

Minnesota Legislative Commission on Pensions and Retirement

Replication of July 1, 2022 PERA Local Government Correctional Service Retirement Plan Actuarial Valuation Report

June 5, 2023



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

Attn: Susan Lenczewski, Executive Director

Re: Replication of July 1, 2022 PERA Correctional Actuarial Valuation Report

This report presents our replication of the July 1, 2022 actuarial valuation report for the Public Employees Retirement Association of Minnesota Local Government Correctional Service Retirement Plan (PERA Correctional). It provides various exhibits illustrating the degree to which we were able to replicate both (1) the retained actuary's liability calculations and (2) their use of those liabilities to determine contribution rates and sufficiency.

In our professional opinion, we were able to reasonably match the retained actuary's data inputs, liability calculations, and contribution determinations. We did not find any meaningful differences or deficiencies in their calculations, and we provide commentary on the few areas where subsets of our results diverged from the retained actuary. In general, these instances were very limited.

Purpose of the Study

This study was prepared at the request of the Legislative Commission on Pensions and Retirement (LCPR). Its sole purpose is to replicate the July 1, 2022 PERA Correctional actuarial valuation calculations 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 VIA Actuarial Solutions 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 in this report are based on the following data sources:

- July 1, 2022 actuarial valuation report prepared by the PERA Correctional's retained actuary;
- July 1, 2022 census data files provided by PERA, and "scrubbed" census files provided by the retained actuary; and
- July 1, 2022 asset and financial data found in the system's audited financial statements.

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, then our conclusions in this actuarial valuation replication may differ significantly.

We wish to thank all the involved parties for providing information in a timely manner and for answering our questions. We are particularly grateful to the staff at GRS for their help answering questions about their valuation system's technical calculations.

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.

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

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Executive Summary

This report summarizes our replication of the July 1, 2022 PERA Local Government Correctional Service Retirement Plan actuarial valuation report. We conclude that the retained actuary reasonably determined the system's July 1, 2022 actuarial liabilities and contribution sufficiency/(deficiency).

The next section of this report describes our process for replicating and evaluating the retained actuary's calculations. It is followed by separate sections addressing different components of the replication process (e.g., validating census data and liability calculations), along with appendices that summarize many of the technical calculations.

We did not find any meaningful differences or deficiencies in the retained actuary's data or calculations. Overall liabilities and contributions were matched with sufficient accuracy, and we provide commentary on the few areas where subsets of our results diverged from the retained actuary. In general, these instances were very limited.

	PERA Correctional Actuarial Valuation	VIA Replication	Difference ¹
Participant data			
Active members	3,564	3,564	0.0%
Service retirements ²	1,407	1,496	6.3%
Survivors	87	87	0.0%
Disability retirements ²	223	134	-39.9%
Deferred retirements	4,129	4,129	0.0%
Other non-vested terminations	2,480	2,480	0.0%
Total	11,890	11,890	0.0%
System assets (\$1,000's)			
Market value of assets	\$ 975,315	\$ 975,315	0.0%
Actuarial Value of Assets	992,811	992,811	0.0%
System liabilities (\$1,000's)			
Present Value of Future Benefits (PFVB)	1,145,322	1,157,313	1.0%
Present Value of Future Normal Costs (PVFNC)	200,581	202,446	0.9%
Actuarial Accrued Liability (AAL)	944,741	954,867	1.1%
Normal Cost (NC)	28,555	27,485	-3.7%
System contributions (% of payroll)			
Normal cost rate	12.50%	12.03%	-0.47%
UAAL amortization payment	-1.27%	-1.00%	0.27%
Expenses	0.16%	0.16%	0.00%
Total required contribution (Chapter 356)	11.39%	11.19%	-0.20%
Statutory contribution rate (Chapter 352)	14.58%	14.58%	0.00%
Contribution sufficiency/(deficiency)	3.19%	3.39%	0.20%

¹ The system contribution comparisons are absolute differences presented as a percent of payroll. All other comparisons are the relative differences between our replication results and the retained actuary.

