Deloitte.

DRAFT

Retirement Plan for the Employees' Retirement Fund of the City of Dallas

Review under Texas Government Code Section 802.1012

Prepared by Deloitte Consulting LLP **April 2019**

Contents

Actuarial Opinion **3**

Executive Summary **4**

Summary of Key Findings and Recommendations **5**

Valuation Report 5

Experience Study 7

Review of Plan Provisions **8**

Review of Census Data **10**

Review of Actuarial Methods **12**

Cost Method 12

Funding Method 12

Actuarial Value of Asset Method 14

Review of Economic Assumptions **16**

Inflation 17

Payroll Growth and Wage Inflation 19

Investment Return 21

Salary Increase 25

Cost-of-Living Adjustment 26

Review of Demographic Assumptions **29**

Mortality 30

Retirement 36

Withdrawal 39

Disability 40

Marital Status 42

Age of Survivor 42

Form of Payment 43

Validation of Actuarial Valuation Results **45**

Actuarial Accrued Liability and Normal Cost 45

Actuarially Required Contribution and Actual Employer Contribution 45

Actuarial Value of Assets 46

Report Content **47**

Review of Sample Lives **49**

DRAFT

Actuarial Opinion

This report presents the results of the actuarial review of the most recently prepared actuarial valuation and experience study for the Retirement Plan for the Employees' Retirement Fund of the City of Dallas ("ERF" or "Fund" or "plan"), a plan sponsored by the City of Dallas ("City"), to satisfy the requirements of Texas Government Code Section 802.1012 ("Section 802").

Our review was based on participant data and financial information provided by the ERF and their retained actuary, Gabriel Roeder Smith & Company ("GRS" or "actuary"), and our interpretation of the applicable Actuarial Standards of Practice issued by the Actuarial Standards Board.

In our opinion, the December 31, 2017 actuarial valuation and the December 31, 2014 experience study for the ERF were performed in compliance with the applicable Actuarial Standards of Practice issued by the Actuarial Standards Board.

Future actuarial measurements may differ significantly from current measurements presented in this report due to such factors as the following: actual plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operations of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's actual future funded status); and changes in plan provisions or applicable law. Our scope did not include analyzing the potential range of such future measurements based on potential impacts of these factors; therefore we did not perform such an analysis.

The undersigned with actuarial credentials collectively meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

This report was prepared solely for the benefit and internal use of the City. This report is not intended for the benefit of any other party and may not be relied upon by any third party for any purpose, and Deloitte Consulting accepts no responsibility or liability with respect to any party other than the City.

To the best of our knowledge, no employee of the Deloitte U.S. Firms is an officer or director of the employer. In addition, we are not aware of any relationship between the Deloitte U.S. Firms and the employer that may impair or appear to impair the objectivity of the work included in this analysis.

DELOITTE CONSULTING LLP

Michael de Leon, ASA, FCA, EA, MAAA	Jeannie Chen, ASA, FCA, EA, MAAA
Managing Director	Specialist Leader

DRAFT

Executive Summary

Intent

The intent of this report is to review the December 31, 2017 actuarial valuation and the December 31, 2014 experience study reports prepared by GRS for compliance with the applicable Actuarial Standards of Practice issued by the Actuarial Standards Board, to satisfy the requirements of Texas Government Code Section 802.1012.

Process

To achieve the above-stated goals, we have reviewed both the ERF-provided and actuary-provided census data, sample life output from the actuary's valuation software, the December 31, 2017 actuarial valuation report, and the December 31, 2014 experience study report. The ERF-provided data was used by the retained actuary to develop the census data used as the basis for the actuarial valuation.

Results and Recommendations

As stated in the previous section, it is our opinion that the December 31, 2017 actuarial valuation and the December 31, 2014 experience study for the ERF were performed in compliance with the applicable Actuarial Standards of Practice issued by the Actuarial Standards Board.

The assumptions used in the December 31, 2017 actuarial valuation were updated as recommended in the experience study, and subsequent changes to certain economic assumptions recommended at December 31, 2016.

Plan provisions, methods and assumptions disclosed in the December 31, 2017 actuarial valuation report were appropriately valued based on our review of the sample life outputs.

We have noted recommendations that could provide additional detail and improve the understanding of the actuarial work performed. In addition to clarifications for certain assumptions and plan provisions being valued, we recommend providing sensitivity analysis associated with certain assumptions.

These comments are discussed further in the Summary of Key Findings section as well as the detailed sections that follow.

DRAFT

Summary of Key Findings and Recommendations

Valuation Report

We recommend the following changes be considered.

Area	Recommendations	Purpose
Plan Provisions	Disclose the Tier A early retirement adjustment table found in Section 40(A)-16 of Chapter 40A and the Tier B actuarial equivalence factors mentioned in 40(A)-16(d)	Provide additional detail on plan design
Plan Provisions	Disclose the eligibility requirements for Tier A and Tier B benefits	Provide additional detail on plan design
Plan Provisions	Enhance the summary of death benefit provisions to include the service eligibility tiers and optional forms available in each tier, according to Section 40A-21(d)-(f)	Provide additional detail on plan design
Plan Provisions	Update Tier B's maximum percentage of annual average change disclosed in item (d) from 5% to 3%	Provide additional detail on plan design
Data	Confirm the consistency between the ERF-provided data and valuation data for the beneficiary date of birth	Enhance accuracy of data
Data	Disclose judgmental data adjustments or assumptions made in the data or note that none exist, to address Section 3.4c of ASOP 23	Provide additional detail on data process for compliance with ASOP 23
Funding Method	Determine the ADC based on funding policy best practices	Provide additional detail between best practice funding policy and statutory contributions
Funding Method	Disclose the history of fully funded year	Provide additional detail on plan funding history
Assumptions	Include a statement that the retirement assumptions, and others as appropriate, are not "best estimates" and include a degree of conservatism	Provide greater understanding of the possibility that different estimates may be considered reasonable
Retirement Assumption	Provide detail on the basis for the selection of the Tier B retirement assumption	Enhance support for assumption selection

DRAFT

Area	Recommendations	Purpose
Retirement Assumption	Disclose the assumption for retirements from deferred vested status and consider studying the retirement behavior of deferred vested participants	Enhance support for assumption selection
Mortality Assumption	Revise the mortality description for disabled lives and other benefit recipients, as the actuarial report incorrectly states that the "annuitant" tables are used instead of the "combined employee and annuitant" tables	Enhance support for assumption selection
Form of Payment Assumption	Disclose the actuarial equivalence assumption	Enhance support for assumption selection
Report Content	Demonstrate the sensitivity of the discount rate assumption by providing key metrics using a discount rate 1% higher and 1% lower than the prescribed rate	Increase understanding of impact of experience deviating from expected
Report Content	Disclose 10-20 years of undiscounted cash flows	Enhance understanding of the plan's financial obligation
Report Content	Include a description of how closely current actual and target asset allocations align with the target asset allocation used to select the investment return assumption during the experience study	Improve ability to validate appropriateness of asset management policies and investment return assumption

The details supporting these findings and recommendations are included in the sections that follow.

DRAFT

Experience Study

The following are our recommendations and purpose for the recommendations to be considered in the next experience study.

Assumption	Recommendations	Purpose
Mortality	Validate the overall Actual/Expected (A/E) ratio for healthy female retirees	Support assumption selection
Mortality	Use a mortality improvement scale for each type of mortality decrement	Align assumption with industry accepted standard
Mortality	Review the appropriateness of updating the base mortality table to the Pub-2010 mortality tables	Align assumption to recently released industry accepted standard
Mortality	Consider a more recently-published mortality improvement scale	Align assumption with industry accepted standard
Mortality	Discuss the basis for the selection of the Blue-Collar adjustment, the set back/forward period, and the multiplier adjustment, including a credibility analysis	Support assumption selection
Mortality	Update the healthy retiree mortality table to be a best estimate, targeting an A/E ratio of 100%	Align assumption selection with anticipated experience
Retirement	Provide additional detail on the actual versus expected retirement assumption by age for completeness	Support assumption selection
Retirement	Consider separate assumption for the first year in which someone becomes eligible for Tier B, since the data supported such a separation for Tier A	Align assumption selection with expected behavior based on plan provisions
Withdrawal	Add a separate withdrawal assumption for Tier B employees	Align assumption selection with expected behavior based on plan provisions
Disability	Supplement historical data with industry-standard data for disability incidence for similar job types	Support assumption selection

The details supporting these findings and recommendations are included in the sections that follow.

DRAFT

Review of Plan Provisions

The plan provisions and some actuarial assumptions and methods are prescribed by the Dallas City Code Chapter 40A ("Chapter 40A"). Our review identifies the prescriptions from Chapter 40A, and compares their requirements against the provisions, assumptions, and methods valued and disclosed in the report by the retained actuary.

Comments and Recommendations

We reviewed the summary of Benefit Provisions on pages 50-52 of the valuation report and assessed the completeness of the summary provided in comparison to Chapter 40A. No benefits specified by Chapter 40A were identified as having been omitted from the valuation.

This December 31, 2017 valuation is the first valuation to include City of Dallas employees hired after December 31, 2016, who are eligible for the new tier of benefits ("Tier B"). The plan changes for "Tier B" members include, but are not limited to:

- Eligibility for unreduced retirement was pushed back to age 65 and 5 years of service or 40 years of service (previously was age 60, or age 50 with age + service greater than 78)
- Eligibility for reduced retirement was changed from age 50 with 30 years of service to any age if age + service exceeds 80
- The benefit multiplier was reduced from 2.75% to 2.50%
- The cap on the cost-of-living adjustments was changed from 5% to 3%
- The normal form of benefit was changed from a Joint and 50% Survivor Annuity with ten years guaranteed to a ten-year certain and life annuity.

