



WORCESTER REGIONAL RETIREMENT SYSTEM

ACTUARIAL VALUATION
as of

January 1, 2018

Prepared by:

KMS Actuarial, LLC
814 Elm Street, Suite 204
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September, 2018



September 13, 2018

Worcester Regional Retirement Board
Midstate Office Park
23 Midstate Drive, Suite 106
Auburn, MA 01501

Dear Board Members:

We are pleased to present the enclosed report providing the results of our actuarial valuation of the Worcester Regional Retirement System as of January 1, 2018. Our valuation was performed in accordance with the provisions contained in Chapter 32 of the Massachusetts General Laws, "M.G.L.", as of January 1, 2018. Disclosures under GASB Statement No. 67, Financial Reporting for Pension Plans (GASB 67) and GASB Statement No. 68, Accounting and Financial Reporting for Pensions (GASB 68) are provided in a separate report.

The principal results of our valuation are summarized in Section 2. The Summary of Plan Provisions and Actuarial Methods and Assumptions are shown in Sections 5 and 6, respectively. Section 7 summarizes the demographic profile of active members, retired plan members and beneficiaries and disabled plan members. Asset information and actuarial liabilities are presented in Section 2. The development of the required appropriations pursuant to Chapter 32 of the M.G.L. is shown in Section 3, including a 30-year forecast of the required appropriations and projected cash flows. The summary of information for PERAC is presented in Section 4.

This valuation is based upon member data provided by the Worcester Regional Retirement Board and asset information reported to the Public Employee Retirement Administration Commission (PERAC) by the Retirement Board. Although we did not audit the data used in the valuation, we believe that the information is complete and reliable.

Liabilities presented in this report are based on a long-term investment return rate assumption of 7.75%, net of investment expense, compounded annually.

This report was completed in accordance with generally accepted actuarial standards and procedures, and conforms to the Code of Professional Conduct of the American Academy of Actuaries. The actuarial assumptions used in the determination of costs are reasonably related to the experience of the System and to reasonable expectations, and represent our best estimate of anticipated long-term experience under the System.

K M S A C T U A R I E S

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Future actuarial valuation results may differ significantly from the current results presented in this report. Examples of potential sources of volatility include plan experience differing from that anticipated by the economic or demographic assumptions, the effect of new entrants, changes in economic or demographic assumptions, the effect of law changes and the delayed effect of smoothing techniques.

Our valuation follows generally accepted actuarial methods and we perform such tests as we consider necessary to assure the accuracy of the results. The amounts presented in this report have been appropriately determined according to the actuarial assumptions and methods stated herein.

This report is intended for the sole use of the Worcester Regional Retirement System and is intended to provide information to comply with the stated purpose of the report. It may not be appropriate for other purposes.

The undersigned credentialed actuaries are Members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries necessary to render the actuarial opinion contained herein. They are available to answer any questions with regard to this report.

Respectfully submitted,



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TABLE OF CONTENTS

SECTION 1 -	SUMMARY	1
SECTION 2 -	PRINCIPAL VALUATION RESULTS	6
	Exhibit 2.1 - PLAN ASSETS	
	Exhibit 2.2 - ACTUARIAL PRESENT VALUE OF FUTURE BENEFITS	
	Exhibit 2.3 - ACTUARIAL ACCRUED LIABILITY	
	Exhibit 2.4 - UNFUNDED ACTUARIAL ACCRUED LIABILITY	
	Exhibit 2.5 - NORMAL COST	
	Exhibit 2.6 - ACTUARIAL EXPERIENCE	
SECTION 3 -	CHAPTER 32 OF M.G.L. APPROPRIATIONS	14
	Exhibit 3.1 - ANNUAL APPROPRIATIONS	
	Exhibit 3.2 - 30-YEAR FORECAST OF ANNUAL APPROPRIATIONS	
	Exhibit 3.3 - 30-YEAR FORECAST OF CASH FLOW	
SECTION 4 -	REQUIRED DISCLOSURES	18
	Exhibit 4.1 - GASB 67 AND GASB 68 DISCLOSURES	
	Exhibit 4.2 - PERAC DISCLOSURE INFORMATION	
SECTION 5 -	SUMMARY OF PLAN PROVISIONS	20
SECTION 6 -	ACTUARIAL ASSUMPTIONS AND METHODS	25
SECTION 7 -	PLAN MEMBER INFORMATION	29
	Exhibit 7.1 - ACTIVE MEMBERS BY AGE and YEARS OF SERVICE	
	Exhibit 7.2 - RETIRED and DISABLED PLAN MEMBERS and BENEFICIARIES	
SECTION 8 -	GLOSSARY OF TERMS	31
SECTION 9 -	MEMBER UNIT FY2020 APPROPRIATION	33

SECTION 1 - SUMMARY

Background

We have completed the Actuarial Valuation of the Worcester Regional Retirement System as of January 1, 2018. This valuation is based upon census data provided by the Retirement Board and asset information reported to the Public Employee Retirement Administration Commission (PERAC) by the Worcester Regional Retirement Board. Information for the prior valuation completed as of January 1, 2016 was obtained from the valuation report prepared by KMS Actuaries, LLC.

Massachusetts General Laws

The valuation was prepared in accordance with Chapter 32 of the Massachusetts General Laws ("M.G.L."). The results are based on the active, inactive and retired members and beneficiaries as of January 1, 2018, the assets as of December 31, 2017 and assumptions regarding investment returns, salary increases, death, turnover, disability and retirement.

The valuation does not take into consideration:

- Changes in the law after the valuation date,
- Transfers between retirement systems pursuant to Section 3(8)(c) of Chapter 32,
- State-mandated benefits and
- Cost-of-living increases granted to members in pay status between 1982 and 1997.

GASB Statement Numbers 67 and 68

In June 2012, the GASB approved two related Statements that significantly changed the way pension plans and governments account and report pension liabilities. Effective for plans with fiscal years beginning after June 15, 2013, GASB Statement No. 67, Financial Reporting for Pension Plans, replaced the requirements of Statement No. 25 and effective for employers with fiscal years beginning after June 15, 2014, GASB Statement No. 68, Accounting and Financial Reporting for Pensions, replaced the requirements of Statement No. 27.

The new pension standards reflect changes from those previously in place regarding how governments calculate total pension liability and pension expense. Further, the new standards contain requirements for disclosing information in the notes to financial statements and presenting required supplementary information following the notes.

The required disclosures and notes under the new GASB Statements for the fiscal year ending December 31, 2017 are provided in a separate report.

SECTION 1 - SUMMARY

Actuarial Valuation

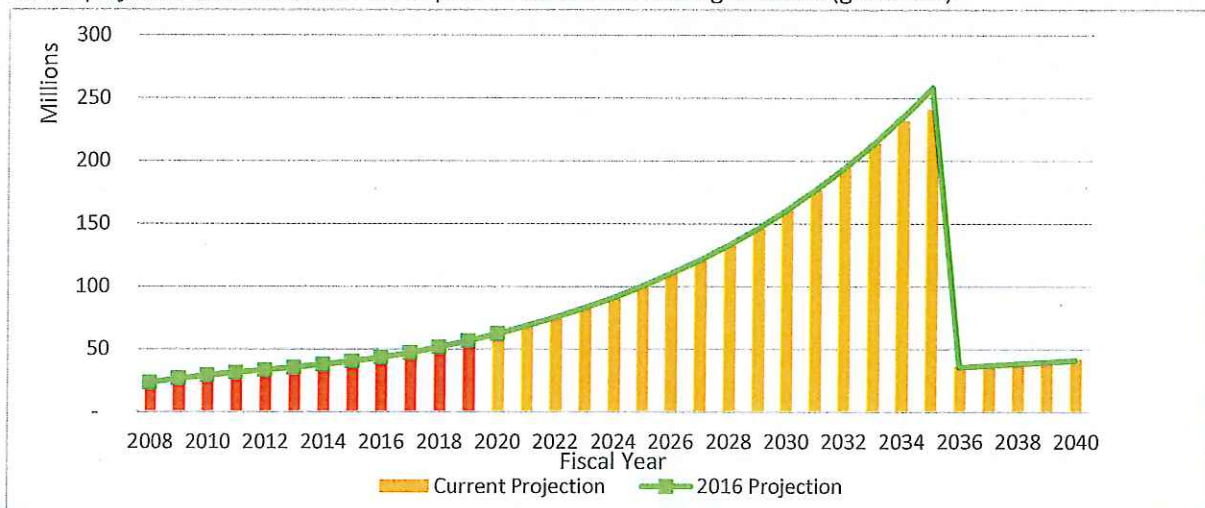
During the two years since the last valuation, the total unfunded actuarial accrued liability of the System was expected to increase from \$774,603,682 as of January 1, 2016 to \$812,148,457 as of January 1, 2018, for a total increase of \$37,544,775. The actual unfunded actuarial accrued liability, before any assumption or plan changes, was \$828,586,851, resulting in an actuarial loss of \$16,438,394. The actuarial loss was primarily due to an asset gain of \$2,895,822 and a demographic experience loss of \$19,334,216. The details of the gain and loss analysis are provided in Exhibit 2.6.

Appropriations

The funding appropriation for each year is computed as the sum of the normal cost, net 3(8)(c) transfers and an amortization payment to pay off the Unfunded Actuarial Liability, adjusted for semi-annual payments of the appropriation made July 1 and January 1. The appropriation calculated as of the January 1, 2018 valuation is \$83,562,816, and is made up of a normal cost payment of \$15,935,598, net 3(8)(c) transfers of \$3,310,021, and an amortization payment of \$64,317,197. The amortization method is an increasing amortization of the unfunded actuarial accrued liability at 4% over 17 years and is expected to fully pay the unfunded actuarial accrued liability by the year 2035. The development of the appropriation as of January 1, 2018 is presented in Exhibit 3.1.

For fiscal year 2019, we show the actual appropriation developed under the previous funding schedule and reported on the PERAC "Required Fiscal Year 2019 Appropriation" letter dated December 14, 2017 of \$56,616,875. For fiscal year 2020, we developed an annual appropriation of \$62,250,254, which is made up of a normal cost and net 3(8)(c) transfers of \$21,024,235 and payment toward the unfunded actuarial accrued liability (including payments for the Early Retirement Incentives) of \$41,226,019. The unfunded actuarial accrued liability is expected to be fully paid by 2035. The current funding schedule is shown in Exhibit 3.2.

The chart below shows the historical (orange bars) and projected (yellow bars) annual appropriations compared to the projected amounts shown in the prior valuation and funding schedule (green line).

