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February 14, 2024

Mr. John Herrington, Director
State of Connecticut
Retirement Services Division
Office of the State Comptroller
165 Capitol Ave.
Hartford, CT 06106

Dear Mr. Herrington:

Enclosed is the "Connecticut Municipal Employees' Retirement System Experience Investigation for the Five-Year Period Ending June 30, 2022". The investigation includes the economic and demographic experience for the Connecticut Municipal Employees' Retirement System (MERS).

Please let us know if there are any questions concerning this report.

Sincerely,

John J. Garrett, ASA, FCA, MAAA
Principal and Consulting Actuary

Edward J. Koebel, ASA, FCA, MAAA
Chief Executive Officer

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CONNECTICUT MUNICIPAL EMPLOYEES' RETIREMENT SYSTEM

EXPERIENCE INVESTIGATION FOR THE FIVE-YEAR PERIOD ENDING JUNE 30, 2022

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February 14, 2024

State of Connecticut
Municipal Employees' Retirement Commission
165 Capitol Ave.
Hartford, CT 06106

Members of the Commission:

We are pleased to submit the results of an investigation of the economic and demographic experience for the Connecticut Municipal Employees' Retirement System (MERS). The purpose of the investigation was to assess the reasonability of the actuarial assumptions for the System and recommend adjustments where necessary. The actuarial assumptions are used by the actuary to provide a best estimate of the value of all benefits expected to be paid by the System over future years. The valuation uses various methods in determining the required funding necessary to accumulate a sufficient amount of assets to fully fund the expected benefit payments.

This experience study covers the five-year period from July 1, 2017 to June 30, 2022. We have analyzed the valuation data provided over this period and assessed the performance of all economic and demographic assumptions utilized in the actuarial valuations over the study period. As a result of the investigation, it is recommended that several modifications to the current assumptions be adopted by the Actuarial Subcommittee and Commission for future use. Specifically, we recommend modifications to the assumed rates of withdrawal, disability, retirement, service-based merit/promotion salary increases, and mortality. We do not recommend adjustments to the economic assumptions (e.g., investment rate of return, inflation, wage inflation, etc.) as they remain reasonable in our opinion. Changing the actuarial assumptions will not change the actual cost of future benefits but will impact the measurement of the expected value of future benefits and the required contributions to maintain actuarial soundness.

This report provides details of the analysis and reasoning for recommended modifications to the assumptions. The analysis of demographic assumptions primarily focuses on the comparison of the actual and expected cases of separation from active service due to withdrawal, disability and retirement, actual and expected number of deaths, and actual and expected salary increases above wage inflation. Several of the tables included in the report are based on current assumed rates and, for comparison purposes, the new proposed rates.

All rates of separation, mortality and salary increase at each age for each system are shown in the attached tables in Appendix D of this report. Use of the new assumptions, when adopted by the Board, will commence with the June 30, 2023 valuation and are suitable for use until further experience indicates that additional modifications are necessary.

In order to prepare the measurement of the impact on liabilities in this report, we have utilized actuarial models that we developed to measure liabilities and develop actuarial costs. These models include tools that we have produced and tested, along with commercially available valuation software that we have reviewed to confirm the appropriateness and accuracy of the output. In utilizing these models, we develop and use input parameters and assumptions about future contingent events along with recognized actuarial approaches to develop the needed results.

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 Public 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).

We note that as we prepare this report, the world has been in a pandemic during much of the experience study period. We have taken this into consideration as we reviewed the experience, particularly regarding mortality, retirement, termination and disability patterns. While we do not believe that there is yet sufficient data to warrant the significant modification of any of our assumptions specifically due to COVID-19, we will continue to monitor the emerging data and advise the Board in the future of any adjustments that we believe would be appropriate.

The experience investigation 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 meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,

John J. Garrett, ASA, FCA, MAAA
Principal and Consulting Actuary

Edward J. Koebel, EA, FCA, MAAA
Chief Executive Officer

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Section I: Executive Summary

The purpose of an actuarial valuation is to provide the best estimate of the expected future costs of a retirement system. An actuarial valuation for the Connecticut Municipal Employees' Retirement System (MERS) is prepared annually to determine the actuarial contribution rates required to fund the system on an actuarial reserve basis, (i.e., the current assets plus future contributions, along with investment earnings will be sufficient to provide the benefits promised by the system). The valuation requires the use of certain assumptions with respect to the occurrence of future events, such as rates of investment return, 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 Plan 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.

Cavanaugh Macdonald Consulting, LLC (CMC) has performed a study of the experience of MERS for the five-year period ending June 30, 2022. This report presents the results, analysis, and resulting recommendations of our study. It is anticipated that the changes, if approved, will first be reflected in the June 30, 2023 actuarial valuation.

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

- **Do Not Overreact**: When we see significant changes in experience, we generally do not adjust our rates to reflect the entire degree of 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 more fully 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.

The following summarizes the findings and recommendations with regard to the assumptions utilized for MERS. Detailed explanations for the recommendations are found in the sections that follow.

Recommended Economic Assumption

Economic assumptions are some of the most visible and significant assumptions used in the valuation process. The items in the broad economy modeled by these assumptions can be very volatile over short periods of time, as clearly seen in the economic recovery from the pandemic in 2021 followed by the downward trend in global markets in 2022. Our goal is to focus on the emerging long-term trends in the midst of this volatility so that we can then apply reasonable assumptions.

Most of the economic assumptions used by actuaries are developed through a building-block approach. For example, the expected return on assets is based on the expectation for inflation plus the expected real return on assets. As this is usually the most significant source of annual gains and losses to a mature pension plan, it is important the each of these components, inflation and real return, are primarily based on long-term future expectation and not the short-term historical performance.

At the core of the economic assumptions is the inflation assumption. As we discuss later in the report, although recently the System has experienced higher than normal inflation due to the recovery from the pandemic, we believe that long-term inflation will settle back down in the pre-pandemic 2.50% range. Therefore, **we are recommending that the price inflation assumption remains at 2.50%**.

We are also recommending that the long-term expected return on assets assumption remain at 7.00%, reflecting the 2.50% inflation assumption and a 4.50% real rate of return assumption. This will be discussed in detail later in this report, but a real rate of return of 4.50% is supported by the forecasting models developed using the State Treasurer's investment consultant's capital market assumptions and the State Treasurer's target asset allocation. Further analysis of the 42 sets of capital market assumptions included in the Horizon Actuarial Services, LLC. Survey conducted in 2022 and the Board's target asset allocation also support this recommendation.

We are also recommending that the general wage inflation assumption be continued at a rate of 3.00%. Although over the study period, there have been significantly higher rates of wage inflation in the last two years that is primarily attributable to higher than expected inflation rather than the real (above price inflation) rate of wage increases.

Cost-of-Living Adjustments (COLAs) under MERS varies by retirement date. For pre-2002 retirees, the COLA is based on excess smoothed assets gains above 6% yield (min 3% - max 5%) and are assumed to be 3.25% annually. **For post-2002 retirees, the following table describes the COLA basis and our recommended assumption:**

Post – June 30, 2002 Retirees COLA Rate Assumption		
Retired as of	**Provision**	**Recommended Assumption**
7/1/2002 – 6/30/2025	60% of CPI up to 6%, Floor of 2.5%	2.55%[1]
7/1/2025 – 6/30/2026	60% of CPI up to 6%, Floor of 2.0%	2.50%
7/1/2026 – 6/30/2027	60% of CPI up to 6%, Floor of 1.5%	2.30%
7/1/2027 – 6/30/2028	60% of CPI up to 6%, Floor of 1.0%	2.10%
7/1/2028 – 6/30/2029	60% of CPI up to 6%, Floor of 0.5%	2.00%
7/1/2029 & After	60% of CPI up to 6%, Floor of 0.0%	2.00%

[1] The recommendation is to grade this assumed rate from 2.50% to 2.65% over the 2023 to 2025 valuations. This recommended rate would be used in the 2023 valuation.

The addition of the MERS Deferred Retirement Option Plan (DROP) beginning July 1, 2025 requires an additional economic assumption to reflect the annual rate of interest credited to the DROP accounts once a member has remained in the DROP for 2 years. As DROP participation is limited to a five-year period, **we recommend using the assumed rate of inflation (2.50%) plus yield on 5-year Treasury Inflation Protected Securities (TIPS) and limited to a maximum interest crediting rate of 4.0% annually**.

To illustrate, as of the end of calendar year 2023, the yield on 5-year TIPS was 1.72% according to the data available from the St. Louis Federal Reserve and when summed with the 2.50% inflation assumptions equals 4.22%. In this case, the 4.00% maximum would apply and result in a crediting rate of 4.00% on DROP accounts with their 2nd or greater anniversary in 2024. To compare, the yield on a 5-year treasury (constant maturity) at the end of calendar year 2023 was 3.84%.

The following table summarizes the current and proposed primary economic assumptions:

Item	Current	Proposed
Price Inflation	2.50%	2.50%
Investment Return*	7.00%	7.00%
Wage Inflation	3.00%	3.00%

* Net of investment related expenses only.

We recognize there may be other sets of economic assumptions that are also reasonable for purposes of funding the System. Actuarial Standards of Practice allow for this difference in approaches and perspective, as long as the assumptions are reasonable and consistent.

Section II of this report provides additional details of these recommended changes.

Actuarial Methods

The basic actuarial methodologies used in the valuation process include the:

- Actuarial Cost Method
- Asset Valuation Method
- Amortization Method

Based on our review, discussed in full detail in Section III of this report, we recommend no changes in these actuarial methods at this time.

Section III of this report discusses the actuarial methods.

Recommended Demographic Assumption Changes

In the experience study, actual demographic experience for the study period is compared to that expected based on the current actuarial assumption. Comparing the actual incidence of the event to what was expected (called the Actual-to-Expected ratio, or A/E ratio) then provides the basis for our analysis.

Mortality is perhaps the most important demographic assumption when valuing the liabilities of a pension plan. The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying in recent years. There have been significant improvements in longevity in the past, although there are different opinions about future expectations. We believe it is prudent to anticipate that this trend will continue to some degree in the future.

The System currently reflects mortality improvements with the use of a static mortality table with "margin." Under this approach, the A/E ratio is intentionally targeted to be over 100% so that mortality can improve without creating actuarial losses. While there is no formal guidance as to the amount of margin required (how far above 100% is appropriate for the A/E ratio), we typically prefer to have a margin of around 10 to 14% at the core ages of the retired member. The goal is still for the general shape of the curve to be a reasonable fit to the observed experience. Depending on the magnitude and duration of actual mortality improvements in the future, the margin may decrease and eventually become insufficient. If that occurs, the assumption will need to be updated.

In this study, we are recommending a change to the mortality improvement methodology from a static approach to a generational mortality approach. This approach directly anticipates future improvements in mortality by using a different set of mortality rates for each year of birth, with the rates for later years of

birth assuming lower mortality rates than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain "built-in" mortality improvements, e.g., a member who turns age 65 in 2040 has a longer life expectancy than a member who turns age 65 in 2023. When using generational mortality, the A/E ratios for the observed experience are set near 100% since future mortality improvements will be taken into account directly in the actuarial valuation process.

The current mortality assumptions are based on the RP-2014 family of mortality tables using a static mortality approach as described above. The Society of Actuaries (SOA) has recently published new mortality tables developed exclusively from public sector retirement system experience. **We are recommending changes in the mortality assumptions to be based on the new Pub-2010 family of mortality tables as well as projecting future mortality improvements using a generational mortality approach. Other adjustments to the published mortality tables will be discussed in the demographic section of this report.**

The following is a list of other recommended changes to the demographic assumptions for MERS.

- **Retirement: For General Employees without Social Security, we recommend decreases in the rates of retirement at most ages. In contrast, for General Employees with Social Security and all of Police and Fire, we recommend increases in the rates of retirement at most ages.**

- **Disability: In general, we recommend slight decreases in the rates of disability as the number of disability retirements for both General Employees and the Public Safety members MERS has declined slightly.**

- **Withdrawal: In general, we recommend minor adjustments in the rates of withdrawal to better match the experience of MERS.**

- **Merit Salary Scale: We recommend decreases in the service-based merit/promotion salary increases at most ages.**

Section IV of this report provides additional details of these recommended changes.

Financial Impact

Although the assumption changes, if approved, will first be reflected in the June 30, 2023 valuation, we have provided the following table which highlights the impact of the recommended changes on the unfunded actuarial accrued liability (UAAL), amortization period, actuarially determined employer contribution (ADEC), and funding ratio based on the June 30, 2022 valuation results.

MERS Summary of Results
($ in Thousands)

	(A)	(B)
	June 30, 2022 Valuation	**With Recommended Assumptions**
Discount Rate	**7.00%**	**7.00%**
UAAL	$1,038,867	1,178,562
Amortization Period	25.0 years	25.0 years
Funding Ratio	75.8%	73.3%
ADEC		
General with SS	15.85%	16.77%
General without SS	20.39%	20.66%
Police and Fire with SS	21.72%	23.48%
Police and Fire without SS	24.68%	27.00%

SS = Social Security Coverage

Section II: Economic Assumptions

There are three economic assumptions used in the actuarial valuations performed for the Plan. They are:

- Price Inflation
- Investment Return
- Wage Inflation

Note that future price inflation has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return and the rates of salary increases. However, it is not directly used in the valuation process.

Actuarial Standard of Practice (ASOP) No. 27, *"Selection of Economic Assumptions for Measuring Pension Obligations"* provides guidance to actuaries in selecting economic assumptions for measuring obligations under defined benefit plans. ASOP No. 27 was revised in September, 2013 and no longer includes the concept of a "best estimate range". Instead, the revised standard now requires that each economic assumption selected by the actuary should be reasonable which means it has the following characteristics:

- It is appropriate for the purpose of the measurement;
- It reflects the actuary's professional judgment;
- It takes into account historical and current economic data that is relevant as of the measurement date;
- 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
- It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed, or when alternative assumptions are used for the assessment of risk.

Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period.

In our opinion, the economic assumptions recommended in this report have been developed in accordance with ASOP No. 27. The following table shows our recommendations followed by detailed discussions of each assumption.

Item	Current	Proposed
Price Inflation	2.50%	2.50%
Real Rate of Return*	4.50	4.50
Investment Return	7.00%	7.00%
Price Inflation	2.50%	2.50%
Real Wage Growth	0.50	0.50
Wage Inflation	3.00%	3.00%

* net of investment expenses.

Section II: Economic Assumptions

Inflation

The assumed rate of inflation is the expectation of the long-term annual rate of increase in the Consumer Price Index and is a component of all economic assumptions. This is also called price inflation.

It is important that the inflation assumption be consistently applied throughout the economic assumptions utilized in an actuarial valuation. This is called for in ASOP No. 27 and is also required to meet the parameters 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 price inflation assumption is an assumed annual rate of 2.50%.

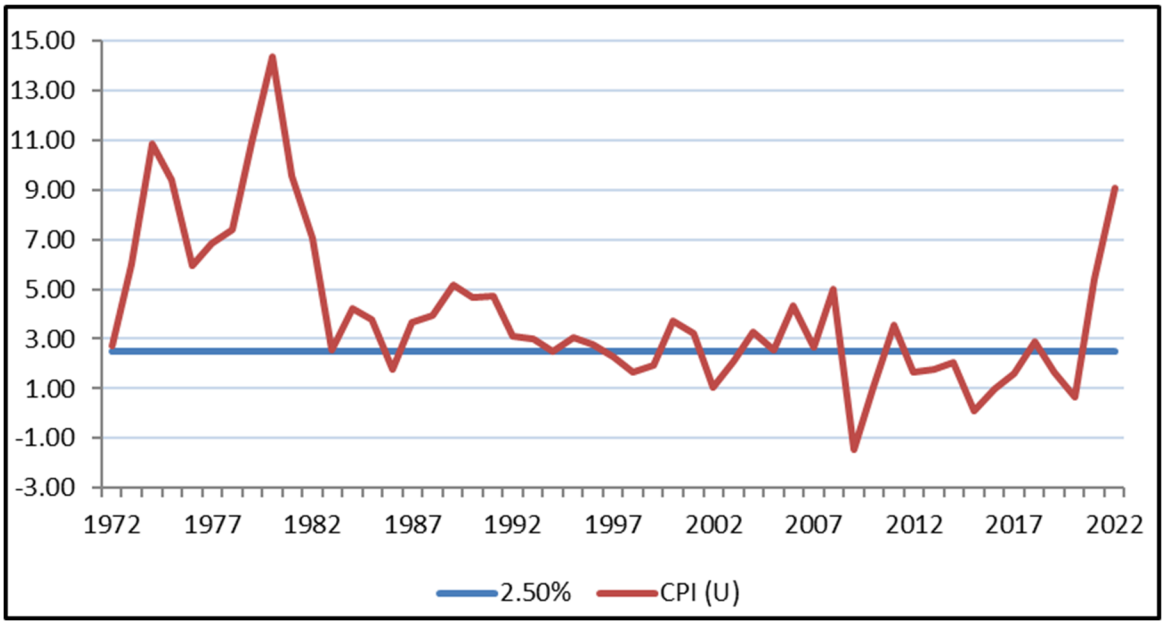
Past Experience

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 table below provides historical annualized rates and annual standard deviation of the CPI-U over periods ending June 30th.

Period	Number of Years	Annualized Rate of Inflation	Annual Standard Deviation
1926 – 2022	96	2.96%	4.06%
1972 – 2022	50	4.00%	3.11%
1982 – 2022	40	2.83%	1.76%
1992 – 2022	30	2.53%	1.86%
2002 – 2022	20	2.53%	2.23%
2012 – 2022	10	2.59%	2.69%

The following graph illustrates the historical levels of price inflation measured as of June 30th of each of the last 50 years and compared to the current 2.50% annual rate currently assumed.

Section II: Economic Assumptions



As can be seen from the table on the previous page, over the last 30 years, the average annual rate of increase in the CPI-U has been just over 2.50%. The higher annual rates over the past two years have increased this average.