We have the following recommendations to provide additional detail and improve the understanding of the valuation report's summary of benefit provisions:

Provisions	Recommendations
Early Retirement Factors	Disclose the Tier A early retirement adjustment table found in Section 40(A)-16 of Chapter 40A and the Tier B actuarial equivalence factors mentioned in 40(A)-16(d)
Eligibility	Disclose the eligibility requirements for Tier A and Tier B benefits
Death Benefits	Enhance the summary of death benefit provisions to include the service eligibility tiers and optional forms available in each tier, according to Section 40A-21(d)-(f)
Cost-of-Living Adjustments	Update Tier B's maximum percentage of annual average change disclosed in item (d) from 5% to 3%

DRAFT

Other than the recommendations above, the summary provisions do not conflict with the provisions described in the plan document, nor do they omit any plan provisions described in the plan document that could have a significant impact on plan benefits.

DRAFT

Review of Census Data

There are typical and anticipated adjustments made to census data in preparing an actuarial valuation. This section assesses the reasonableness of the retained actuary's reconciliation and data adjustment procedures, including their documentation in the valuation report. To perform this analysis, we received data files from the ERF, valuation data files from the retained actuary and sample life output from the actuary's valuation software. The ERF-provided data was used by the retained actuary to develop the census data used as the basis for the actuarial valuation.

Applicable ASOPs

Actuarial Standard of Practice No. 23, *Data Quality*, provides general guidance for determining if data is appropriate for its intended purpose and whether it is sufficiently reasonable, consistent, and comprehensive. Section 3.1 of the ASOP effective for the December 31, 2017 actuarial valuation report states:

> *Appropriate data that are accurate and complete may not be available. The actuary should use available data that, in the actuary's professional judgment, allow the actuary to perform the desired analysis. However, if significant data limitations are known to the actuary, the actuary should disclose those limitations and their implications.*

Section 3.5 of this Standard also addresses the actuary's responsibilities in reviewing data upon which they rely and states that in such cases:

> *… the actuary should perform a review, unless, in the actuary's professional judgment, such review is not necessary or not practical. In exercising such professional judgment, the actuary should take into account the purpose and nature of the assignment, any relevant constraints, and the extent of any known checking, verification, or audit of the data that has already been performed.*

And Section 3.4c. of this Standard states:

> *…judgmental adjustments or assumptions can be applied to the data that allow the actuary to perform the analysis. Any judgmental adjustments to data or assumptions should be disclosed…*

Comments and Recommendations

<u>Documentation of data review procedures performed by the actuary</u>

Page 2 of the letter prefacing the valuation report mentions:

> *Data on the ERF membership and information on the asset values of the Fund as of December 31, 2017. The member, annuitant and asset data used in the valuation were all prepared and furnished by ERF staff. While certain checks for reasonableness were performed, the data used was not audited.*

DRAFT

This statement appropriately addresses Section 3.5 of ASOP 23.

Data reconciliation and adjustment process performed by the actuary

We have reviewed adjustments and assumptions that the actuary deemed necessary to create a valuation database. The actuary developed a set of data questions regarding inconsistencies in participant data between multiple files or unreasonable values or movements for a particular field. We confirmed that the data answers from the City were appropriately reflected in the final valuation data.

The actuary's final valuation file is generally consistent with the data files provided by the ERF, with one exception below:

- We recommend that the actuary confirm the consistency between the ERF-provided data and valuation data for the beneficiary date of birth field for retiree records with forms of payment that continue to the survivor. There are approximately 1,500 retiree records in this category with missing beneficiary date of birth in the valuation data who have a beneficiary date of birth listed in the ERF-provided data. For valuation purposes, the assumption is applied (female spouses are three years younger than males), which will generally produce reasonable results. However, since this information is available in the ERF-provided data, the actuary should consider utilizing it in the valuation.

Additions or removals of records between the raw census file and the final valuation file appear appropriate based on our high-level review of data answers received and information in other key fields (for example, active records with a termination date were removed from the active tab).

The valuation report does not address Section 3.4c of ASOP 23, as it does not mention any judgmental adjustments or assumptions to the data (or provides a statement that no adjustments or assumptions needed to be made).

We recommend the valuation report disclose judgmental data adjustments or assumptions made in the data or note that none exist, to address Section 3.4c of ASOP 23.

Verification of Sample Life Data

For each sample life, the data used in the sample life calculation is consistent with the valuation data and the data provided by the ERF. Additional details of the sample life review can be found in the *Review of Sample Lives* section below.

DRAFT

Review of Actuarial Methods

This section determines if the actuarial cost method, funding method, and actuarial asset valuation method used by the ERF are reasonable and consistent with generally accepted actuarial practice and relevant ASOPs. It also determines if the funding method of the ERF conforms to the Pension Review Board ("PRB") Funding Guidelines effective June 30, 2017.

Cost Method

Applicable ASOPs

Actuarial Standard of Practice No. 4, *Measuring Pension Obligations*, provides guidance regarding the actuarial cost method for pension valuations. According to Section 3.13 of this ASOP, an "acceptable actuarial cost method" meets the following criteria:

- costs are allocated over the period of time that benefits are earned; and
- costs are allocated on a basis that has a logical relationship to the plan's benefit formula (compensation, service, benefit level, etc.).

Comments and Recommendations

The actuarial cost method used is Entry Age Normal (EAN) as a level percentage of pay.

Under this method, the present value of future benefits (PVFB) is determined for each employee and is then spread evenly as a level percentage of pay over each employee's career. This method therefore produces employer contributions that are level as a percentage of payroll. This method also produces an actuarial accrued liability that is generally more conservative than other cost methods.

This meets the "acceptable actuarial cost method" criteria above.

Funding Method

Applicable ASOPs

Actuarial Standard of Practice No. 4, *Measuring Pension Obligations*, provides guidance regarding the amortization/funding method for pension valuations. According to Section 3.14 of this ASOP:

> *A cost allocation procedure or contribution allocation procedure typically combines an actuarial cost method, an asset valuation method, and an amortization method to determine the plan cost or contribution for the period.*

Generally, an "acceptable contribution allocation procedure" meets the following criteria:

- In the actuary's professional judgment, the procedure is consistent with the plan accumulating adequate assets to make benefit payments when due;

- The procedure should consider relevant input received from the principal, such as a desire for stable or predictable costs or contributions, or a desire to achieve a target funding level within a specified time frame.

Additionally, the **PRB Pension Funding Guidelines** provides guidance for the determination of a plan's funding policy:

Public retirement systems should develop a funding policy, the primary objective of which is to fund the obligations over a time frame that ensures benefit security while balancing the additional, and sometimes competing, goals of intergenerational equity and a stable contribution rate.

1. *The funding of a pension plan should reflect all plan obligations and assets.*
2. *The allocation of the normal cost portion of the contributions should be level or declining as a percentage of payroll over all generations of taxpayers, and should be calculated under applicable actuarial standards.*
3. *Funding of the unfunded actuarial accrued liability should be level or declining as a percentage of payroll over the amortization period.*
4. *Actual contributions made to the plan should be sufficient to cover the normal cost and to amortize the unfunded actuarial accrued liability over as brief a period as possible, but not to exceed 30 years, with 10 - 25 years being a more the preferable target range. For plans that use multiple amortization layers, the weighted average of all amortization periods should not exceed 30 years.* Benefit increases should not be adopted if all plan changes being considered cause a material increase in the amortization period and if the resulting amortization period exceeds 25 years.*

**Plans with amortization periods that exceed 30 years as of 06/30/2017 should seek to reduce their amortization period to 30 years or less as soon as practicable, but not later than 06/30/2025.*

<u>Comments and Recommendations</u>

The funding method for the ERF is outlined on pages 17-20 of the valuation report. To summarize the method:

- The Actuarially Determined Contribution (ADC) is determined as an open 30-year amortization of Unfunded Actuarial Accrued Liability (UAAL) as a level percentage of projected payroll.

- The Actuarially Required Rate is the ADC divided by the annual payroll.

- The Current Total Obligation Rate (CTOR) is the sum of the Actuarially Required Rate and the Pension Obligation Bond Credit Rate (debt payments on pension obligation bonds divided by projected payroll).

- Depending on how the CTOR compares to the Prior Adjusted Total Obligation Rate (PATOR), the final Current Adjusted Total Obligation Rate (CATOR) is determined:

Condition	CATOR
If the absolute value of PATOR less CTOR is less than or equal to 3.00%	CATOR equals PATOR

DRAFT

If PATOR less CTOR is greater than 3.00%	CATOR equals the greater of: • The average of CTOR and PATOR • 90% of PATOR
If PATOR less CTOR is less than or equal to -3.00%	CATOR equals the lesser of: • The average of CTOR and PATOR • 110% of PATOR

- Finally, CATOR is capped at 36.00%.

While the ADC uses a 30-year amortization, the presence of the cap on the CATOR and the Pension Obligation Bond debt repayment lowers the contribution percentage towards the ERF and raises the implied amortization period. Page 13 of the valuation report states:

> *Based upon our projections, reflecting the new tier of benefits and assuming the actuarial assumptions are exactly met, the ERF is expected to be fully funded in approximately 47 years.*

As such, the ERF's statutory contributions do not meet the 4th requirement of the PRB Funding Guidelines that suggests that the amortization of the UAAL should be over a period not to exceed 30 years, preferably 10-25 years.

We recommend that the ADC be determined based on funding policy best practices, such as a shorter open amortization period, a closed amortization period, and/or layered amortization bases over periods that may vary by source of (gain)/loss. This will provide additional detail between the best practice funding policy and the statutory contributions.

We also recommend disclosing the history of fully funded year.

Actuarial Value of Asset Method

Applicable ASOPs

Actuarial Standard of Practice No. 44, *Selection and Use of Asset Valuation Methods for Pension Valuations*, governs the asset valuation method for pension valuations, which is used to develop the actuarial value of assets (AVA). In short, the Standard does not take issue with using Market Value of Assets (MVA) as a Plan's Actuarial Value of Assets (AVA).

