Conduent Human Resource Service
Retirement Services

North Carolina Firefighters' and Rescue Squad Workers' Pension Fund

Report on the Actuarial Valuation Prepared as of December 31, 2016

October 2017

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October 13, 2017

Board of Trustees
Local Governmental Employees'
Retirement System of North Carolina
3200 Atlantic Avenue
Raleigh, NC 27604

Members of the Board:

We submit herewith our report on the actuarial valuation of the North Carolina Firefighters' and Rescue Squad Workers' Pension Fund (referred to as "FRSWPF" or the "Firefighter and Rescue Squad Worker Plan") prepared as of December 31, 2016.

The primary purpose of the valuation report is to determine the required member and employer contribution rate (state appropriation), to describe the current financial condition of FRSWPF, and to analyze changes in such condition. In addition, the report provides information that the Office of the State Controller (OSC) requires for its Comprehensive Annual Financial Report (CAFR) and it summarizes census data. Use of this report for any other purposes or by anyone other than OSC and its auditors, or North Carolina Retirement System Division and Department of State Treasurer Staff may not be appropriate and may result in mistaken conclusions because of failure to understand applicable assumptions, methods, or inapplicability of the report for that purpose. The attached pages should not be provided without a copy of this cover letter. Because of the risk of misinterpretation of actuarial results, you should ask Conduent to review any statement you wish to make on the results contained in this report. Conduent will not accept any liability for any such statement made without prior review.

The valuation is based upon membership data and financial information as furnished by the Retirement Systems Division and the Financial Operations Division and as summarized in this report. Although reviewed for reasonableness and consistency with the prior valuation, these elements have not been audited by Conduent and we cannot certify as to the accuracy and completeness of the data supplied. The valuation is also based on benefit and contribution provisions as presented in this report. If you have reason to believe that the plan provisions are incorrectly described, that important plan provisions relevant to this valuation are not described, or that conditions have changed since the calculations were made, you should contact the authors of this actuarial report prior to relying on this information.

The valuation is further based on the actuarial valuation assumptions, approved by the Board of Trustees, as presented in this report. We believe that these assumptions are appropriate and reasonable and also comply with the requirements of GASB Statement No. 67. We prepared this valuation in accordance with the requirements of this standard and in accordance with all applicable Actuarial Standards of Practice.

The return to service assumption (based on the findings of the data audit of the FRSWPF and presented in our letter dated June 10, 2016) was adopted by the Board of Trustees on July 21, 2016. The discount rate of 7.20% was adopted by the Board of Trustees on April 20, 2017. All other assumptions were adopted for use with the December 31, 2016 actuarial valuation, based on the experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016. The economic assumptions with respect to investment yield, salary increase and inflation have been based upon a review of the existing portfolio structure as well as recent and anticipated experience.

Where presented, references to “funded ratio” and “unfunded accrued liability” typically are measured on an actuarial value of assets basis. It should be noted that the same measurements using market value of assets would result in different funded ratios and unfunded accrued liabilities. Moreover, the funded ratio presented is appropriate for evaluating the need and level of future contributions but makes no assessment regarding the funded status of the plan if the plan were to settle (i.e. purchase annuities) for a portion or all of its liabilities. In various places in the report the results also show funded ratios and unfunded liabilities based upon varying sets of assumptions as well as market values of assets as that is required for certain disclosure information required per accounting rules or statutes. Where this has been done it has been clearly indicated.

Future actuarial measurements may differ significantly from current measurements due to plan experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in plan provisions or applicable law. Because of limited scope, Conduent performed no analysis of the potential range of such future differences, except for some limited analysis in financial projections or required disclosure information.

I meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained in this report. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and I am available to answer questions about it.

Respectfully submitted,

Michael A. Ribble

Michael A. Ribble, FSA, EA, MAAA

Principal, Consulting Actuary

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Executive Summary

Overview

The North Carolina Retirement Systems Division (RSD) was established in 1941 to provide retirement benefits for public servants in the State of North Carolina. Today, under the management of the Department of State Treasurer, RSD administers seven public pension plans (defined benefit plans), three supplemental retirement plans (voluntary defined contributions plans), a health trust fund, a disability income plan, death benefit funds and a number of other benefit programs. As of December 31, 2016, the RSD defined benefit plans cover over one million current and prior public servants in the state of North Carolina. During the fiscal year ending June 30, 2017, RSD paid nearly $6.0 billion in pensions to more than 290,000 retirees. And as of June 30, 2017, RSD's assets were valued at almost $94 billion.

Under the supplemental retirement plans, the amount of contributions in any given year is defined by law. The amount of benefits derived is dependent on the investment returns the individual achieves. Conversely, under the pension plans, the amount of the benefit paid to a member upon retirement, termination, death or disability is defined by law. The amount of contributions needed to fund these benefits cannot be known with certainty. In North Carolina, like other states, these contributions are paid during a public servant's career so that upon retirement, termination, death, or disability, there are funds available to pay these benefits. These amounts are determined through an actuarial valuation. Actuarial valuations are performed for each of the pension plans administered by RSD and the results are contained in actuarial valuation reports like this.

The Firefighters' and Rescue Squad Workers' Pension Fund ("FRSWPF") provides benefits to all paid and volunteer certified firefighters and rescue squad workers. FRSWPF has approximately $384 million in assets and over 56,000 members as of December 31, 2016. This actuarial valuation report is our annual analysis of the financial health of FRSWPF. This report, prepared as of December 31, 2016, presents the results of the actuarial valuation of the Retirement System.

Purpose

An actuarial valuation will be performed on FRSWPF annually as of the end of the calendar year. The actuary determines the amount of contributions to be made to FRSWPF during each member's career that, when combined with investment return, will be sufficient to pay for retirement benefits.

In addition, the annual actuarial valuation is performed to:

- Determine the progress on funding FRSWPF,
- Explore why the results of the current valuation differ from the results of the valuation of the previous year, and
- Satisfy regulatory and accounting requirements.

A detailed summary of the valuation process and a glossary of actuarial terms are provided in Appendix A.

Executive Summary (continued)

Key Takeaways

The actuarial valuation is performed each year to replace the estimates the actuary assumed for the prior valuation with the actual events that happened. This past year, as expected, some of the assumptions used in the prior valuation were not realized. Key results of the December 31, 2016 valuation as compared to the December 31, 2015 valuation were:

- Market value returns of 6.24% compared to 7.25% assumed at the beginning of the plan year
- The assumed rate of return on plan assets was lowered from 7.25% to 7.20% effective December 31, 2016. The assumed rate of return is the discount rate used to value plan liabilities.

When compared to the December 31, 2015 actuarial valuation, the above resulted in:

- Lower funded ratio (89.0% in the December 31, 2016 valuation compared to 89.2% in the December 31, 2015 valuation)
- Higher actuarially determined employer contribution ($14,544,083 for fiscal year ending June 30, 2019 compared to the preliminary $14,287,301 calculated in the December 31, 2015 valuation for fiscal year ending June 30, 2018)

FRSWPF is well funded compared to its peers. This is due to:

- Stakeholders working together to keep FRSWPF well-funded since inception
- A history of appropriating and contributing the recommended contribution requirements
- Assumptions that in aggregate are more conservative than peers
- A funding policy that aggressively pays down unfunded liability over a 12-year period
- Modest changes in benefits when compared to peers

Continued focus on these measures will be needed to maintain the solid status of FRSWPF well into the future.

More details can be found later in this report. We encourage readers to start with Sections 1 and 2 and refer to other sections for additional details as needed.

Section 1: Principal Results

This report, prepared as of December 31, 2016, presents the results of the actuarial valuation of the system. The principal results of the valuation and a comparison with the preceding year's results are summarized below.

Table 1: Summary of Principal Results

Valuation results as of	12/31/2016	12/31/2015
Active Members		
Non-lapsed Members	25,210	25,526
Lapsed Members	17,235	17,295
Retired Members and Survivors of Deceased Members Killed in the Line of Duty Currently Receiving Benefits		
Number	13,940	13,463
Annual Allowances	$ 28,437,600	$ 27,464,520
Number of Deferred Members	139	146
Assets		
Actuarial Value (AVA)	$ 402,431,609	$ 393,387,721
Market Value	$ 383,865,563	$ 372,572,223
Actuarial Accrued Liability (AAL)	$ 452,065,480	$ 440,800,424
Unfunded Accrued Liability (AAL-AVA)	$ 49,633,871	$ 47,412,703
Funded Ratio* (AVA/AAL)	89.0%	89.2%
Results for Fiscal Year Ending	**6/30/2019**	**6/30/2018**
Actuarially Determined Employer Contribution (ADEC)		
Normal Cost	$ 5,591,401	$ 6,082,027
Accrued Liability	8,952,682	8,205,274
Total	$ 14,544,083	$ 14,287,301
Impact of Legislative Changes	N/A	0
Final ADEC	N/A	$ 14,287,301
SCRSP Minimum Contribution Rate	$ 18,302,208	$ 17,952,208
Appropriations Act for Fiscal Year Ending	**6/30/2018**	**6/30/2017**
Legislative Appropriation	$ 17,952,208	$ 17,602,208

* The Funded Ratio on a Market Value of Assets basis is 84.9% at December 31, 2016.

Section 2: The Valuation Process

The following diagram summarizes the inputs and results of the actuarial valuation process.

INPUT
Member Data
Asset Data
Benefit Provisions
Actuarial Assumptions
Funding Methodology

RESULTS
Actuarial Value of Assets
Actuarial Accrued Liability
Net Actuarial Gain or Loss
Funded Ratio
Legislative Appropriation

A more detailed description of the valuation process is provided in Appendix A.

Valuation Input: Membership Data

As with any estimate, the actuary collects information that we know now. Under the actuarial valuation process, current information about FRSWPF members is collected annually by the Retirement Systems Division staff at the direction of the actuary. This membership data will assist the actuary in estimating benefits that could be paid in the future. Information about benefit provisions and assets held in the trust as of the valuation date is also collected.

The member information the actuary collects includes data elements such as current service, and benefit group identifier for members that have not separated service, and actual benefit amounts and form of payment for members that have separated service. Data elements such as gender and date of birth are used to determine when a benefit might be paid and for how long.

Section 2: The Valuation Process

Valuation Input: Membership Data (continued)

The table below provides a summary of the membership data used in this valuation compared to the prior valuation.

Number as of	12/31/2016	12/31/2015
Active members	25,210	25,526
Lapsed members	17,235	17,295
Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits	139	146
Retired members and survivors of deceased members killed in the Line of Duty currently receiving benefits	13,940	13,463
Total	56,524	56,430

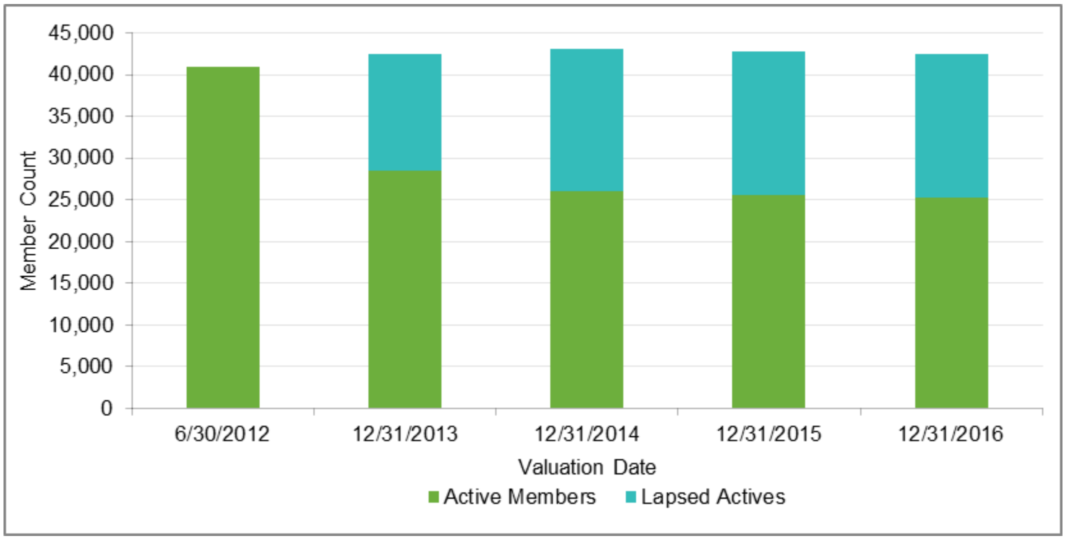
Commentary: The number of active members decreased by 1.2% from the previous valuation date. The decrease in the active population could result in less benefits accruing, but also fewer contributions supporting the system. The number of retired members increased by 3.5% from the previous valuation date. The increase in retiree population is consistent with expectations.

Section 2: The Valuation Process

Valuation Input: Membership Data (continued)

Graph 1: Active and Lapsed Members

The graph below provides a history of the number of active members over the past five years.



