



**Cavanaugh Macdonald**  
CONSULTING, LLC

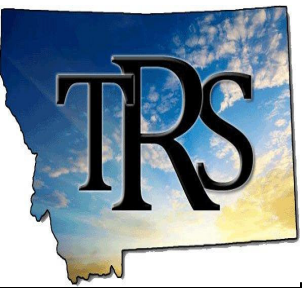
*The experience and dedication you deserve*

## **Montana Teachers' Retirement System**

**Experience Study Results**  
**Five-Year Period Ending June 30, 2021**  
**Presented May 13, 2022**

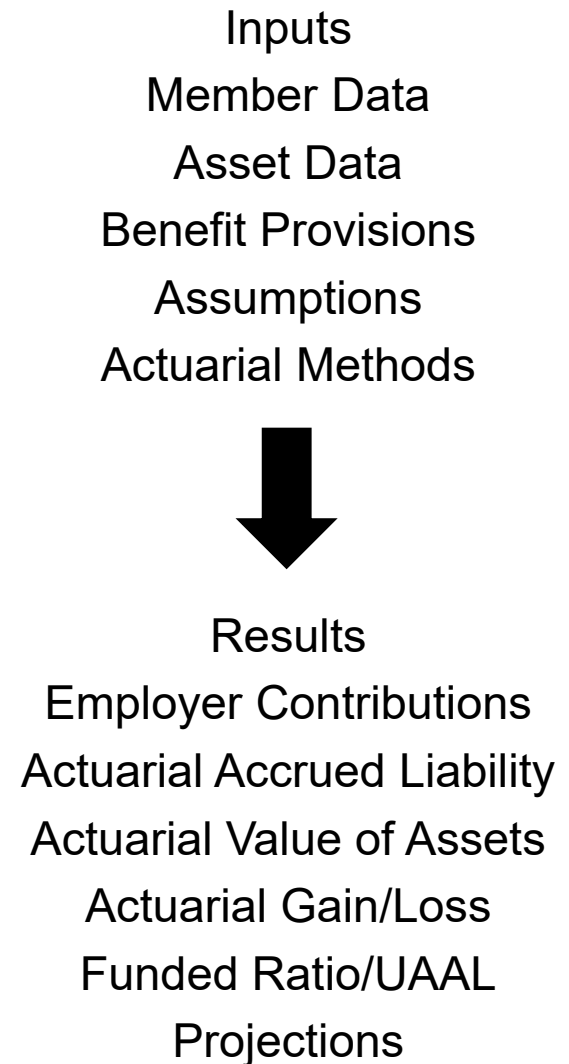
**Todd B. Green ASA, EA, FCA, MAAA**  
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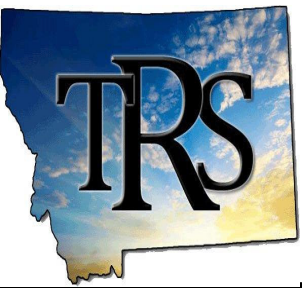




# Actuarial Valuations

- The Actuarial Valuation process uses various inputs to develop various results
- Over the short term, contributions determined by the actuarial valuation are based upon estimated investment returns, benefits and expenses, which utilize assumptions and the Actuarial Methods (Funding Policy) recommended by the actuary and adopted by the Board
- Over the long term, contributions are adjusted to reflect actual investment returns, benefits and expenses





# Actuarial Valuations



- Best estimate of ultimate costs
  
- Requires use of assumptions to estimate benefit payouts
  - When?
  - How much?
  - How long?
  
- Assumptions should represent the best estimate of future experience
  
- Each assumption should be individually reasonable



# Actuarial Assumptions



- No “correct” assumptions
  - Blend of art and science
  - Range of acceptable assumptions
- More aggressive assumptions are more likely to generate actuarial losses in future years; more conservative assumptions are likely to generate actuarial gains
- Assumptions are long term estimates
  - Experience emerges short term
  - Year-to-year fluctuations expected
- Most powerful assumption is the investment return assumption
- Ultimate responsibility for selection of assumptions lies with the Board of Trustees



# Selection of Assumptions

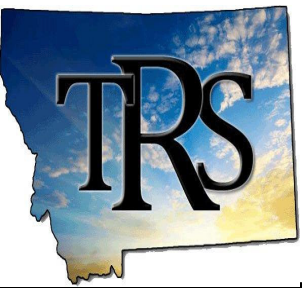


## **Economic**

- Investment Return
- Payroll Growth Rate
- Inflation
- Wage Inflation

## **Demographic**

- Retirement Rates
- Merit Pay Increases
- Disability
- Turnover
- Mortality



# Our Philosophy



- Do Not Overreact
  - Typically, we do not make significant changes in actuarial assumptions unless a major event causes changes in expectations.
  
- Anticipate Trends
  - If an identified trend is expected to continue, like improved retiree mortality experience, then our assumptions should reflect these anticipated trends.
  
- Simplify
  - We identify which factors are significant and eliminate the ones that will not have a material impact on results.



# Actuarial Assumptions

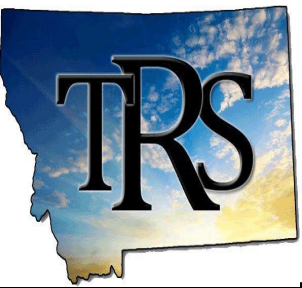
- Used to forecast future contingent events that impact the timing and amount of benefit payments
- Assumptions are long term estimates
  - Experience emerges short term
  - Year to year fluctuations expected
- Should be “best guess” based on both:
  - Past history (actual experience)
    - Strong indicator for some assumptions like mortality
    - Less valuable for other assumptions
  - Future expectations
- Should be explicit – each assumption is individually reasonable and best estimate



# Demographic Assumptions

- Assumptions Reviewed
  - Rates of Withdrawal
  - Rates of Pre-Retirement Mortality
  - Rates of Disability Retirement
  - Rates of Service Retirement
  - Rates of Post-Retirement Mortality
  - Rates of Salary Increase
  
- Actuarial Standard of Practice (ASOP) No. 35, *“Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations”*, which provides guidance to actuaries in selecting demographic assumptions for measuring obligations under defined benefit plans.

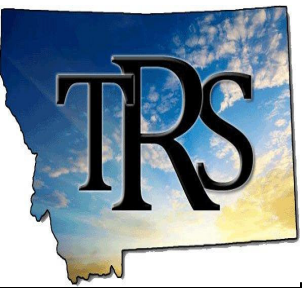




# Demographic Assumptions



- Study compares what actually happened during the study period (7/1/2016 through 6/30/2021) with what was expected to happen.
- Assumption changes recommended if actual experience differs significantly from expected.
- Judgment required to extrapolate future experience from past experience.



# Measuring Demographic Experience (Count vs Liability Basis)

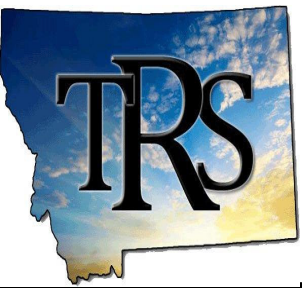


## Count Basis

- **Step 1:** Determine number of members changing membership status (decrements) during study period, tabulated by groupings that may include age, duration, gender and plan
- **Step 2:** Determine number of members expected to change status by multiplying membership statistics (called exposures) by the expected rates of decrement
- **Step 3:** Compare number of actual decrements to number of expected decrements, called the Actual to Expected Ratio (expressed as %)

## Liability Basis

- Same steps as Count Basis, but results are based on the estimated liability of members instead of the count of members



# Demographic Assumptions

- Compare what actually happened to individual members with what was expected to happen based on the actuarial assumptions
- Assess credibility – amount of weight assigned to the recent experience
  - Length of study period
  - Unusual events during study period
  - Size of the group
- Key evaluation tool is actual decrements/expected decrements (called *Actual/Expected* or *A/E ratio*)
  - “Decrement” is a change in the member’s status (e.g., retirement, termination, death)



# Measuring Demographic Experience (Example)



- 10 members eligible to retire at age 62
- Actuarial assumption is 10% retire at age 62

<u>Count</u>	<u>Salary</u>	<u>Service</u>	<u>Liability Weighted</u>
8	\$ 20,000	5	\$ 800,000
<u>2</u>	80,000	20	<u>3,200,000</u>
10			4,000,000

- Actual Experience: 1 member with \$80,000 and 20 years retires

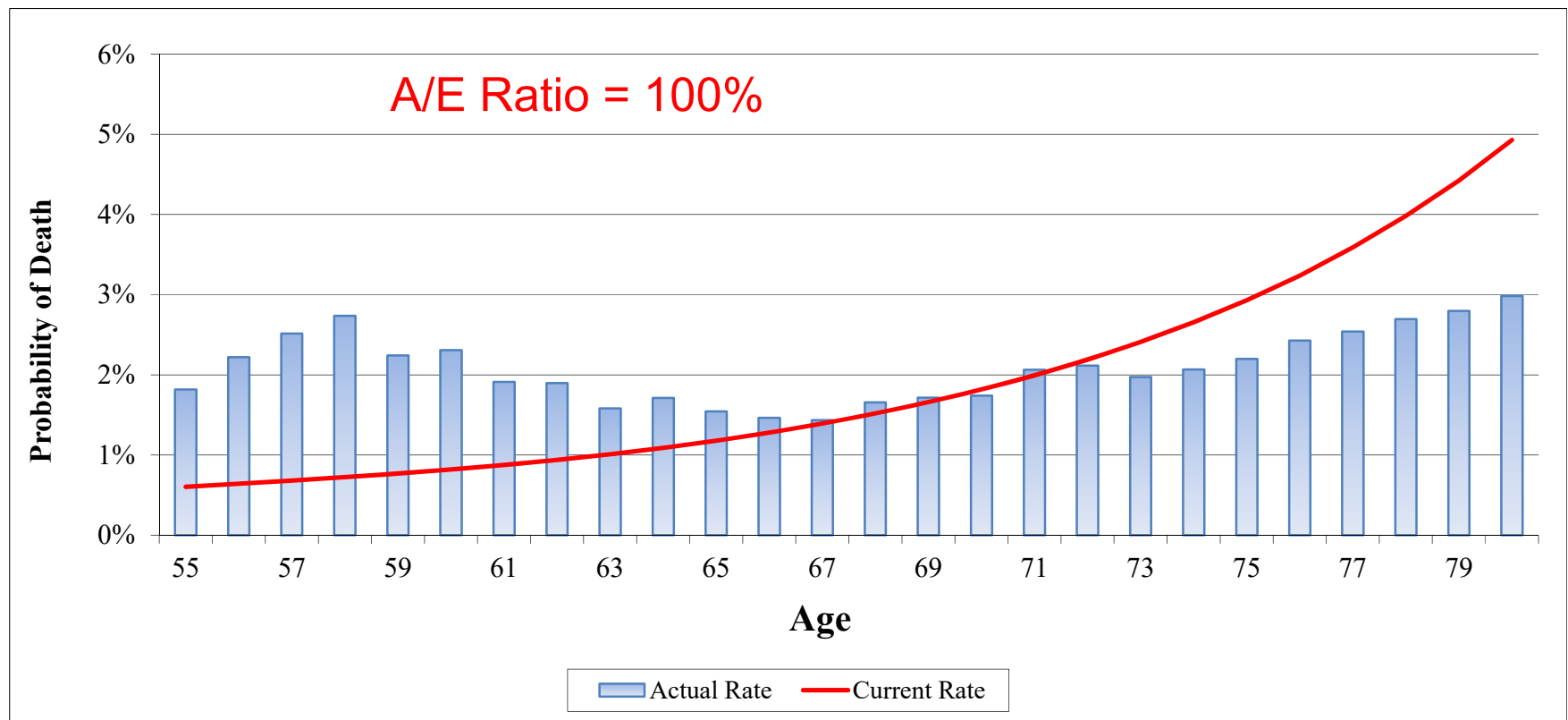
	<u>Count Basis</u>	<u>Liability Weighted</u>
Exposure	10	\$4,000,000
Expected Decrement	1	400,000
Actual Decrement	1	1,600,000
Actual/Expected Ratio	100%	400%

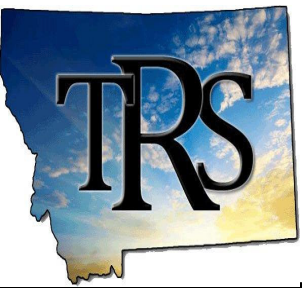


# Evaluating the Results of Demographic Experience



- Generally, the closer the Actual/Expected ratio is to 100%, the better the current assumption anticipated the overall experience. However, the pattern of the actual experience may vary significantly from the assumption indicating a need for change.





