



January 31, 2019

CONFIDENTIAL

Ms. Erin Leonard, Executive Director  
Minnesota State Retirement System  
60 Empire Drive, Suite 300  
St. Paul, Minnesota 55103

**Re: Projection of Contributions and Funding Status – Correctional Employees Retirement Fund**

Dear Erin:

Attached are 30-year projections of estimated funded status, required contributions, and statutory contributions under three asset return scenarios for the Correctional Employees Retirement Fund. These projections, including the underlying investment return assumptions, are required by the Minnesota Standards for Actuarial Work. Unless noted otherwise, the estimates are based on participant data, assets, and plan provisions as outlined in the Correctional Employees Retirement Plan actuarial funding valuation as of July 1, 2018.

**Basis for Projections**

For all enclosed projections, liabilities are determined using the statutory investment return assumption of 7.5%. As required by the Minnesota Standards for Actuarial Work, the projections reflect three asset return scenarios (7.5%, 6.0% and 9.0%). Note that we believe the 9.0% rate of return assumption is outside of the range of reasonable expected returns for this plan.

The estimates are based on the market value of assets with no smoothing of investment gains or losses. Payroll is assumed to increase approximately 3.25% per year over the long-term, consistent with the valuation assumption for total payroll growth.

The projection is an open group projection; meaning, active members projected to retire or otherwise terminate in the future are replaced with new active members so that the total active membership of the fund remains at 4,650 members. The profile of these new members is the same as new members hired between July 1, 2012 and July 1, 2017:

- Average age at hire is 34.2
- Average salary at hire is \$44,700
- Approximately 45% female, 55% male

If actuarial accrued liability exceeds assets, the unfunded actuarial accrued liability is amortized through June 30, 2048 per Minnesota Statute 356.215, Subdivision 11. Per Minnesota Statute 356.215, Subdivision 11 (I), a negative unfunded actuarial accrued liability (i.e., when assets exceed liability) is amortized over a rolling 30-year period.

The State of Minnesota will provide supplemental contributions of 1.45% and 2.95% of payroll in fiscal years ending June 30, 2020 and 2021, respectively, and 4.45% of payroll thereafter until the plan reaches 100% funding (on a Market Value basis), or July 1, 2048, if earlier. The supplemental employer contributions are projected to be eliminated in fiscal years ending 2029, 2037, and 2049 in the 9.0%, 7.5% and 6.0% investment return scenarios, respectively.

### **Comments**

The reader should keep the following in mind when reviewing these results:

- Investment experience that has occurred since the measurement date is not reflected in this report.
- The enclosed projections are based on assumptions as outlined in the Correctional Employees Retirement Plan actuarial funding valuation as of July 1, 2018. Please see that report for comments regarding the 7.5% statutory investment return assumption, and sensitivity test results based on alternate assumptions.
- Note that plan changes reflected in the July 1, 2018 valuation report may result in behavior changes that are not anticipated in the current assumptions.
- In the 7.5% and 9.0% investment return scenarios, surplus assets reduce the projected required contributions to amounts less than normal cost, and eventually to zero. We would typically recommend the contribution be at least equal to the normal cost of the plan.
- We typically suggest that plans with considerable surplus assets investigate the pros and cons of reducing the risk of the plan's investment allocation to preserve surplus assets.

### **Disclosures**

To the best of our knowledge and belief, the calculations were completed in accordance with the requirements of Minnesota Statutes, Section 356.215, and the requirements of the Standards for Actuarial Work established by the Legislative Commission on Pensions and Retirement.

This report should not be relied upon 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. GRS is not responsible for the consequences of any unauthorized use.



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.

The contribution rates shown in this report have been determined using the actuarial assumptions and methods disclosed in the Actuarial Basis section of the July 1, 2018 valuation report. This valuation report includes risk metrics on page 8, but does not include a robust assessment of the risks of future experience not meeting the actuarial assumptions. Additional assessment of risks was outside the scope of this assignment.

