Firefighters' and Rescue Squad Workers' Pension Fund
Principal Results of Actuarial Valuation
as of December 31, 2015

Board of Trustees Meeting

Larry Langer and Mike Ribble

October 27, 2016

buckconsultants

xerox

Purpose of the Annual Actuarial Valuation

- As of the end of each calendar year:
  - An annual actuarial valuation is performed on FRSWPF
  - The actuary determines the amount of employer contributions to be made to FRSWPF during each member's career that, when combined with investment return and member contributions, such contributions 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.

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
- Employer Contributions

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

Key Takeaways

Key results of the December 31, 2015 valuation as compared to the December 31, 2014 valuation were:

- Market value returns of 0.35% compared to 7.25% assumed
- Recent legislation signed into law since the prior valuation
  - Session Law 2016-108 which provides a monthly benefit of $170 to a member's beneficiary if that member is killed in the Line of Duty
- Changes in actuarial assumptions and methods in accordance with the latest experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016
- The final return to service assumption based on the findings of the data audit of the FRSWPF and adopted by the Board of Trustees on July 21, 2016

When compared to the December 31, 2014 valuation, the above resulted in:

- A lower funded ratio (89.2% in the December 31, 2015 valuation compared to 90.9% in the December 31, 2014 valuation)
- A higher actuarially determined employer contribution ($14,287,301 for fiscal year ending June 30, 2018 compared to the preliminary contribution of $12,830,706 calculated in the December 31, 2014 valuation for fiscal year ending June 30, 2017)
  - The experience study increased the preliminary contribution of $12,830,706 to $17,602,208 for fiscal year ending June 30, 2017

Valuation Input

buckconsultants

xerox

Valuation Input

Membership Data

Number as of	12/31/2015	12/31/2014
Active members	25,526	25,970
Lapsed members	17,295	17,164
Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits	146	153
Retired members and survivors of deceased members currently receiving benefits	13,463	12,730
Total	56,430	56,017

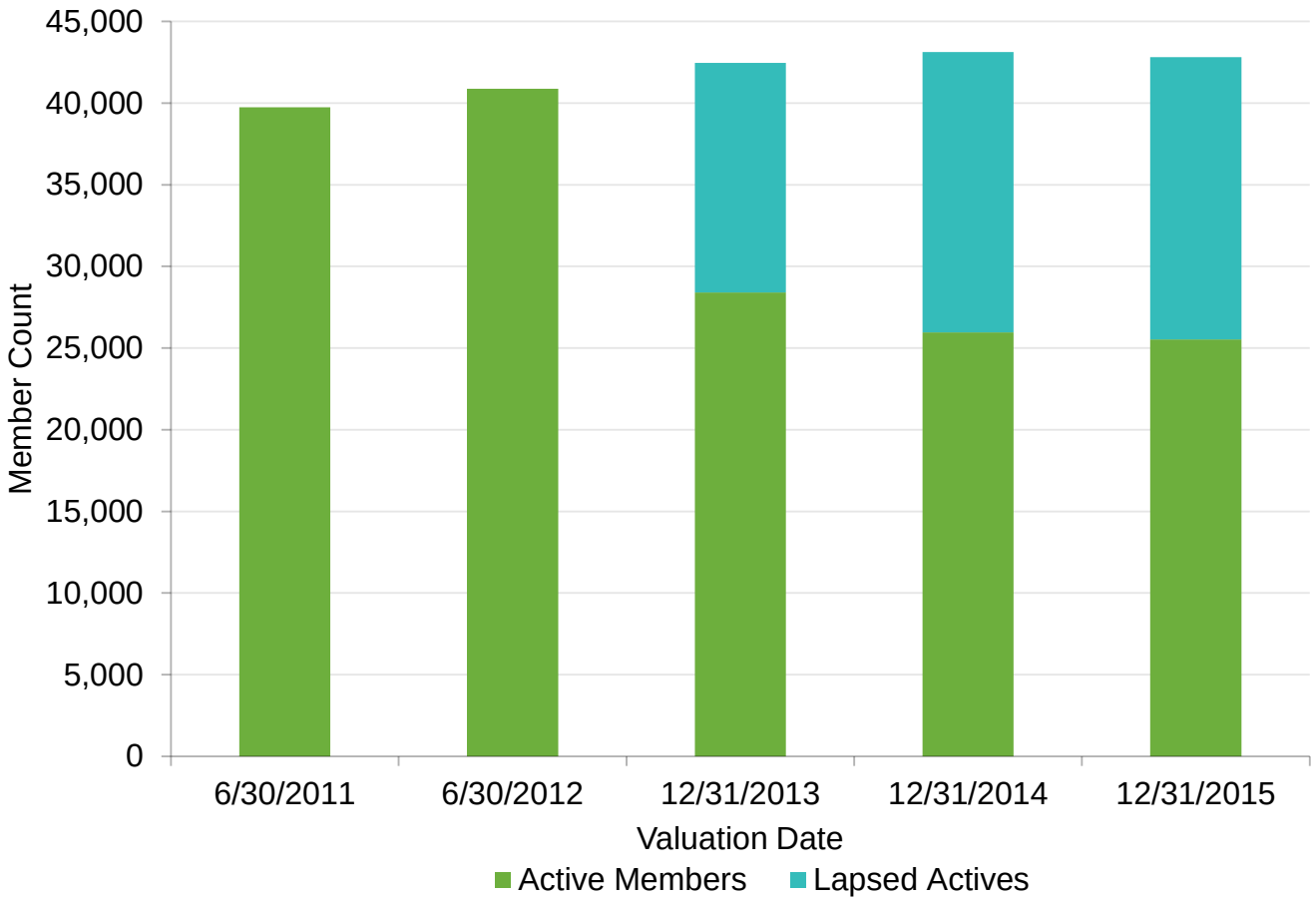
The number of active members decreased by 1.7% from the previous valuation date. The decrease in the active population could result in less benefits accruing, but also fewer contributions supporting the system.

The number of retired members and survivors of deceased members currently receiving benefits increased by 5.8% from the previous valuation date. The increase in retiree population is consistent with expectations.

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

Valuation Input

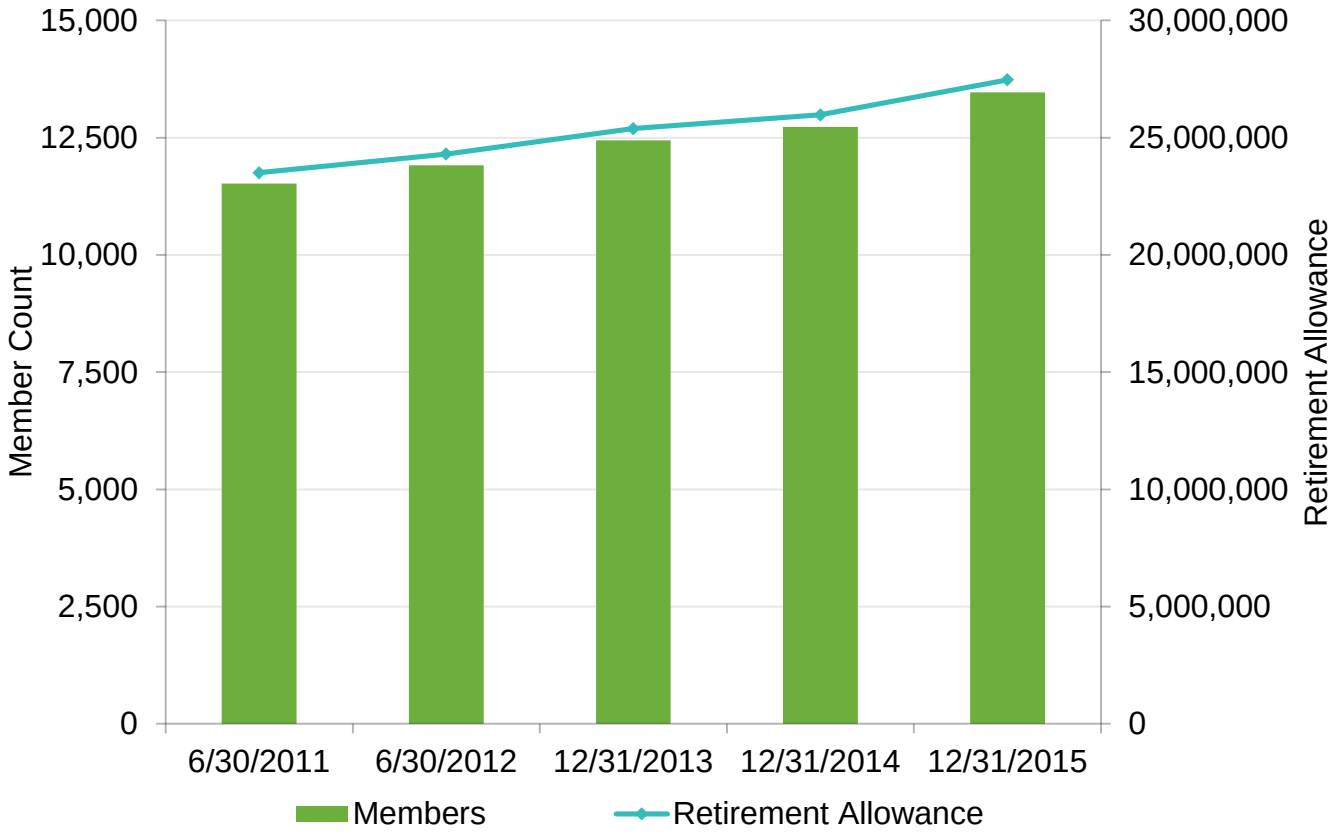
Membership Data: Active and Lapsed Members



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.

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

Membership Data: Retired Members



The number of retired members and survivors of deceased 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 the actuarial report.

Valuation Input

Asset Data: Market Value of Assets

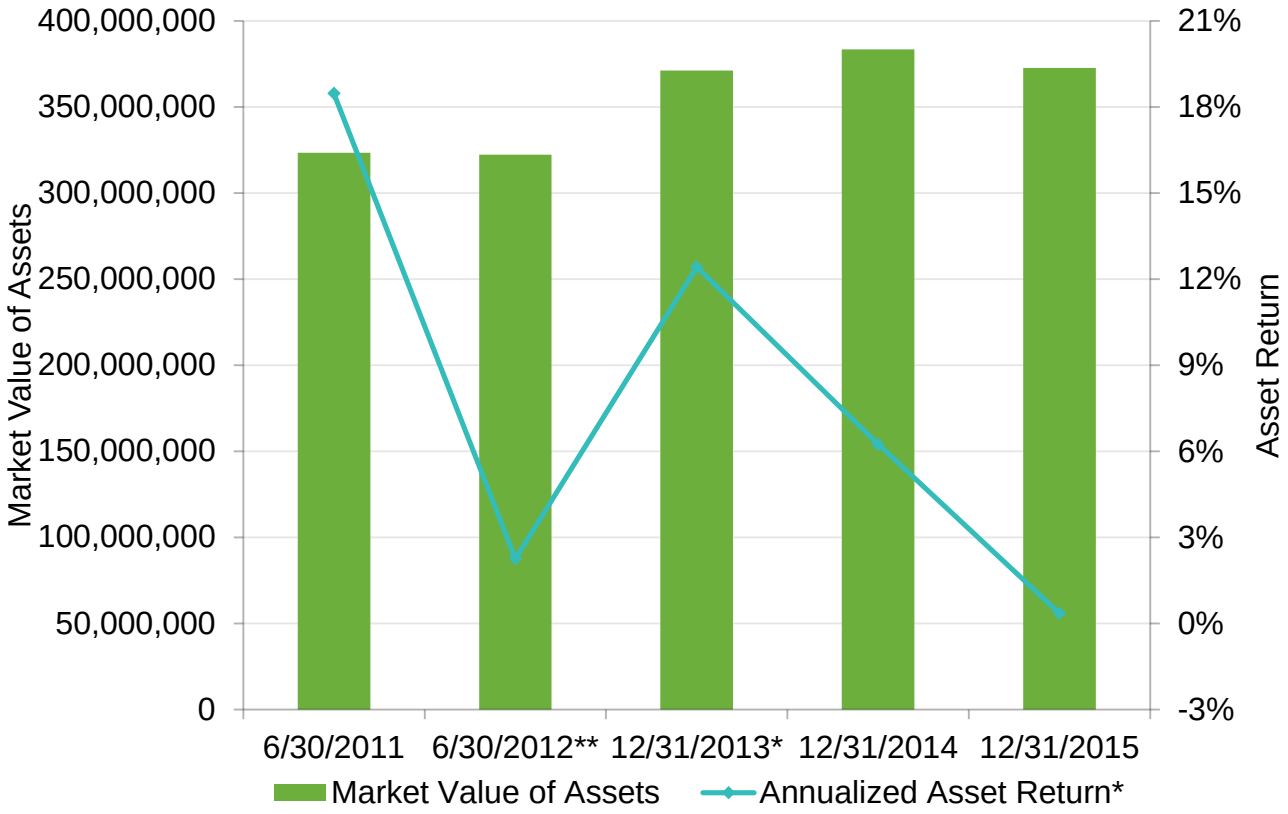
Asset Data as of	12/31/2015	12/31/2014
Beginning of Year Market Value of Assets	$ 383,327,980	$ 371,122,130
Contributions	16,727,357	16,648,810
Benefit Payments	(28,816,779)	(27,276,016)
Investment Income	1,333,665	22,833,056
Net Increase/(Decrease)	(10,755,757)	12,205,850
End of Year Market Value of Assets	$ 372,572,223	$ 383,327,980
Estimated Net Investment Return on Market Value (Annualized)	0.35%	6.24%

The market value of assets is $373 million as of December 31, 2015 and $383 million as of December 31, 2014. The investment return for the market value of assets for calendar year 2015 was 0.35%.

