



**Cavanaugh Macdonald**  
CONSULTING, LLC

*The experience and dedication you deserve*

## **Montana Public Employees' Retirement Board**

**Valuation Results**  
**June 30, 2019**

**Presented October 10, 2019**



➤ Basic Retirement Funding Equation

$$C + I = B + E$$

C = Contributions

I = Investment Income

B = Benefits Paid

E = Expenses (administration)

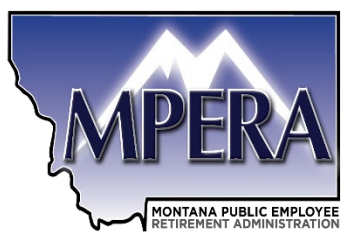
$$C + I = B + E$$

B depends on

- Plan Provisions
- Experience

C depends on

- Short Term: Actuarial Assumptions  
Actuarial Cost Method
- Long Term: I, B, E



# Results

## ➤ Asset returns

- Market asset returns averaged 5.58% vs. 7.65% expected (2.07% less than expected).
- Actuarial asset returns averaged 7.13% vs. 7.65% expected (0.52% less than expected).
  - Actuarial value of assets smooth investment gains and losses on a market value basis over a four year period.
  - The actuarial value of assets indicates unrecognized investment gain will be recognized next year followed by two years of investment losses.

## ➤ Funded Ratios

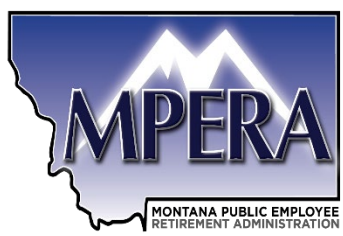
- Funded ratios increased for all systems except for JRS

## ➤ Amortization Periods for Unfunded Liability

- Amortization periods decreased or stayed the same for all systems except for HPORS.
- The amortization periods for GWPORS, HPORS and PERS exceed 30 years.

## ➤ Actuarial Experience

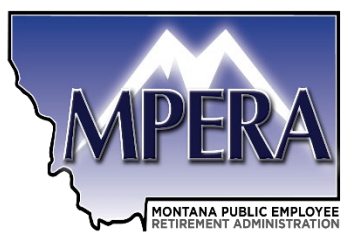
- Actuarial investment experience was less than the assumed rate of return for all plans.
- HPORS, JRS, GWPORS, PERS and MPORS had demographic gains.
- FURS, VFCA, and SRS had demographic losses.



# Comments on Valuation

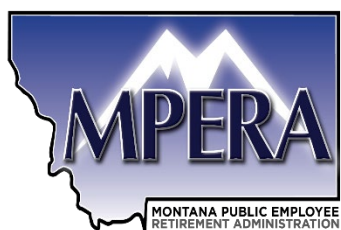


- Contributions
  - PERS
    - In accordance with statute, the employer contribution rate was increased by 0.1%.

