

Wisconsin Retirement System

Thirty-Ninth Annual Actuarial Valuation and
Gain/Loss Analysis
December 31, 2019



Outline of Contents

Section	Pages	Items
		Introduction
A		Executive Summary
	1-4	Executive Summary
B		Valuation Results
	1-6	Valuation Results
	7	Schedule of Funding Progress & Accrued Liabilities
	8	Funding Metrics
	9-12	Risk/Maturity Measures
	13	Contributions
C		Fund Assets
	1-6	Financial Data
	7	Market Recognition Account
D		Gain/Loss
	1	Active Member Gain/Loss Analysis
	2	Development of Total Actuarial Gain (Loss)
	3	Population Development
	4	Gain (Loss) Overview
	5-6	Gain (Loss) Detail
	7	Gain (Loss) from Investment Income
	8	Other Gain (Loss)
	9	Historical Gain (Loss)
E		Census Data
	1	Membership Data Summary
	2-10	Non-Retired Participant Data
	11-12	Retired Participant Data
F		Methods and Assumptions
	1	Summary of Actuarial Assumptions and Methods
	2-3	Financial Principles and Operational Techniques of the Retirement System
	4-6	Actuarial Valuation Method
	7	Asset Valuation Method
	8-14	Summary of Assumptions
G		Plan Provisions
	1-3	Benefit Provisions
H		Gain/Loss Statistical Summary
	1-38	
Appendix		Glossary
	1-2	





May 29, 2020

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, 2019 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 2021 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
0.0%	0.1%	0.1%

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, 2019 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, 2019.

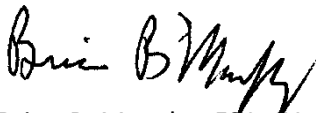
Future actuarial measurements may differ significantly from those presented in this report due to such factors as experience differing from that anticipated by actuarial assumptions, changes in plan provisions, actuarial assumptions/methods or applicable law. Due to the limited scope of this assignment,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

This report includes various risk factors, but does not include an assessment of the risks of future experience not meeting the actuarial assumptions. Additional assessment of risks was outside the scope of this assignment. However, an additional assessment of risk including stress testing for the Wisconsin Retirement System was conducted in the fall of 2019 in conjunction with the State of Wisconsin Investment Board.

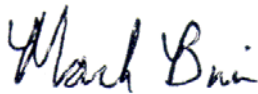
To the best of our knowledge, this report is complete and accurate and was made in accordance with generally recognized actuarial methods. Brian B. Murphy, Mark Buis, and James D. Anderson are Members of the American Academy of Actuaries (MAAA), and meet the Qualification Standards of the American Academy 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.

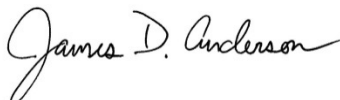
Respectfully submitted,



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



Mark Buis, FSA, EA, FCA, MAAA



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

BBM/MB/JDA:sc



SECTION A

EXECUTIVE SUMMARY

Executive Summary

1. Required Employer Contributions to Support Retirement System Benefits

	General, Executive & Elected Officials		Protective Occupation				Average 2021
			With Soc. Sec.		Without Soc. Sec.		
	2021	2020	2021	2020	2021	2020	
Employer Normal Cost	6.75%	6.75%	11.75%	11.65%	16.35%	16.25%	7.45%
Participant Normal Cost	6.75%	6.75%	6.75%	6.75%	6.75%	6.75%	6.75%
Total Normal Cost	13.5%	13.5%	18.5%	18.4%	23.1%	23.0%	14.20%

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.

Executive Summary

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	13.50%	18.40%	23.00%
Effect of Benefit Change	0.00%	0.00%	0.00%
Effect of Assumption Change	0.00%	0.00%	0.00%
Effect of Asset Performance	(0.06)%	(0.18)%	(0.27)%
Effect of Salary Experience	0.02%	0.14%	0.06%
Effect of Money Purchase Benefit	0.00%	0.00%	0.00%
Demographic and Other Experience	0.04%	0.14%	0.31%
2020 Normal Cost Rate	13.50%	18.50%	23.10%

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.

Executive Summary

3. General Comments

Based upon this valuation, normal cost contribution rates increased by 0.1% for the Protective groups and stayed level for the General/Executive & Elected group despite a very favorable year of investment performance. Since asset gains and losses are phased in over a five-year period in the Market Recognition Account, the 19.4% market value return translates to a 7.4% return on an actuarial basis, which considers past assets gains and losses. While the slight excess return above the 7.0% assumption serves to put slight downward pressure on contribution rates, all of the groups had unfavorable demographic experience reflecting more retirements than expected among other experience. This results in a net loss during calendar year 2019 for all groups (see section D for additional details) which serves to put slight upward pressure on contribution rates. Note that the Protective groups have much higher asset/payroll and liability/payroll ratios than the General, Executive & Elected group (see page B-10 for additional discussion regarding these risk measures). As a result, the Protective groups are much more sensitive to even minor swings in assets and/or liability than the General, Executive & Elected group which explains why the Protective groups saw a rate increase while the General, Executive & Elected group's rate remained unchanged.

In total, during 2019, investment return was above the assumed 2019 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 7.4% return on an Actuarial Value of Assets basis in the Core Fund. The Market Value of Assets exceeds the Actuarial Value of Assets by approximately 5.6% as of the valuation date. The statutory asset valuation method will recognize all of the differences between actuarial value and market value of \$5.7 billion over four future years putting downward pressure on future contribution rates, given that all assumptions are realized.

Conclusion. Based upon the results of the December 31, 2019 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 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.

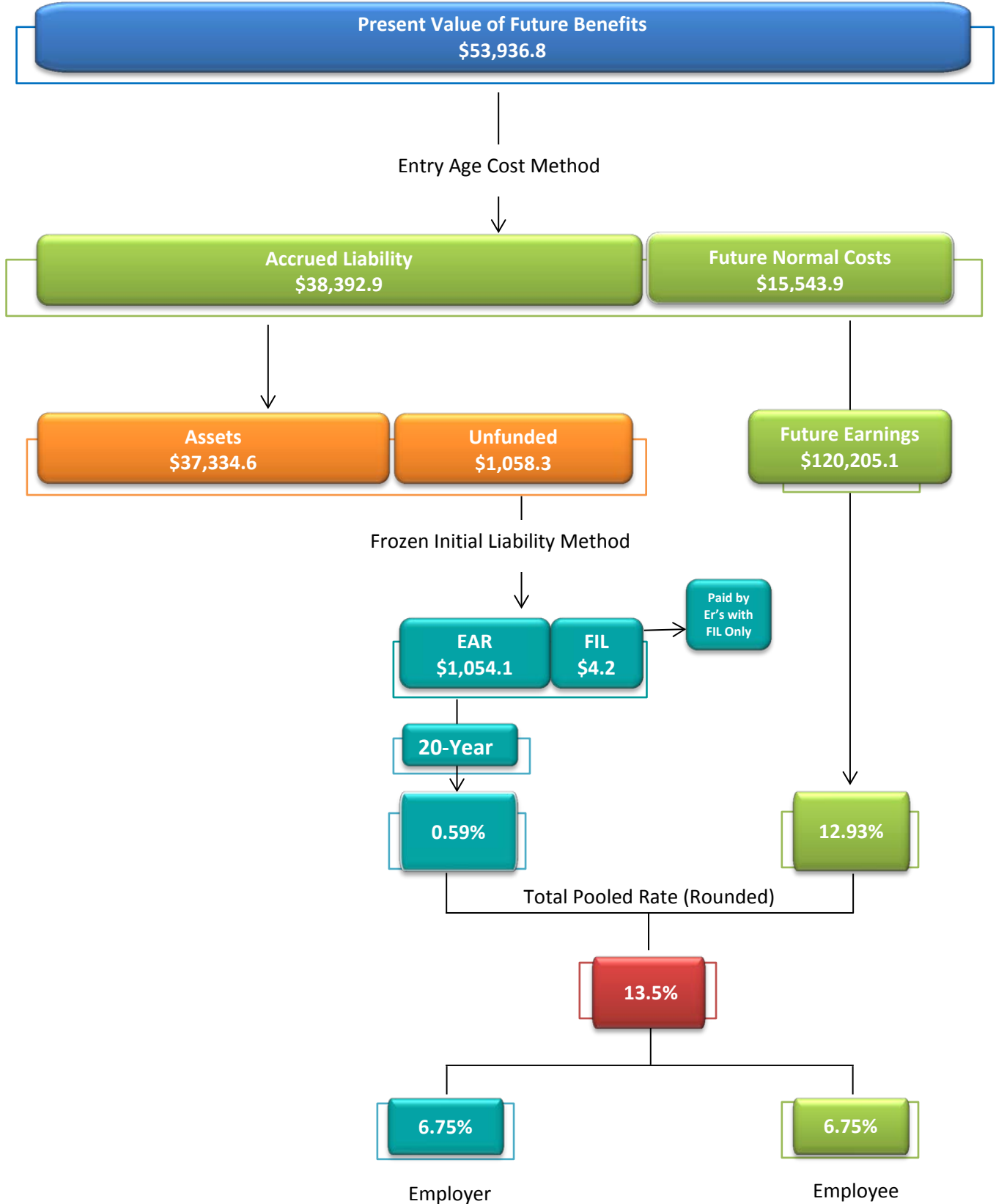


SECTION B

VALUATION RESULTS

Actuarial Valuation Process (Illustration for General/Elected Group)

\$ Millions -- %'s of Payroll



Wisconsin Retirement System

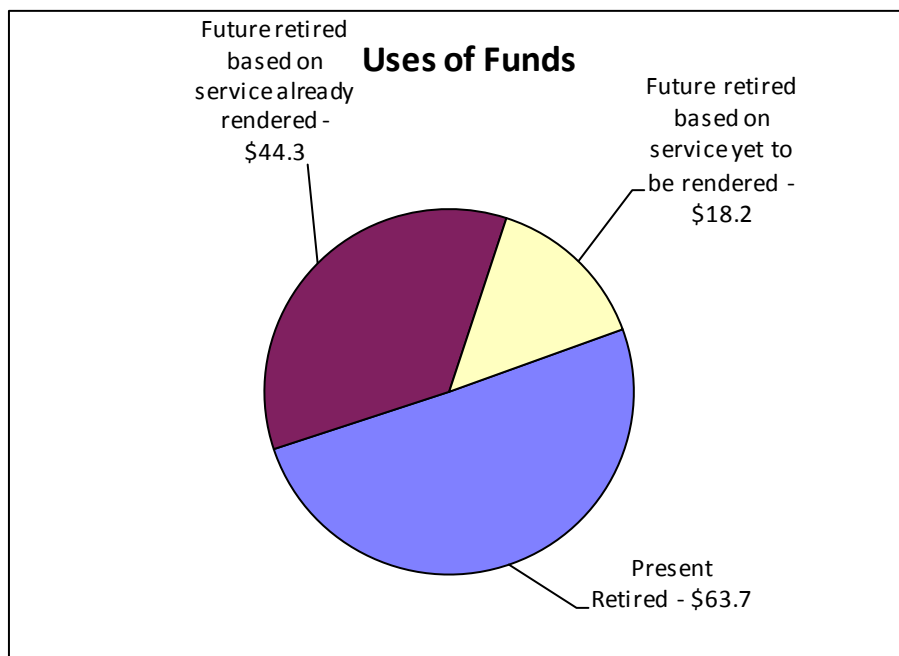
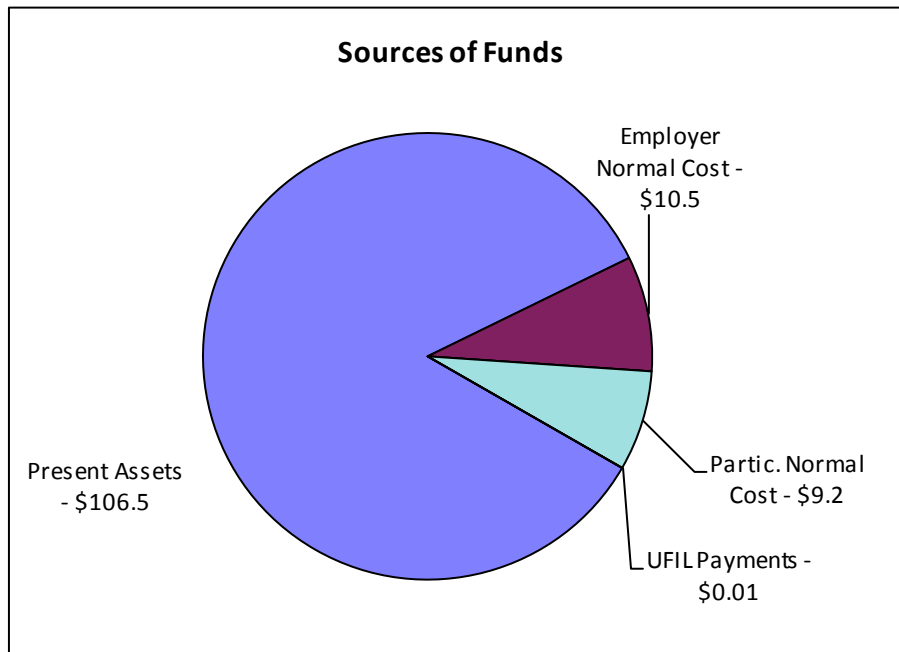
December 31, 2019 Valuation Overview

