Minnesota State Retirement System

Correctional Employees Retirement Fund

Actuarial Valuation Report as of July 1, 2018

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December 5, 2018

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

Dear Board of Directors:

The results of the July 1, 2018 annual actuarial valuation of the Correctional 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 parties other than the intended users 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, 2018, according to the prescribed assumptions. Note that we have not attempted to quantify the impact of GASB Statements No. 67 and No. 68 in this report.

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 a 2018 analysis of long-term rate of investment return and inflation assumptions, GRS suggested that an investment return assumption in the range of 6.64% to 7.56% would be reasonable. Please see our draft letter dated September 17, 2018 for additional information. The current assumed rate, which is mandated by Minnesota Statutes, is 7.5% and is at the upper end of the reasonable range. This report also concluded that the probability of exceeding the current 7.5% assumption over 20 years is only 39%. If capital market assumptions decline further from present levels, the 7.5% return assumption might not comply with actuarial standards for the July 1, 2019 valuation. For informational purposes, results based on a 6.5% discount rate are shown on page four.

The valuation assumed the continuing ability of the plan sponsor to make the contributions necessary to fund this plan. A determination regarding whether or not the plan sponsor is actually able to do so is outside our scope of expertise and was not performed.

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 5 – 8, 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 findings in this report are based on data and other information through June 30, 2018. 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 Correctional Employees Retirement Fund as of the valuation date according to the 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, PhD

Bonita J. Wurst

Bonita J. Wurst, ASA, EA, FCA, MAAA

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 7.50%), it is expected that:

(1) The normal cost of the plan is expected to remain approximately level as a percent of pay,
(2) The funded status of the plan is expected to gradually improve and is expected to be 100% funded within the next 30 years, and
(3) The unfunded liability will grow initially as a dollar amount before beginning to decline.

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.

Contents

Summary of Valuation Results

Contributions

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

Total Contributions	Actuarial Valuation as of July 1, 2018	Actuarial Valuation as of July 1, 2017
Statutory Contributions - Chapter 352.92 (% of Payroll)	24.00%	21.95%
Required Contributions - Chapter 356 (% of Payroll)	25.77%	28.40%
Sufficiency / (Deficiency)	(1.77)%	(6.45)%

The contribution sufficiency/(deficiency) improved from a deficiency of (6.45)% of payroll to a deficiency of (1.77)% of payroll. The primary reasons for the change in contribution sufficiency/(deficiency) were the changes in plan provisions and amortization period, which was partially offset by the change in assumptions, described in the Effects of Changes section. On a market value of assets basis, contributions are deficient by (1.29)% of payroll.

The contribution sufficiency referenced above is based on current snapshot of statutory contributions for the fiscal year ending June 30, 2019. Additional employer contribution increases will be phased in over the next three years, ultimately increasing the statutory contribution rate (and the contribution sufficiency) by an additional 4.45% of payroll, if there are no significant gains or losses.

Based on the actuarial value of assets, statutory contribution rates (including the increases described above), and actuarial assumptions described in this report, statutory contributions are expected to bring the plan to full funding within the 30-year amortization period.

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 10.3% for the plan year ending June 30, 2018. The AVA earned approximately 9.2% for the plan year ending June 30, 2018 as compared to the assumed rate of 8.00%. The assumed rate is mandated by Minnesota Statutes, and was recently lowered to 7.50%.

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 November 29, 2018.

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, 2018	**July 1, 2017**
Contributions (*% of Payroll*)		
Statutory - Chapter 352	24.00%	21.95%
Required - Chapter 356	25.77%	28.40%
Sufficiency / (Deficiency)	(1.77)%	(6.45)%
Funding Ratios (*dollars in thousands*)		
Assets		
- Current assets (AVA)	$ 1,092,719	$1,013,173
- Current assets (MVA)	$ 1,114,887	$1,023,817
Accrued Benefit Funding Ratio		
- Current benefit obligations	$ 1,424,929	$1,352,906
- Funding ratio (AVA)	76.69%	74.89%
- Funding ratio (MVA)	78.24%	75.68%
Accrued Liability Funding Ratio		
- Actuarial accrued liability	$ 1,490,521	$1,414,443
- Funding ratio (AVA)	73.31%	71.63%
- Funding ratio (MVA)	74.80%	72.38%
Projected Benefit Funding Ratio		
- Current and expected future assets	$ 1,749,579	$1,505,335
- Current and expected future benefit obligations	$ 1,830,691	$1,731,837
- Projected benefit funding ratio (AVA)	95.57%	86.92%
Participant Data		
Active members		
- Number	4,650	4,579
- Annual valuation earnings *(000s)*	$ 254,588	$244,427
- Projected annual earnings *(000s)*	$ 267,975	$258,003
- Average projected annual earnings	$ 57,629	$56,345
- Average age	41.3	41.5
- Average service	8.8	8.8
Service retirements	2,736	2,576
Survivors	226	216
Disability retirements	297	292
Deferred retirements	1,347	1,310
Terminated other non-vested	843	818
Total	**10,099**	**9,791**

Summary of Valuation Results

Effects of Changes

The following changes in plan provisions, actuarial assumptions, and methods were recognized as of July 1, 2018:

- The investment return assumption was lowered from 8.00% to 7.50%.
- The assumed payroll growth assumption was lowered from 3.50% to 3.25%.
- The assumed rate of inflation was lowered from 2.75% to 2.50%.
- Salary increase rates were reduced by 0.25% at each year of service.
- The amortization period was reset to 30 years, ending in 2048.
- Post-retirement benefit increases were changed from 2.0% per year, increasing to 2.5% per year upon achieving a 90% funding ratio to a fixed rate of 1.50% per year.
- Member contributions were increased from 9.10% of pay to 9.60% of pay, effective July 1, 2018.
- Regular employer contributions were increased from 12.85% to 14.40%, effective July 1, 2018.
- Supplemental employer contributions of 4.45% will be phased in over three years beginning July 1, 2019.
- Interest credited on member contributions will decrease from 4.0% to 3.0%, beginning July 1, 2018.
- Deferred augmentation was changed to 0.00% for future accruing benefits, effective January 1, 2019. Augmentation that has already accrued for deferred members will still apply.
- Contribution stabilizer provisions were repealed.

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 $6 million and decrease the required contribution by 2.4% of pay, as follows:

	Before Changes	**Reflecting Plan Provision Changes**	**Reflecting Plan Provision and Actuarial Assumption Changes**	**Reflecting Plan Provision, Actuarial Assumption, and Amortization Changes**
Normal Cost Rate, % of pay	16.5%	15.5%	16.8%	16.8%
Amortization of UAAL*, % of pay	11.4%	8.8%	11.0%	8.7%
Expenses (% of pay)	0.3%	0.3%	0.3%	0.3%
Total Required Contribution, % of pay	28.2%	24.6%	28.1%	25.8%
Accrued Liability Funding Ratio	73.0%	77.7%	73.3%	73.3%
Projected Benefit Funding Ratio	87.8%	98.7%	91.9%	95.6%
UAAL* (in millions)	$403.9	$313.3	$397.8	$397.8

**Unfunded Actuarial Accrued Liability*

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' valuations. Per the LCPR's requirement, we have calculated the liabilities associated with the following scenarios:

1) 6.5% interest rate assumption
2) 8.5% interest rate assumption

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 8.5% interest rate assumption would not comply with Actuarial Standards of Practice.