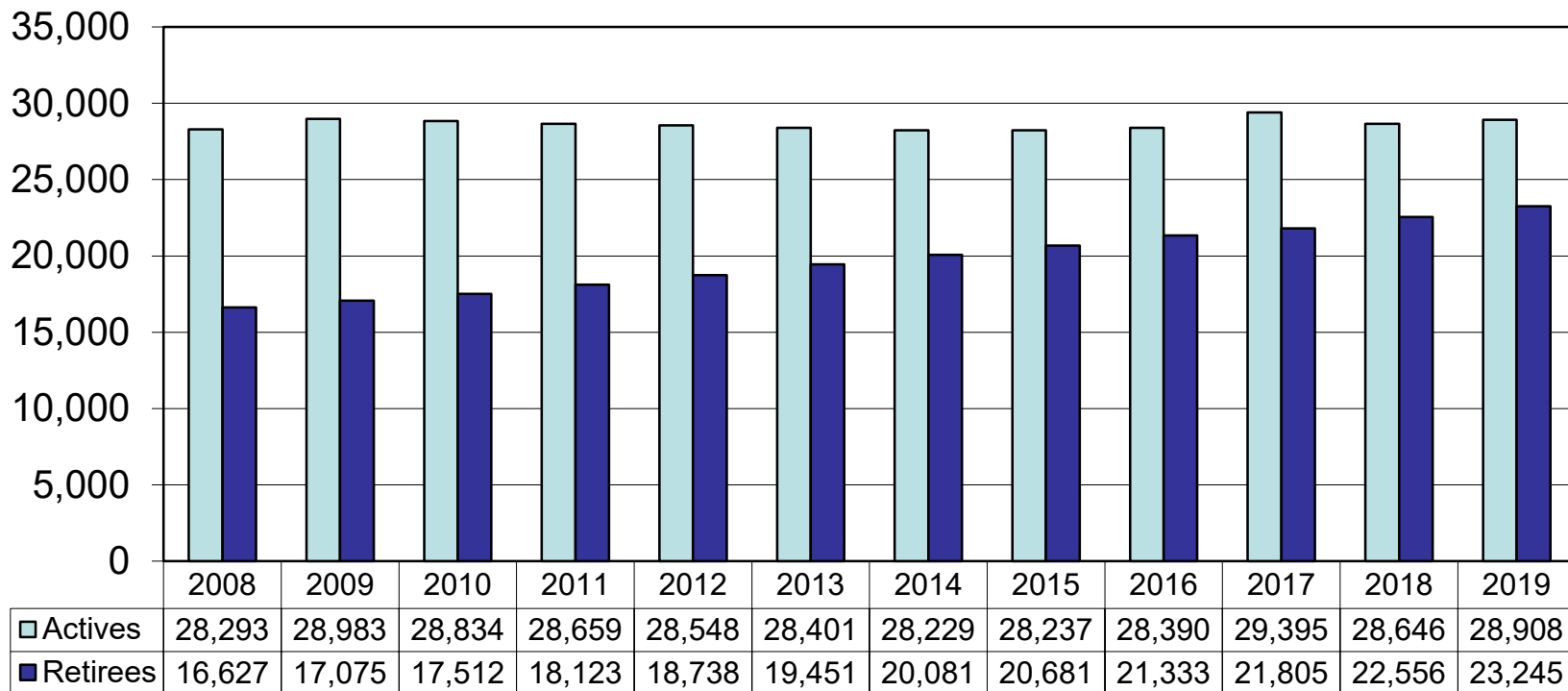


# PERS Valuation Results





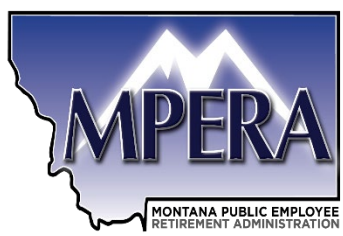
# PERS Active and Retired Membership



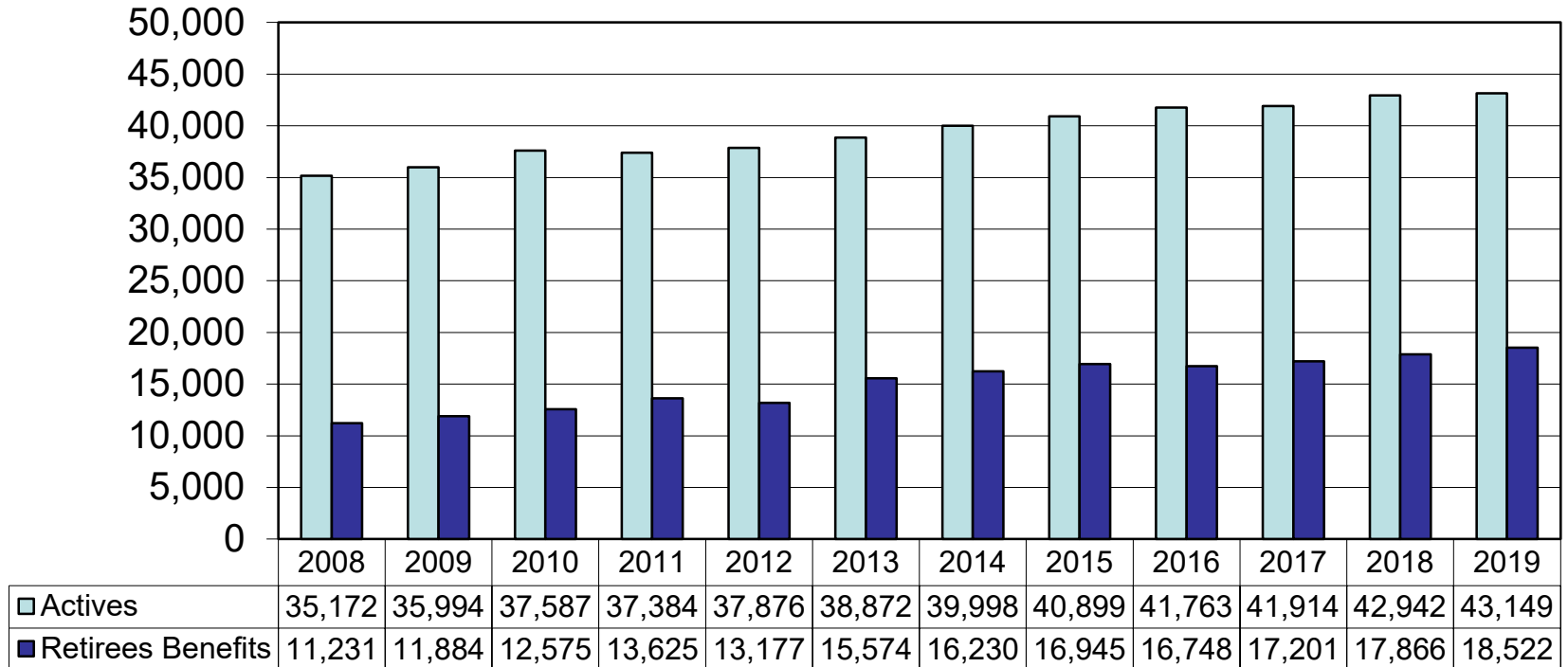
0.2% annual increase for active members since 2008; 0.9% increase for 2019.

3.1% annual increase for retired members since 2008; 3.1% increase for 2019.

0.6 retirees per active 12 years ago; 0.8 retirees per active now.

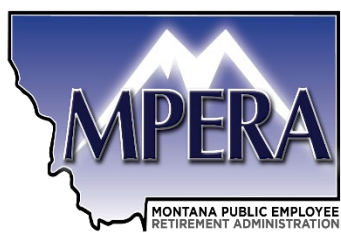


# PERS Average Salary and Benefits

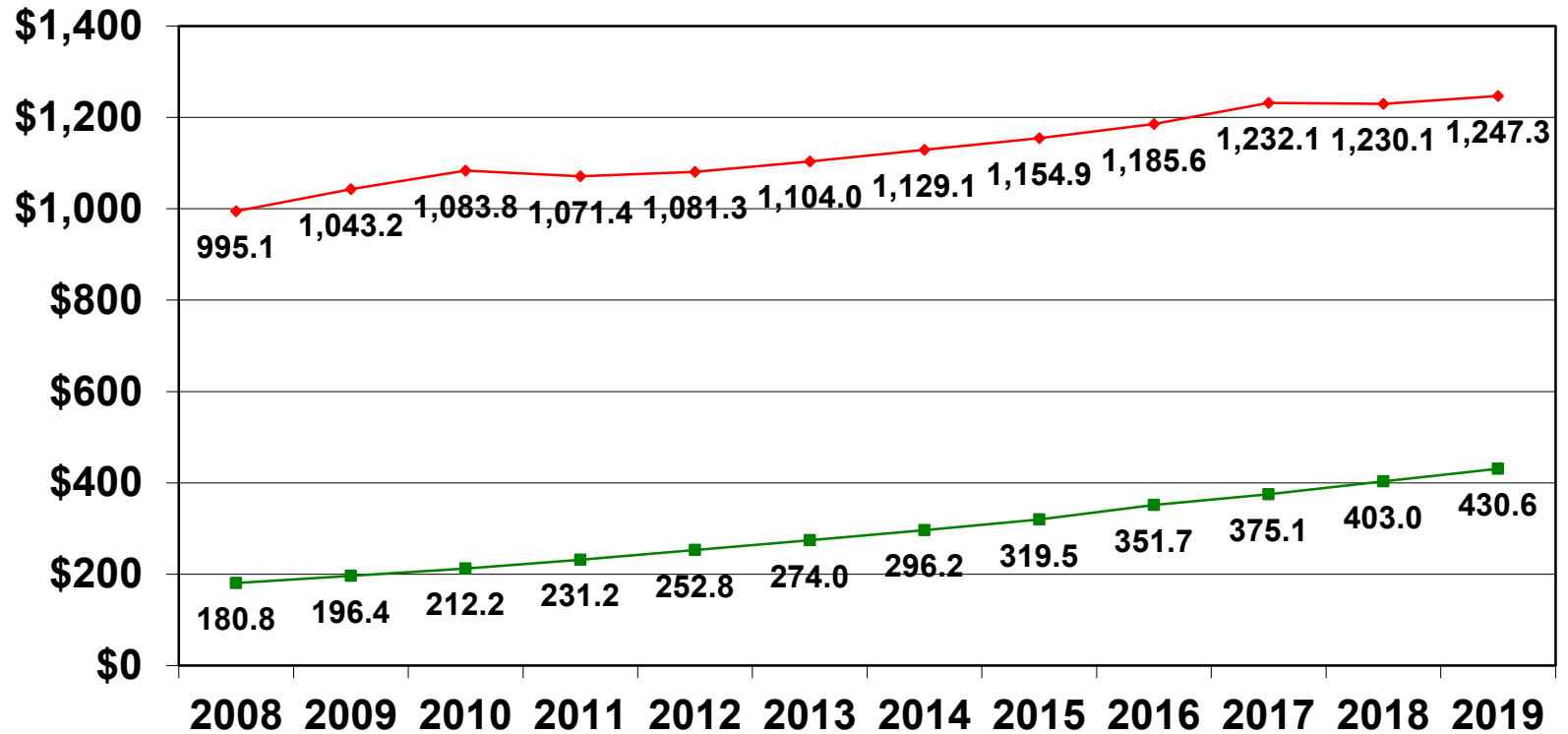


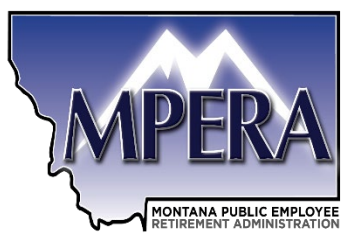
1.9% annual increase for average salary since 2008; 0.5% increase for 2019.

4.7% annual increase for average benefits since 2008; 3.7% increase for 2019.

