

Vermont State Retirement Systems

RISK ASSESSMENT AND STOCHASTIC MODELING

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This document has been prepared by Segal Consulting for the benefit of the Board of Trustees of the Vermont State Retirement Systems and is not complete without the presentation provided to the Board of Trustees.



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The calculations were performed under the supervision of Matthew Strom, FSA, MAAA, EA.

Caveat regarding projections: Projections, by their nature, are not a guarantee of future results. The modeling projections are intended to serve as estimates of future financial outcomes that are based on the information available to us at the time the modeling is undertaken and completed, and the agreed-upon assumptions and methodologies described herein. Emerging results may differ significantly if the actual experience proves to be different from these assumptions or if alternative methodologies are used. Actual experience may differ due to such variables as demographic experience, the economy, stock market performance and the legal environment.



Executive Summary

Executive Summary

Introduction

The actuarial valuation reports completed for the Vermont State Retirement Systems were prepared based on a fixed set of economic and demographic actuarial assumptions under the premise that the future experience of the Systems would be consistent with those assumptions. While those assumptions are reviewed every few years (the last full experience study was completed for the four-year period ending June 30, 2014 and the next full experience study will reflect experience for the five-year period ending June 30, 2019), there is a risk that emerging results may differ significantly as actual experience is fluid and will not completely track current assumptions.

The purpose of this report is to assist the Boards of the State Employees' Retirement System (VSERS), the State Teachers' Retirement System (VSTRS), and the Municipal Employees' Retirement System (VMERS), participating employers and members, and other stakeholders to better understand and assess the risk profile of the Systems, as well as the particular risks inherent in using a fixed set of actuarial assumptions in preparing the valuation reports.

New Actuarial Standard of Practice on Risk Assessment

The Actuarial Standards Board approved the new Actuarial Standard of Practice No. 51 (ASOP 51) regarding risk assessment when performing a funding or pricing valuation. ASOP 51 requires actuaries to identify and assess risks that “may reasonably be anticipated to significantly affect the plan’s future financial condition.” Examples of key risks listed that are relevant to the Vermont Retirement Systems are investment risk, demographic risk, maturity risk, and regulatory risk.

Executive Summary *continued*

The Standard also requires the actuary to consider if there is an ongoing contribution risk to the plan; however, it does not require the actuary to evaluate the particular ability or willingness of contributing entities to make contributions when due.

The actuary's initial assessment can be strictly a qualitative discussion about potential adverse experience and the possible effect on future results, but it may also include quantitative numerical demonstrations where informative. The actuary is also encouraged to consider a recommendation as to whether a more detailed risk assessment would be significantly beneficial for the intended user in order to examine particular financial risks. When making that recommendation, the actuary will take into account such factors as the Systems' plan designs, risk profiles, maturity, size, funded status, asset allocation, cash flow, possible insolvency and current market conditions. This report is the more detailed risk assessment as agreed upon with the Systems and the stakeholders.

Goals of the Risk Assessment

A primary purpose of the risk assessment was to evaluate the reasonableness of the current investment return assumption of 7.50%. The investment return assumption was lowered from 8.25% to 7.95% as a result of the 2014 Experience Study and lowered again to 7.50% with the June 30, 2017 actuarial valuations. As shown in this report, based on 2018 Capital Market Assumptions (CMAs) provided by the Systems' investment advisor, New England Pension Consultants (NEPC), there is a 50% chance of returning a compounded 7.5% return over the next 20 years. To compare the NEPC capital market assumptions to assumptions used by other

Executive Summary *continued*

Investment advisors, we looked at the Survey of Capital Market Assumptions (2018 Edition) completed by Horizon Actuarial Services, LLC. Horizon Actuarial Services, LLC has been surveying investment firms since 2010 and publishing the results. The 2018 survey reflects the capital market assumptions of 34 investment firms, including NEPC. Using the average survey assumptions, we confirmed the 50% chance of returning a compounded 7.5% return over the next 20 years.

It is important to recognize that the actuarial assumption does not affect the performance of the fund, nor should an actuarial assumption dictate asset allocation or investment policy. The Retirement Boards, in consultation with the Vermont Pension Investment Committee (VPIC), sets investment policy based on their determination of the appropriate balance between projected returns and risk, as advised by NEPC.

To illustrate the impact of lowering the investment return assumption further, we determined that there is a 54% chance of returning a compounded 7.3% return over the next 20 years. Therefore, if the investment return assumption was lowered to 7.3%, the Systems could have a higher level of confidence that the assumption would be met. However, in the short-term, the actuarial accrued liability and employer contribution requirements will increase, as shown on slide 15 of the report.

Another primary purpose of the risk assessment was to identify the range of possible outcomes for key metrics of the Systems. For VSERS and VSTRS, these key metrics were the projected funded ratio of the System and the projected State contribution to each System. Because the employer (and employee) contributions are set by statute for VMERS, the key metric for VMERS was the projected funded ratio. The projections based on current assumptions and current law are referred to as the baseline projections.

Executive Summary *continued*

Funding a retirement system generally involves an employer contribution that has two components. The first component is referred to as the normal cost. This is the amount that is required to be paid each year to fund benefits that are expected to be earned during that year by current employees. The normal cost is expected to increase as payroll increases. While the normal cost amount will vary somewhat from year to year, it is expected to remain fairly stable as a percentage of payroll.

The second component is a payment on the unfunded liability. Vermont statute requires that the unfunded liability be liquidated by the fiscal year ending on June 30, 2038. The statute also provides that beginning July 1, 2019, the payment on the unfunded liability shall be calculated such that it is expected to increase 3% per year. From July 1, 2009 through June 30, 2019, payments were expected to increase 5% per year. Due to the size of the unfunded liability, the payment on the unfunded liability is much larger than the normal cost payment. Furthermore, the unfunded liability and therefore the payment on the unfunded liability are much more volatile than the normal cost due to market fluctuations in the value of the Systems' assets. This occurs even with the use of actuarial techniques to smooth out market volatility.

As the System becomes better funded and as the full funding date approaches, even small fluctuations in investment performance will have a significant impact on the State contribution. Large fluctuations will have even more significant impacts. As you review this report, please note that all projections are shown in dollars for the projection year, not in today's dollars, unless otherwise noted. A dollar in the year ended June 30, 2038 is worth 63 cents in today's dollars*.

This report quantifies the range of possible outcomes and assigns probabilities to those outcomes so that the State and stakeholders can appreciate the potential for large increases in employer contributions and begin to think about options to mitigate the risks.

* Based on the inflation assumption of 2.5%

Executive Summary *continued*

Variables Considered in the Risk Assessment

There are a limited number of levers that can be moved to change the cost of a retirement plan. This risk assessment looks at changes in both employer contributions (cash infusions) for VSERS and VSTRS and changes in employee contributions for VSTRS. For VMERS, changes in both employer and employee contribution rates were modeled.

We also looked at the impact of workforce changes on the projections – both the impact of incenting employees to leave employment and the impact of incenting employees to delay retirement. The incentives used to change behavior would be cash payments paid by the State, not the Systems.

While benefit changes will affect the future costs of a retirement plan, benefits changes were not a part of this study.

Finally, changes in investment policy may result in either an increase or decrease in the expected return of invested assets. If the expected return increases, the assumed investment return may be increased or it may be held steady so that the likelihood of achieving the return increases. If the expected return decreases, the assumed investment return will likely be lowered. If a change in the investment policy results in a change in the assumed investment return, the cost of the plan will also change. Changes in investment policy were not a part of this study.

Executive Summary *continued*

Key Takeaways from the Risk Assessment

There is likely to be increased volatility in employer contributions as the System becomes better funded and as the full funding date approaches. We recommend that the Retirement Boards consider implementing a strategy to amortize future gains and losses over an extended time period. That period of time could be from 5 to 15 years. Each gain or loss established in a future year would have a separate amortization schedule. This approach is often referred to as rolling amortization. Because this strategy would require a change to current statute, appropriate lead time would be necessary before implementation.

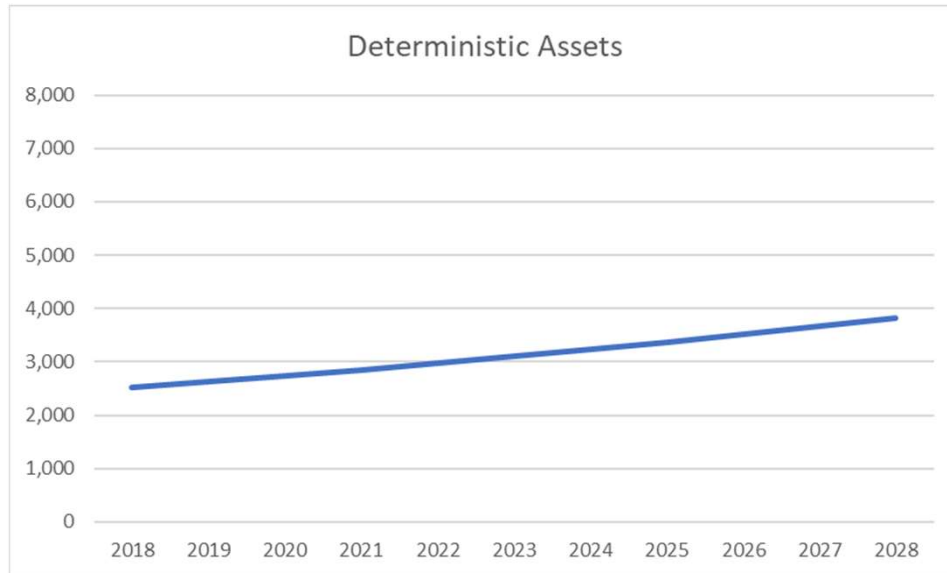
While there is likely to be increased volatility as the Systems approach full funding, there will be relief for the State and the employers when the unfunded liability is eliminated. While some of those contributions may be redirected for other purposes, we recommend that the State and the Boards consider continuing some of those payments to the Systems to derisk the investment portfolio.

Objectives and Background

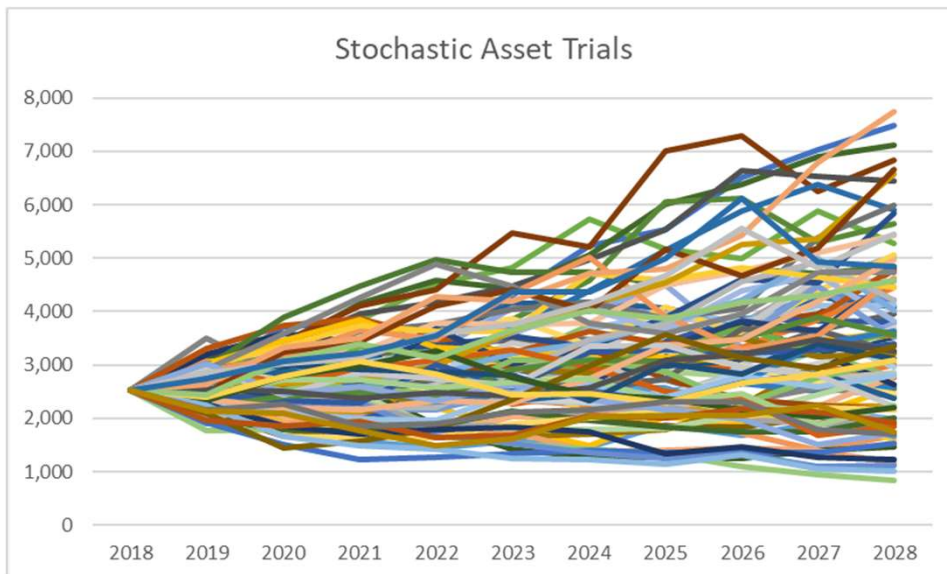
Objectives of a Risk Assessment and Stochastic Modeling

- Segal has been retained to perform stochastic and deterministic modeling for the Vermont State Retirement Systems:
 - State Employees' Retirement System (VSERS);
 - State Teachers' Retirement System (VSTRS);
 - Municipal Employees' Retirement System (VMERS)
- The stochastic analysis presents the projected employer contributions and projected funded percentage in terms of the "likelihood" (probability) and range of certain outcomes:
 - Results are shown under the long-term target asset allocation approved by the Vermont Pension Investment Committee (VPIC)
 - Generally used to assess the long-term funding issues that may not be readily evident in a deterministic analysis as well as comparing results under various employment scenarios
- The deterministic analysis is intended to present the funding position of the Plan under a series of "what if" scenarios:
 - Used to test the sensitivity of projected employer contributions to general market conditions and specific market cycles

Explanation of Deterministic vs. Stochastic



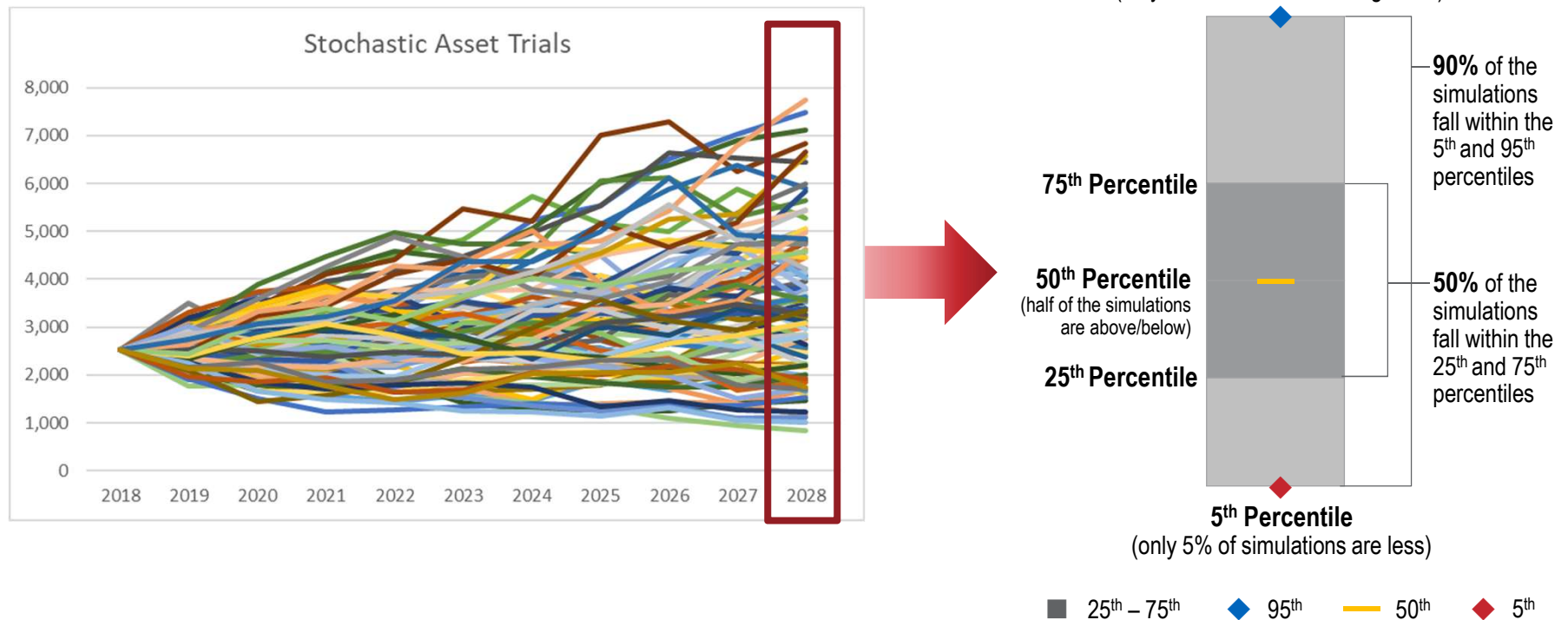
- Deterministic projections convey **expectation** and directional trend, but give no sense of the possible volatility of results
- They are **simpler and easier** to understand but are difficult to use in assessing alternative and do not measure risk/reward trade-offs



- Stochastic projections produce a distribution of results so expectation and **volatility** around expected results can be calculated
- They are **complex** and require many assumptions but are superior in terms of aiding decisions that require the weighing of **risk/reward** trade-offs
- Typically 2,500 to 5,000 trials are run

Explanation of Deterministic vs. Stochastic

The data is grouped into percentiles and summarized as a range



- The median is represented by the yellow line at the center of the distribution
- The dark gray shaded rectangle represents 50% of all outcomes around the median
- The large, light gray rectangle (inclusive of the dark gray area) represents 90% of all outcomes around the median
- Other percentile results/probabilities are calculated as well

Investment Return Assumption for Actuarial Valuation

- The assumed rate of investment return to use in the actuarial valuations for VSERS, VSTRS and VMERS was reviewed and lowered to 7.50% as of June 30, 2017.
- The investment return assumption consists of two components:
 1. Long-term expected inflation, and
 2. Real rate of return
 - Real return represents the excess of what the assets earn over inflation
- Our analysis of the expected real rate of return was based on:
 - The long-term target asset allocation established by the VPIC
 - The Horizon Survey of Capital Market Assumptions (2016 Edition)
 - This survey compiles and averages the capital market assumptions of 35 investment consultants (including NEPC and Segal Marco Advisors)

Assumed Rate of Investment Return

- The following table shows the components of the investment return assumption as reviewed with the June 30, 2017 actuarial valuation:

Component		
Inflation		2.50%
Gross Real Rate of Return	5.55%	
Investment Expense	(0.50%)	
Net Real Rate of Return		5.05%
Total Expected Rate of Return		7.55%
Adjustment ¹	(0.05%)	
Recommended Return Assumption		7.50%
Confidence Level		51%

- As a result of this review, the assumption was lowered from 7.95% to 7.5%
- Capital market assumptions have continued to decline, and public sector retirement systems continue to lower their assumed rate of investment returns.

¹ Adjusting the real rate of return downward increases the likelihood of meeting the expectation over a 20-year period. For example, the 5 basis point reduction in the recommended assumption increases the likelihood of meeting the expectation from 50% to 51%.

Lowering the Investment Return Assumption

- Lowering the investment return assumption from the current 7.50% assumption to 7.30% would increase the likelihood of meeting the assumption to 54%.
- As requested, we have estimated the impact of lowering the assumption on liabilities and employer contributions for VSERS and VSTRS, as shown below:

Description (\$Millions)	VSERS	VSTRS
Actuarial Accrued Liability¹		
• Current Assumption (7.50%)	\$2,758.9	\$3,441.1
• Alternative Assumption (7.30%)	2,823.4	3,516.3
• Increase/(Decrease)	+64.5	+75.2
• Percentage Increase/(Decrease)	+2.3%	+2.2%
Funded Percentage²		
• Current Assumption (7.50%)	71.0%	55.5%
• Alternative Assumption (7.30%)	69.4%	54.3%
• Increase/(Decrease)	-1.6%	-1.2%
Employer Contribution³		
• Current Assumption (7.50%)	\$82.0	\$130.6
• Alternative Assumption (7.30%)	88.6	136.3
• Increase/(Decrease)	+6.6	+5.7
• Percentage Increase/(Decrease)	+8.0%	+4.4%

¹ Estimated July 1, 2019 Actuarial Accrued Liabilities based on the results of the June 30, 2018 Actuarial Valuation Report, projected forward using standard actuarial techniques.

² Estimated July 1, 2019 Funded Percentages based on the results of the June 30, 2018 Actuarial Valuation Report, projected forward using standard actuarial techniques.

³ Estimate fiscal 2021 Employer Contribution results, determined based on the results of the June 30, 2018 Actuarial Valuation Report, projected forward to July 1, 2019 using standard actuarial techniques.

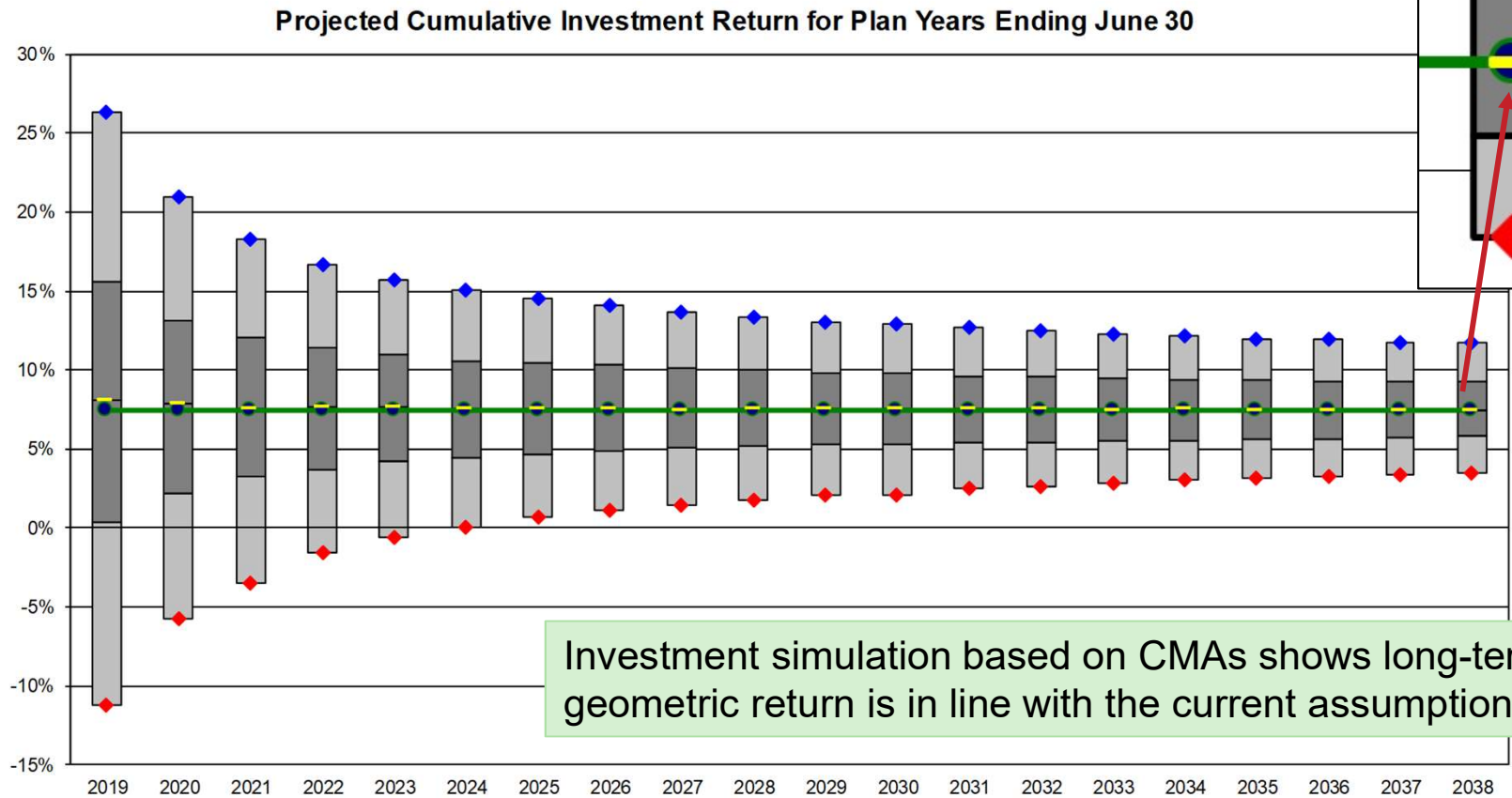
Stochastic Modeling of Investment Return

- The modeling of future simulated return trials in this report is based on NEPC Capital Market Assumptions (CMAs) and the long-term target asset allocation approved by VPIC shown below:

	Asset Class	Target Allocation
Fixed/Alternative	Core Plus/Core Fixed	20%
	US TIPS	3%
	Private Credit	5%
	Emerging Market Debt	4%
	Short-term Quality Credit	5%
	Core Real Estate	5%
	Non-core Real Estate	3%
	Infrastructure	2%
Equity	US Large Cap	4%
	US Small/Mid Cap	3%
	Non-US Developed	5%
	International Small Cap	2%
	Global	29%
	Private Equity	10%

- The 2018 Horizon Survey CMAs were run in parallel and the long-term geometric returns were consistent with the NEPC results.

Investment Simulations Used in Stochastic Modeling



◆ 95th	26.3%	21.0%	18.3%	16.7%	15.7%	15.1%	14.5%	14.1%	13.7%	13.4%	13.1%	12.9%	12.7%	12.5%	12.3%	12.1%	12.0%	11.9%	11.8%	11.7%	
■ 75th	15.6%	13.2%	12.0%	11.4%	11.0%	10.6%	10.5%	10.3%	10.1%	10.0%	9.9%	9.8%	9.6%	9.6%	9.5%	9.4%	9.4%	9.3%	9.2%	9.2%	
■ 50th	8.1%	7.8%	7.6%	7.7%	7.7%	7.6%	7.5%	7.6%	7.5%	7.5%	7.6%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
■ 25th	0.4%	2.2%	3.3%	3.7%	4.2%	4.5%	4.7%	4.9%	5.0%	5.1%	5.3%	5.3%	5.4%	5.4%	5.5%	5.6%	5.6%	5.7%	5.7%	5.8%	
◆ 5th	-11.2%	-5.8%	-3.4%	-1.5%	-0.6%	0.1%	0.7%	1.2%	1.5%	1.8%	2.1%	2.1%	2.5%	2.6%	2.8%	3.0%	3.1%	3.2%	3.3%	3.4%	
●	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	

● Current investment return assumption

Basis for Projections

- Unless otherwise noted, the projections shown in our study were based on the July 1, 2018 actuarial valuations for each system and the following additional assumptions:
 - The liabilities for July 1, 2019 and later years are projected on an open group basis where the number of active participants remains level, unless otherwise noted, with new entrants having the same demographics as new entrants over the past three years;
 - Demographic experience emerges as assumed; and
 - No future changes in plan of benefits, employee contribution rates, laws, or actuarial assumptions.

- Because the market value of assets (MVA) can be very volatile, the Board for each system has adopted an asset valuation method that reduces or smooths year-to-year volatility. The actuarial value of assets (AVA) is used in these projections to determine the unfunded liability, funded ratios and employer contributions.

- Projected dollars shown in this report are nominal for future years and are unadjusted for inflation. Based on an underlying inflation assumption of 2.5% per year, the following table can be used to estimate the value of future amounts in today's dollars.

2020	2022	2024	2026	2028	2030	2032	2034	2036	2038	2040
0.98	0.93	0.88	0.84	0.80	0.76	0.73	0.69	0.66	0.63	0.60

- For example, a projected contribution in 2038 of \$220 million can be adjusted by 0.63 to estimate a contribution in today's dollars of \$139 million.

Baseline Stochastic Modeling Results

- Because the employer contributions for the State Employees' (VSERS) and State Teachers' (VSTRS) plans are based on an actuarially determined contribution amount, the following metrics were modeled:
 - Projected funded percentage (AVA basis)
 - Projected state contribution amount
 - Projected unfunded actuarial accrued liability (AVA basis) (included in *Appendix*)
 - Projected unfunded liability payment (included in *Appendix*)
- Because employer contributions for the Municipal Employees' (VMERS) plan are based on fixed schedules, the following metric was modeled:
 - Projected funded percentage (AVA basis)
- The modeling for VSERS and VSTRS will be shown together, followed by the modeling for VMERS.

Baseline Stochastic Modeling Results *continued*

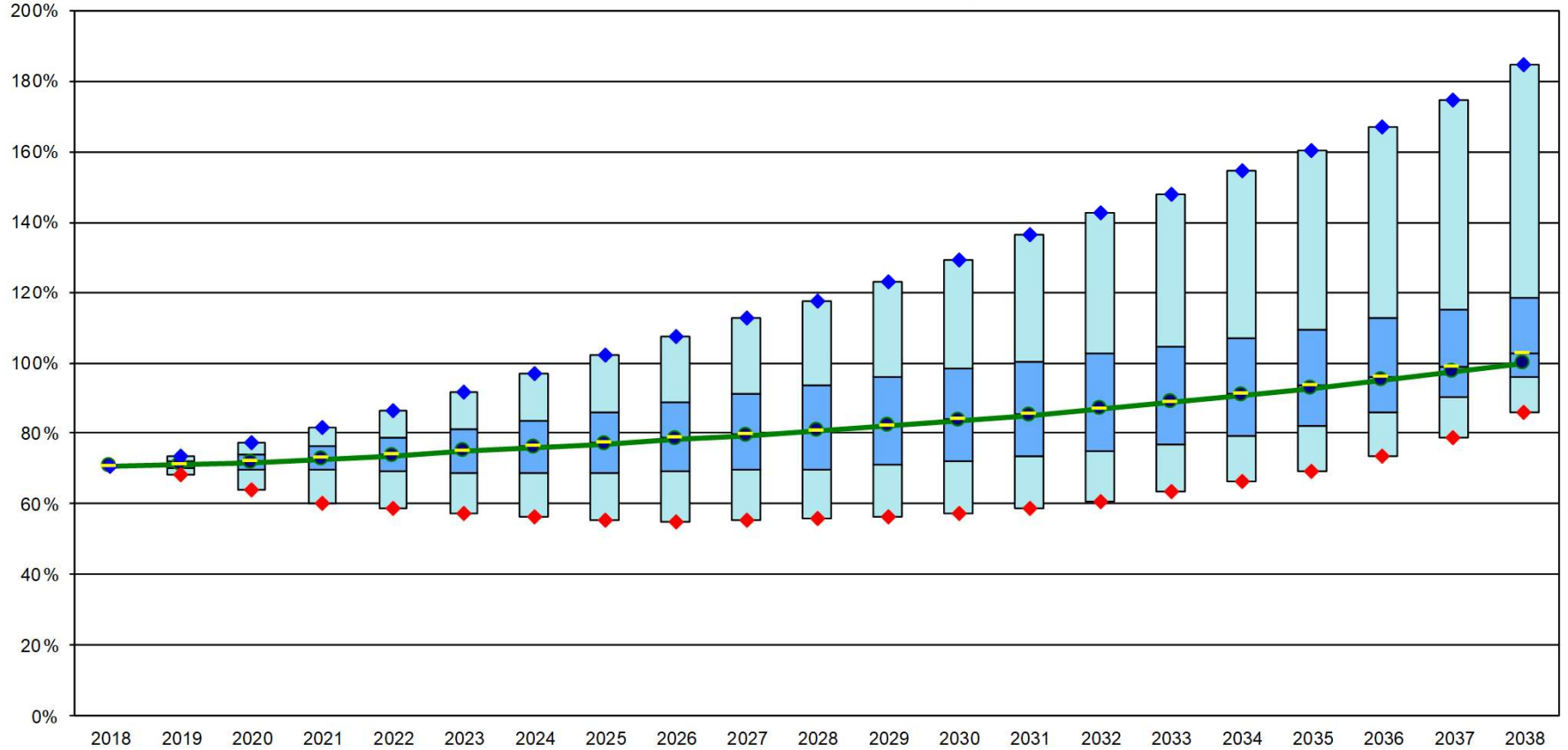
- The projected funded percentages are shown as of the beginning of the fiscal year. Therefore, the last bar labeled as 2038 is as of July 1, 2038. At the 25th and 5th percentiles, the plans are not fully funded by June 30, 2038 due to losses incurred in fiscal 2038.
- The projected employer contributions are shown for the fiscal year ending June 30. The bar labeled 2038 is for the fiscal year ending June 30, 2038 and is the projected contribution needed to fully fund the plan by the end of the fiscal year. The last bar labeled 2039 is for the fiscal year ending June 30, 2039.
- In running our stochastic projections, many trials result in VSERS and VSTRS reaching full funding levels prior to the end of the projection period. At this point in these scenarios, State contributions are limited to \$0. As a result, projected State contributions at the 50th percentile are slightly lower than the deterministic projections in these later years.
- In the deterministic projections, the employer contribution for fiscal 2039 is the normal cost payment. At the 50th percentile, the fiscal 2039 projected employer contribution is zero because there are investment gains on an actuarial basis, which exceed the normal cost payment.
- If at any point in a trial outcome the amortization of any surplus position is greater than the employer normal cost payment, the employer contribution is set equal to zero.