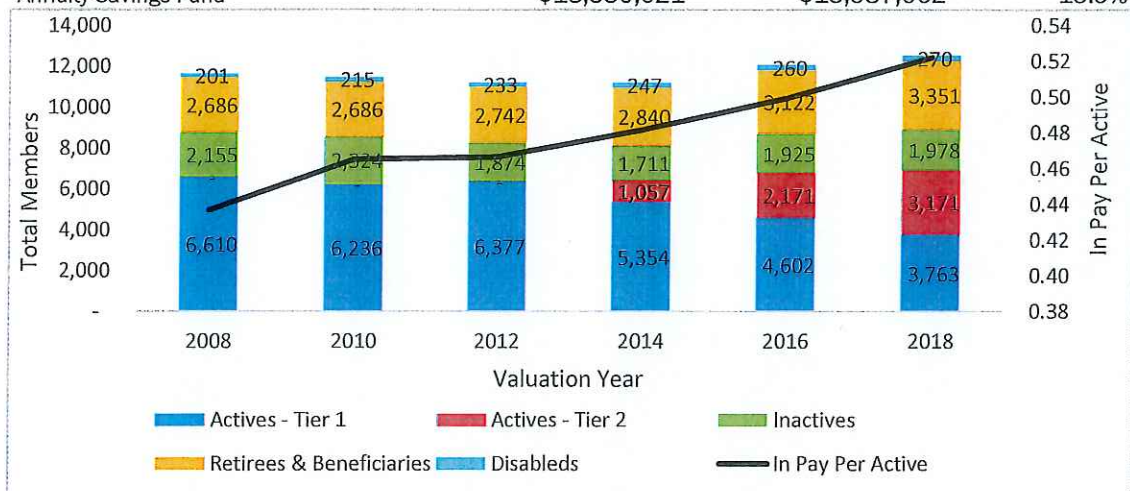


Worcester Regional Retirement System
Actuarial Valuation as of January 1, 2018

SECTION 1 - SUMMARY

A summary of principal valuation results from the current valuation and the prior valuation follows. Changes in actuarial assumptions and methods and Plan provisions are discussed below, as well as changes in census data and asset information.

Valuation Date	1/1/2018	1/1/2016	Increase/ (Decrease)
Summary of Member Data			
Active Members	6,934	6,773	2.4%
Average Age	47.5	48.0	(1.0%)
Average Service	10.1	10.6	(4.3%)
Valuation Salary	\$304,282,630	\$282,918,805	7.6%
Average Salary	\$43,882	\$41,771	5.1%
Retired Members and Beneficiaries	3,351	3,122	7.3%
Average Age	73.5	73.8	(0.4%)
Total Annual Retirement Allowance	\$68,184,912	\$59,160,612	15.3%
Average Annual Retirement Allowance	\$20,348	\$18,950	7.4%
State Reimbursed COLAs	\$354,170	\$465,830	(24.0%)
Total System-Funded Retirement Allowance	\$67,830,742	\$58,694,782	15.6%
Disabled Members	270	260	3.8%
Average Age	62.9	62.6	0.5%
Total Annual Retirement Allowance	\$8,731,339	\$8,025,611	8.8%
Average Annual Retirement Allowance	\$32,338	\$30,868	4.8%
State Reimbursed COLAs	\$63,992	\$74,425	(14.0%)
Total System-Funded Retirement Allowance	\$8,667,347	\$7,951,186	9.0%
Inactive Members	1,978	1,925	2.8%
Annuity Savings Fund	\$18,530,021	\$15,987,062	15.9%



Worcester Regional Retirement System
Actuarial Valuation as of January 1, 2018

SECTION 1 - SUMMARY

Valuation Date	<u>1/1/2018</u>	<u>1/1/2016</u>	<u>Increase/ (Decrease)</u>
Funded Status - Market Value of Assets			
Actuarial Accrued Liability (AAL)	\$1,514,623,300	\$1,369,393,800	10.6%
Market Value of Assets (MVA)	\$710,205,259	\$573,959,894	23.7%
Unfunded Accrued Liability	\$804,418,041	\$795,433,906	1.1%
Funded Status	46.9%	41.9%	11.9%
Funded Status - Actuarial Value of Assets			
Actuarial Accrued Liability (AAL)	\$1,514,623,300	\$1,369,393,800	10.6%
Actuarial Value of Assets (AVA)	685,488,133	\$594,790,118	15.2%
Unfunded Accrued Liability	\$829,135,167	\$774,603,682	7.0%
Funded Status	45.3%	43.4%	4.4%
Normal Cost			
Total Normal Cost	\$43,715,955	\$41,092,346	6.4%
Employee Normal Cost	28,880,357	26,597,269	8.6%
Administrative Expenses	1,100,000	1,100,000	0.0%
Net Employer Normal Cost	\$15,935,598	\$15,595,077	2.2%
Appropriations			
Fiscal Year 2018	N/A	\$51,474,497	N/A
Fiscal Year 2019	\$56,616,875	\$56,598,226	0.0%
Fiscal Year 2020	\$62,250,254	\$62,231,967	0.0%
Fiscal Year 2021	\$68,444,153	\$68,426,485	0.0%

Actuarial Assumptions and Methods

Most Actuarial Assumptions and Methods used in this valuation remained the same from those used in the last valuation, except the net 3(8)(c) transfers were increased from \$3,000,000 to \$3,500,000. The Actuarial Assumptions and Methods utilized in this valuation are detailed in Section 6, Actuarial Assumptions and Methods.

Plan Provisions

Effective January 1, 2018, the Nashoba Valley Regional Dispatchers and Lancaster Sewer became new member units of the Worcester Regional Retirement System. The increase in the Unfunded Actuarial Accrued Liability due to the inclusion of the liabilities attributed to the members of these two groups is \$548,316. All other Plan provisions used in this valuation are the same as those used in the prior valuation, and are summarized in Section 5, Summary of Plan Provisions.

SECTION 1 - SUMMARY

Census Data

As of January 1, 2018, there are 6,934 active members who may be eligible for benefits in the future, 3,351 retirees and beneficiaries, 1,978 inactives and 270 disabled retirees. Summaries of the active, retired and disabled employees are included in Section 7, Demographic Information.

Assets

This valuation is based upon asset information reported to the Public Employee Retirement Administration Commission (PERAC) by the Worcester Regional Retirement Board. The market value of assets increased from \$573,959,894 as of January 1, 2016 to \$710,205,259 as of January 1, 2018. During the plan years ended 2016 and 2017, the market value rates of return were 7.77% and 17.58%, respectively.

The actuarial value of assets increased from \$594,790,118 as of January 1, 2016 to \$685,488,133 as of January 1, 2018. During the plan years ended 2016 and 2017, the rates of return on the actuarial value of assets were 7.41% and 8.55%, respectively.

SECTION 2 - PRINCIPAL VALUATION RESULTS

Exhibit 2.1 - Plan Assets

Asset information is reported annually to the Public Employee Retirement Administration Commission by the Worcester Regional Retirement System. The Market Value of Assets for the three most recent calendar years are as follows:

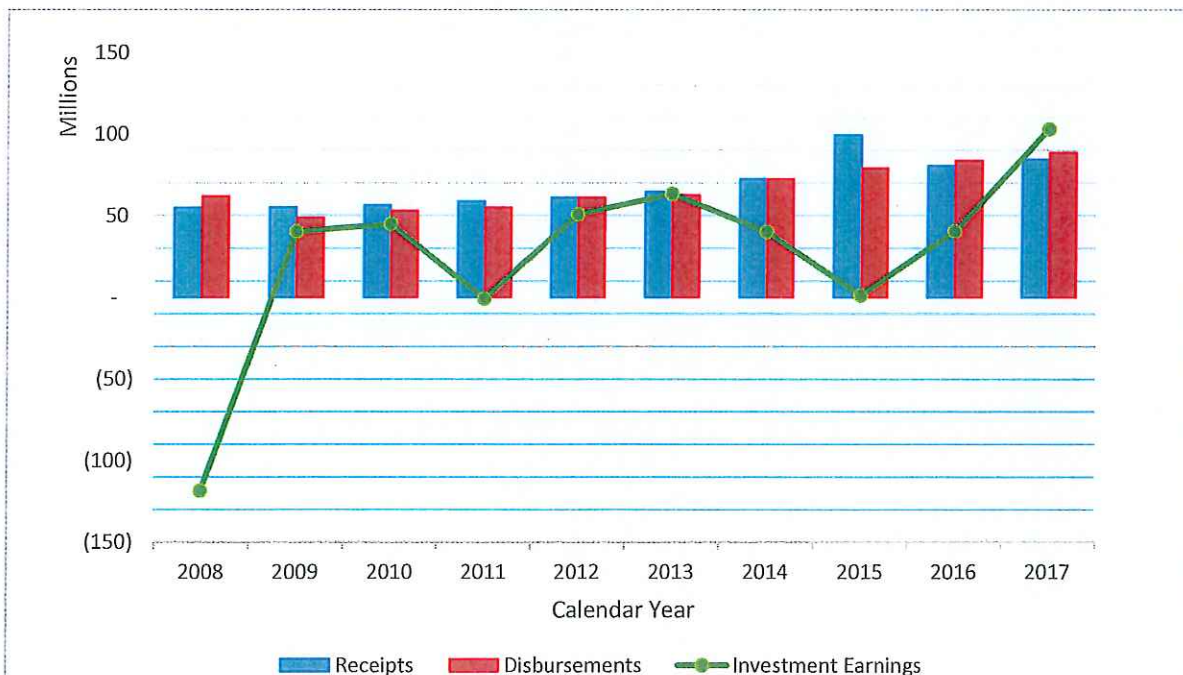
Calendar Year	2017	2016	2015
Trust Fund Composition at Year-End			
Cash	\$2,919,956	\$4,322,402	\$8,256,694
Short-Term Investments	0	0	0
Fixed Income Securities	0	0	0
Equities	0	0	0
Pooled Short Term Funds	0	0	0
Pooled Domestic Equity Funds	0	0	0
Pooled International Equity Funds	0	0	0
Pooled Global Equity Funds	0	0	0
Pooled Domestic Fixed Income Funds	0	0	0
Pooled International Fixed Income Funds	0	0	0
Pooled Global Fixed Income Funds	0	0	0
Pooled Alternative Investments	2,863,638	4,109,766	5,537,390
Pooled Real Estate Funds	449,652	1,737,097	6,002,240
Pooled Domestic Balanced Funds	0	0	0
Pooled International Balanced Funds	0	0	0
Hedge Funds	0	0	0
PRIT Cash	0	0	0
PRIT Fund	705,763,910	601,435,651	554,348,825
Interest Due & Accrued	0	0	0
Prepaid Expenses	0	0	0
Accounts Receivable	4,281,182	6,087,919	5,542,676
Land	0	0	0
Buildings	0	0	0
Accumulated Depreciation - Buildings	0	0	0
Accounts Payable	(6,073,079)	(6,442,319)	(5,727,931)
Total Market Value of Assets	\$710,205,259	\$611,250,516	\$573,959,894

SECTION 2 - PRINCIPAL VALUATION RESULTS

Exhibit 2.1 - Plan Assets

Calendar Year	2017	2016	2015
Funds			
Annuity Savings Fund	\$274,388,785	\$264,886,018	\$256,353,295
Annuity Reserve Fund	71,436,739	67,440,646	63,023,021
Special Military Service Fund	141,576	133,287	146,258
Pension Fund	1,037,428	571,535	264,915
Expense Fund	0	0	0
Pension Reserve Fund	363,200,731	278,219,030	254,172,405
Total Market Value of Assets	\$710,205,259	\$611,250,516	\$573,959,894
Asset Activity			
Market value as of Beginning of Year	\$611,250,516	\$573,959,894	\$552,502,472
Contributions and Receipts	84,608,085	80,679,545	99,522,714
Benefit Payments and Expenses	(88,780,059)	(83,899,923)	(79,247,968)
Investment Return	103,126,717	40,511,000	1,182,676
Market Value as of End of Year	\$710,205,259	\$611,250,516	\$573,959,894
Rate of Return	17.58%	7.77%	0.92%

Below are the receipts and disbursements during the last 10 years. The green line reflects investment gains and losses, which vacillate as investment markets fluctuate. Blue bars indicate contributions, from employees and employers, and red bars show benefit payments and administrative expenses.



