Town of Wellesley Contributory Retirement System

Actuarial Valuation and Review as of January 1, 2021

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May 26, 2021

Retirement Board
Town of Wellesley Contributory Retirement System
525 Washington Street
Wellesley, MA 02482

Dear Board Members:

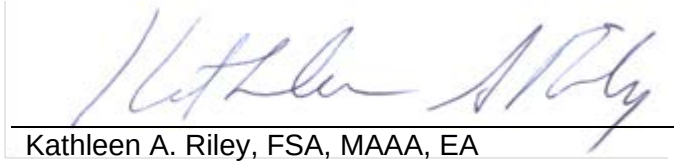
We are pleased to submit this Actuarial Valuation and Review as of January 1, 2021. It summarizes the actuarial data used in the valuation, analyzes the preceding two years' experience, and establishes the funding requirements for fiscal 2022 and later years.

This report was prepared in accordance with generally accepted actuarial principles and practices at the request of the Retirement Board to assist in administering the Retirement System. The census information and financial information on which our calculations were based was prepared by the staff of the Town of Wellesley Contributory Retirement System. That assistance is gratefully acknowledged.

The actuarial calculations were directed under the supervision of Lisa VanDermark, 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. Further, in her opinion, the assumptions as approved by the Retirement Board are reasonably related to the experience of and the expectations for the Town of Wellesley Contributory Retirement System.

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

Sincerely,
Segal



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Vice President and Consulting Actuary

Table of Contents

Section 1: Actuarial Valuation Summary

Purpose and basis

This report was prepared by Segal to present a valuation of the System as of January 1, 2021. The valuation was performed to determine whether the assets and contributions are sufficient to provide the prescribed benefits. The measurements shown in this actuarial valuation may not be applicable for other purposes. In particular, the measures herein are not necessarily appropriate for assessing the sufficiency of System assets to cover the estimated cost of settling the System's benefit obligations. 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 contribution requirements presented in this report are based on:

- The benefit provisions of Massachusetts General Law Chapter 32;
- The characteristics of covered active participants, inactive participants, and retired participants and beneficiaries as of December 31, 2020, provided by the staff of the Retirement System;
- The assets of the Plan as of December 31, 2020, provided by the staff of the Retirement System;
- Economic assumptions regarding future salary increases and investment earnings; and
- Other actuarial assumptions regarding employee terminations, retirement, death, etc.

Certain disclosure information required by GASB Statements No. 67 and 68 as of December 31, 2020 for the 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 a payment on the principal balance. The funding policy adopted by the Town of Wellesley Contributory Retirement System meets this standard and funds the unfunded actuarial accrued liability by June 30, 2030.
2. The funded ratio (the ratio of the actuarial value of assets to actuarial accrued liability) is 84.93%, compared to the prior valuation funded ratio of 77.66%. This ratio is one measure of funding status, and its history is a measure of funding progress. Because the actuarial value of assets was set equal to the market value of assets as of January 1, 2021, the funded ratio on the market value of assets basis is also 84.93%, compared to 75.62% as of the prior valuation date. This improvement in the funded ratios is primarily due to the investment gains in 2019 and 2020, partially offset by the changes in the actuarial assumptions. These measurements are not necessarily appropriate for assessing the sufficiency of System assets to cover the estimated cost of settling the System's benefit obligation or the need for or the amount of future contributions.
3. During the plan years ending December 31, 2020 and December 31, 2019, the rate of return on the market value of assets was 11.82% and 16.01%, respectively. With this valuation, the actuarial value of assets was set equal to the market value of assets. The rate of return on the actuarial value of assets (which gradually recognizes market fluctuations) prior to the change in the asset method for the plan years ending December 31, 2020 and December 31, 2019 was 9.83% and 7.40%, respectively. This would have resulted in an actuarial gain when measured against the assumed rate of return of 6.625%.
4. The following actuarial assumptions were changed with this valuation, in addition to the change in the asset valuation method:
   - The investment return assumption was decreased from 6.625% to 6.00%.
   - The mortality assumption for disabled pensioners was changed from the RP-2000 Healthy Annuitant Mortality Table projected generationally with Scale BB from 2015 to the RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2016.
   - The retirement assumption for members hired on or after April 2, 2012 was adjusted to reflect a 50% increase to retirement rates at age 60 for members of Group 1 and 2.
   - The administrative expense assumption was reset to $275,000 for calendar 2021, increasing 2.75% per year, based on information on expenses provided by the staff of the Retirement System.

   These changes increased the actuarial accrued liability by approximately $20.7 million (7.9%) and increased the normal cost by approximately $1.0 million (15.7%).

Section 1: Actuarial Valuation Summary

5. The following Plan change is included in this valuation:

   - Effective July 1, 2020, the COLA base increased from $17,000 to $18,000.

   This change increased the actuarial accrued liability by approximately $1.2 million (0.4%) and increased the normal cost by approximately $29,000 (0.4%).

6. The unfunded liability was expected to decrease by $5.2 million from $55.5 million as of January 1, 2019 to $50.3 million as of January 1, 2021. The actual unfunded liability as of January 1, 2021 is $43.1 million, $7.2 million lower than expected. The decrease is primarily due to the investment gains in 2019 and 2020, net demographic gains, and the change in the asset valuation method, partially offset by the changes in actuarial assumptions.

7. In the funding schedule included in this report, the fiscal 2022 appropriation has been set equal to the previously budgeted amount of $9,756,209. The funding schedule is projected to fully fund the System by June 30, 2030 with amortization payments on the unfunded liability that increase by 3.0% per year, if all assumptions are met and there are no changes in the plan of benefits or actuarial assumptions. The funding schedule included in the prior report fully funded the System by June 30, 2030 with amortization payments that increased by 3.5% per year.

8. 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 System in *Section 2*. A more detailed assessment would provide the Retirement Board with a better understanding of the inherent risks.

Summary of key valuation results

		2021	2019
Contributions for fiscal year beginning July 1:	• Actuarially Determined Contribution for fiscal year 2022 and 2020	$9,756,209	$8,851,508
	• Actuarially Determined Contribution for fiscal year 2023 and 2021	10,034,958	9,438,070
	• Actuarially Determined Contribution for fiscal year 2024 and 2022	10,338,575	9,756,209
Actuarial accrued liability for plan year beginning January 1:	• Retired participants and beneficiaries	$146,599,664	$125,178,203
	• Inactive vested participants	5,108,558	2,795,400
	• Inactive participants due a refund of employee contributions	2,643,079	1,895,041
	• Active participants	131,727,392	118,685,048
	• Total	286,078,693	248,553,692
	• Normal cost including administrative expense assumption for plan year beginning January 1	7,895,841	6,717,515
Assets for plan year beginning January 1:	• Market value of assets (MVA)	$242,973,730	$187,948,599
	• Actuarial value of assets (AVA)	242,973,730	193,017,080
	• Actuarial value of assets as a percentage of market value of assets	100.00%	102.70%
Funded status for plan year beginning January 1:	• Unfunded actuarial accrued liability on market value of assets	$43,104,963	$60,605,093
	• Funded percentage on MVA basis	84.93%	75.62%
	• Unfunded actuarial accrued liability on actuarial value of assets	$43,104,963	$55,536,612
	• Funded percentage on AVA basis	84.93%	77.66%
Key assumptions:	• Net investment return	6.00%	6.625%
	• Long-term wage inflation rate	2.75%	2.75%
Demographic data for plan year beginning January 1:	• Number of retired participants and beneficiaries	426	418
	• Number of inactive vested participants	25	16
	• Number of inactive participants due a refund of employee contributions	332	270
	• Number of active participants	691	703
	• Total payroll[1]	$40,939,192	$39,169,350
	• Average payroll	59,246	55,717

[1] Payroll figures are for the prior year and reflect annualized salaries for participants hired during the year.