		\$ Millions					
		Non-Retired			Unallocated		
		Protective					
		General, Executives & Elected Officials	With Soc. Sec.	Without Soc. Sec.	Add 'l Contribs	Retired	Total/Average
1	Number of People						
	a. Active	236,947	19,528	2,759			259,234
	b. Inactive, not retired	162,115	7,109	247			169,471
	c. Total	399,062	26,637	3,006		216,944	645,649
2	Current Earnings	\$13,038.6	\$1,314.4	\$230.7			\$14,583.7
3	Present Values of						
	Future Benefits for						
	a. Active	\$46,375.4	\$6,140.5	\$1,494.2			\$54,010.1
	b. Inactive, not retired	\$6,661.3	\$608.3	\$53.7			\$7,323.3
	c. Variable Adjustment	\$900.1	\$88.3	\$18.1			\$1,006.5
	d. Total	\$53,936.8	\$6,837.1	\$1,566.0	\$215.0	\$63,657.8	\$126,212.7
4	Future Entry Age Normal Costs	\$15,543.9	\$2,117.2	\$497.9			\$18,159.0
5	Future Earnings	\$120,205.1	\$13,012.1	\$2,359.1			\$135,576.3
6	Pooled Entry Age Normal Cost (4/5)	12.93%	16.27%	21.11%			13.39%
7	Entry Age Accrued Liability (3d-4)	\$38,392.9	\$4,719.9	\$1,068.1	\$215.0	\$63,657.8	\$108,053.7
8	Assets	\$37,334.6	\$4,314.8	\$1,002.2	\$215.0	\$63,657.8	\$106,524.4
9	Total Entry Age Unfunded Liability (7-8)	\$1,058.3	\$405.1	\$65.9	\$0.0	\$0.0	\$1,529.3
10	Frozen Initial Liability Portion	\$4.2	\$1.1	\$2.7	\$0.0	\$0.0	\$8.0
11	Pooled Unfunded Liability (EAR) (9-10)	\$1,054.1	\$404.0	\$63.2	\$0.0	\$0.0	\$1,521.3
12	20-year amortization factor	13.7930	13.7930	13.7930			13.7930
13	Pooled Amortization % (11/12/2)	0.59%	2.23%	1.99%			0.76%
14	Total Pooled Rate Rounded (6+13)	13.5%	18.5%	23.1%			14.2%
15	2021 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%	11.75%	16.35%			7.45%
18	Total (16+17)	13.5%	18.5%	23.1%			14.20%
19	Entry Age Funded Ratio (8/7)	97.2%	91.4%	93.8%	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, 2019	\$8,150,689	\$1,180,755	\$2,501,734	\$11,833,178
	New Employers	\$0	\$0	\$0	\$0
	Adjustments	\$0	\$0	\$0	\$0
	Payments	(\$4,187,904)	(\$112,327)	(\$22,303)	(\$4,322,534)
	Interest	\$277,395	\$74,790	\$173,560	\$525,745
	Balance December 31, 2019	\$4,240,180	\$1,143,218	\$2,652,991	\$8,036,389
	WRS Average UFIL Contribution	0.03%	0.01%	0.01%	0.03%



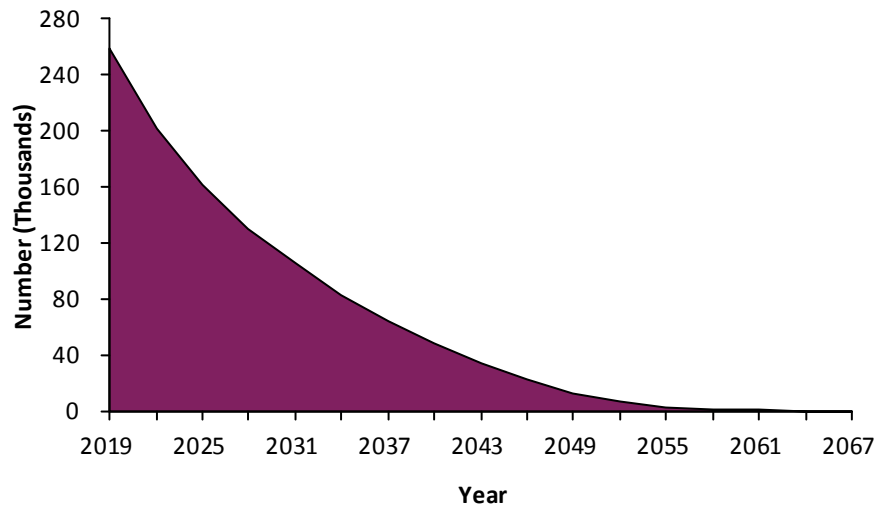
Financing \$126.2 Billion* of Benefit Promises for Present Active and Retired Participants December 31, 2019



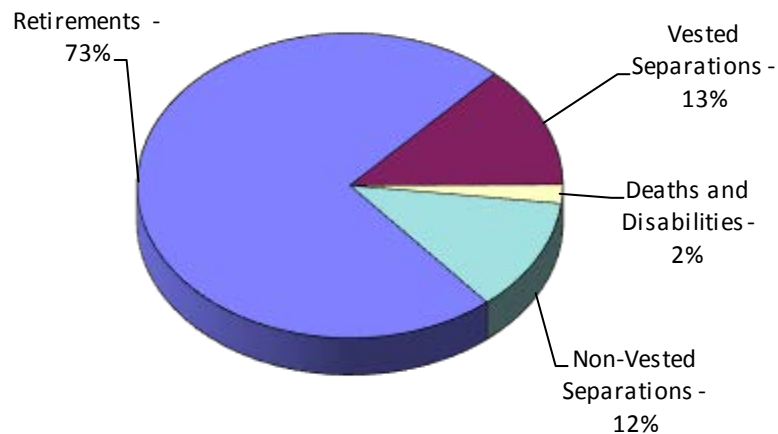
* Present value of future benefits; all divisions combined.

Expected Development of Present Population December 31, 2019

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 259,234 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 10 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
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 %
2019	2021	6.75 %	N/A	6.78 %	13.53 %	6.75 %	N/A	6.78 %	13.53 %

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
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 %
2019	2021	6.75 %	N/A	11.76 %	18.51 %	6.75 %		16.36 %	23.11 %

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)
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 %
2019	106,524.4	106,532.4	8.0	100.0 %	14,832.5	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)
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 %
2019	106,524.4	108,053.7	1,529.3	98.6 %	14,832.5	10.3 %

* 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 and does not necessarily match other figures in this report..

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
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%
2019	106,524.4	63,657.8	19,487.0	23,387.6	106,532.4	100.0%	100.0%	100.0%	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
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%
2019	106,524.4	63,657.8	19,487.0	24,908.9	108,053.7	100.0%	100.0%	93.9%	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. GRS investigates gains or losses due to economic and demographic experience explicitly as they arise each year in this Annual Actuarial Valuation and Gain/Loss Analysis Report. The results of each valuation report then serves as the underlying basis for the three-year experience study, which investigates and adjusts assumptions so that future gains and losses are minimized. 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; and
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. In the WRS, this volatility is mitigated by the extensive risk sharing features that are present in the plan.

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. In the WRS, this volatility is mitigated by the extensive risk sharing features that are present in the 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%
2019	108,053.7	112,098.6	(4,044.9)	14,583.7	3.9%	103.7%	63,657.8	58.9%	740.9%

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%	1.18
2019	768.7%	11.8%	90.7%	-	(3,481.2)	-3.1%	19.4%	1.19

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.

Employer Contributions Required and Contributions Made

Year Ended December 31	Annual Required Contribution (\$ millions)	Percent Contributed*
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%
2019	1,045.0	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	
	2019	2018
Non Retired		
Participant Statutory		
Core	\$ 17,215,817,163	\$ 16,584,211,853
Variable	2,056,205,539	1,670,261,056
Total Statutory	19,272,022,702	18,254,472,909
Additional*	215,046,558	201,059,855
Total Participant	19,487,069,260	18,455,532,764
Employer		
Core	21,323,351,723	21,038,908,059
Variable	2,056,205,539	1,673,137,986
Total Employer	23,379,557,262	22,712,046,045
LTDI Reserve	-	-
Total Employer Net of LTDI	23,379,557,262	22,712,046,045
Total Non Retired	42,866,626,522	41,167,578,809
Retired Assets		
Core	59,138,391,333	56,493,834,982
Variable	4,519,449,723	3,749,047,195
Total Retired Assets	63,657,841,056	60,242,882,177
Total Assets used in Valuation	106,524,467,578	101,410,460,986

	Valuation Assets at December 31	
	2019	2018
Core Assets	\$ 97,875,970,570	\$ 94,304,462,721
Variable Assets	8,648,497,008	7,105,998,265
Total Assets	106,524,467,578	101,410,460,986

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

Reserves for Non-Retired Participants Balances by Valuation Group

	Reserve for Year Ended			
	December 31, 2019			December 31, 2018
	Participant (Statutory)	Employer	Total *	Total
General, Executives & Elected	\$17,658,576,262	\$19,675,967,339	\$37,334,543,601	\$35,779,217,657
Protective with Soc. Sec.	1,368,875,399	2,945,935,897	4,314,811,296	4,205,043,979
Protective w/o Soc. Sec.	244,571,041	757,653,977	1,002,225,018	982,257,318
Total	\$19,272,022,702	\$23,379,557,213	\$42,651,579,915	\$40,966,518,954

* 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			Grand Total
	Core	Variable	Total	Core	Variable	Total	
Ending Balance December 31, 2018	\$16,584,211,854	\$1,670,261,056	\$18,254,472,910	\$21,038,908,058	\$1,673,137,986	\$22,712,046,044	\$40,966,518,954
Closing Adjustments	20,783,916	(158,876)	20,625,040	15,539,527	(2,782,526)	12,757,001	33,382,041
Beginning Balance January 1, 2019	16,604,995,770	1,670,102,180	18,275,097,950	21,054,447,585	1,670,355,460	22,724,803,045	40,999,900,995
Revenues:							
Employer Contributions	-	-	-	962,213,978	87,963,392	1,050,177,370	1,050,177,370
Participant Contributions	887,447,959	88,443,554	975,891,513	-	-	-	975,891,513
Total Revenues	887,447,959	88,443,554	975,891,513	962,213,978	87,963,392	1,050,177,370	2,026,068,883
Expenditures							
Separations	42,079,853	1,986,803	44,066,656	-	-	-	44,066,656
Retirement Single Sums	27,702,925	1,116,235	28,819,160	27,596,033	1,106,474	28,702,507	57,521,667
Death Benefits	17,490,305	1,640,023	19,130,328	11,441,542	1,250,904	12,692,446	31,822,774
Total Expenditures	87,273,083	4,743,061	92,016,144	39,037,575	2,357,378	41,394,953	133,411,097
Transfers:							
Earnings Allocation	1,187,096,511	444,838,919	1,631,935,430	1,569,320,694	435,006,191	2,004,326,885	3,636,262,315
Annuities Awarded	(1,427,800,535)	(91,288,988)	(1,519,089,523)	(2,247,697,596)	(105,877,096)	(2,353,574,692)	(3,872,664,215)
Intra-Fund Transfers	145,315	58,161	203,476	(4,818,813)	38,420	(4,780,393)	(4,576,917)
Inter-Fund Transfers	51,205,226	(51,205,226)	-	51,037,235	(51,037,235)	-	-
Variable Equalization Transfer	-	-	-	(22,113,785)	22,113,785	-	-
Net Transfers	(189,353,483)	302,402,866	113,049,383	(654,272,265)	300,244,065	(354,028,200)	(240,978,817)
Ending December 31, 2019	\$17,215,817,163	\$2,056,205,539	\$19,272,022,702	\$21,323,351,723	\$2,056,205,539	\$23,379,557,262	\$42,651,579,964
Internal Rate of Return	7.3%	27.1%	9.1%	7.7%	26.4%	9.1%	9.1%

This page does not include additional contributions.



