The Water and Power Employees' Retirement Plan of the City of Los Angeles

Actuarial Experience Study

Analysis of Actuarial Experience During the Period July 1, 2018 through June 30, 2021

Segal

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Board of Administration
The Water and Power Employees' Retirement Plan of the City of Los Angeles
111 North Hope St., Room 357
Los Angeles, California 90012

RE: Review of Actuarial Assumptions for the July 1, 2022 Actuarial Valuation

Dear Members of the Board:

We are pleased to submit this report of our review of the actuarial experience for the Water and Power Employees' Retirement Plan of the City of Los Angeles (WPERP). This study utilizes the census data for the experience period from July 1, 2018 to June 30, 2021 and provides the proposed actuarial assumptions, both economic and demographic, to be used in the July 1, 2022 valuation.

We are members of the American Academy of Actuaries and we meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein.

We look forward to reviewing this report with you and answering any questions you may have.

Sincerely,

Paul Angelo, FSA, MAAA, FCA, EA
Senior Vice President and Actuary

Eva Yum, FSA, MAAA, EA
Vice President and Actuary

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1. Introduction, Summary, and Recommendations

To project the cost and liabilities of the Retirement Plan, assumptions are made about all future events that could affect the amount and timing of the benefits to be paid and the assets to be accumulated. Each year actual experience is compared against the projected experience, and to the extent there are differences, the future contribution requirement is adjusted.

If assumptions are modified, contribution requirements are adjusted to take into account a change in the projected experience in all future years. There is a great difference in both philosophy and cost impact between recognizing the actuarial deviations as they occur annually and changing the actuarial assumptions. Taking into account one year's gains or losses without making a change in the assumptions means that year's experience is treated as temporary and that, over the long run, experience will return to what was originally assumed. For example, it is impossible to determine how and to what extent the economy will be affected by the COVID-19 pandemic.[1] Changing assumptions reflects a basic change in thinking about the future, and has a much greater effect on the current contribution requirements than recognizing gains or losses as they occur.

The use of realistic actuarial assumptions is important in maintaining adequate funding, while paying the promised benefit amounts to participants already retired and to those near retirement. The actuarial assumptions used do not determine the "actual cost" of the plan. The actual cost is determined solely by the benefits and administrative expenses paid out, offset by investment income received. However, it is desirable to estimate as closely as possible what the actual cost will be so as to permit an orderly method for setting aside contributions today to provide benefits in the future, and to maintain equity among generations of participants and taxpayers.

This study was undertaken in order to review the economic and demographic actuarial assumptions and to compare the actual experience with that expected under the current assumptions during the three-year experience period from July 1, 2018 through June 30, 2021.[2] The study was performed in accordance with Actuarial Standard of Practice (ASOP) No. 27 "Selection of Economic Assumptions for Measuring Pension Obligations"[3] and ASOP No. 35 "Selection of Demographic and Other Non-Economic Assumptions for Measuring Pension Obligations." These Standards of Practice provide guidance for the selection of the various actuarial assumptions utilized in a pension plan actuarial valuation. Based on the study's results and expected future experience, we are recommending various changes in the current actuarial assumptions.

We are recommending changes in the assumptions for inflation, investment return, merit and promotion salary increases, retirement from active employment, percent married, pre-retirement

[1] An analysis of the ongoing impact of the COVID-19 pandemic is beyond the scope of the current experience study.

[2] As permitted by the Actuarial Standard of Practice No. 4 (Measuring Pension Obligation), the participant data Segal utilized for the actuarial valuation is as of March 31. Consequently, the data used for the 3-year experience study is from April 1, 2018 through March 31, 2021.

[3] References made later in this report are with respect to the revised ASOP 27 adopted in June 2020.

mortality, healthy life post-retirement mortality, disabled life mortality, beneficiary mortality, termination (vested and ordinary), disability, and future service accruals.

Our recommendations for the major actuarial assumption categories are as follows:

Pg #	Actuarial Assumption Categories	Recommendation
10	**Inflation:** Future increases in the Consumer Price Index (CPI), which drives investment returns and active member salary increases.	Reduce the inflation assumption from 2.75% to 2.50% per annum as discussed in Section (3)(A).
11	**Retiree Cost of Living Increases:** Future increases in the cost of living adjustment for retirees.	For Tier 1, maintain the retiree cost of living assumption at 2.75% per annum (based on our recommended inflation assumption of 2.50% plus a margin for adverse deviation of 0.25%) as discussed in Section (3)(A). For Tier 2, maintain the retiree cost of living assumption at 2% per annum as discussed in Section (3)(A).
12	**Investment Return:** The estimated average future net rate of return on current and future assets of the Plan as of the valuation date. This rate is used to discount liabilities.	Reduce the investment return assumption from 7.00% to 6.50% per annum as discussed in Section (3)(B).
19	**Individual Salary Increases:** Increases in the salary of a member between the date of the valuation to the date of separation from active service. This assumption has three components: • Inflationary salary increases • Real "across the board" salary increases • Merit and promotion increases	Reduce the current inflationary salary increase assumption from 2.75% to 2.50% and maintain the current real "across the board" salary increase assumption at 0.50%. This means that the combined inflationary and real "across the board" salary increases will decrease from 3.25% to 3.00%. We recommend adjusting the merit and promotion rates of salary increase as developed in Section (3)(C) to reflect past experience. Overall future merit and promotion salary increases are slightly higher under the proposed assumptions. The recommended total rates of salary increase anticipate lower increases overall than the current assumptions.
24	**Retirement Rates:** The probability of retirement at each age at which participants are eligible to retire. **Other Retirement Related Assumptions including:** • Percent married and spousal age differences for members not yet retired • Retirement age for deferred vested members	For active members, adjust the current retirement rates to those developed in Section (4)(A). The retirement rate assumptions anticipate earlier retirements for Tier 1 members and slightly later retirements for Tier 2 members. For deferred vested Tier 1 and 2 members, maintain the assumed retirement age at 60 and 63, respectively. For deferred vested Tier 1 and Tier 2 members receiving Permanent Total Disability benefit, maintain the assumed retirement age at the earlier of 65 or 55 with 30 years of service. For active and deferred vested members, decrease the percent married at retirement assumption from 85% to 80% for males and from 60% to 55% for females. Maintain the spouse age difference assumption that male retirees are three years older than their spouses and female retirees are two years younger than their spouses.

Pg #	Actuarial Assumption Categories	Recommendation
30	**Mortality Rates:** The probability of dying at each age. Mortality rates are used to project life expectancies.	**Healthy and Disabled Retirees:** Current and recommended base table: Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table, with rates increased by 5% for males. **Beneficiaries:** Current base table: Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table. Recommended base table for beneficiaries of surviving members: Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table, with rates increased by 5% for males. Recommended base table for beneficiaries upon actual death of members: Pub-2010 Contingent Survivor Amount-Weighted Above-Median Mortality Table, with rates increased by 5% for females. For the purposes of the actuarial valuations (for funding and financial reporting), when calculating the liability for the continuance to a beneficiary of a surviving member we recommend that the Healthy Retiree mortality tables be used for beneficiary mortality both before and after the expected death of the member. Upon the actual death of the member (i.e., for all beneficiaries in pay status as of the valuation date), we recommend use of the Contingent Survivor mortality tables as stated above. **Pre-Retirement Mortality:** Current & Recommended base table: Pub-2010 General Employee Amount-Weighted Above-Median Mortality Table. **All current tables** are projected generationally with the two-dimensional mortality improvement scale MP-2018. **All recommended tables** are projected generationally with the two-dimensional mortality improvement scale MP-2021. For optional form of payment amounts at retirement and conversion of contribution balances at retirement, change the mortality rates to those developed in Section (4)(B).
38	**Termination Rates:** The probability of leaving employment at each age and receiving either a refund of member contributions or a deferred vested retirement benefit.	We recommend adjusting the termination rates to those developed in Section (4)(C) to reflect a lower incidence of termination. Additionally, adjust the assumptions for future Tier 2 ordinary withdrawals (i.e., refund of member contributions) and deferred vested terminations.
42	**Disability Incidence Rates:** The probability of becoming disabled at each age.	We recommend adjusting the disability rates to those developed in Section (4)(D) to reflect female disabilities from ages 60 to 64.
44	**Future Service Accruals:** The amount of service projected to be earned by active members in years after the valuation date.	Maintain the assumed annual future service increase of 1.0 year as developed in Section 4(E). For Tier 1 active members, reduce the assumed purchase of additional service from 0.07 years to 0.04 years for each future year of employment. For Tier 2 active members, maintain the assumed purchase of additional service at 0.02 years for each future year of employment.

We have estimated the impact of all the recommended economic and demographic assumptions as if they were applied to the July 1, 2021 actuarial valuation. The table below shows the changes in the employer contribution rates due to the proposed assumption changes separately for the recommended economic assumption changes (as recommended in Section 3 of this report which include the recommended merit and promotion salary increases) and the recommended demographic assumption changes (as recommended in Section 4 of this report).

Cost Impact of the Recommended Assumptions Based on July 1, 2021 Actuarial Valuation

Assumption	Impact on Average Employer Contribution Rates[1]
Increase due to changes in economic assumptions	9.71%
Decrease due to changes in demographic assumptions	(2.29%)
Total increase in average employer rate	7.42%
Total estimated increase in annual dollar amount ($000s)	**$90,491**

	Impact on UAAL and Funded Percentage
Increase in UAAL ($000s)	$655,011
Change in Funded Percentage (AVA basis)	From 99.20% to 95.06%

Of the various assumption changes, the most significant rate increase is due to the change in the investment return assumption from 7.00% to 6.50%, offset somewhat by the change in the inflation assumption from 2.75% to 2.50%. Specifically, a 0.25% reduction in both the investment return assumption and the inflation assumption together with the new merit and promotion salary increase assumptions have the impact of increasing the employer contribution rates by 4.15%. A further 0.25% reduction in only the investment return assumption from 6.75% to 6.50% has the impact of further increasing the employer contribution rates by 5.56%. Note these results do not reflect the cost reductions due to recommended changes in demographic assumptions shown in the table above.

Of the various demographic assumption changes, the most significant rate decrease is due to the changes in mortality assumptions which have the impact of decreasing the employer contribution rate by 1.52%.

Section 2 provides some background on the basic principles and methodology used for the experience study and for the review of the economic and demographic actuarial assumptions. A detailed discussion of each assumption and reasons for the proposed changes are found in Section 3 for the economic assumptions and Section 4 for the demographic assumptions. The cost impact of the proposed changes is detailed in Section 5.

[1] Based on July 1, 2021 projected annual payroll as determined under each set of assumptions.

2. Background and Methodology

In this report, we analyzed both economic and demographic ("non-economic") assumptions. The primary economic assumptions reviewed are inflation, investment return, and salary increases. Demographic assumptions include the probabilities of certain events occurring in the population of members, referred to as "decrements," e.g., termination from service, disability incidence, service retirement, and death before and after retirement. In addition to decrements, other demographic assumptions reviewed in this study include the percentage of members with an eligible spouse or domestic partner, spousal age difference, and the assumption used to anticipate future service accruals including the purchase of service by active members.

Economic Assumptions

Economic assumptions consist of:

- **Inflation:** Increases in the price of goods and services. The inflation assumption reflects the basic return that investors expect from securities markets. It also reflects the expected basic salary increase for active members and drives increases in the allowances of retired members (if any).
- **Investment Return:** Expected long-term rate of return on the Plan's investments after investment expenses. This assumption has a significant impact on contribution rates.
- **Salary Increases:** In addition to inflationary increases, it is assumed that salaries will also grow by "across the board" real pay increases in excess of price inflation. It is also assumed that members will receive raises above these average increases as they advance in their careers. These are commonly referred to as merit and promotion increases.

The setting of these economic assumptions is described in Section 3.

Demographic Assumptions

In order to determine the probability of an event occurring, we examine the "decrements" and "exposures" of that event. For example, taking termination from service, we compare the number of employees who actually terminate in a certain age and/or service category (i.e., the number of "decrements") with those "who could have terminated" (i.e., the number of "exposures"). For example, if there were 500 active employees in the 20-24 age group at the beginning of the year and 50 of them terminate during the year, we would say the probability of termination in that age group is 50 ÷ 500 or 10%.

The reliability of the resulting probability is highly dependent on both the number of decrements and the number of exposures. For example, if there are only a few people in a high age category at the beginning of the year (number of exposures), we would not lend as much credibility to the probability of termination developed for that age category, especially if it is out of line with the pattern shown for the other age groups. Similarly, if we are considering the death decrement, there may be a large number of exposures in the age 20-24 category, but very few decrements (actual deaths); therefore, we would not be able to rely heavily on the probability developed for that category.

One reason we use several years of experience for such a study is to have more exposures and decrements, and therefore more statistical reliability. Another reason for using several years of data is to smooth out fluctuations that may occur from one year to the next. However, we also calculate the rates on a year-to-year basis to check for any trend that may be developing in the later years.

3. Economic Assumptions

A. Inflation

Unless an investment grows at least as fast as prices increase, investors will experience a reduction in the inflation-adjusted value of their investment. There may be times when "riskless" investments return more or less than inflation, but over the long term, investment market forces will generally require an issuer of fixed income securities to maintain a minimum return which protects investors from inflation.

The inflation assumption is long term in nature, so it is set using both historical information and long-term forecasts. Following is an analysis of 15 and 30 year moving averages of historical inflation rates:

Historical Consumer Price Index – 1930 to 2021[1]
(U.S. City Average - All Urban Consumers)

	25th Percentile	Median	75th Percentile
15-year moving averages	2.4%	3.3%	4.4%
30-year moving averages	2.9%	3.7%	4.8%

With the exception of the spike in inflation in 2021[2], the average inflation rates have continued to decline gradually over the last several years due to the relatively low inflationary environment over the past two decades. Also, the later 15-year averages during the period are lower because they do not include the high inflation years of the mid-1970s and early 1980s.

Based on information found in the Public Plans Database, which is produced in partnership with the National Association of State Retirement Administrators (NASRA), the median inflation assumption used by 188 large public retirement funds in their 2020 fiscal year valuations was 2.50%.[3] In California, CalSTRS, LACERS, LA Fire and Police, and twelve 1937 Act CERL systems use an inflation assumption of 2.75%, eight 1937 Act CERL systems use an inflation assumption of 2.50%[4] and CalPERS uses an inflation assumption of 2.30%.

WPERP's investment consultant, RVK, anticipates an annual inflation rate of 2.50%, while the average inflation assumption provided by RVK and five other investment advisory firms retained by Segal's California public sector clients, as well as Segal's investment advisory division (Segal Marco Advisor)[5], was 2.34%. Note that, in general, investment consultants use a time horizon for this assumption that is shorter than the time horizon of the actuarial valuation.[6]

[1] Source: Bureau of Labor Statistics – Based on annual-to-annual CPI for All Items in U.S. city average, all urban consumers, not seasonally adjusted (Series ID: CUUR0000SA0).

[2] The inflation rate from December 2020 to December 2021 was 7.0% while the inflation rate from all of calendar year 2020 to 2021 was 4.7%.

[3] Among 209 large public retirement funds, the 2020 fiscal year inflation assumption was not available for 21 of the public retirement funds in the survey data as of March 2022.

