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Firefighters' and Rescue Squad Workers' Pension Fund Principal Results of Actuarial Valuation as of December 31, 2020

October 28, 2021 Board of Trustees Meeting

Larry Langer, ASA, FCA, EA, MAAA

Wendy Ludbrook, FSA, FCA, EA, MAAA



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Valuation Input

Member Data



Inputs

Membership Data

Asset Data

Benefit Provisions

Assumptions

Funding Methodology



Results

Actuarial Value of Assets

Actuarial Accrued Liability

Net Actuarial Gain or Loss

Funded Ratio

Employer Contributions

Benefit Enhancement

Additional Disclosures

Projections

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

| Number as of | 12/31/2020 | 12/31/2019 |
|---|---------------|---------------|
| Active Members | 24,655 | 24,994 |
| Lapsed Members | 16,465 | 15,225 |
| Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits | 122 | 136 |
| Retired members and survivors of deceased members killed in the Line of Duty currently receiving benefits | <u>14,922</u> | <u>14,765</u> |
| Total | 56,164 | 55,120 |

The number of fully active members decreased by 1.4% from the previous valuation date.

The number of retired members increased by 1.1% 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.

Valuation Input

Asset Data



- Inputs
 - Membership Data
 - Asset Data
 - Benefit Provisions
 - Assumptions
 - Funding Methodology
- ↓
- Results
 - Actuarial Value of Assets
 - Actuarial Accrued Liability
 - Net Actuarial Gain or Loss
 - Funded Ratio
 - Employer Contributions
 - Benefit Enhancement
 - Additional Disclosures
 - Projections

The table below provides details of the Market Value of Assets for the current and prior year's valuations.

| Asset Data as of | 12/31/2020 | 12/31/2019 |
|--|----------------|----------------|
| Beginning of Year Market Value of Assets | \$ 458,687,909 | \$ 408,109,943 |
| Employer Contributions | 18,827,208 | 18,477,208 |
| Employee Contributions | 2,539,802 | 2,723,270 |
| Benefit Payments Other than Refunds | (29,844,643) | (29,368,958) |
| Refunds | (241,587) | (300,366) |
| Administrative Expenses | (936,587) | (935,896) |
| Investment Income | 50,904,504 | 59,982,708 |
| Net Increase/(Decrease) | 41,248,697 | 50,577,966 |
| End of Year Value of Assets | \$ 499,936,606 | \$ 458,687,909 |
| Estimated Net Investment Return on Market Value (Annualized) | 11.22% | 14.87% |

FRSWPF assets are held in trust and are invested for the exclusive benefit of plan members.

Incoming contributions currently cover almost 70% of the outgoing benefit payments and administrative expenses.

Over the long term, benefit payments and administrative expenses not covered by contributions are expected to be covered with investment income, illustrating the benefits of following actuarial pre-funding since inception.

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



Net Actuarial Gain or Loss

Inputs
 Membership Data
 Asset Data
 Benefit Provisions
 Assumptions
 Funding Methodology

↓

Results
 Actuarial Value of Assets
 Actuarial Accrued Liability
Net Actuarial Gain or Loss
 Funded Ratio
 Employer Contributions
 Benefit Enhancement
 Additional Disclosures
 Projections

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

| (in millions) | |
|--|------------|
| Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2019 | \$ 36.9 |
| Normal Cost and Administrative Expense during 2020 | 8.4 |
| Reduction due to Actual Contributions during 2020 | (21.4) |
| Interest on UAAL, Normal Cost, and Contributions | 2.1 |
| Asset (Gain) / Loss | (7.9) |
| Actuarial Accrued Liability (Gain) / Loss | (4.6) |
| Impact of Assumption Changes | 7.5 |
| Impact of Legislative Changes | <u>0.0</u> |
| Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2020 | \$ 21.0 |

The changes in assumptions due to the experience study increased the UAAL by \$7.5 million.

However, this increase was offset by a gain on the actuarial value of assets of \$7.9 million.

The UAAL was further reduced by a gain on liabilities of \$4.6 million and SCRSP contributions exceeding the actuarially determined contribution.

A detailed summary of the net actuarial gain or loss is provided in Section 5.



Employer Contributions

Inputs
 Membership Data
 Asset Data
 Benefit Provisions
 Assumptions
 Funding Methodology

↓

Results
 Actuarial Value of Assets
 Actuarial Accrued Liability
 Net Actuarial Gain or Loss
 Funded Ratio
Employer Contributions
 Benefit Enhancement
 Additional Disclosures
 Projections

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

| | |
|---|------------------|
| Fiscal year ending June 30, 2022 Preliminary ADEC (estimated based on December 31, 2019 Valuation) | 15,182,523 |
| Impact of Legislative Changes | 0 |
| Fiscal year ending June 30, 2022 Final ADEC | 15,182,523 |
| Change Due to Demographic (Gain)/Loss | (731,835) |
| Change Due to Investment (Gain)/Loss | (1,068,545) |
| Change Due to Contributions Greater than ADEC | (476,456) |
| Impact of Assumption Changes | 904,159 |
| Impact of Direct Rate Smoothing | <u>(723,327)</u> |
| Fiscal year ending June 20, 2023 Preliminary ADEC (estimated based on December 31, 2020 Valuation) | \$ 13,086,519 |

The change in the ADEC due to investment gain is based on the actuarial value of assets return of 8.8%, which was greater than the 7.0% assumed return.

The impact of assumption changes is due to the changes in the assumptions and methods in the December 31, 2019 experience study.

The impact of direct-rate smoothing is the first year of the five-year deferred recognition of these assumption changes.

A detailed summary of the actuarially determined employer contribution is provided in Section 6.



State Contribution Rate Stabilization Policy

Inputs

Membership Data
Asset Data
Benefit Provisions
Assumptions
Funding Methodology



Results

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

Employer Contributions

Benefit Enhancement
Additional Disclosures
Projections

- Session Law 2016-108 requires that the Board develop a State Contribution Rate Stabilization Policy (SCRSP) for the FRSWPF
- Below is a summary of the SCRSP that the Board adopted on April 29, 2021
- State Contributions
 - Board will recommend to the General Assembly the higher of the underlying ADEC or \$350,000 greater than the current year's recommendation
 - SCRSP Minimum Contribution Rate for FYE 2023 is \$19,702,208 (Greater of ADEC of \$13,086,519 and FYE 2022 recommendation of \$19,352,208 plus \$350,000)
- Board considerations for Benefit and Member Contribution Increases:
 - Recommended benefit increase is no greater than the CPI-U increase
 - Sufficient funding is available to meet the Benefit Improvement Funding Requirement (BIFR)
 - With a goal of a 50/50 split between member and state contributions toward the normal cost portion of the annual contribution, the Board will recommend that monthly member contributions be set at the \$5 increment closest to a 50/50 share of the Fund's normal cost, along with any recommendation to provide a benefit increase.
 - See next slides for metrics the Board must use to recommend benefit and/or member contribution increases

A detailed summary of the actuarially determined employer contribution is provided in Section 6.

Valuation Results



State Contribution Rate Stabilization Policy

- Inputs**
- Membership Data
- Asset Data
- Benefit Provisions
- Assumptions
- Funding Methodology
- ↓
- Results**
- Actuarial Value of Assets
- Actuarial Accrued Liability
- Net Actuarial Gain or Loss
- Funded Ratio
- Employer Contributions
- Benefit Enhancement**
- Additional Disclosures
- Projections

Metrics the Board must consider to recommend a benefit increase to the General Assembly based on the results of the December 31, 2020 valuation:

- The increase in the AAL and Normal Cost for a proposed \$1 or \$2 benefit improvement:

| | \$1 Improvement | \$2 Improvement |
|-------------------------|-----------------|-----------------|
| Increase in AAL | \$ 2,917,719 | \$ 5,835,439 |
| % increase in AAL | 0.59% | 1.18% |
| Increase in Normal Cost | \$ 41,391 | \$ 82,782 |

- The % increase in AAL for both a \$1 or \$2 improvement is less than the CPI-U increase of 1.36%
- The BIFR for a proposed \$1 or \$2 benefit improvement:

| | \$1 Improvement | \$2 Improvement |
|--|-----------------|-----------------|
| (1) Full Actuarial Cost of Proposed Benefit Improvement | \$ 2,917,719 | \$ 5,835,439 |
| (2) FRSWPF Actuarial Accrued Liability as of 12/31/2020 | 496,012,307 | 496,012,307 |
| (3) FRSWPF Actuarial Value of Assets as of 12/31/2020 | 475,032,285 | 475,032,285 |
| (4) Underlying ADEC for FYE 6/30/2023 | 13,086,519 | 13,086,519 |
| (5) Policy Contribution without Benefit Increase FYE 6/30/2023 | 19,702,208 | 19,702,208 |
| (6) Total Adjustment (2)-(3)+(4)-(5), only if less than \$0 | - | - |
| BIFR: (1) + (6), not less than \$0 | \$ 2,917,719 | \$ 5,835,439 |

- This benefit improvement triggers a member contribution increase from \$10 per month to \$15 per month
 - The \$5 increase is sufficient to pay for the increase in normal cost for both a \$1 or \$2 benefit improvement
 - This increases the member percent share of total normal cost from 31.76% to 47.40% for a \$1 improvement or from 31.76% to 47.15% for a \$2 improvement, inclusive of benefit and member contribution increases

A detailed summary of the actuarially determined employer contribution rates is provided in Section 6.

Valuation Results



State Contribution Rate Stabilization Policy Metrics

- Inputs**
- Membership Data
- Asset Data
- Benefit Provisions
- Assumptions
- Funding Methodology
- ↓
- Results**
- Actuarial Value of Assets
- Actuarial Accrued Liability
- Net Actuarial Gain or Loss
- Funded Ratio
- Employer Contributions
- Benefit Enhancement**
- Additional Disclosures
- Projections

Metrics the Board must use in recommending benefit improvements and member contribution increases based on the December 31, 2020 valuation are as follows:

| | Valuation | \$1 Improvement | \$2 Improvement |
|---|--------------|-----------------|-----------------|
| Total Normal Cost | \$ 7,036,445 | \$ 7,077,836 | \$ 7,119,227 |
| Normal Cost Rate | \$ 335.66 | \$ 337.63 | \$ 339.61 |
| Expense Rate | <u>42.14</u> | <u>42.14</u> | <u>42.14</u> |
| Total Normal Cost Rate | \$ 377.80 | \$ 379.77 | \$ 381.75 |
| State's Rate | \$ 257.80 | \$ 259.77 | \$ 261.75 |
| Employee Rate (\$10 per month) | 120.00 | 120.00 | 120.00 |
| Employee Rate as a % of the Total Rate | 31.76% | 31.60% | 31.43% |
| Increase in EE Rate to get close to a 50/50 | | \$ 180.00 | \$ 180.00 |
| State/EE split in the rate (\$15 per month) | | | |
| EE Cont as a % of the Total Rate | | 47.40% | 47.15% |

A detailed summary of the actuarially determined employer contribution rates is provided in Section 6.



Key Takeaways

- Key results of the December 31, 2020 valuation were:
 - Market value returns of 11.22% during calendar year 2020 compared to 7.0% assumed at the beginning of the plan year
 - SCRSP contributions exceeded ADEC and lowered unfunded actuarial liability



Key Takeaways (continued)

- When compared to the December 31, 2020 actuarial valuation, the previous resulted in:
 - Increase in funded ratio (95.8% in the December 31, 2020 compared to 92.3% in the December 31, 2019 valuation)
 - Lower actuarially determined employer contribution (\$13,086,519 for fiscal year ending June 30, 2023 compared to the preliminary \$15,182,523 calculated in the December 31, 2019 valuation for fiscal year ending June 30, 2022)
- Recommended contribution under the State Contribution Rate Stabilization Policy (SCRSP) of \$19,702,208 which is the greater of:
 - The ADEC of \$13,086,519 and
 - The FYE 2022 recommendation of \$19,352,208 plus \$350,000



Key Takeaways (continued)

- The assumptions used for the December 31, 2020 actuarial valuation are based on the experience study prepared as of December 31, 2019 and adopted by the Board of Trustees on January 28, 2021.
- Material assumptions and methods that were changed since the prior valuation:
 - The investment return assumption was lowered from 7.00% to 6.50%
 - The inflation assumption was lowered from 3.00% to 2.50%
 - The withdrawal rates, retirement rates, disability, mortality assumptions were changed

Key Takeaways (continued)



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.

Certification



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, Cavanaugh Macdonald performed no analysis of the potential range of such future differences, except for some limited analysis in financial projections or required disclosure information. Results prior to December 31, 2017 were provided by the prior consulting actuary.

We 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.

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

Wendy Ludbrook, FSA, EA, FCA, MAAA
Consulting Actuary



Cavanaugh Macdonald
CONSULTING, LLC
The experience and dedication you deserve

North Carolina Firefighters' and Rescue Squad Workers' Pension Fund

Report on the Actuarial Valuation
Prepared as of December 31, 2020

October 2021





Cavanaugh Macdonald

CONSULTING, LLC

The experience and dedication you deserve

October 13, 2021

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

Members of the Board:

We submit herewith our report on the annual 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, 2020. The report has been prepared in accordance with North Carolina General Statute 58-86-1 through 58-86-101. Information contained in our report for plan years prior to December 31, 2017 is based upon valuations performed by the prior actuary.