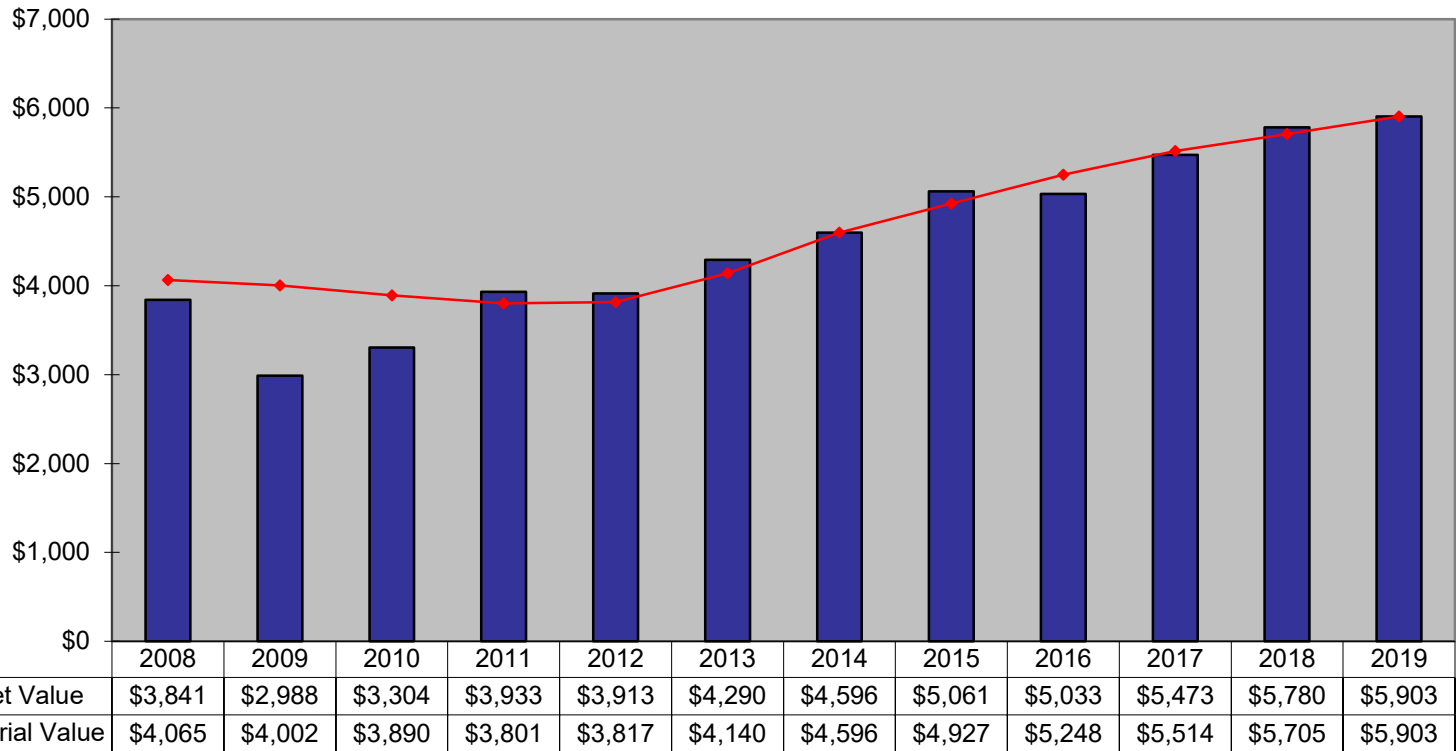


# PERS Payroll & Benefits (\$ Millions)





# PERS Assets (\$ Millions)



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<b>Market Return</b>	(4.9)%	(20.9)%	12.9%	21.7%	2.3%	13.0%	17.1%	4.6%	2.0%	11.9%	8.9%	5.7%
<b>Actuarial Return</b>	7.6%	(0.2)%	(1.2)%	(0.1)%	3.3%	11.9%	13.2%	9.6%	9.3%	8.1%	6.7%	7.1%

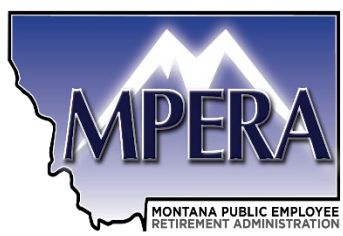


# PERS Funding Results



	July 1, 2019 Valuation	July 1, 2018 Valuation
Total Normal Cost Rate	10.09%	10.27%
Administrative Expense Load	0.30%	0.26%
Rate to Amortize UAL	6.24%	6.00%
Transfer to DB Education Fund	<u>0.04%</u>	<u>0.04%</u>
Statutory Funding Rate*	16.67%	16.57%
Actuarial Accrued Liability	\$7,957.0 million	\$7,730.1 million
Actuarial Value of Assets	\$5,903.2 million	\$5,705.2 million
Unfunded Accrued Liability	\$2,053.8 million	\$2,024.9 million
Funded Ratio	74.19%	73.81%
Amortization Period*	36 Years	38 Years

\* Reflects anticipated increases in employer supplemental contribution rates and projected State revenue. Payable in fiscal year immediately following the valuation date.



# Valuation Results – Other Plans

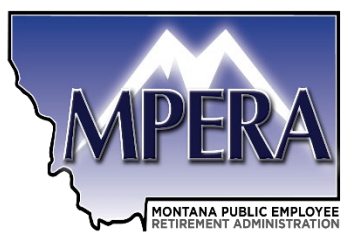


System	Funded Ratio		Amortization Period		Statutory Rate		30-Year Funding Rate	
	2019	2018	2019	2018	2017	2018	2019	2018
JRS	161%	161%	0	0	32.81%	32.81%	(5.46%)	(4.85%)
HPORS	65%	64%	42	40	51.38%	51.38%	55.72%	55.10%
SRS	82%	81%	21	21	23.61%	23.61%	22.01%	22.19%
GWPORS	84%	83%	53	72	19.56%	19.56%	20.45%	20.71%
MPORS	69%	68%	18	20	52.78%	52.78%	45.65%	47.12%
FURS	80%	78%	9	10	57.67%	57.67%	37.79%	39.19%
VFCA*	85%	83%	5	5	5% of premium taxes		\$899,555	\$823,290

\* The actual contributions for the fiscal year ending 2018 and 2019 were \$2,212,113 and \$2,370,454, respectively.

## PERS DCRP Long Term Disability Plan

	July 1, 2019 Valuation	July 1, 2018 Valuation
Total Normal Cost Rate	0.30%	0.30%
Rate to Amortize UAL	<u>0.00%</u>	<u>0.00%</u>
Statutory Funding Rate	0.30%	0.30%
Actuarial Accrued Liability	\$4,896,028	\$4,354,320
Actuarial Value of Assets (Market Value)	\$5,137,296	\$4,455,481
Unfunded Accrued Liability	(\$241,268)	(\$101,161)
Funded Ratio	104.93%	102.32%
Amortization Period	0 Years	0 Years
30-Year Funding Rate	(0.01)%	0.00%

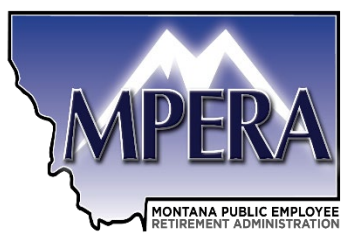


# Actuarial Standards Board



- Nine members
- Selected by Presidents and Presidents-Elect of the five U.S. based actuarial organizations
- 3-year term, maximum 2 terms (could serve longer if initially appointed to finish someone's incomplete term)
- Composition by specialties



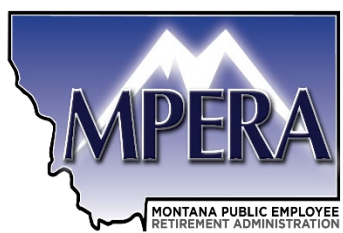


# ASB Committees



- Pension
- Health
- Life
- Casualty
- General
- Enterprise Risk Management
- Various subcommittees and task forces

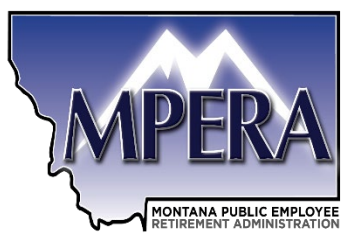
- Establish and improve standards of actuarial practice
  - Identify what the actuary should consider, document and disclose when performing an actuarial assignment
  - Set standards for appropriate practice for the U.S.
- Not interpretation of ASOPs
- Not Code of Conduct or professionalism
- Not discipline
- Not education



