GRS Gabriel Roeder Smith & Company
Consultants & Actuaries

2014 QUADRENNIAL ACTUARIAL AUDIT OF THE VIRGINIA RETIREMENT SYSTEM

JUNE 23, 2014

GRS
Gabriel Roeder Smith & Company
Consultants & Actuaries
5605 N. MacArthur Blvd.
Suite 870
Irving, TX 75038-2631
469.524.0000 phone
469.524.0003 fax
www.gabrielroeder.com

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Mr. Hal Greer
Director
Joint Legislative Audit and Review Commission
General Assembly Building
Suite 1100, Capitol Square
111 Soledad, Fifth Floor
Richmond, VA 23219

Subject: 2014 Quadrennial Actuarial Audit of VRS

Dear Mr. Geer:

Gabriel, Roeder, Smith & Company (GRS) is pleased to present this report of an actuarial audit of the June 30, 2013 Actuarial Valuation of the Virginia Retirement System (VRS). This actuarial audit was conducted in accordance with §30-81 of the Code of Virginia and involves an independent verification and analysis of the assumptions, procedures, methods, and conclusions used in actuarial valuations prepared for VRS to ensure that the conclusions are technically sound and conform to the appropriate Standards of Practice as promulgated by the Actuarial Standards Board.

GRS is pleased to report to the Joint Legislative Audit and Review Commission, in our professional opinion, the June 30, 2013 Actuarial Valuation prepared by the retained actuary provides a fair and reasonable assessment of the financial position of VRS.

Throughout this report we included several recommendations for ways to improve the work product. We hope that the retained actuary, Cavanaugh Macdonald Consulting, and VRS find these items helpful.

We would like to thank Cavanaugh Macdonald Consulting and the staff at the Virginia Retirement System for their cooperation and assistance in providing the requested information as well as their thoughtful responses to our questions and inquiries. We look forward to presenting our report to the Joint Legislative Audit and Review Commission and answering any questions concerning the information provided herein.

Mr. Falls and Mr. White are both Enrolled Actuaries, Fellows of the Society of Actuaries, and Members of the American Academy of Actuaries. Both have experience working with large public retirement systems and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,
Gabriel, Roeder, Smith & Company

R. Ryan Falls, FSA, FCA, EA, MAAA
Senior Consultant

Daniel J. White, FSA, EA, MAAA
Senior Consultant

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SECTION I

EXECUTIVE SUMMARY

Executive Summary

The Joint Legislative Audit and Review Commission (JLARC) engaged Gabriel, Roeder, Smith & Company (GRS) for an actuarial audit of the June 30, 2013 actuarial valuations, studies, and reports on the Virginia Retirement System (VRS) performed by the retained actuary, Cavanaugh Macdonald Consulting (CMC). In accordance with §30-81 of the Code of Virginia, an actuarial audit of VRS is required every four years. This is the fourth quadrennial actuarial audit of VRS.

The actuarial audit included a review of the five primary defined benefit plans which cover State Employees, Teachers, State Police (SPORS), Judges, and Virginia Law Officers (VaLORS). The actuarial audit also included a review of valuation reports provided to a sample of local government employers and the actuarial valuations for the Health Insurance Credit Program, the Group Life Insurance Program, and the Virginia Sickness and Disability Program.

The scope of this actuarial audit includes the following:

- Review and analysis of the calculation results, including an evaluation of the data used for reasonableness and consistency as well as a review of the mathematical calculations for completeness and accuracy, based on a detailed review of a representative sample of the current plan participants.
- Review of the assumptions and methods for appropriateness, consistency, and reasonableness. Such assumptions shall include, but are not limited to: mortality, retirement and separation rates, levels of pay adjustments, and the rate of investment return.
- Verification of the reasonableness of the calculation of the unfunded actuarial accrued liability and the amortization period used under the actuarial cost method.
- Assessment of the adherence to Actuarial Standards of Practice (ASOPs) published by the Actuarial Standards Board.

A full replication of the June 30, 2013 actuarial valuation results was not covered under the scope of this engagement; rather the actuarial audit was a review of the key components in the valuation process.

Summary of Findings and Recommendations

Based on our review of the census data, experience study documents, liability calculations for a sample members, and the actuarial valuation reports, we believe the work regarding the VRS benefit programs is reasonable, is based on appropriate assumptions, and the reports generally comply with the Actuarial Standards of Practice.

Below is a summary of our findings and recommendations based on our review of certain actuarial audit tasks.

- Based on our general review, we believe the actuarial assumptions used in the valuation for all the plans, including the Other Postemployment Benefit (OPEB) programs, are reasonable. Please refer to Section III for details regarding our review of the actuarial assumptions.

- The actuarial cost method and the asset valuation method are reasonable for the valuation of the benefit plans. The entry age normal cost method and the 5-year asset smoothing method are appropriate and key components to satisfying VRS's financing objectives. These are also the most common cost and asset smoothing methods used in the valuation of public sector retirement programs. CMC's application of the entry age normal cost method is reasonable. However, we have provided a recommendation of, what we believe to be, a more appropriate application of the actuarial cost method for calculating the present value of future salary and developing the plan's normal cost rate for CMC to consider when performing the next actuarial valuation for VRS. Please refer to Section IV for details regarding our review of actuarial methods and funding policy.

- Based on our review of the individual test lives, the liability determination of active participants was, in general, reasonably determined. However, Section V includes a series of recommended changes for CMC to incorporate when performing the 2014 actuarial valuation.

  We have also replicated the calculation of the employer contribution rates and believe they are reasonable. We have also provided a few recommendations for CMC to consider in the calculation of the amortization cost when performing the next actuarial valuation to better reflect the timing of the contributions received by the plan and the known contribution rates.

  Please refer to Section V for details regarding our opinions pertaining to this actuarial audit task.

- We have reviewed the contents of the actuarial valuation reports for all the benefit plans, including valuation reports provided to a select number of local governments, and find them complete and in compliance with the Actuarial Standards of Practice. The gain/loss analysis disclosed in the valuation report for the VRS State Plans is detailed and useful in explaining the change in the unfunded actuarial accrued liability.

  CMC provided VRS two reports disclosing the results of the experience study. One report disclosed the analysis and recommended assumptions for the VRS State Plans. The other report documents their analysis for the local government plans. Both reports have a similar format and are used for the dual purpose of documenting the experience analysis and presenting the results to the Board. We recommend CMC prepare one report that provides detail and discussion of their analysis and recommendations for all the assumptions and a separate presentation for communicating a summary of the experience study to the Board. Together, they would improve the documentation of all the recommended assumptions, better comply with the Actuarial Standards of Practice, and improve the communication of this information to the Board.

  Please refer to Section VI for details regarding our review and recommendations regarding the reports and documents.

  We believe that an actuarial audit should not focus on finding differences in actuarial processes and procedures utilized by the consulting actuary and the auditing actuary. Rather, to identify and suggest improvements to the process and procedures utilized by the VRS's actuary. In performing this audit, we attempted to limit our discussions regarding opinion differences and focus our attention on the accuracy of the calculations of the liability and costs, completeness and reliability

of reporting, and compliance with the actuarial standards of practice that apply to the work performed by VRS's retained actuary.

The following section provides a summary of our recommendations to improve the current valuation process utilized by CMC, VRS's actuary. Throughout the report we use the terms recommendations and suggestions. The items that we note as "recommendations" throughout this report relate to items that we believe are important to incorporate in the next actuarial valuation. The items we note as "suggestions" relate to things that are less material, but would still improve the valuation process.

Summary of Recommendations

The summary of our recommendations resulting from our review are in order of importance and are summarized below. We don't consider these recommendations are a result of material deficiencies, but are intended to improve the quality of the next actuarial valuation.

- The experience study report should disclose more detail and documentation regarding the analysis of the assumptions. The report should also disclose the analysis for all plans, including those for SPORS, VaLORS, and JRS. For the next experience study, we recommend CMC prepare a comprehensive experience study report that documents all the analysis and assumptions for all the benefit plans, and a separate presentation to summarize key findings for presenting the results to the Board.

- There are several changes we recommend CMC incorporate in their actuarial model pertaining to the application of actuarial assumptions and the calculation projected benefits for particular member groups in the retirement benefit plans. For instance, there were sample test lives we reviewed of state employees and teachers who are earning Plan 2 benefits and are being valued using Plan 1 assumptions. Also, there are some inconsistencies in the application of plan provisions and stated assumptions for some active members participating in SPORS.

- To be consistent with the valuation assumption that members are assumed to decrement (e.g. terminate or retire) at the beginning of the year, the model should not include a full year of pay in the year of the member's assumed decrement.

- Update the methodology for calculating the amortization portion of the contribution rate to better simulate the plan's actual experience of receiving contributions throughout the year.

The rest of this report includes a more detailed discussion of our review of the methods assumptions, data, calculations, and communications that were in CMC's actuarial work for VRS. To better identify our suggestions, we have highlighted each of our suggestions and recommendations throughout this report in bold font.