² PERA reclassifies disabled members as service retirees once they reach Normal Retirement Age. The retained actuary adjusted the status for 92 service retirees to be disabled retirees based on their historical classification as disabled retirees. Our counts are slightly different with 89 adjusted records

Process Overview

The purpose of this report is to replicate (1) the technical calculation of the plan's actuarial liabilities and (2) the contribution rates and sufficiency results based on those liabilities.

Our report focuses on replicating the following items:

1. Census data summaries;
2. Market asset data and Actuarial Value of Assets calculations;
3. Calculation of plan liabilities;
4. Calculation of contribution sufficiency/(deficiency);
5. Confirmation of actuarial assumptions, methods, and plan provisions; and
6. Review of additional compliance items.

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

Census data	<ul style="list-style-type: none">▪ Compare participant category counts and summary statistics for the retained actuary vs. system census data files▪ Compare detailed participant distributions for the retained actuary's census file vs. the valuation report summaries
Plan assets	<ul style="list-style-type: none">▪ Compare market asset values in the valuation report to those in the system's audited financial statements▪ Replicate retained actuary's Actuarial Value of Assets calculations
Plan liabilities	<ul style="list-style-type: none">▪ Replicate technical liability calculations, including Present Value of Future Benefits (PVFB), Present Value of Future Normal Costs (PVFNC), Actuarial Accrued Liability (AAL), and Normal Cost (NC)▪ Compare liability calculations for various member status groups
Contribution sufficiency/(deficiency)	<ul style="list-style-type: none">▪ Replicate the required normal cost and supplemental contribution rate calculations▪ Replicate retained actuary's contribution sufficiency/(deficiency) determination
Assumptions, methods, and plan provisions	Verify that the actuarial assumptions, methods, and plan provisions used in the July 1, 2022 actuarial valuation are consistent with applicable Minnesota Statutes and the System's recent actuarial experience studies.
Additional compliance requirements	Confirm that other aspects of the valuation report comply with applicable Minnesota Statutes, the LCPR's Standards for Actuarial Work, and relevant actuarial standards of practice (ASOPs).

Census Data

Census data is one of the foundational inputs for actuarial calculations. While it is not practical for data to be perfect, it should be reviewed for overall accuracy and reasonability.

Guidance on actuarial data is provided by Actuarial Standard of Practice No. 23, Data Quality (ASOP 23). It provides, in summary, that “The actuary should use available data that, in the actuary’s professional judgment, allow the actuary to perform the desired analysis. However, if material data limitations are known to the actuary, the actuary should disclose those limitations and their implications”.

To validate the census data used in the July 1, 2022 actuarial valuation report, we used the following process:

- Request separate census files from the retained actuary and the system;
- Compare overall census counts and summary statistics for various member classes (e.g., active members, service retirements, etc.); and
- Prepare detailed participant statistical distribution tables and compare them to those found in the retained actuary’s July 1, 2022 actuarial valuation report.

Overall, we found that the census data used by the retained actuary was consistent with the census data provided by the system. Our census data comparisons and tables can be found in **Appendix A**. These exhibits are described below, along with some brief commentary.

Summary of participant statistics: This table summarizes and compares participant counts and high-level participant category statistics for the retained actuary and system census files. It shows that the two files were very closely aligned.

Distribution of active members: This table summarizes the retained actuary’s active member data by classifying them in various age/service categories, along with the average pay for each classification. We found that this data was consistent with a similar summary table on page 16 of the July 1, 2022 actuarial valuation report.

Distributions of service retirements, survivors, and disability retirements: These tables summarize the retained actuary’s inactive member data by classifying them by age and service since retirement/death/disability, along with the average annual benefit for each classification. We found that the data in each of these tables was consistent with similar tables found on pages 17, 18 and 19 of the July 1, 2022 actuarial valuation report.

Plan Assets

Asset data is another of the foundational inputs for actuarial calculations. In addition to the Market Value of Assets, many public sector pension plans also use a smoothed Actuarial Value of Assets (AVA). The purpose of AVA methods is to stabilize contribution rates by smoothing investment returns – generally over a five-year period.