Forecasts

Based upon information contained in the "Survey of Professional Forecasters" for the second quarter of 2023 as published by the Philadelphia Federal Reserve Bank, the median expected annual rate of inflation for the next ten years is 2.36%. Although 10 years of future expectation is too short of a period for the basis of our inflation assumption, the information does provide some evidence that the consensus expectations of these experts are for rates of inflation slightly less than our current assumption of 2.50% for the near-term future.

The spread between the yield on treasury securities (bonds) and the inflation indexed yield on Treasury Inflation Protected Securities (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 below provides the breakeven rates of inflation as of the end of December 2023.

Years to Maturity	Breakeven Rate of Inflation
10	2.18%
20	2.42%
30	2.19%

Section II: Economic Assumptions

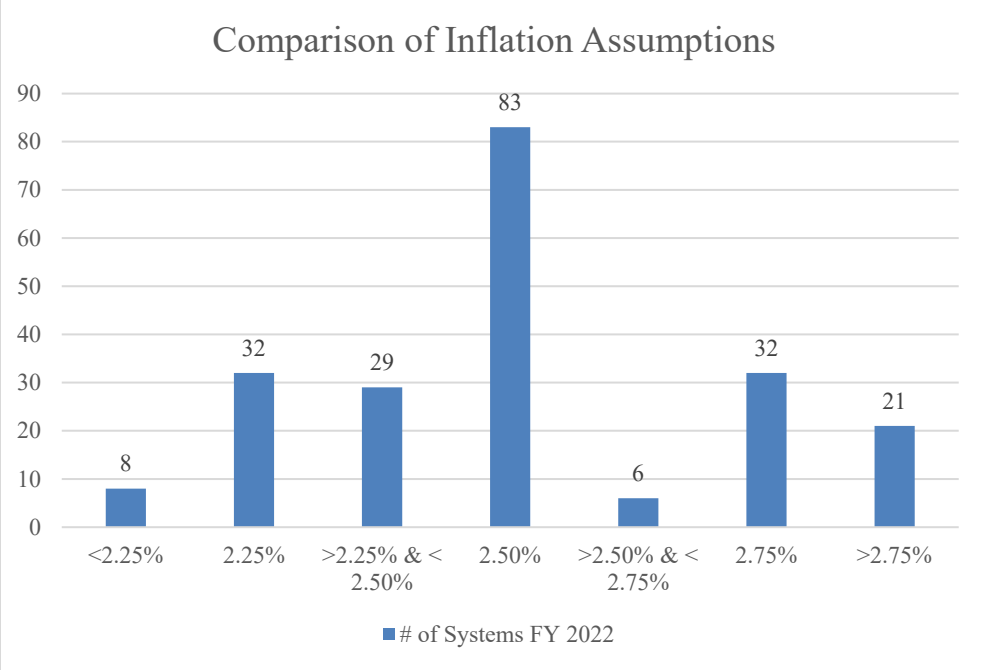
The bond market's expectation for the rate of inflation over the 30-year period is 2.19% which is lower than 30-year historical annualized rates and the current 2.50% assumed rate of inflation.

Social Security Administration

Although many economists forecast lower inflation than the assumption used by most retirement plans, they are generally looking at a shorter time horizon than is appropriate for a pension valuation. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the 2023 annual report, the projected ultimate average annual increase in the CPI over the next 75 years was estimated to be 2.40%, under the intermediate (best estimate) cost assumption. The range of inflation assumptions used in the Social Security 75-year modeling, which includes a low and high-cost scenario, in addition to the intermediate cost projection, was 1.80% to 3.00%. These rates remained unchanged from their 2022 annual report.

Peer Comparison

While we do not recommend the selection of any assumption based on what other systems use, it does provide another set of relevant information to consider. The following chart shows the inflation rate assumptions of 211 systems in the Public Plan Database of the Center for Retirement Research for FY 2022 data. Based on the current data, the average inflation assumption is 2.52%. The assumptions are from actuarial valuations reported in FYE 2022. Although inflation has spiked recently, we have not seen a reversal of this trend and expect most systems to take a wait-and-see approach.



Section II: Economic Assumptions

Recommendation

Inflation's short-term volatility has increased in the short-term, however, the longer-term annualized rate of inflation has remained relatively stable. Although the 10-year average of 2.59% and the 30-year average of 2.53% are slightly higher than the System's assumed rate of 2.50%, the forecasts are for rates of inflation less than the assumption over the next 30 years. Further, the monetary policy of the Federal Reserve continues to target a 2.0% annual rate of inflation as measured by the rate of change in Personal Consumption Expenditures (PCE). Since the year 2000, the rate of change in the PCE has been 0.3% to 0.4% less than the rate of inflation as measured by the change in the CPI (U). We concur with these forecasts and recommend maintaining the inflation assumption for the System at 2.50%.

Price Inflation Assumption	
Current	2.50%
Recommended	2.50%

Section II: Economic Assumptions

Investment Rate of Return

Background

The assumed investment return is one of the most significant assumptions in the annual actuarial valuation process as it is used to discount the expected benefit payments for all active, inactive and retired members. Minor changes in this assumption can have a major impact on valuation results. The investment return assumption should reflect the asset allocation target for the funds as established by the Fund's fiduciary, the State Treasurer.

The current assumption is 7.00%, consisting of a price inflation assumption of 2.50% and a real rate of return assumption of 4.50%.

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. For actuarial calculations, we typically consider very long periods of time. For example, a newly-hired employee who is 25 years old may work for 35 years, to age 60, and live another 30 years, to age 90 (or longer). The retirement system would receive contributions for the first 35 years and then pay out benefits for the next 30 years. During the entire 65-year period, the system is investing assets related to the member. For such a typical career employee, more than one-half of the investment income earned on assets accumulated to pay benefits is received after the employee retires. In addition, in an open, ongoing system like MERS, 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.

Past Experience

One of the inherent problems 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 can also impact the investment returns so comparing results over long periods when different asset allocations were in place may not be meaningful.

The assets for the Plan are valued using a widely accepted asset-smoothing methodology that fully recognizes the expected investment income and also recognizes 20% of each year's investment gain or loss (the difference between actual and expected investment income). The recent experience over the last five years is shown in the table below.

Section II: Economic Assumptions

Historical Rates

Nominal Total Rate of Return		
Year Ending 6/30	Actuarial Value	Market Value
2003	1.41%	1.89%
2004	5.83%	14.49%
2005	6.51%	9.89%
2006	7.19%	10.39%
2007	8.96%	16.60%
2008	6.32%	-4.03%
2009	-6.86%	-15.10%
2010	5.38%	12.98%
2011	7.51%	17.65%
2012	6.16%	0.62%
2013	6.91%	13.59%
2014	8.28%	10.97%
2015	6.60%	2.41%
2016	6.09%	1.02%
2017	7.42%	12.40%
2018	6.72%	6.04%
2019	5.76%	5.90%
2020	5.08%	2.34%
2021	8.71%	24.85%
2022	4.98%	-8.92%
20 year Avg.	**5.75%**	**6.80%**
15 year Avg.	**5.67%**	**5.51%**
10 year Avg.	**6.66%**	**7.06%**
5 year Avg.	**6.25%**	**6.04%**

* Rates prior to 2013 were developed by a previous Actuary

While important to review and analyze, historical returns over such a short time period are not credible for the purpose of setting the long-term assumed future rate of return.

Section II: Economic Assumptions

Future Expectation Analysis

ASOP 27 provides that the actuary may rely on outside experts in setting economic assumptions. The State Treasurer utilizes the services of Meketa Investment Group (Meketa) to assist in the analysis of potential asset strategies and allocations. We were provided with the most recent capital market assumptions of Meketa and the current target allocations of the MERS Fund to assist in our analysis of future return expectation and volatility.

We note Meketa's annual rate of inflation assumption is 2.10%. We then use statistical methods to approximate the longer-term expectation of real rates of returns based on the capital market assumptions. We consider a reasonable range for expected real rates of return would be between the 25th and 75th percentile of long-term (50-year) expected real returns plus inflation.

Statistical Analysis of Expected Real Return Distribution							
Time Span In Years	Mean Rates of Real Return	Standard Deviation	Rates of Real Return by Percentile				
			5th	25th	50th	75th	95th
1	6.08%	13.40%	-14.43%	-3.32%	5.24%	14.56%	29.44%
5	5.41%	5.94%	-4.06%	1.32%	5.24%	9.31%	15.45%
10	5.33%	4.19%	-1.42%	2.46%	5.24%	8.11%	12.36%
20	5.28%	2.96%	0.48%	3.26%	5.24%	7.26%	10.23%
30	5.27%	2.42%	1.34%	3.62%	5.24%	6.89%	9.30%
50	5.26%	1.87%	2.21%	3.99%	5.24%	6.51%	8.37%

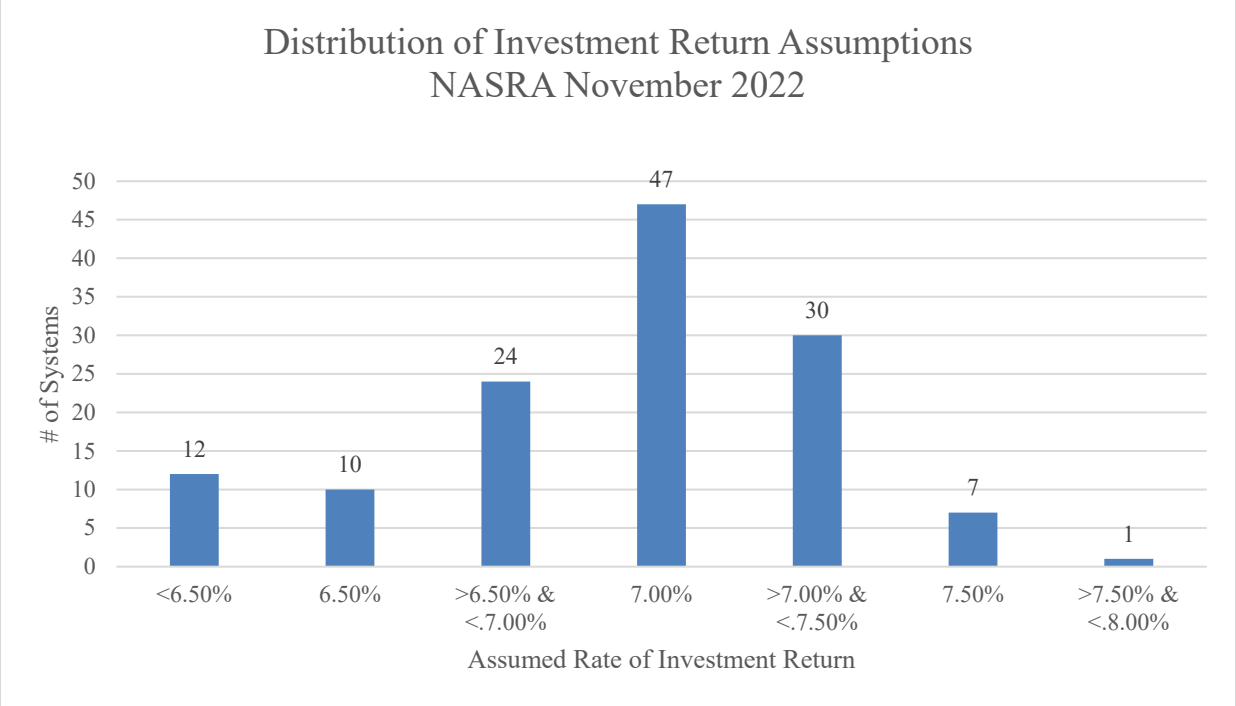
Using Meketa's capital market and inflation assumptions produces a reasonable range for the long-term investment real rate of return assumption, between 6.09% and 8.61% and the median return (midpoint of the range) is 7.34%. Using the recommended 2.50% inflation assumption of MERS would result in a median return expectation of 7.74%. We note that the capital market assumptions of investment consultants may change considerably from year to year.

For a broader view of expected returns, we also reviewed the Survey of Capital Market Assumptions: 2023 Edition produced by Horizon Actuarial Services, LLC to see what other investment professionals are currently developing for expected returns. The Horizon survey includes both 10-year and 20-year timeframe for capital market assumptions. Using the current Plan target asset allocation, we determine the estimated 20-year annual expected rate of return at the 50th percentile to be 7.91%. The average annual rate price inflation assumption over the 20-year period in the Horizon Survey is 2.47%. Using the plan's recommended inflation assumption of 2.50%, the median annual return expected using the Horizon survey is 7.94% for the 20-year timeframe. The 2023 survey average expected return on a hypothetical plan increased nearly 0.88% from the 2022 expectation.

Section II: Economic Assumptions

Peer Comparison

The following chart shows the nominal investment return assumptions of 131 plans from the National Association of State Retirement Administrators (NASRA) Issue Brief entitled, "Public Pension Plan Investment Return Assumptions", updated March. 2023. The median nominal investment return from this survey is 7.00%.



Section II: Economic Assumptions

Recommendation

By actuarial standards, we are required to maintain a long-term perspective in setting all assumptions, including the investment return assumption. Therefore, we believe actuaries must be careful not to let recent experience or short-term expectations excessively impact our judgment regarding the appropriateness of the current assumption over the long term.

There has been a significant trend in lowering the investment return assumption for pension plans across the country. According to the March, 2023 NASRA Issue Brief, the median return assumption has decreased from 8.00% in 2010 to 7.00% in 2023. The significant increase in the return expectation contained in recent capital market assumption may be the onset of a trend of increases in expected returns, however, the assumptions of most large public retirement systems reflect the continuation of a lower return assumption. We continue to favor an assumption which is less than the median rate of return based on current capital market assumptions for the longer timeframes and recommend no change to the current 7.00% annual rate of investment return assumption.

Below is a breakdown of the building block approach as recommended under ASOP No. 27.

Investment Return Assumption		
	Current	**Recommended**
Real Rate of Return*	4.50%	4.50%
Inflation	2.50	2.50
Net Investment Return	7.00%	7.00%

* net of investment expenses.

Section II: Economic Assumptions

Wage Inflation

Background

The wage inflation assumption is composed of the price inflation assumption and an assumption for the real rate of wage increases. The salary increase assumption combines the wage inflation assumption with an assumption for promotion and longevity, often called merit increases. Merit assumptions are generally age and/or service related and will be dealt with in the demographic assumption section of the report. The excess of wage growth over price inflation is also considered the increase in productivity that labor provides.

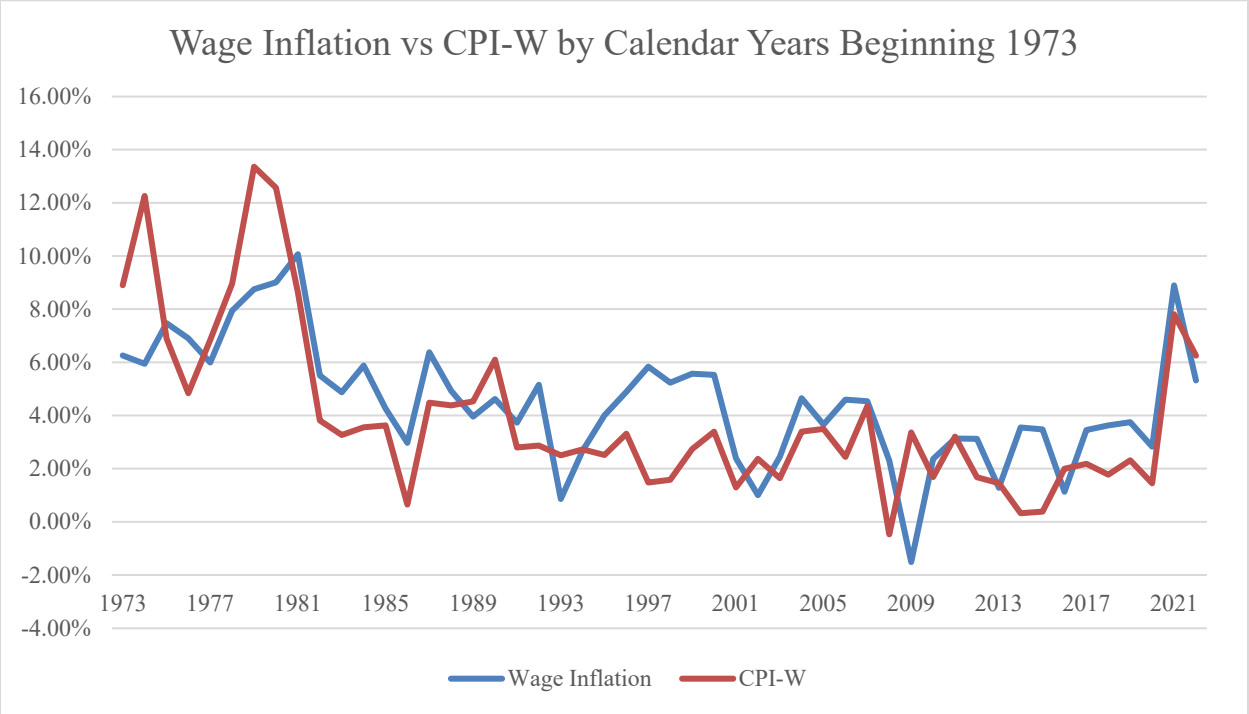
The current wage inflation assumption is 3.00% and is composed of a 2.50% rate of inflation assumption component and a 0.50% real rate of wage inflation component.

Past Experience

The Social Security Administration maintains data on overall average wage growth in the United States and publishes the National Average Wage Index (NAWI). While this is the most comprehensive data available, it is based on all wage earners in the country so it can be influenced by the mix of jobs as well as by changes in certain sectors of the workforce that may not be seen by all segments.