Development of Retiree Reserves During the Year

	Core	Variable	Total
Balance December 31, 2018	\$ 56,493,834,982	\$ 3,749,047,195	\$ 60,242,882,177
Closing Adjustments	(5,164,283)	(1,683,269)	(6,847,552)
Variable Terminations	50,652,614	(50,652,614)	-
Beginning Balance	56,539,323,313	3,696,711,312	60,236,034,625
Additions			-
Reserve transfers	\$ 3,692,549,269	\$ 197,667,812	\$ 3,890,217,081
Earnings	4,096,722,362	1,016,000,325	5,112,722,687
Other	-	-	-
Total Additions	7,789,271,631	1,213,668,137	9,002,939,768
Subtractions			-
Annuities and Lump Sums	\$ 5,162,504,148	\$ 390,994,310	\$ 5,553,498,458
Credit reestablishments	27,699,463	(64,584)	27,634,879
Other	-	-	-
Total Subtractions	5,190,203,611	390,929,726	5,581,133,337
Ending Balance December 31, 2019	\$ 59,138,391,333	\$ 4,519,449,723	\$ 63,657,841,056

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

	2019	2018
Assets		
Cash and Cash Equivalents	\$ 4,668,015	\$ 4,035,969
Securities Lending Collateral	471,467	466,630
Prepaid Expenses	32,151	9,774
Total Short Term Assets	5,171,633	4,512,373
Receivables		
Contributions	147,815	148,399
Prior Service Contributions	10,850	13,832
Benefits Overpayment	2,242	2,418
Due from Other Trust Funds	1,189	568
Miscellaneous	7,976	0
Securities Lending	2,448	4,176
Interest and Dividends	386,662	306,493
Investment Sales	6,490,811	3,566,275
Total Receivables	7,049,993	4,042,161
Investments at Fair Value		
Fixed Income	36,504,305	31,726,626
Financial Futures Contracts	(29,913)	156,900
Preferred Securities	481,730	194,533
Convertible Securities	4,067	326
Stocks	65,975,055	54,783,797
Options	(6,029)	(8,148)
Limited Partnerships	14,729,545	13,590,506
Real Estate	1,374,070	1,372,027
Foreign Currency Contracts	8,316	(21,294)
Multi Asset Investments	5,353,262	5,854,691
Swaps	24,037	0
To Be Announced Securities	913,743	664,461
Total Investments	125,332,188	108,314,425
Capital Assets	3,532	4,376
Total Assets	137,557,346	116,873,335
Liabilities		
Core Investment Due Other Programs	3,981,572	3,494,436
Variable Investment Due Other Programs	20,256	17,053
Obligation Under Reverse Repo Agreement	9,844,991	8,834,034
Short Sell Obligations	4,464,308	3,002,001
Securities Lending Collateral Liability	471,467	466,630
Collateral Due to Counterparty	104,964	4,091
Benefits Payable	399,642	392,916
Unearned Revenue	19	30
Due to Other Trust Funds	7,639	573
Miscellaneous Payables	129,212	128,750
Investment Payables	6,034,661	3,798,564
Total Liabilities	25,458,731	20,139,078
Net Assets in Trust for Pension Benefits	\$112,098,615	\$96,734,257



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

	Activity During Year	
	2019	2018
Additions:		
Contributions:		
Employer Contributions	\$ 1,046,941	\$ 1,030,506
Employee Contributions	987,662	972,952
Total Contributions	2,034,603	2,003,458
Investment Income:		
Net Appreciation (Depreciation) in Fair Value of Investments	18,124,357	(5,754,807)
Interest	767,917	609,618
Dividends	1,386,282	1,380,471
Securities Lending Income	41,981	41,909
Other	250,489	216,036
Less		
Current Income Distributed	(671,578)	136,944
SWIB Investment Expense	(839,819)	(670,610)
Investment Income Distributed to Securities Lending Rebates and Fees	(8,902)	(10,860)
Net Investment Income	19,050,727	(4,051,299)
Interest on Prior Service Receivable	526	774
Miscellaneous Income	240	382
Total Additions	21,086,096	(2,046,685)
Deductions:		
Benefits and Refunds:		
Retirement, Disability, and Beneficiary	5,646,264	5,516,189
Separation Benefits	44,100	40,235
Total Benefits and Refunds	5,690,364	5,556,424
ETF Administrative Expenses	33,799	32,866
Other Expenses	399	26,231
Total Deductions	5,724,562	5,615,521
Net Increase (Decrease)	15,361,534	(7,662,206)
Net Assets Held in Trust:		
Beginning of Year*	\$96,737,081	\$104,396,462
End of Year	\$112,098,616	\$96,734,257

* Report uses preliminary financial statements due to timing of valuation. Any change between the prior year ending balance and the current year beginning balance reflects differences between preliminary and final financial statements.

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						
	2017	2018	2019	2020	2021	2022	2023
Beginning of year							
a. Funding value	\$92,268,055,484	\$96,763,496,611	\$98,081,742,712	\$101,736,623,810	\$103,472,828,885	\$105,089,559,355	\$105,244,947,551
b. Market value	89,181,973,662	100,036,600,775	93,165,775,399	107,449,077,566	107,449,077,566	107,449,077,566	107,449,077,566
End of year							
c. Market value	100,036,600,775	93,165,775,399	107,449,077,566				
d. Non-investment cash flow (contributions minus benefits)	(2,987,822,636)	(3,285,566,232)	(3,481,226,951)				
e. Investment income							
e1. Total investment income	13,842,449,749	(3,585,259,145)	17,764,529,119				
e2. Assumed rate	7.2%	7.0%	7.0%				
e3. Amount for immediate recognition	6,535,738,380	6,658,449,945	6,743,879,047	-	-	-	-
e4. Amount for phased-in recognition: e1-e3	7,306,711,369	(10,243,709,089)	11,020,650,072	-	-	-	-
f. Phased-in recognition of investment income							
f1. Current year: 0.2 x e4	1,461,342,274	(2,048,741,818)	2,204,130,014	-	-	-	-
f2. First prior year	119,474,605	1,461,342,274	(2,048,741,818)	2,204,130,014	-	-	-
f3. Second prior year	(1,343,976,073)	119,474,605	1,461,342,274	(2,048,741,818)	2,204,130,014	-	-
f4. Third prior year	(242,736,599)	(1,343,976,073)	119,474,605	1,461,342,274	(2,048,741,818)	2,204,130,014	-
f5. Fourth prior year	953,421,177	(242,736,599)	(1,343,976,073)	119,474,605	1,461,342,274	(2,048,741,818)	2,204,130,014
f6. Total MRA recognition	947,525,383	(2,054,637,612)	392,229,002	1,736,205,075	1,616,730,470	155,388,196	2,204,130,014
f7. Amount for MRA recognition	-	-	-	-	-	-	-
f8. Total recognized gain (loss)	947,525,383	(2,054,637,612)	392,229,002	1,736,205,075	1,616,730,470	155,388,196	2,204,130,014
g. Total recognized investment income: e3 + f8	7,483,263,763	4,603,812,333	7,136,108,049	1,736,205,075	1,616,730,470	155,388,196	2,204,130,014
h. Funding value end of year: a + d + e3 + f8	96,763,496,611	98,081,742,712	101,736,623,810	103,472,828,885	105,089,559,355	105,244,947,551	107,449,077,565
i. Difference between market and funding values	3,273,104,164	(4,915,967,313)	5,712,453,756	3,976,248,680	2,359,518,210	2,204,130,014	-
j. Recognized rate of return	8.2%	4.8%	7.4%				
k. Market rate of return (net of fee)	15.8%	-3.6%	19.4%				

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.

Assumptions should be carefully chosen and continually monitored. A poor initial choice of assumptions or continued use of outdated assumptions can lead to understated costs resulting in either an inability to pay benefits when due, or sharp increases in required contributions at some point in the future or overstated costs resulting in either benefit levels that are kept below the level that could be supported by the computed rate or an unnecessarily large burden on the current generation of participants, employers and taxpayers. The actuarial assumptions for the Wisconsin Retirement System are reviewed and updated as necessary every three years in an experience study. This triennial review is intended to manage the potential for future gains and losses.

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 \$89 million for the 2019 calendar year. The development of this figure is shown on the following page. Losses from demographic and other experience were partially offset by a small investment gain. The net result was no change in the overall 2021 normal cost rate for the General and Elected group and an increase in the 2021 normal cost rate for protective groups of 0.10% of payroll.



Development of Total Actuarial Gain (Loss) – Calendar Year December 31, 2019 (\$ Millions)

	Year Ended December 31, 2019				
	General	Executive & Elected	Protective		Total
			With S.S.	Without S.S.	
(1) Entry Age UAAL at start of year	\$ 897.1	\$ 83.5	\$ 370.5	\$ 61.7	\$ 1,412.8
(2) Entry Age Normal cost from last valuation	1,679.2	13.8	215.0	49.5	1,957.5
(3) Actual contributions	1,732.3	15.3	228.4	50.0	2,026.0
(4) Interest	60.9	5.8	25.5	4.3	96.5
(5) Expected UAAL before changes: (1) + (2) - (3) + (4)	904.9	87.8	382.6	65.5	1,440.8
(6) Change in actuarial assumptions	0.0	0.0	0.0	0.0	0.0
(7) Other changes	0.0	0.0	0.0	0.0	0.0
(8) Expected UAAL after changes: (5) + (6) + (7)	904.9	87.8	382.6	65.5	1,440.8
(9) Actual Entry Age UAAL at end of year	963.3	95.0	405.1	65.9	1,529.3
(10) Gain (loss): (8) - (9)	\$ (58.4)	\$ (7.2)	\$ (22.5)	\$ (0.4)	\$ (88.5)

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 2019

	General	Executive & Elected	Protective		Total	Expected
			With S.S.	Without S.S.		
Beginning Census	233,462	1,302	19,399	2,770	256,933	
(-) Normal Retirement	3,574	62	535	96	4,267	4,577
(-) Reduced Retirement	3,339	17	129	5	3,490	4,209
(-) Death	100	2	6	1	109	240
(-) Disability Retirement						
-Total disabilities approved	252	0	27	3	282	193
-Less pending at beginning of year	82	(1)	5	1	87	
-Net new from active status	170	1	22	2	195	
(-) Other Separations	13,587	92	841	33	14,553	13,463
(-) Transfers Out	1,688	44	297	12	2,041	
(+) Transfers In	1,646	103	257	35	2,041	
(+) New Entrants	22,995	115	1,702	103	24,915	
Ending Census	235,645	1,302	19,528	2,759	259,234	

This schedule reconciles the active member populations reported in connection with the December 31, 2019 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.). Please note that the number of new retirees shown in the table above may include a small cohort of retirees (primarily members retiring during the end of December) that were not included in the Retired Lives Valuation. This is due to the lag in reporting dates and they will be included in the following year Retired Lives Valuation.

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.

Reduced 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 2019.

Economic Results

On a market recognition account basis net of fee **investment return** was 7.4% and investment activity produced a gain for all groups due to the combined effect of this year's gain and the continued recognition of prior gains and losses. The total recognized investment gain of \$836 million was partially offset by a \$676 million increase in the combined value of variable excess benefits and money purchase benefits (as shown on page D-7), resulting in a net recognized investment gain of about \$160 million.

Pay Increases were overall higher than expected, producing a small loss.