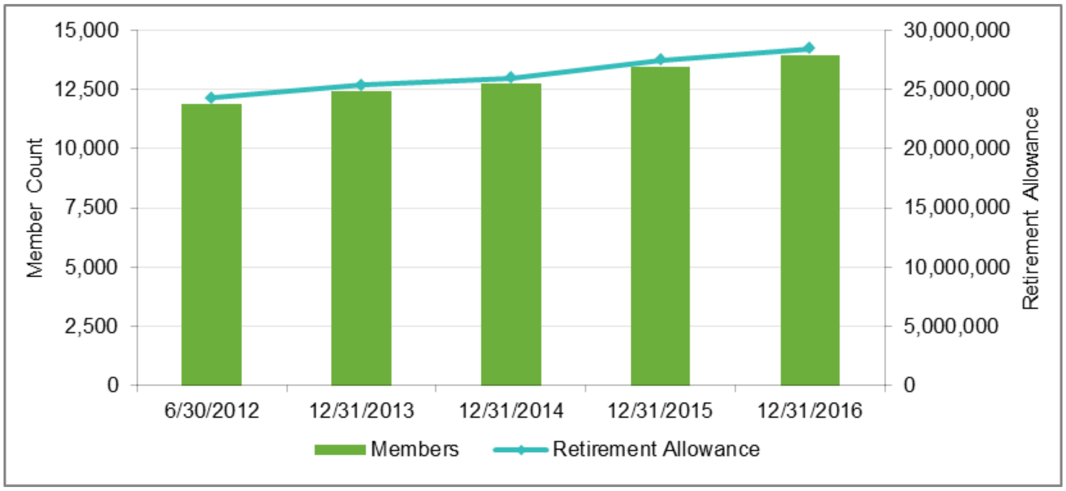
Commentary: Since the December 31, 2013 valuation, members who are not in receipt of benefits and who have not received a refund of employee contributions are split into active members and lapsed members. Lapsed members include members who did not accrue a year of service in the past year. The return to service assumption, which was implemented on a preliminary basis for the December 31, 2013 valuation and was finalized for the December 31, 2015 valuation, assumes that a lapsed member returns to active service at a rate based on the number of years that the member has been lapsed.

Section 2: The Valuation Process

Valuation Input: Membership Data (continued)

Graph 2: Retired Members

The graph below provides a history of the number of retired members and benefit amounts payable over the past five years.



Commentary: The number of retired members and the benefits paid to these members has been increasing steadily, as expected based on plan assumptions.

A detailed summary of the membership data used in this valuation is provided in Section 3 and Appendix B of this report.

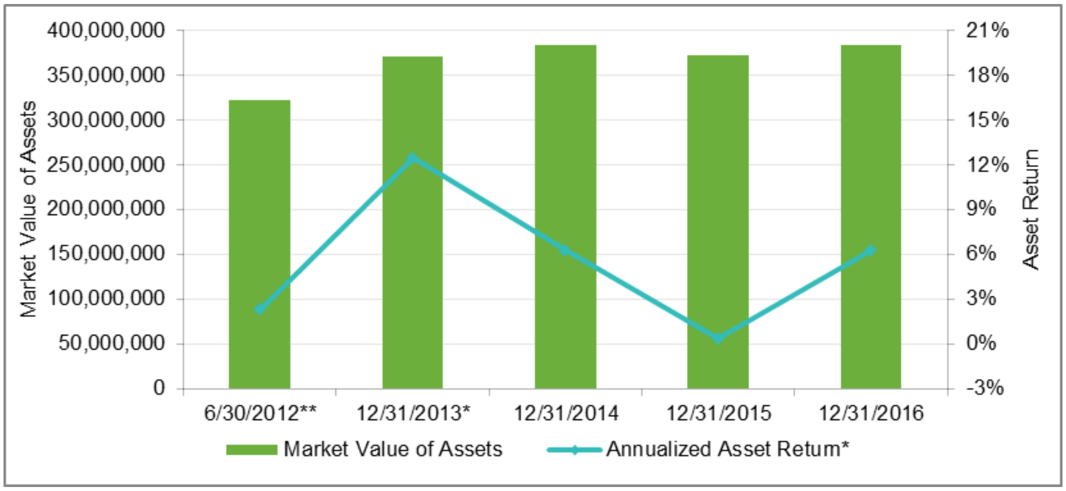
Section 2: The Valuation Process

Valuation Input: Asset Data

FRSWPF assets are held in trust and are invested for the exclusive benefit of plan members. The Market Value of Assets is $384 million as of December 31, 2016 and $373 million as of December 31, 2015. The investment return for the market value of assets for 2016 was 6.24%.

Graph 3: Market Value of Assets and Annualized Asset Returns

The graph below provides a history of the market value of assets and asset returns over the past five years.



* Equals the asset return for the year preceding the valuation date except for the asset return at 12/31/2013 which equals the annualized asset return between 6/30/2012 and 12/31/2013

** The market value of assets as of June 30, 2012 includes legislative appropriations receivable of $4,318,042 as appropriated for fiscal year ending June 30, 2012 but received after such date

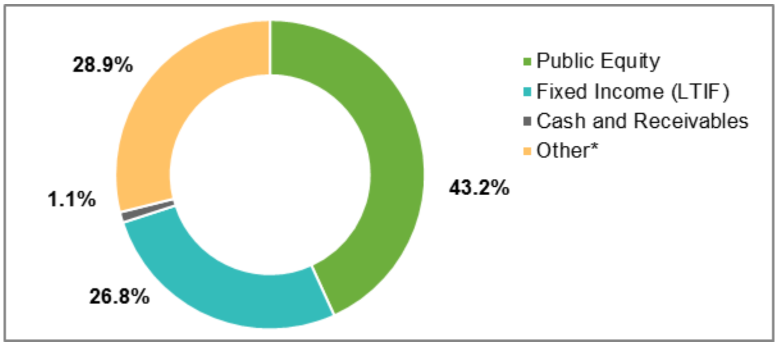
Commentary: Returns were less than the 7.25% assumed rate of return, resulting in higher contributions and lower funded ratio than anticipated, all else being equal. Effective December 31, 2016, the assumed rate of return was lowered from 7.25% to 7.20%.

Section 2: The Valuation Process

Valuation Input: Asset Data (continued)

Graph 4: Allocation of Investments by Category

The graph below provides the breakdown of the market value of assets at December 31, 2016 by asset category.



* Real Estate, Alternatives, Inflation and Credit

Commentary: Based on historical market returns, the current asset allocation, the current investment policy, and the expectation of future asset returns, as reviewed in the last experience study, the 7.20% discount rate used in this valuation is reasonable and appropriate.

A detailed summary of the market value of assets is provided in Section 4 of this report.

Section 2: The Valuation Process

Valuation Input: Benefit Provisions

Benefit provisions are described in North Carolina General Statues, Chapter 58.

There were no changes in benefit provisions since the prior year's valuation.

Highlights of the benefit provisions are described below.

- An unreduced retirement allowance is payable to members who retire from service after attaining age 55 and 20 years of service as an eligible firefighter or eligible rescue squad worker.
- The unreduced retirement allowance is equal to $170 per month.

Commentary: Many Public Sector Retirement Systems in the United States have undergone pension reform where the benefits of members (active or future members) have been reduced. Because of the well-funded status of the Retirement System due to the legislature contributing the actuarially required contribution, benefit cuts have not been needed in North Carolina as they have been in most other states. Instead, we have seen a modest expansion of benefits in recent years based on sound plan design. However, if North Carolina's investment policy shifts substantively, the system should review likely impacts of the shift and consider corresponding changes to actuarial assumptions, funding policy and/or benefit levels.

A detailed summary of the benefit provisions is provided in Appendix C of this report.

Valuation Input: Actuarial Assumptions

Actuarial assumptions bridge the gap between the information that we know with certainty as of the valuation date (age, gender, service, and benefits of the members) and what may happen in the future. The actuarial assumptions of the Retirement System are reviewed at least every five years. Based on this review, the actuary will make recommendations on the demographic and economic assumptions.

Demographic assumptions describe future events that relate to people such as retirement rates, termination rates, disability rates, and mortality rates. Economic assumptions describe future events that relate to the Retirement System's assets such as the interest rate and the real return.

Valuations since December 31, 2015 reflect the return to service assumption (based on the findings of the data audit of the FRSWPF and presented in our letter dated June 10, 2016), which was adopted by the Board of Trustees on July 21, 2016. The return to service assumption assumes that a lapsed member returns to active service at a rate based on the number of years that the member has been lapsed. A preliminary assumption was reflected in the December 31, 2013 and December 31, 2014 actuarial valuations and for actuarially determined employer contributions for fiscal year ending June 30, 2015 through fiscal year ending June 30, 2017.

The latest assumptions were adopted for use with the December 31, 2016 actuarial valuation, based on the experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016, and a discount rate of 7.20% as adopted by the Board of Trustees on April 20, 2017.

Section 2: The Valuation Process

Valuation Input: Funding Methodology

The Funding Methodology is the payment plan for FRSWPF and is composed of the following three components:

- Actuarial Cost Methods allocate costs to the actuarial accrued liability (i.e. the amount of money that should be in the fund) for past service and normal cost (i.e. the cost of benefits accruing during the year) for current service.
  - The Board of Trustees has adopted Entry Age Normal as its actuarial cost method
  - Develops normal costs that stays level
- Asset Valuation Methods smooth or average the market value returns over time to alleviate contribution volatility that results from market returns.
  - Asset returns in excess of or less than the expected return on market value of assets reflected over a five-year period.
  - Assets corridor: not greater than 120% of market value and not less than 80% of market value
- Amortization Methods determine the payment schedule for unfunded actuarial accrued liability (i.e. the difference between the actuarial accrued liability and actuarial value of assets)
  - Payment level: the payment is determined as a level dollar amount, similar to a mortgage payment
  - Payment period: a 12-year closed amortization period was adopted for fiscal year ending 2012. A new amortization base is created each year based on the prior years’ experience.

When compared to other Public Sector Retirement Systems in the United States, the funding policy for FRSWPF is quite aggressive in that the policy pays down the pension debt over a much shorter period of time (12 years) compared to the national average of around 24 years. As such it is a best practice in the industry.

A detailed summary of the actuarial assumptions and methods is provided in Appendix D of this report.

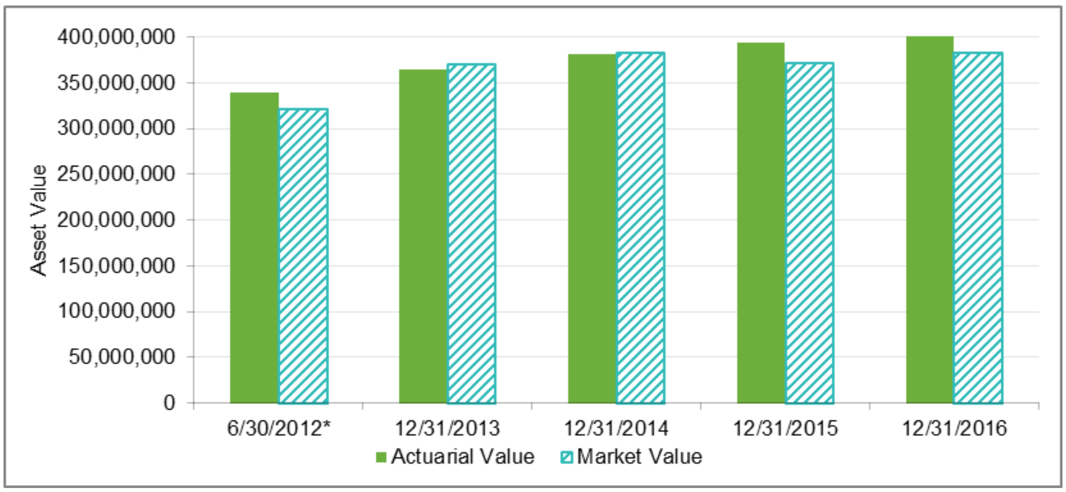
Section 2: The Valuation Process

Valuation Results: Actuarial Value of Assets

In order to reduce the volatility that investment gains and losses can have on required contributions and funded status of FRSWPF, the Board adopted an asset valuation method to determine the Actuarial Value of Assets used for funding purposes. The Actuarial Value of Assets is $402 million as of December 31, 2016 and $393 million as of December 31, 2015.

Graph 5: Actuarial Value and Market Value of Assets

The graph below provides a history of the market value and actuarial value of assets over the past five years.



* The market value and actuarial value of assets as of June 30, 2012 include legislative appropriations receivable of $4,318,042 as appropriated for fiscal year ending June 30, 2012 but received after such date

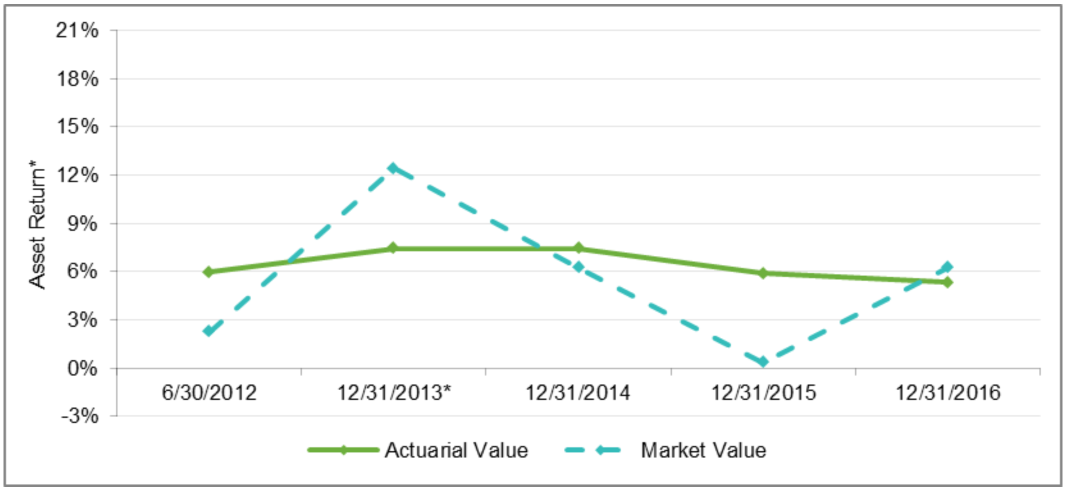
Commentary: The market value of assets is lower than the actuarial value of assets, which is used to determine actuarially determined contributions. This indicates that there are unrecognized asset losses to be recognized in future valuations.