# Applicable ASOPS



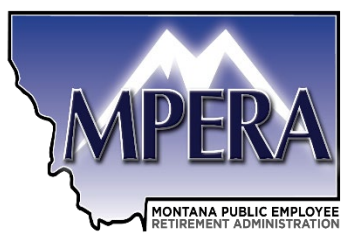
- ASOP No. 1 – Introduction
- ASOP No. 4 – Measuring Pension Obligations and Determining Pension Plan Costs or Contributions
- ASOP No. 23 - Data Quality
- ASOP No. 27 - Economic Assumptions
- ASOP No. 35 - Demographic Assumptions
- ASOP No. 41 - Actuarial Communications
- ASOP No. 44 - Asset Valuation Methods
- ASOP No. 51 – Disclosure of Risk



# ASOP Updates



- ASB proposed updates to ASOPs 4,27,35
  - Not exclusively for public plan, but the changes are in response to the SOA Blue Ribbon Commission
- Biggest concern – disclosure of “investment risk defeasement cost”
  - A way to get to Market Value of Liabilities without using market
  - Will likely be misunderstood
  - Cannot really be calculated exactly



# ASOP Updates



## ➤ Other Changes

- Amortization method restrictions “if selected by the actuary”
  - Open periods with negative amortization will not be allowed

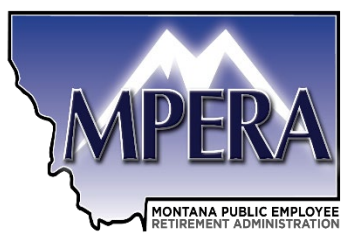
# **ASOP 51**

# **Risk Assessment**

- *New ASOP on Assessment and Disclosure of Risk*
  - Applies to funding valuations (not GASB), projections and pricing of proposed plan changes
  - Effective for work products with measurement date on or after November 1, 2018
    - 6/30/2019 valuation
  - “**Risk**” is defined as the potential of actual future measurements deviating from expected results due to actual experience that is different than the actuarial assumptions

- Actuary is to identify risks that may affect the Plan's future financial condition
- Examples in ASOP 51 that are relevant for most public plans
  - **Investment risk**
    - potential that return will be different than expected
  - **Longevity risk**
    - potential that mortality experience will be different than expected
  - **Covered payroll risk**
    - potential that covered payroll will not increase as assumed (especially important if UAL is amortized as level percent of payroll)
  - **Active Population risk**
    - potential for number of active members to decline or plan closed to new entrants
  - **Contribution rate risk**
    - ability to make contribution requirements
    - $C + I = B + E$





# ASOP No. 51

## Disclosure of Risk

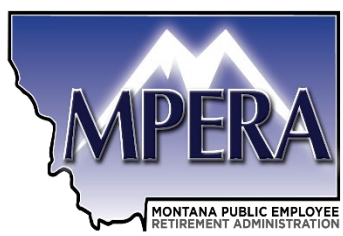


- Assess risks – does not have to be numerical
  
- Methods for assessment of risk
  - Scenario testing
  - Sensitivity testing
  - Stochastic modeling
  - Stress testing
  - Comparison to minimal-risk investments
  
- If other assumptions are used, they must be plausible

## ➤ Investment Risk

- Largest risk to funding a pension plan
- Asset Volatility Ratio (AVR), defined as the market value of assets divided by covered payroll

<b>Actuarial Valuation Date</b>	<b>Market Value of Assets</b>	<b>Estimated Plan Year Payroll</b>	<b>Asset Volatility Ratio</b>
6/30/2015	5,061,058	1,156,855	4.37
6/30/2016	5,032,807	1,185,646	4.24
6/30/2017	5,472,519	1,232,067	4.44
6/30/2018	5,779,994	1,230,105	4.70
6/30/2019	5,903,306	1,247,344	4.73

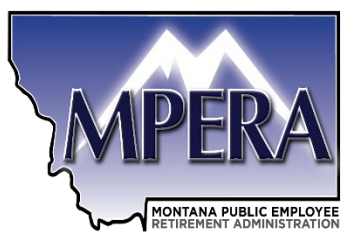


# ASOP No. 51 Disclosure of Risk



- Ratio of cash flow measure to market value of assets

<b>Year End</b>	<b>Market Value of Assets (MVA)</b>	<b>Contributions</b>	<b>Benefit Payments</b>	<b>Net Cash Flow</b>	<b>Net Cash Flow as a Percent of MVA</b>
6/30/2015	5,061,058	230,067	336,885	(106,818)	(2.11%)
6/30/2016	5,032,807	230,471	359,842	(129,371)	(2.57%)
6/30/2017	5,472,519	233,063	384,700	(151,637)	(2.77%)
6/30/2018	5,779,994	243,385	415,158	(171,772)	(2.97%)
6/30/2019	5,903,306	243,613	441,225	(197,612)	(3.35%)

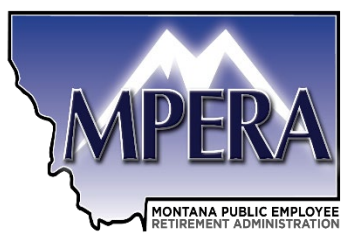


# ASOP No. 51

## Disclosure of Risk



- Plan maturity measures – the actuary should calculate and disclose plan maturity measures, which, in the actuary’s professional judgment, are significant to understanding the risks associated with the plan

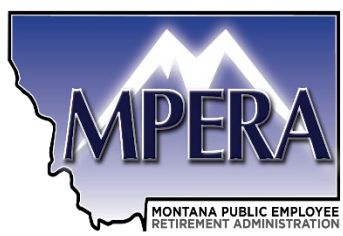


# ASOP No. 51 Disclosure of Risk



➤ Ratio of retired liability to total liability

<b>Year End</b>	<b>Retiree Liability (a)</b>	<b>Total Actuarial Accrued Liability (b)</b>	<b>Retiree Percentage (a) / (b)</b>
6/30/2015	3,880,797,329	6,470,303,179	60.0%
6/30/2016	4,149,716,390	6,787,923,154	61.1%
6/30/2017	4,720,749,061	7,578,384,779	62.3%
6/30/2018	5,018,408,743	7,730,084,077	64.9%
6/30/2019	5,284,851,700	7,957,037,808	66.4%

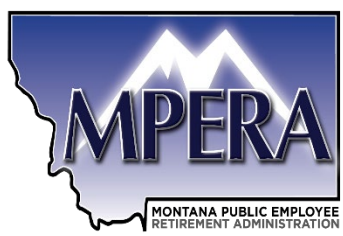


# ASOP No. 51 Disclosure of Risk



➤ Ratio of the number of Actives to Retirees

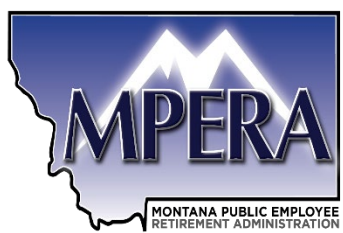
Valuation Date June 30,	Number of		Active/ Retired
	Active	Retired	
2015	28,237	20,681	1.37
2016	28,390	21,333	1.33
2017	29,395	21,805	1.35
2018	28,646	22,555	1.27
2019	28,908	23,245	1.24



# Other Risks



- Mortality Risk
  - Significant assumption for valuation results, second only to the investment assumption in most situations.
- Contribution Risk
  - The System is funded by statutory member and employer contributions.
  - Contributions to the trust fund, together with the earnings on those accumulated contributions Fund the System.
    - $C + I = B + E$

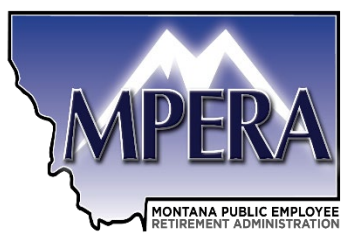


# ASOP No. 51 Disclosure of Risk



- Additional assessment of risk – the actuary can recommend that the intended user have a more complete study performed
  - Anticipating performing a risk assessment





# Risk Study



- On the following slides are examples of exhibits that are included as part of a Risk Analysis Report.
- The values contained in the slides are for illustration purposes only and are not specific to PERA.