The primary purpose of the valuation report is to determine the required member and employer contribution rates, 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 and it summarizes census data. Use of this report for any other purposes or by anyone other than OSC and its auditors, or North Carolina Retirement System Division and Department of State Treasurer staff may not be appropriate and may result in mistaken conclusions because of failure to understand applicable assumptions, methods, or inapplicability of the report for that purpose. The attached pages should not be provided without a copy of this cover letter. Because of the risk of misinterpretation of actuarial results, you should ask Cavanaugh Macdonald Consulting (CMC) to review any statement you wish to make on the results contained in this report. CMC 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 CMC and we cannot certify as to the accuracy and completeness of the data supplied. Sometimes assumptions are made by CMC to interpret membership data that is imperfect. 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 (ASOP).

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The assumptions used for the December 31, 2020 actuarial valuation are based on the experience study prepared as of December 31, 2019 and adopted by the Board of Trustees on January 28, 2021. 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.

In order to prepare the results in this report we have utilized appropriate actuarial models that were developed for this purpose. These models use assumptions about future contingent events along with recognized actuarial approaches to develop the needed results.

Future actuarial results may differ significantly from the current results presented in this report due to such factors as the following: fund experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; and changes in plan provisions or applicable law. Such changes in law may include additional costs resulting from future legislated benefit improvements or cost-of-living pension increases or supplements, which are not anticipated in the actuarial valuation. Because of limited scope, CMC performed no analysis of the potential range of such future differences, except for some limited analysis in financial projections or required disclosure information.

We 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,

A handwritten signature in blue ink, appearing to read 'LL'.

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

A handwritten signature in blue ink, appearing to read 'Wendy Ludbrook'.

Wendy Ludbrook, FSA, EA, FCA, MAAA
Consulting Actuary



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Executive Summary

Overview

The North Carolina Retirement Systems Division (RSD) was established in 1941 to provide retirement benefits for public servants in the State of North Carolina. Today, under the management of the Department of State Treasurer, RSD administers seven public pension plans (defined benefit plans), three supplemental retirement plans (voluntary defined contributions plans), a health trust fund, a disability income plan, death benefit funds and a number of other benefit programs. As of December 31, 2020, the RSD defined benefit plans cover over one million current and prior public servants of the state of North Carolina. During the fiscal year ending June 30, 2021, RSD paid over \$6.7 billion in pensions to more than 330,000 retirees. And as of June 30, 2021, RSD's defined benefit plan assets were valued at over \$120 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 \$500 million in assets and over 56,000 members as of December 31, 2020. This actuarial valuation report is our annual analysis of the financial health of FRSWPF. This report, prepared as of December 31, 2020, presents the results of the actuarial valuation of the Retirement System.

Purpose

An actuarial valuation is 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 of 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

Risk

Measuring pension obligations and actuarially determined contributions requires the use of assumptions regarding future economic and demographic experience. Whenever assumptions are made about future events, there is risk that actual experience will differ from expected. Actuarial valuations include the risk that actual future measurements will deviate from expected future measurements due to actual experience that is different than the actuarial assumptions.

The primary areas of risk in this actuarial valuation are:

- Investment Risk – the potential that investment returns will be different than expected.
- Longevity and Other Demographic Risks – the potential that mortality or other demographic experience will be different than expected.
- Interest Rate Risk – To the extent market rates of interest affect the expected return on assets, there is a risk of change to the discount rate which determines the present value of liabilities and actuarial valuation results.
- Contribution Risk – The potential that actual contributions are different than the actuarially determined contributions.

Annual actuarial valuations are performed for RSD which re-measure the assets and liabilities and compute a new actuarially determined contribution. RSD also has experience studies performed every five years to analyze the discrepancies between actuarial assumptions and actual experience and determine if the actuarial assumptions need to be changed. Annual actuarial valuations and periodic experience studies are practical ways to monitor and reassess risk.



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, 2020 valuation were:

- Changes in actuarial assumptions and methods, including a decrease in the discount rate from 7.00% to 6.50%, in accordance with the latest experience study prepared as of December 31, 2019, and adopted by the Board of Trustees on January 28, 2021
- Direct-rate smoothing of the change in the employer contribution rate due to the changes in assumptions and methods over a 5-year period
- Market value returns of 11.22% during calendar year 2020 compared to 7.00% assumed at the beginning of the plan year
- Employer contributions under the State Contribution Rate Stabilization Policy (SCRSP) significantly exceeded the actuarially determined employer contribution (ADEC)

When compared to the December 31, 2019 valuation, the results show:

- A higher funded ratio (95.8% in the December 31, 2020 valuation compared to 92.3% in the December 31, 2019 valuation)
- A lower actuarially determined employer contribution (\$13,086,519 for fiscal year ending June 30, 2023 compared to \$15,182,523 for fiscal year ending June 30, 2022)

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 a minimum of the recommended contribution requirements
- Implementation of SCRSP which provides additional funding
- 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.

This report, prepared as of December 31, 2020, presents the results of the annual valuation of the system. The principal results of the valuation and a comparison with the preceding year's results are summarized in the following table.



Section 1: Principal Results

This report, prepared as of December 31, 2020, 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

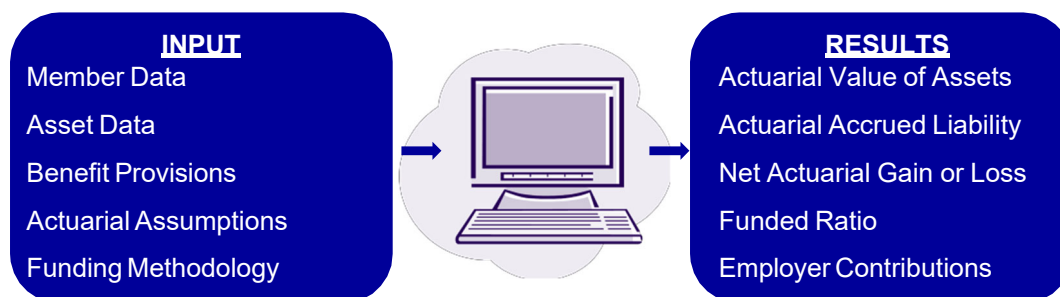
| Valuation Results as of | 12/31/2020 | 12/31/2019 |
|--|------------------|------------------|
| Active Members | | |
| Non-lapsed Members | 24,655 | 24,994 |
| Lapsed Members | 16,465 | 15,225 |
| Retired Members and Survivors of Deceased Members Killed in the Line of Duty | | |
| Number | 14,922 | 14,765 |
| Annual Pensions | \$ 30,440,880 | \$ 30,120,600 |
| Number of Deferred Members | 122 | 136 |
| Assets | | |
| Actuarial Value (AVA) | \$ 475,032,285 | \$ 445,876,956 |
| Market Value (MVA) | \$ 499,936,606 | \$ 458,687,909 |
| Actuarial Accrued Liability (AAL) | \$ 496,012,307 | \$ 482,816,865 |
| Unfunded Accrued Liability (AAL - AVA) | \$ 20,980,022 | \$ 36,939,909 |
| Funded Ratio* (AVA / AAL) | 95.8% | 92.3% |
| Results for Fiscal Year Ending | 6/30/2023 | 6/30/2022 |
| Actuarially Determined Employer Contribution (ADEC) | | |
| Normal Cost | \$ 5,729,089 | \$ 5,899,243 |
| Accrued Liability | 8,080,757 | 9,283,280 |
| Total | \$ 13,809,846 | \$ 15,182,523 |
| Total Based on Direct Rate Smoothing | \$ 13,086,519 | \$ 15,182,523 |
| Impact of Legislative Changes | N/A | N/A |
| Final ADEC | N/A | \$ N/A |
| SCRSP Minimum Contribution Rate | 19,702,208 | 19,352,208 |
| Appropriation Act for Fiscal Year Ending | 6/30/2022 | 6/30/2021 |
| Legislative Appropriation | N/A | 19,002,208 |

* The Funded Ratio on a Market Value of Assets basis is 100.8% at December 31, 2020.



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. 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, salary 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 | 12/31/2020 | 12/31/2019 |
|---|---------------|---------------|
| Active Members | 24,655 | 24,994 |
| Lapsed Members | 16,465 | 15,225 |
| Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits | 122 | 136 |
| Retired members and survivors of deceased members killed in the Line of Duty currently receiving benefits | <u>14,922</u> | <u>14,765</u> |
| Total | 56,164 | 55,120 |

Commentary: The number of fully active and lapsed members increased approximately 2.2% overall. The number of retired members increased 1.1% from the previous valuation date. The increase in retiree population is consistent with expectations.

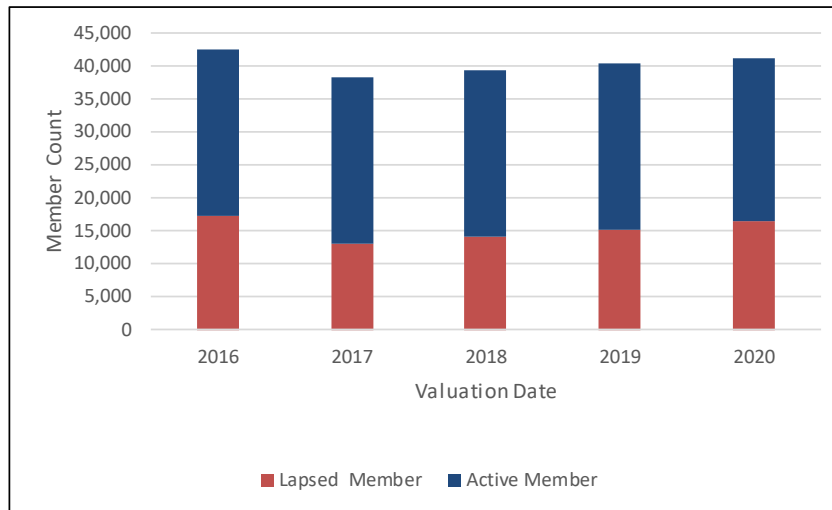


Section 2: The Valuation Process

Valuation Input: Membership Data (continued)

Graph 1: Active 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. Based on the experience study prepared as of December 31, 2019 and adopted by the Board on January 28, 2021, there is no change to this assumption.

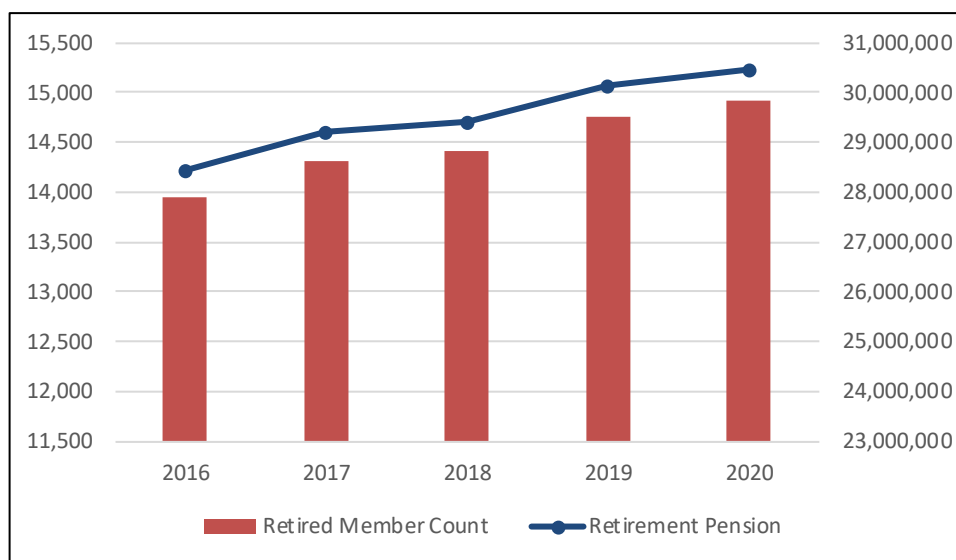


Section 2: The Valuation Process

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.



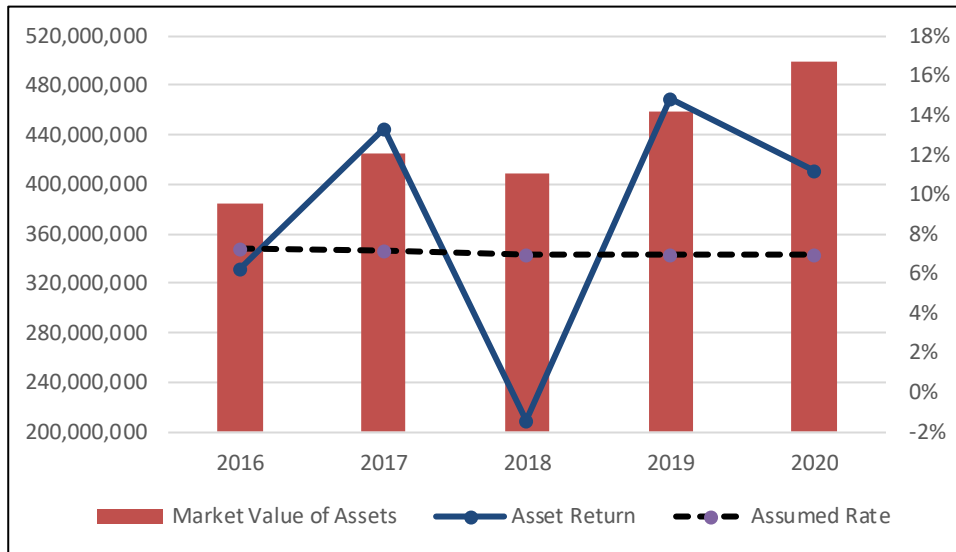
Section 2: The Valuation Process

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 \$500 million as of December 31, 2020 and \$459 million as of December 31, 2019. The investment return for the market value of assets for calendar year 2020 was 11.22%.

