



Cavanaugh Macdonald
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The experience and dedication you deserve



**University of Puerto Rico
Retirement System**

Actuarial Valuation Report

As of June 30, 2017





Cavanaugh Macdonald

CONSULTING, LLC

The experience and dedication you deserve

October 3, 2018

Retirement Board and Governing Board
University of Puerto Rico
Retirement System
P.O. Box 21769
San Juan, Puerto Rico 00925

Dear Board Members:

We are pleased to submit the results of the annual actuarial valuation of the University of Puerto Rico Retirement System (the System) as of June 30, 2017.

The purpose of this report is to provide a summary of the funded status of the System as of June 30, 2017 and to recommend rates of contribution. While not verifying the data at source, the actuary performed tests for consistency and reasonability.

In the table below we present the contribution rates and estimated required University contribution amount for fiscal year 2018 in accordance with the assumptions adopted by the Board, including a 2.50% payroll growth assumption. Please note that we do not recommend this method of amortizing the unfunded accrued liability. For comparison we present the contribution rates and amounts for fiscal year 2017 based on the 2016 valuation.

Valuation Date	June 30, 2017	June 30, 2016
Recommended Contributions for Fiscal Year	2018	2017
Total Contribution Rate	29.20%	25.63%
Average Member Contribution Rate	9.12%	8.07%
University Contribution Rate	20.08%	17.56%
Estimated University Contribution (\$'s millions)	\$ 96.1	\$ 85.8
Actuarial Value Assets Funded Status	48.9%	47.8%
Payroll Growth Assumption	2.50%	3.00%



The promised benefits of the System are included in the actuarially calculated contribution rates, which are developed using the individual entry age normal cost method. A five-year smoothing of the market value of assets is used for actuarial valuation purposes. Gains and losses are reflected in the unfunded accrued liability that is being amortized by regular annual contributions as a level percentage of payroll over a closed 30-year period, on the assumption that payroll will increase by 2.50% per year and the amortization period will decrease by one year until reaching 0 years. The assumptions recommended by the actuary are, in the aggregate, reasonably related to the experience under the System and to reasonable expectations of anticipated experience under the System.

The assumptions and methods adopted by the Board include the assumption that payroll will grow by 2.50% per year in the future. Since 2011, payroll has declined by 1.00% per year. Under level percentage of pay financing of the unfunded accrued liability, the unfunded liability is expected to increase until 2023 until the amortization payment is large enough to pay both interest and principal toward liquidating the unfunded accrued liability. Due to the poor funded status of the System and the fact that total payroll is actually declining, we **do not** recommend the use of level percentage of pay financing of the unfunded accrued liability. For informational purposes, below we present the University contribution rates based on the recommended assumptions and methods, including amortization of the unfunded accrued liability over a closed 30-year period beginning July 1, 2014 and assuming that payroll will remain level over the period.

Valuation Date	June 30, 2017	June 30, 2016
Contributions for Fiscal Year	2018	2017
Total Contribution Rate	35.27%	25.63%
Average Member Contribution Rate	9.12%	8.07%
University Contribution Rate	26.15%	17.56%
Estimated University Contribution (\$'s millions)	\$ 125.1	\$ 85.8
Actuarial Value Assets Funded Status	48.9%	47.8%
Payroll Growth Assumption	0.00%	3.00%



Below we also present a comparison of the University contribution rate based upon the Board's adopted assumptions and the estimated contribution amount assuming a closed 40-year period beginning July 1, 2015 in accordance with Certification No. 146 adopted by the Governing Board of the University during the 2015 fiscal year.

Unfunded Accrued Liability Amortization Method	Closed 30 Year (Level Percentage) ADOPTED ASSUMPTIONS	Closed 40 Year (Level Percentage) ADOPTED ASSUMPTIONS
Contributions for Fiscal Year	2018	2018
Total Contribution Rate	29.20%	26.52%
Average Member Contribution Rate	9.12%	9.12%
University Contribution Rate	20.08%	17.40%
Estimated University Contribution (\$'s millions)	\$ 96.1	\$ 83.3
Amortization Period	27 years	38 Years
Payroll Growth Assumption	2.50%	2.50%



All historical information that references a valuation date prior to June 30, 2013 was prepared by the previous actuary.

Future actuarial results may differ significantly from the current results presented in this report due to such factors as the following: 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 the plan's funded status); and changes in plan provisions or applicable law. Since the potential impact of such factors is outside the scope of a normal annual actuarial valuation, an analysis of the range of results is not presented herein.

The undersigned is a member of the American Academy of Actuaries and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

The Table of Contents, which immediately follows, outlines the material contained in the report.

Respectfully submitted,

A handwritten signature in blue ink that reads 'Todd B. Green' followed by a horizontal flourish.

Todd B. Green, ASA, FCA, MAAA
Principal and Consulting Actuary



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Section I – Summary of Principal Results

- For convenience of reference, the principal results of the valuation and a comparison with the preceding year’s results are summarized in the following table.

