

Intensive Actuarial Review:

Greenville Firemen's Relief and Retirement Fund

January 2018



Table of Contents

Executive Summary.....	1
Background	4
Plan Summary	4
Benefits	4
Contributions	4
Membership.....	4
TLFFRA Board Structure	4
Contribution and Benefit Decision-Making	4
Funding Soundness Restoration Plan (FSRP)	5
Key Metrics	5
Historical Trends	8
Assets and Liabilities	8
Investment Assumption and Returns	9
Contributions	10
Asset Allocation.....	11
Payroll Growth	11
Cash Flow	12
Demographics	12
Retroactive DROP.....	14
Risk Analysis	14
Investment Risk.....	15
Funding Risk	16
Assumption Risk.....	18
Governance Risk.....	19
Conclusions	20
Funding and Governance Risk.....	20
Assumption Risk.....	21
Investment Risk.....	21
Appendix A – Peer Comparison Tables	I
Appendix B – Comments from the City of Greenville.....	II
Appendix C – Comments from Greenville Firemen's Relief and Retirement Fund.....	III

Executive Summary

This intensive actuarial review of Greenville Firemen's Relief and Retirement Fund ("Greenville Fire" or "the Fund") is intended to assist the Fund's board of trustees and the City of Greenville (the City) in assessing the Fund's ability to meet its long-term pension obligation. Overall, the review shows that the Fund is facing significant financial stress and is taking considerable risks in its approach to funding the plan. The review also highlights that Greenville Fire and the City have waited too long to address these challenges, which has exacerbated the situation due to the compound nature of pension liabilities.

Since the start of this review in October 2017, City has agreed to increase its contribution rate by 2% beginning in October 2018. The Fund's actuary estimates that this increase in contribution would lower the Fund's amortization period to 38 years as of the 12/31/2016. The PRB's Actuarial Committee expressed ongoing concern regarding the likelihood of the Fund meeting the assumptions used to fund the plan. The Pension Review Board (PRB) encourages the Fund and the City to review the findings and conclusions of this report carefully and jointly adopt a forward-looking funding plan to guide the Fund towards a path of long-term sustainability. The PRB can provide technical assistance in formulating such a plan.

The health of Greenville Fire has been deteriorating since the early 2000s. Numerous factors have contributed to this deterioration, including inadequate contributions, insufficient investment returns, increased benefit payments, and a low active-to-annuitant ratio in the face of a large unfunded liability. Greenville Fire and the City have made incremental contribution increases since 2006 in response to deteriorating conditions, but these changes have not been enough to put the plan on a solid path to sustainability.

Currently, Greenville Fire's ability to meet its long-term obligations, measured by a number of indicators in addition to amortization period, may be threatened and warrants closer scrutiny. **A few of the key indicators include:**

- At 55 years, Greenville Fire currently has one of the highest amortization periods (the number of years required to pay off any unfunded liability) of all 94 defined benefit pension plans in Texas.¹
- Greenville Fire's funded ratio (assets on hand to cover liabilities) fell from 77% in 2000 to less than 48% in 2016, which is one of the lowest funded ratios in the state.
- Greenville Fire's actuarial accrued liability increased by nearly 90% between the end of 2000 and 2016. Conversely, the Fund's actuarial value of assets grew by less than 18% over that same period, resulting in the unfunded liability more than quadrupling.
- The single largest increase in unfunded liability over the past 15 years was due to investment returns lower than the assumed rate of return.
- While Greenville Fire lowered its assumed rate of return from 8.25% to 8.00% in 2016, 8.00% is one of the highest return assumptions currently used by plans in Texas. The Fund has not achieved an 8.00% return on assets over a consecutive 10-year period in any of the 13 periods ending December 31, 2004 through December 31, 2016.
- According to its actuarial valuations, Greenville Fire has underpaid its reported actuarially determined contribution (ADC) every year since 2004.²

¹ PRB's *Pension Funding Guidelines* recommend a maximum effective amortization period of 30 years, with 10-25 a more preferable target range.

- Greenville Fire's unfunded liability as a percent of payroll, which measures pension debt relative to overall personnel costs and provides information on the employer's fiscal burden, is the highest among TLFFRA firefighter plans of similar asset size at 387.00%.

As of 2016, the present value of benefits payable to inactive members (retirees and beneficiaries) were only 74% funded and the liability associated with active members was completely unfunded. While not all inactive benefits are payable immediately, the intent of pre-funding a defined benefit plan is to pay the cost of the benefit as it is earned such that an individual's benefits are fully funded when they retire. The review measures Greenville Fire based on four main risk factors—investment, funding, assumption, and governance risk— and reveal a significant amount of risk being taken in each of these areas, increasing the probability of a continued period of severe financial stress for the Fund. This also raises the likelihood of deteriorating funding conditions in the coming years, further imperiling the Fund's ability to pay promised benefits. **Key findings related to these risks include:**

- The likelihood of Greenville Fire *not* meeting or exceeding the 8.00% expected return on assets is significantly greater than the odds that they will do so for the near future. The PRB estimated the Fund would be more than twice as likely to earn less than or equal to a 7.00% return versus greater than or equal to a 9.00% return over the next 30-year period.
- The Fund, along with many public pension plans, could suffer from large losses in a down market year, given its overall portfolio risk.
- Several of the Fund's economic and demographic assumptions, including the expected return on assets, may cause liabilities to be understated. While the Fund's actual cost will always be the benefits actually paid, if the liabilities are understated, the contributions necessary to fund the actual costs could be larger than anticipated and could exacerbate the Fund's already precarious actuarial condition. The Fund's contributions are calculated as a percent of active members' pay and are back-loaded based on the expected growth in total payroll. If payroll does not increase at this rate, actual contributions will not meet those expected in the Fund's actuarial valuations. Given the plan's inactive and active liabilities are not fully funded; contributions below expected levels will have serious consequences on the Fund's long-term solvency.
- Greenville Fire's fixed-rate contribution structure may provide budgetary stability for the employer in the short term, but does not include any inherent mechanisms for reacting to changes in a plan's financial condition.
- As required by state law to jointly formulate a funding soundness restoration plan, the City has agreed to increase its contribution rate to 19.30% beginning in October 2018; however, Greenville Fire and the City have yet to make difficult decisions on additional needed changes to benefit or contribution levels to address potential investment and funding risks in the future.

Finally, the review draws conclusions regarding how these risks might be mitigated and the Fund's overall ability to meet its long-term obligations improved. **Conclusions include the following:**

- Greenville Fire, in conjunction with the City, should consider utilizing the funding soundness restoration plan (FSRP) requirement to develop a long-term funding policy for the Fund.

² For a pension plan that receives a fixed contribution rate such as Greenville Fire, the ADC is the contribution needed to fund the benefits accrued in the current year and maintain an amortization period that does not exceed 30 years, as required to be reported under Texas Government Code §802.101(a).

- Greenville Fire's board of trustees should work with their actuary to ensure actuarial assumptions are neither too aggressive nor too conservative.
- Greenville Fire's board of trustees should closely monitor investment managers' performance against appropriate benchmarks, and should revisit investment manager selection periodically to ensure managers are providing the highest possible value at the lowest possible cost. Asset allocation should also be assessed from a risk perspective to evaluate how the fund would weather a market correction.