Section 2: The Valuation Process

Valuation Results: Actuarial Value of Assets (continued)

Graph 6: Asset Returns

The graph below provides a history of the market value and actuarial value of asset returns over the past five year.



* Equals the asset return for the year preceding the valuation date except for the asset return at 12/31/2013 which equals the annualized asset return between 6/30/2012 and 12/31/2013

Commentary: The investment return for the market value of assets for 2016 was 6.24%. The actuarial value of assets smoothes investment gains and losses. Lower than expected market returns in 2015 and 2016 resulted in an actuarial value of asset return for 2016 of 5.33% and a recognized actuarial asset loss of $7.5 million during 2016.

A detailed summary of the Actuarial Value of Assets is provided in Section 4 of this report.

Section 2: The Valuation Process

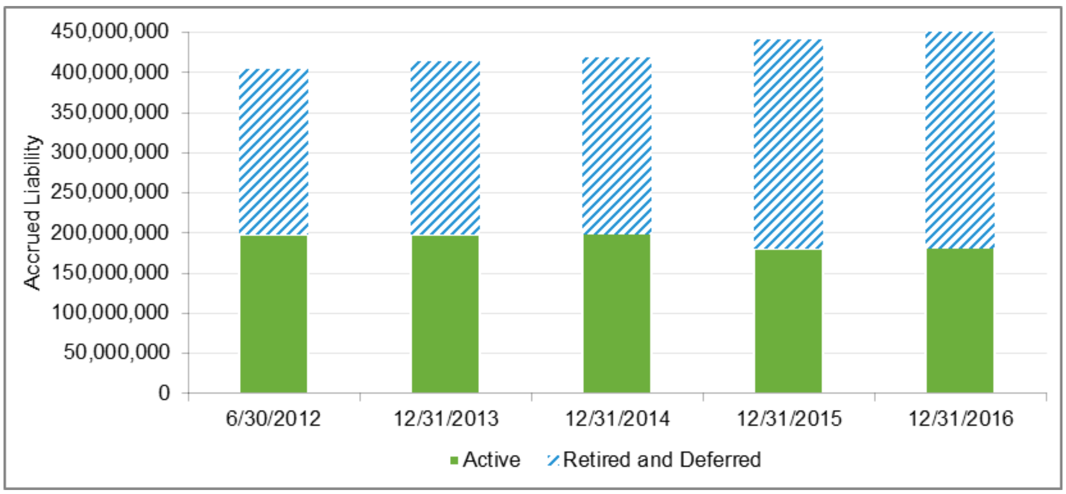
Valuation Results: Actuarial Accrued Liability

Using the provided membership data, benefit provisions, and actuarial assumptions, the Retirement System's future benefit payments are estimated. These projected future benefit payments are discounted into today's dollars using the assumed rate of investment return assumption to determine the Present Value of Future Benefits (PVFB) of the Retirement System. The PVFB is an estimate of the current value of the benefits promised to all members as of a valuation date.

Once the PVFB is developed, an actuarial cost method is used to allocate the PVFB. Under the actuarial cost method, the PVFB is allocated to past, current and future service, respectively known as the actuarial accrued liability (AAL), normal cost (NC) and present value of future normal costs (PVFNC). The AAL is also referred to as the amount of money the Retirement System should ideally have in the trust. The NC is also referred to as the cost of benefits accruing during the year.

Graph 7: Actuarial Accrued Liability

The graph below provides a history of the actuarial accrued liability over the past five years.



Commentary: The AAL increased from $441 million to $452 million in 2016. FRSWPF is an open plan, which means that new members enter the plan each year. In an open plan, liabilities are expected to grow from one year to next as more benefits accrue and the membership approaches retirement. Assumption changes increased the AAL by $2.5 million.

A detailed summary of the AAL is provided in Section 5 of this report.

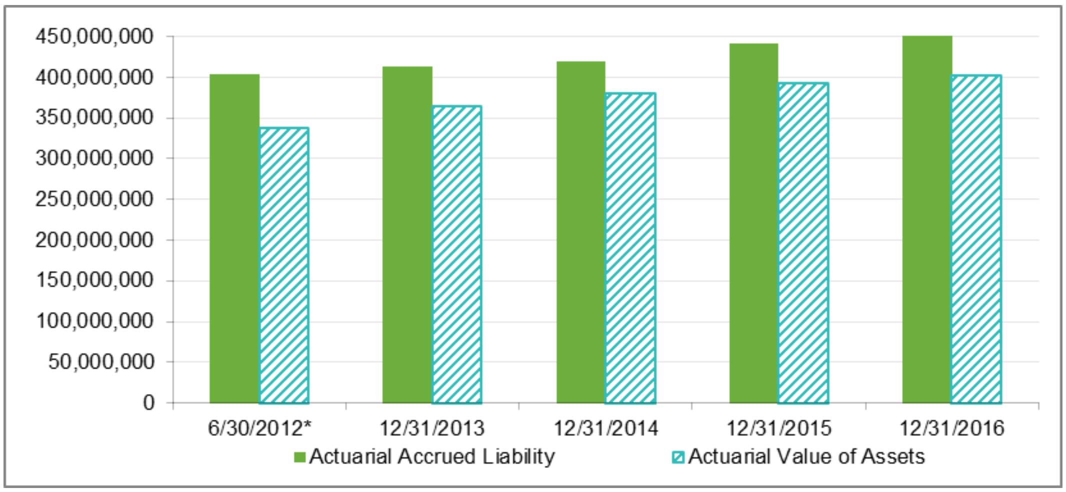
Section 2: The Valuation Process

Valuation Results: Funded Ratio

The funded ratio is a measure of the progress that has been made in funding the plan as of the valuation date. It is the ratio of how much money the Retirement System actually has in the fund to the amount the FRSWPF should have in the fund.

Graph 8: Actuarial Accrued Liability and Actuarial Value of Assets

The graph below provides a history of the actuarial accrued liability and actuarial value of assets over the past 5 years.



* The actuarial value of assets as of June 30, 2012 includes legislative appropriations receivable of $4,318,042 as appropriated for fiscal year ending June 30, 2012 but received after such date.

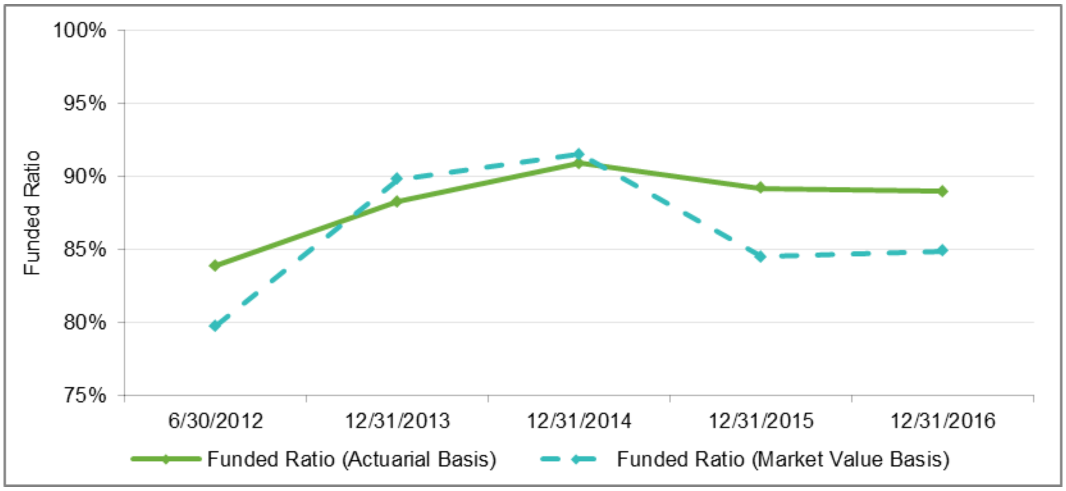
Commentary: The actuarial value of assets basis is used for computing contributions to alleviate contribution volatility. The difference in the actuarial accrued liability and the actuarial value of assets is the amount of pension debt to be paid off in 12 years.

Section 2: The Valuation Process

Valuation Results: Funded Ratio (continued)

Graph 9: Funded Ratios

The graph below provides a history of the funded ratio on a market and actuarial basis over the past five years.



Commentary: The ratio of assets to liabilities shows the health of the plan on an accrued basis. The funded ratio on an actuarial basis decreased from 89.2% at December 31, 2015 to 89.0% at December 31, 2016.

Section 2: The Valuation Process

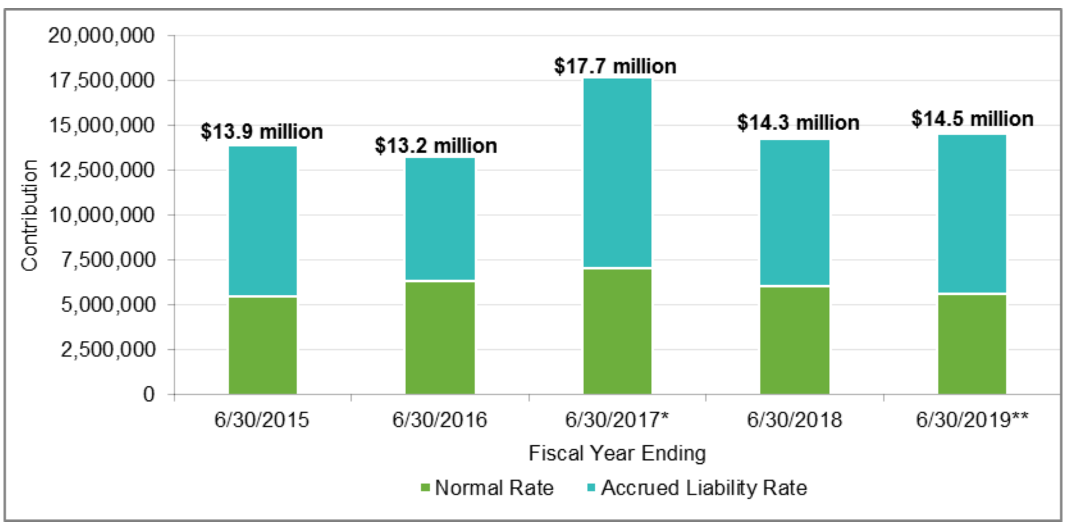
Valuation Results: State Contributions

The North Carolina General Statutes provide that the contributions of employers shall consist of a normal contribution and an accrued liability contribution.

The December 31, 2015 valuation suggested that the preliminary total contribution be set at $14,287,301 for the fiscal year ending June 30, 2018. Subsequently, the 2017 Appropriations Act (Session Laws 2017-57) set the legislative appropriation at $17,952,208 for the fiscal year ending June 30, 2018, in order to account for the State Contribution Rate Stabilization Policy. As a result of this December 31, 2016 valuation, the preliminary actuarially determined contribution is $14,544,083 for the fiscal year ending June 30, 2019, subject to the impact of any future legislative changes effective during that fiscal year.

Graph 10: Actuarially Determined Employer Contributions

The graph below provides a history of actuarially determined employer required contributions over the past five years. The contributions are split into the normal contribution and the accrued liability contribution. The normal contribution is the employer's portion of the cost of benefits accruing after reducing for the member contribution. The accrued liability contribution is the payment toward the unfunded liability.



* The actuarially determined employer contribution shown for fiscal year ending 6/30/2017 includes the impact of the experience study and legislative changes but does not include the impact of the return to service assumption, which would have reduced the contribution by approximately $3.3 million for fiscal year ending 6/30/2017.

****** Subject to the impact of future legislative changes effective during that fiscal year.

Section 2: The Valuation Process

Valuation Results: State Contributions (continued)

Commentary: The actuarially determined employer contribution is the amount needed to pay for the cost of the benefits accruing and to pay off the pension debt over 12 years, offset for the $10 monthly contribution the members make until the member attains 20 years of service. The 12-year period is a short period for Public Sector Retirement Systems in the United States, with most Systems using a period of 25 years or more to pay off the pension debt. The shorter period results in higher contributions and more benefit security. A detailed summary of the actuarially determined employer contributions rates is provided in Section 6 of this report.

Valuation Results: Accounting Information

The Governmental Account Standards Board (GASB) issues statements which establish financial reporting standards for defined benefit pension plans and accounting for pension expenditures and expenses for governmental employers.

The valuation has been prepared in accordance with the parameters of Statement No. 67 of the GASB and all applicable Actuarial Standards of Practice. The Net Pension Liability (Asset) under GASB 67 for the fiscal year ending June 30, 2017, is $48,512,000 (compared to $66,819,000 for fiscal year ending June 30, 2016). The required financial reporting information for the Retirement System under GASB No. 67 can be found in Section 8 of this report.

Section 3: Membership Data

The Retirement Systems Division provided membership data as of the valuation date for each member of the Retirement System. The membership data assists the actuary in estimating benefits that could be paid in the future. The tables below provide a summary of the membership data used in this valuation. Detailed tabulations of data are provided in Appendix B.

Table 2: Active and Lapsed Member Data

	Member Count	Average Age	Average Service
Lapsed Members	17,235	40.24	5.57
Active Members	25,210	39.07	10.84
Total	42,445	39.55	8.70

The table above includes members who are not in receipt of benefits and who have not received a refund of employee contributions. Lapsed members include members who did not accrue a year of service in the past year.