[4] Three of these 1937 Act CERL systems use a 2.50% inflation assumption with a 2.75% COLA assumption.

[5] We note that this is the first time we have included inflation and real rate of return assumptions used by Segal Marco Advisor in our review of economic assumptions.

[6] The time horizon used by the seven investment consultants included in our review generally ranges from 10 years to 30 years. RVK has stated that they use a long-term assumption.

To find a forecast of inflation based on a longer time horizon, we referred to the Social Security Administration's (SSA) 2021 report on the financial status of the Social Security program.[1] The projected average increase in the Consumer Price Index (CPI) over the next 75 years under the intermediate cost assumptions used in that report was 2.40%. The SSA report also includes alternative projections using lower and higher inflation assumptions of 1.80% and 3.00%, respectively.

We also compared the yields on the thirty-year inflation indexed U.S. Treasury bonds to comparable traditional U.S. Treasury bonds.[2] As of April 2022, the difference in yields is about 2.55% which provides a measure of market expectations of inflation. It is worth noting that this market expectation for long term inflation can be quite volatile, and has risen during the recent spike in inflation. For example, this same market expectation for long term inflation was 2.18% as of February 2022 and 2.49% as of March 2022.

Based on all of the above information, we recommend reducing the annual inflation assumption from 2.75% to 2.50%.

The setting of the inflation assumption using the information outlined above is a somewhat subjective process, and Segal does not apply a specific weight to each of the metrics in determining our recommended inflation assumption. Based on a consideration of all of the above metrics, beginning in 2021 we are generally recommending the same 2.50% inflation assumption in our experience studies for our California public retirement system clients.

Retiree Cost of Living Increases

In our last experience study as of June 30, 2018, consistent with the 2.75% annual inflation assumption adopted by the Board for the July 1, 2019 valuation, the Board used a 2.75% cost of living adjustment assumption for Tier 1 retirees[3] and a 2.00% cost of living adjustment assumption for Tier 2 retirees.

In the last experience study, we set the recommended post-retirement cost-of-living adjustment (COLA) assumption to be equal to our recommended inflation assumption. However, we observed in the table below that during the most recent 5-year, 10-year and 20-year periods ending before December 31, 2021, the changes in the Annual CPI based on the Los Angeles-Long Beach-Anaheim area used by the Board to set COLAs have exceeded those of the Annual CPI for the U.S. City Average.

	Change in Annual CPI for Los Angeles-Long Beach-Anaheim Area	Change in Annual CPI for U.S. City Average
5-Year Period	3.02%	2.46%
10-Year Period	2.23%	1.88%
20-Year Period	2.48%	2.15%

[1] Source: Social Security Administration: The 2021 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds

[2] Source: Board of Governors of the Federal Reserve System.

[3] For current Tier 1 retirees and beneficiaries, we utilize the accumulated COLA banks to value an annual 3.00% increase until those banks become depleted.

In order to reflect this experience and to mitigate actuarial losses which may arise from future COLA increases greater than the inflation assumption, we believe it is reasonable for the Board to consider adopting an extra margin above the general price inflation in anticipating future COLAs. **Accordingly, for Tier 1 retirees with a maximum 3% COLA our recommended COLA assumption of 2.75% includes a 0.25% margin above our recommended inflation assumption, which leaves the COLA assumption unchanged as shown below for retirees in both tiers.**

Tier	Maximum COLA	Current Assumption	Proposed Assumption
Tier 1	3.00%	2.75%	2.75%
Tier 2	2.00%	2.00%	2.00%

In developing the COLA assumption, we also considered the results of a stochastic approach that would attempt to account for the possible impact of low inflation that could occur before COLA banks are able to be established for the member. Although the results of this type of analysis might justify the use of a lower COLA assumption, we are not recommending that at this time. The reasons for this conclusion include the following:

- The results of the stochastic modeling are significantly dependent on assuming that lower levels of inflation will persist in the early years of the projections. If this is not assumed, then the stochastic modeling will produce results similar to our proposed COLA assumptions.
- Using lower long-term COLA assumptions based on a stochastic analysis would mean that an actuarial loss would occur even when the inflation assumption of 2.50% is met in a year. We question the reasonableness of this result.

We do not see the stochastic possibility of COLAs averaging less than those predicted by the assumed rate of inflation as a reliable source of cost savings that should be anticipated in our COLA assumptions. Therefore, with this experience study, we recommend setting the COLA assumptions consistent with the COLA assumption we have used in prior years.

B. Investment Return

The investment return assumption is comprised of two primary components, inflation and real rate of investment return, with adjustments for expenses and risk.

Real Rate of Investment Return

This component represents the portfolio's incremental investment market returns over inflation. Generally when an investor takes on greater investment risk, the return on the investment is expected to also be greater, at least in the long run. This additional risk and return is expected to vary by asset class and empirical data supports that expectation. For that reason, the real rate of return assumptions are developed by asset class. Therefore, the real rate of return assumption for a retirement association's portfolio will vary with the Board's asset allocation among asset classes.

The Plan's current target asset allocation and the assumed real rate of return assumptions by asset class are shown in the following table. The first column of real rate of return assumptions

are determined by reducing RVK's total or "nominal" 2022 return assumptions[1] by their assumed 2.50% inflation rate. The second column of returns (except for Hedge Funds, Non-Core Real Estate and Custom Fixed Income) represents the average of a sample of real rate of return assumptions. The sample includes the expected annual real rate of return provided to us by RVK and five other investment advisory firms retained by Segal's public sector clients, as well as Segal's investment advisory division. We believe these averages are a reasonable consensus forecast of long-term future market returns in excess of inflation.[2]

WPERP'S Target Asset Allocation and Assumed Arithmetic Real Rate of Return Assumptions by Asset Class and for the Portfolio

Asset Class	Percentage of Portfolio	RVK's Assumed Real Rate of Return[3]	Average Assumed Real Rate of Return from a Sample of Consultants to Segal's California Public Sector Clients[4]
Large Cap Equity	21.10%	3.51%	5.13%
Small Cap Equity	2.10%	4.01%	5.86%
Developed Int'l Large Cap Equity	12.20%	5.26%	6.01%
Developed Int'l Small Cap Equity	1.80%	5.76%	5.72%
Global Equity	2.70%	4.66%	5.94%
Emerging Market Equity	5.10%	8.12%	8.16%
TIPS	3.50%	-0.84%	-0.23%
Real Estate	7.00%	4.64%	4.60%
Cash & Equivalents	1.00%	-1.00%	-0.77%
Commodities	1.50%	3.19%	2.77%
Private Equity	10.00%	8.23%	10.46%
Private Credit	2.40%	6.00%	5.94%
Hedge Funds	5.00%	1.85%	1.85%[5]
Non-Core Real Estate	3.00%	7.14%	7.14%[5]
Custom Fixed Income	21.60%	0.68%	0.68%[5]
Total	**100.00%**	**3.86%**	**4.61%**

[1] The capital market assumptions provided by RVK were net of investment fees. Because our model includes a separate component for investment expenses, Segal has estimated the fees paid to managers of each investment category, using information provided by WPERP and RVK. Segal then increased RVK's capital market assumptions by those allocated fees so as to adjust those assumptions to be gross of investment fees.

[2] Note that, just as for the inflation assumption, in general the time horizon used by the investment consultants in determining the real rate of return assumption is shorter than the time horizon encompassed by the actuarial valuation.

[3] The rates shown have been estimated by Segal by taking RVK's nominal arithmetic returns and reducing by RVK's assumed 2.50% inflation rate to develop the assumed real rate of return shown. As stated earlier in this section, Segal has used RVK's initial capital market assumptions adjusted to be gross of fees by increasing those returns by estimated investment fees as calculated by Segal using information provided by WPERP and RVK.

[4] These are based on the projected arithmetic returns provided by RVK and five other investment advisory firms serving WPERP and 16 other city and county retirement systems in California, as well as Segal's investment advisory division. These return assumptions are gross of any applicable investment expenses.

[5] For these asset classes, RVK's assumption is applied in lieu of the average because there is a larger disparity in returns for these asset classes among the firms surveyed and using RVK's assumption should more closely reflect the underlying investments made specifically for WPERP.

The above are representative of "indexed" returns and do not include any additional returns ("alpha") from active management. This is consistent with the Actuarial Standard of Practice No. 27, Section 3.8.3.d, which states:

> "Investment Manager Performance - Anticipating superior (or inferior) investment manager performance may be unduly optimistic (or pessimistic). The actuary should not assume that superior or inferior returns will be achieved, net of investment expenses, from an active investment management strategy compared to a passive investment management strategy unless the actuary has reason to believe, based on relevant supporting data, that such superior or inferior returns represent a reasonable expectation over the measurement period."

The following are some observations about the returns provided above:

1. The investment consultants to our California public sector clients, as well as Segal's investment advisory division, have each provided us with their expected real rates of return for each asset class, over various future periods of time. However, in general, the returns available from investment consultants are projected over time periods that are shorter than the durations of a retirement plan's liabilities.
2. Using a sample average of expected real rate of returns allows WPERP's investment return assumption to reflect a broader range of capital market information and should help reduce year to year volatility in the investment return assumption.
3. Therefore, we recommend that the 4.61% portfolio real rate of return be used to determine WPERP's investment return assumption. This is 0.19% lower than the return that was used three years ago in the review of the recommended investment return assumption for the July 1, 2019 valuation. The difference is due to changes in WPERP's target asset allocation (0.16%), changes in the real rate of return assumptions provided to us by the investment advisory firms (-0.42%) and the interaction effect between these two changes (0.07%).

Investment Expenses

For funding purposes, the real rate of return assumption for the portfolio needs to be adjusted for investment expenses expected to be paid from investment income. The following table provides the investment expenses in relation to the average Market Value of Assets for the five-year period ending June 30, 2021.

Investment Expenses as a Percentage of Market Value of Assets ($ in '000s)

Year Ending June 30	Market Value of Assets[1]	Investment Expenses	Investment %
2017	$10,065,468	$35,268	0.35
2018	11,296,104	42,957	0.38
2019	12,236,170	49,250	0.40
2020	12,940,885	55,280	0.43
2021	13,265,986	64,820	0.49
Five-Year Average			**0.41**
Three-Year Average			**0.44**
Current Assumption			**0.35**
Proposed Assumption			**0.40**

Based on the above experience, we recommend increasing the future expense assumption from 0.35% to 0.40%.

Note related to investment expenses paid to active managers – As cited above, under Section 3.8.3.d of ASOP No. 27, the effect of an active investment management strategy can be considered "net of investment expenses" when determining whether "the actuary has reason to believe, based on relevant supporting data, that such superior or inferior returns represent a reasonable expectation over the measurement period."

For WPERP, of the $64.8 million in investment expenses paid in FY 2021, WPERP identified that about $63.6 million was associated with active portfolio management expenses. We have not performed a detailed analysis to measure how much of the investment expenses paid to active managers might have been offset by additional returns ("alpha") earned by that active management.

For this study, we have continued to use the current approach that any "alpha" that may be identified would be treated as an increase in the risk adjustment and corresponding confidence level. For example, 0.25% of alpha would increase the confidence level by 3% (see discussions that follow on definitions of risk adjustment and confidence level).

Risk Adjustment

The real rate of return assumption for the portfolio is adjusted to reflect the potential risk of shortfalls in the return assumptions. WPERP's asset allocation determines this portfolio risk, since risk levels are driven by the variability of returns for the various asset classes and the correlation of returns among those asset classes. This portfolio risk is incorporated into the real rate of return assumption through a risk adjustment.

[1] Average for plan year.

The purpose of the risk adjustment (as measured by the corresponding confidence level) is to increase the likelihood of achieving the actuarial investment return assumption in the long term.[1] This is consistent with our experience that retirement plan fiduciaries would generally prefer that returns exceed the assumed rate more often than not.

The 4.61% expected real rate of return developed earlier in this report was based on expected mean or average arithmetic returns. In our model, the confidence level associated with a particular risk adjustment represents the relative likelihood that future investment earnings would equal or exceed the assumed earnings over a 15-year period on an expected value basis.[2] The 15-year time horizon represents an approximation of the "duration" of the fund's liabilities, where the duration of a liability represents the sensitivity of that liability to interest rate variations. Note that, based on the investment return assumptions recently adopted by systems that have been analyzed under this model, we observe a confidence level in the range of 50% to 60%.

Three years ago, the Board adopted an investment return assumption of 7.00%. That return implied a risk adjustment of 0.20%, reflecting a confidence level of 52% that the actual average return over 15 years would not fall below the assumed return, assuming that the distribution of returns over that period follows the normal statistical distribution.[3]

If we use the same 52% confidence level from our last study to set this year's risk adjustment, based on the current long-term portfolio standard deviation of 11.13% provided by RVK, the corresponding risk adjustment would be 0.18%. Together with the other investment return components, this would result in an investment return assumption of 6.53%, which is 0.47% lower than the current assumption of 7.00%.

Based on the general practice of using one-quarter percentage point increments for economic assumptions, we evaluated the effect on the confidence level of other alternative investment return assumptions. In particular, a net investment return assumption of 6.50%, together with the other investment return components, would produce a risk adjustment of 0.21% which corresponds to a confidence level of 53%. (This is slightly higher than the 52% confidence level from our last study.) A net investment return assumption of 6.25% would have a risk adjustment of 0.46% which corresponds to a confidence level of 56%, while a net investment return of 6.75% would provide no risk adjustment measured using the model.

The table on the next page shows WPERP's recommended investment return assumption, the risk adjustment and confidence level compared to the historical values for prior studies.

[1] This type of risk adjustment is referred to in the Actuarial Standards of Practice as a "margin for adverse deviation."

[2] If a retirement system uses the expected arithmetic average return as the discount rate in the funding valuation, that retirement system is expected to have no surplus or asset shortfall relative to its expected obligations assuming all actuarial assumptions are met in the future.

[3] Based on an annual portfolio return standard deviation of 12.44% provided by RVK in 2019. Strictly speaking, future compounded long-term investment returns will tend to follow a log-normal distribution. However, we believe the normal distribution assumption is reasonable for purposes of setting this type of risk adjustment.

Historical Investment Return Assumptions, Risk Adjustments and Confidence Levels Based on Assumptions Adopted by the Board

Years Ending June 30	Investment Return[1]	Risk Adjustment	Corresponding Confidence Level
2007 – 2009	8.00%	0.89%	62%
2010 – 2013	7.75%	0.89%	61%
2014 – 2015	7.50%	0.29%	53%
2016 – 2018	7.25%	0.19%	52%
2019 – 2021	7.00%	0.20%	52%
2022 (Recommended)	**6.50%**	**0.21%**	**53%**

As we have discussed in prior experience studies, the risk adjustment model and associated confidence level is most useful as a means for comparing how WPERP has positioned itself relative to risk over periods of time.[2] The use of an expected return with a 53% confidence level under Segal's model should be considered in context with other factors, including:

- As noted above, the confidence level is more of a relative measure than an absolute measure, and so can be reevaluated and reset for future comparisons.
- The confidence level is based on the standard deviation of the portfolio that is determined and provided to us by RVK. The standard deviation is a statistical measure of the future volatility of the portfolio and so is itself based on assumptions about future portfolio volatility and can be considered somewhat of a "soft" number.
- A confidence level of 53% is within the range of about 50% to 60% confidence levels that correspond to the risk adjustments currently used by most of Segal's other California public retirement system clients.
- We have not taken into account any additional returns ("alpha") that might be earned on active management. This means that if active management generates enough alpha to cover its related expenses, this would increase returns. This aspect of Segal's model is further evaluated in the next section.
- As with any model, the results of the risk adjustment model should be evaluated for reasonableness and consistency. This is discussed in the later section on "Comparisons with Other Public Retirement Systems".