$ in millions	**Final Valuation Assumptions**	**Final Valuation Assumptions with 6.5%**	**Final Valuation Assumptions with 8.5%**
Normal Cost Rate, % of Pay	16.8%	20.8%	13.8%
Amortization of Unfunded Accrued Liability, % of Pay	8.7%	11.9%	5.5%
Expenses (% of Pay)	0.3%	0.3%	0.3%
Total Required Contribution, % of Pay	25.8%	33.0%	19.6%
Contribution Sufficiency/(Deficiency), % of Pay	(1.8)%	(9.0)%	4.4 %
Accrued Liability Funding Ratio	73.3%	64.2%	82.9%
Present Value of Projected Benefits	$1,831	$2,157	$1,579
Present Value of Future Normal Costs	$340	$455	$261
Actuarial Accrued Liability	$1,491	$1,702	$1,318
Unfunded Accrued Liability	$398	$609	$226

Summary of Valuation Results

Risks Associated with the Measuring the Accrued Liability and Actuarially Determined Contribution

The determination of the accrued liability and the actuarially determined contribution requires the use of assumptions regarding future economic and demographic experience. Risk measures, as illustrated in this report, are intended to aid in the understanding of the effects of future experience differing from the assumptions used in the course of the actuarial valuation. Risk measures may also help with illustrating the potential volatility in the accrued liability and the actuarially determined contribution that result from the differences between actual experience and the actuarial assumptions.

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 due to changing conditions; 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. The scope of an actuarial valuation does not include an analysis of the potential range of such future measurements.

Examples of risk that may reasonably be anticipated to significantly affect the plan's future financial condition include:

1. Investment risk – actual investment returns may differ from the expected returns;
2. Asset/Liability mismatch – changes in asset values may not match changes in liabilities, thereby altering the gap between the accrued liability and assets and consequently altering the funded status and contribution requirements;
3. Contribution risk – actual contributions may differ from expected future contributions. For example, actual contributions may not be made in accordance with the plan's funding policy or material changes may occur in the anticipated number of covered employees, covered payroll, or other relevant contribution base;
4. Salary and Payroll risk – actual salaries and total payroll may differ from expected, resulting in actual future accrued liability and contributions differing from expected;
5. Longevity risk – members may live longer or shorter than expected and receive pensions for a period of time other than assumed;
6. Other demographic risks – members may terminate, retire or become disabled at times or with benefits other than assumed resulting in actual future accrued liability and contributions differing from expected.

The effects of certain trends in experience can generally be anticipated. For example if the investment return since the most recent actuarial valuation is less (or more) than the assumed rate, the cost of the plan can be expected to increase (or decrease). Likewise if longevity is improving (or worsening), increases (or decreases) in cost can be anticipated.

Summary of Valuation Results

The Required Contribution rate shown on page 1 may be considered as a minimum contribution rate that complies with Minnesota Statutes and the requirements of the Standards for Actuarial Work published by the LCPR. The timely receipt of the actuarially determined contributions is critical to support the financial health of the plan. Users of this report should be aware that contributions made at the actuarially determined rate do not necessarily guarantee benefit security.

Plan Maturity Measures

Risks facing a pension plan evolve over time. A young plan with virtually no investments and paying few benefits may experience little investment risk. An older plan with a large number of members in pay status and a significant trust may be much more exposed to investment risk. Generally accepted plan maturity measures and the values for the Correctional Employees Retirement Fund for the last two years include the following. Additional maturity measures are shown on the following pages.

	2018	2017
Ratio of market value of assets to total payroll	4.33	4.11
Ratio of actuarial accrued liability to total payroll	5.79	5.68
Ratio of actives to retirees and beneficiaries	1.43	1.48
Ratio of net cash flow to market value of assets	-1.3%	-1.1%
Approximate modified duration* of:		
▪ Total projected benefits:	15.80	15.87
▪ Actuarial accrued liability:	12.85	12.86

* *Approximate modified duration of total projected benefits based on 7.5% interest for 2018 and 8.0% interest for 2017*

Ratio of Market Value of Assets to Payroll

The relationship between assets and payroll is a useful indicator of the potential volatility of contributions. For example, if the market value of assets is 5.0 times the payroll, a return on assets 5% different than assumed would equal 25% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in plan sponsor contributions as a percentage of payroll.

Ratio of Actuarial Accrued Liability to Payroll

The relationship between actuarial accrued liability and payroll is a useful indicator of the potential volatility of contributions for a fully funded plan. A funding policy that targets a funded ratio of 100% is expected to result in the ratio of assets to payroll and the ratio of liability to payroll converging over time.

The ratio of liability to payroll may also be used as a measure of sensitivity of the contribution rates to liability gains and losses. For example, if the actuarial accrued liability is 5.0 times the payroll, a change in liability 2% other than assumed would equal 10% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in liability (and also plan sponsor contributions) as a percentage of payroll.

Summary of Valuation Results

Ratio of Actives to Retirees and Beneficiaries

A young plan with many active members and few retirees will have a high ratio of active to retirees. A mature open plan may have close to the same number of actives to retirees resulting in a ratio near 1.0. A super-mature or closed plan may have significantly more retirees than actives resulting in a ratio below 1.0.

Ratio of Net Cash Flow to Market Value of Assets

A positive net cash flow means contributions exceed benefits and expenses. A negative cash flow means existing funds are being used to make payments. A certain amount of negative net cash flow is generally expected to occur when benefits are prefunded through a qualified trust. Large negative net cash flows as a percent of assets may indicate a super-mature plan or a need for additional contributions.

Duration of Actuarial Accrued Liability

The duration may be used to approximate the sensitivity of the accrued liability to a small change in the assumed rate of return. For example, a duration of 10 indicates that the liability would change by approximately 10% if the assumed rate of return were changed by 1% (i.e. from 7.5% to 6.5%).

Additional Risk Assessment

Additional risk assessment is outside the scope of the annual actuarial valuation but could aid stakeholders in an understanding of the risks to which the System is exposed. Additional assessment may include scenario tests, sensitivity tests, stochastic modeling, stress tests, and a comparison of the present value of accrued benefits at low-risk discount rates with the actuarial accrued liability.