SUMMARY OF PRINCIPAL RESULTS

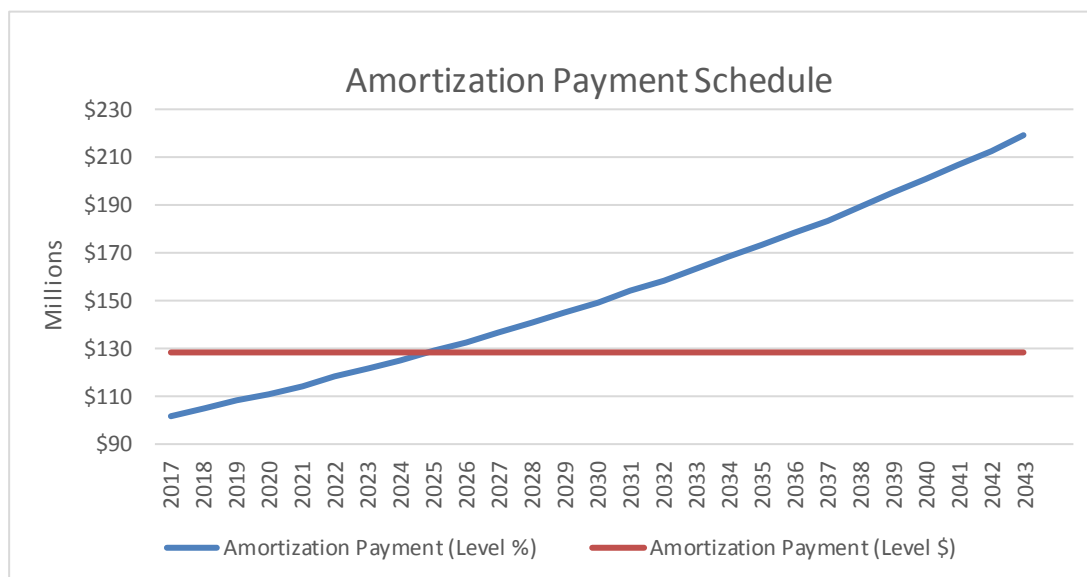
	June 30, 2017	June 30, 2016
Number of Active Members	10,204	10,438
Annual Covered Payroll (Salary used for valuation purposes)	\$478,529,460	\$488,774,924
Number of Retired and Disabled Members and Survivors	8,598	8,417
Annual Benefits	\$190,893,897	\$183,343,739
Number of Terminated Vested Members	457	445
Number of Non-Vested Terminated Members	8,372	8,143
Total Assets		
Actuarial Value	\$1,371,979,452	\$1,321,209,628
Market Value	\$1,385,629,773	\$1,332,667,782
Actuarial Accrued Liability	\$2,807,476,917	\$2,762,852,807
Unfunded Actuarial Accrued Liability	\$1,435,497,465	\$1,441,643,179
Actuarial Value Assets Funded Status	48.9%	47.8%
Market Value Assets Funded Status	49.4%	48.2%
CONTRIBUTIONS FOR FISCAL YEAR ENDING	June 30, 2018	June 30, 2017
Total Contribution Rate:		
Normal (Including Administrative Expenses)	8.45%	7.50%
Unfunded Accrued Liability	<u>20.75%</u>	<u>18.13%</u>
Total Contribution Rate	29.20%	25.63%
Average Member Contribution Rate	9.12%	8.07%
University Contribution Rate	20.08%	17.56%
Amortization Period	27 years	28 years





Section I – Summary of Principal Results

- Comments on the valuation results as of June 30, 2017 are given in Section IV and further discussion of the contribution levels is set out in Section V.
- Schedule B shows the development of the actuarial value of assets. Schedules D and E of this report outline the full set of actuarial assumptions and methods used in the current valuation.
- The Unfunded Accrued Liability (UAL) is amortized using a level percentage of payroll method over the 27-year amortization period. Under the level percentage of payroll method, amortization payments will not be large enough to cover interest on the UAL for the first ten years of the amortization schedule, which means that as a dollar amount the UAL is expected to grow. After five years, amortization payments will be large enough that the amortization payments will cover both interest and principal, and the UAL as a dollar amount will be projected to decrease in each subsequent year. The table below illustrates UAL payment schedule under both level percentage of payroll and level dollar amortization methods.





Section I – Summary of Principal Results

Due to the System's poor funded status combined with the fact that the actual payroll of the System has declined by 1% since 2011 we recommend changing the amortization method from level percentage of payroll to level dollar. This will ensure that the System will make incremental progress toward liquidating the UAL. The effect of this change would increase the total contribution by \$29.0 million, or a 6.07% increase in the recommended actuarial determined contribution.

5. The normal cost method has been updated to align the calculation of the projected compensation and the total present value of plan benefits so that the normal cost rate reflects the most appropriate allocation of plan costs over future compensation. The change decreased the employer normal cost rate by 0.10%.

6. The valuation takes into account the effect of amendments to the System through the valuation date. The Main Provisions of the System, as summarized in Schedule F, were taken into account in the current valuation. There have been no changes since the previous valuation.





Section II – Membership Data

1. Membership data for use in the valuation was furnished by the System. The following table shows the number of active members and their annual compensation for valuation purposes, as of June 30, 2017, on which the valuation was based.

TABLE 1
THE NUMBER AND ANNUAL COMPENSATION OF
ACTIVE MEMBERS AS OF JUNE 30, 2017

Number	Compensation	Average Compensation	Average Age	Average Service
10,204	\$478,529,460	\$46,896	49.9	17.8

2. The following table shows a five-year history of active member valuation data.

TABLE 2
SCHEDULE OF TOTAL ACTIVE MEMBER VALUATION DATA

Valuation Date	Number	Annual Compensation	Average Annual Compensation	% Increase in Average Compensation
6/30/2017	10,204	478,529,460	46,896	0.1
6/30/2016	10,438	488,774,924	46,826	-0.5
6/30/2015	10,644	500,964,899	47,065	0.6
6/30/2014	10,711	501,190,385	46,792	4.8
6/30/2013	11,008	491,291,305	44,630	-0.3





Section II – Membership Data

3. The following table shows the number and annual retirement benefits payable to retired members and survivors on the roll of the System as of the valuation date.

TABLE 3

**THE NUMBER AND ANNUAL RETIREMENT BENEFITS
OF RETIRED MEMBERS AND SURVIVORS OF DECEASED MEMBERS
AS OF JUNE 30, 2017**

Type of Retirement	Number	Annual Benefits	Average Monthly Benefit	Average Age	Actuarial Liabilities
Retiree	7,444	\$180,910,100	\$2,025	72.1	\$1,599,143,235
Disability	1,106	\$9,707,600	\$731	68.5	\$75,244,690
Beneficiary	<u>48</u>	<u>\$276,197</u>	\$480	67.7	<u>\$2,071,467</u>
Total	8,598	\$190,893,897	\$1,850		\$1,676,459,392

3. Schedule G shows the distribution by age and service of the number and annual compensation of active members.





Section III – Assets

Schedule C shows the additions and deductions for the year preceding the valuation date and a reconciliation of the fund balances at market value. The market value of assets as of June 30, 2017 used to determine the actuarial value of assets is shown below. The market related actuarial value of assets used for the current valuation was \$1,371,979,452. Schedule B shows the development of the actuarial value of assets. The following table shows historical asset information. The market value return over the 20 year period shown below was 6.96%.

