Segal Consulting

City of Fresno Retirement Systems

ACTUARIAL EXPERIENCE STUDY

Review of Economic Actuarial Assumptions for the June 30, 2019 Actuarial Valuation

Segal Consulting

180 Howard Street Suite 1100 San Francisco, CA 94105-6147
T 415.263.8200 www.segalco.com

May 22, 2019

Boards of Retirement
City of Fresno Retirement Systems
2828 Fresno Street, Suite 201
Fresno, CA 93721-1327

Re: Review of Economic Actuarial Assumptions for the June 30, 2019 Actuarial Valuation

Dear Members of the Boards:

We are pleased to submit this report of our review of the economic actuarial experience for use in the City of Fresno Retirement Systems' June 30, 2019 actuarial valuation. This report includes our recommendations and the analysis supporting their development.

We have also reviewed the demographic "non-economic" actuarial experience for the three-year period from July 1, 2015 to June 30, 2018 for use in the June 30, 2019 actuarial valuations. The non-economic actuarial assumptions we recommend are provided in a separate report for each of the two systems.

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

Andy Yeung, ASA, MAAA, FCA, EA
Vice President and Actuary

JB/jl

5578999v2/09313.119

Table of Contents

Actuarial Experience Study
Analysis of Actuarial Experience
During the Period July 1, 2015 through June 30, 2018

I. Introduction, Summary, and Recommendations

To project the cost and liabilities of the pension 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. Changing assumptions reflects a basic change in thinking about the future, and it 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 actuarial assumptions. The study was performed in accordance with Actuarial Standard of Practice (ASOP) No. 27 "Selection of Economic Assumptions for Measuring Pension Obligations." This Standard of Practice puts forth guidelines for the selection of the economic actuarial assumptions utilized in a pension plan actuarial valuation.

The last full review of the economic assumptions was as of June 30, 2016.

We are recommending changes in the inflation and "across the board" salary increase assumptions. An alternative investment return assumption is also discussed. Our recommendations for the economic actuarial assumptions for the June 30, 2019 Actuarial Valuation are as follows:

Pg #	Actuarial Assumption Categories	Recommendation
4	**Inflation:** Future increases in the Consumer Price Index (CPI) which drives investment returns, cost-of-living-adjustments for retirees and active member salary increases.	Reduce the inflation assumption from 3.00% to 2.75% per annum as discussed in Section (III)(A).
6	**Investment Return:** The estimated average net rate of return on current and future assets of the Systems of the valuation date. This rate is used to discount liabilities.	Recommend lowering the investment return assumption to 7.00% per annum as discussed in Section (III)(B). An alternative of 7.25% per annum is also discussed.
15	**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 promotional increases	Reduce the current inflationary salary increase assumption from 3.00% to 2.75% 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 3.50% to 3.25%. The review of the merit and promotional increase component of the salary increase assumption will be provided as part of our triennial experience study of non-economic assumptions, along with the other recommended non-economic assumptions for the June 30, 2019 valuation.

Section II provides some background on the basic principles and methodology used for the review of the economic actuarial assumptions. A detailed discussion of each assumption and reasons for the proposed changes are found in Section III.

The cost impact of these recommended economic assumptions will be included in our separate analysis of the "non-economic" assumptions for the June 30, 2019 valuations.

II. Background and Methodology

For this study, we analyzed the "economic" assumptions only. Our analysis of the demographic ("non-economic") assumptions for the June 30, 2019 valuations are provided in separate reports. The primary economic assumptions are inflation, investment return and salary increases.

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.

- **Investment Return:** Expected long-term rate of return on the Systems' investments after 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 promotional increases. Payments to amortize any Unfunded Actuarial Accrued Liability (UAAL) are assumed to increase each year by the price inflation rate plus any "across the board" real pay increases that are assumed.

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

III. 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 primarily historical information. Following is an analysis of 15 and 30 year moving averages of historical inflation rates:

HISTORICAL CONSUMER PRICE INDEX – 1930 TO 2018[1]
(U.S. City Average - All Urban Consumers)

	25th Percentile	Median	75th Percentile
15-year moving averages	2.4%	3.3%	4.5%
30-year moving averages	2.9%	3.8%	4.8%

The average inflation rates have continued to decline gradually over the last several years due to the relatively low inflationary period over the past two decades. Also, the later of the 15-year averages during the period are lower as they do not include the high inflation years of the mid-1970s and early 1980s.

