STATE OF WISCONSIN
Department of Employee Trust Funds
Robert J. Conlin
SECRETARY

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Correspondence Memorandum

Date: May 30, 2019

To: Employee Trust Funds Board

From: Cindy Klimke-Armatoski, CPA
Chief Trust Finance Officer

Subject: WRS Active Lives Valuation & Gain/Loss Analysis

ETF requests the Employee Trust Funds Board (Board) approve the Thirty-Eighth Annual Actuarial Valuation and Gain/Loss Analysis as of December 31, 2018.

Gabriel Roeder Smith & Company (GRS) has completed the actuarial valuation of non-retired members of the Wisconsin Retirement System. The results of the study are summarized below (millions $):

	December 31,	
	2018	2017
Actuarial Accrued Liability	$101,422.3	$ 100,819.3
Actuarial Value of Assets	101,410.5	100,802.5
Unfunded Actuarial Accrued Liability	11.8	16.8
Funded Ratio	99.99%	99.98%

GRS is recommending the following contribution rates for 2020.

	General, Teachers, Executive and Elected Officials		Protective Occupations			
			With Social Security		Without Social Security	
	2020	**2019**	**2020**	**2019**	**2020**	**2019**
Employer Normal Cost	6.75%	6.55%	11.65%	10.55%	16.25%	14.95%
Participant Normal Cost	6.75%	6.55%	6.75%	6.55%	6.75%	6.55%
Total Normal Cost	13.5%	13.1%	18.4%	17.1%	23.0%	21.5%

Actuaries from GRS will be at the Board meeting to present their report and to answer any questions.

Attachment: Thirty-Eighth Annual Actuarial Valuation and Gain/Loss Analysis

Reviewed and approved by Robert J. Conlin, Secretary

Electronically Signed 6/10/19

Board	Mtg Date	Item #
JM	6.20.19	3A
ETF	6.20.19	4A

Wisconsin Retirement System

Thirty-Eighth Annual Actuarial Valuation and Gain/Loss Analysis

December 31, 2018

Outline of Contents

GRS Retirement Consulting

800.521.0498 | P: 248.799.9000 | F: 248.799.9020 | www.grsconsulting.com

May 30, 2019

Employee Trust Funds Board
Wisconsin Department of Employee
Trust Funds
4822 Madison Yards Way
Madison, Wisconsin 53705

Ladies and Gentlemen:

The results of the **December 31, 2018 annual actuarial valuations of non-retired members covered by the Wisconsin Retirement System** are presented in this report. The valuations establish contribution rates for the 2020 calendar year in conformance with Chapter 40 of the Wisconsin Statutes. This report should not be relied upon for any other purpose. This report may be distributed to parties other than the ETF Board and Staff only in its entirety and only with the permission of the Board. GRS is not responsible for unauthorized use of this report. Determinations of financial results, associated with the benefits described in this report, for purposes other than those identified above may be significantly different. The change in the total normal cost rates from last year are shown below:

General and Executive/Elected	Protective with SS	Protective without SS
0.4%	1.3%	1.5%

The valuations are based upon our understanding of the main plan provisions related to General, Executive and Elected, and Protective Occupation employment with and without Social Security coverage. The plan provisions evaluated are summarized in Section G of this report. Please advise us of any material misstatements in the summary and do not rely on this report until such are resolved.

The individual member statistical data required for the valuations was furnished by the Department of Employee Trust Funds (DETF), together with pertinent data on financial operations. The cooperation of DETF staff in furnishing these materials is acknowledged with appreciation. We checked for internal reasonability and year-to-year consistency, but did not audit the data. We are not responsible for the accuracy or completeness of the information provided by others.

Actuarial valuations are based upon assumptions regarding future activity in specific risk areas including the rates of investment return and payroll growth, eligibility for the various classes of benefits, and longevity among retired lives. The Board adopts these assumptions after considering the advice of the actuary and other professionals. Each actuarial valuation takes into account all prior differences between actual and assumed experience in each risk area and adjusts the contribution rates as needed. The December 31, 2018 valuations were based upon assumptions that were recommended in connection with a study of experience during 2015-2017 and benefit provisions in effect on December 31, 2018.

Future actuarial measurements may differ significantly from those presented in this report due to such factors as experience differing from that anticipated by actuarial assumptions, changes in plan provisions, actuarial assumptions/methods or applicable law. Due to the limited scope of this assignment, we did not perform an analysis of the potential range of future measurements.

To the best of our knowledge, this report is complete and accurate and was made in accordance with generally recognized actuarial methods. Brian B. Murphy, Mark Buis, and James D. Anderson are Members of the American Academy of Actuaries (MAAA), and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. The signing actuaries are independent of the plan sponsor.

The valuations were completed by qualified actuaries in accordance with accepted actuarial procedures as prescribed by the Actuarial Standards Board. It is our opinion that the Wisconsin Retirement System is operating in accordance with actuarial principles of level percent-of-payroll financing.

Respectfully submitted,

Brian B. Murphy, FSA, EA, FCA, MAAA, PhD

Mark Buis, FSA, EA, FCA, MAAA

James D. Anderson, FSA, EA, FCA, MAAA

BBM/MB/JDA:dj

SECTION A

EXECUTIVE SUMMARY

Executive Summary

1. Required Employer Contributions to Support Retirement System Benefits

	General, Executive & Elected Officials		Protective Occupation With Soc. Sec.		Protective Occupation Without Soc. Sec.		Average
	2020	2019	2020	2019	2020	2019	2020
Employer Normal Cost	6.75%	6.55%	11.65%	10.55%	16.25%	14.95%	7.35%
Participant Normal Cost	6.75%	6.55%	6.75%	6.55%	6.75%	6.55%	6.75%
Total Normal Cost	**13.5%**	**13.1%**	**18.4%**	**17.1%**	**23.0%**	**21.5%**	**14.10%**

All employers are required to contribute the employer normal cost shown above. Certain employers are required to make additional contributions to fund their "Frozen Initial Liability" which are liabilities that they either brought on when they joined the WRS, or when they increased their prior service percentage. Related information is provided on page B-2.

Under Section 40.05 of the Wisconsin statutes updated for Acts 10 and 32 of 2011, contribution rates are split evenly between the employer normal cost and the participant normal cost for both General Participants and Executive and Elected Officials. For protective occupations, the participant normal cost is set equal to the participant normal cost for General Participants.

Contributions to support the Section 40.65 Duty Disability Program and the Accumulated Sick Leave Conversion Credit Program are in addition to the WRS rates shown above.

2. Reasons for Change

There are three general reasons why contribution rates change from one valuation to the next. The first is a change in the benefits or eligibility conditions of the plan. The second is a change in the valuation assumptions used to project future occurrences. The third is the difference during the year between the plan's actual experience and what the assumptions predicted.

In Wisconsin, there is a fourth reason. When the contribution rate changes for any of the first three reasons, the effect of the change is split evenly between employers and participants, except for protective occupation participants. When the participant normal cost changes, projected future participant account balances also change. By statute, the value of the participant retirement benefits must be at least equal to twice the account balance at retirement. This then changes the value of the retirement benefit, which then changes the total normal cost, which is then split between employers and participants. This final effect on normal cost is referred to as the "Money Purchase Effect".

In total, changes in the contribution rate are illustrated on the following chart. Additional detail on gains and losses can be found in Section D of this report.

	General, Executive & Elected Officials	Protective with Soc. Sec.	Protective without Soc. Sec.
2019 Normal Cost Rate	13.10%	17.10%	21.50%
Effect of Benefit Change	0.00%	0.00%	0.00%
Effect of Assumption Change	0.07%	0.65%	0.62%
Effect of Asset Performance	0.36%	0.55%	0.78%
Effect of Salary Experience	(0.18)%	0.03%	0.06%
Effect of Money Purchase Benefit	0.10%	0.03%	0.02%
Demographic and Other Experience	0.05%	0.05%	0.02%
2020 Normal Cost Rate	13.50%	18.40%	23.00%

Although the investment income is allocated proportionately to each group, the effect on the contribution rate will be different because the ratio of assets to payroll is different for each group.

3. General Comments

Based upon this valuation, normal cost contribution rates increased for all groups primarily due to unfavorable investment performance from prior years flowing through the Market Recognition Account (MRA) and updated actuarial assumptions.

In total, during 2018, investment return was below the assumed 2018 level of 7.00% on a market value basis. Under the asset valuation method (using the MRA), gains and losses are phased-in over a five-year period, resulting in a 4.8% return on an Actuarial Value of Assets basis in the Core Fund. The Actuarial Value of Assets exceeds the Market Value of Assets by approximately 5.0% as of the valuation date. The statutory asset valuation method will recognize all of the differences between actuarial value and market value of $-4.9 billion over four future years putting upward pressure on future contribution rates.

Conclusion. Based upon the results of the December 31, 2018 regular annual actuarial valuation, it is our opinion that ***the Wisconsin Retirement System continues to operate in accordance with actuarial principles of level percent-of-payroll financing.***

Other Observations

General Implications of Contribution Allocation Procedure or Funding Policy on Future Expected Plan Contributions and Funded Status

Given the plan's contribution allocation procedure, if all actuarial assumptions are met (including the assumption of the plan earning 7.00% on the actuarial value of assets), it is expected that:

(1) The normal cost as a percentage of pay will decrease asymptotically to the level of the entry age normal cost as time passes.
(2) The unfunded liability will decrease in dollar amount until it is fully funded.
(3) The funded status of the plan will remain very close to a 100% funded ratio.

Limitations of Funded Status Measurements

Unless otherwise indicated, a funded ratio measurement presented in this report is based upon the actuarial accrued liability and the actuarial value of assets. Unless otherwise indicated, with regard to any funded status measurements presented in this report:

(1) The measurement is inappropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations, in other words, of transferring the obligations to an unrelated third party in an arm's length market value type transaction.
(2) The measurement is dependent upon the actuarial cost method which, in combination with the plan's amortization policy, affects the timing and amounts of future contributions. The amount of future contributions will most certainly differ from those assumed in this report due to future actual experience differing from assumed experience based upon actuarial assumptions. A funded ratio measurement in this report of 100% is not synonymous with no required future contributions. If the funded ratio were 100%, the plan would still require future normal cost contributions (i.e., contributions to cover the cost of the active membership accruing an additional year of service credit).
(3) The measurement would produce a different result if the market value of assets were used instead of the actuarial value of assets, unless the market value of assets is used in the measurement.

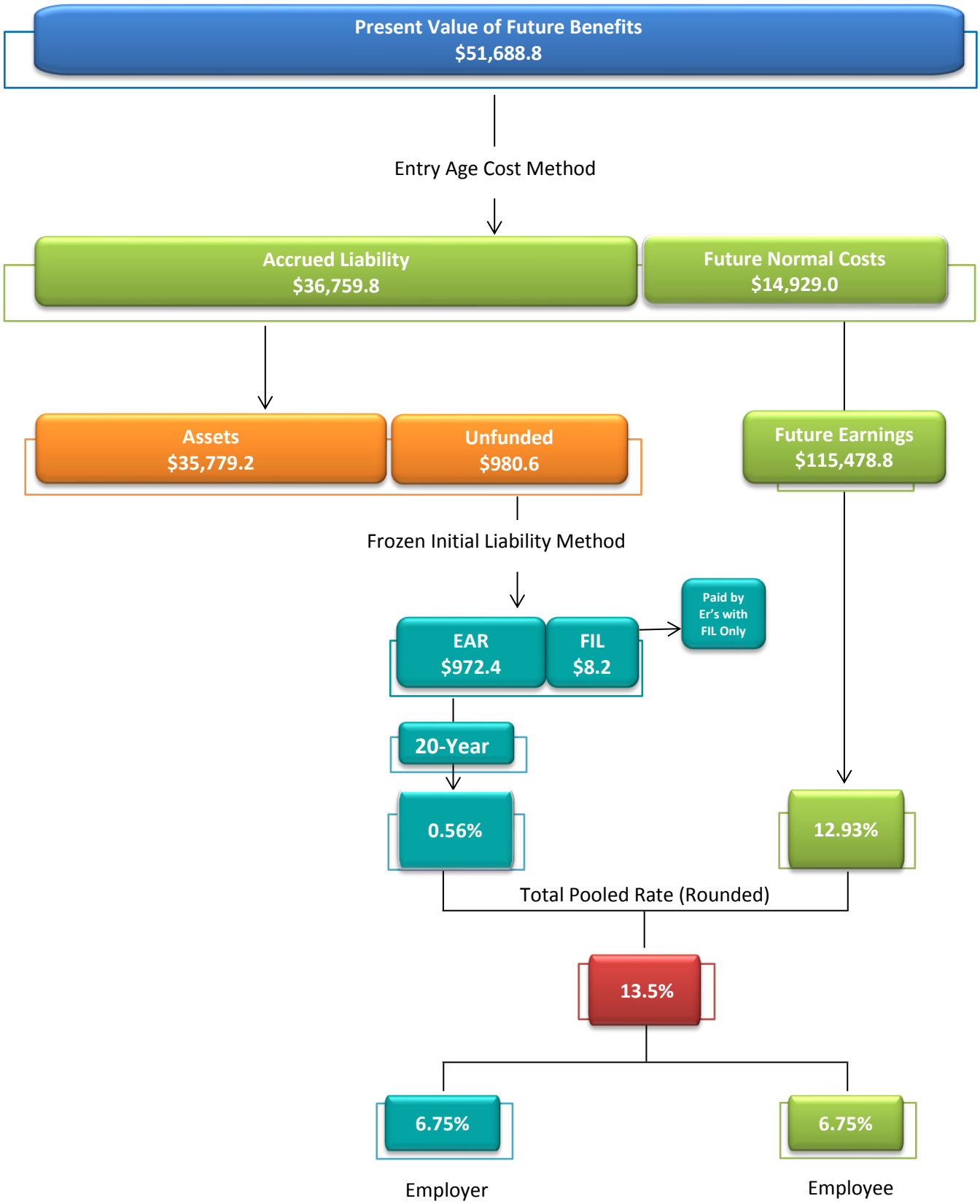
Limitation of Project Scope

Actuarial standards do not require the actuary to evaluate the ability of the plan sponsor or other contributing entity to make required contributions to the plan when due. Such an evaluation was not within the scope of this project and is not within the actuary's domain of expertise. Consequently, the actuary performed no such evaluation.

SECTION B

VALUATION RESULTS

Actuarial Valuation Process
(Illustration for General/Elected Group)
$ Millions -- %'s of Payroll

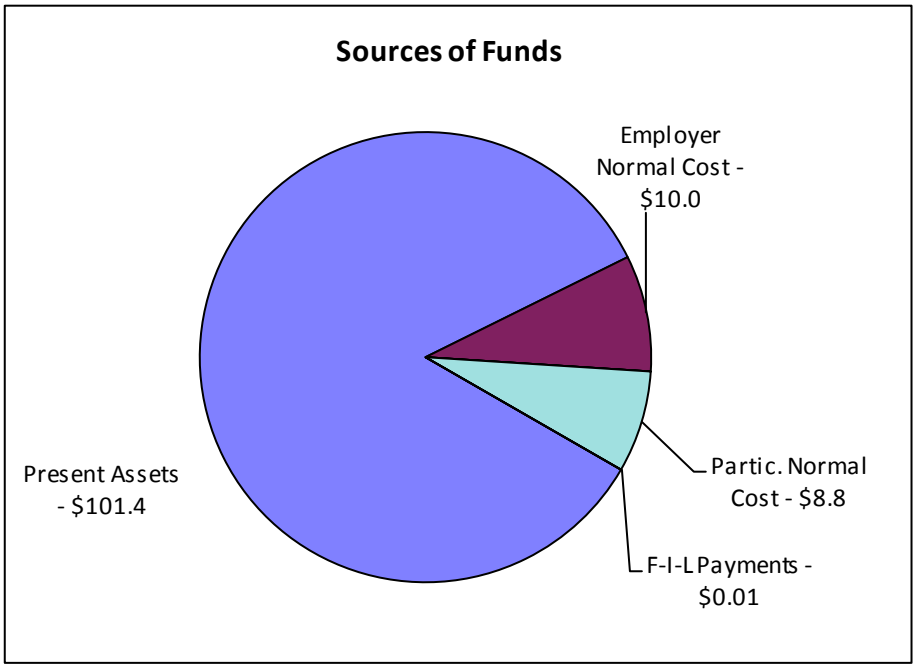


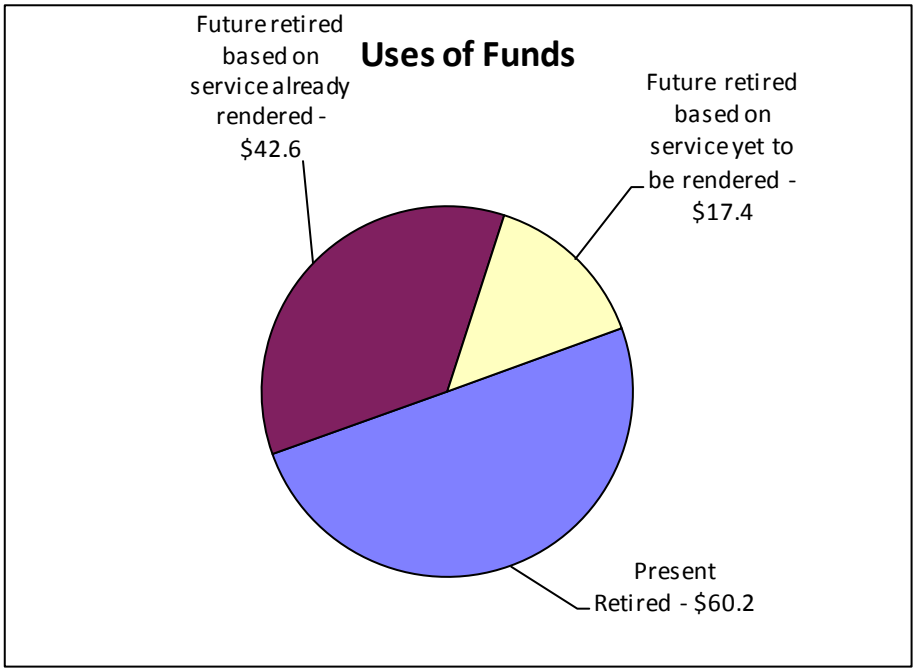
Wisconsin Retirement System
December 31, 2018 Valuation Overview

		$ Millions					
		Non Retired					
			Protective		Unallocated		
		General, Executives & Elected Officials	With Soc. Sec.	Without Soc. Sec.	Add 'l Contribs	Retired	Total/Average
1	Number of People						
	a. Active	234,764	19,399	2,770			256,933
	b. Inactive, not retired	160,669	6,871	238			167,778
	c. Total	395,433	26,270	3,008		211,126	635,837
2	Current Earnings	$12,553.3	$1,263.1	$224.9			$14,041.3
3	**Present Values of**						
	Future Benefits for						
	a. Active	$45,018.5	$5,975.7	$1,463.7			$52,457.9
	b. Inactive, not retired	$6,346.8	$578.9	$55.9			$6,981.6
	c. Variable Adjustment	$323.5	$34.9	$6.9			$365.3
	d. Total	$51,688.8	$6,589.5	$1,526.5	$201.1	$60,242.9	$120,248.8
4	Future Entry Age Normal Costs	$14,929.0	$2,014.0	$482.5			$17,425.5
5	Future Earnings	$115,478.8	$12,395.0	$2,289.4			$130,163.2
6	**Pooled Entry Age Normal Cost (4/5)**	**12.93%**	**16.25%**	**21.08%**			**13.39%**
7	Entry Age Accrued Liability (3d-4)	$36,759.8	$4,575.5	$1,044.0	$201.1	$60,242.9	$102,823.3
8	Assets	$35,779.2	$4,205.0	$982.3	$201.1	$60,242.9	$101,410.5
9	**Total Entry Age Unfunded Liability (7-8)**	**$980.6**	**$370.5**	**$61.7**	**$0.0**	**$0.0**	**$1,412.8**
10	Frozen Initial Liability Portion	$8.2	$1.2	$2.5	$0.0	$0.0	$11.8
11	Pooled Unfunded Liability (EAR) (9-10)	$972.4	$369.3	$59.2	$0.0	$0.0	$1,401.0
12	20 year amortization factor	13.7930	13.7930	13.7930			13.7930
13	**Pooled Amortization % (11/12/2)**	**0.56%**	**2.12%**	**1.91%**			**0.72%**
14	**Total Pooled Rate Rounded (6+13)**	**13.5%**	**18.4%**	**23.0%**			**14.1%**
15	**2020 F-I-L Normal Cost Rates**						
16	**Participant (0.5x14 (Gen'l))**	**6.75%**	**6.75%**	**6.75%**			**6.75%**
17	**Employer (14-16)**	**6.75%**	**11.65%**	**16.25%**			**7.35%**
18	**Total (16+17)**	**13.5%**	**18.4%**	**23.0%**			**14.10%**
19	Entry Age Funded Ratio (8/7)	97.3%	91.9%	94.1%	100.0%	100.0%	98.6%