# Usefulness of Models In Risk Assessment

- “Prediction” is not the goal of modeling. Models are beneficial for:
  - Identifying interactions between inputs that are not self-evident
  - Communicating uncertainties using simple examples or graphs
  - Answering “what if” or comparative questions
  - Identifying sensitivities of outputs to particular inputs, providing guidance on areas that require additional analysis
  - Revealing inconsistencies, discrepancies, or limitations in other types of analysis
  
- Models are useful as a tool for analyzing the system’s objectives and strategies as well as effective as a decision-making tool

# Limitations of Modeling

- All models are simplifications of how experience will unfold in the real world
- Actual experience will almost certainly be different and more complex than any scenarios modeled
- Be careful to understand what a model is intended to communicate

# Sensitivity Analysis

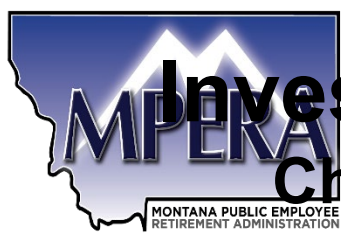
- **Sensitivity analysis:** an analysis or simulation designed to illustrate the range of potential results when actual experience is different than expected, based on assumptions
  - Vary the rate of return incrementally over specified time period (heat map)
  - Compare results under better/worse than expected scenarios, e.g., current investment return assumption plus scenarios of +1% and -1% returns
  - Compare results under different sets of assumptions

# Sensitivity Analysis

Note: investment return assumption is not changed. Actual returns are assumed to be the rate shown over the 10 year period.

	Funded Ratio at June 30 Valuation											
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
5.00%	71%	72%	72%	71%	69%	68%	67%	66%	65%	63%	62%	61%
5.25%	71%	72%	72%	71%	70%	69%	68%	67%	66%	65%	64%	63%
5.50%	71%	72%	72%	71%	71%	70%	69%	68%	67%	66%	66%	65%
5.75%	71%	72%	72%	72%	71%	71%	70%	70%	69%	68%	68%	67%
6.00%	71%	73%	73%	72%	72%	72%	71%	71%	70%	70%	70%	69%
6.25%	71%	73%	73%	73%	73%	73%	72%	72%	72%	72%	72%	72%
6.50%	71%	73%	73%	73%	74%	74%	74%	74%	74%	73%	74%	74%
6.75%	71%	73%	74%	74%	74%	74%	75%	75%	75%	75%	76%	76%
7.00%	71%	73%	74%	74%	75%	75%	76%	76%	77%	77%	78%	78%
7.25%	71%	73%	74%	75%	76%	76%	77%	78%	78%	79%	80%	81%
7.50%	71%	73%	74%	75%	76%	77%	78%	79%	80%	81%	82%	83%
7.75%	71%	74%	75%	76%	77%	78%	79%	81%	82%	83%	85%	86%
8.00%	72%	74%	75%	76%	78%	79%	81%	82%	84%	85%	87%	88%

Uses actuarial value of assets so smoothing of returns is reflected.

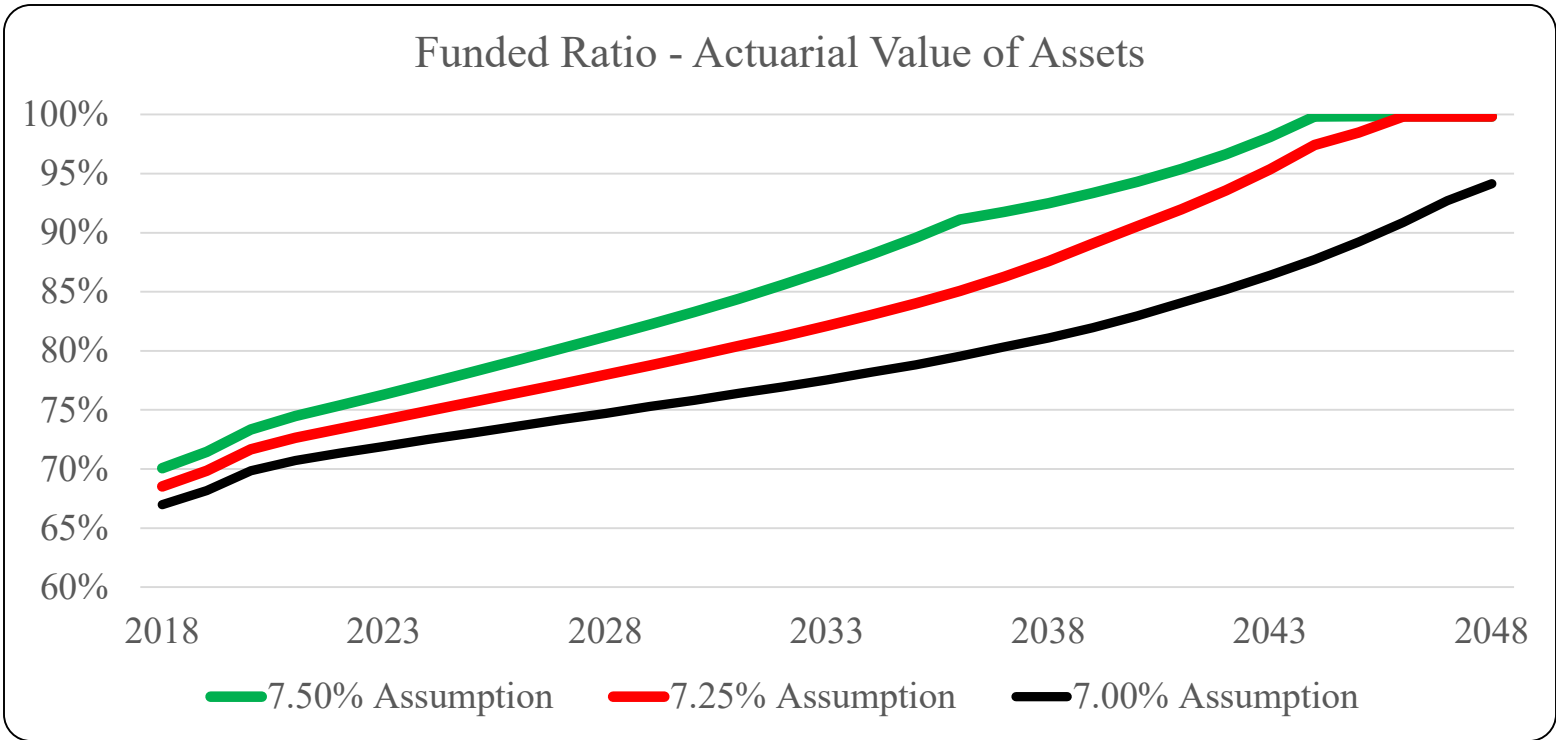


# Investment Risk: Sensitivity Analysis

## Change in Investment Return Assumption

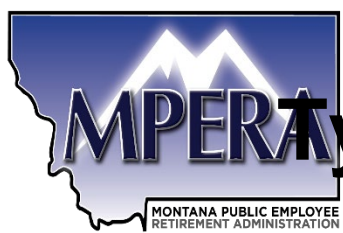


The 7.5% assumption (green line) has the highest funded ratio because liabilities/costs are lowest and assets grow more quickly than in the other two scenarios.