Background

Plan Summary

The Greenville Firemen's Relief and Retirement Fund ("Greenville Fire" or "the Fund") was established in 1941 under what is now entitled the Texas Local Fire Fighter's Retirement Act (TLFFRA). TLFFRA provides general guidelines for fund management, but leaves administration, plan design, contributions, and specific investments to the discretion of the board of trustees. Greenville Fire, as with all TLFFRA systems, is entirely locally funded.

Benefits

Retirement Eligibility	Age: 50 years; Years of Credited Service (YCS): 20 years
Vesting	20 YCS
Benefit Formula	YCS (up to 20 years) x 3.15% x Final Average Salary +\$63 per month for each year > 20 YCS
Final Average Salary (FAS)	Highest 36-Month Average Salary
Automatic COLA	No
Retirement Benefit Options	RETRO DROP: 2-year maximum. Employee contributions credited; no interest. Eligible at 53 years of age and 23 years of service.
Social Security	No

Contributions

Currently, active members of Greenville Fire contribute 16.30% of pay while the City of Greenville (the City) contributes 17.30% of pay. The City's contribution will increase to 19.30% in October 2018.

Membership

Total Active Members	Retired Members	Beneficiaries	Total Annuitants	Total Members	Active-to-Annuitant Ratio
59	60	14	74	133	0.8

TLFFRA Board Structure

Active Members	3 - Members of the retirement system; elected by fund members. Three-year terms.
Sponsor Government	1 - Mayor or designated representative, or the political subdivision's Chief Operating Officer or designated representative. 1 - Chief Financial Officer of the political subdivision, or designated representative. Terms correspond to term of office.
Taxpayer, Not Affiliated With Fund/Sponsor Govt.	2 - Residents of the State of Texas, must not be officers/employees of the political subdivision; elected by other Board of Trustee members. Two-year terms.

Contribution and Benefit Decision-Making

TLFFRA authorizes members of the retirement systems to determine their contribution rates by voting. The statute requires cities to contribute at least the greater of 12% of pay or the rate at which the active

members contribute. TLFFRA also allows a city to contribute at a higher rate than employees do through a change in city ordinance.

TLFFRA gives the board the power to make decisions to modify the benefits (increases and reductions). However, a proposed addition or change must be approved by the actuary and a majority of participating plan members. Benefit changes cannot deprive a member, retiree or beneficiary of the right to receive vested accrued benefits.

Funding Soundness Restoration Plan (FSRP)

Texas Government Code §802.2015 requires the governing body of a public retirement system and its governmental sponsor formulate an FSRP if the system's actuarial valuation shows its amortization period exceeds 40 years for three consecutive annual actuarial valuations, or two consecutive actuarial valuations if the system conducts valuations less frequently.

Greenville Fire was required to submit an FSRP to the PRB in 2016 because the actuarial valuations prepared as of December 31, 2012 and December 31, 2014 reported amortization periods greater than 40 years. The FSRP consisted of increases in both the active members' and the City's contribution rates from 15.30% to 16.30% and 15.30% to 16.80%, respectively. This was expected to be sufficient to reduce the amortization period to 40 years or less by November 2026. However, the latest actuarial valuation, prepared as of December 31, 2016, indicated the Fund's amortization period was higher than the FSRP projection; therefore, the Fund and the City must prepare an updated FSRP by June 12, 2018. To fulfill this mandate, the City has agreed to increase its contribution rate to 19.30% beginning in October 2018. The Fund's actuary estimates that this increase in contribution would lower the Fund's amortization period to 38 years as of the 12/31/2016 valuation and satisfy the updated FSRP requirements.

Key Metrics

Government Code Section 801.202(2) requires the PRB to conduct intensive studies of potential or existing problems that threaten the actuarial soundness of or inhibit an equitable distribution of benefits in one or more public retirement systems. The PRB identified the following key metrics, in addition to amortization period, to determine and prioritize retirement systems for intensive actuarial review. The PRB selected Greenville Fire for review based on the 2014 actuarial valuation data shown below. Unless otherwise noted, the following metrics were calculated as of December 31, 2014.

Amort. Period	Funded Ratio	UAAL as % of Payroll	Assumed Rate of Return	Payroll Growth Rate	Actual Cont. as % of ADC	DROP as % of FNP	Non-Investment Cash Flow as % of FNP
70.4	48.94%	368.49%	8.25%	4.25%	73.99%	N/A	-5.86%

*Contribution, DROP and cash flow data are from the Fund's 12/31/2016 financial audit

Since selecting Greenville Fire, the PRB received the Fund's 2016 actuarial valuation. The 2016 data was used for this review and is summarized in the table below.

Amort. Period	Funded Ratio	UAAL as % of Payroll	Assumed Rate of Return	Payroll Growth Rate	Actual Cont. as % of ADC	DROP as % of FNP	Non-Investment Cash Flow as % of FNP
55.0	47.69%	387.00%	8.00%	4.00%	73.99%	N/A	-5.86%

*Contribution, DROP and cash flow data are from the Fund's 12/31/2016 financial audit

Metric	Amortization period (55 years)
What it measures	Approximately how long it would take to fully fund the unfunded actuarial accrued liability (UAAL) based on the current funding policy.
Why it is important	Given the Fund's current assumptions, an amortization period above 17 indicates the contributions to the fund in the coming year are less than the interest accumulated for that same period and therefore the total UAAL is expected to grow over the near term. In addition, for a plan that contributes on a fixed-rate basis such as Greenville Fire, the higher the amortization period, the more sensitive it is to small changes in the UAAL.
Peer Comparison	Greenville Fire currently has one of the highest amortization periods of all defined benefit pension plans in Texas.

Metric	Funded ratio (47.69%)
What it measures	The percent of a fund's actuarially accrued liabilities covered by its actuarial value of assets.
Why it is important	The lower the funded ratio, the fewer assets a fund has to pay its current and future benefit payments. Also, the present value of benefits payable to members who are no longer working (i.e. retirees and their beneficiaries) are not fully funded. Only 74% of the inactive liability is funded on an actuarial basis, leaving almost \$5 million in inactive liability. All of the more than \$10 million of active liability was completely unfunded as of December 31, 2016 and therefore is dependent on future contributions and investment returns.
Peer Comparison	Greenville Fire's funded ratio is one of the lowest in the state.

Metric	UAAL as a percent of payroll (387.00%)
What it measures	The size of a plan's unfunded liability compared to the annual payroll of its active members.
Why it is important	Provides a way to compare plans of various sizes and expresses the outstanding "pension debt" relative to current personnel costs.
Peer comparison	The Fund's UAAL as a percent of payroll is the highest among TLFFRA plans of similar asset size and one of the highest in the state.

Metric	Assumed rate of return (8.00%)
What it measures	The estimated annual rate of return on the Fund's assets.
Why it is important	If actual future returns are lower than the assumed rate of return, future contributions will need to increase significantly, especially for a poorly funded plan. Greenville Fire's assumed rate of return is 8.00%, while its actual ten-year investment rate of return for the period ending December 31, 2016 was only 4.23%.
Peer comparison	Greenville Fire and one other fund have the highest assumed rate of return in its peer group of TLFFRA plans with similar asset size.

Metric	Payroll growth rate (4.00%)
What it measures	The estimated annual growth in the total payroll of active members contributing into the Fund.
Why it is important	Contributions are calculated as a percent of active members' pay and are back-loaded based on the expected growth in total payroll. If payroll does not increase at this rate, actual contributions will not meet those expected in the Fund's actuarial valuations. Given the plan's inactive and active liabilities are not fully funded; contributions below expected levels will have serious consequences on the Fund's long-term solvency.
Peer comparison	The Fund's payroll growth rate of four percent is tied for the third most aggressive in its peer group.

