



2005 Market Street, Suite 2800
Philadelphia, PA 19103-7077

215.575.9050 Phone

901 E Street NW
Washington, DC 20004

202.552.2000 Phone

www.pewtrusts.org

August 3, 2020

Representative Kimberly Dudik
Chairperson, Legislative Finance Committee
Montana House of Representatives
1301 E 6th Ave
Helena, MT 59601

Dear Chairperson Dudik,

Thank you for the invitation and we look forward to presenting to the full Legislative Finance Committee on Tuesday, August 11th. In preparation for the presentation, we have attached responses to the questions provided to Pew. We will be prepared to present the findings of our analysis, discuss the submitted questions, and address any other questions from the committee.

Sincerely,

David Draine
Sr. Officer
[Strengthening Public Sector Retirement Systems](#)
The Pew Charitable Trusts

Michael Lowenthal
Manager
[Strengthening Public Sector Retirement Systems](#)
The Pew Charitable Trusts

REPORT FROM THE PENSIONS & LOCAL GOVERNMENT PENSIONS SUBCOMMITTEE

ADDITIONAL REQUESTS & QUESTIONS FOR PEW CHARITABLE TRUSTS

PEW'S ANSWERS IN BLUE

REQUESTS

1. *Low Return Scenario*—Identify the ARC under both the 2% below and flat 5% returns.

- Employer contributions under a fixed 5% return scenario were shown in Appendix 2 of the report and are included in the appendix of this document. Employer contributions are set in statute as a percentage of current worker payroll and may decrease if certain requirements outlined in MCA 19-3-316 and MCA 19-20-609 are achieved. Based on our projections, these requirements are not achieved in either a 5% or “assumed minus 2%” scenario and, as a result, the employer contributions are the same in both cases.
- While the results referenced above are based on an interpretation of current funding policy in statute, the system’s actuaries included an analysis of different funding policies as part of their report. Specifically, they calculate the required contributions under a funding policy based on 20-year and 30-year layered amortization.

See Appendix pages 1 – 2 for a discussion on the state’s contribution policy.

See Appendix pages 3 – 5 for the results of a fixed 5% return scenario, by-plan and combined.

2. *Recession Followed by Slow Growth*—Answered at a loss of 25% but would like the items listed in #1 for this scenario or slightly less severe as in the 20% decline listed with the potential ARC.

- The results of a scenario with a 20% loss in assets are included in the appendix of this document. The outcomes are similar between the 25% loss and 20% loss scenarios. For example, assuming no changes in the state’s funding policy, insolvency is reached in 2049 in a 20% loss scenario as compared to 2045 in a 25% loss scenario, on a combined basis.

See Appendix pages 6 – 8 for the results of a 20% asset shock, by-plan and combined.

3. *Simulation Analysis*—Please illustrate the results at the 25th and 75th percentiles. The stress test provided used Pew capital market assumptions. How much change if RVK capital market assumptions were used?

- The appendix of this document includes an update to Figure 5 to include a table of results, including the 25th and 75th percentiles.
- Pew’s expected average returns are higher than RVK’s for PERS on either a geometric or arithmetic basis. The primary reason is that Pew assumes a lower rate of inflation (2.00%) than RVK (2.75%). If both RVK and Pew assumed a 2% rate of inflation, then Pew estimates that RVK’s expected geometric rate of return would be lower – closer to 5.25% – compared to Pew’s 6.45% for PERS. Based on expected returns by asset category, Pew expects RVK results for TRS would have a similar relationship.

See Appendix page 9 for an updated version of Figure 5 with a table of results.

4. *Sensitivity Analysis*—This was provided but not by tier. Can that be done? Was the alternative discount rate done at the State's long term borrowing cost?

- Generally, a sensitivity analysis of the current tier is the most informative as that will be the primary driver of the costs associated with new benefit accruals over the long-term. Evaluation of alternative tiers can be especially valuable if the state is considering or recently passed benefit reforms.
- A preliminary analysis by Pew indicates that the pre-2013 benefit tiers for PERS and TRS have higher costs, particularly under a lower assumed return. Assuming 5% returns, PERS employer costs as a share of payroll are estimated to have been as much as 4% higher; employer costs for TRS are estimated to have been as much as 2% higher.

QUESTIONS FROM STRESS TEST

1. *Scenario Analysis: page 3*

-Please explain the Dodd-Frank reference and the translating that to asset performance.

- The asset shock scenario is based on the “adverse” scenario in the Federal Reserve’s “2017 Supervisory Scenarios for Annual Stress Tests Required under the Dodd-Frank Act Stress Testing Rules” which projects macroeconomic variables (GDP, inflation, treasury yields etc.) under a hypothetical sets of conditions designed to assess the strength of banking organizations and their resilience to adverse economic environments.¹ Pew leverages the Federal Reserve’s predicted changes in macroeconomic conditions under an adverse economic environment to guide the performance of asset classes under our asset shock scenario. Please see Pew’s full stress test methodology as described in our research paper, *Assessing the Risk of Fiscal Distress for Public Pension: State Stress Test Analysis*.²
- The asset shock scenario closely approximates market conditions following the Great Recession. A comparison is included in the appendix of this document.

See Appendix page 10 for a comparison of the asset shock scenario to the Great Recession.

2. *Possible outcomes: page 7*

-Results based on 20 year outcomes vs. Cavanaugh MacDonald at 30 years. Is there more utility in one versus the other?

- Both time periods are useful. Generally speaking, 30-year projections are used in actuarial studies to account for the maximum amortization period that most public plans follow. Our analysis emphasizes a 20-year time frame due to the increased uncertainty as forecast periods are extended.

-Results are shown in funded ratio. Since our action trigger is more amortization based and you tell us the ARC in this scenario?

- As Montana’s contribution policy is mostly fixed in nature, the range of possible employer contributions does not vary greatly. The appendix includes a version of Figure 5 displaying employer contributions instead of funded ratio. The contribution rate under the current funding policy remains stable except for outcomes where investments significantly underperform and the plans reach insolvency requiring the state to increase contributions to directly pay benefit payments due that year (also known as pay-go).

See Appendix page 11 for a version of Figure 5 showing employer contributions instead of funded ratio.

¹ See Table 3A at <https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20170203a5.pdf>

² Mennis, G., Banta, S., & Draine, D. (2018). *Assessing the Risk of Fiscal Distress for Public Pensions: State Stress Test Analysis*. Harvard Kennedy School Mossavar-Rahmani Center Working Paper. Available at: <https://www.hks.harvard.edu/centers/mrcbg/publications/awp/awp92>

3. *Potential for fiscal distress: page 8*

-This example was early declines with a late rise. Please tell us the results with a mid-phase rise and late phase decline.

- An alternative trial can be examined to understand the impact of a mid-phase rise and a late decline outcome. The appendix contains results for trial 7792 which roughly has these characteristics.

See Appendix page 12 for a version of Figure 6 utilizing a different trial with a mid-phase and late decline.

4. *Exhibit #1:*

-Starting numbers don't match the valuation numbers. What date or starting point was chosen?

- Our models were based on the 2019 valuations. The exhibits show our first projected year – in this case 2020.

5. *Exhibit #2:*

-At what point do we, the legislature, need to act?

- Our analysis shows significant funded ratio deterioration under our low return scenarios. For example, in a fixed 5% return scenario, the funded ratio drops to 32% by 2039 on a combined basis. Under this scenario, the state may need to increase contributions to preserve the fiscal health of the plans. We recommend regular reporting and stress testing analysis to inform decision making. The near-term impact of COVID-19 on state budgets will make this practice even more important as the state grapples with revenue shortfalls.