[1] The investment return assumptions are gross of administrative expenses.

[2] In particular, it would not be appropriate to use this type of risk adjustment as a measure of determining an investment return rate that is "risk-free."

Recommended Investment Return Assumption

The following table summarizes the components of the investment return assumption developed in the previous discussion. For comparison purposes, we have also included similar values from the last study.

Calculation of Investment Return Assumption

Assumption Component	July 1, 2022 Recommended	July 1, 2019 Adopted Value
Inflation	2.50%	2.75%
Portfolio Real Rate of Return	4.61%	4.80%
Expense Adjustment	(0.40%)	(0.35%)
Risk Adjustment	(0.21%)	(0.20%)
Total	**6.50%**	**7.00%**
Confidence Level	**53%**	**52%**

Based on this analysis, we recommend that the investment return assumption be decreased from 7.00% to 6.50% per annum.

Comparison with Alternative Model used to Review Investment Return Assumption

Since our appointment as actuary for WPERP, we have consistently reviewed investment return assumptions based on our model that incorporates expected arithmetic real returns for the different asset classes and for the entire portfolio as one component of that model.[1] The use of "forward looking expected arithmetic returns" is one of the approaches discussed for use in the Selection of Economic Assumptions for Measuring Pension Obligations under Actuarial Standards of Practice (ASOP) No. 27.

Besides using forward looking expected arithmetic returns, ASOP No. 27 also discussed setting investment return assumptions using an alternative "forward looking expected geometric returns" approach.[2] Even though expected geometric returns are lower than expected arithmetic returns, those California public retirement systems that have set investment return assumptions using this alternative approach have in practice adopted investment return assumptions that are comparable to those adopted by the Board for WPERP. This is because under the model used by those retirement systems, their investment return assumptions are not reduced to anticipate future investment expenses.[3]

[1] Again, as discussed in the footnote to "Risk Adjustment", if a retirement system uses the expected arithmetic average return as the discount rate in the funding valuation, that retirement system is expected to have no surplus or asset shortfall relative to its expected obligations assuming all actuarial assumptions are met in the future.

[2] If a retirement system uses the expected geometric average return as the discount rate in the funding valuation, that retirement system is expected to have an asset value that generally converges to the median accumulated value as the time horizon lengthens assuming all actuarial assumptions are met in the future.

[3] This means that if that model were to be applied to WPERP, the expected geometric return would not be adjusted for the approximately 0.40% investment expenses paid by WPERP.

For comparison, we evaluated the 6.50% recommended assumptions based on the expected geometric return for the entire portfolio, gross of the investment expenses. Under that model, over a 15-year period, there is a 56% likelihood that future average geometric returns will meet or exceed 6.50%.[1]

Comparisons with Other Public Retirement Systems

One final test of the recommended investment return assumption is to compare it against those used by other public retirement systems, both in California and nationwide.

We note that an investment return of 7.00% or lower is the most common among California public sector retirement systems. In particular, of the twenty 1937 Act CERL systems, ten use a 7.00% investment return assumption, six use 6.75%, one uses 6.50% and one uses 6.25%. The remaining two 1937 Act CERL systems currently use a 7.25% earnings assumption. Furthermore, CalSTRS currently uses a 7.00% earnings assumption and CalPERS uses a 6.80% earnings assumptions, while the San Jose and San Diego City retirement systems use investment return assumptions of 6.625% and 6.50%, respectively.

The following table compares WPERP's recommended net investment return assumption against those of the 207 large public retirement funds in their 2021 fiscal year valuations based on information found in the Public Plans Database, which is produced in partnership with NASRA:[2]

		Public Plans Data[3]		
Assumption	**WPERP**	**Low**	**Median**	**High**
Net Investment Return	6.50%	4.25%	7.00%	8.25%

The detailed survey results show that more than 80% of the systems have an investment return assumption in the range of 6.75% to 7.50%. Also, over half of the systems have reduced their investment return assumption from 2017 to 2021. State systems outside of California tend to change their economic assumptions less frequently and so may lag behind emerging practices in this area.

In summary, we believe the recommended assumption of 6.50% provides for an appropriate risk margin within the risk adjustment model and is consistent with WPERP's historical practice relative to other public systems.

C. Salary Increase

Salary increases impact plan costs by increasing members' benefits (since benefits are a function of the members' highest average pay) and future normal cost collections. The components of the assumption are discussed below.

[1] We performed this stochastic simulation using the capital market assumptions included in the 2021 survey prepared by Horizon Actuarial Services. That simulation was performed using 10,000 trial outcomes of future market returns, using assumptions from 20-year arithmetic returns, standard deviations and correlation matrix that were found in the 2021 survey that included responses from 39 investment advisors.

[2] Among 209 large public retirement funds, the 2021 fiscal year investment return assumption was not available for 2 of the public retirement funds in the Public Plans Database as of March 2022.

[3] Public Plans Data website – Produced in partnership with the National Association of State Retirement Administrators (NASRA).

As an employee progresses through his or her career, increases in pay are expected to come from three sources:

1. **Inflation:** Unless pay grows at least as fast as consumer prices grow, employees will experience a reduction in their standard of living. There may be times when pay increases lag or exceed inflation, but over the long term, labor market forces may require an employer to maintain its employees' standards of living.

   As discussed earlier in this report, we recommend reducing the annual inflation assumption from 2.75% to 2.50%. This inflation component is used as part of the salary increase assumption.

2. **Real "Across the Board" Pay Increases:** These increases are typically termed productivity increases since they are considered to be derived from the ability of an organization or an economy to produce goods and services in a more efficient manner. As that occurs, at least some portion of the value of these improvements can provide a source for pay increases. These increases are typically assumed to extend to all employees "across the board". The State and Local Government Workers Employment Cost Index produced by the Department of Labor provides evidence that real "across the board" pay increases have averaged about 0.5% – 0.8% annually during the last ten to twenty years.

   We also referred to the annual report on the financial status of the Social Security program published in August 2021. In that report, real "across the board" pay increases are forecast to be 1.2% per year under the intermediate assumptions.

   The real pay increase assumption is generally considered a more "macroeconomic" assumption that is not necessarily based on individual plan experience. However, recent salary experience with public systems in California as well as anecdotal discussions with plans and plan sponsors indicate lower future real wage growth expectations for public sector employees. We also note that for WPERP's active members, the actual average inflation plus "across the board" increase (i.e., wage inflation) over the three-year period ending June 30, 2021 was 2.90%, which is greater than the change in CPI of 2.84% during that same period:

Year Ending	Actual Average Increase[1]	Actual Annual-to-Annual Change in CPI[2]
June 30, 2019	3.52%	3.07%
June 30, 2020	1.88%	1.62%
June 30, 2021	3.31%	3.83%
Three-Year Average	**2.90%**	**2.84%**

   Based on all of the above information, we recommend maintaining the real "across the board" salary increase assumption at 0.50%. This means that the combined inflation and "across the board" salary increase assumption will decrease from 3.25% to 3.00%.

3. **Merit and Promotion Increases:** As the name implies, these increases come from an employee's career advances. This form of pay increase differs from the previous two, since

[1] Reflects the increase in average salary for members at the beginning of the year versus those at the end of the year. It does not reflect the average salary increases received by members who worked the full year.

[2] Based on the change in the Annual CPI index for the Los Angeles-Long Beach-Anaheim Area compared to the prior year.

it is specific to the individual. For WPERP, there are service-specific merit and promotion increases.

The annual merit and promotion increases are determined by measuring the actual increases received by members over the experience period, net of the inflationary and real "across the board" pay increases. This is accomplished by:

a. Measuring each continuing member's actual salary increase over each year of the experience period on a salary weighted basis, with higher weights assigned to experience from members with larger salaries;
b. Excluding any members with increases of more than 30% or decrease of more than 10% during any particular year;
c. Categorizing these increases according to member demographics;
d. Removing the wage inflation component from these increases (assumed to be equal to the increase in the members' average salary during the year);
e. Averaging these annual increases over the experience period; and
f. Modifying current assumptions to reflect some portion of these measured increases reflective of their "credibility."

To be consistent with the other economic assumptions, these merit and promotion assumptions should be used in combination with the total 3.00% assumed inflation and real "across the board" increases recommended in this study.

Due to the high variability of the actual salary increases, we have analyzed this assumption using the data for the past six years. We believe that when the experience from the current and prior studies is combined into an average result, it provides a more reasonable representation of potential future merit and promotion salary increases over the long-term.

The following table shows the actual average merit and promotion increases by years of service over the three-year period from July 1, 2018 through June 30, 2021 along with the actual average increases based on combining the current three-year period with the three-year period from the prior experience study. The current and proposed assumptions are also shown. The actual increases for the current three-year period and the prior three-year period were reduced by the actual average inflation plus "across the board" increase (i.e., wage inflation, estimated as the increase in average salaries) for each year over each of the three-year experience periods (2.9% and 2.0% respectively, on average).

Merit and Promotion Increases

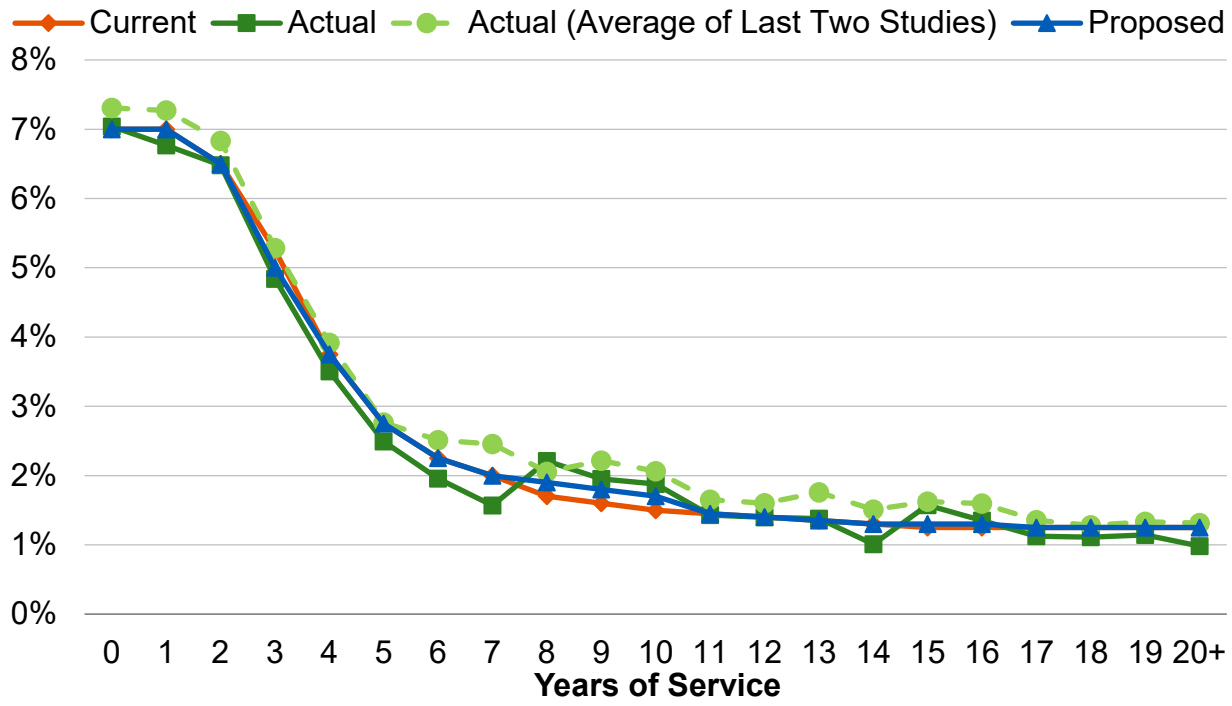
Rates (%)

Years of Service	Current Assumption	Actual Average Increase from Current Study (Last 3 Years)	Actual Average Increase from Current and Prior Studies (Last 6 Years)	Proposed Assumption
Less than 1	7.00	7.04	7.31	7.00
1 – 2	7.00	6.77	7.27	7.00
2 – 3	6.50	6.48	6.83	6.50
3 – 4	5.25	4.84	5.28	5.00
4 – 5	3.75	3.50	3.92	3.75
5 – 6	2.75	2.49	2.77	2.75
6 – 7	2.25	1.96	2.51	2.25
7 – 8	2.00	1.57	2.45	2.00
8 – 9	1.70	2.21	2.05	1.90
9 – 10	1.60	1.95	2.22	1.80
10 – 11	1.50	1.88	2.06	1.70
11 – 12	1.45	1.43	1.65	1.45
12 – 13	1.40	1.40	1.60	1.40
13 – 14	1.35	1.38	1.76	1.35
14 – 15	1.30	1.01	1.51	1.30
15 – 16	1.25	1.57	1.62	1.30
16 – 17	1.25	1.35	1.59	1.30
17 – 18	1.25	1.12	1.35	1.25
18 – 19	1.25	1.11	1.28	1.25
19 – 20	1.25	1.14	1.33	1.25
20 & Over	1.25	0.98	1.31	1.25

Based on this experience, overall we recommend slightly increasing the merit and promotion component of the salary increase assumption. The overall salary increase assumptions will decrease after taking into account the lower inflation component of the salary increase assumption.

Chart 1 compares the actual merit and promotion increase experience with the current and proposed assumptions. Also shown is the actual merit and promotion increases based on an average of both the current and previous three-year experience periods.

Chart 1: Merit and Promotion Salary Increase Rates



4. Demographic Assumptions

A. Retirement Rates

The age at which a member retires will affect both the amount of the benefits that will be paid to that member as well as the period over which funding must take place.

Based on the distinct retirement patterns for Tier 1 members with 30 or more years of service at retirement compared to those with under 30 years, we continue to recommend separate retirement rates for these groups of members. We have analyzed this assumption using the data for the past six years to capture more experience.

The table below shows the observed service (non-disability) retirement rates for Tier 1 members with under 30 years of service at retirement over the last six years, and for Tier 1 members with 30 or more years. The observed service retirement rates were determined by comparing those members who actually retired from service to those eligible to retire from service. This same methodology is followed throughout this report and was described in Section 2. Also shown are the current rates assumed and the rates we propose.

Effective January 1, 2014, a new Tier 2 was implemented. For this new tier, we do not have credible experience from the past three years to propose new rates based on actual retirements from Tier 2 members. However, despite the limited actual experience we are recommending changes at some ages based on the changes that we are recommending for Tier 1 so that the retirement rates for Tier 2 are more consistent with those of Tier 1.

The second table shows the current and proposed rates of retirement for Tier 2 members.