Worcester Regional Retirement System
Actuarial Valuation as of January 1, 2018

SECTION 2 - PRINCIPAL VALUATION RESULTS

Exhibit 2.1 - Plan Assets

The Actuarial Value of Assets is the market value of assets as of the valuation date adjusted to phase in investment gains and losses over a 5-year period, further constrained to be within 20% of the market value of assets. Investment gains and losses are the excess or deficiency of the expected returns over the actual returns.

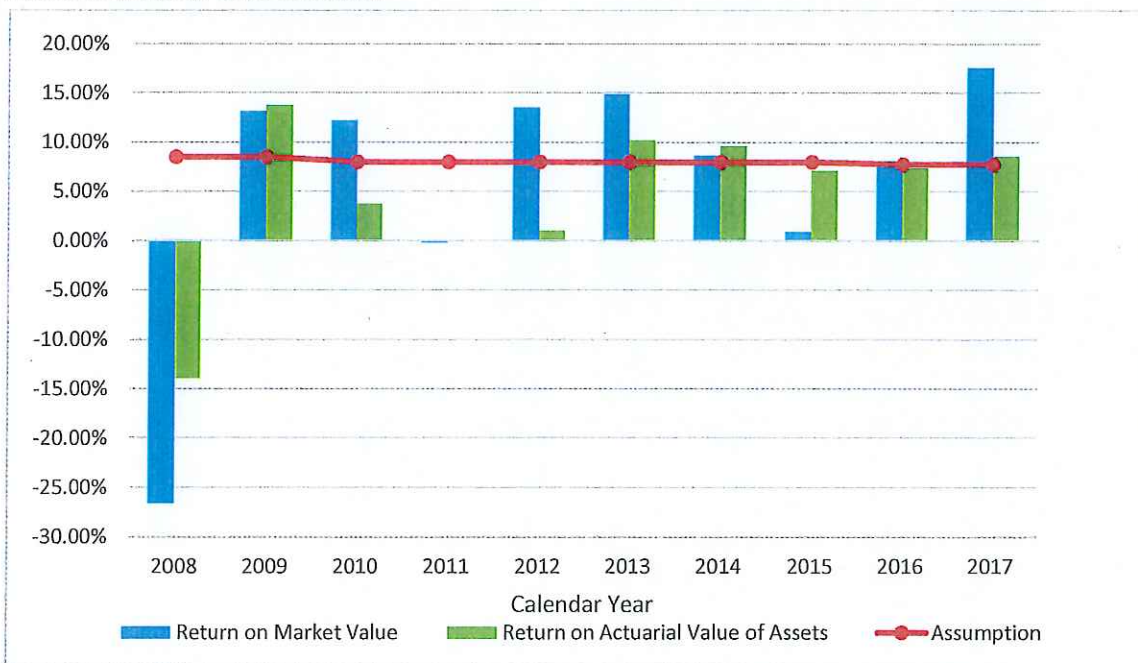
Valuation Date	1/1/2018	1/1/2017	1/1/2016
1. Market Value of Assets as of prior January 1	\$611,250,516	\$573,959,894	\$552,502,472
a. Prior Year Contributions and Receipts	84,608,085	80,679,545	99,522,714
b. Prior Year Benefit Payments and Expenses	(88,780,059)	(83,899,923)	(79,247,968)
c. Expected Investment Return Rate	7.75%	7.75%	8.00%
d. Expected Investment Return	47,196,779	44,346,703	45,078,770
e. Expected Market Value of Assets as of Valuation Date	\$654,275,321	\$615,086,219	\$617,855,988
2. Prior Year Gain / (Loss)			
a. Market Value of Assets as of January 1	\$710,205,259	\$611,250,516	\$573,959,894
b. Expected Market Value of Assets	654,275,321	615,086,219	617,855,988
c. Prior Year Gain / (Loss)	55,929,938	(3,835,703)	(43,896,094)
3. Phase-In of Asset Gains and Losses			
	Unrecognized	Unrecognized	Unrecognized
Calendar Year	Gain / (Loss)	Gain / (Loss)	Gain / (Loss)
a. 2017	\$55,929,938	\$44,743,950	-
b. 2016	(3,835,703)	(2,301,422)	(3,068,562)
c. 2015	(43,896,094)	(17,558,438)	(26,337,656)
d. 2014	(834,822)	(166,964)	(333,929)
e. 2013	27,369,961	-	5,473,992
f. 2012	19,197,802	-	-
g. Total deferred gains/(losses)	24,717,126	(24,266,155)	(20,830,224)

SECTION 2 - PRINCIPAL VALUATION RESULTS

Exhibit 2.1 - Plan Assets

Valuation Date	1/1/2018	1/1/2017	1/1/2016
4. Actuarial Value of Assets			
a. Market Value of Assets	\$710,205,259	\$611,250,516	\$573,959,894
b. Deferred gains/(losses)	24,717,126	(24,266,155)	(20,830,224)
c. Market Value of Assets Less deferred gains/(losses)	\$685,488,133	\$635,516,671	\$594,790,118
d. 80% of Market Value of Assets	568,164,207	489,000,413	459,167,915
e. 120% of Market Value of Assets	852,246,311	733,500,619	688,751,873
f. Actuarial Value of Assets, a., but not less than b. and not greater than c.	\$685,488,133	\$635,516,671	\$594,790,118
g. Ratio of Actuarial Value of Assets to Market Value of Assets	96.52%	103.97%	103.63%
5. Rate of Return on Actuarial Value of Assets for Prior Calendar Year	8.55%	7.41%	7.13%

Below are the investment returns during the last 10 years. The red line reflects the investment return actuarial assumption. Blue bars indicate investment return rates on market value of assets, and green bars show investment return rates on actuarial value of assets.



Worcester Regional Retirement System
Actuarial Valuation as of January 1, 2018

SECTION 2 - PRINCIPAL VALUATION RESULTS

Exhibit 2.2 - Actuarial Present Value of Future Benefits

The Actuarial Present Value of Future Benefits is the present value of the cost to finance all benefits payable in the future, discounted to reflect the probability of payment and the time value of money. Below is the Actuarial Present Value of Future Benefits from the current valuation and the prior valuation:

Valuation Date	<u>1/1/2018</u>	<u>1/1/2016</u>
Actives	\$1,092,799,805	\$1,039,552,247
Retired Members and Beneficiaries	673,804,622	570,882,886
Disabled Members	102,003,269	94,136,290
Inactive Members	18,530,021	16,263,360
Total Present Value of Future Benefits	<u>\$1,887,137,717</u>	<u>\$1,720,834,783</u>

Exhibit 2.3 - Actuarial Accrued Liability

The Actuarial Accrued Liability is the portion of the Actuarial Present Value of Future Benefits which is allocated to all periods prior to a valuation year and therefore is not provided for by future Normal Costs. Below is the Actuarial Accrued Liability from the current valuation and the prior valuation:

Valuation Date	<u>1/1/2018</u>	<u>1/1/2016</u>
Actives	\$720,285,388	\$688,111,264
Retired Members and Beneficiaries	673,804,622	570,882,886
Disabled Members	102,003,269	94,136,290
Inactive Members	18,530,021	16,263,360
Total Actuarial Accrued Liability	<u>\$1,514,623,300</u>	<u>\$1,369,393,800</u>

Exhibit 2.4 - Unfunded Actuarial Accrued Liability

Valuation Date	<u>1/1/2018</u>	<u>1/1/2016</u>
Unfunded Actuarial Accrued Liability		
a. Actuarial Accrued Liability	\$1,514,623,300	\$1,369,393,800
b. Actuarial Value of Assets	685,488,133	594,790,118
c. Unfunded Actuarial Accrued Liability (a. - b.)	\$829,135,167	\$774,603,682
d. Funded Ratio (b. divided by a.)	45.3%	43.4%

SECTION 2 - PRINCIPAL VALUATION RESULTS

Below are the accrued liabilities, asset values (actuarial and market) and funded status during the last 10 years. The black solid line reflects the funded status on an actuarial value of assets (AVA) basis and the black dotted line reflects the funded status on a market value (MVA) basis. Blue bars indicate actuarial accrued liabilities, red bars indicate actuarial value of assets and green bars indicate market value of assets.

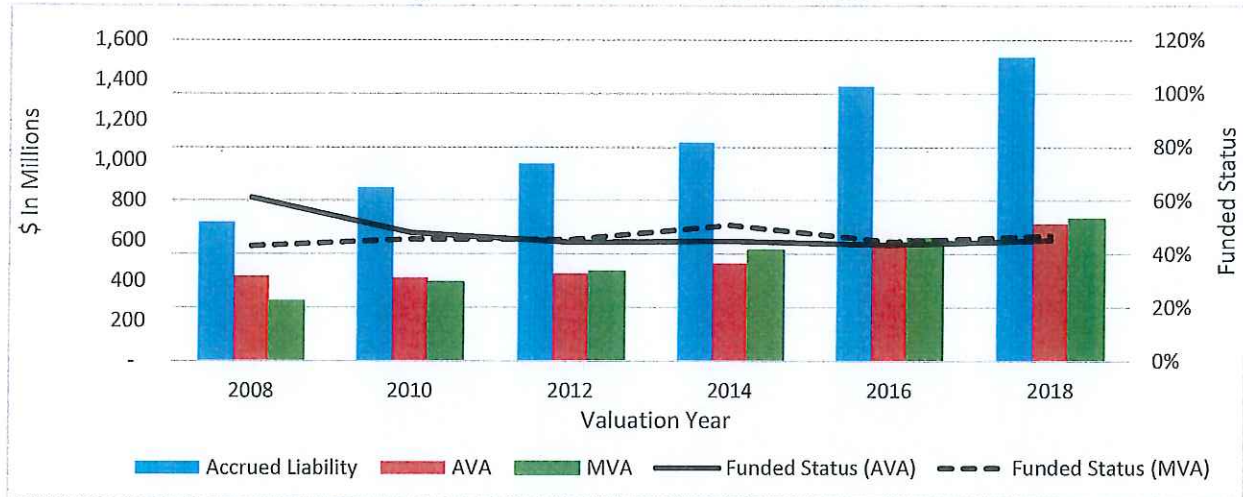


Exhibit 2.5 - Normal Cost

The Normal Cost is the portion of the Actuarial Present Value of Future Benefits which is allocated to a valuation year. Only active employees who have not reached Normal Retirement Age incur a Normal Cost. Below is the Normal Cost from the current valuation and the prior valuation:

