



Memorandum

To	State of Michigan Retirement Systems
From	RVK, Inc.
Subject	MPSERS Asset/Liability Study – Key Conclusions
Date	September 4, 2014

The central purpose of an asset/liability study (“A/L study”) is to examine the probable future consequences of applying alternative asset allocation strategies to the Plan’s investment assets in order to fund the liabilities of the Plan. A/L studies are unique in their ability to combine in a single analysis the three critical factors that together drive the financial health of the Plan—benefit policy (liabilities), contribution policy, and investment strategy (asset allocation).

We draw the following key conclusions from the MPSERS A/L study:

1. As of September 30, 2013, the Plan’s market value funded ratio was 63% (page 6). Using deterministic analysis (assumes all assumptions are met every year without exception), we project the funded ratio to increase to approximately 89% by 2033 (page 17).
2. The Plan’s assets must earn annual returns in excess of 11.7% over the next 10 years or 9.1% over the next 20 years every year without exception in order to reach full funding (page 18).
3. If returns are 100 basis points below the Plan’s current assumed rate of return of 8.00% (7.00% for Hybrid members) each year for the 20 year projection period, the projected funding ratio would still improve, but only to 81% in year 20 (page 19) versus 89% with returns at the current assumed rate of return. Under this scenario cumulative employer contributions would be \$11.3 billion higher over the 20 year period.
4. This A/L study shows that MPSERS is currently underfunded, but significant improvements in financial health are possible through continued use of a well-diversified investment portfolio. With the exception of the Conservative Portfolio, the median projected funding ratio at the end of the 20 year study period is higher than the current funding level (page 42) for all other options studied.
5. With the exception of the Conservative Portfolio all portfolios analyzed show a moderate probability of full funding in 20 years. The Conservative Portfolio shows zero probability of full funding in 20 years (page 33). Additionally, the Conservative Portfolio shows a 43% probability of a Plan funding status in 20 years that is below its current 63%.
6. Payout ratios remain moderate over the next 20 years for all diversified investment approaches.
7. The study is not supportive of a long-term, ultra-conservative approach.
8. There is a limit to the benefits of pursuing additional return at the expense of additional volatility risk in terms of both portfolio efficiency and downside risk to the Plan’s assets.

September 2014



Asset/Liability Study

Michigan Public School Employees' Retirement System



Table of Contents

ACKNOWLEDGEMENTS PAGE 2

INTRODUCTION PAGE 3

CURRENT STATUS PAGE 6

DETERMINISTIC ANALYSIS PAGE 7

DETERMINISTIC SCENARIO ANALYSIS..... PAGE 18

STOCHASTIC ANALYSIS PAGE 21

APPENDIX 1: SENSITIVITY ANALYSIS: VOLATILITY PAGE 43

APPENDIX 2: SENSITIVITY ANALYSIS: CORRELATIONS..... PAGE 60

APPENDIX 3: ASSUMPTIONS AND METHODS..... PAGE 77

Acknowledgements

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Introduction

RVK, Inc. (RVK) has prepared this report for the Michigan Public School Employees' Retirement System (MPSERS) to:

- Present projected valuation results with respect to the funded status of the Plan.
- Present projected benefit payments of the Plan.
- Investigate asset mixes to determine those which best serve to protect and increase funding levels, while providing adequate liquidity for benefit payments.

The valuation projections are shown using both a deterministic and stochastic process.

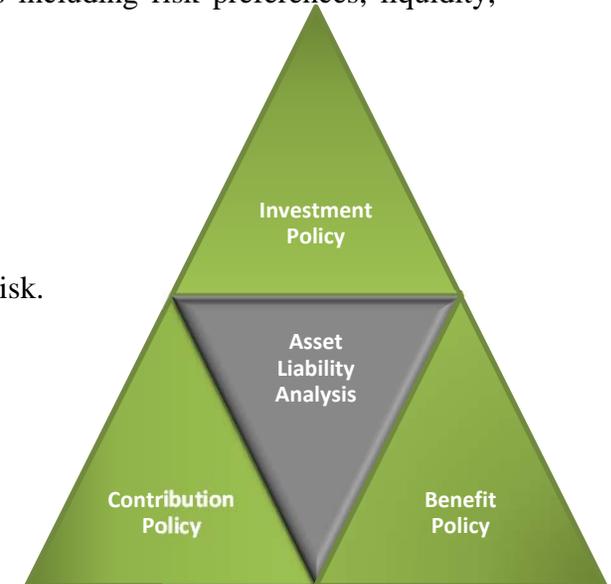
The deterministic process provides an open group analysis of projected valuation results based on a fixed set of future assumptions (see summary in the Assumptions and Methods section of this report).

The stochastic process provides an open group analysis of projected valuation results under many capital market environments based on expected asset returns and inflation, and their expected volatility. Using a Monte Carlo simulation technique, both assets and liabilities are assumed to vary stochastically, linked together by changes in inflation. Expected values, variances of the returns and inflation, and correlations are used to generate 2,000 trials to produce a distribution of potential outcomes. A stochastic analysis can answer questions about the best/worst case outcomes along with the probability of such outcomes.

Introduction (continued)

What is an Asset/Liability Study?

- Investment programs and the strategy they seek to implement (Investment Policy) do not exist in a vacuum. They seek to satisfy one or more investment objectives and operate within a plan framework that includes the investment objectives (Benefit Policy) and plan funding (Contribution Policy).
- The purpose of an Asset/Liability Study is to examine how well alternative investment strategies (i.e., differing asset allocations) address the objectives served by the Plan—the Plan’s “liabilities” in the context of the Plan’s funding streams—the Plan’s Contribution Policy. It is the only standard analysis that fully links all three aspects of the Plan’s key financial drivers.
- In doing so, it creates an important “guidepost” for the actual asset allocation for the Plan; the asset allocation chosen by the Plan’s fiduciaries will likely reflect the nature of the liabilities but also numerous other factors including risk preferences, liquidity, implementation constraints, etc.
- For the MPSERS Asset/Liability Study, we assume the objectives are:
 1. Fund all participants’ benefits over time.
 2. Assure sufficient liquidity to pay benefits at all times.
 3. Foster a stable contribution stream consistent with objectives 1 and 2.
 4. Achieve adequate returns without accepting unnecessary or imprudent levels of risk.



An Asset/Liability Study is NOT . . .

- An actuarial study of the MPSERS liabilities—that is the purview of the Plan’s actuary.
- A prescription for Plan benefits—that is the purview of the elected representatives.
- An assessment of the affordability of contribution levels—that is the purview of the elected officials and their constituents.
- The sole determinant of the final asset allocation adopted for the Plan—there are a number of factors, including insights from an Asset/Liability Study, which will bear on the optimal asset allocation.

Introduction (continued)

Asset/Liability Studies in Practice . . .

- Begin with a forecast of the financial liabilities (i.e., benefit obligations).
- Include a baseline estimation of the financial contributions to the Plan over time.
- Compare alternative investment strategies (i.e., total fund asset allocations to the Plan's financial needs).
- Draw conclusions regarding how well various investment strategies satisfy the Plan's financial needs.

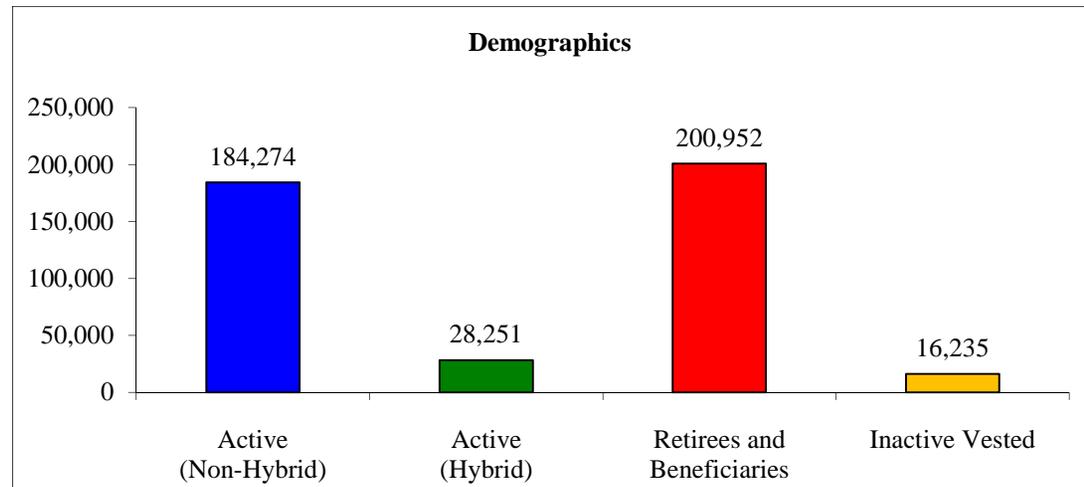
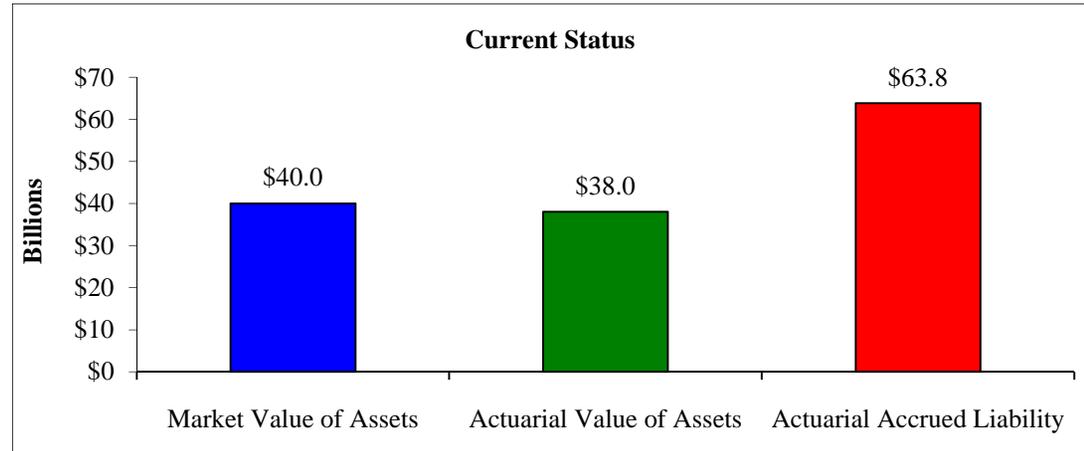
This Asset/Liability Study . . .

- Uses data from the September 30, 2013 MPSERS Actuarial Valuation to project pension liabilities.
- Uses the Actuarial Cost Method and other assumptions described in the September 30, 2013 MPSERS Actuarial Valuation, and the actuarial assumptions adopted for use beginning with the actuarial valuation as of September 30, 2014.
- Compares these specific investment strategies—(A) the Strategic Target, (B) the Current Allocation (as of June 30, 2014), (C) a conservative illustrative portfolio (Conservative Portfolio), and (D) an aggressive illustrative portfolio (Aggressive Portfolio).
- Assumes the Plan's current benefit policy throughout the entire projection period—changes to the benefit policy are the purview of the elected representatives.
- Note: Does not assume any actuarial adjustments that may take place in future years.

Current Status

A summary of the Plan follows:

Valuation Date	September 30, 2013
Market Value of Assets (MVA)	\$40.0 billion
Market Value of Assets (MVA) as of 6/30/2014	\$43.4 billion
Actuarial Value of Assets (AVA)	\$38.0 billion
Actuarial Accrued Liability (AAL)	\$63.8 billion
Market Value Funded Ratio (MVA/AAL)	63%
Actuarial Value Funded Ratio (AVA/AAL)	60%
Active (Non-Hybrid)	184,274
Active (Hybrid)	28,251
Retirees and Beneficiaries	200,952
Inactive Vested	16,235



Deterministic Analysis

This section provides an analysis of the Plan's assets, liabilities, funded status, and benefit payments based on a fixed set of future assumptions. Each analysis that follows in this deterministic section rests on the critical assumptions below and must be read and interpreted with them in mind—particularly assumptions #2, #3 and #4.

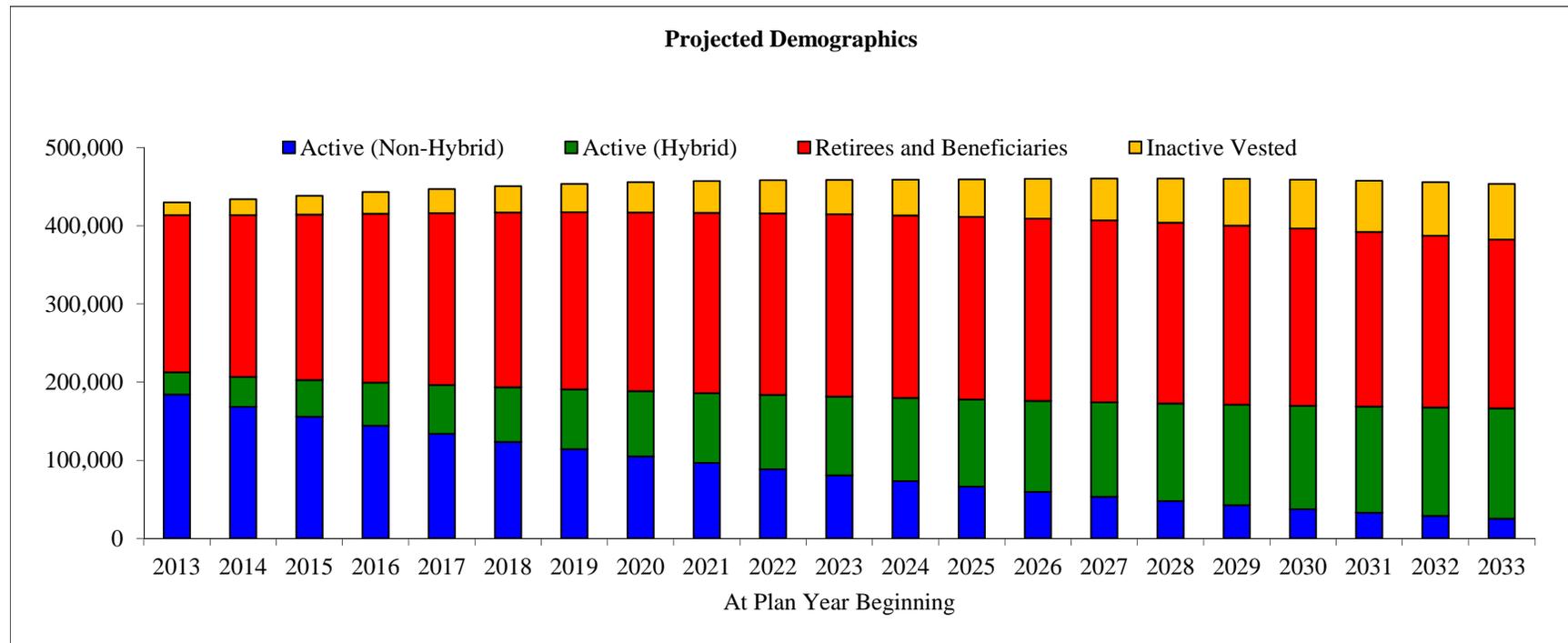
The deterministic assumptions are as follows:

1. Current Plan provisions (see summary of Benefit Provisions in the Assumptions and Methods section of this report).
2. The actuarial data used by GRS (see summary in the Assumptions and Methods section of this report).
3. Actuarially assumed rate of return on Plan assets for all projection years: 8.00% for Non-Hybrid Plan; 7.00% for Hybrid Plan (PPP).
4. For the fiscal year ending 2014, assumes total employer contributions equal to \$2.3 billion. Thereafter, assumes employer contributions are determined as of each valuation date in accordance with the actuarial funding policy and the new assumptions adopted for use with the September 30, 2014 actuarial valuation.
5. Assumes a 3% non-compounding cost of living adjustment for eligible Non-Hybrid Plan retirees.
6. Open group analysis: Level public school employee active population. Of new members entering the Plan, 75% are assumed to elect to participate in the Hybrid Plan (PPP). The other 25% of new members are assumed to elect to participate in the Defined Contribution Plan and are not included in this study. New active participants entering the Plan are assumed to have similar characteristics to recently hired participants.

Deterministic Analysis (continued)

Demographics

Following are the projected number of active and inactive participants at the beginning of each Plan year from 2013 through 2033 (2013 is actual). These projections are based on an open group analysis. Using the actuary's assumptions for death, termination, retirement, and disability, current participants are assumed to leave the Plan in the future. The number of total inactive participants (Retirees and Beneficiaries and Vested Inactive) increases by approximately 32% during the 20-year projection period shown.

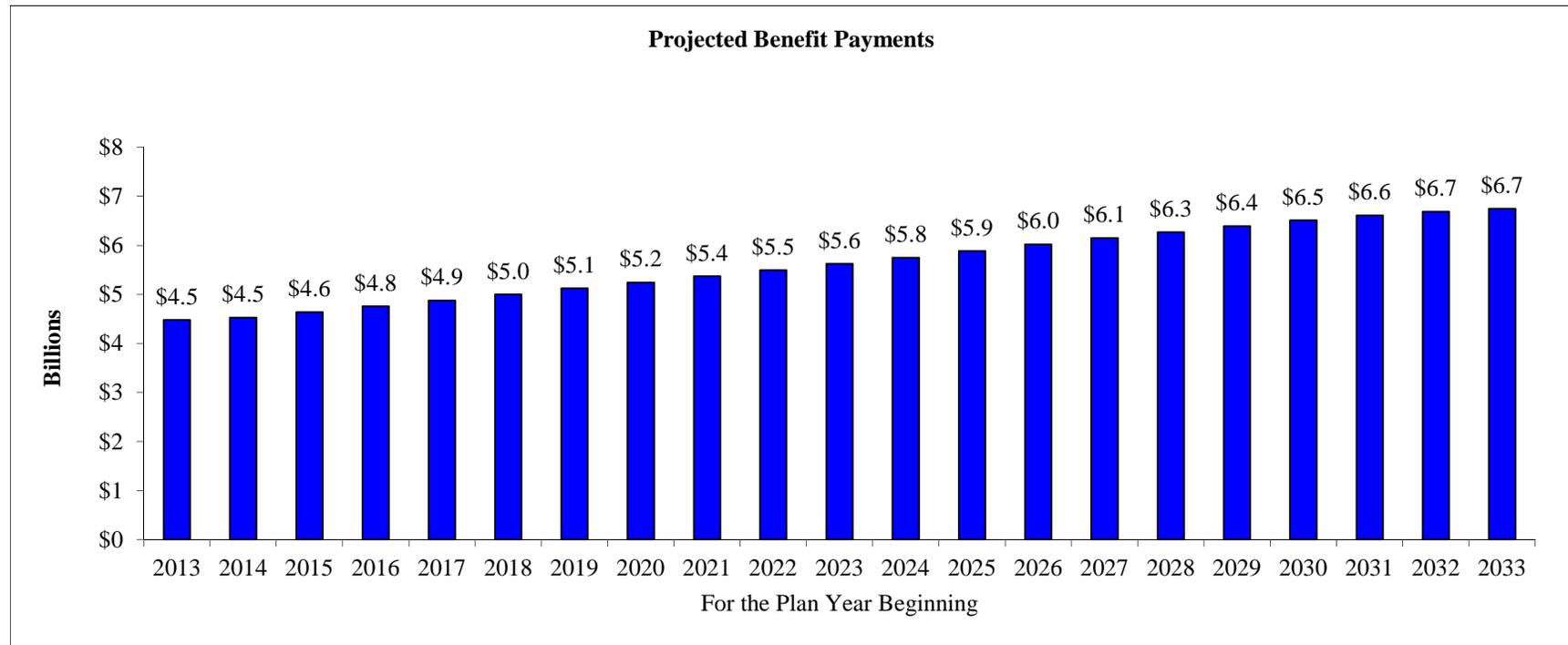


Total Population	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Annual Percent Change	N/A	1.0%	1.0%	1.0%	0.9%	0.8%	0.7%	0.5%	0.4%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	-0.1%	-0.2%	-0.3%	-0.4%	-0.5%

Deterministic Analysis (continued)

Benefit Payments

The Plan's projected annual benefit payments are shown in the chart below. The projected benefit payments are expected to increase by about 51% over the next 20 years. As a percentage of the market value of Plan assets, benefit payments are expected to gradually decline through the end of the projection period (see page 12).

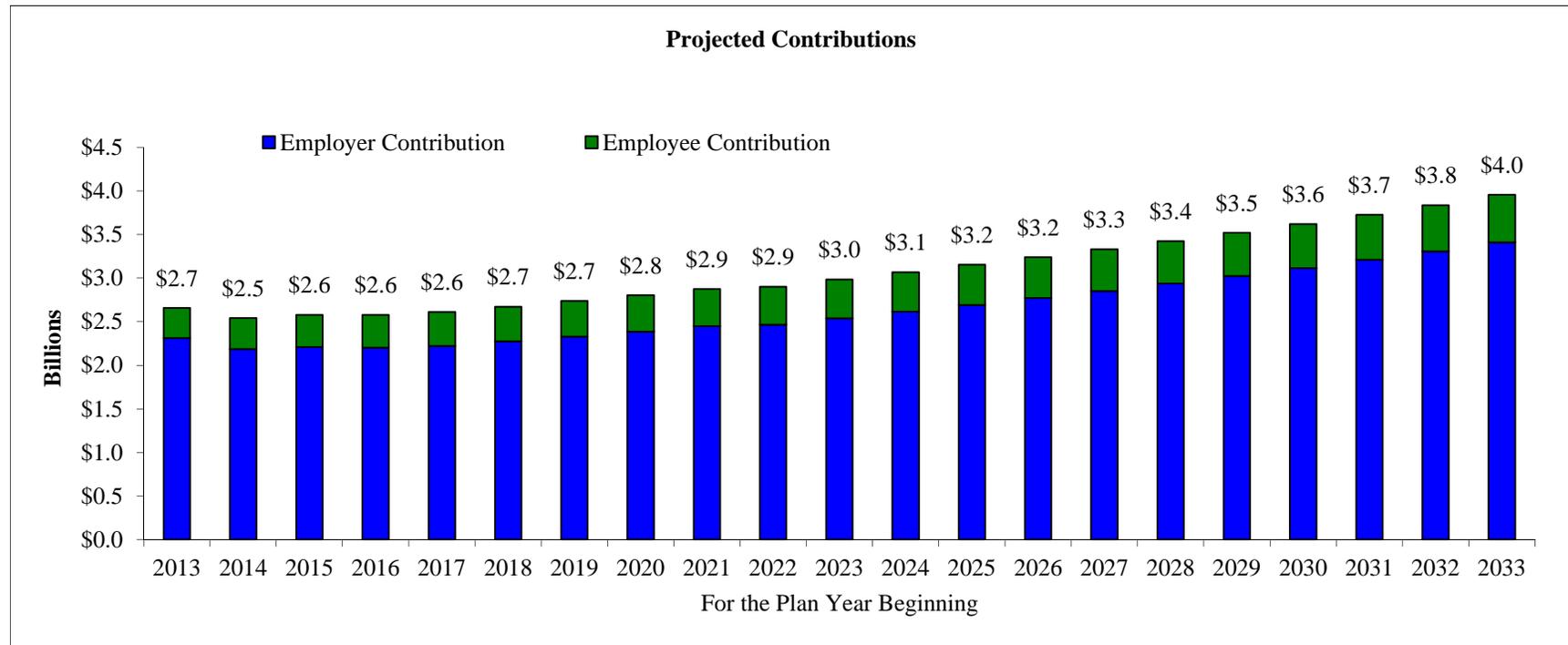


	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Annual Percent Change	N/A	1.1%	2.5%	2.5%	2.5%	2.5%	2.5%	2.4%	2.4%	2.4%	2.3%	2.3%	2.3%	2.3%	2.1%	2.0%	2.0%	1.8%	1.5%	1.2%	0.9%

Deterministic Analysis (continued)

Contributions

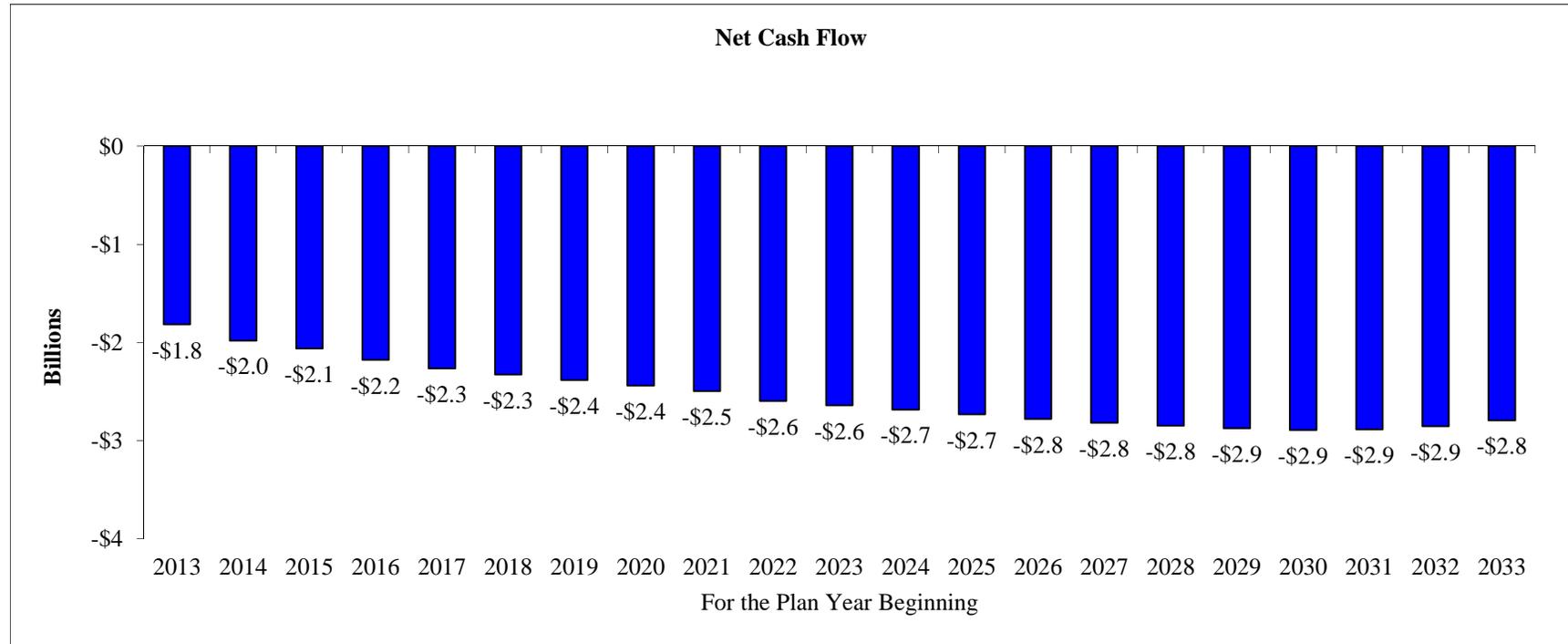
The Plan's projected contributions, expressed as total dollar contributions, are shown in the chart below. The results assume the contribution policy remains unchanged, and that the Plan's assets return precisely the actuarially assumed rate each year without exception for all projection years.



Deterministic Analysis (continued)

Net Cash Flow (contributions – benefit payments)

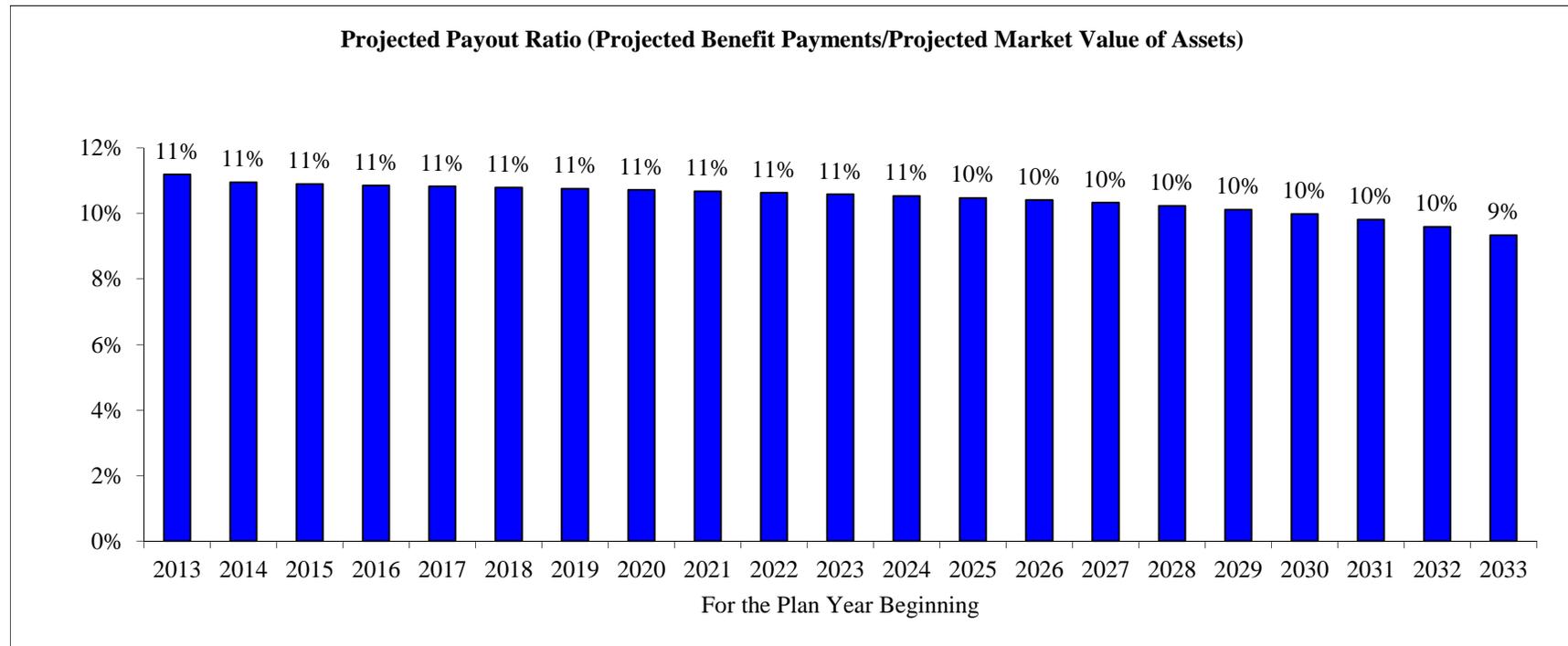
The Plan's projected net cash flow is shown in the chart below. The results assume the contribution policy remains unchanged, and that the Plan's assets return precisely the actuarially assumed rate each year without exception for all projection years.



Deterministic Analysis (continued)

Payout Ratio (benefit payments/market value of assets)

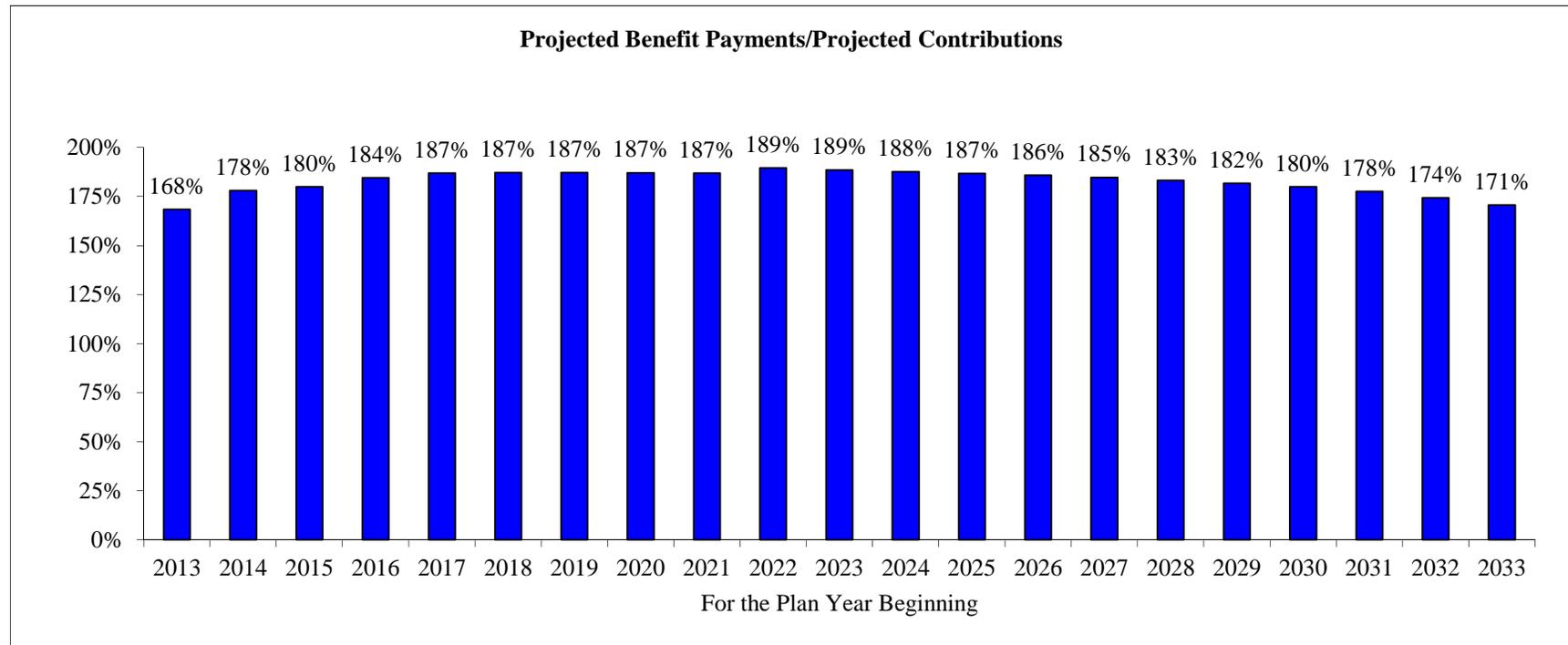
The Plan's projected payout ratios are shown in the chart below. The payout ratios are expected to gradually decline through the end of the projection period. The results assume the current contribution policy remains unchanged and that the Plan's assets return precisely the actuarially assumed rate each year without exception for all projection years.



