Waterford Township Employees Retirement System

Actuarial Valuation Report and Experience Review

December 31, 2017

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GRS Retirement Consulting

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September 12, 2018

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

Dear Committee Members:

The results of the December 31, 2017 Actuarial Valuation and Experience Review of the Waterford Township Employees Retirement System are presented in this report.

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

The purpose of this report is to 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 April 13, 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 for the potential range of such future measurements.

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

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

Computed employer contributions shown on page B-1 are based on the Board's policy, which includes a 15-year, level dollar amortization of unfunded actuarial accrued liabilities. Payment of the computed employer contributions is not a guarantee of benefit security. In addition, the ability of the plan sponsor to pay the computed contributions when due was beyond the scope of the project. The Board is encouraged to consider benefit security when adopting the employer contribution and is always free to adopt a higher contribution or more aggressive funding policy.

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

Respectfully submitted,

Brad Lee Armstrong, ASA, EA, FCA, MAAA

Kenneth G. Alberts

BLA/KGA:sc

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:

- Rates of **withdrawal** of active members.
- Rates of **disability** among active members.
- Patterns of **salary increases** to active members.
- Rates of **retirement** 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; and

- 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 various assumption changes and their impact on the required contribution are described on the following pages.

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	$ (242,223)	$ (367,160)	$ 124,937	$ 62,111,982	0.20%
2016	2,224,417	109,390	2,115,027	62,974,996	3.36%
2015	1,620,419	1,001,726	618,693	62,003,082	1.00%
2014	2,088,319	960,264	1,128,055	61,380,371	1.84%
2013	3,349,810	1,402,067	1,947,743	59,651,139	3.27%

Demographic Assumptions

Pay increases. 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, pays increases were never greater than expected. For the entire period, pays grew by 4% less than expected, based on the assumptions used during the period.

	Active Payroll (Members Active and Beginning and End of Year)		
Year	Expected	Actual	Actual/Expected
2017	$ 4,137,428	$ 4,037,556	97.6%
2016	4,530,517	4,404,334	97.2%
2015	4,792,969	4,572,784	95.4%
2014	5,263,199	4,999,596	95.0%
2013	5,892,812	5,551,391	94.2%
	$ 24,616,925	$ 23,565,661	95.7%

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.

Experience Review – Comments and Recommendations

Demographic Assumptions (Continued)

Retirement Experience. Over the last 5 years 28 members retired compared with about 20 expected. Over the past 10 years, 68 members retired compared with about 48 expected. We therefore recommend increasing current retirement rates by 20%.

Rates of Withdrawal. There were 11 terminations over the 5-year period versus 8.6 expected. We recommend increasing ultimate age-based rates of withdrawal by 30%. We are not recommending changes to the service-based withdrawal rates (first 5 years of service).

Disability Rates. There have not been any disability retirements in the past 5 years, with only 2 in the past 10. We recommend removing disability as an assumed decrement.

Death-in-Service Mortality Rates. We are recommending that mortality tables be updated to the RP-2014 Employee Mortality Table projected to 2026 using projection scale MP-2017. There have not been any benefits resulting from death-in-service in the last 10 years. As a result, we recommend multiplying the rates from the newly implemented mortality table by 50%.

Retired Life Mortality. Based on the size of the population, we believe the actual mortality experience is not useful in determining assumed mortality rates going forward. 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 $950,000 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 2.75%. 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 and the preliminary discussion with the Board, we recommend lowering price inflation from the current assumption of 2.75% to 2.50%.

Experience Review – Comments and Recommendations

Price Inflation (Continued)

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 (Jan 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:

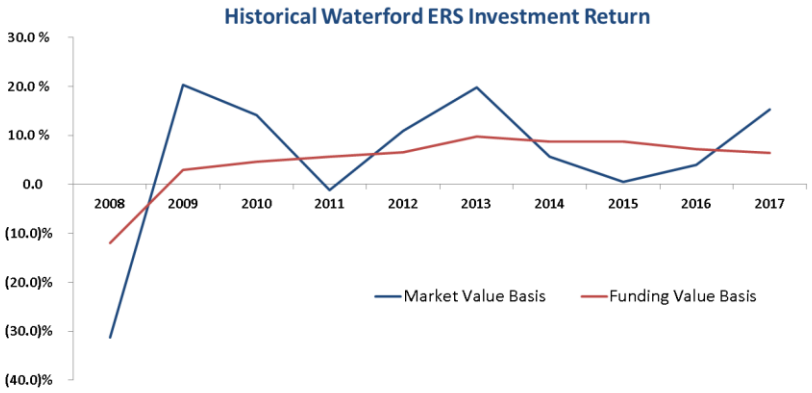
Periods Ending December 2017	Difference Between Increase in National Average Earnings and CPI
Last five (5) years	1.6%
Last ten (10) years	0.8
Last fifteen (15) years	0.9
Last twenty (20) years	1.1
Last twenty-five (25) years	1.1
Last thirty (30) years	0.9

Over the last five years, the increase in average pay for ERS active members has been 1.10%. The current assumption for real wage growth is 1.75%. We recommend lowering this assumption to 1.00%.

Experience Review – Comments and Recommendations

Investment Return

Historical Waterford ERS Investment Return		
Year Ended December 31,	Market Value Basis	Funding Value Basis
2008	(31.3)%	(12.0)%
2009	20.3 %	2.9 %
2010	14.2 %	4.7 %
2011	(1.1)%	5.6 %
2012	11.0 %	6.6 %
2013	19.9 %	9.8 %
2014	5.6 %	8.8 %
2015	0.5 %	8.8 %
2016	4.0 %	7.2 %
2017	15.3 %	6.4 %
5-Year Average	9.0 %	8.2 %
10-Year Average	5.8 %	4.9 %



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 policy 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. We recommend including a provision for administrative expenses in the Employer Contribution. We understand that administrative expenses are approximately $60,000 per year.

Experience Review – Comments and Recommendations

Capital Market Assumption Modeler

The arithmetic expected return developed from the System's investment policy 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 recommended 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).

Investment Consultant	Investment Consultant Expected Nominal Return	Investment Consultant Inflation Assumption	Expected Real Return (2)–(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)	Investment Expenses	Expected Nominal Return Net of Expenses (6)-(7)		Standard Deviation of Expected Return (1-Year)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		(7)
1	5.46%	2.20%	3.26%	2.50%	5.76%	0.00%	5.76%		11.77%
2	6.46%	2.50%	3.96%	2.50%	6.46%	0.00%	6.46%		12.78%
3	6.55%	2.50%	4.05%	2.50%	6.55%	0.00%	6.55%		12.96%
4	6.18%	2.00%	4.18%	2.50%	6.68%	0.00%	6.68%		11.21%
5	6.55%	2.26%	4.29%	2.50%	6.79%	0.00%	6.79%		10.97%
6	6.82%	2.21%	4.61%	2.50%	7.11%	0.00%	7.11%		13.78%
7	7.01%	2.25%	4.76%	2.50%	7.26%	0.00%	7.26%		13.90%
8	7.47%	2.25%	5.22%	2.50%	7.72%	0.00%	7.72%		11.88%
Average	**6.56%**	**2.27%**	**4.29%**	**2.50%**	**6.79%**	**0.00%**	**6.79%**		**12.41%**

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 proposed assumption of 6.75% over a 10-year horizon. 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 6.75%
	40th	50th	60th	
(1)	(2)	(3)	(4)	(5)
1	4.18%	5.11%	6.05%	32.96%
2	4.69%	5.70%	6.72%	39.72%
3	4.74%	5.77%	6.80%	40.45%
4	5.21%	6.09%	6.99%	42.62%
5	5.36%	6.23%	7.11%	44.03%
6	5.15%	6.23%	7.33%	45.22%
7	5.28%	6.37%	7.48%	46.56%
8	6.13%	7.07%	8.01%	53.39%
Average	**5.09%**	**6.07%**	**7.06%**	**43.12%**

Capital Market Assumption Modeler (Continued)

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 6.07% using the System's investment policy 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 6.79% using the System's investment policy 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 below:

Inflation Assumption	Distribution of 20-Year Average Geometric Net Nominal Return (Percentile)			Probability of Exceeding		
	40th	50th	60th	7.00%	6.75%	6.50%
2.25%	4.84%	5.82%	6.81%	38.17%	40.61%	43.10%
2.50%	5.09%	6.07%	7.06%	40.63%	43.12%	45.64%
2.75%	5.34%	6.32%	7.31%	43.13%	45.65%	48.20%

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 Proposed Asset Allocation		
CMAM Year	Mean	Median
2015	7.08%	6.32%
2016	7.40%	6.66%
2017	6.79%	6.07%

Experience Review – Comments and Recommendations

Proposed Assumptions

The chart below shows the current and proposed economic assumptions. It is our understanding that the Board has tentatively adopted the proposed set of economic assumptions for the December 31, 2017 valuation.

