Denison Firemen's Relief and Retirement Fund

Revised Actuarial Valuation as of December 31, 2019

December 14, 2020

Rudd and Wisdom, Inc.

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December 14, 2020

Board of Trustees
Denison Firemen's Relief and Retirement Fund
c/o Ms. Renee' Waggoner, Executive Director of
Finance & Administrative Services
300 W. Main Street
Denison, TX 75020

Members of the Board of Trustees:

At your request, we have prepared this revised report of the results of the revised actuarial valuation of the fund as of December 31, 2019. It replaces the report presented at your December 10, 2020 board meeting. This valuation was prepared to determine whether the fund has an adequate contribution arrangement.

In a separate August 3, 2020 report, we provided the necessary disclosures for the fund's compliance with the Governmental Accounting Standards Board (GASB) Statement No. 67 for the plan year ending December 31, 2019. We will also provide a separate report later containing the pension expense, net pension liability, and disclosure information for the city's compliance with GASB 68 for the fiscal year ending September 30, 2020. GASB 68 prescribes the city's accounting for your fund, while this actuarial valuation report reflects the assumed contribution policy described in this report.

We certify that we are members of the American Academy of Actuaries who meet Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained in this report.

Sincerely,

Mark R. Fenlaw

Mark R. Fenlaw, F.S.A.

Brandon L. Fuller, F.S.A.

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TABLE OF CONTENTS

Section I

Valuation Summary

An actuarial valuation of the assets and liabilities of the Denison Firemen's Relief and Retirement Fund as of December 31, 2019 has been completed. The valuation was based on the Present Plan (plan effective January 1, 2014 and amended effective January 1, 2020) and the provisions of the Texas Local Fire Fighters' Retirement Act (TLFFRA) which were in effect on December 31, 2019. Section II shows the key results of the actuarial valuation as of December 31, 2019 and discusses the changes since the prior valuation as of December 31, 2017 prepared by your prior actuary.

This valuation reflects an actuarially assumed total contribution rate of 31.25%, comprised of 13.25% by the firefighters and an assumed 18.00% by the city. The total contribution rate of 31.25% exceeds the normal cost rate of 12.90%, leaving 18.35% available to amortize the unfunded actuarial accrued liability (UAAL) of $5,901,574. Assuming that the total payroll increases at the rate of 2.75% per year in the future, the contributions in excess of the normal cost **will amortize the UAAL in 12.2 years.**

In order for a retirement plan to have an adequate contribution arrangement, contributions must be made that are sufficient to pay the plan's normal cost and to amortize the plan's UAAL over a reasonable period of time. Based on the Texas State Pension Review Board guidelines for pension funding, our professional judgment, and the actuarial assumptions and methods used in making this valuation, we consider periods of 10 years to 25 years to be preferable and 40 years to be the current maximum acceptable period. The PRB guidelines will be changing to a maximum of 30 years allowing for phase in through 2025. Since the total contributions are sufficient to pay the fund's normal cost and to amortize the fund's UAAL within the maximum acceptable period, we are of the opinion that the fund, based on present levels of benefits and contributions, **has an adequate contribution arrangement.** Section III has considerations for benefit improvements.

Projected Actuarial Valuation Results

In addition to completing this actuarial valuation, we estimated the amortization periods as of December 31, 2021 and as of December 31, 2023 by making projections from the December 31, 2019 actuarial valuation. These projections examine the effect on the amortization period in the next two biennial actuarial valuations of the actuarial investment gains and losses that the fund experienced in the four years prior to the valuation date (gains in 2016, 2017, and 2019 and a loss in 2018) that have been only partially recognized as of December 31, 2019. As shown in Exhibit 8, a smoothing method is used to determine the actuarial value of assets (AVA) for this valuation. This method phases in over a five-year period any investment gains or losses (net actual

investment return greater or less than the actuarially assumed investment return) that the fund has had. The AVA used in this current valuation is deferring recognition of various portions of the gains and losses in 2016-2019 that the fund experienced. The AVA used in this valuation is $17,982,601. The market value of assets (MVA) is $20,225,141. The $2.24 million difference between the MVA and the AVA is the net deferred gain over the past four years that will be recognized in the next two biennial actuarial valuations.

The theory behind the AVA method is to allow time for investment gains and losses to partially offset each other and thereby dampen the volatility associated with the progression of the MVA over time. In practice, the timing and amounts of investment gains and losses can result in irregular effects on the AVA in a given year. However, as intended, the pattern of the AVA is smoother over time than the pattern of the MVA, as seen in Exhibit 9.

For the purpose of projecting the amortization period through 2023 we used six scenarios of various assumed annual rates of investment return, net of investment-related expenses. These projections show the expected effects over the next four years after the valuation date (1) of the recognition of the portions of the investment gains and losses over the past four years that are deferred as of December 31, 2019, and (2) of investment returns over the next four years different from the 7.5% assumption used in this valuation.

	Scenario					
	1	2	3	4	5	6
Assumed Investment Return for Calendar Year						
2020	7.5%	5.0%	0.0%	7.5%	5.0%	5.0%
2021	7.5	5.0	0.0	10.0	15.0	20.0
2022	7.5	5.0	7.5	10.0	10.0	10.0
2023	7.5	5.0	7.5	7.5	7.5	10.0
2024 and later	7.5	7.5	7.5	7.5	7.5	7.5
Amortization Period in Years as of December 31:						
2019 (actual)	12.2	12.2	12.2	12.2	12.2	12.2
2021 (projected)	6.7	7.4	8.8	6.5	6.6	6.2
2023 (projected)	2.7	4.8	7.4	1.7	1.4	0.1

The projected future December 31, 2021 valuation in Scenario 1 reveals that instead of decreasing by the expected two years to 10.2 years, the amortization period is projected to decrease by 5.5 years to 6.7 years because of the recognition of some of the net deferred gain. Even two years of a 0.0% return in Scenario 3 would not totally offset the effect of the $2.24 million net deferred gain to accelerate the amortization of the unfunded liability. The expected four-year reduction between December 31, 2019 and

December 31, 2023 would result in an 8.2-year amortization period. However in Scenario 3, the December 31, 2023 amortization period is shown to be 7.4 years.

We do not know what the investment experience will be for each of the next four calendar years. Variations in experience from the underlying assumptions, other than investment return, will cause the actual amortization periods to be different from the periods shown above, but investment experience is the biggest influence on future actuarial valuations. In addition, the future investment experience in each of the four years could be better or worse than the assumed rates shown. These scenarios present a range of scenarios for the next four years assuming no increases in the total contribution rate and no changes in benefits.

Participant and Asset Data

We have relied on and based our valuation on the active firefighter data, pensioner data, and asset data provided on behalf of the board of trustees by Mr. Raj Allada, the Administrator. We have not audited the data provided but have reviewed it for reasonableness and consistency relative to the data provided for the December 31, 2017 actuarial valuation. Exhibit 1 is a distribution of the active firefighters by age and service. The assumed 2020 compensation used for projecting future contributions and benefits for each active firefighter in the valuation was the actual pay for calendar year 2019 increased by 9.1%. This increase was to reflect the effect of the general pay increase of 20% effective July 1, 2019. The total of these assumed compensation amounts is our assumed annualized covered payroll for the plan year beginning January 1, 2020 and is used in the valuation to determine the UAAL amortization period. The averages of the assumed compensation amounts for the 2020 plan year are shown in Exhibit 1.