Deterministic Analysis (continued)

Benefit Payments/Contributions

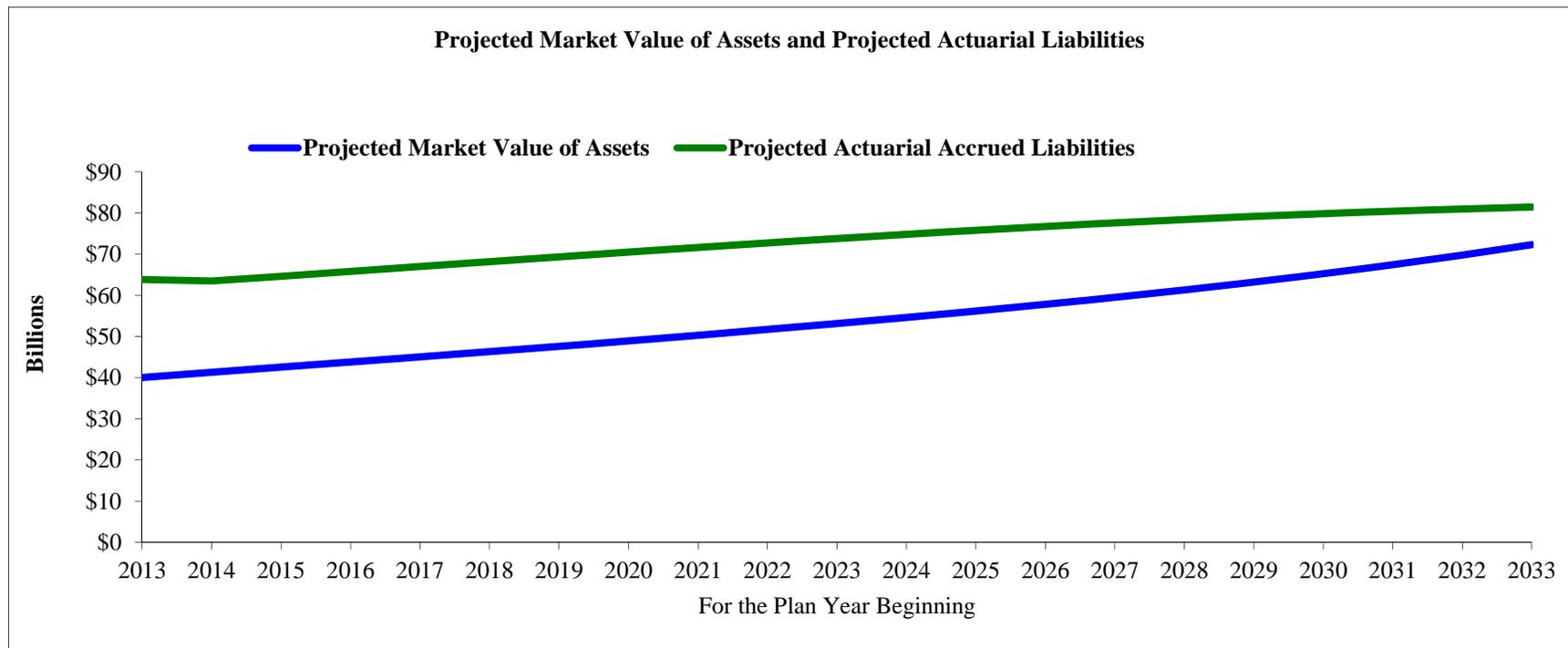
The Plan's projected benefit payments divided by projected contributions are shown in the chart below. The results assume the contribution policy remains unchanged, and that the Plan's assets return precisely the actuarially assumed rate each year without exception for all projection years.



Deterministic Analysis (continued)

Actuarial Accrued Liabilities and Market Value of Assets

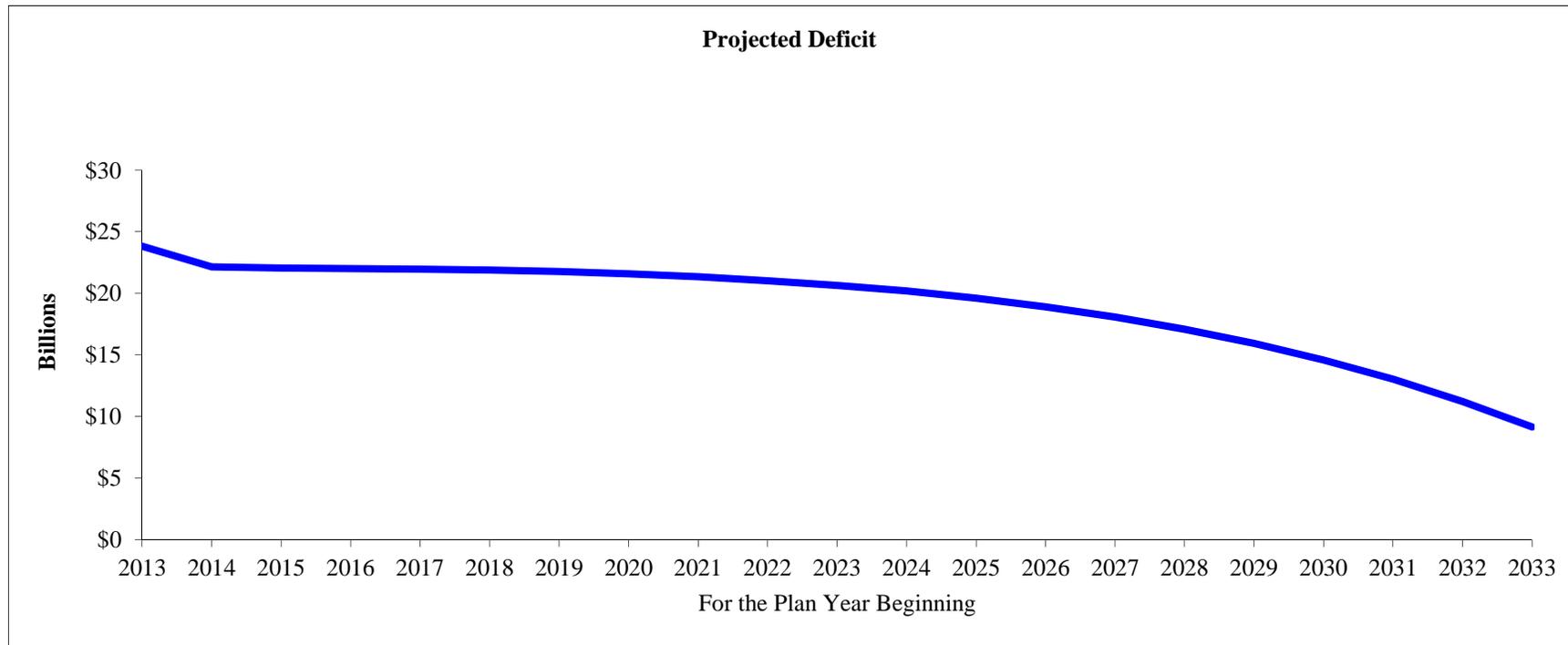
The Plan's projected actuarial accrued liabilities and market value of assets are shown in the chart below. The results assume the contribution policy remains unchanged, and that the Plan's assets return precisely the actuarially assumed rate each year without exception for all projection years. The relative disparity between the market value of assets and Plan liabilities is expected to decrease by 62% through the end of the projection period. The funded ratio (based on market value of assets) is expected to increase to approximately 89% by the end of the projection period. This is shown more clearly on the following pages.



Deterministic Analysis (continued)

Deficit (market value of assets – actuarial accrued liabilities)

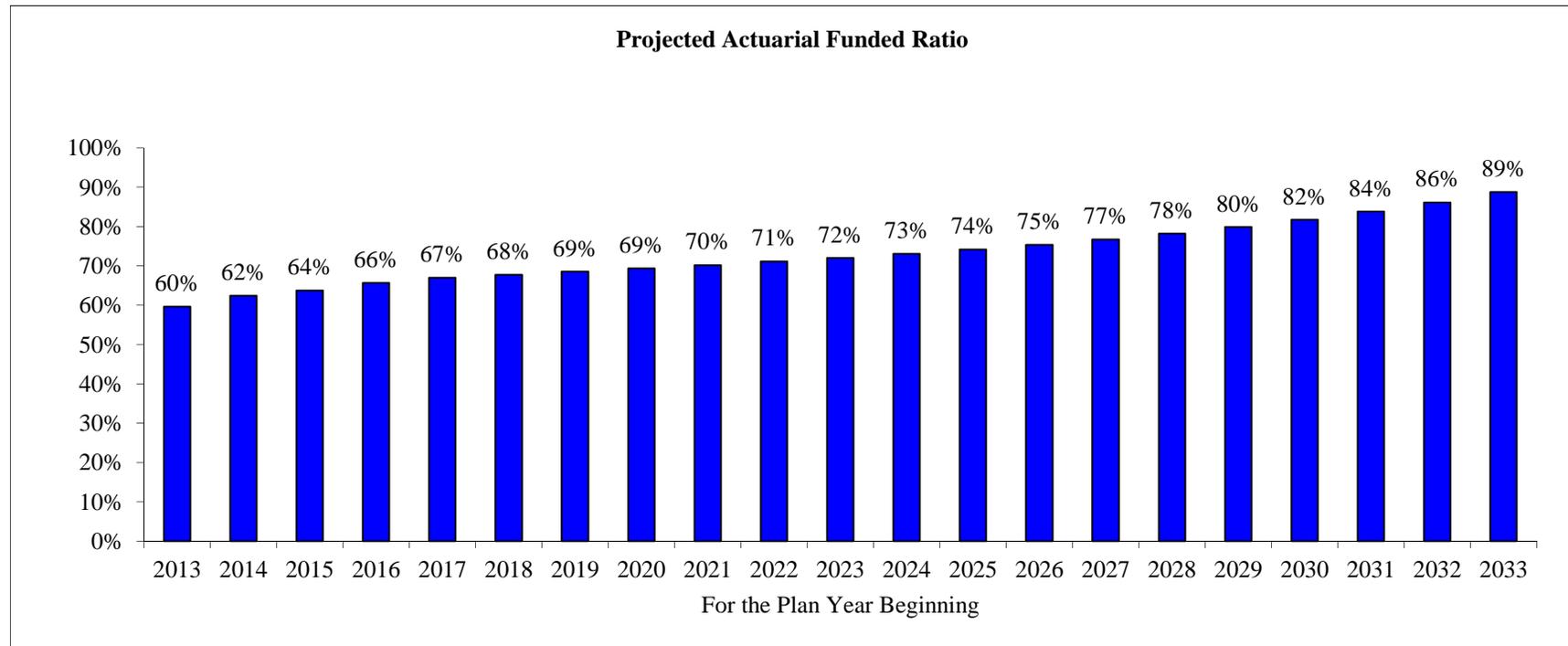
The Plan's projected deficit of assets is shown in the chart below. The results assume the contribution policy remains unchanged, and that the Plan's assets return precisely the actuarially assumed rate each year without exception for all projection years. The disparity between the market value of assets and Plan liabilities is expected to decrease by the end of the projection period by 62%.



Deterministic Analysis (continued)

Actuarial Funded Ratio (actuarial value of assets/actuarial accrued liability)

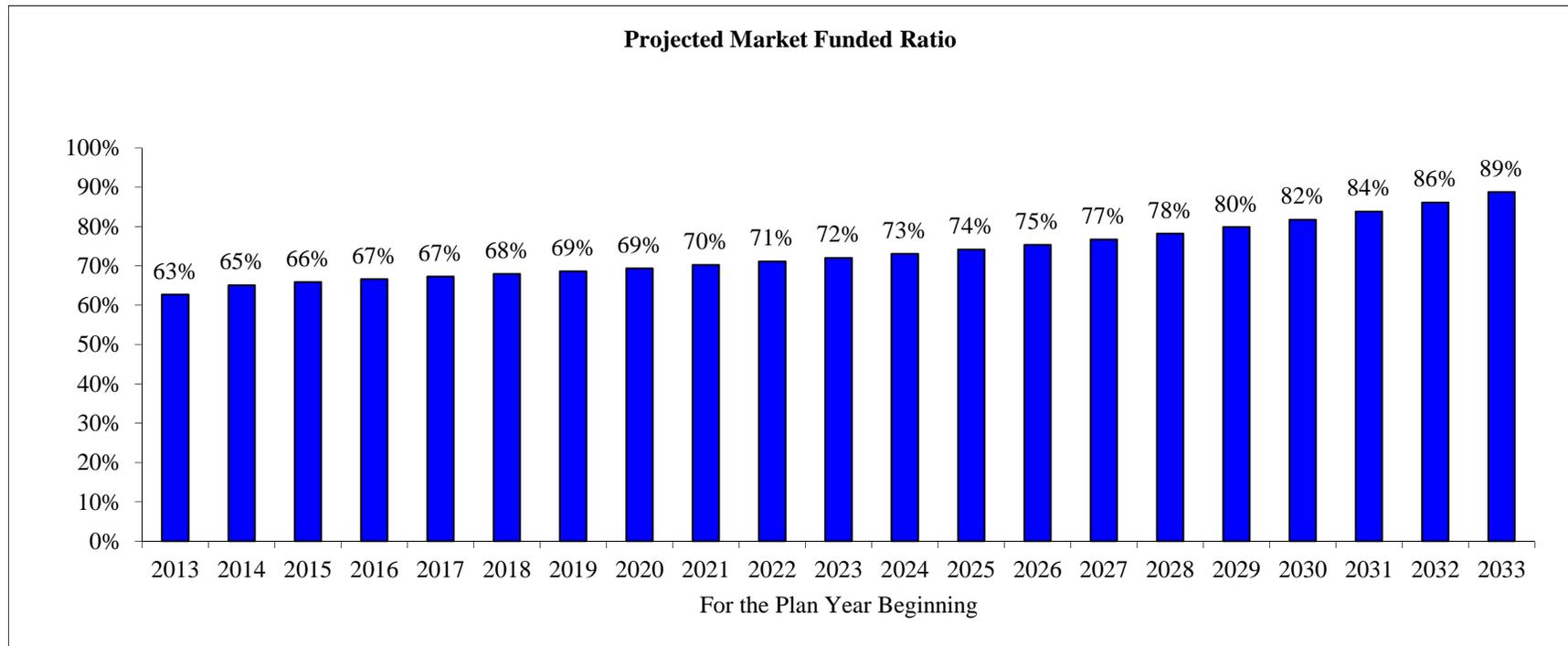
The Plan's projected actuarial funded ratio is shown in the chart below. The Plan is expected to end the projection period at approximately 89% funded. The results assume the contribution policy remains unchanged, and that the Plan's assets return precisely the actuarially assumed rate each year without exception for all projection years.



Deterministic Analysis (continued)

Market Funded Ratio (market value of assets/actuarial accrued liability)

The Plan's projected market funded ratio is shown in the chart below. The Plan is expected to end the projection period at approximately 89% funded. The results assume the contribution policy remains unchanged, and that the Plan's assets return precisely the actuarially assumed rate each year without exception for all projection years.

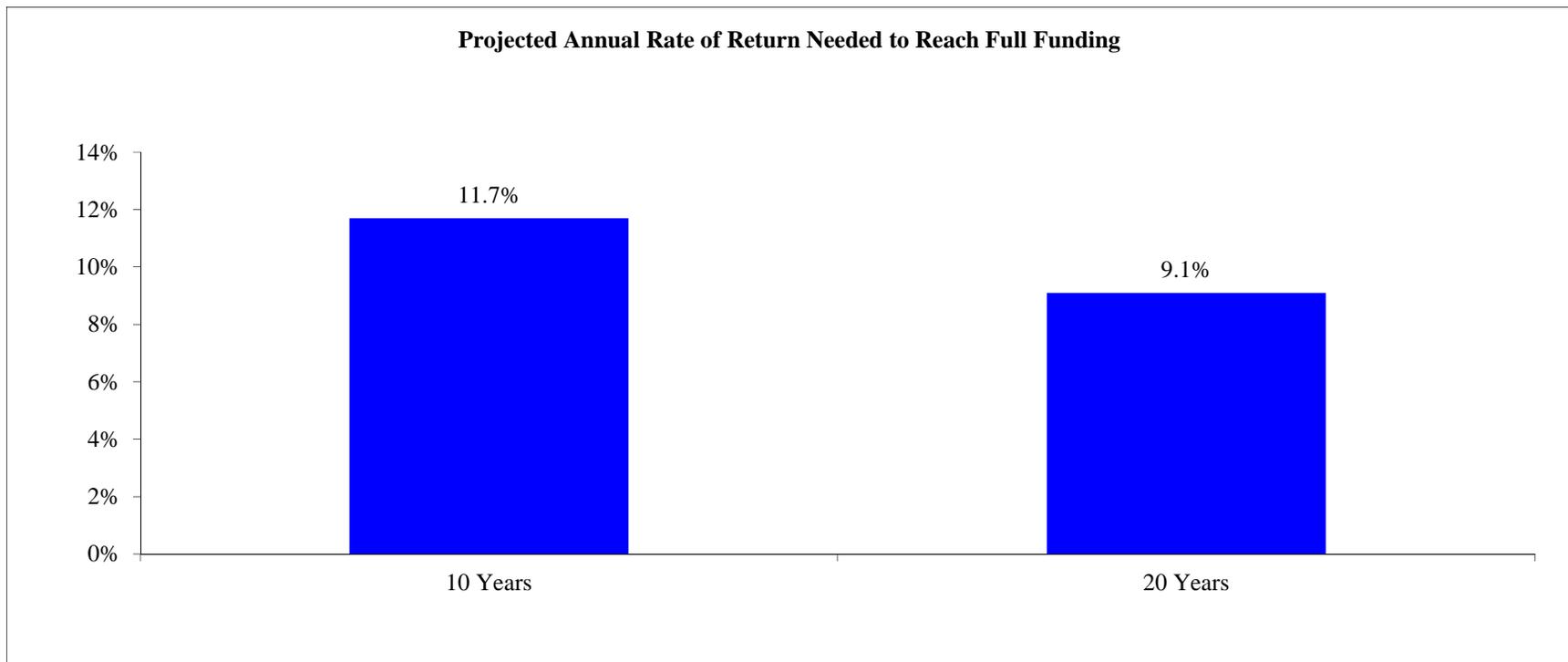


Deterministic Scenario Analysis

Full Funding Implied Returns

The figure below shows the projected investment return for the total fund needed to bring the Plan to 100% funding (on a market value basis) in 10 and 20 years, respectively. The results assume all other actuarial assumptions are precisely met over the time periods shown and that these returns are earned for every year, without variance.

Actuarially assumed rate of return – **8.00%/7.00%**



Deterministic Scenario Analysis (continued)

Sensitivity Analysis – Decreased Return

Under the deterministic analysis presented in the preceding pages, the Plan is projected to have a market funded ratio of 89% in 20 years. The table below summarizes the projected funded ratio and other key statistics in 2033 assuming the Plan experiences an annualized investment return of 100 basis points lower (7.00%/6.00%) than the current actuarially assumed rate of return (8.00%/7.00%). The values assume all other actuarial assumptions are exactly met. The original values are also presented in the table for comparison.

	Value in 2033			
	Actuarially Assumed Rate of Return	Reduced Return (100 bps)	Impact of Reduced Return Assumption	
Projected Payout Ratio	9.3%	10.2%	0.9%	▲
Projected Employer Contributions (billions)	\$3.4	\$5.2	\$1.8	▲
Projected Benefit Payments/Projected Total Contributions	171%	117%	-54%	▼
Projected Actuarial Accrued Liabilities (billions)	\$81.4	\$81.4	\$0.0	↔
Projected Market Value of Assets (billions)	\$72.3	\$65.9	(\$6.4)	▼
Projected Deficit (billions)	\$9.1	\$15.6	\$6.5	▲
Projected Market Funded Ratio	89%	81%	-8%	▼
	20 Year Cumulative Total			
Projected Cumulative Employer Contributions (billions)	\$55.5	\$66.8	\$11.3	▲

Values in impact column may not be additive to due rounding.

Deterministic Scenario Analysis (continued)

Sensitivity Analysis – Increased Contributions

Under the deterministic analysis presented in the preceding pages, the Plan is projected to have a funded ratio of 89% in 20 years. The table below summarizes the projected funded ratio and other key statistics in 2033 assuming the Plan increases employer contributions by \$230 million (approximately 10% of the 2013 employer contribution) each year (the contributions were added to the non-hybrid asset base). The values assume all other actuarial assumptions are exactly met. The original values are also presented in the table for comparison.

	Value in 2033			
	Annual Required Contribution	Increased Contribution	Impact of Increased Contributions	
Projected Payout Ratio	9.3%	9.1%	-0.3%	▼
Projected Employer Contributions (billions)	\$3.4	\$2.8	(\$0.6)	▼
Projected Benefit Payments/Projected Total Contributions	171%	199%	29%	▲
Projected Actuarial Accrued Liabilities (billions)	\$81.4	\$81.4	\$0.0	↔
Projected Market Value of Assets (billions)	\$72.3	\$74.5	\$2.2	▲
Projected Deficit (billions)	\$9.1	\$6.9	(\$2.2)	▼
Projected Market Funded Ratio	89%	91%	3%	▲
	20 Year Cumulative Total			
Projected Cumulative Employer Contributions (billions)	\$55.5	\$54.4	(\$1.0)	▼

Values in impact column may not be additive to due rounding.

Stochastic Analysis

In the previous section of this report, we assumed the Plan operated going forward with certain knowledge of the future investment returns earned by the Plan's assets. This section introduces the element of uncertainty in those future investment returns. This part of the analysis examines Plan assets and liabilities under many capital market environments based on expected future asset returns and inflation, and their expected volatility. Using a Monte Carlo simulation technique, both assets and liabilities are assumed to vary stochastically, linked together by changes in inflation.

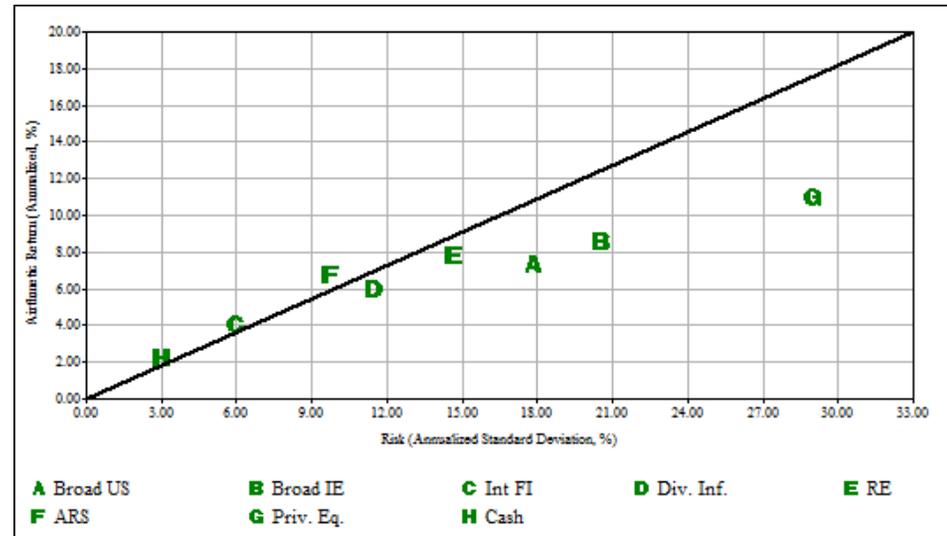
Using the current expected values and variances of the returns and inflation, along with their correlations, 2,000 trials are generated to produce a distribution of results. A stochastic analysis can answer questions about the best/worst case outcomes along with the probability of such outcomes. This is contrasted with the deterministic analysis that provides an expected value if all current Plan assumptions are exactly met.

Stochastic Analysis (continued)

Long-Term Return and Risk Assumptions

In order to perform a stochastic analysis and create asset allocation alternatives, it is necessary to estimate, for each asset class, its probable return and risk. The expected returns are our best estimates of the average annual percentage increases in values of each asset class over a prospective long period of time, and assumed to be normally distributed. The risk of an asset class is measured by its standard deviation, or volatility. If asset returns are normally distributed, two-thirds (67%) of all returns are expected to lie within one standard deviation on either side of the mean. For example, we expect Broad US Equity to return, annually on average, 7.30% with a standard deviation of 17.80%, meaning that two-thirds of the time we expect its return to lie between -10.50% (= 7.30 - 17.80) and 25.10% (= 7.30 + 17.80). Moreover, we expect 95% of all return outcomes to lie within two standard deviations of the mean return, implying only a one-in-twenty chance that the return on Broad US Equity will either fall below -28.30% or rise above 42.90%. The risk and return assumptions used in this study are outlined in the below table and chart:

Asset Class	Arithmetic Return Assumption	Standard Deviation Assumption
Broad US Equity	7.30	17.80
Broad International Equity	8.55	20.55
Int. Duration Fixed Income	4.00	6.00
Diversified Inflation Strategies	6.00	11.50
Real Estate	7.75	14.64
Absolute Return Strategies	6.75	9.75
Private Equity	11.00	29.00
Cash Equivalents	2.25	3.00



Stochastic Analysis (continued)

Correlation Between Asset Classes

Creating a diversified portfolio of asset classes enables the investor to achieve a high rate of return while minimizing volatility of the portfolio. As defined on the previous page, volatility is “risk” or standard deviation. By minimizing the volatility of a portfolio, we produce asset returns that vary less from year to year. Diversification exists because the returns of different asset classes do not always move in the same direction, at the same time, or with the same magnitude. Correlation values are between 1.00 and –1.00. If returns of two asset classes rise or fall at the same time and in the same magnitude, they have a correlation value of 1.00. Conversely, two asset classes that simultaneously move in opposite directions, and in the same magnitude, have a correlation value of –1.00. A correlation of zero indicates no relationship between returns. The assumed correlations are largely based on historical index data, with some qualitative analysis applied. For instance, where appropriate, we have weighted current history more heavily. The correlation matrix used in this study is shown below:

	Broad US Equity	Broad International Equity	Int. Duration Fixed Income	Diversified Infl Strat	Real Estate	Absolute Return Strategies	Private Equity	Cash Equivalents
Broad US Equity	1.00	0.84	0.18	0.65	0.24	0.51	0.71	0.04
Broad International Equity	0.84	1.00	0.01	0.78	0.26	0.70	0.71	-0.06
Int. Duration Fixed Income	0.18	0.01	1.00	0.23	-0.05	0.13	-0.18	0.27
Diversified Infl Strat	0.65	0.78	0.23	1.00	0.33	0.61	0.61	-0.02
Real Estate	0.24	0.26	-0.05	0.33	1.00	0.25	0.51	-0.05
Absolute Return Strategies	0.51	0.70	0.13	0.61	0.25	1.00	0.62	0.22
Private Equity	0.71	0.71	-0.18	0.61	0.51	0.62	1.00	0.08
Cash Equivalents	0.04	-0.06	0.27	-0.02	-0.05	0.22	0.08	1.00

The fact that the correlations shown in the table are nearly all positive does not imply that these asset classes do not diversify one another. Their correlations are significantly less than 1.00, meaning we expect a measurable number of instances when the underperformance of one or more of the asset classes will be offset by the outperformance of others. This point is demonstrated on the following pages, which illustrate that diversification into less correlated asset classes can decrease the expected overall volatility of a portfolio.

Stochastic Analysis (continued)

Efficient Portfolios

Each frontier portfolio (optimal allocation) is created using target rates of return both above and below the projected rate of return for the current allocation. This range illustrates the trade-off between return and risk; additional return can only be achieved by undertaking additional risk. The table below shows the possible optimal allocations given the selected asset classes and their constraints listed under “Min” and “Max.” The table shows the Strategic Target and Current Allocation (as of June 30, 2014) for consideration throughout this study. Two illustrative portfolios (Conservative and Aggressive Portfolios) are also shown for demonstrative purposes.

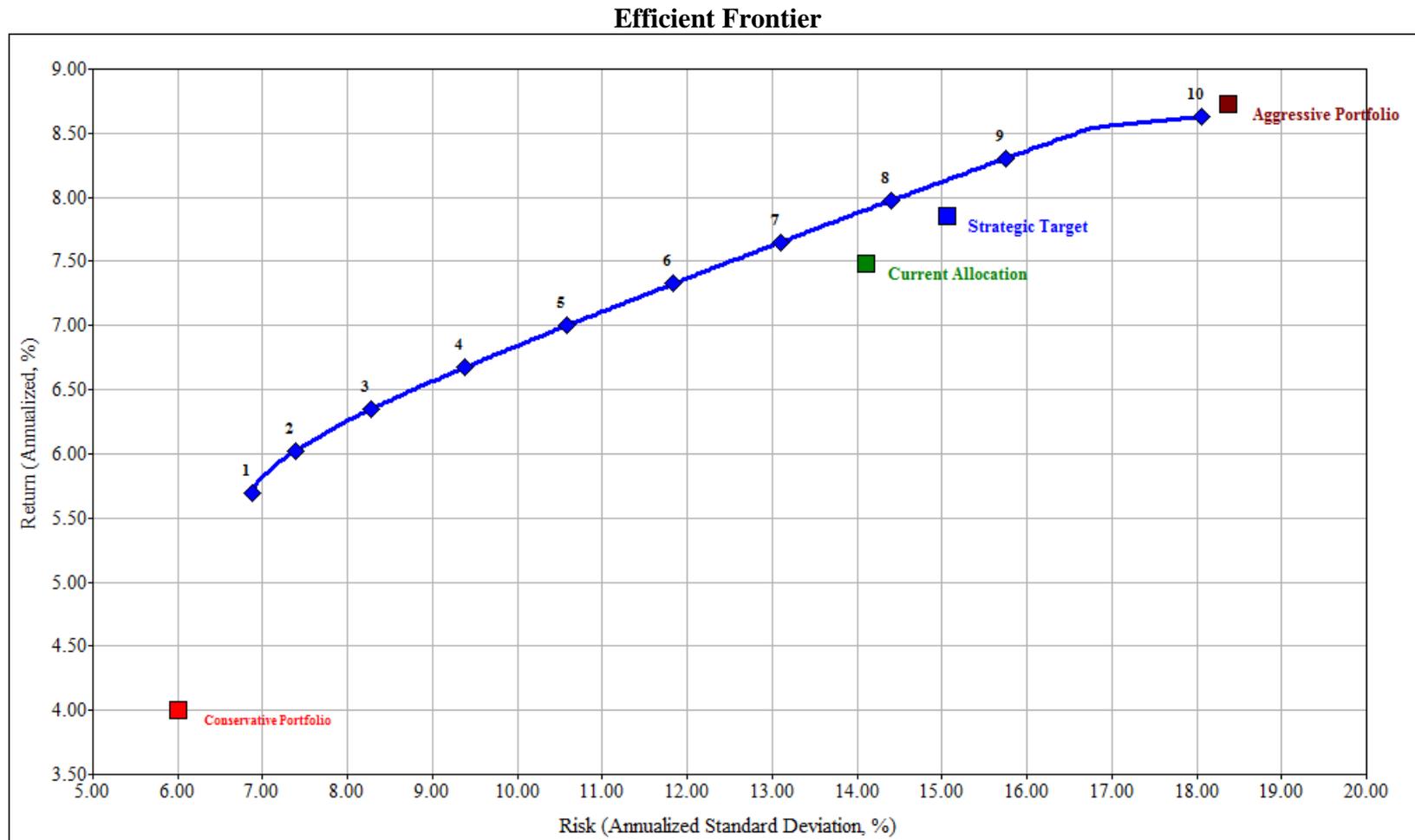
	Min	Max	1	2	3	4	5	6	7	8	9	10	Strategic Target	Current Allocation	Conservative Portfolio	Aggressive Portfolio
Broad US Equity	0	70	21	7	5	6	7	8	9	12	16	33	28.0	30.3	0.0	35.0
Broad International Equity	0	20	0	7	5	6	7	8	9	12	16	20	16.0	16.1	0.0	20.0
Int. Duration Fixed Income	0	40	40	40	40	38	33	27	21	14	6	0	10.5	11.7	100.0	0.0
Diversified Infl Strat	0	10	5	5	5	0	0	0	0	0	0	0	4.5	4.5	0.0	0.0
Real Estate	0	15	15	15	15	15	15	15	15	15	15	15	10.0	9.3	0.0	15.0
Absolute Return Strategies	0	15	15	15	15	15	15	15	15	15	15	0	6.0	4.4	0.0	0.0
Private Equity	0	30	0	6	13	18	22	25	28	30	30	30	23.0	18.4	0.0	30.0
Cash Equivalents	2	4	4	4	2	2	2	2	2	2	2	2	2.0	5.3	0.0	0.0
Total			100	100	100	100	100	100	100	100	100	100	100	100	100	100
Capital Appreciation			21	21	23	30	35	41	47	54	62	83	67	65	0	85
Capital Preservation			44	44	42	40	35	29	23	16	8	2	13	17	100	0
Alpha			15	15	15	15	15	15	15	15	15	0	6	4	0	0
Inflation			20	20	20	15	15	15	15	15	15	15	15	14	0	15
Expected Return			5.7	6.0	6.4	6.7	7.0	7.3	7.7	8.0	8.3	8.6	7.9	7.5	4.0	8.7
Risk (Standard Deviation)			6.9	7.4	8.3	9.4	10.6	11.8	13.1	14.4	15.8	18.1	15.1	14.1	6.0	18.4
Return (Compound)			5.5	5.7	6.1	6.3	6.5	6.7	6.9	7.1	7.2	7.1	6.9	6.6	3.8	7.2
Return/Risk Ratio			0.8	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.7	0.5
RVK Expected Eq Beta (LC US Eq = 1)			0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.9	0.8	0.7	0.1	0.9
RVK Liquidity Metric (T-Bills = 100)			71	65	59	54	52	49	47	46	46	56	61	67	85	56

Due to statutory limits Domestic Equity cannot exceed 70%, International Equity cannot exceed 20%, Absolute Return Strategies and Diversified Inflation Strategies combined cannot exceed 20%, and Private Equity cannot exceed 30% of the total Portfolio. Broad International Equity is constrained to be less than or equal to Broad US Equity.