		Current	Proposed
(A)	**Load for Administrative Expenses**	$0	$60,000
(B)	**Price Inflation Assumption (CPI)**	2.75%	2.50%
(C)	**Real Wage Growth**	1.75%	1.00%
(D)	**Total Payroll Growth (Wage Inflation) (B) + (C)**	**4.50%**	**3.50%**
(E)	**Real Return**	4.25%	4.25%
(F)	**Assumed Rate of Return (B) + (E)**	**7.00%**	**6.75%**

The recommended changes in economic assumptions resulted in accrued liabilities increasing by approximately $870,000 without accounting for the effect of changes in demographic assumptions.

SECTION B

VALUATION RESULTS

Computed Contributions for the Fiscal Year Beginning January 1

Contributions for	Contributions Expressed as Percents of Covered Payroll		
	2019	**2018**	**2017**
Normal Cost (NC)			
Age and service pensions	15.20 %	15.75 %	15.94 %
Death-in-service	0.18 %	0.62 %	0.61 %
Disability pensions	0.00 %	0.96 %	0.96 %
Total	15.38 %	17.33 %	17.51 %
Member's Contributions			
Gross contributions@	0.20 %	0.27 %	0.26 %
Less prospective refunds	0.03 %	0.02 %	0.02 %
Available for pensions	0.17 %	0.25 %	0.24 %
Township's NC	15.21 %	17.08 %	17.27 %
Amortization Period*	15 years	16 years	17 years
Unfunded Actuarial Accrued Liabilities (UAAL)	3.26 %	(2.15) %	3.34 %
Township's Contribution Rate for NC and UAAL	**18.47 %**	**14.93 %**	**20.61 %**
Township's Dollar Contribution for NC and UAAL^	**$701,758**	**$674,987**	**$989,146**
Township's Contribution for Administrative Expenses	**60,000**	**N/A**	**N/A**
Total Township Contribution	**$761,758**	**$674,987**	**$989,146**

@ *Weighted average.*

* *Level dollar Amortization*

^ *The dollar contribution payable at the end of 2019 is $761,758. This amount was prorated using the payroll amounts reported for 2017 projected to the contribution year, allocating $438,565 for General members, $242,415 for Water Department members, and $20,778 for the 51st District Court employees.*

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

The dollar contribution payable at the end of 2017, prorated using the payroll amounts reported for 2015 projected to the contribution year, is $565,548 for General members, $343,217 for Water Department members, and $80,381 for the 51st District Court employees.

Payment Timing Alternatives	Contribution
End of Fiscal Year (current method)	$ 761,758
Middle of Fiscal Year #	$ 737,281
Beginning of Fiscal Year	$ 713,591

 # Equivalent to making 12 monthly contributions in the amount of $61,440.

Actuarial Balance Sheet - December 31, 2017

Present Resources and Expected Future Resources

A.	Valuation assets	
	1. Net assets from System financial statements (market value)	$65,536,884
	2. Valuation adjustment	(1,567,412)
	3. Valuation assets	63,969,472
B.	Actuarial present value of expected future employer contributions *	
	1. For normal costs	3,964,818
	2. For unfunded actuarial accrued liabilities	1,121,648
	3. Total	5,086,467
C.	Actuarial present value of expected future member contributions	54,684
D.	Total Actuarial Present Value of Present and Expected Future Resources	$69,110,622

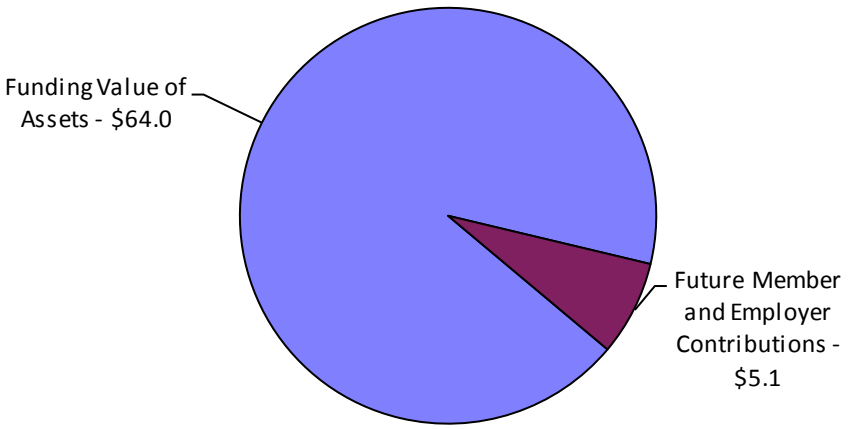
**Excluding administrative expenses.*

Actuarial Present Value of Expected Future Benefit Payments and Reserves

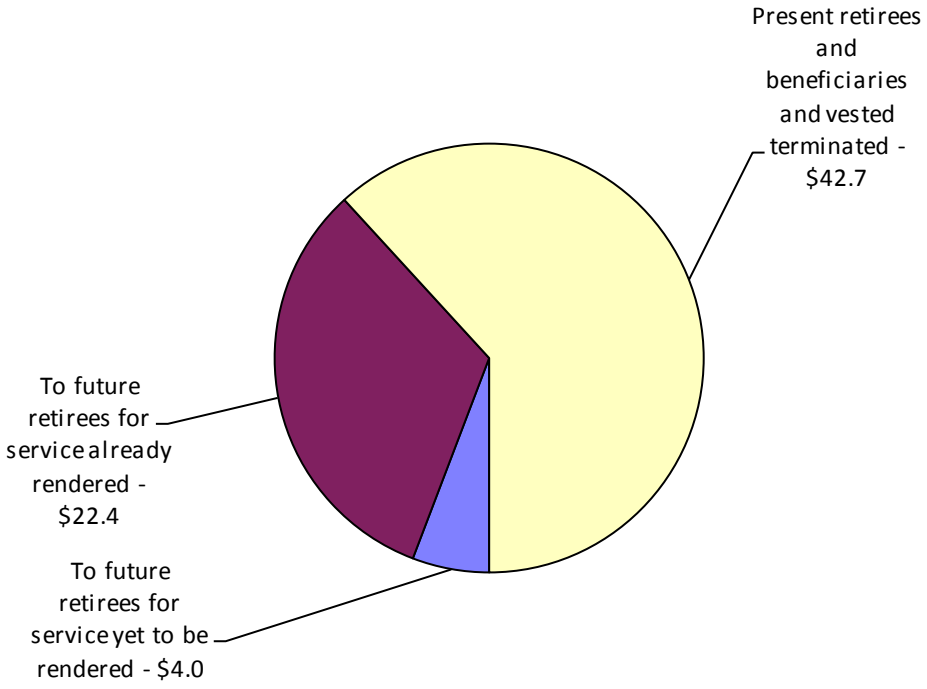
A.	To retirees and beneficiaries	$39,252,493
B.	To vested terminated members	3,487,462
C.	To present active members	
	1. Allocated to service rendered prior to valuation date	22,351,165
	2. Allocated to service likely to be rendered after valuation date	4,019,502
	3. Total	26,370,667
D.	Total Actuarial Present Value of Expected Future Benefit Payments	$69,110,622

Financing $69.1 Million of Benefit Promises
December 31, 2017
($ in millions)

Sources of Funds



Uses of Funds



Comments

Experience: Overall experience during the year was less favorable than assumed, resulting in an overall loss of 0.4% of beginning of year accrued liabilities (or approximately $0.2 million).