TABLE 4
HISTORICAL ASSET INFORMATION
(in \$1,000s)

Plan Year	Market Value as of June 30	Actuarial Value as of June 30	Benefit Payments	Expenses	University and Member Contribs.	Market Value Yield	Actuarial Value Yield
2017	1,385,630	1,371,979	188,311	4,120	112,244	10.3%	10.2%
2016	1,332,668	1,321,210	182,614	4,075	116,643	4.5%	9.6%
2015	1,342,996	1,272,123	176,872	4,172	123,845	5.8%	12.9%
2014	1,325,365	1,179,752	169,163	3,914	129,589	18.2%	14.6%
2013	1,161,569	1,070,402	162,182	3,777	115,333	15.2%	8.1%
2012	1,055,909	1,039,441	153,890	3,518	114,405	4.5%	4.0%
2011	1,052,467	1,041,628	143,198	3,070	110,823	20.9%	4.8%
2010	902,867	1,028,918	133,113	3,709	112,915	13.0%	1.8%
2009	821,867	1,034,645	124,353	3,935	116,436	-12.7%	2.1%
2008	954,307	1,024,987	118,779	3,640	124,518	-5.0%	7.3%
2007	1,002,117	953,197	110,831	3,443	118,341	14.8%	9.2%
2006	869,349	869,211	105,090	3,263	112,368	7.3%	5.4%
2005	806,229	820,501	100,459	3,781	105,755	8.2%	1.9%
2004	743,761	803,498	94,188	2,675	102,369	11.4%	2.5%
2003	662,518	778,265	89,313	2,420	88,988	4.0%	2.1%
2002	639,813	765,329	84,455	2,105	78,220	-5.6%	12.8%
2001	686,067	686,067	78,613	2,178	78,424	-8.7%	-8.7%
2000	754,280	754,280	72,043	2,215	72,036	16.4%	16.4%
1999	650,295	650,295	64,269	6,245	75,034	10.1%	10.1%
1998	586,095	586,095	586,095	1,763	66,866	14.6%	14.6%





Section IV – Comments on Valuation

1. The total valuation balance sheet on account of benefits shows that the System has total prospective benefit liabilities of \$3,052,712,924, of which \$1,676,459,392 is for the prospective benefits payable on account of present retired members, disabled members and survivors of deceased members, \$48,464,256 is for the prospective benefits payable on account of inactive members entitled to future benefits, and \$1,327,789,276 is for the prospective benefits payable on account of present active members. Against these benefit liabilities the System has a total present actuarial value of assets of \$1,371,979,452 as of June 30, 2017. The difference of \$1,680,733,472 between the total liabilities and the total present actuarial value of assets represents the present value of contributions to be made in the future on account of benefits. Of this amount, \$245,236,007 is the present value of future contributions expected to be made by members, and the balance of \$1,435,497,465 represents future University contributions.
2. Since the average member contribution rate exceeds the Normal Rate of the System, the University's contributions on account of benefits consist of accrued liability contributions only.
3. In accordance with Board Resolution #22, the accrued liability contribution rate payable on account of retirement benefits has been set at 20.75% of payroll. This rate is sufficient to liquidate the unfunded accrued liability of \$1,435,497,465 over 27 years beginning June 30, 2017 on the assumption that the aggregate payroll will increase 2.50% each year. Of the total unfunded accrued liability rate of 20.75%, the employer will contribute 20.08% and the extra 0.67% of payroll is from the average member contribution rate, which is 9.12%, that is in excess of the total normal contribution rate of 8.45%.





Section V – Contributions Payable by Employer

The employer contribution rates according to the Rules and Regulations of the System are shown in the following table.

TABLE 5

	June 30, 2017	June 30, 2016
A. Funding Results		
1. Present Value of Future Benefits	\$3,052,712,924	\$3,014,119,411
2. Actuarial Value of Assets	<u>1,371,979,452</u>	<u>1,321,209,628</u>
3. PV of Future Contributions (1) – (2)	1,680,733,472	1,692,909,783
4. PV of Future Member Contributions	<u>245,236,007</u>	<u>251,266,604</u>
5. PV of Future University Contributions (3) – (4)	1,435,497,465	1,441,643,179
6. PV of Future University Normal Conts.	<u>0</u>	<u>0</u>
7. Unfunded Accrued Liability (5) – (6)	1,435,497,465	1,441,643,179
B. Annual Contribution Rate (% of payroll)		
1.Total		
a. Normal rate (including expenses)	8.45%	7.50%
b. Unfunded accrued liability	<u>20.75%</u>	<u>18.13%</u>
c. Sub-total	29.20%	25.63%
2. Members	<u>9.12%</u>	<u>8.07%</u>
3. University	20.08%	17.56%





Section VI – Derivation of Experience Gains and Losses

**CHANGES IN UNFUNDED ACTUARIAL ACCRUED LIABILITIES (UAAL)
DURING PLAN YEAR**

1) Beginning of Year:	
a) Unfunded Actuarial Accrued Liability	\$1,441,643,179
b) Total Normal Cost	33,216,177
c) Expected Total Contributions based on prior valuation contribution rate with Administrative Expenses	125,272,331
d) Actual Total Contributions based on contribution rate applicable to current fiscal year	112,244,122
2) End of Year:	
a) Expected UAAL from previous valuation [(1a) + (1b)] * 1.0775 – (1c) * 1.03875	\$1,459,034,323
b) Expected UAAL on actual contributions [(1a) + (1b)] * 1.0775 – (1d) * 1.03875	1,472,567,375
c) Increase (Decrease) in UAAL due to deficiency (surplus) (2b) – (2a)	13,533,052
3) Gains (Losses) on Year’s Activities	
a) Liability – Assumed vs. Actual	\$4,203,780
b) Assets – Assumed vs. Actual	31,724,846
c) Change in Plan Assumptions	0
d) Change in Plan Provisions	0
e) Change in Methods	<u>1,141,284</u>
f) Total	\$37,069,910
4) Actual UAAL at End of Year (2a) + (2c) – (3f)	\$1,435,497,465

* Expected Total Contributions are based on the Annual Required Contribution (ARC) rate, the average member contribution rate, and annual covered payroll as of the previous valuation date.