Table 3: Data for Members Currently Receiving Benefits

Member Count	Average Age	Annual Retirement Allowances
13,940	68.00	$ 28,437,600

Table 4: Data for Disabled Members Eligible for Deferred Pensions

Member Count	Average Age	Annual Retirement Allowances
139	50.06	$ 283,560

Section 4: Asset Data

Assets are held in trust and are invested for the exclusive benefit of FRSWPF members. The tables below provide the details of the Market Value of Assets for the current and prior years' valuations.

Table 5: Market Value of Assets

Asset Data as of	12/31/2016	12/31/2015
Beginning of Year Market Value of Assets	$ 372,572,223	$ 383,327,980
Contributions	18,070,953	16,727,357
Benefit Payments	(29,675,409)	(28,816,779)
Investment Income	22,897,796	1,333,665
Net Increase/(Decrease)	11,293,340	(10,755,757)
End of Year Market Value of Assets	$ 383,865,563	$ 372,572,223
Estimated Net Investment Return on Market Value (Annualized)	6.24%	0.35%

Table 6: Allocation of Investments by Category of the Market Value of Assets

Asset Data as of	12/31/2016	12/31/2015
Allocation by Dollar Amount		
Public Equity	$ 165,706,987	$ 158,640,112
Fixed Income (LTIF)	103,052,537	105,101,798
Cash and Receivables	4,181,997	6,586,947
Other*	110,924,042	102,243,366
Total Market Value of Assets	$ 383,865,563	$ 372,572,223
Allocation by Percentage of Asset Value		
Public Equity	43.2%	42.6%
Fixed Income (LTIF)	26.8%	28.2%
Cash and Receivables	1.1%	1.8%
Other*	28.9%	27.4%
Total Market Value of Assets	100.0%	100.0%

* Real Estate, Alternatives, Inflation and Credit

Section 4: Asset Data

In order to reduce the volatility that investment gains and losses can have on the required contributions and funded status of FRSWPF, the Board adopted an asset valuation method to determine the Actuarial Value of Assets used for funding purposes. The table below provides the calculation of the Actuarial Value of Assets at the valuation date.

Table 7: Actuarial Value of Assets

Asset Data as of	12/31/2016
Beginning of Year Market Value of Assets	$ 372,572,223
Contributions	18,070,953
Benefit Payments	(29,675,409)
Net Cash Flow	(11,604,456)
Expected Investment Return	26,590,825
Expected End of Year Market Value of Assets	387,558,592
End of Year Market Value of Assets	383,865,563
Excess of Market Value over Expected Market Value of Assets	(3,693,029)
80% of 2016 Asset Gain/(Loss)	(2,954,423)
60% of 2015 Asset Gain/(Loss)	(15,611,623)
40% of 2014 Asset Gain/(Loss)	N/A
20% of 2013 Asset Gain/(Loss)	N/A
Total Deferred Asset Gain/(Loss)	(18,566,046)
Preliminary End of Year Actuarial Value of Assets	402,431,609
Final End of Year Actuarial Value of Assets (not less than 80% and not greater than 120% of Market Value)	402,431,609
Estimated Net Investment Return on Actuarial Value	5.33%

Commentary: The actuarial value of assets smooths investment gains/losses on the market value of assets over a five-year period resulting in less volatility in the actuarially determined employer contribution. The asset valuation recognizes asset returns in excess of or less than the expected return on the market value of assets over a five-year period. Actuarial value of assets was reset to the market value of assets at December 31, 2014.

Lower than expected market returns in 2015 and 2016 resulted in an actuarial value of asset return for calendar year 2016 of 5.33% and a recognized actuarial asset loss of $7.5 million during 2016.

Section 4: Asset Data

The valuation assumes that the funds will earn a 7.20% asset return. Prior to December 31, 2016, the assumed asset return was 7.25%. The table below provides a history of the Actuarial Value and Market Value of Asset returns.

Table 8: Historical Asset Returns (Annualized)

Year*	Actuarial Value of Asset Return	Market Value of Asset Return
2006	8.63%	7.24%
2007	9.98%	14.85%
2008	7.43%	(1.92%)
2009	3.09%	(14.15%)
2010	4.47%	12.09%
2011	6.88%	18.47%
2012	5.96%	2.25%
2013	7.43%	12.42%
2014	7.42%	6.24%
2015	5.87%	0.35%
2016	5.33%	6.24%
Average	6.57%	5.45%
Range	6.89%	32.62%

* Asset returns for years prior to 2013 are the returns for the year ending on June 30 of the applicable year. The 2013 asset return is the annualized return for the 18-month period from June 30, 2012 to December 31, 2013. Asset returns for years after 2013 are for the calendar year.

Commentary: The average investment return recognized for purposes of determining the annual change in contribution each year is the actuarial value of assets return. Currently, the average actuarial return of 6.57% tracks average market return of 5.45% relatively well. But the range of returns is markedly less – 6.89% versus 32.62%. This results in much lower actuarially determined employer contribution volatility using the actuarial value of assets versus market, while ensuring that the actuarial needs of FRSWPF are met.

Section 5: Liability Results

Using the provided membership data, benefit provisions, and actuarial assumptions, the Retirement System's future benefit payments are estimated. These projected future benefit payments are discounted into today's dollars using the assumed rate of investment return assumption to determine the Present Value of Future Benefits. The Present Value of Future Benefits is allocated to past, current and future service, respectively known as the actuarial accrued liability, normal cost and present value of future normal costs. The table below provides these liability numbers for the current and prior years' valuations.

Table 9: Liability Summary

Valuation Results as of	12/31/2016	12/31/2015
(a) Present Value of Future Benefits		
(1) Active Members	$ 229,166,150	$ 229,359,014
(2) Members Currently Receiving Benefits and Members with Deferred Benefits	270,958,443	260,259,878
(3) Total	$ 500,124,593	$ 489,618,892
(b) Present Value of Future Normal Costs		
(1) Employee Future Normal Costs	$ 17,911,966	$ 18,356,116
(2) Employer Future Normal Costs	30,147,147	30,462,352
(3) Total	$ 48,059,113	$ 48,818,468
(c) Actuarial Accrued Liability: (a3) - (b3)	$ 452,065,480	$ 440,800,424
(d) Actuarial Value of Assets	$ 402,431,609	$ 393,387,721
(e) Unfunded Accrued Liability: (c) - (d)	$ 49,633,871	$ 47,412,703

Section 5: Liability Results

The table below provides an allocation of the total present value of future benefits by funding source.

Table 10: Funding Allocation

	12/31/2016	12/31/2015
Allocation by Dollar Amount		
Assets (Actuarial Value)	$ 402,431,609	$ 393,387,721
Future Employee Contributions	17,911,966	18,356,116
Future Normal Contributions	30,147,147	30,462,352
Present Value of Funded Benefits	$ 450,490,722	$ 442,206,189
Present Value of Unfunded Benefits	49,633,871	47,412,703
Total Present Value of Benefits	$ 500,124,593	$ 489,618,892
Allocation by Percentage of PVB		
Assets (Actuarial Value)	80.5%	80.4%
Future Employee Contributions	3.6%	3.7%
Future Normal Contributions	6.0%	6.2%
Present Value of Funded Benefits	90.1%	90.3%
Present Value of Unfunded Benefits	9.9%	9.7%
Total Present Value of Benefits	100.0%	100.0%

Section 5: Liability Results

The table below provides a reconciliation of the prior year's unfunded actuarial accrued liability to the current year's unfunded actuarial accrued liability.

Table 11: Reconciliation of Unfunded Actuarial Accrued Liability

(in millions)	
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2015	$ 47.4
Normal Cost during 2016	8.8
Reduction due to Actual Contributions during 2016	(18.1)
Interest on UAAL, Normal Cost, and Contributions	3.4
Asset (Gain)/Loss	7.5
Actuarial Accrued Liability (Gain)/Loss	(1.9)
Impact of Assumption Changes	2.5
Impact of Legislative Changes	0.0
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2016	$ 49.6

Commentary: During 2016, the UAAL increased more than expected. Asset losses increased the UAAL by $7.5 million and the change to the interest rate from 7.25% to 7.20% increased the UAAL by $2.5 million. These losses were partially offset by a liability gain of $1.9 million.

Section 6: Actuarially Determined Employer Contribution

The actuarially determined employer contribution consists of a normal cost contribution and an accrued liability contribution. The normal cost contribution is the employer’s portion of the cost of benefits accruing during the year after reducing for the member contribution. The accrued liability contribution is the payment toward the unfunded accrued liability in order to pay off the unfunded accrued liability over 12 years.

The table below provides the calculation of the actuarially determined employer contribution for the current and prior years’ valuations.

Table 12: Calculation of the Actuarially Determined Employer Contribution (ADEC) Payable per Active Member

Valuation Date ADEC for Fiscal Year Ending	12/31/2016 6/30/2019	12/31/2015 6/30/2018
Normal Cost Rate Calculation		
(a) Employer Future Normal Cost	$ 30,147,147	$ 30,462,352
(b) Present Value of Future Active Member Count	150,525	154,271
(c) Normal Cost Rate: (a) / (b)	$ 200.28	$ 197.46
(d) Expenses Rate*	$ 40.49	$ 59.48
(e) Total Normal Cost Rate: (c) + (d)	$ 240.77	$ 256.94
Accrued Liability Rate Calculation		
(f) Total Annual Amortization Payments**	$ 8,952,682	$ 8,205,274
(g) Active Member Count***	23,223	23,671
(h) Accrued Liability Rate: (f) / (g)	$ 385.51	$ 346.64
Total ADEC (e) + (h)	$ 626.28	$ 603.58

* Based on actual expenses during the previous year.
** See Table 16 for more detail.
*** The active member count reflects the number of currently active or lapsed members who are expected to accrue additional benefits in the next year.

Section 6: Actuarially Determined Employer Contribution

The tables below provide the calculation of the actuarially determined employer contribution (ADEC) for the current and prior years' valuations.

Table 13: Actuarially Determined Employer Contribution (ADEC)

Valuation Date ADEC for Fiscal Year Ending	12/31/2016 6/30/2019	12/31/2015 6/30/2018
(a) Current Active Member Count*	23,223	23,671
(b) Normal Cost Rate	$ 240.77	$ 256.94
(c) Normal Cost Contribution: (a) x (b)	$ 5,591,401	$ 6,082,027
(d) Accrued Liability Contribution	8,952,682	8,205,274
(e) Total ADEC: (c) + (d)	$ 14,544,083	$ 14,287,301
Impact of Legislative Changes	N/A	0
Final ADEC	N/A	$ 14,287,301

***** The active member count reflects the number of currently active or lapsed members who are expected to accrue additional benefits in the next year.

Section 6: Actuarially Determined Employer Contribution

The table below provides a reconciliation of the actuarially determined employer contribution (ADEC).

Table 14: Reconciliation of the Change in the ADEC

Fiscal year ending June 30, 2018 Preliminary ADEC (estimated based on December 31, 2015 Valuation)	14,287,301
Impact of Legislative Changes	0
Fiscal year ending June 30, 2018 Final ADEC	14,287,301
Change Due to Demographic (Gain)/Loss	(1,146,481)
Change Due to Investment (Gain)/Loss	1,019,624
Change Due to Contributions Greater than ADEC	(14,636)
Impact of Assumption Changes	398,275
Fiscal year ending June 30, 2019 Preliminary ADEC (estimated based on December 31, 2016 Valuation)	14,544,083

Section 6: Actuarially Determined Employer Contribution

Amortization methods determine the payment schedule for the unfunded actuarial accrued liability. FRSWPF adopted a 12-year closed amortization period for fiscal year ending 2012. A new amortization base is created each year based on the prior year's experience. The tables below provide the calculation of the new amortization base and the amortization schedule for the current year's valuation.

Table 15: Calculation of the New Amortization Base

Calculation as of	12/31/2016	12/31/2015
(a) Unfunded Actuarial Accrued Liability	$ 49,633,871	$ 47,412,703
(b) Prior Years' Outstanding Balances	$ 44,062,245	$ 32,835,489
(c) New Amortization Base: (a) - (b)	$ 5,571,626	$ 14,577,214
(d) New Amortization Payment	$ 760,010	$ 1,994,640

Table 16: Amortization Schedule for Unfunded Accrued Liability

Date Established	Original Balance	12/31/2016 Outstanding Balance	Annual Payment
June 30, 2010	$ 51,963,371	$ 35,848,513	$ 6,856,221
June 30, 2011	8,122,313	6,260,921	1,071,476
June 30, 2012	3,813,072	3,227,028	502,915
December 31, 2013	(11,374,070)	(11,570,522)	(1,552,996)
December 31, 2014	(4,939,476)	(5,337,757)	(674,310)
December 31, 2015	14,577,214	15,634,062	1,989,366
December 31, 2016	5,571,626	5,571,626	760,010
Total		$ 49,633,871	$ 8,952,682

Commentary: This is the payment schedule for the pension debt of FRSWPF.

Section 6: Actuarially Determined Employer Contribution

The table below provides a history of the actuarially determined employer contribution and the corresponding appropriated rate.

Table 17: History of Actuarially Determined Employer Contributions and Appropriated Rates

Valuation Date	Fiscal Year Ending	Preliminary ADEC	Subsequent Changes to ADEC***	Final ADEC	Appropriated Rate
12/31/2016	6/30/2019	$14,544,083	N/A	N/A	N/A
12/31/2015	6/30/2018	14,287,301	$ -	$14,287,301	$17,952,208
12/31/2014	6/30/2017	12,830,706	4,874,502	17,705,208	17,602,208
12/31/2013	6/30/2016	13,240,552	-	13,240,552	13,550,000
6/30/2012*	6/30/2015	15,100,000	(1,200,000)**	13,900,000	13,900,000

* Because a valuation was not performed at June 30, 2013, the preliminary total actuarially determined employer contribution was estimated to be $15,100,000 for fiscal year ending June 30, 2015 based on the June 30, 2012 valuation.