The projections assume 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.

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 the valuation report, except as noted. 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 the current statutory investment return assumption of 7.5% is at the top of the reasonable range. Please see our draft letter dated September 17, 2018 for additional information. If capital markets decline further from the present levels, the 7.5% return assumption might not comply with actuarial standards for the July 1, 2019 valuation.

The 2018 analysis also concluded that the probability of exceeding the current 7.5% assumption over 20 years is less than 50%. The statutory requirement for projections that are 1.5% above and 1.5% below the assumed rate may give the reader the impression that the 7.5% projection is an accurate (middle of the road) representation of the expected future results. Based on the modeling we have done, the 7.5% scenario is optimistic and not representative of the expected (median) result. We caution against adjusting contribution rates without full consideration of the median results.

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.



### Professional Qualifications

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 fairly presents the actuarial position of the Correctional Employees Retirement Plan as of the valuation date 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.

Bonita J. Wurst and Brian B. Murphy 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. The signing actuaries are independent of the plan sponsor. We are not aware of any relationship that would impair the objectivity of our work.

Sincerely,



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



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

BJW/BBM:sc:dj  
Enclosure



## 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 assumption of the plan earning 7.50% on the market value of assets), 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 market 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 actuarial value of assets were used instead of the market value of assets.

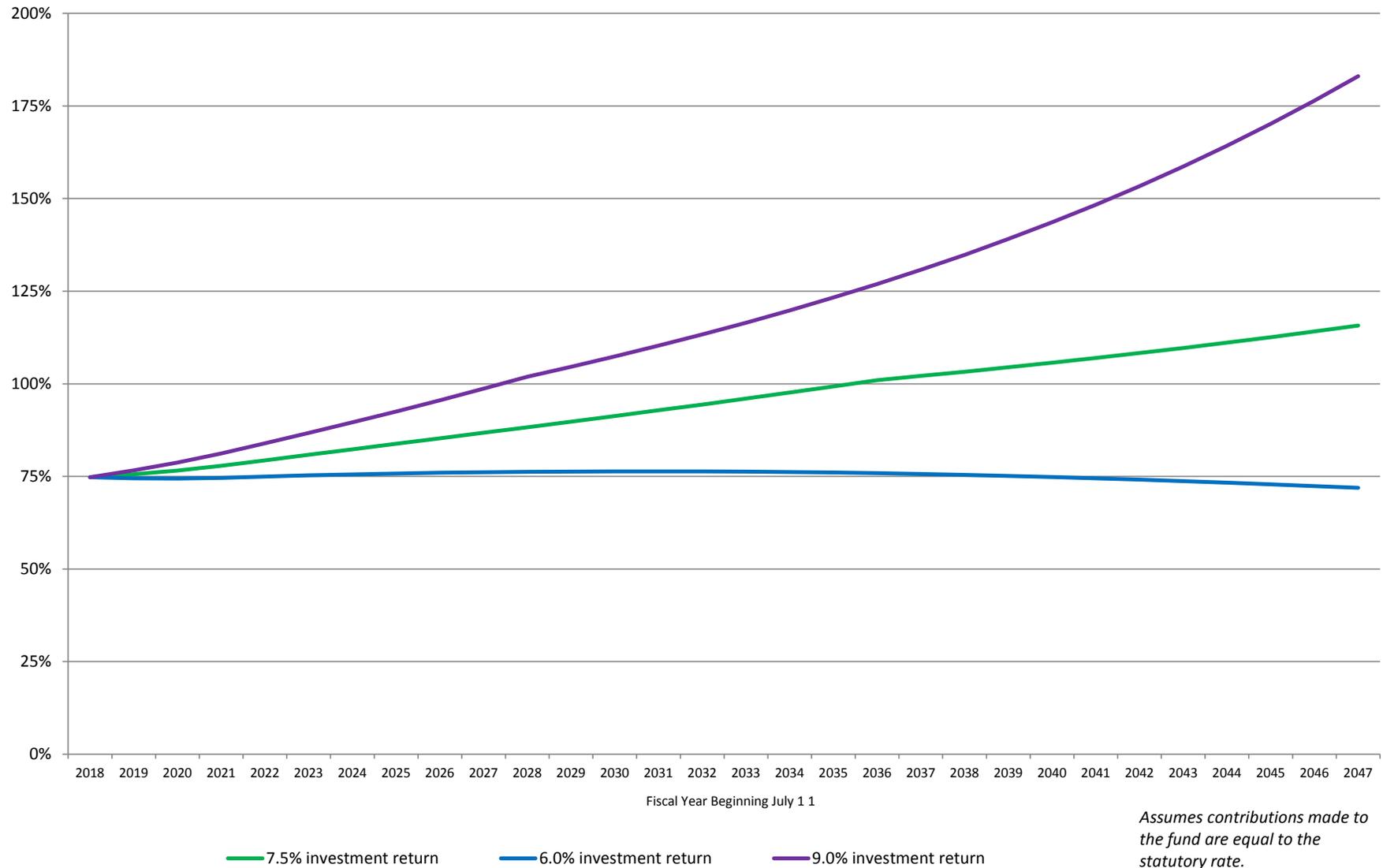
### Limitations of Project Scope

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.

This exhibit should only be viewed in conjunction with GRS' January 31, 2019 letter to MSRS.

## MSRS Correctional Employees Retirement Fund Estimated Funded Ratio

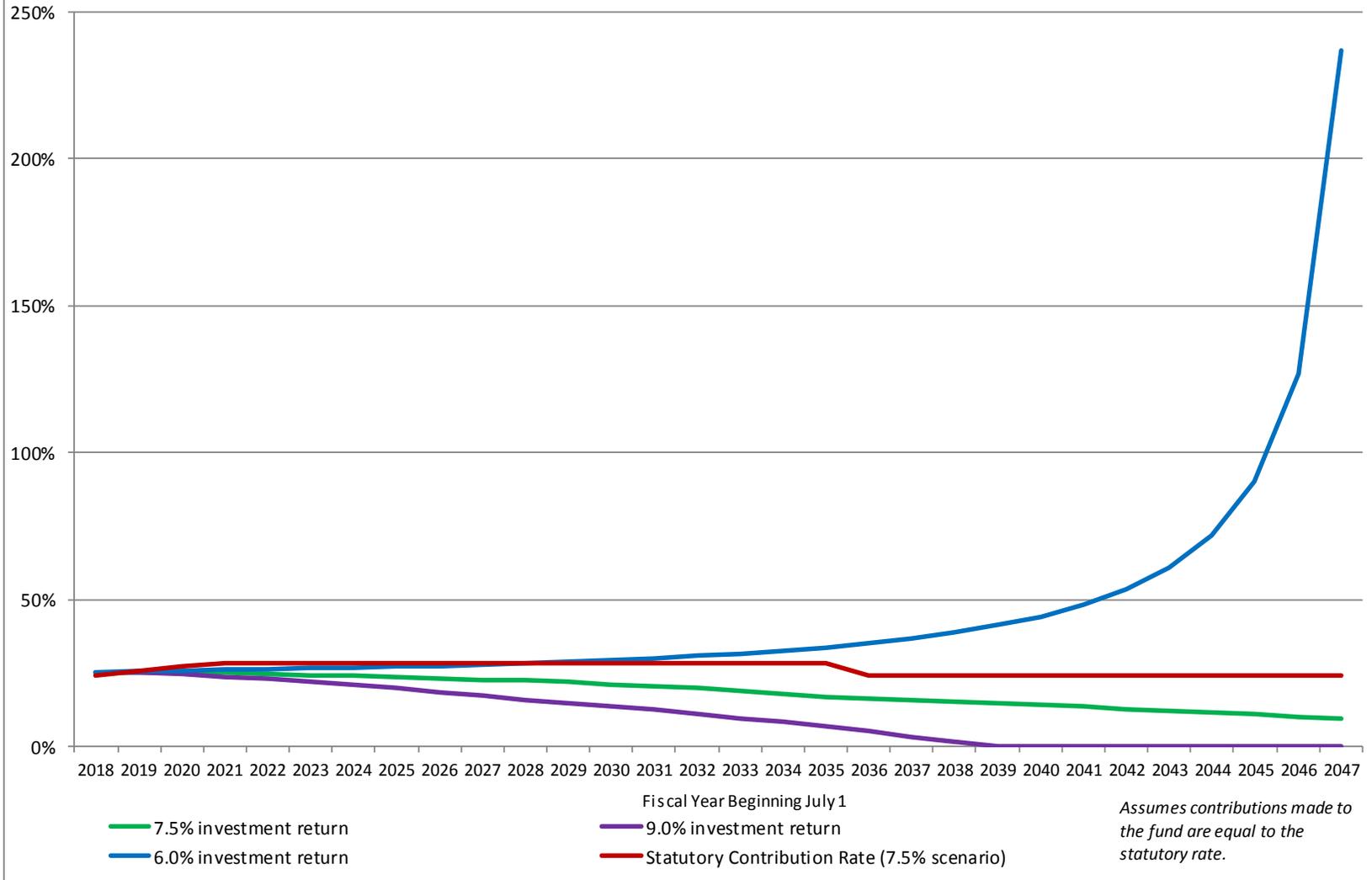
In all scenarios, the interest rate used to discount liabilities was 7.5%.