Experience loss related to:

1) Recognition of investment losses from previous years
2) More members retired than expected (6 actual vs. 2.8 expected); and
3) Retiree experience (despite observing 5 deaths vs. 4.4 expected, the benefits removed due to deaths were less than expected).

Losses were partially offset by gains related to pay increases less than expected.

Funded status on a Funding Value of Assets basis decreased during the year from 101.1% to 98.3%. On a Market Value of Assets basis, the funding status increased from 95.7% to 100.7%. Absent the changes in actuarial assumptions, the funded status on a funding and market value basis would have been 101.1% and 103.6%, respectively

Assets: The rate of return on a Market Value of Assets basis for the year ending December 31, 2017 was approximately 15.3%. The Funding Value of Assets rate of return, however, recognizes ¼ of the gains and losses (with respect to 7.0% assumed) from this year and the past three years in an effort to smooth market volatility. Overall, the aggregate recognized investment return for the year produced a 6.4% recognized rate of return net of expenses (See page C-14). The Funding Value of Assets is currently less than the Market Value of Assets.

Reserve Transfers: The present value of future benefit payments to current retirees and beneficiaries as of December 31, 2017 is $39,252,493. The December 31, 2017 balance in the Reserve for Retired Benefit Payments is $32,700,258. Therefore, the present value of future payments to retired members and beneficiaries exceeds the reserve by $6,552,235. **We recommend that this amount be transferred from the Reserve for Employer Contributions to the Reserve for Retired Benefit Payments effective January 1, 2018. For purposes of this valuation, it was assumed that this transfer would be made.**

Unfunded Actuarial Accrued Liability: Actuarial accrued liabilities exceeded the funding value of assets by $1,121,648. The manner in which this Unfunded Actuarial Accrued Liability (UAAL) is amortized is a matter of Board policy. In compliance with Board policy, the UAAL was amortized as a level dollar amount over a closed 15-year period.

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

Benefit Changes: There were no benefit changes for the December 31, 2017 valuation.

Assumption Changes: The valuation results include the proposed changes to economic and demographic assumptions discussed in the experience review section of the report. By adopting/accepting the report, the Board is adopting the proposed assumptions. The assumptions will need to be reviewed again with the December 31, 2022 valuation, in accordance with P.A. 202 of 2017.

Comments

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

- The active population: as the active population decreases, the contribution rate tends to increase and become less stable relative to payroll. At some point in the future, it will be better to report contributions only as a dollar amount rather than both a percent-of-payroll and dollar amount.
- Asset allocation: as the plan matures and the active population shrinks, the non-investment cash flow will increase and the asset base will decrease. As this happens, asset allocation may need to change to maintain liquidity and investment time horizon preferences of the Board. We recommend reviewing/monitoring the assumed rate of return to ensure the assumption is reflective of the current asset allocation.
- Negative cash flow: As the negative cash flow continues to increase and the asset base begins to decrease, we may recommend changing from the use of a smoothed funding value of asset method to the market value of asset method. This may be done in stages by reducing the smoothing period when the non-investment cash flow becomes 5% to 10% of the asset base (these cash flows represented about 4.6% of assets for the FY 2017) but could exceed 5% in 2018 due to the reduction in Township contributions over the next year. Shown below is a five-year projection of retirement benefit payments.

Year	Expected Benefit Payments
2018	$3,892,843
2019	4,086,954
2020	4,238,688
2021	4,462,087
2022	4,620,689

Methods and Assumptions: This report has been prepared based on a proposed update to actuarial assumptions as discussed in **Section A**. The combined effect of these modified economic and demographic assumptions was an increase of about $1.8 million in accrued liabilities. This growth in liabilities caused the computed employer contribution to rise by about $100,000.

Employer Contributions: Trends in the industry have begun to reflect increases in longevity and decreases in inflation and investment return. These will have upward pressure on Township contributions. Administrative expenses of $60,000 are assumed to be directly included in future contributions.

Conclusion: The Waterford Township Employees Retirement System is in sound financial condition in accordance with actuarial principles of level dollar funding, presuming continued timely receipt of contributions. The computed employer contribution for FY 2019 is 18.47% of covered payroll in addition to assumed administrative expenses or $761,758 if paid at the end of the fiscal year.

Other Observations

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

Given the plan's contribution allocation procedure, if all actuarial assumptions are met (including the assumption of the plan earning 6.75% on the actuarial value of assets), it is expected that:

1) The unfunded actuarial accrued liabilities will become fully funded in 15 years; and
2) The employer contributions will decrease as covered active membership continues to decline.

Limitations of Funded Status Measurements

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

1) The measurement is inappropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations, in other words, of transferring the obligations to an unrelated third party in an arm's length market value type transaction.
2) The measurement is dependent upon the actuarial cost method which, in combination with the plan's amortization policy, affects the timing and amounts of future contributions. A funded status measurement in this report of 100% is not synonymous with no required future contributions. If the funded status were 100%, the plan would still require future normal cost contributions (i.e., contributions to cover the cost of the active membership accruing an additional year of service credit).

Limitations of Project Scope

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

Risks to Future Employer Contribution Requirements

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

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

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

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

		Year Ending December 31, 2017
(1)	UAAL* at start of year	$ (680,259)
(2)	Total normal cost	764,152
(3)	Actual contributions	1,000,635
(4)	Interest accrual	(21,275)
(5)	Expected UAAL before changes: (1) + (2) - (3) + (4)	(938,017)
(6)	Increase from benefit changes	none
(7)	Change from actuarial assumptions and methods	1,817,442
(8)	Expected UAAL after changes: (5) + (6) + (7)	879,425
(9)	Actual UAAL at end of year	1,121,648
(10)	Gain (loss): (8) - (9)	$ (242,223)

* *Unfunded Actuarial Accrued Liability.*

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

Computed Contributions - Comparative Statement

Fiscal Year	Valuation Date Dec. 31	Actuarial Accrued Liabilities (AAL)	Funded Value of Assets	Percent Funded	Unfunded Act. Accr. Liab. (UAAL) Dollar Amount	Financing (base) Period	% of Member Payroll	Township Contribution Rate for Normal Cost and UAAL	Dollar Contribution Recommended	Dollar Contribution Actual
		($ in Thousands)								
1999	1998	$ 29,150	$ 33,389	114.5 %	$ (4,239)	14	(64.6)%	11.75 %	$ 838,085	$ 838,085
2000	1999#	32,425	36,325	112.0 %	(3,901)	13	(49.4)%	12.26 %	1,051,557	1,051,557
2001	2000#	34,816	39,317	112.9 %	(4,501)	12	(55.0)%	11.07 %	984,758	984,758
2002	2001@	36,673	41,190	112.3 %	(4,517)	11	(50.9)%	10.36 %	994,059	994,059
2003	2002	39,903	40,757	102.1 %	(854)	10	(9.1)%	14.66 %	1,487,005	1,487,005
2004	2003	44,263	41,579	93.9 %	2,683	30	28.3 %	17.35 %	1,780,444	1,780,444
2005	2004	45,462	42,863	94.3 %	2,599	29	28.8 %	17.39 %	1,696,164	1,696,164
2006	2005	46,306	43,301	93.5 %	3,005	28	36.8 %	18.08 %	1,574,175	1,574,175
2007	2006#	48,208	46,990	97.5 %	1,218	27	14.9 %	17.49 %	1,475,885	1,475,885
2008	2007	50,798	50,791	100.0 %	7	26	0.1 %	16.26 %	1,402,952	1,402,952
2009	2008	53,360	44,073	82.6 %	9,287	25	111.8 %	25.65 %	2,204,481	2,204,481
2010	2009#	55,024	45,414	82.5 %	9,610	24	118.3 %	26.27 %	2,208,556	2,208,556
2011	2010@	56,521	47,447	83.9 %	9,074	23	129.1 %	27.65 %	2,011,374	2,011,374
2012	2010@	56,521	47,447	83.9 %	9,074	22	129.1 %	28.26 %	2,017,208	2,017,208
2013	2011	58,750	49,385	84.1 %	9,366	21	150.0 %	29.19 %	1,922,105	1,922,105
2014	2012	59,651	51,527	86.4 %	8,125	20	140.9 %	28.58 %	1,729,217	1,729,217
2015	2013@	61,380	55,119	89.8 %	6,261	19	112.8 %	27.08 %	1,555,154	1,555,154
2016	2014	62,003	58,142	93.8 %	3,861	18	77.2 %	24.07 %	1,249,587	1,249,587
2017	2015	62,975	61,125	97.1 %	1,850	17	40.5 %	20.61 %	989,146	989,146
2018	2016	62,112	62,792	101.1 %	(680)	16	(15.4)%	14.93 %	674,987	N/A
2019	**2017**	**63,274**	**63,969**	**101.1 %**	**(696)**	**15**	**(17.2)%**	**15.24 %**	**600,128**	**N/A**
2019	**2017 #**	**65,091**	**63,969**	**98.3 %**	**1,122**	**15**	**27.8 %**	**18.47 %**	**761,758**	**N/A**