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:

Plan of benefits	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 data	An actuarial valuation for a plan is based on data provided to the actuary by the 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.
Assets	The valuation is based on the market value of assets as of the valuation date, as provided by the Retirement System. The Retirement System uses 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. As of January 1, 2021, the Retirement Board reset the actuarial value of assets equal to the market value, with the smoothing method being applied going forward.
Actuarial assumptions	In preparing an actuarial valuation, Segal projects the benefits to be paid to existing plan participants for the rest of their lives and the lives of their beneficiaries. This projection requires actuarial assumptions as to the probability of death, disability, withdrawal, and retirement of each participant for each year. In addition, the benefits projected to be paid for each of those events in each future year reflect actuarial assumptions as to salary increases and cost-of-living adjustments. The projected benefits are then discounted to a present value, based on the assumed rate of return that is expected to be achieved on the plan’s assets. There is a reasonable range for each assumption used in the projection and the results may vary materially based on which assumptions are selected. It is important for any user of an actuarial valuation to understand this concept. Actuarial assumptions are periodically reviewed to ensure that future valuations reflect emerging plan experience. While future changes in actuarial assumptions may have a significant impact on the reported results that does not mean that the previous assumptions were unreasonable.

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 Retirement Board. Segal is not responsible for the use or misuse of its report, particularly by any other party.
An actuarial valuation is a measurement of the plan's assets and liabilities at a specific date. Accordingly, except where otherwise noted, Segal did not perform an analysis of the potential range of future financial measures. 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.
Actuarial results in this report are not rounded, but that does not imply precision.
If the Retirement Board 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. Segal's valuation is based on our understanding of applicable guidance in these areas and of the plan's provisions, but they may be subject to alternative interpretations. The Retirement Board should look to their other advisors for expertise in these areas.

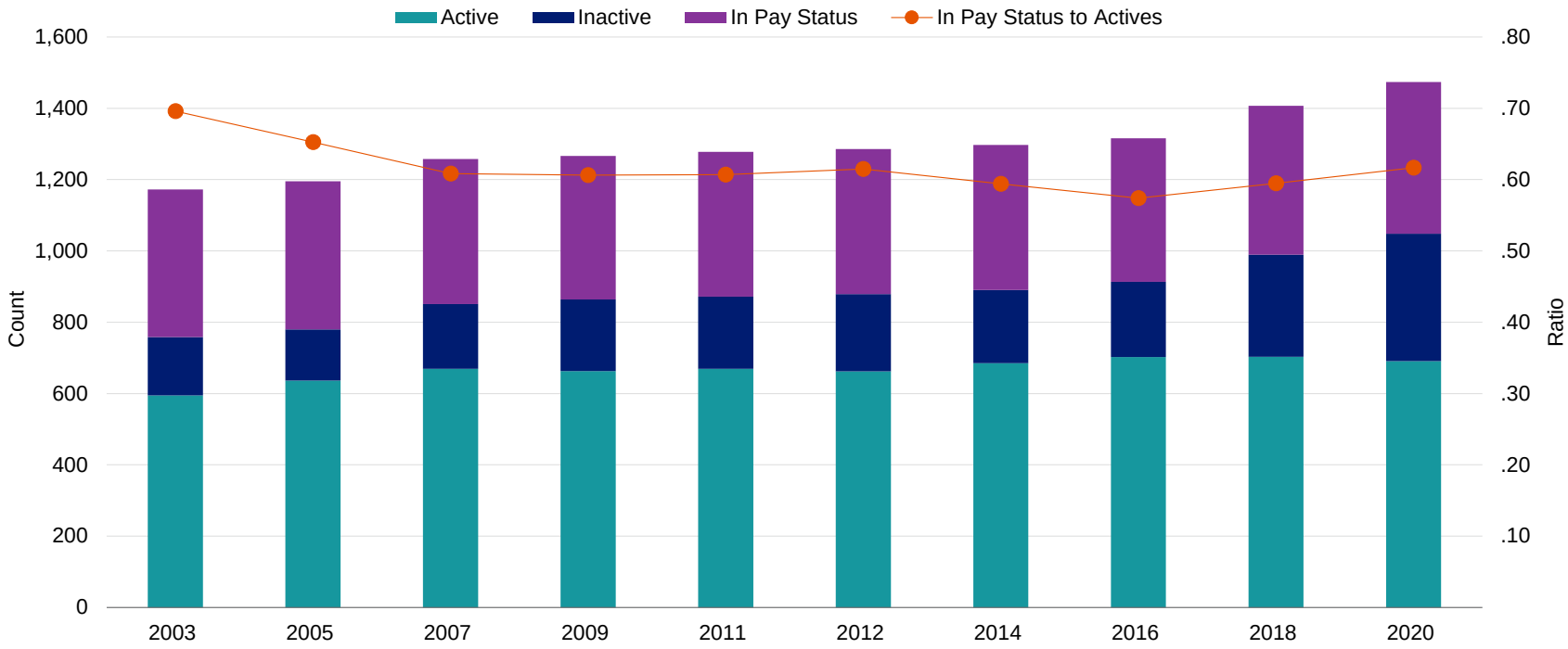
As Segal has no discretionary authority with respect to the management or assets of the System, it is not a fiduciary in its capacity as actuaries and consultants with respect to the System.

Section 2: Actuarial Valuation Results

Participant data

This section presents a summary of significant statistical data on covered participants.

Participant Population: 2003 – 2020



	2003	2005	2007	2009	2011	2012	2014	2016	2018	2020
In Pay Status	414	415	407	402	406	407	407	403	418	426
Inactives	163	144	182	201	203	217	205	211	286	357
Active	595	636	669	663	669	662	685	702	703	691
Ratio	0.70	0.65	0.61	0.61	0.61	0.61	0.59	0.57	0.59	0.62

