Minnesota
Legislative Commission on Pensions and Retirement

Review of July 1, 2019 Actuarial Valuation Reports

MSRS – SERF

PERA – GERP

TRA

SPTRFA

Prepared by:

VAN IWAARDEN

Experience. Knowledge. Practical Advice.

July 31, 2020

Revised to reflect MSRS census data clarifications

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Retirement planning for employers

July 31, 2020

Minnesota Legislative Commission on Pensions and Retirement
55 State Office Building
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St. Paul, MN 55155

Attn: Susan Lenczewski, Executive Director

Re: Review of July 1, 2019 Actuarial Valuation Reports

Commission Members:

This report presents our review of the July 1, 2019 actuarial valuation reports for the following four pension systems:

- 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).

This revised report contains some slight data summary revisions on page 7 to reflect additional data clarifications received from MSRS' retained actuary. It should replace in its entirety the original report dated May 29, 2020.

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, 2019 actuarial valuation reports for reasonability, accuracy, and compliance with applicable Minnesota Statutes, LCPR standards for actuarial work, and relevant Actuarial Standards of Practice (ASOPs).

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."

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, 2019 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' Comprehensive Annual Financial Reports (CAFRs) and the State Board of Investment (SBI).

We have compared census data from the systems and their retained actuaries with the actuarial valuation reports and have not found any substantial differences. The comparison results are shown separately for each plan.

Although we have 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

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Consulting Actuary

L/D/C/R:5 jvi/ek/ms

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Executive Summary

Our review of the July 1, 2019 MSRS SERF, PERA GERP, TRA and SPTRFA actuarial valuation reports finds that the valuations are reasonable and reliable. Our review also confirms that the reports comply with applicable Minnesota Statutes, LCPR Standards for Actuarial Work ("Standards"), and relevant Actuarial Standards of Practice (ASOPs).

One way to check reasonability is to note that each plan's valuation has recently been replicated by the LCPR's prior auditing actuary: SPTRFA in 2017, TRA in 2016, PERA in 2015, and MSRS in 2014. We also recently replicated the 2019 TRA valuation. None of those valuation replications uncovered any material deficiencies in the technical calculations.

We combined the replications with a comparison of each plan's actual vs. expected liabilities over the last five years. With only one exception, the actual liabilities were within 1% of the expected liabilities every time. The SPTRFA 2016 liabilities were just under 2% lower than expected; more volatility is typical for a smaller plan.

	% by which Actual Liabilities were Higher or (Lower) than Expected			
Valuation Date	**MSRS SERF**	**PERA GERP**	**TRA**	**SPTRFA**
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%)
7/1/2016	0.4%	(0.1%)	(0.8%)	(1.7%)
7/1/2015	0.2%	0.2%	(0.1%)	0.5%

We did find some minor differences between the mortality assumptions disclosed in the PERA GERP and SPTRFA valuation reports versus the mortality rates specified in the 2018 Appendix to the LCPR's Actuarial Standards. These include:

- PERA GERP: the valuation report discloses use of the MP-2018 mortality improvement scale, but the Appendix prescribes use of the MP-2017 scale.
- SPTRFA: the valuation report discloses use of the MP-2018 mortality improvement scale, but the Appendix prescribes use of the MP-2017 scale.

We recommend that the Appendix be updated to reflect the retained actuary's current recommended mortality improvement scale.

Our main areas of concern are generally not in the actuarial reports themselves. They are in the structure of Minnesota Statutes and the LCPR's Standards. Specifically, those concerns include:

- Employer and employee contribution rates set by Statutes. We believe they would more prudently be set by the actuarial valuations. See our notes below for recommended timing.
- The expected investment return is specified in the Statutes. Although this is not a specific concern for the July 1, 2019 valuations, it can lead to contribution rates based on actuarial assumptions that fall outside a reasonable range if there is ever a delay in updating the Statutes. The LCPR's Standards are a better place to specify the expected investment return.

