Minnesota Judges Retirement Fund

Four-Year Experience Study

July 1, 2015 through June 30, 2019

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June 30, 2020

Minnesota State Retirement System
Judges Retirement Fund
St. Paul, Minnesota

Dear Board of Directors:

The results of the four-year ***actuarial experience study*** of the Judges Retirement Fund (JRF) are presented in this report. The investigation was conducted for the purpose of updating the actuarial assumptions used in valuing the actuarial liabilities of the Judges Retirement Fund.

The investigation was based upon the statistical data furnished for annual active member and retired life actuarial valuations concerning members who died, withdrew, became disabled or retired during the four-year period of the study by the Minnesota State Retirement System (MSRS). We checked for internal and year-to-year consistency, but did not audit the data. We are not responsible for the accuracy or completeness of the information provided by MSRS.

The investigation covered the four-year period from ***July 1, 2015 to June 30, 2019***, and was carried out using generally accepted actuarial principles and techniques.

We believe that the actuarial assumptions recommended in this experience study report represent individually and in the aggregate reasonable estimates of future experience of the Judges Retirement Fund.

This report should not be relied on for any purpose other than that described above. It was prepared at the request of MSRS 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 System only in its entirety and only with the permission of the Board.

This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. To the best of our knowledge and belief, the information contained in this report was performed in accordance with Minnesota Statutes Section 356.215 and the requirements of the Standards for Actuarial Work established by the Legislative Commission on Pensions and Retirement. We certify that, to the best of our knowledge, this report is complete and accurate and was made in accordance with standards of practice promulgated by the Actuarial Standards Board.

277 Coon Rapids Boulevard | Suite 212 | Coon Rapids, Minnesota 55433-2629

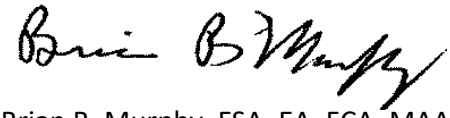
Board of Directors
Minnesota State Retirement System
Judges Retirement Fund
June 30, 2020

This report does not reflect the recent and still developing impact of COVID-19, which is likely to influence demographic experience and economic expectations, at least in the short-term. We will continue to monitor these developments and their impact on retirement plans.

Brian B. Murphy and Bonita J. Wurst are independent of the plan sponsor and are Members of the American Academy of Actuaries (MAAA) and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. In addition, Mr. Murphy meets the requirements of "approved actuary" under Minnesota Statutes Section 356.215, Subdivision 1, Paragraph (c).

Respectfully submitted,

Bonita J. Wurst, ASA, EA, FCA, MAAA



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

BJW/BBM:rmn

Actuarial Experience Study
2015-2019

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SECTION A

OVERVIEW AND SUMMARY OF RESULTS

Summary of Findings

The four-year period (July 1, 2015 to June 30, 2019) covered by this experience study provided sufficient data to form a basis for recommending changes in some of the assumptions and/or methods used in actuarial valuations of the Judges Retirement Fund. The recommended changes in actuarial assumptions and methods resulting from this experience study are summarized below:

Recommendations

- Decrease the price inflation assumption from 2.50% to 2.25%.
- Adjust assumed retirement rates:
  - Decrease the rate of assumed unreduced retirements (i.e., Normal Retirement) at age 67 and increase the rate of assumed unreduced retirements at ages 65 and 69. The overall impact is an increase in the expected number of unreduced retirements.
  - Decrease rates of assumed early retirement rates at age 62 and increase the rate of assumed early retirement at ages 61 and 64. The overall impact is an increase in the expected number of early retirements.
- Decrease rates of disability at all ages, equal to 60% of current disability rates.
- Change the base mortality table to the PUB-2010 General mortality table, with future improvement projected using scale MP-2019.
- Minor change to the spouse age difference assumption.

The recommendations are summarized on the following pages.

Review of the investment return assumption and actuarial methods is outside the scope of this experience study. Please refer to GRS' State Employees Retirement Fund experience study dated June 29, 2019. This report concluded that the current investment return assumption was within a reasonable range as of the date of the report, but that a rate near the median, such as 7.0%, would be likely to be sustainable for a longer period.

It is important to note that, by lowering the assumed rate of inflation but not the assumed investment return rate, the assumptions are actually more optimistic than before because the assumed real rate of return is higher than previously assumed. The 7.50% investment return assumption is required per Minnesota Statutes.

Introduction

Each year as of June 30, 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 (leaving before eligible to retire).
- Rates of **disability** among active members.
- Patterns of **pay increases** to active members.
- Rates of **retirement** among active members.
- Rates of **mortality** among active members, retirees, 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 gradual increases in required contributions as time progresses; and
- Overstated costs resulting in an unnecessarily large burden on the current generation of employers and taxpayers.

All actuarial assumptions are prescribed by Minnesota Statutes, the Legislative Commission on Pensions and Retirement or the MSRS Board of Directors.

A single set of assumptions will not 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. Actuarial assumptions were revised for the June 30, 2017 actuarial valuation based on the results of the most recent experience study. Economic assumptions were last revised for the June 30, 2018 actuarial valuation. All experience was compared to assumptions in effect as of the June 30, 2019 actuarial valuation.

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 the actual experience, we generally recommend a change in assumptions that produces 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. Consequently, 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 and methods. The various assumption changes are described on the following pages.

Summary of Decrement Experience
2015-2019

Decrement Risk Area	Actual Number	Expected		
		Current Assumptions	Proposed Assumptions	Change
*Unreduced Retirement**	46	44.3	51.1	6.8
Reduced Retirement	11	12.2	13.2	1.0
Withdrawal	8	0.0	0.0	-
Disability	0	2.1	1.3	(0.8)
Mortality				
Healthy Retired Lives - Male	29	28.2	32.8	4.6
- Female	2	3.7	3.8	0.1
Disabled Retired Lives - Male	7	2.0	4.0	2.0
- Female	0	0.1	0.3	0.2
Active Lives - Male	0	2.5	2.3	(0.2)
- Female	1	0.8	0.8	-

** The current assumption prescribed by the Minnesota Standards for Actuarial Work is that members who have reached 100% retirement eligibility will delay retirement for one year. Therefore, even though there are members that are age 70, these members are not included in this exhibit since retirement is assumed to be delayed one year. There were 21 actual retirements at age 70.*

The figures in the exhibit above are actual headcounts of occurrences. Calculations in the body of the report are liability weighted for retirement, withdrawal and active mortality and benefit weighted for healthy and disabled retiree mortality.

SECTION B

PAY INCREASES

Pay Increases

Pay increases granted to active members typically consist of two pieces:

- Payroll growth is an across-the-board, economic type of increase granted to most or all members of the group and is associated with a stable or level population. This increase is typically tied to inflation or cost-of-living changes; and

- An increase as a result of merit and seniority. This increase is typically related to the performance of an individual and includes promotions and increased years of experience.

Inflation and Payroll Growth

For the Judges plan, the general inflation assumption is currently 2.50% and the payroll growth assumption is currently 2.50%.

General inflation, as measured by the change in the Consumer Price Index, has averaged about 1.8% over the four-year period ending June 30, 2019. During the 2016 to 2018 calendar year period, the increase in the national average earnings has been about 2.7% (the 2019 national average earnings amount was not available at the time this report was published). Actual annual payroll growth for this plan for the four-year period ending June 30, 2019 has averaged approximately 3.7%. Active membership during this time increased 1.0%, from 312 as of July 1, 2015 to 315 as of July 1, 2019.

A thorough review of general inflation and payroll growth is presented in Section B of the MSRS State Employees Retirement Fund experience study report dated June 29, 2019. In that report, we recommended a general inflation assumption equal to 2.25% and a payroll growth assumption of 3.00%; note that the decrease in payroll growth assumption is due to the change in inflation only (i.e., there was no recommended change to the 0.75% real wage growth assumption).

We recommend reducing the assumed rate for general inflation from 2.50% to 2.25%. Changing the inflation assumption to 2.25% is supported by experience and is consistent with the assumption used for MSRS' State Employees Retirement Fund.

We also recommend increasing the real wage growth assumption from 0.00% to 0.25%, resulting in continuation of the 2.50% payroll growth assumption. Actual salary increases have exceeded inflation in recent years.

Pay Increases

We reviewed total pay increases during the four-year period. For each year, we excluded individual pay increases that were more than 30% and also excluded individual pay increases that were less than 0%. While this was a relatively small number of records, the experience would have distorted the experience of the overall group.

The current assumption is salary increases will equal 2.50% each year, consistent with the current inflation assumption.

Findings

Gross actual salary increases averaged 3.73% over the four-year period, ranging from 2.89% in 2018 to 4.56% in 2016.

Fiscal Year Ending	Count	Gross	
		Expected	Actual
2016	294	2.50%	4.56%
2017	287	2.50%	4.31%
2018	286	2.50%	2.89%
2019	284	2.50%	3.14%
Total	**1,151**	**2.50%**	**3.73%**

Actual salary increases tend to be consistent for all members each year and not dependent on age or service, which indicates merit and seniority does not influence wages. The Minnesota Legislature sets the compensation for judges. Over the study period, legislated increases were 4.0% (2016), 4.0% (2017), 2.5% (2018) and 2.5% (2019), for an average increase of 3.25%. A 2016 report on Minnesota Judicial State Court Salaries stated that the 4.0% increases in fiscal years 2016 and 2017 restored inflation-adjusted judicial salaries to 2002 levels. Actual increases during this period were slightly greater than the average legislated increase due to changes in assignment and data anomalies.

Recommendation

We recommend continuation of the present salary increase assumption of 2.50%, which is consistent with the recommended payroll growth assumption.

SECTION C

RETIREMENT EXPERIENCE

Liability-Weighted Analysis

Our experience with similar systems has shown that sometimes the use of assumptions based solely on counts of people retiring or terminating employment does not always reduce the size of the gain or loss in a particular decrement. Sometimes this can be due to the relative magnitude of the actuarial accrued liability of the members that decrement, rather than number counts alone. Consistent with recent experience studies for other MSRS plans, we have used "liability-weighted rate" for certain decrements. This represents the crude rate of decrement on a liability-weighted basis as opposed to strictly a number count basis. The liability-weighted rates were found to be more highly correlated with withdrawal and retirement decrements (particularly with reduced retirement) than with the population related rates. This makes some intuitive sense, since retirement and termination decisions are often made based on how much the members have to gain or lose if they retire or change jobs, whereas death and disability are typically not decisions at all but rather events that happen. Comments on specific assumptions are provided on the following pages.

While mortality is not a voluntary human behavior, a recent study by the Society of Actuaries found that mortality experience was highly correlated with education and income. That is, people with higher incomes and higher levels of education tended to live longer than others. As such, we also studied mortality rates on a "benefit-weighted" basis. This is discussed in more detail on page F-1.

Age and Service Unreduced (Normal) Retirement

Findings

The benefit provisions of the Judges Retirement Fund (JRF) establish the minimum age and service requirements for unreduced or normal retirement. However, the actual cost of retirement is determined when members actually retire. The assumption about timing of retirements is a major ingredient in cost calculations. Note that higher rates of retirement with full benefits generally results in higher computed contributions, and vice-versa.

Some members terminate employment with eligibility for retirement but elect to defer the benefit. We included these terminations as retirements for the purposes of this study.

The Normal Retirement benefit is determined as follows:

Tier 1: First appointed as a judge before July 1, 2013:
- (a) 2.70% of Average Salary for each year of Allowable Service prior to July 1, 1980; and
- (b) 3.20% of Average Salary for each year of Allowable Service after June 30, 1980
  (Maximum benefit is equal to 76.80% of Average Salary)

Tier 2: First appointed as a judge after June 30, 2013:
- (a) 3.20% of Average Salary for each year of Allowable Service prior to January 1, 2014; plus
- (b) 2.50% of Average Salary for each year of Allowable Service after December 31, 2013

The current assumption ends at age 70; in other words, we assume all members currently under the age of 70 will retire by the age of 70. However, for members currently age 70 or older, we assume retirement one year after the valuation date (effectively 18 months due to mid-year decrementing), as required by the Minnesota Standards for Actuarial Work. As such, there are no Exposures for ages 70 and older since the valuation assumption is that all of these members work an additional year and then retire. During the four-year period, there were 21 actual retirements at age 70 and 0 over age 70. We believe assuming 100% retirement at age 70 is an appropriate approach and reflects the statutory age 70 mandatory retirement age.

Tier 1 members are eligible for unreduced retirement at age 65 while Tier 2 members are eligible for unreduced retirement at age 66. Tier 2 members were appointed after June 30, 2013 and most have not met the five-year service requirement for retirement before age 70. There were no Tier 2 members that met the retirement eligibility requirement at age 65 over the period of the study; if there were, we would include these members in the Early Retirement analysis.

Overall, on a liability-weighted basis, the plan experienced more unreduced retirements than projected by the present assumptions, but the results varied by age.