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## MSRS Correctional Employees Retirement Fund Estimated Required Contribution Rates (% of Pay)

In all scenarios, the interest rate used to discount liabilities was 7.50%.



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in conjunction with GRS' January  
31, 2019 letter to MSRS.

**Correctional Employees Retirement Fund**  
**Scenario: 7.5% investment return for all years**  
**Fiscal year beginning July 1**

\$ in Thousands	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
<b>Contributions (% of Payroll)</b>										
Statutory - Chapter 352	24.0%	25.5%	27.0%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%
Required - Chapter 356 (MVA)	25.3%	25.2%	25.1%	24.9%	24.6%	24.3%	23.9%	23.6%	23.2%	22.7%
Sufficiency / (Deficiency)	(1.3)%	0.2%	1.8%	3.5%	3.8%	4.2%	4.5%	4.9%	5.3%	5.7%
<b>Contributions</b>										
Statutory - Chapter 352	64,314	70,376	76,858	83,624	86,161	88,923	91,744	94,523	97,452	100,587
Required - Chapter 356 (MVA)	67,752	69,792	71,644	73,242	74,554	75,918	77,200	78,306	79,358	80,370
Sufficiency / (Deficiency)	(3,438)	584	5,214	10,382	11,607	13,005	14,544	16,217	18,094	20,217
<b>Funding Ratios</b>										
Current Assets (MVA)	1,114,887	1,186,269	1,265,628	1,353,064	1,449,069	1,549,792	1,655,676	1,767,102	1,883,954	2,006,116
Actuarial Accrued Liability (AAL)	1,490,521	1,569,725	1,652,422	1,737,969	1,826,202	1,917,282	2,011,385	2,108,735	2,209,092	2,312,070
Unfunded AAL	375,634	383,456	386,794	384,905	377,133	367,490	355,709	341,633	325,138	305,954
Funding Ratio	75%	76%	77%	78%	79%	81%	82%	84%	85%	87%
<b>Benefit Payments</b>										
Ratio of Assets to Benefit Payments	75,249	78,755	83,161	87,960	92,862	97,898	103,001	108,573	114,800	121,029
	14.82	15.06	15.22	15.38	15.60	15.83	16.07	16.28	16.41	16.58

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.

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31, 2019 letter to MSRS.

