Minnesota
Legislative Commission on
Pensions and Retirement

Review of July 1, 2021 Actuarial Valuation Reports

MSRS – SERF

PERA – GERP

TRA

SPTRFA

June 22, 2022

VAN IWAARDEN

June 22, 2022

Minnesota Legislative Commission on Pensions and Retirement
600 State Office Building
100 Rev. Dr. Martin Luther King, Jr. Blvd.
St. Paul, MN 55155

Attn: Susan Lenczewski, Executive Director

Re: Review of July 1, 2021 Actuarial Valuation Reports

Commission Members:

This report presents our review of the July 1, 2021 actuarial valuation reports for the following four pension plans:

- Minnesota State Retirement System – State Employees Retirement Fund (MSRS SERF);
- Minnesota Public Employees Retirement Association – General Employees Retirement Plan (PERA GERP);
- Minnesota Teachers Retirement Association (TRA); and
- St. Paul Teachers' Retirement Fund Association (SPTRFA).

We found the valuation reports to be reasonable, reliable, and in compliance with applicable Minnesota Statutes, LCPR Standards for Actuarial Work ("Standards"), and relevant Actuarial Standards of Practice (ASOPs). Additional results and commentary can be found in the Executive Summary section of the report and subsequent sections.

Purpose of the Study

This study was prepared at the request of the Legislative Commission on Pensions and Retirement (LCPR). Its purpose is to review the July 1, 2021 actuarial valuation reports for reasonability, accuracy, and compliance with applicable Minnesota Statutes, LCPR standards for actuarial work, and relevant Actuarial Standards of Practice.

The report is intended to comply with Minnesota Statute 356.214 Subd. 4(b) which states that the auditing actuary shall:

> "audit the valuation reports submitted by the actuary retained by each governing or managing board or administrative official, and provide an assessment of the reasonableness, reliability, and areas of concern or potential improvement in the specific reports reviewed, the procedures utilized by any particular reporting actuary, or general modifications to standards, procedures, or assumptions that the commission may wish to consider."

June 22, 2022

This report may not be used for any other purpose, and Van Iwaarden Associates is not responsible for the consequences of any unauthorized use. Its content may not be modified, incorporated into or used in other material, or otherwise provided, in whole or in part, to any other person or entity, without our permission.

Data Used in the Analysis

The results and recommendations in this report are based on the following data sources:

- July 1, 2021 actuarial valuation reports prepared by the retained actuaries for MSRS SERF, PERA GERP, TRA and SPTRFA;
- Census data files provided by the retirement systems;
- "Scrubbed" census data files provided by the retained actuaries; and
- Asset data from the systems' Annual Financial Reports

Although we reviewed all data sources for reasonability, we have not audited the underlying data and are relying on its substantial accuracy. If any data supplied are not accurate and complete, our conclusions in this actuarial valuation review may differ significantly.

Actuarial Certification

To the best of our knowledge, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices.

Upon receipt of the report, the LCPR should notify us if you disagree with any information contained in the report or if you are aware of any information that would affect the results that has not been communicated to us. The report will be deemed final and acceptable to the LCPR unless you immediately notify us otherwise.

The undersigned credentialed actuaries are Members of the American Academy of Actuaries and meet the Academy's Qualification Standards to render the actuarial opinion contained herein. We are available to answer questions on the material contained in the report or to provide explanations or further detail, as may be appropriate. We are not aware of any financial interest or relationship that could create a conflict of interest or impair the objectivity of our work.

Mark W. Schulte, FSA, EA, MAAA
Consulting Actuary

Emily M. Knutson, FSA, EA, MAAA
Consulting Actuary

Van Iwaarden Associates
100 South 5th Street, Suite 1900
Minneapolis, MN 55402
612.596.5960
www.vaniwaarden.com

L/D/C/R:5/mjc/emk/mws

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Executive Summary

Details of our review of the July 1, 2021 actuarial valuation reports are presented later in this report. The table below summarizes the important conclusions.

In our opinion, the valuations are reasonable and reliable. We also believe that the reports comply with applicable Minnesota Statutes, LCPR Standards for Actuarial Work ("Standards"), and relevant Actuarial Standards of Practice (ASOPs).
For each valuation, the census data used in the actuarial valuation is reasonable compared to the plan data. The assumptions and methods used in the reports are consistent with those specified in relevant Statutes and recent experience studies. Based on the information available to us, we believe the assumptions and methods used are reasonable. The plan provisions valued in the reports accurately reflect those described in Statutes.
Primary results were easy to identify, and information was presented well. We have included some formatting recommendations we believe would further enhance the report presentation and understanding of pension risk measurements.

Summary of Overall Reasonability

One way to check for overall reasonability is to compare each plan's actual vs. expected liabilities. The table below summarizes the non-investment actuarial (gains)/losses over the past five years for each of the four plans reviewed.

	% by which Actual Liabilities were Higher or (Lower) than Expected			
Valuation Date	**MSRS SERF**	**PERA GERP**	**TRA**	**SPTRFA**
7/1/2021	0.0%	(0.6%)	(0.3%)	1.1%
7/1/2020	(0.2%)	(0.1%)	0.5%	(-1.4%)
7/1/2019	0.1%	0.3%	(0.4%)	(0.6%)
7/1/2018	(0.3%)	(0.1%)	(0.3%)	(0.9%)
7/1/2017	(0.2%)	(0.5%)	0.3%	(0.5%)

The actual liabilities were within 1.5% of the expected liabilities each year, which suggests that the overall valuation assumptions and liabilities are reasonable. SPTRFA has the most volatility due to its smaller size.

