Waterford Township Policemen and Firemen Retirement System

Actuarial Valuation Report and Experience Review

December 31, 2017

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GRS Retirement Consulting

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October 3, 2018

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

Dear Board Members:

The results of the December 31, 2017 Actuarial Valuation and Experience Review 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 review actuarial assumptions, propose updates to those assumptions, measure the System's funding progress and to determine the Township's contribution rate for the fiscal year beginning January 1, 2019 in accordance with established funding policies. The results of the valuation may not be applicable for other purposes. A separate report issued March 26, 2018 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, 2017.

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 valuation was based upon information, furnished by the Township's Treasurer, 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

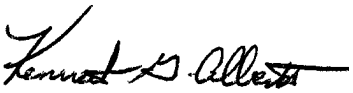
This report has been prepared by individuals who have substantial experience valuing public employee retirement systems and are independent of the plan sponsor and plan administrator. We certify that the information contained in this report is accurate and fairly presents the actuarial position of the 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 B-1 are based on the Board's policy, which includes a 17-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.

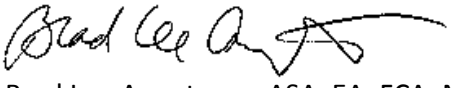
This report replaces our draft report dated August 3, 2018 and incorporates the Board's decisions regarding changes in the assumptions. The Board adopted our proposed demographic assumptions. While the Board did not adopt the economic assumptions we proposed, we believe the assumptions they adopted are reasonable for the purposes of the valuation.

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

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SECTION A

EXPERIENCE REVIEW

Experience Review – Introduction

Each year as of December 31, the actuarial liabilities of the System are valued. In order to perform the valuation, assumptions must be made regarding the future experience of the System with regard to the following risk areas:

- Patterns of **salary increases** to active members.
- Rates of **retirement** among active members.
- Rates of **withdrawal** of active members.
- Rates of **disability** among active members.
- Rates of **mortality** among active members, retirants, and beneficiaries.
- Long-term rates of **investment return** to be generated by the assets of the System.

Assumptions should be carefully chosen and continually monitored. An unrealistic set of assumptions can lead to:

- Understated costs resulting in either an inability to pay benefits when due, or sharp increases in required contributions at some point in the future; or

- Overstated costs resulting in either benefit levels that are kept below the level that could be supported by the computed rate, or an unnecessarily large burden on the current generation of members, employers and taxpayers.

No single set of assumptions will be suitable indefinitely. Things change, and our understanding of things (whether or not they are changing) also changes. The package of assumptions is then adjusted to reflect basic experience trends -- but not random year-to-year fluctuations.

No single experience period should be given full credibility in the setting of actuarial valuation assumptions. When we see significant differences between what is expected from our assumptions and actual experience, our strategy in recommending a change in assumptions is usually to select rates that would produce results somewhere between the actual and expected experience. In this way, with each experience study the actuarial assumptions become better and better representations of actual experience. Temporary conditions that might influence a particular experience study period will not unduly influence the choice of long-term assumptions.

We are recommending certain changes in assumptions. The Board reviewed our recommendations at their September 2018 Board meeting and adopted our proposed demographic assumptions. While the economic assumptions they adopted differed from our proposed economic assumptions, we believe the adopted assumptions are reasonable for use in the valuation.

Experience Review – Comments and Recommendations

Gain/(Loss) Analysis

One measure of the continued appropriateness of the assumptions (or the degree of expected changes) can be found in the annual gains and losses. It is important to remember that because of the size of this plan, it would not be uncommon to have large annual gains and losses even if the assumptions did not need to be updated. The chart below shows the 5-year history of experience gains and losses. In aggregate, there were experience gains each and every year of the measurement period. As the chart shows, liability experience was consistently more favorable than assumed.

Year	Total Gain/(Loss)	Investment	Liability	Beginning of Year Liability (AAL)	Liability G/(L) as a % of AAL
2017	$ 1,208,000	$ 450,505	$ 757,495	$ 106,254,992	0.71%
2016	640,057	561,765	78,292	104,317,428	0.08%
2015	1,512,108	418,481	1,093,627	103,597,715	1.06%
2014	1,460,559	1,453,934	6,625	100,292,714	0.01%
2013	4,871,115	2,469,599	2,401,516	95,799,717	2.51%

The magnitude of the liability gains suggest that large changes in the demographic assumptions (excluding mortality) are not expected, unless the Board is aware of upcoming changes in employment conditions that are expected to change members' behavior.

Demographic Assumptions

Pay increases. We have included the merit and longevity pay increases with the demographic assumptions due to the data-related manner in which this assumption is studied. The large gains shown above are mostly attributable to liability experience resulting from salary increases. Over the last five years, average pay increases have been less than assumed. The table below shows the expected pays for members active at both the beginning and end of the year compared to the actual pays. For the 5-year period ending in 2017, pay increases were never greater than expected. For the entire period, pays grew by 5% less than expected, based on the assumptions used during the period.

	Total Payroll		
Year	Expected	Actual	Actual/Expected
2017	$ 6,765,652	$ 6,605,568	98%
2016	7,061,679	6,839,838	97%
2015	7,352,763	7,094,863	96%
2014	8,410,064	7,890,939	94%
2013	8,729,895	8,114,165	93%
	$ 38,320,053	$ 36,545,373	95%

Experience Review – Comments and Recommendations

Demographic Assumptions (Concluded)

For a group this size, credible data is difficult to obtain (because the activities of one person can greatly affect the average calculations). In addition, the year to year fluctuation in overtime can also mask pay increase patterns. Although pays increased less than assumed, inflation was also less than assumed during the same time period. The CPI-U increased an average of 1.4% (based on the December to December CPI-U index), which is more than 1.5% per year less than expected. We recommend lowering the inflation assumption, as discussed further on in this report. We do not recommend any changes to the current merit and longevity portion of the pay increase assumption.

Retirement Experience. Over the last 5 years, 27 members retired compared with 25 expected. Over the past 10 years, 56 members retired compared with 54 expected. In total over the period we believe that rates of retirement are sufficiently close to expectations to recommend continuing the same base rates of retirement. However; on a year-by-year basis, less members retired than assumed in the earlier years followed by more members retiring than expected in the final year. We believe this is related to the DROP program, which was intended to delay retirements. The current assumption is that the DROP plan will reduce the base retirement rates by 50% in the first five years of eligibility and increase the base retirement rates by 50% in the next five of eligibility. We propose increasing the change to 60% (reducing base retirement rates by 60% in the first five years of eligibility and increasing base rates by 60% in the next 5 years of eligibility).

Rates of Withdrawal. There were 3 terminations over the 5-year period versus 2 expected; however, over a 10-year period there were 13 while only about 7 were expected. We recommend increasing age-based rates of withdrawal by 20%.

Disability Rates. There have not been any disability retirements in the past 5 years while 3 were expected, in the past 10 years there were 5 versus 6 expected. We, therefore, recommend reducing assumed rates of disability by 5%

Death-in-Service Mortality Rates. There were 2 members who died in service, which is approximately what was expected. We are recommending that mortality tables be updated to the RP-2014 Employee Mortality Table projected to 2026 using projection scale MP-2017.

Retired Life Mortality. Based on the size of the population, we believe the actual mortality experience is not credible for determining assumed mortality rates. Instead, we recommend a change to the RP-2014 Healthy Annuitant Mortality Table projected to 2026 using projection scale MP-2017. These are the newest tables and projection scale released by the Society of Actuaries and better account for the mortality improvements of coming generations. The new mortality rates produce life expectancies that are longer for both males and females. In addition, we also recommend changing the mortality assumption for disabled lives to the RP-2014 Disabled Retiree Annuitant Mortality Table projected to 2026 using projection scale MP-2017.

Change to Actuarial Accrued Liabilities. The recommended changes in demographic assumptions resulted in accrued liabilities increasing by approximately $700,000 before reflecting the changes in inflationary pay increases and investment return.

