Worcester Retirement System

Worcester, Massachusetts

(A Component Unit of the City of Worcester, Massachusetts)

Comprehensive Annual Financial Report

Fiscal Year Ended December 31, 2016

Worcester Retirement System
Worcester, Massachusetts
(A Component Unit of the City of Worcester, Massachusetts)

Comprehensive Annual Financial Report
For the Fiscal Year Ended December 31, 2016

Prepared by the Staff of the
Worcester Retirement System

Table of Contents

Introductory Section

Worcester Retirement System

Room 103 City Hall Worcester Massachusetts 01608 Phone (508) 799 1062

June 23, 2017

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

Dear Members of the Board:

We are pleased to submit the Comprehensive Annual Financial Report (CAFR) of the Worcester Retirement System (WRS) for the year ended December 31, 2016. The Government Finance Officers Association of the United States and Canada (GFOA) awarded a Certificate of Achievement for Excellence in Financial Reporting to the WRS for its CAFR for the year ended December 31, 2015. This was the thirteenth consecutive year that the WRS has achieved this prestigious award. In order to be awarded a Certificate of Achievement, the WRS must publish an easily readable and efficiently organized CAFR. This report must satisfy both accounting principles generally accepted in the United States of America and applicable legal requirements. Management accepts responsibility for the contents of the report.

A Certificate of Achievement is valid for a period of one year. We believe that our current CAFR continues to meet the Certificate of Achievement Program's requirements and we are submitting it to the GFOA to determine its eligibility for another certificate.

GASB Statement No. 34 requires that management provide a narrative introduction, overview and analysis to accompany the basic financial statements in the form of Management's Discussion and Analysis (MD&A). This letter of transmittal is designed to compliment the MD&A and should be read in conjunction with it. The WRS's MD&A can be found immediately following the report of the independent auditor.

History of the WRS

The WRS became operative as of January 1, 1945 under Massachusetts General Laws Chapter 32 (M.G.L. c.32). The WRS is a contributory defined benefit plan that covers eligible employees of the City of Worcester (except Worcester Public School teachers) and the Worcester Housing Authority (WHA). The WRS is administered by a five member Board consisting of the City Auditor, two representatives elected from the membership, a City Manager representative and a fifth member chosen by the other four who cannot be an employee, retiree or official of the City. One Board member is elected from the group to serve as Chairman.

Investment Results

The WRS has an Investment Policy Statement which establishes investment objectives and policies providing the framework for investments. This Policy is reviewed on an annual basis. A summary of the Investment Policy is included in the Investment Section. The System uses a custodian bank to safeguard the assets and ensure proper settlement and recording of transactions.

An integral part of the overall Investment Policy is the Asset Allocation Policy. This is designed to provide an optimal mix of asset classes to both preserve principal and provide adequate funds to pay pension benefits. Both traditional assets (cash, bonds, domestic stocks, domestic fixed income and mortgages) and nontraditional assets (real estate, international stock and fixed income, venture capital, mezzanine financing, hedge funds, timber, natural resources, infrastructure and leveraged buyouts) are part of the mix. The investment market results have demonstrated the importance of a diversified asset allocation.

WRS time-weighted investment return of 7.7% for 2016 was greater than both the actuarial expected rate of return and the Investment Policy benchmark. Please refer to the Investment Section of this CAFR for more information on investment results.

Chapter 68 of the Acts of 2007, An Act to Reduce the Stress on Local Property Taxes Through Enhanced Pension Fund Investment, was signed into law July 25, 2007. This Act amends M.G.L. c.32 §22 and directs the Public Employee Retirement Administration Commission (PERAC) to conduct an annual analysis of all Massachusetts public pension plans. The assessment includes the investment performance and funded ratio of each system every January 1st in accordance with the established methodology and standard. Systems failing to meet the standard are mandated to transfer the system's assets to the Massachusetts Pension Reserve Investment Management (PRIM) Board. The WRS met these mandated standards for each year since 2007 and is not subject to the mandatory transfer of system assets.

Major Initiatives

Benefits

A cost-of-living adjustment (COLA) was granted to eligible retirees and survivors effective July 1, 2016. The 3% COLA was paid on a base of $13,000 (maximum $390). The WRS has granted the maximum 3% allowed by law since enactment of the legislation in 1997 in all but one year (2011-2.5%).

Signed into law on November 18, 2011, Chapter 176 of the Acts of 2011 became effective February 16, 2012 and is thought to reform and modernize the pension laws for public employees in Massachusetts. The law creates a new benefit structure for employees hired on or after April 2, 2012. The new age factors established will increase the minimum age for retirement. Calculation of the pension will use a 5 year average and contains anti-spiking provisions for both new members and current employees.

Administration

Chapter 176 of the Acts of 2011 has a number of corporate governance provisions that require the WRS adhere to specific procurement procedures for investment management and related services. The Act also mandates training and financial disclosures of all Board members.

The WRS strives to provide quality service and information to active and retired members and their beneficiaries. To assist in this effort, we maintain and continually update our Internet site through the City web page, which includes our CAFR, at www.worcesterma.gov/retirement-board.

The WRS continues to focus on the education of its members both active and retired and in early 2017 published a newsletter which we hope to continue quarterly. The newsletter is available on our website and has received positive feedback.

Internal and Budgetary Controls

The WRS management is responsible for maintaining a system of internal controls designed to provide reasonable, but not absolute, assurance that the financial statements are fairly stated in accordance with accounting principles generally accepted in the United States of America while adequately safeguarding the assets. We believe the current internal controls accomplish this goal. The concept of reasonable assurance recognizes that the cost of internal controls should not exceed their anticipated benefits (also, the evaluation of costs and benefits requires estimates and judgments by management).

The WRS budget is presented to and approved by the Board each year. All the expenditures are reviewed by the Board at its monthly meeting.

Accounting

This report has been prepared in accordance with accounting principals generally accepted in the United States of America. The basic financial statements are presented in accordance with the principles of the Government Accounting Standards Board (GASB), including guidelines established by GASB Statements No. 34, *Basic Financial Statements – and Management's Discussion and Analysis – for State and Local Governments*; No. 37, *Basic Financial Statements – and Management's Discussion and Analysis – for State and Local Governments; Omnibus*, No. 38, *Certain Financial Statement Note Disclosures*; No. 40 *Deposit and Investment Risk Disclosures (an amendment of GASB No. 3);* No. 63 *Financial Reporting of Deferred Outflows of Resources, Deferred Inflows of Resources, and Net Position;* and No. 67 *Financial Reporting for Pension Plans—an amendment of GASB Statement No. 25*; and No. 82 *Pension Issues*.

CliftonLarsonAllen LLP, a firm of licensed certified public accountants, performed the audit for the WRS. The goal of the independent audit is to provide reasonable assurance that the financial statements for the year ended December 31, 2016 are free of material misstatements. The report of the independent auditors is included in the Financial Section of this report. CliftonLarsonAllen LLP has issued an unqualified opinion on the WRS's basic financial statements for the year ended December 31, 2016.

Actuarial Funding

The WRS has retained the services of The Segal Company, an independent actuarial firm, to conduct an annual actuarial valuation of the WRS. The funded ratio is one measure of the financial condition of the WRS. The funded ratio is calculated by dividing the net position of the WRS by the projected pension liability. The projected pension liability is a measure of the present value of total pension benefits estimated to be payable in the future to both current and future retirees and/or beneficiaries. A higher funding ratio gives the members a greater degree of assurance that their pension benefits are secure. As of January 1, 2017, the funded ratio of the WRS was calculated at 65.71%, a .28% decrease on an actuarial basis from the prior year. On a market value basis the funded ratio has increased from 62.00% to 62.20%.

Acknowledgements

We are pleased to have once again completed this report in accordance with the GFOA Certificate of Achievement guidelines. We are proud to provide an annual report to our members that is both easy to read and comprehensive. We feel it is important to provide a CAFR for our members and other interested parties to follow the progress of the WRS. The publication of this report represents the combined efforts of the WRS staff, auditor, actuary, and investment consultants. We would like to acknowledge and thank them for their hard work and collaboration.

Respectfully submitted,

Elizabeth A. Early
Executive Secretary

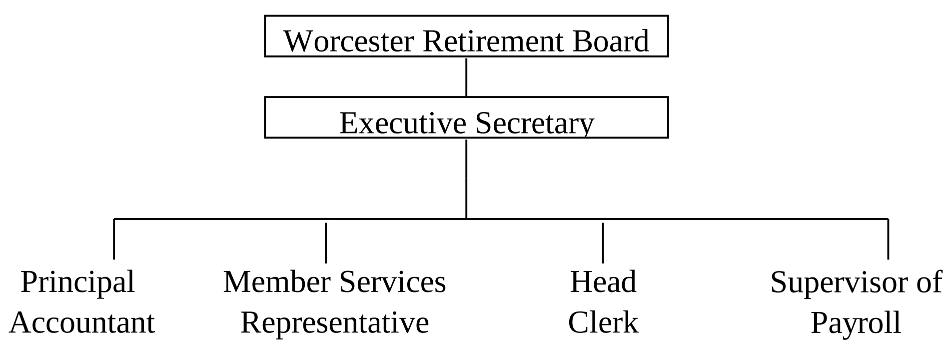
Retirement Board Members

		Terms
Robert V. Stearns	Ex-Officio Member	01/08/2017 - 01/07/2020
Stephen F. Wentzell	City Manager Appointee	At the discretion of the City Manager
Elizabeth A. Early	Elected Member	11/01/2016 - 10/31/2019
John F. Mahan	Elected Member	01/01/2015 - 12/31/2017
Thomas Wade	Appointed Member	01/09/2015 - 01/08/2018

Administrative Staff

Elizabeth A. Early	Executive Secretary
Desiree Sutton	Principal Accountant
Lisa Poske	Supervisor of Payroll
Eileen Powers	Head Clerk
Breanna Barney	Member Services Representative

Organizational Chart*



* Does not include investment professionals who provide services to the WRS. A list of these investment professionals is located on the following page. In addition, please refer to the Schedule of Fees and Commissions located within the Investment Section of this report starting on page 52.

CONSULTANTS AND PROFESSIONAL SERVICES

DOMESTIC EQUITY MANAGERS
LMCG
Boston, MA
Nichols Asset Management, LLC
Sudbury, MA
State Street Global Advisors
Boston, MA

DOMESTIC FIXED INCOME MANAGERS
Income Research & Management
Boston, MA
Loomis Sayles & Company, L.P.
Boston, MA

INTERNATIONAL EQUITY MANAGERS
Acadian Asset Management
Boston, MA
Dimensional Fund Advisors
Austin, TX
Lazard Asset Management
New York, NY
State Street Global Advisors
Boston, MA

ALTERNATIVE CAPITAL INVESTMENT MANAGERS
American Securities Partners
New York, NY
Ascent Venture Management
Boston, MA
Boston Capital Ventures
Boston, MA
Boston Millennia Partners
Boston, MA
Capital International Private Equity Fund
Irvine, CA
Charlesbank Capital Partners
Boston, MA
Global Infrastructure Partners
New York, NY
Harvest Partners, LLC
New York, NY
INVESCO Private Capital, Inc.
Atlanta, GA
Mass PRIM
Boston, MA
Newstone Capital Partners, L.P.
Los Angeles, CA
Northstar Capital, LLC
Minneapolis, MN
Ridgemont Equity Partners
Charlotte, NC
Standard Life Investments Limited
Edinburgh, UK
T.A. Associates
Boston, MA
The Riverside Company
New York, NY
Vitruvian Partners
London, England
White Deer Energy TE L.P.
Houston, TX
William Blair
Chicago, IL

REAL ESTATE MANAGERS
AEW Capital Management, L.P.
Boston, MA
Ares Management, LLC
Atlanta, GA
Hancock Timber Resource Group
Boston, MA
Intercontinental Real Estate Corp.
Boston, MA
INVESCO Core Real Estate
Dallas, TX
Mass PRIM
Boston, MA
RMK Timberland a div. of Regions Bank
Atlanta, GA

HEDGE FUNDS
Mass PRIM
Boston, MA

LEGAL ADVISORS
The Law Offices of Michael Sacco
Southampton, MA

DISABILITY INSURANCE CONSULTANTS
Disability Management Services, Inc.
Springfield, MA

INDEPENDENT AUDITORS
CliftonLarsonAllen LLP
Lexington, MA

INVESTMENT ADVISORS
Meketa Investment Group
Westwood, MA

ACTUARIAL CONSULTANT
The Segal Company
Boston, MA

CUSTODIAN
State Street Corporation
Boston, MA

COMMISSION RECAPTURE BROKERS
BNY ConvergEx Group
New York, NY

SECURITIES LENDING
State Street Corporation
Boston, MA

Government Finance Officers Association

Certificate of Achievement for Excellence in Financial Reporting

Presented to

Worcester Retirement System

Massachusetts

For its Comprehensive Annual
Financial Report
for the Fiscal Year Ended

December 31, 2015

Executive Director/CEO

Financial Section

Independent Auditors' Report

To the Honorable Retirement Board
Worcester Retirement System

We have audited the accompanying financial statements of the Worcester Retirement System (WRS), a component unit of the City of Worcester, Massachusetts, as of and for the year ended December 31, 2016, and the related notes to the financial statements, as listed in the table of contents.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with accounting principles generally accepted in the United States of America; this includes the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditors' Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements referred to above present fairly, in all material respects, the fiduciary net position of the WRS as of December 31, 2016, and the respective changes in fiduciary net position for the year then ended in accordance with accounting principles generally accepted in the United States of America.

Other Matters

Required Supplementary Information

Accounting principles generally accepted in the United States of America require that the management's discussion and analysis (located on pages 13 through 17), schedule of changes in employers' net pension liability and related ratios, schedule of employer contributions and schedule of investment returns (located on page 32 through 33) be presented to supplement the basic financial statements. Such information, although not a part of the basic financial statements, is required by the Governmental Accounting Standards Board who considers it to be an essential part of financial reporting for placing the basic financial statements in an appropriate operational, economic, or historical context. We have applied certain limited procedures to the required supplementary information in accordance with auditing standards generally accepted in the United States of America, which consisted of inquiries of management about the methods of preparing the information and comparing the information for consistency with management's responses to our inquiries, the basic financial statements, and other knowledge we obtained during our audit of the basic financial statements. We do not express an opinion or provide any assurance on the information because the limited procedures do not provide us with sufficient evidence to express an opinion or provide any assurance.

Other Information

Our audit was conducted for the purpose of forming an opinion on the WRS' financial statements. The supplementary information, introductory section, investment section, actuarial section and statistical section are presented for purposes of additional analysis and are not a required part of the financial statements.

The supplementary information is the responsibility of management and was derived from and relates directly to the underlying accounting and other records used to prepare the basic financial statements. Such information has been subjected to the auditing procedures applied in the audit of the basic financial statements and certain additional procedures, including comparing and reconciling such information directly to the underlying accounting and other records used to prepare the basic financial statements or to the basic financial statements themselves, and other additional procedures in accordance with auditing standards generally accepted in the United States of America. In our opinion, the supplementary information is fairly stated, in all material respects, in relation to the basic financial statements as a whole.

The introductory section, investment section, actuarial section and statistical section have not been subjected to the auditing procedures applied in the audit of the basic financial statements, and accordingly, we do not express an opinion or provide any assurance on them.

Other Reporting Required by *Government Auditing Standards*

In accordance with *Government Auditing Standards*, we have also issued our report dated June 23, 2017, on our consideration of the WRS' internal control over financial reporting and on our tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements and other matters. The purpose of that report is to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing, and not to provide an opinion on internal control over financial reporting or on compliance. That report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering WRS' internal control over financial reporting and compliance.