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	\$0.9	\$ (0.7)	\$ (20.8)	\$ (4.5)	\$ (25.1)	\$ (14.5)
Reduced Retirement	(12.5)	(0.1)	(1.2)	0.5	(13.3)	(18.3)
Disability Retirement	(3.3)	(0.1)	(2.6)	0.5	(5.5)	(7.7)
Death with Benefit	(3.7)	0.0	(0.1)	0.1	(3.7)	(2.9)
Other Separations	(13.5)	1.3	(0.9)	(0.4)	(13.5)	(13.8)
Economic Risk Areas						
Salary Increases	(32.6)	(1.8)	(26.6)	(4.5)	(65.5)	317.6
Investment Return	117.7	(1.3)	34.6	9.2	160.2	(697.0)
Other Activity	(111.4)	(4.5)	(4.9)	(1.3)	(122.1)	(88.7)
Total Gain (Loss)	\$ (58.4)	\$ (7.2)	\$ (22.5)	\$ (0.4)	\$(88.5)	\$(525.3)
-% of Accrued Liability	(0.2)%	(4.0)%	(0.5)%	(0.0)%	(0.2)%	(1.3)%

Page D-8 presents a partial explanation of the other activity shown in this schedule.



Gain/Loss Analysis 2019 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	\$16,624.4	\$ 32.7	\$1,347.1	\$250.3	\$18,254.5
(b) PAR Closing Adjustment	18.9	0.0	1.4	0.3	20.6
(c) Employer Accumulation Reserve	18,962.4	159.7	2,857.9	732.0	22,712.0
(d) EAR Closing Adjustment	10.5	0.1	1.7	0.4	12.7
(e) Total	35,616.2	192.5	4,208.1	983.0	40,999.8
(2) End of Year Active Participant Assets					
(a) Participant Accumulation Reserve	17,632.7	25.8	1,368.9	244.6	19,272.0
(b) Employer Accumulation Reserve	19,522.0	153.9	2,945.9	757.7	23,379.5
(c) Total	37,154.7	179.7	4,314.8	1,002.3	42,651.5
(3) Investment Earnings Credited					
(a) Participant Accumulation Reserve	1,477.2	2.0	128.1	24.7	1,632.0
(b) Employer Accumulation Reserve	1,683.8	11.9	246.4	62.2	2,004.3
(c) Total	3,161.0	13.9	374.5	86.9	3,636.3
(4) Average Balance: $.5 \times \{(1e)+(2c)-(3c)\}$	34,805.0	179.2	4,074.2	949.2	40,007.6
(5) Expected Earnings: $.070 \times (4)$	2,436.4	12.5	285.2	66.4	2,800.5
(6) Gain (Loss) for Year from Investment Experience: $(3c)-(5)$	724.6	1.4	89.3	20.5	835.8
(7) Portion applied to Change in Variable Excess Reserve and Money Purchase Minimum Benefit	606.9	2.7	54.7	11.3	675.6
(8) Remaining Gain (Loss): (6)-(7)	\$ 117.7	\$ (1.3)	\$ 34.6	\$ 9.2	\$ 160.2

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 \$122.1 million as shown on page D-5. The schedule below analyzes this activity. The **Reserve Difference** produced a loss of about \$46 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 \$88 million.

	General	Executive & Elected	Protective		Total
			With S.S.	Without S.S.	
Expected Reserve Transfers					
Normal Retirement	\$1,741	\$34	\$ 354	\$99	\$2,228
Reduced Retirement	1,033	4	77	3	1,117
Death	13	0	1	0	14
Disability Retirement	55	0	10	2	67
Deferred Retirement	369	3	36	10	418
Expected Total Reserve Transfers	3,211	41	478	114	3,844
Actual Reserve Transfer (From Retiree Report)	3,250	41	484	115	3,890
Reserve Difference	(39)	0	(6)	(1)	(46)
Expected Refunds	64	1	4	0	69
Actual Refunds	40	0	3	1	44
Refund Difference	24	1	1	(1)	25
Re-established Liability	(80)	1	(8)	(1)	(88)
Total Explained Difference	(95)	2	(13)	(3)	(109)
Unknown Difference	(16)	(7)	8	2	(13)
Total Other Activity	(111)	(5)	(5)	(1)	(122)
Other Activity as % of Liabilities	(0.30)%	(2.78)%	(0.12)%	(0.10)%	(0.29)%



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							
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)
2019	(11.6)	(3.3)	(17.2)	(32.6)	117.7	(111.4)	(58.4)
EXECUTIVE & ELECTED							
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)
2019	(0.8)	(0.1)	1.3	(1.8)	(1.3)	(4.5)	(7.2)
PROTECTIVE WITH SOCIAL SECURITY							
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)
2019	(22.0)	(2.6)	(1.0)	(26.6)	34.6	(4.9)	(22.5)
PROTECTIVE WITHOUT SOCIAL SECURITY							
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)
2019	(4.0)	0.5	(0.3)	(4.5)	9.2	(1.3)	(0.4)

* Includes separation due to death.



SECTION E

CENSUS DATA

Total Participants Included in Valuations December 31, 2019

Valuation Group	Number	Average Annual Earnings/Benefits*
Actives	259,234	\$56,257
Inactives	169,471	\$16,861
Retirees & Beneficiaries	216,944	\$25,645
Total Participants	645,649	

* For inactives, average money purchase balance.

Active Participants Included in Valuations December 31, 2019

Active participants included in the valuations totaled 259,234 with an annual payroll totaling \$14,583.7 million, as follows:

Valuation Group	Number	Annual Earnings (\$ Millions)	Group Averages			
			Earnings	Age	Years of Service	Contribs.
General	235,645	\$12,926.3	\$54,855	45.3	11.2	\$59,406
Executive Group & Elected Officials	1,302	112.3	86,269	55.3	13.8	108,499
Protective Occupation with Social Security	19,528	1,314.4	67,310	39.8	12.1	69,228
Protective Occupation without Social Security	2,759	230.7	83,619	40.9	14.0	87,765
Total Active Participants	259,234	\$14,583.7	\$56,257	44.9	11.3	\$60,694
Prior Year	256,933	\$14,041.3	\$54,650	45.0	11.4	\$59,186

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

Inactive Participants Included in Valuations December 31, 2019

Inactive participants included in the valuations totaled 169,471 as follows:

Valuation Group	Number	Group Averages		
		Age	Service	Money Purchase Balance
General	161,503	47.4	3.3	\$16,611
Executive Group & Elected Officials	612	53.9	4.2	31,752
Protective Occupation with Social Security	7,109	41.6	4.1	20,683
Protective Occupation without Social Security	247	42.7	5.7	33,330
Total Inactive Participants	169,471	47.2	3.3	\$16,861
Prior Year	167,778	47.3	3.4	\$16,180

The valuations also included 3,917 Qualified Domestic Relations Order cases whose average age was 52.7 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, 2019 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	129							129	\$ 3,189,880
20-24	5,515	10						5,525	185,165,209
25-29	17,558	2,116	5					19,679	842,224,877
30-34	13,142	11,230	1,258	8				25,638	1,252,110,270
35-39	11,069	8,318	8,275	1,413	10			29,085	1,560,335,736
40-44	9,002	6,221	5,942	7,906	1,369	5		30,445	1,755,661,952
45-49	7,508	5,388	4,549	5,664	7,003	975	15	31,102	1,878,427,053
50-54	6,511	5,051	4,445	5,112	5,780	5,902	1,075	33,876	2,045,890,348
55	1,154	963	840	939	1,008	1,085	762	6,751	407,027,480
56	1,083	1,000	857	1,004	892	894	815	6,545	388,185,479
57	1,087	875	848	933	833	805	868	6,249	363,333,102
58	1,090	860	850	925	813	732	750	6,020	343,669,799
59	1,017	825	815	926	815	655	829	5,882	331,066,312
60	841	754	745	835	768	594	711	5,248	293,548,563
61	754	658	736	790	721	531	676	4,866	272,144,120
62	709	586	583	664	634	457	576	4,209	231,209,820
63	585	546	463	560	464	410	489	3,517	194,387,558
64	497	425	386	477	365	256	399	2,805	153,371,533
65	339	323	292	362	308	232	314	2,170	119,069,356
66	293	234	205	207	196	132	204	1,471	80,953,023
67	207	143	146	161	106	88	165	1,016	57,026,361
68	187	137	102	111	96	64	113	810	43,938,844
69	155	102	68	69	65	41	96	596	31,771,779
70	126	76	73	60	41	37	74	487	25,048,511
71	101	47	37	39	38	18	52	332	15,453,791
72	96	45	26	24	18	21	28	258	12,240,840
73	81	36	35	32	19	21	27	251	11,806,004
74	43	33	9	17	9	4	25	140	6,253,966
75 & Up	190	128	46	45	27	26	81	543	21,785,731
Totals	81,069	47,130	32,636	29,283	22,398	13,985	9,144	235,645	\$12,926,297,297



**Executive Group and Elected Officials
as of December 31, 2019
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	1							1	\$ 48,582
25-29	4	2						6	\$ 368,304
30-34	19	15	3					37	2,364,179
35-39	29	24	16	1				70	5,932,777
40-44	35	23	28	12	3			101	8,646,173
45-49	38	31	24	28	22	5		148	13,684,752
50-54	47	40	25	37	33	29	5	216	20,029,091
55	12	9	4	4	7	8	2	46	3,884,650
56	10	8	7	6	7	8	4	50	4,417,498
57	12	5	5	8	4	10	4	48	4,441,629
58	11	13	4	5	6	7	9	55	5,098,761
59	10	9	5	5	4	9	12	54	4,878,770
60	11	9	2	9	6	6	13	56	5,396,458
61	12	8	7	2	7	3	19	58	5,582,925
62	11	5	5	6	6	5	10	48	4,448,263
63	10	3	5	4		2	8	32	2,449,524
64	7	6	1	2	5	4	9	34	3,309,221
65	6	11	1		1	2	8	29	2,378,908
66	7	4	4	4	5	2	8	34	2,856,901
67	7	1	3	2	3	3	2	21	1,949,159
68	9	6	2	5	1	2	4	29	1,854,320
69	6	5	2	1	2	1	5	22	1,741,757
70	3	6		1	2		3	15	1,114,379
71	5	1	2	2			2	12	823,479
72	5	2	5			1	2	15	1,271,097
73	2	2	1	3	1	1	1	11	939,392
74	3	2	1			1	1	8	408,088
75 & Up	18	12	3	3	4	5	1	46	2,003,505
Totals	350	262	165	150	129	114	132	1,302	\$112,322,542

**Protective Occupation Participants with Social Security
as of December 31, 2019
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	21							21	\$ 723,475
20-24	1,039							1,039	47,632,474
25-29	2,301	530	1					2,832	160,972,194
30-34	1,103	1,355	461	5				2,924	187,365,220
35-39	573	680	1,220	449	8			2,930	199,182,117
40-44	323	310	534	1,171	509			2,847	201,688,435
45-49	209	191	314	700	1,327	342	4	3,087	231,054,613
50	41	29	46	102	218	206	7	649	49,253,994
51	40	28	34	94	167	203	14	580	43,849,144
52	28	15	41	54	127	199	33	497	39,363,645
53	27	20	29	48	87	158	45	414	33,386,340
54	30	17	29	62	66	77	32	313	23,106,622
55	18	18	18	58	46	49	26	233	17,545,411
56	18	12	22	32	34	47	22	187	13,419,734
57	26	21	14	41	33	33	29	197	13,660,796
58	11	21	26	35	26	28	24	171	12,041,669
59	11	12	19	25	26	20	17	130	9,097,624
60	10	6	8	30	15	19	14	102	6,944,859
61	6	10	13	25	16	6	14	90	6,219,189
62	7	3	17	23	9	10	11	80	5,446,408
63	8	2	9	14	8	6	7	54	3,449,955
64	7	2	7	17	9	3	8	53	3,321,003
65	2	7	3	6	3	6	5	32	2,507,142
66	6	2	2	9	3	1	3	26	1,592,064
67	2	3	2	3	2		2	14	740,809
68	2			1	1	1	1	6	273,703
69		2		1			1	4	145,607
70 & Up	7	4	2	2		1		16	439,115
Totals	5,876	3,300	2,871	3,007	2,740	1,415	319	19,528	\$1,314,423,361