# Demographic Assumptions (Withdrawal Rates)



- Rates of Withdrawal
  - Used to determine the expected number of separations from active service that will occur prior to becoming eligible for retirement as a result of resignation or dismissal
  - Studied separately for full-time/part-time members without regard to gender and based on years of service
  - Liability weighted analysis performed
    - Members who have a higher liability have a larger impact on the gains and losses that occur in the annual valuation
    - Studied on a liability basis using compensation and service as a proxy for the member's liability



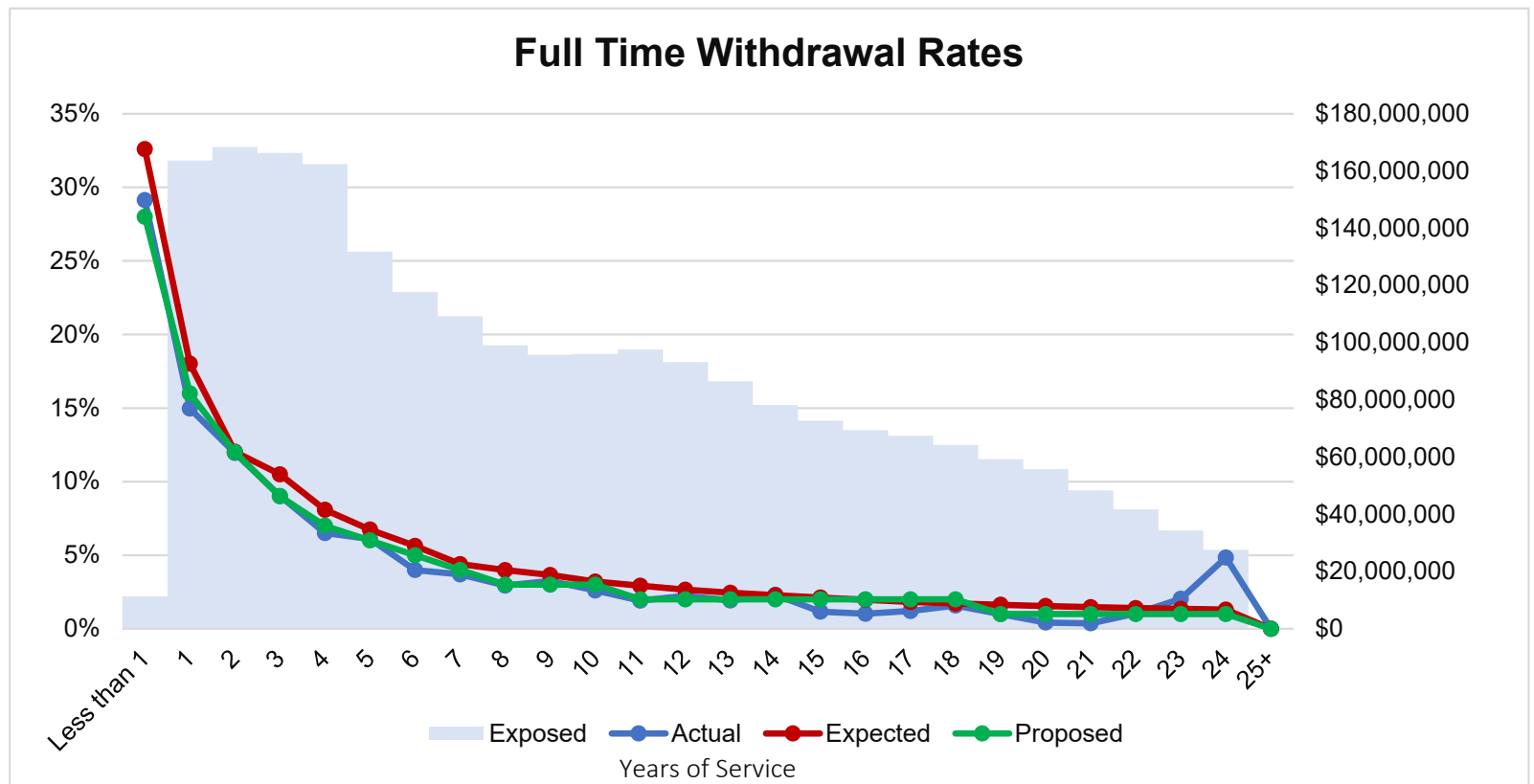
# Demographic Assumptions (Withdrawal Rates)



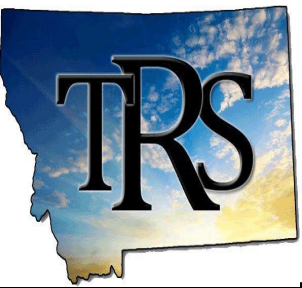
- Rates of Withdrawal
  - During the experience period, the current assumption overestimated the expected number of withdrawals for member with less than 12 years of service.
  - Recommend updating the withdrawal assumption to reflect recent experience
  - A/E ratio under current assumptions
    - Full Time - 85%
    - Part Time – 78%
  - A/E ratio under proposed assumptions
    - Full Time – 96%
    - Part Time – 95%



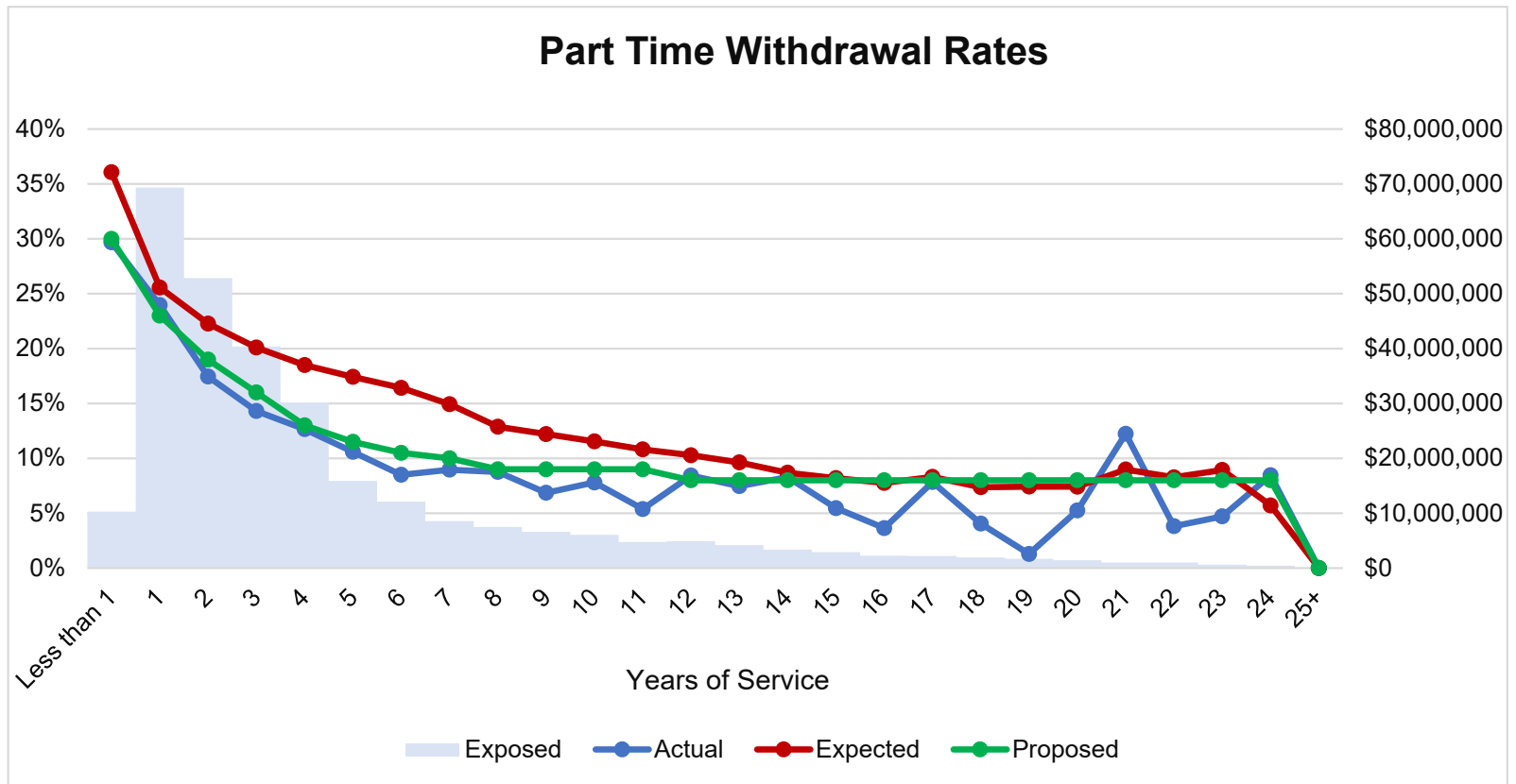
# Demographic Assumptions (Withdrawal Rates)