VSERS AND VSTRS

Baseline Projections

VSERS Baseline – Projected Funded Percentage

Projected Funded Percentage as of July 1

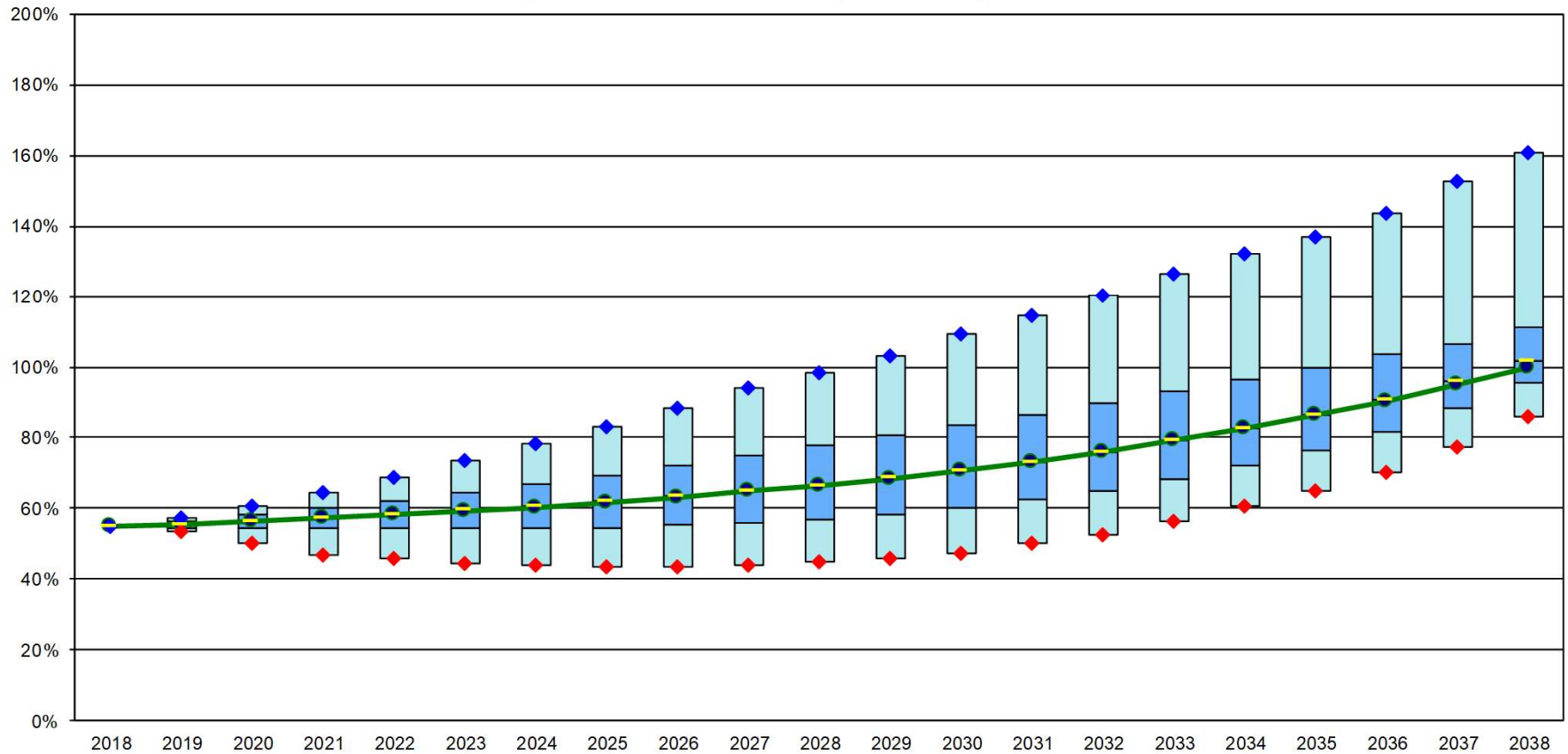


◆ 95th	71%	74%	77%	82%	87%	92%	97%	102%	107%	113%	117%	123%	129%	136%	142%	148%	154%	160%	167%	175%	184%
■ 75th	71%	72%	74%	77%	79%	81%	84%	86%	89%	91%	94%	96%	98%	100%	102%	105%	107%	110%	112%	115%	118%
■ 50th	71%	71%	72%	73%	74%	75%	76%	77%	79%	80%	81%	82%	84%	85%	87%	89%	91%	93%	96%	99%	103%
■ 25th	71%	70%	70%	70%	69%	69%	69%	69%	69%	70%	70%	71%	72%	73%	75%	77%	79%	82%	86%	90%	96%
◆ 5th	71%	69%	64%	60%	59%	57%	56%	55%	55%	55%	56%	57%	57%	59%	61%	63%	66%	70%	73%	79%	86%
●	71%	71%	72%	73%	74%	75%	76%	77%	78%	79%	81%	82%	84%	85%	87%	89%	91%	93%	95%	97%	100%

● Baseline deterministic projection using current 7.5% investment return assumption

VSTRS Baseline – Projected Funded Percentage

Projected Funded Percentage as of July 1



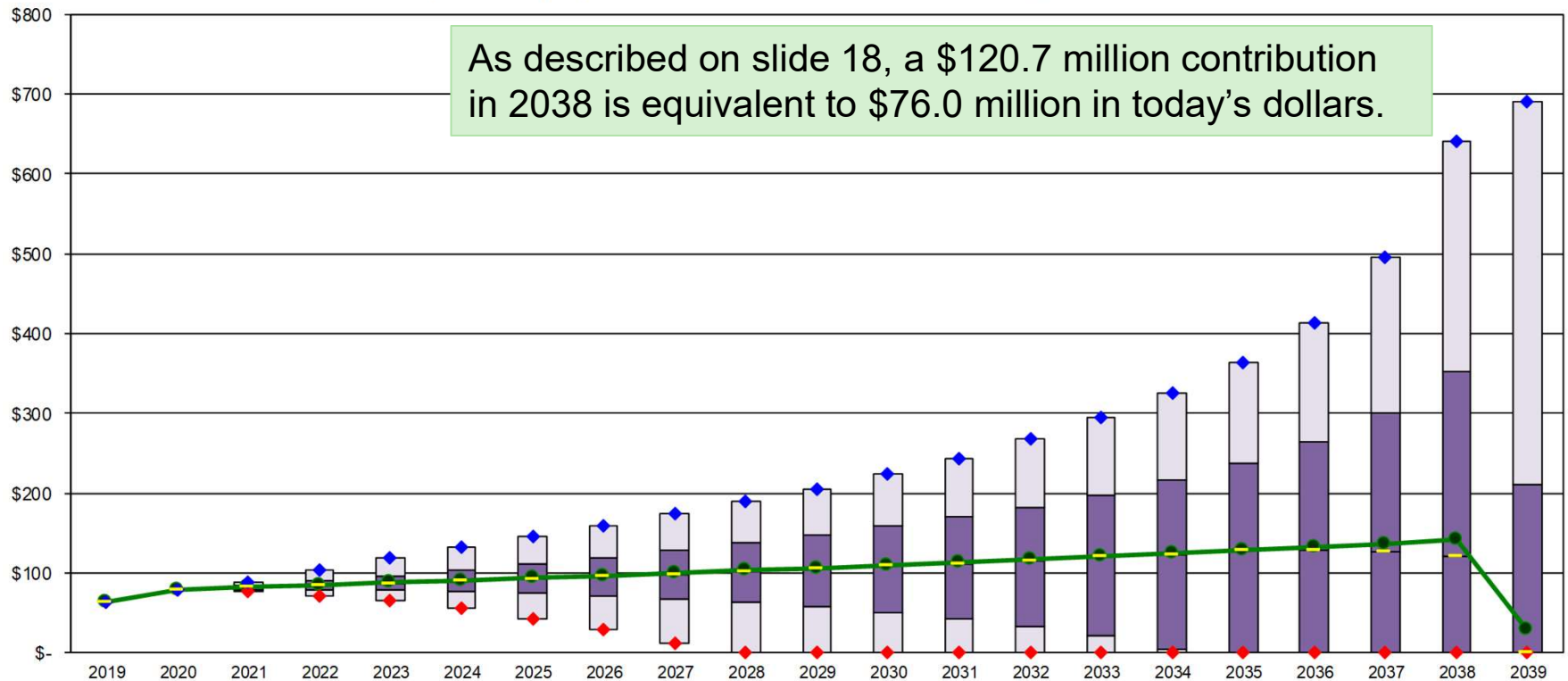
◆ 95th	55%	57%	61%	64%	69%	73%	78%	83%	88%	94%	98%	103%	109%	115%	120%	126%	132%	137%	144%	153%	161%
■ 75th	55%	56%	58%	60%	62%	65%	67%	69%	72%	75%	78%	81%	84%	87%	90%	93%	96%	100%	103%	107%	111%
■ 50th	55%	56%	56%	57%	58%	60%	61%	62%	63%	65%	67%	69%	71%	73%	76%	79%	83%	87%	91%	96%	102%
■ 25th	55%	55%	55%	55%	54%	54%	54%	55%	55%	56%	57%	59%	60%	63%	65%	68%	72%	76%	82%	88%	96%
◆ 5th	55%	54%	50%	47%	46%	45%	44%	43%	43%	44%	45%	46%	48%	50%	53%	56%	61%	65%	70%	77%	86%
●	55%	55%	56%	57%	58%	59%	60%	62%	63%	65%	67%	69%	71%	73%	76%	79%	83%	86%	90%	95%	100%

● Baseline deterministic projection using current 7.5% investment return assumption

VSERS Baseline – Projected State Contribution

\$ in millions

Projected Employer Contribution for Fiscal Years Ending June 30



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
◆ 95th	63.0	78.9	87.5	102.9	119.1	131.9	145.5	159.1	174.6	190.3	205.6	223.3	243.5	268.9	294.4	326.3	363.5	413.0	495.5	641.1	690.0
■ 75th	63.0	78.9	84.1	89.6	95.8	102.9	110.9	119.2	128.2	137.1	146.9	159.2	170.0	183.0	198.1	217.3	237.7	265.0	300.5	352.7	211.6
■ 50th	63.0	78.9	81.9	84.3	87.2	90.2	92.4	95.5	98.0	101.2	105.6	109.1	112.2	114.8	120.3	122.8	128.3	128.9	127.2	120.7	-
■ 25th	63.0	78.9	79.7	79.3	78.2	76.8	74.3	71.5	67.8	63.3	57.8	50.1	41.7	32.4	20.8	4.6	-	-	-	-	-
◆ 5th	63.0	78.9	76.5	71.7	64.9	55.5	43.4	29.0	12.2	-	-	-	-	-	-	-	-	-	-	-	-
●	63.0	78.9	82.0	84.8	87.7	90.6	93.5	96.5	99.5	102.7	106.0	109.4	113.0	116.6	120.4	124.2	128.3	132.4	136.7	141.4	28.8

● Baseline deterministic projection using current 7.5% investment return assumption

Present value of 50th percentile contributions (based on 2.5% inflation assumption):

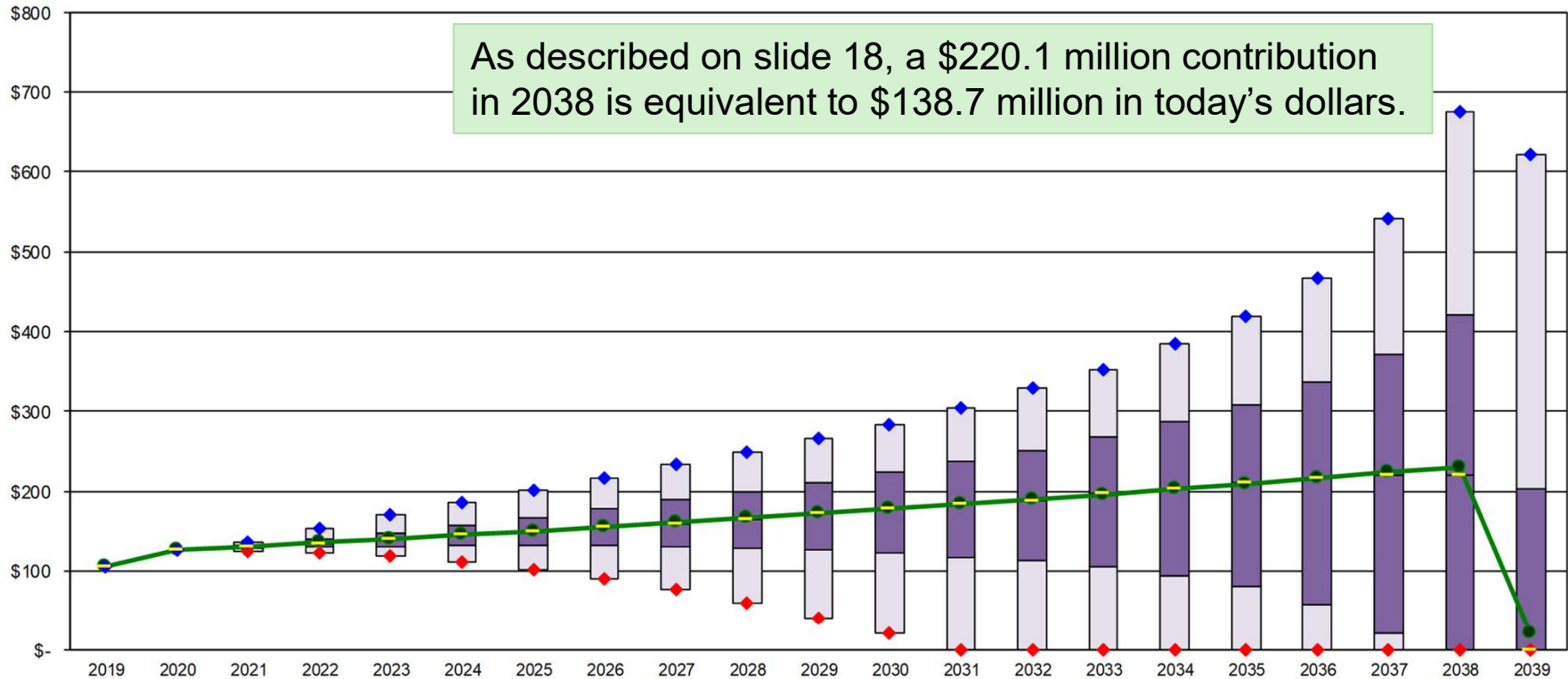
PV	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
	63.0	77.4	77.8	78.4	79.3	79.4	79.5	80.2	80.3	80.9	82.4	82.9	83.0	83.8	85.4	84.7	85.9	85.1	81.4	76.0	-

In the baseline deterministic projection, when all assumptions are met, the contribution in 2039 (after the UAL is paid down) still includes an employer normal cost payment.

VSTRS Baseline – Projected State Contribution

\$ in millions

Projected Employer Contribution for Fiscal Years Ending June 30



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
◆ 95th	105.6	126.2	136.0	153.3	171.2	185.4	200.9	216.1	232.9	249.6	266.1	283.9	304.9	328.8	353.2	384.5	419.6	466.6	541.4	674.8	621.2
■ 75th	105.6	126.2	132.6	140.2	148.3	157.4	167.3	177.7	188.8	199.6	211.3	224.9	237.9	251.6	268.5	287.8	308.2	336.8	371.8	422.0	202.7
■ 50th	105.6	126.2	130.4	134.8	139.8	144.8	149.3	154.6	159.7	165.4	171.9	177.6	183.3	188.6	196.5	202.5	209.9	215.5	219.7	220.1	-
■ 25th	105.6	126.2	128.3	129.9	131.0	131.8	131.9	131.8	130.6	128.8	126.5	122.7	117.2	112.4	105.6	94.7	81.1	58.1	21.3	-	-
◆ 5th	105.6	126.2	125.2	122.5	118.0	110.9	101.6	90.4	76.9	60.5	39.7	20.9	-	-	-	-	-	-	-	-	-
●	105.6	126.2	130.6	135.3	140.3	145.3	150.4	155.7	161.1	166.6	172.2	178.0	183.9	190.0	196.3	202.7	209.3	216.1	223.2	230.6	20.9

● Baseline deterministic projection using current 7.5% investment return assumption

Present value of 50th percentile contributions (based on 2.5% inflation assumption):

PV	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
	105.6	123.7	123.9	125.4	127.2	127.5	128.4	129.8	130.9	132.4	134.1	135.0	135.6	137.7	139.5	139.7	140.6	142.3	140.6	138.7	-

In the baseline deterministic projection, when all assumptions are met, the contribution in 2039 (after the UAL is paid down) still includes an employer normal cost payment.

VMERS

Baseline Projections

VMERS Baseline Projections

- The current member and employer contribution rates are shown on the following page.
- As noted in the July 1, 2018 actuarial valuation report, the current employer contribution rate for Group A exceeds the actuarially determined contribution rate, while the current employer contribution rates for Groups B, C and D are less than the actuarially determined contribution rate.
- However, when the actuarially determined contribution rates are recalculated for fiscal 2020 based on 3% increasing amortization payments, the current employer contribution rates for all Groups will be less than the actuarially determined contribution rate.
- On a deterministic basis, the current contribution rates are insufficient to fund the liabilities by June 30, 2038. In fact, on a deterministic basis, the funded ratio is projected to decline, beginning in a few years. On a stochastic basis, there is an 34% chance of the liabilities being fully funded by June 30, 2038.
- For VMERS, the baseline scenarios generally do not result in full funding, since contribution rates are assumed to remain level. As a result, the funded percentage at the 50th percentile for most years is approximately equal to the funded percentage in our deterministic projection.

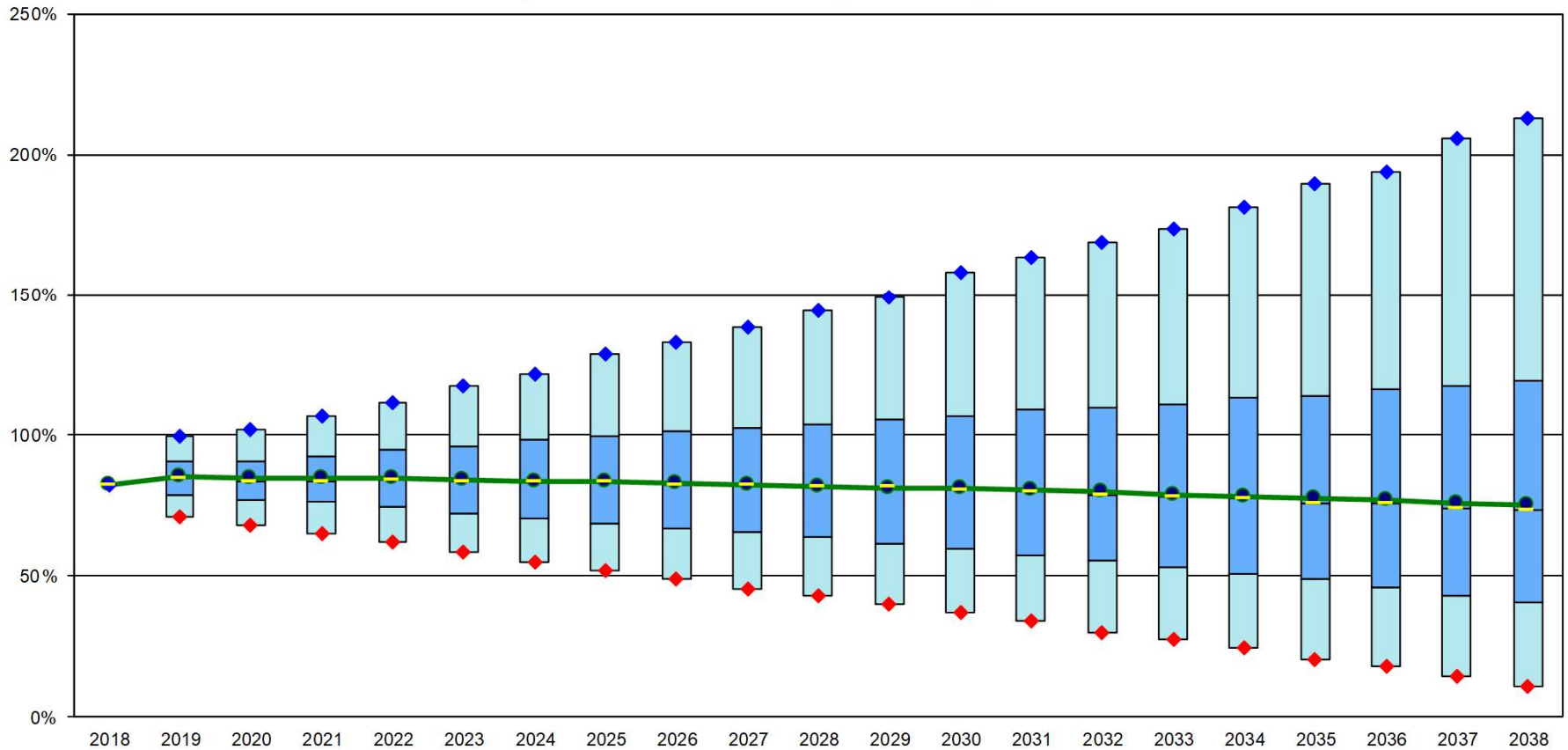
VMERS Baseline Contribution Rates

VMERS Member Contribution Rates								
	Group A		Group B		Group C		Group D	
	Rate	Change	Rate	Change	Rate	Change	Rate	Change
FY19	2.625%	+0.125%	5.000%	+0.125%	10.125%	+0.125%	11.475%	+0.125%
FY20	2.750%	+0.125%	5.125%	+0.125%	10.250%	+0.125%	11.600%	+0.125%
FY21	3.000%	+0.250%	5.375%	+0.250%	10.500%	+0.250%	11.850%	+0.250%
FY22+	3.250%	+0.250%	5.625%	+0.250%	10.750%	+0.250%	12.100%	+0.250%

VMERS Employer Contribution Rates								
	Group A		Group B		Group C		Group D	
	Rate	Change	Rate	Change	Rate	Change	Rate	Change
FY19	4.125%	+0.125%	5.625%	+0.125%	7.375%	+0.125%	9.975%	+0.125%
FY20	4.250%	+0.125%	5.750%	+0.125%	7.500%	+0.125%	10.100%	+0.125%
FY21	4.500%	+0.250%	6.000%	+0.250%	7.750%	+0.250%	10.350%	+0.250%
FY22+	4.750%	+0.250%	6.250%	+0.250%	8.000%	+0.250%	10.600%	+0.250%

VMERS Results – Projected Funded Percentage

Projected Funded Percentage as of July 1



◆ 95th	82%	100%	102%	107%	112%	118%	122%	129%	133%	139%	144%	149%	158%	163%	169%	173%	181%	190%	194%	206%	213%
■ 75th	82%	91%	91%	93%	95%	96%	98%	100%	101%	103%	104%	106%	107%	109%	110%	111%	113%	114%	116%	118%	119%
■ 50th	82%	85%	84%	84%	84%	84%	84%	83%	83%	83%	82%	82%	81%	80%	79%	79%	78%	76%	76%	74%	73%
■ 25th	82%	79%	77%	76%	75%	72%	71%	69%	67%	66%	64%	62%	60%	57%	56%	53%	51%	49%	46%	43%	41%
◆ 5th	82%	71%	68%	65%	62%	59%	55%	52%	49%	46%	43%	40%	37%	34%	30%	28%	25%	21%	18%	14%	11%
●	82%	85%	85%	85%	85%	84%	84%	83%	83%	83%	82%	81%	81%	80%	80%	79%	78%	78%	77%	76%	75%

● Baseline deterministic projection using current 7.5% investment return assumption

VSERS AND VSTRS

Additional Modeling

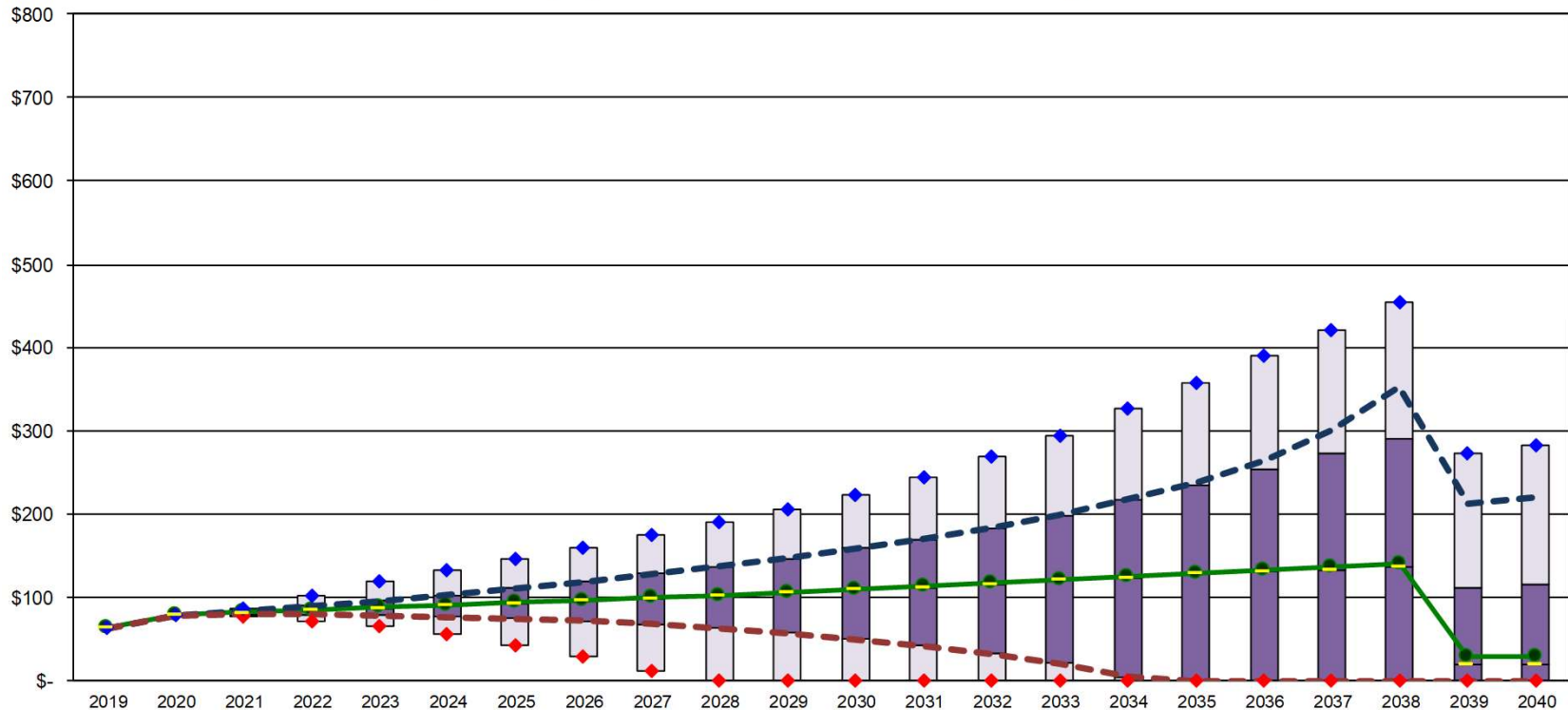
Rolling Amortization Periods

- As shown on the prior slides, with a closed amortization schedule there will be significant volatility in employer contributions as the plans approach fiscal 2038.
- To mitigate the impact of experience gains and losses on the employer contributions, the plans may want to extend the amortization payments on these gains and losses past fiscal 2038.
- We have modeled projected employer contributions using 5- and 10-year rolling amortization periods for gains and losses. The 5-year rolling amortizations are implemented beginning in fiscal 2035 and the 10-year rolling amortizations are implemented in fiscal 2030.
- With rolling amortization, the employer contributions at the 75th and 95th percentiles are lower through fiscal 2038 and higher in fiscal 2039 and beyond compared to the baseline.

VSERS 5-Year Rolling Amortization Period – Projected State Contribution

\$ in millions

Projected Employer Contribution for Fiscal Years Ending June 30



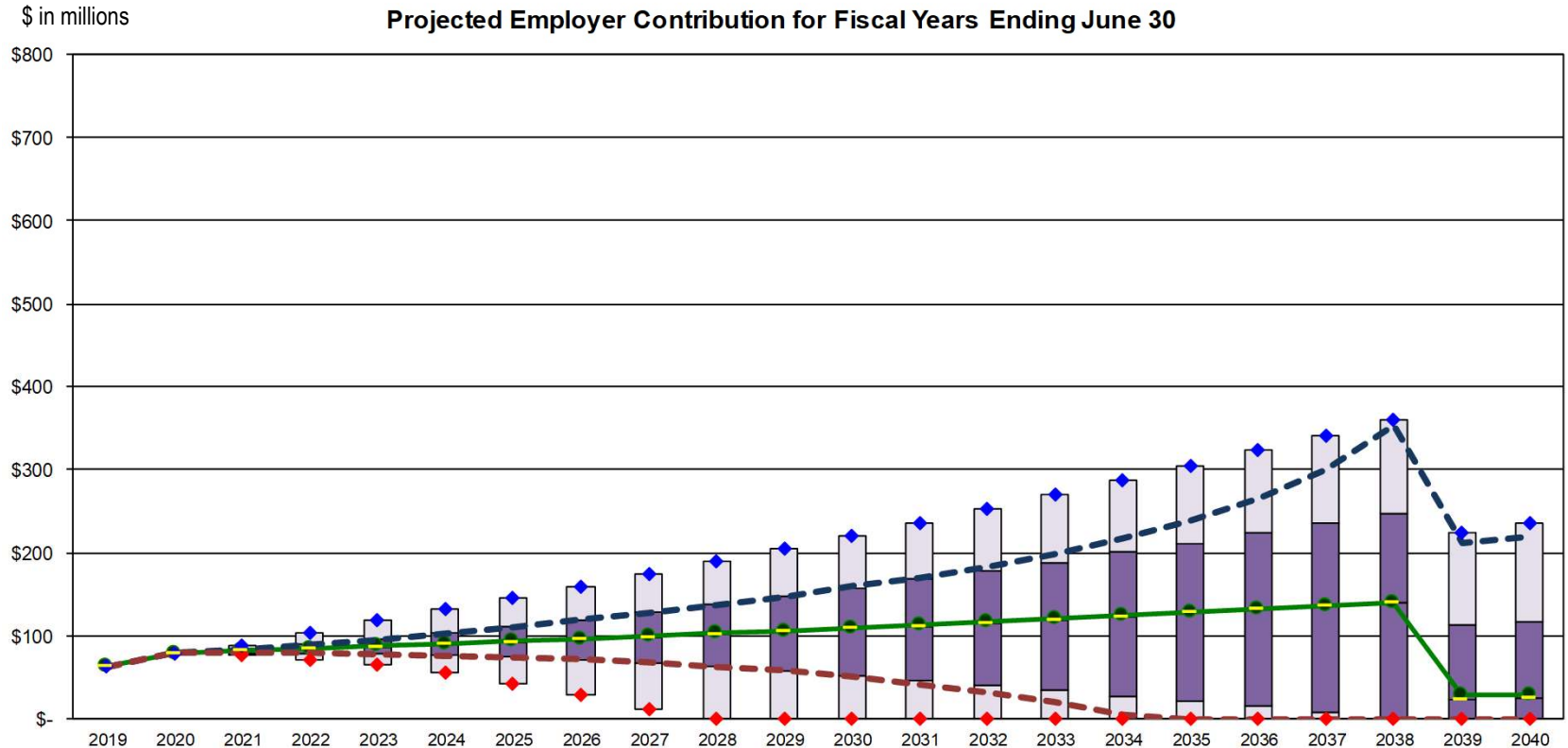
◆ 95th	63.0	78.9	87.5	102.9	119.1	131.9	145.5	159.1	174.6	190.3	205.6	223.3	243.5	268.9	294.4	326.3	356.5	389.3	421.4	455.9	272.6	282.7
— 75th	63.0	78.9	84.1	89.6	95.8	102.9	110.9	119.2	128.2	137.1	146.9	159.2	170.0	183.0	198.1	217.3	234.7	253.9	272.1	289.7	112.0	116.1
■ 50th	63.0	78.9	81.9	84.3	87.2	90.2	92.4	95.5	98.0	101.2	105.6	109.1	112.2	114.8	120.3	122.8	128.7	130.5	132.6	136.0	20.1	19.8
■ 25th	63.0	78.9	79.7	79.3	78.2	76.8	74.3	71.5	67.8	63.3	57.8	50.1	41.7	32.4	20.8	4.6	-	-	-	-	-	-
◆ 5th	63.0	78.9	76.5	71.7	64.9	55.5	43.4	29.0	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-
●	63.0	78.9	82.0	84.8	87.7	90.6	93.5	96.5	99.5	102.7	106.0	109.4	113.0	116.6	120.4	124.2	128.2	132.3	136.4	140.7	28.3	29.0

● Deterministic projection using current 7.5% investment return assumption

For comparison purposes -- 75th (- - -) and 25th (- - -) percentile projections from baseline using no rolling amortization period

- - -	63.0	78.9	84.1	89.6	95.8	102.9	110.9	119.2	128.2	137.1	146.9	159.2	170.0	183.0	198.1	217.3	237.7	265.0	300.5	352.7	211.6	219.3
- - -	63.0	78.9	79.7	79.3	78.2	76.8	74.3	71.5	67.8	63.3	57.8	50.1	41.7	32.4	20.8	4.6	-	-	-	-	-	-

VSERS 10-Year Rolling Amortization Period – Projected State Contribution



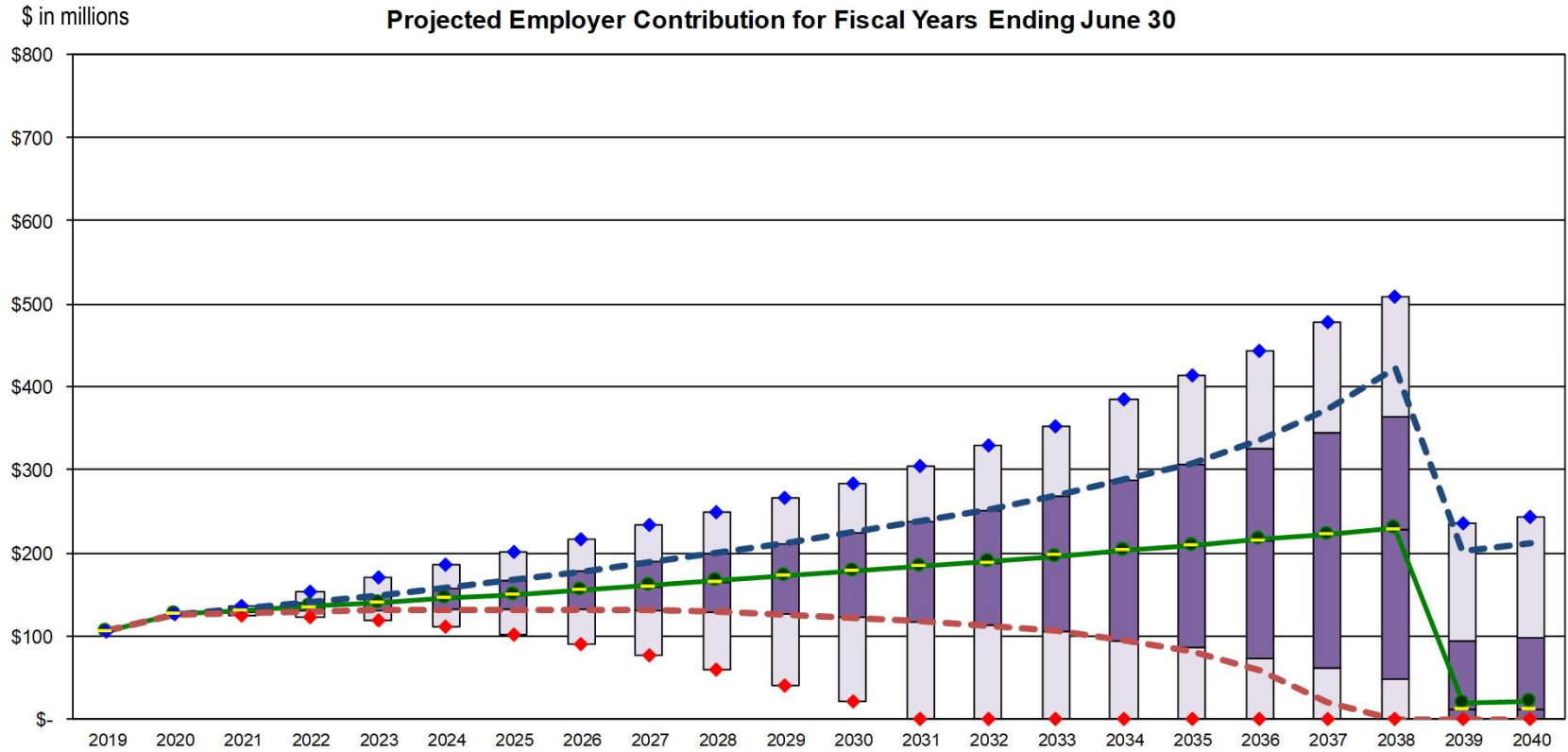
◆ 95th	63.0	78.9	87.5	102.9	119.1	131.9	145.5	159.1	174.6	190.3	205.6	221.0	236.0	253.2	269.4	287.5	305.0	323.9	340.6	359.5	224.5	235.3
— 75th	63.0	78.9	84.1	89.6	95.8	102.9	110.9	119.2	128.2	137.1	146.9	158.1	167.8	177.9	188.4	200.4	211.2	223.7	236.2	247.1	112.8	117.0
— 50th	63.0	78.9	81.9	84.3	87.2	90.2	92.4	95.5	98.0	101.2	105.6	109.2	111.8	114.8	119.0	123.0	127.8	131.8	136.1	139.4	23.8	26.1
— 25th	63.0	78.9	79.7	79.3	78.2	76.8	74.3	71.5	67.8	63.3	57.8	51.3	45.5	40.6	34.2	26.6	21.6	15.9	8.3	-	-	-
◆ 5th	63.0	78.9	76.5	71.7	64.9	55.5	43.4	29.0	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-
●	63.0	78.9	82.0	84.8	87.7	90.6	93.5	96.5	99.5	102.7	106.0	109.4	112.9	116.5	120.1	123.9	127.7	131.7	135.7	139.9	29.2	29.8