Guidance on asset smoothing methods is provided by Actuarial Standard of Practice No. 44, Selection and Use of Asset Valuation Methods for Pension Plans (ASOP 44). It provides considerations for selecting an actuarial asset method, including:

- Purpose of the measurement;
- Objectives of the employer and/or retirement system;
- Use of different methods/assumptions and adjustment for timing differences; and
- Other considerations such as the plan's expected future cash flows and liquidity needs.

Actuarial Standard of Practice No. 4, Measuring Pension Obligations and Determining Pension Plan Costs or Contributions (ASOP 4) also provides guidance, but generally defers to ASOP 44. The specific methodology for determining the AVA is prescribed in Minnesota Statutes, Section 356.215, Subd.1(f).

To validate the asset data and AVA calculations used in the July 1, 2022 actuarial valuation report, we used the following process:

- Review audited financial data and compare it to the information disclosed in the actuarial valuation report; and
- Replicate the AVA calculations shown in the July 1, 2022 actuarial valuation report.

We found that the asset data used by the retained actuary was consistent with the system's audited asset information. We were also able to replicate the AVA calculation prepared by the retained actuary and confirm it follows the methods prescribed in Minnesota Statutes. Our asset data comparison can be found in Appendix B, and the AVA replication can be found in Appendix C.

Plan Liabilities

Actuarial liabilities are calculated by programming actuarial software with a retirement system's data, assumptions, methods, and plan provisions. This is a complex process which involves substantial effort and actuarial programming experience.

For the replication, we independently programmed our valuation software based on our understanding of the data, assumptions, methods, and plan provisions used in the July 1, 2022 actuarial valuation report, Minnesota Statutes, and the LCPR's standards for actuarial work. The primary results we replicated are:

- **Present Value of Future Benefits (PVFB):** plan liability equal to the discounted value of all projected future benefit payments (based on current participant group with projected compensation and service accruals).
- **Normal Cost (NC):** the portion of the PVFB allocated to the valuation year based on current compensation levels.
- **Present Value of Future Normal Costs (PVFNC):** the portion of the PVFB allocated to future years based on the present value of projected participant compensation.
- **Actuarial Accrued Liability (AAL):** the portion of the PVFB allocated to prior years based on each participant's historical and projected compensation.

We expect some liability calculation differences even if we used the exact same inputs as the retained actuary. This is because each actuarial software program may have slightly different ways of applying actuarial formulas. As a general rule, we would like to match the overall PVFB and AAL within 2% and PVFNC and Normal Cost within 5% of the retained actuary's results.

Results for member subgroups or split by benefit source may differ by larger magnitudes depending on how each actuary interprets and programs their actuarial software. We believe these differences are acceptable as long as they are small relative to the overall plan.

The tables in **Appendix D** summarize and compare the liability measurements for different membership groups. **Our overall results are very close to those presented in the July 1, 2022 actuarial valuation, and we believe that the retained actuary is reasonably calculating plan liabilities.**

Contribution Sufficiency/(Deficiency)

PERA's statutory pension contribution rates are defined in Chapter 352 of Minnesota Statutes, but the retained actuary is also required to calculate "required contributions" per Chapter 356 of Minnesota Statutes. The required contribution rates are those which are expected to fully fund the pension plan by the statutory full funding date.

We replicated the contribution sufficiency/(deficiency) calculations as follows:

- **Statutory contributions:** We calculated the estimated dollar value of the statutory normal cost contributions based on the retained actuary's blended statutory normal cost contribution rates applied to our replication of projected payroll. These amounts are added to the statutory supplemental contribution rates to determine the total statutory contribution rate.
- **Required contributions:** We calculated the estimated "percent of payroll" and dollar value of the contributions required to fully fund the plan based on the system's stated funding policy. These consist of normal cost contributions plus the required supplemental contribution rate. The normal cost and supplemental components of the required contributions were based on our replication of the Plan's normal cost, actuarial accrued liability, and projected payroll through the statutory full funding date. A rolling 30-year amortization period is prescribed when a plan's funded status is above 100%.
- **Contribution sufficiency/(deficiency):** We compare our contribution sufficiency calculation (i.e., difference between the statutory and required contributions) to those determined by the retained actuary in the July 1, 2022 actuarial valuation report.