Experience Review – Comments and Recommendations

Economic Assumptions

Economic assumptions include long-term rates of investment return and wage inflation (the across-the-board portion of salary increases). Unlike demographic activities, economic activities do not lend themselves to analysis solely on the basis of internal historical patterns because both salary increases and investment return are more affected by external forces; namely inflation, general productivity changes and changes in financial markets. Estimates of economic activities are generally selected on the basis of the expectations in an inflation-free environment and then both are increased by some provision for long-term inflation.

If inflation and/or productivity increases are higher than expected, actual rates of salary increase and investment return are likely to exceed the assumed rates. Salaries increasing faster than expected produce unexpected liabilities. Investment return exceeding the assumed rates (whether due to manager performance, change in the mix of assets, or general inflation) results in unanticipated assets. To the extent that inflation, productivity, and other factors have about the same effect on both sides of the balance sheet, these additional assets and liabilities can offset one another over the long-term.

Price Inflation

We have performed our economic analysis using a building block method. This method starts with an analysis of price inflation. Once a recommended price inflation assumption is established, we then:

1) Add an assumption of real return to get to the nominal assumed rate of investment return; or
2) Add real wage growth to get to the assumed wage inflation and then add a merit and longevity increase assumption to get to the total assumed pay increases.

The table below shows the average price inflation over various periods:

Fiscal Year	Average Annual Increase in CPI-U
2013	1.50 %
2014	0.76 %
2015	0.73 %
2016	2.07 %
2017	2.11 %
3-Year Average	1.64 %
5-Year Average	1.43 %
10-Year Average	1.62 %
20-Year Average	2.15 %
25-Year Average	2.24 %
30-Year Average	2.57 %
40-Year Average	3.54 %
50-Year Average	4.09 %

Price Inflation (Continued)

As the table shows, experience, both short-term and long-term (up to 30 years), has been below the current assumption of 3.00%. In addition, we can see that rates of inflation have been declining over the last 50 years.

So as not to give undue weight to recent experience, we also consider future expectations. One measure is the spread between yields on U.S. Treasuries and U.S. TIPS. This calculation varies depending on the maturity selected. Moreover, there may be other influences on the result such as a risk premium on Treasuries and a liquidity premium on TIPS. We, therefore, also consider other sources. The TIPS analysis and a description of a few of the additional sources follow.

The December 31, 2017 yield for a 20-year inflation indexed Treasury bond (20-year TIPS) was 0.68% plus actual inflation. The yield for a non-indexed 20-year Treasury bond was 2.60%. The difference between these two yields, 1.92%, gives an approximate measure of the market's expectation of price inflation over the next 20 years.

The Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. Their recent forecast, from the first quarter of 2018, is for inflation over the following ten years to average 2.25%.

We reviewed the forward-looking inflation assumptions used by the eight independent investment consulting firms with longer-term time horizons. The samples from these firms ranged from 2.00% to 2.50%, with an average of 2.27%.

Another point of reference is the 2017 Social Security Trustees Report which assumed three scenarios of ultimate annual increases in CPI of 3.20%, 2.60%, and 2.00% for the low-cost, intermediate, and high-cost scenarios. The Social Security Trustees Report uses the ultimate rates for their 75-year projections, much longer than the longest horizon we can discern from Treasuries and TIPS, but also longer than the effective time horizon for ERS.

The following table summarizes future expectations of inflation from several sources. In every case, expectations of future inflation are below the current assumption. When combining this analysis with historical observation, we recommend lowering price inflation from 3.00% to 2.25%. Although our specific recommendation is 2.25%, we believe an inflation assumption in the range of 2.00% to 2.50% is reasonable.

Experience Review – Comments and Recommendations

Price Inflation (Concluded)

Summary of Forward-Looking Compound Annual Price Inflation Forecasts (From Professional Experts in Forecasting Inflation)	
Investment Consultants and Forecasters	
Average of 8 in 2017 GRS Survey	**2.27%**
Excess Yield of Nominal Treasuries Over Inflation Indexed, December 2017	
30-Year Treasury Constant Maturity – Nominal	2.77%
30-Year Treasury Constant Maturity – Inflation Indexed	0.80%
Difference (30-Year Implied Price Inflation)	**1.97%**
20-Year Treasury Constant Maturity – Nominal	2.60%
20-Year Treasury Constant Maturity – Inflation Indexed	0.68%
Difference (20-Year Implied Price Inflation)	**1.92%**
10-Year Treasury Constant Maturity – Nominal	2.40%
10-Year Treasury Constant Maturity – Inflation Indexed	0.50%
Difference (10-Year Implied Price Inflation)	**1.90%**
Federal Reserve Bank of Cleveland	
30-Year Expectation on December 13, 2017	**2.23%**
20-Year Expectation on December 13, 2017	**2.12%**
10-Year Expectation on December 13, 2017	**1.96%**
Quarterly Survey of Professional Economic Forecasters	
1Q2018 Federal Reserve Bank of Philadelphia 10-Year Forecast	**2.25%**
Federal Reserve Board's Federal Open Market Committee	
Long-run Price Inflation Objective (Since Jan 2012)	**2.00%**
Congressional Budget Office: *The Budget and Economic Outlook*	
Overall Inflation (January 2017)	**2.40%**
2017 Social Security Trustees Report	
GDP Deflator Ultimate Intermediate Assumption	**2.20%**
CPI-W Ultimate Intermediate Assumption	**2.60%**

Experience Review – Comments and Recommendations

Wage Inflation

Real Wage Growth is the increase in average salary levels in excess of pure price inflation (i.e., increases due to changes in productivity levels, supply and demand in the labor market and other macroeconomic factors).

We generally recommend a real wage growth inflation assumption in the range of 0.50% to 1.00%.

The table below shows the difference between the increase in National Average Earnings and price inflation over various periods, ending December 2017:

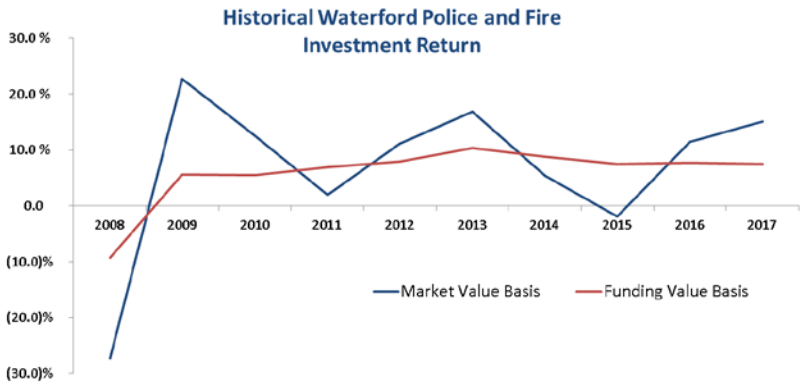
Periods Ending December 2017	Difference Between Increase in National Average Earnings and CPI
Last five (5) years	1.6%
Last ten (10) years	0.8
Last fifteen (15) years	0.9
Last twenty (20) years	1.1
Last twenty-five (25) years	1.1
Last thirty (30) years	0.9

Over the last five years, the increase in average pay for Police and Fire active members has been approximately equal to the rate of price inflation. However, we believe over the long-term, the rate of real wage growth will likely move closer to national averages. We therefore recommend no changes to the current assumption of 1.00% at this time.

Experience Review – Comments and Recommendations

Investment Return

Historical Waterford Police and Fire Investment Return		
Year Ended December 31,	Market Value Basis	Funding Value Basis
2008	(27.2)%	(9.2)%
2009	22.8 %	5.6 %
2010	12.6 %	5.5 %
2011	2.0 %	6.9 %
2012	11.2 %	7.9 %
2013	16.8 %	10.4 %
2014	5.4 %	8.9 %
2015	(2.0)%	7.5 %
2016	11.5 %	7.7 %
2017	15.1 %	7.5 %
5-Year Average	9.4 %	8.4 %
10-Year Average	6.8 %	5.9 %



While the 5-year historical returns for the System have exceeded the assumed rate of return of 7.00%, 10-year historical returns for the System have trailed this assumption. In addition, future capital market expectations have generally been declining over recent past.