Tier 1 Members

Rate of Retirement (%)

Age	Less than 30 Years of Service			30 or More Years of Service		
	Current Rate	Actual Rate (Last 6 Years)	Proposed Rate	Current Rate	Actual Rate (Last 6 Years)	Proposed Rate
50	0.00	0.00	0.00	1.00	1.89	1.50
51	0.00	0.00	0.00	0.00	1.38	1.00
52	0.00	0.00	0.00	0.00	0.28	0.00
53	0.00	0.00	0.00	0.00	0.37	0.00
54	0.00	0.00	0.00	0.00	0.00	0.00
55	4.25	4.61	4.50	27.00	33.58	30.00
56	2.00	2.91	2.50	20.00	20.34	20.00
57	2.50	3.31	3.00	17.50	17.95	18.00
58	3.50	3.56	3.50	17.50	18.69	18.00
59	3.50	3.95	3.50	17.50	18.21	18.00
60	5.50	4.92	5.25	22.00	23.57	22.00
61	6.50	7.96	6.75	22.00	21.43	22.00
62	7.00	6.57	7.00	22.00	25.97	24.00
63	8.00	9.71	8.50	25.00	24.27	25.00
64	8.50	10.35	9.50	27.00	26.06	27.00
65	11.50	11.94	11.50	30.00	28.70	28.00
66	12.00	15.07	13.50	30.00	24.02	28.00
67	12.50	14.80	13.50	30.00	26.95	28.00
68	13.00	13.25	13.50	30.00	26.02	28.00
69	17.00	21.17	19.00	30.00	30.23	30.00
70	22.00	22.11	22.00	25.00	29.69	30.00
71	22.00	23.73	22.00	25.00	25.49	30.00
72	22.00	13.73	22.00	25.00	46.34	30.00
73	22.00	22.50	22.00	25.00	29.03	30.00
74	22.00	7.41	22.00	25.00	24.00	30.00
75 & Over	100.00	19.05	100.00	100.00	23.68	100.00

Based on this experience, we recommend increasing the retirement rate assumption at certain ages while decreasing the retirement rate assumption at other ages. Overall, the proposed rates represent an increase from the current rates for Tier 1 members.

Chart 2 that follows later in this section compares the actual retirement experience with the current and proposed rates of retirement for Tier 1 members with less than 30 years of service.

Chart 3 compares the actual retirement experience with the current and proposed rates of retirement for Tier 1 members with 30 or more years of service.

Tier 2 Members

Rate of Retirement (%)

	Less than 30 Years of Service		30 or More Years of Service	
Age	Current Rate	Proposed Rate	Current Rate	Proposed Rate
55	0.00	0.00	25.00	26.00
56	0.00	0.00	14.00	14.00
57	0.00	0.00	13.00	13.50
58	0.00	0.00	13.00	13.50
59	0.00	0.00	13.00	13.50
60	5.50	5.25	17.50	17.50
61	3.50	3.75	10.00	12.00
62	2.50	2.75	10.00	12.00
63	20.00	20.00	25.00	25.00
64	12.00	11.00	25.00	25.00
65	11.00	11.00	28.00	27.00
66	11.00	12.00	28.00	27.00
67	12.00	12.50	28.00	27.00
68	12.50	12.50	28.00	27.00
69	15.00	16.50	28.00	28.00
70	50.00	40.00	50.00	40.00
71	50.00	40.00	50.00	40.00
72	50.00	40.00	50.00	40.00
73	50.00	40.00	50.00	40.00
74	50.00	40.00	50.00	40.00
75 & Over	100.00	100.00	100.00	100.00

There was very little retirement experience during this period for Tier 2 members. We have based our recommended rates on a combination of the current assumptions used for this tier and some of the proposed changes in rates for Tier 1.

We recommend mostly increasing the retirement rate assumption for earlier ages and decreases in the retirement rates at later ages for Tier 2 members.

Chart 4 compares the current and proposed rates of retirement for Tier 2 members with less than 30 years of service.

Chart 5 compares the current and proposed rates of retirement for Tier 2 members with 30 or more years of service.

Deferred Vested Members

Under the current assumptions, deferred vested Tier 1 and Tier 2 members were assumed to retire at ages 60 and 63, respectively. Also, Tier 1 and Tier 2 members receiving Permanent Total Disability (PTD) benefits were assumed to retire at the earlier of age 65 or age 55 with 30 years of service and receive the Formula pension. The average age at retirement over the last three years is shown in the table below. Also shown are the current ages assumed and the ages we propose.

Deferred Vested Retirement Age

	Tier 1 Members	Tier 2 Members	Tier 1 and Tier 2 Members Receiving PTD
Current Assumption	60.0	63.0	65 or 55 with 30 years of service
Actual Average Age	61.3	68.8[1]	67.6
Proposed Assumption	60.0	63.0	65 or 55 with 30 years of service

Based on this experience, we recommend maintaining the deferred vested retirement assumption of age 60 for Tier 1 members (who are also assumed to receive a Money Purchase Annuity) and age 63 for Tier 2 members. We also recommend maintaining the retirement age for Tier 1 and Tier 2 members receiving a PTD at the earlier of age 65 or age 55 with 30 years of service and receive the Formula pension upon retirement.

Survivor Continuance

Under the current assumptions, it was assumed that 85% of all active and inactive male members and 60% of all active and inactive female members would be married or have an eligible domestic partner at pre-retirement death or when they retire.

The following table shows the observed percentage of new retirees with an eligible spouse or domestic partner at the time of retirement based on the actual experience over the past six years. Also shown are the current rates assumed and the rates we propose:

New Retirees – Actual Percent with Eligible Spouse or Domestic Partner

	Male	Female
Current Assumption	85%	60%
Actual Percent (Last 3 Years)	80%	54%
Actual Percent (Last 6 Years)	79%	54%
Proposed Assumption	**80%**	**55%**

Based on this experience, we recommend decreasing the percent married assumption for male and female members to 80% and 55%, respectively. Also, we recommend that this assumption continue to be applied to current retirees retired before April 1, 2012 with Options Full, A, B or C since they are missing data regarding their survivor.

[1] There were only three Tier 2 deferred vested retirements in the past three years.

Since the value of the survivor's benefit is dependent on the survivor's age and sex, we must also have assumptions for the age and sex of the survivor. Based on the experience for members who retired during the current three-year period and studies done for other retirement systems, **we recommend the following**:

1. Since most of the actual survivors are of the opposite sex, even with the inclusion of domestic partners, **we will continue to assume that for all active and inactive members, the survivor's sex is the opposite of the member.**

2. **Based on the below experience, we recommend maintaining the spouse age difference assumption that male retirees are three years older than their spouses and maintaining the spouse age difference assumption that female retirees are two years younger than their spouses.** These assumptions will continue to be monitored in future experience studies.

Member's Age as Compared to Spouse's Age

	Male Retiree	Female Retiree
Current Assumption	3 years older	2 years younger
Actual Experience (Last 3 Years)	2.2 years older	2.6 years younger
Actual Experience (Last 6 Years)	2.6 years older	2.1 years younger
Proposed Assumption	**3 years older**	**2 years younger**

Chart 2: Retirement Rates – Tier 1 Members Less than 30 Years of Service (July 1, 2015 through June 30, 2021)

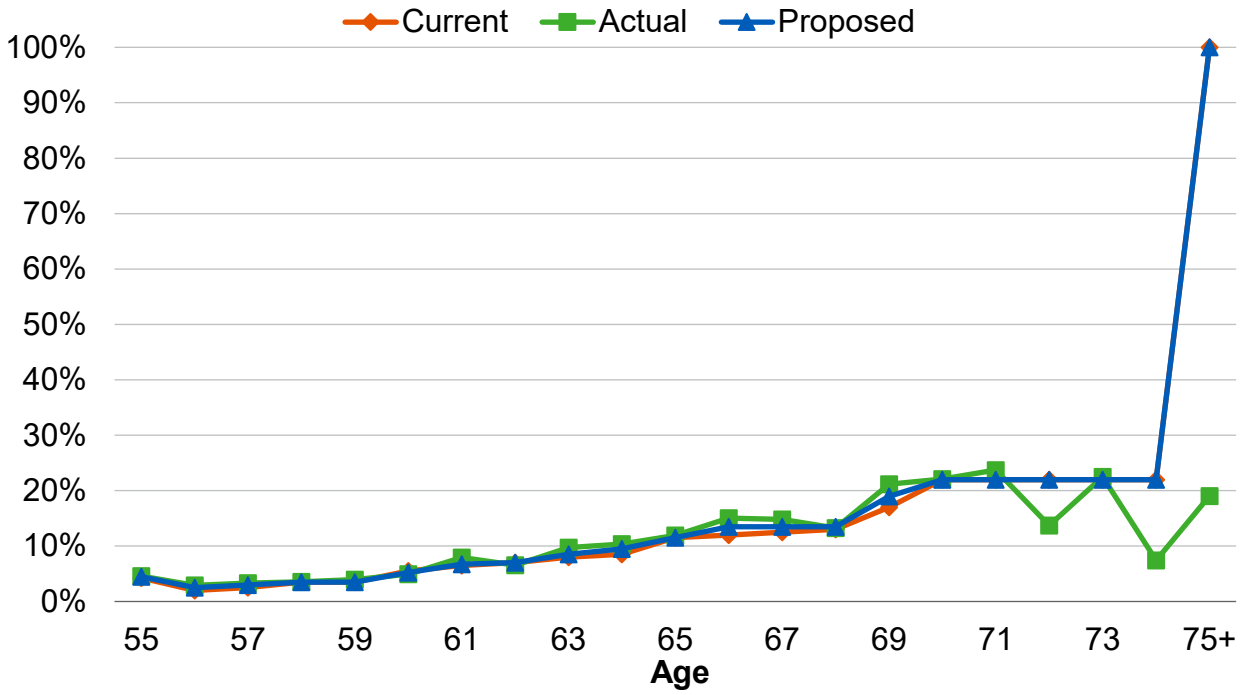


Chart 3: Retirement Rates – Tier 1 Members
30 or More Years of Service
(July 1, 2015 through June 30, 2021)

