Waterford Township
Employees Retirement System
Actuarial Valuation Report
December 31, 2018

Table of Contents

GRS Retirement Consulting

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July 31, 2019

Pension Committee
Waterford Township
Employees Retirement System
5200 Civic Center Drive
Waterford, Michigan 48329

Dear Committee Members:

The results of the December 31, 2018 Actuarial Valuation of the Waterford Township Employees Retirement System are presented in this report.

This report was prepared at the request of the Board and is intended for use by the Retirement System and those designated or approved by the Board. This report may be provided to parties other than the Retirement System only in its entirety and only with the permission of the Board. GRS is not responsible for unauthorized use of this report.

The purpose of this report is to measure the System's funding progress and determine the Township's contribution rate for the fiscal year beginning January 1, 2020 in accordance with established funding policies. The results of the valuation may not be applicable for other purposes. A separate report issued May 3, 2019 includes calculations in accordance with GASB Statement Nos. 67 and 68.

This report should not be relied on for any purposes other than the purpose described. Determinations of the financial results associated with the benefits described in this report in a manner other than the intended purpose may produce significantly different results. No adjustments have been made for events after December 31, 2018.

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

The contribution rate in this report is determined using the actuarial assumptions and methods disclosed in Section C of this report. This report includes risk metrics within Section A but does not include a more robust assessment of the risks of future experience not meeting the actuarial assumptions. Additional assessment of risks was outside the scope of this assignment.

The valuation was based upon information, furnished by the Township, concerning individual participants, terminated participants, retired participants and beneficiaries, plan benefits and financial transactions and assets. Data was checked for reasonableness and missing information, but was not audited. We are not responsible for the accuracy or completeness of the information provided by the Township.

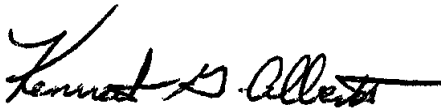
This report has been prepared by individuals who have substantial experience valuing public employee retirement systems and are independent of the plan sponsor and plan administrator. We certify that the information contained in this report is accurate and fairly presents the actuarial position of the Waterford Township Employees Retirement System as of the valuation date. All calculations have been made in conformity with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board. The actuarial assumptions used for the valuation produce results which are reasonable.

Computed employer contributions shown on page A-1 are based on the Board's policy, which includes a 14-year, level dollar amortization of unfunded actuarial accrued liabilities. Payment of the computed employer contributions is not a guarantee of benefit security. In addition, the ability of the plan sponsor to pay the computed contributions when due was beyond the scope of the project. The Board is encouraged to consider benefit security when adopting the employer contribution and is always free to adopt a higher contribution or more aggressive funding policy.

Brad Lee Armstrong is a Member of the American Academy of Actuaries (MAAA) and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

Respectfully submitted,

Brad Lee Armstrong, ASA, EA, FCA, MAAA



Kenneth G. Alberts

BLA/KGA:dj

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SECTION A

VALUATION RESULTS

Computed Contributions for the Fiscal Year Beginning January 1

Contributions for	Contributions Expressed as Percents of Covered Payroll		
	2020	**2019**	**2018**
Normal Cost (NC)			
Age and service pensions	15.13 %	15.20 %	15.75 %
Death-in-service	0.18 %	0.18 %	0.62 %
Disability pensions	0.00 %	0.00 %	0.96 %
Total	15.31 %	15.38 %	17.33 %
Member's Contributions			
Gross contributions@	0.19 %	0.20 %	0.27 %
Less prospective refunds	0.03 %	0.03 %	0.02 %
Available for pensions	0.16 %	0.17 %	0.25 %
Township's NC	15.15 %	15.21 %	17.08 %
Amortization Period*	14 years	15 years	16 years
Unfunded Actuarial Accrued Liabilities (UAAL)	9.70 %	3.26 %	(2.15) %
Township's Contribution Rate for NC and UAAL	**24.85 %**	**18.47 %**	**14.93 %**
Township's Dollar Contribution for NC and UAAL^	**$924,672**	**$701,758**	**$674,987**
Township's Contribution for Administrative Expenses	**60,000**	**60,000**	**N/A**
Total Township Contribution	**$984,672**	**$761,758**	**$674,987**

@ *Weighted average.*

* *Level dollar Amortization.*

^ *The dollar contribution payable at the end of 2020 is $984,672. This amount was prorated using the payroll amounts reported for 2018 projected to the contribution year, allocating $579,285 for General members, $315,994 for Water Department members, and $29,393 for the 51st District Court employees.*

The dollar contribution payable at the end of 2019, prorated using the payroll amounts reported for 2017 projected to the contribution year, is $438,565 for General members, $242,415 for Water Department members, and $20,778 for the 51st District Court employees.

The dollar contribution payable at the end of 2018, prorated using the payroll amounts reported for 2016 projected to the contribution year, is $389,566 for General members, $234,592 for Water Department members, and $50,829 for the 51st District Court employees.

Payment Timing Alternatives	Contribution
End of Fiscal Year (current method)	$ 984,672
Middle of Fiscal Year #	$ 953,032
Beginning of Fiscal Year	$ 922,409

 # Equivalent to making 12 monthly contributions in the amount of $79,419.

Actuarial Balance Sheet - December 31, 2018

Present Resources and Expected Future Resources

A.	Valuation assets	
	1. Net assets from System financial statements (market value)	$59,245,887
	2. Valuation adjustment	3,726,550
	3. Valuation assets	62,972,437
B.	Actuarial present value of expected future employer contributions*	
	1. For normal costs	3,694,782
	2. For unfunded actuarial accrued liabilities	3,096,518
	3. Total	6,791,299
C.	Actuarial present value of expected future member contributions	48,503
D.	Total Actuarial Present Value of Present and Expected Future Resources	$69,812,240

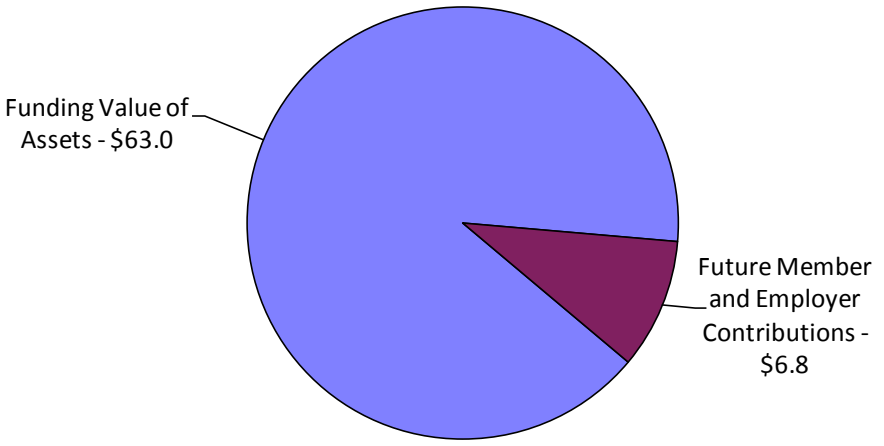
* *Excluding administrative expenses.*

Actuarial Present Value of Expected Future Benefit Payments and Reserves

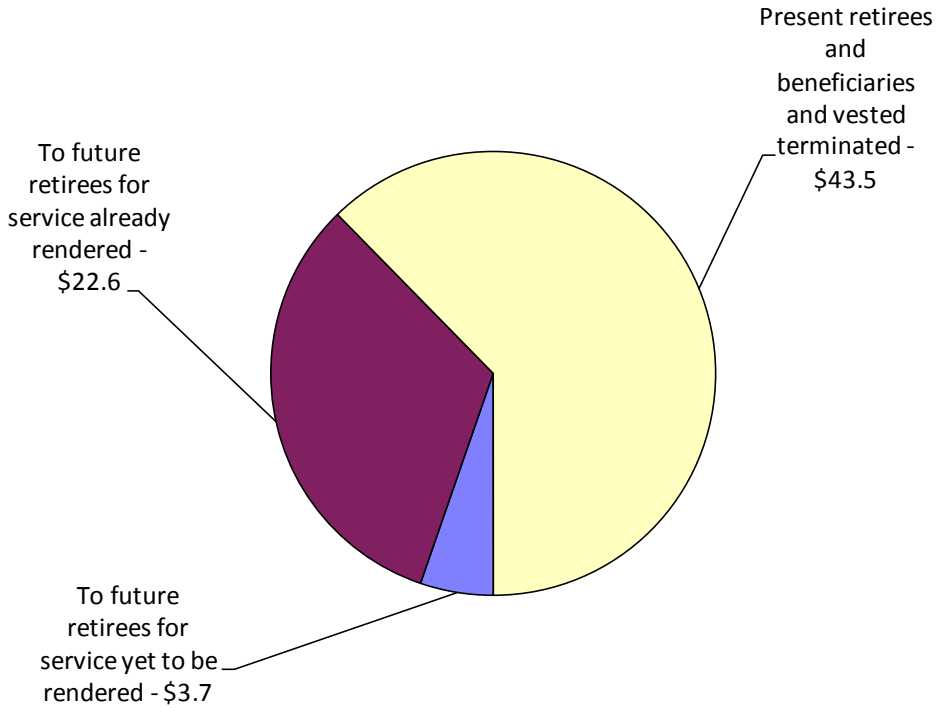
A.	To retirees and beneficiaries	$39,961,510
B.	To vested terminated members	3,508,042
C.	To present active members	
	1. Allocated to service rendered prior to valuation date	22,599,403
	2. Allocated to service likely to be rendered after valuation date	3,743,285
	3. Total	26,342,688
D.	Total Actuarial Present Value of Expected Future Benefit Payments	$69,812,240

Financing $69.8 Million of Benefit Promises
December 31, 2018
($ in millions)

Sources of Funds



Uses of Funds



Comments

Experience: Overall experience during the year was less favorable than assumed, resulting in an overall loss of 3.0% of beginning of year accrued liabilities (or approximately $1.9 million).