CliftonLarsonAllen LLP

CliftonLarsonAllen LLP
Boston, MA
June 23, 2017

Management's Discussion & Analysis

Our discussion and analysis of the Worcester Retirement System's (WRS) financial performance provides an overview of the WRS's financial activities for the fiscal year ended December 31, 2016. Please read it in conjunction with the transmittal letter in the Introductory Section, at the front of this report, and the financial statements that follow this discussion. The Management's Discussion and Analysis (MD&A) is intended to serve as an introduction to the WRS's financial statements, as well as to offer readers of the WRS's financial statements a narrative view and analysis of the WRS's financial activities.

Financial Highlights

The WRS's funding objective is to meet long-term benefit obligations through contributions and investment income. As of December 31, 2016, the funded ratio was 65.71% based on the actuarial value of assets at that date.

Net position increased during the year by $39.5 million or 5.0%, because of positive investment returns. Net position is the residual of the WRS's assets in excess of the WRS's liabilities as of the statement date. The WRS's assets are held in trust to meet future benefit payments.

Total investment returns were $58.7 million. The time weighted investment return was 7.7%, exceeding the actuarial benchmark of 7.375%, and the return of -1.6% in the previous year.

Overview of the Financial Statements

The financial statements are comprised of a Statement of Fiduciary Net Position, Statement of Changes in Fiduciary Net Position, Notes to the Financial Statements and Required Supplementary Information.

The ***Statement of Fiduciary Net Position*** presents information on the WRS's assets and liabilities and the resulting net position restricted for pensions. This is calculated using the following formula: Assets – Liabilities = Net Position restricted for pensions. This statement reflects the WRS's investments at fair value, as well as cash, receivables and other assets and liabilities. The Statement of Fiduciary Net Position reports the financial position of the WRS at December 31, 2016. Over time, the increase or decrease in net position serves as a useful indicator of the WRS's financial health.

The ***Statement of Changes in Fiduciary Net Position*** presents information showing how the WRS's net position restricted for pensions changed during the year ended December 31, 2016. It reflects contributions by members and participating employers along with deductions for retirement benefits, refunds, withdrawals, and administrative expenses. Investment income during the period is also presented showing income from investing and securities lending activities.

Management's Discussion & Analysis

The ***Notes to the Financial Statements*** provide additional information that is essential for the reader to gain a full understanding of the data provided in the financial statements.

The ***Required Supplementary Information*** includes this MD&A and schedules of the net pension liability and changes in the net pension liability, contributions and investment returns.

Financial Analysis

The WRS's total assets as of December 31, 2016 were $847 million and were primarily comprised of cash and cash equivalents, receivables, and investments. Total assets increased $30.8 million, or 3.8%, from the prior year primarily due to investment returns.

Total liabilities as of December 31, 2016 were $9.4 million and were primarily comprised of collateral held under securities lending arrangements and amounts due to the Commonwealth of Massachusetts and other systems. Total liabilities decreased by $8.7 million from the prior year.

The following tables present current and prior year data on the WRS's financial statements.

Fiduciary Net Position

Net position of the WRS were $837.3 million at the close of the fiscal year, summarized as follows:

Statement of Fiduciary Net Position
(In thousands of dollars)

Assets	**2016**	**2015**
Cash and cash equivalents	$ 4,600	$ 3,796
Investments	834,417	795,705
Securities lending short-term collateral investment pool	5,692	14,577
Receivables:		
Interest due and accrued	599	532
Due from Commonwealth of Massachusetts and other systems	712	1,244
Receivable for securities sold	594	15
Other	161	87
Total assets	846,775	815,956
Liabilities		
Accounts payable and accrued expenses	310	300
Due to Commonwealth of Massachusetts and other systems	3,027	2,257
Payable for securities purchased	401	992
Collateral held on securities lending transactions	5,692	14,577
Total liabilities	9,430	18,126
Net position restricted for pensions	$ 837,345	$ 797,830

Management's Discussion & Analysis

Changes in Fiduciary Net Position

The WRS's total net position increased by $39.5 million during the current fiscal year and is summarized as follows:

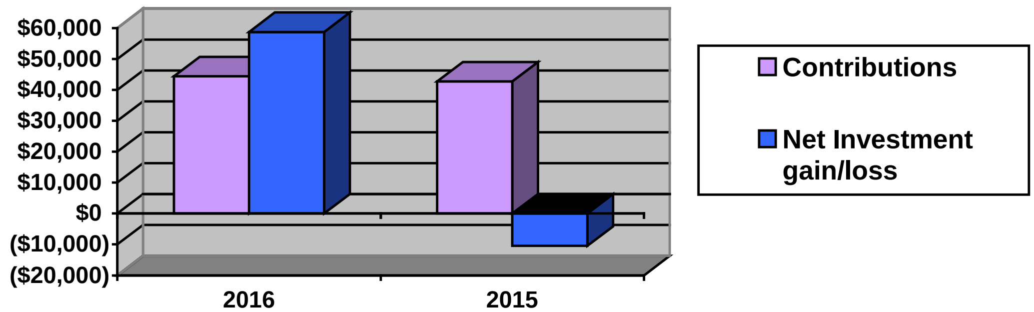
Statement of Changes in Fiduciary Net Position
(In thousands of dollars)

	2016	2015
Additions		
Contributions:		
Employers	$ 44,412	$ 42,704
Members	17,798	17,409
Net investment income:		
Interest and dividends	14,730	8,575
Securities lending income	38	62
Net realized and unrealized gains (losses)	49,304	(14,003)
Less: management fees	(5,307)	(5,091)
Less: borrower rebates & fees	(27)	(33)
Other	1,855	1,809
Total additions	122,803	51,432
Deductions		
Benefits payments to plan members and beneficiaries	77,848	74,243
Reimbursements to other systems	3,027	2,258
Refunds and transfers of plan member accounts to other systems	1,847	2,161
Administrative expenses	566	573
Total deductions	83,288	79,235
Change in net position	39,515	(27,803)
Net position restricted for pensions:		
Beginning of year	797,830	825,633
End of year	$ 837,345	$ 797,830

Additions to Fiduciary Net Position

The amount needed to finance benefits is accumulated through the collection of employers' and plan members' contributions, reimbursements from the Commonwealth of Massachusetts for pre-1998 COLA's and through earnings on investments. Contributions and net investment gains for calendar year 2016 resulted in total gains to net position of $122.8 million. Employers' contributions increased by $1.7 million in 2016. The WRS had a net investment gain of $58.7 million in 2016 versus a loss of $10.5 million in 2015.

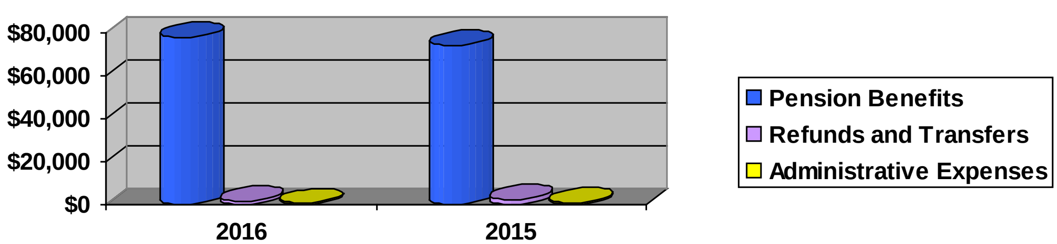
Additions to Plan Net Position
(in thousands of dollars)



Deductions from Fiduciary Net Position

The primary deductions of the WRS include the payment of pension benefits to participants and beneficiaries, refunds of contributions, and the costs of administering the WRS. Total deductions from net position for 2016 were $83.3 million, which represents an increase of 5.1% over deductions of $79.2 million in 2015. The payment of pension benefits increased by $3.6 million, or 4.9%, over the previous year. The increase in these expenses resulted from an increase in benefit payments to newer retirees with higher average compensation and a small increase in the number of pensioners and beneficiaries.

Deductions from Plan Net Position
(in thousands of dollars)



Management's Discussion & Analysis

Overall Financial Position of WRS

Due to strong returns in the financial markets, the WRS has experienced an increase in its investment portfolio for the fiscal year ending December 31, 2016. Management believes the WRS is in a solid financial position and will be able to meet its obligations.

Contacting WRS's Financial Management

This financial report is designed to provide the Board, our membership, taxpayers, investors, and creditors with a general overview of the WRS's financial results and to demonstrate WRS's accountability for the funding it receives. If you have any questions about this report or need additional financial information, contact the Worcester Retirement System, City Hall Room 103, 455 Main Street, Worcester, Massachusetts 01608.

WORCESTER RETIREMENT SYSTEM
(A Component Unit of the City of Worcester, Massachusetts)
Statement of Fiduciary Net Position
December 31, 2016

Assets		
Cash & Cash Equivalents	$	4,599,611
Investments:		
Equities		11,236,496
Fixed Income		103,086,027
Pooled Equities		321,449,471
Pooled Fixed Income		72,242,242
External Investment Pool		54,496,590
Real Estate		133,514,184
Alternative Investments		138,391,814
Total investments		834,416,824
Securities lending short-term collateral investment pool		5,692,143
Receivables:		
Accrued interest and dividends		599,072
Due from Commonwealth of Massachusetts and other systems		712,033
Receivable for securities sold		594,582
Other		160,590
Total receivables		2,066,277
Total assets		846,774,855
Liabilities		
Accounts payable and accrued expenses		309,549
Due to Commonwealth of Massachusetts and other systems		3,027,024
Payable for securities purchased		401,428
Collateral held on securities lending transactions		5,692,143
Total liabilities		9,430,144
Net position restricted for pensions	$	837,344,711

See the accompanying Notes to Financial Statements.

WORCESTER RETIREMENT SYSTEM
(A Component Unit of the City of Worcester, Massachusetts)
Statement of Changes in Fiduciary Net Position
Year ended December 31, 2016

Additions:		
Contributions:		
Employers	$	44,411,990
Members		17,797,519
Total contributions		62,209,509
Investment income:		
Interest and dividends		14,730,252
Securities lending income		37,825
Net realized and unrealized gains		49,304,368
Less: management fees		(5,307,309)
Less: borrower rebates and fees under securities lending program		(27,242)
Net investment income		58,737,894
Other		1,854,736
Total additions		122,802,139
Deductions:		
Benefit payments to plan members and beneficiaries		77,848,021
Reimbursements to other systems		3,027,024
Refunds and transfers of plan member accounts to other systems		1,846,784
Administrative expenses		565,669
Total deductions		83,287,498
Net increase in net position		39,514,641
Net position restricted for pensions:		
Beginning of year		797,830,070
End of year	$	837,344,711

See the accompanying Notes to Financial Statements.

Notes to Financial Statements
December 31, 2016

1. _Summary of Significant Accounting Policies

(a) Financial Reporting Entity

Because of the significance of its operational and financial relationship with the City of Worcester, Massachusetts (City), the Worcester Retirement System (WRS) is included as a blended component unit in the City's financial statements.

(b) Basis of Accounting

The accompanying financial statements are presented on the accrual basis of accounting.

(c) Revenue Recognition

Contributions are recognized as additions in the period when they become due pursuant to formal commitments, statutory or contractual requirements. Investment income is recognized when earned.

(d) Benefits and Refunds

Benefits and refunds to WRS members and beneficiaries are recognized as deductions when due and payable in accordance with the terms of the WRS.

(e) Cash and Investments

Cash is considered to be cash on hand, demand deposits and short-term investments with an original maturity of three months or less from the date of acquisition.

Investments are reported at fair value; with the exception of money market mutual funds which are reported at amortized cost. Fair values of investments are based on quotations from a national securities exchange except for pooled funds, alternative investments and real estate investments, for which fair values are estimated as detailed below.

Pooled Funds

The fair value of shares in managed investment pools is based on unit values reported by the funds.

Alternative Investments

Alternative investments are recorded at fair value as determined in good faith by the investment firms (such as general partners of venture capital firms) after consideration of pertinent information, including current financial position and operating results, price-earnings multiples and available market prices of similar securities, the nature of securities, marketability, restrictions on disposition and other appropriation and do not necessarily represent amounts which might ultimately be realized, since such amounts depend on future circumstances and cannot reasonably be determined until individual securities are liquidated.

Real Estate

The fair value of real estate funds is based on independent third-party appraisals. The investment managers of the funds are responsible for the reported value of those investments. However, because of the inherent uncertainty of valuation, those estimated values may differ significantly from the values that would have been used had a ready market for the real estate existed, and the differences could be material.

(f) Basis of Investment Transactions

Purchases and sales of investments are recorded on the trade date. Transactions remaining unsettled as of year-end are recorded as payables for securities purchased and as a receivable for securities sold.

(g) Use of Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities at the date of the financial statements and the reported amounts of additions and deductions during the reporting period. Fair values of real estate funds and venture capital funds have been estimated in the absence of readily available fair values, and these estimates may be materially different than values that would have been used had a ready market existed.

(h) Administrative Expenses

Administrative expenses are financed by investment income.

2. Plan Description

(a) General

The WRS is a cost-sharing multiple-employer public employee retirement system established by the City on June 12, 1944, under Massachusetts General Laws (MGL), Chapter 32, and is regulated by the Massachusetts Public Employee Retirement Administration Commission (PERAC). The WRS is a defined benefit pension plan that covers certain eligible employees of the City and the Worcester Housing Authority.

Membership in the WRS is mandatory immediately upon the commencement of employment for all permanent full-time employees working at least 20 hours weekly, except for City school teachers and school administrators, who participate in the Massachusetts Teachers' Retirement System.

Membership in the WRS was as follows at December 31, 2016:

Active employees	3,342
Pensioners and beneficiaries	2,728
Inactive employees not entitled to or not receiving benefits	659
Inactive employees entitled to or receiving benefits	96
Total members	6,825
Number of participating employers	2

The WRS is administered by a five-person Retirement Board (the Board) consisting of the City Auditor, who serves *ex-officio*; two members who are elected by the participants in or retired from the service of the WRS; a fourth member appointed by the City Manager; and a fifth member appointed by the other members.

(b) Significant Plan Provisions and Requirements

Benefit provisions and state law establishes contribution requirements of the WRS. Members of the WRS become vested after 10 years of creditable service. Normal retirement occurs at age 65 (age 67 if hired on or after April 2, 2012), except for special situations and the City's police officers and firefighters, whose normal retirement age is 55 (age 57 if hired on or after April 2, 2012).

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 (1) the number of years and full months of creditable service at the time of retirement and (2) a percentage based on age at retirement in accordance with a schedule provided by state law. Assuming normal retirement at age 65, this percentage is 2.5%, which is reduced for individuals who retire prior to age 65 to reflect the longer pay out period. 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 or after April 2, 2012, the annual amount of the retirement allowance is based on the member's final five-year average salary multiplied by (1) the number of years and full months of creditable service at the time of retirement and (2) a percentage based on age at retirement in accordance with a schedule provided by state law. Assuming normal retirement at age 67, this percentage is 2.5%. 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.

Employees may elect early retirement after 20 years of service or at any time after attaining age 55 (age 60 if hired on or after April 2, 2012) with 10 years of eligible service. Plan members who become permanently and totally disabled may be eligible to receive a disability retirement allowance. The amount of benefits to be received depends on several factors, including the member's age, compensation, veteran status, years of service and whether or not the disability is work-related. In addition, certain death benefits exist for beneficiaries of employees who die in active service.

