Waterford Township
Policemen and Firemen Retirement System
Actuarial Valuation Report
December 31, 2018

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July 31, 2019

Retirement Board
Waterford Township
Policemen and Firemen Retirement System
Waterford, Michigan

Dear Board Members:

The results of the December 31, 2018 Actuarial Valuation of the Waterford Township Policemen and Firemen 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 to 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 March 9, 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 of 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 Policemen and Firemen 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 are reasonable for the purpose of this report.

Computed employer contributions shown on page A-1 are based on the Board's policy, which includes a 16-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.

The signing individuals are independent of the plan sponsor.

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,

Kenneth G. Alberts

Brad Lee Armstrong, ASA, EA, FCA, MAAA

KGA/BLA: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 Annual Pay		
	2020	**2019**	**2018**
Normal Cost (NC)			
Age and service pensions	19.96 %	19.96 %	20.12 %
Death-in-service	0.42 %	0.41 %	0.56 %
Disability pensions	2.44 %	2.47 %	2.53 %
Total	22.82 %	22.84 %	23.21 %
Member's Contributions			
Gross contributions	5.00 %	5.00 %	5.69 %
Less prospective refunds	0.25 %	0.25 %	0.24 %
Available for pensions	4.75 %	4.75 %	5.45 %
Township's Normal Cost	18.07 %	18.09 %	17.76 %
Amortization Period*	16 years	17 years	18 years
Unfunded Actuarial Accrued Liabilities (UAAL)			
Retirees and beneficiaries	0.00 %	0.00 %	0.00 %
Active members*	32.09 %	25.08 %	20.90 %
Total	32.09 %	25.08 %	20.90 %
Township's Total Contribution Rate Net of Administrative Expenses	**50.16 %**	**43.17%**	**38.66%**
Township's Dollar Contribution for NC and UAAL	**$3,268,794**	**$2,986,883**	**$2,851,743**
Township's Contribution for Administrative Expenses	**60,000**	**60,000**	**N/A**
Township's Dollar Contribution^	**$3,328,794**	**$3,046,883**	**$2,851,743**

** Level dollar amortization.*

^ Computed at the end of the calendar year, based on the valuation payroll projected to the end of the contribution year, and adjusted for interest.

Alternative Payment Timing	Contribution
End of Fiscal Year (current method)	$ 3,328,794
Middle of Fiscal Year #	3,221,836
Beginning of Fiscal Year	3,118,308

 # Equivalent to making 12 monthly contributions in the amount of $268,486.

Actuarial Balance Sheet – December 31, 2018

Present Resources and Expected Future Resources

A.	Valuation assets	
	1. Net assets from System financial statements (market value)	$ 87,358,531
	2. Valuation adjustment	4,776,519
	3. Valuation assets	92,135,050
B.	Actuarial present value of expected future employer contributions*	
	1. For normal costs	8,238,943
	2. For unfunded actuarial accrued liabilities	20,556,106
	3. Total	28,795,049
C.	Actuarial present value of expected future member contributions	2,381,895
D.	Total Actuarial Present Value of Present and Expected Future Resources	$123,311,994

* *Excluding administrative expenses.*

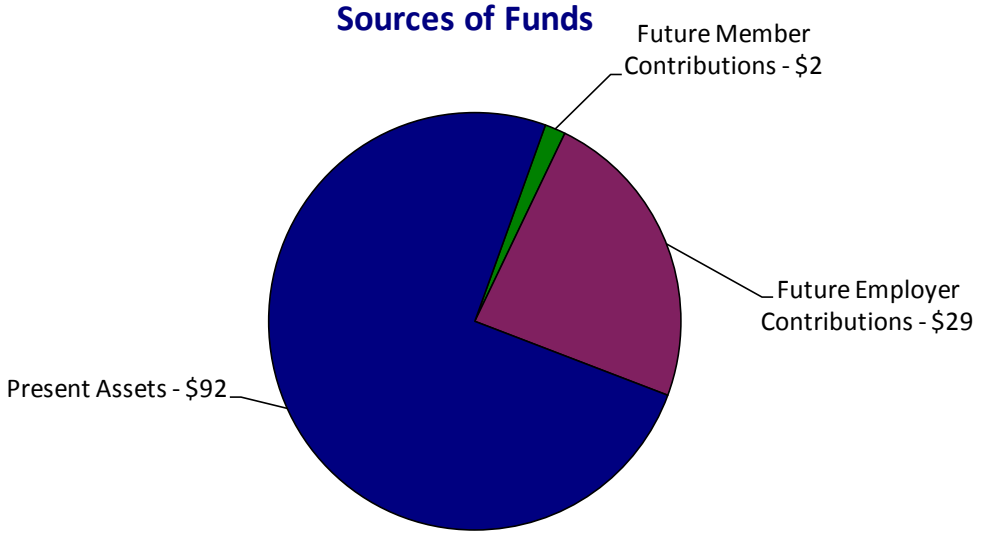
Actuarial Present Value of Expected Future Benefit Payments and Reserves

A.	To retirees and beneficiaries	$ 74,275,545
B.	To vested terminated members	558,296
C.	To present active members	
	1. Allocated to service rendered prior to valuation date	37,857,315
	2. Allocated to service likely to be rendered after valuation date	10,620,838
	3. Total	48,478,153
D.	Total Actuarial Present Value of Expected Future Benefit Payments	$123,311,994

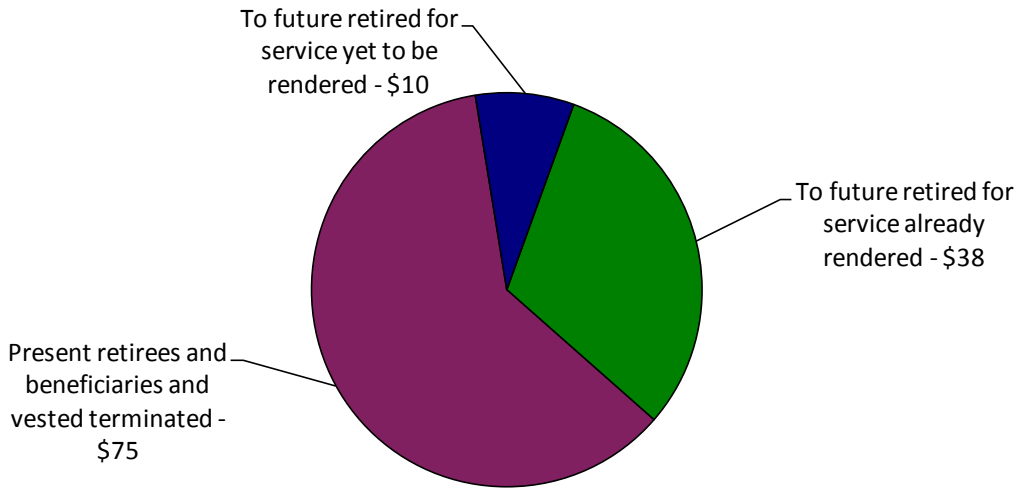
Financing $123 Million of Benefit Promises
December 31, 2018

(In Millions)

Sources of Funds



Uses of Funds



Comments

Experience: Experience during the year ending December 31, 2018 was less favorable than expected. The primary sources of the favorable experience were as follows:

- Investment return (the recognized rate of return was 4.18% on a Funding Value basis compared with a 6.75% assumed rate of return);
- More disability retirements than expected; and
- Less post retirement deaths than expected.