The major source of experience losses was investment returns, which were less than assumed (3.40% recognized return versus 6.75% assumed).

Losses were slightly offset by gains related to pay increases less than assumed.

Funded status on a Funding Value of Assets basis decreased during the year from 98.3% to 95.3%. On a Market Value of Assets basis, the funding status decreased from 100.7% to 89.7%.

Assets: The rate of return on a Market Value of Assets basis for the year ending December 31, 2018 was about (4.96)%. The Funding Value of Assets rate of return, however, recognizes ¼ of the gains and losses (with respect to 6.75% assumed) from this year and the past three years in an effort to smooth market volatility. Overall, the aggregate recognized investment return for the year produced a 3.40% recognized rate of return net of expenses (see page B-14). The Funding Value of Assets is currently greater than the Market Value of Assets. This means there are deferred losses which could increase the Township's contribution amount in next year's report in the absence of offsetting gains that may emerge.

Reserve Transfers: The present value of future benefit payments to current retirees and beneficiaries as of December 31, 2018 is $39,961,510. The December 31, 2018 balance in the Reserve for Retired Benefit Payments is $35,505,469. Therefore, the present value of future payments to retired members and beneficiaries exceeds the reserve by $4,456,041. **We recommend that this amount be transferred from the Reserve for Employer Contributions to the Reserve for Retired Benefit Payments effective January 1, 2019. For purposes of this valuation, it was assumed that this transfer would be made.**

Unfunded Actuarial Accrued Liability: Actuarial accrued liabilities exceeded the funding value of assets by $3,096,518. The manner in which this Unfunded Actuarial Accrued Liability (UAAL) is amortized is a matter of Board policy. In compliance with Board policy, the UAAL was amortized as a level dollar amount over a closed 14-year period. The resulting annual amortization payment is $360,938.

Data: Member data is received from the Township and compared with prior year's data and benefit calculations for general consistency. Any questions resulting from the review are provided to the administrator and resolved. Any data adjustments needed as a result of this process are made manually by GRS, based on instructions provided by the administrator.

Benefit or Assumption Changes: There were no benefit or assumption changes for the December 31, 2018 valuation.

Comments

Future Outlook: There are several special areas of concern that are particular to closed plans that we will monitor going forward, including:

- The active population: as the active population decreases, the contribution rate tends to increase and become less stable relative to payroll. At some point in the future, it will be better to report contributions only as a dollar amount rather than both a percent-of-payroll and dollar amount.
- Asset allocation: as the plan matures and the active population shrinks, the non-investment cash flow will increase and the asset base will decrease. As this happens, asset allocation may need to change to maintain liquidity and investment time horizon preferences of the Board. We recommend reviewing/monitoring the assumed rate of return to ensure the assumption is reflective of the current asset allocation.
- Negative cash flow: As the negative cash flow continues to increase and the asset base begins to decrease, we may recommend changing from the use of a smoothed funding value of asset method to the market value of asset method. This may be done in stages by reducing the smoothing period when the non-investment cash flow becomes 5% to 10% of the asset base (these cash flows represented about 4.8% of assets for the FY 2018). Shown below is a five-year projection of retirement benefit payments.

Year	Expected Benefit Payments
2019	$4,010,152
2020	4,195,741
2021	4,452,321
2022	4,633,043
2023	4,692,540

- Under the current asset smoothing method, a $1.2 million loss is scheduled to be recognized in next year's valuation (before accounting for next year's investment performance). Unless offset by gains next year, this will result in an increase in next year's contribution determination and downward pressure on the funded status.

Employer Contributions: As the amortization period decreases, annual gains and losses (of a similar magnitude) will continue to have a larger and larger effect on the employer contributions. If this increased volatility is a concern to the Board, we recommend the Board consider using a layered amortization approach. We are happy to discuss this further with the Board, if there is interest.

Conclusion: The Waterford Township Employees Retirement System is in sound financial condition in accordance with actuarial principles of level dollar funding, presuming continued timely receipt of contributions. The computed employer contribution for FY 2020 is 24.85% of covered payroll in addition to assumed administrative expenses or $984,672 if paid at the end of the fiscal year.

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 6.75% on the actuarial value of assets), it is expected that:

1) The unfunded actuarial accrued liabilities will become fully funded in 14 years; and
2) The employer contributions will decrease as covered active membership continues to decline.

Limitations of Funded Status Measurements

Unless otherwise indicated, a funded status measurement presented in this report is based upon the actuarial accrued liability and the actuarial value of assets. 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. A funded status measurement in this report of 100% is not synonymous with no required future contributions. If the funded status 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).

Limitations of Project Scope

Actuarial standards do not require the actuary to evaluate the ability of the plan sponsor or other contributing entities 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.

Risks to Future Employer Contribution Requirements

There are ongoing risks to future employer contribution requirements to which the Retirement System is exposed, such as:

- Actual and Assumed Investment Rate of Return
- Actual and Assumed Mortality Rates
- Amortization Policy
- Increased cash flow as a percent of assets
- Declining group size

Risk Measures - Risks Associated with Measuring the Accrued Liability and Actuarially Determined Contribution

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

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions due to changing conditions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period, or additional cost or contribution requirements based on the System'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 Risk** – 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;
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 computed contribution shown on page A-1 may be considered as a minimum contribution rate that complies with the Board's funding policy. 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.

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:

	2018	2017
Ratio of the market value of assets to total payroll	15.18	16.23
Ratio of actuarial accrued liability to payroll	16.93	16.12
Ratio of actives to retirees and beneficiaries	0.41	0.44
Ratio of net cash flow to market value of assets	(4.8)%	(4.6)%
Duration of the actuarial liability	11.42	11.68

Ratio of Market Value of Assets to Payroll

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

Ratio of Actuarial Accrued Liability to Payroll

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

Ratio of Actives to Retirees and Beneficiaries

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

Ratio of Net Cash Flow to Market Value of Assets

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

Duration of Actuarial Liability

The duration of the actuarial liability may be used to approximate the sensitivity to a 1% change in the assumed rate of return. For example, a duration of 10 indicates that the liability would increase approximately 10% if the assumed rate of return were lowered 1%.

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.

Derivation of Experience Gain (Loss)
Year Ended December 31, 2018

Actual experience will never (except by coincidence) exactly match assumed experience. It is expected that gains and losses will largely cancel each other over a period of years, but sizable year-to-year fluctuations are common. Detail on the derivation of the experience gain (loss) is shown below, along with a year-by-year comparative schedule.

		Year Ending December 31, 2018
(1)	UAAL* at start of year	$ 1,121,648
(2)	Total normal cost	622,187
(3)	Actual contributions	686,614
(4)	Interest accrual	96,318
(5)	Expected UAAL before changes: (1) + (2) - (3) + (4)	1,153,539
(6)	Increase from benefit changes	none
(7)	Change from actuarial assumptions and methods	none
(8)	Expected UAAL after changes: (5) + (6) + (7)	1,153,539
(9)	Actual UAAL at end of year	3,096,518
(10)	Gain (loss): (8) - (9)	$ (1,942,978)

** Unfunded Actuarial Accrued Liability.*

Valuation Date December 31	Experience Gain (Loss) as a % of Beginning Accrued Liability
2008	(21.8)%
2009	(1.1)%
2010	0.3 %
2011	(1.0)%
2012	1.6 %
2013	5.6 %
2014	3.4 %
2015	2.6 %
2016	3.5 %
2017	(0.4)%
2018	**(3.0)%**

