

# Actuarial Review of the 2023 Accounting Disclosures for the North Carolina Office of the State Auditor

November 2023



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November 3, 2023

Mr. Jacob Taitague, CPA  
Assistant State Auditor  
Office of the State Auditor  
2 S. Salisbury St.  
20601 Mail Service Center  
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**Re: North Carolina Actuarial Review of 2023 Accounting Disclosures**

Dear Mr. Taitague:

Gabriel, Roeder, Smith & Company (GRS) is pleased to present this report of an Actuarial Review of the 2023 Accounting Disclosures related to the North Carolina Retirement System. We are grateful to the Office of the State Auditor for their responsiveness and assistance throughout the actuarial review process. In addition, we wish to thank the consultants of Buck Global ("Buck") and The Segal Group ("Segal") for their cooperation and assistance with this project.

This project is separated into two engagements. This is a report covering the work of the first engagement. A report covering the work of the second engagement will be issued in early 2024. The first engagement is described as follows:

Evaluate the actuarial valuations of the following plans used in the State's financial statements for the period ended June 30, 2023:

- The Teachers and State Employees Retirement System of North Carolina (TSERS);
- The Local Governmental Employees Retirement System of North Carolina (LGERS);
- The Register of Deeds Supplemental Pension Fund of North Carolina (RODSPF);
- The North Carolina Retiree Health Benefits Plan (RHB); and
- The Disability Income Plan of North Carolina (DIPNC).

The Contractor will conduct a review of all assumptions, procedures, and methodology utilized by the actuary of the TSERS, LGERS, RODSPF, RHB and DIPNC plans. This review should include:

1. A review of the valuation report and results and how they comply with actuarial standards, and whether such valuation reflects appropriate disclosure information under required reporting.
2. An analysis and benchmarking of the actuarial assumptions, and a review of the actuarial methods used in determining the pension liability for compliance with generally accepted actuarial principles.
3. An analysis of the procedures used to validate the participant data, a test of select test lives from the membership group (active and retired) to validate key components, and a detailed review of the results.

Mr. Jacob Taitague  
Office of the State Auditor  
November 3, 2023  
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The purpose of this report is to provide the results of our actuarial review, described on the previous page, including:

- An opinion regarding the reasonableness and accuracy of the actuarial assumptions, actuarial cost methods, procedures, and valuation results; and
- Certification that the plans' actuarial valuation was prepared in accordance with pronouncements issued by the Governmental Accounting Standards Board (GASB), principles and practices prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures.

This report was prepared at the request of the Office of the State Auditor of North Carolina (OSA) for the purposes stated above. It may not be suitable for other purposes. This report may be shared with parties other than the OSA, but only with the OSA's permission and only in its entirety. GRS is not responsible for unauthorized use of this report.

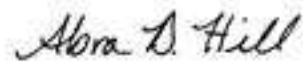
In our opinion, the assumptions and methods used in the 2023 valuations of the aforementioned plans are reasonable and comply with the Governmental Accounting Standards Board (GASB) Statement Nos. 67 and 74 and comply with practices promulgated by the Actuarial Standards. The intended audience is the OSA. The authors of this report are available to answer questions.

The signing actuaries are independent of the plan sponsor.


This report was prepared using our proprietary models (valuation model, capital markets model, etc.) and related software which, in our professional judgment, have the capabilities to provide results that are consistent with the purposes of the review and has no material limitations or known weaknesses. We performed tests to ensure that the models reasonably represent that which is intended to be modeled. We have also relied on the GRS actuaries and Internal Software, Training, and Processes Team who developed and maintain the model.

Abra D. Hill and Jeffrey T. Tebeau are Members of the American Academy of Actuaries (MAAA) as indicated, and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

Respectfully submitted,  
Gabriel, Roeder, Smith & Company



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ADH/JTT:sc



# EXECUTIVE SUMMARY

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# Executive Summary

## Background

Gabriel, Roeder, Smith & Company (GRS) was engaged by the Office of the State Auditor to review calculations related to the 2023 disclosures the State will include in its Comprehensive Annual Financial Report.

This report covers the work of the first engagement. A report covering the work of the second engagement will be issued in early 2024. The first engagement is described as follows:

Evaluate the actuarial valuations of the following plans used in the State's financial statements for the period ended June 30, 2023:

- The Teachers and State Employees Retirement System of North Carolina (TSERS);
- The Local Governmental Employees Retirement System of North Carolina (LGERS);
- The Register of Deeds Supplemental Pension Fund of North Carolina (RODSPF);
- The North Carolina Retiree Health Benefits Plan (RHB); and
- The Disability Income Plan of North Carolina (DIPNC).

The Contractor will conduct a review of all assumptions, procedures, and methodology utilized by the actuary of the TSERS, LGERS, RODSPF, RHB and DIPNC plans. This review should include:

1. A review of the valuation report and results and how they comply with actuarial standards, and whether such valuation reflects appropriate disclosure information under required reporting.
2. An analysis and benchmarking of the actuarial assumptions, and a review of the actuarial methods used in determining the pension liability for compliance with generally accepted actuarial principles.
3. An analysis of the procedures used to validate the participant data, a test of select test lives from the membership group (active and retired) to validate key components, and a detailed review of the results.

The purpose of this report is to provide the results of our actuarial review, described above, including:

- An opinion regarding the reasonableness and accuracy of the actuarial assumptions, actuarial cost methods, procedures, and valuation results; and
- Certification that the plans' actuarial valuation was prepared in accordance with pronouncements issued by the Governmental Accounting Standards Board (GASB), principles and practices prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures.

The balance of this report is organized as follows:

Section 1 – Experience Study Review

- Review of Recommended Demographic Assumptions; and
- Review of Recommended Actuarial Methods.

Section 2 – Review of Economic Assumptions

Section 3 – Review of the Respective Valuation Reports Containing the Underlying Calculations for the GASB Valuations

- Test Lives Exhibits; and
- Comments Regarding Test Lives Review.

Section 4 – Review of the Respective GASB Reports

- Content Review; and
- Calculations Review.

Section 5 – Comments, Conclusions and Recommendations for Future Years

- Comments;
- Prior Year’s Recommendations;
- Conclusions; and
- Recommendations for future years.

## Conclusion

In our opinion, the assumptions and methods used in the December 31, 2022 valuations of the aforementioned plans are reasonable and comply with the Governmental Accounting Standards Board (GASB) Statement Nos. 67 and 74 and comply with practices promulgated by the Actuarial Standards.

Based on our test lives review and our review of the funding and GASB reports, we certify that the plans’ actuarial valuation was prepared in accordance with pronouncements issued by the Governmental Accounting Standards Board (GASB), principles and practices prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures.

## **SECTION 1**

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### **EXPERIENCE STUDY REVIEW**



## Experience Study

The Experience Studies appear to be on a five-year cycle and assumptions have not changed since we reviewed them in our 2021 report. We are therefore incorporating our comments regarding the demographic assumptions from our 2021 report, largely unchanged. Note that the most recent Experience Study was performed by a different actuarial firm than the current firm performing the pension valuations, however the assumptions adopted from the Experience Study are still utilized in the pension valuations. This section reviews the demographic assumptions and actuarial methods, while the next section (II) contains the review of the economic assumptions.

### Review of Recommended Demographic Assumptions

#### TSERS

The TSERS experience study appears to be on a five-year cycle with the next cycle expected to be January 1, 2020 through December 31, 2024. We were provided the most recently completed experience study, dated December 9, 2020, covering the period January 1, 2015 through December 31, 2019. We have reviewed the demographic assumptions recommended from this study that are currently in use for the funding and GASB valuations.

#### *Non-Mortality Demographic Assumptions*

The non-mortality demographic assumptions were reviewed in the experience study dated December 9, 2020, and covering the five-year period ending on December 31, 2019. We have reviewed that report and find that the recommended assumptions are reasonable, based on TSERS actual experience (as detailed in that report). When reviewing demographic experience, actuaries are guided by Actuarial Standards of Practice (ASOP) Statement No. 35. ASOP No. 35 provides that non-mortality demographic assumptions should take into consideration historical experience, future expectations, the actuary's professional judgement, the purpose of the measurement and should not result in significant bias (unless a bias is explicitly intended to cover adverse risk or plan provisions that are difficult to model). The experience study report reviewed demonstrates that these guidelines were followed in the development of the recommended assumptions. The proposed non-mortality demographic assumptions were generally set to reflect actual experience during the study period (i.e., the ratio of actual to expected decrements based on the proposed assumptions was very close 1.0).