6. *Exhibit#3:*

-Same question for #2 above. Both assume that we act when the amortization period rises above 30 years

- Same response as above.

7. *Exhibit #10:*

-Please explain this table.

- Exhibits 10 – 12 are detailed model output tables with key metrics reported across our scenarios at 5, 10, and 20 years. Exhibit 10 is for both plans on a combined basis, Exhibit 11 is for PERS only, and Exhibit 12 is for TRS only. These are intended provide additional data points from our results on balance sheet measures, cash flow metrics, payment and contributions measures, as well as investment performance.

8. *Combination of PERS and TRS*

-Why are PERS and TRS combined in the stress test? The proposed rate of return for each pension was averaged between the two pension programs, but the programs have different assets, adopted assumptions by their boards, numbers of participating individuals (both number of individuals paying into the pension system and number collecting pensions). What is the justification of combining these pensions?

- Our modeling is done at the plan level according to each plan's respective assumptions. The results are then aggregated for purposes of presenting and discussing the results. Our framework for risk reporting³ is designed to provide an assessment targeted primarily to budget decision makers and plan sponsors. As a result, we give focused attention to the aggregated results along with the potential impact on the state's budget.

³ See *Foundation for Pension Risk Reporting*. Available at:

[https://www.hks.harvard.edu/sites/default/files/centers/mrcbg/programs/Foundation%20for%20Pensions%20Risk%20Reporting%20\(Strawman\).pdf](https://www.hks.harvard.edu/sites/default/files/centers/mrcbg/programs/Foundation%20for%20Pensions%20Risk%20Reporting%20(Strawman).pdf)

Appendix: Additional Requests & Questions for Pew Charitable Trusts

Request #1

PERS and TRS Contribution Policies

Contributions to TRS and PERS totaled \$465 million in FY 2019, with \$180 million (39 percent) coming from employees, and \$285 million (61 percent) from the state as well as local governments, school districts, and universities participating in these systems. **Appendix Figure 1** below shows contributions for PERS and TRS through 2024. Employee contributions are currently set at 7.9 percent and 8.15 percent of pay for PERS and TRS, respectively; this includes a 1 percentage point increase in contributions applied to all members who were previously paying less than that, which was included in a set of 2013 reforms to address underfunding, outlined in MCA 19-3-315 and MCA 19-20-608. These employee supplemental contributions are eliminated once specific actuarial targets are achieved for each plan. For PERS, this would be once the amortization period falls to 25 years or fewer without the supplemental contribution. For TRS, this would be once the three-year average funded ratio is above 90 percent and the amortization period is below 15 years.

APPENDIX FIGURE 1

Contribution Rates, 2019-2024

State and Employer Contributions are set to increase through 2024

		<i>Members</i>	<i>State and Employers</i>	<i>Additional State</i>
<i>PERS</i>	2019	7.90%	8.67%	\$ 31,958,000
	2020	7.90%	8.77%	\$ 32,277,580
	2021	7.90%	8.87%	\$32,600,356
	2022	7.90%	8.97%	\$32,926,359
	2023	7.90%	9.07%	\$33,255,623
	2024	7.90%	9.17%	\$33,588,179
<i>TRS</i>	2019	8.15%	11.46%	\$25,000,000
	2020	8.15%	11.56%	\$25,000,000
	2021	8.15%	11.66%	\$25,000,000
	2022	8.15%	11.76%	\$25,000,000
	2023	8.15%	11.86%	\$25,000,000
	2024	8.15%	11.96%	\$25,000,000

Source: Public Employees' Retirement System of the State of Montana and Teachers' Retirement System of the State of Montana

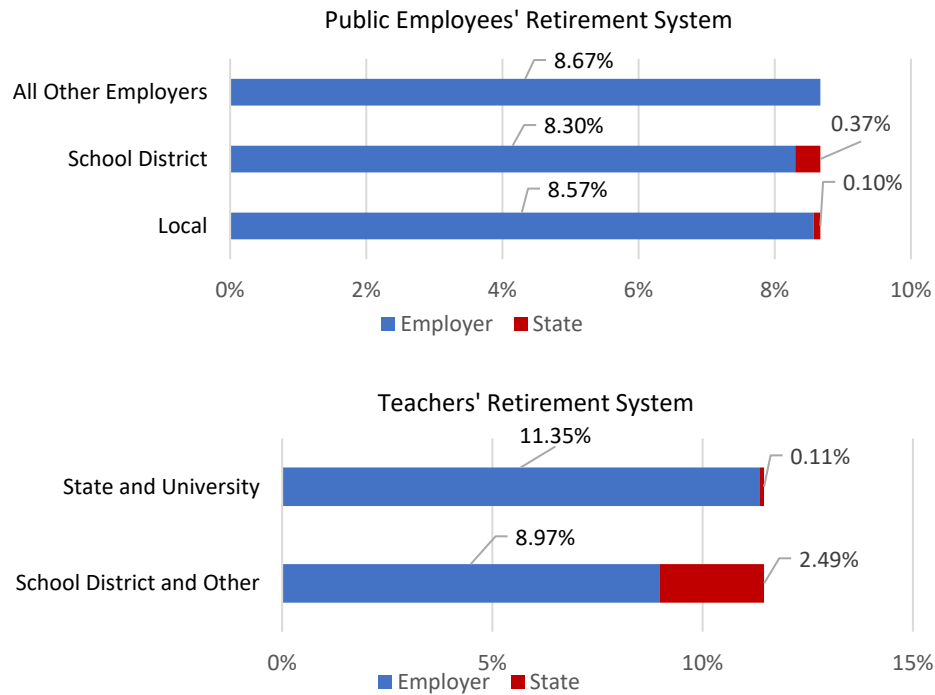
In 2019, the state and employers contributed 8.67 percent and 11.46 percent of pay for PERS and TRS, respectively. These rates are set to increase by 0.10 percentage points each year until FY 2024, also as a result of 2013 reforms, and may decrease to original rates pursuant to the requirements outlined in MCA 19-3-316 and MCA 19-20-609. **Appendix Figure 2** illustrates how employers and the state split contributions. For PERS, the state contributes 0.37 percent of school district payroll and 0.10 percent of local payroll; for TRS, the state makes contributions equal to 0.11 percent of state and university payroll and 2.49 percent of school district and other employer payroll. It is also important to note that .04% of PERS payroll is diverted to the DB education fund, and the TRS contribution includes a 4.72% contribution of MUS-RP payroll.

The state also makes additional statutory general fund contributions to PERS and TRS. In 2019, the state contributed an additional \$34 million to PERS (set to increase 1 percent each year) and a fixed \$25 million to TRS. These contributions, along with the state’s contributions on behalf of employers, totaled \$80 million in 2019.

