b>5. Actuarial Value of Assets</b>				<u>\$ 2,562,847,008</u>	<u>\$ 2,402,707,329</u>
<b>6. Unfunded Actuarial Accrued Liability</b>				\$ 1,663,198,803	\$ 1,726,745,057

Tier 1: Hired before July 1, 2013

Tier 2: Hired between July 1, 2013 and December 31, 2015

Tier 3: Hired on or after January 1, 2016

**Exhibit B.2**  
**City of Phoenix Employees' Retirement System**  
**Actuarial Valuation Results**  
**Normal Cost for Fiscal Year Ending June 30, 2020**

	Tier 1	Tier 2	Tier 3	Total	Prior Year
<b>1. Dollar Normal Cost</b>					
a. Retirement Benefits	\$ 47,374,702	\$ 5,483,943	\$ 7,665,936	\$ 60,524,582	\$ 60,589,038
b. Withdrawal Benefits	6,810,997	995,553	1,777,544	9,584,093	9,343,706
c. Disability Benefits	1,436,065	153,673	240,651	1,830,389	1,816,852
d. Death Benefits	982,962	131,585	201,254	1,315,803	1,321,955
e. Total	<u>\$ 56,604,726</u>	<u>\$ 6,764,754</u>	<u>\$ 9,885,385</u>	<u>\$ 73,254,867</u>	<u>\$ 73,071,551</u>
<b>2. Normal Cost as a Percentage of Pay</b>	14.69%	16.77%	12.76%	14.56%	14.67%
<b>3. Projected Payroll for FYE June 30, 2020</b>	\$ 415,973,533	\$ 42,701,304	\$ 83,792,133	\$ 542,466,970	\$ 536,934,310
<b>4. Dollar Normal Cost for FYE June 30, 2020</b>	\$ 61,097,801	\$ 7,162,574	\$ 10,715,709	\$ 78,976,084	\$ 78,755,065

Tier 1: Hired before July 1, 2013

Tier 2: Hired between July 1, 2013 and December 31, 2015

Tier 3: Hired on or after January 1, 2016

**Exhibit B.3**  
**City of Phoenix Employees' Retirement System**  
**Actuarial Valuation Results**  
**Present Value of Projected Benefits**

	June 30, 2018				June 30, 2017
	Tier 1	Tier 2	Tier 3	Total	Total
<b>1. Active Members</b>					
a. Retirement Benefits	\$ 1,749,360,618	\$ 80,997,683	\$ 92,287,705	\$ 1,922,646,006	\$ 1,897,250,358
b. Withdrawal Benefits	72,917,265	14,179,591	22,832,918	109,929,774	108,130,127
c. Disability Benefits	24,821,799	2,306,795	2,994,263	30,122,857	30,134,103
d. Death Benefits	21,093,030	1,827,648	2,305,323	25,226,001	25,390,808
e. Total	<u>\$ 1,868,192,712</u>	<u>\$ 99,311,717</u>	<u>\$ 120,420,209</u>	<u>\$ 2,087,924,638</u>	<u>\$ 2,060,905,396</u>
<b>2. Members with Deferred Benefits</b>				\$ 70,812,660	\$ 68,936,162
<b>3. Members Receiving Benefits</b>					
a. Healthy Retirees				\$ 2,393,502,724	\$ 2,333,621,103
b. Disabled Retirees				47,719,285	47,210,143
c. Beneficiaries				192,935,928	188,316,481
d. Total				<u>\$ 2,634,157,937</u>	<u>\$ 2,569,147,727</u>
<b>4. Total</b>				\$ 4,792,895,235	\$ 4,698,989,285

Tier 1: Hired before July 1, 2013

Tier 2: Hired between July 1, 2013 and December 31, 2015

Tier 3: Hired on or after January 1, 2016

**Exhibit B.4**  
**City of Phoenix Employees' Retirement System**  
**Development of the Actuarially Determined Contribution**

	June 30, 2018	June 30, 2017
1. Present Value of Projected Benefits		
a. Retirees and Beneficiaries	\$ 2,634,157,937	\$ 2,569,147,727
b. Deferred vested members	70,812,660	68,936,162
c. Active members	<u>2,087,924,638</u>	<u>2,060,905,396</u>
d. Total [(a) + (b) + (c)]	\$ 4,792,895,235	\$ 4,698,989,285
2. Present Value of Future Normal Costs	\$ 566,849,424	\$ 569,536,899
3. Entry Age Normal Accrued Liability [(1) - (2)]	\$ 4,226,045,811	\$ 4,129,452,386
4. Actuarial Value of Assets	<u>2,562,847,008</u>	<u>2,402,707,329</u>
5. Unfunded Actuarial Accrued Liability [(3) - (4)]	\$ 1,663,198,803	\$ 1,726,745,057
<b>Development of the Actuarially Determined Contribution</b>		
<b>Fiscal Year Ending</b>	<b>June 30, 2020</b>	<b>June 30, 2019</b>
6. Entry Age Normal Cost	\$ 78,976,084	\$ 78,755,065
7. Administrative Expenses	400,149	391,511
8. Amortization of UAAL	<u>129,513,670</u>	<u>124,812,101</u>
9. Actuarially Determined Contribution [(6) + (7) + (8)]	\$ 208,889,903	\$ 203,958,677
10. Projected Payroll	\$ 542,466,970	\$ 536,934,310
11. Actuarially Determined Contribution as a Percent of Compensation	38.507%	37.986%

**Exhibit B.5**  
**City of Phoenix Employees' Retirement System**  
**Actuarial Valuation Results**  
**Summary of Contribution Rates and Estimated Amounts**

Fiscal Year Ending	June 30, 2020	June 30, 2019
<b>1. Total Contribution Rate</b>		
a. Total Normal Cost Rate	14.56%	14.67%
b. Administrative Expense Rate	0.07%	0.07%
c. Total UAL Contribution Rate	23.87%	23.25%
<b>d. Total Projected Rate</b>	<b>38.51%</b>	<b>37.99%</b>
<b>2. Member Contribution Rates</b>		
a. Tier 1	5.00%	5.00%
b. Tier 2	11.00%	11.00%
c. Tier 3	11.00%	11.00%
<b>3. City Contribution Rates</b>		
a. Tier 1	33.51%	32.99%
b. Tier 2	27.51%	26.99%
c. Tier 3	27.51%	26.99%
<b>4. Projected Payroll</b>		
a. Tier 1	\$ 415,973,533	\$ 432,741,997
b. Tier 2	42,701,304	44,531,341
c. Tier 3	83,792,133	59,660,972
<b>d. Total</b>	<b>\$ 542,466,970</b>	<b>\$ 536,934,310</b>
<b>5. Estimated Contribution Amounts</b>		
a. Memebrs	\$ 34,712,955	\$ 33,098,254
b. City	174,176,949	170,860,423
<b>c. Total</b>	<b>\$ 208,889,904</b>	<b>\$ 203,958,677</b>

### Development of Actuarially Determined Contribution (Continued)

The Actuarially Determined Contribution (ADC) is calculated in accordance with the Funding Policy adopted by the Board. The unfunded accrued liability is amortized according to the following schedule. Please see Section G of this report for a full description of the funding policy.

