
Corpus Christi Fire Fighters' Retirement System

Actuarial Valuation as of December 31, 2018

November 15, 2019



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November 15, 2019

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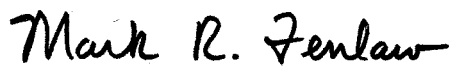
Members of the Board of Trustees:

At the request of the Board of Trustees of the Corpus Christi Fire Fighters' Retirement System, we have prepared this report of the results of the actuarial valuation of the system as of December 31, 2018. This valuation was prepared to determine whether the system has an adequate contribution arrangement.


In a separate report in March, we provided the necessary disclosures for the system's compliance with the Governmental Accounting Standards Board (GASB) Statement No. 67 for the plan year ending December 31, 2018. Similarly, we will provide a separate report later this year 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, 2019. GASB 68 prescribes the city's accounting for your system, while this actuarial valuation report reflects the assumed continuation of the current funding policy.

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, F.S.A.



Rebecca B. Morris, A.S.A.

MRF/RBM:nlg

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Section I

Valuation Summary

An actuarial valuation of the assets and liabilities of the Corpus Christi Fire Fighters' Retirement System as of December 31, 2018 has been completed. The valuation was based on the Present Plan (plan effective January 1, 2016) and the provisions of the Texas Local Fire Fighters' Retirement Act (TLFFRA) which were in effect on December 31, 2018. Section II shows the key results of the actuarial valuation as of December 31, 2018 and discusses the changes since the prior valuation that we prepared as of December 30, 2016.

This valuation reflects an actuarially assumed total contribution rate of 34.38%, comprised of 13.10% by the firefighters and a rate of 21.28% by the city. The total contribution rate of 34.38% exceeds the normal cost rate of 16.11%, leaving 18.27% available to amortize the unfunded actuarial accrued liability (UAAL) of \$99,896,125. Assuming that the total payroll increases at the rate of 3.1% per year in the future, the contributions in excess of the normal cost **will amortize the UAAL in 29.8 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 (PRB) pension funding guidelines, 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 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 system's normal cost and to amortize the system's UAAL within the maximum acceptable period, we are of the opinion that the system, based on present levels of benefits and contributions, **has an adequate contribution arrangement. Section III presents considerations for future changes in the contribution policy as well as for future benefit improvements.**

Projected Actuarial Valuation Results

In addition to completing this actuarial valuation, we estimated the amortization periods as of December 31, 2020 and as of December 31, 2022 by making projections from the December 31, 2018 actuarial valuation. These projections examine the effect on the amortization period in the next two actuarial valuations of the actuarial investment gains and losses that the system experienced in the four years prior to the valuation date (losses in 2015, 2016 and 2018 and a gain in 2017) that have been only partially recognized as of December 31, 2018. As shown in Exhibit 6, 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 system has had. The AVA used in this current valuation is deferring recognition of various portions of the gains and losses in 2015-2018 that the system experienced. The AVA used in this valuation is \$151,136,552. The market value of assets is \$139,811,086. The \$11,325,466 difference between the market value and the AVA is the net of the deferred gains and losses that will be recognized in the next two 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 market value of assets 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 market value of assets, as seen in Exhibit 7.

For the purpose of projecting the amortization period through 2022, we used six scenarios of various assumed annual rates of investment return, net of investment-related expenses, over the 2019-2022 projection period. The projected amortization periods will not be the same as the actual amortization periods from completed future actuarial valuations but are projected future actuarial valuation results based on the completed December 31, 2018 actuarial valuation. 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, 2018, (2) of investment returns over the next four years different from the 7.5% assumption used in this valuation, and (3) of an increase in the city contribution rate to a higher fixed rate beginning October 1, 2020.

	Scenario					
	1	2	3	4	5	6
Assumed Investment Return for Calendar Year						
2019	7.5%	12.0%	7.5%	12.0%	7.5%	12.0%
2020	7.5	12.0	7.5	12.0	7.5	12.0
2021	7.5	7.5	7.5	7.5	7.5	7.5
2022	7.5	7.5	7.5	7.5	7.5	7.5
2023 and later	7.5	7.5	7.5	7.5	7.5	7.5
City Contribution Rate	21.28%	21.28%	23%	23%	25%	25%
Amortization Period in Years as of December 31:						
2018 (actual)	29.8	29.8	29.8	29.8	29.8	29.8
2020 (projected)	32.2	29.7	27.0	25.1	22.8	21.4
2022 (projected)	33.5	27.3	27.4	22.8	22.6	19.1

The projected future December 31, 2020 valuation in Scenario 1 reveals that instead of decreasing by the expected two years from 29.8 years to 27.8 years, the amortization period is projected to increase to 32.2 years due to the recognition of more deferred losses than gains as of December 31, 2020. This result is not surprising when you consider that if the AVA were set equal to the MVA, recognizing all of the past gains and losses in this December 31, 2018 actuarial valuation, the amortization period would have been 37.5 years instead of 29.8 years. The primary conclusion from Scenario 1 is that without any gains or losses the amortization period will increase because of the deferred net investment loss. Scenario 2 shows an example of rates of return in 2019 and 2020 that would keep the amortization period from increasing without an increase in the city contribution rate above 21.28%.

Scenarios 3 and 4 are the same as Scenarios 1 and 2 for the assumed rates of return in the next four years, but they show the effects of an increase in city contribution rate to 23% in October 2020. Comparing Scenarios 3 and 1, the increase to 23% would reduce the amortization period by 5.2 years in the December 31, 2020 actuarial valuation. Scenario 4 shows how investment gains in 2019 and 2020 with the increase to 23% could result in the amortization period below 25 years in the December 31, 2022 actuarial valuation. Scenarios 5 and 6 show that it would take an increase in the city contribution rate to 25% for the amortization period to be below 25 years.

We do not know what the investment experience will be for each of the next four fiscal 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. In addition, the future investment experience in each of the next four fiscal years could be better or worse than the assumed rates shown. These scenarios present a range of plausible scenarios for the next two valuations assuming no changes in benefits and the three different city contribution policies shown.

The primary conclusion from the scenarios is that since the system has a deferred net investment loss that will hinder the amortization of the UAAL, the board and the system members should remember the long-term nature of the system and recognize the need for increases in the total contribution rate before there can be any benefit improvements. We address the contribution policy in more detail in Section III, as well as future benefit improvements.

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 the system's administrator, Ms. Gracie G. Flores. We have not audited the data provided but have reviewed it for reasonableness and consistency relative to the data provided for the December 31, 2016 actuarial valuation. Exhibit 1 is a distribution of the active firefighters by age and

service. The salaries used for projecting future contributions and benefits in the valuation were based on the actual pay for the 2018 calendar year with an adjustment to reflect the general pay increase effective October 1, 2018. The total of these salaries is our assumed annualized covered payroll for the plan year beginning January 1, 2019 and is used in the valuation to determine the UAAL amortization period. The averages of the assumed salaries for the 2019 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 December 31, 2018. Exhibit 2A is a reconciliation of firefighters and pensioners from December 31, 2016 to December 31, 2018. Exhibit 3 shows a breakdown of the dollar level of the monthly benefits for retirees and surviving spouses. Exhibit 4 shows a historical comparison of the actuarial accrued liability and the actuarial value of assets.