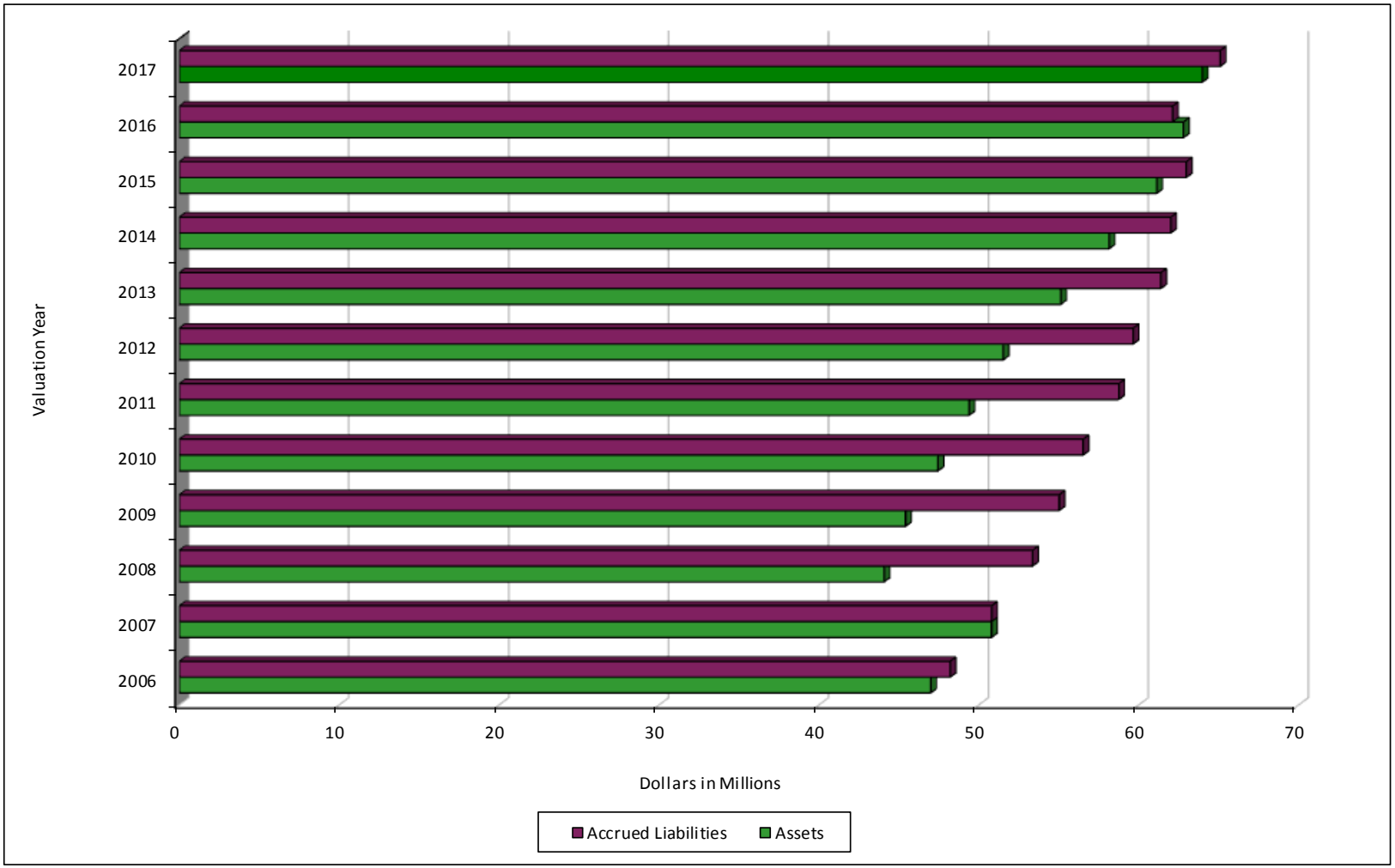
#Changes in assumptions. *@Changes in methods.*

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

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

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

Funding Value of Assets & Accrued Liabilities



2006 Funding Value of Assets equaled 97.5% of accrued liabilities

2017 Funding Value of Assets equaled 98.3% of accrued liabilities

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

SECTION C

SUMMARY OF BENEFIT PROVISIONS AND VALUATION DATA

Brief Summary of Benefit Provisions
December 31, 2017

Eligibility	Amount
Regular Retirement	
Management, Elected Officials before January 1, 1999 (Court Supervisors before April 1, 2002): Sum of age and credited service equals 75 or more, age 55 with 25 years of service, or age 60 with 5 years of service. **Dispatchers**: 25 years of service regardless of age, or age 60 with 8 years of service. **Crime Scene Investigators (CSI)**: 25 years of service regardless of age, or age 60 with 10 years of service. **All Others**: Age 55 with 25 years of service, or age 60 with 8 years of service. Community Service Officers (CSO) may also retire with 30 years of service regardless of age.	**Management, Court Supervisors, Elected Officials, Dispatchers and CSI**: Straight life pension equals total service times 2.5% of final average salary (FAS). Management, Court Supervisors, Elected Officials hired on or after January 1, 1999 and CSI have a maximum benefit of 75% of FAS. **Teamsters hired on or prior to July 1, 2006**: Straight life pension equals total service times 2.375% of FAS. **All Others**: Straight life pension equals total service times 2.25% of FAS. CSO has a maximum benefit of 75% of FAS. **Type of Final Average Salary (FAS)**: Highest 3 years out of the last 5 years of service. **CSI**: Highest 3 years out of the last 10 years of service.
Deferred Retirement	
8 or more years of service (5 years for Management & Administrative before January 1, 1999 and Court Supervisors before April 1, 2002). Benefit begins at age 60 (55 with 25 or more years of service at time of termination). **CSI**: Benefit begins at the date retirement would have occurred had the member remained in employment.	Computed as a regular retirement but based upon service and final average salary at termination date.
Non-Duty Death-in-Service Survivor's Pension *	
Payable to the survivors of a member who dies with 10 years of service.	Pension payable to surviving spouse, computed as a regular retirement but actuarially reduced in accordance with a 100% joint and survivor election.