Summary of Valuation Results

Risk Measures (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	$ 851,086	$ 525,245	$ 325,841	$ 192,450	61.7%	$ 383,387	45.0%	442.2%	272.9%
2011	$ 907,012	$ 646,582	$ 260,430	$ 197,702	71.3%	$ 417,110	46.0%	458.8%	327.0%
2012	$ 968,166	$ 659,523	$ 308,643	$ 200,035	68.1%	$ 456,495	47.2%	484.0%	329.7%
2013	$1,026,098	$ 747,157	$ 278,941	$ 204,198	72.8%	$ 498,718	48.6%	502.5%	365.9%
2014	$1,122,474	$ 877,056	$ 245,418	$ 219,244	78.1%	$ 543,049	48.4%	512.0%	400.0%
2015	$1,239,258	$ 909,002	$ 330,256	$ 231,440	73.4%	$ 634,592	51.2%	535.5%	392.8%
2016	$1,313,516	$ 899,592	$ 413,924	$ 241,242	68.5%	$ 673,129	51.2%	544.5%	372.9%
2017	$1,414,443	$1,023,817	$ 390,626	$ 248,879	72.4%	$ 741,694	52.4%	568.3%	411.4%
2018	$1,490,521	$1,114,887	$ 375,634	$ 257,330	74.8%	$ 792,275	53.2%	579.2%	433.3%

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	(17) SBI 10-Year Trailing Average
2010			169.3%	$ (418)	-0.1%	15.2%	3.4%	N/A
2011			131.7%	$ (76)	0.0%	23.3%	5.3%	N/A
2012			154.3%	$ (2,985)	-0.5%	2.4%	2.3%	N/A
2013			136.6%	$ (5,758)	-0.8%	14.2%	6.2%	N/A
2014			111.9%	$ (7,624)	-0.9%	18.6%	14.5%	N/A
2015	14.1%	55.4%	142.7%	$ (6,678)	-0.7%	4.4%	12.3%	N/A
2016	14.1%	52.6%	171.6%	$ (9,215)	-1.0%	-0.1%	7.7%	N/A
2017	14.1%	58.0%	157.0%	$ (11,134)	-1.1%	15.1%	10.2%	6.2%
2018	14.1%	61.1%	146.0%	$ (14,193)	-1.3%	10.3%	9.4%	7.8%

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) (16) and (17) Investment return is probably the largest single risk that most systems face. The year by year return and the 5-year and 10-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, and historical averages are very sensitive to the time period chosen. 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 was provided by the 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)*

Assets	Market Value June 30, 2018	Market Value June 30, 2017
Cash, equivalents, short term securities	$ 15,753	$ 30,093
Fixed income	174,115	197,493
Equity	923,731	794,971
Other*	111,689	105,151
Total cash, investments, and other assets	**$ 1,225,288**	**$ 1,127,708**
Amounts Receivable	2,873	2,780
Total Assets	**$ 1,228,161**	**$ 1,130,488**
Amounts Payable*	(113,274)	(106,671)
Net Position Restricted for Pensions	**$ 1,114,887**	**$ 1,023,817**

** Includes $111,689 in Securities Lending Collateral as of June 30, 2018 and $105,151 as of June 30, 2017.*

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, 2018**		**June 30, 2017**
1. Fund balance at market value at beginning of year		**1,023,817**		**899,592**
2. Contributions				
a. Member		23,417		22,648
b. Employer		32,893		31,763
c. Other sources		-		-
d. Total contributions	$	56,310	$	54,411
3. Investment income				
a. Investment income/(loss)		106,422		136,409
b. Investment expenses		(1,159)		(1,050)
c. Net investment income/(loss)	$	105,263	$	135,359
4. Other		-		-
5. Total income: *(2.d.) + (3.c.) + (4.)*	**$**	**161,573**	**$**	**189,770**
6. Benefits Paid				
a. Annuity benefits		(67,622)		(63,221)
b. Refunds		(2,052)		(1,466)
c. Total benefits paid	$	(69,674)	$	(64,687)
7. Expenses				
a. Other		(2)		(2)
b. Administrative		(827)		(856)
c. Total expenses	$	(829)	$	(858)
8. Total disbursements: *(6.c.) + (7.c.)*	**$**	**(70,503)**	**$**	**(65,545)**
9. Fund balance at market value at end of year: *(1.) + (5.) + (8.)*	**$**	**1,114,887**	**$**	**1,023,817**
10. State Board of Investment calculated investment return		10.3%		15.1%

Plan Assets

Actuarial Asset Value *(Dollars in Thousands)*

			June 30, 2018		June 30, 2017	
1. Market value of assets available for benefits				**$ 1,114,887**		**$ 1,023,817**
2. Determination of average balance						
a. Total assets available at beginning of year				1,023,817		899,592
b. Total assets available at end of year				1,114,887		1,023,817
c. Net investment income for fiscal year				105,263		135,359
d. Average balance *[a. + b. - c.] / 2*				1,016,721		894,025
3. Expected return *[8.0% x 2.d.]*				81,338		71,522
4. Actual return				105,263		135,359
5. Current year asset gain/(loss) *[4. - 3.]*				23,925		63,837
6. Unrecognized asset returns						
	Original		**Unrecognized Amount**		**Unrecognized Amount**	
	Amount		**%**	**Dollar**	**%**	**Dollar**
a. Year ended June 30, 2018	$ 23,925		80%	$ 19,140		
b. Year ended June 30, 2017	63,837		60%	38,302	80%	$ 51,070
c. Year ended June 30, 2016	(72,547)		40%	(29,019)	60%	(43,528)
d. Year ended June 30, 2015	(31,273)		20%	(6,255)	40%	(12,509)
e. Year ended June 30, 2014	78,055			N/A	20%	15,611
f. Unrecognized return adjustment				**$ 22,168**		**$ 10,644**
7. **Actuarial value at end of year** *(1. - 6.f.)*				**$ 1,092,719**		**$ 1,013,173**
8. Approximate return on actuarial value of assets during fiscal year				9.2%		9.3%
9. Ratio of actuarial value of assets to market value of assets				0.98		0.99