Valuation Date	<u>1/1/2018</u>	<u>1/1/2016</u>
Total Normal Cost	\$43,715,955	\$41,092,346
As of Percentage of Salary	14.4%	14.5%
Employee Normal Cost	\$28,880,357	\$26,597,269
As of Percentage of Salary	9.5%	9.4%
Administrative Expenses	\$1,100,000	\$1,100,000
As a Percentage of Salary	0.4%	0.4%
Net Employer Normal Cost	\$15,935,598	\$15,595,077
As a Percentage of Salary	5.2%	5.5%

SECTION 2 - PRINCIPAL VALUATION RESULTS

Exhibit 2.6 - Actuarial Experience

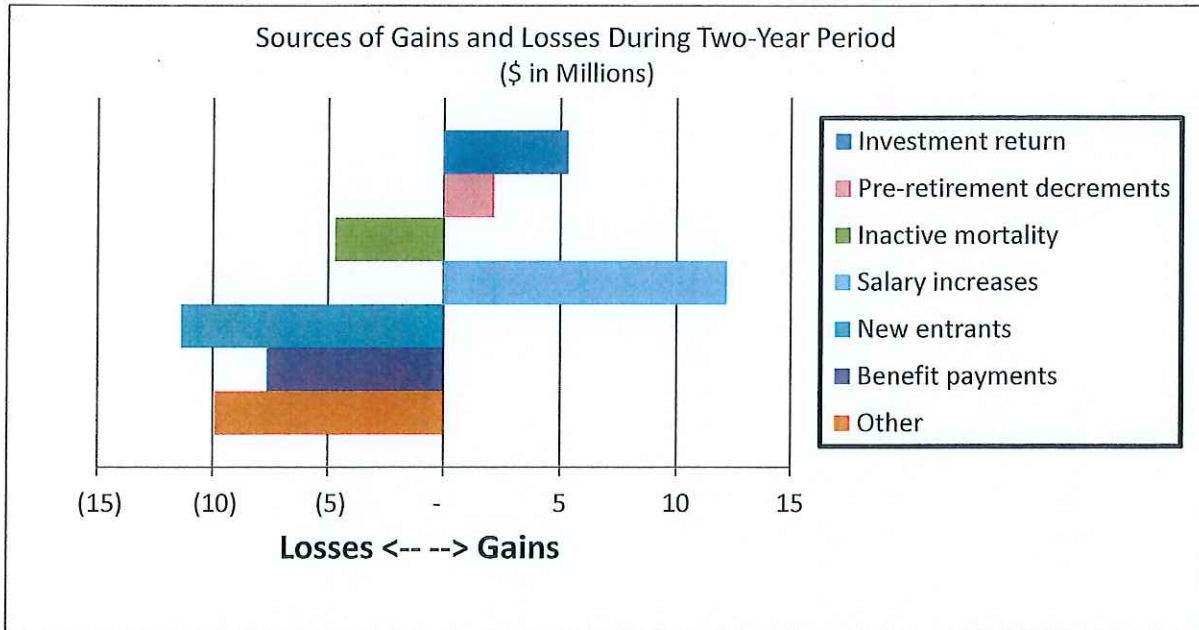
In performing the actuarial valuation, various assumptions are made regarding mortality, retirement, disability and withdrawal rates as well as salary increases and investment returns. A comparison of the results of the current valuation and the prior valuation is made to determine how closely actual experience relates to expected. During the two years since the last valuation, the total unfunded actuarial accrued liability of the System was expected to increase by \$37,544,775. Below is the development of the Actuarial Loss for the current 2-year period:

Calendar Year Ending	<u>12/31/2017</u>	<u>12/31/2016</u>
Expected Unfunded Actuarial Accrued Liability		
a. Unfunded Actuarial Accrued Liability, beginning of year	\$794,846,065	\$774,603,682
b. Normal cost, beginning of year	\$40,706,899	41,092,346
c. Total contributions	84,608,085	80,679,545
d. Interest (full year on a. and b., one-half year on c.)	61,203,578	59,829,582
e. Expected Unfunded Actuarial Accrued Liability	\$812,148,457	\$794,846,065
f. Unfunded Actuarial Accrued Liability (before changes)	828,586,851	
g. (Gain)/Loss	\$16,438,394	
Asset (gain)/loss		
a. Actuarial value of assets, beginning of year	\$635,516,671	\$594,790,118
b. Contributions and Receipts	84,608,085	80,679,545
c. Benefit Payments and Expenses	(88,780,059)	(83,899,923)
d. Assumed rate of return (prior valuation)	7.75%	7.75%
e. Expected return	49,077,406	45,961,045
f. Actuarial value of assets, end of year	685,488,133	635,516,671
g. Actual return	54,143,436	43,946,931
h. Actual rate of return	8.55%	7.41%
i. Asset (gain)/loss	(\$5,066,030)	\$2,014,114
j. Total asset (gain)/loss, 2-year period	(\$2,895,822)	

SECTION 2 - PRINCIPAL VALUATION RESULTS

Exhibit 2.6 - Actuarial Experience

Below are the various sources of gains and losses over the 2-year period. The asset gain during the period was \$2,895,822, and the total demographic loss during the period was \$19,334,216, which totals to an overall loss of \$16,438,394.



Actual Unfunded Actuarial Accrued Liability

a. Changes due to:		
i) Asset (gain)/loss		(\$2,895,822)
ii) (Gain)/loss from demographic experience		19,334,216
iii) (Gain)/loss prior to changes		16,438,394
iv) Plan change - Lancaster Sewer and Nashoba Dispatch		548,316
v) Assumption change		-
vi) Total (gain)/loss (including changes)		16,986,710
b. Unfunded Actuarial Accrued Liability, end of year		\$829,135,167

SECTION 3 - CHAPTER 32 OF M.G.L. APPROPRIATIONS

Exhibit 3.1 - Annual Appropriations

The Annual Appropriation is determined in accordance with the requirements set forth in Section 22D of Chapter 32 of the Massachusetts General Laws ("M.G.L."). The appropriation is comprised of the annual employer normal cost and amortization payments to pay the unfunded actuarial accrued liability. Below are the details of the annual appropriations for the current and prior valuations, adjusted for semi-annual payments made each July 1 and January 1. The appropriations shown are based on the results of the valuations and do not account for any adjustments made to appropriations in the selected funding schedule.

Amortization Payments	<u>1/1/2018</u>	<u>1/1/2016</u>
a. Early Retirement Incentive Plan (2002)		
Fully Funded Year	2028	2028
Investment Return Rate	7.75%	7.75%
Balance as of valuation date	11,776,015	\$12,571,626
Amortization Amount	\$1,346,399	\$1,232,938
Increasing Rate	4.50%	4.50%
Remaining Payment Period (from Valuation date)	10	12
b. Early Retirement Incentive Plan (2003)		
Fully Funded Year	2028	2028
Investment Return Rate	7.75%	7.75%
Balance as of valuation date	2,308,827	\$2,464,816
Amortization Amount	\$263,977	\$241,732
Increasing Rate	4.50%	4.50%
Remaining Payment Period (from Valuation date)	10	12
c. Early Retirement Incentive Plan (2010)		
Fully Funded Year	2022	2022
Investment Return Rate	7.75%	7.75%
Balance as of valuation date	19,582	\$27,386
Amortization Amount	\$5,456	\$5,456
Increasing Rate	0.00%	0.00%
Remaining Payment Period (from Valuation date)	4	6
d. Unfunded Actuarial Accrued Liability		
Fully Funded Year	2035	2035
Balance as of valuation date	\$815,030,743	\$759,539,854
Amortization Amount	\$62,701,364	\$53,964,605
Remaining Payment Period (from Valuation date)	17	19
e. Total Amortization Payments	\$64,317,197	\$55,444,731
Normal Cost	\$15,935,598	\$15,595,077
Net 3(8)(c) Transfers	\$3,310,021	\$2,837,161
Total Appropriation as of January 1	\$83,562,816	\$73,876,969
Adjusted for Payments as of July 1 and January 1	\$88,358,923	\$78,117,154

Worcester Regional Retirement System
Actuarial Valuation as of January 1, 2018

SECTION 3 - CHAPTER 32 OF M.G.L. APPROPRIATIONS

Exhibits 3.2 and 3.3 are based on the assumptions below:

Exhibit 3.2:

- The Employer Normal Cost is expected to increase 4% per year.
- The Unfunded Actuarial Accrued Liability ("UAL") is computed as of January 1 of each year assuming no future gains or losses.
- The Amortization Payment of UAL is an increasing payment at 4% paid over 17 years through 2035.
- The Amortization Payment of the Early Retirement Incentive Plan (2002) is an increasing payment at 4.5% paid over 10 years through 2028.
- The Amortization Payment of the Early Retirement Incentive Plan (2003) is an increasing payment at 4.5% paid over 10 years through 2028.
- The Amortization Payment of the Early Retirement Incentive Plan (2010) is a level payment to be paid over 4 years through 2022.
- Total Employer Cost is the sum of the Employer Normal Cost, net 3(8)(c) transfers and the Amortization of the UAL (including ERIs), all computed as of January 1 of each year and adjusted for semi-annual payments made on July 1 and January 1.
- For fiscal year 2019, we show the actual appropriation developed under the previous funding schedule of \$56,616,875. For fiscal years 2020 and later, the Board has selected a funding schedule that fully amortizes the unfunded actuarial accrued liability by 2035, with annual employer costs limited to increases of 9.95% over the prior year.

Exhibit 3.3:

- Expected benefit payments include payments expected to be made to retired members, beneficiaries, disabled members and active members expected to retire. In addition, expected benefit payments include distribution of the annuity savings fund attributed to inactive members.
- Benefit payments exclude cost-of-living increases granted to members in pay status between 1982 and 1997. In addition, benefit payments are as expected for the first ten years of the forecast, then increase by the greater of 4.5% per year thereafter or the expected future payments for the current population projected by our computer model.
- Calendar year cash flow entries are developed as of each January 1.