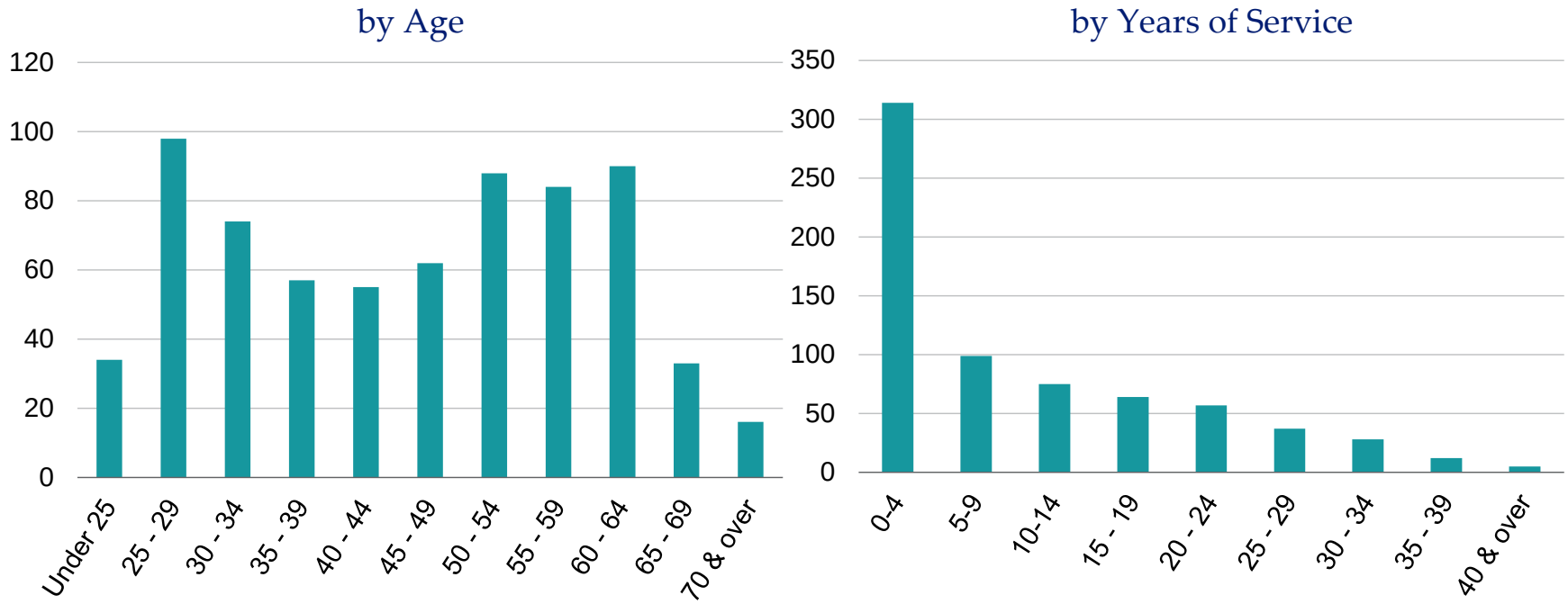
More detailed information for this valuation year and the preceding valuation can be found in *Section 3, Exhibits A and B.*

Active participants

As of December 31,	2020	2018	Change
Active participants	691	703	-1.7%
Average age	46.0	45.8	0.2
Average years of service	10.5	10.6	-0.1
Average compensation	$59,246	$55,717	6.3%

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

Distribution of Active Participants as of December 31, 2020



Inactive participants

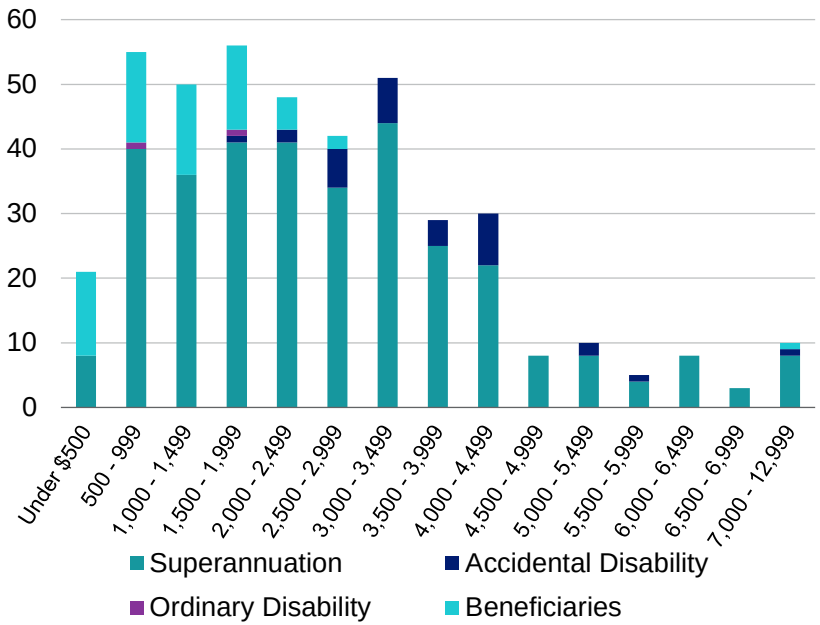
In this year's valuation, there were 25 participants with a vested right to a deferred or immediate vested benefit and 332 participants entitled to a return of their employee contributions.

Retired participants and beneficiaries

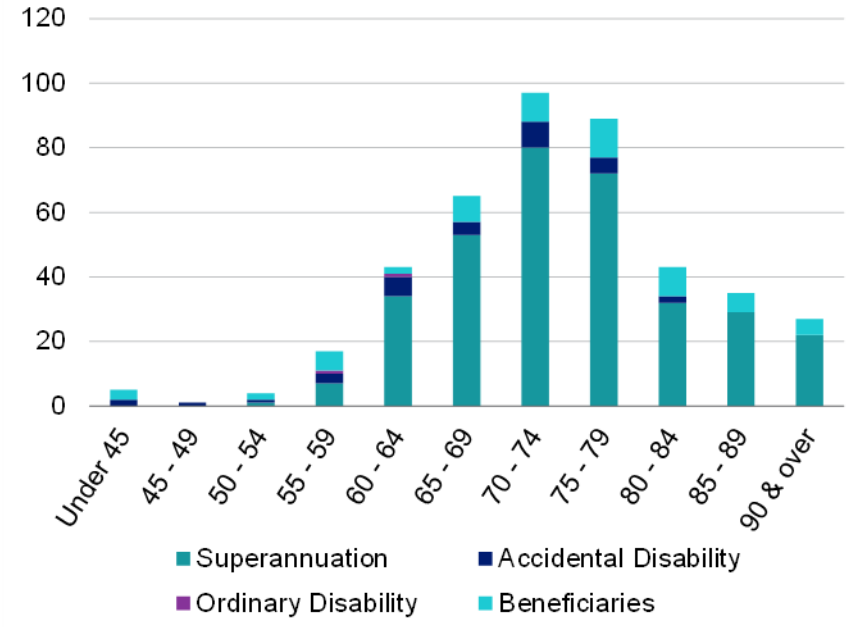
As of December 31,	2020	2018	Change
Retirees	364	357	2.0%
Beneficiaries	62	61	1.6%
Average age	73.9	74.2	-0.3
Average amount	$2,595	$2,411	7.6%
Total monthly amount[1]	$1,105,443	$1,007,635	9.7%

