Minnesota State Retirement System

State Employees Retirement Fund

Actuarial Valuation Report as of July 1, 2017

GRS

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December 6, 2017

Minnesota State Retirement System
State Employees Retirement Fund
St. Paul, Minnesota

Dear Board of Directors:

The results of the July 1, 2017 annual actuarial valuation of the State Employees Retirement Fund are presented in this report. This report was prepared at the request of the Board and is intended for use by the Board and staff and those designated or approved by the Board. This report may be provided to parties other than the Fund only in its entirety. GRS is not responsible for the consequences of any unauthorized use of this report by persons other than the intended users as described above.

The purpose of the valuation is to measure the Fund's funding progress and to determine the required contribution rate for the fiscal year beginning July 1, 2017 according to prescribed assumptions. Note that we have not attempted to quantify the impact of GASB Statements No. 67 and No. 68 in this report.

Based on the current statutory contributions, the unfunded liability determined on an actuarial value of asset basis will not be eliminated if all actuarial assumptions are met.

The required contribution rate shown on page one was designed to comply with Minnesota Statutes. 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 the System in excess of those presented in this report be considered.

Actuarial assumptions, including discount rates, mortality tables and others identified in this report, are prescribed by Minnesota Statutes Section 356.215, the Legislative Commission on Pensions and Retirement (LCPR), and the Board of Directors. These parties are responsible for selecting the plan's funding policy, actuarial valuation methods, asset valuation methods, and assumptions. The policies, methods and assumptions used in this valuation are those that have been so prescribed and are described in the Actuarial Basis of this report. MSRS is solely responsible for communicating to GRS any changes required thereto.

In our professional judgement, the statutory discount rate of 8.0% used in this report deviates materially from the guidance set forth in Actuarial Standards of Practice No. 27 (ASOP No. 27). In a 2017 analysis of long-term rate of investment return and inflation assumptions, GRS suggested that an investment return assumption in the range of 6.85% to 7.68% would be reasonable. Please see our letter dated September 11, 2017 for additional information. If a discount rate within the reasonable range were used in this valuation instead of 8.0%, the unfunded liability and contribution deficiency would be higher than shown. Note that estimated results based on a 7.0% discount rate are shown on page five.

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The contribution rate in this report is determined using the actuarial assumptions and methods disclosed in the Actuarial Basis of this report. This report includes risk metrics on pages five and six, but does not include a more robust assessment of the risks of future experience differing materially from the actuarial assumptions. Additional 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.

The valuation was based upon information furnished by the Minnesota State Retirement System (MSRS), concerning 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 audit the data. We are not responsible for the accuracy or completeness of the information provided by MSRS.

Future actuarial measurements may differ significantly from the current measurements 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. Due to the limited scope of our assignment, we did not perform an analysis of the potential range of such future measurements.

This report should not be relied on for any purpose other than the purpose described herein. Determinations of the financial results associated with the benefits described in this report in a manner other than the intended purpose may produce significantly different results.

The signing actuaries are independent of the plan sponsor. We are not aware of any relationship that would impair the objectivity of our work.

Brian B. Murphy and Bonita J. Wurst are Members of the American Academy of Actuaries (MAAA) and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. In addition, Mr. Murphy meets the requirements of "approved actuary" under Minnesota Statutes Section 356.215, Subdivision 1, Paragraph (c).

This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. To the best of our knowledge and belief, the information contained in this report is accurate and presents the actuarial position of the State Employees Retirement Fund as of the valuation date according to prescribed assumptions, and was performed in accordance with the requirements of Minnesota Statutes Section 356.215, and the requirements of the Standards for Actuarial Work established by the LCPR. All calculations have been made in conformity with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board and with applicable statutes.

We are available to answer any questions or provide further details.

Respectfully submitted,

Brian B. Murphy

Brian B. Murphy, FSA, EA, FCA, MAAA

Bonita J. Wurst

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BBM/BJW:rmn

Other Observations

General Implications of Contribution Allocation Procedure or Funding Policy on Future Expected Plan Contributions and Funded Status

Given the plan's contribution allocation procedure, if there are no changes in benefits or contributions and all actuarial assumptions are met (including the statutory assumption of the plan earning 8.00%), it is expected that:

(1) The unfunded actuarial accrued liabilities will increase and not be eliminated,

(2) The funded status of the plan will decrease, and

(3) The plan may eventually become insolvent and unable to pay benefits.

As noted elsewhere in this report, we do not expect the earnings assumption of 8.00% to be met. The funded status of the plan based on a lower earnings assumption would deteriorate at a faster rate.

Limitations of Funded Status Measurements

Unless otherwise indicated, a funded status measurement presented in this report is based upon the actuarial accrued liability and the actuarial value of assets. Unless otherwise indicated, with regard to any funded status measurements presented in this report:

(1) The measurement is inappropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations, in other words of transferring the obligations to an unrelated third party in an arm's length market value type transaction.

(2) The measurement is dependent upon the actuarial cost method which, in combination with the plan's amortization policy, affects the timing and amounts of future contributions. The amounts of future contributions will most certainly differ from those assumed in this report due to future actual experience differing from assumed experience based upon the actuarial assumptions. A funded status measurement in this report of 100% is not synonymous with no required future contributions. If the funded status were 100%, the plan would still require future normal cost contributions (i.e., contributions to cover the cost of the active membership accruing an additional year of service credit).

(3) The measurement would produce a different result if the market value of assets were used instead of the actuarial value of assets.

Limitations of Project Scope

Actuarial standards do not require the actuary to evaluate the ability of the plan sponsor or other contributing entity to make required contributions to the plan when due. Such an evaluation was not within the scope of this project and is not within the actuary's domain of expertise. Consequently, the actuary performed no such evaluation.

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Summary of Valuation Results

Contributions

The following table summarizes important contribution information as described in the Development of Costs section.

Contributions	Actuarial Valuation as of July 1, 2017	Actuarial Valuation as of July 1, 2016
Statutory Contributions - Chapter 352 (% of Payroll)	11.00%	11.00%
Required Contributions - Chapter 356 (% of Payroll)	13.24%	14.49%
Sufficiency / (Deficiency)	(2.24)%	(3.49)%

The contribution deficiency decreased from (3.49)% of payroll to (2.24)% of payroll. The primary reason for the decreased contribution deficiency was the change in assumptions described in the Effects of Changes section. On a market value of assets basis, contributions are deficient by 1.98% of payroll.

Based on the actuarial value of assets and current contribution rates, statutory contributions are not sufficient to fully amortize the unfunded actuarial accrued liability over the statutory amortization period of 25 years. Based on the current member and employer contribution rates and other statutory methods and assumptions described in this report, the unfunded liability will not be eliminated. Current contributions are not sufficient to cover interest on the unfunded liability, which will result in the unfunded liability growing indefinitely. If all actuarial assumptions are met and contributions are not increased, the plan will eventually become insolvent and unable to pay benefits. We recommend utilizing the contribution stabilizer provisions described in the Summary of Plan Provisions and/or modifying benefits to address the contribution deficiency.

The Plan Assets section provides detail on the plan assets used for the valuation including a development of the Actuarial Value of Assets (AVA). The Market Value of Assets (MVA) earned approximately 15.1% for the plan year ending June 30, 2017. The AVA earned approximately 9.9% for the plan year ending June 30, 2017 as compared to the assumed rate of 8.00%. The assumed rate is a prescribed assumption mandated by Minnesota Statutes, and is outside the upper end of the reasonable range. According to the NASRA survey, the most common assumption for statewide plans is currently 7.50%. Use of a 7.50% return assumption would produce a deficiency greater than shown above.

Participant reconciliation and statistics are detailed in the Membership Data section. The Actuarial Basis section includes a summary of plan provisions and actuarial methods and assumptions used for the calculations in this report.

Accounting and financial reporting information prepared according to GASB Statements No. 67 and No. 68 was provided to MSRS in a separate report dated December 1, 2017.

Summary of Valuation Results

A summary of principal valuation results from the current valuation and the prior valuation follows. Any changes in plan provisions, actuarial assumptions or valuation methods and procedures between the two valuations are described after the summary.

	Actuarial Valuation as of July 1, 2017	Actuarial Valuation as of July 1, 2016
Contributions (*% of Payroll*)		
Statutory - Chapter 352	11.00%	11.00%
Required - Chapter 356	13.24%	14.49%
Sufficiency / (Deficiency)	(2.24)%	(3.49)%
Funding Ratios (*dollars in thousands*)		
Assets		
- Current assets (AVA)	$ 12,364,957	$ 11,676,370
- Current assets (MVA)	12,485,614	11,223,065
Accrued Benefit Funding Ratio		
- Current benefit obligations	$ 13,856,767	$ 13,752,949
- Funding ratio (AVA)	89.23%	84.90%
- Funding ratio (MVA)	90.10%	81.60%
Accrued Liability Funding Ratio		
- Actuarial accrued liability	$ 14,509,150	$ 14,316,886
- Funding ratio (AVA)	85.22%	81.56%
- Funding ratio (MVA)	86.05%	78.39%
Projected Benefit Funding Ratio		
- Current and expected future assets	$ 15,289,079	$ 14,479,681
- Current and expected future benefit obligations	16,312,136	16,034,135
- Projected benefit funding ratio (AVA)	93.73%	90.31%
Participant Data		
Active Members		
- Number	50,578	49,472
- Annual valuation earnings *(000s)*	$ 2,868,430	$ 2,743,866
- Projected annual earnings *(000s)*	$ 3,023,449	$ 2,889,433
- Average projected annual earnings	$ 59,778	$ 58,405
- Average age	46.8	47.0
- Average service	11.3	11.6
Service Retirements	33,563	32,241
Survivors	3,940	3,868
Disability Retirements	1,830	1,843
Deferred Retirements	17,006	17,019
Terminated Other Non-Vested	9,468	7,571
Total	**116,385**	**112,014**

Summary of Valuation Results

Effects of Changes

The following changes in plan provisions, actuarial assumptions, and methods were recognized as of July 1, 2017:

- Actuarial equivalent factors were updated to reflect current mortality and interest assumptions, effective January 1, 2017.
- Loading factors to account for members with Combined Service Annuities were updated as follows:
    - Active Members: Reduced from 1.2% of liabilities to 0.0% of liabilities
    - Deferred Vested Members: Reduced from 40% of liabilities to 4% of liabilities
    - Non-Vested Terminated Members: Reduced from 40% of liabilities to 5% of liabilities
    - The Combined Service Annuity (CSA) assumption changes were approved by the LCPR based on an analysis completed by the LCPR actuary and documented in a report dated October 2016. The prior CSA assumptions were based on a 2001 study performed by a prior actuary.