<b>Exhibit B.6</b>					
<b>City of Phoenix Employees' Retirement System</b>					
<b>Amortization of Unfunded Actuarial Liability as of June 30, 2018</b>					
Base Year	Remaining Base as of June 30, 2018	Years Remaining as of June 30, 2018	Remaining Base as of June 30, 2019	Years Remaining as of June 30, 2019	Amortization Payment For FYE June 30, 2020
2013 UAL	\$ 1,122,958,052	20	\$ 1,118,310,525	19	\$ 85,595,304
2013 Assumption Changes	478,834,535	20	476,852,808	19	36,498,236
2014 Experience Gain	(59,249,308)	20	(59,004,096)	19	(4,516,164)
2015 Experience Gain	(3,028,108)	20	(3,015,576)	19	(230,812)
2015 Assumption Changes	293,059,539	17	295,514,948	16	25,458,980
2016 Experience Gain	(33,550,846)	20	(33,411,991)	19	(2,557,348)
2016 Plan Changes	(3,465,150)	20	(3,450,809)	19	(264,124)
2016 Assumption Changes	(74,494,211)	20	(74,185,906)	19	(5,678,177)
2017 Experience Loss	10,343,471	19	10,273,488	18	815,438
2017 Assumption Changes	2,595,259	19	2,577,700	18	204,600
2018 Experience Gain	(70,804,431)	20	(75,937,752)	19	(5,812,263)
<b>Total</b>	<b>\$ 1,663,198,803</b>		<b>\$ 1,654,523,338</b>		<b>\$ 129,513,670</b>

The payment of the 2015 assumption changes is phased-in over four years. The first year payment was one-fourth of the regularly calculated amortization payment, increasing each year until the end of the phase-in period. The outstanding balance at the end of the phase-in period is then amortized such that the full amount is paid off by the end of the remaining period.



**Exhibit B.7**  
**City of Phoenix Employees' Retirement System**  
**Plan Experience for Fiscal Year 2018**

**Liabilities**

1. Actuarial Accrued Liability at June 30, 2017	\$ 4,129,452,386
2. Normal Cost during Fiscal Year 2018	73,071,551
3. Benefit Payments during Fiscal Year 2018	227,576,107
4. Interest on Items 1-3 to End of Year	293,882,501
5. Change in Actuarial Accrued Liability Due to Assumption Changes	-
6. Change in Actuarial Accrued Liability Due to Provision Changes	-
7. Expected Actuarial Accrued Liability at June 30, 2018	4,268,830,331
8. Actual Actuarial Accrued Liability at June 30, 2018	4,226,045,811
9. Liability (Gain)/Loss	(42,784,520)

**Assets**

10. Actuarial Value of Assets at June 30, 2017	\$ 2,402,707,329
11. Benefit Payments and Administrative Expenses during Fiscal Year 2018	227,953,286
12. Expected Contributions during Fiscal Year 2018	187,323,822
13. Interest on Items 10-12 to End of Year	172,749,232
14. Expected Actuarial Value of Assets at June 30, 2018	2,534,827,097
15. Actual Actuarial Value of Assets at June 30, 2018	2,562,847,008
16. Total Asset and Contribution (Gain)/Loss	(28,019,911)
16.(a) Asset (Gain)/Loss	49,674,465
16.(b) Contribution (Gain)/Loss	(77,694,376)

**Total**

17. Total (Gain)/Loss [ 9. + 16.]	<b>\$ (70,804,431)</b>
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**Exhibit B.8**  
**City of Phoenix Employees' Retirement System**  
**Plan Experience for Fiscal Year 2018**  
**(Gain)/Loss by Source**

1. Liability (Gain)/Loss		
a. Salary (Gain)/Loss		(13,888,692)
b. New Members and Rehire (Gain)/Loss		3,231,844
c. Withdrawal (Gain)/Loss		(2,293,809)
d. Retirement (Gain)/Loss		(10,051,981)
e. Annuitant Mortality (Gain)/Loss		(4,225,432)
f. Difference Between Expected and Actual COLA		(22,199,183)
g. Other Demographic (Gain)/Loss		6,642,733
h. Total		(42,784,520)
2. Asset (Gain)/Loss	\$	49,674,465
3. Contribution (Gain)/Loss	\$	(77,694,376)
4. Total (Gain)/Loss	\$	<b>(70,804,431)</b>

**Exhibit B.9**  
**City of Phoenix Employees' Retirement System**  
**Schedule of Funding Progress**

Actuarial Valuation Date	Actuarial Value of Assets	Actuarial Accrued Liability (AAL)	Unfunded AAL (UAAL)	Funded Ratio	Covered Payroll	UAAL as a Percentage of Covered Payroll
(1)	(2)	(3)	(4)=(3)-(2)	(5)=(2)/(3)	(6)	(7)=(4)/(6)
6/30/2008	\$ 1,908,414	\$ 2,413,365	\$ 504,951	79.1%	\$ 566,512	89.1%
6/30/2009	1,895,148	2,518,094	622,946	75.3%	539,468	115.5%
6/30/2010	1,868,093	2,697,288	829,195	69.3%	550,175	150.7%
6/30/2011	1,834,620	2,752,909	918,289	66.7%	513,322	178.9%
6/30/2012	1,827,528	2,939,374	1,111,845	62.2%	506,017	219.7%
6/30/2013	1,961,939	3,055,606	1,093,668	64.2%	508,032	215.3%
6/30/2014	2,120,700	3,614,784	1,494,084	58.7%	509,267	293.4%
6/30/2015	2,202,923	3,975,908	1,772,985	55.4%	484,853	365.7%
6/30/2016	2,283,216	3,984,137	1,700,921	57.3%	496,333	342.7%
6/30/2017	2,402,707	4,129,452	1,726,745	58.2%	521,709	331.0%
6/30/2018	2,562,847	4,226,046	1,663,199	60.6%	527,161	315.5%