Graph 3: Market Value of Assets and Asset Returns

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



Commentary: Market value returns during 2020 were much higher than the 7.00% assumed rate of return, resulting in a lower required contribution and higher funded ratio than anticipated.

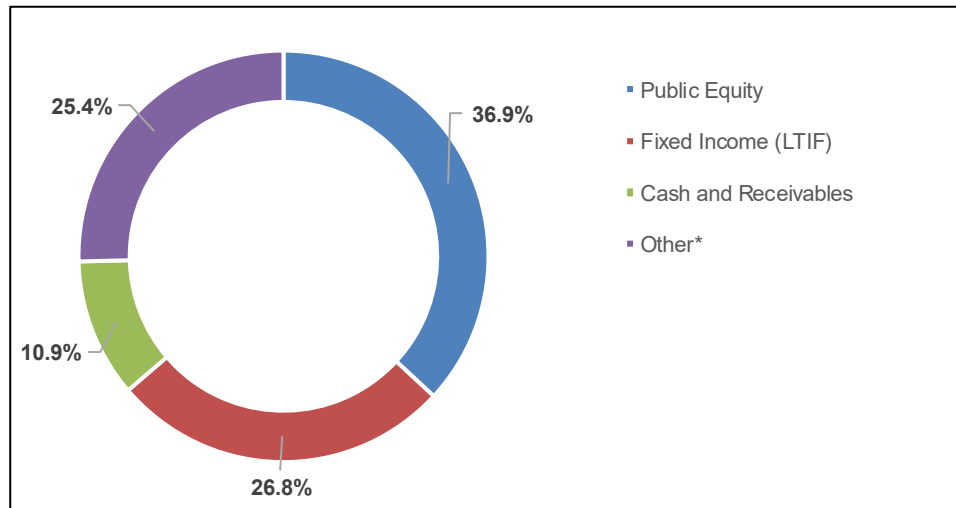


Section 2: The Valuation Process

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, 2020 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 6.50% 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 Statutes, Chapter 58. There were no changes in benefit provisions since the prior year's valuation.

Highlights of the benefit provisions are described below.

- An unreduced retirement pension 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 pension is equal to \$170 per month.

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

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

Valuation Input: Actuarial Assumptions

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

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

Valuations since December 31, 2015 reflect the return to service assumption (based on the findings of the data audit of the FRSWPF and presented in a 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, 2016.

The assumptions used for the December 31, 2020 actuarial valuation are based on the experience study prepared as of December 31, 2019 and adopted by the Board of Trustees on January 28, 2021. Assumptions and methods that were changed since the prior valuation include:

- The investment return assumption was lowered from 7.00% to 6.50%
- The inflation assumption was lowered from 3.00% to 2.50%
- The withdrawal rates, retirement rates and mortality assumption were changed



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 are expected to stay level over time
- Asset Valuation Methods smooth or average the market value returns over time to alleviate contribution volatility that results from market returns. The Board of Trustees has adopted the following:
 - 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). The Board of Trustees has adopted the following:
 - 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 year experience.

Commentary: 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 unfunded actuarial accrued liability over a much shorter period of time (12 years) compared to most other Public Sector Retirement Systems. As such it is a best practice in the industry.

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



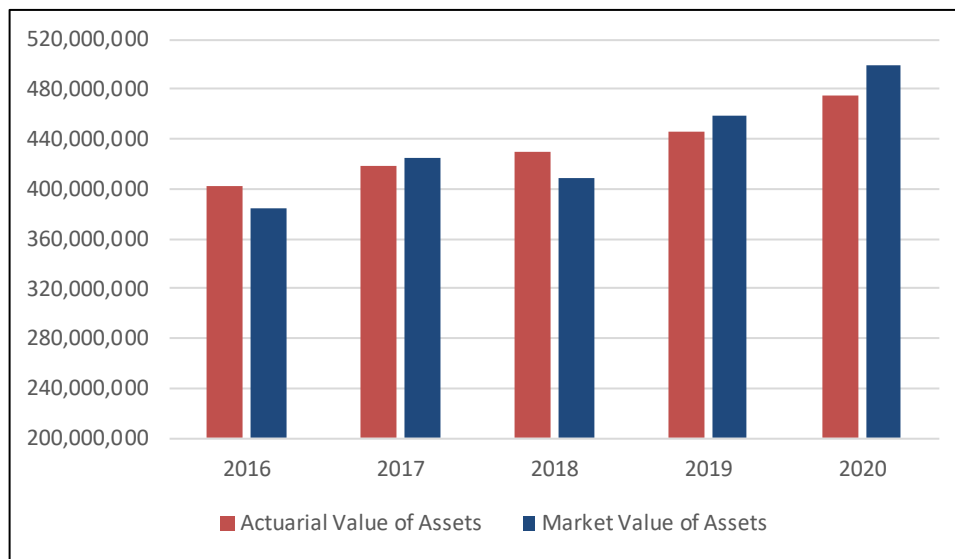
Section 2: The Valuation Process

Valuation Results: Actuarial Value of Assets

In order to reduce the volatility that investment gains and losses can have on required contributions and funded status of FRSWPF, the Board adopted an asset valuation method to determine the Actuarial Value of Assets used for funding purposes. The Actuarial Value of Assets is \$475.0 million as of December 31, 2020 and \$445.9 million as of December 31, 2019.

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.



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

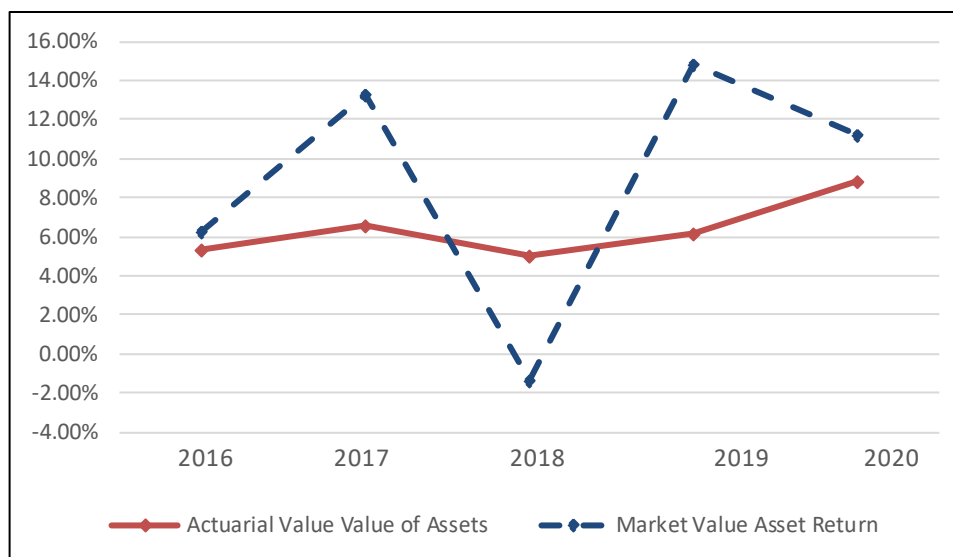


Section 2: The Valuation Process

Valuation Results: Actuarial Value of Assets (continued)

Graph 6: Asset Returns

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



Commentary: The investment return for the market value of assets for calendar year 2020 was 11.22%. The actuarial value of assets smooths investment gains and losses. Higher than expected market returns in 2017, 2019 and 2020, resulted in an actuarial value of asset return for calendar year 2020 of 8.80% and a recognized actuarial asset gain of \$7.9 million during 2020.

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



Section 2: The Valuation Process

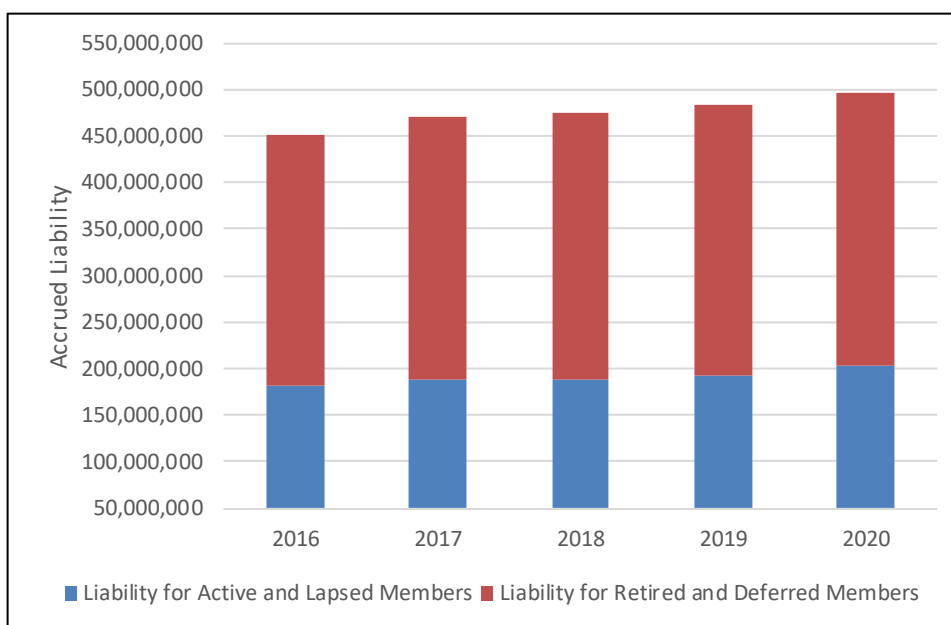
Valuation Results: Actuarial Accrued Liability

Using the provided membership data, benefit provisions, and actuarial assumptions, the future benefit payments of FRSWPF 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 FRSWPF. 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 \$482.8 million to \$496.0 million during 2020. 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. The AAL was \$2.9 million higher than expected, resulting primarily from changes in assumptions and methods.

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



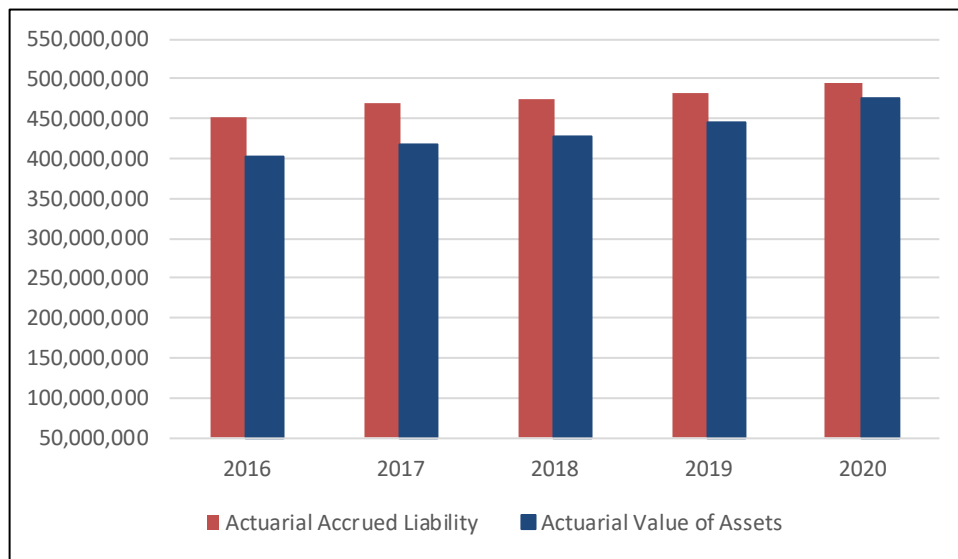
Section 2: The Valuation Process

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.



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 unfunded actuarial accrued liability to be paid off in 12 years.

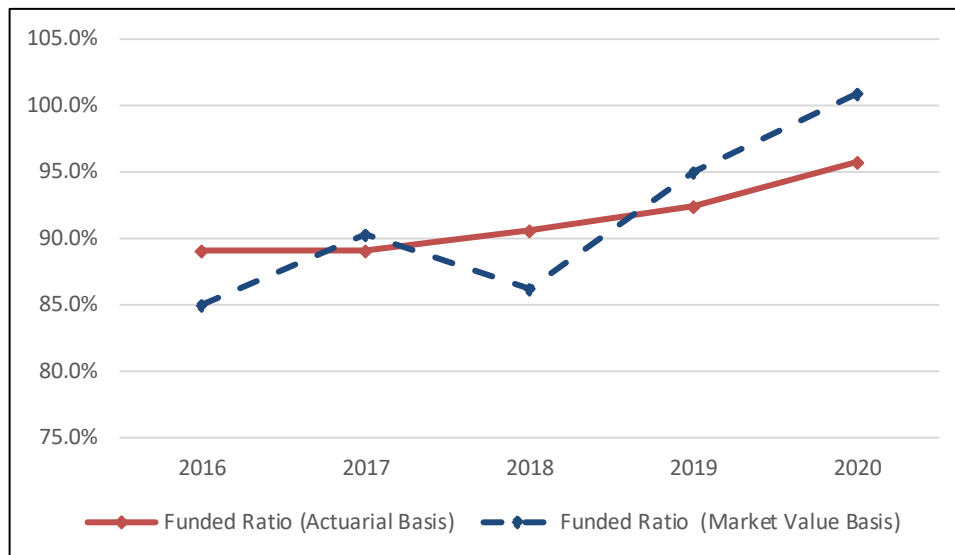


Section 2: The Valuation Process

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 increased from 92.3% at December 31, 2019 to 95.8% at December 31, 2020.



