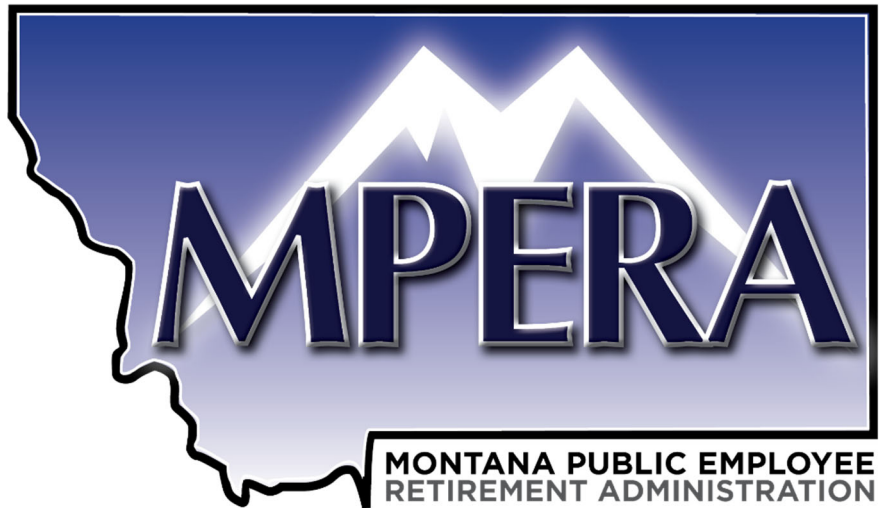




Cavanaugh Macdonald
CONSULTING, LLC

The experience and dedication you deserve



Montana Public Employee Retirement Administration

Experience Study

For the Five-year Period

July 1, 2016 to June 30, 2021



www.CavMacConsulting.com



TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
I	Summary of Results	1
II	Economic Assumptions	6
III	Demographic Assumptions	24
	Rates of Mortality	25
	Rates of Service Retirement	36
	Rates of Disability Retirement	53
	Rates of Withdrawal	58
	Rates of Salary Increase	66
	Miscellaneous Assumptions	70
IV	Actuarial Methods	71
<u>Appendix</u>		
A	Historical June CPI (U) Index	73
B	Social Security Administration Wage Index	74
C	Summary of Recommended Actuarial Assumptions	75



Cavanaugh Macdonald

CONSULTING, LLC

The experience and dedication you deserve

May 2, 2022

Board of Trustees
Montana Public Employee Retirement Administration

Dear Members of the Board:

We are pleased to submit the results of a study of the economic and demographic experience for the Montana Public Employee Retirement Administration. The purpose of this investigation is to assess the reasonability of the actuarial assumptions for each system. This investigation covers the five-year period from July 1, 2016 to June 30, 2021. The purpose of the study is to review the most recent experience in order to make judgments about future experience. Typically, the most recent five-year period is sufficient for this purpose. As a result of the investigation, it is recommended that revised assumptions be adopted by the Board for future use.

The experience studies for each system include all active members, retired members and beneficiaries of deceased members. The mortality experience was studied separately for pre-retirement, post-retirement and disability and also separately for males and females. Incidences of withdrawal, disability, retirement and compensation increases were investigated without regard to gender.

This report shows comparisons between the actual and expected cases of separation from active service, actual and expected number of deaths, and actual and expected salary increases. Tables and graphs are used to show the actual decrement rates, the expected decrement rates and, where applicable, the proposed decrement rates.

The newly proposed rates of decrement for all eight systems are shown in Appendix C of this report. In the actuary's judgment, the recommended rates are suitable for use until further experience indicates that modifications are needed.

Actuarial Assumptions are used to measure and budget future costs. Changing assumptions will not change the actual cost of future benefits.



Board of Trustees
May 2, 2022
Page 2

We hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board (ASB) and the Code of Professional Conduct and Qualification Standards for Statements of Actuarial Opinion of the American Academy of Actuaries.

We further certify that, in our opinion, the assumptions developed in this report satisfy Actuarial Standards of Practice, in particular, No. 27 (Selection of Economic Assumptions for Measuring Pension Obligations) and No. 35 (Selection of Demographic and Other Non-economic Assumptions for Measuring Pension Obligations).

In order to prepare the results in this study, we have utilized appropriate actuarial models and related software that in our professional judgment has the capability to provide results that are consistent with the purpose of this study and have no material limitations or known weaknesses. We performed analysis to ensure the model reasonably represents that which is intended to be modeled. These models use assumptions about future contingent events, along with recognized actuarial approaches, to develop the necessary results.

The experience study was performed by, and under the supervision of, independent actuaries who are Members of the American Academy of Actuaries with experience in performing valuations for public retirement systems. The undersigned meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,

A handwritten signature in blue ink that reads 'Todd B. Green' followed by a horizontal line.

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

A handwritten signature in blue ink that reads 'Bryan Hoge'.

Bryan Hoge, FSA, EA, FCA, MAAA
Consulting Actuary

TBG:BH\bvb



SUMMARY OF RESULTS

Introduction

This investigation covers the five-year period ending June 30, 2021. The purpose of an actuarial valuation is to provide a timely best estimate of the ultimate costs of a retirement system. Actuarial valuations of the Montana Public Employees Retirement Administration (MPERA) eight plans are prepared annually to determine the actuarial recommended contribution, funded status, and amortization periods necessary to achieve a 100% funded status. The valuations require the use of certain assumptions with respect to the occurrence of future events, such as rates of death, termination of employment, retirement age, and salary changes to estimate the obligations of the system.

The basic purpose of an experience study is to determine whether the actuarial assumptions currently in use have adequately anticipated the actual emerging experience. This information, along with the professional judgment of system personnel and advisors, is used to evaluate the appropriateness of continued use of the current actuarial assumptions. When analyzing experience and assumptions, it is important to recognize that actual experience is reported in the short term while assumptions are intended to be long-term estimates of experience. Therefore, actual experience is expected to vary from study period to study period, without necessarily indicating a change in assumptions is needed.

At the request of MPERA, Cavanaugh Macdonald Consulting, LLC (CMC), performed a study of the experience for the five-year period ending in 2021. This report presents the results, analysis, and resulting recommendations of our study. It is anticipated that the changes will first be reflected in the June 30, 2022 actuarial valuations.

These assumptions have been developed in accordance with generally recognized and accepted actuarial principles and practices that are consistent with the applicable Actuarial Standards of Practice adopted by the Actuarial Standards Board (ASB). While the recommended assumptions represent our best estimate of future experience, there are other reasonable assumption sets that could be supported by the results of this experience study. Those other sets of reasonable assumptions could produce liabilities and costs that are either higher or lower.

Our Philosophy

Similar to an actuarial valuation, the calculation of actual and expected experience is a fairly mechanical process, and differences between actuaries in this area are generally minor. However, the setting of assumptions differs, as it is more art than science. In this report, we have



Section I: Summary of Results

recommended changes to certain assumptions. To explain our thought process, we offer a brief summary of our philosophy:

- **Don't Overreact:** When we see significant changes in experience, we generally do not adjust our rates to reflect the entire difference. We will typically recommend rates somewhere between the old rates and the new experience. If the experience during the next study period shows the same result, we will probably recognize the trend at that point in time or at least move further in the direction of the observed experience. On the other hand, if experience returns closer to its prior level, we will not have overreacted, possibly causing volatility in the actuarial contribution rates.
- **Anticipate Trends:** If there is an identified trend that is expected to continue, we believe that this should be recognized. An example is the retiree mortality assumption. It is an established trend that people are living longer. Therefore, we believe the best estimate of liabilities in the valuation should reflect the expected increase in life expectancy.
- **Simplify:** In general, we attempt to identify which factors are significant and eliminate or ignore the ones that do not materially improve the accuracy of the liability projections.

Following are summaries of findings and recommendations regarding assumptions utilized by the MPERA plans. Explanations of the recommendations are found in the sections that follow.

Recommended Economic Assumption Changes

The table below lists the three economic assumptions used in all the actuarial valuations and their current and proposed rates. We recommend lowering the assumed rate of return on assets for all eight Systems.

Assumption	Current	Proposed
Price Inflation	2.75%	2.75%
Wage Inflation	3.50%	3.50%
Investment Return	7.65%	7.30%



Section I: Summary of Results

Recommended Demographic Assumption Changes

The table below lists the recommended demographic assumption changes based on experience during the last five years.

Retirement Plan	Assumption Changes
Public Employees' Retirement System	Mortality, Retirement, Disability, Withdrawal
Public Employees' Retirement System Long-Term Disability Plan	Mortality, Retirement, Disability, Withdrawal
Judges' Retirement System	Mortality, Retirement, Disability
Sheriffs' Retirement System	Mortality, Retirement, Disability, Withdrawal, Merit Scale
Game Wardens' and Peace Officers' Retirement System	Mortality, Retirement, Disability, Withdrawal, Merit Scale
Highway Patrol Officers' Retirement System	Mortality, Retirement, Disability, Merit Scale
Municipal Police Officers' Retirement System	Mortality, Retirement, Disability, Withdrawal, Merit Scale
Firefighters' United Retirement System	Mortality, Retirement, Disability, Withdrawal, Merit Scale
Volunteer Firefighters' Compensation Act	Mortality, Retirement



Section I: Summary of Results

Recommended Method Changes

To partially reflect recent experience and the short-term expectations, we recommend that the payroll growth assumption for amortization as a level percent of pay be reduced from 3.50% to 3.25%.

Financial Impact

The following tables highlight the impact of recommended changes on the unfunded actuarial accrued liabilities (UAAL), funded ratios and employer contribution rates for the nine systems.

Impact of Changes on the Unfunded Actuarial Accrued Liability

Retirement Plan	Before Changes	After Changes	Change
Public Employees' Retirement System	\$2,019,652,381	\$2,324,638,368	\$304,985,987
Public Employees' Retirement System Long-Term Disability Plan	(2,013,863)	(6,185,621)	(4,171,758)
Judges' Retirement System	(52,404,231)	(50,326,572)	2,077,659
Sheriffs' Retirement System	87,203,044	122,806,554	35,603,510
Game Wardens' and Peace Officers' Retirement System	43,463,824	64,372,802	20,908,978
Highway Patrol Officers' Retirement System	84,025,161	100,005,124	15,979,963
Municipal Police Officers' Retirement System	178,467,014	228,679,756	50,212,742
Firefighters' United Retirement System	90,655,985	152,361,319	61,705,334
Volunteer Firefighters' Compensation Act	7,156	1,797	(5,359)



Section I: Summary of Results

Impact of Changes on the Funding Ratio

Retirement Plan	Before Changes	After Changes	Change
Public Employees' Retirement System	76.34%	73.70%	(2.64)%
Public Employees' Retirement System Long-Term Disability Plan	134.85%	484.89%	350.04%
Judges' Retirement System	176.55%	171.35%	(5.20)%
Sheriffs' Retirement System	83.40%	78.10%	(5.30)%
Game Wardens' and Peace Officers' Retirement System	85.06%	79.35%	(5.71)%
Highway Patrol Officers' Retirement System	66.67%	62.69%	(3.98)%
Municipal Police Officers' Retirement System	74.31%	69.30%	(5.01)%
Firefighters' United Retirement System	85.97%	78.48%	(7.49)%
Volunteer Firefighters' Compensation Act	99.98%	100.00%	0.02%

Impact of Changes on the Amortization Period

Retirement Plan	Before Changes	After Changes	Change
Public Employees' Retirement System	28	37	9
Public Employees' Retirement System Long-Term Disability Plan	0	0	No Change
Judges' Retirement System	0	0	No Change
Sheriffs' Retirement System	18	41	23
Game Wardens' and Peace Officers' Retirement System	35	Infinite	N/A
Highway Patrol Officers' Retirement System	26	62	36
Municipal Police Officers' Retirement System	15	26	11
Firefighters' United Retirement System	6	14	8
Volunteer Firefighters' Compensation Act	1	1	No Change



ECONOMIC ASSUMPTIONS

Economic assumptions include:

- the long-term investment return,
- price inflation,
- wage inflation (the across-the-board portion of salary increases), and

The salary increase assumption is made up of both wage inflation and a merit salary scale. The merit salary scale is actually a demographic assumption and will be discussed with the demographic assumptions. Unlike demographic assumptions, economic assumptions do not lend themselves to analysis based heavily upon internal historical patterns. Because both general wage increases and investment return are influenced more by external forces which are difficult to accurately predict over the long term. The investment return and general wage increase assumptions are generally selected on the basis of expectations in an inflation-free environment and then increased by the long-term expectation for price inflation.

Sources of data considered in the analysis and selection of the economic assumptions included:

- Historical observations of price and wage inflation statistics and investment returns
- The 2021 Social Security Trustees Report
- Future expectations of the Board of Investments consultants
- U. S. Department of the Treasury bond rates
- Assumptions used by other large public retirement systems, based on the Public Fund Survey, published by the National Association of State Retirement Administrators.

Guidance regarding the selection of economic assumptions for measuring pension obligations is provided by Actuarial Standard of Practice (ASOP) No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*. Because no one knows what the future holds, the actuary must use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment.

ACTUARIAL STANDARD OF PRACTICE NUMBER 27

Actuarial Standards of Practice are issued by the Actuarial Standards Board to provide guidance to actuaries with respect to certain aspects of performing actuarial work. As mentioned earlier, Actuarial Standard of Practice Number 27 (ASOP 27) is the standard that addresses the selection of economic assumptions for measuring pension obligations. Therefore, our analysis of the expected rate of return, as well as other economic assumptions, was performed following the guidance in ASOP 27.

ASOP 27 applies to the selection of economic assumptions to measure obligations under any defined benefit pension plan that is not a social insurance program (e.g., Social Security).



Section II: Economic Assumptions

The standard recommends the actuary review appropriate recent and long-term historical economic data, but advises the actuary not to give undue weight to recent experience. Furthermore, it advises the actuary to consider that some historical economic data may not be appropriate for use in developing assumptions for future periods due to changes in the underlying environment. Each economic assumption should individually satisfy this standard. In addition, with respect to any particular valuation, each economic assumption should be consistent with all other economic assumptions over the measurement period.

ASOP 27 recognizes that economic data and analyses are available from a variety of sources, including representatives of the plan sponsor, investment advisors, economists, and other professionals. The actuary is permitted to incorporate the views of experts, but the selection or advice must reflect the actuary's professional judgment.

Since the last experience study was performed, the Actuarial Standards Board has issued a revised ASOP 27. The prior standard included the use of a "best estimate range" in developing economic assumptions, but this approach is no longer acceptable. The current standard calls for the actuary to select a "reasonable" assumption. For this purpose, an assumption is reasonable if it has the following characteristics:

- a. it is appropriate for the purpose of the measurement;
- b. it reflects the actuary's professional judgment;
- c. it takes into account historical and current economic data that is relevant as of the measurement date;
- d. it reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
- e. it has no significant bias (i.e., it is neither significantly optimistic nor pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included.

The standard goes on to discuss a "range of reasonable assumptions" which in part states "the actuary should also recognize that different actuaries will apply different professional judgment and may choose different reasonable assumptions. As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice."

The remaining section of this report will address the relevant types of economic assumptions used in the actuarial valuation to determine the obligations of MPERA. In our opinion, the economic assumptions proposed in this report have been developed in accordance with ASOP No. 27.



Section II: Economic Assumptions

The following table summarizes the current and proposed economic assumptions:

Item	Current	Proposed
Price Inflation	2.75%	2.75%
Real Rate of Return	<u>4.90</u>	<u>4.55</u>
Investment Return	7.65%	7.30%
Price Inflation	2.75%	2.75%
Real Wage Growth	<u>0.75</u>	<u>0.75</u>
Wage Inflation	3.50%	3.50%



PRICE INFLATION

Price Inflation

Use in the Valuation: Future price inflation has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return, wage growth, and salary increases. The consistency of the price inflation assumption throughout the economic assumptions utilized in an actuarial valuation is required to meet the requirements of ASOP No. 27 and for determining pension liabilities and expense under Governmental Accounting Standards Board (GASB) Statements No. 67 and 68.

The long-term relationship between price inflation and investment return has long been recognized by economists. The basic principle is that the investor demands a more or less level “real return” – the excess of actual investment return over price inflation. If inflation rates are expected to be high, investment return rates are also expected to be high, while low inflation rates are expected to result in lower expected investment returns, at least in the long run.

The current assumption for price inflation is 2.75% per year.

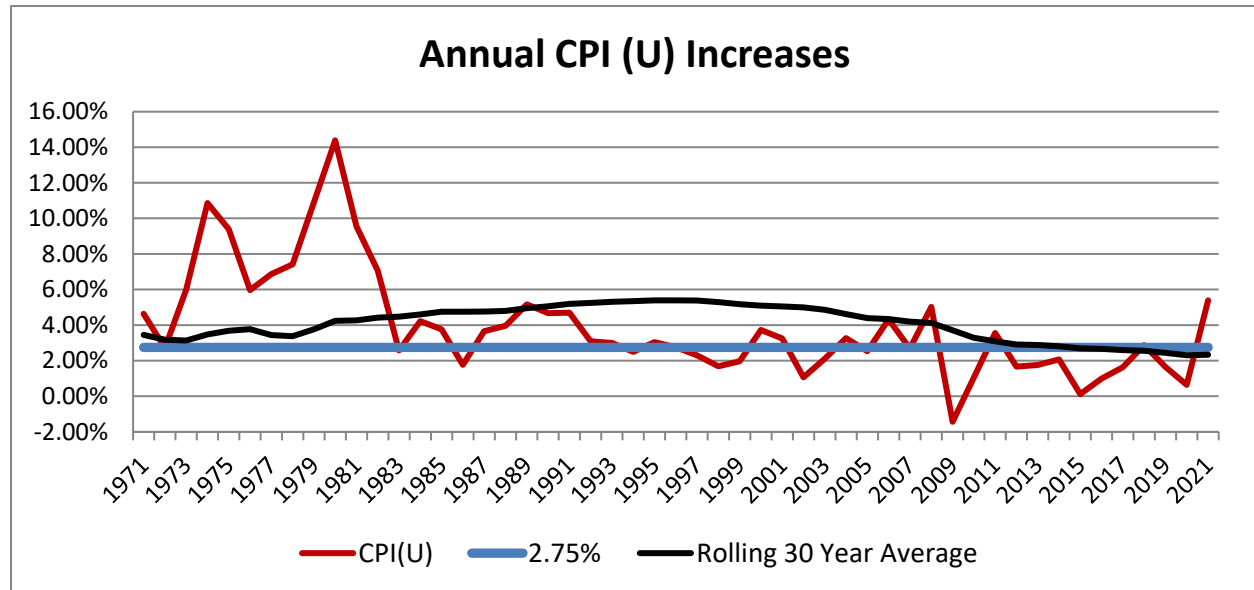
Past Experience: Although economic activities, in general, and inflation in particular, do not lend themselves to prediction solely on the basis of historical analysis, historical patterns and long-term trends are factors to be considered in developing the inflation assumption. The Consumer Price Index, US City Average, All Urban Consumers, CPI (U), has been used as the basis for reviewing historical levels of price inflation. The following table provides historical annualized rates and annual standard deviations of the CPI-U over periods ending June 30th.

Period	Number of Years	Annualized Rate of Inflation	Annual Standard Deviation
1926 – 2021	95	2.90%	4.03%
1961 – 2021	60	3.75%	2.86%
1971 – 2021	50	3.88%	3.03%
1981 – 2021	40	2.78%	1.61%
1991 – 2021	30	2.33%	1.40%
2001 – 2021	20	2.14%	1.65%
2011 - 2021	10	1.87%	1.45%
2016 - 2021	5	2.43%	1.83%



Section II: Economic Assumptions

The following graph illustrates the historical annual change in price inflation, measured as of December 31st for each of the last 50 years, as compared to the current assumption.



Over more recent periods, measured from December 31, 2021, the average annual rate of increase in the CPI-U has been 3.00% or lower. The period of high inflation from 1973 to 1981 has a significant impact on the averages over periods which include these rates.

Forecasts of Inflation:

Additional information to consider in formulating this assumption is obtained from measuring the spread on Treasury Inflation Protected Securities (TIPS) and from the prevailing economic forecasts. The spread between the nominal yield on treasury securities (bonds) and the inflation indexed yield on TIPS of the same maturity is referred to as the “breakeven rate of inflation” and represents the bond market’s expectation of inflation over the period to maturity. The table on top of the next page provides the calculation of the breakeven rate of inflation as of March 31, 2022 over various periods.



Section II: Economic Assumptions

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%

The bond market's expectation for the rate of inflation is significantly lower than historical average annual rates. Additionally, based upon information provided from the "Survey of Professional Forecasters" published by the Philadelphia Federal Reserve Bank, the median expected annual rate of inflation for the 10 years beginning January 1, 2022 is 2.50%.

Recommendation: It is difficult to accurately predict inflation. We realize recent inflation has been higher than assumed. We do not want to give too much credibility to recent experience, but also don't want to over-react and change the assumption too drastically. Based on current break-even inflation and the other research provided, **we recommend retaining the current inflation assumption of 2.75%.**

Consumer Price Inflation	
Current Assumption	2.75%
Recommended Assumption	2.75%



INVESTMENT RETURN

Use in the Valuation: The investment return assumption reflects the anticipated returns on the current and future assets. It is one of the primary determinants in the allocation of the expected cost of MPERA's benefits, providing a discount of the estimated future benefit payments to reflect the time value of money. Minor changes in this assumption can have a major impact on valuation results. Generally, the investment return assumption should be set with consideration of the asset allocation policy, expected long-term real rates of return on the specific asset classes, the underlying price inflation rate, and investment expenses.