We find the recommended assumptions (which were in use for the December 31, 2022 funding valuation) to be reasonable for use in the funding and GASB valuations.

#### *Mortality Assumptions*

ASOP No. 35 states that the actuary should generally consider at least the following when setting mortality assumptions: pre- and post-mortality; potentially different mortality for different employee classifications (if appropriate); adjustments for mortality improvement that occurs from the period studied (in the experience study) to the measurement period (the date of the valuation); and mortality improvements after the measurement date. The experience study started with nationally published mortality tables and were adjusted based on TSERS actual experience. The common industry convention is, that for any group's actual mortality experience to be given full credibility, there should be enough covered

participants to result in at least 1,000 actual deaths during the five-year period studied. The experience study demonstrates that certain groups/statuses (or a combination thereof) were analyzed together in order to increase credibility (e.g., beneficiaries, non-safety disabled retirees and safety disabled retirees). The report demonstrates that considerations for setting mortality assumptions promulgated in ASOP No. 35 were followed. We noted that for some groups various scaling factors were applied based on age (similar to the previous experience study). While we believe this to be a reasonable adjustment to reflect the System's experience, not enough detail was given to see how the adjustments for each age were calculated.

We find the recommended assumptions (which were in use for the December 31, 2022 funding valuation) to be reasonable for use in the funding and GASB valuations.

## **LGERS**

The LGERS experience study appears to be on a five-year cycle with the next cycle expected to be January 1, 2020 through December 31, 2024. We were provided the most recently completed experience study, dated December 9, 2020, covering the period January 1, 2015 through December 31, 2019. We have reviewed the demographic assumptions recommended from this study that are currently in use for the funding and GASB valuations.

### *Non-Mortality Demographic Assumptions*

The non-mortality demographic assumptions were reviewed in the experience study dated December 9, 2020, and covering the five-year period ending on December 31, 2019. We have reviewed that report and find that the recommended assumptions are reasonable, based on LGERS actual experience (as detailed in that report). The experience study report reviewed demonstrates that these guidelines were followed in the development of the recommended assumptions. The proposed non-mortality demographic assumptions were generally set to reflect actual experience during the study period (i.e., the ratio of actual to expected decrements based on the proposed assumptions was very close 1.0).

We find the recommended assumptions (which were in use for the December 31, 2022 funding valuation) to be reasonable for use in the funding and GASB valuations.

### *Mortality Assumptions*

The experience study started with nationally published mortality tables and were adjusted based on LGERS actual experience. As noted under the TSERS section, the report is silent as to the process used to adjust the rates for certain ages. For beneficiaries, the report indicates that beneficiaries from all the systems were combined to provide additional credibility. Non-safety disabled retirees were combined and safety disabled retirees were combined for the same reason. In general, the report demonstrates that considerations for setting mortality assumptions promulgated in ASOP 35 were followed.

We find the recommended assumptions (which were in use for the December 31, 2022 funding valuation) to be reasonable for use in the funding and GASB valuations.

## **RODSPF and DIPNC**

The RODSPF and DIPNC experience study appears to be on a five-year cycle with the next cycle expected to be January 1, 2020 through December 31, 2024. We were provided the most recently completed experience study, dated December 9, 2020, covering the period January 1, 2015 through December 31, 2019. We have reviewed the demographic assumptions recommended from this study that are currently in use for the funding and GASB valuations.

The demographic experience for RODSPF is combined with the LGERS in the analysis. Therefore, the demographic assumptions for the RODSPF are the same as those for LGERS. Please see our aforementioned comments.

Except for rates of disability and recovery or death from disabled status, the demographic assumptions for the DIPNC are the same as those for the TSERS. Please see our aforementioned comments.

The experience study report recommends updated disability and disability claim termination rates for the DIPNC. The report provided to us for review showed neither the details of the current assumptions nor the actual experience. While the process to determine these proposed rates that was described is reasonable and in compliance with ASOPs, there is insufficient detail in the reports to determine if the recommended rates are reasonable. We recommend that future experience studies include the level of detail that compares actual, expected and proposed rates by age so that another actuary can opine on the reasonability of the recommendations.

In addition, for the DIPNC, the experience study recommends projecting the valuation pay to the appropriate period rather than assuming that pay does not increase from disablement.

We find the recommended assumptions (which were in use for the December 31, 2022 funding valuation) to be reasonable for use in the funding and GASB valuations.

## **RHB**

Non-health related demographic assumptions are the same as those used for the pension funding valuations. Specific health related demographic assumptions, such as participation, enrollment and migration assumptions are disclosed in the GASB Statement No. 74 reports. These assumptions are reported to be based on actual experience as well as future plan sponsor expectation as disclosed in the most recent financial report.

We find these assumptions to be reasonable for use in the GASB valuation. Currently, no funding valuation for the RHB is performed.

## **Review of Recommended Actuarial Methods**

### **TSERS, LGERS, RODSPF**

The funding and GASB valuations both use the Entry Age Actuarial Cost method. The asset method is a five-year smoothed market related value with a 20% corridor around the market for funding. The asset method for GASB is market value.

The most recent experience study proposed changes to some of the actuarial methods. The method for calculating the liability attributable to the TSERS and LGERS terminated vested members is based on estimated benefits rather than 200% of each member's contribution balance. For RODSPF, the liability is based on each member's benefit provisions rather than the provisions for pre-2009 hires. In addition, the study recommends implementing direct rate smoothing over a five-year period to mitigate large contribution rate increases.

We find the methods used for the funding valuation to comply with the ASOPs and reasonable for funding. We find the methods used for the GASB valuation to be in accordance with those prescribed by the GASB pronouncements.

#### **DIPNC**

The funding uses the Aggregate Actuarial Cost method. The asset method is a five-year smoothed market related value with a 20% corridor around the market for funding. The funding method for the GASB valuation is the Entry Age Actuarial Cost method. The asset method used for the GASB valuation is market value.

We find the methods used for the funding valuation comply with the ASOPs and reasonable for funding. We find the methods used for the GASB valuation to be in accordance with those prescribed by the GASB pronouncements.

#### **RHB**

The actuarial cost method for the GASB valuation is the Entry Age Actuarial Cost method. The asset method is the market value.

We find the methods used for the GASB valuation to be in accordance with those prescribed by the GASB pronouncements.

In summary, we find the demographic assumptions and actuarial methods used for the funding and GASB valuations to be reasonable.

## **SECTION 2**

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### **REVIEW OF ECONOMIC ASSUMPTIONS**

# Review of Economic Assumptions

The key economic assumptions are:

1. **Assumed Rate of Inflation** – The rate of price inflation (as measured by the Consumer Price Index for all Urban consumers) which underlies the remainder of the economic assumptions.
2. **Assumed Rate of Investment Return** – The expected annual rate of return on System assets, net of expenses, over a long-term period. This is also the rate at which projected future benefits under the system are discounted to the present.
3. **Assumed Rate of Increase in Compensation** – The rate at which a member’s annual salary is assumed to increase each year, which impacts the level of member benefits.

## ASOP No. 27

Actuarial Standards of Practice No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, provides guidance on the selection of economic assumptions for measuring obligations for defined benefit plans. The standard requires that the selected economic assumptions be consistent with each other. That is, the selection of the investment return assumption should be consistent with the selection of the wage inflation and price inflation assumptions.

ASOP No. 27 defines a reasonable economic assumption as an assumption that is:

1. Appropriate for the purpose of the measurement;
2. Reflects the actuary’s professional judgment;
3. Takes into account historical and current economic data that is relevant as of the measurement date;
4. Is an estimate of future experience, an observation of the data inherent in market data or a combination thereof; and
5. Has no significant bias (i.e., it is not significantly optimistic or pessimistic) except when provisions for adverse deviation or other factors included and disclosed under Section 3.5.1, or when alternative assumptions are used for the assessment of risk.