Exhibit 2 contains summary information on the pensioners. The monthly benefit payments are generally based on the amounts paid in January 2020. Exhibit 3 is a reconciliation of firefighters and pensioners from December 31, 2017 to December 31, 2019. Exhibit 4 shows a breakdown of the dollar amount of the monthly benefits for retirees and surviving spouses. Exhibit 5 shows a historical comparison of the actuarial accrued liability and the actuarial value of assets.

The summary of assets contained in Exhibit 6 is based on the allocation of the December 31, 2019 market value of assets in the December 31, 2019 report from the fund's investment consultant. This exhibit also shows a comparison with the market values and actuarial values of assets as of December 31, 2017 and December 31, 2019. Exhibit 7 contains the statement of changes in assets for 2019 and 2018. Exhibit 8 shows the development of the actuarial value of assets. Exhibit 9 shows a historical comparison between the market value and actuarial value of assets. A market value asset allocation by major asset class as of December 31, 2019 is in a pie chart shown in Exhibit 10.

Assumptions

As a part of each actuarial valuation, we review the actuarial assumptions used in the prior actuarial valuation. As a result of our review, we have selected actuarial assumptions we consider to be reasonable and appropriate estimates of future experience for the fund for the long-term future. Their selection complies with the applicable actuarial standards of practice. Significant actuarial assumptions used in this valuation are:

1. 7.5% annual investment return net of investment-related expenses;

2. 2.75% general annual compensation increase plus an average of 1.89% per year for pay increases due to promotions and longevity over a 30-year career;

3. 2.75% aggregate payroll growth (for the purpose of amortizing the UAAL);

4. Retirement rates which result in an average expected age at retirement of 54.0; and

5. PubS-2010 (public safety employees) total dataset mortality tables for employees and for retirees, projected for mortality improvement generationally using the projection scale MP-2019.

A summary of all the assumptions and methods used in the valuation is shown in Exhibits 11 and 12. In our opinion, the assumptions used, both in the aggregate and individually, are reasonably related to the experience of the fund and to reasonable expectations. The assumptions represent a reasonable estimate of anticipated experience of the fund over the long-term future.

The following actuarial assumption changes have been made, and the new assumptions are compared to those used in the December 31, 2017 valuation by the prior actuary:

1. The mortality assumption was changed from the RP-2000 Combined Healthy Mortality Tables projected to 2024 with Scale AA to the PubS-2010 (safety employees) total dataset mortality tables for employees and for retirees, projected for mortality improvement generationally using the projection scale MP-2019. The rationale for the change is to use the results of a new, first-ever study of the mortality of public employee pension plan participants by the Society of Actuaries. The new mortality assumption is more appropriate for the fund for the long-term future than the prior assumption.

2. We changed the aggregate payroll increase assumption used for determining the UAAL amortization period from 3.5% to 2.75%. The 2.75% assumption is more reasonable for the fund for the long-term future, and is the same as the general compensation increase assumption in item 4 below.

3. We changed the investment return assumption from 7.5% net of all expenses to 7.5% net of investment-related expenses. Administrative expenses are now recognized explicitly as required for GASB 67 and 68 and are assumed to be equal to 1.00% of payroll. This percentage is based on the average historical relationship in the last four years, as shown in Appendix A, and is added to the normal cost. We believe these assumptions are more reasonable for the long-term future.

4. We changed the compensation increase assumption for projecting future benefits to assumed general increases of 2.75% per year combined with assumed promotion, step, and longevity increases that vary by year of service, and average 1.89% per year over a 30-year career. The assumption in the prior actuarial valuation consisted of the combination of assumed general increases of 3% combined with assumed promotion, step, and longevity increases that averaged 2.23% per year over a 30-year career. This change had a decreasing effect on projected compensation and benefits. We believe this compensation increase assumption is more reasonable for the long-term future.

5. We changed the demographic assumptions of termination, disability, and retirement to ones which we believe are somewhat more appropriate. However, the aggregate effect was similar to the assumptions of the prior actuary.

The effects of these changes in assumptions in the UAAL amortization period are mentioned in Section II. A summary of all the assumptions and methods used in the valuation is shown in Exhibits 11 and 12. In our opinion, the assumptions used, both in the aggregate and individually, are reasonably related to the experience of the fund and to reasonable expectations. The assumptions represent a reasonable estimate of anticipated experience of the fund over the long-term future.

Supporting Exhibits

Exhibit 13 contains definitions of terms used in this actuarial valuation report. Exhibit 14 summarizes the plan provisions of the Present Plan. Appendix A documents our review of the economic assumptions.

Changes in Contribution Policy

Before January 1, 2020, the contribution policy of the fund required contributions equal to 12% of pay by the firefighters, the rate previously elected by the firefighters according to TLFFRA. The city had been contributing 15% of payroll for several years. In 2019, the firefighters elected to increase their contribution rate to 13.25% effective January 1, 2020. The city contributes according to its annual budget. In 2019, the city decided to increase its contribution rate to the fund to 18% of payroll beginning January 1, 2020. The December 31, 2019 actuarial valuation reflects these increases in the firefighter and the city

contribution rates and includes the assumption that the city contribution rate will be 18% at least as long as the UAAL amortization period.

Funding Policy

The funding policy adopted by the board of trustees at its December 10, 2019 board meeting says that each actuarial valuation report will include a benchmark actuarially determined contribution (ADC) rate beginning January 1, 2020. Then the fund's actuary is to compare the benchmark ADC rate and the total contribution rate. The table below shows the actuarial valuation results in two key metrics, the amortization period and the total contribution rate.

	Amortization Period	Total Contribution Rate
Benchmark ADC rate	30.0 years	23.38%
Actuarial valuation	12.2 years	31.25%
Difference	-17.8 years	+7.87%

The actuarial valuation results are significantly better than those two metrics in the benchmark ADC rate. The current funding policy is silent about your fund's favorable actuarial condition. We will provide a draft of another funding policy for the board's consideration that includes a short paragraph on when the board may consider a benefit increase. It is simpler actuarially and also uses both of the metrics above for comparing the results of each actuarial valuation to the funding policy benchmark.

Variability in Future Actuarial Measurement

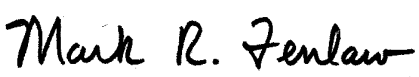
Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following:

- Plan experience differing from that anticipated by the current economic or demographic assumptions;
- Increases or decreases expected as part of the natural operation of the methodology used for these measurements;
- Changes in economic or demographic assumptions; and
- Changes in plan provisions.

Analysis of the potential range of such future measurements resulting from possible sources of measurement variability was provided on pages 1-3 in the projected amortization periods for the next two biennial actuarial valuations under six scenarios. These projections were designed to assess the risk of variance of potential future

investment rates of return in the four years following the actuarial valuation date from the assumed 7.5% rate and the potential effect on the amortization period. Additional or other sensitivity analysis could be performed in a subsequent report if desired by the board of trustees.

Respectfully submitted,
RUDD AND WISDOM, INC.