Refer to the Actuarial Basis section of this report for a complete description of these changes. The combined impact of the above changes was to decrease the accrued liability by $392 million and decrease the required contribution by 0.9% of pay, as follows:

	Before Changes	Reflecting Assumption Changes	Reflecting Benefit Change
Normal Cost Rate, % of Pay	8.2%	8.1%	8.2%
Amortization of Unfunded Accrued Liability, % of Pay	5.6%	4.6%	4.7%
Expenses (% of Pay)	0.3%	0.3%	0.3%
Total Required Contribution, % of Pay	14.1%	13.0%	13.2%
Accrued Liability Funding Ratio	83.0%	85.5%	85.2%
Projected Benefit Funding Ratio	91.5%	94.2%	93.7%
Unfunded Accrued Liability (in billions)	$2.5	$2.1	$2.1

Summary of Valuation Results

Valuation of Future Annual Post-Retirement Benefit Increases

Benefit recipients receive a future annual compounding 2.00% post-retirement benefit increase. If the accrued liability funding ratio, determined on a market value of assets basis, reaches or exceeds 90% (based on a 2.50% post-retirement benefit increase assumption) for two consecutive years, the benefit increase will revert to 2.50%. If, after reverting to a 2.50% increase, the accrued liability funding ratio (determined on a market value of assets basis) declines to 80% or less for the most recent actuarial valuation year or 85% or less for two consecutive years, the benefit increase will decrease to 2.00%. Benefit increases already granted, however, will not be affected.

To determine an assumption regarding a future change in the post-retirement benefit increase, we performed a projection of liabilities and assets based on the following methods and assumptions:

- Future investment returns and liability discount rates of 8.00%;
- Open group; stable active population (new member profile based on average new members hired in recent years);
- The post-retirement benefit increase rate is assumed to be 2.00% per year until the accrued liability funding ratio threshold required to pay a 2.50% post-retirement benefit increase is reached; and
- Current statutory contribution levels (i.e., not including potential contribution increases under the contribution stabilizer statutes).

Based on these assumptions and methods, the projection indicates that this plan is not expected to attain the accrued liability funding ratio threshold required to pay a 2.50% post-retirement benefit increase and will pay a 2.00% post-retirement benefit increase indefinitely. This assumption is reflected in our calculations. This is only an assumption; actual timing will depend on actual experience.

Summary of Valuation Results

Sensitivity Tests

During the 2017 legislative session, the Legislative Commission on Pensions and Retirement (LCPR) enacted a new sensitivity disclosure requirement for MSRS' 2017 valuations. Per the LCPR's requirement, we have calculated the liabilities associated with the following scenarios:

1) 7% interest rate assumption
2) 9% interest rate assumption
3) 2.5% post-retirement benefit increase for all future years

In each case, all other assumptions were unchanged from those used to develop the final valuation results in this report. Note that we believe the 9% interest rate assumption is an unrealistic assumption.

	Final Valuation Assumptions	Final Valuation Assumptions with 7% interest	Final Valuation Assumptions with 9% interest	Final Valuation Assumptions with 2.5% COLA for all future years
Normal Cost Rate, % of Pay	8.2%	10.3%	6.7%	8.6%
Amortization of Unfunded Accrued Liability, % of Pay	4.7%	7.9%	1.5%	6.2%
Expenses (% of Pay)	0.3%	0.3%	0.3%	0.3%
Total Required Contribution, % of Pay	13.2%	18.5%	8.5%	15.1%
Contribution Sufficiency/(Deficiency), % of Pay	(2.2)%	(7.5)%	2.5 %	(4.1)%
Accrued Liability Funding Ratio	85.2%	75.8%	95.1%	81.4%
Actuarial Accrued Liability (in billions)	$14.5	$16.3	$13.0	$15.2
Unfunded Accrued Liability (in billions)	$2.1	$4.0	$0.6	$2.8

Summary of Valuation Results

Risk Measures Summary (Dollars in Thousands)

Valuation Date (July 1)	(1) Accrued Liabilities (AAL)	(2) Market Value of Assets	(3) Market Value Unfunded AAL (1) - (2)	(4) Valuation Payroll	(5) Market Value Funded Ratio (2) / (1)	(6) Retiree Liabilities	(7) RetLiab/ AAL (6) / (1)	(8) AAL/ Payroll (1) / (4)	(9) Assets/ Payroll (2) / (4)
2010	$10,264,071	$7,692,531	$2,571,540	$2,327,398	74.9%	$4,535,401	44.2%	441.0%	330.5%
2011	$10,576,481	9,197,664	1,378,817	2,440,580	87.0%	4,982,212	47.1%	433.4%	376.9%
2012	$11,083,227	9,098,097	1,985,130	2,367,160	82.1%	5,489,756	49.5%	468.2%	384.3%
2013	$11,428,641	10,033,499	1,395,142	2,483,000	87.8%	5,807,381	50.8%	460.3%	404.1%
2014	$12,445,126	11,498,604	946,522	2,620,660	92.4%	6,471,998	52.0%	474.9%	438.8%
2015	$13,092,702	11,638,319	1,454,383	2,714,418	88.9%	6,949,000	53.1%	482.3%	428.8%
2016	$14,316,886	11,223,065	3,093,821	2,797,345	78.4%	7,746,511	54.1%	511.8%	401.2%
2017	$14,509,150	12,485,614	2,023,536	2,939,455	86.1%	8,207,943	56.6%	493.6%	424.8%

Valuation Date (July 1)	(10) Portfolio StdDev	(11) Std Dev % of Pay (9) x (10)	(12) Unfunded / Payroll (3) / (4)	(13) Non-Investment Cash Flow (NICF)	(14) NICF/ Assets (13) / (2)	(15) SBI Market Rate of Return	(16) SBI 5-Year Average
2010			110.5%	$(245,460)	(3.2%)	15.2%	3.4%
2011			56.5%	(259,174)	(2.8%)	23.3%	5.3%
2012			83.9%	(312,027)	(3.4%)	2.4%	2.3%
2013			56.2%	(339,906)	(3.4%)	14.2%	6.2%
2014			36.1%	(364,455)	(3.2%)	18.6%	14.5%
2015	14.1%	60.5%	53.6%	(361,470)	(3.1%)	4.4%	12.3%
2016	14.1%	56.6%	110.6%	(405,621)	(3.6%)	(0.1%)	7.7%
2017	14.1%	59.9%	68.8%	(405,013)	(3.2%)	15.1%	10.2%

Notes pertaining to numbered columns:

(5) The Funded ratio is the most widely known measure of a plan's financial strength, but the trend in the funded ratio is much more important than the absolute ratio. The funded ratio should trend to 100%. As it approaches 100%, it is important to re-evaluate the level of investment risk in the portfolio and potentially to re-evaluate the assumed rate of return.

(6) and (7) The ratio of Retiree liabilities to total accrued liabilities gives an indication of the maturity of the system. As the ratio increases, cash flow needs increase, and the liquidity needs of the portfolio change. A ratio on the order of 50% indicates a maturing system.

(8) and (9) The ratios of liabilities and assets to payroll gives an indication of both maturity and volatility. Many systems have ratios between 500% and 700%. Ratios significantly above that range may indicate difficulty in supporting the benefit level as a level % of payroll.

(10) and (11) The portfolio standard deviation measures the volatility of investment return. When multiplied by the ratio of assets to payroll it gives the effect of a one standard deviation asset move as a percent of payroll. This figure helps users understand the difficulty of dealing with investment volatility and the challenges volatility brings to sustainability.

(12) The ratio of unfunded liability to payroll gives an indication of the plan sponsor's ability to actually pay off the unfunded liability. A ratio above approximately 300% or 400% may indicate difficulty in discharging the unfunded liability within a reasonable time frame.

(13) and (14) The ratio of non-investment cash flow to assets is an important measure of sustainability. Negative ratios are common and expected for a maturing system. In the longer term, this ratio should be on the order of approximately -4%. A ratio that is significantly more negative than that for an extended period could be a leading indicator of potential exhaustion of assets.

(15) and (16) Investment return is probably the largest single risk that most systems face. The year by year return and the 5-year geometric average give an indicator of the realism of the systems assumed return. Of course, past performance is not a guarantee of future results. The performance data for the Combined Funds (pooled investments of major Minnesota Public Retirement Systems) is presented in these columns. The source of this data is the Minnesota State Board of Investment.

Information prior to 2012 provided by prior actuary. See prior reports for additional detail.

Supplemental Information

The remainder of the report includes information supporting the results presented in the previous sections.

- **Plan assets** presents information about the plan's assets as reported by the Minnesota State Retirement System. The assets represent the portion of total fund liabilities that has been funded.
- **Membership data** presents and describes the membership data used in the valuation.
- **Development of costs** shows the liabilities for plan benefits and the derivation of the contribution amount.
- **Actuarial basis** describes the plan provisions, as well as the methods and assumptions used to value the plan. The valuation is based on the premise that the plan is ongoing.
- **Additional schedules** includes a summary of funding progress over the long term.
- **Glossary** defines the terms used in this report.

Plan Assets

Statement of Fiduciary Net Position *(Dollars in Thousands)*

	Market Value	
	June 30, 2017	**June 30, 2016**
Assets		
Cash, equivalents, short term securities	$ 329,906	$ 252,758
Fixed income	2,412,541	2,760,132
Equity	9,711,222	8,179,738
Other*	1,302,954	1,605,610
Total cash, investments, and other assets	**$ 13,756,623**	**$ 12,798,238**
Amounts Receivable	$ 23,944	$ 22,232
Total Assets	**$ 13,780,567**	**$ 12,820,470**
Amounts Payable*	$ (1,294,953)	$ (1,597,405)
Net Position Restricted for Pensions	**$ 12,485,614**	**$ 11,223,065**

** Includes $1,284,498 in Securities Lending Collateral as of June 30, 2017 and $1,586,006 as of June 30, 2016.*

Plan Assets

Reconciliation of Plan Assets *(Dollars in Thousands)*

The following exhibit shows the revenue, expenses and resulting assets of the Fund as reported by the Minnesota State Retirement System for the prior two fiscal years.

