Massachusetts Water Resources Authority Contributory Retirement System

**Actuarial Valuation and Review as of
January 1, 2013**

Segal Consulting

July 24, 2013

Retirement Board
Massachusetts Water Resources Authority Contributory Retirement System
Two Griffin Way
Chelsea, MA 02150

Dear Board Members:

We are pleased to submit this Actuarial Valuation and Review as of January 1, 2013. It summarizes the actuarial data used in the valuation, establishes the funding requirements for fiscal 2014 and later years and analyzes the preceding two years' experience.

This report was prepared in accordance with generally accepted actuarial principles and practices at the request of the 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 MWRA Contributory Retirement System. That assistance is gratefully acknowledged.

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

The actuarial calculations were directed under the supervision of Kathleen A. Riley, FSA, MAAA, EA. She is a member of the American Academy of Actuaries and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein. To the best of her knowledge, the information supplied in this actuarial valuation is complete and accurate. In her opinion, each assumption is reasonable (taking into account the experience of the plan and reasonable expectations) and such other assumptions, in combination, offer her best estimate of anticipated experience under the plan.

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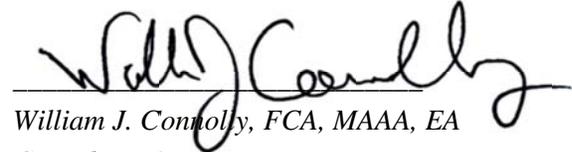
Sincerely,

Segal Consulting, a Member of The Segal Group, Inc.

By: _____   _____
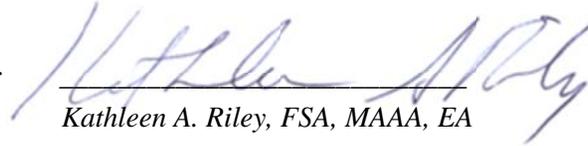
      Kathleen A. Riley, FSA, MAAA, EA   *William J. Connolly, FCA, MAAA, EA*

      Senior Vice President and Actuary   *Consulting Actuary*

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Purpose

This report has been prepared by Segal Consulting to present a valuation of the Massachusetts Water Resources Authority Contributory Retirement System as of January 1, 2013. The valuation was performed to determine whether the assets and contributions are sufficient to provide the prescribed benefits. The contribution requirements presented in this report are based on:

> The benefit provisions of M.G.L. Chapter 32;

> The characteristics of covered active participants, inactive participants, and retired participants and beneficiaries as of January 1, 2013;

> The assets of the Plan as of December 31, 2012;

> Economic assumptions regarding future salary increases and investment earnings; and

> Other actuarial assumptions, regarding employee terminations, retirement, death, etc.

Significant Issues in Valuation Year

The following key findings were the result of this actuarial valuation:

1. The actuarial valuation report as of January 1, 2013 is based on financial information as of that date. Changes in the value of assets subsequent to that date are not reflected.

2. During the plan years ended 2011 and 2012, the market value rates of return were 0.66% and 12.35%, respectively, compared to the assumed rate of return of 8.00%. Because the actuarial value of assets gradually recognizes market value fluctuations over a five-year period, the actuarial rate of return for the plan years ended 2011 and 2012 were 3.99% and 4.85%, respectively. The actuarial value of assets as of December 31, 2012 was $341.5 million, or 97.4% of the market value of assets of $350.5 million reported in the Annual Statement. As of December 31, 2010, the actuarial value of assets was 101.1% of the market value.

3. As indicated in Section 2, the total unrecognized investment gain as of December 31, 2012 is $8,989,634. This investment gain will be recognized in the determination of the actuarial value of assets for funding purposes in the next few years, to the extent it is not offset by recognition of investment losses derived from future experience. This implies that earning the assumed rate of return on a **market value** basis will result in investment gains on the actuarial value of assets in the next few years. Because the unrecognized gain is relatively small, the deferred gains are not reflected in the funding schedule in Section 3, Exhibit F.

4. The unfunded liability has increased from $42.2 million as of January 1, 2011 to $43.8 million as of January 1, 2013. The unfunded liability was expected to increase to $33.2 million. The difference between the expected unfunded liability of $33.2 million and the actual unfunded liability of $43.8 million is $10.6 million and is attributable to an investment loss on an actuarial basis of $22.2 million over the two-year period and assumption changes of $11.4 million described below, partially offset by an $11.7 million gain from salary increases less than expected and a miscellaneous gain of $11.3 million.

5. This valuation reflects the following changes in assumptions:

   ➤ A liability for inactive vested participants equal to the greater of the employee's annuity savings fund or the present value of a deferred annuity.

   ➤ An administrative expense assumption of $390,000 for calendar 2013.

   ➤ An update to the mortality table from the RP-2000 Mortality Table to the RP-2000 Mortality Table projected 13 years with Scale AA.

   ➤ A deduction of $5.2 million from the total liability to account for anticipated net 3(8)(c) reimbursements.

   Changing these assumptions resulted in a net increase in the unfunded liability of $11.4 million and an increase in the employer normal cost of $465,000.

6. Members hired on or after April 2, 2012 are covered by the provisions of Chapter 32 as amended by Chapter 176 of the Acts of 2011 and Chapter 139 of the Acts of 2012.

7. Because the fiscal 2014 appropriation has already been budgeted at $5,903,107, the results of this valuation will first be reflected in the fiscal 2015 appropriation of $7,808,155. Exhibit F in Section 3 shows the recommended contribution through fiscal 2024 based on this funding schedule, which fully funds the System by fiscal year 2024 with amortization payments that increase 4.5% per year.