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Section II

Key Results of the Actuarial Valuation

	December 31, 2017[1]	December 31, 2019
1. Actuarial present value of future benefits		
a. Those now receiving benefits or former firefighters entitled to receive benefits	$ 16,087,964	$ 18,478,741
b. Firefighters	11,719,830	9,512,086
c. Total	$ 27,807,794	$ 27,990,827
2. Actuarial present value of future normal cost contributions	$ 5,124,458	$ 4,106,652
3. Actuarial accrued liability (Item 1c – Item 2)	$ 22,683,336	$ 23,884,175
4. Actuarial value of assets	$ 17,524,049	$ 17,982,601
5. Unfunded actuarial accrued liability (UAAL) (Item 3 - Item 4)	$ 5,159,287	$ 5,901,574
6. Contributions (percent of pay)		
a. Firefighters	12.00%	13.25%
b. City of Denison	15.00%	18.00%
c. Total	27.00%	31.25%
7. Normal cost (percent of payroll)	14.19%	12.90%
8. Percent of payroll available to amortize the UAAL (Item 6c - Item 7)	12.81%	18.35%
9. Annualized covered payroll	$ 3,319,038	$ 3,481,241
10. Present annual amount available to amortize the UAAL (Item 8 x Item 9)	$ 425,169	$ 638,808
11. Years to amortize the UAAL	15.8 years	12.2 years
12. Funded ratio (Item 4 ÷ Item 3)[2]	77.3%	75.3%

[1] All items are from the December 31, 2017 actuarial valuation by the prior actuary.

[2] The funded ratio is not appropriate for assessing either the need for or the amount of future contributions or the adequacy of the assumed contribution rates. Using the market value of assets instead of the actuarial value of assets for Item 12 would have resulted in funded ratios of 78.1% as of December 31, 2017 and 84.7% as of December 31, 2019. **The best indicator of the fund's health is Item 11.**

Changes in the Unfunded Actuarial Accrued Liability

In comparing this actuarial valuation to the prior one, the UAAL increased by $742,287 from $5,159,287 as of December 31, 2017 to $5,901,574 as of December 31, 2019. The table below summarizes the reasons for the increase.

Reason for Change	Amount
• Change in actuarial firm (different software and details of methodology)	$ 64,507
• Expected decrease (interest on UAAL less than expected amortization payments accumulated with interest)	(136,315)
• Investment loss for the two years (based on the AVA average annual return of 6.2%)	491,479
• Contribution loss (actual payroll greater than expected but actual timing of amortization contributions different than assumed)	21,040
• Experience gain (net difference between actual experience and assumed experience for pay increases, retirements, mortality, and terminations, but primarily due to more terminations than assumed)	(664,507)
• Change in assumptions (net effect of all changes)	964,232
• Increase in firefighter contribution rate	1,851
Total	$ 742,287

Changes in the Amortization Period

The amortization period, based on the Present Plan provisions (except for the changes in contribution rates), was determined in the prior actuarial valuation as of December 31, 2017 to be 15.8 years. Since two years have passed since that valuation date, a 13.8-year amortization period would be expected if all actuarial assumptions had been exactly met, no changes had occurred (other than those expected) in the firefighter and pensioner data, and no changes in assumptions or methods had been made. The amortization period is now 12.2 years based on the same plan provisions, except for the changes in contribution rates. The actual experience occurring between December 31, 2017 and December 31, 2019 differed from the expected experience, and in combination with the changes in actuarial firms and in assumptions, the resulting amortization period is 12.2 years for the following reasons:

1. There were differences in the determination of the actuarial liabilities and the normal cost that resulted from the change in actuarial firms. It is not uncommon that the calculation of the liabilities varies somewhat between actuarial firms because of a range of accepted practices, methods, valuation software, etc. The replication of the December 31, 2017 actuarial valuation using all of the prior actuary's assumptions resulted in an **increase** in the amortization period of 0.7 of a year.

2. The average annual rate of investment return, net of investment-related expenses, on the market value of assets during the two years 2018 and 2019 was 12.0%. However, the actuarial value of assets (AVA) used in the valuation and the determination of the amortization period is based on an adjusted market value. The average annual rate of return on the AVA, net of investment-related expenses, for years 2018 and 2019 was 6.2%, less than the assumed rate of return of 7.5%. This resulted in an **increase** in the amortization period of 1.9 years.

3. The aggregate payroll increased at an average rate of 2.4% per year instead of the assumed 3.5% per year rate, which caused the amortization period to **increase** by 0.6 of a year.

4. The net result of all experience other than the investment experience and the aggregate payroll experience had the combined effect of **decreasing** the amortization period by 5.6 years. This was primarily the result of greater-than-expected terminations in 2018 and 2019.

5. The change in the methodology for recognizing the timing of contributions from once a year to biweekly had the effect of **increasing** the amortization period by 1.1 years.

6. The changes in the assumptions had the effect of **increasing** the amortization period by 5.2 years.

7. The increases in the firefighter contribution rate from 12% to 13.25% and in the city contribution rate from 15% to 18% had the net effect of **decreasing** the amortization period by 5.5 years.

Section III

Benefit Improvements

The results of this actuarial valuation as of December 31, 2019 reveal that the fund, based on the Present Plan of benefits, has an adequate contribution arrangement. As disclosed in both Sections I and II, the amortization period of the UAAL is 12.2 years. With an amortization period of 12.2 years, we are willing to give the actuarial approval required by the provisions of Section 7 of the Texas Local Fire Fighters' Retirement Act (TLFFRA) to increase benefits.

The board probably has some ideas for potential benefit improvements. For example, the retirees and surviving spouses probably have not received an ad hoc increase in their monthly benefit in a long time. Perhaps another idea is to increase or remove the dollar limitation on monthly benefits. We strongly encourage you to consider such a benefit improvement. The current design of plan benefits is increasingly limited for the long-term future by the $5,150.00 cap on monthly retirement benefits. While the cap has helped the fund have an adequate contribution arrangement since it was added, it is gradually eroding the value of the fund benefits for the current and future active firefighters. The cap was a temporary fix. Unless the cap is removed, it will limit the projected retirement benefit for more and more future retirees.

Based on some preliminary calculations we performed based on the December 31, 2019 actuarial valuation, removing the cap would increase the liability for active firefighters by 44%. There would also be a significant increase in the normal cost contribution rate. The combination of those two components of an actuarial valuation would result in an unfunded liability amortization period of 44 years. It would have required a city contribution rate of 21.5% beginning January 1, 2020 instead of the 18% contribution rate that began then to comply with the PRB Pension Funding Guidelines maximum amortization period of 25 years when benefits are increased.

However, the cap could be removed incrementally. For example, we could determine what higher dollar cap would result in an unfunded liability amortization period of around 20 years without an increase in contribution rate. We would recommend 20 years as a target amortization period instead of the maximum allowable 25 years in order to provide a cushion for future adverse experience. Over time, the amortization period is expected to decrease. This would provide the board similar opportunities for increasing the cap without out an increase in the total contribution rate by allowing the decreased amortization period to be increased to an acceptable level that would still provide a cushion for future adverse experience. It is anticipated that eventually the cap could be removed by a series of periodic increases.