# Stress Testing

- **Stress test:** an analysis or simulation designed to determine the ability of a financial institution to manage an economic crisis or certain stressors
- **Purpose** is to **identify the stressors** to the System and **optimize policies and procedures** (assumptions, funding policy, and perhaps benefits) in order to **improve sustainability** and **educate stakeholders** of potential risks
  - Focus should be on the decisions to be considered based on the outcomes of the test

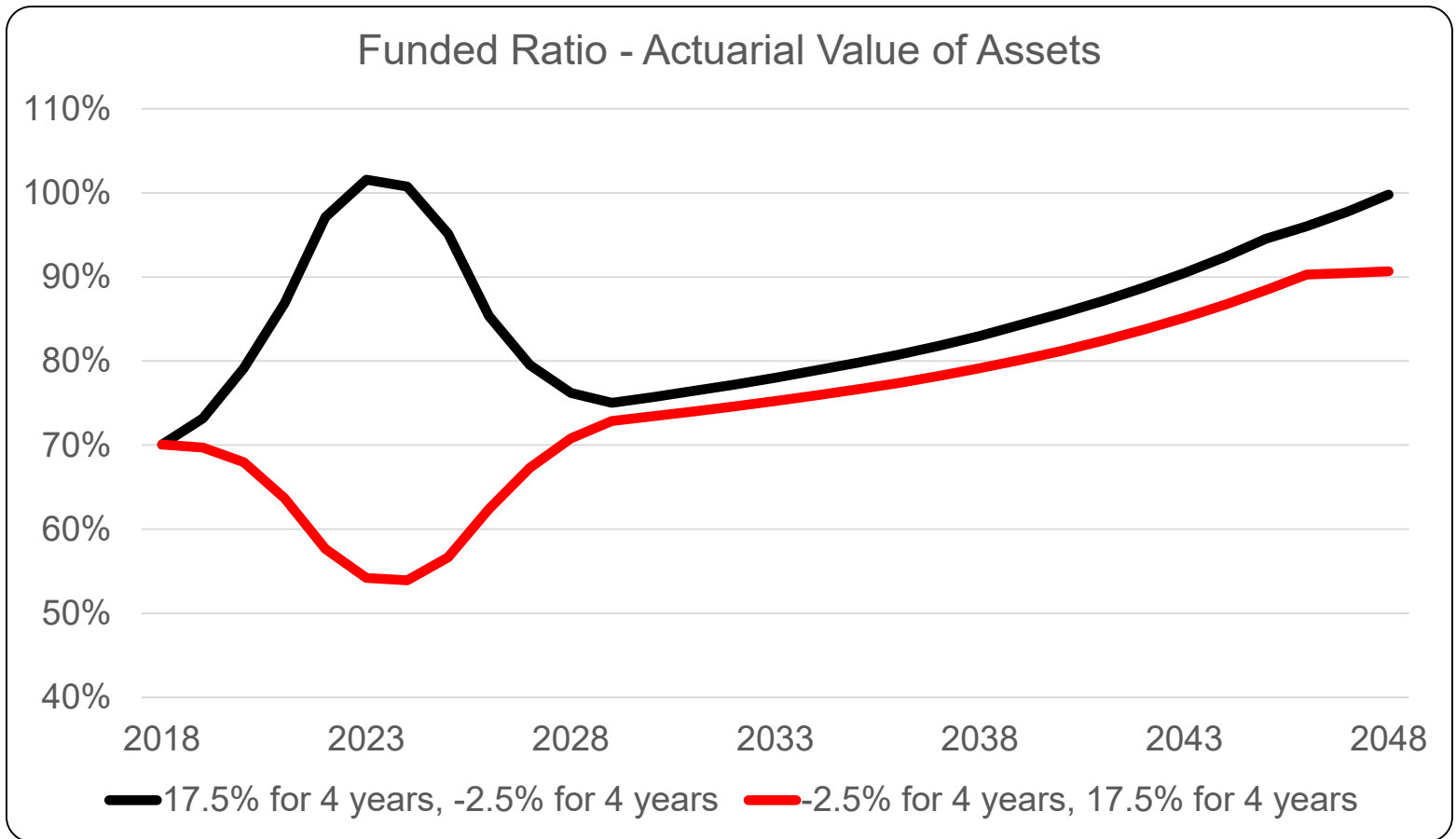


# Typical Procedure for Stress Test



- Project historical crisis data into the future and simulate what would happen to system's funding
- Deterministic projections using one set of assumed returns
- Take several sets of economic scenarios and project and compare key actuarial metrics



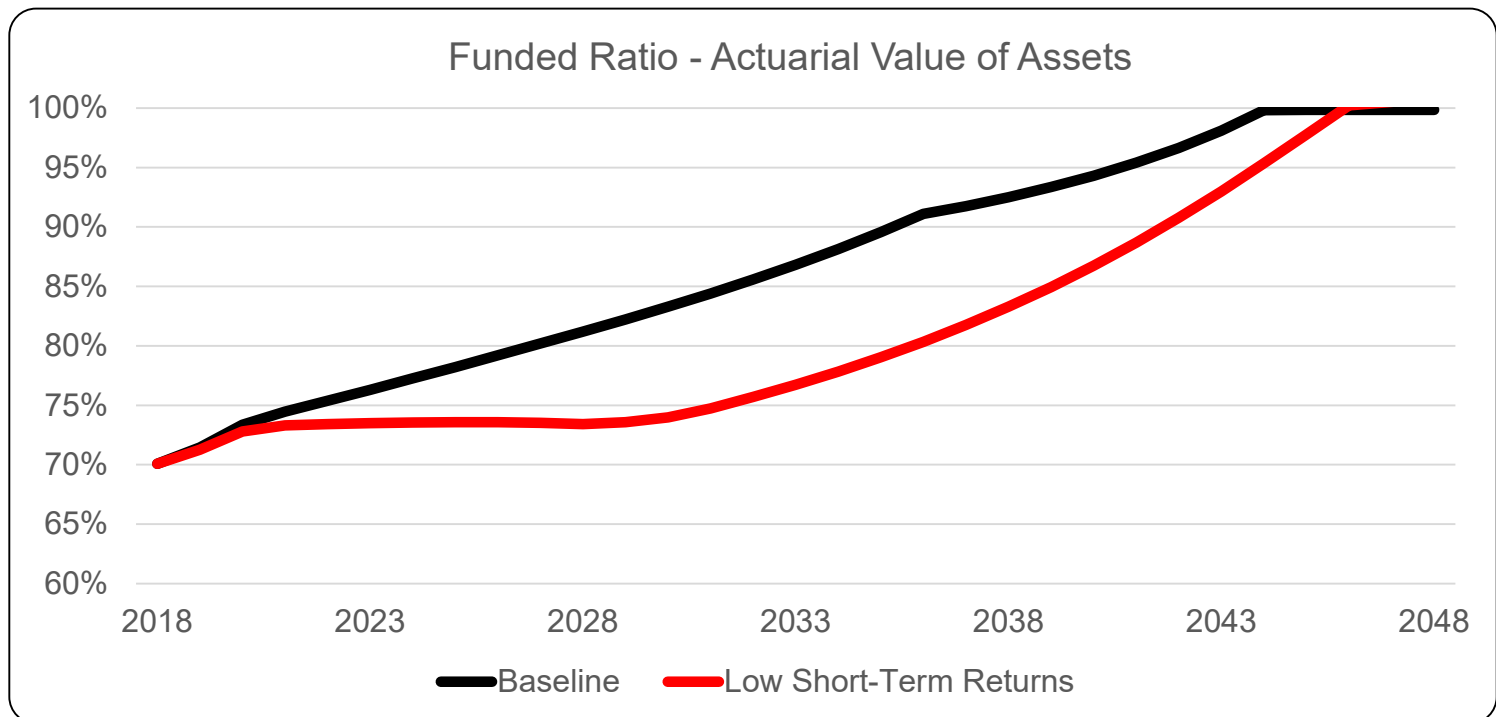


The same geometric return occurs over this period, but when low returns occur first, it results in a difference of \$4.0 billion in asset value.