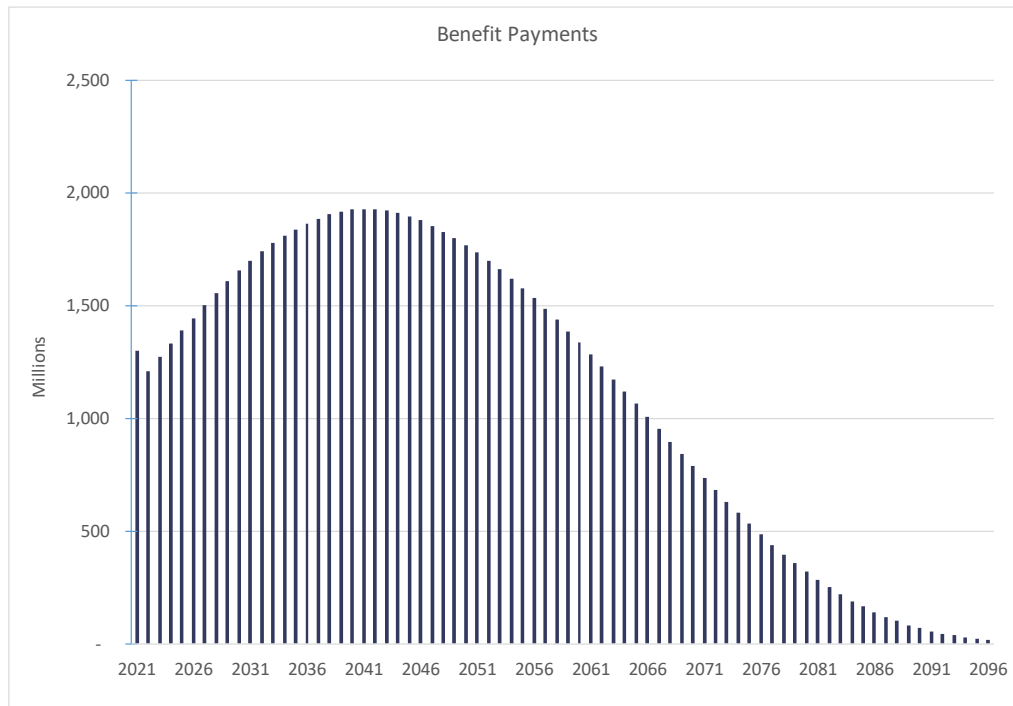
The current investment return assumption is 7.65%, consisting of a price inflation assumption of 2.75% and a real rate of return assumption of 4.90%. The return is net of all investment expenses.

Long Term Perspective

Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon in order to make prudent choices regarding how to invest the trust funds (asset allocation). For actuarial calculations, we typically consider very long periods of time as some current employees will still be receiving benefit payments more than 60 years from now. For example, a newly-hired member who is 25 years old may work for 30 years, to age 55, and live another 30 years, to age 85. The retirement system would receive contributions for the first 30 years and then pay out benefits for the next 30 years. During the entire 60-year period, MPERA is investing assets on behalf of the member. In addition, in an open ongoing system like MPERA, the stream of benefit payments is continually increasing as new hires replace current members who leave covered employment due to death, termination of employment, and retirement. This difference in the time horizon used by actuaries and investment consultants is frequently a source of debate and confusion when setting economic assumptions. The following graph illustrates the long duration of the expected benefit payments for current members on July 1, 2021.



Section II: Economic Assumptions



MPERA Historical Perspective

An inherent problem with analyzing historical data is that the results can look significantly different depending on the timeframe used, especially if the year-to-year results vary widely. In addition, the asset allocation impacts the investment returns so comparing results over long periods when different asset allocations were in place may not be meaningful.



Section II: Economic Assumptions

The charts below shows the actual fiscal year (June 30) net returns for the MPERA portfolio for the last 10 years for market and actuarial values of assets. Despite significant volatility in the results from year to year, the actual geometric (compound) return was between 8.89% and 9.34% for market returns and between 8.21% and 8.67% for actuarial value returns.

Market Value Rate of Return								
Year Ending 6/30	PERS	JRS	SRS	GWPORS	HPORS	MPORS	FURS	VFCA
2012	2.27%	2.20%	2.32%	2.31%	2.24%	2.40%	2.42%	1.67%
2013	12.99%	12.72%	12.88%	12.69%	12.88%	12.42%	12.43%	12.01%
2014	17.12%	17.03%	17.08%	16.97%	17.10%	16.53%	16.53%	16.23%
2015	4.60%	4.59%	4.60%	4.58%	4.60%	4.52%	4.52%	4.49%
2016	2.02%	2.06%	2.06%	2.11%	2.04%	2.13%	2.15%	1.84%
2017	11.93%	11.91%	11.95%	11.92%	11.87%	11.56%	11.56%	11.51%
2018	8.90%	8.88%	8.83%	8.81%	8.86%	8.65%	8.63%	8.68%
2019	5.65%	5.64%	5.70%	5.72%	5.63%	5.42%	5.44%	5.41%
2020	2.73%	2.72%	2.71%	2.70%	2.66%	2.65%	2.64%	2.66%
2021	27.80%	27.69%	27.82%	27.66%	27.80%	27.07%	27.04%	26.93%
Average	9.34%	9.28%	9.33%	9.29%	9.30%	9.09%	9.09%	8.89%

Actuarial Value Rate of Return								
Year Ending 6/30	PERS	JRS	SRS	GWPORS	HPORS	MPORS	FURS	VFCA
2012	3.28%	3.63%	3.82%	4.43%	3.32%	3.71%	3.87%	2.97%
2013	11.91%	11.60%	11.57%	11.13%	11.86%	11.08%	11.05%	11.11%
2014	13.21%	12.92%	12.96%	12.62%	13.13%	12.46%	12.44%	12.34%
2015	9.63%	9.53%	9.60%	9.47%	9.61%	9.32%	9.32%	8.95%
2016	9.27%	8.64%	8.66%	8.42%	8.76%	8.37%	8.33%	8.30%
2017	8.08%	8.22%	8.23%	8.15%	8.25%	8.01%	8.00%	7.89%
2018	6.69%	6.89%	6.92%	7.01%	6.84%	6.81%	6.84%	6.59%
2019	7.06%	7.22%	7.24%	7.28%	7.18%	7.05%	7.07%	6.93%
2020	7.11%	7.08%	7.04%	6.99%	7.06%	6.81%	6.79%	6.87%
2021	10.76%	10.77%	10.81%	10.80%	10.72%	10.50%	10.52%	10.44%
Average	8.67%	8.62%	8.66%	8.61%	8.64%	8.39%	8.40%	8.21%



Capital Market Assumption Analysis

MPERA’s assets are invested by the Montana Board of Investments with the guidance of their investment consultant. Since ASOP 27 allows the actuary to rely on outside experts, it is appropriate to consider the market outlook and expectations published in the *Survey of Capital Market Assumptions: 2021 Edition* published by Horizon Actuarial Services, LLC. Horizon Actuarial Services prepares an annual study in which they survey various investment advisors and provide ranges of results as well as averages. The 2021 Survey included a total of 39 investment advisors who provided their capital market assumptions of which 24 provided both short-term and long-term assumptions. It is worth noting that this Survey has historically been prepared for the multiemployer (Taft-Hartley) plan community and initially included assumptions only from investment advisors serving those plans. The Survey has expanded over the years and now includes assumptions from investment advisors outside of the Taft-Hartley community including consultants such as Aon, New England Pension Consultants (NEPC), Callan Associates, Willis Towers Watson, JP Morgan, RVK, SEI, UBS, Summit Strategies, Blackrock and PCA who work with public plans.

Our analysis is based on the target asset allocation as shown below:

Asset Class	Target Allocation	Long-Term Expected Real Rate of Return
Domestic Equity	30.0%	5.90%
International Equity	17.0%	7.14%
Private Investments	15.0%	9.13%
Real Assets	5.0%	4.03%
Real Estate	9.0%	5.41%
Core Fixed Income	15.0%	1.14%
Non-Core Fixed Income	6.0%	3.02%
Cash	3.0%	-0.33%
Total	100.0%	



Section II: Economic Assumptions

Using projection results produces an expected range of rates of return over a 50-year time horizon. Looking at one year's results produces an expected real return of 5.40% but with a high standard deviation or measurement of volatility. By expanding the time horizon, the mean return changes very little, but the volatility declines significantly. The table below provides a summary of results.

Time Span In Years	Mean Return	Standard Deviation	Real Returns by Percentile				
			5 th	25 th	50 th	75 th	95 th
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	3.48	4.66	5.85	7.59

The percentile results are the percentage of random returns over the time span shown that are expected to be less than the amount indicated. Thus, for the 10-year time span, 5% of the real rates of return will be below -1.62% and 95% will be above that. As the time span increases, the results begin to converge. Over a 50-year time span, the results indicate a 25% chance that the real returns will be below 3.48% and a 25% chance they will be above 5.85%. There is a 50% chance the real returns will be 4.66% or above and a 50% chance the return will be below 4.66%.

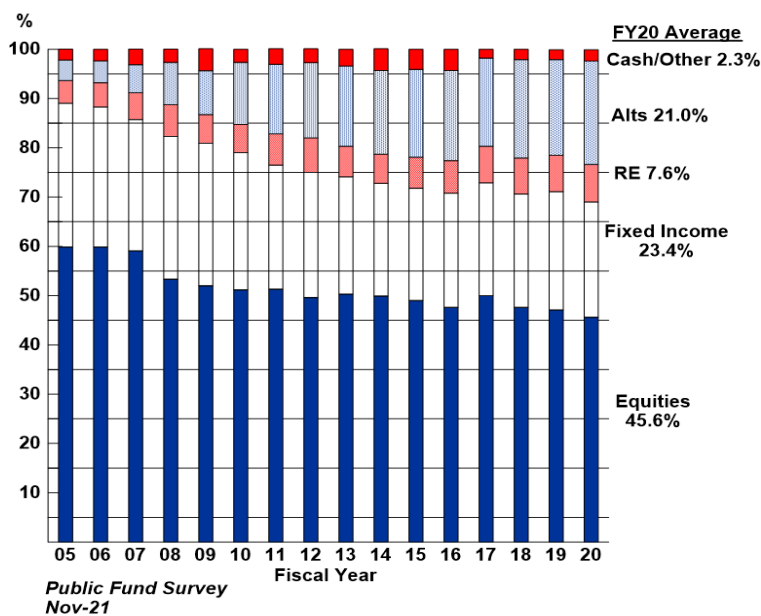
The assumptions chosen by the actuary are intended for the longer timeframes (30 to 50 years). Our goal is to choose an assumption that will be reasonable in the long term with adjustment only when there are compelling changes to investment policy or evidence of a change in the long-term trends in the capital markets.

Peer System Comparison

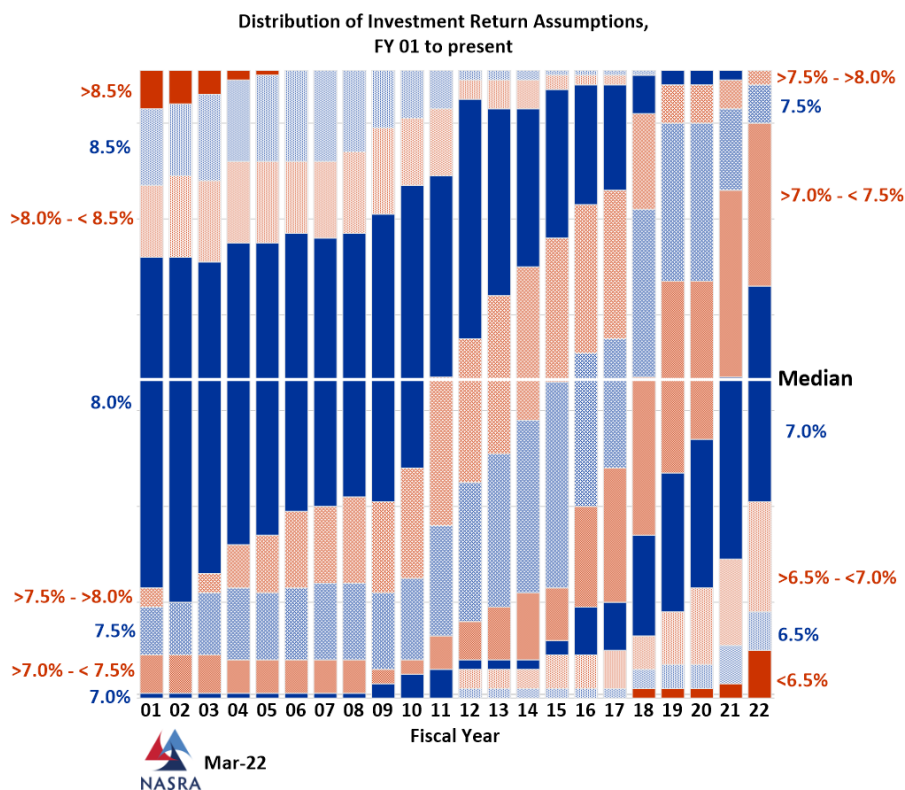
While we do not recommend that the selection of an investment return assumption be based on the assumptions used by other systems, it does provide another set of relevant information to consider. The following graph shows the change in the distribution of the investment return assumption from fiscal year 2005 through 2020 for the 130 large public retirement systems included in the National Association of State Retirement Administrators (NASRA) Public Fund Survey. The assumed rate of return is heavily influenced by each Systems' asset allocation. The average asset allocation for the systems in the Public Fund Survey is 2% cash, 46% equities, 23% fixed income, 9% real estate, and 25% alternative investments which has an impact on the expected return of the systems. Note the increased allocation to alternative investment classes since 2005. The target asset allocation for MPERA is 2% cash, 46% equities, 18% alternatives, 9% real estate and 25% fixed income, which is in line with the portfolio of an average system. As a result, it is reasonable to anticipate that the expected return equal to that of the median system. The chart below shows the asset allocation for funds surveyed in the *Public Fund Survey* since 2005.



Section II: Economic Assumptions

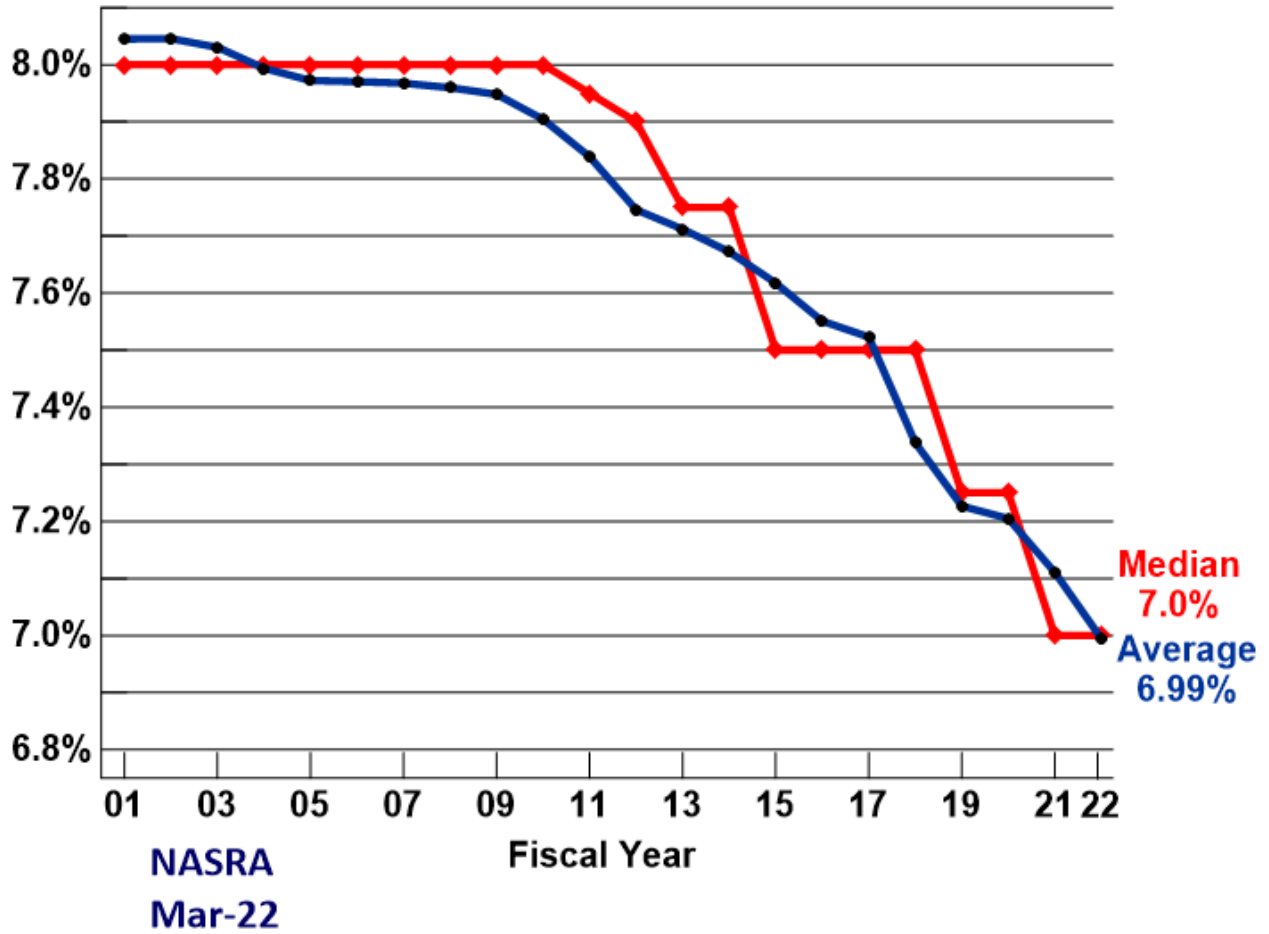


Below and on the following page are graphs published by NASRA that show the decreases in the investment return assumptions used by public plans over the last several years.





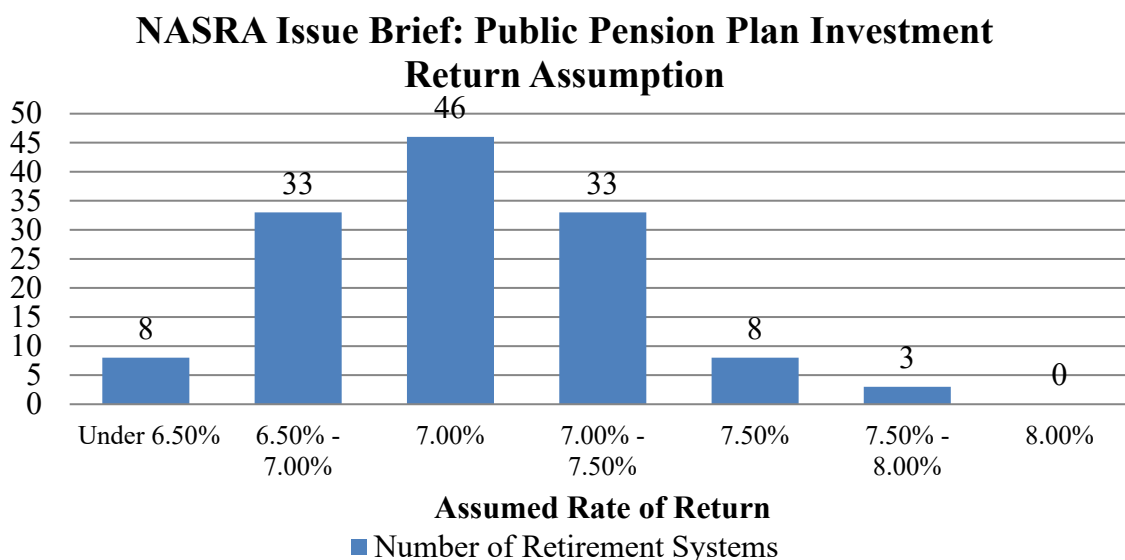
Change to Average and Median Investment Return Assumption, FY 01 to present





Section II: Economic Assumptions

The following table details the expected return assumptions as stated in the NASRA Issue Brief: Public Pension Plan Investment Return Assumptions. The average return assumption is 6.99% and the median return assumptions is 7.00%.



Administrative Expenses: Currently, the investment return is assumed to be net of investment expenses only with the administrative expense assumption added to the total actuarial contribution rate. We recommend an investment return assumption that is net of both investment and administrative expenses. The investment return information we have been provided is net of investment-related expenses. The table below compares, for the last five years, the administrative expense levels during the fiscal year to the market value of assets for all systems at the end of the fiscal years.

FY Ending June 30	Administrative Expenses	Market Value of Assets	Expense Ratio
2017	\$6,638,528	\$7,032,659,279	0.09
2018	6,463,555	7,475,224,879	0.09
2019	5,160,673	7,685,372,436	0.07
2020	5,794,401	7,669,708,009	0.08
2021	6,892,166	9,516,857,085	0.07%

Over the five-year period, the expense ratio averaged 0.08%, therefore we recommend a long-term administrative expense ratio of 0.08% be included in the net investment return assumption.



Section II: Economic Assumptions

Recommendation:

Using the building block approach of ASOP No. 27 and the projection results outlined above, we recommend an investment return assumption near the 50th percentile real returns over the 50-year time span plus the recommended inflation assumption less the recommended expense ratios assumptions. The following table details the 25th, 50th and 75th percentile ranges.

Item	25 th Percentile	50 th Percentile	75 th Percentile
Real Rate of Return	3.48%	4.66%	5.85%
Inflation	2.75	2.75	2.75
Investment Expenses*	(0.00)	(0.00)	(0.00)
Administrative Expenses	<u>(0.08)</u>	<u>(0.08)</u>	<u>(0.08)</u>
Net Investment Return	6.15%	7.33%	8.52%

* *The capital market assumptions used to develop the reasonable range for the real rate of return are net of investment expenses. Therefore, a separate assumption for investment expenses is not necessary.*

The current assumed rate of return of 7.65% is higher than the average assumed rate of return compared with its peer group of other public retirement systems. The 50th percentile net return based on the analysis is 7.33% utilizing the capital market assumption analysis.

The June 30, 2021 Quarterly Investment Performance Analysis prepared for the Montana Board of Investments indicated an annual market value asset return since the inception date of July 1, 1994, exceeded 8.00% for all the Systems. The return on the market value of assets for the 20-year period ended June 30, 2021 was lower, but still exceeded 7.00% for all Systems. This potentially could indicate a downward trend of annualized historical returns in the future.

ASOP 27 explicitly advises the actuary not to give undue weight to recent experience, therefore taking into account the capital market assumption analysis, **we recommend an assumed rate of return net of both investment and administrative expenses of 7.30%. This is a reduction from the current assumption of 7.65%.**



WAGE INFLATION

Background: Wage inflation, thought of as the “across the board” rate of salary increases, is composed of the price inflation assumption, combined with an assumption for the real rate of wage increases. In constructing the salary increase assumption, the wage inflation assumption is further combined with an assumption for service-based salary increases (called a merit scale). The service-based salary increase assumption is discussed in Section III. The current assumption for real rate of wage increase is 0.75% (3.50% wage increase minus 2.75% inflation).

The excess of wage growth over price inflation represents the increase in the standard of living, also called productivity growth. There has been debate on the issue of whether public sector employees will receive, over the long term, the same rewards for productivity as employees in the private sector, where productivity is more readily measurable. To our knowledge, no definitive research has been completed on this topic. Nevertheless, it is our opinion that public sector employees will eventually be rewarded, even if there is a time lag, with the same or nearly the same productivity increases as those participating in the remainder of the economy.

Historical Perspective: We have used statistics from the Social Security System on the National Average Wage back to 1951. Because the National Average Wage is based on all wage earners in the country, it can be influenced by the mix of jobs (full-time vs. part-time, manufacturing vs. service, etc.) as well as by changes in some segments of the workforce that are not seen in all segments (e.g. regional changes or growth in computer technology). Further, if compensation is shifted between wages and benefits, the wage index would not accurately reflect increases in total compensation. However, we feel the National Average Wage is an accurate measure.

