City of Worcester Retirement System

Actuarial Valuation and Review as of January 1, 2024

Segal

Segal

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June 7, 2024

Retirement Board
City of Worcester Retirement System
City Hall, Room 103, 455 Main Street
Worcester, MA 01608

Dear Board Members:

We are pleased to submit this Actuarial Valuation and Review as of January 1, 2024. It summarizes the actuarial data used in the valuation, analyzes the preceding year's experience, and establishes the funding requirements for fiscal 2025 and later years.

This report has been prepared in accordance with generally accepted actuarial principles and practices for the exclusive use and benefit of the Board, based upon information provided by the staff of the City of Worcester Retirement System and the Worcester Retirement System's other service providers.

Segal does not audit the data provided. The accuracy and comprehensiveness of the data is the responsibility of those supplying the data. To the extent we can, however, Segal does review the data for reasonableness and consistency. Based on our review of the data, we have no reason to doubt the substantial accuracy of the information on which we have based this report and we have no reason to believe there are facts or circumstances that would affect the validity of these results.

The measurements shown in this actuarial valuation may not be applicable for other purposes. Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements; and changes in plan provisions or applicable law.

The actuarial calculations were directed under the supervision of Kathleen A. Riley, FSA, MAAA, EA. She is a member of the American Academy of Actuaries and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein. To the best of her knowledge, the information supplied in this actuarial valuation is complete and accurate. The assumptions used in this actuarial valuation were selected by the Board based upon our analysis and recommendations. In her opinion, the assumptions are reasonable and take into account the experience of the System and reasonable expectations. In addition, in her opinion, the combined effect of these assumptions is expected to have no significant bias.

Segal makes no representation or warranty as to the future status of the System and does not guarantee any particular result. This document does not constitute legal, tax, accounting or investment advice or create or imply a fiduciary relationship. The Board is encouraged to discuss any issues raised in this report with the System's legal, tax and other advisors before taking, or refraining from taking, any action.

We look forward to reviewing this report at your next meeting and to answering any questions.

Sincerely,

Segal

Kathleen A. Riley, FSA, MAAA, EA
Senior Vice President and Chief Actuary

Andrew R. Luongo, ASA, MAAA
Consulting Actuary

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Section 1: Actuarial Valuation Summary

Purpose and basis

This report has been prepared by Segal to present a valuation of the City of Worcester Retirement System as of January 1, 2024. The valuation was performed to determine whether the assets and contributions are sufficient to provide the prescribed benefits.

The contribution requirements presented in this report are based on:

- The benefit provisions of the Massachusetts General Law Chapter 32;
- The characteristics of covered active participants, inactive participants, and retired participants and beneficiaries as of December 31, 2023, provided by the staff of the Retirement System;
- The assets of the Plan as of December 31, 2023, provided by the Retirement System;
- Economic assumptions regarding future salary increases and investment earnings; and
- Other actuarial assumptions regarding employee terminations, retirement, death, etc. and

Certain disclosure information required by GASB Statements No. 67 and 68 as of December 31, 2023 for the City of Worcester Retirement System is provided in a separate report.

Valuation highlights

1. Segal strongly recommends an actuarial funding method that targets 100% funding of the actuarial accrued liability. Generally, this implies payments that are ultimately at least enough to cover normal cost, interest on the unfunded actuarial accrued liability and the principal balance. The funding policy adopted by the City of Worcester Retirement System meets this standard and funds the unfunded actuarial accrued liability of the plan by June 30, 2034.
2. The rate of return on the market value of assets was 10.23% for the year ending December 31, 2023. The return on the actuarial value of assets was 8.45% for the same period due to the recognition of prior years' investment gains and losses. This resulted in an actuarial gain when measured against the assumed rate of return of 6.80%.
3. The actuarial value of assets is 101.6% of the market value of assets. The investment experience in the past years has only been partially recognized in the actuarial value of assets. As the deferred net loss is recognized in future years, the cost of the Plan is likely to increase unless the net loss is offset by future experience. The deferred investment losses are not reflected in the funding schedules shown in Section 2.
4. This valuation reflects a change in the administrative expense assumption from $700,000 for calendar year 2023 to $740,000 for calendar year 2024 and $700,000 for calendar year 2025.
5. The actuarial gain of $16,316,319, or 0.9% of actuarial accrued liability, is due to an investment gain of $20,486,700, or 1.2% of actuarial accrued liability, and a loss from sources other than investments of $4,170,381, or 0.2% of the actuarial accrued liability prior to reflection of assumption changes. The loss from non-investment experience was primarily due to salaries increasing more than expected for continuing actives, partially offset by a gain due to mortality experience.
6. The funded ratio (the ratio of the actuarial value of assets to actuarial accrued liability) is 76.56%, compared to the prior year funded ratio of 73.59%. This ratio is one measure of funding status, and its history is a measure of funding progress. Using the market value of assets, the funded ratio is 75.37%, compared to 71.30% as of the prior valuation date. These measurements are not necessarily appropriate for assessing the sufficiency of the System assets to cover the estimated cost of settling the System's benefit obligation or the need for or the amount of future contributions.
7. The funding schedule included in this report shows a projection of the actuarially determined contribution. The fiscal 2025 total appropriation has been set equal to $69,932,716 as determined with the prior valuation. For fiscal 2026 and later years, each year's total appropriation increases 3.50%, with a smaller payment in fiscal 2034, so that the System will be fully funded by June 30, 2034, if all assumptions are met and there are no changes in the plan of benefits or assumptions. The parameters of the funding schedule shown in the prior valuation were the same.
8. The unfunded actuarial accrued liability is $411,589,950, which is a decrease of $37,338,015 million since the prior valuation.

9. Since the actuarial valuation results are dependent on a given set of assumptions, there is a risk that emerging results may differ significantly as actual experience proves to be different from the assumptions. We have not been engaged to perform a detailed analysis of the potential range of the impact of risk relative to the System's future financial condition, but have included a brief discussion of some risks that may affect the System in Section 2. A more detailed assessment would provide the Board with a better understanding of the inherent risks and could be important for the System because relatively small changes in investment performance can produce large swings in the contribution requirements.

Summary of key valuation results

Valuation Result	Current	Prior
Contributions for fiscal year beginning	**July 1, 2024**	**July 1, 2023**
• Actuarially determined contributions	$69,932,716	$66,733,809
• Actuarially determined contributions as a percent of payroll	27.73%	29.08%
Actuarial accrued liability for plan year beginning	**January 1, 2024**	**January 1, 2023**
• Retired participants and beneficiaries	$1,060,042,365	$1,026,745,517
• Inactive vested participants	32,146,609	32,234,904
• Inactive participants due a refund of employee contributions	9,693,348	8,155,050
• Active participants	653,802,797	632,854,564
• Total	1,755,685,119	1,699,990,035
• Normal cost including administrative expenses for plan year beginning January 1	42,607,225	39,212,323
Assets for plan year beginning January 1		
• Market value of assets (MVA)	$1,323,279,350	$1,212,020,446
• Actuarial value of assets (AVA)	1,344,095,169	1,251,062,070
• Actuarial value of assets as a % of market value of assets	101.6%	103.2%
Funded status for plan year beginning January 1		
• Unfunded actuarial accrued liability on market value of assets	$432,405,769	$487,969,589
• Funded percentage on MVA basis	75.37%	71.30%
• Unfunded actuarial accrued liability on actuarial value of assets	$411,589,950	$448,927,965
• Funded percentage on AVA basis	76.56%	73.59%

Section 1: Actuarial Valuation Summary

Valuation Result	Current	Prior
Key assumptions		
• Net investment return	6.80%	6.80%
• Inflation rate	3.00%	3.00%
Demographic data for plan year beginning January 1		
• Number of retired participants and beneficiaries	2,756	2,761
• Number of inactive vested participants	173	167
• Number of inactive participants due a refund of employee contributions	1,310	1,130
• Number of active participants	3,763	3,630
• Average compensation[1]	$63,746	$60,150

[1] Compensation figures are for the prior year and reflect annualized salaries for participants hired during the year. Calendar year 2023 salaries were reduced by 5.2% for police non-officials to reflect retroactive payments that were included in the salary data. In addition, calendar year 2023 salaries were increased by 3.8% for firefighters, and 6.4% for police officials to estimate the impact of salary increases attributable to unsettled bargaining contracts.
Calendar year 2022 salaries were reduced by 3.0% for police and firefighters to reflect retroactive payments that were included in the salary data.

Important information about actuarial valuations

An actuarial valuation is a budgeting tool with respect to the financing of future projected obligations of a pension plan. It is an estimated forecast – the actual long-term cost of the plan will be determined by the actual benefits and expenses paid and the actual investment experience of the plan.

In order to prepare a valuation, Segal relies on a number of input items. These include:

Input Item	Description
Plan provisions	Plan provisions define the rules that will be used to determine benefit payments, and those rules, or the interpretation of them, may change over time. Even where they appear precise, outside factors may change how they operate. It is important to keep Segal informed with respect to plan provisions and administrative procedures, and to review the plan summary included in our report to confirm that Segal has correctly interpreted the plan of benefits.
Participant information	An actuarial valuation for a plan is based on data provided to the actuary by the City of Worcester Retirement System. Segal does not audit such data for completeness or accuracy, other than reviewing it for obvious inconsistencies compared to prior data and other information that appears unreasonable. It is important for Segal to receive the best possible data and to be informed about any known incomplete or inaccurate data.
Financial information	Part of the cost of a plan will be paid from existing assets — the balance will need to come from future contributions and investment income. The valuation is based on the asset values as of the valuation date, typically reported by the City of Worcester Retirement System. A snapshot as of a single date may not be an appropriate value for determining a single year's contribution requirement, especially in volatile markets. Plan sponsors often use an "actuarial value of assets" that differs from market value to gradually reflect year-to-year changes in the market value of assets in determining the contribution requirements.
Actuarial assumptions	In preparing an actuarial valuation, Segal starts by developing a forecast of the benefits to be paid to existing plan participants for the rest of their lives and the lives of their beneficiaries. This requires actuarial assumptions as to the probability of death, disability, withdrawal, and retirement of participants in each year, as well as forecasts of the plan's benefits for each of those events. In addition, the benefits forecasted for each of those events in each future year reflect actuarial assumptions as to salary increases and cost-of-living adjustments. The forecasted benefits are then discounted to a present value, typically based on an estimate of the rate of return that will be achieved on the plan's assets. All of these factors are uncertain and unknowable. Thus, there will be a range of reasonable assumptions, and the results may vary materially based on which assumptions are selected within that range. That is, there is no right answer (except with hindsight). It is important for any user of an actuarial valuation to understand and accept this constraint. The actuarial model may use approximations and estimates that will have an immaterial impact on our results. In addition, the actuarial assumptions may change over time, and while this can have a significant impact on the reported results, it does not mean that the previous assumptions or results were unreasonable or wrong.