Section VI – Derivation of Experience Gains and Losses

**GAINS & LOSSES IN ACTUARIAL ACCRUED LIABILITIES
DURING PLAN YEAR**

Type of Activity	Gain (or Loss)
Age & Service Retirements. If members retire at older ages, there is a gain. If younger ages, a loss.	\$5,070,273
Disability Retirements. If disability claims are less than assumed, there is a gain. If more, a loss.	(64,440)
Death-in Service Benefits. If survivor claims are less than assumed, there is a gain. If more claims, there is a loss.	(1,280,384)
Withdrawal From Employment. If more liabilities are released by withdrawals than assumed, there is a gain. If smaller releases, a loss.	(2,943,705)
Pay Increases. If there are smaller pay increases than assumed, there is a gain. If greater increases, a loss.	4,361,243
New Members. Additional unfunded accrued liability will produce a loss.	(1,627,933)
Investment Income. If there is a greater investment income than assumed, there is a gain. If less income, a loss.	31,724,846
Death After Retirement. If retirees live longer than assumed, there is a loss. If not as long, a gain.	(1,560,170)
Other. Miscellaneous gains and losses resulting from changes in valuation software, data adjustments, timing of financial transactions, etc.	<u>(11,284,156)</u>
Gain (or Loss) During Year From Financial Experience	\$22,395,574
Non-Recurring Items. Adjustments for plan amendments, assumptions changes and method changes.	<u>1,141,284</u>
Composite Gain (or Loss) During Year	\$23,536,858





Schedule A – Valuation Balance Sheet

**VALUATION BALANCE SHEET
SHOWING THE PRESENT AND PROSPECTIVE ASSETS AND LIABILITIES
AS OF JUNE 30, 2017**

PRESENT AND PROSPECTIVE ASSETS		
Actuarial Value of Present Assets		\$1,371,979,452
Present Value of Future Member Contributions		\$245,236,007
Present Value of Future Employer Contributions		
Normal Contributions	0	
Unfunded Accrued Liability Contributions	<u>\$1,435,497,465</u>	
Total Prospective Employer Contributions		<u>\$1,435,497,465</u>
Total Present and Prospective Assets		<u>\$3,052,712,924</u>
ACTUARIAL LIABILITIES		
Present Value of Benefits Payable on Account of Retired Members and Survivors of Deceased Members Now Drawing Retirement Benefits		\$1,676,459,392
Present Value of Prospective Benefits Payable on Account of Inactive Members		\$48,464,256
Present Value of Prospective Benefits Payable on Account of Present Active Members:		
Service Retirement Benefits	\$1,244,045,406	
Disability Retirement Benefits	\$23,691,456	
Death Benefits	\$27,720,051	
Separation Benefits	<u>\$32,332,362</u>	
Total		<u>\$1,327,789,276</u>
Total Actuarial Liabilities		<u>\$3,052,712,924</u>





Schedule A – Schedule of Funding Progress

SCHEDULE OF FUNDING PROGRESS

Actuarial Valuation Date	Value of Plan Assets (a)	Actuarial Accrued Liability (AAL) (b)	Unfunded AAL (UAAL) (b – a)	Funded Ratio (a / b)	Covered Payroll (c)	UAAL as a Percentage of Covered Payroll ((b – a) / (c))
6/30/2017	1,371,979,452	2,807,476,917	1,435,497,465	48.9	478,529,460	300.0%
6/30/2016	1,321,209,628	2,762,852,807	1,441,643,179	47.8	488,774,924	295.0%
6/30/2015	1,272,122,896	2,728,214,819	1,456,091,923	46.6	500,964,899	290.7%
6/30/2014	1,179,752,077	2,684,515,789	1,504,763,712	43.9	501,190,385	300.2%
6/30/2013	1,070,402,499	2,622,367,510	1,551,965,011	40.8	491,291,305	315.9%
6/30/2012	1,039,441,000	2,617,989,147	1,578,548,147	39.7	499,027,788	316.3%

SUMMARY OF ASSUMPTIONS AND METHODS

Valuation Date	June 30, 2017
Actuarial Cost Method	Individual Entry Age Normal
Amortization Method	Level percent, closed
Payroll Growth Rate	2.50%
Asset Valuation Method	5 Year Smoothed Market
Actuarial Assumptions:	
Investment rate of return*	7.75%
Projected salary increases*	3.75%
Cost-of-living adjustments	None
*Includes inflation at	3.00%

All historical information that references a valuation date prior to June 30, 2013 was prepared by the previous actuary.





DEVELOPMENT OF THE JUNE 30, 2017 ACTUARIAL VALUE OF ASSETS

Valuation date June 30:	2013	2014	2015	2016	2017	2018
A. Actuarial Value Beginning of Year	1,039,441,230	\$1,070,402,499	\$1,179,752,077	\$1,272,122,896	\$1,321,209,628	
B. Market Value End of Year	1,161,568,590	1,325,364,820	1,342,996,273	1,332,667,782	1,385,629,773	
C. Market Value Beginning of Year	1,055,908,704	1,161,568,590	1,325,364,820	1,342,996,273	1,332,667,782	
Audit Adjustment	(4,550)	0	(1,336,437)	(4,549)	0	
Adjusted Market Value Beginning of Year	1,055,904,154	1,161,568,590	1,324,028,383	1,342,991,724	1,332,667,782	
D. Cash Flow						
D1. Contributions	115,333,059	129,588,674	123,844,673	116,643,497	112,244,122	
D2. Benefit Payments	(162,182,241)	(169,162,756)	(176,871,770)	(182,614,074)	(188,310,782)	
D3. Administrative Expenses	(3,776,854)	(3,913,504)	(3,377,926)	(3,362,509)	(4,172,828)	
D4. Investment Expenses	0	0	0	0	0	
D5. Net	(50,626,036)	(43,487,586)	(56,405,023)	(69,333,086)	(80,239,488)	
E. Investment Income						
E1. Market Total: B.-C.-D5.	156,290,472	207,283,816	74,031,288	59,004,595	133,201,479	
E2. Assumed Rate	8.00%	8.00%	7.75%	7.75%	7.75%	
E3. Amount for Immediate Recognition	82,447,291	91,185,984	100,426,505	101,395,202	100,172,473	
E4. Amount for Phased-In Recognition	73,843,181	116,097,832	(26,395,217)	(42,390,607)	33,029,006	
F. Phased-In Recognition of Investment Income						
F1. Current Year: 0.20*E4.	14,768,636	23,219,566	(5,279,043)	(8,478,121)	6,605,801	0
F2. First Prior Year	(7,206,422)	14,768,636	23,219,566	(5,279,043)	(8,478,121)	6,605,801
F3. Second Prior Year	22,846,600	(7,206,422)	14,768,636	23,219,566	(5,279,043)	(8,478,121)
F4. Third Prior Year	8,022,800	22,846,600	(7,206,422)	14,768,636	23,219,566	(5,279,043)
F5. Fourth Prior Year	(39,291,600)	8,022,800	22,846,600	(7,206,422)	14,768,636	23,219,566
F6. Total Recognized Investment Gain	(859,986)	61,651,180	48,349,337	17,024,616	30,836,839	16,068,203
G. Actuarial Value End of Year:						
A.+D5.+E3.+F6.	\$1,070,402,499	\$1,179,752,077	\$1,272,122,896	\$1,321,209,628	\$1,371,979,452	
H. Difference Between Market & Actuarial Values	\$ 91,166,091	\$ 145,612,743	\$ 70,873,377	\$ 11,458,154	\$ 13,650,321	\$ (2,417,882)
I. Market Value Rate of Return	15.17%	18.19%	5.81%	4.51%	10.31%	
J. Actuarial Value Rate of Return	8.05% ¹	14.57% ¹	12.92% ¹	9.57% ¹	10.23% ¹	