The summary of assets contained in Exhibit 5 is based on the December 31, 2018 market value of assets shown in the system's draft audited financial statements. This exhibit also shows a comparison of the market values and actuarial values of assets as of December 31, 2016 and December 31, 2018. Exhibit 5A contains the statement of changes in assets for the plan years ending December 31, 2018 and 2017. Exhibit 6 shows the development of the actuarial value of assets. Exhibit 7 shows a historical comparison between the market value and actuarial value of assets. A comparison of the market value asset allocation by asset class as of December 31, 2016 and December 31, 2018 is shown in Exhibit 8.

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 and with the input of the board of trustees during their September and October meetings, we have selected actuarial assumptions we consider to be reasonable and appropriate estimates of future experience for the system for the long-term future. Their selection complies with the applicable actuarial standards of practice. Significant actuarial assumptions used in the valuation are:

1. 7.5% annual investment return net of investment-related expenses;
2. 3.1% annual general compensation increase plus an average of 1.82% per year for pay increases due to promotions and longevity over a 30-year career;
3. Retirement rates which result in an average expected age at retirement of 58.1;
4. PubS-2010 (public safety employees) total dataset mortality tables for employees and for retirees, projected for mortality improvement generationally; and
5. City contribution rate of 21.28% over the UAAL amortization period, a 0.50% increase that began October 1, 2019.

The following actuarial assumption changes have been made, and the new assumptions are compared to those used in the December 31, 2016 valuation:

1. We changed the investment return assumption from 7.75% to 7.5% and modified its components, increasing the assumed net real rate of return from 4.25% to 4.40% and lowering the assumed inflation rate from 3.5% to 3.1%.
2. We changed the general compensation increase from 3.5% per year to 3.1%, making it the same as the underlying price inflation assumption. As a result, we also changed the aggregate payroll increase assumption from 3.5% per year to 3.1%. Because of the somewhat slower growth anticipated in our economy for the long-term future, we think that the 0.4% reduction in the long-term rate of inflation is appropriate.
3. 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-2018. 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.
4. As a part of our 2018 review of the system's experience, we reviewed the termination experience of the system for the last six years and changed the assumed rates of termination to better fit the actual recent experience (higher rates). We believe the new termination rates will result in a more reasonable assumption for the future than our previously assumed termination rates.

The effects of these changes in assumptions on the UAAL amortization period are identified in Section II. A summary of all the assumptions and methods used in the valuation is shown in Exhibits 9 and 10. In our opinion, the assumptions used, both in the aggregate and individually, are reasonably related to the experience of the system and to reasonable expectations. The assumptions represent a reasonable estimate of anticipated experience of the system over the long-term future.

Supporting Exhibits

Exhibit 11 contains definitions of terms used in this actuarial valuation report. Exhibit 12 summarizes the plan provisions of the Present Plan.

Actuarially Determined Contributions by the City

GASB 68 is all about accounting for pensions and did away with the concept of annually required contributions, referred to as the ARC. GASB made a point of separating their accounting standard for public employee defined benefit plans from the actual funding of

those plans. As a result of GASB getting out of the business of providing a funding standard, the PRB recommended in their report to the Texas Legislature at the end of 2014 that actuarial valuation reports for fixed contribution rate plans should disclose contribution levels required for a variety of appropriate amortization periods. Since the preferred range for the UAAL amortization period is 10 to 25 years in the PRB’s pension funding guidelines, and since your plan’s amortization period is above 25 years, we have shown the city contribution rate that would have been required beginning October 1, 2020 for amortization periods of 25, 23, and 21 years based on this December 31, 2018 actuarial valuation.

UAAL Amortization Period	Actuarially Determined Contribution Rate by the City	Firefighter Contribution Rate	Total Contribution Rate
25 Years	23.29%	13.10%	36.39%
23 Years	24.43%	13.10%	37.53%
21 Years	25.82%	13.10%	38.92%

In 2015, the Legislature passed HB 3310 which amended Sections 801 and 802 of the Government Code. It includes a new sentence in Section 802.101(a) which requires an actuarial valuation to include a recommended contribution rate needed to have an amortization period that does not exceed 30 years. Even though the current contribution policy of 13.10% of pay by the firefighters and 21.28% of pay by the city results in an amortization period of just under 30 years, we recommend an increase in the total contribution rate in Section III.

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 the possible sources of measurement variability is typically outside the scope of an actuarial valuation. However, we provided projected amortization periods for the next two

biennial actuarial valuations under six scenarios. 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, 2016 ¹	December 31, 2018
1. Actuarial present value of future benefits		
a. Those now receiving benefits or former firefighters entitled to receive benefits	\$ 113,686,254	\$ 126,390,302
b. Firefighters	<u>163,108,016</u>	<u>171,866,481</u>
c. Total	\$ 276,794,270	\$ 298,256,783
2. Actuarial present value of future normal cost contributions	\$ 49,657,132	\$ 47,224,106
3. Actuarial accrued liability (Item 1c – Item 2)	\$ 227,137,138	\$ 251,032,677
4. Actuarial value of assets	\$ 141,141,270	\$ 151,136,552
5. Unfunded actuarial accrued liability (UAAL) (Item 3 - Item 4)	\$ 85,995,868	\$ 99,896,125
6. Contributions (percent of pay)		
a. Firefighters	13.10%	13.10%
b. City of Corpus Christi	<u>20.78%</u>	<u>21.28%</u>
c. Total	33.88%	34.38%
7. Normal cost (percent of payroll)	15.91%	16.11%
8. Percent of payroll available to amortize the UAAL (Item 6c - Item 7)	17.97%	18.27%
9. Annualized covered payroll	\$ 32,381,246	\$ 32,678,079
10. Present annual amount available to amortize the UAAL (Item 8 x Item 9)	\$ 5,818,910	\$ 5,970,285
11. Years to amortize the UAAL	23.1 years	29.8 years ²
12. Funded ratio (Item 4 ÷ Item 3) ³	62.1%	60.2%

¹ All items are from the December 31, 2016 actuarial valuation and reflect the present plan.

² Calculated reflecting the increase in the city contribution rate from 20.78% to 21.28% in October 2019.