Losses were partially offset by gains resulting from salary increases that were smaller than expected (there was an observed increase in pay of 1.9% for those active at the beginning and end of the year versus an expected increase of 5.0%).

In aggregate, unfavorable experience exceeded favorable experience resulting in an overall experience loss of $3,137,022 which is approximately 2.85% of the beginning of year accrued liabilities.

Investment Return: Assets yielded an approximate rate of return of (6.26)% on a market value basis for the year ending December 31, 2018. While this is lower than the 6.75% investment return assumption, the valuation employs a smoothing process that recognizes 25% of this year's market loss plus 25% of each of the last three years of market gains and losses. Overall, the aggregate recognized rate of return on valuation assets was a positive 4.18%. Please refer to page B-16 for more detail.

Amortization Period: Unfunded accrued liabilities were amortized over a closed level dollar 16-year period (original period of 22 years as a level percent-of-payroll began with the December 31, 2012 valuation and ends with the December 31, 2033 valuation determining contributions for the fiscal year 2035). This closed period was adopted at the October 2013 Board meeting. Due to the closure of this System, this policy should be monitored annually and adjusted as needed. No adjustment is recommended this year.

Valuation Results: The funding ratio on a Funding Value of Assets basis decreased from 84.0% to 81.8% (and decreased from 88.5% to 77.5% on Market Value of Assets basis) and the computed dollar contribution increased from $3,046,883 (for Fiscal Year 2019) to $3,328,794 (for Fiscal Year 2020). This dollar amount is assuming the Township is contributing at the end of the fiscal year.

Comments and Conclusion

Duty Disability Under Defined Contribution Plan: As stated in an agreement between Waterford Township and the Michigan Association of Police, Patrol members contributing to the Defined Contribution Plan who suffer a duty disability shall be retired by the retirement Board and provided a benefit in accordance with Act 345. These benefits are to be offset by the balance of the member's 401(a) Defined Contribution Account. In order to value this provision, we projected the 401(a) balance assuming a 12% contribution rate for Fire Grant Members and a 15% contribution rate for all others (total of employer and employee) and 6% interest. All other assumptions (rates of disability, rates of mortality, rates of pay increases, etc.) were the same as for the Defined Benefit Plan and are disclosed in Section C. The total present value of benefits for those members net of their projected 401(a) balances was added to the accrued liability of the plan. This method is a version of aggregate funding with regard to this benefit.

In general, a qualified plan **must** provide retirement benefits and **may** provide certain ancillary benefits such as disability benefits (*IRC regulation 1.401-1(b)(1)(i)*). Since this plan is closed to new hires for retirement benefits, but open for disability benefits, it may not meet the conditions of the regulation in the future, once all active DB members have retired. We recommend the plan continuously review this issue with legal counsel to ensure compliance with IRS regulations.

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.

Outlook for Future: The actuarial value of assets is currently 105% of the market value. This occurs when investment losses scheduled to be recognized in future valuations exceed the investment gains scheduled to be recognized in future valuations. As those losses are recognized, there will be upward pressure on future contributions, offset somewhat by lower normal costs due to the closure of the System other than disability coverage. In addition, grant employees are assumed to decrement at the same rate as other employees. If these employees terminate in mass due to a non-renewal of the funding grant, gains from those terminations (with respect to the potential future duty disability benefit) will occur in the valuation following that activity. For purposes of this valuation, the grant was assumed to be renewed in the future.

Conclusion: The Waterford Township Policemen and Firemen Retirement System is in sound financial condition in accordance with actuarial principles of level dollar funding presuming continued timely receipt of the required contributions.

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 be fully amortized after 16 years; and
2) The funded status of the plan will increase gradually towards a 100% funded ratio.

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
- Declining Active Member Count and Covered Payroll
- Closed Plan Cash-flows Needs

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	13.97	14.76
Ratio of actuarial accrued liability to payroll	18.03	16.68
Ratio of actives to retirees and beneficiaries	0.46	0.52
Ratio of net cash flow to market value of assets	(4.3)%	(4.9)%
Duration of the actuarial liability	11.96	12.36

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, 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 hoped that gains and losses will 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 Ended December 31, 2018
(1) UAAL at start of year	$17,641,910
(2) Normal cost from last valuation (Total)	1,525,226
(3) Actual employee contributions	359,818
(4) Actual employer contributions (paid at end of year)	2,851,743
(5) Interest	1,230,161
(6) Expected UAAL before changes: (1) + (2) - (3) + (4)	17,185,735
(7) New DC members	233,349
(8) Change from revised actuarial assumptions, methods, and benefit provisions	0
(9) Expected UAAL after changes: (5) + (6) + (7)	17,419,084
(10) Actual UAAL at end of year	20,556,106
(11) Gain (loss): (8) - (9)	(3,137,022)

Valuation Date December 31	Experience Gain (Loss) as % of Beginning Accrued Liability
2009	1.8 %
2010	(1.1)%
2011	3.1 %
2012	(2.5)%
2013	5.1 %
2014	1.5 %
2015	1.5 %
2016	0.6 %
2017	1.1 %
2018	**(2.8)%**