Executive Summary *(continued)*

- The Statutes and Standards are currently quite prescriptive on how to conduct an actuarial valuation and, in some cases, they conflict with actuarial best practices. We support the systems' recommendations that the Statutes and Standards be less prescriptive and more principle based.

We also have several suggestions for improving the presentation and communication of important results in the reports.

Show separate asset and liability reconciliations, as is already done for GASB 67/68 reporting. The TRA and SPTRFA funding reports show changes in only the unfunded actuarial accrued liability, while MSRS and PERA show separate changes in assets and liabilities. Separate reconciliations facilitate a comparison of actual vs. expected assets and liabilities.
Show a reconciliation of the statewide systems' market value of assets with those reported by the State Board of Investments (SBI). This could be in the actuarial valuation reports or, preferably, in each system's Comprehensive Annual Financial Report (CAFR). For illustrative purposes, we have shown an SBI reconciliation in Appendix A for MSRS, PERA, and TRA.
Add charts and graphical illustrations of key results, especially historical and pension risk information, to make the results more understandable to non-technical report readers. Making some of these valuation trends more prominent in the report would also be helpful.
Though contribution rates are currently set in Minnesota Statutes, we believe it would be useful to show recommended contribution rates for both the current fiscal year and the year beginning *after* publication of the actuarial valuation. This information will be useful to show the cumulative effect of contribution rate sufficiency/(deficiency). It may also become more useful in the future if, as we hope, contribution rates will be set by the actuarial valuations rather than the fixed rates in Minnesota Statutes.
All the reports provide a thorough discussion of pension risks, including sensitivity of results to changes in the investment return assumption. However, we also recommend measuring the sensitivity of required contribution rates to changes in the payroll growth assumption since these rates are highly responsive to this factor.

The rest of this report shows more detail on our review of each system's actuarial valuation.

Process Overview

Pension actuarial valuations usually involve two main phases:

- Calculating liabilities for a specific purpose, and
- Using the actuarial liabilities and plan assets to determine various results that fulfill the purpose (e.g., contributions or accounting disclosures).

This report reviews the inputs, calculations, and presentation of results involved in each of these phases. Note that we are not attempting to replicate every number in the actuarial valuation reports (that's a separate project for select plans each year). Instead, we are completing a general overview of the valuation inputs, calculations, and report presentation.

Since the Minnesota Statutes' actuarial review requirements are broad, we are focusing on five areas we believe are most useful:

1. Review of the valuation inputs;
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, and
5. Review of how results are presented in the reports.

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 retained actuary to the data summaries in valuation reports and data files provided by each plan. ▪ Compare asset summaries and Actuarial Value of Assets (AVA) calculations in actuarial reports to asset data in the audited financial statements and assets in the SBI CAFR. 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.

Review for compliance with Statutes, Standards and ASOPs

The MSRS, PERA, TRA and SPTRFA actuarial valuations must comply with a number of requirements. 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);
- 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 (356.215 Subd.4 through 18).

LCPR Standards for Actuarial Work

These Standards, including the July 1, 2018 Appendix, 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.

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.

Process Overview *(continued)*

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 is a new standard 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.

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.

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Process Overview *(continued)*

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 systems' actuarial experience studies and the retained actuaries' recommendations. We reviewed those assumptions for overall reasonability.

Plan provisions

Plan provisions are outlined in Minnesota Statutes for each of the four systems reviewed here. We have reviewed the plan provisions described in the actuarial valuation report to confirm that they 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 will focus on suggestions for improving the presentation and communication of important results in the report