³ 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 59.0% as of December 31, 2016 and 55.7% as of December 31, 2018. **The best indicator of the system's health is Item 11.**

Change in Amortization Period

The amortization period, based on the prior plan provisions, was determined in the actuarial valuation as of December 31, 2016 to be 23.1 years. Since two years have passed since that valuation date, a 21.1-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 benefits or contribution rates had been made. The amortization period is now 29.8 years based on the Present Plan provisions. The actual experience occurring between December 31, 2016 and December 31, 2018 differed from the expected experience, and in combination with the changes in assumptions and in the city contribution rate, the resulting amortization period was 29.8 years, which is 8.7 years more than the expected 21.1-year period for the following reasons:

1. The average annual rate of investment return, net of investment-related expenses, on the market value of assets during the two plan years 2017 and 2018 was 5.00%. 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 plan years 2017 and 2018 was 6.16%, less than the assumed rate of return for those years of 7.75%. This resulted in an **increase** in the amortization period of 2.2 years.
2. The aggregate payroll increased an average of 0.5% per year from two years earlier instead of increasing at the assumed 3.5% per year rate, which caused the amortization period to **increase** by 2.1 years. There was a decrease in the number of active firefighters from two years earlier.
3. 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 1.7 years. This was primarily the result of lower than assumed individual compensation increases and slightly favorable demographic experience.
4. The change in the mortality assumptions **increased** the amortization period by 3.5 years.
5. The change in the economic assumptions (the general compensation increase and aggregate payroll increase assumptions from 3.5% to 3.1%, and the investment return assumption from 7.75% to 7.5% had the combined effect of **increasing** the amortization period by 5.4 years.
6. The increase in the city contribution rate from 20.78% to 21.28% **decreased** the amortization period by 1.8 years.
7. The change in the assumed termination rates resulted in a **decrease** in the amortization period of 1.0 year.

Section III

Contribution Policy and Benefit Improvements

The results of this actuarial valuation as of December 31, 2018 reveal that the system, 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 29.8 years. In order for benefit improvements to be made to the plan, they must be made in accordance with Section 7 of TLFRA which requires approval of the board's actuarial firm, approval of the board, and approval of the firefighters.

The plan provisions in Section 3.9 of the present plan say that an amortization period of under 25 years is the first condition required for increases in benefits. The second condition required is that the actuary determines that the financial condition of the system allows the actuary to approve benefit increases. Neither condition is met at this time.

Contribution Policy

The city's contribution policy before October 1, 2019 was developed in 2006 and 2007 and adopted by the city council in a resolution in March 2007. Prior to the adoption of the resolution, the city contribution rate had been 12.0% for many years. The resolution was to significantly increase the city contribution rate from 12.5% to 20.78% over six years. The rationale for the 20.78% rate was equality with all of the other city employees who participate both in the city's plan in the Texas Municipal Retirement System (TMRS) and in Social Security, both the OASDI and Medicare portions. The firefighters participate in their system, which was established before TMRS was in existence. It was established under the authority of a state law known as the Texas Local Fire Fighters Retirement Act. However, the firefighters do not participate in the OASDI portion of Social Security, participating in the Medicare portion if they were hired after March 1986.

At the time the 20.78% rate was selected as the ultimate city contribution rate, the city's TMRS rate was 14.58%. Added to that was the 6.2% employer rate for OASDI to get to the 20.78% city rate. Also at that time, the employee contribution rate to TMRS was 6%. So the city employees in TMRS and OASDI were contributing a total of 12.2% to their two retirement plans. The city agreed to phase into a rate of 20.78% to the system if the firefighters would vote to increase their contribution rate to the system to 12.2%, which they did. Since then they have increased their rate to 13.1%.

Recently, the city has adopted improvements in benefits in their TMRS plan. As a result, their contribution rate to TMRS in both 2019 and 2020 is 24.61%. So the sum of their TMRS and OASDI contribution rates is 30.81% (24.61% + 6.2%). The city employees in TMRS now contribute 7%. So the sum of their TMRS and OASDI contribution rates is 13.2% (7% + 6.2%).

Striving for equality in contribution rates in 2007 was a great help to the system, with the city increasing its contribution rate from 12.5% to 20.78%. It has now been brought to the city's attention that the measuring standard of the sum of the TMRS rate and the OASDI rate has increased significantly from 20.78% to 30.81%. The 0.5% increase effective October 1, 2019 to 21.28% is a step in the right direction. **We encourage the board of trustees and the city to continue to engage in discussions of how the city could perhaps once again phase into a higher contribution rate to the system, such as 25.0%. We recommend that the city contribution to the firefighter plan remain a fixed contribution rate that is not directly tied to the TMRS rate since it can vary from year to year and is expected to decrease over time because of a series of closed amortization periods that average about 20 years.**

Benefit Improvements

The board should be cautious in their expectations about benefit improvements in the future due to the effect of the current net deferred investment losses and future volatility in the investment return. In addition, we have a strategy for injecting caution in future benefit improvements. The idea is to coordinate periodic benefit improvements with a gradual lowering of the benefit improvement cap on the UAAL amortization period to a long-term goal such as 15 years, even though we have been using 25 years as the cap for the 12 years prior to 2018 as it has been in the plan provisions. We recommend this strategy primarily for the following reasons:

1. The Texas Pension Review Board (PRB) pension funding guidelines, and
2. The increasing scrutiny of public employee pension plans.

We are recommending removing the 25-year benefit improvement cap from the plan provisions and implementing a new approach for approving benefit improvements in the future. The approach for implementing this strategy for injecting caution in future benefit improvements would be to wait until the amortization period is below 23 years and then to approve benefit improvements that would increase the amortization period up to as much as 23 years. In subsequent years, we would progressively lower the benefit improvement cap to 21 years, then 19 years, etc., coordinating periodic benefit improvements with the gradual lowering, until getting to a long-term goal such as 15 years. With this approach we would potentially next approve benefit improvements based on a future actuarial valuation when the amortization period is below 23 years.

This approach would both strengthen the actuarial condition of the system and better prepare for the possibility of adverse experience to the system in the future. The stronger actuarial condition of the system would be demonstrated by the progressively lower UAAL amortization period until getting to the lower part of the preferred range in the PRB guidelines (10 to 25 years). The kinds of future adverse experience that the system would be better prepared to withstand would be primarily adverse investment experience.

**Exhibit 1
Distribution of Firefighters by Age and Service on December 31, 2018
with Average Annual Salary**

Years of Service	Age									Total	Average Salary
	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60 or Over		
0	0	23	0	0	0	0	0	0	0	23	\$40,000
1	0	1	1	1	0	0	0	0	0	3	51,936
2	6	13	10	3	0	0	0	0	0	32	59,390
3	0	0	0	0	0	0	0	0	0	0	0
4	1	19	8	5	1	0	0	0	0	34	70,511
5	0	0	4	2	0	0	0	0	0	6	76,004
6	0	9	6	4	0	0	0	0	0	19	75,827
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	8	6	2	1	0	0	0	17	78,435
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	1	8	2	4	0	0	0	15	78,257
12	0	0	2	11	5	2	0	0	0	20	80,383
13	0	0	1	5	5	4	0	0	0	15	81,151
14	0	0	0	4	7	5	2	0	0	18	77,906
15	0	0	0	5	13	10	0	0	0	28	86,362
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	1	10	4	4	0	0	19	83,318
18	0	0	0	1	7	12	6	0	0	26	83,103
19	0	0	0	0	0	0	0	0	0	0	0
20-24	0	0	0	0	9	16	21	6	0	52	86,305
25-29	0	0	0	0	0	6	15	19	1	41	91,147
30-34	0	0	0	0	0	0	15	13	4	32	88,758
35+	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>6</u>	<u>8</u>	<u>15</u>	96,413
Totals	7	65	41	56	61	64	64	44	13	415	\$78,742

Average Salary \$61,793 \$72,585 \$83,078 \$89,200 \$94,335
 \$57,769 \$78,159 \$83,461 \$86,211 \$78,742

Average age 42.1
 Average years of service 15.2
 Average age at hire 26.9

Exhibit 2
Summary of Pensioner Data

Type of Benefit	Pensioner Data Used in December 31, 2018 Valuation	
	Number of Recipients	Total Monthly Benefit Payments
Service Retirement ¹	140	\$ 474,281
Disability Retirement ¹		
Not Eligible for Service Retirement	52	114,799
Eligible for Service Retirement	78	287,056
Vested Terminated (Deferred)	10	22,404
Surviving Spouse	49	133,720
Surviving Child	<u>2</u>	<u>4,325</u>
Total	331	\$ 1,036,585

¹ Includes alternate payees.