The market value of assets is provided in Section 4 of the actuarial report.

Valuation Input

Asset Data: Market Value of Assets and Annualized Asset Returns



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.

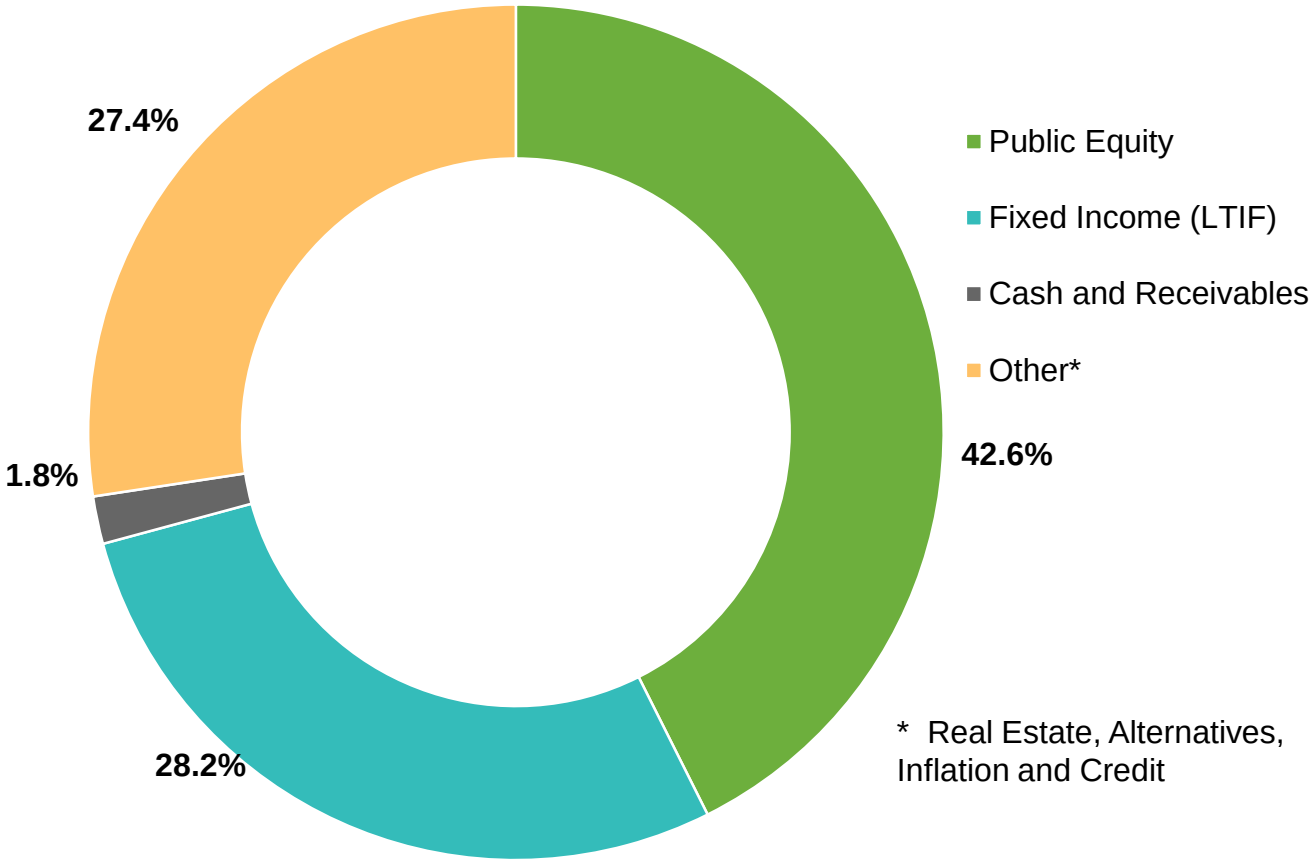
* Equals the asset return for the year preceding the valuation date except for the asset return at 12/31/2013 which equals the annualized asset return between 6/30/2012 and 12/31/2013

** 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.

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

Valuation Input

Asset Data: Allocation of Investments by Category



* Real Estate, Alternatives, Inflation and Credit

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 7.25% 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 the actuarial report.

Valuation Input

Benefit Provisions

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

The valuation reflects the following change in benefit provisions from the prior year's valuation:

- Session Law 2016-108 which provides a monthly benefit of $170 to a member's beneficiary if that member is killed in the Line of Duty

Highlights of the benefit provisions are described below:

- An unreduced retirement allowance is payable to members who attain 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.

Many Public Sector Retirement Systems in the United States have undergone pension reform where the benefits of members (current retirees and 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.

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

Valuation Input

Actuarial Assumptions

- Demographic (future events that relate to people)
  - Retirement
  - Termination
  - Disability
  - Death
- Economic (future events that relate to money)
  - Interest rate – 7.25% per year
- The actuarial assumptions and asset valuation method were updated since the prior year's valuation in accordance with the latest experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016 and in accordance with the final return to service assumption adopted by the Board of Trustees on July 21, 2016

Other than the return to service assumption, the latest assumptions were adopted for use with the December 31, 2015 actuarial valuation, based on the experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016.

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

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 stay 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

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

Valuation Input

Funding Methodology (continued)

- 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 FRWPF 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 the actuarial report.

Valuation Results

buckconsultants

xerox

Actuarial Value of Assets

Asset Data as of	12/31/2015
Beginning of Year Market Value of Assets	$ 383,327,980
Contributions	16,727,357
Benefit Payments	(28,816,779)
Net Cash Flow	(12,089,422)
Expected Investment Return	27,353,037
Expected End of Year Market Value of Assets	398,591,595
End of Year Market Value of Assets	372,572,223
Excess of Market Value over Expected Market Value of Assets	(26,019,372)
80% of 2015 Asset Gain/(Loss)	(20,815,498)
60% of 2014 Asset Gain/(Loss)	N/A
40% of 2013 Asset Gain/(Loss)	N/A
20% of 2012 Asset Gain/(Loss)	N/A
Total Deferred Asset Gain/(Loss)	(20,815,498)
Preliminary End of Year Actuarial Value of Assets	393,387,721
Final End of Year Actuarial Value of Assets (not less than 80% and not greater than 120% of Market Value)	393,387,721
Estimated Net Investment Return on Actuarial Value	5.87%

The actuarial value of assets smooths investment gains/losses, resulting in less volatility in the employer contribution.

The new asset valuation method adopted with the experience study assumptions re-set the actuarial value of assets to the market value of assets at December 31, 2014, effective for the December 31, 2015 valuation.

Lower than expected returns in 2015 resulted in an actuarial value of asset return for calendar year 2015 of 5.87% and an asset loss of $5.2 million during 2015.

The actuarial value of assets is provided in Section 4 of the actuarial report.

Valuation Results

Historical Annualized Asset Returns

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%
Average	6.70%	5.37%
Range	6.89%	32.62%

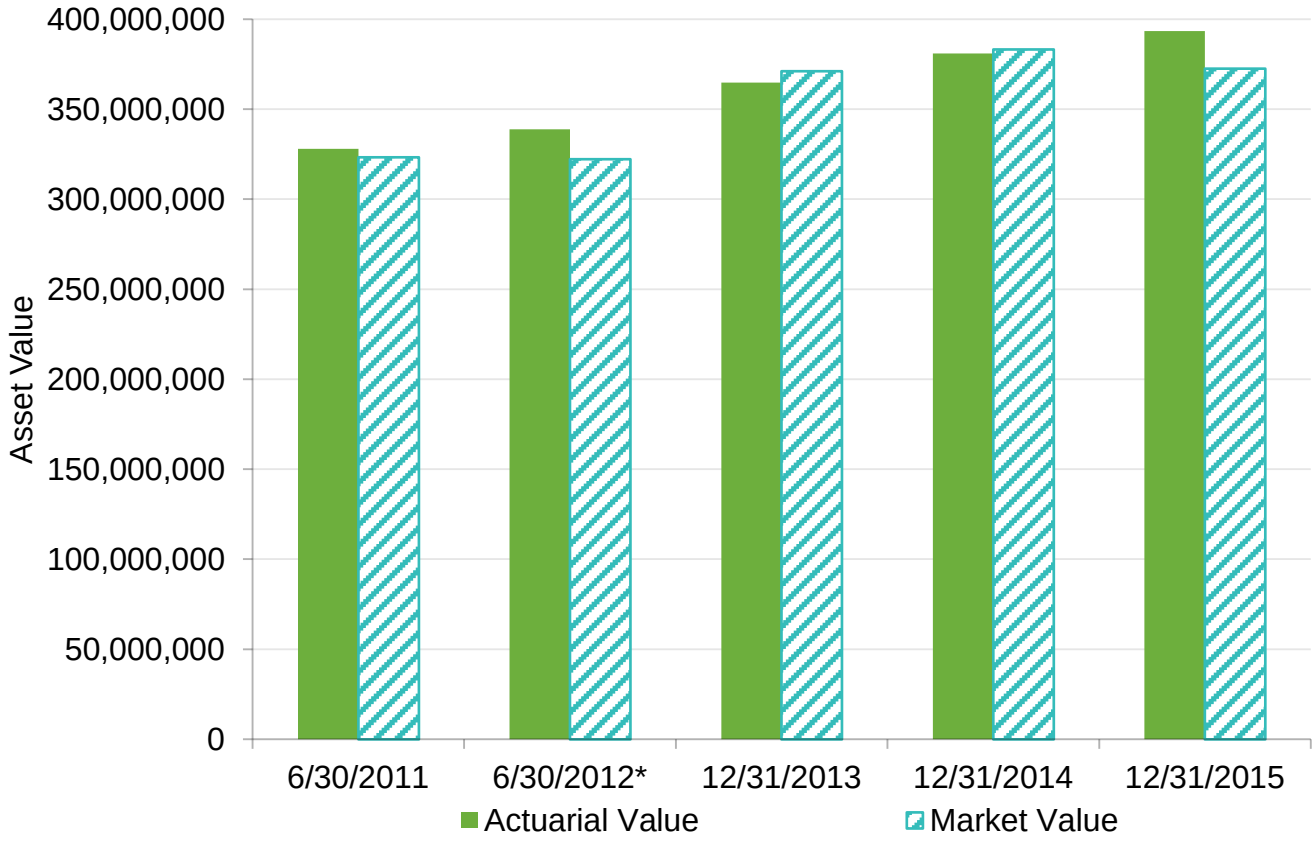
* Asset returns for years prior to 2013 are the returns for the year ending on June 30 of the applicable year. The 2013 asset return is the annualized return for the 18-month period from June 30, 2012 to December 31, 2013. Asset returns for years after 2013 are for the calendar year.

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 6.70% tracks average market return of 5.37% rather well. But the range of returns is markedly less – 6.89% versus 32.62%. This results in much lower employer contribution volatility using the actuarial value of assets versus market, while ensuring that the actuarial needs of FRSWPF are met.

The valuation assumes that the funds will earn a 7.25% asset return. This table provides a history of the Actuarial Value and Market Value of Asset annualized returns.

Actuarial Value of Assets: Compared to Market Value

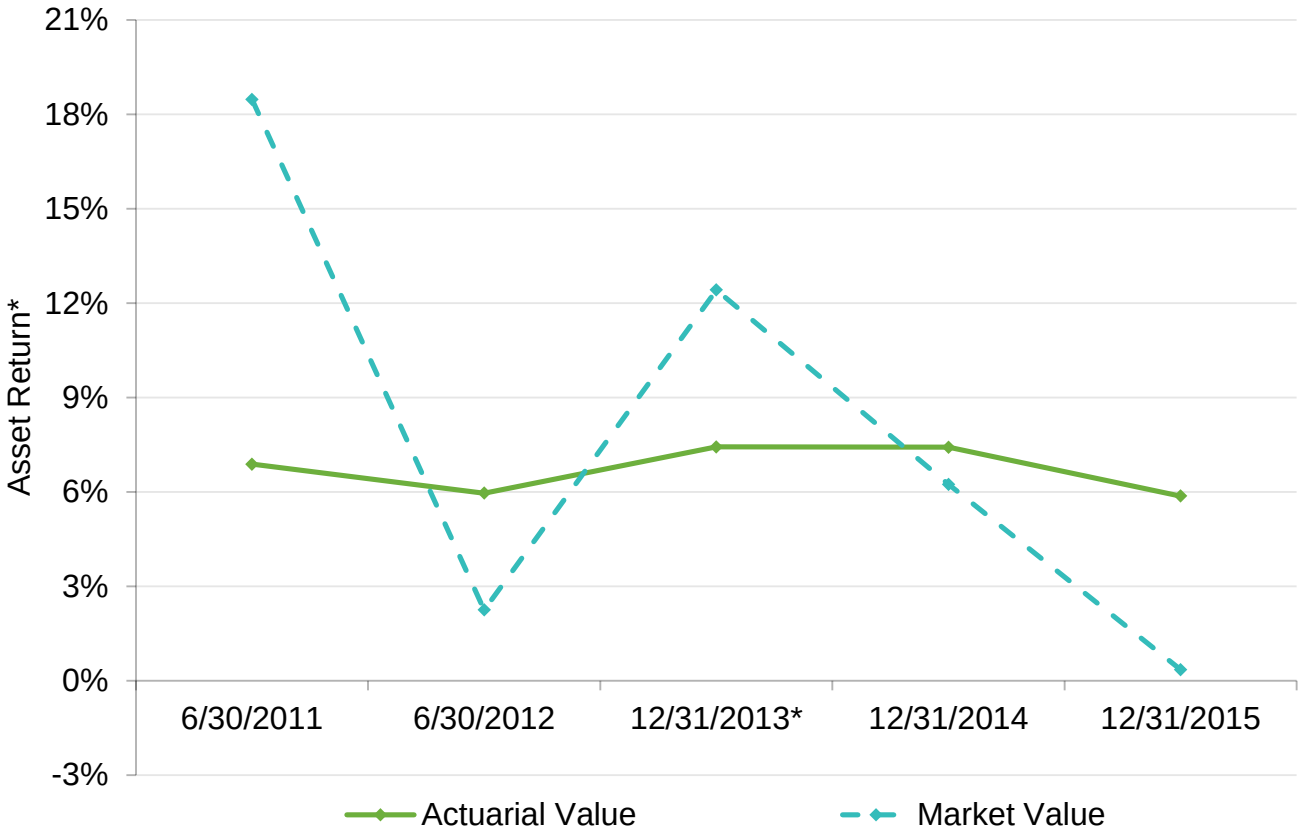


The market value of assets is lower than the actuarial value of assets, which is used to determine employer contributions. This indicates that there are unrecognized asset losses to be recognized in future valuations.