However, the standard explicitly advises an actuary not to give undue weight to recent experience.

ASOP No. 27 acknowledges that for any given economic assumption, there is a reasonable range of opinions on that assumption.

## Inflation

By “inflation,” we mean price inflation, as measured by annual increases in the Consumer Price Index (CPI). This inflation assumption underlies all of the other economic assumptions. It not only impacts investment return, but also salary increases and other inflation linked benefits.

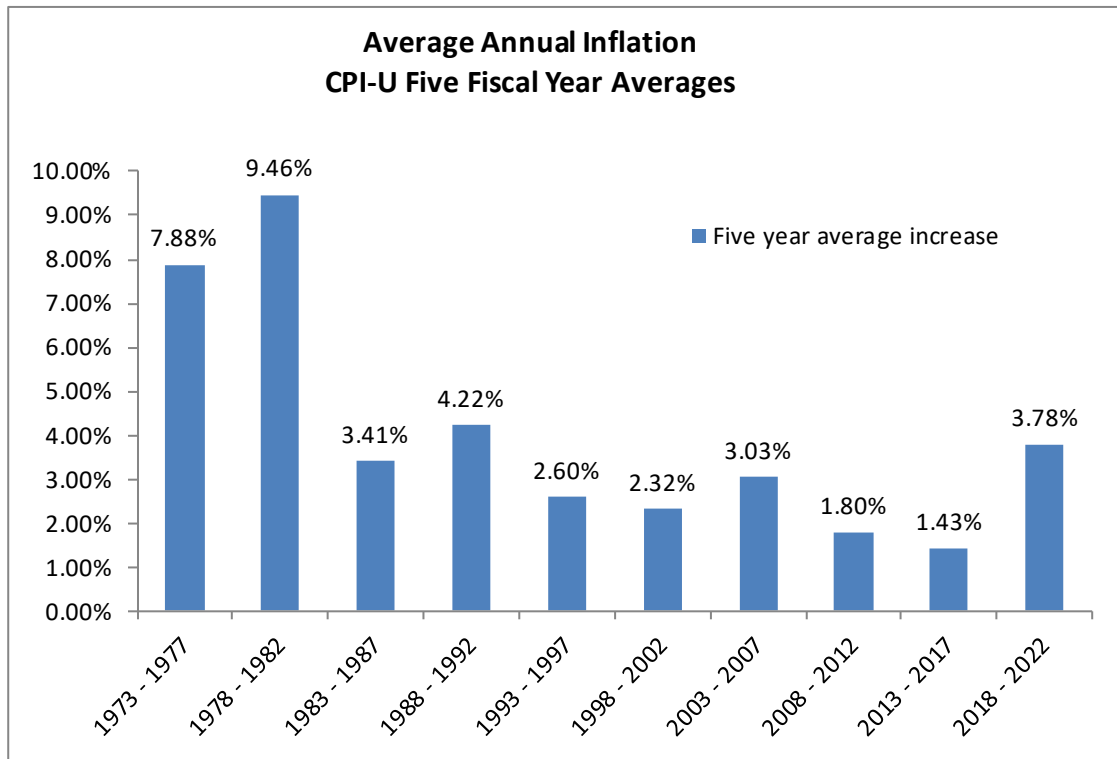
Over the five-year period from 2017 through 2022, the CPI-U has increased at an average rate of 3.78%.

The table on the following page shows the average inflation over various periods ending December 31, 2022.



Fiscal Year	Annual Increase in CPI-U
2018	1.91%
2019	2.29%
2020	1.36%
2021	7.04%
2022	6.45%
3-Year Average	4.92%
5-Year Average	3.78%
10-Year Average	2.60%
20-Year Average	2.51%
25-Year Average	2.47%
30-Year Average	2.49%
40-Year Average	2.82%
50-Year Average	3.96%

The following graph shows the average inflation over five-year periods over the last 50 years:



As the above graph illustrates, recent inflation experience is much different than that of the 1970s and 1980s. The geometric average price inflation was 2.49% per year over the last 30 years, ending December 31, 2022; 2.51% over the last 20 years and 2.60% over the last 10 years.

## Future Inflation Expectations

Since price inflation is relatively volatile and is subject to a number of influences not based on recent history, economic assumptions are less reliably based on recent past experience than are the demographic assumptions. Therefore, it is important not to give undue weight to recent experience. We must also consider future expectations for inflation as well.

We surveyed the inflation assumption used by 12 nationally recognized firms (investment consultants, asset managers, and insurance companies) across the country. In our sample of these firms, the short-term inflation assumption ranged from 2.26% to 2.90%, with an average of 2.52%; the long-term inflation assumptions ranged from 2.27% to 2.90%, with an average of 2.56%.

Another point of reference is the Social Security Administration's (SSA) 2023 Trustees Report, in which the Office of the Chief Actuary is projecting a long-term ultimate intermediate annual inflation rate assumption of 2.4%. The Social Security Trustees Report uses the ultimate rates for their 75-year projections, much longer than the longest horizon we can discern from Treasuries and TIPS.

The table on the following page presents a summary of inflation rate forecasts from various professional experts.



<b>Forward-Looking Annual Inflation Forecasts</b> <b>(From Professional Experts in the Field of Forecasting Inflation)<sup>a</sup></b>	
<b>Congressional Budget Office<sup>b</sup></b> 5-Year Annual Average 10-Year Annual Average	2.83% 2.57%
<b>Federal Reserve Bank of Philadelphia<sup>c</sup></b> 5-Year Annual Average 10-Year Annual Average	2.50% 2.36%
<b>Federal Reserve Bank of Cleveland<sup>d</sup></b> 10-Year Expectation 20-Year Expectation 30-Year Expectation	1.66% 1.88% 2.05%
<b>Federal Reserve Bank of St. Louis<sup>e</sup></b> 10-Year Breakeven Inflation 20-Year Breakeven Inflation 30-Year Breakeven Inflation	2.20% 2.48% 2.23%
<b>U.S. Department of the Treasury<sup>f</sup></b> 10-Year Breakeven Inflation 20-Year Breakeven Inflation 30-Year Breakeven Inflation 50-Year Breakeven Inflation 100-Year Breakeven Inflation	2.10% 2.40% 2.19% 2.29% 2.37%
<b>Social Security Trustees<sup>g</sup></b> Ultimate Intermediate Assumption	2.40%

<sup>a</sup>End of the Second Quarter, 2023. Version 2023-07-10 by Gabriel, Roeder, Smith & Company

<sup>b</sup>The Budget and Economic Outlook: 2023 to 2033, Release Date: February 2023, Consumer Price Index (CPI-U), Percentage Change from Year to Year, 5-Year Annual Average (2023 - 2027), 10-Year Annual Average (2023 - 2032).

<sup>c</sup>Second Quarter 2023 Survey of Professional Forecasters, Release Date: May 12, 2023, Headline CPI, Annualized Percentage Points, 5-Year Annual Average (2023 - 2027), 10-Year Annual Average (2023 - 2032).

<sup>d</sup>Inflation Expectations, Model output date: June 1, 2023.

<sup>e</sup>The breakeven inflation rate represents a measure of expected inflation derived from X-Year Treasury Constant Maturity Securities and X-Year Treasury Inflation-Indexed Constant Maturity Securities. Observation date: June, 2023.

<sup>f</sup>The Treasury Breakeven Inflation (TBI) Curve, Monthly Average Rates, June, 2023.

<sup>g</sup>The 2023 Annual Report of The Board of Trustees of The Federal Old-Age And Survivors Insurance and Federal Disability Insurance Trust Funds, March 31, 2023, p. 10, Key Assumptions and Summary Measures for the Last 65 Years of the Long-Range (75-year) Projection Period, Intermediate, Consumer Price Index (CPI-W).