Metric	Actual contributions as a percent of actuarially determined contributions (73.99%)
What it measures	Whether the current employer contributions have met a theoretical minimum threshold. ¹
Why it is important	The employer's portion of the contribution is less than 75% of the amount needed to fund the plan on a rolling 30-year amortization period. The PRB's 2014 Study of the Financial Health of Texas Public Retirement Systems found that plans that have consistently received adequate funding are in a better position to meet their long-term obligations.
Peer comparison	This is one of the largest shortfall percentages in the state and the second largest in its peer group.

Metric	Non-investment cash flow as a percent of fiduciary net position (-5.86%)
What it measures	Non-investment cash flow shows how much the plan is receiving through contributions in relation to its outflows: benefit payments, withdrawals and expenses.
Why it is important	Viewing this metric as a percent of total net assets (or fiduciary net position (FNP)), in conjunction with the funded ratio and recognition of the relative maturity of a plan, provides information about the stability of a plan's funding arrangement.
Peer comparison	Greenville Fire's non-investment cash flow as a percent of FNP is one of the lowest in the state. If this trend continues, the Fund could face the potential risk of needing to liquidate a portion of existing assets to pay current benefits and/or expenses.

Historical Trends

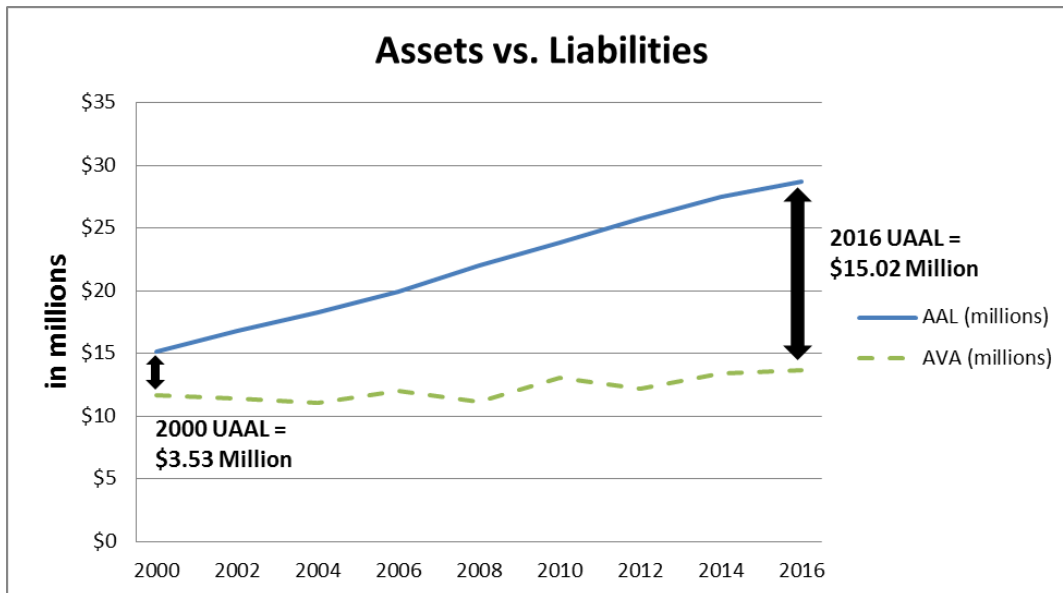
To conduct an intensive review of risks associated with the long-term funding of a pension plan, it is important to analyze trends in multiple metrics. A plan with an asset level lower than its accrued liability has insufficient funds to cover benefits. A plan can experience an increase in unfunded liability due to various factors, including insufficient investment returns, inadequate contributions and inaccurate or overly aggressive assumptions. Hence, a single metric cannot effectively capture the different drivers contributing to the increase of a plan's unfunded pension obligation. This section analyzes historical trends in various metrics identified by the PRB and makes comparisons to understand the sources of growth in unfunded liability for Greenville Fire.

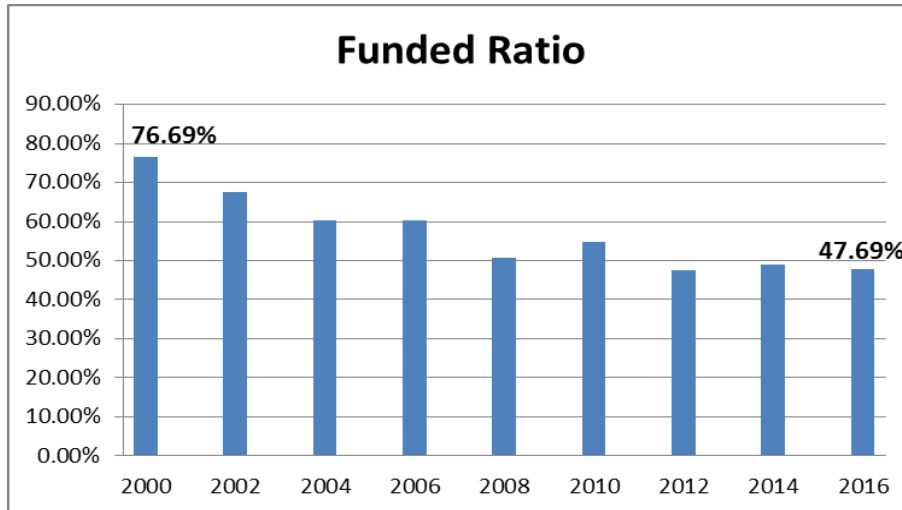
The health of Greenville Fire has been deteriorating since the early 2000s. Numerous factors have contributed to this deterioration, including inadequate contributions, insufficient investment returns, increased benefit payments, and a low active-to-annuitant ratio in the face of a large unfunded liability. The following sections discuss these and other factors in detail.

Assets and Liabilities

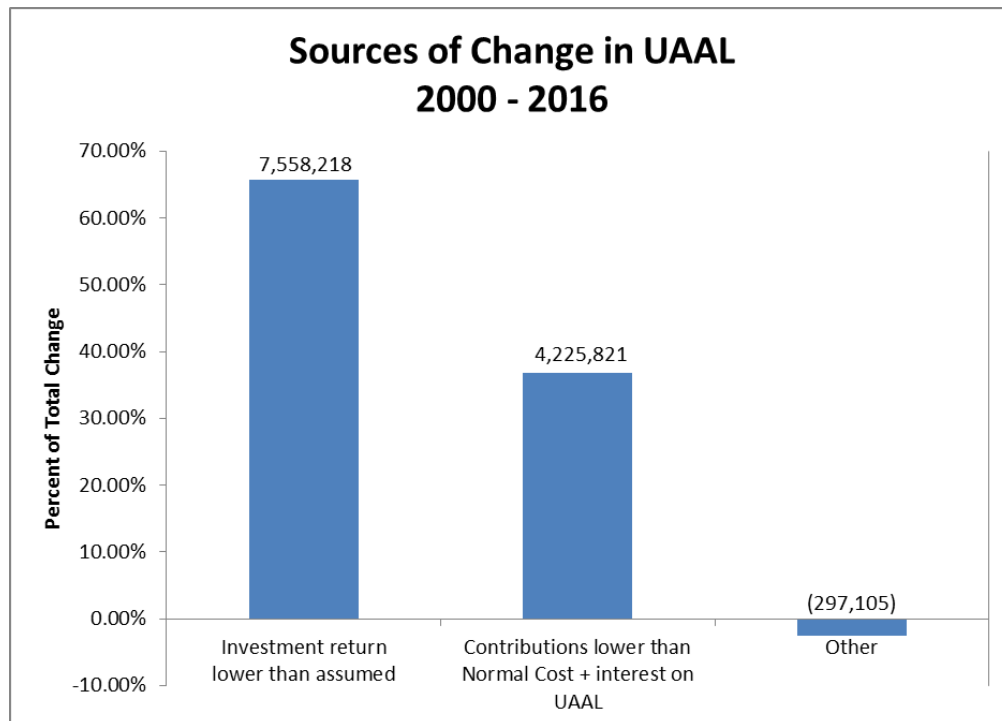
For a plan's funding level to improve, its assets should grow faster than liabilities, which can be achieved by contribution increases, benefit reductions, and/or consistently high investment returns over a long period of time.