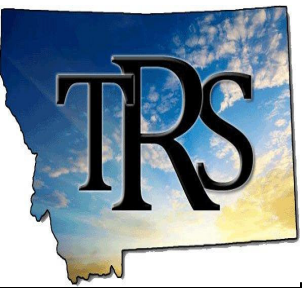






# Demographic Assumptions (Withdrawal Rates)



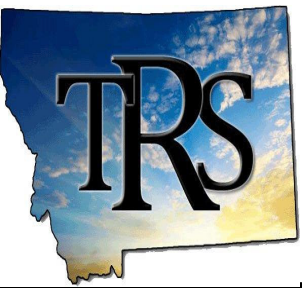


# Demographic Assumptions (Disability Retirements)

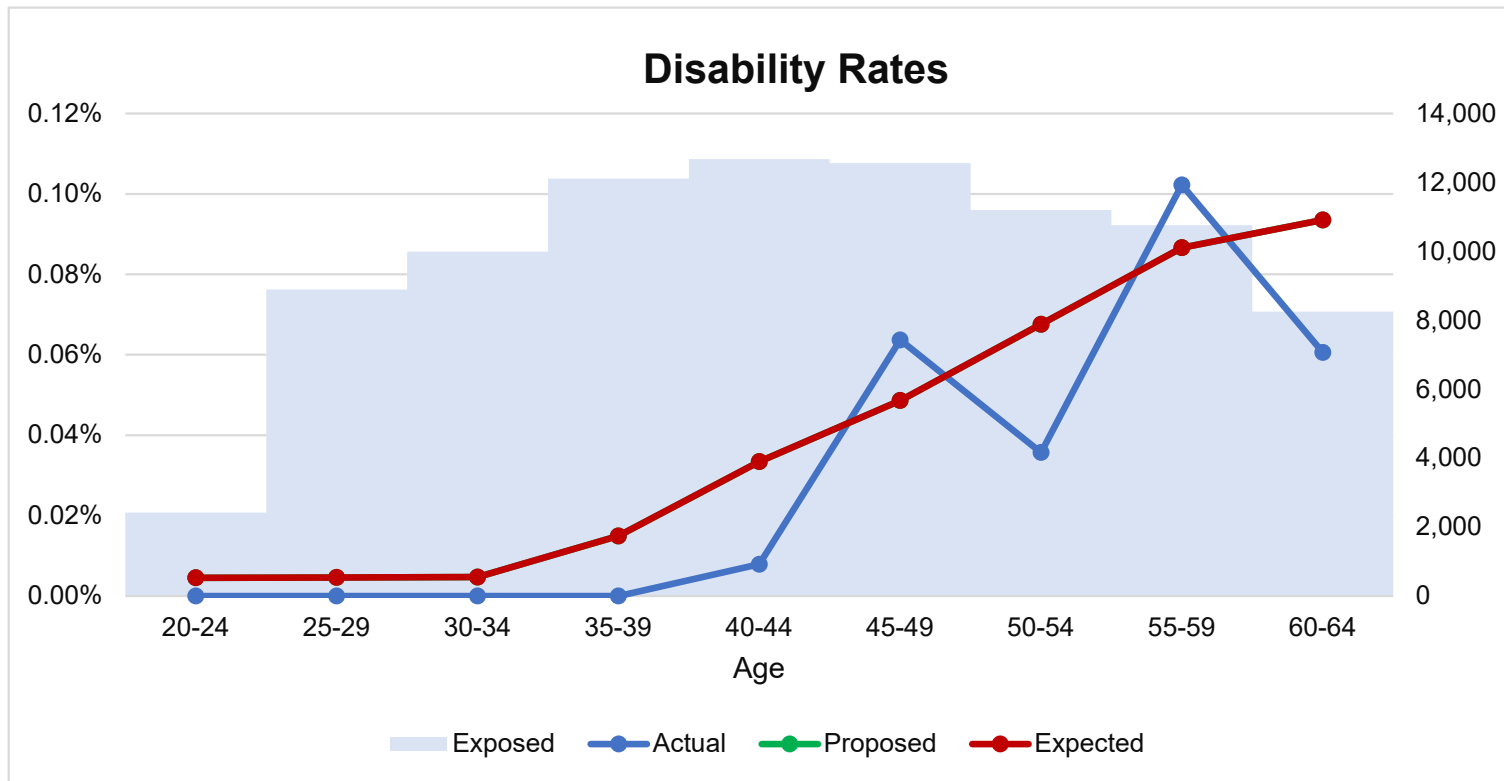


## ➤ Rates of disability

- Used to determine the expected number of members who will become disabled during the year
- Studied based on age
- Headcount weighted analysis performed
- A/E ratio under current assumptions – 73%
- Current assumption overestimated the number of disability retirements. If we combine current experience with experience from two prior experience studies, the total number of disability retirements was 103 compared to the expected number of disability retirements which was 117. The A/E ratio on this basis is 88%.
- Over the short-term, the assumption overestimated the number of retirements, but over longer experience periods, the assumption has been a closer estimate of actual experience. In general, there is not enough information to warrant revising assumed disability retirements at this time.



# Demographic Assumptions (Disability Retirements)





# Demographic Assumptions (Service Retirements)



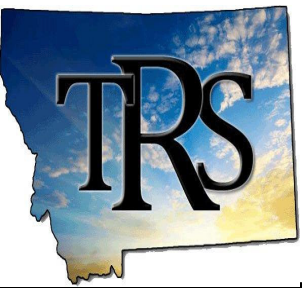
- Rates of Retirement
  - Used to determine the expected number of retirements from active service that will occur after becoming eligible for retirement
  - Studies without regard to gender and based on age and years of service
  - Liability weighted analysis performed
    - Members who have a higher liability have a larger impact on the gains and losses that occur in the annual valuation
    - Studied on a liability basis using compensation and service as a proxy for the member's liability



# Demographic Assumptions (Service Retirements)



- Rates of retirement
  - Tier One
    - Unreduced retirement
      - Age 60 with 5 years of service
      - 25 years of service
    - Reduced Retirement
      - Age 50 with 5 years of service
  - Tier Two
    - Unreduced retirement
      - Age 60 with 5 years of service
      - Age 55 with 30 years of service
    - Reduced Retirement
      - Age 55 with 5 years of service



# Demographic Assumptions (Service Retirements)



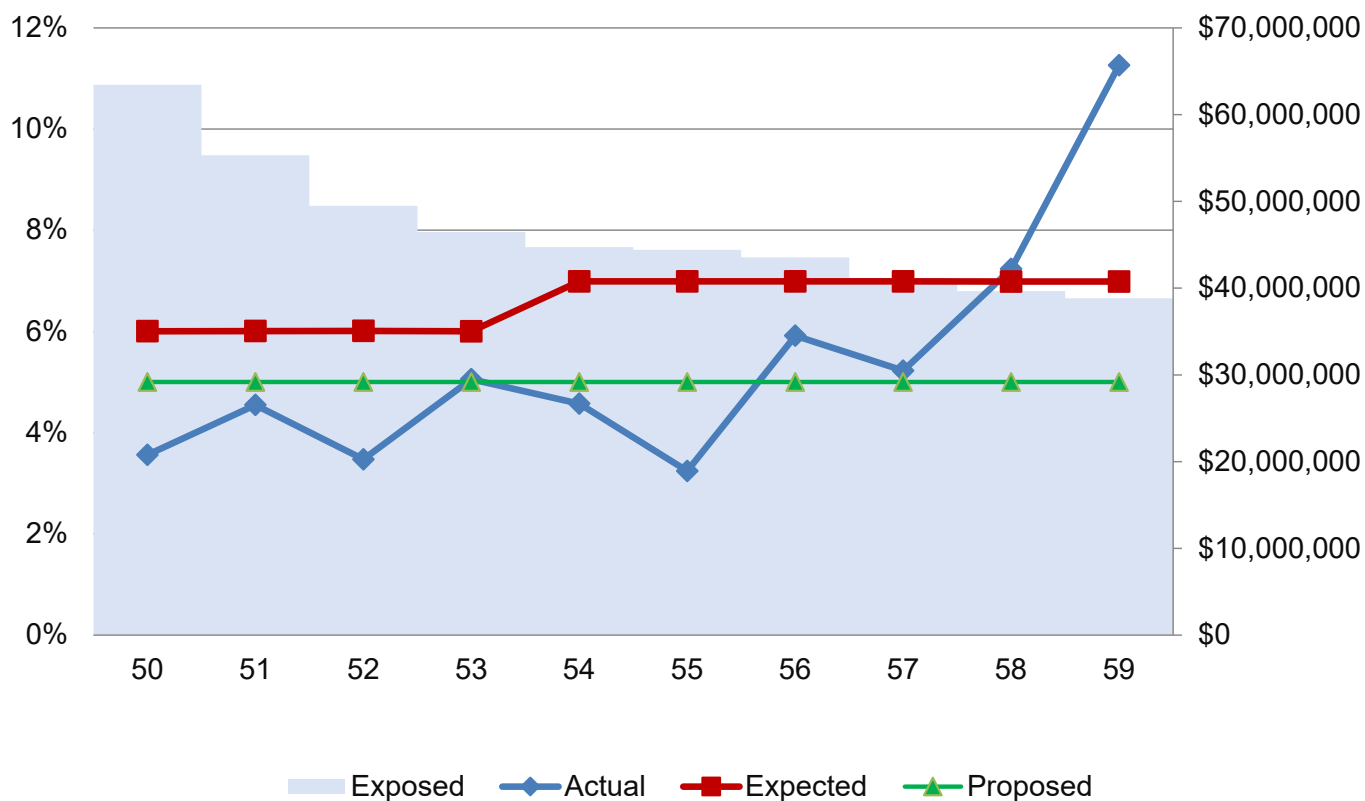
- Rates of retirement
  - Studied in the following groups
    - Unreduced retirement (first eligibility)
    - Unreduced retirement (beyond first eligibility)
    - Reduced Retirement
  - A/E ratio under current assumptions
    - Unreduced retirement (first eligibility) – 85%
    - Unreduced retirement (beyond first eligibility) – 104%
    - Reduced Retirement – 80%
  - A/E ratio under proposed assumptions
    - Unreduced retirement (first eligibility) – 95%
    - Unreduced retirement (beyond first eligibility) – 98%
    - Reduced Retirement – 104%



# Demographic Assumptions (Service Retirements)



### Retirement with Reduced Benefits

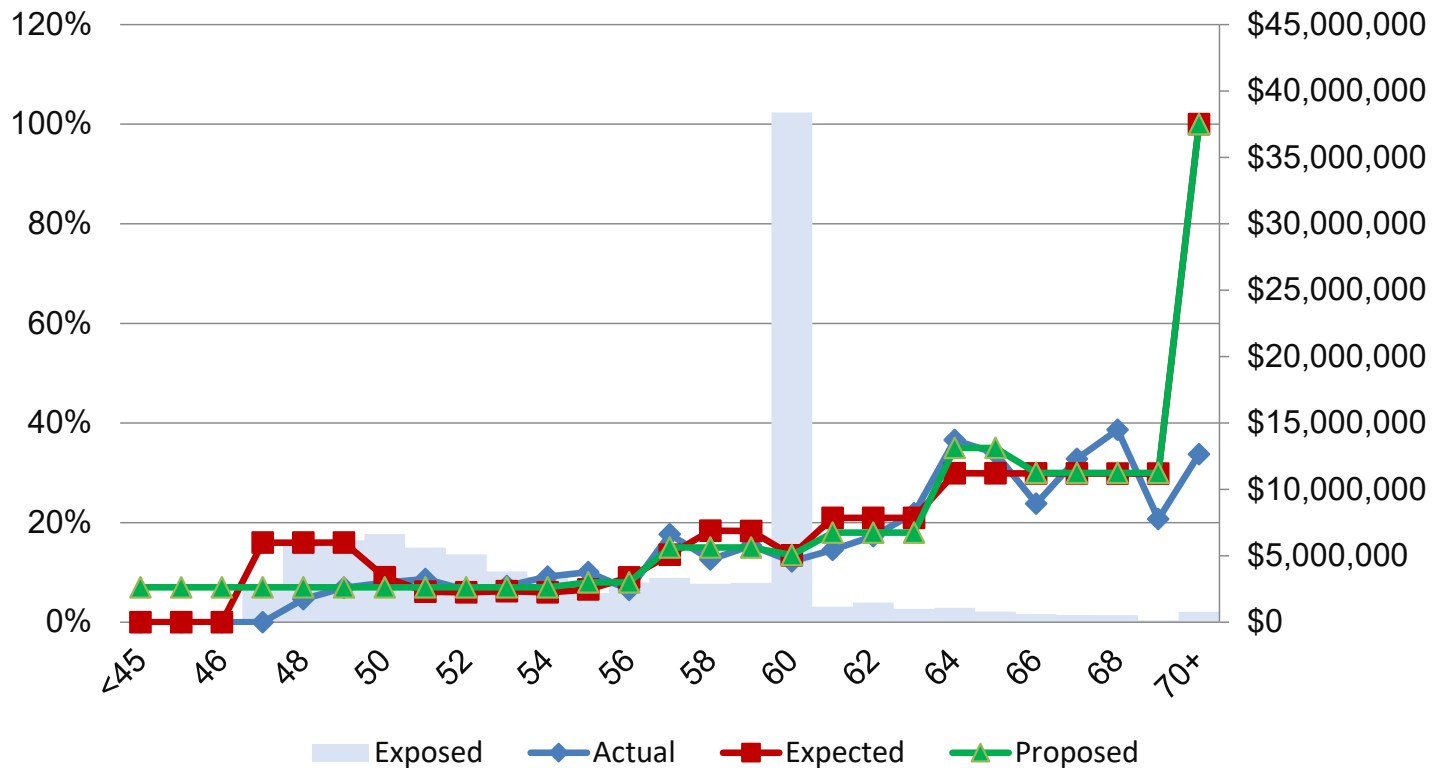




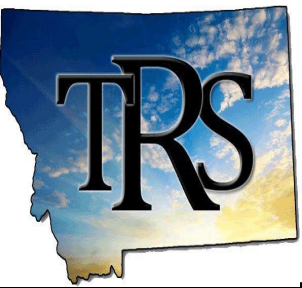
# Demographic Assumptions (Service Retirements)