● Deterministic projection using current 7.5% investment return assumption

For comparison purposes -- 75th (- - -) and 25th (- - -) percentile projections from baseline using no rolling amortization period

- - -	63.0	78.9	84.1	89.6	95.8	102.9	110.9	119.2	128.2	137.1	146.9	159.2	170.0	183.0	198.1	217.3	237.7	265.0	300.5	352.7	211.6	219.3
- - -	63.0	78.9	79.7	79.3	78.2	76.8	74.3	71.5	67.8	63.3	57.8	50.1	41.7	32.4	20.8	4.6	-	-	-	-	-	-

VSTRS 5-Year Rolling Amortization Period – Projected State Contribution



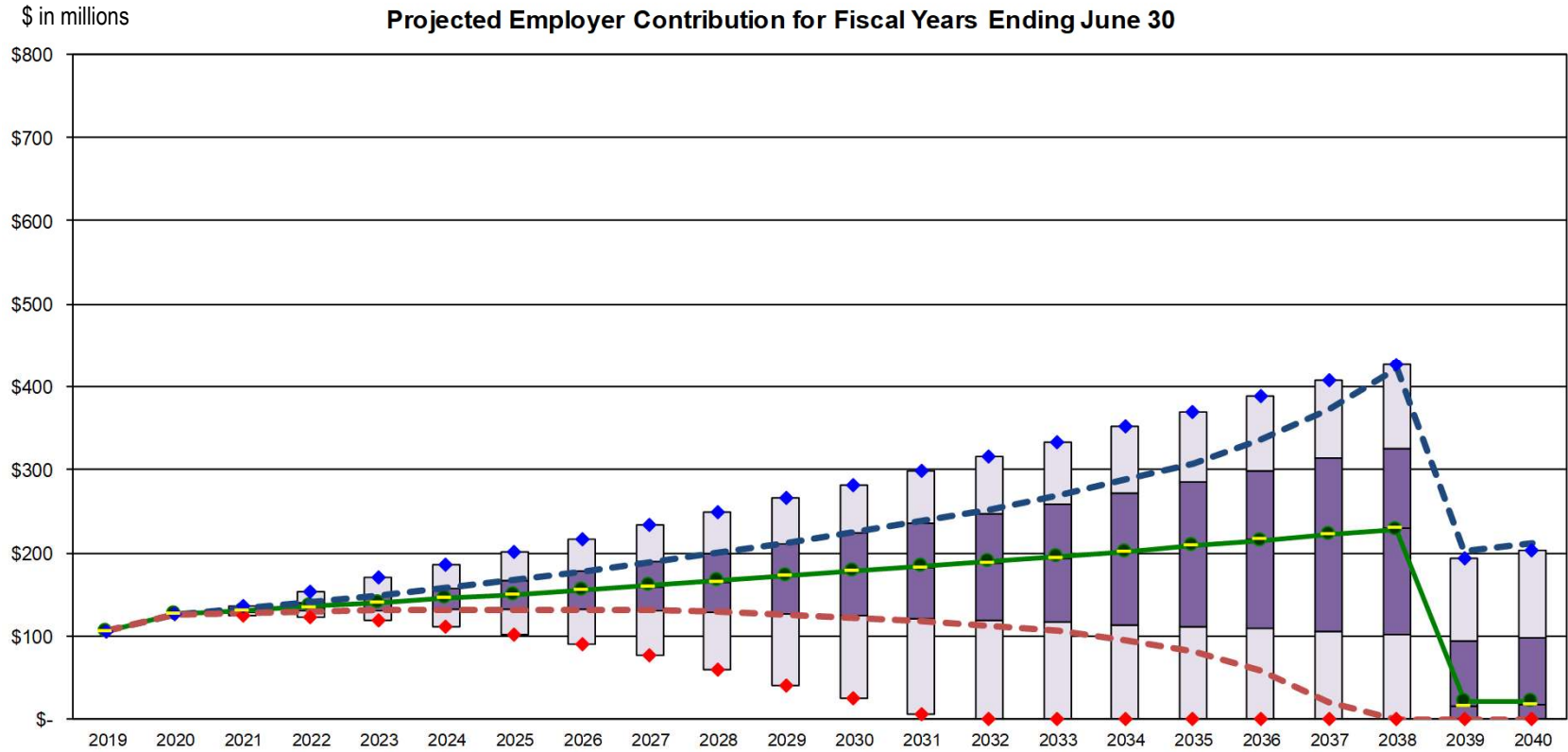
◆ 95th	105.6	126.2	136.0	153.3	171.2	185.4	200.9	216.1	232.9	249.6	266.1	283.9	304.9	328.8	353.2	384.5	413.5	443.8	477.9	509.5	236.2	242.9
■ 75th	105.6	126.2	132.6	140.2	148.3	157.4	167.3	177.7	188.8	199.6	211.3	224.9	237.9	251.6	268.5	287.8	306.0	326.1	345.5	364.4	93.2	97.5
● 50th	105.6	126.2	130.4	134.8	139.8	144.8	149.3	154.6	159.7	165.4	171.9	177.6	183.3	188.6	196.5	202.5	209.6	214.9	221.6	227.0	12.4	11.8
■ 25th	105.6	126.2	128.3	129.9	131.0	131.8	131.9	131.8	130.6	128.8	126.5	122.7	117.2	112.4	105.6	94.7	85.9	73.1	61.6	47.6	-	-
◆ 5th	105.6	126.2	125.2	122.5	118.0	110.9	101.6	90.4	76.9	60.5	39.7	20.9	-	-	-	-	-	-	-	-	-	-
●	105.6	126.2	130.6	135.3	140.3	145.3	150.4	155.7	161.1	166.6	172.2	178.0	183.9	190.0	196.3	202.7	209.2	215.8	222.6	229.6	20.0	20.6

● Deterministic projection using current 7.5% investment return assumption

For comparison purposes -- 75th (- - -) and 25th (- - -) percentile projections from baseline using no rolling amortization period

- - -	105.6	126.2	132.6	140.2	148.3	157.4	167.3	177.7	188.8	199.6	211.3	224.9	237.9	251.6	268.5	287.8	308.2	336.8	371.8	422.0	202.7	212.1
- - -	105.6	126.2	128.3	129.9	131.0	131.8	131.9	131.8	130.6	128.8	126.5	122.7	117.2	112.4	105.6	94.7	81.1	58.1	21.3	-	-	-

VSTRS 10-Year Rolling Amortization Period – Projected State Contribution



◆ 95th	105.6	126.2	136.0	153.3	171.2	185.4	200.9	216.1	232.9	249.6	266.1	281.5	297.9	315.5	332.7	351.4	369.1	388.7	407.1	425.9	193.6	202.5
■ 75th	105.6	126.2	132.6	140.2	148.3	157.4	167.3	177.7	188.8	199.6	211.3	223.8	235.3	247.1	259.1	272.8	285.3	299.5	313.9	326.2	94.3	97.7
▲ 50th	105.6	126.2	130.4	134.8	139.8	144.8	149.3	154.6	159.7	165.4	171.9	177.6	183.0	188.2	194.5	201.5	209.1	216.0	222.0	229.0	15.9	17.2
■ 25th	105.6	126.2	128.3	129.9	131.0	131.8	131.9	131.8	130.6	128.8	126.5	124.1	121.0	119.4	117.1	112.8	111.4	108.6	105.2	101.2	-	-
◆ 5th	105.6	126.2	125.2	122.5	118.0	110.9	101.6	90.4	76.9	60.5	39.7	24.7	6.9	-	-	-	-	-	-	-	-	-
●	105.6	126.2	130.6	135.3	140.3	145.3	150.4	155.7	161.1	166.6	172.2	177.9	183.7	189.7	195.8	202.0	208.4	215.0	221.7	228.6	20.7	21.2

● Deterministic projection using current 7.5% investment return assumption

For comparison purposes -- 75th (- - -) and 25th (- - -) percentile projections from baseline using no rolling amortization period

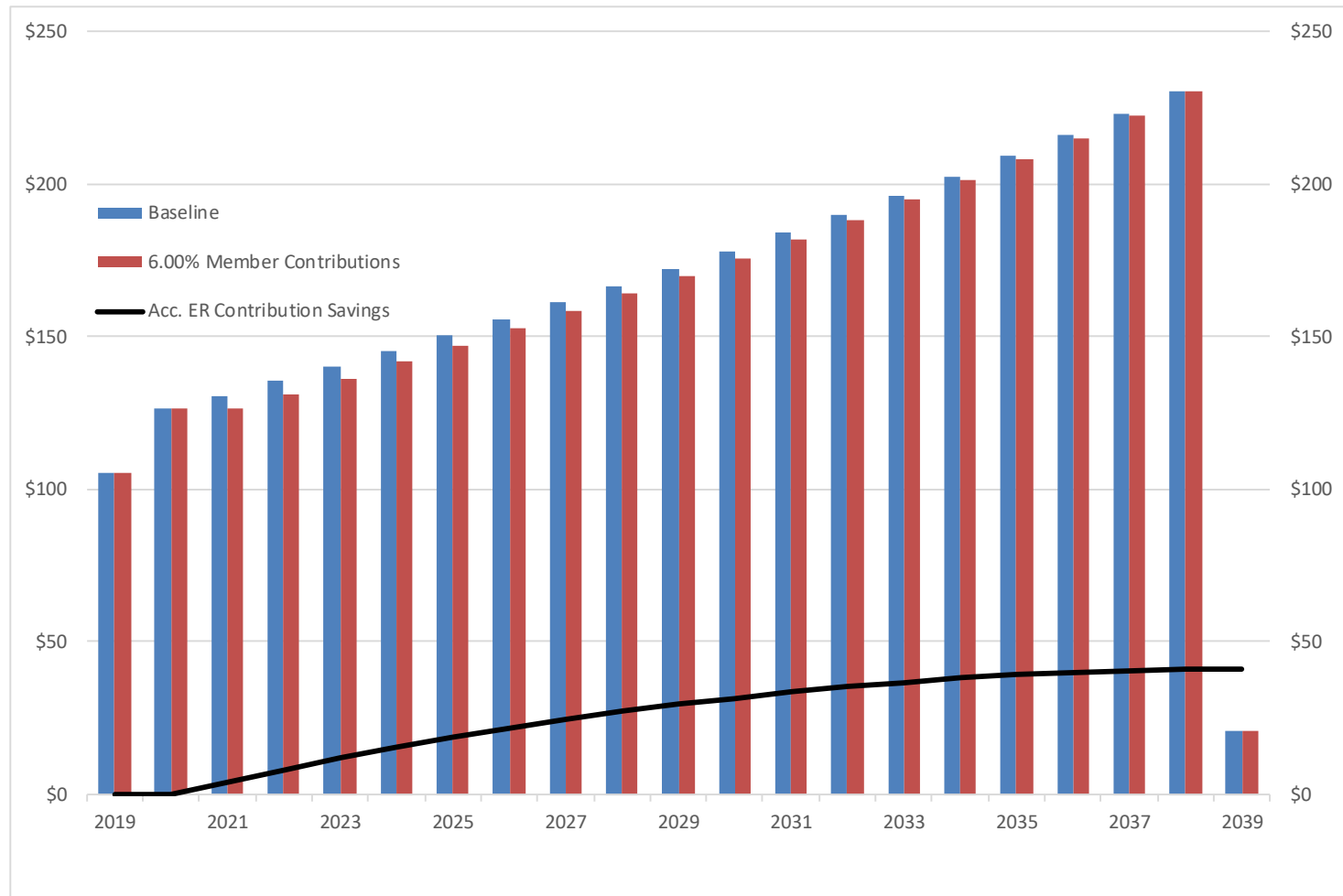
- - -	105.6	126.2	132.6	140.2	148.3	157.4	167.3	177.7	188.8	199.6	211.3	224.9	237.9	251.6	268.5	287.8	308.2	336.8	371.8	422.0	202.7	212.1
- - -	105.6	126.2	128.3	129.9	131.0	131.8	131.9	131.8	130.6	128.8	126.5	122.7	117.2	112.4	105.6	94.7	81.1	58.1	21.3	-	-	-

Employee Contribution Rate Increases for VSTRS

- The employee contribution rate for Group C participants hired before July 1, 2009 is 5% and for employees hired after July 1, 2009 is 6%.
- As shown in the July 1, 2018 actuarial valuation report, the average contribution rate is 5.35%.
- We modeled an increase in the employee contribution rate to 6% and to 6.65% for all active employees.
- When the contribution rate is increased to 6%, there is an offsetting savings to the State as employees currently contributing at 5% will contribute an extra 1%. However, the savings to the State declines over time as the employees currently contributing at 5% retire and are replaced by employees who would have contributed 6%.
- When the contribution rate is increased to 6.65%, there is an even greater offsetting savings to the State as all employees will contribute more. Although the savings to the State declines somewhat over time, the savings in all years is at least 0.65%.
- The projected State contributions and employee contributions are modeled deterministically on the next few pages under the current employee contribution rates and the alternative employee contributions rate.

VSTRS 6.00% Member Contribution Rates for All Members – Projected State Contributions

\$ in millions



Baseline - ER Conts:

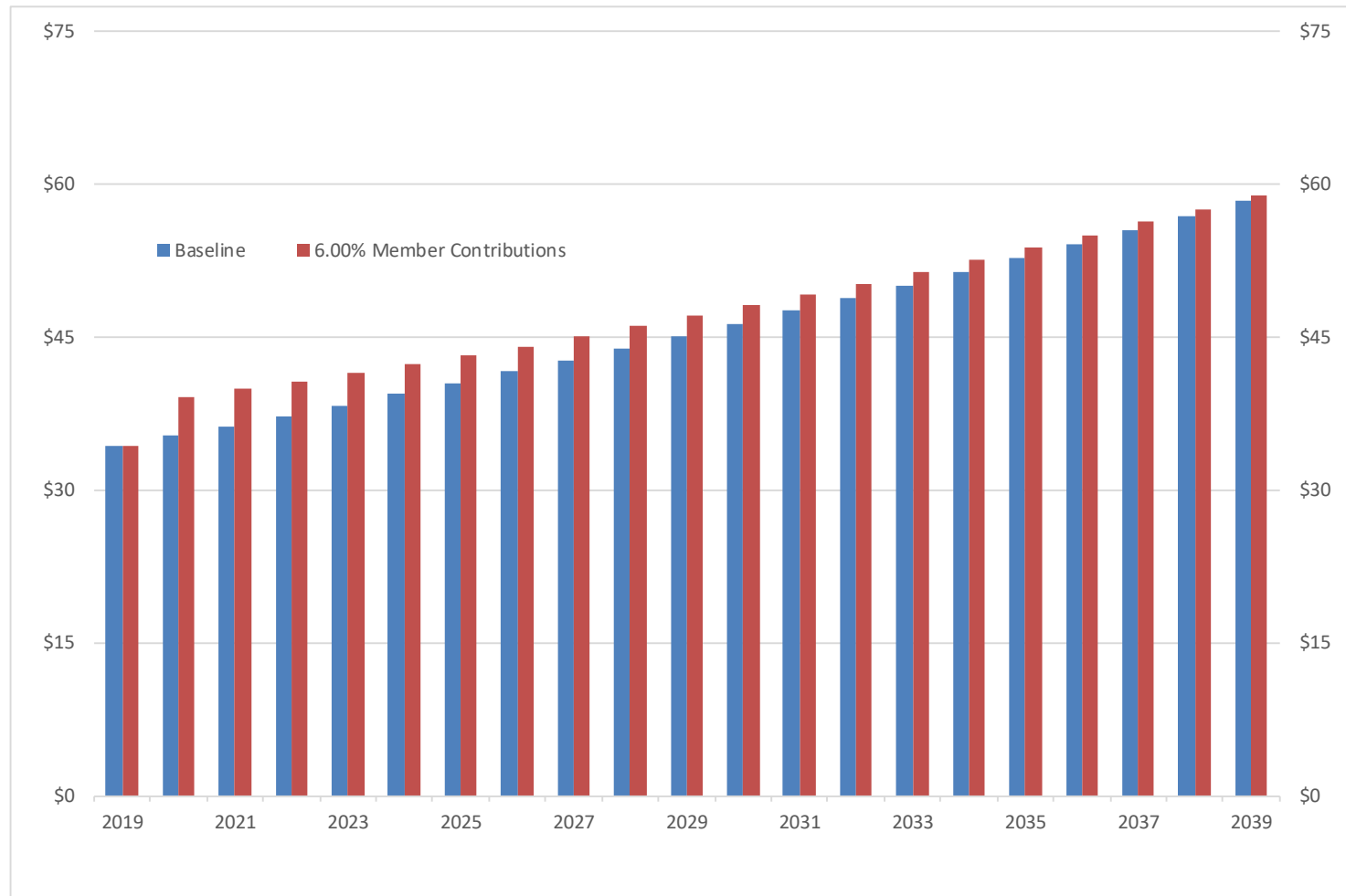
6.00% Cont Rate - ER Conts:

Accumulated ER Savings:

105.6	130.6	140.3	150.4	161.1	172.2	183.9	196.3	209.3	223.2	20.9
105.6	126.6	136.5	147.1	158.3	169.9	182.0	194.8	208.2	222.6	20.7
0.0	4.0	11.9	18.8	24.6	29.6	33.6	36.9	39.2	40.7	41.3

VSTRS 6.00% Member Contribution Rates for All Members – Projected Member Contributions

\$ in millions



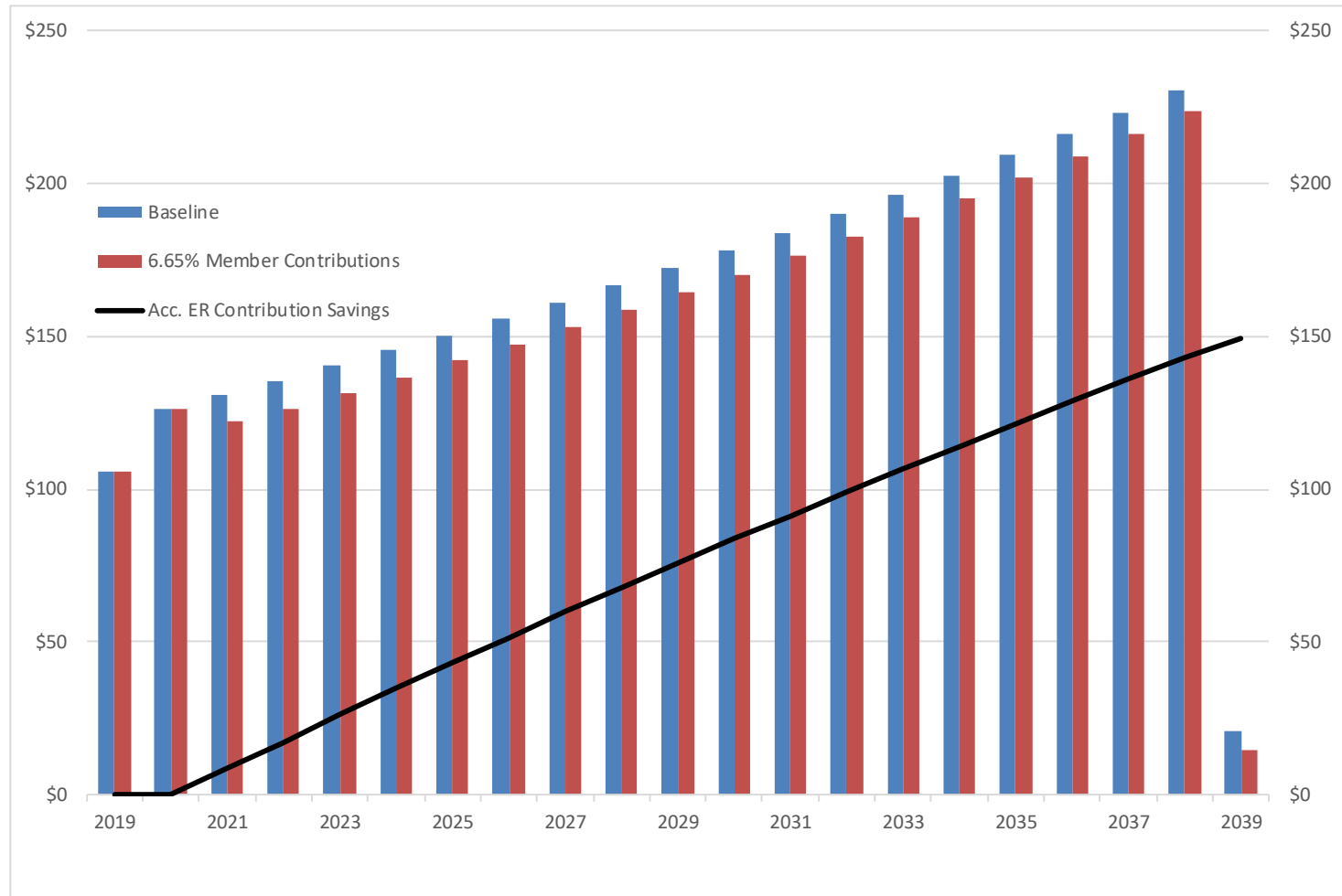
Baseline - EE Conts:

6.00% Cont Rate - EE Conts:

34.3	36.2	38.3	40.5	42.7	45.1	47.5	50.1	52.7	55.5	58.4
34.3	39.9	41.4	43.2	45.1	47.0	49.2	51.4	53.7	56.3	58.9

VSTRS 6.65% Member Contribution Rates for All Members – Projected State Contributions

\$ in millions



Baseline - ER Conts:

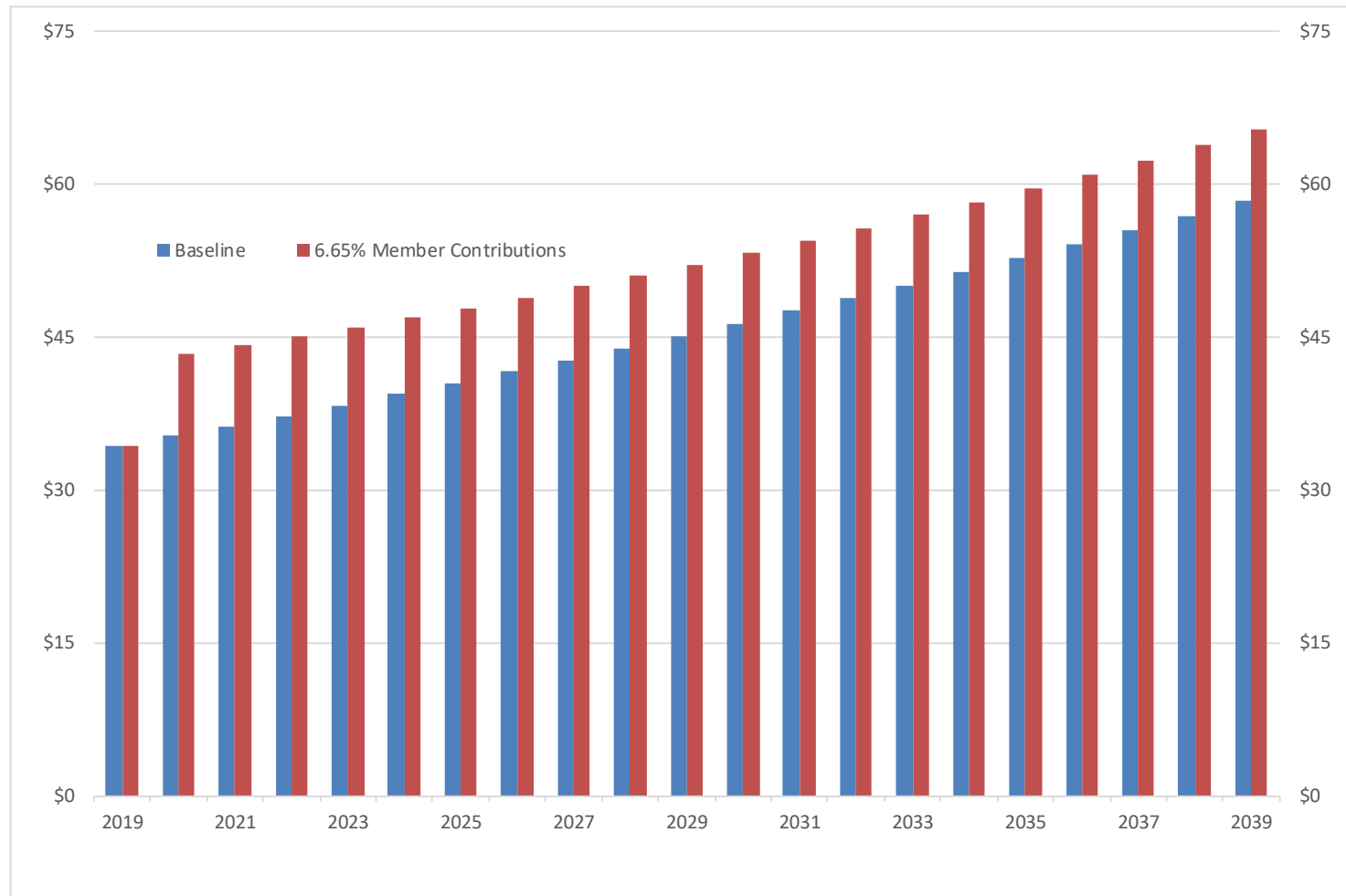
6.65% Cont Rate - ER Conts:

Accumulated ER Savings:

105.6	130.6	140.3	150.4	161.1	172.2	183.9	196.3	209.3	223.2	20.9
105.6	122.2	131.5	142.0	152.9	164.3	176.2	188.7	201.9	216.0	14.5
0.0	8.4	26.1	43.2	59.6	75.7	91.3	106.5	121.4	135.9	149.4

VSTRS 6.65% Member Contribution Rates for All Members – Projected Member Contributions

\$ in millions



Baseline - EE Conts:

6.65% Cont Rate - EE Conts:

34.3	36.2	38.3	40.5	42.7	45.1	47.5	50.1	52.7	55.5	58.4
34.3	44.2	45.9	47.8	49.9	52.1	54.5	57.0	59.6	62.4	65.3

Investment Return Sensitivity Testing

- We have modeled seven specific investment return scenarios provided by NEPC for VSERS and VSTRS to show the sensitivity of the projections to return scenarios that are significantly different from expected returns.
- The investment return sensitivity testing was performed on a deterministic basis.
- Four scenarios have been identified as the results of common market trends. These “General Market Condition” scenarios, as defined by NEPC, are:
 - Stagflation – Characterized by three years of a falling economic growth and rising inflation regime followed by a year of a rising growth and inflation regime and a final year of a rising growth and falling inflation regime.
 - Recession – Characterized by three years of a falling economic growth and falling inflation regime followed by two years of an economic growth recovery and muted changes to inflation.
 - Overextension – Characterized by two years of a rising economic growth and rising inflation regime followed by a year of a rising growth and falling inflation regime, a year of a balanced economic growth and inflation regime, and a final year of a falling growth and inflation regime.
 - Expansion – Characterized by two years of a rising economic growth and falling inflation regime followed by two years of a rising growth and rising inflation regime and a final year of a balanced economic growth and inflation regime.
- The return streams and 5-year, 20-year and 30-year averages and stochastic percentiles for these scenarios are shown on the following slide.
 - Stochastic percentiles are the percentile of the average investment return based on the 5,000 trial runs used in our stochastic analysis
- Our projected State Contributions for VSERS and VSTRS under these scenarios are shown on Slides 43 and 44.

Investment Return Sensitivity Testing *continued*

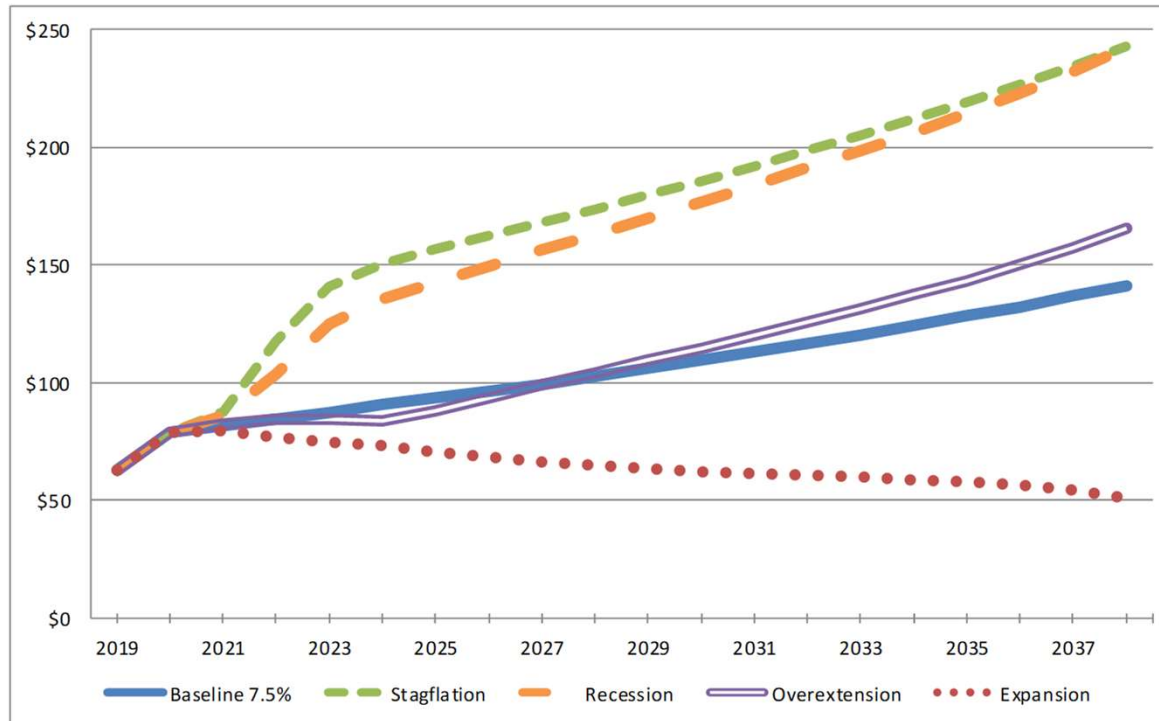
		Stagflation	Recession	Overextension	Expansion
	Year 1	-11.5%	-5.8%	7.2%	15.8%
	Year 2	-10.1%	-6.7%	7.7%	15.8%
	Year 3	-3.9%	-3.3%	16.8%	7.2%
	Year 4	10.2%	7.2%	9.2%	7.7%
	Year 5	18.1%	16.1%	-4.9%	9.2%
5-Year	Average	-0.1%	1.1%	7.0%	11.1%
	<i>Stochastic Percentile</i>	<i>6th</i>	<i>10th</i>	<i>44th</i>	<i>75th</i>
	Assumption for years 6+	7.5%	7.5%	7.5%	7.5%
20-Year	Average	5.6%	5.9%	7.4%	8.4%
	<i>Stochastic Percentile</i>	<i>22nd</i>	<i>26th</i>	<i>49th</i>	<i>64th</i>
30-Year	Average	6.2%	6.4%	7.4%	8.1%
	<i>Stochastic Percentile</i>	<i>27th</i>	<i>30th</i>	<i>49th</i>	<i>62nd</i>

- Note: None of the above scenarios reflect a full market cycle, which, based on our analysis, is projected to yield a long-term 7.5% investment return, as shown on slide 10.