Below are historical information on real wage inflation which use the National Average Wage Index and inflation as measured by CPI (W). Currently, this wage data is only available through the calendar year 2022. We remove the rate of price inflation as measured by CPI (W) for each year from the data to review the historical real rate of wage inflation.

Section II: Economic Assumptions



Based on the data in the chart above, it is difficult to assess a clear trend in the real rate of wage growth for our purposes. The recent historical impact of the pandemic on both wages and inflation are clearly evident in the recent rates.

Historical Data of Real Wage Growth Compound Average Rates

Period Ending 12/31/2022	Wage Inflation	Price Inflation	Real Wage Growth
10 Year	3.71%	2.57%	1.14%
20 Year	3.31%	2.52%	0.79%
30 Year	3.47%	2.47%	0.99%
40 Year	3.77%	2.76%	1.01%
50 Year	4.48%	3.91%	0.57%

Over the 50-year period ending 12/31/2022, the annual real wage growth rate was negative 16 of the 50 years, nearly one-third of the time. This is commonly due to the lag in the rates of wage increases compared to rates of price inflation. For our purposes, we favor the 50-year annualized rate of real wage growth when considering this historical data in general.

Section II: Economic Assumptions

The MERS salary data over the study period for both General Employees and Public Safety is not useful for assessing the real rate of "across the board" wage increases due to the extreme rates of price inflation over the period. Any actual experience resulting in higher than expected rates of salary increases is attributable to the difference in the actual and expected rate of price inflation and not the assumed rate of real wage growth. The is no evidence apparent in the data which reflects that the current real rate of wage inflation requires adjustment.

Recommendation

We are recommending no change in the rate of real wage growth of 0.50% and added to the 2.50% rate of price inflation assumptions results in no change to the 3.00% assumed rate of wage inflation.

Wage Inflation Assumption		
	Current	Recommended
Price Inflation	2.50%	2.50%
Real Wage Growth	0.50%	0.50%
Wage Inflation	3.00%	3.00%

Section II: Economic Assumptions

Cost of Living Adjustments

Background

MERS provides post-retirement annual cost of living adjustments to benefits based on the provisions effective at the date of retirement as follows:

For those retired prior to January 1, 2002:

(i) The benefits of disabled retirees, service retirees who have reached age 65, and beneficiaries of deceased retirees who would have reached age 65 are adjusted each July 1. The difference between the actual annual yield of the actuarial value of assets on a calendar year basis to a 6% yield is calculated. This difference is the adjustment applied the following July 1. The minimum adjustment is 3% and the maximum is 5%.

(ii) The benefits for all others on the roll are adjusted on January 1, 2002, and on each subsequent July 1. The amount of each adjustment is 2.5%.

For those retiring on or after January 1, 2002 and before July 1, 2025, benefits are adjusted each July 1. The adjustment is 60% of the annual increase in the CPI up to 6%. The minimum annual COLA is 2.5%; the maximum is 6%.

A phase out the COLA floor from the existing 2.5% guaranteed minimum to zero over 5-years as follows:

- For those retiring between 7/1/2025 and 6/30/2026 – MERS COLA Minimum = 2.0%
- For those retiring between 7/1/2026 and 6/30/2027 – MERS COLA Minimum = 1.5%
- For those retiring between 7/1/2027 and 6/30/2028 – MERS COLA Minimum = 1.0%
- For those retiring between 7/1/2028 and 6/30/2029 – MERS COLA Minimum = 0.5%
- For those retiring on or after 7/1/2029 – MERS COLA Minimum = 0%

Beginning July 1, 2025, for years in which inflation (as measured by the CPI-W) increases by 2% or less, the MERS COLA will track inflation directly. For those years in which inflation increases by 3.33% or more, the COLA will be 60% of the annual increase in the CPI up to 6% plus 75% of the annual increase in the CPI above 6% and capped at 7.5% and subject to the floor rate in the applicable year. The table below provides the current assumed annual COLA rate for each current eligibility criteria:

Retirement Date	Assumed COLA Rate
Prior to 1/1/2002 (≥ Age 65)	3.25%
Prior to 1/1/2002 (< Age 65)	2.50%
On and after 1/1/2002 to 6/30/2025	2.50%
7/1/2025 to 6/30/2026	2.50%
7/1/2026 to 6/30/2027	2.30%
7/1/2027 to 6/30/2028	2.10%
7/1/2028 and after	2.00%

Recommendations

The COLA assumption for those retired prior to 1/1/2002 and at least age 65, has annually been the minimum 3.00% for over consecutive 11 years. We do not feel this assumption needs adjustment as there is a small likelihood that assets could perform at a level that would result in this rate exceeding the 3.00% floor. The rate for those not at least age 65 and retired prior to 1/1/2002 is fixed at 2.50% annually.

We have analyzed both historical data and stochastic models pertaining to the 2.50% COLA assumption for those retired on or after 1/1/2002 and prior to 7/1/2025. As the COLA is based on 60% of the annual rate of increase in the CPI, rates in excess of 4.1667% would result in a COLA rate higher than 2.50%. Based on historical CPI(W) for the latest 40 years ending June 30, the annual CPI(W) rate of increase has exceeded a rate of 4.1667% seven times or 17.5% of the time. When it exceeded the threshold, the average COLA rate was 3.44%. Based on a blended average, the historical expected annual rate of COLA for this group is 2.66%. Based on 1,000 random trials from a normal distribution with mean of 2.50% and an annual standard deviation of 2.13% (based on actual rates of CPI(W) over the latest 30 years), The resulting COLA rates would exceed the current 2.50% assumption 21% of the time. The median COLA rate is, of course, 2.50%, but so is the 1st percentile. The geometric mean of the resulting COLA outcomes is the preferred metric for this assumption and equals 2.65%. We recommend grading into this assumed rate of 2.65% over a 3-year period resulting in an assumed rate of 2.55% for the 7/1/2023 valuation, a rate of 2.60% for the 2024 valuation and ultimately the 2.65% rate beginning with the 2025 valuation and thereafter.

Finally, concerning the other assumed annual COLA rates for post 7/1/2025 retirees, these were established using a stochastic approach and represent rates which are slightly higher than the geometric means of the stochastic analysis of each of the annual graded rates of COLA expected and are recommended for continued use.

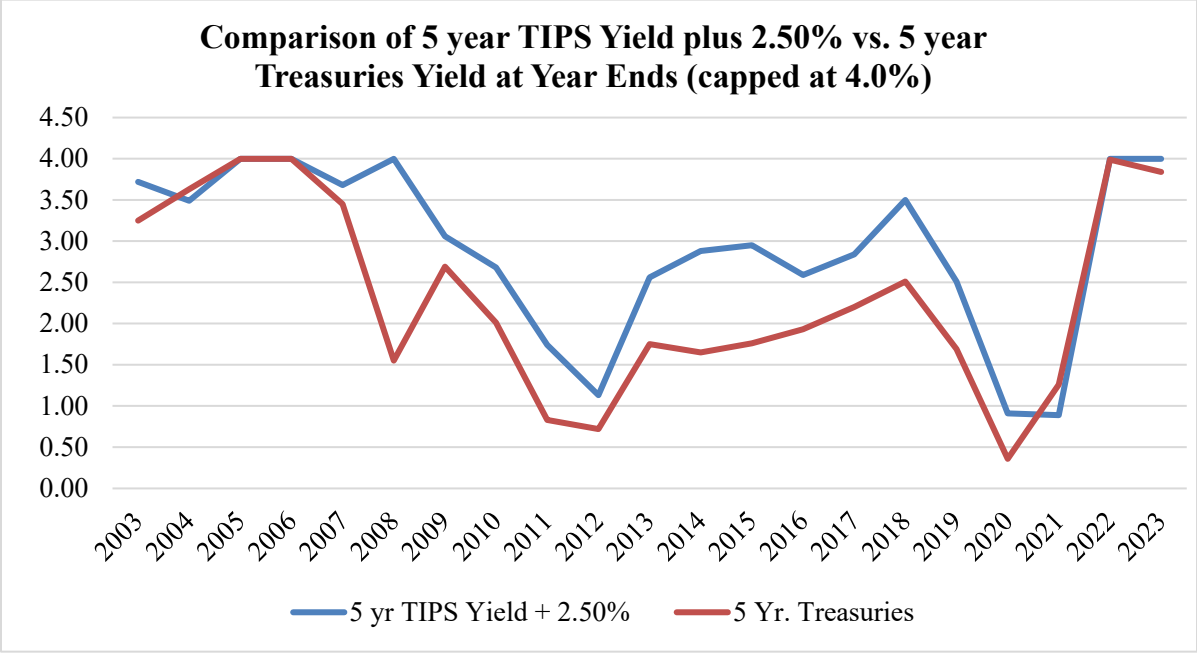
Rate of Interest Credited to DROP Account Balances

Background

With the addition of a DROP plan option for eligible members beginning July 1, 2025, this provision of the plan provides interest on the members' DROP account beginning at the 2nd anniversary of their entry into DROP. The interest rate is credited to the balance at the beginning of the year and is capped at a 4.00% annual rate. The DROP period cannot exceed 60 months, so we recommend consideration of shorter-term (5-years or less) interest rates for this assumption.

Recommendations

Short-term rates can be volatile, especially in periods where the Federal Reserve is changing monetary policy. To avoid periods where short-term rates are significantly depressed, we recommend using the assumed rate of inflation for MERS, currently 2.50%, and adding the yield on 5-year Treasury Inflation Protected Securities (TIPS) provided by the St. Louis Federal Reserve. Specifically, we refer to the *Market Yield on U.S. Treasury Securities at 5-Year Constant Maturity, Quoted on an Investment Basis, Inflation-Indexed* available as of the last trading day in June or December preceding the DROP participant's anniversary date. To illustrate, as of the end of December 2023, the index yield rate was 1.72% and when added to the 2.50% inflation assumption equals 4.22% which would result in a 4.00% rate of interest (capped) for DROP accounts with anniversaries from 1/1/2024 to 6/30/2024. We also considered the yield on 5-year Treasury Notes for the rate of interest but in our opinion, the is additional volatility of the resulting rates. The table below compares the yield on 5-year TIPS plus 2.50% assumed inflation to the yield on 5-year Treasury Notes over the period since 1/1/2003:



Section II: Economic Assumptions

The DROP interest rate will not actually be used to credit DROP accounts until July 1, 2027, however, an assumption is need for our analysis of future DROP liabilities. We are currently using a 4.00% rate of interest on eligible DROP accounts in the actuarial valuations and projections. Based on current conditions, we do not recommend changing this assumption.

Assumed Rate of Interest Credited on Eligible DROP Accounts	
Current 4.00%	Recommended 4.00%

Section III: Actuarial Methods

Actuarial Cost Method

There are various actuarial cost methods, each of which has different characteristics, advantages and disadvantages. However, Governmental Accounting Standard Board (GASB) Statement Numbers 67 and 68 require that the Entry Age Normal cost method be used for financial reporting. Most systems do not want to use a different actuarial cost method for funding and financial reporting. In addition, the Entry Age Normal method has been the most common funding method for public systems for many years. This is the cost method currently used by the Plan.

The rationale of the Entry Age Normal (EAN) cost method is that the cost of each member's benefit is determined to be a level percentage of his salary from date of hire to the end of his employment with the employer. This level percentage multiplied by the member's annual salary is referred to as the normal cost and is that portion of the total cost of the employee's benefit that is allocated to the current year. The portion of the present value of future benefits allocated to the future is determined by multiplying this percentage times the present value of the member's assumed earnings for all future years including the current year. The Entry Age Normal actuarial accrued liability is then developed by subtracting from the present value of future benefits that portion of costs allocated to the future. To determine the unfunded actuarial accrued liability, the value of plan assets is subtracted from the Entry Age Normal actuarial accrued liability. The current year's cost to amortize the unfunded actuarial accrued liability is developed by applying an amortization factor.

It is to be expected that future events will not occur exactly as anticipated by the actuarial assumptions in each year. Actuarial gains/losses from experience under this actuarial cost method can be directly calculated and are reflected as a decrease/increase in the unfunded actuarial accrued liability. Consequently, the gain/loss results in a decrease/increase in the amortization payment, and therefore the contribution rate.

Considering that the Entry Age Normal cost method is the most commonly used cost method by public plans, that it develops a normal cost rate that tends to be less volatile and is the required cost method under calculations required by GASB disclosures, **we recommend use of the Entry Age Normal actuarial cost method be continued.**

Actuarial Value of Assets

In preparing an actuarial valuation, the actuary must assign a value to the assets of the fund. An adjusted market value is often used to smooth out the volatility that is reflected in the market value of assets. This is because most employers would rather have annual costs remain relatively smooth, as a percentage of payroll or in actual dollars, as opposed to a cost pattern that is extremely volatile.

The actuary does not have complete freedom in assigning this value. The Actuarial Standards Board also has basic principles regarding the calculation of a smoothed asset value, Actuarial Standard of Practice No. 44 (ASOP 44), *Selection and Use of Asset Valuation Methods for Pension Valuations.*

ASOP 44 provides that the asset valuation method should bear a reasonable relationship to the market value. Furthermore, the asset valuation method should be likely to satisfy both of the following:

- Produce values within a reasonable range around market value, AND
- Recognize differences from market value in a reasonable amount of time.

In lieu of both of the above, the standard will be met if either of the following requirements is satisfied:

- There is a sufficiently narrow range around the market value, OR
- The method recognizes differences from market value in a sufficiently short period.

These rules or principles prevent the asset valuation methodology from being used to manipulate annual funding patterns. No matter what asset valuation method is used, it is important to note that, like a cost method or actuarial assumptions, the asset valuation method does not affect the true cost of the plan; it only impacts the incidence of cost.

The current asset valuation method for MERS determines the actuarial value of assets at the valuation date as the expected actuarial value at the end of the year adjusted 20% toward the actual market value. If the market value if higher than the expected actuarial value, the adjustment increases the actuarial value by 20% of the difference and vice versa when market value is lower than the expected actuarial value. In our opinion, this method, called the 20% write-up method, is among the least volatile smoothing methods typically in use.

The current 20% write-up method used by MERS is acceptable by ASOP 44 standards and we recommend no change in this methodology.

Amortization of the Unfunded Actuarial Accrued Liability

The actuarial accrued liability is the portion of the actuarial present value of future benefits that are not included in future normal costs. Thus, it represents the liability that, in theory, should have been funded through normal costs for past service. Unfunded actuarial accrued liability (UAAL) exists when the actuarial accrued liability exceeds the actuarial value of plan assets. These deficiencies can result from:

(i) plan improvements,
(ii) experience that is less favorable than expected, or
(iii) assumption changes that increase liabilities.

There are a variety of different methods that can be used to amortize the UAAL. Each method results in a different payment stream and, therefore, has cost implications. For each methodology, there are three characteristics:

- The period over which the UAAL is amortized,
- The rate at which the amortization payment increases, and
- The number of components of UAAL (separate amortization bases).

Amortization Period: The amortization period can be either closed or open. If it is a closed amortization period, the number of years remaining in the amortization period declines by one in each future year. Alternatively, if the amortization period is an open or rolling period, the amortization period does not decline but is reset to the same number each year. This approach essentially "refinances" the System's debt (UAAL) every year. **MERS currently utilizes a closed amortization period approach and we recommend no change to this method.**

Amortization Payment: The level dollar amortization method is similar to the method in which a homeowner pays off a mortgage. The liability, once calculated, is financed by a constant fixed dollar amount, based on the amortization period until the liability is extinguished. This results in the liability steadily decreasing while the payments, though remaining level in dollar terms, in all probability decrease as a percentage of payroll. (Even if a plan sponsor's population is not growing, inflationary salary increases will usually be sufficient to increase the aggregate covered payroll). **MERS currently utilizes a level dollar amortization payment approach, and we recommend no change to this method.**

Amortization Bases: The UAAL can be amortized either as one single amount or as components or "layers", each with a separate amortization base, payment and period. If the UAAL is amortized as one amount, the UAAL is recalculated each year in the valuation and experience gains/losses or other changes in the UAAL are folded into the single UAAL amortization base. The amortization payment is then the total UAAL divided by an amortization factor for the applicable amortization period.

If separate amortization bases are maintained, the UAAL is composed of multiple amortization bases, each with its own payment schedule and remaining amortization period. In each valuation, the unexpected change in the UAAL is established as a new amortization base over the appropriate amortization period beginning on that valuation date. The UAAL is then the sum of all of the outstanding

amortization bases on the valuation date and the UAAL payment is the sum of all of the amortization payments on the existing amortization bases. This approach provides transparency in that the current UAAL is paid off over a fixed period of time and the remaining components of the UAAL are clearly identified. Adjustments to the UAAL are also separately identified in each future year. One downside of this approach is that it can create some discontinuities in contribution rates when UAAL layers/components are fully paid off. If this occurs, it likely would be far in the future, with adequate time to address any adjustments needed.

Currently, the amortization methodology is based on the level dollar amortization method using a layered approach with each layer amortized over a closed, 25-year period beginning the year established. We recommend no change in this methodology at this time.

Section IV: Demographic Assumptions

There are several demographic assumptions used in the actuarial valuations performed for the Connecticut Retirement Systems. They are:

- Rates of Withdrawal
- Rates of Disability Retirement
- Rates of Service Retirement
- Rates of Post-retirement and Pre-Retirement Mortality
- Rates of Salary Increase

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.

Detailed tabulations by age, service and/or gender are performed over the entire study period. These tabulations look at all active and retired members during the period as well as separately annotating those who experience a demographic event, also referred to as a decrement. In addition, the tabulation of all members together with the current assumptions permits the calculation of the number of expected decrements during the study period.

Instead of relying on the counts of actual and expected decrements, we utilized a weighted experience approach which better reflects the impact demographic experience has liability measures. We weight decrements from active service with the monthly salary of the individual members and we weight the post-retirement mortality experience with the monthly retirement benefits of the individuals.