** Based on the findings in Phase One of the audit of the census data for lapsed members, the total required contribution was estimated to decrease by $2,200,000. House Bill 1034 (Session Law 2014-64) increased the required contribution by $1,000,000. Subsequently, the 2014 Appropriations Act (Session Laws 2014-100) set the legislative appropriation at $13,900,000 effective for the fiscal year ending June 30, 2015.

*** The change due to legislation for the contribution for fiscal year ending 6/30/2017 includes a $4,771,502 increase in the ADEC due to the experience study and a $103,000 increase in the ADEC due to legislation passed in the past year that allows for the payment line of duty death benefits.

Section 7: Valuation Balance Sheet

The valuation balance sheet shows the assets and liabilities of FRSWPF. The items shown in the balance sheet are present values actuarially determined as of the relevant valuation date. The table below provides the valuation balance sheet for the current year and prior year.

Table 18: Valuation Balance Sheet

Balance Sheet as of	12/31/2016	12/31/2015
Assets		
Current Actuarial Value of Assets		
Annuity Savings Fund	$ 40,905,890	$ 41,402,228
Pension Accumulation Fund	361,525,719	351,985,493
Total	$ 402,431,609	$ 393,387,721
Future Member Contributions to the		
Annuity Savings Fund	$ 17,911,966	$ 18,356,116
Prospective Appropriations to the Pension Accumulation Fund		
Normal Appropriations	$ 30,147,147	$ 30,462,352
Unfunded Accrued Liability Appropriations	49,633,871	47,412,703
Total	$ 79,781,018	$ 77,875,055
Total Assets	$ 500,124,593	$ 489,618,892
Liabilities		
Annuity Savings Fund		
Past Member Contributions	$ 40,905,890	$ 41,402,228
Future Member Contributions	17,911,966	18,356,116
Total Contributions	$ 58,817,856	$ 59,758,344
Pension Accumulation Fund		
Benefits Currently in Payment	$ 270,958,443	$ 260,259,878
Benefits to be Paid to		
Current Active Members	170,348,294	169,600,670
Total Benefits Payable	$ 441,306,737	$ 429,860,548
Total Liabilities	$ 500,124,593	$ 489,618,892

Section 8: Accounting Results

The section contains the accounting information for Governmental Accounting Standards Board (GASB) Statement No. 67 for fiscal year ending June 30, 2017 based on a valuation date of December 31, 2016.

Please note that GASB Statement No. 67 (*Financial Reporting for Pension Plans) is applicable* for fiscal years ending 2014 and later.

The June 30, 2017 total pension liability presented in this section was determined by an actuarial valuation as of December 31, 2016, based on the assumptions, methods and plan provisions described in this report. The actuarial cost method used to develop the total pension liability is the Entry Age Normal Cost method, as required by GASB Statement No. 67.

GASB Statement No. 67 set forth certain items of information to be disclosed in the financial statements of the Plan. The tables below provide a distribution of the number of employees by type of membership.

Table 19: Number of Active and Retired Members as of December 31, 2016

Group	Number
Retired members and survivors of deceased members killed in the Line of Duty currently receiving benefits	13,940
Terminated members and survivors of deceased members killed in the Line of Duty entitled to benefits but not yet receiving benefits	139
Active members*	42,445
Total	56,524

* Includes all members who have not received a refund of contributions. This group includes 25,210 active members and 17,235 lapsed members whose service did not increase during 2016.

Section 8: Accounting Results

GASB Statement No. 67 set forth certain items of information to be disclosed in the financial statements of the Plan. The tables below provide the schedule of changes in Net Pension Liability (Asset).

Table 20: Schedule of Changes in Net Pension Liability (Asset)

Calculation as of	June 30, 2017
Total Pension Liability	
Service Cost	$ 4,841,000
Interest	31,475,000
Changes of Benefit Terms	0
Difference between Expected and Actual Experience	2,048,000
Change of Assumptions	2,549,000
Benefit Payments, including Refund of Member Contributions	(29,070,000)
Net Change in Total Pension Liability	$ 11,843,000
Total Pension Liability - Beginning of Year	$ 443,832,000
Total Pension Liability - End of Year	$ 455,675,000
Plan Fiduciary Net Position	
Legislative Appropriations	$ 17,602,000
Member Contributions	2,594,000
Net Investment Income	39,928,000
Benefit Payments, including Refund of Member Contributions	(29,070,000)
Administrative Expenses	(919,000)
Other	15,000
Net Change in Fiduciary Net Position	$ 30,150,000
Plan Fiduciary Net Position - Beginning of Year	$ 377,013,000
Plan Fiduciary Net Position - End of Year	$ 407,163,000

Table 21: Net Pension Liability (Asset)

Calculation as of	June 30, 2017	June 30, 2016
Total Pension Liability	$ 455,675,000	$ 443,832,000
Plan Fiduciary Net Position	407,163,000	377,013,000
Net Pension Liability (Asset)	$ 48,512,000	$ 66,819,000
Plan Fiduciary Net Position as a Percentage of the Total Pension Liability	89.35%	84.94%

Section 8: Accounting Results

The table below is the sensitivity of the net pension liability to changes in the discount rate.

Table 22: Sensitivity of the Net Pension Liability (Asset) at June 30, 2017 to Changes in the Discount Rate

	1% Decrease	Current	1% Increase
Discount Rate	6.20%	7.20%	8.20%
Net Pension Liability (Asset)	105,209,000	48,512,000	1,908,000

The discount rate used to measure the total pension liability was 7.20%. The projection of cash flows used to determine the discount rate assumed that System appropriations will continue to follow the current funding policy. Based on those assumptions, the System's fiduciary net position was projected to be available to make all projected future benefit payments of current plan members. Please see Appendix E for additional detail.

The table below provides the methods and assumptions used to calculate the actuarially determined contribution rate.

Table 23: Additional Information for GASB Statement No. 67

Valuation Date	12/31/2016
Actuarial Cost Method	Entry Age
Amortization Method	Level dollar closed
Amortization Period	12 years
Asset Valuation Method	Asset returns in excess of or less than the expected return on market value of assets reflected over a five-year period (not greater than 120% of market value and not less than 80% of market value)
Actuarial Assumptions	
Investment Rate of Return*	7.20%
Projected Salary Increases	N/A
*Includes Inflation of	3.50%
Cost-of-living Adjustments	N/A

Appendix A: Valuation Process and Glossary of Actuarial Terms

Purpose of an Actuarial Valuation

The majority of Public Sector Retirement Systems in the State of North Carolina are defined benefit (DB) retirement systems. Under a DB Retirement System, the amount of benefits payable to a member upon retirement, termination, death or disability is defined in various contracts and legal instruments and is based, in part, on the member's years of credited service and final compensation. The amount of contribution needed to fund these benefits cannot be known with certainty. A primary responsibility of the Board of Trustees of a Retirement System is to establish and monitor a funding policy for the contributions made to the Retirement System.

While somewhat uncommon, in some jurisdictions, contributions are made by the plan sponsor as benefits come due. This is known as pay-as-you-go financing. More commonly, contributions for benefits are made in advance during the course of active employment of the members. This is known as actuarial pre-funding. For example, the State of North Carolina mandates for the Teachers' and State Employees' Retirement System (the "State Plan") that "on account of each member there shall be paid into the pension accumulation fund by employers an amount equal to a certain percentage of the actual compensation of each member to be known as the 'normal contribution'…" and further "the normal rate of contribution shall be determined by the actuary after each valuation."

The Actuarial Valuation Process

The following diagram summarizes the inputs and results of the actuarial valuation process. A narrative of the process follows the diagram. The reader may find it worthwhile to refer to the diagram from time to time.

Under the actuarial valuation process, current information about Retirement System members is collected annually by staff at the direction of the actuary, namely member data, asset data and information on benefit provisions. Member data is collected for each member of the Retirement System. The member data will assist the actuary in estimating benefits that could be paid in the future. The member information the actuary collects to estimate the amount of benefit includes elements such as current service, salary and benefit group identifier for members that have not separated service; for those that have, the actual benefit amounts are collected. The actuary collects information such as gender and date of birth to determine when a benefit might be paid

Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

and for how long. The actuary collects summary information about assets as of the valuation date and information on cash flows for the year ending on the valuation date. Information about benefit provisions as of the valuation date is also collected. To bridge the gap between the information collected and potential benefits to be paid in the future, the actuary must make assumptions about future activities. These assumptions are recommended by the actuary to the Boards based on the results of an experience review. An experience review is a review of the Retirement System over a period of time, typically five years, where the actuary analyzes the demographic and economic assumptions of the Retirement System. Based on this review, the actuary will make recommendations on the demographic assumptions, such as when members will be projected to retire, terminate, become disabled and/or die in the future, as well as the economic assumptions, such as what rate of return is projected to be earned by the fund based on the Retirement System investment policy and what level of future salary increases is expected for members. To maintain the assumptions, the Board should adopt a prudent policy of having an experience review being performed every five years. The next experience review for the North Carolina Retirement Systems will be based on the five-year period ending on December 31, 2019 and will be presented during 2020. Using these assumptions, the actuary is able to use the member data, asset data and benefit provision information collected to project the benefits that will be paid from the Retirement System to current members. These projected future benefit payments are based not only on service and pay through the valuation date but includes future pay and service, which has not yet been earned by the members but is expected to be earned.

These projected future benefit payments are discounted into today's dollars using the assumed rate of investment return assumption to determine the Present Value of Future Benefits (PVFB) of the Retirement System. The PVFB is an estimate of the value of the benefits promised to all members as of a valuation date. If the Retirement System held assets equal to the PVFB and all the assumptions were realized, there would be sufficient funds to pay off all the benefits to be paid in the future for members in the Retirement System as of the valuation date.

The PVFB is a large sum of money, typically much larger than the amount of Retirement System assets held in the trust. The next step is for the actuary to apply the Funding Policy as adopted by the Board to determine the employer contributions to be made to the Retirement System so that the gap between the PVFB and assets is systematically paid off over time. The Funding Policy is adopted by the Board based on discussions with the actuary. When the Board develops a funding policy, a balance between contributions which are responsive to the needs of the Retirement System yet stable should be struck. There are many different funding policies for the Board to consider, and the actuary is responsible for discussing the various features of the funding policies under consideration. Funding Policies are generally reviewed during an experience review, but it is not uncommon to review a funding policy in between, particularly during period where large increases or decreases in contributions are expected. The Funding Policy is composed of three components: the actuarial cost method, the asset valuation method, and the amortization method.

Once the PVFB is developed, an actuarial cost method is used to allocate the PVFB. Under the actuarial cost method, the PVFB is allocated to past, current and future service, respectively known as the actuarial accrued liability (AAL), normal cost (NC) and present value of future normal costs (PVFNC). The actuary computes the liability components (PVFB, NC, AAL, and PVFNC) for each participant in the Retirement System at the valuation date. These liability components are then totaled for the Retirement System. There are many actuarial cost methods. Different actuarial methods will produce different contribution patterns, but do not change the ultimate cost of the benefits. The entry age normal cost method is the most prevalent method used for public sector

Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

plans in the United States, because the expected normal cost is calculated in such a way that it will tend to stay level as a percent of pay over a member's career. Most of the North Carolina Retirement Systems use the entry age normal cost method.

The actuarial accrued liability (AAL) is also referred to as the amount of money the Retirement System should ideally have in the trust. The unfunded actuarial accrued liability (UAAL) is the portion of actuarial accrued liability that is not covered by the assets of the Retirement System. The UAAL can be a negative number, which means that the Retirement System has more assets than actuarial accrued liability. We refer to this condition as overfunded liability in this summary. Having UAAL does not indicate that the Retirement System is in failing actuarial health. UAAL is a common occurrence. Currently, many Retirement Systems in the United States have UAAL as a result of the Great Recession of 2008. Another related statistic of the Retirement System is the funded ratio. The funded ratio is the percent of the actuarial accrued liabilities covered by the actuarial value of assets. The assets used for these purposes are an actuarial value of assets (AVA), not market. The actuarial value of assets is based on the asset valuation method as recommended by the actuary and adopted by the Board. An actuarial value of assets is a smoothed, or averaged, value of assets, which is used to limit employer contribution volatility. Typically, assets are smoothed, or averaged, over a period of 3 to 5 years, although longer periods are becoming more common. By averaging returns, the UAAL is not as volatile, which we will see later results in contributions that are not as volatile as well. The North Carolina Retirement Systems use an actuarial value of assets with a smoothing period of 5 years.

While having UAAL is common, it is acceptable only if it is systematically being paid off. The method by which the UAAL is paid off is known as the amortization method. The concept is similar to that of a mortgage payment. The Board adopts the amortization method used to pay off the UAAL over a period of time. The amortization method is composed of the amortization period, the amount of payment increase, whether the period is open or closed and by the amount of amortization schedules. The amortization period is the amount of time over which the UAAL will be paid off. This is generally a period of thirty years or less, but actuaries are beginning to recommend shorter periods. The payments can be developed to stay constant from year to year like a mortgage, but often they are developed to increase each year at the same level payroll increases. Amortization type can be closed or open. Under a closed period, the UAAL is expected to be paid off over the amortization period. This is similar to a typical mortgage. Under an open period, the amortization period remains unchanged year after year. The concept is similar to re-mortgaging annually. In many instances, an amortization schedule is developed, whereby the UAAL is amortized over a closed period from the point the UAAL is incurred. Finally, some amortization methods are defined by a schedule of payments, where a new schedule of payments is added with each valuation. Regardless of the amortization type or period, the funding policy should generate a contribution that pays off the UAAL, which results in the funded ratio trending to 100% over time. Caution should be used when an open method is used, because typically an open amortization policy does not result in the UAAL being paid off. North Carolina pays off a much larger amount of UAAL compared to other states. While many states struggle to pay a 30-year level percent of pay UAAL contribution, which doesn't even reduce the amount of UAAL, North Carolina pays down the UAAL with level dollar payments over 12 years. This aggressive payment of UAAL results in North Carolina being home to many of the best funded Public Retirement Systems in the United States.

Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

To satisfy the requirements of the State of North Carolina, the actuary calculates the total annual contribution to the Retirement System as the normal cost plus a contribution towards UAAL. Said another way, this contribution is sufficient to pay for the cost of benefits accruing during the year (normal cost) plus the mortgage payment (UAAL payment). The total contribution is reduced by the amount of member contributions, if any, to arrive at the employer contribution. For the aggressive North Carolina contribution policy to be effective, the amounts that Conduent calculates need to be contributed. With very limited exception, North Carolina has contributed the amounts that Conduent has calculated, which has resulted in the North Carolina Retirements Systems being among the best funded in the United States.

An actuarial valuation report is produced annually, which contains the contribution for the fiscal year as well as the funded ratio of the Retirement System. The primary purpose of performing an actuarial valuation annually is to replace the estimated activities from the previous valuation, which were based on assumptions, with the actual experience of the Retirement System for the prior year. The experience gain (loss) is the difference between the expected and the actual UAAL of the Retirement System. An experience loss can be thought of as the amount of additional UAAL over and above the amount that was expected from the prior year due to deviation of actual experience from the assumption. Similarly, an experience gain can be thought of as having less UAAL than that which was expected from the prior year assumptions. As an example, if the Retirement System achieves an asset return of 15% when the assumption was a 7.20% return, an actuarial gain is said to have happened, which typically results in lower contributions and higher funded ratio, all else being equal. Alternatively, a return of 2% under the same circumstances would result in an actuarial loss, requiring an increase in contributions and a funded ratio that is lower than anticipated. Experience gains and losses are common within the valuation process. Typically gains and losses offset each other over time. To the extent that does not occur, the reasons for the gains and losses should be understood, and appropriate recommendations should be made by the actuary after an experience review to adjust the assumptions.

The actuarial valuation report will contain histories of key statistics from prior actuarial valuation reports. In particular, a history of the funded ratio of the Retirement System is an important exhibit. Trustees should understand the reason for the trend of the funded ratio of the Retirement System over time. The actuary will discuss the reasons for changes in the funded ratio of the Retirement System with each valuation report. To the extent that there are unexplained changes in funded ratio corrective action should be explored and the actuary will make recommendations as to whether there should be changes in the assumptions, funding policy, or some other portion of the actuarial valuation process.

In addition to historical information, projections of contributions and funded ratio based on current assumptions can sometimes be found in an actuarial valuation report. Projections of contributions can allow the employer to plan their budget accordingly. Surprises in Retirement System contributions to be paid by the employer serve no one. A one-year projection based on "bad" asset returns can provide ample time for the employer to plan, or allow for a discussion of changing the funding policy to occur. Contribution surprises are a primary contributor to employers considering pension reform. It is important to keep the employer apprised of future contribution requirements. A projection of funded ratio can serve the Trustees by illustrating the trend of the funded ratio over time. The funded ratio, under a prudent funding policy, should trend to 100% over a period of less than 30 years. (It is worthwhile to note that while 30 years has served as an industry standard for the longest period over which 100% funding should be achieved, that period is coming under scrutiny by the actuarial community and will likely be shortened.) If a projection of funded ratio

Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

does not trend to 100% over time, consideration should be given to fixing the funding policy to achieve this goal. For the North Carolina Retirement Systems, projections are generally performed for the January Board meetings. While the projection period has tended to be limited to five years, a longer projection would show the funded ratio trend to 100% much faster than other Public Retirement Systems.

The actuarial report will contain schedules of information about the census, plan and asset information submitted by Retirement System staff upon which the actuarial valuation is based. It is important that the Board of Trustees review that information and determine if the information is consistent with their understanding of the Retirement System. If after questioning staff, the Board of Trustees is not comfortable that the information provided is correct, the actuary should be notified to determine if the actuarial valuation report should be corrected.

Finally, the valuation report and/or presentation should contain sufficient information in an understandable fashion to allow the Board to take action and adopt the contribution rate for the upcoming year. It should also allow stakeholders to understand key observations over the past year that resulted in contributions increasing (or decreasing) and where contributions are headed. The actuary is always open to making the results understandable. Conduent works with the North Carolina Retirement Division to make your reports and presentations understandable and actionable. If something doesn't make sense – speak up!!

Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

Glossary

Note that the first definitions given are the "official" definitions of the term. For some terms there is a second definition, in italics, which is the unofficial definition.

Actuarial Accrued Liability (AAL). The portion of the Present Value of Projected Benefits (PVFB) allocated to past service. Also difference between (i) the actuarial present value of future benefits, and (ii) the present value of future normal cost. Sometimes referred to as "accrued liability" or "past service liability." *The amount of money that should be in the Fund. The funding target.*

Actuarial Assumptions. Estimates of future plan experience with respect to rates of mortality, disability, retirement, investment income and salary increases. Demographic ("people") assumptions (rates of mortality, separation, and retirement) are generally based on past experience, often modified for projected changes in conditions. Economic ("money") assumptions (salary increases and investment income) consist of an underlying rate appropriate in an inflation-free environment plus a provision for a long-term average rate of inflation. *Estimates of future events used to project what we know now- current member data, assets, and benefit provisions – into an estimate of future benefits.*

Actuarial Cost Method. A mathematical budgeting procedure for allocating the dollar amount of the Present Value of Projected Benefits (PVFB) between the normal costs to be paid in the future and the actuarial accrued liability. Sometimes referred to as the "actuarial funding method."

Actuarial Methods. The collective term for the Actuarial Cost Method, the Amortization Payment for UAAL Method, and the Asset Valuation Method used to develop the contribution requirements for the Retirement System. *The Funding Policy*.

Actuarial Equivalent. Benefits whose actuarial present values are equal.

Actuarial Present Value. The amount of funds presently required to provide a payment or series of payments in the future. It is determined by discounting the future payments at a predetermined rate of interest, taking into account the probability of payment.

Actuarial Value of Assets (AVA). A smoothed value of assets which is used to limit contribution volatility. Also known as the funding value of assets. *Smoothed value of assets.*

Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

Amortization Payment for UAAL. Payment of the unfunded actuarial accrued liability by means of periodic contributions of interest and principal, as opposed to a lump sum payment. The components of the amortization payment for UAAL includes:

- Amortization Period Length – Generally amortization periods of up to 15 to 20 years (and certainly not longer than 25) are allowed. Similar to a mortgage, the shorter the amortization period, the higher the payment and the faster the UAAL is paid off.
- Amortization payment increases – Future payments can be level dollar, like a mortgage, or as a level percent of pay. Most Retirement Systems amortize UAAL as a level percent of pay which when combined with the employer normal cost that is developed as a level percent of pay can result in contributions that are easier to budget.
- Amortization type Amortization schedule can be closed or open. A closed amortization schedule is similar to a mortgage – at the end of the amortization period the UAAL is designed to be paid off. An open amortization period is similar to refinancing the UAAL year after year.
- Amortization schedule UAAL can be amortized over a single amortization period, or it can be amortized over a schedule.

The amortization payment for UAAL can be thought of as the UAAL mortgage payment.

Asset Valuation Method. The components of how the actuarial value of assets is to be developed.

Experience Gain Loss. A measure of the difference between actual experience and experience anticipated by a set of actuarial assumptions during the period between two actuarial valuation dates, in accordance with the actuarial cost method being used. *The experience Gain (Loss) represents how much the actuary missed the mark in a given year.*

Funded Ratio. The percent of the actuarial accrued liabilities covered by the actuarial value of assets. Also known as the funded status. *The ratio of how much money you actually have in the fund to the amount you should have in the fund.*

Normal Cost. The annual cost assigned, under the actuarial funding method, to current and subsequent plan years. Sometimes referred to as "current service cost." An amortization payment toward the unfunded actuarial accrued liability is paid in addition to the normal cost to arrive at the total contribution in a given year. *The cost of benefits accruing during the year*.

Present Value of Future Normal Cost (PVFNC). The portion of the Present Value of Projected Benefits (PVFB) allocated to future service. *The value in today's dollars of the amount of contribution to be made in the future for benefits accruing for members in the Retirement System as of the valuation date. Note that in practice, this number is rarely discussed.*

Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

Present Value of Future Benefits (PVFB). The projected future benefit payments of the plan are discounted into today's dollars using an assumed rate of investment return assumption to determine the Present Value of Future Benefits (PVFB) of the Retirement System. The PVFB is the discounted value of the projected benefits promised to all members as of a valuation date, including future pay and service for members which has not yet been earned. *If the Retirement System held assets equal to the PVFB and all the assumptions were realized, there would be sufficient funds to pay off all the benefits to be paid in the future for members in the Retirement System as of the valuation date.*

Reserve Account. An account used to indicate that funds have been set aside for a specific purpose and are not generally available for other uses.

Unfunded Actuarial Accrued Liability (UAAL). The difference between the actuarial accrued liability (AAL) and actuarial value of assets (AVA). The UAAL is sometimes referred to as "unfunded accrued liability." *Funding shortfall, or prefunded amount if negative.*

Valuation Date. The date that the actuarial valuation calculations are performed as of. *Also known as the "snapshot date".*

Appendix B: Detailed Tabulations of Member Data

Table B-1: The Number of Active Members Distributed by Age and Service as of December 31, 2016

	Years of Service										
Age	Under 1	1 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 & Up	Total
Under 25	777	2,314	390	0	0	0	0	0	0	0	3,481
25 to 29	357	2,042	2,864	357	0	0	0	0	0	0	5,620
30 to 34	238	1,387	2,123	2,258	192	0	0	0	0	0	6,198
35 to 39	184	944	1,446	1,811	1,581	128	0	0	0	0	6,094
40 to 44	124	740	1,192	1,393	1,585	1,081	91	0	0	0	6,206
45 to 49	90	584	1,006	1,149	1,430	1,193	959	93	0	0	6,504
50 to 54	50	421	571	718	996	860	1,088	625	57	0	5,386
55 to 59	32	197	283	359	355	150	121	57	24	3	1,581
60 to 64	19	88	143	158	187	70	47	23	6	3	744
65 to 69	5	66	81	67	88	27	30	11	6	3	384
70 & Up	2	32	70	54	56	16	7	6	4	0	247
Total	1,878	8,815	10,169	8,324	6,470	3,525	2,343	815	97	9	42,445

Appendix B: Detailed Tabulations of Member Data (continued)

Table B-2: The Number of Active Members Distributed by Age as of December 31, 2016

Age	Active Members Number	Lapsed Members Number
17	3	
18	21	
19	153	8
20	342	63
21	460	158
22	466	211
23	506	234
24	587	269
25	581	359
26	639	425
27	713	468
28	728	490
29	728	489
30	699	544
31	740	481
32	764	497
33	707	507
34	737	522
35	747	523
36	697	519
37	647	536
38	709	513
39	667	536
40	736	514
41	675	530
42	711	510
43	736	517
44	743	534
45	753	544
46	807	573
47	772	558
48	754	519
49	714	510
50	641	498
51	619	480
52	567	546
53	629	480
54	583	343
55	278	194
56	185	149

Appendix B: Detailed Tabulations of Member Data (continued)

Table B-2: The Number of Active Members Distributed by Age as of December 31, 2016 (continued)

Age	Active Members Number	Lapsed Members Number
57	176	113
58	159	104
59	144	79
60	98	84
61	96	70
62	99	50
63	78	59
64	70	40
65	48	38
66	46	42
67	42	27
68	42	31
69	43	25
70	25	14
71	16	20
72	11	14
73	17	14
74	18	12
75	9	9
76	6	6
77	3	7
78	5	4
79	3	5
80	3	6
81	1	4
82	3	1
83	2	
84	1	1
85		3
86	2	1
89		1
Total	25,210	17,235

Appendix B: Detailed Tabulations of Member Data (continued)

Table B-3: The Number of Active Members Distributed by Service as of December 31, 2016

	Active Members	Lapsed Members
Service	Number	Number
0	445	
1	1,874	69
2	1,572	589
3	1,380	631
4	1,766	1,013
5	1,300	875
6	1,253	983
7	1,118	944
8	1,021	856
9	1,015	855
10	993	977
11	944	922
12	861	793
13	772	791
14	818	767
15	792	638
16	851	733
17	796	575
18	662	562
19	705	482
20	556	439
21	495	393
22	350	232
23	390	271
24	402	253
25	320	242
26	370	220
27	262	212
28	244	190
29	216	166
30	246	172
31	131	99
32	97	94
33	65	70
34	39	46

Appendix B: Detailed Tabulations of Member Data (continued)

Table B-3: The Number of Active Members Distributed by Service as of December 31, 2016 (continued)

	Active Members	Lapsed Members
Service	Number	Number
35	51	44
36	20	14
37	12	5
38	3	6
39		3
40	1	3
41	1	3
42	1	2
49		1
Total	25,210	17,235

Appendix B: Detailed Tabulations of Member Data (continued)

Table B-4: The Number and Annual Retirement Allowances of Retired Members Distributed by Age as of December 31, 2016