First Eligible for an Unreduced Benefit



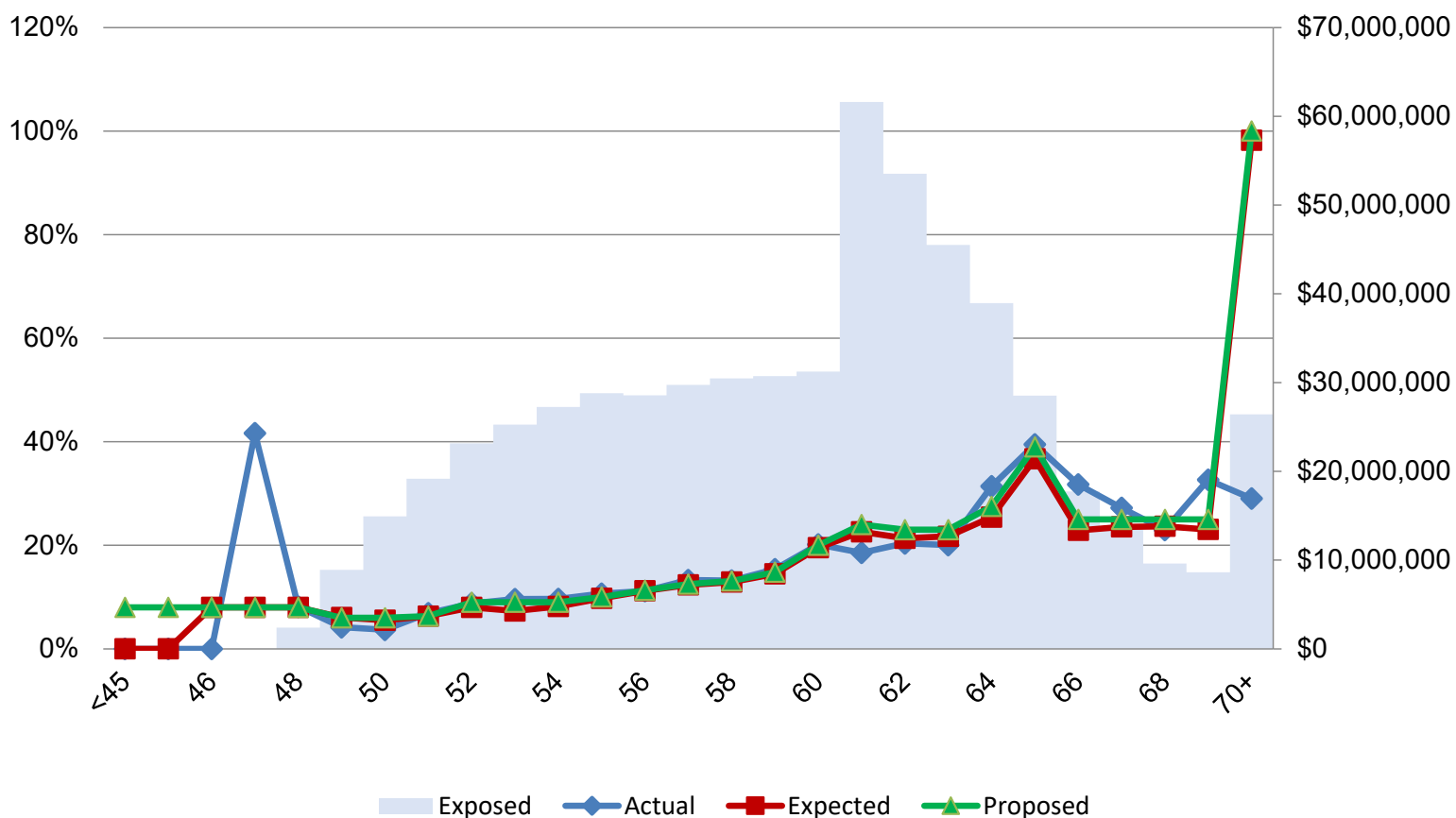


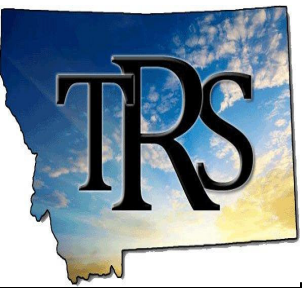


# Demographic Assumptions (Service Retirements)



### Beyond First Year Eligibility for Unreduced Benefit

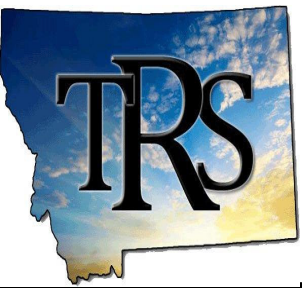




# Demographic Assumptions (Healthy Mortality)



- Rates of Pre- and Post-Retirement Mortality
  - Benefits are paid over a retiree's life; therefore, it is important to accurately reflect the typical life expectancy
  - The mortality assumption is used to determine the number of deaths that will occur during the year
  - Studied based on gender and age
  - Liability weighted analysis performed using the retirees and beneficiary's retirement benefit as a proxy for liability
  - The Society of Actuaries recently released a set of mortality tables based solely on public plan data. The family of tables is called the Pub-2010 tables



# Demographic Assumptions (Mortality)



- Mortality table assumption must account for future improvements by either maintaining a margin for mortality improvement or by generationally projecting future improvements
- Recommend changes
  - Retiree Mortality: PubT-2010 Amount Weighted Healthy Retiree mortality table projected to 2021 adjusted 102% for males and 103% for females.
  - Contingent Survivor Mortality: PubT-2010 Amount Weighted Contingent Survivor mortality table projected to 2021
  - Disabled Retiree Mortality: PubT-2010 Disabled Retiree mortality table
  - Pre-Retirement Mortality: PubT-2010 Employee mortality table
  - Future improvement in mortality rates is reflected by applying the MP-2021 projection scale generationally except for disabled retiree mortality which is not generationally projected



# Demographic Assumptions (Healthy Mortality)



- Rates of Pre- and Post-Retirement Mortality
  - A/E ratios under current and proposed assumption

	Current Assumption		Proposed Assumption	
	Males	Female	Male	Female
Healthy Retirees	100%	100%	100%	102%
Contingent Survivors	173%	140%	122%	105%
Disabled Retirees	159%	168%	162%	184%

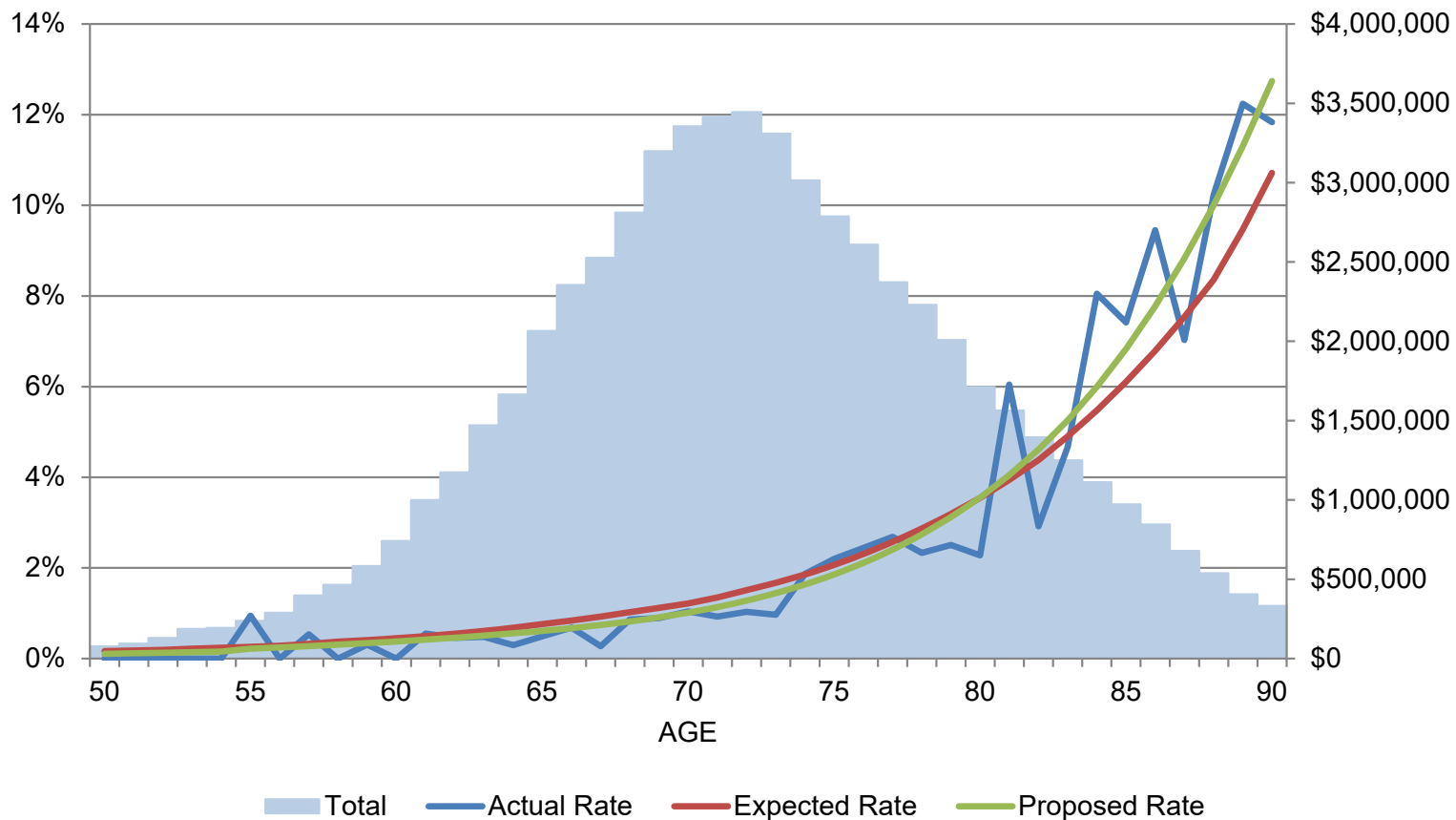
- Not enough experience to perform an analysis for deaths occurring to active employee, contingent survivors and disabled retirees therefore we have recommended the standard table without adjustment.