The tables in **Appendix E** summarize and compare our calculations. **Our overall results are close to those calculated by the retained actuary, and we believe that the retained actuary is reasonably calculating the contribution sufficiency/(deficiency).**

Assumptions, Methods, and Plan Provisions

The retained actuary's July 1, 2022 actuarial valuation report contains a detailed description of the actuarial assumptions, methods, and plan provisions used to prepare their results. These items are summarized in their report on pages 25 through 36. We do not reprint all the assumptions, methods, and plan provisions in this replication report, but we do provide a high-level commentary below.

Actuarial Methods

Actuarial Cost Method: Minnesota Statutes, Section 356.215 Subd.1(b) and (d) require that PERA use the Entry Age Normal level percent of pay actuarial cost method. In this method, the actuarial Present Value of Future Benefits (PVFB) for each individual is allocated as a level percent of pay from entry age (hire age, for most employees) to decrement age (e.g., expected age at termination or retirement).

The portion of the PVFB allocated to the valuation year is called the Normal Cost (NC). The portion of the PVFB allocated to past years is called the Actuarial Accrued Liability (AAL). The retained actuary documents using this cost method in their report, and the closeness of our replication liabilities (Appendix D) indicate that it was applied appropriately.

Asset valuation method: The asset valuation method is used to smooth market fluctuations over time to create contribution stability. Minnesota Statutes, Section 356.215 Subd.1(f) requires using an Actuarial Value of Assets that smooths investment gains and losses over a five-year period. We confirmed that the retained actuary described and used the statutory asset smoothing method, and our replication calculations can be found in Appendix C of this report.

Contribution method: The contribution method specifies a process for funding the current year incurred liabilities (the Normal Cost) plus paying down/amortizing a portion of unfunded past liabilities (the Unfunded Actuarial Accrued Liability, or UAAL amortization).

These contribution parameters are defined in Minnesota Statutes, Section 356.215 Subd.5 and Subd.11. They specify that (1) the Normal Cost must be expressed as a level percent of payroll and (2) the required supplemental contribution must be calculated by amortizing the UAAL as a level percent of projected payroll over the closed period ending June 30, 2048 (or a rolling 30-year period when the plan's funded status is above 100%).

We confirmed that pages 21-24 of the July 1, 2022 actuarial valuation report describes the correct contribution calculation process, and our replication calculations (Appendix E of this report) indicate that the retained actuary applied the methods and assumptions appropriately.

Actuarial Assumptions

Demographic assumptions: We verified that the demographic assumptions described in the July 1, 2022 actuarial valuation report were based on those developed in the 2015-2019 actuarial experience study dated July 10, 2020. The allowance for Combined Service Annuity assumptions are based on the LCPR prior actuary's report dated October 2016.

Economic assumptions: We verified that the economic assumptions described in the July 1, 2022 actuarial valuation report were based on those developed in the 2020 experience study, with an investment return assumption and discount rate per Minnesota Statute, Section 356.215 Subd.8(a). They also include the COLA, salary scale, payroll growth, and other assumptions described in 356.215 Subd.8(b)-(d) and Subd.9

We also confirmed that demographic and economic assumptions used in the valuation are consistent with those described in Appendix A (effective July 1, 2021) to the LCPR's Standards for Actuarial Work. These assumptions include 2.25% price inflation, 3.00% payroll growth, age-based salary increase table, and PUB-2010 mortality tables.

Plan Provisions

Minnesota Statutes, Chapter 352 describe the retirement benefits provided to PERA members, and the primary service annuity formulas. We reviewed the plan provisions summarized in the July 1, 2022 actuarial valuation report and believe they are consistent with our understanding of the benefits described in Minnesota Statutes.