Valuation Review – MSRS SERF

Review of census data

We obtained July 1, 2019 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	**51,997**	**51,997**	**51,997**	**0.0%**
Average Age	46.5	46.5	46.5	0.0%
Average Service	10.8	10.8	10.8	0.0%
Average Pay	$59,808	$59,808	$59,807	0.0%
Service Retirements	**36,432**	**36,432**	**36,432**	**0.0%**
Average Age	72.4	72.4	72.4	0.0%
Average Annual Annuity	$20,568	$20,568	$20,568	0.0%
Survivors	**4,148**	**4,148**	**4,140** [2]	
Average Age	75.4	75.4	75.4	0.0%
Average Annual Annuity	$18,402	$18,402	$18,437	0.0%
Disability Retirements	**1,801**	**1,801**	**1,801**	**0.0%**
Average Age	66.7	66.7	66.7	0.0%
Average Annual Annuity	$15,270	$15,270	$15,270	0.0%
Deferred Retirements	**17,154**	**17,154**	**17,154**	**0.0%**
Average Age	51.5	51.5	51.5	0.0%
Average Annual Annuity	$9,405	$9,405	$8,734 [3]	
Terminated Non-Vested	**9,110**	**9,110**	**9,110**	**0.0%**
Total	**120,642**	**120,642**	**120,634**	

[1]Difference between System and Actuary data files

[2]Data files include 8 survivors with an expired certain only benefit and were exlcuded from report counts

[3]Actuarial report shows estimated benefits based on the plan's benefit formula for 8,571 members after adjustments to the system data detailed on page 28 of the actuarial valuation report. According to the retained actuary, these estimates were needed because MSRS informed them during the data process that the amounts shown in the original data file were not entirely accurate.

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.

Compliance with Statutes, Standards, and ASOPs

We reviewed the MSRS SERF July 1, 2019 actuarial valuation for compliance with applicable Minnesota Statutes, LCPR Actuarial Standards, and relevant ASOPs. We found that the report satisfactorily complied with all major requirements in these guidance sources.

Valuation Review – MSRS SERF *(continued)*

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 gains and losses 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	2.50% per 2018 Appendix to the Standards
Payroll growth assumption	3.25% per 2018 Appendix to the Standards
Merit and seniority pay increase assumptions	Service-based table per 2018 Appendix to the Standards
Mortality rates	RP-2014 tables with specified age adjustments and MP-2015 improvement scale per 2018 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

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, and 51. A summary of the primary elements for each of these ASOPs can be found in the Process section of this report.

Valuation Review – MSRS SERF *(continued)*

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 system's 2008-2014 experience study.

We have reviewed those 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 have reviewed the plan provisions described in the actuarial valuation report, and we believe they accurately reflect the Statutes.

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.

However, there are a few items that could improve the presentation of results and illustrate pension risks. These include:

- Using charts and other graphical illustrations, where appropriate, to communicate results for non-technical reports users. Possible exhibits to illustrate include:
  - Funded status sensitivity tests on valuation page 3
  - Historical funded status, investment returns, and other items on valuation page 7
  - Schedule of Funding Progress on valuation page 39
  - Contribution Schedule on valuation page 40
- Including the Schedule of Funding Progress and Contribution Schedule (valuation pages 39 and 40) earlier in the report where they would be more prominent reminders of the Plan's journey towards full funding.
- Including a projection of net plan cash flows (i.e., future retiree benefit payments vs. contributions) relative to market value of assets to illustrate the plan's cash flow maturity.

Valuation Review – PERA GERP

Review of census data

We obtained July 1, 2019 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	**154,130**	**154,130**	**154,130**	**0.0%**
Average Age	46.2	46.3	46.2	0.1%
Average Service	9.5	9.6	9.6	0.7%
Average Pay	$39,440	$39,443	$41,362 [2]	
Service Retirements	**95,730**	**92,659**	**92,659** [3]	
Average Age	72.9	72.9	72.9	0.0%
Average Annual Annuity	$14,904	$14,785	$14,785	-0.8%
Survivors	**8,851**	**8,844**	**8,844**	**-0.1%**
Average Age	76.5	76.5	76.5	0.0%
Average Annual Annuity	$16,007	$16,012	$15,973	0.0%
Disability Retirements	**1,508**	**3,740**	**3,740** [3]	
Average Age	59.7	67.9	67.9	13.8%
Average Annual Annuity	$13,065	$13,901	$13,901	6.4%
Deferred Retirements	**63,296**	**63,311**	**63,311**	**0.0%**
Average Age	50.4	50.5	50.4	0.2%
Terminated Non-Vested	**126,113**	**126,116**	**126,116**	**0.0%**
Total	**449,628**	**448,800**	**448,800**	**-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 (3,910 members).