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

Brief Summary of Benefit Provisions
December 31, 2017
(Continued)

Duty Death-In-Service Survivor's Pension *

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

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

Non-Duty Disability *

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

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

Duty Disability *

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

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

Member Contributions

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

Township Contributions

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

Compensation

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

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

Brief Summary of Benefit Provisions
December 31, 2017
(Concluded)

Participation

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

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

Deferred Retirement Option Plan (DROP)

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

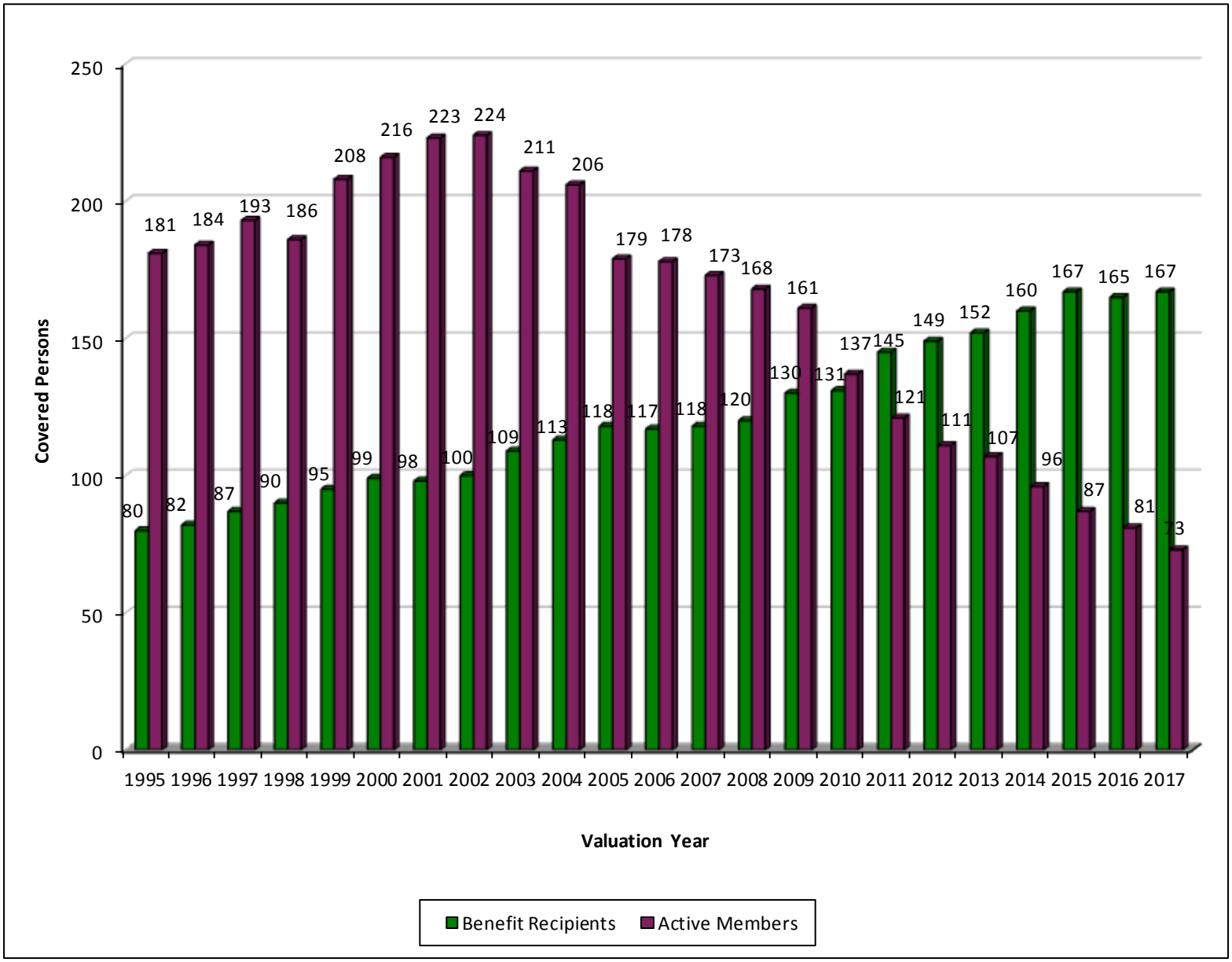
These members may participate in the DROP after attaining the minimum requirements for a normal service retirement. A monthly amount equal to the amount that would have been paid had the member retired and current member contributions accumulate in a DROP account. The account is credited with the system's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

Retiree and Beneficiary Comparative Schedule

Year Ended	Added to Rolls		Removed from Rolls		Rolls End of Year				Average Pension	Expected Removals	
						Active	Annual Pensions				
	No.	Annual* Pensions	No.	Annual* Pensions	No.	Per Retired	Dollars	% of Pay		No.	Annual Pensions
1997	7	$ 124,093	2	$ 4,892	87	2.2	$ 1,076,800	16.6 %	$ 12,377	1.8	$ 15,271
1998	8	94,667	5	34,801	90	2.1	1,136,666	17.3 %	12,630	2.0	17,631
1999	5	78,770			95	2.2	1,215,436	15.4 %	12,794	2.1	19,728
2000	4	90,878			99	2.2	1,306,314	16.0 %	13,195	2.5	25,172
2001	6	72,178	7	24,863	98	2.3	1,353,630	15.3 %	13,813	2.8	28,349
2002	4	137,119	2	23,399	100	2.2	1,467,350	15.6 %	14,674	2.6	30,263
2003	13	377,721	4	26,795	109	1.9	1,818,276	19.2 %	16,681	2.7	36,026
2004	4	174,733			113	1.8	1,993,009	22.1 %	17,637	2.9	41,604
2005	5	59,049			118	1.5	2,052,057	25.1 %	17,390	3.2	47,208
2006	5	113,420	6	84,511	117	1.5	2,080,966	25.5 %	17,786	3.6	52,435
2007	5	77,708	4	53,942	118	1.5	2,104,732	25.2 %	17,837	3.8	51,782
2008	2	53,185			120	1.4	2,157,917	26.0 %	17,983	4.0	55,663
2009	7	125,987	6	64,620	121	1.3	2,219,284	27.3 %	18,341	4.4	61,920
2010	19	555,597	9	136,752	131	1.0	2,638,129	37.5 %	20,138	4.4	64,759
2011	22	542,808	8	104,703	145	0.8	3,076,234	49.3 %	21,215	4.4	66,524
2012	8	172,719	4	40,500	149	0.7	3,208,453	55.6 %	21,533	4.5	70,959
2013	11	148,540	8	124,954	152	0.7	3,232,039	58.2 %	21,263	4.6	75,786
2014	13	274,305	5	38,803	160	0.6	3,467,540	69.4 %	21,672	3.8	62,458
2015	12	263,901	5	65,339	167	0.5	3,666,102	80.2 %	21,953	4.0	70,415
2016	3	81,535	5	147,823	165	0.5	3,599,814	81.7 %	21,817	4.0	75,018
2017	**7**	**211,332**	**5**	**64,705**	**167**	**0.4**	**3,746,441**	**92.8 %**	**22,434**	**4.4**	**82,309**

** Includes post-retirement adjustments.*

Active Members & Benefit Recipients



Retirees and Beneficiaries December 31, 2017
Tabulated by Attained Ages

Attained Ages	No.	Annual Pensions
43	1	$ 17,022
47	2	69,552
50	1	9,215
51	3	110,594
52	1	50,088
54	1	9,296
55	2	47,502
56	4	138,403
57	4	143,234
58	2	55,950
59	4	174,199
60	4	153,405
61	5	124,843
62	8	233,914
63	8	194,766
64	10	170,303
65	6	127,683
66	12	250,726
67	3	31,317
68	10	194,301
69	1	37,746
70	6	104,521
71	5	111,646
72	4	135,240
73	5	110,837
74	4	59,857
75	6	69,070
76	4	70,489
77	1	8,435
78	3	66,825
79	3	45,192
80	4	74,186
81	5	138,018
82	3	51,371
83	2	32,180
84	5	53,391
85	3	78,520
86	1	8,118
87	4	77,587
88	1	5,356
89	3	44,300
90	2	28,788
92	1	31,444
Totals	**167**	**$3,749,430**