SECTION 3 - CHAPTER 32 OF M.G.L. APPROPRIATIONS

Exhibit 3.2 - 30-Year Forecast of Annual Appropriations

Fiscal Year	Employer Normal Cost	Amortization Payment of UAL	Amortization Payment of ERI 2002	Amortization Payment of ERI 2003	Amortization Payment of ERI 2010	Total Employer Cost	Increase over Prior Year	Unfunded Actuarial Accrued Liability
2019	\$20,350,226	\$34,558,075	\$1,423,676	\$279,128	\$5,770	\$56,616,875		\$829,135,167
2020	21,024,235	39,440,820	1,487,741	291,689	5,769	62,250,254	9.95%	856,436,937
2021	21,725,204	44,853,675	1,554,689	304,815	5,770	68,444,153	9.95%	880,800,931
2022	22,454,212	50,851,184	1,624,651	318,532	5,769	75,254,348	9.95%	901,455,763
2023	23,212,380	57,499,149	1,697,760	332,866	-	82,742,155	9.95%	917,514,533
2024	24,000,875	64,852,121	1,774,159	347,845	-	90,975,000	9.95%	927,960,266
2025	24,820,910	72,988,609	1,853,996	363,498	-	100,027,013	9.95%	931,629,650
2026	25,673,745	81,988,674	1,937,425	379,855	-	109,979,699	9.95%	927,194,915
2027	26,560,696	91,940,424	2,024,611	396,949	-	120,922,680	9.95%	913,143,617
2028	27,483,123	102,940,836	2,115,718	414,811	-	132,954,488	9.95%	887,756,113
2029	28,442,448	117,741,010	-	-	-	146,183,458	9.95%	849,080,469
2030	29,440,146	131,288,566	-	-	-	160,728,712	9.95%	794,904,529
2031	30,477,752	146,243,467	-	-	-	176,721,219	9.95%	722,724,811
2032	31,556,862	162,748,118	-	-	-	194,304,980	9.95%	629,711,919
2033	32,679,136	180,959,190	-	-	-	213,638,326	9.95%	512,672,066
2034	33,846,301	198,008,618	-	-	-	231,854,919	8.53%	368,004,295
2035	35,060,153	205,928,963	-	-	-	240,989,116	3.94%	194,751,175
2036	36,322,559	-	-	-	-	36,322,559	-84.93%	-
2037	37,635,462	-	-	-	-	37,635,462	3.61%	-
2038	39,000,881	-	-	-	-	39,000,881	3.63%	-
2039	40,420,916	-	-	-	-	40,420,916	3.64%	-
2040	41,897,753	-	-	-	-	41,897,753	3.65%	-
2041	43,433,664	-	-	-	-	43,433,664	3.67%	-
2042	45,031,010	-	-	-	-	45,031,010	3.68%	-
2043	46,692,250	-	-	-	-	46,692,250	3.69%	-
2044	48,419,940	-	-	-	-	48,419,940	3.70%	-
2045	50,216,738	-	-	-	-	50,216,738	3.71%	-
2046	52,085,407	-	-	-	-	52,085,407	3.72%	-
2047	54,028,823	-	-	-	-	54,028,823	3.73%	-
2048	56,049,976	-	-	-	-	56,049,976	3.74%	-

Worcester Regional Retirement System
Actuarial Valuation as of January 1, 2018

SECTION 3 - CHAPTER 32 OF M.G.L. APPROPRIATIONS

Exhibit 3.3 - 30-Year Forecast of Cash Flow

Calendar Year	Market Value of Assets, BOY	Benefit Payments	Employee Contributions	Employer Contributions	Investment Return	Market Value of Assets, EOY
2018	\$710,205,259	\$102,385,221	\$28,880,357	\$53,543,721	\$57,130,727	\$747,374,843
2019	747,374,843	89,280,271	30,035,571	58,871,321	61,063,923	808,065,387
2020	808,065,387	94,847,263	31,236,994	64,729,017	66,080,824	875,264,959
2021	875,264,959	100,606,485	32,486,474	71,169,555	71,643,000	949,957,503
2022	949,957,503	106,738,276	33,785,933	78,250,925	77,823,779	1,033,079,864
2023	1,033,079,864	113,022,584	35,137,370	86,036,893	84,710,101	1,125,941,644
2024	1,125,941,644	119,186,573	36,542,865	94,597,563	92,420,508	1,230,316,007
2025	1,230,316,007	125,414,199	38,004,580	104,010,021	101,090,839	1,348,007,248
2026	1,348,007,248	131,718,055	39,524,763	114,359,018	110,867,141	1,481,040,115
2027	1,481,040,115	138,153,512	41,105,754	125,737,741	121,911,410	1,631,641,508
2028	1,631,641,508	144,894,345	42,749,984	138,248,645	134,397,067	1,802,142,859
2029	1,802,142,859	151,748,672	44,459,983	152,004,385	148,521,777	1,995,380,332
2030	1,995,380,332	158,577,362	46,238,382	167,128,822	164,520,989	2,214,691,163
2031	2,214,691,163	165,713,343	48,087,917	183,758,139	182,650,126	2,463,474,002
2032	2,463,474,002	173,170,443	50,011,434	202,042,075	203,183,831	2,745,540,899
2033	2,745,540,899	180,963,113	52,011,891	219,269,875	226,207,076	3,062,066,628
2034	3,062,066,628	189,106,453	54,092,367	227,908,269	251,226,682	3,406,187,493
2035	3,406,187,493	197,616,243	56,256,062	34,350,977	262,705,811	3,561,884,100
2036	3,561,884,100	206,508,974	58,506,304	35,592,616	274,669,609	3,724,143,655
2037	3,724,143,655	215,801,878	60,846,556	36,883,920	287,136,062	3,893,208,315
2038	3,893,208,315	225,512,963	63,280,418	38,226,876	300,123,613	4,069,326,259
2039	4,069,326,259	235,661,046	65,811,635	39,623,550	313,651,158	4,252,751,556
2040	4,252,751,556	246,265,793	68,444,100	41,076,092	327,738,028	4,443,743,983
2041	4,443,743,983	257,347,754	71,181,864	42,586,735	342,403,981	4,642,568,809
2042	4,642,568,809	268,928,403	74,029,139	44,157,803	357,669,180	4,849,496,528
2043	4,849,496,528	281,030,181	76,990,305	45,791,714	373,554,175	5,064,802,541
2044	5,064,802,541	293,676,539	80,069,917	47,490,982	390,079,870	5,288,766,771
2045	5,288,766,771	306,891,983	83,272,714	49,258,220	407,267,502	5,521,673,224
2046	5,521,673,224	320,702,122	86,603,623	51,096,148	425,138,599	5,763,809,472
2047	5,763,809,472	335,133,717	90,067,768	53,007,593	443,714,940	6,015,466,056

SECTION 4 - REQUIRED DISCLOSURES

Exhibit 4.1 - GASB 67 and GASB 68 Disclosures

In June 2012, the GASB approved two related Statements that significantly changed the way pension plans and governments account and report pension liabilities. Effective for plans with fiscal years beginning after June 15, 2013, GASB Statement No. 67, *Financial Reporting for Pension Plans*, replaced the requirements of Statement No. 25 and effective for employers with fiscal years beginning after June 15, 2014, GASB Statement No. 68, *Accounting and Financial Reporting for Pensions*, replaced the requirements of Statement No. 27.

The new pension standards reflect changes from those currently in place regarding how governments calculate total pension liability and pension expense. Further, the new standards contain requirements for disclosing information in the notes to financial statements and presenting required supplementary information following the notes.

GASB 67 requires defined benefit pension plans, such as the Worcester Regional Retirement System, to present a statement of fiduciary net position (pension plan assets) and a statement of changes in fiduciary net position. Further, the statement requires that notes to financial statements include descriptive information such as the types of benefits provided, the classes of plan members covered and the composition of the pension plan's retirement board. Finally, GASB 67 requires pension plans to present in required supplementary information the sources of the changes in the net pension liability and information about the actuarially determined contributions compared with the actual contributions made to the plan and related ratios.

GASB 67 and GASB 68 require projected benefit payments be discounted to their actuarial present value using the single rate that reflects:

- (1) a long-term expected rate of return on pension plan investments *to the extent that the pension plan's assets are sufficient to pay benefits and pension plan assets are expected to be invested using a strategy to achieve that return and*
- (2) a tax-exempt, high-quality municipal bond rate *to the extent that the conditions for use of the long-term expected rate of return are not met.*

GASB 68 establishes standards for measuring and recognizing liabilities, deferred outflows of resources, deferred inflows of resources and pension expense by state and local governments.

The effective date for GASB 67 is for plan years beginning after June 15, 2013, which is fiscal year ending December 31, 2014 for the Worcester Regional Retirement System. The effective date for GASB 68 is for employers' fiscal years beginning after June 15, 2014. The GASB report, submitted under separate cover and prepared as of December 31, 2017 (the measurement date), presents information to assist the Worcester Regional Retirement System in providing the required information under GASB 68 to participating employers.

SECTION 4 - REQUIRED DISCLOSURES

Exhibit 4.2 - PERAC Disclosure Information

The most recent actuarial valuation of the System was prepared by KMS Actuaries, LLC as of January 1, 2018.

The normal cost for employees on that date was:	\$28,880,357	9.5% of payroll
The normal cost for the employer was:	\$15,935,598	5.2% of payroll

The actuarial liability for active members was:	\$720,285,388
The actuarial liability for retired and inactive members was:	794,337,912
Total actuarial liability:	\$1,514,623,300
System assets as of that date:	\$685,488,133
Unfunded actuarial accrued liability:	\$829,135,167

The ratio of System assets to total actuarial accrued liability was:	45.3%
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The principal actuarial assumptions used in the valuation are as follows:

Investment Return:	7.75%
Rate of Salary Increase:	Based on service, 6% graded down to 4.25% for Group 1
	Based on service, 7% graded down to 4.75% for Group 4

SECTION 5 - SUMMARY OF PLAN PROVISIONS

Administration

There are 104 contributory retirement systems for public employees in Massachusetts. Each system is governed by a retirement board and all boards, although operating independently, are governed by Chapter 32 of the Massachusetts General Laws and other applicable statutes. This law in general provides uniform benefits, uniform contribution requirements and a uniform accounting and funds structure for all systems.

Participation

Participation is mandatory for all full-time employees. Eligibility with respect to part-time, provisional, temporary, seasonal or intermittent employment is governed by regulations promulgated by the local retirement board, and approved by PERAC. Membership is optional for certain elected officials.

There are four classes of membership in the Retirement System:

- | | |
|----------|--|
| Group 1: | General employees, including clerical, administrative, technical and all other employees not otherwise classified. |
| Group 2: | Certain specified hazardous duty positions. |
| Group 3: | State police officers and inspectors. |
| Group 4: | Local police officers, firefighters and other specified hazardous positions. |

For members in more than one group, participation will be proportional.

Member Contributions

Member contributions vary depending on the most recent date of membership:

Prior to 1975:	5% of Salary
1975 – 1983:	7% of Salary
1984 – June 30, 1996:	8% of Salary
July 1, 1996 – present:	9% of Salary
1979 – present:	An additional 2% of Salary in excess of \$30,000.
Group 1 members hired on or after April 2, 2012:	6% of Salary with 30 or more years of creditable service.

Rate of Interest

Interest on regular deductions made after January 1, 1984 is a rate established by PERAC in consultation with the Commissioner of Banks. The rate is obtained from the average rates paid on individual savings accounts by a representative sample of at least ten financial institutions.