**Protective Occupation Participants without Social Security
as of December 31, 2019
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	62							62	\$ 3,430,972
25-29	228	70	2					300	20,103,262
30-34	137	221	83					441	33,354,640
35-39	58	148	197	62				465	37,401,237
40-44	30	46	120	167	64			427	36,189,273
45-49	10	15	45	122	230	55	1	478	43,588,722
50		1	4	22	47	33	7	114	11,100,336
51	2		2	19	25	34	3	85	8,026,857
52		2	4	8	25	26	7	72	6,852,491
53	2	2	3	11	27	25	8	78	7,540,184
54		1	4	4	26	20	10	65	6,388,788
55	2			7	10	20	5	44	4,221,846
56	1	1		4	7	13	9	35	3,290,221
57	1	3	1	3	4	4	5	21	2,150,624
58			2	4	7	4	9	26	2,637,690
59			1	1	5	3	1	11	1,078,784
60	1		1	1	5	3		11	1,018,542
61			1	2	1	4	1	9	887,994
62				1	1	2	1	5	505,135
63					1	2		3	279,620
64	1					1	1	3	239,920
65							1	1	102,186
66				1			1	2	208,030
69							1	1	107,976
Totals	535	510	470	439	485	249	71	2,759	\$230,705,330

Active Participants as of December 31, 2019 by Years of Service and Gender

Completed Years of Service	Males	Females	Totals	Valuation Payroll	
				Total	Average
0	7,319	15,380	22,699	\$ 717,757,953	\$31,621
1	6,726	12,690	19,416	800,288,069	41,218
2	5,931	11,088	17,019	765,839,981	44,999
3	5,544	9,717	15,261	728,878,361	47,761
4	4,931	8,504	13,435	667,626,663	49,693
5	4,707	8,154	12,861	654,770,617	50,911
6	4,232	7,342	11,574	617,150,537	53,322
7	4,005	6,328	10,333	563,156,317	54,501
8	3,338	5,649	8,987	498,556,320	55,475
9	2,699	4,748	7,447	421,829,147	56,644
10	2,354	4,402	6,756	393,883,165	58,301
11	2,855	4,902	7,757	459,855,188	59,283
12	2,904	4,875	7,779	473,928,613	60,924
13	2,628	4,558	7,186	444,097,017	61,800
14	2,399	4,265	6,664	417,341,873	62,626
15 & Up	34,628	49,432	84,060	5,958,788,708	70,887
Totals	97,200	162,034	259,234	\$14,583,748,529	\$56,257

Average

Age	45.0	44.9	44.9
Service	12.0	10.8	11.3



Comparative Statement of Active Participants in Valuations

Valuation 12/31	General				Executive and Elected			
	No.	Earnings			No.	Earnings		
		\$ Millions	Average	% Incr.		\$ Millions	Average	% Incr.
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 %
2019	235,645	12,926	54,855	2.9%	1,302	112	86,269	4.0 %

* 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.
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 %
2019	19,528	1,314	67,310	3.4%	2,759	231	83,619	3.0 %

* 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	12	114,649	17	157,380
25-29	0	0	10	79,083	20	111,139	30	190,222
30-34	1	4,527	30	421,386	24	163,834	55	589,747
35-39	1	8,117	84	1,148,535	43	245,294	128	1,401,946
40-44	15	118,243	192	3,231,956	30	330,770	237	3,680,969
45-49	179	508,327	340	6,270,065	58	453,077	577	7,231,469
50-54	2,510	42,748,126	712	13,917,915	72	803,796	3,294	57,469,837
55-59	15,172	347,955,299	1,309	27,989,524	153	2,077,271	16,634	378,022,094
60-64	33,690	758,595,172	1,620	37,010,340	214	3,321,001	35,524	798,926,513
65-69	49,592	1,175,323,760	1,223	28,709,672	236	4,779,782	51,051	1,208,813,214
70-74	43,306	1,118,465,242	989	23,735,703	187	3,786,894	44,482	1,145,987,839
75-79	27,532	679,253,198	740	15,605,667	124	2,055,731	28,396	696,914,596
80-84	17,897	420,236,921	506	10,509,721	88	1,465,725	18,491	432,212,367
85-89	10,584	266,666,656	278	5,014,608	63	738,957	10,925	272,420,221
90-94	4,478	119,451,120	96	1,941,895	36	708,538	4,610	122,101,553
95& Up	1,175	34,070,562	28	589,114	23	251,569	1,226	34,911,245
Certain Only*	1,230	22,269,604	1	3,694	34	387,099	1,265	22,660,397
Totals	207,362	\$4,985,674,874	8,163	\$176,221,609	1,419	\$21,823,640	216,944	\$5,183,720,123

Averages in Years

Age at retirement	59.8	50.9	52.1	59.5
Attained age	71.1	64.3	67.4	70.9

* 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	\$ 1,826	3	\$ 3,729	5	\$ 5,555
25-29	0	0	3	3,882	3	1,714	6	5,596
30-34	0	0	8	7,705	5	3,525	13	11,230
35-39	0	0	16	28,963	9	6,437	25	35,400
40-44	6	36,970	12	33,774	7	24,030	25	94,774
45-49	55	66,260	30	55,274	23	56,131	108	177,665
50-54	578	1,754,170	94	280,760	17	81,250	689	2,116,180
55-59	3,036	15,148,050	158	529,890	46	171,643	3,240	15,849,583
60-64	6,274	27,536,206	214	606,844	46	153,243	6,534	28,296,293
65-69	9,039	49,119,598	234	886,214	57	274,887	9,330	50,280,699
70-74	8,775	82,438,996	181	1,223,351	45	339,187	9,001	84,001,534
75-79	5,001	72,368,383	128	1,254,063	36	261,817	5,165	73,884,263
80-84	3,372	55,757,804	100	1,035,243	21	267,409	3,493	57,060,456
85-89	2,313	39,268,284	52	372,442	17	140,784	2,382	39,781,510
90-94	1,130	20,354,177	22	221,766	19	123,063	1,171	20,699,006
95 & Up	314	5,690,594	7	45,080	8	93,200	329	5,828,874
Certain Only*	258	1,559,617	0	0	3	29,878	261	1,589,495
Totals	40,151	\$371,099,109	1,261	\$6,587,077	365	\$2,031,927	41,777	\$379,718,113

Averages in Years

Age at retirement	59.2	52.6	52.0	59.0
Attained age	71.1	66.6	67.9	71.0

* 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, 2019
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	
Assumed Rates of Investment Return for:	
Retired participants	5.0%
Post-retirement active participants	5.0%
Pre-retirement active participants	7.0%
Weighted Average Investment Rate of Return	5.4%
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 ...
Interest 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.

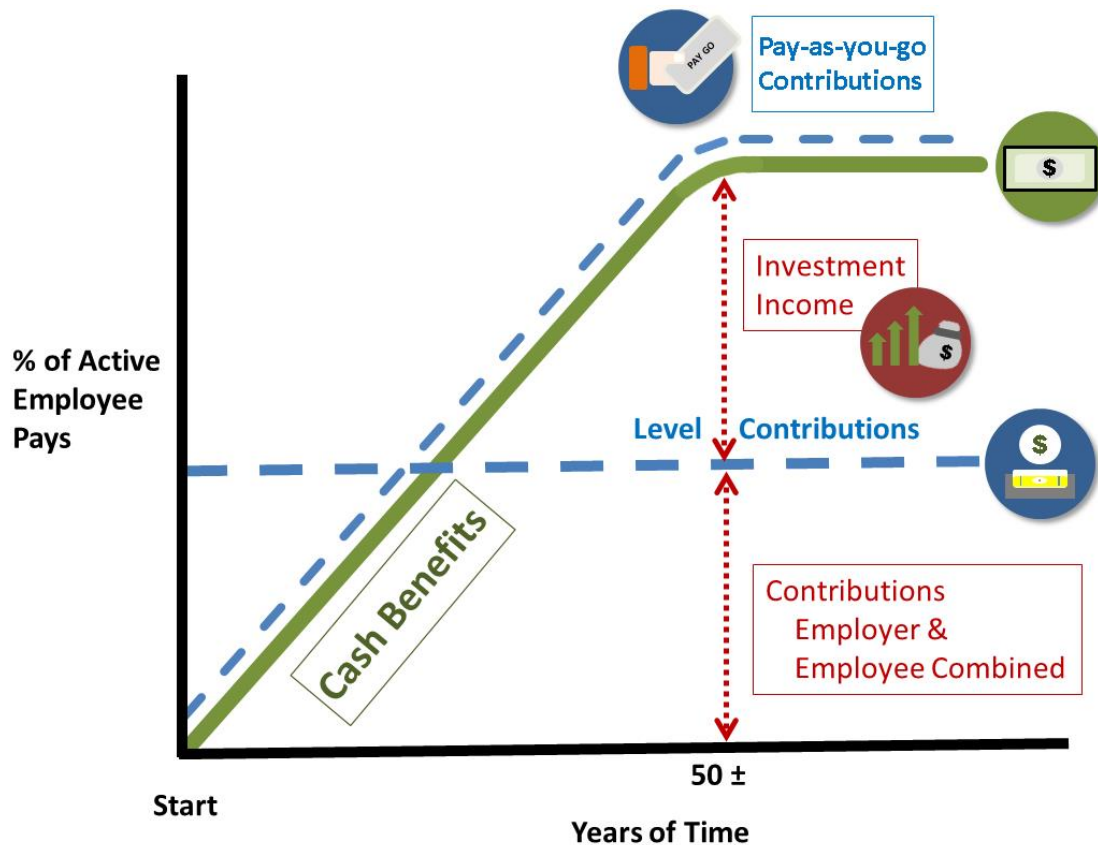
Actuarial Method and Assumptions Used in Valuations

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; and
- 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 2019, 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						
Service	Gen.	Exec. & Elec.	University Teachers	Public School Teachers	Protective	
					With S.S.	W/O S.S.
1	3.5%	2.5%	3.0%	5.6%	4.8%	5.5%
2	3.5%	2.5%	3.0%	5.6%	4.8%	5.5%
3	3.1%	2.0%	2.9%	5.2%	4.1%	4.7%
4	2.8%	1.6%	2.8%	4.7%	3.5%	3.8%
5	2.5%	1.1%	2.7%	4.3%	2.8%	3.0%
10	1.5%	0.2%	2.2%	2.6%	1.1%	0.9%
15	1.1%	0.2%	1.7%	1.4%	0.8%	0.5%
20	0.9%	0.2%	1.2%	0.6%	0.7%	0.4%
25	0.6%	0.2%	0.9%	0.3%	0.6%	0.3%
30	0.4%	0.2%	0.7%	0.2%	0.5%	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 was the Wisconsin 2018 Mortality Table adopted by the Board in connection with the 2015-2017 Experience Study. The rates in this table were based on actual WRS experience adjusted for future mortality improvements using the MP-2018 fully generational improvement scale. In accordance with the experience study’s in-depth review of Wisconsin-specific mortality experience, the MP-2018 fully generational improvement scale was multiplied by a 60% factor. This approach will be reviewed in the next experience study covering 2018-2020. 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 2019	Present Value of \$1 Monthly for Life*		Future Life Expectancy (years)*		Mortality Rates*	
	Males	Females	Males	Females	Males	Females
40	\$212.96	\$217.63	45.3	48.2	0.000990	0.000614
45	204.65	210.28	40.3	43.1	0.001238	0.000921
50	194.18	201.13	35.3	38.1	0.001615	0.001339
55	181.54	189.97	30.4	33.2	0.003763	0.002413
60	167.29	176.71	25.8	28.4	0.005438	0.003515
65	150.31	160.75	21.3	23.7	0.008324	0.005262
70	131.09	141.76	17.1	19.2	0.013497	0.008737
75	109.61	120.10	13.2	15.0	0.022662	0.015813
80	86.87	96.74	9.7	11.1	0.041599	0.029763
85	65.44	73.54	6.8	7.9	0.077801	0.059843

* 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 2019. For disabled participants, the following table was used:

Sample Attained Ages in 2019	Present Value of \$1 Monthly for Life		Future Life Expectancy (years)		Mortality Rates*	
	Males	Females	Males	Females	Males	Females
40	\$199.56	\$207.83	37.7	41.8	0.001426	0.001019
45	187.92	198.13	32.8	36.7	0.002348	0.001534
50	174.47	186.35	28.0	31.8	0.004657	0.002707
55	158.72	172.25	23.4	27.0	0.006292	0.003981
60	140.24	155.41	19.1	22.4	0.010955	0.006133
65	119.88	135.75	15.0	18.0	0.017782	0.010516
70	97.88	113.76	11.3	13.9	0.030679	0.019
75	75.72	90.28	8.2	10.2	0.058153	0.035883
80	56.09	67.67	5.7	7.1	0.107102	0.073379
85	40.07	49.49	3.9	4.9	0.172842	0.126673

* 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 2019	Mortality Rates*	
	Males	Females
20	0.000135	0.000081
25	0.000165	0.000090
30	0.000213	0.000123
35	0.000376	0.000222
40	0.000495	0.000307
45	0.000619	0.000461
50	0.000807	0.000670
55	0.001881	0.001208
60	0.002719	0.001759
65	0.004162	0.002634
70	0.006748	0.004373
75	0.011331	0.007914
80	0.020799	0.014897

** 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.*

This assumption is used to measure the probability of participants dying while in service.