	Unfunded Frozen Initial Liability (UFIL)			
		Protective		
	General, Executives & Elected Officials	With Soc. Sec.	Without Soc Sec	Total
Balance January 1, 2018	$13,185,218	$1,250,839	$2,392,944	$16,829,001
New Employers	$0	$0	$0	$0
Adjustments	$0	$0	$0	$0
Payments	($5,567,751)	($147,330)	($54,875)	($5,769,956)
Interest	$533,222	$77,246	$163,665	$774,133
Balance December 31, 2018	**$8,150,689**	**$1,180,755**	**$2,501,734**	**$11,833,178**
WRS Average UFIL Contribution	**0.04%**	**0.01%**	**0.02%**	**0.04%**

Financing $120.2 Billion* of Benefit Promises for Present Active and Retired Participants December 31, 2018

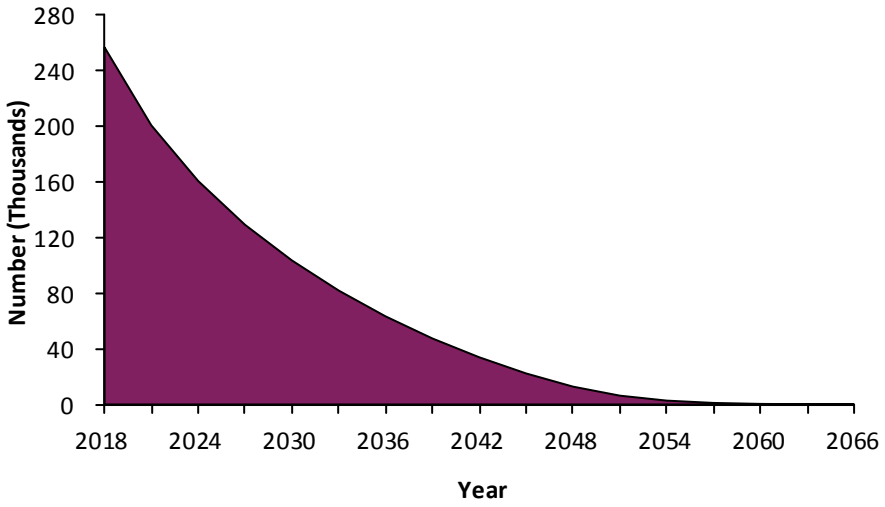




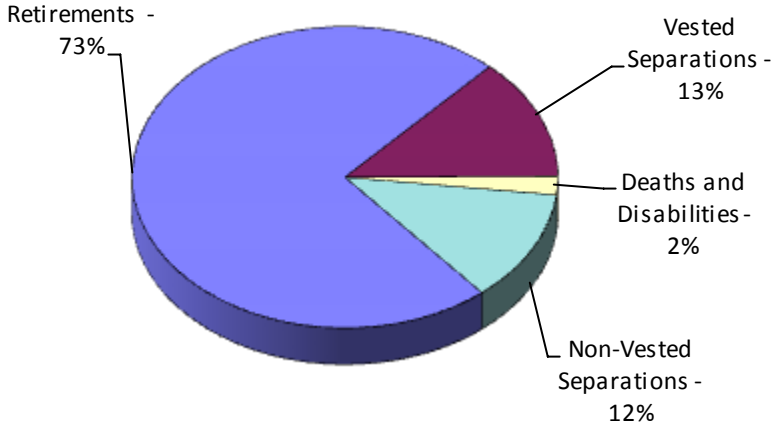
* *Present value of future benefits; all divisions combined.*

Expected Development of Present Population
December 31, 2018

Closed Group Active Population Projection



Expected Terminations from Active Employment for Current Active Members



The charts above show the expected future development of the present population in simplified terms. The retirement system presently covers 256,933 active members. Eventually, 12% of the population is expected to terminate covered employment prior to retirement and forfeit eligibility for a monthly benefit. About 86% of the present population is expected to receive monthly retirement benefits either by retiring directly from active service, or by retiring from vested deferred status. The remaining 2% of the present population is expected to become eligible for death-in-service or disability benefits. Within **ten** years, over half of the covered membership is expected to consist of new hires.

Comparative Statement of Computed Contribution Rates

Valuation 12/31	Rate Effective 1/1	General				Executive and Elected			
		Participant	Benefit Adj. Contr.	Employer[1]	Total	Participant	Benefit Adj. Contr.	Employer[1]	Total
1994	1996	5.00 %	1.50 %	6.40 %	12.90 %	4.60 %	0.00 %	11.10 %	15.70 %
1995	1997	5.00 %	1.40 %	6.30 %	12.70 %	4.70 %	0.00 %	11.20 %	15.90 %
1996	1998	5.00 %	1.20 %	6.10 %	12.30 %	4.70 %	0.00 %	11.20 %	15.90 %
1997	1999	5.00 %	0.80 %	5.80 %	11.60 %	4.30 %	0.00 %	10.80 %	15.10 %
1998	2000	5.00 %	0.50 %	5.50 %	11.00 %	4.10 %	0.00 %	10.60 %	14.70 %
1999	2001	5.00 %	0.20 %	5.10 %	10.30 %	3.90 %	0.00 %	10.40 %	14.30 %
2000	2002	5.00 %	0.20 %	5.10 %	10.30 %	3.10 %	0.00 %	9.60 %	12.70 %
2001 [2]	2003	5.00 %	0.40 %	5.23 %	10.63 %	2.60 %	0.00 %	9.06 %	11.66 %
2002	2004	5.00 %	0.60 %	5.22 %	10.82 %	2.60 %	0.00 %	8.91 %	11.51 %
2003	2005	5.00 %	0.80 %	4.70 %	10.50 %	2.80 %	0.00 %	8.40 %	11.20 %
2004	2006	5.00 %	0.90 %	4.73 %	10.63 %	2.90 %	0.00 %	8.47 %	11.37 %
2005	2007	5.00 %	1.00 %	4.81 %	10.81 %	3.00 %	0.00 %	8.56 %	11.56 %
2006	2008	5.00 %	1.00 %	4.79 %	10.79 %	3.00 %	0.00 %	8.56 %	11.56 %
2007	2009	5.00 %	0.90 %	4.68 %	10.58 %	3.00 %	0.00 %	8.55 %	11.55 %
2008	2010	5.00 %	1.20 %	4.95 %	11.15 %	3.20 %	0.00 %	8.75 %	11.95 %
2009	2011	5.00 %	1.50 %	5.22 %	11.72 %	3.90 %	0.00 %	9.45 %	13.35 %
2010	2012	5.00 %	1.60 %	5.30 %	11.90 %	4.30 %	0.00 %	9.80 %	14.10 %
2011 [3]	2013	6.65 %	N/A	6.75 %	13.40 %	7.00 %	N/A	7.00 %	14.00 %
2012	2014	7.00 %	N/A	7.00 %	14.00 %	7.75 %	N/A	7.75 %	15.50 %
2013	2015	6.80 %	N/A	6.80 %	13.60 %	7.70 %	N/A	7.70 %	15.40 %
2014	2016	6.60 %	N/A	6.60 %	13.20 %	7.80 %	N/A	7.80 %	15.60 %
2015 [4]	2017	6.80 %	N/A	6.87 %	13.67 %	6.80 %	N/A	6.87 %	13.67 %
2016	2018	6.70 %	N/A	6.73 %	13.43 %	6.70 %	N/A	6.73 %	13.43 %
2017	2019	6.55 %	N/A	6.57 %	13.12 %	6.55 %	N/A	6.57 %	13.12 %
2018	2020	6.75 %	N/A	6.79 %	13.54 %	6.75 %	N/A	6.79 %	13.54 %

1 Employer normal cost plus weighted average of unfunded Frozen Initial liability contribution rates.

2 Act 11 of 1999 was implemented in 2001.

3 Act 10 and Act 32 were implemented in 2011.

4 Contribution rates for General and Executive and Elected Officials groups were combined beginning with the 2015 valuation. Actual 2016 Participant and Employer contribution rates for the Executive and Elected Officials group were each 6.6% respectively.

Comparative Statement of Computed Contribution Rates

Valuation 12/31	Rate Effective 1/1	Protective With Social Security				Protective Without Social Security			
		Participant	Benefit Adj. Contr.	Employer[1]	Total	Participant	Benefit Adj. Contr.	Employer[1]	Total
1994	1996	6.00 %	0.10 %	10.20 %	16.30 %	6.80 %		15.70 %	22.50 %
1995	1997	5.80 %	0.00 %	9.80 %	15.60 %	6.20 %		15.10 %	21.30 %
1996	1998	5.40 %	0.00 %	9.40 %	14.80 %	5.80 %		14.60 %	20.40 %
1997	1999	4.90 %	0.00 %	8.90 %	13.80 %	5.40 %		14.30 %	19.70 %
1998	2000	4.10 %	0.00 %	8.00 %	12.10 %	4.40 %		13.30 %	17.70 %
1999	2001	3.80 %	0.00 %	7.60 %	11.40 %	3.30 %		12.20 %	15.50 %
2000	2002	4.00 %	0.00 %	7.80 %	11.80 %	3.00 %		11.90 %	14.90 %
2001 [2]	2003	4.00 %	0.00 %	7.68 %	11.68 %	2.40 %		11.28 %	13.68 %
2002	2004	4.50 %	0.00 %	8.02 %	12.52 %	3.20 %		11.81 %	15.01 %
2003	2005	4.90 %	0.00 %	8.10 %	13.00 %	3.30 %		11.30 %	14.60 %
2004	2006	5.00 %	0.00 %	8.19 %	13.19 %	3.30 %		11.11 %	14.41 %
2005	2007	5.10 %	0.00 %	8.28 %	13.38 %	3.40 %		11.16 %	14.56 %
2006	2008	5.10 %	0.00 %	8.27 %	13.37 %	3.40 %		11.17 %	14.57 %
2007	2009	5.00 %	0.00 %	8.15 %	13.15 %	3.20 %		10.89 %	14.09 %
2008	2010	5.50 %	0.00 %	8.64 %	14.14 %	3.90 %		11.56 %	15.46 %
2009	2011	5.80 %	0.00 %	8.94 %	14.74 %	4.80 %		12.46 %	17.26 %
2010	2012	5.90 %	0.00 %	9.00 %	14.90 %	4.90 %		12.60 %	17.50 %
2011 [3]	2013	6.65 %	N/A	9.75 %	16.40 %	6.65 %		12.65 %	19.30 %
2012	2014	7.00 %	N/A	10.10 %	17.10 %	7.00 %		14.00 %	21.00 %
2013	2015	6.80 %	N/A	9.50 %	16.30 %	6.80 %		13.40 %	20.20 %
2014	2016	6.60 %	N/A	9.40 %	16.00 %	6.60 %		13.40 %	20.00 %
2015	2017	6.80 %	N/A	10.70 %	17.50 %	6.80 %		15.00 %	21.80 %
2016	2018	6.70 %	N/A	10.73 %	17.43 %	6.70 %		14.95 %	21.65 %
2017	2019	6.55 %	N/A	10.55 %	17.10 %	6.55 %		15.04 %	21.59 %
2018	2020	6.75 %	N/A	11.66 %	18.41 %	6.75 %		16.27 %	23.02 %

1 Employer normal cost plus weighted average of unfunded Frozen Initial liability contribution rates.

2 Act 11 of 1999 was implemented in 2001.

3 Act 10 and Act 32 were implemented in 2011.

Schedule of Funding Progress & Accrued Liabilities
($ Millions)

Frozen Initial Liability Method

Valuation Date Dec. 31	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) Frozen Entry Age (b)	Unfunded AAL (UAAL) (b) - (a)	Funded Ratio (a)/(b)	Covered Payroll* (c)	UAAL as a Percent of Covered Payroll [(b) - (a)] / (c)
2009	$ 78,911.3	$ 79,104.6	$ 193.3	99.8 %	$ 12,622.2	1.5 %
2010	80,626.9	80,758.8	131.9	99.8 %	12,744.0	1.0 %
2011	78,940.0	79,039.3	99.3	99.9 %	12,855.6	0.8 %
2012	78,613.0	78,682.7	69.7	99.9 %	12,627.6	0.6 %
2013	85,276.1	85,328.7	52.6	99.9 %	12,884.8	0.4 %
2014	89,360.4	89,392.1	31.7	100.0 %	13,219.5	0.2 %
2015	91,502.4	91,526.5	24.1	100.0 %	13,530.5	0.2 %
2016	95,396.2	95,414.0	17.8	100.0 %	13,706.0	0.1 %
2017	100,802.5	100,819.3	16.8	100.0 %	13,943.1	0.1 %
2018	101,410.5	101,422.3	11.8	100.0 %	14,301.4	0.1 %

Entry Age Method

Valuation Date Dec. 31	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) Entry Age (b)	Unfunded AAL (UAAL) (b) - (a)	Funded Ratio (a)/(b)	Covered Payroll* (c)	UAAL as a Percent of Covered Payroll [(b) - (a)] / (c)
2009	$ 78,911.3	$ 77,856.5	$ (1,054.8)	101.4 %	$ 12,622.2	(8.4)%
2010	80,626.9	80,004.4	(622.5)	100.8 %	12,744.0	(4.9)%
2011	78,940.0	79,584.1	644.1	99.2 %	12,855.6	5.0 %
2012	78,613.0	80,225.3	1,612.3	98.0 %	12,627.6	12.8 %
2013	85,276.1	86,055.0	778.9	99.1 %	12,884.8	6.0 %
2014	89,360.4	89,794.0	433.6	99.5 %	13,219.5	3.3 %
2015	91,502.4	92,736.3	1,233.9	98.7 %	13,530.5	9.1 %
2016	95,396.2	96,351.2	955.0	99.0 %	13,706.0	7.0 %
2017	100,802.5	101,321.9	519.4	99.5 %	13,943.1	3.7 %
2018	101,410.5	102,823.3	1,412.8	98.6 %	14,301.4	9.9 %

** As reported by ETF staff. This figure is intended to represent the total pay upon which contributions were based during the year ended on the valuation date.*

Funding Metrics ($ Millions)

Frozen Initial Liability Method

Valuation Date Dec. 31	Actuarial Value of Assets	F-I-L Accrued Liability for				Percent Funded for			
		Annuitants and Beneficiaries	Member Contribs.	Active & Inactive Members	Total	Annuitants and Beneficiaries	Participant Contributions	Active & Inactive Members	Total
2009	$78,911.3	$39,734.2	$16,156.6	$23,213.8	$79,104.6	100.0%	100.0%	99.2%	99.8%
2010	80,626.9	41,139.0	16,253.6	23,366.2	80,758.8	100.0%	100.0%	99.4%	99.8%
2011	78,940.0	43,609.4	14,434.4	20,995.5	79,039.3	100.0%	100.0%	99.5%	99.9%
2012	78,613.0	44,055.5	14,401.1	20,226.1	78,682.7	100.0%	100.0%	99.7%	99.9%
2013	85,276.1	48,460.5	15,559.2	21,309.0	85,328.7	100.0%	100.0%	99.8%	99.9%
2014	89,360.4	51,131.1	16,259.3	22,001.7	89,392.1	100.0%	100.0%	99.9%	100.0%
2015	91,502.4	52,851.8	16,707.2	21,967.5	91,526.5	100.0%	100.0%	99.9%	100.0%
2016	95,396.2	55,764.0	17,361.7	22,288.3	95,414.0	100.0%	100.0%	99.9%	100.0%
2017	100,802.5	59,224.9	18,434.4	23,160.0	100,819.3	100.0%	100.0%	99.9%	100.0%
2018	101,410.5	60,242.9	18,455.6	22,723.9	101,422.3	100.0%	100.0%	99.9%	100.0%

Entry Age Method

Valuation Date Dec. 31	Actuarial Value of Assets	Entry Age Accrued Liability for				Percent Funded for			
		Annuitants and Beneficiaries	Member Contribs.	Active & Inactive Members	Total	Annuitants and Beneficiaries	Participant Contributions	Active & Inactive Members	Total
2009	$78,911.3	$39,734.2	$16,156.6	$21,965.7	$77,856.5	100.0%	100.0%	104.8%	101.4%
2010	80,626.9	41,139.0	16,253.6	22,611.8	80,004.4	100.0%	100.0%	102.8%	100.8%
2011	78,940.0	43,609.4	14,434.4	21,540.3	79,584.1	100.0%	100.0%	97.0%	99.2%
2012	78,613.0	44,055.5	14,401.1	21,768.7	80,225.3	100.0%	100.0%	92.6%	98.0%
2013	85,276.1	48,460.5	15,559.2	22,035.3	86,055.0	100.0%	100.0%	96.5%	99.1%
2014	89,360.4	51,131.1	16,259.3	22,403.6	89,794.0	100.0%	100.0%	98.1%	99.5%
2015	91,502.4	52,851.8	16,707.2	23,177.3	92,736.3	100.0%	100.0%	94.7%	98.7%
2016	95,396.2	55,764.0	17,361.7	23,225.5	96,351.2	100.0%	100.0%	95.9%	99.0%
2017	100,802.5	59,224.9	18,434.4	23,662.6	101,321.9	100.0%	100.0%	97.8%	99.5%
2018	101,410.5	60,242.9	18,455.6	24,124.8	102,823.3	100.0%	100.0%	94.1%	98.6%

Discussion of Risk/Maturity Measures

The determination of the accrued liability and the actuarially determined contribution requires the use of assumptions regarding future economic and demographic experience. Risk measures, as illustrated in this report, are intended to aid in the understanding of the effects of future experience differing from the assumptions used in the course of the actuarial valuation. Risk measures may also help with illustrating the potential volatility in the accrued liability and the actuarially determined contribution that result from the differences between actual experience and the actuarial assumptions.

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions due to changing conditions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period, or additional cost or contribution requirements based on the Plan's funded status); and changes in plan provisions or applicable law. The scope of an actuarial valuation does not include an analysis of the potential range of such future measurements.

Examples of risk that may reasonably be anticipated to significantly affect the plan's future financial condition include:

1. Investment risk – actual investment returns may differ from the expected returns;
2. Asset/Liability mismatch – changes in asset values may not match changes in liabilities, thereby altering the gap between the accrued liability and assets and consequently altering the funded status and contribution requirements; because of the way most public retirement systems invest, this tends to be synonymous with investment risk;
3. Contribution risk – actual contributions may differ from expected future contributions. For example, actual contributions may not be made in accordance with the plan's funding policy or material changes may occur in the anticipated number of covered employees, covered payroll, or other relevant contribution base;
4. Salary and Payroll risk – actual salaries and total payroll may differ from expected, resulting in actual future accrued liability and contributions differing from expected;
5. Longevity risk – members may live longer or shorter than expected and receive pensions for a period of time other than assumed;
6. Other demographic risks – members may terminate, retire or become disabled at times or with benefits other than assumed resulting in actual future accrued liability and contributions differing from expected.

The effects of certain trends in experience can generally be anticipated. For example if the investment return since the most recent actuarial valuation is less (or more) than the assumed rate, the cost of the plan can be expected to increase (or decrease). Likewise if longevity is improving (or worsening), increases (or decreases) in cost can be anticipated.

The contribution rates shown on page A-1 and A-2 may be considered as minimum contribution rates that comply with the Board's funding policy and statutes. The timely receipt of the actuarially determined contributions is critical to support the financial health of the plan. Users of this report should be aware that contributions made at the actuarially determined rate do not necessarily guarantee benefit security.

Discussion of Risk/Maturity Measures

PLAN MATURITY MEASURES

Risks facing a pension plan evolve over time. A young plan with virtually no investments and paying few benefits may experience little investment risk. An older plan with a large number of members in pay status and a significant trust may be much more exposed to investment risk. Generally accepted plan maturity measures include the following: ratio of the market value of assets to total payroll, ratio of actuarial accrued liability to payroll, ratio of actives to retirees and beneficiaries, and the ratio of net cash flow to market value of assets.

RATIO OF MARKET VALUE OF ASSETS TO PAYROLL

The relationship between assets and payroll is a useful indicator of the potential volatility of contributions. For example, if the market value of assets is 2.0 times the payroll, a return on assets 5% different than assumed would equal 10% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in plan sponsor contributions as a percentage of payroll.