SECTION 1:   Valuation Summary for the Massachusetts Water Resources Authority Contributory Retirement System

Summary of Key Valuation Results

	2013	2011
Contributions for fiscal year beginning July 1:		
Recommended for fiscal 2014 and 2012	$5,903,107	$5,488,792
Recommended for fiscal 2015 and 2013	7,808,155	5,750,085
Recommended for fiscal 2016 and 2014	8,159,521	5,903,107
Funding elements for plan year beginning January 1:		
Normal cost, including administrative expenses in 2013	$10,466,083	$8,663,977
Market value of assets	350,504,657	295,982,876
Actuarial value of assets	341,515,023	299,331,117
Actuarial accrued liability	385,296,073	341,520,848
Unfunded actuarial accrued liability	43,781,050	42,189,731
GASB 25/27 for fiscal year beginning July 1:		
Annual required contributions (ARC)	$5,903,107	$5,488,792
Actual contributions	--	5,488,792
Percentage of ARC contributed	--	100.00%
Funded ratio using actuarial value of assets	88.64%	87.65%
Funded ratio using market value of assets	90.97%	86.67%
Demographic data for plan year beginning January 1:		
Number of retired participants and beneficiaries	397	341
Number of inactive participants with a vested right to a deferred or immediate benefit	51	- - *
Number of inactive participants entitled to a return of their employee contributions	55	102**
Number of active participants	1,091	1,110
Total payroll*	$80,893,018	$78,973,170
Average payroll*	74,146	71,147

Note: 2011 results are based on the January 1, 2011 valuation report prepared by Buck Consultants, LLC.
*   Information not available.
** Includes all inactive participants not currently collecting a benefit.

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A. PARTICIPANT DATA

The Actuarial Valuation and Review considers the number and demographic characteristics of covered participants, including active participants, inactive participants, retired participants and beneficiaries.

This section presents a summary of significant statistical data on these participant groups.

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

A historical perspective of how the participant population has changed over the past three valuations can be seen in this chart.

CHART 1

Participant Population: 2009 – 2012

Year Ended December 31	Active Participants	Inactive Participants	Retired Participants and Beneficiaries	Ratio of Non-Actives to Actives
2009	1,108	114	313	0.39
2010	1,110	102	341	0.40
2012	1,091	106	397	0.46

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Active Participants

Plan costs are affected by the age, years of service and payroll of active participants. In this year's valuation, there were 1,091 active participants with an average age of 51.8, average years of service of 18.0 years and average payroll of $73,980. The 1,110 active participants in the prior valuation had an average payroll of $71,147.

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

Inactive Participants

In this year's valuation, there were 51 participants with a vested right to a deferred or immediate vested benefit and 55 participants entitled to a return of their employee contributions.

These graphs show a distribution of active participants by age and by years of service.

CHART 2

Distribution of Active Participants by Age as of December 31, 2012
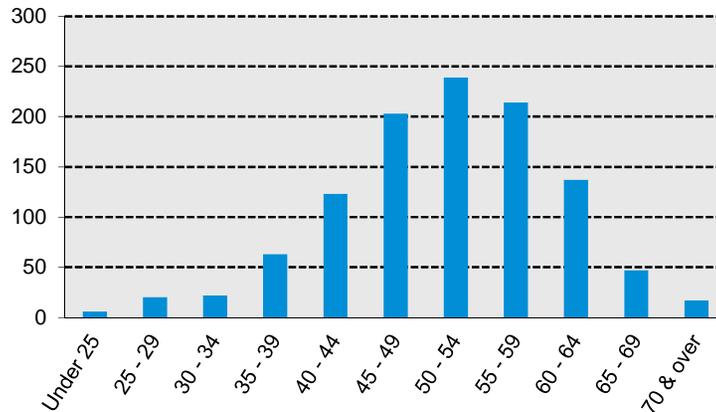
CHART 3

Distribution of Active Participants by Years of Service as of December 31, 2012
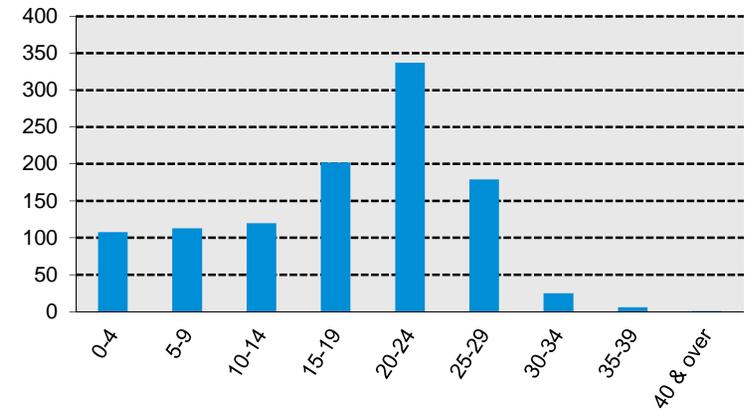
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Retired Participants and Beneficiaries
As of December 31, 2012, 348 retired participants and 49
beneficiaries were receiving total monthly benefits of
$922,155. For comparison, in the previous valuation, there
were 341 retired participants and beneficiaries receiving
monthly benefits of $706,158.

*These graphs show a
distribution of the current
retired participants and
beneficiaries based on
their monthly amount and
age, by type of pension.*

CHART 4

**Distribution of Retired Participants and Beneficiaries by
Type and by Monthly Amount as of December 31, 2012**
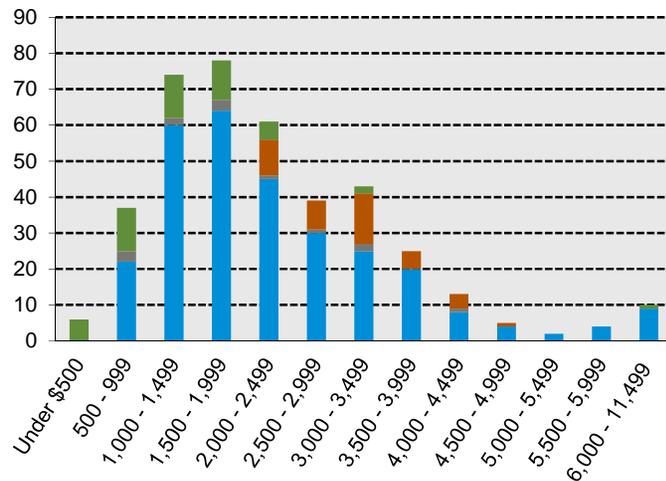
CHART 5