Rates of Retirement for Those Eligible to Retire

Normal Retirement

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

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

Reduced Retirement

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



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

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

Disability Rates

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



Miscellaneous and Technical Assumptions

Amortization Payoff Reserve:	Additional reserves in the amount of \$6,588,043 (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.
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.
Benefit Service:	Exact fractional service on the decrement date is used to determine the amount of benefit payable.
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.
Decrement Timing:	Decrements of all types are assumed to occur mid-year.
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.
Expenses:	Assumed investment return is net of administrative and investment expenses.
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.
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.
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.
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.



Miscellaneous and Technical Assumptions (Concluded)

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.
Normal Form of Benefit:	The assumed normal form of benefit is a straight life benefit, except where otherwise noted.
Pay Annualization:	Reported pay for members with less than 12 contributing months was annualized by the ratio of 12 to the number of contributing months in the year.
Pay Increase Timing:	Beginning of (calendar) year for most people. Middle of calendar year for teachers.
Service Credit Accruals:	It is assumed that members accrue one year of service credit per year.
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.)

SECTION G

PLAN PROVISIONS

Summary of Benefit Provisions Evaluated December 31, 2019 Actuarial Valuation

Normal Retirement Eligibility

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

General, Public School, and University		Protective		Executive & Elected [#]	
Age	Service	Age	Service	Age	Service
65	Any*	54	Any*	62	Any*
57	30	53	25	57	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			Group
Before 2000	Between 2000 and 2011	After 2011	
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 (i.e., the Money Purchase Minimum).



Reduced Retirement. Any participant who has attained age 55 and any Protective occupation participant who has attained age 50 may apply for a reduced 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 reduced 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:

Date of Participation	Rate Credited for Purpose of	
	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, Public School, and University	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 2019

Male Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	455	2,258	0.2015	0.1700	384
2	595	4,105	0.1449	0.1230	505
3	383	3,713	0.1032	0.0930	345
4	266	3,043	0.0874	0.0760	231
5	193	2,870	0.0672	0.0750	215
6	181	2,541	0.0712	0.0580	147
7	140	2,172	0.0645	0.0480	104
8	101	2,042	0.0495	0.0470	96
9	62	1,479	0.0419	0.0410	61
10	39	1,138	0.0343	0.0400	46
Totals	2,415	25,361	0.0952	0.0841	2,134

Service index 1 corresponds to service between 0 and 1 years, service index 2 corresponds to service between 1 and 2 years of service, etc. As such, service index 10 corresponds to service between 9 and 10 years of service.

Male Age-Based Withdrawals 10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	3	0.0000	0.0400	-
30-34	11	277	0.0397	0.0350	10
35-39	40	1,414	0.0283	0.0260	37
40-44	52	2,201	0.0236	0.0230	51
45-49	74	3,044	0.0243	0.0180	55
50-54	100	4,209	0.0238	0.0160	67
Over 54	111	10,391	0.0107		111
Totals	388	21,539	0.0180	0.0154	331

General Females Withdrawal Experience During Calendar Year 2019

Female Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	1,132	5,576	0.2030	0.2000	1,115
2	1,548	9,105	0.1700	0.1500	1,366
3	1,053	7,803	0.1349	0.1150	897
4	603	6,034	0.0999	0.1000	603
5	465	5,210	0.0893	0.0950	495
6	327	4,480	0.0730	0.0780	349
7	277	3,934	0.0704	0.0700	275
8	221	3,421	0.0646	0.0600	205
9	152	2,783	0.0546	0.0570	159
10	126	2,460	0.0512	0.0530	130
Totals	5,904	50,806	0.1162	0.1101	5,594

Service index 1 corresponds to service between 0 and 1 years, service index 2 corresponds to service between 1 and 2 years of service, etc. As such, service index 10 corresponds to service between 9 and 10 years of service.

Female Age-Based Withdrawals 10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	2	10	0.2000	0.0500	1
30-34	34	456	0.0746	0.0450	21
35-39	86	2,037	0.0422	0.0350	71
40-44	108	3,326	0.0325	0.0300	100
45-49	156	4,302	0.0363	0.0250	108
50-54	173	6,410	0.0270	0.0200	128
Over 54	216	18,156	0.0119		216
Totals	775	34,697	0.0223	0.0186	645

Public Schools Males Withdrawal Experience During Calendar Year 2019

Male Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	71	472	0.1504	0.1850	87
2	99	939	0.1054	0.1100	103
3	87	943	0.0923	0.0800	75
4	58	882	0.0658	0.0650	57
5	58	884	0.0656	0.0550	49
6	49	889	0.0551	0.0400	36
7	37	855	0.0433	0.0350	30
8	24	800	0.0300	0.0320	26
9	16	680	0.0235	0.0300	20
10	12	545	0.0220	0.0280	15
Totals	511	7,889	0.0648	0.0631	498

Service index 1 corresponds to service between 0 and 1 years, service index 2 corresponds to service between 1 and 2 years of service, etc. As such, service index 10 corresponds to service between 9 and 10 years of service.

Male Age-Based Withdrawals 10+ Years of Service

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	-	N/A	0.0250	-
30-34	3	163	0.0184	0.0200	3
35-39	27	1,486	0.0182	0.0160	24
40-44	35	2,429	0.0144	0.0150	36
45-49	46	2,797	0.0164	0.0140	39
50-54	49	2,790	0.0176	0.0130	36
Over 54	28	2,984	0.0094		28
Totals	188	12,649	0.0149	0.0131	166

Public Schools Females Withdrawal Experience During Calendar Year 2019

Female Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	138	1,500	0.0920	0.1500	225
2	257	2,896	0.0887	0.1100	319
3	230	2,859	0.0804	0.0800	229
4	190	2,676	0.0710	0.0600	161
5	179	2,857	0.0627	0.0550	157
6	163	2,834	0.0575	0.0500	142
7	107	2,574	0.0416	0.0400	103
8	97	2,355	0.0412	0.0370	87
9	66	2,018	0.0327	0.0330	67
10	53	1,726	0.0307	0.0300	52
Totals	1,480	24,295	0.0609	0.0635	1,542

Service index 1 corresponds to service between 0 and 1 years, service index 2 corresponds to service between 1 and 2 years of service, etc. As such, service index 10 corresponds to service between 9 and 10 years of service.

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	11	530	0.0208	0.0230	12
35-39	89	4,519	0.0197	0.0170	77
40-44	94	6,120	0.0154	0.0140	86
45-49	115	6,855	0.0168	0.0130	89
50-54	107	7,216	0.0148	0.0120	87
Over 54	86	8,295	0.0104		86
Totals	502	33,535	0.0150	0.0130	437

University Males Withdrawal Experience During Calendar Year 2019

Male Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	56	364	0.1538	0.1600	58
2	119	709	0.1678	0.1500	106
3	106	732	0.1448	0.1300	95
4	82	629	0.1304	0.1100	69
5	53	520	0.1019	0.0900	47
6	45	535	0.0841	0.0800	43
7	30	508	0.0591	0.0750	38
8	18	461	0.0390	0.0600	28
9	18	377	0.0477	0.0550	21
10	11	337	0.0326	0.0500	17
Totals	538	5,172	0.1040	0.1009	522

Service index 1 corresponds to service between 0 and 1 years, service index 2 corresponds to service between 1 and 2 years of service, etc. As such, service index 10 corresponds to service between 9 and 10 years of service.

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	26	0.0385	0.0450	1
35-39	9	159	0.0566	0.0400	6
40-44	17	473	0.0359	0.0300	14
45-49	19	785	0.0242	0.0250	20
50-54	26	937	0.0277	0.0200	19
Over 54	14	2,505	0.0056		14
Totals	86	4,885	0.0176	0.0151	74

University Females Withdrawal Experience During Calendar Year 2019

Female Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	69	447	0.1544	0.1450	65
2	160	952	0.1681	0.1400	133
3	159	1,018	0.1562	0.1300	132
4	96	829	0.1158	0.1000	83
5	79	763	0.1035	0.0950	72
6	45	683	0.0659	0.0900	61
7	37	642	0.0576	0.0700	45
8	28	549	0.0510	0.0600	33
9	22	507	0.0434	0.0500	25
10	19	413	0.0460	0.0400	17
Totals	714	6,803	0.1050	0.0979	666

Service index 1 corresponds to service between 0 and 1 years, service index 2 corresponds to service between 1 and 2 years of service, etc. As such, service index 10 corresponds to service between 9 and 10 years of service.

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	-	54	0.0000	0.0400	2
35-39	15	361	0.0416	0.0400	14
40-44	13	708	0.0184	0.0350	25
45-49	21	887	0.0237	0.0300	27
50-54	23	1,006	0.0229	0.0250	25
Over 54	14	2,229	0.0063		14
Totals	86	5,245	0.0164	0.0204	107

Protective with Social Security Withdrawal Experience During Calendar Year 2019

Male and Female Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	136	659	0.2064	0.1600	105
2	193	1,338	0.1442	0.0950	127
3	119	1,249	0.0953	0.0600	75
4	64	1,096	0.0584	0.0500	55
5	48	868	0.0553	0.0450	39
6	34	854	0.0398	0.0400	34
7	22	720	0.0306	0.0375	27
8	13	662	0.0196	0.0350	23
9	19	497	0.0382	0.0300	15
10	7	431	0.0162	0.0250	11
Totals	655	8,374	0.0782	0.0610	511

Service index 1 corresponds to service between 0 and 1 years, service index 2 corresponds to service between 1 and 2 years of service, etc. As such, service index 10 corresponds to service between 9 and 10 years of service.

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

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	4	0.0000	0.0250	-
30-34	15	519	0.0289	0.0220	11
35-39	40	1,740	0.0230	0.0180	31
40-44	39	2,270	0.0172	0.0150	34
45-49	73	2,823	0.0259	0.0130	37
50-54	11	2,328	0.0047	0.0120	28
Over 54	8	1,329	0.0060		8
Totals	186	11,013	0.0169	0.0135	149

Protective without Social Security Withdrawal Experience During Calendar Year 2019

Male and Female Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	1	32	0.0313	0.0400	1
2	6	122	0.0492	0.0350	4
3	1	104	0.0096	0.0150	2
4	4	112	0.0357	0.0130	1
5	2	112	0.0179	0.0120	1
6	1	117	0.0085	0.0110	1
7	2	112	0.0179	0.0100	1
8	1	97	0.0103	0.0090	1
9	-	94	0.0000	0.0080	1
10	1	95	0.0105	0.0070	1
Totals	19	997	0.0191	0.0140	14

Service index 1 corresponds to service between 0 and 1 years, service index 2 corresponds to service between 1 and 2 years of service, etc. As such, service index 10 corresponds to service between 9 and 10 years of service.

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

Age	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
25-29	-	3	0.0000	0.0070	-
30-34	-	80	0.0000	0.0070	1
35-39	2	255	0.0078	0.0065	2
40-44	5	359	0.0139	0.0060	2
45-49	2	455	0.0044	0.0055	3
50-54	2	416	0.0048	0.0050	2
Totals	11	1,568	0.0070	0.0064	10

Executive and Elected Withdrawal Experience During Calendar Year 2019

Male and Female Service-Based Withdrawals All Ages

Service Index	Withdrawals	Exposure	Crude Rates	Current Rates	Expected Withdrawals
1	2	27	0.0741	0.1400	4
2	8	54	0.1481	0.1300	7
3	15	89	0.1685	0.1200	11
4	12	57	0.2105	0.1000	6
5	5	65	0.0769	0.1000	7
6	5	40	0.1250	0.0500	2
7	7	64	0.1094	0.0500	3
8	10	54	0.1852	0.0500	3
9	8	72	0.1111	0.0500	4
10	1	32	0.0313	0.0500	2
Totals	73	554	0.1318	0.0884	49

Service index 1 corresponds to service between 0 and 1 years, service index 2 corresponds to service between 1 and 2 years of service, etc. As such, service index 10 corresponds to service between 9 and 10 years of service.