RATIO OF ACTUARIAL ACCRUED LIABILITY TO PAYROLL

The relationship between actuarial accrued liability and payroll is a useful indicator of the potential volatility of contributions for a fully funded plan. A funding policy that targets a funded ratio of 100% is expected to result in the ratio of assets to payroll and the ratio of liability to payroll converging over time. The ratio of liability to payroll may also be used as a measure of sensitivity of the liability itself. For example, if the actuarial accrued liability is 2.5 times the payroll, a change in liability 2% other than assumed would equal 5% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in liability (and also plan sponsor contributions) as a percentage of payroll.

RATIO OF ACTIVES TO RETIREES AND BENEFICIARIES

A young plan with many active members and few retirees will have a high ratio of active to retirees. A mature open plan may have close to the same number of actives to retirees resulting in a ratio near 1.0. A super-mature or closed plan may have significantly more retirees than actives resulting in a ratio below 1.0.

RATIO OF NET CASH FLOW TO MARKET VALUE OF ASSETS

A positive net cash flow means contributions exceed benefits and expenses. A negative cash flow means existing funds are being used to make payments. A certain amount of negative net cash flow is generally expected to occur when benefits are prefunded through a qualified trust. Large negative net cash flows as a percent of assets may indicate a super-mature plan or a need for additional contributions.

ADDITIONAL RISK ASSESSMENT

Additional risk assessment is outside the scope of the annual actuarial valuation. Additional assessment may include scenario tests, sensitivity tests, stochastic modeling, stress tests, and a comparison of the present value of accrued benefits at low-risk discount rates with the actuarial accrued liability.

Risk/Maturity Measures

$ Millions									
Valuation Date	(1) Entry Age Accrued Liabilities (AAL)	(2) Market Value of Assets	(3) (Overfunded)/ Unfunded AAL (1) - (2)	(4) Valuation Payroll	(5) Change in Valuation Payroll	(6) Funded Ratio (2)/(1)	(7) Annuitant Liabilities (AnnLiab)	(8) AnnLiab/ AAL (7)/(1)	(9) AAL/ Valuation Payroll (1)/(4)
2017	$101,321.9	$104,159.6	$(2,837.7)	$13,720.5	1.7%	102.8%	$59,224.9	58.5%	738.5%
2018	102,823.3	96,734.3	6,089.0	14,041.3	2.3%	94.1%	60,242.9	58.6%	732.3%

These Risk Measures were based on assumptions in place on the valuation date. For the current valuation, this includes 7.0% future investment return, Entry Age Normal accrued liabilities and Market Value of Assets.
The Risk/Maturity measures shown on this page and on the following page have been developed in response to Actuarial Standard of Practice ("ASOP") No. 51 entitled "Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions." In a maturing plan, the ratio of retiree liabilities to total liabilities increases, and the ratios of both assets and liabilities to payroll increases, and contribution rates tend to become increasingly volatile. The risk/maturity measures and associated commentary are intended to help keep stakeholders informed of some of the risks that the plan faces, and the potential contribution rate volatility. In the WRS, however, contribution volatility is mitigated by the extensive risk sharing features of the plan, including the dividend process, the Money Purchase Effect, the sharing of contribution rate changes, etc. Thus, these measures, while interesting, have somewhat less meaning for the WRS than they do for most systems.

Notes:

The measures shown above provide information in accordance with Actuarial Standard of Practice No. 51.

Columns (1) to (4). These columns provide various items for comparison in Columns 5 through 16.

Column (5). When payroll grows at or faster than the assumed rate of 3.0%, funding of unfunded accrued liabilities is likely to proceed at least at the scheduled rate. Payroll growing slower than the assumed rate can lead to underfunding of the plan because expected contributions for unfunded liability may not be received.

Column (6). The Funded ratio is the most widely known measure of a plan's financial strength, but the trend in the funded ratio is much more important than the absolute ratio. The funded ratio should trend to 100%. As it approaches 100%, it is important to re-evaluate the level of investment risk in the portfolio and potentially to re-evaluate the assumed rate of return.

Columns (7) and (8). The ratio of Annuitant liabilities to total accrued liabilities gives an indication of the maturity of the system. As the ratio increases, cash flow needs increase, and the investment policy may need to change. A ratio on the order of 50% indicates a maturing system. Ratios near or above 50% are common today.

Column (9). The ratio of liabilities to payroll gives an indication of both maturity and volatility. Many systems have ratios between 500% and 700%. Ratios significantly above that range may indicate difficulty in supporting the benefit level as a level % of payroll. In the WRS, this potential difficulty is mitigated by the many risk sharing features inherent in the plan design since liabilities are impacted by the dividend process and the impact on money purchase benefits.

Risk/Maturity Measures (Concluded)

$ Millions								
Valuation Date	(10) Assets/ Payroll (2)/(4)	(11) Core Trust Fund Portfolio StdDev	(12) Std Dev % of Pay (10)x(11)	(13) Unfunded/ Payroll (3)/(4)	(14) Net External Cash Flow (NECF)	(15) NECF/ Assets (14)/(2)	(16) Core Trust Fund NOF Return	(17) Ratio of Actives to Retirees
2017	759.2%	12.0%	91.1%	-	$(3,055.1)	-2.9%	15.8%	1.26
2018	688.9%	11.8%	81.3%	43.4%	(3,282.2)	-3.4%	-3.6%	1.22

Notes:

Column (10). The ratio of assets to payroll gives an indication of both maturity and volatility. Many systems have ratios between 500% and 700%. Ratios significantly above that range may indicate difficulty in supporting the benefit level as a level % of payroll. In the WRS, this potential difficulty is mitigated by the many risk sharing features inherent in the plan design.

Columns (11) and(12). The portfolio standard deviation measures the volatility of investment return. When multiplied by the ratio of assets to payroll it gives the effect of a one standard deviation asset move as a percent of payroll. This figure helps users understand the difficulty of dealing with investment volatility and the challenges volatility brings to sustainability. In the WRS, the potential threat to sustainability is mitigated by the many risk sharing features inherent in the plan design. The portfolio standard deviation represents the standard deviation of the Core Trust Fund.

Column (13). The ratio of unfunded liability to payroll gives an indication of the plan sponsor's ability to actually pay off the unfunded liability. A ratio above approximately 300% or 400% may indicate difficulty in discharging the unfunded liability within a reasonable time frame.

Columns (14) and (15). The ratio of Net External Cash Flow to assets is an important measure of sustainability. Negative ratios are common and expected for a maturing system. In the longer term, this ratio should be on the order of approximately -4%. A ratio that is significantly more negative than that for an extended period could be a leading indicator of potential exhaustion of assets.

Column (16). Investment return is probably the largest single risk that most systems face. The year by year return gives an indicator of the performance of the portfolio versus the system's assumed return.

Column (17). In the 1970's and 1980's it was common for the ratio of actives to retirees to be 3 or 4 to 1. As plans mature, this ratio can drop significantly. Ratios below 2 are common today. A ratio significantly below 1 usually indicates a closed plan, a shrinking workforce or other special situation.

Contributions Required and Contributions Made

Year Ended December 31	Annual Required Contribution ($ millions)	Percent Contributed*
2009	$699.3	108.0%
2010	686.7	108.0%
2011	784.1	104.0%
2012	826.1	100.0%
2013	912.4	100.0%
2014	977.1	100.0%
2015	966.5	100.0%
2016	954.2	100.0%
2017	1,014.9	100.0%
2018	1,028.4	100.0%

** Includes additional UAAL payments when amount is greater than 100%.*

SECTION C

FUND ASSETS

Total Valuation Assets
(Reserves)

	Valuation Assets at December 31	
	2018	**2017**
Non Retired		
Participant Statutory		
Core	$ 16,584,211,853	$ 16,379,440,351
Variable	1,670,261,056	1,857,957,813
Total Statutory	18,254,472,909	18,237,398,164
Additional*	201,059,855	196,958,250
Total Participant	18,455,532,764	18,434,356,414
Employer		
Core	21,038,908,059	21,269,930,952
Variable	1,673,137,986	1,872,710,038
Total Employer	22,712,046,045	23,142,640,990
LTDI Reserve	-	642,452
Total Employer Net of LTDI	22,712,046,045	23,143,283,442
Total Non Retired	**41,167,578,809**	**41,577,639,856**
Retired Assets		
Core	56,493,834,982	54,899,948,656
Variable	3,749,047,195	4,324,896,801
Total Retired Assets	**60,242,882,177**	**59,224,845,457**
Total Assets used in Valuation	**101,410,460,986**	**100,802,485,313**

	Valuation Assets at December 31	
	2018	**2017**
Core Assets	$ 94,304,462,721	$ 92,746,920,661
Variable Assets	7,105,998,265	8,055,564,652
Total Assets	101,410,460,986	100,802,485,313

* *Includes employer, employee, and tax deferred additional contributions.*

Reserves for Non-Retired Participants
Balances by Valuation Group

	Reserve for Year Ended			
	December 31, 2018			December 31, 2017
	Participant (Statutory)	Employer	Total *	Total
General, Executives & Elected	$16,657,085,787	$19,122,131,870	$35,779,217,657	$36,151,112,133
Protective with Soc. Sec.	1,347,113,741	2,857,930,238	4,205,043,979	4,243,523,706
Protective w/o Soc. Sec.	250,273,382	731,983,936	982,257,318	985,403,314
Total	**$18,254,472,910**	**$22,712,046,044**	**$40,966,518,954**	**$41,380,039,153**

* *Totals differ slightly from page C-1 due to rounding and additional contributions.*

The above schedule shows the distribution of Participant and Employer reserves among the valuation groups according to WRS accounting records. This separation of assets is needed because the valuation groups are separately experience rated. The assets are pooled for investment purposes.

Development of Participant and Employer Reserves During the Year

	Participant Accumulation			Employer Accumulation			
	Core	Variable	Total	Core	Variable	Total	Grand Total
Ending Balance December 31, 2017	$16,379,440,351	$1,857,957,813	$18,237,398,164	$21,269,930,952	$1,872,710,038	$23,142,640,990	$41,380,039,154
Closing Adjustments	(10,582)	(292)	(10,874)	(30,317,198)	(14,752,520)	(45,069,718)	(45,080,592)
Beginning Balance January 1, 2018	16,379,429,769	1,857,957,521	18,237,387,290	21,239,613,754	1,857,957,518	23,097,571,272	41,334,958,562
Revenues:							
Employer Contributions	-	-	-	944,419,170	90,383,270	1,034,802,440	1,034,802,440
Participant Contributions	871,280,336	90,779,773	962,060,109	-	-	-	962,060,109
Total Revenues	871,280,336	90,779,773	962,060,109	944,419,170	90,383,270	1,034,802,440	1,996,862,549
Expenditures							
Separations	38,689,281	1,837,027	40,526,308	-	-	-	40,526,308
Retirement Single Sums	30,338,047	1,208,322	31,546,369	33,345,998	1,184,386	34,530,384	66,076,753
Death Benefits	22,684,202	1,903,541	24,587,743	14,271,554	1,597,519	15,869,073	40,456,816
Total Expenditures	91,711,530	4,948,890	96,660,420	47,617,552	2,781,905	50,399,457	147,059,877
Transfers:							
Earnings Allocation	772,673,479	(117,118,987)	655,554,492	1,018,474,361	(119,521,947)	898,952,414	1,554,506,906
Annuities Awarded	(1,409,749,926)	(93,709,144)	(1,503,459,070)	(2,154,563,333)	(108,491,328)	(2,263,054,661)	(3,766,513,731)
Intra-Fund Transfers	(447,427)	37,935	(409,492)	(5,834,558)	8,595	(5,825,963)	(6,235,455)
Inter-Fund Transfers	62,737,152	(62,737,152)	-	62,661,846	(62,661,846)	-	-
Manual Equalization Transfer	-	-	-	(18,245,629)	18,245,629	-	-
Net Transfers	(574,786,722)	(273,527,348)	(848,314,070)	(1,097,507,313)	(272,420,897)	(1,369,928,210)	(2,218,242,280)
Ending December 31, 2018	**$16,584,211,853**	**$1,670,261,056**	**$18,254,472,909**	**$21,038,908,059**	**$1,673,137,986**	**$22,712,046,045**	**$40,966,518,954**
Internal Rate of Return	4.8%	(6.4)%	3.7%	4.9%	(6.5)%	4.0%	3.9%

This page does not include additional contributions.

Development of Retiree Reserves During the Year

	Core	Variable	Total
Balance December 31, 2017	$ 54,899,948,656	$ 4,324,896,800	$ 59,224,845,456
Closing Adjustments	308,897,621	(1,308,840)	307,588,781
Variable Terminations	84,299,961	(84,299,961)	-
Beginning Balance	55,293,146,238	4,239,287,999	59,532,434,237
Additions			-
Reserve transfers	$ 3,583,794,558	$ 203,191,282	$ 3,786,985,840
Earnings	2,607,722,202	(282,186,348)	2,325,535,854
Other	-	-	-
Total Additions	6,191,516,760	(78,995,066)	6,112,521,694
Subtractions			-
Annuities and Lump Sums	$ 4,990,797,967	$ 411,245,738	$ 5,402,043,705
Credit reestablishments	30,049	-	30,049
Other	-	-	-
Total Subtractions	4,990,828,016	411,245,738	5,402,073,754
Ending Balance December 31, 2018	$ 56,493,834,982	$ 3,749,047,195	$ 60,242,882,177

Statement of Net Plan Assets ($ Thousands)
(Market Value)

	2018	2017
Assets		
Cash and Cash Equivalents	$ 4,035,969	$ 3,550,138
Securities Lending Collateral	466,630	1,576,662
Prepaid Expenses	9,774	27,425
Total Short Term Assets	4,512,373	5,154,225
Receivables		
Contributions	148,399	180,032
Prior Service Contributions	13,832	17,199
Benefits Overpayment	2,418	2,570
Due from Other Trust Funds	568	448,684
Due from General Fund	0	634
Miscellaneous	4,176	7,488,372
Interest and Dividends	306,493	314,112
Investment Sales	3,566,275	1,188,399
Total Receivables	4,042,161	9,640,002
Investments at Fair Value		
Fixed Income	31,726,626	30,709,368
Financial Futures Contracts	156,900	47,079
Preferred Securities	194,533	241,674
Convertible Securities	326	196
Stocks	54,783,797	63,241,061
Options	(8,148)	(3,830)
Limited Partnerships	13,590,506	12,212,410
Real Estate	1,372,027	1,368,583
Foreign Currency Contracts	(21,294)	(1,131)
Multi Asset Investments	5,854,691	4,791,880
Investment in Core Fund	0	0
Investment in External Pool	0	4,171
Other Investments	664,461	95,489
Total Investments	108,314,425	112,706,950
Capital Assets	4,376	33,895
Total Assets	**116,873,335**	**127,535,072**
Liabilities		
Core Investment Due Other Programs	3,494,436	4,051,373
Variable Investment Due Other Programs	17,053	26,332
Obligation Under Reverse Repo Agreement	8,834,034	6,114,256
Short Sell Obligations	3,002,001	2,722,194
Securities Lending Collateral Liability	466,630	1,576,662
Collateral Due to Counterparty	4,091	2,860
Benefits Payable	392,916	360,605
Unearned Revenue	30	41
Due to Other Trust Funds	573	438,003
Miscellaneous Payables	128,750	7,615,939
Investment Payables	3,798,564	467,189
Total Liabilities	**20,139,078**	**23,375,454**
Net Assets in Trust for Pension Benefits	**$96,734,257**	**$104,159,618**

Statement of Changes in Assets ($ Thousands)
(Market Value)

	Activity During Year	
	2018	2017
Additions:		
Contributions:		
Employer Contributions	$ 1,030,506	$ 1,024,632
Employee Contributions	972,952	965,453
Total Contributions	2,003,458	1,990,085
Investment Income:		
Net Appreciation (Depreciation) in Fair Value of Investments	(5,754,807)	13,831,016
Interest	609,618	569,459
Dividends	1,380,471	1,243,516
Securities Lending Income	41,909	37,990
Other	216,036	213,128
Less		
Current Income Distributed	136,944	(528,581)
SWIB Investment Expense	(670,610)	(487,384)
Investment Income Distributed to Securities Lending Rebates and Fees	(10,860)	(8,342)
Net Investment Income	(4,051,299)	14,870,802
Interest on Prior Service Receivable	774	1,130
Miscellaneous Income	382	227,825
Total Additions	(2,046,685)	17,089,842
Deductions:		
Benefits and Refunds:		
Retirement, Disability, and Beneficiary	5,516,189	5,167,990
Separation Benefits	40,235	38,358
Total Benefits and Refunds	5,556,424	5,206,348
ETF Administrative Expenses	32,866	23,142
Other Expenses	26,231	280,837
Total Deductions	5,615,521	5,510,327
Net Increase (Decrease)	(7,662,206)	11,579,515
Net Assets Held in Trust:		
Beginning of Year[(1)]	$104,396,462	$92,580,102
End of Year	$96,734,257	$104,159,618

[(1)] *Beginning of year for 2018 does not match end of year 2017 amount due to roll in of LTDI asset amounts.*

The figures on this page do not always reconcile exactly to the amounts used in the valuation.

Core Investment Trust: Market Recognition Account

	For the Year Ended December 31						
	2016	2017	2018	2019	2020	2021	2022
Beginning of year							
a. Funding value	$88,695,483,883	$92,268,055,484	$96,763,496,611	$98,085,174,233	$96,273,249,855	$95,805,301,550	$95,217,878,640
b. Market value	85,291,480,633	89,181,973,662	100,036,600,775	93,169,113,454	93,169,113,454	93,169,113,454	93,169,113,454
End of year							
c. Market value	89,181,973,662	100,036,600,775	93,169,113,454				
d. Non-investment cash flow (contributions minus benefits)	(2,985,477,640)	(2,987,822,636)	(3,282,228,177)				
e. Investment income							
e1. Total investment income	6,875,970,669	13,842,449,749	(3,585,259,145)				
e2. Assumed rate	7.2%	7.2%	7.0%				
e3. Amount for immediate recognition	6,278,597,645	6,535,738,380	6,658,566,777	-	-	-	-
e4. Amount for phased-in recognition: e1-e3	597,373,024	7,306,711,369	(10,243,825,921)	-	-	-	-
f. Phased-in recognition of investment income							
f1. Current year: 0.2 x e4	119,474,605	1,461,342,274	(2,048,765,184)	-	-	-	-
f2. First prior year	(1,343,976,073)	119,474,605	1,461,342,274	(2,048,765,184)	-	-	-
f3. Second prior year	(242,736,599)	(1,343,976,073)	119,474,605	1,461,342,274	(2,048,765,184)	-	-
f4. Third prior year	953,421,177	(242,736,599)	(1,343,976,073)	119,474,605	1,461,342,274	(2,048,765,184)	-
f5. Fourth prior year	793,268,488	953,421,177	(242,736,599)	(1,343,976,073)	119,474,605	1,461,342,274	(2,048,765,184)
f6. Total MRA recognition	279,451,597	947,525,383	(2,054,660,978)	(1,811,924,378)	(467,948,305)	(587,422,910)	(2,048,765,184)
f7. Amount for MRA recognition	-	-	-	-	-	-	-
f8. Total recognized gain (loss)	279,451,597	947,525,383	(2,054,660,978)	(1,811,924,378)	(467,948,305)	(587,422,910)	(2,048,765,184)
g. Total recognized investment income: e3 + f8	6,558,049,242	7,483,263,763	4,603,905,799	(1,811,924,378)	(467,948,305)	(587,422,910)	(2,048,765,184)
h. Funding value end of year: a + d + e3 + f8	92,268,055,484	96,763,496,611	98,085,174,233	96,273,249,855	95,805,301,550	95,217,878,640	93,169,113,456
i. Difference between market and funding values	(3,086,081,822)	3,273,104,164	(4,916,060,779)	(3,104,136,399)	(2,636,188,094)	(2,048,765,184)	-
j. Recognized rate of return	7.5%	8.2%	4.8%				
k. Market rate of return (net of fee)	8.2%	15.8%	-3.6%				

The Core Investment Trust includes all WRS core assets, as well as the assets of certain other programs. The Market Recognition Account is a statutory method applicable to all assets invested in the Core Trust. Considerable additional information would be required to reconcile these figures to other asset figures in this report.

SECTION D

GAIN/LOSS

Active Member Gain/Loss Analysis

Purpose of Gain/Loss Analysis. Regular actuarial valuations provide information about the composite change in computed contribution rates and total liabilities -- whether or not the rates and related liabilities are increasing or decreasing, and by how much. However, valuations do not show the portion of the change attributable to each risk area within the Wisconsin Retirement System financial mechanism: the rate of recognized investment income on plan assets; the rates of withdrawal of active participants who leave covered employment; the rates of mortality; the rates of disability; the rates of salary increases; and the assumed ages at actual retirement. In an actuarial valuation, assumptions are made as to what these rates will be for the next year and for decades in the future.