*Amounts in thousands*

**Exhibit B.10**  
**City of Phoenix Employees' Retirement System**  
**Solvency Test**

Valuation Date	Aggregated Accrued Liabilities for				Actuarial Value of Assets	Portion of Accrued Liabilities Covered by Reported Assets		
	Active Members Contributions	Retirees Beneficiaries and Vested Terminations	Members (Employer Financed Portion)	[(5)-(2)]/(3)		(5)/(2)	[(5)-(2)]/(3)	[(5)-(2)-(3)]/(4)
	(2)	(3)	(4)					
June 30, 2008	\$ 433,742	\$ 1,066,886	\$ 912,737	\$ 1,908,414	100.0%	100.0%	44.7%	
June 30, 2009	446,039	1,193,391	878,664	1,895,148	100.0%	100.0%	29.1%	
June 30, 2010	445,141	1,311,929	940,217	1,868,093	100.0%	100.0%	11.8%	
June 30, 2011	446,456	1,431,877	874,576	1,834,620	100.0%	96.9%	0.0%	
June 30, 2012	443,964	1,525,152	970,258	1,827,528	100.0%	90.7%	0.0%	
June 30, 2013	396,583	1,881,123	1,201,741	1,962,533	100.0%	83.2%	0.0%	
June 30, 2014	393,754	2,099,274	1,121,756	2,120,700	100.0%	82.3%	0.0%	
June 30, 2015	383,029	2,465,862	1,127,017	2,202,923	100.0%	73.8%	0.0%	
June 30, 2016	393,626	2,522,989	1,067,522	2,283,216	100.0%	74.9%	0.0%	
June 30, 2017	406,651	2,638,084	1,084,717	2,402,707	100.0%	75.7%	0.0%	
June 30, 2018	417,314	2,704,971	1,103,761	2,562,847	100.0%	79.3%	0.0%	

*Amounts in thousands*

**Exhibit B.11**  
**City of Phoenix Employees' Retirement System**  
**Analysis of Financial Experience**  
**Dollar Amounts in Thousands**

Fiscal Year	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
1. UAAL at Start of Year	\$ 1,726,745	1,700,921	1,772,985	1,494,084	1,516,915	1,111,845	918,289	829,195	622,946	504,950
2. Normal Cost for Year*	73,449	73,256	80,757	75,310	78,331	71,828	77,366	80,099	78,731	83,089
3. Expected Contributions	(187,324)	(183,023)	(178,288)	(157,314)	(153,885)	(143,502)	(133,822)	(119,613)	(116,482)	(98,157)
4. Assumed Investment Income Accrual on (1), (2) and (3)	<u>121,133</u>	<u>123,527</u>	<u>129,383</u>	<u>109,037</u>	<u>110,987</u>	<u>86,136</u>	<u>71,248</u>	<u>64,652</u>	<u>48,228</u>	<u>39,755</u>
5. Expected UAAL Before Changes	\$ 1,734,003	1,714,681	1,804,836	1,521,117	1,552,347	1,126,307	933,081	854,333	633,424	529,637
6. Effect of Assumption/Method Changes	-	2,420	(69,420)	254,870	-	423,247	-	-	-	-
7. Effect of Benefit Changes	-	-	<u>(3,229)</u>	-	-	-	-	-	-	-
8. Expected UAAL After Changes	\$ 1,734,003	1,717,101	1,732,187	1,775,987	1,552,347	1,549,554	933,081	854,333	633,424	529,637
9. Actual UAAL	<u>1,663,199</u>	<u>1,726,745</u>	<u>1,700,921</u>	<u>1,772,985</u>	<u>1,494,084</u>	<u>1,516,915</u>	<u>1,111,845</u>	<u>918,289</u>	<u>829,195</u>	<u>622,946</u>
10. Gain / (Loss) [8. - 9.]	\$ 70,804	(9,644)	31,266	3,002	58,263	32,639	(178,764)	(63,956)	(195,771)	(93,309)
11. As % of AAL at Start of Year	1.71%	-0.24%	0.80%	0.10%	1.70%	1.10%	-6.50%	-2.40%	-7.80%	-3.90%

\* Includes administrative expenses beginning in 2017

## **SECTION C**

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### **PLAN ASSETS**

**Exhibit C.1**  
**City of Phoenix Employees' Retirement System**  
**Statement of Plan Net Assets**

	<b>June 30, 2018</b>
<b>Assets</b>	
Cash and Cash Equivalents	\$ 90,104,716
Investments, at fair value:	
Fixed income	296,713,970
Equity securities	1,174,009,575
Hedge funds	297,438,048
Real estate investments	347,187,878
International equities	362,700,759
Total investments	\$ 2,478,050,230
Receivables:	
Employer contributions	5,917,570
Employee contributions	1,159,378
Dividends and Interest	1,545,288
Unsettled transactions	9,757,190
Other	643,956
Total receivables	\$ 19,023,382
Total assets	\$ 2,587,178,328
<b>Accounts Payable</b>	
Accrued investment expenses	1,238,883
Unsettled transactions	31,060,551
Other	365,185
Total payables	\$ 32,664,619
<b>Net assets held in trust for pension benefits</b>	<b>\$ 2,554,513,709</b>

**Exhibit C.2**  
**City of Phoenix Employees' Retirement System**  
**Statement of Changes in Plan Net Assets**

	<u>Year Ended June 30, 2018</u>	<u>Year Ended June 30, 2017</u>
<b>Additions to Net Assets Attributed to:</b>		
Contributions		
Employer contributions	\$ 229,006,261	\$ 152,153,254
Plan members contributions	33,339,957	30,870,070
Inter-system transfers	484,140	42,597
Total	<u>\$ 262,830,358</u>	<u>\$ 183,065,921</u>
Net Investment Income		
Net appreciation in fair value of investments	150,962,881	221,631,739
Interest and dividends	30,559,354	26,899,919
Other	2,064,266	4,386,387
	<u>183,586,501</u>	<u>252,918,045</u>
Less Investment expense	<u>(17,073,054)</u>	<u>(9,707,146)</u>
Net investment income	<u>\$ 166,513,447</u>	<u>\$ 243,210,899</u>
Total additions	<u>\$ 429,343,805</u>	<u>\$ 426,276,820</u>
<b>Deductions to Net Assets Attributed to:</b>		
Benefit payments	224,453,753	220,276,330
Refunds	3,472,481	3,226,736
Inter-system transfers	134,013	206,835
Administrative expenses	377,179	380,108
Total deductions	<u>\$ 228,437,426</u>	<u>\$ 224,090,009</u>
Change in net assets	200,906,379	202,186,811
<b>Net assets held in trust for benefits:</b>		
Beginning of year	2,353,607,330	2,151,420,519
End of year	<u>\$ 2,554,513,709</u>	<u>\$ 2,353,607,330</u>



**Exhibit C.3**  
**City of Phoenix Employees' Retirement System**  
**Development of the Actuarial Value of Assets**

Item	Year Ending June 30, 2018
1. Actuarial Value of Assets, Beginning of Year	\$ 2,402,707,329
2. Net Cash Flow	\$ 34,392,932
3. Expected return	\$ 175,421,212
4. Actual Return	\$ 166,513,447
5. Excess return [ (4) - (3) ]	\$ (8,907,765)
6. Gains/(Losses)	
a. Current Year	(8,907,765)
b. Prior Year	73,480,315
c. 2nd Prior Year	(153,570,531)
d. 3rd Prior Year	(109,699,880)
e. Total	(198,697,861)
7. Phase-In Amount [25% of 6.e.]	\$ (49,674,465)
8. Actuarial Value of Assets, End of Year [(1) + (2) + (3) + (7)]	\$ 2,562,847,008
9. Estimated Rate of Return	5.20%
10. Ratio of Actuarial to Market Value of Assets	100.3%