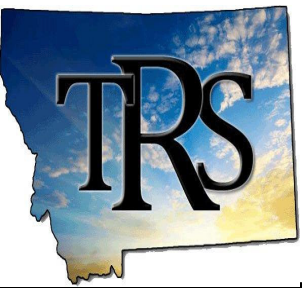


# Demographic Assumptions (Retiree Mortality)



### Male Retiree Mortality Rates

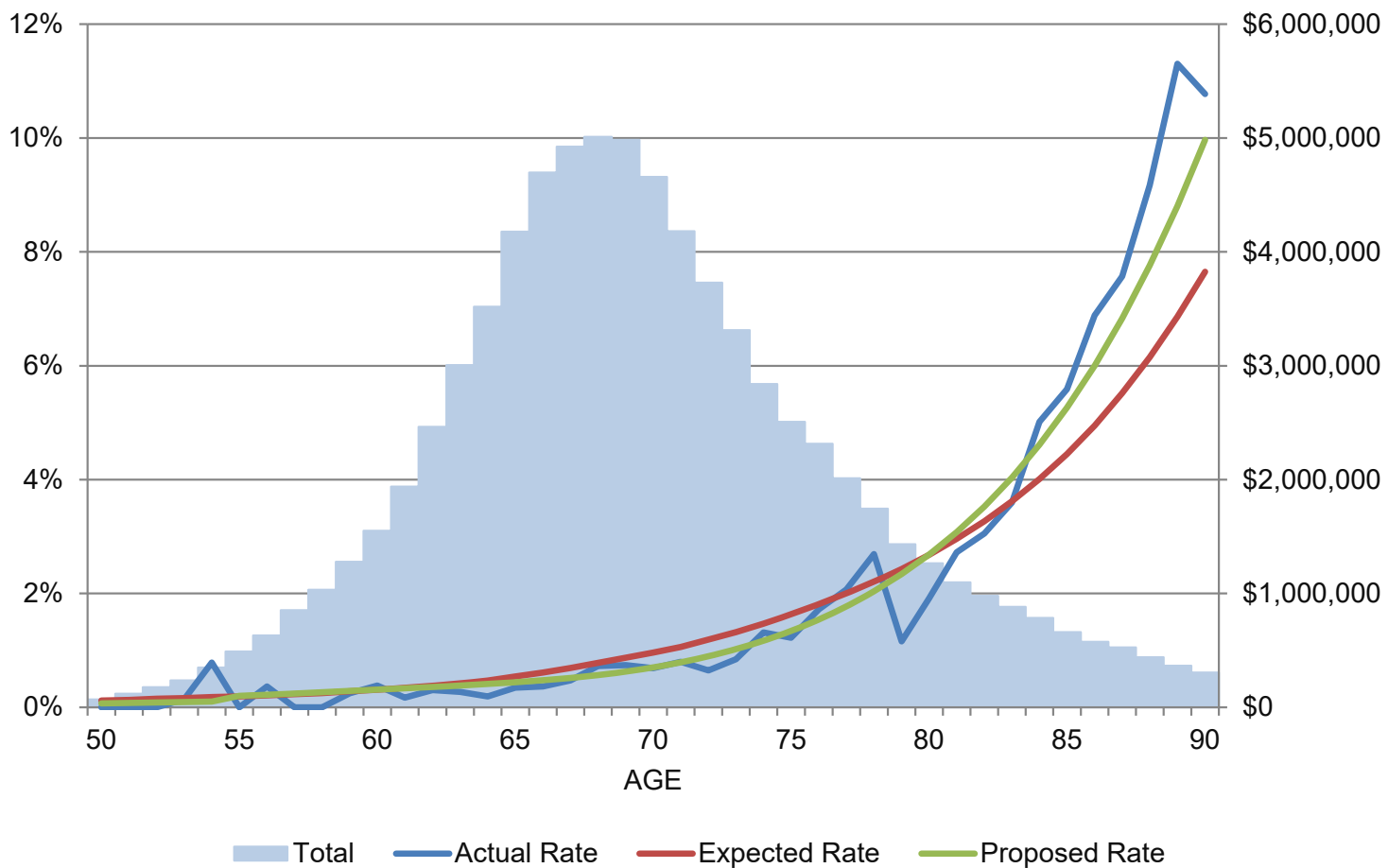




# Demographic Assumptions (Retiree Mortality)



### Female Retiree Mortality Rates





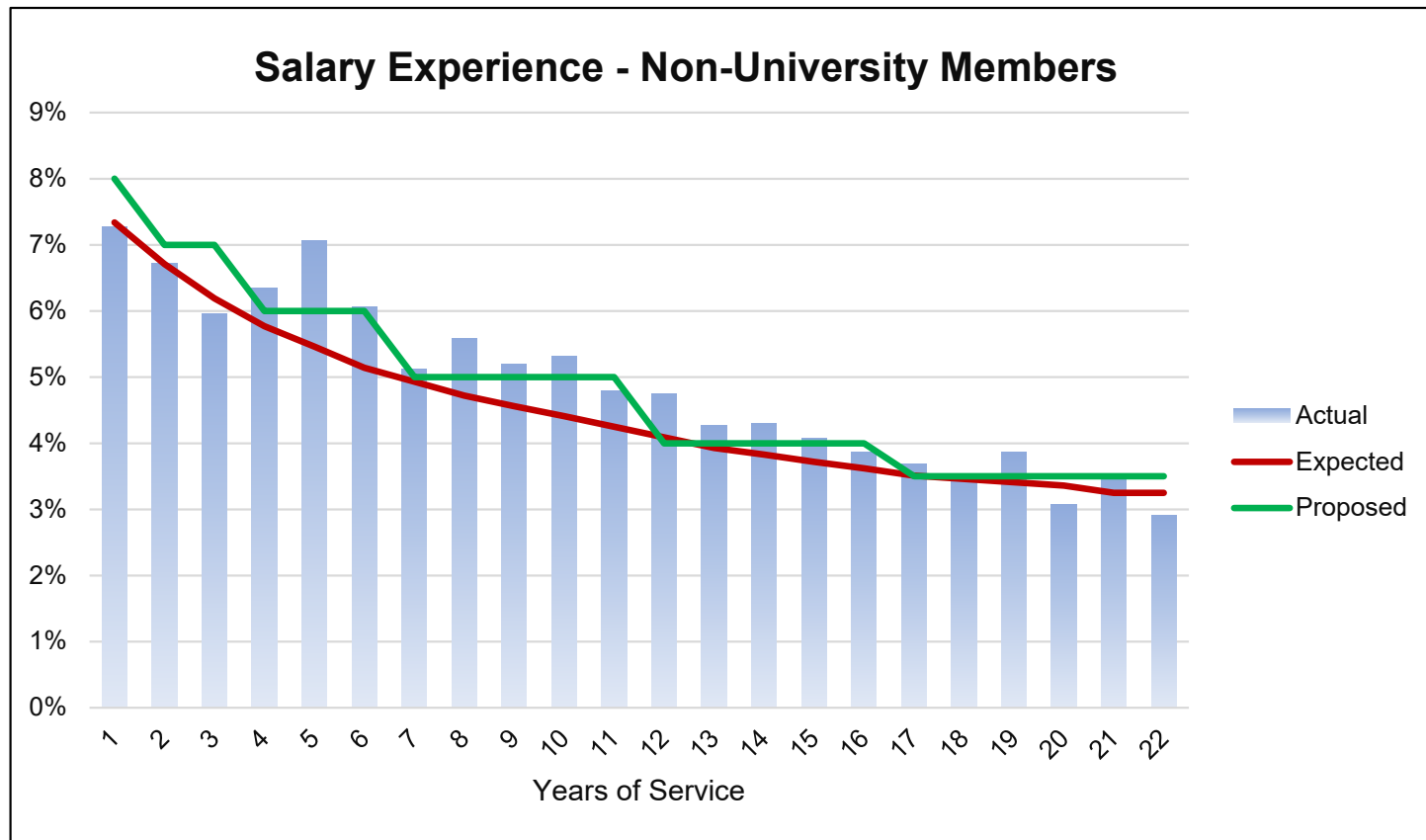
# Demographic Assumptions (Salary Increase Experience)



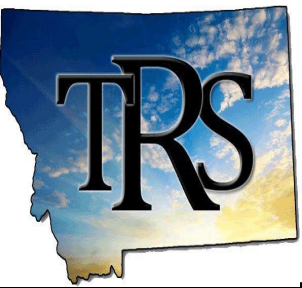
- Experience yielded an actual/expected ratio of 101% and 99% for non-university members and university members.
- Recommend adjustment to the merit component of the salary scales for non-university members to provide a better fit.
- The increase in real wage growth assumption (covered later) was reflected in the final salary scales.



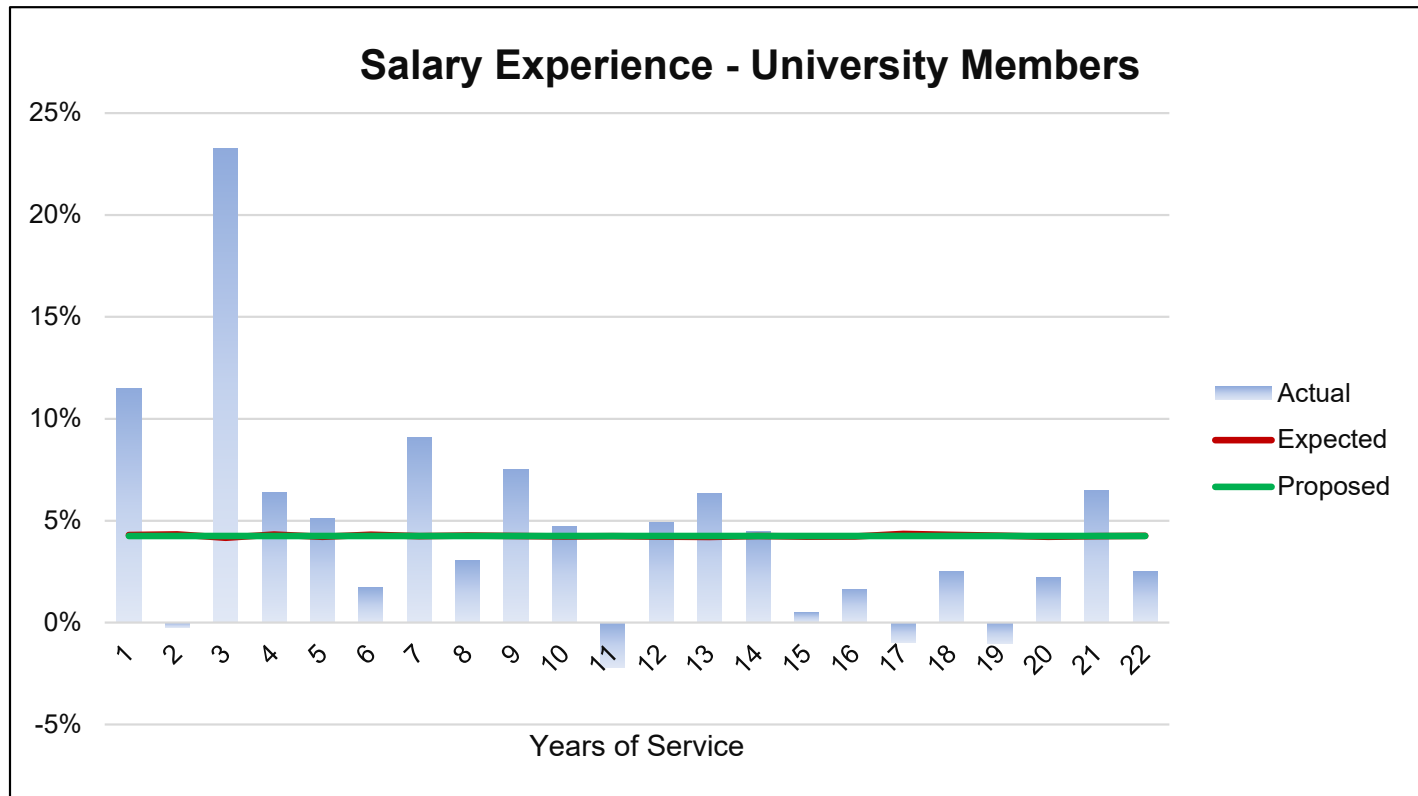
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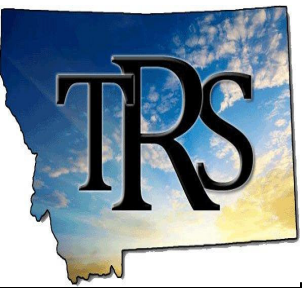