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 service does not follow the expected pattern, new assumptions are recommended. Recommended changes usually do not follow the exact actual experience during the observation period. Judgment is required to extrapolate future experience from past trends and current member behavior. In addition, non-recurring events, such as early retirement windows, need to be taken into account in determining the weight to give to recent experience.

The remainder of this section presents the results of the demographic study. We have prepared tables that show a comparison of the actual and expected decrements and the overall ratio of actual to expected results (A/E Ratios) under the current assumptions. If a change is proposed, the revised A/E Ratios are shown as well. Salary adjustments, other than the economic assumption for wage inflation discussed in the previous section, are treated as demographic assumptions.

Section IV: Demographic Assumptions

Rates of Withdrawal

The rates of withdrawal are used to determine the expected number of separations from active service which will occur as a result of resignation or dismissal. As mentioned earlier, the experience data is salary weighted to better reflect the impact to measures of the rates. Note that the active employees in the Police and Fire group are predominately male and we have combined the genders for the purposes of our analysis of the experience for this group.

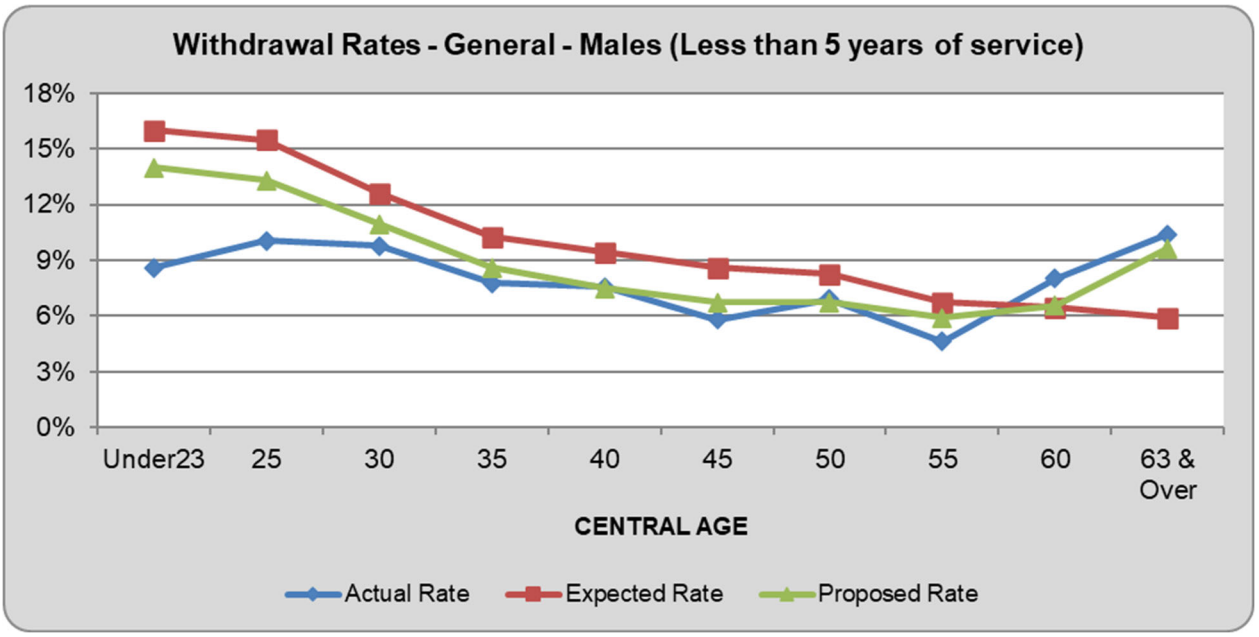
The tables below provide a summary of the weighted actual and expected experience for MERS withdrawals for non-vested active members with 0 to 4 years of service.

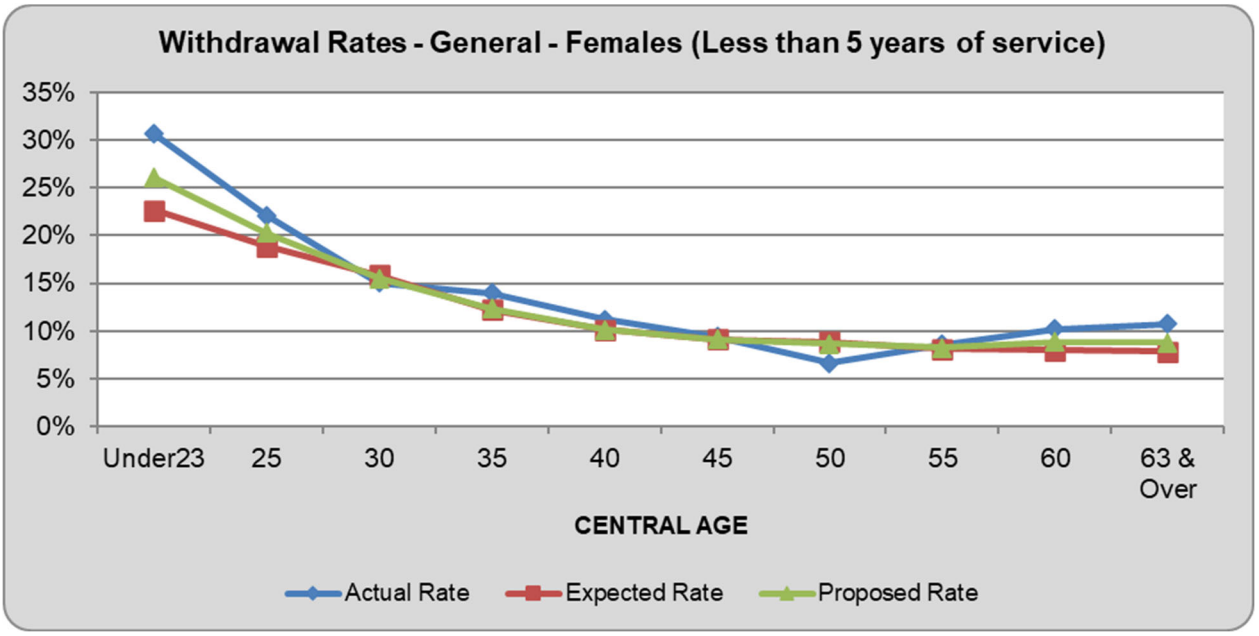
Gender	Weighted Exposure	Weighted Actual	Weighted Expected	A/E Ratio
General Employee Non-Vested Rates of Withdrawal				
Male	274,206,280	21,262,908	26,554,545	0.801
Female	265,218,198	30,833,008	29,186,882	1.056
Police and Fire Non-Vested Rates of Withdrawal				
Combined	259,804,454	7,626,105	12,528,058	0.609

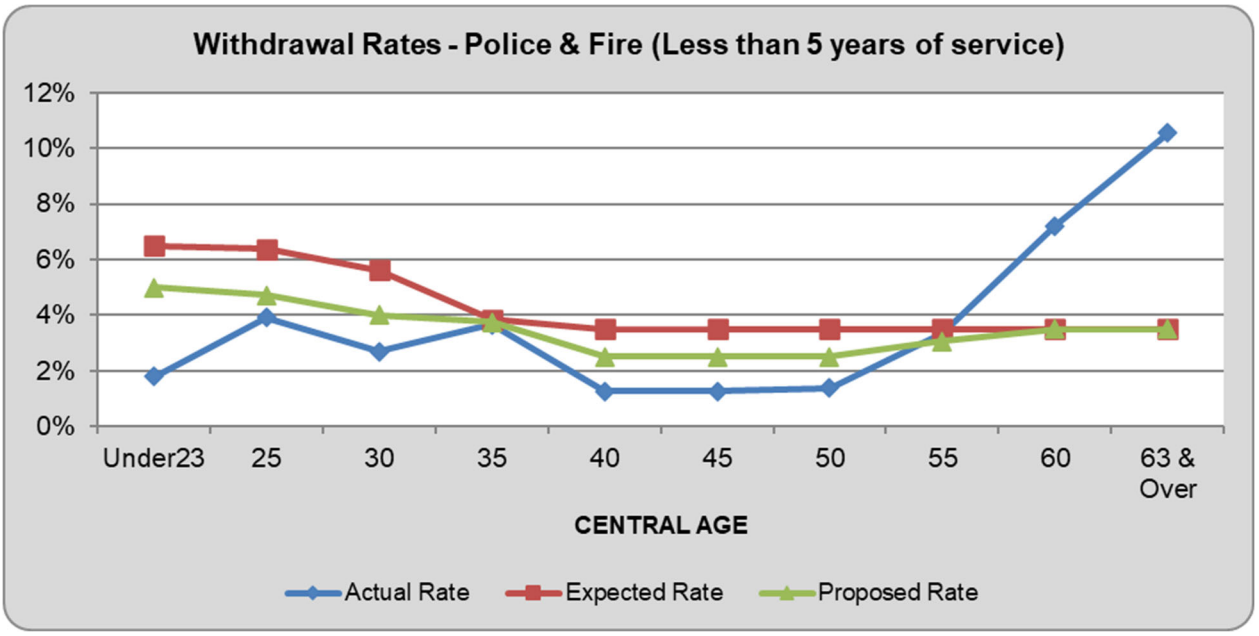
From the tables above, the rates of withdrawal for male General Employees and Police and Fire non-vested members overestimated the amount of withdrawals actually experienced. The desired range for the actual to expected (A/E) ratios for withdrawal experience is in the 1.00 to 1.05 range. We recommend adjustment to the rates to reflect the recent experience and increase the A/E ratio toward the desired range. We also recommend minor adjustments to the female non-vested withdrawal rates.

Section IV: Demographic Assumptions

To review the experience and recommended adjustment to the rates, the following graphs show a comparison of the actual rates, the current assumed rates and proposed assumed rates of non-vested withdrawal.







The table below provides the actual to expected ratio where the expected experience is based on the proposed assumptions.

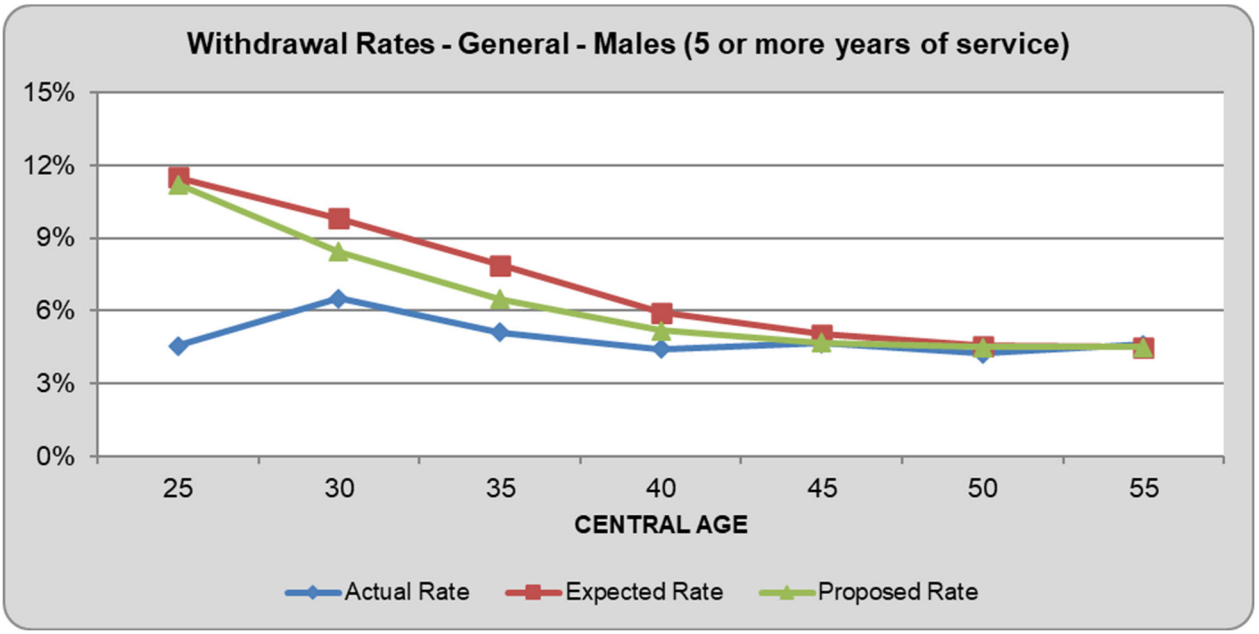
Gender	Weighted Exposure	Weighted Actual	Weighted Proposed	A/E Ratio
General Employee Non-Vested Rates of Withdrawal				
Male	274,206,280	21,262,908	23,353,420	0.910
Female	265,218,198	30,833,008	29,782,377	1.035
Police and Fire Non-Vested Rates of Withdrawal				
Combined	259,804,454	7,626,105	9,581,857	0.796

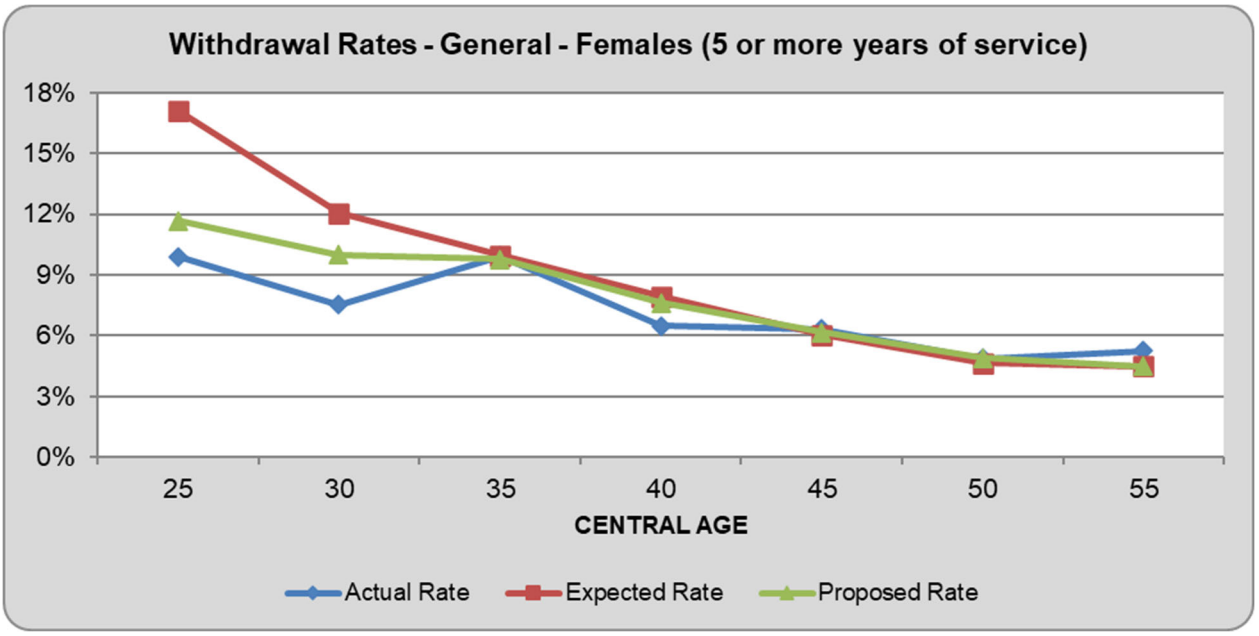
Section IV: Demographic Assumptions

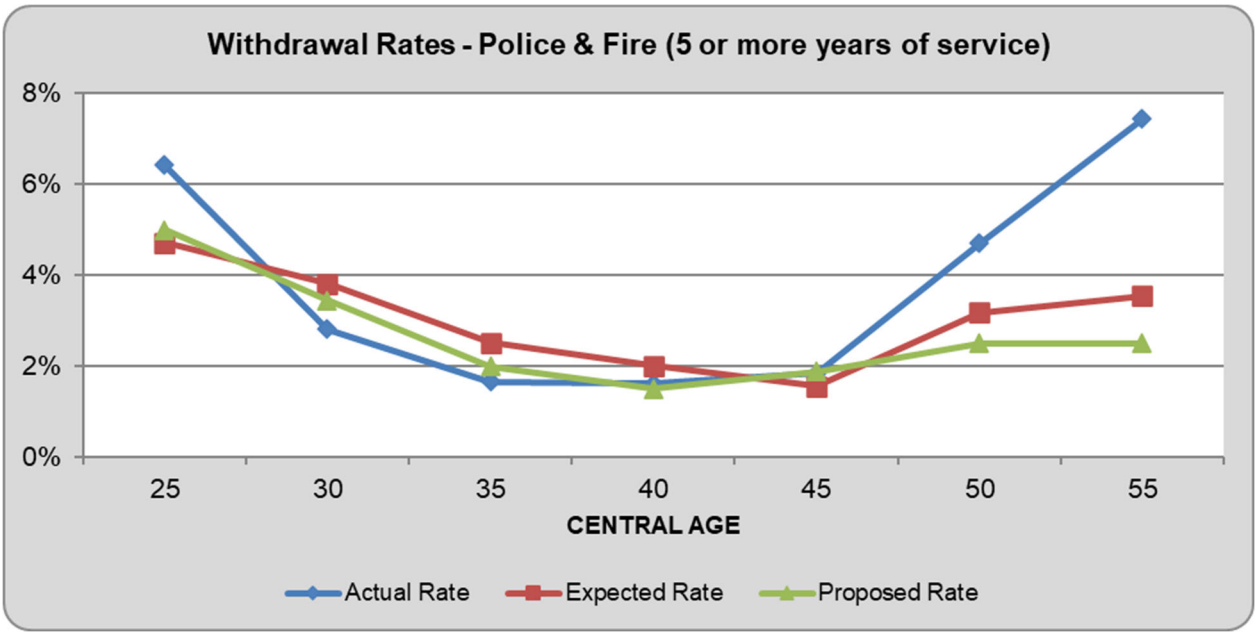
The table below summarizes the withdrawal experience for active vested members prior to age 55 and 25 years of service. For both male and female general employee vested members, the current assumed rates were higher than the actual experience over the period and we recommend, in general, lowering the assumed rates. Police and Fire experienced slightly higher rates of vested member withdrawal especially at younger ages.