Based on information found in the Public Plans Data website, which is produced in partnership with the National Association of State Retirement Administrators (NASRA), the median inflation assumption used by 178 large public retirement funds[2] in their 2017 fiscal year valuations was 2.75%. In California, CalSTRS and ten other 1937 Act CERL systems use an inflation assumption of 2.75%, one other 1937 Act CERL system uses an inflation assumption of 2.90% and two 1937 Act CERL systems use an inflation assumption of 2.50%. CalPERS recently lowered their inflation assumption from 2.75% to 2.50% over a 3-year period. Seven other 1937 Act CERL systems use an inflation assumption of 3.00%.

The Systems' investment consultant, NEPC, anticipates an annual inflation rate of 2.75% over a 30-year horizon, while the average inflation assumption provided by NEPC and six other investment advisory firms retained by Segal's California public sector clients was 2.35%. Note that, in general, investment consultants use a time horizon[3] for this assumption that is shorter than the time horizon of the actuarial valuation.

---

1 Source: Bureau of Labor Statistics – Based on CPI for All items in U.S. city average, all urban consumers, not seasonally adjusted (Series Id: CUUR0000SA0)

2 Among 178 large public retirement funds in the public retirement funds in the survey data, the inflation assumption was not available for 32 of the funds.

3 The time horizon used by the seven investment consultants included in our review generally ranges from 10 years to 30 years and NEPC uses both 5-7 year and 30-year horizons.

To find a forecast of inflation based on a longer time horizon, we referred to the 2018 report on the financial status of the Social Security program.[4] 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 2.60%. Besides projecting the results under the intermediate cost assumptions using an inflation assumption of 2.60%, alternative projections were also made using a lower and a higher inflation assumption of 2.00% and 3.20%, respectively.

We also compared the yields on the thirty-year inflation indexed U.S. Treasury bonds to comparable traditional U.S. Treasury bonds.[5] As of January 2019, the difference in yields is about 1.85%, which provides a measure of market expectations of inflation.

Based on all of the above information, we recommend that the current 3.00% annual inflation assumption be reduced to 2.75% for the June 30, 2019 actuarial valuation.

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 these metrics, since 2018 we have been recommending the same 2.75% inflation assumption in our experience studies for our California based public retirement system clients.

Retiree Cost of Living Increases

The retiree cost-of-living adjustments assumed in the prior valuations were 3.00% for the Employees System; and 3.50% and 3.00% for Tier 1 and Tier 2 employees, respectively, in the Fire and Police System.

Consistent with our 2.75% inflation assumption, we recommend a 2.75% COLA assumption for the Employees System and the Tier 2 Fire and Police System. As the Tier 1 Fire and Police System has a "pay" based COLA, we recommend a 3.25% COLA assumption consistent with the total of the recommended price inflation assumption plus the "across the board" real pay increase assumption of 0.50% detailed later in this report.

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.

[4] Source: Social Security Administration – The 2018 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds

[5] Source: Board of Governors of the Federal Reserve System

- 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 2.75% 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, we continue to recommend setting the COLA assumptions based on the lesser of the plan specific COLA and the long-term annual inflation assumption, as we have in prior years. (As discussed earlier, for the Tier 1 Fire and Police System we have also included an additional 0.50% "across the board" real pay increase assumption on top of the long-term annual inflation assumption to reflect the "pay" base COLA.)

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. Theory has it that as an investor takes a greater investment risk, the return on the investment is expected to also be greater, at least in the long run. This additional 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 the Systems' portfolio will vary with the Boards' asset allocation among asset classes.

The following is the Systems' current target asset allocation and the assumed real rate of return assumptions by asset class. The first column of real rate of return assumptions are determined by reducing NEPC's total or "nominal" 2019 return assumptions over a 30-year horizon by their assumed 2.75% inflation rate. The second column of returns (except for Private Debt/Direct Lending, Midstream Energy, and Private Real Assets - Infrastructure/Land) 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 NEPC and six other investment advisory firms retained by Segal's public sector clients. We believe these averages are a reasonable consensus forecast of long-term future market returns in excess of inflation.