Type of Benefit	Comparison of Pensioner Count by Type as of The Prior and Current Actuarial Valuations			
	December 31, 2016	New ¹	Ceased	December 31, 2018
Service Retirement ¹	137	+12	-9	140
Disability Retirement ¹				
Not Eligible for Service Ret.	53	+1	-2	52
Eligible for Service Ret.	70	+10	-2	78
Vested Terminated (Deferred)	6	+6	-2	10
Surviving Spouse	53	+4	-8	49
Surviving Child	<u>3</u>	<u>0</u>	<u>-1</u>	<u>2</u>
Total	322	+33	-24	331

¹ Includes alternate payees.

Exhibit 2A
Firefighter and Pensioner Reconciliation

	Firefighters	Current Payment Status	Vested Terminated Firefighters	Total
1. As of December 31, 2016	428	316 ¹	6	750
2. Change of status				
a. retirement	(8)	10	(2)	0
b. disability	(10)	10	0	0
c. death	0	(21)	0	(21)
d. survivor payment begins	0	4	0	4
e. withdrawal	(15)	0	0	(15)
f. vested termination	(6)	0	6	0
g. QDRO alternate payee	0	3	0	3
h. payment completed	<u>0</u>	<u>(1)</u>	<u>0</u>	<u>(1)</u>
i. net changes	(39)	5	4	(30)
3. New firefighters	<u>26</u> ³	<u>0</u>	<u>0</u>	<u>26</u>
4. As of December 31, 2018	415	321 ²	10	746

¹ Includes 17 alternate payees.

² Includes 19 alternate payees.

³ Twenty-six (26) new firefighters is the sum of the 3 new firefighters in 2017 and 2018 plus 23 John Does included in the December 31, 2018 actuarial valuation to partially reflect the cadet class in the spring of 2019.