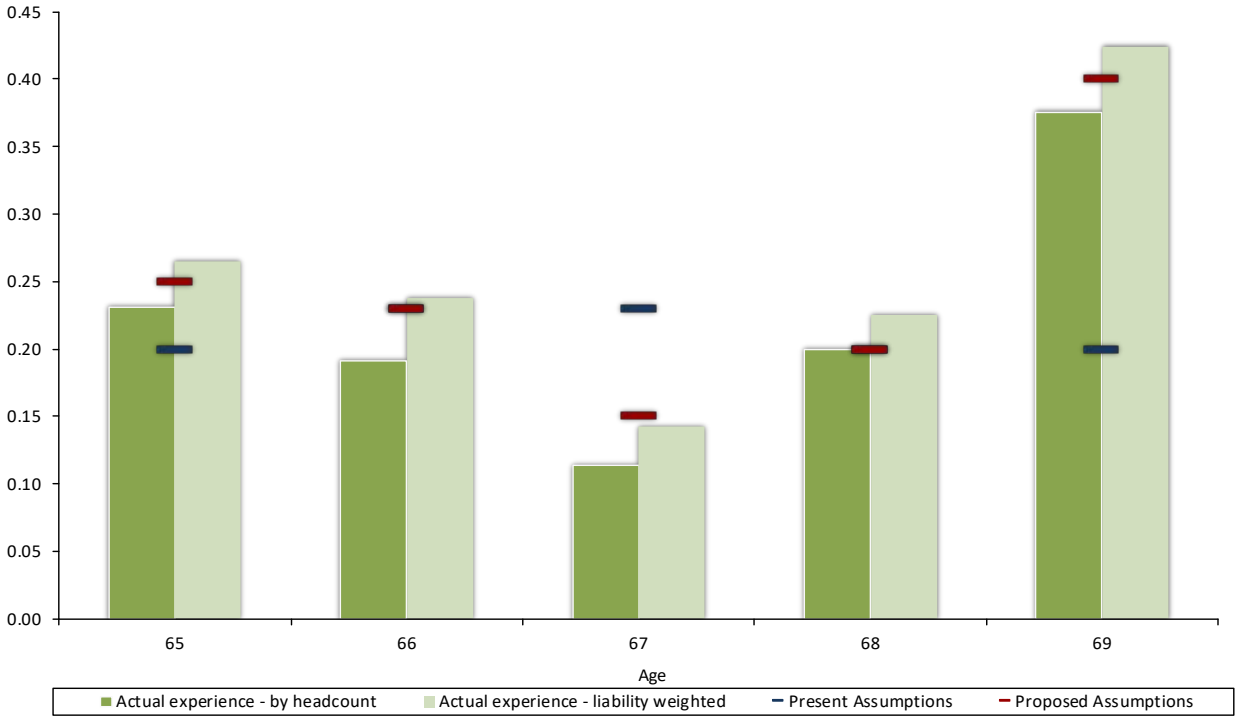
Recommendations

We recommend adjusting the assumed unreduced retirement rates to reflect observed experience, as shown on the next page. In addition, we recommend the Minnesota Standards for Actuarial Work be modified to remove the requirement that members currently age 70 delay retirement one year and instead assume these members retire mid-year following the valuation date, the same as members younger than age 70.

Age and Service Unreduced (Normal) Retirement

Age	Liability Weighted ($000s)		Crude Rates		Sample Rates		Expected Retirements*		Ratio of Actuals/Expecteds	
	Retirements	Exposure	Liability Weighted	Population Weighted	Current	Proposed*	Current	Proposed*	Current	Proposed
65	13,510	50,998	0.2649	0.2308	0.2000	0.2500	10,199.51	12,749.50	132.5%	106.0%
66	8,881	37,318	0.2380	0.1915	0.2300	0.2300	8,582.98	8,583.14	103.5%	103.5%
67	3,944	27,646	0.1427	0.1143	0.2300	0.1500	6,358.45	4,146.90	62.0%	95.1%
68	5,142	22,833	0.2252	0.2000	0.2000	0.2000	4,566.82	4,566.60	112.6%	112.6%
69	10,111	23,861	0.4237	0.3750	0.2000	0.4000	4,772.02	9,544.40	211.9%	105.9%
70	*	*	N/A	N/A	1.0000	1.0000	-	-	N/A	N/A
Totals	**41,588**	**162,656**					**34,479.78**	**39,590.54**	**120.6%**	**105.0%**

** The current assumption prescribed by the Minnesota Standards for Actuarial Work is that members who have reached 100% retirement eligibility will delay retirement for one year. Therefore, even though there are members that are age 70, these members are not included in the Exposures since retirement is assumed to be delayed one year. There were 21 actual retirements at age 70.*



Reduced Early Retirement

Findings

JRF members may retire with a reduced benefit prior to the attainment of Normal Retirement. We refer to these cases as early retirements.

Early retirement benefits are equal to the normal retirement benefit with a reduction equal to 0.50% for each month the member is under Normal Retirement Age (age 65 for judges appointed prior to July 1, 2013 and age 66 for judges appointed after June 30, 2013).

Generally, higher rates of early retirement generally result in slightly lower computed contributions, and vice versa.

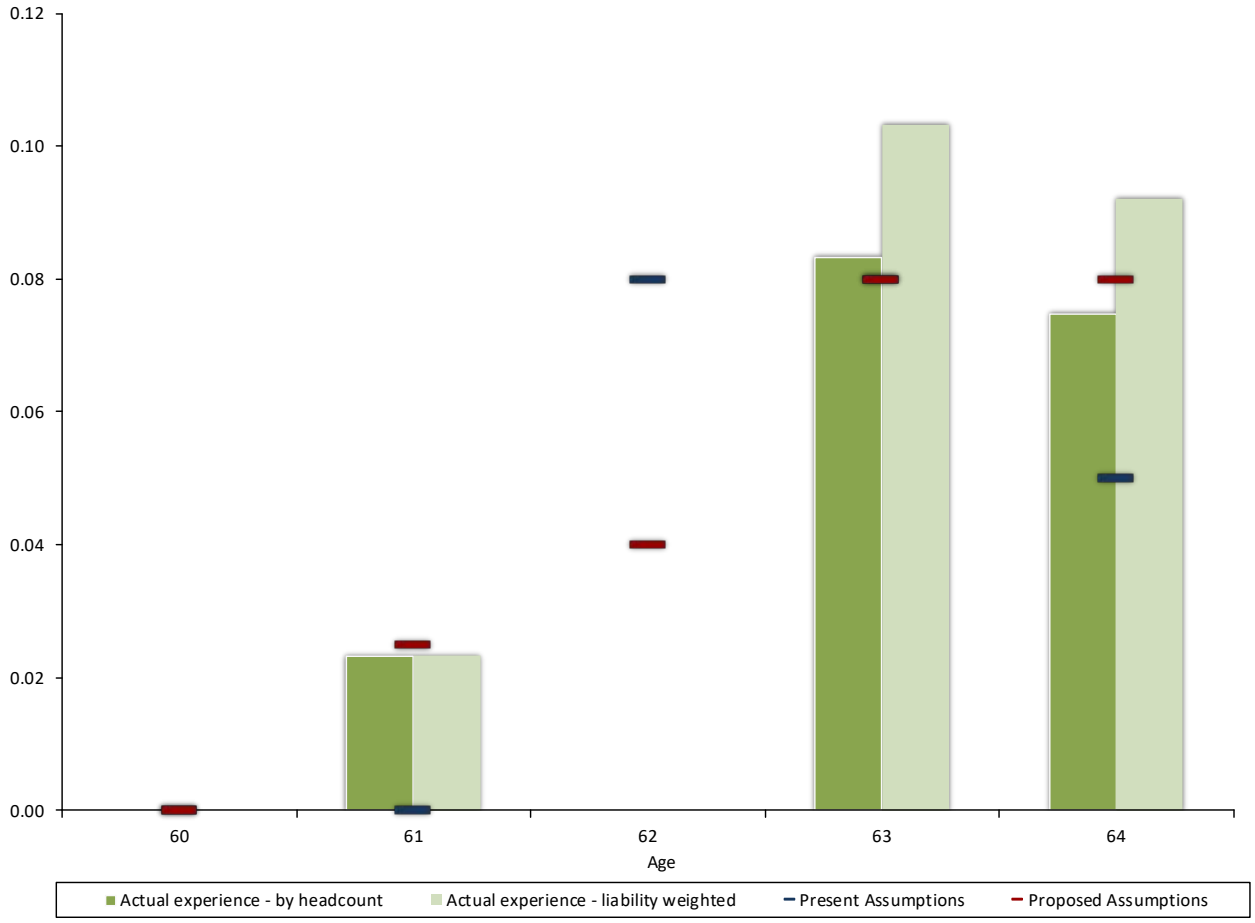
We reviewed the experience during the study period. On a liability-weighted basis, there were more early retirements than expected.

Recommendation

We recommend a change in early retirement rates, as indicated on the next page. The proposed rates predict more early retirements.

Reduced Early Retirement

Age	Liability Weighted ($000s)		Crude Rates		Sample Rates		Expected Retirements* ($000s)		Ratio of Actuals/Expecteds	
	Retirements	Exposure	Liability Weighted	Population Weighted	Current	Proposed	Current	Proposed	Current	Proposed
60	-	30,650	0.0000	0.0000	0.0000	0.0000	-	-	N/A	N/A
61	774	33,100	0.0234	0.0233	0.0000	0.0250	-	827.50	N/A	93.5%
62	-	39,137	0.0000	0.0000	0.0800	0.0400	3,130.95	1,565.48	0.0%	0.0%
63	4,926	47,725	0.1032	0.0833	0.0800	0.0800	3,818.07	3,818.00	129.0%	129.0%
64	4,672	50,731	0.0921	0.0746	0.0500	0.0800	2,536.56	4,058.48	184.2%	115.1%
Total	**10,372**	**201,343**	**0.0515**	**0.0418**			**9,485.58**	**10,269.46**	**109.3%**	**101.0%**



Retirement from Deferred Status

Members who terminate and have five years of service are entitled to either a refund of employee contributions, with interest, or a deferred retirement benefit.

While some members actually elect a refund even if it is less valuable than the deferred annuity, the current valuation assumption is that members will elect a refund only if it is more valuable than the deferred annuity. When a member elects a refund that is less valuable than the member's deferred annuity (or when a member elects the deferred annuity even if the refund is more valuable), the plan experiences a small liability gain. Since the current assumption results in very small gains to the plan, we recommend no change to this assumption.

For those deferred vested members for whom the deferred benefit is more valuable than a refund, the current valuation assumption is that the member will commence benefits at Normal Retirement Age. The benefit is reduced 0.50% per month, meaning this assumption would generate a small actuarial loss if retirement occurs prior to Normal Retirement Age. We recommend no change to this set of assumptions.

SECTION D

WITHDRAWAL EXPERIENCE

Withdrawal Experience

Members who leave active employment, for reasons other than retirement, disability or death, may be eligible for the following payments from the pension trust:

- A refund of employee contributions; or
- A deferred retirement benefit, if they are vested.

Deferred retirement benefits are based on the pay and service credit at the time of withdrawal. The benefit is payable at Normal Retirement (or at Early Retirement with a reduction). Consequently, members who withdraw receive much less from the plan than members who stay in employment until retirement. Higher rates of withdrawal result in lower computed contributions, and vice-versa.

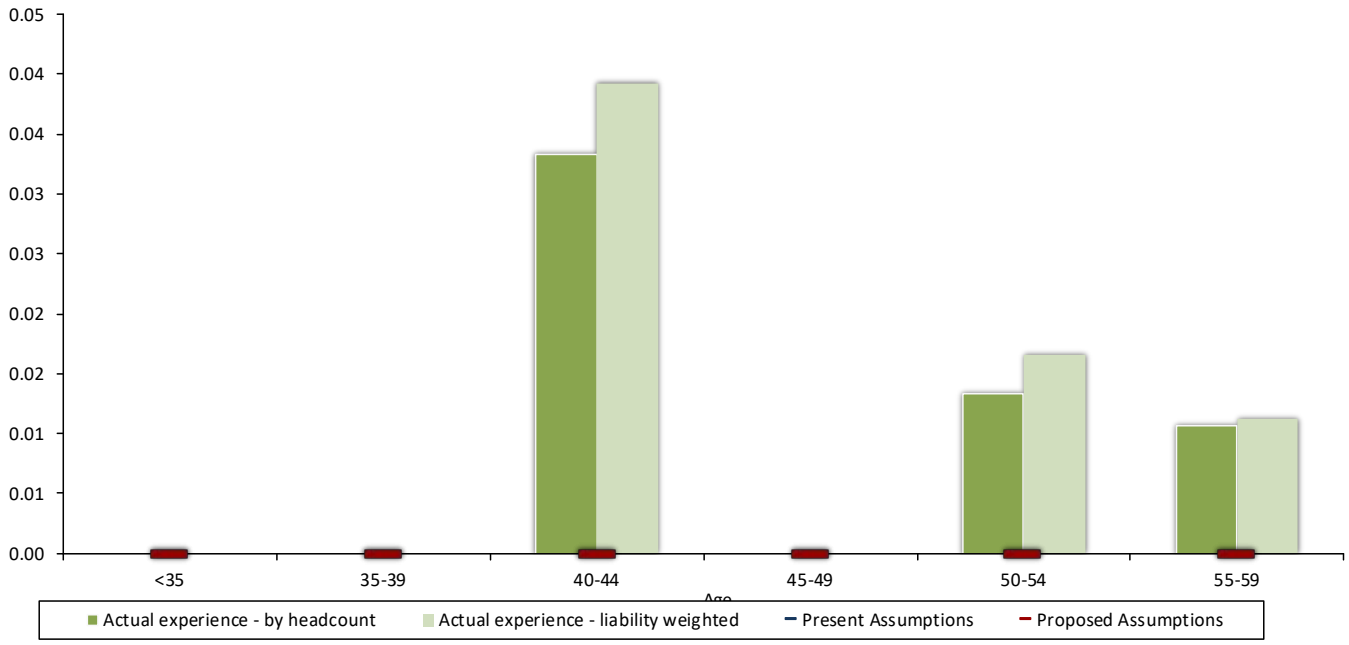
Our current valuation assumptions are that no members terminate prior to retirement. The actual number of terminations prior to retirement has historically been very low, consistent with the findings in this report. If there are terminations, they will result in small actuarial gains.