THE SYSTEMS' TARGET ASSET ALLOCATION AND ASSUMED ARITHMETIC REAL RATE OF RETURN ASSUMPTIONS BY ASSET CLASS AND FOR THE PORTFOLIO

Asset Class	Percentage of Portfolio	NEPC's Assumed Real Rate of Return[6]	Average Assumed Real Rate of Return from a Sample of Consultants to Segal's California Public Sector Clients[7]
Large Cap U.S. Equity	15.80%	5.94%	5.44%
Small/Mid Cap U.S. Equity	7.20%	6.72%	6.18%
Developed International Equity	19.00%	6.81%	6.54%
Emerging Market Equity	6.00%	9.72%	8.73%
Private Equity	5.00%	10.81%	9.27%
Core Bonds	10.00%	1.79%	1.42%
High Yield Bonds	5.00%	4.45%	3.64%
Private Debt/Direct Lending	8.00%	5.54%	5.54%*
Midstream Energy	5.00%	6.24%	6.24%*
Real Estate[8]	15.00%	4.66%	4.60%
Private Real Assets - Infrastructure/Land	4.00%	4.89%	4.89%*
Total	**100.00%**	**5.89%**	**5.50%**

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 3.6.3.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 believes, based on relevant supporting data, that such superior or inferior returns represent a reasonable expectation over the measurement period."

* *For these asset classes, NEPC's assumptions are applied in lieu of the average because there is a larger disparity in returns for these asset classes among the firms survey and using NEPC's assumptions should more closely reflect the underlying investments made specifically for the Systems.*

---

6 Derived by reducing NEPC's nominal return assumptions by their 2.75% inflation assumption over a 30-year horizon.

7 These are based on the projected arithmetic returns provided by NEPC and six other investment advisory firms serving the City county retirement systems of Fresno and 16 other city and county retirement systems in California. These return assumptions are gross of any applicable investment expenses.

8 The allocation of 15% Real Estate includes 11% Core Real Estate and 4% Non-Core Real Estate.

The following are some observations about the returns provided above:

1. The investment consultants to our California public sector clients 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 shorter than the durations of a retirement plan's liabilities.

2. Using a sample average of expected real rate of returns allows the Systems' 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 5.50% portfolio real rate of return be used to determine the Systems' investment return assumption. This is 0.23% higher than the return that was used three years ago in the review of the recommended investment return assumption for the June 30, 2016 valuation. The difference is due to changes in the Systems' target asset allocation (0.33%) and changes in the real rate of return assumptions provided to us by the investment advisory firms (-0.10%).

Systems' Expenses

For funding purposes (and for financial reporting), the real rate of return assumption for the portfolio needs to be adjusted for investment expenses to be paid from investment income. Current practice for the Systems also adjusts for expected administrative expenses. The following table provides these expenses in relation to the actuarial value of assets for the five years ending June 30, 2018.

CITY OF FRESNO EMPLOYEES RETIREMENT SYSTEM ADMINISTRATIVE AND INVESTMENT EXPENSES AS A PERCENTAGE OF ACTUARIAL VALUE OF ASSETS (Dollars in 000's)

Year Ending June 30	Actuarial Value of Assets[9]	Administrative Expenses	Investment Expenses[10]	Administrative %	Investment %	Total %
2014	$933,722	$1,086	$5,203	0.12	0.56	0.68
2015	993,540	1,071	5,442	0.11	0.55	0.66
2016	1,049,093	1,346	5,666	0.13	0.54	0.67
2017	1,087,125	1,387	7,150	0.13	0.66	0.79
2018	1,145,061	1,619	8,452	0.14	0.74	0.88
Five-Year Average				**0.13**	**0.61**	**0.74**
Recommendation				**0.12**	**0.63**	**0.75**

CITY OF FRESNO FIRE & POLICE RETIREMENT SYSTEM ADMINISTRATIVE AND INVESTMENT EXPENSES AS A PERCENTAGE OF ACTUARIAL VALUE OF ASSETS (Dollars in 000's)