SECTION II

GENERAL ACTUARIAL AUDIT PROCEDURE

General Actuarial Audit Procedure

At the commencement of this engagement, GRS requested the information necessary to thoroughly review the work product of the retained actuary. Specifically, GRS received and reviewed the following items:

- Actuarial valuation reports as of June 30, 2013, for the VRS State Plans (i.e. State Employees, Teachers, SPORS, ValORS, JRS), and valuation reports prepared for select local governments;
- Actuarial valuation reports as of June 30, 2013, for the Group Life Insurance Plan, Health Insurance Credit Plan, and the Virginia Sickness and Disability Program;
- The experience study for the observation period ending June 30, 2012;
- A full set of census data for plan participants and beneficiaries as of June 30, 2013 used by the retained actuary for the actuarial valuation;
- The VRS defined benefit plan investment policy statement, as updated June 20, 2013;
- The VRS funding policy statement for the defined benefit plans, effective with the June 30, 2013 valuation; and
- Detailed calculations from the retained actuary for a sampling of 65 plan members who are were not receiving benefits as of June 30, 2013, and 36 plan members who were receiving benefits as of June 30, 2013.

The valuation reports we reviewed for the political subdivisions were based on a list of employers provided by JLARC and include:

- City of Chesapeake
- City of Lynchburg
- City of Virginia Beach
- Roanoke County
- Town of Haysi
- Town of Stephens City

In performing our review, we:

- Reviewed the VRS benefit handbooks and applicable statutes to understand the benefits provided by VRS,
- Reviewed the appropriateness of the actuarial assumptions,
- Reviewed the actuarial valuation reports, and
- Reviewed the detailed liability calculation of the sample lives to ensure that the calculations were consistent with the stated plan provisions, actuarial methods and assumptions.

The audit findings, which follow, are based on our review of this information and subsequent correspondence with the retained actuary for clarification and further documentation.

SECTION III

ACTUARIAL ASSUMPTIONS

Actuarial Assumptions

Overview

The set of actuarial assumptions is one of the foundations upon which an actuarial valuation is based. An actuarial valuation is, essentially, a statistical projection of the amount and timing of future benefits to be paid under the retirement plan. In any statistical projection, assumptions as to future events will drive the process. Actuarial valuations are no exception.

An experience study report is a record of the actuary's review and assessment of the actuarial assumptions and, as such, is a very important document. It needs to stand alone and contain all of the information regarding the development of the recommended assumptions. The retained actuary provided the VRS two documents with an analysis of the experience of the system from July 1, 2008 to June 30, 2012. One document discloses their analysis of the economic and demographic assumptions used for the valuation of the State Employees, Teachers, and OPEB plans. The second document discloses the results of their analysis of the assumptions used in the valuation of the local government plans. CMC also provided GRS a third document disclosing their analysis of SPORS and VaLORS. We have reviewed this information in detail in order to assess the reasonableness of the assumptions used in the actuarial valuation.

It is important to understand the nature of the retirement plan and the plan sponsor when assessing the reasonableness of the actuarial assumptions. No projection of future events can be labeled as "correct" or "incorrect". Setting actuarial assumption involves professional judgment that is both and art and a science. Within the Actuarial Standards of Practice for identifying and evaluating appropriate assumptions, each assumption has a "range of reasonableness". We evaluated each individual assumption as follows:

- Whether or not they fall within the range of reasonableness, and
- If they fall within that range, whether they are reasonable for the actuarial valuation of the plan.

Actuarial assumptions for the valuation of retirement plans are of two types: (i) economic assumptions, and (ii) demographic assumptions. We have assessed the reasonableness of both types as part of this actuarial audit.

Economic Assumptions

General

These assumptions simulate the impact of economic forces on the amounts and values of future benefits. Key economic assumptions include inflation, investment return, and rates of future salary increases.

Inflation

Inflation refers to mean price inflation as measured by annual increases in the Consumer Price Index (CPI). This assumption underlies and is the building block for most of the other economic assumptions, including the investment return assumption and assumed rate of salary increases.

Also, because VRS provides retirees a cost of living adjustment (COLA) that is based on the annual increase in CPI, future increases in CPI have a direct result on the valuation and future benefit payments.

The current inflation assumption is 2.50%.

Actual historical increases in CPI have averaged about 2.50% over the last 20 years. Average increases in inflation for the 20 years prior to the year 1990 have averaged much higher than the current assumption. However, since this is a forward-looking assumption, historical experience is not the best measure for predicting future increases in inflation. Rather, there are several sources that provide forward-looking inflation expectations. These sources include the bond market, investment consulting firms, surveys of professional forecasters conducted by the Philadelphia Federal Reserve, and assumptions used by the Chief Actuary at the Social Security Administration for projecting the long-term cost of benefits provided by the Social Security Administration.

These sources have similar inflation expectations. Namely, inflation during the next five years is expected to be lower than long-term inflation expectations. Also, each of these sources have consistent projections for their long-term inflation expectations, and project inflation for the next 10 to 20 years to range from 2.40% to 2.80% annually.

Because VRS provides a COLA that is based on annual increases in CPI, there is a risk of setting the inflation assumption too low and that plan benefits and cost will increase faster than expected if actual inflation is higher than assumed. However, this risk has been mitigated with the COLA design. Specifically, Plan 1 retirees receive a COLA equal to the first 3% increase in CPI, plus 50% of any additional increase (up to an additional 4% of the increase in CPI), for a maximum annual COLA of 5%. Retirees in Plan 2 receive a slightly smaller COLA that is equal to the first 2% increase in CPI plus 50% of any additional increase (up to an additional 2% of the increase in CPI), for a maximum annual COLA of 3%.

Taking this information into consideration, including the COLA design, we believe the current 2.50% price inflation assumption to be reasonable.

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 the valuation of benefit plans maintained by VRS this assumption should represent the long-term rate of return expected on the plan assets, considering the asset allocation, and the rate of return on each asset class. If the valuation does not include explicit assumptions for administrative and investment expenses, then the investment return assumption should be net of these fees. The experience study documents that the current assumption is comprised of a 2.50% price inflation, plus a 4.50% real net rate of return, for an assumed nominal rate of return of 7.00% that is net of administrative and investment expenses.

CMC assumes future administrative expenses are 0.06% of assets, which is developed by analyzing the ratio of the prior year's administrative expenses to market value of assets. This is a common method for developing an administrative expense assumption and we believe the administrative expense assumption is reasonable.

The experience study document provided the forward-looking rates of return for the entire portfolio. However, the document did not include any information regarding VRS's investment policy, such as a target asset allocation, or the source of the forward-looking return assumption used in the analysis.

Therefore, we have assessed the reasonableness of this assumption using VRS's current investment policy mapped to forward-looking capital market assumptions developed by several nationally recognized investment consulting firms.

Our analysis was based on the target asset allocation in VRS's investment policy documented on page 96 of the June 30, 2013 Comprehensive Financial Annual Report. VRS's forward looking investment policy is:

Asset Class	Target Allocation
Public Equity	42%
Credit	15%
Fixed Income	15%
Real Assets	15%
Private Equity	12%
Cash	1%
Total	100%

Source: 2013 VRS CAFR

We observed that VRS's actual asset allocation as of June 30, 2013 is slightly different than their newly adopted target asset allocation. This is not surprising as it can take a few years to select investment managers and allocate funds to the real and private equity asset classes. However, since the investment return assumption is a long-term assumption, we believe it is appropriate to perform the return analysis using the target asset allocation established by the updated investment policy.

Because GRS does not develop or maintain its own capital market assumptions, we reviewed assumptions developed and published by the following investment consulting firms:

- BNY Mellon
- Hewitt
- JP Morgan
- Mercer
- RV Kuhns
- Towers Watson

These investment consulting firms issue reports that describe their capital market assumptions, which include their estimates of expected returns, volatility, and correlations. While these assumptions are developed based upon historical analysis, many of these firms also incorporate forward looking adjustments to better reflect near-term expectations.

Given VRS's target asset allocation and the investment firms' capital market assumptions for 2013, the development of the average nominal return, net of investment and administration fees paid from the trust, is provided in the table below:

Table 1. Development of the One-Year Expected Return Without Regard to the Volatility Drag on Asset Accumulation

Investment Consultant	Investment Consultant Expected Nominal Return	Investment Consultant Inflation Assumption	Expected Real Return (2)–(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)	Estimated Administrative Fees Paid from the Trust	Expected Nominal Return Net of Expenses (6)-(7)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	6.89%	2.50%	4.39%	2.50%	6.89%	0.06%	6.83%
2	6.98%	2.40%	4.58%	2.50%	7.08%	0.06%	7.02%
3	7.23%	2.50%	4.73%	2.50%	7.23%	0.06%	7.17%
4	7.56%	2.51%	5.05%	2.50%	7.55%	0.06%	7.49%
5	7.87%	2.30%	5.57%	2.50%	8.07%	0.06%	8.01%
6	8.31%	2.50%	5.81%	2.50%	8.31%	0.06%	8.25%
Average	7.47%	2.45%	5.02%	2.50%	7.52%	0.06%	7.46%

Source: GRS Analysis

We determined, for each firm, the expected nominal return rate based on VRS's target allocation and then subtracted that investment consulting firm's expected inflation to arrive at their expected real return in column (4). Then we added back VRS's 2.50% inflation assumption and subtracted 0.06% for the administrative expense assumption to arrive at an expected nominal return, net of expenses. As the table shows, the resulting average arithmetic one-year return of the six firms is 7.46%. However, the annual returns will vary, often significantly, from year to year. Therefore, it is imperative the analysis reflects the volatility drag on the accumulation of assets over time.