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	-	2	0.0000	0.0500	-
35-39	-	13	0.0000	0.0500	1
40-44	3	35	0.0857	0.0500	2
45-49	6	75	0.0800	0.0450	3
50-54	7	123	0.0569	0.0400	5
Over 54	3	437	0.0069		3
Totals	19	685	0.0277	0.0204	14

General Disability Experience During Calendar Year 2019

Male Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0000	-
20-24	-	10	0.0000	0.0000	-
25-29	-	596	0.0000	0.0000	-
30-34	-	2,231	0.0000	0.0000	-
35-39	-	3,252	0.0000	0.0001	-
40-44	2	3,596	0.0006	0.0003	1
45-49	1	4,367	0.0002	0.0004	2
50-54	10	5,363	0.0019	0.0012	6
55-59	20	11,330	0.0018	0.0021	23
60-64	11	7,598	0.0014	0.0041	31
65-69	3	-	N\A	0.0016	-
70-74	-	-	N\A	0.0014	-
75 and over	-	-	N/A	0.0014	-
Totals	47	38,343	0.0012	0.0016	63

Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0000	-
20-24	-	12	0.0000	0.0000	-
25-29	-	830	0.0000	0.0000	-
30-34	-	3,454	0.0000	0.0002	1
35-39	1	4,712	0.0002	0.0002	1
40-44	4	5,701	0.0007	0.0003	2
45-49	8	6,914	0.0012	0.0004	3
50-54	17	9,285	0.0018	0.0008	7
55-59	26	21,318	0.0012	0.0014	31
60-64	26	15,132	0.0017	0.0018	27
65-69	3	-	N\A	0.0014	-
70-74	-	-	N\A	0.0012	-
75 and over	-	-	N/A	0.0012	-
Totals	85	67,358	0.0013	0.0011	72

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 2019

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	-	317	0.0000	0.0000	-
30-34	-	1,708	0.0000	0.0000	-
35-39	-	2,400	0.0000	0.0000	-
40-44	-	2,937	0.0000	0.0001	-
45-49	-	3,140	0.0000	0.0003	1
50-54	2	3,034	0.0007	0.0010	3
55-59	1	3,500	0.0003	0.0013	5
60-64	2	1,338	0.0015	0.0023	3
65-69	-	-	N\A	0.0032	-
70-74	-	-	N\A	0.0034	-
75 and over	-	-	N/A	0.0034	-
Totals	5	18,374	0.0003	0.0007	12

Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0001	-
20-24	-	1	0.0000	0.0001	-
25-29	-	1,391	0.0000	0.0001	-
30-34	-	5,568	0.0000	0.0001	-
35-39	-	6,885	0.0000	0.0001	-
40-44	1	7,443	0.0001	0.0002	1
45-49	3	7,937	0.0004	0.0006	5
50-54	5	8,053	0.0006	0.0008	7
55-59	10	10,016	0.0010	0.0013	13
60-64	4	4,116	0.0010	0.0018	7
65-69	-	-	N\A	0.0010	-
70-74	-	-	N\A	0.0008	-
75 and over	-	-	N/A	0.0008	-
Totals	23	51,410	0.0004	0.0006	33

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University Disability Experience During Calendar Year 2019

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	-	61	0.0000	0.0000	-
30-34	-	345	0.0000	0.0000	-
35-39	-	703	0.0000	0.0000	-
40-44	-	1,053	0.0000	0.0000	-
45-49	-	1,158	0.0000	0.0001	-
50-54	-	1,160	0.0000	0.0002	-
55-59	1	2,020	0.0005	0.0006	1
60-64	1	1,620	0.0006	0.0005	1
65-69	-	-	N\A	0.0007	-
70-74	-	-	N\A	0.0006	-
75 and over	-	-	N/A	0.0006	-
Totals	2	8,120	0.0002	0.0002	2

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	-	109	0.0000	0.0000	-
30-34	-	589	0.0000	0.0000	-
35-39	1	1,090	0.0009	0.0002	-
40-44	-	1,362	0.0000	0.0003	-
45-49	1	1,270	0.0008	0.0002	-
50-54	1	1,287	0.0008	0.0005	1
55-59	3	2,416	0.0012	0.0007	2
60-64	2	1,454	0.0014	0.0011	2
65-69	-	-	N\A	0.0007	-
70-74	-	-	N\A	0.0006	-
75 and over	-	-	N/A	0.0006	-
Totals	8	9,577	0.0008	0.0005	5

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 2019

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	-	96	0.0000	0.0003	-
30-34	-	319	0.0000	0.0003	-
35-39	-	414	0.0000	0.0003	-
40-44	-	412	0.0000	0.0005	-
45-49	-	476	0.0000	0.0010	-
50-54	2	543	0.0037	0.0070	4
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	2	2,260	0.0009	0.0018	4

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 2019

Male and Female Disability Experience

Age	Disabilities	Exposure	Crude Rates	Current Rates	Expected Disabilities
Under 20	-	-	N/A	0.0001	-
20-24	-	2	0.0000	0.0001	-
25-29	-	714	0.0000	0.0001	-
30-34	-	1,979	0.0000	0.0001	-
35-39	-	2,413	0.0000	0.0001	-
40-44	5	2,600	0.0019	0.0002	-
45-49	4	3,041	0.0013	0.0003	1
50-54	13	3,190	0.0041	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	22	13,939	0.0016	0.0001	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 2019

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	-	2	0.0000	0.0000	-
30-34	-	28	0.0000	0.0000	-
35-39	-	38	0.0000	0.0001	-
40-44	-	64	0.0000	0.0001	-
45-49	1	115	0.0087	0.0002	-
50-54	-	168	0.0000	0.0003	-
55-59	-	358	0.0000	0.0012	-
60-64	-	116	0.0000	0.0011	-
65-69	-	-	N/A	0.0009	-
70-74	-	-	N/A	0.0009	-
75 and over	-	-	N/A	0.0009	-
Totals	1	889	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 2019

Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	42,443	11.02 %	6.45 %
6-10	24,276	5.62 %	4.90 %
11-15	16,694	4.88 %	4.25 %
16-20	13,975	4.18 %	4.00 %
21-25	9,551	3.92 %	3.75 %
26-30	6,207	3.82 %	3.50 %
31-35	3,022	3.61 %	3.30 %
36-40	1,105	3.49 %	3.20 %
Over 40	360	3.18 %	3.10 %
Total	117,633		

Public Schools Pay Increase Assumption During Calendar Year 2019

Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	15,455	11.25 %	8.60 %
6-10	14,538	5.37 %	6.40 %
11-15	12,186	4.35 %	5.10 %
16-20	12,393	3.26 %	4.00 %
21-25	9,970	2.65 %	3.35 %
26-30	6,144	2.23 %	3.20 %
31-35	2,277	2.25 %	3.15 %
36-40	359	1.74 %	3.10 %
Over 40	63	3.34 %	3.05 %
Total	73,385		

University Pay Increase Assumption During Calendar Year 2019

Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	5,922	17.95 %	6.00 %
6-10	4,639	6.63 %	5.50 %
11-15	3,249	5.94 %	5.00 %
16-20	2,652	5.18 %	4.50 %
21-25	1,668	4.68 %	3.95 %
26-30	995	4.79 %	3.80 %
31-35	564	3.92 %	3.60 %
36-40	214	3.05 %	3.20 %
Over 40	83	3.94 %	3.10 %
Total	19,986		

Protective with Social Security Pay Increase Assumption During Calendar Year 2019

Male and Female Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	4,491	16.08 %	7.75 %
6-10	3,007	4.99 %	4.50 %
11-15	2,880	5.23 %	3.90 %
16-20	3,054	4.34 %	3.80 %
21-25	2,630	3.99 %	3.70 %
26-30	1,265	3.71 %	3.60 %
31-35	191	3.73 %	3.50 %
36-40	39	4.19 %	3.40 %
Over 40	12	2.65 %	3.20 %
Total	17,569		

Protective without Social Security Pay Increase Assumption During Calendar Year 2019

Male and Female Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	465	15.79 %	8.50 %
6-10	504	5.52 %	4.30 %
11-15	445	4.11 %	3.60 %
16-20	463	3.85 %	3.50 %
21-25	462	3.96 %	3.40 %
26-30	243	2.81 %	3.30 %
31-35	34	2.30 %	3.20 %
36-40	5	4.68 %	3.10 %
Over 40	-	N/A	3.05 %
Total	2,621		

Executive and Elected Pay Increase Assumption During Calendar Year 2019

Service-Based Pay Increase Experience

Service Group		Total % Increase	
Beginning of Year	Number	Actual	Expected
1-5	270	11.81 %	5.50 %
6-10	226	5.10 %	3.20 %
11-15	139	4.78 %	3.20 %
16-20	120	4.56 %	3.20 %
21-25	120	5.24 %	3.20 %
26-30	91	4.08 %	3.20 %
31-35	70	3.38 %	3.20 %
36-40	30	4.10 %	3.20 %
Over 40	18	5.26 %	3.20 %
Total	1,084		

General Males
Normal Retirement Experience
During Calendar Year 2019

Male Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	59	218	0.2706	0.1900	41
58	40	255	0.1569	0.1900	48
59	34	255	0.1333	0.1900	48
60	46	214	0.2150	0.1900	41
61	46	243	0.1893	0.1900	46
62	47	192	0.2448	0.2600	50
63	49	182	0.2692	0.2900	53
64	40	138	0.2899	0.2800	39
65	150	693	0.2165	0.3000	208
66	150	495	0.3030	0.3500	173
67	71	327	0.2171	0.3000	98
68	45	247	0.1822	0.1900	47
69	32	196	0.1633	0.1900	37
70	21	136	0.1544	0.1900	26
71	12	99	0.1212	0.1900	19
72	8	92	0.0870	0.1900	17
73	7	59	0.1186	0.1900	11
74	5	43	0.1163	0.1900	8
Totals	862	4,084	0.2111	0.2473	1,010
75 & Over	14	188			188
Totals	876	4,272			1,198

General Males

Reduced Retirement Experience During Calendar Year 2019

Male Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	63	1,277	0.0493	0.0800	102
56	50	1,213	0.0412	0.0800	97
57	60	1,130	0.0531	0.0480	54
58	39	1,044	0.0374	0.0570	60
59	48	1,001	0.0480	0.0680	68
60	66	938	0.0704	0.0850	80
61	53	876	0.0605	0.0900	79
62	105	789	0.1331	0.1700	134
63	96	658	0.1459	0.1800	118
64	88	538	0.1636	0.1700	91
Totals	668	9,464	0.0706	0.0933	883

**General Females
Normal Retirement Experience
During Calendar Year 2019**

Female Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	60	287	0.2091	0.1700	49
58	49	290	0.1690	0.1700	49
59	49	314	0.1561	0.1700	53
60	81	328	0.2470	0.1700	56
61	68	313	0.2173	0.1700	53
62	62	270	0.2296	0.2700	73
63	57	219	0.2603	0.2700	59
64	42	166	0.2530	0.2700	45
65	331	1,172	0.2824	0.3000	352
66	250	801	0.3121	0.3500	280
67	107	475	0.2253	0.3000	143
68	69	360	0.1917	0.2500	90
69	54	268	0.2015	0.2500	67
70	34	198	0.1717	0.2500	50
71	26	145	0.1793	0.2000	29
72	13	109	0.1193	0.2000	22
73	17	94	0.1809	0.2000	19
74	8	73	0.1096	0.2000	15
Totals	1,377	5,882	0.2341	0.2557	1,504
75 & Over	25	234			234
Totals	1,402	6,116			1,738