Additional Compliance Requirements

In addition to correctly summarizing and applying the assumptions, methods, and plan provisions, the actuarial valuation report must comply with other statutory requirements and professional standards. We reviewed the PERA Correctional July 1, 2022 actuarial valuation report for compliance with applicable Minnesota Statutes, LCPR Actuarial Standards, and relevant Actuarial Standards of Practice. 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	
The applicable Minnesota Statutes include Sections 356.214 (actuarial valuation preparation) and 356.215 (actuarial valuations and experience studies). We confirmed compliance with the following requirements as described below.	
Normal cost	Calculated as a level percentage of payroll per 356.215 Subd.5
Amortization of unfunded liabilities	Since the PERA Correctional Plan's funded status is above 100%, the excess assets are amortized as a level percent of payroll ending June 30, 2052 per 356.215 Subd.11(k)
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	
In addition to specific actuarial assumptions (described earlier in this report), the LCPR's Standards for Actuarial Work and its Appendix A specify actuarial cost methods and detailed report contents. We confirmed compliance with these requirements as described below.	
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

Actuarial Standards of Practice Compliance

Actuarial Standards of Practice (ASOPs) provide broad standards that all actuaries must follow as part of our professional standards. The relevant ASOPs for pension actuarial reports include:

- ASOP 4, Measuring Pension Obligations and Determining Pension Plan Costs or Contributions
- ASOP 23, Data Quality
- ASOP 27, Selection of Economic Assumptions for Measuring Pension Obligations
- ASOP 35, Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations
- ASOP 41, Actuarial Communications
- ASOP 44, Selection and Use of Asset Valuation Methods for Pension Valuations
- ASOP 51, Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions
- ASOP 56, Modeling

We reviewed the report and believe that it adequately complies with all relevant Actuarial Standards of Practice, including ASOPs 4, 23, 27, 35, 41, 44, 51, and 56.

We specifically note GRS' compliance with ASOP 27 on page 1 of the report cover letter and page 1 of the valuation report where they identify assumptions "that significantly conflicts with what, in the actuary's professional judgement, is reasonable for the purpose of the measurement."

Appendix A – Census Data Comparisons

The exhibits below compare the participant counts and certain data statistics between the “raw” system data and the “scrubbed” actuarial data.

Summary of Participant Statistics

	Retained Actuary	System Data	Difference
Active members	3,564	3,564	0
Average age	38.7	38.7	0.0%
Average service	7.6	7.6	0.0%
Average salary ³	\$ 61,024	\$ 54,217	-11.2%
Service retirements⁴	1,407	1,496	89
Average age	66.5	66.7	0.3%
Average annual annuity	\$ 13,779	\$ 14,135	2.6%
Survivors	87	87	0
Average age	63.6	63.6	0.0%
Average annual annuity	\$ 10,772	\$ 10,772	0.0%
Disability retirements⁴	223	134	(89)
Average age	60.0	53.2	-11.3%
Average annual annuity	\$ 20,790	\$ 21,472	3.3%
Deferred retirements	4,129	4,129	0
Average age	43.1	43.1	0.0%
Other non-vested terminations	2,480	2,480	0
Total	11,890	11,890	0

³ The average salary for active members from the System Data does not include the data adjustments described in the assumption section of the 2022 valuation report that are applied in the Retained Actuary valuation data.

⁴ PERA reclassifies disabled members as service retirees once they reach Normal Retirement Age. The retained actuary adjusted the status for 92 service retirees to be disabled retirees based on their historical classification as disabled retirees. Our counts are slightly different with 89 adjusted records.

Distribution of Active Member Data

The table below summarizes the retained actuary’s active member data by age and years of service, and it also includes the average earnings for each grouping. It can be compared to the similar summary table on page 16 from the July 1, 2022 actuarial report. We find that the entries compare well to those in the actuarial valuation report.