SECTION 5 - SUMMARY OF PLAN PROVISIONS

Retirement Age	The mandatory retirement age for some Group 2 and Group 4 members is age 65. Most Group 2 and Group 4 members may remain in service after reaching age 65. Group 4 members who are employed in certain public safety positions are required to retire at age 65. There is no mandatory retirement age for members in Group 1.
Salary	Gross regular compensation. This does not include bonuses, overtime, severance pay, unused sick leave credit or other similar compensation.
Average Salary	<p>Membership before April 2, 2012: Average annual rate of regular compensation received during the three consecutive years that produce the highest average, or, if greater, during the last three years (whether or not consecutive) preceding retirement.</p> <p>Membership on or after April 2, 2012: Average annual rate of regular compensation received during the five consecutive years that produce the highest average, or, if greater, during the last five years (whether or not consecutive) preceding retirement.</p>
Creditable Service	The period during which a member contributes to the retirement system plus certain periods of military service and "purchased" service.
Benefit Rate	The benefit rate varies with the member's retirement age, Group, membership date and years of creditable service at retirement. Each year a member retires prior to the age at which the 2.5% maximum benefit rate applies, a reduction is applied to each year of age under the maximum age. The maximum age and reduction for each Group and membership date is as follows:

	Group 1	Group 2	Group 4
2.5% for Membership before April 2, 2012:			
Maximum age:	65	60	55
Reduction:	0.1%	0.1%	0.1%
2.5% for Membership on or after April 2, 2012 (less than 30 years of service):			
Maximum age:	67	62	57
Reduction:	0.15%	0.15%	0.15%
2.5% for Membership on or after April 2, 2012 (30+ years of service):			
Maximum age:	67	62	57
Reduction:	0.125%	0.125%	0.125%

SECTION 5 - SUMMARY OF PLAN PROVISIONS

Superannuation Retirement	Eligibility if membership before April 2, 2012:	<ul style="list-style-type: none"> • completion of 20 years of Creditable Service, or • attainment of age 55 if hired prior to 1978, or • attainment of age 55 with 10 years of Creditable Service, if hired after 1978.
	Eligibility if membership on or after April 2, 2012:	<ul style="list-style-type: none"> • attainment of age 60 with 10 years of Creditable Service if classified in Group 1 • attainment of age 55 with 10 years of Creditable Service if classified in Group 2 • attainment of age 55 if classified in Group 4
	Benefit Amount	Product of the member's Benefit Rate, Average Salary and Creditable Service.
	Maximum Benefit	80% of the member's Average Salary.
	Veteran's Benefit	Additional benefit of \$15 per year of Creditable Service, up to a maximum of \$300.
Deferred Vested	Eligibility	<ul style="list-style-type: none"> • completion of ten or more years of Creditable Service. • elected officials hired prior to 1978, completion of six years of Creditable Service.
	Benefit Amount	Accrued benefit payable commencing at age 55, or the completion of 20 years of Creditable Service, or may be deferred until later at the participant's option.
Withdrawal of Contributions		<p>Contributions may be withdrawn upon termination of employment.</p> <ul style="list-style-type: none"> • Members hired on or after January 1, 1984 who terminate with less than ten years of Creditable Service receive contributions plus interest on the Annuity Savings Account at an annual rate of 3%. • All other withdrawals receive contributions plus 100% of the regular interest that has accrued to the Annuity Savings Account.

SECTION 5 - SUMMARY OF PLAN PROVISIONS

Ordinary Disability Retirement	Eligibility	Non-job related disability after completion of ten years of Creditable Service.
	Benefit Amount for Group 1 membership before April 2, 2012 or Group 2 or Group 4	Superannuation benefit determined if the member is age 55, up to a maximum of 80% of Average Salary over three years. If the member is a veteran, 50% of final rate of salary (final year) plus an annuity based on the accumulated member contributions plus credited interest, up to a maximum of 80% of Average Salary over five years.
	Benefit Amount for Group 1 membership on or after April 2, 2012	Superannuation benefit determined if the member is age 60, up to a maximum of 80% of Average Salary over three years. If the member is a veteran, 50% of final rate of salary (final year) plus an annuity based on the accumulated member contributions plus credited interest, up to a maximum of 80% of Average Salary over five years.
Accidental Disability Retirement	Eligibility	Disabled as a result of an accident in the performance of duties. There is no minimum age or service requirement.
	Benefit Amount	72% of Salary plus an annuity based on accumulated member contributions plus credited interest.
	Maximum Benefit	100% of Salary if hired before January 1, 1988, otherwise 75% of Salary.
	Veteran's Benefit	Additional allowance of \$15 per year of Creditable Service, up to a maximum of \$300.
	Supplemental Dependent Allowance	Additional allowance of \$415 per year for each child.
Non-Occupational Death	Eligibility	For members with at least two years of creditable service who die while in active service, but not due to occupational injury.
	Benefit Amount	Benefit as if Option C had been elected. Minimum benefit of \$250 per month for surviving spouse, \$120 per month for first child and \$90 per month for each additional child.

SECTION 5 - SUMMARY OF PLAN PROVISIONS

Accidental Death	Eligibility	For members who die as a result of an occupational injury.
	Benefit Amount	72% of Salary plus an annuity based on accumulated member contributions plus credited interest.
	Maximum Benefit	100% of Salary if hired before January 1, 1988, otherwise 75% of Salary.
	Veteran's Benefit	Additional allowance of \$15 per year of creditable service, up to a maximum of \$300.
	Supplemental Dependent Allowance	Additional allowance of \$708.60 per year for each child until age 18 (or age 22 if a full-time student).
Cost-of-Living Adjustment (COLA)	In accordance with the adoption of Chapter 17 of the Acts of 1997, the granting of a Cost-of-Living Adjustment will be determined by an annual vote by the Retirement Board. The amount of increase will be based upon the Consumer Price Index, limited to a maximum of 3.0%, beginning on July 1. All retirees, disabled retirees and beneficiaries who have been receiving benefit payments for at least one year as of July 1 are eligible for the adjustment. The maximum amount of pension benefit subject to a COLA is \$16,000. All COLAs granted to members after 1981 and prior to July 1, 1998 are deemed to be an obligation of the Commonwealth of Massachusetts and are not the liability of the Retirement System.	
Optional Forms of Payment	A member may elect to receive his or her retirement allowance, payable in monthly installments, in one of three forms of payment:	
	<ul style="list-style-type: none"> • Option A – Total annual allowance commencing at retirement and terminating at member's death. • Option B – A reduced annual allowance commencing at retirement with death benefit equal to excess of member contributions plus credited interest to retirement over annuity benefit paid to member. • Option C – A reduced annual allowance commencing at retirement with 66⅔% of benefit continued to designated beneficiary upon death of member. For members who retired on or after January 12, 1988, if the beneficiary pre-deceases the retiree, the benefit payable increases based on the factor used to determine the Option C benefit at retirement. For members who retired prior to January 12, 1988, if the System has accepted Section 288 of Chapter 194 of the Acts of 1998 and the beneficiary pre-deceases the retiree, the benefit payable increases based on the factor used to determine the Option C benefit at retirement. 	

SECTION 6 - ACTUARIAL ASSUMPTIONS AND METHODS

Valuation Date January 1, 2018

Investment Return 7.75% per year.

The investment return assumption is a long-term assumption based on capital market expectations by asset class, historical returns and professional judgment. We considered analysis prepared by PRIM's investment advisor using a building block approach and using the target asset allocation, expected returns by asset class and risk analysis to determine a long-term expected average annual rate of return.

Annuity Savings Fund Interest Rate 2.00% per year

Amortization Method *Unfunded Actuarial Accrued Liability (UAL):*

Increasing dollar amount at 4% to reduce the Unfunded Actuarial Accrued Liability to zero on or before June 30, 2035.

Early Retirement Incentive Programs (ERI) for 2002 and 2003:

Increasing dollar amount at 4.5% to reduce the Unfunded Actuarial Accrued Liability attributable to ERI to zero on or before June 30, 2028.

Early Retirement Incentive Program (ERI) for 2010:

Level dollar amount to reduce the Unfunded Actuarial Accrued Liability attributable to ERI to zero on or before June 30, 2022.

Salary Scale The assumed annual rates for salary increases including longevity are illustrated by the following rates:

Years of Service	Groups 1 and 2	Group 4
0	6.00%	7.00%
1	5.50%	6.50%
2	5.50%	6.00%
3	5.25%	5.75%
4	5.25%	5.25%
5	4.75%	5.25%
6	4.75%	4.75%
7	4.50%	4.75%
8	4.50%	4.75%
9+	4.25%	4.75%

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

SECTION 6 - ACTUARIAL ASSUMPTIONS AND METHODS

Cost-of-Living Allowance

Cost-of-Living Allowances (COLA) are assumed to be 3% of the pension amount, capped at \$480 per year.

Mortality Rates

RP-2000 Mortality Table (base year 2009) with full generational mortality improvement using Scale BB. For disabled members, RP-2000 Mortality Table (base year 2012) with full generational mortality improvement using Scale BB.

General Employees: 55% of deaths are job-related.

Police and Fire: 90% of deaths are job-related.

The underlying tables with generational mortality improvement reasonably reflect the mortality experience of the System as of the valuation date based on historical and current demographic data. Further, PERAC reviewed a sampling of a few larger local retirement systems and compared the results with the results found in performing the analysis of the State Retirement System for years 2012 - 2014. For the State Retirement System analysis, the mortality assumptions reflect the recent experience study published in 2014.

Turnover Rates

Illustrative turnover rates are shown below:

Creditable Service	Groups 1 and 2	Group 4
0	0.1500	0.0150
10	0.0540	0.0150
20	0.0200	0.0000
30	0.0000	0.0000

SECTION 6 - ACTUARIAL ASSUMPTIONS AND METHODS

Disability Rates

Illustrative disability rates are shown below:

Attained Age	Groups 1 and 2	Group 4
20	0.0001	0.0010
30	0.0003	0.0030
40	0.0010	0.0030
50	0.0019	0.0125
60	0.0028	0.0085

General Employees: 55% of disabilities are accidental and 45% are ordinary.

Police and Fire: 90% of disabilities are accidental and 10% are ordinary.

Retirement Rates

Illustrative retirement rates are shown below:

Age	Groups 1 and 2		Group 4
	Male	Female	Male & Female
50	0.0100	0.0150	0.0200
51	0.0100	0.0150	0.0200
52	0.0100	0.0200	0.0200
53	0.0100	0.0250	0.0500
54	0.0200	0.0250	0.0750
55	0.0200	0.0550	0.1500
56	0.0250	0.0650	0.1000
57	0.0250	0.0650	0.1000
58	0.0500	0.0650	0.1000
59	0.0650	0.0650	0.1500
60	0.1200	0.0500	0.2000
61	0.2000	0.1300	0.2000
62	0.3000	0.1500	0.2500
63	0.2500	0.1250	0.2500
64	0.2200	0.1800	0.3000
65	0.4000	0.1500	1.0000
66	0.2500	0.2000	1.0000
67	0.2500	0.2000	1.0000
68	0.3000	0.2500	1.0000
69	0.3000	0.2000	1.0000
70	1.0000	1.0000	1.0000

The turnover, disability and retirement rates are based on PERAC's most recent experience analysis of local retirement systems which reviewed age, gender and job group. The assumptions reflect this analysis as well as professional judgment.