Exhibit 1

Distribution of Firefighters by Age and Service on December 31, 2019 with Average Annual Compensation

Years of Service	Age									Total	Average Compen-sation
	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60 or Over		
0	1	2	3	1	0	0	0	0	0	7	$ 49,750
1	2	2	0	0	0	0	0	0	0	4	53,596
2	0	3	2	0	0	0	0	0	0	5	66,297
3	1	1	1	1	0	0	0	0	0	4	75,041
4	0	0	1	1	0	0	0	0	0	2	70,451
5	0	0	1	0	0	0	0	0	0	1	79,285
6	0	0	0	1	0	0	0	0	0	1	79,781
7	0	0	0	1	0	0	0	0	0	1	86,411
8	0	0	0	0	0	0	0	0	0	0	0
9	0	1	0	0	0	0	0	0	0	1	75,662
10	0	0	0	1	0	0	0	0	0	1	93,316
11	0	0	0	0	2	0	0	0	0	2	81,248
12	0	0	1	2	0	1	0	0	0	4	80,205
13	0	0	0	2	1	1	0	0	0	4	85,343
14	0	0	0	0	0	1	1	0	0	2	91,669
15	0	0	0	0	0	1	0	0	0	1	89,567
16	0	0	0	2	0	0	0	0	0	2	101,853
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	1	0	0	0	0	0	1	90,923
20-24	0	0	0	0	0	2	0	1	0	3	80,659
25-29	0	0	0	0	0	0	1	0	0	1	97,405
30-34	0	0	0	0	0	0	0	0	0	0	0
35+	0	0	0	0	0	0	0	0	0	0	0
Totals	4	9	9	13	3	6	2	1	0	47	$ 74,069

Average	$54,786	$63,270	$80,404	$89,015	$ 0	
Compensation	$64,095	$84,040	$88,545	$72,782	$74,069	

Average age	35.0
Average years of service	8.0
Average age at hire	27.0

Exhibit 2

Summary of Pensioner Data

Type of Benefit	Pensioner Data Used in December 31, 2019 Valuation	
	Number of Recipients	Total Monthly Benefit Payments
Service Retirement	43[1]	$ 119,510
Disability Retirement	1	1,050
Vested Terminated (Deferred)	9	18,938
Surviving Spouse	5	7,278
Surviving Child	4	800
Total	62[1]	$ 147,576

Type of Benefit	Comparison of Pensioner Count by Type as of The Prior and Current Actuarial Valuations			
	December 31, 2017	New	Ceased	December 31, 2019
Service Retirement	42	+5[1]	-4	43[1]
Disability Retirement	1	0	0	1
Vested Terminated (Deferred)	2	+8	-1	9
Surviving Spouse	6	0	-1	5
Surviving Child	5	0	-1	4
Total	56	+13	-7	62[1]

[1] One of the 2018 retirees divorced after retirement. The number includes the one alternate payee.

Exhibit 3

Firefighter and Pensioner Reconciliation

	Firefighters	Current Payment Status	Vested Terminated Firefighters	Total
1. As of December 31, 2017	54	54	2	110
2. Change of status				
a. retirement	(3)	4	(1)	0
b. disability	0	0	0	0
c. death	0	(3)	0	(3)
d. survivor payment begins	0	0	0	0
e. withdrawal	(10)	0	0	(10)
f. vested termination	(8)	0	8	0
g. QDRO alternate payee	0	1	0	1
h. child benefit ceases	0	(1)	0	(1)
i. correction	0	(2)	0	(2)
j. net changes	(21)	(1)	7	(15)
3. New firefighters	14	0	0	14
4. As of December 31, 2019	47	53 [1]	9	109

[1] One of the 2018 retirees divorced after retirement. The number includes the one alternate payee.

Exhibit 4

Breakdown of Monthly Benefit Payment Amounts as of December 31, 2019

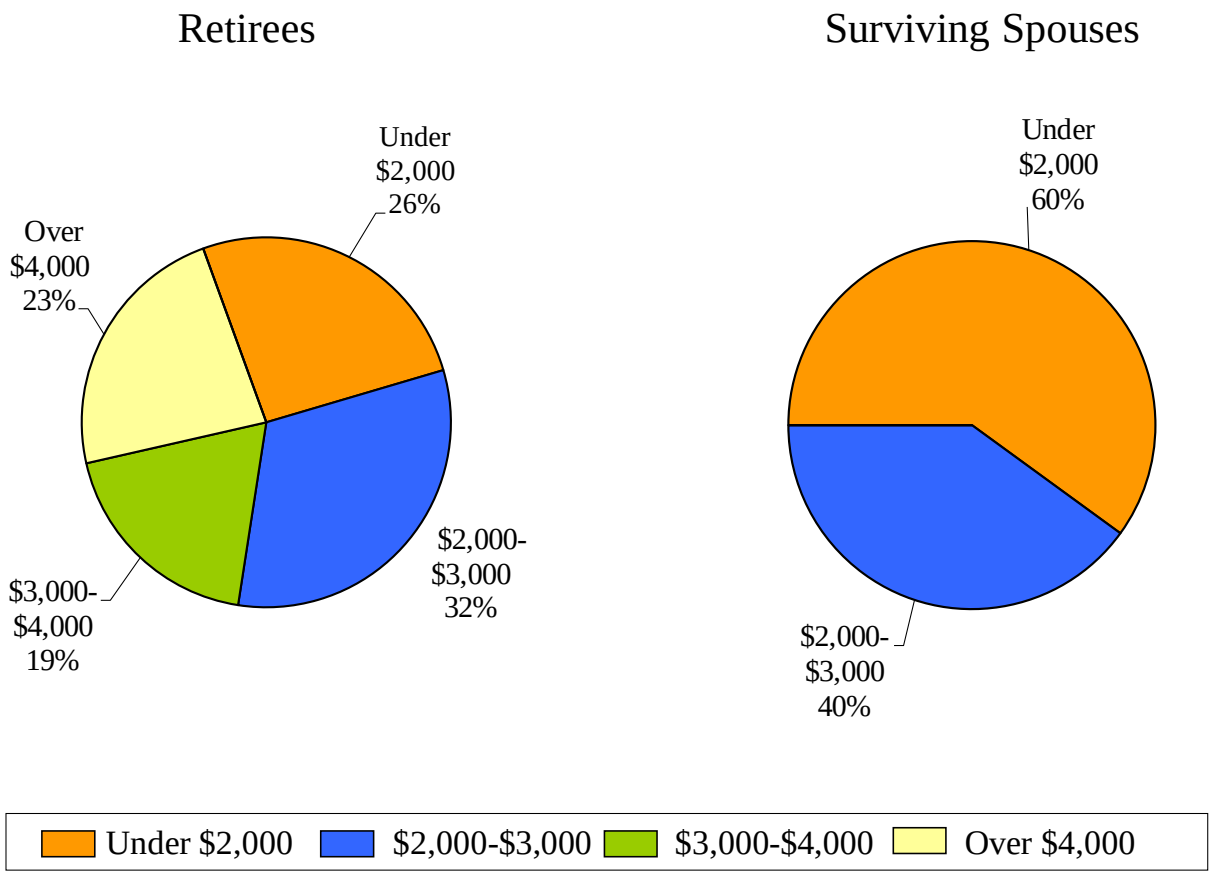

Exhibit 5

Historical Comparison of Actuarial Accrued Liability and Actuarial Value of Assets
(Present Plan Valuations as of December 31)