**Distribution of Retired Participants and Beneficiaries by
Type and by Age as of December 31, 2012**
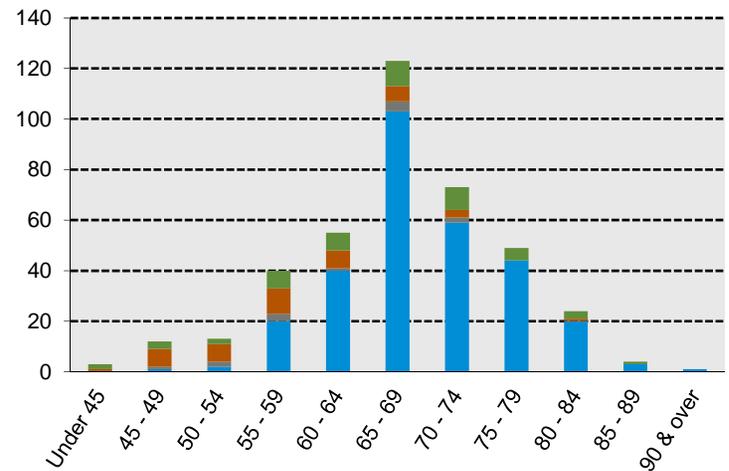
■ Beneficiaries

■ Accidental Disability

■ Ordinary Disability

■ Superannuation

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B. FINANCIAL INFORMATION

Retirement plan funding anticipates that, over the long term, both net contributions and net investment earnings (less investment fees and administrative expenses) 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 these transactions for the valuation year, is presented in Section 3, Exhibits C and D.

The chart depicts the components of changes in the actuarial value of assets over the last three years. Note: The first bar represents increases in assets during each year while the second bar details the decreases.

CHART 6

Comparison of Increases and Decreases in the Actuarial Value of Assets for Years Ended December 31, 2010 – 2012
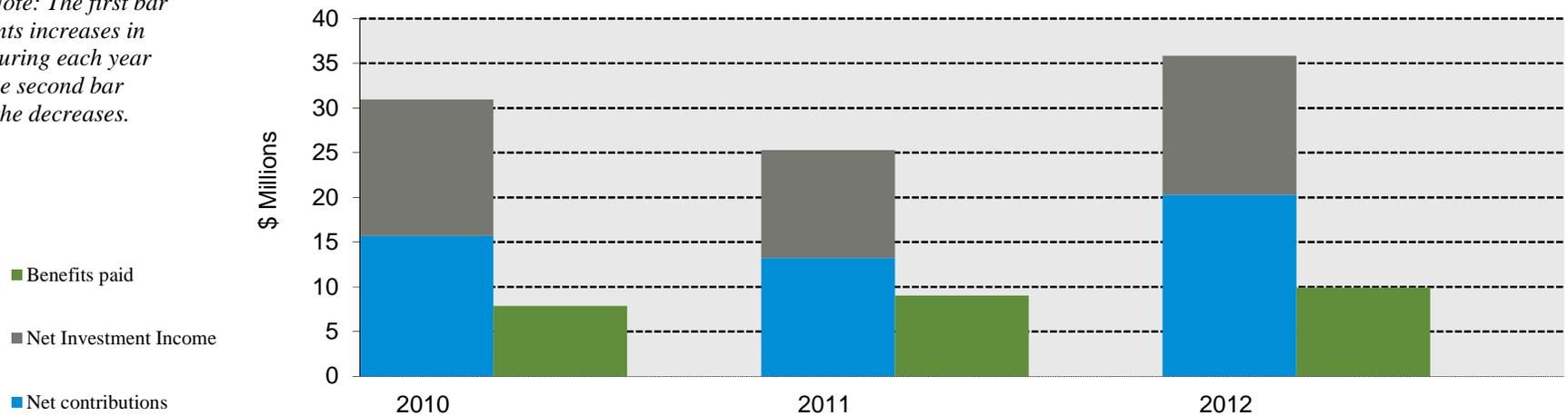
Benefits paid

Net Investment Income

Net contributions

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It is desirable to have level and predictable plan costs from one year to the next. For this reason, the Board has approved an asset valuation method that gradually adjusts to market value. Under this valuation method, the full value of market fluctuations is not recognized in a single year and, as a result, the asset value and the plan costs are more stable.

The amount of the adjustment to recognize market value is treated as income, which may be positive or negative. Realized and unrealized gains and losses are treated equally and, therefore, the sale of assets has no immediate effect on the actuarial value.

The chart shows the determination of the actuarial value of assets as of the valuation date.

CHART 7

Determination of Actuarial Value of Assets

		Year Ended	
		December 31, 2012	**December 31, 2011**
1. Market value of assets, December 31, 2012		$350,504,657	$302,160,993
	Original	Unrecognized	Unrecognized
2. Calculation of unrecognized return*	Amount	Return	Return
(a) Year ended December 31, 2012	$13,366,332	$10,693,066	N/A
(b) Year ended December 31, 2011	-21,877,664	-13,126,599	-$17,502,131
(c) Year ended December 31, 2010	13,704,919	5,481,968	8,222,951
(d) Year ended December 31, 2009	29,705,996	5,941,199	11,882,398
(e) Year ended December 31, 2008	-80,118,919	N/A	-16,023,784
(f) Total unrecognized return		8,989,634	-13,420,565
3. Preliminary actuarial value: (1) - (2f)		341,515,023	315,581,558
4. Adjustment to be within 10% corridor		0	0
5. Final actuarial value of assets as of December 31, 2012: (3) + (4)		341,515,023	$315,581,558
6. Actuarial value as a percentage of market value: (5) ÷ (1)		97.4%	104.4%
7. Amount deferred for future recognition: (1) - (5)		$8,989,634	-$13,420,565

* Unrecognized return is the difference between the total return and expected return on a market value basis and is recognized over a five-year period.

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Both the actuarial value and market value of assets are representations of the MWRA Contributory Retirement System's financial status. As investment gains and losses are gradually taken into account, the actuarial value of assets tracks the market value of assets. The actuarial asset value is significant because the MWRA 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.

This chart shows the change in the actuarial value of assets versus the market value over the past four years.