Stochastic Analysis (continued)

Efficient Frontier

The risk of each alternative allocation is plotted against the horizontal axis, while the return is measured on the vertical axis. The line connecting the points represents all the optimal portfolios subject to the given constraints and is known as the “efficient frontier.” The upward slope of the efficient frontier indicates the direct relationship between return and risk.



Stochastic Analysis (continued)

Asset Mixes

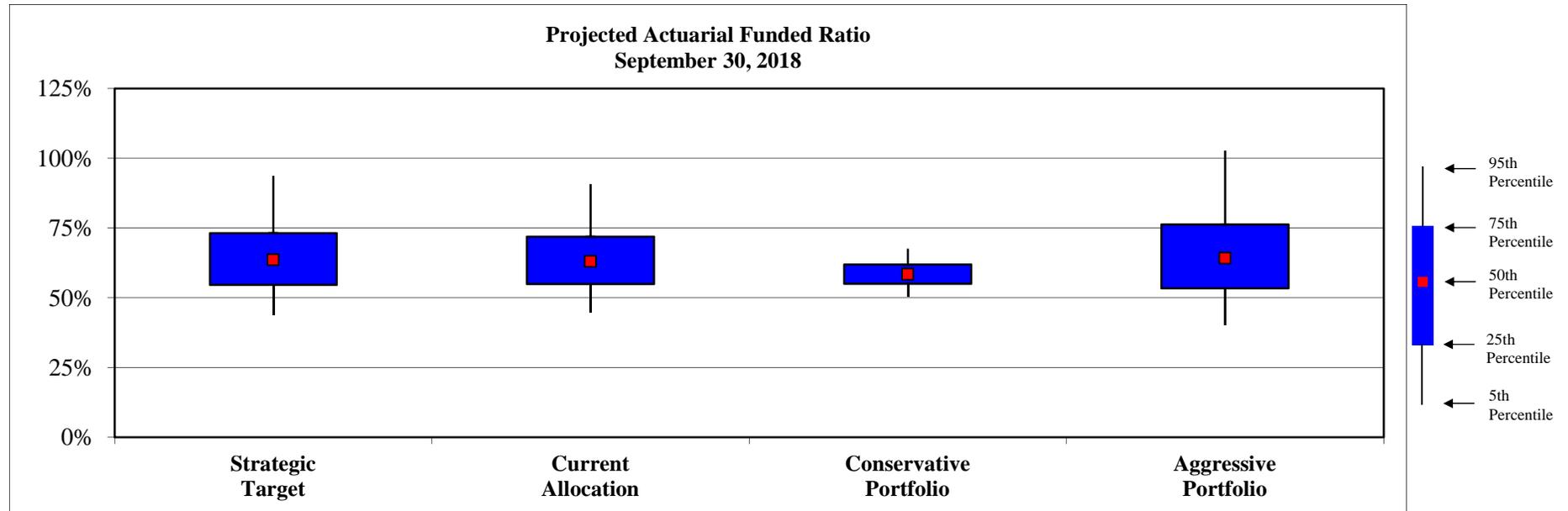
Outlined below are the Strategic Target, Current Allocation, Conservative Portfolio, and Aggressive Portfolio. The expected return, expected risk (as measured by standard deviation), and RVK Liquidity Metric, for each is also shown.

Asset Class	Strategic Target	Current Allocation	Conservative Portfolio	Aggressive Portfolio
Broad US Equity	28.0%	30.3%	0.0%	35.0%
Broad International Equity	16.0%	16.1%	0.0%	20.0%
Int. Duration Fixed Income	10.5%	11.7%	100.0%	0.0%
Diversified Inflation Strategies	4.5%	4.5%	0.0%	0.0%
Real Estate	10.0%	9.3%	0.0%	15.0%
Absolute Return Strategies	6.0%	4.4%	0.0%	0.0%
Private Equity	23.0%	18.4%	0.0%	30.0%
Cash Equivalents	2.0%	5.3%	0.0%	0.0%
Total Equity	67%	65%	0%	85%
Expected Return	7.9%	7.5%	4.0%	8.7%
Expected Risk	15.1%	14.1%	6.0%	18.4%
RVK Liquidity Metric	61	67	85	56

Stochastic Analysis (continued)

Projected Actuarial Funded Ratio (actuarial value of assets/actuarial accrued liability); 5 Years

The graph below shows the distribution of possible actuarial funded ratios five years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



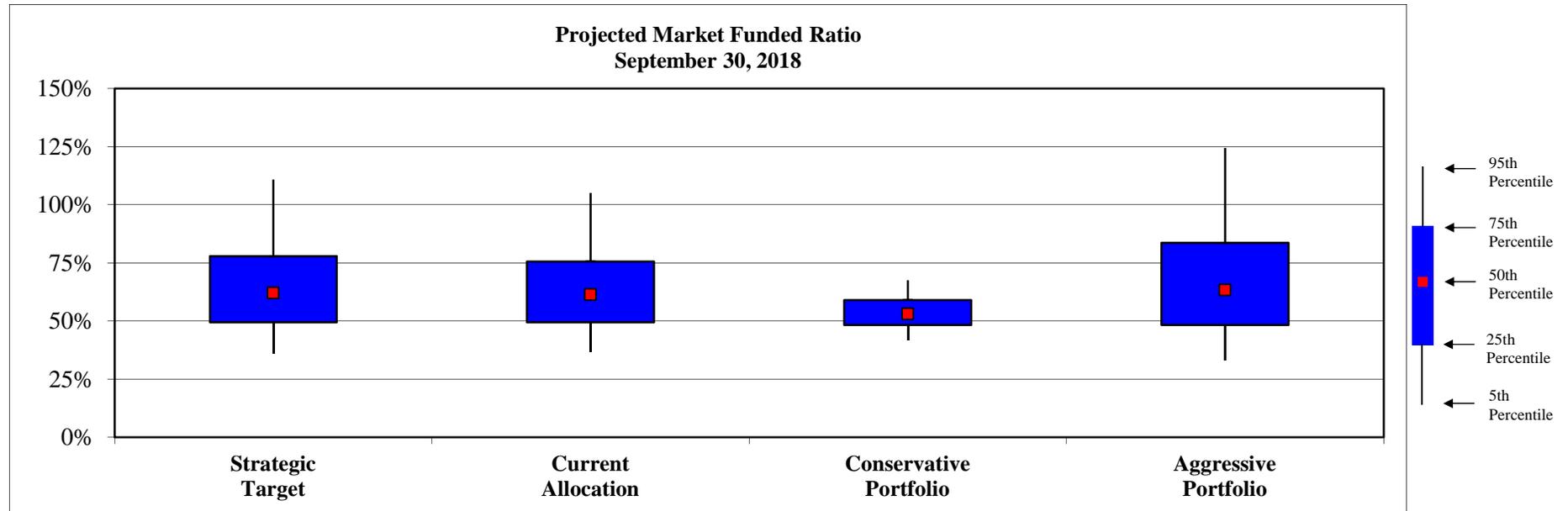
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$38.4	43.8%	\$37.8	44.7%	\$33.8	50.3%	\$40.8	40.4%
25th Percentile	\$31.1	54.6%	\$31.1	54.9%	\$30.9	55.0%	\$32.1	53.4%
50th Percentile	\$25.2	63.5%	\$25.6	63.0%	\$28.6	58.4%	\$24.6	64.1%
75th Percentile	\$18.8	73.1%	\$19.5	71.9%	\$26.4	61.9%	\$16.4	76.3%
95th Percentile	\$4.3	93.7%	\$6.4	90.8%	\$22.7	67.6%	(\$1.9)	102.7%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Stochastic Analysis (continued)

Projected Market Funded Ratio (market value of assets/actuarial accrued liability); 5 Years

The graph below shows the distribution of possible market funded ratios five years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



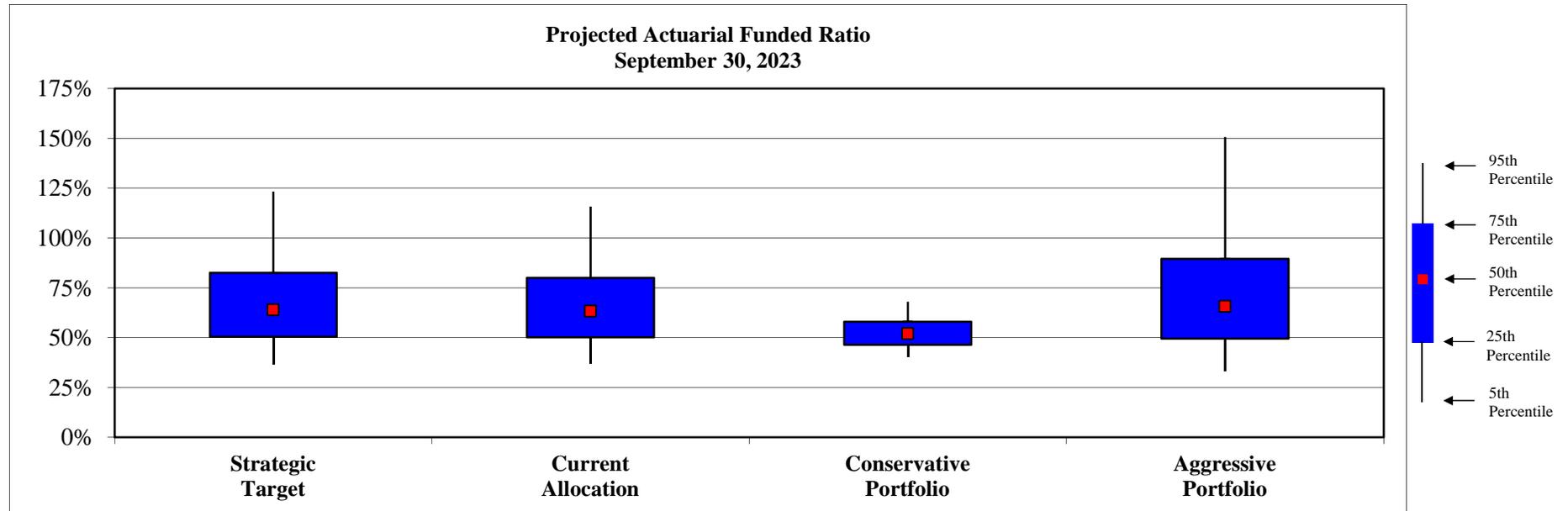
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$43.4	36.1%	\$43.0	36.7%	\$39.4	41.8%	\$45.8	33.1%
25th Percentile	\$34.7	49.4%	\$34.7	49.4%	\$35.5	48.3%	\$35.6	48.2%
50th Percentile	\$26.2	62.0%	\$26.7	61.4%	\$32.3	53.1%	\$25.2	63.3%
75th Percentile	\$15.2	77.8%	\$16.9	75.6%	\$28.6	58.9%	\$11.4	83.6%
95th Percentile	(\$7.7)	110.9%	(\$3.5)	105.0%	\$22.8	67.5%	(\$17.2)	124.4%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Stochastic Analysis (continued)

Projected Actuarial Funded Ratio (actuarial value of assets/actuarial accrued liability); 10 Years

The graph below shows the distribution of possible actuarial funded ratios ten years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



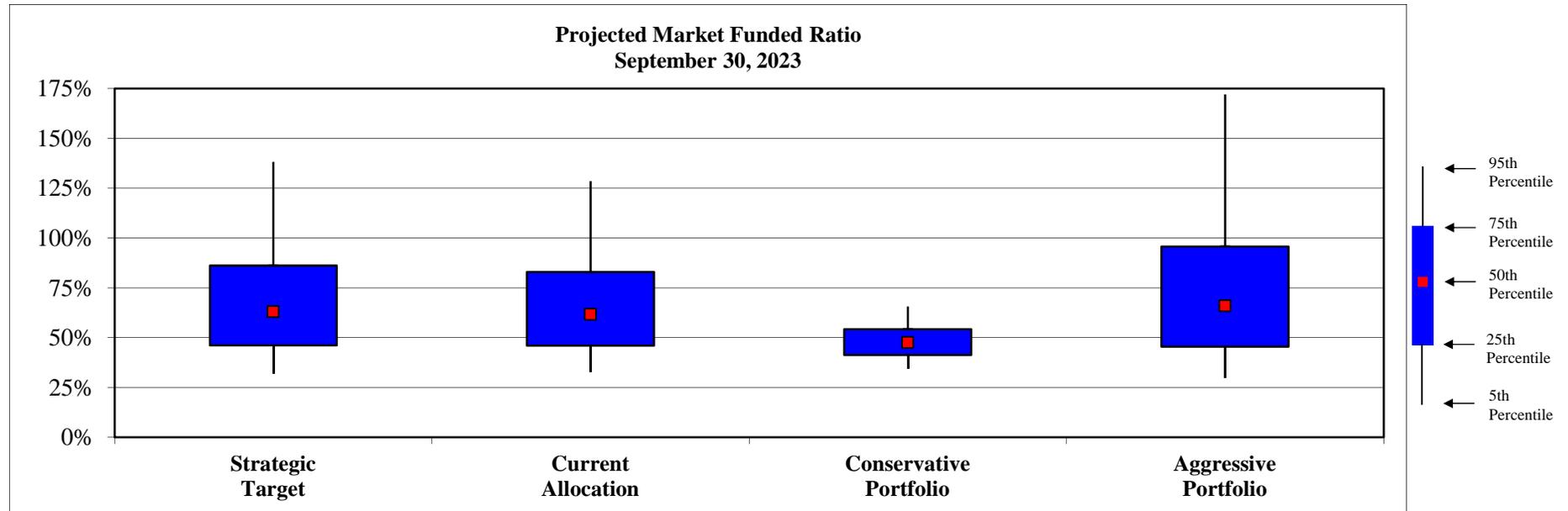
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$46.2	36.3%	\$45.8	37.1%	\$43.4	40.3%	\$48.4	33.4%
25th Percentile	\$36.5	50.4%	\$36.5	50.1%	\$39.2	46.3%	\$37.4	49.5%
50th Percentile	\$26.7	63.9%	\$27.3	63.2%	\$35.8	51.9%	\$25.2	65.7%
75th Percentile	\$13.0	82.5%	\$15.0	79.9%	\$31.6	57.9%	\$7.7	89.5%
95th Percentile	(\$18.1)	123.3%	(\$11.7)	115.7%	\$24.4	68.0%	(\$38.0)	150.6%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Stochastic Analysis (continued)

Projected Market Funded Ratio (market value of assets/actuarial accrued liability); 10 Years

The graph below shows the distribution of possible market funded ratios ten years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



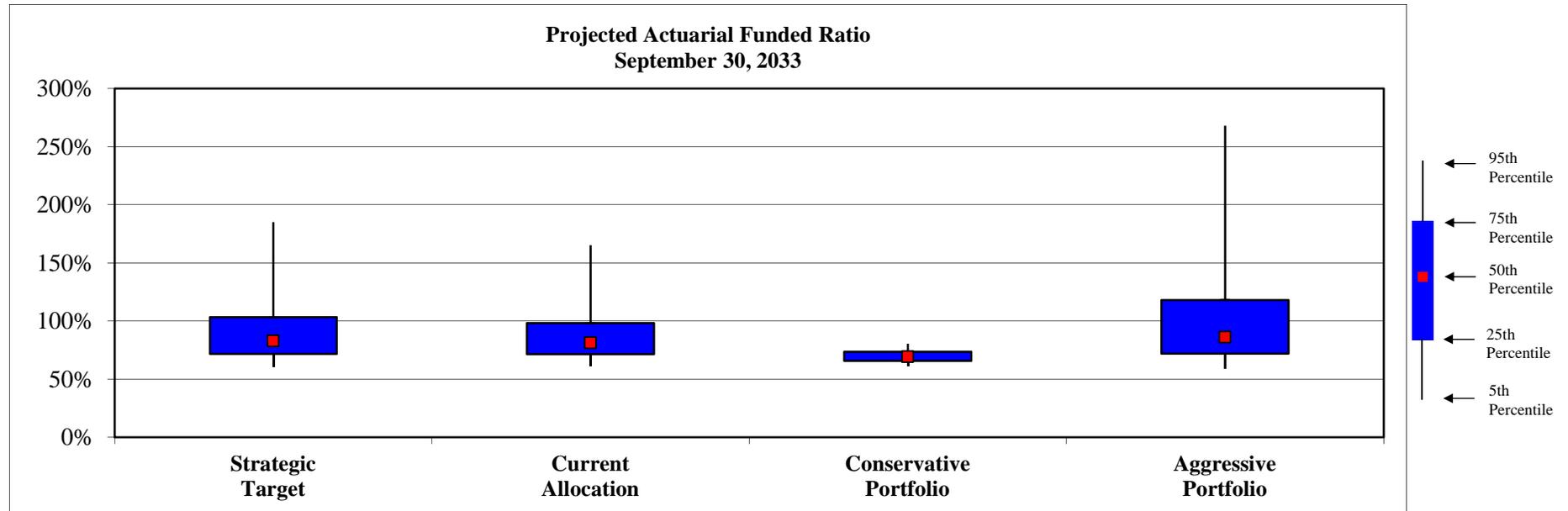
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$49.3	32.2%	\$48.8	32.7%	\$47.3	34.2%	\$51.6	29.7%
25th Percentile	\$39.4	46.1%	\$39.5	46.0%	\$42.9	41.3%	\$39.9	45.4%
50th Percentile	\$27.5	62.9%	\$28.5	61.7%	\$39.0	47.5%	\$25.4	66.0%
75th Percentile	\$10.4	86.2%	\$13.1	82.8%	\$34.4	54.1%	\$3.1	95.6%
95th Percentile	(\$29.8)	138.2%	(\$21.3)	128.5%	\$26.9	65.6%	(\$53.6)	172.0%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Stochastic Analysis (continued)

Projected Actuarial Funded Ratio (actuarial value of assets/actuarial accrued liability); 20 Years

The graph below shows the distribution of possible actuarial funded ratios twenty years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



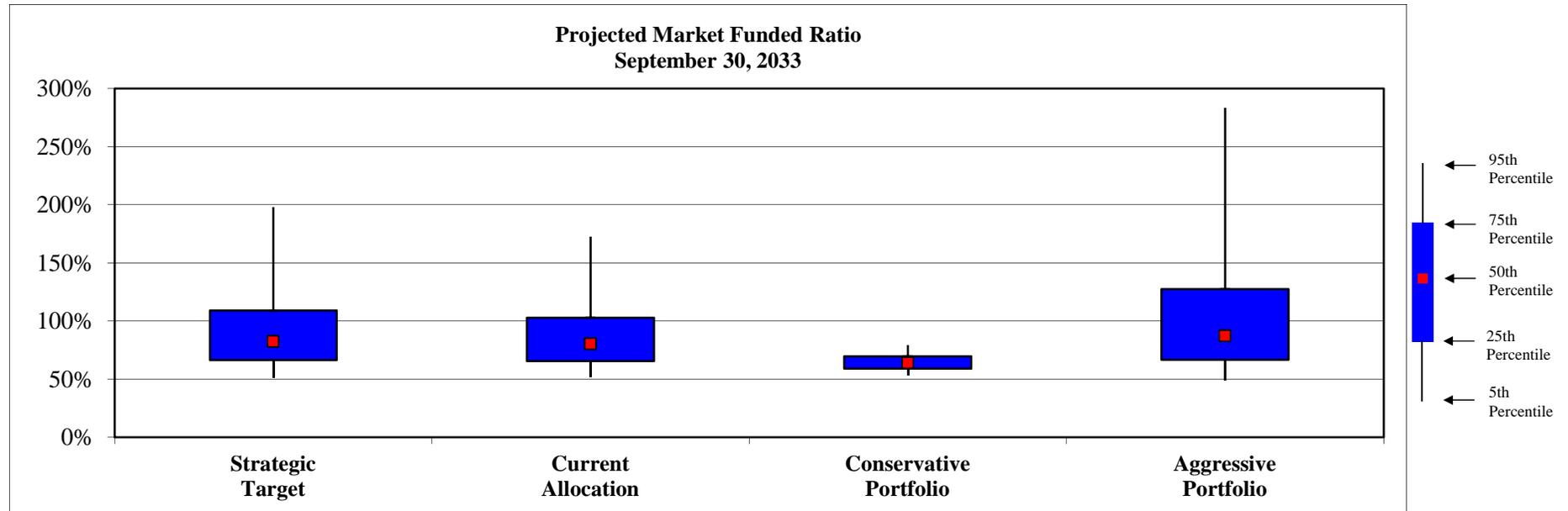
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$30.6	60.6%	\$30.4	60.9%	\$30.1	60.8%	\$32.2	58.8%
25th Percentile	\$22.3	71.7%	\$22.8	71.4%	\$26.9	65.8%	\$22.2	71.9%
50th Percentile	\$13.8	82.9%	\$14.9	81.2%	\$24.6	69.4%	\$10.9	86.2%
75th Percentile	(\$2.5)	103.2%	\$1.4	98.2%	\$21.6	73.6%	(\$14.8)	118.0%
95th Percentile	(\$72.4)	185.1%	(\$55.4)	165.0%	\$17.0	80.4%	(\$135.3)	268.0%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Stochastic Analysis (continued)

Projected Market Funded Ratio (market value of assets/actuarial accrued liability); 20 Years

The graph below shows the distribution of possible market funded ratios twenty years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$38.0	51.2%	\$37.8	51.7%	\$36.5	53.1%	\$39.9	49.0%
25th Percentile	\$26.4	66.3%	\$27.0	65.5%	\$32.2	59.2%	\$26.1	66.7%
50th Percentile	\$13.9	82.5%	\$15.7	80.4%	\$28.7	64.0%	\$10.2	87.2%
75th Percentile	(\$7.4)	109.0%	(\$2.2)	102.7%	\$24.9	69.7%	(\$21.7)	127.4%
95th Percentile	(\$81.2)	198.1%	(\$62.0)	172.6%	\$17.9	79.2%	(\$150.5)	283.3%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Stochastic Analysis (continued)

Projected Market Funded Ratio and Maximum 1 Year Investment Loss (market value of assets/actuarial accrued liability)

The tables below show the probability that the Plan will be at various funding levels for each of the four different asset mixes highlighted on the prior pages. The tables also illustrate the maximum 1 year investment loss each portfolio is expected to experience during the given time period. The results assume the current contribution policy remains unchanged for all projection years.

5 Years	Probability of Full Funding in 2018	Probability of less than 63% (Current) Funding in 2018	Probability of less than 50% Funding in 2018	Maximum 1 Year Portfolio Investment Loss
Strategic Target	9%	51%	26%	-35%
Current Allocation	7%	53%	26%	-33%
Conservative Portfolio	0%	87%	34%	-19%
Aggressive Portfolio	13%	49%	28%	-42%

10 Years	Probability of Full Funding in 2023	Probability of less than 63% (Current) Funding in 2023	Probability of less than 50% Funding in 2023	Maximum 1 Year Portfolio Investment Loss
Strategic Target	16%	50%	31%	-38%
Current Allocation	13%	51%	32%	-36%
Conservative Portfolio	0%	92%	61%	-19%
Aggressive Portfolio	23%	47%	32%	-47%

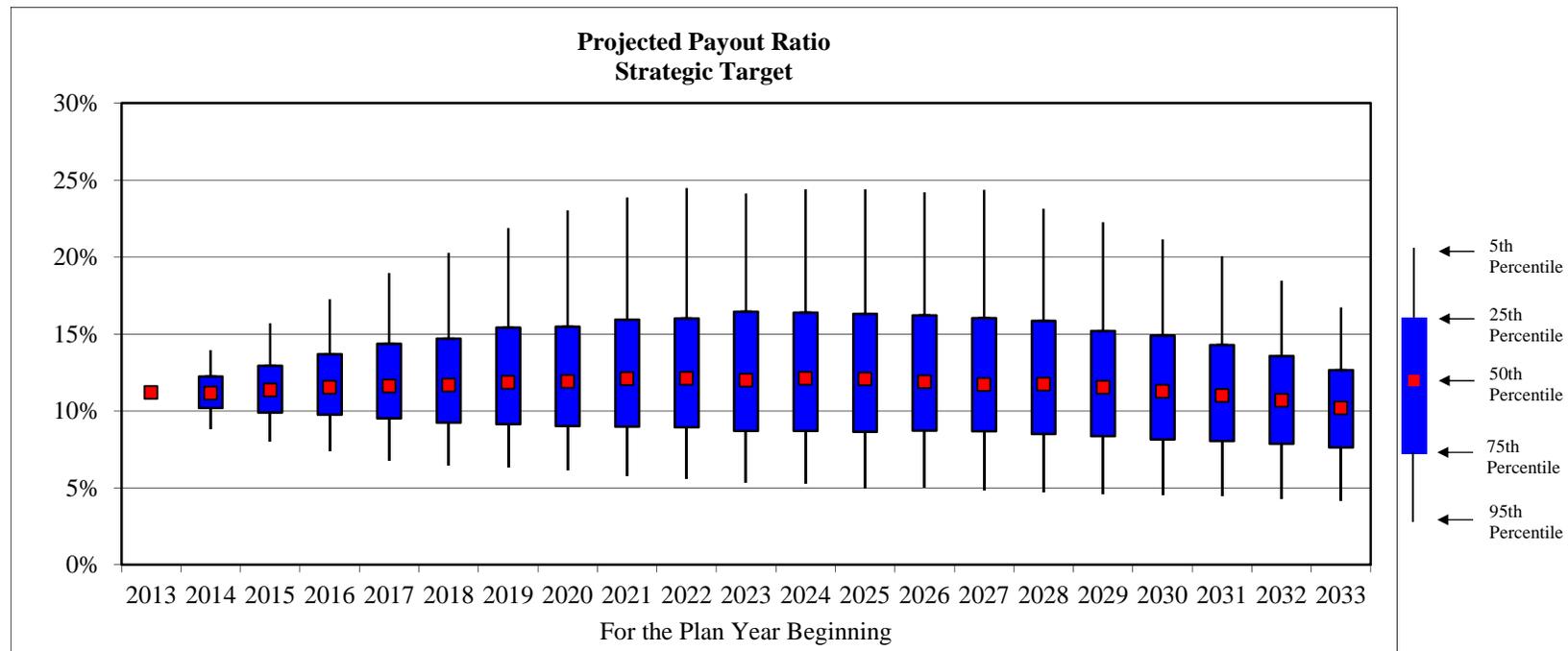
20 Years	Probability of Full Funding in 2033	Probability of less than 63% (Current) Funding in 2033	Probability of less than 50% Funding in 2033	Maximum 1 Year Portfolio Investment Loss
Strategic Target	31%	18%	4%	-38%
Current Allocation	27%	19%	4%	-36%
Conservative Portfolio	0%	43%	1%	-19%
Aggressive Portfolio	39%	19%	6%	-47%

Stochastic Analysis (continued)

Projected Payout Ratio (expected benefit payments/market value of assets); Strategic Target

The graph below displays the range of possible payout ratios over the next twenty years, assuming the Plan's assets are allocated according to the Strategic Target (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.

The annual median benefit payment as percentage of market value of assets is expected to range between 10.2% and 12.1%. The worst-case scenario could reach 24% or higher.



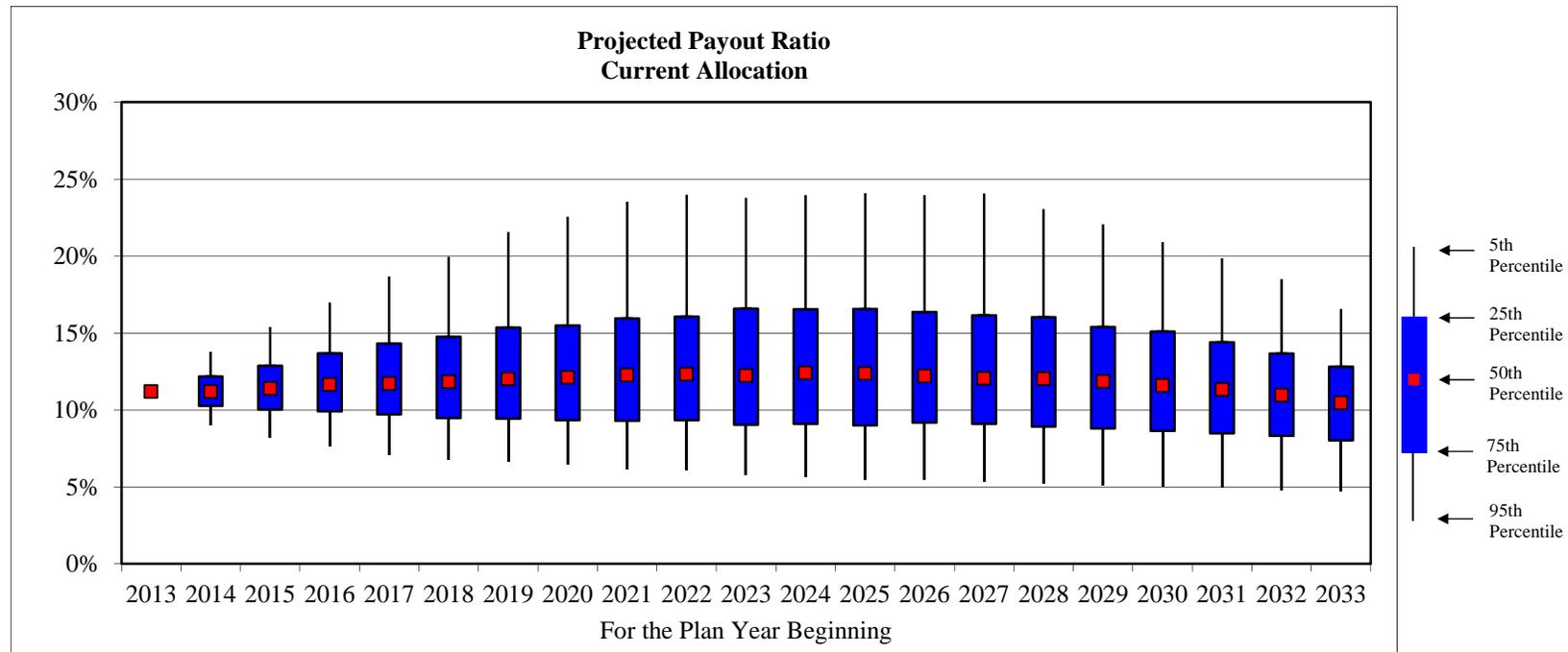
Percentiles indicate the probability of achieving a Payout Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Payout Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Stochastic Analysis (continued)

Projected Payout Ratio (expected benefit payments/market value of assets); **Current Allocation**

The graph below displays the range of possible payout ratios over the next twenty years, assuming the Plan's assets are allocated according to the Current Allocation (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.