Exhibit 3

Breakdown of Pensioners by Monthly Benefit Amounts as of December 31, 2018

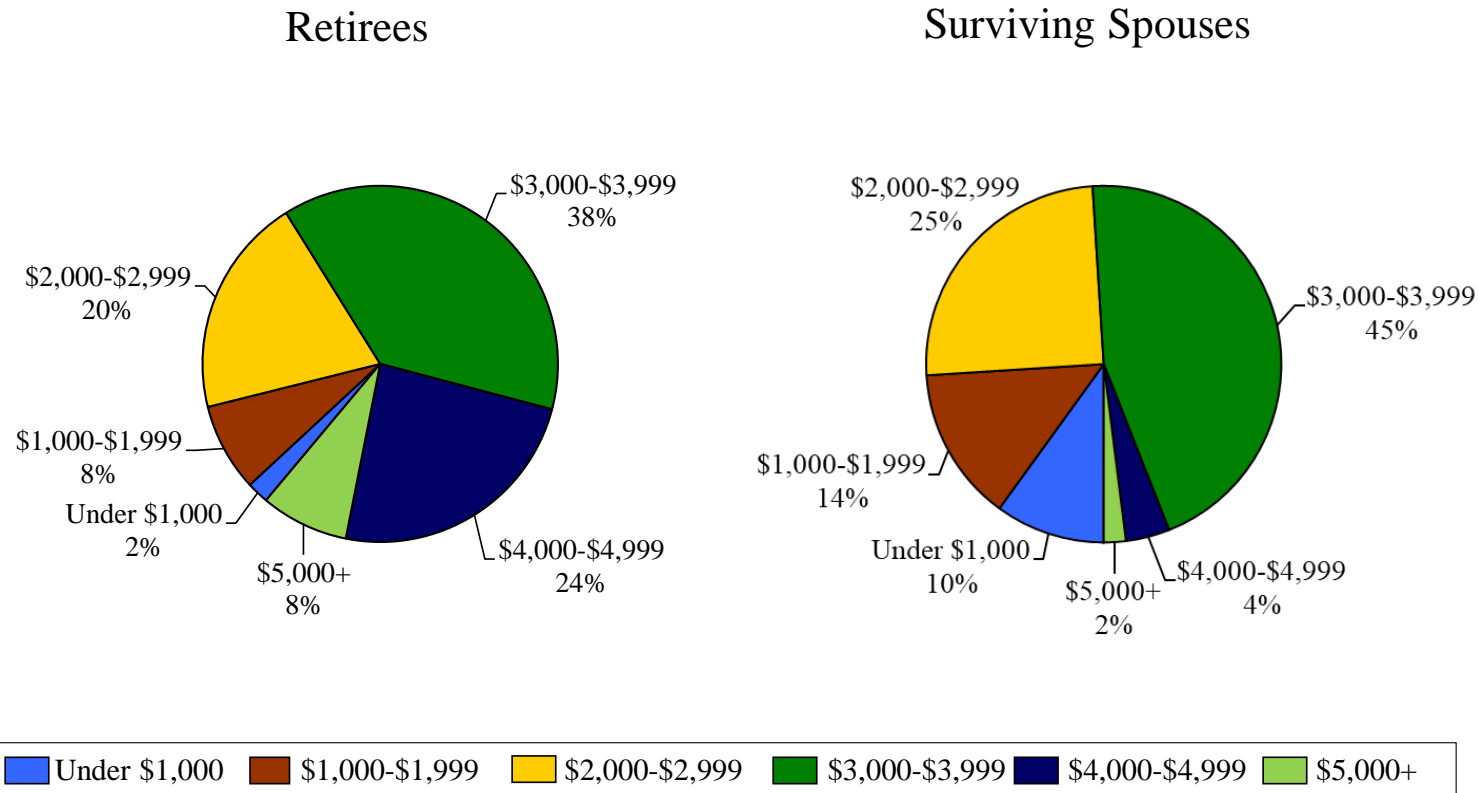


Exhibit 4

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

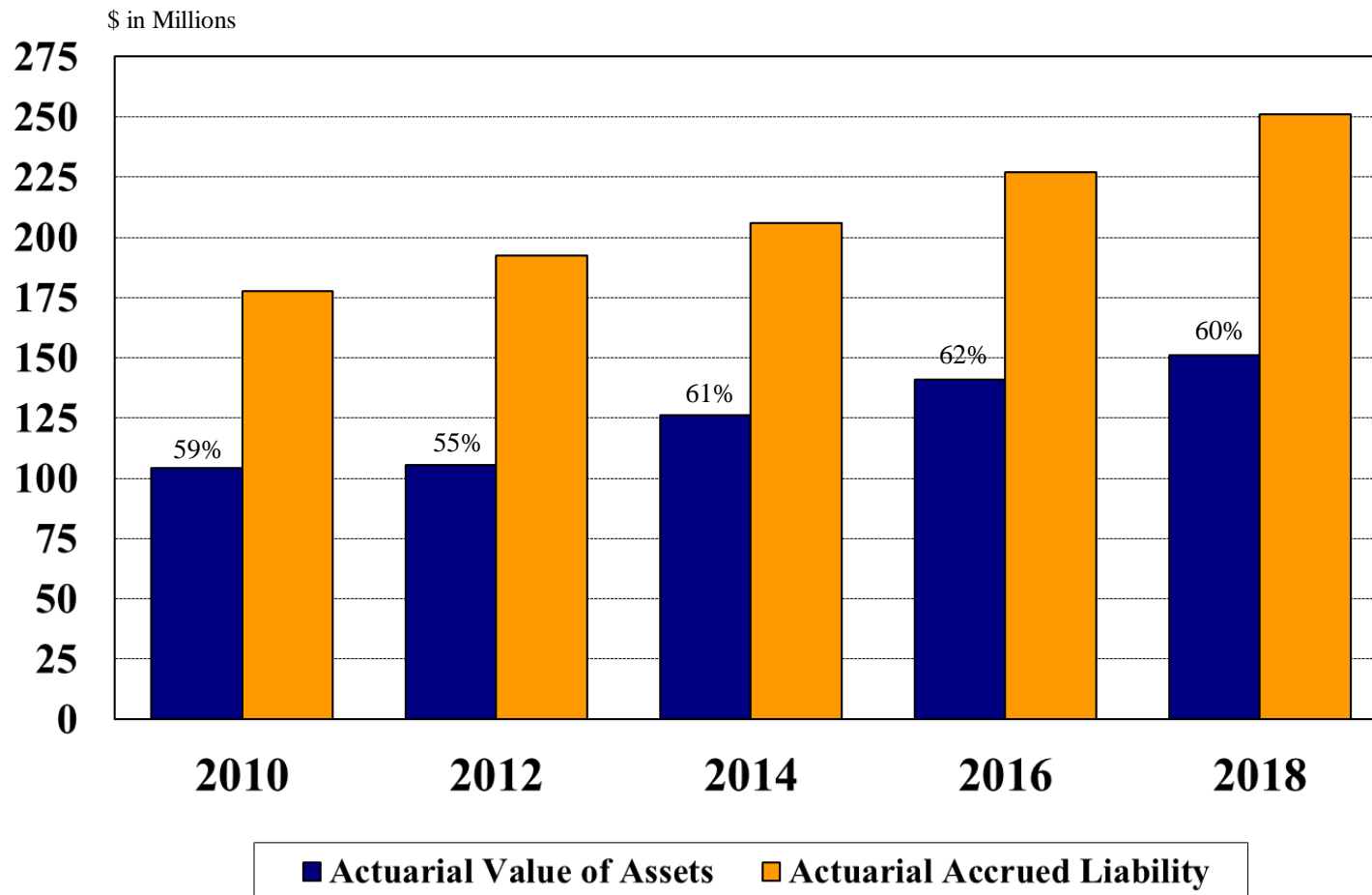


Exhibit 5
Summary of Asset Data

Asset Type	Market Value as of December 31, 2018	Allocation As a Percent of Grand Total
Equities		
Large Cap	\$36,111,846	25.8%
Small Cap	14,015,582	10.0
International Developed	15,101,041	10.8
Emerging Markets	<u>6,769,635</u>	<u>4.9</u>
Total	71,998,104	51.5
Fixed Income	48,835,432	34.9
Real Estate	18,753,571	13.4
Cash and Equivalents	223,979	0.2
Grand Total	\$139,811,086 ¹	100.0%

¹ The grand total is the draft audited amount. All of the investment amounts except cash are from the December 31, 2018 report from the investment consultant. Cash is the balancing item.

Comparison of Asset Values as of the Prior and Current Actuarial Valuation Dates		
	<u>December 31, 2016</u>	<u>December 31, 2018</u>
Market Value	\$133,901,631	\$139,811,086
Actuarial Value	\$141,141,270	\$151,136,552
Actuarial Value as a Percent of Market Value	105.4%	108.1%

Exhibit 5A
Statement of Changes in Assets
for the Years Ended December 31, 2018 and 2017

	<u>12/31/2018</u>	<u>12/31/2017</u>
Additions		
1. Contributions		
a. Employer	\$ 6,503,739	\$ 6,562,646
b. Employees	<u>4,100,046</u>	<u>4,137,182</u>
c. Total	\$ 10,603,785	\$ 10,699,828
2. Investment Income		
a. Interest and dividends	\$ 3,082,368	\$ 2,826,830
b. Net appreciation in fair value	<u>(7,757,336)</u>	<u>16,260,350</u>
c. Total	\$ (4,674,968)	\$ 19,087,180
3. Other Additions	<u>0</u>	<u>0</u>
Total Additions	\$ 5,928,817	\$ 29,787,008
Deductions		
4. Benefit Payments	\$ 14,045,886	\$ 14,180,509
5. Expenses		
a. Direct investment-related	\$ 552,022	\$ 505,903
b. General administrative	<u>252,645</u>	<u>269,405</u>
c. Total	\$ 804,667	\$ 775,308
Total Deductions	\$ 14,850,553	\$ 14,955,817
Net Increase in Assets	\$ (8,921,736)	\$ 14,831,191
Market Value of Assets (Plan Net Position)		
Beginning of Year	\$ 148,732,822	\$ 133,901,631
End of Year	\$ 139,811,086	\$ 148,732,822
Rate of Return		
Net of All Expenses	-3.73%	13.86%
Net of Investment-Related Expenses	-3.56%	14.07%
Gross	-3.19%	14.48%
Direct Investment-Related Expenses	0.37%	0.41%

Exhibit 6

Development of Actuarial Value of Assets

Calculation of Actuarial Investment Gain/(Loss) Based on Market Value for Plan Years Ending December 31				
	2018	2017	2016	2015
1. Market Value of Assets as of Beginning of Year	\$148,732,822	\$133,901,631	\$130,013,803	\$130,814,419
2. Firefighter Contributions	4,100,046	4,137,182	4,137,400	3,896,613
3. City Contributions	6,503,739	6,562,646	6,562,993	6,361,276
4. Benefit Payments and Administrative Expenses ¹	(14,298,531)	(14,449,914)	(14,313,500)	(11,371,215)
5. Expected Investment Return ²	<u>11,383,622</u>	<u>10,232,061</u>	<u>10,128,373</u>	<u>10,290,363</u>
6. Expected Market Value of Assets as of End of Year	156,421,698	140,383,606	136,529,069	139,991,456
7. Actual Market Value of Assets as of End of Year	<u>139,811,086</u>	<u>148,732,822</u>	<u>133,901,631</u>	<u>130,013,803</u>
8. Actuarial Investment Gain/(Loss)	(16,610,612)	8,349,216	(2,627,438)	(9,977,653)
9. Market Value Rate of Return Net of Expenses	(3.56)%	14.07%	5.85%	0.24%
10. Rate of Actuarial Investment Gain/(Loss)	(11.31)%	6.32%	(2.05)%	(7.66)%

¹ Administrative expenses are included for all four years because the investment return assumption was net of investment-related expenses for those years.