CHART 8

Actuarial Value of Assets vs. Market Value of Assets as of December 31, 2009 – 2012
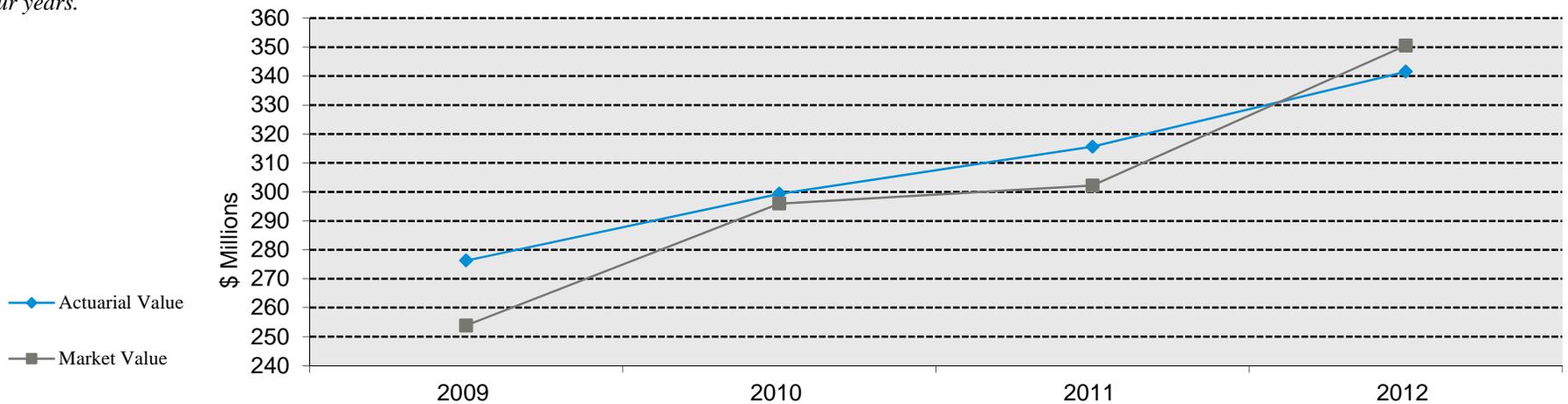
C. ACTUARIAL EXPERIENCE

To calculate the required 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), the contribution requirement will decrease from the previous year. On the other hand, the 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.

The net experience gain for the two-year period ending December 31, 2012 is $848,047. A discussion of the major components of the actuarial experience is on the following pages.

This chart provides a summary of the actuarial experience over the past two years.

CHART 9

Actuarial Experience for Two-Year Period Ended December 31, 2012

1. Net loss from investments*	-$22,190,712
2. Net gain from other experience	23,038,759
3. Net experience gain: (1) + (2)	$848,047

* Details in Chart 10

Investment Rate of Return

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 MWRA Contributory Retirement System's investment policy. For valuation purposes, the assumed rate of return on the actuarial value of assets is 8.00%. The actual rates of return on an actuarial basis for the 2012 and 2011 plan years were 4.85% and 3.99%, respectively.

Since the actual return for the last two years was less than the assumed return, the MWRA Contributory Retirement System experienced an actuarial loss of $22,190,712 with regard to its investments.

This chart shows the gain/(loss) due to investment experience.

CHART 10

Actuarial Value Investment Experience

	Year Ended	
	December 31, 2012	**December 31, 2011**
1. Actual return	$15,544,568	$12,041,642
2. Average value of assets	320,776,007	301,435,517
3. Actual rate of return: (1) ÷ (2)	4.85%	3.99%
4. Assumed rate of return	8.00%	8.00%
5. Expected return: (2) x (4)	$25,662,081	$24,114,841
6. Actuarial gain/(loss): (1) – (5)	-$10,117,513	-$12,073,199

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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 market value investment return for the last four years.

Based on this experience and future expectations, we have maintained the assumed investment return of 8.00%. However, previously the investment return assumption was net of investment and administrative expenses. Effective January 1, 2013, the investment return assumption is net of investment expenses only and an explicit expense assumption has been added as noted later in the report.

CHART 11

Investment Return – Actuarial Value vs. Market Value: 2009 – 2012

Year Ended December 31	Actuarial Value Investment Return		Market Value Investment Return	
	Amount	**Percent**	**Amount**	**Percent**
2009	- -*	21.45%	- -*	22.49%
2010	$15,233,758	5.44	$34,324,480	13.32
2011	12,041,642	3.99	1,969,318	0.66
2012	15,544,568	4.85	37,954,767	12.35
Total	$42,819,968		$74,248,565	

Notes: Each year's yield is weighted by the average asset value in that year.
Returns are net of investment and administrative expenses.
* *Information not available.*

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Subsection B described the actuarial asset valuation method that gradually takes into account fluctuations in the market value rate of return. The effect of this is to stabilize the actuarial rate of return, which contributes to leveling pension plan costs.

This chart illustrates how this leveling effect has actually worked over the years 2009 - 2012.

CHART 12

Market and Actuarial Rates of Return for Years Ended December 31, 2009 - 2012
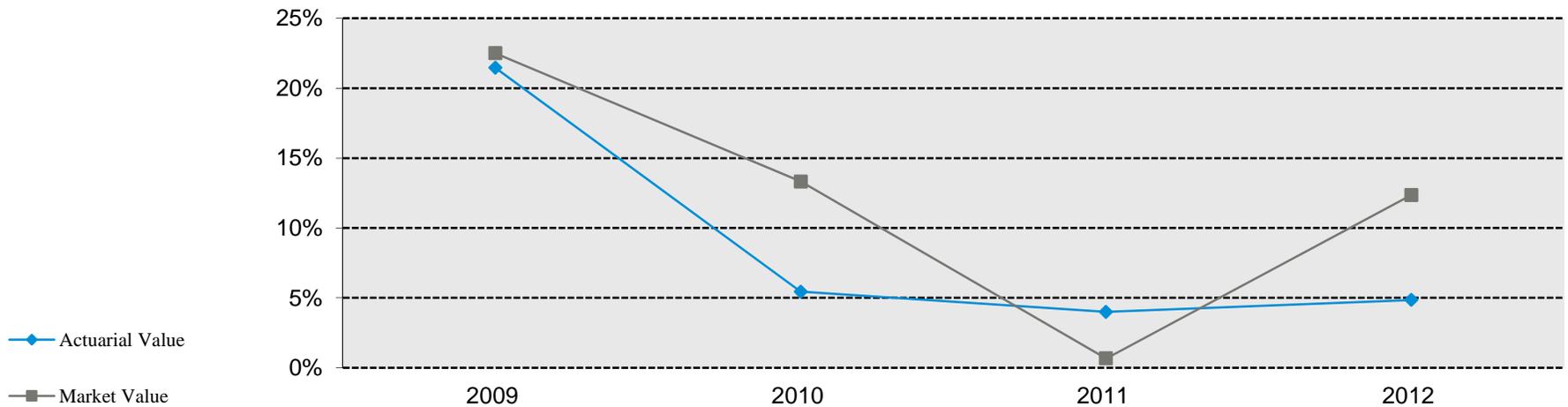
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Other Experience

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 the participants,

➤ retirement experience (earlier or later than expected),

➤ mortality (more or fewer deaths than expected),

➤ the number of disability retirements, and

➤ salary increases different than assumed.