Membership Data

Distribution of Active Members

	Years of Service as of June 30, 2018									
Age	**<3***	**3 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25 - 29**	**30 - 34**	**35+**	**Total**
< 25	187	9	1							**197**
Avg. Earnings	$ 34,001	$ 41,722	$ 46,931							**$ 34,419**
25 - 29	336	125	49							**510**
Avg. Earnings	$ 38,218	$ 46,976	$ 51,130							**$ 41,605**
30 - 34	242	162	253	76						**733**
Avg. Earnings	$ 43,967	$ 49,444	$ 51,878	$ 56,048						**$ 49,160**
35 - 39	150	99	182	289	32					**752**
Avg. Earnings	$ 44,445	$ 50,970	$ 53,722	$ 58,550	$ 63,803					**$ 53,794**
40 - 44	128	58	109	210	117	14				**636**
Avg. Earnings	$ 48,501	$ 54,709	$ 56,134	$ 59,120	$ 66,192	$ 73,918				**$ 57,696**
45 - 49	89	56	83	157	121	104	7			**617**
Avg. Earnings	$ 44,775	$ 56,918	$ 56,691	$ 62,055	$ 64,952	$ 71,586	$ 76,579			**$ 60,714**
50 - 54	70	30	88	123	109	123	71	10	1	**625**
Avg. Earnings	$ 47,246	$ 50,889	$ 56,890	$ 64,512	$ 65,314	$ 69,444	$ 72,491	$ 78,506	$ 83,052	**$ 63,122**
55 - 59	56	38	72	91	54	39	17	8	1	**376**
Avg. Earnings	$ 49,921	$ 59,421	$ 58,164	$ 63,895	$ 68,281	$ 69,047	$ 70,963	$ 84,427	$ 65,897	**$ 62,190**
60 - 64	31	19	31	46	22	12	2		1	**164**
Avg. Earnings	$ 55,344	$ 54,775	$ 67,906	$ 67,438	$ 69,923	$ 65,300	$ 77,220		$ 78,140	**$ 64,135**
65 - 69	6	4	8	5	7	2	1		1	**34**
Avg. Earnings	$ 23,303	$ 74,518	$ 64,869	$ 67,436	$ 83,388	$ 69,435	$ 89,882		$ 71,752	**$ 64,066**
70+	1	2			2	1				**6**
Avg. Earnings	$ 14,904	$ 65,035			$ 62,359	$ 147,080				**$ 69,462**
Total	**1,296**	**602**	**876**	**997**	**464**	**295**	**98**	**18**	**4**	**4,650**
Avg. Earnings	**$ 42,186**	**$ 51,358**	**$ 54,905**	**$ 60,709**	**$ 66,160**	**$ 70,453**	**$ 72,792**	**$ 81,138**	**$ 74,711**	**$ 54,750**

** 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 average valuation earnings for the fiscal year ending on the valuation date.

Membership Data

Distribution of Service Retirements

	Years Retired as of June 30, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<50	1	1	2					**4**
Avg. Benefit	$ 13,758	$ 5,165	$ 6,076					**$ 7,769**
50 - 54	17	39	3					**59**
Avg. Benefit	$ 14,859	$ 17,111	$ 4,996					**$ 15,846**
55 - 59	109	333	82		1			**525**
Avg. Benefit	$ 30,663	$ 28,859	$ 21,735		$ 5,864			**$ 28,077**
60 - 64	42	230	388	54		1		**715**
Avg. Benefit	$ 21,063	$ 22,169	$ 23,662	$ 22,842		$ 42,289		**$ 22,993**
65 - 69	18	102	146	332	38			**636**
Avg. Benefit	$ 10,132	$ 14,930	$ 16,352	$ 21,394	$ 17,932			**$ 18,674**
70 - 74	1	18	98	80	245	9		**451**
Avg. Benefit	$ 1,551	$ 11,416	$ 9,981	$ 13,654	$ 20,974	$ 23,795		**$ 16,919**
75 - 79		2	16	40	53	72		**183**
Avg. Benefit		$ 15,500	$ 11,235	$ 11,754	$ 20,820	$ 28,139		**$ 20,822**
80 - 84		2	3	7	30	35	32	**109**
Avg. Benefit		$ 5,879	$ 20,263	$ 28,018	$ 20,074	$ 26,554	$ 33,399	**$ 26,322**
85 - 89					2	4	33	**39**
Avg. Benefit					$ 4,048	$ 21,671	$ 25,259	**$ 23,803**
90+							15	**15**
Avg. Benefit							$ 29,953	**$ 29,953**
Total	**188**	**727**	**738**	**513**	**369**	**121**	**80**	**2,736**
Avg. Benefit	**$ 24,879**	**$ 23,593**	**$ 19,778**	**$ 19,678**	**$ 20,433**	**$ 27,261**	**$ 29,395**	**$ 21,824**

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, 2018							
Age	**<1**	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25+**	**Total**
<45	2	14	7		1			**24**
Avg. Benefit	$ 4,058	$ 11,113	$ 5,052		$ 0			**$ 8,294**
45 - 49	2	3	2					**7**
Avg. Benefit	$ 6,455	$ 19,782	$ 11,409					**$ 13,582**
50 - 54		4	2	4	1			**11**
Avg. Benefit		$ 19,701	$ 13,563	$ 7,251	$ 17,873			**$ 13,892**
55 - 59	1	7	2	3	3	1		**17**
Avg. Benefit	$ 39,620	$ 13,316	$ 18,940	$ 15,154	$ 6,306	$ 16,626		**$ 14,807**
60 - 64	4	11	10	9	4	2		**40**
Avg. Benefit	$ 14,655	$ 19,025	$ 19,380	$ 14,602	$ 9,597	$ 10,172		**$ 16,296**
65 - 69	2	11	6	7	9	2	1	**38**
Avg. Benefit	$ 10,528	$ 19,541	$ 10,302	$ 14,474	$ 14,631	$ 8,195	$ 10,203	**$ 14,669**
70 - 74	3	7	6	12	5	5		**38**
Avg. Benefit	$ 14,347	$ 18,615	$ 17,561	$ 16,208	$ 11,865	$ 12,538		**$ 15,664**
75 - 79		1	4	3	4	1	2	**15**
Avg. Benefit		$ 7,033	$ 22,512	$ 17,957	$ 26,060	$ 23,357	$ 8,874	**$ 19,753**
80 - 84	2	2	2	5	4	2		**17**
Avg. Benefit	$ 21,696	$ 25,975	$ 38,527	$ 22,831	$ 17,592	$ 13,077		**$ 22,534**
85 - 89		2	4		1	1	2	**10**
Avg. Benefit		$ 45,646	$ 25,675		$ 13,903	$ 9,176	$ 10,949	**$ 23,897**
90+	1	2	3		1	1	1	**9**
Avg. Benefit	$ 19,905	$ 18,555	$ 13,637		$ 17,018	$ 1,884	$ 4,399	**$ 13,470**
Total	**17**	**64**	**48**	**43**	**33**	**15**	**6**	**226**
Avg. Benefit	**$ 14,509**	**$ 17,639**	**$ 16,560**	**$ 15,575**	**$ 14,294**	**$ 11,775**	**$ 9,041**	**$ 15,676**