**Correctional Employees Retirement Fund**  
**Scenario: 7.5% investment return for all years**  
**Fiscal year beginning July 1**

\$ in Thousands	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
<b>Contributions (% of Payroll)</b>										
Statutory - Chapter 352	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	24.0%	24.0%
Required - Chapter 356 (MVA)	22.3%	21.7%	21.2%	20.5%	19.8%	18.9%	18.0%	16.9%	16.0%	15.5%
Sufficiency / (Deficiency)	6.2%	6.7%	7.3%	8.0%	8.7%	9.5%	10.5%	11.6%	8.0%	8.5%
<b>Contributions</b>										
Statutory - Chapter 352	103,784	107,048	110,378	113,822	117,393	121,065	124,878	128,713	111,922	115,455
Required - Chapter 356 (MVA)	81,192	81,769	82,053	82,016	81,572	80,592	78,969	76,450	74,443	74,471
Sufficiency / (Deficiency)	22,592	25,279	28,325	31,806	35,821	40,473	45,909	52,263	37,479	40,984
<b>Funding Ratios</b>										
Current Assets (MVA)	2,134,192	2,268,583	2,409,385	2,556,774	2,711,330	2,873,303	3,043,146	3,221,098	3,407,203	3,579,919
Actuarial Accrued Liability (AAL)	2,418,005	2,527,084	2,639,128	2,754,036	2,872,068	2,993,124	3,117,297	3,244,413	3,374,169	3,506,076
Unfunded AAL	283,813	258,501	229,743	197,262	160,738	119,821	74,151	23,315	(33,034)	(73,843)
Funding Ratio	88%	90%	91%	93%	94%	96%	98%	99%	101%	102%
<b>Benefit Payments</b>										
Ratio of Assets to Benefit Payments	127,363	134,125	141,247	148,399	155,954	163,708	171,940	180,738	190,260	199,838
	16.76	16.91	17.06	17.23	17.39	17.55	17.70	17.82	17.91	17.91

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.

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**Correctional Employees Retirement Fund**  
**Scenario: 7.5% investment return for all years**  
**Fiscal year beginning July 1**

\$ in Thousands	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
<b>Contributions (% of Payroll)</b>										
Statutory - Chapter 352	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%
Required - Chapter 356 (MVA)	15.0%	14.5%	13.9%	13.4%	12.8%	12.2%	11.5%	10.9%	10.2%	9.4%
Sufficiency / (Deficiency)	9.0%	9.6%	10.1%	10.7%	11.2%	11.9%	12.5%	13.2%	13.8%	14.6%
<b>Contributions</b>										
Statutory - Chapter 352	119,089	122,806	126,669	130,748	134,988	139,357	143,838	148,508	153,324	158,325
Required - Chapter 356 (MVA)	74,320	73,962	73,420	72,707	71,760	70,528	68,969	67,112	64,887	62,277
Sufficiency / (Deficiency)	44,769	48,844	53,249	58,041	63,228	68,829	74,869	81,396	88,437	96,048
<b>Funding Ratios</b>										
Current Assets (MVA)	3,759,269	3,945,825	4,139,810	4,341,726	4,552,647	4,773,478	5,005,085	5,248,140	5,503,324	5,771,447
Actuarial Accrued Liability (AAL)	3,640,354	3,777,245	3,916,618	4,058,546	4,203,606	4,352,209	4,504,704	4,661,232	4,821,840	4,986,692
Unfunded AAL	(118,915)	(168,580)	(223,192)	(283,180)	(349,041)	(421,269)	(500,381)	(586,908)	(681,484)	(784,755)
Funding Ratio	103%	104%	106%	107%	108%	110%	111%	113%	114%	116%
<b>Benefit Payments</b>										
Ratio of Assets to Benefit Payments	17.95	17.98	18.03	18.12	18.25	18.41	18.57	18.75	18.93	19.14

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.

This exhibit should only be viewed  
in conjunction with GRS' January  
31, 2019 letter to MSRS.