Average Age Now: 69.8

Average Age at Retirement: 57.3

Retirees and Beneficiaries December 31, 2017
Tabulated by Type of Pension

Type of Pension Being Paid*	No.	Annual Pensions
Age and Service Pensions		
Regular	70	$ 1,639,437
100% Joint and Survivor	48	1,142,332
50% Joint and Survivor	29	705,795
Survivor Beneficiary	14	186,114
Totals	161	3,673,678
Casualty Benefits		
Non-Duty Death	0	0
Non-Duty Disability	4	54,535
Duty Disability	2	21,217
Survivor Beneficiary of Disability Pension	0	0
Totals	6	75,752
Total Pensions Being Paid	**167**	**$ 3,749,430**

** One member has two different pension types due to an EDRO.*

Vested Terminated Members December 31, 2017
Tabulated by Attained Ages

Attained Ages	No.	Annual Pensions
37	1	$ 7,500
41	1	12,040
44	2	26,611
45	4	62,394
46	3	32,234
48	1	29,463
50	1	25,624
51	1	12,276
52	1	21,067
53	3	29,634
54	4	75,011
55	1	13,602
56	4	48,224
57	3	33,616
58	3	32,907
59	2	18,083
66	1	2,989
69	1	15,495
Totals	**37**	**$498,770**

Active Members December 31, 2017
by Township Department

Department	Number of Members	Annual Payroll	Valuation Payroll
General			
Dispatch	4	$ 225,661	$ 225,661
CSI	0	0	0
General Union	29	1,417,183	1,417,183
Management and Admin Pre 1/1/1999	8	627,131	627,131
Management and Admin Post 1/1/1999	4	253,301	253,301
Total General	45	2,523,276	2,523,276
Water			
Water Union	23	1,169,367	1,169,367
Water Management Pre 1/1/1999	2	149,724	149,724
Water Management Post 1/1/1999	1	75,642	75,642
Total Water	26	1,394,733	1,394,733
51st District Court			
Court Union	2	119,547	119,547
Court Supervisors Pre 4/1/2002	0	0	0
Court Supervisors Post 4/1/2002	0	0	0
Total 51st District Court	2	119,547	119,547
Totals	**73**	**$4,037,556**	**$4,037,556**

Active Members December 31, 2017
by Township Department

Comparative Schedule

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

Active Members Added to and Removed from Rolls

Year	No. Added During Year	Removed During Year										Active Members End of Year
		Normal Retirement		Disabled		Died-in-Service		Terminations				
								Vested	Other	Total		
	A	A	E	A	E	A	E	A	A	A	E	
2008	0	2	5.4	0	0.5	0	0.4	3	0	3	4.3	168
2009	0	3	5.4	0	0.5	0	0.4	3	1	4	4.3	161
2010	0	13	6.4	0	0.5	0	0.4	7	4	11	3.6	137
2011	4*	17	6.6	2	0.5	0	0.4	0	1	1	2.7	121
2012	0	5	4.4	0	0.4	0	0.3	4	1	5	2.5	111
2013	0	3	4.3	0	0.4	0	0.3	1	0	1	2.2	107
2014	0	9	5.1	0	0.4	0	0.2	1	1	2	1.9	96
2015	0	8	4.1	0	0.4	0	0.2	1	0	1	1.7	87
2016	1	2	3.6	0	0.4	0	0.2	4	1	5	1.5	81
2017	0	**6**	**2.8**	**0**	**0.4**	**0**	**0.2**	**2**	**0**	**2**	**1.3**	**73**
10 Yr. Totals	5	68	48.1	2	4.4	0	3.0	26	9	35	26.0	

** Re-hired from lay-off.*

A = Actual
E = Expected

All Active Members December 31, 2017
by Attained Age and Years of Service

Attained Age	Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	No	Valuation Payroll
35-39				4				4	$ 234,737
40-44			1	7	2			10	529,610
45-49			1	6	8	1	1	17	909,675
50-54			1	5	6	5	2	19	1,005,922
55-59			1	1	5	5	1	13	707,028
60			1		1			2	92,618
61					1	2		3	176,671
62							1	1	96,844
63							1	1	81,069
64			1		2			3	203,382
Total			**6**	**23**	**25**	**13**	**6**	**73**	**$4,037,556**

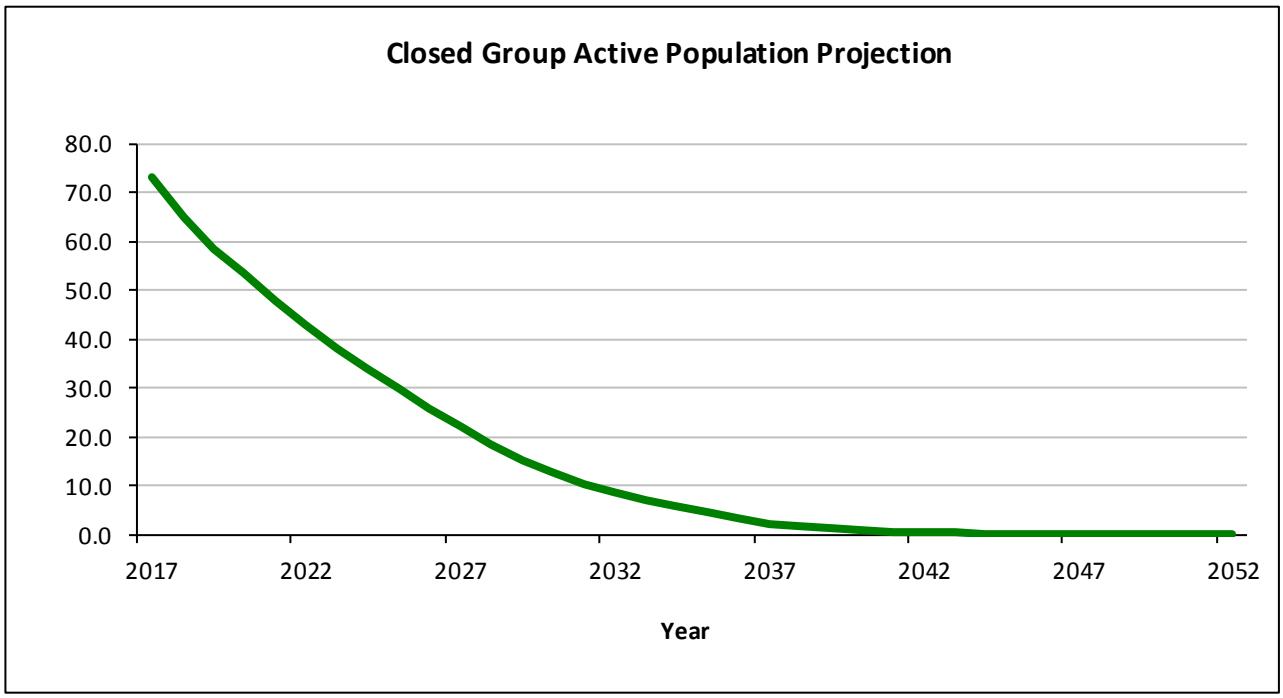
While not used in the financial computations, the following group averages are computed and shown because of their general interest.