Recommendation

We recommend continuation of the current assumption that no members terminate prior to retirement eligibility.

Withdrawal Experience – Males and Females

Age	Liability Weighted ($000s)		Crude Rates		Sample Rates		Expected Withdrawals		Ratio of Actuals/Expecteds	
	Withdrawals	Exposure	Liability Weighted	Population Weighted	Current	Proposed	Current	Proposed	Current	Proposed
<35	-	-	N/A	N/A	0.0000	0.0000	-	-	N/A	N/A
35-39	-	3,835	0.0000	0.0000	0.0000	0.0000	-	-	N/A	N/A
40-44	844	21,488	0.0393	0.0333	0.0000	0.0000	-	-	N/A	N/A
45-49	-	56,910	0.0000	0.0000	0.0000	0.0000	-	-	N/A	N/A
50-54	1,872	113,358	0.0165	0.0133	0.0000	0.0000	-	-	N/A	N/A
55-59	1,841	163,399	0.0113	0.0107	0.0000	0.0000	-	-	N/A	N/A
60+	-	9,053	0.0000	0.0000	0.0000	0.0000	-	-	N/A	N/A
Totals	**4,557**	**368,043**	**0.0124**	**0.0113**	**0.0000**	**0.0000**	**-**	**-**	**N/A**	**N/A**



SECTION E

DISABILITY EXPERIENCE

Disability Experience

Judges who are unable to perform normal duties are eligible to receive a disability benefit. Disability benefits are not paid by the fund during the first year; instead, salary is continued for one year but not beyond age 70. Member contributions continue and Allowable Service is earned. If disability continues after the first year (or age 70 if earlier), the larger of 25.00% of Average Salary and the Normal Retirement benefit (without reduction) is paid.

The assumed rates of disability (leaving active service due to injury or illness while not entitled to age and service retirement benefits) are a minor ingredient in cost calculations, since the incidence of disability is low. Higher rates of disability generally result in somewhat higher computed contributions, and vice-versa.

Findings

The process of qualifying for a disability benefit requires some burden of proof. This process may result in a member being reported as a termination or withdrawal while the disability application is being reviewed. We reviewed termination experience for the JRF over the course of the four-year period and found there were no members who were reclassified as a disability retirement after first being reported as a termination.

We reviewed the disability experience during the four-year period. The results are shown on the following pages. There were no disability retirements during the past four years. There were also no disability retirements during the 2011-2015 experience study.

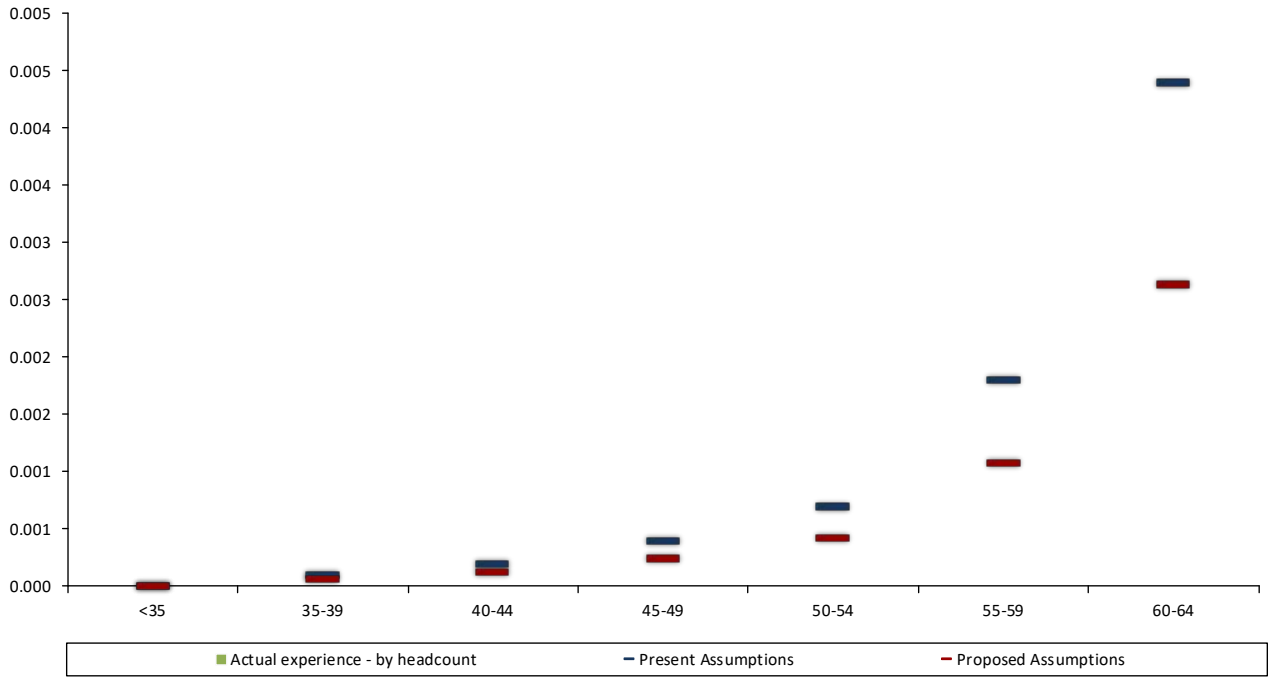
Recommendation

We recommend adopting lower rates of disability for all members, equal to 60% of the current disability rates.

Disability Experience
Males and Females

Age	Disabilities	Exposure	Crude Rates	Sample Rates*		Expected Disabilities		Ratio of Actuals/Expecteds	
				Current	Proposed	Current	Proposed	Current	Proposed
<35	-	-	N/A	0.0000	0.0000	-	-	N/A	N/A
35-39	-	-	N/A	0.0001	0.0001	-	-	N/A	N/A
40-44	-	42	0.0000	0.0002	0.0001	0.01	0.01	0.0%	0.0%
45-49	-	90	0.0000	0.0004	0.0002	0.03	0.03	0.0%	0.0%
50-54	-	193	0.0000	0.0007	0.0004	0.11	0.10	0.0%	0.0%
55-59	-	255	0.0000	0.0018	0.0011	0.34	0.34	0.0%	0.0%
60-64	-	421	0.0000	0.0044	0.0026	1.65	0.81	0.0%	0.0%
Totals	**-**	**1,001**	**0.0000**	**0.0021**	**0.0013**	**2.13**	**1.29**	**0.0%**	**0.0%**

** Sample rates taken from the mid-point of the age group.*



SECTION F

MORTALITY EXPERIENCE

Mortality Experience

Post-retirement mortality is an important component in cost calculations and should be updated from time-to-time to reflect current and expected future longevity improvements. Pre-retirement mortality is a relatively minor component in cost calculations. The frequency of pre-retirement deaths is so low that mortality assumptions based on actual experience can only be produced for very large retirement systems, if at all.

Actuarial Standards of Practice

Actuarial Standards of Practice (ASOP) No. 35 Disclosure Section 4.1.1 states, "The disclosure of the mortality assumption should contain sufficient detail to permit another qualified actuary to understand the provision made for future mortality improvement. If the actuary assumes zero mortality improvement after the measurement date, the actuary should state that no provision was made for future mortality improvement." The current mortality rates used in the valuation include a provision for future mortality improvement.

The New Mortality Tables and Projection Scale

Recently, the Society of Actuaries published a mortality study that was specific to public sector retirement systems. This is a very comprehensive study and there are numerous mortality tables created for each classification of employee (General members, Public Safety, Teachers, Survivors, Juvenile, headcount-weighted, benefit-weighted, above median income, below median income).

One of the key findings of the study is that there is a high correlation between longevity and income and education. As such, the SOA highly recommended the use of 'benefit-weighted' rates when developing mortality tables. We were able to review JRF retiree and disability mortality on a "benefit-weighted" basis and have shown the results on pages F-4 through F-7 of this report. Consistent with the SOA study, JRF members with higher benefits generally appear to experience longer lifespans, resulting in lower mortality rates.

Projection Scale

Fully generational tables, which are utilized for the MSRS valuations, help take into account future improvements in mortality that are expected to occur. The Society of Actuaries updates the projection scale annually and the latest published table is called the MP-2019 Projection Scale.

Mortality Experience

Findings

Most pension systems will have insufficient data for full credibility in setting a mortality assumption. The general rule of thumb is that approximately 1,000 deaths are required of each gender in the experience period for full credibility with a 90% confidence level. When less than 1,000 deaths occur during the experience study period, partial credibility can be given to the plan's experience based on the actual number of deaths that occurred.

During the four-year period, there were 29 male retiree deaths and 2 female retiree deaths. The healthy retiree mortality experience is not considered to be credible since there were so few deaths. Pre-retirement mortality and disabled retiree experience is also not considered to be credible. Therefore, we are recommending the use of standard mortality tables without adjustment.

We reviewed the mortality experience during the four-year period. The results are shown on the following pages.

Healthy Retirees

Due to potential anti-selection bias as well as data needs which are outside the scope of the annual valuation process, we did not include beneficiary and survivor mortality experience in our study.
In total, on a benefit weighted basis, the plan experienced more male deaths than expected ($2,204,000 actual versus $2,071,000 expected) and fewer female deaths than expected ($108,000 actual versus $236,000 expected).

Disabled Retirees

On a benefit-weighted basis, the plan experienced more deaths among disabled males ($647,000) than projected by the present assumptions ($164,000). The actual number of deaths on a benefit-weighted basis among disabled females ($0) was less than the number projected by the present assumptions ($5,000).

Active Members

On a liability-weighted basis, the actual number of male deaths among active members ($0) was less than the number projected by the present assumption ($1,746,000). The plan experienced more deaths on a liability-weighted basis among females ($701,000) than projected by the present assumptions ($558,000).

Mortality Experience

Recommendations

Due to the size of this plan, the experience is not considered credible. As such, we recommend adoption of the Pub-2010 mortality tables. All recommended tables are Benefit-Weighted.

We recommend adoption of the following mortality tables:

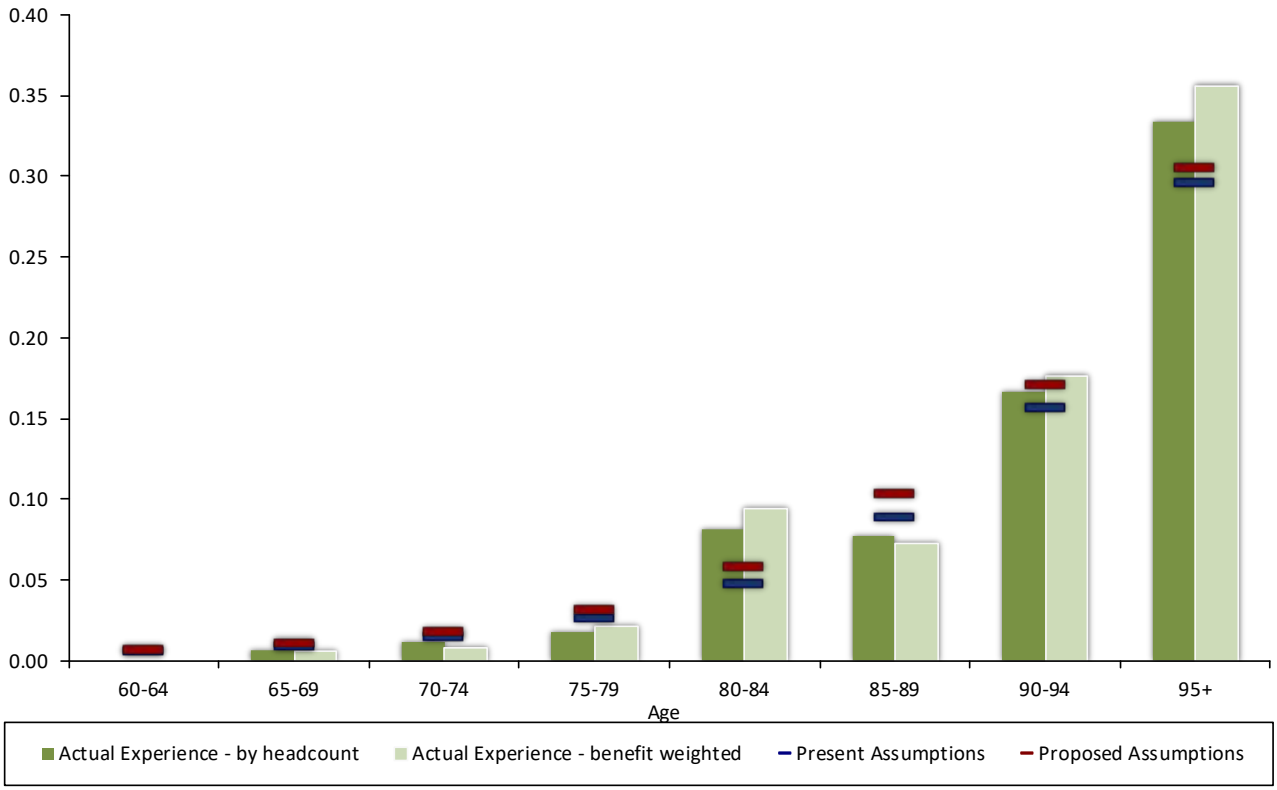
Healthy Male Retirees:	Pub-2010 Male Healthy Retired General Mortality Table adjusted for mortality improvements using projection scale MP-2019.
Healthy Female Retirees:	Pub-2010 Female Healthy Retired General Mortality Table, adjusted for mortality improvements using projection scale MP-2019.
Disabled Male Retirees:	Pub-2010 Male General Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2019.
Disabled Female Retirees:	Pub-2010 Female General Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2019.
Male Active Members:	Pub-2010 Male General Mortality Table adjusted for mortality improvements using projection scale MP-2019.
Female Active Members:	Pub-2010 Female General Mortality Table adjusted for mortality improvements using projection scale MP-2019.