Under MGL, c.32 Section 3(8)(c), members leaving the City's employment to work for other Massachusetts governmental units requires the WRS transfers their accumulated account balances and creditable service to the retirement system of their new employer. Other such retirement systems are in turn required to make comparable transfers to the WRS for employees coming to work at the City or the Worcester Housing Authority. Per statute, the PERAC actuary shall consider length of service as well as acceptance of military service credit and salary cap provisions if applicable in calculating the liability.

3. Deposits and Investments

Investment Policy

Deposits and investments made by the WRS are governed by the MGL c.32. The WRS has the ability to invest in equity securities, corporate bonds, annuities and other specified investments in accordance with state laws and regulations.

The Board has the authority for establishing and amending investment policy decisions by majority vote. Asset allocation policies allocate investments across those asset classes that, based on historical and expected returns and risks, provide the highest likelihood of meeting the WRS's investment objectives. The Board has specifically indicated those asset classes that may be utilized when investing the WRS's assets. The Board specifies a long-term target allocation for each class of permissible assets expressed as a percentage of the WRS's overall fair value, surrounded by a band of permissible variation resulting from market forces. On at least an annual basis, if any strategic allocation is outside the specified target range, assets will be shifted to return the strategy to the target range. The specific plan for rebalancing will identify those assets that can be shifted at the lowest possible risk and cost, if the rebalancing cannot be accomplished solely by allocating contributions and withdrawals. Permanent changes in the WRS's target asset allocation will take place only in response to significant changes in the objectives and constraints of the WRS, or in response to material changes in the fundamental nature or appropriateness of the asset classes themselves. The following was the asset allocation policy as of December 31, 2016:

Asset Class	Target	Range
Domestic Equity	22%	17-27%
International Developed Market Equity	12%	7-17%
International Emerging Market Equity	9%	5-13%
Investment Grade Bonds	9%	6-12%
Treasury Inflation-Protected Securities (TIPS)	5%	2-8%
High Yield Bonds / Bank Loans	4%	1-7%
Emerging Market Debt	3%	1-5%
Real Estate	10%	5-15%
Timber	3%	2-4%
Private Equity	10%	7-13%
Hedge Funds	2%	0-4%
Global Tactical Asset Allocation	7%	4-10%
Infrastructure	2%	0-3%
Natural Resources	2%	1-3%
Cash	0%	< 5%

Rate of Return

For the year ended December 31, 2016, the annual money-weighted rate of return on pension plan investments, net of pension plan investment expense, was 7.87%. The money-weighted rate of return expresses investment performance, net of investment expense, adjusted for the changing amounts actually invested.

Deposits - Custodial Credit Risk

Custodial credit risk for deposits is the risk that, in the event of a bank failure, the WRS's deposits may not be recovered. The WRS's policy for custodial credit risk of deposits is to rely on FDIC insurance coverage for the first $250,000 of deposits held at each financial institution. As of December 31, 2016, the WRS's bank balance of $566,139 was not exposed to custodial credit risk.

Investments Summary

The WRS's investments at December 31, 2016 are presented below. All investments are presented by investment type, with debt securities presented by maturity (using segmented time distribution).

		Investment Maturities (in Years)			
Investment Type	Total Amount	Less Than 1	1 - 5	6 - 10	More Than 10
Debt Securities:					
U.S. Treasuries	$ 45,434,802	$ 1,000	$ 18,564,168	$ 21,484,894	$ 5,384,740
U.S. Agencies	18,637,757	-	1,294,101	-	17,343,656
Corporate bonds	24,464,358	503,825	5,852,677	10,674,570	7,433,286
Money market mutual funds	4,558,204	4,558,204	-	-	-
Securities lending short-term collateral investment pool	5,692,143	5,692,143	-	-	-
External investment pool	54,496,590	54,496,590	-	-	-
Fixed income mutual funds	72,242,242	72,242,242	-	-	-
Mortgage backed securities	8,425,592	-	30,751	-	8,394,841
Asset backed securities	6,123,518	-	3,785,359	1,192,171	1,145,988
Total debt securities	$ 240,075,206	$ 137,494,004	$ 29,527,056	$ 33,351,635	$ 39,702,511
Other Investments:					
Equity securities	11,236,496				
Equity mutual funds	321,449,471				
Real estate investments	133,514,184				
Alternative investments	138,391,814				
Total other investments	604,591,965				
Total investments	$ 844,667,171				

Investments - Interest Rate Risk of Debt Securities

Interest rate risk for debt securities is the risk that changes in interest rates of debt securities will adversely affect the fair value of an investment. The WRS's policies for interest rate risk intend that the average duration of investments remain fairly stable over time and be focused in the intermediate range. The WRS's debt security managers are not permitted to make large-scale changes in portfolio duration in an attempt to anticipate interest rate changes. However, they are permitted to shift portfolio duration within a limited range (defined by their guidelines) in an effort to enhance performance.

Investments - Custodial Credit Risk

Custodial credit risk for investments is the risk that, in the event of the failure of the counterparty, the WRS will not be able to recover the value of its investments or collateral securities that are in the possession of an outside party. The WRS's policy for custodial credit risk of investments intends that all investments are either insured and/or registered in the name of the WRS.

Investments - Credit Risk of Debt Securities

Credit risk for debt securities is the risk that an issuer or other counterparty to a debt security will not fulfill its obligations. The WRS does not have a policy for credit risk of debt securities. As of December 31, 2016, the credit quality ratings of the WRS's debt securities are summarized as follows:

	Investment Type								
Quality Ratings *	U.S. Agencies	Corporate Bonds	Money Market Mutual Funds	Securities Lending Pool	Fixed Income Mutual Funds	External Investment Pool	Mortgage Backed Securities	Asset Backed Securities	Total Amount
AAA………………	$ 193,509	$ 1,542,350	$ -	$ -	$ -	$ -	$ 4,209,698	$ 1,584,623	$ 7,530,180
AA+………………	-	941,373	-	-	-	-	359,053	-	1,300,426
AA………………	1,464,059	207,779	-	-	-	-	-	-	1,671,838
AA-………………	302,503	3,057,724	-	-	-	-	-	-	3,360,227
A+………………	222,583	637,507	-	-	-	-	-	-	860,090
A………………	-	2,727,234	-	-	-	-	-	-	2,727,234
A-………………	-	3,001,073	-	-	-	-	-	-	3,001,073
BBB+………………	-	7,431,495	-	-	-	-	-	-	7,431,495
BBB………………	-	3,676,502	-	-	-	-	-	-	3,676,502
BBB-………………	-	1,241,321	-	-	-	-	-	-	1,241,321
Unrated……………	15,437,938	-	4,558,204	5,692,143	72,242,242	54,496,590	3,856,841	4,538,895	160,822,853
Total………………	$ 17,620,592	$ 24,464,358	$ 4,558,204	$ 5,692,143	$ 72,242,242	$ 54,496,590	$ 8,425,592	$ 6,123,518	$ 193,623,239

* Per the rating scale of Standard & Poors, a national credit rating organization

Deposits and Investments – Foreign Currency Risk

Foreign currency risk is the risk that fluctuations in exchange rates will adversely affect the fair value of an investment or a deposit. The WRS's policy is to limit investments in non-U.S. dollar-denominated securities to not exceed 10% of the total fair value of investments at all times. As of December 31, 2016, the WRS had no exposure to foreign currency risk.

Investments – Concentration of Credit Risk

Concentration of credit risk is the risk of loss attributed to the magnitude of the WRS's investment in a single issuer. The WRS's policy for concentration of credit risk instructs investment managers not to invest more than 5% of their portfolio at fair value in a single security, or in the securities of a single issuer or its subsidiaries. U.S. Treasury, U.S. government agency, mutual fund and pooled fund investments are exempted from this restriction. As of December 31, 2016, the WRS was not exposed to concentration of credit risk.

Investments – Fair Value

The System categorizes its fair value measurements within the fair value hierarchy established by generally accepted accounting principles. The hierarchy is based on the valuation inputs used to measure the fair value of the asset. Level 1 inputs are quoted market prices in active markets for identical assets; Level 2 inputs are significant other observable inputs; Level 3 inputs are significant unobservable inputs. The System has the following recurring fair value measurements as of December 31, 2016:

		Fair Value Measurements Using		
Investments by Fair Value Level	Fair Value	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Debt Securities:				
U.S. Treasuries	$ 45,434,802	$ 45,434,802	$ -	$ -
U.S. Agencies	18,637,757	18,637,757	-	-
Corporate bonds	24,464,358	24,464,358	-	-
Fixed income mutual funds	72,242,242	72,242,242	-	-
Mortgage backed securities	8,425,592	8,425,592	-	-
Asset backed securities	6,123,518	6,123,518	-	-
Total Debt Securities	175,328,269	175,328,269	-	-
Equity Securities:				
Equity securities	11,236,496	11,236,496	-	-
Equity mutual funds	261,786,435	261,786,435	-	-
Total Equity Securities	273,022,931	273,022,931	-	-
Total Investments by Fair Value Level	448,351,200	$ 448,351,200	$ -	$ -
Investments measured at the net asset value (NAV)				
Private equities	70,717,136			
Macro allocation collective investment fund	47,713,081			
Real estate	133,514,184			
External investment pool (PRIT)	54,496,590			
Pooled hedge funds (PRIT)	19,537,642			
Pooled international equities fund (PRIT)	59,663,036			
Other pooled funds (PRIT)	423,955			
Investments measured at the net asset value (NAV)	386,065,624			
Total Investments measured at Fair Value	$ 834,416,824			

Debt and equity securities classified in Level 1 of the fair value hierarchy are valued using prices quoted in active markets for those securities.

	Fair Value	Unfunded Commitments	Redemption Frequency	Redemption Notice Period
Private equities (1)	$ 70,717,136	50,796,078	N/A(1)	N/A(1)
Macro allocation collective investment fund (2)	47,713,081	-	N/A(2)	N/A(2)
Real estate (3)	133,514,184	3,936,787	N/A(3)	N/A(3)
External investment pool (PRIT) (4)	54,496,590	7,338,564	N/A(4)	N/A(4)
Pooled hedge funds (PRIT) (5)	19,537,642	-	N/A(5)	N/A(5)
Pooled international equities fund (PRIT) (6)	59,663,036	-	N/A(6)	N/A(6)
Other pooled funds (PRIT) (7)	423,955	7,050,974	N/A(7)	N/A(7)
Total Investments measured at NAV	$ 386,065,624			

(1) *Private equities* - This investment type includes investments in 36 private equity funds that invest primarily in private domestic and international companies of diversified industries. The fair value measurements of this type have been determined using the NAV per share (or its equivalent) of the System's ownership interest in partners' capital. These investments are illiquid. Distributions from each fund will be received as the underlying investments of the funds are liquidated. For approximately 38 percent of the investments it is expected that the underlying assets of the funds will be liquidated over the next 1 to 5 years. For the remaining investments, it is expected that the underlying assets of the funds will be liquidated over the next 5 to 10 years.

(2) *Macro Allocation Collective Investment Fund* – This investment type consists of one fund that seeks to maximize its long-term risk adjusted total return through investments in equity, fixed income, commodities, real estate, and currencies. These investments can be redeemed with three days' notice.

(3) *Real estate* - This investment type includes investments in 9 funds that invest primarily in real estate and North American timberlands. The fair value measurements of this type have been determined using the NAV per share (or its equivalent) of the System's ownership interest in partners' capital. Approximately 80 percent of these investments can be redeemed on the first business day of the quarter following 45 days' notice. The remaining investments are illiquid. Distributions from each fund will be received as the underlying investments of the funds are liquidated. It is expected that the underlying assets of the funds will be liquidated over the next 1 to 6 years.

(4) *External investment pool (PRIT)* - The System is a participating retirement system in the PRIT fund. The System owns units, or shares in the PRIT fund, which is a pooled investment trust. The investments made by the System are governed by Chapter 32 of the MGL. The fair values of the investments in this type have been determined using the NAV per share (or its equivalent) of the System's ownership in the pool. The investments can be redeemed monthly on the first day of the month with one day's notice.

(5) *Pooled hedge funds (PRIT)* – This investment type consists of pooled diversified hedge funds using strategies including fund of funds, direct funds, and separately managed mandates. The fair values of the investments in this type have been determined using the NAV per share (or its equivalent) of the System's ownership in the pool. The investments can be redeemed monthly on the first day of the month with one day's notice.

(6) *Pooled international equities (PRIT)* - This investment type consists of pooled international equities of emerging and frontier market securities portfolios. The fair values of the investments in this type have been determined using the NAV per share (or its equivalent) of the System's ownership in the pool. The investments can be redeemed monthly on the first day of the month with one day's notice.

(7) *Other pooled funds (PRIT)* – This investment type consists one fund of pooled private equities and venture capital investments diversified by region, industry, and sector. The fair values of the investments in this type have been determined using the NAV per share (or its equivalent) of the System's ownership in the pool. The investments are illiquid. Distributions from the fund will be received as the underlying investments of the fund are liquidated. It is expected that the underlying assets of the funds will be liquidated over the next 7 to 10 years.

4. Securities Lending Transactions

PERAC has issued supplemental regulations that permit the WRS to engage in securities lending transactions. These transactions are conducted by the WRS's custodian, who lends certain securities owned by the WRS to other broker-dealers and banks pursuant to a form of loan agreement. The WRS and the borrowers maintain the right to terminate all securities lending transaction on demand.

The custodian lends, at the direction of the lending agent, the WRS's securities and cash received (including both U.S. and foreign currency), U.S. government securities, sovereign debt of foreign countries, and irrevocable bank letters of credit as collateral. The custodian does not have the ability to pledge or sell collateral unless the borrower defaults. Borrowers are required to deliver cash collateral in amounts equal to not less than 105% of the fair value of foreign securities on loan and 102% of the fair value of domestic securities on loan (Required Collateral Level). If at any time the fair value of the collateral for any loan decreases to 100% or less of the fair value of the loaned securities, borrowers are required to provide additional collateral sufficient to increase the fair value of the collateral to at least the Required Collateral Level.

The WRS does not impose any restrictions on the amount of securities lent on its behalf by the custodian. There were no failures by any borrowers to return loaned securities or pay distributions thereon, nor were there any losses from default of the borrowers or the custodian for the year ended December 31, 2016. The cash collateral received on each loan was invested; together with the cash collateral of other qualified tax-exempt plan lenders, in a collective investment pool. The relationship between the average maturities of the investment pool and loans was affected by the maturities of the loans made by other plans that invested cash collateral in the collective investment pool, which the WRS could not determine. At December 31, 2016, the WRS had no credit risk exposure to borrowers because the amounts the WRS owed the borrowers exceeded the amounts owed the WRS. The cash and non-cash collateral held and the fair value of the securities on loan for the WRS at December 31, 2016 and 2015 was $5,816,272 and $5,692,143 and $15,019,980 and $14,577,328, respectively. Borrower rebates and fees paid to the broker were $27,242 for the year ended December 31, 2016.

5. Funding Policy

Chapter 32 of MGL governs the contributions of plan members and the City. Depending on their employment date, active System members must contribute anywhere between 5%-9% of their gross regular compensation. Members hired after December 31, 1978 must contribute an additional 2% of regular compensation in excess of $30,000. 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%. These deductions earn interest at a rate determined by PERAC that vests based upon years of service. Employers are required to pay into the WRS its share of the system-wide actuarial determined contribution that is apportioned among the employers based on annual covered payroll. For the year ended December 31, 2016, active member contributions totaled $17,797,519 and employer contributions totaled $44,411,990.

Contributions are recognized as additions in the period when they become due pursuant to formal commitments, statutory or contractual requirements. Benefits and refunds are recognized as deductions when incurred and administrative expenses are funded through investment earnings.