Change in Assets	**Market Value**	
Year Ending	**June 30, 2017**	**June 30, 2016**
1. Fund balance at market value at beginning of year	**$ 11,223,065**	**$ 11,638,319**
2. Contributions		
a. Member	161,670	153,854
b. Employer	158,352	151,168
c. Other sources	-	-
d. Total contributions	$ 320,022	$ 305,022
3. Investment income		
a. Investment income/(loss)	1,680,494	5,356
b. Investment expenses	(12,932)	(14,989)
c. Net investment income/(loss)	$ 1,667,562	$ (9,633)
4. Other	47,287	20,281
5. Total income: *(2.d.) + (3.c.) + (4.)*	**$ 2,034,871**	**$ 315,670**
6. Benefits Paid		
a. Annuity benefits	(750,526)	(707,361)
b. Refunds	(11,576)	(13,345)
c. Total benefits paid	$ (762,102)	$ (720,706)
7. Expenses		
a. Other	(55)	(22)
b. Administrative	(10,165)	(10,196)
c. Total expenses	$ (10,220)	$ (10,218)
8. Total disbursements: *(6.c.) + (7.c.)*	**(772,322)**	**(730,924)**
9. Fund balance at market value at end of year *(1.) + (5.) + (8.)*	**$ 12,485,614**	**$ 11,223,065**
10. State Board of Investment calculated investment return	15.1%	-0.1%

Plan Assets

Actuarial Asset Value *(Dollars in Thousands)*

			June 30, 2017		June 30, 2016
1. Market value of assets available for benefits			**$ 12,485,614**		**$ 11,223,065**
2. Determination of average balance					
a. Total assets available at beginning of year			11,223,065		11,638,319
b. Total assets available at end of year			12,485,614		11,223,065
c. Net investment income for fiscal year			1,667,562		(9,633)
d. Average balance *[a. + b. - c.] / 2*			11,020,559		11,435,509
3. Expected return *[8.0% x 2.d.]*			881,645		914,841
4. Actual return			1,667,562		(9,633)
5. Current year asset gain/(loss) *[4. - 3.]*			785,917		(924,474)
6. Unrecognized asset returns					
	Original	**Unrecognized Amount**		**Unrecognized Amount**	
	Amount	**%**	**$**	**%**	**$**
a. Year ended June 30, 2017	$ 785,917	80%	$ 628,734		
b. Year ended June 30, 2016	(924,474)	60%	(554,684)	80%	$ (739,579)
c. Year ended June 30, 2015	(404,245)	40%	(161,698)	60%	(242,547)
d. Year ended June 30, 2014	1,041,524	20%	208,305	40%	416,610
e. Year ended June 30, 2013	561,056		N/A	20%	112,211
f. Unrecognized return adjustment			**$ 120,657**		**$ (453,305)**
7. **Actuarial value at end of year** *(1. - 6.f.)*			**$ 12,364,957**		**$ 11,676,370**
8. Approximate return on actuarial value of assets during fiscal year			9.9%		7.9%
9. Ratio of actuarial value of assets to market value of assets			0.99		1.04

Membership Data

Distribution of Active Members

	Years of Service as of June 30, 2017									
Age	**<3***	**3 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25 - 29**	**30 - 34**	**35+**	**Total**
< 25	1,209	31	2							**1,242**
Avg. Earnings	$ 28,448	$ 35,814	$ 34,799							**$ 28,642**
25 - 29	2,924	774	293	3						**3,994**
Avg. Earnings	$ 36,652	$ 45,318	$ 49,609	$ 42,027						**$ 39,286**
30 - 34	2,414	1,195	1,436	322	4					**5,371**
Avg. Earnings	$ 42,002	$ 50,838	$ 53,232	$ 55,520	$ 55,238					**$ 47,791**
35 - 39	1,817	997	1,518	1,144	295	2				**5,773**
Avg. Earnings	$ 43,858	$ 54,862	$ 57,232	$ 60,012	$ 62,579	$ 49,156				**$ 53,435**
40 - 44	1,313	664	1,100	966	802	115	1			**4,961**
Avg. Earnings	$ 46,712	$ 57,821	$ 60,947	$ 64,135	$ 67,857	$ 66,473	$ 53,791			**$ 58,626**
45 - 49	1,171	665	1,160	980	1,000	553	143	1		**5,673**
Avg. Earnings	$ 45,290	$ 58,088	$ 59,661	$ 63,355	$ 69,695	$ 73,124	$ 73,063	$ 49,289		**$ 60,565**
50 - 54	1,070	627	1,130	1,009	1,121	736	757	347	26	**6,823**
Avg. Earnings	$ 44,919	$ 55,570	$ 59,280	$ 63,572	$ 67,504	$ 72,370	$ 72,833	$ 69,586	$ 66,122	**$ 62,139**
55 - 59	869	580	1,075	1,032	1,078	816	1,027	934	470	**7,881**
Avg. Earnings	$ 46,112	$ 54,796	$ 59,031	$ 61,479	$ 65,986	$ 70,401	$ 71,561	$ 72,166	$ 64,333	**$ 63,250**
60 - 64	520	354	800	775	885	651	798	642	907	**6,332**
Avg. Earnings	$ 44,470	$ 54,466	$ 59,041	$ 61,867	$ 64,876	$ 68,022	$ 70,435	$ 70,996	$ 67,404	**$ 63,519**
65 - 69	162	123	284	281	329	185	200	143	359	**2,066**
Avg. Earnings	$ 31,836	$ 51,224	$ 54,975	$ 61,486	$ 67,359	$ 68,051	$ 67,967	$ 70,188	$ 71,592	**$ 62,164**
70+	85	30	56	60	57	38	38	23	75	**462**
Avg. Earnings	$ 16,615	$ 29,701	$ 44,442	$ 50,043	$ 64,521	$ 60,635	$ 69,452	$ 63,614	$ 71,850	**$ 50,363**
Total	**13,554**	**6,040**	**8,854**	**6,572**	**5,571**	**3,096**	**2,964**	**2,090**	**1,837**	**50,578**
Avg. Earnings	**$ 40,936**	**$ 53,271**	**$ 57,596**	**$ 61,856**	**$ 66,928**	**$ 70,435**	**$ 71,380**	**$ 71,138**	**$ 67,600**	**$ 56,713**

* *This exhibit does not reflect service earned in other MSRS Plans or Combined Service Annuity benefits. It should not be relied upon as an indicator of non-vested status.*

In each cell, the top number is the count of active participants for the age/service combination and the bottom number is valuation earnings for the fiscal year ending on the valuation date.

Membership Data

Distribution of Service Retirements

	Years Retired as of June 30, 2017							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<50	1	7	13					**21**
Avg. Benefit	$ 2,531	$ 6,206	$ 4,220					**$ 4,801**
50 - 54	2	10	5					**17**
Avg. Benefit	$ 3,882	$ 5,662	$ 5,324					**$ 5,353**
55 - 59	240	602	35	1				**878**
Avg. Benefit	$ 20,778	$ 16,324	$ 10,442	$ 2,746				**$ 17,292**
60 - 64	796	2,252	1,070	24				**4,142**
Avg. Benefit	$ 21,283	$ 20,465	$ 18,156	$ 12,668				**$ 19,981**
65 - 69	934	4,127	3,416	1,169	19	1		**9,666**
Avg. Benefit	$ 20,738	$ 20,262	$ 21,338	$ 17,184	$ 15,887	$ 1,845		**$ 20,305**
70 - 74	146	1,318	3,403	2,360	857	12		**8,096**
Avg. Benefit	$ 20,998	$ 19,403	$ 20,384	$ 20,440	$ 16,719	$ 18,179		**$ 19,861**
75 - 79	24	137	738	1,924	1,653	404	3	**4,883**
Avg. Benefit	$ 15,101	$ 17,563	$ 18,106	$ 18,747	$ 19,864	$ 18,419	$ 8,720	**$ 18,944**
80 - 84	5	39	101	361	1,339	913	234	**2,992**
Avg. Benefit	$ 20,514	$ 11,023	$ 14,512	$ 15,380	$ 18,901	$ 21,413	$ 26,027	**$ 19,552**
85 - 89	1	5	24	55	220	857	579	**1,741**
Avg. Benefit	$ 39,892	$ 18,819	$ 16,222	$ 10,264	$ 16,627	$ 21,312	$ 25,578	**$ 21,723**
90+		1	3	13	33	166	911	**1,127**
Avg. Benefit		$ 6,218	$ 17,041	$ 8,205	$ 12,336	$ 20,346	$ 21,531	**$ 20,908**
Total	**2,149**	**8,498**	**8,808**	**5,907**	**4,121**	**2,353**	**1,727**	**33,563**
Avg. Benefit	**$ 20,883**	**$ 19,786**	**$ 20,141**	**$ 18,779**	**$ 18,646**	**$ 20,762**	**$ 23,475**	**$ 19,890**

In each cell, the top number is the count of retired participants for the age/years retired combination and the bottom number is the average annual benefit amount.

Membership Data

Distribution of Survivors

	Years Since Death as of June 30, 2017							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<45	16	43	31	11			2	**103**
Avg. Benefit	$ 4,801	$ 7,349	$ 7,649	$ 14,458			$ 16,782	**$ 7,986**
45 - 49	3	18	13	7	3			**44**
Avg. Benefit	$ 5,080	$ 7,128	$ 11,122	$ 15,107	$ 5,437			**$ 9,323**
50 - 54	5	22	23	6	5	2		**63**
Avg. Benefit	$ 12,939	$ 12,672	$ 8,739	$ 8,571	$ 4,843	$ 3,042		**$ 9,939**
55 - 59	24	63	43	23	6	8	1	**168**
Avg. Benefit	$ 15,670	$ 11,857	$ 9,624	$ 12,325	$ 7,250	$ 5,650	$ 9,999	**$ 11,423**
60 - 64	28	107	83	59	26	15	2	**320**
Avg. Benefit	$ 16,732	$ 18,558	$ 16,257	$ 13,317	$ 8,625	$ 10,451	$ 6,713	**$ 15,574**
65 - 69	51	123	160	104	50	19	5	**512**
Avg. Benefit	$ 18,668	$ 17,692	$ 17,339	$ 14,916	$ 12,352	$ 13,544	$ 4,324	**$ 16,309**
70 - 74	63	150	135	131	61	31	12	**583**
Avg. Benefit	$ 19,578	$ 18,381	$ 16,430	$ 15,688	$ 16,256	$ 15,915	$ 11,458	**$ 16,957**
75 - 79	35	146	157	105	74	55	20	**592**
Avg. Benefit	$ 20,179	$ 20,732	$ 17,975	$ 16,658	$ 15,876	$ 17,164	$ 19,642	**$ 18,270**
80 - 84	42	144	139	104	84	47	32	**592**
Avg. Benefit	$ 23,718	$ 22,469	$ 21,033	$ 21,153	$ 21,754	$ 20,393	$ 15,124	**$ 21,326**
85 - 89	18	119	121	84	71	55	50	**518**
Avg. Benefit	$ 13,988	$ 21,129	$ 22,143	$ 21,513	$ 22,143	$ 21,851	$ 18,782	**$ 21,169**
90+	17	62	79	101	82	58	46	**445**
Avg. Benefit	$ 13,988	$ 23,170	$ 22,427	$ 20,188	$ 22,227	$ 18,536	$ 21,349	**$ 21,044**
Total	**302**	**997**	**984**	**735**	**462**	**290**	**170**	**3,940**
Avg. Benefit	**$ 17,811**	**$ 18,658**	**$ 17,820**	**$ 17,397**	**$ 17,996**	**$ 17,718**	**$ 17,730**	**$ 17,962**

In each cell, the top number is the count of survivors for the age/years since death combination and the bottom number is the average annual benefit amount.