Although the recommended mortality tables appear to not be a good fit based on the plan's actual experience, the plan's experience is not considered to be credible, as noted earlier in this report. The number of active member and retiree deaths during the four-year period was very low (0 male and 1 female for active member deaths; 7 male and 0 female for disabled retiree deaths; 29 male and 2 female for healthy retiree deaths).

Post-Retirement Mortality Experience
Healthy Males

	Benefit Weighted ($000s)		Crude Rates		Sample Rates		Benefit Weighted ($000s) Expected Deaths		Ratio of Actuals/Expecteds	
Age	Deaths	Exposure	Benefit Weighted	Population Weighted	Current	Proposed*	Current	Proposed*	Current	Proposed*
60-64	-	819	0.000000	0.000000	0.005886	0.007408	5.27	6.63	0.0%	0.0%
65-69	65	10,749	0.006047	0.006623	0.008949	0.010935	101.91	123.83	63.8%	52.5%
70-74	143	17,059	0.008383	0.011905	0.015236	0.018037	253.44	300.66	56.4%	47.6%
75-79	247	11,506	0.021467	0.017341	0.026726	0.031846	298.44	356.19	82.8%	69.3%
80-84	551	5,842	0.094317	0.081395	0.048203	0.057912	277.75	333.58	198.4%	165.2%
85-89	430	5,899	0.072894	0.076923	0.088958	0.103360	517.58	602.03	83.1%	71.4%
90-94	612	3,478	0.175963	0.166667	0.156655	0.170660	509.51	559.45	120.1%	109.4%
95+	156	438	0.356164	0.333333	0.295898	0.305663	106.76	111.77	146.1%	139.6%
Totals	**2,204**	**55,790**	**0.039505**	**0.036115**	**0.037115**	**0.042913**	**2,070.66**	**2,394.14**	**106.4%**	**92.1%**

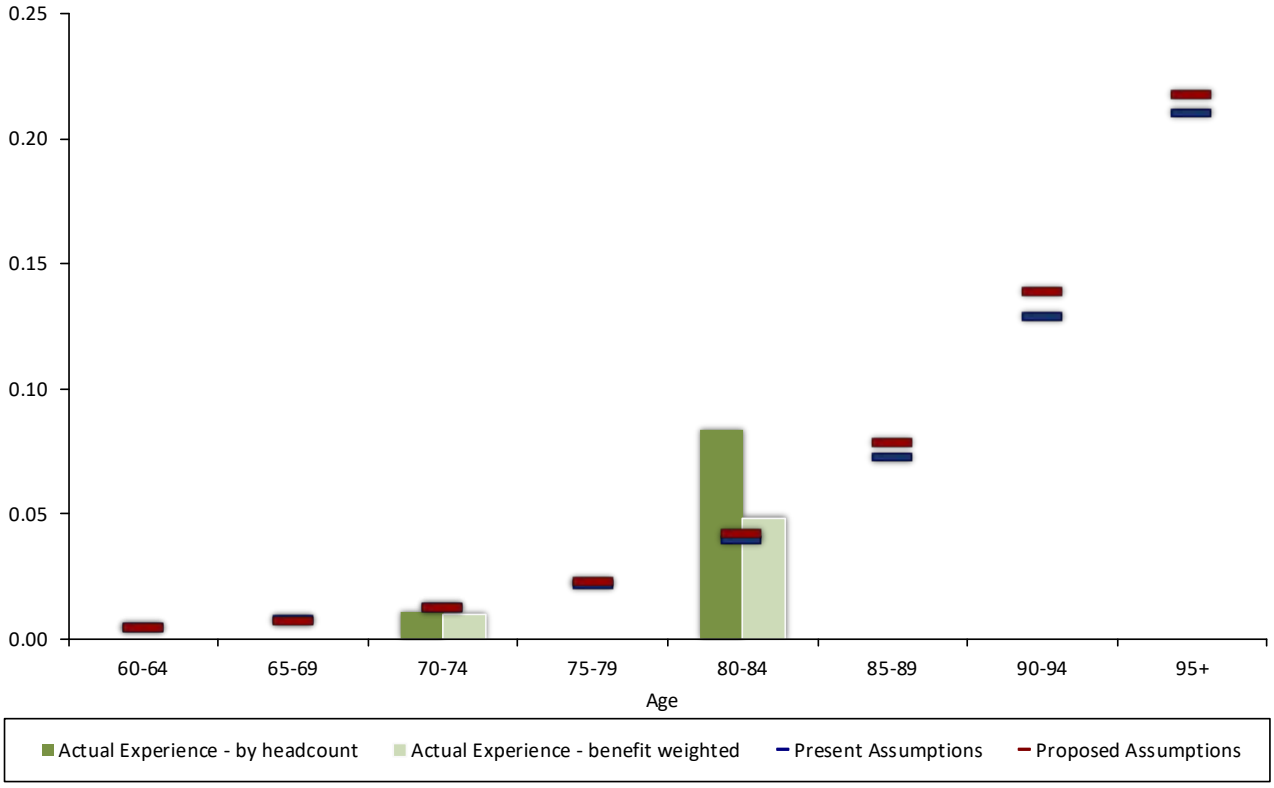
** In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.*



Post-Retirement Mortality Experience
Healthy Females

	Benefit Weighted ($000s)		Crude Rates		Sample Rates		Benefit Weighted ($000s) Expected Deaths		Ratio of Actuals/Expecteds	
Age	Deaths	Exposure	Benefit Weighted	Population Weighted	Current	Proposed*	Current	Proposed*	Current	Proposed*
60-64	-	549	0.000000	0.000000	0.004850	0.004659	3.04	2.84	0.0%	0.0%
65-69	-	3,756	0.000000	0.000000	0.007741	0.007238	30.51	28.54	0.0%	0.0%
70-74	62	6,367	0.009738	0.010870	0.012724	0.012555	76.76	75.61	80.8%	82.0%
75-79	-	1,097	0.000000	0.000000	0.021942	0.022750	23.29	24.16	0.0%	0.0%
80-84	46	949	0.048472	0.083333	0.039482	0.041956	36.97	39.32	124.4%	117.0%
85-89	-	808	0.000000	0.000000	0.072456	0.078565	57.32	62.31	0.0%	0.0%
90-94	-	68	0.000000	0.000000	0.128802	0.138540	7.77	8.49	0.0%	0.0%
95+	-	-	N/A	N/A	0.209951	0.217224	-	-	N/A	N/A
Totals	**108**	**13,594**	**0.007945**	**0.009346**	**0.017336**	**0.017748**	**235.67**	**241.27**	**45.8%**	**44.8%**

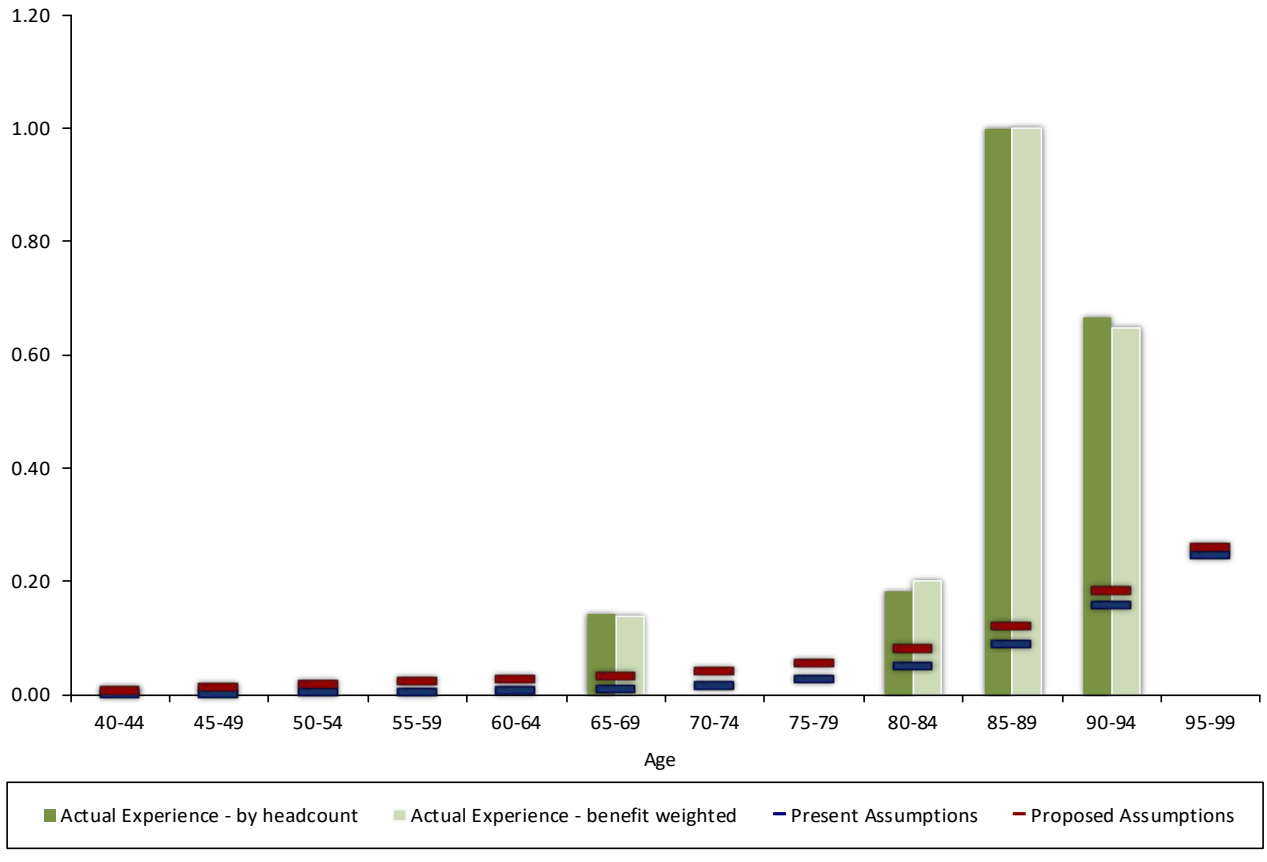
** In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.*



Post-Retirement Mortality Experience
Disabled Males

	Benefit Weighted ($000s)		Crude Rates		Sample Rates		Benefit Weighted ($000s) Expected Deaths		Ratio of Actuals/Expecteds	
Age	Deaths	Exposure	Benefit Weighted	Population Weighted	Current	Proposed*	Current	Proposed*	Current	Proposed*
40-44	-	-	N/A	N/A	0.001319	0.008146	-	-	N/A	N/A
45-49	-	-	N/A	N/A	0.001982	0.011692	-	-	N/A	N/A
50-54	-	-	N/A	N/A	0.003015	0.017400	-	-	N/A	N/A
55-59	-	-	N/A	N/A	0.004255	0.023097	-	-	N/A	N/A
60-64	-	165	0.000000	0.000000	0.005912	0.027741	1.04	4.72	0.0%	0.0%
65-69	64	468	0.136752	0.142857	0.008991	0.032765	4.45	15.63	1439.8%	409.5%
70-74	-	1,110	0.000000	0.000000	0.015332	0.040848	16.66	45.04	0.0%	0.0%
75-79	-	1,485	0.000000	0.000000	0.026903	0.055704	40.81	83.99	0.0%	0.0%
80-84	195	971	0.200824	0.181818	0.048502	0.081397	38.24	69.59	509.9%	280.2%
85-89	194	194	1.000000	1.000000	0.089488	0.121322	22.08	27.60	878.6%	702.9%
90-94	194	300	0.646667	0.666667	0.157582	0.183382	41.19	49.39	471.0%	392.8%
95-99	-	-	N/A	N/A	0.246100	0.259294	-	-	N/A	N/A
Totals	**647**	**4,693**	**0.137865**	**0.111111**	**0.035045**	**0.063064**	**164.47**	**295.96**	**393.4%**	**218.6%**