There are numerous ways to review this data. For consistency with our observations of CPI, the table below shows the compound annual rates of wage growth for various periods ended in 2020 (most recent available data).

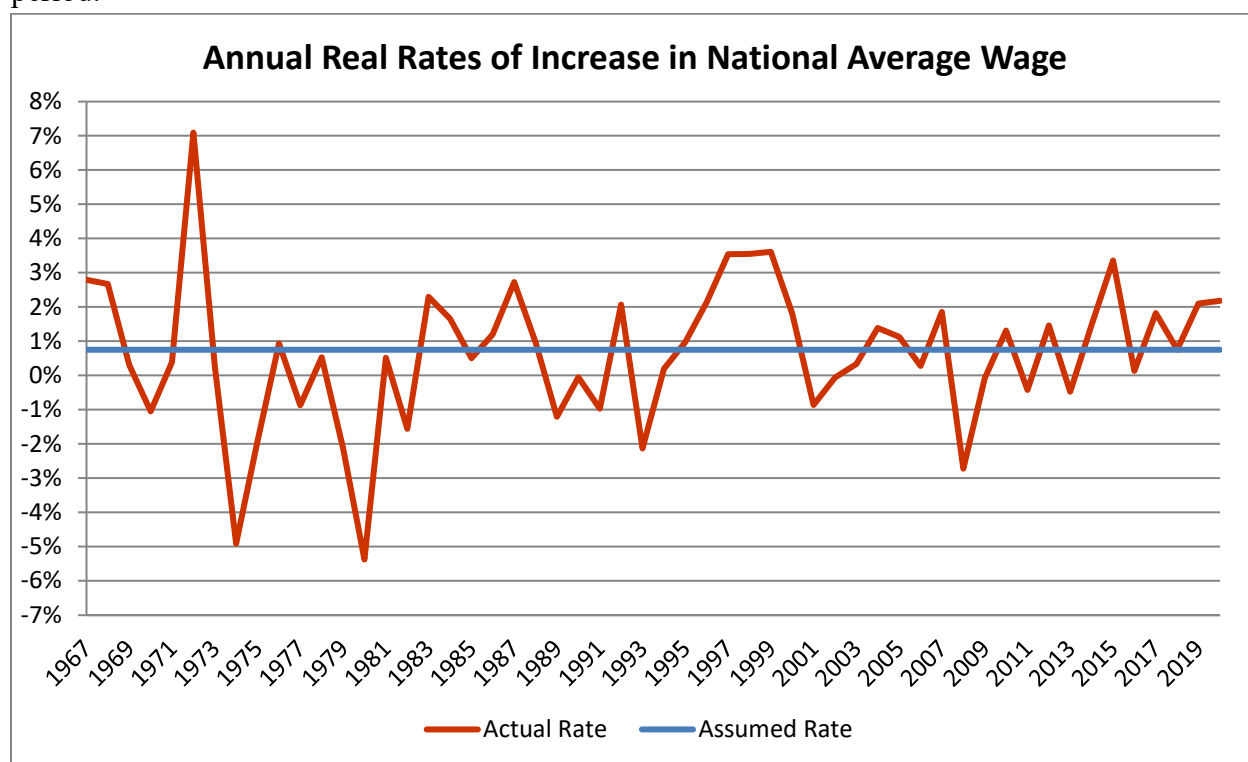
Period	Wage Inflation	Price Inflation	Real Wage Growth
2011-2020	2.9%	1.5%	1.4%
2001-2020	2.8%	2.0%	0.8%
1991-2020	3.3%	2.2%	1.1%
1981-2020	3.6%	2.7%	0.9%
1971-2020	4.5%	3.8%	0.7%
1961-2020	4.5%	3.7%	0.8%



Section II: Economic Assumptions

The excess of wage growth over price inflation represents the real wage inflation rate. Although real wage inflation has been very low in recent years, likely due to the recovery from the 2008 financial crisis, our focus must remain on the long term. The above table shows the compounded wage growth over various periods, along with the comparable price inflation rate for the same period. The differences represent the real wage inflation rate. The data for each year is documented in Appendix B.

Over the last 60 years, annual real wage growth has averaged 0.8%, but has been higher over the more recent periods, with 1.1% over the last 30 years and 1.4% over the last 10 years. We would note that this includes wages across all sectors, not just public employees. In general, we have seen public employees receive compensation increases more in the form of benefits than wages, so the averages shown here may be higher than if only public sector employees were considered. The following graph shows the annual increases in real wage growth over the entire 50-year period.





Section II: Economic Assumptions

Recommendation: Based on the data reviewed and our future outlook, we recommend retaining the 0.75% real wage growth, 2.75% price inflation and 3.50% wage inflation assumption.

Wage Inflation Assumption	
Current	3.50%
Recommended	
Real Wage Growth	0.75%
Inflation	<u>2.75%</u>
Total	3.50%



DEMOGRAPHIC ASSUMPTIONS

There are several demographic assumptions used in the actuarial valuations performed for systems in the Montana Public Employee Retirement Administration. They are:

- Rates of Post-retirement Mortality
- Rates of Post-retirement Disabled Mortality
- Rates of Pre-Retirement Mortality
- Rates of Service Retirement
- Rates of Disability Retirement
- Rates of Withdrawal
- Rates of Salary Increase for Merit and Promotions

The Actuarial Standards Board has issued 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. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP No. 35.

The purpose of a study of demographic experience is to compare what actually happened to the membership during the study period with what was expected to happen based on the assumptions used in the most recent actuarial valuations.

Studies of demographic experience generally involve three steps:

- First, the number of members changing membership status, called decrements, during the study is tabulated by age, duration, sex, group, and membership class (active, retired, etc.).
- Next, the number of members expected to change status is calculated by multiplying certain membership statistics, called exposure, by the expected rates of decrement.
- Finally, actual decrements are compared with expected decrements. These comparisons, called the actual to expected ratios (A/E Ratio) are expressed as percentages.
 - The System's experience was liability weighted for observed incidents of withdrawal, retirement, and pre- and post- mortality. When performing a liability weighted analysis, the actuarial liability attributed to the number of actual decrements is compared to the actuarial liability attributed to the number of expected decrements. The System's experience for disability retirements was analyzed on a count basis because there is generally little to no correlation between a member becoming disabled and their salary or service.



Section III: Demographic Assumptions

In general, if the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements, or rates of decrement, by age, gender, or duration deviates significantly from the expected pattern, new assumptions are considered. Recommended revisions are normally not an exact representation of the experience during the observation period. Professional judgment is required to set assumptions for future experience from past trends and current evidence, including a determination of the amount of weight to assign to the most recent experience.

The remainder of this section presents the results of the demographic study. We have prepared charts and graphs that show a comparison of the actual and expected decrements and the overall ratio of actual-to-expected results under the current assumptions. If a change is being proposed, the revised actual-to-expected ratios are shown as well.

RATES OF MORTALITY

Mortality tables are a fundamental assumption in actuarial valuations. Benefits are typically paid over a retiree's lifetime, so it is important to appropriately reflect what a typical lifetime looks like. In addition, deaths before retirement typically result in the payout of benefits to a spouse or survivor. For valuation purposes, we must consider mortality tables for retirees, beneficiaries of retirees, disabled retirees, and active members.

The Society of Actuaries periodically publishes mortality tables derived from large, national studies. In recent years, they have tended to publish families of tables, allowing actuaries to select a table that is based on a subset of data most similar to that of the data the actuary is trying to value.

In early 2019, the Society released a set of tables based solely on public plan data. This family of tables, called the Pub-2010 tables, includes tables based not only on the gender and status factors already noted, but also on the type of membership (teachers, public safety, and general government), as well as further breakdowns based on those members who were above or below the median benefit amounts. Because most other recent families of tables had excluded public sector data, the Pub-2010 tables are expected to be quite useful for valuing the benefits for public retirement systems.

The post-retirement mortality rates used in the actuarial valuation project the percentage of retirees who are expected to die in a given future year. This assumption is a very material assumption and has the most significant impact of all demographic assumptions on liability projections. An important note in the examination of mortality it is an observed correlation that life expectancy is greater for retirees with higher benefits than retirees with lower benefits. Because the goal of an actuarial valuation is to model the expected benefit payments to be provided by a system and the



Section III: Demographic Assumptions

liability associated with these payments, actuaries increasingly analyze mortality experience on a benefit-weighted basis rather than simply considering headcounts (number of members dying).

The recommended mortality tables in the analysis on the following pages include adjustments. The adjustments to the standard mortality tables were determined following the procedures outlined in the Credibility Educational Resource for Pension Actuaries, Application of Credibility Theory to Mortality Assumption published by the Society of Actuaries. For the credibility analysis, we utilized a 90% confidence interval on the benefit weighted basis.

Based upon the long-term trend of mortality improvement, actuaries seek to account for future improvements in longevity, either by generationally projecting future improvements or by maintaining a sufficient margin in expected rates of mortality to allow for future improvement. We recommend generationally projected mortality improvement approach.

RETIREE MORTALITY

The current table is the RP-2000 Combined Employee and Annuitant Mortality Table projected to 2020 using scale BB, set back one year for males. This table is used for all non-disabled members.

Retiree Mortality Recommendations

Public Safety Plans (FURS, GWPORS, HPORS, MPORS, SRS and VFCA)

The liability weighted analysis of the actual post-retirement mortality experience over the five-year study period for the combined Public Safety Plans (FURS, GWPORS, HPORS, MPORS, SRS, and VFCA) yields actual/expected ratios of 130% and 90% respectively for males and females.

Public Safety Plans Retiree Mortality Experience – Current Table

	Exposures	Actual Deaths	Expected Deaths	A/E Ratio
Males	355,395,052	7,421,941	5,751,829	1.290
Females	13,391,343	98,549	109,590	0.899



Retiree Mortality Findings and Recommendations

Experience indicates that overall, the aggregate liability released due to death is greater than expected for males and less than expected for females. As a result, we recommend updating the mortality assumption to the PUB-2010 Safety Amount Weighted Healthy Retiree mortality table projected to 2021 set forward one year and adjusted 105% for males and with no adjustment for females. Future improvement in mortality rates is reflected by applying the MP-2021 projection scale generationally. The actual/expected ratios under the proposed mortality assumption are 106% and 92% for males and females respectively.

The complete tables of recommended mortality rates are shown in Appendix C.

The following pages contain charts and graphs with detailed results of our mortality analysis.



Section III: Demographic Assumptions

Public Safety Mortality Experience – Proposed Table

Post-Retirement Mortality - Males						
Central Age	Current Table			Proposed Table		
	Actual	Expected	Ratio Actual/Expected	Actual	Expected	Ratio Actual/Expected
Under 45	0	2,132	0.000	0	1,928	0.000
45-49	40,540	20,523	1.975	40,540	21,967	1.845
50-54	208,635	78,689	2.651	208,635	86,996	2.398
55-59	213,035	209,245	1.018	213,035	237,216	0.898
60-64	351,065	423,629	0.829	351,065	489,755	0.717
65-69	881,415	787,903	1.119	881,415	894,938	0.985
70-74	1,441,507	1,050,515	1.372	1,441,507	1,220,282	1.181
75-79	1,115,644	987,976	1.129	1,115,644	1,203,875	0.927
80-84	1,159,421	916,624	1.265	1,159,421	1,195,808	0.970
85-89	1,253,411	755,487	1.659	1,253,411	1,027,000	1.220
90 & Over	757,269	519,107	1.459	757,269	641,224	1.181
Total	7,421,941	5,751,829	1.290	7,421,941	7,020,989	1.057

Post-Retirement Mortality - Females						
Central Age	Current Table			Proposed Table		
	Actual	Expected	Ratio Actual/Expected	Actual	Expected	Ratio Actual/Expected
Under 45	0	18	0.000	0	13	0.000
45-49	0	1,040	0.000	0	859	0.000
50-54	0	4,215	0.000	0	3,988	0.000
55-59	0	7,867	0.000	0	8,627	0.000
60-64	29,657	15,521	1.911	29,657	16,236	1.827
65-69	0	30,884	0.000	0	28,708	0.000
70-74	2,100	15,556	0.135	2,100	13,985	0.150
75-79	10,588	12,376	0.856	10,588	11,890	0.891
80-84	5,865	2,636	2.225	5,865	2,736	2.143
85-89	30,684	6,870	4.466	30,684	7,362	4.168
90 & Over	19,656	12,607	1.559	19,656	13,275	1.481
Total	98,549	109,590	0.899	98,549	107,679	0.915

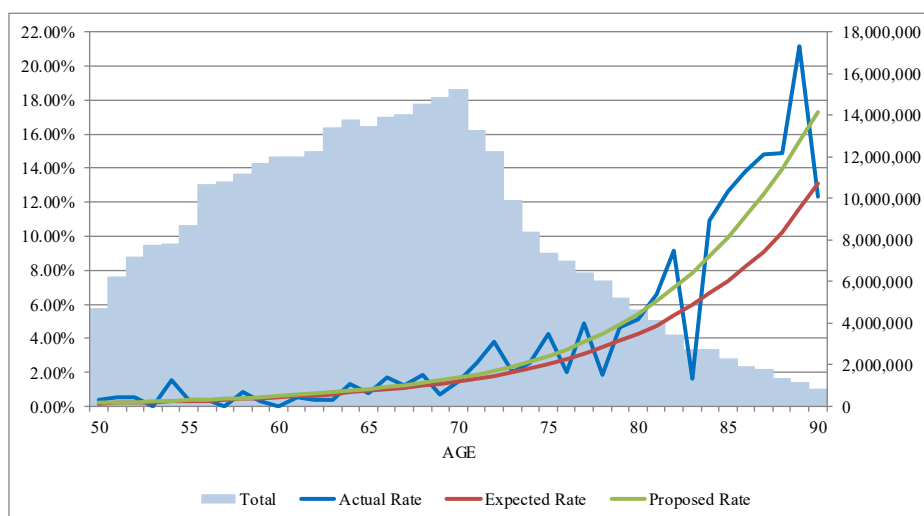


Section III: Demographic Assumptions

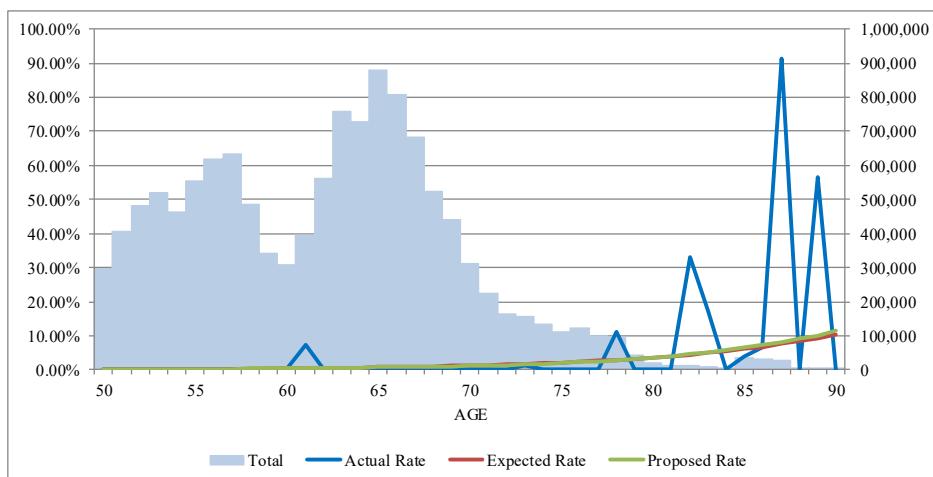
The right axis of the charts below represents the number of exposed liabilities. The exposed liabilities are the total number of benefits subject to mortality rates based upon the benefit recipient's age during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.

The left axis of the charts below show (i) the actual rates of mortality for retirees and beneficiaries by age during the past five years, (ii) the current assumed rates of mortality and (iii) the recommended assumed rates of mortality.

Public Safety Probability of Death – Male Retirees



Public Safety Probability of Death – Female Retirees





General Employee Plans (PERS and JRS)

The analysis of the actual post-retirement mortality experience over the five-year study period for the combined General Employee Plans (PERS and JRS) yields actual/expected ratios of 118% and 102% respectively for males and females.

	Exposures	Actual Deaths	Expected Deaths	A/E Ratio
Males	1,018,991,668	28,652,771	24,394,946	1.175
Females	834,138,815	17,413,470	17,159,763	1.015

Retiree Mortality Findings and Recommendations

Experience indicates that overall, the aggregate liability released due to death for both males and females are more than the numbers expected. We recommend updating the mortality assumption to the PUB-2010 General Employees Amount Weighted Healthy Retiree mortality table projected to 2021 with ages set forward one year and adjusted 104% for males and 103% for females. Future improvement in mortality rates is reflected by applying the MP-2021 projection scale generationally. The actual/expected ratios under the proposed mortality assumption are 100% and 101% for males and females, respectively.

The complete tables of recommended mortality rates are shown in Appendix C.



Section III: Demographic Assumptions

General Employees Mortality Experience – Proposed Table

The following pages contain charts and graphs with detailed results of our mortality analysis.

Post-Retirement Mortality - Males						
Central Age	Current Table			Proposed Table		
	Actual	Expected	Ratio Actual/Expected	Actual	Expected	Ratio Actual/Expected
Under 45	0	16	0.000	0	17	0.000
45-49	0	587	0.000	0	843	0.000
50-54	0	14,223	0.000	0	22,570	0.000
55-59	443,400	169,010	2.624	443,400	241,466	1.836
60-64	1,472,681	1,051,492	1.401	1,472,681	1,299,981	1.133
65-69	3,058,427	3,249,990	0.941	3,058,427	3,633,292	0.842
70-74	4,959,387	4,533,869	1.094	4,959,387	5,005,582	0.991
75-79	4,423,464	4,306,173	1.027	4,423,464	4,894,375	0.904
80-84	5,238,906	4,170,669	1.256	5,238,906	5,083,696	1.031
85-89	4,643,672	3,650,937	1.272	4,643,672	4,615,662	1.006
90 & Over	4,412,834	3,247,981	1.359	4,412,834	3,749,803	1.177
Total	28,652,771	24,394,946	1.175	28,652,771	28,547,289	1.004

Post-Retirement Mortality - Females						
Central Age	Current Table			Proposed Table		
	Actual	Expected	Ratio Actual/Expected	Actual	Expected	Ratio Actual/Expected
Under 45	0	23	0.000	0	18	0.000
45-49	0	454	0.000	0	470	0.000
50-54	4,547	12,947	0.351	4,547	17,368	0.262
55-59	164,278	126,826	1.295	164,278	148,581	1.106
60-64	758,542	763,903	0.993	758,542	726,037	1.045
65-69	1,906,380	2,311,060	0.825	1,906,380	1,926,271	0.990
70-74	2,107,500	2,991,168	0.705	2,107,500	2,515,199	0.838
75-79	2,841,914	2,974,314	0.955	2,841,914	2,773,464	1.025
80-84	2,852,955	2,689,139	1.061	2,852,955	2,845,968	1.002
85-89	2,860,643	2,481,398	1.153	2,860,643	2,916,921	0.981
90 & Over	3,916,711	2,808,531	1.395	3,916,711	3,368,508	1.163
Total	17,413,470	17,159,763	1.015	17,413,470	17,238,804	1.010

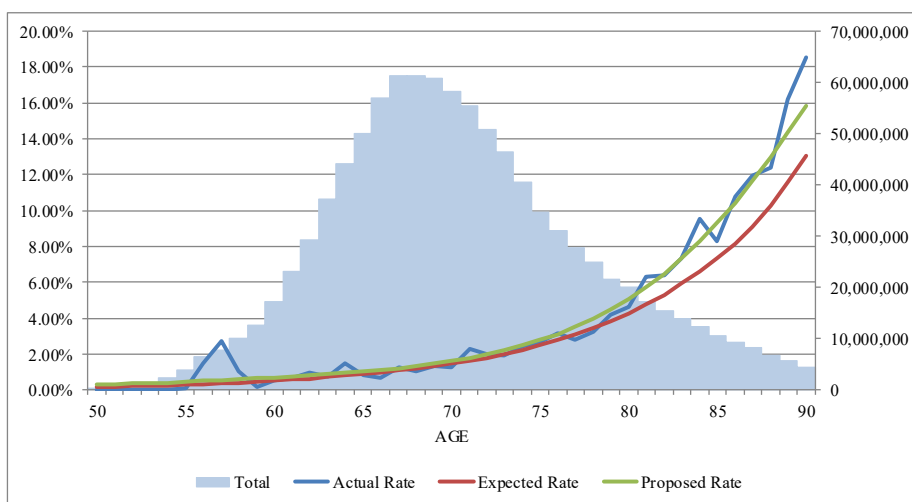


Section III: Demographic Assumptions

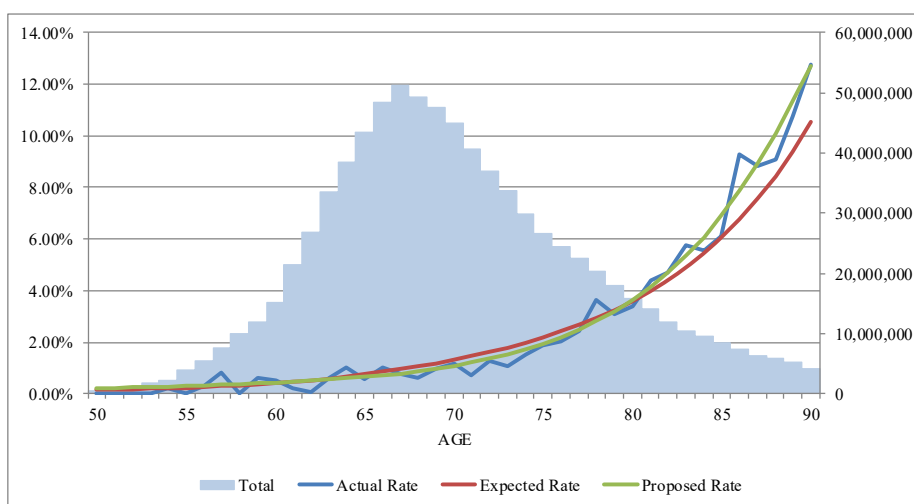
The right axis of the charts below represents the number of exposed liabilities. The exposed liabilities are the total number of benefits subject to mortality rates based upon the benefit recipient's age during the experience period. When recommending assumption changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.

The left axis of the charts below show (i) the actual rates of mortality for retirees and beneficiaries by age during the past five years, (ii) the current assume rates of mortality and (iii) the recommended assumed rates of mortality.