Comparative Schedule

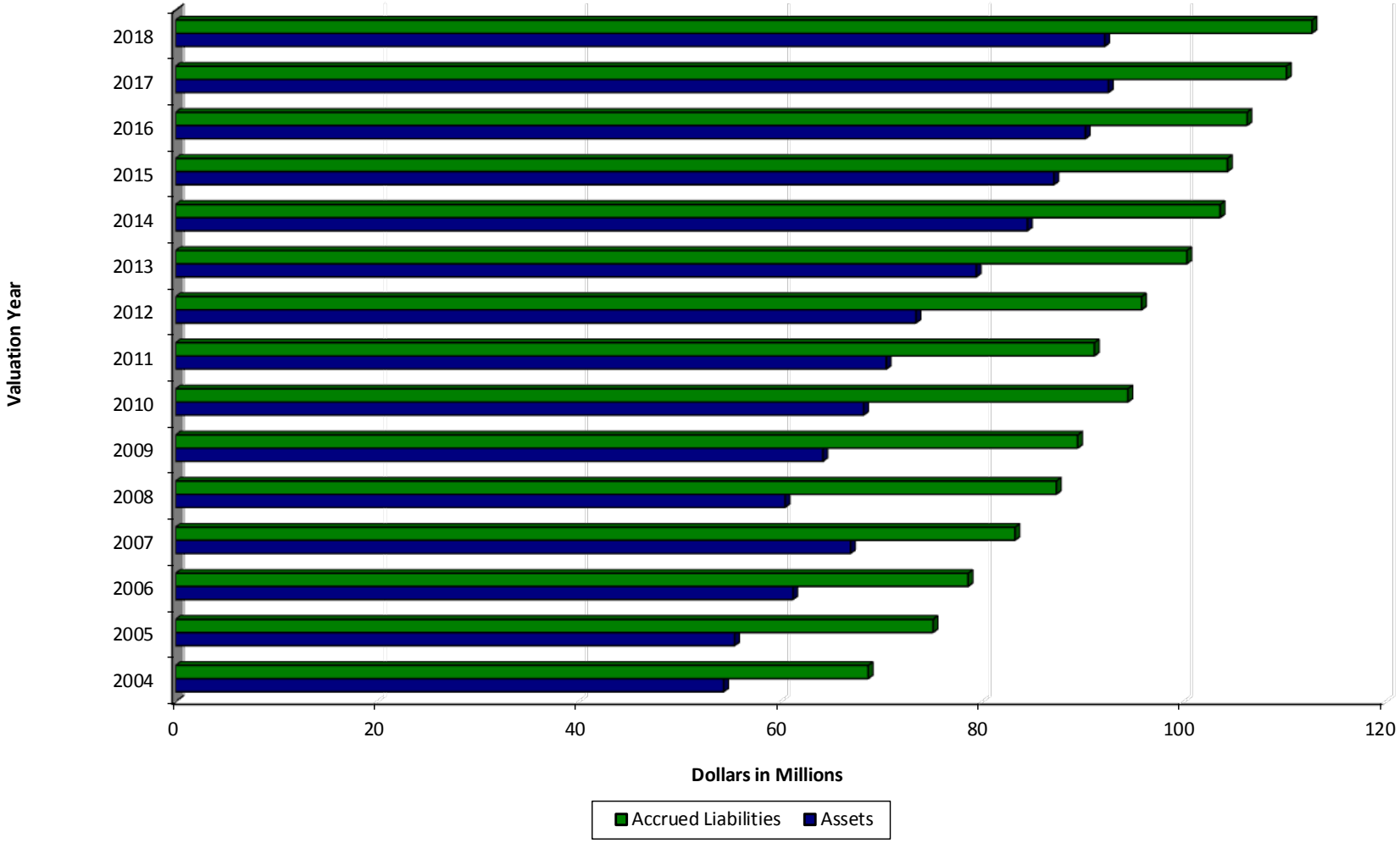
Valuation Date	Fiscal Year	Actuarial Accrued Liabilities	Funding Value of Assets	% Funded	Unfunded Actuarial Accrued Liabilities & Reserves			Township's Contribution Rate		
					Dollars	Amortiz. Period	% of Payroll	Payroll Percents	Dollars Recommended	Dollars Actual
12-31-98*	1999	$ 43,606,490	$ 39,341,442	90.2 %	$ 4,265,048	17	60 %	20.23 %	$ 1,568,120	$ 1,568,120
12-31-99*	2000	47,593,121	44,260,803	93.0 %	3,332,318	16	43 %	19.16 %	1,605,659	1,605,659
12-31-00	2001	52,005,555	48,100,441	92.5 %	3,905,114	15	47 %	19.68 %	1,755,033	1,755,033
12-31-01#	2002	57,645,151	50,655,089	87.9 %	6,990,062	30	80 %	22.76 %	2,153,300	2,153,300
12-31-02	2003	62,184,758	50,344,359	81.0 %	11,840,399	29	129 %	25.34 %	2,510,091	2,510,091
12-31-03	2004	67,536,268	50,556,308	74.9 %	16,979,960	28	162 %	27.27 %	3,078,138	3,078,138
12-31-04	2005	68,684,048	52,252,682	76.1 %	16,431,366	27	164 %	27.61 %	2,975,839	2,975,839
12-31-05*	2006	75,117,790	55,437,735	73.8 %	19,680,055	26	194 %	27.18 %	2,968,691	2,968,691
12-31-06*	2007	78,594,252	61,219,555	77.9 %	17,374,697	25	175 %	25.97 %	2,775,163	2,775,163
12-31-07*	2008	83,243,210	66,933,522	80.4 %	16,309,688	24	158 %	23.79 %	2,638,538	2,638,538
12-31-08	2009	87,342,563	60,449,461	69.2 %	26,893,102	23	247 %	29.41 %	3,451,506	3,451,506
12-31-09	2010	89,458,873	64,196,851	71.8 %	25,262,022	22	229 %	28.79 %	3,416,401	3,416,401
12-31-10	2012	94,441,518	68,226,205	72.2 %	26,215,313	21	292 %	33.37 %	3,356,274	3,356,274
12-31-11*@	2013	91,114,884	70,482,994	77.4 %	20,631,890	19	254 %	37.40 %	3,251,498	3,251,498
12-31-12@	2014	95,799,717	73,420,924	76.6 %	22,378,793	22	255 %	36.26 %	3,386,289	3,386,289
12-31-13#	2015	100,292,714	79,398,528	79.2 %	20,894,186	21	246 %	36.53 %	3,263,241	3,263,241
12-31-14@	2016	103,597,715	84,465,043	81.5 %	19,132,672	20	242 %	40.36 %	3,188,351	3,188,351
12-31-15	2017	104,317,428	87,095,743	83.5 %	17,221,685	19	243 %	39.23 %	2,946,541	2,946,541
12-31-16	2018	106,254,992	90,225,196	84.9 %	16,029,796	18	234 %	38.66 %	2,851,743	2,851,743
12-31-17 *#	2019	110,153,757	92,511,847	84.0 %	17,641,910	17	267 %	43.17 %	3,046,883	
12-31-18	**2020**	**112,691,156**	**92,135,050**	**81.8 %**	**20,556,106**	**16**	**329 %**	**50.16 %**	**3,328,794**	

** Changes in benefits.* *# Changes in assumptions.* *@ Changes in methods.*

The Ratio of Funding 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 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 and Accrued Liabilities



2004 Funding Value of Assets Equaled 79.1% of Accrued Liabilities
2018 Funding Value of Assets Equaled 81.8% of Accrued Liabilities

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

SECTION B

SUMMARY OF BENEFIT PROVISIONS AND VALUATION DATA

Brief Summary of Benefit Provisions
December 31, 2018

Eligibility	Amount
Service Retirement	
25 years of service, regardless of age or age 60 regardless of service.	2.5% of AFC times years of service. The maximum benefit at retirement is 75% of AFC.
Type of Average Final Compensation (AFC).	Highest 3 out of last 10 years.
Police Officers and Police Supervisors hired between January 1, 2004 and November 1, 2014. and Firefighters hired between February 12, 2007 and December 31, 2011:	
Normal Retirement eligibility at age 55 with 25 years of service or 60 and 10 years. *Firefighters* can also retire at any age with 30 years of service.	2.3% of AFC times years of service up to 25 years and 1.5 % for each year of service beyond 25 years of service to a maximum of 71% of AFC.
Type of Average Final Compensation (AFC).	Highest 3 out of last 5 years.
Covered Compensation	
Management: Average Final Compensation includes base pay.	
Non-Management: Average Final Compensation includes base pay plus holiday, overtime, and longevity pay, if any.	
Deferred Retirement	
8 years of service for Management & Administrative. *All others:* 10 or more years of service.	Computed as service retirement but based upon service, AFC and benefit formula in effect at termination. Benefit begins at date retirement would have occurred had member remained in employment.
Death After Retirement Survivor's Pension	
Payable to a surviving spouse, if any, upon the death of a retired member who was receiving a straight life pension which was effective July 1, 1975 or later.	Spouse's pension equals 60% of the straight life pension the deceased retiree was receiving.
Non-Duty Death-in-Service Survivor's Pension	
Payable to a surviving spouse, if any, upon the death of a member with 20 or more years of service. (10 years of service for Fire and COAM.)	Accrued straight life pension actuarially reduced in accordance with an Option I election.