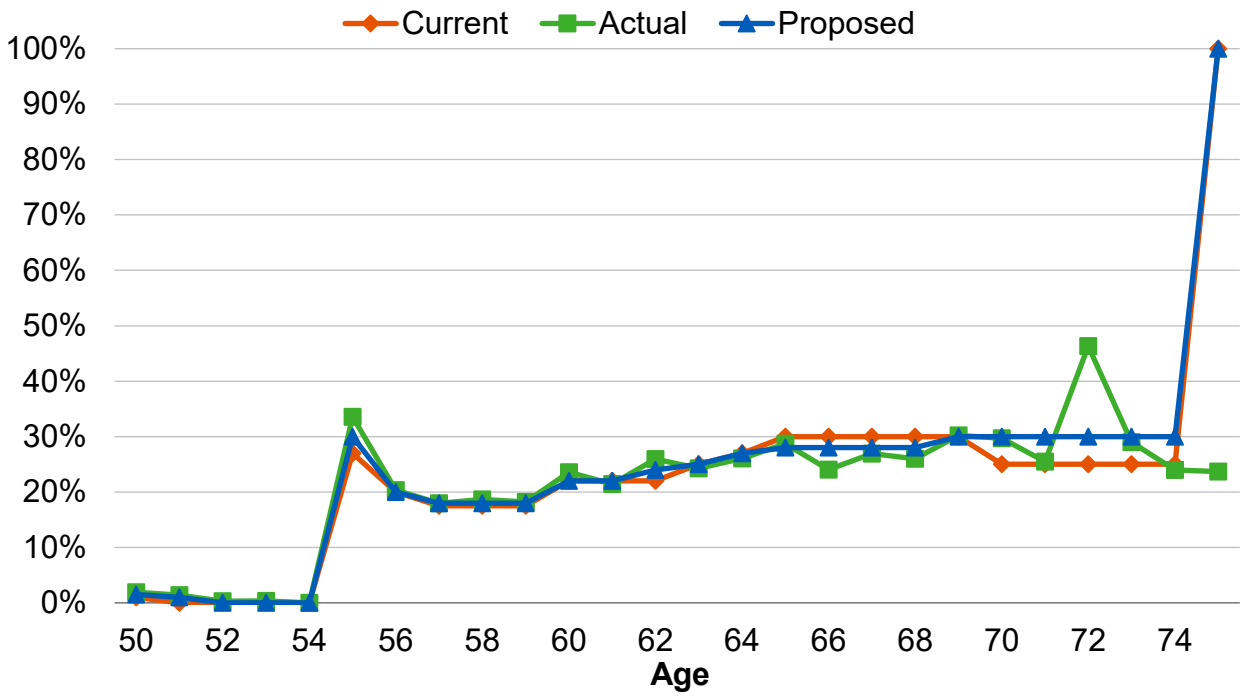


Chart 4: Retirement Rates – Tier 2 Members
Less than 30 Years of Service

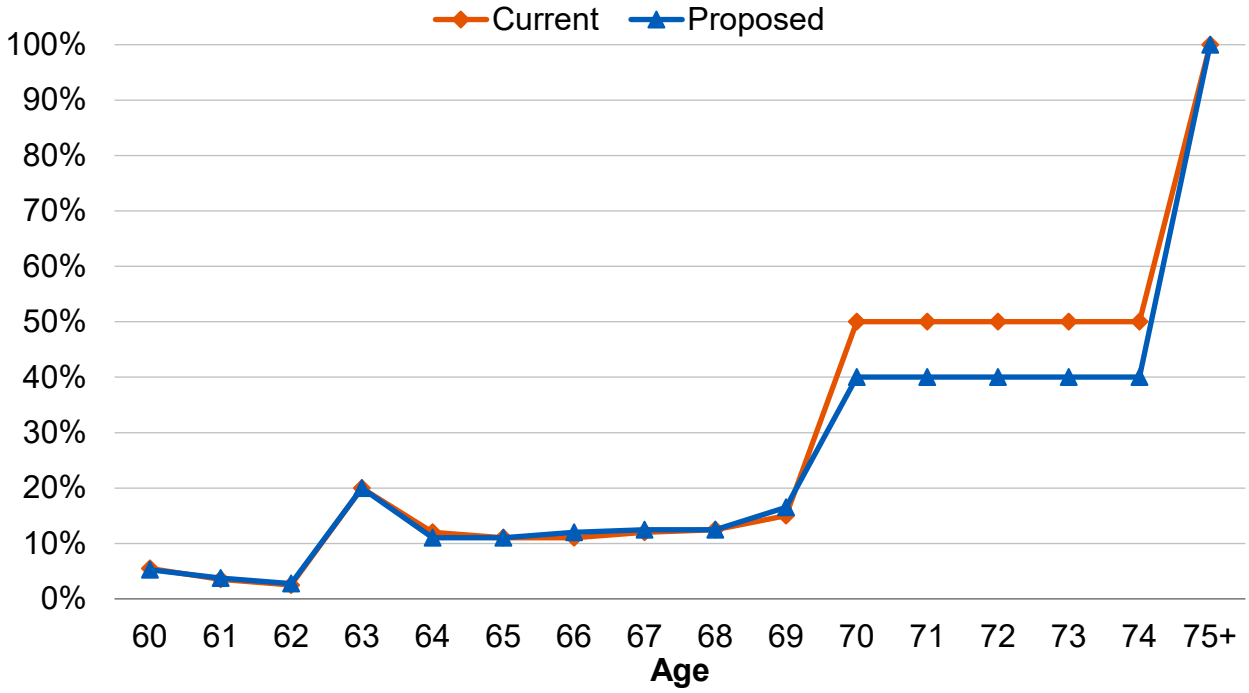
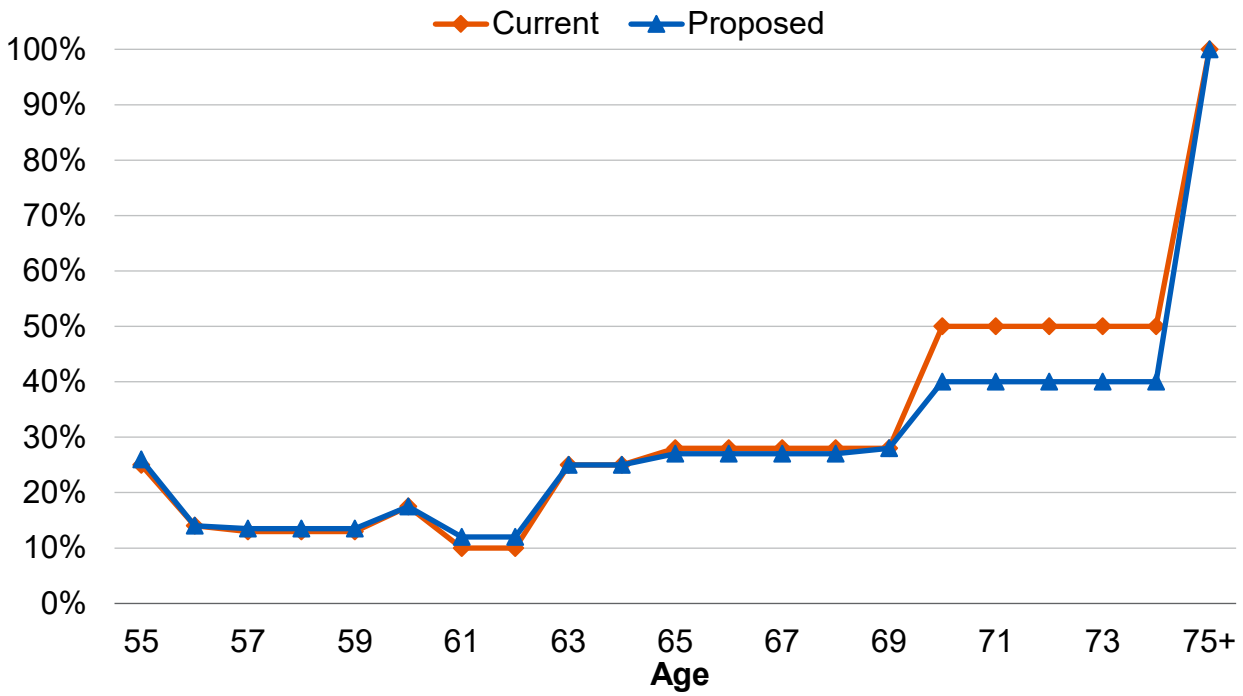


Chart 5: Retirement Rates – Tier 2 Members
30 or More Years of Service



B. Mortality Rates

The “healthy” mortality rates project the life expectancy of a member who retires from service (i.e., who does not receive a Permanent Total Disability benefit). Also, the “healthy” pre-retirement mortality rates project what proportion of members will die before retirement. The table currently being used for post-service retirement mortality rates is the Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females) with rates increased by 5% for males, projected generationally with the two-dimensional mortality improvement scale MP-2018. For beneficiaries, the table currently being used is the Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2018.

The Public Retirement Plans Mortality tables (Pub-2010) was published by the Retirement Plans Experience Committee (RPEC) of the SOA in 2019. For the first time, the published mortality tables are based exclusively on public sector pension plan experience in the United States. Within the Pub-2010 family of mortality tables, there are separate tables by job categories of General, Safety and Teachers. Included with the mortality tables is the analysis prepared by RPEC that continues to observe that benefit amount for healthy retirees and salary for employees are the most significant predictors of mortality differences within the job categories. Therefore, Pub-2010 includes mortality rates developed for annuitants on a “benefit” weighted basis, with higher credibility assigned to experience from annuitants receiving larger benefits. We continue to recommend using the "amount weighted" above-median version of the Pub-2010 mortality tables (adjusted for WPERP experience as discussed herein) for the retirement plan valuation.

We also continue to recommend that the mortality improvement scale be applied generationally where each future year has its own mortality table that reflects the forecasted improvements, using the published improvement scales. The "generational" approach is now the established practice within the actuarial profession.

A generational mortality table provides dynamic projections of mortality experience for each cohort of retirees. For example, the mortality rate for someone who is 65 next year will be slightly less than for someone who is 65 this year. In general, using generational mortality anticipates increases in the cost of the Plan over time as participants' life expectancies are projected to increase.

We understand that RPEC intends to publish annual updates to their mortality improvement scales. Improvement scale MP-2021 is the latest improvement scale available. We recommend that the Board adopt the Amount-Weighted Above-Median Pub-2010 mortality tables (adjusted for WPERP experience as discussed herein), and project the mortality improvement generationally using the MP-2021 mortality improvement scale.

In order to reflect more actual WPERP experience in our analysis, we have used experience for a nine-year period by using data from the current (from July 1, 2018 to June 30, 2021) and the last two (from July 1, 2015 to June 30, 2018 and from July 1, 2012 to June 30, 2015) experience study periods in order to analyze this assumption.

Even with the use of nine years of experience, based on standard statistical theory the data is only partially credible especially under the recommended amount-weighted basis when dispersion of retirees' benefit amounts is taken into account, particularly for female retirees. In 2008 the SOA published an article recommending that mortality assumptions include an adjustment for credibility. Under this approach, the number of deaths needed for full credibility for a headcount-weighted mortality table is just over 1,000, where full credibility means a 90% confidence that the actual experience will be within 5% of the expected value. Therefore, in our recommended assumptions, we have only partially adjusted the Pub-2010 mortality tables to fit WPERP's experience, particularly for females. In future experience studies, more data will be available which may further increase the credibility of the WPERP experience.

Post-Retirement Mortality (Service Retirements)

Among all retired members, the actual deaths compared to the expected deaths weighted by benefit amounts under the current assumptions for the last nine years are shown in the table below. We also show the deaths weighted by benefit amount under the proposed assumptions. We continue to recommend the use of a generational mortality table, which incorporates a more explicit assumption for future mortality improvement. Accordingly, the goal is to start with a mortality table that closely matches the current experience (without a margin for future mortality improvement), and then reflect mortality improvement by projecting lower mortality rates in future years.

The proposed mortality table also reflects current experience to the extent that the experience is credible based on standard statistical theory. For WPERP, the volume of member data makes it relatively credible for males. In contrast, there is much less female retiree data, so it is given less credibility. The proposed mortality table has an actual to expected ratio of 105%, after an adjustment to the female rates for partial credibility. In future years the ratio should remain

around 105%, as long as actual mortality improves at the same rate as anticipated by the generational mortality tables. The number of actual deaths weighted by benefit amount compared to the number expected under the current and proposed assumptions weighted by benefit amounts for the last nine years are as follows:

Healthy Retiree Mortality Experience – Benefit Weighted
($ in millions)

	Healthy Retirees		
Gender	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths
Male	$103.7	$110.0	$104.0
Female	$14.0	$14.2	$14.0
Total	**$117.7**	**$124.2**	**$118.0**
Actual / Expected	**105%**		**105%[1]**

Notes:

1. Experience shown above is weighted by annual benefit amounts for deceased members.
2. Expected amounts under the proposed generational mortality table are based on mortality rates from the base year projected with mortality improvements to the experience study period.
3. Results may not add due to rounding.

We recommend updating the post-retirement mortality to follow the Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females), with rates increased by 5% for males, projected generationally with the two-dimensional mortality improvement scale MP-2021.

Chart 6 compares the actual to expected deaths on a benefit-weighted basis under the current and proposed assumptions over the past nine years.

Chart 7 shows the life expectancies (i.e., expected future lifetime) under the current and proposed tables on a benefit-weighted basis. Life expectancies under the current and proposed generational mortality rates are based on age as of 2022. In practice, life expectancies will be assumed to increase based on applying the mortality improvement scale.

Disabled Mortality

Disabled mortality was included in the development of assumed healthy mortality rates. This was done because the number of disabled pensioners who were receiving benefits from both the Permanent Total Disability Fund and the Retirement Plan is minimal compared to the total number of pensioners receiving only Retirement Plan benefits. We continue to recommend using the same mortality table for disabled members who received a Permanent Total Disability benefit as is used for healthy service retired members.

[1] If we use the benchmark Pub-2010 table without any adjustment, the proposed actual to expected ratio would be 110%.

Beneficiaries Mortality

In studying the mortality for beneficiaries in our prior experience study, we reviewed the actual deaths compared to the expected deaths and recommended the same mortality tables for healthy retirees and all beneficiaries but applying different rate adjustments. However, Pub-2010 has separate mortality tables for healthy retirees and beneficiaries.

The Pub-2010 Contingent Survivors Table is developed only based on Contingent Survivor data after the death of the retirees. This is consistent with the mortality experience that we have available for beneficiaries. In addition, the Pub-2010 contingent survivor mortality rates are comparable to WPERP's actual mortality experience for beneficiaries. However, in contrast to service retirees, there is less beneficiary data, so it is given little credibility when adjusting the base table. The proposed mortality tables have an actual to expected ratio of 102%, after adjustments for partial credibility. In future years the ratio should remain around 102% as long as actual mortality improves at the same rates as anticipated by the generational mortality tables. The number of actual deaths compared to the number expected under the current and proposed assumptions weighted by benefit amounts for the last six years are as follows:

Beneficiary Mortality Experience – Benefit Weighted
($ in millions)

	Beneficiaries		
Gender	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths
Male	$1.3	$1.2	$1.5
Female	$26.0	$28.6	$27.7
Total	**$27.3**	**$29.8**	**$29.2**
Actual / Expected	**109%**		**102%[1]**

Notes:

1. Experience shown above is weighted by annual benefit amounts for deceased beneficiaries.
2. Expected amounts under the proposed generational mortality table are based on mortality rates from the base year projected with mortality improvements to the experience study period.
3. Results may not add due to rounding.

For all beneficiaries in pay status, we recommend updating the mortality assumption from the Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2018, to the Pub-2010 Contingent Survivor Amount-Weighted Above-Median Mortality Table (separate tables for males and females), with rates increased by 5% for females, projected generationally with the two-dimensional mortality improvement scale MP-2021.

[1] If we use the benchmark Pub-2010 table without any adjustment, the proposed actual to expected ratio would be 107%.

Chart 8 compares the actual to expected deaths on a benefit-weighted basis under the current and proposed assumptions over the past six years.

Chart 9 shows the life expectancies (i.e., expected future lifetime) under the current and proposed tables on a benefit-weighted basis. Life expectancies under the current and proposed generational mortality rates are based on age as of 2022. In practice, life expectancies will be assumed to increase based on applying the mortality improvement scale.

As stated above, the Contingent Survivor mortality tables are developed based on contingent survivor data only after the death of the retirees (i.e., it does not reflect any contingent survivor data before the death of the retirees). According to analysis provided by RPEC, the mortality rates for the beneficiaries could be somewhat overstated before the death of the retirees as the Contingent Survivor mortality tended to be higher than retiree mortality and the difference was statistically significant. Based on this analysis, for the purposes of the actuarial valuations (for funding and financial reporting), when calculating the liability for the continuance to a beneficiary of a surviving member, we recommend that the Healthy Retiree mortality tables be used for beneficiary mortality both before and after the expected death of the member. Upon the actual death of the member (i.e., for all beneficiaries in pay status as of the valuation date), we recommend for the purposes of the actuarial valuations that we use the Contingent Survivor mortality tables as stated above. We note that the use of different mortality tables (before and after the death of the member) has been found by the RPEC to be reasonable.

Pre-Retirement Mortality

The table currently being used for pre-retirement mortality rates is the Pub-2010 General Employee Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional scale MP-2018.

We recommend updating the pre-retirement mortality to follow the Pub-2010 General Employee Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2021.

We also recommend maintaining the current assumption that 5% of pre-retirement deaths are duty related.

Mortality Table for Optional Form of Payment Amounts and Conversion of Contribution Balances to Annuities at Retirement

If these mortality assumptions are adopted by the Board, then based on Plan language, the actuarial factors used for optional form of payment amounts and conversion of contribution balances to annuities at retirement may be adjusted to be consistent with the mortality assumptions proposed in this report. This would ensure that the optional forms of payment, etc. are actuarially equivalent to the Full Retirement Allowance form of payment used in the determination of employer contribution rates. Furthermore, as there are complications associated with using different mortality tables for the beneficiaries before and after the death of the retiree, **we recommend that the General Healthy Retiree mortality tables be used for the beneficiaries in determining optional form of payment amounts for retirees.**

Similar to the approach used in the prior experience study that was adopted by the Board, we recommend the following unisex mortality table be used in determining optional form of payments amounts and converting contribution balances to annuities at retirement:

Member and Beneficiary:

Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table, with rates increased by 5% for males, projected generationally with the two-dimensional improvement scale MP-2021 associated with a retirement year of 2025, weighted 75% male and 25% female for the member, and weighted 25% male and 75% female for the beneficiary

Chart 6: Post-Retirement Benefit-Weighted Deaths
(In Millions)
(July 1, 2012 through June 30, 2021)