General Employees Probability of Death - Healthy Males



General Employees Probability of Death - Healthy Females





Contingent Survivor Mortality

Currently, the assumption for this group is based on rates from the RP-2000 Combined Healthy Mortality table for Males and Females without projection. For the survivors in the Public Safety Plans, the study period yielded actual/expected ratios of 606.7% and 155.1% respectively for males and females. For survivors in the General Employee Plans, the study period yielded actual/expected ratios of 184.4% and 143.5% respectively for males and females. These ratios indicate survivors are dying at a rate greater than as currently assumed.

Beneficiary Mortality Experience under Current Assumptions

	Exposures	Actual Deaths	Expected Deaths	A/E Ratio
Public Safety Plans				
Males	1,369,138	224,723	37,042	6.067
Females	58,545,171	3,549,209	2,288,144	1.551
General Employees				
Males	21,182,040	1,234,553	669,351	1.844
Females	123,156,464	7,832,877	5,459,068	1.435

Contingent Survivor Mortality Findings and Recommendations

Experience indicates that overall, more survivors have died than expected during the study period. However, the number of actual and expected survivor deaths are not fully credible due to a low number of exposed lives during the experience period, therefore we have not performed adjustments due to credibility. We recommend the use of the PUB-2010 Safety Amount Weighted Contingent Survivor mortality tables set forward one year for males and the PUB-2010 General Amount Weighted Contingent Survivor Retiree mortality table projected to 2021 set forward one year for both male and females. Future improvement in mortality rates is reflected by applying the MP-2021 projection scale generationally.

Disabled Retiree Mortality

Members who retire under the disability retirement provisions are generally expected to be less healthy than the overall population. Currently, the assumption for this group is based on rates from the RP-2000 Combined Healthy Mortality table for Males and Females without projection. For the retirees in the Public Safety Plans, the study period yielded actual/expected ratios 156.5% and 231.3% respectively for males and females. For retirees in the General Employee Plans, the study



Section III: Demographic Assumptions

period yielded actual/expected ratios of 192.2% and 183.0% respectively for males and females. These ratios indicate disabled individuals are dying at a rate that is greater than is currently assumed.

Disabled Retiree Mortality Experience under Current Assumptions

	Exposures	Actual Deaths	Expected Deaths	A/E Ratio
Public Safety Plans				
Males	33,053,403	1,041,377	665,228	1.565
Females	3,762,404	32,640	14,110	2.313
General Employees				
Males	22,666,652	1,289,854	671,243	1.922
Females	16,747,206	670,936	366,566	1.830

Disabled Retiree Mortality Findings and Recommendations

Experience indicates that overall, more members have died than expected during the study period. However, the number of actual and expected disabled deaths are not fully credible due to a low number of exposed lives during the experience period, therefore we have not performed credibility adjustments to the standard table. We recommend the use of a more modern base table for disabled mortality. For the Public Safety Plans, we recommend adopting the PUB-2010 Safety Amount Weighted Disabled Retiree mortality tables set forward one year for males. For the General Employees Plans, we recommend adopting the PUB-2010 General Amount Weighted Disabled Retiree mortality table set forward 1 year for both male and females. No future improvements are reflected for the disabled retirees.



Rates of Pre-Retirement Mortality

The rates of pre-retirement mortality are used in the actuarial valuation to project the percentage of employees who are expected to terminate due to death.

EXPERIENCE UNDER CURRENT ASSUMPTIONS

	Actual	Expected	A/E Ratio
PERS	5,150,853	17,047,338	30.22%
JRS	0	169,965	0.00%
HPORS	79,529	78,535	101.27%
SRS	186,306	545,498	34.15%
GWPORS	114,353	408,210	28.01%
MPORS	73,635	248,409	29.64%
FURS	58,998	332,285	17.76%
VFCA	19	30	63.48%

Findings and Recommendations

As is typical with most large public pension plans, a small number of deaths occur amongst the active member population during the experience period. The data is not sufficient to recommend a change in the actuarial assumption for pre-retirement mortality. As a result, we recommend the use of a more modern base table that would be expected to accurately predict mortality rates in the future for the active membership. For the Public Safety Plans, we recommend adopting the PUB-2010 Safety Employee mortality tables. For the General Employees Plans, we recommend adopting the PUB-2010 General Employee mortality table. Future improvement in mortality rates is reflected by applying the MP-2021 projection scale generationally.



RATES OF SERVICE RETIREMENT

The service retirement rates used in the actuarial valuations project the percentage of employees who are expected to retire during a given year. This assumption does not include the retirement patterns of the individuals who terminated from active membership prior to their retirement.

Higher paid members typically have a greater liability compared to members who are lower paid. As a result, retirement rates for members with higher compensation levels and higher service will have a greater influence on the liabilities of the System. As a result, we liability weighted the experience to better reflect the impact of the current assumption on liability measures. The liability is approximated by using the member’s compensation and years of service to estimate the member’s benefit level. The exposure and actual occurrences are then multiplied by the benefit level to provide the liability-weighted experience. We find the liability-weighted experience to better correlate to the impact of actual and expected rates of withdrawal on the valuation results. The table below shows the liability weighted experience for all the Systems.

	Actual	Expected	A/E Ratio
PERS	284,316,500	273,382,147	104.00%
JRS	1,446,726	816,516	177.18%
HPORS	2,549,622	1,501,984	169.75%
SRS	5,764,561	3,626,035	158.98%
GWPORS	6,716,139	6,545,962	102.60%
MPORS	5,977,240	5,884,922	101.57%
FURS	7,151,001	6,332,414	112.93%
VFCA	272	328	82.93%

PERS Members

For members who began participation prior to July 1, 2011, PERS provides an unreduced retirement benefit upon obtaining age 60 and with at least five years of membership service, age 65 or any age with 30 or more years of membership service. PERS also provides a reduced benefit to members who retire upon obtaining age 50 with at least 5 years of membership service or any age with at least 25 years of membership service (but below 30 years). The normal retirement benefit is reduced by 6.0% per year for the first five years and 3.6% per year for the next five years for each year the member is younger than age 65 or has less than 30 years of service, whichever is smaller.



Section III: Demographic Assumptions

For members who began participation on or after July 1, 2011, PERS provides an unreduced retirement benefit upon obtaining age 65 and with at least five years of membership service or age 70. PERS also provides a reduced benefit to members who retire upon obtaining age 55 with at least 5 years of service. The early retirement benefit is the actuarial equivalent benefit of the normal retirement benefit payable at age 65.

The retirement experience was analyzed for two groups of members who qualified for a retirement benefit during the experience period. The first group included members who had obtained less than 30 years of service. The second group included members who had obtained 30 years of service or had obtained age 60 with 25 years of service. The analysis of the actual retirement experience over the five-year period yielded an actual/expected ratio of 104.0%. An actual/expected ratio that is greater than 100% indicates that more members have retired during the experience period than anticipated. We recommend adjusting the assumed rates of retirement for PERS members to reflect recent experience.

The table below illustrates the liability weighted actual/expected ratio for PERS members based on the recommended assumption.

	Actual	Expected	A/E Ratio
PERS	284,316,500	287,370,447	98.94%

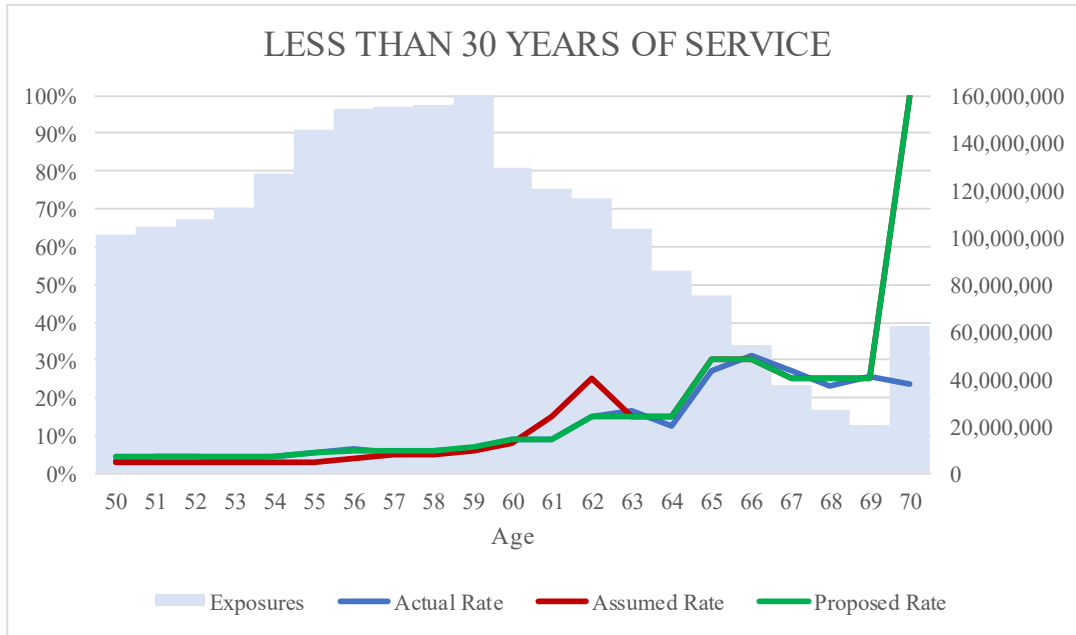
The right axis of the charts below represents exposed liabilities. The exposed liabilities are the total number of annual salaries subject to retirement rates based upon the member's age and service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.



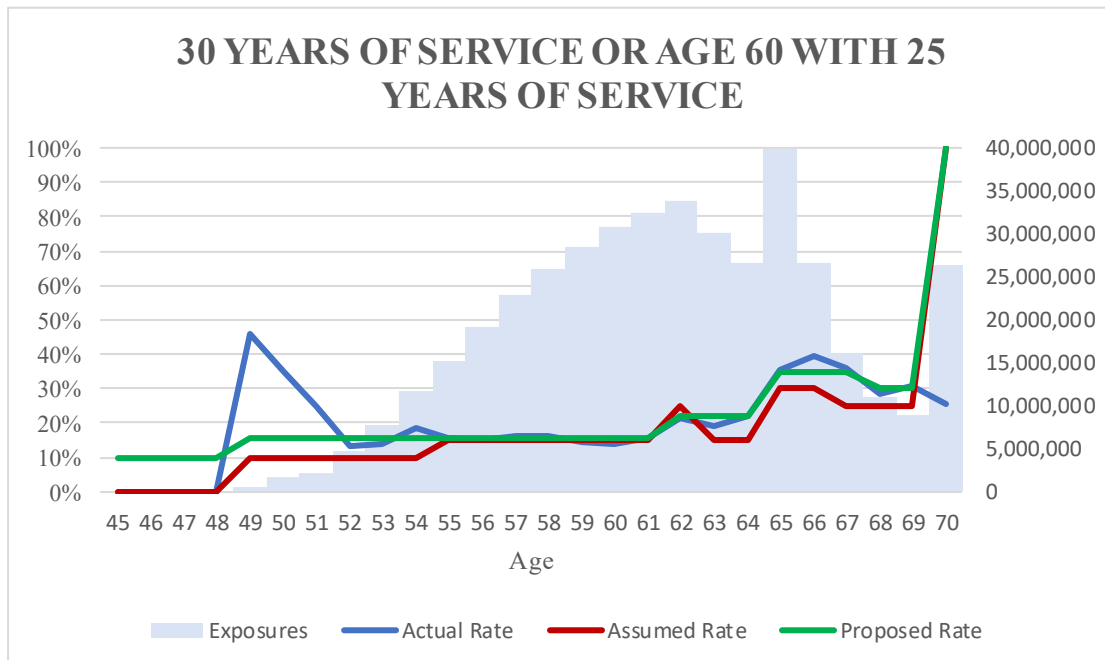
Section III: Demographic Assumptions

The charts below show a comparison between (i) the actual rates of retirement, (ii) the current assumed rates of retirement and (iii) the number of exposed lives during the experience period.

PERS - Service Retirements



PERS - Service Retirements





Section III: Demographic Assumptions

JRS Members

JRS provides an unreduced retirement benefit upon obtaining age 60 with at least five years of membership service.

It is currently assumed these members will begin retiring at the attainment of age 60.

Retirement analysis was based on age for members who qualified for retirement benefit during the experience period. The analysis of the actual retirement experience yields an actual/expected ratio of 177.2%. An actual/expected ratio that is greater than 100% indicates that more than the assumed amounts of members have retired during the experience period. We recommend changing the assumed rates of retirement for JRS members to reflect recent experience.

The table below illustrates the liability weighted actual/expected ratio for JRS members based on the recommended assumption.

	Actual	Expected	A/E Ratio
JRS	1,446,726	1,630,719	88.72%

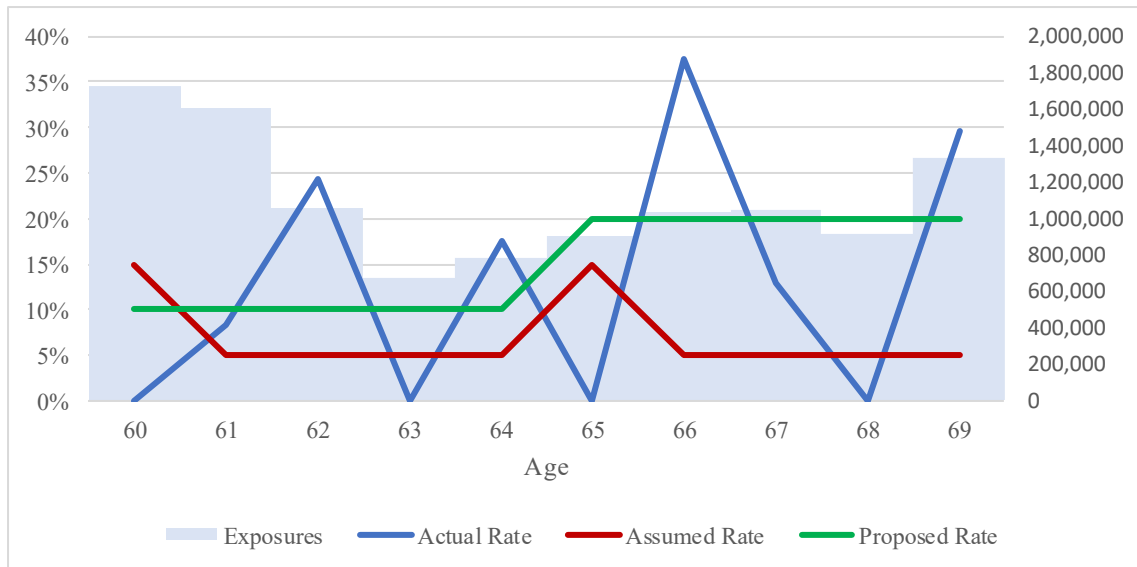
The right axis of the charts below represents exposed liabilities. The exposed liabilities are the total number of annual salaries subject to retirement rates based upon the member's age during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.



Section III: Demographic Assumptions

The chart below shows a comparison between (i) the actual rates of retirement, (ii) the current assumed rates of retirement and (iii) the number of exposed lives during the experience period.

JRS - Service Retirements





Section III: Demographic Assumptions

HPORS Members

HPORS provides an unreduced retirement benefit upon the completion of 20 years of membership service. HPORS also provides actuarially reduced benefits (from age 60) to members hired before July 1, 2013 who retire before reaching normal retirement age with at least five years of membership service, as well as to members hired after July 1, 2013 who retire before reaching normal retirement age with at least 10 years of membership service.

It is currently assumed that HPORS members will begin retiring upon obtaining any age with 20 years of membership service or upon obtaining age 60 and 5 years of service.

HPORS includes a Deferred Retirement Option Plan (DROP). A member is eligible to enter the DROP upon obtaining 20 years of service. The DROP allows active members to accumulate their retirement benefit with interest while continuing to remain employed for up to 60 months. If a member chooses the DROP, the DROP member's monthly retirement benefit along with the required member contributions are accumulated in a hypothetical DROP account. Upon exiting the DROP, the member will begin receiving directly, their monthly retirement allowance, which was determined on the date they entered the DROP and will receive their DROP account balance accumulated with interest as a lump sum. The assumed rates of retirement are increased for members with 20 up to 26 years of service to account for members choosing to enter the DROP.

The retirement experience was analyzed for two groups of members who qualified for an unreduced retirement benefit during the experience period. The first group included members with 20 up to 26 years of service and the second group has members with 26 or more years of service. The analysis of the actual retirement experience yields an actual/expected ratio of 169.8%. An actual/expected ratio that is greater than 100% indicates that more than the assumed amounts of members have retired during the experience period. We do not recommend changing the assumed rates of retirement for HPORS to reflect recent experience.

The table below illustrates the liability weighted actual/expected ratio for HPORS members based on the recommended assumption.

	Actual	Expected	A/E Ratio
HPORS	2,549,622	2,066,484	123.38%

The right axis of the charts below represents exposed liabilities. The exposed liabilities are the total number of annual salaries subject to retirement rates based upon the member's age and service during the experience period. When recommending assumptions changes, it is important to

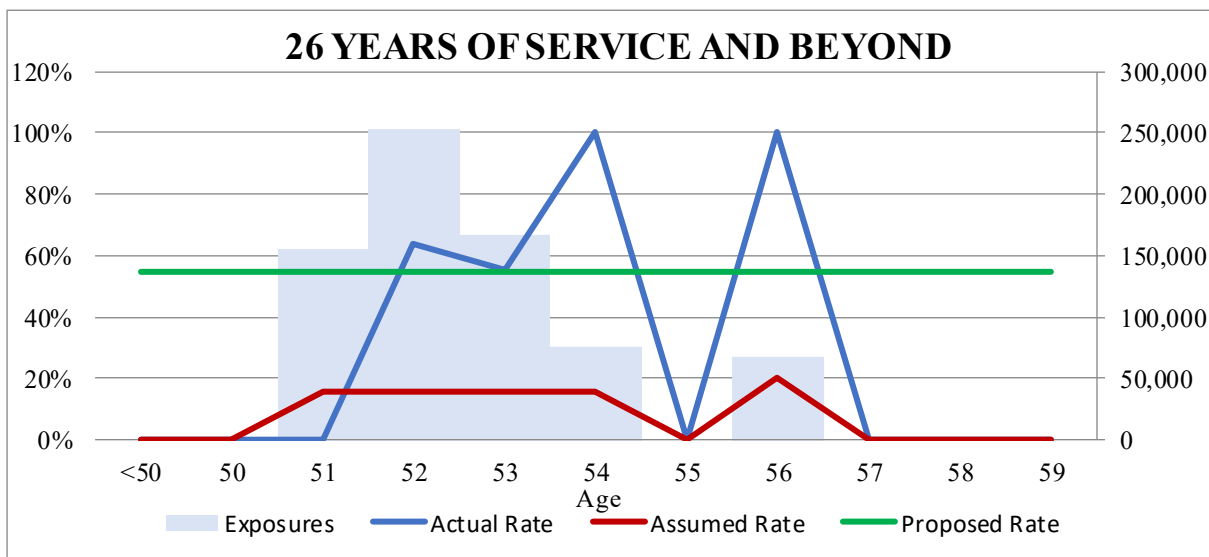


Section III: Demographic Assumptions

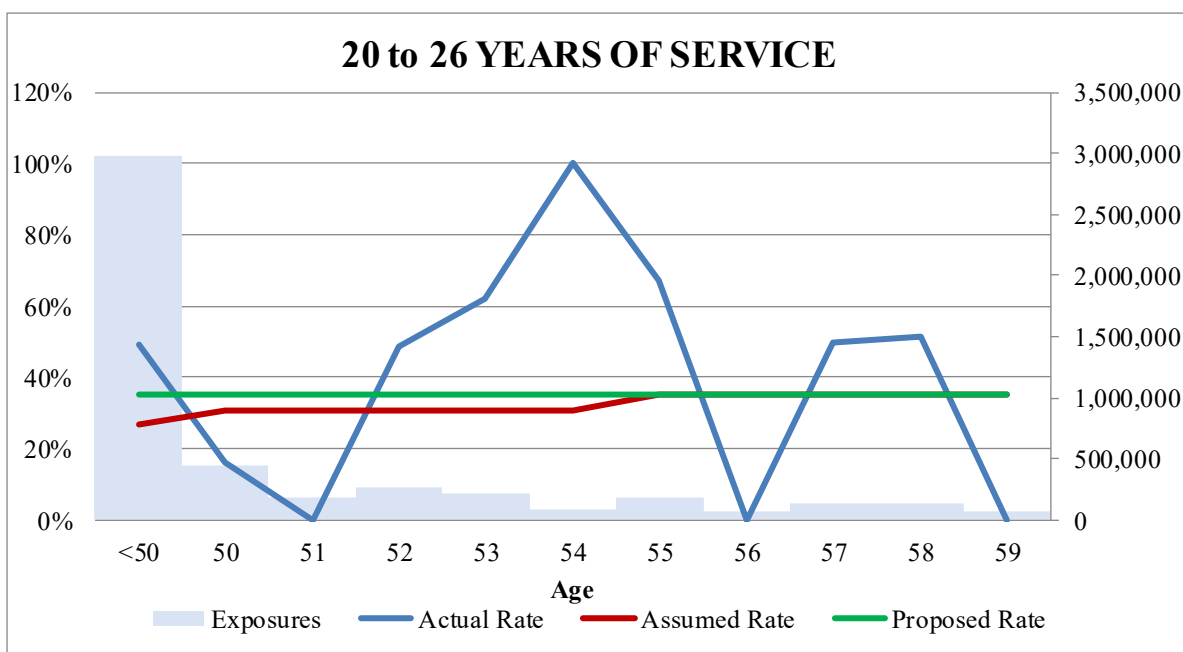
recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.

The charts below show a comparison between (i) the actual rates of retirement, (ii) the current assumed rates of retirement and (iii) the number of exposed lives during the experience period.

HPORS - Service Retirements



HPORS - Service Retirements





SRS Members

SRS provides an unreduced retirement benefit after 20 years of membership service. SRS also provides an actuarially reduced benefit (from age 60 or the attainment of 20 years of service) to members who retire upon obtaining age 50 with at least five years of membership service.

It is currently assumed that these members will begin retiring upon obtaining any age with 20 years of membership service or upon obtaining age 65 and 5 years of service.

The retirement experience was based on members who obtained 20 years of service or age 65 and five years of service during the experience period. The analysis yielded an actual/expected ratio of 159.0%. An actual/expected ratio that is greater than 100% indicates that more than the assumed amounts of members have retired during the experience period. We recommend changing the assumed rates of retirement for SRS to reflect recent experience.

The table below illustrates the liability weighted actual/expected ratio for SRS members based on the recommended assumption.