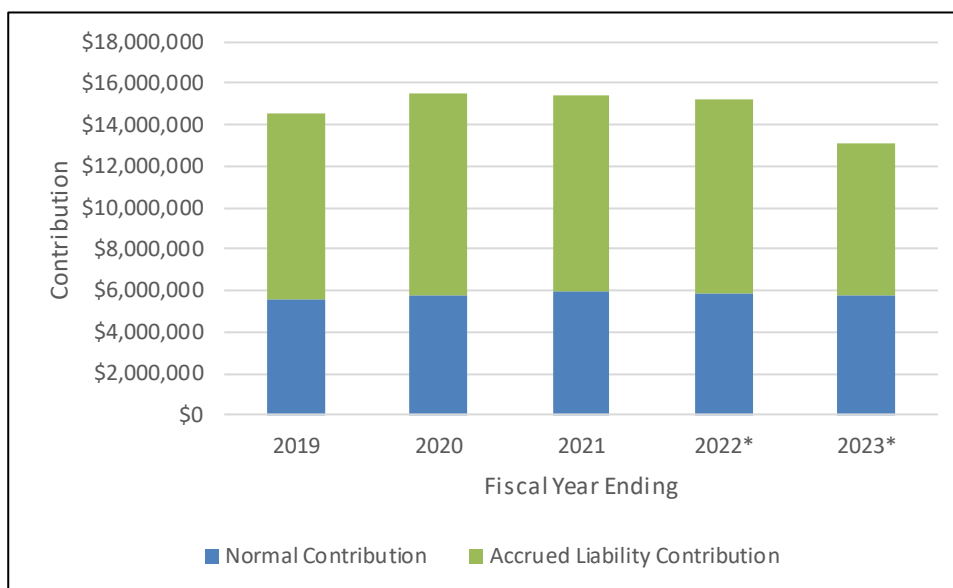
Section 2: The Valuation Process

Valuation Results: State Contributions

The December 31, 2019 valuation suggested that the preliminary total employer contribution be set at \$15,182,523 for the fiscal year ending June 30, 2022 subject to the SCRSP (which would suggest a contribution of at least \$19,352,208) and the impact of any future legislative changes effective during that fiscal year. As a result of the December 31, 2020 valuation, the preliminary actuarially determined employer contribution is \$13,809,846 for the fiscal year ending June 30, 2023, subject to the SCRSP (which would suggest a contribution of at least \$19,702,208) and the impact of any future legislative changes effective during that fiscal year.

Graph 10: Employer Actuarially Determined Employer Contributions

The graph below provides a history of actuarially determined employer contributions over the past five years.



*Subject to the impact of future legislative changes effective before or 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 unfunded actuarial accrued liability over a 12 year period, offset for the \$10 monthly contribution the members make until they attain 20 years of service. The 12-year period is a relatively short period for Public Sector Retirement Systems in the United States, with the funding period for most of these systems much longer. The shorter period results in higher contributions and more benefit security.

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



Section 2: The Valuation Process

Valuation Results: Accounting Information

The Governmental Accounting 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, 2021, is \$(27,931,000) (compared to \$36,185,000 for fiscal year ending June 30, 2020). The required financial reporting information for FRSWPF 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 Member Data

| | Member Count | Average Age | Average Service |
|----------------|---------------------|--------------------|------------------------|
| Lapsed Members | 16,465 | 41.01 | 5.93 |
| Active Members | <u>24,655</u> | <u>39.36</u> | <u>11.21</u> |
| Total | 41,120 | 40.02 | 9.10 |

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 Pension |
|---------------------|--------------------|----------------------------------|
| 14,922 | 68.77 | \$ 30,440,880 |

Table 4: Data for Disabled Members Eligible for Deferred Pensions

| Member Count | Average Age | Annual Retirement Pension |
|---------------------|--------------------|----------------------------------|
| 122 | 51.02 | \$ 248,880 |



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 | 12/31/2020 | 12/31/2019 |
|--|----------------|----------------|
| Beginning of Year Market Value of Assets | \$ 458,687,909 | \$ 408,109,943 |
| Employer Contributions | 18,827,208 | 18,477,208 |
| Employee Contributions | 2,539,802 | 2,723,270 |
| Benefit Payments Other than Refunds | (29,844,643) | (29,368,958) |
| Refunds | (241,587) | (300,366) |
| Administrative Expenses | (936,587) | (935,896) |
| Investment Income | 50,904,504 | 59,982,708 |
| Net Increase/(Decrease) | 41,248,697 | 50,577,966 |
| End of Year Value of Assets | \$ 499,936,606 | \$ 458,687,909 |
| Estimated Net Investment Return on Market Value (Annualized) | 11.22% | 14.87% |

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

| Category | 12/31/2020 | 12/31/2019 |
|------------------------------|----------------|----------------|
| Allocation by Dollar Amount | | |
| Public Equity | \$ 184,565,985 | \$ 150,367,999 |
| Fixed Income (LTIF) | \$ 134,012,941 | \$ 121,083,177 |
| Cash and Receivables | \$ 54,654,002 | \$ 61,768,348 |
| Other* | \$ 126,703,678 | \$ 125,468,386 |
| Total Market Value of Assets | \$ 499,936,606 | \$ 458,687,909 |
| Public Equity | 36.9% | 32.8% |
| Fixed Income (LTIF) | 26.8% | 26.4% |
| Cash and Receivables | 10.9% | 13.5% |
| Other* | <u>25.4%</u> | <u>27.3%</u> |
| 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 | 12/31/2020 |
|--|---------------------|
| Beginning of Year Actuarial Value of Assets | \$ 445,876,956 |
| Beginning of Year Market Value of Assets | 458,687,909 |
| Contributions | 21,367,010 |
| Benefit Payments, Refunds and Administrative Expenses | <u>(31,022,817)</u> |
| Net Cash Flow | (9,655,807) |
| Expected Investment Return | 31,775,916 |
| Expected End of Year Market Value of Assets | 480,808,018 |
| End of Year Market Value of Assets | 499,936,606 |
| Excess of Market Value over Expected Market Value of Assets | 19,128,588 |
| 80% of 2020 Asset Gain/(Loss) | 15,302,870 |
| 60% of 2019 Asset Gain/(Loss) | 19,043,167 |
| 40% of 2018 Asset Gain/(Loss) | (14,084,203) |
| 20% of 2017 Asset Gain/(Loss) | 4,642,487 |
| Total Deferred Asset Gain/(Loss) | 24,904,321 |
| Preliminary End of Year Actuarial Value of Assets | 475,032,285 |
| Final End of Year Actuarial Value of Assets (not less than 80% and not greater than 120% of Market Value) | 475,032,285 |
| Estimated Net Investment Return on Actuarial Value | 8.80% |

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



Section 4: Asset Data

The valuation assumed that the funds will earn a 7.00% asset return. The table below provides a history of the Actuarial Value and Market Value of Asset returns.

Table 8: Historical Asset Returns

| Calendar Year | Actuarial Value of Asset Return | Market Value of Asset Return |
|---------------|---------------------------------|------------------------------|
| 2011 | 6.88% | 18.47% |
| 2012 | 5.96% | 2.25% |
| 2013 | 7.43% | 12.42% |
| 2014 | 7.42% | 6.24% |
| 2015 | 5.87% | 0.35% |
| 2016 | 5.33% | 6.24% |
| 2017 | 6.54% | 13.33% |
| 2018 | 5.08% | -1.40% |
| 2019 | 6.19% | 14.87% |
| 2020 | 8.80% | 11.22% |
| Average | 6.54% | 8.21% |
| Range | 3.72% | 19.87% |

* 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 over 10 years of 6.54% compares with an average market return of 8.21%. But the range of returns is markedly more volatile, 19.87% versus 3.72%. This results in much lower actuarially determined employer contribution volatility using the actuarial value of assets versus market, while ensuring that the actuarial needs of FRSWPF are met.



Section 5: Liability Results

Using the provided membership data, benefit provisions, and actuarial assumptions, future benefit payments of FRSWPF 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 | 12/31/2020 | 12/31/2019 |
|--|--------------------|--------------------|
| (a) Present Value of Future Benefits | | |
| (1) Active Members | \$ 254,656,393 | \$ 242,446,149 |
| (2) Members Currently Receiving Benefits and Members with Deferred Benefits | <u>292,577,066</u> | <u>290,265,691</u> |
| (3) Total | \$ 547,233,459 | \$ 532,711,840 |
| (b) Present Value of Future Normal Costs | | |
| (1) Employee Future Normal Costs | \$ 18,267,240 | \$ 17,689,320 |
| (2) Employer Future Normal Costs | <u>32,953,912</u> | <u>32,205,655</u> |
| (3) Total | \$ 51,221,152 | \$ 49,894,975 |
| (c) Actuarial Accrued Liability: (a3) - (b3) | \$ 496,012,307 | \$ 482,816,865 |
| (d) Actuarial Value of Assets | \$ 475,032,285 | \$ 445,876,956 |
| (e) Unfunded Actuarial Accrued Liability: (c) - (d) | \$ 20,980,022 | \$ 36,939,909 |



Section 5: Liability Results

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

TABLE 10: Funding Allocation

| | 12/31/2020 | 12/31/2019 |
|------------------------------------|-------------------|-------------------|
| Allocation by Dollar Amount | | |
| Assets (Actuarial Value) | \$ 475,032,285 | \$ 445,876,956 |
| Future Employee Contributions | 18,267,240 | 17,689,320 |
| Future Normal Contributions | 32,953,912 | 32,205,655 |
| Present Value of Funded Benefits | \$ 526,253,437 | \$ 495,771,931 |
| Present Value of Unfunded Benefits | <u>20,980,022</u> | <u>36,939,909</u> |
| Total Present Value of Benefits | \$ 547,233,459 | \$ 532,711,840 |
| Allocation by Percentage of PVB | | |
| Assets (Actuarial Value) | 86.8% | 83.7% |
| Future Employee Contributions | 3.3% | 3.3% |
| Future Normal Contributions | 6.0% | 6.0% |
| Present Value of Funded Benefits | 96.1% | 93.0% |
| Present Value of Unfunded Benefits | 3.9% | 7.0% |
| Total Present Value of Benefits | 100.0% | 100.0% |



Section 5: Liability Results

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

Table 11: Reconciliation of Unfunded Actuarial Accrued Liability

| (in millions) | |
|--|------------|
| Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2019 | \$ 36.9 |
| Normal Cost and Administrative Expense during 2020 | 8.4 |
| Reduction due to Actual Contributions during 2020 | (21.4) |
| Interest on UAAL, Normal Cost, and Contributions | 2.1 |
| Asset (Gain) / Loss | (7.9) |
| Actuarial Accrued Liability (Gain) / Loss | (4.6) |
| Impact of Assumption Changes | 7.5 |
| Impact of Legislative Changes | <u>0.0</u> |
| Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2020 | \$ 21.0 |

Commentary: During 2020, the UAAL increased more than expected due to the impact of assumption changes during the year of \$7.5 million. This was offset by an asset gain during the year that decreased the UAAL by \$7.9 million and SCRSP contributions exceeding the actuarially determined contribution. Additionally, demographic experience decreased the UAAL by \$4.6 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 a 12-year period.

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

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

| Valuation Date | 12/31/2020 | 12/31/2019 |
|---|--------------|--------------|
| ADEC for Fiscal Year Ending | 6/30/2023 | 6/30/2022 |
| Normal Cost Rate | | |
| (a) Total Normal Rate | \$ 335.66 | \$ 338.26 |
| (b) Employee Normal Cost | \$ 120.00 | \$ 120.00 |
| (c) Employer Normal Cost: (a) - (b) | \$ 215.66 | \$ 218.26 |
| (d) Expenses Rate* | \$ 42.14 | \$ 41.15 |
| (e) Total Normal Cost Rate: (c) + (d) | \$ 257.80 | \$ 259.41 |
| Accrued Liability Rate Calculation | | |
| (f) Total Annual Amortization Payments ** | \$ 8,080,757 | \$ 9,283,280 |
| (g) Active Member Count*** | 22,223 | 22,741 |
| (h) Accrued Liability Rate: (f) / (g) | \$ 363.62 | \$ 408.22 |
| Total ADEC (e)+(h) | \$ 621.42 | \$ 667.63 |

* Based on actual expenses during the previous year.

** See Table 16 for more detail.

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



Section 6: Actuarially Determined Employer Contribution

The table below provides a reconciliation of the actuarially determined employer contributions.