[3]PERA reclassifies disabled members as service retirees once they reach Normal Retirement Age. Therefore, the retained actuary adjusted the status for 2,180 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. We also believe the retained actuary's data assumptions and adjustments described above and on pages 43-44 of the valuation report are reasonable.

Compliance with Statutes, Standards, and ASOPs

We reviewed the PERA GERP July 1, 2019 actuarial valuation for compliance with applicable Minnesota Statutes, LCPR Actuarial Standards, and relevant ASOPs. We found that the report satisfactorily 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.

Valuation Review – PERA GERP *(continued)*

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 gains and losses 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	2.50% per 2018 Appendix to the Standards
Payroll growth assumption	3.25% per 2018 Appendix to the Standards
Merit and seniority pay increase assumptions	Service-based table per 2018 Appendix to the Standards
Mortality rates	The valuation report uses the RP-2014 tables with age adjustments and MP-2018 mortality improvement scale. However, the 2018 Appendix to the Standards states that the valuation will use the MP-2017 mortality improvement scale.
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

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, and 51. 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 system's 2008-2014 experience study.

We have reviewed those 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 have reviewed the plan provisions described in the actuarial valuation report, and we believe they accurately reflect the Statutes.

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.

However, there are a few items that could improve the presentation of results and illustrate pension risks. These include:

- Using charts and other graphical illustrations, where appropriate, to communicate results for non-technical reports users. Possible exhibits to illustrate include:
  - Funded status sensitivity tests on valuation page 5
  - Historical funded status, investment returns, and other items on valuation page 9
  - Schedule of Funding Progress on valuation page 69
  - Contribution Schedule on valuation page 70
- Including the Schedule of Funding Progress and Contribution Schedule (valuation pages 69 and 70) earlier in the report where they would be more prominent reminders of the Plan's journey towards full funding.
- Including a projection of net plan cash flows (i.e., future retiree benefit payments vs. contributions) relative to market value of assets to illustrate the plan's cash flow maturity.

Valuation Review – TRA

Review of census data

We obtained July 1, 2019 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	**82,965**	**82,965**	**82,965**	**0.0%**
Average Age	43.2	43.2	43.2	0.0%
Average Service	12.0	12.0	12.0	0.0%
Average Salary	$60,187	$60,187	$60,523	0.0%
Service Retirements	**61,046**	**61,073**	**61,073**	**0.0%**
Average Age	73.6	73.6	N/A	0.0%
Average Annual Annuity	$28,120	$28,121	$28,121	0.0%
Survivors	**5,714**	**5,727**	**5,727**	**0.2%**
Average Age	81.1	81.2	N/A	0.0%
Average Annual Annuity	$28,389	$28,626	$28,626	0.8%
Disability Retirements	**480**	**485**	**485**	**1.0%**
Average Age	58.0	58.0	N/A	0.1%
Average Annual Annuity	$21,553	$21,633	$21,633	0.4%
Deferred Retirements	**15,518**	**15,517**	**15,517**	**0.0%**
Average Age	48.4	48.4	48.4	0.0%
Average Annual Annuity (at NRD)	N/A	$8,012	$8,012	N/A
Terminated Other Non-Vested	**35,918**	**35,919**	**35,919**	**0.0%**
Average Age	46.9	46.9	46.9	0.0%
Total	**201,641**	**201,686**	**201,686**	**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. 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 page 80 of the valuation report are reasonable.

Compliance with Statutes, Standards, and ASOPs

We reviewed the TRA July 1, 2019 actuarial valuation for compliance with applicable Minnesota Statutes, LCPR Actuarial Standards, and relevant ASOPs. We found that the report satisfactorily 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.