Gender	Weighted Exposure	Weighted Actual	Weighted Expected	A/E Ratio
General Employee Vested Rates of Withdrawal				
Male	379,688,376	17,774,421	21,991,276	0.808
Female	319,175,450	19,807,580	20,666,966	0.958
Police and Fire Vested Rates of Withdrawal				
Combined	629,831,205	17,967,765	16,407,001	1.095

The following charts graphically present the actual experience, current assumed rates and proposed rates of vested member withdrawal.




Withdrawal Rates - General - Females (5 or more years of service)
18%
15%
12%
9%
6%
3%
0%
25
30
35
40
45
50
55
CENTRAL AGE
Actual Rate
Expected Rate
Proposed Rate


Withdrawal Rates - Police & Fire (5 or more years of service)
8%
6%
4%
2%
0%
25
30
35
40
45
50
55
CENTRAL AGE
Actual Rate
Expected Rate
Proposed Rate

Section IV: Demographic Assumptions

And finally, the table below provides the actual to expected ratio where the expected experience is based on the proposed assumptions. The complete tables of proposed rates are contained in Appendix D.

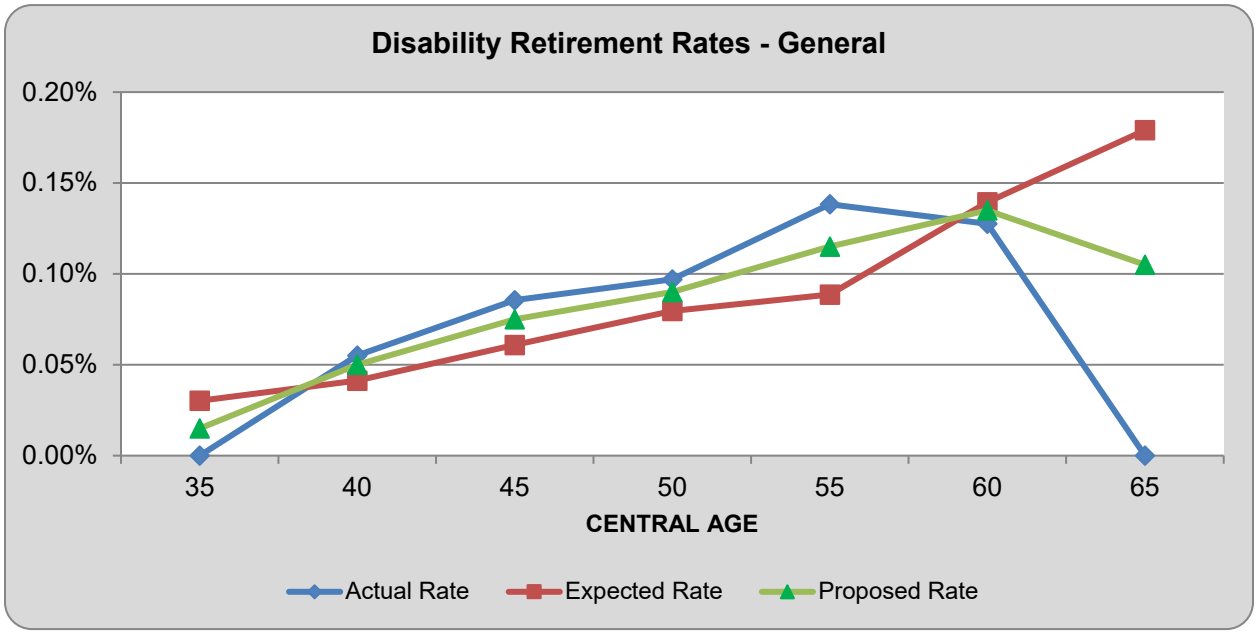
Gender	Weighted Exposure	Weighted Actual	Weighted Proposed	A/E Ratio
General Employee Vested Rates of Withdrawal				
Male	379,688,376	17,774,421	20,098,911	0.884
Female	319,175,450	19,807,580	20,356,943	0.973
Police and Fire Vested Rates of Withdrawal				
Combined	629,831,205	17,967,765	16,839,633	1.067

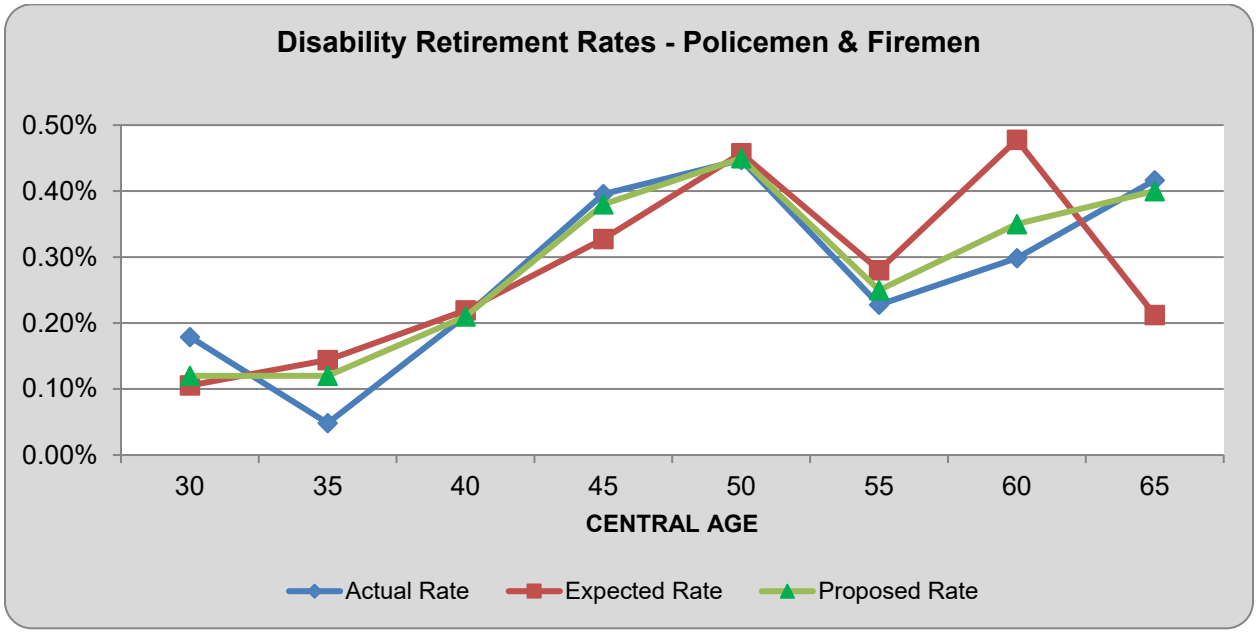
Rates of Disability Retirement

The rates of disability retirements are used to determine the expected number of separations from active service due to a service connected or non-service connected disability. It is important to recognize that public safety employees are typically exposed to more hazards than general employees but are typically required to meet certain fitness standards. Also, since the passage and expansion of the Heart-Lung Bill, there are several more presumptions that disabilities result from service-connected causes for public safety positions compared to general employees. The tables below provide a summary of the weighted actual and expected experience for disability retirements separately for General Employees and Police and Fire over the study period.

Group	Weighted Exposure	Weighted Actual	Weighted Expected	A/E Ratio
Rates of Disability				
General Employees	1,854,881,991	1,487,064	1,661,270	0.895
Police and Fire	1,036,234,826	2,756,496	2,864,150	0.962

Although the experience was near the expectation, the goal for the A/E ratio under disability experience is a ratio of 1.0. We recommend small adjustments in the expected rates of disability to better reflect the latest trends. The following graphs show a comparison of the actual disability rates, the current assumed rates, and the proposed rates of disability retirements.


Disability Retirement Rates - General
0.20%
0.15%
0.10%
0.05%
0.00%
35
40
45
50
55
60
65
CENTRAL AGE
Actual Rate
Expected Rate
Proposed Rate


Disability Retirement Rates - Policemen & Firemen
0.50%
0.40%
0.30%
0.20%
0.10%
0.00%
30
35
40
45
50
55
60
65
CENTRAL AGE
Actual Rate
Expected Rate
Proposed Rate

Section IV: Demographic Assumptions

The table below provides the actual to expected ratio where the expected experience is based on the proposed assumptions.

Group	Weighted Exposure	Weighted Actual	Weighted Proposed	A/E Ratio
Rates of Disability				
General Employees	1,854,881,991	1,487,064	1,627,964	0.914
Police and Fire	1,036,234,826	2,756,496	2,820,776	0.977

Additionally, we recommend assuming that 100% of Police and Fire disabilities and 50% of General Employee disabilities are Service-Related. This represents an increase in the percentage for General Employees to reflect that over the last 5 years, nearly 50% of disabilities have been classified as service-related. The complete tables of proposed rates are contained in Appendix D.

Rates of Service Retirement

The rates of retirements are used to determine the expected number of separations from active service due to election of retirement under the applicable retirement provisions. The tables below provide the A/E ratios of the current assumption for rates of retirement. The current assumption was in effect only for the revised 2022 valuation which reflects the plan changes agreed to in early 2023. The rates were adjusted in the course of preparing the analysis of the DROP program and the desire to make preliminary adjustments to the retirement rates used in that analysis.

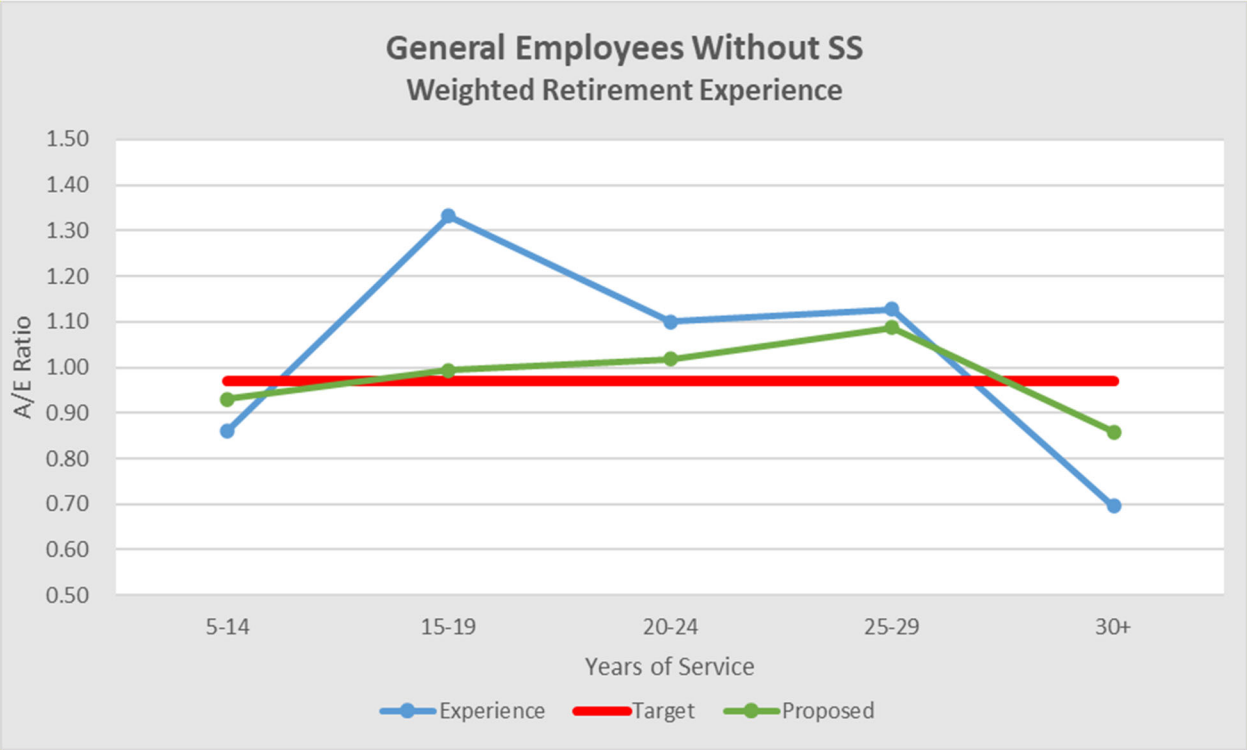
General Employees without Social Security Rates of Retirement

The table below provides the weighted experience and A/E ratios of the currently assumed rates (effective 2022) of retirement grouped by years of service.

General Employees Without Social Security Weighted Retirement Experience (thousands)						
Service (yrs)	5-14	15-19	20-24	25-29	30+	Total
Actual	5,955	5,541	5,914	6,484	6,985	30,880
Expected	6,929	4,162	5,379	5,750	10,043	32,262
A/E Ratio	**0.86**	**1.33**	**1.10**	**1.13**	**0.70**	**0.96**

The current assumption for General Employees without Social Security is reasonable in total, however, we recommend adjustments to the table of rates to better reflect the age and service trends in the recent experience. The chart below provides the impact on the actual to expected ratios of the recommended rates of retirement adjustments by years of service groups. Note we display the desired A/E Ratio for retirement experience of 0.97 (shown as Target on the graph).

Section IV: Demographic Assumptions



The table below provides the A/E ratios under the proposed rates or retirement assumption.

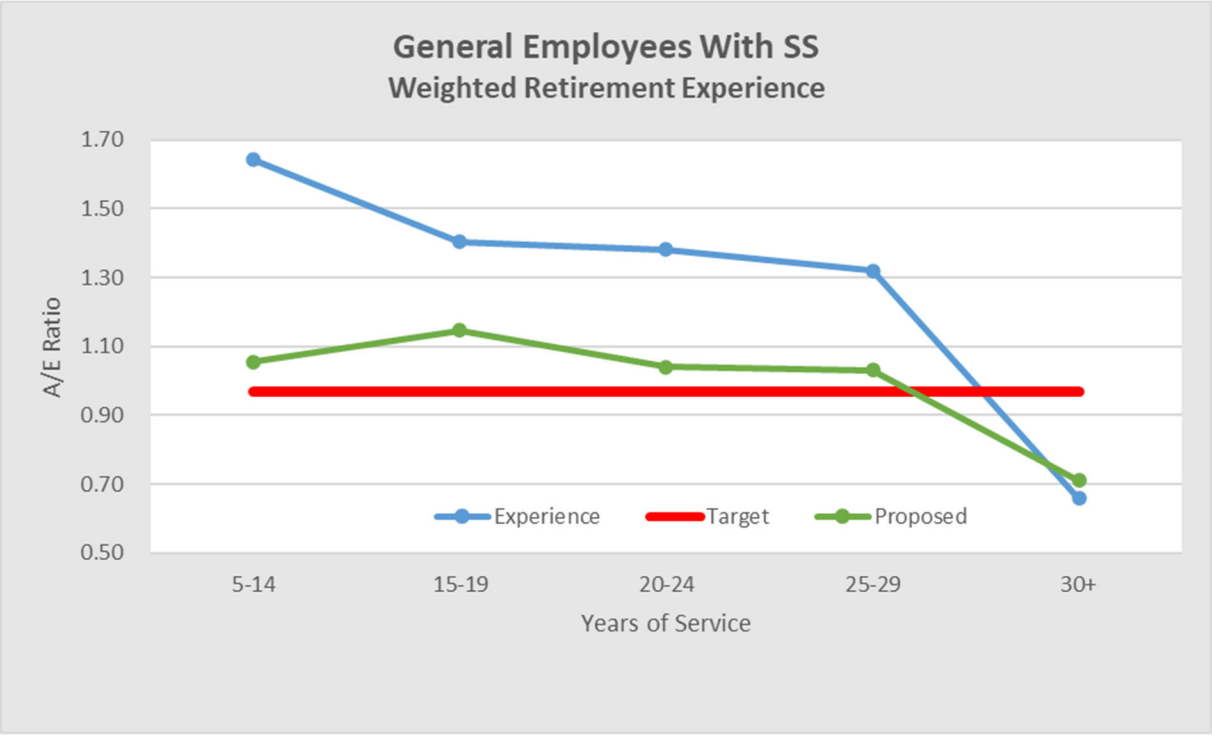
General Employees Without Social Security Weighted Retirement Experience with Proposed Assumption (thousands)						
Service (yrs)	5-14	15-19	20-24	25-29	30+	Total
Actual	5,955	5,541	5,914	6,484	6,985	30,880
Proposed	6,397	5,576	5,807	5,964	8,143	31,886
A/E Ratio	**0.93**	**0.99**	**1.02**	**1.09**	**0.86**	**0.97**

General Employees with Social Security Rates of Retirement

The table below provides the weighted experience and A/E ratios of the currently assumed rates or retirement grouped by years of service.

General Employees With Social Security Weighted Retirement Experience (thousands)						
Service (yrs)	5-14	15-19	20-24	25-29	30+	Total
Actual	19,707	11,225	12,129	11,321	11,564	65,946
Expected	12,005	7,998	8,775	8,574	17,543	54,895
A/E Ratio	**1.64**	**1.40**	**1.38**	**1.32**	**0.66**	**1.20**

The current assumption for General Employees with Social Security has under anticipated the actual rates of retirement by 20% overall. We recommend significant changes to the table of rates to better reflect the age and service trends of recent experience which display increased rates of retirement. The chart below provides the impact on the actual to expected ratios of the recommended rates of retirement adjustments.



Section IV: Demographic Assumptions

The table below provides the A/E ratios under the proposed rates of retirement assumption.