The rest of this report provides more detail on our review of each actuarial valuation report.

Process Overview

This report reviews the inputs, calculations, and presentation of results in four actuarial valuations. Since the Minnesota Statutes' actuarial review requirements are broad, we are focusing on six areas we believe are most useful:

1. Review of the valuation census data,
2. Review for compliance with Minnesota Statutes, LCPR Standards for Actuarial Work, and relevant Actuarial Standards of Practice (ASOPs),
3. Review of actuarial assumptions other than those specified in the Statutes and Standards.
4. Review of the plan provisions reflected in the valuation,
5. Review of the required contribution rate calculations, and
6. Review of how results are presented in the reports.

Note that we are not attempting to replicate the underlying liability calculations. Replicating detailed valuation calculations is a separate project completed for select plans each year.

Review of valuation inputs

Actuarial calculations are based on four primary inputs:

- Data (census and assets)
- Assumptions
- Methods
- Plan provisions

The table below summarizes how our valuation review incorporates each of these items.

Data	▪ Compare census data provided by the retained actuary to the data summaries in the valuation reports and the data files provided by each plan. ▪ Compare asset summaries and Actuarial Value of Assets (AVA) calculations in the actuarial reports to asset data in the audited financial statements. These comparisons are shown in Appendix A.
Assumptions	Review actuarial assumptions disclosed in the reports to ensure they are consistent with Statutes, the LCPR's Standards, and relevant ASOPs.
Methods	Review actuarial methods disclosed in the reports to ensure they are consistent with Statutes, the LCPR's Standards, and relevant ASOPs.
Plan Provisions	Verify that plan provisions summarized in the actuarial valuation reports are representative of the benefit provisions described in Minnesota Statutes.

Process Overview *(continued)*

Review for compliance with Statutes, Standards, and ASOPs

The MSRS SERF, PERA GERP, TRA, and SPTRFA actuarial valuations must comply with several statutory requirements and professional standards. These are summarized in the tables below.

Minnesota Statutes

The applicable Minnesota Statutes include Sections 356.214 (actuarial valuation preparation) and 356.215 (actuarial valuations and experience studies). The Statutes prescribe:

- The actuarial cost method (Entry Age method; 356.215 Subd.1(b) and (d)),
- The asset valuation method (five-year smoothing of gains and losses; 356.215 Subd.1(f)),
- The investment return assumption (currently 7.5% for the four plans reviewed; 356.215 Subd.8(a)),
- The COLA, salary scale, payroll growth, and other assumptions described in 356.215 Subd.8(b)-(d) and Subd.9,
- Calculation of the Normal Cost as a level percentage of payroll per 356.215 Subd.5,
- Amortization of unfunded liabilities (ending in 2048 for the four plans reviewed; 356.215 Subd.11(d),(e),(i), and (j)),
- Measurement of actuarial gains and losses (356.215 Subd.12), and
- Report contents, actuarial qualifications, and other general requirements (356.215 Subd.4 through 18).

LCPR Standards for Actuarial Work

These Standards, including the updated Appendix A effective July 1, 2021, specify several actuarial methods and assumptions. These include:

- Actuarial assumptions (other than the investment return assumption),
- Details for application of the Entry Age Actuarial Cost Method; and
- Detailed report contents.

Actuarial Standards of Practice

ASOP 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*. ASOP 4 is a broad standard that overlaps with the LCPR Standards and provides guidance on:

- Measurement of pension obligations,
- Funded status measurement,
- Contribution allocation procedures,
- Evaluation of actuarial assumptions, and
- Required disclosures.

Process Overview *(continued)*

ASOP 23, *Data Quality*. ASOP 23 provides guidance on:

- Selection of data,
- Reliance on data supplied by others, and
- Required disclosures, including limitations on data quality**.**

ASOP 27, *Selection of Economic Assumptions for Measuring Pension Obligations*. ASOP 27 provides guidance on:

- Selecting economic assumptions like investment return, inflation, and compensation increases; and
- Required disclosure of the rationale for the assumptions chosen.

ASOP 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*. ASOP 35 provides guidance on:

- Selecting demographic assumptions like retirement, turnover, disability, benefit election, and mortality; and
- Required disclosure of the rationale for the assumptions chosen.

ASOP 41, *Actuarial Communications*. ASOP 41 is a broad standard that affects all actuarial practice areas. ASOP 41 provides guidance on:

- Appropriate form and content,
- Identifying the data, assumptions, methods, and plan provisions used,
- Responsibility for assumptions and methods, and
- Required disclosures.

ASOP 44, *Selection and Use of Asset Valuation Methods for Pension Valuations*. ASOP 44 overlaps with Minnesota Statutes, with a more principle-based focus. It provides guidance on:

- Selection of asset valuation methods, and
- Required disclosures.

ASOP 51, *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions*. ASOP 51 provides standards for assessing and disclosing the risk that future measurements may differ from expectations. It provides guidance on:

- Identifying risks like investment, asset/liability mismatch, interest rates, longevity, and contribution risk,
- Assessment of those risks,
- Plan maturity measures, and
- Required disclosures.