Age: 50.8 years

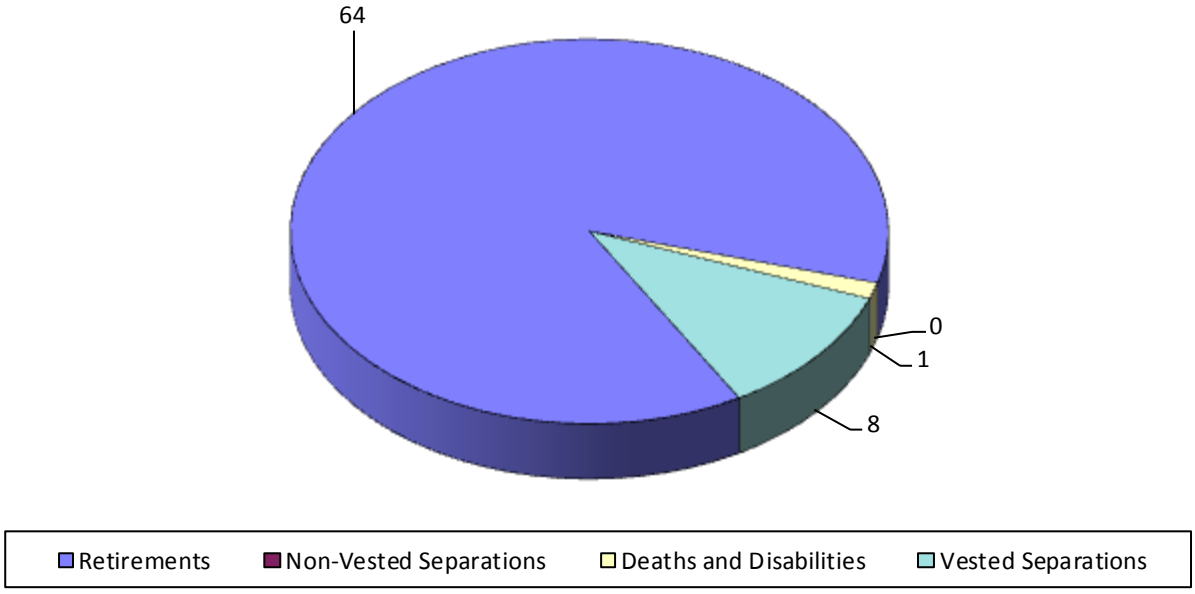
Service: 21.8 years

Annual Pay: $55,309

Expected Development of Present Population
December 31, 2017



Expected Terminations from Active Employment for Current Active Members



The charts show the expected future development of the present population in simplified terms. The Retirement System presently covers 73 active members. 72 people are expected to receive monthly retirement benefits either by retiring directly from active service, or by retiring from vested deferred status. One person is expected to become eligible for death-in-service or disability benefits. Within 7 years, over half of the covered membership is expected to terminate.

Development of Funding Value of Retirement System Assets

Year Ended December 31:	2014	2015	2016	2017	2018	2019	2020
A. Funding Value Beginning of Year	$ 55,119,221	$ 58,141,962	$ 61,125,070	$ 62,792,241			
B. Market Value End of Year	61,438,239	59,740,412	59,432,235	65,536,884			
C. Market Value Beginning of Year	59,859,497	61,438,239	59,740,412	59,432,235			
D. Non-Investment Net Cash Flow	(1,735,139)	(2,017,928)	(2,628,960)	(2,754,653)			
E. Investment Income							
E1. Market Total: B - C - D	3,313,881	320,101	2,320,783	8,859,302			
E2. Amount for Immediate Recognition (7.0%)	3,797,616	3,999,310	4,186,741	4,299,044			
E3. Amount for Phased-In Recognition: E1-E2	(483,735)	(3,679,209)	(1,865,958)	4,560,258			
F. Phased-In Recognition of Investment Income							
F1. Current Year: 0.25 x E3	(120,934)	(919,802)	(466,490)	1,140,065			
F2. First Prior Year	1,616,616	(120,934)	(919,802)	(466,490)	$ 1,140,065		
F3. Second Prior Year	425,848	1,616,616	(120,934)	(919,802)	(466,490)	$ 1,140,065	
F4. Third Prior Year	(961,266)	425,846	1,616,616	(120,933)	(919,803)	(466,488)	$ 1,140,063
F5. Total Recognized Investment Gain (Loss)	960,264	1,001,726	109,390	(367,160)	(246,228)	673,577	1,140,063
G. Funding Value End of Year							
G1. Preliminary Funding Value End of Year: A+D+E2+F5	58,141,962	61,125,070	62,792,241	63,969,472			
G2. Upper Corridor Limit: 125% x B	76,797,799	74,675,515	74,290,294	81,921,105			
G3. Lower Corridor Limit: 75% x B	46,078,679	44,805,309	44,574,176	49,152,663			
G4. Funding Value End of Year	**58,141,962**	**61,125,070**	**62,792,241**	**63,969,472**			
H. Difference between Market & Funding Value	$ 3,296,277	$ (1,384,658)	$ (3,360,006)	$ 1,567,412	$ 1,813,640	$ 1,140,063	$ 0
I. Recognized Rate of Return	**8.77%**	**8.75%**	**7.18%**	**6.40%**			
J. Market Value Rate of Return	5.62%	0.53%	3.97%	15.26%			
K. Ratio of Funding Value to Market Value	94.63%	102.32%	105.65%	97.61%			

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 less than the assumed rate, Funding Value of Assets will tend to be greater than Market Value. The Funding Value of Assets is *unbiased* with respect to Market Value. At any time, it may be either greater or lesser than Market Value. If assumed rates are exactly realized for 3 consecutive years, it will become equal to Market Value.

Summary of
Current Asset Information

Balance Sheet

Valuation Assets		Reserve for	
Cash & Equivalents	$ 2,606,885	Employee Contributions	$ 237,168
Common Stock	48,676,890	Employer Contributions	32,599,458
Bonds	14,764,887	Retired Benefit Payments	32,700,258
Real Estate	280,819	Undistributed Investment	0
Other Assets: Prepaids	316,517		
Accounts Payable	(1,109,114)		
Market Adjustment	(1,567,412)	Market Adjustment	(1,567,412)
Funding Value of Assets	$63,969,472	Total Reserves	$63,969,472

Receipts and Disbursements

	2017	2016
Funding Value - January 1	$62,792,241	$61,125,070
Receipts		
Employee Contributions	11,489	14,822
Employer Contributions	989,146	1,249,587
Recognized Investment Income	4,315,696	4,664,220
Total	5,316,331	5,928,629
Disbursements		
Benefit Payments	3,755,288	3,893,369
Transfer to DC Plan	-	-
Administrative & Investment Expense	383,812	368,089
Other	-	-
Total	4,139,100	4,261,458
Funding Value of Assets	$63,969,472	$62,792,241

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

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 they are, in effect, handed an "IOU" which reads: "The Employees Retirement System promises to pay you one unit of retirement benefits, payments in cash commencing when you retire."

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

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

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

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

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

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

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

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

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

$$B = C + I - E$$

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

The aggregate amount of Contributions received on behalf of the group

... plus ...

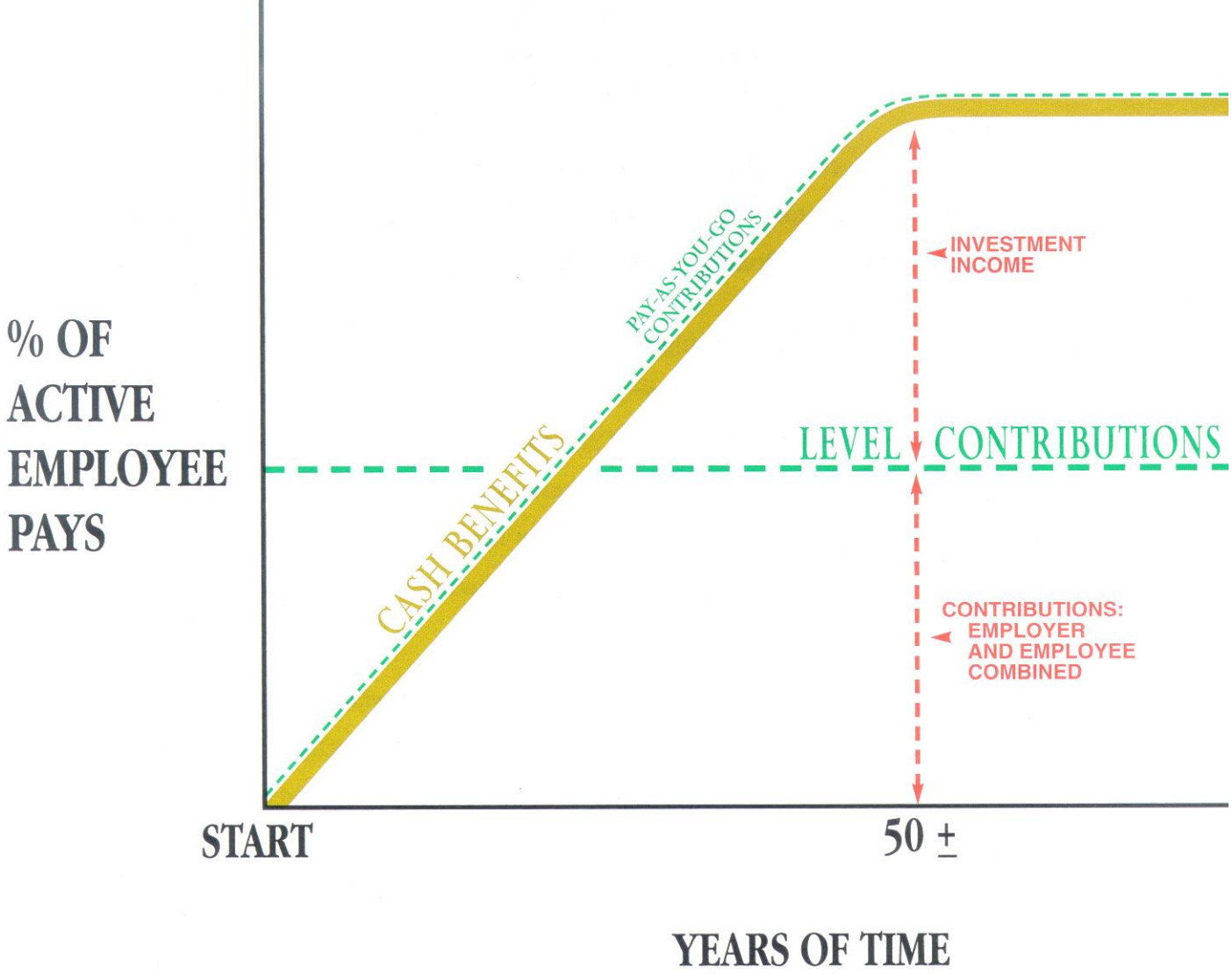
Investment earnings on contributions received and not required for immediate payment of benefits