## **SECTION D**

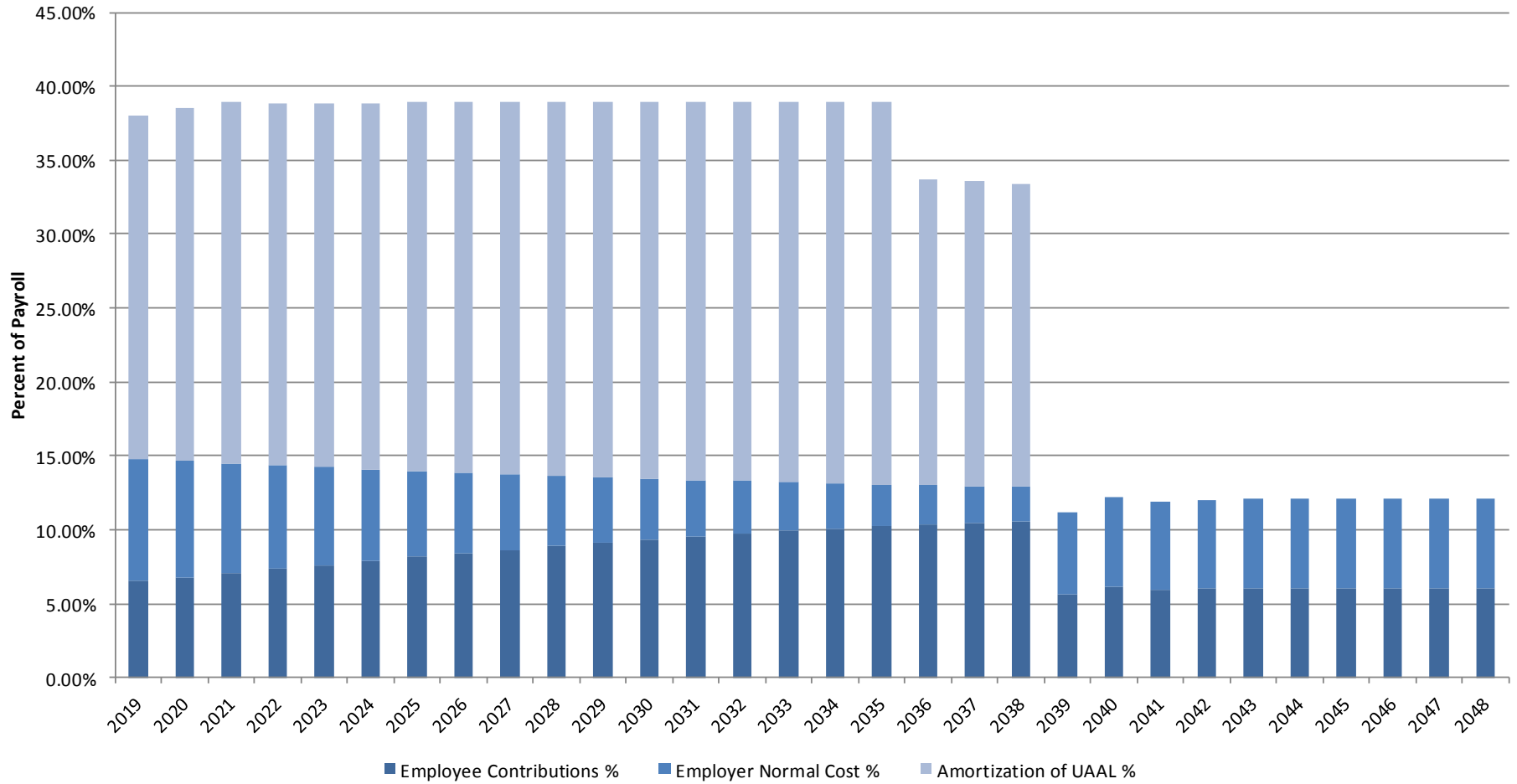
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### **PROJECTIONS**

**City of Phoenix Employees Retirement System  
Projection Results Based on June 30, 2018 Actuarial Valuation**

Valuation as of June 30,	Contribution Rate Effective June 30,	Market Return for FY Beginning on Valuation Date	Payroll (in Millions)	Employee Contributions (% of Payroll)	Employer Contributions in FY Following Val Date (% of Payroll)	Employer Contributions in FY Following Val Date (in Millions)	Actuarial Accrued Liability (AAL, in Millions)	Actuarial Value of Assets (AVA, in Millions)	Unfunded Actuarial Accrued Liability (UAAL, in Millions)	Funded Ratio	Projected Benefit Payments in FY Following Val Date (in Millions)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
2018	2019	7.25%	\$527	6.51%	31.47%	\$166	\$4,226	\$2,563	\$1,663	60.6%	\$237
2019	2020	7.25%	542	6.74%	31.77%	172	4,364	2,687	1,677	61.6%	251
2020	2021	7.25%	553	7.05%	31.86%	176	4,498	2,854	1,644	63.4%	265
2021	2022	7.25%	564	7.33%	31.48%	177	4,629	3,007	1,622	65.0%	278
2022	2023	7.25%	576	7.61%	31.24%	180	4,757	3,163	1,593	66.5%	290
2023	2024	7.25%	588	7.88%	31.00%	182	4,882	3,323	1,559	68.1%	303
2024	2025	7.25%	602	8.14%	30.76%	185	5,004	3,487	1,517	69.7%	316
2025	2026	7.25%	615	8.39%	30.52%	188	5,123	3,654	1,469	71.3%	328
2026	2027	7.25%	630	8.63%	30.28%	191	5,239	3,827	1,412	73.0%	341
2027	2028	7.25%	645	8.87%	30.05%	194	5,352	4,004	1,348	74.8%	354
2028	2029	7.25%	661	9.10%	29.83%	197	5,461	4,187	1,273	76.7%	367
2029	2030	7.25%	677	9.32%	29.62%	201	5,565	4,377	1,189	78.6%	380
2030	2031	7.25%	694	9.53%	29.41%	204	5,666	4,573	1,093	80.7%	393
2031	2032	7.25%	712	9.73%	29.21%	208	5,763	4,777	986	82.9%	405
2032	2033	7.25%	730	9.91%	29.02%	212	5,855	4,990	865	85.2%	417
2033	2034	7.25%	749	10.08%	28.83%	216	5,943	5,213	731	87.7%	429
2034	2035	7.25%	769	10.23%	28.66%	220	6,029	5,448	581	90.4%	439
2035	2036	7.25%	791	10.37%	23.32%	184	6,112	5,697	414	93.2%	449
2036	2037	7.25%	813	10.50%	23.15%	188	6,193	5,920	272	95.6%	458
2037	2038	7.25%	836	10.61%	22.78%	190	6,272	6,157	115	98.2%	467
2038	2039	7.25%	860	5.57%	5.57%	48	6,352	6,409	(56)	100.9%	474
2039	2040	7.25%	885	6.11%	6.11%	54	6,434	6,481	(48)	100.7%	480
2040	2041	7.25%	912	5.95%	5.95%	54	6,518	6,566	(48)	100.7%	485
2041	2042	7.25%	940	6.02%	6.02%	57	6,606	6,652	(46)	100.7%	489
2042	2043	7.25%	969	6.03%	6.03%	58	6,700	6,744	(45)	100.7%	492
2043	2044	7.25%	1,000	6.03%	6.03%	60	6,800	6,844	(44)	100.6%	495
2044	2045	7.25%	1,032	6.03%	6.03%	62	6,908	6,951	(43)	100.6%	499
2045	2046	7.25%	1,064	6.04%	6.04%	64	7,024	7,066	(42)	100.6%	503
2046	2047	7.25%	1,097	6.04%	6.04%	66	7,148	7,189	(41)	100.6%	509
2047	2048	7.25%	1,130	6.04%	6.04%	68	7,279	7,319	(41)	100.6%	516
2048	2049	7.25%	1,164	6.05%	6.05%	70	7,415	7,456	(40)	100.5%	524