Greenville Fire's actuarial accrued liability (AAL) increased by nearly 90% between the end of 2000 and 2016. Conversely, the Fund's actuarial value of assets (AVA) grew by less than 18% over that same period resulting in the unfunded actuarial accrued liability (UAAL) more than quadrupling. The funded ratio (AVA/AAL) also fell from 77% in 2000 to less than 48% in 2016.





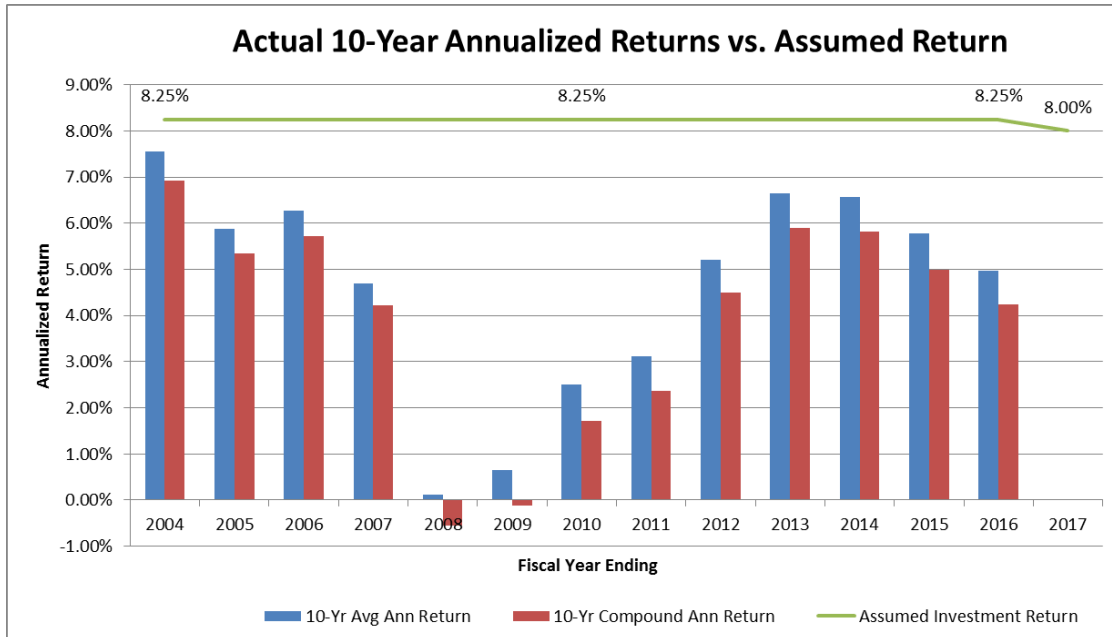
The graph below illustrates that the \$11.5 million increase in UAAL (from \$3.5 million in 2000 to \$15 million in 2016) can be fully attributed to investment returns lower than the assumed rate of return (\$7.5 million increase in UAAL) and the annual contribution being lower than the normal cost plus the interest accumulated on the UAAL (\$4.2 million increase in UAAL).



Investment Assumption and Returns

As illustrated above, actual investment returns lower than the assumed investment returns increased the UAAL by more than \$7.5 million between 2000 and 2016. While Greenville Fire lowered its assumed rate of return from 8.25% to 8.00% in 2016, it still exceeds the 2017 national average of 7.52% (reported by NASRA) and is one of the highest return assumptions used by plans in Texas. In addition, the Fund has

not achieved an 8.00% return on assets over a consecutive 10-year period in any of the 13 periods ending December 31, 2004 through December 31, 2016 as shown in the graph below.



Contributions

Most Texas plans use a fixed percent of pay funding approach. This is especially true for plans governed by the TLFRRRA statute. Under a fixed-rate funding structure, no formal amortization policy (i.e. the expected time to fully fund the plan) exists; therefore, the plan's actuary estimates the amortization period at each valuation date based on the current financial condition of the plan and the current contribution rates. This fixed-rate funding structure provides contribution stability for the plan sponsor in the short term, but does not include any inherent mechanisms for reacting to changes in a plan's financial condition.

As of October 2017, active members of the Fund contributed 16.30% and the City contributed 17.30% of pay. This reflects multiple increases in both the active members' and the City's contribution rates over the past 15 years. Despite the increases in contribution rates, during this period, the Fund's UAAL increased by \$4.2 million. This increase in the UAAL was caused by total contributions that were not sufficient to cover both the new benefits being accrued (normal cost) and the interest accumulated on the unfunded benefits already earned (interest accumulated on the UAAL), or to start reducing the total UAAL. This result, a payment that is not expected to cover the interest that accrues during the year, is known as negative amortization.

The Conference of Consulting Actuaries' Public Plans Community White Paper *Actuarial Funding Policies and Practices for Public Pension Plans* suggests that an "amortization policy should reflect explicit consideration of the level and duration of negative amortization," and identifies a "rolling/open amortization of [the] entire UAAL as a single combined layer ... where the amortization period entails negative amortization" as an unacceptable practice.²

According to its actuarial valuations, Greenville Fire has not received the reported actuarially determined contribution (ADC) every year since 2004. Even with contribution increases in 2006, 2014, and 2016, employer contributions have averaged less than 80% of the Fund's ADC over that period. Furthermore, the reported ADC rate is calculated utilizing an "open amortization of [the] entire UAAL as a single combined layer". For the fiscal year ending December 31, 2017, the expected contributions are less than 78 percent of the reported ADC. This shortfall of \$184,379 is equal to 0.97% of the City's total General Fund expenditures for the fiscal year ending December 31, 2016 and is greater than most other TLFRA plans of similar size. The City has agreed to increase its contribution rate to 19.30% beginning in October 2018; however, this is still less than the most recently calculated ADC.

Contribution Levels vs. Actuarially Determined Contribution									
Date (12/31)	2000	2002	2004	2006	2008	2010	2012	2014	2016
Employee Contribution	13.20%	13.20%	13.20%	15.30%	15.30%	15.30%	15.30%	15.30%	16.30%
Employer Contribution	13.20%	13.20%	13.20%	15.30%	15.30%	15.30%	15.30%	16.30%	16.80%
30-Year ADC*	N/A	13.12%	16.08%	17.58%	19.55%	18.57%	22.66%	22.20%	21.55%
% of ADC funded	> 100.00%	100.61%	82.09%	87.03%	78.26%	82.39%	67.52%	73.42%	77.96%
Covered Payroll	\$1,992,655	\$2,350,430	\$2,486,757	\$2,554,102	\$3,170,813	\$3,414,694	\$3,576,528	\$3,805,174	\$3,881,665
Contribution Shortfall	-	-	\$71,619	\$58,234	\$134,760	\$111,660	\$263,232	\$224,505	\$184,379

*The ADC rate referenced a 40-year amortization period through 2006, after which it changed to 30 years.