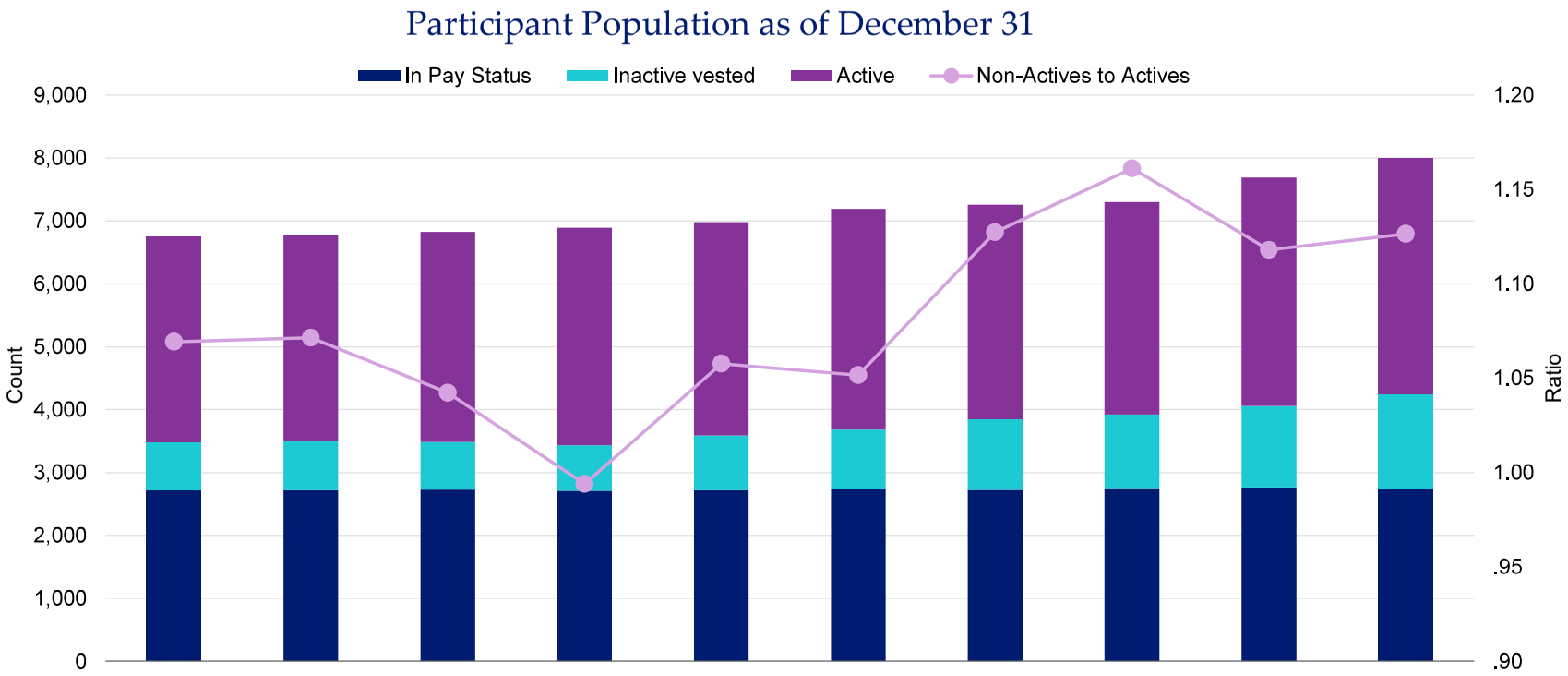
Section 1: Actuarial Valuation Summary

The user of Segal's actuarial valuation (or other actuarial calculations) should keep the following in mind:

- The actuarial valuation is prepared at the request of the City of Worcester Retirement System. Segal is not responsible for the use or misuse of its report, particularly by any other party.
- An actuarial valuation is a measurement at a specific date — it is not a prediction of a plan's future financial condition. Accordingly, Segal did not perform an analysis of the potential range of financial measurements, except where otherwise noted.
- If the City of Worcester Retirement System is aware of any event or trend that was not considered in this valuation that may materially change the results of the valuation, Segal should be advised, so that we can evaluate it.
- Segal does not provide investment, legal, accounting, or tax advice and is not acting as a fiduciary to the Worcester Retirement System. The valuation is based on Segal's understanding of applicable guidance in these areas and of the Worcester Retirement System's provisions, but they may be subject to alternative interpretations. The City of Worcester Retirement System should look to their other advisors for expertise in these areas.
- While Segal maintains extensive quality assurance procedures, an actuarial valuation involves complex computer models and numerous inputs. In the event that an inaccuracy is discovered after presentation of Segal's valuation, Segal may revise that valuation or make an appropriate adjustment in the next valuation.
- Segal's report shall be deemed to be final and accepted by the City of Worcester Retirement System upon delivery and review. The Board should notify Segal immediately of any questions or concerns about the final content.

Section 2: Actuarial Valuation Results

Participant information



Legend	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
In Pay Status	2,717	2,722	2,728	2,707	2,717	2,738	2,724	2,753	2,761	2,756
Inactive Vested[1]	771	787	755	727	872	949	1,121	1,168	1,297	1,483
Active	3,262	3,275	3,342	3,455	3,393	3,506	3,411	3,377	3,630	3,763
Ratio	1.07	1.07	1.04	0.99	1.06	1.05	1.13	1.16	1.12	1.13

[1] Including terminated participants due a refund of employee contributions.

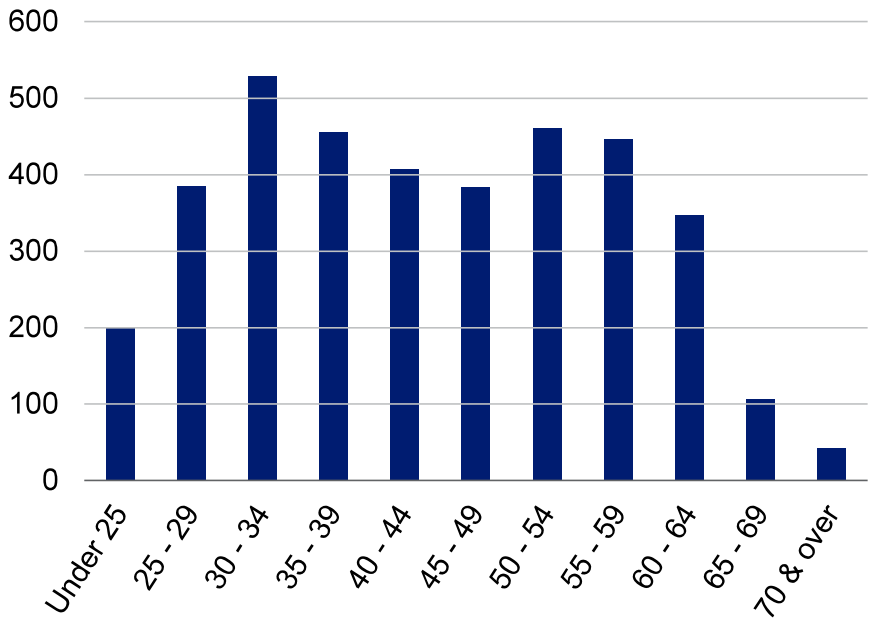
Active participants

As of December 31,	2023	2022	Change
Active participants	3,763	3,630	3.7%
Average age	44.3	44.7	-0.4
Average years of service	10.4	10.9	-0.5
Average compensation	$63,746	$60,150	6.0%

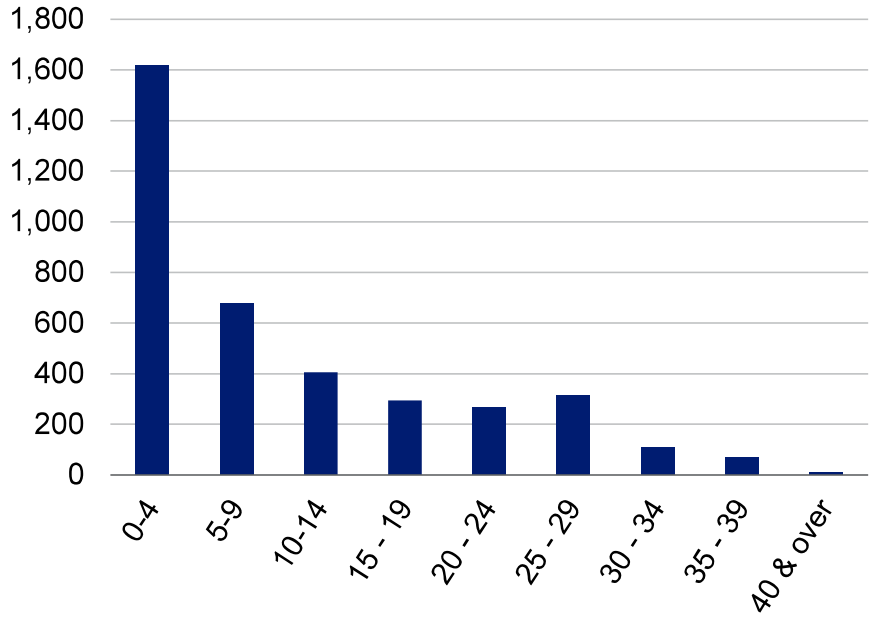
- Among the active participants, there were none with unknown age and/or service information.