ASOP 56, *Modeling*. ASOP 56 is a new standard that addresses actuarial models. ASOP 56 provides guidance on:

- Identifying the models used,
- Stating the intended purpose of the models, and
- Required disclosures.

This ASOP is effective for work performed on or after October 1, 2020. All the reports reviewed provide some disclosures about models used in the valuations.

Based on our review, the MSRS SERF, PERA GERP, TRA, and SPTRFA actuarial valuation reports comply with the Statutes, Standards, and ASOPs. Additional detail is shown separately for each plan later in this report.

Other actuarial assumptions

Some of the actuarial assumptions are specified in Minnesota Statutes and LCPR Standards for Actuarial Work. Others, including most of the demographic assumptions, are not. They are generally based on the plans' actuarial experience studies and the retained actuaries' recommendations. We reviewed those assumptions for overall reasonability and consistency with the experience studies.

Plan provisions

Plan provisions are outlined in Minnesota Statutes for each of the four plans reviewed here. We have reviewed the plan provisions described in the actuarial valuation reports to confirm that they accurately reflect the Statutes.

Valuation computations

One of the primary purposes of the valuation reports is to determine the required pension contribution rates under Minnesota Statute 356. The calculations include development of the Actuarial Value of Assets, amortization of the Unfunded Actuarial Accrued Liability, and determination of the contribution sufficiency/(deficiency). We reviewed these calculations to confirm they are reasonable and accurately reflect the Statutes.

Review of valuation report presentation

In addition to summarizing technical information, a valuation report should communicate the results clearly so that it is useful for the intended users.

Our review of valuation report presentation includes suggestions for improving the presentation and communication of important results in the report.

Review of census data

We obtained July 1, 2021 census data from MSRS and its retained actuary, Gabriel Roeder Smith (GRS), and compared statistics from both sources with those shown in the actuarial report:

	System Data	Actuary Data	Report	Difference[1]
Active members	**50,889**	**50,889**	**50,889**	**0.0%**
Average age	46.6	46.6	46.5	0.0%
Average service	10.74	10.74	10.70	0.0%
Average salary	$ 63,231	$ 63,231	$ 64,519	[2]
Service retirements	**39,335**	**39,335**	**39,335**	**0.0%**
Average age	72.8	72.8	72.8	0.0%
Average annual annuity	$ 21,068	$ 21,068	$ 21,068	0.0%
Survivors	**4,371**	**4,371**	**4,357**	**0.0%**
Average age	75.6	75.6	75.6	0.0%
Average annual annuity	$ 18,506	$ 18,506	$ 18,565	0.0%
Disability retirements	**1,738**	**1,738**	**1,738**	**0.0%**
Average age	67.8	67.8	67.8	0.0%
Average annual annuity	$ 15,544	$ 15,544	$ 15,544	0.0%
Deferred retirements	**17,317**	**17,317**	**17,317**	**0.0%**
Average age	51.9	51.9	51.9	0.0%
Average annual annuity	$ 8,053	8,053	8,438	[3]
Other non-vested terminations	**9,562**	**9,562**	**9,562**	**0.0%**
Total	**123,212**	**123,212**	**123,198**	**0.0%**

[1] Difference between System and Actuary data files.
[2] Annual pay was adjusted from the system data for valuation purposes. The adjustments include using either prior year salary or five-year average salary for those reported with annual pay less than $100 (200 members).
[3] Monthly annuity was adjusted from the system data for valuation purposes. The adjustments include using other information available to estimate the benefit. (247 members).

Based on the information above, we believe the census data used in the actuarial valuation is reasonable compared to the system data. There were some small data differences, but they were insignificant compared to overall valuation totals.

We also believe the retained actuary's data assumptions and adjustments described on pages 28-29 of the valuation report are reasonable. There was an increase in the number of active members that required data assumptions, but fewer terminated members missing data. Overall, the number of records requiring data adjustments was relatively small compared to the overall plan membership.

Compliance with Statutes, Standards, and ASOPs

We reviewed the MSRS SERF July 1, 2021 actuarial valuation for compliance with applicable Minnesota Statutes, LCPR Actuarial Standards, and relevant ASOPs. We found that the report complied with all major requirements in these guidance sources. The primary items we reviewed, along with any relevant observations, are summarized in the tables below.

Minnesota Statute Compliance – MSRS SERF	
Actuarial cost method	Entry age normal per 356.215 Subd.1(b) and (d)
Asset valuation method	Five-year smoothing of investment returns per 356.215 Subd.1(f)
Investment return assumption	7.50% per 356.215 Subd.8
Normal cost	Calculated as a level percentage of payroll per 356.215 Subd.5
Amortization of unfunded liabilities	Amortized as a level percent of payroll ending June 30, 2048 per 356.215 Subd.11
Measurement of actuarial gains and losses	Required gain/loss items measured per 356.215 Subd.12
Report contents	Consistent with the remaining requirements of 356.215 Subd.4 through 18. These include presentation of the accrued liability, membership tabulations, and summary of plan provisions.