VSERS Projected State Contribution

Investment Return Sensitivity – General Market Conditions

\$ in millions



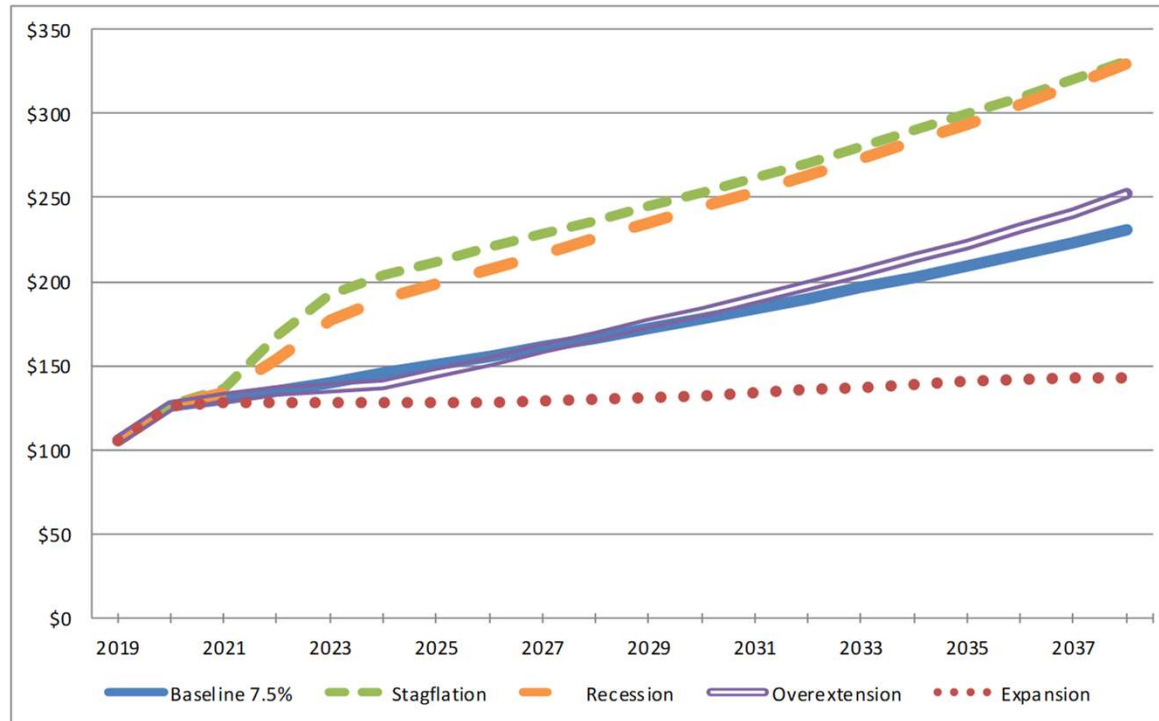
	2019	2021	2023	2025	2027	2029	2031	2033	2035	2037	2039
Baseline 7.5%	63.0	82.0	87.7	93.5	99.5	106.0	113.0	120.4	128.3	136.7	28.8
Stagflation	63.0	87.6	140.6	156.6	167.9	179.7	192.2	205.3	219.4	234.6	31.6
Recession	63.0	85.9	124.9	142.9	156.3	169.9	184.1	198.8	214.5	232.1	37.8
Overextension	63.0	82.1	84.6	88.3	98.9	109.5	120.3	131.5	143.5	157.2	38.9
Expansion	63.0	79.6	74.9	70.6	66.6	63.7	61.6	59.8	57.9	54.5	10.9

Percentiles

	2019	2021	2023	2025	2027	2029	2031	2033	2035	2037	2039
95th	63.0	87.5	119.1	145.5	174.6	205.6	243.5	294.4	363.5	495.5	690.0
75th	63.0	84.1	95.8	110.9	128.2	146.9	170.0	198.1	237.7	300.5	211.6
50th	63.0	81.9	87.2	92.4	98.0	105.6	112.2	120.3	128.3	127.2	0.0
25th	63.0	79.7	78.2	74.3	67.8	57.8	41.7	20.8	0.0	0.0	0.0
5th	63.0	76.5	64.9	43.4	12.2	0.0	0.0	0.0	0.0	0.0	0.0

VSTRS Projected State Contribution Investment Return Sensitivity – General Market Conditions

\$ in millions



	2019	2021	2023	2025	2027	2029	2031	2033	2035	2037	2039
Baseline 7.5%	105.6	130.6	140.3	150.4	161.1	172.2	183.9	196.3	209.3	223.2	20.9
Stagflation	105.6	136.1	192.2	212.3	228.3	244.8	262.1	280.2	299.4	320.2	24.1
Recession	105.6	134.4	176.9	198.8	216.7	234.9	253.6	273.2	293.9	316.7	29.8
Overextension	105.6	130.7	137.3	145.4	160.1	174.9	190.1	205.8	222.5	241.1	30.0
Expansion	105.6	128.2	127.8	128.0	128.9	131.0	133.9	137.3	140.8	143.2	3.6

Percentiles

◆ 95th	105.6	136.0	171.2	200.9	232.9	266.1	304.9	353.2	419.6	541.4	621.2
— 75th	105.6	132.6	148.3	167.3	188.8	211.3	237.9	268.5	308.2	371.8	202.7
■ 50th	105.6	130.4	139.8	149.3	159.7	171.9	183.3	196.5	209.9	219.7	0.0
■ 25th	105.6	128.3	131.0	131.9	130.6	126.5	117.2	105.6	81.1	21.3	0.0
◆ 5th	105.6	125.2	118.0	101.6	76.9	39.7	0.0	0.0	0.0	0.0	0.0

Investment Return Sensitivity Testing *continued*

- Three scenarios have been identified as recreations of recent downturns in the investment markets. These “Specific Market Cycle” scenarios are:
 - Global Financial Crisis;
 - Dot-Com Crisis; and
 - 1970’s Stagflation.
- The Global Financial Crisis projections result in somewhat lower employer contributions in most years compared to the general recession and general stagflation scenarios.
- The 1970’s Stagflation projections results in significantly lower contributions compared to the general stagflation scenarios in the later years of the projections.
- The return streams and short-term, 20-year and 30-year averages and stochastic percentiles for these scenarios are shown on the following slide.
 - Stochastic percentiles are the percentile of the average investment return based on the 5,000 trial runs used in our stochastic analysis
- Our projected State Contributions for VSERS and VSTRS under these scenarios are shown on Slides 47 and 48.

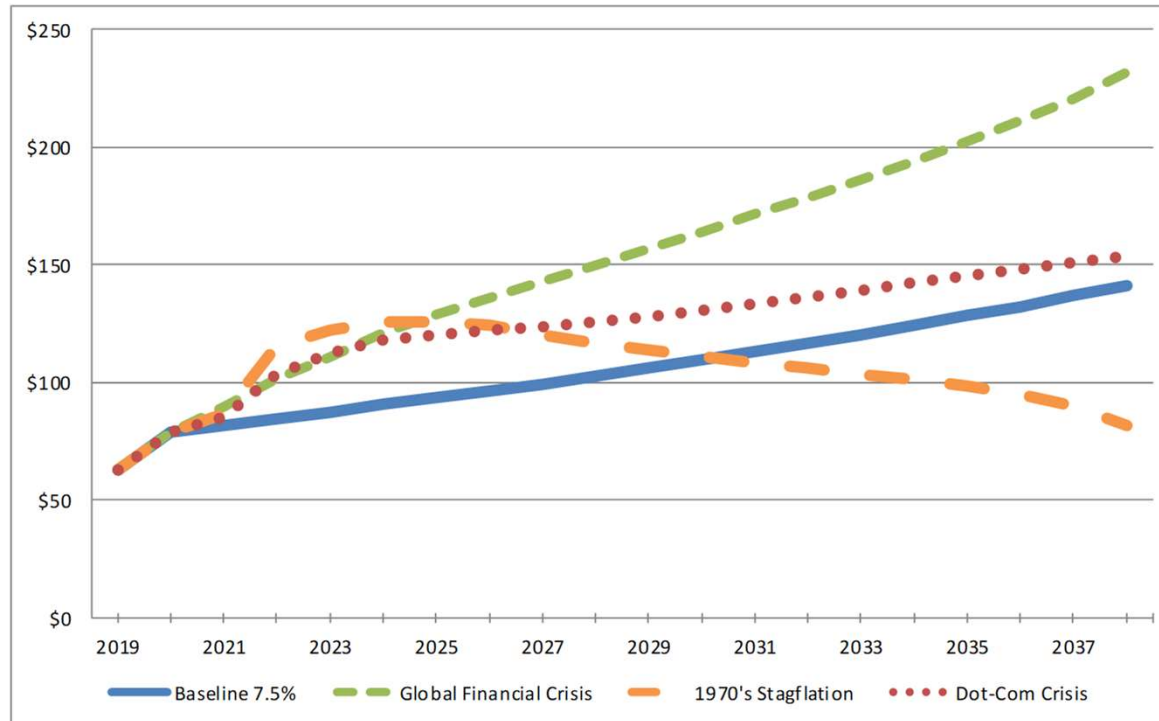
Investment Return Sensitivity Testing *continued*

		Global Financial Crisis	Dot-Com Crisis	1970's Stagflation
	Year 1	-12.9%	-4.5%	-7.9%
	Year 2	1.9%	-8.4%	-12.0%
	Year 3	10.5%	12.8%	23.2%
	Year 4	-1.3%	13.8%	13.2%
	Year 5	17.8%	15.9%	14.9%
	Year 6		8.6%	12.9%
	Year 7			12.1%
Short-term	Average	2.5%	5.9%	7.4%
	<i>Stochastic Percentile</i>	<i>15th</i>	<i>36th</i>	<i>48th</i>
	Assumption for later years	7.5%	7.5%	7.5%
20-Year	Average	6.2%	7.0%	7.5%
	<i>Stochastic Percentile</i>	<i>31st</i>	<i>44th</i>	<i>50th</i>
30-Year	Average	6.7%	7.2%	7.5%
	<i>Stochastic Percentile</i>	<i>35th</i>	<i>44th</i>	<i>50th</i>

➤ Note: None of the above scenarios reflect a full market cycle, which, based on our analysis, is projected to yield a long-term 7.5% investment return, as shown on slide 17.

VSERS Projected State Contribution Investment Return Sensitivity – Specific Market Cycles

\$ in millions



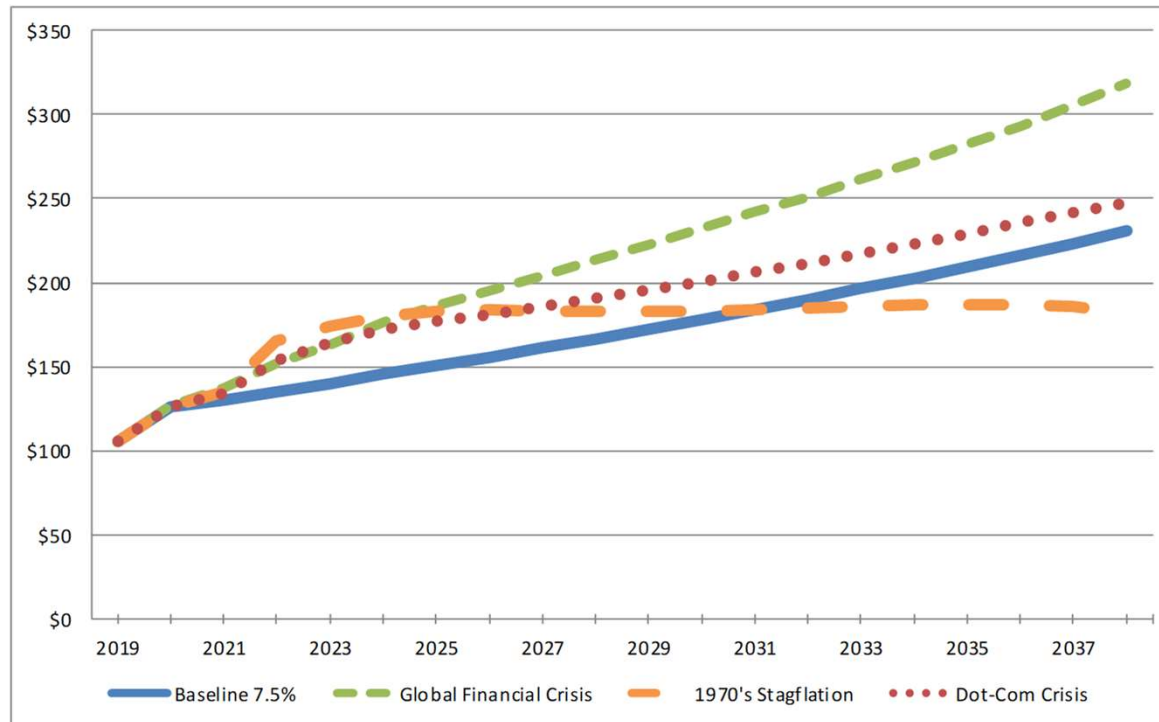
	2019	2021	2023	2025	2027	2029	2031	2033	2035	2037	2039
— Baseline 7.5%	63.0	82.0	87.7	93.5	99.5	106.0	113.0	120.4	128.3	136.7	28.8
— Global Crisis	63.0	89.6	110.5	129.0	143.0	157.1	171.5	186.4	202.5	220.5	40.8
— 70's Stagflation	63.0	86.5	122.2	126.0	120.5	113.7	108.5	103.7	98.5	90.2	0.0
— Dot-Com Crisis	63.0	85.5	112.3	120.2	123.8	128.2	133.5	139.2	145.4	151.3	20.3

Percentiles

◆ 95th	63.0	87.5	119.1	145.5	174.6	205.6	243.5	294.4	363.5	495.5	690.0
— 75th	63.0	84.1	95.8	110.9	128.2	146.9	170.0	198.1	237.7	300.5	211.6
■ 50th	63.0	81.9	87.2	92.4	98.0	105.6	112.2	120.3	128.3	127.2	0.0
— 25th	63.0	79.7	78.2	74.3	67.8	57.8	41.7	20.8	0.0	0.0	0.0
◆ 5th	63.0	76.5	64.9	43.4	12.2	0.0	0.0	0.0	0.0	0.0	0.0

VSTRS Projected State Contribution Investment Return Sensitivity – Specific Market Cycles

\$ in millions



	2019	2021	2023	2025	2027	2029	2031	2033	2035	2037	2039
— Baseline 7.5%	105.6	130.6	140.3	150.4	161.1	172.2	183.9	196.3	209.3	223.2	20.9
- - Global Crisis	105.6	137.9	163.1	186.1	204.4	222.9	241.7	261.3	282.2	305.3	32.2
- - 70's Stagflation	105.6	135.0	174.2	182.9	183.3	182.9	183.9	185.6	187.2	186.4	0.0
•••• Dot-Com Crisis	105.6	134.0	164.4	177.0	185.9	195.6	206.1	217.4	229.3	241.4	13.8

Percentiles

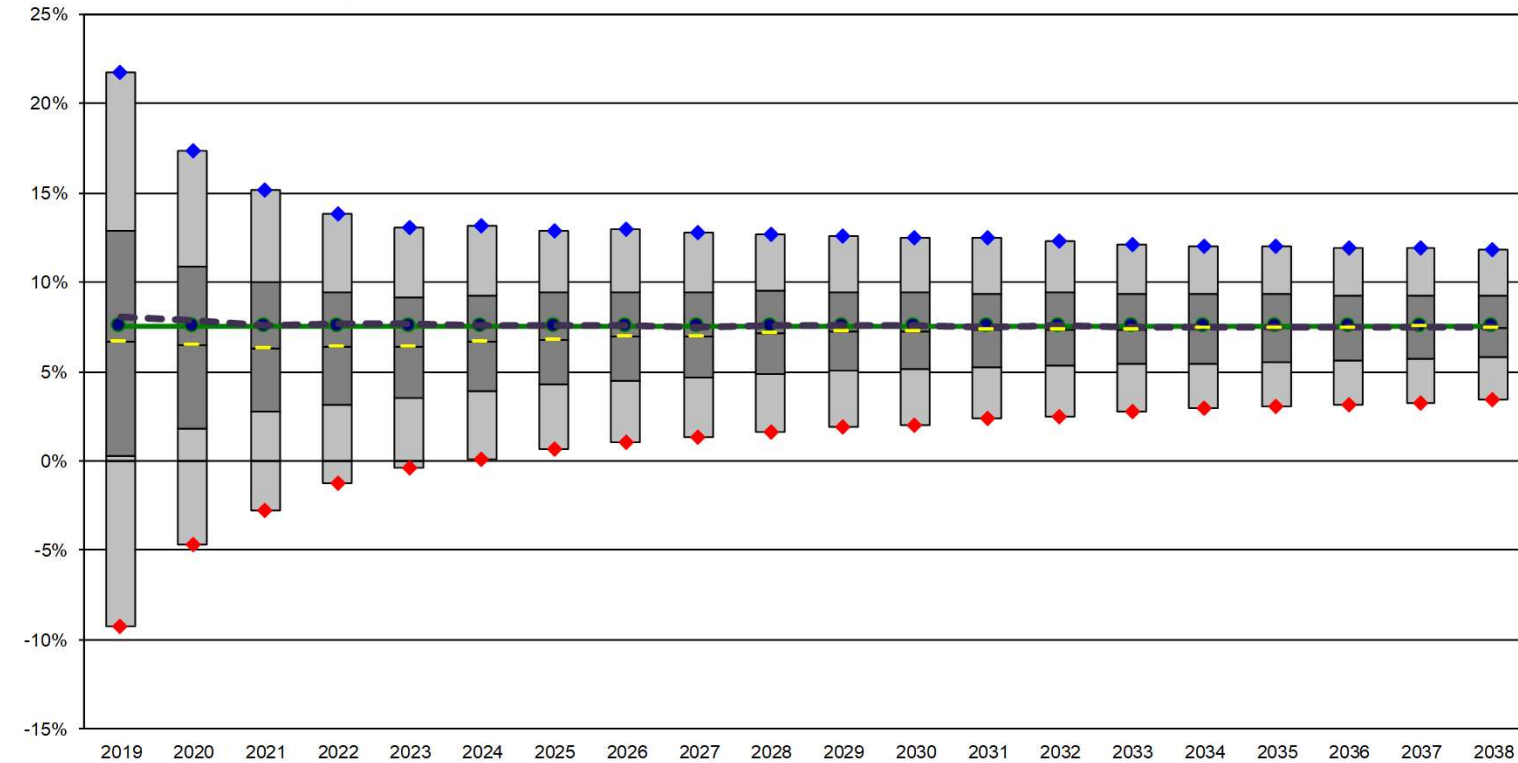
◆ 95th	105.6	136.0	171.2	200.9	232.9	266.1	304.9	353.2	419.6	541.4	621.2
— 75th	105.6	132.6	148.3	167.3	188.8	211.3	237.9	268.5	308.2	371.8	202.7
■ 50th	105.6	130.4	139.8	149.3	159.7	171.9	183.3	196.5	209.9	219.7	0.0
— 25th	105.6	128.3	131.0	131.9	130.6	126.5	117.2	105.6	81.1	21.3	0.0
◆ 5th	105.6	125.2	118.0	101.6	76.9	39.7	0.0	0.0	0.0	0.0	0.0

Additional Investment Return Sensitivity Testing

- In addition to the General Market Conditions scenarios and the Specific Market Cycles scenarios, we have stochastically modeled returns that average 6.4% for the five years beginning July 1, 2018 and 7.5% over the 20 years beginning July 1, 2018.
- As might be expected, at the 50% percentile, employer contributions are higher than the baseline for a number of years and less than the baseline in later years.

Modified Portfolio Returns

Projected Cumulative Investment Return for Plan Years Ending June 30



◆ 95th	21.7%	17.3%	15.1%	13.8%	13.0%	13.1%	12.9%	13.0%	12.8%	12.7%	12.5%	12.4%	12.5%	12.3%	12.1%	12.0%	12.0%	11.9%	11.9%	11.8%
— 75th	12.9%	10.9%	10.0%	9.5%	9.2%	9.2%	9.4%	9.4%	9.4%	9.5%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.3%	9.3%	9.3%	9.3%
■ 50th	6.7%	6.5%	6.3%	6.4%	6.4%	6.7%	6.8%	6.9%	7.0%	7.2%	7.2%	7.3%	7.3%	7.3%	7.4%	7.4%	7.4%	7.5%	7.5%	7.5%
— 25th	0.3%	1.8%	2.8%	3.1%	3.6%	3.9%	4.3%	4.5%	4.7%	4.8%	5.1%	5.2%	5.2%	5.3%	5.4%	5.5%	5.6%	5.6%	5.7%	5.8%
◆ 5th	-9.3%	-4.7%	-2.8%	-1.2%	-0.4%	0.1%	0.7%	1.0%	1.3%	1.6%	1.9%	2.0%	2.3%	2.5%	2.7%	2.9%	3.0%	3.1%	3.3%	3.4%
●	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%

● Current investment return assumption

For comparison purposes -- 50th percentile projection from baseline

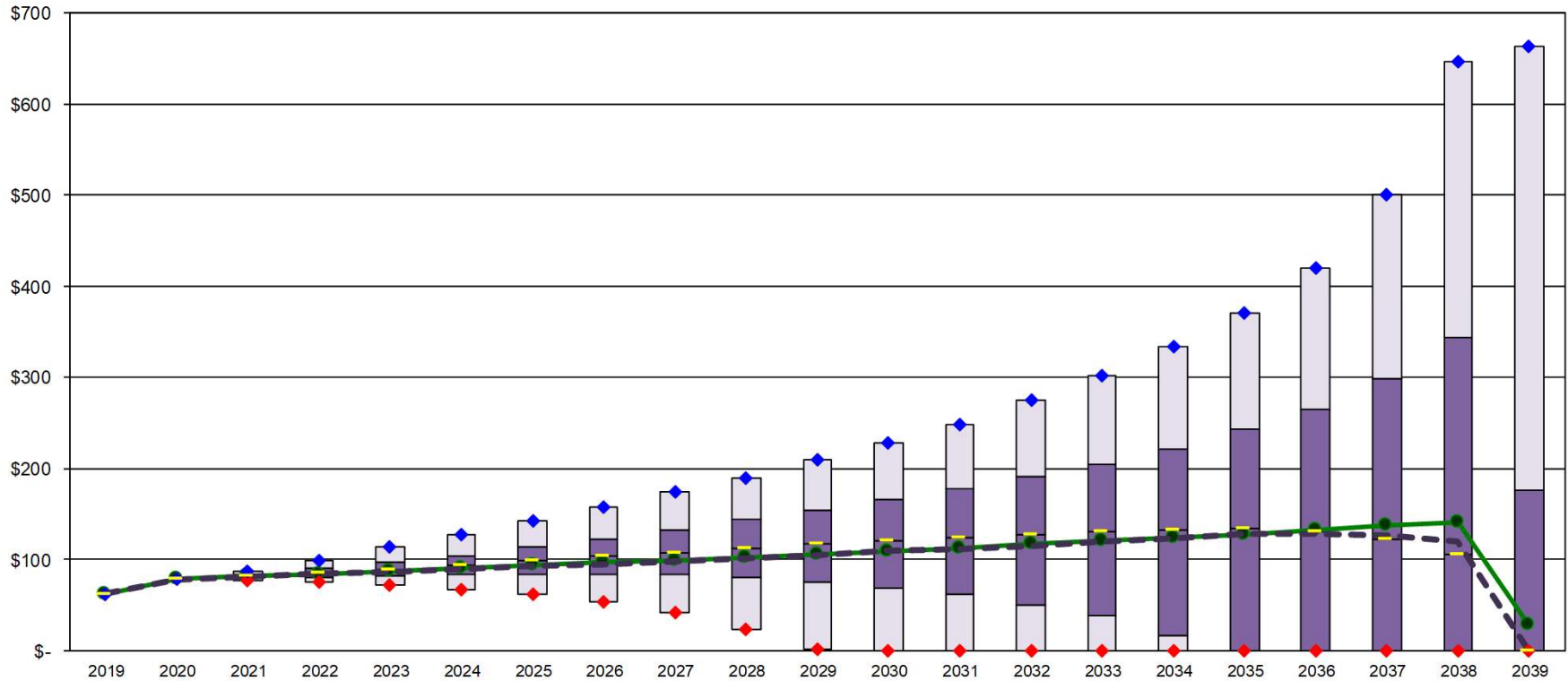
---	8.1%	7.8%	7.6%	7.7%	7.7%	7.6%	7.5%	7.6%	7.5%	7.5%	7.6%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
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VSERS Projected State Contribution

6.4% Average Return Over First 5 Years

\$ in millions

Projected Employer Contribution for Fiscal Years Ending June 30



◆ 95th	63.0	78.9	86.9	99.0	114.5	127.8	142.4	157.5	174.5	189.8	208.8	228.7	248.8	274.6	300.9	333.9	370.7	420.7	501.0	647.0	662.7
— 75th	63.0	78.9	84.1	89.9	96.6	104.5	113.3	123.1	133.3	143.7	154.4	165.6	178.1	190.3	204.6	221.9	242.4	264.3	298.4	343.4	176.5
■ 50th	63.0	78.9	82.3	85.5	89.6	94.1	98.6	103.3	107.8	112.3	116.8	120.8	124.2	126.7	130.1	132.8	133.4	131.3	121.9	105.7	-
— 25th	63.0	78.9	80.5	81.4	82.3	83.6	84.4	84.4	83.3	80.1	75.8	69.3	62.0	51.0	38.4	17.1	-	-	-	-	-
◆ 5th	63.0	78.9	77.9	75.3	71.9	67.3	61.8	54.2	41.5	24.2	2.0	-	-	-	-	-	-	-	-	-	-
●	63.0	78.9	82.0	84.8	87.7	90.6	93.5	96.5	99.5	102.7	106.0	109.4	113.0	116.6	120.4	124.2	128.3	132.4	136.7	141.4	28.8

● Deterministic projection using current 7.5% investment return assumption

For comparison purposes -- 50th percentile projection from baseline

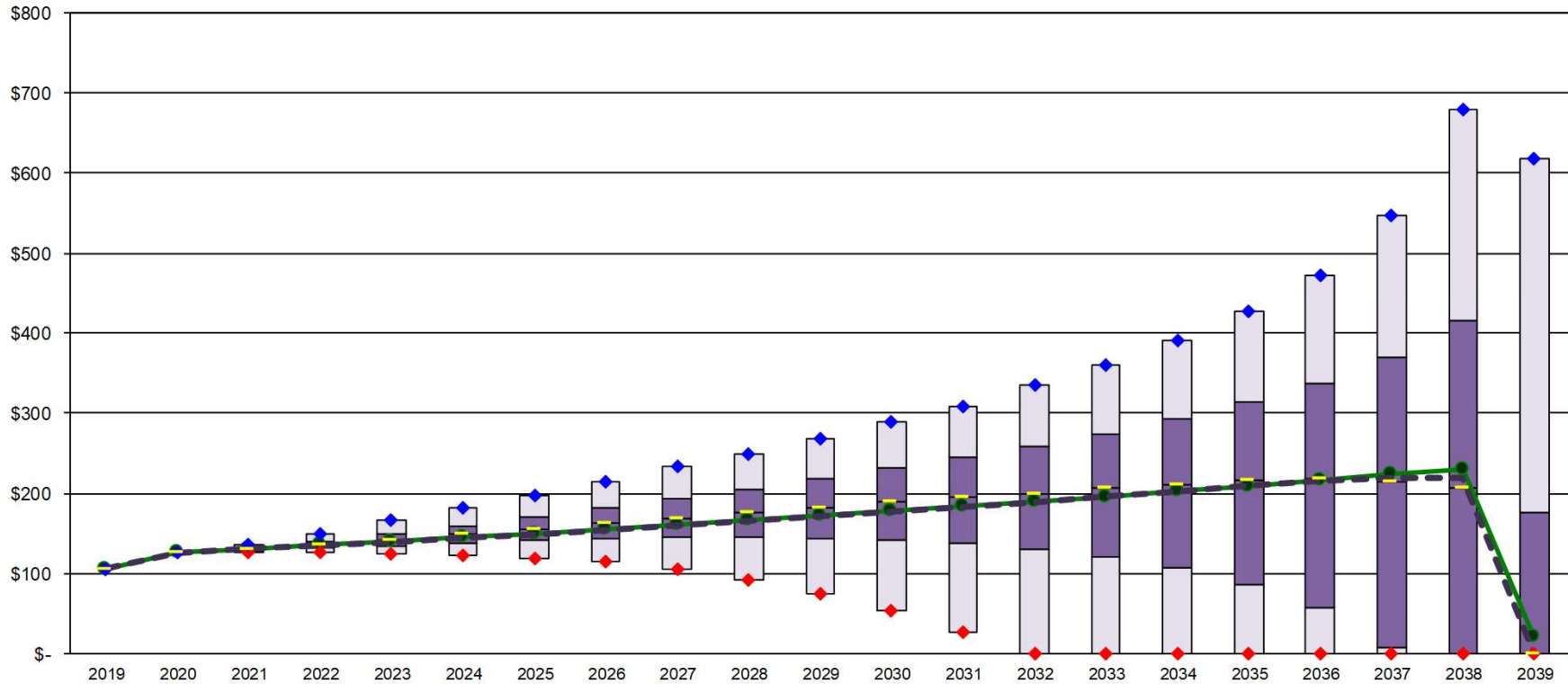
---	63.0	78.9	81.9	84.3	87.2	90.2	92.4	95.5	98.0	101.2	105.6	109.1	112.2	114.8	120.3	122.8	128.3	128.9	127.2	120.7	-
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VSTRS Projected State Contribution

6.4% Average Return Over First 5 Years

\$ in millions

Projected Employer Contribution for Fiscal Years Ending June 30



◆ 95th	105.6	126.2	135.4	149.3	166.8	181.7	198.0	214.5	233.0	248.9	267.8	288.9	308.6	334.6	359.5	390.6	426.5	472.0	546.5	679.7	618.1
— 75th	105.6	126.2	132.7	140.4	149.0	158.8	169.6	181.5	193.7	205.7	218.1	231.5	244.7	258.6	274.4	292.5	314.0	336.6	369.7	415.0	176.0
— 50th	105.6	126.2	130.8	136.1	142.1	148.7	155.3	162.2	169.0	176.0	182.9	189.0	195.0	199.9	206.1	211.3	215.7	219.1	215.2	207.0	-
— 25th	105.6	126.2	129.0	132.0	135.0	138.4	141.5	144.0	145.7	145.4	144.4	141.5	137.3	130.8	121.5	108.3	87.3	57.0	8.3	-	-
◆ 5th	105.6	126.2	126.5	126.0	124.9	122.7	119.8	114.7	105.9	92.3	74.0	54.6	27.1	-	-	-	-	-	-	-	-
●	105.6	126.2	130.6	135.3	140.3	145.3	150.4	155.7	161.1	166.6	172.2	178.0	183.9	190.0	196.3	202.7	209.3	216.1	223.2	230.6	20.9

● Deterministic projection using current 7.5% investment return assumption

For comparison purposes -- 50th percentile projection from baseline

---	105.6	126.2	130.4	134.8	139.8	144.8	149.3	154.6	159.7	165.4	171.9	177.6	183.3	188.6	196.5	202.5	209.9	215.5	219.7	220.1	-
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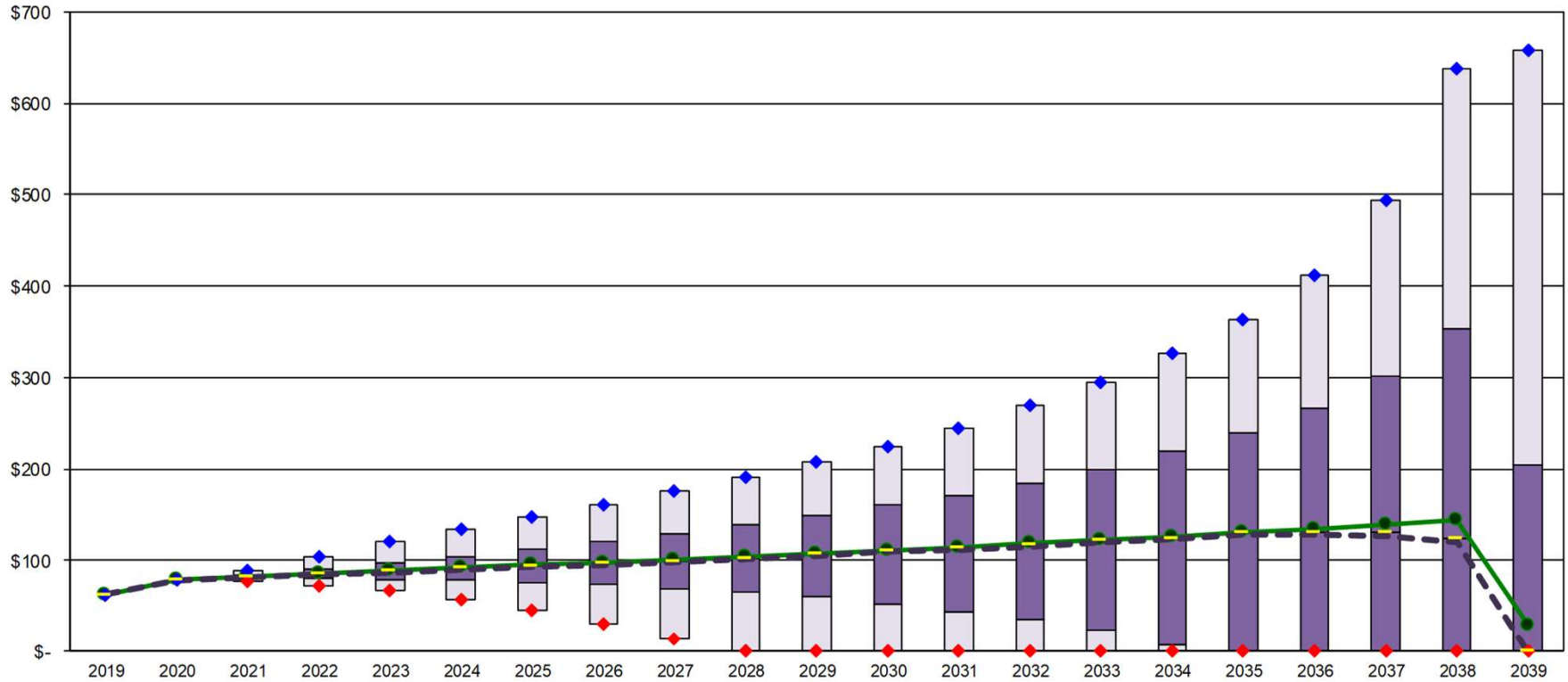
VSERS Demographic Change Sensitivities

- We have modeled scenarios that simulate shocks to the active population. Specifically, we modeled permanent decreases to the active population of 200 participants and 400 participants, or approximately 2.5% and 5.0% of the total active population, respectively:
 - To simulate the effects of a retirement incentive, we reduced the active population over a period of two years with participants eligible to retire
 - To simulate the effects of a workforce contraction, we reduced the active population over a period of two years with participants not eligible to retire (and not vested)
- Additionally, we modeled the impact of incentivizing retirement-eligible participants to continue working (a “reverse retirement incentive”):
 - To simulate the effects of a reverse retirement incentive, we assumed that the number of members that choose to take the cash incentive and delay retirement is 100 in Year 1, 66 in Year 2, and 33 in Year 3.
- Any incentive payments to retire or to remain working are assumed to be made by the State and are not reflected in these projections

VSERS – 200 Active Decrease Due to Immediate Retirement by Eligible Actives

\$ in millions

Projected Employer Contribution for Fiscal Years Ending June 30



◆ 95th	63.0	78.9	88.2	104.3	120.7	133.5	147.1	160.7	176.2	191.5	207.0	224.6	244.7	270.1	295.0	326.7	363.6	412.4	493.8	637.7	658.0
■ 75th	63.0	78.9	84.8	91.1	97.4	104.5	112.5	120.8	129.8	138.8	148.6	160.9	171.8	184.6	199.8	218.9	239.1	265.8	301.4	353.2	204.3
■ 50th	63.0	78.9	82.6	85.7	88.7	91.7	94.0	97.1	99.7	102.9	107.4	111.0	114.1	116.9	122.3	124.9	130.5	131.3	130.3	123.8	-
■ 25th	63.0	78.9	80.4	80.7	79.7	78.4	75.9	73.2	69.6	65.1	59.8	52.2	43.9	34.8	23.4	7.2	-	-	-	-	-
◆ 5th	63.0	78.9	77.2	73.1	66.4	57.1	45.0	30.7	14.0	-	-	-	-	-	-	-	-	-	-	-	-
●	63.0	78.9	82.7	86.2	89.2	92.2	95.1	98.2	101.2	104.5	107.8	111.3	114.9	118.6	122.4	126.3	130.4	134.6	139.0	143.6	29.4