Taking all of this information into consideration, we believe that the 2.5% price inflation assumption currently used in the funding and GASB valuations is reasonable. We believe that a price inflation assumption in the range of 2.25% to 2.75% is supportable by historical experience and future expectations. That being said, price inflation is the starting point for the other economic assumptions, such as the investment rate of return, wage increases, and health trend rates. If a price inflation assumption is too high (low) and it results in an investment rate of return that is also too high (low), the resulting valuations can be too optimistic (pessimistic) and/or contributions that may be too low (high). However, if the investment rate of return assumption is not too high, then a price inflation that is higher than future expectations could actually add a margin for adverse experience when measuring liabilities. In other words, it is important not to just look at this assumption in isolation.

## **Investment Return**

The investment return assumption, also referred to as the valuation interest rate, is one of the principal assumptions in any actuarial valuation. It is used to discount future expected benefit payments back to the valuation date, which ultimately determines the liability (i.e., present value of benefits) of the retirement plan. Even a small change to this assumption can produce significant changes to the liabilities and contribution rates.

For TSERS, LGERS, RODSPF, and DIPNC, this assumption was adjusted after the 2015-2019 experience study. For the RHB, this assumption is set by the State (and is currently the same as TSERS and LGERS). However, because the RHB is not a funded plan, this assumption is not the discount rate. Rather, the discount rate is based on the Bond Buyer 20-year GO index.

The assumed rate of investment return for the TSERS and LGERS December 31, 2022 funding valuations was 6.5%. Based on the reported asset allocation (and the target allocation shown in the Annual Comprehensive Financial Report) and a 2.50% price inflation assumption, we believe this assumption is reasonable for use as the assumed rate of return for the funding valuations and the expected long-term rate of return for the GASB valuations, based on the information provided for this review. It is important to note that for both the LGERS and TSERS, a large portion (approximately 25%, each) of their asset allocation (as reported in the December 31, 2022 valuations) is in the “other” category. This category is footnoted to indicate it covers real estate, alternatives, inflation and credit. We recommend this category be further subdivided since these categories do not all have the same future expectations. Subdividing this category would allow an auditor (or other user of the report) to perform a more robust analysis to determine if the assumption continues to be appropriate. The RODSPF and DIPNC uses an assumed of investment return of 3.00%. Since these funds are primarily invested in fixed income vehicles, we believe this is a reasonable assumption for funding and for the long-term expected rate of return for GASB, based on a 2.50% inflation assumption.

We have tested this assumption using our 2023 Capital Markets Assumption Model and the reported asset allocation in the December 31, 2022 reports. In 2023, the capital market assumptions used by the consultants who provide that information to us increased since 2022. Based on our 2023 model, the 6.5% assumption is just below the 50<sup>th</sup> percentile return over the next ten years using the current NCRS asset allocation.

## **Wage inflation, Payroll Growth and Pay Increases**

These items were studied as part of the most recent experience study. These respective experience studies provide enough detail to demonstrate that the recommended assumptions (which were used in the December 31, 2022 funding valuations) are reasonable.

## **RHB Trend Rates**

The trend rates used for the GASB valuation of the RHB are similar to the trend rates that GRS currently uses, but end in an ultimate rate higher than what GRS currently uses. However, we believe they are reasonable. We note the trend rates are consistent with the rates used in the previous valuation.

## **Summary**

In summary, we find the economic assumptions to be reasonable for the funding and GASB valuations.

## **SECTION 3**

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**REVIEW OF THE RESPECTIVE VALUATION REPORTS  
CONTAINING THE UNDERLYING CALCULATIONS FOR THE  
GASB VALUATIONS**

# Test Lives Review

## TSERS

### Actives

GRS requested test life information on 10 active cases. The active cases are shown below:

Test Case	Age	Service	Reported Pay	Sex	Valuation Result	GRS	Buck	% Diff
1 Teacher	42.3267	11.5378	\$ 55,223.12	F	EAAL	\$ 102,354	\$ 105,927	-3.37%
					PVB	167,679	179,647	-6.66%
					NC	6,514	6,443	1.10%
					PVFS	579,895	632,537	-8.32%
2 Teacher	57.1107	5.6667	1,060,000.00	M	EAAL	1,273,064	1,123,094	13.35%
					PVB	2,393,307	2,256,872	6.05%
					NC	168,968	149,759	12.83%
					PVFS	7,495,016	8,075,444	-7.19%
3 General	62.1189	7.1667	104,682.47	M	EAAL	141,922	140,844	0.77%
					PVB	215,844	220,821	-2.25%
					NC	16,961	16,032	5.79%
					PVFS	467,440	506,161	-7.65%
4 Other	43.6831	20.8333	80,959.90	F	EAAL	350,694	361,232	-2.92%
					PVB	389,205	413,888	-5.96%
					NC	6,167	6,946	-11.22%
					PVFS	522,478	604,250	-13.53%
5 Other	59.7746	21.0000	55,559.05	M	EAAL	216,006	215,124	0.41%
					PVB	244,101	241,029	1.27%
					NC	7,151	6,380	12.08%
					PVFS	221,070	216,956	1.90%
6 General	36.0821	3.9167	39,361.78	M	EAAL	23,057	21,147	9.03%
					PVB	75,563	71,339	5.92%
					NC	4,629	4,083	13.37%
					PVFS	457,160	466,438	-1.99%
7 General	55.75	13.2500	33,602.02	M	EAAL	75,154	80,428	-6.56%
					PVB	105,734	117,277	-9.84%
					NC	4,749	5,075	-6.42%
					PVFS	223,341	241,103	-7.37%
8 Teacher	46.9824	23.4545	68,476.38	F	EAAL	347,736	347,301	0.13%
					PVB	370,490	395,703	-6.37%
					NC	5,549	7,585	-26.84%
					PVFS	287,120	430,475	-33.30%
9 Teacher	54.1189	24.5000	36,007.36	M	EAAL	182,862	180,991	1.03%
					PVB	201,403	201,719	-0.16%
					NC	4,210	3,972	5.99%
					PVFS	161,640	185,042	-12.65%
10 Teacher	26.5548	1.2727	48,898.37	F	EAAL	8,006	5,949	34.58%
					PVB	42,502	61,481	-30.87%
					NC	4,063	5,474	-25.78%
					PVFS	424,252	473,728	-10.44%
<b>Total Test Cases</b>					EAAL	2,720,855	2,582,037	5.38%
					PVB	4,205,828	4,159,776	1.11%
					NC	228,961	211,749	8.13%

In prior reports, we valued Test Case 2 reflecting the compensation limit under 401(a)(17). Buck indicated that they did not apply any salary limits in their valuation and, therefore, our figures in the report do not reflect the salary limit.



# TSERS

## Retirees

GRS requested test life information on 18 retiree cases. The retiree cases are shown below:

Test Case	Age	Option Code	Current Monthly Benefit	Sex	Valuation Result	GRS	Buck	% Diff
1 - Law Enf. (beneficiary)	83.3250	OPT3	\$ 525.90	F	EAAL/PVB	\$ 38,516	\$ 37,742	2.05%
2 - General	77.0472	MAX	281.00	F	EAAL/PVB	28,166	28,216	-0.18%
3 - Teacher	65.4917	MAX	3,499.43	F	EAAL/PVB	498,731	503,215	-0.89%
4 - General	79.6639	OPT62	718.35	F	EAAL/PVB	82,410	82,097	0.38%
5 - General	68.9000	MAX	365.78	F	EAAL/PVB	47,273	47,170	0.22%
6 - General (beneficiary)	58.6278	OPT62	1,621.65	F	EAAL/PVB	257,397	231,072	11.39%
7 - Other	71.4056	MAX	1,476.94	M	EAAL/PVB	164,178	166,081	-1.15%
8 - Other	69.2583	OPT62	1,795.69	M	EAAL/PVB	256,747	255,517	0.48%
9 - General (disabled)	62.9083	OPT2	1,656.99	F	EAAL/PVB	253,549	250,715	1.13%
10 - Teacher (disabled)	70.0361	OPT62	1,231.57	M	EAAL/PVB	166,613	164,584	1.23%
11 - General (disabled)	59.8167	MAX	1,349.73	M	EAAL/PVB	153,834	153,438	0.26%
12 - Other	59.7778	MAX	778.77	F	EAAL/PVB	118,555	118,239	0.27%
13 - General	69.9722	OPT62	2,966.47	F	EAAL/PVB	528,993	523,373	1.07%
14 - General (disabled)	62.9833	OPT2	970.95	F	EAAL/PVB	139,896	138,835	0.76%
15 - General (disabled)	64.4417	MAX	1,913.79	M	EAAL/PVB	200,989	202,465	-0.73%
16 - Teacher (disabled)	62.6056	MAX	2,079.58	F	EAAL/PVB	263,325	262,197	0.43%
17 - Other	69.2056	MAX	487.05	F	EAAL/PVB	62,515	62,808	-0.47%
18 - General (disabled)	67.0583	MAX	2,049.06	M	EAAL/PVB	203,488	203,727	-0.12%
<b>Total Test Cases</b>					<b>EAAL/PVB</b>	<b>3,465,175</b>	<b>3,431,491</b>	<b>0.98%</b>