We have analyzed the System's asset allocations as of December 31, 2017 with the capital market assumptions from eight nationally recognized investment consultants to model forward-looking expectations. The investment consultants who have shared their capital market assumptions (forward-looking expectations) with us are (in alphabetical order) BNY Mellon, JPMorgan, Marquette, Mercer, NEPC, PCA, RVK, and VOYA. It is important to understand that, in general, the asset classes provided by different investment consultants will not coincide exactly. Moreover, there are differences in investment horizons, price inflation, the treatment of investment expenses, excess manager performance (i.e., alpha), geometric vs. arithmetic averages, and other technical differences.

We have incorporated the assumptions of these eight consultants into our GRS Capital Market Assumption Modeler (CMAM). To the best of our ability, we have adapted the System's investment allocation to fit with the eight consultants' assumptions adjusting for these known differences in assumptions and methodology. In the following charts, all returns are net of investment expenses and have no assumption for excess manager performance (alpha). The results are shown before adjustments for administrative expenses, i.e., gross of administrative expenses.

Both investment expenses and administrative expenses are currently assumed to be covered by investment return. The reported administrative expenses have averaged approximately $60,000 over the last five years. The assumed rate of return will not be adjusted for this activity as administrative expenses will be directly included in future calculated contributions for administrative expenses ($60,000 for the December 31, 2017 valuation).

Experience Review – Comments and Recommendations

Current Asset Allocation

Based on financial information provided to us by the System, the following current asset allocation was used in determining a reasonable range of investment return based on capital market assumptions.

Cash and Short-term	8.06%
Fixed Income	18.92%
Equities	71.73%
Real Estate	1.29%
Total	100.00%

Capital Market Assumption Modeler

The arithmetic expected return developed from the System's current asset allocation is shown in the table below. The CMAM begins with the nominal expected return from each consultant (Column 2), takes out each consultant's price inflation assumption (Column 3) to arrive at the real return (Column 4). We then incorporate a Board-adopted price inflation assumption of 2.50% (Column 5) to get the expected nominal return (Column 6). Average annual expenses as a percentage of market value of assets over the last five years (Column 7) were taken into account to yield expected nominal return net of expenses (Column 8). Note that this return has not yet been adjusted for risk or "volatility drag." We have shown the standard deviation of returns as one measure of the investment risk (Column 9).

Short-Term Investment Consultant	Investment Consultant Expected Nominal Return	Investment Consultant Inflation Assumption	Expected Real Return (2)–(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)	Expected Nominal Return Net of Expenses (6)-(7)	Standard Deviation of Expected Return (1-Year)
(1)	(2)	(3)	(4)	(5)	(6)	(8)	(9)
1	6.33%	2.20%	4.13%	2.50%	6.63%	6.63%	14.08%
2	6.71%	2.50%	4.21%	2.50%	6.71%	6.71%	14.12%
3	6.85%	2.50%	4.35%	2.50%	6.85%	6.85%	13.89%
4	6.88%	2.25%	4.63%	2.50%	7.13%	7.13%	13.97%
5	6.86%	2.21%	4.64%	2.50%	7.14%	7.14%	14.22%
6	6.99%	2.26%	4.73%	2.50%	7.23%	7.23%	12.19%
7	6.77%	2.00%	4.77%	2.50%	7.27%	7.27%	12.87%
8	7.70%	2.25%	5.45%	2.50%	7.95%	7.95%	13.85%
Average	**6.89%**	**2.27%**	**4.62%**	**2.50%**	**7.12%**	**7.12%**	**13.65%**

Experience Review – Comments and Recommendations

Capital Market Assumption Modeler (Continued)

We then compare the probabilities of achieving returns over a 10-year horizon. We compute the 40th, 50th, and 60th percentiles of returns as well as the probability of achieving the current assumption of 7.00% over a 10-year horizon. Alternative probabilities are shown for various assumed rates of return for comparison. Note that the investment horizon for most of the capital market assumption sets is between 5 and 10 years.

Short-Term Investment Consultant	Distribution of 10-Year Average Geometric Net Nominal Return			Probability of exceeding 6.50%	Probability of exceeding 6.75%	Probability of exceeding 7.00%
	40th	50th	60th			
(1)	(2)	(3)	(4)	(6)	(5)	(6)
1	4.60%	5.71%	6.83%	42.90%	40.70%	38.53%
2	4.68%	5.79%	6.91%	43.64%	41.44%	39.26%
3	4.86%	5.96%	7.06%	45.04%	42.78%	40.56%
4	5.13%	6.23%	7.34%	47.54%	45.27%	43.03%
5	5.09%	6.21%	7.34%	47.42%	45.19%	42.98%
6	5.58%	6.54%	7.52%	50.46%	47.86%	45.26%
7	5.49%	6.51%	7.53%	50.07%	47.60%	45.14%
8	5.99%	7.08%	8.18%	55.32%	53.02%	50.71%
Average	**5.18%**	**6.25%**	**7.34%**	**47.80%**	**45.48%**	**43.18%**

The 50th percentile return is also the geometric average return net of investment expenses (this is a characteristic of the lognormal distribution which is the most common distribution used to model investment returns). This is the expected return adjusted for volatility drag and is a reasonable rate of return for purposes of the valuation.

The preferred investment return assumption in the actuarial community is the forward-looking expected geometric return (i.e., 50th percentile). Based upon the average of each of the investment consultants' expectations, this would lead to an investment return assumption of 6.25% using the System's investment current allocation. A less preferred investment return assumption, but still reasonable assumption, is the forward-looking expected arithmetic return (i.e., expected nominal return). Based on the average of each of the investment consultants' expectations, this would lead to an investment return assumption of 7.12% using the System's investment current allocation.

To analyze the relationship between assumed investment return and price inflation in the context of the capital market assumption modeler, one can examine the different scenarios outlined in the chart found on the following page.

Experience Review – Comments and Recommendations

Capital Market Assumption Modeler (Concluded)

Inflation Assumption	Distribution of 20-Year Average Geometric Net Nominal Return (Percentile)			Probability of Exceeding		
	40th	50th	60th	6.50%	6.75%	7.00%
2.25%	4.93%	6.00%	7.09%	45.46%	43.17%	40.90%
2.50%	5.18%	6.25%	7.34%	47.80%	45.48%	43.18%
2.75%	5.43%	6.51%	7.59%	50.15%	47.82%	45.50%

The forward-looking expectations of the eight investment consultants are updated in our model year over year. The CMAM results from the past three years of expectations are shown below (assuming 2.50% price inflation).

	Investment Return for Current Asset Allocation	
CMAM Year	Mean	Median
2015	7.29%	6.39%
2016	7.57%	6.72%
2017	7.12%	6.25%

Proposed Assumptions

Based on our findings, we believe the proposed and Board-adopted economic assumptions are reasonable:

		Current	Proposed	Board Adopted
(A)	**Load for Administrative Expenses**	$0	$60,000	$60,000
(B)	**Price Inflation Assumption (CPI)**	3.00%	2.25%	2.50%
(C)	**Real Wage Growth**	1.00%	1.00%	1.00%
(D)	**Total Payroll Growth (Wage Inflation) (B) + (C)**	**4.00%**	**3.25%**	**3.50%**
(E)	**Real Return**	4.00%	4.25%	4.25%
(F)	**Assumed Rate of Return (B) + (E)**	**7.00%**	**6.50%**	**6.75%**

The Board-adopted change in economic assumptions resulted in accrued liabilities increasing by approximately $2.3 million, in addition to $0.7 million due to changes in demographic assumptions.