Year Ending June 30	Actuarial Value of Assets[9]	Administrative Expenses	Investment Expenses[10]	Administrative %	Investment %	Total %
2014	$1,061,399	$1,119	$6,084	0.11	0.57	0.68
2015	1,142,649	1,108	6,396	0.10	0.56	0.66
2016	1,220,269	1,397	6,687	0.11	0.55	0.66
2017	1,276,604	1,500	8,471	0.12	0.66	0.78
2018	1,354,974	1,710	10,021	0.13	0.74	0.87
Five-Year Average				**0.11**	**0.62**	**0.73**
Recommendation				**0.12**	**0.63**	**0.75**

[9] As of beginning of plan year.

[10] Net of securities lending expenses. Because we do not assume any additional net return for this program, we effectively assume that any securities lending expenses will be offset by related income.

The average expense percentage over the most recent five-year period for the two Systems combined is 0.73%. However, the combined expense percentage was 0.78% and 0.87% for June 30, 2017 and 2018, respectively. According to the Systems, the main driver of the increase in investment expenses was (based on experience from the last year) due to higher private market manager expenses for direct lending and value added real estate. Of the combined $18.5 million in investment expenses and fees paid in fiscal year ending June 30, 2018, the Systems' identified that about $6.4 million (or about 0.26% of plan assets) was associated with these 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. However, we did observe the following from the Investment Report provided by NEPC dated November 15, 2018 for the fiscal year ended June 30, 2018:

Data as of 6/30/2018	1 Yrs(%)	3 Yrs(%)	10 Yrs(%)	15 Yrs(%)
Systems' Total Return (Gross of Fees)	8.9	8.0	7.1	8.1
Systems' Total Return (Net of Fees)	8.5	7.6	6.7	7.6
Weighted Benchmark	8.5	7.5	6.9	7.8

As shown above, the Systems' total investment performance net of fees has been mostly in line with the weighted benchmark.

As cited in our analysis of the Systems' real rate of investment return, according to Section 3.6.3.d of ASOP No. 27 the effect of an active investment management strategy "should not assume that superior or inferior returns will be achieved, net of investment expenses…unless the actuary believes, based on relevant data, that such superior or inferior returns represent a reasonable expectation over the measurement period."

For this study, we have continued to use the current approach that any "alpha" that may be identified, including any alpha to cover investment expenses, 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).

Based on the experience from the last two years, and with consideration of the above, we have increased the future expense assumption from 0.65% to 0.75%. This assumption will be re-examined in subsequent assumption reviews as new data becomes available.

Risk Adjustment

The real rate of return assumption for the portfolio is adjusted to reflect the potential risk of shortfalls in the return assumptions. The Systems' 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.

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.[11] This is consistent with our experience that retirement plan fiduciaries would generally prefer that returns exceed the assumed rate more often than not.

The 5.50% 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.[12] 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 generally in the range of 50% to 55%.

Three years ago, the Boards adopted an investment return assumption of 7.25%. That return implied a risk adjustment of 0.37%, reflecting a confidence level of 54% 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.[13]

If we use the same 54% confidence level from our last study to set this year's risk adjustment, based on the current long-term portfolio standard deviation of 12.74% provided by NEPC, the corresponding risk adjustment would be 0.36%. Together with the other investment return components, this would result in an investment return assumption of 7.14%, which is 0.11% lower than the current assumption of 7.25%.

Based on the general practice of using one-quarter percentage point increments for economic assumptions, we evaluated the effect on the confidence level of two investment return assumptions. In particular, we recommend lowering the current net investment return assumption of 7.25% to 7.00%, which would have a risk adjustment of 0.50% and corresponds to a confidence level of 56%. Alternatively, maintaining the net investment return assumption at 7.25%, together with the other investment return components, would produce a risk adjustment of 0.25% and corresponds to a confidence level of 53%.

The table below shows the Systems' recommended investment return assumption, the risk adjustment and confidence level compared to the historical values for prior studies.

[11] This type of risk adjustment is sometimes referred to as a "margin for adverse deviation."

[12] 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.