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

Age	Years Disabled as of June 30, 2018 <1	1 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25+	Total
< 45		9	8	1	1			**19**
Avg. Benefit		$ 17,900	$ 17,774	$ 17,564	$ 17,158			**$ 17,790**
45 - 49	2	7	12	9	8	1		**39**
Avg. Benefit	$ 17,049	$ 20,211	$ 17,489	$ 16,202	$ 21,264	$ 23,414		**$ 18,584**
50 - 54	2	13	9	9	7	1		**41**
Avg. Benefit	$ 24,821	$ 22,401	$ 18,906	$ 22,830	$ 17,629	$ 32,688		**$ 21,282**
55 - 59	2	16	16	13	9	5	1	**62**
Avg. Benefit	$ 16,882	$ 16,031	$ 23,650	$ 20,241	$ 20,500	$ 33,397	$ 31,036	**$ 21,199**
60 - 64	1	7	18	14	11	7		**58**
Avg. Benefit	$ 1,739	$ 14,394	$ 19,019	$ 22,213	$ 23,605	$ 25,957		**$ 20,641**
65 - 69		5	10	14	14	5	1	**49**
Avg. Benefit		$ 18,600	$ 20,078	$ 20,980	$ 20,626	$ 20,987	$ 31,456	**$ 20,667**
70 - 74			4	3	11	4		**22**
Avg. Benefit			$ 18,567	$ 24,918	$ 16,653	$ 20,632		**$ 18,851**
75+				3	2	1	1	**7**
Avg. Benefit				$ 18,868	$ 30,431	$ 41,284	$ 21,538	**$ 25,755**
Total	**7**	**57**	**77**	**66**	**63**	**24**	**3**	**297**
Avg. Benefit	**$ 17,035**	**$ 18,316**	**$ 19,714**	**$ 20,728**	**$ 20,439**	**$ 26,397**	**$ 28,010**	**$ 20,386**

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 7/1/2017	**4,579**	**1,310**	**818**	**2,576**	**292**	**216**	**9,791**
New members	554	0	0	0	0	0	**554**
Return to active	33	(15)	(18)	0	0	0	**0**
Terminated non-vested	(170)	0	170	0	0	0	**0**
Service retirements	(148)	(33)	0	181	0	0	**0**
Terminated deferred	(78)	78	0	0	0	0	**0**
Terminated refund/transfer	(114)	(13)	(171)	0	0	0	**(298)**
Deaths	(2)	(1)	(1)	(28)	(5)	(7)	**(44)**
New beneficiary	0	0	0	0	0	17	**17**
Disabled	(4)	0	0	0	4	0	**0**
Unexpected status changes	0	21	45	7	6	0	**79**
Net change	71	37	25	160	5	10	**308**
Members on 6/30/2018	**4,650**	**1,347**	**843**	**2,736**	**297**	**226**	**10,099**

Terminated Member Statistics	**Deferred Retirement**	**Other Non-Vested**	**Total**
Number	1,347	843	2,190
Average age	46.4	37.0	42.8
Average service	6.0	1.3	4.2
Average annual benefit, with augmentation to December 31, 2018 and 17% CSA load	$ 10,022	N/A	$ 10,022
Average refund value, with 17% CSA load (6% for non-vested members)	$ 31,347	$ 6,082	$ 21,622

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 24.00% 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.

	Non-Vested	Vested	June 30, 2018 / Total
A. Actuarial Value of Assets			$ 1,092,719
B. Expected Future Assets			
1. Present value of expected future statutory supplemental contributions*			316,690
2. Present value of future normal cost contributions			340,170
3. Total expected future assets: *(1.) + (2.)*			$ 656,860
C. Total Current and Expected Future Assets			1,749,579
D. Current Benefit Obligations**			
1. Benefit recipients	**Non-Vested**	**Vested**	**Total**
a. Service retirements	$ -	$ 682,890	$ 682,890
b. Disability retirements	-	73,331	73,331
c. Survivors	-	36,054	36,054
2. Deferred retirements	-	116,232	116,232
3. Former members without vested rights***	2,579	-	2,579
4. Active members	40,520	473,323	513,843
5. Total Current Benefit Obligations	$ 43,099	$ 1,381,830	$ 1,424,929
E. Expected Future Benefit Obligations			405,762
F. Total Current and Expected Future Benefit Obligations****			1,830,691
G. Unfunded Current Benefit Obligations: *(D.5.) - (A.)*			332,210
H. Unfunded Current and Future Benefit Obligations: *(F.) - (C.)*			81,112
I. Accrued Benefit Funding Ratio: *(A.)/(D.5.)*			76.69%
J. Projected Benefit Funding Ratio: *(C.)/(F.)*			95.57%

* *Per the LCPR Standards for Actuarial Work, calculated assuming the current contribution toward the unfunded liability continues for the entire amortization period. Excludes future statutory contribution increases.*

** *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	$ 804,255	$ 247,501	$ 556,754
b. Disability benefits	42,299	32,004	10,295
c. Survivor's benefits	7,637	2,647	4,990
d. Deferred retirements	61,513	46,906	14,607
e. Refunds*	3,901	11,112	(7,211)
f. Total	$ 919,605	$ 340,170	$ 579,435
2. Deferred retirements	116,232	-	116,232
3. Former members without vested rights	2,579	-	2,579
4. Benefit recipients	792,275	-	792,275
5. Total	$ 1,830,691	$ 340,170	$ 1,490,521
B. Determination of Unfunded Actuarial Accrued Liability (UAAL)			
1. Actuarial accrued liability			$ 1,490,521
2. Current assets (AVA)			1,092,719
3. Unfunded actuarial accrued liability			$ 397,802
C. Determination of Supplemental Contribution Rate**			
1. Present value of future payrolls through the amortization date of June 30, 2048			$ 4,576,439
2. Supplemental contribution rate: *(B.3.) / (C.1.)*			8.69% ***

* *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, 2018 is 17.0779.*

Development of Costs

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

	Year Ending June 30, 2018		
	Actuarial Accrued Liability	Current Assets	Unfunded Actuarial Accrued Liability
A. Unfunded actuarial accrued liability at beginning of year	$ 1,414,443	$ 1,013,173	$ 401,270
B. Changes due to interest requirements and current rate of funding			
1. Normal cost, including expenses	43,707	-	43,707
2. Benefit payments	(69,674)	(69,674)	-
3. Contributions	-	56,310	(56,310)
4. Interest on A., B.1., B.2. and B.3.	112,116	80,519	31,597
5. Total *(B.1. + B.2. + B.3. + B.4.)*	$ 86,149	$ 67,155	$ 18,994
C. Expected unfunded actuarial accrued liability at end of year *(A. + B.5.)*	$ 1,500,592	$ 1,080,328	$ 420,264
D. Increase (decrease) due to actuarial losses (gains) because of experience deviations from expected			
1. Age and service retirements			3,308
2. Disability retirements			(1,971)
3. Death-in-service benefits			(59)
4. Withdrawals			(963)
5. Salary increases			(4,382)
6. Investment income			(12,391)
7. Mortality of annuitants			(77)
8. Other items			150
9. Total			$ (16,385)
E. Unfunded actuarial accrued liability at end of year before plan amendments and changes in actuarial assumptions *(C. + D.9.)*			$ 403,879
F. Change in unfunded actuarial accrued liability due to changes in plan provisions			(90,562)
G. Change in unfunded actuarial accrued liability due to changes in actuarial assumptions			84,485
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.)**			397,802

** The unfunded actuarial accrued liability on a market value of assets basis is $375,634.*

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	9.60%	$ 25,726
2. Employer contributions	14.40%	38,588
3. Total	24.00%	$ 64,314
B. Required contributions - Chapter 356		
1. Normal cost		
a. Retirement benefits	12.55%	$ 33,631
b. Disability benefits	1.55%	4,154
c. Survivors	0.13%	348
d. Deferred retirement benefits	2.01%	5,386
e. Refunds*	0.52%	1,393
f. Total	16.76%	$ 44,912
2. Supplemental contribution amortization of Unfunded Actuarial Accrued Liability by June 30, 2048	8.69%	$ 23,287
3. Allowance for expenses	0.32%	$ 858
4. Total	25.77% **	$ 69,057
C. Contribution sufficiency/(deficiency) *(A.3. - B.4.)*	(1.77)%	$ (4,743)

Note: Projected annual payroll for fiscal year beginning on the valuation date: $267,975 (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 25.29% of payroll.*

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 normal cost, expenses, and the payment toward the UAAL.