APPENDIX FIGURE 2

State and Employer Contribution Rates, PERS and TRS, 2019

The state and participating employers split statutory contribution rates



Source: Public Employees’ Retirement System of the State of Montana and Teachers’ Retirement System of the State of Montana

Request #1

Montana Retirement System 30-Year Projections

Plans included: Public Employees' Retirement System and Teachers' Retirement System

State contribution policy at 5% returns

\$MMs

Fiscal Year	Pension Liability (Actuarial Accrued Liability)						Pension Assets (Market Value)					Change in Pension Debt			Cash Flow	Employer Contribution			
	Payroll	Beginning of Period	Service Cost	Interest	Benefit Payments	End of Period	Beginning of Period	Total Contribution	Interest	Benefit Payments	End of Period	Debt	\$	% of Payroll	% Funded	% of Assets	\$	% Change	% Payroll
2020	2,126	14,106	212	1,046	(867)	14,496	10,124	450	489	(867)	10,196	4,300	318	15%	70%	-4%	280	N/A	13%
2021	2,199	14,496	218	1,074	(922)	14,866	10,196	466	492	(922)	10,231	4,634	334	15%	69%	-4%	290	4%	13%
2022	2,274	14,866	224	1,100	(969)	15,221	10,231	482	493	(969)	10,237	4,984	350	15%	67%	-5%	300	4%	13%
2023	2,351	15,221	231	1,126	(1,016)	15,562	10,237	501	492	(1,016)	10,214	5,348	364	15%	66%	-5%	311	4%	13%
2024	2,431	15,562	238	1,150	(1,060)	15,890	10,214	521	490	(1,060)	10,165	5,725	377	16%	64%	-5%	322	4%	13%
2025	2,513	15,890	245	1,174	(1,104)	16,204	10,165	537	487	(1,104)	10,085	6,119	394	16%	62%	-6%	332	3%	13%
2026	2,599	16,204	252	1,196	(1,146)	16,506	10,085	554	482	(1,146)	9,975	6,531	412	16%	60%	-6%	341	3%	13%
2027	2,687	16,506	259	1,218	(1,186)	16,797	9,975	572	475	(1,186)	9,836	6,962	430	16%	59%	-6%	351	3%	13%
2028	2,779	16,797	267	1,239	(1,224)	17,080	9,836	590	468	(1,224)	9,669	7,411	449	16%	57%	-6%	361	3%	13%
2029	2,873	17,080	275	1,259	(1,259)	17,355	9,669	608	458	(1,259)	9,477	7,878	468	16%	55%	-7%	372	3%	13%
2030	2,971	17,355	284	1,279	(1,293)	17,625	9,477	628	448	(1,293)	9,260	8,365	487	16%	53%	-7%	383	3%	13%
2031	3,072	17,625	292	1,299	(1,325)	17,892	9,260	648	437	(1,325)	9,020	8,872	507	17%	50%	-7%	394	3%	13%
2032	3,176	17,892	301	1,319	(1,354)	18,158	9,020	668	424	(1,354)	8,758	9,400	527	17%	48%	-8%	405	3%	13%
2033	3,284	18,158	311	1,338	(1,382)	18,425	8,758	690	411	(1,382)	8,477	9,948	549	17%	46%	-8%	417	3%	13%
2034	3,396	18,425	320	1,358	(1,407)	18,696	8,477	711	396	(1,407)	8,177	10,519	570	17%	44%	-8%	430	3%	13%
2035	3,511	18,696	330	1,378	(1,430)	18,974	8,177	734	381	(1,430)	7,862	11,112	593	17%	41%	-9%	443	3%	13%
2036	3,631	18,974	341	1,399	(1,451)	19,262	7,862	758	365	(1,451)	7,533	11,729	617	17%	39%	-9%	456	3%	13%
2037	3,754	19,262	352	1,420	(1,469)	19,564	7,533	782	348	(1,469)	7,193	12,371	642	17%	37%	-9%	469	3%	13%
2038	3,882	19,564	363	1,443	(1,486)	19,884	7,193	807	331	(1,486)	6,845	13,040	668	17%	34%	-9%	483	3%	12%
2039	4,014	19,884	374	1,461	(1,499)	20,220	6,845	833	313	(1,499)	6,491	13,729	690	17%	32%	-10%	498	3%	12%
2040	4,151	20,220	387	1,480	(1,510)	20,578	6,491	859	295	(1,510)	6,136	14,442	712	17%	30%	-10%	513	3%	12%
2041	4,292	20,578	399	1,502	(1,517)	20,962	6,136	887	278	(1,517)	5,783	15,179	737	17%	28%	-10%	529	3%	12%
2042	4,438	20,962	412	1,527	(1,521)	21,380	5,783	915	260	(1,521)	5,438	15,942	764	17%	25%	-10%	545	3%	12%
2043	4,589	21,380	426	1,554	(1,523)	21,837	5,438	945	243	(1,523)	5,102	16,735	793	17%	23%	-11%	561	3%	12%
2044	4,745	21,837	440	1,586	(1,521)	22,341	5,102	975	227	(1,521)	4,782	17,559	824	17%	21%	-11%	579	3%	12%
2045	4,907	22,341	454	1,621	(1,518)	22,899	4,782	1,006	211	(1,518)	4,481	18,417	858	17%	20%	-11%	596	3%	12%
2046	5,073	22,899	469	1,661	(1,514)	23,515	4,481	1,039	196	(1,514)	4,202	19,313	896	18%	18%	-11%	615	3%	12%
2047	5,246	23,515	485	1,706	(1,510)	24,197	4,202	1,072	183	(1,510)	3,947	20,250	937	18%	16%	-10%	633	3%	12%
2048	5,425	24,197	501	1,757	(1,506)	24,949	3,947	1,107	170	(1,506)	3,718	21,231	982	18%	15%	-10%	653	3%	12%
2049	5,609	24,949	518	1,814	(1,502)	25,779	3,718	1,143	159	(1,502)	3,517	22,262	1,031	18%	14%	-10%	673	3%	12%

Request #1

Montana Retirement System 30 Year Projections

Plans included: Public Employees' Retirement System
 State contribution policy at 5% returns