Since future returns can vary considerably, it is relevant to quantify the effect of the anticipated volatility of the investment returns on the accumulation of assets and understand the range of long-term net return that could be expected to be produced by the investment portfolio. Therefore, Table 2 on the following page provides the 25th, 50th, and 75th percentiles of the 20-year geometric average of the expected nominal return, net of investment fees paid from the trust, as well as the probability of exceeding the current 7.00% assumption.

In other words, the 50th percentile represents the long-term expected return, where half of the cumulative return scenarios are expected to be less than this annualized return amount and half of the cumulative return scenarios are expected to exceed this amount.

Table 2. Development of the Distribution of Expected Investment Returns Reflecting the Volatility Drag on Asset Accumulation

Investment Consultant	Distribution of 20-Year Average Geometric Net Nominal Return			Probability of exceeding
	25th	50th	75th	7.00%*
(1)	(2)	(3)	(4)	(5)
1	4.40%	6.16%	7.95%	37.6%
2	5.03%	6.53%	8.06%	41.8%
3	4.66%	6.47%	8.30%	42.2%
4	5.21%	6.89%	8.59%	48.2%
5	5.41%	7.27%	9.16%	53.9%
6	5.49%	7.44%	9.42%	56.0%
Average	**5.04%**	**6.79%**	**8.58%**	**46.6%**

* VRS's current return assumption net of expenses is 7.00%.
Source: GRS Analysis

As the analysis shows, there is a 50% likelihood that the 20-year average net nominal return will be between 5.04% and 8.58%. Under the current Actuarial Standards of Practice No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, this is the best estimate range for a reasonable investment return assumption. Further, while the table above documents that the average probability of exceeding the current 7.00% investment return assumption is 46.6%, there is nothing certain in these return expectations. Therefore, for business making decisions, it is reasonable to conclude that the probability of meeting the 7.00% investment return assumption is reasonably close to 50%.

The current investment return assumption falls within our best-estimate range and we believe that the current 7.00% assumption is reasonable for this purpose.

In September 2013, the Actuarial Standard Board adopted changes to ASOP No. 27 which significantly reduced the reasonable range for an acceptable investment return assumption. The effective date for this new standard is for measurement dates on or after September 30, 2014. While this new standard does not apply to the actuarial valuation that is being audited, we believe the current return assumption would also be reasonable under this new standard.

Wage Inflation and Payroll Growth Assumptions

The wage inflation assumption is 3.50% for all employee groups and was decreased 0.25% for state employees, teachers, and political subdivision employees who are not receiving hazardous duty benefits. The 3.50% wage inflation assumption is comprised of 2.50% for price inflation and 1.00% for assumed economic productivity increases.

GRS believes the current wage inflation assumption of 3.50% is reasonable for all employee groups.

We believe the assumed rate of total payroll growth of 3.00% that is used to amortize the unfunded actuarial accrued liability is also reasonable.

Earnings Progression

Generally, assumed rates of pay increase are constructed as the total of two main components:

- Wage Inflation – currently 3.50% (comprised of 2.50% for price inflation and 1.00% of real wage increases)
- Merit, Promotion, and Longevity – This portion of the salary increase assumption reflects components such as promotional increases as well as "step" increases and longevity pay. This portion of the assumption is not related to inflation.

In the context of a typical employer pay scale, pay levels are set for various employment grades, or "steps". In general, this pay scale is adjusted as follows:

- The inflation and economic productivity assumptions, collectively referred to as wage inflation, reflect the overall increases of the entire pay scale, and
- The Merit, Promotion, and Longevity increase assumption reflects movement of members through the pay scale.

The experience study reports provide documentation of the salary increase experience for state employees, teachers, and Law Enforcement Officer (LEO) and Non-LEO employees of the political subdivisions. Based on the information provided, actual salary increases for all employee groups were significantly lower than the assumed rate of increase during the observation period. However, actual rates of increase in the price inflation and real wage growth were also less than assumed. CMC kept the step-rate assumption for all the employee groups unchanged from the prior experience study.

The rates of salary increase due to step-rate merit and promotional assumption appear to continue to reasonably follow the actual experience for the employee groups documented in the report.

Demographic Assumptions

These assumptions simulate the movement of participants into and out of plan coverage and between status types. ASOP No. 35, Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations, provides guidance to actuaries in selecting (including giving advice on selecting) demographic and other noneconomic assumptions for measuring pension obligations.

Retirement

The retirement assumption is used to model the likelihood that a member retires from employment and immediately commences their VRS retirement benefit. CMC uses retirement assumptions based on age, gender, employee type, and whether the employee is eligible for a reduced or unreduced retirement benefit. Utilizing different retirement assumptions like this is common for performing actuarial valuations for large retirement systems.

The number of members who actually retired during the observation period was fewer than expected. VRS's retirement experience during the observation period is similar to what we have observed with other statewide retirement systems. Generally, people have been working to later ages before retiring. This is almost certainly driven, in part, by perceived uncertainties in the economy and financial markets.

As a result, CMC recommended slight adjustments to the retirement assumption at various ages for state employees, teachers, employees of political subdivisions, and members in SPORS and VaLORS. In particular, retirement rates were reduced for state employees, teachers, and non-LEO employees of political subdivisions with less than 30-years of service at ages 65 through 69. The retirement rates for male teachers with 30 or more years of service were increased after age 65 and the rates of retirement for female teachers with 30 or more years of service was adjusted to be 35% per year for ages on and after age 62.

Retirement rates were also adjusted for female LEOs with 25 or more years of service who are employees of one of the non-10 largest political subdivisions. The recommended retirement rates were generally increased from ages 50 to 61 to better match actual experience, which suggests that CMC gave the actual experience during the observation period partial credibility.

We believe the retirement assumptions documented in the experience study are reasonable. GRS was not able to compare the actual experience to the recommended assumptions for the Judicial Retirement System because the analysis for that system was not provided, but believe the recommended assumptions are not unreasonable.

Withdrawal

Not all active members of VRS continue employment with a participating employer of VRS during their entire career through retirement. The purpose of the withdrawal assumption is to model the likelihood that an active member will continue to work for the employer to their retirement. Employee turnover behavior can be influenced by many factors, including external effects such as the economy. Therefore, it is important for the actuary to consider these factors when determining how much credibility to assign the experience when adjusting the current assumption to better model expected future experience.

State Employees:
Fewer state employees actually terminated employment than expected during the observation period, especially with regard to members with less than 10 years of service. As a result, CMC decreased the withdrawal assumption for state employees (male and female) with less than 10-years of service.

Teachers:
There were also fewer teachers that actually terminated employment compared to expected, although the difference between the expected and actual experience was less significant than differences for state employees. In response to this experience, CMC slightly reduced the rates of termination for female teachers between 3 and 9 years of service.

Local Government Employers (LEOs and Non-LEOs):
There were relatively minor differences between actual and expected experience for Non-LEOs and there were no recommended changes to the termination rates. CMC slightly increased the rates of termination for LEOs employed by one of the non-ten largest local employers.

SPORS and VaLORS
CMC reduced the rates of termination for females with less than 10 years of service in SPORS and slightly increased the rates of termination for females with more than 10 years of service in VaLORS.

We believe the updated withdrawal assumptions documented in the experience study reports are reasonable.

Disability Incidence

The disability incidence assumption models the number of members who will become disabled each year. Disabilities can occur to service related or non-service related incidences. Compared to other changes in employment status, such as termination and retirement, disability behavior is not significantly influenced by changes in the economy.

Actual incidences of disability were consistently less than expected during the observation period for state employees, teachers, and employees of local governments. CMC slightly decreased the rates of disability for male state employees and teachers (male and female). CMC also increased the rates of disability at various ages for members in VaLORS. This assumption was left unchanged for female state employees, female LEOs that are employed by one of the ten largest local government employers, members in SPORS, and judges.

We believe the disability assumptions documented in the experience documents are reasonable.

Mortality

Post-retirement mortality

The post-retirement mortality assumption is one of the most important demographic assumptions used in the valuation of a pension plan because it models how long benefit payments are expected to be paid to retirees. The longer retirees live, the larger VRS's liability, thus requiring more contributions to fund VRS.