SECTION B

VALUATION RESULTS

Computed Contributions for the Fiscal Year Beginning January 1

Contributions for	Contributions Expressed as Percents of Annual Pay		
	2019	**2018**	**2017**
Normal Cost (NC)			
Age and service pensions	19.96 %	20.12 %	20.29 %
Death-in-service	0.41 %	0.56 %	0.55 %
Disability pensions	2.47 %	2.53 %	2.50 %
Total	22.84 %	23.21 %	23.34 %
Member's Contributions			
Gross contributions	5.00 %	5.69 %	5.72 %
Less prospective refunds	0.25 %	0.24 %	0.25 %
Available for pensions	4.75 %	5.45 %	5.47 %
Township's Normal Cost	18.09 %	17.76 %	17.87 %
Amortization Period*	17 years	18 years	19 years
Unfunded Actuarial Accrued Liabilities (UAAL)			
Retirees and beneficiaries	0.00 %	0.00 %	0.00 %
Active members*	25.08 %	20.90 %	21.36 %
Total	25.08 %	20.90 %	21.36 %
Township's Total Contribution Rate Net of Administrative Expenses	**43.17 %**	**38.66%**	**39.23%**
Township's Dollar Contribution for NC and UAAL	**$2,986,883**	**$2,851,743**	**$2,946,541**
Township's Contribution for Administrative Expenses	**60,000**	**N/A**	**N/A**
Township's Dollar Contribution^	**$3,046,883**	**$2,851,743**	**$2,946,541**

** 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)	$ 3,046,883
Middle of Fiscal Year #	2,948,980
Beginning of Fiscal Year	2,854,223

 # Equivalent to making 12 monthly contributions in the amount of $245,748.

Actuarial Balance Sheet – December 31, 2017

Present Resources and Expected Future Resources

A.	Valuation assets	
	1. Net assets from System financial statements (market value)	$ 97,481,517
	2. Valuation adjustment	(4,969,670)
	3. Valuation assets	92,511,847
B.	Actuarial present value of expected future employer contributions*	
	1. For normal costs	9,287,985
	2. For unfunded actuarial accrued liabilities	17,641,910
	3. Total	26,929,895
C.	Actuarial present value of expected future member contributions	2,669,096
D.	Total Actuarial Present Value of Present and Expected Future Resources	$122,110,838

** Excluding administrative expenses.*

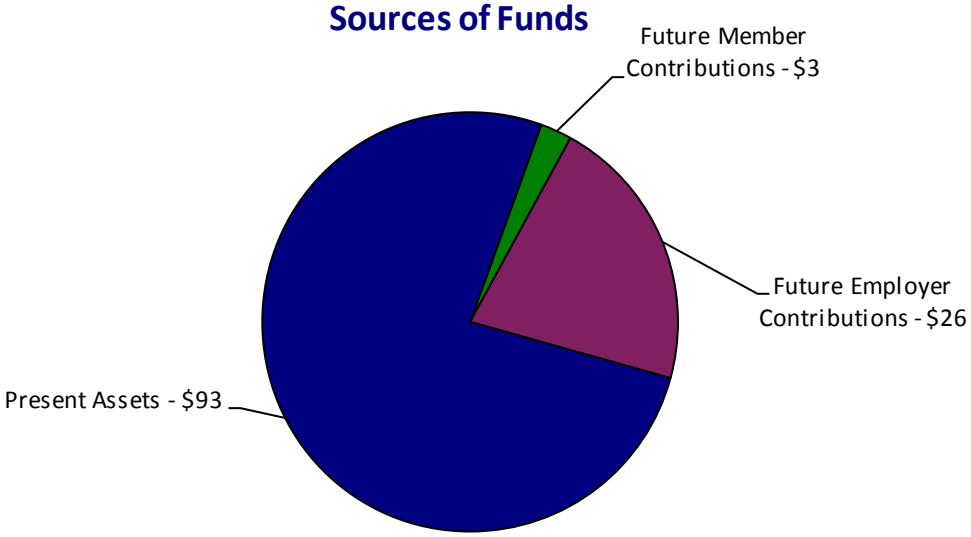
Actuarial Present Value of Expected Future Benefit Payments and Reserves

A.	To retirees and beneficiaries	$ 71,681,938
B.	To vested terminated members	913,262
C.	To present active members	
	1. Allocated to service rendered prior to valuation date	37,558,557
	2. Allocated to service likely to be rendered after valuation date	11,957,081
	3. Total	49,515,638
D.	Total Actuarial Present Value of Expected Future Benefit Payments	$122,110,838

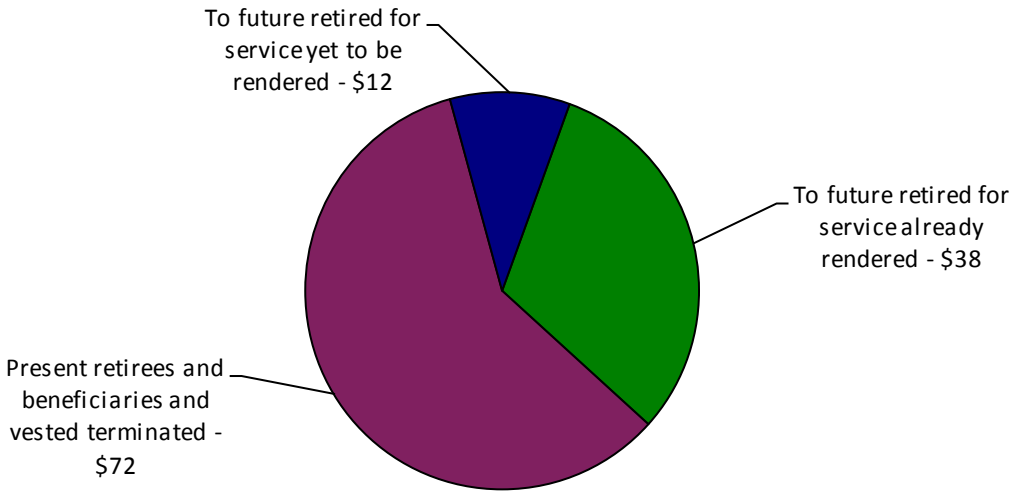
Financing $122 Million of Benefit Promises
December 31, 2017

(In Millions)

Sources of Funds



Uses of Funds



Comments

Experience: Experience during the year ending December 31, 2017 was more favorable than expected. The primary sources of the favorable experience were as follows:

- Salary increases less than assumed (members active at both the beginning and end of the year experienced average salary increases of approximately 3.1% compared with an assumed increase of 5.6%); and
- Investment return (the recognized rate of return was 7.5% on a Funding Value basis compared with a 7.0% assumed rate of return).

Gains were partially offset by losses due to mortality experience (0 deaths versus 2.5 expected).

In aggregate, favorable experience exceeded unfavorable resulting in an overall experience gain of $1,208,000 which is approximately 1.14% of the beginning of year accrued liabilities.

Investment Return: Assets yielded an approximate rate of return of 15.07% on a market value basis for the year ending December 31, 2017. While this is above the 7% investment return assumption, the valuation employs a smoothing process that recognizes 25% of this year's market gain 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 7.51%. Please refer to page C-16 for more detail.

Amortization Period: Unfunded accrued liabilities were amortized over a closed level dollar 17-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 was needed this year.

Valuation Results: Before accounting for plan changes and assumption changes, the funding ratio on a Funding Value of Assets basis increased from 84.9% to 86.4% (and increased from 83.5% to 91.0% on Market Value of Assets basis) and the computed dollar contribution decreased from $2,851,743 (for Fiscal Year 2018) to $2,676,173 (for Fiscal Year 2019). After reflecting the plan and assumption changes, the funded ratio fell to 84.0% (88.5% on Market Value of Assets basis) and the calculated contribution increased to $3,046,883 (for Fiscal Year 2019). This dollar amount is assuming the Township is contributing at the end of the fiscal year.