\$MMs

Fiscal Year	Pension Liability (Actuarial Accrued Liability)						Pension Assets (Market Value)					Change in Pension Debt			Cash Flow		Employer Contribution		
	Payroll	Beginning of Period	Service Cost	Interest	Benefit Payments	End of Period	Beginning of Period	Total Contribution	Interest	Benefit Payments	End of Period	Debt	\$	% of Payroll	% Funded	% of Assets	\$	% Change	% Payroll
2020	1,269	7,957	128	596	(470)	8,211	5,903	243	286	(470)	5,962	2,249	195	15%	73%	-4%	143	N/A	11%
2021	1,313	8,211	132	614	(501)	8,455	5,962	252	288	(501)	6,001	2,454	206	16%	71%	-4%	149	4%	11%
2022	1,359	8,455	135	632	(533)	8,690	6,001	262	289	(533)	6,019	2,671	216	16%	69%	-5%	154	4%	11%
2023	1,407	8,690	139	649	(564)	8,914	6,019	271	289	(564)	6,016	2,898	227	16%	67%	-5%	160	4%	11%
2024	1,456	8,914	143	665	(594)	9,128	6,016	282	289	(594)	5,992	3,136	238	16%	66%	-5%	167	4%	11%
2025	1,507	9,128	147	680	(623)	9,333	5,992	291	287	(623)	5,947	3,386	250	17%	64%	-6%	172	3%	11%
2026	1,560	9,333	152	695	(651)	9,528	5,947	300	284	(651)	5,879	3,649	263	17%	62%	-6%	177	3%	11%
2027	1,615	9,528	156	709	(679)	9,715	5,879	310	280	(679)	5,790	3,925	276	17%	60%	-6%	182	3%	11%
2028	1,671	9,715	161	723	(705)	9,893	5,790	320	275	(705)	5,679	4,214	289	17%	57%	-7%	188	3%	11%
2029	1,730	9,893	165	736	(729)	10,066	5,679	330	269	(729)	5,549	4,516	302	17%	55%	-7%	193	3%	11%
2030	1,790	10,066	170	748	(752)	10,233	5,549	341	262	(752)	5,400	4,833	316	18%	53%	-7%	199	3%	11%
2031	1,853	10,233	175	760	(773)	10,395	5,400	352	254	(773)	5,232	5,163	330	18%	50%	-8%	205	3%	11%
2032	1,918	10,395	181	772	(793)	10,555	5,232	363	245	(793)	5,047	5,508	345	18%	48%	-8%	211	3%	11%
2033	1,985	10,555	186	784	(811)	10,714	5,047	375	235	(811)	4,846	5,868	360	18%	45%	-9%	218	3%	11%
2034	2,054	10,714	192	796	(828)	10,874	4,846	387	225	(828)	4,630	6,244	376	18%	43%	-9%	225	3%	11%
2035	2,126	10,874	198	808	(843)	11,036	4,630	400	214	(843)	4,400	6,636	392	18%	40%	-10%	232	3%	11%
2036	2,200	11,036	204	820	(857)	11,204	4,400	413	202	(857)	4,158	7,046	409	19%	37%	-10%	239	3%	11%
2037	2,277	11,204	211	832	(869)	11,378	4,158	426	190	(869)	3,905	7,473	427	19%	34%	-11%	246	3%	11%
2038	2,357	11,378	218	846	(879)	11,563	3,905	440	177	(879)	3,644	7,919	446	19%	32%	-11%	254	3%	11%
2039	2,440	11,563	225	853	(887)	11,755	3,644	454	164	(887)	3,376	8,379	460	19%	29%	-12%	262	3%	11%
2040	2,525	11,755	232	862	(892)	11,957	3,376	469	151	(892)	3,103	8,854	475	19%	26%	-13%	270	3%	11%
2041	2,613	11,957	240	872	(896)	12,174	3,103	485	137	(896)	2,829	9,345	491	19%	23%	-13%	278	3%	11%
2042	2,705	12,174	248	884	(897)	12,409	2,829	501	123	(897)	2,557	9,853	508	19%	21%	-14%	287	3%	11%
2043	2,800	12,409	256	898	(897)	12,667	2,557	517	110	(897)	2,287	10,380	527	19%	18%	-15%	296	3%	11%
2044	2,898	12,667	265	914	(894)	12,952	2,287	534	97	(894)	2,024	10,928	548	19%	16%	-16%	306	3%	11%
2045	2,999	12,952	274	933	(889)	13,270	2,024	552	84	(889)	1,771	11,499	571	19%	13%	-17%	315	3%	11%
2046	3,104	13,270	283	955	(883)	13,625	1,771	570	71	(883)	1,529	12,096	597	19%	11%	-18%	325	3%	10%
2047	3,213	13,625	293	981	(876)	14,023	1,529	589	60	(876)	1,302	12,721	625	19%	9%	-19%	336	3%	10%
2048	3,325	14,023	303	1,010	(868)	14,468	1,302	609	48	(868)	1,092	13,376	656	20%	8%	-20%	346	3%	10%
2049	3,441	14,468	313	1,044	(859)	14,966	1,092	629	38	(859)	900	14,066	690	20%	6%	-21%	357	3%	10%

Request #1

Montana Retirement System 30 Year Projections

Plans included: Teachers' Retirement System
 State contribution policy at 5% returns

SMMs

Fiscal Year	Pension Liability (Actuarial Accrued Liability)						Pension Assets (Market Value)					Change in Pension Debt			Cash Flow		Employer Contribution		
	Payroll	Beginning of Period	Service Cost	Interest	Benefit Payments	End of Period	Beginning of Period	Total Contribution	Interest	Benefit Payments	End of Period	Debt	\$	% of Payroll	% Funded	% of Assets	\$	% Change	% Payroll
2020	857	6,149	84	450	(397)	6,285	4,220	207	204	(397)	4,233	2,052	123	14%	67%	-5%	137	N/A	16%
2021	885	6,285	86	459	(420)	6,410	4,233	213	204	(420)	4,230	2,180	128	15%	66%	-5%	141	3%	16%
2022	914	6,410	89	468	(436)	6,531	4,230	220	203	(436)	4,218	2,313	133	15%	65%	-5%	146	3%	16%
2023	944	6,531	92	477	(452)	6,648	4,218	230	203	(452)	4,198	2,450	136	14%	63%	-5%	151	3%	16%
2024	974	6,648	95	485	(466)	6,762	4,198	239	201	(466)	4,173	2,589	139	14%	62%	-5%	156	3%	16%
2025	1,006	6,762	97	493	(481)	6,871	4,173	247	200	(481)	4,138	2,733	144	14%	60%	-6%	160	3%	16%
2026	1,039	6,871	100	501	(495)	6,978	4,138	254	198	(495)	4,096	2,882	149	14%	59%	-6%	164	3%	16%
2027	1,073	6,978	103	509	(507)	7,083	4,096	262	195	(507)	4,046	3,037	155	14%	57%	-6%	169	3%	16%
2028	1,107	7,083	107	516	(519)	7,186	4,046	270	193	(519)	3,990	3,197	160	14%	56%	-6%	174	3%	16%
2029	1,143	7,186	110	524	(531)	7,289	3,990	279	190	(531)	3,927	3,362	165	14%	54%	-6%	178	3%	16%
2030	1,181	7,289	113	531	(541)	7,393	3,927	287	186	(541)	3,860	3,533	171	14%	52%	-6%	183	3%	16%
2031	1,219	7,393	117	539	(551)	7,497	3,860	296	183	(551)	3,787	3,709	177	14%	51%	-7%	189	3%	15%
2032	1,259	7,497	120	546	(561)	7,603	3,787	305	179	(561)	3,711	3,892	182	14%	49%	-7%	194	3%	15%
2033	1,300	7,603	124	554	(570)	7,711	3,711	315	175	(570)	3,630	4,080	188	14%	47%	-7%	199	3%	15%
2034	1,342	7,711	128	562	(579)	7,822	3,630	325	171	(579)	3,547	4,275	195	15%	45%	-7%	205	3%	15%
2035	1,385	7,822	132	570	(587)	7,938	3,547	335	167	(587)	3,462	4,476	201	15%	44%	-7%	211	3%	15%
2036	1,430	7,938	136	579	(594)	8,059	3,462	345	162	(594)	3,375	4,684	208	15%	42%	-7%	217	3%	15%
2037	1,477	8,059	140	588	(601)	8,186	3,375	356	158	(601)	3,288	4,898	215	15%	40%	-7%	223	3%	15%
2038	1,525	8,186	145	597	(607)	8,321	3,288	367	153	(607)	3,201	5,120	222	15%	38%	-7%	230	3%	15%
2039	1,574	8,321	149	607	(613)	8,465	3,201	378	149	(613)	3,115	5,350	230	15%	37%	-7%	236	3%	15%
2040	1,626	8,465	154	618	(617)	8,620	3,115	390	145	(617)	3,032	5,588	238	15%	35%	-7%	243	3%	15%
2041	1,678	8,620	159	630	(621)	8,788	3,032	402	141	(621)	2,954	5,834	246	15%	34%	-7%	250	3%	15%
2042	1,733	8,788	164	643	(624)	8,971	2,954	414	137	(624)	2,881	6,090	256	15%	32%	-7%	258	3%	15%
2043	1,789	8,971	169	656	(626)	9,170	2,881	427	133	(626)	2,815	6,355	265	15%	31%	-7%	265	3%	15%
2044	1,847	9,170	175	672	(627)	9,389	2,815	441	130	(627)	2,758	6,631	276	15%	29%	-7%	273	3%	15%
2045	1,908	9,389	180	688	(629)	9,629	2,758	454	127	(629)	2,711	6,918	287	15%	28%	-6%	281	3%	15%
2046	1,970	9,629	186	706	(631)	9,890	2,711	468	125	(631)	2,673	7,217	299	15%	27%	-6%	289	3%	15%
2047	2,034	9,890	192	726	(634)	10,174	2,673	483	123	(634)	2,645	7,529	312	15%	26%	-6%	298	3%	15%
2048	2,100	10,174	198	747	(638)	10,481	2,645	498	122	(638)	2,626	7,855	326	16%	25%	-5%	307	3%	15%
2049	2,168	10,481	205	770	(643)	10,813	2,626	513	121	(643)	2,617	8,196	341	16%	24%	-5%	316	3%	15%