	Actual	Expected	A/E Ratio
SRS	5,764,561	6,565,558	87.80%

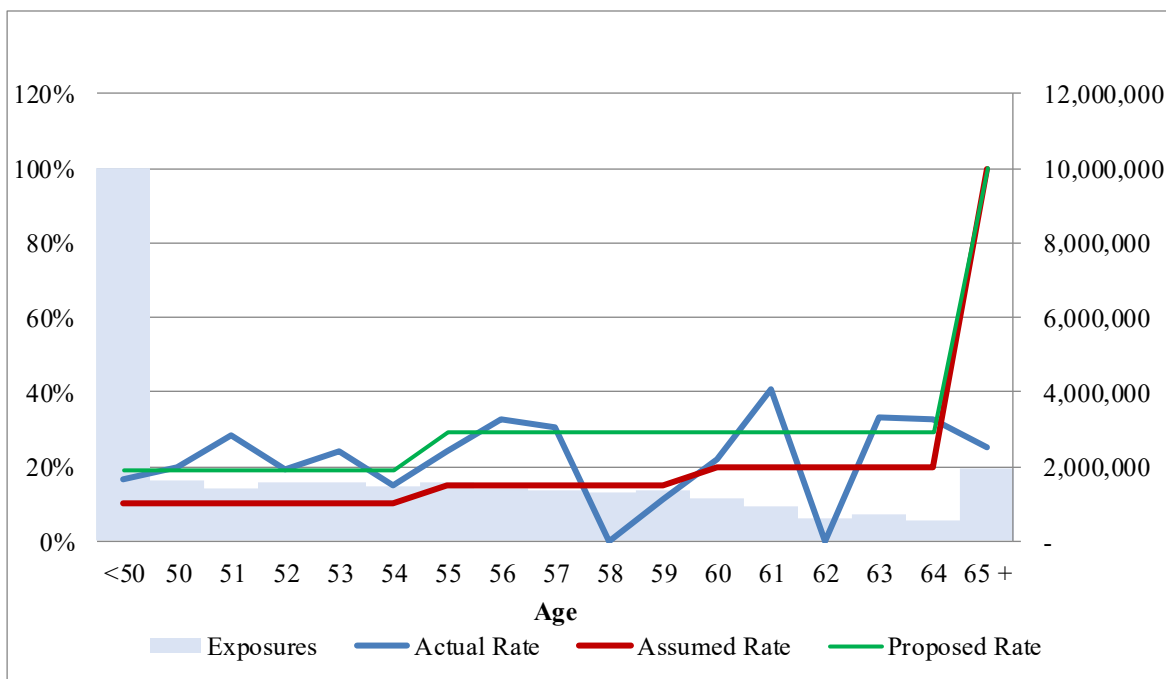
The right axis of the charts below represents exposed liabilities. The exposed liabilities are the total number of annual salaries subject to retirement rates based upon the member's age and service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.



Section III: Demographic Assumptions

The chart below shows a comparison between (i) the actual rates of retirement, (ii) the current assumed rates of retirement and (iii) the number of exposed lives during the experience period.

SRS - Service Retirements





GWPORS Members

GWPORS provides an unreduced retirement benefit upon obtaining age 50 and with at least 20 years of membership service or obtaining age 55 with at least 5 years of service. It is currently assumed these members will begin retiring upon the earlier of obtaining age 50 with 20 years of membership service or age 55 with 5 years of membership service.

The retirement experience was analyzed for two groups of members who qualified for an unreduced retirement benefit during the experience period. The first group was for members who satisfied obtaining age 55 with 5 years of service and the second group was for members who obtained age 50 with 20 years of service. The analysis of the actual retirement experience yields an actual/expected ratio of 102.6%. An actual/expected ratio that is greater than 100% indicates that more than the assumed amounts of members have retired during the experience period. We recommend changing the assumed rates of retirement for GWPORS members with 20 or more years of service to reflect recent experience and provide a better fit of the observed experience.

The table below illustrates the liability weighted actual/expected ratio for GWPORS members based on the recommended assumption.

	Actual	Expected	A/E Ratio
GWPORS	6,716,139	6,460,747	103.95%

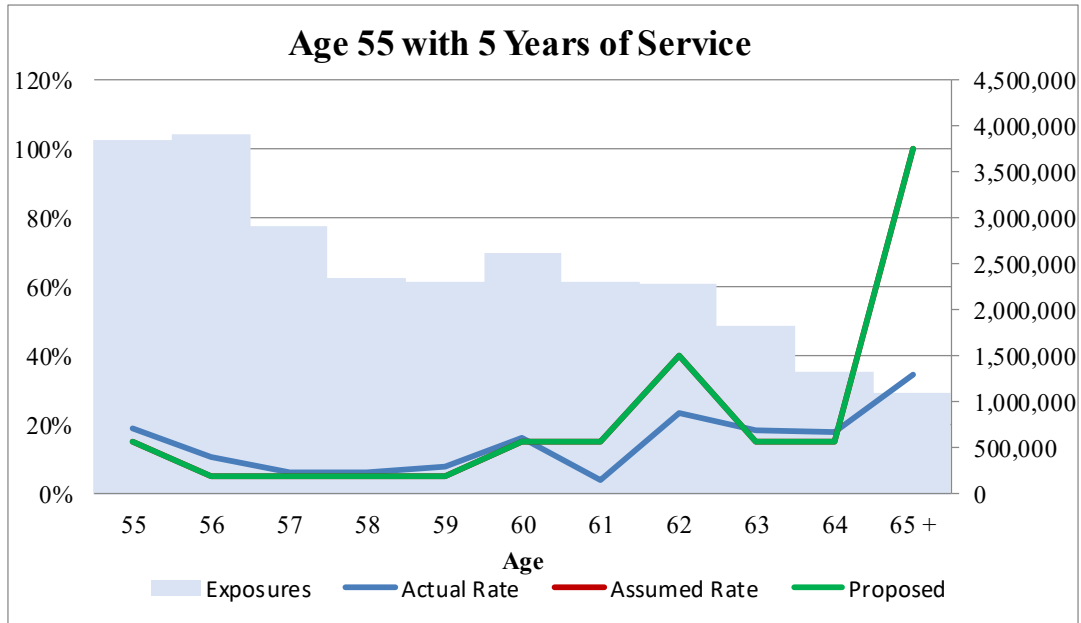
The right axis of the charts below represents exposed liabilities. The exposed liabilities are the total number of annual salaries subject to retirement rates based upon the member's age and service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.



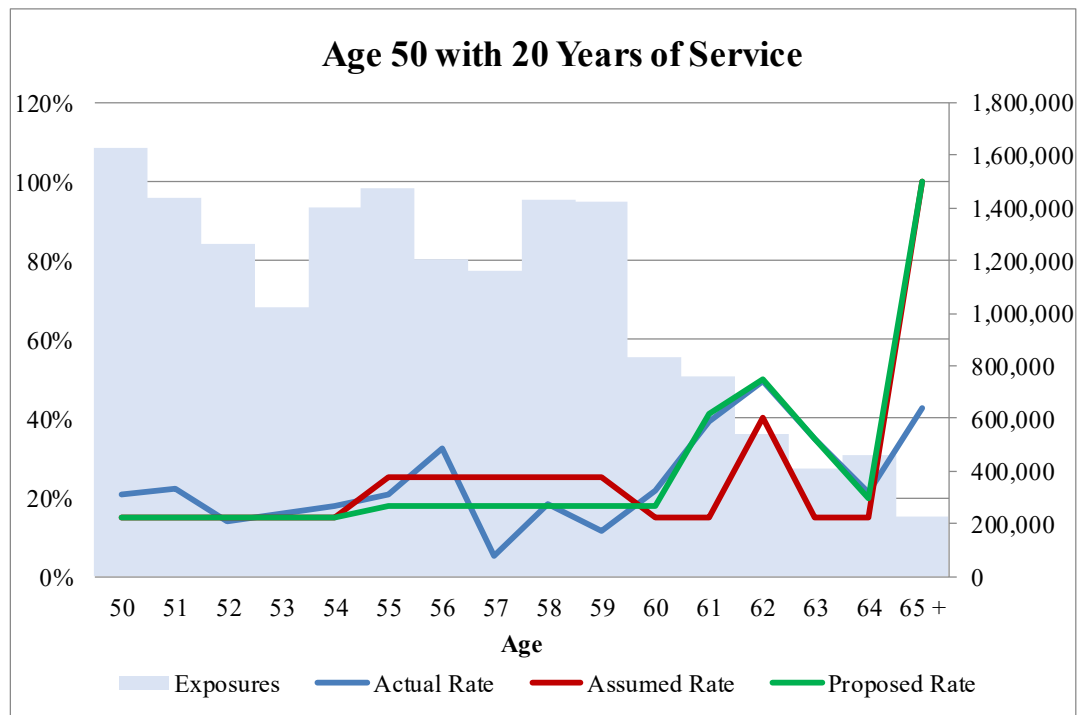
Section III: Demographic Assumptions

The charts below show a comparison between (i) the actual rates of retirement, (ii) the current assumed rates of retirement, and (iii) the number of exposed lives during the experience period.

GWPORS - Service Retirements



Service Retirements





Section III: Demographic Assumptions

MPORS Members

MPORS provides an unreduced retirement benefit upon obtaining age 50 and with at least 5 years of membership service or any age with at least 20 years of membership service. It is currently assumed these members will begin retiring upon the earlier of obtaining 20 years of membership service, regardless of age, or age 65 with at least 5 years of service.

MPORS includes a Deferred Retirement Option Plan (DROP). A member is eligible to enter the DROP upon obtaining 20 years of service. The DROP allows active members to accumulate their retirement benefit with interest while continuing to remain employed for up to 60 months. If a member chooses the DROP, the DROP member’s monthly retirement benefit, including cost-of-living increases, are accumulated in a hypothetical DROP account. Upon exiting the DROP, the member will begin receiving directly, their monthly retirement allowance which was determined on the date they entered the DROP, including increases for cost-of-living adjustments, and will receive their DROP account balance accumulated with interest as a lump sum. The assumed rates of retirement are increased for 20 up to 26 years of service to account for members choosing to enter the DROP.

The retirement experience was analyzed for two groups of members who qualified for an unreduced retirement benefit during the experience period. The first group included members with 20 up to 26 years of service and the second group included those members with 26 years of service and beyond for being eligible for a retirement benefit. The analysis of the actual retirement experience yields an actual/expected ratio of 101.6%. An actual/expected ratio that is greater than 100% indicates that more than the assumed amounts of members have retired during the experience period. We recommend changing the assumed rates of retirement for MPORS members at this time.

The table below illustrates the liability weighted actual/expected ratio for MPORS members based on the recommended assumption.

	Actual	Expected	A/E Ratio
MPORS	5,977,240	6,036,330	99.02%

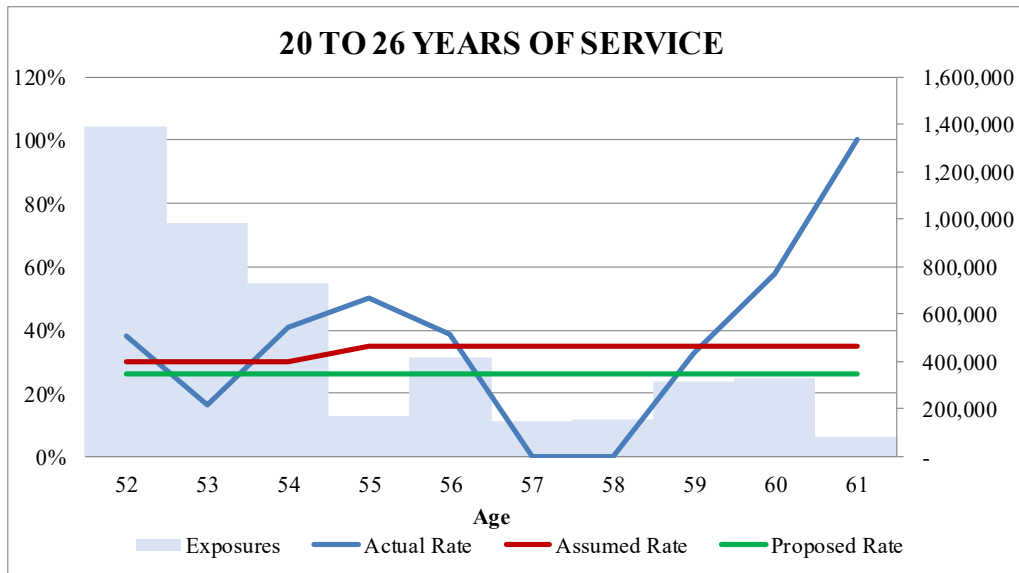
The right axis of the charts below represents exposed liabilities. The exposed liabilities are the total number of annual salaries subject to retirement rates based upon the member’s age and service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.



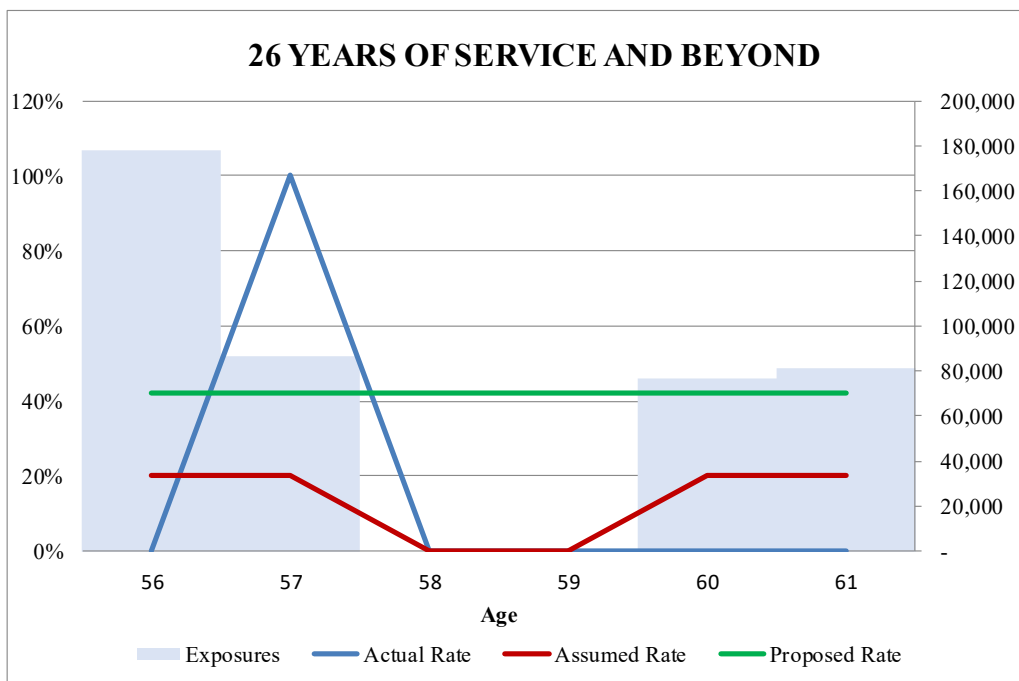
Section III: Demographic Assumptions

The charts below show a comparison between (i) the actual rates of retirement, (ii) the current assumed rates of retirement and (iii) the number of exposed lives during the experience period.

MPORS - Service Retirements



MPORS - Service Retirements





Section III: Demographic Assumptions

FURS Members

FURS provides an unreduced retirement benefit upon obtaining 20 years of membership service, regardless of age. FURS also provides an unreduced early retirement benefit to members who retire upon obtaining age 50 with at least 5 years of membership service.

It is currently assumed these members will begin retiring upon obtaining 20 years of membership service, regardless of age, or age 63 with 5 years of membership service.

Retirement experience was analyzed by age for members with 20 or more years of service. The analysis of the actual retirement experience yields an actual/expected ratio of 112.9%. An actual/expected ratio that is greater than 100% indicates that more than the assumed amounts of members have retired during the experience period. We recommend changing the assumed rates of retirement for FURS to reflect recent experience and provide a better fit of the observed experience.

The table below illustrates the liability weighted actual/expected ratio for FURS members based on the recommended assumption.

	Actual	Expected	A/E Ratio
FURS	7,151,001	8,669,214	82.49%

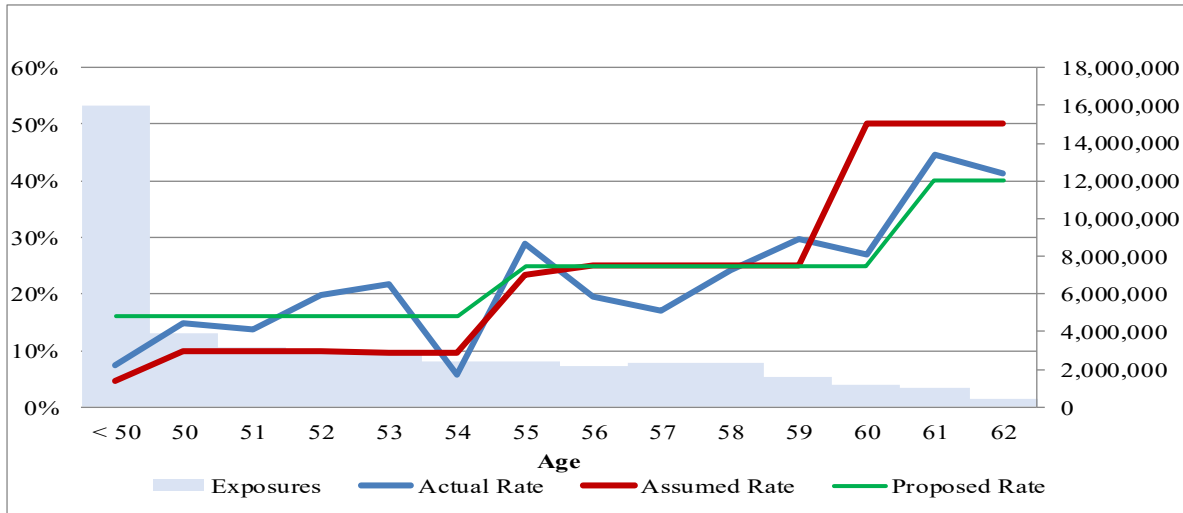
The right axis of the charts below represents exposed liabilities. The exposed liabilities are the total number of annual salaries subject to retirement rates based upon the member's age and service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.



Section III: Demographic Assumptions

The chart below shows (i) the actual rates of retirement for employees by service during the past six years, (ii) the current assume rates of retirement and (iii) the number of exposed lives during the experience period.

FURS - Service Retirements





Section III: Demographic Assumptions

VFCA Members

VFCA provides a retirement benefit upon obtaining age 55 with at least 20 years of membership service or a partial retirement benefit upon obtaining age 60 with at least 10 years of membership service.

It is currently assumed these members will begin retiring upon the earlier of obtaining age 55 with 20 years of membership service or age 60 with 10 years of membership service.

The retirement experience was analyzed for two groups of members who qualified for a retirement benefit during the experience period. The first group included those that retired with less than 20 years of service and the second group included those that retired with 20 or more years of service. The analysis of the actual retirement experience yields an actual/expected ratio of 82.9%. An actual/expected ratio less than 100% indicates that the current assumption overestimated the number of retirements during the experience period. We recommend changing the current assumed retirement rates for VFCA.

The table below illustrates the headcount weighted actual/expected ratio for VFCA members based on the recommended assumption.

	Actual	Expected	A/E Ratio
VFCA	272	284	95.75%

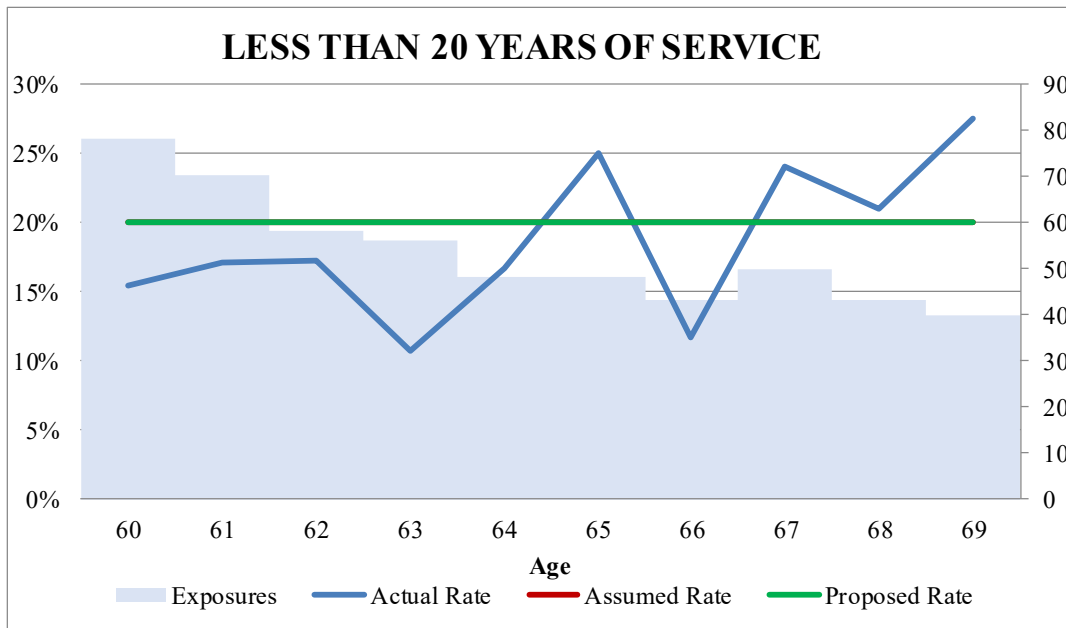
The right axis of the charts below represents exposed headcounts. The exposed headcounts are the total number of members subject to retirement rates based upon the member's age and service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.



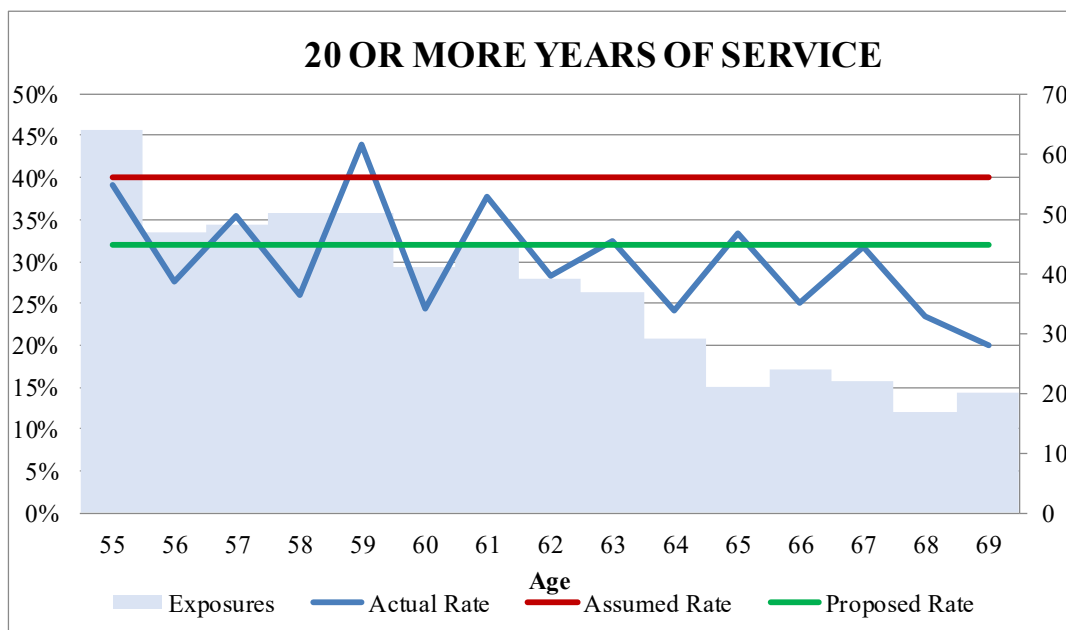
Section III: Demographic Assumptions

The charts below show (i) the actual rates of retirement for employees by service during the past six years, (ii) the current assumed rates of retirement and (iii) the number of exposed lives during the experience period.