Distribution of Retired Participants as of December 31, 2020

by Type and Monthly Amount



by Type and Age



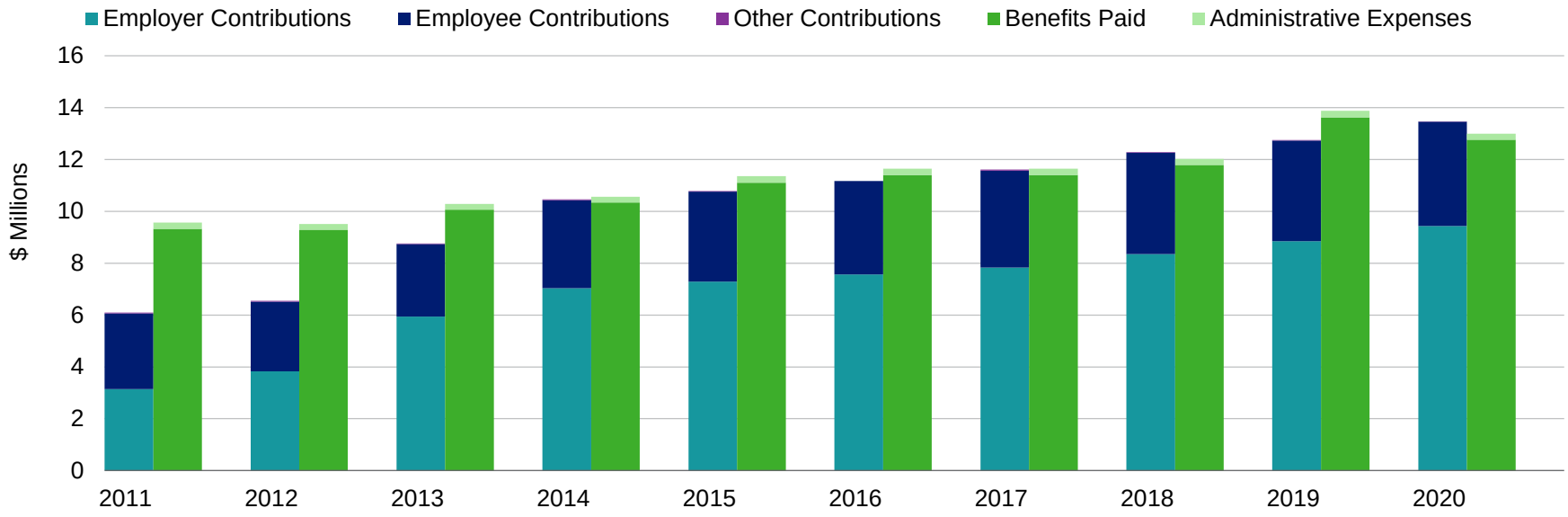
[1] Excluding COLAs reimbursed by the Commonwealth.

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.

Additional financial information, including a summary of transactions for the valuation year, is presented in *Section 3, Exhibit C.*

Comparison of Contributions with Benefits and Expenses for Years Ended December 31, 2011 – 2020



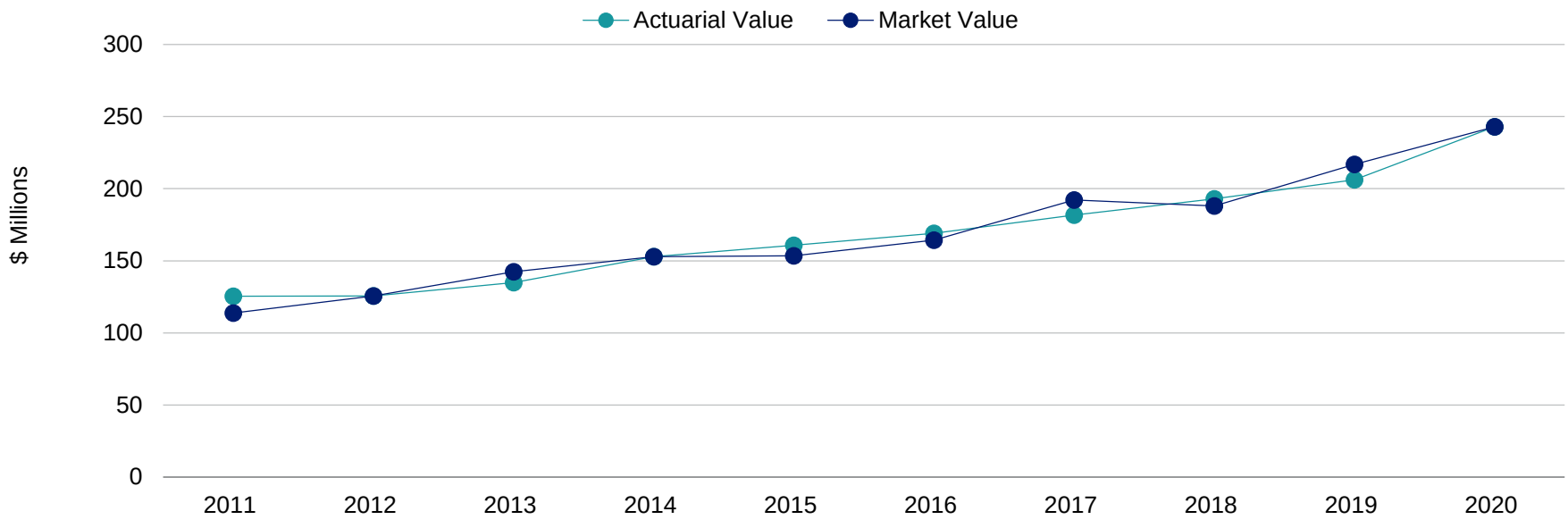
Section 2: Actuarial Valuation Results

Both the actuarial value and market value of assets are representations of the System's financial status. The actuarial asset value is significant because the Town of Wellesley Contributory Retirement System's liabilities are compared to these assets to determine what portion, if any, remains unfunded. Amortization of the unfunded actuarial accrued liability is an important element in determining the contribution requirement.

As described earlier in this section, the actuarial asset valuation method gradually recognizes fluctuations in the market value rate of return. The goal of this is to stabilize the actuarial rate of return and to produce more level pension plan costs.

Effective January 1, 2021, the Retirement Board set the actuarial value of assets equal to the market value of assets, with the smoothing method being applied going forward.