Distribution of Active Participants as of December 31, 2023

Actives by Age



Actives by Years of Service



Inactive participants

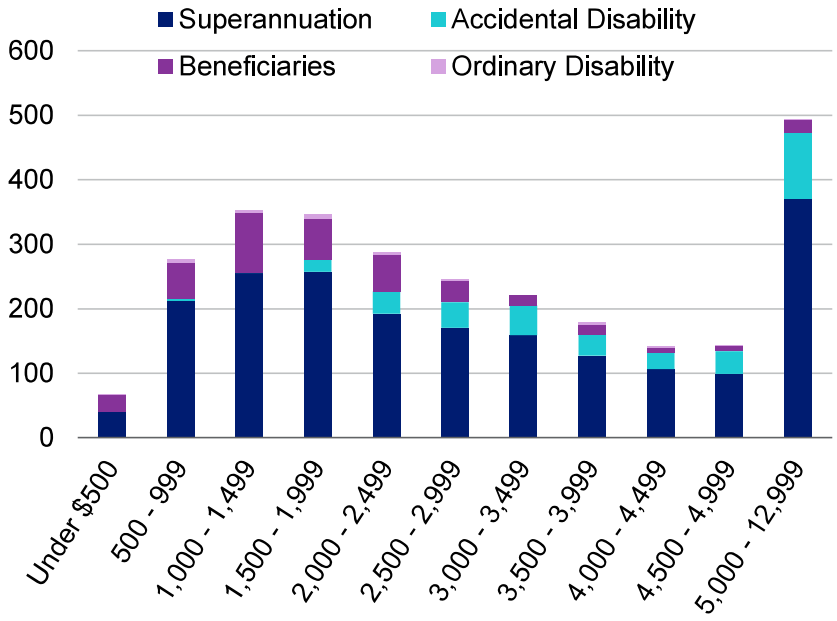
- In this year's valuation, there were 173 inactive participants with a vested right to a deferred or immediate vested benefit.
- In addition, there were 1,310 inactive participants entitled to a return of their employee contributions.

Retired participants and beneficiaries

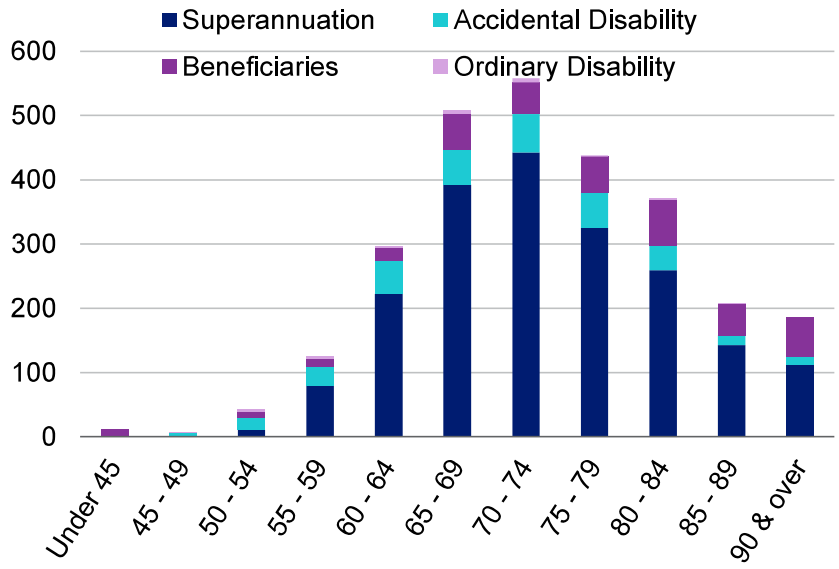
As of December 31,	2023	2022	Change
Retired participants	2,359	2,366	-0.3%
Beneficiaries	397	395	0.5%
Average age	73.5	73.6	-0.1
Average amount[1]	$3,020	$2,924	3.3%
Total monthly amount[3]	8,324,201	8,072,498	3.1%

Distribution of Retired Participants and Beneficiaries as of December 31, 2023

By Type and Monthly Amount



By Type and Age

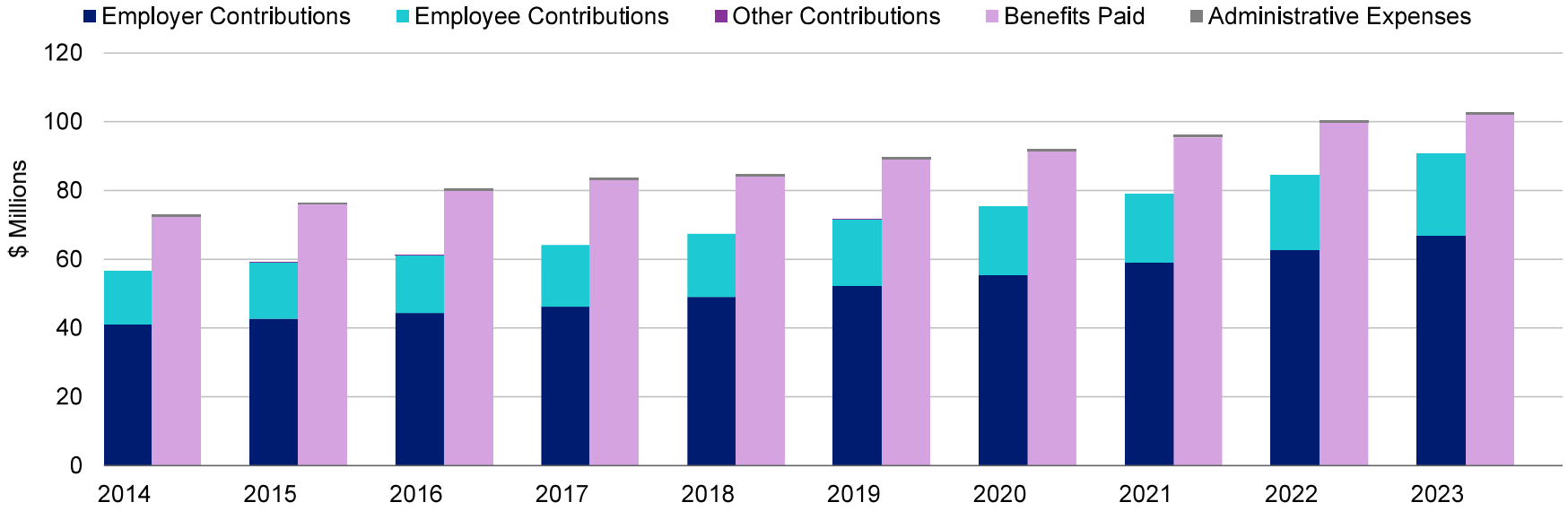


[1] Excludes COLAs reimbursed by the Commonwealth.

Financial information

- Retirement plan funding anticipates that, over the long term, both contributions (less administrative expenses) and investment earnings (less investment fees) will be needed to cover benefit payments. Retirement plan assets change as a result of the net impact of these income and expense components.

Comparison of Contributions with Benefits and Expenses
for Years Ended December 31



Section 2: Actuarial Valuation Results

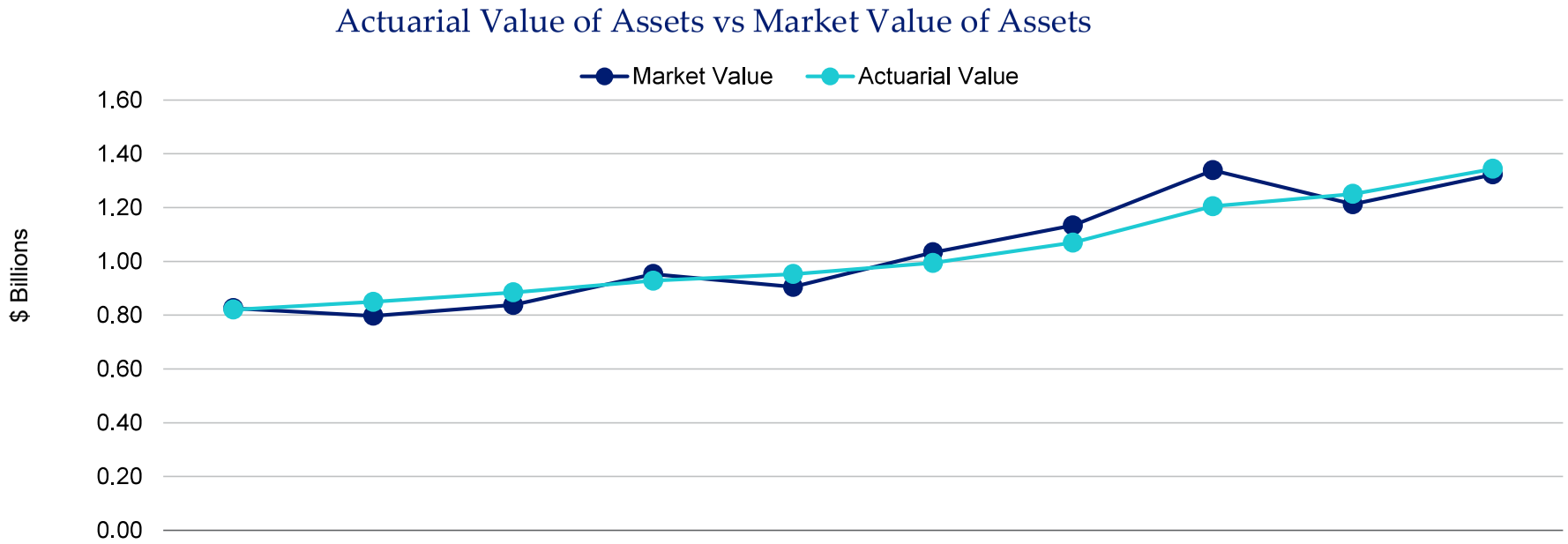
It is desirable to have level and predictable plan costs from one year to the next. For this reason, the Board has approved an asset valuation method that gradually adjusts to market value. Under this valuation method, the full value of market fluctuations is not recognized in a single year and, as a result, the asset value and the plan costs are more stable. The amount of the adjustment to recognize market value is treated as income, which may be positive or negative. Realized and unrealized gains and losses are treated equally and, therefore, the sale of assets has no immediate effect on the actuarial value.

Determination of Actuarial Value of Assets for Year Ended December 31, 2023

	Component	Original Amount[1]	Percent Deferred	Unrecognized Amount[2]	Amount
1.	Market value of assets, December 31, 2023				$1,323,279,350
2.	Calculation of unrecognized return				
	a. Year ended December 31, 2023	$41,367,336	80%	$33,093,869	
	b. Year ended December 31, 2022	-201,147,921	60%	-120,688,752	
	c. Year ended December 31, 2021	143,804,413	40%	57,521,766	
	d. Year ended December 31, 2020	46,286,489	20%	9,257,298	
	e. Year ended December 31, 2019	85,397,341	0%	0	
	f. Total unrecognized return				-$20,815,819
3.	Preliminary actuarial value: **(1) - (2f)**				1,344,095,169
4.	Adjustment to be within 10% corridor				0
5.	**Final actuarial value of assets as of December 31, 2023: (3) + (4)**				**$1,344,095,169**
6.	Actuarial value as a percentage of market value: **(5) ÷ (1)**				101.6%
7.	Amount deferred for future recognition: **(1) - (5)**				-$20,815,819

[1] Total return minus expected return on a market value basis.
[2] Recognition at 20% per year over five years.