# Demographic Assumptions (Salary Increase Experience)

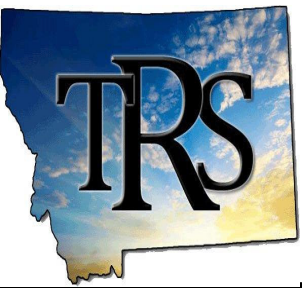




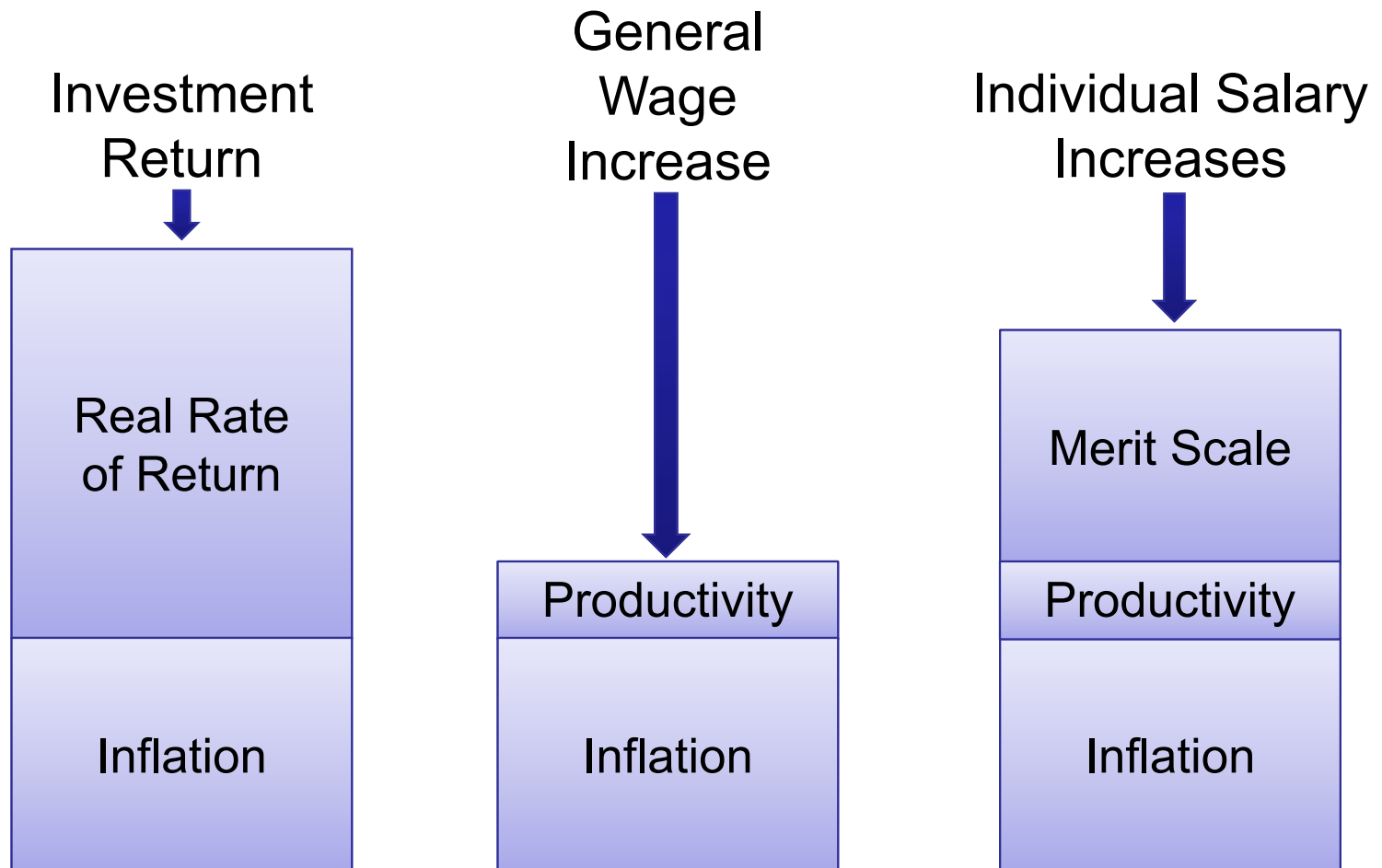
# Economic Assumptions

- Assumptions reviewed
  - Price inflation
  - Investment return
  - Wage inflation
- Actuarial Standard of Practice (ASOP) No. 27, “*Selection of Economic Assumptions for Measuring Pension Obligations*” provides guidance to actuaries in selecting economic assumptions for measuring obligations under defined benefit plans.
- Recommendations

Item	Current	Proposed
Price Inflation	2.50%	2.75%
Real Rate of Return	<u>5.00%</u>	<u>4.55%</u>
Investment Return	7.50%	7.30%
Price Inflation	2.50%	2.75%
Real Wage Growth	<u>0.75%</u>	<u>0.75%</u>
Wage Inflation	3.25%	3.50%



# Building Block Method is Used to Develop Economic Assumptions



Note: inflation assumption and productivity must be consistent in all assumptions.

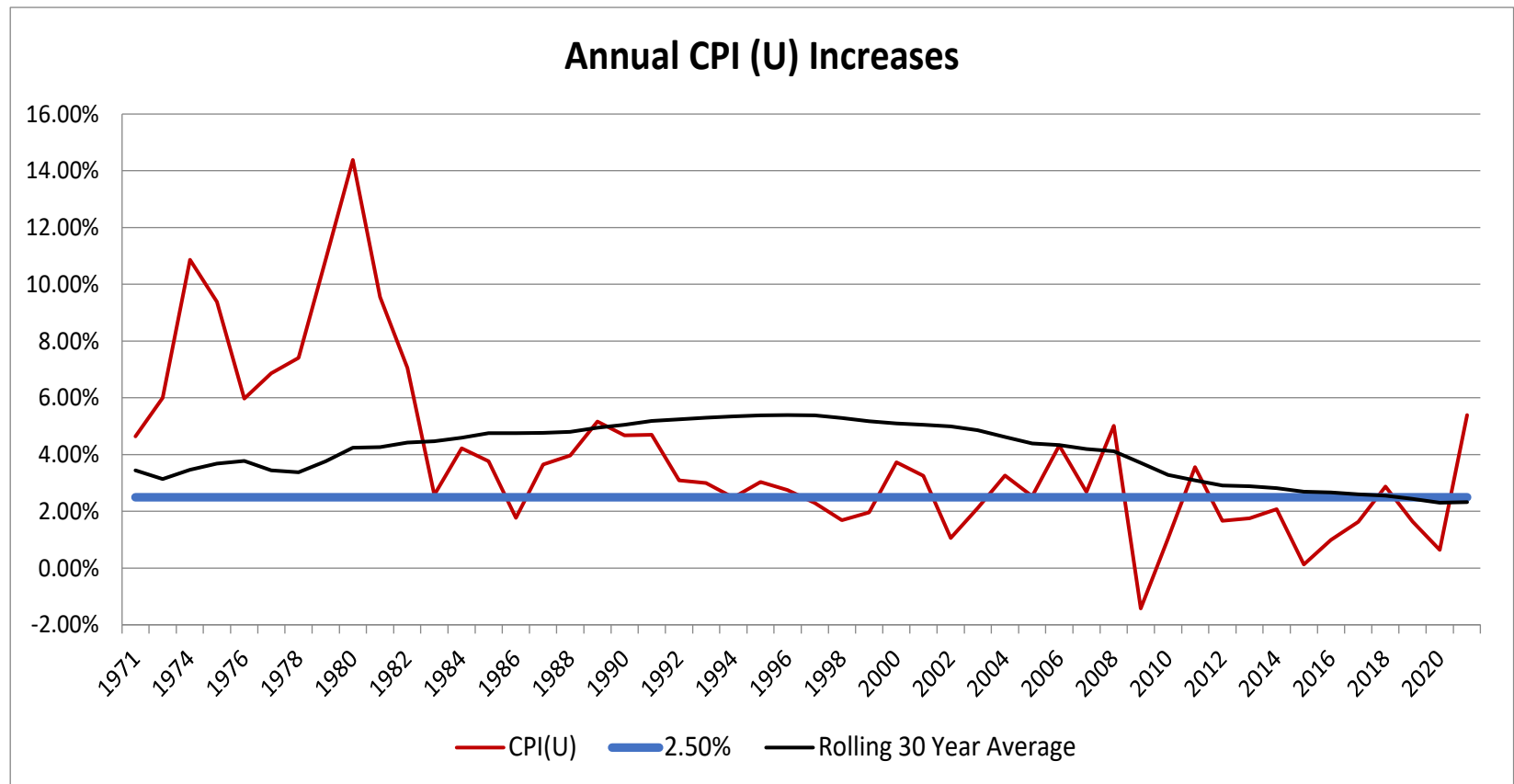


# Economic Assumptions

## Price Inflation



- Current assumption: 2.50%
- Historical data: Annual CPI (U) Increases





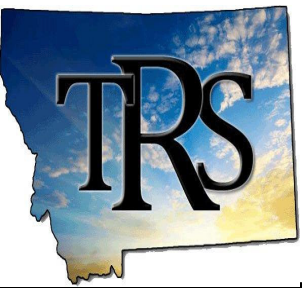
# Economic Assumptions

## Price Inflation



- Historical data: Annual CPI (U) Increases

Period	Average Annual Rate of Inflation
2016 – 2021	2.43%
2011 – 2021	1.87%
2001 – 2021	2.14%
1991 – 2021	2.33%
1981 – 2021	2.78%
1971 – 2021	3.88%
1961 – 2021	3.75%
1926 – 2021	2.90%



# Economic Assumptions

## Price Inflation



- Bond Market Expectation of Inflation as of March 31, 2022

Years to Maturity	Bond Nominal Yield	TIPS Nominal Yield	Breakeven Rate of Inflation
10	2.32%	-0.52%	2.84%
20	2.59%	-0.20%	2.79%
30	2.44%	-0.03%	2.47%



# Economic Assumptions

## Price Inflation



➤ Recommendation:

Price Inflation Assumption	
Current	2.50%
Recommended	2.75%



# Economic Assumptions

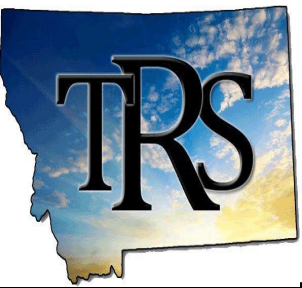
## Investment Return



### ➤ Current Assumption

- |   |              |
|---|--------------|
| ▪ Price inflation                           | 2.50%        |
| ▪ Real rate of return                       | <u>5.00%</u> |
| ▪ Total return (net of investment expenses) | 7.50%        |