Actuarial Value of Assets vs. Market Value of Assets



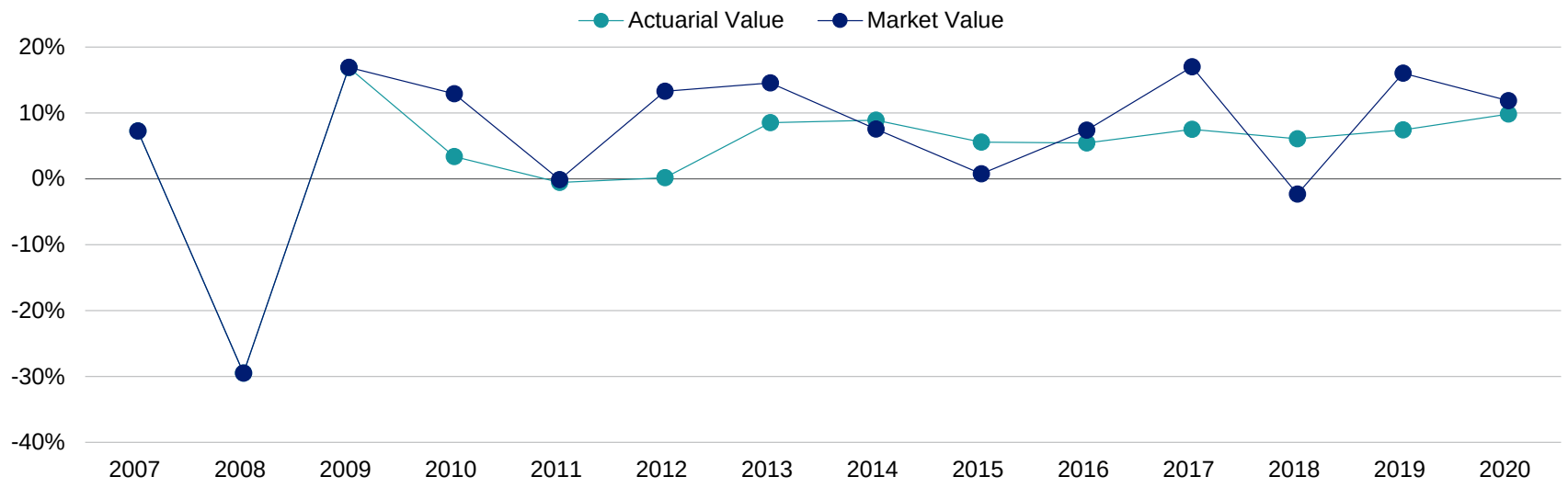
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Actuarial Value[1]	$113.75	$125.71	$142.34	$152.96	$153.54	$164.35	$192.20	$187.95	$216.83	$242.97
Market Value[1]	125.42	125.71	134.82	152.96	160.86	169.09	181.70	193.02	206.13	242.97

[1] In $ millions

Section 2: Actuarial Valuation Results

Because actuarial planning is long term, it is useful to see how the assumed investment rate of return has followed actual experience over time. The chart below shows the rate of return on an actuarial basis compared to the actual market value investment return for the last 14 years.

Market and Actuarial Rates of Return for Years Ended December 31, 2007 - 2020[1]



[1] 2020 shown before the change in the asset method.

Actuarial experience

To calculate any actuarially determined contribution, assumptions are made about future events that affect the amount and timing of benefits to be paid and assets to be accumulated. Each year actual experience is measured against the assumptions. If overall experience is more favorable than anticipated (an actuarial gain), any contribution requirement will decrease from the previous year. On the other hand, any contribution requirement will increase if overall actuarial experience is less favorable than expected (an actuarial loss).

Taking account of experience gains or losses in one year without making a change in assumptions reflects the belief that the single year's experience was a short-term development and that, over the long term, experience will return to the original assumptions. For contribution requirements to remain stable, assumptions should approximate experience. If assumptions are changed, the contribution requirement is adjusted to take into account a change in experience anticipated for all future years.

If assumptions are changed, the contribution requirement is adjusted to take into account a change in experience anticipated for all future years.

The net experience gain over the two-year period is $13,027,438, which includes $8,106,776 from investment gains and $4,920,662 in losses from all other sources. The net experience variation from individual sources other than investments was 1.8% of the actuarial accrued liability. A discussion of the major components of the actuarial experience is on the following pages.

Actuarial Experience for Two-Year Period Ended December 31, 2020

1	Net gain from investments	$8,106,776
2	Net gain from administrative expenses	73,237
3	Net gain from other experience	4,847,425
4	Net experience gain: **1 + 2 + 3**	$13,027,438

Investment experience

A major component of projected asset growth is the assumed rate of return. The assumed return should represent the expected long-term rate of return, based on the Plan's investment policy. The rate of return on the market value of assets for the 2020 and 2019 plan years was 11.82% and 16.01%.

For valuation purposes, the assumed rate of return on the actuarial value of assets was 6.625% for 2020 and 2019. The actual rate of return on an actuarial basis was 9.83% for the 2020 plan year (before reflecting the change in asset method) and 7.40% for the 2019 year. Since the actual return was greater than the assumed return, the Plan experienced an actuarial gain during the two-year period ending December 31, 2020 with regard to its investments.

Investment Experience

		Year Ended December 31, 2020		Year Ended December 31, 2019	
		Market Value	Actuarial Value	Market Value	Actuarial Value
1	Net investment income	$25,665,658	$20,291,256	$30,009,377	$14,237,197
2	Average value of assets	217,068,705	206,365,005	187,384,279	192,452,760
3	Rate of return: **1 ÷ 2**	11.82%	9.83%	16.01%	7.40%
4	Assumed rate of return	6.625%	6.625%	6.625%	6.625%
5	Expected investment income: **2 x 4**	$14,380,802	$13,671,682	$12,414,208	$12,749,995
6	Actuarial gain: **1 - 5**	$11,284,856	$6,619,574	$17,595,169	$1,487,201

Non-investment experience

Administrative expenses

Administrative expenses for the years ended December 31, 2019 and December 31, 2020 were $255,182 and $234,335, respectively, compared to the assumption of $275,000 for 2019 and $282,563 for 2020. This resulted in a gain of $73,237 for the two-year period, including an adjustment for interest. Based on information on expenses provided by the Retirement System, we have reset the assumption to $275,000 for calendar year 2021.

Mortality experience

Mortality experience (more or fewer than expected deaths) yields actuarial gains or losses.

The average number of deaths for nondisabled pensioners over the past two years was 15.5 per year compared to 14.8 projected deaths per year. The average number of deaths for disabled pensioners over the past two years was 0.5 per year compared to 0.8 projected deaths per year. The average number of deaths for beneficiaries over the past two years was 4.5 per year compared to 2.8 projected deaths per year.

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:

- the extent of turnover among participants,
- retirement experience (earlier or later than projected),
- the number of disability retirements (more or fewer than projected), and
- salary increases (greater or smaller than projected).

The net gain from other experience for the two-year period ending December 31, 2020 amounted to $4,847,425, which is 1.8% of the projected actuarial accrued liability.

Liability Changes Due to Demographic Experience for Two-Year Period Ended December 31, 2020

Gain due to salaries increasing less than expected	$4,574,706
Loss due to mortality experience among retired participants and beneficiaries	-1,172,162
Miscellaneous experience gain	1,444,881
Total	$4,847,425

Actuarial assumptions

The Retirement Board adopted the following assumption changes with this valuation:

- The investment return assumption was decreased from 6.625% to 6.00%.
- The mortality assumption for disabled pensioners was changed from the RP-2000 Healthy Annuitant Mortality Table projected generationally with Scale BB from 2015 to the RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2016.
- The retirement assumption for members hired on or after April 2, 2012 was adjusted to reflect a 50% increase to retirement rates at age 60 for members of Group 1 and 2.
- The administrative expense assumption was reset to $275,000 for calendar 2021, increasing 2.75% per year, based on information on expenses provided by the staff of the Retirement System.

These changes increased the actuarial accrued liability by approximately $20.7 million (7.9%) and increased the normal cost by approximately $1.0 million (15.7%).

Additionally, the actuarial value of assets was set equal to the market value of assets as of January 1, 2021. This change decreased the unfunded liability by $16.1 million.

Details on actuarial assumptions and methods are in *Section 4, Exhibit I.*

Plan provisions

The following Plan change is included in this valuation:

- Effective July 1, 2020, the COLA base increased from $17,000 to $18,000.