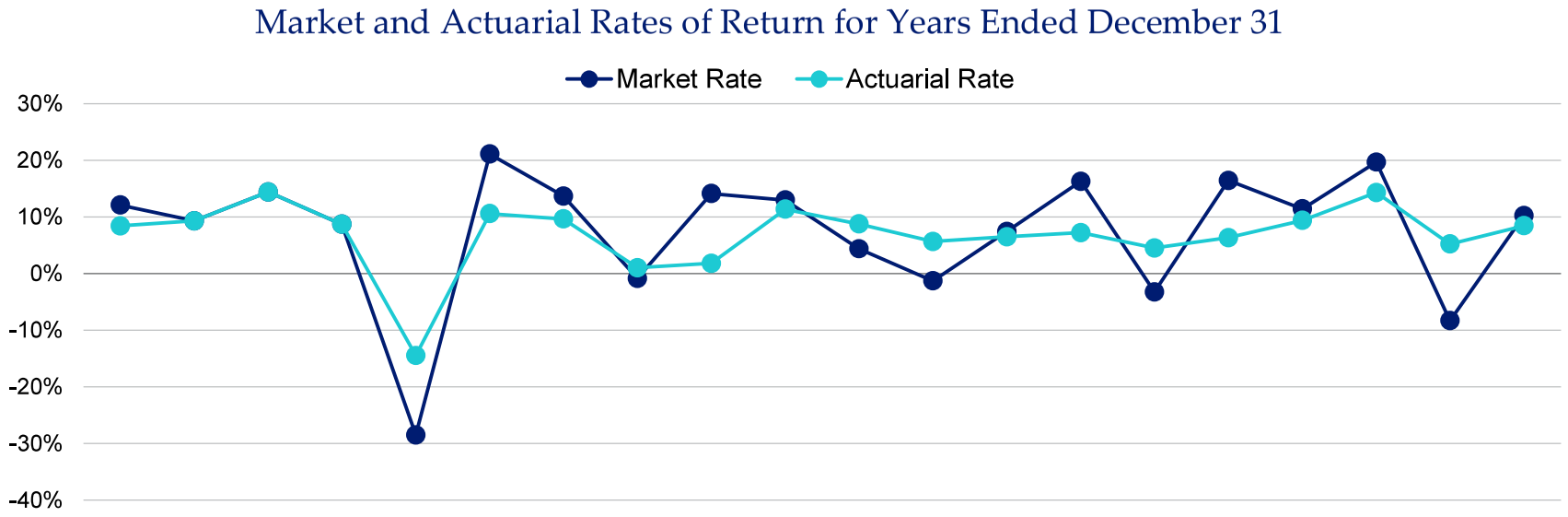
Asset history for years ended December 31



Legend	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Actuarial value*	$0.82	$0.85	$0.88	$0.93	$0.95	$0.99	$1.07	$1.20	$1.25	$1.34
Market value*	0.83	0.80	0.84	0.95	0.90	1.03	1.13	1.34	1.21	1.32
Ratio	0.994	1.064	1.056	0.975	1.053	0.962	0.943	0.900	1.032	1.016

* In $ billions

Historical investment returns



Legend	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Market rate	12.09%	9.29%	14.42%	8.72%	-28.49%	21.12%	13.69%	-0.84%	14.10%	12.97%	4.38%	-1.28%	7.45%	16.27%	-3.24%	16.44%	11.41%	19.68%	-8.32%	10.23%
Actuarial rate	8.43%	9.29%	14.42%	8.72%	-14.45%	10.56%	9.64%	1.03%	1.80%	11.36%	8.75%	5.65%	6.49%	7.23%	4.51%	6.32%	9.38%	14.32%	5.20%	8.45%

Average Rates of Return	Actuarial Value	Market Value
Most recent five-year average return	8.68%	8.93%
Most recent ten-year average return	7.71%	7.03%
Most recent 15-year average return	7.46%	8.18%
20-year average return	6.88%	6.92%

Actuarial experience

Assumptions should consider experience and should be based on reasonable expectations for the future.

Section 2: Actuarial Valuation Results

Each year actual experience is compared to that projected by the assumptions. Differences are reflected in the actuarial valuation.

Assumptions are not changed if experience is believed to be a short-term development that will not continue over the long term. On the other hand, if experience is expected to continue, assumptions are changed.

Actuarial Experience for Year Ended December 31, 2023

	Assumption	Amount
1.	Gain from investments	$20,486,700
2.	Gain from administrative expenses	43,047
3.	Loss from other experience	-4,213,428
4.	**Net experience gain: 1 + 2 + 3**	**$16,316,319**

Investment experience

Actuarial planning is long term. The obligations of a pension plan are expected to continue for the lifetime of all its participants.

The assumed long-term rate of return of 6.80% considers past experience, the asset allocation policy of the Board and future expectations. We will continue to monitor the System's actual and anticipated investment returns and may revise our assumed long-term rate of return in a future actuarial valuation, if warranted.

Investment Experience Year Ended December 31, 2023

	Investment	Market Value	Actuarial Value
1.	Net investment income	$123,372,852	$105,147,047
2.	Average value of assets	1,205,963,472	1,245,005,096
3.	Rate of return: **1 ÷ 2**	10.23%	8.45%
4.	Assumed rate of return	6.80%	6.80%
5.	Expected investment income: **2 x 4**	82,005,516	84,660,347
6.	Investment gain/(loss): **1 – 5**	$41,367,336	$20,486,700

Non-investment experience

Administrative expenses

Administrative expenses for the year ended December 31, 2023 totaled $681,755, as compared to the assumption of $700,000. This resulted in an experience gain of $43,047 for the year, including an adjustment for interest.

Other experience

There are other differences between the expected and the actual experience that appear when the new valuation is compared with the projections from the previous valuation. These include:

- Mortality experience (more or fewer than expected deaths)
- The extent of turnover among participants
- Retirement experience (earlier or later than projected)
- The number of disability retirements (more or fewer than projected)
- Salary increases (greater or smaller than projected)

The net loss from this other experience for the year ended December 31, 2023 amounted to $4,213,428, which is 0.2% of the actuarial accrued liability.

Liability Changes Due to Demographic Experience for Year Ended December 31, 2023

Other Experience	Gain or Loss
Gain due to mortality experience among retired members and beneficiaries	$4,777,023
Loss due to salaries increasing more than expected for continuing actives	-15,761,947
Miscellaneous gain	6,771,496
Total	**-$4,213,428**

Actuarial assumptions

Based on information provided by the Retirement System, the administrative expense assumption was increased from $700,000 for calendar year 2023 to $740,000 for calendar year 2024 and $700,000 for calendar year 2025. This reflects the one-time expenses anticipated in 2024.

Plan provisions

There were no changes in plan provisions since the prior valuation.

Unfunded actuarial accrued liability

Development of Unfunded Actuarial Accrued Liability for Year Ended December 31, 2023

	Component	Amount
1.	Unfunded actuarial accrued liability at beginning of year	$448,927,965
2.	Normal cost at beginning of year	39,212,323
3.	Total contributions	-90,636,280
4.	Interest on **1, 2 & 3**	30,402,261
5.	**Expected unfunded actuarial accrued liability**	**$427,906,269**
6.	Changes due to:	
	a. Net experience gain	-$16,316,319
	Total changes	**-$16,316,319**
7.	Unfunded actuarial accrued liability at end of year	$411,589,950

Actuarially determined contribution

The actuarially determined contribution is equal to the employer normal cost payment and a payment on the unfunded actuarial accrued liability. For fiscal 2025, the actuarially determined contribution has been set equal to the previously budgeted amount of $69,932,716.

The funding schedule included in this report shows a projection of the actuarially determined contribution. The fiscal 2025 total appropriation has been set equal to $69,932,716 as determined with the prior valuation. For fiscal 2026 and later years, each year's total appropriation increases 3.50%, with a smaller payment in fiscal 2034, so that the System will be fully funded by June 30, 2034, if all assumptions are met and there are no changes in the plan of benefits or assumptions. The parameters of the funding schedule shown in the prior valuation were the same. The current funding schedule is intended to result in predictable employer contributions that eliminate the unfunded actuarial accrued liability within 10 years, thereby providing benefit security to plan participants while balancing the needs of current and future contributors to the plan.

Actuarially Determined Contribution for Years Beginning July 1, 2024 and July 1, 2023

Component	2024 Amount	2024 Percent of Projected Payroll	2023 Amount	2023 Percent of Projected Payroll
1. Total normal cost	$41,867,225	16.85%	$38,512,323	17.04%
2. Administrative expenses	740,000	0.30%	700,000	0.31%
3. Expected employee contributions	-24,640,690	-9.92%	-22,356,013	-9.89%
6. Actuarial value of assets	1,344,095,169		1,251,062,070	
7. Unfunded actuarial accrued liability: (5) - (6)	**$411,589,950**		**$448,927,965**	
Projection to beginning of fiscal year				
8. Employer normal cost projected to July 1, 2024 and 2023	18,234,042	7.23%	$17,107,286	7.46%
9. Projected unfunded actuarial accrued liability	425,353,870		463,940,500	
10. Payment on unfunded actuarial accrued liability	51,698,674	20.50%	49,626,523	21.63%
11. Actuarially determined contribution: (8) + (10)	**$69,932,716**	**27.73%**	**$66,733,809**	**29.08%**
12. Projected payroll as of July 1	$252,157,461		$229,459,596	

Notes:
Actuarially Determined Contributions are assumed to be paid at the beginning of the fiscal year.
Actuarially Determined Contributions are set equal to the budgeted amounts determined with the prior valuation.