● Deterministic projection using current 7.5% investment return assumption

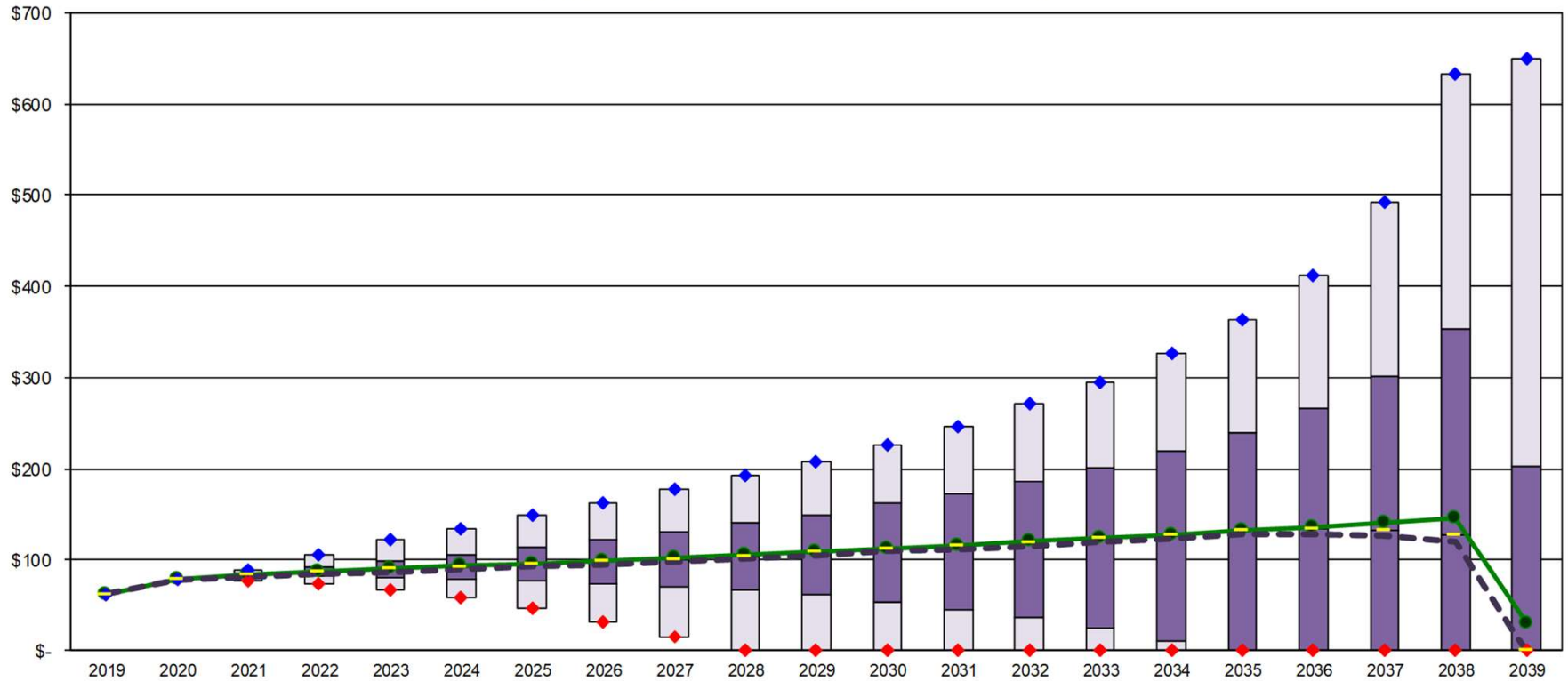
For comparison purposes – 50th percentile projection from baseline with no change to demographics

---	63.0	78.9	81.9	84.3	87.2	90.2	92.4	95.5	98.0	101.2	105.6	109.1	112.2	114.8	120.3	122.8	128.3	128.9	127.2	120.7	-
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VSERS – 400 Active Decrease Due to Immediate Retirement by Eligible Actives

\$ in millions

Projected Employer Contribution for Fiscal Years Ending June 30



◆ 95th	63.0	78.9	88.8	105.6	122.0	134.9	148.5	162.1	177.6	193.0	208.4	225.8	245.8	270.8	295.5	327.0	363.1	411.6	492.1	633.6	649.7
■ 75th	63.0	78.9	85.4	92.3	98.7	105.9	113.9	122.3	131.3	140.3	150.0	162.3	173.4	186.1	201.0	219.8	240.0	266.9	302.2	353.3	202.7
■ 50th	63.0	78.9	83.2	86.9	90.0	93.1	95.5	98.6	101.2	104.6	109.0	112.6	115.8	118.5	124.1	126.7	132.6	133.8	133.0	127.1	-
■ 25th	63.0	78.9	81.0	81.9	81.0	79.7	77.4	74.7	71.1	66.7	61.5	54.1	45.7	37.1	25.8	9.9	-	-	-	-	-
◆ 5th	63.0	78.9	77.8	74.3	67.8	58.5	46.5	32.3	15.6	-	-	-	-	-	-	-	-	-	-	-	-
●	63.0	78.9	83.3	87.4	90.5	93.5	96.5	99.6	102.7	106.0	109.4	112.9	116.6	120.3	124.1	128.1	132.2	136.5	140.9	145.7	29.8

● Deterministic projection using current 7.5% investment return assumption

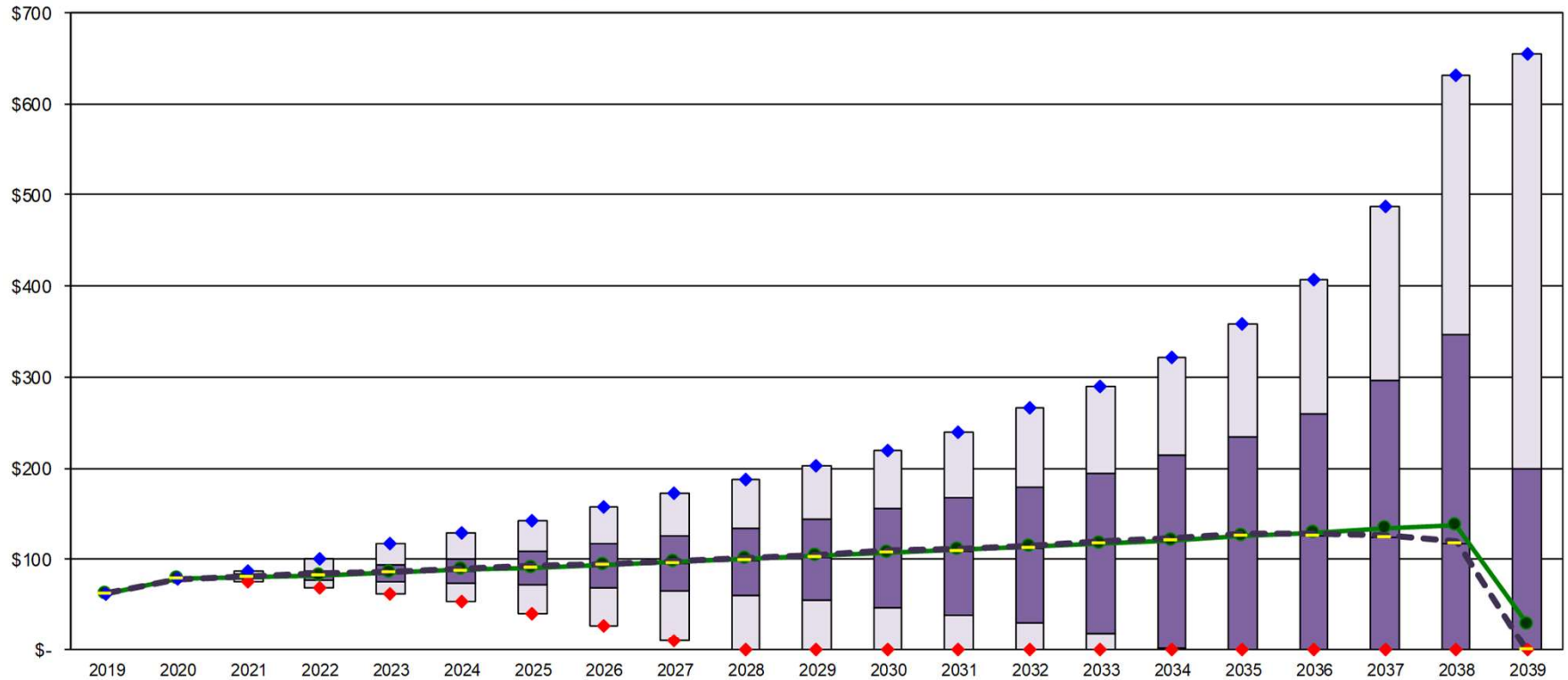
For comparison purposes – 50th percentile projection from baseline with no change to demographics

---	63.0	78.9	81.9	84.3	87.2	90.2	92.4	95.5	98.0	101.2	105.6	109.1	112.2	114.8	120.3	122.8	128.3	128.9	127.2	120.7	-
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VSERS – 200 Active Decrease Due to Immediate Withdrawal by Actives Not Eligible to Retire

\$ in millions

Projected Employer Contribution for Fiscal Years Ending June 30



◆ 95th	63.0	78.9	86.6	101.0	117.1	129.8	143.3	156.9	172.2	187.5	202.9	220.4	240.4	265.6	290.4	321.9	358.6	407.2	488.1	631.7	654.1
▬ 75th	63.0	78.9	83.2	87.7	93.8	100.8	108.7	117.0	125.8	134.7	144.4	156.6	167.4	180.0	195.1	213.9	234.2	260.5	295.9	347.3	200.2
■ 50th	63.0	78.9	81.0	82.4	85.1	88.1	90.2	93.2	95.7	98.8	103.2	106.7	109.7	112.2	117.5	120.1	125.4	126.4	124.6	118.2	-
▬ 25th	63.0	78.9	78.8	77.4	76.1	74.7	72.1	69.3	65.6	60.9	55.5	47.8	39.4	30.1	18.5	1.6	-	-	-	-	-
◆ 5th	63.0	78.9	75.7	69.8	62.9	53.4	41.2	26.8	9.9	-	-	-	-	-	-	-	-	-	-	-	-
●	63.0	78.9	81.2	82.9	85.6	88.5	91.3	94.3	97.2	100.4	103.6	106.9	110.4	114.0	117.6	121.4	125.4	129.4	133.7	138.2	28.2

● Deterministic projection using current 7.5% investment return assumption

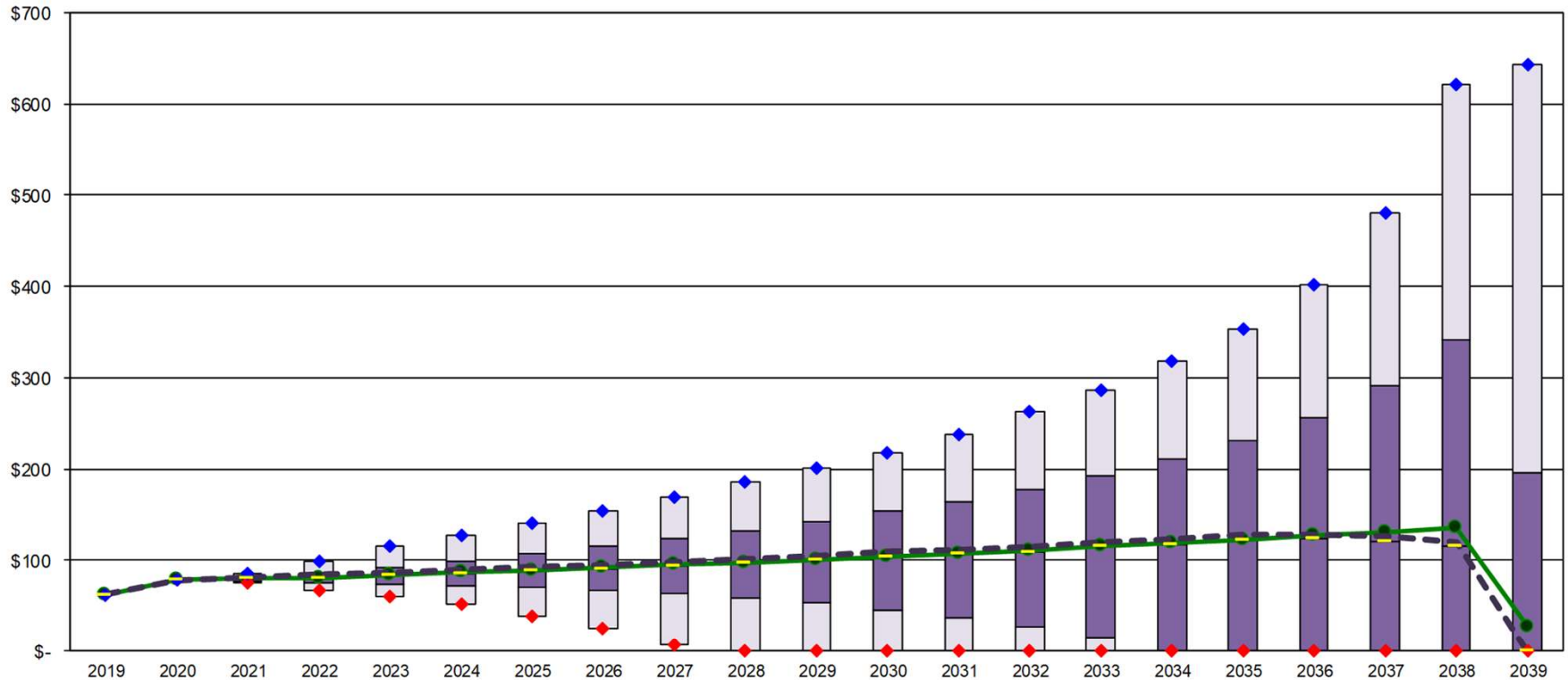
For comparison purposes -- 50th percentile projection from baseline with no change to demographics

---	63.0	78.9	81.9	84.3	87.2	90.2	92.4	95.5	98.0	101.2	105.6	109.1	112.2	114.8	120.3	122.8	128.3	128.9	127.2	120.7	-
-----	------	------	------	------	------	------	------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	---

VSERS – 400 Active Decrease Due to Immediate Withdrawal by Actives Not Eligible to Retire

\$ in millions

Projected Employer Contribution for Fiscal Years Ending June 30



◆ 95th	63.0	78.9	85.8	99.3	115.2	127.9	141.4	154.8	170.1	185.4	200.5	217.6	237.6	262.5	286.8	317.9	354.0	402.0	481.2	621.0	642.4
■ 75th	63.0	78.9	82.4	86.0	91.9	98.9	106.8	114.9	123.7	132.5	142.1	154.2	165.0	177.5	192.3	210.7	230.7	256.7	292.2	342.5	195.7
■ 50th	63.0	78.9	80.2	80.6	83.3	86.1	88.2	91.2	93.6	96.8	100.9	104.3	107.2	109.7	115.0	117.6	122.8	123.6	121.5	115.1	-
■ 25th	63.0	78.9	78.0	75.6	74.2	72.7	70.2	67.3	63.5	58.9	53.3	45.6	37.1	27.9	16.2	-	-	-	-	-	-
◆ 5th	63.0	78.9	74.8	68.0	61.0	51.5	39.2	24.8	7.8	-	-	-	-	-	-	-	-	-	-	-	-
●	63.0	78.9	80.3	81.1	83.7	86.5	89.3	92.3	95.1	98.2	101.3	104.6	108.1	111.6	115.1	118.9	122.7	126.7	130.9	135.3	27.6

● Deterministic projection using current 7.5% investment return assumption

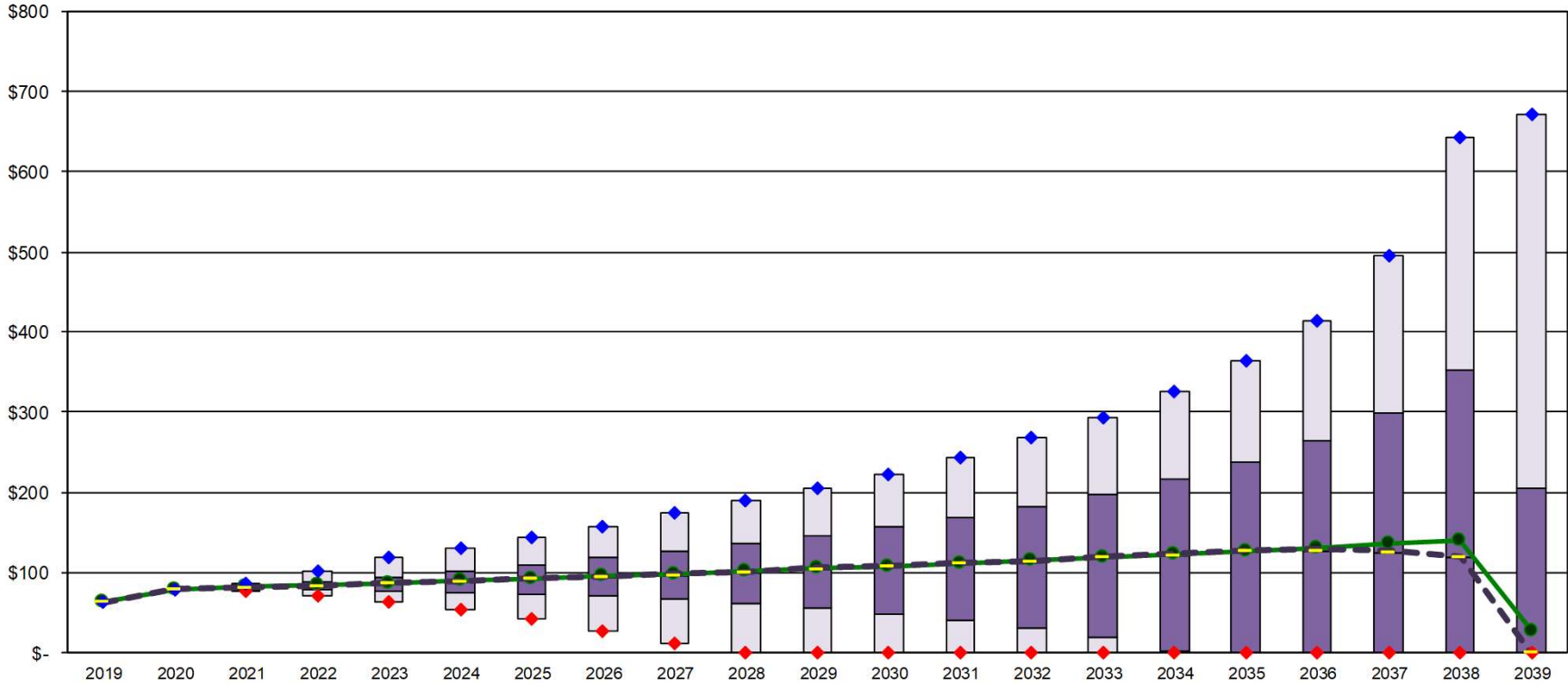
For comparison purposes -- 50th percentile projection from baseline with no change to demographics

---	63.0	78.9	81.9	84.3	87.2	90.2	92.4	95.5	98.0	101.2	105.6	109.1	112.2	114.8	120.3	122.8	128.3	128.9	127.2	120.7	-
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VRSERS – Reverse Retirement Incentive

\$ in millions

Projected Employer Contribution for Fiscal Years Ending June 30



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
◆ 95th	63.0	78.9	87.0	101.8	118.1	130.9	144.4	158.0	173.4	189.2	204.5	222.4	242.6	268.0	293.8	326.1	363.6	413.6	496.0	643.4	672.4
— 75th	63.0	78.9	83.6	88.6	94.8	101.9	109.8	118.1	127.0	135.9	145.6	158.0	169.0	181.6	196.8	216.2	236.6	264.4	299.6	351.8	205.9
— 50th	63.0	78.9	81.3	83.2	86.1	89.1	91.3	94.3	96.7	100.0	104.4	107.7	110.7	113.5	119.1	121.4	126.5	127.3	125.1	118.9	-
— 25th	63.0	78.9	79.1	78.2	77.1	75.7	73.2	70.3	66.5	62.0	56.5	48.7	40.2	30.7	19.0	2.2	-	-	-	-	-
◆ 5th	63.0	78.9	76.0	70.6	63.9	54.4	42.3	27.8	11.0	-	-	-	-	-	-	-	-	-	-	-	-
●	63.0	78.9	81.7	83.9	86.8	89.7	92.6	95.6	98.6	101.7	105.0	108.4	111.9	115.5	119.2	123.1	127.1	131.2	135.5	140.1	27.4

● Deterministic projection using current 7.5% investment return assumption

For comparison purposes -- 50th percentile projection from baseline with no change to demographics

---	63.0	78.9	81.9	84.3	87.2	90.2	92.4	95.5	98.0	101.2	105.6	109.1	112.2	114.8	120.3	122.8	128.3	128.9	127.2	120.7	-
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VMERS

Additional Modeling

VMERS Projections With Alternate Contributions

- As illustrated in the baseline projections, the current fixed contribution schedule is not sufficient to fully fund the plan by 2038
- We modeled the impact of two alternative contribution schedules that improve the funded position of VMERS over time relative to the baseline
 - Both schedules include increased member contribution rates as well as increased employer contribution rates

VMERS Alternative Contribution Rates “A”

Ultimate VMERS member and employer contribution rates reflecting four additional 0.250% increases (+1.000% total for both member and employer)

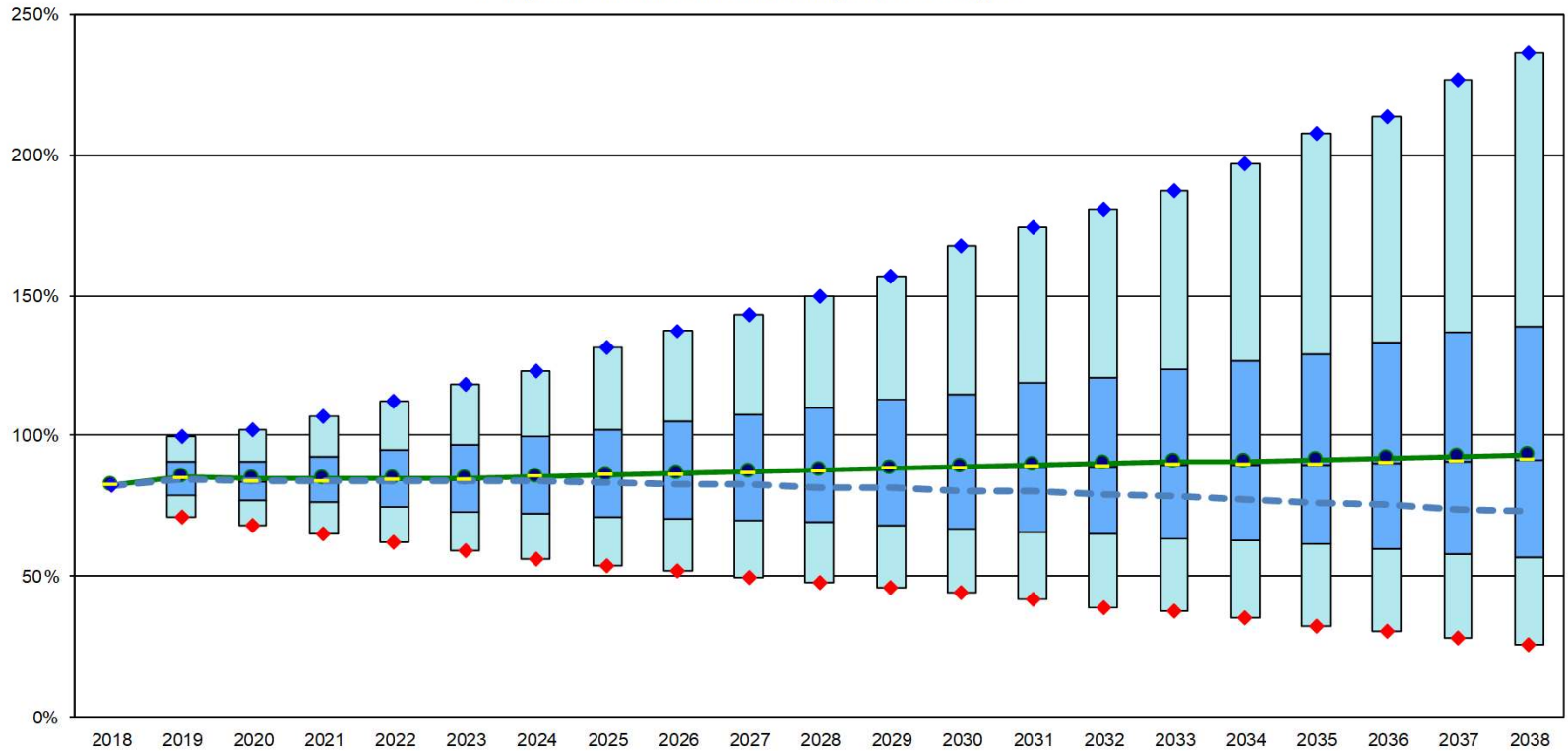
	Group A		Group B		Group C		Group D	
	Member	Employer	Member	Employer	Member	Employer	Member	Employer
FY26+	4.250%	5.750%	6.625%	7.250%	11.750%	9.000%	13.100%	11.600%
Delta (+/-)		+1.500%		+0.625%		-2.750%		-1.500%

Additional changes to employer rates for consistent +1.500% difference

	Group A		Group B		Group C		Group D	
	Rate	Change	Rate	Change	Rate	Change	Rate	Change
FY22	4.750%		6.250%		8.000%		10.600%	
FY23	5.000%	+0.250%	6.675%	+0.425%	9.250%	+1.250%	11.600%	+1.000%
FY24	5.250%	+0.250%	7.125%	+0.450%	10.500%	+1.250%	12.600%	+1.000%
FY25	5.500%	+0.250%	7.625%	+0.500%	11.875%	+1.375%	13.600%	+1.000%
FY26+	5.750%	+0.250%	8.125%	+0.500%	13.250%	+1.375%	14.600%	+1.000%

VMERS Projected Funded Percentage – Alternative “A”

Projected Funded Percentage as of July 1



◆ 95th	82%	100%	102%	107%	112%	118%	123%	131%	137%	143%	150%	157%	167%	174%	180%	187%	197%	208%	213%	227%	236%
— 75th	82%	91%	91%	93%	95%	97%	100%	102%	105%	107%	110%	113%	115%	118%	121%	123%	126%	129%	133%	136%	139%
■ 50th	82%	85%	84%	84%	84%	84%	85%	86%	86%	87%	87%	88%	88%	89%	89%	90%	90%	90%	90%	91%	91%
— 25th	82%	79%	77%	76%	75%	73%	72%	71%	70%	70%	69%	68%	67%	66%	65%	64%	63%	62%	60%	58%	57%
◆ 5th	82%	71%	68%	65%	62%	59%	56%	54%	52%	50%	48%	46%	44%	42%	39%	38%	35%	33%	31%	28%	26%
●	82%	85%	85%	85%	85%	85%	85%	86%	87%	87%	88%	88%	89%	89%	90%	91%	91%	92%	92%	93%	93%

● Deterministic projection using current 7.5% investment return assumption

For comparison purposes -- 50th percentile projection from baseline using current member and employer contribution rates

■	82%	85%	84%	84%	84%	84%	84%	83%	83%	83%	82%	82%	81%	80%	79%	79%	78%	76%	76%	74%	73%
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VMERS Alternative Contribution Rates “B”

Ultimate VMERS member and employer contribution rates reflecting four additional 0.250% increases (+1.000% total for both member and employer)

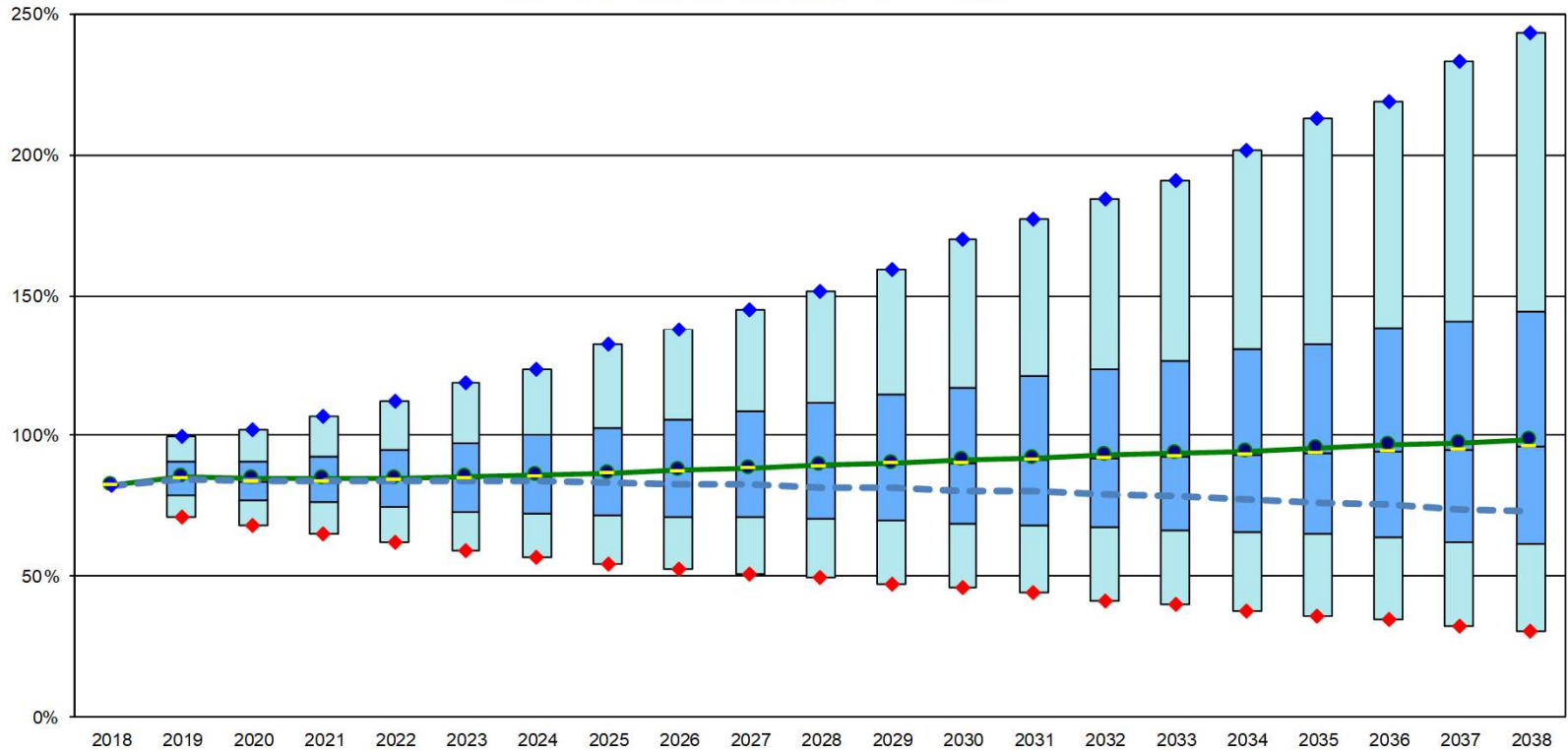
	Group A		Group B		Group C		Group D	
	Member	Employer	Member	Employer	Member	Employer	Member	Employer
FY26+	4.250%	5.750%	6.625%	7.250%	11.750%	9.000%	13.100%	11.600%
Ratio		135%		109%		77%		89%

Additional changes to employer rates for consistent +1.500% difference

	Group A		Group B		Group C		Group D	
	Rate	Change	Rate	Change	Rate	Change	Rate	Change
FY22	4.750%		6.250%		8.000%		10.600%	
FY23	5.000%	+0.250%	6.850%	+0.600%	10.000%	+2.000%	12.100%	+1.500%
FY24	5.250%	+0.250%	7.450%	+0.600%	12.000%	+2.000%	13.600%	+1.500%
FY25	5.500%	+0.250%	8.150%	+0.700%	14.000%	+2.000%	15.600%	+2.000%
FY26+	5.750%	+0.250%	8.850%	+0.700%	16.000%	+2.000%	17.600%	+2.000%

VMERS Projected Funded Percentage – Alternative “B”

Projected Funded Percentage as of July 1



◆ 95th	82%	100%	102%	107%	112%	118%	123%	132%	138%	145%	152%	159%	170%	177%	184%	191%	201%	213%	219%	233%	243%
■ 75th	82%	91%	91%	93%	95%	97%	100%	103%	106%	109%	111%	115%	117%	121%	124%	127%	130%	133%	138%	141%	145%
■ 50th	82%	85%	84%	84%	84%	85%	86%	86%	87%	88%	89%	90%	90%	91%	92%	93%	93%	94%	95%	95%	96%
■ 25th	82%	79%	77%	76%	75%	73%	73%	72%	71%	71%	71%	70%	69%	68%	68%	67%	66%	65%	64%	62%	61%
◆ 5th	82%	71%	68%	65%	62%	59%	57%	55%	53%	51%	50%	48%	46%	44%	42%	40%	38%	36%	35%	32%	30%
●	82%	85%	85%	85%	85%	85%	86%	87%	88%	89%	89%	90%	91%	92%	93%	94%	95%	96%	96%	97%	98%