General Employees With Social Security Weighted Retirement Experience with Proposed Assumption (thousands)						
Service (yrs)	5-14	15-19	20-24	25-29	30+	Total
Actual	19,707	11,225	12,129	11,321	11,564	65,946
Proposed	18,678	9,781	11,652	10,978	16,250	67,339
A/E Ratio	**1.06**	**1.15**	**1.04**	**1.03**	**0.71**	**0.98**

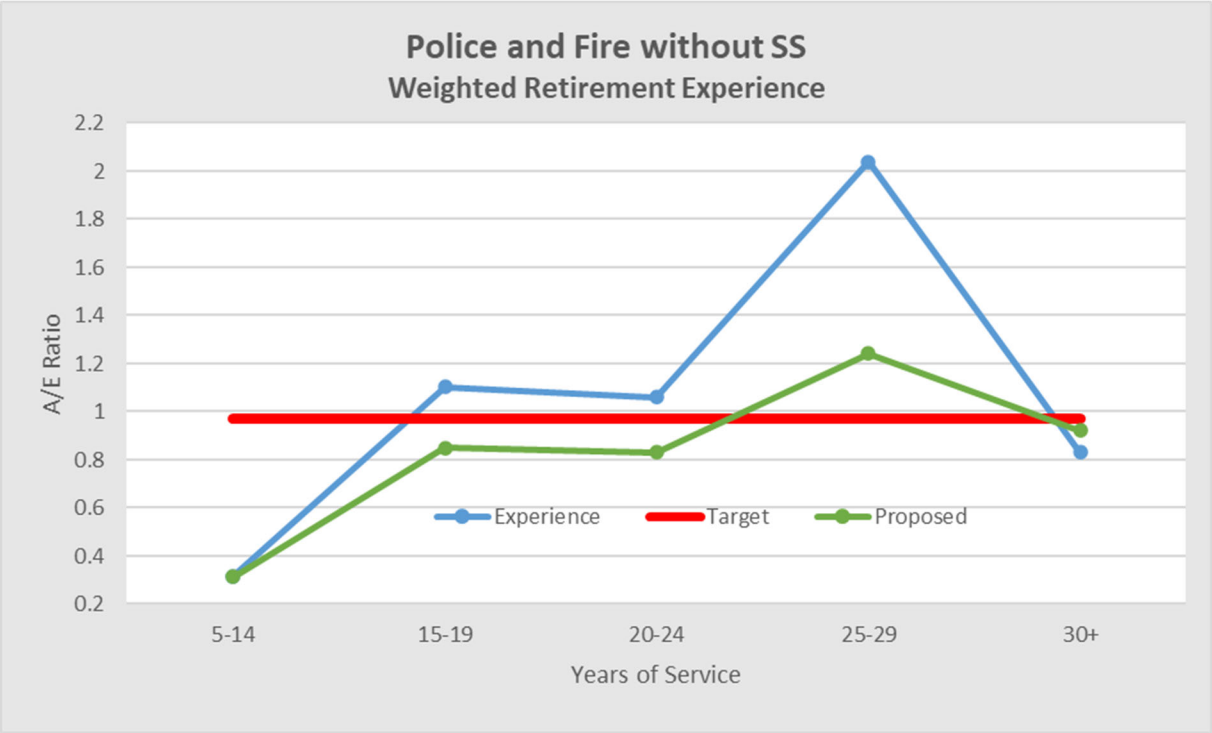
Police and Fire without Social Security Rates of Retirement

The table below provides the weighted experience and A/E ratios of the currently assumed rates or retirement grouped by years of service.

Police and Fire Without Social Security Weighted Retirement Experience (thousands)						
Service (yrs)	5-14	15-19	20-24	25-29	30+	Total
Actual	1,031	933	2,091	16,099	15,482	35,636
Expected	3,253	845	1,974	7,896	18,626	32,594
A/E Ratio	**0.32**	**1.10**	**1.06**	**2.04**	**0.83**	**1.09**

The current assumption for Police and Fire without Social Security has under anticipated the actual rates of retirement by 9% overall. We recommend changes to the table of rates to better reflect the age and service trends of recent experience. The chart below provides the impact on the actual to expected ratios of the recommended rates of retirement adjustments.

Section IV: Demographic Assumptions



The table below provides the A/E ratios under the proposed rates of retirement assumption.

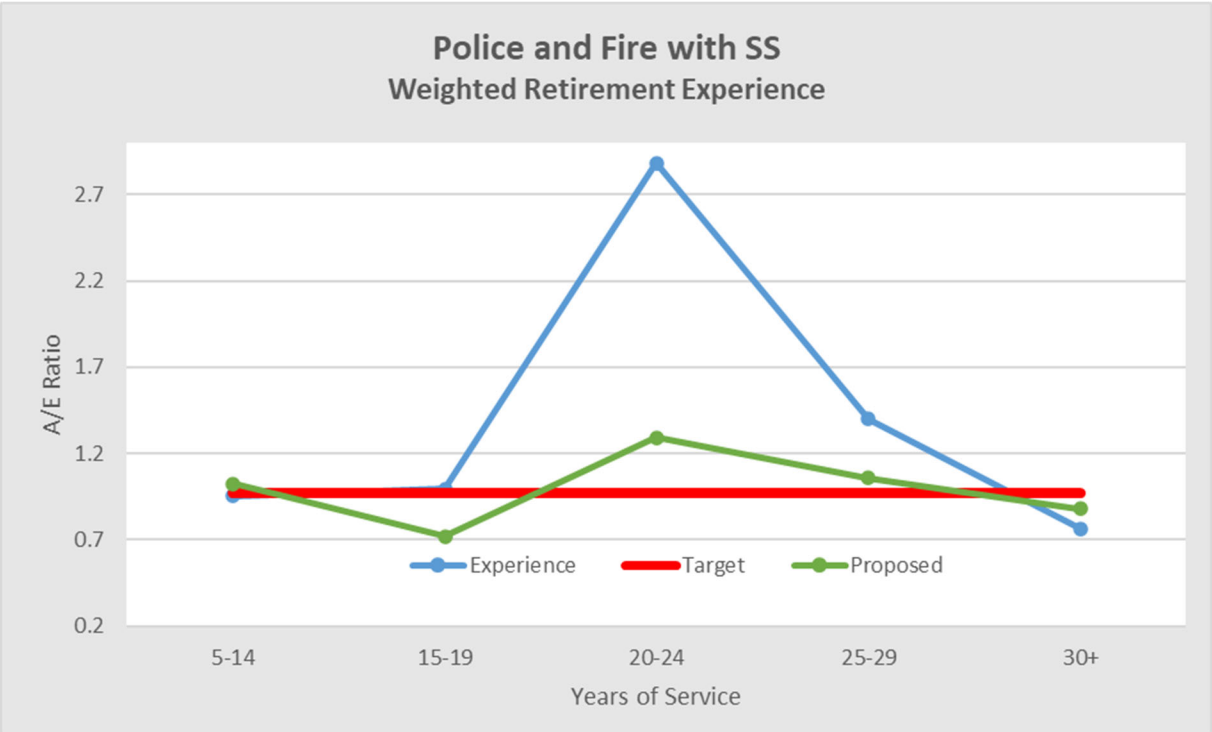
Police and Fire Without Social Security Weighted Retirement Experience with Proposed Assumption (thousands)						
Service (yrs)	5-14	15-19	20-24	25-29	30+	Total
Actual	1,031	933	2,091	16,099	15,482	35,636
Proposed	3,307	1,098	2,519	12,975	16,817	36,716
A/E Ratio	**0.31**	**0.85**	**0.83**	**1.24**	**0.92**	**0.97**

Police and Fire with Social Security Rates of Retirement

The table below provides the weighted experience and A/E ratios of the currently assumed rates or retirement grouped by years of service.

Police and Fire With Social Security Weighted Retirement Experience (thousands)						
Service (yrs)	5-14	15-19	20-24	25-29	30+	Total
Actual	426	464	723	2,815	2,555	6,983
Expected	446	467	251	2,011	3,350	6,526
A/E Ratio	**0.95**	**0.99**	**2.88**	**1.40**	**0.76**	**1.07**

The current assumption for Police and Fire with Social Security has under anticipated the actual rates of retirement by 7% overall. We recommend changes to the table of rates to better reflect the age and service trends of recent experience. The chart below provides the impact on the actual to expected ratios of the recommended rates of retirement adjustments.



Section IV: Demographic Assumptions

The table below provides the A/E ratios under the proposed rates of retirement assumption.

Police and Fire With Social Security Weighted Retirement Experience with Proposed Assumption (thousands)						
Service (yrs)	5-14	15-19	20-24	25-29	30+	Total
Actual	426	464	723	2,815	2,555	6,983
Proposed	416	646	559	2,662	2,902	7,185
A/E Ratio	**1.02**	**0.72**	**1.29**	**1.06**	**0.88**	**0.97**

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The complete tables of proposed rates for all groups are contained in Appendix D.

Section IV: Demographic Assumptions

Rates of Mortality

One of the most important demographic assumptions in the valuation is mortality because it defines the expectation for how long benefit payments will be made. The longer members live, the greater the true cost of future benefit obligations will be.

For many years, rates of mortality have been declining, meaning people, in general, are living longer. Consequently, we anticipate that mortality tables will need to be updated periodically. Because of potential differences in mortality, we break down our study by gender (males and females) and by status (healthy retirees, beneficiaries, disabled retirees, and active members).

Because of the substantial amount of data required to construct a mortality table, actuaries usually rely on standard tables published by the Society of Actuaries. Actuaries then use various adjustments such as age or scaling adjustments to the standard, published mortality tables in order to better match the expected trend in mortality rates of a specific group.

In 2019, the Society of Actuaries released a family of mortality tables named the Pub-2010 tables. While prior pension mortality tables have been based solely on private corporate and union retirement plans, these new tables are based entirely on public sector plan data. These tables are split by three membership types: Public Safety, Teachers, and General Employees to reflect the observed differences in mortality patterns related to the three groups. Tables are further split for healthy retirees, disabled retirees, contingent beneficiaries, and employees. There are still other breakdowns in these tables for at, above or below median annuity values. We anticipate that this family of tables will be a good starting point in developing a recommended mortality assumption.

The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying and monitoring. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*. This ASOP requires the pension actuary to make and disclose a specific recommendation with respect to future improvements in mortality after the valuation date, although it does not require that an actuary assume there will be future improvements. There have been significant improvements in longevity in the past, although there are different opinions about future expectations, and thus there is a subjective component in the estimation of future mortality improvement. We believe it is prudent to anticipate that the trend will continue to some degree in the future and that it is appropriate to reflect some future mortality improvement as part of the mortality assumption.

Section IV: Demographic Assumptions

There are two, widely used ways to reflect future improvements in mortality:

(1) Static table with "margin"
(2) Generational mortality

The first approach of reflecting mortality improvements is through the use of a static mortality table with "margin." Under this approach, the Actual to Expected Ratio is intentionally targeted to be over 100% so that mortality can improve without creating actuarial losses over the period prior to the next experience study. This has been the approach used historically by MERS and other systems. In this manner, it could be expected that as mortality improves, each successive experience study will require mortality assumption changes which will have an increase to the measured liabilities.

Another approach, referred to as generational mortality, directly anticipates future improvements in mortality by using a different set of mortality rates based on each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain "built-in" mortality improvements, e.g., a member who turns age 65 in 2035 has a longer life expectancy than a member who turns age 65 in 2020. When using generational mortality, the Actual to Expected Ratios for the observed experience are set near 100% as future mortality improvements will be considered directly in the actuarial valuation process. The generational approach is the preferred method for recognizing future mortality improvements in the valuation process because it is more direct and results in longer life expectancy for members who are younger, consistent with established trends in improved longevity. In this manner, with future mortality improvements already considered, the adjustments to the mortality assumptions in each experience study will be expected to be minor and not significantly impact the measured liabilities.

Our analysis of mortality experience uses a benefit weighted approach to tabulating the data and analyzing the experience on the basis of the impact on the liability of the System rather than the headcounts of members. Once the data is weighted; we then assess the credibility of the data using the least fluctuation credibility theory (LFCT) method to determine if the data is sufficient to establish an assumption based entirely on the experience (fully credible) or to what extent we blend the current experience with a reasonable standard table of expected mortality for the populations (partially credible). Under the LFCT method, using a 90% the resulting credibility factor is the basis for blind the rates for establishing the proposed assumption. We then construct the proposed assumption for mortality and make reasonable adjustments to the proposed rates such that the experience expected over the period under the proposed assumption is relatively the same as actual experience (A/E ratio of 1.0).

Rates of Post-Retirement Mortality – Retirees

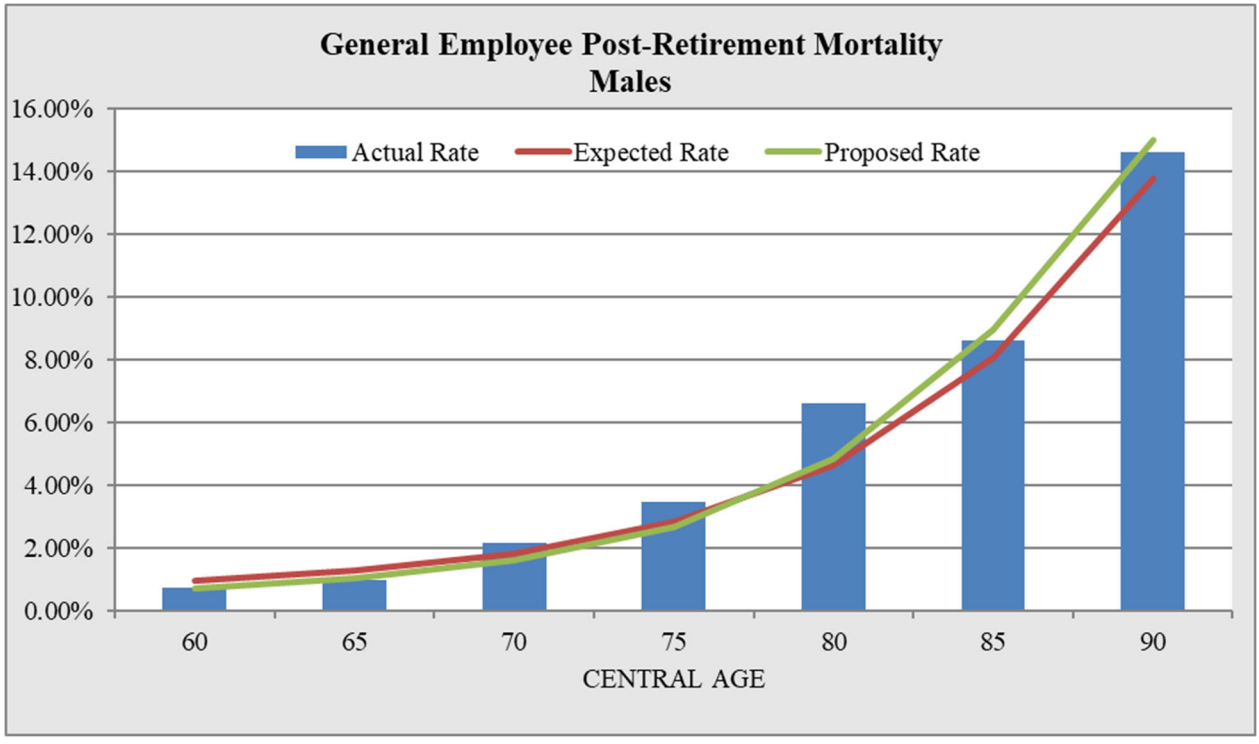
General Employees

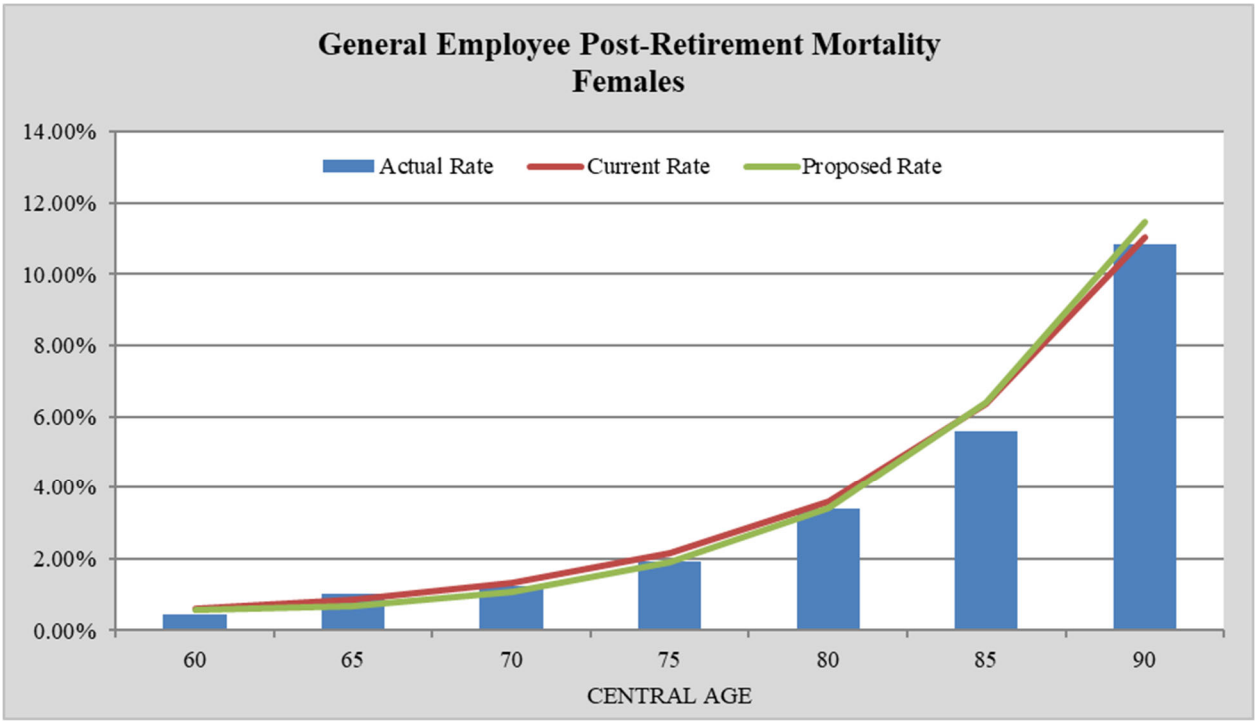
We have combined the post-retirement mortality experience of General Employees retirees regardless of Social Security coverage. The current assumption for healthy General Employee retiree mortality is the RP-2014 Combined Mortality Table projected to 2015 with Scale MP-2017 and projected to 2022 with Scale BB. This table has reasonably anticipated the experience of the General Employee retirees and has been a consistent source of slight actuarial gains for the General Employee groups over the past five valuations.