When a plan opts to use a smoothing method, the ASOP provides that the actuary should select an asset valuation method that is designed to produce actuarial values of assets that bear a reasonable relationship to the corresponding market values. In making that determination, the Standard indicates that such a method would be likely to produce:

- AVAs that are sometimes greater than and sometimes less than the corresponding market values
- AVAs that fall within a reasonable range of market values

- Recognition of differences between a plan's AVA and MVA within a reasonable period of time

All three requirements above are considered to be met if in the actuary's professional judgment the asset valuation method:

- Produces AVAs within a sufficiently narrow range of market values; and/or
- Recognizes differences between AVA and MVA in a sufficiently short period

Comments and Recommendations

The actuarial value of assets method was changed as of December 31, 2017. The current method disclosed in the valuation report is included below:

> *The actuarial value of assets was reset to equal the market value of assets as of December 31, 2017. The method for determining the actuarial value of assets in future years is equal to the market value of assets less a five-year phase in of the excess (shortfall) between expected investment return and actual income. The actual calculation is based on the difference between actual market value and the expected actuarial value of assets each year, and recognizes the cumulative excess return (or shortfall) at a minimum rate of 20% per year. Each year a base is set up to reflect this difference. If the current year's base is of opposite sign to the deferred bases then it is offset dollar for dollar against the deferred bases. Any remaining bases are then recognized over the remaining period for the base (5 less the number of years between the base year and the valuation year). This is intended to facilitate the smoothed value of assets will converge towards the market value in a reasonable amount of time.*

The current actuarial value of asset method is consistent with the requirements of ASOP 44.

DRAFT

Review of Economic Assumptions

Actuarial calculations inherently make predictions about future events to estimate financial costs on a present value basis and to quantify and/or qualify the risks and volatility associated with the financial costs. To do so, actuaries must make best-estimate assumptions about these possible future events and establish methods for performing the calculations. Actuarial assumptions are needed to determine the value of plan obligations to its participants, and actuarial methods create a schedule for allocating costs over a participant's career. The assumptions and methods are established by adhering to best practices for determination, studying historical experience, utilizing relevant external data, and considering internal and reputable external opinions on expected future experience. Comprehensive reporting of the assumptions and methods is required under ASOPs 27, 35, and 41.

Actuarial assumptions used in the valuation of retirement benefits are generally broken into two categories: economic and demographic. This section considers only those assumptions we have categorized as economic, which include assumptions dependent on economic factors, such as the inflation rate, payroll growth rate, investment return, and salary increase rate.

This section determines if the economic assumptions are reasonable and consistent with generally accepted actuarial practice and relevant ASOPs. As a component of our review we have also reviewed the results and recommendations of the December 31, 2014 experience study, and subsequent changes to certain economic assumptions approved by the Board at December 31, 2016.

Applicable ASOPs

Actuarial Standards of Practice No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*, provides guidance to actuaries in selecting and recommending economic assumptions. ASOP No. 27 has been restated effective for any actuarial work product with a measurement date on or after September 30, 2014.

The following process is set forth by ASOP 27 in selecting an identified economic assumption:

a. Identify any components of the assumption
b. Evaluate relevant data
c. Consider factors specific to the measurement
d. Consider other general factors
e. Select a reasonable assumption

The standard also requires the actuary to review the entire assumption set upon selection of each individual assumption to validate internal consistency, and make adjustments as necessary.

The standard defines a reasonable assumption as follows:

3.6 — Selecting a Reasonable Assumption—Each economic assumption selected by the actuary should be reasonable. For this purpose, an assumption is reasonable if it has the following characteristics:

a. It is appropriate for the purpose of the measurement;
b. It reflects the actuary's professional judgment;
c. It takes into account historical and current economic data that is relevant as of the measurement date;
d. It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
e. It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed under section 3.5.1, or when alternative assumptions are used for the assessment of risk.

3.6.1 — Reasonable Assumption Based on Future Experience or Market Data—The actuary should develop a reasonable economic assumption based on the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof.

3.6.2 —Range of Reasonable Assumptions—The actuary should recognize the uncertain nature of the items for which assumptions are selected and, as a result, may consider several different assumptions reasonable for a given measurement. The actuary should also recognize that different actuaries will apply different professional judgment and may choose different reasonable assumptions. As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice.

ASOP 27 provides assumption specific guidance for each of the assumptions below. The remainder of this section of our report presents our review of selected economic assumptions to establish that the retained actuaries have followed the ASOP's general guidance and the assumption-specific guidance provided by the ASOP.

Inflation

The inflation assumption is not directly used to measure the liabilities of the plan; rather it is a component of all economic assumptions, including payroll growth, investment return, and salary increase.

Applicable ASOPs

The Actuarial Standards of Practice has brief guidance regarding inflationary data to consider, as noted below:

ASOP No. 27, *Section 3.7.1 – Data –The actuary should review appropriate inflation data. These data may include consumer price indices, the implicit price deflator, forecasts of inflation, yields on government securities of various maturities, and yields on nominal and inflation-indexed debt.*

Retained Actuary's Assumption

The ERF uses an inflation assumption of 2.75%.

Experience Study Considerations

The inflation assumption was revised as of December 31, 2016 from 3.00% (selected in the December 31, 2014 experience study) to 2.75%.

In the experience study, the retained actuary considered the average annual inflation in each of the ten consecutive five-year periods over the last fifty years:

Average Annual Inflation, CPI-U, Five Fiscal Year Averages			
1965-1969	3.38%	1990-1994	3.59%
1970-1974	6.01%	1995-1999	2.35%
1975-1979	8.09%	2000-2004	2.68%
1980-1984	7.48%	2005-2009	2.60%
1985-1989	3.66%	2010-2014	2.02%

The retained actuary also considered historical Consumer Price Index (CPI) data for various lengths of time over the past century, noting that inflation continues at relatively low levels from a historical perspective:

Average Annual Change in CPI-U, Through 2014	
Last 5 years	2.00%
Last 10 years	2.30%
Last 20 years	2.40%
Last 30 years	2.80%
Since 1913 (first available year)	3.20%

The retained actuary also considered several benchmarking sources for information on the inflation assumption used in the industry, including:

- 2014 capital market assumption sets for eight investment consulting firms: PCA, BNY Mellon, Towers Watson, Mercer, JP Morgan, Hewitt Ennis Knupp, RV Kuhns, and New England Pension Consulting (NEPC). The average assumption for inflation was 2.46%, with a range of 2.20% to 3.00%.

- The spread between 20-year non-indexed U.S. treasury bonds and 20-year inflation-indexed U.S. treasury bonds. This led to an implied 20-year inflation of 1.79% as of December 31, 2014, and 2.36% as of December 31, 2013.

- The Social Security Administration's 2014 Trustees Report, which projects a long-term annual inflation of 2.00%, 2.70%, and 3.40% in the low cost, intermediate cost, and high cost scenarios.

- The Public Funds Survey that is prepared on behalf of the National Association of State Retirement Administrators (NASRA) and the National Council on Teacher Retirement (NCTR). This report surveys about 125 plans, including all of the largest public funds. The latest survey at the time of the study showed that the median inflation rate assumed for large public retirement systems in the U.S. is 3.00%, with about 40% of the surveyed systems using 3.00% and a majority of the remaining plans using higher assumptions.

DRAFT

Ultimately, the retained actuary proposed retaining the prior assumption of 3.00% based on all of the information.

Comments and Recommendations

The experience study considered both historical and forward-looking data. To supplement the experience study analysis, which is now several years old, we considered more recent benchmarking information to validate the current inflation assumption of 2.75%. The forward-looking 30-year inflation forecasts from the Office of the Chief Actuary of the Social Security Administration provided in the 2018 OASDI Trustees Report is as follows:

Scenario	CPI
Low Cost	2.0%
Intermediate Cost	2.6%
High Cost	3.2%

Based on the historical data collected in the experience study as well as the forward-looking data considered in the experience study, the recommended inflation assumption of 3.00% is on the high-end of the range. As of December 31, 2016, the assumption was revised to 2.75%.

Based on the information above, an inflation assumption of 2.75% is reasonable.

Payroll Growth and Wage Inflation

The assumed aggregate payroll growth is used in the amortization of the unfunded actuarial accrued liability. Payroll growth is chosen using a building block approach in which the inflation assumption is added to the assumed real wage growth. Real wage growth includes wage growth due to productivity, but excludes individual compensation increases above wage growth, also called "merit" increases.

Applicable ASOPs

The section of ASOP No. 27 addressing payroll growth provides the actuary with general guidance but is far from prescriptive:

ASOP No. 27, *Section 3.11.3 — Rate of Payroll Growth—As a result of terminations and new participants, total payroll generally grows at a different rate than does a participant's salary or the average of all current participants combined. As such, when a payroll growth assumption is needed, the actuary should use an assumption that is consistent with but typically not identical to the compensation increase assumption. One approach to setting the payroll growth assumption may be to reduce the compensation increase assumption by the effect of any assumed merit increases. The actuary should apply professional judgment in determining whether, given the purpose of the measurement, the payroll growth assumption should be based on a closed or open group and, if the latter, whether the size of that group should be expected to increase, decrease, or remain constant.*

Retained Actuary's Assumption

The ERF uses a payroll growth assumption of 2.75% and a wage inflation assumption of 3.25%. Therefore, the ERF's payroll growth assumption is the same as the inflation assumption while the real wage growth assumption is 0.50%, net of the ERF's inflation assumption.

Experience Study Considerations

The retained actuary acknowledges that, in theory, the payroll growth assumption should be equal to the wage inflation assumption (3.50%). However, the retained actuary anticipates slower growth over the next fifteen years as baby boomers retire and are replaced by younger employees with lower salaries. The retained actuary also analyzed historical payroll growth from December 31, 2005 to December 31, 2014. They observed an average growth of 0.7% per year, and 2.0% per year if adjusting for population changes which is approximately equal to the actual inflation over the same timeframe, 2.31%.

The historical data suggests that a payroll growth assumption that is lower than the wage inflation assumption but equal to the inflation assumption is reasonable. Therefore, the retained actuary recommended 3.00% in the experience study. As of December 31, 2016, the wage inflation assumption was adjusted to 3.25% and payroll growth assumption was adjusted to 2.75% to be consistent with the 25 basis points decrease in the inflation assumption.