Because of potential differences in expected mortality experience, it is common to use different mortality assumptions for disabled and non-disabled retirees. It is also common to use gender distinct assumptions and different assumptions for certain membership groups that are expected to have different mortality patterns, such as teachers.

The mortality assumptions used in the actuarial valuation of the VRS plans (before and after the assumption changes) are based on standard mortality tables published by the Society of Actuaries, adjusted using various techniques to provide a better fit to the expected mortality for the retirees

covered by the benefit plan. CMC recommended a change in base mortality assumption from the 1994 Group Annuity Mortality Table (94 GAM) to the RP-2000 Mortality Tables. The RP-2000 mortality tables are commonly used by statewide retirement systems to model retirement mortality experience. CMC also uses techniques to adjust these based mortality tables to better reflect the anticipated mortality experience for the covered group. These adjustment techniques, such as projecting mortality improvement with Scale AA to the year 2020 and the application of age set backs and set forwards are also common actuarial practices. To provide a straightforward idea of the change in mortality assumption, we have also included a table that compares the life expectancy for an age 65 retiree under the current and recommended assumptions.

Below is a table comparing the life expectancy for an age 65 retiree under the prior and current mortality assumption:

	Life Expectancy for an Age 65 Retiree (Years)		
Employee Group	Prior Assumption	Current Assumption	Change in Life Expectancy
State employees			
- Male	18.6	19.2	+0.6
- Female	22.1	21.8	-0.3
Teachers			
- Male	20.2	20.8	+0.6
- Female	23.8	23.6	-0.2
SPORS & ValORS			
- Male	21.0	19.2	-1.8
- Female	24.7	21.8	-2.9
Judicial			
- Male	18.6	19.2	+0.6
- Female	22.1	21.8	-0.3
Loc Gov Non LEO			
- Male	18.6	18.3	-0.3
- Female	22.1	21.0	-1.1
Loc Gov LEO			
- Male	21.0	18.3	-2.7
- Female	24.7	21.0	-3.7

Source: GRS Analysis.

Generally, the updated mortality assumption is to keep pace with an established trend in longer life expectancy. While the new mortality assumptions for females and members in public safety positions (i.e. SPORS, VaLORS, and LEOs) have a lower life expectancy under the new mortality assumption, the updated assumptions appear to continue to have some margin, or room for longer life expectancy, compared to the experience during the observation period.

We believe the post-retirement mortality assumptions are within a reasonable range for each employee group. While the updated assumptions appear to have some margin for future improvement in mortality, we do not consider the margin to be substantial. As a result, it is possible the mortality assumption will need to be updated during the next experience study as the trend in future improvement in mortality continues.

Pre-retirement mortality

CMC also recommended similar updates to the mortality assumption for active members. This is a relatively insignificant assumption (compared to the post-retirement mortality assumption), in part, due to the low probability of occurrences.

The rates of death in the updated assumptions are not significantly different than the prior mortality assumption. We believe the updated pre-retirement mortality assumption is reasonable for each employee group.

Disability mortality

The mortality assumption was updated to a RP-2000 mortality assumption that designed to be used for modeling mortality rates for disabled retirees. The rates of death of the updated assumptions are not significantly different than the prior mortality assumption. The updated mortality assumption is reasonable for each employee group.

Assumptions Specific for OPEB Plans

Because there is significant overlap in the employee group covered by the pension and OPEB plans (i.e. Health Insurance Credit (HIC) Program, Group Life Insurance Program, and the Virginia Sickness and Disability Program (VSDP)), the valuation of the OPEB plans utilize many of the same assumptions used in the valuation of the pension plan, including rates of termination, retirement, and mortality.

The valuation of the HIC Program includes assumptions regarding participation rates and benefit utilization.

CMC recommended a slight decrease in the participation rates (i.e. the percentage of future retired members that elect HIC coverage) for teachers and members in SPORS and VaLORS. They also recommended a change in the participation rate for members who commence HIC coverage from a deferred withdrawal status. Similar changes were also recommended to the valuation of the HIC program for the local government employers. The updated assumptions appear reasonable.

The experience study document for large systems did not include a comparison of the proposed assumption to the plan's actual experience, so we are unable to provide an opinion with certainty that the recommended assumptions are reasonable. However, they do not appear unreasonable.

CMC also conducted an extensive review of the assumptions that were specific to the valuation of the VSDP. Some of these updates appear to be in response to suggestions provided in the last actuarial audit. The experience study document provided sufficient detail of the actual experience so stakeholders can understand the relation of the plan's experience to the proposed assumptions. We believe each of the updates to the assumptions that are unique to the valuation of the VSDP is reasonable.

Other Assumptions

The actuarial valuation also utilizes several other assumptions, some of which include: (1) percentage of active members who are married, (2) assumed difference in age of the member and spouse, (3) the percent of terminating members electing a refund or deferred annuity, and (4) benefit commencement age for members with a deferred benefit.

Each of these other assumptions is reasonable.

Actuarial Experience Review Report

The experience study documents (one for the large systems, and another for the local government plans) are effective at illustrating the difference between the expected and actual experience and the proposed assumption adjustments, especially with regard to the demographic assumptions. However, the documents provided to VRS were incomplete in that the reports did not include documentation of the analysis and assumption changes for SPORS, VaLORS and JRS (the documents did include the cost impact of the assumption changes for these plans).

To improve the overall completeness of the next actuarial experience review report, we recommend CMC include documentation on their review of all the assumptions, including those used for SPORS, VaLORS, and JRS. Also, given the importance of the investment return assumption, we suggest they provide more information and discussion regarding the investigation process. Specifically, we recommend that CMC disclose the asset allocation used in their review as well as the source of the capital market assumptions used in the analysis.

Also, it can be a challenge to effectively communicate this information to the Board of a retirement system that maintains several different benefit plans, like VRS. **To improve this process, we recommend CMC prepare a comprehensive report that includes the discussion and detailed information for all of the assumptions reviewed for each benefit plan and a separate presentation to communicate to the Board a summary of the findings documented in the experience study report.** The stand-alone experience study report would provide more detail of the processes and judgment used in the development of the recommended assumptions, thus better complying with the Actuarial Standards of Practice. A separate presentation could then focus on communicating the main points of the experience study analysis to the Board.

SECTION IV

ACTUARIAL METHODS AND FUNDING POLICY

Actuarial Methods and Funding Policy

Actuarial Cost Methods

The ultimate cost of VRS is equal to the benefits paid plus the expenses related to operating the plans. This cost is funded through contributions to VRS plus the investment return on accumulated contributions which are not immediately needed to pay benefits or expenses. The projected level and timing of the contributions needed to fund the ultimate cost are determined by the actuarial assumptions, plan provisions, participant characteristics, investment experience, and the actuarial cost method.

An actuarial cost method is a mathematical process for allocating the dollar amount of the total present value of plan benefits (TPV) between future normal costs and actuarial accrued liability (AAL). The retained actuary uses the Entry Age Normal actuarial cost method, characterized by:

(1) Normal Cost – the level percent of payroll contribution, paid from each participant's date of hire to date of retirement, which will accumulate enough assets at retirement to fund the participant's projected benefits from retirement to death.

(2) Actuarial Accrued Liability – the assets which would have accumulated to date had contributions been made at the level of the normal cost since the date of the first benefit accrual, if all actuarial assumptions had been exactly realized, and there had been no benefit changes.

The Entry Age Normal actuarial cost method is the most prevalent funding method in the public sector. It is appropriate for the public sector because it produces costs that remain stable as a percentage of payroll over time, resulting in intergenerational equity for taxpayers. The Public Fund Survey published in 2013, sponsored by the National Association of State Retirement Administrators and the National Council on Teacher Retirement, surveyed 126 retirement systems (mostly statewide). Almost 80% of the plans reported using the Entry Age Normal actuarial cost method. Therefore, the retained actuary's stated methods for allocating the liabilities of VRS are certainly in line with national trends.

We have reviewed the retained actuary's application of the Entry Age Normal actuarial cost method and we believe that the method is reasonable.

However, we believe that there is a more appropriate application of the actuarial cost method for CMC to utilize when performing the next actuarial valuation for VRS. There are benefits to modifying the valuation software's calculation of the present value of future salary, which primarily impacts the normal cost rate, but it also has an impact on the allocation of TPV between future normal costs and AAL. Based on the sample test lives we reviewed, the decrements (i.e. termination, retirement, disability, and death) are assumed to occur in the beginning of the year. However, for purposes of projecting the member's future pay, the actuarial model is assuming members receive a full year pay in the year the member is expected to decrement. **It would be more consistent to exclude the projected pay in the year of decrement in calculating the present value of future salary.** This adjustment does not impact the calculation of the present value of future benefits, but it

will reduce the projected payroll of the member (i.e. the present value of future salary). Since the future payroll is reduced, the normal cost rate will increase to maintain the same amount monies to fund the member's retirement benefit. Since we did not perform a full replication audit, we are unable to quantify the impact of this modification on the contribution rates with certainty.