	Male General Employees	Female General Employees
Weighted Exposure	23,639,726	22,363,093
Actual Weighted Deaths	831,351	667,784
Expected Weighted Deaths	717,845	680,092
Actual to Expected Ratio	**1.158**	**0.982**
LFCT Credibility Factor	0.501	0.499

In our analysis, the LFCT credibility factor of the male and female experience is approximately 0.50, reflecting the data is partially credible. The current assumption based on the RP-2014 tables has produced an expectation of significantly fewer male deaths and slightly more female deaths than actually experienced over the period. In our analysis, the LFCT credibility factor of the male and female experience is approximately 0.50. We use the latest published mortality tables for public sector plans, the PUB 2010 for retired general employees (PUB-G Healthy Retirees) tables with improvement based on the MP-2021 scale to the midpoint of the study period (2020) as the standard table of rates and under the LFCT method, the rates for males would require a significant increase to the standard table rates of approximately 15% and females would require a 4% increase.

We prefer to alternatively use a one-year set forward to standard table accomplish the necessary adjustment for the proposed mortality table. A set forward is a practical modification to the rates which uses the mortality rate for each age based on the tabular rate for the age one year older. The result is the proposed mortality assumption based on the 2010 PUB-G Healthy Retiree Table with a one-year set forward and projected generationally with the MP-2021 improvement scale. The charts below graphically present the experience, the current assumption and the proposed assumption over the high exposure post-retirement ages (58 to 92):





The table below provides the A/E ratios under the proposed rates of post-retirement mortality assumption.

	Male General Employees	Female General Employees
Weighted Exposure	23,639,726	22,363,093
Actual Weighted Deaths	831,351	667,784
Proposed Weighted Deaths	711,563	672,976
Actual to Expected Ratio	**1.168**	**0.992**

Police and Fire

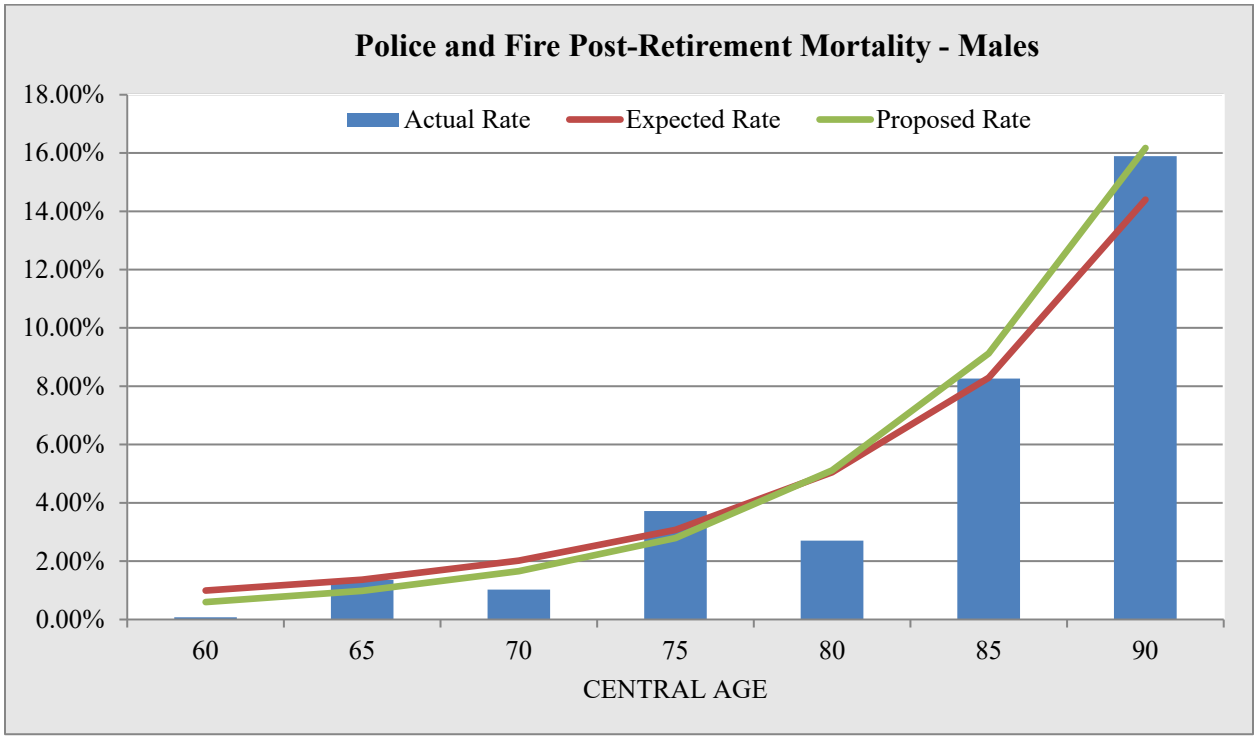
We have combined the post-retirement mortality experience of Police and Fire retirees regardless of Social Security coverage. The current assumption for healthy Police and Fire retiree mortality is the RP-2014 Blue Collar Mortality Table projected to 2015 with Scale MP-2017 and projected to 2022 with Scale BB. This mortality assumption has overestimated the mortality rates on a weighted basis and has resulted in small losses for the Non-Social Security covered group and slight gains for the Social Security covered group.

	Police and Fire
Weighted Exposure	16,170,400
Actual Weighted Deaths	228,034
Expected Weighted Deaths	290,697
Actual to Expected Ratio	**0.784**
LFCT Credibility Factor	0.201

Section IV: Demographic Assumptions

In our analysis, the LFCT credibility factor of the male experience is approximately 0.20, reflecting the data is partially credible and less credible than the General Employee data. The current assumption based on the RP-2014 tables has produced an expectation of more male deaths than actually experienced over the period. There were only 4 female deaths over the study period and the credibility factor was insignificant. We will analyze the male experience and apply the same recommendation of adjustments to the tabular rates. We use the latest published mortality tables for public sector plans, the PUB 2010 for retired public safety employees (PUB-S Healthy Retirees) tables with improvement based on the MP-2021 scale to the midpoint of the study period (2020) as the standard table of rates and under the LFCT method, the rates for males would require an increase to the standard table rates of approximately 1.1% increase.

Similar to the General Employee rates, which produce a much larger credibility factor, we apply a one-year set forward to standard table to accomplish a reasonable adjustment for the proposed mortality table. The result is the proposed mortality assumption based on the 2010 PUB-S Healthy Retiree Table with a one-year set forward and projected generationally with the MP-2021 improvement scale. The chart below graphically presents the male mortality experience, the current assumption and the proposed assumption over the high exposure post-retirement ages (58 to 92):



The table below provides the A/E ratios under the proposed rates of post-retirement mortality assumption.

	Police and Fire
Weighted Exposure	16,170,400
Actual Weighted Deaths	228,034
Proposed Weighted Deaths	240,114
Actual to Expected Ratio	**0.950**

Therefore, we recommend that the rates of retiree and beneficiary mortality be revised to the 2010 PUB-G Healthy Mortality Tables generationally projected with Scale MP-2021 and set forward one-year for General Employees. For Police and Fire, we recommend the 2010 PUB-S Healthy Mortality Tables generationally projected with Scale MP-2021 and set forward one-year.

Compared to the current mortality table, the proposed mortality table increases the life expectancy for both males and females, but significantly more for males. The following table is the life expectancy of a retiree at age 60 in the year 2023.

	General Employees		Police and Fire	
	Current Table	Proposed Table	Current Table	Proposed Table
Male, Age 60	83.5	83.4	82.3	83.1
Female, Age 60	85.9	86.0	84.9	85.0

Rates of Mortality – Disabled Retirees, Survivors and Active Members

The mortality experience for MERS for disabled retirees, survivors and active members is insufficient to use the approach we followed for recommending the retiree mortality assumption above. The 2010 PUB family of mortality tables includes standard tables of mortality rates for disabled retired, contingent annuitants (survivors), and employees that we recommend are utilized for these purposes. We also recommend, based on the analysis conducted on the retiree mortality rates, we apply a one year set forward to the standard tables for disabled retirees and survivors and generationally project the tabular rates using the MP-2021 improvement scale. We recommend the following Pub-2010 Mortality Tables:

General Employees

- Disabled Retirees
    - General, Disabled Retiree Mortality Table set-forward one-year and generationally projected with scale MP-2021.
- Beneficiaries
    - General, Contingent Annuitant Mortality Table set-forward one-year and generationally projected with scale MP-2021.
- Active Employees
    - General, Employee Mortality Table generationally projected with scale MP-2021.

Police and Fire

- Disabled Retirees
    - Public Safety, Disabled Retiree Mortality Table set-forward one-year and generationally projected with scale MP-2021.
- Beneficiaries
    - Public Safety, Contingent Annuitant Mortality Table set-forward one-year and generationally projected with scale MP-2021.
- Active Employees
    - Public Safety, Employee Mortality Table generationally projected with scale MP-2021.

The complete tables of proposed rates for all tables are contained in Appendix D.

Rates of Salary Increases due to Merit and Promotional

The rates of salary increase due to merit and promotion, often called the merit scale, represent the increase in annual salaries in excess of wage inflation. The assumptions for the annual rates of salary increases are the compound rate of increase of both wage inflation and the service based merit scale. As presented earlier in the Economic Assumptions Section of this report, the wage inflation assumption is 3.00% annually. We relied on a building block approach to separate out the apparent merit scale at each year of service by taking the average increase in salary at each year of service less the actual price inflation and apparent real rate of wage inflation over the period.

Section IV: Demographic Assumptions

We begin with an assessment of the current assumption for salary increases for General Employee groups and the Police and Fire groups regardless of Social Security coverage as presented in the table below:

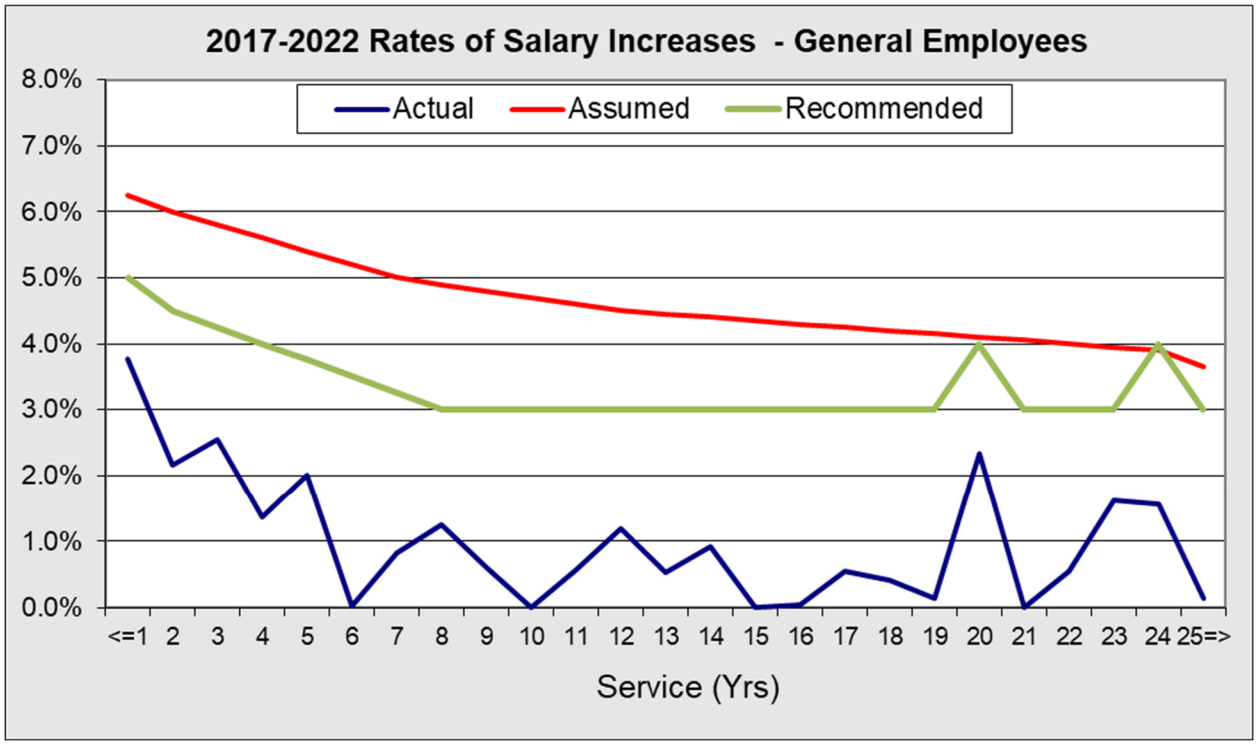
COMPARISON OF ACTUAL AND EXPECTED SALARIES OF ACTIVE MEMBERS

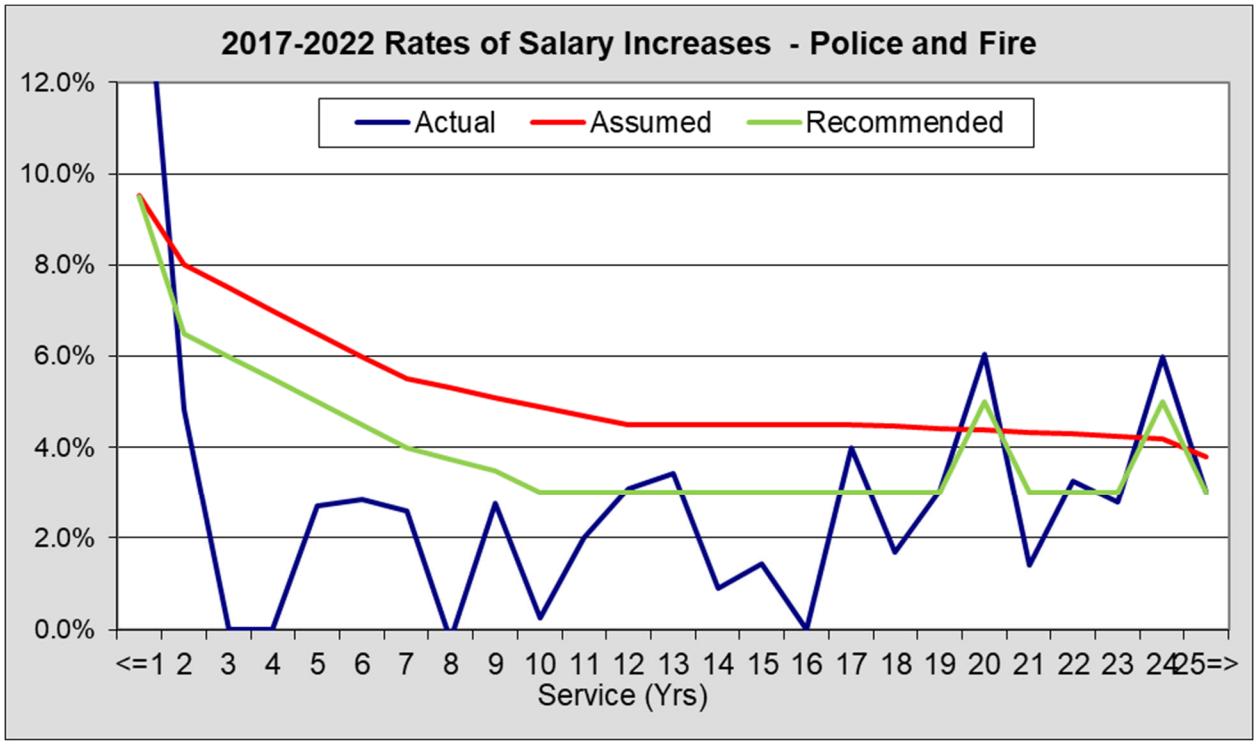
SALARIES AT END OF YEAR (Thousands)						
Service	GENERAL EMPLOYEES			POLICEMEN AND FIREMEN		
	Actual	Expected	A/E	Actual	Expected	A/E
< 1	157,745	160,401	0.983	74,763	66,490	1.124
1	122,086	126,490	0.965	55,279	55,904	0.989
2	113,691	117,962	0.964	58,112	59,866	0.971
3	108,866	112,318	0.969	82,131	91,735	0.895
4	98,460	102,568	0.960	67,776	75,259	0.901
5	84,643	87,468	0.968	44,784	46,444	0.964
6	72,364	76,102	0.951	40,509	41,752	0.970
7	62,337	64,918	0.960	32,504	33,423	0.973
8	60,323	62,498	0.965	30,192	31,861	0.948
9	58,896	61,344	0.960	34,215	34,999	0.978
10	65,395	68,832	0.950	35,765	37,421	0.956
11	66,277	68,934	0.961	41,857	42,972	0.974
12	69,172	71,434	0.968	42,336	42,908	0.987
13	62,107	64,526	0.963	36,796	37,174	0.990
14	56,717	58,679	0.967	26,572	27,516	0.966
15	53,497	56,114	0.953	25,353	26,120	0.971
16	51,699	53,892	0.959	23,223	24,401	0.952
17	51,896	53,807	0.964	30,908	31,060	0.995
18	51,580	53,521	0.964	30,182	31,005	0.973
19	48,565	50,512	0.961	32,437	32,870	0.987
20	42,940	43,680	0.983	33,643	33,118	1.016
21	39,543	41,372	0.956	30,071	30,942	0.972
22	35,068	36,269	0.967	26,719	26,986	0.990
23	30,955	31,664	0.978	18,249	18,509	0.986
24	25,725	26,318	0.977	18,007	17,702	1.017
25	20,685	21,110	0.980	9,785	10,148	0.964
26	17,333	18,165	0.954	11,003	11,170	0.985
27	16,470	17,140	0.961	10,694	10,651	1.004
28	16,464	17,370	0.948	10,056	10,432	0.964
29	14,449	14,986	0.964	11,886	11,966	0.993
30	13,287	13,742	0.967	11,554	11,465	1.008
31	12,197	12,707	0.960	8,442	8,531	0.990
32	9,703	9,961	0.974	7,252	7,081	1.024
33	7,312	7,547	0.969	4,086	4,063	1.006
34	6,819	6,971	0.978	2,781	2,766	1.005
35+	29,049	29,817	0.974	7,824	7,829	0.999
Total	**1,854,315**	**1,921,139**	**0.965**	**1,067,746**	**1,094,539**	**0.976**

Over this five-year period, the preceding table indicates that salary increases were generally lower than expected for the General Employees and the Police and Fire groups. We also reviewed the data for individual years of the study period and found the current assumption was higher than the experience over the plan years ending 2018, 2019 and 2020 but under anticipated the significant salary increases over the 2021 and 2022 plan years. This is common for many of our public plan clients as the significant increases in price inflation experienced during and just after the pandemic resulted in significant salary increases. The tables below summarize the data and provides comparative analysis for the last two years of the study period.