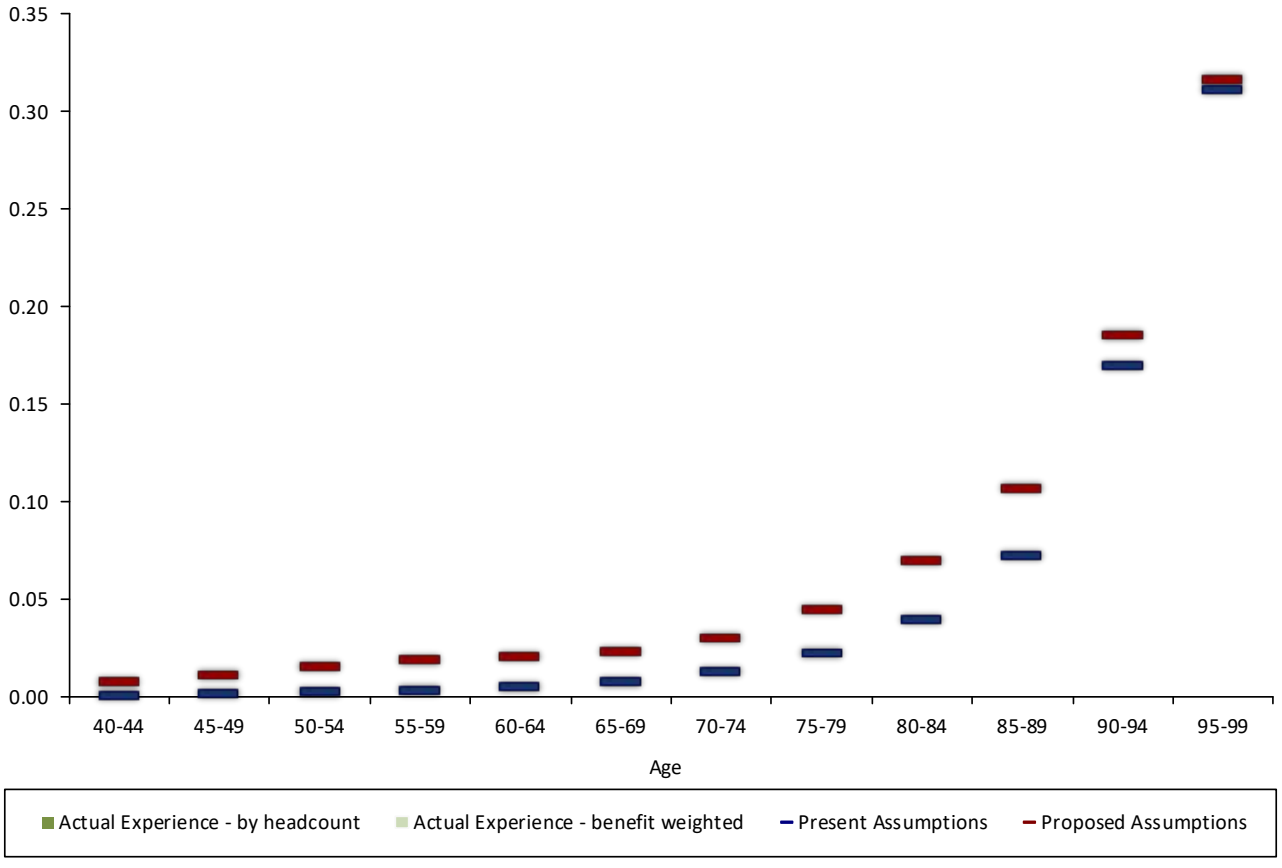
** In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.*



Post-Retirement Mortality Experience
Disabled Females

	Benefit Weighted ($000s)		Crude Rates		Sample Rates		Benefit Weighted ($000s) Expected Deaths		Ratio of Actuals/Expecteds	
Age	Deaths	Exposure	Benefit Weighted	Population Weighted	Current	Proposed*	Current	Proposed*	Current	Proposed*
40-44	-	-	N/A	N/A	0.001272	0.007796	-	-	N/A	N/A
45-49	-	-	N/A	N/A	0.001644	0.011262	-	-	N/A	N/A
50-54	-	-	N/A	N/A	0.002234	0.015953	-	-	N/A	N/A
55-59	-	-	N/A	N/A	0.003182	0.019378	-	-	N/A	N/A
60-64	-	48	0.000000	0.000000	0.004870	0.020846	0.28	1.02	0.0%	0.0%
65-69	-	259	0.000000	0.000000	0.007787	0.023178	2.05	6.05	0.0%	0.0%
70-74	-	233	0.000000	0.000000	0.012816	0.030284	2.59	6.52	0.0%	0.0%
75-79	-	-	N/A	N/A	0.022084	0.044694	-	-	N/A	N/A
80-84	-	-	N/A	N/A	0.039711	0.069597	-	-	N/A	N/A
85-89	-	-	N/A	N/A	0.072860	0.106984	-	-	N/A	N/A
90-94	-	-	N/A	N/A	0.170283	0.185774	-	-	N/A	N/A
95-99	-	-	N/A	N/A	0.311270	0.316929	-	-	N/A	N/A
Totals	**-**	**540**	**0.000000**	**0.000000**	**0.009131**	**0.025167**	**4.93**	**13.59**	**0.0%**	**0.0%**

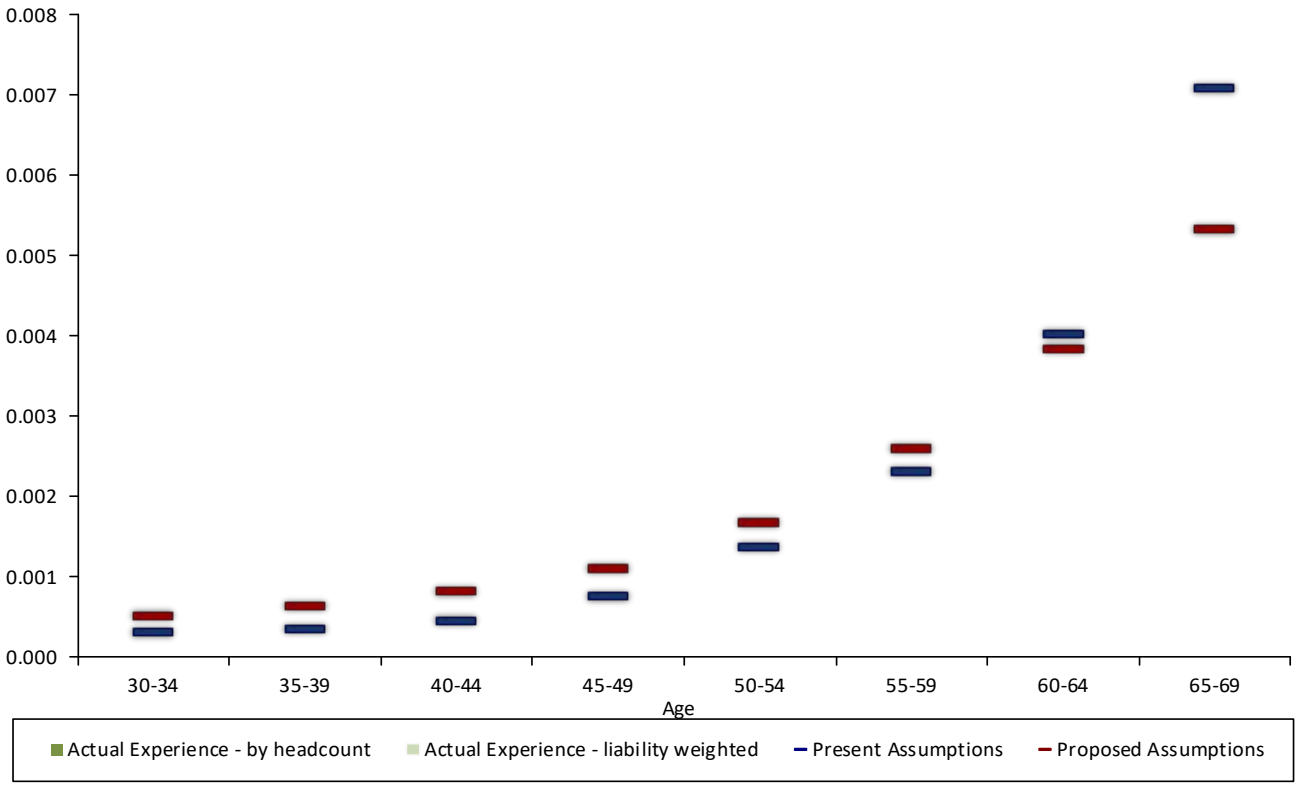
** In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.*



Pre-Retirement Mortality Experience
Healthy Males

	Liability Weighted ($000s)		Crude Rates		Sample Rates		Liability Weighted ($000s) Expected Deaths		Ratio of Actuals/Expecteds	
Age	Deaths	Exposure	Liability Weighted	Population Weighted	Current	Proposed*	Current	Proposed*	Current	Proposed
30-34	-	-	N/A	N/A	0.0003	0.0005	-	-	N/A	N/A
35-39	-	-	N/A	N/A	0.0004	0.0006	-	-	N/A	N/A
40-44	-	9,398	0.0000	0.0000	0.0005	0.0008	4.55	7.95	0.0%	0.0%
45-49	-	21,033	0.0000	0.0000	0.0008	0.0011	16.52	23.84	0.0%	0.0%
50-54	-	46,909	0.0000	0.0000	0.0014	0.0017	66.55	81.40	0.0%	0.0%
55-59	-	100,779	0.0000	0.0000	0.0023	0.0026	238.98	265.65	0.0%	0.0%
60-64	-	128,483	0.0000	0.0000	0.0040	0.0038	543.83	506.99	0.0%	0.0%
65-69	-	127,601	0.0000	0.0000	0.0071	0.0053	875.78	669.23	0.0%	0.0%
Totals	**-**	**434,203**	**0.0000**	**0.0000**	**0.0040**	**0.0036**	**1,746.22**	**1,555.06**	**0.0%**	**0.0%**

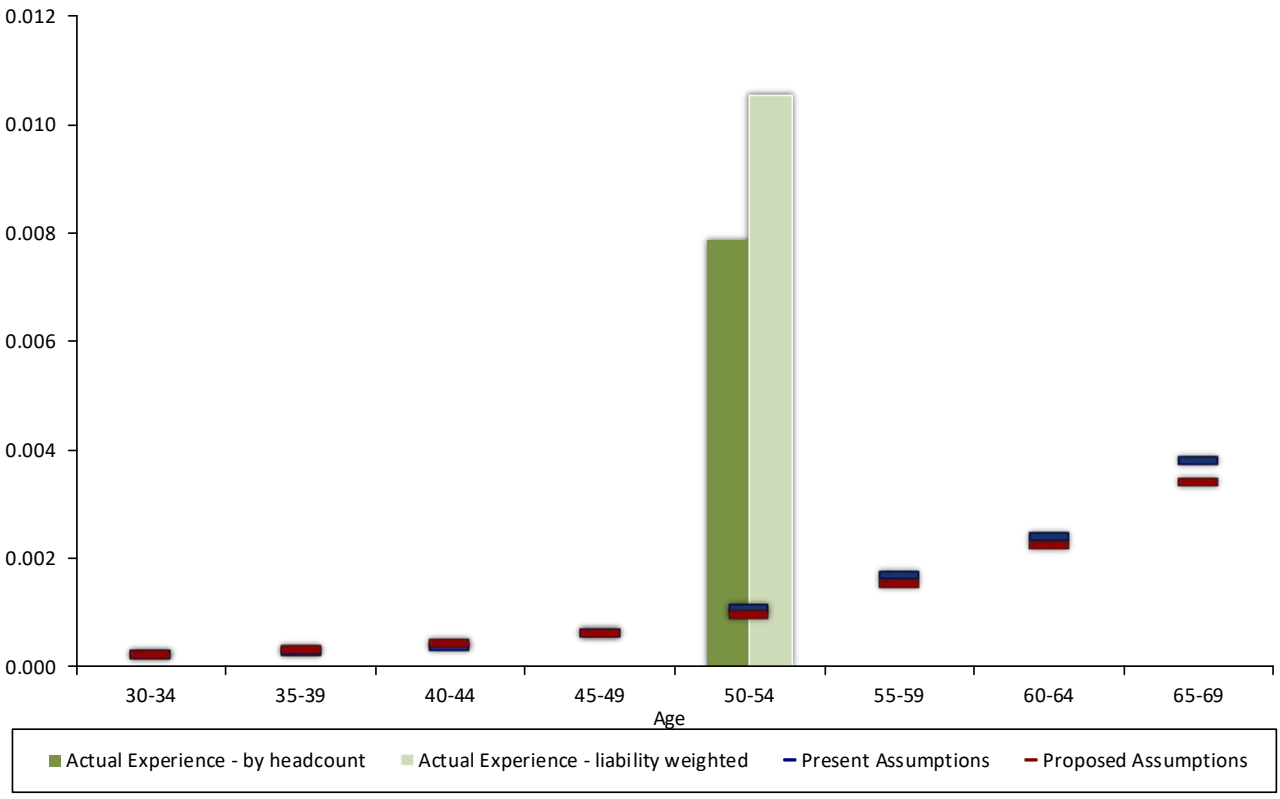
** In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.*



Pre-Retirement Mortality Experience
Healthy Females

	Liability Weighted ($000s)		Crude Rates		Sample Rates		Liability Weighted ($000s) Expected Deaths		Ratio of Actuals/Expecteds	
Age	Deaths	Exposure	Liability Weighted	Population Weighted	Current	Proposed*	Current	Proposed*	Current	Proposed
30-34	-	-	N/A	N/A	0.0002	0.0002	-	-	N/A	N/A
35-39	-	3,835	0.0000	0.0000	0.0003	0.0003	1.17	1.36	0.0%	0.0%
40-44	-	12,090	0.0000	0.0000	0.0004	0.0004	4.80	5.46	0.0%	0.0%
45-49	-	35,877	0.0000	0.0000	0.0006	0.0006	23.88	23.53	0.0%	0.0%
50-54	701	66,449	0.0105	0.0079	0.0011	0.0010	69.74	64.03	1005.2%	1094.8%
55-59	-	78,285	0.0000	0.0000	0.0017	0.0015	132.99	122.21	0.0%	0.0%
60-64	-	80,748	0.0000	0.0000	0.0024	0.0023	196.69	184.77	0.0%	0.0%
65-69	-	36,215	0.0000	0.0000	0.0038	0.0034	128.65	117.44	0.0%	0.0%
Totals	**701**	**313,499**	**0.0022**	**0.0019**	**0.0018**	**0.0017**	**557.90**	**518.80**	**125.6%**	**135.1%**

* *In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.*



SECTION G

MISCELLANEOUS AND TECHNICAL ASSUMPTIONS

Marital Status and Age of Survivor

Marital Status

Married members will frequently make different annuity selections than non-married members. We use marital status as provided by MSRS.