[13] Based on an annual portfolio return standard deviation of 13.00% provided by NEPC. 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

Year Ending June 30	Investment Return	Risk Adjustment	Corresponding Confidence Level
2007	8.25%	0.34%	55%
2010	8.00%	0.19%	53%
2013	7.50%	0.07%	51%
2016	7.25%	0.37%	54%
2019 Recommended	7.00%	0.50%	56%
2019 Alternative	7.25%	0.25%	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 the Systems' have positioned themselves relative to risk over periods of time.[14] The use of expected returns with either a 56% or 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 NEPC. 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 56% is still consistent with the range of about 50% to 55% 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 only enough alpha to cover its related expenses, there would be some reduction to the 0.63% investment expenses used under our model. In particular, if active management generated enough return to cover the 0.10% increase in assumed investment expenses, the confidence level associated with the 7.25% (alternative) assumption would increase from 53% to 54%.
- 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".

[14] 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."

Taking into account the factors above, we recommend the Boards lower the 7.25% assumption to 7.00% that implies a 0.50% risk adjustment, reflecting a confidence level of 56%. Alternatively, maintaining the assumption at 7.25% would imply a 0.25% risk adjustment, reflecting a confidence level of 53%.

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.

	June 30, 2016	June 30, 2019	
Assumption Component	**Adopted**	**Recommended**	**Alternative**
Inflation	3.00%	2.75%	2.75%
Plus Portfolio Real Rate of Return	5.27%	5.50%	5.50%
Minus Expense Adjustment	(0.65%)	(0.75%)	(0.75%)
Minus Risk Adjustment	(0.37%)	(0.50%)	(0.25%)
Total	**7.25%**	**7.00%**	**7.25%**
Confidence Level	**54%**	**56%**	**53%**

Based on this analysis, we recommend that the investment return assumption be lowered to 7.00% per annum. In effect, this recommendation uses the increase in the portfolio real rate of return to increase the risk adjustment and confidence level, rather than increasing the net real return from 4.25% (i.e., 7.25% - 3.00%) to 4.50% (7.25% - 2.75%).

Comparison with Alternative Model used to Review Investment Return Assumption

Since our appointment as actuary for the Systems in 2006, 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.[15] 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.[16] 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

[15] Again, as discussed in footnote 12, 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.

[16] 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 asset value that generally converges to the median accumulated value as the time horizon lengthens assuming all actuarial assumptions are met in the future.

to those adopted by the Boards for the Systems. This is because under the model used by those retirement systems, their investment return assumptions are not reduced to anticipate future investment expenses.[17]

For comparison, we evaluated both the 7.00% recommended and 7.25% alternative assumptions based on the expected geometric return for the entire portfolio, gross of the investment expenses under that model, over a 20-year period, there is a 57% likelihood that future average geometric returns will meet or exceed 7.00% and a 54% likelihood that future average geometric returns will meet or exceed 7.25%.[18]

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 assumption of 7.00% or lower is becoming more common among California public sector retirement systems. In particular, eleven of the County employees' retirement systems use either a 7.00% or 6.75% investment return assumption. Furthermore, the CalPERS Board approved a reduction in the earnings assumption to 7.00% and CalSTRS adopted a 7.00% earnings assumption for the 2017 valuation. With the exception of the retirement systems stated above, nearly all other public sector retirement systems in California currently are using a 7.25% earnings assumption.

The following table compares the Systems' recommended net investment return assumption against those of the 178 large public retirement funds[19] in their 2017 fiscal year valuations based on information found in the Public Plans Data website, which is produced in partnership with the NASRA:

		Public Plans Data[20]		
Assumption	**City of Fresno Retirement Systems**	**Low**	**Median**	**High**
Net Investment Return	7.00% or 7.25%	5.75%	7.50%	8.50%

The detailed data shows that more than two-thirds of the systems have an investment return assumption in the range of 6.75% to 7.50%, and a little less than one-half of those systems (or about one-third overall) have used an assumption of 7.50%. Also, about one-third of the systems have reduced their investment return assumption during the last year. State systems outside of

[17] This means that if that model were to be applied to Systems, the expected geometric return would not be adjusted for the approximately 0.75% expenses paid by the Systems.