Membership Data

Distribution of Disability Retirements

	Years Disabled as of June 30, 2017							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
< 45	4	2	5	3				**14**
Avg. Benefit	$ 7,466	$ 3,974	$ 5,691	$ 2,454				**$ 5,259**
45 - 49	3	9	6	5	2			**25**
Avg. Benefit	$ 8,845	$ 11,623	$ 4,740	$ 5,121	$ 7,962			**$ 8,044**
50 - 54	7	38	31	18	3	3		**100**
Avg. Benefit	$ 14,087	$ 10,086	$ 9,687	$ 7,632	$ 4,216	$ 7,325		**$ 9,542**
55 - 59	18	93	72	51	16	6	4	**260**
Avg. Benefit	$ 17,832	$ 14,646	$ 14,155	$ 11,473	$ 8,133	$ 10,774	$ 4,798	**$ 13,467**
60 - 64	21	113	122	83	51	33	3	**426**
Avg. Benefit	$ 15,716	$ 14,884	$ 17,351	$ 13,435	$ 11,210	$ 12,162	$ 6,924	**$ 14,642**
65 - 69	3	49	155	161	87	25	5	**485**
Avg. Benefit	$ 8,542	$ 15,857	$ 16,322	$ 16,821	$ 13,749	$ 13,732	$ 11,760	**$ 15,750**
70 - 74			45	101	64	32	20	**262**
Avg. Benefit			$ 15,144	$ 15,429	$ 14,418	$ 15,986	$ 15,914	**$ 15,238**
75+				27	92	82	57	**258**
Avg. Benefit				$ 12,727	$ 14,710	$ 17,838	$ 14,034	**$ 15,347**
Total	**56**	**304**	**436**	**449**	**315**	**181**	**89**	**1,830**
Avg. Benefit	**$ 14,851**	**$ 14,200**	**$ 15,377**	**$ 14,434**	**$ 13,342**	**$ 15,500**	**$ 13,674**	**$ 14,513**

In each cell, the top number is the count of disabled participants for the age/years since disability combination and the bottom number is the average annual benefit amount.

Membership Data

Reconciliation of Members

		Terminated*		Recipients**			
	Actives	Deferred Retirement	Other Non-Vested	Service Retirement	Disability Retirement	Survivor	Total
Members on July 1, 2016	**49,472**	**17,019**	**7,571**	**32,241**	**1,843**	**3,868**	**112,014**
New members	5,845	0	0	0	0	0	**5,845**
Return to active	316	(168)	(148)	0	0	0	**0**
Terminated non-vested	(1,943)	0	1,943	0	0	0	**0**
Service retirements	(1,345)	(627)	0	1,972	0	0	**0**
Unclassified retirements	0	0	0	100	0	0	**100**
Terminated deferred	(978)	978	0	0	0	0	**0**
Terminated refund/transfer	(683)	(168)	(379)	0	0	0	**(1,230)**
Deaths	(68)	(27)	(12)	(820)	(76)	(186)	**(1,189)**
New beneficiary	0	0	0	0	0	273	**273**
Disabled	(36)	0	0	0	36	0	**0**
Data adjustments	(2)	(1)	493	70	27	(15)	**572**
Net change	1,106	(13)	1,897	1,322	(13)	72	**4,371**
Members on July 1, 2017	**50,578**	**17,006**	**9,468**	**33,563**	**1,830**	**3,940**	**116,385**

* *Includes members in the General or Military Affairs Plans.*
** *Includes members in the General, Military Affairs or Unclassified Plans.*

Terminated Member Statistics on June 30, 2017	Deferred Retirement	Other Non-Vested	Total
Number	17,006	9,468	26,474
Average age	51.1	37.5	46.2
Average service	7.9	1.2	5.5
Average annual benefit, with augmentation to Normal Retirement Date and 4% CSA load	$11,157	N/A	$11,157
Average refund value, with 4% CSA load (5% CSA load for Non-Vested)	$28,763	$2,839	$19,492

Development of Costs

Actuarial Valuation Balance Sheet *(Dollars in Thousands)*

The actuarial balance sheet is based on the principle that the long-term projected benefit obligations of the plan should be ideally equal to the long-term resources available to fund those obligations. **A Projected Benefit Funding Ratio less than 100% indicates that contributions are insufficient.** The resources available to meet projected obligations for current members consist of current fund assets plus the present value of anticipated future contributions intended to fund benefits for current members. In the exhibit below, B.2 is the estimated present value of contributions to fund the normal cost rate for current members until their respective termination dates. Item B.1 is the present value of the total 11% statutory contribution net of normal cost and anticipated plan expenses during the period from the valuation date to the statutory unfunded amortization date.

The contributions made in excess of amounts required for current benefit payments are accumulated as a reserve to help meet benefit payments in later years. It is this reserve system which permits the establishment of a level rate of contribution each year.

			June 30, 2017
A. Actuarial Value of Assets			$ 12,364,957
B. Expected Future Assets			
1. Present value of expected future statutory supplemental contributions			1,121,136
2. Present value of future normal cost contributions			1,802,986
3. Total expected future assets: *(1.) + (2.)*			$ 2,924,122
C. Total Current and Expected Future Assets			15,289,079
D. Current Benefit Obligations*			
1. Benefit recipients	**Non-Vested**	**Vested**	**Total**
a. Service retirements	$ -	$ 7,352,530	$ 7,352,530
b. Disability retirements	-	266,001	266,001
c. Survivors	-	589,412	589,412
2. Deferred retirements with augmentation	-	1,065,663	1,065,663
3. Former members without vested rights**	10,622	-	10,622
4. Active members	147,600	4,424,939	4,572,539
5. Total Current Benefit Obligations	$ 158,222	$ 13,698,545	$ 13,856,767
E. Expected Future Benefit Obligations			2,455,369
F. Total Current and Expected Future Benefit Obligations***			16,312,136
G. Unfunded Current Benefit Obligations: *(D.5.) - (A.)*			1,491,810
H. Unfunded Current and Future Benefit Obligations: *(F.) - (C.)*			1,023,057
I. Accrued Benefit Funding Ratio: *(A.)/(D.5.)*			89.23%
J. Projected Benefit Funding Ratio: *(C.)/(F.)*			93.73%

* *Present value of credited projected benefits (projected compensation, current service).*

** *Former members who have not satisfied vesting requirements and have not collected a refund of member contributions as of the valuation date.*

*** *Present value of projected benefits (projected compensation, projected service).*

Development of Costs

Determination of Unfunded Actuarial Accrued Liability and Supplemental Contribution Rate (*Dollars in Thousands)*

	Actuarial Present Value of Projected Benefits	Actuarial Present Value of Future Normal Costs	Actuarial Accrued Liability
A. Determination of Actuarial Accrued Liability (AAL)			
1. Active members			
a. Retirement annuities	$ 6,395,909	$ 1,322,086	$ 5,073,823
b. Disability benefits	217,061	82,937	134,124
c. Survivor's benefits	93,559	26,038	67,521
d. Deferred retirements	275,960	285,026	(9,066)
e. Refunds*	36,925	86,899	(49,974)
f. Total	$ 7,019,414	$ 1,802,986	$ 5,216,428
2. Deferred retirements with future augmentation	1,065,663	-	1,065,663
3. Former members without vested rights	10,622	-	10,622
4. Benefit recipients	8,207,943	-	8,207,943
5. Contingent actuarial accrued liability - UNCL Plan	8,494	-	8,494
6. Total	$ 16,312,136	$ 1,802,986	$ 14,509,150
B. Determination of Unfunded Actuarial Accrued Liability (UAAL)			
1. Actuarial accrued liability			$ 14,509,150
2. Current assets (AVA)			12,364,957
3. Unfunded actuarial accrued liability			$ 2,144,193
C. Determination of Supplemental Contribution Rate**			
1. Present value of future payrolls through the amortization date of June 30, 2042			$ 45,574,651
2. Supplemental contribution rate: *(B.3.) / (C.1.)*			4.70% ***

* *Includes non-vested refunds and non-married survivor benefits only.*

** *The amortization of the unfunded actuarial accrued liability (UAAL) using the current amortization method results in initial payments less than the "interest only" payment on the UAAL. Payments less than the interest only amount will result in the UAAL increasing for an initial period of time.*

*** *The amortization factor as of July 1, 2017 is 15.07373.*

Development of Costs

Changes in Unfunded Actuarial Accrued Liability (UAAL)
(Dollars in Thousands)

	Year Ending June 30, 2017		
	Actuarial Accrued Liability	**Current Assets**	**Unfunded Actuarial Accrued Liability**
A. Unfunded actuarial accrued liability at beginning of year	$ 14,316,886	$ 11,676,370	$ 2,640,516
B. Changes due to interest requirements and current rate of funding			
1. Normal cost, including expenses	246,809	-	246,809
2. Benefit payments	(762,102)	(762,102)	-
3. Contributions	-	320,022	(320,022)
4. Interest on A., B.1., B.2. and B.3.	1,124,739	916,426	208,313
5. Total *(B.1. + B.2. + B.3. + B.4.)*	$ 609,446	$ 474,346	$ 135,100
C. Expected unfunded actuarial accrued liability at end of year *(A. + B.5.)*	$ 14,926,332	$ 12,150,716	$ 2,775,616
D. Increase (decrease) due to actuarial losses (gains) because of experience deviations from expected			
1. Age and service retirements			2,486
2. Disability retirements			(1,290)
3. Death-in-service benefits			(22)
4. Withdrawals			383
5. Salary increases			(9,015)
6. Investment income			(214,241)
7. Mortality of annuitants			(9,596)
8. Other items			(8,420)
9. Total			$ (239,715)
E. Unfunded actuarial accrued liability at end of year before plan amendments and changes in actuarial assumptions *(C. + D.9.)*			$ 2,535,901
F. Change in unfunded actuarial accrued liability due to changes in plan provisions			42,807
G. Change in unfunded actuarial accrued liability due to changes in actuarial assumptions			(434,515)
H. Change in unfunded actuarial accrued liability due to changes in actuarial methods			-
I. Unfunded actuarial accrued liability at end of year *(E. + F. + G. + H.)**			$ 2,144,193

** The unfunded actuarial accrued liability on a market value of assets basis is $2,023,536.*

Development of Costs

Determination of Contribution Sufficiency/(Deficiency) *(Dollars in Thousands)*

The required contribution is defined in Minnesota Statutes as the sum of normal cost, a supplemental contribution to amortize the UAAL, and an allowance for expenses. The dollar amounts shown are for illustrative purposes and equal percent of payroll multiplied by projected annual payroll.