The objective of a gain and loss analysis is to determine the portion of the change that is attributable to each risk area.

The fact that actual experience differs from assumed experience should be expected. The future cannot be predicted with complete precision. Further, year-to-year statistical fluctuations occur, even in very large groups. This year's report reflects just a single year's experience. Changes in the valuation assumed experience for a risk area should be made only when the differences between assumed and actual experience have been observed to be sizable and persistent. One year's gain and loss analysis may or may not be indicative of ***long-term trends, which are the basis of actuarial assumptions.*** However, a persistent series of gains and losses can indicate a need for an assumption change or a method change, even if on a demographic basis, the assumptions appear to model reality well. In the Wisconsin Retirement System, longer term trends are reviewed in connection with the regular three-year investigation of experience (the most recent three-year investigation covered the period January 1, 2015 to December 31, 2017). It is the results of the three-year investigation that lead to recommendations for changes in the actuarial assumptions.

Overall Experience

Overall experience resulted in a net actuarial loss of $525 million for the 2018 calendar year. The development of this figure is shown on the following page. The loss was primarily attributable to unfavorable investment performance. The net result was an increase in the overall 2020 normal cost rate of 0.45% of payroll.

Development of Total Actuarial Gain (Loss) – Calendar Year December 31, 2018 ($ Millions)

	Year Ended December 31, 2018				
		Executive	Protective		
	General	& Elected	With S.S.	Without S.S.	Total
(1) Entry Age UAAL at start of year	$ 269.3	$ 76.6	$ 150.9	$ 22.6	$ 519.4
(2) Entry Age Normal cost from last valuation	1,639.2	13.4	208.9	47.8	1,909.3
(3) Actual contributions	1,709.3	15.2	223.6	48.8	1,996.9
(4) Interest	16.4	5.3	10.0	1.5	33.2
(5) Expected UAAL before changes: (1) + (2) - (3) + (4)	215.6	80.1	146.2	23.1	465.0
(6) Change in actuarial assumptions	297.0	3.2	108.6	13.7	422.5
(7) Other changes	0.0	0.0	0.0	0.0	0.0
(8) Expected UAAL after changes: (5) + (6) + (7)	512.6	83.3	254.8	36.8	887.5
(9) Actual Entry Age UAAL at end of year	897.1	83.5	370.5	61.7	1,412.8
(10) Gain (loss): (8) - (9)	**$ (384.5)**	**$ (0.2)**	**$ (115.7)**	**$ (24.9)**	**$ (525.3)**

The gain/loss analysis is intended to explain the financial effect of differences between actual and assumed experience in basic risk areas: Investment income, pay increases, retirement rates, turnover rates, etc. In order for the gain/loss analysis to proceed, the change in the Entry Age Unfunded Actuarial Accrued Liabilities from one year to the next is analyzed to remove the effect of expected changes. The table above develops this year's gain or loss (line 10) which is subtracted from the Experience Amortization Reserve (EAR). When the EAR decreases "unexpectedly", this is favorable experience and downward pressure is exerted on contribution rates. Similarly, an unexpected increase in the EAR is unfavorable experience and upward pressure is exerted on contribution rates.

By measuring gains and losses each year and, to the extent possible, determining the "responsible" assumptions, insight is gained into how well the actuarial assumptions estimate WRS liabilities. Such information aids in understanding financial effects of emerging trends and is particularly useful during preparation of the WRS experience study.

Population Development During Calendar Year 2018

	General	Executive & Elected	Protective		Total	Expected
			With S.S.	Without S.S.		
Beginning Census	232,874	1,335	19,431	2,743	256,383	
(-) Normal Retirement	3,535	38	493	76	4,142	4,488
(-) Early Retirement	3,427	13	86	8	3,534	4,255
(-) Death	85	0	10	2	97	240
(-) Disability Retirement						
-Total disabilities approved	232	0	8	5	245	121
-Less pending at beginning of year	59	0	4	1	64	
-Net new from active status	173	0	4	4	181	
(-) Other Separations	13,572	59	864	30	14,525	13,333
(-) Transfers Out	1,627	20	367	5	2,019	
(+) Transfers In	1,691	50	243	35	2,019	
(+) New Entrants	21,316	47	1,549	117	23,029	
Ending Census	233,462	1,302	19,399	2,770	256,933	

This schedule reconciles the active member populations reported in connection with the December 31, 2018 and the prior year valuations. Assumptions related to population development are a primary focus of the gain/loss analysis. They generally tend to be more stable than economic assumptions, and therefore, measurements have more meaning. Please note also that the table above represents changes in actual and expected counts of members. Beginning with the 2009 valuations, some of the actuarial assumptions (retirement, turnover, etc.) are based on liability weighted rates. Therefore, comparing actual to expected number counts alone may not form the basis for our conclusions.

Transfers for the General group include transfer between subgroups (teachers, university, general employees, etc.).

Gain (Loss) Overview

Population Results

Normal Retirements varied by group and gender. Overall normal retirements were slightly less than expected. In general, fewer normal retirements than assumed often creates a gain. However, looking at counts alone is not always an accurate predictor of whether a gain or loss occurs. If there are fewer retirements in shorter service, lower paid groups and more retirements than expected in longer service, higher paid groups, there will be a net loss to the System even if the actual total counts might be equal to or less than expected. In order to account for this, retirement rates are now developed partially on a liability weighted methodology. The net result for this past year was a small loss.

Early Retirements were less than expected, overall producing a small loss.

Disabilities were more than expected and produced a loss. This means that the reserves needed for the disability benefit were slightly larger than the reserves that had been held for retirement benefits.

Deaths among active participants were less than expected. The net result for the past year was a small loss.

Other Separations varied by group, gender, and service but were overall higher than expected. The net result for the past year was a small loss.

In total, the population risk areas (retirement, death, disability, and other separations) all produced losses, producing a small net loss during 2018.

Economic Results

On a market recognition account basis net of fee **investment return** was 4.8% and investment activity produced a loss for all groups due to the combined effect of this year's loss and the continued recognition of prior gains and losses. The total recognized investment loss of $1,272 million was partially offset by a $575 million decrease in the combined value of variable excess benefits and money purchase benefits (as shown on page D-7), resulting in a net recognized investment loss of about $697 million.

Pay Increases were overall lower than expected, producing a gain.

Gain (Loss) Detail
($ Millions)

Type of Activity	General	Executive & Elected	Protective		Total	Prior Year
			With S.S.	Without S.S.		
Decrement Risk Areas						
Normal Retirement	$ (2.2)	$ 0.6	$ (12.0)	$ (0.9)	$ (14.5)	$ (27.0)
Early Retirement	(19.3)	0.0	1.0	0.0	(18.3)	(13.4)
Disability Retirement	(7.7)	0.1	0.0	(0.1)	(7.7)	15.9
Death with Benefit	(3.3)	0.0	(0.1)	0.5	(2.9)	(2.4)
Other Separations	(10.5)	0.2	(2.2)	(1.3)	(13.8)	37.4
Economic Risk Areas						
Salary Increases	322.0	1.7	(5.4)	(0.7)	317.6	101.0
Investment Return	(583.3)	(0.7)	(89.9)	(23.1)	(697.0)	349.0
Other Activity	(80.2)	(2.1)	(7.1)	0.7	(88.7)	(122.4)
Total Gain (Loss)	**$ (384.5)**	**$ (0.2)**	**$ (115.7)**	**$ (24.9)**	**$(525.3)**	**$ 338.1**
-% of Accrued Liability	**(1.1)%**	**(0.1)%**	**(2.8)%**	**(2.5)%**	**(1.3)%**	**0.8%**

Gain/Loss Analysis
2018 Experience
Divisions Combined

Gain (Loss) from Investment Income During Calendar Year
($ Millions)

	General	Executive & Elected	Protective		Total
			With SS	Without SS	
(1) Beginning of Year Active Participant Assets					
(a) Participant Accumulation Reserve	$16,552.1	$ 37.5	$1,384.8	$263.0	$18,237.4
(b) PAR Closing Adjustment	1.8	0.3	(1.4)	(0.8)	(0.1)
(c) Employer Accumulation Reserve	19,395.7	165.9	2,858.7	722.4	23,142.7
(d) EAR Closing Adjustment	(38.1)	(0.2)	(5.4)	(1.3)	(45.0)
(e) Total	35,911.5	203.5	4,236.7	983.3	41,335.0
(2) End of Year Active Participant Assets					
(a) Participant Accumulation Reserve	16,624.4	32.7	1,347.1	250.3	18,254.5
(b) Employer Accumulation Reserve	18,962.4	159.7	2,857.9	732.0	22,712.0
(c) Total	35,586.8	192.4	4,205.0	982.3	40,966.5
(3) Investment Earnings Credited					
(a) Participant Accumulation Reserve	604.4	1.4	42.5	7.3	655.6
(b) Employer Accumulation Reserve	747.1	7.8	114.5	29.5	898.9
(c) Total	1,351.5	9.2	157.0	36.8	1,554.5
(4) Average Balance: .5 x {(1e)+(2c)-(3c)}	35,073.4	193.4	4,142.4	964.4	40,373.6
(5) Expected Earnings: .070 x (4)	2,455.1	13.5	290.0	67.5	2,826.1
(6) Gain (Loss) for Year from Investment Experience: (3c)-(5)	(1,103.6)	(4.3)	(133.0)	(30.7)	(1,271.6)
(7) Portion applied to Change in Variable Excess Reserve and Money Purchase Minimum Benefit	(520.3)	(3.7)	(43.1)	(7.6)	(574.7)
(8) Remaining Gain (Loss): (6)-(7)	**$ (583.3)**	**$ (0.7)**	**$ (89.9)**	**$(23.1)**	**$ (696.9)**

Analysis of "Other" Activity
($ Millions)

"Other" activity refers to gain or loss activity that is not directly related to the main actuarial assumptions. Other activity this year resulted in a loss of $88.7 million as shown on page D-5. The schedule below analyzes this activity. The **Reserve Difference** produced a loss of about $44 million. There are two identifiable sources for this loss. The first relates to cases where the service credit or final average salary at retirement differed from what was expected based upon the prior valuation. The second relates to final computations of annuities that were originally based on estimates. The **Re-established Liability** represents the liability for new or rehired active members who were not active in the prior year. Typically, it is expected that a new hire will have very little liability. However, often new members appear with more than one year of service or with liability greater than contributions made on their behalf. Although this amount is difficult to determine accurately due to the timing of contribution amounts, we estimate the Re-established Liability loss at about $78 million.

	General	Executive & Elected	Protective		Total
			With S.S.	Without S.S.	
Expected Reserve Transfers					
Normal Retirement	$1,654	$22	$ 289	$70	$2,035
Early Retirement	1,018	3	47	7	1,075
Death	13	0	1	0	14
Disability Retirement	57	0	2	3	62
Deferred Retirement	491	6	52	8	557
Expected Total Reserve Transfers	3,233	31	391	88	3,743
Actual Reserve Transfer (From Retiree Report)	3,267	36	394	90	3,787
Reserve Difference	(34)	(5)	(3)	(2)	(44)
Expected Refunds	62	0	4	0	66
Actual Refunds	37	0	3	1	41
Refund Difference	25	0	1	(1)	25
Re-established Liability	(70)	0	(7)	(1)	(78)
Total Explained Difference	(79)	(5)	(9)	(4)	(97)
Unknown Difference	(1)	3	2	5	8
Total Other Activity	(80)	(2)	(7)	1	(89)
Other Activity as % of Liabilities	(0.22)%	(1.04)%	(0.17)%	0.10 %	(0.22)%

Comparative Schedule of Experience
5-Year History of Gains and Losses
($ Millions)

Year	Retmt.	Disability Retmt.	Other Separations*	Salary Increases	Investment Return	Other	Total
			GENERAL				
2014	$ (25.5)	$ 18.1	$ 24.5	$ 14.5	$ 269.0	$ (111.0)	$ 189.6
2015	(33.3)	13.5	20.8	74.5	(163.0)	(11.8)	(99.3)
2016	(32.6)	15.3	18.2	268.1	112.8	(40.9)	340.9
2017	(19.0)	14.3	34.1	114.0	287.8	(91.8)	339.4
2018	**(21.5)**	**(7.7)**	**(13.8)**	**322.0**	**(583.3)**	**(80.2)**	**(384.5)**
			EXECUTIVE & ELECTED				
2014	$ 1.8	$ 0.1	$ (0.7)	$ (0.7)	$ 2.1	$ (6.4)	$ (3.8)
2015	2.2	0.1	(1.2)	2.8	(0.7)	(4.4)	(1.2)
2016	(0.5)	0.1	(1.2)	14.0	0.7	1.5	14.6
2017	(2.5)	0.1	0.3	(14.7)	0.1	(8.2)	(24.9)
2018	**0.6**	**0.1**	**0.2**	**1.7**	**(0.7)**	**(2.1)**	**(0.2)**
			PROTECTIVE WITH SOCIAL SECURITY				
2014	$ (6.1)	$ 1.5	$ 0.3	$ 13.0	$ 42.6	$ (14.9)	$ 36.4
2015	(15.9)	0.6	1.4	(11.1)	(30.3)	3.3	(52.0)
2016	(17.4)	1.2	4.0	8.5	19.0	17.8	33.1
2017	(17.6)	0.8	1.3	3.9	48.6	(10.3)	26.7
2018	**(11.0)**	**-**	**(2.3)**	**(5.4)**	**(89.9)**	**(7.1)**	**(115.7)**
			PROTECTIVE WITHOUT SOCIAL SECURITY				
2014	$ (0.3)	$ 0.6	$ (0.7)	$ (3.3)	$ 11.8	$ (7.4)	$ 0.7
2015	(1.8)	0.2	(1.4)	(5.5)	(7.8)	(6.1)	(22.4)
2016	(1.1)	0.6	(1.2)	7.6	5.6	2.0	13.5
2017	(1.3)	0.7	(0.7)	(2.2)	12.5	(12.1)	(3.1)
2018	**(0.9)**	**(0.1)**	**(0.8)**	**(0.7)**	**(23.1)**	**0.7**	**(24.9)**

* *Includes separation due to death.*

SECTION E

CENSUS DATA

Total Participants Included in Valuations
December 31, 2018

Valuation Group	Number	Average Annual Earnings/Benefits*
Actives	256,933	$54,650
Inactives	167,778	$16,180
Retirees & Beneficiaries	211,126	$25,893
Total Participants	**635,837**	

* *For inactives, average money purchase balance.*

Active Participants Included in Valuations
December 31, 2018

Active participants included in the valuations totaled 256,933 with an annual payroll totaling $14,041.3 million, as follows:

Valuation Group	Number	Annual Earnings ($Millions)	Group Averages			
			Earnings	Age	Years of Service	Contribs.
General	233,462	$12,445.3	$53,307	45.4	11.3	$57,865
Executive Group & Elected Officials	1,302	108.0	82,986	55.4	13.9	107,053
Protective Occupation with Social Security	19,399	1,263.1	65,113	40.1	12.3	68,238
Protective Occupation without Social Security	2,770	224.9	81,206	40.9	14.0	84,702
Total Active Participants	**256,933**	**$14,041.3**	**$54,650**	**45.0**	**11.4**	**$59,186**
Prior Year	256,383	$13,720.5	$53,515	45.1	11.5	$58,815

Group averages are not used in the valuation, but are shown here for their general interest.

Inactive Participants Included in Valuations
December 31, 2018

Inactive participants included in the valuations totaled 167,778 as follows:

Valuation Group	Number	Group Averages		
		Age	Service	Money Purchase Balance
General	160,074	47.5	3.3	$15,930
Executive Group & Elected Officials	595	54.7	12.9	29,437
Protective Occupation with Social Security	6,871	41.6	4.2	20,169
Protective Occupation without Social Security	238	43.3	6.4	36,528
Total Inactive Participants	**167,778**	**47.3**	**3.4**	**$16,180**
Prior Year	165,051	47.3	3.3	$15,774

The valuations also included 3,944 Qualified Domestic Relations Order cases whose average age was 52.6 years. These accounts for divorced spouses of WRS participants have been established in accordance with Wisconsin Domestic Relations Law.

General Participants as of December 31, 2018
by Attained Age and Years of Service

Attained Ages	Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	No.	Valuation Payroll
15-19	111							111	$ 2,829,585
20-24	5,237	9						5,246	172,260,161
25-29	17,519	2,016	10					19,545	815,127,420
30-34	13,095	10,469	1,526	12				25,102	1,186,922,484
35-39	10,762	7,662	8,576	1,507	8			28,515	1,492,470,483
40-44	8,704	5,620	5,808	8,144	1,227	6		29,509	1,659,827,613
45-49	7,563	5,154	4,735	6,098	6,863	1,010	9	31,432	1,842,189,630
50-54	6,423	4,806	4,625	5,305	5,481	5,967	1,012	33,619	1,963,469,916
55	1,171	991	968	1,102	929	1,081	747	6,989	402,354,419
56	1,075	931	891	1,048	879	917	831	6,572	374,355,230
57	1,118	855	948	1,008	880	846	821	6,476	362,270,740
58	1,028	865	896	1,031	840	767	849	6,276	346,116,716
59	903	774	854	941	793	688	761	5,714	313,077,182
60	790	710	827	918	769	619	752	5,385	296,871,680
61	807	615	691	800	669	560	619	4,761	255,948,236
62	665	587	576	701	607	507	579	4,222	227,845,539
63	561	454	487	606	424	324	466	3,322	177,019,053
64	404	388	397	496	398	301	376	2,760	147,828,524
65	360	334	301	356	297	222	315	2,185	117,348,235
66	234	197	206	243	179	140	222	1,421	77,924,012
67	228	164	146	159	115	87	146	1,045	56,043,942
68	173	121	99	99	83	62	122	759	39,981,251
69	157	81	97	79	59	46	91	610	30,793,477
70	117	62	51	57	35	31	62	415	20,304,149
71	114	55	32	35	18	28	42	324	15,942,297
72	97	33	43	33	26	23	37	292	13,667,798
73	54	33	12	24	14	11	32	180	8,415,517
74	55	34	9	16	7	15	25	161	6,678,583
75 & Up	185	113	56	34	31	21	74	514	19,384,404
Totals	**79,710**	**44,133**	**33,867**	**30,852**	**21,631**	**14,279**	**8,990**	**233,462**	**$12,445,268,276**

Executive Group and Elected Officials
as of December 31, 2018
by Attained Age and Years of Service

Attained Ages	Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	No.	Valuation Payroll
15-19									
20-24									
25-29	9	2						11	$ 733,351
30-34	27	20	1					48	3,459,962
35-39	19	24	13	2				58	4,741,004
40-44	27	27	15	21	3			93	7,341,042
45-49	31	32	24	21	23	6		137	11,915,607
50-54	57	43	30	32	28	29	4	223	19,296,883
55	9	7	8	8	6	6	5	49	4,163,406
56	9	6	4	5	7	5	4	40	3,744,303
57	11	11	5	7	5	9	4	52	4,652,060
58	13	9	5	6	6	6	14	59	4,866,031
59	13	5	6	7	7	3	12	53	4,771,693
60	12	6	6	2	8	4	17	55	5,084,628
61	12	4	6	10	8	4	10	54	5,005,373
62	11	2	4	4		5	9	35	2,761,255
63	6	5	3	2	5	2	14	37	4,216,184
64	6	10	2		3	4	8	33	2,538,709
65	8	8	7	3	5	4	9	44	3,578,336
66	6	4	3	3	3	4	3	26	2,236,393
67	10	7	3	7	1	2	4	34	2,422,563
68	7	5	3		4	1	9	29	2,275,682
69	2	7		1	4	1	3	18	1,457,087
70	12	1	2	3			2	20	1,454,683
71	5	3	4	1		1	4	18	1,503,077
72	2	3	2	3	2	1	2	15	1,177,538
73	5	2				1	1	9	403,361
74	3		3		1	1		8	602,495
75 & Up	14	16	2	3	2	5	2	44	1,645,263
Totals	**346**	**269**	**161**	**151**	**131**	**104**	**140**	**1,302**	**$108,047,969**

Protective Occupation Participants with Social Security as of December 31, 2018 by Attained Age and Years of Service