### Projected Contribution Rate for FYE June 30,



## **SECTION E**

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### **SUMMARY OF BENEFIT PROVISIONS**

## SUMMARY OF BENEFIT PROVISIONS

### **Membership**

Full-time employees of the City of Phoenix other than police officers, firefighters, or elected officials who are covered by another retirement system to which the City contributes.

Members who were hired before July 1, 2013, as well as members who join the City after July 1, 2013 who were members of ASRS prior to July 1, 2011 and did not withdraw their contributions are Tier 1 members.

Members hired into employment with the City between July 1, 2013 and December 31, 2015 who are not Tier 1 members are Tier 2 members.

Members hired into employment with the City on or after January 1, 2016 who are not Tier 1 members or Tier 2 members are Tier 3 members.

### **Final Average Compensation (FAC)**

#### *Tier 1/Tier 2*

The average of annual compensation for the period of 3 consecutive years producing the highest average contained within the last 10 years immediately preceding retirement.

#### *Tier 3*

The average of annual compensation for the period of 5 consecutive years producing the highest average contained within the last 10 years immediately preceding retirement. Annual compensation will be limited to the first \$125,000 of compensation, indexed to inflation (Phoenix Area CPI-U) each January 1, commencing on January 1, 2017.

### **Credited Service**

Credited service is determined based on Section 14 of Chapter XXIV of the Phoenix City Charter as well as COPERS administrative policy number 43. In no case is more than a year of service credited to any member for all service rendered in any calendar year. The amount of service credited to members varies by Tier, as detailed below.

#### *Tier 1*

A member is credited with a month of service for each calendar month in which the member performs at least 10 days of City service. A member is credited with a year of service for any calendar year in which the member has at least 10 months of credited service. If a member has less than 10 months of credited service for any calendar year, they are credited for the actual number of months.

Tier 2/Tier 3

A member is credited with a month of service for each calendar month in which the member performs at least 20 days of City service. A member is credited with a year of service for any calendar year in which the member has at least 12 months of credited service. If a member has less than 12 months of credited service for any calendar year, they are credited for the actual number of months.

**Voluntary Retirement (no reduction for age)**

Tier 1

*Eligibility:*

Sum of age and credited service equals 80 or more, age 60 with 10 or more years of credited service or age 62 with 5 or more years of credited service.

*Annual Benefit:*

Unused sick leave service multiplied by 2% of FAC plus 2% of FAC times credited service up to 32.5 years plus 1% of FAC times service in excess of 32.5 years plus 0.5% of FAC times service in excess of 35.5 years. Minimum monthly pension is \$250 (\$500 if member has 15 or more years of service).

Tier 2/Tier3

*Eligibility:*

Sum of age and credited service equals 87 or more, age 60 with 10 or more years of credited service or age 62 with 5 or more years of credited service.

*Annual Benefit:*

Unused sick leave service multiplied by 2% of FAC for Tier 2 members only plus FAC times credited service times the corresponding accrual rate:

Tier 2		Tier 3	
Years of Service	Accrual Rate	Years of Service	Accrual Rate
0<Service≤20	2.10%	0<Service≤10	1.85%
20<Service≤25	2.15%	10<Service≤20	1.90%
25<Service≤30	2.20%	20<Service≤30	2.00%
Service>30	2.30%	Service>30	2.10%

Note that for Tier 2 and Tier 3, the same accrual rate will apply for each year of service based on the total years of service.

### **Deferred Vested Retirement**

*Eligibility:*

Termination of City employment prior to age 62 with 5 or more years of credited service.

*Annual Benefit:*

Accrued regular retirement amount based on credited service, unused sick leave service, and FAC at time of termination, payable beginning at age 62.

### **Duty Disability Retirement**

*Eligibility:*

Total and permanent disability incurred in line of duty with the City.

*Annual Benefit:*

Computed in the same manner as the regular retirement amount base on FAC and credited service at time of disability retirement. Minimum is 15% of FAC for Tier 1 members and 15.75% for Tier 2 and Tier 3 members. Maximum during worker's compensation period is difference between final compensation and annualized workers compensation. At expiration of worker's compensation period, amount is recomputed to include years during which worker's compensation was paid.

### **Non-Duty Disability Retirement**

*Eligibility:*

Total and permanent disability after 10 or more years of credited service.

*Annual Benefit:*

Computed in the same manner as the regular retirement amount base on FAC and credited service at time of disability retirement.

### **Pre-Retirement Duty Death Benefit**

*Eligibility:*

Death in line of duty with the City and compensable under worker's compensation.

*Annual Benefit:*

To the spouse: Joint and 100% survivor actuarial equivalent of accrued regular retirement amount based on FAC and credited service and unused sick leave service at time of death. Minimum of 10 years of service is credited. To the children of a deceased member with 10 or more years of credited service: each child shall receive a monthly pension of \$200 until adoption, marriage, death or attainment of age 18.



### **Pre-Retirement Non-Duty Death Benefit**

*Eligibility:*

10 or more years of credited service.

*Annual Benefit:*

Same as Pre-Retirement Duty Death Benefit.

### **Refund of Contributions**

*Eligibility:*

Termination of covered service employment prior to eligibility for any other benefits.

*Annual Benefit:*

Accumulated member contribution with interest at no more than 3.75% annually after July 1, 2016.

### **Pension Equalization Reserve (PER)**

The PER is credited with Excess Earnings, if any, each calendar year. Excess Earnings are defined as the excess over 8.0% of the annual average of the time-weighted rates of return for the immediately preceding five calendar years. The amounts credited to the PER are either used to fund percentage increases to pension amounts or one-time post retirement distribution benefits (13<sup>th</sup> checks).