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.

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.

Actuarial Basis

Actuarial Methods (Concluded)

Payment on the Unfunded Actuarial Accrued Liability

Payment equals a level percentage of payroll each year to the statutory amortization date of June 30, 2048 assuming payroll increases of 3.25% 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.

As required by the Standards for Actuarial Work, projected payroll is 1) determined by increasing reported payroll for each member by one full year's assumed pay increase according to the actuarial salary scale and 2) multiplied by 0.962 in the determination of the present value of future payroll to account for timing differences.

Changes in Methods since Prior Valuation

The amortization period was reset to 30 years, ending in 2048.

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. The assumptions prescribed are based on the last experience study, dated July 26, 2016, and a review of inflation and investment return assumptions, dated September 11, 2017. 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	7.50% 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	2.50% per year.
Payroll Growth	3.25% 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 2006, white collar adjustment.
Healthy post-retirement	RP-2014 annuitant generational mortality table projected with mortality improvement Scale MP-2015 from a base year of 2006, white collar adjustment, set forward two years for males and set forward one year for females.
Disabled	RP-2014 disabled mortality table projected with mortality improvement Scale MP-2015 from a base year of 2006.
Notes	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. Note that plan changes reflected in this report may result in behavior changes that are not anticipated in the current retirement rates.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Withdrawal	Select and Ultimate rates based on actual experience. Ultimate rates after the third year are shown in rate table. Select rates in the first three years are:

	Select Withdrawal Rates	
Year	**Male**	**Female**
1	10%	12%
2	10%	12%
3	10%	12%

Disability	Age-related rates based on experience; see table of sample rates. All incidences are assumed to be duty-related.
Allowance for combined service annuity	Liabilities for former members are increased by 17.0% for vested members and 6.0% for non-vested members to account for the effect of some participants having eligibility for a Combined Service Annuity.
Administrative expenses	Prior year administrative expenses expressed as a 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 are assumed to take the larger of the contributions accumulated with interest or the value of the deferred benefit.
Commencement of deferred benefits	Members receiving deferred annuities (including current terminated deferred members) are assumed to begin receiving benefits at age 55.
Percentage married	75% of active members are assumed to be married. Actual marital status is used for members in payment status.
Age of spouse	Females are assumed to be two years younger than their male spouses.
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:	10% elect 50% Joint & Survivor option 10% elect 75% Joint & Survivor option 35% elect 100% Joint & Survivor option

Summary of Actuarial Assumptions (Continued)

Form of payment (Concluded)	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 straight life annuity, except that current terminated deferred members who terminated prior to July 1, 1997, are assumed to receive the Level Social Security option to age 62.
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.
Unknown data for certain members	To prepare this report, GRS has used and relied on participant data supplied by MSRS. 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, based on average results for applicable members at the time of the last experience study, were applied: Data for active members: There were 13 members reported without a gender and no members reported with an invalid date of birth. We assumed male gender. There were 8 members reported with zero or invalid salary. We used prior year salary (5 members), if available, otherwise, high five salary with a 10% load to account for salary increases (1 member). If neither pay or high five salary was available, we assumed a value of $30,000 (2 members). There was 1 member reported with zero service. Due to the small number of members with 0 service, and based on direction from MSRS, we used service of 0 years for this member.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

Unknown data for certain members (Concluded)	Data for terminated members: Benefits were reported with full augmentation to Normal Retirement age. Based on direction from MSRS, we adjusted benefits by removing augmentation on a prospective basis beginning January 1, 2019. There were no members reported with missing or invalid gender or birth dates. There were 48 members reported without a 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 (20 members), we assumed a value of $30,000. There were no members reported without a Termination Date or Credited Service. There were 52 members who terminated after June 30, 1997 and who were reported with a benefit in the Accelerated to Age 62 option. Based on direction from MSRS, we adjusted benefits for these members to reflect the assumed life annuity election. Data for members receiving benefits: There were 3 members reported with a missing gender. We assumed male gender. There were no members reported with a missing or invalid birth date. There were no survivors reported on the data file with an expired benefit. There were 2 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. There were no retirees reported with a survivor option and a survivor date of death. There were no retirees reported with a bounce back annuity and an unreasonable reduction factor. There was one retiree reported with an accelerated benefit election and a missing accelerated benefit amount and end date. We assumed the accelerated period has ended. There were retired members reported with a survivor option and an invalid or missing survivor gender (360 members) and/or survivor date of birth (296 members). We used the valuation assumptions if the survivor gender or date of birth was missing or invalid.
Changes in actuarial assumptions	The assumed investment return was lowered from 8.0% to 7.5%. The assumed rate of inflation decreased from 2.75% to 2.50%. The assumed payroll growth rate decreased from 3.50% to 3.25%. Salary increase rates were reduced by 0.25% at each year of service.

Actuarial Basis

Summary of Actuarial Assumptions (Continued)

	Percentage of Members Dying Each Year*					
Age in 2018	Healthy Post-Retirement Mortality**		Healthy Pre-Retirement Mortality**		Disability Mortality**	
	Male	Female	Male	Female	Male	Female
20	0.03%	0.01%	0.02%	0.01%	0.04%	0.02%
25	0.04	0.03	0.03	0.01	0.17	0.08
30	0.06	0.05	0.03	0.02	0.42	0.22
35	0.09	0.09	0.03	0.03	0.78	0.44
40	0.13	0.12	0.04	0.03	1.13	0.66
45	0.19	0.15	0.06	0.05	1.46	0.84
50	0.28	0.20	0.11	0.09	1.83	1.10
55	0.40	0.29	0.18	0.14	2.21	1.45
60	0.60	0.45	0.32	0.21	2.59	1.71
65	0.90	0.70	0.56	0.30	3.06	2.02
70	1.50	1.12	0.99	0.52	3.89	2.71
75	2.60	1.91	1.79	0.93	5.33	4.01
80	4.67	3.41	3.20	1.65	7.61	6.10
85	8.66	6.29	6.66	4.41	11.29	9.22
90	15.43	11.40	12.64	9.84	17.12	13.45