* 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.

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

Annualized Asset Returns: Actuarial Value and Market Value

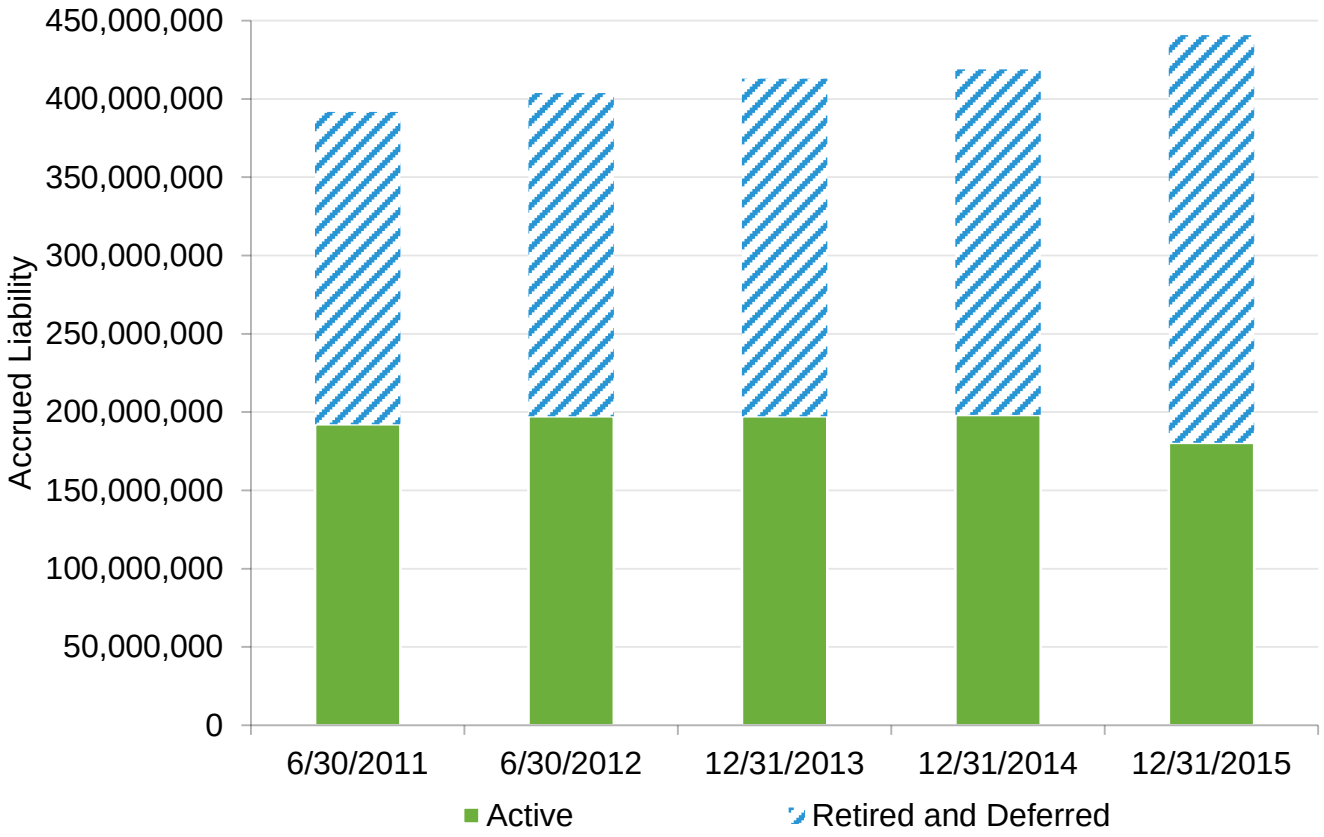


The actuarial value of assets smooths investment gains/losses, resulting in less volatility in the employer contribution.

* 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

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

Actuarial Accrued Liability (AAL)



The AAL increased from $419 million to $441 million in 2015. 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.

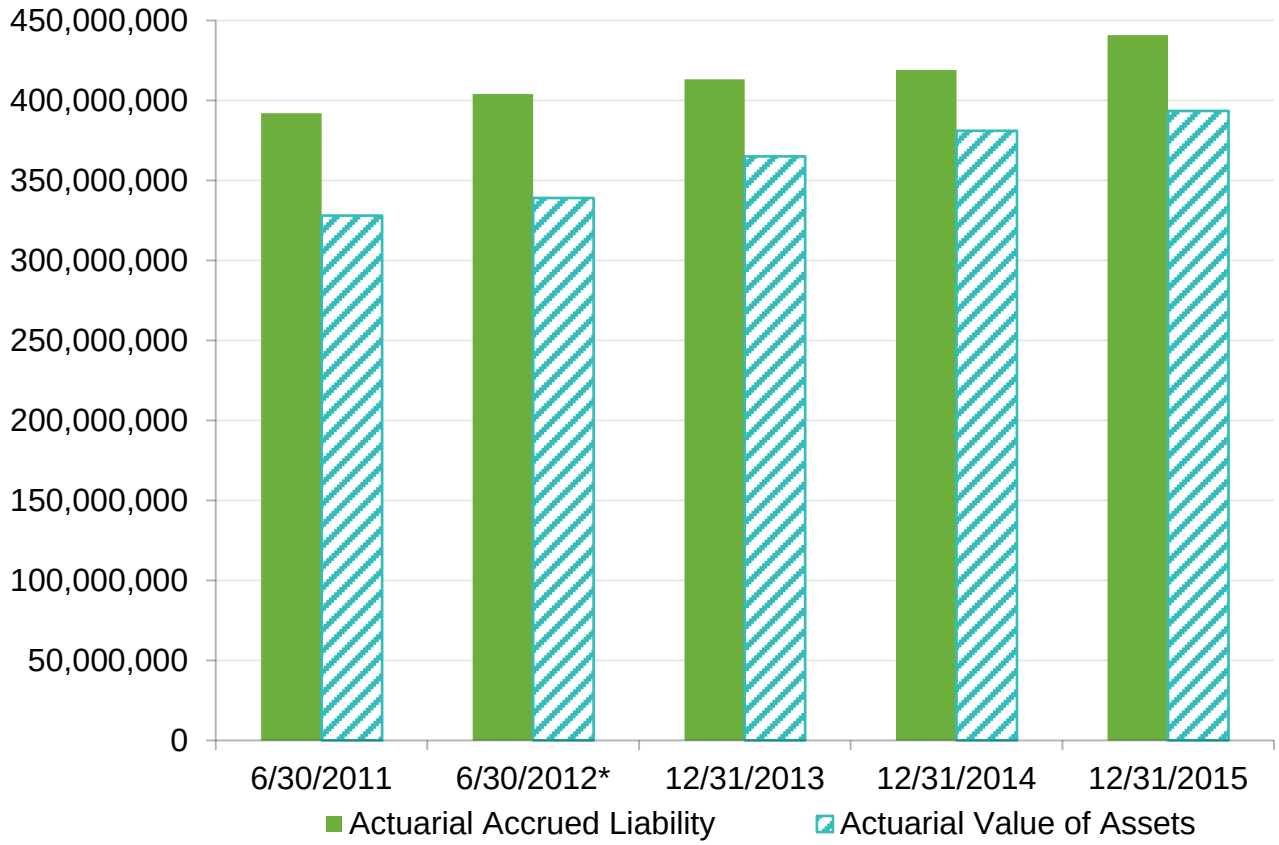
Assumption changes due to the experience study increased the AAL by $33.9 million at December 31, 2014.

The AAL prior to the return to service assumption and legislative changes was $7.4 million lower than expected, which resulted in a demographic gain of $7.4 million during 2015.

Assumption changes due to the return to service assumption decreased the AAL by $18.4 million. Legislative changes increased the AAL by $0.1 million.

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

Actuarial Accrued Liability (AAL) and Actuarial Value of Assets (AVA)



The AVA basis is used for computing contributions to alleviate contribution volatility.

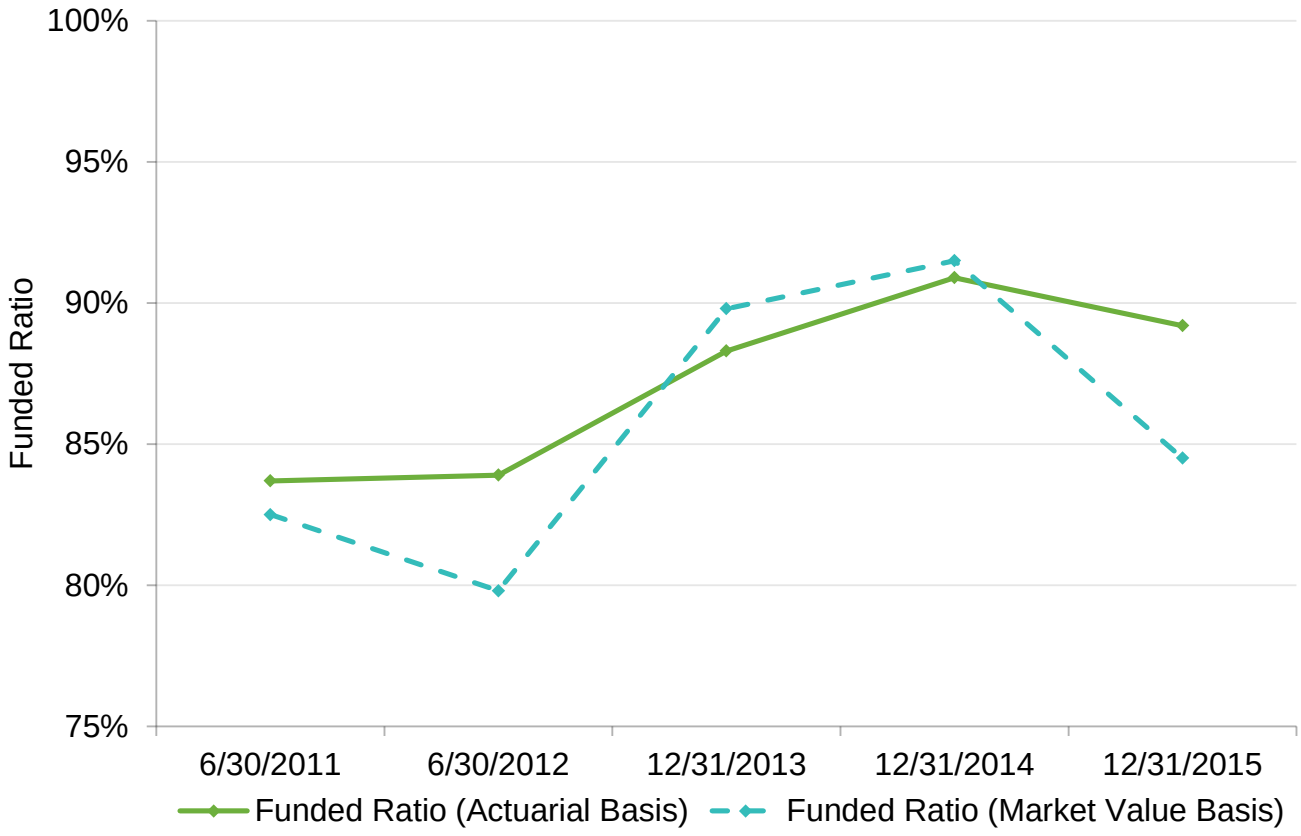
The difference in the AAL and the AVA is the amount of pension debt to be paid off in 12 years.

* The 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.

A detailed summary of the AVA is provided in Section 4 of the actuarial report, and a detailed summary of the AAL is provided in Section 5 of the actuarial report.

Valuation Results

Funded Ratio: AAL Divided by AVA



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 90.9% at December 31, 2014 to 89.2% at December 31, 2015.