LCPR Actuarial Standards Compliance – MSRS SERF	
Inflation assumption	2.25% per updated Appendix A to the Standards
Payroll growth assumption	3.00% per updated Appendix A to the Standards
Merit and seniority pay increase assumptions	Service-based table per updated Appendix A to the Standards
Mortality rates	Pub-2010 mortality tables per updated Appendix A to the Standards
Other assumptions	Other actuarial assumptions and asset valuation methods calculated per Standards, Section II
Actuarial cost methods	Entry age cost method, benefits recognized, and contribution rates calculated per Standards, Section III
Report contents	All required elements included per Standards, Section IV

Valuation Review – MSRS SERF *(continued)*

Compliance with Statutes, Standards, and ASOPs (continued)

ASOP Compliance – MSRS SERF
We reviewed the report and believe that it adequately complies with all relevant Actuarial Standards of Practice (ASOPs). These include ASOPs 4, 23, 27, 35, 41, 44, 51, and 56. A summary of the primary elements for each of these ASOPs can be found in the Process section of this report.
We specifically note two items that demonstrate GRS' compliance with ASOP disclosure requirements: ▪ Page 1 of the report cover letter and page 1 of the valuation report comply with the ASOP 27 requirement that the actuary identify any assumption "that significantly conflicts with what, in the actuary's professional judgement, is reasonable for the purpose of the measurement." ▪ Page 2 of the report cover letter describes GRS' actuarial valuation/modeling system as required by ASOP 56.

Other actuarial assumptions

Some of the actuarial assumptions are specified in Minnesota Statutes and LCPR Standards for Actuarial Work. Others, including most of the demographic assumptions, are not. They are generally based on the plan's experience study dated June 27, 2019.

We reviewed the valuation assumptions and believe they are reasonable given the small deviations from expected liabilities noted in the executive summary.

Plan provisions

MSRS plan provisions are outlined in Minnesota Statutes chapter 352. We reviewed the plan provisions described in the actuarial valuation report, and we believe they accurately reflect the Statutes.

Valuation computations

We reviewed the required contribution calculations on pages 18 – 20 of the valuation report and believe they are reasonable and consistent with MN Statute 356. We also replicated the Actuarial Value of Assets calculation, and details are shown in Appendix A of this report.

Valuation results presentation

Our review of the valuation report found that information was presented well, and primary results were easy to identify. Pension risk information was also prominent and incorporated well.

There are a few items that could improve the presentation of results and understanding of pension risk measurements. These include:

- Including the Schedules of Funding Progress and Contributions (valuation pages 39 and 40) earlier in the report where they would be more prominent reminders of the Plan's journey towards full funding.
- Split the historical Actuarially Required Contribution rates (shown on page 40) into two pieces: Normal Cost and amortization of Unfunded Accrued Liability. This would help illustrate the source of changes in the overall Actuarially Required Contribution rate.
- Using charts and other graphical illustrations, where appropriate, to communicate results for non-technical reports users.

Valuation Review – PERA GERP

Review of census data

We obtained July 1, 2021 census data from PERA and its retained actuary, Gabriel Roeder Smith (GRS), and compared statistics from both sources with those shown in the actuarial report:

	System Data	Actuary Data	Report		Difference[1]
Active members	**149,281**	**149,281**	**149,281**		**0.0%**
Average age	46.2	46.2	46.2		0.0%
Average service	9.63	9.63	9.60		0.0%
Average salary	$ 42,392	$ 42,395	$ 44,450	2	
Service retirements	**102,667**	**99,441**	**99,441**	3	
Average age	73.2	73.2	73.2		0.0%
Average annual annuity	$ 15,132	$ 15,005	$ 15,005		-0.8%
Survivors	**9,220**	**9,214**	**9,214**		**-0.1%**
Average age	76.3	76.4	76.4		0.0%
Average annual annuity	$ 15,671	$ 15,679	$ 15,644		0.0%
Disability retirements	**1,264**	**3,577**	**3,577**	3	
Average age	59.8	68.8	68.7		15.0%
Average annual annuity	$ 13,349	$ 14,200	$ 14,200		6.4%
Deferred retirements	**66,038**	**66,048**	**66,048**		**0.0%**
Average age	50.8	50.8	50.8		0.0%
Other non-vested terminations	**81,056**	**81,052**	**81,052**		**0.0%**
Total	**409,526**	**408,613**	**408,613**		**-0.2%**

[1] Difference between System and Actuary data files.
[2] Annual pay was adjusted from the system data for valuation purposes. The adjustments include using either prior year salary or five year average salary for those reported with annual pay less than $100 (5,967 members).
[3] PERA reclassifies disabled members as service retirees once they reach Normal Retirement Age. Therefore, the retained actuary adjusted the status for 2,260 service retirees to be disabled retirees based on their historical classification as disabled retirees.

Based on the information above, we believe the census data used in the actuarial valuation is reasonable compared to the system data. There were some small data differences, but they were insignificant compared to overall valuation totals.

We also believe the retained actuary's data assumptions and adjustments described on pages 43-44 of the valuation report are reasonable. There was an increase in the number of active and terminated members requiring data assumptions, but these were still relatively small compared to total plan membership.

Valuation Review – PERA GERP *(continued)*

Compliance with Statutes, Standards, and ASOPs

We reviewed the PERA GERP July 1, 2021 actuarial valuation for compliance with applicable Minnesota Statutes, LCPR Actuarial Standards, and relevant ASOPs. We found that the report complied with all major requirements in these guidance sources. The primary items we reviewed, along with any relevant observations, are summarized in the tables below.