On July 1 of each year, persons in receipt of a pension for at least 36 months receive a percentage increase based on the lesser of:

- i. Phoenix area Consumer Price Index (CPI) and
- ii. The amount the balance in the PER can fully fund

The increase, subject to the availability of funds in the PER, is payable beginning with the April 1 payment each year, retroactive to January 1 of the same year.

Also, after each plan year's return is known, all pensioners (excluding minors) as of the end of the plan year are eligible to receive a one-time post retirement distribution (13<sup>th</sup> check). The 13<sup>th</sup> check is a percentage of the pensioner's annual benefits based on the lesser of:

- i. One half of the Phoenix area Consumer Price Index (CPI) and
- ii. The excess of the rate of return over the assumed interest rate

The percentage cannot be more than three percent, but must be at least one percent and is subject to the availability of funds in the PER. The 13<sup>th</sup> check is payable on December 1.

The PER is only applicable for Tiers 1 and 2.

### **Projected Percentage**

Actuarially determined normal cost rate plus an amortization rate on the unfunded actuarial liability and a rate for administrative expenses, stated as a percentage of projected member compensation.

### **Member Contribution Rates**

Tier 1: 5% of pay  
Tier 2/Tier 3: 50% of the Projected Percentage not to exceed 11% of pay on or after January 1, 2016

### **City Contribution Rates**

Total Projected Percentage less Member Contribution Rates for each Tier.

**Note: The summary of plan provisions is designed to outline principal plan benefits. If COPERS should find the plan summary not in accordance with the actual plan provisions, the actuary should immediately be alerted so the proper provisions are valued.**

## **SECTION F**

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### **SUMMARY OF PARTICIPANT DATA**

**Exhibit F.1**  
**City of Phoenix Employees' Retirement System**  
**Summary of Census Data**

	June 30, 2018	June 30, 2017
<b>1. Active Members</b>		
a. Counts	7,977	8,030
b. Annual Compensation	\$ 527,160,824	\$ 521,709,266
c. Average Annual Compensation	\$ 66,085	\$ 64,970
d. Average Age	46.6	46.5
e. Average Service	12.4	12.3
<b>2. Deferred Vested Members</b>		
a. Counts	943	925
b. Annual Deferred Benefits	\$ 12,167,691	\$ 11,638,455
c. Average Benefit	\$ 12,903	\$ 12,582
<b>3. Retired Members</b>		
a. Counts	5,813	5,661
b. Annual Benefits	\$ 202,550,837	\$ 195,912,247
c. Average Benefit	\$ 34,844	\$ 34,607
<b>4. Disability</b>		
a. Counts	249	247
b. Annual Deferred Benefits	\$ 4,069,714	\$ 4,000,756
c. Average Benefit	\$ 16,344	\$ 16,197
<b>5. Beneficiaries and QDROs</b>		
a. Counts	1,076	1,072
b. Annual Benefits	\$ 21,231,243	\$ 20,639,481
c. Average Benefit	\$ 19,732	\$ 19,253
<b>6. Total Members Included in Valuation</b>	16,058	15,935

**Exhibit F.2**  
**Summary of Changes in Participant Status**  
**During Fiscal Year 2018**

	Active Participants	With Deferred Benefits	Retirees	Disability	QDROs	Beneficiaries	Total
A. Number as of June 30, 2017	8,030	925	5,661	247	158	914	15,935
1. Age Retirements	(255)	(37)	292				-
2. Disability	(1)	(9)		10			-
3. Deceased	(8)	(5)	(140)	(8)	(3)	(68)	(232)
4. New Beneficiary					9	68	77
5. Terminated - Vested	(112)	112					-
6. Terminated - Nonvested	(335)						(335)
7. Cashouts	(7)	(23)					(30)
8. Benefits Expired						(2)	(2)
9. Rehired as Active	22	(22)					-
10. New Members	665	2					667
11. Expired Benefits							-
12. Transfers	(22)						(22)
B. Number as of June 30, 2018	7,977	943	5,813	249	164	912	16,058

**Exhibit F.3**  
**Active Member Counts by Age and Service**  
**as of June 30, 2018**

Age	Service							Total
	0-4	5-9	10-14	15-19	20-24	25-29	Over 30	
<b>Under 20</b>								
<b>20-24</b>	139							139
<b>25-29</b>	383	35	6					424
<b>30-34</b>	426	95	148	2				671
<b>35-39</b>	344	97	320	98	1			860
<b>40-44</b>	327	113	298	259	92	1		1,090
<b>45-49</b>	302	85	356	317	226	76	2	1,364
<b>50-54</b>	200	90	261	284	282	185	49	1,351
<b>55-59</b>	207	67	256	244	219	119	74	1,186
<b>60-64</b>	92	45	141	147	100	67	67	659
<b>Over 65</b>	17	15	71	53	31	24	22	233
<b>Total</b>	2,437	642	1,857	1,404	951	472	214	7,977

**Exhibit F.4**  
**Active Member Average Salary by Age and Service**  
**as of June 30, 2018**

Age	Service							Total
	0-4	5-9	10-14	15-19	20-24	25-29	Over 30	
<b>Under 20</b>								
<b>20-24</b>	\$40,356							\$40,356
<b>25-29</b>	47,286	53,995	49,707					46,380
<b>30-34</b>	50,887	64,325	58,966	*				54,666
<b>35-39</b>	53,390	67,948	67,180	69,090	*			61,753
<b>40-44</b>	56,487	66,207	70,282	74,230	74,553	*		67,200
<b>45-49</b>	56,021	66,831	69,317	76,776	82,909	85,719	*	70,859
<b>50-54</b>	60,631	65,469	66,890	69,492	78,756	84,139	77,586	71,224
<b>55-59</b>	56,420	66,216	64,231	71,942	75,688	77,526	81,534	69,363
<b>60-64</b>	70,044	73,089	68,720	69,078	73,597	79,394	76,822	71,757
<b>Over 65</b>	68,679	77,995	61,371	71,057	71,634	78,652	87,043	70,483
<b>Total</b>	\$54,472	66,264	66,824	72,443	77,841	81,794	79,613	\$66,085

\*Average salary not shown for fields with less than four active members.