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

Eligibility	Amount
Duty Death-in-Service Survivor's Pension	
Payable upon the expiration of Worker's Compensation to the survivors of a member who died in the line of duty.	Same amount that was paid by Worker's Compensation.
Duty Disability	
Payable upon the total and permanent disability of a member in the line of duty. Members of the 401(a) Defined Contribution Plan are eligible for Duty Disability benefits, which are to be offset by the balance of their 401(a) account.	*To Age 55:* 62.5% of AFC. *At Age 55:* Same as Service Retirement Pension with service credit from date of disability to age 55.
Non-Duty Disability	
Payable upon the total and permanent disability of a member with 5 or more years of service.	*To Age 55:* 1.5% of AFC times years of service. *At Age 55:* Same as Service Retirement Pension.
Member Contributions	
	All Members: 5% of pay. Refund of member contributions at retirement permitted. Merrill Lynch Bond Index determines interest rate used in adjusting pension.
Post-Retirement Benefit Increases	
Police and Fire Management & Administrative with 25 years of service at retirement.	Up to 10 annual increases of 2.0% of the original benefit depending upon manager service earned after retirement eligibility. (Each year of manager service in excess of retirement eligibility will entitle a retired manager to 2 annual increases.) Purchased service is used in calculating eligibility for the increases.
Service Purchases	
Fire:	Military service prior to employment may be purchased.
Police Officers and Police Supervisors (as of 1/1/2003):	Military and/or sworn service time may be purchased.

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

Employer Contributions

Employer pays an annual contribution based on an actuarial valuation. The employer's actuarially determined rate covers all costs net of employee contributions.

Deferred Retirement Option Plan (DROP)

Employees in the Police Officer Union are ineligible to participate in the DROP. Effective January 1, 2012, Police Supervisors are ineligible to DROP. Management employees from both Police and Fire are no longer eligible for the DROP, apart from those already participating or grandfathered as of December 31, 2016.

All Others: A member 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. Management DROP participants may continue in covered employment after 5 years of participation, but do not accumulate additional service credit or make member contributions. DROP service for Management participants is included for purposes of eligibility for the escalator. Fire DROP 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 during the DROP period are not included in the computation of the annuity withdrawal reduction. Upon exit from the DROP, the original monthly amount established upon entry in the DROP continues in addition to any other benefits or adjustments.

Membership

Police Officers and Police Supervisors hired prior to 11/1/2014 participate in this plan. Police Officers hired on or after 11/1/2014 participate in a different plan. Firefighters hired prior to January 1, 2012 participate in this plan. Firefighters hired on or after January 1, 2012 participate in a different plan.

Retirees and Beneficiaries Added to and Removed from Rolls

Valuation Date	Added		Removed		Net Increase		Recipients End of Year			
	No.	Annual Pensions*	No.	Annual Pensions*	No.	Annual Pensions*	No.	Active Per Retired	Annual Pensions $	Annual Pensions % of Pay
12-31-94	2	$ 41,750	1	$ 12,024	1	$ 29,726	40	3.2	$ 913,812	15.4%
12-31-95	5	169,807			5	169,807	45	2.9	1,083,619	17.7%
12-31-96	4	171,603	2	43,387	4	128,216	47	2.8	1,211,835	19.2%
12-31-97	1	35,197			1	35,197	48	2.8	1,247,032	18.3%
12-31-98	4	142,508			4	142,508	52	2.7	1,389,540	19.4%
12-31-99	4	158,304			4	158,304	56	2.5	1,547,844	20.0%
12-31-00	11	473,119			11	473,119	67	2.2	2,020,963	24.5%
12-31-01	7	309,566	2	12,121	5	297,445	72	2.0	2,318,408	26.4%
12-31-02	6	280,722	1	18,314	5	262,408	77	1.8	2,580,816	28.0%
12-31-03	2	112,988			2	112,988	79	1.9	2,693,804	25.7%
12-31-04	2	124,967			2	124,967	81	1.8	2,818,771	28.2%
12-31-05	3	107,731	1	22,808	2	84,923	83	1.7	2,903,694	28.6%
12-31-06	7	368,783	1	17,483	6	351,300	89	1.5	3,254,994	32.8%
12-31-07	2	70,478	1	21,268	1	49,210	90	1.6	3,304,204	32.1%
12-31-08	3	110,753	1	30,229	2	80,524	92	1.5	3,384,728	31.0%
12-31-09	2	67,677	2	40,310		27,367	92	1.6	3,412,095	31.0%
12-31-10	20	967,240			20	967,240	112	1.0	4,379,335	48.7%
12-31-11	11 @	485,692	2 #	3,308	9	482,384	121	0.9	4,861,719	60.0%
12-31-12	2	107,504	2	29,823		77,681	121	0.9	4,939,400	56.3%
12-31-13	3	121,877	2	69,094	1	52,783	122	0.9	4,992,183	58.8%
12-31-14	7	281,809	1	35,976	6	245,833	128	0.8	5,238,016	66.4%
12-31-15	18	603,962	2	44,747	16	559,215	144	0.6	5,797,231	81.7%
12-31-16	5 **	246,653	1	20,571	4	226,082	148	0.6	6,023,313	88.1%
12-31-17	6	264,119	0	0	6	264,119	154	0.5	6,287,432	95.2%
12-31-18	**8 ** **	**331,945**	**1**	**45,336**	**7**	**286,609**	**161**	**0.5**	**6,574,041**	**105.2%**

* *Includes post-retirement adjustments.*

** *For valuation purposes it was assumed active members, whose DROP period had expired as of the valuation date, have gone into retirement as of December 31 of that year. There were two (2) such members in 2016 and one (1) in 2018.*

\# *Includes ex-spouse of retired member, as their records were combined because both annuities terminate upon the death of the retiree.*

@ *Does not include an individual whose benefit was counted as part of a retiree's record because both annuities terminate upon the death of the retiree.*

Retirees and Beneficiaries December 31, 2018
Tabulated by Type of Pensions Being Paid

Type of Pension Being Paid*	No.	Annual Pensions
Age and Service Pensions		
Regular	32	$ 893,987
100% Joint & Survivor	3	123,586
Automatic 60% to Spouse	108	5,000,564
Survivor Beneficiary	7	141,542
Totals	150	6,159,679
Disability Pensions		
Non-Duty	1	6,259
Duty	9	363,372
Survivor Beneficiary of Duty Disability Pension	1	44,731
Totals	11	414,362
Total Pensions Being Paid	**161**	**$6,574,041**

* *Includes the following:*
1 member that elected to annuitize DROP accounts under one form of payment but chose another form of payment for the remaining annuity.
An estimated EDRO election for 1 alternate payee.

Retirees and Beneficiaries December 31, 2018
Tabulated by Attained Ages

Attained Ages	No.	Annual Pensions
37	1	$ 27,201
46	1	43,751
48	2	70,474
49	2	99,089
50	1	37,115
51	2	113,901
52	8	284,193
53	2	95,668
54	7	252,177
55	7	307,528
56	6	306,379
57	8	352,980
58	4	181,258
59	4	121,007
60	2	93,806
61	7	346,216
62	5	227,066
63	8	307,138
64	3	183,890
65	9	436,076
66	5	270,590
67	7	346,370
68	4	130,686
69	4	121,609
70	6	231,790
71	2	94,877
72	7	282,358
73	4	119,158
74	3	102,040
75	2	81,400
76	6	216,240
77	6	278,712
78	4	136,961
79	2	62,424
80	4	65,419
81	2	33,543
85	1	26,136
87	1	24,488
92	1	39,203
96	1	23,124
Totals	**161**	**$6,574,041**

December 31, 2018
Tabulated by Attained Ages

Vested Former Members Eligible for a Deferred Benefit

Attained Ages	No.*	Annual Pensions
37	1	$ 9,422
42	1	41,327
Totals	**2**	**$ 50,749**

* *One alternate payee resulting from an EDRO who has not yet begun to receive benefits was added to the rolls for deferred benefits.*

Members Laid-Off Not Currently Eligible for a Deferred Benefit

Attained Ages	No.	Estimated Annual Pensions	Accumulated Contributions
Totals	**0**	**$ -**	**$ -**