The net gain from this other experience for the two-year period ending December 31, 2012 amounted to $23,038,759, which is 6.0% of the actuarial accrued liability. This gain was primarily due to salary increases less than expected.

This valuation reflects the following changes in assumptions:

➤ A liability for inactive vested participants equal to the greater of the employee's annuity savings fund or the present value of a deferred annuity.

➤ An administrative expense assumption of $390,000 for calendar 2013.

➤ An update to the mortality table from the RP-2000 Mortality Table to the RP-2000 Mortality Table projected 13 years with Scale AA.

➤ A deduction of $5.2 million from the total liability to account for anticipated net 3(8)(c) reimbursements.

Changing these assumptions resulted in a net increase in the unfunded liability of $11.4 million and an increase in the employer normal cost of $465,000.

Members hired on or after April 2, 2012 are covered by the provisions of Chapter 32 as amended by Chapter 176 of the Acts of 2011 and Chapter 139 of the Acts of 2012.

D. RECOMMENDED CONTRIBUTION

The amount of annual contribution required to fund the Plan is comprised of an employer normal cost payment and a payment on the unfunded actuarial accrued liability. The preliminary recommended contribution for fiscal year 2014 is based on an 11-year (increasing 4.5% per year) amortization of the unfunded actuarial accrued liability.

Because the fiscal 2014 appropriation has already been budgeted at $5,903,107, the results of this valuation will first be reflected in the fiscal 2015 appropriation of $7,808,155. Exhibit F in Section 3 shows the recommended contribution through fiscal 2024 based on this funding schedule.

The chart compares this valuation's recommended contribution with the prior valuation.

CHART 13

Employer Normal Cost and Projected Unfunded Actuarial Accrued Liability

| | Year Beginning January 1 | | | |
| | 2012 | | 2010 | |
	Amount	% of Payroll	Amount	% of Payroll
1. Total normal cost	$10,076,083	11.88%	$8,663,977	10.45%
2. Administrative expenses	390,000	0.46%	0	0.00%
3. Expected employee contributions	-8,065,358	-9.51%	-7,210,710	-8.70%
4. Employer normal cost: (1) + (2) + (3)	$2,400,725	2.83%	$1,453,267	1.75%
5. Actuarial accrued liability	385,296,073		341,520,848	
6. Actuarial value of assets	341,515,023		299,331,117	
7. Unfunded actuarial accrued liability: (5) - (6)	$43,781,050		$42,189,731	
8. Employer normal cost projected to July 1, 2013 and 2011	2,454,147		1,510,279	
9. Projected unfunded actuarial accrued liability	45,498,602		43,844,855	
10. Payment on projected unfunded actuarial accrued liability	4,850,523	5.59%	4,078,737	4.81%
11. Preliminary recommended contribution: (8) + (10), adjusted for timing	$7,304,670	8.42%	$5,589,016	6.60%
12. Budgeted appropriation	5,903,107	6.81%	5,488,792	6.48%
13. Projected payroll	$86,716,684		$84,714,451	

Note: Recommended contributions are assumed to be paid on July 1.

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E. INFORMATION REQUIRED BY THE GASB

Governmental Accounting Standards Board (GASB) reporting information provides standardized information for comparative purposes of governmental pension plans. This information allows a reader of the financial statements to compare the funding status of one governmental plan to another on relatively equal terms.

Critical information to the GASB is the historical comparison of the GASB required contribution to the actual contributions. This comparison demonstrates whether a plan is being funded within the range of the GASB reporting requirements. Chart 14 below presents a graphical representation of this information for the Plan.

The other critical piece of information regarding the Plan's financial status is the funded ratio. This ratio compares the actuarial value of assets to the actuarial accrued liabilities of the Plan as calculated under the GASB Standards. High ratios indicate a well-funded plan with assets sufficient to cover the plan's actuarial accrued liabilities. Lower ratios may indicate recent changes to benefit structures, funding of the plan below actuarial requirements, poor asset performance, or a variety of other factors.

Although the GASB requires that the actuarial value of assets be used to determine the funded ratio, Chart 15 shows the funded ratio calculated using both the actuarial value of assets (88.64%) and the market value of assets (90.97%).

The details regarding the calculations of these values and other GASB numbers may be found in Section 4, Exhibits II, III, and IV.

These graphs show key GASB factors.

CHART 14

Required Versus Actual Contributions
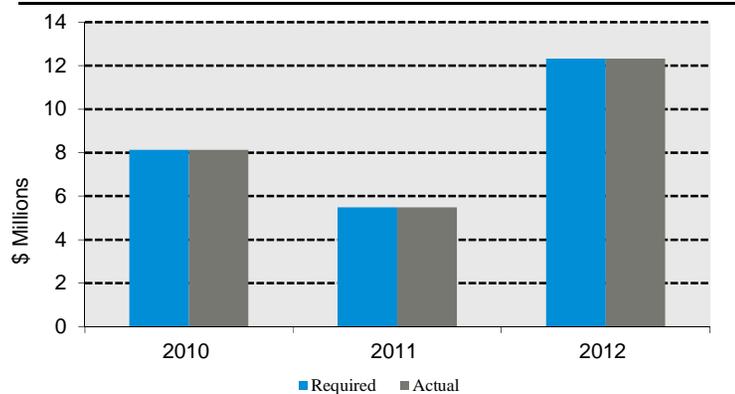
CHART 15