# TSERS

## Terminated Vested

GRS requested test life information on 12 terminated cases. The terminated vested and non-vested cases, are shown below:

Test Case	Age	Service	Accumulated Contributions	Sex	Valuation Result	GRS	Buck	% Diff
1 - General	64.2159	14.1667	\$ 42,118.43	M	EAAL/PVB	\$ 67,158	\$ 78,837	-14.81%
2 - Teacher*	41.3470	9.7727	34,820.73	M	EAAL/PVB	34,821	34,821	0.00%
3 - General	51.1886	8.9166	43,487.97	F	EAAL/PVB	53,986	55,198	-2.20%
4 - Other	60.4906	11.5833	75,381.58	M	EAAL/PVB	119,722	122,545	-2.30%
5 - Teacher	54.649	5.8636	12,345.44	F	EAAL/PVB	16,627	17,381	-4.34%
6 - General	54.1831	16.2500	69,369.20	M	EAAL/PVB	70,051	72,093	-2.83%
7 - Other	47.5246	16.0000	124,042.57	F	EAAL/PVB	132,136	174,895	-24.45%
8 - Teacher*	42.1381	11.8455	39,533.33	F	EAAL/PVB	39,533	39,533	0.00%
9 - Teacher*	41.1995	5.0122	15,493.33	F	EAAL/PVB	15,493	15,493	0.00%
10 - Other <sup>#</sup>	63.3157	2.2727	2,046.61	F	EAAL/PVB	2,047	2,047	0.00%
11 - Teacher <sup>#</sup>	34.4045	5.0000	14,987.43	F	EAAL/PVB	14,987	14,987	0.00%
12 - Teacher <sup>#</sup>	25.7555	3.0000	4,148.32	F	EAAL/PVB	4,148	4,148	0.00%
<b>Total Test Cases</b>					<b>EAAL/PVB</b>	<b>570,709</b>	<b>631,978</b>	<b>-9.69%</b>

\* GRS Present Value of deferred benefits were lower than the contribution balances.

# Values are equal to contribution balances.

## Total TSERS

(Actives, Retirees, and Terminated Vested)

Valuation Result	GRS	Buck	% Diff
EAAL	\$6,756,739	\$6,645,506	1.67%
PVB	8,241,712	8,223,245	0.22%





# LGERS

## Actives

GRS requested test life information on 10 active cases. One member entered terminated vested status during the year; the remaining active cases are shown below:

Test Case	Age	Service	Reported Pay	Sex	Valuation			
					Result	GRS	Buck	% Diff
1 Law Enforcement	36.7132	15.4167	\$79,632.64	M	EAAL	\$ 243,686	\$ 246,823	-1.27%
					PVB	334,293	350,565	-4.64%
					NC	9,596	10,249	-6.37%
					PVFS	783,512	800,486	-2.12%
2 Law Enforcement	95.1627	26.5833	51,028.45	M	EAAL	118,895	91,469	29.98%
					PVB	118,895	91,469	29.98%
					NC	0	0	
					PVFS	0	0	
3 Fire & Rescue	42.3854	16.7500	77,537.95	F	EAAL	227,718	253,022	-10.00%
					PVB	317,247	339,409	-6.53%
					NC	9,810	9,415	4.20%
					PVFS	737,521	703,930	4.77%
4 Fire & Rescue	48.4127	28.4167	57,474.08	M	EAAL	507,819	509,438	-0.32%
					PVB	524,155	531,177	-1.32%
					NC	7,300	9,162	-20.33%
					PVFS	132,194	134,456	-1.68%
5 Fire & Rescue	57.8321	23.0833	65,416.41	M	EAAL	310,862	300,022	3.61%
					PVB	344,068	333,082	3.30%
					NC	8,853	8,946	-1.04%
					PVFS	255,191	237,152	7.61%
6 Fire & Rescue	38.3799	12.6667	86,327.74	M	EAAL	163,265	194,897	-16.23%
					PVB	269,263	299,113	-9.98%
					NC	10,019	9,893	1.27%
					PVFS	956,758	897,488	6.60%
7 General	62.7187	17.4167	37,177.84	F	EAAL	130,633	123,637	5.66%
					PVB	147,774	143,162	3.22%
					NC	4,993	5,433	-8.10%
					PVFS	125,125	124,359	0.62%
8 Law Enforcement	47.2214	23.5000	84,840.43	M	EAAL	446,159	455,142	-1.97%
					PVB	513,098	508,803	0.84%
					NC	12,189	10,854	12.30%
					PVFS	484,963	416,243	16.51%
9 General	32.9386	1.0833	62,826.32	F	EAAL	6,715	7,551	-11.07%
					PVB	67,897	77,122	-11.96%
					NC	6,311	7,006	-9.92%
					PVFS	623,456	597,781	4.30%
<b>Total Test Cases</b>					EAAL	2,155,752	2,182,001	-1.20%
					PVB	2,636,690	2,673,902	-1.39%
					NC	69,071	70,958	-2.66%
					PVFS	4,098,720	3,911,895	4.78%



# LGERS

## Retirees

GRS requested test life information on 12 retiree cases. The retiree cases are shown below:

<b>Test Case</b>	<b>Age</b>	<b>Option Code</b>	<b>Current Monthly Benefit</b>	<b>Sex</b>	<b>Valuation Result</b>	<b>GRS</b>	<b>Buck</b>	<b>% Diff</b>
<b>1 - Law Enforcement</b>	72.59	MAX	\$1,129.62	M	<b>EAAL/PVB</b>	\$ 117,510	\$ 116,532	0.84%
<b>2 - General</b>	75.08	OPT62	2,451.86	F	<b>EAAL/PVB</b>	324,051	327,326	-1.00%
<b>3 - General</b>	73.22	MAX	1,279.95	F	<b>EAAL/PVB</b>	147,527	149,132	-1.08%
<b>4 - General</b>	75.90	OPT62	861.66	F	<b>EAAL/PVB</b>	105,011	105,172	-0.15%
<b>5 - General</b>	84.76	MAX	1,943.90	F	<b>EAAL/PVB</b>	137,011	136,385	0.46%
<b>6 - General</b>	69.13	MAX	360.39	F	<b>EAAL/PVB</b>	46,365	46,688	-0.69%
<b>7 - Law Enforcement</b>	61.38	OPT63	2,943.97	M	<b>EAAL/PVB</b>	449,222	452,104	-0.64%
<b>8 - General</b>	72.95	MAX	1,101.97	F	<b>EAAL/PVB</b>	127,988	128,395	-0.32%
<b>9 - General</b>	59.24	OPT4	3,029.60	M	<b>EAAL/PVB</b>	290,236	295,157	-1.67%
<b>10 - Law Enforcement</b>	57.13	OPT62	4,792.63	M	<b>EAAL/PVB</b>	800,785	804,049	-0.41%
<b>11 - Fire</b>	76.44	OPT2	1,319.25	M	<b>EAAL/PVB</b>	180,058	180,929	-0.48%
<b>12 - General</b>	77.13	MAX	1,442.55	F	<b>EAAL/PVB</b>	145,466	146,929	-1.00%
<b>Total Test Cases</b>					<b>EAAL/PVB</b>	2,871,230	2,888,798	-0.61%