Age of Survivor

Actual age difference as provided by MSRS is used for most members. If spouse age is not provided, the current valuation assumption is that females are three years younger than their male spouses. Due to the small size of the Judges Plan, we recommend basing the age difference assumption on State Employees Retirement Fund experience.

Recommendation

We recommend changing the spouse age assumption from a three year age difference to the following: male members are assumed to have a beneficiary three years younger and female members are assumed to have a beneficiary two years older.

Form of Payment

Upon retirement, a member can elect any of the following forms of payment:

- **Single-life annuity** – the benefit is paid for the lifetime of the member. No benefit (other than a refund of remaining employee contributions, if applicable) is payable to a beneficiary upon the member's death.
- **15-Year Certain & Life** – a reduced benefit is paid for the lifetime of the member. If the member dies before 180 payments have been made, the benefit continues to be paid to a beneficiary until 180 payments have been made.
- **50% Joint & Survivor*** – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 50% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.
- **75% Joint & Survivor*** – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 75% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.
- **100% Joint & Survivor*** – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 100% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.

* *Joint & Survivor optional forms are available with and without bounceback on an actuarially equivalent basis. If the member does not elect the benefit with the bounceback, the benefit is unchanged if the beneficiary predeceases the member.*

We currently assume all members elect a life annuity. Since all optional forms are determined on an actuarial equivalent basis, we are not proposing a change to this assumption.

Actuarial Equivalent Factors

Joint and Survivor benefits are actuarially equivalent to the Single-life annuity. Effective July 1, 2019 and phased in over a 24-month period, actuarial equivalent factors are based on the RP-2014 mortality table for healthy annuitants, reflecting projected mortality improvements for a member turning age 66 in 2021 using Scale MP-2017, white collar adjustment, blended 70% males, 5.65% post-retirement interest and 7.50% pre-retirement interest. Reflecting statutory requirements, joint and survivor factors are based on an interest assumption of 6.5%.

Recommendation

We recommend updating the actuarial equivalent factors to reflect changes in expected mortality and developing an appropriate implementation schedule.

Proposed Miscellaneous and Technical Assumptions

Background

A number of miscellaneous and technical assumptions are used in the actuarial valuation. The present assumptions are listed on the following page.

Recommendation

Miscellaneous and Technical Assumptions are listed on page G-5. We recommend continued use of the other Miscellaneous and Technical Assumptions.

Miscellaneous and Technical Assumptions

Benefit Service	Exact fractional service is used to determine the amount of benefit payable.
Decrement Operation	Withdrawal decrements do not operate during retirement eligibility.
Decrement Timing	Decrements of all types are assumed to occur mid-year.
Eligibility Testing	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
Forfeitures	For vested separations from service, it is assumed that members separating will withdraw their contributions and forfeit an employer financed benefit when the value of member contributions is greater than the value of the employer financed benefit.
Incidence of Contributions	Contributions are assumed to be received on a monthly basis, per the Standards of Actuarial Work.
Pay Increase Timing	Pay increases were assumed to be at the beginning of the fiscal year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.
Service Credit Accruals	Members were assumed to accrue one year of service credit per year.

SECTION H

PROPOSED ASSUMPTION LISTING

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Merit and Seniority Pay Increases

We recommend continuing the present payroll growth and salary increase assumptions of 2.50%. Since the recommended inflation assumption is 2.25%, the implied real wage growth is 0.25%.

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Age and Service Retirement Pattern
Unreduced (Normal) Retirement

Age	% Retiring
65	25.0%
66	23.0%
67	15.0%
68	20.0%
69	40.0%
70+*	100%

** The current assumption prescribed by the Minnesota Standards for Actuarial Work is that members who have reached 100% retirement eligibility will delay retirement one year.*

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Age and Service Retirement Pattern
Reduced (Early) Retirement

Age	% Retiring
60	0.0%
61	2.5%
62	4.0%
63	8.0%
64	8.0%

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Withdrawal

We recommend no change to the current assumption of 0.0%.

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Disability Rates

Age	% Becoming Disabled	
	Male	Female
<35	0.000%	0.000%
36	0.006%	0.006%
37	0.006%	0.006%
38	0.006%	0.006%
39	0.006%	0.006%
40	0.006%	0.006%
41	0.006%	0.006%
42	0.012%	0.012%
43	0.012%	0.012%
44	0.012%	0.012%
45	0.018%	0.018%
46	0.018%	0.018%
47	0.024%	0.024%
48	0.024%	0.024%
49	0.030%	0.030%
50	0.030%	0.030%
51	0.036%	0.036%
52	0.042%	0.042%
53	0.048%	0.048%
54	0.060%	0.060%
55	0.072%	0.072%
56	0.090%	0.090%
57	0.108%	0.108%
58	0.132%	0.132%
59	0.156%	0.156%
60	0.186%	0.186%
61	0.222%	0.222%
62	0.264%	0.264%
63	0.312%	0.312%
64	0.366%	0.366%
65+	0.000%	0.000%

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Healthy Post-Retirement Mortality Rates

Age in 2019	% Dying Next Year*	
	Male	Female
60	0.6419%	0.4079%
61	0.6917%	0.4356%
62	0.7441%	0.4669%
63	0.7978%	0.5038%
64	0.8563%	0.5444%
65	0.9214%	0.5920%
66	0.9959%	0.6466%
67	1.0822%	0.7093%
68	1.1819%	0.7831%
69	1.2981%	0.8689%
70	1.4315%	0.9681%
71	1.5836%	1.0831%
72	1.7597%	1.2156%
73	1.9596%	1.3671%
74	2.1892%	1.5398%
75	2.4515%	1.7360%
76	2.7505%	1.9574%
77	3.0913%	2.2088%
78	3.4799%	2.4941%
79	3.9208%	2.8180%
80	4.4230%	3.1879%
81	4.9935%	3.6097%
82	5.6394%	4.0906%
83	6.3652%	4.6388%
84	7.1744%	5.2641%
85	8.0734%	5.9754%
86	9.0612%	6.7859%
87	10.1372%	7.7007%
88	11.3089%	8.7235%
89	12.5695%	9.8499%
90	13.9248%	11.0720%

Age in 2019	% Dying Next Year*	
	Male	Female
91	15.3528%	12.3669%
92	16.8482%	13.7136%
93	18.3917%	15.1121%
94	19.9820%	16.5642%
95	21.6137%	18.0815%
96	23.4247%	19.7288%
97	25.2907%	21.4821%
98	27.2292%	23.3335%
99	29.2162%	25.2814%
100	31.2364%	27.3181%
101	33.2716%	29.4221%
102	35.3028%	31.5433%
103	37.2999%	33.6715%
104	39.2536%	35.7732%
105	41.1519%	37.8479%
106	42.9921%	39.8838%
107	44.7481%	41.8393%
108	46.4297%	43.7197%
109	48.0045%	45.5171%
110	49.2895%	47.2105%
111	49.4329%	48.8127%
112	49.5766%	49.7008%
113	49.7107%	49.8004%
114	49.8552%	49.8951%
115	50.0000%	50.0000%
116	50.0000%	50.0000%
117	50.0000%	50.0000%
118	50.0000%	50.0000%
119	50.0000%	50.0000%
120	100.0000%	100.0000%

** The rates shown are PUB-2010 mortality for healthy annuitants, General table, with adjustments, if applicable (see Section F). Recommended rates include mortality improvements using projection scale MP-2019.*

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Disabled Post-Retirement Mortality Rates

Age in 2019	% Dying Next Year*	
	Male	Female
30	0.4763%	0.3374%
31	0.5091%	0.3720%
32	0.5411%	0.4080%
33	0.5720%	0.4460%
34	0.6034%	0.4837%
35	0.6319%	0.5217%
36	0.6610%	0.5593%
37	0.6898%	0.5972%
38	0.7191%	0.6351%
39	0.7487%	0.6740%
40	0.7798%	0.7140%
41	0.8136%	0.7555%
42	0.8519%	0.7998%
43	0.8955%	0.8482%
44	0.9484%	0.9026%
45	1.0096%	0.9640%
46	1.0828%	1.0335%
47	1.1685%	1.1135%
48	1.2669%	1.2060%
49	1.3775%	1.3119%
50	1.5020%	1.4307%
51	1.6078%	1.5025%
52	1.7207%	1.5808%
53	1.8381%	1.6650%
54	1.9576%	1.7502%
55	2.0785%	1.8323%
56	2.1966%	1.9060%
57	2.3089%	1.9684%
58	2.4159%	2.0170%
59	2.5173%	2.0522%
60	2.6126%	2.0777%
61	2.7041%	2.0944%
62	2.7936%	2.1094%
63	2.8855%	2.1259%
64	2.9786%	2.1482%
65	3.0721%	2.1788%
66	3.1704%	2.2243%
67	3.2750%	2.2865%
68	3.3889%	2.3695%
69	3.5166%	2.4751%
70	3.6595%	2.6065%
71	3.8247%	2.7638%
72	4.0148%	2.9493%
73	4.2330%	3.1634%
74	4.4812%	3.4098%
75	4.7653%	3.6905%
76	5.0851%	4.0076%
77	5.4460%	4.3635%
78	5.8508%	4.7621%
79	6.3039%	5.2066%
80	6.8078%	5.6993%
81	7.3676%	6.2433%
82	7.9811%	6.8400%
83	8.6530%	7.4956%
84	9.3804%	8.2086%
85	10.1634%	8.9857%
86	11.0054%	9.7948%
87	11.9053%	10.6193%
88	12.8764%	11.4546%
89	14.0871%	12.2998%
90	15.4253%	13.1713%
91	16.7874%	14.0861%
92	18.1594%	15.0581%
93	19.5260%	16.1111%
94	20.9013%	17.2631%
95	22.3021%	18.5358%
96	23.8936%	19.9973%
97	25.5661%	21.6422%
98	27.3568%	23.4098%
99	29.2525%	25.3027%
100	31.2364%	27.3181%

** The rates shown are PUB-2010 mortality for disabled annuitants, General table, with adjustments, if applicable (see Section F). Recommended rates include mortality improvements using projection scale MP-2019.*

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Healthy Pre-Retirement Mortality Rates

Age in 2019	% Dying Next Year*	
	Male	Female
20	0.0384%	0.0141%
21	0.0381%	0.0133%
22	0.0357%	0.0124%
23	0.0343%	0.0115%
24	0.0330%	0.0106%
25	0.0329%	0.0108%
26	0.0363%	0.0123%
27	0.0387%	0.0138%
28	0.0424%	0.0153%
29	0.0448%	0.0169%
30	0.0484%	0.0197%
31	0.0520%	0.0212%
32	0.0554%	0.0239%
33	0.0585%	0.0252%
34	0.0612%	0.0277%
35	0.0648%	0.0299%
36	0.0680%	0.0319%
37	0.0706%	0.0349%
38	0.0739%	0.0364%
39	0.0765%	0.0387%
40	0.0798%	0.0409%
41	0.0825%	0.0439%
42	0.0860%	0.0456%
43	0.0891%	0.0483%
44	0.0932%	0.0510%
45	0.0983%	0.0548%

Age in 2019	% Dying Next Year*	
	Male	Female
46	0.1045%	0.0588%
47	0.1110%	0.0630%
48	0.1199%	0.0676%
49	0.1293%	0.0736%
50	0.1394%	0.0801%
51	0.1521%	0.0881%
52	0.1656%	0.0966%
53	0.1808%	0.1066%
54	0.1967%	0.1169%
55	0.2153%	0.1294%
56	0.2355%	0.1417%
57	0.2582%	0.1546%
58	0.2821%	0.1679%
59	0.3069%	0.1823%
60	0.3330%	0.1976%
61	0.3600%	0.2126%
62	0.3872%	0.2283%
63	0.4155%	0.2458%
64	0.4435%	0.2653%
65	0.4723%	0.2859%
66	0.5024%	0.3100%
67	0.5352%	0.3378%
68	0.5712%	0.3689%
69	0.6130%	0.4043%
70	0.6595%	0.4453%

** The rates shown are PUB-2010 mortality for employees, General table, with adjustments, if applicable (see Section F). Recommended rates include mortality improvements using projection scale MP-2019.*

SECTION I

GLOSSARY

Glossary

The following glossary is intended to provide definitions of a number of terms which are used throughout this report and which are somewhat unique to the discussion of an Experience Study.

Actuarial Decrement. The actual number of decrements which occurred during the study. This number is a straight tabulation of the actual number of occurrences of the particular decrement in question. Normally, the actual number of decrements will be subdivided by age and possibly sex.

Aggregate Assumptions. Assumptions which vary only by sex and/or age. The impact of year of service on the decrement is ignored. All experience is combined by age and/or sex without regard to service. Rates of death and disablement are more appropriate to aggregate measurement in a retirement system.

Crude Rate of Decrement. The rate of decrement determined by dividing the actual number of the respective decrement for that age and sex by the corresponding exposure for that age and sex. The rate is described as a crude rate because no smoothing or elimination of statistical fluctuations has been made. It is indicative of the underlying true rate of the decrement and is the basis used in graduation to obtain the graduated or tabular rate.