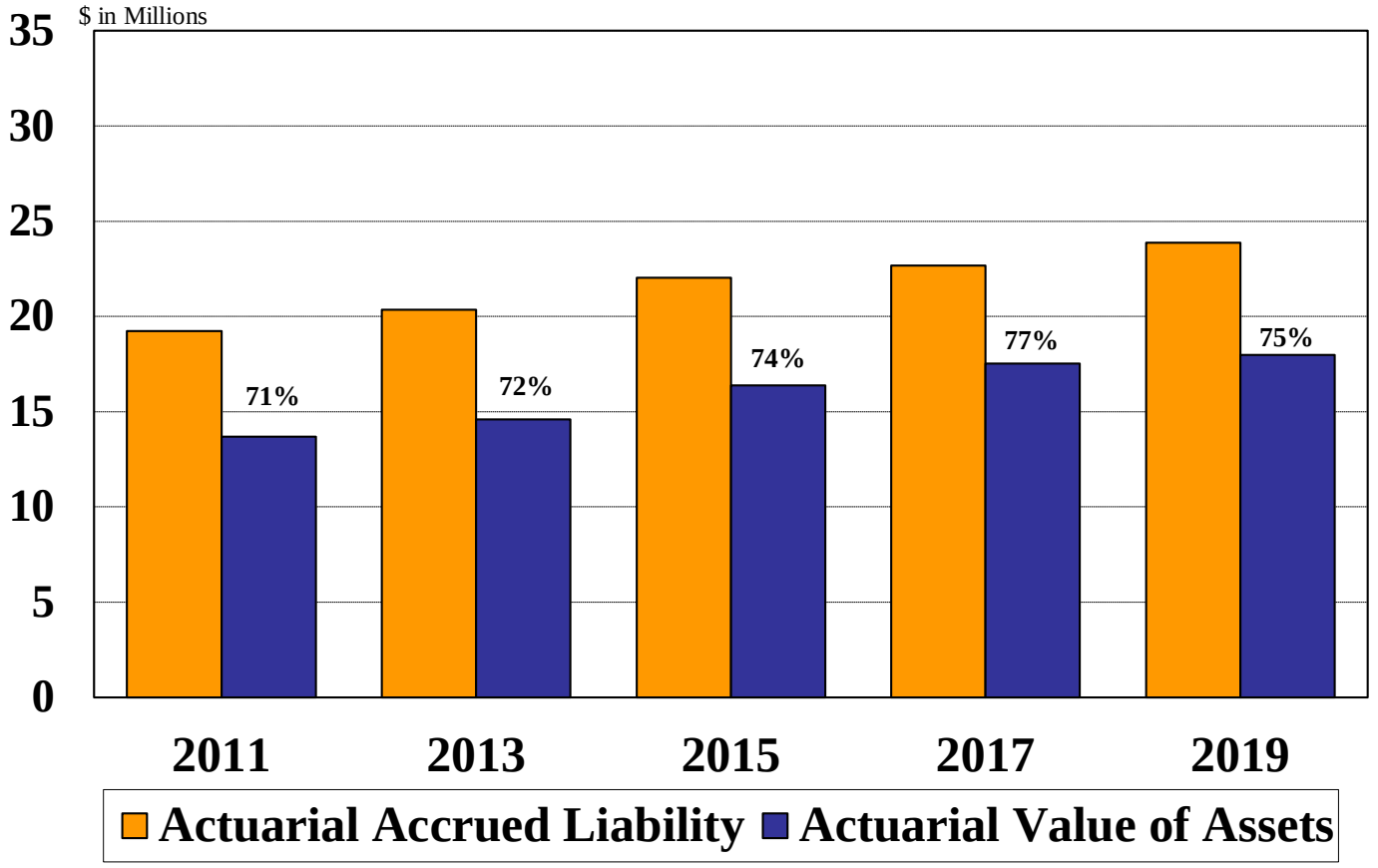

Exhibit 6

Summary of Asset Data

Asset Type	Market Value as of December 31, 2019	Allocation As a Percent of Grand Total
Domestic equities	$16,322,720	80.7%
REITS	1,350,078	6.7
Closed-end mutual funds	2,399,022	11.9
Fixed income	4,233	0.0
Cash net of payables	149,088	0.7
Grand Total	$20,225,141 [1]	100.0%

[1] The grand total is the audited amount. All of the invested amounts are from the December 31, 2019 report from the investment consultant. Cash net of payables is from the audited financial report.

Comparison of Asset Values as of the Prior and Current Actuarial Valuation Dates		
	December 31, 2017	December 31, 2019
Market Value	$17,725,070	$20,225,141
Actuarial Value	$17,524,049	$17,982,601
Actuarial Value as a Percent of Market Value	98.9%	88.9%

Exhibit 7

Statement of Changes in Audited Assets for the Years Ended December 31, 2019 and 2018

	12/31/2019	12/31/2018
Additions		
1. Contributions		
a. Employer	$ 529,465	$ 504,819
b. Employees	423,572	404,045
c. Total	$ 953,037	$ 908,864
2. Investment Income		
a. Interest and dividends	$ 726,452	$ 721,724
b. Net appreciation in fair value	3,988,632	(1,094,911)
c. Total	$ 4,715,084	$ (373,187)
3. Other Additions	0	0
Total Additions	**$ 5,668,121**	**$ 535,677**
Deductions		
4. Benefit Payments	$ 1,897,085	$ 1,559,639
5. Expenses		
a. Investment-related	$ 91,096	$ 88,431
b. Administrative	43,403	24,075
c. Total	$ 134,499	$ 112,506
Total Deductions	**$ 2,031,584**	**$ 1,672,145**
Net Increase in Assets	**$ 3,636,537**	**$ (1,136,468)**
Market Value of Assets (Fiduciary Net Position)		
Beginning of Year	$ 16,588,604	$ 17,725,070
End of Year	$ 20,225,141	$ 16,588,602
Rate of Return		
Net of All Expenses	28.42%	(2.79)%
Net of Investment-Related Expenses	28.73%	(2.65)%
Gross	29.38%	(2.15)%
Direct Investment-Related Expenses	0.65%	0.50%

Exhibit 8

Development of Actuarial Value of Assets

Calculation of Actuarial Investment Gain/(Loss) Based on Market Value for Plan Years Ending December 31				
	2019	2018	2017	2016
1. Market Value of Assets as of beginning of year	$16,588,602	$17,725,070	$15,721,368	$15,214,736
2. Firefighter Contributions	423,572	404,045	401,067	400,158
3. City Contributions	529,465	504,819	501,647	500,182
4. Benefit Payments and Administrative Expenses[1]	(1,940,488)	(1,583,714)	(1,467,072)	(1,533,123)
5. Expected Investment Return[2]	1,207,116	1,304,073	1,157,939	1,117,376
6. Expected Market Value of Assets as of end of year	16,808,267	18,354,293	16,314,949	15,699,329
7. Actual Market Value of Assets as of end of year	20,225,141	16,588,602	17,725,070	15,721,368
8. Actuarial Investment Gain/(Loss)	3,416,874	(1,765,691)	1,410,121	22,039
9. Market Value Rate of Return Net of Expenses	28.73%	(2.65)%	16.63%	7.65%
10. Rate of Actuarial Investment Gain/(Loss)	21.23%	(10.15)%	9.13%	0.15%

[1] Administrative expenses are included for all years to retroactively make the investment return assumption net of investment-related expenses.
[2] Assuming uniform distribution of contributions and payments during the plan year; investment return assumption was 7.5% per year.

Plan Year	Investment Gain/(Loss)	Deferral Percentage	Deferred Gain/(Loss) as of 12/31/2019
2019	$ 3,416,874	80%	$ 2,733,499
2018	(1,765,691)	60%	(1,059,415)
2017	1,410,121	40%	564,048
2016	22,039	20%	4,408
Total			$ 2,242,540

Actuarial Value of Assets as of December 31, 2019	
11. Market Value of Assets as of December 31, 2019	$ 20,225,141
12. Deferred Gain/(Loss) to be Recognized in Future	2,242,540
13. Preliminary Value (Item 11 – Item 12)	$ 17,982,601
14. Corridor for Actuarial Value of Assets	
a. 80% of Market Value as of December 31, 2019 (minimum)	$ 16,180,113
b. 120% of Market Value as of December 31, 2019 (maximum)	$ 24,270,169
15. Actuarial Value as of December 31, 2019	$ 17,982,601
16. Write Up/(Down) of Assets (Item 15 – Item 11)	$ (2,242,540)

Exhibit 9

Historical Comparison of Market and Actuarial Value of Assets
(Valuation as of December 31)