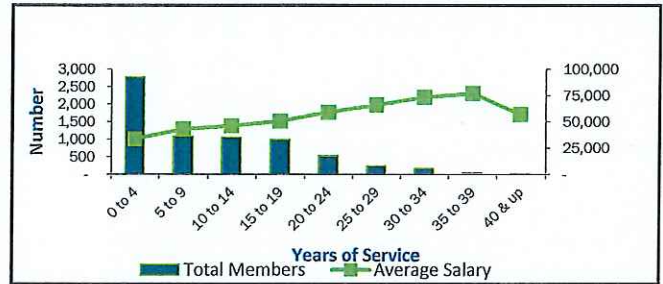
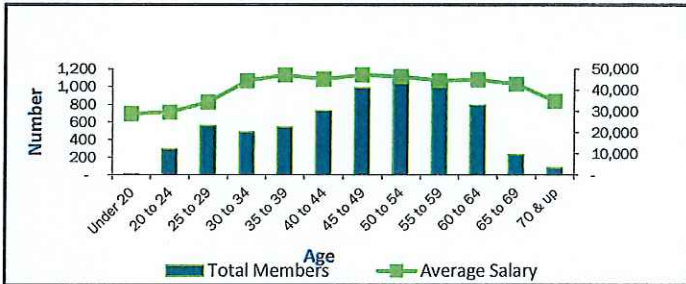
SECTION 6 - ACTUARIAL ASSUMPTIONS AND METHODS

Actuarial Cost Method	Individual Entry Age Normal.
Actuarial Asset Method	<p>The Actuarial Value of Assets is the market value of assets as of the valuation date reduced by the sum of:</p> <ul style="list-style-type: none">a) 80% of gains and losses of the prior year,b) 60% of gains and losses of the second prior year,c) 40% of gains and losses of the third prior year,d) 20% of gains and losses of the fourth prior year, <p>Investment gains and losses are determined by the excess or deficiency of the expected return over the actual return on the market value. The actuarial valuation of assets is further constrained to be not less than 80% or more than 120% of market value.</p>
Census Data	Census data as of the valuation date were submitted by the Retirement Board.
Asset Data	Asset information is reported annually to the Public Employee Retirement Administration Commission by the Worcester Regional Retirement System.
Dependents	80% of all members will be survived by a spouse. Age assumption for spouses is that males are assumed to be three years older than females.
Net Section 3(8)(c) Transfers	Reimbursements paid to and received from other retirement systems for that portion of a retiree's pension that is based on service earned in another retirement system. Net 3(8)(c) transfers are assumed to be \$3,500,000 per year.
Administrative Expenses	<p>The anticipated administrative expenses for the fiscal year. For Fiscal Year 2019, the administrative expenses were assumed to be \$1,100,000 and is anticipated to increase 4% per year.</p> <p>The administrative expense assumption is based on information relating to the System's administrative expenses provided by the Retirement System.</p>

SECTION 7 - PLAN MEMBER INFORMATION

Exhibit 7.1 - ACTIVE MEMBERS BY AGE and YEARS OF SERVICE AS OF JANUARY 1, 2018

Age	Years of Service									Total	Total Salary	Average Salary
	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 & up			
Under 20	11	-	-	-	-	-	-	-	-	11	318,465	28,951
20 to 24	292	1	-	-	-	-	-	-	-	293	8,672,295	29,598
25 to 29	498	55	4	-	-	-	-	-	-	557	19,083,669	34,262
30 to 34	290	140	53	4	-	-	-	-	-	487	21,636,922	44,429
35 to 39	297	86	103	54	3	-	-	-	-	543	25,580,915	47,110
40 to 44	362	122	96	106	40	1	-	-	-	727	32,851,192	45,187
45 to 49	378	186	142	143	99	32	4	-	-	984	46,427,639	47,183
50 to 54	316	207	202	181	99	78	50	1	-	1,134	52,651,489	46,430
55 to 59	184	158	242	253	128	45	59	24	1	1,094	48,661,294	44,480
60 to 64	113	89	160	184	121	54	37	25	9	792	35,684,080	45,056
65 to 69	21	31	45	50	33	26	17	4	4	231	9,888,750	42,808
70 & up	13	11	9	16	11	5	7	5	4	81	2,825,918	34,888
Total	2,775	1,086	1,056	991	534	241	174	59	18	6,934	304,282,630	43,883
Average Salary	33,599	42,843	46,002	50,567	59,190	65,957	73,322	76,957	57,092			
Average Age:							47.51	Average Service:		10.14		

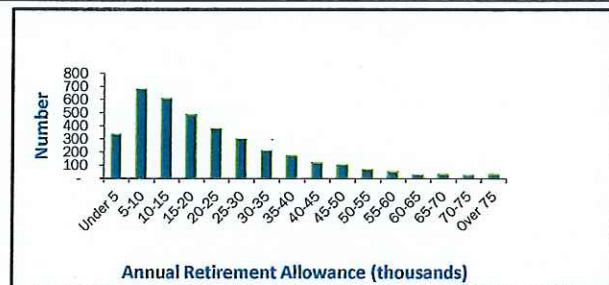


Worcester Regional Retirement System
Actuarial Valuation as of January 1, 2018

SECTION 7 - PLAN MEMBER INFORMATION

Exhibit 7.2 - Retired Plan Members and Beneficiaries Annual Pensions as of January 1, 2018

Attained Age	Service Retirements		Disability Retirements		Beneficiaries	
	Number	Annual Retirement Allowance	Number	Annual Retirement Allowance	Number	Annual Retirement Allowance
Under 20	0	0	0	0	1	22,420
20-24	0	0	0	0	1	9,262
25-29	0	0	0	0	0	0
30-34	0	0	0	0	0	0
35-39	0	0	5	138,492	1	20,595
40-44	1	12,714	15	623,807	5	52,379
45-49	4	71,487	12	436,454	9	241,094
50-54	17	408,905	33	1,159,414	8	134,344
55-59	158	3,961,519	37	1,177,871	23	365,970
60-64	404	9,449,261	58	1,976,530	34	532,380
65-69	672	16,613,071	41	1,325,704	48	949,932
70-74	571	13,126,741	33	1,008,815	31	404,959
75-79	462	9,257,057	15	377,438	42	577,559
80-84	306	5,327,053	15	372,826	49	523,166
85-89	231	3,408,128	5	117,960	38	376,548
90-94	145	1,546,439	1	16,028	26	242,291
95+	51	458,308	0	0	13	91,330
Total	3,022	63,640,683	270	8,731,339	329	4,544,229
Average Age	73.4		62.9		74.1	
Average Retirement Allowance		21,059		32,338		13,812



Worcester Regional Retirement System
Actuarial Valuation as of January 1, 2018

SECTION 8 - GLOSSARY OF TERMS

Actuarial Accrued Liability – That portion of the Actuarial Present Value of pension plan benefits which is not provided by future Normal Costs or employee contributions. It is the portion of the Actuarial Present Value attributable to service rendered as of the Valuation Date.

Actuarial Assumptions – Assumptions, based upon past experience or standard tables, used to predict the occurrence of future events affecting the commencement, amount and duration of pension benefits, such as: changes in compensation, mortality, withdrawal, disablement and retirement; rates of investment earnings and asset appreciation or depreciation; and any other relevant items.

Actuarial Cost Method (or Funding Method) – A procedure for allocating the Actuarial Present Value of all past and future pension plan benefits to the current year (Normal Cost) and the past (Actuarial Accrued Liability).

Actuarial Gain or Loss (or Experience Gain or Loss) – A measure of the difference between actual experience and that expected based upon the set of Actuarial Assumptions, during the period between the valuation date and the most recent immediately preceding valuation date.

Actuarial Present Value – The dollar value on the valuation date of all benefits expected to be paid to current members based upon the Actuarial Assumptions and the terms of the Plan.

Amortization Payment – That portion of the pension plan appropriation which represents payments made to pay interest on and the reduction of the Unfunded Accrued Liability.

Annual Statement – The statement submitted by the local retirement board to PERAC each year that describes the asset holdings and Fund balances as of December 31 and the transactions during the calendar year that affected the financial condition of the retirement system.

Annuity Reserve Fund – The fund into which total accumulated Member Contributions, including interest, is transferred at the time a member retires, and from which annuity payments are made.

Annuity Savings Fund – The fund in which Member Contributions plus interest credited are held for active members and for former members who have not withdrawn their contributions and are not yet receiving a benefit (inactive members).

Assets – The total value of the investments held by the Plan trust that are for the payment of promised benefits. Employer appropriations and Member Contributions, as well as investment earnings, are added to the Plan trust. Benefit payments and other disbursements are withdrawn from the Plan trust. For valuation purposes, assets are usually measured at market value.

Cost of Benefits – The estimated payment from the pension system for benefits for the fiscal year.

Expense Fund – The fund into which the appropriation for administrative expenses is paid and from which all such expenses are paid.

SECTION 8 - GLOSSARY OF TERMS

Funded Ratio – The Actuarial Value of Assets expressed as a percentage of the Actuarial Accrued Liability.

Funding Schedule – The schedule based upon the most recently approved actuarial valuation which sets forth the amount which would be appropriated to the pension system in accordance with Section 22D of M.G.L. Chapter 32.

GASB – Governmental Accounting Standards Board.

Normal Cost – Total Normal Cost is that portion of the Actuarial Present Value of pension plan benefits which is expected to accrue in the current fiscal year. The Employee Normal Cost is the amount of the expected Member Contributions for the current fiscal year. The Employer Normal Cost is the difference between the Total Normal Cost and the Employee Normal Cost.

Pension Fund – The fund into which appropriation amounts as determined by PERAC are paid and from which pension benefits are paid.

Pension Reserve Fund – The fund which shall be credited with all amounts set aside by a system for the purpose of establishing a reserve to meet future pension liabilities. These amounts would include excess interest earnings.

Present Value of Future Benefits – The actuarial present value of the cost to finance benefits payable in the future, discounted to reflect the expected effects of the time value of money and the probabilities of payment.

Special Fund for Military Service Credit – The fund which is credited with amounts paid by the retirement board equal to the amount which would have been contributed by a member during a military leave of absence as if the member had remained in active service of the retirement board. In the event of retirement or a non-job related death, such amount is transferred to the Annuity Reserve Fund. In the event of termination prior to retirement or death, such amount shall be transferred to the Pension Fund.

Total Pension Liability – The portion of the Actuarial Present Value attributable to past service in accordance with the Entry Age cost method as stipulated by GASB Statement Number 67 (GASB 67).

Unfunded Actuarial Accrued Liability – The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets.