Table 13: Actuarially Determined Employer Contributions (ADEC)

| Valuation Date ADEC for Fiscal Year Ending | 12/31/2020 6/30/2023 | 12/31/2019 6/30/2022 |
|---|-------------------------|-------------------------|
| (a) Current Active Member Count* | 22,223 | 22,741 |
| (b) Normal Cost Rate | 257.80 | 259.41 |
| (c) Normal Cost Contribution (a) x (b) | \$ 5,729,089 | \$ 5,899,243 |
| (d) Accrued Liability Contribution | \$ 8,080,757 | \$ 9,283,280 |
| (e) Preliminary ADEC: (c) + (d) | 13,809,846 | 15,182,523 |
| (f) ADEC: Direct Rate Smoothing | \$ 13,086,519 | \$ 15,182,523 |
| Impact of Legislative Changes | N/A | N/A |
| Final ADEC | N/A | N/A |
| SCRSP Minimum Contribution | \$19,702,208 | \$19,352,208 |

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



Section 6: Actuarially Determined Employer Contribution

Table 14: Reconciliation of the Change in the ADEC

| | |
|---|------------------|
| Fiscal year ending June 30, 2022 Preliminary ADEC (estimated based on December 31, 2019 Valuation) | 15,182,523 |
| Impact of Legislative Changes | 0 |
| Fiscal year ending June 30, 2022 Final ADEC | 15,182,523 |
| Change Due to Demographic (Gain)/Loss | (731,835) |
| Change Due to Investment (Gain)/Loss | (1,068,545) |
| Change Due to Contributions Greater than ADEC | (476,456) |
| Impact of Assumption Changes | 904,159 |
| Impact of Direct Rate Smoothing | <u>(723,327)</u> |
| Fiscal year ending June 20, 2023 Preliminary ADEC (estimated based on December 31, 2020 Valuation) | \$ 13,086,519 |



Section 6: Actuarially Determined Employer Contribution

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

Table 15: Calculation of the New Amortization Base

| Calculation as of | 12/31/2020 | 12/31/2019 |
|--|----------------|----------------|
| (a) Unfunded Actuarial Accrued Liability | \$ 20,980,022 | \$ 36,939,909 |
| (b) Prior Years' Outstanding Bases | \$ 29,602,588 | \$ 38,462,429 |
| (c) New Amortization Base: (a) - (b) | \$ (8,622,566) | \$ (1,522,520) |
| (d) New Amortization Payment | \$ (1,125,535) | \$ (205,104) |

Table 16: Amortization Schedule for Unfunded Accrued Liability

| Date Established | Original Balance | 12/31/2020 Outstanding Balance | Annual Payment |
|-------------------|------------------|--------------------------------|----------------|
| June 30, 2010 | \$ 51,963,371 | \$ 15,690,859 | \$ 6,784,330 |
| June 30, 2011 | 8,122,313 | 3,319,886 | 1,057,068 |
| June 30, 2012 | 3,813,072 | 1,938,237 | 494,704 |
| December 31, 2013 | (11,374,070) | (8,101,402) | (1,519,055) |
| December 31, 2014 | (4,939,476) | (3,931,387) | (657,787) |
| December 31, 2015 | 14,577,214 | 12,737,376 | 1,935,502 |
| December 31, 2016 | 5,571,626 | 5,268,955 | 737,095 |
| December 31, 2017 | 5,881,084 | 5,953,969 | 775,156 |
| December 31, 2018 | (1,528,072) | (1,644,808) | (201,047) |
| December 31, 2019 | (1,522,520) | (1,629,097) | (199,673) |
| December 31, 2020 | (8,622,566) | (8,622,566) | (1,125,535) |
| Total | | \$ 20,980,022 | \$ 8,080,757 |

Commentary: This is the payment schedule for the unfunded actuarial accrued liability of FRSWPF.



Section 6: Actuarially Determined Employer Contribution

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

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

| Valuation Date | Fiscal Year Ending | Preliminary ADEC | Subsequent Changes to ADEC * | Final ADEC | Appropriated Rate |
|----------------|--------------------|------------------|------------------------------|------------|-------------------|
| 12/31/2020 | 6/30/2023 | \$ 13,086,519 | N/A | N/A | N/A |
| 12/31/2019 | 6/30/2022 | 15,182,523 | N/A | N/A | N/A |
| 12/31/2018 | 6/30/2021 | 14,845,609 | - | 14,845,609 | 19,002,208 |
| 12/31/2017 | 6/30/2020 | 14,323,684 | - | 14,323,684 | 18,652,208 |
| 12/31/2016 | 6/30/2019 | 14,544,083 | - | 14,544,083 | 18,302,208 |



Section 7: Valuation Balance Sheet

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

Table 18: Valuation Balance Sheet

| Balance Sheet as of | 12/31/2020 | 12/31/2019 |
|--|------------------------------|------------------------------|
| Assets | | |
| Current Actuarial Value of Assets | | |
| Annuity Savings Fund | \$ 40,502,997 | \$ 39,659,354 |
| Pension Accumulation Fund | <u>434,529,288</u> | <u>406,217,602</u> |
| Total | <u>\$ 475,032,285</u> | <u>\$ 445,876,956</u> |
| Future Member Contributions to the Annuity Savings Fund | \$ 18,267,240 | \$ 17,689,320 |
| Prospective Appropriations to the Pension Accumulation Fund | | |
| Normal Appropriations | \$ 32,953,912 | \$ 32,205,655 |
| Unfunded Accrued Liability Appropriations | <u>20,980,022</u> | <u>36,939,909</u> |
| Total | <u>\$ 53,933,934</u> | <u>\$ 69,145,564</u> |
| Total Assets | <u>\$ 547,233,459</u> | <u>\$ 532,711,840</u> |
| Liabilities | | |
| Annuity Savings Fund | | |
| Past Member Contributions | \$ 40,502,997 | \$ 39,659,354 |
| Future Member Contributions | <u>18,267,240</u> | <u>17,689,320</u> |
| Total Contributions | <u>\$ 58,770,237</u> | <u>\$ 57,348,674</u> |
| Pension Accumulation Fund | | |
| Benefits to Retired Members, Survivors and Deferred Members | \$ 292,577,066 | \$ 290,265,691 |
| Benefits to be Paid to Current Active and Lapsed Members | <u>195,886,156</u> | <u>185,097,475</u> |
| Total Benefits Payable | <u>\$ 488,463,222</u> | <u>\$ 475,363,166</u> |
| Total Liabilities | <u>\$ 547,233,459</u> | <u>\$ 532,711,840</u> |



Section 8: Accounting Results

This section contains the accounting information for Governmental Accounting Standards Board (GASB) Statement No. 67 for fiscal year ending June 30, 2021 based on a valuation date of December 31, 2020.

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

The June 30, 2021 total pension liability presented in this section was determined by an actuarial valuation as of December 31, 2020, based on the assumptions, methods and plan provisions described in this report. The actuarial cost method used to develop the total pension liability is the Entry Age Normal Cost method, as required by GASB Statement No. 67.

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

Table 19: Number of Active and Retired Members as of December 31, 2020

| Number of Active and Retired Participants as of December 31, 2020 | |
|--|---------------|
| Group | Number |
| Retired members and survivors of deceased members currently receiving benefits | 14,922 |
| Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits | 122 |
| Active members* | <u>41,120</u> |
| Total | 56,164 |

* Includes all members who have not received a refund of contributions. This group includes 24,655 active members and 16,465 lapsed members whose service did not decrease during 2020.



Section 8: Accounting Results

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

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

| Schedule of Changes in Net Pension Liability as of June 30, 2021 | |
|--|---------------------|
| Total Pension Liability | |
| Service Cost | \$ 7,675,000 |
| Interest | 33,116,000 |
| Changes of Benefit Terms | 0 |
| Difference between Expected and Actual Experience | (4,881,000) |
| Change of Assumptions | 6,525,000 |
| Benefit Payments, including Refund of Member Contributions | <u>(30,147,000)</u> |
| Net Change in Total Pension Liability | 12,288,000 |
| Total Pension Liability – Beginning of Year | \$ 487,908,000 |
| Total Pension Liability – End of Year | \$ 500,196,000 |
| Plan Fiduciary Net Pension | |
| Employer Contributions | \$ 19,002,000 |
| Member Contributions | 2,569,000 |
| Net Investment Income | 85,952,000 |
| Benefit Payments, including Refund of Member Contributions | (30,147,000) |
| Administrative Expenses | (987,000) |
| Other | <u>15,000</u> |
| Net Change in Plan Fiduciary Net Pension | 76,404,000 |
| Plan Fiduciary Net Pension – Beginning of Year | \$ 451,723,000 |
| Plan Fiduciary Net Pension – End of Year | \$ 528,127,000 |

Table 21: Net Pension Liability (Asset)

| Net Pension Liability (Asset) | | |
|---|--------------------|--------------------|
| | June 30, 2021 | June 30, 2020 |
| Total Pension Liability | \$ 500,196,000 | \$ 487,908,000 |
| Plan Fiduciary Net Position | <u>528,127,000</u> | <u>451,723,000</u> |
| Net Pension Liability (Asset) | \$ (27,931,000) | \$ 36,185,000 |
| Plan Fiduciary Net Position as a Percentage of the Total Pension Liability (Asset) | 105.58% | 92.58% |



Section 8: Accounting Results

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

Table 22: Sensitivity of the Net Pension Liability at June 30, 2021 to Changes in the Discount Rate

| Sensitivity of the Net Pension Liability to Changes in the Discount Rate | | | |
|--|--------------|----------------|----------------|
| | 1% Decrease | Current | 1% Increase |
| Discount Rate | 5.50% | 6.50% | 7.50% |
| Net Pension Liability (Asset) | \$35,655,000 | \$(27,931,000) | \$(79,941,000) |

The discount rate used to measure the total pension liability was 6.50%. The projection of cash flows used to determine the discount rate assumed that System contributions will continue to follow the current funding policy, including “direct-rate smoothing” as adopted by the Board on January 28, 2021. 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. Additional SCRSP contributions are not included in Appendix E.

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

Table 23: Additional Information for GASB Statement No. 67

| | |
|------------------------------|--|
| Valuation Date | 12/31/2020 |
| Actuarial Cost Method | Entry Age |
| Amortization Method | Level dollar closed |
| Amortization Period | 12 year closed period |
| Asset Valuation Method | Asset return 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* | 6.50% |
| Projected Salary Increases** | N/A |
| *Includes Inflation of | 2.50% |
| Cost-of-living Adjustments | N/A |



Appendix A: Valuation Process and Glossary of Actuarial Terms

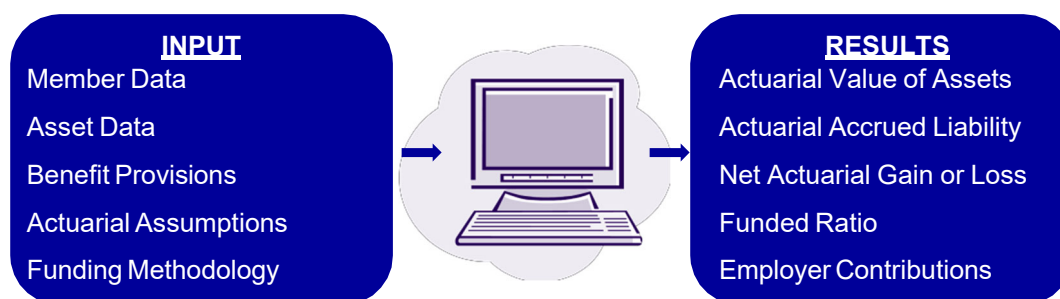
Purpose of an Actuarial Valuation

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 ("TSERS") under G.S.135-8(d) 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 an additional amount equal to a percentage of the member's actual compensation to be known as the 'accrued liability contribution'... The rate per centum of such contributions shall be fixed on the basis of the liabilities of the Retirement System as shown by actuarial valuation, duly approved by the Board of Trustees, and shall be called the 'actuarially determined employer contribution rate'. The actuarially determined employer contribution rate shall be calculated annually by the actuary using assumptions and a cost method approved by the Actuarial Standards Board of the American Academy of Actuaries and selected by the Board of Trustees."

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.



Appendix A: Valuation Process and Glossary of Actuarial Terms

The actuary collects summary information about assets as of the valuation date and information on cash flows for the year ending on the valuation date. Information about benefit provisions as of the valuation date is also collected. To bridge the gap between the information collected and potential benefits to be paid in the future, the actuary must make assumptions about future activities. These assumptions are recommended by the actuary to the Boards based on the results of an experience review. An experience review is a review of the Retirement System over a period of time, typically five years, where the actuary analyzes the demographic and economic assumptions of the Retirement System. Based on this review, the actuary will make recommendations on the demographic assumptions, such as when members will be projected to retire, terminate, become disabled and/or die in the future, as well as the economic assumptions, such as what rate of return is projected to be earned by the fund based on the Retirement System investment policy and what level of future salary increases is expected for members. To maintain the assumptions, the Board should adopt a prudent policy of having an experience review being performed every five years. The next experience review for the North Carolina Retirement Systems will be based on the five-year period ending on December 31, 2024 and will be presented during 2025. Using these assumptions, the actuary is able to use the member data, asset data and benefit provision information collected to project the benefits that will be paid from the Retirement System to current members. These projected future benefit payments are based not only on service and pay through the valuation date but includes future pay and service, which has not yet been earned by the members but is expected to be earned.

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

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

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



Appendix A: Valuation Process and Glossary of Actuarial Terms

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. Most retirement systems have UAAL. 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. By averaging returns, the UAAL is not as volatile, which we will see later results in contributions that are not as volatile as well. The North Carolina Retirement Systems use an actuarial value of assets with a smoothing period of 5 years.

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



Appendix A: Valuation Process and Glossary of Actuarial Terms

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. Continuing to follow the aggressive North Carolina contribution policy will keep the North Carolina Retirement Systems 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 6.50% return, an actuarial gain is said to have happened, which typically results in lower contributions and higher funded ratio, all else being equal. Alternatively, a return of 2% under the same circumstances would result in an actuarial loss, requiring an increase in contributions and a funded ratio that is lower than anticipated. Experience gains and losses are common within the valuation process. Typically gains and losses offset each other over time. To the extent that does not occur, the reasons for the gains and losses should be understood, and appropriate recommendations should be made by the actuary after an experience review to adjust the assumptions.