Section 2: Actuarial Valuation Results

The funding schedule adopted by the Board is designed to reduce the volatility of the actuarially determined contribution by increasing the total contribution by a fixed percentage per year. If the actuarially determined contribution were determined by amortizing the projected July 1, 2024 unfunded actuarial accrued liability over 10 years as a level percentage of payroll (a 3.0% increasing amortization schedule), plus payment of the fiscal 2025 employer normal cost, the actuarially determined contribution for fiscal 2025 would decrease from $69,932,716 to $68,031,221 and increase by approximately 3.0% per year through 2034.

Funding schedule

(1) Fiscal Year Ended June 30	(2) Employer Normal Cost	(3) Amortization of Special Legislations	(4) Amortization of Remaining Unfunded Liability	(5) Actuarially Determined Contribution (ADC): (2) + (3) + (4)	(6) Unfunded Actuarial Accrued Liability at Beginning of Fiscal Year	(7) Percent Increase in ADC Over Prior Year
2025	$18,234,042	$170,990	$51,527,684	$69,932,716	$425,353,870	- -
2026	18,783,585	170,990	53,425,786	72,380,361	399,063,749	3.50%
2027	19,414,811	170,990	55,327,873	74,913,674	368,958,727	3.50%
2028	20,067,111	170,990	57,297,552	77,535,653	334,775,135	3.50%
2029	20,741,183	170,990	59,337,228	80,249,401	296,163,441	3.50%
2030	21,437,750	170,990	61,449,390	83,058,130	252,747,778	3.50%
2031	22,157,560	170,990	63,636,615	85,965,165	204,124,061	3.50%
2032	22,901,383	170,990	65,901,573	88,973,946	149,857,975	3.50%
2033	23,670,014	170,990	68,247,030	92,088,034	89,482,820	3.50%
2034	24,464,278	170,990	22,326,216	46,961,484	22,497,206	-49.00%
2035	25,285,026	0	0	25,285,026	0	-46.16%

Notes:
Actuarially determined contribution for fiscal year 2025 is set equal to the amount determined with the prior valuation.
Actuarially determined contributions are assumed to be paid on July 1.
Item (2) reflects 3.0% growth in payroll and a 0.15% adjustment to total normal cost to reflect the effect of mortality improvements due to the generational mortality assumption.
Projected normal cost does not reflect the future impact of pension reform for new hires.
Projected unfunded actuarial accrued liability does not reflect the recognition of deferred investment gains or losses.

Low-Default-Risk Obligation Measure (LDROM)

In December 2021, the Actuarial Standards Board issued a revision of Actuarial Standard of Practice No. 4 (ASOP 4), *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*. One of the revisions to ASOP 4 requires the disclosure of a Low-Default-Risk Obligation Measure (LDROM) when performing a funding valuation. The LDROM presented in this report is calculated using the same methodology and assumptions used to determine the Actuarial Accrued Liability (AAL) used for funding, except for the discount rate. The LDROM is required to be calculated using "a discount rate…derived from low-default-risk fixed income securities whose cash flows are reasonably consistent with the pattern of benefits expected to be paid in the future."

The LDROM is a calculation assuming a plan's assets are invested in an all-bond portfolio, generally lowering expected long-term investment returns. The discount rate selected and used for this purpose is the Bond Buyer General Obligation 20-year Municipal Bond Index Rate, published at the end of each week. The last published rate in December of the measurement period, by The Bond Buyer (www.bondbuyer.com), is 3.26% for use effective December 31, 2023. This is the rate used to determine the discount rate for valuing reported public pension plan liabilities in accordance with Governmental Accounting Standards when plan assets are projected to be insufficient to make projected benefit payments, and the 20-year period reasonably approximates the duration of plan liabilities. The LDROM is not used to determine a plan's funded status or Actuarially Determined Contribution. The plan's expected return on assets, currently 6.80%, is used for these calculations.

As of December 31, 2023, the LDROM for the system is $2,668,341,010. The difference between the plan's AAL of $1,755,685,119 and the LDROM can be thought of as the increase in the AAL if the entire portfolio were invested in low-default-risk securities. Alternatively, this difference could also be viewed as representing the expected savings from investing in the plan's diversified portfolio compared to investing only in low-default-risk securities.

ASOP 4 requires commentary to help the intended user understand the significance of the LDROM with respect to the funded status of the plan, plan contributions, and the security of participant benefits. In general, if plan assets were invested exclusively in low-default-risk securities, the funded status would be lower and the Actuarially Determined Contribution would be higher. While investing in a portfolio with low-default-risk securities may be more likely to reduce investment volatility and the volatility of employer contributions, it also may be more likely to result in higher employer contributions or lower benefits.

Risk

The actuarial valuation results are dependent on a single set of assumptions; however, there is a risk that emerging results may differ significantly as actual experience proves to be different from the current assumptions.

We have not been engaged to perform a detailed analysis of the potential range of the impact of risk relative to the System's future financial condition but have included a brief discussion of some risks that may affect the System.

- Economic and Other Related Risks. Potential implications for the System due to the following economic effects (that were not reflected as of the valuation date) include:
  - Volatile financial markets and investment returns lower than assumed
  - High inflationary environment impacting salary increases
  - Lingering direct and indirect effects of the COVID-19 pandemic
- Investment Risk (the risk that returns will be different than expected)

  If the actual return on market value for the prior plan year were 1% different (either higher or lower), the unfunded actuarial liability would change by 2.93%, or about $12,059,635, disregarding the asset smoothing method.

  The market value rate of return over the last 20 years has ranged from a low of -28.49% to a high of 21.12%.
- Longevity Risk (the risk that mortality experience will be different than expected)

  The actuarial valuation includes an expectation of future improvement in life expectancy. Emerging plan experience that does not match these expectations will result in either an increase or decrease in the actuarially determined contribution.
- Contribution Risk (the risk that actual contributions will be different from actuarially determined contribution)

  Massachusetts General Law Chapter 32 requires payment of the actuarially determined contribution. If future experience matches current assumptions, we project the unfunded actuarial accrued liability will be paid off in 10 years.
- Demographic Risk (the risk that participant experience will be different than assumed)

  Examples of this risk include:
  - Actual retirements occurring earlier or later than assumed.
  - More or less active participant turnover than assumed.
  - Disability retirement experience different than assumed.
  - Salary increases greater or less than expected

Section 2: Actuarial Valuation Results

- There are external factors including legislative or financial reporting changes that could impact the System's funding and disclosure requirements. While we do not assume any changes in such external factors, it is important to understand that they could have significant consequences for the System.
- Actual Experience Over the Last Ten Years

  Past experience can help demonstrate the sensitivity of key results to the Plan's actual experience. Over the past ten years:

  – The investment gain(loss) for a year has ranged from a loss of 201,147,921 to a gain of 143,804,413 and the non-investment gain(loss) for a year has ranged from a loss of $4,170,381 to a gain of $14,073,248.

Plan Year Ended	Investment Gain/(Loss)	All Other Gains and (Losses)
2014	-$26,959,628	$1,121,486
2015	-72,784,493	1,886,071
2016	-378,488	2,801,045
2017	73,613,455	1,270,240
2018	-96,610,073	8,597,452
2019	85,397,341	-1,476,159
2020	46,286,489	10,960,045
2021	143,804,413	14,073,248
2022	-201,147,921	6,691,308
2023	41,367,336	-4,170,381

  – The funded percentage on the actuarial value of assets has ranged from a low of 63.2% to a high of 76.6% since 2015.

- Maturity Measures

  As pension plans mature, the cash needed to fulfill benefit obligations will increase over time. Therefore, cash flow projections and analysis should be performed to assure that the Plan's asset allocation is aligned to meet emerging pension liabilities.

  Currently the Plan has a non-active to active participant ratio of 1.13.

  For the prior year, benefits paid and administrative expenses were $12,113,948 more than contributions received. Plans with high levels of negative cash flows may have a need for a larger allocation to income generating assets, which can create a drag on investment return.

- Detailed Risk Assessment

  We recommend a more detailed assessment of the risks to provide the Board with a better understanding of the risks inherent in the Plan. This assessment may include scenario testing, sensitivity testing, stress testing, and stochastic modeling.

Section 3: Supplemental Information

Exhibit A: Table of plan demographics

Category	Year Ended December 31, 2023	Year Ended December 31, 2022	Change From Prior Year
Active participants in valuation:			
• Number	3,763	3,630	3.7%
• Average age	44.3	44.7	-0.4
• Average years of service	10.4	10.9	-0.5
• Average compensation[1]	$63,746	$60,150	6.0%
• Account balances	204,381,630	199,717,823	2.3%
Inactive participants			
• Inactive participants with a vested right to a deferred or immediate benefit	173	167	3.6%
• Inactive participants due a refund of employee contributions	1,310	1,130	15.9%
Retired participants:			
• Number in pay status	1,988	1,983	0.3%
• Average age	73.6	73.7	-0.1
• Average monthly benefit	$3,049	$2,944	3.6%
Disabled participants:			
• Number in pay status	371	383	-3.1%
• Average age	69.9	69.7	0.2
• Average monthly benefit	$3,925	$3,777	3.9%
Beneficiaries:			
• Number in pay status	397	395	0.5%
• Average age	76.7	77.0	-0.3
• Average monthly benefit	$2,033	$1,997	1.8%

[1] Compensation figures are for the prior year and reflect annualized salaries for participants hired during the year. Calendar year 2023 salaries were reduced by 5.2% for police non-officials to reflect retroactive payments that were included in the salary data. In addition, calendar year 2023 salaries were increased by 3.8% for firefighters, and 6.4% for police officials to estimate the impact of salary increases attributable to unsettled bargaining contracts. Calendar year 2022 salaries were reduced by 3.0% for police and firefighters to reflect retroactive payments that were included in the salary data.