Net Actuarial Gain or Loss: Reconciliation of Unfunded Actuarial Accrued Liability

(in millions)		
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2014	$	38.0
Impact of Experience Study		31.5
Normal Cost during 2015		9.9
Reduction due to Actual Contributions during 2015		(16.7)
Interest on UAAL, Normal Cost, and Contributions		5.2
Asset (Gain)/Loss		5.2
Actuarial Accrued Liability (Gain)/Loss		(7.4)
Impact of Return to Service Assumption		(18.4)
Impact of Legislative Changes		0.1
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2015	$	47.4

The experience study increased the UAAL, or pension debt, by $31.5 million at December 31, 2014.

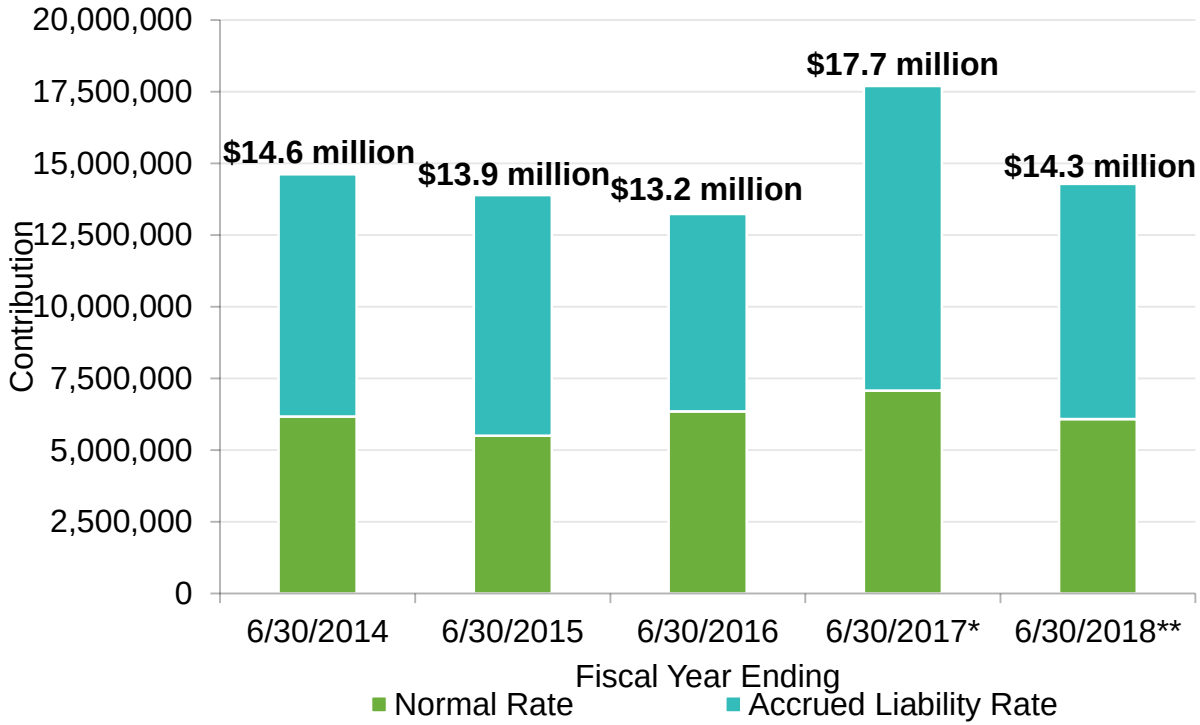
During 2015, the UAAL increased faster than expected due to asset losses that were offset by a liability gain.

The accrued liability gain of $7.4 million means that the unfunded actuarial accrued liability was $7.4 million lower than we would have expected based on the assumptions.

The asset loss of $5.2 million means that the asset valuation method resulted in a recognition of $5.2 million of deferred asset losses.

The net actuarial gain/(loss) is provided in Section 5 of the actuarial report.

Actuarially Determined Employer Contributions



* 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.

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 30 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 is provided in Section 6 of the actuarial report.

Valuation Results

Actuarially Determined Employer Contribution Rates

Valuation Date	Fiscal Year Ending	Preliminary ADEC	Subsequent Changes to ADEC***	Final ADEC	Appropriated Rate
12/31/2015	6/30/2018	$14,287,301	N/A	N/A	N/A
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	0	13,240,552	13,550,000
6/30/2012*	6/30/2015	15,100,000	(1,200,000)**	13,900,000	13,900,000
6/30/2012	6/30/2014	14,620,362	0	14,620,362	14,626,599

* Because a valuation was not performed at June 30, 2013, the preliminary 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 employer contribution was estimated to decrease by $2,200,000. House Bill 1034 (Session Law 2014-64) increased the employer contribution by $1,000,000. Subsequently, the 2014 Appropriations Act (Session Laws 2014-100) set contributions 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 of line of duty death benefits.

The actuarially determined employer contributions are provided in Section 6 of the actuarial report.

Reconciliation of the Change in the Actuarially Determined Employer Contribution

Fiscal year ending June 30, 2017 Preliminary ADEC (estimated based on December 31, 2014 Valuation)	12,830,706
Impact of Experience Study	4,771,502
Impact of Legislative Changes	103,000
Fiscal year ending June 30, 2017 Final ADEC*	17,705,208
Change Due to Demographic (Gain)/Loss	(432,844)
Change Due to Investment (Gain)/Loss	712,060
Change Due to Contributions Greater than ADEC	(21,939)
Impact of Return to Work Assumption	(3,675,184)
Fiscal year ending June 30, 2018 Preliminary ADEC (estimated based on December 31, 2015 Valuation)	14,287,301

Demographic gain primarily due to salary increases less than assumed based on the assumptions adopted with the experience study.

Investment loss is a recognition of asset losses from 2015.

* 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.

A detailed summary of the actuarially determined employer contributions is provided in Section 6 of the actuarial report.

Key Takeaways

Key results of the December 31, 2015 valuation as compared to the December 31, 2014 valuation were:

- Market value returns of 0.35% compared to 7.25% assumed
- Recent legislation signed into law since the prior valuation
  - Session Law 2016-108 which provides a monthly benefit of $170 to a member's beneficiary if that member is killed in the Line of Duty
- Changes in actuarial assumptions and methods in accordance with the latest experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016
- The final return to service assumption based on the findings of the data audit of the FRSWPF and adopted by the Board of Trustees on July 21, 2016

When compared to the December 31, 2014 valuation, the above resulted in:

- A lower funded ratio (89.2% in the December 31, 2015 valuation compared to 90.9% in the December 31, 2014 valuation)
- A higher actuarially determined employer contribution ($14,287,301 for fiscal year ending June 30, 2018 compared to the preliminary contribution of $12,830,706 calculated in the December 31, 2014 valuation for fiscal year ending June 30, 2017)
  - The experience study increased the preliminary contribution of $12,830,706 to $17,602,208 for fiscal year ending June 30, 2017

Key Takeaways

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

As has been done over the past 70 years, continued focus on these measures will be needed to maintain the solid status of CJRS well into the future.

Certification

The assumptions, methods, and plan provisions used in the results presented in this presentation were provided in October 2016 in the "Report Actuarial Valuation of the North Carolina Firefighters' and Rescue Squad Workers' Pension Fund prepared as of December 31, 2015."

The results were prepared under the direction of Michael Ribble and Larry Langer who meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. These results have been prepared in accordance with all applicable Actuarial Standards of Practice, and we are available to answer questions about them.

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.

Michael A. Ribble, FSA, EA, MAAA
Principal, Consulting Actuary

Larry Langer, ASA, EA, MAAA
Principal, Consulting Actuary

Questions?

THANK YOU

buckconsultants

xerox

North Carolina Firefighters' and Rescue Squad Workers' Pension Fund

Report on the Actuarial Valuation
Prepared as of December 31, 2015

October 2016

Buck Consultants, LLC
A Xerox Company
14911 Quorum Drive
Suite 200
Dallas, TX 75254

P: 972.628.6800
F: 972.628.6801

www.xerox.com\hrconsulting

October 13, 2016

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, 2015.

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 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 Buck to review any statement you wish to make on the results contained in this report. Buck 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 Buck 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. Other than the return to service assumption, the latest assumptions were adopted for use with the December 31, 2015 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, Buck performed no analysis of the potential range of such future differences, except for some limited analysis in financial projections or required disclosure information.

The undersigned 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 we are available to answer questions about it.

Respectfully submitted,

Michael A. Ribble, FSA, EA, MAAA
Principal, Consulting Actuary

Larry Langer, ASA, EA, MAAA
Principal, Consulting Actuary

MAR:mg
\NC\VAL\2015 Fire and Rescue.DOCX

Table of Contents

Table of Contents

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 eight 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, 2015, the Retirement Systems defined benefit plans cover about 980,000 current and prior public servants in the state of North Carolina. During the fiscal year ending June 30, 2016, the Systems paid $5.7 billion in pensions to about 280,000 retirees. And as of June 30, 2016, the Systems' assets were valued at $87 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 $373 million in assets and over 56,000 members as of December 31, 2015. This actuarial valuation report is our annual analysis of the financial health of FRSWPF. This report, prepared as of December 31, 2015, 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

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, 2015 valuation as compared to the December 31, 2014 valuation were:

- Market value returns of 0.35% compared to 7.25% assumed
- Recent legislation signed into law since the prior valuation:
  - Session Law 2016-108 which provides a monthly benefit of $170 to a member's beneficiary if that member is killed in the Line of Duty
- Changes in actuarial assumptions and methods in accordance with the latest experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016
- The final return to service assumption based on the findings of the data audit of the FRSWPF and adopted by the Board of Trustees on July 21, 2016

When compared to the December 31, 2014 actuarial valuation, the above resulted in:

- Lower funded ratio (89.2% in the December 31, 2015 valuation compared to 90.9% in the December 31, 2014 valuation)
- Higher actuarially determined employer contribution ($14,287,301 for fiscal year ending June 30, 2018 compared to the preliminary $12,830,706 calculated in the December 31, 2014 valuation for fiscal year ending June 30, 2017)

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, 2015, 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	12/31/2015	12/31/2014
Active Members		
Non-lapsed Members	25,526	25,970
Lapsed Members	17,295	17,164
Retired Members and Survivors of Deceased Members Currently Receiving Benefits		
Number	13,463	12,730
Annual Allowances	$ 27,464,520	$ 25,969,200
Number of Deferred Disabled Members	146	153
Assets		
Actuarial Value (AVA)	$ 393,387,721	$ 380,885,154
Market Value	$ 372,572,223	$ 383,327,980
Actuarial Accrued Liability (AAL)	$ 440,800,424	$ 418,915,121
Unfunded Accrued Liability (AAL-AVA)	$ 47,412,703	$ 38,029,967
Funded Ratio* (AVA/AAL)	89.2%	90.9%
Results for Fiscal Year Ending	**6/30/2018**	**6/30/2017**
Actuarially Determined Employer Contribution (ADEC)		
Normal Cost	$ 6,082,027	$ 6,620,072
Accrued Liability	8,205,274	6,210,634
Total	$ 14,287,301	$ 12,830,706
Impact of Experience Study	N/A	$ 4,771,502
Impact of Legislative Changes	N/A	103,000
Final ADEC**	N/A	$ 17,705,208
Appropriations Act for Fiscal Year Ending	**6/30/2017**	**6/30/2016**
Employer Contribution	$ 17,602,208	$ 13,550,000

* The Funded Ratio on a Market Value of Assets basis is 84.5% at December 31, 2015.
** 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.

Section 2: The Valuation Process

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

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	12/31/2015	12/31/2014
Active members	25,526	25,970
Lapsed members	17,295	17,164
Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits	146	153
Retired members and survivors of deceased members currently receiving benefits	13,463	12,730
Total	56,430	56,017

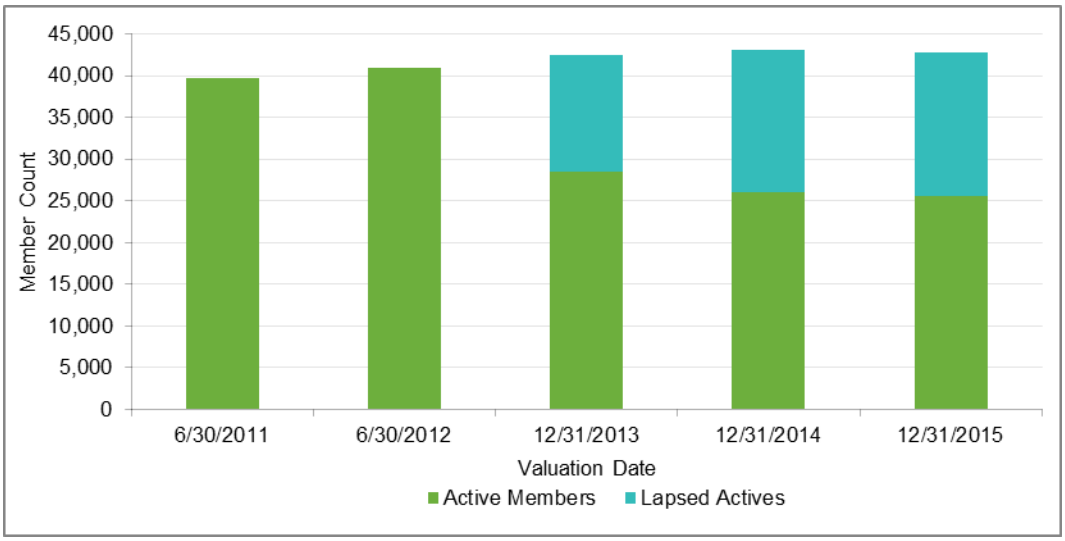
Commentary: The number of active members decreased by 1.7% from the previous valuation date. The decrease in the active population could result in less benefits accruing, but also fewer contributions supporting the system. The number of retired members increased by 5.8% from the previous valuation date. 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.