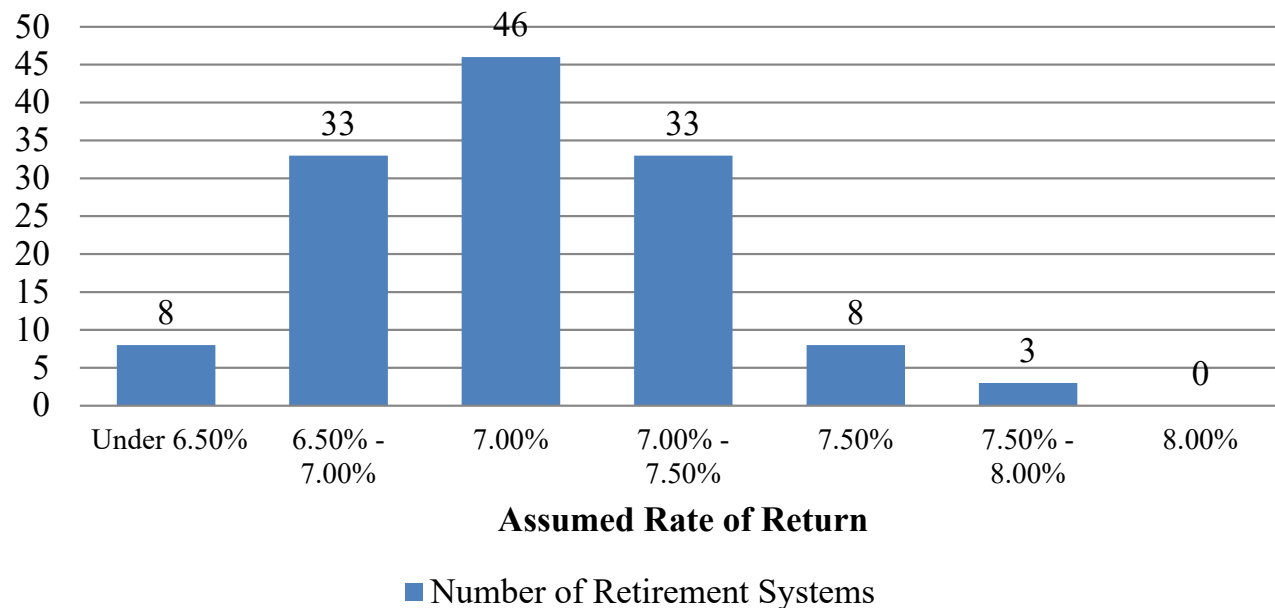




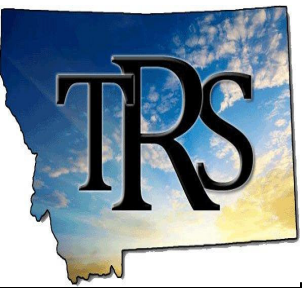
# Economic Assumptions Investment Return



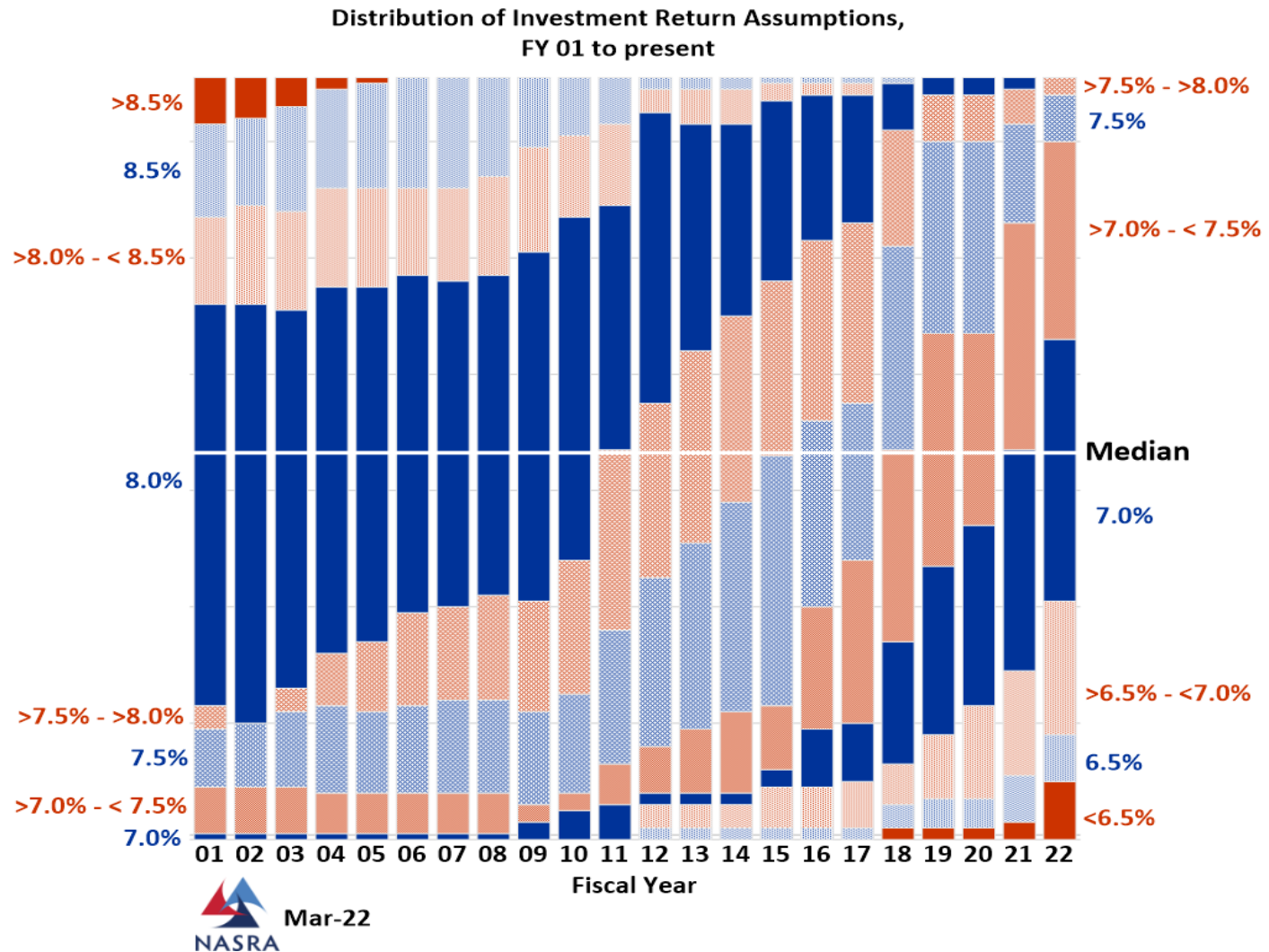
**NASRA Issue Brief: Public Pension Plan Investment  
Return Assumption**



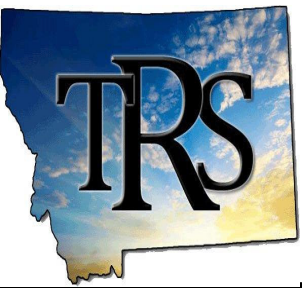
The average assumed rate of return among Public Retirement Systems is 7.00% according to the February 2021 NASRA Issue Brief: “Public Pension Plan Investment Return Assumptions”



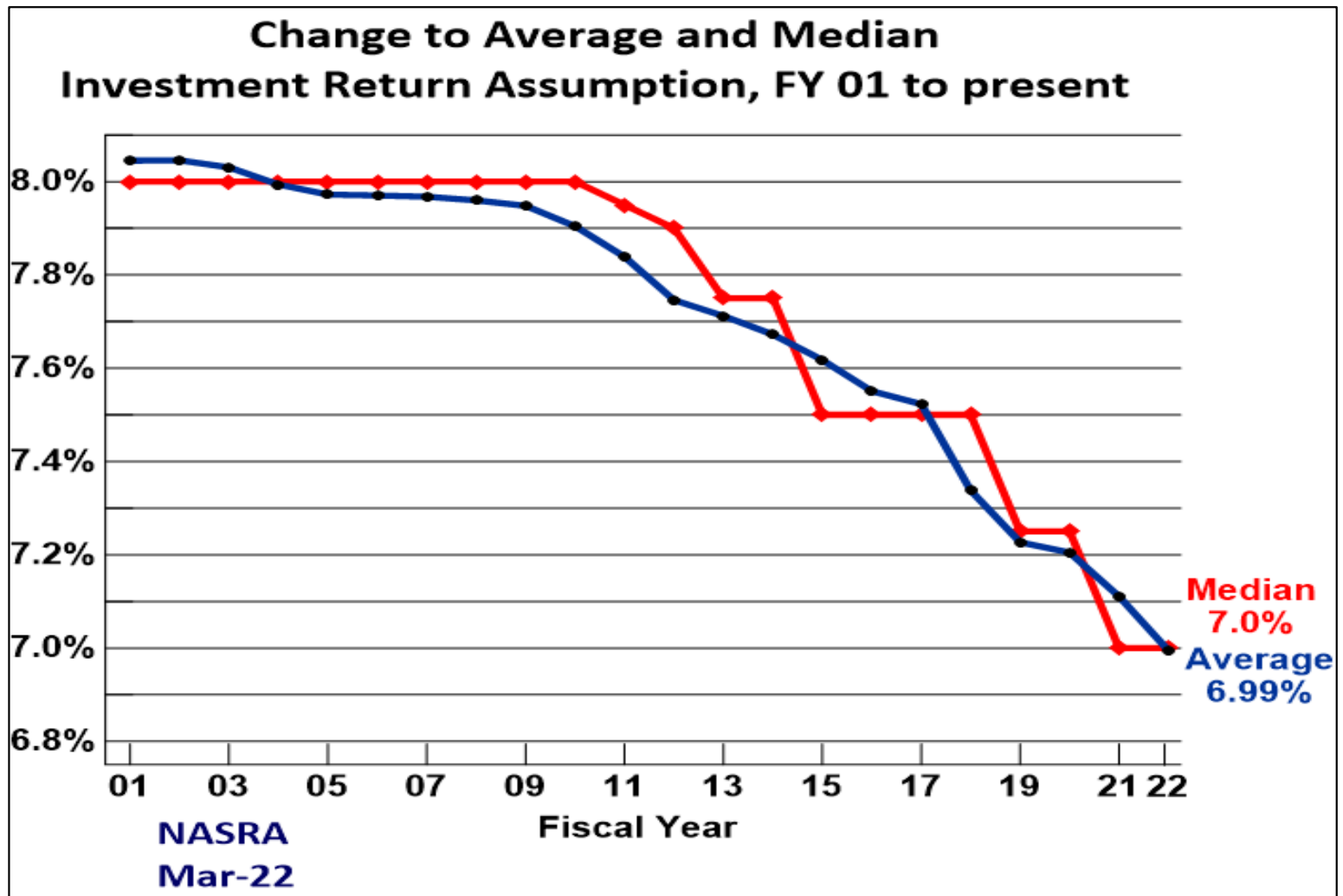
# Economic Assumptions Investment Return



The median assumed rate of return among Public Retirement Systems has been trending down for the past decade.