Decrements. The decrements are the means by which a member ceases to be a member. For active members, the decrements are death, withdrawal, service retirement, and disability retirement. For retired members, the only decrement is death. The purpose of the Experience Study is to determine the underlying rates of each decrement.

Expected Decrement. This is the number of occurrences of a given decrement expected to occur for a given age and sex based on the number of lives exposed to the risk of the particular decrement and the current assumed rate for that decrement. It may also be referred to as the tabular number of decrements. It is the number of deaths, withdrawals, retirements, or disabilities (whichever is applicable) that would have actually occurred had the actuarial assumptions been exactly realized.

Exposure. The number of lives exposed to a given risk of decrement for a particular age and sex. It represents the number of members who could have potentially died, retired, become disabled, or withdrawn at that particular age and for that particular sex. This term will also be described as “the number exposed to a given risk.”

Graduated Rates. Graduation is the mathematical process by which a set of crude rates of a particular type is translated into graduated or tabular rates. The graduation process attempts to smooth out statistical fluctuations and to arrive at a set of rates that adequately fit the underlying actual experience of the crude rates that are being graduated. The graduation process involves smoothing the results, but at the same time trying to fit the results to be consistent with the original data. It requires that the actuary exercise his or her judgment in what the underlying shape of the risk curve should look like.

Interpolated Rates. For the active rates of decrement (death, disability, retirement, and withdrawal), the actuary will develop graduated rates based on quinquennial age groupings (see definition). To arrive at the rates of decrement for ages between two quinquennial ages, the graduated quinquennial rates must be interpolated for these intermediate ages. The interpolated results are arrived at by applying a mathematical interpolation formula to the quinquennial graduated rates.

Glossary

Merit and Seniority Pay Increase Rate. The portion of the total salary scale which varies by service. It reflects the impact of moving up the salary grid in a given year, rather than the increase in the overall grid. It includes the salary increase associated with promotions during the year.

Quinquennial Age Groupings. For the active decrements, it is preferable to group the experience in five-year age groups for graduation and analysis purposes so as to minimize statistical fluctuations resulting from a lack of exposure which may occur for individual ages. Quinquennial age grouping is the five-year age grouping which is used to develop the graduated rates of decrement for active membership. The quinquennial age is the central age of the five-year grouping.

SECTION J

APPENDIX

Appendix – Detailed Experience Analysis

In this section, we present the annual experience for each major assumption that was analyzed for the study. Results are based on liability-weighted experience for withdrawal, retirement and pre-retirement mortality, benefit-weighted for post-retirement and disabled mortality, and population-weighted for all other analysis. Please note that totals may not sum correctly due to rounding of intermediate results.

Appendix – Detailed Experience Analysis
Salary Increases

2015-2019 Experience

Age	Exposure	Gross Actual Increases	Gross Expected Increases
<35	-	N/A	2.50%
35-39	15	5.26%	2.50%
40-44	67	4.29%	2.50%
45-49	138	4.25%	2.50%
50-54	212	3.80%	2.50%
55-59	303	3.65%	2.50%
60-64	268	3.50%	2.50%
65-69	148	3.33%	2.50%
Totals	**1,151**	**3.73%**	**2.50%**

Appendix – Detailed Experience Analysis
Salary Increases

2015-2016 Experience

Age	Exposure	Gross Actual Increases	Gross Expected Increases
<35	-	N/A	2.50%
35-39	4	5.79%	2.50%
40-44	17	4.83%	2.50%
45-49	38	4.92%	2.50%
50-54	46	4.46%	2.50%
55-59	74	4.47%	2.50%
60-64	81	4.34%	2.50%
65-69	34	4.76%	2.50%
Totals	**294**	**4.56%**	**2.50%**

2016-2017 Experience

Age	Exposure	Gross Actual Increases	Gross Expected Increases
<35	-	N/A	2.50%
35-39	2	4.00%	2.50%
40-44	15	5.77%	2.50%
45-49	36	4.78%	2.50%
50-54	47	4.01%	2.50%
55-59	74	4.80%	2.50%
60-64	72	3.95%	2.50%
65-69	41	3.44%	2.50%
Totals	**287**	**4.31%**	**2.50%**

Appendix – Detailed Experience Analysis
Salary Increases

2017-2018 Experience

Age	Exposure	Gross Actual Increases	Gross Expected Increases
<35	-	N/A	2.50%
35-39	5	3.66%	2.50%
40-44	17	3.15%	2.50%
45-49	30	2.91%	2.50%
50-54	58	3.20%	2.50%
55-59	80	2.80%	2.50%
60-64	59	2.78%	2.50%
65-69	37	2.56%	2.50%
Totals	**286**	**2.89%**	**2.50%**

2018-2019 Experience

Age	Exposure	Gross Actual Increases	Gross Expected Increases
<35	-	N/A	2.50%
35-39	4	7.36%	2.50%
40-44	18	3.63%	2.50%
45-49	34	4.13%	2.50%
50-54	61	3.71%	2.50%
55-59	75	2.62%	2.50%
60-64	56	2.49%	2.50%
65-69	36	2.66%	2.50%
Totals	**284**	**3.14%**	**2.50%**

Appendix – Detailed Experience Analysis
Retirements

2015-2019 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
60	-	30,650	-	N/A
61	774	33,100	-	N/A
62	-	39,137	3,130.95	0.0%
63	4,926	47,725	3,818.07	129.0%
64	4,672	50,731	2,536.56	184.2%
65	13,510	50,998	10,199.51	132.5%
66	8,881	37,318	8,582.98	103.5%
67	3,944	27,646	6,358.45	62.0%
68	5,142	22,833	4,566.82	112.6%
69	10,111	23,861	4,772.02	211.9%
Totals	**51,960**	**363,999**	**43,965.36**	**118.2%**

Appendix – Detailed Experience Analysis
Retirements

2015-2016 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
60	-	7,788	-	N/A
61	774	9,201	-	N/A
62	-	12,285	982.79	0.0%
63	-	11,951	956.11	0.0%
64	-	11,925	596.23	0.0%
65	3.526	8.465	1.692.97	208.3%
66	1,011	6,235	1,433.95	70.5%
67	-	7,090	1,630.68	0.0%
68	-	5,629	1,125.81	0.0%
69	3,464	6,324	1,264.82	273.9%
Totals	**8,775**	**86,893**	**9,683.36**	**90.6%**

2016-2017 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
60	-	6,824	-	N/A
61	-	8,890	-	N/A
62	-	9,596	767.65	0.0%
63	1,072	14,733	1,178.60	91.0%
64	2,082	14,215	710.77	292.9%
65	-	13,433	2,686.51	0.0%
66	830	5,445	1,252.34	66.3%
67	957	6,004	1,380.95	69.3%
68	-	7,809	1,561.89	0.0%
69	1,341	6,232	1,246.37	107.6%
Totals	**6,282**	**93,181**	**10,785.08**	**58.2%**

Appendix – Detailed Experience Analysis
Retirements

2017-2018 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
60	-	6,887	-	N/A
61	-	7,210	-	N/A
62	-	9,442	755.38	0.0%
63	1,833	10,866	869.32	210.9%
64	424	14,935	746.77	56.8%
65	2,757	13,489	2,697.86	102.2%
66	5,012	14,149	3,254.22	154.0%
67	1,015	4,743	1,090.81	93.1%
68	2,361	5,257	1,051.49	224.5%
69	4,157	8,211	1,642.11	253.1%
Totals	**17,559**	**95,189**	**12,107.96**	**145.0%**

2018-2019 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
60	-	9,151	-	N/A
61	-	7,799	-	N/A
62	-	7,814	625.13	0.0%
63	2,021	10,175	814.04	248.3%
64	2,166	9,656	482.79	448.6%
65	7,227	15,611	3,122.17	231.5%
66	2,028	11,489	2,642.47	76.7%
67	1,972	9,809	2,256.01	87.4%
68	2,781	4,138	827.63	336.0%
69	1,149	3,094	618.72	185.7%
Totals	**19,344**	**88,736**	**11,388.96**	**169.8%**

Appendix – Detailed Experience Analysis
Terminations

2015-2019 Experience, ($000s)

	Males and Females			
Age Group	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
<35	-	-	-	N/A
35-39	-	3,835	-	N/A
40-44	844	21,488	-	N/A
45-49	-	56,910	-	N/A
50-54	1,872	113,358	-	N/A
55-59	1,841	163,399	-	N/A
60+	-	9,053	-	N/A
Totals	**4,557**	**368,043**	**-**	**N/A**

Appendix – Detailed Experience Analysis
Terminations

2015-2016 Experience, ($000s)

	Males and Females			
Age Group	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
<35	-	-	-	N/A
35-39	-	715	-	N/A
40-44	-	4,442	-	N/A
45-49	-	14,795	-	N/A
50-54	685	24,627	-	N/A
55-59	724	39,318	-	N/A
60+	-	3,525	-	N/A
Totals	**1,409**	**83,897**	**-**	**N/A**

2016-2017 Experience, ($000s)

	Total			
Age Group	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
<35	-	-	-	N/A
35-39	-	839	-	N/A
40-44	-	6,345	-	N/A
45-49	-	14,001	-	N/A
50-54	-	27,691	-	N/A
55-59	273	45,056	-	N/A
60+	-	2,171	-	N/A
Totals	**273**	**93,932**	**-**	**N/A**

Appendix – Detailed Experience Analysis
Terminations

2017-2018 Experience, ($000s)

	Males and Females			
Age Group	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
<35	-	-	-	N/A
35-39	-	1,146	-	N/A
40-44	508	4,879	-	N/A
45-49	-	13,959	-	N/A
50-54	-	29,332	-	N/A
55-59	-	47,411	-	N/A
60+	-	1,278	-	N/A
Totals	**508**	**96,727**	**-**	**N/A**

2018-2019 Experience, ($000s)

	Males and Females			
Age Group	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
<35	-	-	-	N/A
35-39	-	1,135	-	N/A
40-44	336	5,822	-	N/A
45-49	-	14,155	-	N/A
50-54	1,187	31,708	-	N/A
55-59	844	31,614	-	N/A
60+	-	2,079	-	N/A
Totals	**2,367**	**86,513**	**-**	**N/A**

Appendix – Detailed Experience Analysis
Disability Retirements

2015-2019 Experience

	Males and Females			
Age Group	**Actual Disabiities**	**Exposure**	**Expected Disabiities**	**Actual/ Expected**
<35	-	-	-	N/A
35-39	-	-	-	N/A
40-44	-	42	0.01	0.0%
45-49	-	90	0.03	0.0%
50-54	-	193	0.11	0.0%
55-59	-	255	0.34	0.0%
60+	-	421	1.65	0.0%
Totals	**-**	**1,001**	**2.13**	**0.0%**

Appendix – Detailed Experience Analysis
Disability Retirements

2015-2016 Experience

	Males and Females			
Age Group	**Actual Disabiities**	**Exposure**	**Expected Disabiities**	**Actual/ Expected**
<35	-	-	-	N/A
35-39	-	-	-	N/A
40-44	-	12	0.00	0.0%
45-49	-	22	0.01	0.0%
50-54	-	51	0.03	0.0%
55-59	-	67	0.09	0.0%
60+	-	108	0.45	0.0%
Totals	**-**	**152**	**0.58**	**0.0%**

2016-2017 Experience

	Total			
Age Group	**Actual Disabiities**	**Exposure**	**Expected Disabiities**	**Actual/ Expected**
<35	-	-	-	N/A
35-39	-	-	-	N/A
40-44	-	12	0.00	0.0%
45-49	-	23	0.01	0.0%
50-54	-	50	0.03	0.0%
55-59	-	66	0.09	0.0%
60+	-	104	0.43	0.0%
Totals	**-**	**151**	**0.56**	**0.0%**

Appendix – Detailed Experience Analysis
Disability Retirements

2017-2018 Experience

	Males and Females			
Age Group	**Actual Disabiities**	**Exposure**	**Expected Disabiities**	**Actual/ Expected**
<35	-	-	-	N/A
35-39	-	-	-	N/A
40-44	-	10	0.00	0.0%
45-49	-	21	0.01	0.0%
50-54	-	47	0.03	0.0%
55-59	-	73	0.10	0.0%
60+	-	101	0.40	0.0%
Totals	**-**	**151**	**0.53**	**0.0%**

2018-2019 Experience

	Males and Females			
Age Group	**Actual Disabiities**	**Exposure**	**Expected Disabiities**	**Actual/ Expected**
<35	-	-	-	N/A
35-39	-	-	-	N/A
40-44	-	8	0.00	0.0%
45-49	-	24	0.01	0.0%
50-54	-	45	0.02	0.0%
55-59	-	49	0.06	0.0%
60+	-	108	0.38	0.0%
Totals	**-**	**234**	**0.46**	**0.0%**

Appendix – Detailed Experience Analysis
Post-Retirement Mortality

2015-2019 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	-	-	N/A	50-54	-	-	-	N/A
55-59	-	-	-	N/A	55-59	-	-	-	N/A
60-64	-	819	5.27	0.0%	60-64	-	549	3.04	0.0%
65-69	65	10,749	101.91	63.8%	65-69	-	3,756	30.51	0.0%
70-74	143	17,059	253.44	56.4%	70-74	62	6,367	76.76	80.8%
75-79	247	11,506	298.44	82.8%	75-79	-	1,097	23.29	0.0%
80-84	551	5,842	277.75	198.4%	80-84	46	949	36.97	124.4%
85-89	430	5,899	517.58	83.1%	85-89	-	808	57.32	0.0%
90-94	612	3,478	509.51	120.1%	90-94	-	68	7.77	0.0%
95+	156	438	106.76	146.1%	95+	-	-	-	N/A
Totals	**2,204**	**55,790**	**2,070.66**	**106.4%**	**Totals**	**108**	**13,594**	**235.67**	**45.8%**