Active Members in Valuation
Comparative Schedule

Valuation Date	No.	Valuation Payroll	Average Pay	% Incr. Avg. Pay	Age	Service
12-31-89	121	$ 4,465,326	$36,904	11.1 %	38 yrs.	11.5 yrs.
12-31-90	126	4,899,176	38,882	5.4 %	38.5	12.6
12-31-91	132	5,196,147	39,365	1.2 %	37.2	11.1
12-31-92	128	5,483,737	42,842	8.8 %	37.8	11.4
12-31-93	124	5,473,201	44,139	3.0 %	38.0	11.7
12-31-94	126	5,932,902	47,087	6.7 %	38.4	12.2
12-31-95	129	6,136,260	47,568	1.0 %	38.1	12.2
12-31-96	132	6,316,460	47,852	0.6 %	38.3	12.1
12-31-97	135	6,819,832	50,517	5.6 %	38.9	12.6
12-31-98	139	7,166,824	51,560	2.1 %	38.8	12.5
12-31-99	142	7,748,207	54,565	5.8 %	39.0	12.6
12-31-00	147	8,245,245	56,090	2.8 %	37.6	11.2
12-31-01	142	8,789,388	61,897	10.4 %	38.1	11.6
12-31-02	140	9,202,571	65,733	6.2 %	38.4	11.9
12-31-03	151	10,486,469	69,447	5.7 %	38.7	11.8
12-31-04	145	10,013,118	69,056	(0.6)%	39.6	12.8
12-31-05	142	10,147,098	71,458	3.5 %	40.5	13.8
12-31-06	135	9,927,567	73,538	2.9 %	40.8	14.1
12-31-07	141	10,303,747	73,076	(0.6)%	41.0	14.4
12-31-08	141	10,902,847	77,325	5.8 %	41.6	15.0
12-31-09	145	11,024,364	76,030	(1.7)%	41.9	15.4
12-31-10	117	8,984,506	76,791	1.0 %	43.1	16.3
12-31-11	107	8,107,893	75,775	(1.3)%	43.2	16.5
12-31-12	108	8,780,319	81,299	7.3 %	43.9	17.1
12-31-13	107	8,494,364	79,387	(2.4)%	44.4	17.7
12-31-14*	101	7,890,938	78,128	(1.6)%	44.9	18.3
12-31-15	90	7,094,863	78,832	0.9 %	44.5	17.9
12-31-16	85	6,839,838	80,469	2.1 %	45.2	18.4
12-31-17	80	6,605,568	82,570	2.6 %	45.7	18.9
12-31-18	**74**	**6,251,905**	**84,485**	**2.3 %**	**46.3**	**19.6**

** Valuation Payroll includes adjustment for 27th paycheck during 2014 Fiscal Year.*

Active Members Added to and Removed from Rolls

DB Members

Year	Actual Number Added During Year	Terminations During the Year										Active Members End of Year
		Normal Retirement		Disabled		Died-in-Service		Withdrawal				
								Vested	Other	Total		
		A	E	A	E	A	E	A	A	A	E	
2009	5	1	5.6	0	0.8	0	0.2	0	0	0	1.1	145
2010	0	19	6.1	2	0.7	0	0.2	0	9	9	1.1	117
2011	0	7	6.7	2	0.5	1	0.2	0	1	1	0.8	107
2012	3	1	5.2	0	0.5	1	0.2	0	0	0	0.6	108
2013	2	2	5.7	0	0.5	0	0.2	1	0	1	0.5	107
2014	0	5	6.1	0	0.5	0	0.1	1	0	1	0.6	101
2015	0	11	7.2	0	0.6	0	0.1	0	0	0	0.4	90
2016	0	4*	3.8	0	0.5	0	0.1	1	0	1	0.4	85
2017	0	5	2.0	0	0.6	0	0.1	0	0	0	0.3	80
2018	0	4*	3.1	2	0.6	0	0.1	0	0	0	0.3	74
10-Year Totals	10	59	51.5	6	5.8	2	1.5	3	10	13	6.1	

A = Actual
E = Expected

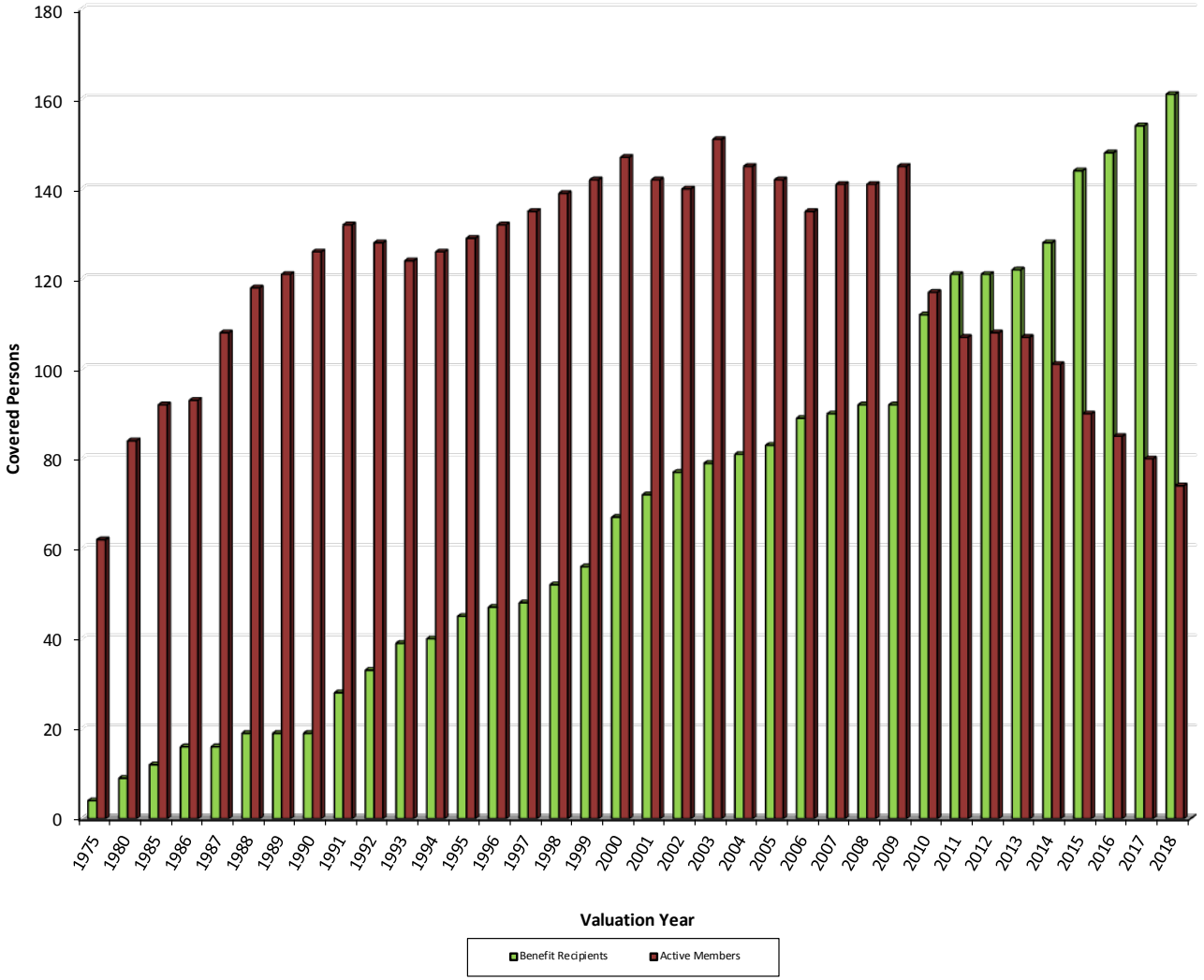
* *For valuation purposes it was assumed active members, whose DROP period had expired as of the valuation date, have gone into retirement as of December 31 of that year. There were two (2) such members in 2016 and one (1) in 2018.*