**Exhibit F.5**  
**Summary of Inactive Vested Members**

<b>Age</b>	<b>Number of Members</b>	<b>Monthly Benefit</b>
<30	8	\$3,484
30-34	61	41,440
35-39	100	83,650
40-44	150	166,460
45-49	189	217,145
50-54	180	216,481
55-59	166	193,305
60-64	87	90,146
65& Up	2	1,862



**Exhibit F.6  
Summary of Members in Pay Status**

Age	Service Retirees		Disabled Retirees		Beneficiaries/QDROs	
	Number of Members	Annual Benefit	Number of Members	Annual Benefit	Number of Members	Annual Benefit
<55	167	\$8,166,365	42	\$794,587	92	\$1,312,891
55-59	601	\$28,513,497	42	\$743,358	71	\$1,543,867
60-64	1168	\$46,819,447	59	\$933,952	98	\$1,845,974
65-69	1463	\$49,649,580	50	\$841,379	176	\$3,648,845
70-74	1097	\$34,780,394	20	\$272,280	143	\$3,155,899
75-79	663	\$18,417,898	14	\$156,297	168	\$3,778,326
80-84	359	\$9,373,487	15	\$233,661	134	\$2,553,753
85-89	189	\$4,526,270	6	\$72,768	124	\$2,194,350
90 & Up	106	\$2,303,898	1	\$21,434	70	\$1,197,338

**Exhibit F.7**  
**Schedule of Retired Members Added to and Removed from Rolls**  
**as of June 30, 2018**

Year Ended	Added to Rolls		Removed		Total		Average Annual Pensions	% Increase in Pensions
	Count	Annual Pensions	Count	Annual Pensions	Count	Annual Pensions		
6/30/2009	426	15,789	174	3,002	4,669	126,220	27,034	11.3%
6/30/2010	432	15,259	170	3,206	4,931	138,273	28,042	9.5
6/30/2011	444	15,251	184	3,574	5,191	149,950	28,887	8.4
6/30/2012	448	14,488	161	4,174	5,478	160,264	29,256	6.9
6/30/2013	426	12,574	201	3,996	5,703	168,843	29,606	5.4
6/30/2014	597	21,948	145	3,232	6,155	187,559	30,473	11.1
6/30/2015	578	22,483	192	4,225	6,541	205,816	31,466	9.7
6/30/2016	375	11,573	182	4,329	6,734	213,061	31,640	3.5
6/30/2017	321	9,317	233	4,395	6,822	218,364	32,009	2.5
6/30/2018	370	11,314	218	4,825	6,974	225,644	32,355	3.3

Note: The dollar amounts of the pensions added to and removed from the rolls for years prior to June 30, 2017 were determined by prior actuaries. The amounts added to the rolls includes additions and deletions due to PER increases, in addition to the annual pensions for new retirees.

**Exhibit F.8**  
**Schedule of Retired Members by Type**  
**as of June 30, 2018**

Monthly Benefit	# of Retirees	Type of Retirement						
		Deferred	Normal or Voluntary	Duty Disability	Non-Duty Disability	Survivor Payment	Death Benefit	Alternate Payee
Deferred	943	943						
\$1 - \$300	98		47	1	0	14	22	14
\$301 - \$400	135		89	6	1	27	3	9
\$401 - \$500	135		87	7	3	29	1	8
\$501 - \$600	138		96	4	4	22	3	9
\$601 - \$700	159		85	3	9	47	5	10
\$701 - \$800	173		99	2	10	40	8	14
\$801 - \$900	187		116	5	21	28	9	8
\$901 - \$1,000	175		97	1	14	48	4	11
\$1,001 - \$1,100	202		122	4	12	42	10	12
\$1,101 - \$1,200	194		124	1	15	36	5	13
\$1,201 - \$1,300	172		122	1	14	22	4	9
\$1,301 - \$1,400	177		116	0	15	30	7	9
\$1,401 - \$1,500	177		129	3	5	29	9	2
\$1,501 - \$2,000	822		631	13	39	89	31	19
\$2,001 - \$2,500	877		752	2	13	89	12	9
\$2,501 - \$3,000	774		698	0	10	52	10	4
\$3,001 - \$4,000	1,173		1,094	0	9	56	13	1
\$4,001 - \$5,000	666		638	0	2	18	6	2
\$5,001 +	704		671	0	0	29	3	1
<b>Total</b>	<b>8,081</b>	<b>943</b>	<b>5,813</b>	<b>53</b>	<b>196</b>	<b>747</b>	<b>165</b>	<b>164</b>

## **SECTION G**

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### **ACTUARIAL ASSUMPTIONS AND METHODS**

## SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

### I. Valuation Date

The valuation date is June 30th of each plan year. This is the date as of which the actuarial present value of future benefits and the actuarial value of assets are determined.

### II. Actuarial Cost Method

The actuarial valuation uses the Entry Age Normal actuarial cost method. Under this method, the employer contribution rate is the sum of (i) the employer normal cost rate, and (ii) a rate that will amortize the unfunded actuarial liability.

1. The valuation is prepared on the projected benefit basis. The present value of each participant's expected benefit payable at retirement or termination is determined, based on age, service, sex, compensation, and the interest rate assumed to be earned in the future (7.25%). The calculations take into account the probability of a participant's death or termination of employment prior to becoming eligible for a benefit, as well as the possibility of his terminating with a service benefit. Future salary increases are also anticipated. The present value of the expected benefits payable on account of the active participants is added to the present value of the expected future payments to retired participants and beneficiaries to obtain the present value of all expected benefits payable from the Plan on account of the present group of participants and beneficiaries.
2. The employer contributions required to support the benefits of the Plan are determined following a level percent of pay funding approach, and consist of a normal cost contribution and an unfunded accrued liability contribution, plus a component to cover administrative expenses.
3. The normal cost and the allocation of benefit values between service rendered before and after the valuation date were determined using the individual entry age actuarial cost method having the following characteristics of (i) the annual normal costs for each active member, payable from the date of entry into the system to the date of retirement, are sufficient to accumulate the value of the member's benefit at the time of retirement, and (ii) each annual normal cost is constant percentage of the member's year-by-year projected covered pay.
4. The unfunded accrued liability contributions are determined by subtracting the actuarial value of assets from the actuarial accrued liability. Amortization bases are established each year and amortized over periods in accordance with the following amortization methods.
  - a. The UAL as of June 30, 2013, developed prior to implementing the September 2013 assumption changes, is amortized over a closed 25-year period as a level percentage of payroll.

- b. The impact of the September 2013 assumption changes on the UAL is amortized over a closed 25-year period as a level percentage of payroll with a four-year phase-in to the full amortization rate. The phase-in is calculated by multiplying the first year amortization payment by 25 percent. For the second year, the amortization schedule is recalculated reflecting the 25 percent payment in the first year and the remaining 24-year period and the calculated amortization payment is then multiplied by 50 percent. The process is repeated until the full amortization payment is made beginning in the fourth year of the 25-year period.
- c. The impact of the August 2015 assumption changes on the UAL is amortized over a closed 20-year period as a level percentage of payroll with a four-year phase-in to the full amortization rate. The phase-in is calculated by multiplying the first year amortization payment by 25 percent. For the second year, the amortization schedule is recalculated reflecting the 25 percent payment in the first year and the remaining 19-year period and the calculated amortization payment is then multiplied by 50 percent. The process is repeated until the full amortization payment is made beginning in the fourth year of the 20-year period.
- d. Future gains and losses are amortized over closed 20-year periods as a level percentage of payroll from the valuation date in which they are first recognized. However, gains will not be amortized over a shorter period than the remaining period on the amortization of the 2013 UAL.