Funded Ratio
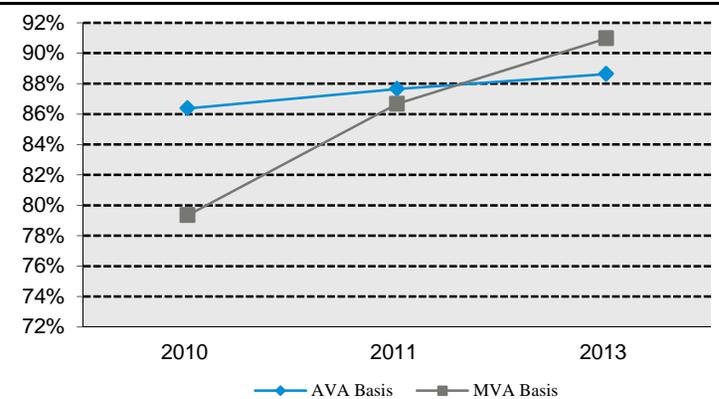
EXHIBIT A

Table of Plan Coverage

Category	Year Ended December 31		Change From Prior Year
	2012	**2010**	
Active participants in valuation:			
Number	1,091	1,110	-1.7%
Average age	51.8	- -*	N/A
Average years of service	18.0	- -*	N/A
Total payroll	$80,893,018	$78,973,170	2.43%
Average payroll	74,146	71,147	4.22%
Member contributions	103,687,918	- -*	N/A
Inactive participants entitled to a return of employee contributions	55	102**	N/A
Inactive participants with a vested right to a deferred or immediate benefit	51	- -*	N/A
Retired participants:			
Number in pay status	293	287***	N/A
Average age	69.2	68	N/A
Average monthly benefit	$2,375	$1,971	N/A
Disabled participants:			
Number in pay status	55	54	1.9%
Average age	58.6	57	N/A
Average monthly benefit	$2,832	$2,602	8.8%
Beneficiaries in pay status	49	- -*	N/A

* *Information not available.*

** *Includes all inactive participants not currently collecting a benefit.*

*** *Includes retirees and beneficiaries.*

Note: Year end 2010 results are based on the January 1, 2011 valuation report prepared by Buck Consultants, LLC.

EXHIBIT B

Participants in Active Service as of December 31, 2012
By Age, Years of Service, and Average Payroll

Age	Years of Service									
	Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40 & over
Under 25	6	6	- -	- -	- -	- -	- -	- -	- -	- -
	$34,453	$34,453	- -	- -	- -	- -	- -	- -	- -	- -
25 - 29	20	13	7	- -	- -	- -	- -	- -	- -	- -
	$49,995	$48,859	$52,105	- -	- -	- -	- -	- -	- -	- -
30 - 34	22	11	10	1	- -	- -	- -	- -	- -	- -
	$51,962	$47,486	$56,105	$59,758	- -	- -	- -	- -	- -	- -
35 - 39	63	19	18	14	12	- -	- -	- -	- -	- -
	$61,549	$50,800	$63,479	$64,955	$71,697	- -	- -	- -	- -	- -
40 - 44	123	15	15	23	35	32	3	- -	- -	- -
	$68,718	$50,077	$68,510	$69,938	$75,619	$70,153	$57,790	- -	- -	- -
45 - 49	203	14	22	19	38	77	33	- -	- -	- -
	$74,641	$58,656	$62,894	$70,677	$81,571	$77,327	$77,290	- -	- -	- -
50 - 54	239	19	12	24	38	83	57	5	1	- -
	$75,095	$59,165	$64,226	$73,044	$80,147	$75,995	$79,064	$74,023	$69,778	- -
55 - 59	214	6	20	18	40	69	50	10	1	- -
	$79,617	$71,260	$68,309	$76,055	$84,183	$76,115	$80,728	$110,962	$109,943	- -
60 - 64	137	4	4	17	20	52	27	9	3	1
	$81,880	$52,777	$55,748	$75,294	$82,027	$84,249	$87,407	$81,381	$108,599	$63,788
65 - 69	47	1	3	2	14	17	9	1	- -	- -
	$76,725	$74,377	$70,036	$89,722	$71,451	$76,236	$85,532	$76,039	- -	- -
70 & over	17	- -	2	2	5	7	- -	- -	1	- -
	$73,644	- -	$65,770	$64,663	$82,967	$67,848	- -	- -	$101,320	- -
Total	1,091	108	113	120	202	337	179	25	6	1
	$74,146	$53,138	$63,551	$71,928	$79,581	$76,886	$80,429	$91,528	$101,140	$63,788

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EXHIBIT C

Summary Statement of Income and Expenses on an Actuarial Value Basis

	Year Ended December 31, 2012		Year Ended December 31, 2011	
Net assets at actuarial value at the beginning of the year		$315,581,558		$299,331,117
Contribution income:				
Employer contributions	$12,326,022		$5,488,792	
Employee contributions	7,952,164		7,734,335	
Other contributions	15,871		22,732	
Net contribution income		$20,294,057		$13,245,859
Net investment income		15,544,568		12,041,642
Total income available for benefits		$35,838,625		$25,287,501
Less benefit payments:				
Pensions	-$7,974,201		-$7,186,246	
Net 3(8)(c) reimbursements	578,571		500,655	
Refunds, annuities, & Option B refunds	-2,528,530		-2,386,364	
Workers Compensation	19,000		34,895	
Net benefit payments		-$9,905,160		-$9,037,060
Change in reserve for future benefits		$25,933,465		$16,250,441
Net assets at actuarial value at the end of the year		$341,515,023		$315,581,558

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SECTION 3: **Supplemental Information for the Massachusetts Water Resources Authority Contributory Retirement System**

EXHIBIT D

Development of the Fund Through December 31, 2012

Year Ended December 31	Employer Contributions	Employee Contributions	Other Contributions	Net Investment Return*	Benefit Payments	Actuarial Value of Assets at End of Year
2010	$8,136,240	$7,563,665	$13,815	$15,233,758	$7,885,963	$299,331,117
2011	5,488,792	7,734,335	22,732	12,041,642	9,037,060	315,581,558
2012	12,326,022	7,952,164	15,871	15,544,568	9,905,160	341,515,023