Methods and Assumptions: This report has been prepared based on the Board-adopted assumptions as discussed in **Section A**. The combined effect of these modified economic and demographic assumptions was an increase of about $3.0 million in accrued liabilities.

Plan Provision Changes: The contribution rate for Police Patrol members decreased from 7% to 5% for the December 31, 2017 valuation. In addition, the duty disability benefit to age 55 was increased from 50% to 62.5% for Fire members. These plan changes lead to an increase in accrued liabilities of about $53,000 and an increase in the computed contribution of approximately $61,000.

Comments

Below is the reconciliation of the Employer Contribution Changes. Note the order of evaluation affects the magnitude of subsequent changes. As a result, certain items may be different than shown in the draft report as a result of the different economic assumptions.

Reconciliation of Employer Contribution Changes:

	Rate	Dollar Amount
December 31, 2016 Valuation	**38.66 %**	**$ 2,851,743**
New DC members	0.53 %	36,452
(Gain)/Loss	(1.85) %	(127,239)
Changes in Economic Assumptions	3.42 %	207,598
Plan Changes	0.90 %	62,120
Changes in Demographic Assumptions	0.49 %	100,991
Administrative Expense	N/A	60,000
Other Miscellaneous Changes*	1.02 %	(144,783)
December 31, 2017 Valuation	**43.17%**	**$ 3,046,883**

* *Changes in timing of contributions, weighting of individual pays, payroll growth different than assumed, contraction of active population faster than assumed.*

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 D. 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. This year there was a significant increase in the number of members covered by this provision. This was the result of the inclusion of Fire Grant Employees in valuing this liability. This increase added $341,914 to the accrued liabilities for the members participating in the DC plan, and approximately $36,500 to the employer contribution.

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.

Comments and Conclusion

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. Payroll for Fire members was adjusted to account for the fact that a 2% pay increase for 2016 was included in 2017 pay retroactively. Pay was annualized to prior year levels for members who had large decreases this year due to Workers' Compensation.

Outlook for Future: The actuarial value of assets is currently 95% of the market value. This occurs when investment gains scheduled to be recognized in future valuations exceed the investment losses scheduled to be recognized in future valuations. As those gains are recognized, there will be downward pressure on future contributions, compounded somewhat by lower normal costs due to the closure of the System other than disability coverage.

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 17 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

Derivation of Experience Gain (Loss)
Year Ended December 31, 2017

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, 2017
(1) UAAL at start of year	$16,029,796
(2) Normal cost from last valuation (Total)	1,603,942
(3) Actual employee contributions	381,439
(4) Actual employer contributions (paid at end of year)	2,946,541
(5) Interest	1,164,873
(6) Expected UAAL before changes: (1) + (2) - (3) + (4)	15,470,631
(7) New DC members	341,914
(8) Change from revised actuarial assumptions, methods, and benefit provisions	3,037,365
(9) Expected UAAL after changes: (5) + (6) + (7)	18,849,910
(10) Actual UAAL at end of year	17,641,910
(11) Gain (loss): (8) - (9)	$ 1,208,000

Valuation Date December 31	Experience Gain (Loss) as % of Beginning Accrued Liability
2008	(12.8)%
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 %**

Comparative Schedule

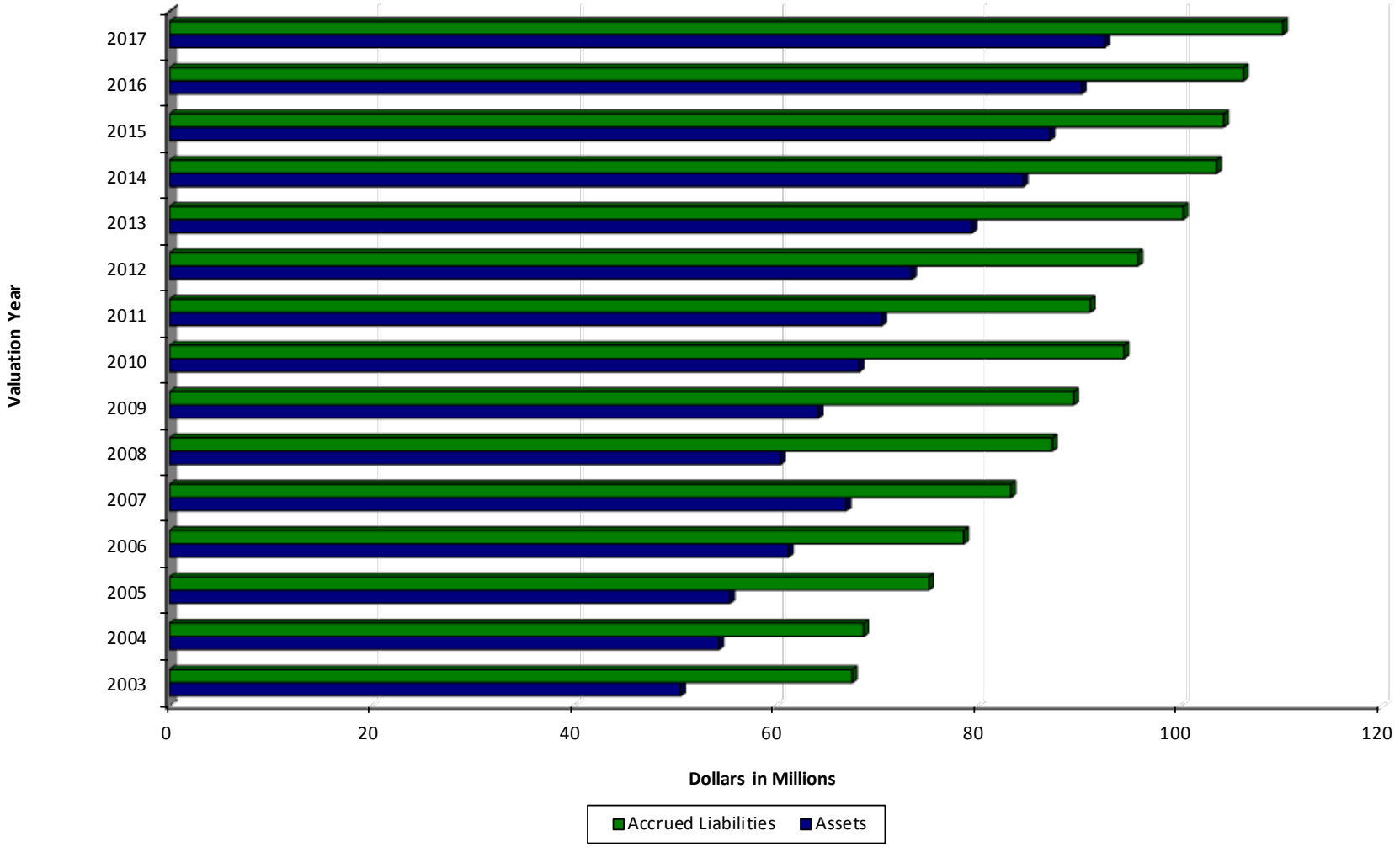
Valuation Date	Fiscal Year	Actuarial Accrued Liabilities	Funding Value of Assets	% Funded	Unfunded Actuarial Accrued Liabilities & Reserves			Township's Contribution Rate		
					Dollars	Amortiz. Period	% of Payroll	Payroll Percents	Dollars Recommended	Dollars Actual
12-31-97*	1998	$ 39,666,654	$ 33,985,689	85.7 %	$ 5,680,965	18	83 %	21.09 %	$ 1,555,632	$ 1,555,632
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	
12-31-17	**2019**	**107,116,392**	**92,511,847**	**86.4 %**	**14,604,545**	**17**	**221 %**	**38.36 %**	**2,676,173**	
12-31-17 *#	**2019**	**110,153,757**	**92,511,847**	**84.0 %**	**17,641,910**	**17**	**267 %**	**43.17 %**	**3,046,883**	