DC Members

Year	Actual Number Added During Year	Terminations During the Year										Active Members End of Year
		Normal Retirement		Disabled		Died-in-Service		Withdrawal				
								Vested	Other	Total		
		A	E	A	E	A	E	A	A	A	E	
2016	6	0	0.0	0	0.0	0	0.0	0	0	0	0.0	6
2017	30	0	0.0	0	0.0	0	0.0	0	1	1	0.1	35
2018	15	0	0.0	0	0.0	0	0.1	0	4	4	1.2	46
3-Year Totals	51	0	0.0	0	0.0	0	0.1	0	5	5	1.3	

A = Actual
E = Expected

Active Members and Benefit Recipients



Police Active DB Members December 31, 2018
by Nearest Age and Years of Service

Nearest 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
30-34									$ -
35-39		2						2	147,565
40-44				2	2			4	315,307
45-49				6	17			23	1,886,606
50-54				1	8			9	731,080
55-59					1			1	92,981
Totals		**2**		**9**	**28**			**39**	**$3,173,539**

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

Age: 47.3 years
Service: 21 years
Annual Pay: $81,373

Fire Active DB Members December 31, 2018
by Nearest Age and Years of Service

Nearest 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		3	2					5	$ 439,748
40-44		2						2	158,070
45-49				4	2			6	546,013
50-54				9	2	2		13	1,160,412
55-59				4	2			6	515,344
60 & Over						2	1	3	258,779
Totals		**5**	**2**	**17**	**6**	**4**	**1**	**35**	**$ 3,078,366**

** Includes 5 DROP members.*

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

Age: 45.1 years
Service: 18 years
Annual Pay: $87,953

Police Active DC Members December 31, 2018
by Nearest Age and Years of Service

Nearest 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
25-29	6							6	$ 311,255
30-34	1							1	51,716
35-39	4							4	271,388
45-49	1							1	74,291
50-54	2							2	134,113
Totals	**14**							**14**	**$ 842,763**

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

Age: 35.88 years
Service: 1.93 years
Annual Pay: $60,197

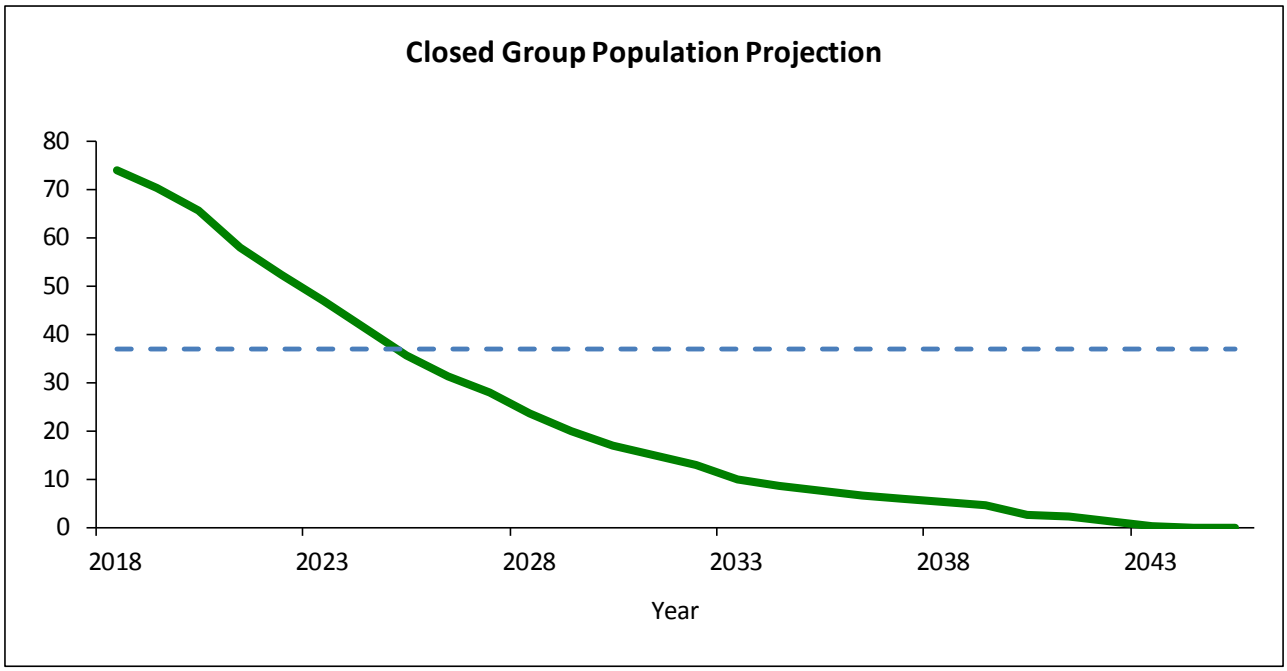
Fire Active DC Members December 31, 2018
by Nearest Age and Years of Service

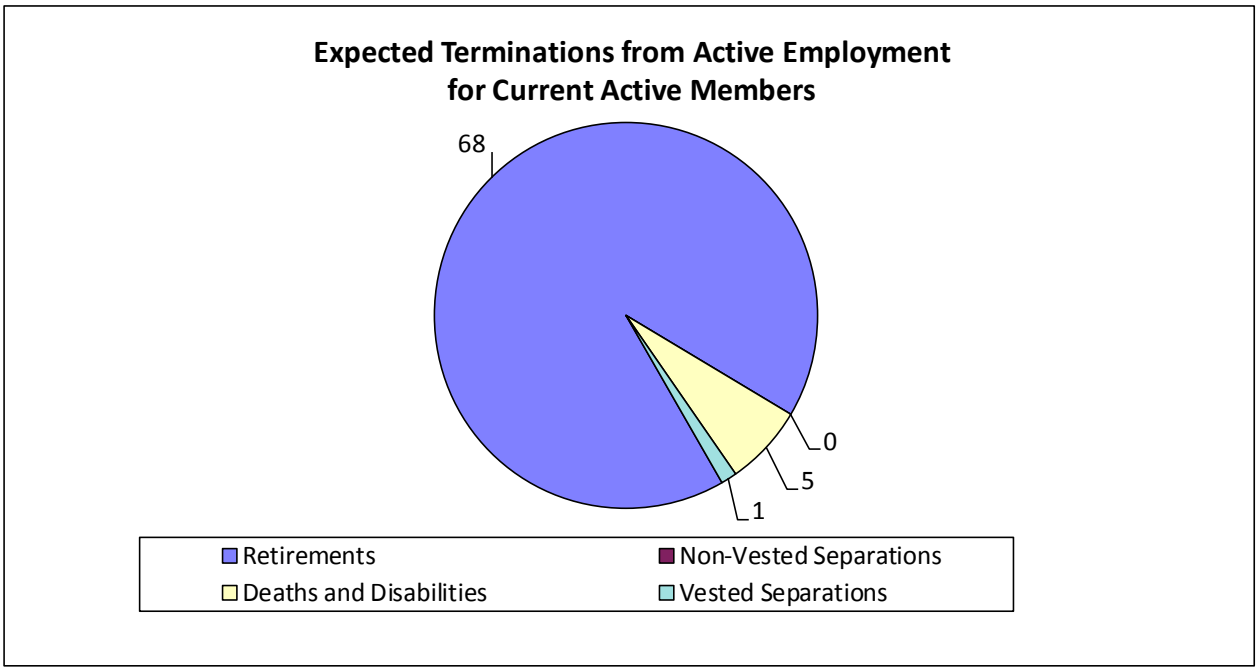
Nearest Age	Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	No	Valuation Payroll
20-24	10							10	$ 513,466
25-29	6							6	342,438
30-34	10	1						11	652,762
35-39	1	2						3	200,501
40-44		1						1	76,146
45-49	1							1	57,019
Totals	**28**	**4**						**32**	**$ 1,842,332**