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

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



Appendix A: Valuation Process and Glossary of Actuarial Terms

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. The actuary works with the North Carolina Retirement Systems 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.*

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 30) 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 – An 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.



Appendix A: Valuation Process and Glossary of Actuarial Terms

- 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 FRSWPF uses a five-year smoothing of asset gains and losses, which is the most commonly used method.

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.*

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 and Lapsed Members Distributed by Age and Service as of December 31, 2020

| Age | Years of Service | | | | | | | | | | Total |
|-----------|------------------|--------|--------|----------|----------|----------|----------|----------|----------|---------|--------|
| | 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 | |
| Under 25 | 257 | 2,485 | 290 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3,033 |
| 25 to 29 | 262 | 2,914 | 1,879 | 251 | 3 | 0 | 0 | 0 | 0 | 0 | 5,309 |
| 30 to 34 | 283 | 2,676 | 1,800 | 1,408 | 187 | 3 | 0 | 0 | 0 | 0 | 6,357 |
| 35 to 39 | 221 | 2,084 | 1,388 | 1,191 | 1,059 | 150 | 3 | 0 | 0 | 0 | 6,096 |
| 40 to 44 | 153 | 1,602 | 1,058 | 888 | 906 | 811 | 117 | 0 | 0 | 0 | 5,535 |
| 45 to 49 | 108 | 1,260 | 858 | 793 | 740 | 976 | 677 | 88 | 2 | 0 | 5,502 |
| 50 to 54 | 81 | 953 | 726 | 605 | 600 | 1,137 | 773 | 580 | 56 | 0 | 5,511 |
| 55 to 59 | 40 | 565 | 452 | 373 | 354 | 209 | 80 | 53 | 14 | 0 | 2,140 |
| 60 to 64 | 16 | 251 | 187 | 170 | 201 | 62 | 17 | 3 | 2 | 1 | 910 |
| 65 to 69 | 13 | 117 | 87 | 89 | 92 | 23 | 2 | 2 | 0 | 0 | 425 |
| 70 & Over | 11 | 83 | 72 | 63 | 48 | 20 | 1 | 3 | 1 | 0 | 302 |
| Total | 1,445 | 14,990 | 8,797 | 5,831 | 4,190 | 3,392 | 1,670 | 729 | 75 | 1 | 41,120 |



Appendix B: Detailed Tabulations of Member Data

Table B-2: The Number of Active and Lapsed Members Distributed by Age as of December 31, 2020

| Age | Active Members | Lapsed Members |
|-----|----------------|----------------|
| | Number | Number |
| 18 | 7 | 0 |
| 19 | 135 | 3 |
| 20 | 249 | 25 |
| 21 | 385 | 90 |
| 22 | 449 | 135 |
| 23 | 467 | 211 |
| 24 | 592 | 285 |
| 25 | 609 | 377 |
| 26 | 609 | 418 |
| 27 | 628 | 407 |
| 28 | 668 | 425 |
| 29 | 680 | 488 |
| 30 | 739 | 505 |
| 31 | 764 | 559 |
| 32 | 770 | 533 |
| 33 | 728 | 482 |
| 34 | 733 | 544 |
| 35 | 761 | 490 |
| 36 | 759 | 491 |
| 37 | 708 | 464 |
| 38 | 737 | 507 |
| 39 | 709 | 470 |
| 40 | 676 | 447 |
| 41 | 620 | 457 |
| 42 | 684 | 421 |
| 43 | 634 | 465 |
| 44 | 678 | 453 |
| 45 | 611 | 430 |
| 46 | 673 | 408 |
| 47 | 669 | 432 |
| 48 | 682 | 450 |
| 49 | 706 | 441 |
| 50 | 740 | 484 |
| 51 | 692 | 436 |
| 52 | 643 | 461 |
| 53 | 597 | 480 |



Appendix B: Detailed Tabulations of Member Data

Table B-2: The Number of Active and Lapsed Members Distributed by Age as of December 31, 2020 (continued)

| Age | Active Members | Lapsed Members |
|-------|----------------|----------------|
| | Number | Number |
| 54 | 541 | 437 |
| 55 | 319 | 290 |
| 56 | 197 | 260 |
| 57 | 210 | 213 |
| 58 | 198 | 147 |
| 59 | 146 | 160 |
| 60 | 120 | 124 |
| 61 | 108 | 104 |
| 62 | 91 | 87 |
| 63 | 96 | 59 |
| 64 | 61 | 60 |
| 65 | 52 | 55 |
| 66 | 63 | 41 |
| 67 | 45 | 42 |
| 68 | 45 | 27 |
| 69 | 26 | 29 |
| 70 | 27 | 28 |
| 71 | 24 | 18 |
| 72 | 25 | 18 |
| 73 | 18 | 16 |
| 74 | 15 | 7 |
| 75 | 8 | 8 |
| 76 | 6 | 6 |
| 77 | 7 | 12 |
| 78 | 6 | 6 |
| 79 | 3 | 8 |
| 80 | 1 | 4 |
| 81 | 0 | 6 |
| 82 | 2 | 2 |
| 83 | 1 | 5 |
| 84 | 0 | 5 |
| 85 | 1 | 1 |
| 86 | 1 | 2 |
| 87 | 1 | 0 |
| 88 | 0 | 1 |
| 89 | 0 | 2 |
| 90 | 0 | 1 |
| Total | 24,655 | 16,465 |



Appendix B: Detailed Tabulations of Member Data

Table B-3: The Number of Active and Lapsed Members Distributed by Service as of December 31, 2020

| Service | Active Members | Lapsed Members |
|---------|----------------|----------------|
| | Number | Number |
| 0 | 351 | 1,094 |
| 1 | 1,625 | 3,643 |
| 2 | 1,559 | 2,288 |
| 3 | 1,734 | 1,613 |
| 4 | 1,348 | 1,180 |
| 5 | 1,177 | 978 |
| 6 | 1,189 | 760 |
| 7 | 1,127 | 605 |
| 8 | 1,242 | 464 |
| 9 | 844 | 411 |
| 10 | 948 | 355 |
| 11 | 865 | 329 |
| 12 | 771 | 289 |
| 13 | 1,065 | 220 |
| 14 | 782 | 207 |
| 15 | 780 | 166 |
| 16 | 704 | 142 |
| 17 | 688 | 130 |
| 18 | 654 | 125 |
| 19 | 693 | 108 |
| 20 | 636 | 204 |
| 21 | 618 | 271 |
| 22 | 422 | 185 |
| 23 | 437 | 140 |
| 24 | 356 | 123 |
| 25 | 341 | 86 |
| 26 | 262 | 64 |
| 27 | 280 | 56 |
| 28 | 270 | 48 |
| 29 | 206 | 57 |
| 30 | 197 | 40 |
| 31 | 129 | 36 |
| 32 | 121 | 22 |
| 33 | 84 | 12 |



Appendix B: Detailed Tabulations of Member Data

Table B-3: The Number of Active and Lapsed Members Distributed by Service as of December 31, 2020 (continued)

| Service | Active Members Number | Lapsed Member Number |
|----------------|----------------------------------|---------------------------------|
| 34 | 80 | 8 |
| 35 | 37 | 3 |
| 36 | 17 | 3 |
| 37 | 8 | 0 |
| 38 | 3 | 0 |
| 39 | 4 | 0 |
| 45 | 1 | 0 |
| Total | 24,655 | 16,465 |



Appendix B: Detailed Tabulations of Member Data

Table B-4: The Number and Annual Retirement Pensions of Retired Members Distributed by Age as of December 31, 2020

| Age | Number | Annual Pensions |
|-----|--------|-----------------|
| 54 | 4 | \$ 8,160 |
| 55 | 349 | 711,960 |
| 56 | 487 | 993,480 |
| 57 | 570 | 1,162,800 |
| 58 | 555 | 1,132,200 |
| 59 | 588 | 1,199,520 |
| 60 | 617 | 1,258,680 |
| 61 | 550 | 1,122,000 |
| 62 | 627 | 1,279,080 |
| 63 | 533 | 1,087,320 |
| 64 | 629 | 1,283,160 |
| 65 | 575 | 1,173,000 |
| 66 | 646 | 1,317,840 |
| 67 | 616 | 1,256,640 |
| 68 | 619 | 1,262,760 |
| 69 | 574 | 1,170,960 |
| 70 | 562 | 1,146,480 |
| 71 | 529 | 1,079,160 |
| 72 | 475 | 969,000 |
| 73 | 495 | 1,009,800 |
| 74 | 513 | 1,046,520 |
| 75 | 363 | 740,520 |
| 76 | 384 | 783,360 |
| 77 | 374 | 762,960 |
| 78 | 385 | 785,400 |
| 79 | 287 | 585,480 |
| 80 | 288 | 587,520 |
| 81 | 263 | 536,520 |
| 82 | 209 | 426,360 |
| 83 | 184 | 375,360 |
| 84 | 170 | 346,800 |
| 85 | 174 | 354,960 |
| 86 | 153 | 312,120 |
| 87 | 126 | 257,040 |



Appendix B: Detailed Tabulations of Member Data

Table B-4: The Number and Annual Retirement Pensions of Retired Members Distributed by Age as of December 31, 2020 (continued)

| Age | Number | Annual Pensions |
|-------|--------|-----------------|
| 88 | 107 | \$ 218,280 |
| 89 | 76 | 155,040 |
| 90 | 68 | 138,720 |
| 91 | 51 | 104,040 |
| 92 | 41 | 83,640 |
| 93 | 30 | 61,200 |
| 94 | 25 | 51,000 |
| 95 | 21 | 42,840 |
| 96 | 12 | 24,480 |
| 97 | 7 | 14,280 |
| 98 | 5 | 10,200 |
| 99 | 3 | 6,120 |
| 100 | 3 | 6,120 |
| Total | 14,922 | \$ 30,440,880 |



Appendix B: Detailed Tabulations of Member Data

Table B-5: The Number and Annual Retirement Pensions of Disabled Members Eligible for Deferred Pensions Distributed by Age as of December 31, 2020

| Age | Number | Annual Pensions |
|-------|--------|-----------------|
| 32 | 1 | \$ 2,040 |
| 35 | 2 | 4,080 |
| 37 | 2 | 4,080 |
| 38 | 4 | 8,160 |
| 40 | 1 | 2,040 |
| 41 | 2 | 4,080 |
| 42 | 3 | 6,120 |
| 43 | 2 | 4,080 |
| 45 | 7 | 14,280 |
| 46 | 4 | 8,160 |
| 47 | 2 | 4,080 |
| 48 | 2 | 4,080 |
| 49 | 8 | 16,320 |
| 50 | 11 | 22,440 |
| 51 | 13 | 26,520 |
| 52 | 8 | 16,320 |
| 53 | 10 | 20,400 |
| 54 | 12 | 24,480 |
| 55 | 5 | 10,200 |
| 56 | 6 | 12,240 |
| 57 | 2 | 4,080 |
| 58 | 3 | 6,120 |
| 59 | 1 | 2,040 |
| 60 | 2 | 4,080 |
| 61 | 1 | 2,040 |
| 62 | 1 | 2,040 |
| 63 | 1 | 2,040 |
| 64 | 1 | 2,040 |
| 67 | 1 | 2,040 |
| 69 | 3 | 6,120 |
| 70 | 1 | 2,040 |
| Total | 122 | \$ 248,880 |



Appendix C: Summary of Main Benefits & 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 firefighters 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 attaining age 55 and with credit for 20 years of service as a firefighter 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 credit for 20 years of service as a firefighter or rescue squad worker in North Carolina but before age 55 is eligible to receive a deferred retirement pension, starting at age 55, provided he or she continues to make regular contributions until age 55 or until he or she 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 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 or she 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.

Return of Contributions Upon the death (not in the line of duty) or withdrawal of a member prior to retirement, the member's 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 the member's aggregate contributions over the total of the pension payments the member 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.



Appendix C: Summary of Main Benefits & Contribution Provisions

Contributions

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



Appendix D: Actuarial Assumptions and Methods

Assumptions are based on the experience investigation prepared as of December 31, 2019 and adopted by the Board of Trustees on January 28, 2021 for use beginning with the December 31, 2020 annual actuarial valuation.

Interest Rate: 6.50% per annum, compounded annually.

Price Inflation: 2.50% 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 Withdrawal | | | |
|----------------------------|---------|-------|-------|
| | Service | | |
| Age | <5 | 5-19 | 20+ |
| < 55 | 0.030 | 0.015 | 1.000 |
| 55 | 0.100 | 0.075 | 0.000 |
| >55 | 0.000 | 0.000 | 0.000 |

| Annual Rates of Retirement | | | |
|----------------------------|---------|-------|-------|
| | Service | | |
| Age | <20 | 20 | 21+ |
| 55 | 0.000 | 0.850 | 0.850 |
| 56-79 | 0.000 | 0.750 | 0.600 |
| 80 | 1.000 | 1.000 | 1.000 |

| Age | Annual Rates of | | |
|-----|------------------|--------|------------|
| | Base Mortality** | | Disability |
| | Male | Female | Male |
| 25 | .00037 | .00020 | .0005 |
| 30 | .00041 | .00027 | .0005 |
| 35 | .00047 | .00036 | .0008 |
| 40 | .00059 | .00049 | .0018 |
| 45 | .00082 | .00067 | .0021 |
| 50 | .00120 | .00091 | .0030 |
| 55 | .00175 | .00123 | .0036 |
| 60 | .00264 | .00168 | .0061 |
| 65 | .00410 | .00228 | |
| 70 | .00766 | .00454 | |
| 75 | .01432 | .00903 | |
| 79 | .02361 | .01566 | |

** Base mortality rates using Pub-2010 Safety Amount-Weighted mortality table



Appendix D: Actuarial Assumptions and Methods

Return to Service: The assumed rates in which lapsed member returns to active service are based on the number of years that 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% | 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 are based on the Pub-2010 Safety Retirees Amount-Weighted mortality table for healthy retirees and the Pub-2010 General Disabled Retirees Amount-Weighted mortality table for disabled retirees, prior to any mortality improvements, are as follows:

| Annual Rate of Death after Retirement | | | | |
|---------------------------------------|------------------|--------|-------------------|--------|
| Age | Healthy Retirees | | Disabled Retirees | |
| | Male | Female | Male | Female |
| 55 | .00327 | .00279 | .01818 | .01587 |
| 60 | .00549 | .00482 | .02280 | .01833 |
| 65 | .00957 | .00832 | .02677 | .02051 |
| 70 | .01711 | .01438 | .03353 | .02450 |
| 75 | .03085 | .02483 | .04344 | .03239 |
| 80 | .05571 | .04287 | .05921 | .04678 |

Mortality Assumption: All mortality rates use Pub-2010 amount-weighted tables.