Minnesota Statute Compliance – PERA GERP	
Actuarial cost method	Entry age normal per 356.215 Subd.1(b) and (d)
Asset valuation method	Five-year smoothing of investment returns per 356.215 Subd.1(f)
Investment return assumption	7.50% per 356.215 Subd.8
Normal cost	Calculated as a level percentage of payroll per 356.215 Subd.5
Amortization of unfunded liabilities	Amortized as a level percent of payroll ending June 30, 2048 per 356.215 Subd.11
Measurement of actuarial gains and losses	Required gain/loss items measured per 356.215 Subd.12
Report contents	Consistent with the remaining requirements of 356.215 Subd.4 through 18. These include presentation of the accrued liability, membership tabulations, and summary of plan provisions.

LCPR Actuarial Standards Compliance – PERA GERP	
Inflation assumption	2.25% per updated Appendix A to the Standards
Payroll growth assumption	3.00% per updated Appendix A to the Standards
Merit and seniority pay increase assumptions	Service-based table per updated Appendix A to the Standards
Mortality rates	Pub-2010 mortality tables per updated Appendix A to the Standards
Other assumptions	Other actuarial assumptions and asset valuation methods calculated per Standards, Section II
Actuarial cost methods	Entry age cost method, benefits recognized, and contribution rates calculated per Standards, Section III
Report contents	All required elements included per Standards, Section IV

Valuation Review – PERA GERP *(continued)*

Compliance with Statutes, Standards, and ASOPs (continued)

ASOP Compliance – PERA GERP
We reviewed the report and believe that it adequately complies with all relevant Actuarial Standards of Practice (ASOPs). These include ASOPs 4, 23, 27, 35, 41, 44, 51, and 56. A summary of the primary elements for each of these ASOPs can be found in the Process section of this report.
We specifically note two items that demonstrate GRS' compliance with ASOP disclosure requirements: ▪ Page 1 of the report cover letter and page 1 of the valuation report comply with the ASOP 27 requirement that the actuary identify any assumption "that significantly conflicts with what, in the actuary's professional judgement, is reasonable for the purpose of the measurement." ▪ Page 2 of the report cover letter describes GRS' actuarial valuation/modeling system as required by ASOP 56.

Other Actuarial Assumptions

Some of the actuarial assumptions are specified in Minnesota Statutes and LCPR Standards for Actuarial Work. Others, including most of the demographic assumptions, are not. They are generally based on the plan's June 27, 2019 experience study.

We reviewed the valuation assumptions and believe they are reasonable given the small deviations from expected liabilities noted in the executive summary.

Plan provisions

PERA plan provisions are outlined in Minnesota Statutes chapter 353. We reviewed the plan provisions described in the actuarial valuation report, and we believe they accurately reflect the Statutes.

Valuation computations

We reviewed the required contribution calculations on pages 33 – 35 of the valuation report and believe they are reasonable and consistent with MN Statute 356. We also replicated the Actuarial Value of Assets calculation, and details are shown in Appendix A of this report.

Valuation Review – PERA GERP *(continued)*

Valuation results presentation

Our review of the valuation report found that information was presented well, and primary results were easy to identify. Pension risk information was also prominent and incorporated well.

There are a few items that could improve the presentation of results and understanding of pension risk measurements. These include:

- Including the Schedules of Funding Progress and Contributions (valuation pages 70 and 71) earlier in the report where they would be more prominent reminders of the Plan's journey towards full funding.
- Split the historical Actuarially Required Contribution rates (shown on page 71) into two pieces: Normal Cost and amortization of Unfunded Accrued Liability. This would help illustrate the source of changes in the overall Actuarially Required Contribution rate.
- Using charts and other graphical illustrations, where appropriate, to communicate results for non-technical reports users.

Valuation Review – TRA

Review of census data

We obtained July 1, 2021 census data from TRA and its retained actuary, Cavanaugh MacDonald Consulting (CavMac), and compared statistics from both sources with those shown in the actuarial report:

	System Data	Actuary Data	Report	Difference[1]
Active members	**81,821**	**81,821**	**81,821**	**0.0%**
Average age	43.2	43.2	43.2	0.0%
Average service	12.42	12.42	12.40	0.0%
Average salary	$ 65,344	$ 65,344	$ 65,344	0.0%
Service retirements	**62,345**	**62,367**	**62,367**	**0.0%**
Average age	74.2	74.2	N/A	0.0%
Average annual annuity	$ 28,416	$ 28,402	$ 28,402	0.0%
Survivors	**6,207**	**6,220**	**6,220**	**0.2%**
Average age	81.9	81.9	N/A	0.0%
Average annual annuity	$ 28,311	$ 28,527	$ 28,527	0.8%
Disability retirements	**438**	**446**	**446**	**1.8%**
Average age	57.8	58.0	N/A	0.3%
Average annual annuity	$ 21,763	$ 21,880	$ 21,880	0.5%
Deferred retirements	**17,300**	**17,300**	**17,300**	**0.0%**
Average age	48.8	48.8	48.8	0.0%
Average annual annuity	N/A	8,265	8,265	
Other non-vested terminations	**38,717**	**38,717**	**38,717**	**0.0%**
Average age	47.5	47.5	47.5	0.0%
Total	**206,828**	**206,871**	**206,871**	**0.0%**

[1] Difference between System and Actuary data files.