The annual median benefit payment as percentage of market value of assets is expected to range between 10.5% and 12.4%. The worst-case scenario could reach 24% or higher.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Median	11.2%	11.2%	11.4%	11.6%	11.7%	11.8%	12.0%	12.1%	12.3%	12.3%	12.2%	12.4%	12.4%	12.2%	12.0%	12.0%	11.8%	11.6%	11.3%	11.0%	10.5%

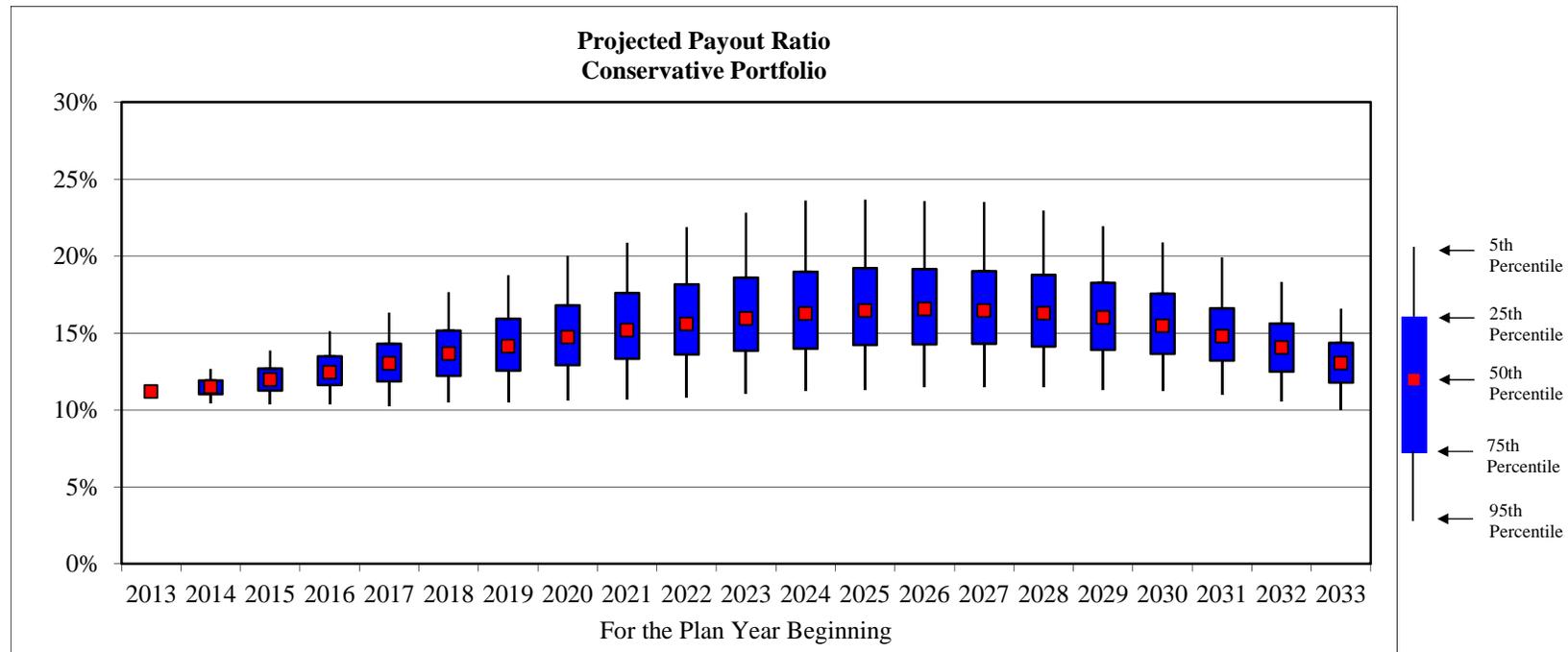
Percentiles indicate the probability of achieving a Payout Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Payout Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Stochastic Analysis (continued)

Projected Payout Ratio (expected benefit payments/market value of assets); **Conservative Portfolio**

The graph below displays the range of possible payout ratios over the next twenty years, assuming the Plan's assets are allocated according to the Conservative Portfolio (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.

The annual median benefit payment as percentage of market value of assets is expected to range between 11.2% and 16.6%. The worst-case scenario could reach 24% or higher.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Median	11.2%	11.5%	12.0%	12.4%	13.0%	13.6%	14.1%	14.7%	15.2%	15.6%	15.9%	16.3%	16.5%	16.6%	16.5%	16.3%	16.0%	15.5%	14.8%	14.0%	13.0%

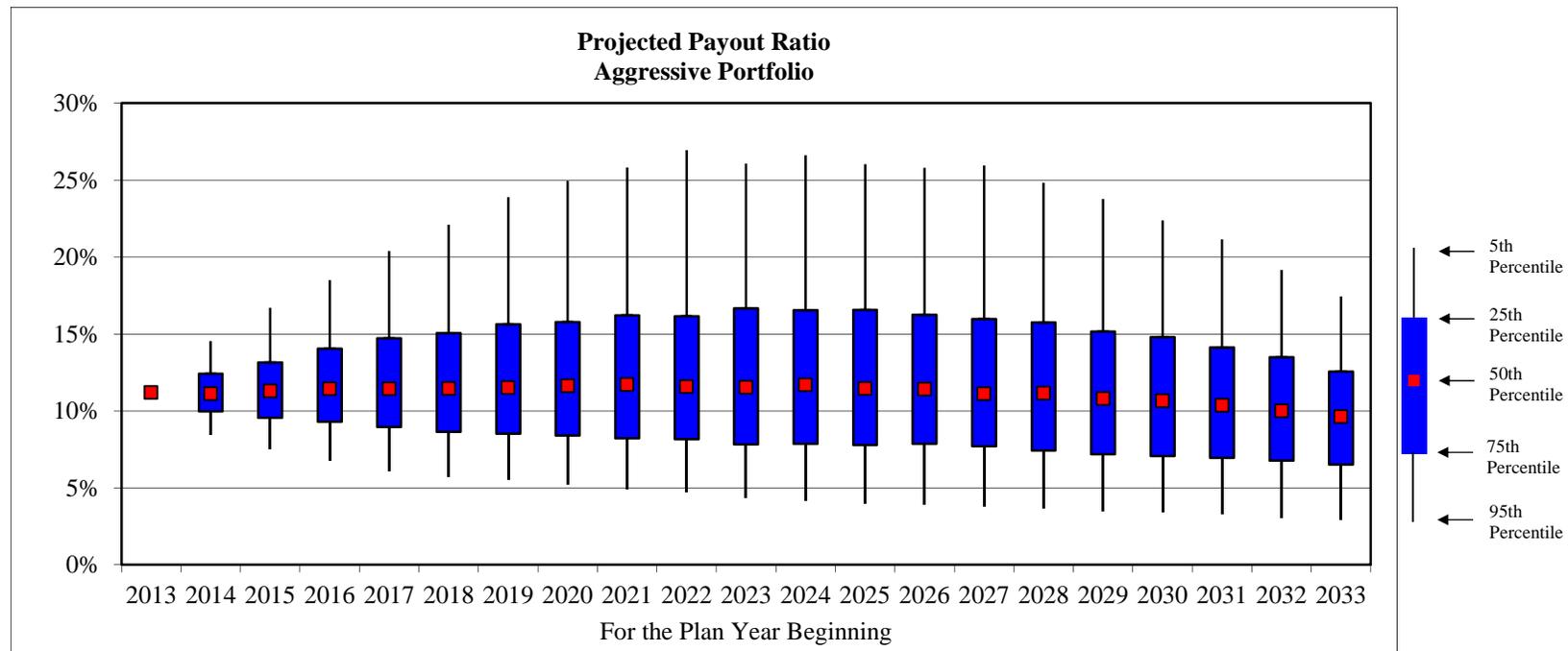
Percentiles indicate the probability of achieving a Payout Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Payout Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Stochastic Analysis (continued)

Projected Payout Ratio (expected benefit payments/market value of assets); Aggressive Portfolio

The graph below displays the range of possible payout ratios over the next twenty years, assuming the Plan's assets are allocated according to the Aggressive Portfolio (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.

The annual median benefit payment as percentage of market value of assets is expected to range between 9.6% and 11.7%. The worst-case scenario could reach 27% or higher.



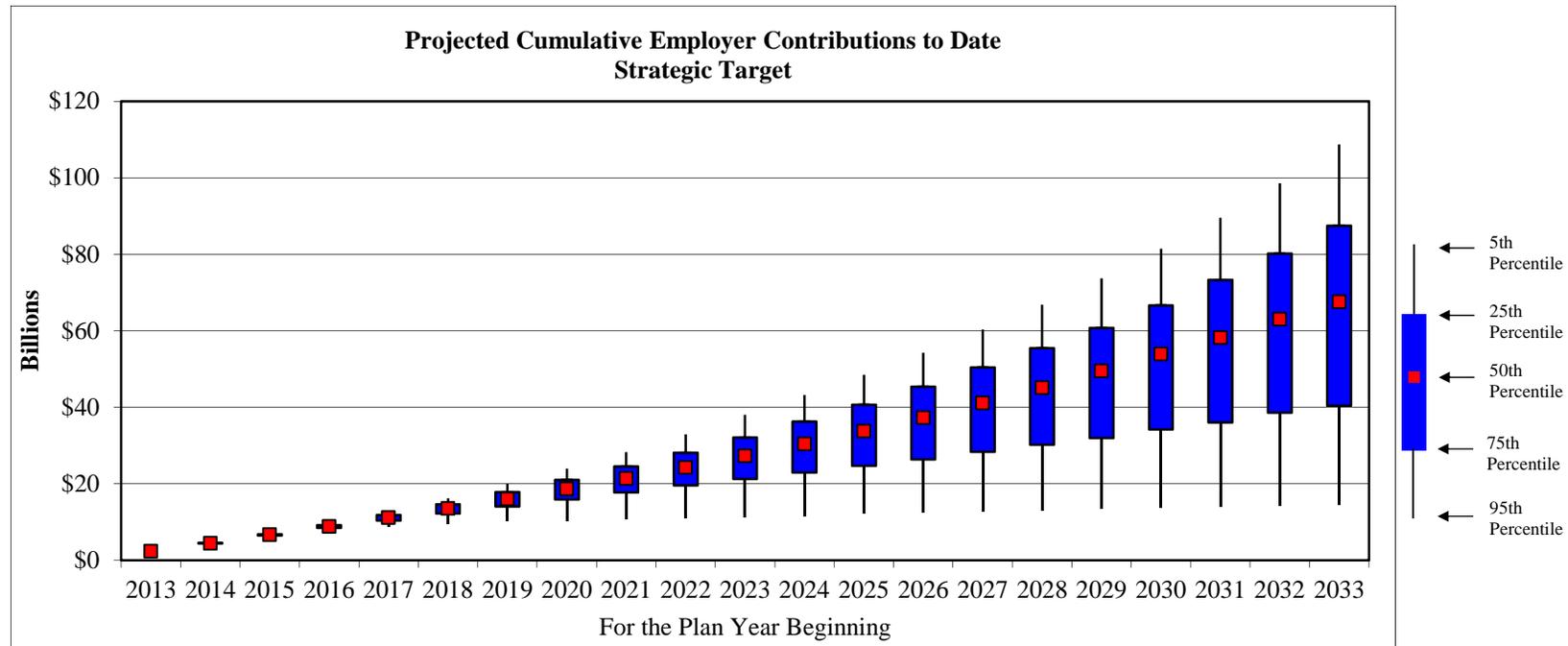
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Median	11.2%	11.1%	11.3%	11.4%	11.4%	11.5%	11.5%	11.6%	11.7%	11.6%	11.5%	11.7%	11.5%	11.4%	11.1%	11.1%	10.8%	10.7%	10.4%	10.0%	9.6%

Percentiles indicate the probability of achieving a Payout Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Payout Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Stochastic Analysis (continued)

Cumulative Employer Contributions to Date; Strategic Target

The graph and table below show the range of projected cumulative employer contributions over the next twenty years, assuming the Plan's assets are allocated according to the Strategic Target (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.



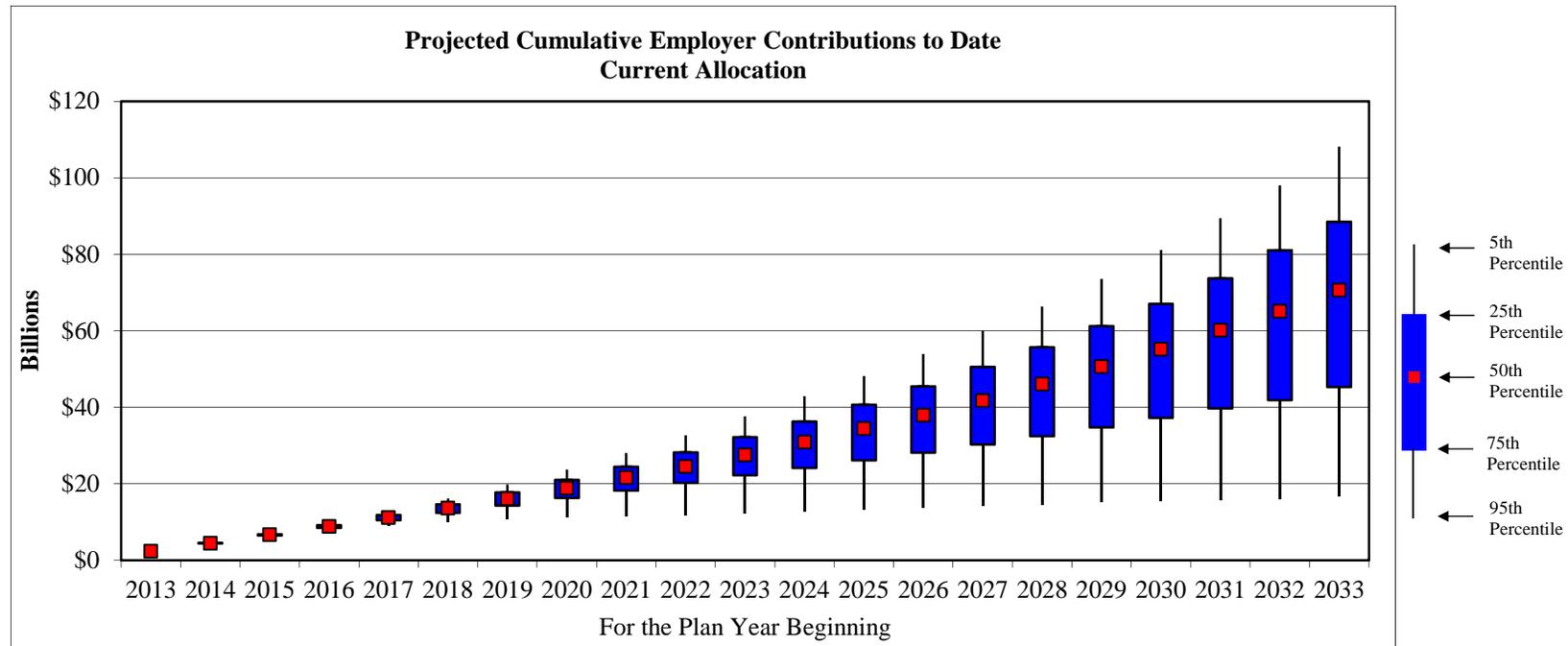
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5th Percentile	\$2.3	\$4.5	\$7.0	\$9.7	\$12.8	\$16.2	\$20.0	\$23.9	\$28.2	\$32.9	\$38.0	\$43.2	\$48.5	\$54.2	\$60.3	\$66.8	\$73.7	\$81.4	\$89.5	\$98.6	\$108.7
25th Percentile	\$2.3	\$4.5	\$6.8	\$9.2	\$11.8	\$14.6	\$17.7	\$21.0	\$24.5	\$28.1	\$32.1	\$36.2	\$40.6	\$45.3	\$50.4	\$55.4	\$60.7	\$66.6	\$73.3	\$80.2	\$87.5
50th Percentile	\$2.3	\$4.4	\$6.6	\$8.8	\$11.1	\$13.5	\$16.0	\$18.6	\$21.4	\$24.2	\$27.2	\$30.3	\$33.7	\$37.2	\$41.0	\$45.0	\$49.4	\$53.9	\$58.2	\$63.0	\$67.5
75th Percentile	\$2.3	\$4.4	\$6.4	\$8.4	\$10.3	\$12.2	\$14.1	\$15.9	\$17.7	\$19.5	\$21.3	\$22.9	\$24.6	\$26.3	\$28.3	\$30.1	\$31.9	\$34.2	\$36.0	\$38.6	\$40.4
95th Percentile	\$2.3	\$4.3	\$6.1	\$7.7	\$8.8	\$9.6	\$10.0	\$10.4	\$10.7	\$11.0	\$11.3	\$11.6	\$12.2	\$12.5	\$12.8	\$13.0	\$13.4	\$13.7	\$13.9	\$14.3	\$14.5

Percentiles indicate the probability of achieving total employer contributions higher or lower than the corresponding figure. For instance, the 50th percentile indicates that 50% of the time the Plan can expect total contributions lower than the figure shown, and 50% of the time a higher figure can be expected.

Stochastic Analysis (continued)

Cumulative Employer Contributions to Date; Current Allocation

The graph and table below show the range of projected cumulative employer contributions over the next twenty years, assuming the Plan's assets are allocated according to the Current Allocation (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.



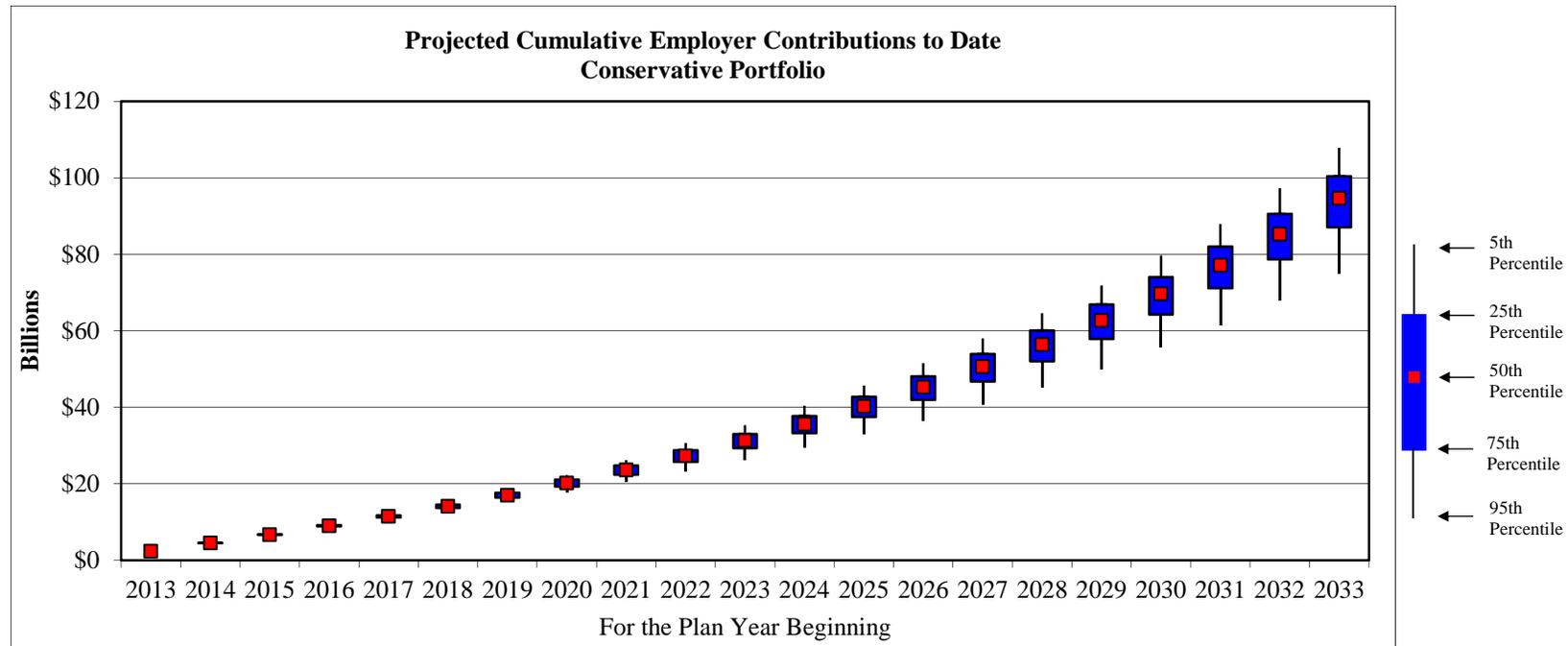
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5th Percentile	\$2.3	\$4.5	\$7.0	\$9.7	\$12.7	\$16.1	\$19.8	\$23.7	\$28.0	\$32.6	\$37.6	\$42.8	\$48.2	\$53.9	\$59.9	\$66.3	\$73.5	\$81.1	\$89.5	\$98.0	\$108.1
25th Percentile	\$2.3	\$4.5	\$6.8	\$9.2	\$11.8	\$14.6	\$17.7	\$21.0	\$24.4	\$28.2	\$32.1	\$36.3	\$40.7	\$45.5	\$50.5	\$55.6	\$61.2	\$67.0	\$73.7	\$81.1	\$88.5
50th Percentile	\$2.3	\$4.4	\$6.6	\$8.8	\$11.1	\$13.6	\$16.1	\$18.8	\$21.6	\$24.5	\$27.5	\$30.9	\$34.4	\$37.9	\$41.7	\$46.0	\$50.5	\$55.1	\$60.1	\$65.1	\$70.6
75th Percentile	\$2.3	\$4.4	\$6.4	\$8.5	\$10.4	\$12.4	\$14.3	\$16.2	\$18.2	\$20.2	\$22.2	\$24.1	\$26.1	\$28.1	\$30.3	\$32.4	\$34.7	\$37.2	\$39.7	\$41.9	\$45.3
95th Percentile	\$2.3	\$4.3	\$6.2	\$7.8	\$9.1	\$10.0	\$10.6	\$11.2	\$11.6	\$11.7	\$12.2	\$12.8	\$13.2	\$13.7	\$14.0	\$14.6	\$15.0	\$15.4	\$15.8	\$16.1	\$16.6

Percentiles indicate the probability of achieving total employer contributions higher or lower than the corresponding figure. For instance, the 50th percentile indicates that 50% of the time the Plan can expect total contributions lower than the figure shown, and 50% of the time a higher figure can be expected.

Stochastic Analysis (continued)

Cumulative Employer Contributions to Date; Conservative Portfolio

The graph and table below show the range of projected cumulative employer contributions over the next twenty years, assuming the Plan's assets are allocated according to the Conservative Portfolio (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.



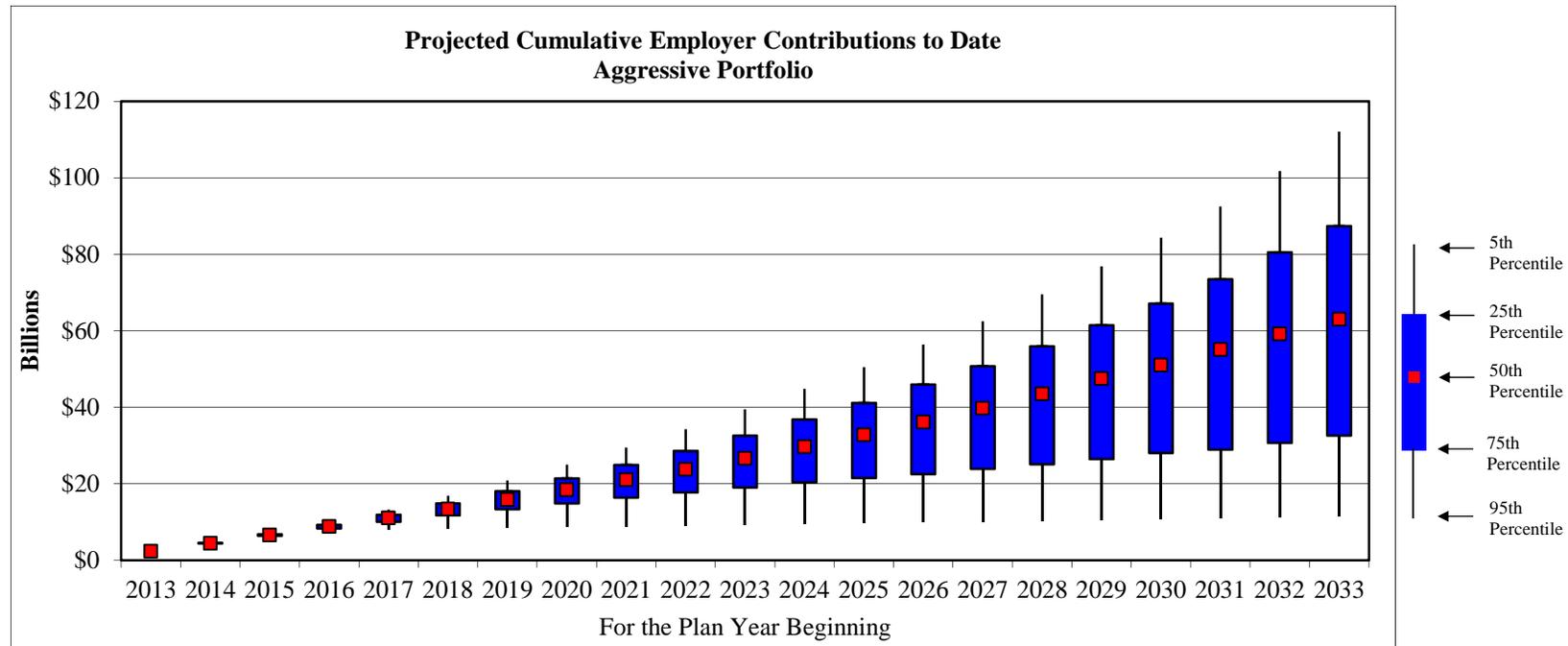
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5th Percentile	\$2.3	\$4.5	\$6.9	\$9.4	\$12.1	\$15.2	\$18.5	\$22.2	\$26.2	\$30.6	\$35.3	\$40.4	\$45.6	\$51.5	\$57.9	\$64.5	\$71.8	\$79.7	\$87.9	\$97.3	\$107.8
25th Percentile	\$2.3	\$4.5	\$6.7	\$9.1	\$11.7	\$14.5	\$17.6	\$21.0	\$24.7	\$28.7	\$33.0	\$37.7	\$42.7	\$48.1	\$53.9	\$60.1	\$66.8	\$74.0	\$82.0	\$90.6	\$100.4
50th Percentile	\$2.3	\$4.4	\$6.7	\$9.0	\$11.4	\$14.1	\$17.0	\$20.1	\$23.6	\$27.3	\$31.3	\$35.6	\$40.2	\$45.2	\$50.5	\$56.3	\$62.6	\$69.6	\$77.1	\$85.3	\$94.6
75th Percentile	\$2.3	\$4.4	\$6.6	\$8.8	\$11.1	\$13.6	\$16.3	\$19.2	\$22.3	\$25.7	\$29.3	\$33.2	\$37.4	\$41.9	\$46.7	\$52.0	\$57.8	\$64.2	\$71.0	\$78.6	\$87.1
95th Percentile	\$2.3	\$4.4	\$6.5	\$8.6	\$10.7	\$12.9	\$15.3	\$17.8	\$20.3	\$23.2	\$26.3	\$29.5	\$32.9	\$36.6	\$40.6	\$45.1	\$50.0	\$55.5	\$61.4	\$67.8	\$74.8

Percentiles indicate the probability of achieving total employer contributions higher or lower than the corresponding figure. For instance, the 50th percentile indicates that 50% of the time the Plan can expect total contributions lower than the figure shown, and 50% of the time a higher figure can be expected.

Stochastic Analysis (continued)

Cumulative Employer Contributions to Date; Aggressive Portfolio

The graph and table below show the range of projected cumulative employer contributions over the next twenty years, assuming the Plan's assets are allocated according to the Aggressive Portfolio (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5th Percentile	\$2.3	\$4.6	\$7.2	\$10.0	\$13.3	\$16.9	\$20.8	\$24.9	\$29.4	\$34.2	\$39.4	\$44.8	\$50.5	\$56.4	\$62.4	\$69.5	\$76.8	\$84.3	\$92.5	\$101.7	\$112.1
25th Percentile	\$2.3	\$4.5	\$6.8	\$9.2	\$11.9	\$14.8	\$18.0	\$21.3	\$24.9	\$28.5	\$32.6	\$36.8	\$41.1	\$45.9	\$50.7	\$55.9	\$61.4	\$67.1	\$73.5	\$80.5	\$87.4
50th Percentile	\$2.3	\$4.4	\$6.6	\$8.8	\$11.0	\$13.4	\$15.8	\$18.4	\$21.0	\$23.7	\$26.6	\$29.6	\$32.7	\$36.1	\$39.7	\$43.5	\$47.5	\$51.0	\$55.1	\$59.2	\$63.0
75th Percentile	\$2.3	\$4.4	\$6.4	\$8.3	\$10.1	\$11.7	\$13.3	\$14.8	\$16.3	\$17.7	\$19.0	\$20.3	\$21.5	\$22.5	\$23.9	\$25.1	\$26.4	\$28.0	\$28.9	\$30.7	\$32.5
95th Percentile	\$2.3	\$4.3	\$5.9	\$7.2	\$8.0	\$8.2	\$8.5	\$8.7	\$8.8	\$8.9	\$9.2	\$9.4	\$9.7	\$9.9	\$10.1	\$10.3	\$10.4	\$10.8	\$11.0	\$11.2	\$11.5

Percentiles indicate the probability of achieving total employer contributions higher or lower than the corresponding figure. For instance, the 50th percentile indicates that 50% of the time the Plan can expect total contributions lower than the figure shown, and 50% of the time a higher figure can be expected.

Stochastic Analysis (continued)

Drawing Inferences

The tables below compare the projected actuarial and market funded ratios five, ten, and twenty years from now, under the median (50th percentile), worst-case (5th percentile), and best-case (95th percentile) scenarios, assuming the four different asset mixes highlighted on the prior pages. The table also displays for comparative purposes the median, peak, and trough projected payout ratios and cumulative employer contributions assuming the same four asset mixes being examined.