This change increased the actuarial accrued liability by approximately $1.2 million (0.4%) and increased the normal cost by approximately $29,000 (0.4%).

Section 2: Actuarial Valuation Results

Development of Unfunded Actuarial Accrued Liability

		Year Ended	
		December 31, 2020	December 31, 2019
1	Unfunded actuarial accrued liability at beginning of year	$53,242,385	$55,536,612
2	Normal cost at beginning of year	6,902,247	6,717,515
3	Total contributions	-13,469,274	-12,746,387
4	Interest on 1, 2 & 3	3,580,330	3,734,645
5	Expected unfunded actuarial accrued liability	$50,255,688	$53,242,385
6	Changes due to:		
	• Net gain from investments	-$8,106,776	- -
	• Net increase from assumption changes	20,784,416	- -
	• Net decrease from change in asset method	-16,078,101	- -
	• Net increase from plan changes	1,170,398	- -
	• Net gain from other experience	-4,920,662	- -
	Total changes	-$7,150,725	- -
7	Unfunded actuarial accrued liability at end of year	$43,104,963	- -

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 2022, the Actuarially Determined Contribution has been set equal to the previously budgeted amount of $9,756,209 determined with the prior valuation.

The funding schedule included in this report is projected to fully fund the System by June 30, 2030 with amortization payments on the unfunded liability that increase by 3.0% per year, if all assumptions are met and there are no changes in the plan of benefits or actuarial assumptions. The funding schedule included in the prior report fully funded the System by June 30, 2030 with amortization payments that increased by 3.5% per year.

Actuarially Determined Contribution for Year Beginning January 1

		2021		2019	
		Amount	% of Projected Payroll	Amount	% of Projected Payroll
1	Total normal cost	$7,620,841	17.93%	$6,442,515	15.84%
2	Administrative expenses	275,000	0.65%	275,000	0.68%
3	Expected employee contributions	-4,175,748	-9.83%	-3,952,186	-9.71%
4	Employer normal cost: **(1) + (2) + (3)**	$3,720,093	8.75%	$2,765,329	6.80%
5	Actuarial accrued liability	$286,078,693		$248,553,692	
6	Actuarial value of assets	242,973,730		193,017,080	
7	Unfunded actuarial accrued liability: **(5) - (6)**	$43,104,963		$55,536,612	
8	Employer normal cost projected the following July 1, adjusted for timing	3,830,120	8.89%	2,848,410	6.91%
9	Projected unfunded actuarial accrued liability	44,379,276		57,346,763	
10	Payment on unfunded actuarial accrued liability, adjusted for timing	5,926,089	13.76%	6,003,098	14.56%
11	Actuarially Determined Contribution: **(8) + (10)**	$9,756,209	22.65%	$8,851,508	21.46%
12	Projected payroll as of the following July 1	$43,073,214		$41,237,720	

Notes:
Actuarially Determined Contributions are set equal to the budgeted amounts determined with the prior valuation.
Actuarially Determined Contributions are assumed to be paid on October 1.

Funding Schedule

(1) Fiscal Year Ended June 30	(2) Employer Normal Cost	(3) Amortization of 2010 ERI Liability	(4) Amortization of Remaining Unfunded Actuarial Accrued 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
2022	$3,830,120	$15,970	$5,910,119	$9,756,209	$44,379,276	--
2023	3,947,535	0	6,087,423	10,034,958	40,867,904	2.86%
2024	4,068,530	0	6,270,045	10,338,575	36,960,626	3.03%
2025	4,193,213	0	6,458,146	10,651,359	32,628,131	3.03%
2026	4,321,697	0	6,651,891	10,973,588	27,839,183	3.03%
2027	4,454,097	0	6,851,448	11,305,545	22,560,499	3.03%
2028	4,590,531	0	7,056,992	11,647,523	16,756,622	3.02%
2029	4,731,123	0	7,268,701	11,999,824	10,389,788	3.02%
2030	4,875,997	0	3,469,958	8,345,955	3,419,777	-30.45%
2031	5,025,284	0	0	5,025,284	0	-39.79%

Notes:
Actuarially Determined Contributions are assumed to be paid on October 1.
Assumes contribution of budgeted amount for fiscal year 2022.
Item (2) reflects 2.75% growth in payroll, as well as a 0.15% adjustment to total normal cost to reflect the effects of mortality improvements due to the generational mortality assumption.
Amortization payments of unfunded liability increase 3.00% per year.
Projected normal cost does not reflect the future impact of pension reform for future hires.

Risk

Since the actuarial valuation results are dependent on a given set of assumptions and data as of a specific date, there is a risk that emerging results may differ significantly as actual experience differs from the assumptions.

This report does not contain a detailed analysis of the potential range of future measurements, but does include a brief discussion of some risks that may affect the System. This discussion is focused on funding-related risks, but similar concerns may apply to risks regarding the level of expense and liabilities reported for System accounting purposes as well.

A more detailed assessment would provide the Retirement Board with a better understanding of the risks inherent in the System. This assessment may include scenario testing, sensitivity testing, stress testing and stochastic modeling.

- Investment Risk (the risk that returns will be different than expected)

  The market value rate of return over the last 14 years has ranged from a low of -29.51% to a high of 16.96%.

  As an illustration of the sensitivity of future employer contributions to investment volatility, we have estimated the impact of a -4% (a loss of 10%) return in 2022 on the funding schedule, if all assumptions other than the investment return assumption for 2022 are met. We estimate that this investment return would result in fiscal 2025 - 2030 appropriations that increase by approximately 4.4% per year, compared with approximately 3.0% increases in the current funding schedule, if the current full funding date of 2030 is maintained. If there are no market value gains in 2023 and 2024, there will be further actuarial losses in those years which will be reflected in the funding schedule adopted with the January 1, 2025 actuarial valuation.

- 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 requires payment of the actuarially determined contribution. If future experience matches the current assumptions, we project the unfunded actuarial accrued liability will be paid off in 9 years.

Section 2: Actuarial Valuation Results

- 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 experience greater or less than expected.
  – Salary increases greater or less than projected.

- Actual Experience and Implications for the Future

  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) has ranged from a loss of $17.3 million to a gain of $17.6 million.

  The non-investment gain(loss) has ranged from a loss of $2.5 million to a gain of $5.1 million.

  The funded percentage on the actuarial value of assets has ranged from a low of 67.5% as of January 1, 2013 to a high of 89.4% as of January 1, 2021.

- Maturity Measures

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

  In 2020, contributions received exceeded benefits paid plus administrative expenses by $0.5 million. As the System matures, cash will be needed from the investment portfolio to meet benefit payments.