Age	Years of Service as of June 30, 2022									Total
	<3	3-4	5-9	10-14	15-19	20-24	25-29	30-34	35+	
<25	349	22								371
Avg pay	\$33,271	\$55,917								\$34,614
25-29	371	127	57							555
Avg pay	\$45,007	\$57,740	\$59,307							\$49,389
30-34	233	112	220	11						576
Avg pay	\$47,637	\$62,551	\$66,092	\$71,567						\$58,043
35-39	147	70	142	91	29					479
Avg pay	\$45,780	\$58,199	\$65,251	\$74,544	\$79,963					\$60,901
40-44	100	49	104	72	101	23				449
Avg pay	\$47,280	\$61,103	\$65,093	\$74,550	\$83,115	\$78,451				\$66,945
45-49	53	32	66	45	77	98				371
Avg pay	\$47,094	\$67,895	\$66,346	\$77,345	\$81,236	\$83,757				\$72,753
50-54	49	26	44	47	67	146				379
Avg pay	\$76,700	\$71,021	\$65,496	\$71,700	\$81,156	\$85,902				\$78,722
55-59	25	15	27	23	48	80				218
Avg pay	\$36,376	\$53,470	\$58,168	\$70,197	\$81,705	\$89,819				\$73,412
60-64	17	7	13	20	30	47				134
Avg pay	\$35,660	\$70,613	\$63,373	\$63,359	\$83,741	\$84,026				\$72,037
65-69	4	1	6	3	5	9				28
Avg pay	\$79,471	\$23,933	\$28,755	\$69,261	\$92,234	\$80,873				\$68,255
70+	1		1	1		1				4
Avg pay	\$59,778		\$1,874	\$45,876		\$77,663				\$46,298
Total	1,349	461	680	313	357	404				3,564
Avg pay	\$43,746	\$60,686	\$64,391	\$73,240	\$82,077	\$85,382				\$61,026

Note that the average pay in this table does not match the average pay for active members from the System Data on the prior page because the amounts shown above include data adjustments as described in the assumption section of the 2022 valuation report.

Distribution of Service Retirements

The table below summarizes the retained actuary’s service retirement data by age and years since retirement, and it also includes the average annual pension benefit for each grouping. It can be compared to the similar summary table on page 17 from the July 1, 2022 actuarial report. We find that the entries compare well to those in the actuarial valuation report.

Age	Years Retired as of June 30, 2022							Total
	<1	1-4	5-9	10-14	15-19	20-24	25+	
<50								
Avg benefit								
50-54	8	21						29
Avg benefit	\$8,994	\$10,932						\$10,397
55-59	52	138	42					232
Avg benefit	\$23,078	\$16,202	\$11,736					\$16,935
60-64	36	161	104	13				314
Avg benefit	\$22,755	\$17,021	\$13,189	\$7,314				\$16,007
65-69	28	130	147	63	5			373
Avg benefit	\$16,722	\$16,961	\$15,104	\$10,163	\$5,952			\$14,915
70-74	3	26	119	90	26			264
Avg benefit	\$23,799	\$15,666	\$13,595	\$10,569	\$6,472			\$12,182
75-79		3	15	60	45	7		130
Avg benefit		\$10,423	\$13,484	\$9,343	\$5,497	\$2,471		\$8,145
80-84		2		9	31	14		56
Avg benefit		\$13,413		\$7,713	\$5,282	\$1,269		\$4,960
85-89					2	5		7
Avg benefit					\$3,572	\$999		\$1,734
90+						2		2
Avg benefit						\$1,361		\$1,361
Total	127	481	427	235	109	28		1,407
Avg benefit	\$20,715	\$16,375	\$13,829	\$9,858	\$5,654	\$1,528		\$13,779

Distribution of Survivors

The table below summarizes the retained actuary’s survivor data by age and years since death, and it also includes the average annual pension benefit for each grouping. It can be compared to the similar summary table on page 18 of the July 1, 2022 actuarial report. We find that the entries compare well to those in the actuarial valuation report.