	Percent of Payroll	Dollar Amount
A. Statutory contributions - Chapter 352		
1. Employee contributions	5.50%	$ 166,290
2. Employer contributions	5.50%	166,290
3. Total	11.00%	$ 332,580
B. Required contributions - Chapter 356		
1. Normal cost		
a. Retirement benefits	6.20%	$ 187,454
b. Disability benefits	0.34%	10,280
c. Survivors	0.12%	3,628
d. Deferred retirement benefits	1.16%	35,072
e. Refunds*	0.37%	11,187
f. Total	8.19%	$ 247,621
2. Supplemental contribution amortization of Unfunded Actuarial Accrued Liability by June 30, 2042	4.70%	$ 142,102
3. Allowance for expenses	0.35%	10,582
4. Total	13.24%	$ 400,305
C. Contribution Sufficiency/(Deficiency) *(A.3. - B.4.)*	(2.24%)	$ (67,725)

Note: Projected annual payroll for fiscal year beginning on the valuation date: $3,023,449 (based on methods prescribed in the LCPR Standards for Actuarial Work).

** Includes non-vested refunds and non-married survivor benefits only.*
*** The required contribution on a market value of assets basis is 12.98% of payroll.*

Development of Costs

Special Groups - Military Affairs Calculation

Section 352.85 of Chapter 352 of Minnesota Statutes provides that certain military affairs personnel may retire, with an unreduced benefit, at age 60. In addition, they may receive disability benefits upon being found disqualified for retention in active military duty. To fund these special benefits, employees and employer contribute an extra 1.60% of payroll.

To recognize the effect of the unreduced early retirement benefit available at age 60, we have assumed that all military affairs personnel will retire at age 60, or if over age 60, one year from the valuation date.

The unfunded liability for these members, if any, is reflected in the total unfunded liability shown on page 16.

	Year Ending June 30, 2017
A. Projected annual earnings	$ 361,111
B. Total normal cost	
1. Dollar amount	$ 41,311
2. Percent of payroll	11.44%
C. Normal cost of State Employees Retirement Fund (percent of payroll)	8.19%
D. Difference in normal cost *(B. - C., not less than zero)*	3.25%

Active Military Affairs Statistics	**Active Members**
Number	5
Average Age, in years	41.4
Average Service, in years	6.4

Development of Costs

Special Groups - Pilots Calculation

Section 352.86 of Chapter 352 of Minnesota Statutes provides that certain transportation department pilots may retire, with an unreduced benefit, at age 62. In addition, they may receive disability benefits upon being found disqualified for retention as pilots. To fund these special benefits, employees and employer contribute an extra 1.60% of payroll.

This group is closed to new entrants effective June 1, 2008. As of July 1, 2017, there are no remaining active members affected by this plan provision.

Development of Costs

Special Groups - Fire Marshals Calculation

Section 352.87 of Chapter 352 of Minnesota Statutes provides that deputy state fire marshals may retire, with an unreduced benefit (with respect to service after July 1, 1999), at age 55. Credited Service after July 1, 1999 accrues retirement benefits at a rate of 2.00% per year, and disability benefits are based on a minimum of 15 years of service (20 years if duty related). To fund these special benefits, members contribute an extra 2.78% of payroll and employers contribute an extra 4.20% of payroll.

To recognize the effect of the unreduced early retirement benefit available at age 55, we have assumed that all fire marshals will retire in accordance with the retirement assumptions which apply to the members of the Correctional Employees Retirement Fund.

The unfunded liability for these members, if any, is reflected in the total unfunded liability shown on page 16.

	Year Ending June 30, 2017
A. Projected annual earnings	$ 1,093,677
B. Total normal cost	
1. Dollar amount	$ 175,754
2. Percent of payroll	16.07%
C. Normal cost of State Employees Retirement Fund (percent of payroll)	8.19%
D. Difference in normal cost (B. - C.)	7.88%

Active Fire Marshals Statistics	Active Members
Number	15
Average Age, in years	53.0
Average Service, in years	12.6

Development of Costs

Special Groups - Unclassified Plan Contingent Liability Calculation
(Dollars in Thousands)

Section 352D.02 of Chapter 352D of Minnesota Statutes provides that members credited with employee shares in the Unclassified Plan may elect to terminate participation in the Unclassified Plan and be covered by the State Employees Retirement Fund (General Plan) prior to termination of covered employment assuming that the member has acquired at least 10 years of allowable state service if hired prior to July 1, 2010 and has no more than 7 years of service if hired after June 30, 2010. Unclassified Plan members contribute 5.50% of payroll and employers contribute 6% of payroll. Certain members (Judges and Legislators) are not eligible to elect coverage under the State Employees Retirement Fund.

To recognize the effect of the option to elect coverage under the General Plan, we have assumed that all eligible Unclassified Plan members will elect coverage under the General Plan if such election provides the member with a greater economic present value than the accumulated contribution balance under the Unclassified Plan. The liabilities were measured using the actuarial assumptions that are applied to the State Employees Retirement Fund.

		Year Ending June 30, 2017
A.	Number of active eligible members	1,363
B.	Account balances for active members	$ 161,834
C.	Accrued liability for active members	$ 170,328
D.	Number of inactive members and ineligible active members*	1,932
E.	Account balances for inactive members	$ 143,194
F.	Net assets held in trust for Unclassified Plan members	$ 304,590
G.	Contingent liability (C. - B.)	$ 8,494
H.	Projected annual earnings for active members	$ 105,389
I.	Normal cost	
	1. Dollar amount	$ 12,120
	2. Percent of payroll	11.50%
J.	Normal cost of State Employee Retirement Fund (percent of payroll)	8.19%
K.	Difference in normal cost (I.2. - J.)	3.31%

** Includes 1,691 terminated members, 229 active Legislators and 12 active Judges that are not eligible to elect coverage.*

Unclassified Member Statistics	Active Eligible Members
Number	1,363
Average Age, in years	43.5
Average Service, in years	8.4
Average Unclassified Account Balance	$ 118,733

Actuarial Basis

Actuarial Methods

All actuarial methods are prescribed by Minnesota Statutes, the Legislative Commission on Pensions and Retirement, or the MSRS Board of Directors. Different methodologies may also be reasonable and results based on other methodologies would be different.

Actuarial Cost Method

Actuarial accrued liability and required contributions in this report are computed using the Entry Age Normal Cost method. This method is prescribed by Minnesota Statute. Under this method, a normal cost is developed by amortizing the actuarial value of benefits expected to be received by each active participant (as a level percentage of pay) over the total working lifetime of that participant, from hire to termination. Age as of the valuation date was calculated based on the dates of birth provided by the Fund. Entry age for valuation purposes was calculated as the age on the valuation date minus the provided years of service on the valuation date.

To the extent that current assets and future normal costs do not support participants' expected future benefits, an Unfunded Actuarial Accrued Liability ("UAAL") develops. The UAAL is amortized over the statutory amortization period using level percent of payroll assuming payroll increases. The total contribution developed under this method is the sum of the normal cost, expenses, and the payment toward the UAAL.

Valuation of Future Post-Retirement Benefit Increases

If the plan has reached the accrued liability funding ratio threshold (determined on a market value of assets basis) required to pay a 2.50% benefit increase, Minnesota Statutes require the 2.50% benefit increase rate to be reflected in the liability calculations. If the plan has not yet reached the accrued liability funding ratio threshold required to pay a 2.50% benefit increase, Minnesota Statutes require a projection to be performed to determine the expected attainment of the accrued liability funding ratio threshold, and the expected reversion to a 2.50% benefit increase rate must be reflected in the liability calculations.

Funding Objective

The fundamental financing objective of the fund is to establish contribution rates which, when expressed as a percentage of active member payroll, will remain approximately level from generation to generation and meet the required deadline for full funding.

Actuarial Methods (Concluded)

Asset Valuation Method

The assets are valued based on a five-year moving average of expected and market values (five-year average actuarial value) determined as follows:

- At the end of each plan year, an average asset value is calculated as the average of the market asset value at the beginning and end of the fiscal year net of investment income for the fiscal year;
- The investment gain or (loss) is taken as the excess of actual investment income over the expected investment income based on the average asset value as calculated above;
- The investment gain or (loss) so determined is recognized over five years at 20% per year; and
- The asset value is the sum of the market asset value plus the scheduled recognition of investment gains or (losses) during the current and the preceding four fiscal years.

Payment on the Unfunded Actuarial Accrued Liability

Payment equals a level percentage of payroll each year to the statutory amortization date of June 30, 2042 assuming payroll increases of 3.50% per annum. If there is a negative Unfunded Actuarial Accrued Liability, the surplus amount is amortized over 30 years as a level percentage of payroll. If the unfunded liability increases due to changes in benefits, assumptions, or methods, the statutory amortization date may be extended. Projected payroll is multiplied by 0.959 in the determination of the present value of future payroll to account for timing differences (as required by the Standards for Actuarial Work).

Changes in Methods since Prior Valuation

There have been no changes in actuarial methods since the prior valuation.

Actuarial Basis

Summary of Actuarial Assumptions

The following assumptions were used in valuing the liabilities and benefits under the plan. All actuarial assumptions are prescribed by Minnesota Statutes, the Legislative Commission on Pensions and Retirement (LCPR), or the MSRS Board of Directors. These parties are responsible for selecting the assumptions used for this valuation. Unless noted otherwise, the assumptions prescribed are based on the last experience study, dated June 30, 2015. The Allowance for Combined Service Annuity assumptions are based on an analysis completed by the LCPR actuary and documented in a report dated October 2016.