Exhibit B: Participants in active service as of December 31, 2023 by age, years of service, and average compensation[1]

Years of Service

Age	Total	0-4	5-9	10-14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 & over
Under 25	201	199	2	0	0	0	0	0	0	0
	$38,765	$38,606	$54,633	0	0	0	0	0	0	0
25 - 29	385	339	46	0	0	0	0	0	0	0
	$51,147	$49,543	$62,968	0	0	0	0	0	0	0
30 - 34	529	317	173	39	0	0	0	0	0	0
	$63,949	$53,907	$77,065	$87,391	0	0	0	0	0	0
35 - 39	455	206	123	111	15	0	0	0	0	0
	$69,545	$51,742	$74,256	$93,314	$99,514	0	0	0	0	0
40 - 44	407	153	82	75	84	12	1	0	0	0
	$66,994	$45,729	$62,401	$85,767	$90,756	$87,000	$53,273	0	0	0
45 - 49	384	128	59	47	66	56	28	0	0	0
	$66,583	$44,472	$52,873	$64,050	$89,689	$97,038	$85,431	0	0	0
50 - 54	460	102	64	49	44	65	105	29	2	0
	$74,438	$51,302	$53,587	$65,297	$80,272	$79,587	$101,818	$97,783	$73,877	0
55 - 59	446	97	60	45	35	54	91	33	30	1
	$68,329	$50,219	$54,946	$53,995	$61,704	$67,490	$91,582	$88,037	$92,366	$62,555
60 - 64	347	58	44	25	37	50	67	32	30	4
	$60,611	$44,375	$48,746	$64,615	$50,392	$53,175	$65,304	$84,660	$91,333	$87,579
65 - 69	106	11	20	11	10	23	18	10	1	2
	$55,157	$45,927	$53,537	$56,222	$59,355	$50,907	$48,818	$60,166	$181,668	$112,907
70 & over	43	8	3	3	4	6	5	5	6	3
	$57,953	$48,877	$76,833	$46,532	$79,306	$44,510	$50,932	$51,357	$63,073	$85,561
Total	**3,763**	**1,618**	**676**	**405**	**295**	**266**	**315**	**109**	**69**	**10**
	$63,746	**$48,509**	**$64,912**	**$77,066**	**$79,670**	**$72,904**	**$85,647**	**$85,399**	**$90,128**	**$89,537**

[1] Compensation figures are for the prior year and reflect annualized salaries for participants hired during the year. Calendar year 2023 salaries were reduced by 5.2% for police non-officials to reflect retroactive payments that were included in the salary data. In addition, calendar year 2023 salaries were increased by 3.8% for firefighters, and 6.4% for police officials to estimate the impact of salary increases attributable to unsettled bargaining contracts.

Exhibit C: Summary statement of income and expenses on a market value basis

Year Ended December 31, 2023 versus Year Ended December 31, 2022

Item	Income and Expenses	2023 Assets	Income and Expenses	2022 Assets
Net assets at market value at the beginning of the year		**$1,212,020,446**		**$1,338,509,591**
Contribution and other income:				
Employer contributions	$66,733,809		$62,761,035	
Employee contributions	23,902,471		21,764,386	
Total contribution income		$90,636,280		$84,525,421
Investment income:				
Investment income	$130,974,800		-$103,477,696	
Less investment fees	-7,601,948		-7,189,518	
Net investment income	$123,372,852		-$110,667,214	
Total income available for benefits		$214,009,132		-$26,141,793
Less benefit payments and administrative expenses:				
Administrative expenses	-$681,755		-$575,104	
Pensions	-100,851,174		-97,814,691	
Net 3(8)(c) reimbursements	-1,217,299		-1,957,557	
Net benefit payments and administrative expenses		-$102,750,228		-$100,347,352
Change in market value of assets		**$111,258,904**		**-$126,489,145**
Net assets at market value at the end of the year		**$1,323,279,350**		**$1,212,020,446**

Exhibit D: Development of the fund through December 31, 2023

Year Ended December 31	Employer Contributions	Employee Contributions	Other Income	Net Investment Return[1]	Admin. Expenses	Benefit Payments	Market Value of Assets at Year-End	Actuarial Value of Assets at Year-End	Actuarial Value as a Percent of Market Value
2014	$41,200,578	$15,514,691	$0	$34,950,210	$587,157	$72,435,431	$825,633,173	$820,708,236	99.4%
2015	42,703,837	16,483,087	30,685	-10,490,025	572,743	75,957,944	797,830,070	849,286,321	106.4%
2016	44,411,990	16,816,229	55,027	58,737,894	565,669	79,940,830	837,344,711	884,576,848	105.6%
2017	46,188,470	17,970,100	0	134,646,815	583,404	83,122,621	952,444,071	928,286,125	97.5%
2018	49,098,344	18,336,273	0	-30,549,013	587,936	84,275,963	904,465,776	952,294,056	105.3%
2019	52,206,269	19,388,692	24,356	147,182,537	658,258	89,017,374	1,033,591,998	993,870,483	96.2%
2020	55,510,926	19,953,393	0	117,032,426	556,040	91,485,398	1,134,047,305	1,069,701,047	94.3%
2021	59,024,767	20,012,226	0	221,467,014	568,333	95,473,388	1,338,509,591	1,204,658,632	90.0%
2022	62,761,035	21,764,386	0	-110,667,214	575,104	99,772,248	1,212,020,446	1,251,062,070	103.2%
2023	66,733,809	23,902,471	0	123,372,852	681,755	102,068,473	1,323,279,350	1,344,095,169	101.6%

[1] On a market value basis, net of investment fees.

Exhibit E: Table of amortization bases

Type	Annual Payment	Years Remaining	Outstanding Balance
Special Legislation (Chapter 157 of the Acts of 2008)	$83,296	10	$630,635
Special Legislation (Chapter 203 of the Acts of 2020)	54,869	10	415,417
Special Legislation (Chapter 377 of the Acts of 2018)	32,825	10	248,517
Remaining unfunded liability	51,527,684	10	424,059,301
Total	**$51,698,674**		**$425,353,870**

Notes:
Actuarially determined contributions are assumed to be paid at the beginning of the fiscal year.
The Special Legislation liabilities are amortized in level payments.
Payment on remaining unfunded liability reflects adjustment to set fiscal 2025 appropriation to budgeted amount.

Exhibit F: Department results as of January 1, 2024

Category	DPW	Fire	Police	Schools	Housing	Other	All Department Total
Active participants in valuation							
• Number	277	423	480	1,741	210	632	3,763
• Average age	48.1	40.2	43.2	44.8	42.2	45.8	44.3
• Average service	12.5	12.6	17.1	8.1	7.7	10.2	10.4
• Average compensation	$63,832	$99,223	$95,349	$44,196	$61,728	$70,488	$63,746
Inactive participants entitled to a return of their employee contributions	44	15	22	855	166	208	1,310
Inactive participants with a vested right to a deferred or immediate benefit	14	6	9	83	13	48	173
Retired participants and beneficiaries in pay status							
• Retired participants	218	248	245	739	74	464	1,988
• Average age	73.6	69.5	70.2	74.2	73.8	76.6	73.6
• Disabled participants	29	141	104	49	9	39	371
• Average age	69.7	70.7	70.8	69.8	64.1	66.1	69.9
• Beneficiaries	61	103	88	68	15	62	397
• Average age	76.3	77.8	78.1	71.3	78.4	78.9	76.7
Total number in pay status	**308**	**492**	**437**	**856**	**98**	**565**	**2,756**
Total monthly benefits	**$865,044**	**$2,326,622**	**$1,905,900**	**$1,518,150**	**$248,210**	**$1,460,275**	**$8,324,201**
Average monthly benefit	2,809	4,729	4,361	1,774	2,533	2,585	3,020
Department Results							
1. Total normal cost	$2,693,559	$8,910,604	$9,157,661	$12,438,143	$1,943,369	$6,723,888	$41,867,225
2. Administrative expenses	47,608	157,494	161,861	219,843	34,349	118,844	740,000
3. Expected employee contribution	-1,807,782	-4,492,320	-4,797,252	-7,578,152	-1,331,652	-4,633,532	-24,640,690
4. Employer normal cost	**$933,386**	**$4,575,779**	**$4,522,270**	**$5,079,834**	**$646,065**	**$2,209,201**	**$17,966,535**
5. Employer normal cost as a percent of payroll	5.09%	10.49%	9.50%	6.40%	4.82%	4.79%	7.23%
6. Actuarial accrued liability	$159,127,781	$446,607,862	$445,826,903	$359,228,714	$60,918,717	$283,975,142	$1,755,685,119
7. Actuarial value of assets	121,823,030	341,908,389	341,310,512	275,013,768	46,637,379	217,402,091	1,344,095,169
8. Unfunded actuarial accrued liability: (6) – (7)	**$37,304,751**	**$104,699,474**	**$104,516,391**	**$84,214,947**	**$14,281,337**	**$66,573,051**	**$411,589,950**

Section 4: Actuarial Valuation Basis

Exhibit 1: Actuarial assumptions, methods and models

Net investment return

6.80%

The net investment return assumption is a long-term estimate derived from historical data, current and recent market expectations, and professional judgment. As part of the analysis, a building block approach was used that reflects inflation expectations and anticipated risk premiums for each of the portfolio's asset classes, as well as the System's target asset allocation.

Salary increases

4.00% per year, with an allowance for wage inflation of 3.00%.

The salary scale assumption is a long-term estimate derived from historical data, current and recent market expectations, and professional judgment.

Cost-of-living adjustments

3.00% increase on the first $16,000 of retirement allowance. For recipients of Section 100 and Special Legislation benefits, 3.00% per year.

401(a)(17) salary limit projection

3.00% per year

Interest on employee contributions

3.50%

Administrative expenses

$740,000 for calendar 2024 and $700,000 for calendar 2025, increasing 3.00% per year thereafter (previously, $700,000 for calendar 2023, increasing 3.00% per year).

The administrative expense assumption is based on information on expected expenses provided by the Retirement System.

Mortality rates

Pre-Retirement: RP-2014 Blue Collar Employee Mortality Table projected generationally with Scale MP-2021

Healthy Retiree: RP-2014 Blue Collar Healthy Annuitant Mortality Table projected generationally with MP-2021

Disabled Retiree: RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2021

The mortality tables reasonably reflect the projected mortality experience of the Plan as of the measurement date based on historical and current demographic data. As part of the analysis, a comparison was made between the actual number of retiree deaths and the projected number based on the prior years' assumptions over the most recent five years. The mortality tables were then adjusted to future years using generational projection under Scale MP-2021 to reflect future mortality improvement.

Termination rates before retirement

Groups 1 and 2

Age	Mortality Male	Mortality Female	Disability	Withdrawal
20	0.05%	0.02%	0.01%	12.00%
25	0.06%	0.02%	0.03%	8.78%
30	0.06%	0.02%	0.04%	5.55%
35	0.07%	0.03%	0.07%	3.93%
40	0.08%	0.04%	0.13%	2.31%
45	0.13%	0.07%	0.18%	1.89%
50	0.22%	0.12%	0.24%	1.46%
55	0.36%	0.19%	0.30%	0.00%
60	0.61%	0.27%	0.35%	0.00%

Notes:
Mortality rates do not reflect generational projection.
55% of the disability rates shown represent accidental disability.
20% of the accidental disabilities will die from the same cause as the disability.
55% of the death rates shown represent accidental death.