5 Years	Actuarial Funded Ratio in Year 5			Market Funded Ratio in Year 5			Cumulative Employer Contributions in Year 5 (Billions)			Payout Ratios		
	50th	5th	95th	50th	5th	95th	50th	5th	95th	Year 5	2013-2018	
										Median	Peak	Trough
Strategic Target	63.5%	43.8%	93.7%	62.0%	36.1%	110.9%	\$13.5	\$16.2	\$9.6	11.7%	20.3%	6.5%
Current Allocation	63.0%	44.7%	90.8%	61.4%	36.7%	105.0%	\$13.6	\$16.1	\$10.0	11.8%	20.0%	6.8%
Conservative Portfolio	58.4%	50.3%	67.6%	53.1%	41.8%	67.5%	\$14.1	\$15.2	\$12.9	13.6%	17.7%	10.3%
Aggressive Portfolio	64.1%	40.4%	102.7%	63.3%	33.1%	124.4%	\$13.4	\$16.9	\$8.2	11.5%	22.1%	5.7%

10 Years	Actuarial Funded Ratio in Year 10			Market Funded Ratio in Year 10			Cumulative Employer Contributions in Year 10 (Billions)			Payout Ratios		
	50th	5th	95th	50th	5th	95th	50th	5th	95th	Year 10	2013-2023	
										Median	Peak	Trough
Strategic Target	63.9%	36.3%	123.3%	62.9%	32.2%	138.2%	\$27.2	\$38.0	\$11.3	12.0%	24.5%	5.3%
Current Allocation	63.2%	37.1%	115.7%	61.7%	32.7%	128.5%	\$27.5	\$37.6	\$12.2	12.2%	24.0%	5.8%
Conservative Portfolio	51.9%	40.3%	68.0%	47.5%	34.2%	65.6%	\$31.3	\$35.3	\$26.3	15.9%	22.8%	10.3%
Aggressive Portfolio	65.7%	33.4%	150.6%	66.0%	29.7%	172.0%	\$26.6	\$39.4	\$9.2	11.5%	26.9%	4.4%

20 Years	Actuarial Funded Ratio in Year 20			Market Funded Ratio in Year 20			Cumulative Employer Contributions in Year 20 (Billions)			Payout Ratios		
	50th	5th	95th	50th	5th	95th	50th	5th	95th	Year 20	2013-2033	
										Median	Peak	Trough
Strategic Target	82.9%	60.6%	185.1%	82.5%	51.2%	198.1%	\$67.5	\$108.7	\$14.5	10.2%	24.5%	4.2%
Current Allocation	81.2%	60.9%	165.0%	80.4%	51.7%	172.6%	\$70.6	\$108.1	\$16.6	10.5%	24.1%	4.7%
Conservative Portfolio	69.4%	60.8%	80.4%	64.0%	53.1%	79.2%	\$94.6	\$107.8	\$74.8	13.0%	23.7%	10.0%
Aggressive Portfolio	86.2%	58.8%	268.0%	87.2%	49.0%	283.3%	\$63.0	\$112.1	\$11.5	9.6%	26.9%	2.9%

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility”

This section provides a sensitivity analysis of the original stochastic projections by assuming the risk (as measured by standard deviation) of each asset class is doubled. These modified assumptions are outlined in the table below, compared to the original values:

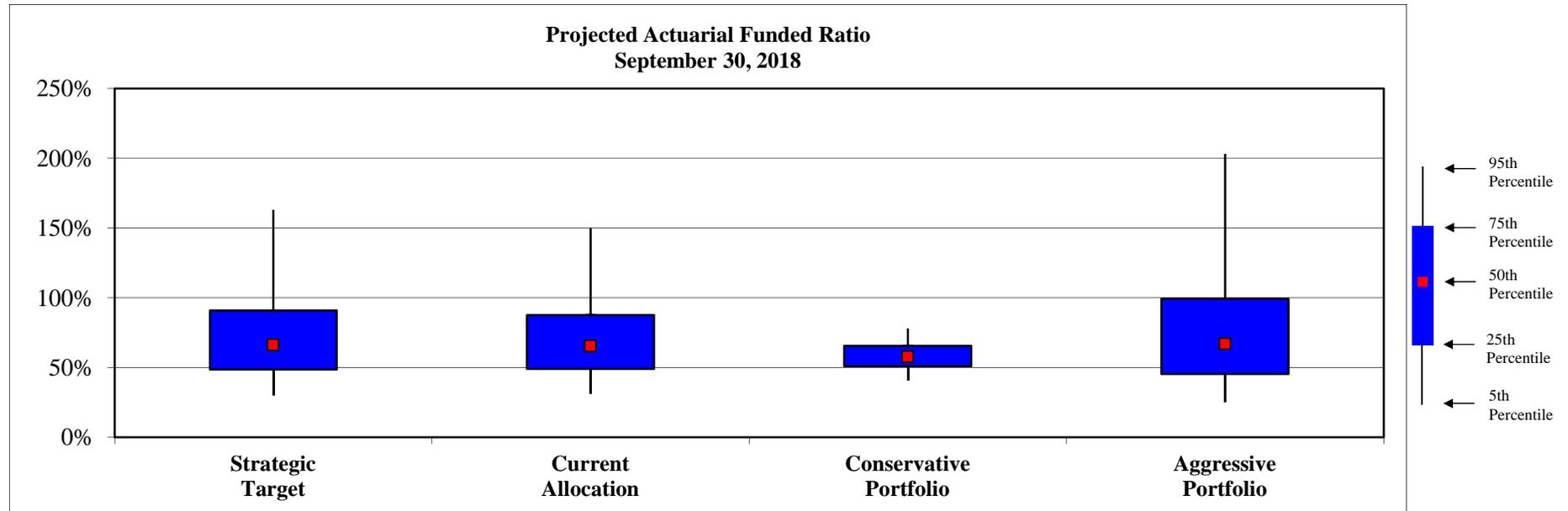
Asset Class	Arithmetic Return Assumption	Standard Deviation Assumption	Standard Deviation Assumption Doubled
Broad US Equity	7.30	17.80	35.60
Broad International Equity	8.55	20.55	41.10
Int. Duration Fixed Income	4.00	6.00	12.00
Diversified Inflation Strategies	6.00	11.50	23.00
Real Estate	7.75	14.64	29.28
Absolute Return Strategies	6.75	9.75	19.50
Private Equity	11.00	29.00	58.00
Cash Equivalents	2.25	3.00	6.00

RVK supports the recommendations based on the original assumptions shown in the Stochastic Analysis section of this report. However, this stress-testing illustrates that potential increased capital market volatility does not change the asset allocation recommendations, based on the current status of the Plan. Instead it simply widens the range of potential results, exacerbating the potential best and worst-case scenarios.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Projected Actuarial Funded Ratio (actuarial value of assets/actuarial accrued liability); 5 Years

The graph below shows the distribution of possible actuarial funded ratios five years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



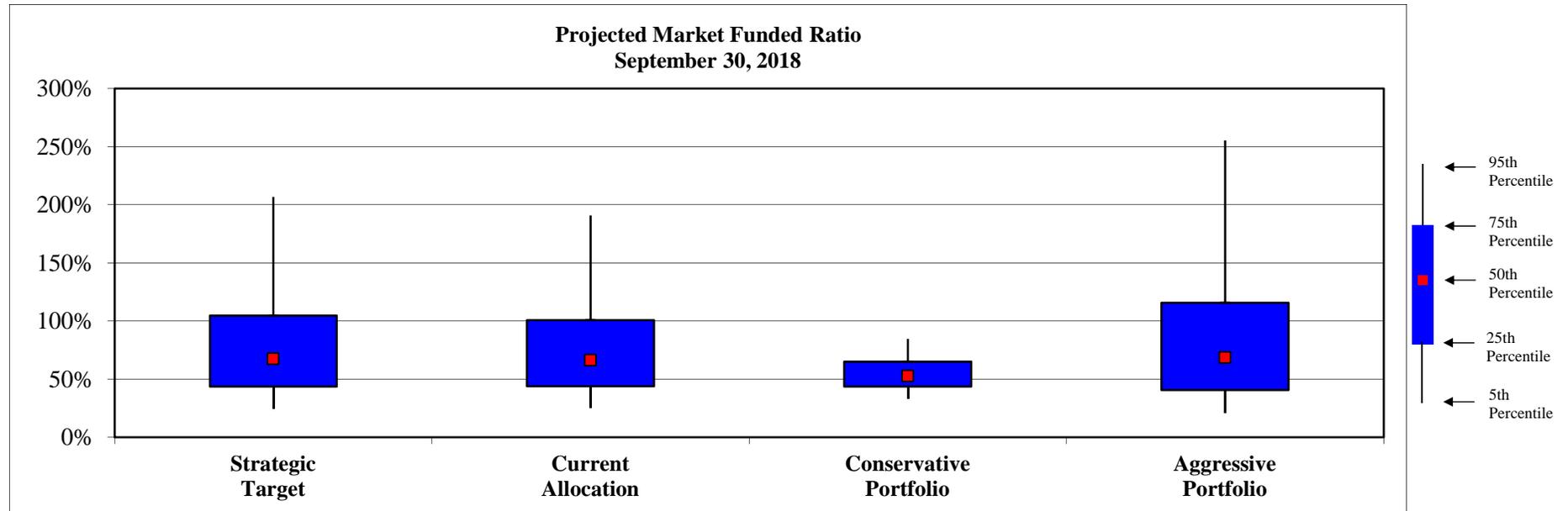
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$47.1	30.1%	\$46.3	31.5%	\$39.7	41.0%	\$50.6	25.4%
25th Percentile	\$35.1	48.6%	\$34.9	49.1%	\$33.9	50.9%	\$37.6	45.4%
50th Percentile	\$23.6	66.1%	\$23.9	65.4%	\$29.2	57.8%	\$22.8	67.0%
75th Percentile	\$6.4	90.8%	\$8.4	87.5%	\$24.2	65.5%	\$0.5	99.2%
95th Percentile	(\$45.7)	163.0%	(\$35.4)	149.9%	\$15.7	77.9%	(\$74.9)	203.1%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Projected Market Funded Ratio (market value of assets/actuarial accrued liability); 5 Years

The graph below shows the distribution of possible market funded ratios five years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



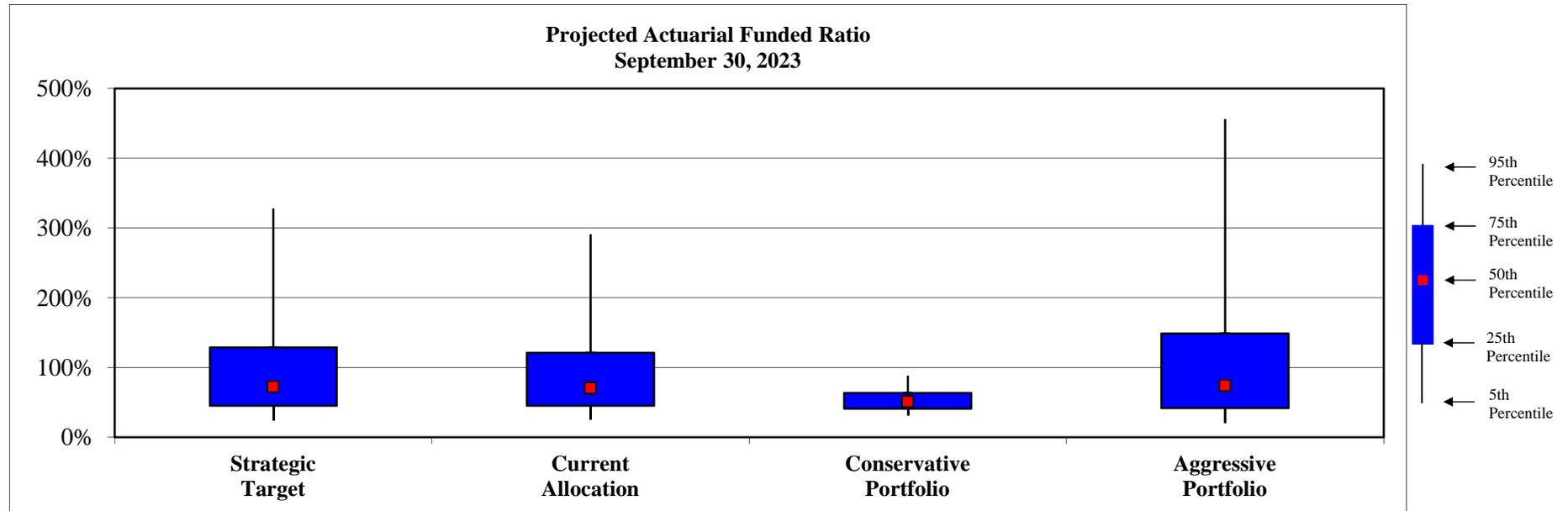
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$51.1	24.4%	\$50.2	25.3%	\$44.6	33.3%	\$54.3	20.6%
25th Percentile	\$38.7	43.6%	\$38.5	43.9%	\$38.5	43.7%	\$40.7	40.6%
50th Percentile	\$22.4	67.5%	\$23.3	66.4%	\$32.4	52.7%	\$21.6	68.7%
75th Percentile	(\$3.3)	104.7%	(\$0.5)	100.7%	\$24.7	64.9%	(\$11.0)	115.6%
95th Percentile	(\$76.9)	206.7%	(\$65.3)	191.0%	\$11.0	84.6%	(\$109.4)	255.2%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Projected Actuarial Funded Ratio (actuarial value of assets/actuarial accrued liability); 10 Years

The graph below shows the distribution of possible actuarial funded ratios ten years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



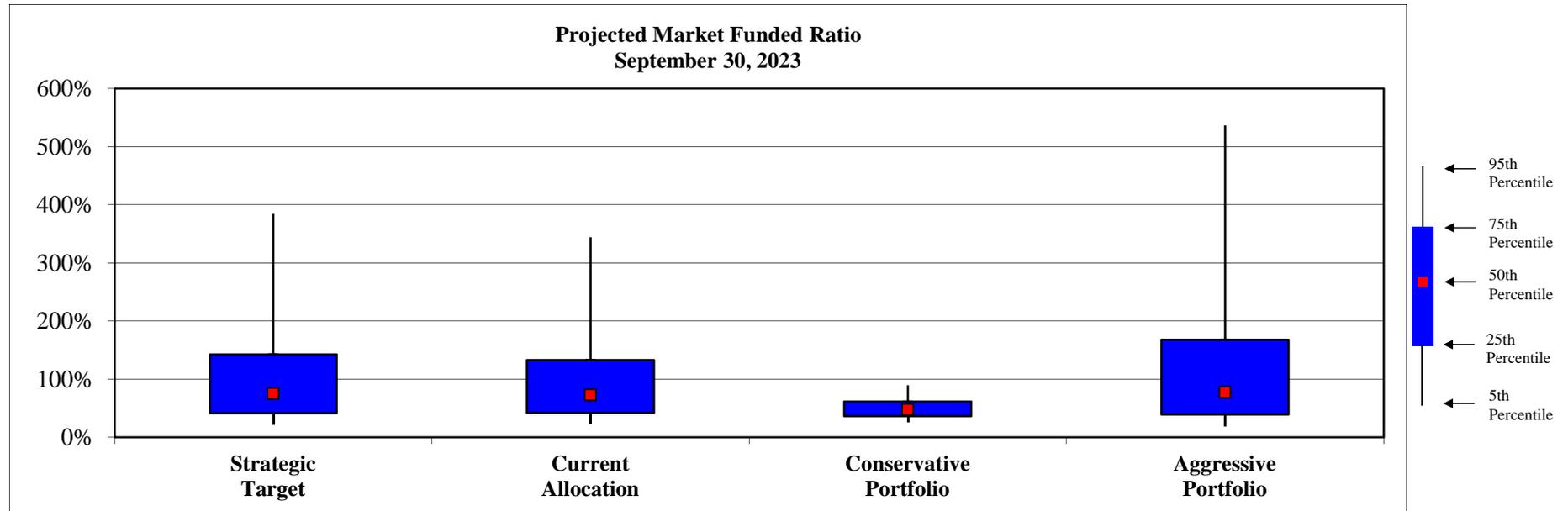
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$53.6	24.6%	\$52.9	25.5%	\$49.7	30.8%	\$57.2	21.2%
25th Percentile	\$40.0	45.1%	\$40.0	45.2%	\$42.8	40.9%	\$42.9	41.8%
50th Percentile	\$20.3	72.4%	\$21.4	70.8%	\$36.6	51.2%	\$19.6	74.0%
75th Percentile	(\$22.6)	128.6%	(\$16.2)	121.2%	\$27.6	63.6%	(\$37.1)	148.7%
95th Percentile	(\$181.9)	328.1%	(\$150.5)	290.7%	\$9.3	88.3%	(\$281.3)	456.2%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Projected Market Funded Ratio (market value of assets/actuarial accrued liability); 10 Years

The graph below shows the distribution of possible market funded ratios ten years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



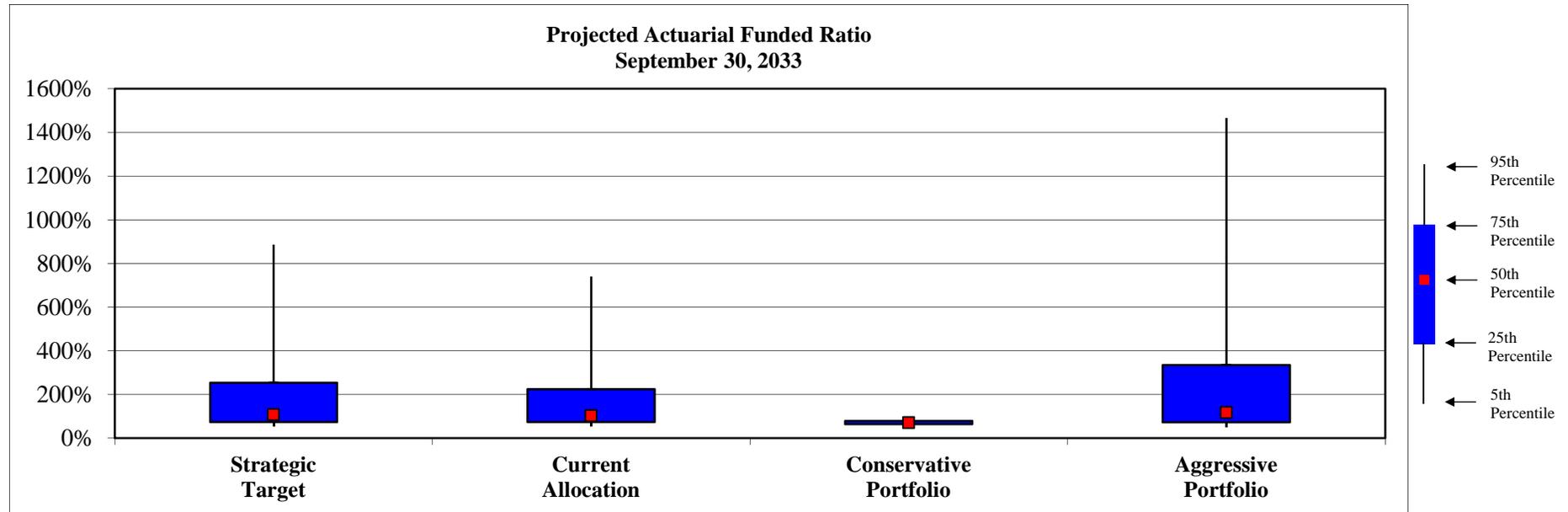
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$56.1	21.7%	\$55.5	22.5%	\$53.1	25.7%	\$59.2	18.5%
25th Percentile	\$42.1	41.4%	\$42.1	41.8%	\$46.0	36.4%	\$44.2	39.0%
50th Percentile	\$18.7	75.0%	\$20.4	72.7%	\$39.1	47.5%	\$17.2	77.6%
75th Percentile	(\$33.1)	142.5%	(\$24.2)	132.9%	\$29.5	61.4%	(\$52.8)	167.6%
95th Percentile	(\$228.0)	384.6%	(\$191.1)	344.1%	\$8.9	89.5%	(\$341.5)	536.1%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Projected Actuarial Funded Ratio (actuarial value of assets/actuarial accrued liability); 20 Years

The graph below shows the distribution of possible actuarial funded ratios twenty years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



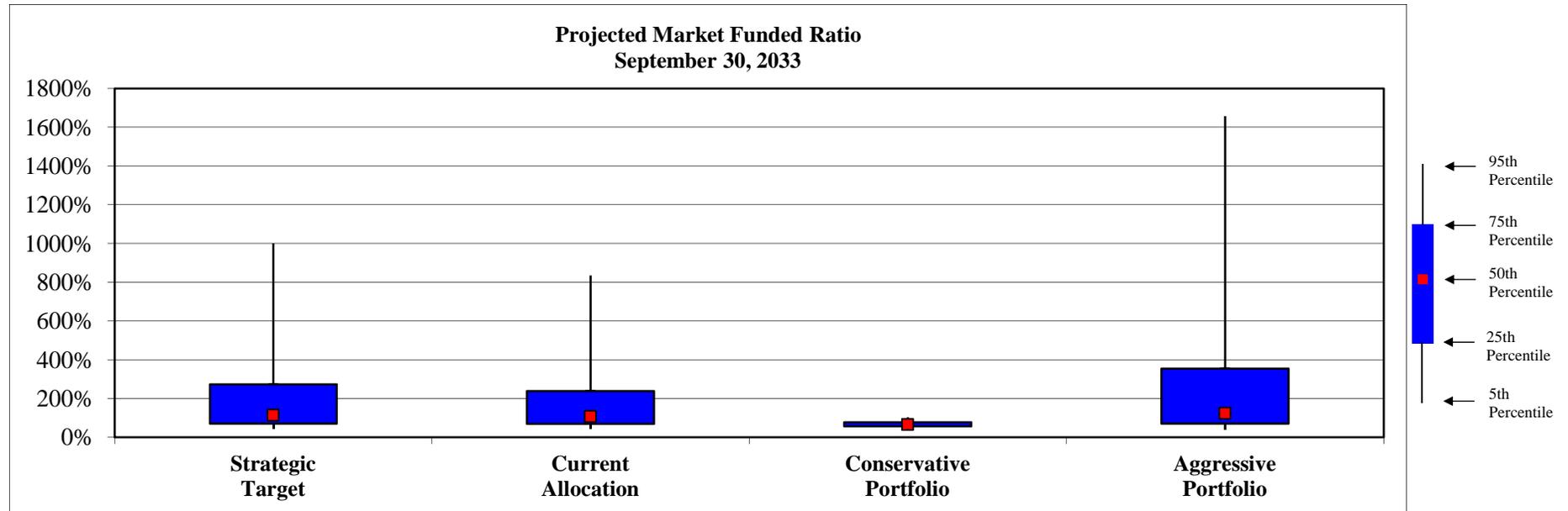
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$36.6	52.5%	\$36.3	53.1%	\$35.0	54.8%	\$40.6	49.1%
25th Percentile	\$20.5	73.2%	\$21.3	72.8%	\$28.7	63.0%	\$21.2	72.4%
50th Percentile	(\$5.3)	106.5%	(\$1.5)	101.9%	\$24.1	69.9%	(\$13.9)	117.2%
75th Percentile	(\$125.7)	254.1%	(\$102.2)	224.1%	\$18.0	78.3%	(\$193.5)	335.2%
95th Percentile	(\$756.6)	885.1%	(\$595.5)	740.0%	\$3.0	96.8%	(\$1,208.0)	1465.9%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Projected Market Funded Ratio (market value of assets/actuarial accrued liability); 20 Years

The graph below shows the distribution of possible market funded ratios twenty years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$43.6	43.1%	\$42.7	43.7%	\$42.8	46.2%	\$47.2	39.3%
25th Percentile	\$23.1	70.5%	\$23.9	69.1%	\$33.8	55.9%	\$23.0	70.4%
50th Percentile	(\$11.2)	113.7%	(\$6.0)	107.3%	\$27.8	65.0%	(\$19.0)	123.5%
75th Percentile	(\$143.7)	273.2%	(\$116.4)	239.0%	\$19.5	76.9%	(\$213.6)	355.1%
95th Percentile	(\$836.4)	1000.7%	(\$675.1)	834.1%	(\$2.4)	102.8%	(\$1,327.6)	1657.1%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Projected Market Funded Ratio and Maximum 1 Year Investment Loss (market value of assets/actuarial accrued liability)

The tables below show the probability that the Plan will be at various funding levels for each of the four different asset mixes highlighted on the prior pages. The tables also illustrate the maximum 1 year investment loss each portfolio is expected to experience during the given time period. The results assume the current contribution policy remains unchanged for all projection years.

5 Years	Probability of Full Funding in 2018	Probability of less than 63% (Current) Funding in 2018	Probability of less than 50% Funding in 2018	Maximum 1 Year Portfolio Investment Loss
Strategic Target	27%	46%	33%	-57%
Current Allocation	25%	46%	33%	-54%
Conservative Portfolio	2%	72%	43%	-37%
Aggressive Portfolio	31%	46%	36%	-66%

10 Years	Probability of Full Funding in 2023	Probability of less than 63% (Current) Funding in 2023	Probability of less than 50% Funding in 2023	Maximum 1 Year Portfolio Investment Loss
Strategic Target	38%	43%	32%	-60%
Current Allocation	36%	44%	32%	-57%
Conservative Portfolio	3%	77%	55%	-37%
Aggressive Portfolio	40%	43%	34%	-72%

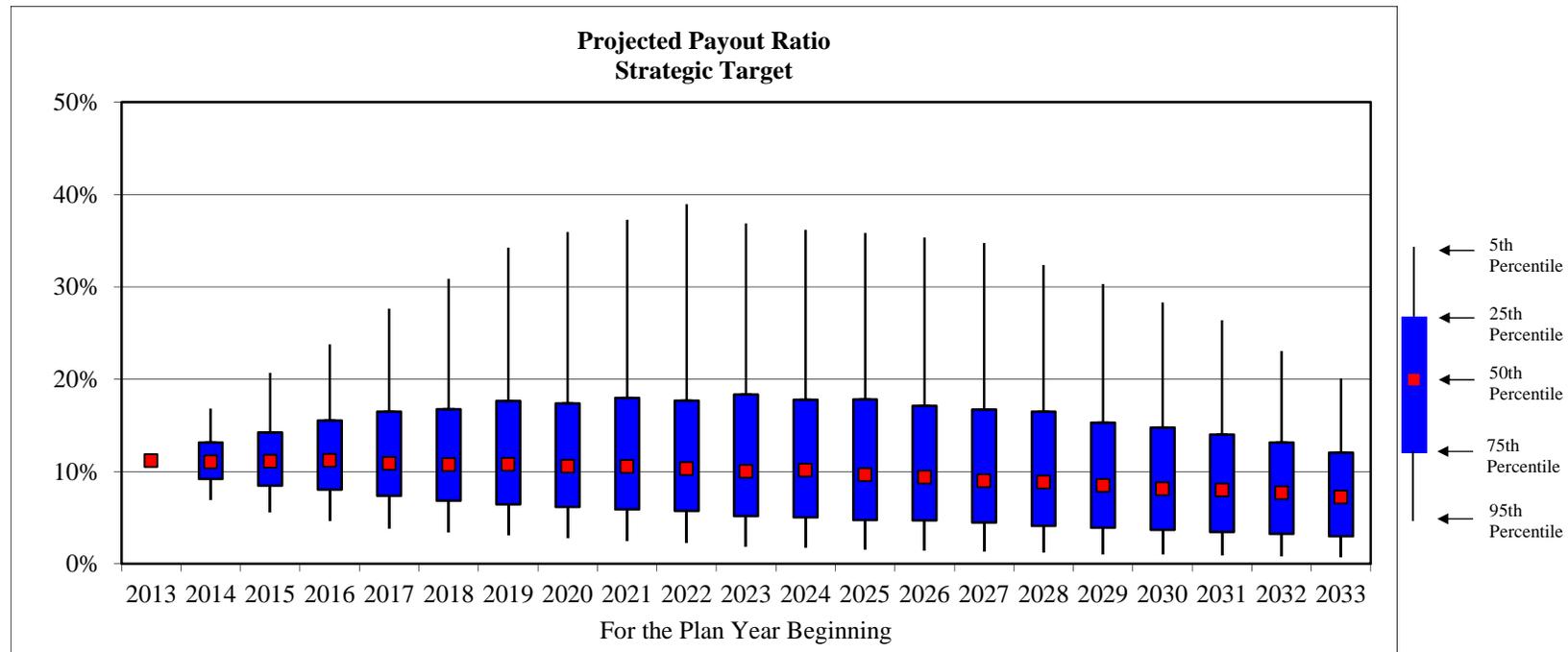
20 Years	Probability of Full Funding in 2033	Probability of less than 63% (Current) Funding in 2033	Probability of less than 50% Funding in 2033	Maximum 1 Year Portfolio Investment Loss
Strategic Target	56%	19%	9%	-60%
Current Allocation	54%	20%	9%	-57%
Conservative Portfolio	6%	44%	11%	-37%
Aggressive Portfolio	59%	20%	11%	-72%

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Projected Payout Ratio (expected benefit payments/market value of assets); Strategic Target

The graph below displays the range of possible payout ratios over the next twenty years, assuming the Plan’s assets are allocated according to the Strategic Target (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.

The annual median benefit payment as percentage of market value of assets is expected to range between 7.2% and 11.2%. The worst-case scenario could reach 39% or higher.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Median	11.2%	11.1%	11.1%	11.2%	10.9%	10.7%	10.8%	10.6%	10.5%	10.3%	10.0%	10.1%	9.7%	9.4%	9.0%	8.9%	8.5%	8.1%	8.0%	7.7%	7.2%

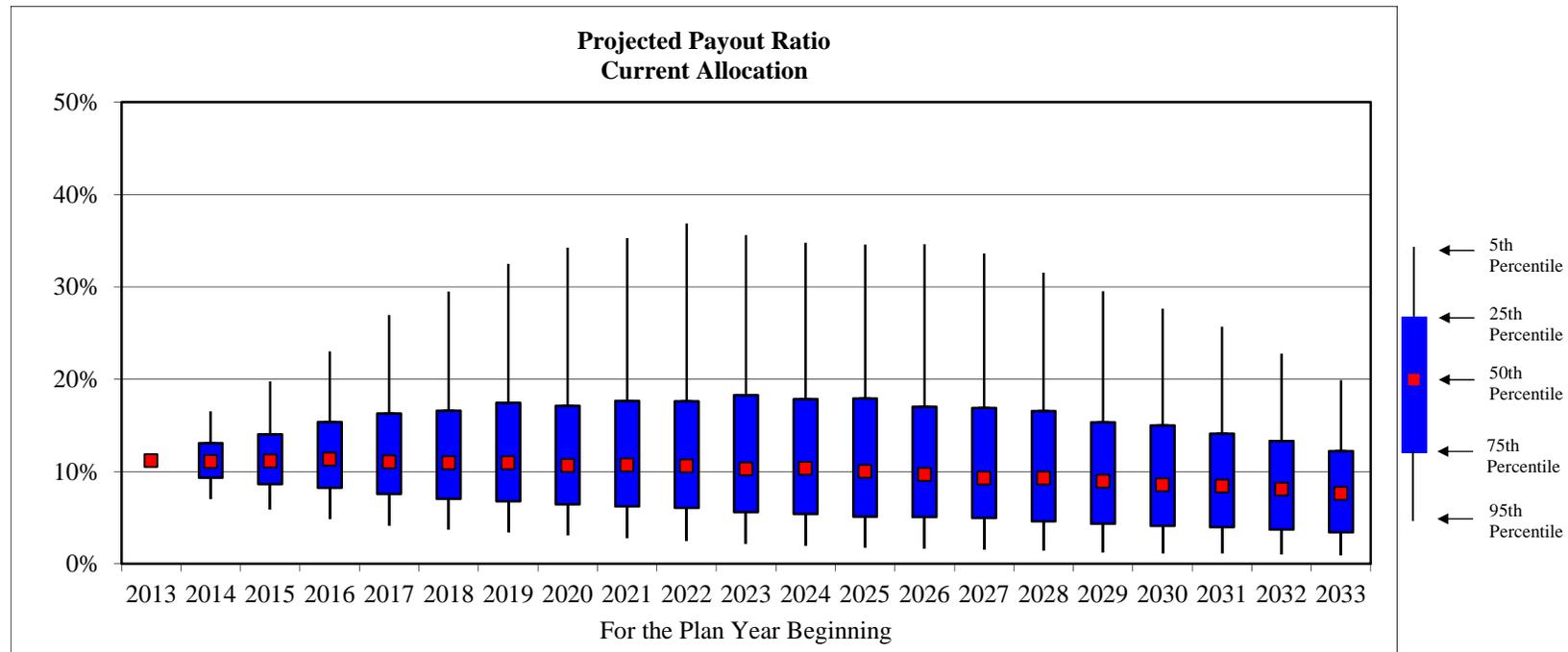
Percentiles indicate the probability of achieving a Payout Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Payout Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Projected Payout Ratio (expected benefit payments/market value of assets); Current Allocation

The graph below displays the range of possible payout ratios over the next twenty years, assuming the Plan’s assets are allocated according to the Current Allocation (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.

The annual median benefit payment as percentage of market value of assets is expected to range between 7.6% and 11.3%. The worst-case scenario could reach 37% or higher.