Comments and Recommendations

National real wages can be studied by reviewing increases in the historical Average Wage Index, or AWI, published by the Social Security Administration. The AWI from 1977 to 2017, is shown below. Real Payroll Growth is the AWI less the CPI-U.

Period	Years	AWI	CPI-U (US)	Real Payroll Growth
2012-2017	5	2.31%	1.02%	1.29%
2007-2017	10	1.99%	1.30%	0.69%
1997-2017	20	2.82%	2.06%	0.76%
1987-2017	30	3.24%	2.46%	0.78%
1977-2017	40	3.98%	3.37%	0.61%

Also, the Office of the Chief Actuary of the Social Security Administration provided real payroll growth forecasts for a 30-year period in the 2018 OASDI Trustees Report:

Scenario	Payroll Differential
Low Cost	1.82%
Intermediate Cost	1.20%
High Cost	0.58%

Based on the information above, as well as the retained actuary's commentary on the future outlook and historical payroll growth, the 0.50% real wage growth assumption and payroll growth assumption that is the same as the inflation assumption are reasonable.

DRAFT

Investment Return

The investment return assumption reflects anticipated returns on the plan's current and future assets. It is also used to calculate the present value of all plan liabilities and generally has the greatest impact of all assumptions reviewed in this report. The investment return assumption is chosen using a building block approach in which the inflation assumption is added to the assumed real rate of return.

Applicable ASOPs

In selecting or recommending an investment return assumption, ASOP No. 27, Section 3.8 provides actuaries with guidance. The standard recommends the actuary review the investment data as follows.

ASOP No. 27, *Section 3.8.1 — Data—The actuary should review appropriate investment data. These data may include the following:*

- *a. current yields to maturity of fixed income securities such as government securities and corporate bonds;*
- *b. forecasts of inflation, GDP growth, and total returns for each asset class;*
- *c. historical and current investment data including, but not limited to, real and nominal returns, the inflation and inflation risk components implicit in the yield of inflation-protected securities, dividend yields, earnings yields, and real estate capitalization rates; and*
- *d. historical plan performance.*

The actuary may also consider historical and current statistical data showing standard deviations, correlations, and other statistical measures related to historical or future expected returns of each asset class and to inflation. Stochastic simulation models or other analyses may be used to develop expected investment returns from this statistical data.

The standards also state the actuary may adjust or customize the data above to reflect asset allocation, investment volatility and investment manager performance among other factors, and that combining estimated components of the investment return assumption and using multiple return rates in lieu of a single rate is also acceptable.

Retained Actuary's Assumption

The ERF uses an annual rate of investment return assumption of 7.75%, which consists of a 2.75% inflation assumption and a 5.00% real rate of return assumption.

Experience Study Considerations

The investment return assumption was revised as of December 31, 2016 from 8.00% to 7.75% to be consistent with the adjustment of the inflation assumption from 3.00% to 2.75%.

In the experience study, the retained actuary considered several sources of information. First, it considered information on peers from the Public Funds Survey, where it showed that the median investment return assumption was 7.75% and close to 50% of funds had an investment return

DRAFT

assumption of 8.00% or higher. The retained actuary caveated this exhibit, acknowledging that many firms were currently in the process of revising downward their assumption, so the figures from the survey were inflated.

Secondly, the retained actuary considered the most recent 20 years of market returns for the ERF:

Year Ended December 31	Market Value Investment Return	Year Ended December 31	Market Value Investment Return
1995	20%	2005	8%
1996	14%	2006	17%
1997	20%	2007	4%
1998	17%	2008	-31%
1999	17%	2009	31%
2000	-3%	2010	16%
2001	-5%	2011	1%
2002	-10%	2012	14%
2003	27%	2013	17%
2004	16%	2014	6%

	5 Years	10 Years	20 Years
Arithmetic Return	10.80%	8.30%	9.80%
Geometric Return	10.62%	7.00%	8.80%

In addition to looking at the ERF's historical rates of return, the retained actuary considered the expected return based on the ERF's target asset allocation. Considering the ERF's target asset allocation, they used capital market assumptions published by eight independent investment consulting firms to determine the expected rate of return. They also considered the 20-year expected return from the eight sources:

DRAFT

Investment Consultant*	Investment Consultant Expected Nominal Return	Investment Consultant Inflation Assumption	Expected Real Return	Actuary Inflation Assumption	Expected Nominal Return Net of Expenses	Distribution of 20-Year Average Geometric Net Nominal Return (25th, 50th, 75th percentile)	Probability of Exceeding 8.00%
1	7.37%	3.00%	4.37%	3.00%	7.37%	4.93% / 6.70% / 8.49%	31.00%
2	7.37%	2.75%	4.62%	3.00%	7.62%	5.16% / 6.94% / 8.74%	35.00%
3	7.79%	2.50%	5.29%	3.00%	8.29%	5.14% / 7.29% / 9.49%	41.00%
4	7.65%	2.22%	5.43%	3.00%	8.43%	5.94% / 7.74% / 9.56%	46.00%
5	8.19%	2.20%	5.99%	3.00%	8.99%	5.99% / 8.07% / 10.19%	51.00%
6	8.50%	2.50%	6.00%	3.00%	9.00%	6.13% / 8.13% / 10.18%	52.00%
7	8.35%	2.25%	6.10%	3.00%	9.10%	5.85% / 8.06% / 10.31%	51.00%
8	8.44%	2.26%	6.18%	3.00%	9.18%	6.53% / 8.42% / 10.34%	56.00%
Average	**7.96%**	**2.46%**	**5.50%**	**3.00%**	**8.50%**	**5.71% / 7.67% / 9.66%**	**45.00%**

* The eight consultants were PCA, BNY Mellon, NEPC, Mercer, Towers Watson, JP Morgan, R.V. Kuhns, and Hewitt Ennis Knupp

Based on the information discussed above, the retained actuary recommended that the investment return assumption be 8.00%, net of investment expenses. This would be composed of an inflation rate of 3.00%, a real return of 5.50% (including 0.50% for active management), and a gross return of 8.50%. This would then be offset by 0.50% for investment expenses, for a nominal return assumption of 8.00%.

As of December 31, 2016, the inflation rate was decreased by 25 basis points and no other components were changed, resulting in an expected nominal return of 7.75%.

Comments and Recommendations

The retained actuary considered sufficient applicable data to make an investment return assumption recommendation. While the original assumption was determined based on an underlying inflation rate of 3.00%, the valuation report noted that the assumption was revised downward with the revised inflation assumption of 2.75%. As disclosed in the valuation report, the assumption is also based on the anticipated risk premiums for each of the portfolio's asset classes, as well as the ERF's target asset allocation.

Overall, the experience study contained sufficient information to support the selection of the assumption. The retained actuary considers other sources of information, including analysis of both historical information and future outlook. The experience study discloses the target asset allocation and integrates this into the analysis.

We have assessed the validity of the 2.75% inflation assumption above. In this section, we assessed the validity of the 5.00% real return assumption based on the provided target asset allocation. A survey released by Horizon Actuarial Services, LLC provides alternate expected returns by asset classes. The survey provides capital market assumptions specific to projections over 10 years and 20 years. The investment return assumption, as noted by the SOA's Report of the Blue Ribbon Panel on Public Pension Plan Funding, should be using rates of return that can be achieved over the next 20 to 30-year period. Therefore, we selected the 20-year time horizon for our analysis.

DRAFT

Using the survey's expected returns by asset class for the 20-year horizon, the asset allocation modeled by the retained actuary, and adjusting for inflation differences and expenses, we have the following results:

Asset Class	Target Allocation	Long-Term Expected Real Rate of Return (Horizon)[1]
Domestic Equities	15.00%	6.25%
International Equities	15.00%	6.98%
Global Equities	15.00%	6.98%
High Yield Fixed Income	15.00%	3.96%
Core Fixed Income	15.00%	2.15%
Real Estate	10.00%	5.19%
Real Assets	10.00%	3.99%
Private Equity	5.00%	9.69%
Weighted Average Real Return		**5.35%**
Weighted Average Nominal Return		**8.10%**

[1]Expected return for the 20-year time horizon for those consultants that responded to the survey, adjusted by Horizon's inflation expectation of 2.48%, as noted in Exhibit 15 of the Horizon Actuarial 2018 Survey of Capital Market Assumptions.

The expected real rate of return based on the target asset allocation is 5.35%.

While the investment return assumption was chosen using the underlying target asset allocation, we also verified if the actual asset allocation aligns with the target asset allocation. Page 21 of the valuation report discloses the actual asset allocation as of December 31, 2017:

Asset Class	Target Allocation	Actual December 31, 2017 Allocation
Index Funds[1]	10.0%	4.7%
Fixed Income[2]	30.0%	26.7%
Equities[3]	45.0%	54.1%
Real Estate[4]	10.0%	8.8%
Private Equity[5]	5.0%	5.6%

[1] Real Assets

[2] High Yield and Core

[3] Domestic, International, and Global

[4] Real Estate

[5] Private Equity

DRAFT

The actual allocation is comparable to the target allocation.

Based on the information above, the real rate of return assumption of 5.00% as well as the investment return of 7.75% are reasonable.

Salary Increase

The salary increase assumption is used to project an employee's salary from the valuation date to the assumed termination date(s). It is comprised of inflation, real wage growth and a merit scale. Inflation and real wage growth were already discussed above. This section focuses on the determination of the merit scale.

Applicable ASOPs

In selecting or recommending a total wage scale, ASOP No. 27, Section 3.10 provides actuaries with guidance. The standard recommends the actuary review the compensation data as follows.

ASOP No. 27, *Section 3.10.1— Data—The actuary should review available compensation data. These data may include the following:*

a. the plan sponsor's current compensation practice and any anticipated changes in this practice;
b. current compensation distributions by age or service;
c. historical compensation increases and practices of the plan sponsor and other plan sponsors in the same industry or geographic area; and
d. historical national wage increases and productivity growth.

The actuary should consider available plan-sponsor-specific compensation data, but the actuary should carefully weigh the credibility of these data when selecting the compensation increase assumption.