Net of investment fees and administrative expenses

EXHIBIT E

Development of Unfunded Actuarial Accrued Liability and (Gain)/Loss

		Year Ended	
		December 31, 2012	**December 31, 2011**
1. Unfunded actuarial accrued liability at beginning of year		$41,197,213	$42,189,731
2. Normal cost at beginning of year		9,053,856	8,663,977
3. Total contributions		-20,294,057	-13,245,859
4. Interest			
(a) For whole year on (1) + (2)	$4,020,085		$4,068,297
(b) For half year on (3)	-733,777		-478,933
(c) Total interest		3,286,308	3,589,364
5. Expected unfunded actuarial accrued liability		$33,243,320	$41,197,213
6. Changes due to:			
(a) Experience gain	-$848,047		- -
(b) Assumption changes	11,385,777		- -
(c) Total changes		10,537,730	- -
7. Unfunded actuarial accrued liability at end of year		$43,781,050	- -

SECTION 3: **Supplemental Information for the Massachusetts Water Resources Authority Contributory Retirement System**

EXHIBIT F

Funding Schedule

(1) Fiscal Year Ended June 30	(2) Employer Normal Cost	(3) Amortization Payment	(4) Total Plan Cost: (2) + (3)	(5) Unfunded Actuarial Accrued Liability at Beginning of Fiscal Year	(6) Percent Increase in Total Cost
2014	$2,454,147	$3,448,960	$5,903,107	$45,498,602	- -
2015	2,564,584	5,243,571	7,808,155	45,413,614	32.27%
2016	2,679,990	5,479,531	8,159,521	43,383,647	4.50%
2017	2,800,590	5,726,110	8,526,700	40,936,445	4.50%
2018	2,926,617	5,983,785	8,910,402	38,027,162	4.50%
2019	3,058,315	6,253,056	9,311,371	34,606,847	4.50%
2020	3,195,939	6,534,443	9,730,382	30,622,095	4.50%
2021	3,339,756	6,828,493	10,168,249	26,014,664	4.50%
2022	3,490,045	7,135,775	10,625,820	20,721,064	4.50%
2023	3,647,097	7,456,885	11,103,982	14,672,112	4.50%
2024	3,811,216	7,792,445	11,603,661	7,792,445	4.50%

Notes: Recommended contributions are assumed to be paid on July 1.
    Assumes amortization payments of remaining liability increase at 4.50% per year.
    Assumes contribution of budgeted amount for fiscal year 2014.

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EXHIBIT G

Definitions of Pension Terms

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

Assumptions or actuarial assumptions:	The estimates on which the cost of the Plan is calculated including:

(a)   <u>Investment return</u> — the rate of investment yield that the Plan will earn over the long-term future;

(b)   <u>Mortality rates</u> — the death rates of employees and pensioners; life expectancy is based on these rates;

(c)   <u>Retirement rates</u> — the rate or probability of retirement at a given age;

(d)   <u>Turnover rates</u> — the rates at which employees of various ages are expected to leave employment for reasons other than death, disability, or retirement.

Normal cost:	The amount of contributions required to fund the benefit allocated to the current year of service.
Actuarial accrued liability for actives:	The equivalent of the accumulated normal costs allocated to the years before the valuation date.
Actuarial accrued liability for pensioners:	The single sum value of lifetime benefits to existing pensioners. This sum takes account of life expectancies appropriate to the ages of the pensioners and the interest that the sum is expected to earn before it is entirely paid out in benefits.
Unfunded actuarial accrued liability:	The extent to which the actuarial accrued liability of the Plan exceeds the assets of the Plan. There are many approaches to paying off the unfunded actuarial accrued liability, from meeting the interest accrual only to amortizing it over a specific period of time.

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Amortization of the unfunded actuarial accrued liability: Payments made over a period of years equal in value to the Plan's unfunded actuarial accrued liability.

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.

EXHIBIT I

Summary of Actuarial Valuation Results

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 49 beneficiaries in pay status)	397
2. Participants active during the year ended December 31, 2012 with total accumulated contributions of $103,687,918 and projected 2013 payroll of $84,829,033	1,091
3. Inactive participants with a right to a return of their employee contributions as of December 31, 2012	55
4. Inactive participants with a vested right to a deferred or immediate benefit as of December 31, 2012	51

The actuarial factors as of January 1, 2013 are as follows:

1. Normal cost, including administrative expenses		$10,466,083
2. Expected employee contributions		-8,065,358
3. Employer normal cost: (1) + (2)		2,400,725
4. Actuarial accrued liability		385,296,073
Retired participants and beneficiaries	$106,973,144	
Active participants	265,865,610	
Inactive participants	12,457,319	
5. Actuarial value of assets ($350,504,657 at market value as reported in the Annual Statement)		341,515,023
6. Unfunded actuarial accrued liability: (4) – (5)		43,781,030

The actuarial factors projected to July 1, 2013 are as follows:

1. Employer normal cost projected to July 1, 2013	$2,454,147
2. Projected unfunded actuarial accrued liability	45,498,602
3. Payment on projected unfunded actuarial accrued liability	4,850,523
4. Preliminary recommended contribution: (1) + (3)	7,304,670
5. Budgeted appropriation	5,903,107
6. Projected payroll	86,716,684
7. Total budgeted appropriation as a percentage of projected payroll	6.81%

Note: Recommended contributions are assumed to be paid on July 1.

SECTION 4: Reporting Information for the Massachusetts Water Resources Authority Contributory Retirement System

EXHIBIT II

Supplementary Information Required by the GASB – Schedule of Employer Contributions

Plan Year Ended December 31	Annual Required Contributions	Actual Contributions	Percentage Contributed
2010	$8,136,240	$8,136,240	100.0%
2011	5,488,792	5,488,792	100.0%
2012	12,326,022	12,326,022	100.0%

EXHIBIT III

Supplementary Information Required by the GASB – Schedule of Funding Progress

Actuarial Valuation Date	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) (b)	Unfunded AAL (UAAL) not less than $0 (b) - (a)	Funded Ratio (a) / (b)	Covered Payroll (c)	UAAL as a Percentage of Covered Payroll* [(b) - (a)] / (c)
01/01/1999	$96,318,000	$96,318,000	$0	100.00%	$66,782,000	0.00%
01/01/2001	128,385,000	128,385,000	0	100.00%	65,955,000	0.00%
01/01/2002	141,069,000	141,069,000	0	100.00%	66,322,000	0.00%
01/01/2003	146,188,000	146,188,000	0	100.00%	66,711,000	0.00%
01/01/2005	172,512,000	172,512,000	0	100.00%	65,790,000	0.00%
01/01/2007	211,716,000	255,962,000	44,246,000	82.71%	75,444,000	58.65%
01/01/2009	222,477,000	301,652,000	79,175,000	73.75%	82,314,000	96.19%
01/01/2010	276,270,000	319,876,000	43,606,000	86.37%	81,962,000	53.20%
01/01/2011	299,331,000	341,521,000	42,190,000	87.65%	82,870,000	50.91%
01/01/2013	341,515,023	385,296,073	43,781,050	88.64%	84,829,033	51.61%

Not less than zero. Information prior to 2013 taken from the January 1, 2011 valuation report prepared by Buck Consultants, LLC.