¹ Reflects phase-in of 5-year "smoothed" market value of assets.





Schedule C – Summary of Changes in Net Assets

**SUMMARY OF CHANGES IN NET ASSETS
FOR THE YEAR ENDING JUNE 30, 2017**

Additions for the Year		
Contributions		
Members	\$39,042,431	
University	\$73,201,691	
Transfers	<u>\$0</u>	
Total		\$112,244,122
Net Investment Income		<u>\$133,201,479</u>
TOTAL		\$245,445,601
Deductions for the Year		
Benefit Payments	(\$188,310,782)	
Administrative Expenses	<u>(\$4,172,828)</u>	
TOTAL		(\$192,483,610)
Excess of Additions Over Deductions		
TOTAL		\$52,961,991
Reconciliation of Asset Balances		
Market Value of Assets as of June 30, 2016		\$1,332,667,782
Audit Adjustment		0
Excess of Additions over Deductions		\$52,961,991
Market Value of Assets as of June 30, 2017*		\$1,385,629,773

* The Market Value of Assets shown above is used in the determination of the Actuarial Value of Assets (Schedule B).





Schedule D – Outline of Actuarial Assumptions and Methods

INVESTMENT RATE OF RETURN: 7.75% per annum, compounded annually (net of investment expenses).

INFLATION ASSUMPTION: 3.00% per year.

PAYROLL GROWTH ASSUMPTION: 2.50% per year

ADMINISTRATIVE EXPENSE ASSUMPTION: 0.70% of total payroll of covered employees

PERCENT MARRIED: 80% of employees are assumed to be married, and wives are assumed to be the same age as their husbands.

ACTUARIAL METHOD: Individual Entry Age Normal cost method. Actuarial gains and losses are reflected in the unfunded actuarial accrued liability. The unfunded actuarial accrued liability is amortized over a closed 30-year period beginning June 30, 2014. This amortization assumes no future payroll increases. See Schedule E for a detailed explanation.

DECREMENTS:

PRE-RETIREMENT MORTALITY: RP-2000 Healthy Annuitant Mortality for ages 50 and greater and the RP-2000 Combined Mortality table for ages less than 50 projected to 2020 using Scale BB, set back 5 years for males and set forward 1 year for females. Representative values are presented below.

Age	Men	Women
20	0.025%	0.018%
25	0.033%	0.020%
30	0.035%	0.029%
35	0.042%	0.048%
40	0.073%	0.073%
45	0.102%	0.115%
50	0.142%	0.232%
55	0.524%	0.348%
60	0.603%	0.555%
64	0.719%	0.814%





Schedule D – Outline of Actuarial Assumptions and Methods

- **POST-RETIREMENT HEALTHY MORTALITY:** RP-2000 Healthy Annuitant Mortality for ages 50 and greater and the RP-2000 Combined Mortality table for ages less than 50 projected to 2020 using Scale BB, set back 5 years for males and set forward 1 year for females. Representative values are presented below.

Age	Men	Women
50	0.142%	0.232%
55	0.524%	0.348%
60	0.603%	0.555%
65	0.772%	0.897%
70	1.142%	1.459%
75	1.779%	2.432%
80	3.031%	3.989%
85	5.156%	6.785%
90	8.521%	11.827%
95	14.701%	18.579%

- **POST-RETIREMENT DISABLED MORTALITY:** RP-2000 Disabled Mortality projected to 2020 using Scale BB, set back 5 years for males and set forward 2 years for females. Representative values are presented below.

Age	Men	Women
50	2.13%	1.27%
55	2.73%	1.62%
60	3.34%	1.89%
65	3.65%	2.46%
70	3.94%	3.37%
75	4.63%	4.68%
80	6.07%	6.46%
85	8.08%	8.99%
90	10.47%	13.35%
95	14.70%	19.87%





Schedule D – Outline of Actuarial Assumptions and Methods

- **DISABILITY:** Representative values are presented below (65% of the projected disabilities are assumed to be due to occupational causes).

Age	Men	Women
20	0.005%	0.005%
25	0.029%	0.029%
30	0.052%	0.052%
35	0.076%	0.076%
40	0.100%	0.100%
45	0.150%	0.150%
50	0.200%	0.250%
55	0.300%	0.200%
60	0.200%	0.200%

- **TERMINATION:** Assumed rates are presented below.

Years of Service	Rate
0	22%
1	22%
2	15%
3	10%
4	7%
5	7%
6	5%
7	4%
8	3%
9	3%
10-14	2%
15+	1%





Schedule D – Outline of Actuarial Assumptions and Methods

- **RETIREMENT:** Representative values are presented below.