Computed Contributions - Comparative Statement

Fiscal Year	Valuation Date Dec. 31	Actuarial Accrued Liabilities (AAL)	Funded Value of Assets	Percent Funded	Unfunded Act. Accr. Liab. (UAAL)			Township Contribution Rate for Normal Cost and UAAL	Dollar Contribution	
					Dollar Amount	Financing (base) Period	% of Member Payroll		Recommended	Actual
		($ in Thousands)								
1999	1998	$ 29,150	$ 33,389	114.5 %	$ (4,239)	14	(64.6)%	11.75 %	$ 838,085	$ 838,085
2000	1999#	32,425	36,325	112.0 %	(3,901)	13	(49.4)%	12.26 %	1,051,557	1,051,557
2001	2000#	34,816	39,317	112.9 %	(4,501)	12	(55.0)%	11.07 %	984,758	984,758
2002	2001@	36,673	41,190	112.3 %	(4,517)	11	(50.9)%	10.36 %	994,059	994,059
2003	2002	39,903	40,757	102.1 %	(854)	10	(9.1)%	14.66 %	1,487,005	1,487,005
2004	2003	44,263	41,579	93.9 %	2,683	30	28.3 %	17.35 %	1,780,444	1,780,444
2005	2004	45,462	42,863	94.3 %	2,599	29	28.8 %	17.39 %	1,696,164	1,696,164
2006	2005	46,306	43,301	93.5 %	3,005	28	36.8 %	18.08 %	1,574,175	1,574,175
2007	2006#	48,208	46,990	97.5 %	1,218	27	14.9 %	17.49 %	1,475,885	1,475,885
2008	2007	50,798	50,791	100.0 %	7	26	0.1 %	16.26 %	1,402,952	1,402,952
2009	2008	53,360	44,073	82.6 %	9,287	25	111.8 %	25.65 %	2,204,481	2,204,481
2010	2009#	55,024	45,414	82.5 %	9,610	24	118.3 %	26.27 %	2,208,556	2,208,556
2011	2010@	56,521	47,447	83.9 %	9,074	23	129.1 %	27.65 %	2,011,374	2,011,374
2012	2010@	56,521	47,447	83.9 %	9,074	22	129.1 %	28.26 %	2,017,208	2,017,208
2013	2011	58,750	49,385	84.1 %	9,366	21	150.0 %	29.19 %	1,922,105	1,922,105
2014	2012	59,651	51,527	86.4 %	8,125	20	140.9 %	28.58 %	1,729,217	1,729,217
2015	2013@	61,380	55,119	89.8 %	6,261	19	112.8 %	27.08 %	1,555,154	1,555,154
2016	2014	62,003	58,142	93.8 %	3,861	18	77.2 %	24.07 %	1,249,587	1,249,587
2017	2015	62,975	61,125	97.1 %	1,850	17	40.5 %	20.61 %	989,146	989,146
2018	2016	62,112	62,792	101.1 %	(680)	16	(15.4)%	14.93 %	674,987	674,987
2019	2017 #	65,091	63,969	98.3 %	1,122	15	27.8 %	18.47 %	761,758	N/A
2020	**2018**	**66,069**	**62,972**	**95.3 %**	**3,097**	**14**	**79.4 %**	**24.85 %**	**984,672**	**N/A**

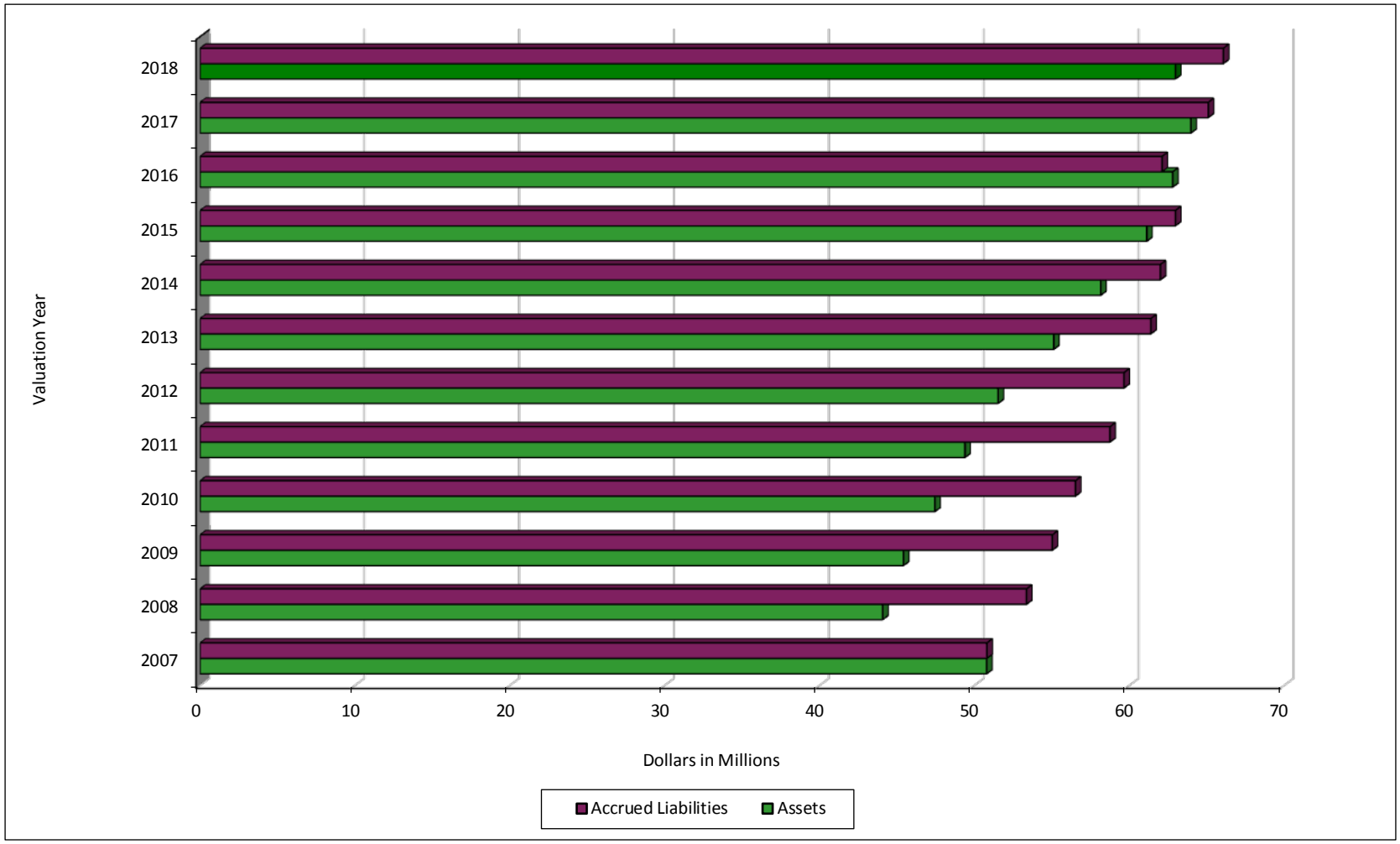
 # Changes in assumptions.
@ Changes in methods.

The Ratio of Funded Value of Assets to AAL is a traditional measure of a Retirement System's funding progress. Except in years when the System is amended or actuarial assumptions are revised, this ratio can be expected to increase gradually toward 100%. This ratio is the most appropriate of those described for assessing the need for future contributions above the amounts needed to fund the normal cost.

The Ratio of UAAL to Valuation Payroll is another relative index of condition. Unfunded Actuarial Accrued Liabilities (UAAL) represent debt, while active member payroll represents the System's capacity to collect contributions to pay toward debt. The lower the ratio, the greater the financial strength and vice-versa.

None of these funding progress indicators are appropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations.

Funding Value of Assets & Accrued Liabilities



2007 Funding Value of Assets equaled 100.0% of accrued liabilities
2018 Funding Value of Assets equaled 95.3% of accrued liabilities

The funded status would be different if based on the Market Value of Assets.

SECTION B

SUMMARY OF BENEFIT PROVISIONS AND VALUATION DATA

Brief Summary of Benefit Provisions
December 31, 2018

Eligibility	Amount

Regular Retirement

Management, Elected Officials before January 1, 1999 (Court Supervisors before April 1, 2002): Sum of age and credited service equals 75 or more, age 55 with 25 years of service, or age 60 with 5 years of service.

Dispatchers: 25 years of service regardless of age, or age 60 with 8 years of service.

Crime Scene Investigators (CSI): 25 years of service regardless of age, or age 60 with 10 years of service.

All Others: Age 55 with 25 years of service, or age 60 with 8 years of service. Community Service Officers (CSO) may also retire with 30 years of service regardless of age.

Management, Court Supervisors, Elected Officials, Dispatchers and CSI: Straight life pension equals total service times 2.5% of final average salary (FAS). Management, Court Supervisors, Elected Officials hired on or after January 1, 1999 and CSI have a maximum benefit of 75% of FAS.

Teamsters hired on or prior to July 1, 2006: Straight life pension equals total service times 2.375% of FAS.

All Others: Straight life pension equals total service times 2.25% of FAS. CSO has a maximum benefit of 75% of FAS.

Type of Final Average Salary (FAS): Highest 3 years out of the last 5 years of service. **CSI**: Highest 3 years out of the last 10 years of service.

Deferred Retirement

8 or more years of service (5 years for Management & Administrative before January 1, 1999 and Court Supervisors before April 1, 2002). Benefit begins at age 60 (55 with 25 or more years of service at time of termination). **CSI**: Benefit begins at the date retirement would have occurred had the member remained in employment.

Computed as a regular retirement but based upon service and final average salary at termination date.

Non-Duty Death-in-Service Survivor's Pension *

Payable to the survivors of a member who dies with 10 years of service.

Pension payable to surviving spouse, computed as a regular retirement but actuarially reduced in accordance with a 100% joint and survivor election.

* *Death and disability benefits for CSI members are the same as those for Police members in the Waterford Township Policemen and Firemen Retirement System.*

Brief Summary of Benefit Provisions
December 31, 2018
(Continued)

Duty Death-in-Service Survivor's Pension *

Payable to survivors of a member who died as a result of a job related injury. No age or service requirements.

Upon termination of worker's compensation the same amount is continued to widow or dependent, widower and unmarried children under 18 years old.

Non-Duty Disability *

Payable upon the total and permanent disability of a member with 10 or more years of service.