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EXHIBIT IV

Supplementary Information Required by the GASB

Valuation date	January 1, 2013
Actuarial cost method	Entry Age Normal Cost Method
Amortization method	Amortization payments increased 4.5% per year
Remaining amortization period	11 years as of July 1, 2013
Asset valuation method	The market value of assets less unrecognized returns in each of the last five years. Unrecognized return is equal to the difference between the expected return and the actuarial investment return on a market value and is recognized over a five-year period. The actuarial value of assets is adjusted, if necessary, to be within 10% of the market value.
Actuarial assumptions:	
Investment rate of return	8.00%
Projected salary increases	Based on years of service, ranging from 7.00% decreasing to 4.75% after 9 years of service
Cost of living adjustments	3.00% of first $12,000 of retirement income
Plan membership:	
Retired participants and beneficiaries receiving benefits	397
Inactive participants entitled to a return of their employee contributions	55
Inactive participants with a vested right to a deferred or immediate benefit	51
Active participants	<u>1,091</u>
Total	1,594

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EXHIBIT V

Actuarial Assumptions and Actuarial Cost Method

Mortality Rates:

Healthy:	RP-2000 Mortality Table projected 13 years using Scale AA (previously, RP-2000 Mortality Table)
Disabled:	RP-2000 Mortality Table projected 13 years using Scale AA, set forward 2 years (previously, RP-2000 Mortality Table, set forward 2 years)
	The RP-2000 Mortality Table projected 13 years using Scale AA was determined to contain provision appropriate to reasonably reflect future mortality improvement, based on a review of mortality experience as of the measurement date.

Termination Rates before Retirement:

Rate (%)

	Mortality		
Age	**Male**	**Female**	**Disability**
20	0.03	0.02	0.01
25	0.03	0.02	0.02
30	0.04	0.02	0.03
35	0.07	0.04	0.05
40	0.10	0.06	0.10
45	0.13	0.09	0.15
50	0.17	0.13	0.19
55	0.28	0.24	0.24
60	0.55	0.47	0.28

Notes: *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.

Withdrawal Rates:	Years of Service	Rate per year (%)
	0	15.0
	1	12.0
	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

	Rate per year (%)		
Retirement Rates:			
	Age	**Male**	**Female**
	50	1.0	1.5
	51	1.0	1.5
	52	1.0	2.0
	53	1.0	2.5
	54	2.0	2.5
	55	2.0	5.5
	56	2.5	6.5
	57	2.5	6.5
	58	5.0	6.5
	59	6.5	6.5
	60	12.0	5.0
	61	20.0	13.0
	62	30.0	15.0
	63	25.0	12.5
	64	22.0	18.0
	65	40.0	15.0
	66	25.0	20.0
	67	25.0	20.0
	68	30.0	25.0
	69	30.0	20.0
	70	100.0	100.0

Retirement Age for Inactive Vested Participants: Age 55

Unknown Data for Participants: Same as those exhibited by participants with similar known characteristics.

Age of Spouse: Females three years younger than their spouses.

Percent Married: 80%

Benefit Election:	All participants are assumed to elect Option A.
Net Investment Return:	8.00%, net of investment expenses (Previously, 8.0% net of investment and administrative expenses)

Salary Increases:

Years of Service	Rate
0	7.00%
1	6.50%
2	6.50%
3	6.00%
4	5.50%
5	5.50%
6	5.50%
7	5.00%
8	5.00%
9+	4.75%

Interest on Employee Contributions:	3.50%
Administrative Expenses:	$390,000 for calendar 2013, increasing 4.50% per year (Previously, administrative expenses were subtracted from investment income).
2012 Salary:	2012 salary equal to salaries provided in the data, except for new hires where salaries were annualized based on date of hire.
Total Service:	Total creditable service reported in the data.
Net 3(8)(c) Liability:	Estimated based on the average annual net 3(8)(c) benefits of the prior two years ($5.2 million reduction for 2013).

Actuarial Value of Assets:	Market value of assets as reported in the System's Annual Statement less unrecognized return in each of the last five years. Unrecognized return is equal to the difference between the actual market value return and the expected market value return and is recognized over a five-year period, further adjusted, if necessary, to be within 10% of the market value.
Actuarial Cost Method:	Entry Age Normal Actuarial Cost Method. Entry Age is the 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.
Changes in Assumptions:	This valuation reflects the following changes in assumptions:

> A liability for inactive vested participants equal to the greater of the employee's annuity savings fund or the present value of a deferred annuity.

> An administrative expense assumption of $390,000 for calendar 2013.

> An update to the mortality table of from the RP-2000 Mortality Table to the RP-2000 Mortality Table projected 13 years with Scale AA.

> A deduction of $5.2 million from the total liability to account for anticipated net 3(8)(c) disbursements.

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EXHIBIT VI

Summary of Plan Provisions

This exhibit summarizes the major provisions of Chapter 32 of the Laws of Massachusetts.

Plan Year:	January 1 – December 31

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.

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

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

Employee Contributions

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

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

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

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

Retirement Benefits (Superannuation)

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

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

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

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

Ordinary Disability Benefits

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.

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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 be the member at the time of death.

"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.
Post-Retirement Benefits	
	The Board has adopted the provisions of Section 51 of Chapter 127 of the Acts of 1999, which provide that the Retirement Board may approve an annual COLA in excess of the Consumer Price Index but not to exceed a 3% COLA on the first $12,000 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	Members hired on or after April 2, 2012 are covered by the provisions of Chapter 32 as amended by Chapter 176 of the Acts of 2011 and Chapter 139 of the Acts of 2012.