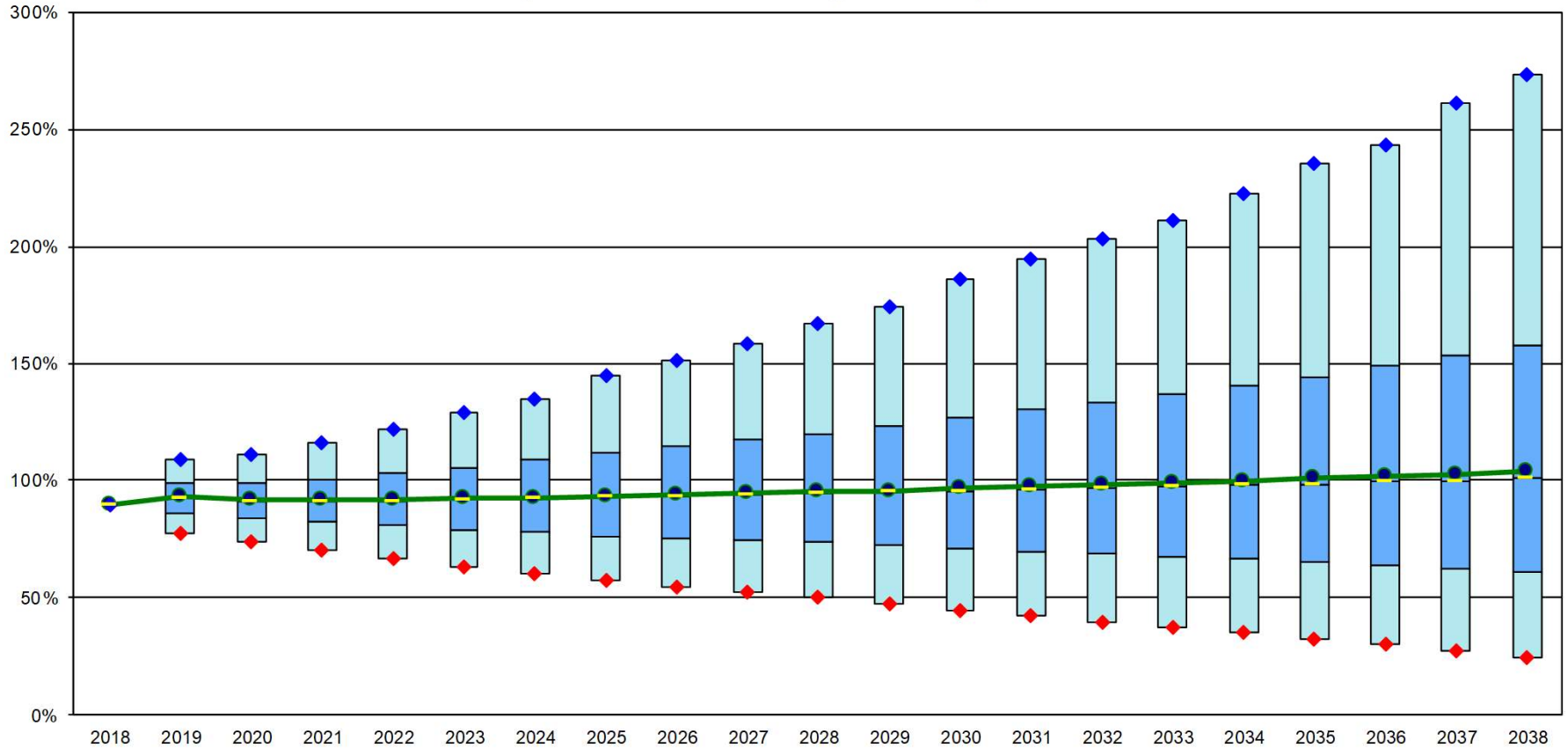
● Deterministic projection using current 7.5% investment return assumption

For comparison purposes -- 50th percentile projection from baseline using current member and employer contribution rates

■	82%	85%	84%	84%	84%	84%	84%	83%	83%	83%	82%	82%	81%	80%	79%	79%	78%	76%	76%	74%	73%
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VMERS Group A Projected Funded Percentage – Alternative “B”

Projected Funded Percentage as of July 1

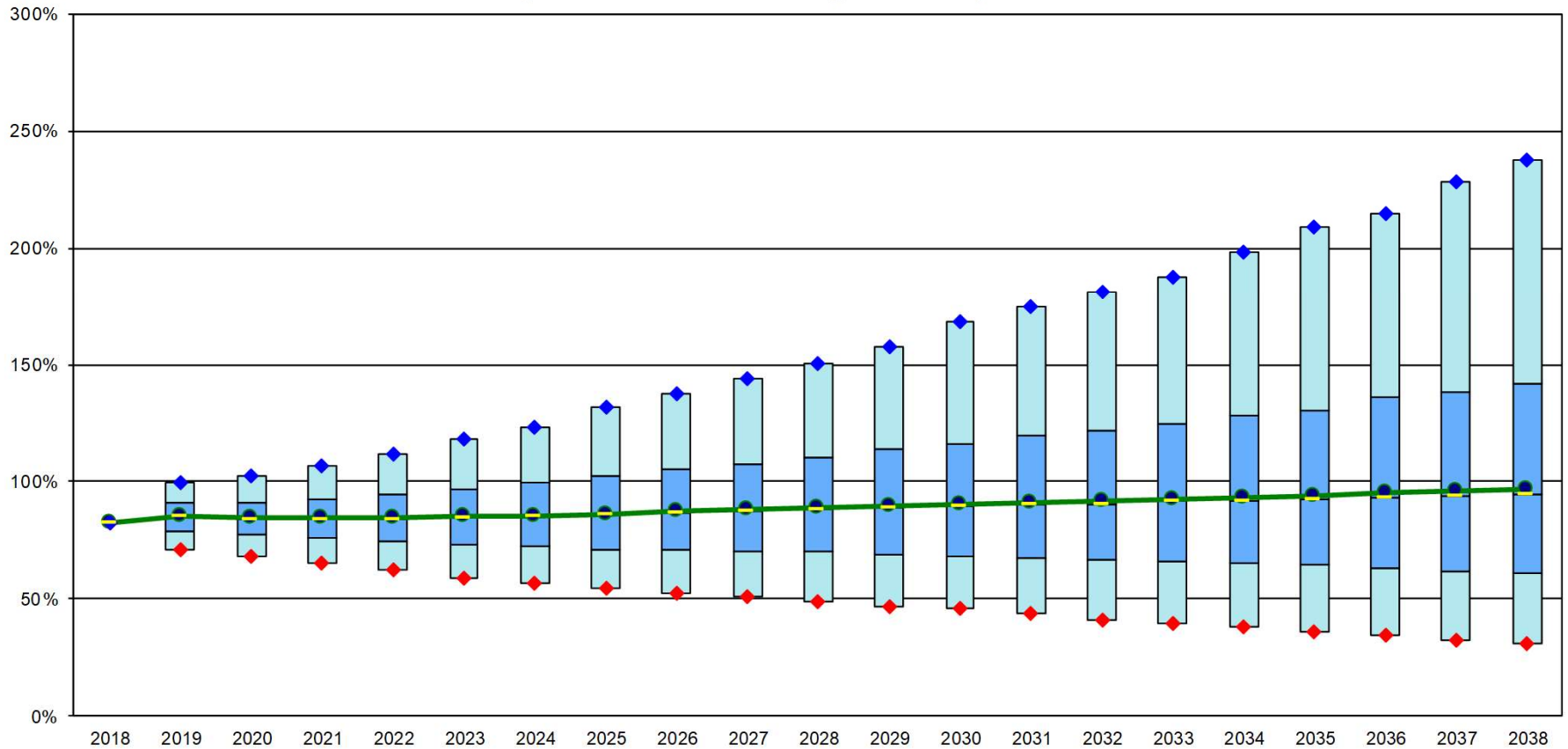


◆ 95th	90%	109%	111%	116%	122%	129%	135%	144%	151%	158%	167%	174%	186%	195%	203%	211%	222%	235%	243%	261%	273%
— 75th	90%	99%	99%	101%	103%	106%	109%	111%	114%	117%	120%	123%	127%	130%	133%	137%	141%	144%	149%	153%	158%
— 50th	90%	92%	91%	91%	91%	91%	92%	93%	93%	94%	94%	95%	96%	96%	97%	97%	98%	98%	100%	100%	101%
— 25th	90%	86%	84%	83%	81%	79%	78%	76%	75%	75%	74%	72%	71%	70%	69%	67%	67%	66%	64%	63%	61%
◆ 5th	90%	78%	74%	71%	67%	63%	60%	57%	55%	52%	50%	47%	45%	43%	39%	37%	35%	32%	30%	28%	25%
●	90%	93%	92%	92%	92%	92%	93%	93%	94%	95%	95%	96%	97%	97%	98%	99%	100%	101%	102%	103%	104%

● Deterministic projection using current 7.5% investment return assumption

VMERS Group B Projected Funded Percentage – Alternative “B”

Projected Funded Percentage as of July 1

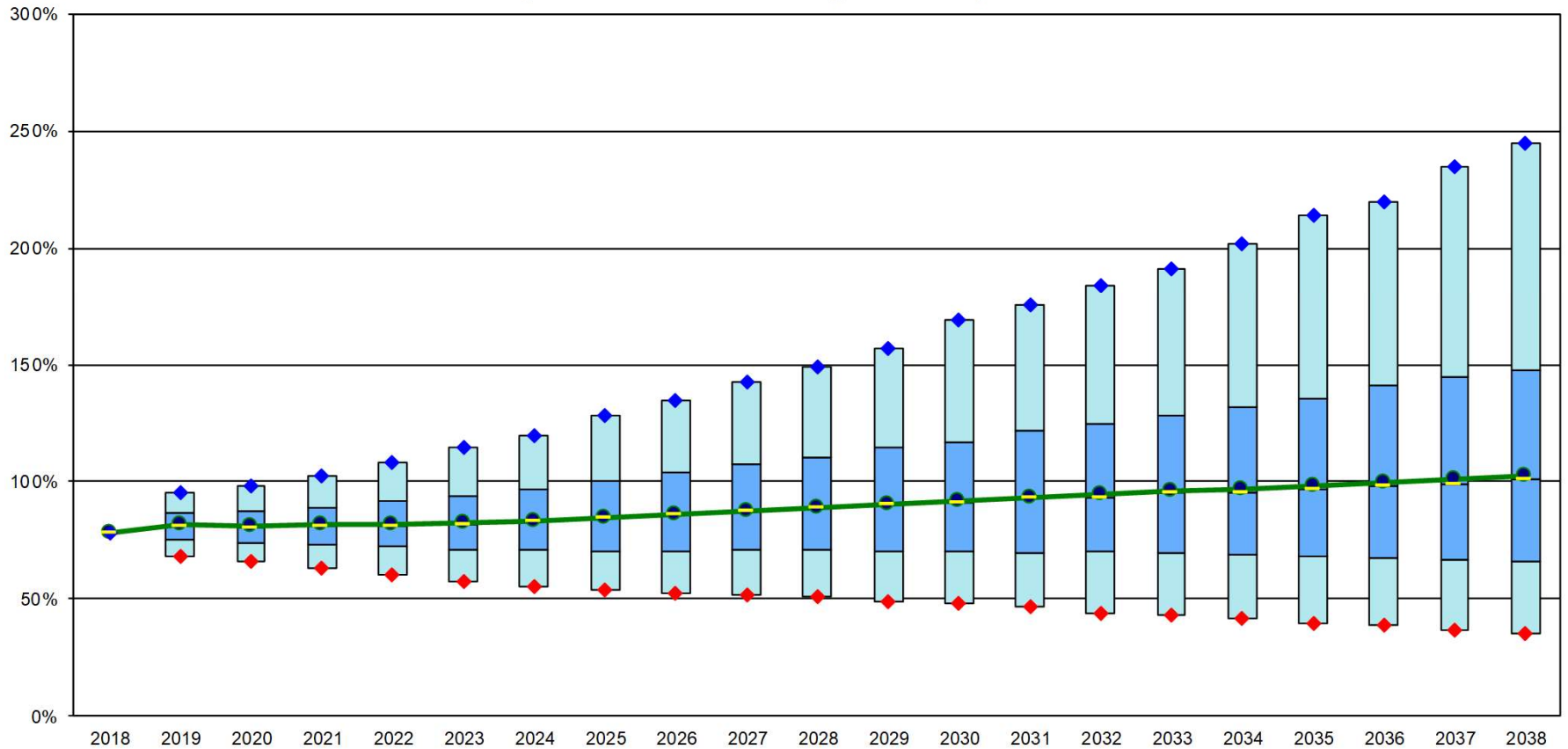


	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
◆ 95th	83%	100%	102%	107%	112%	118%	123%	132%	137%	144%	150%	157%	168%	175%	181%	188%	198%	209%	215%	228%	238%
■ 75th	83%	91%	91%	93%	95%	97%	100%	102%	105%	108%	110%	114%	116%	120%	122%	125%	128%	131%	136%	138%	142%
■ 50th	83%	85%	84%	84%	84%	84%	85%	86%	86%	88%	88%	89%	90%	90%	91%	92%	92%	92%	93%	94%	95%
■ 25th	83%	79%	77%	76%	75%	73%	72%	71%	71%	71%	70%	69%	68%	67%	67%	66%	65%	64%	63%	62%	61%
◆ 5th	83%	71%	68%	65%	62%	59%	56%	54%	52%	51%	49%	47%	46%	44%	41%	40%	38%	36%	35%	32%	31%
●	83%	86%	85%	85%	85%	85%	86%	86%	87%	88%	89%	89%	90%	91%	92%	93%	93%	94%	95%	96%	97%

● Deterministic projection using current 7.5% investment return assumption

VMERS Group C Projected Funded Percentage – Alternative “B”

Projected Funded Percentage as of July 1

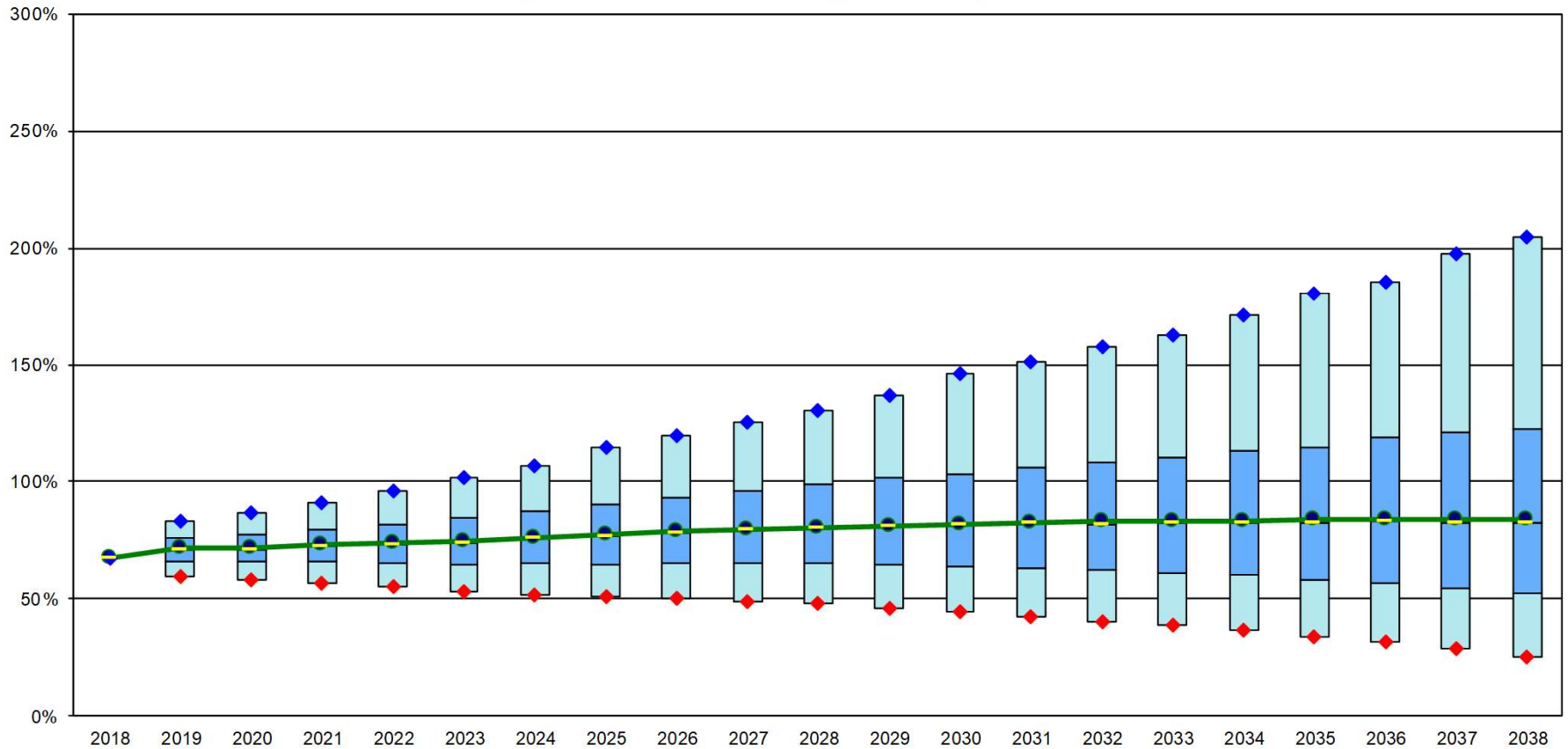


	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
◆ 95th	78%	95%	98%	103%	108%	114%	119%	128%	135%	142%	149%	157%	169%	175%	184%	191%	202%	214%	220%	235%	245%
■ 75th	78%	87%	87%	89%	92%	94%	97%	100%	104%	107%	111%	115%	117%	122%	125%	128%	132%	135%	141%	144%	148%
■ 50th	78%	81%	80%	81%	81%	82%	83%	85%	86%	88%	89%	90%	91%	93%	94%	95%	96%	97%	98%	99%	101%
■ 25th	78%	75%	74%	74%	72%	71%	71%	70%	71%	71%	71%	71%	70%	70%	70%	69%	69%	68%	68%	67%	66%
◆ 5th	78%	68%	66%	63%	60%	58%	55%	54%	53%	52%	51%	49%	48%	47%	44%	43%	42%	40%	39%	37%	35%
● Deterministic	78%	82%	81%	82%	82%	83%	84%	85%	86%	88%	89%	90%	92%	93%	95%	96%	97%	98%	100%	101%	103%

● Deterministic projection using current 7.5% investment return assumption

VMERS Group D Projected Funded Percentage – Alternative “B”

Projected Funded Percentage as of July 1



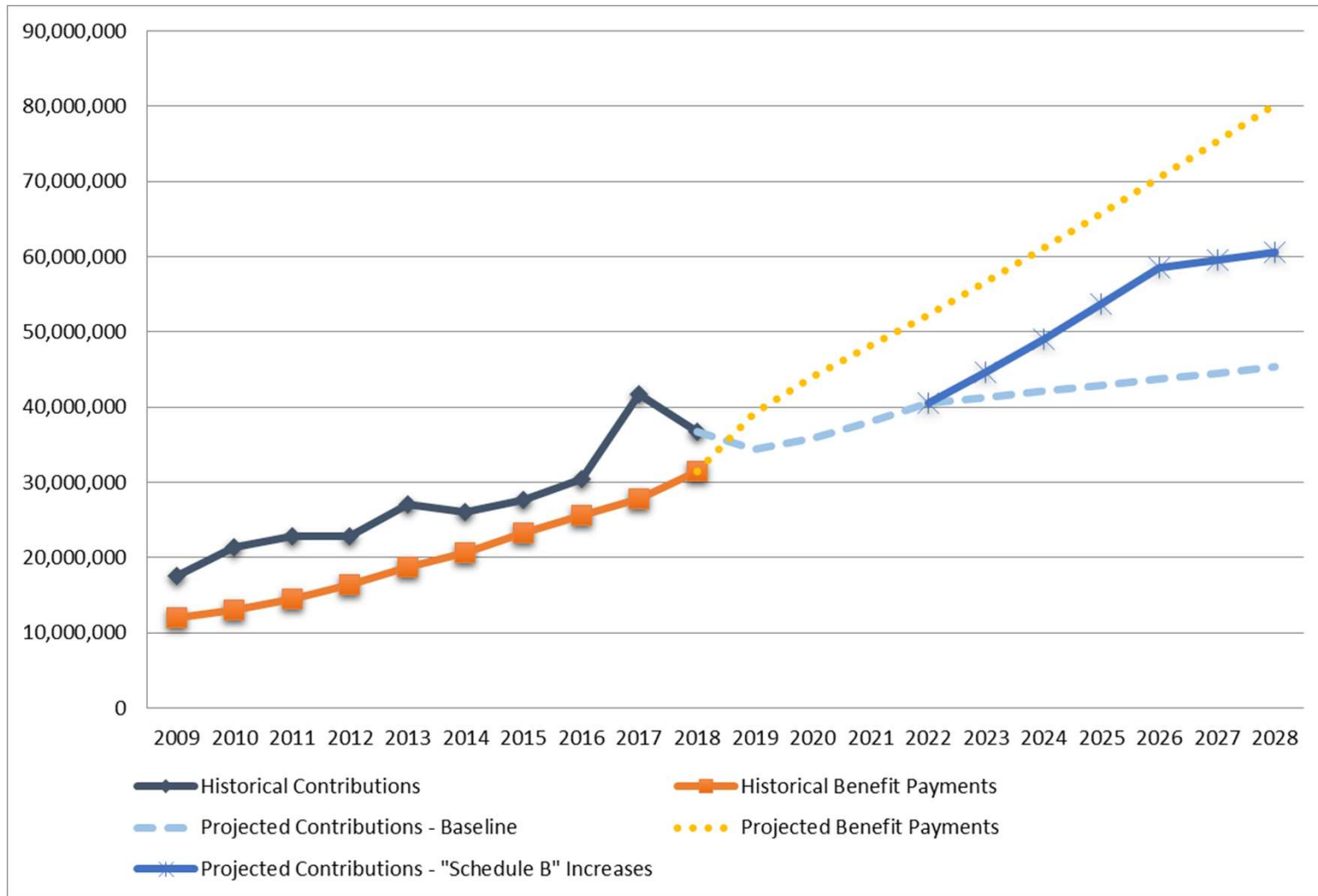
◆ 95th	68%	83%	87%	91%	96%	102%	106%	114%	119%	125%	131%	137%	146%	151%	158%	163%	171%	181%	186%	197%	205%
— 75th	68%	76%	77%	79%	82%	85%	87%	91%	94%	96%	99%	102%	103%	106%	108%	110%	113%	115%	119%	121%	122%
■ 50th	68%	71%	71%	72%	73%	74%	76%	77%	78%	79%	80%	81%	82%	82%	82%	83%	82%	83%	83%	82%	82%
■ 25th	68%	66%	66%	66%	65%	65%	65%	65%	65%	65%	66%	65%	64%	63%	62%	61%	60%	58%	57%	55%	53%
◆ 5th	68%	60%	58%	57%	55%	53%	52%	51%	50%	49%	48%	46%	45%	43%	40%	39%	37%	34%	32%	29%	26%
●	68%	72%	72%	73%	74%	75%	76%	77%	79%	80%	80%	81%	82%	82%	83%	83%	83%	84%	84%	84%	84%

● Deterministic projection using current 7.5% investment return assumption

Other Probabilities (Total VMERS System)

Event	Baseline	Alternative "A"	Alternative "B"
Probability that the funded percentage is more than 100% in 10 years	29%	35%	36%
Probability that the funded percentage is more than 100% in 15 years	32%	41%	44%
Probability that the funded percentage is less than 60% in 10 years	20%	15%	13%
Probability that the funded percentage is less than 60% in 15 years	32%	21%	18%

Comparison of VMERS Contributions to Benefit Payments

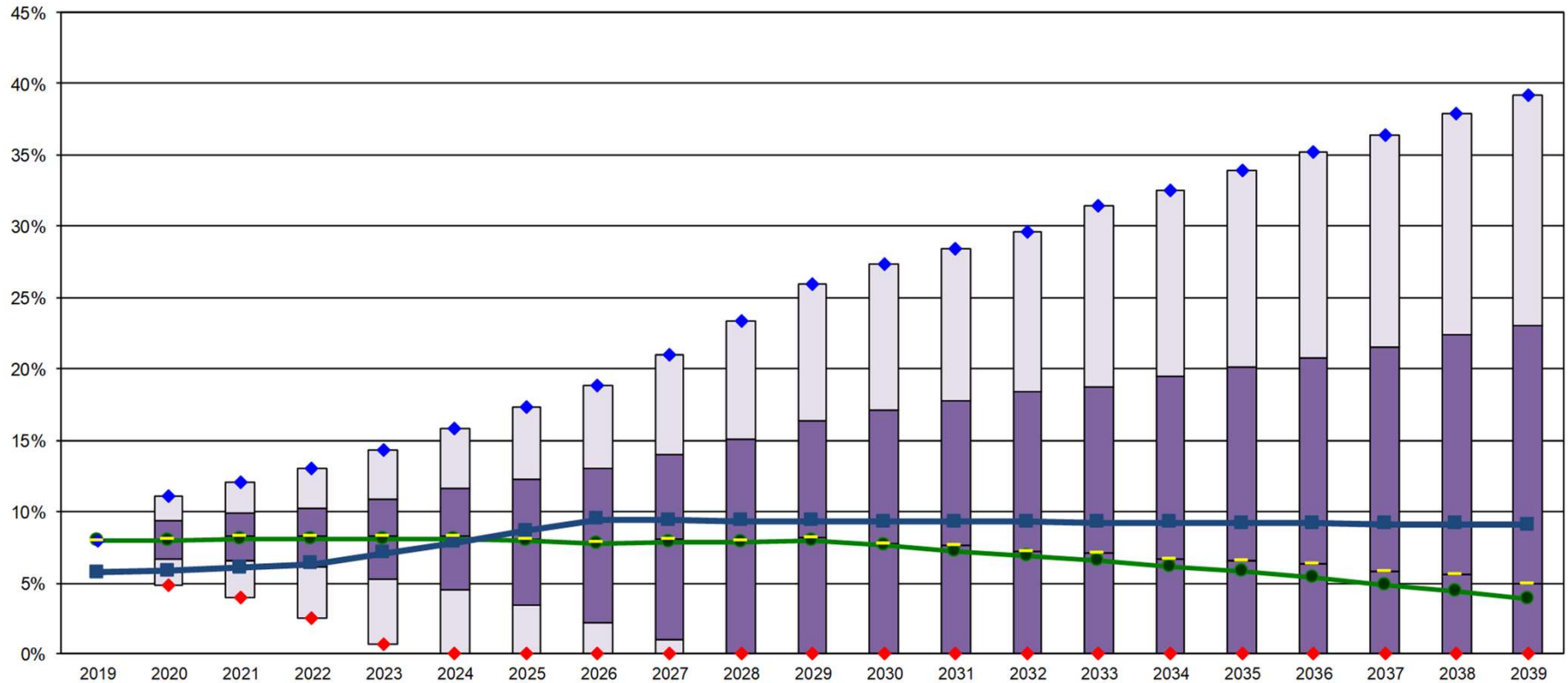


VMERS – ADC Based on Entry Age Normal

- Employer contribution rates are compared to an Actuarially Determined Contribution rate to assess adequacy
- The current VMERS ADC is based on a hybrid funding method that prioritizes stable cost and defers recognition of gains and losses
- The following slides show a comparison of Alternative Schedule “B” employer contribution rates to an ADC that is determined on a basis similar to VSERS and VSTRS:
 - Actuarial Accrued Liability and Normal Cost determined under the Entry Age Normal actuarial cost method
 - Amortization of unfunded liability based on a closed amortization period ending June 30, 2038 with payments increasing at 3% per year

VMERS Projected EAN ADC – Alternative “B”

Projected Actuarially Determined Contribution Rate for Plan Years Ending June 30



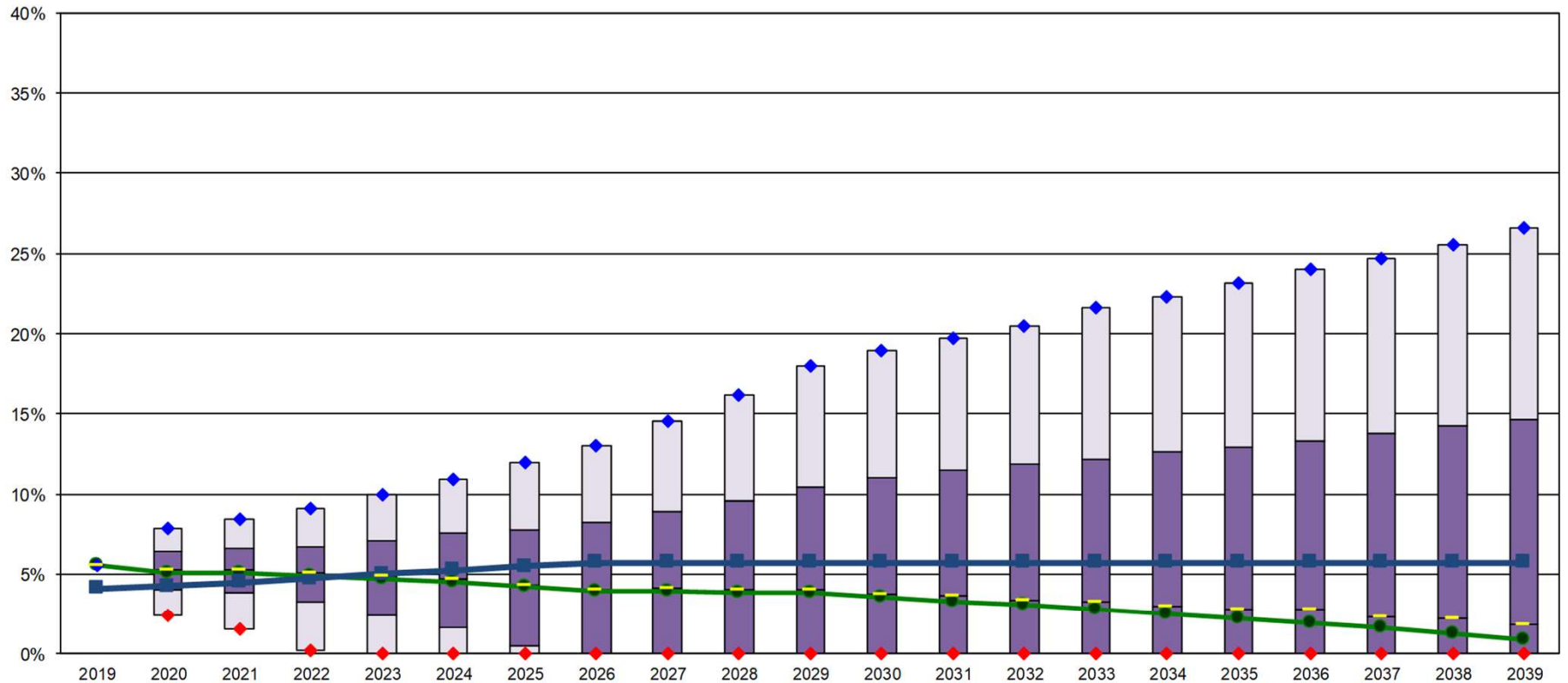
◆ 95th	8.0%	11.1%	12.0%	13.1%	14.3%	15.8%	17.3%	18.9%	21.0%	23.3%	26.0%	27.4%	28.4%	29.6%	31.4%	32.5%	33.9%	35.2%	36.4%	37.9%	39.1%
■ 75th	8.0%	9.4%	9.9%	10.3%	10.9%	11.7%	12.2%	13.0%	14.0%	15.1%	16.4%	17.1%	17.8%	18.4%	18.7%	19.5%	20.1%	20.7%	21.5%	22.4%	23.1%
■ 50th	8.0%	8.1%	8.3%	8.3%	8.3%	8.3%	8.0%	7.9%	8.1%	8.0%	8.2%	7.8%	7.6%	7.2%	7.1%	6.6%	6.6%	6.4%	5.9%	5.6%	5.0%
■ 25th	8.0%	6.7%	6.6%	6.1%	5.3%	4.5%	3.4%	2.2%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
◆ 5th	8.0%	4.8%	4.0%	2.5%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
●	8.0%	8.0%	8.1%	8.1%	8.1%	8.1%	8.0%	7.8%	7.8%	7.9%	8.0%	7.7%	7.3%	6.9%	6.6%	6.2%	5.8%	5.4%	4.9%	4.4%	3.9%
■	5.7%	5.8%	6.1%	6.3%	7.1%	7.8%	8.6%	9.4%	9.4%	9.4%	9.4%	9.3%	9.3%	9.3%	9.2%	9.2%	9.2%	9.2%	9.1%	9.1%	9.1%

● Baseline deterministic projection using current 7.5% investment return assumption

■ Composite actual employer contribution rate ("Alternative B")

VMERS Group A Projected EAN ADC – Alternative “B”