Asset Valuation Method

The market value of assets can experience significant short-term swings, which can cause large fluctuations in the development of the actuarially determined contributions required to fund retirement systems. Thus, many systems use an asset valuation method which dampens these short-term volatilities to achieve more stability in the employer contribution. A good asset valuation method places values on a retirement plan's assets which are related to the current market value, but which will also produce a smoother pattern of costs.

ASOP No. 44, Selection and Use of Asset Valuation Methods for Pension Valuations, provides a framework for the determination of the actuarial value of assets (AVA), emphasizing that the method should: (1) bear a reasonable relationship to the market value of assets (MVA), (2) recognize investment gains and losses over an appropriate time period, and (3) avoid systematic bias that would overstate or understate the AVA in comparison to MVA.

The asset valuation method used by the systems in VRS, including the OPEB plans, is a five-year smoothing method that recognizes the difference between the actual return (net of investment and administrative expenses) and the expected return based on the market asset value for each fiscal year at the rate of 20% each year, with the entire difference being fully recognized in the fifth year after the investment gain or loss has occurred. This method is the most common asset valuation method used by other large public employee retirement systems and we believe it is appropriate to use for all the plans in VRS.

Also VRS utilizes a 20% corridor around the MVA that restricts the degree which the AVA can vary from the MVA. The use of a corridor is fairly common and used for balancing smoothness and deviation from the MVA. The current use of a corridor is also reasonable.

We also verified the calculation of the actuarial value of assets as of June 30, 2013 for each benefit plan.

Funding Policy

The Board adopted a new funding policy effective with the June 30, 2013 actuarial valuation. The decision to review and revise their funding policy is in part, because of recent accounting changes enacted by the Governmental Accounting Standards Board which separates the accounting cost and funding cost.

The Funding Policy addresses the following general policy objectives:

- Ensure pension funding plans are based on actuarially determined contributions;
- Build funding discipline into the policy to ensure promised benefits can be paid;
- Maintain intergenerational equity so the cost of employee benefits is financed by the generation of taxpayers who receives services;
- Make employer costs a consistent percentage of payroll; and
- Require clear reporting to show how and when pension plans will be adequately funded.

VRS operates the same target funding level for all the benefit plans with the intent of ultimately attaining a 100% funded ratio.

In summary, the Board has elected to calculate the actuarially determined contribution using the Entry Age Normal cost method (as a level percentage of payroll), a five-year asset smoothing method, and amortization rates that, with exception of recognition of the deferred contributions from the 2010-2012 biennium, are determined as a level percentage of payroll. The deferred contributions of the 2010-2012 biennium will be amortized over a closed, 10-year period beginning June 30, 2011. The unfunded liability as of June 30, 2013 that is not attributable to the deferred contributions of the 2010-2012 biennium will be amortized over a closed 30-year period beginning June 30, 2013. All new sources of unfunded liability incurred in future years will be explicitly amortized over closed 20-year periods.

Based on the current interest rate and payroll growth assumptions, the outstanding balance of each amortization base will decrease as long as the amortization period remains below approximately 22 years. Therefore, the unrecognized portion of the initial outstanding balance of the unfunded liability as of June 30, 2013, will increase through June 30, 2021, before the balance begins to decline. The outstanding balances of all new amortization bases will decrease with each subsequent year.

If the participating employers of VRS, including the State, adhere to this funding policy, then we expect the funded ratio to gradually improve and eventually attain a 100% funded ratio. We believe that the Board's new funding policy is an appropriate balance of cost stability, and maintaining intergenerational equity. This funding policy is also consistent with the principles and objectives recommended by the Government Finance Officers Association (GFOA) in a report they issued in 2013 regarding funding policies for defined benefit plans, as well as the Actuarial Funding Policies for Public Pension and OPEB Plans issued by the Conference of Consulting Actuaries Public Plans Committee in February 2014.

CMC also recommended to VRS an alternative funding approach for certain political subdivision plans with insolvency risk, the risk of depleting assets before all benefit obligations have been satisfied.

Generally, these are plans with relatively low funded ratios or have high external cash flows (i.e. benefit payments significantly exceed contributions). The approach to identifying the additional funding contribution for the employer is by projecting, on a closed group basis, the additional contributions necessary to fund the projected benefits for current active and retired members. The projected assets and funded ratio may continue to decrease, and even approach $0, but is not intended to actually reach $0.

Of course, there are alternative accelerated funding strategies that would achieve similar outcomes; however, in our opinion, the additional funding contribution that VRS will require these employers to contribute should achieve the desired outcome. Also, since this review is performed each valuation, the additional funding contribution will be increased or decreased to reflect the plan's experience accordingly.

SECTION V

ACTUARIAL VALUATION RESULTS

Actuarial Valuation Results

Review of Census Data

We received the member census data files as transmitted by VRS to CMC to prepare the June 30, 2013 actuarial valuation. CMC also provided us with the final data files that were ultimately used by their valuation software program to calculate the liability and cost of the plans.

We then independently applied typical procedures to the data files provided by VRS to verify that the final data files used by CMC were complete and accurate for use in the actuarial valuation. Below is a table with a summary of the results of our comparison for the VRS State Plans. In our opinion, differences in the counts shown below are minor and would not result in a material difference in the valuations results.

System/Membership	CMC	GRS	Difference	% Difference
(1)	(2)	(3)	(4)	(5)
State Employees				
- Active	75,879	75,833	44	0.06%
- Inactive Vested	11,289	11,162	127	1.13%
- Disabled	2,080	2,080	0	0.00%
- Retirees/Beneficiaries	55,658	55,638	20	0.04%
Teachers				
- Active	147,257	147,238	19	0.01%
- Inactive Vested	19,148	19,012	136	0.71%
- Disabled	N/A	N/A	N/A	N/A
- Retirees/Beneficiaries	77,699	77,685	14	0.02%
SPORS				
- Active	2,002	2,002	0	0.00%
- Inactive Vested	110	110	0	0.00%
- Disabled	11	11	0	0.00%
- Retirees/Beneficiaries	1,348	1,352	(4)	(0.30%)
VaLORS				
- Active	9,372	9,376	(4)	(0.04%)
- Inactive Vested	765	729	36	4.71%
- Disabled	546	539	7	1.28%
- Retirees/Beneficiaries	3,415	3,432	(17)	0.50%
Judicial				
- Active	381	381	0	0.00%
- Inactive Vested	6	5	1	16.67%
- Disabled	0	0	0	0.00%
- Retirees/Beneficiaries	503	503	0	0.00%

Source: GRS Analysis.

We are sure that current differences between participant counts could be reconciled by making adjustments for differences in business rules or the classification of members with incomplete or inconsistent information. The largest inconsistencies occurred with the inactive vested members. However, we consider these differences to be immaterial and do not impact the results of the actuarial valuation. For instance, the entire group of inactive vested members only accounts for 4% of the total actuarial accrued liability for the state employees and 2% of the total actuarial accrued liability for teachers.

We also reconciled the membership count for the OPEB plans (i.e. the Health Insurance Credit Program, Group Life Insurance Program, and Virginia Sickness and Disability Program) and found the number of participants used in the actuarial valuation to also be consistent with the data provided by VRS. For practical purposes, the membership data for these benefit programs is the same used for the actuarial valuation of the pension plans in VRS. The valuation of the Group Life Insurance Program includes 21,050 members who are participating in the State Optional Retirement Plan (ORP) or employed by one of the five political subdivisions who are not participating in VRS (i.e. the City of Richmond, City of Portsmouth, City of Roanoke, City of Norfolk, and Roanoke City School Board). The members included in the valuation of VSDP included those who were flagged in the census data provided by the VRS.

Review of Test Life Calculations for Accuracy

As part of its review, GRS requested sample participant calculations from the retained actuary to ensure that the actuarial valuation is calculated based on the benefit provisions specified in Title 51.1 of State Code and the valuation uses the assumptions disclosed in the experience study document and valuation report.

Generally accepted actuarial standards and practices provide actuaries with the basic mathematics and frameworks for calculating the actuarial results. When it comes to applying those actuarial standards to complex calculations, differences may exist due to individual opinion on the best way to make those complex calculations. Other differences may occur due to nuances in the valuation software programming. This may lead to differences in the calculated results, but these differences should not be material.

***Calculation of the Actuarial Liability Information for Active Members*:** At the onset of the review, we requested that the retained actuary provide sample liability calculations that show probabilities of decrement by age, estimated pay and benefits by age, and values of benefits or pay by age for each decrement in sufficient detail to verify the liability and cost calculations. The retained actuary provided all of the detail necessary to verify the calculation of the present value of benefits, pay, and other cost components for all the members.

Based on our review of the individual test lives and aspects of the actuarial valuation, the liability determination of active participants was generally reasonably determined. However, below are a series of recommended changes to incorporate when performing the 2014 actuarial valuation. Since we did not perform a full replication audit, we are unable to quantify the effect of each recommended change

on the actuarial accrued liability or the employer contribution rate. However, we have noted where we are confident such changes are immaterial. Also, we have separately communicated to CMC the specific test life references so they may review and make adjustments, accordingly.