Mortality Projection: All mortality rates are projected from 2010 using generational improvement with Scale MP-2019.

Deaths After Retirement (Healthy at Retirement): Mortality rates are based on the Safety Retirees Mortality table. Rates for all members are multiplied by 97% and Set Forward 1 year. Because the retiree tables have no rates prior to age 45, the Safety Mortality Table for Employees is used for ages less than 45.

Deaths After Retirement (Disabled Members at Retirement): Mortality rates are based on the General Mortality Table for Disabled Retirees. Rates for all members are Set Back 3 years.

Deaths After Retirement (Survivors of Deceased Members): Mortality rates are based on the Below-Median Teachers Mortality Table for Contingent Survivors. Rates for male members are Set Forward 3 years. Rates for female members are Set Forward 1 year. Because the contingent survivor tables have no rates prior to age 45, the Below-Median Teachers Mortality Table for Employees is used for ages less than 45.

Deaths Prior to Retirement: Mortality rates are based on the Safety Mortality Table for all Employees.

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

Marriage Assumption: 90% of male members married and 50% of female members married with the male spouses three years older than female spouses.



Appendix D: Actuarial Assumptions and Methods

Missing Gender Code: For members reported on the data without a gender code, we use the prior year's code where available or assign a code based on inspection.

Timing of Assumptions: All withdrawals, deaths, disabilities, retirements and salary increases are assumed to occur July 1 of each year. The timing of retirement changes from mid-year to beginning of year at and after the 100% retirement age.

Future Expenses: Equal to prior year actual administrative expenses added to Normal Cost.

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 8. The 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 Actuarial Value of Assets was reset to the market value of assets at December 31, 2014. 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 Previous Valuation:

The assumptions used for the December 31, 2020 actuarial valuation are based on the experience study prepared as of December 31, 2019 and adopted by the Board of Trustees on January 28, 2021. Material assumptions and methods that were changed since the prior valuation:

- The investment return assumption was lowered from 7.00% to 6.50%
- The inflation assumption was lowered from 3.00% to 2.50%
- The withdrawal rates, retirement rates, disability rates and mortality assumptions were changed



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 |
|---------------|------------------------------|----------------------|------------------------|------------------|-------------------------|---------------------|---------------------------|
| 2021 | \$ 499,937 | \$ 2,667 | \$ 14,405 | \$ 32,509 | \$ 936 | \$ 31,972 | \$ 515,536 |
| 2022 | 515,536 | 2,558 | 13,313 | 32,175 | 898 | 32,960 | 531,294 |
| 2023 | 531,294 | 2,414 | 11,553 | 32,879 | 848 | 33,902 | 545,435 |
| 2024 | 545,435 | 2,281 | 10,557 | 33,507 | 801 | 34,766 | 558,731 |
| 2025 | 558,731 | 2,148 | 6,086 | 34,099 | 754 | 35,466 | 567,578 |
| 2026 | 567,578 | 2,023 | 1,081 | 34,725 | 710 | 35,858 | 571,105 |
| 2027 | 571,105 | 1,891 | - | 35,161 | 664 | 36,036 | 573,208 |
| 2028 | 573,208 | 1,765 | 71 | 35,575 | 620 | 36,159 | 575,009 |
| 2029 | 575,009 | 1,616 | 934 | 36,005 | 567 | 36,287 | 577,274 |
| 2030 | 577,274 | 1,498 | 37 | 36,360 | 526 | 36,392 | 578,315 |
| 2031 | 578,315 | 1,376 | - | 36,639 | 483 | 36,447 | 579,016 |
| 2032 | 579,016 | 1,252 | - | 36,923 | 440 | 36,481 | 579,386 |
| 2033 | 579,386 | 1,141 | - | 37,113 | 401 | 36,497 | 579,509 |
| 2034 | 579,509 | 1,002 | - | 37,382 | 352 | 36,493 | 579,270 |
| 2035 | 579,270 | 872 | - | 37,512 | 306 | 36,471 | 578,795 |
| 2036 | 578,795 | 741 | - | 37,750 | 260 | 36,429 | 577,955 |
| 2037 | 577,955 | 616 | - | 38,061 | 216 | 36,362 | 576,656 |
| 2038 | 576,656 | 483 | - | 38,408 | 170 | 36,264 | 574,825 |
| 2039 | 574,825 | 333 | 106 | 38,738 | 117 | 36,135 | 572,543 |
| 2040 | 572,543 | 197 | 61 | 39,175 | 69 | 35,968 | 569,525 |
| 2041 | 569,525 | 52 | 3 | 39,603 | 18 | 35,754 | 565,713 |
| 2042 | 565,713 | 5 | 9 | 39,806 | 2 | 35,498 | 561,417 |
| 2043 | 561,417 | 2 | 4 | 39,858 | 1 | 35,217 | 556,782 |
| 2044 | 556,782 | 1 | 1 | 39,998 | - | 34,911 | 551,697 |
| 2045 | 551,697 | - | 1 | 40,090 | - | 34,578 | 546,185 |
| 2046 | 546,185 | - | - | 40,083 | - | 34,220 | 540,322 |
| 2047 | 540,322 | - | - | 39,995 | - | 33,842 | 534,169 |
| 2048 | 534,169 | - | - | 39,847 | - | 33,446 | 527,768 |
| 2049 | 527,768 | - | - | 39,619 | - | 33,038 | 521,187 |
| 2050 | 521,187 | - | - | 39,382 | - | 32,617 | 514,423 |
| 2051 | 514,423 | - | - | 39,122 | - | 32,186 | 507,487 |
| 2052 | 507,487 | - | - | 38,806 | - | 31,745 | 500,426 |
| 2053 | 500,426 | - | - | 38,281 | - | 31,303 | 493,448 |
| 2054 | 493,448 | - | - | 37,715 | - | 30,868 | 486,602 |
| 2055 | 486,602 | - | - | 37,039 | - | 30,444 | 480,007 |
| 2056 | 480,007 | - | - | 36,137 | - | 30,045 | 473,915 |
| 2057 | 473,915 | - | - | 35,072 | - | 29,683 | 468,526 |
| 2058 | 468,526 | - | - | 33,837 | - | 29,372 | 464,061 |
| 2059 | 464,061 | - | - | 32,601 | - | 29,121 | 460,581 |
| 2060 | 460,581 | - | - | 31,375 | - | 28,934 | 458,140 |
| 2061 | 458,140 | - | - | 30,160 | - | 28,814 | 456,794 |
| 2062 | 456,794 | - | - | 28,957 | - | 28,765 | 456,603 |
| 2063 | 456,603 | - | - | 27,766 | - | 28,791 | 457,628 |
| 2064 | 457,628 | - | - | 26,589 | - | 28,895 | 459,935 |
| 2065 | 459,935 | - | - | 25,426 | - | 29,082 | 463,592 |
| 2066 | 463,592 | - | - | 24,277 | - | 29,357 | 468,672 |
| 2067 | 468,672 | - | - | 23,143 | - | 29,723 | 475,252 |
| 2068 | 475,252 | - | - | 22,025 | - | 30,187 | 483,414 |
| 2069 | 483,414 | - | - | 20,922 | - | 30,753 | 493,244 |
| 2070 | 493,244 | - | - | 19,836 | - | 31,426 | 504,835 |



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 |
|---------------|------------------------------|----------------------|------------------------|------------------|-------------------------|---------------------|---------------------------|
| 2071 | \$ 504,835 | \$ - | \$ - | \$ 18,766 | \$ - | \$ 32,214 | \$ 518,283 |
| 2072 | 518,283 | - | - | 17,713 | - | 33,122 | 533,692 |
| 2073 | 533,692 | - | - | 16,679 | - | 34,156 | 551,170 |
| 2074 | 551,170 | - | - | 15,663 | - | 35,325 | 570,831 |
| 2075 | 570,831 | - | - | 14,668 | - | 36,635 | 592,798 |
| 2076 | 592,798 | - | - | 13,694 | - | 38,094 | 617,198 |
| 2077 | 617,198 | - | - | 12,743 | - | 39,710 | 644,165 |
| 2078 | 644,165 | - | - | 11,817 | - | 41,493 | 673,840 |
| 2079 | 673,840 | - | - | 10,917 | - | 43,450 | 706,374 |
| 2080 | 706,374 | - | - | 10,045 | - | 45,593 | 741,922 |
| 2081 | 741,922 | - | - | 9,202 | - | 47,931 | 780,651 |
| 2082 | 780,651 | - | - | 8,392 | - | 50,474 | 822,733 |
| 2083 | 822,733 | - | - | 7,615 | - | 53,234 | 868,352 |
| 2084 | 868,352 | - | - | 6,873 | - | 56,223 | 917,702 |
| 2085 | 917,702 | - | - | 6,170 | - | 59,453 | 970,986 |
| 2086 | 970,986 | - | - | 5,505 | - | 62,938 | 1,028,419 |
| 2087 | 1,028,419 | - | - | 4,880 | - | 66,691 | 1,090,230 |
| 2088 | 1,090,230 | - | - | 4,297 | - | 70,728 | 1,156,661 |
| 2089 | 1,156,661 | - | - | 3,756 | - | 75,063 | 1,227,968 |
| 2090 | 1,227,968 | - | - | 3,258 | - | 79,714 | 1,304,423 |
| 2091 | 1,304,423 | - | - | 2,804 | - | 84,698 | 1,386,317 |
| 2092 | 1,386,317 | - | - | 2,392 | - | 90,034 | 1,473,959 |
| 2093 | 1,473,959 | - | - | 2,023 | - | 95,743 | 1,567,679 |
| 2094 | 1,567,679 | - | - | 1,694 | - | 101,845 | 1,667,830 |
| 2095 | 1,667,830 | - | - | 1,403 | - | 108,364 | 1,774,791 |
| 2096 | 1,774,791 | - | - | 1,149 | - | 115,325 | 1,888,967 |
| 2097 | 1,888,967 | - | - | 929 | - | 122,753 | 2,010,791 |
| 2098 | 2,010,791 | - | - | 741 | - | 130,678 | 2,140,729 |
| 2099 | 2,140,729 | - | - | 582 | - | 139,129 | 2,279,276 |
| 2100 | 2,279,276 | - | - | 449 | - | 148,139 | 2,426,965 |
| 2101 | 2,426,965 | - | - | 341 | - | 157,742 | 2,584,365 |
| 2102 | 2,584,365 | - | - | 254 | - | 167,976 | 2,752,087 |
| 2103 | 2,752,087 | - | - | 186 | - | 178,880 | 2,930,781 |
| 2104 | 2,930,781 | - | - | 133 | - | 190,497 | 3,121,145 |
| 2105 | 3,121,145 | - | - | 93 | - | 202,871 | 3,323,924 |
| 2106 | 3,323,924 | - | - | 63 | - | 216,053 | 3,539,914 |
| 2107 | 3,539,914 | - | - | 42 | - | 230,093 | 3,769,965 |
| 2108 | 3,769,965 | - | - | 27 | - | 245,047 | 4,014,985 |
| 2109 | 4,014,985 | - | - | 17 | - | 260,973 | 4,275,941 |
| 2110 | 4,275,941 | - | - | 10 | - | 277,936 | 4,553,866 |
| 2111 | 4,553,866 | - | - | 6 | - | 296,001 | 4,849,861 |
| 2112 | 4,849,861 | - | - | 4 | - | 315,241 | 5,165,098 |
| 2113 | 5,165,098 | - | - | 2 | - | 335,731 | 5,500,828 |
| 2114 | 5,500,828 | - | - | 1 | - | 357,554 | 5,858,380 |
| 2115 | 5,858,380 | - | - | 1 | - | 380,795 | 6,239,174 |
| 2116 | 6,239,174 | - | - | 0 | - | 405,546 | 6,644,720 |
| 2117 | 6,644,720 | - | - | 0 | - | 431,907 | 7,076,627 |
| 2118 | 7,076,627 | - | - | 0 | - | 459,981 | 7,536,608 |
| 2119 | 7,536,608 | - | - | 0 | - | 489,879 | 8,026,487 |
| 2120 | 8,026,487 | - | - | 0 | - | 521,722 | 8,548,209 |