Except for a portion of benefits owed due to cost-of-living adjustments granted through June 30, 1998, member employers are required to contribute the remaining amounts necessary to finance benefits. Member employer contributions are determined by the annual actuarial valuation.

COLA's granted through June 30, 1998 are reimbursed by the Commonwealth of Massachusetts (the Commonwealth). COLA's granted subsequent to June 30, 1998 must be granted by the Board and are the responsibility of the WRS. COLA may be approved in excess of the Consumer Price Index but not to exceed 3% of the base retirement allowance.

A cost-of-living adjustment (COLA) was granted to eligible retirees and survivors effective July 1, 2016. The 3% COLA was paid on a base of $13,000 (maximum $390). The WRS has granted the maximum 3% allowed by law since enactment of the legislation in 1997 in all but one year (2011-2.5%).

6. Net Pension Liability

The components of the net pension liability of the WRS at December 31, 2016, were as follows:

Total pension liability	$ 1,346,266,105
Plan fiduciary net position	(837,344,711)
WRS's net pension liability	$ 508,921,394
Plan fiduciary net position as a percentage of the total pension liability	62.20%

Actuarial Assumptions

The total pension liability was determined by an actuarial valuation as of January 1, 2017, using the following actuarial assumptions, applied to all periods included in the measurement:

Amortization method	Level payments on the 2002 and 2010 ERI liability; total appropriation increases 6.3% per year, beginning with the fiscal 2019 payment
Remaining amortization period	1 year from July 1, 2017 for the 2002 ERI liability, 4 years from July 1, 2017 for the 2010 ERI liability and 16 years from July 1, 2017 for the remaining unfunded liability
Asset valuation method	5-year smoothed fair value
Inflation	2.5% for 2017 and 3.5% per year thereafter
Salary increases	3.5% for 2017 and 4.5% per year thereafter
Investment rate of return	7.375%, net of pension plan investment expense, including inflation

Mortality rates were based on the following:

Pre-Retirement	RP-2000 Employee Mortality Table projected generationally using Scale BB2D from 2009
Healthy Retiree	RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale BB2D from 2009
Disabled Retiree	RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale BB2D from 2015

The actuarial assumptions used in the January 1, 2017 valuation were based on the results of an actuarial experience study for the period January 1, 2016 through December 31, 2016.

The long-term expected rate of return on pension plan investments was determined using a building-block method in which best-estimate ranges of expected future real rates of return (expected returns, net of pension plan investment expense and inflation) are developed for each major asset class. These ranges are combined to produce the long-term expected rate of return by weighting the expected future real rates of return by the target asset allocation percentage and by adding expected inflation. Best estimates of arithmetic real rates of return for each major asset class included in the pension plan's target asset allocation as of December 31, 2016 (see the discussion of the WRS's investment policy) are summarized in the following table:

Asset Class	Long-Term Expected Real Rate of Return (%)
Domestic equity	6.44
International developed markets equity	7.40
International emerging markets equity	9.42
Core fixed income	2.02
High-yield fixed income	4.43
Real estate	5.00
Commodities	4.43
Hedge fund, global tactical asset allocation, risk parity	3.75
Private equity	10.47
Cash	1.06

Discount Rate

The discount rate used to measure the total pension liability was 7.375 percent. The discount rate in the prior fiscal year was 7.500 percent. The projection of cash flows used to determine the discount rate assumed that plan member contributions will be made at the current contribution rate and that WRS's contributions will be made at rates equal to the actuarially determined contribution rates. Based on those assumptions, the pension plan's fiduciary net position was projected to be available to make all projected future benefit payments of current plan members. Therefore, the long-term expected rate of return on pension plan investments was applied to all periods of projected benefit payments to determine the total pension liability.

Sensitivity of the Net Pension Liability to Changes in the Discount Rate

The following presents the net pension liability of the WRS calculated using the discount rate of 7.375 percent, as well as what the WRS's net pension liability would be if it were calculated using a discount rate that is 1-percentage-point lower (6.375 percent) or 1-percentage-point higher (8.375 percent) than the current rate:

	1% Decrease (6.375%)	Current Discount Rate (7.375%)	1% Increase (8.375%)
WRS's net pension liability	657,352,606	508,921,394	383,113,718

7. Legally Required Reserve Accounts

The balances in the WRS' legally required reserves as of December 31, 2016 are as follows:

Description	Amount	Purpose
Annuity Savings Fund	$ 188,910,537	Active members' contribution balance
Annuity Reserve Fund	63,217,316	Retired members' contribution account
Military Service Fund	200,946	Members' contribution account while on military leave
Pension Reserve Fund	579,748,829	Amounts appropriated to fund future retirement
Pension Fund	5,267,083	Remaining net position
Total	$ 837,344,711	

All reserve accounts are funded at levels required by state law.

Required Supplementary Information
December 31, 2016

Schedule of Changes in Employers' Net Pension Liability and Related Ratios (1)

		2016	2015	2014
Total pension liability				
Service cost	$	27,155,573	26,309,138	24,977,553
Interest		95,556,357	92,787,477	89,852,374
Differences between expected and actual experience		(2,523,911)	(1,619,304)	(901,542)
Changes of assumptions		19,119,320	16,825,451	16,436,189
Benefit payments, including refunds of member contributions		(79,940,830)	(75,957,945)	(72,435,430)
Net change in total pension liability		59,366,509	58,344,817	57,929,144
Total pension liability - beginning		1,286,899,596	1,228,554,779	1,170,625,635
Total pension liability - ending (a)	$	1,346,266,105	1,286,899,596	1,228,554,779
Plan fiduciary net position				
Contributions - employer	$	44,411,990	42,703,837	41,200,578
Contributions - member		17,797,519	17,409,182	16,320,772
Net investment income		58,737,894	(10,490,024)	34,950,210
Benefit payments, including refunds of member contributions		(79,940,830)	(75,957,945)	(72,435,430)
Administrative expense		(565,669)	(572,743)	(587,157)
Other		(926,263)	(895,410)	(806,081)
Net change in plan fiduciary net position		39,514,641	(27,803,103)	18,642,892
Plan fiduciary net position - beginning		797,830,070	825,633,173	806,990,281
Plan fiduciary net position - ending (b)	$	837,344,711	797,830,070	825,633,173
WRS's net pension liability - ending (a) - (b)	$	508,921,394	489,069,526	402,921,606
Plan fiduciary net position as a percentage of the total pension liability		62.20%	62.00%	67.20%
Covered-employee payroll	$	175,910,160	173,759,691	168,856,039
Net pension liability as a percentage of covered-employee payroll		289.31%	281.46%	238.62%

(1) Data is only available for the years presented and will be accumulated annually to present 10 years of the reported information.

Schedule of Employer Contributions
Last 10 Fiscal Years

	2016	2015	2014	2013	2012
Actuarially determined contribution	$ 44,411,990	42,703,837	41,200,578	38,148,683	35,409,140
Contributions in relation to the actuarially determined contribution	44,411,990	42,703,837	41,200,578	38,148,683	35,409,140
Contribution deficiency (excess)	$ -	-	-	-	-
Covered-employee payroll	$ 175,910,160	173,759,691	168,856,039	166,094,906	159,669,859
Contributions as a percentage of covered-employee payroll	25.25%	24.58%	24.40%	22.97%	22.18%

(continued)

	2011	2010	2009	2008	2007
Actuarially determined contribution	$ 32,706,347	29,770,499	28,505,066	24,947,158	24,166,318
Contributions in relation to the actuarially determined contribution	32,706,347	30,196,904	28,505,066	24,947,158	24,166,318
Contribution deficiency (excess)	$ -	(426,405)	-	-	-
Covered-employee payroll	$ 157,720,871	166,392,075	166,050,095	156,585,326	152,838,201
Contributions as a percentage of covered-employee payroll	20.74%	18.15%	17.17%	15.93%	15.81%

(concluded)

Schedule of Investment Returns (1)

	2016	2015	2014
Annual money-weighted rate of return, net of investment expense	7.87%	-1.46%	4.96%

(1) Data is available only for the years presented and will be accumulated annually to present 10 years of the reported information.

Changes of Assumptions

The investment return assumption was lowered from 8.50% to 8.25% as of January 1, 2007. As of January 1, 2011, it was lowered to 8.00%. As of January 1, 2013, it was lowered to 7.75%. As of January 1, 2015 it was lowered to 7.625%. As of January 1, 2016 it was lowered to 7.5%. As of January 1, 2017, it was lowered to 7.375%.

The salary increase assumption was lowered as of January 1, 2011 from 5.00% to 4.75%. As of January 1, 2013, it was lowered to 4.5%. As of January 1, 2014, a select and ultimate assumption of 3.5% for 2014 and 2015 and 4.5% thereafter was used. As of January 1, 2016, a select and ultimate assumption of 3.5% for 2016 and 2017 and 4.5% thereafter was used.

As of January 1, 2009, the actuarial value of assets was changed from fair value of assets to a five-year smoothing method. As of January 1, 2010, the actuarial value of assets was changed from being within 20% of the fair value of assets to being within 10% of the fair value of assets.

The mortality assumption for healthy participants was changed from the 1994 Group Annuity Mortality Table to the RP-2000 Combined Healthy Mortality Table projected 12 years using Scale AA as of January 1, 2012. As of January 1, 2013, the pre-retirement mortality assumption was changed to the RP-2000 Employee Mortality Table projected 20 years using Scale AA. As of January 1, 2014, the pre-retirement mortality assumption was changed to the RP-2000 Employee Mortality Table projected generationally using Scale AA. As of January 1, 2016, the pre-retirement mortality assumption was changed to the RP-2000 employee Mortality Table projected generationally using Scale BB2D from 2009.

The mortality assumption for healthy retirees was changed from the RP-2000 Combined Healthy Mortality Table projected 12 years using Scale AA to the RP-2000 Healthy Annuitant Mortality Table projected 15 years using Scale AA as of January 1, 2013. As of January 1, 2014, the mortality assumption for non-disabled retirees was changed to the RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale AA. As of January 1, 2016, the mortality assumption for non-disabled retirees was changed to the RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale BB2D from 2009.

The mortality assumption for disabled participants was changed from the 1994 Group Annuity Mortality Table set forward 10 years to the 1994 Group Annuity Mortality Table set forward 7 years, as of January 1, 2010. As of January 1, 2011, the table was changed to the 1994 Group Annuity Mortality Table set forward 5 years. As of January 1, 2012, the assumption was changed to the RP-2000 Combined Healthy Mortality Table set forward 5 years projected 12 years using Scale AA. As of January 1, 2013, the assumption was changed to the RP-2000 Healthy Annuitant Mortality Table projected 5 years using Scale AA with a 3-year set forward for males. As of January 1, 2014, the assumption was changed to the RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale AA from 2010 with a 3-year set forward for males. As of January 1, 2015, the assumption was changed to the RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale AA with a 3-year set forward for males. As of January 1, 2016, the assumption was changed to the RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale BB2D from 2015.

Methods and Assumptions Used in Calculations of Actuarially Determined Contributions

The actuarially determined contribution rates in the schedule of WRS's contributions are calculated as of January 1, two years prior to the end of the fiscal year in which contributions are reported. The following actuarial methods and assumptions were used to determine contribution rates reported in that schedule:

Actuarial cost method (2007-2016):	Entry Age Normal
Amortization method (2007):	Payment increases 4.00% per year
Amortization method (2008):	Payment increases 4.50% per year
Amortization method (2009 - 2014):	Payment increases 4.00% per year
Amortization method (2015):	Payment increases 5.85% per year
Amortization method (2016):	Payment increases 4.00% per year through fiscal year 2018; 6.3% per year starting in fiscal year 2019
Remaining amortization period (2007):	11 years
Remaining amortization period (2008):	21 years
Remaining amortization period (2009):	30 years
Remaining amortization period (2010):	24 years
Remaining amortization period (2011):	23 years
Remaining amortization period (2012):	19 years
Remaining amortization period (2013):	17 years
Remaining amortization period (2014):	18 years
Remaining amortization period (2015):	17 years
Remaining amortization period (2016):	16 years
Asset valuation method (2007):	Fair value
Asset valuation method (2008-2016):	5-year smoothed fair value
Inflation (2007-2009):	4.00%
Inflation (2010-2011):	3.75%
Inflation (2012):	3.50%
Inflation (2013-2014):	3.00% for the next 2 years; 4.00% thereafter
Inflation (2015-2016):	2.50% for the next year; 3.50% thereafter
Salary increases (2007):	5.00%
Salary increases (2008):	3.00% for the next 2 years: 5.00% thereafter
Salary increases (2009):	5.00%
Salary increases (2010-2011):	4.75%
Salary increases (2012):	4.50%
Salary increases (2013-2016):	3.50% for the next year; 4.50% thereafter
Investment rate of return (2007-2009):	8.25%
Investment rate of return (2010-2011):	8.00%
Investment rate of return (2012-2013):	7.75%
Investment rate of return (2014):	7.625%
Investment rate of return (2015):	7.50%
Investment rate of return (2016):	7.375%

Supplementary Information
December 31, 2016

Schedule of Administrative Expenses

The composition of administrative expenses for the year ended December 31, 2016 is as follows:

Personal services:		
Staff salaries	$	309,168
Board Member compensation		22,500
Insurance		48,003
Total personal services		379,671
Consultant expenses:		
Legal expenses		76,248
Actuarial fees		32,000
Audit fees		22,000
Medical fees		13,125
Total professional services		143,373
Miscellaneous:		
Other		42,625
Total administrative expenses	$	565,669

Schedule of Investment and Consultants' Expenses

Investment expenses		
Management fees:		
Domestic equity managers	$	194,520
Private equity capital fund managers		2,159,635
Domestic fixed income managers		557,715
International equity managers		761,210
Real estate investments managers		1,245,744
Consultant fees		230,000
Custodial fees		158,485
Total management fees		5,307,309
Securities lending fees:		
Borrowers rebates		16,462
Fees		10,780
Total securities lending fees		27,242
Total investment expenses	$	5,334,551
Consultant expenses:		
Independent audit fees	$	22,000
Actuarial fees		32,000
Legal fees		76,248
Medical fees		13,125
Total consultant expenses	$	143,373

Investment Section

REPORT ON INVESTMENT ACTIVITY

The information contained in the Investment Section of the Comprehensive Annual Financial Report (CAFR) has been prepared by Meketa Investment Group, acting as the investment consultant for the Worcester Retirement System (WRS). All investment information herein has been reconciled between the WRS, the investment managers hired by the WRS, WRS' custodian, and Meketa Investment Group. Performance for liquid, publicly-traded asset classes are presented utilizing time-weighted return calculations based upon market values. Alternative asset classes which are private and/or illiquid are presented utilizing dollar-weighted, rather than time-weighted returns.

OUTLINE OF INVESTMENT POLICIES

The purpose of this document is to set forth the goals and objectives of the WRS, and to establish guidelines for the implementation of investment strategy.

The Board of the WRS recognizes that a stable, well-articulated investment policy is crucial to the long-term success of the WRS. As such, the Board has developed this Investment Policy Statement with the following goals in mind:

- To clearly and explicitly establish the objectives and constraints that govern the investment of the WRS's assets,
- To establish a long-term target asset allocation with a high likelihood of meeting the WRS's objectives given the explicit constraints, and
- To protect the financial heal of the WRS through the implementation of this stable long-term investment policy.

I. Worcester Retirement System Goals

The WRS was established to provide retirement income for the City of Worcester and WHA employees and their families. The WRS's assets are structured to provide real growth from capital gains and income, while maintaining sufficient liquidity to meet the WRS's benefit payments.