# Economic Assumptions Investment Return





# Economic Assumptions

## Investment Return



### ➤ Recent Experience

Nominal Total Rate of Return					
Year Ending 6/30	Market Value	Actuarial Value	Year Ending 6/30	Market Value	Actuarial Value
2002	(7.3)%	3.8%	2012	2.2%	3.2%
2003	6.2%	1.6%	2013	12.9%	12.0%
2004	13.3%	2.1%	2014	17.1%	13.2%
2005	8.0%	2.7%	2015	4.6%	9.6%
2006	8.9%	8.5%	2016	2.1%	8.8%
2007	17.6%	10.2%	2017	11.9%	8.2%
2008	(4.9)%	7.2%	2018	8.8%	6.9%
2009	(20.8)%	(10.3)%	2019	5.7%	7.0%
2010	12.9%	9.8%	2020	2.7%	7.0%
2011	21.7%	(0.1)%	2021	27.7%	10.7%



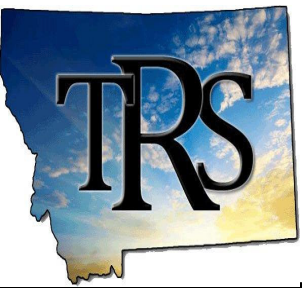
# Economic Assumptions

## Investment Return



➤ Recent Experience

Nominal Total Rate of Return		
Year Ending 6/30/2021	Market Value	Actuarial Value
<b>20 Year Avg.</b>	<b>7.0%</b>	<b>6.0%</b>
<b>15 Year Avg.</b>	<b>7.5%</b>	<b>6.7%</b>
<b>10 Year Avg.</b>	<b>9.3%</b>	<b>8.6%</b>
<b>5 Year Avg.</b>	<b>11.0%</b>	<b>8.0%</b>



# Economic Assumptions

## Investment Return



- Stochastic projection expected range of real rates of return, net of expenses (Horizon Survey)

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	95 <sup>th</sup>
1	5.40%	12.58%	-13.94%	-3.41%	4.66%	13.40%	27.27%
5	4.81%	5.58%	-4.11%	0.97%	4.66%	8.48%	14.23%
10	4.73%	3.94%	-1.62%	2.04%	4.66%	7.35%	11.34%
20	4.69%	2.79%	0.18%	2.80%	4.66%	6.55%	9.34%
30	4.68%	2.27%	0.99%	3.14%	4.66%	6.20%	8.46%
50	4.67%	1.76%	1.80%	<b>3.48%</b>	4.66%	<b>5.85%</b>	7.59%



# Economic Assumptions

## Investment Return



- The table below compares, for the last five years, the administrative expense levels during the fiscal year to the market value of assets for the system at the end of the fiscal years.

FY Ending June 30	Administrative Expenses	Market Value of Assets	Expense Ratio
2017	\$2,459,458	\$3,950,704,563	0.06%
2018	2,849,527	4,148,324,206	0.07
2019	2,947,109	4,220,285,752	0.07
2020	3,767,693	4,167,839,558	0.09
2021	3,936,633	5,116,849,108	0.08

- Since June 30, 2017, the expense ratio averaged approximately 0.07%, but has clearly trended upward. We recommend a long-term administrative expense ratio of 0.09% be included in the net investment return assumption.
- Recommend changing to include admin expenses as a reduction to investment return (Explicit to Implicit Assumption)



# Economic Assumptions Investment Return

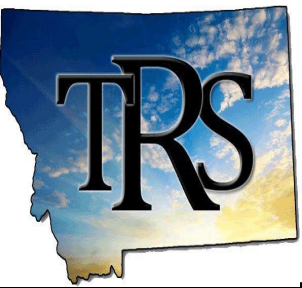


- Recommendation
  - ASOP No. 27 approach
  - Projection results – 50 years

Item	50 <sup>th</sup> Percentile
Real Rate of Return	4.66%
Inflation	2.75%
Investment Expenses	(0.00)%
Administrative Expenses	<u>(0.09)%</u>
Net Investment Return	7.32%

- Capital Market Assumptions are net of investment expense





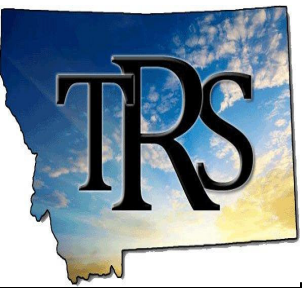
# Economic Assumptions

## Investment Return



- Recommend reducing the assumed rate of return from 7.50% to 7.30%

Investment Return Assumption	
Current	7.50%
Recommended	7.30%



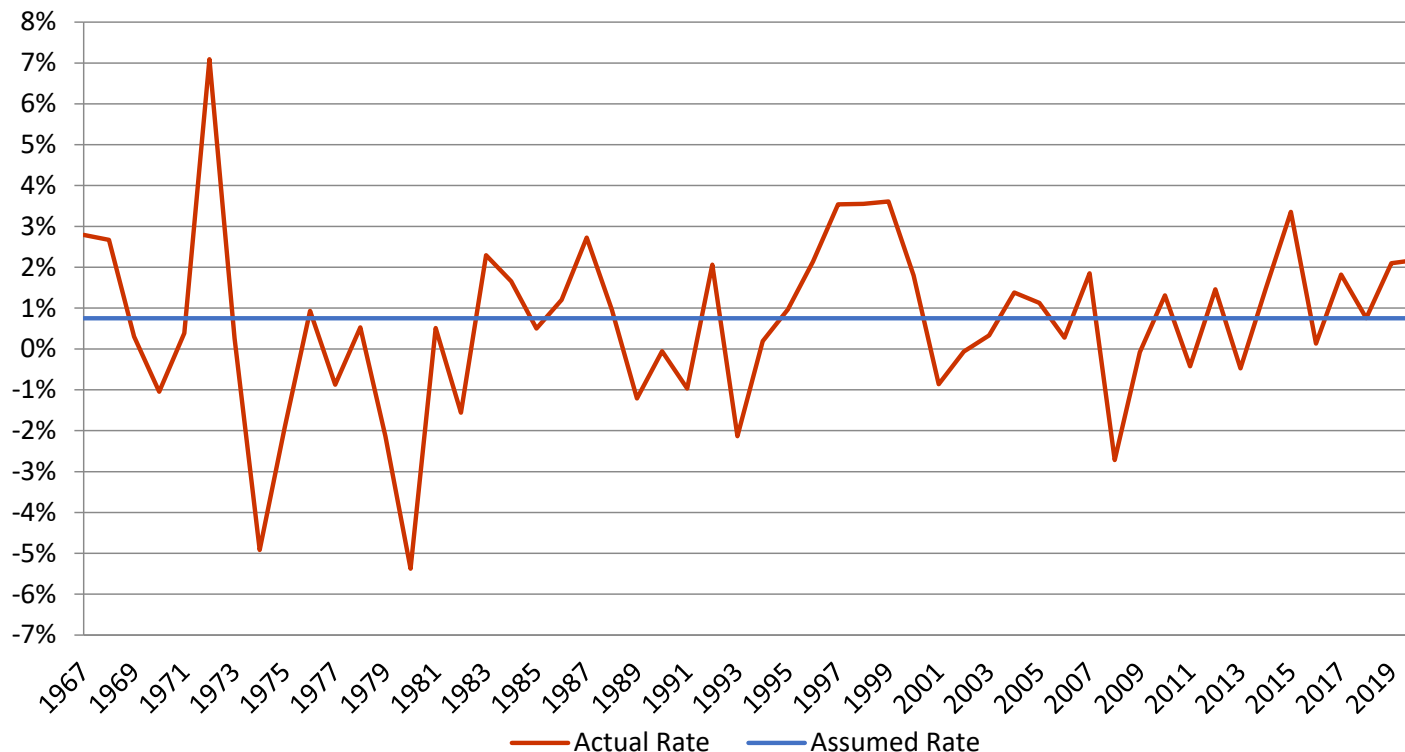
# Economic Assumptions

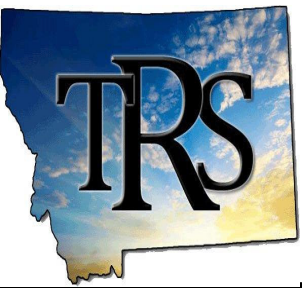
## Wage Inflation



- Current assumption: 3.25%, which is 0.75% above current price inflation assumption of 2.50%
- Social Security Administration data

Annual Real Rates of Increase in National Average Wage





# Economic Assumptions

## Wage Inflation



### ➤ Historical Experience

Period	Wage Inflation	Price Inflation	Real Wage Growth
2011-2020	2.9%	1.5%	1.4%
2001-2020	2.8%	2.0%	0.8%
1991-2020	3.3%	2.2%	1.1%
1981-2020	3.6%	2.7%	0.9%
1971-2020	4.5%	3.8%	0.7%
1961-2020	4.5%	3.7%	0.8%

- This shows real wage growth across all sectors
  - In general, public employees tend to receive compensation more in the form of benefits than wage, so these may be on the high end



# Economic Assumptions

## Wage Inflation



- We recommend no change to the current productivity assumption of 0.75%. This combined with the recommended inflation assumption of 2.75 leads to the recommended wage inflation assumption of 3.50%

	<b>Proposed</b>
Price Inflation	2.75%
Real Wage Growth	<u>0.75%</u>
Wage Inflation	3.50%

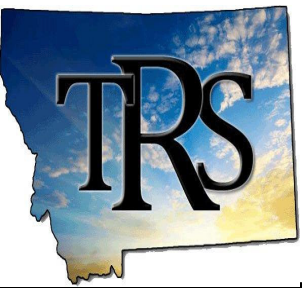


# Payroll Growth Assumptions



## ➤ Method Changes

- Recommend no change to payroll growth assumption of 3.25% which is less than the current underlying wage inflation assumption



## Other Assumptions



- Interest on Member Contributions – Member contributions grow with interest each year. We recommend reducing the assumed interest on members contributions from 5% to the rate adopted by the Board each year.



# Actuarial Methods



- Actuarial Cost Method
  - Recommend no change in the Entry Age Normal Cost Method
  
- Actuarial Smoothing of Assets
  - Recommend no change in 4-year smoothing of market value gains and losses
  
- Amortization of Unfunded Accrued Liability (UAL)
  - Recommend no change in Level Percent of Payroll Amortization Payment Method
  - UAL is amortized as one single amount each valuation.
  - Amortization period is “open” and is solved for each valuation.
  - Result depends on UAL and fixed contribution rate.



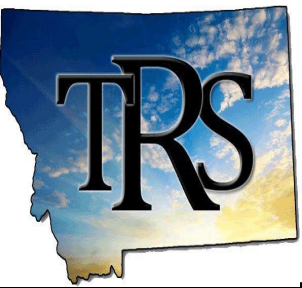
# Impact of Recommendations



	Valuation July 1, 2021	Demographic Assumption Changes	Economic & Demographic Assumption Changes
<b>Employer Contribution Rate:</b>			
Normal Rate	1.52%	1.92%	2.75%
Admin. Expense Load	0.46%	0.46%	0.00%
UAAL	<u>9.78%</u>	<u>9.38%</u>	<u>9.01%</u>
Total Statutory Employer Rate	11.76%	11.76%	11.76%
Actuarial Accrued Liability*	\$6,463,247	\$6,384,101	\$6,537,386
Actuarial Value of Assets*	<u>4,616,374</u>	<u>4,616,374</u>	<u>4,616,374</u>
UAAL*	\$1,846,873	\$1,767,726	\$1,921,012
Amortization Period	24	23	27

\* In Thousands





# Actuarial Certification and Disclosures



- Todd B. Green, is a member of the American Academy of Actuaries, Associate of the Society of Actuaries, and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.
- Bryan Hoge, is a member of the American Academy of Actuaries, Fellow of the Society of Actuaries, and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.