Based on the information above, we believe the census data used in the actuarial valuation is reasonable compared to the system data.

We also believe the retained actuary's data assumptions and adjustments described on page 82 of the valuation report are reasonable.

Valuation Review – TRA *(continued)*

Compliance with Statutes, Standards, and ASOPs

We reviewed the TRA July 1, 2021 actuarial valuation for compliance with applicable Minnesota Statutes, LCPR Actuarial Standards, and relevant ASOPs. We found that the report complied with all major requirements in these guidance sources.

The primary items we reviewed, along with any relevant observations, are summarized in the tables below.

Minnesota Statute Compliance – TRA	
Actuarial cost method	Entry age normal per 356.215 Subd.1(b) and (d)
Asset valuation method	Five-year smoothing of investment returns per 356.215 Subd.1(f)
Investment return assumption	7.50% per 356.215 Subd.8
Normal cost	Calculated as a level percentage of payroll per 356.215 Subd.5
Amortization of unfunded liabilities	Amortized as a level percent of payroll ending June 30, 2048 per 356.215 Subd.11
Measurement of actuarial gains and losses	Required gain/loss items measured per 356.215 Subd.12
Report contents	Consistent with the remaining requirements of 356.215 Subd.4 through 18. These include presentation of the accrued liability, membership tabulations, and summary of plan provisions.

LCPR Actuarial Standards Compliance – TRA	
Inflation assumption	2.50% per updated Appendix A to the Standards
Payroll growth assumption	3.00% per updated Appendix A to the Standards
Merit and seniority pay increase assumptions	Service-based table per updated Appendix A to the Standards
Mortality rates	RP-2014 tables with specified age adjustments, further adjustments, and MP-2015 improvement scale per updated Appendix to the Standards
Other assumptions	Other actuarial assumptions and asset valuation methods calculated per Standards, Section II
Actuarial cost methods	Entry age cost method, benefits recognized, and contribution rates calculated per Standards, Section III
Report contents	All required elements included per Standards, Section IV

Valuation Review – TRA *(continued)*

ASOP Compliance – TRA
We reviewed the report and believe that it adequately complies with all relevant Actuarial Standards of Practice (ASOPs). These include ASOPs 4, 23, 27, 35, 41, 44, 51, and 56. In particular, the report cover letter contains a new disclosure about actuarial models as required by ASOP 56. A summary of the primary elements for each ASOP can be found in the Process section of this report.

Other actuarial assumptions

Some of the actuarial assumptions are specified in Minnesota Statutes and LCPR Standards for Actuarial Work. Others, including most of the demographic assumptions, are not. They are generally based on the plan's June 28, 2019 experience study.

We reviewed the valuation assumptions and believe they are reasonable given the small deviations from expected liabilities noted in the executive summary.

Plan provisions

TRA plan provisions are outlined in Minnesota Statutes chapter 354. We reviewed the plan provisions described in the actuarial valuation report, and we believe they accurately reflect the Statutes.

Valuation computations

We reviewed the required contribution calculations on pages 28-32 of the valuation report and believe they are reasonable and consistent with MN Statute 356. We also replicated the Actuarial Value of Assets calculation, and details are shown in Appendix A of this report.

Valuation results presentation

Our review of the valuation report found that information was presented well, and primary results were easy to identify. Pension risk information was also prominent and incorporated well.

There are a few items that could improve the presentation of results and understanding of pension risk measurements. These include:

- Including the Schedules of Funding Progress and Contributions (valuation pages 45 and 46) earlier in the report where they would be more prominent reminders of the Plan's journey towards full funding.
- Split the historical Actuarially Required Contribution rates (shown on page 46) into two pieces: Normal Cost and amortization of Unfunded Accrued Liability. This would help illustrate the source of changes in the overall Actuarially Required Contribution rate.
- Using charts and other graphical illustrations, where appropriate, to communicate results for non-technical reports users.

Valuation Review – SPTRFA

Review of census data

We obtained July 1, 2021 census data from SPTRFA and its retained actuary, Gabriel Roeder Smith (GRS), and compared statistics from both sources with those shown in the actuarial report:

	System Data	Actuary Data	Report	Difference[1]
Active members	**3,294**	**3,294**	**3,294**	**0.0%**
Average age	45.1	45.1	45.0	0.0%
Average service	13.4	13.4	13.4	0.0%
Average salary[2]	$ 78,105	$ 83,024	$ 83,487	6.3%
Service retirements	**3,766**	**3,782**	**3,782**	**0.4%**
Average age	73.9	73.9	N/A	0.0%
Average annual annuity	$ 28,402	$ 28,471	$ 28,471	0.2%
Survivors	**369**	**369**	**369**	**0.0%**
Average age	78.5	78.5	N/A	0.0%
Average annual annuity	$ 32,185	$ 32,185	$ 32,185	0.0%
Disability retirements	**22**	**22**	**22**	**0.0%**
Average age	57.8	57.9	N/A	0.1%
Average annual annuity	$ 17,383	$ 17,380	$ 17,380	0.0%
Deferred retirements	**2,430**	**2,414**	**2,414**	**-0.7%**
Average age	49.3	49.3	N/A	0.0%
Other non-vested terminations	**2,941**	**2,941**	**2,941**	**0.0%**
Average age	45.5	45.5	N/A	0.0%
Total	**12,822**	**12,822**	**12,822**	**0.0%**

[1] Difference between System and Actuary data files.
[2] Average pay from valuation report includes leave of absence members and annualized pay for new hires, as well as other adjustments detailed in the valuation report.