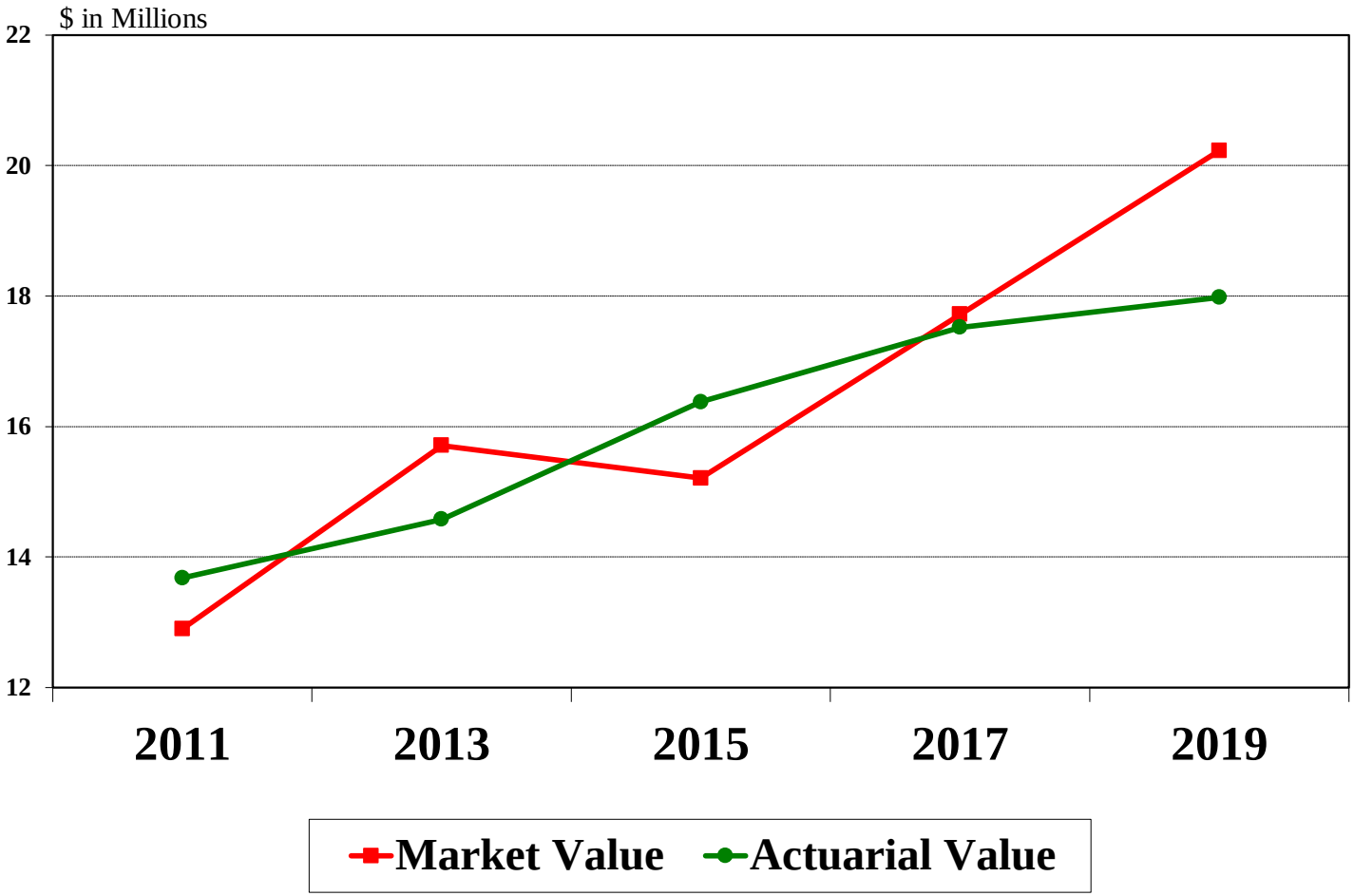

Exhibit 10

Market Value Asset Allocation as of the Current Actuarial Valuation Date

December 31, 2019

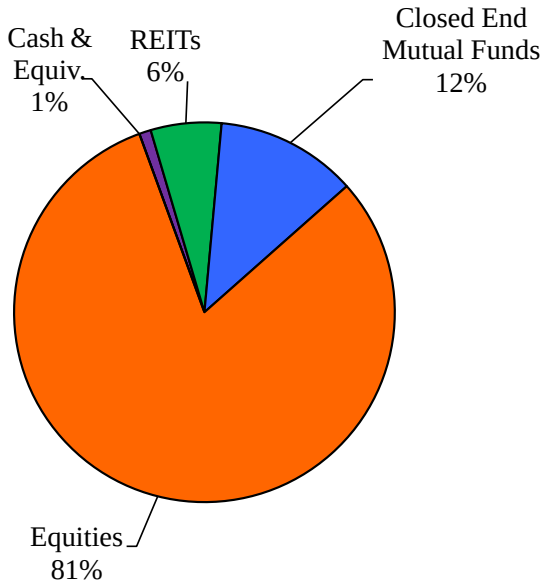

Exhibit 11

Actuarial Methods and Assumptions

A. Actuarial Methods

1. Actuarial Cost Method

The Entry Age Actuarial Cost Method is an actuarial cost method in which the actuarial present value of projected benefits of each active firefighter included in the valuation is allocated as a level percentage of compensation between age at hire and assumed termination. Each active firefighter's normal cost is the current annual contribution in a series of annual contributions which, if made throughout the firefighter's total period of employment. The normal cost for the fund is the sum of the normal costs for each active firefighter for the year following the valuation date. The normal cost as a percent of payroll reflects that contributions are made biweekly.

The fund's actuarial accrued liability is the excess of the actuarial present value of projected benefits over the actuarial present value of all future remaining normal cost contributions. The unfunded actuarial accrued liability (UAAL) is the amount by which the actuarial accrued liability exceeds the actuarial value of assets. The UAAL is recalculated each time a valuation is performed. Experience gains and losses, which represent deviations of the UAAL from its expected value based on the prior valuation, are determined at each valuation and are amortized as part of the newly calculated UAAL.

2. Amortization Method

The UAAL is assumed to be amortized with level percentage of payroll contributions (total assumed contribution rate less normal cost contribution rate) based on assumed payroll growth of 2.75% per year. The actuarial determination of the amortization period reflects that contributions are made biweekly.

3. Actuarial Value of Assets Method

All assets are valued at market value with an adjustment made to uniformly spread actuarial gains or losses (as measured by actual market value investment return vs. expected market value investment return) over a five-year period. The total adjustment amount shall be limited as necessary such that the actuarial value of assets shall not be less than 80% of market value nor greater than 120% of market value.

B. Actuarial Assumptions

As a part of each actuarial valuation, we review the actuarial assumptions used in the prior actuarial valuation. The investment return assumption is reviewed using the building block approach that includes several asset allocations, assumed real rates of return for each asset class, an assumed rate of investment-related expenses, and an assumed rate of inflation, with all assumptions for the long-term future. Our economic assumptions are influenced both by long-term historical experience and by future expectations of investment consultants and economists, but we select the economic assumptions and normally discuss them with the board before completing the actuarial valuation. See Appendix A for our review of the economic assumptions.

We review the termination and retirement experience since the prior valuation and periodically look back more than two years. We also periodically review the average salaries by years of service to get insights into the promotion, step, and longevity compensation patterns for the purpose of reviewing our compensation increase assumption. For the mortality assumptions, we use an appropriate published mortality table with projections for improvement beyond the valuation date. We are guided in our review and selection of assumptions by the relevant actuarial standards of practice. As a result of our review, we have selected actuarial assumptions we consider to be reasonable and appropriate estimates of future experience for the fund for the long-term future.