Projected Actuarially Determined Contribution Rate for Plan Years Ending June 30



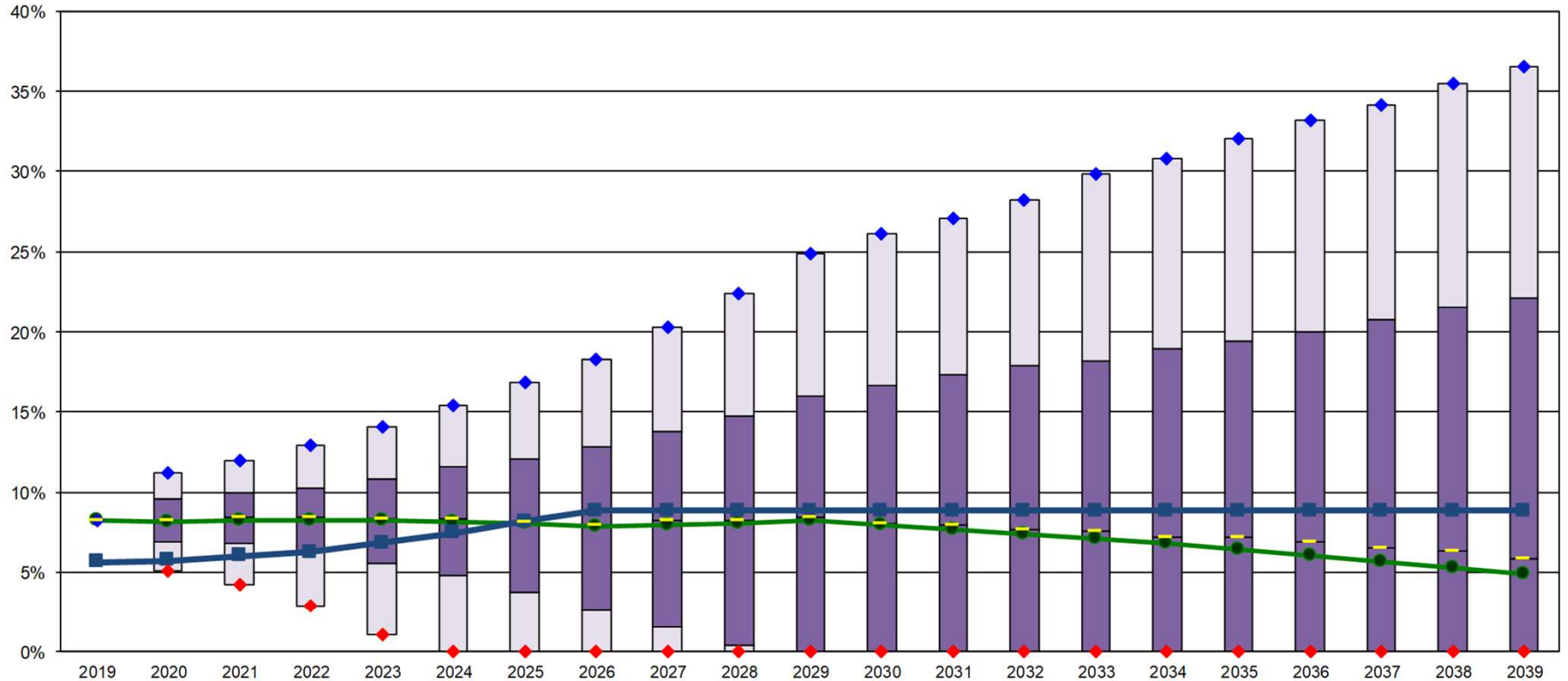
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
◆ 95th	5.5%	7.8%	8.4%	9.1%	9.9%	10.9%	12.0%	13.0%	14.5%	16.2%	18.0%	19.0%	19.7%	20.5%	21.6%	22.3%	23.2%	24.0%	24.7%	25.6%	26.6%
■ 75th	5.5%	6.4%	6.6%	6.8%	7.1%	7.5%	7.8%	8.3%	8.9%	9.6%	10.5%	11.0%	11.5%	11.9%	12.1%	12.7%	12.9%	13.3%	13.8%	14.3%	14.7%
■ 50th	5.5%	5.2%	5.3%	5.1%	4.9%	4.7%	4.4%	4.0%	4.2%	4.0%	4.0%	3.7%	3.7%	3.4%	3.3%	3.0%	2.8%	2.8%	2.3%	2.2%	1.9%
■ 25th	5.5%	4.1%	3.8%	3.2%	2.4%	1.6%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
◆ 5th	5.5%	2.4%	1.6%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
● Baseline	5.5%	5.1%	5.1%	4.9%	4.7%	4.5%	4.3%	3.9%	3.9%	3.9%	3.8%	3.6%	3.3%	3.1%	2.8%	2.5%	2.2%	1.9%	1.6%	1.3%	0.9%
■ Group A	4.1%	4.3%	4.5%	4.8%	5.0%	5.3%	5.5%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%

● Baseline deterministic projection using current 7.5% investment return assumption

■ Group A actual employer contribution rate ("Alternative B")

VMERS Group B Projected EAN ADC – Alternative “B”

Projected Actuarially Determined Contribution Rate for Plan Years Ending June 30



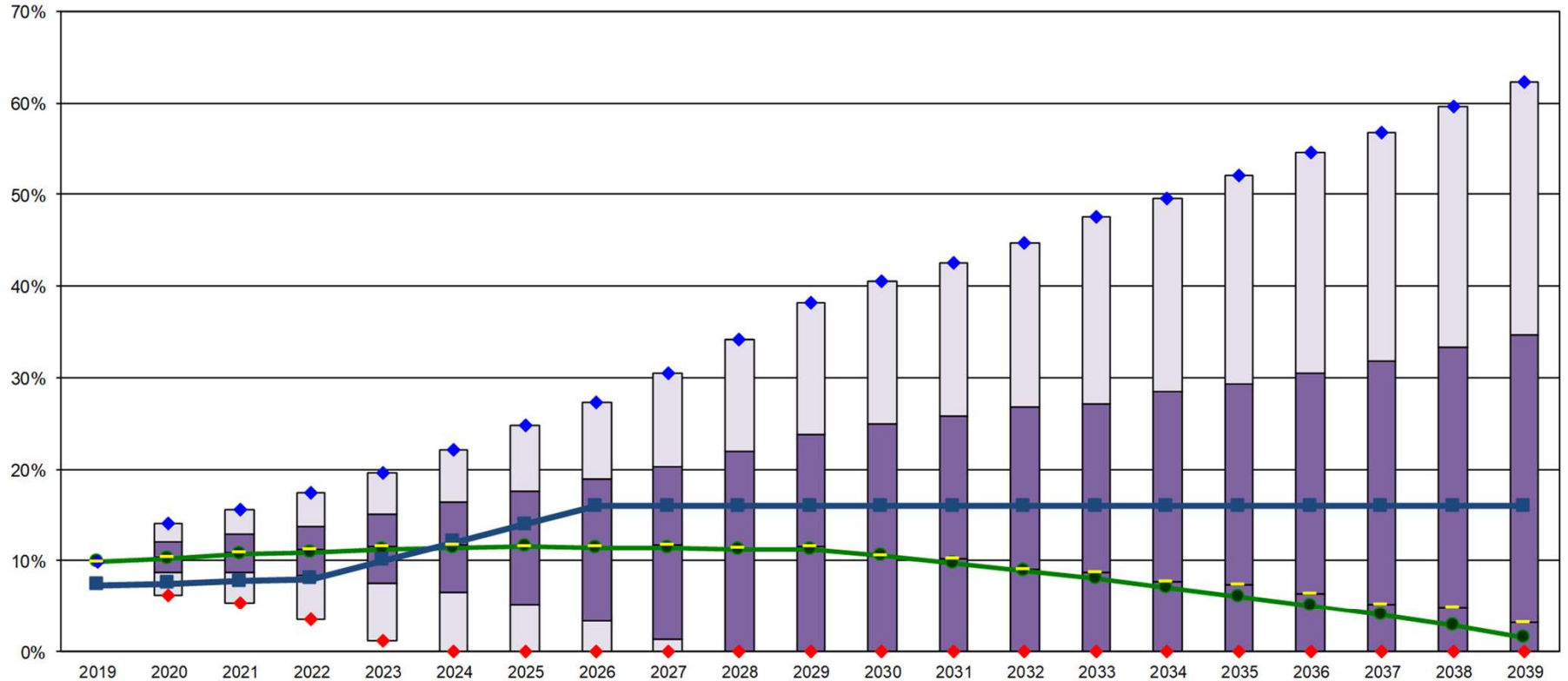
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
◆ 95th	8.2%	11.2%	12.0%	13.0%	14.1%	15.5%	16.8%	18.3%	20.3%	22.4%	24.9%	26.1%	27.1%	28.2%	29.8%	30.8%	32.1%	33.2%	34.2%	35.5%	36.6%
■ 75th	8.2%	9.5%	10.0%	10.3%	10.8%	11.6%	12.1%	12.8%	13.8%	14.8%	16.0%	16.7%	17.3%	17.9%	18.2%	18.9%	19.5%	20.0%	20.7%	21.5%	22.1%
■ 50th	8.2%	8.2%	8.5%	8.4%	8.4%	8.3%	8.1%	8.0%	8.2%	8.2%	8.4%	8.1%	8.0%	7.6%	7.6%	7.2%	7.2%	6.9%	6.5%	6.4%	5.8%
■ 25th	8.2%	6.9%	6.8%	6.3%	5.6%	4.8%	3.8%	2.6%	1.6%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
◆ 5th	8.2%	5.1%	4.2%	2.8%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
●	8.2%	8.1%	8.2%	8.2%	8.2%	8.1%	8.0%	7.9%	8.0%	8.1%	8.2%	8.0%	7.6%	7.4%	7.1%	6.8%	6.4%	6.1%	5.7%	5.3%	4.9%
■	5.6%	5.8%	6.0%	6.3%	6.9%	7.5%	8.2%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%

● Baseline deterministic projection using current 7.5% investment return assumption

■ Group B actual employer contribution rate ("Alternative B")

VMERS Group C Projected EAN ADC – Alternative “B”

Projected Actuarially Determined Contribution Rate for Plan Years Ending June 30

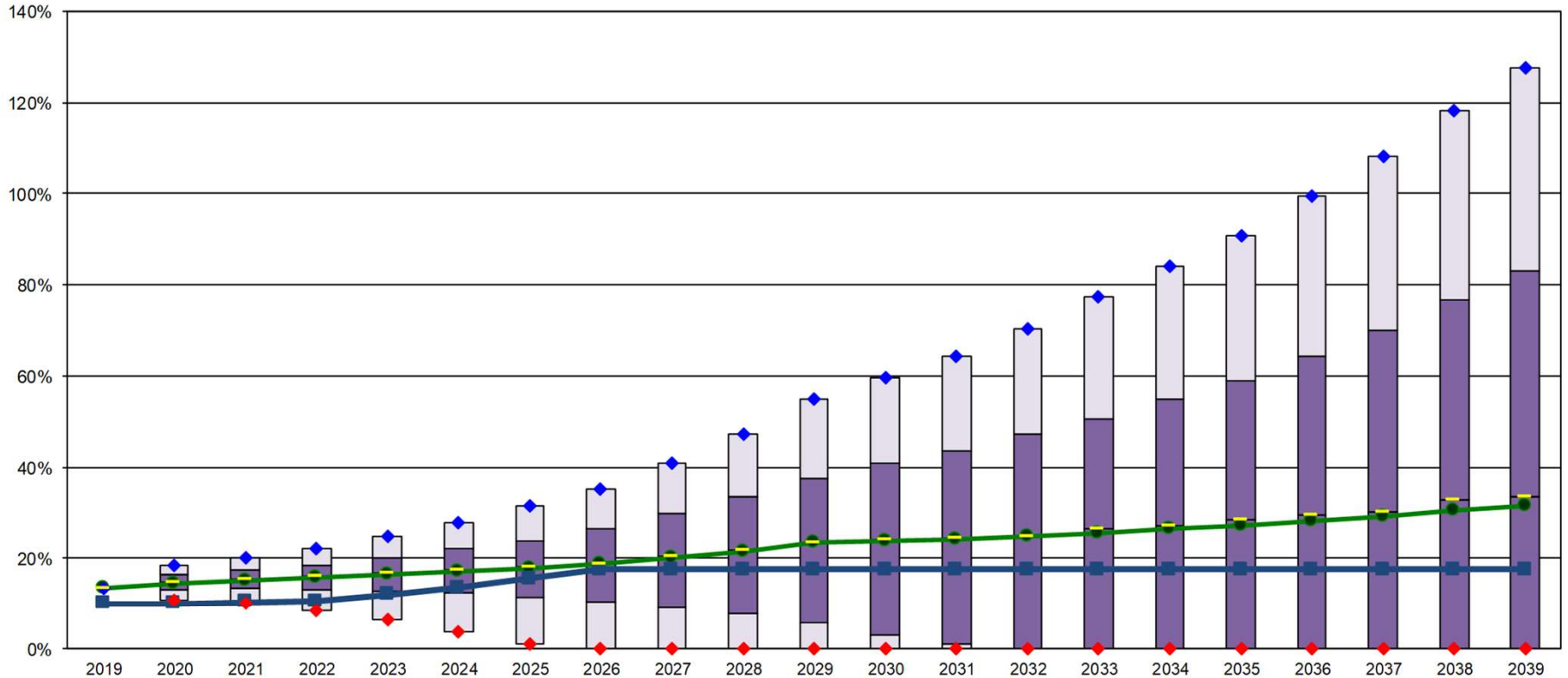


	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
◆ 95th	9.8%	14.1%	15.7%	17.5%	19.7%	22.1%	24.7%	27.2%	30.5%	34.1%	38.1%	40.5%	42.5%	44.7%	47.6%	49.6%	52.0%	54.5%	56.8%	59.7%	62.3%
■ 75th	9.8%	12.0%	13.0%	13.8%	15.1%	16.4%	17.5%	18.9%	20.3%	21.9%	23.8%	24.9%	25.9%	26.9%	27.2%	28.4%	29.4%	30.4%	31.8%	33.3%	34.6%
■ 50th	9.8%	10.4%	11.0%	11.2%	11.5%	11.8%	11.6%	11.5%	11.7%	11.5%	11.5%	10.6%	10.2%	9.1%	8.8%	7.8%	7.4%	6.4%	5.2%	4.9%	3.2%
■ 25th	9.8%	8.7%	8.8%	8.3%	7.5%	6.6%	5.2%	3.3%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
◆ 5th	9.8%	6.3%	5.3%	3.5%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
● Baseline	9.8%	10.2%	10.7%	10.9%	11.3%	11.5%	11.5%	11.3%	11.3%	11.3%	11.3%	10.6%	9.7%	8.9%	8.0%	7.1%	6.1%	5.1%	4.0%	2.8%	1.6%
■ Group C	7.4%	7.5%	7.8%	8.0%	10.0%	12.0%	14.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%

- Baseline deterministic projection using current 7.5% investment return assumption
- Group C actual employer contribution rate ("Alternative B")

VMERS Group D Projected EAN ADC – Alternative “B”

Projected Actuarially Determined Contribution Rate for Plan Years Ending June 30



◆ 95th	13.3%	18.3%	20.1%	22.2%	24.8%	27.9%	31.4%	35.3%	40.8%	47.4%	54.9%	59.7%	64.4%	70.4%	77.5%	84.2%	90.9%	99.6%	108.1%	118.3%	127.6%
■ 75th	13.3%	16.3%	17.5%	18.6%	20.3%	22.2%	24.0%	26.6%	29.8%	33.5%	37.7%	40.9%	43.6%	47.2%	50.5%	55.0%	59.1%	64.2%	70.1%	76.7%	82.9%
■ 50th	13.3%	14.7%	15.5%	16.1%	16.8%	17.5%	18.0%	19.0%	20.4%	21.7%	23.6%	24.1%	24.6%	24.9%	26.6%	27.3%	28.6%	29.6%	30.3%	32.9%	33.6%
■ 25th	13.3%	13.0%	13.4%	13.2%	12.9%	12.3%	11.6%	10.3%	9.1%	7.7%	5.8%	2.9%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
◆ 5th	13.3%	10.7%	10.0%	8.6%	6.6%	3.7%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
●	13.3%	14.5%	15.2%	15.8%	16.5%	17.3%	17.9%	18.7%	20.0%	21.6%	23.4%	23.9%	24.2%	24.8%	25.6%	26.4%	27.2%	28.1%	29.2%	30.4%	31.4%
■	10.0%	10.1%	10.4%	10.6%	12.1%	13.6%	15.6%	17.6%	17.6%	17.6%	17.6%	17.6%	17.6%	17.6%	17.6%	17.6%	17.6%	17.6%	17.6%	17.6%	17.6%

● Baseline deterministic projection using current 7.5% investment return assumption

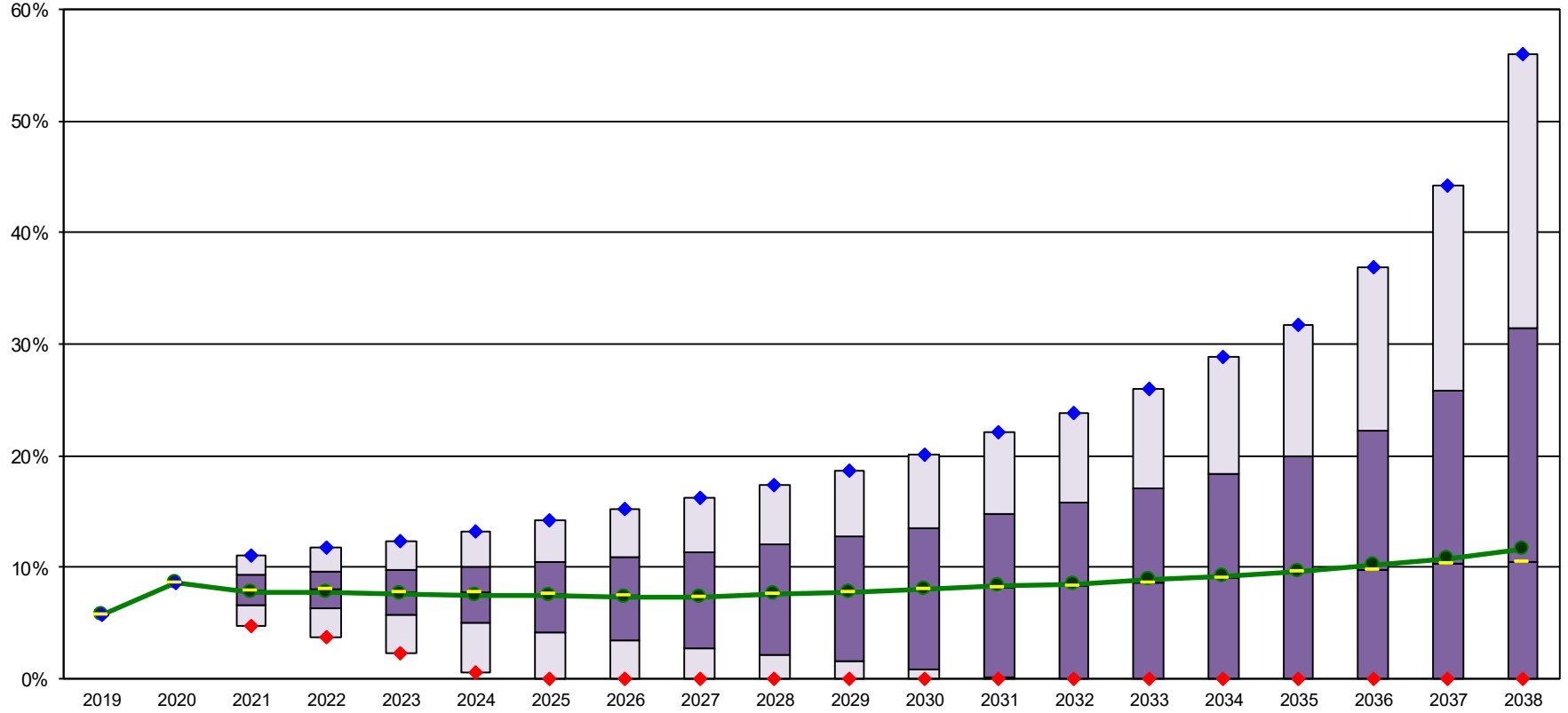
■ Group D actual employer contribution rate ("Alternative B")

VMERS – Employer Contributions Based on ADC

- We have also analyzed the required employer contribution rates if, instead of fixed rates, they were based on an Actuarially Determined Contribution rate
- The following slides show a comparison of employer contribution rates using an ADC that is determined on a basis similar to VSERS and VSTRS:
 - Actuarial Accrued Liability and Normal Cost determined under the Entry Age Normal actuarial cost method
 - Amortization of unfunded liability based on a closed amortization period ending June 30, 2038 with payments increasing at 3% per year
 - Based on additional 1% member contribution increase spread over four years (0.25% per year) from fiscal 2023 through fiscal 2026

VMERS Contribute Projected EAN ADC

Projected Employer Contribution Rate for Plan Years Ending June 30

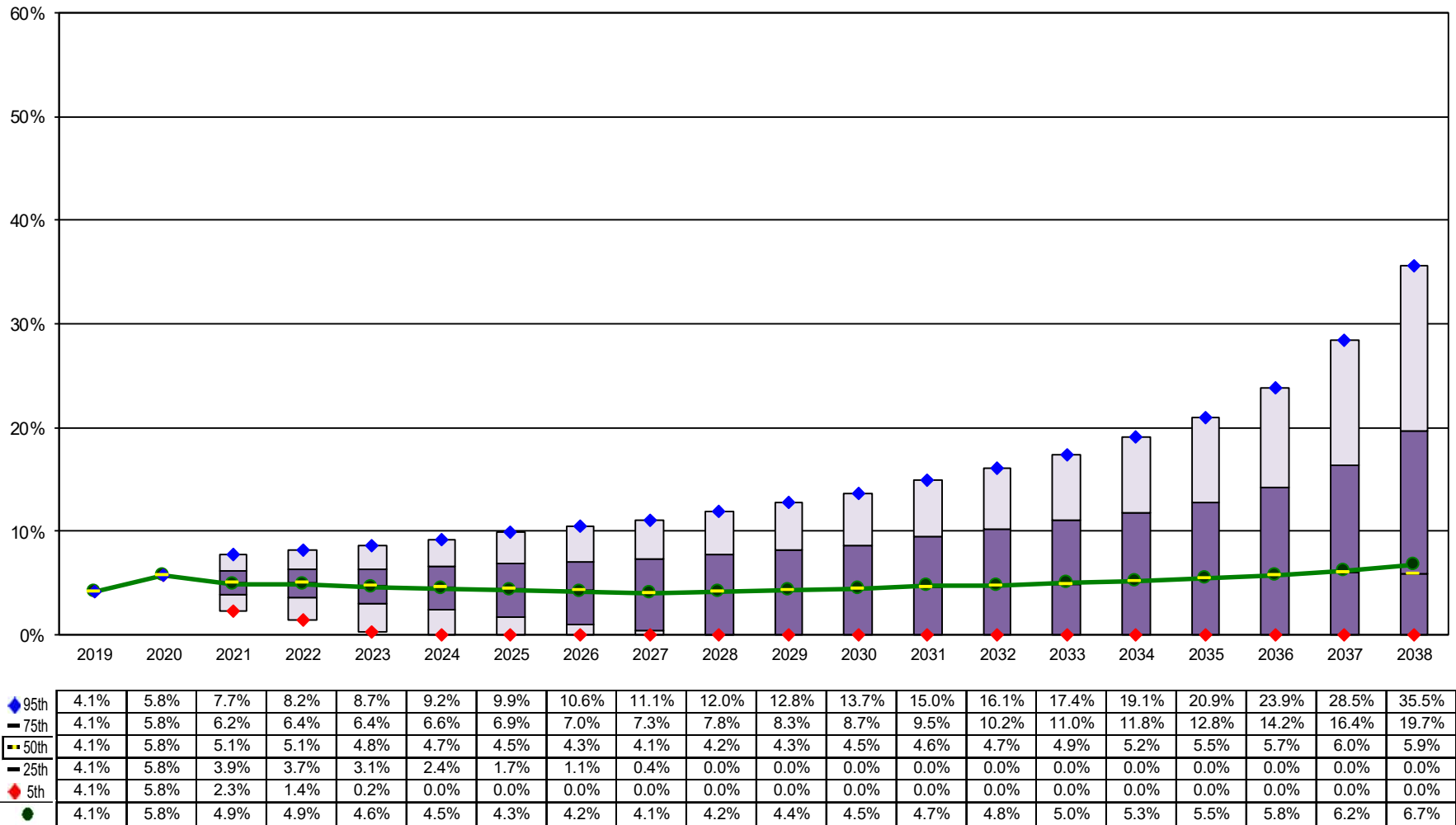


◆ 95th	5.7%	8.7%	11.0%	11.7%	12.4%	13.2%	14.2%	15.3%	16.2%	17.4%	18.7%	20.1%	22.2%	23.8%	26.0%	28.9%	31.8%	36.8%	44.3%	56.0%
■ 75th	5.7%	8.7%	9.3%	9.6%	9.7%	10.1%	10.5%	10.9%	11.4%	12.1%	12.8%	13.5%	14.8%	15.9%	17.2%	18.4%	19.9%	22.3%	25.8%	31.4%
■ 50th	5.7%	8.7%	8.0%	8.1%	7.8%	7.7%	7.6%	7.4%	7.4%	7.6%	7.7%	8.0%	8.2%	8.4%	8.6%	9.1%	9.7%	9.8%	10.3%	10.5%
■ 25th	5.7%	8.7%	6.6%	6.4%	5.7%	5.0%	4.3%	3.5%	2.8%	2.2%	1.6%	1.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
◆ 5th	5.7%	8.7%	4.7%	3.7%	2.4%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
●	5.7%	8.7%	7.8%	7.8%	7.6%	7.5%	7.4%	7.4%	7.3%	7.6%	7.8%	8.1%	8.4%	8.6%	8.9%	9.3%	9.7%	10.2%	10.8%	11.6%

● Baseline deterministic projection using current 7.5% investment return assumption

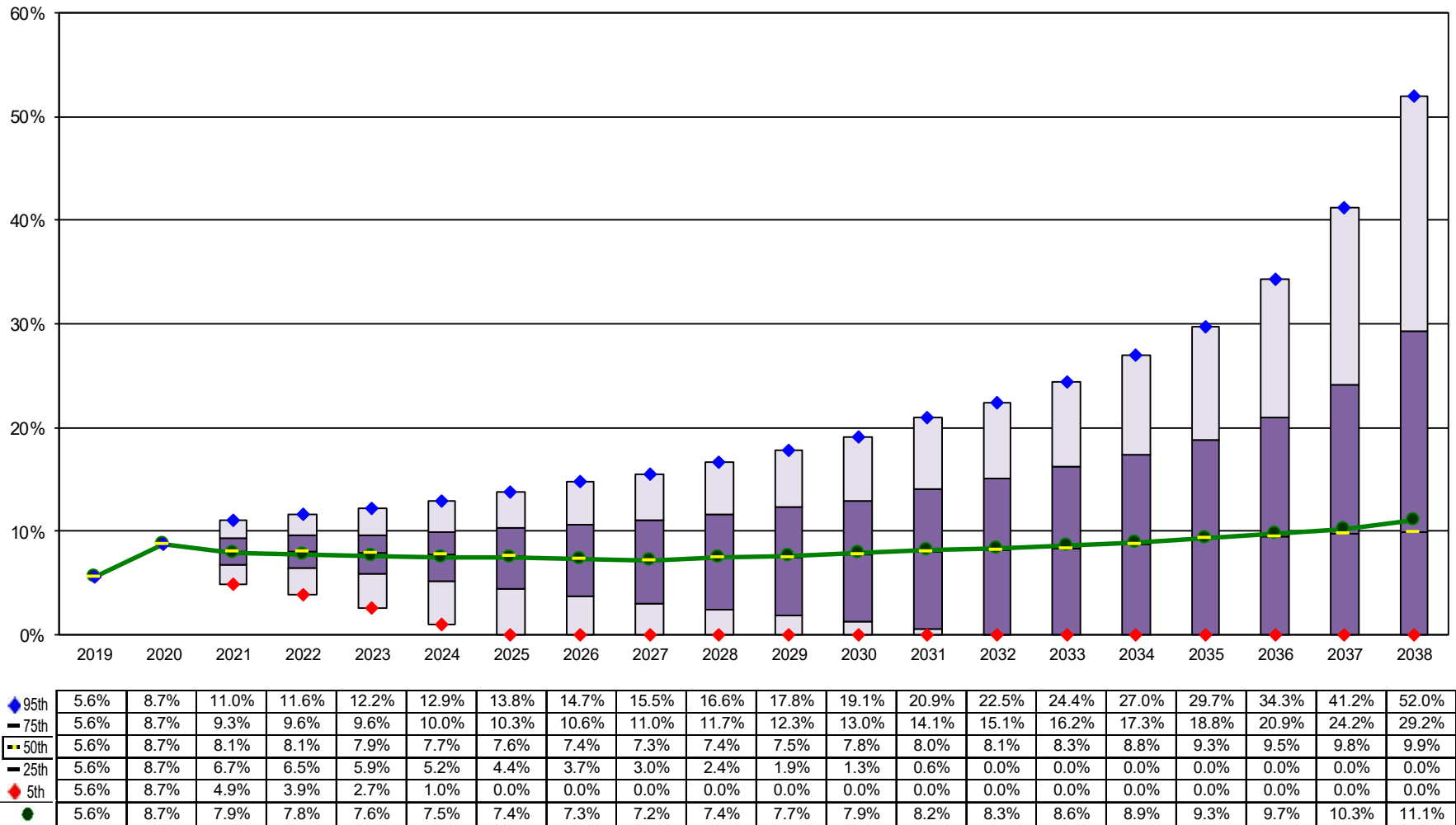
VMERS Group A Contribute Projected EAN ADC

Projected Employer Contribution Rate for Plan Years Ending June 30



VMERS Group B Contribute Projected EAN ADC

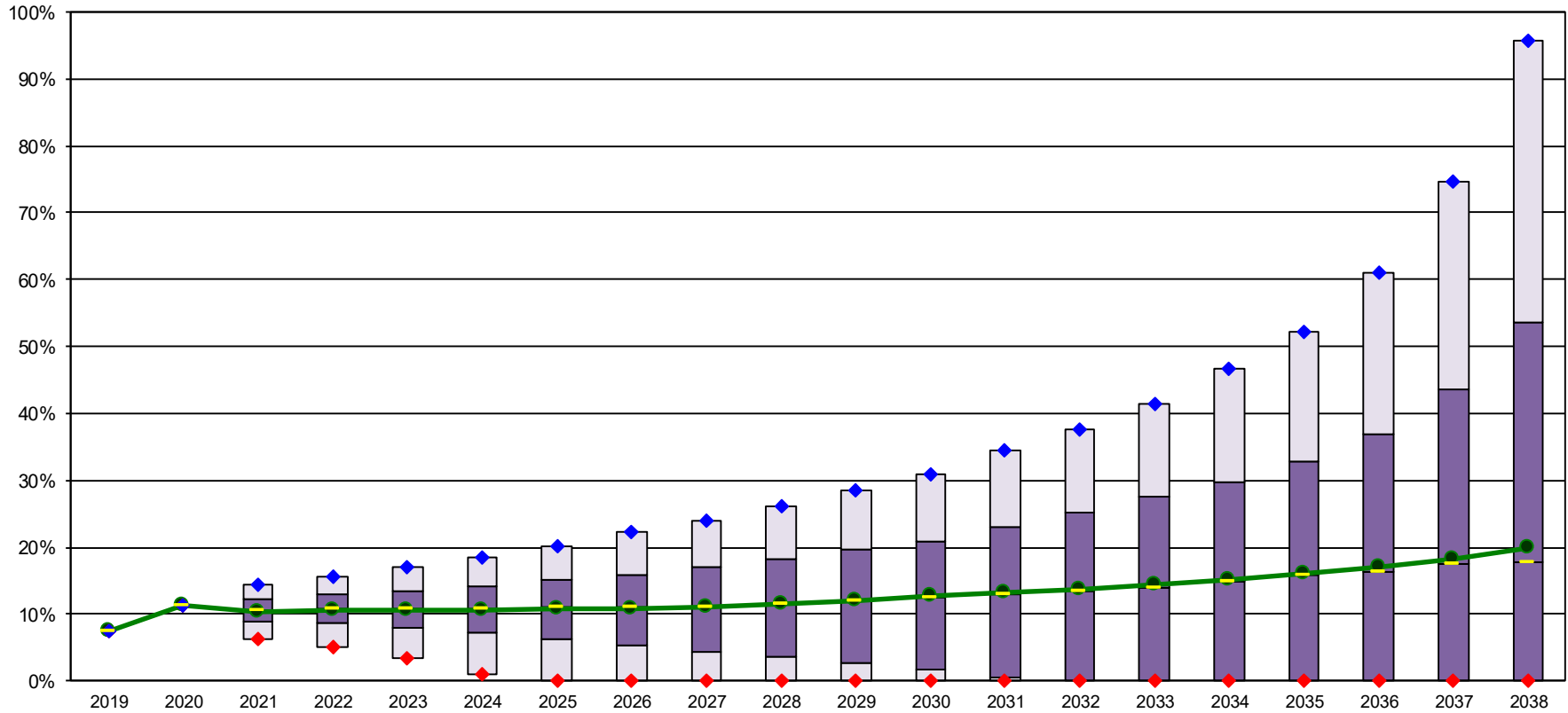
Projected Employer Contribution Rate for Plan Years Ending June 30



● Baseline deterministic projection using current 7.5% investment return assumption

VMERS Group C Contribute Projected EAN ADC

Projected Employer Contribution Rate for Plan Years Ending June 30

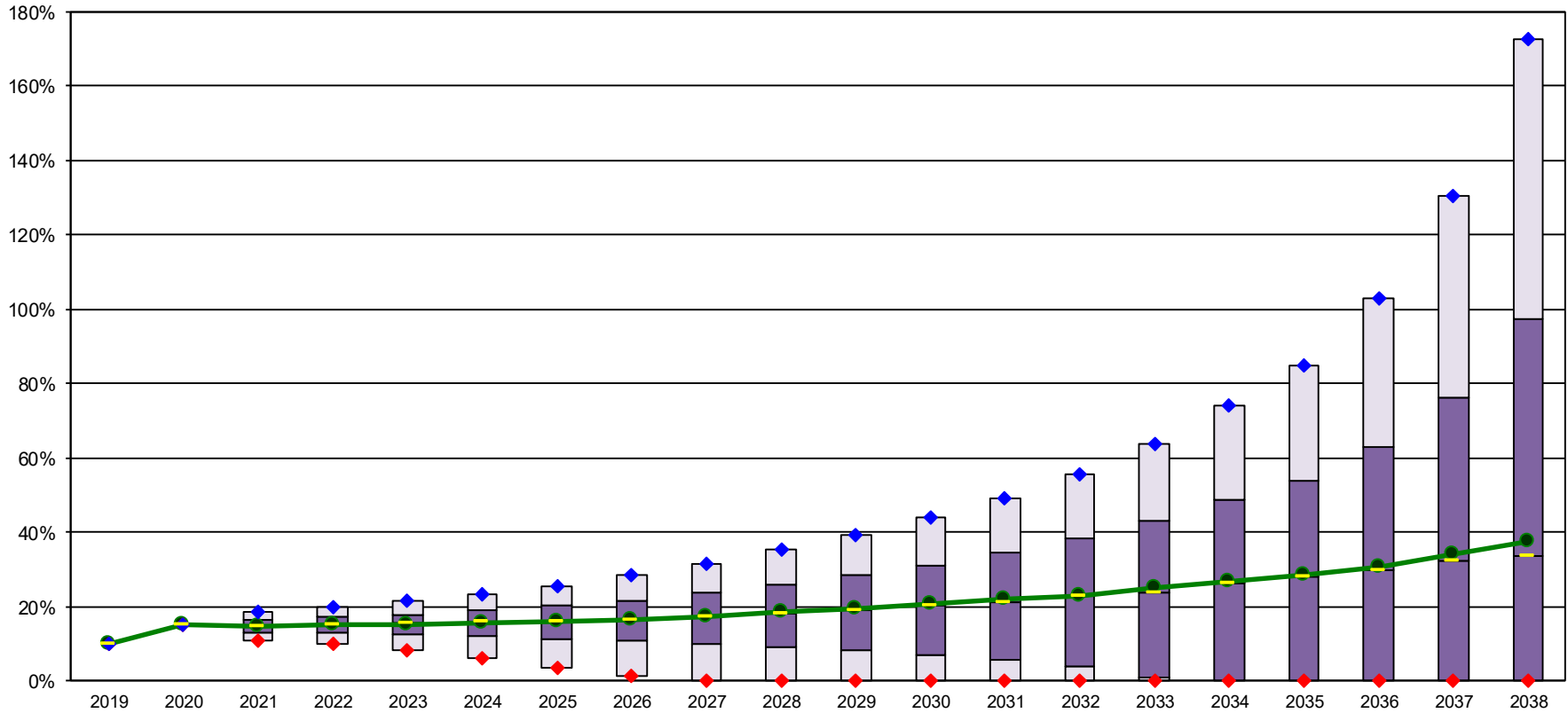


	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
◆ 95th	7.4%	11.2%	14.5%	15.6%	17.0%	18.3%	20.2%	22.2%	23.9%	26.1%	28.5%	31.0%	34.4%	37.6%	41.4%	46.7%	52.1%	61.0%	74.6%	95.7%
■ 75th	7.4%	11.2%	12.3%	12.8%	13.3%	14.1%	15.1%	15.9%	17.0%	18.3%	19.6%	20.9%	23.1%	25.1%	27.5%	29.7%	32.7%	36.9%	43.5%	53.6%
■ 50th	7.4%	11.2%	10.5%	10.8%	10.8%	10.8%	11.0%	10.9%	11.1%	11.6%	11.9%	12.4%	13.0%	13.4%	13.8%	14.9%	15.9%	16.4%	17.4%	17.8%
■ 25th	7.4%	11.2%	8.8%	8.6%	7.9%	7.1%	6.2%	5.3%	4.4%	3.6%	2.8%	1.8%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
◆ 5th	7.4%	11.2%	6.3%	5.1%	3.4%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
●	7.4%	11.2%	10.3%	10.5%	10.5%	10.6%	10.7%	10.9%	11.0%	11.6%	12.1%	12.6%	13.2%	13.7%	14.3%	15.1%	16.0%	17.0%	18.2%	19.9%