Age	Years Since Death as of June 30, 2022							Total
	<1	1-4	5-9	10-14	15-19	20-24	25+	
<45		2	4	1				7
Avg benefit		\$5,841	\$7,876	\$4,540				\$6,818
45-49		1	3	1				5
Avg benefit		\$3,028	\$14,860	\$5,158				\$10,553
50-54		2	1	2				5
Avg benefit		\$23,487	\$7,062	\$10,410				\$14,971
55-59	1	3	3	3				10
Avg benefit	\$1,805	\$23,839	\$12,380	\$8,350				\$13,551
60-64	1	3	7		1	1		13
Avg benefit	\$27,362	\$14,127	\$18,549		\$2,729	\$1,210		\$15,656
65-69	2	7	9	3	1			22
Avg benefit	\$19,152	\$8,591	\$9,401	\$6,987	\$1,453			\$9,339
70-74	3	1	4	3	1			12
Avg benefit	\$1,261	\$20,926	\$9,795	\$9,007	\$25,002			\$9,659
75-79	1	4	2		3			10
Avg benefit	\$10,342	\$8,101	\$5,864		\$6,585			\$7,423
80-84		2	1					3
Avg benefit		\$13,015	\$1,165					\$9,065
85-89								
Avg benefit								
90+								
Avg benefit								
Total	8	25	34	13	6	1		87
Avg benefit	\$10,200	\$12,603	\$11,377	\$7,965	\$8,157	\$1,210		\$10,772

Distribution of Disability Retirements

The table below summarizes the retained actuary's disability retirement data by age and years since disability retirement, and it also includes the average annual pension benefit for each grouping. It can be compared to the similar summary table on page 19 of the July 1, 2022 actuarial report. We find that the entries compare well to those in the actuarial valuation report.

Age	Years Disabled as of June 30, 2022							Total
	<1	1-4	5-9	10-14	15-19	20-24	25+	
<45	3	12	5	3	1			24
Avg benefit	\$27,727	\$24,614	\$19,797	\$12,849	\$13,874			\$22,082
45-49	1	3	3	6	1			14
Avg benefit	\$34,952	\$17,011	\$12,452	\$17,031	\$9,219			\$16,767
50-54	3	9	8	2	3			25
Avg benefit	\$21,451	\$23,550	\$24,166	\$20,665	\$22,566			\$23,146
55-59	5	12	6	13	3	2		41
Avg benefit	\$26,107	\$22,889	\$18,475	\$16,598	\$17,756	\$28,554		\$20,542
60-64	4	8	8	9	5	2		36
Avg benefit	\$23,507	\$22,782	\$17,407	\$18,087	\$26,773	\$29,560		\$21,425
65-69	6	23	1	1	2			33
Avg benefit	\$24,385	\$18,254	\$19,700	\$10,453	\$29,740			\$19,872
70-74		3	31					34
Avg benefit		\$15,418	\$21,315					\$20,795
75+			2	11	3			16
Avg benefit			\$32,362	\$19,941	\$10,830			\$19,785
Total	22	70	64	45	18	4		223
Avg benefit	\$25,153	\$21,162	\$20,703	\$17,565	\$20,550	\$29,057		\$20,790

Appendix B – Market Value of Assets Comparison

The exhibit below compares the market value of assets from the system’s annual financial report to the amounts used by the retained actuary (see page 12 in the July 1, 2022 valuation report). We find that the entries compare well, which indicates that the market asset data used in the valuation report was correct. All amounts shown are in \$1,000’s.

	<u>Retained Actuary</u>	<u>System Financials</u>
Assets in Trust		
Cash, equivalents, short term securities	16,177	16,177
Fixed income	222,439	222,439
Equity and private equity	489,555	489,555
Other	247,026	247,026
Total Assets in Trust	975,197	975,197
Assets Receivable	743	743
Amounts Payable	(625)	(625)
Net Assets Held in Trust for Pension Benefits	975,315	975,315

Appendix C – Actuarial Value of Assets Replication

The exhibit below compares the retained actuary's July 1, 2022 AVA calculation (see page 14 in the July 1, 2022 valuation report) to our replication. The calculations match and are consistent with relevant Minnesota Statutes, Section 356.215, Subd.1(f) so we believe they were prepared correctly. All amounts shown are in \$1,000's.