**Correctional Employees Retirement Fund**  
**Scenario: 6.0% investment return for all years**  
**Fiscal year beginning July 1**

\$ in Thousands	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
<b>Contributions (% of Payroll)</b>										
Statutory - Chapter 352	24.0%	25.5%	27.0%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%
Required - Chapter 356 (MVA)	25.3%	25.6%	25.9%	26.1%	26.3%	26.5%	26.7%	27.0%	27.4%	27.7%
Sufficiency / (Deficiency)	(1.3)%	(0.2)%	1.1%	2.3%	2.2%	2.0%	1.7%	1.4%	1.1%	0.7%
<b>Contributions</b>										
Statutory - Chapter 352	64,314	70,376	76,858	83,624	86,161	88,923	91,744	94,523	97,452	100,587
Required - Chapter 356 (MVA)	67,752	70,784	73,791	76,736	79,618	82,811	86,218	89,794	93,717	98,064
Sufficiency / (Deficiency)	(3,438)	(408)	3,067	6,888	6,543	6,112	5,526	4,729	3,735	2,523
<b>Funding Ratios</b>										
Current Assets (MVA)	1,114,887	1,169,634	1,230,270	1,296,655	1,369,019	1,443,260	1,519,580	1,598,097	1,678,416	1,760,125
Actuarial Accrued Liability (AAL)	1,490,521	1,569,725	1,652,422	1,737,969	1,826,202	1,917,282	2,011,385	2,108,735	2,209,092	2,312,070
Unfunded AAL	375,634	400,091	422,152	441,314	457,183	474,022	491,805	510,638	530,676	551,945
Funding Ratio	75%	75%	74%	75%	75%	75%	76%	76%	76%	76%
<b>Benefit Payments</b>										
	75,249	78,755	83,161	87,960	92,862	97,898	103,001	108,573	114,800	121,029
Ratio of Assets to Benefit Payments	14.82	14.85	14.79	14.74	14.74	14.74	14.75	14.72	14.62	14.54

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.

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31, 2019 letter to MSRS.

Correctional Employees Retirement Fund  
Scenario: 6.0% investment return for all years  
Fiscal year beginning July 1

\$ in Thousands	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
<b>Contributions (% of Payroll)</b>										
Statutory - Chapter 352	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%
Required - Chapter 356 (MVA)	28.2%	28.7%	29.2%	29.9%	30.6%	31.5%	32.5%	33.7%	35.1%	36.7%
Sufficiency / (Deficiency)	0.3%	(0.2)%	(0.8)%	(1.4)%	(2.2)%	(3.1)%	(4.1)%	(5.2)%	(6.6)%	(8.3)%
<b>Contributions</b>										
Statutory - Chapter 352	103,784	107,048	110,378	113,822	117,393	121,065	124,878	128,713	132,674	136,863
Required - Chapter 356 (MVA)	102,767	107,867	113,434	119,587	126,425	134,052	142,662	152,396	163,586	176,668
Sufficiency / (Deficiency)	1,017	(819)	(3,056)	(5,765)	(9,032)	(12,987)	(17,784)	(23,683)	(30,912)	(39,805)
<b>Funding Ratios</b>										
Current Assets (MVA)	1,843,512	1,928,634	2,015,223	2,103,062	2,192,313	2,282,774	2,374,416	2,466,960	2,559,902	2,652,645
Actuarial Accrued Liability (AAL)	2,418,005	2,527,084	2,639,128	2,754,036	2,872,068	2,993,124	3,117,297	3,244,413	3,374,169	3,506,076
Unfunded AAL	574,493	598,450	623,905	650,974	679,755	710,350	742,881	777,453	814,267	853,431
Funding Ratio	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%
<b>Benefit Payments</b>										
Ratio of Assets to Benefit Payments	127,363	134,125	141,247	148,399	155,954	163,708	171,940	180,738	190,260	199,838
	14.47	14.38	14.27	14.17	14.06	13.94	13.81	13.65	13.45	13.27

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Correctional Employees Retirement Fund  
Scenario: 6.0% investment return for all years  
Fiscal year beginning July 1