Based on the information above, we believe the census data used in the actuarial valuation is reasonable compared to the system data.

We also believe GRS' data assumptions and adjustments described on pages 29-30 of the actuarial valuation report are reasonable.

Compliance with Statutes, Standards, and ASOPs

We reviewed the SPTRFA July 1, 2021 actuarial valuation for compliance with applicable Minnesota Statutes, LCPR Actuarial Standards, and relevant ASOPs. We found that the report complied with all major requirements in these guidance sources.

The primary items we reviewed, along with any relevant observations are summarized in the tables below.

Minnesota Statute Compliance – SPTRFA	
Actuarial cost method	Entry age normal per 356.215 Subd.1(b) and (d)
Asset valuation method	Five-year smoothing of investment returns per 356.215 Subd.1(f)
Investment return assumption	7.50% per 356.215 Subd.8
Normal cost	Calculated as a level percentage of payroll per 356.215 Subd.5
Amortization of unfunded liabilities	Amortized as a level percent of payroll ending June 30, 2048 per 356.215 Subd.11
Measurement of actuarial gains and losses	Required gain/loss items measured per 356.215 Subd.12
Report contents	Consistent with the remaining requirements of 356.215 Subd.4 through 18. These include presentation of the accrued liability, membership tabulations, and summary of plan provisions.

LCPR Actuarial Standards Compliance – SPTRFA	
Inflation assumption	2.50% per updated Appendix A to the Standards
Payroll growth assumption	3.00% per updated Appendix A to the Standards
Merit and seniority pay increase assumptions	Service-based table per updated Appendix A to the Standards
Mortality rates	The valuation report uses the RP-2014 tables with age adjustments and as described in the updated Appendix A to the Standards. The one difference is that the valuation uses a mortality improvement scale that is newer than the one described in Appendix A, as allowed by 356.215 Subd.9(b).
Other assumptions	Other actuarial assumptions and asset valuation methods calculated per Standards, Section II
Actuarial cost methods	Entry age cost method, benefits recognized, and contribution rates calculated per Standards, Section III
Report contents	All required elements included per Standards, Section IV

Though the mortality improvement scale difference noted above is allowed by MN Statute 356.215 Subd.9(b), we recommend that the LCPR revise Appendix A to be less prescriptive and/or include the new assumption.

Valuation Review – SPTRFA *(continued)*

Compliance with Statutes, Standards, and ASOPs (continued)

ASOP Compliance – SPTRFA
We reviewed the report and believe that it adequately complies with all relevant Actuarial Standards of Practice (ASOPs). These include ASOPs 4, 23, 27, 35, 41, 44, 51, and 56. In particular, the report cover letter contains a new disclosure about actuarial models as required by ASOP 56. A summary of the primary elements for each of these ASOPs can be found in the Process section of this report.

Other actuarial assumptions

Some of the actuarial assumptions are specified in Minnesota Statutes and LCPR Standards for Actuarial Work. Others, including most of the demographic assumptions, are not. They are generally based on the plan's March 1, 2018 experience study.

We reviewed the valuation assumptions and believe they are reasonable given the small deviations from expected liabilities noted in the executive summary.

Plan provisions

SPTRFA plan provisions are outlined in Minnesota Statutes chapter 354A. We reviewed the plan provisions described in the actuarial valuation report, and we believe they accurately reflect the Statutes.

Valuation computations

We reviewed the required contribution calculations on pages 20 and 22 of the valuation report and believe they are reasonable and consistent with MN Statute 356. We also replicated the Actuarial Value of Assets calculation, and details are shown in Appendix A of this report.

Valuation Review – SPTRFA *(continued)*

Valuation results presentation

Our review of the valuation report found that information was presented well, and primary results were easy to identify. Pension risk information was also prominent and incorporated well.

There are a few items that could improve the presentation of results and understanding of pension risk measurements. These include:

- Including the Schedules of Funding Progress and Employer Contributions (valuation pages 51 and 52) earlier in the report where they would be more prominent reminders of the Plan's journey towards full funding.
- Split the historical Actuarially Required Contribution rates (shown on page 52) into two pieces: Normal Cost and amortization of Unfunded Accrued Liability. This would help illustrate the source of changes in the overall Actuarially Required Contribution rate.
- Using charts and other graphical illustrations, where appropriate, to communicate results for non-technical reports users.

Appendix A – Plan Asset Review

Actuarial Value of Assets Calculations

The exhibits below compare the retained actuary's July 1, 2021 Actuarial Value of Assets (AVA) calculations to ours for each of the four plans being reviewed. The calculations match and are consistent with relevant Minnesota Statutes, Section 356.215, Subd.1(f) and we believe they were prepared correctly. All amounts shown are in $1,000's.