Group 4

Age	Mortality Male	Mortality Female	Disability	Withdrawal
20	0.05%	0.02%	0.13%	2.10%
25	0.06%	0.02%	0.25%	1.88%
30	0.06%	0.02%	0.38%	1.65%
35	0.07%	0.03%	0.38%	1.11%
40	0.08%	0.04%	0.38%	0.56%
45	0.13%	0.07%	1.25%	0.28%
50	0.22%	0.12%	1.56%	0.00%
55	0.36%	0.19%	1.50%	0.00%
60	0.61%	0.27%	1.06%	0.00%

Notes:
Mortality rates do not reflect generational projection.
90% of the disability rates shown represent accidental disability.
60% of the accidental disabilities will die from the same cause as the disability.
90% of the death rates shown represent accidental death.

The termination rates and disability rates were based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment. As part of the analysis, a comparison was made between the actual number of terminations and disability retirements and the projected number based on the prior years' assumptions over the past five years.

Retirement rates

Age	Groups 1 and 2	Group 4
50	3.0%	5.0%
51 – 54	1.0%	1.0%
55	2.0%	16.0%
56	2.0%	9.0%
57	3.0%	9.0%
58	3.0%	12.0%
59	3.0%	11.0%
60	8.0%	24.0%
61	7.0%	14.0%
62	15.0%	20.0%
63	11.0%	13.0%
64	10.0%	19.0%
65	36.0%	100.00%
66	22.0%	
67	22.0%	
68	22.0%	
69	25.0%	
70	100.0%	

The retirement rates were based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment. As part of the analysis, a comparison was made between the actual number of retirements by age and the projected number based on the prior years' assumptions over the past five years.

Retirement ages for inactive vested participants

55 for participants hired prior to April 2, 2012. For participants hired April 2, 2012 or later, 60 for Group 1, 55 for Group 2 and 50 for Group 4.

The retirement age for inactive vested participants was based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment.

Unknown data for participants

Same as those exhibited by participants with similar known characteristics. If not specified, participants are assumed to be male.

Family composition

80% of participants are assumed to be married. None are assumed to have dependent children. Females are assumed to be three years younger than their male spouses.

Benefit election

All participants are assumed to elect Option A. The benefit election reflects the fact that all benefit options are actuarially equivalent.

2023 Salary

2023 salaries are equal to salaries provided in the data, annualized for new hires, reduced by 5.2% for police non-officials to reflect retroactive payments that were included in the salary data, and increased by 3.8% for firefighters and 6.4% for police officials to estimate the impact of salary increases attributable to unsettled bargaining contracts.

Total Service

Total creditable service reported in the data. If missing, total creditable service estimated from date of hire.

Net 3(8)(c) Liability

Estimated liability of $16.6 million based on the average annual net 3(8)(c) benefits in the prior two years and the average demographics of retired participants.

Actuarial value of assets

Market value of assets as reported in the System's Annual Statement less unrecognized return in each of the last five years. Unrecognized return is equal to the difference between the actual market value return and the expected market value return and is recognized over a five-year period, further adjusted, if necessary, to be within 10% of the market value.

Actuarial cost method

Entry Age Normal Actuarial Cost Method. Entry Age is the attained age of the participant less Total Service as defined above. Normal Cost and Actuarial Accrued Liability are calculated on an individual basis and are allocated by salary. Normal Cost is determined using the plan of benefits applicable to each participant.

Models

Segal valuation results are based on proprietary actuarial modeling software. The actuarial valuation models generate a comprehensive set of liability and cost calculations that are presented to meet regulatory, legislative and client requirements. Our Actuarial Technology and Systems unit, comprised of both actuaries and programmers, is responsible for the initial development and maintenance of these models. The models have a modular structure that allows for a high degree of accuracy, flexibility and user control. The client team programs the assumptions and the plan provisions, validates the models, and reviews test lives and results, under the supervision of the responsible actuary.

Justification for change in actuarial assumptions

Based on information on expected expenses provided by the Retirement System, the administrative expense assumption was changed from $700,000 for calendar year 2023 to $740,000 for calendar year 2024 and $700,000 for calendar year 2025.

Exhibit 2: Summary of plan provisions

This exhibit summarizes the major provisions of the Plan included in the valuation. It is not intended to be, nor should it be interpreted as, a complete statement of all plan provisions.

Plan year

January 1 through December 31

Plan status

Ongoing

Retirement Benefits

Employees covered by the Contributory Retirement Law are classified into one of four groups depending on job classification. Group 1 comprises most positions in state and local government. It is the general category of public employees. Group 4 comprises mainly police and firefighters. Group 2 is for other specified hazardous occupations. (Officers and inspectors of the State Police are classified as Group 3.)

For employees hired prior to April 2, 2012, the annual amount of the retirement allowance is based on the member's final three-year average salary multiplied by the number of years and full months of creditable service at the time of retirement and multiplied by a percentage according to the following table based on the age of the member at retirement:

Age Last Birthday at Date of Retirement

Percent	Group 1	Group 2	Group 4
2.5	65 or over	60 or over	55 or over
2.4	64	59	54
2.3	63	58	53
2.2	62	57	52
2.1	61	56	51
2.0	60	55	50
1.9	59	--	49
1.8	58	--	48
1.7	57	--	47
1.6	56	--	46
1.5	55	--	45

A member's final three-year average salary is defined as the greater of the highest consecutive three-year average annual rate of regular compensation and the average annual rate of regular compensation received during the last three years of creditable service prior to retirement.

For employees hired on April 2, 2012 or later, the annual amount of the retirement allowance is based on the member's final five-year average salary multiplied by the number of years and full months of creditable service at the time of retirement and multiplied by a percentage according to the following tables based on the age and years of creditable service of the member at retirement:

For Members with Less Than 30 Years of Creditable Service or Greater Age Last Birthday at Date of Retirement

Percent	Group 1	Group 2	Group 4
2.50	67 or over	62 or over	57 or over
2.35	66	61	56
2.20	65	60	55
2.05	64	59	54
1.90	63	58	53
1.75	62	57	52
1.60	61	56	51
1.45	60	55	50

For Members with 30 Years of Creditable Service or Greater Age Last Birthday at Date of Retirement

Percent	Group 1	Group 2	Group 4
2.500	67 or over	62 or over	57 or over
2.375	66	61	56
2.250	65	60	55
2.125	64	59	54
2.000	63	58	53
1.875	62	57	52
1.750	61	56	51
1.625	60	55	50

A member's final five-year average salary is defined as the greater of the highest consecutive five-year average annual rate of regular compensation and the average annual rate of regular compensation received during the last five years of creditable service prior to retirement.

For employees who became members after January 1, 2011, regular compensation is limited to 64% of the federal limit found in 26 U.S.C. 401(a)(17). In addition, regular compensation for members who retire after April 2, 2012 will be limited to prohibit "spiking" of a member's salary to increase the retirement benefit.

For all employees, the maximum annual amount of the retirement allowance is 80 percent of the member's final average salary. Any member who is a veteran also receives an additional yearly retirement allowance of $15 per year of creditable service, not exceeding $300. The veteran allowance is paid in addition to the 80 percent maximum.

Employee contributions

Date of Hire	Contribution Rate
Prior to January 1, 1975	5%
January 1, 1975 – December 31, 1983	7%
January 1, 1984 – June 30, 1996	8%
July 1, 1996 onward	9%

In addition, employees hired after December 31, 1978 contribute an additional 2 percent of salary in excess of $30,000.

Employees hired after 1983 who voluntarily withdraw their contributions with less than 10 ten years of credited service receive 3% interest on their contributions.

Employees in Group 1 hired on or after April 2, 2012 with 30 years of creditable service or greater will pay a base contribution rate of 6%.

Retirement benefits (Superannuation)

Members of Group 1, 2 or 4 hired prior to April 2, 2012 may retire upon the attainment of age 55. For retirement at ages below 55, twenty years of creditable service is required.

Members hired prior to April 2, 2012 who terminate before age 55 with ten or more years of creditable service are eligible for a retirement allowance upon the attainment of age 55 (provided they have not withdrawn their accumulated deductions from the Annuity Savings Fund of the System).

Members of Group 1 hired April 2, 2012 or later may retire upon the attainment of age 60. Members of Group 2 or 4 hired April 2, 2012 or later may retire upon the attainment of age 55. Members of Group 4 may retire upon attainment of age 50 with ten years of creditable service.

Members hired April 2, 2012 or later who terminate before age 55 (60 for members of Group 1) with ten or more years of creditable service are eligible for a retirement allowance upon the attainment of age 55 (60 for members of Group 1) provided they have not withdrawn their accumulated deductions from the Annuity Savings Fund of the System.

Ordinary disability benefit

A member who is unable to perform his or her job due to a non-occupational disability will receive a retirement allowance if he or she has ten or more years of creditable service and has not reached age 55. The annual amount of such allowance shall be determined as if the member retired for superannuation at age 55 (age 60 for Group 1 members hired on or after April 2, 2012), based on the amount of creditable service at the date of disability. For veterans, there is a minimum benefit of 50 percent of the member's most recent year's pay plus an annuity based on his or her own contributions.

Accidental disability benefit

For a job-connected disability, the benefit is 72 percent of the member's most recent annual pay plus an annuity based on his or her own contributions, plus additional amounts for surviving children. Benefits are capped at 75 percent of annual rate of regular compensation for employees who become members after January 1, 1988.

Death benefits

In general, the beneficiary of an employee who dies in active service will receive a refund of the employee's own contributions. Alternatively, if the employee were eligible to retire on the date of death, a spouse's benefit will be paid equal to the amount the employee would have received under Option C. The surviving spouse of a member who dies with two or more years of credited service has the option of a refund of the employee's contributions or a monthly benefit regardless of eligibility to retire, if they were married for at least one year. There is also a minimum widow's pension of $250 per month, and there are additional amounts for surviving children.

If an employee's death is job-connected, the spouse will receive 72 percent of the member's most recent annual pay, in addition to a refund of the member's accumulated deductions, plus additional amounts for surviving children. However, in accordance with Section 100 of Chapter 32, the surviving spouse of a police officer, firefighter or corrections officer is killed in the line of duty will be eligible to receive an annual benefit equal to the maximum salary held by the member at the time of death.