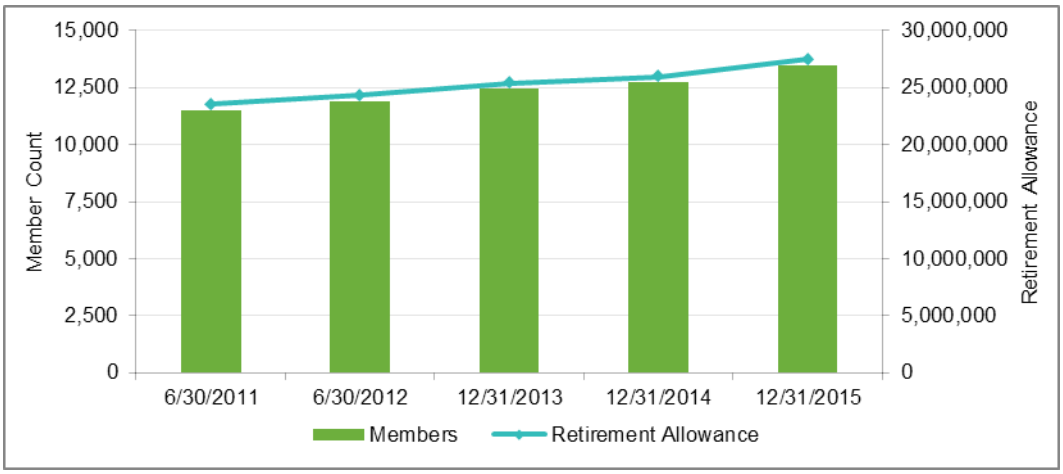
Commentary: Since the December 31, 2013 valuation, members who are not in receipt of benefits and who have not received a refund of employee contributions are split into active members and lapsed members. Lapsed members include members who did not accrue a year of service in the past year. The return 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.

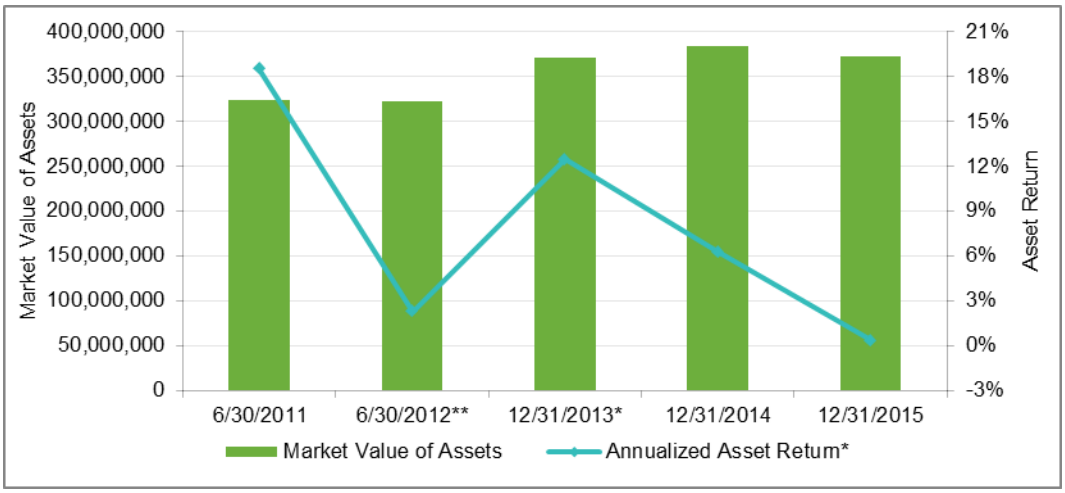
Section 2: The Valuation Process

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 $373 million as of December 31, 2015 and $383 million as of December 31, 2014. The investment return for the market value of assets for 2015 was 0.35%.

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 employer contributions receivable of $4,318,042 as appropriated for fiscal year ending June 30, 2012 but received after such date

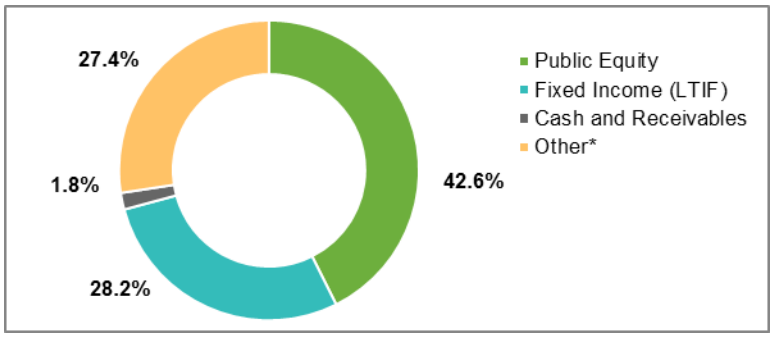
Commentary: Returns were less than the 7.25% assumed rate of return, resulting in higher contributions and lower funded ratio than anticipated, all else being equal.

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, 2015 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 7.25% 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.

The valuation reflects the following change in benefit provisions from the prior year's valuation:

- Session Law 2016-108 which provides a monthly benefit of $170 to a member's beneficiary if that member is killed in the Line of Duty

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 (current retirees and 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.

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.

This valuation reflects 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.

Other than the return to service assumption, the latest assumptions were adopted for use with the December 31, 2015 actuarial valuation, based on the experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016.

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.

The actuarial assumptions and asset valuation method were updated since the prior year's valuation in accordance with the latest experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016 and in accordance with the final return to service assumption adopted by the Board of Trustees on July 21, 2016. A detailed summary of the actuarial assumptions and methods is provided in Appendix D of this report.

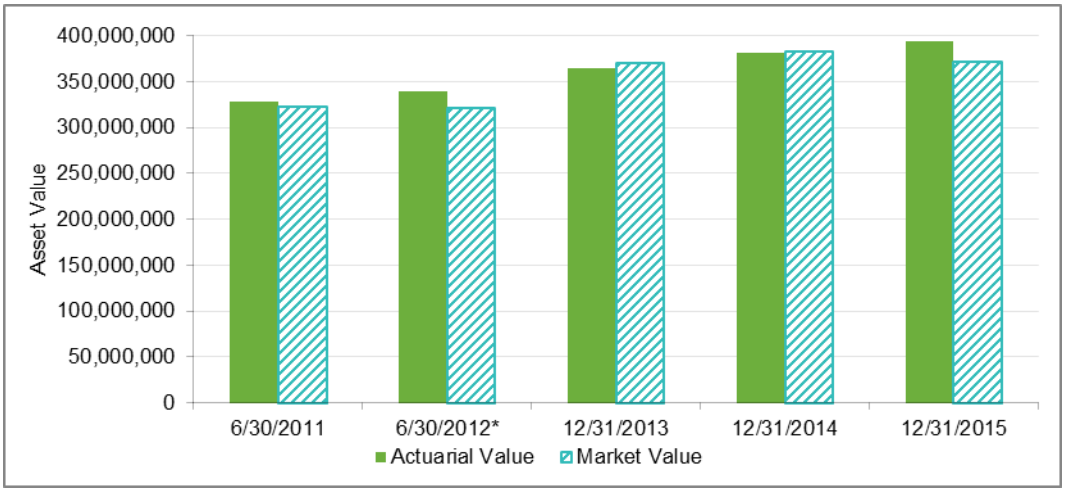
Section 2: The Valuation Process

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 $393 million as of December 31, 2015 and $381 million as of December 31, 2014.

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 employer contributions 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 employer contributions. This indicates that there are unrecognized asset losses to be recognized in future valuations.

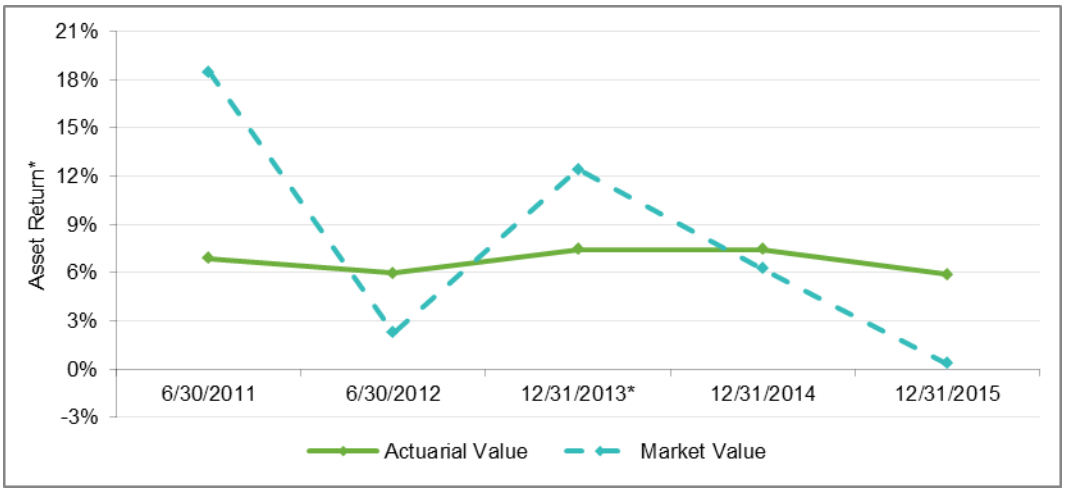
The actuarial value of assets would have been $391 million as of December 31, 2015 under the asset valuation method used in the prior valuation.

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 2015 was 0.35%. The actuarial value of assets smoothes investment gains and losses. The new asset valuation method adopted with the experience study assumptions re-set the actuarial value of assets to the market value of assets at December 31, 2014, effective for the December 31, 2015 valuation. Lower than expected market returns in 2015 resulted in an actuarial value of asset return for 2015 of 5.87% and an asset loss of $5.2 million during 2015.

The actuarial value of asset return for calendar year 2015 prior to the asset valuation method change was 6.00%, which would have resulted in an asset loss of $4.7 million during 2015.

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

Section 2: The Valuation Process

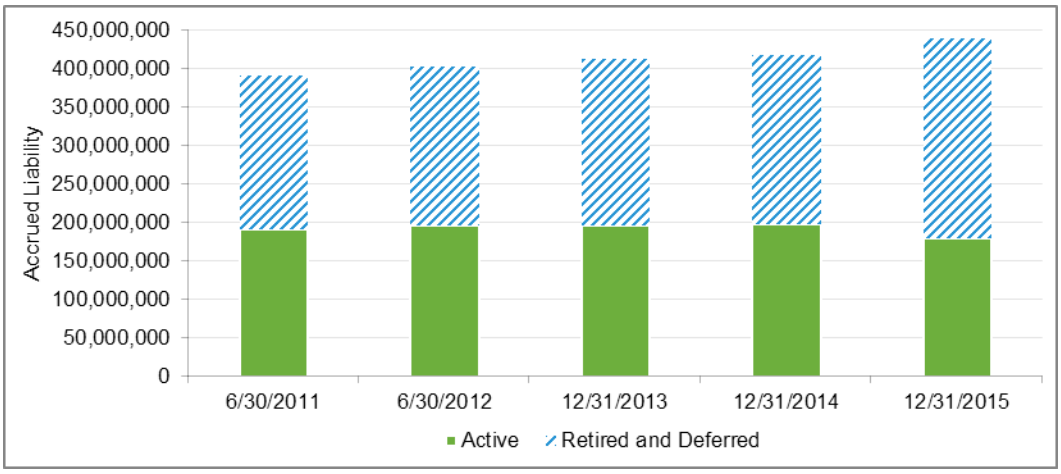
Valuation Results: Actuarial Accrued Liability

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 $419 million to $441 million in 2015. 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 due to the experience study increased the AAL by $33.9 million at December 31, 2014. The AAL prior to the return to service assumption and legislative changes was $7.4 million lower than expected, which resulted in a demographic gain of $7.4 million during 2015. Assumption changes due to the return to service assumption decreased the AAL by $18.4 million. Legislative changes increased the AAL by $0.1 million.