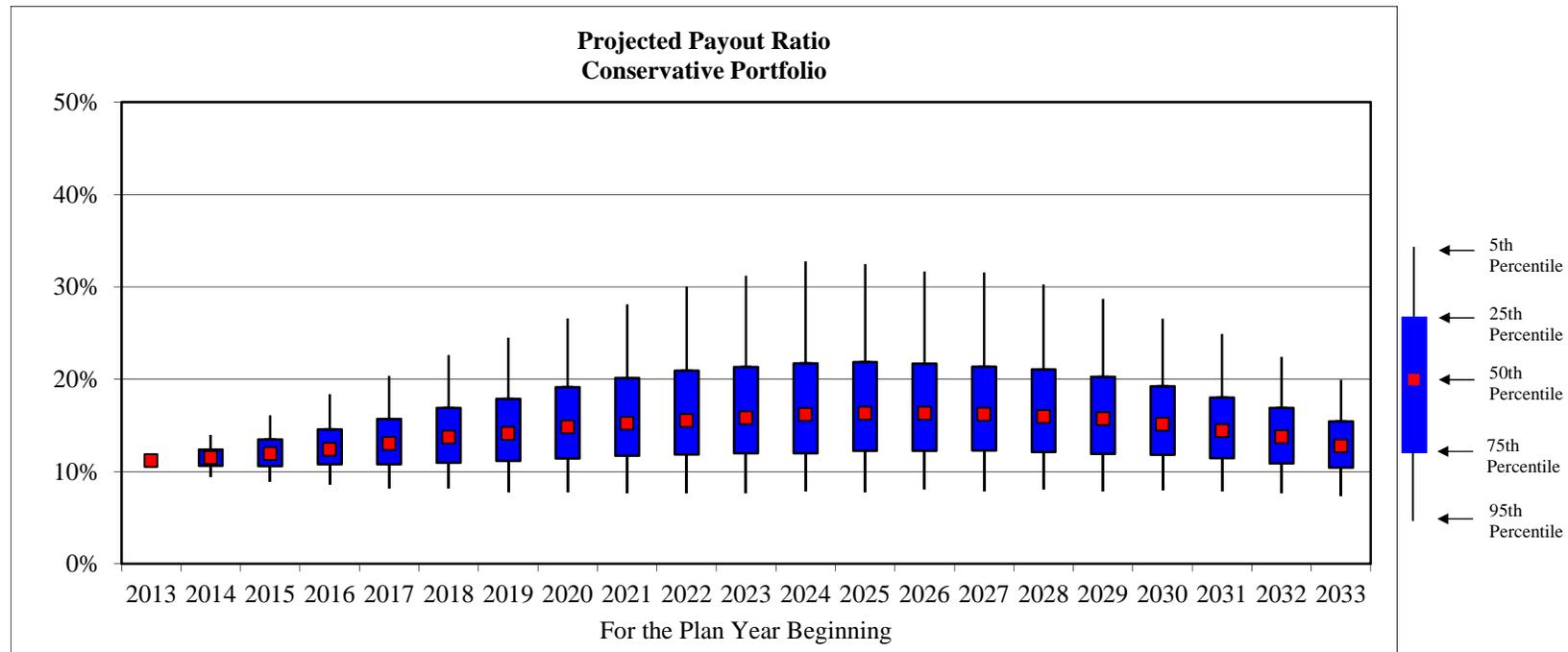
Percentiles indicate the probability of achieving a Payout Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Payout Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Projected Payout Ratio (expected benefit payments/market value of assets); Conservative Portfolio

The graph below displays the range of possible payout ratios over the next twenty years, assuming the Plan’s assets are allocated according to the Conservative Portfolio (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.

The annual median benefit payment as percentage of market value of assets is expected to range between 11.2% and 16.3%. The worst-case scenario could reach 33% or higher.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Median	11.2%	11.5%	12.0%	12.4%	13.0%	13.7%	14.1%	14.8%	15.2%	15.5%	15.8%	16.2%	16.3%	16.3%	16.2%	15.9%	15.7%	15.1%	14.4%	13.8%	12.8%

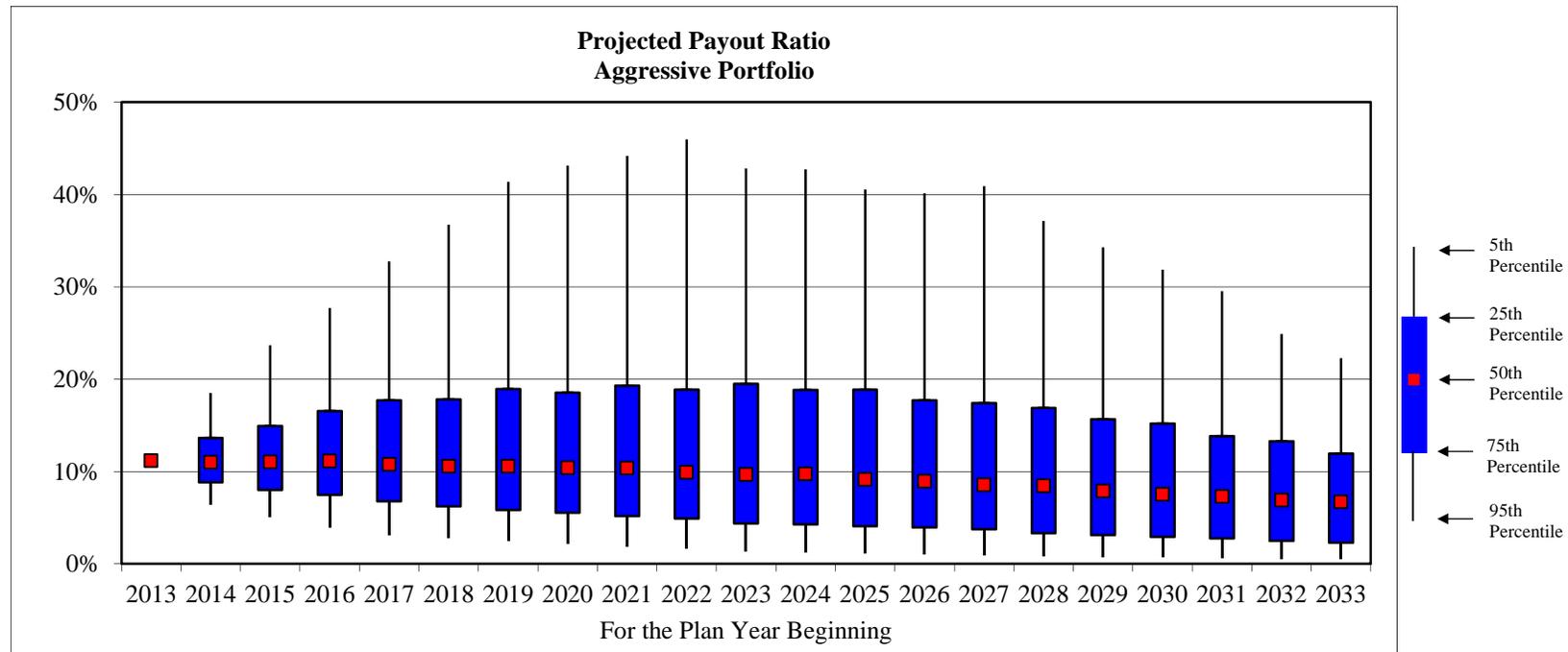
Percentiles indicate the probability of achieving a Payout Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Payout Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Projected Payout Ratio (expected benefit payments/market value of assets); Aggressive Portfolio

The graph below displays the range of possible payout ratios over the next twenty years, assuming the Plan’s assets are allocated according to the Aggressive Portfolio (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.

The annual median benefit payment as percentage of market value of assets is expected to range between 6.7% and 11.2%. The worst-case scenario could reach 46% or higher.



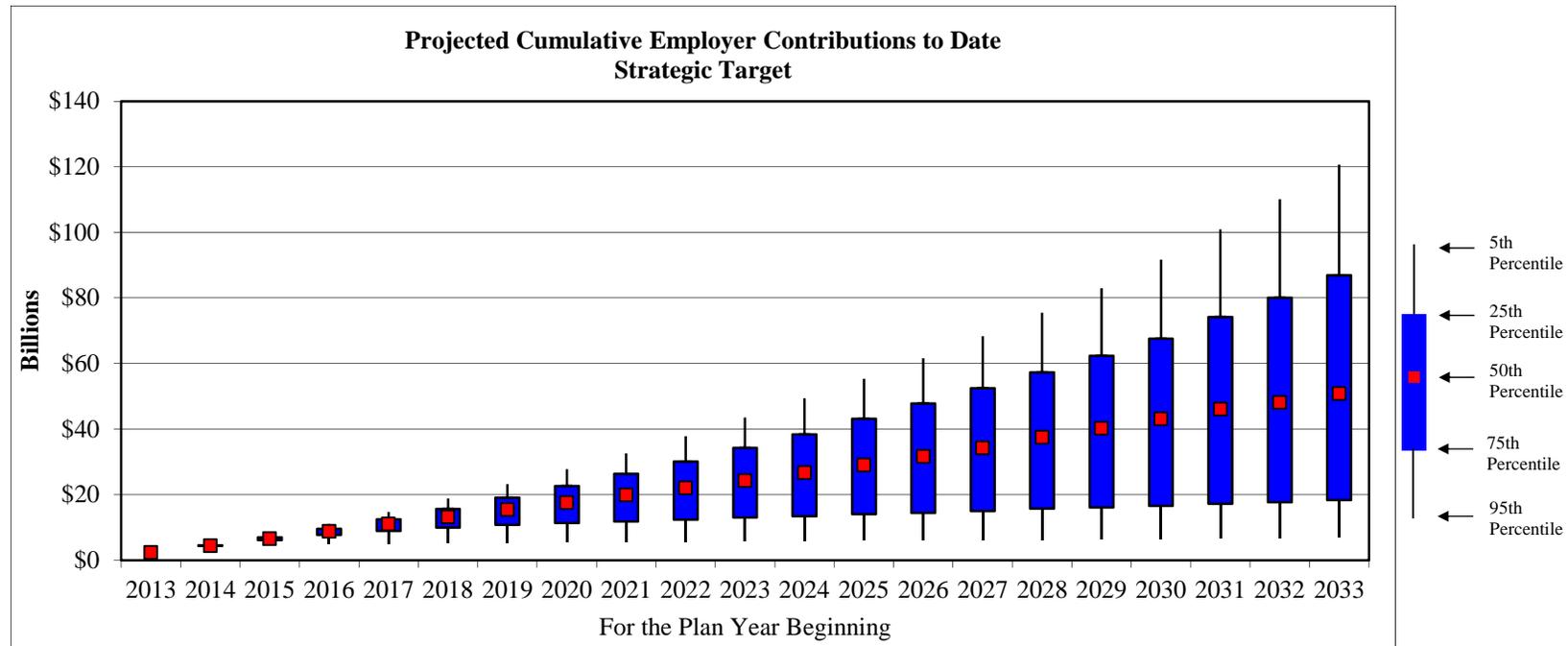
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Median	11.2%	11.0%	11.1%	11.1%	10.8%	10.6%	10.6%	10.4%	10.4%	9.9%	9.7%	9.7%	9.2%	9.0%	8.6%	8.5%	7.9%	7.6%	7.3%	6.9%	6.7%

Percentiles indicate the probability of achieving a Payout Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Payout Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Cumulative Employer Contributions to Date; Strategic Target

The graph and table below show the range of projected cumulative employer contributions over the next twenty years, assuming the Plan’s assets are allocated according to the Strategic Target (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.



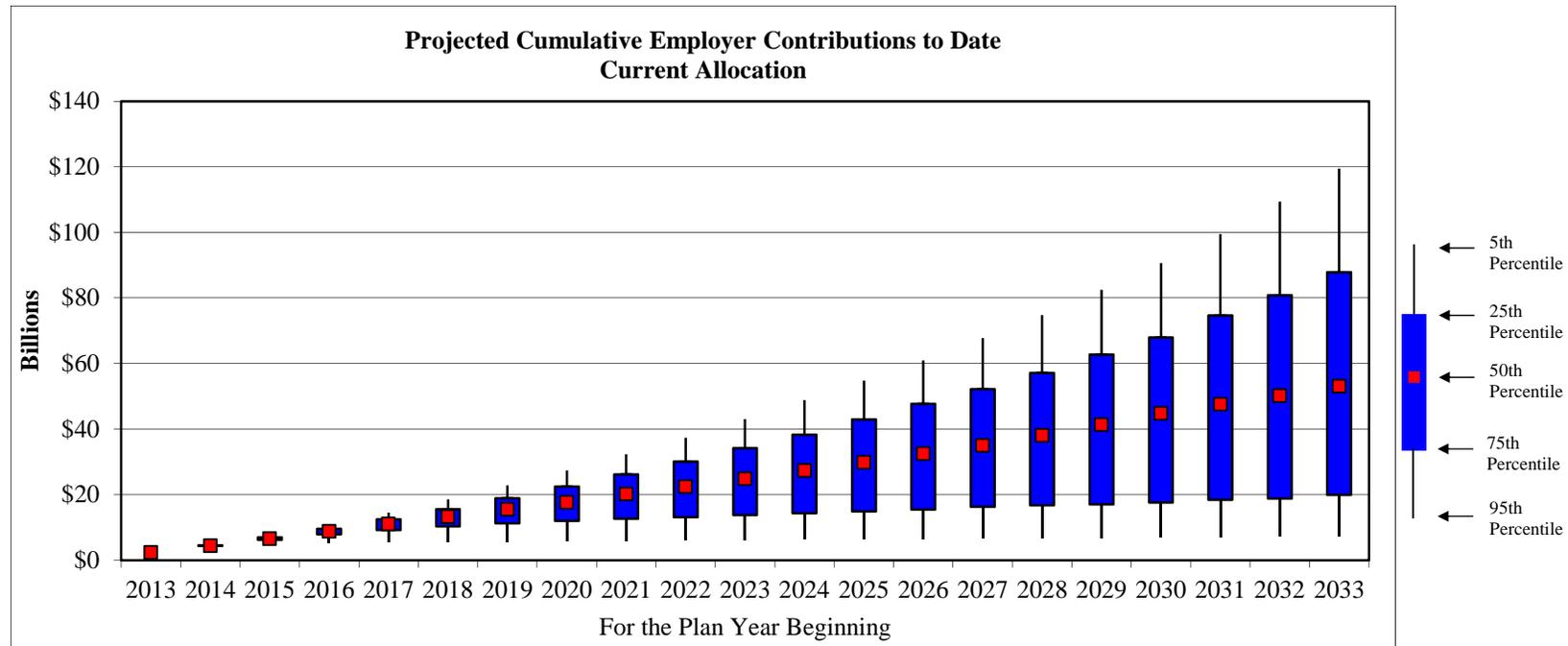
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5th Percentile	\$2.3	\$4.8	\$7.8	\$11.0	\$14.7	\$18.8	\$23.1	\$27.7	\$32.6	\$37.8	\$43.5	\$49.3	\$55.3	\$61.6	\$68.3	\$75.5	\$82.9	\$91.7	\$100.9	\$110.2	\$120.6
25th Percentile	\$2.3	\$4.5	\$6.9	\$9.6	\$12.5	\$15.6	\$19.1	\$22.6	\$26.3	\$30.1	\$34.2	\$38.3	\$43.1	\$47.7	\$52.4	\$57.3	\$62.4	\$67.6	\$74.1	\$80.1	\$86.9
50th Percentile	\$2.3	\$4.4	\$6.6	\$8.7	\$11.0	\$13.2	\$15.4	\$17.5	\$19.9	\$22.0	\$24.3	\$26.7	\$29.0	\$31.6	\$34.2	\$37.5	\$40.2	\$43.1	\$46.1	\$48.1	\$50.8
75th Percentile	\$2.3	\$4.3	\$6.1	\$7.7	\$8.9	\$9.9	\$10.7	\$11.3	\$11.8	\$12.4	\$13.0	\$13.4	\$14.1	\$14.4	\$15.0	\$15.7	\$16.1	\$16.5	\$17.2	\$17.7	\$18.4
95th Percentile	\$2.3	\$3.8	\$4.5	\$4.8	\$5.0	\$5.2	\$5.3	\$5.5	\$5.6	\$5.7	\$5.8	\$5.9	\$6.0	\$6.0	\$6.1	\$6.2	\$6.3	\$6.4	\$6.6	\$6.8	\$7.0

Percentiles indicate the probability of achieving total employer contributions higher or lower than the corresponding figure. For instance, the 50th percentile indicates that 50% of the time the Plan can expect total contributions lower than the figure shown, and 50% of the time a higher figure can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Cumulative Employer Contributions to Date; Current Allocation

The graph and table below show the range of projected cumulative employer contributions over the next twenty years, assuming the Plan’s assets are allocated according to the Current Allocation (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.



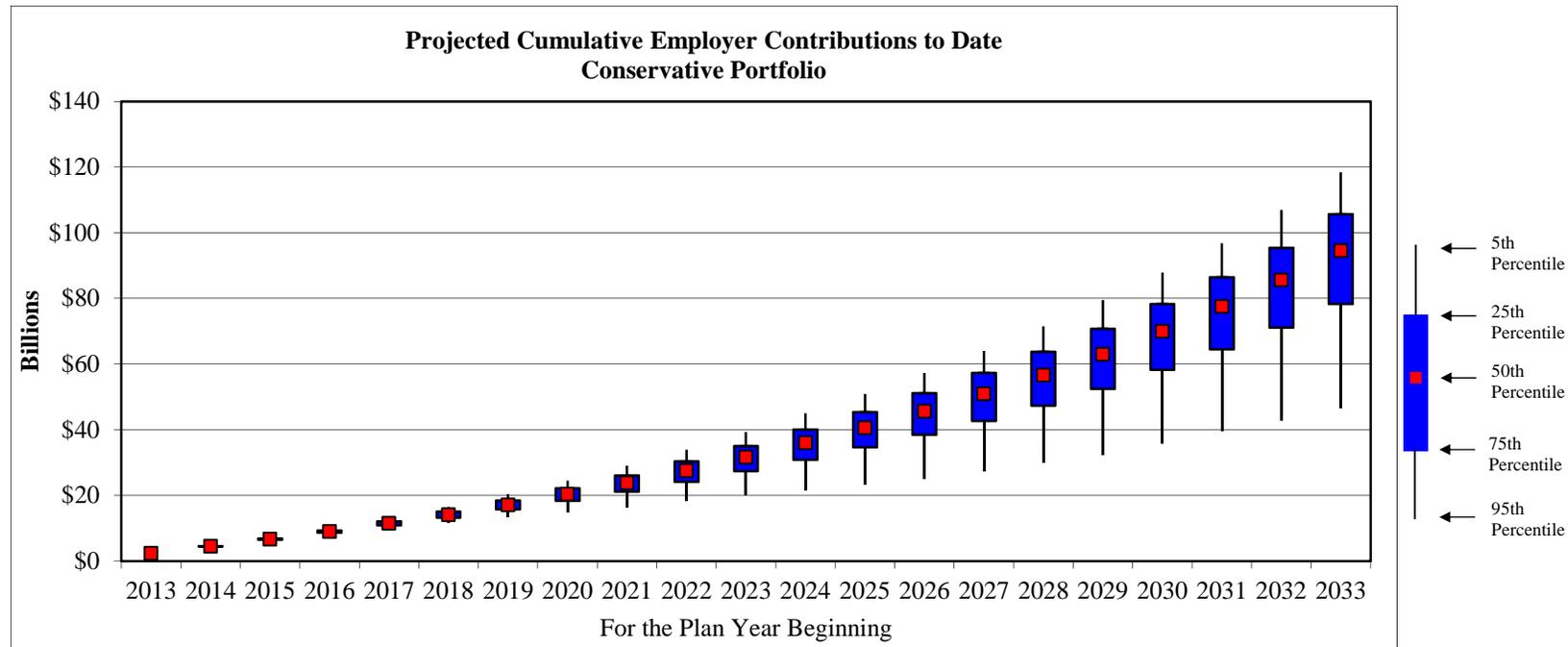
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5th Percentile	\$2.3	\$4.8	\$7.6	\$10.9	\$14.5	\$18.5	\$22.8	\$27.4	\$32.3	\$37.3	\$43.0	\$48.8	\$54.8	\$60.9	\$67.7	\$74.7	\$82.4	\$90.7	\$99.5	\$109.4	\$119.4
25th Percentile	\$2.3	\$4.5	\$6.9	\$9.5	\$12.4	\$15.5	\$18.9	\$22.5	\$26.2	\$30.1	\$34.2	\$38.3	\$42.9	\$47.7	\$52.1	\$57.1	\$62.7	\$67.9	\$74.6	\$80.8	\$87.9
50th Percentile	\$2.3	\$4.4	\$6.6	\$8.8	\$11.0	\$13.3	\$15.5	\$17.6	\$20.1	\$22.4	\$24.8	\$27.3	\$29.8	\$32.5	\$35.0	\$38.1	\$41.3	\$44.7	\$47.6	\$50.2	\$53.1
75th Percentile	\$2.3	\$4.3	\$6.2	\$7.8	\$9.2	\$10.3	\$11.2	\$12.0	\$12.6	\$13.1	\$13.7	\$14.3	\$14.9	\$15.5	\$16.3	\$16.7	\$17.0	\$17.6	\$18.4	\$18.8	\$19.9
95th Percentile	\$2.3	\$3.9	\$4.7	\$5.3	\$5.5	\$5.5	\$5.7	\$5.8	\$5.9	\$6.0	\$6.1	\$6.3	\$6.4	\$6.4	\$6.5	\$6.6	\$6.7	\$6.9	\$7.0	\$7.2	\$7.3

Percentiles indicate the probability of achieving total employer contributions higher or lower than the corresponding figure. For instance, the 50th percentile indicates that 50% of the time the Plan can expect total contributions lower than the figure shown, and 50% of the time a higher figure can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Cumulative Employer Contributions to Date; Conservative Portfolio

The graph and table below show the range of projected cumulative employer contributions over the next twenty years, assuming the Plan’s assets are allocated according to the Conservative Portfolio (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.



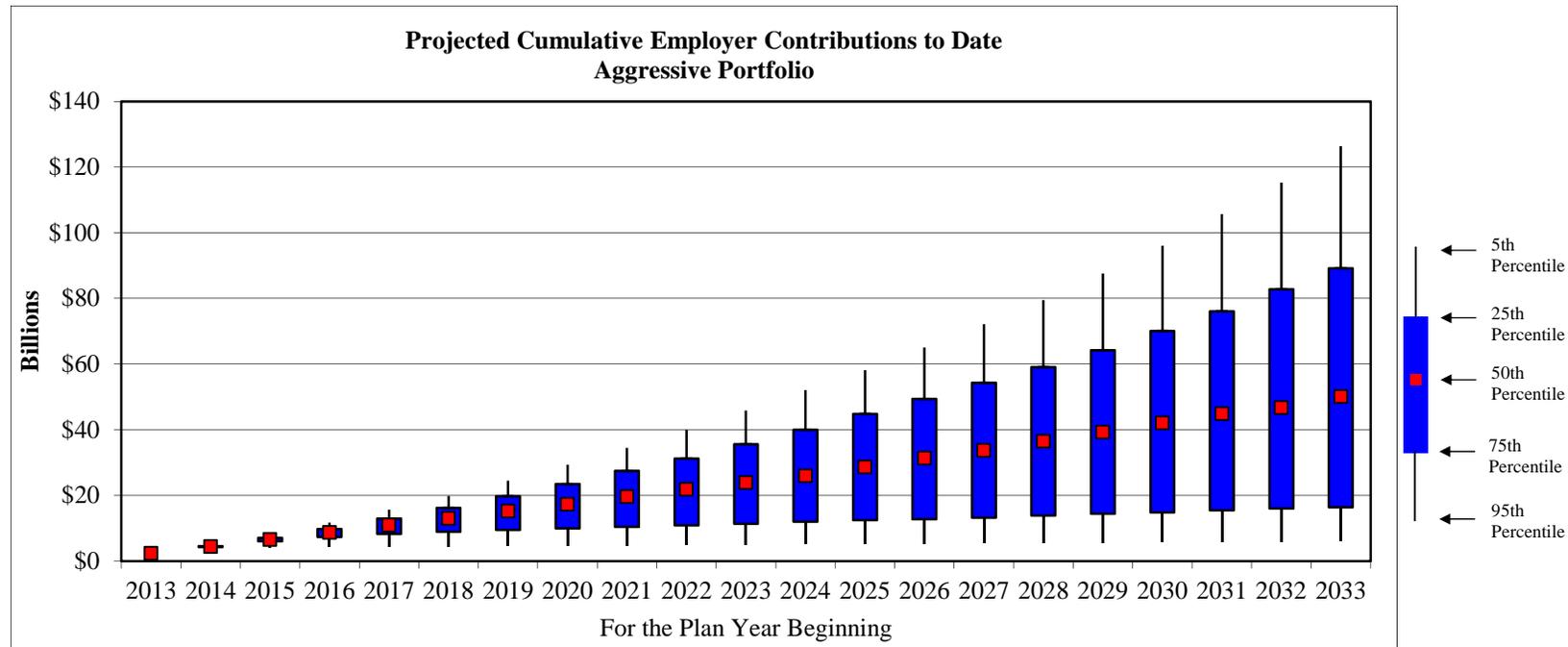
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5th Percentile	\$2.3	\$4.6	\$7.1	\$9.9	\$13.0	\$16.5	\$20.3	\$24.5	\$29.1	\$33.9	\$39.3	\$44.9	\$50.8	\$57.2	\$64.0	\$71.4	\$79.5	\$87.8	\$96.8	\$106.9	\$118.4
25th Percentile	\$2.3	\$4.5	\$6.8	\$9.3	\$12.0	\$15.1	\$18.4	\$22.1	\$26.1	\$30.3	\$35.0	\$40.0	\$45.4	\$51.1	\$57.3	\$63.7	\$70.7	\$78.3	\$86.5	\$95.4	\$105.7
50th Percentile	\$2.3	\$4.4	\$6.7	\$9.0	\$11.4	\$14.1	\$17.1	\$20.3	\$23.8	\$27.5	\$31.6	\$36.0	\$40.6	\$45.6	\$50.9	\$56.6	\$63.0	\$69.9	\$77.5	\$85.6	\$94.6
75th Percentile	\$2.3	\$4.4	\$6.5	\$8.7	\$10.9	\$13.2	\$15.7	\$18.3	\$21.1	\$24.1	\$27.4	\$30.8	\$34.6	\$38.5	\$42.7	\$47.3	\$52.4	\$58.2	\$64.4	\$71.1	\$78.2
95th Percentile	\$2.3	\$4.3	\$6.3	\$8.1	\$9.9	\$11.6	\$13.3	\$14.8	\$16.4	\$18.3	\$20.0	\$21.5	\$23.2	\$24.9	\$27.3	\$29.9	\$32.4	\$35.9	\$39.4	\$42.7	\$46.6

Percentiles indicate the probability of achieving total employer contributions higher or lower than the corresponding figure. For instance, the 50th percentile indicates that 50% of the time the Plan can expect total contributions lower than the figure shown, and 50% of the time a higher figure can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Cumulative Employer Contributions to Date; Aggressive Portfolio

The graph and table below show the range of projected cumulative employer contributions over the next twenty years, assuming the Plan’s assets are allocated according to the Aggressive Portfolio (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5th Percentile	\$2.3	\$5.0	\$8.2	\$11.7	\$15.6	\$19.8	\$24.5	\$29.4	\$34.4	\$40.0	\$45.8	\$52.1	\$58.1	\$65.0	\$72.1	\$79.5	\$87.6	\$96.0	\$105.6	\$115.2	\$126.4
25th Percentile	\$2.3	\$4.5	\$7.0	\$9.8	\$12.9	\$16.2	\$19.7	\$23.5	\$27.4	\$31.2	\$35.5	\$39.9	\$44.8	\$49.3	\$54.3	\$59.1	\$64.2	\$70.1	\$76.0	\$82.8	\$89.2
50th Percentile	\$2.3	\$4.4	\$6.5	\$8.7	\$10.9	\$13.0	\$15.2	\$17.2	\$19.6	\$21.8	\$23.9	\$26.0	\$28.6	\$31.3	\$33.6	\$36.5	\$39.2	\$42.1	\$44.8	\$46.7	\$50.0
75th Percentile	\$2.3	\$4.3	\$6.0	\$7.3	\$8.2	\$8.9	\$9.5	\$9.9	\$10.4	\$10.9	\$11.4	\$11.9	\$12.4	\$12.7	\$13.2	\$13.8	\$14.4	\$14.7	\$15.5	\$16.0	\$16.4
95th Percentile	\$2.3	\$3.5	\$4.2	\$4.3	\$4.4	\$4.4	\$4.6	\$4.7	\$4.8	\$4.9	\$5.0	\$5.1	\$5.2	\$5.2	\$5.3	\$5.5	\$5.6	\$5.7	\$5.8	\$5.9	\$6.0

Percentiles indicate the probability of achieving total employer contributions higher or lower than the corresponding figure. For instance, the 50th percentile indicates that 50% of the time the Plan can expect total contributions lower than the figure shown, and 50% of the time a higher figure can be expected.

Appendix 1: Sensitivity Analysis: “Effect of Higher Volatility” (continued)

Drawing Inferences

The tables below compare the projected actuarial and market funded ratios five, ten, and twenty years from now, under the median (50th percentile), worst-case (5th percentile), and best-case (95th percentile) scenarios, assuming the four different asset mixes highlighted on the prior pages. The table also displays for comparative purposes the median, peak, and trough projected payout ratios and cumulative employer contributions assuming the same four asset mixes being examined.