MSRS SERF			Retained Actuary	VIA Calculations
1. Market value of assets available for benefits[1]			**17,440,051**	**17,440,051**
2. Determination of average asset balance				
a. Total assets at beginning of year			13,855,691	13,855,691
b. Total assets at end of year			17,440,051	17,440,051
c. Net investment income for fiscal year			4,098,129	4,098,129
d. Average balance (a. + b. - c.)/2			13,598,807	13,598,807
3. Expected return (7.50% x 2.d.)			1,019,910	1,019,910
4. Actual return			4,098,129	4,098,129
5. Current year asset gain/(loss) (4. - 3.)			3,078,219	3,078,219
6. Unrecognized asset returns	Original amounts	Unrecognized percent	Unrecognized amounts	Unrecognized amounts
a. FYE 2021	3,078,219	80%	2,462,575	2,462,575
b. FYE 2020	(445,017)	60%	(267,010)	(267,010)
c. FYE 2019	(31,034)	40%	(12,414)	(12,414)
d. FYE 2018	296,451	20%	59,290	59,290
e. Total unrecognized amount			2,242,441	2,242,441
7. AVA at end of year (1. - 6.e.)			**15,197,610**	**15,197,610**

[1] The amount shown under VIA calculations is from the System's Annual Financial Report.

Appendix A – Plan Asset Review *(continued)*

PERA GERP				Retained Actuary	VIA Calculations
1.	**Market value of assets available for benefits[1]**			**28,587,653**	**28,587,653**
2.	Determination of average asset balance				
	a. Total assets at beginning of year			22,631,459	22,631,459
	b. Total assets at end of year			28,587,653	28,587,653
	c. Net investment income for fiscal year			6,712,710	6,712,710
	d. Average balance (a. + b. - c.)/2			22,253,201	22,253,201
3.	Expected return (7.50% x 2.d.)			1,668,990	1,668,990
4.	Actual return			6,712,710	6,712,710
5.	Current year asset gain/(loss) (4. - 3.)			5,043,720	5,043,720
6.	Unrecognized asset returns	Original amounts	Unrecognized percent	Unrecognized amounts	Unrecognized amounts
	a. FYE 2021	5,043,720	80%	4,034,976	4,034,976
	b. FYE 2020	(724,261)	60%	(434,557)	(434,557)
	c. FYE 2019	(44,547)	40%	(17,819)	(17,819)
	d. FYE 2018	479,963	20%	95,993	95,993
	e. Total unrecognized amount			3,678,593	3,678,593
7.	**AVA at end of year (1. - 6.e.)**			**24,909,060**	**24,909,060**

[1] The amount shown under VIA calculations is from the System's Annual Financial Report.

Appendix A – Plan Asset Review *(continued)*

TRA				Retained Actuary	VIA Calculations
1.	**Market value of assets available for benefits[1]**			**28,357,828**	**28,357,828**
2.	Determination of average asset balance				
	a. Total assets at beginning of year[2]			22,744,996	22,744,996
	b. Total assets at end of year[2]			28,361,757	28,361,757
	c. Net investment income for fiscal year			6,684,106	6,684,106
	d. Average balance (a. + b. - c.)/2			22,211,324	22,211,324
3.	Expected return (7.50% x 2.d.)			1,665,849	1,665,849
4.	Actual return			6,684,106	6,684,106
5.	Current year asset gain/(loss) (4. - 3.)			5,018,257	5,018,257
6.	Unrecognized asset returns	Original amounts	Unrecognized percent	Unrecognized amounts	Unrecognized amounts
	a. FYE 2021	5,018,257	80%	4,014,606	4,014,606
	b. FYE 2020	(735,801)	60%	(441,481)	(441,481)
	c. FYE 2019	(58,115)	40%	(23,246)	(23,246)
	d. FYE 2018	398,058	20%	79,612	79,612
	e. Total unrecognized amount			3,629,491	3,629,491
7.	**AVA at end of year (1. - 6.e.)**			**24,728,337**	**24,728,337**

[1] The amount shown under VIA calculations is from the System's Annual Financial Report.
[2] Before recognition of Earnings Limitation Savings Account (ELSA) accounts payable.

Appendix A – Plan Asset Review *(continued)*

SPTRFA				Retained Actuary	VIA Calculations
1.	**Market value of assets available for benefits[1]**			**1,295,064**	**1,295,064**
2.	Determination of average asset balance				
	a. Total assets at beginning of year			1,037,613	1,037,613
	b. Total assets at end of year			1,295,064	1,295,064
	c. Net investment income for fiscal year			305,232	305,232
	d. Average balance (a. + b. - c.)/2			1,013,723	1,013,723
3.	Expected return (7.50% x 2.d.)			76,029	76,029
4.	Actual return			305,232	305,232
5.	Current year asset gain/(loss) (4. - 3.)			229,203	229,203
6.	Unrecognized asset returns	Original amounts	Unrecognized percent	Unrecognized amounts	Unrecognized amounts
	a. FYE 2021	229,203	80%	183,362	183,362
	b. FYE 2020	(73,490)	60%	(44,094)	(44,094)
	c. FYE 2019	(18,200)	40%	(7,280)	(7,280)
	d. FYE 2018	15,610	20%	3,122	3,122
	e. Total unrecognized amount			135,110	135,110
7.	**AVA at end of year (1. - 6.e.)**			**1,159,954**	**1,159,954**

[1] The amount shown under VIA calculations is from the System's Annual Financial Report.