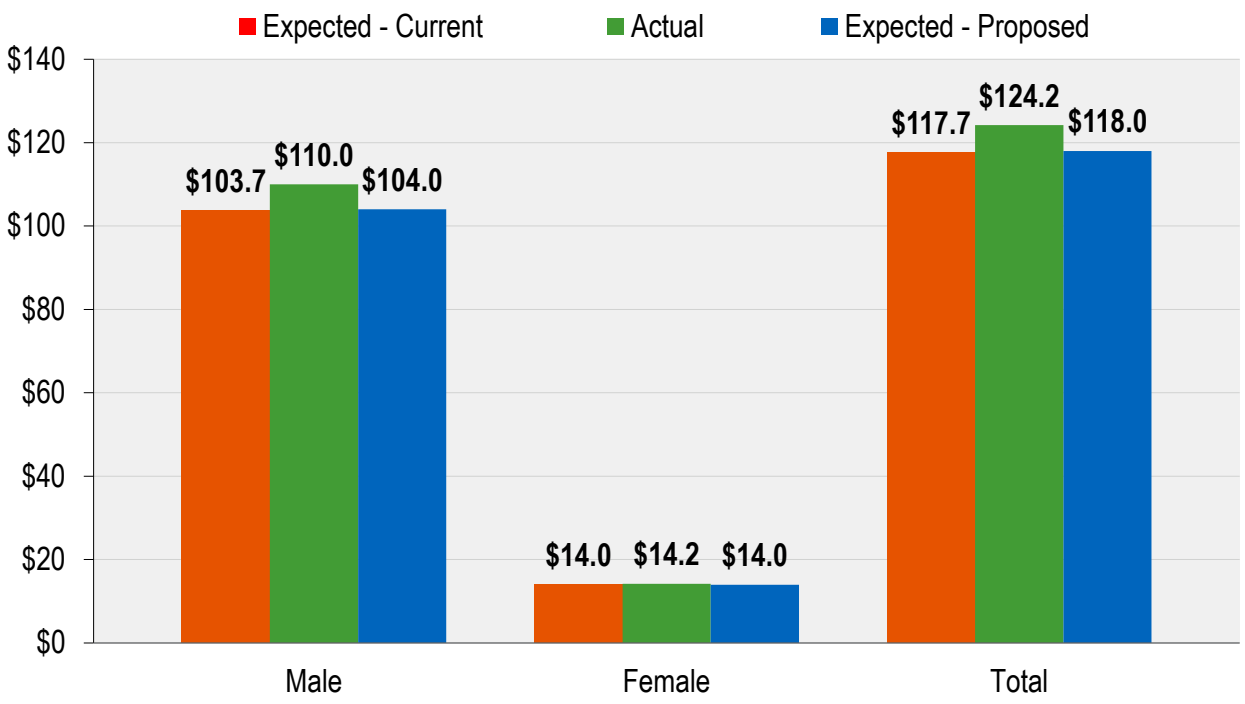


Chart 7: Post-Retirement Benefit-Weighted Life Expectancies

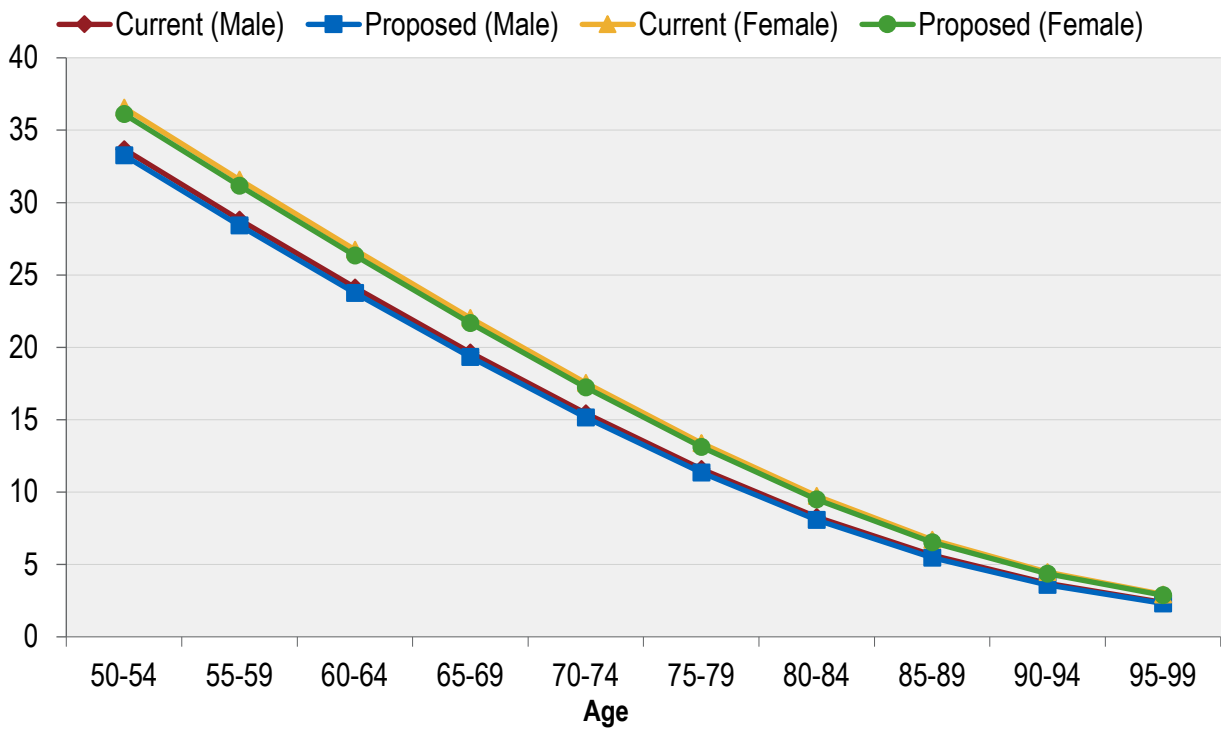


Chart 8: Beneficiaries Benefit-Weighted Deaths
(In Millions)
(July 1, 2015 through June 30, 2021)

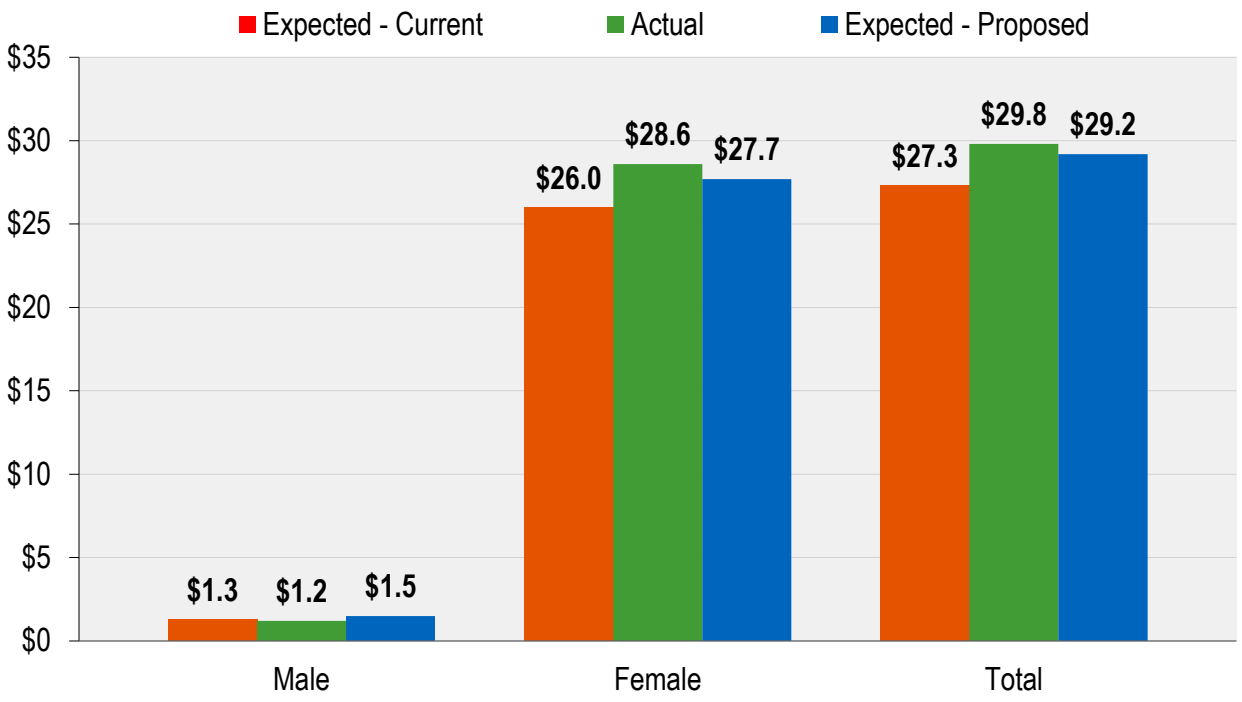
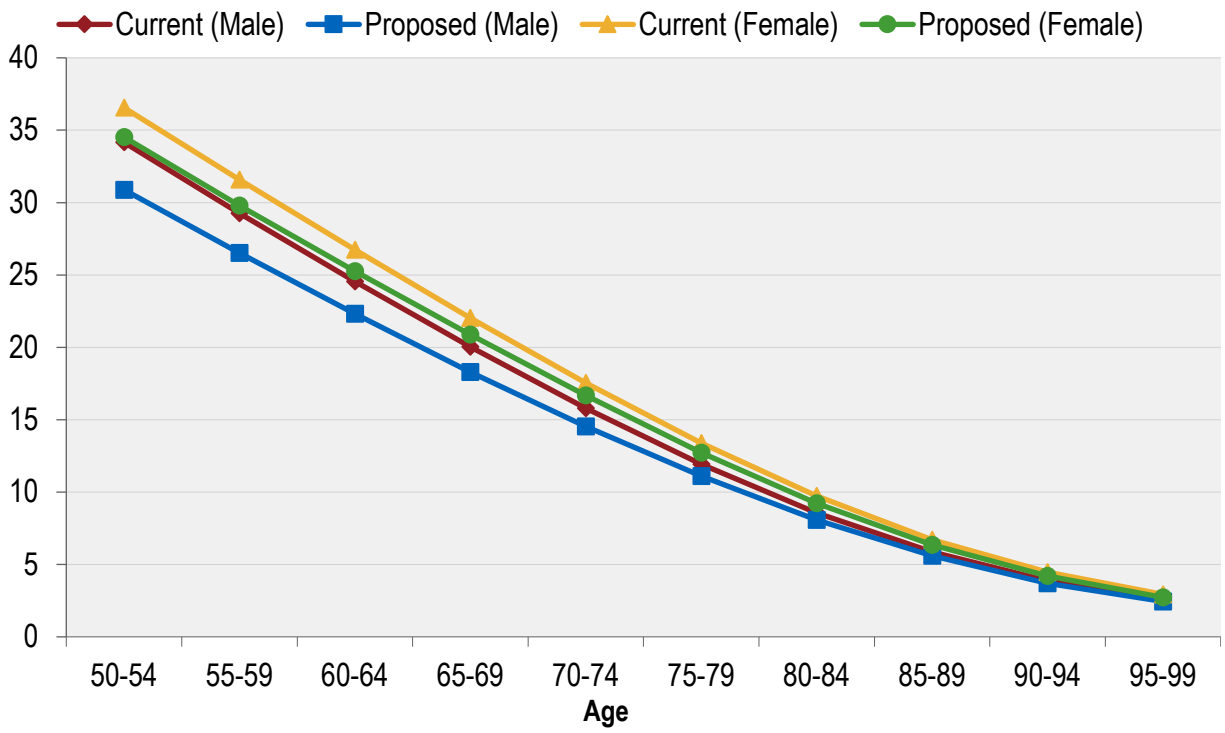


Chart 9: Beneficiaries Benefit-Weighted Life Expectancies



C. Termination Rates

Termination rates include all terminations for reasons other than death, disability or retirement. Under the current assumptions, there is an overall incidence of terminations assumed, combined with an assumption that a member will choose between a refund of member contributions (ordinary withdrawal) or a deferred retirement benefit (vested termination). With this experience study we are continuing to recommend that a combined set of withdrawal and termination assumptions be used with a separate assumption regarding the proportion of members who choose a refund of member contributions or a deferred benefit.

Currently, the termination assumptions are a function of years of service. We recommend maintaining this assumption structure. The termination experience over the last three years is shown by years of service in the following table. Also shown is the average of the current three-year period with the prior three-year period from the previous experience study. Please note that we have excluded any members that were eligible for retirement. We also show the current and proposed assumptions.

Termination

Rates (%)

Years of Service	Current Rate	Actual Rate from Current Study (Last 3 Years)	Actual Rate from Current and Prior Studies (Last 6 Years)	Proposed Rate
Less than 1	10.00	9.25	8.53	9.25
1 – 2	5.25	1.94	3.05	4.25
2 – 3	3.75	1.52	1.98	3.25
3 – 4	3.50	2.33	3.31	3.25
4 – 5	2.50	1.94	2.45	2.25
5 – 6	2.00	1.44	1.58	1.75
6 – 7	1.50	1.44	1.29	1.50
7 – 8	1.50	1.93	2.09	1.50
8 – 9	1.50	0.80	1.56	1.50
9 – 10	1.00	1.43	1.24	1.25
10 – 11	0.75	0.40	0.75	0.75
11 – 12	0.75	1.49	1.63	0.75
12 – 13	0.75	0.81	0.91	0.75
13 – 14	0.75	0.59	0.83	0.75
14 – 15	0.75	0.59	0.53	0.75
15 – 16	0.75	0.31	1.02	0.70
16 – 17	0.75	0.91	0.99	0.70
17 – 18	0.75	0.77	0.51	0.70
18 – 19	0.75	0.13	0.34	0.70
19 – 20	0.75	0.90	0.58	0.70
20 & Over	0.50	0.49	0.41	0.50

It is important to note that not every service category has enough exposures and/or decrements such that the results in that category are statistically credible.

The actual number of terminations over the three-year period was lower than what was assumed. We also examined the prior three-year experience period and we believe that the combined average result of the two three-year experience periods provides a reasonable representation of expected future terminations over the long-term.

Based on this experience, we recommend decreasing the termination rate assumption for certain service groups while increasing the termination rate assumption for other service groups. Overall, the proposed rates represent a decrease from the current rates.

Chart 10 compares the actual to expected number of terminations over the past three years for the current and proposed assumptions.

Chart 11 compares the actual experience over the past three years with the current and proposed rates of termination by years of service. The chart also shows the actual experience based on an average of both the current and previous three-year experience periods.

Currently, termination rates are not applied for members eligible to retire, that is, we assume that members eligible to retire at termination will retire in accordance with the retirement rate assumptions rather than terminate and defer their benefit. While the actual termination experience over the three-year period shows that there are some terminations occurring for members eligible to retire, we did not find this experience sufficient to change the current assumption.

We recommend maintaining the assumption that members who are eligible to retire will elect to receive their retirement benefit in lieu of a deferred vested benefit.

The table below shows the current, actual and proposed percentages for members who would elect a refund of contributions (ordinary withdrawals) or a deferred retirement benefit (vested terminations). For Tier 1, we have also included the actual experience over the last six years.