Under the Fund's assumptions both before 2016 (8.25% discount rate and 4.25% payroll growth rate) and as of the end of 2016 (8.00% discount rate and 4.00% payroll growth rate), negative amortization occurs when the amortization period is more than approximately 16 or 17 years. While the plan does not have an explicit amortization policy, the effect of its current funding structure results in an implicit amortization policy that includes negative amortization (i.e. intentionally increases the total UAAL even under the best of scenarios) for the next 30 or more years.

Asset Allocation

As shown in the chart below, the Fund's actual asset allocation is fairly close to its target allocations in all but one asset class, alternatives. However, the PRB's asset classification breaks out real estate as a separate asset class, which the Fund may consider to be an alternative investment.

Asset Allocation					
Asset Class	Equities	Fixed Income	Alternatives	Real Estate	Cash
Current Allocation	54.2%	31.2%	4.1%	5.5%	5.0%
Target Allocation	50%	30%	20%	-	-

*Current allocation as of 12/31/2016 financial audit

Payroll Growth

Greenville Fire lowered its annualized payroll growth assumption from 4.25% to 4.00% as of December 31, 2016. Even with this decrease, the Fund still has one of the highest payroll growth rate assumptions when compared to other TLFRA plans of similar size. Although the Fund's overall actual payroll growth average exceeded that target from 2000 to 2014, it has decreased in recent years to around 3.00%.

While this assumption under a fixed-rate funding policy does not directly affect actual contributions, the calculation of the amortization period is highly sensitive to it, especially when a plan's amortization period is as high as the Fund's.

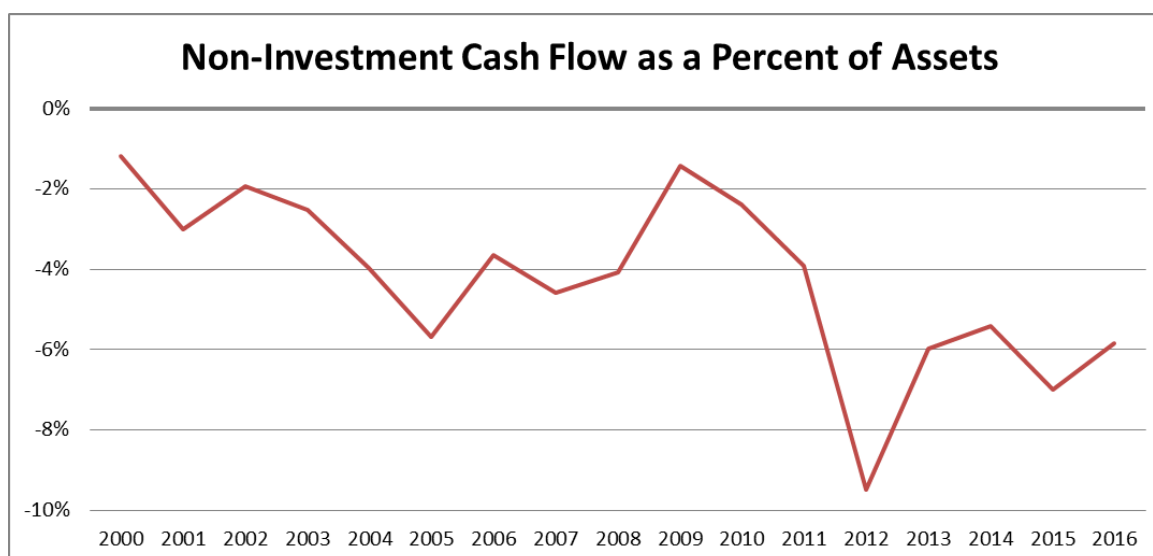
<u>Sensitivity to Changes in Payroll Growth Assumption</u>	
Assumed Payroll Growth	Amortization Period
4.00%	50
3.50%	76

*Based on UAAL as of December 31, 2016 and an employer contribution of 17.30%

It should be noted that the Fund's actuary has been recommending lowering the payroll growth rate and the discount rate since 2012.

Cash Flow

Greenville Fire's non-investment cash flow dipped from -3.9% in 2011 to -9.5% in 2012 and has averaged around -6.0% thereafter. A negative non-investment cash flow is not abnormal for mature defined benefit pension plans. However, a cash flow percentage this low is likely to be a drag on potential investment returns because a fund must either invest in a higher proportion of income-producing investments, which traditionally provide lower returns, or must liquidate existing assets to pay out current benefits and/or expenses.