Investment return	8.00% per annum.
Benefit increases after retirement	2.00% per annum
Salary increases	Reported salary at valuation date increased according to the rate table, to current fiscal year and annually for each future year. Prior fiscal year salary is annualized for members with less than one year of service.
Inflation	2.75% per year.
Payroll growth	3.50% per year.
Mortality rates	
Healthy Pre-retirement	RP-2014 employee generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2014, white collar adjustment, set forward one year for males and no age adjustment for females.
Healthy Post-retirement	RP-2014 annuitant generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2014, white collar adjustment, set forward two years for males and no age adjustment for females.
Disabled	RP-2014 disabled mortality table projected with mortality improvement Scale MP-2015 from a base year of 2014, set forward two years for males and four years for females.
	The RP-2014 employee mortality table as published by the Society of Actuaries (SOA) contains mortality rates for ages 18 to 80 and the annuitant mortality table contains mortality rates for ages 50 to 120. We have extended the annuitant mortality table as needed for members younger than age 50 who are receiving a benefit by deriving rates based on the employee table and the juvenile table. Similarly, we have extended the employee table as needed for members older than age 80 by deriving rates based on the annuitant table.
Retirement	Members retiring from active status are assumed to retire according to the age related rates shown in the rate table. Members who have attained the highest assumed retirement age are assumed to retire in one year.
Withdrawal	Service-related rates based on experience; see table of sample rates.
Disability	Age-related rates based on experience; see table of sample rates.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Allowance for Combined Service Annuity	Liabilities for former, vested members are increased by 4.00%, and liabilities for former, non-vested members are increased by 5.00% to account for the effect of some participants having eligibility for a Combined Service Annuity.
Administrative expenses	Prior year administrative expenses expressed as percentage of prior year projected payroll.
Refund of contributions	Account balances accumulate interest until normal retirement date and are discounted back to the valuation date. All employees withdrawing after becoming eligible for a deferred benefit take the larger of their contributions accumulated with interest or the value of their deferred benefit.
Commencement of deferred benefits	Members receiving deferred annuities (including current terminated deferred members) are assumed to begin receiving benefits at normal retirement age.
Percentage married	80% of active male members and 65% of female members are assumed to be married. Actual marital status is used for members in payment status.
Age of spouse	Male members are assumed to have a beneficiary three years younger and female members are assumed to have a beneficiary two years older.
Form of payment	Married members retiring from active status are assumed to elect subsidized joint and survivor form of annuity as follows: Males: 15% elect 50% Joint & Survivor option 15% elect 75% Joint & Survivor option 50% elect 100% Joint & Survivor option Females: 15% elect 50% Joint & Survivor option 10% elect 75% Joint & Survivor option 30% elect 100% Joint & Survivor option Remaining married members and unmarried members are assumed to elect the Straight Life option. Members receiving deferred annuities (including current terminated deferred members) are assumed to elect a life annuity.
Eligibility testing	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
Decrement operation	Withdrawal decrements do not operate during retirement eligibility. Decrements are assumed to occur mid-fiscal year.
Service credit accruals	It is assumed that members accrue one year of service credit per year.
Pay increases	Pay increases are assumed to happen at the beginning of the fiscal year. This is equivalent to assuming that reported earnings are pensionable earnings for the year ending on the valuation date.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Unknown data for certain members	To prepare this report, GRS has used and relied on participant data supplied by the Fund. Although GRS has reviewed the data in accordance with Actuarial Standards of Practice No. 23, GRS has not verified or audited any of the data or information provided. In cases where submitted data was missing or incomplete, the following assumptions were applied: <u>Data for active members:</u> There were 146 members reported with zero or invalid salary (<$100). We used prior year salary (73 members), if available, otherwise, high five salary with a 10% load to account for salary increases (67 members). If neither pay or high five salary was available, we assumed a value of $35,000 (6 members). There were 8 members reported with zero or negative service. Due to the small number of members with zero service, and based on direction from MSRS, we used service of 0 years for these members. There were also 108 members reported without a gender and 47 members reported with an invalid date of birth. We assumed the member was hired at age 37 and female gender. <u>Data for terminated members:</u> There were 462 members reported with a missing or invalid benefit. If available, we calculated benefits for these members using the reported Average Salary, Credited Service and Termination Date provided. If Average Salary was not reported or invalid (446 members), we assumed a value of $30,000. If termination date was not reported (11 members), we assumed the member terminated at age 40 (or current age if younger than 40). If credited service was either not reported or invalid (12 members), we assumed a value of 7.5 years. There were no members with a missing date of birth, and no members with an invalid gender. <u>Data for members receiving benefits:</u> There were 16 members reported without a gender. We assumed female gender for the valuation. No retired members were reported with an invalid date of birth. There were 5 members reported without a benefit. Due to the small number of members with missing benefits, we made no adjustment to the reported data for members receiving benefits.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Unknown data for certain members	Data for members receiving benefits: There were 8 survivor members reported with a certain end date prior to the valuation date. These members were excluded from the valuation. There were 110 retirees reported with a survivor option and a survivor date of death. We assumed no benefit was payable to the survivor, and the member benefit already reflected the increase to the life annuity (i.e., "bounce back"), if applicable. There were 122 retirees reported with a bounce back annuity but were not reported with a reasonable reduction factor. A factor of 0.80, 0.85 and 0.90 was assumed for the 100%, 75% and 50% joint and survivor annuity, respectively. There were retired members reported with a survivor option and an invalid or missing survivor gender (4,276 members) and/or survivor date of birth (3,765 members). We used the valuation assumptions if the survivor gender or date of birth was missing or invalid.
Changes in actuarial assumptions	The Combined Service Annuity (CSA) loads were 1.20% for active member liability and 40% for vested and non-vested deferred member liability. The revised CSA loads are now 0.00% for active member liability, 4.00% for vested deferred member liability, and 5.00% for non-vested deferred member liability.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

	Percent of Members Dying Each Year*					
Age in 2017	Healthy Post-Retirement Mortality** Male	Healthy Post-Retirement Mortality** Female	Healthy Pre-Retirement Mortality** Male	Healthy Pre-Retirement Mortality** Female	Disability Mortality** Male	Disability Mortality** Female
20	0.03%	0.01%	0.03%	0.01%	0.08%	0.06%
25	0.04	0.02	0.03	0.01	0.28	0.18
30	0.06	0.05	0.03	0.02	0.59	0.38
35	0.09	0.08	0.04	0.02	0.97	0.61
40	0.14	0.11	0.04	0.03	1.34	0.84
45	0.20	0.15	0.07	0.05	1.68	1.07
50	0.29	0.20	0.12	0.09	1.99	1.33
55	0.42	0.27	0.21	0.14	2.35	1.63
60	0.59	0.38	0.36	0.20	2.78	1.96
65	0.89	0.63	0.63	0.30	3.37	2.53
70	1.47	1.00	1.10	0.52	4.32	3.60

* *Generally, mortality rates are expected to increase as age increases. These standard mortality rates have been adjusted slightly to prevent decreasing mortality rates. If the rates were not adjusted as described, we would not expect the valuation results to be materially different.*

** *Rates are adjusted for mortality improvements using Scale MP-2015 from a base year of 2014.*

	Percent of Members Decrementing Each Year	
	Disability Retirement	
Age	Male	Female
20	0.00%	0.00%
25	0.01	0.01
30	0.01	0.01
35	0.02	0.02
40	0.06	0.06
45	0.11	0.11
50	0.22	0.22
55	0.32	0.32
60	0.47	0.47
65	0.00	0.00

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Age	Percent Retiring Each Year		
	Rule of 90 Eligible	Hired prior to 7/1/1989	Hired after 6/30/1989
55	15.0%	4.0%	4.0%
56	15.0	4.0	4.0
57	12.5	4.0	4.0
58	12.5	4.0	4.0
59	15.0	6.0	5.0
60	15.0	8.0	5.0
61	20.0	10.0	10.0
62	30.0	20.0	15.0
63	25.0	18.0	15.0
64	25.0	18.0	15.0
65	35.0	35.0	20.0
66	30.0	30.0	30.0
67	25.0	25.0	25.0
68	25.0	25.0	25.0
69	22.0	22.0	22.0
70	30.0	30.0	30.0
71+	100.0	100.0	100.0

Summary of Actuarial Assumptions (Concluded)

Salary Scale	
Year	**Increase**
1	14.00%
2	11.50
3	6.25
4	5.50
5	5.25
6	5.15
7	5.00
8	4.75
9	4.50
10	4.25
11	4.20
12	4.15
13	4.10
14	4.05
15	4.00
16	3.95
17	3.90
18	3.85
19	3.80
20	3.75
21	3.70
22	3.65
23	3.60
24	3.55
25+	3.50

Percent of Members Terminating (Withdrawing) Each Year		
Year	**Males**	**Females**
1	20.00%	24.00%
2	15.00	18.00
3	11.00	13.00
4	8.50	11.00
5	7.75	9.00
6	6.50	8.50
7	5.75	7.50
8	5.00	5.75
9	4.00	5.00
10	3.25	4.50
11	3.00	4.00
12	2.75	4.00
13	2.50	3.00
14	2.50	2.75
15	2.50	2.50
16	2.00	2.25
17	2.00	2.25
18	2.00	2.25
19	2.00	2.25
20	1.50	2.25
21	1.50	2.00
22	1.50	2.00
23	1.00	1.50
24	1.00	1.50
25	1.00	1.50
26	1.00	1.50
27	1.00	1.25
28	1.00	1.25
29	1.00	1.25
30+	1.00	1.00

Actuarial Basis

Summary of Plan Provisions

Following is a summary of the major plan provisions used in the valuation of this report. MSRS is solely responsible for the validity, accuracy and comprehensiveness of this information. If any of the plan provisions shown below are not accurate and complete, the valuation results may differ significantly from those shown in this report and may require a revision of this report.

Plan Year	July 1 through June 30.
Eligibility	State employees, non-academic staff of the University of Minnesota and employees of certain Metro level government units, unless excluded by law.
Contributions	Shown as a percent of salary: **<u>Member</u>** **<u>Employer</u>** 5.50% 5.50% Member contributions are "picked up" according to the provisions of Internal Revenue Code 414(h).
Allowable Service	Service during which member contributions were made. May also include certain leaves of absence, military service and periods while temporary Worker's Compensation is paid. Excludes lump sum vacation and severance pay at termination.
Average Salary	Average of the five highest successive years of Salary. Average Salary is based on all Allowable Service if less than five years.
Salary	Includes wages, allowances and fees. Excludes lump sum payments at separation, employer contributions to deferred compensation and tax-sheltered annuity plans and benevolent vacation and sick leave donation programs.
Retirement	
<u>Normal retirement benefit</u>	
Age/Service requirement	First hired before July 1, 1989: (a.) Age 65 and three years of Allowable Service. (b.) Proportionate Retirement Annuity is available at age 65 and one year of Allowable Service. First hired after June 30, 1989: (a.) The greater of age 65 or the age eligible for full Social Security retirement benefits (but not higher than age 66) and three years of Allowable Service (five years if hired after June 30, 2010). (b.) Proportionate Retirement Annuity is available at normal retirement age and one year of Allowable Service.
Amount	1.70% of Average Salary for each year of Allowable Service.