Request #2

Montana Retirement System 30-Year Projections

Plans included: Public Employees' Retirement System and Teachers' Retirement System
 State contribution policy under asset shock with 20% loss

\$MMs

Fiscal Year	Pension Liability (Actuarial Accrued Liability)						Pension Assets (Market Value)					Change in Pension Debt			Cash Flow		Employer Contribution		
	Payroll	Beginning of Period	Service Cost	Interest	Benefit Payments	End of Period	Beginning of Period	Total Contribution	Interest	Benefit Payments	End of Period	Debt	\$	% of Payroll	% Funded	% of Assets	\$	% Change	% Payroll
2020	2,126	14,106	212	1,046	(867)	14,496	10,124	450	(1,989)	(867)	7,717	6,779	2,797	132%	53%	-4%	280	N/A	13%
2021	2,199	14,496	218	1,074	(922)	14,866	7,717	466	938	(922)	8,199	6,667	(112)	-5%	55%	-6%	290	4%	13%
2022	2,274	14,866	224	1,100	(969)	15,221	8,199	482	1,105	(969)	8,816	6,405	(262)	-12%	58%	-6%	300	4%	13%
2023	2,334	15,221	229	1,108	(1,016)	15,542	8,816	498	946	(1,016)	9,245	6,298	(107)	-5%	59%	-6%	309	3%	13%
2024	2,396	15,542	234	1,130	(1,060)	15,847	9,245	514	406	(1,060)	9,106	6,741	444	19%	57%	-6%	319	3%	13%
2025	2,459	15,847	239	1,152	(1,103)	16,135	9,106	527	433	(1,103)	8,962	7,172	431	18%	56%	-6%	326	2%	13%
2026	2,524	16,135	245	1,172	(1,145)	16,406	8,962	540	425	(1,145)	8,783	7,623	451	18%	54%	-7%	333	2%	13%
2027	2,591	16,406	250	1,191	(1,184)	16,663	8,783	554	415	(1,184)	8,568	8,096	472	18%	51%	-7%	341	2%	13%
2028	2,660	16,663	256	1,209	(1,221)	16,908	8,568	568	404	(1,221)	8,318	8,589	494	19%	49%	-8%	349	2%	13%
2029	2,733	16,908	262	1,228	(1,255)	17,143	8,318	582	390	(1,255)	8,036	9,107	517	19%	47%	-8%	357	2%	13%
2030	2,807	17,143	268	1,245	(1,287)	17,369	8,036	597	376	(1,287)	7,722	9,647	540	19%	44%	-9%	365	2%	13%
2031	2,884	17,369	274	1,261	(1,317)	17,587	7,722	613	359	(1,317)	7,377	10,210	563	20%	42%	-9%	374	2%	13%
2032	2,963	17,587	281	1,277	(1,345)	17,800	7,377	628	342	(1,345)	7,003	10,798	588	20%	39%	-10%	383	2%	13%
2033	3,044	17,800	288	1,292	(1,370)	18,010	7,003	645	322	(1,370)	6,600	11,410	613	20%	37%	-10%	392	2%	13%
2034	3,127	18,010	295	1,307	(1,393)	18,218	6,600	661	302	(1,393)	6,169	12,049	639	20%	34%	-11%	402	2%	13%
2035	3,212	18,218	302	1,322	(1,414)	18,428	6,169	678	280	(1,414)	5,713	12,715	666	21%	31%	-12%	411	2%	13%
2036	3,299	18,428	310	1,337	(1,433)	18,642	5,713	696	257	(1,433)	5,233	13,410	695	21%	28%	-13%	421	2%	13%
2037	3,389	18,642	317	1,353	(1,449)	18,864	5,233	714	232	(1,449)	4,729	14,134	724	21%	25%	-14%	431	2%	13%
2038	3,482	18,864	325	1,369	(1,464)	19,095	4,729	732	207	(1,464)	4,205	14,890	756	22%	22%	-15%	442	2%	13%
2039	3,577	19,095	334	1,380	(1,475)	19,334	4,205	751	181	(1,475)	3,662	15,672	782	22%	19%	-17%	452	2%	13%
2040	3,674	19,334	342	1,392	(1,483)	19,585	3,662	770	153	(1,483)	3,102	16,483	811	22%	16%	-19%	463	2%	13%
2041	3,775	19,585	351	1,405	(1,488)	19,854	3,102	790	126	(1,488)	2,530	17,324	841	22%	13%	-22%	475	2%	13%
2042	3,878	19,854	360	1,421	(1,490)	20,145	2,530	810	97	(1,490)	1,947	18,198	874	23%	10%	-27%	486	2%	13%
2043	3,983	20,145	370	1,438	(1,489)	20,463	1,947	831	68	(1,489)	1,357	19,106	909	23%	7%	-34%	498	2%	13%
2044	4,092	20,463	379	1,459	(1,486)	20,816	1,357	1,030	43	(1,486)	944	19,871	765	19%	5%	-34%	687	38%	17%
2045	4,204	20,816	389	1,482	(1,480)	21,207	944	1,276	29	(1,480)	769	20,438	567	13%	4%	-22%	924	34%	22%
2046	4,318	21,207	400	1,509	(1,474)	21,642	769	1,279	20	(1,474)	594	21,048	610	14%	3%	-25%	917	-1%	21%
2047	4,436	21,642	410	1,540	(1,467)	22,124	594	1,281	11	(1,467)	419	21,706	658	15%	2%	-31%	909	-1%	20%
2048	4,557	22,124	421	1,574	(1,461)	22,659	419	1,283	2	(1,461)	242	22,417	711	16%	1%	-43%	901	-1%	20%
2049	4,682	22,659	433	1,614	(1,455)	23,251	242	1,284	(7)	(1,455)	64	23,187	770	16%	0%	-71%	891	-1%	19%

Request #2

Montana Retirement System 30 Year Projections

Plans included: Public Employees' Retirement System
 State contribution policy under asset shock with 20% loss