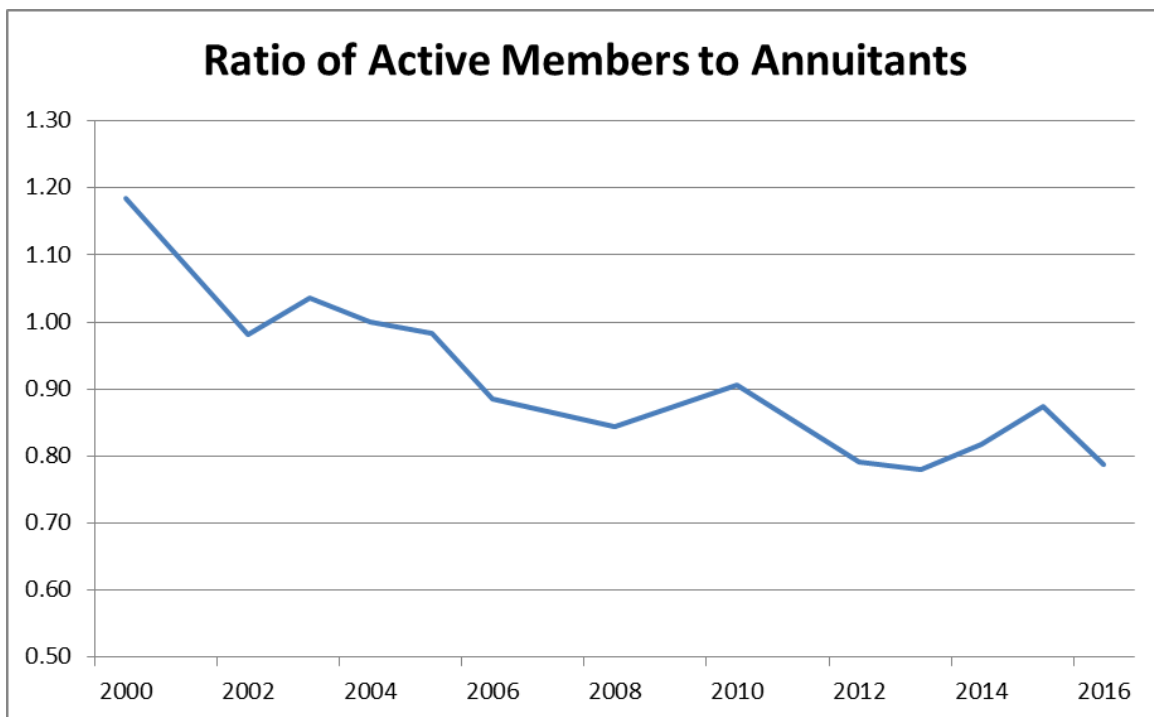


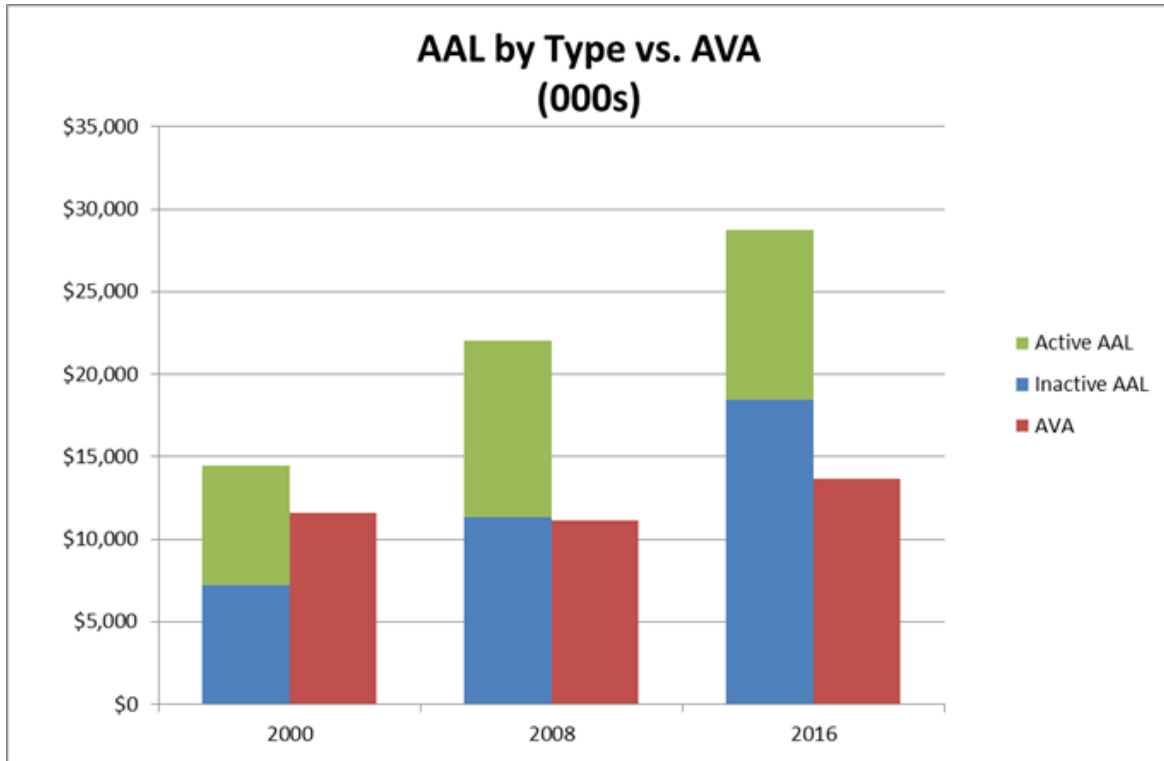
Demographics

As a pension plan matures, it will experience a shift in demographics with a declining ratio of active members to retirees. This demographic shift is expected and is taken into account in the long-term funding of a pension plan. However, for a plan with a large unfunded liability, a declining active to retiree ratio can exert financial stress from a contribution perspective. Contributions to the Fund are on a percent of pay basis, and assume an ever-growing contribution base (i.e. the total payroll is assumed to grow at a constant percentage so the dollar contributions into the plan are also assumed to grow at the same rate). This percent-of-pay approach results in back-loaded contributions for fully funding any

unfunded liability as compared to a level dollar approach. It is therefore helpful to compare the active member population, the basis on which contributions are calculated, to the annuitant population. A shrinking active member population, as compared to the annuitant population, indicates a smaller and smaller base available to fund any outstanding unfunded liability or to provide the needed support in times of distress.

Since 2012, the Fund's active-to-annuitant ratio has been hovering around 0.80, or four active members for every five retirees. This ratio is lower than all but one similarly-sized TLFFRA system, and is one of the lowest of all defined benefit public pension plans in Texas. With increased longevity of members, this ratio is expected to continue to decline and put more pressure on the active members to fund the plan. In addition, the fact that the current assets are not sufficient to support the existing inactive population, much less future retirees and beneficiaries, exacerbates this issue.





Retroactive DROP

Greenville Fire has a Retroactive Deferred Retirement Option Program (RETRO DROP) provision that allows members to retroactively end their years of service up to two years before their actual retirement date and receive a lump sum payment equal to the total retirement benefits the member would have received plus the amount of contributions, with no interest, the member made into the Fund over that time.

However, due to the Fund's relatively small size and poor funded status, it could experience liquidity issues that significantly impact investment returns if several of these RETRO DROP lump-sum payouts occur in a short period. For example in 2012, there were five retirements from the Fund, compared with an average of just one per year over the four previous years. That year, the Fund experienced a large increase in benefit payments and a dip in non-investment cash flow to -9.5%.