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

Age: 29.45 years
Service: 2.22 years

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 74 active members. Eventually, 69 people are expected to receive monthly retirement benefits either by retiring directly from active service, or by retiring from vested deferred status. Five (5) people are 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 Assets

Year Ended December 31:	2016	2017	2018	2019	2020	2021
A. Funding Value Beginning of Year	$87,095,743	$90,225,196	$92,511,847			
B. Market Value End of Year	88,760,295	97,481,517	87,358,531			
C. Market Value Beginning of Year	82,844,748	88,760,295	97,481,517			
D. Non-Investment Net Cash Flow	(3,409,675)	(4,328,133)	(4,152,687)			
E. Investment Income						
E1. Market Total: B - C - D	9,325,222	13,049,355	(5,970,299)			
E2. Assumed Rate of Investment Return	7.00%	7.00%	6.75%			
E3. Amount for Immediate Recognition	5,977,363	6,164,279	6,104,396			
E4. Amount for Phased-In Recognition: E1-E3	3,347,859	6,885,076	(12,074,695)			
F. Phased-In Recognition of Investment Income						
F1. Current Year: 0.25 x E3	836,965	1,721,269	(3,018,674)			
F2. First Prior Year	(1,868,068)	836,965	1,721,269	$ (3,018,674)		
F3. Second Prior Year	(239,663)	(1,868,068)	836,965	1,721,269	$ (3,018,674)	
F4. Third Prior Year	1,832,531	(239,661)	(1,868,066)	836,964	1,721,269	$ (3,018,673)
F5. Total Recognized Investment Gain Before Corridor	561,765	450,505	(2,328,506)	(460,441)	(1,297,405)	(3,018,673)
G. Funding Value End of Year						
G1. Preliminary Funding Value End of Year: A+D+E3+F5	90,225,196	92,511,847	92,135,050			
G2. Upper Corridor Limit: 120% x B	106,512,354	116,977,820	104,830,237			
G3. Lower Corridor Limit: 80% x B	71,008,236	77,985,214	69,886,825			
G4. Funding Value End of Year	**90,225,196**	**92,511,847**	**92,135,050**			
G5. Total Recognized Investment Income after Corridor	561,765	450,505	(2,328,506)			
H. Difference between Market & Funding Value: B-G	(1,464,901)	4,969,670	(4,776,519)	(4,316,078)	(3,018,673)	0
I. Recognized Rate of Return	**7.66%**	**7.51%**	**4.18%**			
J. Market Value Rate of Return	11.49%	15.07%	(6.26)%			
K. Ratio of Funding Value to Market Value	101.65%	94.90%	105.47%			

The Funding Value of Assets recognizes assumed investment income (line E2) fully each year. Differences between actual and assumed investment income (line E3) are phased-in over a closed 4-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 lesser 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 less than Market Value. If recognized and assumed rates of investment income are exactly equal for 3 consecutive years, the Funding Value will become equal to Market Value.

Summary of Current Asset Information

Balance Sheet

Current Assets		Reserve for	
Cash & equivalent	$ 3,996,381		
Fixed income	15,385,925		
Equities	66,772,636	Member contributions	$ 6,030,250
Real estate	783,025	Employer contributions	58,179,652
Foreign investments	0	Retired benefit payments	23,148,631
Other	1,149,069	Undistributed income	0
Total	$88,087,036	Total Market Value	$ 87,358,533
Accounts Payable	(728,505)		
Funding Adjustment	4,776,519	Funding Adjustment	4,776,519
Total Valuation Assets	$92,135,050	Total Valuation Assets*	$ 92,135,052

** $2 difference due to rounding.*

Receipts and Disbursements

	2018	2017
Valuation Assets - January 1	$92,511,847	$90,225,196
Receipts		
Member contributions	359,818	381,439
Employer contributions	2,851,743	2,946,541
Recognized investment income	4,262,512	7,073,283
Total	$ 7,474,073	$10,401,263
Disbursements		
Benefit payments	$ 7,289,656	$ 7,656,113
Refund of member contributions	0	0
Administrative expenses*	74,592	458,499
Investment expenses	486,622	0
Total	$ 7,850,870	$ 8,114,612
Valuation Assets - December 31	$92,135,050	$92,511,847
Ratio of net investment income to mean assets	4.18%	7.51%

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

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 he is, in effect, handed an "IOU" which reads: "The Retirement System promises to pay you one unit of pension 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."

Section 9(2) of Act 345 is also directed to the question:

> "Sec. 9(2). - - - For the purpose of creating and maintaining a fund for the payment of the pensions and other benefits payable hereunder the said city, village or municipality, subject to the provisions of this act, shall appropriate, at the end of such regular intervals as may be adopted, quarterly, semi-annually, or annually, an amount sufficient to maintain actuarially determined reserves covering pensions payable or which might be payable on account of service performed and to be performed by active members and pensions being paid retired members and beneficiaries - - -."

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).

Basic Financial Objective and Operation of the Retirement System

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 a 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 pension 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