Computed as a regular retirement with a minimum benefit of 10% of final average salary at time of disability.

Duty Disability *

Payable upon the total and permanent disability of a member as a result of a job related injury. No age or service requirements. Must be in receipt of worker's compensation.

Computed as a regular retirement with a minimum benefit of 10% of FAS. Based on service and FAS at time of disability.

Member Contributions

Dispatchers and CSI	5.00% of annual earnings. Annuity withdrawal based on ML Bond index.
Others	None

Township Contributions

Actuarially determined amounts which are sufficient to cover both (i) normal costs of the plan, and (ii) financing of unfunded accrued benefit values over a selected period of future years.

Compensation

Covered compensation includes base pay plus longevity pay (overtime is included for Crime Scene Investigators).

* *Death and disability benefits for CSI members are the same as those for Police members in the Waterford Township Policemen and Firemen Retirement System.*

Brief Summary of Benefit Provisions
December 31, 2018
(Concluded)

Participation

Full-time employees of the Township not covered by Act 345 participate in WTERS except Firefighters. However, members hired after the dates below are not eligible to participate and are, instead, covered by a separate defined contribution plan.

Members of	Hire Date
Mgmt / Elected	1/1/2005
Court	1/1/2005
Dispatch	7/1/2006
Teamster	7/1/2006

Deferred Retirement Option Plan (DROP)

Certain employees in the dispatch Union deemed eligible as of December 31, 2016 are able to participate in the DROP.

These members may participate in the DROP after attaining the minimum requirements for a normal service retirement. A monthly amount equal to the amount that would have been paid had the member retired and current member contributions accumulate in a DROP account. The account is credited with the system's prior calendar year's market rate of return (but not greater than 4% interest) each year. Additions cease at the earlier of 5 years of DROP participation or separation from service, although interest on the DROP account will continue to accrue during such time. Participants may continue in covered employment after 5 years of participation or until their 33rd year of service, but do not accumulate additional service credit. Upon actual retirement the member may receive the DROP account balance in the form of a lump sum or as an additional annuity. Member contributions continue during the DROP period. Upon exit from the DROP, the original monthly amount established upon entry in the DROP continues in addition to any other benefits or adjustments. Member contributions made during the DROP period are added to the DROP account.

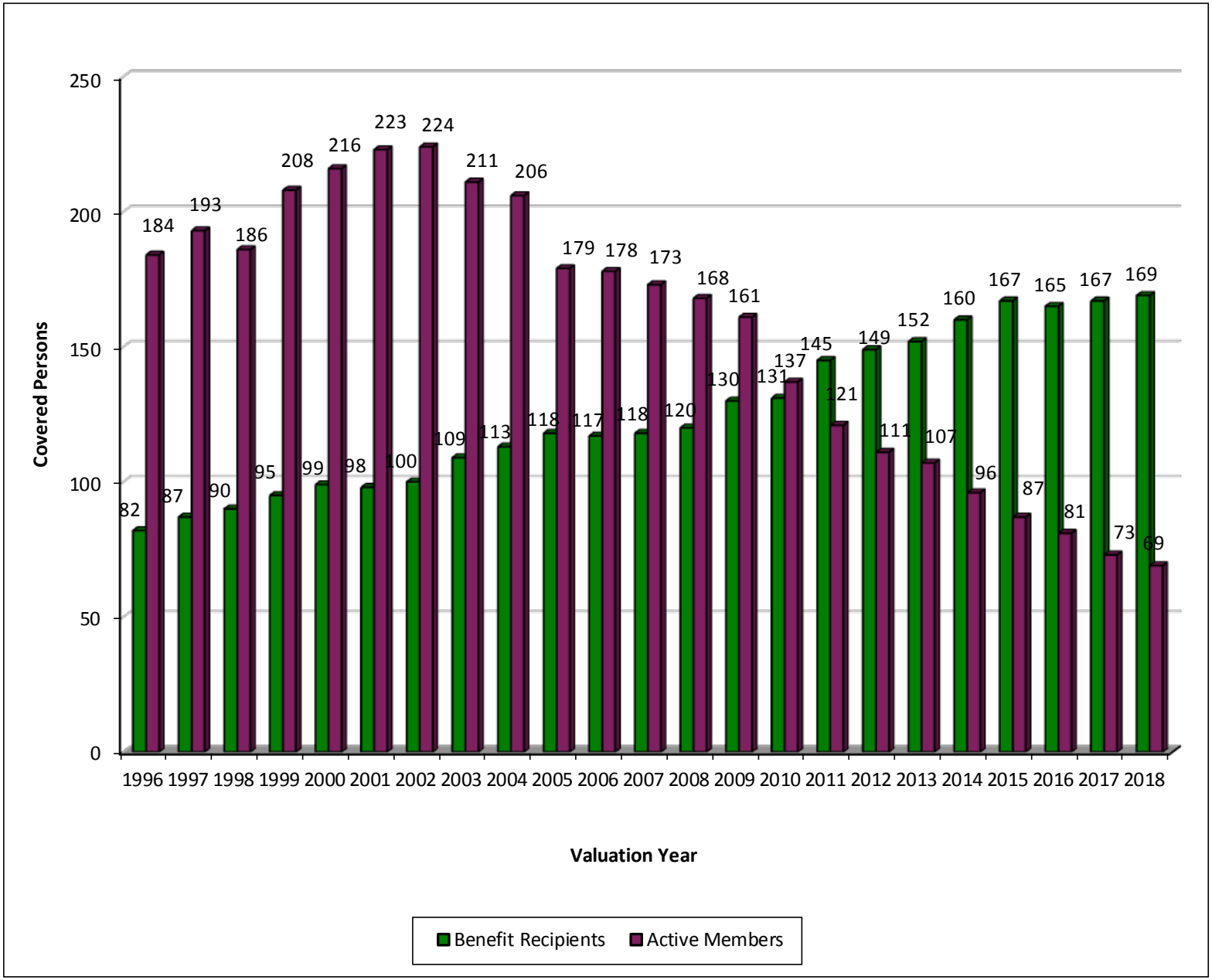
Retiree and Beneficiary Comparative Schedule

Year Ended	Added to Rolls		Removed from Rolls		Rolls End of Year				Average Pension	Expected Removals	
	No.	Annual[#] Pensions	No.	Annual[#] Pensions	No.	Active Per Retired	Annual Pensions Dollars	Annual Pensions % of Pay		No.	Annual Pensions
1999	5	$ 78,770			95	2.2	$ 1,215,436	15.4 %	$ 12,794	2.1	$ 19,728
2000	4	90,878			99	2.2	1,306,314	16.0 %	13,195	2.5	25,172
2001	6	72,178	7	$ 24,863	98	2.3	1,353,630	15.3 %	13,813	2.8	28,349
2002	4	137,119	2	23,399	100	2.2	1,467,350	15.6 %	14,674	2.6	30,263
2003	13	377,721	4	26,795	109	1.9	1,818,276	19.2 %	16,681	2.7	36,026
2004	4	174,733			113	1.8	1,993,009	22.1 %	17,637	2.9	41,604
2005	5	59,049			118	1.5	2,052,057	25.1 %	17,390	3.2	47,208
2006	5	113,420	6	84,511	117	1.5	2,080,966	25.5 %	17,786	3.6	52,435
2007	5	77,708	4	53,942	118	1.5	2,104,732	25.2 %	17,837	3.8	51,782
2008	2	53,185			120	1.4	2,157,917	26.0 %	17,983	4.0	55,663
2009	7	125,987	6	64,620	121	1.3	2,219,284	27.3 %	18,341	4.4	61,920
2010	19	555,597	9	136,752	131	1.0	2,638,129	37.5 %	20,138	4.4	64,759
2011	22	542,808	8	104,703	145	0.8	3,076,234	49.3 %	21,215	4.4	66,524
2012	8	172,719	4	40,500	149	0.7	3,208,453	55.6 %	21,533	4.5	70,959
2013	11	148,540	8	124,954	152	0.7	3,232,039	58.2 %	21,263	4.6	75,786
2014	13	274,305	5	38,803	160	0.6	3,467,540	69.4 %	21,672	3.8	62,458
2015	12	263,901	5	65,339	167	0.5	3,666,102	80.2 %	21,953	4.0	70,415
2016	3	81,535	5	147,823	165	0.5	3,599,814	81.7 %	21,817	4.0	75,018
2017	7	211,332	5	64,705	167	0.4	3,746,441	92.8 %	22,434	4.4	82,309
2018	**8**	**183,943**	**6 ***	**71,734**	**169**	**0.4**	**3,858,650**	**98.9 %**	**22,832**	**4.2**	**80,675**

[#] *Includes post-retirement adjustments.*

* *One benefit recipient who had two different pension types due to an EDRO is now being valued as one record, further reducing the count by one (1).*