	Tier 1 Ordinary Withdrawals				Tier 1 Vested Terminations			
Years of Service	Current Rate	Actual Rate	Actual Rate (6 years)	Proposed Rate	Current Rate	Actual Rate	Actual Rate (6 years)	Proposed Rate
Less than 1	100%	N/A	N/A	100%	0%	N/A	N/A	0%
1 – 10	30%	39%	32%	30%	70%	61%	68%	70%
10 & Over	15%	21%	17%	15%	85%	79%	83%	85%

	Tier 2 Ordinary Withdrawals			Tier 2 Vested Terminations		
Years of Service	Current Rate	Actual Rate	Proposed Rate	Current Rate	Actual Rate	Proposed Rate
Less than 5	100%	73%	80%	0%	27%	20%
5 – 10	15%	43%	25%	85%	57%	75%
10 & Over	15%	N/A	15%	85%	N/A	85%

Based on this experience, for Tier 1 members, **we recommend maintaining the current assumption of 100% ordinary withdrawals for members with less than 1 year of service, 30% ordinary withdrawals for members with more than 1 but less than 10 years of service, and 15% ordinary withdrawals for members with 10 or more years of service.** For Tier 2 members, **we recommend changing the current assumption to 80% ordinary withdrawals for members with less than 5 years of service, 25% ordinary withdrawals for members with more than 5 but less than 10 years of service, and 15% ordinary withdrawals for members with 10 or more years of service.**

Chart 10: Actual Number of Terminations Compared to Expected

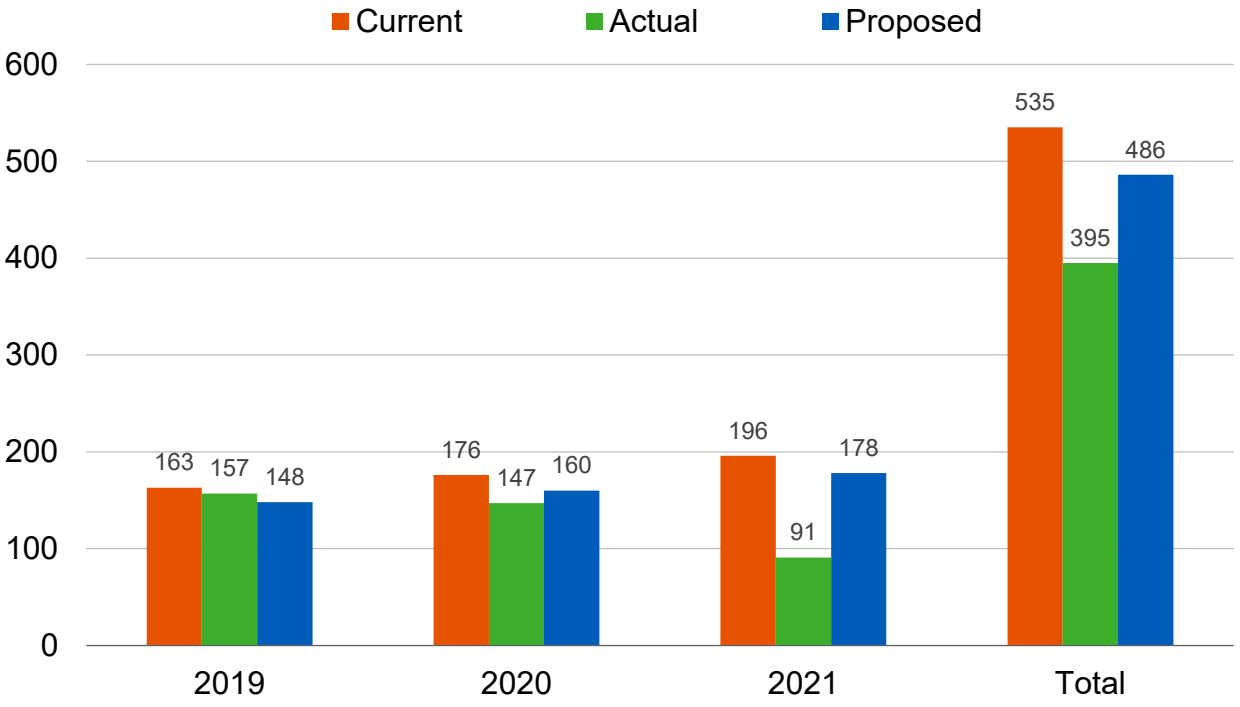
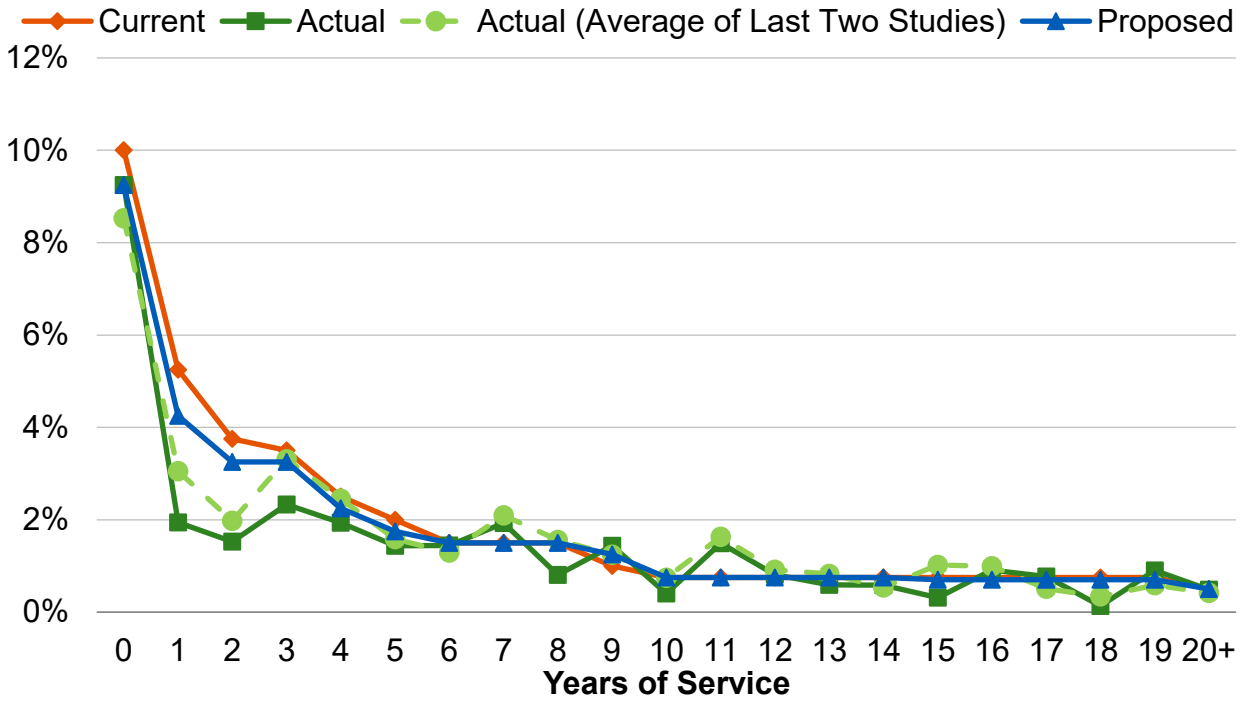


Chart 11: Termination Rates



D. Disability Incidence Rates

When a member becomes disabled, he or she may be entitled to a Permanent Total Disability benefit from the Disability Fund. In order to capture more experience, we looked at the actual incidence of permanent total disabilities over the last two three-year experience periods compared to the number expected. The following tables summarize that data:

Disability Incidence

Rates (%)

	Male		Female	
Age	Current Rate	Proposed Rate	Current Rate	Proposed Rate
20 – 24	0.000	0.000	0.000	0.000
25 – 29	0.006	0.006	0.000	0.000
30 – 34	0.012	0.012	0.018	0.018
35 – 39	0.012	0.012	0.048	0.048
40 – 44	0.024	0.024	0.084	0.084
45 – 49	0.036	0.036	0.114	0.114
50 – 54	0.084	0.084	0.150	0.150
55 – 59	0.162	0.162	0.180	0.180
60 – 64	0.300	0.300	0.000	0.210

	Actual Disabilities	Total Expected Disabilities
Six Years	43	49
Actual to Expected Ratio	**88%**	

Based on this experience, we recommend maintaining the male disability incidence rates. We recommend maintaining the female disability incidence rates through age 59, and adding disability rates for ages 60 to 64.

Chart 12 compares the actual to expected number of disabilities over the past six years for the current and proposed assumptions.

Chart 13 shows the current and proposed rates of disability incidence.

Chart 12: Actual Number of Disabilities Compared to Expected (July 1, 2015 through June 30, 2021)

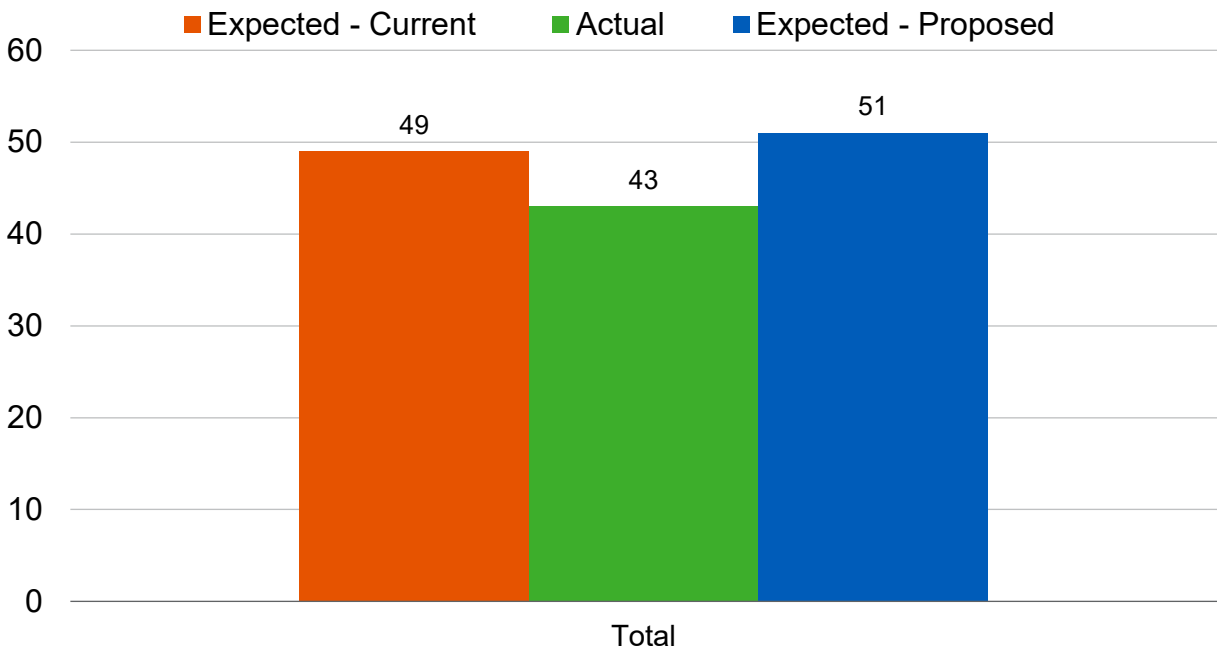
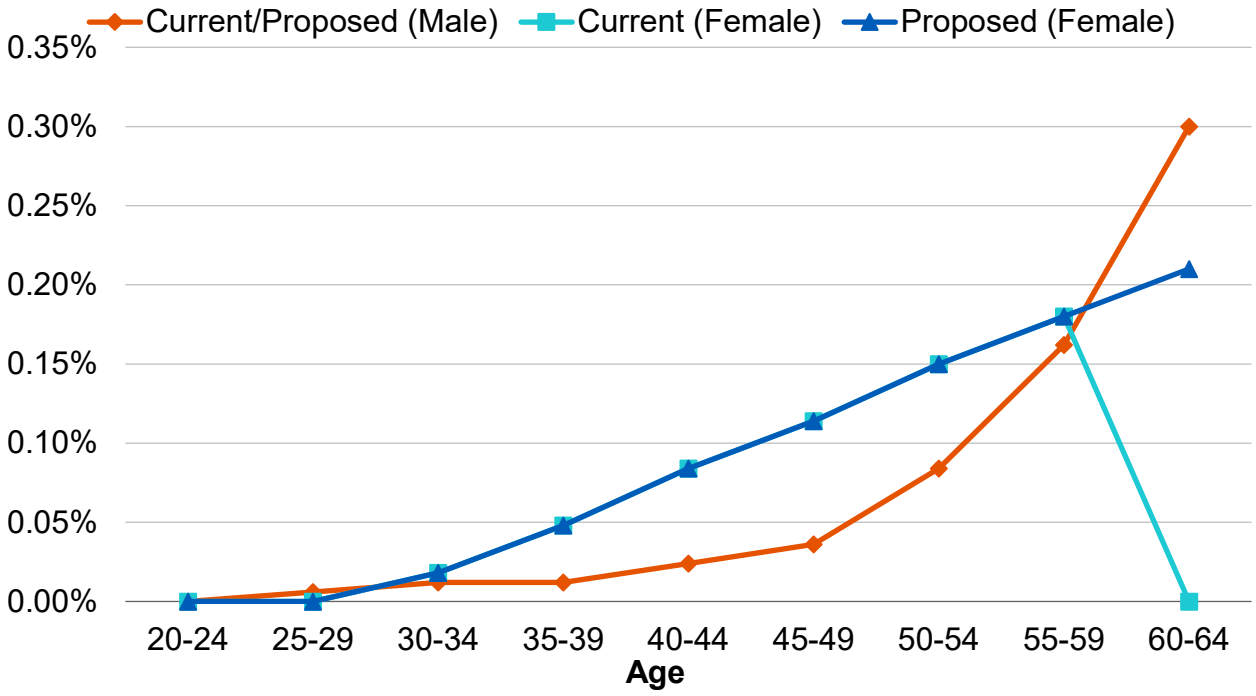


Chart 13: Disability Incidence Rates



E. Future Service Accruals

Benefits under the Retirement Plan are based on a member's total service, including any purchased service. In order to project benefits and determine the liabilities, an assumption about the amount of service earned and purchased by members each year is necessary. The current assumption is that each Tier 1 and Tier 2 active member will earn 1.00 year of service and purchase an additional 0.07 and 0.02 years of service, respectively, for each future year of employment.

The actual average annual service increase for continuing Tier 1 active members was 1.023 years over the past three years. Based on this experience, we recommend reducing the Tier 1 active member purchase of additional service from 0.07 years to 0.04 years for each future year of employment.

The actual average annual service increase for continuing Tier 2 active members was 1.021 years over the past three years. Based on this experience, we recommend maintaining the Tier 2 active member purchase of additional service at 0.02 years for each future year of employment.

5. Cost Impact

We have estimated the impact of all the recommended economic and demographic assumptions as if they were applied to the July 1, 2021 actuarial valuation. The table below shows the changes in the employer contribution rates due to the proposed assumption changes separately for the recommended economic assumption changes (as recommended in Section 3 of this report which include the recommended merit and promotion salary increases) and the recommended demographic assumption changes (as recommended in Section 4 of this report).

Cost Impact of the Recommended Assumptions Based on July 1, 2021 Actuarial Valuation

Assumption	Impact on Average Employer Contribution Rates[1]
Increase due to changes in economic assumptions	9.71%
Decrease due to changes in demographic assumptions	(2.29%)
Total increase in average employer rate	7.42%
Total estimated increase in annual dollar amount ($000s)	**$90,491**

	Impact on UAAL and Funded Percentage
Increase in UAAL ($000s)	$655,011
Change in Funded Percentage (AVA basis)	From 99.20% to 95.06%

Of the various assumption changes, the most significant rate increase is due to the change in the investment return assumption from 7.00% to 6.50%, offset somewhat by the change in the inflation assumption from 2.75% to 2.50%. Specifically, a 0.25% reduction in both the investment return assumption and the inflation assumption together with the new merit and promotion salary increase assumptions have the impact of increasing the employer contribution rates by 4.15%. A further 0.25% reduction in the investment return assumption from 6.75% to 6.50% has the impact of further increasing the employer contribution rates by 5.56%. Note these results do not reflect the cost reductions due to recommended changes in demographic assumptions shown in the table above.

Of the various demographic assumption changes, the most significant rate decrease is due to the changes in mortality assumptions which have the impact of decreasing the employer contribution rate by 1.52%.

The table below shows the changes in the funding elements due to the proposed assumption changes.

[1] Based on July 1, 2021 projected annual payroll as determined under each set of assumptions.