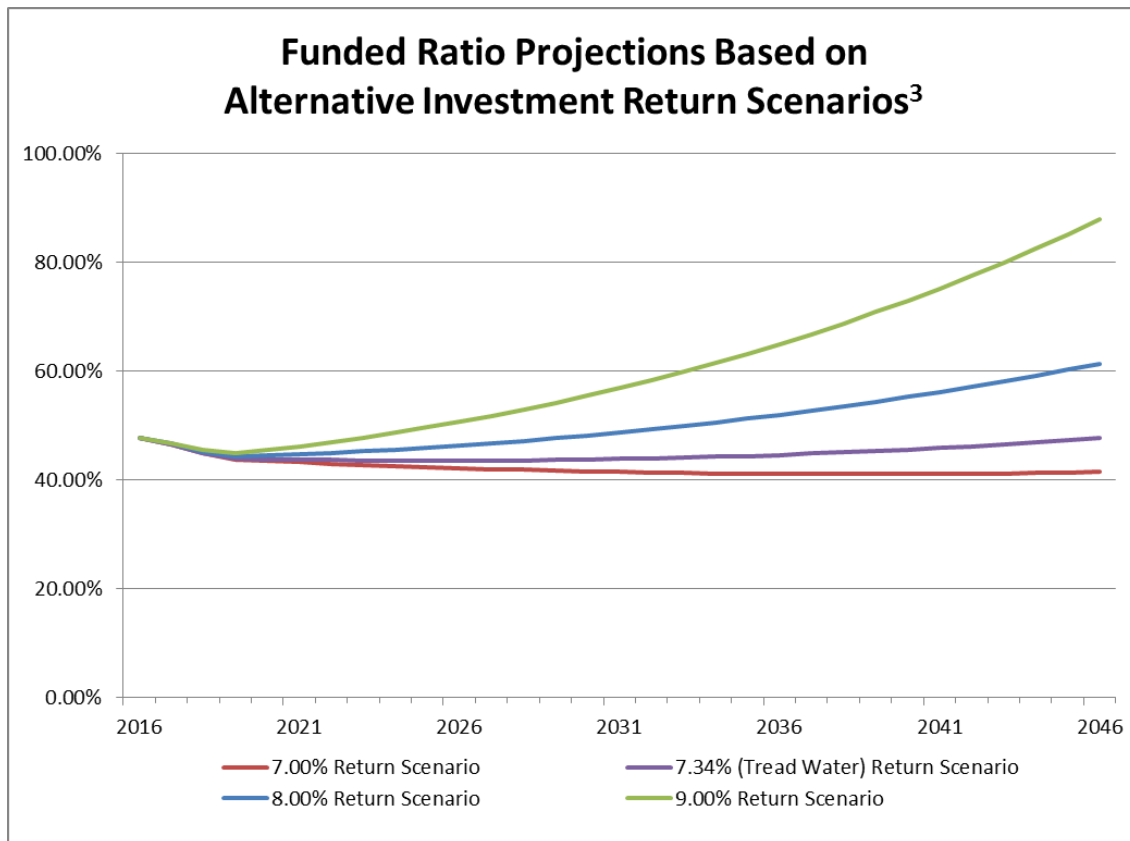
Risk Analysis

The various risks faced by a pension fund all boil down to one relatively simple question, "Will there be enough money to pay benefits when due?" This section discusses four main risk factors facing the Fund: investment, funding, assumption, and governance risks. Measuring Greenville Fire based on these factors reveals a significant amount of risk being taken in each of these areas, increasing the probability of a continued period of severe financial stress for the Fund. This also raises the likelihood of deteriorating funding conditions in the coming years, further imperiling the Fund's ability to pay promised benefits.

Investment Risk

Investment risk is the risk that actual future returns will be different from expected. Generally, some risk always exists associated with actual returns deviating significantly below or above the expected return on assets over the long term. However, the likelihood of Greenville Fire *not* meeting or exceeding the 8.00% expected return on assets is significantly greater than the odds that they will do so for the near future.

The graph below projects the funded ratio for the next 30 years under the following four different actual investment return scenarios: the expected return on assets (EROA) or 8.00%; the EROA +1%; the EROA - 1%; and the “tread-water” rate of return on assets, or rate of return on assets necessary to have the same funded ratio at the end of the 30-year period. Given no changes in plan benefits or contribution rates, *the Fund barely passes 60% funded status in 30 years even if all assumptions are met, including if the Fund meets the EROA.*



In addition, as was illustrated in the Historical Trends section, the Fund has not achieved an 8.00% annualized return over a consecutive 10-year period in any of the 13 periods ending December 31, 2004 through December 31, 2016. The impact of consistently earning less than the EROA *but even as high as 7.00% over* on the current asset allocation, the Fund's 8.00% assumed rate of return, and expected capital market assumptions published by organizations such as JP Morgan and Horizon Actuarial Services, the PRB estimates the probability of earning less than or equal to a 7.00% annual return is approximately twice as likely as achieving a 9.00% or greater annual return over the next 30-year period.

The Fund's current asset allocation is not significantly different from other public pension plans. However, to maintain an expected return on assets of 8.00%, public pension plans have generally taken on significantly more risk than in the past. Public pension portfolios with an 8.00% expected return have increased risk by more than 3-fold between 1995 and 2016.⁴ Generally, this is a result of shifting investments from more stable fixed income securities (with significantly lower returns in 2016 than in 1995) into equities and equity-like products. The Fund has followed a similar trend holding closer to a 40% equity/60% fixed income asset allocation in 1995 and over time shifting to a 60% equity/40% fixed income split at the end of 2016. This results in a higher likelihood of large losses in any given year. Thus, even if an 8.00% return assumption in any given year is reasonable, one year with large losses reduces the actual long-term expected return, which is what we see in the 10-year returns graphed above.

Funding Risk

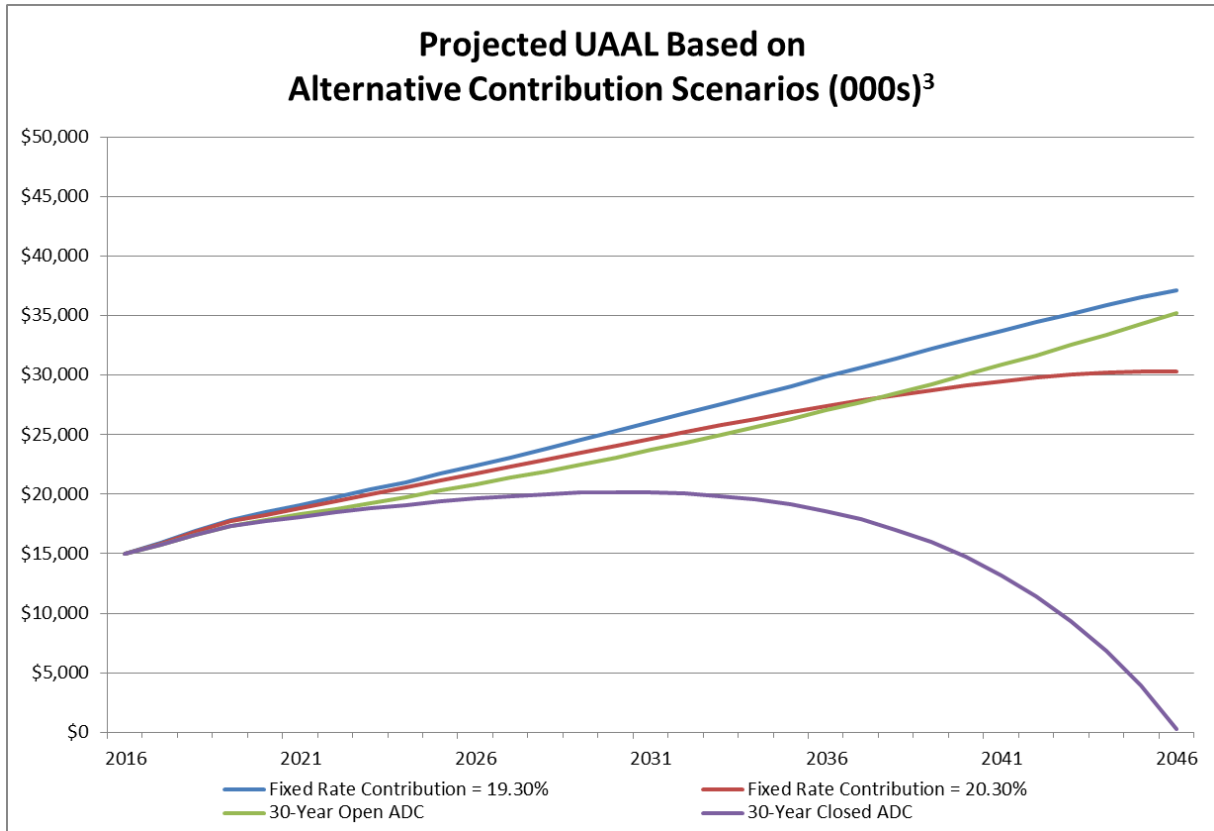
Funding or contribution risk is the risk that actual future contributions will be less than expected future contributions. For purposes of this section, funding risk will also refer to the risk that future contributions are less than "needed" to maintain a financially stable pension fund.