Active Members & Benefit Recipients



Retirees and Beneficiaries December 31, 2018
Tabulated by Attained Ages

Attained Ages	No.	Annual Pensions
44	1	$ 17,022
48	2	69,552
51	1	9,215
52	3	110,594
53	1	50,088
55	2	39,508
56	2	47,502
57	4	138,403
58	4	143,234
59	2	55,950
60	6	191,402
61	5	181,805
62	6	153,571
63	8	233,914
64	8	194,766
65	10	205,760
66	6	127,683
67	12	250,727
68	3	31,317
69	10	194,301
70	1	37,746
71	6	104,521
72	5	111,646
73	5	147,356
74	6	139,674
75	3	53,137
76	5	56,954
77	3	41,652
78	1	8,435
79	3	66,825
80	3	45,192
81	4	74,186
82	5	138,018
83	3	51,371
84	2	32,180
85	3	29,330
86	3	78,520
87	1	8,118
88	4	77,587
89	1	5,356
90	3	44,300
91	2	28,788
93	1	31,444
Totals	**169**	**$3,858,650**

Average Age Now: 70.3

Average Age at Retirement: 57.3

Retirees and Beneficiaries December 31, 2018
Tabulated by Type of Pension

Type of Pension Being Paid	No.	Annual Pensions
Age and Service Pensions		
Regular	75	$ 1,752,327
100% Joint and Survivor	45	1,108,765
50% Joint and Survivor	27	695,895
Survivor Beneficiary	16	225,911
Totals	163	3,782,898
Casualty Benefits		
Non-Duty Death	0	0
Non-Duty Disability	4	54,535
Duty Disability	2	21,217
Survivor Beneficiary of Disability Pension	0	0
Totals	6	75,752
Total Pensions Being Paid	**169**	**$ 3,858,650**

Vested Terminated Members December 31, 2018
Tabulated by Attained Ages

Attained Ages	No.	Annual Pensions
38	1	$ 7,500
42	1	12,040
45	2	26,611
46	4	62,394
47	3	32,234
49	1	29,463
51	1	25,624
52	1	12,276
53	1	21,067
54	3	29,634
55	4	75,011
56	1	13,602
57	4	48,224
58	3	33,616
59	3	32,907
67	1	2,989
70	1	15,495
Totals	**35**	**$480,687**

Active Members December 31, 2018
by Township Department

Department	Number of Members	Annual Payroll	Valuation Payroll
General			
Dispatch	4	$ 233,683	$ 233,683
CSI	0	0	0
General Union	27	1,398,886	1,398,886
Management and Admin Pre 1/1/1999	7	550,997	550,997
Management and Admin Post 1/1/1999	4	260,989	260,989
Total General	42	2,444,555	2,444,555
Water			
Water Union	22	1,093,073	1,093,073
Water Management Pre 1/1/1999	2	163,244	163,244
Water Management Post 1/1/1999	1	77,160	77,160
Total Water	25	1,333,477	1,333,477
51st District Court			
Court Union	2	124,036	124,036
Court Supervisors Pre 4/1/2002	0	0	0
Court Supervisors Post 4/1/2002	0	0	0
Total 51st District Court	2	124,036	124,036
Totals	**69**	**$3,902,068**	**$3,902,068**

Active Members December 31, 2018
by Township Department

Comparative Schedule

Valuation Date	Active Members				Valuation	Average			
Dec. 31	Gen.	Water	Court	Total	Payroll	Age	Service	Pay	% Incr.
1980	117	36	N/A	153	$2,596,759	40.0 yrs.	7.7 yrs.	$16,972	12.0 %
1985	114	31	N/A	145	3,270,861	42.0	9.9	22,558	6.0 %
1990	110	36	30	176	4,605,296	42.3	10.1	26,166	6.0 %
1995	105	44	32	181	5,565,897	41.2	9.8	30,751	0.1 %
1996	108	45	31	184	6,086,705	42.4	10.2	33,080	7.6 %
1997	113	49	31	193	6,487,465	42.2	9.8	33,614	1.6 %
1998	112	46	28	186	6,563,277	42.3	10.5	35,286	5.0 %
1999	127	51	30	208	7,892,467	41.6	9.7	37,945	7.5 %
2000	135	49	32	216	8,185,631	41.8	9.7	37,896	(0.1)%
2001	141	50	32	223	8,871,473	42.3	10.0	39,782	5.0 %
2002	140	50	34	224	9,378,252	43.2	10.6	41,867	5.2 %
2003	125	53	33	211	9,487,946	43.4	10.6	44,967	7.4 %
2004	124	51	31	206	9,018,029	44.2	11.3	43,777	(2.6)%
2005	112	48	19	179	8,167,274	44.8	12.6	45,627	4.2 %
2006	109	51	18	178	8,153,092	45.2	13.1	45,804	0.4 %
2007	105	50	18	173	8,336,466	45.9	14.0	48,188	5.2 %
2008	101	50	17	168	8,303,833	46.7	15.0	49,428	2.6 %
2009	98	48	15	161	8,122,841	47.7	15.9	50,452	2.1 %
2010	87	39	11	137	7,028,413	48.5	16.6	51,302	1.7 %
2011	73	38	10	121	6,245,774	47.9	16.7	51,618	0.6 %
2012	66	35	10	111	5,766,161	48.3	17.5	51,947	0.6 %
2013	63	34	10	107	5,551,391	49.3	18.3	51,882	(0.1)%
2014	56	33	7	96	4,999,601	49.2	19.1	52,079	0.4 %
2015	49	31	7	87	4,572,784	49.2	19.9	52,561	0.9 %
2016	46	29	6	81	4,404,334	50.3	21.0	54,374	3.5 %
2017	45	26	2	73	4,037,556	50.8	21.8	55,309	1.7 %
2018	**42**	**25**	**2**	**69**	**$3,902,068**	**51.3**	**22.7**	**$56,552**	**2.2 %**

Active Members Added to and Removed from Rolls

Year	No. Added During Year	Removed During Year										Active Members End of Year
		Normal Retirement		Disabled		Died-in-Service		Terminations				
								Vested	Other	Total		
	A	A	E	A	E	A	E	A	A	A	E	
2009	0	3	5.4	0	0.5	0	0.4	3	1	4	4.3	161
2010	0	13	6.4	0	0.5	0	0.4	7	4	11	3.6	137
2011	4*	17	6.6	2	0.5	0	0.4	0	1	1	2.7	121
2012	0	5	4.4	0	0.4	0	0.3	4	1	5	2.5	111
2013	0	3	4.3	0	0.4	0	0.3	1	0	1	2.2	107
2014	0	9	5.1	0	0.4	0	0.2	1	1	2	1.9	96
2015	0	8	4.1	0	0.4	0	0.2	1	0	1	1.7	87
2016	1	2	3.6	0	0.4	0	0.2	4	1	5	1.5	81
2017	0	6	2.8	0	0.4	0	0.2	2	0	2	1.3	73
2018	0	**4**	**6.8**	**0**	**0.0**	**0**	**0.1**	**0**	**0**	**0**	**1.3**	**69**
10 Yr. Totals	5	70	49.5	2	3.9	0	2.7	23	9	32	23.0	

* *Re-hired from lay-off.*

A = Actual
E = Expected

All Active Members December 31, 2018
by Attained Age and Years of Service

Attained Age	Years of Service to Valuation Date							Totals*	
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	No	Valuation Payroll
35-39				4				4	$ 240,315
40-44			1	5	1			7	370,179
45-49				6	10	1		17	965,742
50-54			1	3	6	4	3	17	920,516
55-59			1	2	3	6	3	15	850,579
60			1		1			2	87,283
61			1		1			2	94,521
62						1		1	72,711
63							1	1	98,794
64							1	1	82,690
65			1		1			2	118,738
Total			**6**	**20**	**23**	**12**	**8**	**69**	**$3,902,068**

** Includes one (1) member currently participating in the DROP.*

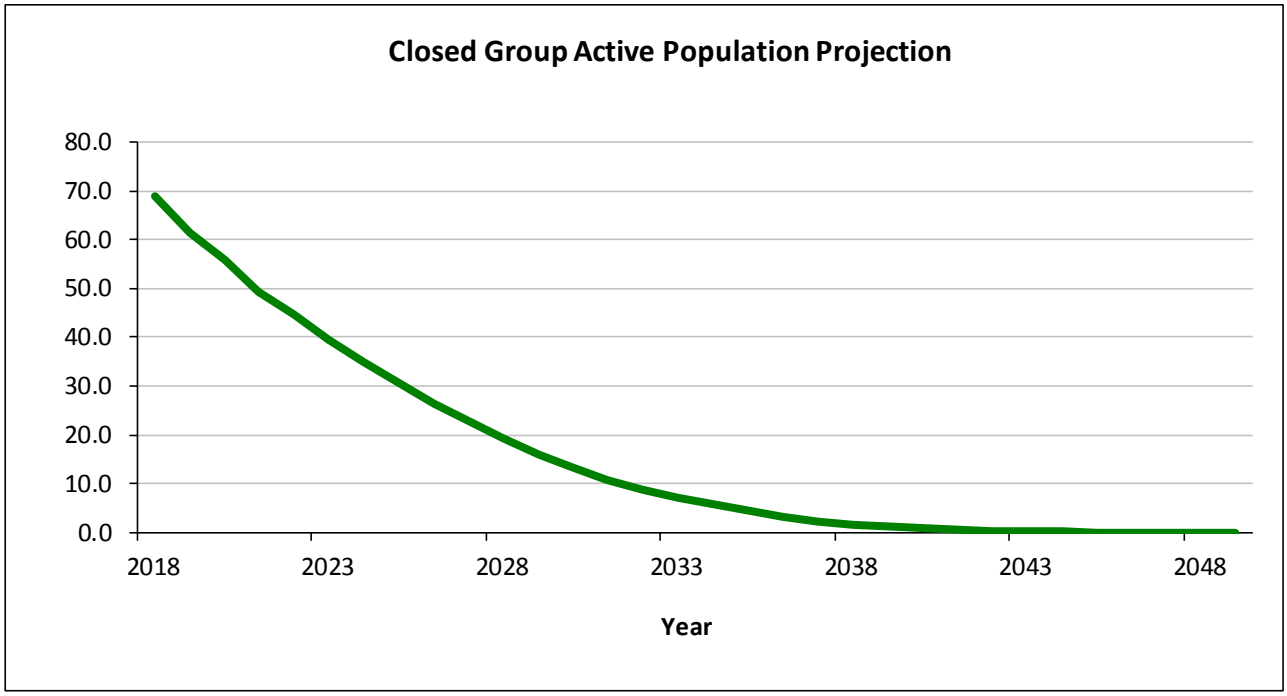
While not used in the financial computations, the following group averages are computed and shown because of their general interest.