... minus ...

The Expenses of operating the program.

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

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

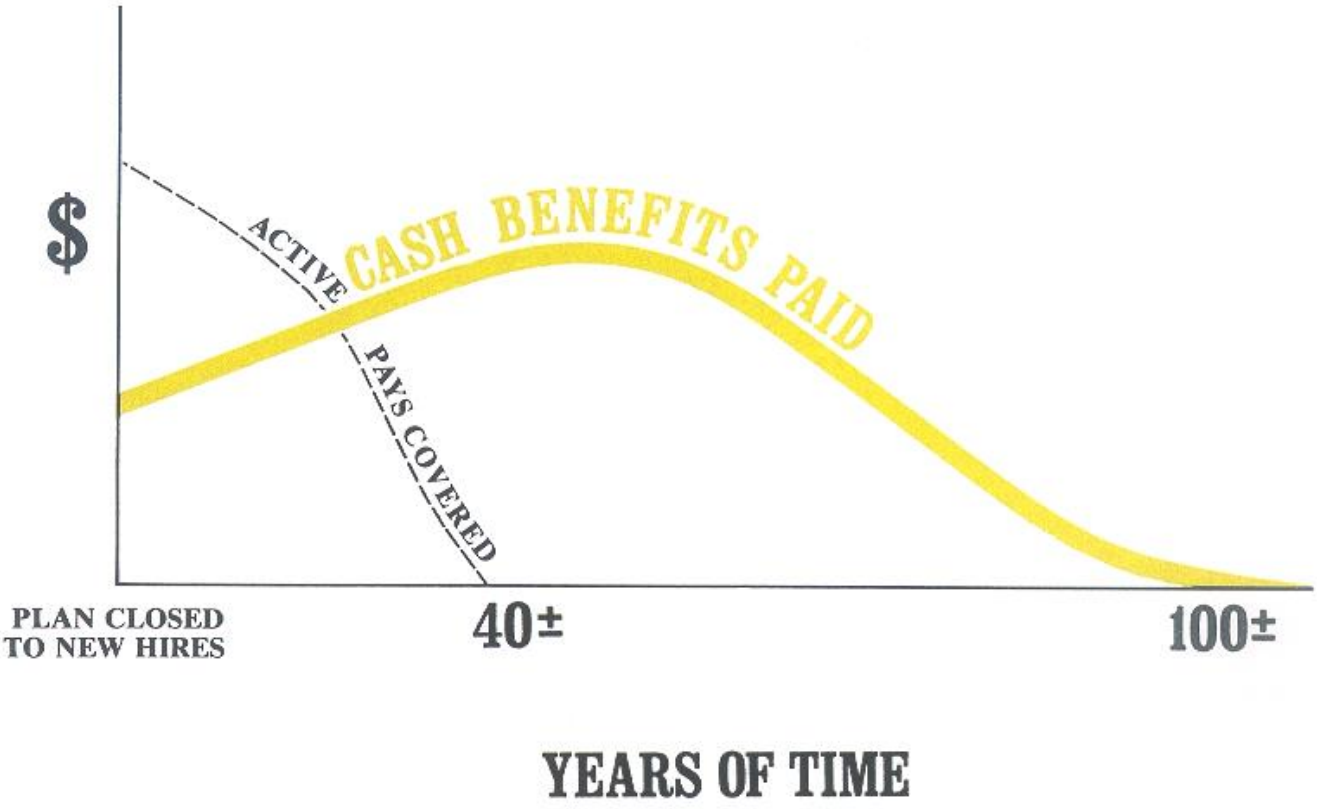


CASH BENEFITS LINE. This relentlessly increasing line is the fundamental reality of retirement plan financing. It happens each time a new benefit is added for future retirements (and happens regardless of the design for contributing for benefits).

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

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

A CLOSED PENSION PLAN



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

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

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

Methodology

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

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

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

Financing of Unfunded Actuarial Accrued Liabilities. Unfunded actuarial accrued liabilities (the portion of total liabilities not covered by present assets or expected future normal cost contributions) were amortized by level (principal or interest combined) dollar contributions over a closed period of 15 years. Level dollar amortization was used since the plan is closed to new hires. There is a 1-year lag between the valuation date and the contribution effective date. Unfunded liabilities were projected to the contribution effective date based on the valuation assumed rate of return and the adopted contributions and then amortized.

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

Actuarial Assumptions Used for the Valuation

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

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

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

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

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

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

Actuarial Assumptions Used for the Valuation

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

Investment Return (net of investment expenses): 6.75% a year, compounded yearly. This rate is consistent with a rate of wage inflation of 3.5% a year. There is no specific assumption regarding price inflation, but a price inflation assumption of 2.5% would be consistent with the other economic assumptions.

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

	Year Ended December 31					5-Year
	2017	2016	2015	2014	2013	Average*
Rate of Investment Return	6.4 %	7.2 %	8.8 %	8.8 %	9.8 %	8.2 %
Increase in Average Pay	1.7 %	3.5 %	0.9 %	0.4 %	(0.1)%	1.3 %
Real Rate of Return	4.7 %	3.7 %	7.9 %	8.4 %	9.9 %	6.9 %

* *Compounded rate of increase.*

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

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

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

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

Actuarial Assumptions Used for the Valuation

Probabilities of retirement for members eligible to retire were:

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

Actuarial Assumptions Used for the Valuation

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

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

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

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

Actuarial Assumptions Used for the Valuation

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

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

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

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

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

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

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

Miscellaneous and Technical Assumptions
December 31, 2017

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

Glossary

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

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

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

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

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

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

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

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

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

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

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

Glossary

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

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

GRS Retirement Consulting

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September 12, 2018

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

Attention: Ms. Bonnie Verbos

Dear Ms. Verbos:

Please find enclosed 15 copies of the report of the Annual Actuarial Valuation, as of December 31, 2017, of the Waterford Township Employees Retirement System.

Sincerely,

Kenneth G. Alberts

KGA:sc
Enclosures

cc: Plante & Moran
Attn: Keith Szymanski, CPA (email)
Ms. Cynthia Billings, Esq. (email)
Ms. Julie Moll (email)

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