Section 3: Supplemental Information

Exhibit A: Table of Plan Demographics

Category	Year Ended December 31 2020	2018	Change From Prior Year
Active participants in valuation:			
• Number	691	703	-1.7%
• Average age	46.0	45.8	0.2
• Average years of service	10.5	10.6	-0.1
• Total payroll	$40,939,192	$39,169,350	4.5%
• Average payroll	59,246	55,717	6.3%
• Total account balances	37,441,001	36,761,831	1.8%
Inactive participants:			
Inactive participants with a vested right to a deferred or immediate benefit	25	16	56.3%
Inactive participants due a refund of employee contributions	332	270	23.0%
Retired participants:			
• Number in pay status	330	322	2.5%
• Average age	74.8	75.3	-0.5
• Average monthly benefit	$2,750	$2,533	8.6%
Disabled participants:			
• Number in pay status	34	35	-2.9%
• Average age	65.5	64.2	1.3
• Average monthly benefit	$3,521	$3,410	3.3%
Beneficiaries:			
• Number in pay status	62	61	1.6%
• Average age	73.3	74.3	-1.0
• Average monthly benefit	$1,260	$1,193	5.6%

Note:
Payroll figures are for the prior year and reflect annualized salaries for participants hired during the year.

Exhibit B: Participants in Active Service as of December 31, 2020 by Age, Years of Service, and Average Compensation

		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	34	34	- -	- -	- -	- -	- -	- -	- -	- -
	$34,785	$34,785	- -	- -	- -	- -	- -	- -	- -	- -
25 - 29	98	93	5	- -	- -	- -	- -	- -	- -	- -
	$42,859	$41,612	$66,041	- -	- -	- -	- -	- -	- -	- -
30 - 34	74	54	14	6	- -	- -	- -	- -	- -	- -
	$53,720	$48,822	$60,123	$82,861	- -	- -	- -	- -	- -	- -
35 - 39	57	21	12	19	4	1	- -	- -	- -	- -
	$61,768	$48,707	$65,424	$72,843	$64,393	$71,222	- -	- -	- -	- -
40 - 44	55	25	9	6	10	5	- -	- -	- -	- -
	$66,665	$42,843	$65,865	$83,662	$101,127	$97,895	- -	- -	- -	- -
45 - 49	62	12	11	5	14	16	4	- -	- -	- -
	$77,315	$47,840	$65,667	$63,065	$79,203	$102,726	$107,324	- -	- -	- -
50 - 54	88	31	11	10	9	10	9	8	- -	- -
	$61,468	$43,681	$57,679	$64,338	$59,994	$78,582	$93,059	$76,743	- -	- -
55 - 59	84	14	15	12	11	10	11	9	2	- -
	$64,376	$48,692	$54,616	$56,573	$79,855	$64,265	$78,765	$77,848	$69,851	- -
60 - 64	90	21	14	12	10	9	8	7	7	2
	$66,491	$46,646	$62,255	$61,789	$54,432	$79,663	$85,116	$93,599	$90,208	$81,377
65 - 69	33	5	6	4	4	3	4	2	3	2
	$59,070	$51,854	$48,002	$68,082	$55,782	$71,385	$53,823	$65,650	$67,200	$72,123
70 & over	16	4	2	1	2	3	1	2	- -	1
	$53,116	$52,760	$46,671	$17,836	$40,555	$54,140	$46,629	$81,473	- -	$74,530
Total	691	314	99	75	64	57	37	28	12	5
	$59,246	$44,085	$60,392	$67,365	$72,572	$82,918	$83,138	$80,858	$81,063	$76,306

Exhibit C: Summary Statement of Income and Expenses on a Market Value Basis

	Year Ended December 31, 2020		Year Ended December 31, 2019	
Net assets at market value at the beginning of the year		$216,829,337		$187,948,599
Contribution income:				
• Employer contributions	$9,438,070		$8,851,507	
• Employee contributions	4,014,796		3,877,403	
• Other contributions	16,408		17,477	
• Less administrative expenses	-234,335		-255,812	
Net contribution income		$13,234,939		$12,490,575
Net investment income		25,665,658		30,009,377
Total income available for benefits		**$38,900,597**		**$42,499,952**
Less benefit payments:				
• Pensions, annuities, refunds and net transfers	-$12,831,475		-$13,604,752	
• Net 3(8)(c) reimbursements	75,271		-14,462	
Net benefit payments		-$12,756,204		-$13,619,214
Change in reserve for future benefits		**$26,144,393**		**$28,880,738**
Net assets at market value at the end of the year		**$242,973,730**		**$216,829,337**

Exhibit D: Group Results as of January 1, 2021

		Groups 1 and 2		Group 4		Total	
1	Participant Counts						
	a) Active employees	585		106		691	
	b) Inactive members entitled to a return of their employee contributions	329		3		332	
	c) Inactive members with a vested right to a deferred or immediate benefit	21		4		25	
	d) Retired members	306		120		426	
	e) Total members: **(a) + (b) + (c) + (d)**	1,241		233		1,474	
2	Projected payroll for calendar year 2021	$32,403,592		$10,089,307		$42,492,899	
3	Normal Cost		**Percent of Pay**		**Percent of Pay**		**Percent of Pay**
	a) Total normal cost	$5,154,774	15.91%	$2,466,067	24.44%	$7,620,841	17.93%
	b) Expense allowance	186,011	0.57%	88,989	0.88%	275,000	0.65%
	c) Employee contributions	-3,162,269	-9.76%	-1,013,479	-10.05%	-4,175,748	-9.83%
	d) Employer normal cost: **(a) + (b) + (c)**	$2,178,516	6.72%	$1,541,577	15.28%	$3,720,093	8.75%
4	Total actuarial accrued liability	177,240,534		108,838,159		286,078,693	
5	Actuarial value of assets	150,548,080		92,425,650		242,973,730	
6	Unfunded actuarial accrued liability: **(4) - (5)**	$26,692,454		$16,412,509		$43,104,963	

Exhibit E: Department Results as of January 1, 2021

		Housing	Water	Light	School	Veteran	All Other	Total
1	Participant Counts							
a)	Active employees[1]	7	25	30	275	2	352	691
b)	Inactive members entitled to a return of their employee contributions	4	0	1	281	1	45	332
c)	Inactive members with a vested right to a deferred or immediate benefit	0	1	0	11	0	13	25
d)	Retired members[1]	5	8	35	119	1	258	426
e)	Total members: **(a) + (b) + (c) + (d)**	16	34	66	686	4	668	1,474
2	Projected payroll for calendar year 2021	$434,266	$1,866,827	$2,784,802	$11,659,407	$114,433	$25,633,164	$42,492,899
3	Normal Cost							
a)	Total normal cost	$58,647	$289,785	$653,023	$1,793,152	$16,586	$4,809,648	$7,620,841
b)	Expense allowance	2,116	10,457	23,565	64,706	599	173,557	275,000
c)	Employee contributions	-42,888	-175,255	-282,297	-1,114,446	-11,388	-2,549,474	-4,175,748
d)	Employer normal cost: **(a) + (b) + (c)**	$17,875	$124,987	$394,291	$743,412	$5,797	$2,433,731	$3,720,093
4	Total actuarial accrued liability	2,435,433	11,552,245	26,779,100	49,979,615	276,147	195,056,153	286,078,693
5	Actuarial value of assets	2,068,474	9,811,608	22,744,154	42,448,927	234,538	165,666,029	242,973,730
6	Unfunded actuarial accrued liability: **(4) - (5)**	$366,959	$1,740,637	$4,034,946	$7,530,688	$41,609	$29,390,124	$43,104,963
7	Projected Employer Normal Cost, adjusted for timing	18,415	128,701	405,874	765,537	5,971	2,505,622	3,830,120
8	Projected unfunded/(overfunded) actuarial accrued liability	377,808	1,792,095	4,154,231	7,753,318	42,839	30,258,985	44,379,276
9	2010 ERI Payment	0	0	15,534	0	0	0	15,534
10	Payment on projected remaining unfunded/ (overfunded) actuarial accrued liability	53,365	359,361	530,333	962,879	3,838	4,000,779	5,910,555
11	Budgeted contribution for fiscal 2022: **(7) + (9) + (10)**	$71,780	$488,062	$951,741	$1,728,416	$9,809	$6,506,401	$9,756,209
12	Recommended contribution for fiscal 2023	70,845	378,554	987,095	1,853,096	12,038	6,733,328	10,034,958
13	Recommended contribution for fiscal 2024	73,019	390,052	1,016,728	1,909,642	12,411	6,936,723	10,338,575

[1] Certain participants have benefits allocated to multiple departments.