Retained Actuary's Assumption

The ERF uses the following service-based assumption for merit, promotion, and longevity increases:

Years of Service	Merit, Promotion, Longevity	Years of Service	Merit, Promotion, Longevity
0	3.00%	10	0.75%
1	3.00%	11	0.75%
2	2.75%	12	0.50%
3	2.00%	13	0.50%
4	1.50%	14	0.50%
5	1.50%	15	0.50%
6	1.50%	16	0.50%
7	1.00%	17	0.50%
8	1.00%	18	0.25%
9	0.75%	19 & Over	0.00%

DRAFT

These assumptions are combined with a flat 3.25% "general" component which is composed of inflation and real wage growth.

Experience Study Considerations

The actual salary experience was examined for a ten-year period. However, 2010-2012 was excluded from the analysis because the City experienced severe financial hardship in these years. The retained actuary believed that salary experience was considered an anomaly for these years and was not representative of the long-term projections of salaries.

The retained actuary separated the analysis into two parts – the assumption for longer-service employees and the additional increases to be applied to shorter-service employees.

The assumption for longer-service employees is equal to "wage inflation" which is composed of general inflation and real national wage growth which were discussed above. Shorter-service employees also receive merit, promotion, and longevity-based increases. The retained actuary studied the excess of salary increases above inflation from 2005 through 2015, excluding 2010, 2011, and 2012. The actual salary increases observed were significantly higher than the prior assumption, and also extended to 20 years (previously, the merit/promotion/longevity assumption stopped at ten years). The retained actuary increased the merit/promotion/longevity increase schedule between 0.25% to 0.75%.

Comments and Recommendations

The retained actuary is appropriately using the building blocks approach, with the salary assumption equal to 2.75% inflation plus 0.50% real wage growth plus a merit/promotion/longevity scale for employees with 0-20 years of service.

Page 35 of the valuation report shows the pay experience of employees who were active at the beginning and end of year. This analysis shows that actual pay is close to expected based on experience for 2015 – 2017.

Based on the information above, the salary increase assumption is reasonable.

Cost-of-Living Adjustment

The cost-of-living-adjustment (COLA) assumption is used to estimate the plan's future COLA adjustments for retirees, which are often based on an inflation index.

Applicable ASOPs

The section of ASOP No. 27 addressing COLA's provides the actuary with general guidance but is far from prescriptive:

ASOP No. 27, *Section 3.11.2 — Cost-of-Living Adjustments — Plan benefits or limits affecting plan benefits (including the Internal Revenue Code (IRC) section 401(a)(17) compensation limit and section 415(b) maximum annuity) may be automatically adjusted for inflation or assumed to be adjusted for inflation in some manner (for example, through regular plan amendments). However, for some purposes*

(such as qualified pension plan funding valuations), the actuary may be precluded by applicable laws or regulations from anticipating future plan amendments or future cost-of-living adjustments in certain IRC limits.

COLA Plan Provision

As described in Section 28 of Chapter 40A, an annual cost-of-living adjustment to the base pension benefit shall be made based on the greater of:

- The percentage of change in the price index from October of the current year over October of the previous year, up to:
    - 5% for a Tier A retiree or beneficiary; or
    - 3% for a Tier B retiree or beneficiary; or
- The percentage of annual average change in the price index for the latest 12 months available, up to:
    - 5% for a Tier A retiree or beneficiary; or
    - 3% for a Tier B retiree or beneficiary.

Retained Actuary's Assumption

Annual cost-of-living adjustments are assumed to occur on average at the rate of 2.75% per annum for Tier A members and 2.35% for Tier B members (due to the lower maximum on cost-of-living-adjustments).

Experience Study Considerations

The December 31, 2014 experience study was conducted before the plan changes as of December 31, 2016. As a result of these plan changes, members hired after December 31, 2016 are part of Tier B, which has different COLA provisions, as outlined above. The experience study's recommendations apply to Tier A participants, and the retained actuary has developed a separate assumption for Tier B participants.

The experience study does not specifically detail the COLA assumption. The COLA assumption was assumed to be 3.00%, the same as the inflation assumption. The COLA assumption was revised as of December 31, 2016 from 3.00% to 2.75% for Tier A, and was selected to be 2.35% for Tier B.

Comments and Recommendations

The ERF's COLA assumption ties to inflation, with the added complexity of a 5% maximum for Tier A and a 3% maximum for Tier B. Section 3.5.1 of ASOP 27 provides guidance on assumptions for plan provisions that are difficult to measure, such as a COLA with a maximum:

> *Depending on the purpose of the measurement, the actuary may determine that it is appropriate to adjust the economic assumptions to provide for considerations such as adverse deviation or plan provisions that are difficult to measure, as discussed in ASOP No. 4. Any such adjustment made should be disclosed in accordance with section 4.1.1.*

For Tier A, it is reasonable that the COLA assumption is the same as the inflation assumption – the maximum COLA of 5% is well above the assumed inflation of 2.75%. For Tier B, due to the lower

maximum COLA of 3%, it is reasonable that the COLA assumption is adjusted downward to 2.35% to reflect the impact of the 3% maximum, as per Section 3.5.1 of ASOP 27.

Based on the information above, the COLA assumption is reasonable.

DRAFT

Review of Demographic Assumptions

Actuarial assumptions used in the valuation of retirement benefits are generally broken into two categories: economic and demographic. This section of the report considers only those assumptions we have categorized as demographic, which include any non-economic assumption and generally include assumptions regarding how the workforce will behave.

Applicable ASOPs

Actuarial Standard of Practice No. 35, *Selection of Demographic and other Noneconomic Assumptions for Measuring Pension Obligations*, provides guidance to actuaries in selecting demographic and other assumptions not covered by ASOP No. 27. ASOP No. 35 has been restated effective for any actuarial work product with a measurement date on or after June 30, 2015. Because the assumptions resulting from this experience study will be used in actuarial valuations with measurement dates no sooner than July 1, 2015, we consider this standard applicable.

As set forth by ASOP 35, the actuary should follow the process below for selecting demographic assumptions, as applicable:

a. Identify the types of assumptions
b. Consider the relevant assumption universe
c. Consider assumption formats
d. Select the specific assumptions
e. Select a reasonable assumption

The standard defines a *reasonable* assumption as follows:

3.3.5 — Selecting a Reasonable Assumption—Each demographic assumption selected by the actuary should be reasonable. For this purpose, an assumption is reasonable if it has the following characteristics:

a. It is appropriate for the purpose of the measurement;
b. It reflects the actuary's professional judgment;
c. It takes into account historical and current demographic data that is relevant as of the measurement date;
d. It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data (if any), or a combination thereof; and
e. It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included (as discussed in section 3.10.1), and disclosed under section 4.1.1 or when alternative assumptions are used for the assessment of risk.

3.4 — Range of Reasonable Assumptions—The actuary should recognize the uncertain nature of the items for which assumptions are selected and, as a result, may consider several different assumptions equally

reasonable for a given measurement. The actuary should also recognize that different actuaries will apply different professional judgment and may choose different reasonable assumptions. As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice.

The standard also discusses consistency among selection of demographic assumptions and requires the actuary to review the combined effect of all non-prescribed assumptions selected by the actuary (both demographic assumptions selected in accordance with this standard and economic assumptions selected in accordance with ASOP No. 27).

3.7 — Consistency among Demographic Assumptions Selected by the Actuary for a Particular Measurement—With respect to any particular measurement, each demographic assumption selected by the actuary should be consistent with the other assumptions selected by the actuary unless the assumption, considered individually, is not material (see section 3.10.2). For example, if an employer's business is in decline and the effect of that decline is reflected in the turnover assumption, it should also be reflected in the retirement assumption.

ASOP 35 provides assumption specific guidance for each of the assumptions below. The remainder of this section of our report presents our review of selected demographic assumptions to establish that the retained actuaries have followed the ASOP's general guidance and the assumption-specific guidance provided by the ASOP.

Mortality

The mortality assumption is used to determine when an active employee or retired employee will become deceased.

Applicable ASOPs

ASOP No. 35, *Section 3.5.3 — Mortality and Mortality Improvement—The actuary should take into account factors such as the following in the selection of mortality and mortality improvement assumptions:*

a. the possible use of different assumptions before and after retirement (for example, in some small plan cases a reasonable model for mortality may be to assume no mortality before retirement);
b. the use of a different assumption for disabled lives, which in turn may depend on the plan's definition of disability and how it is administered; and
c. the use of different assumptions for different participant subgroups and beneficiaries.

The actuary should reflect the effect of mortality improvement both before and after the measurement date. With regard to mortality improvement, the actuary should do the following:

i. adjust mortality rates to reflect mortality improvement before the measurement date. For example, if the actuary starts with a published mortality table, the mortality rates may need to be adjusted to reflect mortality improvement from the effective date of the table to the measurement date. Such an adjustment is not necessary if, in the actuary's professional judgment, the published mortality table reflects expected mortality rates as of the measurement date.

ii. include an assumption as to expected mortality improvement after the measurement date. This assumption should be disclosed in accordance with section 4.1.1, even if the actuary concludes that an assumption of zero future improvement is reasonable as described in section 3.3.5. Note that the existence of uncertainty about the occurrence or magnitude of future mortality improvement does not by itself mean that an assumption of zero future improvement is a reasonable assumption.

Background on Recent National Mortality Studies

Base Mortality Tables

In October 2014, the Society of Actuaries ("SOA") published several reports of the Retirement Plans Experience Committee ("RPEC"). The RP-2014 Mortality Tables Report[1] reflects observed data for single-employer defined benefit pension plans covering the years 2004 – 2008 (central year, 2006). The RPEC observed that this data was relatively consistent with the data underlying the RP 2000 mortality tables (that is, from 1990 – 1994, central year 1992) adjusted for longevity improvements using MP-2014[2]. The rates in the RP-2014 tables were developed on a liability weighted basis (i.e. exposures and deaths were weighted by compensation for actives and by benefit amount for retirees).