		Retained Actuary	VIA Match
1.	Market value of assets available for benefits	975,315	975,315
2.	Determination of average asset balance		
a.	Total assets at beginning of year	1,035,716	1,035,716
b.	Total assets at end of year	975,315	975,315
c.	Net investment income for fiscal year	(66,015)	(66,015)
d.	Average balance (a. + b. - c.)/2	1,038,523	1,038,523
3.	Expected return (7.50% x 2.d.)	77,889	77,889
4.	Actual return	(66,015)	(66,015)
5.	Current year asset gain/(loss) (4. - 3.)	(143,904)	(143,904)
6.	Unrecognized asset returns	Original	Unrecognized
		amounts	percent
a.	FYE 2022	(143,904)	80%
b.	FYE 2021	179,252	60%
c.	FYE 2020	(24,475)	40%
d.	FYE 2019	(671)	20%
e.	FYE 2018	14,166	0%
f.	Total unrecognized amount		
		(115,123)	(115,123)
		107,551	107,551
		(9,790)	(9,790)
		(134)	(134)
		N/A	N/A
		(17,496)	(17,496)
7.	AVA at end of year (1. - 6.f.)	992,811	992,811

Appendix D – Plan Liability Replications

The exhibits below compare our replication of the plan liabilities to those calculated by the retained actuary. We believe that the overall closeness of the results indicates the July 1, 2022 actuarial valuation report liabilities are reasonable. There are a couple of small benefit subclasses with larger differences (e.g., survivor benefits, deferred retirements and refunds for active members) but these are very small relative to the overall plan. All amounts shown are in \$1,000's.

Present Value of Benefits (PVB) Liability	Retained Actuary	VIA Replication	\$ Difference	% Difference
Active members				
Retirement annuities	\$ 462,335	\$ 468,687	\$ 6,352	1.4%
Disability benefits	56,736	57,075	339	0.6%
Survivor benefits	5,149	5,340	191	3.7%
Deferred retirements	57,641	60,780	3,139	5.4%
Refunds	3,463	3,566	103	3.0%
Subtotal	\$ 585,324	\$ 595,448	\$ 10,124	1.7%
Deferred retirements	229,150	230,706	1,556	0.7%
Former members without vested rights	2,151	2,170	19	0.9%
Annuitants	328,697	328,989	292	0.1%
Total	\$ 1,145,322	\$ 1,157,313	\$ 11,991	1.0%
Present Value of Future Normal Costs (PVFNC)	Retained Actuary	VIA Replication	\$ Difference	% Difference
Active members				
Retirement annuities	\$ 115,351	\$ 117,170	\$ 1,819	1.6%
Disability benefits	32,285	32,448	163	0.5%
Survivor benefits	1,580	1,648	68	4.3%
Deferred retirements	39,805	40,840	1,035	2.6%
Refunds	11,560	10,340	(1,220)	-10.6%
Total	\$ 200,581	\$ 202,446	\$ 1,865	0.9%
Actuarial Accrued Liability (AAL)	Retained Actuary	VIA Replication	\$ Difference	% Difference
Active members				
Retirement annuities	\$ 346,984	\$ 351,517	\$ 4,533	1.3%
Disability benefits	24,451	24,627	176	0.7%
Survivor benefits	3,569	3,692	123	3.4%
Deferred retirements	17,836	19,940	2,104	11.8%
Refunds	(8,097)	(6,774)	1,323	-16.3%
Subtotal	\$ 384,743	\$ 393,002	\$ 8,259	2.1%
Deferred retirements	229,150	230,706	1,556	0.7%
Former members without vested rights	2,151	2,170	19	0.9%
Annuitants	328,697	328,989	292	0.1%
Total	\$ 944,741	\$ 954,867	\$ 10,126	1.1%

Appendix D – Plan Liability Replications

Normal Cost	Retained Actuary	VIA Replication	\$ Difference	% Difference
Active members				
Retirement annuities	\$ 16,768	\$ 16,260	\$ (508)	-3.0%
Disability benefits	4,843	4,642	(201)	-4.2%
Survivor benefits	228	220	(8)	-3.5%
Deferred retirements	5,163	5,042	(121)	-2.3%
Refunds	1,553	1,321	(232)	-14.9%
Total	\$ 28,555	\$ 27,485	\$ (1,070)	-3.7%