II. Investment Objectives

The investment strategy of the WRS is designed to ensure the prudent investment of funds in such a manner as to provide real growth of assets over time while protecting the value of the assets from undue volatility or risk of loss.

A. Risk Objectives

- To accept a level of market risk consistent with moderate interim volatility without sacrificing the potential for long-term real growth of assets.
- To use extensive diversification to minimize or eliminate completely exposure to company and industry-specific risks in the aggregate investment portfolio.
- To avoid extreme levels of volatility that could adversely affect WRS's portfolio.

- To limit the likelihood of investment return patterns that could negatively impact the funded status of the WRS.

B. Return objective

- Within the risk constraints outlined above, to achieve the highest real return possible.
- To achieve, over long time periods, investment returns consistent with the actuarial return on assets of 7.375%.

III. Investment Constraints

A. Legal and Regulatory

The WRS is a qualified defined benefit pension plan governed by the Massachusetts General Laws, Chapter 32 and Chapter 176. Investment procedures and restrictions stipulated under these regulations must be followed.

The Board intends to manage the assets of the WRS at all times in accordance with the provisions of the Public Employee Retirement Administration Commission (PERAC) and the Massachusetts General Laws, Chapter 32 and Chapter 176. The Board will retain legal counsel when appropriate to review contracts and provide advice with respect to applicable statutes and regulations.

B. Time Horizon

The WRS will be managed on a going-concern basis. The assets of the WRS will be invested with long-term time horizon (twenty years or more), consistent with the participant demographics and the purpose of the WRS.

C. Tax Considerations

The WRS is a tax-exempt entity. Therefore, investments and strategies will be evaluated only on the basis of expected risks and potential returns.

IV. Risk and Return Considerations

The WRS's Board recognizes that a persistent positive relationship exists between risk and return, whether risk is described as possibility of loss or as interim volatility. The Board also recognizes that investors are rarely compensated for risks that can be eliminated through diversification. Within the risk and return parameters discussed above, the Board accepts the risks associated with investing in the capital markets (market risks), but will minimize wherever possible those risks for which the WRS is unlikely to be compensated (non-market or diversifiable risks).

V. Diversification

The WRS's Board recognizes that a primary element of risk control is diversification. Therefore, investments will be allocated across multiple classes of assets, chosen in part for their low correlation of returns. Within each asset type, investments will be distributed across many individual holdings, thus further reducing volatility. In addition, each investment manager's guidelines will specify the largest permissible investment in any one asset, and the largest permissible investment in any group of related assets.

The WRS's aggregate equity portfolio will be diversified by individual issue, capitalization, and industry (international equity portfolios will also be diversified by country). The WRS's aggregate fixed income portfolio will, at a minimum, be diversified by individual issue, by issuer, by maturity, and by industry. Residual cash will be swept by the custody bank into a short-term fixed income investment pool that is broadly diversified across individual issue and issuer. The WRS's aggregate real estate portfolio will be invested across a spectrum of geographic regions and property types.

The specific degrees of diversification within the above asset classes will be addressed in each manager's investment guidelines.

VI. Asset Allocation

The Board recognizes that the allocation of monies to various asset classes will be the major determinant of the WRS return and risk experience over time. Therefore, the WRS will allocate investments across those asset classes that, based on historical and expected returns and risks, provide the highest likelihood of meeting the WRS's investment objectives.

A. Permissible Asset Classes

Because investment in any particular asset class may or may not be consistent with the objectives of the WRS, the Board has specifically indicated those asset classes that may be utilized when investing the WRS's assets, and are summarized on the following page:

Asset Type	Asset Class	Purpose
Equity	U.S. Common Stocks	Total Return Potential
Equity	Non-U.S. Common Stocks	Total Return Potential Diversification
Equity	Private Equity	Total Return Potential Diversification
Fixed Income	Investment Grade Bonds	Return Stability Income
Fixed Income	TIPS	Return Stability Income
Fixed Income	High Yield Bonds/ Bank Loans	Total Return Potential Diversification Income
Fixed Income	Emerging Market Debt	Total Return Potential Diversification Income
Real Estate	Real Estate	Total Return Potential Diversification Income
Real Estate	Timber	Total Return Potential Diversification Income
Hedge Funds	Absolute Return Strategies	Return Stability Diversification
Infrastructure	Private Infrastructure	Total Return Potential Diversification Income
Natural Resources	Public/Private Natural Resources	Total Return Potential Diversification
Fixed Income / Equity	Global Tactical Asset Allocation	Total Return Potential Diversification
Cash	Cash Equivalents	Liquidity Return Stability

B. Expected Returns, Risks, and Correlations for Permissible Asset Classes

The risk and return behavior of the WRS will be driven primarily by the allocation of investments across asset classes. In determining the appropriate allocation, the expected return and risk behavior of each asset class and the likely interaction of various asset classes in a portfolio must be examined.

C. Long-Term Target Allocations

Based on the investment objectives and constraints of the WRS, and on the expected behavior of the permissible asset classes, the Board will specify a long-term target allocation for each class of permissible assets. These targets will be expressed as a percentage of the WRS's overall market value, surrounded by a band of permissible variation resulting from market forces.

The long-term target allocations are intended as strategic goals, not short-term imperatives. Thus, it is permissible for the overall System's asset allocation to deviate from the long-term target, as would likely occur during manager transitions, asset class restructurings, and other temporary changes in the WRS. Deviations from targets that occur due to capital market changes are discussed after the following table:

Asset Allocation Targets

	Target (%)	Range (%)
Domestic Equity	**22%**	**17-27%**
International Developed Market Equity	**12%**	**7-17%**
International Emerging Market Equity	**9%**	**5-13%**
Investment Grade Bonds	**9%**	**6-12%**
Treasury Inflation-Protected Securities (TIPS)	**5%**	**2-8%**
High Yield Bonds / Bank Loans	**4%**	**1-7%**
Emerging Market Debt	**3%**	**1-5%**
Real Estate	**10%**	**5-15%**
Timber	**3%**	**2-4%**
Private Equity	**10%**	**7-13%**
Hedge Funds	**2%**	**0-4%**
Global Tactical Asset Allocation	**7%**	**4-10%**
Infrastructure	**2%**	**0-3%**
Natural Resources	**2%**	**1-3%**
Cash[1]	**0%**	**< 5%**

[1] The cash target of zero defines the System's objective of keeping cash balances as low as possible, at least below 5% at all times. The Retirement Board is aware, however, that a certain cash balance is needed for the efficient operation of the System and its various portfolios.

D. Rebalancing

In general, cash flows to and from the WRS will be allocated in such a manner as to move each asset class toward its target allocation.

The Board recognizes that, periodically, market forces may move the WRS's allocations outside the target ranges. The Board also recognizes that failing to rebalance the allocations would unintentionally change the WRS's structure and risk posture. However, the Board understands that constant rebalancing would result in a significant increase in explicit and implicit trading costs to the WRS. Consequently, the Board has established a process to rebalance the allocations periodically.

On at least an annual basis, if any strategic allocation is outside the specified target range, assets will be shifted to return the strategy to the target range. The specific plan for rebalancing will identify those assets that can be shifted at the lowest possible risk and cost, if the rebalancing cannot be accomplished solely by allocating contributions and withdrawals.

E. Changes to Asset Allocation

Once established, permanent changes in the WRS's target asset allocation will take place only in response to significant changes in the objectives and constraints of the WRS, or in response to material changes in the fundamental nature or appropriateness of the asset classes themselves.

VII. Review of Investment Policy, Asset Allocation, and Performance

The Investment Policy Statement will be reviewed at least annually, and specifically upon each actuarial valuation, to ensure that the objectives and constraints remain relevant. However, the Board recognizes the need for a stable long-term policy for the WRS, and major changes to this policy statement will be made only when significant developments in the circumstances of the WRS occur. The Board will notify PERAC of any changes to this document within ten days of the effective date of those changes.

The asset allocation of the WRS will be reviewed on an on-going basis, and at least annually. When necessary, such reviews may result in a rebalancing of asset allocations. In general, the Board intends that the WRS will adhere to its long-term target allocations, and that major changes to these targets will be made rarely and only in response to significant developments in the circumstances of the WRS.

The Board will specifically evaluate the performance of the WRS relative to its objectives and to the returns available from the capital markets during the period under review. In general, the Board will utilize relative, rather than absolute, benchmarks in evaluating performance.

VIII. Trading and Proxy Voting by Investment Managers

In accordance with the fiduciary and other obligations imposed on investment managers by their agreements with the Board, all trades executed by managers must be for the exclusive benefit of the WRS's participants and beneficiaries. Managers are expected to seek best execution on all trades. This is addressed in the individual manager guidelines.

The Board recognizes that the right to vote proxies for securities held represents an asset of the WRS. As such, the Board has specifically delegated the responsibility for voting all security proxies to the individual managers. The Board believes that the voting of proxies constitutes an investment decision by the managers, and that prudent voting of proxies is important to the overall performance of the WRS. Investment managers are expected to execute all proxy votes in a timely fashion and to provide a full written accounting of proxy votes on an annual basis.

IX. Management Structure

To diversify the WRS's assets so as to minimize the risk associated with dependence on the success of one enterprise, the Board Members have decided to employ a multi-manager team approach to investing System assets.

A consultant will be employed whose responsibilities will be to: 1) provide risk and return assumptions for various asset classes, 2) to diversify WRS so as to minimize risk, while enhancing the probability of achieving the WRS's return objectives, and 3) to evaluate the performance and compliance of investment managers.

Investment managers will be employed to utilize individual expertise within their assigned area of responsibility. Each manager will be governed by individual investment guidelines.

X. Implementation

All monies invested for the WRS after the adoption of this investment policy statement shall conform to this statement.

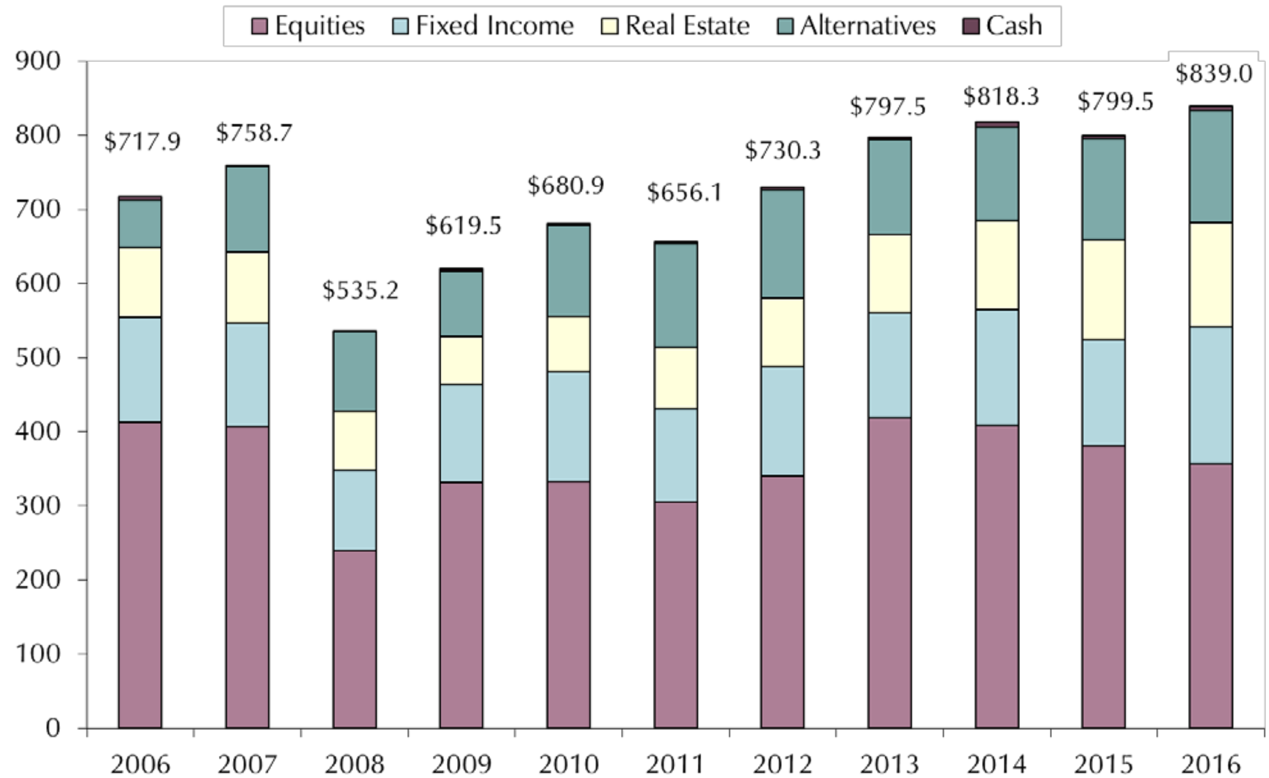
INVESTMENT RESULTS*

	4Q16	1 YR	3 YR	5 YR	10 YR	Since Inception	Inception Date
Total System	**0.4**	**7.7**	**3.6**	**7.3**	**4.2**	**7.1**	**10/1/1995**
CPI (inflation)	0.0	2.1	1.2	1.4	1.8	2.2	
Total Equity	**1.3**	**10.4**	**3.6**	**10.2**	**4.3**	**5.9**	**4/1/1998**
Russell 3000	4.2	12.7	8.4	14.7	7.1	6.1	
MSCI ACWI (ex. U.S.) IMI	-1.6	4.4	-1.4	5.3	1.2	4.4	
Total Fixed Income	**-1.5**	**6.5**	**2.7**	**6.5**	**5.1**	**5.7**	**1/1/1998**
Barclays Universal	-2.6	3.9	3.3	2.8	4.6	5.3	
Total Open-End Real Estate	**0.7**	**7.9**	**10.9**	**10.9**	**4.3**	**7.3**	**1/1/1999**
NCREIF ODCE	2.1	8.8	12.1	12.2	5.8	8.1	
Total Hedge Funds**	**2.5**	**4.4**	**2.4**	**4.8**	**3.1**	**4.2**	**7/1/2005**
HFRI Fund of Funds Composite	0.9	0.5	1.2	3.4	1.3	0.5	
Total GTAA**	**0.8**	**2.7**	**-2.0**	**1.8**	**NA**	**1.7**	**8/1/2007**
60% MSCI ACWI / 40% Barclays Global Aggregate	-2.2	5.7	2.0	5.8	3.8	3.4	
Total Balanced**	**-0.3**	**NA**	**NA**	**NA**	**NA**	**NA**	**7/1/2005**
60% MSCI ACWI / 40% Barclays Global Aggregate	-2.2	5.7	2.0	5.8	3.8	2.0	
Total Public Natural Resources	**4.5**	**31.0**	**-4.8**	**-2.0**	**NA**	**-6.0**	**5/1/2011**
S&P Glbl LrgMid Cap Commod. & Res.	4.6	31.5	-4.6	-1.9	2.4	-5.7	

* The WRS's policy is a time weighted average of the representative asset class benchmarks.