Attained Ages	Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	No.	Valuation Payroll
15-19	3							3	$ 100,767
20-24	940	3						943	41,255,162
25-29	2,281	471	6					2,758	149,303,652
30-34	1,078	1,255	543	7				2,883	178,930,979
35-39	544	556	1,241	517	11			2,869	188,502,313
40-44	289	294	571	1,250	480	4		2,888	198,114,766
45-49	200	176	323	763	1,404	340		3,206	231,248,502
50	42	26	45	104	223	186	3	629	45,607,049
51	26	22	38	68	170	198	15	537	40,747,219
52	29	24	33	60	118	193	36	493	38,459,158
53	25	17	37	78	91	141	43	432	31,703,855
54	14	19	29	61	61	79	34	297	22,277,053
55	17	21	25	43	42	63	30	241	16,766,125
56	28	17	22	42	40	49	34	232	16,235,494
57	17	21	28	45	35	36	23	205	13,726,354
58	14	13	21	35	32	22	22	159	10,690,645
59	8	5	9	34	25	24	20	125	8,636,897
60	7	10	18	26	20	12	24	117	8,315,428
61	8	3	22	26	12	10	13	94	5,964,413
62	8	5	13	23	4	11	13	77	4,645,691
63	8	3	13	17	11	2	12	66	3,948,476
64	7	7	7	9	4	8	12	54	3,577,818
65	6	3	4	9	3	1	5	31	1,794,931
66	3	3	3	5	4	1	3	22	1,188,282
67	2	1		3		2	2	10	464,213
68		2	1	1	1	1	1	7	313,395
69	1	1	1					3	100,534
70 & Up	9	5	2			1	1	18	515,258
Totals	**5,614**	**2,983**	**3,055**	**3,226**	**2,791**	**1,384**	**346**	**19,399**	**$1,263,134,429**

Protective Occupation Participants without Social Security
as of December 31, 2018
by Attained Age and Years of Service

Attained Ages	Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	No.	Valuation Payroll
20-24	63							63	$ 3,197,329
25-29	240	66						306	19,757,481
30-34	126	224	84					434	32,194,062
35-39	72	131	201	55				459	35,387,948
40-44	26	38	102	193	67			426	35,662,338
45-49	8	19	51	143	218	70		509	45,079,585
50	1		4	24	32	25	1	87	7,867,265
51		2	4	11	32	23	1	73	6,830,946
52		3	1	21	22	31	4	82	7,672,729
53	1	1	4	9	33	34	4	86	8,115,146
54	1			10	19	23	6	59	5,415,504
55		1	1	5	12	22	15	56	5,205,815
56	2	2	1	3	5	11	4	28	2,765,137
57			2	4	10	8	10	34	3,406,331
58			2	2	6	4	3	17	1,682,508
59	2	1		3	9	4	2	21	1,785,472
60	1		2	2	2	5	1	13	1,268,494
61			1		2	2	1	6	581,353
62					1	3		4	369,841
63						2		2	207,158
64							1	1	92,034
65			1	1			1	3	295,906
68							1	1	101,259
Totals	**543**	**488**	**461**	**486**	**470**	**267**	**55**	**2,770**	**$224,941,641**

Active Participants
as of December 31, 2018
by Years of Service and Gender

Completed Years of Service	Males	Females	Totals	Valuation Payroll	
				Total	Average
0	6,857	14,396	21,253	$ 647,329,878	$30,458
1	6,649	12,849	19,498	780,712,721	40,041
2	6,134	10,959	17,093	745,063,004	43,589
3	5,263	9,314	14,577	667,341,594	45,780
4	5,065	8,727	13,792	660,314,356	47,877
5	4,548	7,939	12,487	620,828,483	49,718
6	4,217	6,726	10,943	560,872,453	51,254
7	3,509	6,016	9,525	495,544,697	52,026
8	2,807	4,993	7,800	416,153,556	53,353
9	2,454	4,664	7,118	386,503,122	54,299
10	2,960	5,145	8,105	454,777,476	56,111
11	3,027	5,168	8,195	473,745,713	57,809
12	2,724	4,749	7,473	438,638,774	58,696
13	2,495	4,534	7,029	417,358,651	59,377
14	2,457	4,285	6,742	412,057,008	61,118
15 & Up	35,400	49,903	85,303	5,864,150,831	68,745
Totals	**96,566**	**160,367**	**256,933**	**$14,041,392,317**	**$54,650**
Average					
Age	45.1	45.0	45.0		
Service	12.1	11.0	11.4		

Comparative Statement of Active Participants in Valuations

Valuation 12/31	General				Executive and Elected			
		Earnings				Earnings		
	No.	$ Millions	Average	% Incr.	No.	$ Millions	Average	% Incr.
1994	214,280	$ 6,342	$ 29,595	2.5%	1,450	$ 63	$43,528	4.9 %
1995	216,434	6,597	30,479	3.0%	1,475	67	45,135	3.7 %
1996	219,265	6,832	31,160	2.2%	1,459	67	45,967	1.8 %
1997	222,888	7,128	31,980	2.6%	1,455	71	48,881	6.3 %
1998	227,017	7,457	32,847	2.7%	1,450	73	50,664	3.6 %
1999*	229,657	7,704	34,445	4.9%	1,468	77	53,263	5.1 %
2000	234,076	8,335	35,610	3.4%	1,486	83	55,582	4.4 %
2001	238,944	8,746	36,605	2.8%	1,486	85	57,060	2.7 %
2002	240,990	9,007	37,377	2.1%	1,476	87	58,865	3.2 %
2003	239,696	9,273	38,686	3.5%	1,468	86	58,336	(0.9)%
2004	238,943	9,501	39,764	2.8%	1,469	89	60,379	3.5 %
2005	237,501	9,661	40,678	2.3%	1,452	90	61,788	2.3 %
2006	236,877	9,933	41,935	3.1%	1,436	93	64,480	4.4 %
2007	237,124	10,278	43,344	3.4%	1,427	95	66,320	2.9 %
2008**	238,994	10,806	45,216	4.3%	1,430	101	70,316	6.0 %
2009	240,401	11,098	46,165	2.1%	1,427	101	70,786	0.7 %
2010	239,959	11,195	46,655	1.1%	1,418	101	71,394	0.9 %
2011	232,518	10,947	47,080	0.9%	1,393	99	70,802	(0.8)%
2012	231,765	11,041	47,639	1.2%	1,408	104	73,968	4.5 %
2013	231,973	11,270	48,584	2.0%	1,397	106	76,125	2.9 %
2014	232,433	11,574	49,794	2.5%	1,401	109	77,998	2.5 %
2015	231,631	11,786	50,881	2.2%	1,380	108	78,230	0.3 %
2016	232,684	11,964	51,417	1.1%	1,347	106	78,667	0.6 %
2017	232,874	12,167	52,249	1.6%	1,335	107	80,366	2.2 %
2018	233,462	12,445	53,307	2.0%	1,302	108	82,986	3.3 %

* *After change in method of calculating average pay.*

** *Some groups had a 27 period payroll during 2008.*

Comparative Statement of Active Participants in Valuations

Valuation 12/31	Protective with Social Security				Protective without Social Security			
	No.	Earnings			No.	Earnings		
		$ Millions	Average	% Incr.		$ Millions	Average	% Incr.
1994	12,825	$ 436	$ 34,005	3.3%	2,612	$106	$40,633	3.2 %
1995	13,434	467	34,747	2.2%	2,630	112	42,478	4.5 %
1996	13,820	495	35,807	3.1%	2,625	116	44,063	3.7 %
1997	14,232	536	37,625	5.1%	2,654	121	45,568	3.4 %
1998	14,810	570	38,509	2.3%	2,658	127	47,733	4.8 %
1999*	16,483	649	39,864	3.5%	2,691	131	48,947	2.5 %
2000	16,970	717	42,263	6.0%	2,685	135	50,423	3.0 %
2001*	17,981	772	42,914	1.5%	2,715	142	52,339	3.8 %
2002	18,325	804	43,871	2.2%	2,709	148	54,603	4.3 %
2003	18,660	856	45,891	4.6%	2,714	154	56,673	3.8 %
2004	18,964	896	47,266	3.0%	2,709	159	58,546	3.3 %
2005	19,036	920	48,330	2.3%	2,689	162	60,241	2.9 %
2006	19,297	977	50,622	4.7%	2,692	167	62,153	3.2 %
2007	19,757	1,036	52,419	3.5%	2,695	174	64,449	3.7 %
2008**	20,038	1,099	54,859	4.7%	2,724	181	66,502	3.2 %
2009	20,205	1,124	55,636	1.4%	2,733	189	69,149	4.0 %
2010	20,019	1,125	56,184	1.0%	2,754	189	68,559	(0.9)%
2011	19,610	1,119	57,065	1.6%	2,711	189	69,898	2.0 %
2012	19,353	1,105	57,104	0.1%	2,727	193	70,949	1.5 %
2013	19,290	1,121	58,127	1.8%	2,736	197	71,960	1.4 %
2014	19,533	1,151	58,916	1.4%	2,733	204	74,487	3.5 %
2015	19,273	1,171	60,755	3.1%	2,730	209	76,376	2.5 %
2016	19,431	1,203	61,924	1.9%	2,746	213	77,553	1.5 %
2017	19,431	1,227	63,145	2.0%	2,743	219	79,753	2.8 %
2018	19,399	1,263	65,113	3.1%	2,770	225	81,206	1.8 %

* *After change in method of calculating average pay.*

** *Some groups had a 27 period payroll during 2008.*

Core Annuities Being Paid
Tabulated by Attained Ages

Attained Ages	Regular		Disability		Death-in-Service		Totals	
	No.	Annual Amount	No.	Annual Amount	No.	Annual Amount	No.	Annual Amount
Under 20	0	$ 0	0	$ 0	2	$ 28,514	2	$ 28,514
20-24	0	0	5	42,731	10	74,679	15	117,410
25-29	0	0	11	196,790	19	115,357	30	312,147
30-34	1	4,527	30	408,385	20	125,815	51	538,727
35-39	0	0	72	1,248,044	36	275,665	108	1,523,709
40-44	10	124,028	169	3,243,639	28	216,642	207	3,584,309
45-49	55	550,918	310	6,151,487	48	457,037	413	7,159,442
50-54	1,296	38,572,158	649	14,991,502	66	773,016	2,011	54,336,676
55-59	12,093	354,322,224	1,255	28,841,188	136	1,969,032	13,484	385,132,444
60-64	30,185	790,329,264	1,687	38,140,654	204	3,397,300	32,076	831,867,218
65-69	48,152	1,183,641,781	1,289	29,371,690	228	4,658,822	49,669	1,217,672,293
70-74	43,417	1,025,014,965	1,014	21,900,913	186	3,400,769	44,617	1,050,316,647
75-79	28,024	624,266,234	778	15,629,875	133	2,106,957	28,935	642,003,066
80-84	18,609	402,377,671	539	10,154,548	90	1,278,949	19,238	413,811,168
85-89	11,519	257,743,844	315	5,216,939	74	733,294	11,908	263,694,077
90-94	5,328	113,024,390	122	2,056,819	39	759,204	5,489	115,840,413
95& Up	1,591	30,779,554	36	425,479	23	128,118	1,650	31,333,151
Certain Only*	1,186	21,160,212	0	0	37	459,252	1,223	21,619,464
Totals	**201,466**	**$4,841,911,770**	**8,281**	**$178,020,683**	**1,379**	**$20,958,422**	**211,126**	**$5,040,890,875**

Averages in Years				
Age at retirement	59.8	51.0	52.0	59.5
Attained age	70.9	64.0	67.4	70.6

* *Certain Only category consists of continuations of 5, 10 and 15-year certain and life annuities to beneficiaries of deceased annuitants.*

Variable Annuities Being Paid
Tabulated by Attained Ages

Attained Ages	Regular		Disability		Death-in-Service		Totals	
	No.	Annual Amount	No.	Annual Amount	No.	Annual Amount	No.	Annual Amount
20-24	0	$ 0	2	$ 2,028	3	$ 6,047	5	$ 8,075
25-29	0	0	3	5,433	3	2,734	6	8,167
30-34	0	0	7	6,319	5	1,341	12	7,660
35-39	0	300	13	39,344	8	12,661	21	52,305
40-44	5	60,666	10	19,526	5	15,993	20	96,185
45-49	15	135,334	22	112,532	20	75,549	57	323,415
50-54	299	3,167,098	81	354,097	15	49,260	395	3,570,455
55-59	2,499	19,388,968	150	544,725	41	193,315	2,690	20,127,008
60-64	5,841	36,183,163	207	833,495	46	266,378	6,094	37,283,036
65-69	8,942	68,313,490	240	1,091,879	55	247,644	9,237	69,653,013
70-74	8,842	95,013,141	183	1,576,941	44	403,761	9,069	96,993,843
75-79	5,100	73,983,503	134	1,420,169	37	349,145	5,271	75,752,817
80-84	3,507	57,890,237	106	854,206	23	159,547	3,636	58,903,990
85-89	2,511	38,994,231	63	387,057	20	199,439	2,594	39,580,727
90-94	1,322	17,089,720	25	134,511	22	178,291	1,369	17,402,522
95 & Up	437	4,186,718	10	32,074	8	72,088	455	4,290,880
Certain Only*	254	1,729,247	0	0	2	33,275	256	1,762,522
Totals	**39,574**	**$416,135,816**	**1,256**	**$7,414,336**	**357**	**$2,266,468**	**41,187**	**$425,816,620**

Averages in Years				
Age at retirement	59.2	52.5	52.0	59.0
Attained age	70.8	66.6	68.1	70.7

** Certain Only category consists of continuations of 5, 10 and 15-year certain and life annuities to beneficiaries of deceased annuitants.*

SECTION F

METHODS AND ASSUMPTIONS

Summary of Actuarial Assumptions and Methods

Valuation Date	December 31, 2018
Actuarial Cost Method	Frozen Entry Age
Amortization Method	Level Percent -- Closed Period
Amortization Period	30-Year closed from date of participation in WRS
Asset Valuation Method	5-Year Smoothed Market (Closed)
Actuarial Assumptions	
Net Investment Rate of Return	5.4%
Weighted based on assumed rate for:	
Retired participants	5.0%
Post-retirement active participants	5.0%
Pre-retirement active participants	7.0%
Projected Salary Increases*	3.1% to 8.6%
Payroll Growth Rate	3.0%
Population Growth Rate	0.0%

* *Includes merit and seniority increases that vary by service plus wage inflation of 3.0%/year.*

Financial Principles and Operational Techniques of the Wisconsin Retirement System

Benefit Promises Made Which Must Be Paid For. A retirement program is an orderly means of handing out, keeping track of, and financing contingent retirement promises. As each participant of the Retirement System acquires a unit of service credit he is, in effect, handed an "IOU" which reads: "The Wisconsin Retirement System promises to pay you one unit of annuity benefits, payments in cash commencing when you retire."

The principal related financial question is: ***When shall the money required to cover the "IOU" be contributed?*** This year, when the benefit of the participant's unit of service is received? Or, some future year, when the "IOU" becomes a cash demand?

The law governing the Wisconsin Retirement System financing intends that the money to cover an "IOU" is contributed in the year the "IOU" is handed out. In this way contribution rates expressed as percents of participant payroll can be determined so as to remain approximately level from year to year and decade to decade as long as the basic experience and make-up of the group of participants does not change significantly. This means that for equivalent benefits each generation of Wisconsin taxpayers will contribute at approximately the same payroll rates.

Translated into actuarial terminology, the level percent-of-payroll contribution objective means that the contribution rate must total at least:

> **Normal Cost** (the current discounted value of benefits likely to be paid on account of participants' service rendered in the current year)
>
> … plus …
>
> **Amortization of any Unfunded Frozen Initial Liabilities (UFIL)**

If contributions to the system are less than the preceding amount, the difference, **plus investment earnings not realized thereon**, will have to be contributed at some later time, or benefits will have to be reduced, to satisfy the fundamental equation under which all retirement programs must operate; that is:

$$B = C + I - E$$

Benefit payments to any group of participants and their beneficiaries cannot exceed

Contributions received on behalf of the group
… plus …
Investment earnings on those contributions
… minus …
Expenses incurred in operating the program.

There are retirement programs (Social Security is an example) designed to defer the bulk of contributions far into the future. The present contribution rate for such systems is artificially low, but is destined to increase relentlessly to a level which may be greatly in excess of the level percent-of-payroll rate.

A by-product of a level percent-of-payroll contribution objective is the accumulation of invested assets for varying periods of time. Investment income becomes the third and largest contributor to the retirement system and the amount is directly related to the amount of contributions and investment performance.

Computing Contribution Rates to Finance Benefits. From a given schedule of benefits and from the data furnished, the actuary calculates the contribution rates **by means of an actuarial valuation** – the technique of assigning monetary values to the risks assumed in operating a retirement program.

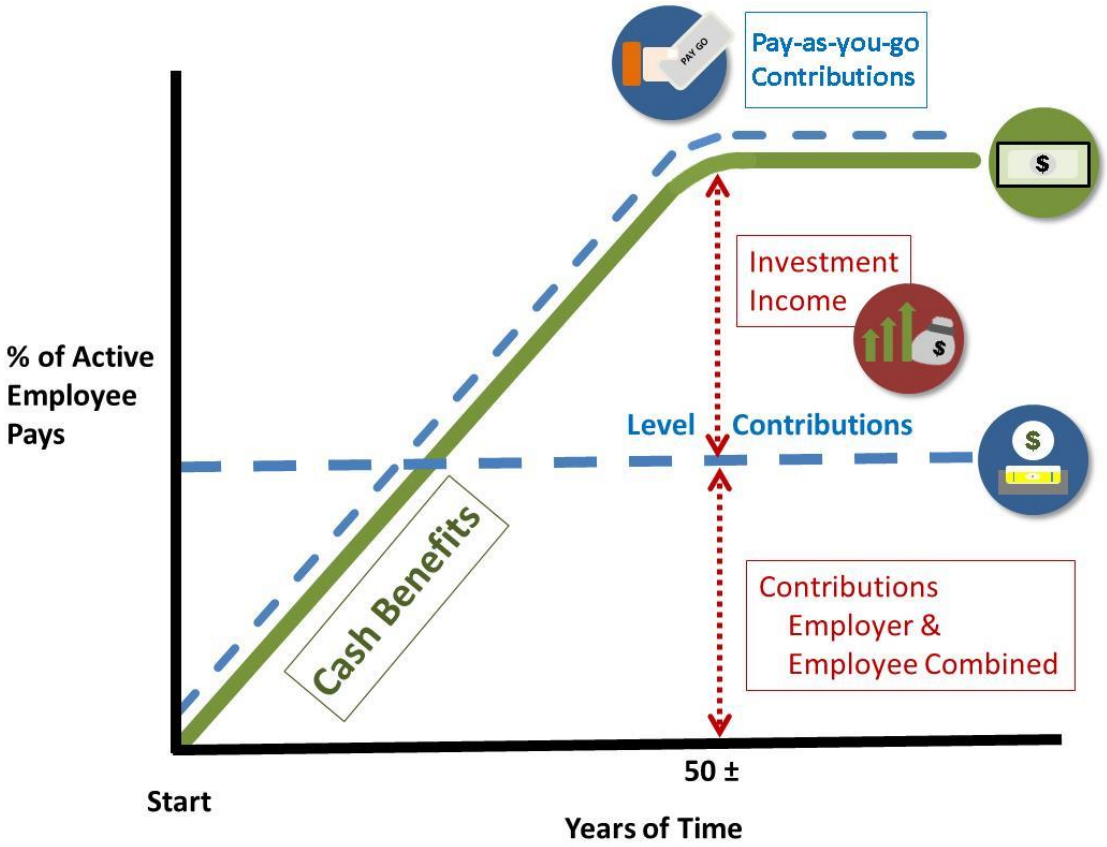
Actuarial Method and Assumptions Used in Valuations

The principal actuarial assumptions relate to:

- long-term ***rates of investment income*** likely to be generated by system assets
- ***rates of mortality*** among participants, retirants and beneficiaries
- ***rates of withdrawal*** of active participants
- ***rates of disability*** among participants
- ***patterns of salary increases*** to be experienced by participants
- the age and service ***distribution of actual retirements***

In an actuarial valuation, the actuary projects the monetary effect of each assumption for each distinct experience group, for the next year and for each year over the next half-century or longer.

Once actual risk experience has occurred and been observed, it will not coincide exactly with assumed risk experience, regardless of the skill of the actuary, the completeness of the data, and the precision of the calculations. Each valuation provides a complete recalculation of assumed future risk experience and takes into account all past differences between assumed and actual risk experience. The result is a continual series of small adjustments to the computed contribution rate. From time to time it becomes necessary to adjust the package of risk measurements to reflect basic experience trends – but not random year-to-year fluctuations.



CASH BENEFITS LINE. This relentlessly increasing line is the fundamental reality of retirement plan financing. It happens each time a new benefit is added for future retirements (and happens regardless of the design for contributing for benefits).