² Assuming uniform distribution of contributions and payments during the plan year; actuarially assumed investment return was 7.9% for 2015 and 2016 and was 7.75% for 2017 and 2018.

Plan Year	Investment Gain/(Loss)	Deferral Percentage	Deferred Gain/(Loss) as of 12/31/2018
2018	\$(16,610,612)	80%	\$ (13,288,490)
2017	8,349,216	60%	5,009,530
2016	(2,627,438)	40%	(1,050,975)
2015	(9,977,653)	20%	<u>(1,995,531)</u>
Total			\$ (11,325,466)

Actuarial Value of Assets as of December 31, 2018	
11. Market Value of Assets as of December 31, 2018	\$ 139,811,086
12. Deferred Gain/(Loss) to be Recognized in Future	<u>(11,325,466)</u>
13. Preliminary Value (Item 11 – Item 12)	\$ 151,136,552
14. Corridor for Actuarial Value of Assets	
a. 80% of Market Value as of December 31, 2018 (minimum)	\$ 111,848,869
b. 120% of Market Value as of December 31, 2018 (maximum)	\$ 167,773,303
15. Actuarial Value as of December 31, 2018	\$ 151,136,552
16. Write Up/(Down) of Assets (Item 15 – Item 11)	\$ 11,325,466

Exhibit 7

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

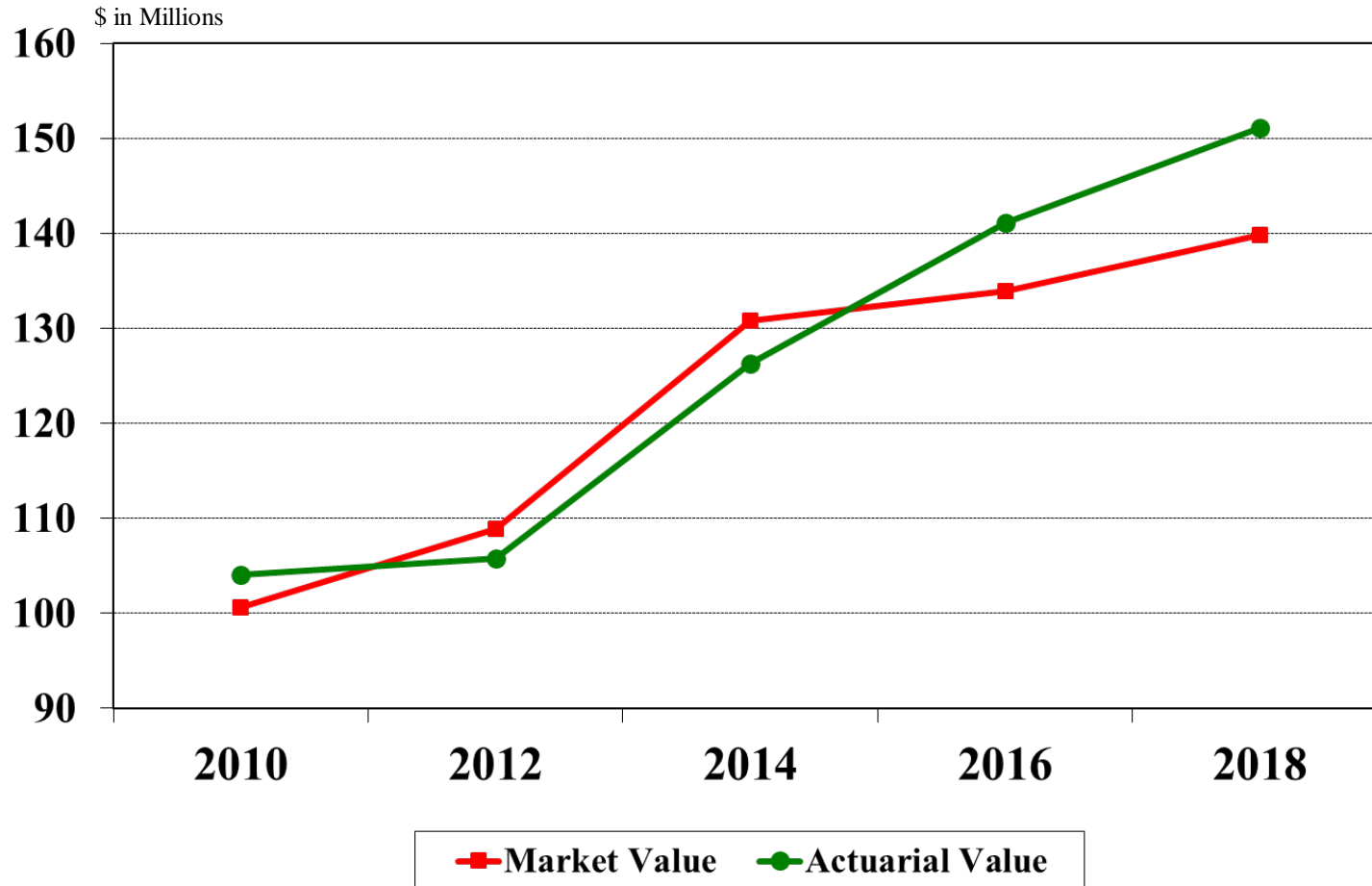
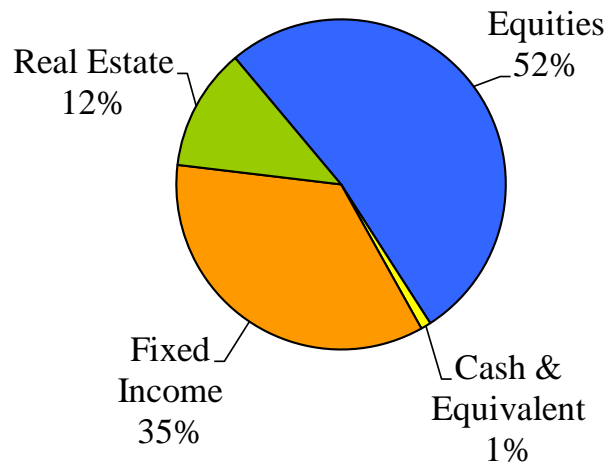


Exhibit 8

**Comparison of Market Value Asset Allocation as of the Prior and
Current Actuarial Valuation Dates**

December 31, 2016



December 31, 2018

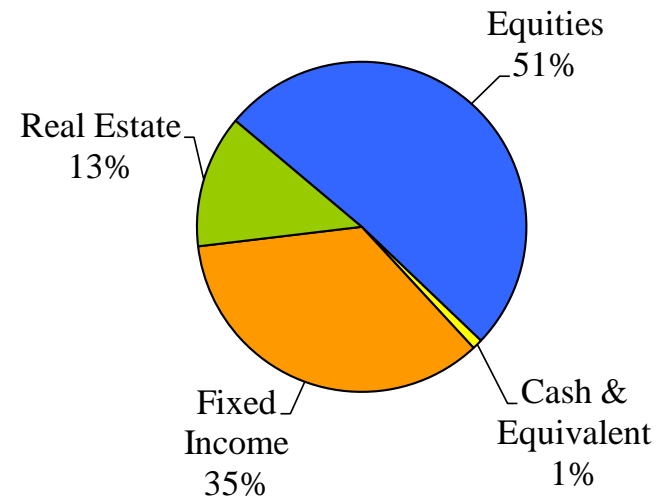


Exhibit 9

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, would fund his expected benefits. Each firefighter's normal cost is calculated to be a constant percentage of his expected compensation in each year 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 3.1% 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. See Exhibit 6.