* *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 2006.*

	Percent of Members Decrementing Each Year			
Age	Termination (Withdrawal) Rates After Third Year		Disability Retirement	
	Male	Female	Male	Female
20	10.00%	12.00%	0.05%	0.05%
25	10.00	11.50	0.08	0.08
30	5.00	9.10	0.11	0.11
35	4.50	7.10	0.15	0.15
40	3.50	5.70	0.22	0.22
45	1.95	3.50	0.35	0.35
50	0.00	0.00	0.54	0.54
55	0.00	0.00	0.00	0.00
60	0.00	0.00	0.00	0.00
65	0.00	0.00	0.00	0.00
70	0.00	0.00	0.00	0.00

Actuarial Basis

Summary of Actuarial Assumptions (Concluded)

Age	Percent Retiring
50	5%
51	3
52	3
53	3
54	5
55	45
56	20
57	15
58	15
59	15
60	15
61	15
62	25
63	25
64	25
65	30
66	30
67	25
68	25
69	40
70+	100

Salary Scale	
Year	Increase
1	12.25%
2	8.75
3	5.75
4	5.25
5	5.00
6	4.75
7	4.75
8	4.75
9	4.75
10	4.75
11	4.75
12	4.50
13	4.25
14	4.25
15	4.00
16	4.00
17	4.00
18	3.75
19	3.75
20	3.75
21	3.50
22	3.50
23	3.50
24+	3.25

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 in covered Correctional service. Certain state employees with 75 percent working time spent in direct contact with inmates or patients are also eligible.
Contributions	Shown as a percent of salary:

Effective as of	Member	Regular Employer	Supplemental Employer	Total
Prior to July 1, 2018	9.10%	12.85%	0.00%	21.95%
July 1, 2018	9.60%	14.40%	0.00%	24.00%
July 1, 2019	9.60%	14.40%	1.45%	25.45%
July 1, 2020	9.60%	14.40%	2.95%	26.95%
July 1, 2021 and later	9.60%	14.40%	4.45%	28.45%

Supplemental employer contribution remains in effect until the plan is 100% funded.

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 leave of absence, military service and periods while temporary Worker’s Compensation is paid.
Salary	Includes wages, allowances and fees. Excludes lump sum payments of separation and reduced salary while receiving Worker’s Compensation benefits.
Average salary	Average of the five highest successive years of Salary. Average Salary is based on all Allowable Service if less than five years.
Vesting	Hired before July 1, 2010: 100% vested after 3 years of Allowable Service. Hired after June 30, 2010: 50% vested after 5 years of Allowable Service; 60% vested after 6 years of Allowable Service; 70% vested after 7 years of Allowable Service; 80% vested after 8 years of Allowable Service; 90% vested after 9 years of Allowable Service; and 100% vested after 10 years of Allowable Service.

Summary of Plan Provisions (Continued)

Retirement

Normal retirement benefit

Age/Service requirement	Age 55 and at least partially vested. Proportionate Retirement Annuity is available at age 65 and one year of Allowable Service.
Amount	2.40% (2.20% if first hired after June 30, 2010) of Average Salary for each year of Allowable Service, pro-rata for completed months, adjusted for partial vesting if applicable.

Early retirement

Age/Service requirement	Age 50 and vested.
Amount	Normal Retirement Benefit based on Allowable Service and Average Salary at retirement date reduced by 2/10% (5/12% if first hired after June 30, 2010, or if hired before July 1, 2010, and retire after June 30, 2015) per month for each month that the member is under age 55.

Form of payment	Life annuity. Actuarially equivalent options are: 50%, 75%, or 100% Joint and Survivor, or 15-year certain. If a Joint and Survivor benefit is elected and the beneficiary predeceases the annuitant, the annuitant's benefit increases to the Life Annuity amount. This "bounce back" is subsidized by the plan.
Benefit increases	Through December 31, 2018: 2.00% January 1, 2019 and after: 1.50% 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.

Disability

Duty Disability

Age/Service requirement	Physically or mentally unable to perform normal job duties as a direct result of a disability relating to an incident while performing the duties of the job which present inherent dangers to the employee. Members who become disabled after June 30, 2009, will have disability benefits converted to retirement benefits at age 55 instead of age 65.
Amount	50.00% of Average Salary plus 2.40% (2.20% if first hired after June 30, 2010) of Average Salary for each year in excess of 20 years and 10 months of Allowable Service (pro rata for completed months).

Summary of Plan Provisions (Continued)

Disability (Continued)

Duty Disability (Continued)

Amount (Continued)	Payment begins at disability and ends at age 55 (age 65 if disabled prior to July 1, 2009) or the five-year anniversary of the effective date of the disability benefit, whichever is later. Payments stop earlier if disability ceases or death occurs. Benefits may be paid upon re-employment but salary plus benefit cannot exceed current salary of position held at time of disability. Member is reclassified from disabled to retired at age 55 (age 65 if disabled prior to July 1, 2009). Optional amount continues. Otherwise, normal retirement benefit equal to the disability benefit paid, or an actuarially equivalent option.

Regular Disability

Age/Service requirement	At least one year of covered Correctional service for employees hired before July 1, 2009, or a vested Correctional employee hired after June 30, 2009, and the employee is determined to have a regular disability not related to an incident while performing the duties of the job.
Amount	Normal retirement benefit based on covered Correctional Service (minimum of 15 years if hired prior to July 1, 2009) and Average Salary at disability. Payment begins at disability and ends at age 55 (age 65 if disabled prior to July 1, 2009) or the five-year anniversary of the effective date of the disability benefit, whichever is later. Payments stop earlier if disability ceases or death occurs. Benefits may be paid upon re-employment but salary plus benefit cannot exceed current salary of position held at time of disability. Member is reclassified from disabled to retired at age 55 (age 65 if disabled prior to July 1, 2009). Optional amount continues. Otherwise, normal retirement benefit equal to the disability benefit paid, or an actuarially equivalent option.
Benefit Increases	Same as for retirement.

Death

Surviving spouse benefit

Age/Service requirement	Member at any age or former member age 50 or older who dies before retirement or disability benefit commences and was vested. 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.

Actuarial Basis

Summary of Plan Provisions (Continued)

Death (Continued)	
<u>Surviving spouse benefit (Concluded)</u>	
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 50 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 (lump sum payable to estate at death).
Benefit increases	Same as for retirement.
<u>Surviving dependent children's benefit</u>	
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 to surviving spouse 100% Joint and Survivor annuity payable to the later of age 20 or five years. The amount is to be proportionally divided among surviving children.
Benefit increases	Same as for retirement.
<u>Refund of contributions with interest</u>	
Age/service requirement	Active employee dies and survivor benefits are not payable or a former employee dies before annuity begins. If accumulated member contributions with interest exceed total payments to the surviving spouse and children, then the remainder is paid out.
Amount	Member's contributions with 6.00% interest through June 30, 2011, compounded daily. Beginning July 1, 2011, a member's contributions increase with 4.00% interest compounded daily. Beginning July 1, 2018, member contributions increase with 3.00% interest compounded daily.
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 with 4.00% interest compounded daily. Beginning July 1, 2018, member contributions increase with 3.00% interest compounded daily. If a member is vested, a deferred annuity may be elected in lieu of a refund.