VFCA - Service Retirements



VFCA - Service Retirements





RATES OF DISABILITY RETIREMENT

The rates of disability retirement used in the actuarial valuation project the percentage of employees who are expected to become disabled each year and begin receiving a disability retirement benefit. All members qualify for a disability retirement benefit upon employment, with the exception of PERS members, who must have at least 5 years of service. The table below shows the disability experience for each of the Systems. In general there were fewer disability retirements during the experience period except for HPORS and MPORS which experienced more disability retirements than anticipated.

	Actual	Expected	A/E Ratio
PERS	65	169.15	38.43%
JRS	0	0.38	0.00%
HPORS	3	2.6	115.38%
SRS	9	15.28	58.90%
GWPORS	0	11.77	0.00%
MPORS	18	12.45	144.58%
FURS	7	9.71	72.09%
VFCA	0	0.00	N/A



Section III: Demographic Assumptions

PERS and JRS

The analysis yields an actual/expected ratio of 38.4% over the experience period. A ratio of 38% indicates that the current assumption is overestimating the number of disability retirements. As a result, we recommend revising the rates of disability. The actual/expected ratio under the proposed assumption is 92%.

The right axis of the chart below represents the number of exposed lives. The exposed lives are the total number of individuals who were subject to disability rates based upon the benefit recipient's age during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed disability rates.

The table below illustrates the headcount weighted actual/expected ratio for PERS and JRS members based on the recommended assumption.

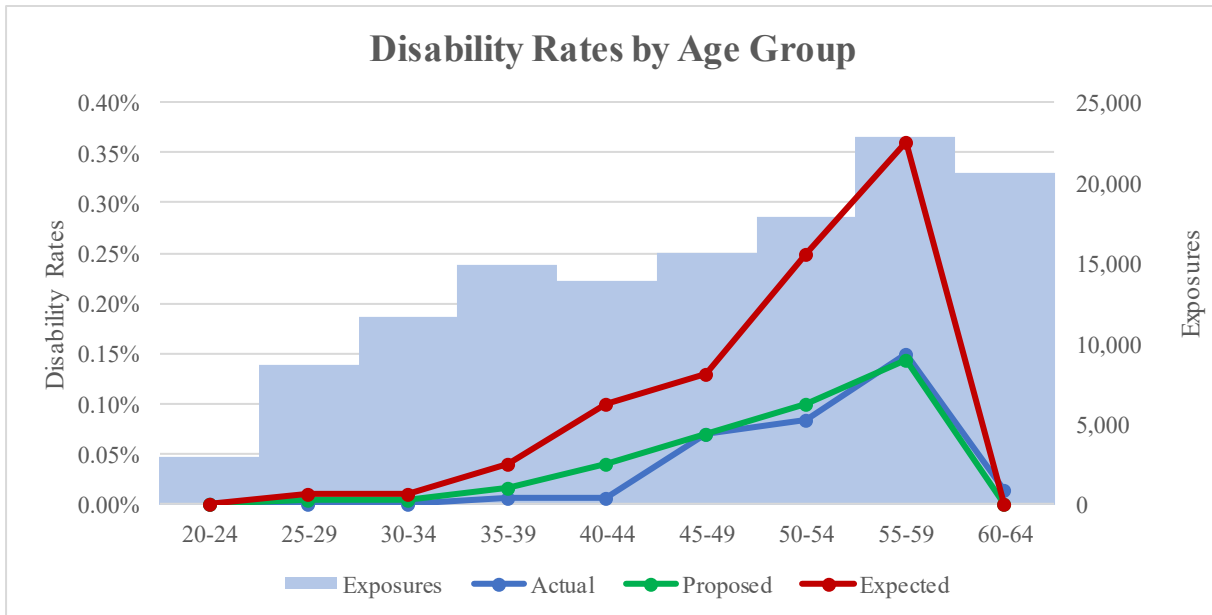
	Actual	Expected	A/E Ratio
PERS & JRS	65	70.55	92.13%

The right axis of the charts below represents exposed headcounts. The exposed headcounts are the total number of members subject to retirement rates based upon the member's age and service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.



Section III: Demographic Assumptions

The left axis of the charts below show (i) the actual disability rates of employment by age during the past five years, (ii) the current assumed disability rates and (iii) the proposed assumed disability rates.





Section III: Demographic Assumptions

Public Safety Members (FURS, GWPORS, HPORS, MPORS, and SRS)

The analysis of the combined Public Safety members yields an actual/expected ratio of 71.4% over the experience period. A ratio of 71% indicates that the current assumption is overestimating the number of disability retirements. As a result, we recommend revising the rates of disability by reducing the rates by 15% to partially reflect the observed experience. The actual/expected ratio under the proposed assumption is 84%.

The right axis of the chart below represents the number of exposed lives. The exposed lives are the total number of individuals who were subject to disability rates based upon the benefit recipient's age during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed disability rates.

The table below illustrates the headcount weighted actual/expected ratio for public safety members based on the recommended assumption.

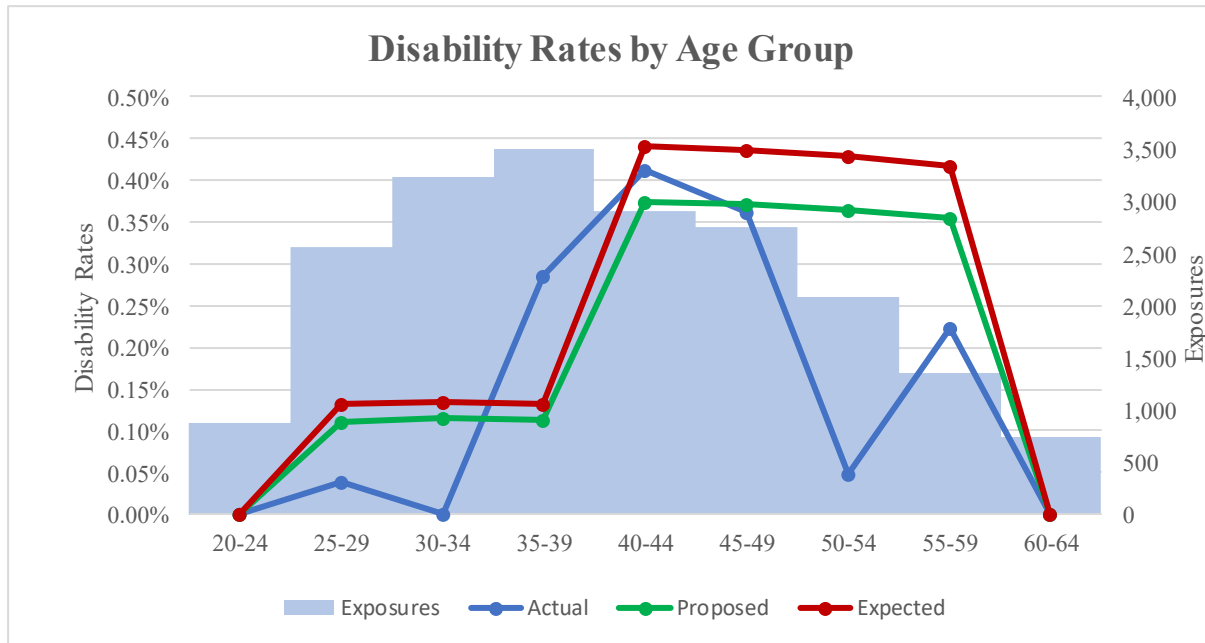
	Actual	Expected	A/E Ratio
Public Safety	37	44.02	84.05%

The right axis of the charts below represents exposed headcounts. The exposed headcounts are the total number of members subject to retirement rates based upon the member's age and service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.



Section III: Demographic Assumptions

The left axis of the charts below show (i) the actual disability rates of employment by age during the past five years, (ii) the current assumed disability rates and (iii) the proposed assumed disability rates.





RATES OF WITHDRAWAL

The rates of withdrawal are used to determine the expected number of separations from active service that will occur prior to attaining the eligibility requirement for a retirement benefit as a result of resignation or dismissal.

Higher paid members typically have a greater liability compared to members who are lower paid. As a result, termination rates for members with higher compensation levels and higher service will have a greater influence on the liabilities of the System. As a result, we liability weighted the experience to better reflect the impact of the current assumption on liability measures. The liability is approximated by using the member’s compensation and years of service to estimate the member’s benefit level. The exposure and actual occurrences are then multiplied by the benefit level to provide the liability-weighted experience. We find the liability-weighted experience to better correlate to the impact of actual and expected rates of withdrawal on the valuation results.

The current assumption utilizes a service-based approach for all but JRS, which has no withdrawal assumption.

The table below shows the withdrawal experience for each of the Systems. In general there were more withdrawals during the experience periods, except for VFCA, which experienced fewer withdrawals than anticipated.

	Actual	Expected	A/E Ratio
PERS	451,976,394	378,817,639	119.31%
JRS	N/A	N/A	N/A
HPORS	2,468,527	2,389,696	103.30%
SRS	37,919,049	28,405,317	133.49%
GWPORS	21,701,959	19,554,556	110.98%
MPORS	12,808,850	10,919,687	117.30%
FURS	4,610,301	3,546,612	130.00%
VFCA	1,956	2,083	93.91%



Section III: Demographic Assumptions

PERS Members

The analysis of actual withdrawals from active service yielded an actual/expected ratio of 119.3%. A ratio greater than 100% indicates that there were more withdrawals than anticipated by the current assumption. The data reflects a general increase in the rates of withdrawal. This is consistent with the findings of the last experience study ending June 30, 2016. As a result, we recommend adjusting the withdrawal rates to reflect actual experience.

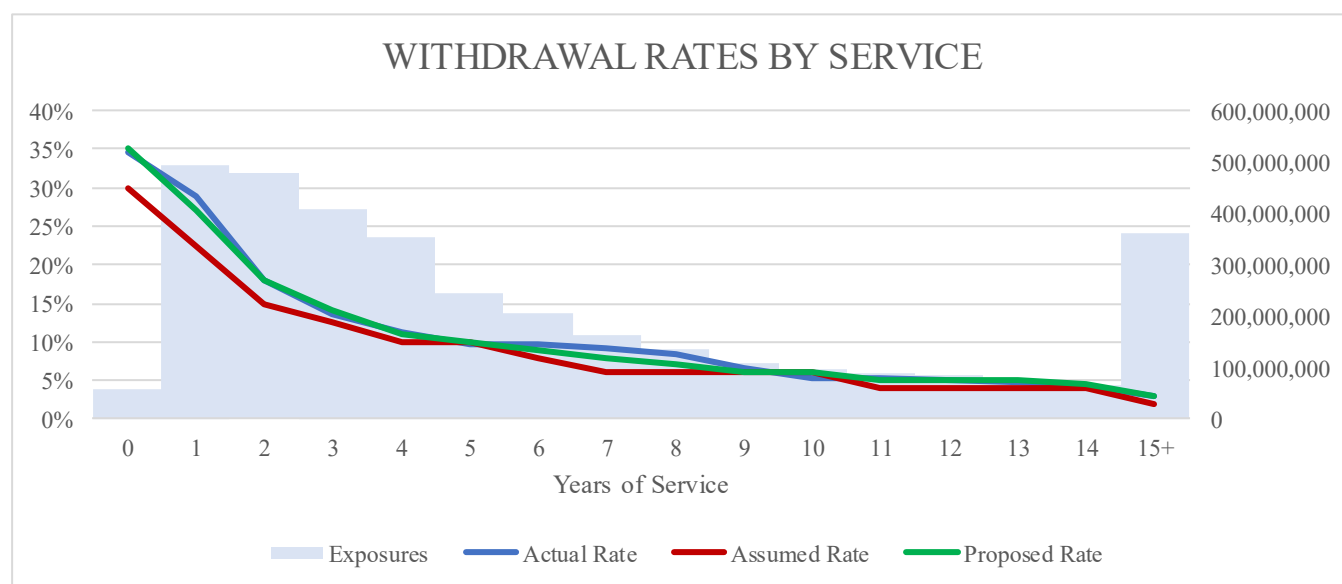
The complete tables of recommended withdrawal rates are shown in Appendix C.

The table below illustrates the liability weighted actual/expected ratio for PERS members based on the recommended assumption.

	Actual	Expected	A/E Ratio
PERS	451,976,394	441,192,762	102.44%

The right axis of the charts below represents exposed liabilities. The exposed liabilities are the total number of annual salaries subject to termination rates based upon the member’s service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.

The chart below shows (i) the actual rates of withdrawal for employees by service during the past six years, (ii) the current assumed rates of withdrawal, (iii) the recommended assumed rates of withdrawal and (iv) the number of exposed lives at each year of service.



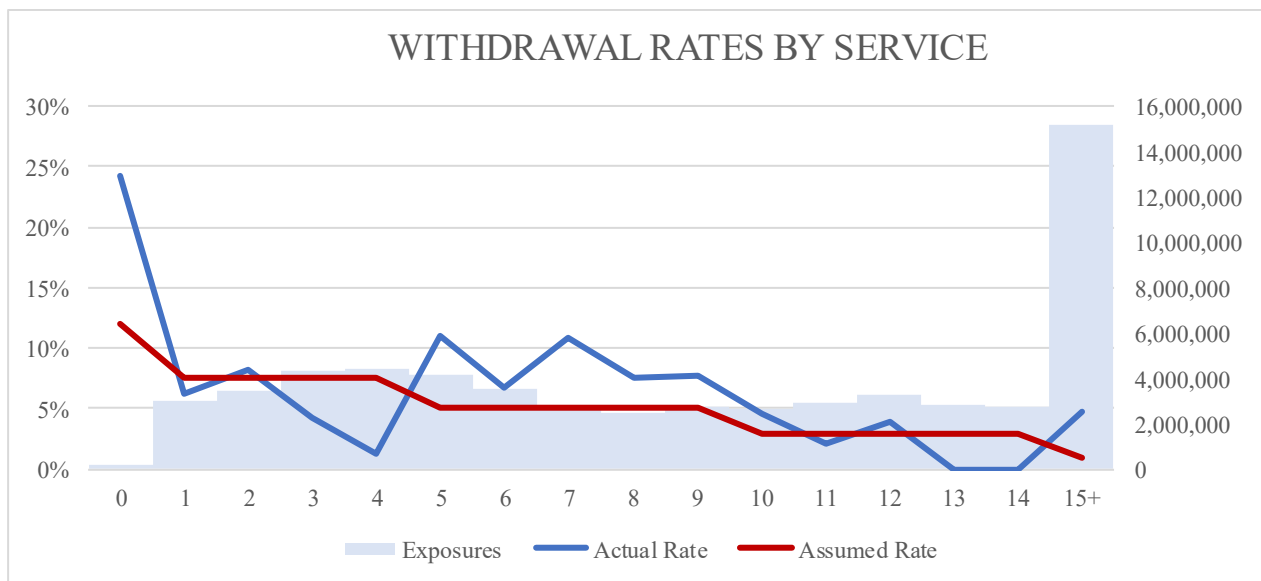


Section III: Demographic Assumptions

HPORS Members

The analysis of actual withdrawals from active service yielded an actual/expected ratio of 103.30%. A ratio greater than 100% indicates that there were more withdrawals than expected. The data reflects that the current assumption in general fits the actual experience and does not warrant a change.

The chart below shows (i) the actual rates of withdrawal for employees by service during the past six years, (ii) the current assumed rates of withdrawal and (iii) the number of exposed lives.





Section III: Demographic Assumptions

SRS Members

The analysis of actual withdrawals from active service yielded an actual/expected ratio of 133.5%. A ratio greater than 100% indicates that there were more withdrawals than anticipated by the current assumption. The data reflects a general increase in the rates of withdrawal. As a result, we recommend adjusting the withdrawal rates to more closely reflect actual experience.

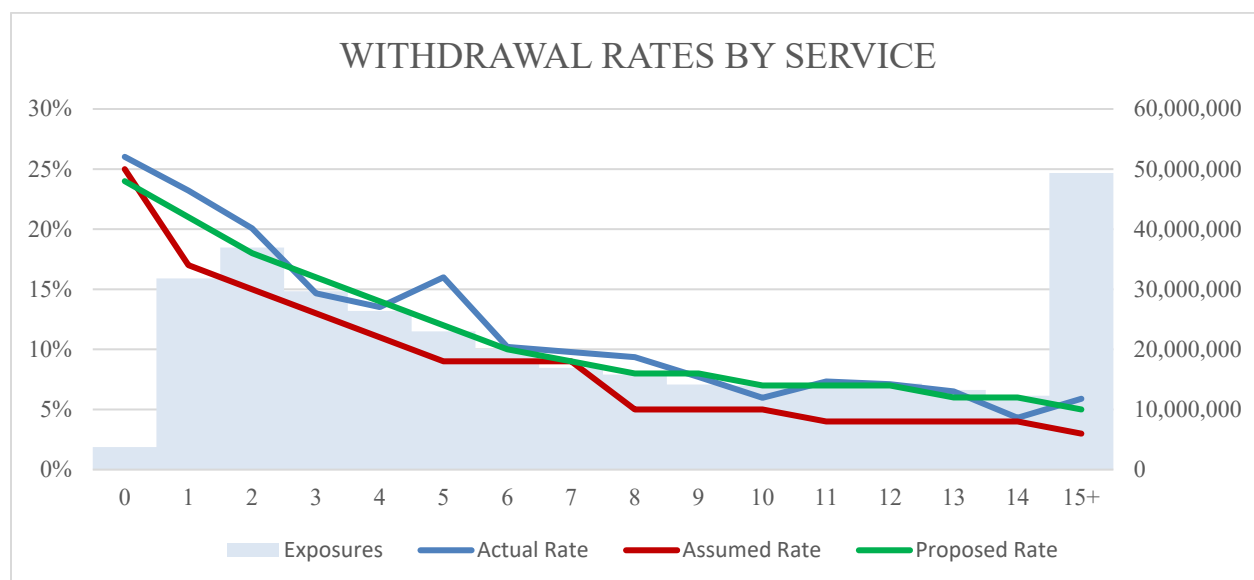
The complete tables of recommended withdrawal rates are shown in Appendix C.

The table below illustrates the liability weighted actual/expected ratio for SRS members based on the recommended assumption.

	Actual	Expected	A/E Ratio
SRS	37,919,049	35,866,215	105.72%

The right axis of the charts below represents exposed liabilities. The exposed liabilities are the total number of annual salaries subject to termination rates based upon the member’s service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.

The chart below shows (i) the actual rates of withdrawal for employees by service during the past six years, (ii) the current assumed rates of withdrawal, (iii) the recommended assumed rates of withdrawal and (iv) the number of exposed lives at each year of service.





Section III: Demographic Assumptions

GWPORS Members

The analysis of actual withdrawals from active service yielded an actual/expected ratio of 111.0%. A ratio greater than 100% indicates that there were more withdrawals than anticipated by the current assumption. The data reflects a general increase in the rates of withdrawal. As a result, we recommend adjusting the withdrawal rates to more closely reflect actual experience.

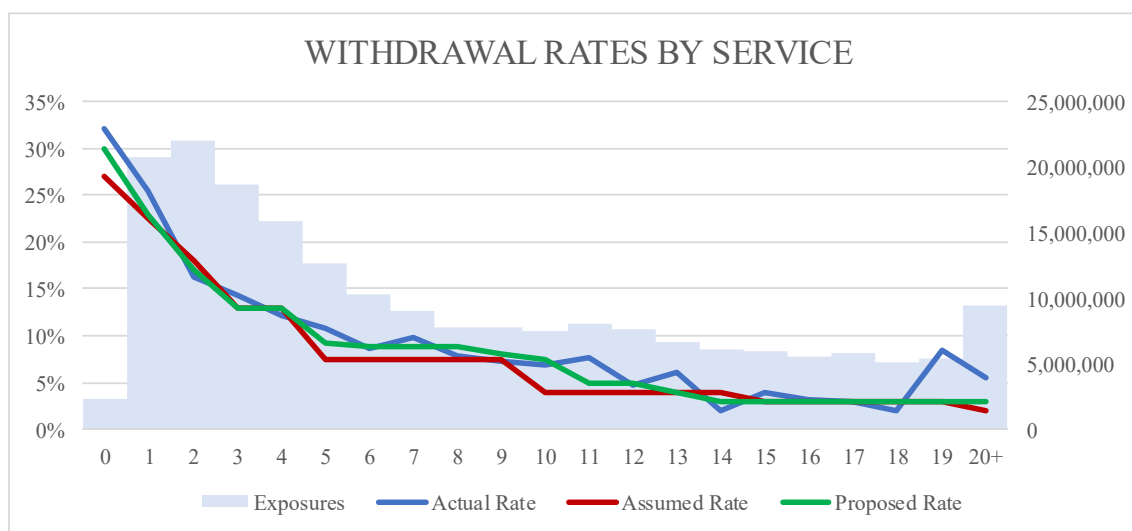
The complete tables of recommended withdrawal rates are shown in Appendix C.

The table below illustrates the liability weighted actual/expected ratio for GWPORS members based on the recommended assumption.

	Actual	Expected	A/E Ratio
GWPORS	21,701,959	20,463,698	106.05%

The right axis of the charts below represents exposed liabilities. The exposed liabilities are the total number of annual salaries subject to termination rates based upon the member’s service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.

The chart below shows (i) the actual rates of withdrawal for employees by service during the past six years, (ii) the current assumed rates of withdrawal (iii) the recommended assumed rates of withdrawal and (iv) the number of lives exposed to withdrawal.





Section III: Demographic Assumptions

MPORS Members

The analysis of actual withdrawals from active service yielded an actual/expected ratio of 117.3%. A ratio greater than 100% indicates that there were more withdrawals than anticipated by the current assumption. The data reflects a general increase in the rates of withdrawal. As a result, we recommend adjusting the withdrawal rates to more closely reflect actual experience.