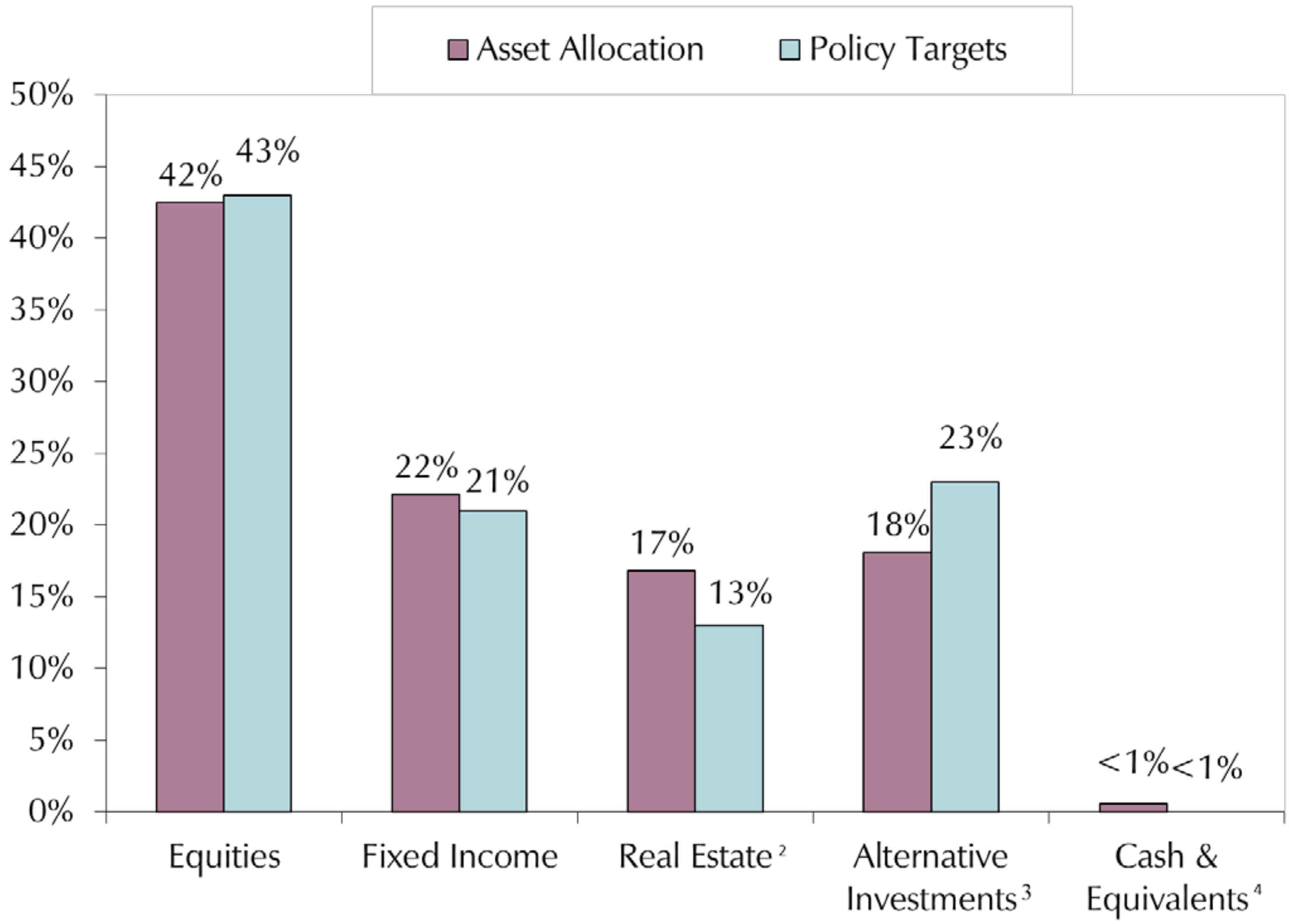
** Other alternative investments include private equity, infrastructure, and natural resources limited partnerships that are measured by dollar weighted, rather than time weighted returns. For the calendar year period covered by this report, the WRS's private equity investments increased by $3.8 million, including approximately $11.6 million in capital called and $8.7 million in distributions. The WRS's private infrastructure investments increased by $0.5 million, there was < $2.9 million called and $3.6 million distributed. The WRS's private natural resources investments increased by $2.0 million, including $1.9 million called and $0.1 million distributed.

ASSET ALLOCATION - ASSET SIZE[1]



[1] Graph reflects the PRIT Core Fund's market value distributed among the System's asset classes in line with the Core Fund's underlying asset allocation as of December 31, 2016.

AGGREGATE ASSET ALLOCATION VS. POLICY TARGETS[1]



---

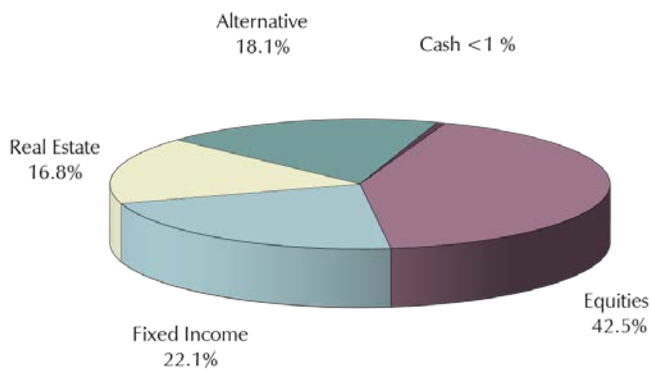
[1] Graph reflects the PRIT Core Fund's market value distributed among the System's asset classes in line with the Core Fund's underlying asset allocation as of December 31, 2016.

[2] The Real Estate policy target includes a strategic allocation to Timber of 3%.

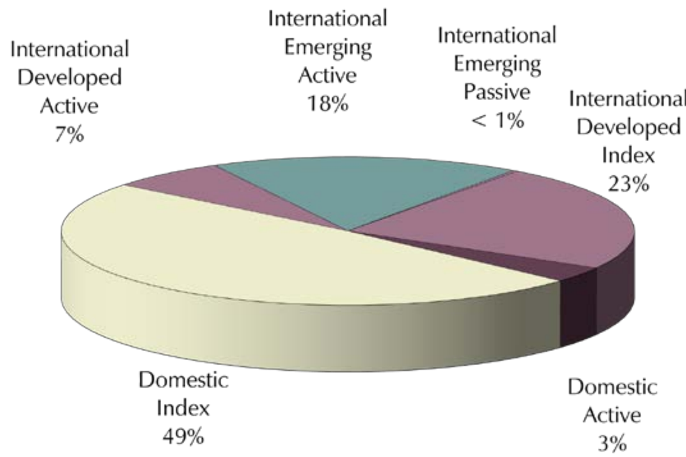
[3] The Alternative Investments allocation includes Private Equity, Hedge Funds, Global Tactical Asset Allocation, Infrastructure and Natural Resources assets.

[4] Includes cash and cash held by managers within separate accounts.

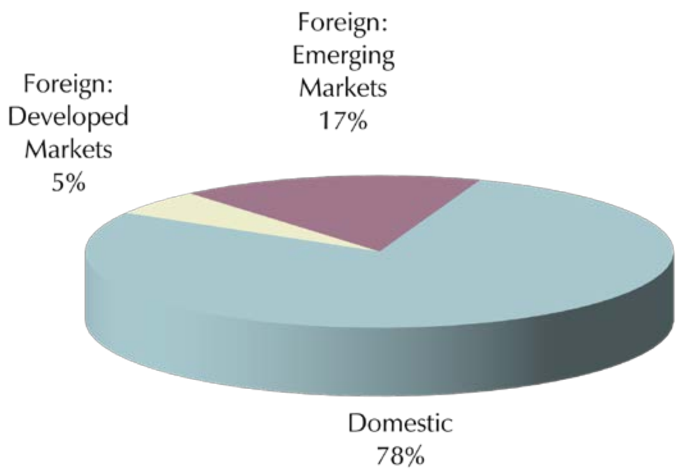
AGGREGATE ASSET ALLOCATION[1]



EQUITY ALLOCATION



FIXED INCOME ALLOCATION



[1] Graphs reflect the PRIT Core Fund's market value distributed among the System's asset classes in line with the Core Fund's underlying asset allocation as of December 31, 2016.

TEN LARGEST STOCK HOLDINGS BY FAIR VALUE

Company	Number of Shares	Fair Value	% of Total Equity	Industry
STERLING BANCORP/DE	10,346	242,096	< 0.1%	FINANCIALS
IBERIABANK CORP	2,779	232,741	< 0.1%	FINANCIALS
TREEHOUSE FOODS INC	3,176	229,275	< 0.1%	CONSUMER STAPLES
BANKUNITED INC	5,679	214,042	< 0.1%	FINANCIALS
BLACKSTONE MORTGAGE TRU CL A	6,960	209,287	< 0.1%	FINANCIALS
HORACE MANN EDUCATORS	4,827	206,596	< 0.1%	FINANCIALS
HANCOCK HOLDING CO	4,681	201,751	< 0.1%	FINANCIALS
FIRST HORIZON NATIONAL CORP	9,802	196,138	< 0.1%	FINANCIALS
SLM CORP	17,528	193,159	< 0.1%	FINANCIALS
MB FINANCIAL INC	3,938	185,992	< 0.1%	FINANCIALS

TEN LARGEST FIXED INCOME HOLDINGS BY FAIR VALUE

Security	Coupon (%)	Maturity Date	Market Value ($)	% of Fixed Income
US TREASURY N/B	1.125000	09/30/2021	3,654,756	2.1%
TSY INFL IX N/B	0.125000	04/15/2019	2,770,937	1.6%
TSY INFL IX N/B	0.125000	04/15/2018	2,565,181	1.5%
US TREASURY N/B	4.500000	02/15/2036	2,511,640	1.4%
TSY INFL IX N/B	0.125000	07/15/2024	2,166,180	1.2%
TSY INFL IX N/B	0.250000	01/15/2025	2,123,788	1.2%
TSY INFL IX N/B	0.125000	01/15/2022	2,103,198	1.2%
TSY INFL IX N/B	0.625000	01/15/2024	2,058,758	1.2%
TSY INFL IX N/B	0.625000	01/15/2026	2,020,551	1.2%
TSY INFL IX N/B	0.125000	07/15/2022	2,013,772	1.1%

A complete portfolio is available upon request.

SCHEDULE OF FEES & COMMISSIONS

Investment Manager Fees: December 31, 2016	
Acadian Asset Management	135,765
AEW VI	155,658
AEW VII	200,323
American Securities Partners	42,534
Ascent Venture Management IV	15,875
Ascent Venture Management V	69,919
Ascent Venture Management VI	72,679
Boston Millennia Partners II	5,799
Boston Millennia Partners III	45,000
Capital International Private Equity Fund	70,477
Charlesbank Capital Partners VI	13,227
Dimensional	56,246
Global Infrastructure Partners	210,250
Hancock Timber Resource Group	69,345
Invesco	454,303
IR&M Core Bond	174,547
IR&M TIPS	20,215
Lazard Asset Management	385,627
Lee Munder Capital Group	88,121
Loomis Sayles & Company	208,582
Mass PRIM (Hedge Funds)	245,291
Mass PRIM (Real Estate)	286,456
Mass PRIM (General Allocation)	154,371
Mass PRIM (PEVY 2016)	11,211
Mass PRIM (EM)	108,599
Newstone Capital Partners I	4,757
Newstone Capital Partners II	36,563
Nichols	17,364
Northstar Capital III	2,300
Northstar Capital IV	10,338
Northstar Capital V	27,567
Northstar Capital VI	155,177

(Continued)

SCHEDULE OF FEES & COMMISSIONS (CONTINUED)

Investment Manager Fees: December 31, 2016		
Ridgemont		54,684
RMK Balanced Timberland B		18,469
RMK Fund I		31,152
RMK Select Timberland Fund II		34,397
SSgA Daily EAFE Index		46,669
SSgA EAFE Index		28,305
SSgA Flagship Index		28,767
SSgA Global Natural Resources		9,578
SSgA Russell 1000 Growth Index		22,272
SSgA Russell 1000 Value Index		22,225
SSgA S&P Midcap Index		6,195
Standard Life Investments Limited		344
TA XII		34,885
The Riverside Company VI		97,341
The Riverside Company Europe III		333,751
The Riverside Company Microcap III		29,210
Vitruvian Partners		37,917
White Deer		20,146
White Deer II		150,000
William Blair		358,031
Total Investment Manager Fees	**$**	**4,918,824**
State Street Bank (Custodian Bank Fee)		158,485
Meketa Investment Group (Consultant Fee)		210,000
Fiduciary Investment Advisors		20,000
Securities Lending Rebates and Fees		27,242
Total Other Fees	**$**	**415,727**
Total Fees	**$**	**5,334,551**

2016 COMMISSIONS TO BROKERS

Broker Name	Total Commission ($)	Shares/Par	$ / Share
BARCLAYS CAPITAL LE	30.40	608	0.05
BLOOMBERG TRADEBOOK LLC	93.23	9,323	0.01
BNY CONVERGEX LJR	92.44	2,141	0.04
CANTOR CLEARING SERVICES	27.62	1,381	0.02
CANTOR FITZGERALD + CO.	8.36	209	0.04
CITIGROUP GLOBAL MARKETS INC	28.25	565	0.05
CONVERGEX LLC	301.08	10,071	0.03
DEUTSCHE BANK SECURITIES INC	96.10	1,922	0.05
FBR CAPITAL MARKETS & CO.	56.94	1,188	0.05
FIS BROKERAGE & SECURITIES SERVICES LLC	1.46	73	0.02
GOLDMAN SACHS + CO	41.65	833	0.05
INVESTMENT TECHNOLOGY GROUP INC.	765.65	37,330	0.02
JEFFERIES + COMPANY INC	140.34	4,646	0.03
JMP SECURITIES	92.48	2,312	0.04
JONESTRADING INSTITUTIONAL SERVICES LLC	9.92	248	0.04
KEEFE BRUYETTE + WOODS INC	172.15	3,443	0.05
KEYBANC CAPITAL MARKETS INC	99.75	1,995	0.05
KNIGHT EQUITY MARKETS L.P.	426.92	21,346	0.02
LEERINK PARTNERS LLC	58.00	1,160	0.05
LIQUIDNET INC	567.72	18,924	0.03
LUMINEX TRADING AND ANALYTICS LLC	0.36	110	0.00
MORGAN STANLEY CO INCORPORATED	64.70	1,294	0.05
RAYMOND JAMES AND ASSOCIATES INC	68.75	1,375	0.05
ROBERT W. BAIRD CO.INCORPORATE	245.15	4,903	0.05
SANDLER ONEILL AND PARTNERS L.P.	9.25	185	0.05
SANFORD C BERNSTEIN CO LLC	1,308.38	65,419	0.02
STATE STREET GLOBAL MARKETS, LLC	154.90	6,514	0.02
STEPHENS, INC.	184.65	3,693	0.05
STIFEL NICOLAUS + CO INC	159.95	3,199	0.05
UBS SECURITIES LLC	102.65	2,053	0.05
WEEDEN + CO.	1,031.42	52,970	0.02
WELLS FARGO SECURITIES, LLC	62.60	1,252	0.05
WILLIAM BLAIR & COMPANY LLC	56.55	1,131	0.05
TOTAL	**$6,559.77**	**263,816**	**0.02**

INVESTMENT SUMMARY*

	Fair Value 12/31/2016 ($ mm)	% of Total Fair Value
Total System	**839.0**	**100%**
Total Equity Assets	**332.7**	**39%**
Equities	11.2	1%
Pooled Equities	321.5	38%
Total Fixed Income Assets	**175.3**	**21%**
Fixed Income	103.1	12%
Pooled Fixed Income	72.2	9%
Total Alternative Assets	**271.9**	**32%**
Alternative Assets	71.1	8%
Real Estate	133.5	16%
Hedge Funds / GTAA	67.3	8%
External Investment Pool	**54.5**	**7%**
PRIT Core Fund	54.5	7%
Cash & Cash Equivalents	**4.6**	**< 1%**

* This table does not include the securities lending short-term collateral investment pool.