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 6.50% | Unfunded Payments at 2.16% | Using Single Discount Rate of 6.50% |
| 2021 | \$ 499,937 | \$ 32,509 | \$ 32,509 | \$ - | \$ 31,501 | \$ - | \$ 31,501 |
| 2022 | 515,536 | 32,175 | 32,175 | - | 29,275 | - | 29,275 |
| 2023 | 531,294 | 32,879 | 32,879 | - | 28,090 | - | 28,090 |
| 2024 | 545,435 | 33,507 | 33,507 | - | 26,879 | - | 26,879 |
| 2025 | 558,731 | 34,099 | 34,099 | - | 25,685 | - | 25,685 |
| 2026 | 567,578 | 34,725 | 34,725 | - | 24,560 | - | 24,560 |
| 2027 | 571,105 | 35,161 | 35,161 | - | 23,350 | - | 23,350 |
| 2028 | 573,208 | 35,575 | 35,575 | - | 22,183 | - | 22,183 |
| 2029 | 575,009 | 36,005 | 36,005 | - | 21,081 | - | 21,081 |
| 2030 | 577,274 | 36,360 | 36,360 | - | 19,989 | - | 19,989 |
| 2031 | 578,315 | 36,639 | 36,639 | - | 18,914 | - | 18,914 |
| 2032 | 579,016 | 36,923 | 36,923 | - | 17,897 | - | 17,897 |
| 2033 | 579,386 | 37,113 | 37,113 | - | 16,891 | - | 16,891 |
| 2034 | 579,509 | 37,382 | 37,382 | - | 15,975 | - | 15,975 |
| 2035 | 579,270 | 37,512 | 37,512 | - | 15,052 | - | 15,052 |
| 2036 | 578,795 | 37,750 | 37,750 | - | 14,223 | - | 14,223 |
| 2037 | 577,955 | 38,061 | 38,061 | - | 13,465 | - | 13,465 |
| 2038 | 576,656 | 38,408 | 38,408 | - | 12,759 | - | 12,759 |
| 2039 | 574,825 | 38,738 | 38,738 | - | 12,083 | - | 12,083 |
| 2040 | 572,543 | 39,175 | 39,175 | - | 11,473 | - | 11,473 |
| 2041 | 569,525 | 39,603 | 39,603 | - | 10,891 | - | 10,891 |
| 2042 | 565,713 | 39,806 | 39,806 | - | 10,279 | - | 10,279 |
| 2043 | 561,417 | 39,858 | 39,858 | - | 9,664 | - | 9,664 |
| 2044 | 556,782 | 39,998 | 39,998 | - | 9,106 | - | 9,106 |
| 2045 | 551,697 | 40,090 | 40,090 | - | 8,570 | - | 8,570 |
| 2046 | 546,185 | 40,083 | 40,083 | - | 8,045 | - | 8,045 |
| 2047 | 540,322 | 39,995 | 39,995 | - | 7,538 | - | 7,538 |
| 2048 | 534,169 | 39,847 | 39,847 | - | 7,051 | - | 7,051 |
| 2049 | 527,768 | 39,619 | 39,619 | - | 6,583 | - | 6,583 |
| 2050 | 521,187 | 39,382 | 39,382 | - | 6,144 | - | 6,144 |
| 2051 | 514,423 | 39,122 | 39,122 | - | 5,731 | - | 5,731 |
| 2052 | 507,487 | 38,806 | 38,806 | - | 5,338 | - | 5,338 |
| 2053 | 500,426 | 38,281 | 38,281 | - | 4,944 | - | 4,944 |
| 2054 | 493,448 | 37,715 | 37,715 | - | 4,574 | - | 4,574 |
| 2055 | 486,602 | 37,039 | 37,039 | - | 4,218 | - | 4,218 |
| 2056 | 480,007 | 36,137 | 36,137 | - | 3,864 | - | 3,864 |
| 2057 | 473,915 | 35,072 | 35,072 | - | 3,521 | - | 3,521 |
| 2058 | 468,526 | 33,837 | 33,837 | - | 3,190 | - | 3,190 |
| 2059 | 464,061 | 32,601 | 32,601 | - | 2,886 | - | 2,886 |
| 2060 | 460,581 | 31,375 | 31,375 | - | 2,608 | - | 2,608 |
| 2061 | 458,140 | 30,160 | 30,160 | - | 2,354 | - | 2,354 |
| 2062 | 456,794 | 28,957 | 28,957 | - | 2,122 | - | 2,122 |
| 2063 | 456,603 | 27,766 | 27,766 | - | 1,911 | - | 1,911 |
| 2064 | 457,628 | 26,589 | 26,589 | - | 1,718 | - | 1,718 |
| 2065 | 459,935 | 25,426 | 25,426 | - | 1,542 | - | 1,542 |
| 2066 | 463,592 | 24,277 | 24,277 | - | 1,383 | - | 1,383 |
| 2067 | 468,672 | 23,143 | 23,143 | - | 1,238 | - | 1,238 |
| 2068 | 475,252 | 22,025 | 22,025 | - | 1,106 | - | 1,106 |
| 2069 | 483,414 | 20,922 | 20,922 | - | 987 | - | 987 |
| 2070 | 493,244 | 19,836 | 19,836 | - | 878 | - | 878 |



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 6.50% | Unfunded Payments at 2.16% | Using Single Discount Rate of 6.50% |
| 2071 | \$ 504,835 | \$ 18,766 | \$ 18,766 | \$ - | \$ 780 | \$ - | \$ 780 |
| 2072 | 518,283 | 17,713 | 17,713 | - | 691 | - | 691 |
| 2073 | 533,692 | 16,679 | 16,679 | - | 611 | - | 611 |
| 2074 | 551,170 | 15,663 | 15,663 | - | 539 | - | 539 |
| 2075 | 570,831 | 14,668 | 14,668 | - | 474 | - | 474 |
| 2076 | 592,798 | 13,694 | 13,694 | - | 416 | - | 416 |
| 2077 | 617,198 | 12,743 | 12,743 | - | 363 | - | 363 |
| 2078 | 644,165 | 11,817 | 11,817 | - | 316 | - | 316 |
| 2079 | 673,840 | 10,917 | 10,917 | - | 274 | - | 274 |
| 2080 | 706,374 | 10,045 | 10,045 | - | 237 | - | 237 |
| 2081 | 741,922 | 9,202 | 9,202 | - | 204 | - | 204 |
| 2082 | 780,651 | 8,392 | 8,392 | - | 175 | - | 175 |
| 2083 | 822,733 | 7,615 | 7,615 | - | 149 | - | 149 |
| 2084 | 868,352 | 6,873 | 6,873 | - | 126 | - | 126 |
| 2085 | 917,702 | 6,170 | 6,170 | - | 106 | - | 106 |
| 2086 | 970,986 | 5,505 | 5,505 | - | 89 | - | 89 |
| 2087 | 1,028,419 | 4,880 | 4,880 | - | 74 | - | 74 |
| 2088 | 1,090,230 | 4,297 | 4,297 | - | 61 | - | 61 |
| 2089 | 1,156,661 | 3,756 | 3,756 | - | 50 | - | 50 |
| 2090 | 1,227,968 | 3,258 | 3,258 | - | 41 | - | 41 |
| 2091 | 1,304,423 | 2,804 | 2,804 | - | 33 | - | 33 |
| 2092 | 1,386,317 | 2,392 | 2,392 | - | 27 | - | 27 |
| 2093 | 1,473,959 | 2,023 | 2,023 | - | 21 | - | 21 |
| 2094 | 1,567,679 | 1,694 | 1,694 | - | 17 | - | 17 |
| 2095 | 1,667,830 | 1,403 | 1,403 | - | 13 | - | 13 |
| 2096 | 1,774,791 | 1,149 | 1,149 | - | 10 | - | 10 |
| 2097 | 1,888,967 | 929 | 929 | - | 8 | - | 8 |
| 2098 | 2,010,791 | 741 | 741 | - | 6 | - | 6 |
| 2099 | 2,140,729 | 582 | 582 | - | 4 | - | 4 |
| 2100 | 2,279,276 | 449 | 449 | - | 3 | - | 3 |
| 2101 | 2,426,965 | 341 | 341 | - | 2 | - | 2 |
| 2102 | 2,584,365 | 254 | 254 | - | 1 | - | 1 |
| 2103 | 2,752,087 | 186 | 186 | - | 1 | - | 1 |
| 2104 | 2,930,781 | 133 | 133 | - | 1 | - | 1 |
| 2105 | 3,121,145 | 93 | 93 | - | - | - | - |
| 2106 | 3,323,924 | 63 | 63 | - | - | - | - |
| 2107 | 3,539,914 | 42 | 42 | - | - | - | - |
| 2108 | 3,769,965 | 27 | 27 | - | - | - | - |
| 2109 | 4,014,985 | 17 | 17 | - | - | - | - |
| 2110 | 4,275,941 | 10 | 10 | - | - | - | - |
| 2111 | 4,553,866 | 6 | 6 | - | - | - | - |
| 2112 | 4,849,861 | 4 | 4 | - | - | - | - |
| 2113 | 5,165,098 | 2 | 2 | - | - | - | - |
| 2114 | 5,500,828 | 1 | 1 | - | - | - | - |
| 2115 | 5,858,380 | 1 | 1 | - | - | - | - |
| 2116 | 6,239,174 | 0 | 0 | - | - | - | - |
| 2117 | 6,644,720 | 0 | 0 | - | - | - | - |
| 2118 | 7,076,627 | 0 | 0 | - | - | - | - |
| 2119 | 7,536,608 | 0 | 0 | - | - | - | - |
| 2120 | 8,026,487 | 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 Members

| | Lapsed Member Count | Active Member Count |
|------|------------------------|------------------------|
| 2016 | 17,235 | 25,210 |
| 2017 | 13,134 | 25,068 |
| 2018 | 14,091 | 25,154 |
| 2019 | 15,225 | 24,994 |
| 2020 | 16,465 | 24,655 |

Graph 2: Retired Members

| | Retired Member Count | Retirement Pension |
|------|-------------------------|--------------------|
| 2016 | 13,940 | \$ 28,437,600 |
| 2017 | 14,308 | 29,188,320 |
| 2018 | 14,422 | 29,420,880 |
| 2019 | 14,765 | 30,120,600 |
| 2020 | 14,922 | 30,440,880 |

Graph 3: Market Value of Assets and Asset Returns

| | Market Value of Assets | Asset Return |
|------|---------------------------|--------------|
| 2016 | 383,865,563 | 6.24% |
| 2017 | 424,211,921 | 13.33% |
| 2018 | 408,109,943 | -1.40% |
| 2019 | 458,687,909 | 14.87% |
| 2020 | 499,936,606 | 11.22% |



Appendix F: Data for Section 2 Graphs

Graph 5: Actuarial Value and Market Value of Assets

| | Actuarial Value of Assets | Market Value of Assets |
|------|----------------------------------|-------------------------------|
| 2016 | 402,431,609 | 383,865,563 |
| 2017 | 418,265,538 | 424,211,921 |
| 2018 | 429,031,975 | 408,109,943 |
| 2019 | 445,876,956 | 458,687,909 |
| 2020 | 475,032,285 | 499,936,606 |

Graph 6: Asset Returns

| | Actuarial Value Value of Assets | Market Value Asset Return |
|------|--|----------------------------------|
| 2016 | 5.33% | 6.24% |
| 2017 | 6.54% | 13.33% |
| 2018 | 5.08% | -1.40% |
| 2019 | 6.19% | 14.87% |
| 2020 | 8.80% | 11.22% |

Graph 7: Actuarial Accrued Liability

| Fiscal Year Ending | Liability for Active and Lapsed Members | Liability for Retired and Deferred Members | Total |
|---------------------------|--|---|--------------|
| 2016 | 181,107,137 | 270,958,443 | 452,065,580 |
| 2017 | 187,805,856 | 282,113,410 | 469,919,266 |
| 2018 | 189,040,602 | 284,919,963 | 473,960,565 |
| 2019 | 192,551,174 | 290,265,691 | 482,816,865 |
| 2020 | 203,435,241 | 292,577,066 | 496,012,307 |



Appendix F: Data for Section 2 Graphs

Graph 8: Actuarial Accrued Liability and Actuarial Value of Assets

| | Actuarial Accrued Liability | Actuarial Value of Assets |
|------|-----------------------------|---------------------------|
| 2016 | 452,065,480 | 402,431,609 |
| 2017 | 469,919,266 | 418,265,538 |
| 2018 | 473,960,565 | 429,031,975 |
| 2019 | 482,816,865 | 445,876,956 |
| 2020 | 496,012,307 | 475,032,285 |

Graph 9: Funded Ratios

| | Funded Ratio (Actuarial Basis) | Funded Ratio (Market Value Basis) |
|------|--------------------------------|-----------------------------------|
| 2016 | 89.0% | 84.9% |
| 2017 | 89.0% | 90.3% |
| 2018 | 90.5% | 86.1% |
| 2019 | 92.3% | 95.0% |
| 2020 | 95.8% | 100.8% |

Graph 10: Actuarially Determined Employer Contribution Rates

| Fiscal Year Ending | Normal Contribution | Accrued Liability Contribution | Total Contribution |
|--------------------|---------------------|--------------------------------|--------------------|
| 2019 | \$ 5,591,401 | \$ 8,952,682 | \$ 14,544,083 |
| 2020 | 5,775,743 | 9,694,236 | 15,469,979 |
| 2021 | 5,930,372 | 9,488,384 | 15,418,756 |
| 2022* | 5,899,243 | 9,283,280 | 15,182,523 |
| 2023* | 5,729,089 | 7,357,430 | 13,086,519 |

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