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 discuss them with the board before completing the actuarial valuation.

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 system for the long-term future.

1. Investment Return

7.5% per year net of investment-related expenses.

2. Inflation

3.1% 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-2018.

4. Compensation Increases

General increases of 3.1% per year in addition promotion, step, and longevity increases that average 1.82% per year over a 30-year career. See Exhibit 10.

5. Retirement Rates

Age	Rate per Year for Paid Firefighters Eligible to Retire
54	5%
55	15
56	20
57	30
58	25
59	10
60	30
61	45
62	40
63-65	25
66	100

The average expected retirement age for paid firefighters not yet eligible to retire based on these rates is 58.1.

6. RETRO DROP Election

- a. Percent of firefighters eligible electing RETRO DROP: 100% of service retirements eligible to elect at least a 12-month lump sum.
- b. Months assumed for lump sum: Maximum they are eligible for, up to 36 months for retirement before 60 and up to 48 months for retirement at ages 60 and above.

7. Termination Rates

See Exhibit 10.

8. Disability Rates

See Exhibit 10.

9. Reduction in Benefit after 2½ Years of Disability Retirement

45% weighted average reduction in benefit until eligible for normal service retirement.

10. Percent Married

85% of the firefighters are assumed to be married at retirement, disability, or death while employed, with male firefighters having a spouse two years younger and female firefighters having a spouse two years older.

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

- Joint and 100% to surviving spouse for the 85% assumed to be married
- Life annuity for the 15% assumed to be single

To the extent early retirement is elected and the amounts are determined under an actuarial basis which differs from the basis used in the valuation, actuarial gains or losses will occur. These gains or losses are expected to be immaterial and will be recognized through the valuation process for those retiring since the prior valuation who made an early retirement election.

12. Surviving Child's Death Benefit

None are assumed as a result of future deaths.

13. Firefighters' Contribution Rate

13.10% of covered pay.

14. City's Assumed Contribution Rate

21.28% of covered payroll for at least as long as the period required to amortize the unfunded actuarial accrued liability.

15. Covered Payroll for First Year Following Valuation Date

Actual (or annualized) pay for 2018 increased 2.25% for each firefighter to reflect the general pay increase of 3% effective in October 2018.

16. General Administrative Expenses

The expenses paid by fund assets for other than investment-related expenses are assumed to be 0.85% of payroll. The normal cost rate as a percent of payroll is assumed to be 0.85% of payroll higher to reflect these expenses.

Exhibit 10
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	0.60	0	60	1	21.66%
21	0.60	1	54	2	11.35
22	0.60	2	48	3	9.29
23	0.60	3	42	4	9.29
24	0.60	4	37	5	9.29
25	0.60	5	32	6	4.13
26	0.62	6	27	7	4.13
27	0.64	7	24	8	4.13
28	0.66	8	21	9	4.13
29	0.70	9	19	10	4.13
30	0.76	10	17	11	4.65
31	0.80	11	14	12	4.65
32	0.84	12	12	13	4.65
33	0.88	13	11	14	4.65
34	0.96	14	10	15	4.65
35	1.04	15	9	16	3.10
36	1.12	16	9	17	3.10
37	1.18	17	8	18	3.10
38	1.26	18	8	19	3.10
39	1.40	19	8	20	3.10
40	2.34	20 & Over	0	21	3.10
41	2.58			22	3.10
42	2.80			23	3.10
43	3.02			24	3.10
44	3.44			25	3.10
45	3.86			26	3.10
46	4.28			27	3.10
47	4.70			28	3.10
48	5.10			29	3.10
49	6.06			30	3.10
50	7.00			31	3.10
51	7.96			32	3.10
52	8.90			33	3.10
53	9.86			34	3.10
54	12.54			35	3.10
55	0.00			36	3.10
56	0.00			37	3.10
57	0.00			38	3.10
58	0.00			39	3.10
59	0.00			40	3.10

Exhibit 11

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 12
Summary of Present Plan**

1. Normal Service and Disability Retirement Monthly Benefit is the greater of the Formula 1 Amount or the Formula 2 Amount
 - (a) Formula 1 Amount is (i) plus (ii)

(i) Percent of Highest 60-Month Average Pay	52.00%
(ii) Additional benefit for each year of service in excess of 20 years	\$150.00
 - (b) Formula 2 Amount is for each year of service \$137.00

2. Normal Service Retirement Eligibility Age 54 and 20 Years

3. Retroactive Deferred Retirement Option Plan (RETRO DROP) provides a reduced monthly benefit and a lump sum
 - (a) Earliest RETRO DROP benefit calculation date Age 54 and 20 Years
 - (b) Maximum RETRO DROP benefit accumulation period

(i) Retirement before age 60	36 Months
(ii) Retirement at age 60 or above	48 Months
 - (c) Earliest employment termination date with maximum RETRO DROP accumulation period

(i) Retirement before age 60	Age 57 and 23 Years
(ii) Retirement at age 60 or above	Age 60 and 26 Years
 - (d) RETRO DROP lump sum includes
 - (i) Monthly benefits that would have been received between RETRO DROP benefit calculation date and termination of employment,
 - (ii) accumulated contributions made by the firefighter after the RETRO DROP benefit calculation date, and
 - (iii) no interest

4. Actuarially Equivalent Early Retirement Eligibility (Reduced Benefit Begins Immediately) 10 Years

5. Vested Terminated Benefit
 - (a) Eligibility 10 Years
 - (b) Percent vested with 10 years 50%
 - (c) Additional percent vested for each year above 10 years 5%
 - (d) Percent vested with 20 or more years 100%
 - (e) Benefit is deferred to date person would have satisfied normal service retirement eligibility
 - (f) Benefit is percent vested times normal service benefit

6. Disability Retirement Monthly Benefit for Firefighters Who Become Totally Disabled while Employed
 - (a) For initial 30-month period, is (i) plus (ii)
 - (i) Minimum monthly amount based on 20 years
 - (ii) Additional monthly amount per year of service in excess of 20 years
 - (b) Following initial 30-month period, is the greater of (i) and (ii)
 - (i) Initial benefit reduced by the portion of the initial benefit equal to estimated annual residual earning capacity divided by annual base earnings
 - (ii) Initial benefit multiplied by percentage of disability
 - (c) Upon attaining eligibility for normal retirement, the member's vested retirement benefit becomes payable if the disability benefit has been reduced

7. Surviving Spouse Monthly Death Benefit for Firefighters Who Die while Employed
 - (a) Minimum monthly amount based on 20 years
 - (b) Additional monthly amount per year of service in excess of 20 years
 - (c) Surviving spouse may elect RETRO DROP if firefighter was eligible for a service retirement benefit at time of death

8. The normal form of annuity payment at retirement is a Joint and 100% to Surviving Spouse, and payment is the last day of each month. The same benefit payable to the retired firefighter is payable to the surviving spouse as long as the spouse is alive (and does not remarry if the firefighter terminated employment as a firefighter prior to February 25, 1997). If there is no surviving spouse or the surviving spouse is ineligible, the death benefit shall be paid to the guardian of the deceased firefighter's dependent children, if any.