Upon the death of a job-connected disability retiree who retired prior to November 7, 1996 and could not elect an Option C benefit, a surviving spouse will receive an allowance of $12,000 per year if the member dies for a reason unrelated to cause of disability.

"Heart And Lung Law" and cancer presumption

Any case of hypertension or heart disease resulting in total or partial disability or death to a uniformed fireman, permanent member of a police department, or certain employees of a county correctional facility is presumed to have been suffered in the line of duty, unless the contrary is shown by competent evidence. Any case of disease of the lungs or respiratory tract resulting in total disability or death to a uniformed fireman is presumed to have been suffered in the line of duty, unless the contrary is shown by competent evidence. There is an additional presumption for uniformed firemen that certain types of cancer are job-related if onset occurs while actively employed or within five years of retirement.

Special Legislation Benefits

The following legislation benefits are included in this valuation:

a. Chapter 377 of the Acts of 2018: Disabled firefighter is awarded a pension of 80% of the compensation, increased annually with salary-related COLAs through maximum retirement age, at which point the benefit is converted to a standard accidental disability benefit. Upon death prior to maximum retirement age, 67% of the benefit at time of death is payable to the surviving spouse.

b. Chapter 157 of the Acts of 2008: Disabled firefighter is awarded a pension of 100% of the compensation, increased annually with salary-related COLAs through maximum retirement age, at which point the benefit is converted to a standard accidental disability benefit. Upon death prior to maximum retirement age, 75% of the benefit at time of death is payable to the surviving spouse.

c. Chapter 203 of the Acts of 2020: Child of fallen firefighter is awarded an annual pension amount that otherwise would have been paid to a surviving spouse pursuant to Section 100 of Chapter 32 (increased annually with salary-related COLAs) until age 26.

Options

Members may elect to receive a full retirement allowance payable for life under Option A. Under Option B a member may elect to receive a lower monthly allowance in exchange for a guarantee that at the time of death any contributions not expended for annuity payments will be refunded to the beneficiary. Option C allows the member to take a lesser retirement allowance in exchange for providing a survivor with two-thirds of the lesser amount. Option C pensioners will have benefits converted from a reduced to a full retirement if the beneficiary predeceases the retiree.

Post-retirement benefits

The Board has adopted the provisions of Section 51 of Chapter 127 of the Acts of 1999, which provide that the Retirement Board may approve an annual COLA in excess of the Consumer Price Index but not to exceed a 3% COLA on the first $16,000 of a retirement allowance. Cost-of-living increases granted prior to July 1, 1998 are reimbursed by the Commonwealth and not reflected in this report.

Changes in plan provisions

None.

Appendix A: Definition of Pension Terms

The following list defines certain technical terms for the convenience of the reader:

Term	Definition
Actuarial accrued liability for actives	The equivalent of the accumulated normal costs allocated to the years before the valuation date.
Actuarial accrued liability for retirees and beneficiaries	Actuarial Present Value of lifetime benefits to existing retirees and beneficiaries. This sum takes account of life expectancies appropriate to the ages of the annuitants and the interest that the sum is expected to earn before it is entirely paid out in benefits.
Actuarial cost method	A procedure allocating the Actuarial Present Value of Future Benefits to various time periods; a method used to determine the Normal Cost and the Actuarial Accrued Liability that are used to determine the actuarially determined contribution.
Actuarial gain or loss	A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two Actuarial Valuation dates. To the extent that actual experience differs from that assumed, Actuarial Accrued Liabilities emerge which may be the same as forecasted or may be larger or smaller than projected. Actuarial gains are due to favorable experience, e.g., assets earn more than projected, salary increases are less than assumed, members retire later than assumed, etc. Favorable experience means actual results produce actuarial liabilities not as large as projected by the actuarial assumptions. On the other hand, actuarial losses are the result of unfavorable experience, i.e., actual results yield actuarial liabilities that are larger than projected.
Actuarially equivalent	Of equal Actuarial Present Value, determined as of a given date and based on a given set of Actuarial Assumptions.
Actuarial present value	The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions. Each such amount or series of amounts is: Adjusted for the probable financial effect of certain intervening events (such as changes in compensation levels, marital status, etc.) Multiplied by the probability of the occurrence of an event (such as survival, death, disability, withdrawal, etc.) on which the payment is conditioned, and Discounted according to an assumed rate (or rates) of return to reflect the time value of money.

Appendix A: Definition of Pension Terms

Term	Definition
Actuarial present value of future benefits	The Actuarial Present Value of benefit amounts expected to be paid at various future times under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age, anticipated future compensation, and future service credits. The Actuarial Present Value of Future Benefits includes the liabilities for active members, retired members, beneficiaries receiving benefits, and inactive members entitled to either a refund of member contributions or a future retirement benefit. Expressed another way, it is the value that would have to be invested on the valuation date so that the amount invested plus investment earnings would provide sufficient assets to pay all projected benefits and expenses when due.
Actuarial valuation	The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a plan, as well as Actuarially Determined Contributions.
Actuarial value of assets	The value of the Plan's assets as of a given date, used by the actuary for valuation purposes. This may be the market or fair value of plan assets, but commonly plans use a smoothed value in order to reduce the year-to-year volatility of calculated results, such as the funded ratio and the Actuarially Determined Contribution.
Actuarially determined	Values that have been determined utilizing the principles of actuarial science. An actuarially determined value is derived by application of the appropriate actuarial assumptions to specified values determined by provisions of the Plan.
Actuarially determined contribution	The employer's contributions, expressed as a dollar amount or a percentage of covered plan compensation, determined under the Plan's funding policy. The ADC consists of the Employer Normal Cost and the Amortization Payment.
Amortization method	A method for determining the Amortization Payment. The most common methods used are level dollar and level percentage of payroll. Under the Level Dollar method, the Amortization Payment is one of a stream of payments, all equal, whose Actuarial Present Value is equal to the Unfunded Actuarial Accrued Liability. Under the Level Percentage of Pay method, the Amortization Payment is one of a stream of increasing payments, whose Actuarial Present Value is equal to the Unfunded Actuarial Accrued Liability. Under the Level Percentage of Pay method, the stream of payments increases at the assumed rate at which total covered payroll of all active members will increase.
Amortization payment	The portion of the pension plan contribution, or ADC, that is intended to pay off the Unfunded Actuarial Accrued Liability.
Assumptions or actuarial assumptions	The estimates upon which the cost of the Plan is calculated, including: **Investment return** — the rate of investment yield that the Plan will earn over the long-term future; **Mortality rates** — the rate or probability of death at a given age for employees and retirees; **Retirement rates** — the rate or probability of retirement at a given age or service; **Disability rates** — the rate or probability of disability retirement at a given age; **Withdrawal rates** — the rate or probability at which employees of various ages are expected to leave employment for reasons other than death, disability, or retirement; **Salary increase rates** — the rates of salary increase due to inflation, real wage growth and merit and promotion increases.

Appendix A: Definition of Pension Terms

Term	Definition
Closed amortization period	A specific number of years that is counted down by one each year, and therefore declines to zero with the passage of time. For example, if the amortization period is initially set at 20 years, it is 19 years at the end of one year, 18 years at the end of two years, etc. See Open Amortization Period.
Decrements	Those causes/events due to which a member's status (active-inactive-retiree-beneficiary) changes, that is: death, retirement, disability, or withdrawal.
Defined benefit plan	A retirement plan in which benefits are defined by a formula based on the member's compensation, age and/or years of service.
Defined contribution plan	A retirement plan, such as a 401(k) plan, a 403(b) plan, or a 457 plan, in which the contributions to the plan are assigned to an account for each member, the plan's earnings are allocated to each account, and each member's benefits are a direct function of the account balance.
Employer normal cost	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
Experience study	A periodic review and analysis of the actual experience of the Plan that may lead to a revision of one or more actuarial assumptions. Actual rates of decrement and salary increases are compared to the actuarially assumed values and modified based on recommendations from the Actuary.
Funded ratio	The ratio of the Actuarial Value of Assets (AVA) to the Actuarial Accrued Liability (AAL). Plans sometimes also calculate a market funded ratio, using the Market Value of Assets (MVA), rather than the AVA.
GASB 67 and GASB 68	Governmental Accounting Standards Board (GASB) Statements No. 67 and No. 68. These are the governmental accounting standards that set the accounting rules for public retirement systems and the employers that sponsor or contribute to them. Statement No. 68 sets the accounting rules for the employers that sponsor or contribute to public retirement systems, while Statement No. 67 sets the rules for the systems themselves.
Investment return	The rate of earnings of the Plan from its investments, including interest, dividends and capital gain and loss adjustments, computed as a percentage of the average value of the fund. For actuarial purposes, the investment return often reflects a smoothing of the capital gains and losses to avoid significant swings in the value of assets from one year to the next.
Net Pension Liability (NPL)	The Net Pension Liability is equal to the Total Pension Liability minus the Plan Fiduciary Net Position.
Normal cost	The portion of the Actuarial Present Value of Future Benefits and expenses, if applicable, allocated to a valuation year by the Actuarial Cost Method. Any payment with respect to an Unfunded Actuarial Accrued Liability is not part of the Normal Cost (see Amortization Payment). For pension plan benefits that are provided in part by employee contributions, Normal Cost refers to the total of member contributions and employer Normal Cost unless otherwise specifically stated.
Open amortization period	An open amortization period is one which is used to determine the Amortization Payment but which does not change over time. If the initial period is set as 30 years, the same 30-year period is used in each future year in determining the Amortization Period.

Appendix A: Definition of Pension Terms

Term	Definition
Plan Fiduciary Net Position	Market value of assets.
Service costs	The portions of the actuarial present value of projected benefit payments that are attributed to valuation years.
Total Pension Liability (TPL)	The actuarial accrued liability under the entry age normal cost method and based on the blended discount rate as described in GASB 67 and 68.
Unfunded actuarial accrued liability	The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets. This value may be negative, in which case it may be expressed as a negative Unfunded Actuarial Accrued Liability, also called the Funding Surplus or an Overfunded Actuarial Accrued Liability.
Valuation date or actuarial valuation date	The date as of which the value of assets is determined and as of which the Actuarial Present Value of Future Benefits is determined. The expected benefits to be paid in the future are discounted to this date.