Age	Number	Allowances
54	23	$ 46,920
55	478	975,120
56	567	1,156,680
57	522	1,064,880
58	588	1,199,520
59	512	1,044,480
60	621	1,266,840
61	566	1,154,640
62	645	1,315,800
63	610	1,244,400
64	617	1,258,680
65	588	1,199,520
66	585	1,193,400
67	544	1,109,760
68	497	1,013,880
69	529	1,079,160
70	549	1,119,960
71	397	809,880
72	424	864,960
73	422	860,880
74	437	891,480
75	324	660,960
76	339	691,560
77	312	636,480
78	255	520,200
79	240	489,600
80	222	452,880
81	223	454,920
82	218	444,720
83	182	371,280
84	167	340,680
85	128	261,120
86	123	250,920
87	100	204,000
88	70	142,800

Appendix B: Detailed Tabulations of Member Data (continued)

Table B-4: The Number and Annual Retirement Allowances of Retired Members Distributed by Age as of December 31, 2016 (continued)

Age	Number	Allowances
89	74	$ 150,960
90	71	144,840
91	58	118,320
92	41	83,640
93	25	51,000
94	19	38,760
95	10	20,400
96	6	12,240
97	6	12,240
98	4	8,160
99	2	4,080
Total	13,940	$ 28,437,600

Appendix B: Detailed Tabulations of Member Data (continued)

Table B-5: The Number and Annual Retirement Allowances of Disabled Members Eligible for Deferred Pensions Distributed by Age of December 31, 2016

Age	Number	Allowances
31	1	$ 2,040
33	1	2,040
34	3	6,120
36	1	2,040
38	3	6,120
39	1	2,040
41	2	4,080
42	5	10,200
43	2	4,080
45	7	14,280
46	9	18,360
47	9	18,360
48	6	12,240
49	8	16,320
50	6	12,240
51	10	20,400
52	17	34,680
53	12	24,480
54	13	26,520
55	3	6,120
56	4	8,160
57	2	4,080
58	4	8,160
59	1	2,040
60	2	4,080
61	2	4,080
63	1	2,040
65	3	6,120
67	1	2,040
Total	139	$ 283,560

Appendix C: Summary of Main Benefit and Contribution Provisions

All regular and volunteer firefighters of the State of North Carolina whose qualifications are certified by their respective Boards of County Commissioners are eligible to be members of the Fund. All rescue squad workers who are eligible for membership in the North Carolina Association of Rescue Squads, Inc. are eligible to be members of the Fund. Credit for prior service (that is, service rendered prior to July 1, 1959) is granted to firemen who were eligible on July 1, 1959 and became members on or before June 30, 1961. Credit may also be given for certain special purchased service.

Benefits

Service Retirement Pension

Condition for Pension	A member who retires after he has attained age 55 and has credit for 20 years of service as a fireman or rescue squad worker in North Carolina is entitled to a monthly pension.
Amount of Pension	The amount of the pension is equal to $170 per month.

Deferred Early Retirement Pension

Condition for Pension	A member whose service is terminated after he has credit for 20 years of service as a fireman or rescue squad worker in North Carolina but before he has attained age 55 is eligible to receive a deferred retirement pension, starting at age 55, provided he continues to make regular contributions until age 55 or until he has contributed for a total of 20 years, whichever event occurs earlier. Any member who is totally and permanently disabled while in the discharge of his official duties and leaves service as a result of such disability is eligible for a deferred retirement pension commencing at age 55 without continuing to make contributions. Any member who becomes totally and permanently disabled for any cause, other than line of duty, after 10 years of credited service under the Pension Fund may continue to make monthly contributions until he has paid $2,400 into the Fund and receive a pension upon attainment of age 55.
Amount of Pension	The deferred pension is $170 per month.

Appendix C: Summary of Main Benefit and Contribution Provisions (continued)

Return of Contributions	Upon the death (not in the line of duty) or withdrawal of a member prior to retirement, his aggregate contributions are refunded in a lump sum.
	Upon the death (not in the line of duty) of a retired member, the excess, if any, of his aggregate contributions over the total of the pension payments he has received is refunded.
Line of Duty Death Benefit	Upon the death (in the line of duty) of a retired or active member, an amount of $170 per month is payable to the member's beneficiary, if living, beginning the month following the month the member would have attained age 55, or if the member had already attained age 55, beginning the month following the member's death, payable until the beneficiary's death.

Contributions

By Members	Each member contributes $10 per month until retirement or until he has contributed for a total of 20 years, whichever event occurs earlier.
By State	The State makes annual contributions sufficient, with the members' contributions, to meet the cost of the benefits under the Fund.
Changes Since Prior Valuation:	None.

Appendix D: Actuarial Assumptions and Methods

The withdrawal rates and return to service assumptions are based on the findings of the data audit of the FRSWPF and adopted by the Board of Trustees on July 21, 2016. The interest rate of 7.20% was adopted by the Board of Trustees on April 20, 2017 based upon a review of the existing portfolio structure as well as recent and anticipated experience. All other assumptions are based on the experience investigation prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016 for use with the December 31, 2016 annual actuarial valuation.

Interest Rate: 7.20% per annum, compounded annually.

Separations from Active Service: Representative values of the assumed annual rates of withdrawal and vesting, retirement, death and disability are as follows:

Annual Rates of

Service	Withdrawal	Age	Retirement*
0	0.0754	55+	1.00
1	0.0609		
2	0.0551		
3	0.0493		
4	0.0435		

* These rates apply only after 20 years of membership in the system.

Annual Rates of

Age	Withdrawal and Vesting*		Base Mortality**		Disability	
	Male	Female	Male	Female	Male	Female
25	.0203	.0203	.0005	.0002	.0010	.0006
30	.0232	.0232	.0005	.0002	.0010	.0009
35	.0174	.0174	.0005	.0003	.0015	.0024
40	.0145	.0145	.0006	.0004	.0040	.0038
45	.0145	.0145	.0010	.0007	.0055	.0048
50	.0145	.0145	.0017	.0011	.0100	.0076
55	.0145	.0145	.0028	.0017	.0150	.0176
60	.0145	.0145	.0047	.0024	.0150	.0276
65			.0083	.0037		
69			.0125	.0057		

* These rates apply only after five years of membership in the system.

** Base mortality rates as of 2014.

Appendix D: Actuarial Assumptions and Methods (continued)

Return to Service: The assumed rates in which a lapsed member returns to active service are based on the number of years that the member has been lapsed. These rates are as follows:

Number of Years the Member has been Lapsed	Percentage of Members Assumed to Return to Active Service*	Number of Years the Member has been Lapsed	Percentage of Members Assumed to Return to Active Service*
1 Year	42.0%	5 Years	6.0%
2 Years	23.0%	6 Years	4.5%
3 Years	14.0%	7 Years	3.0%
4 Years	10.0%	More than 8 Years	0.0%

* Members who are assumed to return to service are assumed to do so at the valuation date. Members who are assumed to not return to service (and have not yet attained 20 years of service) are assumed to receive a refund of contribution at age 55.

Post-Retirement Mortality: Representative values of the assumed post-retirement mortality rates as of 2014 prior to any mortality improvements are as follows:

Annual Rate of Death after Retirement

Age	Male Healthy Retirees	Female Healthy Retirees	Male Disabled Retirees	Female Disabled Retirees
55	.0057	.0036	.0241	.0143
60	.0078	.0052	.0274	.0168
65	.0110	.0080	.0326	.0207
70	.0168	.0129	.0416	.0279
75	.0268	.0209	.0559	.0406
80	.0447	.0348	.0789	.0604

Deaths After Retirement (Healthy at Retirement): Mortality rates are based on the RP-2014 Total Data Set for Healthy Annuitants Mortality Table. The RP-2014 annuitant tables have no rates prior to age 50. The RP-2014 Total Data Set Employee Mortality Table (with no adjustments) is used for ages less than 50.

Death After Retirement (Disabled at Retirement): Mortality rates are based on the RP-2014 Total Data Set for Disabled Annuitants Mortality Table. Rates for male members are multiplied by 103% for all ages. Rates for female members are multiplied by 99% for all ages.

Appendix D: Actuarial Assumptions and Methods (continued)

Deaths Prior to Retirement: Mortality rates are based on the RP-2014 Total Data Set Employee Mortality Table.

Mortality Projection: All mortality rates are projected from 2014 using generational improvement with Scale MP-2015.

Line of Duty Death Assumption: 10% of pre-retirement deaths are assumed to be in the line of duty.

Timing of Assumptions: All withdrawals, deaths, disabilities, retirements and salary increases are assumed to occur January 1 of each year.

Future Expenses: Equal to prior year actual administrative expenses.

Actuarial Cost Method: Entry age normal cost method. Entry age is established on an individual basis.

Amortization Period: 12-year closed, level-dollar amount. The first amortization base was created for the contribution payable for fiscal year ending 2012.

Asset Valuation Method: Actuarial value, as developed in Table 7. Actuarial value of assets is based upon a smoothed market value method. Under this method, asset returns in excess of or less than the expected return on market value of assets will be reflected in the actuarial value of assets over a five-year period. The calculation of the Actuarial Value of Assets is based on the following formula:

$MV – 80\% \times G/(L)_1 – 60\% \times G/(L)_2 – 40\% \times G/(L)_3 – 20\% \times G/(L)_4$

MV = the market value of assets as of the valuation date

$G/(L)_i$ = the asset gain or (loss) for the i-th year preceding the valuation date

Changes Since Prior Valuation: The interest rate was changed from 7.25% to 7.20% as of December 31, 2016. This change increased the actuarial accrued liability as of the valuation date by $2.5 million.

Appendix E: GASB 67 Fiduciary Net Position Projection

Table E-1: Projection of Fiduciary Net Positions

(in thousands)

Calendar Year	Beginning Fiduciary Position	Member Contributions	Employer Contributions	Benefit Payments	Administrative Expenses	Investment Earnings	Ending Fiduciary Position
2017	$ 383,866	$ 2,787	$ 12,743	$ 29,994	$ 974	$ 27,092	$ 395,520
2018	395,520	2,656	13,677	29,942	928	27,963	408,946
2019	408,946	2,494	14,178	30,807	871	28,914	422,854
2020	422,854	2,345	14,805	31,565	819	29,906	437,526
2021	437,526	2,197	15,410	32,159	768	30,961	453,167
2022	453,167	2,061	15,611	32,890	720	32,064	469,293
2023	469,293	1,929	11,958	33,666	674	33,066	481,906
2024	481,906	1,804	7,718	34,405	630	33,795	490,188
2025	490,188	1,679	6,668	35,150	586	34,324	497,123
2026	497,123	1,555	6,128	35,963	543	34,774	503,074
2027	503,074	1,423	6,622	36,630	497	35,193	509,185
2028	509,185	1,296	7,386	37,353	453	35,631	515,692
2029	515,692	1,139	6,497	37,973	398	36,042	520,999
2030	520,999	1,021	4,894	38,577	357	36,344	524,324
2031	524,324	898	3,771	39,176	314	36,519	526,022
2032	526,022	764	2,582	39,760	267	36,576	525,917
2033	525,917	645	1,329	40,488	225	36,496	523,674
2034	523,674	479	592	41,056	167	36,284	519,806
2035	519,806	339	283	41,508	118	35,975	514,777
2036	514,777	147	89	42,049	69	35,582	508,477
2037	508,477	0	33	42,429	22	35,110	501,169
2038	501,169	0	5	42,518	0	34,581	493,237
2039	493,237	0	4	42,504	0	34,010	484,747
2040	484,747	0	4	42,548	0	33,397	475,600
2041	475,600	0	5	42,522	0	32,740	465,823
2042	465,823	0	7	42,425	0	32,037	455,442
2043	455,442	0	6	42,298	0	31,296	444,446
2044	444,446	0	4	42,173	0	30,508	432,785
2045	432,785	0	3	41,992	0	29,676	420,472
2046	420,472	0	2	41,666	0	28,800	407,608
2047	407,608	0	1	41,244	0	27,888	394,253
2048	394,253	0	0	40,759	0	26,945	380,439
2049	380,439	0	0	40,168	0	25,971	366,242
2050	366,242	0	0	39,508	0	24,971	351,705
2051	351,705	0	0	38,808	0	23,950	336,847
2052	336,847	0	0	37,906	0	22,912	321,853
2053	321,853	0	0	36,764	0	21,873	306,962
2054	306,962	0	0	35,481	0	20,846	292,327
2055	292,327	0	0	34,188	0	19,838	277,977
2056	277,977	0	0	32,900	0	18,851	263,928
2057	263,928	0	0	31,623	0	17,884	250,189
2058	250,189	0	0	30,358	0	16,940	236,771
2059	236,771	0	0	29,105	0	16,018	223,684
2060	223,684	0	0	27,866	0	15,119	210,937
2061	210,937	0	0	26,642	0	14,246	198,541
2062	198,541	0	0	25,434	0	13,395	186,502
2063	186,502	0	0	24,244	0	12,570	174,828
2064	174,828	0	0	23,073	0	11,772	163,527
2065	163,527	0	0	21,921	0	10,998	152,604
2066	152,604	0	0	20,791	0	10,251	142,064

Appendix E: GASB 67 Fiduciary Net Position Projection (continued)

Table E-1: Projection of Fiduciary Net Positions (continued)

(in thousands)