1. Investment Return

   7.5% per year net of investment-related expenses.

2. Inflation

   2.75% per year included in compensation increases and investment return assumptions.

3. Mortality Rates

   PubS-2010 (public safety) total dataset mortality tables for employees and for retirees (sex distinct), projected for mortality improvement generationally using the projection scale MP-2019.

4. Compensation Increases

   General increases of 2.75% per year combined with promotion, step, and longevity increases that average 1.89% per year over a 30-year career. See Exhibit 12.

5. Retirement Rates

Age	Rate per Year for Paid Firefighters Eligible to Retire
50-51	10%
52-53	20
54	30
55-57	25
58-59	50
60	100

The average expected retirement age for firefighters not yet eligible to retire based on these rates is 54.0.

6. Termination Rates

See Exhibit 12.

7. Disability Rates

See Exhibit 12.

8. Reduction in Benefit after 1½ Years of Disability Retirement

15% weighted average reduction in benefit.

9. Percent Married

100% of the active firefighters are assumed to be married at retirement, disability, or death while employed, with male firefighters having a spouse three years younger and female firefighters having a spouse three years older. Actual marital status and spouse date of birth are used for retirees.

10. Payment Form for Retirement Benefits Due to Service Retirement, Disability Retirement, or Vested Termination

- Joint and 75% to surviving spouse

11. Surviving Child's Death Benefit

None are assumed as a result of future deaths.

12. Firefighters' Contribution Rate

13.25% of covered compensation.

13. City's Assumed Contribution Rate

    18.0% of covered compensation for at least as long as the period required to amortize the UAAL.

14. Covered Payroll for First Year Following Valuation Date

    Actual (or annualized) pay for 2019 increased 9.1% for each firefighter to fully reflect the effect of the general pay increase of 20% effective July 1, 2019.

15. Administrative Expenses

    The expenses paid by fund assets for other than investment-related expenses are assumed to be 1.00% of payroll. The normal cost rate as a percent of payroll is assumed to be 1.00% of payroll higher to reflect these expenses.

Exhibit 12
Disability and Termination Rates per 1,000 Active Members
Compensation Increases by Years of Service

Disability Rates		Termination Rates		Compensation Increases	
Attained Age	Rate per 1,000	Years of Service	Rate per 1,000	Years of Service	Increase Percent
20	0.14	0	119	1	9.43%
21	0.15	1	107	2	9.43
22	0.16	2	95	3	9.43
23	0.17	3	84	4	9.43
24	0.18	4	73	5	9.43
25	0.19	5	63	6	4.81
26	0.21	6	54	7	4.81
27	0.23	7	48	8	4.81
28	0.25	8	42	9	4.81
29	0.28	9	38	10	4.81
30	0.31	10	33	11	4.81
31	0.35	11	28	12	4.81
32	0.40	12	24	13	4.81
33	0.45	13	21	14	4.81
34	0.49	14	19	15	4.81
35	0.52	15	18	16	3.78
36	0.54	16	18	17	3.78
37	0.57	17	16	18	3.78
38	0.62	18	15	19	3.78
39	0.73	19	15	20	3.78
40	0.92	20 & Over	0	21	2.75
41	1.14			22	2.75
42	1.32			23	2.75
43	1.48			24	2.75
44	1.73			25	2.75
45	2.09			26	2.75
46	2.55			27	2.75
47	2.98			28	2.75
48	3.34			29	2.75
49	3.62			30	2.75
50	3.79			31	2.75
51	3.92			32	2.75
52	4.04			33	2.75
53	4.24			34	2.75
54	4.56			35	2.75
55	0.00			36	2.75
56	0.00			37	2.75
57	0.00			38	2.75
58	0.00			39	2.75
59	0.00			40	2.75

Exhibit 13

Definitions

1. Actuarial Accrued Liability	That portion, as determined by the particular actuarial cost method used, of the Actuarial Present Value of future pension plan benefits as of the Valuation Date that is not provided for by the Actuarial Present Value of future Normal Costs.
2. Actuarial Assumptions	Assumptions as to the occurrence of future events affecting pension costs, such as: mortality, termination, disablement and retirement; changes in compensation; rates of investment earnings and asset appreciation; and other relevant items.
3. Actuarially Equivalent	Of equal Actuarial Present Value, determined as of a given date with each value based on the same set of Actuarial Assumptions.
4. Actuarial Gain (Loss)	A measure of the difference between actual experience and that expected based on the Actuarial Assumptions during the period between two Actuarial Valuation dates, as determined in accordance with the particular actuarial cost method used.
5. Actuarial Present Value	The value of an amount or series of amounts payable or receivable at various times, determined as of a given date (the Valuation Date) by the application of the Actuarial Assumptions.
6. Actuarial Valuation	The determination, as of a Valuation Date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets and related Actuarial Present Values for a pension plan.
7. Actuarial Value of Assets	The value of cash, investments and other property belonging to a pension plan, as determined by a method and used by the actuary for the purpose of an Actuarial Valuation.

8. Entry Age Actuarial Cost Method	An actuarial cost method under which the Actuarial Present Value of the Projected Benefits of each individual included in the Actuarial Valuation is allocated as a level percentage of earnings between entry age and assumed termination. The portion of this Actuarial Present Value allocated to a valuation year is called the Normal Cost. The portion of this Actuarial Present Value not provided for at a Valuation Date by the Actuarial Present Value of future Normal Costs is called the Actuarial Accrued Liability. Under this method, Actuarial Gains (Losses), as they occur, reduce (increase) the Unfunded Actuarial Accrued Liability.
9. Plan Year	A 12-month period beginning January 1 and ending December 31.
10. Normal Cost	That portion of the Actuarial Present Value of pension plan benefits that is allocated to a valuation year by the actuarial cost method.
11. Projected Benefits	Those pension plan benefit amounts that are expected to be paid at various future times according to the Actuarial Assumptions, taking into account such items as the effect of advancement in age and past and anticipated future qualified service.
12. Overfunded Actuarial Accrued Liability	The excess, if any, of the Actuarial Value of Assets over the Actuarial Accrued Liability.
13. Unfunded Actuarial Accrued Liability	The excess, if any, of the Actuarial Accrued Liability over the Actuarial Value of Assets.
14. Valuation Date	The date upon which the Normal Cost, Actuarial Accrued Liability and Actuarial Value of Assets are determined. Generally, the Valuation Date will coincide with the end of a Plan Year.
15. Years to Amortize the Unfunded Actuarial Accrued Liability	The period is determined in each Actuarial Valuation as the number of years, beginning with the Valuation Date, to amortize the Unfunded Actuarial Accrued Liability with a level percent of payroll that is the difference between the expected total contribution rate and the Normal Cost contribution rate.