** 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



2003 Funding Value of Assets Equaled 74.9% of Accrued Liabilities
2017 Funding Value of Assets Equaled 84.0% of Accrued Liabilities

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

SECTION C

SUMMARY OF BENEFIT PROVISIONS AND VALUATION DATA

Brief Summary of Benefit Provisions
December 31, 2017

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, 2017 (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, 2017 (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
12-31-93	6	$ 186,809			6	$ 186,809	39	3.2	$ 884,086	16.2%
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%**

* *Includes post-retirement adjustments.*

** *For valuation purposes it was assumed that 2 active members, whose DROP period had expired as of the valuation date, have gone into retirement as of December 31, 2016.*

\# *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, 2017
Tabulated by Type of Pensions Being Paid

Type of Pension Being Paid*	No.	Annual Pensions
Age and Service Pensions		
Regular	32	$ 891,472
100% Joint & Survivor	3	123,586
Automatic 60% to Spouse	104	4,830,546
Survivor Beneficiary	6	114,340
Totals	145	5,959,944
Disability Pensions		
Non-Duty	1	6,259
Duty	7	276,498
Survivor Beneficiary of Duty Disability Pension	1	44,731
Totals	9	327,488
Total Pensions Being Paid	**154**	**$6,287,432**

* *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, 2017
Tabulated by Attained Ages

Attained Ages	No.	Annual Pensions
47	1	$ 42,614
48	2	99,089
49	1	37,115
50	1	63,076
51	7	235,873
52	2	95,668
53	6	210,338
54	6	266,928
55	6	304,629
56	8	352,980
57	4	181,258
58	4	121,007
59	2	93,806
60	7	345,065
61	5	226,439
62	8	305,875
63	3	190,132
64	9	429,835
65	5	269,167
66	7	346,370
67	4	130,686
68	4	121,609
69	6	231,790
70	2	94,877
71	7	282,358
72	4	119,158
73	3	102,040
74	2	81,400
75	6	216,240
76	6	278,712
77	4	136,961
78	2	62,424
79	4	65,419
80	2	33,543
84	1	26,136
86	1	24,488
91	1	39,203
95	1	23,124
Totals	**154**	**$6,287,432**

December 31, 2017
Tabulated by Attained Ages

Vested Former Members Eligible for a Deferred Benefit

Attained Ages	No.	Annual Pensions
41	1	$ 41,327
47	1	41,304
Totals	**2**	**$ 82,631**

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
12-31-88	118	$ 3,918,499	$33,208	3.1 %	37.3 yrs.	11.1 yrs.
12-31-89	121	4,465,326	36,904	11.1 %	38.0	11.5
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**

** 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	
2008	2	1	5.6	1	0.8	0	0.2	0	0	0	1.1	141
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
10-Year Totals	19	56	54.0	5	6.0	2	1.6	3	10	13	6.9	

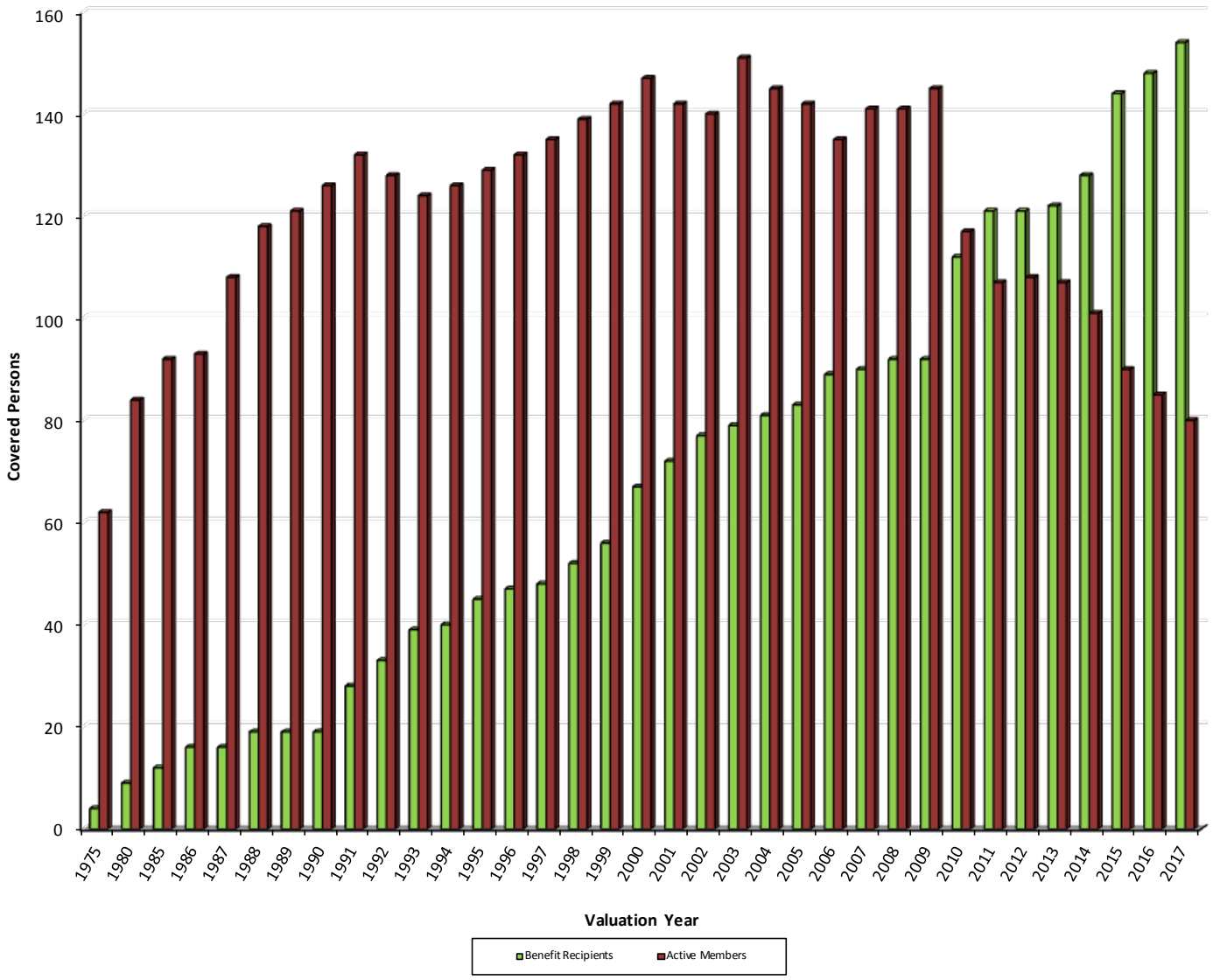
A = Actual
E = Expected
* *For valuation purposes it was assumed that 2 active members, whose DROP period had expired as of the valuation date, have gone into retirement as of December 31, 2016.*

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
2-Year Totals	36	0	0.0	0	0.0	0	0.0	0	1	1	0.1	

A = Actual
E = Expected

Active Members and Benefit Recipients



Police Active DB Members December 31, 2017
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		1						1	$ 73,850
35-39		1						1	76,125
40-44			1	6	1			8	637,083
45-49				9	16			25	1,974,319
50-54				2	4			6	477,625
55-59					2			2	160,186
Totals		**2**	**1**	**17**	**23**			**43**	**$ 3,399,188**

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

Age: 46.7 years
Service: 20 years
Annual Pay: $79,051

Fire Active DB Members December 31, 2017
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		3	2					5	$ 426,115
35-39		2		1				3	234,843
40-44			4	4				8	720,191
45-49			6	2	2	2		12	1,054,665
50-54				3	1	2		6	519,120
55-59						3		3	251,446
Totals		**5**	**12**	**10**	**3**	**7**		**37**	**$ 3,206,380**