LEVEL CONTRIBUTION LINE. Determining the level contribution line requires detailed assumptions concerning a variety of experiences in future decades, including:

- **Economic Areas**
  - Rates of investment return
  - Rates of pay increase
  - Changes in active member group size
- **Non-Economic Areas**
  - Ages at actual retirement
  - Rates of mortality
  - Rates of withdrawal of active members (turnover)
  - Rates of disability

Actuarial Valuation Method

The actuarial funding method prescribed in the statute for WRS is the Frozen Entry Age Method which is also referred to as the Frozen Initial Liability (FIL) method in this report. Under this method, the amount of remaining unfunded actuarial accrued liabilities at any valuation date is affected only by the monthly amortization payments, compound interest, the added liability created by new employer units, and any added liabilities caused by changes in benefit provisions.

Actuarial gains or losses arising from the difference between actual and assumed experience are reflected in the determination of the normal cost. In this manner, experience gains or losses in any year are amortized (spread) over the average future working lifetime of the active participant group - a period of approximately 12 years. Hence, the computed normal cost is made up of two parts:

- The pure entry-age normal cost (EANC) determined without regard to past gains or losses, and
- An experience amortization component.

Section 40.04(1) of the Wisconsin Statutes provides authority to maintain accounts and reserves determined to be "useful in achieving the funds' purposes - - -". A fundamental WRS objective is stable contribution rates. Accordingly, based on the authority granted under Section 40.04, the experience portion of the normal cost is separately calculated each year and the amortization period is varied upward or downward in order to minimize short-term rate fluctuations. The policy regarding the EAR amortization period is described below:

- The standard period is set 20 years.
- The standard period is reconsidered as part of each triennial experience study (no changes were made with the most recent experience study).
- Temporary interim changes in the period are made only when there are large, but mostly offsetting market gains and losses known to be flowing through the MRA that would otherwise result in contribution rate volatility. Large changes would be defined as those which, over a 2-year period, were expected to result in contribution rate changes of at least 0.4% of payroll.
- The minimum and maximum EAR amortization periods are 10 years and 30 years respectively.
- The amortization policy will be applied in the same manner to market gains and losses flowing through the MRA.
- For 2018, a 20-year period was used.

Asset Valuation Method

An essential step in the valuation process is comparing valuation assets with computed liabilities. Computed liabilities result from actuarial calculations involving the covered population, the benefits, and actuarial assumptions. Valuation assets are those assets that are recognized and available to fund the System's liabilities. WRS assets are invested in the Core Investment Trust, and in the Variable Investment Trust, both of which are managed by the State of Wisconsin Investment Board (SWIB). Assets in the Variable Investment Trust are marked to market each year. Assets in the Core Investment Trust (most of the assets) are valued (or recognized) using an "asset valuation method."

Asset valuation methods are distinguished by the timing of the recognition of investment return. Total investment return is the sum of ordinary income and capital value changes. Under a book value approach, ordinary income is recognized immediately and capital gains (or losses) are recognized only when securities are sold. Book value investment return is directly affected by the timing of sales activity and underlying experience may be distorted. Under a pure market value approach, ordinary investment income and all capital value changes are recognized immediately. Because of market volatility, use of pure market values in retirement funding can result in volatile contribution rates and unstable financial ratios, contrary to WRS objectives.

The asset valuation method used for WRS valuations is statutory, and is referred to as the "Market Recognition Account" or MRA. Act 11 of 1999 closed the former Transaction Amortization Account (TAA) and created the Market Recognition Account (MRA). The MRA recognizes assumed returns fully each year. Differences between actual and assumed returns are phased-in over a closed five-year period. The objective is to give recognition to long-term changes in asset values while minimizing the effect of short-term fluctuations in the capital markets. In accordance with its smoothing objective, the MRA will tend to exceed the market value when the markets are doing poorly, and will fall short of the market value when markets are doing well. Some retirement systems set limits on the amount by which the recognized value of assets can differ from the market value.

Annual Actuarial Valuations
Assumptions Adopted by ETF Board After Consulting with Actuary

ECONOMIC ASSUMPTIONS

The rationale for these assumptions is based upon an experience study covering the period 2015-2017.

For determining plan liabilities, the discount rate is 5.0% for retired participants, 5.0% for active and inactive participants following retirement, and 7.0% for active and inactive participants prior to their retirement. A valuation performed assuming a 5.4% discount rate for all participants at all stages of life, reproduces the results of an actuarial valuation using the 5.0% post-retirement and 7.0% pre-retirement assumptions. Thus, it can be said that **the net discount rate assumed in the valuations was 5.4% per year, compounded annually (net after administrative expenses).**

The **Wage Inflation Rate** assumed in this valuation was 3.0% per year. The wage inflation rate is defined to be the portion of total pay increases for an individual that are due to macroeconomic forces including productivity, price inflation, and labor market conditions. The wage inflation rate does not include pay changes rated to individual merit and seniority effects.

No specific **Price Inflation** assumption is required to perform this valuation. The price inflation assumption used to evaluate the investment return assumption is 2.5%.

The assumed **Real Rate of Return** over wage inflation is defined to be the portion of total investment return that is more than the assumed total wage growth rate. Considering other economic assumptions, the 7.0% pre-retirement investment return rate translates to an assumed real rate of return over wage inflation of 4.0%. The assumed real rate of return over price inflation is 4.5% considering an inflation assumption of 2.5%.

Merit and Longevity pay increase assumptions for individual active members are shown for sample services below. An additional 3.0% recognizes wage inflation, including price inflation, productivity increases, and other macroeconomic forces.

% Merit and Longevity Increase Next Year						
		University	Public School	Protective		Exec. &
Service	Gen.	Teachers	Teachers	With S.S.	W/O S.S.	Elec.
1	3.5%	3.0%	5.6%	4.8%	5.5%	2.5%
2	3.5%	3.0%	5.6%	4.8%	5.5%	2.5%
3	3.1%	2.9%	5.2%	4.1%	4.7%	2.0%
4	2.8%	2.8%	4.7%	3.5%	3.8%	1.6%
5	2.5%	2.7%	4.3%	2.8%	3.0%	1.1%
10	1.5%	2.2%	2.6%	1.1%	0.9%	0.2%
15	1.1%	1.7%	1.4%	0.8%	0.5%	0.2%
20	0.9%	1.2%	0.6%	0.7%	0.4%	0.2%
25	0.6%	0.9%	0.3%	0.6%	0.3%	0.2%
30	0.4%	0.7%	0.2%	0.5%	0.2%	0.2%

Decrement Probabilities

The Active Member Population is assumed to remain constant. For purposes of financing the unfunded liabilities and amortizing the EAR, total payroll is assumed to grow at the wage inflation rate – 3.00% per year.

The mortality table used to measure mortality for retired participants was the Wisconsin 2018 Mortality Table. The rates in this table were based on actual WRS experience adjusted for future mortality improvements using the MP-2018 fully generational improvement scale (multiplied by 60%). This mortality assumption was adopted by the Board in connection with the 2015-2017 Experience Study. Sample retirement values from this table are shown below. This assumption is used to measure the probabilities of participants dying before retirement and the probabilities of each benefit payment being made after retirement.

Single Life Retirement Values
Wisconsin 2018 Mortality Table with 5% Interest

Sample Attained Ages in 2018	Present Value of $1 Monthly for Life*		Future Life Expectancy (years)*		Mortality Rates*	
	Males	Females	Males	Females	Males	Females
40	$212.90	$217.57	45.2	48.2	0.000978	0.000608
45	204.56	210.20	40.2	43.1	0.001233	0.000919
50	194.06	201.03	35.2	38.1	0.001621	0.001343
55	181.39	189.85	30.3	33.1	0.003778	0.002415
60	167.14	176.59	25.7	28.3	0.005441	0.003507
65	150.16	160.61	21.3	23.7	0.008316	0.005262
70	130.92	141.58	17.1	19.2	0.013518	0.008775
75	109.41	119.90	13.2	14.9	0.022764	0.015900
80	86.66	96.54	9.7	11.1	0.041815	0.029897
85	65.27	73.38	6.8	7.8	0.078176	0.060047

* *With a fully generational mortality table, the mortality rate depends on the year of birth. Later years of birth will correspond to a lower mortality rate at a given age.*

The values shown above are for non-disabled participants in 2018. For disabled participants, the following table was used:

Sample Attained Ages in 2018	Present Value of $1 Monthly for Life		Future Life Expectancy (years)		Mortality Rates*	
	Males	Females	Males	Females	Males	Females
40	$199.47	$207.75	37.7	41.7	0.001409	0.001010
45	187.81	198.03	32.7	36.7	0.002340	0.001532
50	174.32	186.22	28.0	31.8	0.004674	0.002715
55	158.54	172.11	23.4	27.0	0.006317	0.003984
60	140.06	155.27	19.0	22.4	0.010961	0.006118
65	119.73	135.60	15.0	17.9	0.017766	0.010514
70	97.72	113.56	11.3	13.8	0.030729	0.019083
75	75.52	90.06	8.1	10.1	0.058413	0.036082
80	55.90	67.48	5.7	7.1	0.107657	0.073711
85	39.92	49.35	3.8	4.9	0.173675	0.127108

* *With a fully generational mortality table, the mortality rate depends on the year of birth. Later years of birth will correspond to a lower mortality rate at a given age.*

Active Participant Mortality Rates

Sample Attained Ages in 2018	Mortality Rates*	
	Males	Females
20	0.000134	0.000081
25	0.000164	0.000090
30	0.000211	0.000122
35	0.000371	0.000220
40	0.000489	0.000305
45	0.000617	0.000460
50	0.000810	0.000672
55	0.001889	0.001209
60	0.002720	0.001755
65	0.004158	0.002634
70	0.006759	0.004392
75	0.011382	0.007958
80	0.020907	0.014964

* *With a fully generational mortality table, the mortality rate depends on the year of birth. Later years of birth will correspond to a lower mortality rate at a given age.*

Rates of Retirement for Those Eligible to Retire

Normal Retirement

Age	General		Public School		University		Protective*		Exec. &
	Male	Female	Male	Female	Male	Female	With S.S.	W/O S.S.	Elected
50							6%	2%	
51							8%	4%	
52							10%	4%	
53							25%	17%	
54							20%	23%	
55							20%	25%	
56							20%	25%	
57	19%	17%	33%	27%	12%	15%	20%	25%	8%
58	19%	17%	29%	27%	12%	15%	20%	33%	8%
59	19%	17%	24%	27%	12%	10%	20%	33%	8%
60	19%	17%	25%	27%	12%	12%	20%	20%	20%
61	19%	17%	25%	27%	12%	16%	20%	20%	12%
62	26%	27%	35%	37%	12%	15%	30%	40%	12%
63	29%	27%	32%	30%	12%	20%	30%	40%	12%
64	28%	27%	29%	28%	12%	20%	30%	40%	15%
65	30%	30%	29%	37%	15%	20%	40%	40%	15%
66	35%	35%	35%	39%	20%	24%	40%	100%	15%
67	30%	30%	33%	33%	20%	20%	40%	100%	15%
68	19%	25%	27%	30%	18%	17%	40%	100%	15%
69	19%	25%	23%	28%	16%	17%	40%	100%	20%
70	19%	25%	25%	38%	20%	18%	100%	100%	20%
71	19%	20%	20%	20%	18%	18%	100%	100%	20%
72	19%	20%	15%	20%	16%	18%	100%	100%	20%
73	19%	20%	15%	20%	16%	15%	100%	100%	20%
74	19%	20%	15%	20%	16%	15%	100%	100%	20%
75	100%	100%	100%	100%	100%	100%	100%	100%	100%

** Includes reduced retirements for protective with 20+ years of service.*

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Reduced Retirement

Age	% Retiring Next Year						
	General		Public School		University		Exec. &
	Male	Female	Male	Female	Male	Female	Elected
55	8.0%	7.0%	13.0%	12.0%	3.0%	5.0%	3.0%
56	8.0%	7.0%	13.0%	12.0%	3.0%	5.0%	3.0%
57	4.8%	5.5%	12.0%	12.0%	3.0%	5.0%	3.0%
58	5.7%	6.5%	13.0%	12.0%	3.0%	5.0%	3.0%
59	6.8%	7.0%	14.0%	13.0%	4.0%	5.0%	3.0%
60	8.5%	9.5%	14.0%	17.0%	5.5%	9.0%	5.0%
61	9.0%	9.5%	15.0%	17.0%	5.5%	9.0%	5.0%
62	17.0%	16.0%	21.0%	23.0%	7.4%	12.0%	
63	18.0%	18.0%	21.0%	23.0%	7.4%	12.0%	
64	17.0%	18.0%	21.0%	23.0%	10.0%	15.0%	

The assumed rates of separation from employment prior to service retirement due to disability and other causes are shown below for sample ages. For other terminations it was assumed that a percentage, depending on age of participants terminating after age 35 with 5 or more years of service, will leave their contributions on deposit and be paid a benefit at normal retirement age and that the remaining participants would take a separation benefit. The percentage taking a separation benefit is 25% at age 35, grading downward to 0% at retirement eligibility. All participants terminating prior to normal retirement age with less than five years of service were assumed to take a separation benefit.

Assumed Termination Rates
by Attained Age and Years of Service

		% of Active Participants Terminating								
		Protective								
		With Soc.	Without Soc.	Public Schools		University		Exec. &	General	
Age	Service	Sec.	Sec.	Males	Females	Males	Females	Elected	Males	Females
	0	16.0%	4.0%	18.5%	15.0%	16.0%	14.5%	14.0%	17.0%	20.0%
	1	9.5%	3.5%	11.0%	11.0%	15.0%	14.0%	13.0%	12.3%	15.0%
	2	6.0%	1.5%	8.0%	8.0%	13.0%	13.0%	12.0%	9.3%	11.5%
	3	5.0%	1.3%	6.5%	6.0%	11.0%	10.0%	10.0%	7.6%	10.0%
	4	4.5%	1.2%	5.5%	5.5%	9.0%	9.5%	10.0%	7.5%	9.5%
	5	4.0%	1.1%	4.0%	5.0%	8.0%	9.0%	5.0%	5.8%	7.8%
	6	3.8%	1.0%	3.5%	4.0%	7.5%	7.0%	5.0%	4.8%	7.0%
	7	3.5%	0.9%	3.2%	3.7%	6.0%	6.0%	5.0%	4.7%	6.0%
	8	3.0%	0.8%	3.0%	3.3%	5.5%	5.0%	5.0%	4.1%	5.7%
	9	2.5%	0.7%	2.8%	3.0%	5.0%	4.0%	5.0%	4.0%	5.3%
25	10 & Over	2.5%	0.7%	2.5%	2.5%	5.0%	4.0%	5.0%	4.0%	5.0%
30		2.3%	0.7%	2.2%	2.4%	4.7%	4.0%	5.0%	3.7%	4.7%
35		2.0%	0.7%	1.8%	1.9%	4.2%	4.0%	5.0%	3.0%	3.9%
40		1.6%	0.6%	1.5%	1.5%	3.4%	3.7%	5.0%	2.4%	3.2%
45		1.4%	0.6%	1.4%	1.3%	2.7%	3.2%	4.7%	2.0%	2.7%
50		1.2%	0.5%	1.3%	1.2%	2.2%	2.7%	4.2%	1.7%	2.2%
55		1.2%	0.5%	1.3%	1.2%	2.0%	2.5%	4.0%	1.6%	2.0%
60		1.2%	0.5%	1.3%	1.2%	2.0%	2.5%	4.0%	1.6%	2.0%

Disability Rates

	% of Active Participants Becoming Disabled									
	Protective		Public Schools		University		Exec. & Elected		General	
Age	With SS	W/O SS	Males	Females	Males	Females	Males	Females	Males	Females
20	0.01%	0.03%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
25	0.01%	0.03%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
30	0.01%	0.03%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%
35	0.01%	0.03%	0.00%	0.01%	0.00%	0.02%	0.01%	0.01%	0.01%	0.02%
40	0.02%	0.04%	0.01%	0.01%	0.00%	0.02%	0.01%	0.01%	0.02%	0.03%
45	0.02%	0.08%	0.02%	0.04%	0.01%	0.02%	0.01%	0.01%	0.04%	0.04%
50	0.04%	0.46%	0.06%	0.07%	0.01%	0.04%	0.02%	0.02%	0.09%	0.06%
55	0.61%	0.34%	0.12%	0.10%	0.04%	0.06%	0.09%	0.09%	0.17%	0.12%
60	1.02%	0.10%	0.19%	0.15%	0.06%	0.09%	0.11%	0.11%	0.30%	0.16%

Miscellaneous and Technical Assumptions

Expenses:	Assumed investment return is net of administrative and investment expenses.
Marriage Assumption:	80% of males and 70% of females are assumed to be married for purposes of death-in-service benefits. Male spouses are assumed to be three years older than female spouses.
Pay Increase Timing:	Beginning of (calendar) year for most people. Middle of calendar year for teachers.
Pay Annualization:	Reported pay for members with less than twelve contributing months was annualized by the ratio of 12 to the number of contributing months in the year.
Final Average Salary:	For present value of future benefit purposes, final average salary was calculated in accordance with pay increase assumptions, but was not permitted to fall below the final average salary reported in the data.
Decrement Timing:	Decrements of all types are assumed to occur mid-year.
Decrement Operation:	Disability operates during the retirement pattern.
Decrement Relativity:	Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.
Eligibility Testing:	Eligibility for benefits is determined based upon the age nearest birthday and total service (in all benefit groups) nearest whole year on the date the decrement is assumed to occur.
Benefit Service:	Exact fractional service on the decrement date is used to determine the amount of benefit payable.
Non-Benefit Service:	Liabilities for service in divisions other than the division in which the individual is currently active are calculated as indexed deferred vested benefits. Benefits are indexed in accordance with the salary adjustment factors for the division where the member was formerly employed. People are assumed to retire at the earliest age that full benefits will become available. The liabilities are assigned to the division in which the service was rendered.
Service Credit Accruals:	It is assumed that members accrue one year of service credit per year.

Miscellaneous and Technical Assumptions (Concluded)

Incidence of Contributions:	Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made.
Assumed Retirement for Deferred Members:	Members with a deferred vested benefit were assumed to retire at age 65 for General members, age 54 for Protective members and age 62 for Executive and Elected members.
Normal Form of Benefit:	The assumed normal form of benefit is a straight life benefit, except where otherwise noted.
Variable Excess Benefits:	These benefits are valued by increasing the otherwise calculated liabilities by an amount equal to twice the value of the variable excess. (The variable excess is the difference between the variable account and the variable at core account, summed over all participants.)
Liability Adjustments:	Final Average Salaries were increased 2.5% (3.0% for Executive and Elected and 3.5% for Protectives) to account for additional contingencies in actual benefit amount calculated at the time of retirement.
Amortization Payoff Reserve:	Additional reserves in the amount of $7,457,708 (discounted from the year 2029 to the current valuation date) were added to general group liabilities to account for the possibility that some non-state employers may never be able to pay off their unfunded actuarial accrued liability.

SECTION G

PLAN PROVISIONS

Summary of Benefit Provisions Evaluated
December 31, 2018 Actuarial Valuation

Normal Retirement Eligibility

The age a participant becomes eligible for an unreduced age and service annuity is:

General		Protective		Executive & Elected#	
Age	**Service**	**Age**	**Service**	**Age**	**Service**
65 57	Any* 30	54 53	Any* 25	62 57	Any* 30

* *Participants first employed after 1989 and terminated before April 24, 1998 must have creditable service in five calendar years.*

\# *These conditions apply to those people hired on or before December 31, 2016. For others, the General eligibility conditions apply.*

Normal Retirement Annuity

The age and service annuity payable at Normal Retirement Age is based on Final Average Earnings (FAE) and Creditable Service (CS) as follows:

Multiplier for Service Rendered			
Before 2000	**Between 2000 and 2011**	**After 2011**	**Group**
2.165%	2.0%	1.6%	Executive group and elected officials
2.165%	2.0%	2.0%	Protective occupation participants covered by Social Security
2.665%	2.5%	2.5%	Protective occupation participants not covered by Social Security
1.765%	1.6%	1.6%	All other participants

FAE is generally the average of the three highest years of earnings (July 1 - June 30 for teachers, educational support staff, and judges; calendar year for others) preceding retirement. These years do not have to be consecutive. For legislators and state constitutional officers who are ineligible to receive pay increases during their term, FAE is the statutory rate of earnings at termination.

Maximum formula annuity is 85% of FAE for protective occupation participants not covered by Social Security, 65% of FAE for protectives covered by Social Security, and 70% for all other participants. If greater than the formula amount, an annuity equal to the actuarial equivalent of two times the required accumulated contributions is paid in lieu of the formula amount.