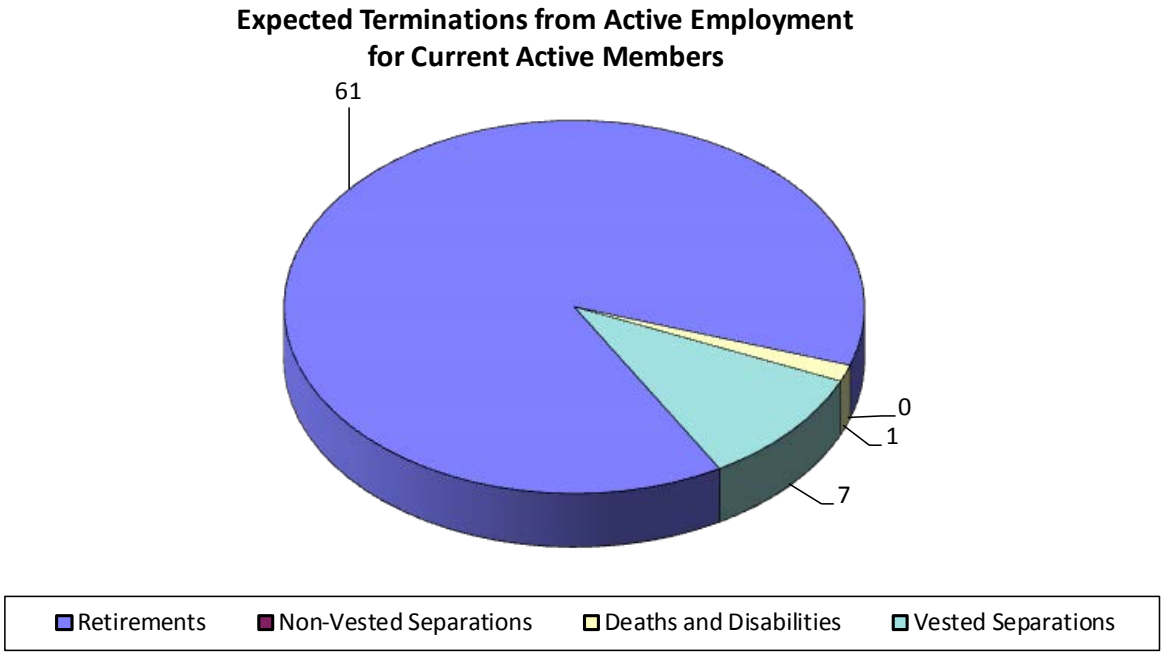
Age: 51.3 years

Service: 22.7 years

Annual Pay: $56,552

Expected Development of Present Population
December 31, 2018





The charts show the expected future development of the present population in simplified terms. The Retirement System presently covers 69 active members. 68 people are expected to receive monthly retirement benefits either by retiring directly from active service, or by retiring from vested deferred status. One person is expected to become eligible for death-in-service or disability benefits. Within seven years, over half of the covered membership is expected to terminate.

Development of Funding Value of Retirement System Assets

Year Ended December 31:	2015	2016	2017	2018	2019	2020	2021
A. Funding Value Beginning of Year	$ 58,141,962	$ 61,125,070	$ 62,792,241	$ 63,969,472			
B. Market Value End of Year	59,740,412	59,432,235	65,536,884	59,245,887			
C. Market Value Beginning of Year	61,438,239	59,740,412	59,432,235	65,536,884			
D. Non-Investment Net Cash Flow	(2,017,928)	(2,628,960)	(2,754,653)	(3,116,824)			
E. Investment Income							
E1. Market Total: B - C - D	320,101	2,320,783	8,859,302	(3,174,173)			
E2. Assumed Rate of Investment Return	7.00%	7.00%	7.00%	6.75%			
E3. Amount for Immediate Recognition	3,999,310	4,186,741	4,299,044	4,212,747			
E4. Amount for Phased-In Recognition: E1-E2	(3,679,209)	(1,865,958)	4,560,258	(7,386,920)			
F. Phased-In Recognition of Investment Income							
F1. Current Year: 0.25 x E4	(919,802)	(466,490)	1,140,065	(1,846,730)			
F2. First Prior Year	(120,934)	(919,802)	(466,490)	1,140,065	$ (1,846,730)		
F3. Second Prior Year	1,616,616	(120,934)	(919,802)	(466,490)	1,140,065	$ (1,846,730)	
F4. Third Prior Year	425,846	1,616,616	(120,933)	(919,803)	(466,488)	1,140,063	$ (1,846,730)
F5. Total Recognized Investment Gain (Loss)	1,001,726	109,390	(367,160)	(2,092,958)	(1,173,153)	(706,667)	(1,846,730)
G. Funding Value End of Year							
G1. Preliminary Funding Value End of Year: A+D+E3+F5	61,125,070	62,792,241	63,969,472	62,972,437			
G2. Upper Corridor Limit: 125% x B	74,675,515	74,290,294	81,921,105	74,057,359			
G3. Lower Corridor Limit: 75% x B	44,805,309	44,574,176	49,152,663	44,434,415			
G4. Funding Value End of Year	**61,125,070**	**62,792,241**	**63,969,472**	**62,972,437**			
H. Difference between Market & Funding Value	$(1,384,658)	$ (3,360,006)	$1,567,412	$(3,726,550)	$ (2,553,397)	$ (1,846,730)	$ 0
I. Recognized Rate of Return	**8.75%**	**7.18%**	**6.40%**	**3.40%**			
J. Market Value Rate of Return	0.53%	3.97%	15.26%	(4.96)%			
K. Ratio of Funding Value to Market Value	102.32%	105.65%	97.61%	106.29%			

The Funding Value of Assets recognizes assumed investment income (line E3) fully each year. Differences between actual and assumed investment income (line E4) are phased-in over a closed four-year period. During periods when investment performance exceeds the assumed rate, Funding Value of Assets will tend to be less than Market Value. During periods when investment performance is less than the assumed rate, Funding Value of Assets will tend to be greater than Market Value. The Funding Value of Assets is *unbiased* with respect to Market Value. At any time, it may be either greater or lesser than Market Value. If assumed rates are exactly realized for 3 consecutive years, it will become equal to Market Value.

Summary of
Current Asset Information

Balance Sheet

Valuation Assets		Reserve for	
Cash & Equivalents	$ 2,400,600	Employee Contributions	$ 258,780
Common Stock	42,533,817	Employer Contributions	23,481,638
Bonds	14,713,019	Retired Benefit Payments	35,505,469
Real Estate	248,454	Undistributed Investment	0
Other Assets: Prepaids	317,295		
Accounts Payable	(967,298)		
Market Adjustment	3,726,550	Market Adjustment	3,726,550
Funding Value of Assets	$62,972,437	Total Reserves	$62,972,437

Receipts and Disbursements

	2018	2017
Funding Value - January 1	$63,969,472	$62,792,241
Receipts		
Employee Contributions	11,627	11,489
Employer Contributions	674,987	989,146
Recognized Investment Income	2,479,831	4,315,696
Total	3,166,445	5,316,331
Disbursements		
Benefit Payments	3,746,991	3,755,288
Transfer to DC Plan	-	-
Administrative Expense*	56,447	383,812
Investment Expense	360,042	-
Other	-	-
Total	4,163,480	4,139,100

** Prior to 2018, administrative and investment expenses were reported to be one combined amount.*

Valuation assets are equal to the funding value of assets. See page B-14.

SECTION C

SUMMARY OF ACTUARIAL COST METHOD AND ASSUMPTIONS

Basic Financial Objective and Operation of the Retirement System

Benefit Promises Made Which Must Be Paid For. A retirement system is an orderly means of handing out, keeping track of, and financing contingent pension promises to a group of employees. As each member of the Retirement System acquires a unit of service credit they are, in effect, handed an "IOU" which reads: "The Employees Retirement System promises to pay you one unit of retirement 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 member's service is received? Or, some future year when the "IOU" becomes a cash demand?

The Constitution of the State of Michigan is directed to the question:

> "Financial benefits arising on account of service rendered in each fiscal year shall be funded during that year and such funding shall not be used for financing unfunded accrued liabilities."