Valuation Review – TRA *(continued)*

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 gains and losses 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 2018 Appendix to the Standards. This assumption is not explicitly disclosed in the actuarial valuation report, so we recommend it be included in the 2020 report.
Payroll growth assumption	3.00% per 2018 Appendix to the Standards
Merit and seniority pay increase assumptions	Service-based table per 2018 Appendix to the Standards
Mortality rates	RP-2014 tables with specified age adjustments and MP-2015 improvement scale per 2018 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

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, and 51. 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 system's 2008-2014 experience study and the 2017 economic experience study.

We have reviewed those 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 have reviewed the plan provisions described in the actuarial valuation report, and we believe they accurately reflect the Statutes.

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. We greatly appreciated that several of the historical results in the Executive Summary and some of the risk measures in the Risk Assessment were illustrated graphically. This makes the results more understandable to a non-technical audience.

We recommend a few items that could improve the presentation of results and illustrate pension risks. These include:

- Show separate asset and liability reconciliations, as is already done for GASB 67/68 reporting. The TRA funding report shows changes in only the *unfunded* actuarial accrued liability. Separate reconciliations would facilitate a comparison of actual vs. expected assets and liabilities.
- Show average age statistics for inactive members. This statistic is helpful for several purposes: liability duration assessment, plan maturity and year to year comparisons.
- Disclose the price inflation assumption.
- Provide graphical illustrations of the Schedule of Funding Progress (Table 13, valuation page 43) and Schedule of Contributions (Table 14, valuation page 44) since they have slightly more historical information than the Executive Summary data.
- Include the Schedule of Funding Progress and Contribution Schedule (valuation pages 43 and 44) earlier in the report where they would be more prominent reminders of the Plan's journey towards full funding.
- Include a projection of net plan cash flows (i.e., future retiree benefit payments vs. contributions) relative to market value of assets to illustrate the plan's cash flow maturity. This would be in addition to the projected benefit payment exhibit in Table 15 (valuation page 45).

Valuation Review – SPTRFA

Review of census data

We obtained July 1, 2019 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	**3,347**	**3,347**	**3,347**	**0.0%**
Average Age	44.9	45.0	44.9	0.1%
Average Service	13.1	13.1	13.1	0.0%
Average Pay[2]	$74,818	$75,408	$76,110	0.8%
Leave of Absence Members	**120**	**120**	**120**	**0.0%**
Average Age	43	43	N/A	0.1%
Service Retirements	**3,663**	**3,632**	**3,632**	**-0.8%**
Average Age	73.5	73.3	N/A	-0.3%
Average Annual Annuity	$29,233	$28,902	$28,902	-1.1%
Survivors	**347**	**347**	**347**	**0.0%**
Average Age	78.9	78.9	N/A	0.1%
Average Annual Annuity	$32,438	$32,438	$32,438	0.0%
Disability Retirements	**25**	**25**	**25**	**0.0%**
Average Age	58.2	58.3	N/A	0.1%
Average Annual Annuity	$18,547	$18,547	$18,547	0.0%
Deferred Retirements	**2,489**	**2,489**	**2,489**	**0.0%**
Average Age	48.3	48.4	N/A	0.1%
Terminated Non-Vested	**2,739**	**2,742**	**2,742**	**0.1%**
Total	**12,730**	**12,702**	**12,702**	**-0.2%**

[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

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 GRS' data assumptions and adjustments described on page 30 of the actuarial valuation report are reasonable.

Compliance with Statutes, Standards, and ASOPs

We reviewed the SPTRFA July 1, 2019 actuarial valuation for compliance with applicable Minnesota Statutes, LCPR Actuarial Standards, and relevant ASOPs. We found that the report satisfactorily 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 gains and losses 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 2018 Appendix to the Standards
Payroll growth assumption	3.00% per 2018 Appendix to the Standards
Merit and seniority pay increase assumptions	Service-based table per 2018 Appendix to the Standards
Mortality rates	The valuation report uses the RP-2014 tables with age adjustments and MP-2018 mortality improvement scale. However, the 2018 Appendix to the Standards states that the valuation will use the MP-2017 mortality improvement scale.
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

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, and 51. 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 system's 2011-2016 experience study.

We have reviewed those 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 have reviewed the plan provisions described in the actuarial valuation report, and we believe they accurately reflect the Statutes.