\$ in Thousands	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
<b>Contributions (% of Payroll)</b>										
Statutory - Chapter 352	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%
Required - Chapter 356 (MVA)	38.7%	41.2%	44.2%	48.2%	53.4%	60.7%	71.8%	90.1%	126.9%	237.1%
Sufficiency / (Deficiency)	(10.3)%	(12.7)%	(15.8)%	(19.7)%	(24.9)%	(32.3)%	(43.3)%	(61.7)%	(98.4)%	(208.7)%
<b>Contributions</b>										
Statutory - Chapter 352	141,170	145,576	150,156	154,991	160,017	165,197	170,508	176,044	181,753	187,682
Required - Chapter 356 (MVA)	192,091	210,606	233,402	262,305	300,249	352,575	429,999	557,627	810,523	1,564,244
Sufficiency / (Deficiency)	(50,921)	(65,030)	(83,246)	(107,314)	(140,232)	(187,378)	(259,491)	(381,583)	(628,770)	(1,376,562)
<b>Funding Ratios</b>										
Current Assets (MVA)	2,745,353	2,838,118	2,930,644	3,022,889	3,115,354	3,208,309	3,301,932	3,396,148	3,490,853	3,586,005
Actuarial Accrued Liability (AAL)	3,640,354	3,777,245	3,916,618	4,058,546	4,203,606	4,352,209	4,504,704	4,661,232	4,821,840	4,986,692
Unfunded AAL	895,001	939,127	985,974	1,035,657	1,088,252	1,143,900	1,202,772	1,265,084	1,330,987	1,400,687
Funding Ratio	75%	75%	75%	74%	74%	74%	73%	73%	72%	72%
<b>Benefit Payments</b>										
Ratio of Assets to Benefit Payments	13.11	12.93	12.76	12.62	12.49	12.37	12.25	12.13	12.01	11.89

Numbers may not add due to rounding.

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**Correctional Employees Retirement Fund**  
**Scenario: 9.0% investment return for all years**  
**Fiscal year beginning July 1**

\$ in Thousands	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
<b>Contributions (% of Payroll)</b>										
Statutory - Chapter 352	24.0%	25.5%	27.0%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%	28.5%
Required - Chapter 356 (MVA)	25.3%	24.9%	24.4%	23.7%	22.9%	22.0%	20.9%	19.8%	18.5%	17.1%
Sufficiency / (Deficiency)	(1.3)%	0.6%	2.6%	4.8%	5.6%	6.5%	7.5%	8.6%	9.9%	11.3%
<b>Contributions</b>										
Statutory - Chapter 352	64,314	70,376	76,858	83,624	86,161	88,923	91,744	94,523	97,452	100,587
Required - Chapter 356 (MVA)	67,752	68,801	69,466	69,648	69,273	68,628	67,525	65,806	63,513	60,564
Sufficiency / (Deficiency)	(3,438)	1,575	7,392	13,976	16,888	20,295	24,219	28,717	33,939	40,023
<b>Funding Ratios</b>										
Current Assets (MVA)	1,114,887	1,202,904	1,301,485	1,411,078	1,532,561	1,662,476	1,801,674	1,950,983	2,110,778	2,281,474
Actuarial Accrued Liability (AAL)	1,490,521	1,569,725	1,652,422	1,737,969	1,826,202	1,917,282	2,011,385	2,108,735	2,209,092	2,312,070
Unfunded AAL	375,634	366,821	350,937	326,891	293,641	254,806	209,711	157,752	98,314	30,596
Funding Ratio	75%	77%	79%	81%	84%	87%	90%	93%	96%	99%
<b>Benefit Payments</b>										
Ratio of Assets to Benefit Payments	75,249	78,755	83,161	87,960	92,862	97,898	103,001	108,573	114,800	121,029
	14.82	15.27	15.65	16.04	16.50	16.98	17.49	17.97	18.39	18.85

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.