\$MMs

Fiscal Year	Pension Liability (Actuarial Accrued Liability)						Pension Assets (Market Value)					Change in Pension Debt			Cash Flow		Employer Contribution		
	Payroll	Beginning of Period	Service Cost	Interest	Benefit Payments	End of Period	Beginning of Period	Total Contribution	Interest	Benefit Payments	End of Period	Debt	\$	% of Payroll	% Funded	% of Assets	\$	% Change	% Payroll
2020	1,269	7,957	128	596	(470)	8,211	5,903	243	(1,160)	(470)	4,516	3,694	1,641	129%	55%	-4%	143	N/A	11%
2021	1,313	8,211	132	614	(501)	8,455	4,516	252	561	(501)	4,828	3,627	(67)	-5%	57%	-6%	149	4%	11%
2022	1,359	8,455	135	632	(533)	8,690	4,828	262	664	(533)	5,221	3,469	(158)	-12%	60%	-6%	154	4%	11%
2023	1,395	8,690	138	636	(564)	8,900	5,221	269	572	(564)	5,498	3,402	(67)	-5%	62%	-6%	159	3%	11%
2024	1,432	8,900	141	651	(593)	9,099	5,498	277	243	(593)	5,425	3,674	272	19%	60%	-6%	164	3%	11%
2025	1,470	9,099	144	665	(623)	9,285	5,425	284	259	(623)	5,346	3,939	265	18%	58%	-6%	168	2%	11%
2026	1,509	9,285	147	678	(651)	9,459	5,346	291	255	(651)	5,241	4,218	279	18%	55%	-7%	172	2%	11%
2027	1,549	9,459	150	691	(677)	9,622	5,241	298	249	(677)	5,111	4,511	293	19%	53%	-7%	176	2%	11%
2028	1,590	9,622	153	702	(702)	9,775	5,111	306	242	(702)	4,956	4,819	307	19%	51%	-8%	180	2%	11%
2029	1,634	9,775	156	714	(726)	9,919	4,956	314	233	(726)	4,777	5,142	323	20%	48%	-8%	184	2%	11%
2030	1,678	9,919	160	724	(747)	10,055	4,777	321	224	(747)	4,575	5,480	338	20%	45%	-9%	189	2%	11%
2031	1,724	10,055	163	734	(768)	10,184	4,575	330	213	(768)	4,350	5,834	354	21%	43%	-10%	193	2%	11%
2032	1,771	10,184	167	743	(786)	10,308	4,350	338	202	(786)	4,103	6,204	370	21%	40%	-10%	198	2%	11%
2033	1,819	10,308	171	752	(803)	10,427	4,103	347	189	(803)	3,836	6,591	387	21%	37%	-11%	203	2%	11%
2034	1,869	10,427	175	760	(819)	10,543	3,836	355	175	(819)	3,547	6,996	405	22%	34%	-12%	208	2%	11%
2035	1,919	10,543	179	769	(832)	10,658	3,547	364	160	(832)	3,240	7,419	423	22%	30%	-13%	213	2%	11%
2036	1,972	10,658	183	777	(844)	10,774	3,240	374	145	(844)	2,914	7,860	442	22%	27%	-15%	218	2%	11%
2037	2,025	10,774	188	785	(855)	10,893	2,914	383	128	(855)	2,571	8,322	462	23%	24%	-16%	223	2%	11%
2038	2,081	10,893	192	794	(863)	11,017	2,571	393	111	(863)	2,212	8,805	483	23%	20%	-18%	229	2%	11%
2039	2,137	11,017	197	797	(870)	11,141	2,212	403	93	(870)	1,838	9,303	498	23%	16%	-21%	234	2%	11%
2040	2,196	11,141	202	801	(874)	11,270	1,838	413	74	(874)	1,452	9,819	515	23%	13%	-25%	240	2%	11%
2041	2,255	11,270	207	805	(876)	11,407	1,452	424	55	(876)	1,055	10,352	534	24%	9%	-31%	246	2%	11%
2042	2,317	11,407	212	810	(875)	11,555	1,055	435	35	(875)	649	10,906	553	24%	6%	-42%	252	2%	11%
2043	2,380	11,555	218	817	(873)	11,717	649	446	15	(873)	236	11,480	575	24%	2%	-66%	258	2%	11%
2044	2,445	11,717	224	826	(869)	11,897	236	634	(1)	(869)	0	11,897	417	17%	0%	-99%	441	71%	18%
2045	2,511	11,897	229	836	(863)	12,100	0	870	(8)	(863)	0	12,100	203	8%	0%	N/A	672	52%	27%
2046	2,580	12,100	235	849	(855)	12,329	0	863	(8)	(855)	0	12,329	230	9%	0%	N/A	659	-2%	26%
2047	2,650	12,329	242	864	(846)	12,589	0	854	(8)	(846)	0	12,589	260	10%	0%	N/A	645	-2%	24%
2048	2,722	12,589	248	883	(836)	12,884	0	844	(8)	(836)	0	12,884	295	11%	0%	N/A	629	-2%	23%
2049	2,796	12,884	255	904	(826)	13,217	0	834	(8)	(826)	0	13,217	333	12%	0%	N/A	613	-3%	22%

Request #2

Montana Retirement System 30 Year Projections

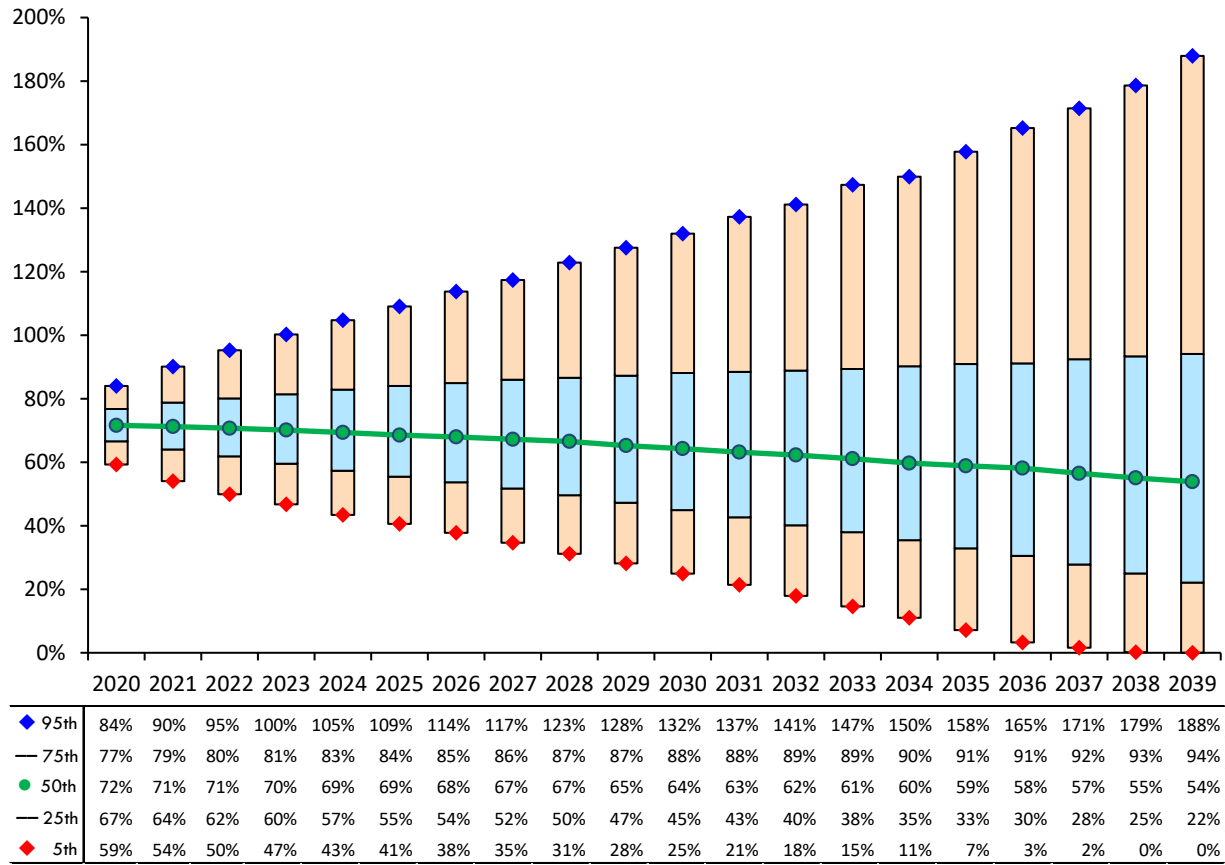
Plans included: Teachers' Retirement System
 State contribution policy under asset shock with 20% loss