9. Pay used to determine the Highest 60-Month Average Pay includes all pay except for unused sick leave, unused vacation, unused comp time, or injury pay. The average is based on the 130 consecutive biweekly pay periods during which covered pay was highest. Any lump sum payment for a retroactive pay increase will be allocated to the applicable past biweekly pay periods and excluded from pay for the biweekly pay period in which it was actually paid.

10. 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 system or request a refund from the system.

11. Contributions
 - (a) Firefighters (percent of covered pay) 13.10%
 - (b) City of Corpus Christi (percent of covered payroll) 21.28%

Appendix A

Review of the Actuarial Economic Assumptions
for the December 31, 2018 Actuarial Valuation

Asset Allocation and Investment Return Assumption Development

<u>Asset Class (Investment Manager)</u>	<u>Gross Real Rate of Return¹</u>	<u>Investment Management Expenses²</u>	<u>Other Investment Expenses³</u>	<u>Net Real Rate of Return⁴</u>	<u>Asset Allocation</u>	
					<u>12/31/2018</u>	<u>Target</u>
Domestic Equity						
Large Cap Growth (Polen Cap Mgmt)	6.5%	0.55%	0.11%	5.84%	7.0%	6.25%
Large Cap Growth (Clear Bridge)	6.5	0.50	0.11	5.89	6.8	6.25
Large Cap Value (LSV Asset Mgmt)	6.5	0.60	0.11	5.79	12.1	12.50
Small Cap Growth (JP Morgan)	7.0	0.74	0.11	6.15	5.0	5.00
Small Cap Value (Fuller & Thaler)	7.0	1.07	0.11	5.82	<u>5.0</u>	<u>5.00</u>
					35.9	35.00
International Equity						
Developed (Templeton)	7.0	0.80	0.11	6.09	10.8	12.50
Emerging Market (Eaton Vance)	8.0	0.78	0.11	7.11	<u>4.8</u>	<u>6.00</u>
					15.6	18.50
Alternatives						
Real Estate (JP Morgan)	5.5	1.00	0.11	4.39	13.4	10.00
Fixed Income						
Domestic Core Plus (Garcia Hamilton)	2.5	0.18	0.11	2.21	34.9	36.50
Cash	0.5	0.00	0.11	0.39	<u>0.2</u>	<u>0.00</u>
					<u>35.1</u>	<u>36.50</u>
					100.0%	100.00%
<u>Weighted Average Assumption</u>						
Net Real Rate of Return (net of investment-related expenses)					4.47%	4.49%
<u>Possible Theoretical Investment Return Assumption</u> <u>(Net Real Rate of Return Plus Assumed Rate of Inflation)</u>						
Assumed 3.25% Inflation					7.72%	7.74%
Assumed 3.00% Inflation					7.47	7.49

¹ A gross real rate of return is the long-term total average annual rate of investment return, before any expenses, that is in excess of the assumed annual inflation rate. These are assumptions made by Rudd and Wisdom, Inc.

² These assumed investment management expenses are based on expense information from UBS as of December 31, 2018 and include both direct and indirect management expenses.

³ Other direct investment expenses paid from the system in 2017 and 2018 were 0.11% of assets. These include investment consultant fees (0.050%), bank custodial fees (0.050%), and foreign taxes (0.005%).

⁴ Net = Gross – (Management Expenses) – (Other Expenses)

Appendix A (continued)

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

<u>Years (Dec. to Dec.)</u>	<u>Number of Years</u>	<u>Average Annual Increase</u>
1953 – 2018	65	3.50%
1958 – 2018	60	3.67
1963 – 2018	55	3.88
1968 – 2018	50	3.99
1973 – 2018	45	3.83
1978 – 2018	40	3.33
1983 – 2018	35	2.63
1988 – 2018	30	2.48
1993 – 2018	25	2.20
1998 – 2018	20	2.16

Most inflation forecasts are for 10 years or less. For example, the average 10-year forecast in the June 2019 Livingston Survey published by the Federal Reserve Bank of Philadelphia was 2.26%. Similarly, the 2019 Wall Street Consensus Survey for the next decade included an average inflation forecast of 2.2%. However, 10 years is much too short a forecast period for a public employee defined benefit pension plan. In the 2018 annual report of the OASDI Trust Funds (Social Security), the ultimate inflation assumptions for their 75-year projections are 3.2%, 2.6%, and 2.0% 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 2.5% to 3.5%. Shorter term considerations make the bottom half of that range more desirable.**

Administrative Expenses as a Percent of Payroll

<u>Plan Year Ending 12/31</u>	<u>Administrative Expenses Paid by the System</u>	<u>Estimated Payroll</u>	<u>% of Payroll (2) ÷ (3)</u>
(1)	(2)	(3)	(4)
2018	\$252,645	\$31,298,070	0.81%
2017	269,405	31,581,550	0.85
2016	257,440	31,583,219	0.82
2015	279,729	30,612,493	0.91
2015-2018	\$1,059,219	\$125,075,332	0.85%

The administrative expenses are reflected as a percent of payroll that is added to the normal cost contribution rate. For the December 31, 2018 actuarial valuation, we recommend 0.85%, the average developed above for the last four plan years. (The estimated payroll was determined as the city contributions for the plan year divided by the city contribution rate during the plan year.) The 0.85% assumption is the same as for the December 31, 2016 actuarial valuation.

Appendix A (continued)

Comparison of 12/31/2016 Actuarial Economic Assumptions
with 12/31/2018 Actuarial Economic Assumptions

<u>Actuarial Assumption^(A)</u>	<u>12/31/2016 Actuarial Economic Assumptions</u>	<u>12/31/2018 Actuarial Economic Assumptions</u>
Inflation (Price)	3.50%	3.10%
Net real rate of return ^(B)	<u>4.25</u>	<u>4.40%</u>
Net total investment return ^(B)	7.75%	7.50%
Firefighter pay increase ^(C)	5.32%	4.92%
Aggregate payroll increase	3.50%	3.10%
Admin. Expense (% of payroll)	0.85%	0.85%

^(A) All assumptions are annual rates.

^(B) Net of investment-related expenses.

^(C) 3.50% annual general pay increase plus 1.82% average annual promotion, step, and longevity pay increase over a 30-year career for 12/31/2016; 3.10% annual general pay increase and 1.82% average annual promotion and longevity pay increase over a 30-year career for 12/31/2018.