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.

However, there are a few items that could improve the presentation of results and illustrate pension risks. These include:

- Show separate asset and liability reconciliations, as is already done for GASB 67/68 reporting. The SPTRFA funding report shows changes in only the *unfunded* actuarial accrued liability. Separate reconciliations would facilitate a comparison of actual vs. expected assets and liabilities.
- Show average age statistics for non-active members. This statistic is helpful for several purposes: liability duration assessment, plan maturity and year to year comparisons.
- Switch the order of result columns on page 6 so the current year is on the left and prior year is on the right, which would be consistent with the other systems' valuation reports.
- Use charts and other graphical illustrations, where appropriate, to communicate results for non-technical reports users. Possible exhibits to illustrate include:
  - Funded status sensitivity tests on valuation page 5
  - Historical funded status, investment returns, and other items on valuation page 10
  - Schedule of Funding Progress on valuation page 52
  - Contribution Schedule on valuation page 53
- Include the Schedule of Funding Progress and Contribution Schedule (valuation pages 52 and 53) earlier in the report where they would be more prominent reminders of the Plan's journey towards full funding.
- Include a projection of net plan cash flows (i.e., future retiree benefit payments vs. contributions) relative to market value of assets to illustrate the plan's cash flow maturity.

Appendix A – System Asset Review

System Asset Reconciliation with SBI

The June 30, 2019 market value of assets reported in each actuarial valuation report matches the audited assets in the systems' CAFRs. However, it would be helpful to see a breakdown of system assets between State Board of Investments (SBI) and non-SBI assets so that the SBI portion can be reconciled with the amounts shown in the SBI CAFR.

The table below shows a reconciliation of the three statewide plans' assets with those reported by the SBI. Going forward, this could be shown in the actuarial valuation reports or, preferably, in each system's CAFR.

	MSRS SERF	PERA GERP	TRA
SBI investments			
Long-term	$ 13,353,345	$ 21,767,859	$ 22,101,080
Short-term	367,165	620,905	735,735
SBI subtotal	$ 13,720,510	$ 22,388,764	$ 22,836,815
Other assets			
Cash	$ 16,368	$ 7,372	$ 11,123
Receivables	28,337	50,077	22,324
Securities lending collateral	1,022,558	1,666,916	1,692,433
Capital assets	15,746	6,332	19,142
Other assets subtotal	$ 1,083,009	$ 1,730,697	$ 1,745,022
Total assets	$ 14,803,519	$ 24,119,461	$ 24,581,837
Liabilities	$ (1,031,230)	$ (1,678,493)	$ (1,705,781)
Net position restricted for pensions[1]	$ 13,772,289	$ 22,440,968	$ 22,876,056

[1] TRA Net Position does not reflect adjustment for Earnings Limitation Savings Account payable.

Appendix A – System Asset Review *(continued)*

Actuarial Value of Assets Calculations

The exhibits below compare the retained actuary's July 1, 2019 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 Actuarial Value of Assets Calculation

			Retained Actuary	VIA Calculations
1. Market value of assets available for benefits[1]			**13,772,289**	**13,772,289**
2. Determination of average asset balance				
a. Total assets at beginning of year			13,293,422	13,293,422
b. Total assets at end of year			13,772,289	13,772,289
c. Net investment income for fiscal year			948,366	948,366
d. Average balance (a. + b. - c.)/2			13,058,673	13,058,673
3. Expected return (7.50% x 2.d.)			979,400	979,400
4. Actual return			948,366	948,366
5. Current year asset gain/(loss) (4. - 3.)			(31,034)	(31,034)
6. Unrecognized asset returns	Original amounts	Unrecognized percent	Unrecognized amounts	Unrecognized amounts
a. FYE 2019	(31,034)	80%	(24,827)	(24,827)
b. FYE 2018	296,451	60%	177,871	177,871
c. FYE 2017	785,917	40%	314,367	314,367
d. FYE 2016	(924,474)	20%	(184,895)	(184,895)
e. Total unrecognized amount			282,516	282,516
7. AVA at end of year (1. - 6.f.)			**13,489,773**	**13,489,773**