1) The Plan 1 actuarial assumptions were being used in the valuation of certain Plan 2 test lives we reviewed for state employees and teachers. Based on our review of selected test lives, we believe that this is only occurring for members that were hired prior to July 1, 2010 but who were not vested as of January 1, 2013. For this group, we also noted that the "withdrawal (refund) benefit" was being double counted in one state employee test life and Plan 1 COLA provisions were being applied in one teacher test life. **We recommend CMC review their valuation model and employ the necessary modifications to ensure the Plan 2 assumptions and provisions are being appropriately applied to all Plan 2 members.**

   It should be noted that there are 7,521 active state employees and 13,969 active teachers included in the most recent actuarial valuation that were hired prior to July 1, 2010 but who were not vested as of January 1, 2013 (or slightly less than 10% of the active members for each employer group). Since we only reviewed select test lives, we cannot determine if the necessary modifications apply to all members in this group or only a further subset.

2) The retained actuary indicated that the pay information received in the census data to perform the valuation is approximately the rate of pay for the calendar year inclusive of the valuation date. As a result, the retained actuary makes an adjustment to the calculation of the average final compensation to align the reported pay history with the July 1 valuation date and beginning-of-year assumed decrement timing. We believe this adjustment is applied in a reasonable manner. However, a similar adjustment is not made to the pay used to calculate the Present Value of Future Salary (PVFS). In other words, the PVFS determined as of the June 30 valuation date is determined using projected calendar year pay. **We recommend CMC align the projected pay used for calculating benefits and the projected pay used for calculating the PVFS.**

3) One of the test-lives for a member in SPORS is currently age 54 and eligible to retire, but the projected retirement benefit at ages 54 through 56 were zero in the model (except for the supplement). **We recommend the actuarial model be reviewed and updated so the valuation appropriately values a retirement benefit for these cohort ages.**

4) The stated assumption for the SPORS valuation is that "terminating members are assumed to elect a return of contributions or a deferred annuity, whichever is most valuable at the time of termination." In the SPORS test lives we reviewed, the actuarial valuation only includes a liability for the deferred annuity and the comparison to the contribution balance was not conducted. **We recommend CMC align the stated assumptions with the calculation methodology.**

5) For SPORS members that are assumed to terminate prior to age 50, but have accrued 25 years of hazardous duty service at the time of termination, the valuation assumes that the commencement of this benefit is deferred to age 50 (retirement eligibility). In the test lives we reviewed, the supplement was not assumed to increase during the deferral period. **We recommend that the**

actuarial model be updated to apply the assumed rate of increase to the supplement during the deferral period. We do not anticipate that this modification will have a material impact on the actuarial valuation.

Members in SPORS receive a temporary supplement if they have 20 or more years of hazardous service at retirement. The census data provided to CMC distinguishes service with the current employer and the member's total service with VRS. The data does not separately identify a member's hazardous duty service. Approximately 30% of the members in SPORS have prior service with another VRS plan (612 of the 2,002 active members as of the valuation date). For valuation purposes, CMC assumes that an active member in SPORS has spent their entire career in a position that qualifies for hazardous duty, which includes the member's service in another VRS plan. This method is conservative, but reasonable given the relative value of the temporary supplement. This is the same process for the valuation of members in VaLORS, but is less relevant since a lower percentage of members in VaLORS have earned service in another VRS plan. We suggest CMC disclose this assumption in the valuation report.

6. **For the valuation of the Health Insurance Credit Program, we recommend the age set-back for the pre-retirement mortality assumption for female teachers be 5 years instead of 3 years.** We do not anticipate that this modification will have a material impact on the actuarial valuation.

***Calculation of the Actuarial Liability Information for Inactive and Retired Members*:** We also requested that the retained actuary provide liability amount, benefit amount, form of benefit, age of participant, and age of beneficiary (where applicable) for 45 members who are currently receiving benefits from the various benefit plans. The retained actuary provided all of the information we requested.

Based on our review, the liability determination for the annuitants was reasonable and consistent with the stated assumptions and methods. We have no suggestions regarding the current valuation process.

Other than our comment regarding the pre-retirement mortality assumption for the HIC program, we do not have any suggestions regarding the test-lives we reviewed for the OPEB plans (i.e. the HIC, LI, for VSDP).

Calculation of the Employer Contribution Rate

The employer contribution rate is comprised of two components, an employer normal cost rate and an amortization percentage. The normal cost rate is the theoretical percentage of pay that would be required to fund the member's benefits if this amount had been contributed from each member's entry date and if the fund's experience exactly followed the actuarial assumptions. The normal cost of the plan is a weighted average of cost of providing benefits to all the active members in the plan. For VRS, the normal cost will gradually decrease in future years as the number of members earning the relatively more valuable Plan 1 benefits decrease and the number of members in Plan 2 and the new Hybrid plan (for applicable employee groups) increases.

The amortization percentage is the cost of financing the difference between the actuarial accrued liability and the actuarial value of assets. The methods for determining the amortization percentage, such as the funding period, are dictated by the Board's funding policy.

The calculation of the amortization of deferred contributions (i.e. the unfunded actuarial accrued liability due to deferred contributions for the 2010-2012 biennium) for the VRS State Pension Plans are calculated as a level dollar amount over a closed period with eight years remaining as of June 30, 2013. Based on the current funding policy, the remaining outstanding unfunded actuarial accrued liability is amortized over a closed 30-year period beginning June 30, 2013.

We have replicated the process for determining the amortization percentage costs for each benefit plan, including the contribution rate for a select group of local government plans. The current method for developing the amortization rate assumes the full amortization payment will be made at the beginning of the year and earn a full year of investment earnings. In actuality, the employers make contributions uniformly throughout the year. The payroll of the covered group will gradually increase through the year due to pay increases; however, monies contributed in the latter half of the fiscal year do not have the opportunity to earn a full year of investment earnings. **As a result, we recommend CMC update the amortization methodology to better simulate the timing of the actual contribution receipts and expected investment earnings thereon.** This alternative method for calculating the amortization cost would increase the employer contribution rate for state employees and teachers by approximately 0.20% of pay.

As new amortization bases are established each subsequent year, it would be beneficial to document the original amortization base, the current outstanding balance, and current year's amortization cost. This information is already maintained for the development of the contribution rate. Documenting this information in the report will be informative to stakeholders in understanding the historical change in amortization costs.

Also, there is a one-year lag between the valuation date and the effective date of the contribution rate. For instance, the contribution rate determined by the June 30, 2013 actuarial valuation will become effective for the biennium period beginning July 1, 2014. Currently, VRS State plans are experiencing losses because the actual contributions are less than the calculated rates, resulting in larger contribution rates in future years. Part of this contribution rate difference is due to the one-year lag in the effective date of the contribution rate, and could be eliminated by reflecting this lag when determining the amortization cost. This would result in slightly higher near-term contribution rates, and slightly lower the long-term contribution rates (on a comparative basis), but they would be expected to be more level over time. We are not recommending this change, rather we only suggest that this as an issue for CMC and VRS to discuss and identify whether this modification would better fit VRS's funding objectives.

SECTION VI

CONTENT OF THE VALUATION REPORT

Content of the Valuation Report

ASOP No. 4, Measuring Pension Obligations and Determining Pension Plan Costs, ASOP No. 6, Measuring Retiree Group Benefit Obligations, provides guidance for performing actuarial valuations of OPEB plans, and ASOP No. 41, Actuarial Communications, provide guidance for measuring pension obligations and communicating the results. These Standards of Practice list specific elements to be included, either directly or by references to prior communication, in pension actuarial communications. The pertinent items that should be included in an actuarial valuation report on a pension plan should include:

- The name of the person or firm retaining the actuary and the purposes that the communication is intended to serve.
- A statement as to the effective date of the calculations, the date as of which the participant and financial information were compiled, and the sources and adequacy of such information.
- An outline of the benefits being discussed or valued and of any significant benefits not included in the actuarial determinations.
- A summary of the participant information, separated into significant categories such as active, retired, and terminated with future benefits payable. Actuaries are encouraged to include a detailed display of the characteristics of each category and reconciliation with prior reported data.
- A description of the actuarial assumptions, the cost method and the asset valuation method used. Changes in assumptions and methods from those used in previous communications should be stated and their effects noted. If the actuary expects that the long-term trend of costs resulting from the continued use of present assumptions and methods would result in a significantly increased or decreased cost basis, this should also be communicated.
- A summary of asset information and derivation of the actuarial value of assets. Actuaries are encouraged to include an asset summary by category of investment and reconciliation with prior reported assets showing total contributions, benefits, investment return, and any other reconciliation items.
- A statement of the findings, conclusions, or recommendations necessary to satisfy the purpose of the communication and a summary of the actuarial determinations upon which these are based. The communication should include applicable actuarial information regarding financial reporting. Actuaries are encouraged to include derivation of the items underlying these actuarial determinations.
- A disclosure of any facts which, if not disclosed, might reasonably be expected to lead to an incomplete understanding of the communication.