\$MMs

Fiscal Year	Pension Liability (Actuarial Accrued Liability)						Pension Assets (Market Value)					Change in Pension Debt			Cash Flow		Employer Contribution		
	Payroll	Beginning of Period	Service Cost	Interest	Benefit Payments	End of Period	Beginning of Period	Total Contribution	Interest	Benefit Payments	End of Period	Debt	\$	% of Payroll	% Funded	% of Assets	\$	% Change	% Payroll
2020	857	6,149	84	450	(397)	6,285	4,220	207	(829)	(397)	3,201	3,084	1,156	135%	51%	-5%	137	N/A	16%
2021	885	6,285	86	459	(420)	6,410	3,201	213	377	(420)	3,371	3,040	(45)	-5%	53%	-6%	141	3%	16%
2022	914	6,410	89	468	(436)	6,531	3,371	220	441	(436)	3,595	2,936	(104)	-11%	55%	-6%	146	3%	16%
2023	938	6,531	91	471	(452)	6,642	3,595	228	374	(452)	3,746	2,896	(40)	-4%	56%	-6%	150	3%	16%
2024	963	6,642	93	479	(466)	6,748	3,746	237	164	(466)	3,681	3,068	172	18%	55%	-6%	154	3%	16%
2025	989	6,748	96	486	(481)	6,849	3,681	243	174	(481)	3,616	3,233	165	17%	53%	-6%	158	2%	16%
2026	1,015	6,849	98	494	(494)	6,947	3,616	249	170	(494)	3,542	3,405	172	17%	51%	-7%	161	2%	16%
2027	1,042	6,947	101	500	(507)	7,041	3,542	256	166	(507)	3,457	3,584	179	17%	49%	-7%	165	2%	16%
2028	1,070	7,041	103	507	(518)	7,133	3,457	262	162	(518)	3,362	3,771	186	17%	47%	-7%	169	2%	16%
2029	1,099	7,133	106	514	(529)	7,224	3,362	269	157	(529)	3,259	3,965	194	18%	45%	-8%	173	2%	16%
2030	1,129	7,224	108	521	(539)	7,314	3,259	276	152	(539)	3,147	4,166	202	18%	43%	-8%	177	2%	16%
2031	1,160	7,314	111	527	(549)	7,403	3,147	283	146	(549)	3,027	4,376	209	18%	41%	-8%	181	2%	16%
2032	1,192	7,403	114	534	(558)	7,492	3,027	290	140	(558)	2,899	4,593	217	18%	39%	-9%	185	2%	16%
2033	1,225	7,492	117	540	(567)	7,583	2,899	298	133	(567)	2,764	4,819	226	18%	36%	-9%	189	2%	15%
2034	1,258	7,583	120	547	(575)	7,675	2,764	306	127	(575)	2,622	5,053	234	19%	34%	-10%	194	2%	15%
2035	1,292	7,675	123	553	(582)	7,770	2,622	314	119	(582)	2,473	5,296	243	19%	32%	-10%	198	2%	15%
2036	1,328	7,770	126	560	(589)	7,868	2,473	322	112	(589)	2,319	5,549	253	19%	29%	-11%	203	2%	15%
2037	1,364	7,868	130	567	(595)	7,970	2,319	330	104	(595)	2,159	5,812	263	19%	27%	-11%	208	2%	15%
2038	1,401	7,970	133	575	(600)	8,078	2,159	339	96	(600)	1,993	6,085	273	19%	25%	-12%	213	2%	15%
2039	1,440	8,078	137	583	(605)	8,192	1,993	348	88	(605)	1,824	6,369	284	20%	22%	-13%	218	2%	15%
2040	1,479	8,192	140	591	(609)	8,315	1,824	357	79	(609)	1,651	6,664	295	20%	20%	-14%	224	2%	15%
2041	1,519	8,315	144	601	(612)	8,447	1,651	366	71	(612)	1,475	6,971	307	20%	17%	-15%	229	2%	15%
2042	1,561	8,447	148	610	(615)	8,590	1,475	376	62	(615)	1,298	7,292	320	21%	15%	-16%	235	2%	15%
2043	1,604	8,590	152	621	(616)	8,747	1,298	386	53	(616)	1,121	7,626	334	21%	13%	-18%	240	2%	15%
2044	1,647	8,747	156	633	(617)	8,919	1,121	396	45	(617)	944	7,974	348	21%	11%	-20%	246	2%	15%
2045	1,692	8,919	160	646	(617)	9,107	944	406	36	(617)	769	8,338	364	22%	8%	-22%	252	2%	15%
2046	1,739	9,107	164	660	(619)	9,312	769	416	27	(619)	594	8,718	380	22%	6%	-26%	258	2%	15%
2047	1,786	9,312	169	675	(621)	9,535	594	427	19	(621)	419	9,116	398	22%	4%	-33%	265	2%	15%
2048	1,835	9,535	173	692	(625)	9,775	419	438	10	(625)	242	9,533	417	23%	2%	-45%	271	2%	15%
2049	1,885	9,775	178	710	(629)	10,034	242	450	1	(629)	64	9,970	437	23%	1%	-74%	278	2%	15%

Request #3

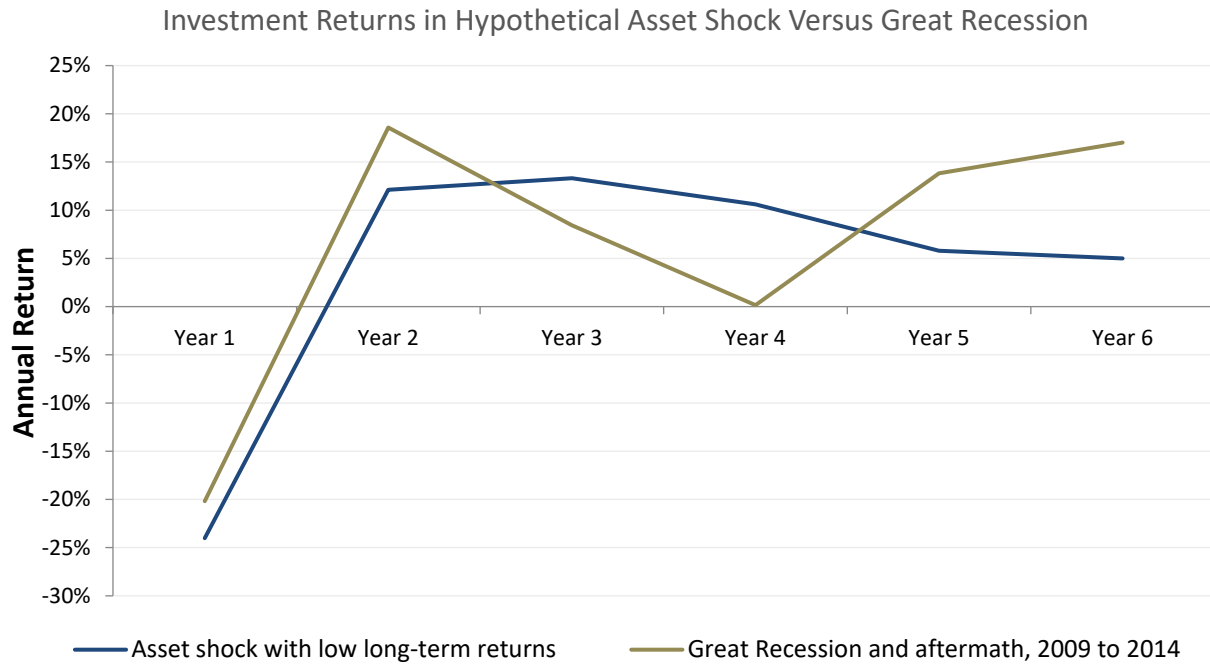
FIGURE 5
Range of Projected Funded Ratios, PERS and TRS Combined