Actuarial Basis

Summary of Plan Provisions (Continued)

Retirement (Continued)

Early retirement

Age/Service requirement	First hired before July 1, 1989: (a.) Age 55 and three years of Allowable Service. (b.) Any age with 30 years of Allowable Service. (c.) Rule of 90: Age plus Allowable Service totals 90. First hired after June 30, 1989: (a.) Age 55 and three years (five years if hired after June 30, 2010) of Allowable Service.
Amount	First hired before July 1, 1989: The greater of (a) or (b): (a.) 1.20% of Average Salary for each of the first ten years of Allowable Service and 1.70% of Average Salary for each subsequent year with reduction of 0.25% for each month the member is under age 65 at time of retirement or under age 62 if 30 or more years of Allowable Service. No reduction if age plus years of Allowable Service totals 90. (b.) 1.70% of Average Salary for each year of Allowable Service assuming augmentation to age 65 at 3.00% per year and actuarial reduction for each month the member is under age 65. First hired after June 30, 1989: 1.70% of Average Salary for each year of Allowable Service assuming augmentation to the age eligible for full Social Security retirement benefit (but not higher than age 66) at 3.00% (2.50% if hired after June 30, 2006) per year and actuarial reduction for each month the member is under the normal retirement age.
Form of payment	Life annuity with return on death of any balance of member contributions over aggregate monthly payments. Actuarially equivalent options are: (a.) 50%, 75%, or 100% Joint and Survivor with bounce back feature without additional reduction. (b.) 15-year Certain and Life.
Benefit increases	Since 2011, benefit recipients have received annual 2.00% benefit increases. When the accrued liability funding ratio reaches or exceeds 90% (determined on a market value of assets basis) for two consecutive years, the benefit increase will revert to 2.50%. If, after reverting to a 2.50% increase, the accrued liability funding ratio (determined on a market value of assets basis) declines to 80% or less for the most recent actuarial valuation year or 85% or less for two consecutive years, the benefit increase will decrease to 2.00%.

Summary of Plan Provisions (Continued)

Retirement (Continued)	
Benefit increases (Continued)	A benefit recipient who has been receiving a benefit for at least 12 full months as of the June 30 of the calendar year immediately before the adjustment will receive a full increase. Members receiving benefits for at least one month but less than 12 full months as of the June 30 of the calendar year immediately before the adjustment will receive a pro rata increase. Prior to 2002, members who retired under the laws in effect before July 1, 1973, received an additional lump sum payment each year. In 1989, this lump sum payment was the greater of $25 times each full year of Allowable Service or $400 per full year of service less any Social Security benefits received or annuity from a Minnesota public employee pension plan. In each following year, the lump sum payment was increased by the same percentage increase that was applied to regular annuities paid from the Minnesota Post Retirement Investment Fund. Effective January 1, 2002, the annual lump sum payment was divided by 12 and paid as a monthly life annuity in the annuity form elected.
Disability	
Disability benefit	
Age/Service requirement	Total and permanent disability before normal retirement age with three years of Allowable Service (five years if hired after June 30, 2010).
Amount	Normal Retirement benefit based on Allowable Service and Average Salary at disability without reduction for commencement before normal retirement age. Payments stop if disability ceases or death occurs. Payments revert to a retirement annuity at normal retirement age. Benefits may be reduced on resumption of partial employment.
Retirement after disability	
Age/Service requirement	Normal retirement age with continued disability.
Amount	Any optional annuity continues. Otherwise, a normal retirement benefit equal to the disability benefit paid before normal retirement age, or an actuarially equivalent optional annuity.
Form of payment	Same as for retirement.
Benefit Increases	Same as for retirement.

Summary of Plan Provisions (Continued)

Death	
Surviving spouse optional benefit	
Age/Service requirement	Member or former member who dies before retirement or disability benefits commence with three years of Allowable Service (five years if hired after June 30, 2010). If a former member dies before age 55 and has less than 30 years of Allowable Service, benefits commence when the former member would have been age 55. If an active member dies, benefits may commence immediately, regardless of age.
Amount	Surviving spouse receives the 100% joint and survivor benefits using the Normal Retirement formula above. If commencement is prior to age 55, the appropriate early retirement formula described above applies except that one-half the monthly reduction factor is used from age 55 to the commencement age and the Rule of 90 does not apply. In lieu of this benefit, the surviving spouse may elect a refund of member contributions with interest or an actuarially equivalent term certain annuity.
Benefit increases	If a member dies prior to July 1, 1997, and the beneficiary was not eligible to commence a survivor benefit as of July 1, 1997, an actuarial increase shall be made for the change in the post-retirement interest rates from 5.00% to 6.00%. Same as for retirement.
Surviving dependent children's benefit	
Age/Service requirement	If no surviving spouse, all children (biological or adopted) below age 20 who are dependent for more than half of their support on deceased member.
Amount	Actuarially equivalent 100% joint and survivor annuity to surviving spouse payable to the later of age 20 or five years. The amount is proportionally divided among surviving children.
Benefit increases	Same as for retirement.
Refund of contributions	
Age/Service requirement	Active member dies and survivor benefits are not payable or a former member dies before annuity begins or former member who is not entitled to an annuity dies.
Amount	Member's contributions with 6.00% interest through June 30, 2011, compounded daily. Beginning July 1, 2011, a member's contributions increase at 4.00% interest compounded daily.

Summary of Plan Provisions (Continued)

Death (Continued)	
<u>**Refund of contributions (Continued)**</u>	
Age/Service requirement	Retired or disabled annuitant who did not select an optional annuity dies, or the remaining recipient of an option dies.
Amount	The excess of the member's contributions over all benefits paid.
Unclassified Plan Provision	Eligible members credited with employee shares in the Unclassified Plan may elect to terminate participation in the Unclassified Plan and be covered by the State Employees Retirement Fund prior to termination of covered employment assuming that the member has acquired at least 10 years of allowable state service (no more than seven years of service if hired after June 30, 2010).
Termination	
<u>**Refund of contributions**</u>	
Age/Service requirement	Termination of state service.
Amount	Member's contributions with 6.00% interest through June 30, 2011, compounded daily. Beginning July 1, 2011, a member's contributions increase at 4.00% interest compounded daily. If a member is vested, a deferred annuity may be elected in lieu of a refund.
<u>**Deferred benefit**</u>	
Age/Service requirement	Three years of Allowable Service if hired prior to June 30, 2010, five years of Allowable Service if hired after June 30, 2010.
Amount	Benefit computed under law in effect at termination and increased by the following annual augmentation percentage: (a.) 0.00% before July 1, 1971; (b.) 5.00% from July 1, 1971 to January 1, 1981; (c.) 3.00% thereafter (2.50% if hired after June 30, 2006) until January 1 of the year following attainment of age 55 or January 1, 2012, whichever is earlier; (d.) 5.00% thereafter until the annuity begins (2.50% if hired after June 30, 2006), but before January 1, 2012. Amount is payable as a normal or early retirement; and (e.) 2.00% from January 1, 2012, thereafter. Amount is payable at normal or early retirement. If a member terminated employment prior to July 1, 1997, but was not eligible to commence their pension before July 1, 1997, an actuarial increase shall be made for the change in the post-retirement interest rates from 5.00% to 6.00%.

Actuarial Basis

Summary of Plan Provisions (Concluded)

Combined Service Annuity	Members are eligible for combined service benefits if they: (a.) Have sufficient allowable service in total that equals or exceeds the applicable service credit vesting requirement of the retirement plan with the longest applicable service credit vesting requirement; (b.) Have at least six months of allowable service credit in each plan worked under; and (c.) Are not in receipt of a benefit from another plan, or have applied for benefits with an effective date within one year. Members who meet the above requirements must have their benefit based on the following: (a.) Allowable service in all covered plans is combined in order to determine eligibility for early retirement. (b.) Average salary is based on the high five consecutive years during their entire service in all covered plans.
Actuarial Equivalent Factors	Actuarially equivalent factors based on RP-2014 mortality for healthy annuitants, white collar adjustment, male rates set forward two years, projected to 2019 using Scale MP-2015, blended 50% males, 5.88% post-retirement interest, and 8.00% pre-retirement interest. Based upon statutory requirements, joint and survivor factors are based on an interest assumption of 6.50%.
Contribution Stabilizer	The following is a summary of the contribution stabilizer provisions in Minnesota Statute 352.045: If a contribution sufficiency of at least 1.00% of covered payroll exists, member and employer contributions may be adjusted by the MSRS Board of Directors to a level necessary to maintain a 1.00% sufficiency. Member and employer contributions may not be less than the sum of normal cost and administrative expenses. If a contribution deficiency of at least 0.50% of covered payroll exists, the member and employer contribution rates may be increased equally by the MSRS Board of Directors to eliminate the deficiency. Any adjustment to the contribution rates must be reported to the Legislative Commission on Pensions and Retirement (LCPR) by January 15 following the most recent valuation report. If the LCPR does not recommend against or alter the change in rates, the adjustment becomes effective on the first day of the first full payroll period of the fiscal year following receipt of the actuarial valuation that gave rise to the adjustment.
Changes in Plan Provisions	Actuarial equivalent factors were updated to reflect current mortality and interest assumptions, effective January 1, 2017.