Age	Less than 25 Years of Service	25 Years of Service or More, but Less than 30	30 Years of Service-Members with less than 25 years of Service as of 7/1/2015	31 or More Years of Service-Members with less than 25 years of Service as of 7/1/2015	30 or More Years of Service-Members with 25 or More Years of Service as of 7/1/2015
45			9.5%	9.5%	9.5%
50			9.5%	9.5%	9.5%
55		5%	15%	15%	42%
58	5%	5%	45%	25%	32%
60	5%	5%	45%	25%	26%
61	10%	10%	45%	25%	23%
62	11%	11%	45%	25%	28%
63	10%	10%	45%	25%	28%
64	10%	10%	45%	25%	28%
65	20%	20%	50%	30%	28%
66	15%	15%	50%	30%	30%
67	15%	15%	50%	30%	30%
68	15%	15%	50%	30%	30%
69	15%	15%	50%	30%	30%
70+	100%	100%	100%	100%	100%

ASSETS: The method of valuing assets is intended to recognize a “smoothed” market value of assets. Under this method, the difference between actual return on market value from investment experience and the expected return on market value is recognized over a 5-year period.

SALARY INCREASES: 3.75% per annum





Schedule E – Actuarial Cost Method

1. The valuation is prepared on the projected benefit basis, which is used to determine the present value of each member's expected benefit payable at retirement, disability or death. The calculations are based on the member's age, years of service, sex, compensation, expected future salary increases, and an assumed future interest earnings rate (currently 7.75%). The calculations consider the probability of a member's death or termination of employment prior to becoming eligible for a benefit and the probability of the member terminating with a service, disability, or survivor's benefit. The present value of the expected benefits payable to active members is added to the present value of the expected future payments to current benefit recipients to obtain the present value of all expected benefits payable to the present group of members and survivors.
2. The employer contributions required to support the benefits of the System are determined using the individual entry age normal cost method. Under this method, the actuarial present value of the projected benefits of each individual included in the valuation is allocated as a level percentage of the individual's projected compensation between entry age and assumed exit.

The portion of the actuarial present value allocated to a valuation year is called the normal cost. The normal cost is calculated for each individual member. The normal cost rate is defined as the total of the individual normal cost divided by the total annual covered payroll.

The portion of the actuarial present value not provided for at a valuation date by the sum of (a) the actuarial value of assets and (b) the actuarial present value of future normal cost is called the Unfunded Actuarial Accrued Liability (UAAL). The UAAL is amortized as a level percentage of the projected salaries of the present and future members of the System, over a 30 year period beginning June 30, 2014 on a closed basis.





Schedule F– Summary of Plan Provisions

1. Provisions applicable to those members who had completed 20 years of service by July 1, 1979 (Certification 7/7 Supplemented)

a) Service retirement annuity payable:

- i. After 30 years of service; or
- ii. At age 58 after 10 years of service; or
- iii. At age 55 after 25 years of service.

b) Amount of service retirement annuity:

- i. Before age 65 – member with at least 30 years of service: 75% of average compensation if age 55 at beginning date; 65% if under age 55. If member completed 30 years of service before July 1973, annuity is increased by 2% of average compensation for each year of service beyond 30 and before July 1973, but to not more than 85% of average compensation.
- ii. Before age 65 – member with less than 30 years of service: 1.50% of average compensation per year of service for member with 20 or fewer years. Percentage increased by 0.05% for each year in excess of 20 years up to a maximum of 1.95% of average compensation per year of service. Amount reduced by ½% for each month member is under age 58 at time annuity begins.
- iii. After age 65 – same as before age 65.
- iv. Minimum annuity: \$250 per month.
- v. Average compensation means the average for the highest-paid 36 months of service without limit on compensation.
- vi. Employee contributions:
 - Complete supplementation: 7.00% of compensation.
 - Coordinated: 4.00% up to \$4,200 of compensation plus 6.50% of compensation in excess of \$4,200.





Schedule F– Summary of Plan Provisions

- 2. Provisions applicable to all members who were affected under Certification 37 and who had not completed 20 years of service by July 1, 1979 plus those members who entered the system on or after July 1, 1978 and who did not elect Certification 55 or 94 and did not elect full supplementation under Certification 54 (Certification 37/37 Coordinated)**
- a) Service retirement annuity payable:
- i. After 30 years of service and age 55; or
 - ii. At age 58 after 10 years of service; or
 - iii. At age 55 after 25 years of service.
- b) Amount of service retirement annuity:
- i. Before age 65 – member with at least 30 years of service: 75% of average compensation. Amount reduced by $\frac{1}{2}\%$ for each month member is under age 58 at time annuity begins.
 - ii. Before age 65 – member with less than 30 years of service: 1.50% of average compensation per year of service for member with 20 or fewer years. Percentage increased by 0.05% for each year in excess of 20 years up to a maximum of 1.95% of average compensation per year of service. Amount reduced by $\frac{1}{2}\%$ for each month member is under age 58 at time annuity begins.
 - iii. After age 65 – Benefit is coordinated. Annuity is reduced by $\frac{1}{2}\%$ of average compensation not in excess of the Social Security wage base in effect at retirement for each year of service up to 30 years. If member was under age 58 at beginning date, the coordination adjustment is made before application of $\frac{1}{2}\%$ reduction per month under 58.
 - iv. Minimum annuity: \$250 per month.
 - v. Average compensation means the average for the highest-paid 36 months of service, excluding that portion of compensation in any year which is in excess of \$35,000.
 - vi. Employee contributions for coordinated benefit: 5.00% of compensation up to maximum salary of \$35,000 for members with





Schedule F– Summary of Plan Provisions

25 or more years of service as of July 1, 2015, and 6.00% of compensation up to maximum salary of \$35,000 for members with less than 25 years of service as of July 1, 2015.