SECTION 9 - MEMBER UNIT FY2020 APPROPRIATION

Unit	Unit Name	Normal Cost	UAL	2002 ERI	2003 ERI	2010 ERI	FYE2020 Appropriation	FYE2019 Appropriation	Increase over FYE 2019	Payment on 7/1/2019
010	Ashburnham	301,036	481,782	32,091	-	-	814,909	752,472	8.30%	799,982
020	Ashburnham-Westminster Regional	262,120	408,651	-	-	-	670,771	613,717	9.30%	658,485
025	Athol	403,674	1,407,416	-	-	-	1,811,090	1,354,103	33.75%	1,777,916
026	Athol Housing Authority	13,167	22,352	-	-	-	35,519	38,879	-8.64%	34,868
027	Athol-Royalston Regional School District	164,368	404,009	-	-	-	568,377	538,208	5.61%	557,966
030	Auburn	1,127,350	1,960,883	176,762	27,426	-	3,292,421	2,938,176	12.06%	3,232,114
040	Auburn Housing Authority	22,279	41,726	-	-	-	64,005	61,048	4.84%	62,833
050	Auburn Water District	27,894	60,640	5,260	-	-	93,794	96,976	-3.28%	92,076
060	Barre	136,848	187,218	5,788	2,315	-	332,169	298,599	11.24%	326,085
070	Barre Housing Authority	4,049	14,608	-	-	-	18,657	15,271	22.17%	18,315
080	Berlin	185,969	306,166	-	-	-	492,135	469,886	4.73%	483,121
090	Berlin-Boylston Regional	66,729	98,235	-	-	-	164,964	125,067	31.90%	161,942
100	Blackstone	315,211	540,608	-	-	-	855,819	747,271	14.53%	840,143
105	Blackstone Housing Authority	7,584	10,002	-	-	-	17,586	18,506	-4.97%	17,264
110	Blackstone-Millville Regional	196,321	340,019	-	-	-	536,340	498,924	7.50%	526,516
120	Bolton	169,398	294,091	17,362	-	-	480,851	418,645	14.86%	472,043
130	Boylston	296,942	362,836	13,153	-	-	672,931	616,424	9.17%	660,605
135	Boylston Water District	3,717	8,497	-	-	-	12,214	10,427	17.14%	11,990
140	Brookfield	103,491	178,266	8,768	-	-	290,525	275,263	5.54%	285,203
150	Charlton	516,181	818,892	44,893	-	-	1,379,966	1,186,966	16.26%	1,354,689
160	Cherry Valley-Rochdale Water	6,759	48,081	-	-	-	54,840	46,094	18.97%	53,835
165	Cherry Valley Sewer District	-	-	-	-	-	-	1,747	-100.00%	-
170	Douglas	476,996	606,930	12,624	12,109	-	1,108,659	1,016,758	9.04%	1,088,352
180	Dudley	242,253	500,994	134,150	8,014	-	885,411	817,916	8.25%	869,193
190	Dudley Housing Authority	2,680	13,072	-	-	-	15,752	14,002	12.50%	15,463
200	Dudley-Charlton Regional	340,004	643,625	41,208	17,987	-	1,042,824	945,837	10.25%	1,023,723
210	East Brookfield	72,684	84,738	-	-	-	157,422	140,354	12.16%	154,539
220	Grafton	666,022	1,189,977	40,507	17,452	-	1,913,958	1,709,441	11.96%	1,878,900
230	Grafton Housing Authority	12,967	37,971	-	-	-	50,938	50,350	1.17%	50,005
240	Hardwick	53,587	126,963	13,329	-	-	193,879	191,746	1.11%	190,328
250	Harvard	282,604	634,971	-	-	-	917,575	851,961	7.70%	900,768
260	Hillcrest Water District	211	3,358	-	-	-	3,569	2,890	23.49%	3,504

Worcester Regional Retirement System
Actuarial Valuation as of January 1, 2018

SECTION 9 - MEMBER UNIT FY2020 APPROPRIATION

Unit	Unit Name	Normal Cost	UAL	2002 ERI	2003 ERI	2010 ERI	FYE2020 Appropriation	FYE2019 Appropriation	Increase over FYE 2019	Payment on 7/1/2019
270	Holden	600,797	1,522,299	66,461	-	-	2,189,557	2,114,167	3.57%	2,149,451
280	Holden Housing Authority	15,922	17,387	-	-	-	33,309	28,888	15.30%	32,699
290	Hopedale	397,859	589,858	-	-	-	987,717	928,529	6.37%	969,625
300	Hopedale Housing Authority	-	4,991	-	-	-	4,991	5,000	-0.18%	4,900
310	Hubbardston	114,578	126,166	10,521	4,451	-	255,716	260,487	-1.83%	251,032
320	Lancaster	233,925	435,943	-	-	-	669,868	570,763	17.36%	657,598
325	Lancaster Housing Authority	5,642	10,091	-	-	-	15,733	14,766	6.55%	15,445
327	Lancaster Sewer	2,141	-	-	-	-	2,141	1,586	34.99%	2,102
330	Leicester	411,279	873,133	52,782	2,138	-	1,339,332	1,183,623	13.16%	1,314,800
340	Leicester Housing Authority	17,444	30,026	-	-	-	47,470	38,234	24.16%	46,600
350	Leicester Water District	3,993	43,588	-	-	-	47,581	50,335	-5.47%	46,709
360	Lunenburg	457,035	922,589	-	-	-	1,379,624	1,244,611	10.85%	1,354,353
370	Lunenburg Housing Authority	1,159	540	-	-	-	1,699	1,346	26.23%	1,668
380	Lunenburg Water District	127	57,844	-	-	-	57,971	49,960	16.03%	56,909
390	Mendon	244,370	389,168	8,417	22,616	-	664,571	579,367	14.71%	652,398
400	Mendon-Upton Regional	319,522	458,257	7,015	7,833	-	792,627	722,770	9.67%	778,108
410	Millbury	482,865	1,235,490	143,268	-	-	1,861,623	1,781,760	4.48%	1,827,524
420	Millbury Housing Authority	25,724	64,564	-	6,412	-	96,700	90,482	6.87%	94,929
430	Millville	132,421	49,216	-	-	-	181,637	156,998	15.69%	178,310
440	Narragansett Regional	133,785	248,487	24,726	-	-	406,998	377,383	7.85%	399,543
450	Nashoba Regional	416,230	642,990	-	-	-	1,059,220	997,428	6.20%	1,039,818
455	Nashoba Valley Dispatch	17,748	21,240	-	-	-	38,988	17,063	128.49%	38,274
460	New Braintree	16,432	41,239	-	-	-	57,671	50,451	14.31%	56,615
470	Northboro	660,563	1,497,870	-	-	-	2,158,433	1,922,020	12.30%	2,118,897
480	Northboro Housing Authority	22,607	45,240	-	-	-	67,847	62,318	8.87%	66,604
490	Northboro-Southboro Regional	170,547	232,474	-	-	-	403,021	360,254	11.87%	395,639
500	North Brookfield	200,697	310,635	-	14,424	-	525,756	432,112	21.67%	516,126
510	North Brookfield Housing Authority	2,009	14,504	-	-	-	16,513	18,244	-9.49%	16,211
530	Oakham	24,766	47,493	-	-	-	72,259	65,335	10.60%	70,935
540	Oxford	618,997	1,247,607	136,956	15,492	-	2,019,052	1,908,579	5.79%	1,982,069
550	Oxford Housing Authority	27,009	48,739	-	-	-	75,748	57,696	31.29%	74,361
555	Oxford-Rochdale Sewer District	10,172	24,439	-	-	-	34,611	30,017	15.30%	33,977

Worcester Regional Retirement System
Actuarial Valuation as of January 1, 2018

SECTION 9 - MEMBER UNIT FY2020 APPROPRIATION

Unit	Unit Name	Normal Cost	UAL	2002 ERI	2003 ERI	2010 ERI	FYE2020 Appropriation	FYE2019 Appropriation	Increase over FYE 2019	Payment on 7/1/2019
560	Paxton	367,331	413,080	-	-	-	780,411	666,530	17.09%	766,116
570	Petersham	58,649	97,496	-	2,315	-	158,460	151,368	4.69%	155,557
580	Phillipston	64,136	74,852	-	-	-	138,988	123,033	12.97%	136,442
590	Princeton	70,755	291,768	8,417	-	-	370,940	360,593	2.87%	364,146
600	Quabbin Regional	298,747	675,859	53,308	7,833	-	1,035,747	961,940	7.67%	1,016,775
610	Quaboag Regional	125,328	215,333	30,862	-	-	371,523	336,612	10.37%	364,718
620	Royalston	15,512	41,141	-	-	-	56,653	52,449	8.02%	55,615
630	Rutland	232,759	392,195	6,315	-	-	631,269	569,877	10.77%	619,706
640	Southboro	678,627	1,316,755	-	-	-	1,995,382	1,810,251	10.23%	1,958,833
650	Southboro Housing	4,453	336	11,047	-	-	15,836	14,698	7.74%	15,546
660	Spencer	296,411	601,852	-	-	-	898,263	856,334	4.90%	881,810
670	Spencer-East Brookfield Regional	211,469	366,283	23,848	4,094	-	605,694	576,493	5.07%	594,600
680	Spencer Housing Authority	10,400	35,711	-	-	-	46,111	39,634	16.34%	45,266
690	Sterling	418,826	673,047	-	14,067	-	1,105,940	947,023	16.78%	1,085,683
700	Sterling Housing Authority	-	5,447	-	-	-	5,447	8,849	-38.45%	5,347
710	Sturbridge	574,196	758,343	-	64,110	-	1,396,649	1,299,478	7.48%	1,371,067
720	Sutton	392,650	813,975	-	-	-	1,206,625	1,086,678	11.04%	1,184,523
730	Tantasqua Regional	291,395	430,059	-	-	-	721,454	639,738	12.77%	708,239
740	Templeton	228,808	562,380	21,569	-	-	812,757	751,302	8.18%	797,870
750	Templeton Housing Authority	6,252	15,374	21,392	-	-	43,018	40,190	7.04%	42,230
760	Upton	216,932	423,437	-	-	-	640,369	574,668	11.43%	628,639
770	Uxbridge	540,501	1,267,413	74,351	-	-	1,882,265	1,762,014	6.82%	1,847,788
780	Uxbridge Housing Authority	13,017	40,468	-	-	-	53,485	47,624	12.31%	52,505
790	Wachusett Regional	785,182	1,089,686	56,992	-	-	1,931,860	1,860,026	3.86%	1,896,474
800	Warren	110,651	204,833	52,958	-	5,769	374,211	365,564	2.37%	367,357
810	Warren Water District	7,850	10,256	-	-	-	18,106	15,628	15.86%	17,774
820	Westboro	1,273,403	2,817,790	-	35,615	-	4,126,808	3,820,303	8.02%	4,051,220
825	Westboro Housing Authority	15,063	26,544	5,083	-	-	46,690	36,891	26.56%	45,835
830	West Boylston	523,121	746,207	60,325	-	-	1,329,653	1,179,791	12.70%	1,305,298
835	West Boylston Housing Authority	-	5,445	-	-	-	5,445	10,385	-47.57%	5,345
840	West Boylston Water District	13,774	52,873	-	-	-	66,647	51,850	28.54%	65,426
850	West Brookfield	121,118	171,962	-	-	-	293,080	258,800	13.25%	287,712

Worcester Regional Retirement System
Actuarial Valuation as of January 1, 2018

SECTION 9 - MEMBER UNIT FY2020 APPROPRIATION

Unit	Unit Name	Normal Cost	UAL	2002 ERI	2003 ERI	2010 ERI	FYE2020 Appropriation	FYE2019 Appropriation	Increase over FYE 2019	Payment on 7/1/2019
860	Westminster	267,306	610,819	-	4,986	-	883,111	827,175	6.76%	866,935
870	Winchendon	481,808	1,026,988	60,499	-	-	1,569,295	1,433,892	9.44%	1,540,550
880	Winchendon Housing Authority	38,345	73,129	4,734	-	-	116,208	92,698	25.36%	114,079
Total		21,024,235	39,440,820	1,487,741	291,689	5,769	62,250,254	56,616,875	9.95%	61,110,021