# LGERS

## Terminated Vested

GRS requested test life information on 10 Terminated Vested cases. In addition, 1 active member entered terminated vested status during the year. The terminated vested cases are shown below:

Test Case	Age	Service	Accumulated Contributions	Sex	Valuation Result	GRS	Buck	% Diff
1 - Fire & Rescue	61.2719	18.4166	\$98,714.62	M	EAAL/PVB	\$ 207,721	\$ 224,749	-7.58%
2 - Fire & Rescue*	42.4605	7.7500	24,636.85	M	EAAL/PVB	24,637	24,637	0.00%
3 - Fire & Rescue*	39.2801	8.3333	35,374.27	M	EAAL/PVB	35,374	35,374	0.00%
4 - Fire & Rescue*	41.4127	7.4166	29,108.66	F	EAAL/PVB	29,109	29,109	0.00%
5 - Fire & Rescue	68.0411	10.5000	38,132.14	M	EAAL/PVB	53,107	63,229	-16.01%
6 - General*	45.1025	7.4167	18,315.43	F	EAAL/PVB	18,315	18,315	0.00%
7 - General	55.3799	10.3332	39,336.51	F	EAAL/PVB	56,971	64,161	-11.21%
8 - General*	63.3580	8.2500	36,907.80	M	EAAL/PVB	36,908	37,707	-2.12%
9 - General	56.7351	12.0000	58,961.50	F	EAAL/PVB	86,957	103,479	-15.97%
10 - General	60.3470	12.4166	48,274.18	F	EAAL/PVB	62,075	63,368	-2.04%
11 - General*	34.8415	7.4998	25,568.63	M	EAAL/PVB	25,569	25,569	0.00%
<b>Total Test Cases</b>					<b>EAAL/PVB</b>	<b>636,743</b>	<b>689,697</b>	<b>-7.68%</b>

\* GRS Present Value of deferred benefits were lower than the contribution balances.

## Total LGERS

(Actives, Retirees, and Terminated Vested)

Valuation Result	GRS	Buck	% Diff
EAAL	\$5,663,725	\$5,760,496	-1.68%
PVB	6,144,664	6,252,397	-1.72%

# RODSPF

## Actives

GRS requested test life information on 10 active cases. The active cases are shown below:

Test Case	Age	Service	Reported Pay	Sex	Valuation			
					Result	GRS	Buck	% Diff
1	81.7050	36.2500	\$64,958.05	F	EAAL	\$ 147,924	\$ 147,396	0.36%
					PVB	147,924	147,396	0.36%
					NC	0	0	
					PVFS	0	0	
2	44.9659	17.9167	73,270.25	F	EAAL	103,819	77,378	34.17%
					PVB	197,065	197,451	-0.20%
					NC	7,054	10,866	-35.08%
					PVFS	1,000,713	809,090	23.68%
3	59.3212	22.5833	95,756.42	F	EAAL	245,571	216,186	13.59%
					PVB	285,390	280,488	1.75%
					NC	11,272	15,737	-28.37%
					PVFS	309,719	389,169	-20.42%
4	53.4879	19.3333	84,442.03	F	EAAL	175,873	136,747	28.61%
					PVB	258,866	243,075	6.50%
					NC	10,854	12,491	-13.11%
					PVFS	668,333	718,441	-6.97%
5	41.0548	6.0833	52,445.41	F	EAAL	57,015	50,692	12.47%
					PVB	144,327	146,720	-1.63%
					NC	6,061	6,248	-2.99%
					PVFS	782,556	816,136	-4.11%
6	68.0329	18.0833	51,963.55	M	EAAL	109,410	120,009	-8.83%
					PVB	147,762	166,553	-11.28%
					NC	8,665	11,033	-21.46%
					PVFS	237,377	219,489	8.15%
7	65.9495	15.1667	47,783.46	F	EAAL	177,694	150,966	17.70%
					PVB	234,397	212,434	10.34%
					NC	14,469	14,102	2.60%
					PVFS	174,055	209,301	-16.84%
8	39.6831	11.4167	105,314.68	M	EAAL	102,629	91,376	12.32%
					PVB	183,997	178,346	3.17%
					NC	6,469	5,869	10.22%
					PVFS	1,367,967	1,569,258	-12.83%
9	58.6804	4.0833	67,122.19	F	EAAL	73,520	54,618	34.61%
					PVB	159,100	139,918	13.71%
					NC	10,753	10,045	7.05%
					PVFS	562,093	562,684	-0.11%
10	55.1655	2.0833	143,291.93	F	EAAL	35,112	22,096	58.91%
					PVB	115,296	111,132	3.75%
					NC	9,075	9,051	0.27%
					PVFS	1,283,495	1,385,499	-7.36%
<b>Total Test Cases</b>					EAAL	1,228,567	1,067,464	15.09%
					PVB	1,874,124	1,823,513	2.78%
					NC	84,672	95,442	-11.28%
					PVFS	6,386,308	6,679,067	-4.38%



# RODSPF

## Retirees

GRS requested test life information on 10 retiree cases. The retiree cases are shown below:

Test Case	Age	Option Code*	Current** Monthly Benefit	Sex	Valuation Result #	GRS	Buck	% Diff
1	77.1222	OPT62	\$1,903.46	F	EAAL/PVB	\$ 191,723	\$ 191,834	-0.06%
2	69.2639	MAX	5,145.26	M	EAAL/PVB	226,154	226,220	-0.03%
3	75.4222	MAX	4,499.86	F	EAAL/PVB	209,914	210,016	-0.05%
4	74.5528	OPT63	1,645.20	F	EAAL/PVB	209,914	210,016	-0.05%
5	68.9000	MAX	794.63	F	EAAL/PVB	263,517	263,600	-0.03%
6	65.6000	MAX	2,811.35	F	EAAL/PVB	288,925	289,002	-0.03%
7	80.7444	MAX	4,357.65	M	EAAL/PVB	124,011	124,150	-0.11%
8	64.7194	OPT63	3,954.55	F	EAAL/PVB	297,116	297,190	-0.02%
9	64.2583	MAX	0.00	M	EAAL/PVB	268,314	268,368	-0.02%
10	56.1222	OPT4	3,664.02	F	EAAL/PVB	363,866	363,924	-0.02%
<b>Total Test Cases</b>					<b>EAAL/PVB</b>	<b>2,443,454</b>	<b>2,444,320</b>	<b>-0.04%</b>

\* ROD benefits are paid for the life of the member only (MAX), regardless of beneficiary/option election for benefits paid from other plans.

\*\* Benefit listed is LGERS benefit; ROD benefits are valued at \$1,500 monthly.

# Nearest integer ages used for valuation results, in accordance with the method described in Buck's report.

## Terminated Vested

GRS requested test life information for three terminated vested cases. One of the cases changed status and the others were not valued.

## Total ROSDPF

(Actives, Retirees, and Terminated Vested)

Valuation Result	GRS	Buck	% Diff
EAAL	\$3,672,021	\$3,511,784	4.56%
PVB	4,317,578	4,267,833	1.17%



# DIPNC

## Actives

GRS requested test life information on 10 active cases. The active cases are shown below:

Test Case	Age	Service	Reported Pay	Sex	Valuation Result	GRS	Buck	% Diff
1	52.2159	23.30	\$ 22,121.52	F	EAAL	\$ 22	\$ 154	-85.71%
					PVB	344	361	-4.71%
					NC	49	40	22.50%
					PVFS	143,500	136,194	5.36%
2	56.3157	17.56	49,012.23	F	EAAL	(242)	279	-186.74%
					PVB	1,151	927	24.16%
					NC	172	126	36.51%
					PVFS	394,502	285,428	38.21%
3	38.7406	13.85	62,287.69	F	EAAL	811	558	45.34%
					PVB	1,728	1,315	31.41%
					NC	80	63	26.98%
					PVFS	701,444	788,644	-11.06%
4	27.5465	5.27	51,757.13	F	EAAL	353	187	88.77%
					PVB	803	538	49.26%
					NC	41	26	57.69%
					PVFS	544,444	649,019	-16.11%
5	50.9550	20.45	75,521.36	F	EAAL	257	272	-5.51%
					PVB	1,333	1,288	3.49%
					NC	114	144	-20.83%
					PVFS	707,322	703,042	0.61%
6	70.2433	12.75	29,517.09	F	EAAL	(12)	0	
					PVB	0	0	
					NC	4	0	
					PVFS	76,022	76,853	-1.08%
7	42.3267	11.54	58,144.43	F	EAAL	943	695	35.68%
					PVB	2,702	1,963	37.65%
					NC	137	97	41.24%
					PVFS	741,486	783,055	-5.31%
8	63.2746	14.83	89,506.97	F	EAAL	(853)	(147)	480.27%
					PVB	0	48	-100.00%
					NC	226	196	15.31%
					PVFS	336,182	316,732	6.14%
9	28.5465	1.18	22,456.04	F	EAAL	64	31	106.45%
					PVB	568	391	45.27%
					NC	39	28	39.29%
					PVFS	275,991	267,005	3.37%
10	40.1573	6.83	65,216.43	F	EAAL	980	526	86.31%
					PVB	2,786	1,586	75.66%
					NC	122	76	60.53%
					PVFS	957,430	961,127	-0.38%
<b>Total Test Cases</b>					EAAL	2,323	2,555	-9.08%
					PVB	11,415	8,417	35.62%
					NC	984	796	23.62%
					PVFS	4,878,323	4,967,099	-1.79%



# DIPNC

## Retirees

GRS requested test life information on 10 retiree cases (of which not all were receiving disability benefits). The retiree cases currently receiving benefits are shown below:

<u>Test Case</u>	<u>Age</u>	<u>Disability Start Date</u>	<u>Current Monthly Benefit</u>	<u>Sex</u>	<u>Valuation Result</u>	<u>GRS</u>	<u>Buck</u>	<u>% Diff</u>
1	54.35	11/2012	\$ 1,840.77	F	EAAL/PVB	\$ 31,786	\$ 31,743	0.14%
2	70.54	4/1981	702.90	F	EAAL/PVB	2,395	2,108	13.61%
3	55.54	1/2011	3,172.86	F	EAAL/PVB	89,019	87,673	1.54%
4	62.27	6/2007	1,197.37	F	EAAL/PVB	3,848	3,352	14.79%
5	50.26	3/2018	2,421.70	M	EAAL/PVB	125,717	123,412	1.87%
6	64.65	4/2016	2,439.75	M	EAAL/PVB	5,993	5,765	3.95%
7	62.72	1/2019	1,894.51	M	EAAL/PVB	21,460	20,959	2.39%
8	47.55	10/2015	1,639.81	M	EAAL/PVB	58,101	56,773	2.34%
<b>Total Test Cases</b>					<b>EAAL/PVB</b>	<b>338,319</b>	<b>331,785</b>	<b>1.97%</b>

## Terminated Vested

Terminated vested members of TSERS are not eligible for DIPNC benefits, therefore none were requested.

## Total DIPNC

(Actives and Retirees)

<u>Valuation Result</u>	<u>GRS</u>	<u>Buck</u>	<u>% Diff</u>
EAAL	\$340,642	\$334,340	1.88%
PVB	349,734	340,202	2.80%

# RHB

GRS requested test life information on 10 active, 12 retiree and 12 terminated vested cases. Some of the requested cases changed status and were not included. Segal previously indicated that they do not run valuations seriatim. Instead, they group the data into smaller categories, run each group as if it was an individual record, and then gross the results up by the number in the group. Segal was very helpful and worked with us to identify testing that GRS would be comfortable in using instead of individual records when we first began reviewing these reports (in 2018). Each test record in the following table actually represents a group of members.

## Actives

Test Case	Age	Service	Reported Pay	Sex	Valuation			
					Result	GRS	Segal	% Diff
1 Teachers	42.32	11.54	\$ 55,223	F	EAAL	\$ 51,681	\$ 57,165	-9.59%
					PVB	140,021	145,665	-3.87%
					NC	7,262	6,409	13.31%
					PVFS	685,106	762,552	-10.16%
2 Teachers	57.17	16.45	\$ 40,544	F	EAAL	44,168	42,871	3.03%
					PVB	70,470	68,495	2.88%
					NC	4,665	3,712	25.67%
					PVFS	232,213	279,863	-17.03%
3 General	38.39	17.90	\$ 57,090	M	EAAL	121,848	159,499	-23.61%
					PVB	233,328	263,004	-11.28%
					NC	9,439	9,977	-5.39%
					PVFS	680,179	592,280	14.84%
4 General	57.69	17.00	\$ 33,656	M	EAAL	46,677	46,401	0.59%
					PVB	73,393	70,195	4.56%
					NC	4,363	3,608	20.93%
					PVFS	209,084	221,971	-5.81%
5 General	52.43	12.42	\$ 40,274	F	EAAL	38,233	36,063	6.02%
					PVB	68,641	62,850	9.21%
					NC	3,281	2,594	26.48%
					PVFS	380,248	415,958	-8.58%
6 Other	79.56	20.90	\$ 43,471	M	EAAL	14,910	17,375	-14.19%
					PVB	16,404	17,375	-5.59%
					NC	1,521	0	
					PVFS	22,399	0	
7 Other	58.26	19.30	\$ 20,925	F	EAAL	49,891	47,291	5.50%
					PVB	70,908	70,500	0.58%
					NC	4,287	3,772	13.65%
					PVFS	103,423	128,756	-19.68%
8 Other	36.68	12.25	\$ 67,570	F	EAAL	99,289	100,928	-1.62%
					PVB	171,199	164,432	4.12%
					NC	5,952	4,895	21.59%
					PVFS	824,808	876,640	-5.91%
9 Other	52.99	6.92	\$ 38,018	F	EAAL	22,464	20,397	10.13%
					PVB	50,798	46,055	10.30%
					NC	2,731	2,348	16.31%
					PVFS	407,541	415,411	-1.89%
<b>Total Test Cases</b>					EAAL	489,161	527,990	-7.35%
					PVB	895,162	908,571	-1.48%
					NC	43,501	37,315	16.58%
					PVFS	3,545,001	3,693,432	-4.02%





# RHB

## Retirees

Test Case	Age	Sex	Valuation Result	GRS	Segal	% Diff
1 General	93.59	F	EAAL/PVB	\$ 4,374	\$ 4,678	-6.50%
2 General	86.02	F	EAAL/PVB	8,935	9,523	-6.17%
3 General	78.76	M	EAAL/PVB	17,142	17,489	-1.98%
4 General	74.04	F	EAAL/PVB	22,373	23,079	-3.06%
5 General	74.29	M	EAAL/PVB	23,201	24,358	-4.75%
6 General	69.77	M	EAAL/PVB	30,157	30,477	-1.05%
7 General	68.62	F	EAAL/PVB	30,004	30,079	-0.25%
8 General (disabled)	69.09	F	EAAL/PVB	24,131	24,864	-2.95%
9 Teachers	64.65	M	EAAL/PVB	25,038	25,375	-1.33%
10 General	70.54	F	EAAL/PVB	6,132	2,710	126.27%
11 General	63.26	M	EAAL/PVB	25,939	24,873	4.29%
<b>Total Test Cases</b>			<b>EAAL/PVB</b>	<b>217,426</b>	<b>217,505</b>	<b>-0.04%</b>

## Terminated Vested

Test Case	Age	Service	Sex	Valuation Result	GRS	Segal	% Diff
1 Teacher	49.61	18.42	F	EAAL/PVB	\$ 82,264	\$ 84,035	-2.11%
2 Teacher	44.59	7.60	F	EAAL/PVB	88,289	90,206	-2.13%
3 Teacher	44.27	8.05	F	EAAL/PVB	88,505	91,505	-3.28%
4 Teacher	38.17	7.58	F	EAAL/PVB	35,228	27,498	28.11%
5 Teacher	53.81	7.91	F	EAAL/PVB	29,132	22,769	27.95%
6 Teacher	61.68	5.33	F	EAAL/PVB	25,750	18,993	35.58%
7 General	58.83	5.00	M	EAAL/PVB	41,949	37,692	11.29%
8 General	65.61	6.17	F	EAAL/PVB	34,897	35,128	-0.66%
9 General	58.41	11.17	F	EAAL/PVB	70,631	72,351	-2.38%
10 Law Enforcement	48.70	18.42	M	EAAL/PVB	91,228	94,093	-3.04%
<b>Total Test Cases</b>				<b>EAAL/PVB</b>	<b>587,873</b>	<b>574,270</b>	<b>2.37%</b>