	General Employees	Police and Fire
	2017 to 2022 Experience (thousands)	
Prior Year Actual Salaries	1,830,337	1,034,569
Actual Salaries	1,854,313	1,067,746
Expected Salaries	1,921,139	1,094,539
Actual to Expected Ratio	**0.965**	**0.976**
	2020 to 2022 Experience (thousands)	
Prior Year Actual Salaries	718,327	410,029
Actual Salaries	756,906	445,537
Expected Salaries	754,158	433,404
Actual to Expected Ratio	**1.004**	**1.028**

Further examination of the latest two plan years confirms the source of the under-performance of the current assumption for salary increases was attributable to the spike in price inflation (compound average of over 7.2% for 7/1/2020 to 6/30/2022) rather that the merit component of the rates of salary increase. The annual rates of price inflation are moderating, and the Federal Reserve continues to maintain the pre-pandemic target for future inflation so looking ahead, we view the data over the 5-year period as relevant and have considered a slight decrease to the merit scale and a simplification to the scale to reflect that merits rates in the experience are less persistent that previously assumed. Additionally, we find that consistent in the data are increases in the annual rates of salary increases at both 20 and 24 years of service for both groups. We do not find the data anomalous and have added a reasonable rate of increase at those years of service. The charts below provide a comparison of the actual rates of increase of the experience, the current assumptions and the recommended assumptions:





The table below provides the A/E Ratio of the proposed salary increase rates including the recommended adjustments to the merit scales for both groups.

	General Employees	Police and Fire
	2017 to 2022 Experience (thousands)	
Prior Year Actual Salaries	1,830,337	1,034,569
Actual Salaries	1,854,313	1,067,746
Proposed Expected Salaries	1,896,420	1,082,364
Actual to Expected Ratio	**0.978**	**0.986**

DROP Election Assumptions

As the DROP plan is not effective until July 1, 2025, there is no experience to review. Currently 33% of eligible members are assumed to enter DROP when eligible. 33% of members who elect DROP are assumed to retire after 2 years, 33% are assumed to retire after 3 years, and 33% are assumed to retire after 4 years. No DROP elections are assumed for members with less than 10 years of service; for Police and Fire after age 61 or for General Employees after age 66.

Miscellaneous Assumptions

We recommend modifications to the following miscellaneous assumption:

Spouse Age: For members who have elected spouse coverage, husbands are assumed to be two years older than their wives where spouse age is missing (previous assumption was three years).

We recommend no modifications to the following miscellaneous assumptions:

Percent Married: 80% of active members are assumed to be married.

Load: For those members who retired under and joint & survivor option and have no reported information for a prospective beneficiary, a probabilistic factor was applied to the reversionary portion of the liability. The factor measures the survivorship of the assumed spouse (with men three years older than women) from the date of retirement to the valuation date, based on the assumptions for death after retirement.

Rate of Growth in Breakpoint: The rate of growth in the breakpoint for Social Security covered groups, we assume an annual rate of increase of 3.50%.

Appendix A: CPI (U) Index

Historical June CPI (U) Index

Year	CPI (U)	Year	CPI (U)
1962	30.2	1993	144.4
1963	30.6	1994	148.0
1964	31.0	1995	152.5
1965	31.6	1996	156.7
1966	32.4	1997	160.3
1967	33.3	1998	163.0
1968	34.7	1999	166.2
1969	36.6	2000	172.4
1970	38.8	2001	178.0
1971	40.6	2002	179.9
1972	41.7	2003	183.7
1973	44.2	2004	189.7
1974	49.0	2005	194.5
1975	53.6	2006	202.9
1976	56.8	2007	208.352
1977	60.7	2008	218.815
1978	65.2	2009	215.693
1979	72.3	2010	217.965
1980	82.7	2011	225.722
1981	90.6	2012	229.478
1982	97.0	2013	233.504
1983	99.5	2014	238.343
1984	103.7	2015	238.638
1985	107.6	2016	241.018
1986	109.5	2017	244.955
1987	113.5	2018	251.989
1988	118.0	2019	256.143
1989	124.1	2020	257.797
1990	129.9	2021	271.696
1991	136.0	2022	296.311
1992	140.2		

Appendix B: Capital Market Assumptions and Asset Allocation

The tables below and on the following page are extracted from materials provided to us by the Treasurer's Office prepared by the investment consultant serving that office, Meketa.

Real Rates of Return and Target Allocation by Asset Class

Asset Class	Target Allocation	Long-Term Expected Real Rate of Return
Global Equity	37.0%	6.8%
Public Credit	2.0	2.9
Core Fixed Income	13.0	0.4
Liquidity Fund	1.0	-0.4
Risk Mitigation	5.0	0.1
Private Equity	15.0	11.2
Private Credit	10.0	6.1
Real Estate	10.0	6.2
Infrastructure and Natural Resources	7.0	7.7

Appendix C: Social Security Administration Wage Index

Year	Wage Index	Annual Increase	Year	Wage Index	Annual Increase
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	(1.50)
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
1991	21,811.60	3.73	2021	60,575.07	8.89
1992	22,935.42	5.15	2022	63,795.13	5.32

TABLE 1
RATES OF WITHDRAWAL FROM ACTIVE SERVICE

GENERAL EMPLOYEES								
AGE	Males		Females		AGE	Males		Females	
	0 - 4 yrs	5 - 24 yrs	0 - 4 yrs	5 - 24 yrs		0 - 4 yrs	5 - 24 yrs	0 - 4 yrs	5 - 24 yrs
20	14.00 %	12.00 %	30.00 %	15.00 %	48	6.75 %	4.50 %	9.00 %	5.00 %
21	14.00	12.00	25.00	15.00	49	6.75	4.50	9.00	5.00
22	14.00	12.00	25.00	15.00	50	6.75	4.50	8.50	5.00
23	14.00	12.00	24.00	15.00	51	6.75	4.50	8.40	5.00
24	14.00	12.00	22.00	14.00	52	6.75	4.50	8.40	4.50
25	14.00	12.00	20.00	13.00	53	6.50	4.50	8.40	4.50
26	13.00	11.00	20.00	12.00	54	6.50	4.50	8.40	4.50
27	12.00	11.00	18.50	11.00	55	6.50	0.00	8.00	0.00
28	12.00	11.00	18.00	10.00	56	5.00		8.00	
29	12.00	9.00	16.00	10.00	57	5.00		8.50	
30	11.00	8.50	15.00	10.00	58	5.00		8.50	
31	10.00	8.00	15.00	10.00	59	6.00		9.00	
32	9.75	7.50	14.00	10.00	60	7.00		9.00	
33	9.50	7.50	13.50	10.00	61	7.50		9.00	
34	8.75	7.50	13.00	10.00	62	8.00		9.00	
35	8.50	6.50	12.50	10.00	63	8.50		9.00	
36	8.25	6.00	11.50	10.00	64	9.00		9.00	
37	8.00	5.50	11.50	9.00	65	9.50		9.00	
38	8.00	5.50	10.80	8.50	66	10.00		9.00	
39	7.75	5.50	10.50	8.00	67	10.50		9.00	
40	7.50	5.00	10.00	8.00	68	11.00		9.00	
41	7.25	5.00	9.80	7.50	69	12.00		9.00	
42	7.00	5.00	9.60	6.50	70	13.00		9.00	
43	6.75	5.00	9.40	6.50	71	14.00		9.00	
44	6.75	5.00	9.20	6.50	72	15.00		9.00	
45	6.75	4.50	9.00	6.50	73	15.00		9.00	
46	6.75	4.50	9.00	6.00	74	15.00		9.00	
47	6.75	4.50	9.00	5.50	75	0.00		0.00	

TABLE 1
RATES OF WITHDRAWAL FROM ACTIVE SERVICE
(Continued)

POLICEMEN AND FIREMEN					
AGE	Unisex		AGE	Unisex	
	0 - 4 yrs	5 - 24 yrs		0 - 4 yrs	5 - 24 yrs
20	5.00 %	5.00 %	43	2.50	1.50
21	5.00	5.00	44	2.50	1.60
22	5.00	5.00	45	2.50	1.70
23	5.00	5.00	46	2.50	2.00
24	5.00	5.00	47	2.50	2.50
25	5.00	5.00	48	2.50	2.50
26	4.50	5.00	49	2.50	2.53
27	4.50	5.00	50	2.50	2.50
28	4.00	4.50	51	2.50	2.50
29	4.00	3.50	52	2.50	2.50
30	4.00	3.50	53	2.50	2.50
31	4.00	3.50	54	3.00	2.50
32	4.00	3.00	55	3.50	0.00
33	3.75	2.50	56	3.50	
34	3.75	2.00	57	3.50	
35	3.75	2.00	58	3.50	
36	3.75	2.00	59	3.50	
37	3.75	1.50	60	3.50	
38	2.50	1.50	61	3.50	
39	2.50	1.50	62	3.50	
40	2.50	1.50	63	3.50	
41	2.50	1.50	64	3.50	
42	2.50	1.50	65	0.00	

TABLE 2
RATES OF SERVICE RETIREMENT FROM ACTIVE SERVICE

RATES OF SERVICE RETIREMENT												
Age	GENERAL EMPLOYEES WITHOUT SOCIAL SECURITY											
	Current					Proposed						
	Years of Service					Years of Service						
	5 to 19	20 to 24	25 to 29	30 to 34	>= 35	5 thru 14	15 to 19	20 to 24	25 to 26	27 to 29	30 to 34	>= 35
45 to 49	0.00 %	0.00 %	8.50 %	17.00 %	20.00 %	0.00 %	0.00 %	0.00 %	7.30 %	19.60 %	14.60 %	17.20 %
50 to 53	0.00	0.00	8.50	17.00	20.00	0.00	0.00	0.00	7.30	7.30	9.70	17.20
54	0.00	0.00	8.50	17.00	20.00	0.00	0.00	0.00	7.30	10.40	9.70	17.20
55 to 59	4.25	6.38	8.50	17.00	20.00	3.60	5.20	5.40	6.70	10.40	11.70	17.20
60 to 64	4.25	8.50	11.05	17.00	25.00	3.60	7.90	10.40	11.20	9.50	14.60	12.90
65 to 66	8.50	12.75	12.75	17.00	25.00	12.00	14.80	18.90	23.70	32.70	14.60	21.50
67 to 68	12.75	15.30	15.30	17.00	25.00	10.90	15.00	13.10	13.10	13.10	14.60	21.50
69	12.75	15.30	15.30	17.00	25.00	10.90	15.00	13.10	13.10	13.10	14.60	25.80
70 to 74	12.75	15.30	15.30	17.00	25.00	8.60	15.30	16.20	16.20	13.10	14.60	25.80
75+	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE 2
RATES OF SERVICE RETIREMENT FROM ACTIVE SERVICE
(Continued)

RATES OF SERVICE RETIREMENT												
Age	GENERAL EMPLOYEES WITH SOCIAL SECURITY											
	Current					Proposed						
	Years of Service					Years of Service						
	5 to 19	20 to 24	25 to 29	30 to 34	>= 35	5 thru 14	15 to 19	20 to 24	25 to 26	27 to 29	30 to 34	>= 35
45 to 49	0.00 %	0.00 %	9.00 %	18.00 %	20.00 %	0.00 %	0.00 %	0.00 %	18.40 %	12.70 %	17.60 %	19.60 %
50 to 54	0.00	0.00	9.00	18.00	20.00	0.00	0.00	0.00	8.80	8.80	17.60	19.60
55 to 59	4.50	6.75	9.00	18.00	20.00	6.30	4.40	9.90	8.80	16.20	12.80	19.60
60 to 64	4.50	9.00	11.70	18.00	25.00	9.70	8.90	10.40	16.30	11.40	11.40	24.50
65 to 66	9.00	13.50	13.50	18.00	25.00	17.70	19.00	25.60	30.60	33.90	26.10	24.50
67 to 68	13.50	16.20	16.20	18.00	25.00	19.60	24.80	25.80	29.10	15.80	17.60	24.50
69	13.50	16.20	16.20	18.00	25.00	19.60	24.80	25.80	29.10	15.80	17.60	24.50
70 to 74	13.50	16.20	16.20	18.00	25.00	13.20	13.20	15.80	15.80	22.30	17.60	24.50
75+	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE 2
RATES OF SERVICE RETIREMENT FROM ACTIVE SERVICE
(Continued)

RATES OF SERVICE RETIREMENT														
Age	POLICEMEN AND FIREMEN WITHOUT SOCIAL SECURITY													
	Current							Proposed						
	Years of Service							Years of Service						
	5 to 19	20 to 24	25	26	27	28 to 29	>= 30	5 to 14	15 to 19	20 to 24	25	26 to 27	28 to 29	>= 30
45	0.00 %	0.00 %	15.00 %	17.50 %	20.00 %	20.00 %	25.00 %	0.00 %	0.00 %	0.00 %	22.00 %	15.30 %	6.60 %	17.60 %
46	0.00	0.00	12.00	14.00	16.00	16.00	20.00	0.00	0.00	0.00	22.00	15.30	6.60	17.60
47	0.00	0.00	9.00	10.50	12.00	16.00	20.00	0.00	0.00	0.00	22.00	15.30	6.60	17.60
48 to 49	0.00	0.00	7.80	9.10	10.40	16.00	20.00	0.00	0.00	0.00	22.00	15.30	6.60	17.60
50 to 54	0.00	0.00	7.80	9.10	10.40	16.00	20.00	0.00	0.00	0.00	22.30	17.00	20.20	17.60
55 to 59	3.00	4.50	7.80	9.10	10.40	16.00	25.00	3.80	6.70	7.40	20.60	14.80	16.70	17.60
60 to 64	4.00	6.00	9.00	10.50	12.00	16.00	25.00	2.90	3.50	8.80	24.80	24.00	32.80	27.00
65+	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE 2
RATES OF SERVICE RETIREMENT FROM ACTIVE SERVICE
(Continued)

RATES OF SERVICE RETIREMENT														
Age	POLICEMEN AND FIREMEN WITH SOCIAL SECURITY													
	Current							Proposed						
	Years of Service							Years of Service						
	5 to 19	20 to 24	25	26	27	28 to 29	>= 30	5 to 14	15 to 19	20 to 24	25	26 to 27	28 to 29	>= 30
45	0.00 %	0.00 %	18.75 %	20.63 %	22.50 %	22.50 %	25.00 %	0.00 %	0.00 %	0.00 %	13.00 %	14.40 %	15.70 %	19.60 %
46	0.00	0.00	15.00	16.50	18.00	18.00	20.00	0.00	0.00	0.00	13.00	14.40	15.70	15.70
47	0.00	0.00	11.25	12.38	13.50	18.00	20.00	0.00	0.00	0.00	13.00	14.40	15.70	15.70
48 to 49	0.00	0.00	9.75	10.73	11.70	18.00	20.00	0.00	0.00	0.00	13.00	14.40	15.70	15.70
50 to 54	0.00	0.00	9.75	10.73	11.70	18.00	20.00	0.00	0.00	0.00	17.40	21.90	13.00	13.00
55 to 59	3.00	4.50	9.75	10.73	11.70	18.00	25.00	2.60	5.70	8.40	43.60	19.20	15.70	21.80
60 to 64	4.50	6.75	11.25	12.38	13.50	18.00	25.00	4.90	18.50	20.30	43.60	19.20	15.70	21.80
65+	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE 3
RATES OF DISABILITY RETIREMENT FROM ACTIVE SERVICE

AGE	RATES OF DISABILITY RETIREMENTS			
	General Employees		Policemen and Firemen	
	Current	Proposed	Current	Proposed
30	0.02 %	0.01 %	0.10 %	0.12 %
35	0.03	0.02	0.14	0.12
40	0.04	0.05	0.22	0.21
45	0.06	0.08	0.30	0.38
50	0.09	0.09	0.64	0.45
55	0.40	0.12	2.40	0.25
60	1.00	0.14	4.80	0.35
65	1.60	0.11	0.00	0.40

TABLE 4
RATES OF ANTICIPATED SALARY INCREASES

SERVICE IN YEARS	RATES OF SALARY INCREASE	
	GENERAL EMPLOYEES	POLICEMEN AND FIREMEN
<= 1	5.00%	9.50%
2	4.50	6.50
3	4.25	6.00
4	4.00	5.50
5	3.75	5.00
6	3.50	4.50
7	3.25	4.00
8	3.00	3.75
9	3.00	3.50
10	3.00	3.25
11 to 19	3.00	3.00
20	4.00	5.00
21 to 23	3.00	3.00
24	4.00	5.00
25+	3.00	3.00