3. Provision applicable to all members who were affected by Certification 37 and who had not completed 20 years of service by July 1, 1979 as well as those members who entered the system on or after July 1, 1978 and later elected Certification 55 or those who elected full supplementation under Certification 54 (but not Certification 94) (Certification 55/55 Coordinated)

a) Service retirement annuity payable:

- i. After 30 years of service; or
- ii. At age 58 after 10 years of service; or
- iii. At age 55 after 25 years of service.

b) Amount of service retirement annuity:

- i. Before age 65 – member with at least 30 years of service: 75% of average compensation. Amount reduced by $\frac{1}{3}\%$ for each month member is under age 58 at time annuity begins if member had less than 25 years of service as of July 1, 2015 and reduced from age 55 for members with 25 or more years of service as of July 1, 2015.
- ii. Before age 65 – member with less than 30 years of service: 1.50% of average compensation per year of service for member with 20 or fewer years. Percentage increased by 0.05% for each year in excess of 20 years up to a maximum of 1.95% of average compensation per year of service. Amount reduced by $\frac{1}{3}\%$ for each month member is under age 58 at time annuity begins if member had less than 25 years of service as of July 1, 2015 and reduced from age 55 for members with 25 or more years of service as of July 1, 2015.
- iii. After age 65 – if member elected full supplementation, annuity is the same as before age 65. Otherwise, annuity is reduced by $\frac{1}{2}\%$ of average compensation at time of retirement multiplied by years of service up to 30 years.
- iv. Minimum annuity: \$250 per month.
- v. Average compensation means the average for the highest-paid 36 months of service, excluding that portion of compensation in any year which is in excess of \$35,000.
- vi. Employee contributions:





Schedule F– Summary of Plan Provisions

1. Complete supplementation: 7.00% of compensation up to \$35,000 for members with 25 or more years of service as of July 1, 2015.
 2. Complete supplementation: 8.00% of compensation up to \$35,000 for members with less than 25 years of service as of July 1, 2015.
 3. Coordinated: For members with 25 or more years of service as of July 1, 2015, 4% up to \$4,200 of compensation plus 6.50% of the excess up to the compensation limit of \$35,000. For members with less than 25 years of service as of July 1, 2015, 5% up to \$4,200 of compensation plus 6.50% of the excess up to the compensation limit of \$35,000.
- 4. For those entering between January 1, 1990 and June 30, 1998 who did not elect Certification 94 (Certification 55/55 Supplemented)**
- a) Service retirement annuity payable:
 - i. After 30 years of service; or
 - ii. At age 58 after 10 years of service; or
 - iii. At age 55 after 25 years of service.
 - b) Amount of service retirement annuity:
 - i. Before age 65 – member with at least 30 years of service: 75% of average compensation. Amount reduced by $\frac{1}{3}\%$ for each month member is under age 58 at time annuity begins if member had less than 25 years of service as of July 1, 2015 and reduced from age 55 for members with 25 or more years of service as of July 1, 2015.
 - ii. Before age 65 – member with less than 30 years of service: 1.50% of average compensation per year of service for member with 20 or fewer years. Percentage increased by 0.05% for each year in excess of 20 years up to a maximum of 1.95% of average compensation per year of service. Amount reduced by $\frac{1}{3}\%$ for each month member is under age 58 at time annuity begins if member had less than 25 years of service as of July 1, 2015 and reduced from age 55 for members with 25 or more years of service as of July 1, 2015.
 - iii. After age 65 – Same as before age 65.





Schedule F– Summary of Plan Provisions

- iv. Minimum annuity: \$250 per month.
- v. Average compensation means the average for the highest-paid 36 months of service, excluding that portion of compensation in any year which is in excess of \$35,000.
- vi. Employee contributions:
 - All completely supplemented: 8.00% of compensation up to compensation limit of \$35,000 for members with 25 or more years of service as of July 1, 2015.
 - All completely supplemented: 9.00% of compensation up to compensation limit of \$35,000 for members with less than 25 years of service as of July 1, 2015.

5. Certification 94:

- a) Increase compensation up to \$50,000.
- b) Those electing coverage under the above certification agree to pay 9.00% of compensation up to \$50,000 for members with 25 or more years of service as of July 1, 2015, and 10.00% of compensation up to maximum salary of \$50,000 for members with less than 25 years of service as of July 1, 2015.

6. Certification 139:

- a) Increase compensation up to a \$60,000 maximum. The \$60,000 cap was increased by 3.00% every two years until 7/1/2014. Effective 7/1/2014, the maximum compensation is frozen at \$69,557.
- b) Those electing coverage under the above certification agree to pay 11.00% of compensation up to the applicable indexed maximum for members with 25 or more years of service as of July 1, 2015, and 12% of compensation up to the applicable indexed maximum for members with less than 25 years of service as of July 1, 2015 (see (a) above).
- c) Effective July 1, 2015, all new employees will be covered under this certification and will pay 12.00% of compensation up to the applicable indexed maximum (see (a) above).





Schedule F– Summary of Plan Provisions

7. Disability Benefits

- a) A disability retirement annuity is payable upon:
- i. Disability due to occupational causes, regardless of service, or
 - ii. Disability due to non-occupational causes after 15 years of service. If member is also eligible for a service retirement annuity, benefit payable is the higher of the two.
- b) Amount of disability retirement annuity:
- i. Before age 65 – If service connected, 50% of rate of salary (subject to applicable salary cap) at retirement. If not service connected, 90% of the member's regular retirement benefit payable by the applicable retirement benefit formula above.
 - ii. After age 65 – Reduced to amount payable by the applicable retirement benefit formula above. However, if post 65 retirement benefit plus Primary Social Security benefit is less than pre 65 disability benefit, then post 65 benefit is adjusted (increased) by the amount necessary to match pre 65 disability benefit.
 - iii. Minimum annuity: \$250 per month.

8. Vested Benefits

A member whose employment terminates after ten (10) years of service, and who does not withdraw his contributions, receives a retirement annuity payable beginning at age 60 based on the applicable retirement formula above.

9. Non-vested Termination Benefits

If termination of employment occurs prior to completing ten (10) years of service, member is entitled only to a refund of his/her own contributions. Refund of a member's own contributions can also be obtained after attainment of ten (10) years of service but in that event the vested benefit is forfeited.

10. Pre-retirement Death Benefits

- a) A pre-retirement death benefit is payable upon:





Schedule F– Summary of Plan Provisions

- i. A service-connected death, or
 - ii. A non-service connected death.
- b) Amount of pre-retirement death benefit:
- i. The widow of a deceased member whose death is service-connected receives an annuity of 50% of final salary (subject to applicable salary cap), plus \$10 per month for each child under age 18 (21 if at school) or disabled. If no annuity is paid to widow, \$20 per month per eligible child. Widow receives annuity until death or remarriage. Maximum family benefit is 75% of final salary (subject to applicable salary cap).

If there is no surviving widow or eligible children, a lump sum amount equal to the member's contributions plus one year's final salary (subject to applicable salary cap), but not less than \$6,000, will be payable to the employee's designated beneficiary.
 - ii. Should the member's death be non-service connected then a lump sum amount is paid which is equal to the member's contributions plus one year's final salary (subject to applicable salary cap), but not less than \$6,000.