Appendix – Detailed Experience Analysis
Post-Retirement Mortality

2015-2016 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	-	-	N/A	50-54	-	-	-	N/A
55-59	-	-	-	N/A	55-59	-	-	-	N/A
60-64	-	157	1.01	0.0%	60-64	-	173	0.96	0.0%
65-69	65	3,041	28.75	226.1%	65-69	-	1,176	9.71	0.0%
70-74	97	3,848	60.36	160.7%	70-74	-	1,104	13.28	0.0%
75-79	90	2,144	58.06	155.0%	75-79	-	175	4.13	0.0%
80-84	-	1,463	73.18	0.0%	80-84	-	241	9.61	0.0%
85-89	116	1,462	126.34	91.8%	85-89	-	143	9.57	0.0%
90-94	-	788	111.56	0.0%	90-94	-	-	-	N/A
95+	84	153	40.55	207.2%	95+	-	-	-	N/A
Totals	**452**	**13,056**	**499.81**	**90.4%**	**Totals**	**-**	**3,012**	**47.26**	**0.0%**

2016-2017 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	-	-	N/A	50-54	-	-	-	N/A
55-59	-	-	-	N/A	55-59	-	-	-	N/A
60-64	-	160	0.96	0.0%	60-64	-	84	0.47	0.0%
65-69	-	2,939	27.95	0.0%	65-69	-	1,038	8.61	0.0%
70-74	-	3,773	56.35	0.0%	70-74	62	1,393	16.34	379.5%
75-79	71	2,735	68.83	103.2%	75-79	-	348	7.61	0.0%
80-84	155	1,606	78.01	198.7%	80-84	-	155	5.81	0.0%
85-89	94	1,653	149.97	62.7%	85-89	-	215	13.74	0.0%
90-94	288	820	126.76	227.2%	90-94	-	22	2.26	0.0%
95+	-	70	15.77	0.0%	95+	-	-	-	N/A
Totals	**608**	**13,756**	**524.60**	**115.9%**	**Totals**	**62**	**3,255**	**54.84**	**113.1%**

Appendix – Detailed Experience Analysis
Post-Retirement Mortality

2017-2018 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	-	-	N/A	50-54	-	-	-	N/A
55-59	-	-	-	N/A	55-59	-	-	-	N/A
60-64	-	320	2.11	0.0%	60-64	-	149	0.83	0.0%
65-69	-	2,179	20.81	0.0%	65-69	-	713	5.74	0.0%
70-74	46	4,364	62.88	73.2%	70-74	-	1,809	21.69	0.0%
75-79	-	3,375	87.39	0.0%	75-79	-	214	4.31	0.0%
80-84	165	1,150	53.07	310.9%	80-84	46	297	10.82	425.1%
85-89	115	1,547	130.85	87.9%	85-89	-	217	15.48	0.0%
90-94	324	999	149.04	217.4%	90-94	-	23	2.62	0.0%
95+	-	71	17.21	0.0%	95+	-	-	-	N/A
Totals	**650**	**14,005**	**523.37**	**124.2%**	**Totals**	**46**	**3,422**	**61.48**	**74.8%**

2018-2019 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	-	-	N/A	50-54	-	-	-	N/A
55-59	-	-	-	N/A	55-59	-	-	-	N/A
60-64	-	182	1.19	0.0%	60-64	-	143	0.78	0.0%
65-69	-	2,590	24.41	0.0%	65-69	-	829	6.45	0.0%
70-74	-	5,074	73.85	0.0%	70-74	-	2,061	25.46	0.0%
75-79	86	3,252	84.15	102.2%	75-79	-	360	7.25	0.0%
80-84	231	1,623	73.49	314.3%	80-84	-	256	10.72	0.0%
85-89	105	1,237	110.42	95.1%	85-89	-	233	18.53	0.0%
90-94	-	871	122.14	0.0%	90-94	-	23	2.89	0.0%
95+	72	144	33.23	216.6%	95+	-	-	-	N/A
Totals	**494**	**14,973**	**522.89**	**94.5%**	**Totals**	**-**	**3,905**	**72.09**	**0.0%**

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality

2015-2019 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
30-34	-	-	-	N/A	30-34	-	-	-	N/A
35-39	-	-	-	N/A	35-39	-	3,835	1.17	0.0%
40-44	-	9,398	4.55	0.0%	40-44	-	12,090	4.80	0.0%
45-49	-	21,033	16.52	0.0%	45-49	-	35,877	23.88	0.0%
50-54	-	46,909	66.55	0.0%	50-54	701	66,449	69.74	1005.2%
55-59	-	100,779	238.98	0.0%	55-59	-	78,285	132.99	0.0%
60-64	-	128,483	543.83	0.0%	60-64	-	80,748	196.69	0.0%
65-69	-	127,601	875.78	0.0%	65-69	-	36,215	128.65	0.0%
Totals	**-**	**434,203**	**1,746.22**	**0.0%**	**Totals**	**701**	**313,499**	**557.90**	**125.6%**

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality

2015-2016 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
30-34	-	-	-	N/A	30-34	-	-	-	N/A
35-39	-	-	-	N/A	35-39	-	715	0.22	0.0%
40-44	-	2,378	1.13	0.0%	40-44	-	2,064	0.82	0.0%
45-49	-	4,888	4.05	0.0%	45-49	-	9,907	6.70	0.0%
50-54	-	12,113	17.90	0.0%	50-54	-	12,514	13.37	0.0%
55-59	-	22,363	52.88	0.0%	55-59	-	16,955	27.81	0.0%
60-64	-	36,007	153.95	0.0%	60-64	-	20,198	49.11	0.0%
65-69	-	29,734	209.52	0.0%	65-69	-	4,475	18.62	0.0%
Totals	**-**	**107,483**	**439.43**	**0.0%**	**Totals**	**-**	**66,828**	**116.64**	**0.0%**

2016-2017 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
30-34	-	-	-	N/A	30-34	-	-	-	N/A
35-39	-	-	-	N/A	35-39	-	839	0.25	0.0%
40-44	-	3,091	1.52	0.0%	40-44	-	3,254	1.29	0.0%
45-49	-	4,655	3.71	0.0%	45-49	-	9,346	6.31	0.0%
50-54	-	12,976	19.12	0.0%	50-54	-	14,715	14.92	0.0%
55-59	-	24,140	57.33	0.0%	55-59	-	20,916	35.02	0.0%
60-64	-	34,492	147.59	0.0%	60-64	-	21,723	54.09	0.0%
65-69	-	32,247	223.58	0.0%	65-69	-	6,889	25.93	0.0%
Totals	**-**	**111,601**	**452.86**	**0.0%**	**Totals**	**-**	**77,682**	**137.81**	**0.0%**

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality

2017-2018 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
30-34	-	-	-	N/A	30-34	-	-	-	N/A
35-39	-	-	-	N/A	35-39	-	1,146	0.35	0.0%
40-44	-	1,961	0.96	0.0%	40-44	-	2,918	1.15	0.0%
45-49	-	5,618	4.29	0.0%	45-49	-	8,341	5.54	0.0%
50-54	-	10,901	15.34	0.0%	50-54	-	18,431	19.16	0.0%
55-59	-	26,481	62.64	0.0%	55-59	-	20,930	36.22	0.0%
60-64	-	31,467	134.58	0.0%	60-64	-	18,929	46.26	0.0%
65-69	-	34,403	239.50	0.0%	65-69	-	11,669	39.36	0.0%
Totals	**-**	**110,831**	**457.30**	**0.0%**	**Totals**	**-**	**82,364**	**148.05**	**0.0%**

2018-2019 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
30-34	-	-	-	N/A	30-34	-	-	-	N/A
35-39	-	-	-	N/A	35-39	-	1,135	0.35	0.0%
40-44	-	1,968	0.94	0.0%	40-44	-	3,854	1.53	0.0%
45-49	-	5,872	4.47	0.0%	45-49	-	8,283	5.33	0.0%
50-54	-	10,919	14.20	0.0%	50-54	701	20,789	22.29	3145.4%
55-59	-	27,795	66.13	0.0%	55-59	-	19,484	33.93	0.0%
60-64	-	26,517	107.71	0.0%	60-64	-	19,898	47.23	0.0%
65-69	-	31,217	203.18	0.0%	65-69	-	13,182	44.74	0.0%
Totals	**-**	**104,288**	**396.64**	**0.0%**	**Totals**	**701**	**86,625**	**155.41**	**451.1%**

Appendix – Detailed Experience Analysis
Disabled Mortality

2015-2019 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
40-44	-	-	-	N/A	40-44	-	-	-	N/A
45-49	-	-	-	N/A	45-49	-	-	-	N/A
50-54	-	-	-	N/A	50-54	-	-	-	N/A
55-59	-	-	-	N/A	55-59	-	-	-	N/A
60-64	-	165	1.04	0.0%	60-64	-	48	0.28	0.0%
65-69	64	468	4.45	1439.8%	65-69	-	259	2.05	0.0%
70-74	-	1,110	16.66	0.0%	70-74	-	233	2.59	0.0%
75-79	-	1,485	40.81	0.0%	75-79	-	-	-	N/A
80-84	195	971	38.24	509.9%	80-84	-	-	-	N/A
85-89	194	194	22.08	878.6%	85-89	-	-	-	N/A
90-94	194	300	41.19	471.0%	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	**647**	**4,693**	**164.47**	**393.4%**	**Totals**	**-**	**540**	**4.93**	**0.0%**

Appendix – Detailed Experience Analysis
Disabled Mortality

2015-2016 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
40-44	-	-	-	N/A	40-44	-	-	-	N/A
45-49	-	-	-	N/A	45-49	-	-	-	N/A
50-54	-	-	-	N/A	50-54	-	-	-	N/A
55-59	-	-	-	N/A	55-59	-	-	-	N/A
60-64	-	54	0.32	0.0%	60-64	-	48	0.28	0.0%
65-69	-	204	1.91	0.0%	65-69	-	83	0.77	0.0%
70-74	-	283	4.35	0.0%	70-74	-	-	-	N/A
75-79	-	421	11.54	0.0%	75-79	-	-	-	N/A
80-84	-	191	7.27	0.0%	80-84	-	-	-	N/A
85-89	194	194	22.08	878.6%	85-89	-	-	-	N/A
90-94	86	192	25.91	331.9%	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	**280**	**1,539**	**73.39**	**381.5%**	**Totals**	**-**	**131**	**1.05**	**0.0%**

2016-2017 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
40-44	-	-	-	N/A	40-44	-	-	-	N/A
45-49	-	-	-	N/A	45-49	-	-	-	N/A
50-54	-	-	-	N/A	50-54	-	-	-	N/A
55-59	-	-	-	N/A	55-59	-	-	-	N/A
60-64	-	55	0.35	0.0%	60-64	-	-	-	N/A
65-69	64	207	2.12	3015.9%	65-69	-	75	0.56	0.0%
70-74	-	219	3.42	0.0%	70-74	-	59	0.61	0.0%
75-79	-	496	14.42	0.0%	75-79	-	-	-	N/A
80-84	195	195	8.25	2364.8%	80-84	-	-	-	N/A
85-89	-	-	-	N/A	85-89	-	-	-	N/A
90-94	108	108	15.28	706.8%	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	**367**	**1,280**	**43.84**	**837.1%**	**Totals**	**-**	**134**	**1.17**	**0.0%**

Appendix – Detailed Experience Analysis
Disabled Mortality

2017-2018 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
40-44	-	-	-	N/A	40-44	-	-	-	N/A
45-49	-	-	-	N/A	45-49	-	-	-	N/A
50-54	-	-	-	N/A	50-54	-	-	-	N/A
55-59	-	-	-	N/A	55-59	-	-	-	N/A
60-64	-	56	0.38	0.0%	60-64	-	-	-	N/A
65-69	-	-	-	N/A	65-69	-	50	0.35	0.0%
70-74	-	302	4.19	0.0%	70-74	-	86	0.94	0.0%
75-79	-	315	8.15	0.0%	75-79	-	-	-	N/A
80-84	-	256	9.48	0.0%	80-84	-	-	-	N/A
85-89	-	-	-	N/A	85-89	-	-	-	N/A
90-94	-	-	-	N/A	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	**-**	**929**	**22.20**	**0.0%**	**Totals**	**-**	**136**	**1.28**	**0.0%**

2018-2019 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
40-44	-	-	-	N/A	40-44	-	-	-	N/A
45-49	-	-	-	N/A	45-49	-	-	-	N/A
50-54	-	-	-	N/A	50-54	-	-	-	N/A
55-59	-	-	-	N/A	55-59	-	-	-	N/A
60-64	-	-	-	N/A	60-64	-	-	-	N/A
65-69	-	57	0.41	0.0%	65-69	-	51	0.38	0.0%
70-74	-	306	4.69	0.0%	70-74	-	88	1.05	0.0%
75-79	-	253	6.70	0.0%	75-79	-	-	-	N/A
80-84	-	329	13.24	0.0%	80-84	-	-	-	N/A
85-89	-	-	-	N/A	85-89	-	-	-	N/A
90-94	-	-	-	N/A	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	**-**	**945**	**25.03**	**0.0%**	**Totals**	**-**	**139**	**1.43**	**0.0%**