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

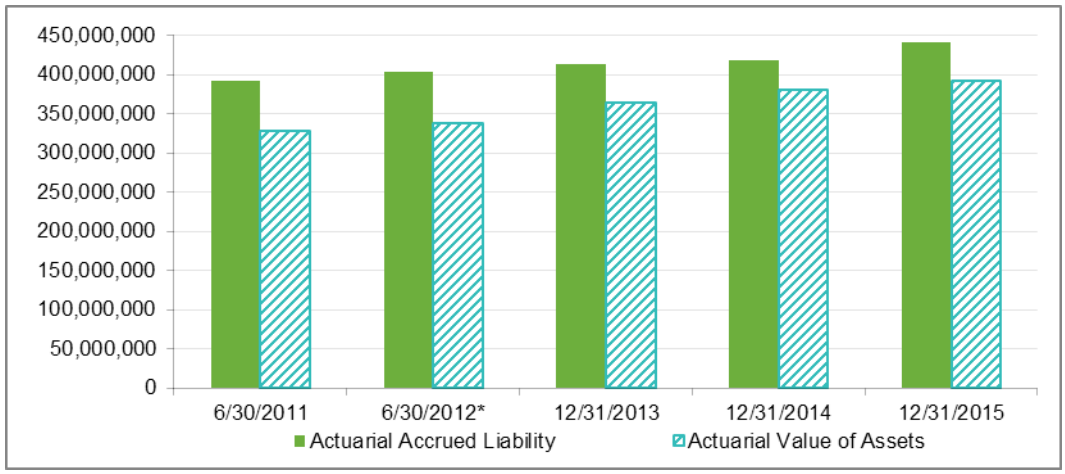
Section 2: The Valuation Process

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 employer contributions receivable of $4,318,042 as appropriated for fiscal year ending June 30, 2012 but received after such date

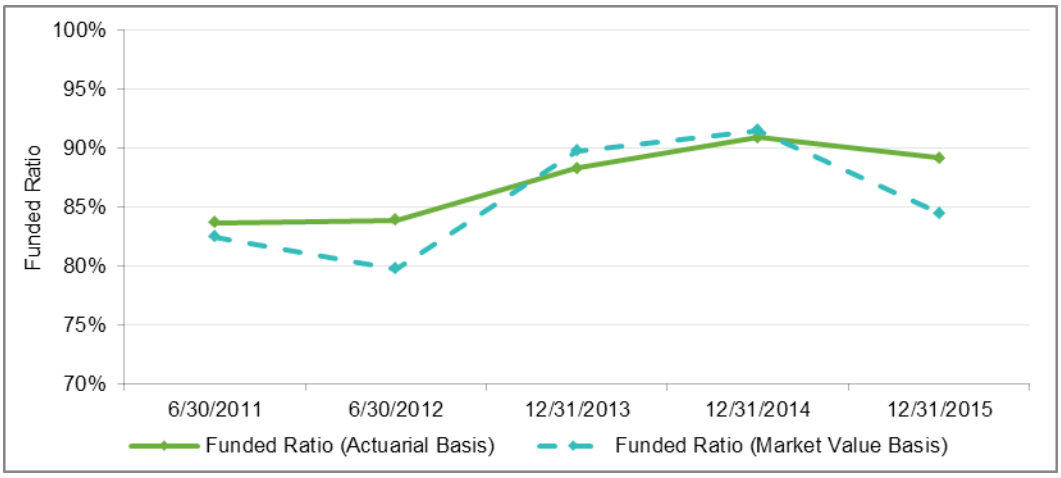
Commentary: The actuarial value of assets basis is used for computing contributions to alleviate contribution volatility. The difference in the actuarial accrued liability and the actuarial value of assets is the amount of pension debt to be paid off in 12 years.

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 90.9% at December 31, 2014 to 89.2% at December 31, 2015.

Section 2: The Valuation Process

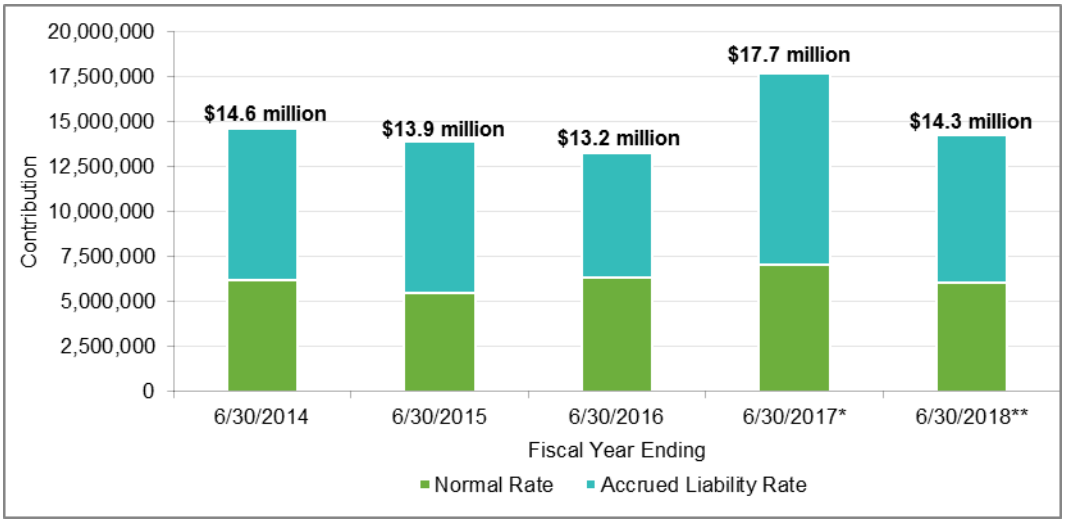
Valuation Results: Employer Contributions

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, 2014 valuation suggested that the preliminary total contribution be set at $12,830,706 for the fiscal year ending June 30, 2017. Subsequently, the 2016 Appropriations Act (Session Laws 2016-94) set the contribution at $17,602,208 for the fiscal year ending June 30, 2017 in order to account for the experience study and recent legislation passed into law. As a result of this December 31, 2015 valuation, the preliminary actuarially determined contribution is $14,287,301 for the fiscal year ending June 30, 2018, 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.

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 30 years or more to pay off the pension debt. The shorter period results in higher contributions and more

Section 2: The Valuation Process

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, 2016, is $66,819,000 (compared to $36,359,000 for fiscal year ending June 30, 2015). 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	17,295	41.10	5.76
Active Members	25,526	39.00	10.68
Total	42,821	39.85	8.69

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
13,463	68.01	$ 27,464,520

Table 4: Data for Disabled Members Eligible for Deferred Pensions

Member Count	Average Age	Annual Retirement Allowances
146	50.97	$ 297,840

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	12/31/2015	12/31/2014
Beginning of Year Market Value of Assets	$ 383,327,980	$ 371,122,130
Contributions	16,727,357	16,648,810
Benefit Payments	(28,816,779)	(27,276,016)
Investment Income	1,333,665	22,833,056
Net Increase/(Decrease)	(10,755,757)	12,205,850
End of Year Market Value of Assets	$ 372,572,223	$ 383,327,980
Estimated Net Investment Return on Market Value (Annualized)	0.35%	6.24%

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

Asset Data as of	12/31/2015	12/31/2014
Allocation by Dollar Amount		
Public Equity	$ 158,640,112	$ 168,249,986
Fixed Income (LTIF)	105,101,798	114,099,537
Cash and Receivables	6,586,947	6,582,943
Other*	102,243,366	94,395,514
Total Market Value of Assets	$ 372,572,223	$ 383,327,980
Allocation by Percentage of Asset Value		
Public Equity	42.6%	43.9%
Fixed Income (LTIF)	28.2%	29.8%
Cash and Receivables	1.8%	1.7%
Other*	27.4%	24.6%
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	12/31/2015
Beginning of Year Market Value of Assets	$ 383,327,980
Contributions	16,727,357
Benefit Payments	(28,816,779)
Net Cash Flow	(12,089,422)
Expected Investment Return	27,353,037
Expected End of Year Market Value of Assets	398,591,595
End of Year Market Value of Assets	372,572,223
Excess of Market Value over Expected Market Value of Assets	(26,019,372)
80% of 2015 Asset Gain/(Loss)	(20,815,498)
60% of 2014 Asset Gain/(Loss)	N/A
40% of 2013 Asset Gain/(Loss)	N/A
20% of 2012 Asset Gain/(Loss)	N/A
Total Deferred Asset Gain/(Loss)	(20,815,498)
Preliminary End of Year Actuarial Value of Assets	393,387,721
Final End of Year Actuarial Value of Assets (not less than 80% and not greater than 120% of Market Value)	393,387,721
Estimated Net Investment Return on Actuarial Value	5.87%

Commentary: The actuarial value of assets smooths investment gains/losses, resulting in less volatility in the employer contribution. The asset valuation method was changed during the experience study from a method that calculated the actuarial value of assets as 20% of the market value of assets plus 80% of the expected actuarial value of assets to a method that recognizes asset returns in excess of or less than the expected return on the market value of assets over a five-year period.

The new asset valuation method re-set the actuarial value of assets to the market value of assets at December 31, 2014, effective for the December 31, 2015 valuation. Lower than expected market returns in 2015 resulted in an actuarial value of asset return for calendar year 2015 of 5.87% and an asset loss of $5.2 million during 2015.

The actuarial value of assets would have been $391,291,776 as of December 31, 2015 under the asset method used in the prior valuation.

Section 4: Asset Data

The valuation assumes that the funds will earn a 7.25% asset return. 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%
Average	6.70%	5.37%
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 6.70% tracks average market return of 5.37% rather well. But the range of returns is markedly less – 6.89% versus 32.62%. This results in much lower 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	12/31/2015	12/31/2014
(a) Present Value of Future Benefits		
(1) Active Members	$ 229,359,014	$ 267,823,610
(2) Members Currently Receiving Benefits and Members with Deferred Benefits	260,259,878	220,628,896
(3) Total	$ 489,618,892	$ 488,452,506
(b) Present Value of Future Normal Costs		
(1) Employee Future Normal Costs	$ 18,356,116	$ 27,666,734
(2) Employer Future Normal Costs	30,462,352	41,870,651
(3) Total	$ 48,818,468	$ 69,537,385
(c) Actuarial Accrued Liability: (a3) - (b3)	$ 440,800,424	$ 418,915,121
(d) Actuarial Value of Assets	$ 393,387,721	$ 380,885,154
(e) Unfunded Accrued Liability: (c) - (d)	$ 47,412,703	$ 38,029,967

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 10: Reconciliation of Unfunded Actuarial Accrued Liability

(in millions)	
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2014	$ 38.0
Impact of Experience Study	31.5
Normal Cost during 2015	9.9
Reduction due to Actual Contributions during 2015	(16.7)
Interest on UAAL, Normal Cost, and Contributions	5.2
Asset (Gain)/Loss	5.2
Actuarial Accrued Liability (Gain)/Loss	(7.4)
Impact of Return to Work Assumption	(18.4)
Impact of Legislative Changes	0.1
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2015	$ 47.4

Commentary: The changes in assumptions and methods from the experience study increased the unfunded actuarial accrued liability (UAAL), or pension debt, by $31.5 million at December 31, 2014. During 2015, the UAAL increased faster than expected due to asset losses that were offset by a liability gain. Additionally, the final return to service assumption decreased the UAAL by $18.4 million, and legislation passed in the past year that allows for the payment line of duty death benefits increased the UAAL by $0.1 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 11: Calculation of the Actuarially Determined Employer Contribution (ADEC) Payable per Active Member

Valuation Date	12/31/2015	12/31/2014
ADEC for Fiscal Year Ending	6/30/2018	6/30/2017
Normal Cost Rate Calculation		
(a) Employer Future Normal Cost	$ 30,462,352	$ 41,870,651
(b) Present Value of Future Active Member Count	154,271	298,309
(c) Normal Cost Rate: (a) / (b)	$ 197.46	$ 140.36
(d) Expenses Rate*	$ 59.48	$ 31.18
(e) Total Normal Cost Rate: (c) + (d)	$ 256.94	$ 171.54
Accrued Liability Rate Calculation		
(f) Total Annual Amortization Payments**	$ 8,205,274	$ 6,210,634
(g) Active Member Count***	23,671	38,592
(h) Accrued Liability Rate: (f) / (g)	$ 346.64	$ 160.93
Total ADEC (e) + (h)	$ 603.58	$ 332.47

* Based on actual expenses during the previous year.
** See Table 15 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. The change in the return to service assumption decreased this number from 38,298 to 23,671 at December 31, 2015.

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 12: Actuarially Determined Employer Contribution (ADEC)

Valuation Date ADEC for Fiscal Year Ending	12/31/2015 6/30/2018	12/31/2014 6/30/2017
(a) Current Active Member Count*	23,671	38,592
(b) Normal Cost Rate	$ 256.94	$ 171.54
(c) Normal Cost Contribution: (a) x (b)	$ 6,082,027	$ 6,620,072
(d) Accrued Liability Contribution	8,205,274	6,210,634
(e) Total ADEC: (c) + (d)	$ 14,287,301	$ 12,830,706
Impact of Experience Study	N/A	$ 4,771,502
Impact of Legislative Changes	N/A	103,000
Final ADEC**	N/A	$ 17,705,208

***** The active member count reflects the number of currently active or lapsed members who are expected to accrue additional benefits in the next year. The change in the return to service assumption decreased this number from 38,298 to 23,671 at December 31, 2015.

** 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.

Section 6: Actuarially Determined Employer Contribution

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

Table 13: Reconciliation of the Change in the ADEC

Fiscal year ending June 30, 2017 Preliminary ADEC (estimated based on December 31, 2014 Valuation)	12,830,706
Impact of Experience Study	4,771,502
Impact of Legislative Changes	103,000
Fiscal year ending June 30, 2017 Final ADEC*	17,705,208
Change Due to Demographic (Gain)/Loss	(432,844)
Change Due to Investment (Gain)/Loss	712,060
Change Due to Contributions Greater than ADEC	(21,939)
Impact of Return to Work Assumption	(3,675,184)
Fiscal year ending June 30, 2018 Preliminary ADEC (estimated based on December 31, 2015 Valuation)	14,287,301

* 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.