Our review of reports includes the June 30, 2013 valuation report for the Virginia Retirement System (i.e. valuation of the state employees, teachers, State police, VaLORS, and JRS). CMC prepares individual valuation reports for each of the local governments that participate in VRS. The scope of the actuarial audit included a review of actuarial valuations prepared for six local government employers. Finally, we also reviewed separate reports documenting the valuation results for each of the OPEB programs (i.e. the Group Life Insurance Program, Health Insurance Credit Program, and the Virginia Sickness and Disability Program).

The actuarial valuation reports, including the individual reports for the participating local governments, complied with the applicable Actuarial Standards of Practice and are generally complete. The primary report that communicates the results of the large systems is well organized and provides stakeholders sufficient information to understand how the contribution rates are calculated as well as a reconciliation of the change in unfunded actuarial accrued liability from the prior year's results. In particular, the gain/loss analysis provided in Section VII provides ample detail on the source of liability experience. This information can be particularly valuable in understanding the importance of each actuarial assumption and provides great insight into adjustments necessary in the next experience study.

We do have a few minor suggestions regarding the valuation reports. First, we suggest the format of the retirement and termination assumptions in the actuarial assumptions and methods section of the report be updated to more accurately reflect the assumptions used in the valuation. For example, the column header of the table disclosing the termination assumption for state employees leads a reader to believe the same termination assumption is used during the entire applicable select period. However, the rates used may vary during the select period. We suggest CMC either disclose the entire table, or clarify the column headers to indicate service period that is representative of the rates that are currently disclosed.

We suggest the assumption section be updated to disclose that the valuation does not include an adjustment for social security or worker's compensation benefits for members who incur a service related disability and receive non-VSDP disability benefits. Also, we suggest CMC disclose that for purposes of determining the eligibility for the temporary supplement provided in SPORS and VaLORS, it is assumed the member's entire service in VRS is considered to be hazardous duty service.

The reports for the OPEB plans are also well organized. **For the next valuation, we suggest CMC add a brief discussion providing some insight regarding the source(s) of the gain/loss due to liability experience**. It does not need to be as comprehensive as the gain/loss analysis disclosed in the actuarial valuation report for the VRS State Plans. Rather, a high-level explanation of the gain/loss due to liability experience would be useful to the stakeholders to better understand the change in the liability.

SECTION VII

REVIEW OF VRS'S FUNDED RATIO

Review of VRS's Funded Ratio

The service scope required by JLARC in connection with this audit includes GRS's review of and comments on VRS's funded ratio (i.e. the actuarial value of assets over the actuarial accrued liability) compared to the funded ratio of other statewide retirement systems.

A fact sheet issued by the PEW Charitable Trusts in March 2014, ranks VRS's funded ratio (based on all retirement plans combined) in roughly the 50th percentile, compared to other states. However, this is misleading because other systems use different assumptions for determining their actuarial accrued liability. Most notably, most other statewide retirement systems use a rate of return assumption that is higher than the 7.00% assumption used by VRS. If the other retirement systems calculated their liability, and corresponding funded ratio, using a 7.00% discount rate, then VRS would compare much more favorably to other statewide retirement systems.

The funding policy between a retirement system, the members, and the employer will also have a significant impact on the direction (i.e., improving or deteriorating) of the funded ratio. If contributions are made in accordance with the newly adopted funding policy, the funded ratio of the VRS should improve over time. The table below provides the schedule of funding progress for all systems on a combined basis.

Schedule of Funding Progress (All Systems Combined)

Year	Actuarial Value of Assets	Actuarial Accrued Liability	Unfunded Actuarial Accrued Liability	Funded Ratio	Covered Payroll	Unfunded Liability as a % of Payroll
(1)	(2)	(3)	(4)	(5)	(6)	(7)
2013	$ 54,027	$ 82,407	$ 28,380	65.6%	$ 15,777	180%
2012	53,069	81,207	28,138	65.4%	15,388	183%
2011	54,473	78,423	23,950	69.5%	15,226	157%
2010	54,660	75,889	21,229	72.0%	15,265	139%
2009	55,123	69,135	14,012	79.7%	15,469	91%
2008	54,441	65,174	10,733	83.5%	15,088	71%
2007	49,516	60,530	11,014	81.8%	14,330	77%
2006	44,166	55,072	10,906	80.2%	13,469	81%

$ in millions.

Source: June 30, 2013 actuarial valuation report issued by CMC and the 2013 VRS Comprehensive Annual Financial Report.

The decline in funded ratio after 2008 has been primarily attributable to: (1) the market crash during the financial crisis, (2) a decrease in the investment return assumption from 7.50% to 7.00% for calculating the June 30, 2010 valuation, and (3) contributions to the system that have been less than needed to fully finance the interest on the existing unfunded actuarial accrued liability.

The legislative reform that was enacted over the last few years, including the amendment to Section 51.1-145 of the Code, that requires the General Assembly to phase-in to the contribution rates established by the Board, should result in a gradual increase in the funded ratio for the Systems in future years and ultimately attain a 100% funded ratio. However, stakeholders can expect to see the dollar amount of the unfunded liability (column 4 in the above exhibit) continue to increase for the next several years before it will begin to decrease.

Closing Remarks

We reiterate that we believe the work regarding the VRS benefit programs is reasonable, is based on appropriate assumptions, and the reports generally comply with the Actuarial Standards of Practice. The primary purpose of our suggestions and recommendations given throughout this report is to improve the actuarial valuation process.

Again, we thank Cavanaugh Macdonald Consulting and the Virginia Retirement System for their cooperation with the audit process.

SECTION VIII

AGENCY RESPONSES

Virginia Retirement System

1200 East Main Street, P.O. Box 2500, Richmond, Virginia 23218-2500
Telephone: (804) 344-3120 Fax: (804) 786-1541

Robert P. Schultze
Director

June 27, 2014

Mr. Hal E. Greer
Director
Joint Legislative Audit and Review Commission
201 North 9th Street
General Assembly Building, Suite 1100
Richmond, Virginia 23219

Dear Hal:

Thank you for the opportunity to review the exposure draft of *Quadrennial Actuarial Audit of the Virginia Retirement System*. We also appreciated the chance to discuss the report's findings in the meeting between our respective actuaries on June 11, 2014, during which the actuaries reached substantial agreement on the report's major findings.

We are pleased that Gabriel, Roeder, Smith ("GRS") found the work of Cavanaugh MacDonald Consulting, LLC ("CMC") to be performed according to generally accepted actuarial standards and principles using reasonable assumptions and methods. While we generally concur with the report's findings and recommendations, we wanted to provide some additional clarification and context for several of GRS' findings.

Documentation - Investment Return Assumption

Though CMC did not document its source of the forward investment return assumption, VRS had just finished a thorough investigation of the investment policy, capital market assumptions, and asset allocation targets.

Following a rigorous six-month process that extended throughout the second half of 2012, the VRS Board, Investment Policy Committee ("IPC"), Investment Advisory Committee ("IAC"), and VRS' asset-liability consultant, Pension Consulting Alliance, Inc./ EFI Actuaries, Inc. ("PCA/EFI"), deliberated over revisions to the VRS investment policy. This process included a multitude of projections over a wide range of future economic scenarios that the VRS portfolio might experience.

The result was an asset allocation that would likely provide gradual improvement in the System's financial condition over time, but with a priority on protecting the System from downside risk.

We agree that the experience study report could use more documentation of the prior asset allocation process. However, we want to assure you that VRS thoroughly explored the

investment policy and capital market outlooks when setting the target allocation, which CMC ultimately used to validate the 7.0% discount rate used in its valuations.

Actuarial Cost Method

GRS suggested that CMC exclude the projected pay in the year of decrement when calculating the present value of future salaries. VRS understands that this may be consistent with how decrements are applied in the valuation, but might not be consistent with how actual pays are reported for the two largest member groups, State Employees and Teachers. The difference in employer contribution rates derived under the two different methodologies appears to be minor, but VRS will explore this alternative methodology in our next valuation cycle.

Contribution Rates

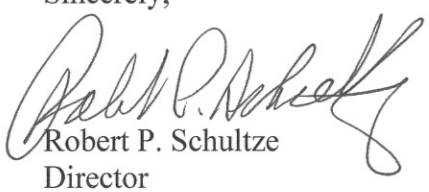
GRS recommended that the methodology used to amortize unfunded liabilities be altered to better simulate the timing of actual contributions. The change in methodology does not appear to have a large impact on employer rates, but we agree that this is something to consider during the next valuation cycle and we will consult with CMC on alternatives.

We have attached a separate letter from CMC that provides more detailed comments on each of the issues raised by the GRS report.

Conclusion

We would again like to express our appreciation to the actuaries of GRS and to the JLARC staff for the professional, courteous and cooperative manner in which this actuarial audit was conducted. VRS and its actuaries from CMC concur with the report's major findings and find the Quadrennial Audit conducted by JLARC and its actuary to be a valuable tool for validating and fine tuning VRS' valuation and rate setting processes.