** 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: 44.6 years
Service: 17.7 years
Annual Pay: $86,659

Police Active DC Members December 31, 2017
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	4							4	$ 194,516
30-34	1							1	43,493
35-39	3							3	185,415
45-49	1							1	72,102
50-54	2							2	126,280
Totals	**11**							**11**	**$ 621,806**

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: 1.27 years
Annual Pay: $56,528

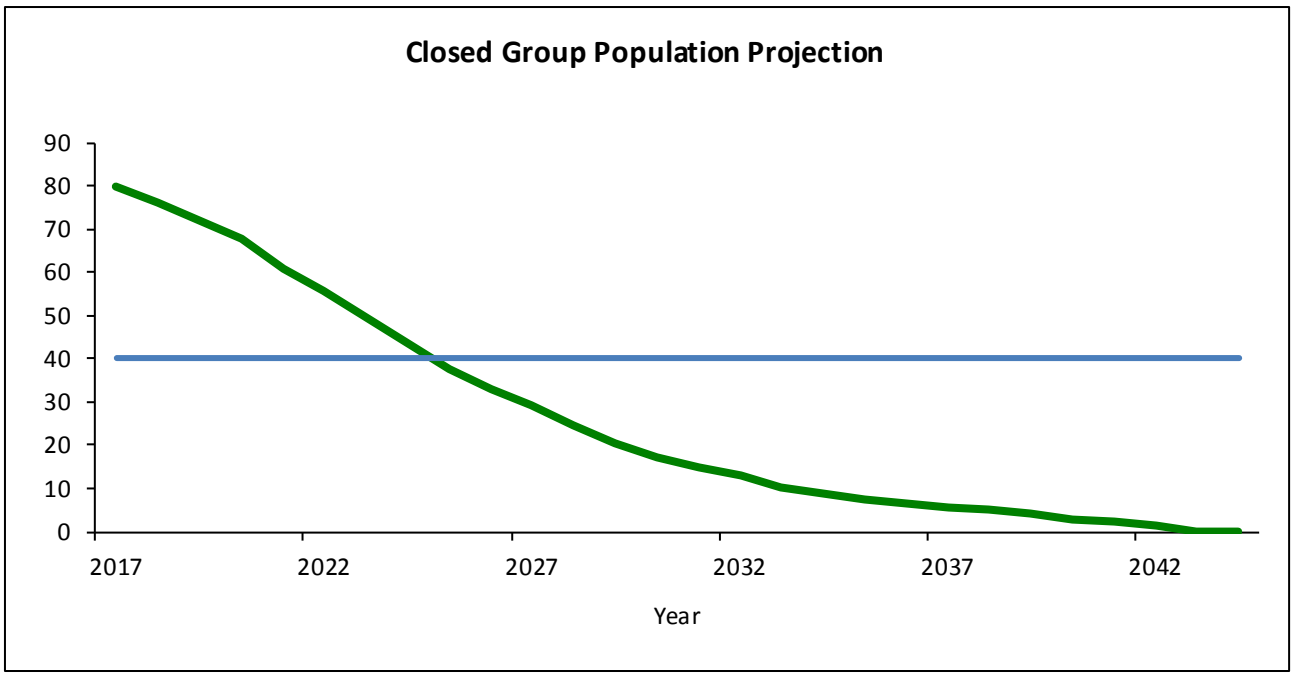
Fire Active DC Members December 31, 2017
by Nearest Age and Years of Service

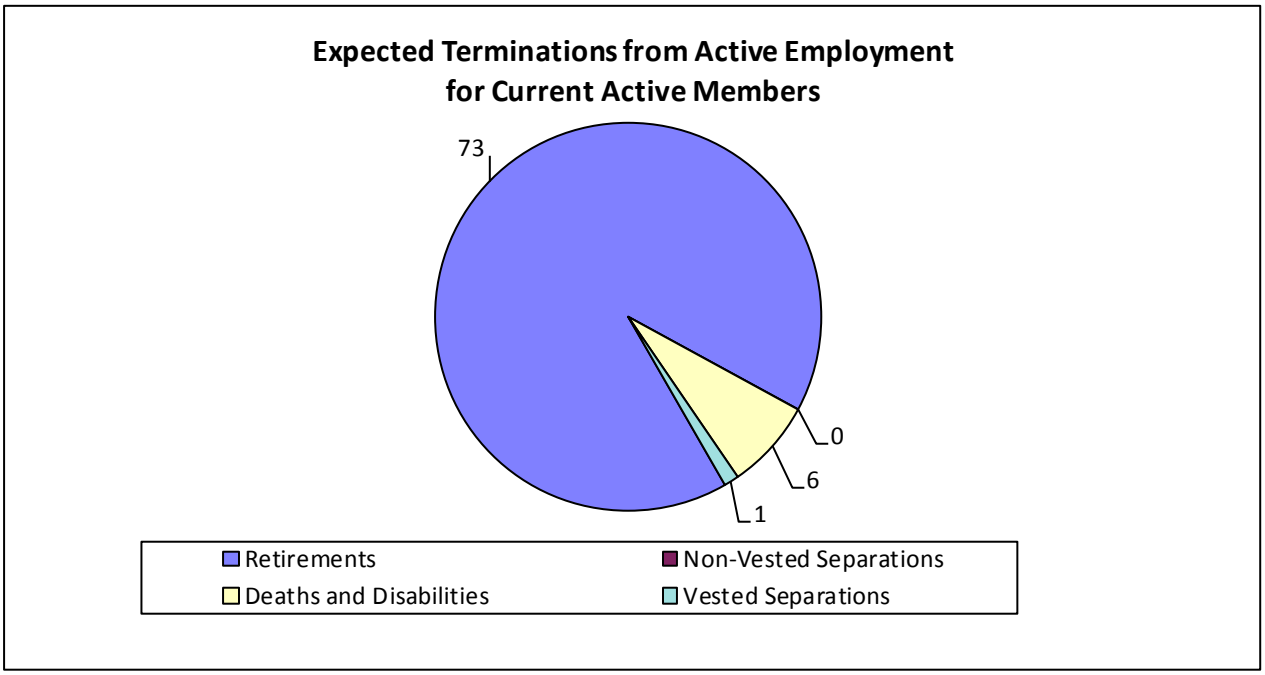
Nearest Age	Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	No	Valuation Payroll
25-29	10							10	$ 439,672
30-34	2							2	108,460
35-39	11							11	518,563
40-44	1							1	50,205
Totals	**24**							**24**	**$ 1,116,900**

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

Age: 28.4 years
Service: 1.14 years
Annual Pay: $46,538

Expected Development of Present Population
December 31, 2017





The charts show the expected future development of the present population in simplified terms. The Retirement System presently covers 80 active members. Eventually, 73 people are expected to receive monthly retirement benefits either by retiring directly from active service, or by retiring from vested deferred status. Seven people are expected to become eligible for death-in-service or disability benefits.