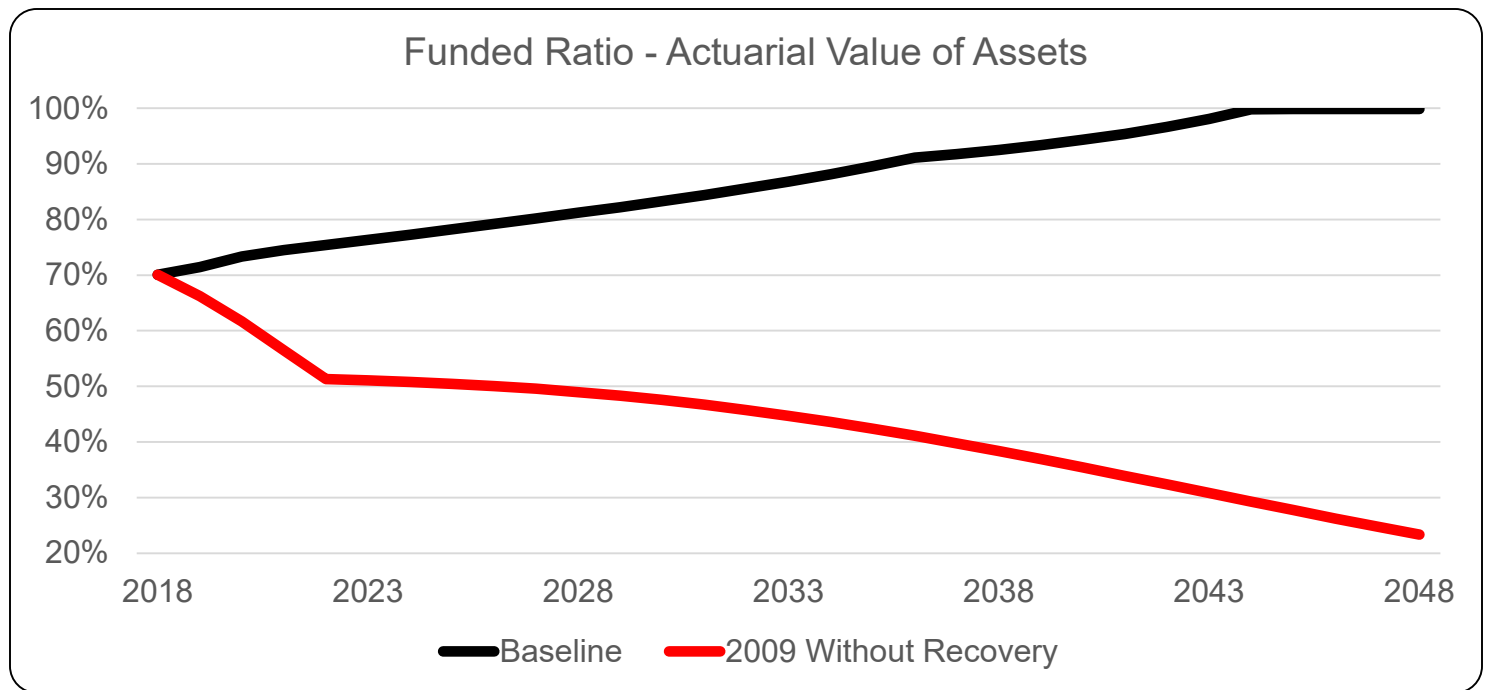
# Stress Testing

## Low Returns for Sustained Period

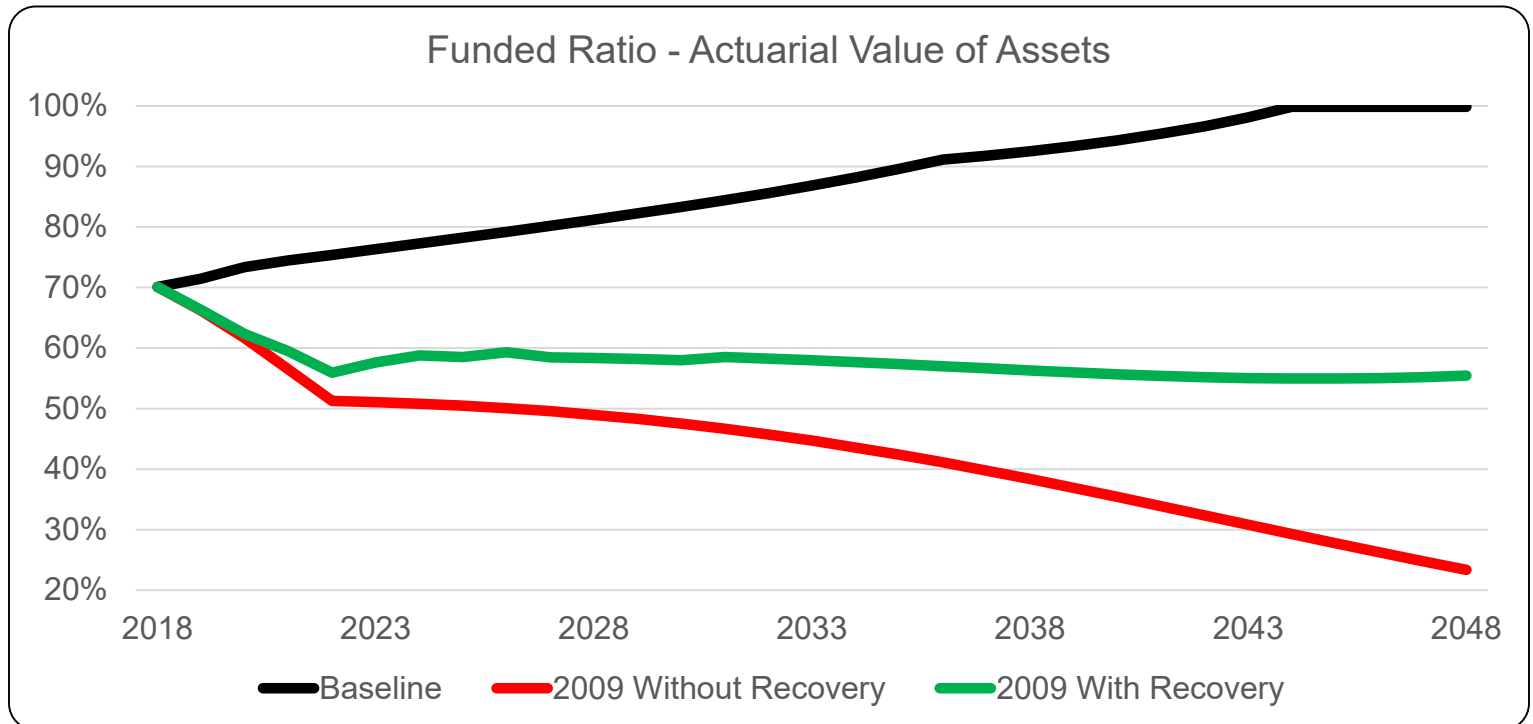
Low returns over the next 10 years reduce the funded ratio until 2030. Ultimately, the difference is eliminated and reversed as the higher investment returns result in a higher funded ratio at the end of the period.



Without the recovery, the funded ratio drops for the entire period projection period.



The green line shows that the recovery in the financial markets helps to reverse the declining funded ratio but still does not produce an ideal result in which the funded ratio begins to improve.