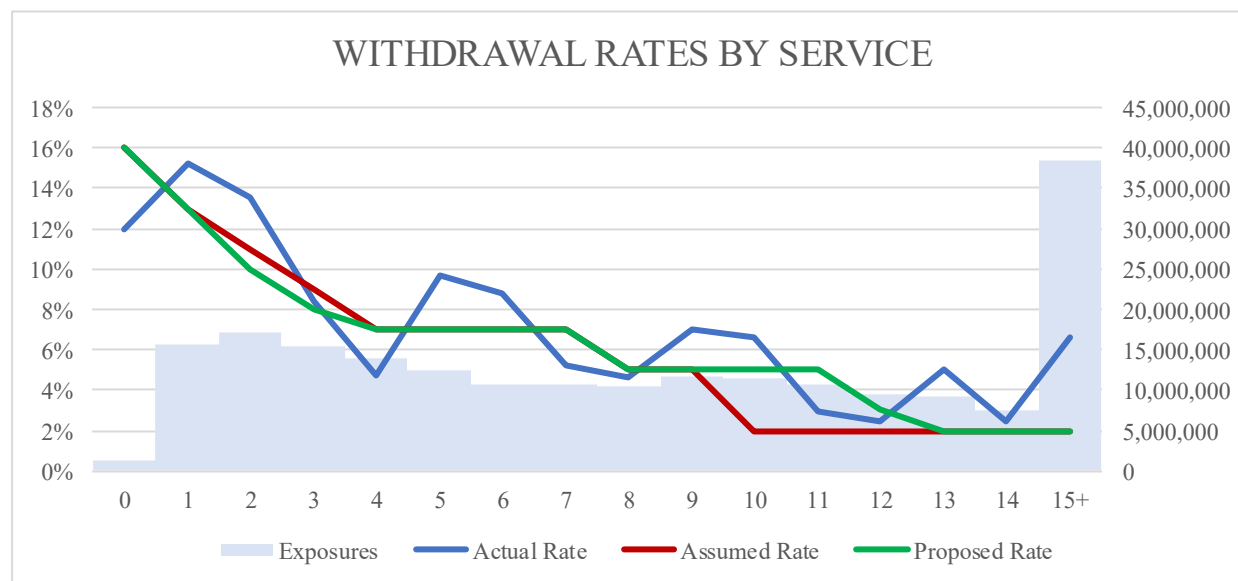
The complete tables of recommended withdrawal rates are shown in Appendix C.

The table below illustrates the liability weighted actual/expected ratio for MPORS members based on the recommended assumption.

	Actual	Expected	A/E Ratio
MPORS	12,808,850	11,358,445	112.77%

The right axis of the charts below represents exposed liabilities. The exposed liabilities are the total number of annual salaries subject to termination rates based upon the member’s service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.

The chart below shows (i) the actual rates of termination for employees by service during the past six years, (ii) the current assumed rates of retirement (iii) the recommended assumed rates of withdrawal and (iv) the number of lives exposed to withdrawal.





Section III: Demographic Assumptions

FURS Members

The analysis of actual withdrawals from active service yielded an actual/expected ratio of 130.0%. A ratio greater than 100% indicates that there were more withdrawals than anticipated by the current assumption. The data reflects a general increase in the rates of withdrawal. As a result, we recommend adjusting the withdrawal rates to more closely reflect actual experience.

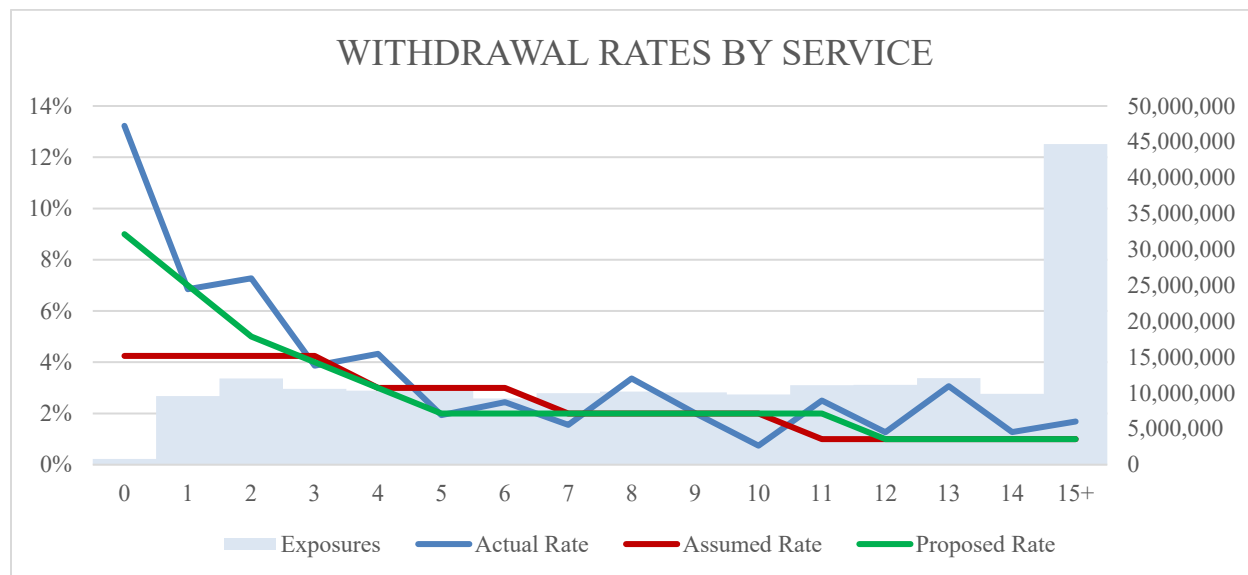
The complete tables of recommended withdrawal rates are shown in Appendix C.

The table below illustrates the liability weighted actual/expected ratio for FURS members based on the recommended assumption.

	Actual	Expected	A/E Ratio
FURS	4,610,301	3,824,479	120.55%

The right axis of the charts below represents exposed liabilities. The exposed liabilities are the total number of annual salaries subject to termination rates based upon the member’s service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.

The chart below shows (i) the actual rates of withdrawal for employees by service during the past six years, (ii) the current assumed rates of withdrawal (iii) the recommended assumed rates of withdrawal and (iv) the number of live exposed to withdrawal.





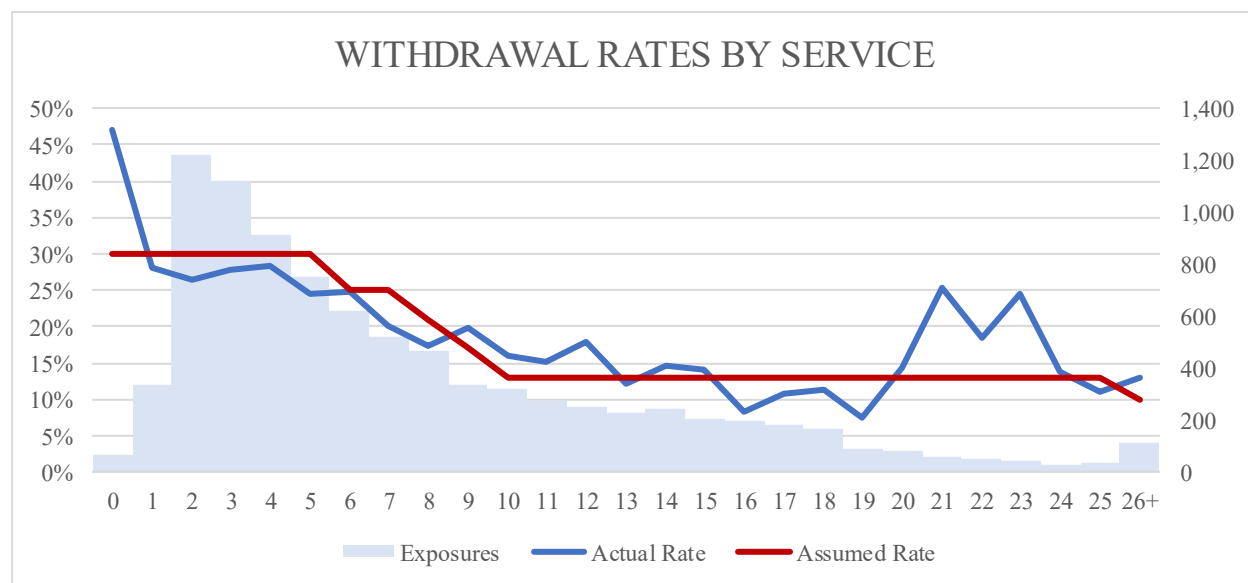
Section III: Demographic Assumptions

VFCA Members

The analysis of actual withdrawals from active service yielded an actual/expected ratio of 93.9%. A ratio less than 100% indicates that there were fewer withdrawals than anticipated by the current assumption. In general, the number of exposed lives at each year of service is relatively small, therefore we conclude the current assumed rates of withdrawal are sufficient in that any assumption for withdrawal for such a small group is likely to be inaccurate. We will continue to monitor withdrawal experience in future experience studies to determine if it warrants a change in the assumed rates of withdrawal for VFCA.

The right axis of the charts below represents exposed lives. The exposed lives are the total number of members subject to termination rates based upon the member's service during the experience period. When recommending assumptions changes, it is important to recognize actual experience in areas of higher exposures versus areas of lower exposures when recommending changes to the assumed retirement rates.

The chart below shows (i) the actual rates of withdrawal for employees by service during the past six years, (ii) the current assumed rates of withdrawal, (iii) the recommended assumed rates of withdrawal and (iv) the number of live exposed to withdrawal.





RATES OF SALARY INCREASE

Under the “building block” approach recommended in ASOP 27, the salary increase assumption is composed of three components: inflation, productivity (real wage increases), and merit/promotion. The inflation and productivity components are combined to produce the assumed rates of wage inflation. The rate represents the “across the board” average annual increase in salaries shown in the experience data. The merit component includes the additional increases in salary due to performance, seniority, promotions, etc.

The VFCA is not a salary-based benefit, therefore there is no assumption for salary increases members of VFCA.

The table below shows the actual/expected ratios for total salary increases over the five-year period. In general salary increases were slightly less than anticipated over the experience period for PERS, JRS and HPORS, and more than anticipated for SRS, GWPORS, MPORS and FURS.

	Salaries End of Year (in thousands)		
	Actual	Expected	A/E Ratio
PERS	5,665,621	5,671,534	99.90%
JRS	30,735	30,949	99.31%
HPORS	59,024	59,956	98.45%
SRS	297,132	296,928	100.07%
GWPORS	203,397	200,600	101.39%
MPORS	157,961	156,464	100.96%
FURS	221,481	218,896	101.18%

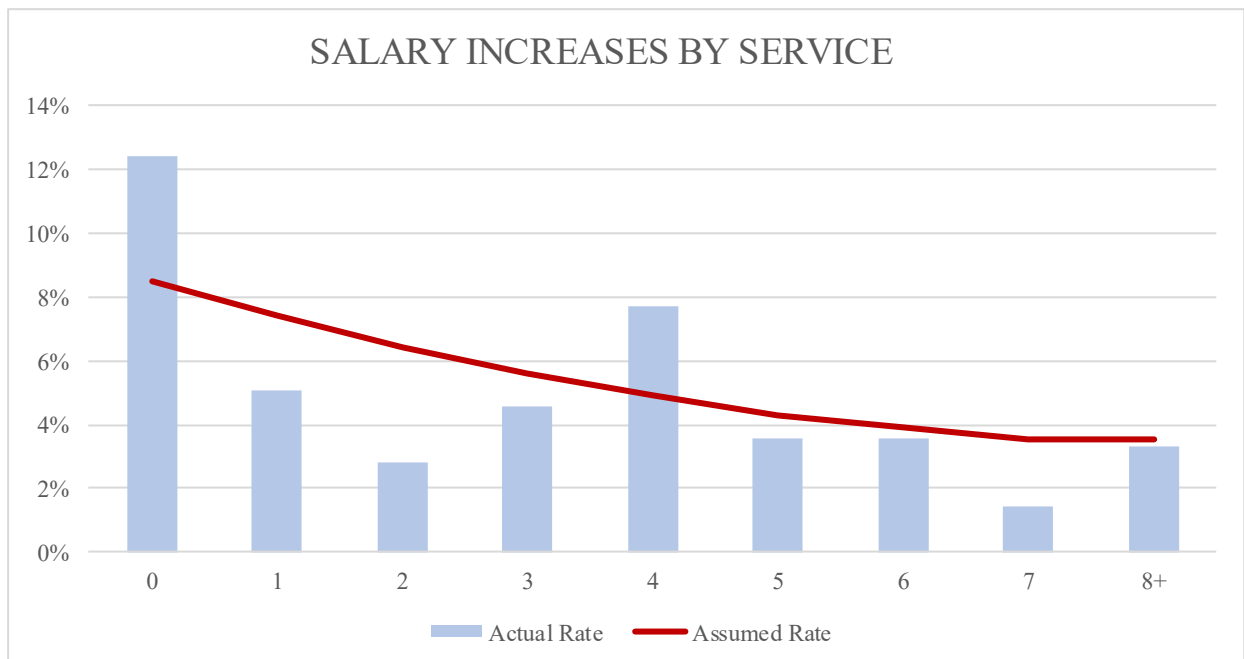


Section III: Demographic Assumptions

PERS Members

The analysis of salary increases yielded an actual/expected ratio of 99.9%. This ratio indicates that salary increases in general were as anticipated by the current assumption. In Section II of this report, we recommended no change to the wage base component of the total salary increase assumption. In addition, we do not recommend adjusting the merit component of the salary scale assumption.

The chart below shows (i) the actual rates of salary increase for employees by service during the past six years, (ii) the current assumed rates of salary.



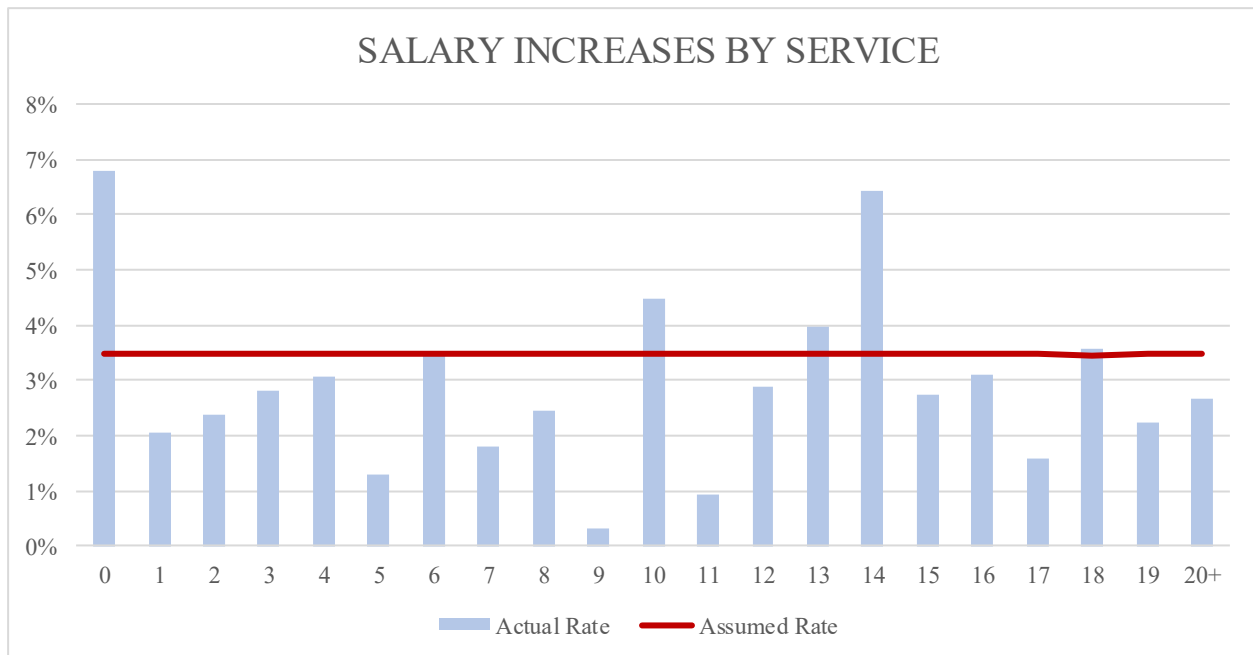


Section III: Demographic Assumptions

JRS Members

The JRS assumed salary increase is based on the underlying wage inflation only. The analysis of salary increases yielded an actual/expected ratio of 99.3%. This ratio indicates that salary increases in general were as anticipated by the current assumption. We make no further recommended changes to the assumed rates of salary increases.

The chart below shows (i) the actual rates of salary increase for employees by service during the past six years, (ii) the current assumed rates of salary increases and (iii) the recommended assumed rates of salary increases.



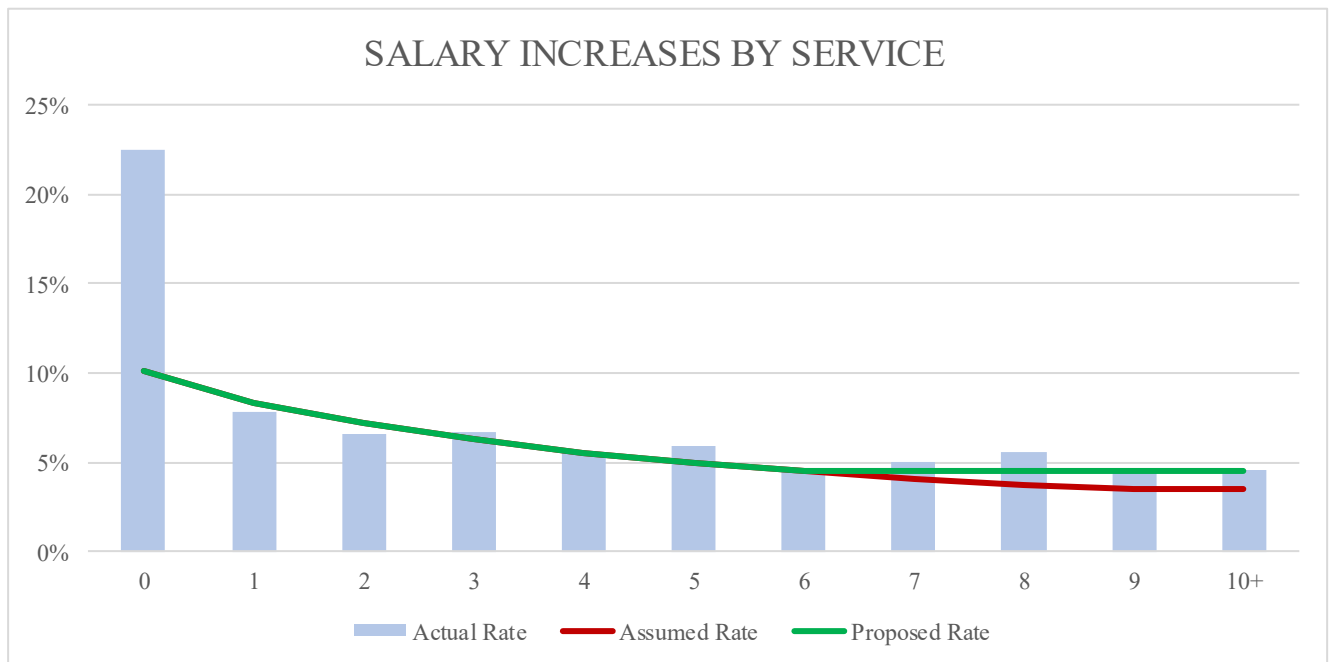


Section III: Demographic Assumptions

Public Safety Members (FURS, GWPORS, HPORS, MPORS, and SRS)

In order to increase the credibility of the data, we have combined all the public safety plans together in performing this analysis. The analysis of salary increases of the combined Public Safety members yielded an actual/expected ratio of 100.7%. A ratio more than 100% indicates that salary increases in general were more than anticipated by the current assumption for the public safety plans. We recommend adjusting the merit component of the salary scale assumption to reflect recent experience for lengths of service greater than seven years to match recent experience.

The chart below shows (i) the actual rates of salary increase for employees by service during the past six years, (ii) the current assumed rates of salary increases and (iii) the recommended assumed rates of salary increases.



The actual/expected ratio based on the recommended assumption is 100.1% compared to 100.7% based on the current assumption.



MISCELLANEOUS ASSUMPTIONS

Percent Married: Currently, 100% of members are assumed to be married with the husband three years older than the wife. This is a common and reasonable assumption, and we recommend maintaining this assumption.

Probability of Electing a Refund of Member Contributions upon Termination: It is currently assumed that 100% of non-vested terminations elect a refund of their member contributions upon termination. Members who terminate after becoming vested, but prior to becoming eligible for a retirement benefit, may forfeit their vested right to a future retirement benefit in return for a lump sum payment equal to their accumulated employee contributions with interest. It is assumed that members of JRS who withdraw after becoming vested will not elect a refund of their employee contributions with interest. For members of the other systems that have member contributions, there is an age-based assumption that varies by each system, with rates increasing as the member ages. At this time, we do not recommend changing this assumptions.



ACTUARIAL METHODS

Actuarial valuations utilize methods to determine the liabilities, assets, and costs of the systems. While these are not like other assumptions that may change over time, an experience study is still a good opportunity to review these methods to see if they are still appropriate for systematically funding the promised benefits. Significant methods are described below.

Actuarial Cost Method: The cost method is used to allocate the present value of benefits between past service (actuarial accrued liability) and future service (normal cost). Currently, the valuation applies the entry age normal cost method. This is the most widely used cost method of large public sector plans and has demonstrated the highest degree of stability as compared to alternative methods. We recommend no change in the use of this method.

Actuarial Value of Assets: The purpose of asset smoothing is to dampen the impact that market volatility has on valuation results by spreading the unexpected market gains and losses over several years. Currently, the System uses a smoothing method that recognizes 25% of the difference between the assumed rate of return on the market value of assets and the actual rate of return on the market value of assets. We recommend no change to the current method at this time.



Amortization Method: The unfunded actuarial accrued liability is amortized using a level percentage of payroll method over the amortization period as a single base. Under the level percentage of payroll method, amortization payments will not be large enough to cover interest on the UAAL in the beginning of the amortization schedule, which means that as a dollar amount the UAAL is expected to grow. After a period of time, amortization payments will be large enough that the amortization payments will cover both interest and principal, and the UAAL as a dollar amount will be projected to decrease in each subsequent year. We recommend no change in the use of this method.

The payroll growth assumption is used to determine the percentage of payroll required over the remaining amortization period to fully amortize the unfunded liability. We recommend reducing the payroll growth assumption of 3.50% to 3.25%.