Source: The Terry Group and The Pew Charitable Trusts

Question #1

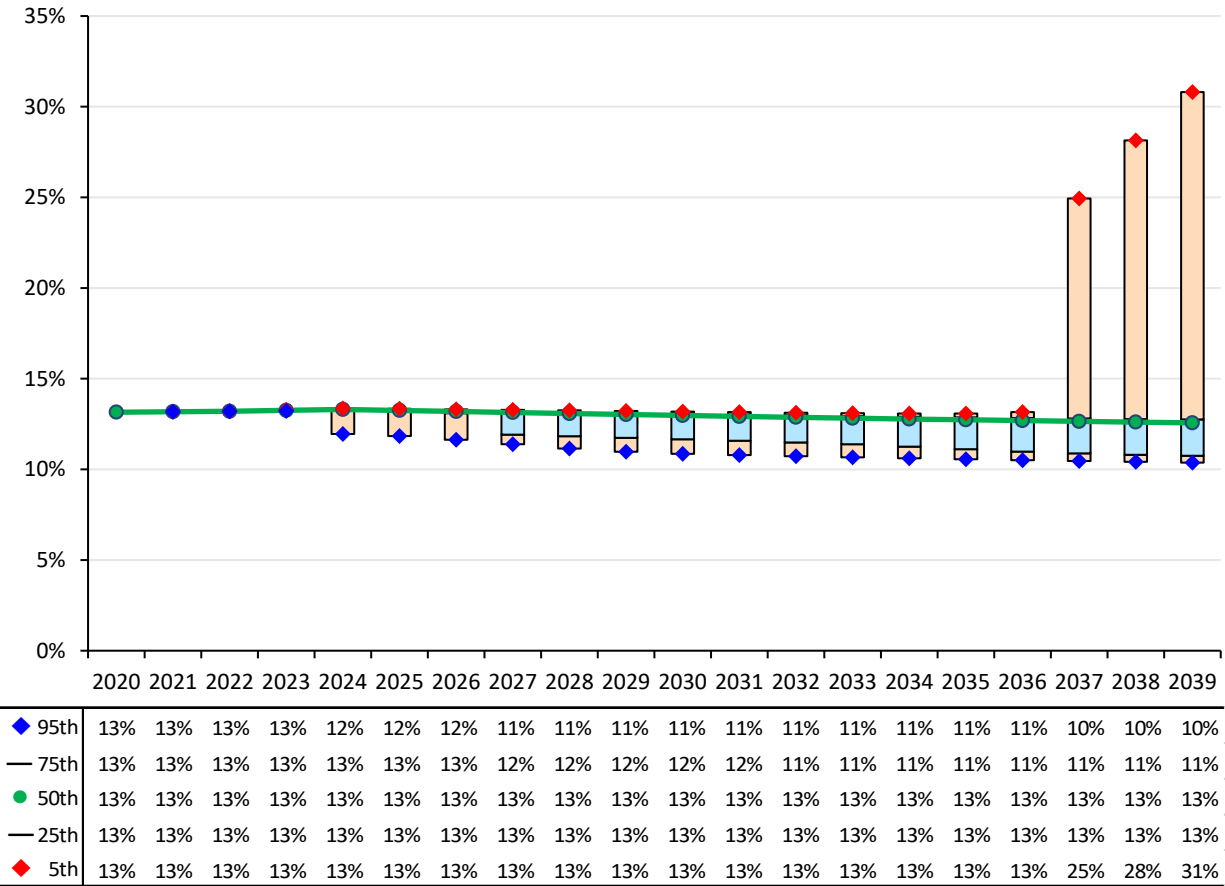
Pew's Asset Shock Scenario
Investment Returns Are Similar to Great Recession



Source: The Pew Charitable Trusts, The Terry Group, and FactSet Research Systems Inc.
Based on Federal Reserve's "2017 Supervisory Scenarios for Annual Stress Tests Required under the Dodd-Frank Act Stress Testing Rules."

Question #2

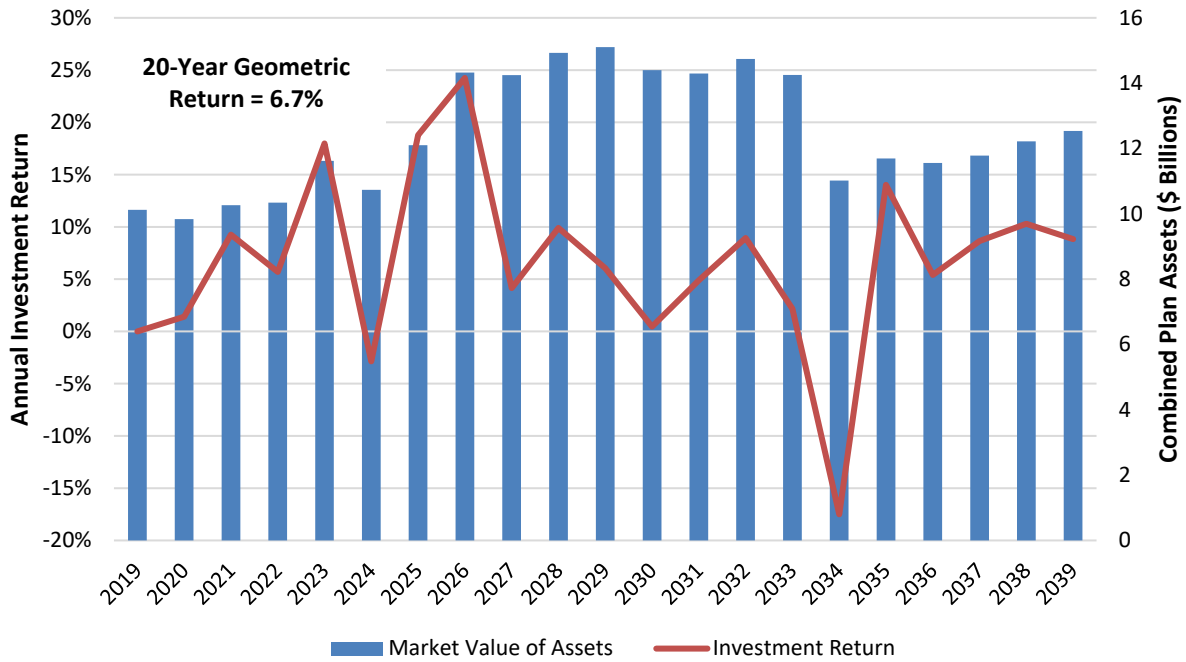
**FIGURE 5 – Alternative
Range of Projected Employer Contribution Rates (% of Payroll), PERS and TRS Combined**



Source: The Terry Group and The Pew Charitable Trusts

Question #3

FIGURE 6 – Alternative
Annual Investment Returns and Combined Plan Assets in Stochastic Trial 7792



Note: Combined plan funded ratio in 2039 is 66%, down from 72% in 2019.
Source: The Terry Group and The Pew Charitable Trusts