# Total RHB

(Actives, Retirees, and Terminated Vested)

Valuation Result	GRS	Segal	% Diff
EAAL	\$1,294,460	\$1,319,765	-1.92%
PVB	1,700,461	1,700,346	0.01%

## Test Lives Comments

We believe that the test lives are close enough to state that the liabilities shown in the funding valuations are reasonable and an appropriate representation of the liabilities, based on the current assumptions. When performing a full replication valuation, we generally consider replication a successful match if the replication is within the following tolerances (in plan total):

Total Present Value of Benefits	2%
Total Accrued Liability	5%
Normal Cost	5%
Present Value of Future Pay	2%

When looking at individual test life cases, differences may be much larger due to differences in rounding between actuarial software. For this reason, it is also important to consider the variance between the sums of the test cases, which will generally dampen the effect of differences due to rounding. However, the smaller the group of test cases, the larger the acceptable tolerances should be. We have found that the sums of the test cases (actives, retirees and terminated vested) for each of the plans we have reviewed are all within or acceptably close to the tolerance we would have applied to the plan totals when performing a full replication. We therefore believe the plan total results for TSERS, LGERS, RODSPF, DIPNC and RHB are reasonable.

This is our sixth year performing this analysis. As such, we attempted to request some of the same test life cases this year as we did in previous years, so we could review how the results changed from year-to-year. The results of our test life comparisons are generally consistent with the analysis performed in past years.

We have the following comments regarding the valuation reports and the current actuaries' calculations:

- Several of the terminated vested test cases showed greater discrepancies than others. GRS was not provided with the estimated benefits for the vested terminated members and, therefore, attempted to estimate the members' benefits using methods and assumptions described in the Buck reports. It may be that test cases where the difference is greater is attributable to using actual available data versus an estimation. In addition, we could not locate an assumption detailing when a terminated vested member would commence benefits. We assumed these members would commence receipt of benefits at earliest eligibility for reduced retirement benefits.
- We continue to recommend a description concerning how RODSPF service is determined and/or maintained (see applicable comment on the following page).
- We recommend Segal review the disability rates used in their actuarial valuation for consistency with the rates disclosed by Buck in the DIPNC valuation. Buck notes that the rates disclosed in a previous prior valuation (performed by Cavanaugh Macdonald Consulting) were incorrectly disclosed.

We have the following comments regarding future audits:

- In reviewing the RODSPF actives, it became clear that the reported service on the file was not RODSPF service in all cases (it was most likely total LGERS service). We were able to find RODSPF start dates based on internet searches of public data to better match calculations. We suspect that Buck must have had additional data regarding RODSPF service for active members (as searching public databases would not be practical for the entire RODSPF active population). We recommend that such additional information be included in data provided to the auditor.
- As discussed previously, provide the estimated benefits for terminated vested members to the auditor.

## SECTION 4

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### REVIEW OF THE RESPECTIVE GASB REPORTS

## Content Review

The GASB Statement Nos. 67 and 74 letters combined with the schedules in the funding valuation appear to have all of the actuarial schedules required by GASB Statement Nos. 67 and 74.

For the reports prepared by Buck, there are separate GASB letters issued with the main results. We believe that all of the actuarial schedules and actuarial disclosures required by GASB Statement Nos. 67 and 74 are detailed in the GASB letters and funding valuation reports.

For the report prepared by Segal, there is no funding valuation (in accordance with the plan sponsor's decisions). The report that Segal provided for the GASB Statement No. 74 results contained the underlying valuation results as of December 31, 2022. We believe that the Segal GASB Statement No. 74 report contains all the actuarial schedules and disclosures required by GASB Statement No. 74.

## Calculations Review

While our review affirmed the December 31, 2022 calculations of liabilities, the following chart shows our attempt at replicating the roll forward to June 30, 2023. Since the exact calculations were not provided and certain elements had to be estimated, we did not expect to exactly reproduce the June 30, 2023 numbers. As the schedules show, our estimates were extremely close.

	TSERS	LGERS	RODSPF	DIPNC	RHB
Data					
1 December 31, 2022 AAL	\$96,675,255,859	\$37,089,528,129	\$33,460,759	\$ 294,445,719	\$29,016,334,000
2 Employee Contribs during 12 months, ending 6/30/23	1,059,460,000	524,830,000	-	-	-
3 Employer Normal Cost Rate (Excl Admin Exp) as of 1/1/23	6.17%	6.71%	16.78%	0.10%	1,318,987,000
4 Payroll as of 12/31/22	16,141,902,861	7,526,815,916	7,901,629	18,314,307,283	
5 Benefits Paid during 12 months ending 6/30/23	5,636,727,000	1,865,415,000	1,850,000	37,470,000	1,120,623,000
GRS' approximation of numbers needed for roll forward					
Change in Benefit Terms or Assumptions (not already					
6 included in 12/31/2022 AAL)					
7 Service Cost from 12/31/22 to 6/30/23: (3)*(4)/2	497,977,703	252,617,639	663,114	9,157,154	659,493,500
8 Benefit Payments from 12/31/22 to 6/30/23: (5)/2	2,818,363,500	932,707,500	925,000	18,735,000	560,311,500
GRS' approximation of 6/30/23 TPL/OBEP Liab (roll forward)					
9 12/31/22 TPL: (1)+(6)	96,675,255,859	37,089,528,129	33,460,759	294,445,719	29,016,334,000
10 Service Cost: (2)/2 + (7)	1,027,707,703.26	515,032,638.57	663,114	9,157,153.64	659,493,500
11 Benefit Payments	2,818,363,500	932,707,500	925,000	18,735,000	560,311,500
12 Interest: (1)* i/2 + [(10)-(11)]* i/4 <sup>#</sup>	3,112,847,659	1,198,622,448	499,947	4,344,852	530,453,131
13 TPL/OPEB Liab 6/30/23: (9) + (10) - (11) + (12)	97,997,447,721	37,870,475,715	33,698,820	289,212,725	29,645,969,131
14 TPL/OPEB Liab 6/30/23 developed by Buck/Segal	97,921,037,000	37,828,184,000	33,626,000	283,168,000	29,850,087,000
15 Ratio of GRS approximation to Buck/Segal Calculations	100.1%	100.1%	100.2%	102.1%	99.3%

<sup>#</sup> i = 6.50% for TSERS and LGERS; 3.00% for RODSPF; 3.00% for DIPNC, and 3.65% for RHB.



## **SECTION 5**

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### **COMMENTS, CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE YEARS**

## Comments

We would like to thank Segal and Buck for their cooperation in the completion of this review.

We have indicated we believe the assumed rate of return of 6.50% was reasonable for TSERS and LGERS (based on the information provided for this review).

## Prior Year's Recommendations

We have reviewed the reports with regard to our recommendations from last year (and the prior years) and have found implementation of most of our recommendations.

## Conclusions

We believe the actuarial assumptions, actuarial cost methods, procedures, and valuation results are reasonable and based on our test life review, the valuation results are of reasonable accuracy.

We certify that the plans' actuarial valuation was prepared in accordance with pronouncements issued by the Governmental Accounting Standards Board (GASB), principles and practices prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures.



## Recommendations for Future Years

We have the following recommendations for future valuations:

- We recommend the North Carolina Retirement Systems continue working to provide their actuary with more complete information regarding terminated vested members.
- We recommend that Buck increase the documentation regarding their data processing. Specifically, we suggest that documentation/commentary include:
  - How RODSPF service is determined/maintained
- We recommend Buck and/or Segal review their calculations, assumptions, and/or disclosures with regard to the following:
  - Assumed commencement age for vested terminated members (pension valuations)
  - Disability rates (RHB/DIPNC)
- Providing additional data used in the valuation to the actuarial auditor:
  - RODSPF service for active members
  - Estimated benefits for terminated vested members