This Retirement System meets this constitutional requirement by having as its ***financial objective to establish and receive contributions, expressed as percents of active member payroll, which will achieve progress towards 100% funded status and will remain approximately level from year to year*** and will not have to be increased for future generations of taxpayers.

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

> ***Normal Cost*** (the current value of benefits likely to be paid on account of members' service being rendered in the current year)
>
> ... plus ...
>
> Interest on the Unfunded Actuarial Accrued Liability (the difference between the actuarial accrued liability and current system assets).

A by-product of the level percent-of-payroll contribution objective is the accumulation of invested assets for varying periods of time.

Invested assets are a by-product of level percent-of-payroll contributions, not the objective. Investment income becomes the major contributor to the Retirement System, and the amount is directly related to the amount of contributions and investment performance.

If contributions to the Retirement 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 fiscal equation under which all retirement programs must operate; that is:

$$B = C + I - E$$

The aggregate amount of Benefit payments to any group of members and their beneficiaries cannot exceed the sum of:

The aggregate amount of Contributions received on behalf of the group

... plus ...

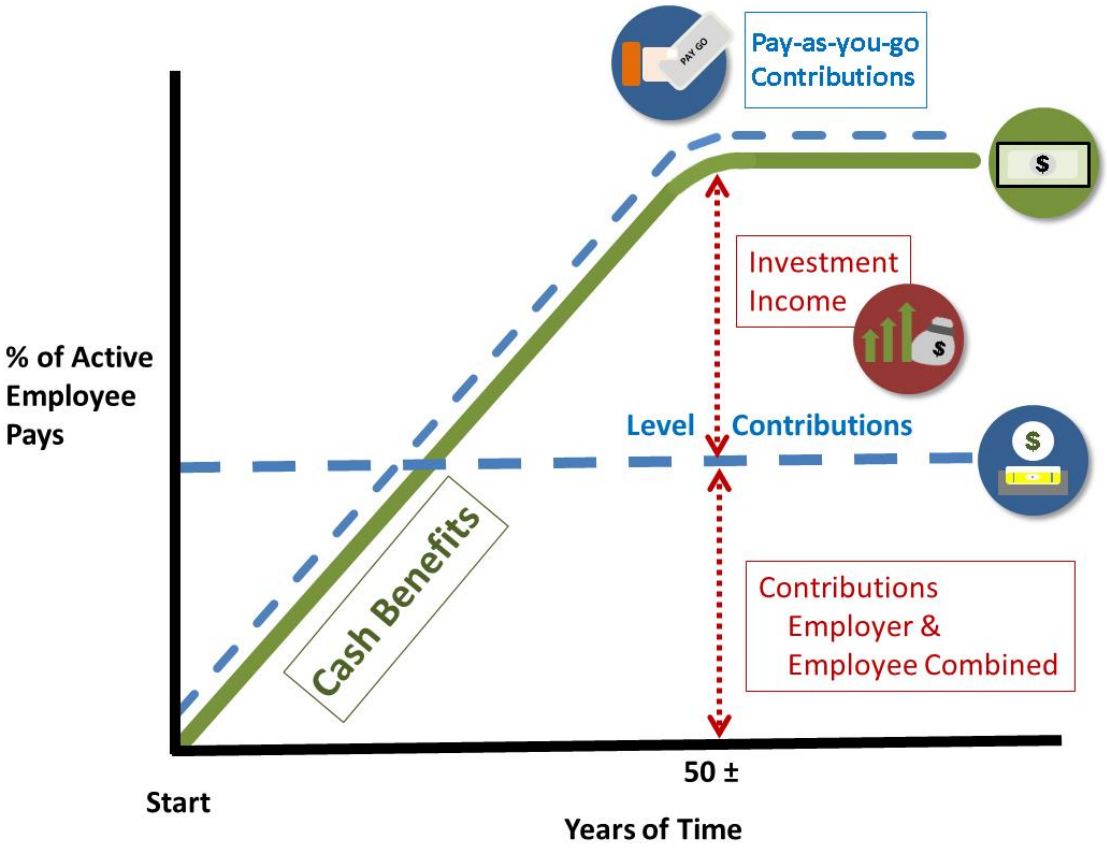
Investment earnings on contributions received and not required for immediate payment of benefits

... minus ...

The Expenses of operating the program.

There are retirement systems designed to defer the bulk of contributions far into the future. Lured by artificially low present contributions, the inevitable consequence of a relentlessly increasing contribution rate -- to a level greatly in excess of the level percent-of-payroll rate -- is ignored. ***This method of financing is prohibited in Michigan by the State constitution***.

Computed Contribution Rate Needed to Finance Benefits. From a given schedule of benefits and from the data furnished, the actuary calculates the contribution rate by means of an actuarial valuation - the technique of assigning monetary values to the risks assumed in operating a retirement system.

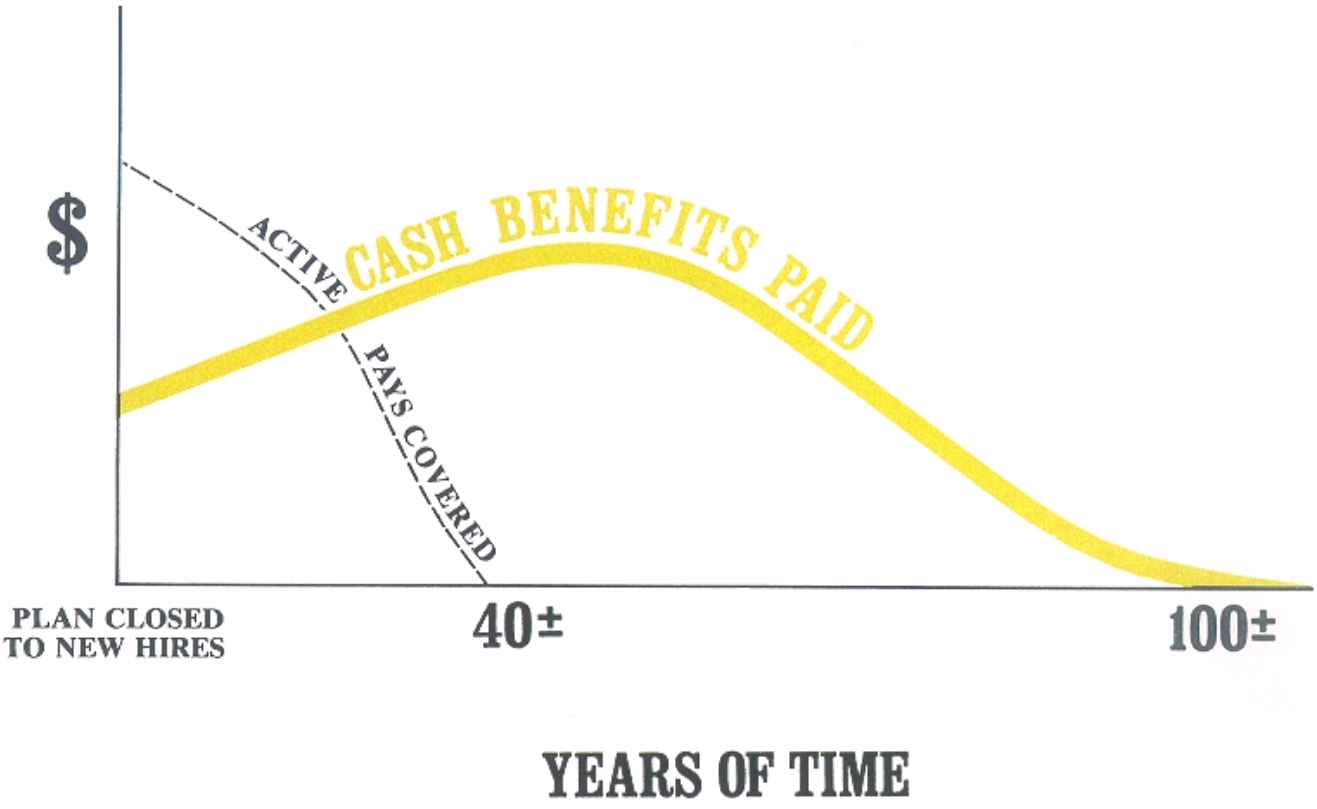


CASH BENEFITS LINE. This relentlessly increasing line is the fundamental reality of retirement plan financing. It happens each time a new benefit is added for future retirements (and happens regardless of the design for contributing for benefits).

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

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

A CLOSED PENSION PLAN



A plan becomes closed when no new hires are admitted to active membership. The persons covered by the plan at the time of closing continue their normal activities and continue to be covered by the plan, until the last survivor dies.

CASH BENEFITS LINE. After a pension plan becomes closed, the usual pattern is for cash benefits to continue to increase for decades of time. Eventually the cash benefits will peak, and then gradually decrease over more decades of time, ultimately to zero. The last cash benefit is likely to occur a century after the time the plan is closed.

The precise amounts of cash benefits cannot be known now, and must be estimated by assumptions of future experiences in a variety of financial risk areas.

Methodology

Actuarial Cost Method. Normal cost and the allocation of benefit values between service rendered before and after the valuation date were determined using the individual entry-age actuarial cost method having the following characteristics:

i) the annual normal costs for each individual active member, payable from the date of employment to the date of retirement, are sufficient to accumulate the value of the member's benefit at the time of retirement or termination; and

ii) each annual normal cost is a constant percentage of the member's year-by-year projected covered pay.