General Females Reduced Retirement Experience During Calendar Year 2019

Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	101	2,231	0.0453	0.0700	156
56	113	2,314	0.0488	0.0700	162
57	69	2,028	0.0340	0.0550	112
58	107	2,070	0.0517	0.0650	135
59	107	2,016	0.0531	0.0700	141
60	127	1,913	0.0664	0.0950	182
61	125	1,667	0.0750	0.0950	158
62	208	1,611	0.1291	0.1600	258
63	211	1,274	0.1656	0.1800	229
64	165	1,101	0.1499	0.1800	198
Totals	1,333	18,225	0.0731	0.0950	1,731

**Public School Males
Normal Retirement Experience
During Calendar Year 2019**

Male Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	38	134	0.2836	0.3300	44
58	34	110	0.3091	0.2900	32
59	24	96	0.2500	0.2400	23
60	26	77	0.3377	0.2500	19
61	20	61	0.3279	0.2500	15
62	25	62	0.4032	0.3500	22
63	6	21	0.2857	0.3200	7
64	7	31	0.2258	0.2900	9
65	32	101	0.3168	0.2900	29
66	21	81	0.2593	0.3500	28
67	15	63	0.2381	0.3300	21
68	10	60	0.1667	0.2700	16
69	3	32	0.0938	0.2300	7
70	6	28	0.2143	0.2500	7
71	4	18	0.2222	0.2000	4
72	1	15	0.0667	0.1500	2
73	1	11	0.0909	0.1500	2
74	2	11	0.1818	0.1500	2
Totals	275	1,012	0.2717	0.2856	289
75 & Over	3	27			27
Totals	278	1,039			316

Public School Males Reduced Retirement Experience During Calendar Year 2019

Male Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	48	542	0.0886	0.1300	70
56	49	464	0.1056	0.1300	60
57	34	286	0.1189	0.1200	34
58	20	256	0.0781	0.1300	33
59	21	202	0.1040	0.1400	28
60	22	190	0.1158	0.1400	27
61	24	180	0.1333	0.1500	27
62	27	128	0.2109	0.2100	27
63	15	95	0.1579	0.2100	20
64	17	76	0.2237	0.2100	16
Totals	277	2,419	0.1145	0.1414	342

**Public School Females
Normal Retirement Experience
During Calendar Year 2019**

Female Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	94	349	0.2693	0.2700	94
58	84	302	0.2781	0.2700	82
59	56	236	0.2373	0.2700	64
60	49	211	0.2322	0.2700	57
61	40	128	0.3125	0.2700	35
62	42	130	0.3231	0.3700	48
63	26	73	0.3562	0.3000	22
64	19	55	0.3455	0.2800	15
65	96	261	0.3678	0.3700	97
66	66	174	0.3793	0.3900	68
67	29	124	0.2339	0.3300	41
68	18	90	0.2000	0.3000	27
69	21	59	0.3559	0.2800	17
70	5	53	0.0943	0.3800	20
71	8	30	0.2667	0.2000	6
72	6	26	0.2308	0.2000	5
73	3	18	0.1667	0.2000	4
74	1	12	0.0833	0.2000	2
Totals	663	2,331	0.2844	0.3020	704
75 & Over	5	40			40
Totals	668	2,371			744

Public School Females Reduced Retirement Experience During Calendar Year 2019

Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	109	1,444	0.0755	0.1200	173
56	140	1,310	0.1069	0.1200	157
57	81	829	0.0977	0.1200	99
58	77	727	0.1059	0.1200	87
59	70	698	0.1003	0.1300	91
60	102	616	0.1656	0.1700	105
61	68	503	0.1352	0.1700	86
62	77	383	0.2010	0.2300	88
63	68	331	0.2054	0.2300	76
64	44	225	0.1956	0.2300	52
Totals	836	7,066	0.1183	0.1435	1,014

University Males Normal Retirement Experience During Calendar Year 2019

Male Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	4	28	0.1429	0.1200	3
58	4	22	0.1818	0.1200	3
59	4	24	0.1667	0.1200	3
60	5	32	0.1563	0.1200	4
61	3	31	0.0968	0.1200	4
62	2	51	0.0392	0.1200	6
63	5	39	0.1282	0.1200	5
64	13	51	0.2549	0.1200	6
65	28	180	0.1556	0.1500	27
66	35	145	0.2414	0.2000	29
67	18	112	0.1607	0.2000	22
68	16	102	0.1569	0.1800	18
69	13	76	0.1711	0.1600	12
70	13	66	0.1970	0.2000	13
71	12	45	0.2667	0.1800	8
72	10	41	0.2439	0.1600	7
73	4	30	0.1333	0.1600	5
74	8	32	0.2500	0.1600	5
Totals	197	1,107	0.1780	0.1626	180
75 & Over	10	70			70
Totals	207	1,177			250

University Males Reduced Retirement Experience During Calendar Year 2019

Male Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	10	255	0.0392	0.0300	8
56	6	213	0.0282	0.0300	6
57	9	181	0.0497	0.0300	5
58	7	178	0.0393	0.0300	5
59	8	183	0.0437	0.0400	7
60	6	190	0.0316	0.0550	10
61	6	166	0.0361	0.0550	9
62	10	169	0.0592	0.0740	13
63	14	146	0.0959	0.0740	11
64	21	139	0.1511	0.1000	14
Totals	97	1,820	0.0533	0.0484	88

University Females Normal Retirement Experience During Calendar Year 2019

Female Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	1	25	0.0400	0.1500	4
58	4	25	0.1600	0.1500	4
59	5	24	0.2083	0.1000	2
60	6	41	0.1463	0.1200	5
61	6	32	0.1875	0.1600	5
62	6	34	0.1765	0.1500	5
63	2	36	0.0556	0.2000	7
64	2	35	0.0571	0.2000	7
65	31	140	0.2214	0.2000	28
66	32	114	0.2807	0.2400	27
67	15	85	0.1765	0.2000	17
68	11	60	0.1833	0.1700	10
69	3	46	0.0652	0.1700	8
70	8	32	0.2500	0.1800	6
71	1	20	0.0500	0.1800	4
72	3	21	0.1429	0.1800	4
73	1	17	0.0588	0.1500	3
74	2	9	0.2222	0.1500	1
Totals	139	796	0.1746	0.1847	147
75 & Over	4	27			27
Totals	143	823			174

University Females Reduced Retirement Experience During Calendar Year 2019

Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	9	291	0.0309	0.0500	15
56	17	253	0.0672	0.0500	13
57	9	237	0.0380	0.0500	12
58	13	212	0.0613	0.0500	11
59	12	215	0.0558	0.0500	11
60	14	192	0.0729	0.0900	17
61	10	146	0.0685	0.0900	13
62	12	156	0.0769	0.1200	19
63	16	121	0.1322	0.1200	15
64	16	112	0.1429	0.1500	17
Totals	128	1,935	0.0661	0.0739	143

Protective with Social Security Normal Retirement Experience During Calendar Year 2019

Male and Female Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
50	41	443	0.0926	0.0600	27
51	41	417	0.0983	0.0800	33
52	43	389	0.1105	0.1000	39
53	110	328	0.3354	0.2500	82
54	97	364	0.2665	0.2000	73
55	60	253	0.2372	0.2000	51
56	46	219	0.2100	0.2000	44
57	43	206	0.2087	0.2000	41
58	28	166	0.1687	0.2000	33
59	25	134	0.1866	0.2000	27
60	27	110	0.2455	0.2000	22
61	21	100	0.2100	0.2000	20
62	19	76	0.2500	0.3000	23
63	11	63	0.1746	0.3000	19
64	17	54	0.3148	0.3000	16
65	17	42	0.4048	0.4000	17
66	4	23	0.1739	0.4000	9
67	7	11	0.6364	0.4000	4
68	2	8	0.2500	0.4000	3
69	3	6	0.5000	0.4000	2
70	-	1	0.0000	1.0000	1
71	1	3	0.3333	1.0000	3
72	-	1	0.0000	1.0000	1
73	-	1	0.0000	1.0000	1
74	-	-	N/A	1.0000	-
Totals	663	3,418	0.1940	0.1729	591
75 & Over	1	6			6
Totals	664	3,424			597

**Protective without Social Security
Normal Retirement Experience
During Calendar Year 2019**

Male and Female Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
50	3	92	0.0326	0.0200	2
51	-	54	0.0000	0.0400	2
52	1	56	0.0179	0.0400	2
53	14	76	0.1842	0.1700	13
54	17	72	0.2361	0.2300	17
55	20	63	0.3175	0.2500	16
56	17	37	0.4595	0.2500	9
57	4	32	0.1250	0.2500	8
58	5	21	0.2381	0.3300	7
59	11	22	0.5000	0.3300	7
60	4	13	0.3077	0.2000	3
61	2	8	0.2500	0.2000	2
62	1	7	0.1429	0.4000	3
63	-	2	0.0000	0.4000	1
64	-	2	0.0000	0.4000	1
65	1	1	1.0000	0.4000	-
66	-	2	0.0000	1.0000	2
67	-	-	N/A	1.0000	-
68	-	1	0.0000	1.0000	1
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	100	561	0.1783	0.1711	96
75 & Over	1	-	N/A		-
Totals	101	561			96

Executive and Elected Normal Retirement Experience During Calendar Year 2019

Male and Female Age-Based Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
57	-	6	0.0000	0.0800	-
58	2	9	0.2222	0.0800	1
59	-	16	0.0000	0.0800	1
60	-	10	0.0000	0.2000	2
61	3	21	0.1429	0.1200	3
62	2	36	0.0556	0.1200	4
63	5	31	0.1613	0.1200	4
64	5	26	0.1923	0.1500	4
65	5	37	0.1351	0.1500	6
66	7	25	0.2800	0.1500	4
67	8	28	0.2857	0.1500	4
68	4	20	0.2000	0.1500	3
69	6	22	0.2727	0.2000	4
70	2	9	0.2222	0.2000	2
71	3	12	0.2500	0.2000	2
72	2	14	0.1429	0.2000	3
73	2	7	0.2857	0.2000	1
74	1	8	0.1250	0.2000	2
Totals	57	337	0.1691	0.1484	50
75 & Over	5	32			32
Totals	62	369			82

Executive and Elected Reduced Retirement Experience During Calendar Year 2019

Male and Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Crude Rates	Current Rates	Expected Retirements
55	2	36	0.0556	0.0300	1
56	2	38	0.0526	0.0300	1
57	-	31	0.0000	0.0300	1
58	5	39	0.1282	0.0300	1
59	-	35	0.0000	0.0300	1
60	2	22	0.0909	0.0500	1
61	3	36	0.0833	0.0500	2
62	-	8	0.0000	0.0200	-
63	-	9	0.0000	0.0200	-
64	-	6	0.0000	0.0200	-
Over 64	3	68	0.0441		
Totals	17	328			8

Death-in-Service During Calendar Year 2019

Male

Age	Deaths	Exposure	Crude Rates	Current Rates	Expected Deaths
Under 20	-	18	0.0000	0.0001	-
20-24	1	1,690	0.0006	0.0001	-
25-29	1	7,686	0.0001	0.0002	1
30-34	4	10,647	0.0004	0.0003	3
35-39	2	12,188	0.0002	0.0004	5
40-44	4	12,492	0.0003	0.0005	7
45-49	6	13,541	0.0004	0.0007	9
50-54	4	13,717	0.0003	0.0011	16
55-59	5	12,150	0.0004	0.0023	28
60-64	11	8,200	0.0013	0.0030	25
65-69	5	3,112	0.0016	0.0051	16
70-74	6	772	0.0078	0.0082	6
75 and over	3	2	1.5000	0.0141	-
Totals	52	96,215	0.0005	0.0012	116

Female

Age	Deaths	Exposure	Crude Rates	Current Rates	Expected Deaths
Under 20	-	30	0.0000	0.0001	-
20-24	-	3,027	0.0000	0.0001	-
25-29	2	13,916	0.0001	0.0001	1
30-34	-	17,386	0.0000	0.0002	3
35-39	5	19,354	0.0003	0.0003	5
40-44	4	20,365	0.0002	0.0004	7
45-49	1	21,385	0.0000	0.0005	11
50-54	11	22,976	0.0005	0.0008	19
55-59	12	22,051	0.0005	0.0014	31
60-64	14	14,401	0.0010	0.0020	29
65-69	6	4,291	0.0014	0.0031	13
70-74	-	872	0.0000	0.0055	5
75 and over	2	-	N/A	0.0101	-
Totals	57	160,054	0.0004	0.0008	124

APPENDIX

GLOSSARY

Glossary

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

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.”

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.