5 Years	Actuarial Funded Ratio in Year 5			Market Funded Ratio in Year 5			Cumulative Employer Contributions in Year 5 (Billions)			Payout Ratios		
	50th	5th	95th	50th	5th	95th	50th	5th	95th	Year 5	2013-2018	
										Median	Peak	Trough
Strategic Target	66.1%	30.1%	163.0%	67.5%	24.4%	206.7%	\$13.2	\$18.8	\$5.2	10.7%	30.9%	3.4%
Current Allocation	65.4%	31.5%	149.9%	66.4%	25.3%	191.0%	\$13.3	\$18.5	\$5.5	10.9%	29.5%	3.7%
Conservative Portfolio	57.8%	41.0%	77.9%	52.7%	33.3%	84.6%	\$14.1	\$16.5	\$11.6	13.7%	22.6%	8.2%
Aggressive Portfolio	67.0%	25.4%	203.1%	68.7%	20.6%	255.2%	\$13.0	\$19.8	\$4.4	10.6%	36.7%	2.8%

10 Years	Actuarial Funded Ratio in Year 10			Market Funded Ratio in Year 10			Cumulative Employer Contributions in Year 10 (Billions)			Payout Ratios		
	50th	5th	95th	50th	5th	95th	50th	5th	95th	Year 10	2013-2023	
										Median	Peak	Trough
Strategic Target	72.4%	24.6%	328.1%	75.0%	21.7%	384.6%	\$24.3	\$43.5	\$5.8	10.0%	39.0%	1.9%
Current Allocation	70.8%	25.5%	290.7%	72.7%	22.5%	344.1%	\$24.8	\$43.0	\$6.1	10.3%	36.9%	2.1%
Conservative Portfolio	51.2%	30.8%	88.3%	47.5%	25.7%	89.5%	\$31.6	\$39.3	\$20.0	15.8%	31.2%	7.6%
Aggressive Portfolio	74.0%	21.2%	456.2%	77.6%	18.5%	536.1%	\$23.9	\$45.8	\$5.0	9.7%	46.0%	1.4%

20 Years	Actuarial Funded Ratio in Year 20			Market Funded Ratio in Year 20			Cumulative Employer Contributions in Year 20 (Billions)			Payout Ratios		
	50th	5th	95th	50th	5th	95th	50th	5th	95th	Year 20	2013-2033	
										Median	Peak	Trough
Strategic Target	106.5%	52.5%	885.1%	113.7%	43.1%	1000.7%	\$50.8	\$120.6	\$7.0	7.2%	39.0%	0.8%
Current Allocation	101.9%	53.1%	740.0%	107.3%	43.7%	834.1%	\$53.1	\$119.4	\$7.3	7.6%	36.9%	0.9%
Conservative Portfolio	69.9%	54.8%	96.8%	65.0%	46.2%	102.8%	\$94.6	\$118.4	\$46.6	12.8%	32.8%	7.4%
Aggressive Portfolio	117.2%	49.1%	1465.9%	123.5%	39.3%	1657.1%	\$50.0	\$126.4	\$6.0	6.7%	46.0%	0.5%

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations”

This section provides a sensitivity analysis of the original stochastic projections by assuming that all asset classes are perfectly positively correlated (i.e. correlation = 1.00). A correlation matrix reflecting these modified assumptions is provided below:

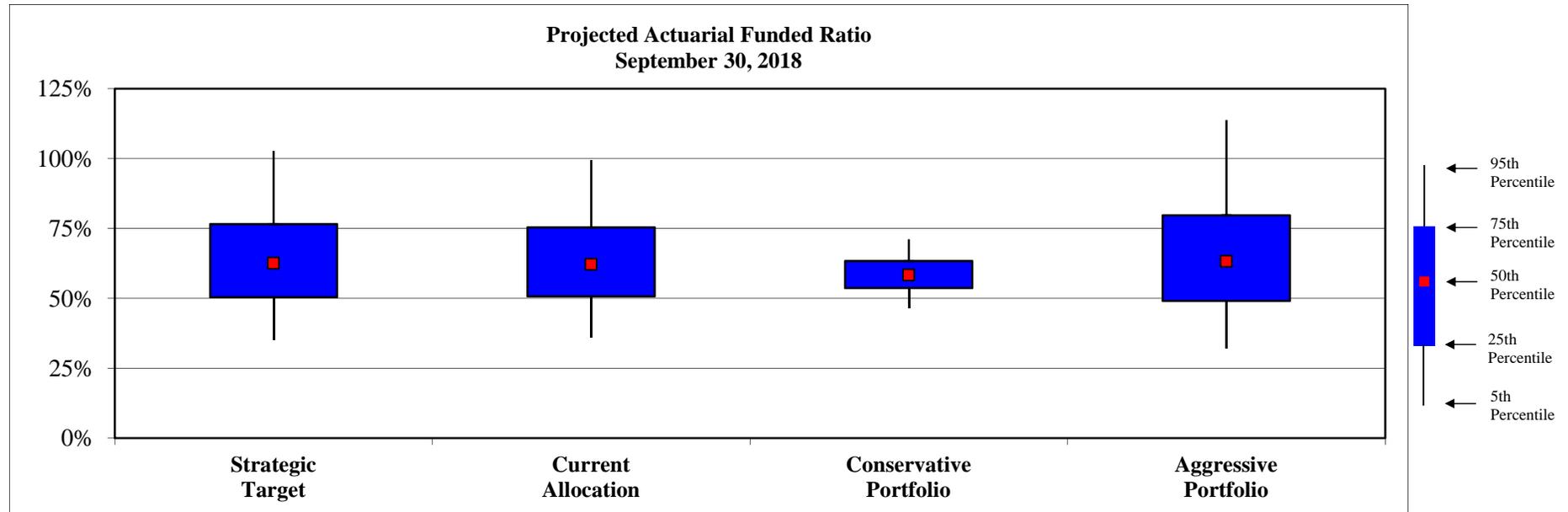
	Broad US Equity	Broad International Equity	Int. Duration Fixed Income	Diversified Infl Strat	Real Estate	Absolute Return Strategies	Private Equity	Cash Equivalents
Broad US Equity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Broad International Equity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Int. Duration Fixed Income	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Diversified Infl Strat	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Real Estate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Absolute Return Strategies	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Private Equity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cash Equivalents	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

RVK supports the recommendations based on the original assumptions shown in the Stochastic Analysis section of this report. However, this stress-testing illustrates that converging correlations across capital markets does not change the asset allocation recommendations, based on the current status of the Plan. Instead it simply widens the range of potential results, indicating higher risk for all asset mixes given the dampened effects of total fund diversification.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Projected Actuarial Funded Ratio (actuarial value of assets/actuarial accrued liability); 5 Years

The graph below shows the distribution of possible actuarial funded ratios five years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



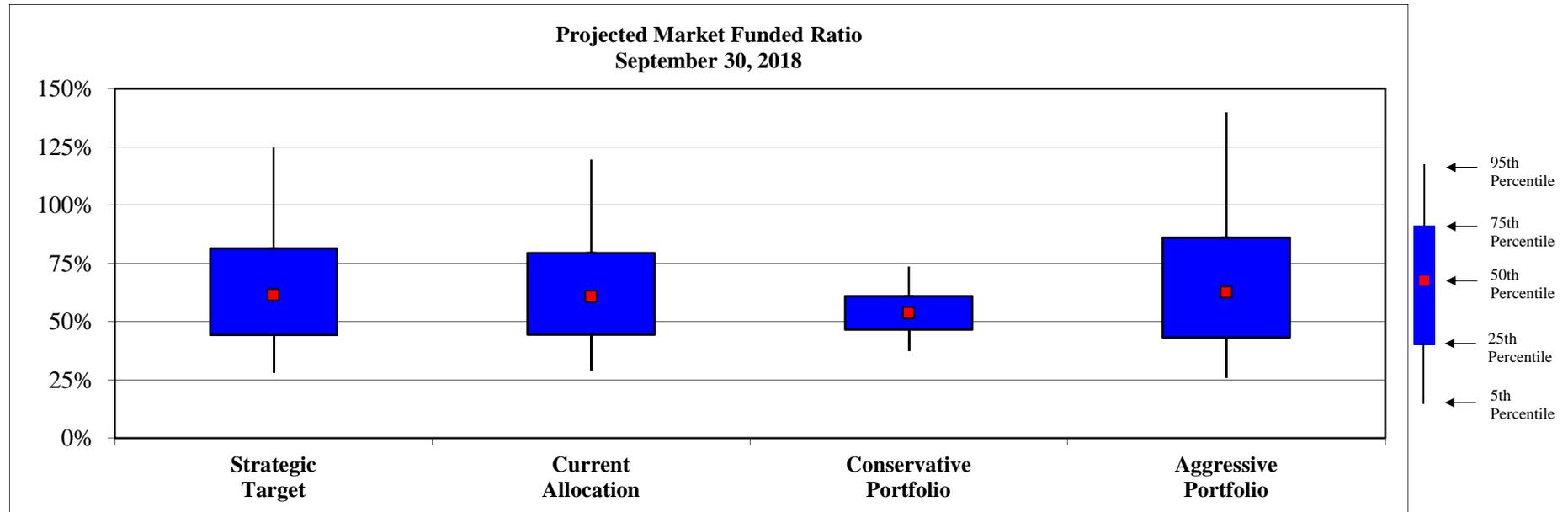
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$42.8	35.2%	\$42.2	36.0%	\$35.4	46.4%	\$44.7	32.2%
25th Percentile	\$33.6	50.4%	\$33.4	50.6%	\$31.4	53.7%	\$34.5	49.0%
50th Percentile	\$25.9	62.5%	\$26.1	62.2%	\$28.8	58.3%	\$25.4	63.2%
75th Percentile	\$16.4	76.6%	\$17.3	75.4%	\$25.8	63.3%	\$14.2	79.7%
95th Percentile	(\$1.9)	102.7%	\$0.4	99.5%	\$20.9	71.1%	(\$9.9)	113.7%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Projected Market Funded Ratio (market value of assets/actuarial accrued liability); 5 Years

The graph below shows the distribution of possible market funded ratios five years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



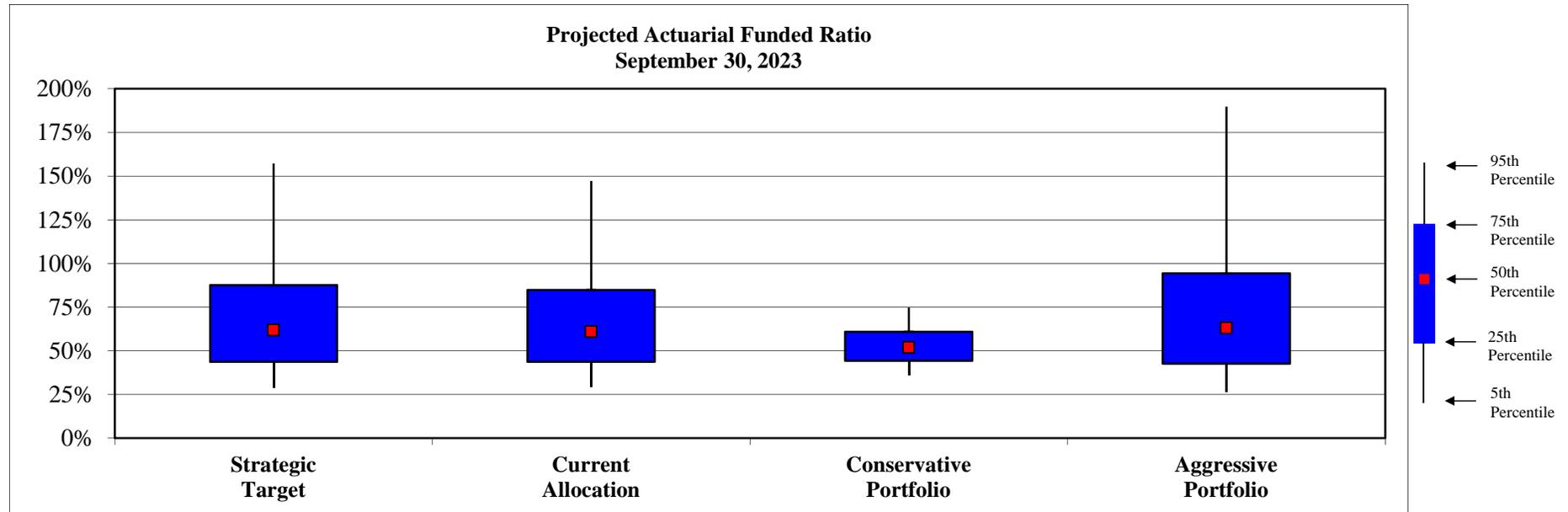
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$47.3	28.3%	\$46.8	29.0%	\$41.2	37.5%	\$48.9	26.0%
25th Percentile	\$37.8	44.2%	\$37.7	44.4%	\$36.3	46.5%	\$38.5	43.2%
50th Percentile	\$26.6	61.5%	\$27.1	60.8%	\$31.9	53.7%	\$25.8	62.6%
75th Percentile	\$13.0	81.4%	\$14.4	79.5%	\$27.5	60.9%	\$9.9	86.0%
95th Percentile	(\$17.8)	124.7%	(\$14.1)	119.6%	\$19.0	73.6%	(\$28.8)	139.9%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Projected Actuarial Funded Ratio (actuarial value of assets/actuarial accrued liability); 10 Years

The graph below shows the distribution of possible actuarial funded ratios ten years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



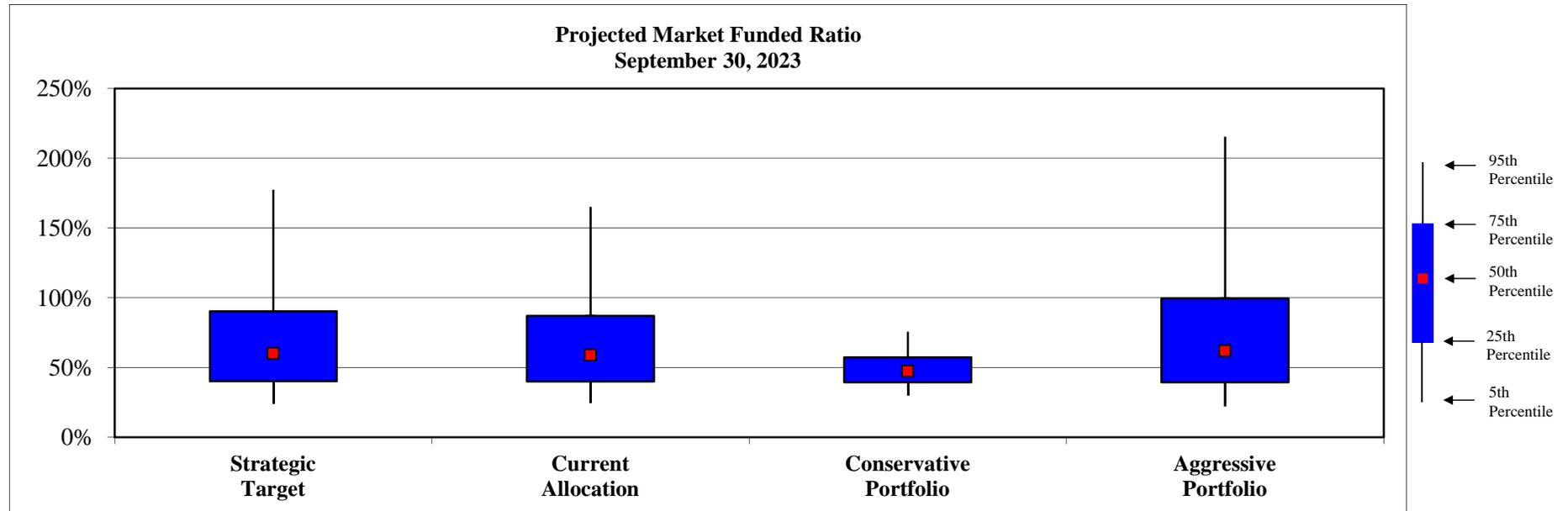
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$48.8	28.7%	\$48.5	29.3%	\$44.0	36.0%	\$50.3	26.4%
25th Percentile	\$40.3	43.7%	\$40.4	43.7%	\$39.8	44.3%	\$41.0	42.6%
50th Percentile	\$28.5	61.8%	\$29.1	60.9%	\$35.6	51.9%	\$27.4	63.1%
75th Percentile	\$9.6	87.5%	\$11.6	84.8%	\$30.1	60.8%	\$4.4	94.2%
95th Percentile	(\$46.4)	157.2%	(\$38.2)	147.2%	\$20.6	74.6%	(\$73.1)	189.6%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Projected Market Funded Ratio (market value of assets/actuarial accrued liability); 10 Years

The graph below shows the distribution of possible market funded ratios ten years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



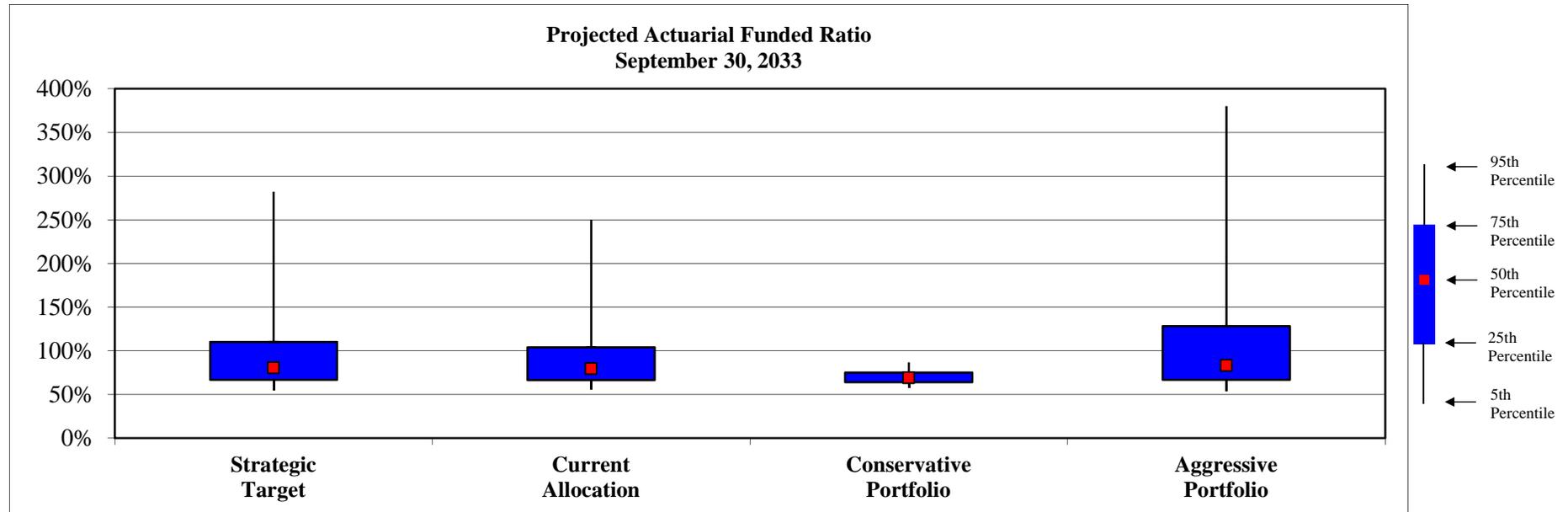
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$52.1	24.0%	\$51.8	24.5%	\$47.7	30.5%	\$53.4	22.1%
25th Percentile	\$42.8	40.1%	\$42.8	40.0%	\$43.5	39.3%	\$43.3	39.4%
50th Percentile	\$29.6	60.0%	\$30.5	58.8%	\$39.0	47.4%	\$28.0	62.0%
75th Percentile	\$7.4	90.3%	\$10.1	87.0%	\$32.8	57.3%	\$0.5	99.4%
95th Percentile	(\$62.9)	177.4%	(\$53.0)	165.3%	\$19.7	75.7%	(\$94.3)	215.4%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Projected Actuarial Funded Ratio (actuarial value of assets/actuarial accrued liability); 20 Years

The graph below shows the distribution of possible actuarial funded ratios twenty years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



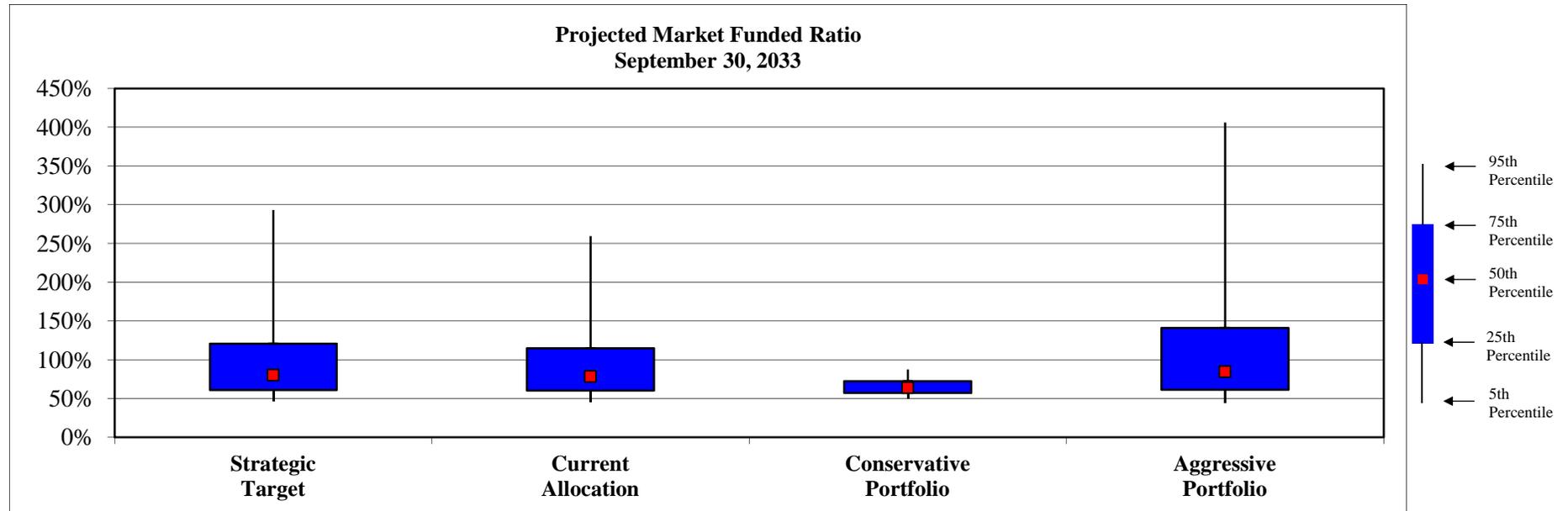
	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$31.5	55.1%	\$31.2	55.4%	\$29.1	58.2%	\$32.7	53.9%
25th Percentile	\$24.8	66.7%	\$25.0	66.5%	\$27.0	64.0%	\$24.7	66.8%
50th Percentile	\$15.5	80.5%	\$16.4	79.4%	\$24.7	69.1%	\$13.4	83.2%
75th Percentile	(\$8.8)	110.1%	(\$3.4)	104.0%	\$21.1	75.2%	(\$23.8)	128.0%
95th Percentile	(\$174.0)	282.0%	(\$143.6)	249.9%	\$12.7	86.8%	(\$266.7)	379.8%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Projected Market Funded Ratio (market value of assets/actuarial accrued liability); 20 Years

The graph below shows the distribution of possible market funded ratios twenty years from now, assuming the four different asset mixes highlighted on the prior pages. The results assume the current contribution policy remains unchanged for all projection years.



	Strategic Target		Current Allocation		Conservative Portfolio		Aggressive Portfolio	
	Unfunded Liability (Bil)	Funded Ratio						
5th Percentile	\$39.5	45.7%	\$39.3	46.0%	\$36.4	50.2%	\$40.7	44.1%
25th Percentile	\$29.5	61.0%	\$29.8	60.5%	\$32.5	57.2%	\$29.2	61.4%
50th Percentile	\$15.5	80.3%	\$17.0	78.5%	\$29.0	63.8%	\$12.0	84.8%
75th Percentile	(\$17.3)	120.7%	(\$12.6)	114.8%	\$23.5	72.3%	(\$34.7)	141.0%
95th Percentile	(\$186.1)	293.1%	(\$152.4)	259.5%	\$11.7	87.6%	(\$292.8)	406.0%

Percentiles indicate the probability of achieving a Funded Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Funded Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Projected Market Funded Ratio and Maximum 1 Year Investment Loss (market value of assets/actuarial accrued liability)

The tables below show the probability that the Plan will be at various funding levels for each of the four different asset mixes highlighted on the prior pages. The tables also illustrate the maximum 1 year investment loss each portfolio is expected to experience during the given time period. The results assume the current contribution policy remains unchanged for all projection years.

5 Years	Probability of Full Funding in 2018	Probability of less than 63% (Current) Funding in 2018	Probability of less than 50% Funding in 2018	Maximum 1 Year Portfolio Investment Loss
Strategic Target	14%	52%	33%	-44%
Current Allocation	13%	54%	33%	-42%
Conservative Portfolio	0%	79%	36%	-22%
Aggressive Portfolio	17%	50%	34%	-50%

10 Years	Probability of Full Funding in 2023	Probability of less than 63% (Current) Funding in 2023	Probability of less than 50% Funding in 2023	Maximum 1 Year Portfolio Investment Loss
Strategic Target	21%	53%	37%	-48%
Current Allocation	19%	54%	38%	-46%
Conservative Portfolio	0%	84%	58%	-25%
Aggressive Portfolio	25%	51%	37%	-54%

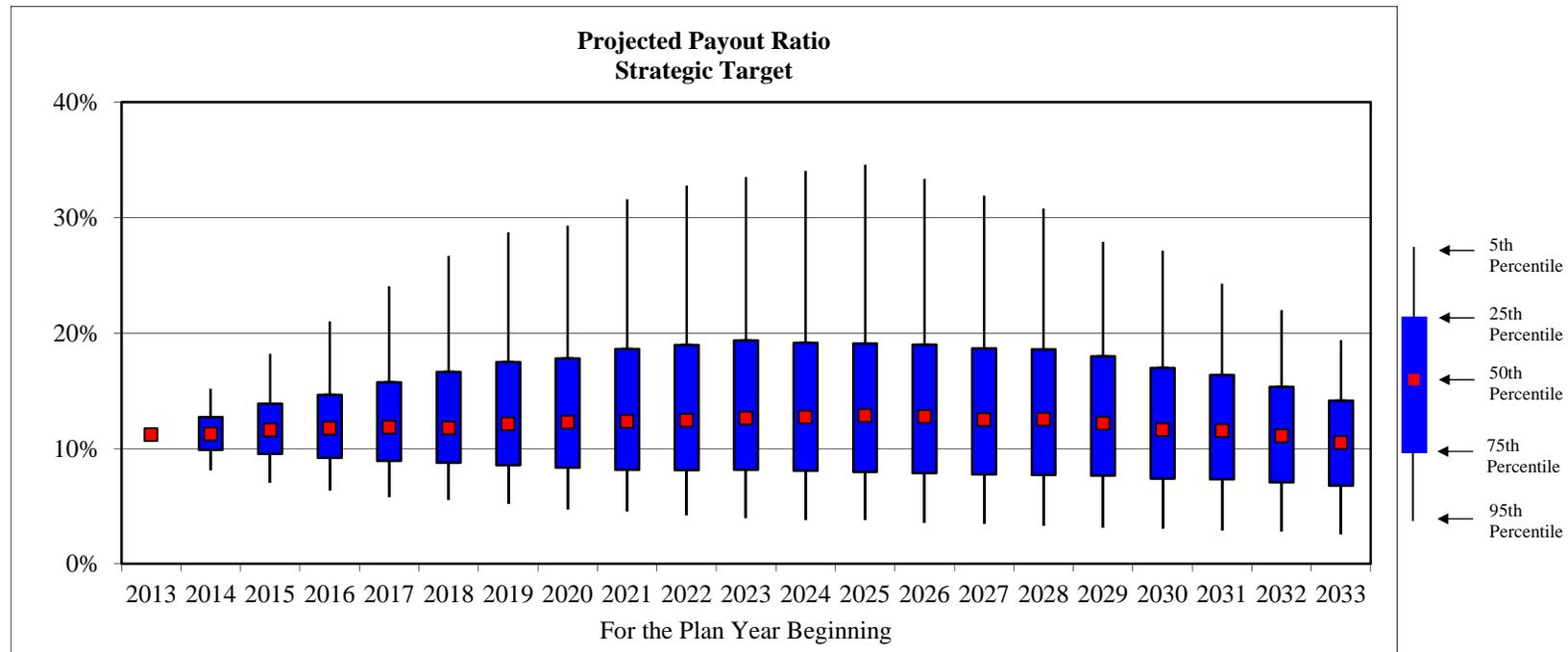
20 Years	Probability of Full Funding in 2033	Probability of less than 63% (Current) Funding in 2033	Probability of less than 50% Funding in 2033	Maximum 1 Year Portfolio Investment Loss
Strategic Target	35%	28%	10%	-51%
Current Allocation	32%	29%	10%	-49%
Conservative Portfolio	1%	46%	5%	-26%
Aggressive Portfolio	41%	27%	11%	-58%

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Projected Payout Ratio (expected benefit payments/market value of assets); Strategic Target

The graph below displays the range of possible payout ratios over the next twenty years, assuming the Plan’s assets are allocated according to the Strategic Target (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.

The annual median benefit payment as percentage of market value of assets is expected to range between 10.5% and 12.8%. The worst-case scenario could reach 35% or higher.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Median	11.2%	11.2%	11.6%	11.7%	11.8%	11.8%	12.1%	12.3%	12.3%	12.4%	12.6%	12.7%	12.8%	12.8%	12.5%	12.5%	12.2%	11.6%	11.5%	11.1%	10.5%

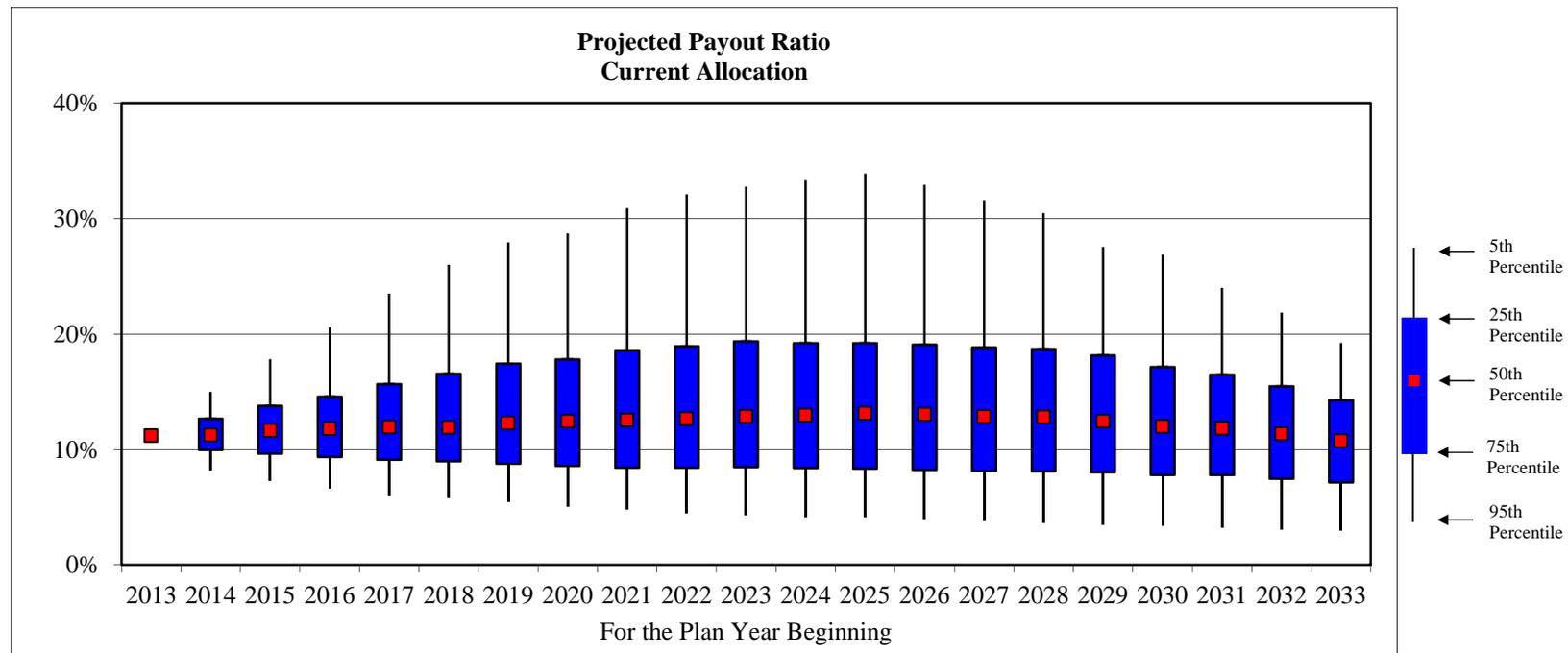
Percentiles indicate the probability of achieving a Payout Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Payout Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Projected Payout Ratio (expected benefit payments/market value of assets); Current Allocation

The graph below displays the range of possible payout ratios over the next twenty years, assuming the Plan’s assets are allocated according to the Current Allocation (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.

The annual median benefit payment as percentage of market value of assets is expected to range between 10.7% and 13.1%. The worst-case scenario could reach 34% or higher.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Median	11.2%	11.3%	11.6%	11.8%	11.9%	11.9%	12.3%	12.4%	12.5%	12.7%	12.9%	13.0%	13.1%	13.1%	12.8%	12.8%	12.4%	12.0%	11.8%	11.3%	10.7%

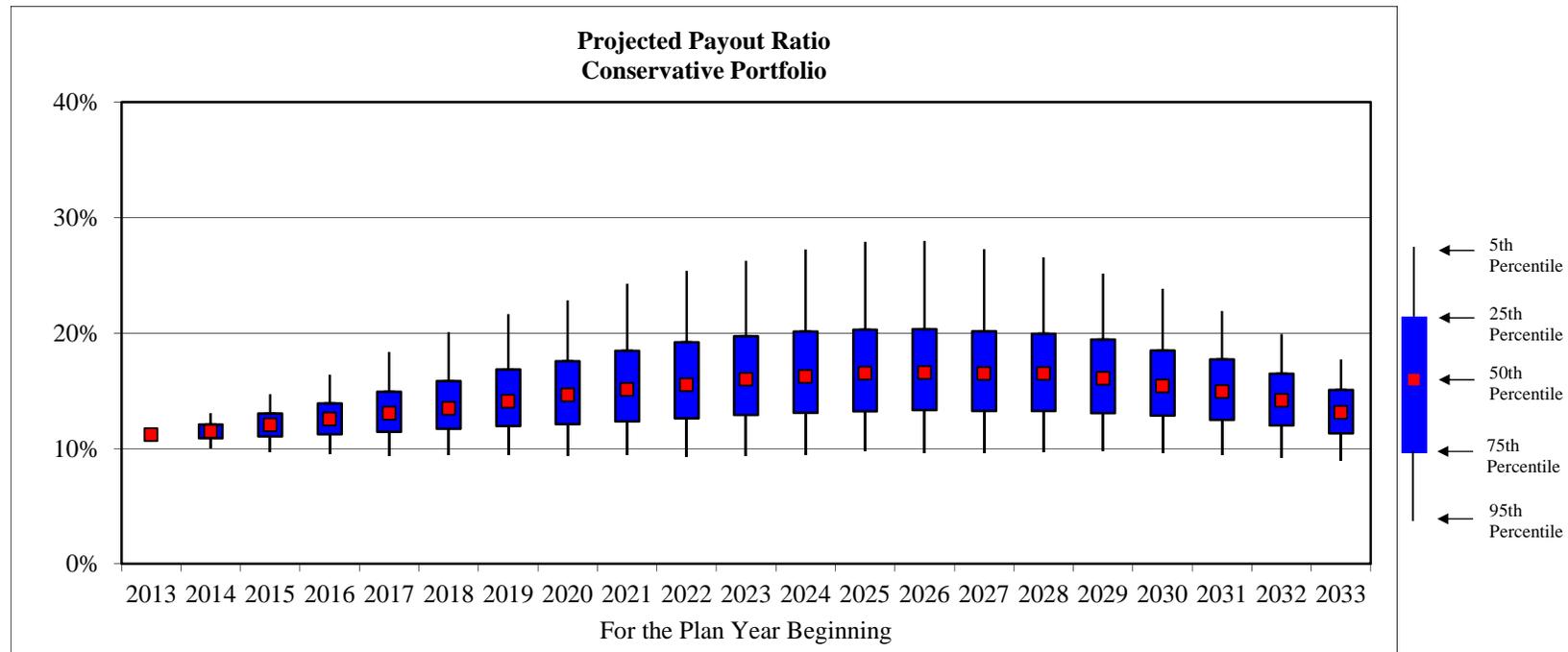
Percentiles indicate the probability of achieving a Payout Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Payout Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Projected Payout Ratio (expected benefit payments/market value of assets); Conservative Portfolio

The graph below displays the range of possible payout ratios over the next twenty years, assuming the Plan’s assets are allocated according to the Conservative Portfolio (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.