Amortization payments are calculated as increasing each year. If future experience follows the actuarial assumptions, this should result in amortization payments that align with the assumed growth in overall compensation. It is important to note, that the normal cost rate for new hires is less than the current members. As members terminate or retire and are replaced with a new hire with a lower normal cost rate, more of the employer contribution will be available to amortize the unfunded accrued liability. As a result, the effective amortization period is less than the amortization period calculated in the actuarial valuation which does not reflect new hires.

Interest on Member Contributions: The assumed crediting rate on member contributions is 2.75% per year. We recommend changing the assumed crediting rate on member contributions to the actual crediting rate adopted by the PERA Board.

Administrative Expense Load: The current investment return assumption is net of investment expenses only. We are recommending an assumed rate of return that is net of investment and administrative expenses. Therefore, an administrative expense load is not necessary



HISTORICAL JUNE CPI (U) INDEX

Year	CPI (U)	Year	CPI (U)
1970	38.80	1996	160.30
1971	40.60	1997	163.00
1972	41.70	1998	166.20
1973	44.20	1999	172.40
1974	49.00	2000	178.00
1975	53.60	2001	179.90
1976	56.80	2002	183.70
1977	60.70	2003	189.70
1978	65.20	2004	194.50
1979	72.30	2005	202.90
1980	82.70	2006	208.35
1981	90.60	2007	218.82
1982	97.00	2008	215.69
1983	99.50	2009	217.96
1984	103.70	2010	217.97
1985	107.60	2011	225.72
1986	109.50	2012	229.48
1987	113.50	2013	233.50
1988	118.00	2014	238.34
1989	124.10	2015	238.64
1990	136.00	2016	241.02
1991	140.20	2017	244.96
1992	144.40	2018	251.99
1993	148.00	2019	256.14
1994	152.50	2020	257.80
1995	156.70	2021	271.70

**SOCIAL SECURITY ADMINISTRATION WAGE INDEX**

Year	Wage Index	Annual Increase	Year	Wage Index	Annual Increase
1961	\$4,086.76		1991	\$21,811.60	3.73%
1962	4,291.40	5.01%	1992	22,935.42	5.15
1963	4,396.64	2.45	1993	23,132.67	0.86
1964	4,576.32	4.09	1994	23,753.53	2.68
1965	4,658.72	1.80	1995	24,705.66	4.01
1966	4,938.36	6.00	1996	25,913.90	4.89
1967	5,213.44	5.57	1997	27,426.00	5.84
1968	5,571.76	6.87	1998	28,861.44	5.23
1969	5,893.76	5.78	1999	30,469.84	5.57
1970	6,186.24	4.96	2000	32,154.82	5.53
1971	6,497.08	5.02	2001	32,921.92	2.39
1972	7,133.80	9.80	2002	33,252.09	1.00
1973	7,580.16	6.26	2003	34,064.95	2.44
1974	8,030.76	5.94	2004	35,648.55	4.65
1975	8,630.92	7.47	2005	36,952.94	3.66
1976	9,226.48	6.90	2006	38,651.41	4.60
1977	9,779.44	5.99	2007	40,405.48	4.54
1978	10,556.03	7.94	2008	41,334.97	2.30
1979	11,479.46	8.75	2009	40,711.61	-1.51
1980	12,513.46	9.01	2010	41,673.83	2.36
1981	13,773.10	10.07	2011	42,979.61	3.13
1982	14,531.34	5.51	2012	44,321.67	3.12
1983	15,239.24	4.87	2013	44,888.16	1.28
1984	16,135.07	5.88	2014	46,481.52	3.55
1985	16,822.51	4.26	2015	48,098.63	3.48
1986	17,321.82	2.97	2016	48,642.15	1.13
1987	18,426.51	6.38	2017	50,321.89	3.45
1988	19,334.04	4.93	2018	52,145.80	3.62
1989	20,099.55	3.96	2019	54,099.99	3.75
1990	21,027.98	4.62	2020	55,628.60	2.83



MONTANA PUBLIC EMPLOYEE'S RETIREMENT SYSTEM

SUMMARY OF RECOMMENDED ACTUARIAL ASSUMPTIONS

Economic Assumptions

Investment Return: 7.30% net of expenses, compounded annually

Salary Increases: Sample rates below, plus an annual inflation rate of 2.75% and real wage growth rate of 0.75%:

<u>Service Years</u>	<u>Annual Merit Increase</u>
0 – 1	4.8%
1 – 2	3.8
2 – 3	2.8
3 – 4	2.0
4 – 5	1.4
5 – 6	0.8
6 – 7	0.4
7 – 8	0.0
8 & Over	0.0

Payroll Growth: 3.25% per year



MONTANA PUBLIC EMPLOYEE'S RETIREMENT SYSTEM

Demographic Assumptions

Retirement Rates: Sample rates per 1,000 members

<u>Age</u>	<u>Less than 30 years of service</u>	<u>30 or more years of service or age 60 25 years of service</u>
<50	0	100
50-54	45	158
55	55	158
56	60	158
57	60	158
58	60	158
59	70	158
60	90	158
61	90	158
62	150	220
63	150	220
64	150	220
65	300	350
66	300	350
67	250	350
68	250	300
69	250	300
70 &	1,000	1,000



MONTANA PUBLIC EMPLOYEE’S RETIREMENT SYSTEM

Demographic Assumptions (continued)

Mortality Rates

Active participants	PUB 2010 General Amount Weighted Employee Mortality projected to 2021 for males and females. Projected generationally using MP-2021.
Disabled pensioners	PUB 2010 General Amount Weighted Disabled Retiree Mortality with ages set forward 1 year for males and females.
Contingent Survivor pensioners	PUB 2010 General Amount Weighted Contingent Survivor Mortality projected to 2021 with ages set forward 1 year for males and females. Projected generationally using MP-2021.
Retired Healthy pensioners	PUB 2010 General Amount Weighted Healthy Retiree Mortality Table projected to 2021 with ages set forward 1 year and adjusted 104% for males and 103% for females. Projected generationally using MP-2021.

Disability Rates:

Sample disability rates per 1,000 members

Nearest	
<u>Age</u>	<u>Male</u>
22	0.00
27	0.04
32	0.04
37	0.04
42	0.16
47	0.40
52	0.71
57	1.00
60	1.44
62	0.00



MONTANA PUBLIC EMPLOYEE’S RETIREMENT SYSTEM

Demographic Assumptions (continued)

Withdrawal Rates:

Sample withdrawal rates per 1000 members

<u>Service</u>	<u>Members Rates of</u>
0 – 1	350
1 – 2	270
2 – 3	180
3 – 4	140
4 – 6	110
6 – 7	100
7 – 8	90
8 – 9	80
9 – 10	70
10 – 12	60
12 – 14	50
14 – 15	45
15 & Over	30

Marital Status:

Percentage Married

100%

Age difference

Males are assumed to be three years older than spouses.

Form of Payment:

Participants are assumed to elect a life-only form of payment.



JUDGES' RETIREMENT SYSTEM

SUMMARY OF ACTUARIAL ASSUMPTIONS

Economic Assumptions

Investment Return: 7.30% net of expenses, compounded annually

Salary Increases: Increase 3.50% yearly (based on an annual inflation rate of 2.75% and 0.75% real wage growth) with no increases assumed for merit and seniority.

Demographic Assumptions

Retirement Rates: Sample rates per 1,000 members

<u>Age</u>	<u>Rates</u>
60	100
61	100
62	100
63	100
64	100
65	200
66	200
67	200
68	200
69	200
70 & Over	1,000



JUDGES' RETIREMENT SYSTEM

Demographic Assumptions (continued)

Mortality Rates

Active participants	PUB 2010 General Amount Weighted Employee Mortality projected to 2021 for males and females. Projected generationally using MP-2021.
Disabled pensioners	PUB 2010 General Amount Weighted Disabled Retiree Mortality projected to 2021 with ages set forward 1 year for males and females.
Contingent Survivor pensioners	PUB 2010 General Amount Weighted Contingent Survivor Mortality projected to 2021 with ages set forward 1 year for males and females. Projected generationally using MP-2021.
Retired Healthy pensioners	PUB 2010 General Amount Weighted Healthy Retiree Mortality Table projected to 2021 with ages set forward 1 year and adjusted 104% for males and 103% for females. Projected generationally using MP-2021.

Disability Rates:

Sample disability rates per 1,000 members

Nearest	
<u>Age</u>	<u>Male</u>
22	0.00
27	0.04
32	0.04
37	0.04
42	0.16
47	0.40
52	0.71
57	1.00
60	1.44
62	0.00



JUDGES' RETIREMENT SYSTEM

Demographic Assumptions (continued)

Withdrawal Rates: No terminations are assumed other than for retirement, death or disability.

Marital Status:

Percentage Married 100%

Age difference Males are assumed to be four years older than spouses.

Form of Payment: Participants are assumed to elect a life-only form of payment.



SHERIFFS' RETIREMENT SYSTEM

SUMMARY OF ACTUARIAL ASSUMPTIONS

Economic Assumptions

Investment Return: 7.30% net expenses, compounded annually

Salary Increases: Sample rates below, plus an annual inflation rate of 2.75% and real wage growth of 0.75%:

<u>Service Years</u>	<u>Annual Merit Increase</u>
0 – 1	6.4%
1 – 2	4.7
2 – 3	3.6
3 – 4	2.7
4 – 5	2.0
5 – 6	1.4
6 & Over	1.0

Payroll Growth: 3.25% per year



SHERIFFS' RETIREMENT SYSTEM

Demographic Assumptions

Retirement Rates: Sample rates per 1,000 members

<u>Age</u>	<u>Rates</u>
< 55	190
55 – 59	290
60 – 64	290
65 & Over	1,000

Mortality Rates

Active participants	PUB 2010 Safety Amount Weighted Employee Mortality projected to 2021 for males and females. Projected generationally using MP-2021.
Disabled pensioners	PUB 2010 Safety Amount Weighted Disabled Retiree Mortality projected to 2021, set forward one year for males.
Contingent Survivor pensioners	PUB 2010 Safety Amount Weighted Contingent Survivor Mortality projected to 2021, set forward one year for males. Projected generationally using MP-2021.
Retired Healthy pensioners	PUB 2010 Safety Amount Weighted Healthy Retiree Mortality Table projected to 2021, set forward one year for males and adjusted 105% for males and 100% for females. Projected generationally using MP-2021.



Disability Rates:

Sample disability rates per 1,000 members

Nearest	
<u>Age</u>	<u>Male</u>
22	0.0
27	1.1
32	1.1
37	1.1
42	3.7
47	3.7
52	3.7
57	3.6
62	0.0

Withdrawal Rates:

Sample withdrawal rates per 1000 members

<u>Service</u>	<u>Members Rates of Termination</u>
0 – 1	240
1 – 2	210
2 – 3	180
3 – 4	160
4 – 5	140
5 – 6	120
6 – 7	100
7 – 8	90
8 – 10	80
10 – 13	70
13 – 15	60
15 & Over	50



Marital Status:

Percentage Married

100%

Age difference

Males are assumed to be three years older than spouses.

Form of Payment:

Participants are assumed to elect a life-only form of payment.



GAME WARDENS' AND PEACE OFFICERS' RETIREMENT SYSTEM

SUMMARY OF ACTUARIAL ASSUMPTIONS

Economic Assumptions

Investment Return: 7.30% net of expenses, compounded annually

Salary Increases: Sample rates below, plus an annual inflation rate of 2.75% and real wage growth of 0.75%:

<u>Service Years</u>	<u>Annual Merit Increase</u>
0 – 1	6.4%
1 – 2	4.7
2 – 3	3.6
3 – 4	2.7
4 – 5	2.0
5 – 6	1.4
6 & Over	1.0

Payroll Growth: 3.25% per year



GAME WARDENS' AND PEACE OFFICERS' RETIREMENT SYSTEM

Demographic Assumptions

Retirement Rates:

Sample rates per 1,000 members

<u>Age</u>	<u>Age 55 with 5 years of service</u>	<u>Age 55 with 20 years of service</u>
<50	N/A	0
50 – 54	N/A	150
55	150	180
56 – 59	50	180
60	150	180
61	150	410
62	400	500
63	150	350
64	150	200
65 & Over	1,000	1,000

Mortality Rates

Active participants	PUB 2010 Safety Amount Weighted Employee Mortality projected to 2021 for males and females. Projected generationally using MP-2021.
Disabled pensioners	PUB 2010 Safety Amount Weighted Disabled Retiree Mortality projected to 2021, set forward one year for males.
Contingent Survivor pensioners	PUB 2010 Safety Amount Weighted Contingent Survivor Mortality projected to 2021, set forward one year for males. Projected generationally using MP-2021.
Retired Healthy pensioners	PUB 2010 Safety Amount Weighted Healthy Retiree Mortality Table projected to 2021, set forward one year for males and adjusted 105% for males and 100% for females. Projected generationally using MP-2021.



GAME WARDENS' AND PEACE OFFICERS' RETIREMENT SYSTEM

Demographic Assumptions (continued)

Disability Rates:

Sample disability rates per 1,000 members

Nearest	
<u>Age</u>	<u>Male</u>
22	0.0
27	1.1
32	1.1
37	1.1
42	3.7
47	3.7
52	3.7
57	3.6
62	0.0



GAME WARDENS' AND PEACE OFFICERS' RETIREMENT SYSTEM

Demographic Assumptions (continued)

Withdrawal Rates:

Sample withdrawal rates per 1,000 members

<u>Service</u>	<u>Members Rates of Termination</u>
0 – 1	300
1 – 2	230
2 – 3	170
3 – 5	130
5 – 6	93
6 – 9	88
10 – 11	75
11 – 13	50
13 - 14	40
14 & Over	30

Marital Status:

Percentage Married

100%

Age difference

Males are assumed to be three years older than spouses.

Form of Payment:

Participants are assumed to elect a life-only form of payment.



HIGHWAY PATROL OFFICERS' RETIREMENT SYSTEM

SUMMARY OF ACTUARIAL ASSUMPTIONS

Economic Assumptions

Investment Return: 7.30% net of expenses, compounded annually

Salary Increases: Sample rates below, plus an annual inflation rate of 2.75% and real wage growth of 0.75%:

<u>Service Years</u>	<u>Annual Merit Increase</u>
0 – 1	6.4%
1 – 2	4.7
2 – 3	3.6
3 – 4	2.7
4 – 5	2.0
5 – 6	1.4
6 & Over	1.0

Payroll Growth: 3.25% per year



HIGHWAY PATROL OFFICERS’ RETIREMENT SYSTEM

Demographic Assumptions

Retirement Rates: Sample rates per 1,000 members

<u>Age</u>	<u>Less than 26 years of service</u>	<u>26 or more years of service</u>
< 50	350	550
50 – 54	350	550
55 – 59	350	550
60 & Over	350	1,000

Mortality Rates

Active participants	PUB 2010 Safety Amount Weighted Employee Mortality projected to 2021 for males and females. Projected generationally using MP-2021.
Disabled pensioners	PUB 2010 Safety Amount Weighted Disabled Retiree Mortality projected to 2021, set forward one year for males.
Contingent Survivor pensioners	PUB 2010 Safety Amount Weighted Contingent Survivor Mortality projected to 2021, set forward one year for males. Projected generationally using MP-2021.
Retired Healthy pensioners	PUB 2010 Safety Amount Weighted Healthy Retiree Mortality Table projected to 2021, set forward one year for males and adjusted 105% for males and 100% for females. Projected generationally using MP-2021.



HIGHWAY PATROL OFFICERS' RETIREMENT SYSTEM

Demographic Assumptions (continued)

Disability Rates:

Sample disability rates per 1,000 members

Nearest	
<u>Age</u>	<u>Male</u>
22	0.0
27	1.1
32	1.1
37	1.1
42	3.7
47	3.7
52	3.7
57	3.6
62	0.0



HIGHWAY PATROL OFFICERS' RETIREMENT SYSTEM

Demographic Assumptions (continued)

Withdrawal Rates:

Sample withdrawal rates per 1,000 members

<u>Service</u>	<u>Members Rates of Termination</u>
0 – 1	120
1 – 4	75
4 – 10	50
10 – 15	30
15 & Over	10

Marital Status:

Percentage Married

100%

Age difference

Males are assumed to be three years older than spouses.

Form of Payment:

Participants are assumed to elect a life-only form of payment.



MUNICIPAL POLICE OFFICERS' RETIREMENT SYSTEM

SUMMARY OF ACTUARIAL ASSUMPTIONS

Economic Assumptions

Investment Return: 7.30% net of expenses, compounded annually

Salary Increases: Sample rates below, plus an annual inflation rate of 2.75% and real wage growth of 0.75%:

<u>Service Years</u>	<u>Annual Merit Increase</u>
0 – 1	6.4%
1 – 2	4.7
2 – 3	3.6
3 – 4	2.7
4 – 5	2.0
5 – 6	1.4
6 & Over	1.0

Payroll Growth: 3.25% per year



MUNICIPAL POLICE OFFICERS’ RETIREMENT SYSTEM

Demographic Assumptions

Retirement Rates: Sample rates per 1,000 members

<u>Age</u>	<u>Less than 26 years of service</u>	<u>26 or more years of</u>
<50	260	420
50 – 54	260	420
55 – 61	260	420
62 – 64	260	420
65 & Over	1,000	1,000

Mortality Rates

Active participants	PUB 2010 Safety Amount Weighted Employee Mortality projected to 2021 for males and females. Projected generationally using MP-2021.
Disabled pensioners	PUB 2010 Safety Amount Weighted Disabled Retiree Mortality projected to 2021, set forward one year for males.
Contingent Survivor pensioners	PUB 2010 Safety Amount Weighted Contingent Survivor Mortality projected to 2021, set forward one year for males. Projected generationally using MP-2021.
Retired Healthy pensioners	PUB 2010 Safety Amount Weighted Healthy Retiree Mortality Table projected to 2021, set forward one year for males and adjusted 105% for males and 100% for females. Projected generationally using MP-2021.



MUNICIPAL POLICE OFFICERS' RETIREMENT SYSTEM

Demographic Assumptions (continued)

Disability Rates:

Sample disability rates per 1000 members

Nearest	
<u>Age</u>	<u>Male</u>
22	0.0
27	1.1
32	1.1
37	1.1
42	3.7
47	3.7
52	3.7
57	3.6
62	0.0



MUNICIPAL POLICE OFFICERS’ RETIREMENT SYSTEM

Demographic Assumptions (continued)

Withdrawal Rates: Sample withdrawal rates per 1000 members

<u>Service</u>	<u>Members Rates of Termination</u>
0 – 1	160
1 – 2	130
2 – 3	100
3 – 4	80
4 – 8	70
8 – 12	50
12 – 13	30
13 & Over	20

Marital Status:

Percentage Married 100%

Age difference Males are assumed to be three years older than spouses.

Form of Payment: Participants are assumed to elect a life-only form of payment.



FIREFIGHTERS' UNIFIED RETIREMENT SYSTEM

SUMMARY OF ACTUARIAL ASSUMPTIONS

Economic Assumptions

Investment Return: 7.30% net of expenses, compounded annually

Salary Increases: Sample rates below, plus an annual inflation rate of 2.75% and real wage growth of 0.75%:

<u>Service Years</u>	<u>Annual Merit Increase</u>
0 – 1	6.4%
1 – 2	4.7
2 – 3	3.6
3 – 4	2.7
4 – 5	2.0
5 – 6	1.4
6 & Over	1.0

Payroll Growth: 3.25% per year



FIREFIGHTERS’ UNIFIED RETIREMENT SYSTEM

Demographic Assumptions

Retirement Rates: Sample rates per 1,000 members

<u>Age</u>	<u>Rates</u>
< 50	160
50 – 54	160
55 – 60	250
61 – 62	400
63 & Over	1,000

Mortality Rates

Active participants	PUB 2010 Safety Amount Weighted Employee Mortality projected to 2021 for males and females. Projected generationally using MP-2021.
Disabled pensioners	PUB 2010 Safety Amount Weighted Disabled Retiree Mortality projected to 2021, set forward one year for males.
Contingent Survivor pensioners	PUB 2010 Safety Amount Weighted Contingent Survivor Mortality projected to 2021, set forward one year for males. Projected generationally using MP-2021.
Retired Healthy pensioners	PUB 2010 Safety Amount Weighted Healthy Retiree Mortality Table projected to 2021, set forward one year for males and adjusted 105% for males and 100% for females. Projected generationally using MP-2021.



FIREFIGHTERS’ UNIFIED RETIREMENT SYSTEM

Demographic Assumptions (continued)

Disability Rates: Sample disability rates per 1,000 members

Nearest	
<u>Age</u>	<u>Male</u>
22	0.0
27	1.1
32	1.1
37	1.1
42	3.7
47	3.7
52	3.7
57	3.6
62	0.0

Withdrawal Rates: Sample withdrawal rates per 1,000 members

<u>Service</u>	<u>Rates of Termination</u>
0 – 1	90
1 – 2	70
2 – 3	50
3 – 4	40
4 – 5	30
5 – 12	20
12 & Over	10

Marital Status:

Percentage Married	100%
Age difference	Males are assumed to be three years older than spouses.

Form of Payment: Participants are assumed to elect a life-only form of payment.



VOLUNTEER FIREFIGHTERS’ COMPENSATION ACT

SUMMARY OF ACTUARIAL ASSUMPTIONS

Economic Assumptions

Investment Return: 7.30% net of expenses, compounded annually

Demographic Assumptions

Retirement Rates: Sample rates per 1,000 members

Age	10 – 19 years of service	20 or more years of
<55	0	0
55 – 59	0	320
60 – 69	200	320
70 & Over	1,000	1,000

Mortality Rates

Active participants	PUB 2010 Safety Amount Weighted Employee Mortality projected to 2021 for males and females. Projected generationally using MP-2021.
Disabled pensioners	PUB 2010 Safety Amount Weighted Disabled Retiree Mortality projected to 2021, set forward one year for males.
Contingent Survivor pensioners	PUB 2010 Safety Amount Weighted Contingent Survivor Mortality projected to 2021, set forward one year for males. Projected generationally using MP-2021.
Retired Healthy pensioners	PUB 2010 Safety Amount Weighted Healthy Retiree Mortality Table projected to 2021, set forward one year for males and adjusted 105% for males and 100% for females. Projected generationally using MP-2021.



VOLUNTEER FIREFIGHTERS' COMPENSATION ACT

Demographic Assumptions (continued)

Disability Rates: None

Withdrawal Rates: Sample withdrawal rates per 1,000 members

<u>Service</u>	<u>Members Rates of Termination</u>
0 – 6	300
6 – 8	250
8 – 9	210
9 – 10	170
10 – 26	130
26 & Over	100

Marital Status:

Percentage Married 100%

Age difference Males are assumed to be three years older than spouses.

Form of Payment: Participants are assumed to elect a life-only form of payment.