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 14: Calculation of the New Amortization Base

Calculation as of	12/31/2015	12/31/2014
(a) Unfunded Actuarial Accrued Liability	$ 47,412,703	$ 38,029,967
(b) Prior Years' Outstanding Balances	$ 32,835,489	$ 42,969,443
(c) New Amortization Base: (a) - (b)	$ 14,577,214	$ (4,939,476)
(d) New Amortization Payment	$ 1,994,640	$ (675,882)

Table 15: Amortization Schedule for Unfunded Accrued Liability

Date Established	Original Balance	12/31/2015 Outstanding Balance	Annual Payment
June 30, 2010	$ 51,963,371	$ 40,054,918	$ 6,865,854
June 30, 2011	8,122,313	6,873,972	1,073,191
June 30, 2012	3,813,072	3,495,373	503,816
December 31, 2013	(11,374,070)	(12,291,186)	(1,556,345)
December 31, 2014	(4,939,476)	(5,297,588)	(675,882)
December 31, 2015	14,577,214	14,577,214	1,994,640
Total		$ 47,412,703	$ 8,205,274

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 16: History of Actuarially Determined Employer Contributions and Appropriated Rates

Valuation Date	Fiscal Year Ending	Preliminary ADEC	Subsequent Changes to ADEC***	Final ADEC	Appropriated Rate
12/31/2015	6/30/2018	$14,287,301	N/A	N/A	N/A
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	0	13,240,552	13,550,000
6/30/2012*	6/30/2015	15,100,000	(1,200,000)**	13,900,000	13,900,000
6/30/2012	6/30/2014	14,620,362	0	14,620,362	14,626,599

* Because a valuation was not performed at June 30, 2013, the preliminary total 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 employer contribution was estimated to decrease by $2,200,000. House Bill 1034 (Session Law 2014-64) increased the employer contribution by $1,000,000. Subsequently, the 2014 Appropriations Act (Session Laws 2014-100) set contributions 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 17: Valuation Balance Sheet

Balance Sheet as of	12/31/2015	12/31/2014
Assets		
Current Actuarial Value of Assets		
Annuity Savings Fund	$ 41,402,228	$ 40,869,614
Pension Accumulation Fund	351,985,493	340,015,540
Total	$ 393,387,721	$ 380,885,154
Future Member Contributions to the Annuity Savings Fund	$ 18,356,116	$ 27,666,734
Prospective Contributions to the Pension Accumulation Fund		
Normal Contributions	$ 30,462,352	$ 41,870,651
Unfunded Accrued Liability Contributions	47,412,703	38,029,967
Total	$ 77,875,055	$ 79,900,618
Total Assets	$ 489,618,892	$ 488,452,506
Liabilities		
Annuity Savings Fund		
Past Member Contributions	$ 41,402,228	$ 40,869,614
Future Member Contributions	18,356,116	27,666,734
Total Contributions	$ 59,758,344	$ 68,536,348
Pension Accumulation Fund		
Benefits Currently in Payment	$ 260,259,878	$ 220,628,896
Benefits to be Paid to Current Active Members	169,600,670	199,287,262
Total Benefits Payable	$ 429,860,548	$ 419,916,158
Total Liabilities	$ 489,618,892	$ 488,452,506

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, 2016 based on a valuation date of December 31, 2015.

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

The June 30, 2016 total pension liability presented in this section was determined by an actuarial valuation as of December 31, 2015, 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 18: Number of Active and Retired Members as of December 31, 2015

Group	Number
Retired members and survivors of deceased members currently receiving benefits	13,463
Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits	146
Active members*	42,821
Total	56,430

* Includes all members who have not received a refund of contributions. This group includes 25,526 active members and 17,295 lapsed members whose service did not increase during 2015.

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 19: Schedule of Changes in Net Pension Liability (Asset)

Calculation as of	June 30, 2016
Total Pension Liability	
Service Cost	$ 5,610,000
Interest	30,035,000
Changes of Benefit Terms	118,000
Difference between Expected and Actual Experience	(2,177,000)
Change of Assumptions	15,577,000
Benefit Payments, including Refund of Member Contributions	(27,998,000)
Net Change in Total Pension Liability	$ 21,165,000
Total Pension Liability - Beginning of Year	$ 422,667,000
Total Pension Liability - End of Year	$ 443,832,000
Plan Fiduciary Net Position	
Employer Contributions	$ 13,900,000
Member Contributions	2,778,000
Net Investment Income	2,867,000
Benefit Payments, including Refund of Member Contributions	(27,998,000)
Administrative Expenses	(860,000)
Other	18,000
Net Change in Fiduciary Net Position	$ (9,295,000)
Plan Fiduciary Net Position - Beginning of Year	$ 386,308,000
Plan Fiduciary Net Position - End of Year	$ 377,013,000

Table 20: Net Pension Liability (Asset)

Calculation as of	June 30, 2016	June 30, 2015
Total Pension Liability	$ 443,832,000	$ 422,667,000
Plan Fiduciary Net Position	377,013,000	386,308,000
Net Pension Liability (Asset)	$ 66,819,000	$ 36,359,000
Plan Fiduciary Net Position as a Percentage of the Total Pension Liability	84.94%	91.40%

Section 8: Accounting Results

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

Table 21: Sensitivity of the Net Pension Liability (Asset) at June 30, 2016 to Changes in the Discount Rate

	1% Decrease	Current	1% Increase
Discount Rate	6.25%	7.25%	8.25%
Net Pension Liability (Asset)	122,146,000	66,819,000	21,335,000

The discount rate used to measure the total pension liability was 7.25%. The projection of cash flows used to determine the discount rate assumed that System contributions 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 22: Additional Information for GASB Statement No. 67

Valuation Date	12/31/2015
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*	7.25%
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

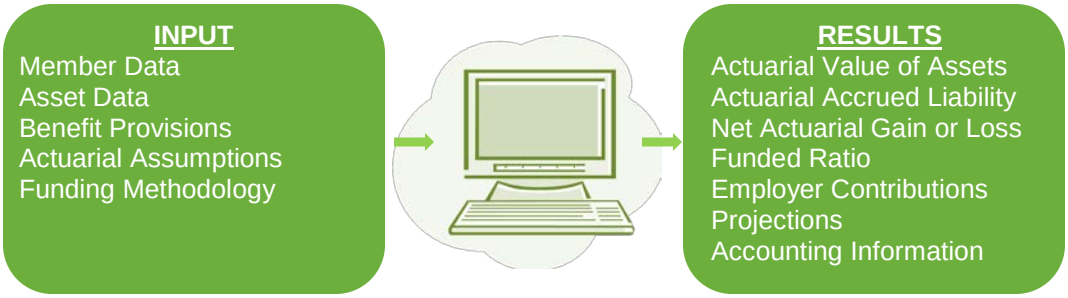
Purpose of an Actuarial Valuation

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 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

Appendix A: Valuation Process and Glossary of Actuarial Terms

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

Appendix A: Valuation Process and Glossary of Actuarial Terms

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 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

Appendix A: Valuation Process and Glossary of Actuarial Terms

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.

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 Buck calculates need to be contributed. With very limited exception, North Carolina has contributed the amounts that Buck 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 7.25% 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.

Appendix A: Valuation Process and Glossary of Actuarial Terms

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 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. Buck 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

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

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

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, 2015

	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	619	2,606	348	1	0	0	0	0	0	0	3,574
25 to 29	677	2,845	1,900	226	1	0	0	0	0	0	5,649
30 to 34	451	2,460	1,734	1,248	163	3	0	0	0	0	6,059
35 to 39	337	1,960	1,492	1,172	881	150	0	0	0	0	5,992
40 to 44	261	1,657	1,372	1,021	964	837	105	0	0	0	6,217
45 to 49	194	1,357	1,161	891	905	1,040	711	84	0	0	6,343
50 to 54	126	912	793	629	656	995	860	371	45	0	5,387
55 to 59	51	421	356	351	354	137	47	14	6	1	1,738
60 to 64	25	278	235	223	201	39	14	3	3	0	1,021
65 to 69	24	143	148	87	90	25	11	0	1	0	529
70 & Up	16	103	93	50	39	11	0	0	0	0	312
Total	2,781	14,742	9,632	5,899	4,254	3,237	1,748	472	55	1	42,821

Appendix B: Detailed Tabulations of Member Data

Table B-2: The Number of Active Members Distributed by Age as of December 31, 2015

Age	Active Members Number	Lapsed Members Number
18	28	8
19	209	24
20	390	89
21	425	146
22	452	183
23	535	220
24	558	307
25	639	357
26	708	407
27	728	438
28	716	449
29	681	526
30	726	463
31	761	462
32	702	474
33	731	506
34	737	497
35	702	488
36	655	511
37	708	495
38	673	517
39	763	480
40	706	479
41	737	492
42	742	501
43	744	524
44	771	521
45	823	547
46	809	525
47	765	503
48	750	478
49	672	471
50	666	445
51	598	518
52	643	499
53	608	453
54	533	424
55	266	228
56	191	174
57	186	151

Appendix B: Detailed Tabulations of Member Data

Table B-2: The Number of Active Members Distributed by Age as of December 31, 2015 (continued)

Age	Active Members Number	Lapsed Members Number
58	151	129
59	117	145
60	113	130
61	103	130
62	89	140
63	73	98
64	67	78
65	61	79
66	45	72
67	49	69
68	52	51
69	24	27
70	18	29
71	21	19
72	18	16
73	21	17
74	15	15
75	9	8
76	5	12
77	7	6
78	7	9
79	5	9
80	4	7
81	5	1
82	3	1
83	3	2
84		6
85	3	2
86	1	1
87		2
88		1
91		1
93		1
94		1
98		1
Total	25,526	17,295

Appendix B: Detailed Tabulations of Member Data

Table B-3: The Number of Active Members Distributed by Service as of December 31, 2015

Service	Active Members Number	Lapsed Members Number
0	539	2,242
1	1,828	2,826
2	1,787	2,111
3	1,991	1,608
4	1,203	1,388
5	1,362	1,063
6	1,177	831
7	1,029	696
8	1,378	539
9	1,052	505
10	998	398
11	913	349
12	855	301
13	795	238
14	819	233
15	771	168
16	787	131
17	693	134
18	695	138
19	633	104
20	589	201
21	438	290
22	445	182
23	446	153
24	378	115
25	376	81
26	293	78
27	282	50
28	250	51
29	252	35
30	136	20
31	117	19
32	70	7
33	53	4
34	45	1

Appendix B: Detailed Tabulations of Member Data

Table B-3: The Number of Active Members Distributed by Service as of December 31, 2015 (continued)

Service	Active Members Number	Lapsed Members Number
35	32	1
36	11	3
37	2	
38	3	1
39	2	
40	1	
Total	25,526	17,295

Appendix B: Detailed Tabulations of Member Data

Table B-4: The Number and Annual Retirement Allowances of Retired Members Distributed by Age as of December 31, 2015

Age	Number	Allowances
55	472	$ 962,880
56	465	948,600
57	560	1,142,400
58	500	1,020,000
59	592	1,207,680
60	554	1,130,160
61	631	1,287,240
62	601	1,226,040
63	609	1,242,360
64	589	1,201,560
65	583	1,189,320
66	536	1,093,440
67	503	1,026,120
68	531	1,083,240
69	554	1,130,160
70	405	826,200
71	424	864,960
72	429	875,160
73	445	907,800
74	335	683,400
75	353	720,120
76	323	658,920
77	268	546,720
78	254	518,160
79	231	471,240
80	230	469,200
81	236	481,440
82	200	408,000
83	178	363,120
84	142	289,680
85	135	275,400
86	114	232,560
87	85	173,400
88	82	167,280
89	87	177,480

Appendix B: Detailed Tabulations of Member Data

Table B-4: The Number and Annual Retirement Allowances of Retired Members Distributed by Age as of December 31, 2015 (continued)

Age	Number	Allowances
90	73	$ 148,920
91	53	108,120
92	31	63,240
93	21	42,840
94	14	28,560
95	12	24,480
96	9	18,360
97	8	16,320
98	3	6,120
99	3	6,120
Total	13,463	$ 27,464,520

Appendix B: Detailed Tabulations of Member Data

Table B-5: The Number and Annual Retirement Allowances of Disabled Members Eligible for Deferred Pensions Distributed by Age of December 31, 2015

Age	Number	Allowances
30	1	$ 2,040
33	1	2,040
35	1	2,040
37	3	6,120
38	1	2,040
40	2	4,080
41	3	6,120
42	1	2,040
44	6	12,240
45	8	16,320
46	7	14,280
47	6	12,240
48	8	16,320
49	6	12,240
50	9	18,360
51	15	30,600
52	12	24,480
53	13	26,520
54	8	16,320
55	6	12,240
56	4	8,160
57	5	10,200
58	1	2,040
59	3	6,120
60	4	8,160
61	3	6,120
62	1	2,040
63	2	4,080
64	3	6,120
66	1	2,040
70	1	2,040
71	1	2,040
Total	146	$ 297,840

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

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:	Session Law 2016-108 which provides a monthly benefit of $170 to a member's beneficiary if that member is killed in the Line of Duty

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. 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, 2015 annual actuarial valuation.

Interest Rate: 7.25% 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

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.

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.

Appendix D: Actuarial Assumptions and Methods

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 disability rates, the mortality assumption, and the asset valuation method were changed based on the experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016. The withdrawal rates and the return to service assumption were changed based on the findings of the data audit of the FRSWPF and adopted by the Board of Trustees on July 21, 2016.