LIQUIDITY PROFILE

Benefits payments totaled approximately $77.8 million during the year and along with other payments of $5.5 million resulted in total cash outflows of $83.3 million in 2016. These payments were partially offset by a contribution of approximately $44.4 million from employers and other cash receipts of $19.6 million for a total of $64.0 million in 2016. This resulted in a negative cash flow of approximately $19.3 million for the fiscal year. Note that these figures do not incorporate expected income and asset gains from the WRS's investments. The WRS's portfolio is structured with a long-term expected return of 7.375%.

Actuarial Section

Segal Consulting

116 Huntington Avenue 8th Floor Boston, MA 02116-5744
T 617.424.7336 www.segalco.com

Kathleen A. Riley FSA, MAAA, EA
Senior Vice President and Actuary
kriley@segalco.com

June 6, 2017

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

Dear Board Members:

Segal Consulting has performed a January 1, 2017 actuarial valuation of the City of Worcester Retirement System. This actuarial valuation has been completed in accordance with generally accepted actuarial principles and practices. To the best of our knowledge, the information supplied in this actuarial valuation is complete and accurate. Further, in our opinion, the assumptions as approved by the Retirement Board are reasonably related to the experience of and the expectations for the Plan.

As part of performing the valuation, Segal Consulting was furnished member data by the City of Worcester Retirement System's administrative staff. Although examined for general reasonableness, the data was not audited by the actuary. In addition, the administrative staff furnished financial statements that were not audited by the actuary.

The funding objective of the plan is to provide for the current cost of benefits (*i.e.*, normal cost) and to reduce the unfunded liability to zero by June 30, 2033. The normal cost is expected to remain approximately at a level percentage of payroll. The remaining liability of the 2002 ERI is amortized over a 1-year period (by June 30, 2018) with level payments. The 2010 ERI liability is amortized over a 4-year period (by June 30, 2021) with level payments. The remaining unfunded liability is amortized over a 16-year period. The fiscal 2018 appropriation of $46,188,470 was determined with the January 1, 2016 actuarial valuation and was calculated such that the total appropriation was 4% greater than the fiscal 2017 payment. For fiscal 2019 and later years, each year's total appropriation increases 6.30%.

Actuarial valuations have been performed annually. This is consistent with the guidelines promulgated by PERAC and GASB. The previous valuation was performed as of January 1, 2016. The assumptions and methods used for funding purposes meet the parameters set by the Actuarial Standards of Practice (ASOPs).

Segal Consulting has prepared all the supporting schedules for the Actuarial Section and Statistical Section of the CAFR.

Please let us know if you have any questions on this material.

Sincerely,

SEGAL CONSULTING

By: Kathleen A. Riley

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

I. Summary of Actuarial Assumptions and Actuarial Cost Method

The actuarial assumptions, as set forth in the accompanying supporting schedules, were selected by the City of Worcester Retirement Board and actuary. Unless stated otherwise, the actuarial assumptions are based upon the actuarial valuation as of January 1, 2017, which was adopted by the City of Worcester Retirement System on May 11, 2017.

Mortality Rates

Pre-retirement:	RP-2000 Employee Mortality Table projected generationally using Scale BB2D from 2009
Healthy Retiree:	RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale BB2D from 2009
Disabled Retiree:	RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale BB2D from 2015
	The underlying tables with generational projection to the ages of participants as of the measurement date reasonably reflect the mortality experience of the plan as of the measurement date based on historical and current demographic data. As part of the analysis, a comparison was made between the actual number of retiree deaths and the projected number based on the prior years' assumptions over the past five years. The mortality tables were then adjusted to future years using the generational projection under Scale BB to reflect future mortality improvement between the measurement date and those years.

Termination Rates before Retirement

Groups 1 and 2 - Rate (%)

Age	Mortality: Male	Mortality: Female	Disability	Withdrawal
20	0.03	0.02	0.01	12.00
25	0.04	0.02	0.03	8.78
30	0.04	0.03	0.04	5.55
35	0.08	0.05	0.07	3.93
40	0.11	0.07	0.13	2.31
45	0.15	0.11	0.18	1.89
50	0.21	0.17	0.24	1.46
55	0.30	0.25	0.30	0.00
60	0.49	0.39	0.35	0.00

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

Group 4 - Rate (%)

Age	Mortality: Male	Mortality: Female	Disability	Withdrawal
20	0.03	0.02	0.13	2.10
25	0.04	0.02	0.25	1.88
30	0.04	0.03	0.38	1.65
35	0.08	0.05	0.38	1.11
40	0.11	0.07	0.38	0.56
45	0.15	0.11	1.25	0.28
50	0.21	0.17	1.56	0.00
55	0.30	0.25	1.50	0.00
60	0.49	0.39	1.06	0.00

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

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

Retirement Rates

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

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

Retirement Age for Inactive Vested Participants

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

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

Unknown Data for Participants

Same as those exhibited by participants with similar known characteristics.

Family Composition

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

Benefit Election

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

Net Investment Return

7.375% (same rate used to discount the actuarial accrued liability)

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

Salary Scale

3.50% for 2017, with an allowance for inflation of 2.50%, and 4.50% per year thereafter, with an allowance for inflation of 3.50%.

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

Interest on Employee Contributions

3.50%

Administrative Expenses

$600,000 for calendar year 2017, increasing 2.50% for 2017 and 3.50% per year thereafter.

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

2016 Salary

2016 salary equal to salaries provided in the data, except for new hires where salaries were calculated from annualized contributions divided by the contribution rate(s) reported.

Payroll figures are for the prior year and reflect annualized salaries for participants hired during the year. Calendar year 2016 salaries for certain police officials were reduced by 6.4% to reflect retroactive payments that were included in the data. Calendar year 2016 salaries for firefighters were increased by 6.1% to reflect unsettled bargaining agreements.

Total Service

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

Net 3(8)(c) Liability

Estimated liability of $18.7 million based on the average amount net 3(8)(c) benefits of the prior two years and the average demographics of retired participants.

Actuarial Value of Assets

Fair 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 fair value return and the expected fair value return and is recognized over a five-year period, further adjusted, if necessary, to be within 10% of the fair 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.

Amortization Method

Level payments on the 2002 and 2010 ERI liability; total appropriation increases 6.30% in fiscal 2019 and later years.

Recent Changes

The investment return assumption was lowered from 8.50% to 8.25% as of January 1, 2006. As of January 1, 2011, it was lowered to 8.00%. As of January 1, 2013, it was lowered to 7.75%. As of January 1, 2015 it was lowered to 7.625%. As of January 1, 2016, it was lowered to 7.50%. As of January 1, 2017 it was lowered to 7.375%.

The salary increase assumption was lowered as of January 1, 2003 from 5.50% to 5.00%. As of January 1, 2011, it was lowered to 4.75%. As of January 1, 2013, it was lowered to 4.5%. As of January 1, 2014, a select and ultimate assumption of 3.5% for 2014 and 2015 and 4.5% thereafter was used. As of January 1, 2015, a select and ultimate assumption of 3.5% for 2015 and 2016 and 4.5% thereafter was used. As of January 1, 2016, a select and ultimate assumption of 3.5% for 2016 and 2017 and 4.5% thereafter was used.

An asset smoothing method was first applied with the January 1, 2000 valuation and modified as of January 1, 2004. As of December 31, 2004, the actuarial value of assets was set equal to fair value. As of January 1, 2009, the actuarial value of assets was changed from fair value of assets to a five-year smoothing method. As of January 1, 2010, the actuarial value of assets was changed from being within 20% of the fair value of assets to being within 10% of the fair value of assets.

The mortality assumption for healthy participants was changed from the 1994 Group Annuity Mortality Table to the RP-2000 Combined Healthy Mortality Table projected 12 years using Scale AA as of January 1, 2012. As of January 1, 2013, the pre-retirement mortality assumption was changed to the RP-2000 Employee Mortality Table projected 20 years using Scale AA. As of January 1, 2014, the pre-retirement mortality assumption was changed to the RP-2000 Employee Mortality Table projected generationally using Scale AA. As of January 1, 2016, the pre-retirement mortality assumption was changed to the RP-2000 Employee Mortality Table projected generationally using Scale BB2D from 2009.

The mortality assumption for healthy retirees was changed from the RP-2000 Combined Healthy Mortality Table projected 12 years using Scale AA to the RP-2000 Healthy Annuitant Mortality Table projected 15 years using Scale AA as of January 1, 2013. As of January 1, 2014, the mortality assumption for non-disabled retirees was changed to the RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale AA. As of January 1, 2016, the mortality assumption for non-disabled retirees was changed to the RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale BB2D from 2009.

The mortality assumption for disabled participants was changed from the 1994 Group Annuity Mortality Table set forward 10 years to the 1994 Group Annuity Mortality Table set forward 7 years, as of January 1, 2010. As of January 1, 2011, the table was changed to the 1994 Group Annuity Mortality Table set forward 5 years. As of January 1, 2012, the assumption was changed to the RP-2000 Combined Healthy Mortality Table set forward 5 years projected 12 years using Scale AA. As of January 1, 2013, the assumption was changed to the RP-2000 Healthy Annuitant Mortality Table projected 5 years using Scale AA with a 3-year set forward for males. As of January 1, 2014, the assumption was changed to the RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale AA from 2010 with a 3-year set forward for males. As of January 1, 2015, the assumption was changed to the RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale AA with a 3-year set forward for males. As of January 1, 2016, the assumption was changed to the RP-2000 Healthy Annuitant Mortality Table projected generationally using Scale BB2D from 2015.

The estimated liability for future 3(8)(c) payments was lowered from $20.1 million based on estimated net annual benefits of $2.4 million to $15.7 million based on estimated net annual benefits of $1.8 million as of January 1, 2011 and to an estimated liability of $15.3 million based on net annual benefits of $1.7 million as of January 1, 2012. Beginning January 1, 2013, the estimated liability for future net 3(8)(c) payments was based on the average net 3(8)(c) benefits of prior two years and the average demographics of retired participants as follows:

January 1, 2013	$15.0 million
January 1, 2014	15.3 million
January 1, 2015	17.0 million
January 1, 2016	16.4 million
January 1, 2017	18.7 million

As of January 1, 2012, the annual rates of retirement and disability were changed.

The administrative expense assumption was changed from $625,000 to $600,000 as of January 1, 2012 and to $575,000 as of January 1, 2013. The administrative expense assumption increases with inflation each year. As of January 1, 2014, the administrative expense assumption was reset to $575,000. As of January 1, 2015, the administrative expense assumption was changed from $575,000 to $600,000. As of January 1, 2016 and January 1, 2017, the administrative expense assumption was reset to $600,000.

As of January 1, 2014, the assumed retirement age for inactive vested participants was changed from age 65 to age 55 for Group 1 and 2 members hired prior to April 2, 2012. For inactive vested participants hired April 2, 2012 or later, the assumed retirement age was lowered from age 65 to age 60 for Group 1 members, from age 65 to age 55 for Group 2 members and from age 55 to age 50 for Group 4 members.

II. Schedule of Active Member Valuation Data

Valuation date	Number of Employers	Active Members	Projected annual payroll ($)	Annual average pay ($)	% Increase in average pay
1/1/2008	2	3,299	$ 156,585,326	$ 47,464	5.49%
1/1/2009	2	3,352	166,050,095	49,538	4.37%
1/1/2010	2	3,262	166,392,075	51,009	2.97%
1/1/2011	2	3,208	157,720,871	49,165	-3.62%
1/1/2012	2	3,178	159,669,859	50,242	2.19%
1/1/2013	2	3,260	166,094,906	50,949	1.41%
1/1/2014	2	3,293	168,856,039	51,277	0.64%
1/1/2015	2	3,262	173,759,691	53,268	3.88%
1/1/2016	2	3,275	175,910,160	53,713	0.84%
1/1/2017	2	3,342	182,832,183	54,707	1.85%

Please also refer to the “Recent Changes” portion of this Actuarial Section.

III. Schedule of Retirees and Beneficiaries Added to and Removed from Rolls

		Added to Rolls		Removed from Rolls		Rolls - end of year			
Year ended	Valuation Date	Number	Annual allowances[1]	Number	Annual allowances	Number	Annual allowances[1]	% Increase in annual allowances	Average annual allowances
2007	01/01/08	105	$ 2,719,667	120	$ 1,728,323	2,849	$ 55,329,380	3.28%	$ 19,421
2008	01/01/09	93	2,867,851	150	2,034,502	2,792	56,905,570	2.85%	20,382
2009	01/01/10	97	3,476,053	115	1,643,865	2,774	59,512,448	4.58%	21,454
2010	01/01/11	182	5,534,863	158	2,487,548	2,798	63,008,939	5.88%	22,519
2011	01/01/12	88	2,550,597	109	1,683,482	2,776	64,470,827	2.32%	23,216
2012	01/01/13	120	3,501,290	142	2,564,860	2,754	66,738,274	3.52%	24,242
2013	01/01/14	112	3,510,330	133	2,262,416	2,733	69,107,130	3.55%	25,286
2014	01/01/15	128	4,240,131	144	2,393,537	2,717	72,007,429	4.20%	26,512
2015	01/01/16	135	4,994,889	130	2,298,965	2,722	75,746,634	5.19%	27,838
2016	01/01/17	144	4,986,404	138	2,931,552	2,728	78,900,779	4.16%	28,933

[1] Annual allowances are shown for retirees in pay status at the end of the year

IV. Solvency Test

	Actuarial Accrued Liability				Portion of Actuarial Accrued Liability Covered by Assets		
Valuation Date	(1) Active/Inactive member contributions	(2) Retirees and beneficiaries	(3) Active/Inactive members (Employer financed)	Actuarial value of assets	(1)	(2)	(3)
1/1/2008	$ 144,175,273	$ 476,412,539	$ 269,336,498	$ 759,410,332	100%	100%	52%
1/1/2009	152,780,052	488,818,808	287,970,604	631,893,995	100%	98%	0%
1/1/2010	158,217,390	524,211,594	305,263,311	679,509,973	100%	99%	0%
1/1/2011	158,761,215	573,267,875	293,046,333	724,997,822	100%	99%	0%
1/1/2012	165,908,395	586,490,665	298,791,730	712,110,360	100%	93%	0%
1/1/2013	172,550,795	620,756,055	324,131,714	706,950,694	100%	86%	0%
1/1/2014	178,648,060	649,780,235	342,197,340	770,334,007	100%	91%	0%
1/1/2015	183,475,605	687,917,537	357,161,637	820,708,236	100%	93%	0%
1/1/2016	186,699,458	738,049,932	362,150,206	849,286,321	100%	90%	0%
1/1/2017	188,910,537	777,664,492	379,691,076	884,576,848	100%	89%	0%

V. Analysis of Financial Experience

	Year Ended December 31,				
	2016	2015	2014	2013	2012
1. Unfunded actuarial accrued liability as of January 1	$ 437,613,275	$ 407,846,543	$ 400,291,628	$ 410,487,870	$ 339,080,430
2. Normal cost as of January 1	27,755,573	26,909,138	25,552,553	24,481,163	23,720,313
3. Employer, employee and other contributions during year	(61,283,246)	(59,217,609)	(56,715,269)	(53,519,634)	(50,129,615)
4. Interest					
(a) For whole year on (1)+(2)	34,902,664	33,150,121	33,002,924	33,710,099	29,024,059
(b) For half year on (3)	(2,079,106)	(2,042,077)	(1,987,425)	(1,875,443)	(1,812,547)
(c) Total interest	$ 32,823,558	$ 31,108,044	$ 31,015,499	$ 31,834,656	$ 27,211,512
5. Expected unfunded actuarial liability	436,909,160	406,646,116	400,144,411	413,284,055	339,882,640
6. Actual unfunded actuarial accrued liability	461,689,257	437,613,275	407,846,543	400,291,628	410,487,870
7. (Gain) or loss for the year: (6)-(5)	$ 24,780,097	$ 30,967,159	$ 7,702,132	$ (12,992,427)	$ 70,605,230
8. Investment (gain) or loss	$8,461,822	$ 16,027,779	$ (7,612,571)	$ (25,231,411)	$ 43,630,333
9. (Gains) or losses from sources other than investments	(2,801,045)	(1,886,071)	(1,121,486)	(7,994,158)	(45,863)
10. Plan changes	-	-	-	-	-
11. Assumption changes	19,119,320	16,825,451	16,436,189	20,233,142	27,020,760