Exhibit F: Definition of Pension Terms

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

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 (APV):	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.
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.

Section 3: Supplemental Information

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 (AVA):	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 (ADC):	The employer's periodic required 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.
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.

Section 3: Supplemental Information

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 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 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.
Plan Fiduciary Net Position:	Market value of assets.
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.

Section 3: Supplemental Information

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.

Section 4: Actuarial Valuation Basis

Exhibit I: Actuarial Assumptions, Actuarial Cost Method and Models

Net Investment Return:

6.0% (previously, 6.625%)

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 Plan's target asset allocation.

Salary Increases:

Years of Service	Groups 1 and 2	Group 4
0	7.00%	8.00%
1	6.50%	7.50%
2	6.00%	7.00%
3	5.50%	6.50%
4	5.25%	6.00%
5	5.00%	5.50%
6	4.75%	5.25%
7	4.50%	5.00%
8	4.25%	4.75%
9	4.00%	4.50%
10	3.75%	4.25%
11+	3.50%	4.00%

Includes allowance for wage inflation of 2.75%.

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

Interest on Employee Contributions:

3.50%

Cost of Living Adjustment (COLA):

2.75% increase on the first $18,000 (previously, $17,000) of retirement allowance.

Section 4: Actuarial Valuation Basis

Administrative Expenses:	$275,000 for calendar 2021 increasing 2.75% per year (previously, $275,000 for calendar 2019 increasing 2.75% 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 set forward one year for females projected generationally with Scale MP-2016 *Healthy Retiree:* RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year for females projected generationally with Scale MP-2016 *Disabled Retiree:* RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2016 (previously, RP-2000 Healthy Annuitant Mortality Table projected generationally with Scale BB from 2015) 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 five most recent valuations. The mortality tables were then adjusted to future years using generational projection to reflect future mortality improvement.

Section 4: Actuarial Valuation Basis

Termination Rates before Retirement:

	Groups 1 and 2 – Rate per year (%)		
	Mortality		
Age	Male	Female	Disability
20	0.05	0.02	0.01
25	0.06	0.02	0.02
30	0.06	0.02	0.03
35	0.07	0.03	0.05
40	0.08	0.05	0.10
45	0.13	0.08	0.15
50	0.22	0.14	0.19
55	0.36	0.20	0.24
60	0.61	0.30	0.28

Notes:
Mortality rates do not reflect generational projection.
55% of the disability rates shown represent accidental disability.
40% of the accidental disabilities will die from the same cause as the disability.
55% of the death rates shown represent accidental death.

Section 4: Actuarial Valuation Basis

Group 4 – Rate per year (%)

Age	Mortality Male	Mortality Female	Disability
20	0.05	0.02	0.10
25	0.06	0.02	0.20
30	0.06	0.02	0.30
35	0.07	0.03	0.30
40	0.08	0.05	0.30
45	0.13	0.08	1.00
50	0.22	0.14	1.25
55	0.36	0.20	1.20
60	0.61	0.30	0.85

Notes:
Mortality rates do not reflect generational projection.
90% of the disability rates shown represent accidental disability.
40% of the accidental disabilities will die from the same cause as the disability.
90% of the death rates shown represent accidental death.

The 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 five most recent valuations.

Section 4: Actuarial Valuation Basis

Withdrawal Rates:

Rate per year (%)			
Years of Service	**Groups 1 and 2**	**Years of Service**	**Group 4**
0	15.0	0 – 10	1.5
1	12.0	11+	0.0
2	10.0		
3	9.0		
4	8.0		
5	7.6		
6	7.5		
7	6.7		
8	6.3		
9	5.9		
10	5.4		
11	5.0		
12	4.6		
13	4.1		
14	3.7		
15	3.3		
16 – 20	2.0		
21 – 29	1.0		
30+	0.0		

The termination 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 the projected number based on the prior years' assumptions over the five most recent valuations.

Section 4: Actuarial Valuation Basis

Retirement Rates:

	Rate per year (%)		
	Groups 1 and 2		
Age	Male	Female	Group 4
50 – 54	- -	- -	2.0
55	1.00	2.750	10.0
56 – 57	1.25	3.250	5.0
58	2.50	3.250	5.0
59	3.25	3.250	15.0
60	9.00[1]	3.750[1]	20.0
61	15.00	9.750	20.0
62	22.50	11.250	25.0
63	18.75	9.375	25.0
64	16.50	13.500	30.0
65	40.00	15.000	100.0
66 – 67	25.00	20.000	100.0
68	30.00	25.000	100.0
69	30.00	20.000	100.0
70	100.00	100.000	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 five most recent valuations.

Retirement Age for Inactive Vested Participants:

Age 60 for Groups 1 and 2 and age 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.

[1] Because members of Group 1 and 2 hired on or after April 2, 2012 cannot retire before age 60, the rates at age 60 are increased 50% (to 13.50% for males and 5.625% for females; previously 9.00% and 3.75%, respectively)

Section 4: Actuarial Valuation Basis

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.
2020 Salary:	2020 salary equal to salaries provided in the data except for employees hired in 2020 for whom salaries were annualized.
Total Service:	Total creditable service reported in the data.
Net 3(8)(c) Liability:	No liability is valued for benefits paid to or received from other municipal systems.
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 with a fresh start as of January 1, 2021. 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 20% 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.
Actuarial 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 past experience and future expectations, the following actuarial assumptions were changed with this valuation: • The mortality assumption for disabled pensioners was changed from the RP-2000 Healthy Annuitant Mortality Table projected generationally with Scale BB from 2015 to the RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2016. • The retirement assumption for members hired on or after April 2, 2012 was adjusted to reflect a 50% increase to retirement rates at age 60 for members of Group 1 and 2. • The investment return assumption was decreased from 6.625% to 6.00%. • The administrative expense assumption was reset to $275,000 for calendar 2021, increasing 2.75% per year, based on information on expenses provided by the staff of the Retirement System.

Exhibit II: 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:
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.

Section 4: Actuarial Valuation Basis

	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.

Section 4: Actuarial Valuation Basis

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 $6,000 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.
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.

Section 4: Actuarial Valuation Basis

Post-Retirement Benefits:	The Retirement 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 $18,000 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:	The following plan provision is reflected with this valuation: Effective July 1, 2020, the COLA base increased from $17,000 to $18,000.