This exhibit should only be viewed  
in conjunction with GRS' January  
31, 2019 letter to MSRS.

**Correctional Employees Retirement Fund**  
**Scenario: 9.0% investment return for all years**  
**Fiscal year beginning July 1**

\$ in Thousands	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
<b>Contributions (% of Payroll)</b>										
Statutory - Chapter 352	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%
Required - Chapter 356 (MVA)	15.7%	14.7%	13.5%	12.3%	11.0%	9.6%	8.1%	6.6%	5.0%	3.2%
Sufficiency / (Deficiency)	8.3%	9.4%	10.5%	11.7%	13.0%	14.4%	15.9%	17.4%	19.0%	20.8%
<b>Contributions</b>										
Statutory - Chapter 352	87,551	90,304	93,113	96,019	99,031	102,128	105,345	108,581	111,922	115,455
Required - Chapter 356 (MVA)	57,418	55,124	52,348	49,081	45,269	40,832	35,740	29,856	23,153	15,607
Sufficiency / (Deficiency)	30,133	35,180	40,765	46,938	53,762	61,296	69,605	78,725	88,769	99,848
<b>Funding Ratios</b>										
Current Assets (MVA)	2,464,263	2,643,223	2,834,062	3,037,530	3,254,833	3,486,904	3,734,951	4,000,038	4,283,125	4,585,182
Actuarial Accrued Liability (AAL)	2,418,005	2,527,084	2,639,128	2,754,036	2,872,068	2,993,124	3,117,297	3,244,413	3,374,169	3,506,076
Unfunded AAL	(46,258)	(116,139)	(194,934)	(283,494)	(382,765)	(493,780)	(617,654)	(755,625)	(908,956)	(1,079,106)
Funding Ratio	102%	105%	107%	110%	113%	116%	120%	123%	127%	131%
<b>Benefit Payments</b>										
	127,363	134,125	141,247	148,399	155,954	163,708	171,940	180,738	190,260	199,838
Ratio of Assets to Benefit Payments	19.35	19.71	20.06	20.47	20.87	21.30	21.72	22.13	22.51	22.94

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.

This exhibit should only be viewed  
in conjunction with GRS' January  
31, 2019 letter to MSRS.

**Correctional Employees Retirement Fund**  
**Scenario: 9.0% investment return for all years**  
**Fiscal year beginning July 1**

\$ in Thousands	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
<b>Contributions (% of Payroll)</b>										
Statutory - Chapter 352	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%
Required - Chapter 356 (MVA)	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sufficiency / (Deficiency)	22.6%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%
<b>Contributions</b>										
Statutory - Chapter 352	119,089	122,806	126,669	130,748	134,988	139,357	143,838	148,508	153,324	158,325
Required - Chapter 356 (MVA)	7,052	-	-	-	-	-	-	-	-	-
Sufficiency / (Deficiency)	112,037	122,806	126,669	130,748	134,988	139,357	143,838	148,508	153,324	158,325
<b>Funding Ratios</b>										
Current Assets (MVA)	4,908,060	5,253,707	5,623,852	6,020,644	6,446,965	6,905,702	7,399,897	7,932,605	8,507,113	9,127,081
Actuarial Accrued Liability (AAL)	3,640,354	3,777,245	3,916,618	4,058,546	4,203,606	4,352,209	4,504,704	4,661,232	4,821,840	4,986,692
Unfunded AAL	(1,267,706)	(1,476,462)	(1,707,234)	(1,962,098)	(2,243,359)	(2,553,493)	(2,895,193)	(3,271,373)	(3,685,273)	(4,140,389)
Funding Ratio	135%	139%	144%	148%	153%	159%	164%	170%	176%	183%
<b>Benefit Payments</b>										
Ratio of Assets to Benefit Payments	209,443	219,435	229,626	239,567	249,446	259,334	269,463	279,951	290,679	301,490
	23.43	23.94	24.49	25.13	25.85	26.63	27.46	28.34	29.27	30.27

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.