Additional Schedules

Schedule of Funding Progress[1] *(Dollars in Thousands)*

Actuarial Valuation Date	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) (b)	Unfunded (Overfunded) AAL (UAAL) (b) - (a)	Funded Ratio (a)/(b)	Actual Covered Payroll (Previous FY) (c)	UAAL as a Percentage of Covered Payroll [(b)-(a)]/(c)
7-1-1991	$ 2,304,311	$ 2,883,603	$ 579,292	79.91%	$ 1,370,964	42.25%
7-1-1992	2,613,472	3,125,299	511,827	83.62%	1,409,108	36.32%
7-1-1993	2,905,578	3,563,492	657,914	81.54%	1,482,005	44.39%
7-1-1994	3,158,068	3,876,584	718,516	81.47%	1,536,978	46.75%
7-1-1995	3,462,098	3,795,926	333,828	91.21%	1,514,177	22.05%
7-1-1996	3,975,832	4,087,273	111,441	97.27%	1,560,369	7.14%
7-1-1997	4,664,519	4,519,542	(144,977)	103.21%	1,568,747	(9.24%)
7-1-1998	5,390,526	5,005,165	(385,361)	107.70%	1,557,880	(24.74%)
7-1-1999	5,968,692	5,464,207	(504,485)	109.23%	1,649,469	(30.58%)
7-1-2000	6,744,165	6,105,703	(638,462)	110.46%	1,733,054	(36.84%)
7-1-2001	7,366,673	6,573,193	(793,480)	112.07%	1,834,042	(43.26%)
7-1-2002	7,673,028	7,340,397	(332,631)	104.53%	1,915,350	(17.37%)
7-1-2003	7,757,292	7,830,671	73,379	99.06%	2,009,975	3.65%
7-1-2004	7,884,984	7,878,363	(6,621)	100.08%	1,965,546	(0.34%)
7-1-2005	8,081,736	8,455,336	373,600	95.58%	1,952,320	19.14%
7-1-2006	8,486,756	8,819,161	332,405	96.23%	2,016,588	16.48%
7-1-2007	8,904,517	9,627,305	722,788	92.49%	2,095,310	34.50%
7-1-2008	9,013,456	9,994,602	981,146	90.18%	2,256,528	43.48%
7-1-2009	9,030,401	10,512,760	1,482,359	85.90%	2,329,499	63.63%
7-1-2010	8,960,391	10,264,071	1,303,680	87.30%	2,327,398	56.01%
7-1-2011	9,130,011	10,576,481	1,446,470	86.32%	2,440,580	59.27%
7-1-2012	9,162,301	11,083,227	1,920,926	82.67%	2,367,160 [2]	81.15%
7-1-2013	9,375,780	11,428,641	2,052,861	82.04%	2,483,000 [2]	82.68%
7-1-2014	10,326,272	12,445,126	2,118,854	82.97%	2,620,660 [2]	80.85%
7-1-2015	11,223,285	13,092,702	1,869,417	85.72%	2,714,418 [3]	68.87%
7-1-2016	11,676,370	14,316,886	2,640,516	81.56%	2,797,345 [3]	94.39%
7-1-2017	12,364,957	14,509,150	2,144,193	85.22%	2,939,455 [3]	72.95%

[1] *Information prior to 2012 provided by prior actuaries. See prior reports for additional detail.*
[2] *Assumed equal to actual member contributions divided by 5.00%.*
[3] *Assumed equal to actual member contributions divided by 5.50%.*

Additional Schedules

Schedule of Contributions from the Employer and Other Contributing Entities[1]

(Dollars in Thousands)

Plan Year Ended June 30	Actuarially Required Contribution Rate (a)	Actual Covered Payroll (b)	Actual Member Contributions (c)	Annual Required Contributions [(a)x(b)] - (c) = (d)	Actual Employer Contributions[2] (e)	Percentage Contributed (e)/(d)
1991	8.17%	$ 1,370,964	$ 56,895	$ 55,113	$ 57,986	105.21%
1992	7.86%	1,409,108	58,478	52,278	59,244	113.33%
1993	8.27%	1,482,005	59,132	63,430	58,982	92.99%
1994	8.93%	1,536,978	62,555	74,697	60,741	81.32%
1995	9.15%	1,514,177	61,627	76,920	63,161	82.11%
1996	8.05%	1,560,369	63,507	62,103	65,557	105.56%
1997	7.21%	1,568,747	63,848	49,259	66,568	135.14%
1998	7.13%	1,557,880	62,901	48,176	62,315	129.35%
1999	6.48%	1,649,469	66,823	40,063	65,979	164.69%
2000	6.12%	1,733,054	70,378	35,685	69,322	194.26%
2001	7.12%	1,834,042	74,364	56,220	73,362	130.49%
2002	6.79%	1,915,350	79,487	50,565	76,614	151.52%
2003	8.34%	2,009,975	83,850	83,782	80,399	95.96%
2004	9.43%	1,965,546	82,103	103,248	78,622	76.15%
2005	9.33%	1,952,323	83,101	99,051	80,312	81.08%
2006	10.55%	2,016,588	85,379	127,371	82,645	64.88%
2007	10.11%	2,095,310	89,447	122,389	86,492	70.67%
2008	11.76%	2,256,528	99,280	166,088	96,746	58.25%
2009	12.39%	2,329,499	108,866	179,759	107,211	59.64%
2010	14.85%	2,327,398	115,180	230,439	113,716	49.35%
2011	10.99%	2,440,580	122,029	146,191	118,563	81.10%
2012	11.03%	2,367,160 [3]	118,358	142,740	115,159	80.68%
2013	12.32%	2,483,000 [3]	124,150	181,756	121,673	66.94%
2014	12.45%	2,620,660 [3]	131,033	195,239	128,037	65.58%
2015	12.82%	2,714,418 [4]	149,293	198,695	146,333	73.65%
2016	12.44%	2,797,345 [4]	153,854	194,136	151,168	77.87%
2017	14.49%	2,939,455 [4]	161,670	264,257	158,352	59.92%
2018	13.24%	N/A	N/A	N/A	N/A	N/A

[1] *Information prior to 2012 provided by prior actuary. See prior reports for additional detail.*
[2] *Includes contributions from other sources (if applicable).*
[3] *Assumed equal to actual member contributions divided by 5.00%.*
[4] *Assumed equal to actual member contributions divided by 5.50%.*

Glossary of Terms

Accrued Benefit Funding Ratio	The ratio of assets to Current Benefit Obligations.
Accrued Liability Funding Ratio	The ratio of assets to Actuarial Accrued Liability.
Actuarial Accrued Liability (AAL)	The difference between the Actuarial Present Value of Future Benefits, and the Actuarial Present Value of Future Normal Costs.
Actuarial Assumptions	Assumptions about future plan experience that affect costs or liabilities, such as: mortality, withdrawal, disablement, and retirement; future increases in salary; future rates of investment earnings; future investment and administrative expenses; characteristics of members not specified in the data, such as marital status; characteristics of future members; future elections made by members; and other items.
Actuarial Cost Method	A procedure for allocating the Actuarial Present Value of Future Benefits between the Actuarial Present Value of future Normal Costs and the Actuarial Accrued Liability.
Actuarial Equivalent	Of equal Actuarial Present Value, determined as of a given date and based on a given set of Actuarial Assumptions.
Actuarial Present Value (APV)	The amount of funds required to provide a payment or series of payments in the future. It is determined by discounting the future payments with an assumed interest rate and with the assumed probability each payment will be made.
Actuarial Present Value of Projected Benefits	The Actuarial Present Value of amounts which are expected to be paid at various future times to active members, retired members, beneficiaries receiving benefits, and inactive, non-retired members entitled to either a refund or a future retirement benefit. Expressed another way, it is the value that would have to be invested on the valuation date so that the amount invested plus investment earnings would provide sufficient assets to pay all projected benefits and expenses when due.
Actuarial Valuation	The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a plan. An Actuarial Valuation for a governmental retirement system typically also includes calculations of items needed for developing and monitoring a retirement system's funding policy, such as the Funded Ratio and the Annual Required Contribution (ARC).
Actuarial Value of Assets	The value of the assets as of a given date, used by the actuary for valuation purposes. This may be the market or fair value of plan assets or a smoothed value in order to reduce the year-to-year volatility of calculated results, such as the Funded Ratio and the Annual Required Contribution (ARC).
Amortization Method	A method for determining the Amortization Payment. Under the Level Percentage of Pay method, the Amortization payment is one of a stream of increasing payments, whose Actuarial Present Value is equal to the UAAL. The stream of payments increases at the rate at which total covered payroll of all active members is assumed to increase.

Glossary of Terms (Continued)

Amortization Payment	That portion of the plan contribution or ARC which is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.
Amortization Period	The period used in calculating the Amortization Payment.
Annual Required Contribution (ARC)	The employer's periodic required contributions, expressed as a dollar amount or a percentage of covered plan compensation. The ARC consists of the Employer Normal Cost and Amortization Payment.
Augmentation	Annual increases to deferred benefits.
Closed Amortization Period	A specific number of years that is reduced by one each year, and declines to zero with the passage of time. For example if the amortization period is initially set at 30 years, it is 29 years at the end of one year, 28 years at the end of two years, etc.
Current Benefit Obligations	The present value of benefits earned to the valuation date, based on current service and including future salary increases to retirement (comparable to a Projected Unit Credit measurement).
Employer Normal Cost	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
Expected Assets	The present value of anticipated future contributions intended to fund benefits for current members.
Experience Gain/Loss	A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two actuarial valuations. To the extent that actual experience differs from that assumed, Unfunded Actuarial Accrued Liabilities emerge which may be larger or smaller than projected. Gains are due to favorable experience; e.g., the assets earn more than projected, salaries do not increase as fast as assumed, members retire later than assumed, etc. Favorable experience means actual results produce actuarial liabilities not as large as projected by the actuarial assumptions. On the other hand, losses are the result of unfavorable experience; i.e., actual results that produce Unfunded Actuarial Accrued Liabilities which are larger than projected.
GASB	Governmental Accounting Standards Board.
GASB Statements No. 25 and No. 27	These are the governmental accounting standards that set the accounting and financial reporting rules for public retirement systems and the employers that sponsor or contribute to them. Statement No. 27 sets the accounting and financial reporting rules for the employers that sponsor or contribute to public retirement systems, while Statement No. 25 sets the rules for the systems themselves. These statements remain in effect only for pension plans that are not administered as trusts or equivalent arrangements. Please refer to the definition of GASB Statements No. 67 and No. 68 on the following page.

Glossary of Terms (Concluded)

GASB Statement No. 50	The accounting standard governing a state or local governmental employer's accounting for pensions. This statement remains in effect only for pension plans that are not administered as trusts. Please refer to the definition of GASB Statements No. 67 and No. 68.
GASB Statements No. 67 and No. 68	Statements No. 67 and No. 68, issued in June 2012, replace the requirements of Statements No. 25, No. 27 and No. 50, respectively, for pension plans administered as trusts. Statement No. 68, effective for the fiscal year beginning July 1, 2014, sets the accounting and financial reporting rules for the employers that sponsor or contribute to public retirement systems, while Statement No. 67, effective for the fiscal year beginning July 1, 2013, sets the rules for the systems themselves. Accounting and financial reporting information prepared according to Statements No. 67 and No. 68 is provided in a separate report beginning with the June 30, 2014 actuarial valuation.
GASB Statement No. 82	Statement No. 82, issued in March 2016, is an amendment to Statements No. 67, No. 68, and No. 73, and is intended to improve consistency in the application of the accounting statements.
Normal Cost	The annual cost assigned, under the Actuarial Cost Method, to the current plan year.
Projected Benefit Funding Ratio	The ratio of the sum of Actuarial Value of Assets and Expected Assets to the Actuarial Present Value of Projected Benefits. A ratio less than 100% indicates that contributions are insufficient.
Unfunded Actuarial Accrued Liability	The difference between the Actuarial Accrued Liability and Actuarial Value of Assets.
Valuation Date	The date as of which the Actuarial Present Value of Future Benefits are determined. The benefits expected to be paid in the future are discounted to this date.