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

Appendix A – System Asset Review *(continued)*

PERA Actuarial Value of Assets Calculation			Retained Actuary	VIA Calculations
1. Market value of assets available for benefits[1]			**22,440,968**	**22,440,968**
2. Determination of average asset balance				
a. Total assets at beginning of year			21,553,477	21,553,477
b. Total assets at end of year			22,440,968	22,440,968
c. Net investment income for fiscal year			1,547,224	1,547,224
d. Average balance (a. + b. - c.)/2			21,223,611	21,223,611
3. Expected return (7.50% x 2.d.)			1,591,771	1,591,771
4. Actual return			1,547,224	1,547,224
5. Current year asset gain/(loss) (4. - 3.)			(44,547)	(44,547)
6. Unrecognized asset returns	Original amounts	Unrecognized percent	Unrecognized amounts	Unrecognized amounts
a. FYE 2019	(44,547)	80%	(35,637)	(35,638)
b. FYE 2018	479,963	60%	287,978	287,978
c. FYE 2017	1,266,388	40%	506,555	506,555
d. FYE 2016	(1,484,753)	20%	(296,950)	(296,951)
e. Total unrecognized amount			461,946	461,944
7. AVA at end of year (1. - 6.f.)			**21,979,022**	**21,979,024**

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

Appendix A – System Asset Review *(continued)*

TRA Actuarial Value of Assets Calculation			Retained Actuary	VIA Calculations
1. Market value of assets available for benefits[1]			**22,872,153**	**22,872,153**
2. Determination of average asset balance				
a. Total assets at beginning of year			22,362,087	22,362,087
b. Total assets at end of year			22,876,056	22,876,056
c. Net investment income for fiscal year			1,579,099	1,579,099
d. Average balance (a. + b. - c.)/2			21,829,522	21,829,522
3. Expected return (7.50% x 2.d.)			1,637,214	1,637,214
4. Actual return			1,579,099	1,579,099
5. Current year asset gain/(loss) (4. - 3.)			(58,115)	(58,115)
6. Unrecognized asset returns	Original amounts	Unrecognized percent	Unrecognized amounts	Unrecognized amounts
a. FYE 2019	(58,115)	80%	(46,492)	(46,492)
b. FYE 2018	398,058	60%	238,835	238,835
c. FYE 2017	1,342,126	40%	536,850	536,850
d. FYE 2016	(1,619,440)	20%	(323,888)	(323,888)
e. Total unrecognized amount			405,305	405,305
7. AVA at end of year (1. - 6.f.)			**22,466,848**	**22,466,848**

[1]The amount shown under VIA calculations is from the System's CAFR. It reflects an adjustment for the Earnings Limitation Savings Account payable.

Appendix A – System Asset Review *(continued)*

SPTRFA Actuarial Value of Assets Calculation			Retained Actuary	VIA Calculations
1. Market value of assets available for benefits[1]			**1,080,544**	**1,080,544**
2. Determination of average asset balance				
a. Total assets at beginning of year			1,070,572	1,070,572
b. Total assets at end of year			1,080,544	1,080,544
c. Net investment income for fiscal year			60,209	60,209
d. Average balance (a. + b. - c.)/2			1,045,454	1,045,454
3. Expected return (7.50% x 2.d.)			78,409	78,409
4. Actual return			60,209	60,209
5. Current year asset gain/(loss) (4. - 3.)			(18,200)	(18,200)
6. Unrecognized asset returns	Original amounts	Unrecognized percent	Unrecognized amounts	Unrecognized amounts
a. FYE 2019	(18,200)	80%	(14,560)	(14,560)
b. FYE 2018	15,610	60%	9,366	9,366
c. FYE 2017	54,191	40%	21,676	21,676
d. FYE 2016	(77,451)	20%	(15,490)	(15,490)
e. Total unrecognized amount			992	992
7. AVA at end of year (1. - 6.f.)			**1,079,552**	**1,079,552**

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