# Stochastic Analysis

- Stochastic modeling is the most sophisticated analysis available for investment return impact
- Produces a distribution of possible returns, directly reflecting the impact of investment return volatility on pension funding over time
- Often used by investment consultants in asset/liability studies
- More complex and, therefore, more difficult to understand

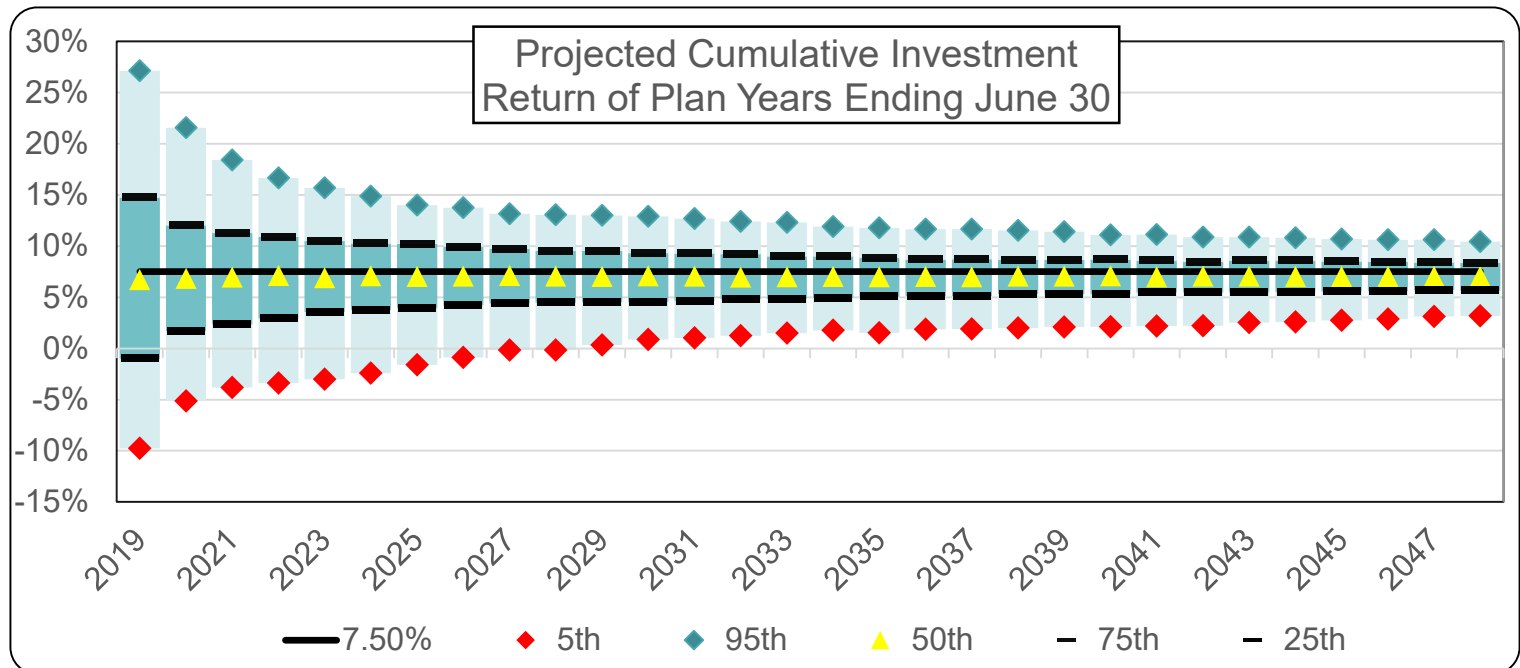
# Stochastic Analysis

Probability of funded ratio being lower than a certain threshold at any time during the projection period.

	Ratio <40%	Ratio <50%	Ratio <60%	Ratio <70%	Ratio <80%
2018 – 2023	0%	2%	13%	33%	61%
2018 – 2028	5%	13%	24%	38%	51%
2018 – 2033	13%	21%	31%	41%	52%

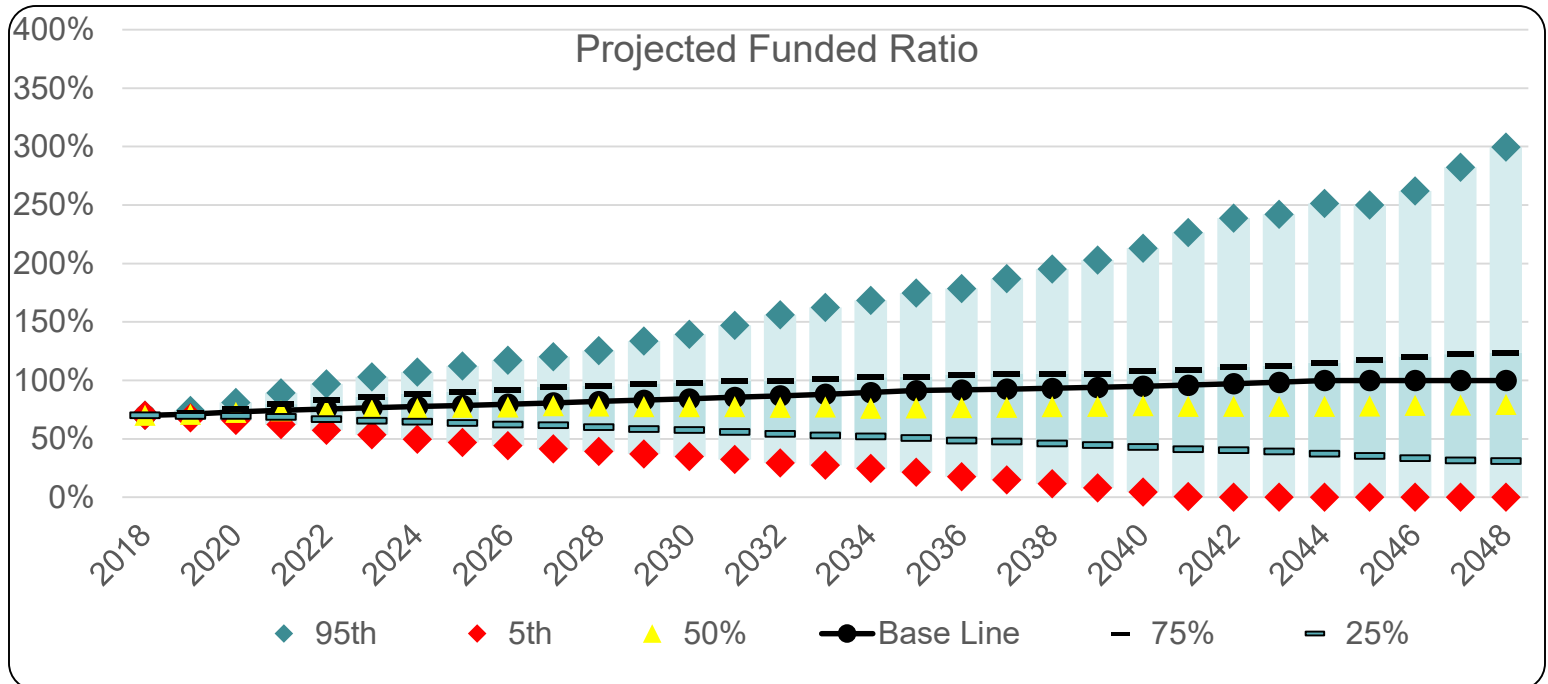
# Stochastic Analysis

The chart below is based on the capital market assumptions of the investment professionals serving the System. We utilize those assumptions to produce the percentile ranks of expected returns over 30 years. The analysis indicates that over the next 30 years there is a 50% chance the cumulative market returns over the next 30 years will be between 5.64% and 8.36%. The 50<sup>th</sup> percentile cumulative investment return over the next 30 years is 7.02% which is less than the current assumed rate of return which is 7.50%.



# Stochastic Analysis

The median funded ratio tends to remain less than baseline deterministic scenario over the projection period. If the period was extended past 30 years, the 50<sup>th</sup> percentile would most likely achieve the same pattern as the baseline deterministic projection. This graph indicates that in 10 years, the middle 50% of possible outcomes are between 75% and 109% funded. There is a 5% chance of being more than 138% funded, and a 5% chance of being less than 56% funded.





# Stochastic Analysis

The median negative cash flow tends to -5.0% over the next 30 years. This is a contributing factor to the fact that the median funded ratio is 80% in the projected funded ratio chart on the previous page.