III. Actuarial Value of Assets

The actuarial value of assets is determined by recognizing market value gains and losses over a four-year period. Gain and loss bases to be spread over the four-year period are determined by comparing expected returns based on the market value of assets and cash flows during the year to actual investment returns. The actuarial value of assets must be between 80 and 120% of market value.

IV. Actuarial Assumptions

A. Economic Assumptions

1. Investment return: 7.25% per annum, compounded annually. Inflation is assumed to be 2.50%.
2. Salary increase rate: Individual salary increases are composed of a price inflation component, a real wage growth component, and a merit or longevity component that varies by age. The table below combines the various components of salary increases for sample ages. Growth in the total payroll is assumed to be 3.00%.

Sample Attained Age	Percentage Increase in Salary			
	Price Inflation	Real Wage Growth	Merit or Longevity	Total
20	2.50 %	0.50 %	6.60 %	9.60 %
25	2.50	0.50	5.00	8.00
30	2.50	0.50	3.65	6.65
35	2.50	0.50	2.60	5.60
40	2.50	0.50	1.85	4.85
45	2.50	0.50	1.25	4.25
50	2.50	0.50	0.75	3.75
55	2.50	0.50	0.40	3.40
60	2.50	0.50	0.15	3.15
65	2.50	0.50	0.00	3.00

3. COLA Due to Pension Equalization Reserve (PER): In September 2013, the Board first adopted an assumption valuing future benefits payable through the PER as a 1.5% annual compound cost-of-living adjustment (COLA). The PER only applies to Tier 1 and Tier 2 benefits. In August 2017, the assumption was lowered to 1.25% effective with the June 30, 2017 valuation.
4. Administrative expenses are assumed to be equal to the prior year's amount, increased by 3.00%.
5. Tier 3 capped pay was assumed to be \$128,125 at the valuation date.

B. Demographic Assumptions

1. Rates of Mortality for Healthy and Disabled Lives: Mortality rates are based on the sex-distinct employee and annuitant mortality tables described below, including adjustment factors applied to the published tables for each group. Half of active member deaths are assumed to be duty related. Future mortality improvements are reflected by applying the MP-2015 projection scale on a generational basis to the adjusted base tables from the base year shown below.

(i) Non-Annuitant – CalPERS employee mortality table without scale BB projection

Gender	Adjustment Factor	Base Year
<i>Male</i>	1.054	2009
<i>Female</i>	1.112	2009

(ii) Healthy Annuitant – CalPERS healthy annuitant mortality table without scale BB projection

Gender	Adjustment Factor	Base Year
<i>Male</i>	1.019	2009
<i>Female</i>	1.061	2009

(iii) Disabled Annuitant –RP-2014 Disabled Annuitant Mortality Tables without MP-2014 projection

Gender	Adjustment Factor	Base Year
<i>Male</i>	0.984	2006
<i>Female</i>	1.038	2006

Sample rates, including projections to 2018, are shown below (not including adjustment factors).

Sample Attained Ages	Probability of Death Pre-Retirement		Sample Attained Ages	Probability of Death Post-Retirement		Sample Attained Ages	Probability of Death Post-Disability	
	Men	Women		Men	Women		Men	Women
20	0.024 %	0.016 %	20	0.020 %	0.014 %	20	0.579 %	0.190 %
25	0.032	0.020	25	0.024	0.018	25	0.664	0.193
30	0.042	0.025	30	0.033	0.028	30	0.610	0.262
35	0.051	0.036	35	0.054	0.048	35	0.775	0.403
40	0.066	0.049	40	0.097	0.090	40	1.022	0.589
45	0.090	0.065	45	0.193	0.183	45	1.572	0.861
50	0.131	0.092	50	0.422	0.428	50	1.758	1.024
55	0.210	0.143	55	0.551	0.431	55	2.052	1.378
60	0.328	0.210	60	0.756	0.504	60	2.534	1.802
65	0.472	0.296	65	0.980	0.676	65	3.286	2.210
70	0.633	0.406	70	1.577	1.100	70	4.197	2.843
75	0.850	0.587	75	2.628	1.923	75	5.658	4.122
80	1.186	0.926	80	4.673	3.303	80	8.017	6.250
85	8.404	6.015	85	8.404	6.015	85	11.761	9.444
90	14.467	11.095	90	14.467	11.095	90	17.612	13.774



3. Disability rates. The disability incidence rates are 0.960 times the CalPERS Public Agency Miscellaneous Ordinary Disability Incidence table for Males. Half of disabilities are assumed to be duty related. Sample disability rates of active members are provided in the table below. There rates apply to both male and female COPERS member.

Sample Attained Ages	Probability of Disablement
25	0.0163 %
30	0.0183
35	0.0471
40	0.1172
45	0.1834
50	0.2046
55	0.2122
60	0.2132

4. Termination rates (for causes other than death, disability or retirement): Termination rates are based on age and service. Termination rates are not applied after a member becomes eligible for a retirement benefit. Rates at selected ages are shown:

Probability of Termination						
Age	Years of Service					
	0	1	2	3	4	5+
20	17.00 %	15.00 %	9.00 %	8.00 %	6.25 %	5.50 %
25	17.00	15.00	9.00	8.00	6.25	5.50
30	15.00	11.25	8.00	6.75	5.25	4.50
35	15.00	8.75	7.00	5.50	4.50	3.50
40	15.00	7.50	6.25	4.50	4.00	2.75
45	15.00	6.50	5.50	4.50	4.00	2.25
50	15.00	6.50	5.50	4.50	4.00	2.00
55	15.00	6.50	5.50	4.50	4.00	2.00
60	15.00	6.50	5.50	4.50	4.00	2.00

5. Retirement rates.

Probability of Retirement				
Age	Years of Service			
	<15	15-24	25-31	>31
50-51	0.00 %	0.00 %	40.00 %	40.00 %
52	0.00	0.00	35.00	40.00
53	0.00	0.00	32.50	32.50
54	0.00	22.50	27.50	32.50
55-58	0.00	22.50	22.50	32.50
59	0.00	22.50	22.50	42.50
60	10.00	22.50	27.50	42.50
61	17.00	22.50	32.50	42.50
62	17.00	30.00	32.50	42.50
63	17.00	25.00	32.50	42.50
64	17.00	25.00	37.50	42.50
65	30.00	32.50	40.00	42.50
66-69	25.00	32.50	40.00	42.50
70	100.00	100.00	100.00	100.00

C. Other Assumptions

1. Percent married: 90% of employees are assumed to be married.
2. Age difference: Male members are assumed to be three years older than their spouses, and female members are assumed to be three years younger than their spouses.
3. Unused Vacation and Compensatory Time: For Tier 1 and Tier 2 members, compensatory service credits and lump sum payments for unused vacation and compensatory time are assumed to increase the present value of normal retirement benefits by 9.0%. No increase to the present value of normal retirement benefits was assumed for Tier 3 members.
4. Member Contribution Crediting Rate: Member contributions are credited with interest at 3.75% per annum.