● Baseline deterministic projection using current 7.5% investment return assumption

VMERS Group D Contribute Projected EAN ADC

Projected Employer Contribution Rate for Plan Years Ending June 30



◆ 95th	10.0%	15.3%	18.6%	20.0%	21.4%	23.4%	25.5%	28.3%	31.6%	35.2%	39.4%	43.8%	49.3%	55.5%	63.6%	74.2%	84.8%	102.8%	130.6%	172.5%
■ 75th	10.0%	15.3%	16.5%	17.3%	17.9%	19.1%	20.3%	21.8%	23.9%	26.0%	28.5%	31.0%	34.4%	38.3%	43.1%	48.5%	54.0%	63.1%	76.3%	97.2%
■ 50th	10.0%	15.3%	14.8%	15.3%	15.4%	15.8%	16.1%	16.6%	17.4%	18.2%	19.2%	20.2%	21.3%	22.7%	23.8%	26.2%	28.0%	29.9%	32.5%	33.5%
■ 25th	10.0%	15.3%	13.1%	13.2%	12.6%	12.1%	11.3%	10.6%	10.0%	9.1%	8.3%	7.1%	5.5%	4.1%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%
◆ 5th	10.0%	15.3%	10.8%	9.8%	8.2%	6.1%	3.5%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
●	10.0%	15.3%	14.6%	15.0%	15.1%	15.6%	15.8%	16.5%	17.4%	18.4%	19.5%	20.7%	21.8%	23.0%	24.8%	26.7%	28.5%	30.8%	33.9%	37.7%

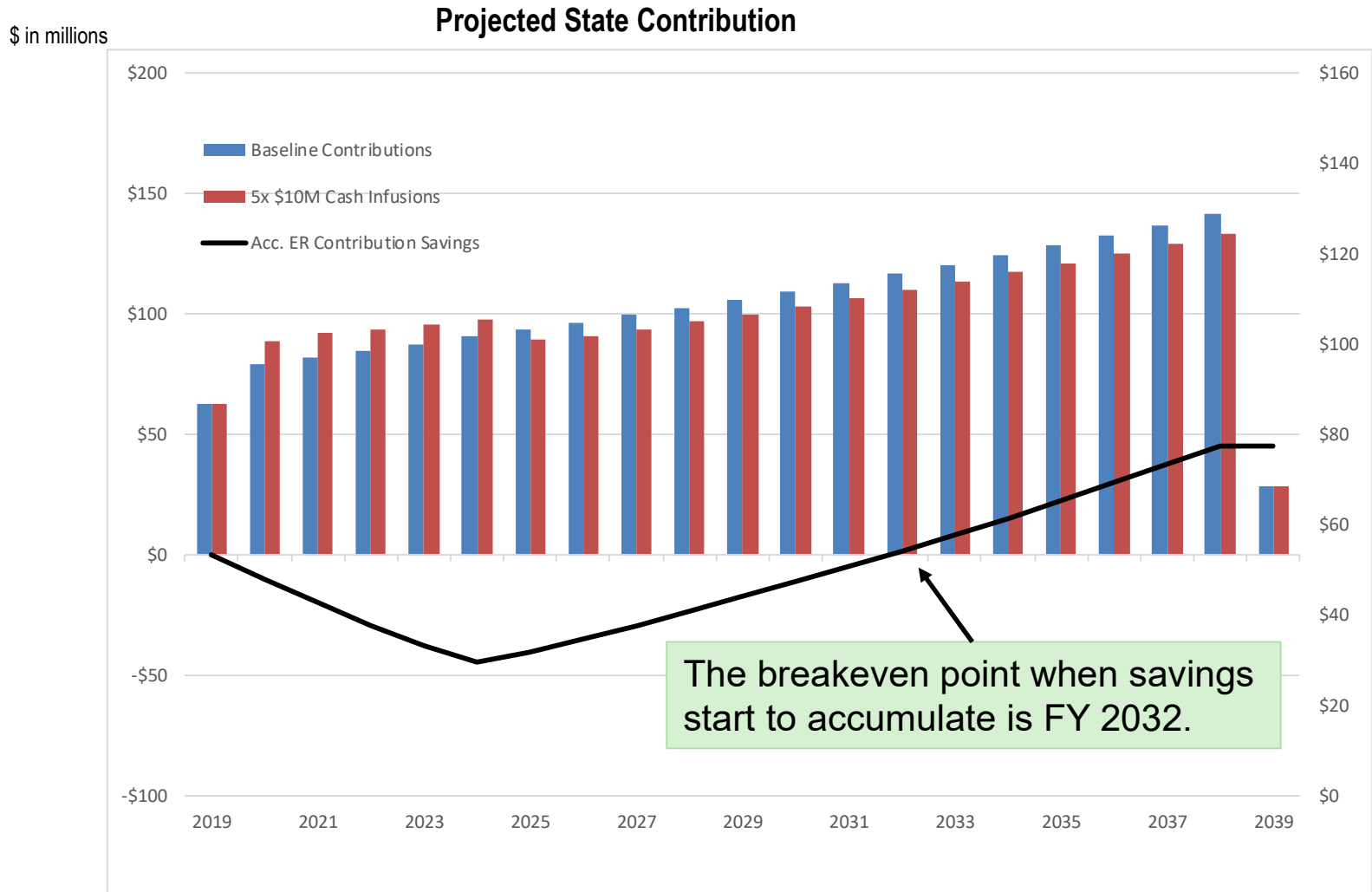
● Baseline deterministic projection using current 7.5% investment return assumption

IMPACT OF CASH INFUSIONS

Cash Infusions

- Studied the impact of additional contributions made for VSERS and VSTRS above and beyond the actuarially required amount:
 - Examined an additional \$10 million per year for five years for VSERS and an additional \$15 million per year for five years for VSTRS
- Given the funding approach for VSERS and VSTRS, additional contributions in earlier years offset future contribution requirements such that the present value of projected contribution streams is equal
- Under the VMERS fixed contribution approach, additional contributions will improve the funded status:
 - Examined an additional \$1 million per year for five years for Group D

VSERS Projection – With Additional Contributions



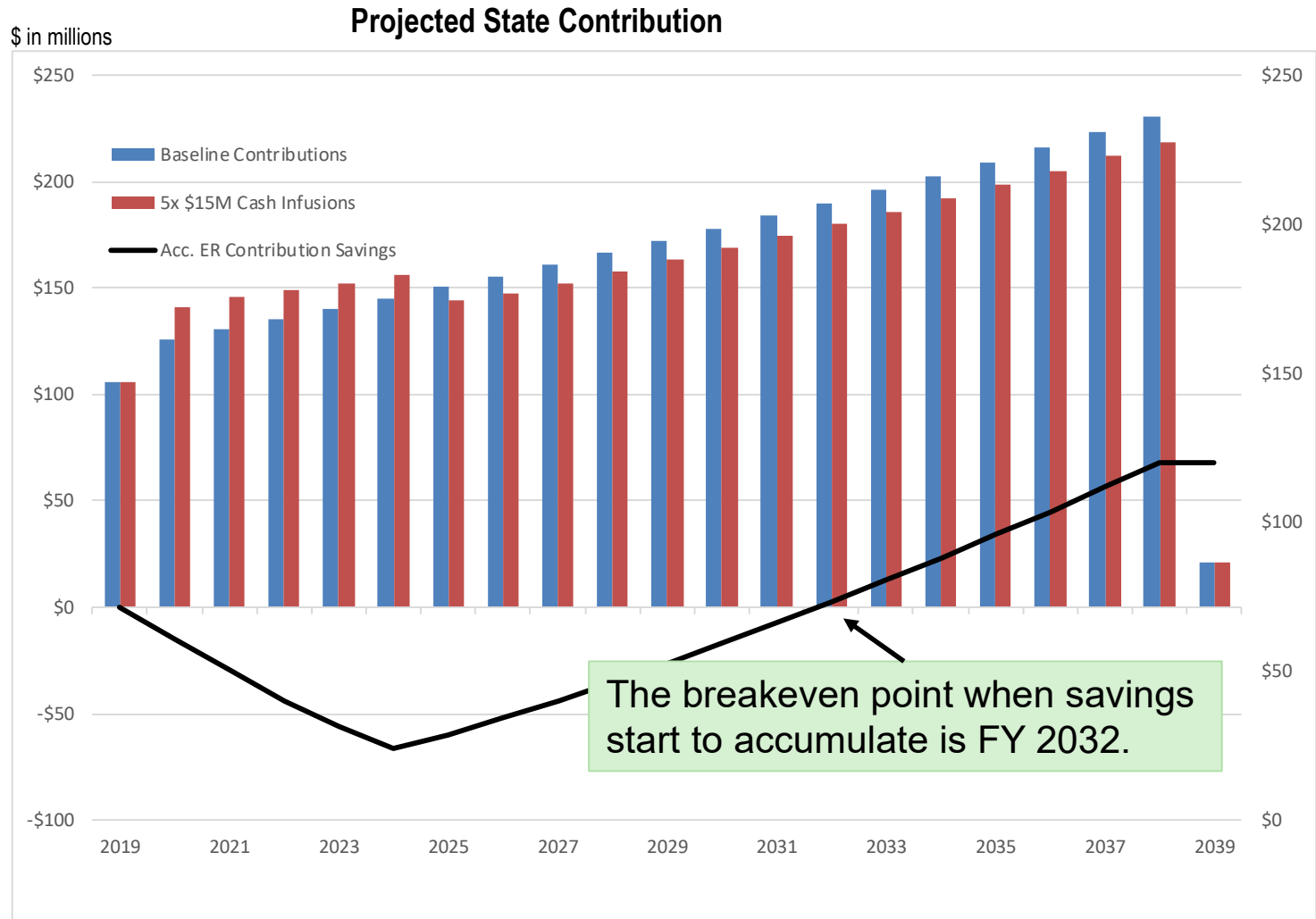
Baseline Contributions:

With 5x \$10M Cash Infusions:

Accumulated Savings:

63.0	82.0	87.7	93.5	99.5	106.0	113.0	120.4	128.3	136.7	28.8
63.0	92.0	95.8	89.4	93.9	100.0	106.6	113.6	121.1	129.1	28.8
0.0	-20.0	-37.3	-40.2	-29.2	-17.4	-4.8	8.5	22.6	37.6	45.5

VSTRS Projection – With Additional Contributions



Baseline Contributions:

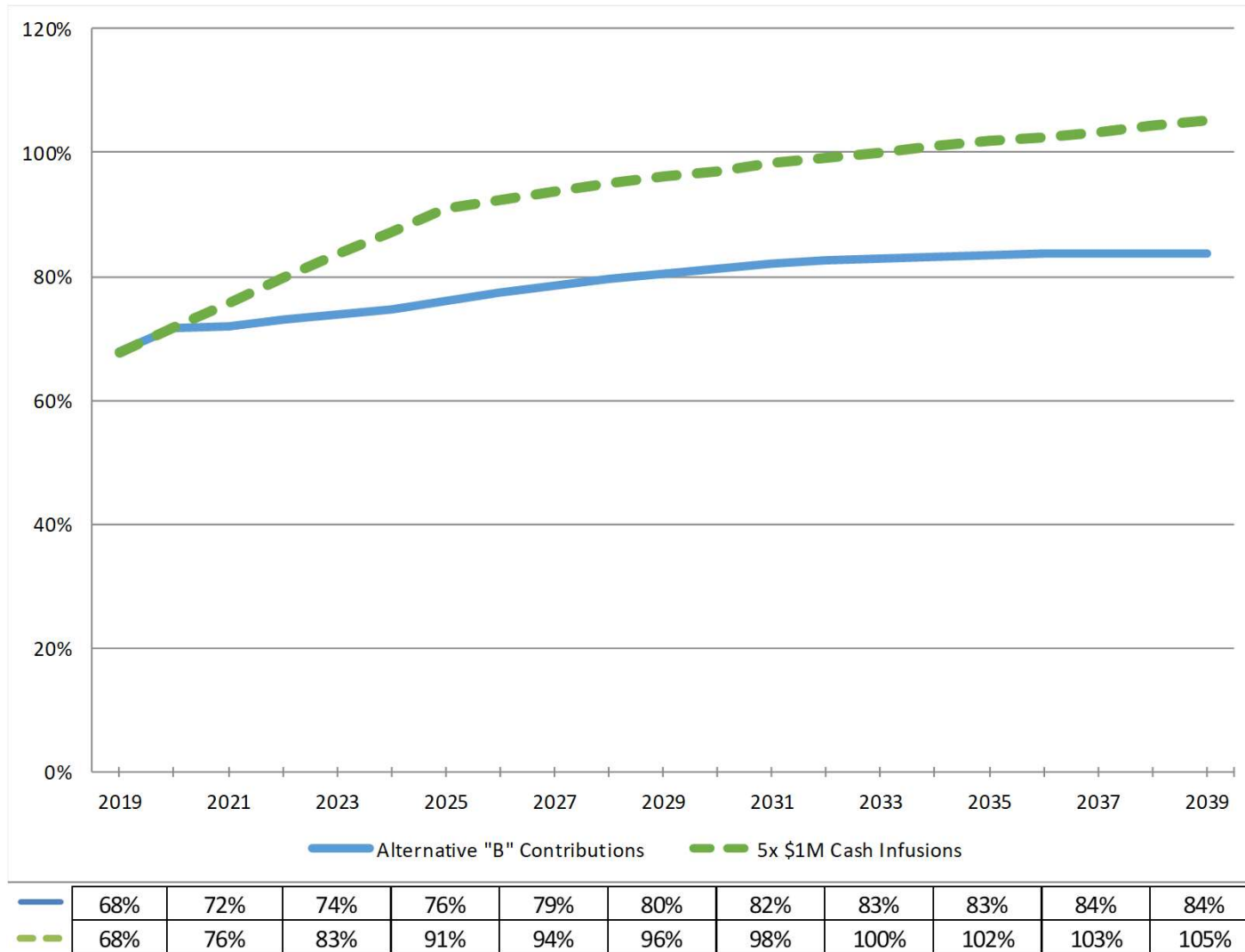
With 5x \$15M Cash Infusions:

Accumulated Savings:

105.6	130.6	140.3	150.4	161.1	172.2	183.9	196.3	209.3	223.2	20.9
105.6	145.6	152.5	144.3	152.6	163.2	174.4	186.1	198.5	211.8	20.9
0.0	-30.0	-55.9	-60.3	-43.8	-26.1	-7.2	12.7	33.9	56.4	68.2

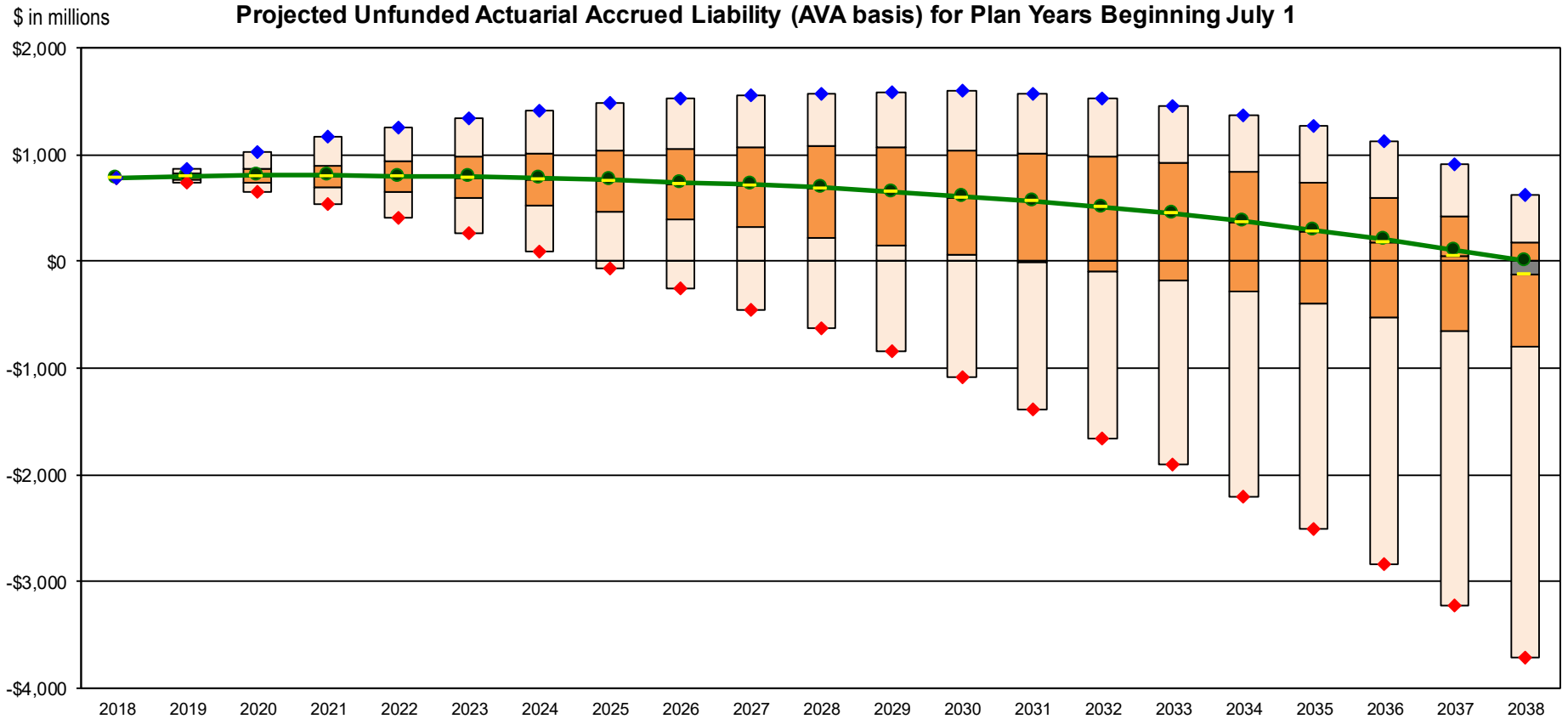
VMERS Group D – Alternative “B” With Additional Contributions

Projected Funded Percentage



APPENDIX

VSERS Results – Projected Unfunded Liability

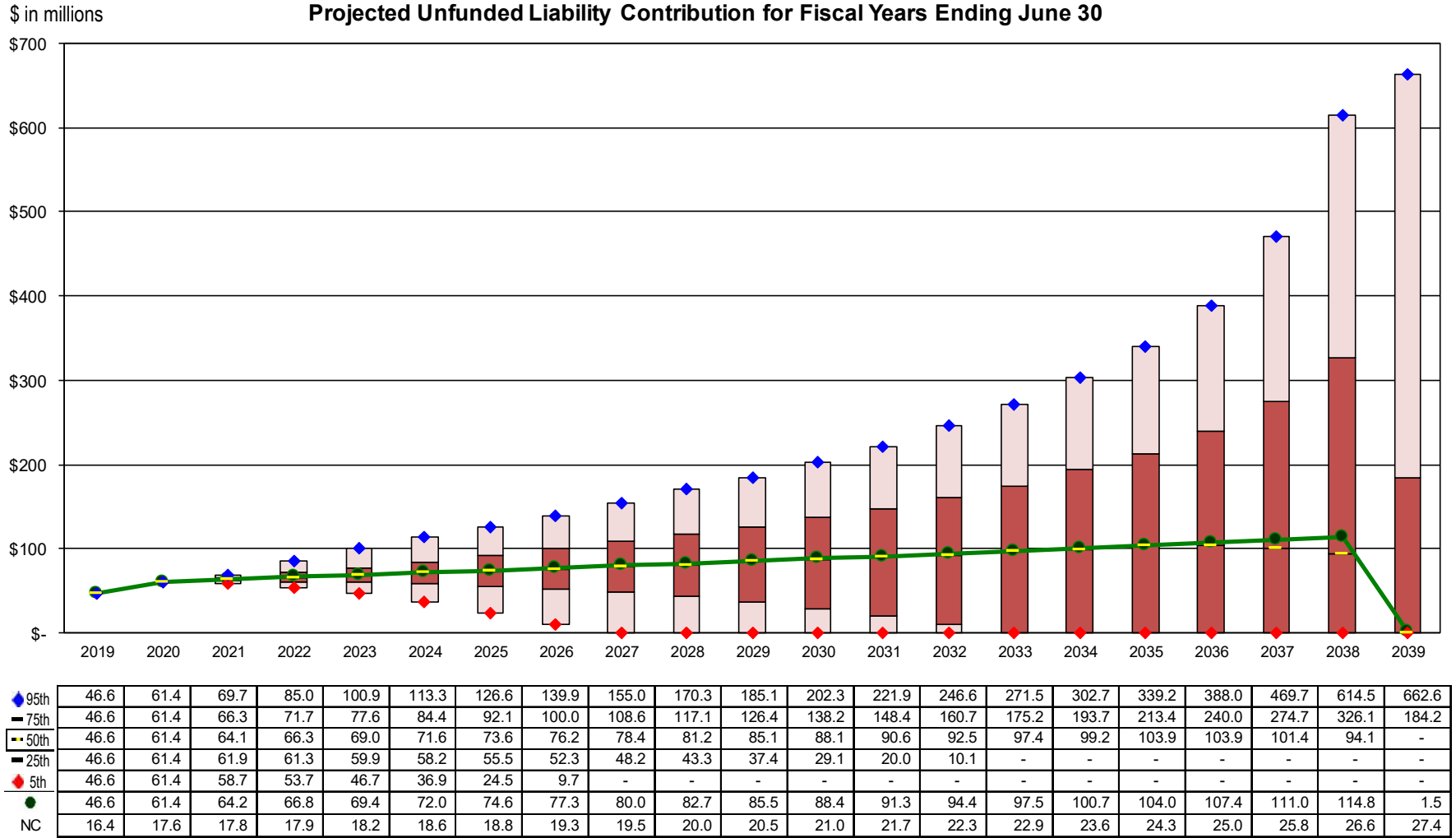


	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
◆ 95th	780	867	1,021	1,166	1,256	1,341	1,409	1,479	1,529	1,554	1,574	1,586	1,598	1,571	1,532	1,461	1,365	1,265	1,127	908	616
— 75th	780	825	861	897	935	975	1,007	1,036	1,051	1,061	1,075	1,060	1,041	1,014	980	919	844	740	598	415	171
■ 50th	780	797	797	797	794	779	768	748	729	714	686	647	600	564	502	448	366	273	173	43	(119)
■ 25th	780	770	736	692	645	588	527	460	389	314	227	143	65	(12)	(96)	(186)	(281)	(395)	(526)	(655)	(797)
◆ 5th	780	731	645	539	409	260	98	(70)	(253)	(448)	(619)	(842)	(1,091)	(1,384)	(1,655)	(1,906)	(2,210)	(2,506)	(2,834)	(3,221)	(3,708)
● 7.5%	780	799	803	802	798	791	779	763	743	718	688	653	612	564	510	448	378	299	210	112	1

● Baseline deterministic projection using current 7.5% investment return assumption

The asset valuation method smooths out volatility between the expected actuarial value of assets and the market value of assets. As of July 1, 2018, the actuarial value of assets exceeded the market value. For the deterministic projections, because there are no future gains or losses, the current loss is recognized over an infinite time period. As a result, there is a very small unfunded liability remaining as of July 1, 2038.

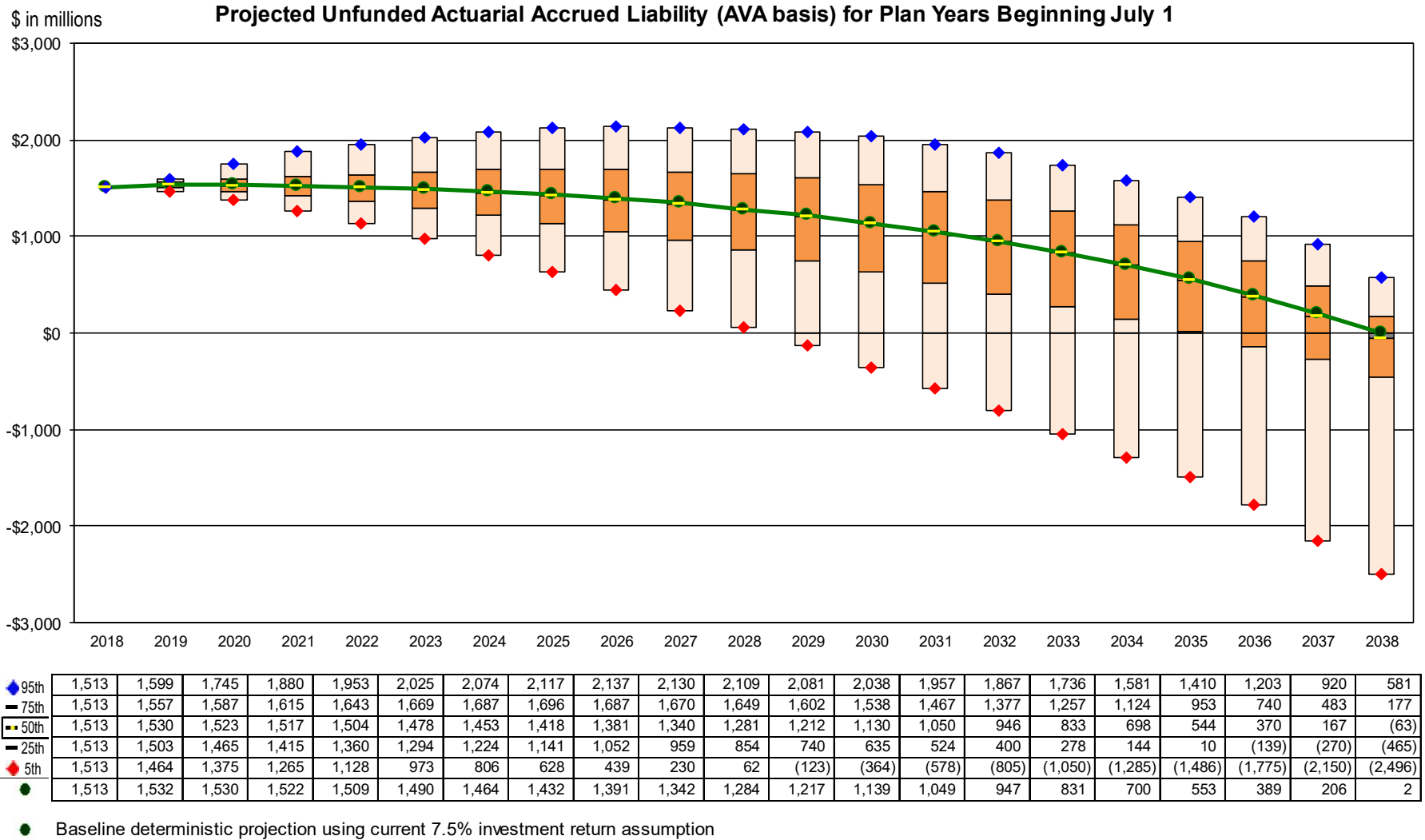
VSERS Results – Projected UAL Contribution



● Baseline deterministic projection using current 7.5% investment return assumption

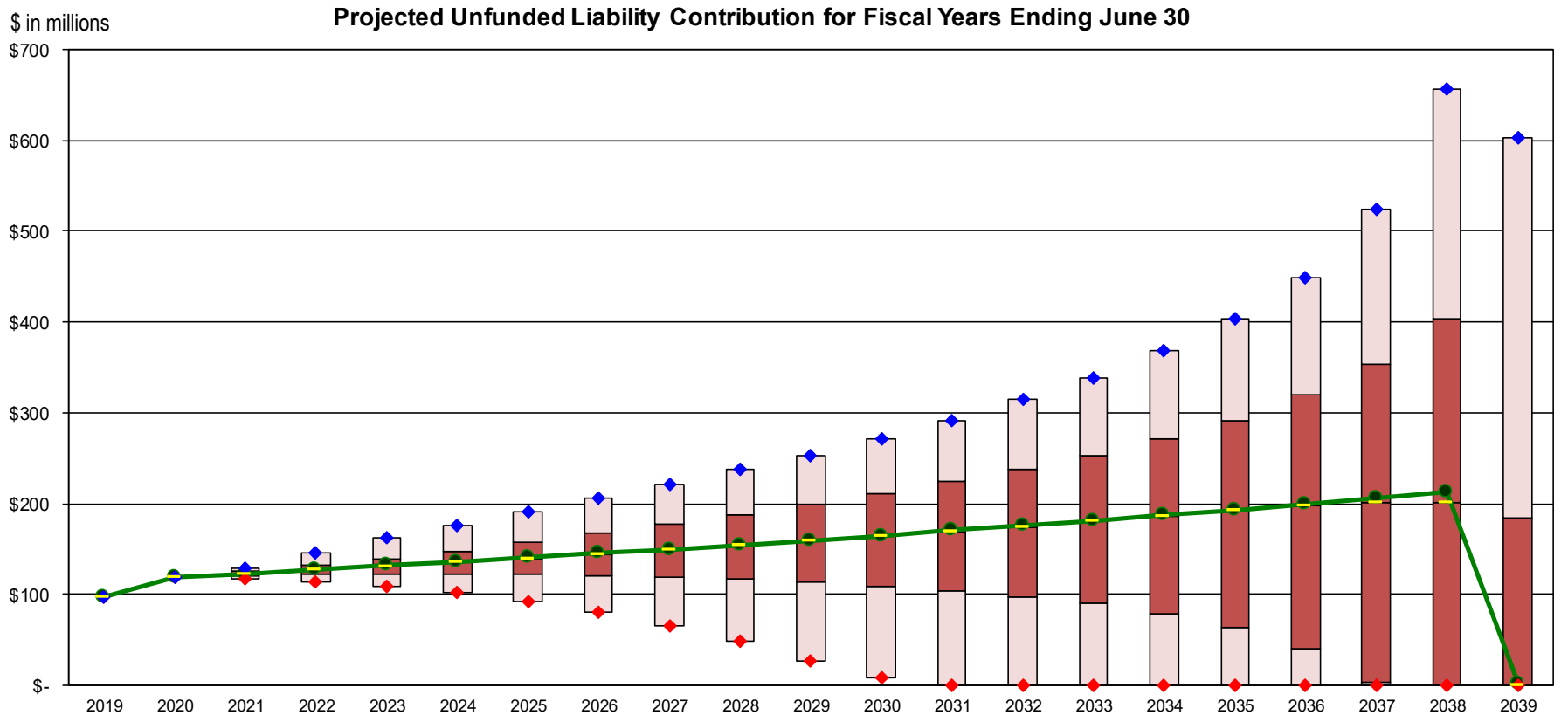
NC Projected Normal Cost contribution for the year

VSTRS Results – Projected Unfunded Liability



The asset valuation method smooths out volatility between the expected actuarial value of assets and the market value of assets. As of July 1, 2018, the actuarial value of assets exceeded the market value. For the deterministic projections, because there are no future gains or losses, the current loss is recognized over an infinite time period. As a result, there is a very small unfunded liability remaining as of July 1, 2038.

VSTRS Results – Projected UAL Contribution



◆ 95th	97.6	119.1	128.5	145.3	162.6	176.2	191.2	205.8	221.9	238.0	253.8	271.0	291.3	314.5	338.2	368.8	403.3	449.5	523.6	656.3	602.0
— 75th	97.6	119.1	125.2	132.2	139.7	148.2	157.6	167.4	177.8	187.9	199.0	211.9	224.2	237.3	253.5	272.1	291.8	319.7	354.0	403.5	183.6
■ 50th	97.6	119.1	122.9	126.8	131.2	135.7	139.6	144.2	148.7	153.8	159.6	164.6	169.7	174.3	181.5	186.8	193.5	198.4	201.9	201.6	-
■ 25th	97.6	119.1	120.8	121.9	122.4	122.7	122.1	121.4	119.6	117.1	114.2	109.8	103.6	98.0	90.5	79.0	64.7	41.0	3.6	-	-
◆ 5th	97.6	119.1	117.7	114.5	109.5	101.8	91.9	80.0	65.9	48.9	27.4	8.0	-	-	-	-	-	-	-	-	-
●	97.6	119.1	123.1	127.4	131.7	136.2	140.7	145.3	150.1	154.9	159.9	165.0	170.3	175.7	181.2	187.0	192.9	199.0	205.4	212.2	1.8
NC	8.1	7.2	7.5	8.0	8.6	9.1	9.7	10.3	11.0	11.7	12.3	13.0	13.6	14.3	15.0	15.7	16.4	17.1	17.8	18.5	19.2

● Baseline deterministic projection using current 7.5% investment return assumption

NC Projected Normal Cost contribution for the year