(continued)

	2011	2010	2009	2008	2007
1. Unfunded actuarial accrued liability as of January 1	$ 300,077,601	$ 308,182,322	$ 297,675,469	$ 130,513,978	$ 120,811,463
2. Normal cost as of January 1	23,414,464	24,074,576	23,936,084	22,574,842	22,122,545
3. Employer, employee and other contributions during year	(46,308,754)	(44,157,370)	(42,695,664)	(39,375,618)	(36,995,766)
4. Interest					
(a) For whole year on (1)+(2)	25,879,365	27,411,194	26,532,953	12,629,827	11,792,055
(b) For half year on (3)	(1,674,395)	(1,645,804)	(1,591,325)	(1,467,582)	(1,378,882)
(c) Total interest	$ 24,204,970	25,765,390	24,941,628	11,162,245	10,413,173
5. Expected unfunded actuarial liability	301,388,281	313,864,918	303,857,517	124,875,447	116,351,415
6. Actual unfunded actuarial accrued liability	339,080,430	300,077,601	308,182,322	297,675,469	130,513,978
7. (Gain) or loss for the year: (6)-(5)	$ 37,692,149	$ (13,787,317)	$ 4,324,805	$ 172,800,022	$ 14,162,563
8. Investment (gain) or loss	$ 49,817,777	$ (9,317,263)	$ (55,454,843)	$ 275,514,085	$ (3,341,587)
9. (Gains) or losses from sources other than investments	(14,469,293)	(32,351,823)	12,290,038	2,601,602	1,694,376
10. Plan changes	5,186,817	3,879,584	-	-	-
11. Assumption changes	(2,843,152)	24,002,185	47,489,610	(105,315,665)	15,809,774

VI. Schedule of Funding Progress

Actuarial Valuation Date	Actuarial Value of Plan Assets (a)	Actuarial Accrued Liability (b)	Unfunded Actuarial Accrued Liability (b - a)	Funded Ratio (%) (a/b)	Covered Employee Payroll (c)	UAAL as a Percent of Covered Payroll (%) (b - a)/c
01/01/2008	$ 759,410,332	$ 889,924,310	$ 130,513,978	85.33%	$ 156,585,326	83.35%
01/01/2009	631,893,995	929,569,464	297,675,469	67.98%	166,050,095	179.27%
01/01/2010	679,509,973	987,692,295	308,182,322	68.80%	166,392,075	185.21%
01/01/2011	724,997,822	1,025,075,423	300,077,601	70.73%	157,720,871	190.26%
01/01/2012	712,110,360	1,051,190,790	339,080,430	67.74%	159,669,859	212.36%
01/01/2013	706,950,694	1,117,438,564	410,487,870	63.27%	166,094,906	247.14%
01/01/2014	770,334,007	1,170,625,635	400,291,628	65.81%	168,856,039	237.06%
01/01/2015	820,708,236	1,228,554,779	407,846,543	66.80%	173,759,691	234.72%
01/01/2016	849,286,321	1,286,899,596	437,613,275	65.99%	175,910,160	248.77%
01/01/2017	884,576,848	1,346,266,105	461,689,257	65.71%	182,832,183	252.52%

Also refer to the "Schedule of WRS's Contributions – Last 10 Fiscal Years" in the Required Supplementary Information section of this report.

VII. Summary of Plan Provisions

In addition to this summary of plan provisions, also refer to the "Financial Section" of this report for further information related to plan provisions.

The following summarizes the major provisions of Chapter 32 of the Massachusetts General Laws.

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 three-year 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

Employees hired before January 1, 1975 contribute 5 percent of their salary; employees hired after January 1, 1975 and before December 31, 1983 contribute 7 percent; employees hired after January 1, 1984 and before June 30, 1996 contribute 8 percent; employees hired after July 1, 1996 contribute 9 percent.

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 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 job due to a non-occupational disability will receive a retirement allowance if he 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 own contributions, plus additional amounts for surviving children. Benefits are capped at 75 percent of annual rate of regular compensation for employees who become members after January 1, 1988.

Death Benefits

In general, the beneficiary of an employee who dies in active service will receive a refund of the employee's own contributions. Alternatively, if the employee were eligible to retire on the date of his or her 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. The allowance provided for under this option shall not be less than $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 killed in the line of duty will be eligible to receive an annual benefit equal to the maximum salary held by the member at the time of death, and will be eligible for pay increases that would have been awarded to the officer if they were still living.

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

"Heart and Lung Law" and Cancer Presumption

Any case of hypertension or heart disease resulting in total or partial disability or death to a uniformed fireman or 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 contributions not expended for annuity payments will be refunded to his 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 their 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 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. As of July 1, 2012, this increased to an annual COLA in excess of the CPI, but not to exceed 3% of the first $13,000 of a retirement allowance. Cost-of-living increases granted prior to July 1, 1998 are reimbursed by the Commonwealth and are not reflected in this report.

Changes in Plan Provisions

None.

Statistical Section

STATISTICAL SECTION

This part of the WRS' Comprehensive Annual Financial Report presents information as a context for understanding what the information in the financial statements, note disclosures, and required supplementary information says about the WRS' overall financial health.

Table of Contents

Schedule of Additions to Fiduciary Net Position by Source

Fiscal Year	Member Contributions	Employer Contributions	Employer Contributions as % of Covered Payroll	Investment Income(a)	Other(b)	Total
2007	$ 13,922,938	$ 24,166,318	15.81	$ 61,690,401	$ 2,800,696	$ 102,580,353
2008	14,695,126	24,947,158	15.93	(213,653,903)	1,553,980	(172,457,639)
2009	14,785,935	28,505,066	17.17	109,307,795	2,308,137	154,906,933
2010	14,731,633	29,770,499	18.15	83,274,908	2,148,586	129,925,626
2011	14,526,760	32,706,347	20.74	(5,631,768)	2,084,878	43,686,217
2012	15,358,457	35,409,140	22.18	91,252,263	2,040,339	144,060,199
2013	16,208,897	38,148,683	22.97	93,539,100	2,485,176	150,381,856
2014	16,320,772	41,200,578	24.40	34,950,210	1,845,922	94,317,482
2015	17,409,182	42,703,837	24.58	(10,490,024)	1,808,517	51,431,512
2016	17,797,519	44,411,990	25.25	58,737,894	1,854,736	122,802,139

(a) Net of Investment expenses

(b) Includes state pension reimbursements and transfer of employees' contributions from other public pension plans as defined by Massachusetts General Law, Chapter 32.

Schedule of Deductions from Fiduciary Net Position by Type

Fiscal Year	Benefits	Administrative Expenses	Withdrawals(a)	Total
2007	$ 55,033,466	$ 555,774	$ 4,377,551	$ 59,966,791
2008	56,516,348	554,276	3,303,810	60,374,434
2009	58,698,242	538,983	4,511,626	63,748,851
2010	61,274,343	557,170	4,355,679	66,187,192
2011	64,477,915	569,245	4,538,471	69,585,631
2012	66,303,041	528,845	3,762,744	70,594,630
2013	68,152,214	562,729	4,143,967	72,858,910
2014	70,761,551	587,157	4,325,882	75,674,590
2015	74,243,486	572,743	4,418,386	79,234,615
2016	77,848,021	565,669	4,873,808	83,287,498

(a) Includes amounts for employee withdrawals and employee transfers to other governmental units.

Schedule of Total Change in Net Position

Fiscal Year	Total Change in Net Position
2007	$ 42,613,562
2008	(232,832,073)
2009	91,158,082
2010	64,164,839
2011	(25,899,414)
2012	73,465,569
2013	77,522,946
2014	18,642,892
2015	(27,803,103)
2016	39,514,641

Schedule of Benefit Expenses by Type

Year ended December 31	Regular	Disability	Beneficiary	COLA	Annuities	Total
2007	$ 23,437,804	$ 10,890,179	$ 5,081,340	$ 9,147,566	$ 6,476,577	$ 55,033,466
2008	23,937,559	11,123,001	5,285,744	9,355,548	6,814,496	56,516,348
2009	24,711,047	11,798,651	5,331,443	9,522,992	7,334,109	58,698,242
2010	26,885,194	11,404,371	5,621,282	9,695,254	7,668,242	61,274,343
2011	28,911,453	11,616,006	5,677,792	9,878,255	8,394,409	64,477,915
2012	29,865,177	11,478,657	5,846,990	10,036,821	9,075,396	66,303,041
2013	30,940,561	11,481,993	6,275,471	10,277,781	9,176,408	68,152,214
2014	33,659,810	11,596,064	5,066,472	10,496,771	9,942,434	70,761,551
2015	35,487,721	11,841,135	5,267,784	10,923,579	10,723,267	74,243,486
2016	37,977,162	12,615,968	4,670,120	11,157,039	11,427,732	77,848,021

Schedule of Refund Expenses by Type (a)

Year ended December 31	Voluntary Refunds (Resignation)	Involuntary Refunds (Termination)	Deaths	Overpayment Contributions	Total
2013	$ 543,990	$ 485,490	$ 58,589	$ 970	$ 1,089,039
2014	639,481	287,034	23,279	-	949,794
2015	540,978	341,054	62,642	10,211	954,885
2016	690,021	213,630	126,575	-	1,030,226

(a) Data is provided beginning in calendar year 2013, which is the first year data in this format is available.

Schedule of Retired Members by Benefit

	12/31/2016	12/31/2015	12/31/2014	12/31/2013	12/31/2012	12/31/2011	12/31/2010	12/31/2009	12/31/2008	12/31/2007
Superannuation										
Group 1	1,472	1,454	1,465	1,474	1,471	1,499	1,524	1,482	1,493	1,545
Group 2&4	387	375	347	327	322	306	302	289	276	270
Total	1,859	1,829	1,812	1,801	1,793	1,805	1,826	1,771	1,769	1,815
Ordinary Disability										
Group 1	31	33	35	34	35	34	33	36	39	43
Group 2&4	7	7	8	8	8	8	7	6	6	7
Total	38	40	43	42	43	42	40	42	45	50
Accidental Disability										
Group 1	117	119	117	117	119	124	117	124	130	128
Group 2&4	268	271	273	278	281	296	301	315	317	319
Total	385	390	390	395	400	420	418	439	447	447
Benficiaries										
Group 1	249	263	273	289	310	304	311	340	349	361
Group 2&4	197	200	199	206	208	205	203	182	182	176
Total	446	463	472	495	518	509	514	522	531	537
Total Retired Members										
Group 1	1,869	1,869	1,890	1,914	1,935	1,961	1,985	1,982	2,011	2,077
Group 2&4	859	853	827	819	819	815	813	792	781	772
Total	2,728	2,722	2,717	2,733	2,754	2,776	2,798	2,774	2,792	2,849

Source: Actuarial valuation as of January 1, 2017

Schedule of Average Benefit Payments (2011-2016)

Years of Credited Service	2011 (a) Average Monthly Benefit ($)	2011 (a) Average Final Average Salary ($)	2011 (a) Number of Retired Members (b)	2012 (a) Average Monthly Benefit ($)	2012 (a) Average Final Average Salary ($)	2012 (a) Number of Retired Members (b)	2013 (a) Average Monthly Benefit ($)	2013 (a) Average Final Average Salary ($)	2013 (a) Number of Retired Members (b)
0	706	4,320	1	1,154	20,974	2	749	4,320	1
1 - 5	1,365	18,653	34	1,513	20,504	32	1,680	22,209	30
6 - 10	952	22,003	175	1,029	22,961	164	1,085	22,628	153
11 - 15	1,018	23,755	350	1,054	24,561	328	1,099	25,410	330
16 - 20	1,329	26,953	405	1,354	27,431	404	1,415	28,159	409
21 - 25	1,819	33,984	376	1,874	34,923	370	1,917	34,576	362
26 - 30	2,626	40,393	312	2,674	41,175	313	2,736	41,002	314
31 - 35	3,402	50,416	395	3,496	52,036	403	3,618	50,365	401
36 - 40	3,497	52,215	187	3,588	53,742	185	3,670	49,364	197
41 - 45	3,003	43,288	30	3,083	44,075	32	3,158	45,860	38
46 - 50	2,381	43,069	2	2,413	43,069	2	2,446	43,069	2
51 - 55	3,334	51,857	1	3,367	51,857	1	3,399	51,857	1

Years of Credited Service	2014 (a) Average Monthly Benefit ($)	2014 (a) Average Final Average Salary ($)	2014 (a) Number of Retired Members (b)	2015 (a) Average Monthly Benefit ($)	2015 (a) Average Final Average Salary ($)	2015 (a) Number of Retired Members (b)	2016 (a) Average Monthly Benefit ($)	2016 (a) Average Final Average Salary ($)	2016 (a) Number of Retired Members (b)
0	772	4,320	1	795	4,320	1	819	4,320	1
1 - 5	1,709	22,437	31	1,806	23,334	27	1,835	24,384	28
6 - 10	1,143	24,924	145	1,200	26,274	141	1,232	27,024	138
11 - 15	1,146	27,712	326	1,191	28,923	316	1,240	29,534	307
16 - 20	1,476	29,785	401	1,504	30,804	401	1,539	31,881	402
21 - 25	1,969	36,071	364	2,025	36,637	361	2,100	38,099	364
26 - 30	2,816	43,438	319	2,910	45,028	319	2,949	46,123	336
31 - 35	3,738	55,330	405	3,928	58,294	434	4,065	60,356	441
36 - 40	3,832	57,901	208	3,946	59,520	212	4,107	62,086	214
41 - 45	3,393	50,488	41	3,600	53,861	42	3,767	56,267	47
46 - 50	2,808	43,069	2	2,895	43,609	3	2,928	43,609	3
51 - 55	3,432	51,857	1	3,464	51,857	1	3,497	51,857	1

(a) Data in the format presented in this table is provided beginning in calendar year 2011, which is the first year data in this format is available. Please see the "Schedule of Average Benefit Payments (2007-2010)" for average benefit payment data for calendar years 2007-2010.

(b) Since the data in this table is organized by creditable service, it does not include "Beneficiaries"

Schedule of Average Benefit Payments (2007-2010) (a)

Year ended December 31	Number	Annual benefits ($)	Monthly average ($)	Annual average ($)	% Increase
2007	2,849	55,033,466	1,610	19,317	3.70
2008	2,792	56,516,348	1,687	20,242	4.79
2009	2,774	58,698,242	1,763	21,160	4.54
2010	2,798	61,274,343	1,825	21,899	3.49

(a) Data in the format presented in this table is provided for calendar years 2007-2010. The table provides for the most comprehensive average benefit payment data available for this time period.

Schedule of Participating Employers

Fiscal Year	Employer Name	Number of Covered Employees	Percentage of Total Covered Employees
2007	City of Worcester	3,120	94.6%
2007	Worcester Housing Authority	178	5.4%
2016	City of Worcester	3,146	94.1%
2016	Worcester Housing Authority	196	5.9%

Source: The WRS administrative staff