11. Post-retirement Death Benefits

Member contributions are refunded to the extent that they exceed retirement payments already made, unless a reversionary annuity was elected. Minimum payment is \$600. In addition, 50% of retirement annuity is payable to the surviving spouse until death, remarriage, or until the spouse begins to receive Social Security benefits. Minimum annuity, \$75 per month; maximum annuity, \$150 per month.

12. Reversionary Annuity

Member may elect to receive a reduced annuity in order to provide a lifetime benefit after death to a spouse or relative. The benefit to the spouse or relative may be as low as \$25 per month or as high as 100% of the member's reduced annuity. This option is not permitted if member retires on a disability annuity.





Schedule F– Summary of Plan Provisions

13. Christmas Bonus

A \$400 annual bonus is given to all retired participants.





Schedule G– Schedule of Active Member Data

**SCHEDULE OF ACTIVE MEMBER DATA
AS OF JUNE 30, 2017**

Age	Completed Years of Service							Total	Payroll
	Under 5	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30+		
Under 20	0	0	0	0	0	0	0	0	0
20 to 24	45	0	0	0	0	0	0	45	664,667
25 to 29	321	32	0	0	0	0	0	353	6,663,239
30 to 34	302	166	55	1	0	0	0	524	14,320,310
35 to 39	278	203	367	115	1	0	0	964	33,719,744
40 to 44	211	200	344	431	148	3	0	1,337	53,218,031
45 to 49	140	135	288	391	440	76	1	1,471	66,170,913
50 to 54	114	108	199	374	451	456	123	1,825	87,933,296
55 to 59	54	76	159	247	405	433	361	1,735	92,071,998
60 to 64	27	25	108	137	197	240	371	1,105	65,918,991
65 to 69	13	13	35	64	81	107	250	563	37,282,749
70+	2	3	15	19	32	33	178	282	20,565,520
Total	1,507	961	1,570	1,779	1,755	1,348	1,284	10,204	478,529,459

Average Active Age: 49.9

Average Service: 17.8





Schedule G– Schedule of Active Member Data

**DISTRIBUTION OF ACTIVE PARTICIPANTS BY PENSION ELIGIBILITY,
CONTRIBUTORY MAXIMUM, AND PLAN TYPE**

<u>Pension Eligibility Certification</u>	<u>Contributory Maximum Certification</u>	<u>Employee Contribution Wage Base</u>	<u>Plan Type</u>	<u>Participant Count @ 6/30/2017</u>	<u>Participant Count @ 6/30/2016</u>
Cert. #7	Cert. #7	None	Coordinated	-	-
Cert. #55	Cert. #55	\$35,000	Coordinated	57	67
Cert. #37	Cert. #37	\$35,000	Coordinated	653	728
Cert. #55	Cert. #55	\$35,000	Supplemented	2,054	2,155
Cert. #7	Cert. #7	None	Supplemented	6	5
Cert. #37	Cert. #94	\$50,000	Coordinated	69	76
Cert. #55	Cert. #94	\$50,000	Supplemented	4,420	4,639
Cert. #55	Cert. #94	\$50,000	Coordinated	37	44
Cert. #37	Cert. #139*	\$69,557	Coordinated	80	95
Cert. #55	Cert. #139*	\$69,557	Coordinated	18	21
Cert. #55	Cert. #139*	\$69,557	Supplemented	<u>2,810</u>	<u>2,608</u>
				10,204	10,438

*Effective 7/1/2014, the Certification 139 contribution wage base is frozen at \$69,557.





Schedule H – Data Reconciliation

**DATA RECONCILIATION
AS OF JUNE 30, 2017**

	Active	Terminated Vested	Receiving Benefits	Total
1. Number of Participants as of June 30, 2016	10,438	445	8,417	19,300
2. Change in status during the plan year:				
a. Active to inactive	(330)	99		(231)
b. Active to retiree	(374)		374	
c. Inactive to active	113	(25)		88
d. Inactive to retired		(32)	32	
e. Retired to active				
3. No longer participating due to:				
a. Death	(5)	(4)	(221)	(230)
b. Termination / Refund	(24)	(16)	(10)	(50)
c. Deletion of duplicate data				
d. Data adjustment		(10)		(10)
4. New participant due to:				
a. Initial participation	383			383
b. Omitted in error last year				
c. Pickups and Corrections	3		2	5
d. New beneficiaries			4	4
5. Number of Participants as of June 30, 2017	10,204	457	8,598	19,259





Schedule I – Estimated Benefit Payments

ESTIMATED PROJECTED BENEFIT PAYMENTS*

<u>Year End</u>	<u>Current In-Pay</u>	<u>Current Not-In-Pay</u>	<u>Total</u>
2017	\$190,315,901	\$19,137,250	\$209,453,151
2018	185,719,151	32,067,664	217,786,815
2019	180,913,686	44,215,002	225,128,688
2020	176,011,853	55,669,293	231,681,146
2021	171,185,119	65,701,013	236,886,132
2022	166,200,194	74,866,977	241,067,171
2023	161,012,583	83,335,422	244,348,005
2024	155,850,303	90,982,756	246,833,059
2025	150,507,832	98,635,538	249,143,370
2026	145,065,019	106,400,100	251,465,119
2027	139,454,436	114,121,147	253,575,583
2028	133,794,943	121,302,000	255,096,943
2029	128,090,927	128,273,452	256,364,379
2030	122,186,950	135,291,266	257,478,216
2031	116,189,732	142,196,837	258,386,569
2032	110,134,549	148,644,504	258,779,053
2033	104,043,455	154,483,233	258,526,688
2034	97,923,896	159,846,991	257,770,887
2035	91,789,690	164,613,130	256,402,820
2036	85,618,980	168,629,733	254,248,713
2037	79,564,526	171,978,329	251,542,855
2038	73,493,126	174,478,528	247,971,654
2039	67,496,801	175,996,118	243,492,919
2040	61,623,334	176,356,074	237,979,408
2041	55,917,484	175,979,777	231,897,261

*Amounts shown are the cash flows for current members only, based on the current benefit structure and assuming that all actuarial assumptions are met each year. To the extent that actual experience deviates from that expected, results will vary. Amounts are shown in future nominal dollars and have not been discounted to the valuation date.