Cost Impact of the Recommended Assumptions
Based on July 1, 2021 Actuarial Valuation

	Current Assumptions	Recommended Assumptions	Change
All Tiers Combined (Aggregate)			
Actuarial accrued liability	$15,008,817,566	$15,663,828,918	
Actuarial value of assets	14,889,255,775	14,889,255,775	
Unfunded actuarial accrued liability (UAAL)	$119,561,791	$774,573,143	Increase of $655 Million
1. Total normal cost	22.48%	24.27%	
2. Expected member contributions	-7.58%	-7.50%	
3. Employer normal cost: (1)+(2)	14.90%	16.77%	
4. Amortization of UAAL	10.26%	15.63%	
5. Total required employer contribution: (3)+(4), with mid-year interest adjustment	26.04%	33.46%	+7.42% of pay
6. Projected compensation	$1,233,265,179	$1,230,362,275	
Tier 1			
1. Total normal cost	24.97%	26.89%	
2. Expected member contributions	-6.10%	-5.95%	
3. Employer normal cost: (1)+(2)	18.87%	20.94%	
4. Amortization of UAAL	10.26%	15.63%	
5. Total required employer contribution: (3)+(4), with mid-year interest adjustment	30.15%	37.76%	+7.61% of pay
6. Projected compensation	$747,482,480	$745,775,129	
Tier 2			
1. Total normal cost	18.64%	20.24%	
2. Expected member contributions	-9.86%	-9.88%	
3. Employer normal cost: (1)+(2)	8.78%	10.36%	
4. Amortization of UAAL	10.26%	15.63%	
5. Total required employer contribution: (3)+(4), with mid-year interest adjustment	19.72%	26.84%	+7.12% of pay
6. Projected compensation	$485,782,699	$484,587,146	

Appendix A: Current Actuarial Assumptions

Economic Assumptions

Net Investment Return:	7.00%; net of investment expenses.
Employee Contribution, Additional Annuity and Matching Account Crediting Rate:	7.00%, based on Plan provisions.
Consumer Price Index (CPI) and Cost of Living Adjustments (COLA):	Increase of 2.75% per year. Retiree COLA increases due to CPI are subject to a 3% maximum change per year for Tier 1 and 2% maximum change per year for Tier 2. For members that have COLA banks, they are reflected in projected future COLAs.
Administration Expenses:	Offset by additional employer contributions.
Increase in Internal Revenue Code Section 401(a)(17) Compensation Limit:	Increase of 2.75% per year from the valuation date.
Salary Increases:	The annual rate of compensation increase includes: inflation at 2.75%, plus "across the board" salary increases of 0.50% per year, plus the following merit and promotion increases:

	Rate (%)
Years of Service	**Rate (%)**
Less than 1	7.00
1 – 2	7.00
2 – 3	6.50
3 – 4	5.25
4 – 5	3.75
5 – 6	2.75
6 – 7	2.25
7 – 8	2.00
8 – 9	1.70
9 – 10	1.60
10 – 11	1.50
11 – 12	1.45
12 – 13	1.40
13 – 14	1.35
14 – 15	1.30
15 & Over	1.25

Demographic Assumptions

Post-Retirement Mortality Rates:	*Service Retirement and Disability Retirement* • Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females) increased by 5% for males, projected generationally with the two-dimensional mortality improvement scale MP-2018. *Beneficiaries* • Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2018. *Optional Form of Payment Amounts at Retirement and Conversion of Contribution Balance to Annuities at Retirement* • *Members*: Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table increased by 5% for males, projected generationally with the two-dimensional mortality improvement scale MP-2018 associated with a retirement year of 2022, weighted 75% male and 25% female. • *Beneficiaries*: Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table, projected generationally with the two-dimensional mortality improvement scale MP-2018 associated with a retirement year of 2022, weighted 25% male and 75% female. The Pub-2010 mortality tables and adjustments as shown above reasonably reflect the mortality experience as of the measurement date. These mortality tables were adjusted to future years using the generational projection to reflect future mortality improvement between the measurement date and those years.

Pre-Retirement Mortality Rates:

Pub-2010 General Employee Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2018.

	Rate (%)	
Age	**Male**	**Female**
25	0.024	0.008
30	0.031	0.013
35	0.041	0.021
40	0.057	0.033
45	0.085	0.051
50	0.129	0.076
55	0.190	0.112
60	0.276	0.169
65	0.405	0.270
70	0.609	0.445

5% of pre-retirement deaths are assumed to be duty related, with the remaining being non-duty related. Note that generational projections beyond the base year (2010) are not reflected in the above mortality rates.

Disability Incidence Rates:

Disability Incidence		
	Rate (%)	
Age	**Male**	**Female**
25	0.006	0.000
30	0.012	0.006
35	0.012	0.036
40	0.018	0.072
45	0.030	0.102
50	0.054	0.138
55	0.126	0.168
60	0.240	0.000

Termination Rates

Total Termination

Years of Service	Rate (%)
Less than 1	10.00
1 – 2	5.25
2 – 3	3.75
3 – 4	3.50
4 – 5	2.50
5 – 6	2.00
6 – 7	1.50
7 – 8	1.50
8 – 9	1.50
9 – 10	1.00
10 – 20	0.75
20 & over	0.50

Tier 1 Allocation of Termination Rates (%) between Ordinary Withdrawals and Vested Terminations

Years of Service	Ordinary Withdrawals	Vested Terminations
Less than 1	100	0
1 – 10	30	70
10 & Over	15	85

Tier 2 Allocation of Termination Rates (%) between Ordinary Withdrawals and Vested Terminations

Years of Service	Ordinary Withdrawals	Vested Terminations
Less than 5	100	0
5 & Over	15	85

Ordinary withdrawals are assumed to receive their account balance at termination. Vested terminations are assumed to receive a deferred retirement benefit. No termination is assumed after a member is first eligible to retire.

Retirement Rates:

Age	Retirement Rates (%)			
	Tier 1		Tier 2	
	Under 30 Years of Service	30 or More Years of Service	Under 30 Years of Service	30 or More Years of Service
50	0.00	1.00	0.00	0.00
51	0.00	0.00	0.00	0.00
52	0.00	0.00	0.00	0.00
53	0.00	0.00	0.00	0.00
54	0.00	0.00	0.00	0.00
55	4.25	27.00	0.00	25.00
56	2.00	20.00	0.00	14.00
57	2.50	17.50	0.00	13.00
58	3.50	17.50	0.00	13.00
59	3.50	17.50	0.00	13.00
60	5.50	22.00	5.50	17.50
61	6.50	22.00	3.50	10.00
62	7.00	22.00	2.50	10.00
63	8.00	25.00	20.00	25.00
64	8.50	27.00	12.00	25.00
65	11.50	30.00	11.00	28.00
66	12.00	30.00	11.00	28.00
67	12.50	30.00	12.00	28.00
68	13.00	30.00	12.50	28.00
69	17.00	30.00	15.00	28.00
70	22.00	25.00	50.00	50.00
71	22.00	25.00	50.00	50.00
72	22.00	25.00	50.00	50.00
73	22.00	25.00	50.00	50.00
74	22.00	25.00	50.00	50.00
75 & Over	100.00	100.00	100.00	100.00

Retirement Age and Benefit for Inactive Vested Members:	For Tier 1, inactive vested members are assumed to retire at age 60 with a Money Purchase Annuity. For Tier 2, inactive vested members are assumed to retire at age 63. Tier 1 and Tier 2 members receiving Permanent Total Disability benefits are assumed to retire at the earlier of age 65 or age 55 with 30 years of service.
Definition of Active Members:	First day of biweekly payroll following employment.
Unknown Data for Members:	Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.
Form of Payment:	All active and inactive members are assumed to elect the unmodified option at retirement.
Percent Married/ Domestic Partner:	85% of male members and 60% of female members are assumed to have an eligible spouse or domestic partner at pre-retirement death or retirement. The assumption is also applied for current retirees retired before April 1, 2012 with Options Full, A, B, or C since they are missing this data. Spousal gender is assumed to be opposite that of the member.
Age of Spouse:	Male retirees are assumed to be 3 years older than their spouses, and female retirees are assumed to be 2 years younger than their spouses.
Future Benefit Accruals:	1.0 year of service per year.
Additional Service Accrual:	Tier 1 members are assumed to purchase an additional 0.07 years of service per year. Tier 2 members are assumed to purchase an additional 0.02 years of service per year. These service purchases exclude those priced at full actuarial cost. The valuation reflects expected future member contributions that are associated with these assumed service purchases.

Appendix B: Proposed Actuarial Assumptions

Economic Assumptions

Net Investment Return:	6.50%; net of investment expenses.
Employee Contribution, Additional Annuity and Matching Account Crediting Rate:	7.00%, based on Plan provisions.
Consumer Price Index (CPI) and Cost of Living Adjustments (COLA):	CPI Increase of 2.50% per year. Retiree COLA increases of 2.75% per year for Tier 1 and 2% per year for Tier 2. For members that have COLA banks, they are reflected in projected future COLAs.
Administration Expenses:	Offset by additional employer contributions.
Increase in Internal Revenue Code Section 401(a)(17) Compensation Limit:	Increase of 2.50% per year from the valuation date.
Salary Increases:	The annual rate of compensation increase includes: inflation at 2.50%, plus "across the board" salary increases of 0.50% per year, plus the following merit and promotion increases:

	Rate (%)
Years of Service	**Rate (%)**
Less than 1	7.00
1 – 2	7.00
2 – 3	6.50
3 – 4	5.00
4 – 5	3.75
5 – 6	2.75
6 – 7	2.25
7 – 8	2.00
8 – 9	1.90
9 – 10	1.80
10 – 11	1.70
11 – 12	1.45
12 – 13	1.40
13 – 14	1.35
14 – 15	1.30
15 – 16	1.30
16 – 17	1.30
17 & Over	1.25

Demographic Assumptions

Post-Retirement Mortality Rates:	*Service Retirement, Disability Retirement, and Beneficiaries not Currently in Pay Status* • Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females) increased by 5% for males, projected generationally with the two-dimensional mortality improvement scale MP-2021. *Beneficiaries in Pay Status* • Pub-2010 Contingent Survivor Amount-Weighted Above-Median Mortality Table (separate tables for males and females) increased by 5% for females, projected generationally with the two-dimensional mortality improvement scale MP-2021. *Optional Form of Payment Amounts at Retirement and Conversion of Contribution Balance to Annuities at Retirement* • Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table increased by 5% for males, projected generationally with the two-dimensional mortality improvement scale MP-2021 associated with a retirement year of 2025, weighted 75% male and 25% female for members and weighted 25% male and 75% female for beneficiaries. The Pub-2010 mortality tables and adjustments as shown above reasonably reflect the mortality experience as of the measurement date. These mortality tables were adjusted to future years using the generational projection to reflect future mortality improvement between the measurement date and those years.

Pre-Retirement Mortality Rates:

Pub-2010 General Employee Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2021.

	Rate (%)	
Age	**Male**	**Female**
25	0.024	0.008
30	0.031	0.013
35	0.041	0.021
40	0.057	0.033
45	0.085	0.051
50	0.129	0.076
55	0.190	0.112
60	0.276	0.169
65	0.405	0.270
70	0.609	0.445

5% of pre-retirement deaths are assumed to be duty related, with the remaining being non-duty related. Note that generational projections beyond the base year (2010) are not reflected in the above mortality rates.

Disability Incidence Rates:

Disability Incidence		
	Rate (%)	
Age	**Male**	**Female**
25	0.006	0.000
30	0.012	0.006
35	0.012	0.036
40	0.018	0.072
45	0.030	0.102
50	0.054	0.138
55	0.126	0.168
60	0.240	0.202

Termination Rates

Total Termination

Years of Service	Rate (%)
Less than 1	9.25
1 – 2	4.25
2 – 3	3.25
3 – 4	3.25
4 – 5	2.25
5 – 6	1.75
6 – 7	1.50
7 – 8	1.50
8 – 9	1.50
9 – 10	1.25
10 – 15	0.75
15 – 20	0.70
20 & over	0.50

Tier 1 Allocation of Termination Rates (%) between Ordinary Withdrawals and Vested Terminations

Years of Service	Ordinary Withdrawals	Vested Terminations
Less than 1	100	0
1 – 10	30	70
10 & Over	15	85

Tier 2 Allocation of Termination Rates (%) between Ordinary Withdrawals and Vested Terminations

Years of Service	Ordinary Withdrawals	Vested Terminations
Less than 5	80	20
5 – 10	25	75
10 & Over	15	85

Ordinary withdrawals are assumed to receive their account balance at termination. Vested terminations are assumed to receive a deferred retirement benefit. No termination is assumed after a member is first eligible to retire.

Retirement Rates:

Age	Retirement Rates (%)			
	Tier 1		Tier 2	
	Under 30 Years of Service	30 or More Years of Service	Under 30 Years of Service	30 or More Years of Service
50	0.00	1.50	0.00	0.00
51	0.00	1.00	0.00	0.00
52	0.00	0.00	0.00	0.00
53	0.00	0.00	0.00	0.00
54	0.00	0.00	0.00	0.00
55	4.50	30.00	0.00	26.00
56	2.50	20.00	0.00	14.00
57	3.00	18.00	0.00	13.50
58	3.50	18.00	0.00	13.50
59	3.50	18.00	0.00	13.50
60	5.25	22.00	5.25	17.50
61	6.75	22.00	3.75	12.00
62	7.00	24.00	2.75	12.00
63	8.50	25.00	20.00	25.00
64	9.50	27.00	11.00	25.00
65	11.50	28.00	11.00	27.00
66	13.50	28.00	12.00	27.00
67	13.50	28.00	12.50	27.00
68	13.50	28.00	12.50	27.00
69	19.00	30.00	16.50	28.00
70	22.00	30.00	40.00	40.00
71	22.00	30.00	40.00	40.00
72	22.00	30.00	40.00	40.00
73	22.00	30.00	40.00	40.00
74	22.00	30.00	40.00	40.00
75 & Over	100.00	100.00	100.00	100.00

Retirement Age and Benefit for Inactive Vested Members:	For Tier 1, inactive vested members are assumed to retire at age 60 with a Money Purchase Annuity. For Tier 2, inactive vested members are assumed to retire at age 63. Tier 1 and Tier 2 members receiving Permanent Total Disability benefits are assumed to retire at the earlier of age 65 or age 55 with 30 years of service.
Definition of Active Members:	First day of biweekly payroll following employment.
Unknown Data for Members:	Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.
Form of Payment:	All active and inactive members are assumed to elect the unmodified option at retirement.
Percent Married/ Domestic Partner:	80% of male members and 55% of female members are assumed to have an eligible spouse or domestic partner at pre-retirement death or retirement. The assumption is also applied for current retirees retired before April 1, 2012 with Options Full, A, B, or C since they are missing this data. Spousal gender is assumed to be opposite that of the member.
Age of Spouse:	Male retirees are assumed to be 3 years older than their spouses, and female retirees are assumed to be 2 years younger than their spouses.
Future Benefit Accruals:	1.0 year of service per year.
Additional Service Accrual:	Tier 1 members are assumed to purchase an additional 0.04 years of service per year. Tier 2 members are assumed to purchase an additional 0.02 years of service per year. These service purchases exclude those priced at full actuarial cost. The valuation reflects expected future member contributions that are associated with these assumed service purchases.

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