As a supplement to the RP-2014 Mortality Tables Report, the Society of Actuaries also published the Supplement to the RP-2014 Mortality Tables Report, RPH-2014 Headcount-Weighted Tables[3]. The rates in these tables, denoted RPH-2014 (for Retirement Plans by Headcount), were calculated using the same underlying datasets and methods as those used in the development of the corresponding RP-2014 tables, but with exposures and deaths weighted by headcount rather than by amount.

As a result of comments received on the prior RP-2014 study, which included only data from private pension plans, the SOA and the RPEC initiated a mortality study of public pension plans in January 2015. The primary focus of this study was a comprehensive review of recent mortality experience of public retirement plans in the United States. The objectives of this study were the following:

1. Develop mortality tables based exclusively on public-sector pension plan experience.

2. Provide new insights into the composition of gender-specific pension mortality by factors such as job category (e.g., Teachers, Public Safety, General), salary/benefit amount, health status (i.e., healthy or disabled), geographic region and duration since event.

In October, 2018 the Pub-2010 Public Retirement Plans Mortality Tables Report[4] was published, with job category-specific mortality base tables for Teachers, Public Safety, and General populations. Additional factors were considered and subset mortality tables were released based on income

---

[1] RP-2014 Mortality Tables Report (https://www.soa.org/Files/Research/Exp-Study/research-2014-rp-report.pdf)

[2] Mortality Improvement Scale MP-2014 Report (http://www.soa.org/Research/Experience-Study/pension/research-2014-mp.aspx)

[3] Supplement to the RP-2014 Mortality Tables Report (https://www.soa.org/Files/Research/Exp-Study/research-2014-rp-supplement.pdf)

[4] Pub-2010 Public Retirement Plans Mortality Tables Report (https://www.soa.org/Files/resources/research-report/2019/pub-2010-mort-report.pdf)

level, with which they determined mortality had a strong correlation. Separate tables were also developed for contingent survivors, as their experience was determined to differ from that of other annuitants. We believe that this study is the most credible basis on which to base public sector mortality at this time.

Mortality Improvement Scale

The RPEC's Mortality Improvement Scale MP-2014 Report[5] reflects data from the Social Security Administration through 2009. As discussed in the report, the historical data was graduated and then projected from the resulting smoothed 2007 values to reach an ultimate rate of 1%[6] after 20 years (from 2007[7]). As discussed in the RPEC's Mortality Improvement Scale MP-2014 Report[8], we believe this is a reasonable ultimate rate and convergence period.

The Society of Actuaries published the MP-2015 scale of longevity improvements in October 2015, the MP-2016 scale of longevity improvements in October 2016, the MP-2017 scale of longevity improvements in October 2017, and the MP-2018 scale of longevity improvements in October 2018. The MP-2015 scale reflected two additional years of Social Security data, the MP-2016 scale reflected an additional three[9] years (beyond those reflected in MP-2015) of Social Security data, the MP-2017 scale reflected one additional year (beyond those reflected in MP-2016) of Social Security data and the MP-2018 scale reflected one additional year (beyond those reflected in MP-2017) of Social Security data.

Retained Actuary's Assumption

The following table shows the current mortality assumptions for each group of participants:

Participant Group	Assumption
Disabled Lives	RP-2000 Disabled Mortality Table for male annuitants*, set forward one year
Healthy Retirees	RP-2000 Blue Collar Healthy Mortality Table for annuitants*, with a 109% multiplier for males and a 103% multiplier for females, and fully generational mortality using improvement Scale BB.
Active Members	RP-2000 Healthy Mortality Table, set forward 4 years for males and set backward 5 years for females

*As discussed in the recommendations below, the combined (employee and annuitant) table is actually used in the valuation.

5 www.soa.org/Research/Experience-Study/pension/research-2014-mp.aspx

6 The ultimate rate is actually 1% at ages up to 85, then grading down to 0.85% at 95 and 0% at 110.

7 To avoid so-called edge effect distortions, the last two years of actual data (2008 and 2009) were replaced with the first two years of smoothed data.

8 www.soa.org/Research/Experience-Study/pension/research-2014-mp.aspx

9 SSA published data was used for 2012 and 2013, while preliminary data was used for 2014.

Experience Study Considerations

The actual mortality experience was examined for disabled lives, healthy retirees, and active members, separately for males and females. The following tables contains the results of the ERF's experience over the study period including the ratio of actual deaths to expected deaths (based on the prior assumption).

Healthy Retirees

Summary of Healthy Retirement Mortality for Males – 2010 to 2015					
		Expected Deaths		Ratio A/E	
Age	Actual Deaths	Prior Assumption	Current Assumption	Prior Assumption	Current Assumption
50-54	3.0	2.8	2.7	106%	109%
55-59	23.0	12.5	12.3	184%	186%
60-64	56.0	42.1	40.3	133%	139%
65-69	63.0	61.4	58.2	103%	108%
70-74	51.0	73.3	67.7	70%	75%
75-79	84.0	88.4	76.9	95%	109%
80-84	91.0	105.7	87.0	86%	105%
85-89	76.0	95.1	76.5	80%	99%
90 and over	59.0	64.9	56.6	91%	104%
Total - Male	**506.0**	**546.1**	**478.2**	**93%**	**106%**

Summary of Healthy Retirement Mortality for Females – 2010 to 2015					
		Expected Deaths		Ratio A/E	
Age	Actual Deaths	Prior Assumption	Current Assumption	Prior Assumption	Current Assumption
50-54	1.0	1.0	1.0	101%	96%
55-59	5.0	3.8	3.3	133%	149%
60-64	20.0	15.2	13.5	131%	148%
65-69	21.0	22.2	20.8	95%	101%
70-74	23.0	21.6	21.1	107%	109%
75-79	19.0	23.5	22.1	81%	86%
80-84	32.0	33.5	31.0	95%	103%
85-89	37.0	38.2	34.0	97%	109%
90 and over	53.0	41.6	37.0	127%	143%
Total - Female	**211.0**	**200.6**	**183.8**	**105%**	**115%**

The retained actuary explains that if mortality improvement is not being applied, an "ideal" Actual/Expected ratio is around 110% to introduce some conservatism, since mortality will improve in the future. However, if mortality improvement is being applied, a 100% Actual/Expected ratio is

DRAFT

preferred. The retained actuary chose to include mortality improvement Scale BB and adjusted the base table for males and females to target an Actual/Expected ratio of close to 100%.

Disabled Retirees

Summary of Disabled Mortality – 2010 to 2015					
		Expected Deaths		Ratio A/E	
Age	Actual Deaths	Prior Assumption	Current Assumption	Prior Assumption	Current Assumption
Males	36.0	31.1	31.1	116%	116%
Females	11.0	19.2	19.2	57%	57%
Total	**47.0**	**50.3**	**50.3**	**93%**	**93%**

The retained actuary proposed no change to the prior assumption, since for males and females combined the actual experience matches the assumption relatively well, and there are so few deaths to observe in the study period.

Active Employees

Summary of Active Mortality – 2010 to 2015					
		Expected Deaths		Ratio A/E	
Age	Actual Deaths	Prior Assumption	Current Assumption	Prior Assumption	Current Assumption
Males	34.0	72.0	72.0	47%	47%
Females	10.0	29.0	29.0	34%	34%
Total	**44.0**	**101.0**	**101.0**	**44%**	**44%**

The retained actuary proposed no change to the prior assumption despite there being many fewer deaths than assumed since there is not sufficient data to warrant a change.

Comments and Recommendations

In accordance with ASOP 35 Section 3.5.3, the retained actuary considered the mortality for participants in post-retirement status, disabled retirement status, and pre-retirement (active) status. Within each of these participant groups, male and female experience was considered separately.

We have several recommendations regarding the mortality assumption:

- We recommend that the next experience study validate the overall A/E ratio for healthy female retirees. Page 21 of the experience study states that, "the proposed rates produce an overall A/E ratio of 100%." However, as seen in the table provided on page 21 of the experience study, the overall A/E ratio is 115%.

- We recommend revising the mortality description for disabled lives and other benefit recipients in the valuation report, as it states that the "annuitant" tables are used instead of the "combined employee and annuitant" as indicated by our sample lives review.

DRAFT

- We recommend using a mortality improvement scale for each type of mortality decrement. Mortality improvement is applied for healthy retirees, but not for actives or disabled retirees. While healthy retiree mortality is by far the most impactful assumption, the retained actuary should be consistent in its assumption regarding mortality improvements.

- We recommend that the next experience study review the appropriateness of updating the base mortality table to a more recently published table. The mortality base table assumption should be based on more recent tables and reflect the employee base covered under the ERF to the extent that such plan experience is credible. The RP-2000 tables were published in 2000 and based on data from 1990 to 1994. At the time of the experience study, the RP-2014 mortality tables were the most current basis available and could have been considered as the base table for ERF. For mortality base tables, the most recently available tables are not necessarily the best fit for the plan if the plan has at least partially credible data and can prove otherwise. However, the subsequent release of the Pub-2010 tables should be considered and we recommend that the appropriateness of these tables be considered for this population.

- We recommend updating the improvement to a more recently published table. Improvement Scale BB was published in 2012 and is based on data from the Social Security Administration through 2007. Updated versions of improvement scale MP are published each year.

- We recommend that the next experience study discuss the basis for the selection of the Blue-Collar adjustment, the set back/forward period, and the multiplier adjustment, including a credibility analysis. If there is no credible experience, we recommend using a standard published mortality table. The experience study does not provide sufficient discussion for the selection of these adjustments or if credible experience exists by cohort. The retained actuary noted that there was no sufficient credible data to warrant a change in the active employee mortality, despite there being 56% fewer actual deaths than expected, but does not discuss the rationale for continuing to use set back/forward adjustments without mortality improvement scale.