Reduced Retirement. Any participant who has attained age 55 and any Protective occupation participant who has attained age 50 may apply for an early retirement annuity. The benefit is reduced 0.4% for each month that the annuity effective date precedes the Normal Retirement Age. For Non-Protective participants terminating after 6/30/90, the 0.4% is reduced for months after the attainment of age 57 and before the annuity effective date by .001111% for each month of creditable service.

Voluntary Termination Before Immediate Benefit Eligibility. Participant may either (i) receive a refund of accumulated contributions, or (ii) leave contributions on deposit and apply for a retirement annuity on or after the minimum retirement age based upon age and accrued service at time of termination.

Post-Retirement Adjustments. Annuities are increased annually if the investment income credited to retired life funds is in excess of the assumed benefit rate (presently 5%), other plan experiences are within projected ranges, and the resulting adjustment would be at least 0.5% (2.0% for the variable fund).

Disability Benefits. Generally, disability means the inability to engage in any substantial gainful activity by reason of a medically determinable physical or mental impairment which can be expected to result in death or to be of long-continued and indefinite duration. Disability applicants must be participating employees who are under normal retirement age, have not already taken a WRS benefit and who meet a service requirement.

For this purpose **normal retirement age** is:

- 65 for general employees and executives and elected officials hired after December 31, 2016
- 62 for executives and elected officials hired on or before December 31, 2016
- 53 for protective occupation employees with 25 or more years of creditable service
- 54 for other protective occupation employees

The **service requirement** is that during the seven years preceding application the individual must have earned:

- At least 6 months of service credit in five of those years or
- A total of five years of service credit.

The service credit requirement may be waived if the disability is work related.
Protective occupation employees who become disabled between the ages of 50 and 55, who have at least 15 years of service, and who can no longer perform the duties of their position may apply for a special disability benefit until age 55.

Disability Amount: The disability benefit is the WRS formula benefit based upon service projected to normal retirement age as described above, without regard to the early Retirement reduction.

Death-in-Service.

(a) Prior to age 50 for Protective participants, age 55 for others, the benefit is the equivalent of twice the accumulated employee contributions required and all additional contributions and employer amounts contributed prior to 1974 for teachers, or 1966 for others.

(b) After age 50 for Protective participants, age 55 for others, the benefit is the amount that would have been paid if participant had retired and elected 100% survivor option. Benefit is payable to any natural living person. If there is no eligible beneficiary, a refund of contributions is paid to the estate.

Interest Credits. For years after 1999, and for people with some active service after 1999, participant core accounts (including the variable at core accounts) are credited with interest at the full (core) effective rate. For others, accounts are credited with interest as follows:

	Rate Credited for Purpose of	
Date of Participation	Money Purchase Minimum	Refunds
Prior to 1982	Actual	Actual
January 1, 1982 & Later	5%	3%

Participant variable accounts are credited with interest based on the earnings in the variable portfolio.

Contribution Rates. The financial objective of WRS is to establish and receive contributions that will remain level from year to year and decade to decade.

Statutory required participant contributions prior to July 1, 2011 were as follows:

General	5.0%
Executives & Elected Officials	5.5
Protectives	
- With Social Security	6.0
- Without Social Security	8.0

Statutory required participant contributions after July 1, 2011 are set equal to one-half of the actuarially determined rate for General participants and Executive and Elected Officials. Participant contributions for Protective participants are set equal to the participant contribution for General members.

Normal Form of Benefit. The normal form of benefit is a straight life annuity with no death benefits. Optional forms of benefit which are actuarially reduced are listed below:

- A life annuity with 60 or 180 monthly payments guaranteed.
- A joint survivorship annuity with 75% continued to beneficiary.
- A joint survivorship annuity with 100% continued to beneficiary.
- A joint survivorship annuity reduced 25% upon either your death or your beneficiary's death.
- A joint survivorship annuity with 100% continued to beneficiary combined with 180 monthly payments guaranteed.

For formula benefit calculations, optional forms are calculated at the lower of the current age or age 62 (Normal Retirement Age for Protective occupations). If a retiree (and beneficiary if in receipt of a joint survivorship annuity) dies prior to receiving benefits which, in total, are at least equal to the members contributions, a "residual refund" for the difference is paid.

Vesting. Participants hired prior to July 1, 2011 vest immediately. After July 1, 2011, participants vest after five years of service.

SECTION H

GAIN/LOSS STATISTICAL SUMMARY

General Males
Withdrawal Experience
During Calendar Year 2018

Male Service-Based Withdrawals
All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	410	2,232	0.1837	0.1700	379
2	625	4,331	0.1443	0.1230	533
3	376	3,397	0.1107	0.0930	316
4	253	3,185	0.0794	0.0760	242
5	207	2,811	0.0736	0.0750	211
6	156	2,376	0.0657	0.0580	138
7	124	2,167	0.0572	0.0480	104
8	92	1,595	0.0577	0.0470	75
9	63	1,217	0.0518	0.0410	50
10	66	1,333	0.0495	0.0400	53
Totals	2,372	24,644	0.0963	0.0853	2,101

Male Age-Based Withdrawals
10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	4	0.0000	0.0400	-
30-34	12	303	0.0396	0.0350	11
35-39	44	1,415	0.0311	0.0260	37
40-44	78	2,240	0.0348	0.0230	52
45-49	76	3,207	0.0237	0.0180	58
50-54	100	4,361	0.0229	0.0160	70
Over 54	95	10,687	0.0089		95
Totals	405	22,217	0.0182	0.0145	323

General Females
Withdrawal Experience
During Calendar Year 2018

Female Service-Based Withdrawals
All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	1,136	5,489	0.2070	0.2000	1,098
2	1,557	9,566	0.1628	0.1500	1,435
3	962	7,187	0.1339	0.1150	827
4	647	5,989	0.1080	0.1000	599
5	385	4,972	0.0774	0.0950	472
6	352	4,365	0.0806	0.0780	340
7	268	3,779	0.0709	0.0700	265
8	181	3,030	0.0597	0.0600	182
9	174	2,706	0.0643	0.0570	154
10	153	2,756	0.0555	0.0530	146
Totals	5,815	49,839	0.1167	0.1107	5,518

Female Age-Based Withdrawals
10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	1	5	0.2000	0.0500	-
30-34	20	508	0.0394	0.0450	23
35-39	77	2,027	0.0380	0.0350	71
40-44	114	3,293	0.0346	0.0300	99
45-49	168	4,461	0.0377	0.0250	112
50-54	198	6,754	0.0293	0.0200	135
Over 54	234	18,598	0.0126		234
Totals	812	35,646	0.0228	0.0189	674

Public Schools Males
Withdrawal Experience
During Calendar Year 2018

Male Service-Based Withdrawals
All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	59	489	0.1207	0.1850	90
2	107	984	0.1087	0.1100	108
3	84	933	0.0900	0.0800	75
4	70	919	0.0762	0.0650	60
5	55	948	0.0580	0.0550	52
6	44	891	0.0494	0.0400	36
7	40	836	0.0478	0.0350	29
8	22	719	0.0306	0.0320	23
9	24	568	0.0423	0.0300	17
10	20	583	0.0343	0.0280	16
Totals	525	7,870	0.0667	0.0643	506

Male Age-Based Withdrawals
10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	1	0.0000	0.0250	-
30-34	1	190	0.0053	0.0200	4
35-39	30	1,567	0.0191	0.0160	25
40-44	43	2,490	0.0173	0.0150	37
45-49	49	2,863	0.0171	0.0140	40
50-54	48	2,692	0.0178	0.0130	35
Over 54	32	3,012	0.0106		32
Totals	203	12,815	0.0158	0.0135	173

Public Schools Females
Withdrawal Experience
During Calendar Year 2018

Female Service-Based Withdrawals
All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	139	1,564	0.0889	0.1500	235
2	258	2,852	0.0905	0.1100	314
3	248	2,813	0.0882	0.0800	225
4	171	2,961	0.0578	0.0600	178
5	178	2,933	0.0607	0.0550	161
6	110	2,666	0.0413	0.0500	133
7	118	2,427	0.0486	0.0400	97
8	81	2,095	0.0387	0.0370	78
9	77	1,800	0.0428	0.0330	59
10	63	1,884	0.0334	0.0300	57
Totals	1,443	23,995	0.0601	0.0641	1,537

Female Age-Based Withdrawals
10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	-	N\A	0.0250	-
30-34	9	633	0.0142	0.0230	15
35-39	92	4,619	0.0199	0.0170	79
40-44	118	6,121	0.0193	0.0140	86
45-49	108	6,848	0.0158	0.0130	89
50-54	114	7,081	0.0161	0.0120	85
Over 54	73	8,323	0.0088		73
Totals	514	33,625	0.0153	0.0127	427

University Males
Withdrawal Experience
During Calendar Year 2018

Male Service-Based Withdrawals
All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	59	324	0.1821	0.1600	52
2	127	732	0.1735	0.1500	110
3	112	740	0.1514	0.1300	96
4	63	565	0.1115	0.1100	62
5	37	558	0.0663	0.0900	50
6	48	546	0.0879	0.0800	44
7	39	495	0.0788	0.0750	37
8	24	396	0.0606	0.0600	24
9	18	356	0.0506	0.0550	20
10	16	322	0.0497	0.0500	16
Totals	543	5,034	0.1079	0.1015	511

Male Age-Based Withdrawals
10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	-	N/A	0.0500	-
30-34	1	20	0.0500	0.0450	1
35-39	6	175	0.0343	0.0400	7
40-44	25	460	0.0543	0.0300	14
45-49	26	790	0.0329	0.0250	20
50-54	27	935	0.0289	0.0200	19
Over 54	13	2,522	0.0052		13
Totals	98	4,902	0.0200	0.0151	74

University Females
Withdrawal Experience
During Calendar Year 2018

Female Service-Based Withdrawals
All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	83	482	0.1722	0.1450	70
2	159	967	0.1644	0.1400	135
3	131	920	0.1424	0.1300	120
4	111	841	0.1320	0.1000	84
5	73	720	0.1014	0.0950	68
6	56	692	0.0809	0.0900	62
7	44	567	0.0776	0.0700	40
8	23	511	0.0450	0.0600	31
9	25	422	0.0592	0.0500	21
10	23	457	0.0503	0.0400	18
Totals	728	6,579	0.1107	0.0986	649

Female Age-Based Withdrawals
10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	-	N/A	0.0400	-
30-34	1	40	0.0250	0.0400	2
35-39	20	347	0.0576	0.0400	14
40-44	34	695	0.0489	0.0350	24
45-49	23	862	0.0267	0.0300	26
50-54	27	995	0.0271	0.0250	25
Over 54	9	2,169	0.0041		9
Totals	114	5,108	0.0223	0.0196	100

Protective with Social Security
Withdrawal Experience
During Calendar Year 2018

Male and Female Service-Based Withdrawals
All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	115	597	0.1926	0.1600	96
2	217	1,447	0.1500	0.0950	137
3	118	1,186	0.0995	0.0600	71
4	65	931	0.0698	0.0500	47
5	50	904	0.0553	0.0450	41
6	34	752	0.0452	0.0400	30
7	34	705	0.0482	0.0375	26
8	18	533	0.0338	0.0350	19
9	20	453	0.0442	0.0300	14
10	20	579	0.0345	0.0250	14
Totals	691	8,087	0.0854	0.0612	495

Male and Female Age-Based Withdrawals
10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	8	0.0000	0.0250	-
30-34	10	562	0.0178	0.0220	12
35-39	39	1,829	0.0213	0.0180	33
40-44	53	2,362	0.0224	0.0150	35
45-49	42	2,926	0.0144	0.0130	38
50-54	18	2,260	0.0080	0.0120	27
Over 54	11	1,383	0.0080		11
Totals	173	11,330	0.0153	0.0138	156

Protective without Social Security
Withdrawal Experience
During Calendar Year 2018

Male and Female Service-Based Withdrawals
All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	2	39	0.0513	0.0400	2
2	6	99	0.0606	0.0350	3
3	-	109	0.0000	0.0150	2
4	2	107	0.0187	0.0130	1
5	1	115	0.0087	0.0120	1
6	3	117	0.0256	0.0110	1
7	1	100	0.0100	0.0100	1
8	-	93	0.0000	0.0090	1
9	1	93	0.0108	0.0080	1
10	1	96	0.0104	0.0070	1
Totals	17	968	0.0176	0.0145	14

Male and Female Age-Based Withdrawals
10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	-	N/A	0.0070	-
30-34	-	78	0.0000	0.0070	1
35-39	1	245	0.0041	0.0065	2
40-44	-	364	0.0000	0.0060	2
45-49	3	498	0.0060	0.0055	3
50-54	5	400	0.0125	0.0050	2
Totals	9	1,585	0.0057	0.0063	10

Executive and Elected
Withdrawal Experience
During Calendar Year 2018

Male and Female Service-Based Withdrawals
All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	9	33	0.2727	0.1400	5
2	15	101	0.1485	0.1300	13
3	4	68	0.0588	0.1200	8
4	5	69	0.0725	0.1000	7
5	6	46	0.1304	0.1000	5
6	4	75	0.0533	0.0500	4
7	1	47	0.0213	0.0500	2
8	2	73	0.0274	0.0500	4
9	1	31	0.0323	0.0500	2
10	-	36	0.0000	0.0500	2
Totals	47	579	0.0812	0.0898	52

Male and Female Age-Based Withdrawals
10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	-	N/A	0.0500	-
30-34	-	1	0.0000	0.0500	-
35-39	-	16	0.0000	0.0500	1
40-44	1	42	0.0238	0.0500	2
45-49	3	76	0.0395	0.0450	3
50-54	6	128	0.0469	0.0400	5
Over 54	2	432	0.0046		2
Totals	12	695	0.0173	0.0187	13

General
Disability Experience
During Calendar Year 2018

Male Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0000	-
20-24	-	11	0.0000	0.0000	-
25-29	-	561	0.0000	0.0000	-
30-34	1	2,100	0.0005	0.0000	-
35-39	2	3,106	0.0006	0.0001	-
40-44	1	3,461	0.0003	0.0003	1
45-49	2	4,429	0.0005	0.0004	2
50-54	14	5,522	0.0025	0.0012	6
55-59	27	5,797	0.0047	0.0021	12
60-64	15	3,803	0.0039	0.0041	16
65-69	1	-	N\A	0.0016	-
70-74	-	-	N\A	0.0014	-
75 and over	-	-	N/A	0.0014	-
Totals	63	28,790	0.0022	0.0013	37

Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0000	-
20-24	-	16	0.0000	0.0000	-
25-29	-	799	0.0000	0.0000	-
30-34	2	3,268	0.0006	0.0002	1
35-39	-	4,554	0.0000	0.0002	1
40-44	4	5,591	0.0007	0.0003	2
45-49	4	7,031	0.0006	0.0004	3
50-54	14	9,675	0.0014	0.0008	7
55-59	17	11,101	0.0015	0.0014	16
60-64	24	7,545	0.0032	0.0018	14
65-69	1	-	N\A	0.0014	-
70-74	-	-	N\A	0.0012	-
75 and over	-	-	N/A	0.0012	-
Totals	66	49,580	0.0013	0.0009	44

The people shown on this page are cases involving §40.63 disability benefits and includes those who were either active or inactive with pending benefits at the beginning of the year.

Public Schools
Disability Experience
During Calendar Year 2018

Male Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0000	-
20-24	-	-	N/A	0.0000	-
25-29	-	324	0.0000	0.0000	-
30-34	-	1,682	0.0000	0.0000	-
35-39	1	2,479	0.0004	0.0000	-
40-44	-	2,958	0.0000	0.0001	-
45-49	1	3,179	0.0003	0.0003	1
50-54	4	2,922	0.0014	0.0010	3
55-59	4	1,780	0.0022	0.0013	2
60-64	1	664	0.0015	0.0023	2
65-69	-	-	N\A	0.0032	-
70-74	-	-	N\A	0.0034	-
75 and over	-	-	N/A	0.0034	-
Totals	11	15,988	0.0007	0.0005	8

Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0001	-
20-24	-	-	N/A	0.0001	-
25-29	1	1,337	0.0007	0.0001	-
30-34	-	5,389	0.0000	0.0001	-
35-39	-	6,880	0.0000	0.0001	-
40-44	2	7,329	0.0003	0.0002	1
45-49	2	7,917	0.0003	0.0006	5
50-54	8	7,880	0.0010	0.0008	7
55-59	8	5,133	0.0016	0.0013	6
60-64	4	2,017	0.0020	0.0018	4
65-69	-	-	N\A	0.0010	-
70-74	-	-	N\A	0.0008	-
75 and over	-	-	N/A	0.0008	-
Totals	25	43,882	0.0006	0.0005	23

The people shown on this page are cases involving §40.63 disability benefits and includes those who were either active or inactive with pending benefits at the beginning of the year.

University
Disability Experience
During Calendar Year 2018

Male Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0000	-
20-24	-	-	N/A	0.0000	-
25-29	-	63	0.0000	0.0000	-
30-34	-	323	0.0000	0.0000	-
35-39	-	719	0.0000	0.0000	-
40-44	-	999	0.0000	0.0000	-
45-49	1	1,157	0.0009	0.0001	-
50-54	1	1,151	0.0009	0.0002	-
55-59	-	1,018	0.0000	0.0006	1
60-64	1	817	0.0012	0.0005	-
65-69	-	-	N\A	0.0007	-
70-74	-	-	N\A	0.0006	-
75 and over	-	-	N/A	0.0006	-
Totals	3	6,247	0.0005	0.0002	1

Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0000	-
20-24	-	-	N/A	0.0000	-
25-29	-	75	0.0000	0.0000	-
30-34	-	544	0.0000	0.0000	-
35-39	-	1,048	0.0000	0.0002	-
40-44	2	1,311	0.0015	0.0003	-
45-49	1	1,258	0.0008	0.0002	-
50-54	1	1,275	0.0008	0.0005	1
55-59	1	1,161	0.0009	0.0007	1
60-64	-	721	0.0000	0.0011	1
65-69	-	-	N\A	0.0007	-
70-74	-	-	N\A	0.0006	-
75 and over	-	-	N/A	0.0006	-
Totals	5	7,393	0.0007	0.0004	3

The people shown on this page are cases involving §40.63 disability benefits and includes those who were either active or inactive with pending benefits at the beginning of the year.

Protective with Social Security
Disability Experience
During Calendar Year 2018

Male and Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0003	-
20-24	-	-	N/A	0.0003	-
25-29	-	82	0.0000	0.0003	-
30-34	-	330	0.0000	0.0003	-
35-39	-	384	0.0000	0.0003	-
40-44	-	414	0.0000	0.0005	-
45-49	2	517	0.0039	0.0010	1
50-54	2	284	0.0070	0.0070	2
55-59	-	-	N\A	0.0010	-
60-64	-	-	N\A	0.0010	-
65-69	-	-	N/A	0.0010	-
70-74	-	-	N/A	0.0010	-
75 and over	-	-	N/A	0.0010	-
Totals	4	2,011	0.0020	0.0015	3

The people shown on this page are cases involving §40.63 disability benefits and includes those who were either active or inactive with pending benefits at the beginning of the year.

Protective without Social Security
Disability Experience
During Calendar Year 2018

Male and Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0001	-
20-24	-	7	0.0000	0.0001	-
25-29	-	621	0.0000	0.0001	-
30-34	1	1,979	0.0005	0.0001	-
35-39	-	2,475	0.0000	0.0001	-
40-44	-	2,686	0.0000	0.0002	-
45-49	-	3,129	0.0000	0.0003	1
50-54	3	1,840	0.0016	0.0005	1
55-59	-	-	N\A	0.0098	-
60-64	-	-	N\A	0.0105	-
65-69	-	-	N\A	0.0007	-
70-74	-	-	N/A	0.0007	-
75 and over	-	-	N/A	0.0007	-
Totals	4	12,737	0.0003	0.0002	2

The people shown on this page are cases involving §40.63 disability benefits and includes those who were either active or inactive with pending benefits at the beginning of the year.

Executive and Elected
Disability Experience
During Calendar Year 2018

Male and Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0000	-
20-24	-	-	N/A	0.0000	-
25-29	-	3	0.0000	0.0000	-
30-34	-	20	0.0000	0.0000	-
35-39	-	39	0.0000	0.0001	-
40-44	-	72	0.0000	0.0001	-
45-49	-	108	0.0000	0.0002	-
50-54	-	175	0.0000	0.0003	-
55-59	-	172	0.0000	0.0012	-
60-64	-	62	0.0000	0.0011	-
65-69	-	-	N\A	0.0009	-
70-74	-	-	N\A	0.0009	-
75 and over	-	-	N/A	0.0009	-
Totals	-	651	N/A	N/A	-

The people shown on this page are cases involving §40.63 disability benefits and includes those who were either active or inactive with pending benefits at the beginning of the year.