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
2016	$ 372,572	$ 2,841	$ 12,603	$ 29,653	$ 1,458	$ 26,454	$ 383,359
2017	383,359	2,712	12,805	29,161	1,392	27,258	395,581
2018	395,581	2,549	13,850	29,877	1,309	28,153	408,947
2019	408,947	2,396	14,402	30,690	1,230	29,110	422,935
2020	422,935	2,253	14,905	31,399	1,157	30,114	437,651
2021	437,651	2,111	15,382	32,014	1,083	31,174	453,221
2022	453,221	1,978	15,459	32,752	1,015	32,277	469,168
2023	469,168	1,847	11,729	33,520	948	33,271	481,547
2024	481,547	1,722	7,463	34,270	884	33,987	489,565
2025	489,565	1,595	6,390	35,044	819	34,501	496,188
2026	496,188	1,470	5,829	35,886	755	34,929	501,775
2027	501,775	1,338	6,294	36,610	687	35,322	507,432
2028	507,432	1,206	7,043	37,380	619	35,730	513,412
2029	513,412	1,048	6,168	38,017	538	36,107	518,180
2030	518,180	929	4,459	38,682	477	36,365	520,774
2031	520,774	799	3,261	39,312	410	36,486	521,598
2032	521,598	661	2,183	39,947	339	36,482	520,638
2033	520,638	540	1,026	40,750	277	36,340	517,517
2034	517,517	370	354	41,389	190	36,066	512,728
2035	512,728	160	131	41,905	112	35,687	506,689
2036	506,689	0	50	42,253	36	35,230	499,680
2037	499,680	0	10	42,368	0	34,718	492,040
2038	492,040	0	5	42,430	0	34,163	483,778
2039	483,778	0	4	42,378	0	33,564	474,968
2040	474,968	0	4	42,400	0	32,925	465,497
2041	465,497	0	5	42,354	0	32,240	455,388
2042	455,388	0	6	42,231	0	31,513	444,676
2043	444,676	0	5	42,062	0	30,741	433,360
2044	433,360	0	4	41,922	0	29,925	421,367
2045	421,367	0	3	41,710	0	29,064	408,724
2046	408,724	0	1	41,366	0	28,159	395,518
2047	395,518	0	0	40,903	0	27,219	381,834
2048	381,834	0	0	40,345	0	26,246	367,735
2049	367,735	0	0	39,665	0	25,248	353,318
2050	353,318	0	0	38,925	0	24,230	338,623
2051	338,623	0	0	38,107	0	23,193	323,709
2052	323,709	0	0	37,039	0	22,149	308,819
2053	308,819	0	0	35,769	0	21,115	294,165
2054	294,165	0	0	34,474	0	20,100	279,791
2055	279,791	0	0	33,187	0	19,103	265,707
2056	265,707	0	0	31,910	0	18,128	251,925
2057	251,925	0	0	30,642	0	17,172	238,455
2058	238,455	0	0	29,386	0	16,241	225,310
2059	225,310	0	0	28,143	0	15,333	212,500
2060	212,500	0	0	26,913	0	14,448	200,035
2061	200,035	0	0	25,698	0	13,588	187,925
2062	187,925	0	0	24,499	0	12,752	176,178
2063	176,178	0	0	23,318	0	11,942	164,802
2064	164,802	0	0	22,155	0	11,159	153,806
2065	153,806	0	0	21,013	0	10,402	143,195

Appendix E: GASB 67 Fiduciary Net Position Projection

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
2066	$ 143,195	$ 0	$ 0	$ 19,893	$ 0	$ 9,674	$ 132,976
2067	132,976	0	0	18,795	0	8,971	123,152
2068	123,152	0	0	17,721	0	8,297	113,728
2069	113,728	0	0	16,672	0	7,653	104,709
2070	104,709	0	0	15,648	0	7,034	96,095
2071	96,095	0	0	14,651	0	6,444	87,888
2072	87,888	0	0	13,682	0	5,885	80,091
2073	80,091	0	0	12,741	0	5,354	72,704
2074	72,704	0	0	11,828	0	4,849	65,725
2075	65,725	0	0	10,946	0	4,375	59,154
2076	59,154	0	0	10,093	0	3,929	52,990
2077	52,990	0	0	9,272	0	3,512	47,230
2078	47,230	0	0	8,483	0	3,122	41,869
2079	41,869	0	0	7,726	0	2,761	36,904
2080	36,904	0	0	7,003	0	2,426	32,327
2081	32,327	0	0	6,314	0	2,119	28,132
2082	28,132	0	0	5,660	0	1,838	24,310
2083	24,310	0	0	5,043	0	1,582	20,849
2084	20,849	0	0	4,464	0	1,353	17,738
2085	17,738	0	0	3,923	0	1,147	14,962
2086	14,962	0	0	3,421	0	963	12,504
2087	12,504	0	0	2,958	0	801	10,347
2088	10,347	0	0	2,535	0	660	8,472
2089	8,472	0	0	2,151	0	537	6,858
2090	6,858	0	0	1,807	0	434	5,485
2091	5,485	0	0	1,500	0	344	4,329
2092	4,329	0	0	1,230	0	269	3,368
2093	3,368	0	0	995	0	209	2,582
2094	2,582	0	0	794	0	159	1,947
2095	1,947	0	0	623	0	119	1,443
2096	1,443	0	0	481	0	88	1,050
2097	1,050	0	0	364	0	63	749
2098	749	0	0	271	0	45	523
2099	523	0	0	197	0	31	357
2100	357	0	0	140	0	21	238
2101	238	0	0	97	0	14	155
2102	155	0	0	66	0	9	98
2103	98	0	0	43	0	5	60
2104	60	0	0	28	0	4	36
2105	36	0	0	17	0	2	21
2106	21	0	0	10	0	1	12
2107	12	0	0	6	0	1	7
2108	7	0	0	3	0	0	4
2109	4	0	0	2	0	0	2
2110	2	0	0	1	0	0	1
2111	1	0	0	0	0	0	1
2112	1	0	0	0	0	0	0
2113	0	0	0	0	0	0	0
2114	0	0	0	0	0	0	0
2115	0	0	0	0	0	0	0

Appendix E: GASB 67 Fiduciary Net Position Projection

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

Calendar Year	Beginning Fiduciary Position	Benefit Payments	Funded Benefit Payments	Unfunded Benefit Payments	Present Value of Benefit Payments: Funded Payments at 7.25%	Present Value of Benefit Payments: Unfunded Payments at 2.71%	Present Value of Benefit Payments: Using Single Discount Rate of 7.25%
2016	$ 372,572	$ 29,653	$ 29,653	$ 0	$ 28,633	$ 0	$ 28,633
2017	383,359	29,161	29,161	0	26,255	0	26,255
2018	395,581	29,877	29,877	0	25,081	0	25,081
2019	408,947	30,690	30,690	0	24,022	0	24,022
2020	422,935	31,399	31,399	0	22,915	0	22,915
2021	437,651	32,014	32,014	0	21,785	0	21,785
2022	453,221	32,752	32,752	0	20,780	0	20,780
2023	469,168	33,520	33,520	0	19,830	0	19,830
2024	481,547	34,270	34,270	0	18,903	0	18,903
2025	489,565	35,044	35,044	0	18,024	0	18,024
2026	496,188	35,886	35,886	0	17,209	0	17,209
2027	501,775	36,610	36,610	0	16,369	0	16,369
2028	507,432	37,380	37,380	0	15,584	0	15,584
2029	513,412	38,017	38,017	0	14,778	0	14,778
2030	518,180	38,682	38,682	0	14,020	0	14,020
2031	520,774	39,312	39,312	0	13,285	0	13,285
2032	521,598	39,947	39,947	0	12,587	0	12,587
2033	520,638	40,750	40,750	0	11,972	0	11,972
2034	517,517	41,389	41,389	0	11,338	0	11,338
2035	512,728	41,905	41,905	0	10,703	0	10,703
2036	506,689	42,253	42,253	0	10,063	0	10,063
2037	499,680	42,368	42,368	0	9,408	0	9,408
2038	492,040	42,430	42,430	0	8,785	0	8,785
2039	483,778	42,378	42,378	0	8,181	0	8,181
2040	474,968	42,400	42,400	0	7,632	0	7,632
2041	465,497	42,354	42,354	0	7,108	0	7,108
2042	455,388	42,231	42,231	0	6,608	0	6,608
2043	444,676	42,062	42,062	0	6,137	0	6,137
2044	433,360	41,922	41,922	0	5,703	0	5,703
2045	421,367	41,710	41,710	0	5,291	0	5,291
2046	408,724	41,366	41,366	0	4,892	0	4,892
2047	395,518	40,903	40,903	0	4,511	0	4,511
2048	381,834	40,345	40,345	0	4,148	0	4,148
2049	367,735	39,665	39,665	0	3,803	0	3,803
2050	353,318	38,925	38,925	0	3,480	0	3,480
2051	338,623	38,107	38,107	0	3,176	0	3,176
2052	323,709	37,039	37,039	0	2,878	0	2,878
2053	308,819	35,769	35,769	0	2,592	0	2,592
2054	294,165	34,474	34,474	0	2,329	0	2,329
2055	279,791	33,187	33,187	0	2,091	0	2,091
2056	265,707	31,910	31,910	0	1,874	0	1,874
2057	251,925	30,642	30,642	0	1,678	0	1,678
2058	238,455	29,386	29,386	0	1,501	0	1,501
2059	225,310	28,143	28,143	0	1,340	0	1,340
2060	212,500	26,913	26,913	0	1,195	0	1,195
2061	200,035	25,698	25,698	0	1,064	0	1,064
2062	187,925	24,499	24,499	0	946	0	946
2063	176,178	23,318	23,318	0	839	0	839
2064	164,802	22,155	22,155	0	743	0	743
2065	153,806	21,013	21,013	0	657	0	657

Appendix E: GASB 67 Fiduciary Net Position Projection

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

(in thousands)

Calendar Year	Beginning Fiduciary Position	Benefit Payments	Funded Benefit Payments	Unfunded Benefit Payments	Present Value of Benefit Payments: Funded Payments at 7.25%	Present Value of Benefit Payments: Unfunded Payments at 2.71%	Present Value of Benefit Payments: Using Single Discount Rate of 7.25%
2066	$ 143,195	$ 19,893	$ 19,893	$ 0	$ 580	$ 0	$ 580
2067	132,976	18,795	18,795	0	511	0	511
2068	123,152	17,721	17,721	0	449	0	449
2069	113,728	16,672	16,672	0	394	0	394
2070	104,709	15,648	15,648	0	345	0	345
2071	96,095	14,651	14,651	0	301	0	301
2072	87,888	13,682	13,682	0	262	0	262
2073	80,091	12,741	12,741	0	228	0	228
2074	72,704	11,828	11,828	0	197	0	197
2075	65,725	10,946	10,946	0	170	0	170
2076	59,154	10,093	10,093	0	146	0	146
2077	52,990	9,272	9,272	0	125	0	125
2078	47,230	8,483	8,483	0	107	0	107
2079	41,869	7,726	7,726	0	91	0	91
2080	36,904	7,003	7,003	0	77	0	77
2081	32,327	6,314	6,314	0	64	0	64
2082	28,132	5,660	5,660	0	54	0	54
2083	24,310	5,043	5,043	0	45	0	45
2084	20,849	4,464	4,464	0	37	0	37
2085	17,738	3,923	3,923	0	30	0	30
2086	14,962	3,421	3,421	0	25	0	25
2087	12,504	2,958	2,958	0	20	0	20
2088	10,347	2,535	2,535	0	16	0	16
2089	8,472	2,151	2,151	0	13	0	13
2090	6,858	1,807	1,807	0	10	0	10
2091	5,485	1,500	1,500	0	8	0	8
2092	4,329	1,230	1,230	0	6	0	6
2093	3,368	995	995	0	4	0	4
2094	2,582	794	794	0	3	0	3
2095	1,947	623	623	0	2	0	2
2096	1,443	481	481	0	2	0	2
2097	1,050	364	364	0	1	0	1
2098	749	271	271	0	1	0	1
2099	523	197	197	0	1	0	1
2100	357	140	140	0	0	0	0
2101	238	97	97	0	0	0	0
2102	155	66	66	0	0	0	0
2103	98	43	43	0	0	0	0
2104	60	28	28	0	0	0	0
2105	36	17	17	0	0	0	0
2106	21	10	10	0	0	0	0
2107	12	6	6	0	0	0	0
2108	7	3	3	0	0	0	0
2109	4	2	2	0	0	0	0
2110	2	1	1	0	0	0	0
2111	1	0	0	0	0	0	0
2112	1	0	0	0	0	0	0
2113	0	0	0	0	0	0	0
2114	0	0	0	0	0	0	0
2115	0	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
6/30/2011	N/A	39,734
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

Graph 2: Retired Members

	Retired Member Count	Retirement Allowance
6/30/2011	11,520	$ 23,500,800
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

Appendix F: Data for Section 2 Graphs

Graph 3: Market Value of Assets and Asset Returns

	Market Value of Assets	Annualized Asset Return*
6/30/2011	$ 323,354,190	18.47%
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%

* 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
6/30/2011	$ 327,984,054	$ 323,354,190
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

* 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

Graph 6: Asset Returns

	Asset Return* (Actuarial Value)	Asset Return* (Market Value)
6/30/2011	6.88%	18.47%
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%

* 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
6/30/2011	$ 192,333,934	$ 199,503,148	$ 391,837,082
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

Graph 8: Actuarial Accrued Liability and Actuarial Value of Assets

	Actuarial Accrued Liability	Actuarial Value of Assets
6/30/2011	$ 391,837,082	$ 327,984,054
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

* 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

Graph 9: Funded Ratios

	Funded Ratio (Actuarial Basis)	Funded Ratio (Market Basis)
6/30/2011	83.7%	82.5%
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%

Graph 10: Actuarially Determined Employer Contribution Rates

Fiscal Year Ending	Normal Contribution	Accrued Liability Contribution	Total Contribution
6/30/2014	$ 6,177,501	$ 8,442,861	$ 14,620,362
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

* 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