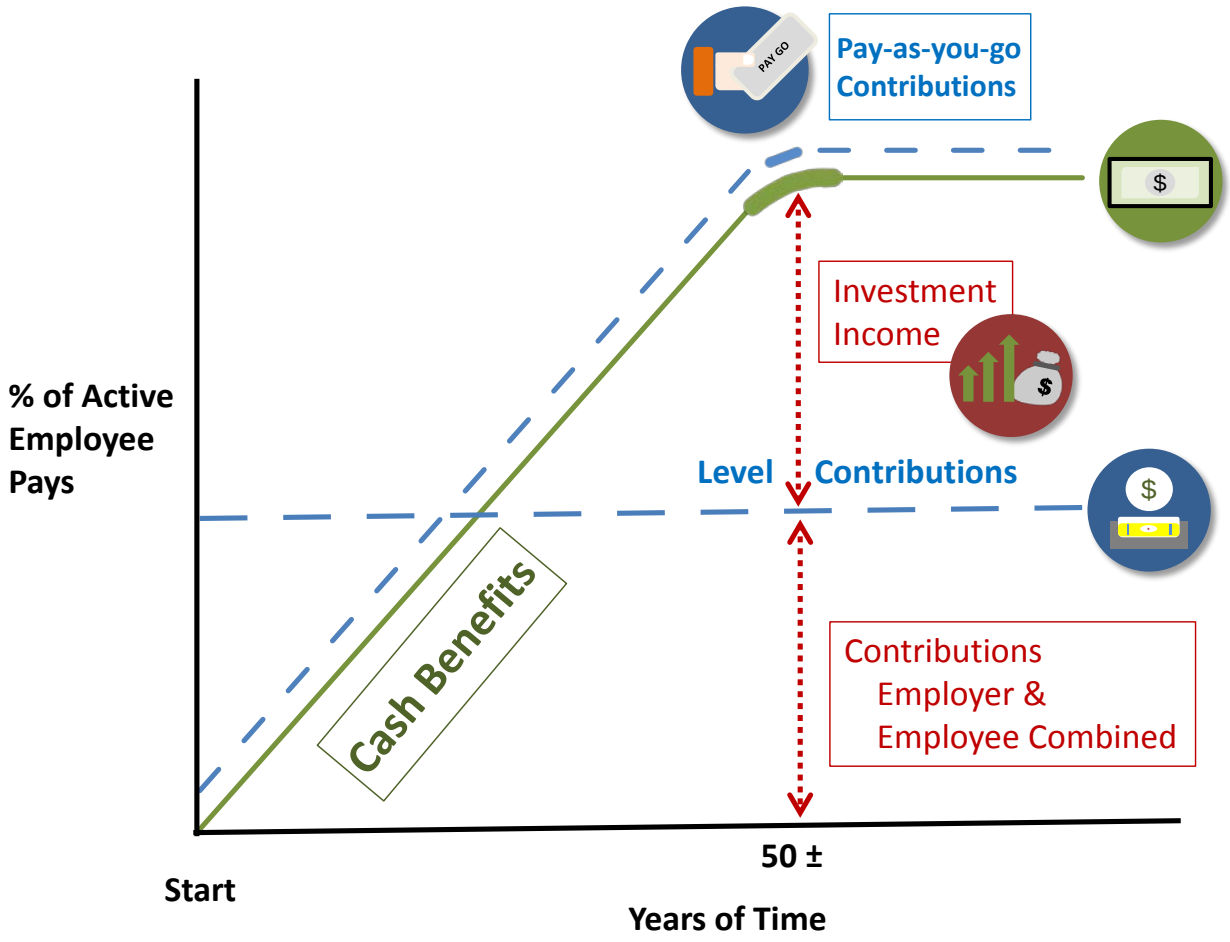
... plus ...

Investment earnings on retirement system assets

... minus ...

The **Expenses** of operating the program.

***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

Methodology

***Actuarial Cost Method*.** Normal cost and the allocation of benefit values between service rendered before and after the valuation date for members of the DB plan was 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; based on the benefits payable to each member.

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

Disability Benefits potentially payable to members of the DC plan are funded by adding the expected net present value of future benefits to the System's accrued liabilities for DB members.

***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 16 years. 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.

Lump Sum Loading. Management member liabilities have been increased by 6% as an estimate of payroll activity not included in reported data.

Rationale. The rationale for the assumptions is the 2017 experience review. Assumptions are forward-looking.

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.

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

- long-term rates of investment return
- patterns of pay increases to members
- rates of mortality among members, retirees and beneficiaries
- rates of withdrawal of active members
- rates of disability among members
- the age patterns of actual retirement

In a 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 rate of investment return was 6.75% a year net of administrative expenses, compounded annually. This assumption is used to make money payable at one point in time equal in value to a different amount of money payable at another point in time.

Experience over the last 5 years has been as illustrated below:

	Year Ended December 31					5-Year
	2018	2017	2016	2015	2014	Average*
Rate of investment return	4.2%	7.5%	7.7%	7.5%	8.9%	7.1%
Increase in average pay	2.3%	2.6%	2.1%	0.9%	(1.6)%	1.2%
Real rate of return	1.9%	4.9%	5.6%	6.6%	10.5%	5.9%

* *Compound 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 realized 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***.

Sample Salary Adjustment Factors used to project current salaries are shown below:

Sample Ages	Percent Increase in Salary During Next Year		
	Economic	Promotion & Longevity	Total
20	3.50%	7.9%	11.4%
25	3.50%	5.8%	9.3%
30	3.50%	4.0%	7.5%
35	3.50%	2.9%	6.4%
40	3.50%	2.1%	5.6%
45	3.50%	1.5%	5.0%
50	3.50%	1.0%	4.5%
55	3.50%	0.5%	4.0%
60	3.50%	0.1%	3.6%
Ref		173	

The rate of price inflation 2.50% per annum.

Actuarial Assumptions Used for the Valuation

Probabilities of retirement for members eligible to retire were:

Percents of Active Members Retiring Within Next Year	
Years of Service	Police-Fire
25	35%
26	30%
27	30%
28	30%
29	30%
30	30%
31	30%
32	30%
33	30%
34	40%
35 & over	100%

Percents of Active Members Retiring Within Next Year	
Age	Police-Fire
60	40%
61	40%
62	40%
63	40%
64	40%
65	40%
66	35%
67	25%
68	25%
69	25%
70	25%
71	25%
72	25%
73	25%
74	25%
75 & over	100%

All members are eligible for retirement after attaining age 60 or with 25 years of service regardless of age. Police Officers and Police Supervisors hired after January 1, 2004 are eligible after attaining age 55 with 25 years of service or age 60 with 10 years of service. The retirement probabilities above apply after eligibility is reached.

DROP Plan Assumptions: Retirement probabilities were reduced by 60% in the first 5 years and increased by 60% in the second 5 years of eligibility, and for Police Supervisors and Fire members set to 100% in the 33rd year of service.

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

Sample Ages	% of Active Members Separating Within Next Year
20	4.8%
25	4.6%
30	4.0%
35	2.4%
40	0.5%
45	0.0%
50	0.0%
55	0.0%
60	0.0%

These rates were first used for the December 31, 2017 valuation.

Actuarial Assumptions Used for the Valuation

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.

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

Disability Rates: This assumption is used to measure the probabilities of members dying before retirement and the probabilities of each benefit being made after retirement.

Sample Ages	Probability of Becoming Disabled Within Next Year	
	Men	Women
20	0.11%	0.11%
25	0.11%	0.11%
30	0.14%	0.14%
35	0.26%	0.26%
40	0.39%	0.39%
45	0.74%	0.74%
50	1.18%	1.18%
55	1.62%	1.62%
60	2.90%	2.90%

Fifty percent of future disability retirements were assumed to be non-duty related and 50% were assumed to be duty related. These rates were decreased by 5% for the December 31, 2017 valuation.

Miscellaneous and Technical Assumptions
December 31, 2018

Marriage Assumption:	100% of members are assumed to be married for purposes of death-in-service benefits. 90% of the active members are assumed to be married at retirement and death for purposes of the automatic survivor benefit. 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 on the date the decrement is assumed to occur.
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 5 years of service or during retirement. Mortality does operate during retirement.
Normal Form of Benefit:	The assumed normal form of benefit at retirement is the 60% joint and survivor form for married members and straight-life for single members.
Option Factors:	Option factors are based upon 7.0% interest and the 1971 Group Annuity Mortality Table for males and the 1971 Group Annuity Mortality Table setback 5 years for females. The interest rate used for annuity withdrawal is based on the Merrill Lynch Corporate and Government Master Bond Average for the month of May preceding retirement.
Incidence of Contributions:	Contributions are assumed to be received at the end of the calendar year based upon the computed percent of payroll shown in this report, and the payroll projected to the time contributions are made.
Benefit Service:	Service nearest whole year is used to determine the amount of benefit payable.
Administrative Expenses:	$60,000 is expected to be included in future employer contributions to account for future administrative expenses.
Cost-of-Living Adjustments (COLAs):	All retirees deemed eligible for COLAs are assumed to receive 10 annual increases.

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.

Reserve Account. Account used to indicate that funds have been set-aside for a specific purpose and is 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."