- We recommend updating the healthy retiree mortality table to be a best estimate, targeting an A/E ratio of 100%. The experience study report stated the following for the development of the healthy retiree mortality assumption:

  > *We generally want to keep the ratio for this assumption around 110% (i.e., 10% more deaths than expected) to introduce some conservatism, because we would anticipate life expectancies to continue to increase somewhat in the future. However, an A/E ratio of 100% is targeted if generational mortality (i.e., improvement scale BB) is included in the mortality assumption. … We also propose using improvement scale BB to incorporate future expected improvements in mortality. The proposed rates produce an overall A/E ratio of 106%. The A/E ratio in the "core" age band from age 60-80 is now 109%.*

  Since the current mortality assumption has a generational mortality improvement scale, we would have expected the retained actuary to target an A/E of 100%, as described above. However, the current rates produced an overall A/E ratio of 106% for male and 115% for females, leading to a more conservative assumption. Page 41of the valuation report also

shows that retiree mortality continues to be conservative as the experience for 2015 – 2017 is 110.71% higher than expected.

Retirement

The retirement assumption is used to determine when an employee is expected to commence benefits.

Actuarial Standards

ASOP No. 35, *Section 3.5.1 — Retirement—The actuary should take into account factors such as the following:*

a. employer-specific or job-related factors such as occupation, employment policies, work environment, unionization, hazardous conditions, and location of employment;
b. the plan design, where specific incentives may influence when participants retire;
c. the design of, and date of anticipated payment from, social insurance programs (for example, Social Security or Medicare); and
d. the availability of other employer-sponsored postretirement benefit programs (for example, postretirement health coverage or savings plan).

Retained Actuary's Assumption

The ERF uses a separate retirement assumption for Tier A and Tier B members.

For Tier A, rates are based on age and gender. For participants over age 60, rates are also separated for those with less than 18 years of service and greater than 18 years of service. Additionally, there are separate rates for the first year in which a participant is eligible for unreduced retirement.

For Tier B, rates are based on age and gender, and are also separated for those with less than 40 years of service and greater than 40 years of service.

The assumption related to retirement from deferred status is not disclosed.

Experience Study Considerations

The December 31, 2014 experience study was conducted before the plan changes as of December 31, 2016. As a result of these plan changes, members hired after December 31, 2016 are part of Tier B, which has a different benefit formula, early retirement provisions, and normal retirement age, among other changes. The experience study's recommendations apply to Tier A participants, and the retained actuary has developed a separate assumption for Tier B participants. Therefore, our commentary regarding the experience study only applies to the Tier A assumption.

The retained actuary considered data from the prior nine years to evaluate the retirement assumption. First, they investigated the effect of first eligibility on retirement rates, as generally rates are higher the first year an active becomes eligible for unreduced retirement. The following table contains the results of the ERF's experience over the study period:

DRAFT

		Expected Retirements		Ratio A/E	
Age	Actual Retirements	Prior Assumption	Current Assumption	Prior Assumption	Current Assumption
At First Eligibility - Male	417.0	427.5	458.6	98%	91%
Past First Eligibility - Male	431.0	540.5	506.3	80%	85%
Total - Male	**848.0**	**968.0**	**964.9**	**88%**	**88%**
At First Eligibility - Female	203.0	202.0	228.5	100%	89%
Past First Eligibility - Female	253.0	333.2	305.0	76%	83%
Total - Female	**456**	**535**	**534**	**85%**	**85%**

The data supports a different assumption between male and female, as well as a different assumption between first eligibility and past first eligibility. The retained actuary stated that they would like for there to be some conservatism in the assumption, and therefore they recommended a small increase in the retirement rates for the group.

Additionally, the retained actuary studied retirement behavior for members in their sixties, based on whether they had less than or greater than 18 years of service:

		Expected Retirements		Ratio A/E	
Age	Actual Retirements	Prior Assumption	Current Assumption	Prior Assumption	Current Assumption
Less than 18 years of service - Male	328.0	398.6	373.1	82%	88%
18 or more years of service - Male	280.0	349.6	339.3	80%	83%
Total - Male	**608.0**	**748.2**	**712.4**	**81%**	**85%**
Less than 18 years of service - Female	163.0	190.5	190.5	86%	86%
18 or more years of service - Female	156.0	209.2	188.0	75%	83%
Total - Female	**319**	**400**	**379**	**80%**	**84%**

Overall, the summary of changes to the assumption is as follows:

- Early retirement rates remained unchanged.
- The current rates for male and female members retiring in their fifties are slightly higher at first eligibility and lower beyond first eligibility compared to those previously assumed. Higher retirement rates at first eligibility are included in the current structure for males and females.
- For ages sixty and over, different rates are used depending on whether the member has more or less than 18 years of service. The current rates are lower than the prior rates for members retiring after attaining age 60.

DRAFT

As mentioned above, this does not include an analysis for the assumption that applies to Tier B employees.

Comments and Recommendations

We have several recommendations regarding the retirement assumption:

- We recommend that the valuation report include a statement that the retirement assumptions, and others as appropriate, are not "best estimates" and include a degree of conservatism. In the experience study, the retained actuary stated the following:

  An ideal A/E ratio is slightly below 100%. An A/E ratio of less than 100% implies that member's retire less often (work longer) than we expect, which is good for the funding position of the plan.

  And additionally:

  However, we would like for there to be some conservatism in this assumption, so we are recommending a small increase in the retirement rates for this group.

  The current assumptions are conservative as can be seen by the A/E ratios, which range from 83% to 91%. Page 36 of the valuation report also shows that retirement rates continues to be conservative as the experience for 2015 – 2017 is mostly lower than expected. The ASOPs do not specifically prohibit this practice, and, in fact, ASOP 35 states that it is appropriate to adjust the demographic assumptions to provide for adverse deviation as long as it is appropriately disclosed.

- We recommend that the valuation report disclose the assumption for retirements from deferred vested status and consider studying the retirement behavior of deferred vested participants. The valuation report does not disclose this assumption.

- We recommend that the valuation report provide detail on the basis for the selection of the Tier B retirement assumption. Tier B retirement assumption was added to the valuation as of December 31, 2017 as this is the first year there are Tier B employees but there was no discussion of the basis for selecting the assumption. While there will not be sufficient experience to analyze their retirement behavior until Tier B employees start to retire (20-30 years from now), based on the changes in Tier B benefits, we would expect Tier B employees to work longer.

- We recommend that the next experience study provide additional detail on the actual versus expected retirement assumption by age for completeness.

- We recommend that the retained actuary consider having separate assumption for the first year in which someone becomes eligible for Tier B, since the data supported such a separation for Tier A.

DRAFT

Withdrawal

The withdrawal assumption is used to determine when an employee who is not eligible for retirement will terminate employment.

Actuarial Standards

ASOP No. 35, *Section 3.5.2 — Termination of Employment—The actuary should take into account factors such as the following:*

a. employer-specific or job-related factors such as occupation, employment policies, work environment, unionization, hazardous conditions, and location of employment; and
b. plan provisions, such as early retirement benefits, vesting schedule, or payout options.

Retained Actuary's Assumption

The ERF uses service-based withdrawal rates as follows:

Years of Service	Rate	Years of Service	Rate
0	21.00%	7	5.75%
1	16.00%	8	4.90%
2	13.00%	9	4.60%
3	10.50%	10-14	3.70%
4	8.50%	15-19	2.20%
5	6.75%	20 & Over	1.40%
6	6.25%		

There is 0% assumption of termination for members eligible for retirement.

Experience Study Considerations

The actual turnover experience was examined from 2010 to 2015. The retained actuary found that the patterns of termination have a strong relationship with service. The retained actuary proposed no change to the termination rates, considering the actual rates were quite close to expected.

DRAFT

Comments and Recommendations

The withdrawal assumption is based on years of service. This is a robust basis for the assumption because it reflects the general tendency of shorter-tenured employees to incur higher rates of turnover. The assumed rates reflect higher expected turnover within the first several years of service, which is not uncommon. Based on the information provided, the withdrawal assumption appears reasonable for Tier A employees.

We recommend adding a separate withdrawal assumption for Tier B employees. As Tier B benefits are less valuable, withdrawal rates may increase as participants are less likely to remain with the City to preserve their pension benefits. Unlike the retirement assumption, which will take 20-30 years to develop meaningful experience, termination rates, especially for early years of service, can be immediately studied.

Disability

The disability assumption is used to determine when an employee becomes disabled and qualifies for disability benefits.

Actuarial Standards

ASOP No. 35, *Section 3.5.4 — Disability and Disability Recovery—The actuary should take into account factors such as the following:*

a. the plan's definition of disability (for example, whether the disabled person is eligible for Social Security benefits); and

b. the potential for recovery. For example, if the plan requires continued disability monitoring and if the plan's definition of disability is very liberal, an assumption for rates of recovery may

be appropriate. Alternatively, the probability of recovery may be reflected by assuming a lower incidence of disability than the actuary might otherwise assume.

Retained Actuary's Assumption

The ERF uses a disability incidence table with sample rates as follows:

Age	Rate
30	0.03%
40	0.06%
50	0.24%
60	0.60%

20% of disabilities are assumed to be service related.

Experience Study Considerations

There were 36 members approved for a disability benefit during the five-year study period ending 12/31/2014, producing A/E ratios shown in the table below:

		Expected Retirements	Ratio A/E
	Actual Retirements	Prior/Current Assumption	Prior/Current Assumption
Ordinary	34.0	37.0	92%
Duty	2.0	20.0	10%
Male	27.0	34.1	79%
Female	9.0	22.9	39%
Total	**36**	**57**	**63%**

The retained actuary recommended no change to the assumption. Based on the experience, the assumption was a reasonable fit for males, but a less reasonable assumption for females. The retained actuary decided not to make any changes to the rates or adopt a gender-specific table, considering the very small sample size of the experience.

Additionally, the retained actuary reviewed duty versus ordinary (service-based versus non-service based) disability incidence. The prior assumption was that 35% of disabilities will be duty related. The actual experience shows that during the study period duty related disabilities were around 10% of all disabilities (2 out of 36, rounded to the nearest 10%). Therefore, the retained actuary recommended reducing the assumption such that 20% of disabilities be assumed to be duty-related.

Comments and Recommendations

DRAFT

The current disability rates appear reasonable and consistent with the experience reviewed. Using a single table for males and females groups is an appropriate simplification due to the small sample size and inability to infer significant information about each group separately.

Duty (service) related disability and ordinary (non-service) related disability must be separated because the duty-related disability benefit includes a $1,000 per month floor. We agree with the methodology used to select the assumption for the percentage of duty-related disabilities.