Calendar Year	Beginning Fiduciary Position	Member Contributions	Employer Contributions	Benefit Payments	Administrative Expenses	Investment Earnings	Ending Fiduciary Position
2067	$ 142,064	$ 0	$ 0	$ 19,683	$ 0	$ 9,533	$ 131,914
2068	131,914	0	0	18,598	0	8,840	122,156
2069	122,156	0	0	17,536	0	8,175	112,795
2070	112,795	0	0	16,499	0	7,538	103,834
2071	103,834	0	0	15,488	0	6,928	95,274
2072	95,274	0	0	14,502	0	6,347	87,119
2073	87,119	0	0	13,544	0	5,793	79,368
2074	79,368	0	0	12,612	0	5,268	72,024
2075	72,024	0	0	11,709	0	4,772	65,087
2076	65,087	0	0	10,835	0	4,303	58,555
2077	58,555	0	0	9,990	0	3,863	52,428
2078	52,428	0	0	9,175	0	3,450	46,703
2079	46,703	0	0	8,392	0	3,066	41,377
2080	41,377	0	0	7,640	0	2,708	36,445
2081	36,445	0	0	6,922	0	2,380	31,903
2082	31,903	0	0	6,238	0	2,076	27,741
2083	27,741	0	0	5,589	0	1,800	23,952
2084	23,952	0	0	4,976	0	1,548	20,524
2085	20,524	0	0	4,401	0	1,322	17,445
2086	17,445	0	0	3,864	0	1,118	14,699
2087	14,699	0	0	3,367	0	940	12,272
2088	12,272	0	0	2,908	0	780	10,144
2089	10,144	0	0	2,490	0	643	8,297
2090	8,297	0	0	2,111	0	522	6,708
2091	6,708	0	0	1,771	0	421	5,358
2092	5,358	0	0	1,469	0	333	4,222
2093	4,222	0	0	1,203	0	262	3,281
2094	3,281	0	0	972	0	201	2,510
2095	2,510	0	0	774	0	154	1,890
2096	1,890	0	0	607	0	115	1,398
2097	1,398	0	0	467	0	84	1,015
2098	1,015	0	0	353	0	60	722
2099	722	0	0	262	0	43	503
2100	503	0	0	190	0	30	343
2101	343	0	0	135	0	20	228
2102	228	0	0	93	0	13	148
2103	148	0	0	63	0	8	93
2104	93	0	0	41	0	5	57
2105	57	0	0	26	0	3	34
2106	34	0	0	16	0	2	20
2107	20	0	0	10	0	2	12
2108	12	0	0	6	0	1	7
2109	7	0	0	3	0	0	4
2110	4	0	0	2	0	0	2
2111	2	0	0	1	0	1	2
2112	2	0	0	0	0	0	1
2113	1	0	0	0	0	0	1
2114	1	0	0	0	0	0	1
2115	1	0	0	0	0	0	1
2116	1	0	0	0	0	0	1

Appendix E: GASB 67 Fiduciary Net Position Projection (continued)

Table E-2: Actuarial Present Value of Projected Benefit Payments

(in thousands)

					Present Value of Benefit Payments		
Calendar Year	Beginning Fiduciary Position	Benefit Payments	Funded Benefit Payments	Unfunded Benefit Payments	Funded Payments at 7.20%	Unfunded Payments at 3.13%	Using Single Discount Rate of 7.20%
2017	$ 383,866	$ 29,994	$ 29,994	$ 0	$ 28,969	$ 0	$ 28,969
2018	395,520	29,942	29,942	0	26,977	0	26,977
2019	408,946	30,807	30,807	0	25,892	0	25,892
2020	422,854	31,565	31,565	0	24,747	0	24,747
2021	437,526	32,159	32,159	0	23,519	0	23,519
2022	453,167	32,890	32,890	0	22,438	0	22,438
2023	469,293	33,666	33,666	0	21,425	0	21,425
2024	481,906	34,405	34,405	0	20,425	0	20,425
2025	490,188	35,150	35,150	0	19,466	0	19,466
2026	497,123	35,963	35,963	0	18,578	0	18,578
2027	503,074	36,630	36,630	0	17,652	0	17,652
2028	509,185	37,353	37,353	0	16,791	0	16,791
2029	515,692	37,973	37,973	0	15,924	0	15,924
2030	520,999	38,577	38,577	0	15,090	0	15,090
2031	524,324	39,176	39,176	0	14,295	0	14,295
2032	526,022	39,760	39,760	0	13,534	0	13,534
2033	525,917	40,488	40,488	0	12,856	0	12,856
2034	523,674	41,056	41,056	0	12,161	0	12,161
2035	519,806	41,508	41,508	0	11,469	0	11,469
2036	514,777	42,049	42,049	0	10,838	0	10,838
2037	508,477	42,429	42,429	0	10,202	0	10,202
2038	501,169	42,518	42,518	0	9,536	0	9,536
2039	493,237	42,504	42,504	0	8,893	0	8,893
2040	484,747	42,548	42,548	0	8,304	0	8,304
2041	475,600	42,522	42,522	0	7,742	0	7,742
2042	465,823	42,425	42,425	0	7,205	0	7,205
2043	455,442	42,298	42,298	0	6,701	0	6,701
2044	444,446	42,173	42,173	0	6,233	0	6,233
2045	432,785	41,992	41,992	0	5,789	0	5,789
2046	420,472	41,666	41,666	0	5,358	0	5,358
2047	407,608	41,244	41,244	0	4,948	0	4,948
2048	394,253	40,759	40,759	0	4,561	0	4,561
2049	380,439	40,168	40,168	0	4,193	0	4,193
2050	366,242	39,508	39,508	0	3,847	0	3,847
2051	351,705	38,808	38,808	0	3,525	0	3,525
2052	336,847	37,906	37,906	0	3,212	0	3,212
2053	321,853	36,764	36,764	0	2,906	0	2,906
2054	306,962	35,481	35,481	0	2,616	0	2,616
2055	292,327	34,188	34,188	0	2,352	0	2,352
2056	277,977	32,900	32,900	0	2,111	0	2,111
2057	263,928	31,623	31,623	0	1,893	0	1,893
2058	250,189	30,358	30,358	0	1,695	0	1,695
2059	236,771	29,105	29,105	0	1,516	0	1,516
2060	223,684	27,866	27,866	0	1,354	0	1,354
2061	210,937	26,642	26,642	0	1,208	0	1,208
2062	198,541	25,434	25,434	0	1,075	0	1,075
2063	186,502	24,244	24,244	0	956	0	956
2064	174,828	23,073	23,073	0	849	0	849
2065	163,527	21,921	21,921	0	752	0	752
2066	152,604	20,791	20,791	0	666	0	666

Appendix E: GASB 67 Fiduciary Net Position Projection (continued)

Table E-2: Actuarial Present Value of Projected Benefit Payments (continued)

(in thousands)

					Present Value of Benefit Payments		
Calendar Year	Beginning Fiduciary Position	Benefit Payments	Funded Benefit Payments	Unfunded Benefit Payments	Funded Payments at 7.20%	Unfunded Payments at 3.13%	Using Single Discount Rate of 7.20%
2067	$ 142,064	$ 19,683	$ 19,683	$ 0	$ 588	$ 0	$ 588
2068	131,914	18,598	18,598	0	518	0	518
2069	122,156	17,536	17,536	0	456	0	456
2070	112,795	16,499	16,499	0	400	0	400
2071	103,834	15,488	15,488	0	350	0	350
2072	95,274	14,502	14,502	0	306	0	306
2073	87,119	13,544	13,544	0	267	0	267
2074	79,368	12,612	12,612	0	232	0	232
2075	72,024	11,709	11,709	0	201	0	201
2076	65,087	10,835	10,835	0	173	0	173
2077	58,555	9,990	9,990	0	149	0	149
2078	52,428	9,175	9,175	0	128	0	128
2079	46,703	8,392	8,392	0	109	0	109
2080	41,377	7,640	7,640	0	92	0	92
2081	36,445	6,922	6,922	0	78	0	78
2082	31,903	6,238	6,238	0	66	0	66
2083	27,741	5,589	5,589	0	55	0	55
2084	23,952	4,976	4,976	0	46	0	46
2085	20,524	4,401	4,401	0	38	0	38
2086	17,445	3,864	3,864	0	31	0	31
2087	14,699	3,367	3,367	0	25	0	25
2088	12,272	2,908	2,908	0	20	0	20
2089	10,144	2,490	2,490	0	16	0	16
2090	8,297	2,111	2,111	0	13	0	13
2091	6,708	1,771	1,771	0	10	0	10
2092	5,358	1,469	1,469	0	8	0	8
2093	4,222	1,203	1,203	0	6	0	6
2094	3,281	972	972	0	4	0	4
2095	2,510	774	774	0	3	0	3
2096	1,890	607	607	0	2	0	2
2097	1,398	467	467	0	2	0	2
2098	1,015	353	353	0	1	0	1
2099	722	262	262	0	1	0	1
2100	503	190	190	0	1	0	1
2101	343	135	135	0	0	0	0
2102	228	93	93	0	0	0	0
2103	148	63	63	0	0	0	0
2104	93	41	41	0	0	0	0
2105	57	26	26	0	0	0	0
2106	34	16	16	0	0	0	0
2107	20	10	10	0	0	0	0
2108	12	6	6	0	0	0	0
2109	7	3	3	0	0	0	0
2110	4	2	2	0	0	0	0
2111	2	1	1	0	0	0	0
2112	2	0	0	0	0	0	0
2113	1	0	0	0	0	0	0
2114	1	0	0	0	0	0	0
2115	1	0	0	0	0	0	0
2116	1	0	0	0	0	0	0

Appendix F: Data for Section 2 Graphs

The tables below provide the numbers associated with the graphs in Section 2 of this report.

Graph 1: Active and Lapsed Members

	Lapsed Member Count	Active Member Count
6/30/2012	N/A	40,870
12/31/2013	14,054	28,410
12/31/2014	17,164	25,970
12/31/2015	17,295	25,526
12/31/2016	17,235	25,210

Graph 2: Retired Members

	Retired Member Count	Retirement Allowance
6/30/2012	11,912	$ 24,300,480
12/31/2013	12,445	25,387,800
12/31/2014	12,730	25,969,200
12/31/2015	13,463	27,464,520
12/31/2016	13,940	28,437,600

Appendix F: Data for Section 2 Graphs (continued)

Graph 3: Market Value of Assets and Asset Returns

	Market Value of Assets	Annualized Asset Return*
6/30/2012**	$ 322,225,386	2.25%
12/31/2013*	371,122,130	12.42%
12/31/2014	383,327,980	6.24%
12/31/2015	372,572,223	0.35%
12/31/2016	383,865,563	6.24%

* Equals the asset return for the year preceding the valuation date except for the asset return at 12/31/2013 which equals the annualized asset return between 6/30/2012 and 12/31/2013

** The market value of assets as of June 30, 2012 includes employer contributions receivable of $4,318,042 as appropriated for fiscal year ending June 30, 2012 but received after such date.

Graph 5: Actuarial Value and Market Value of Assets

	Actuarial Value of Assets	Market Value of Assets
6/30/2012*	$ 338,885,087	$ 322,225,386
12/31/2013	364,836,260	371,122,130
12/31/2014	380,885,154	383,327,980
12/31/2015	393,387,721	372,572,223
12/31/2016	402,431,609	383,865,563

* The market value and actuarial value of assets as of June 30, 2012 include employer contributions receivable of $4,318,042 as appropriated for fiscal year ending June 30, 2012 but received after such date.

Appendix F: Data for Section 2 Graphs (continued)

Graph 6: Asset Returns

	Asset Return* (Actuarial Value)	Asset Return* (Market Value)
6/30/2012	5.96%	2.25%
12/31/2013*	7.43%	12.42%
12/31/2014	7.42%	6.24%
12/31/2015	5.87%	0.35%
12/31/2015	5.33%	6.24%

* Equals the asset return for the year preceding the valuation date except for the asset return at 12/31/2013 which equals the annualized asset return between 6/30/2012 and 12/31/2013

Graph 7: Actuarial Accrued Liability

	Liability for Active Members	Liability for Retired and Deferred Members	Total Liability
6/30/2012	$ 197,473,495	$ 206,343,408	$ 403,816,903
12/31/2013	197,492,759	215,560,754	413,053,513
12/31/2014	198,286,225	220,628,896	418,915,121
12/31/2015	180,540,546	260,259,878	440,800,424
12/31/2016	181,107,037	270,958,443	452,065,480

Graph 8: Actuarial Accrued Liability and Actuarial Value of Assets

	Actuarial Accrued Liability	Actuarial Value of Assets
6/30/2012*	$ 403,816,903	$ 338,885,087
12/31/2013	413,053,513	364,836,260
12/31/2014	418,915,121	380,885,154
12/31/2015	440,800,424	393,387,721
12/31/2016	452,065,480	402,431,609

* The actuarial value of assets as of June 30, 2012 includes employer contributions receivable of $4,318,042 as appropriated for fiscal year ending June 30, 2012 but received after such date

Appendix F: Data for Section 2 Graphs (continued)

Graph 9: Funded Ratios

	Funded Ratio (Actuarial Basis)	Funded Ratio (Market Basis)
6/30/2012	83.9%	79.8%
12/31/2013	88.3%	89.8%
12/31/2014	90.9%	91.5%
12/31/2015	89.2%	84.5%
12/31/2016	89.0%	84.9%

Graph 10: Actuarially Determined Employer Contribution Rates

Fiscal Year Ending	Normal Contribution	Accrued Liability Contribution	Total Contribution
6/30/2015	$ 5,500,000	$ 8,400,000	$ 13,900,000
6/30/2016	6,354,036	6,886,516	13,240,552
6/30/2017*	7,083,948	10,621,260	17,705,208
6/30/2018	6,082,027	8,205,274	14,287,301
6/30/2019**	5,591,401	8,952,682	14,544,083

* The actuarially determined employer contribution shown for fiscal year ending 6/30/2017 includes the impact of the experience study and legislative changes but does not include the impact of the return to service assumption, which would have reduced the contribution by approximately $3.3 million for fiscal year ending 6/30/2017.

** Subject to the impact of future legislative changes during that fiscal year