Sincerely,



Robert P. Schultze
Director

Cavanaugh Macdonald
CONSULTING, LLC
The experience and dedication you deserve

June 27, 2014

Ms. Cynthia W. Comer
Policy Planning and Compliance Director
Virginia Retirement System
1200 E. Main Street
Richmond, VA 23219

RE: ACTUARIAL REVIEW RESULTS

Dear Ms. Comer:

We have received a copy of the exposure draft of the Quadrennial Actuarial Audit of the Virginia Retirement System which was produced by Gabriel Roeder Smith & Company (GRS) to detail their findings of the review of our June 30, 2013 valuations, as well as our latest experience study report.

We are, of course, pleased that GRS's overall findings conclude that our results are reasonable and performed in accordance with generally accepted actuarial principles and practices.

GRS has detailed a number of issues that will allow us to fine-tune future valuations and experience studies. We have reviewed each issue and, as appropriate, provided our comments below.

We want to thank GRS and the JLARC staff for the professional and courteous manner in which they conducted their review.

Sincerely,

Jose I. Fernandez, ASA, FCA, EA, MAAA
Principal and Consulting Actuary

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Economic assumptions

Investment Return

GRS comment: The experience study document provided the forward-looking rates of return for the entire portfolio. However, the document did not include any information regarding VRS's investment policy, such as a target asset allocation, or the source of the forward-looking return assumption used in the analysis.

Cavanaugh Macdonald comment: We would like to clarify that VRS provided us with the target asset allocation and forward-looking capital market assumptions used in our analysis. It is our understanding that the VRS Board and the VRS Investment Management Committee follow a rigorous process to develop and continuously monitor the capital market assumptions for VRS.

Demographic assumptions

Post-retirement mortality

GRS comment: While the updated assumptions appear to have some margin for future improvement in mortality, we do not consider the margin to be substantial. As a result, it is possible the mortality assumption will need to be updated during the next experience study as the trend in future improvement in mortality continues.

Cavanaugh Macdonald comment: Due to the scale of the graphs in the experience study, it is difficult to determine the margin for future mortality improvement. Generally, there is approximately a 10% margin for future improvement. We believe this is a sufficient margin between actual and expected deaths to accommodate future mortality improvements. We will review this assumption in the next experience study and recommend whether any adjustment is necessary at that time. Selecting future looking assumptions requires considerable judgment. We feel it is reasonable to provide sufficient margin at this time and make future adjustments as needed, rather than use a greater margin and risk overestimating the required contribution to the plans.

Assumptions Specific for OPEB Plans

GRS comment: The experience study document for large systems did not include a comparison of the proposed assumption to the plan's actual experience, so we are unable to provide an

opinion with certainty that the recommended assumptions are reasonable. However, they do not appear unreasonable.

Cavanaugh Macdonald comment: For brevity, the experience study document for large systems did not include an explicit comparison of experience for HIC benefit elections and rates of increase for partial HIC benefits. CMC will consider these comments for future experience studies and will work with VRS to present the information in a manner that is more detailed particularly with respect to comparisons related to plan assumptions and actual experience and thereby more useful to VRS and its Board.

Actuarial Experience Review Report

GRS comment: To improve the overall completeness of the next actuarial experience review report, we recommend CMC include documentation on their review of all the assumptions, including those used for SPORS, VaLORS, and JRS. Also, given the importance of the investment return assumption, we suggest they provide more information and discussion regarding the investigation process. Specifically, we recommend that CMC disclose the asset allocation used in their review as well as the source of the capital market assumptions used in the analysis.

To improve this process, we recommend CMC prepare a comprehensive report that includes the discussion and detailed information for all of the assumptions reviewed for each benefit plan and a separate presentation to communicate to the Board a summary of the findings documented in the experience study report.

Cavanaugh Macdonald comment: CMC will consider these comments for future experience studies and will work with VRS to present the information in a manner that is more detailed and useful to VRS and its Board.

Actuarial Methods and Funding Policy

Actuarial Cost Methods

GRS comment: It would be more consistent to exclude the projected pay in the year of decrement in calculating the present value of future salary.

Cavanaugh Macdonald comment: CMC will consider this comment for future valuations of VRS. While GRS's suggestion might appear consistent with the use of beginning of year decrements, we feel it would not be consistent with the pay data reported and used in the valuations for the two largest groups in VRS – teachers and state employees. For these employees, we understand pay increases are generally granted on August 1 for teachers and on November 1 for state employees. At the beginning of the valuation year, the valuation pay has been almost entirely paid to teachers and two-thirds received by state employees. Since as of the valuation date for the most part the pay as of the valuation data has already been paid to these groups of employees we feel it is reasonable to include it in the year of decrement. We have tested the impact of changing the method to the approach GRS has suggested and have found it is negligible.

Actuarial Valuation Results

Review of Test Life Calculations for Accuracy

GRS comment: We recommend CMC review their valuation model and employ the necessary modifications to ensure the Plan 2 assumptions and provisions are being appropriately applied to all Plan 2 members.

Cavanaugh Macdonald comment: We have reviewed our valuation model and found that the Plan 2 provisions are applied correctly to Plan 2 members. There is a sub-group of Plan 2 members (Plan 1 members not vested as of January 1, 2013) in the Teacher plan with the correct benefit provisions in the model, but with Plan 1 set of actuarial assumptions. We will modify our model to reflect the correct assumption set for this group. The impact of this change on the contribution rates for the Teacher Plan based on the June 30, 2013 actuarial valuation is negligible.

GRS comment: We recommend CMC align the projected pay used for calculating benefits and the projected pay used for calculating PVFS.

Cavanaugh Macdonald comment: CMC will consider this comment for future valuations of VRS. Please refer to our response to a similar comment by GRS under the Actuarial Cost Methods section. To reiterate, we have tested the impact of changing the method to the approach GRS has suggested and have found it is negligible.

GRS comment: We recommend the actuarial model be reviewed and updated so the valuation appropriately values a retirement benefit for these cohort ages.

Cavanaugh Macdonald comment: GRS's comment refers to a test case for a SPORS member for which benefits at ages 54 through 56 were zero in the model (except for the supplement). We agree with this finding and will update the actuarial model to value a retirement benefit at these ages for those members eligible. The cost impact of this update will be negligible.

GRS comment: We recommend CMC align the stated assumptions with the calculation methodology for terminated vested SPORS members.

Cavanaugh Macdonald comment: We agree with GRS's comment. For the next valuation of SPORS we will also consider reflecting the stated assumption in the actuarial model. That is, valuing the greater of the refund of member contributions and the value of the deferred annuity.

GRS comment: We recommend that the actuarial model be updated to apply the assumed rate of increase to the supplement during the deferral period.

Cavanaugh Macdonald comment: We agree with GRS's comment and will incorporate this change in the next valuation of SPORS. The cost impact of this change will not be material.

GRS comment: For the calculation of the Health Insurance Credit Program, we recommend the age set-back for the pre-retirement mortality assumption for female teachers be 5 years instead of 3 years.

Cavanaugh Macdonald comment: We agree with GRS's comment and will incorporate this change in the next valuation of the Health Insurance Credit Program. The cost impact of this change will be immaterial.

Calculation of the Employer Contribution Rate

GRS comment: We recommend CMC update the amortization methodology to better simulate the timing of the actual contribution receipts and expected investment earnings thereon.

Cavanaugh Macdonald comment: CMC will consider incorporating GRS's observation in the methodology for future valuations of VRS. We will discuss with VRS the implications of this change and analyze the impact on employer contribution rates. Issues to consider are the timing of pay increases which may tend to overstate the contribution rate and the application of the employer contribution rate to the payroll of future hybrid plan members not included in the data for the rate setting valuation, but with lower benefits and costs. These issues together with the interest adjustment may technically lead to an over collection of contributions. Even with this change we anticipate that the overall impact on the contribution rate should be minimal.

We will also discuss with VRS the prospect of an adjustment to reflect the one-year lag between the valuation date and the effective date of the employer contribution rate.

Content of the Valuation Report

GRS comment:

We suggest the format of the retirement and termination assumptions in the actuarial assumptions and methods section of the report be updated to more accurately reflect the assumptions used in the valuation.

We suggest the assumption section be updated to disclose that the valuation does not include an adjustment for social security or worker's compensation benefits for members who incur a service related disability and receive non-VSDP disability benefits.

Also, we suggest CMC disclose that for purposes of determining the eligibility for the temporary supplement provided in SPORS and VaLORS, it is assumed the member's entire service in VRS is considered to be hazardous duty service.

For the next valuation (OPEB), we suggest CMC add a brief discussion providing some insight regarding the source(s) of the gain/loss due to liability experience.

Cavanaugh Macdonald comment: CMC agrees with these suggestions and will incorporate them in the 2014 actuarial valuation reports.