Financing of Unfunded Actuarial Accrued Liabilities. Unfunded actuarial accrued liabilities (the portion of total liabilities not covered by present assets or expected future normal cost contributions) were amortized by level (principal or interest combined) dollar contributions over a closed period of 14 years. Level dollar amortization was used since the plan is closed to new hires. There is a 1-year lag between the valuation date and the contribution effective date. Unfunded liabilities were projected to the contribution effective date based on the valuation assumed rate of return and the adopted contributions and then amortized.

Asset Valuation Method. Last year's valuation assets are increased by contributions and reduced by refunds, benefit payments and expenses. An amount equal to the assumed investment return for the year is then added. Differences between actual return on a market value basis and an assumed return are phased-in over a four-year period.

Actuarial Assumptions Used for the Valuation

The actuary calculates the contribution requirements and benefit values of the System by applying actuarial assumptions to the benefit provisions and people information furnished, using the actuarial cost method described on the previous page. All actuarial assumptions used in this report are estimates of future experience not market measures.

The principal areas of financial risk which require assumptions about the future are:

- long-term rates of investment return to be generated by the assets of the Fund
- patterns of pay increases to members
- rates of mortality among members, retirees and beneficiaries
- rates of withdrawal of active members (without entitlement to a retirement benefit)
- rates of disability among members
- the age patterns of actual retirement

In an actuarial valuation, the actuary calculates the monetary effect of each assumption for as long as a present covered person survives - - - a period of time which can be as long as a century.

Actual experience of the System will not coincide exactly with assumed experience, regardless of the wisdom of the assumptions, or the skill of the actuary and the precision of the many calculations made. Each valuation provides a complete recalculation of assumed future experience and takes into account all past differences between assumed and actual experience. The result is a continual series of adjustments (usually small) to the computed contribution rate.

From time to time it becomes appropriate to modify one or more of the assumptions, to reflect experience trends (but not random year-to-year fluctuations).

Actuarial Assumptions Used for the Valuation

The basis for all assumptions lies in a 2000 Experience Study. These assumptions were adjusted as the result of an experience review conducted for the December 31, 2017 valuation. Assumptions are forward looking.

Investment Return (net of investment expenses): 6.75% a year, compounded yearly. This rate is consistent with a rate of wage inflation of 3.5% a year.

This assumption is used to equate the value of payments due at different points in time and was first used for the December 31, 2017 valuation. Approximate rates of investment return, for the purpose of comparisons with assumed rates, are shown below. Actual increases in average active member pay are also shown for comparative purposes.

	Year Ended December 31					5-Year
	2018	2017	2016	2015	2014	Average*
Rate of Investment Return	3.4 %	6.4 %	7.2 %	8.8 %	8.8 %	6.9 %
Increase in Average Pay	2.2 %	1.7 %	3.5 %	0.9 %	0.4 %	1.7 %
Real Rate of Return	1.2 %	4.7 %	3.7 %	7.9 %	8.4 %	5.1 %

* *Compounded rate of increase.*

The nominal rate of return was computed using the approximate formula i = I divided by 1/2 (A + B - I), where I is recognized investment income net of expenses, A is the beginning of year asset value, and B is the end of year asset value.

These rates of return should not be used for measurement of an investment advisor's performance or for comparisons with other systems ***– to do so will mislead***.

Price Inflation: 2.50% per year.

Pay Projections. These assumptions are used to project current pays to those upon which benefits will be based. The assumptions were first used for the December 31, 2017 valuation.

Sample Ages	Percent Increase in Salary		
	Base Economic	Promotion & Longevity	Total
20	3.5%	3.2%	6.7%
25	3.5%	3.0%	6.5%
30	3.5%	2.5%	6.0%
35	3.5%	2.4%	5.9%
40	3.5%	2.1%	5.6%
45	3.5%	1.5%	5.0%
50	3.5%	1.2%	4.7%
55	3.5%	1.0%	4.5%
60	3.5%	0.0%	3.5%

Actuarial Assumptions Used for the Valuation

Probabilities of retirement for members eligible to retire were:

Retirement Ages	Percent of Eligible Active Members Retiring Within Next Year			
	Rule of 75 for Management & Administrative Hired Before 1999	Others	Service	CSI and Dispatchers
45	12%		25	42%
46	12%		26	36%
47	12%		27	36%
48	12%		28	36%
49	12%		29	36%
50	12%	24%	30	36%
51	12%	24%	31	36%
52	12%	24%	32	36%
53	12%	24%	33	36%
54	12%	24%	34	48%
55	12%	24%	35	100%
56	12%	24%	36	
57	12%	24%	37	
58	12%	24%	38	
59	12%	24%	39	
60	12%	24%	40	
61	12%	24%	41	
62	36%	24%	42	
63	12%	24%	43	
64	12%	30%	44	
65	100%	36%	45	
66		30%	46	
67		30%	47	
68		30%	48	
69		48%	49	
70		100%	50	

Actuarial Assumptions Used for the Valuation

Probabilities of retirement (continued): Management, and Elected Officials before January 1, 1999 and members of Court Supervisors before April 1, 2002 are eligible to retire once the sum of their age and credited service equals 75 or more or at age 60 with 5 years of service. Dispatchers and CSI are eligible to retire once they have completed 25 years of service regardless of age (30 years for CSO). All other members are eligible for retirement after attaining age 55 with 25 years of service. All members are eligible at age 60 with 8 (10 years for CSI) or more years of service. Retirement probabilities for Dispatch are adjusted due to the DROP plan as follows:

- Probabilities are multiplied by 50% for each of the first 5 years of eligibility.
- Probabilities are multiplied by 150% for each of the next 5 years of eligibility.
- Resulting probabilities cannot be more than 100%.
- Probabilities are 100% upon attainment of 33 years of service.

Withdrawal Rates: Separations from active employment before retirement, death or disability:

Sample Ages	Years of Service	% of Active Members Separating Within Next Year
ALL	0	10.0%
	1	8.0%
	2	7.0%
	3	6.0%
	4	5.0%
20	5 & Over	7.8%
25		7.8%
30		6.6%
35		5.7%
40		4.2%
45		2.7%
50		2.2%
55		2.2%
60		2.2%

Actuarial Assumptions Used for the Valuation

The post-retirement healthy mortality: RP-2014 Mortality Table projected to 2026 using projection scale MP-2017.

Sample Attained Ages	Single Life Retirement Values					
	Present Value of $1 Monthly for Life		Percent Dying Next Year		Future Life Expectancy (years)	
	Men	Women	Men	Women	Men	Women
50	$156.53	$160.91	0.3826%	0.2596%	35.07	37.62
55	148.98	153.95	0.5366%	0.3600%	30.31	32.68
60	139.59	145.16	0.7607%	0.5462%	25.72	27.88
65	128.13	134.33	1.1113%	0.8176%	21.33	23.29
70	114.43	121.12	1.6572%	1.2451%	17.20	18.93
75	98.49	105.44	2.6043%	2.0005%	13.39	14.86
80	80.84	87.65	4.3403%	3.4148%	9.98	11.18

This assumption is used to measure the probabilities of members dying after retirement. The projection to 2026 is the margin for mortality improvement.

Post-retirement disabled mortality: RP-2014 Disabled Retiree Annuitant Table projected to 2026 using projection scale MP-2017.

***Pre-retirement mortality*:** RP-2014 Employee Mortality Table projected to 2026 using projection scale MP-2017 and multiplied by a factor of 50%.

These mortality tables were updated for the December 31, 2017 valuation.

Disability Rates: No future disability retirements are assumed to occur, beginning with the December 31, 2017 valuation.

Miscellaneous and Technical Assumptions
December 31, 2018

Marriage Assumption:	100% of males and 100% of females are assumed to be married for purposes of death-in-service benefits. Male spouses are assumed to be three years older than female spouses.
Pay Increase Timing:	Beginning of (Fiscal) year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.
Decrement Timing:	Decrements are assumed to occur mid-year.
Eligibility Testing:	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year in the middle of the year (coincident with timing of decrements).
Decrement Relativity:	Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.
Decrement Operation:	Disability and mortality decrements do not operate during the first five years of service. Disability and withdrawal decrements do not operate during retirement eligibility.
Normal Form of Benefit:	The assumed normal form of benefit is the straight life form.
Option Factors:	Option factors are based upon 7.0% interest and the 1971 Group Annuity Mortality Table with a 90% Male/10% Female Blend.
Incidence of Contributions:	Contributions are assumed to be received at the end of the year based upon the computed dollar amount of contributions shown in the report.
Benefit Service:	Exact fractional service is used to determine the amount of benefit payable.
Administrative Expenses:	$60,000 is assumed to be included directly in future annual employer contributions to account for administrative expenses.
Data Adjustments:	One benefit recipient who had two different pension types due to an EDRO is now being valued as one record.

Glossary

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

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

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

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

Actuarial Equivalent. A single amount or series of amounts of equal value to another single amount or series of amounts, computed on the basis of the rate(s) of interest and mortality tables used by the plan.

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.

Funding Value of Assets (also referred to as valuation assets or actuarial value of assets). The value of current plan assets recognized for valuation purposes.

Normal Cost. The annual cost assigned, under the actuarial funding method, to 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 further accruals for the 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.

Glossary

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.

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