The annual median benefit payment as percentage of market value of assets is expected to range between 11.2% and 16.6%. The worst-case scenario could reach 28% or higher.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Median	11.2%	11.5%	12.0%	12.5%	13.0%	13.5%	14.1%	14.6%	15.1%	15.5%	16.0%	16.2%	16.5%	16.6%	16.5%	16.5%	16.1%	15.4%	14.9%	14.1%	13.1%

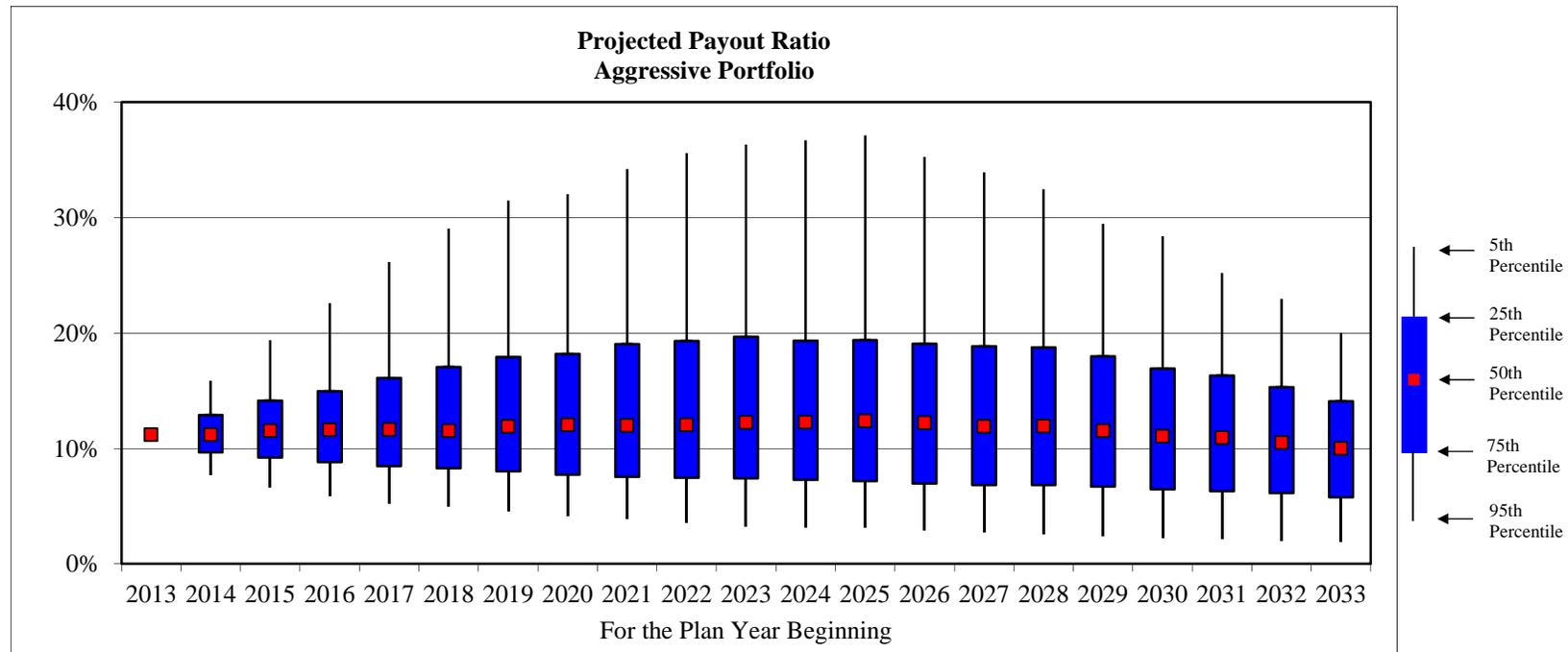
Percentiles indicate the probability of achieving a Payout Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Payout Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Projected Payout Ratio (expected benefit payments/market value of assets); Aggressive Portfolio

The graph below displays the range of possible payout ratios over the next twenty years, assuming the Plan’s assets are allocated according to the Aggressive Portfolio (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.

The annual median benefit payment as percentage of market value of assets is expected to range between 10.0% and 12.4%. The worst-case scenario could reach 37% or higher.



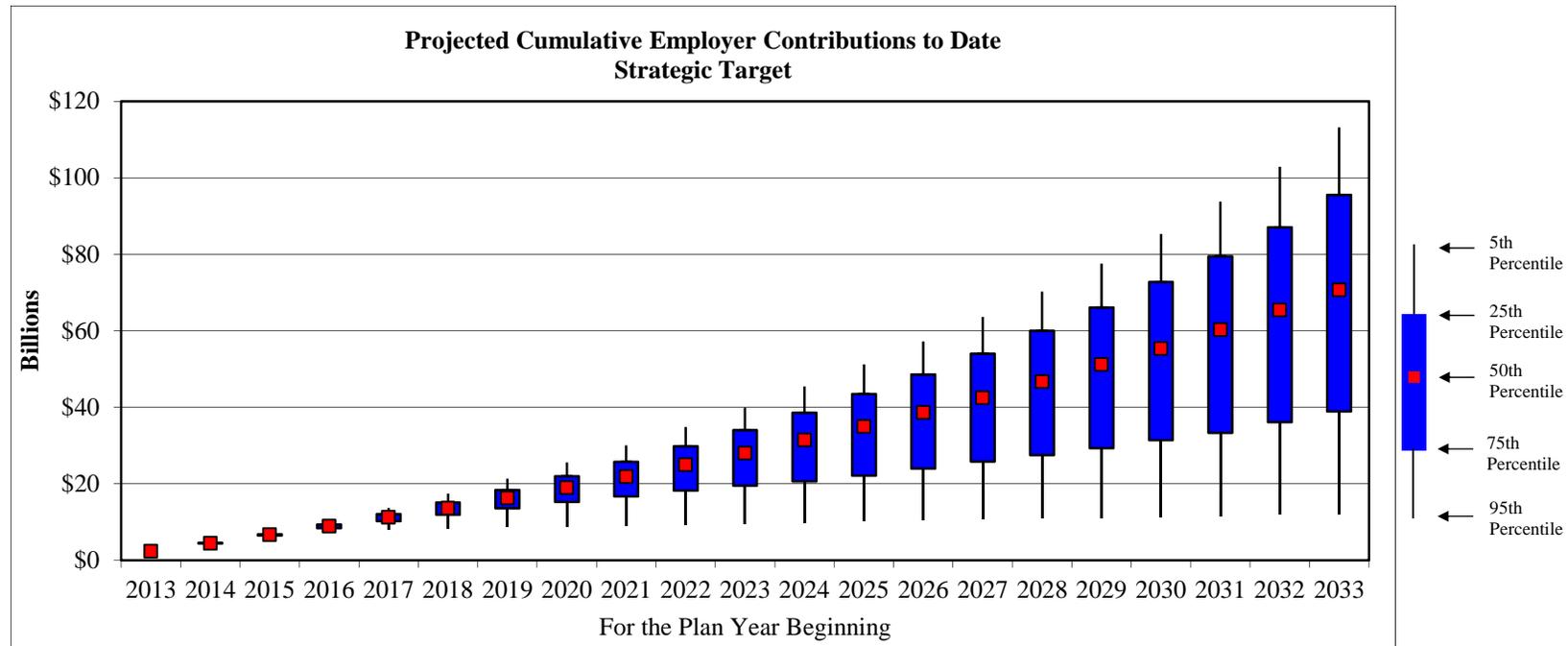
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Median	11.2%	11.2%	11.5%	11.6%	11.7%	11.5%	11.9%	12.0%	12.0%	12.0%	12.2%	12.3%	12.4%	12.2%	11.9%	11.9%	11.6%	11.0%	10.9%	10.5%	10.0%

Percentiles indicate the probability of achieving a Payout Ratio higher or lower than the corresponding ratio. For instance, the 50th percentile indicates that 50% of the time the Plan can expect a Payout Ratio lower than the ratio shown, and 50% of the time a higher ratio can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Cumulative Employer Contributions to Date; Strategic Target

The graph and table below show the range of projected cumulative employer contributions over the next twenty years, assuming the Plan’s assets are allocated according to the Strategic Target (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.



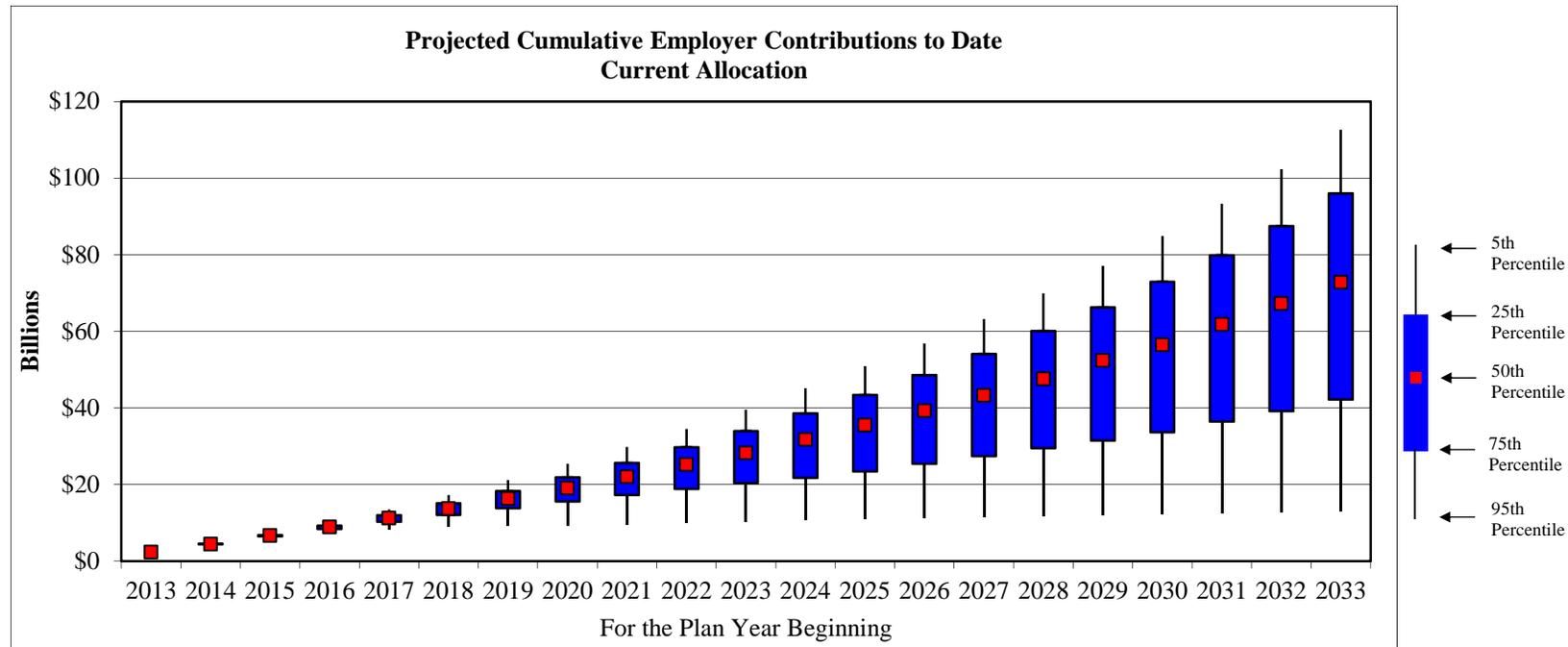
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5th Percentile	\$2.3	\$4.5	\$7.3	\$10.3	\$13.6	\$17.4	\$21.3	\$25.6	\$30.0	\$34.8	\$39.8	\$45.4	\$51.2	\$57.2	\$63.6	\$70.2	\$77.5	\$85.3	\$93.7	\$102.8	\$113.1
25th Percentile	\$2.3	\$4.5	\$6.8	\$9.3	\$12.0	\$15.1	\$18.3	\$21.9	\$25.7	\$29.8	\$34.0	\$38.5	\$43.4	\$48.5	\$54.0	\$59.9	\$66.0	\$72.8	\$79.4	\$87.1	\$95.5
50th Percentile	\$2.3	\$4.4	\$6.6	\$8.8	\$11.2	\$13.6	\$16.2	\$18.9	\$21.8	\$24.9	\$28.0	\$31.4	\$34.9	\$38.6	\$42.5	\$46.7	\$51.2	\$55.3	\$60.2	\$65.3	\$70.6
75th Percentile	\$2.3	\$4.4	\$6.4	\$8.3	\$10.2	\$11.9	\$13.5	\$15.2	\$16.7	\$18.2	\$19.5	\$20.6	\$22.1	\$24.0	\$25.7	\$27.4	\$29.3	\$31.3	\$33.3	\$36.0	\$38.9
95th Percentile	\$2.3	\$4.3	\$5.9	\$7.1	\$8.0	\$8.3	\$8.6	\$8.7	\$9.0	\$9.3	\$9.4	\$9.7	\$10.2	\$10.5	\$10.7	\$10.8	\$11.0	\$11.3	\$11.5	\$12.0	\$12.1

Percentiles indicate the probability of achieving total employer contributions higher or lower than the corresponding figure. For instance, the 50th percentile indicates that 50% of the time the Plan can expect total contributions lower than the figure shown, and 50% of the time a higher figure can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Cumulative Employer Contributions to Date; Current Allocation

The graph and table below show the range of projected cumulative employer contributions over the next twenty years, assuming the Plan’s assets are allocated according to the Current Allocation (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.



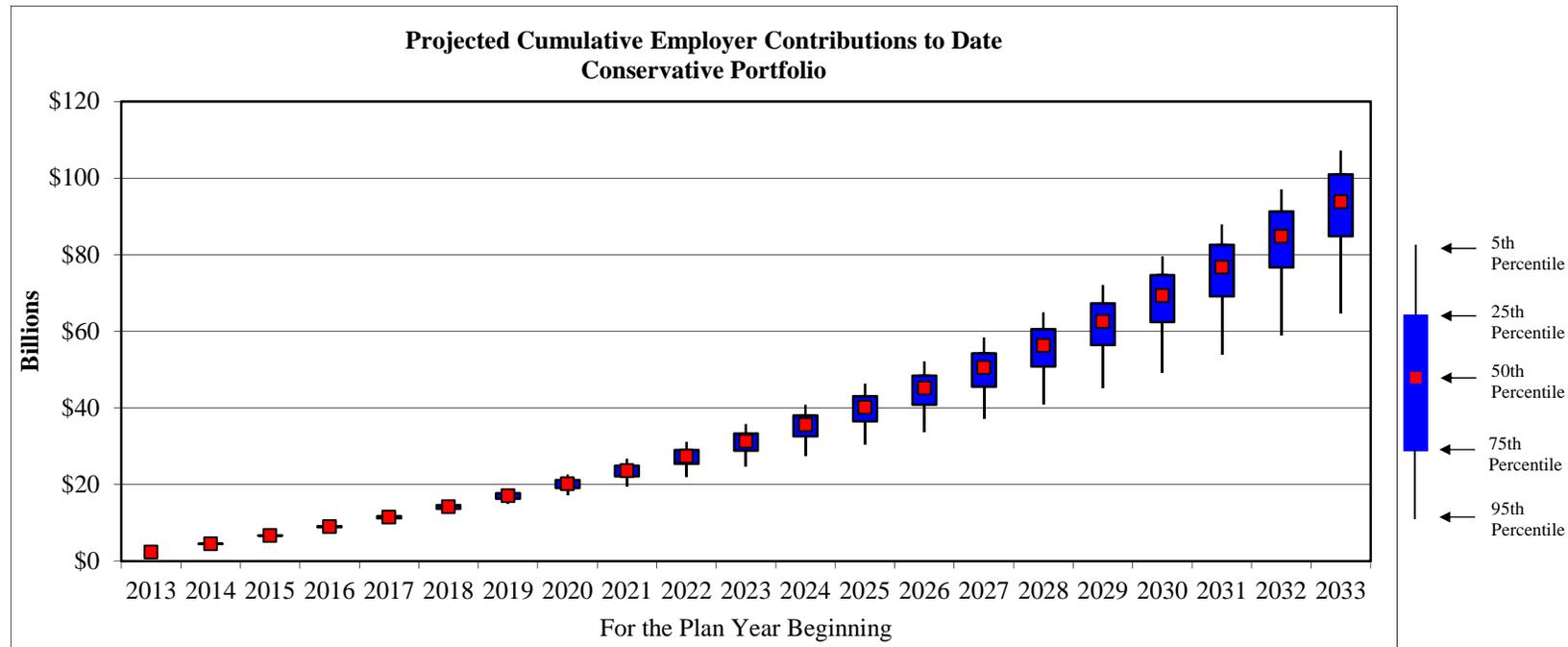
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5th Percentile	\$2.3	\$4.5	\$7.2	\$10.2	\$13.5	\$17.2	\$21.1	\$25.3	\$29.7	\$34.5	\$39.5	\$45.1	\$50.9	\$56.8	\$63.1	\$69.9	\$77.0	\$84.9	\$93.3	\$102.3	\$112.6
25th Percentile	\$2.3	\$4.5	\$6.8	\$9.3	\$12.0	\$15.0	\$18.3	\$21.9	\$25.6	\$29.7	\$34.0	\$38.5	\$43.4	\$48.5	\$54.0	\$60.0	\$66.2	\$72.9	\$79.9	\$87.4	\$96.0
50th Percentile	\$2.3	\$4.4	\$6.6	\$8.9	\$11.2	\$13.7	\$16.3	\$19.0	\$22.0	\$25.1	\$28.2	\$31.7	\$35.4	\$39.2	\$43.2	\$47.5	\$52.3	\$56.4	\$61.8	\$67.2	\$72.8
75th Percentile	\$2.3	\$4.4	\$6.4	\$8.4	\$10.3	\$12.0	\$13.8	\$15.5	\$17.3	\$18.8	\$20.4	\$21.7	\$23.4	\$25.3	\$27.3	\$29.5	\$31.5	\$33.6	\$36.4	\$39.1	\$42.1
95th Percentile	\$2.3	\$4.3	\$6.0	\$7.3	\$8.3	\$8.8	\$9.1	\$9.3	\$9.6	\$9.9	\$10.2	\$10.6	\$11.0	\$11.2	\$11.4	\$11.7	\$12.1	\$12.2	\$12.5	\$12.7	\$13.0

Percentiles indicate the probability of achieving total employer contributions higher or lower than the corresponding figure. For instance, the 50th percentile indicates that 50% of the time the Plan can expect total contributions lower than the figure shown, and 50% of the time a higher figure can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Cumulative Employer Contributions to Date; Conservative Portfolio

The graph and table below show the range of projected cumulative employer contributions over the next twenty years, assuming the Plan’s assets are allocated according to the Conservative Portfolio (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.



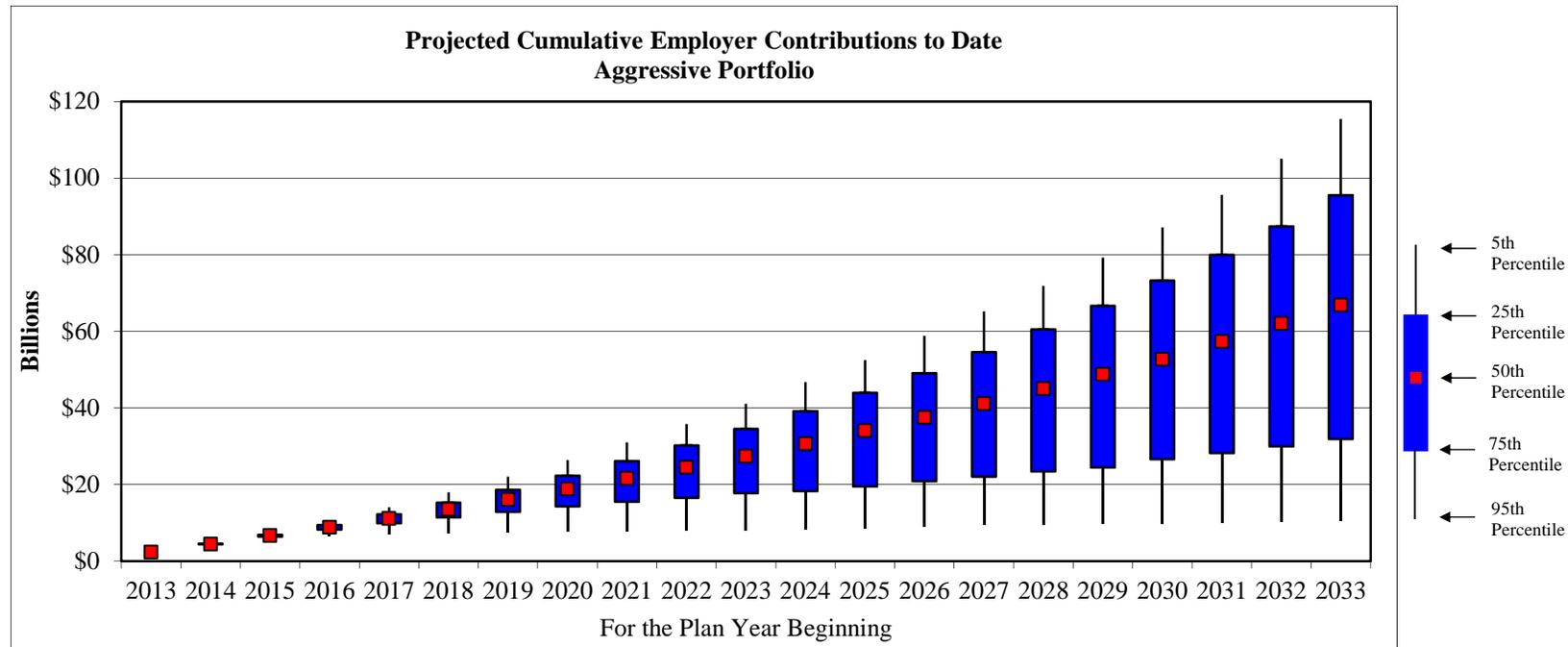
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5th Percentile	\$2.3	\$4.5	\$6.8	\$9.3	\$12.1	\$15.3	\$18.8	\$22.6	\$26.7	\$31.1	\$35.8	\$40.8	\$46.3	\$52.1	\$58.3	\$64.9	\$72.1	\$79.6	\$87.9	\$97.0	\$107.2
25th Percentile	\$2.3	\$4.5	\$6.7	\$9.1	\$11.7	\$14.6	\$17.7	\$21.2	\$24.9	\$28.9	\$33.3	\$38.0	\$43.0	\$48.4	\$54.2	\$60.5	\$67.2	\$74.6	\$82.5	\$91.3	\$100.9
50th Percentile	\$2.3	\$4.4	\$6.7	\$9.0	\$11.4	\$14.1	\$17.0	\$20.2	\$23.6	\$27.3	\$31.3	\$35.5	\$40.1	\$45.1	\$50.5	\$56.3	\$62.5	\$69.3	\$76.7	\$84.8	\$93.8
75th Percentile	\$2.3	\$4.4	\$6.6	\$8.8	\$11.2	\$13.6	\$16.2	\$19.0	\$22.1	\$25.4	\$28.8	\$32.5	\$36.5	\$40.8	\$45.5	\$50.7	\$56.4	\$62.4	\$69.1	\$76.6	\$84.8
95th Percentile	\$2.3	\$4.4	\$6.5	\$8.6	\$10.7	\$12.8	\$14.9	\$17.2	\$19.5	\$22.0	\$24.7	\$27.5	\$30.5	\$33.6	\$37.1	\$40.8	\$45.1	\$49.1	\$54.0	\$59.0	\$64.6

Percentiles indicate the probability of achieving total employer contributions higher or lower than the corresponding figure. For instance, the 50th percentile indicates that 50% of the time the Plan can expect total contributions lower than the figure shown, and 50% of the time a higher figure can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Cumulative Employer Contributions to Date; Aggressive Portfolio

The graph and table below show the range of projected cumulative employer contributions over the next twenty years, assuming the Plan’s assets are allocated according to the Aggressive Portfolio (highlighted on the prior pages). The results assume the current contribution policy remains unchanged for all projection years.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5th Percentile	\$2.3	\$4.7	\$7.5	\$10.6	\$14.0	\$17.9	\$22.0	\$26.3	\$31.0	\$35.7	\$41.0	\$46.7	\$52.5	\$58.7	\$65.1	\$71.8	\$79.2	\$87.1	\$95.6	\$105.0	\$115.4
25th Percentile	\$2.3	\$4.5	\$6.8	\$9.4	\$12.2	\$15.3	\$18.6	\$22.3	\$26.1	\$30.2	\$34.5	\$39.1	\$43.9	\$49.0	\$54.6	\$60.5	\$66.6	\$73.2	\$79.9	\$87.3	\$95.6
50th Percentile	\$2.3	\$4.4	\$6.6	\$8.8	\$11.1	\$13.5	\$16.0	\$18.8	\$21.6	\$24.5	\$27.3	\$30.6	\$34.0	\$37.5	\$41.1	\$45.0	\$48.7	\$52.7	\$57.3	\$62.0	\$66.8
75th Percentile	\$2.3	\$4.4	\$6.4	\$8.2	\$9.9	\$11.4	\$12.8	\$14.3	\$15.5	\$16.5	\$17.7	\$18.3	\$19.4	\$20.8	\$22.0	\$23.4	\$24.4	\$26.6	\$28.2	\$29.9	\$31.8
95th Percentile	\$2.3	\$4.2	\$5.5	\$6.5	\$7.0	\$7.3	\$7.4	\$7.6	\$7.7	\$7.9	\$8.0	\$8.1	\$8.5	\$8.9	\$9.3	\$9.4	\$9.7	\$9.8	\$9.9	\$10.2	\$10.5

Percentiles indicate the probability of achieving total employer contributions higher or lower than the corresponding figure. For instance, the 50th percentile indicates that 50% of the time the Plan can expect total contributions lower than the figure shown, and 50% of the time a higher figure can be expected.

Appendix 2: Sensitivity Analysis: “Effect of Higher Correlations” (continued)

Drawing Inferences

The tables below compare the projected actuarial and market funded ratios five, ten, and twenty years from now, under the median (50th percentile), worst-case (5th percentile), and best-case (95th percentile) scenarios, assuming the four different asset mixes highlighted on the prior pages. The table also displays for comparative purposes the median, peak, and trough projected payout ratios and cumulative employer contributions assuming the same four asset mixes being examined.

5 Years	Actuarial Funded Ratio in Year 5			Market Funded Ratio in Year 5			Cumulative Employer Contributions in Year 5 (Billions)			Payout Ratios		
	50th	5th	95th	50th	5th	95th	50th	5th	95th	Year 5	2013-2018	
										Median	Peak	Trough
Strategic Target	62.5%	35.2%	102.7%	61.5%	28.3%	124.7%	\$13.6	\$17.4	\$8.3	11.8%	26.7%	5.6%
Current Allocation	62.2%	36.0%	99.5%	60.8%	29.0%	119.6%	\$13.7	\$17.2	\$8.8	11.9%	26.0%	5.8%
Conservative Portfolio	58.3%	46.4%	71.1%	53.7%	37.5%	73.6%	\$14.1	\$15.3	\$12.8	13.5%	20.1%	9.4%
Aggressive Portfolio	63.2%	32.2%	113.7%	62.6%	26.0%	139.9%	\$13.5	\$17.9	\$7.3	11.5%	29.0%	5.0%

10 Years	Actuarial Funded Ratio in Year 10			Market Funded Ratio in Year 10			Cumulative Employer Contributions in Year 10 (Billions)			Payout Ratios		
	50th	5th	95th	50th	5th	95th	50th	5th	95th	Year 10	2013-2023	
										Median	Peak	Trough
Strategic Target	61.8%	28.7%	157.2%	60.0%	24.0%	177.4%	\$28.0	\$39.8	\$9.4	12.6%	33.5%	4.0%
Current Allocation	60.9%	29.3%	147.2%	58.8%	24.5%	165.3%	\$28.2	\$39.5	\$10.2	12.9%	32.7%	4.3%
Conservative Portfolio	51.9%	36.0%	74.6%	47.4%	30.5%	75.7%	\$31.3	\$35.8	\$24.7	16.0%	26.3%	9.3%
Aggressive Portfolio	63.1%	26.4%	189.6%	62.0%	22.1%	215.4%	\$27.3	\$41.0	\$8.0	12.2%	36.3%	3.3%

20 Years	Actuarial Funded Ratio in Year 20			Market Funded Ratio in Year 20			Cumulative Employer Contributions in Year 20 (Billions)			Payout Ratios		
	50th	5th	95th	50th	5th	95th	50th	5th	95th	Year 20	2013-2033	
										Median	Peak	Trough
Strategic Target	80.5%	55.1%	282.0%	80.3%	45.7%	293.1%	\$70.6	\$113.1	\$12.1	10.5%	34.6%	2.6%
Current Allocation	79.4%	55.4%	249.9%	78.5%	46.0%	259.5%	\$72.8	\$112.6	\$13.0	10.7%	33.9%	3.0%
Conservative Portfolio	69.1%	58.2%	86.8%	63.8%	50.2%	87.6%	\$93.8	\$107.2	\$64.6	13.1%	28.0%	9.0%
Aggressive Portfolio	83.2%	53.9%	379.8%	84.8%	44.1%	406.0%	\$66.8	\$115.4	\$10.5	10.0%	37.1%	1.9%

Appendix 3: Assumptions and Methods

Actuarial Valuation Assumptions and Methods: At the beginning of each projection year, an actuarial valuation is performed to determine employer contributions. The assumptions adopted for use with the September 30, 2014, actuarial valuation were used with actuarial valuations beginning in 2014 and beyond. These methods and assumptions are described in the 5-Year Experience Study (October 1, 2007 through September 30, 2012) prepared by GRS, and are summarized below:

Actuarial Cost Method	Entry-Age Normal (level % of pay). Funding policies and methods are described in Section H of the 5-Year Experience Study (October 1, 2007 through September 30, 2012).
Liability Discount Rate	8.00% per year (Non-Hybrid), 7.00% per year (Hybrid PPP), compounded annually.
Future Pay Increases	Future pay increases are outlined in Sections B and C of the 5-Year Experience Study (October 1, 2007 through September 30, 2012). Pay increases include a 3.50% base wage inflation rate.
Retirement	Retirement assumptions as outlined in Section D of the 5-Year Experience Study (October 1, 2007 through September 30, 2012).
Mortality	Mortality assumptions as outlined in Section G of the 5-Year Experience Study (October 1, 2007 through September 30, 2012).
Disability	Rates of disability as outlined in Section F of the 5-Year Experience Study (October 1, 2007 through September 30, 2012).
Withdrawal	Rates of withdrawal as outlined in Section E of the 5-Year Experience Study (October 1, 2007 through September 30, 2012).
Asset Valuation Method	The asset valuation method is described in Section H of the 5-Year Experience Study (October 1, 2007 through September 30, 2012). The asset valuation method utilizes a five-year smoothing period. We assumed a 25% corridor around market value.

Appendix 3: Assumptions and Methods (continued)

Contribution Policy

For the fiscal year ending 2014, assumes total employer contributions equal to \$2.3 billion. Thereafter, assumes employer contributions are determined as of each valuation date in accordance with the actuarial funding policy and the new assumptions adopted for use with the September 30, 2014, actuarial valuation.

Projection Assumptions (used in the deterministic and stochastic asset/liability projections): These projections begin with the Plan's participant population as of September 30, 2013, as provided by the Plan Administrator. The Plan's population is projected forward and assumed to change as a result of employment separation, death, disability, and retirement, as predicted by the assumptions adopted for use with the September 30, 2014 actuarial valuation, (and described on the prior pages). New members are assumed to enter the Plan such that the active MPSERS population remains level throughout the projection. Employee compensation is projected into the future in accordance with the assumptions described on the prior pages. Investment returns are projected into the future in accordance with the assumptions described below.

Employer Contributions

For the fiscal year ending 2014, assumes total employer contributions equal to \$2.3 billion. Thereafter, assumes employer contributions are determined as of each valuation date in accordance with the actuarial funding policy and the new assumptions adopted for use with the September 30, 2014, actuarial valuation.

Member Contributions

Member contributions are determined based on current contribution rates, and projected pay.

New Entrants

Level public school employee active population. Of new members entering the Plan, 75% are assumed to elect to participate in the Hybrid Plan (PPP). The other 25% of new members are assumed to elect to participate in the Defined Contribution Plan and are not included in this study. New active participants entering the Plan are assumed to have similar characteristics to recently hired participants.

Rate of Return on Assets

Deterministic Analysis: 8.00% (Non-Hybrid), 7.00% (Hybrid PPP), compounded annually.

Stochastic Analysis: Returns on the portfolio are based on the expected returns of each asset class and the correlations between each class which are detailed in the Stochastic Analysis section of this report.

Appendix 3: Assumptions and Methods (continued)

Inflation

2.50% per year with a standard deviation of 3.00%.

Other

All other projection assumptions are the same as those chosen by the Plan's actuary shown above.

The participant data, Plan liabilities, and assets as of September 30, 2013, were provided by the Plan Administrator and GRS.