Development of Funding Value of Assets

Year Ended December 31:	2013	2014	2015	2016	2017	2018	2019	2020
A. Funding Value Beginning of Year	$73,420,924	$79,398,528	$84,465,043	$87,095,743	$90,225,196			
B. Market Value End of Year	85,450,868	88,104,799	82,844,748	88,760,295	97,481,517			
C. Market Value Beginning of Year	74,612,739	85,450,868	88,104,799	82,844,748	88,760,295			
D. Non-Investment Net Cash Flow	(1,576,290)	(1,879,532)	(3,575,202)	(3,409,675)	(4,328,133)			
E. Investment Income								
E1. Market Total: B - C - D	12,414,419	4,533,463	(1,684,849)	9,325,222	13,049,355			
E2. Amount for Immediate Recognition (7.0%)	5,084,295	5,492,113	5,787,421	5,977,363	6,164,279			
E3. Amount for Phased-In Recognition: E1-E2	7,330,124	(958,650)	(7,472,270)	3,347,859	6,885,076			
F. Phased-In Recognition of Investment Income								
F1. Current Year: 0.25 x E3	1,832,531	(239,663)	(1,868,068)	836,965	1,721,269			
F2. First Prior Year	693,681	1,832,531	(239,663)	(1,868,068)	836,965	$ 1,721,269		
F3. Second Prior Year	(832,617)	693,681	1,832,531	(239,663)	(1,868,068)	836,965	$ 1,721,269	
F4. Third Prior Year	776,004	(832,615)	693,681	1,832,531	(239,661)	(1,868,066)	836,964	$ 1,721,269
F5. Total Recognized Investment Gain Before Corridor	2,469,599	1,453,934	418,481	561,765	450,505	690,168	2,558,233	1,721,269
G. Funding Value End of Year								
G1. Preliminary Funding Value End of Year: A+D+E2+F5	79,398,528	84,465,043	87,095,743	90,225,196	92,511,847			
G2. Upper Corridor Limit: 120% x B	102,541,042	105,725,759	99,413,698	106,512,354	116,977,820			
G3. Lower Corridor Limit: 80% x B	68,360,694	70,483,839	66,275,798	71,008,236	77,985,214			
G4. Funding Value End of Year	**79,398,528**	**84,465,043**	**87,095,743**	**90,225,196**	**92,511,847**			
G5. Total Recognized Investment Income after Corridor	2,469,599	1,453,934	418,481	561,765	450,505			
H. Difference between Market & Funding Value: B-G	$ 6,052,340	$ 3,639,756	$ (4,250,995)	$ (1,464,901)	4,969,670	4,279,502	1,721,269	0
I. Recognized Rate of Return	**10.40%**	**8.85%**	**7.51%**	**7.66%**	**7.51%**			
J. Market Value Rate of Return	16.82%	5.36%	(1.95)%	11.49%	15.07%			
K. Ratio of Funding Value to Market Value	92.92%	95.87%	105.13%	101.65%	94.90%			

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	$ 7,508,507		
Fixed income	18,867,681		
Equities	71,536,277	Member contributions	$ 6,028,170
Real estate	1,287,616	Employer contributions	61,628,321
Foreign investments	0	Retired benefit payments	29,825,028
Other	524,340	Undistributed income	0
Total	$99,724,421	Total Market Value	$ 97,481,519
Accounts Payable	(2,242,904)		
Funding Adjustment	(4,969,670)	Funding Adjustment	(4,969,670)
Total Valuation Assets	$92,511,847	Total Valuation Assets*	$ 92,511,849

** $2 difference due to rounding.*

Receipts and Disbursements

	2017	2016
Valuation Assets - January 1	$90,225,196	$87,095,743
Receipts		
Member contributions	381,439	367,992
Employer contributions	2,946,541	3,188,351
Recognized investment income	7,073,283	6,991,906
Total	$10,401,263	$10,548,249
Disbursements		
Benefit payments	$ 7,656,113	$ 6,966,018
Refund of member contributions	0	0
Administrative & investment expenses	458,499	452,778
Total	$ 8,114,612	$ 7,418,796
Valuation Assets - December 31	$92,511,847	$90,225,196
Ratio of net investment income to mean assets	7.51%	7.66%

SECTION D

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

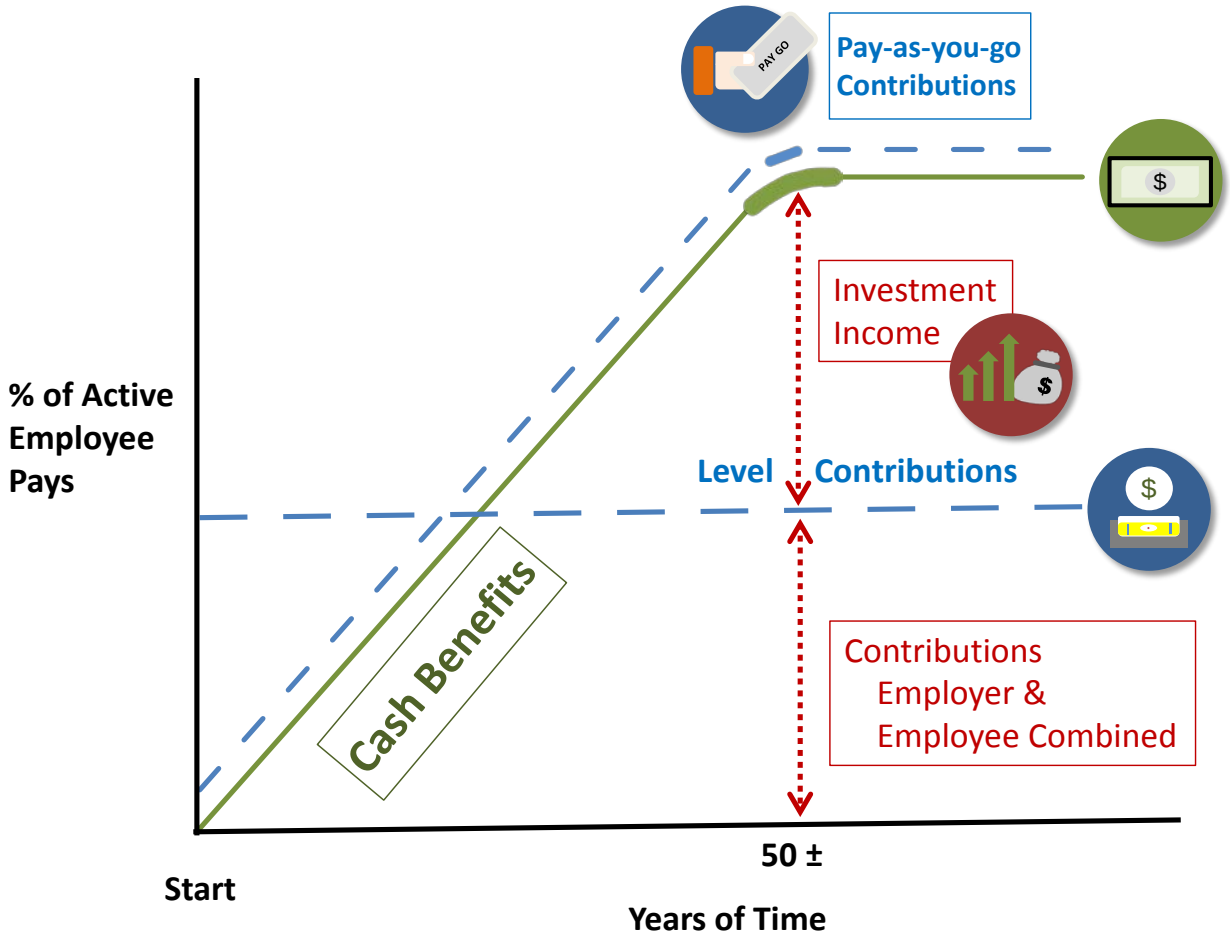
... plus ...

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 17 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
	2017	2016	2015	2014	2013	Average*
Rate of investment return	7.5%	7.7%	7.5%	8.9%	10.4%	8.4%
Increase in average pay	2.6%	2.1%	0.9%	(1.6)%	(2.4)%	0.3%
Real rate of return	4.9%	5.6%	6.6%	10.5%	12.8%	8.1%

* *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	32%
26	27%
27	27%
28	27%
29	27%
30	27%
31	27%
32	27%
33	27%
34	36%
35 & over	100%

Percents of Active Members Retiring Within Next Year	
Age	Police-Fire
60	36%
61	36%
62	36%
63	36%
64	36%
65	36%
66	32%
67	23%
68	23%
69	23%
70	23%
71	23%
72	23%
73	23%
74	23%
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, 2017

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."