Summary of Plan Provisions (Continued)

Termination (Continued)	
Deferred benefit	
Age/service requirement	Partially or fully vested.
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; (e.) 2.00% from January 1, 2012 to December 31, 2018; and (f.) 0.00% thereafter. Amount is payable at normal or early retirement.
Optional form conversion factors	Actuarially equivalent factors based on RP-2000 mortality for healthy annuitants, white collar adjustment, projected to 2027 using scale AA, set forward one year for males and set back one year for females, blended 70% males, and 6.50% post-retirement interest. The actuarially equivalent factors are currently being updated to reflect changes adopted during the 2018 legislative session.
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 are 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 Basis

Summary of Plan Provisions (Concluded)

Changes in plan provisions	Member contributions were increased from 9.10% of pay to 9.60% of pay, effective July 1, 2018.
	Regular employer contributions were increased from 12.85% of pay to 14.40% of pay, effective July 1, 2018.
	Supplemental employer contributions totaling 4.45% of pay will be phased-in through fiscal year 2022; supplemental employer contributions remain in effect until the plan is 100% funded.
	Interest credited on member contributions will decrease from 4.0% to 3.0%, beginning July 1, 2018.
	Deferred augmentation was changed to 0.00% for future accruing benefits, effective January 1, 2019. Augmentation that has already accrued for deferred members will still apply.
	Contribution stabilizer provisions were repealed.
	Post-retirement benefit increases were changed from 2.0% per year, increasing to 2.5% per year upon achieving a 90% funding ratio to a fixed rate of 1.5% per year.

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	$ 105,925	$ 112,171	$ 6,246	94.43%	$ 43,429	14.38 %
7-1-1992	121,051	123,515	2,464	98.01	47,592	5.18
7-1-1993	135,939	134,280	(1,659)	101.24	52,122	(3.18)
7-1-1994	148,163	152,702	4,539	97.03	54,673	8.30
7-1-1995	165,427	153,491	(11,936)	107.78	66,939	(17.83)
7-1-1996	193,833	170,959	(22,874)	113.38	72,959	(31.35)
7-1-1997	241,916	212,638	(29,278)	113.77	112,408	(26.05)
7-1-1998	295,291	261,869	(33,422)	112.76	105,796	(31.59)
7-1-1999	335,408	307,408	(28,000)	109.11	106,131	(26.38)
7-1-2000	386,964	359,885	(27,079)	107.52	112,587	(24.05)
7-1-2001	431,134	398,633	(32,501)	108.15	120,947	(26.87)
7-1-2002	457,416	446,426	(10,990)	102.46	124,373	(8.84)
7-1-2003	470,716	484,974	14,258	97.06	131,328	10.86
7-1-2004	486,617	524,215	37,598	92.83	133,172	28.23
7-1-2005	503,573	546,118	42,545 [2]	92.21	132,335	32.15
7-1-2006	535,357	647,480	112,123	82.68	145,879	76.86
7-1-2007	559,852	708,292	148,440	79.04	167,727	88.50
7-1-2008	572,719	760,363	187,644	75.32	194,391	96.53
7-1-2009	590,399	821,250	230,851	71.89	193,445	119.34
7-1-2010	603,863	851,086	247,223	70.95	192,450	128.46
7-1-2011	637,027	907,012	269,985	70.23	197,702	136.56
7-1-2012	663,713	968,166	304,453	68.55	200,035 [3]	152.20
7-1-2013	701,091	1,026,098	325,007	68.33	204,198 [3]	159.16
7-1-2014	790,304	1,122,474	332,170	70.41	219,244 [3]	151.51
7-1-2015	878,624	1,239,258	360,634	70.90	231,440 [4]	155.82
7-1-2016	937,000	1,313,516	376,516	71.34	241,242 [4]	156.07
7-1-2017	1,013,173	1,414,443	401,270	71.63	248,879 [4]	161.23
7-1-2018	1,092,719	1,490,521	397,802	73.31	257,330 [4]	154.59

[1] *Information prior to 2012 provided by prior actuary. See prior reports for additional detail.*
[2] *Provided by MSRS instead of prior actuary.*
[3] *Assumed equal to actual member contributions divided by 8.60%.*
[4] *Assumed equal to actual member contributions divided by 9.10%.*

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 (e)	Percentage Contributed (e)/(d)
1991	10.73%	$ 43,429	$ 2,128	$ 2,532	$ 2,731	107.86%
1992	10.82	47,592	2,332	2,817	2,955	104.90
1993	11.41	52,122	2,554	3,393	3,217	94.81
1994	10.97	54,673	2,679	3,319	3,355	101.08
1995	11.30	66,939	3,280	4,284	4,195	97.92
1996	11.11	72,959	3,575	4,531	4,559	100.62
1997	11.21	112,408	5,508	7,093	9,129	128.70
1998	12.49	105,796	5,954	7,260	8,146	112.20
1999	12.99	106,131	6,378	7,408	8,172	110.31
2000	13.66	112,587	6,526	8,853	8,984	101.48
2001	13.72	120,947	6,996	9,598	9,652	100.56
2002	13.81	124,373	7,207	9,969	9,925	99.56
2003	14.73	131,328	7,610	11,735	10,480	89.31
2004	15.83	133,172	7,748	13,333	10,627	79.71
2005	17.48	132,335	7,943	15,189	11,016	72.52
2006	17.71	145,879	8,964	16,871	12,152	72.03
2007	23.34	167,727	10,032	29,115	13,927	47.83
2008	24.44	194,391	12,775	34,734	18,623	53.62
2009	23.66	193,445	14,031	31,738	20,126	63.41
2010	24.85	192,450	15,267	32,557	21,988	67.54
2011	25.43	197,702	17,002	33,274	23,892	71.80
2012	26.00	200,035 [2]	17,203	34,806	24,188	69.49
2013	25.28	204,198 [2]	17,561	34,060	24,632	72.32
2014	26.11	219,244 [2]	18,855	38,390	26,468	68.95
2015	26.43	231,440 [3]	21,061	40,109	29,480	73.50
2016	27.41	241,242 [3]	21,953	44,171	30,678	69.45
2017	27.56	248,879 [3]	22,648	45,943	31,763	69.14
2018	28.40	257,330 [3]	23,417	49,665	32,893	66.23
2019	25.77	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] *Assumed equal to actual member contributions divided by 8.60%.*
[3] *Assumed equal to actual member contributions divided by 9.10%.*

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 actuarially required contribution (ARC).

Glossary of Terms (Continued)

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.
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.

Glossary of Terms (Concluded)

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 below.
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 rules 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.