Due to the very small sample size, we recommend supplementing historical data with industry-standard data for disability incidence for similar job types.

Marital Status

It is common for actuaries to make an assumption regarding the marital status of plan participants for use in assuming future benefit eligibility and election. Like the inflation assumption, the marital status assumption is often a component of several other assumptions.

Actuarial Standards

ASOP No. 35, *Section 3.6.3 — Marriage, Divorce, and Remarriage— The actuary should consider whether marriage, divorce, or remarriage affects the payment of benefits, the amount or type of benefits, or the continuation of benefit payments. If such an assumption is selected, it may also be necessary to make an assumption regarding beneficiary ages.*

Retained Actuary's Assumption

75% of male participants and 50% of female participants are assumed to be married.

Experience Study Considerations

During the study period, 78% of males retiring were married, while 50% of females retiring were married. The retained actuary recommended no change to the assumption of 75% for males and 50% for females.

Comments and Recommendations

The observed data supported no change to the assumption. Based on the information provided, the method and assumption is reasonable.

Age of Survivor

Future Joint & Survivor annuity payment amounts are based in part on the age of the survivor. Because valuation mortality and interest rates are not equal to those used to calculate optional forms of payment, the age of survivors impacts liability amounts.

Actuarial Standards

ASOP No. 35, *Section 3.6.7 — Missing or Incomplete Data— At times, the actuary may find that the data provided are incomplete due to missing elements such as birth dates or hire dates. Provided that the*

DRAFT

actuary has determined, in accordance with ASOP No. 23, Data Quality, that the overall data are of sufficient quality to complete the assignment, the actuary may need to make reasonable assumptions for the missing data elements. In making such assumptions, the actuary should consider the relevant data actually supplied. For example, it may be appropriate to assume a missing birth date is equal to the average birth date for other participants who have complete data and who have the same service credits as the participant whose date of birth is missing.

Retained Actuary's Assumption

The female spouse is assumed to be 3 years younger than the male spouse.

Experience Study Considerations

During the study period, males who retired were slightly less than 3 years older than their spouse, while female members were 3.7 years younger than their spouse. The retained actuary recommended no change to the assumption of a 3 year age difference for both male and female members.

Comments and Recommendations

The observed data supported no change to the assumption. Based on the information provided, the method and assumption is reasonable.

Form of Payment

In cases where participants receive no subsidy among payment forms and valuation actuarial equivalence matches that of optional payment forms, this assumption is not necessary. However, because valuation mortality and interest rates are not equal to those used to calculate optional forms of payment and because the ERF subsidizes pop-up benefits, this assumption impacts liabilities.

Actuarial Standards

ASOP No. 35, *Section 3.5.5 — Optional Form of Benefit Assumption—The actuary should consider factors such as the following:*

a. *the benefit forms and benefit commencement dates available under the plan being valued;*
b. *the historical or expected experience of elections under the plan being valued and similar plans; and*
c. *the degree to which particular benefit forms may be subsidized.*
d. *cost projections, including those made in conjunction with establishing or modifying the plan's design; and*
e. *determinations of actuarial present values.*

Retained Actuary's Assumption

For Tier A it is assumed that 60% of married active male members and 84% of married active female employees will elect a Joint & 50% Survivor form of payment. Taking into consideration the marriage

assumption and the inherent subsidy in the System's Joint & 100% Survivor factors, the male employees are valued with Joint and 29.0% Survivor annuities and the female employees are valued with Joint and 16.5% Survivor annuities. It is also assumed that 100% of Tier B employees will elect the normal form of payment under Tier B.

Additionally, with respect to refunds of contributions, it is assumed that members elect the most valuable termination benefit (they have the choice between a refund of employee contributions and a deferred annuity).

Experience Study Considerations

Like the other assumptions, the experience study only applies to Tier A.

The retained actuary compared the expected benefit payments based on the actual actuarial equivalence factors specified in Chapter 40A to the expected benefit payments by the valuation software using valuation assumptions. The retained actuary found that there was a considerable discrepancy between these two amounts due to differing assumptions between the two methods. Based on the Marital Status assumption, the assumption for married participants electing the Joint & 50% survivor form of payment, and the difference between the valuation assumptions and Chapter 40A assumptions, the actuary concluded that assuming a Joint and 29% Survivor annuity for males and a Joint and 16.5% Survivor annuity for females is appropriate.

Comments and Recommendations

The plan provisions allow active participants who terminate prior to retirement eligibility to elect either a lump sum refund of accumulated employee contributions made (without interest), or a deferred annuity at retirement age based on the benefit provisions. There may be a significant difference in the future plan liability between a refund of employee contributions and the deferred annuity. Based on the information provided, the assumption that these participants will elect the more valuable of the options is reasonable.

We recommend that the valuation report disclose the actuarial equivalence assumption. The actuarial equivalence factors are used to calculate the amount of the actuarially reduced Joint and 100% survivor annuity with 10 years certain. A form of payment assumption is needed because the actuarial equivalence assumptions to calculate the benefits differ from the valuation assumptions, and because the 10-year certain and life annuity and the Joint and 50% survivor annuity with 10 years certain are unreduced for Tier A (both the Joint and 50% option and the Joint and 100% option are actuarially reduced for Tier B). Both of these features will create gain or loss when an active transitions to a retiree.

DRAFT

Validation of Actuarial Valuation Results

This section will validate the retained actuary's calculation of several key items in the valuation report, including Actuarial Accrued Liability (AAL), Normal Cost, ADC, and AVA.

Actuarial Accrued Liability and Normal Cost

Representative sample lives have been selected and reviewed as summarized in the *Review of Sample Lives* section below. By confirming decrement rates, benefit amounts, and select Present Value of Benefit calculations, we determined the reasonableness of liabilities and normal cost for sample participants.

Actuarially Required Contribution and Actual Employer Contribution

The ERF's contribution policy is outlined in Section 40A-7 of Chapter 40A and is discussed in detail in the *Review of Actuarial Methods* section. The ADC is a component of the ERF's contribution, but the actual employer contribution is determined differently. The purpose of this section is to verify the retained actuary's calculation of the ADC, as well as to verify the determination of the actual employer contribution.

Based on the information provided, including the UAAL, Normal Cost, and Administrative Expenses, we were able to verify the ADC as shown below (in $000's).

	(In thousands of $'s)	Retained Actuary	Deloitte
		12/31/2017	**12/31/2017**
1	**UAAL**	776,232	
2	**Payment to Amortize UAAL over 30 Years**	50,730	51,095
3	**Normal Cost**	82,871	
4	**Administrative Expenses**	5,883	
5	**ADC**	139,484	139,849

The actual employer contribution is determined via the Current Adjusted Total Obligation Rate (CATOR). The methodology for the determination of the CATOR is outlined in the *Review of Actuarial Methods* section. We independently calculated the Current Adjusted Total Obligation Rate (CATOR) and it reflects the funding method outlined in the actuarial valuation report and Section 40A-7 of Chapter 40-A.

The results confirm that the actuary's calculation is consistent with the method described in the valuation report.

DRAFT

Actuarial Value of Assets

The components of the ERF's AVA are the Market Value of Assets (MVA) as of the Valuation Date, as well as the excess (shortfall) between expected investment return and actual investment income for each of the five previous years. As discussed in the *Review of Actuarial Methods* section above, the ERF "reset" its AVA determination such that the AVA as of December 31, 2017 is equal to the MVA. In future years, we will validate the calculation of the excess (shortfall) between expected investment return and actual investment income, as well a match of the retained actuary's AVA calculation.

DRAFT

Report Content

In this section, we review the content of the actuarial report for required disclosures.

Applicable ASOPs

Actuarial Standard of Practice No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions***,** provides guidance regarding nearly all aspects of the actuarial valuation method, including several cross-references to other ASOPs cited in this review.

Actuarial Standard of Practice No. 41, *Actuarial Communications*, provides guidance for any written, electronic, or oral communication issued by an actuary with respect to actuarial services. The standard specifically identifies disclosures that must be made within Actuarial Reports like the annual valuation provided by the ERF.

Generally, an actuarial report should:

- Accurately and fairly represent the financial condition of the System
- Be written so that it can be reasonably understood by the intended audience
- Make disclosures necessary to allow a qualified actuary to approximate the results, if required data were provided.

The standards above identify what must be reported within the reviewed valuations. We have recommended additional disclosure where we judged its value to be worth the effort of production.

Comments and Recommendations

The actuarial report meets applicable actuarial standards of practice and appears to accurately represent the funded status of the plan. However, we do recommend making the following additions to the report:

- Demonstrate the sensitivity of the discount rate assumption by providing the following key metrics using a discount rate 1% higher and 1% lower than the prescribed rate:
    - Actuarial Accrued Liability
    - Unfunded Actuarial Accrued Liability
    - Funded Ratio
- Disclose the undiscounted cash flows, a beneficial tool for understanding the financial obligation presented by the plan. This could be for a 10 to 20 year period, showing current and future retirees separately.

DRAFT

- Include a description of how closely current actual and target asset allocations align with the target asset allocation used to select the investment return assumption during the experience study

DRAFT

Review of Sample Lives

Summary of Reviewed Sample Lives

Sample life output is used by actuaries to confirm the actuarial assumptions, plan provisions, and actuarial methods used in actuarial valuations.

The retained actuary provided sample life data for active and inactive participants. For inactive sample lives, the present value of benefits was provided. For active sample lives, the present value of benefits, accrued liability, and normal cost were provided. The tables below summarize the sample lives that Deloitte reviewed.

Status	Number of Sample Lives Reviewed
Active	8
Terminated Vested	3
Retiree	5
Disabled	2
QDRO	3
Beneficiary	2

Our review of representative sample lives consists of the following:

- Review the data provided for the sample participants to confirm its consistency with the valuation data. All data was consistent with the valuation data.
- Review sample life results for compliance with the plan provisions, assumptions and methods disclosed in the actuarial valuation report using our actuarial valuation software. Results were within a reasonable threshold.

DRAFT