Exhibit 14

Summary of Present Plan

1.	Normal Service Retirement Monthly Benefit - Percentage of Highest 24-Month Average Salary per Year of Service	
	(a) for each of the first 20 years of service	2.65%
	(b) for each year in excess of 20 years	3.00%
2.	Normal Service Retirement Eligibility (Minimum)	Age 50 and 20 Years
3.	Vested Terminated Benefit	
	(a) Eligibility for firefighters (minimum service)	10 Years
	(b) Benefit based on formula in item 1	
	(c) Benefit is deferred to date person would have satisfied normal service retirement eligibility	
4.	Disability Retirement Monthly Benefit for Firefighters Who Become Disabled while Employed	
	(a) For initial 18-month period if not able to perform job in fire department – 50% of Highest 24-Month Average Salary	
	(b) Following initial 18-month period depending upon status	
	(i) Initial benefit	
	(ii) One-half of initial benefit	
	(iii) Zero	
	(c) Upon attaining eligibility for normal retirement, the member's vested retirement benefit becomes payable if the disability benefit has been reduced or terminated	
5.	Maximum Monthly Benefit for Items 1, 3, and 4	$5,150.00
6.	Surviving Spouse's Monthly Death Benefit for a Firefighter Who Dies While Employed [(a) plus (b), subject to (c)]	
	(a) Percent of Highest 24-Month Average Salary	39.75%
	(b) Three-fourths of any additional service benefit earned as of date of death for years in excess of 20 years	
	(c) Maximum monthly benefit	$3,862.50

7. Surviving Spouse's Monthly Death Benefit for a firefighter who dies after service retirement, disability retirement, or vested termination will be equal to three-fourths of the monthly benefit the firefighter was receiving or entitled to receive as of the date of death.

8. Surviving Children's Monthly Death Benefit
   (a) Where the spouse is receiving a benefit $100.00
   (b) Where the spouse is not receiving a benefit or there is no spouse $200.00

9. Contributions as a Percent of Compensation by:
   (a) Firefighters 13.25%
   (b) City of Denison 18.00%

10. The normal form of annuity payment at retirement is a Joint and Three-Fourths to Surviving Spouse, and payment is the first business day of each month. No optional forms of annuity payments are available.

11. Compensation used to determine contributions and the Highest 24-Month Average Salary includes all pay except for lump sum distributions for unused sick leave or vacation pay. The average is based on the 24 consecutive months with the fire department during which his total pay was highest.

12. Refund of firefighters' accumulated contributions without interest will be made to firefighters who terminate employment and either are not eligible for any other benefit from the fund or request a refund from the fund.

Appendix A

Review of the Actuarial Economic Assumptions for the December 31, 2019 Actuarial Valuation

Theoretical Investment Return Assumption Development

Manager and Class	Gross Annual Real Rate of Return (ROR)[1]	Asset Allocation 12/31/2019 Actual[2]	Asset Allocation 6/30/2020 Actual[3]
Domestic equities	6.5%	80.7%	72.1%
REITs	4.5	6.7	18.6
Closed end mutual funds	2.0[4]	11.9	5.5
Cash	0.5	0.7	3.8
		100.0%	100.0%
Weighted Average Gross Real ROR Assumption		5.79%	5.65%
Weighted Average Net Real ROR Assumption[5]		5.24%	5.10%
Theoretical Annual Investment Return Assumption: Net Real ROR Plus Assumed Annual Rate of Inflation			
Assumed 2.75% Inflation		7.99%	7.85%
Assumed 2.50% Inflation		7.74%	7.60%

[1] A gross annual real rate of investment return is the total annual rate of investment return, before any expenses, that is in excess of the assumed annual inflation rate. These are long-term assumptions made by Rudd and Wisdom, Inc.
[2] This allocation is from the December 31, 2019 report from Fiduciary Financial Services Wealth Management.
[3] This allocation is from their June 30, 2020 report.
[4] This return assumption is net of the indirect expenses for the mutual funds.
[5] The investment-related expenses, for direct expenses, are assumed to be 0.55% of assets and are based on direct expenses for the last four years (page 32).

Appendix A (continued)

Price Inflation in the USA - Average Annual Rates of Increase in the CPI-U

Years (Dec. to Dec.)	Number of Years	Average Annual Increase
1954 – 2019	65	3.54%
1959 – 2019	60	3.68
1964 – 2019	55	3.91
1969 – 2019	50	3.91
1974 – 2019	45	3.62
1979 – 2019	40	3.07
1984 – 2019	35	2.58
1989 – 2019	30	2.40
1994 – 2019	25	2.18
1999 – 2019	20	2.14

Most inflation forecasts are for 10 years or less. For example, the average 10-year forecast in the June 2020 Livingston Survey published by the Federal Reserve Bank of Philadelphia was 2.0%. Similarly, the 2020 Wall Street Consensus Survey for the next decade included an average inflation forecast of 2.1%. However, 10 years is much too short a forecast period for a public employee defined benefit pension plan. In the 2020 annual report of the OASDI Trust Funds (Social Security), the ultimate inflation assumptions for their 75-year projections are 3.0%, 2.4%, and 1.8% for the low-cost, intermediate, and high-cost assumptions, respectively. Looking at the average annual increase in the CPI-U over historical periods of 30 to 65 years above and considering the Social Security forecasts, we believe that reasonable assumed rates of inflation for the long-term future would range from 2.25% to 3.25%. Shorter term considerations make the bottom half of that range more desirable.

Expenses Paid from Fund

		Expenses		Expenses as a % of Assets	
Plan Year Ending 12/31	Beginning of Year Assets	Admin.	Direct Investmt	Admin. (3) ÷ (2)	Investmt (4) ÷ (2)
(1)	(2)	(3)	(4)	(5)	(6)
2019	$16,588,604	$43,403	$91,096	0.26%	0.55%
2018	17,725,070	24,075	88,431	0.14	0.50
2017	15,721,368	38,876	82,139	0.25	0.52
2016	15,214,736	28,393	78,775	0.19	0.52

Appendix A (continued)

Administrative Expenses Paid by the Fund

Plan Year Ending 12/31 (1)	Administrative Expenses Paid by the Fund (2)	Covered Payroll (3)	% of Payroll (2) ÷ (3) (4)
2019	$ 43,403	$ 3,529,767	1.23%
2018	24,075	3,365,460	0.72
2017	38,876	3,344,313	1.16
2016	28,393	3,334,547	0.85
2016-2019	$134,747	$13,574,087	0.99%

For the December 31, 2019 actuarial valuation, the administrative expenses are not reflected in the investment return assumption but are reflected as a percent of payroll that is added to the normal cost contribution rate. We recommend 1.00%, the average developed above for the last four plan years, rounded up to a multiple of 0.05%. (The covered payroll was determined as the city contributions for the plan year divided by the city contribution rate during the plan year.)

Comparison of 12/31/2017 Actuarial Economic Assumptions with 12/31/2019 Actuarial Economic Assumptions

Actuarial Assumption[1]	12/31/2017 Actuarial Economic Assumptions	12/31/2019 Actuarial Economic Assumptions
Inflation (Price)	2.50%	2.75%
Net real rate of return[2]	5.00	4.75
Net total investment return[2]	7.50%	7.50%
Firefighter pay increase[3]	5.23%	4.64%
Aggregate payroll increase	3.50%	2.75%
Administrative expenses[4]	netted out of return	1.00% of payroll

[1] All assumptions are annual rates.

[2] Net of all expenses for the prior actuary's 12/31/2017 assumption, and net of all investment-related expenses for the 12/31/2019 assumption.

[3] For 12/31/2017, a 3.00% annual general pay increase combined with an average annual promotion, step, and longevity pay increase of 2.23% over a 30-year career. For 12/31/2019, a 2.75% annual general pay increase combined with an average annual promotion, step, and longevity pay increase of 1.89% over a 30-year career.

[4] The prior actuary's recognition of administrative expenses was through using an investment return assumption that was net of all expenses. For 12/31/2019, administrative expenses are reflected as a percent of payroll that is added to the normal cost contribution rate. Administrative expenses are more likely to be relatively consistent over time as a percent of payroll than as a percent of assets. In addition, the recognition of administrative expenses separate from the investment return assumption is consistent with the requirement of GASB 67 and 68 for accounting disclosures.