[18] We performed this stochastic simulation using the capital market assumptions included in the 2018 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 adjusted by 0.12% for administrative expenses, standard deviations and correlation matrix that were found in the 2018 survey that included responses from 34 investment advisors.

[19] Among 178 large public retirement funds, the investment return assumption was not available for 25 of the public retirement funds in the survey data.

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

California tend to change their economic assumptions less frequently and so may lag behind emerging practices in this area.

In summary, we believe that the recommended assumption of 7.00% provides for a risk margin within the risk adjustment model and is consistent with the Systems' current practice relative to other public systems.

C. Salary Increase

Salary increases impact plan costs in two ways: (i) by increasing members' benefits (since benefits are a function of the members' highest average pay) and future normal cost collections; and (ii) by increasing total active member payroll which in turn generates lower UAAL contribution rates. These two impacts are discussed separately below.

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 are recommending that the assumed rate of inflation be reduced from 3.00% to 2.75% per annum. 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 0.3% - 0.7% 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 June 2018. 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, which 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 the Systems' active non-DROP and DROP members, the actual average inflation plus "across the board" increase (i.e., wage inflation) over the three-year period ending June 30, 2018 was 1.46% for the Employees and Fire & Police Systems members combined, which is lower than the change in CPI of 2.64% during that same period:

Valuation Date	Actual Average Increase for active non-DROP and DROP members[21]	Actual Change in CPI[22]
June 30, 2016	-0.92%	1.85%
June 30, 2017	2.21%	2.79%
June 30, 2018	3.08%	3.29%
Three-Year Average	**1.46%**	**2.64%**

Considering these factors, 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 3.50% to 3.25%.

Active Member Payroll

Projected active member payrolls are used to develop the UAAL contribution rate (if any). Future values are determined as a product of the number of employees in the workforce and the average pay for all employees. The average pay for all employees increases only by inflation and real "across the board" pay increases. The merit and promotional increases are not an influence, because this average pay is not specific to an individual.

Under the Boards' current practice, the UAAL contribution rate (if any) is developed by assuming that the total payroll for all active members will increase annually over the amortization periods at the same assumed rates of inflation plus real "across the board" salary increase assumptions as are used to project the member's future benefits.

We recommend that the active member payroll increase assumption be decreased from 3.50% to 3.25% annually, consistent with the combined inflation plus real "across the board" salary increase assumptions.

[21] 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.

[22] Based on the change in 1st Semiannual CPI for the Western Region compared to the prior year.

Appendix A: Current Economic Assumptions

Economic Assumptions

Net Investment Return:	7.25%, net of administrative and investment expenses.
Employee Contribution Crediting Rate:	7.25%, assumed in the valuation
Consumer Price Index:	Increase of 3.00% per year, retiree COLA increases due to CPI are limited to maximum at 3.00% per year for Employees System members and Tier 2 Fire & Police System members. Tier 1 retiree COLA increases due to changes in average compensation or new salaries adopted are limited to maximum at 3.50% per year (equal to total wage growth composed of 3.00% CPI plus 0.50% across-the-board salary increase).
Payroll Growth:	Inflation of 3.00% per year plus “across the board” real salary increases of 0.50% per year.
Inflationary and Real “Across the Board” Salary Increases:	Inflation of 3.00% per year plus “across the board” real salary increases of 0.50% per year.

Appendix B: Proposed Economic Assumptions

Economic Assumptions

Net Investment Return:	7.00% (recommended) or 7.25% (alternative), net of administrative and investment expenses.
Employee Contribution Crediting Rate:	7.00% or 7.25%, assumed in the valuation
Consumer Price Index:	Increase of 2.75% per year, retiree COLA increases due to CPI are limited to maximum at 3.00% per year for Employees System members and Tier 2 Fire & Police System members. Tier 1 retiree COLA increases due to changes in average compensation or new salaries adopted are limited to maximum at 3.25% per year (equal to total wage growth composed of 2.75% CPI plus 0.50% across-the-board salary increase).
Payroll Growth:	Inflation of 2.75% per year plus “across the board” real salary increases of 0.50% per year.
Inflationary and Real “Across the Board” Salary Increases:	Inflation of 2.75% per year plus “across the board” real salary increases of 0.50% per year.

5578999v2/09313.119