General
Pay Increase Assumption
During Calendar Year 2018

Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	42,052	9.62 %	6.45 %
6-10	23,193	4.50 %	4.90 %
11-15	16,983	3.50 %	4.25 %
16-20	15,075	3.12 %	4.00 %
21-25	9,228	2.89 %	3.75 %
26-30	6,567	2.69 %	3.50 %
31-35	2,998	2.35 %	3.30 %
36-40	1,216	2.37 %	3.20 %
Over 40	345	2.09 %	3.10 %
Total	117,657		

Public Schools
Pay Increase Assumption
During Calendar Year 2018

Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	15,936	10.26 %	8.60 %
6-10	13,753	5.07 %	6.40 %
11-15	12,640	3.86 %	5.10 %
16-20	12,874	2.52 %	4.00 %
21-25	9,488	2.08 %	3.35 %
26-30	6,065	1.78 %	3.20 %
31-35	2,145	1.50 %	3.15 %
36-40	353	1.48 %	3.10 %
Over 40	63	1.95 %	3.05 %
Total	73,317		

University
Pay Increase Assumption
During Calendar Year 2018

Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	5,817	16.37 %	6.00 %
6-10	4,356	4.77 %	5.50 %
11-15	3,193	4.04 %	5.00 %
16-20	2,691	3.46 %	4.50 %
21-25	1,526	3.16 %	3.95 %
26-30	1,065	2.97 %	3.80 %
31-35	542	2.62 %	3.60 %
36-40	212	1.45 %	3.20 %
Over 40	79	1.43 %	3.10 %
Total	19,481		

Protective with Social Security
Pay Increase Assumption
During Calendar Year 2018

Male and Female Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	4,371	15.03 %	7.75 %
6-10	2,801	4.76 %	4.50 %
11-15	2,985	4.02 %	3.90 %
16-20	3,337	3.73 %	3.80 %
21-25	2,602	3.56 %	3.70 %
26-30	1,217	3.07 %	3.60 %
31-35	235	3.22 %	3.50 %
36-40	42	1.65 %	3.40 %
Over 40	17	2.22 %	3.20 %
Total	17,607		

Protective without Social Security
Pay Increase Assumption
During Calendar Year 2018

Male and Female Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	455	13.01 %	8.50 %
6-10	488	3.71 %	4.30 %
11-15	436	3.62 %	3.60 %
16-20	515	3.39 %	3.50 %
21-25	433	3.31 %	3.40 %
26-30	252	3.33 %	3.30 %
31-35	34	4.06 %	3.20 %
36-40	5	3.69 %	3.10 %
Over 40	-	N/A	3.05 %
Total	2,618		

Executive and Elected
Pay Increase Assumption
During Calendar Year 2018

Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	304	7.66 %	5.50 %
6-10	257	3.27 %	3.20 %
11-15	146	2.09 %	3.20 %
16-20	152	2.41 %	3.20 %
21-25	116	2.87 %	3.20 %
26-30	108	1.99 %	3.20 %
31-35	72	1.16 %	3.20 %
36-40	35	1.76 %	3.20 %
Over 40	15	1.49 %	3.20 %
Total	1,205		

General Males
Normal Retirement Experience
During Calendar Year 2018

Male Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	68	253	0.2688	0.1900	48
58	48	261	0.1839	0.1900	50
59	41	224	0.1830	0.1900	43
60	43	236	0.1822	0.1900	45
61	50	214	0.2336	0.1900	41
62	62	231	0.2684	0.2600	60
63	58	182	0.3187	0.2900	53
64	35	144	0.2431	0.2800	40
65	145	660	0.2197	0.3000	198
66	149	493	0.3022	0.3500	173
67	70	326	0.2147	0.3000	98
68	55	252	0.2183	0.1900	48
69	27	163	0.1656	0.1900	31
70	29	138	0.2101	0.1900	26
71	24	116	0.2069	0.1900	22
72	8	79	0.1013	0.1900	15
73	7	55	0.1273	0.1900	10
74	5	58	0.0862	0.1900	11
Totals	924	4,085	0.2262	0.2477	1,012
75 & Over	25	189			189
Totals	949	4,274			1,201

General Males
Early Retirement Experience
During Calendar Year 2018

Male Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	63	1,266	0.0498	0.0800	101
56	63	1,385	0.0455	0.0800	111
57	46	1,103	0.0417	0.0480	53
58	42	1,050	0.0400	0.0570	60
59	47	993	0.0473	0.0680	68
60	79	983	0.0804	0.0850	84
61	55	856	0.0643	0.0900	77
62	118	767	0.1538	0.1700	130
63	114	656	0.1738	0.1800	118
64	78	541	0.1442	0.1700	92
Totals	705	9,600	0.0734	0.0931	894

General Females
Normal Retirement Experience
During Calendar Year 2018

Female Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	58	279	0.2079	0.1700	47
58	61	334	0.1826	0.1700	57
59	52	332	0.1566	0.1700	56
60	61	328	0.1860	0.1700	56
61	61	299	0.2040	0.1700	51
62	70	245	0.2857	0.2700	66
63	60	209	0.2871	0.2700	56
64	53	172	0.3081	0.2700	46
65	291	1,129	0.2578	0.3000	339
66	223	725	0.3076	0.3500	254
67	108	482	0.2241	0.3000	145
68	69	347	0.1988	0.2500	87
69	44	245	0.1796	0.2500	61
70	42	204	0.2059	0.2500	51
71	28	140	0.2000	0.2000	28
72	18	113	0.1593	0.2000	23
73	6	81	0.0741	0.2000	16
74	10	61	0.1639	0.2000	12
Totals	1,315	5,725	0.2297	0.2534	1,451
75 & Over	30	252			252
Totals	1,345	5,977			1,703

General Females
Early Retirement Experience
During Calendar Year 2018

Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	95	2,380	0.0399	0.0700	167
56	108	2,398	0.0450	0.0700	168
57	100	2,166	0.0462	0.0550	119
58	98	2,106	0.0465	0.0650	137
59	108	2,051	0.0527	0.0700	144
60	155	1,859	0.0834	0.0950	177
61	143	1,780	0.0803	0.0950	169
62	207	1,536	0.1348	0.1600	246
63	200	1,307	0.1530	0.1800	235
64	163	1,063	0.1533	0.1800	191
Totals	1,377	18,646	0.0738	0.0940	1,753

Public School Males
Normal Retirement Experience
During Calendar Year 2018

Male Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	39	125	0.3120	0.3300	41
58	37	125	0.2960	0.2900	36
59	34	95	0.3579	0.2400	23
60	24	83	0.2892	0.2500	21
61	16	73	0.2192	0.2500	18
62	18	37	0.4865	0.3500	13
63	12	42	0.2857	0.3200	13
64	8	24	0.3333	0.2900	7
65	17	100	0.1700	0.2900	29
66	22	92	0.2391	0.3500	32
67	10	69	0.1449	0.3300	23
68	5	40	0.1250	0.2700	11
69	3	35	0.0857	0.2300	8
70	7	28	0.2500	0.2500	7
71	2	22	0.0909	0.2000	4
72	2	13	0.1538	0.1500	2
73	3	17	0.1765	0.1500	3
74	1	12	0.0833	0.1500	2
Totals	260	1,032	0.2519	0.2839	293
75 & Over	3	22			22
Totals	263	1,054			315

Public School Males
Early Retirement Experience
During Calendar Year 2018

Male Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	39	508	0.0768	0.1300	66
56	60	485	0.1237	0.1300	63
57	33	312	0.1058	0.1200	37
58	31	243	0.1276	0.1300	32
59	32	232	0.1379	0.1400	32
60	23	208	0.1106	0.1400	29
61	17	147	0.1156	0.1500	22
62	25	120	0.2083	0.2100	25
63	20	99	0.2020	0.2100	21
64	20	90	0.2222	0.2100	19
Totals	300	2,444	0.1227	0.1416	346

Public School Females
Normal Retirement Experience
During Calendar Year 2018

Female Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	106	347	0.3055	0.2700	94
58	68	263	0.2586	0.2700	71
59	69	246	0.2805	0.2700	66
60	53	163	0.3252	0.2700	44
61	23	133	0.1729	0.2700	36
62	47	114	0.4123	0.3700	42
63	30	80	0.3750	0.3000	24
64	20	57	0.3509	0.2800	16
65	91	269	0.3383	0.3700	100
66	79	207	0.3816	0.3900	81
67	20	113	0.1770	0.3300	37
68	11	75	0.1467	0.3000	23
69	7	62	0.1129	0.2800	17
70	8	40	0.2000	0.3800	15
71	6	35	0.1714	0.2000	7
72	1	17	0.0588	0.2000	3
73	3	20	0.1500	0.2000	4
74	1	13	0.0769	0.2000	3
Totals	643	2,254	0.2853	0.3030	683
75 & Over	3	36			36
Totals	646	2,290			719

Public School Females
Early Retirement Experience
During Calendar Year 2018

Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	117	1,435	0.0815	0.1200	172
56	130	1,301	0.0999	0.1200	156
57	82	857	0.0957	0.1200	103
58	80	799	0.1001	0.1200	96
59	88	741	0.1188	0.1300	96
60	72	594	0.1212	0.1700	101
61	55	462	0.1190	0.1700	79
62	86	425	0.2024	0.2300	98
63	46	274	0.1679	0.2300	63
64	54	262	0.2061	0.2300	60
Totals	810	7,150	0.1133	0.1432	1,024

University Males
Normal Retirement Experience
During Calendar Year 2018

Male Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	-	17	0.0000	0.1200	2
58	1	18	0.0556	0.1200	2
59	3	22	0.1364	0.1200	3
60	5	31	0.1613	0.1200	4
61	3	42	0.0714	0.1200	5
62	9	41	0.2195	0.1200	5
63	6	45	0.1333	0.1200	5
64	14	62	0.2258	0.1200	7
65	27	171	0.1579	0.1500	26
66	25	138	0.1812	0.2000	28
67	26	126	0.2063	0.2000	25
68	20	96	0.2083	0.1800	17
69	7	74	0.0946	0.1600	12
70	8	54	0.1481	0.2000	11
71	15	59	0.2542	0.1800	11
72	11	43	0.2558	0.1600	7
73	3	35	0.0857	0.1600	6
74	4	16	0.2500	0.1600	3
Totals	187	1,090	0.1716	0.1642	179
75 & Over	12	74			74
Totals	199	1,164			253

University Males
Early Retirement Experience
During Calendar Year 2018

Male Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	9	221	0.0407	0.0300	7
56	12	212	0.0566	0.0300	6
57	8	188	0.0426	0.0300	6
58	8	196	0.0408	0.0300	6
59	13	201	0.0647	0.0400	8
60	10	179	0.0559	0.0550	10
61	7	182	0.0385	0.0550	10
62	18	164	0.1098	0.0740	12
63	16	165	0.0970	0.0740	12
64	11	127	0.0866	0.1000	13
Totals	112	1,835	0.0610	0.0490	90

University Females
Normal Retirement Experience
During Calendar Year 2018

Female Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	1	23	0.0435	0.1500	3
58	6	28	0.2143	0.1500	4
59	2	34	0.0588	0.1000	3
60	2	26	0.0769	0.1200	3
61	2	26	0.0769	0.1600	4
62	5	31	0.1613	0.1500	5
63	8	37	0.2162	0.2000	7
64	5	27	0.1852	0.2000	5
65	23	137	0.1679	0.2000	27
66	20	105	0.1905	0.2400	25
67	17	79	0.2152	0.2000	16
68	9	57	0.1579	0.1700	10
69	6	41	0.1463	0.1700	7
70	10	30	0.3333	0.1800	5
71	3	24	0.1250	0.1800	4
72	1	18	0.0556	0.1800	3
73	6	15	0.4000	0.1500	2
74	1	8	0.1250	0.1500	1
Totals	127	746	0.1702	0.1796	134
75 & Over	6	27			27
Totals	133	773			161

University Females
Early Retirement Experience
During Calendar Year 2018

Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	9	257	0.0350	0.0500	13
56	10	263	0.0380	0.0500	13
57	5	215	0.0233	0.0500	11
58	11	224	0.0491	0.0500	11
59	19	202	0.0941	0.0500	10
60	8	153	0.0523	0.0900	14
61	14	176	0.0795	0.0900	16
62	13	140	0.0929	0.1200	17
63	14	126	0.1111	0.1200	15
64	20	126	0.1587	0.1500	19
Totals	123	1,882	0.0654	0.0739	139

Protective with Social Security
Normal Retirement Experience
During Calendar Year 2018

Male and Female Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
50	25	421	0.0594	0.0600	25
51	42	410	0.1024	0.0800	33
52	39	341	0.1144	0.1000	34
53	88	313	0.2812	0.2500	78
54	79	333	0.2372	0.2000	67
55	58	277	0.2094	0.2000	55
56	39	238	0.1639	0.2000	48
57	37	206	0.1796	0.2000	41
58	30	164	0.1829	0.2000	33
59	23	133	0.1729	0.2000	27
60	23	126	0.1825	0.2000	25
61	14	91	0.1538	0.2000	18
62	22	85	0.2588	0.3000	26
63	18	70	0.2571	0.3000	21
64	16	57	0.2807	0.3000	17
65	7	32	0.2188	0.4000	13
66	9	20	0.4500	0.4000	8
67	6	14	0.4286	0.4000	6
68	1	7	0.1429	0.4000	3
69	1	2	0.5000	0.4000	1
70	-	3	0.0000	1.0000	3
71	-	1	0.0000	1.0000	1
72	1	2	0.5000	1.0000	2
73	-	-	N/A	1.0000	-
74	-	1	0.0000	1.0000	1
Totals	578	3,347	0.1727	0.1751	586
75 & Over	1	7			7
Totals	579	3,354			593

Protective without Social Security
Normal Retirement Experience
During Calendar Year 2018

Male and Female Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
50	3	52	0.0577	0.0200	1
51	2	57	0.0351	0.0400	2
52	4	72	0.0556	0.0400	3
53	11	72	0.1528	0.1700	12
54	16	79	0.2025	0.2300	18
55	12	48	0.2500	0.2500	12
56	8	41	0.1951	0.2500	10
57	7	30	0.2333	0.2500	8
58	6	28	0.2143	0.3300	9
59	4	17	0.2353	0.3300	6
60	1	8	0.1250	0.2000	2
61	3	10	0.3000	0.2000	2
62	2	4	0.5000	0.4000	2
63	2	5	0.4000	0.4000	2
64	1	2	0.5000	0.4000	1
65	-	2	0.0000	0.4000	1
66	1	-	N/A	1.0000	-
67	-	1	0.0000	1.0000	1
68	-	-	N/A	1.0000	-
69	-	-	N/A	1.0000	-
70	-	-	N/A	1.0000	-
71	-	-	N/A	1.0000	-
72	-	-	N/A	1.0000	-
73	-	-	N/A	1.0000	-
74	-	-	N/A	1.0000	-
Totals	83	528	0.1572	0.1742	92
75 & Over	-	-	N/A		-
Totals	83	528			92

Executive and Elected
Normal Retirement Experience
During Calendar Year 2018

Male and Female Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	2	8	0.2500	0.0800	1
58	3	19	0.1579	0.0800	2
59	3	12	0.2500	0.0800	1
60	-	20	0.0000	0.2000	4
61	-	6	0.0000	0.1200	1
62	1	30	0.0333	0.1200	4
63	1	27	0.0370	0.1200	3
64	2	38	0.0526	0.1500	6
65	6	31	0.1935	0.1500	5
66	4	31	0.1290	0.1500	5
67	4	24	0.1667	0.1500	4
68	3	27	0.1111	0.1500	4
69	1	11	0.0909	0.2000	2
70	2	13	0.1538	0.2000	3
71	1	15	0.0667	0.2000	3
72	-	7	0.0000	0.2000	1
73	-	7	0.0000	0.2000	1
74	-	5	0.0000	0.2000	1
Totals	33	331	0.0997	0.1541	51
75 & Over	4	31			31
Totals	37	362			82

Executive and Elected
Early Retirement Experience
During Calendar Year 2018

Male and Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	5	44	0.1136	0.0300	1
56	-	33	0.0000	0.0300	1
57	-	38	0.0000	0.0300	1
58	2	35	0.0571	0.0300	1
59	1	22	0.0455	0.0300	1
60	1	31	0.0323	0.0500	2
61	2	31	0.0645	0.0500	2
62	1	11	0.0909	0.0200	-
63	-	6	0.0000	0.0200	-
64	-	7	0.0000	0.0200	-
Over 64	1	70	0.0143		
Totals	13	328			9

Death-in-Service
During Calendar Year 2018

Male

Age	Deaths	Exposure	Crude Rates	Current Rates	Expected Deaths
Under 20	-	14	0.0000	0.0001	-
20-24	1	1,668	0.0006	0.0001	-
25-29	-	7,521	0.0000	0.0002	1
30-34	4	10,657	0.0004	0.0003	3
35-39	4	12,176	0.0003	0.0004	5
40-44	3	12,332	0.0002	0.0005	7
45-49	5	13,740	0.0004	0.0007	9
50-54	6	13,732	0.0004	0.0011	16
55-59	13	12,311	0.0011	0.0023	28
60-64	6	8,338	0.0007	0.0030	25
65-69	1	3,021	0.0003	0.0051	15
70-74	4	791	0.0051	0.0082	6
75 and over	3	1	3.0000	0.0142	-
Totals	50	96,302	0.0005	0.0012	115

Female

Age	Deaths	Exposure	Crude Rates	Current Rates	Expected Deaths
Under 20	-	37	0.0000	0.0001	-
20-24	1	3,077	0.0003	0.0001	-
25-29	1	13,794	0.0001	0.0001	1
30-34	2	17,118	0.0001	0.0002	3
35-39	2	19,017	0.0001	0.0002	5
40-44	3	19,881	0.0002	0.0004	7
45-49	3	21,594	0.0001	0.0005	11
50-54	11	23,178	0.0005	0.0008	19
55-59	15	22,617	0.0007	0.0014	32
60-64	6	14,130	0.0004	0.0020	29
65-69	3	4,129	0.0007	0.0031	13
70-74	-	833	0.0000	0.0055	5
75 and over	-	-	N/A	0.0101	-
Totals	47	159,405	0.0003	0.0008	125

APPENDIX

GLOSSARY

Glossary

Actuarial Accrued Liability. The difference between (i) the actuarial present value of future plan benefits, and (ii) the actuarial present value of future normal cost. Sometimes referred to as "accrued liability" or "past service liability."

Accrued Service. The service credited under the plan which was rendered before the date of the actuarial valuation.

Actuarial Assumptions. Estimates of future plan experience with respect to rates of mortality, disability, turnover, retirement, rate or rates of investment income and salary increases. Decrement assumptions (rates of mortality, disability, turnover and retirement) are generally based on past experience, often modified for projected changes in conditions. Economic assumptions (salary increases and investment income) consist of an underlying rate in an inflation-free environment plus a provision for a long-term average rate of inflation.

Actuarial Cost Method. A mathematical budgeting procedure for allocating the dollar amount of the "actuarial present value of future plan benefits" between the actuarial present value of future normal cost and the actuarial accrued liability. Sometimes referred to as the "actuarial funding method."

Actuarial Equivalent. A series of payments is called an actuarial equivalent of another series of payments if the two series have the same actuarial present value.

Actuarial Present Value. The amount of funds presently required to provide a payment or series of payments in the future. It is determined by discounting the future payments at a predetermined rate of interest, taking into account the probability of payment.

Amortization. Paying off an interest-bearing liability by means of periodic payments of interest and principal, as opposed to paying it off with a lump sum payment.

Experience Gain (Loss). A measure of the difference between actual experience and that expected based upon a set of actuarial assumptions during the period between two actuarial valuation dates, in accordance with the actuarial cost method being used.

Normal Cost. The annual cost assumed, under the actuarial funding method, for current and subsequent plan years. Sometimes referred to as "current service cost." Any payment toward the unfunded actuarial accrued liability is not part of the normal cost.

Plan Termination Liability. The actuarial present value of future plan benefits based on the assumption that there will be no future accruals for future service and salary. The termination liability will generally be less than the liabilities computed on a "going-concern" basis and is not normally determined in a routine actuarial valuation.

Reserve Account. An account used to indicate that funds have been set aside for a specific purpose and are not generally available for other uses.

Glossary
(Concluded)

Unfunded Actuarial Accrued Liability. The difference between the actuarial accrued liability and valuation assets. Sometimes referred to as "unfunded accrued liability."

Valuation Assets. The value of current plan assets recognized for valuation purposes. Generally based on book value plus a portion of unrealized appreciation or depreciation.