There are two primary issues with fixed-rate, percent of pay plans that may result in long-term problems:

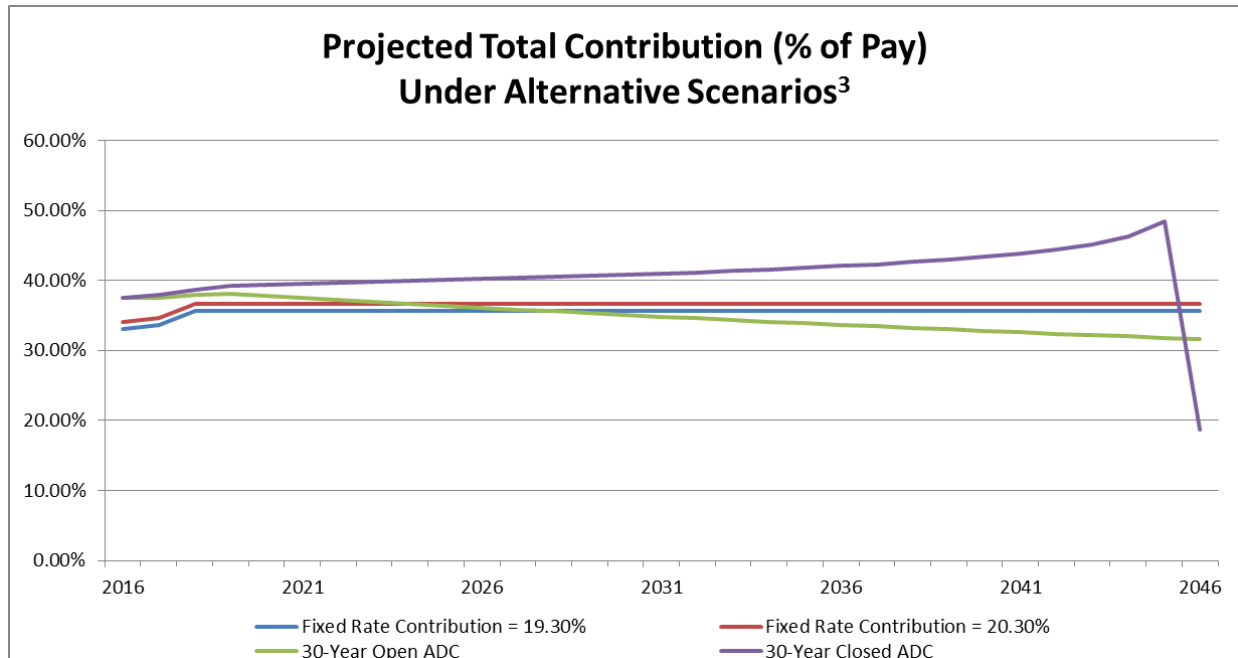
- 1) Contributions to percent of pay plans are inherently back-loaded because the expected contributions to a percent of pay plan grow on a nominal basis at the assumed rate of total payroll growth.
- 2) Fixed rate plans provide budgetary stability for the employer in the short term, but do not include any inherent mechanisms for reacting to changes in a plan's financial condition.

Based on the Fund's current contribution rates, including the planned contribution rate increase in October 2018, on an open group projection basis the total UAAL is expected to increase for the next 30 years before it starts to decrease. The implication is that someone who is hired by the Fire Department or someone who moves to the City 30 to 50 years in the future will still be paying for services received in the past. This raises the concern of intergenerational equity. Moreover, if actual investment returns and/or payroll growth are lower than expected, the UAAL will only continue to increase more.

To address these concerns, a plan can adopt a funding policy with a target to fully fund the plan. One approach is for the employer to contribute based on an actuarially determined contribution (ADC) that is designed to decrease contribution volatility, while addressing changing financial conditions. The impact on the UAAL of adopting a simple funding policy designed to fully fund the plan in 30 years is shown below. The projected UAAL is shown for each of the scenarios: maintaining the current fixed rate contribution schedule (17.30% increasing to 19.30% in October 2018); increasing the employer contribution by 1.00% above the current plan; adopting a funding policy that pays the rolling 30-year actuarially determined contribution; and adopting a funding policy that utilizes a single layer 30-year closed amortization approach (i.e. will fully fund the plan in 30 years).



The total contributions (both employer and employee) necessary for each funding policy are shown below.



Assumption Risk

Actuarial valuations and projections are by their nature simplifications of an extremely complex reality. As G.E.P. Box is famously quoted, "All models are wrong, but some are useful." The actuarial valuation, like a map of the world, is not 100% accurate but is instead a useful tool to help guide decision making on the most effective way to get from point A to point B. For that reason, it is best not to rely too much on a single snapshot of any given metric, but rather examine the progression of multiple metrics over time. An important part of that process involves selecting the economic and demographic assumptions about future plan experience.

Actuarial Standards of Practice (ASOPs) 27, *Selection of Economic Assumptions for Measuring Pension Obligations*, and 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*, provide a framework for the selection of assumptions. They state that each assumption selected by an actuary must be "reasonable," where reasonable is defined as being appropriate for the purpose, reflects the actuary's professional judgement, takes into account historical and current data, as well as future expectations, and has no significant bias. The ASOPs also recognize that "different actuaries will apply different professional judgement" such that a "range of reasonable assumptions may develop."

As was noted previously, for the Fund, the single largest increase in UAAL over the past 15 years was due to investment returns lower than the assumed rate of return, and the potential for this trend to continue is one of the largest concerns moving forward. In addition, the amortization period calculation is highly sensitive to the selection of an assumed rate of payroll growth. The development of both of these assumptions relies first on the selection of the inflation assumption. While there are approaches to selecting the investment return assumption other than the traditional "building block" approach, the Governmental Accounting Standards Board's reporting requirements implicitly assume the building block approach is used by requiring plans to report expected real rates of return (i.e. "after adjustment to eliminate inflation") for each asset class.⁵

While the Fund's 3.00% inflation assumption may not appear high for public pension plans (approximately 62% of Texas plans in the most recent information reported to the PRB and 58% of the plans in the Public Plans Database for the fiscal year ending in 2016 used a 3.00% or higher inflation assumption), other industry data indicates inflation could be significantly lower. The following table illustrates several published inflation rates for various mid- to long-term horizons:

Source	Time Horizon (Years)	Rate
Greenville Fire 12/31/2016 Actuarial Valuation	N/A	3.00%
Treasury Inflation Protected Securities ⁶	30	2.01%
SSA 2017 Trustees Report – Intermediate Assumptions ⁷	75	2.60%
JP Morgan 2017 Long-Term Capital Market Assumptions ⁸	10	2.25%
Horizon Actuarial Services 2017 Survey of Capital Market Assumptions ⁹	20	2.44%

Based on projections in the Investment Risk section above, if the mean rate of return is reduced from 8.00% to 7.50% to reflect a 2.50% inflation rate rather than 3.00%, the PRB estimates the Fund would be

more than three times as likely to earn less than or equal to a 7.00% return versus greater than or equal to a 9.00% return over the next 30-year period.

The payroll growth assumption is also frequently calculated using a building block approach with inflation as the base and an adjustment for general productivity growth. Therefore, any reduction to the inflation assumption is likely to impact the payroll growth assumption as well. Also, as noted previously, the amortization period calculation is highly sensitive to the payroll growth assumption. The amortization period is used as the primary metric for decision-making by many Texas public pension plans, as well as the trigger for requirements under the Texas Government Code, so any assumption that has a significant impact on the amortization period should be scrutinized very closely.

The inflation, payroll growth and investment return assumptions are all economic assumptions that have a significant impact on valuation of the liabilities and the anticipated cost of the plan. The demographic assumption with the largest impact is the mortality table.

Greenville Fire currently uses the RP-2000 Mortality Table, projected to 2024 with Scale AA. In December 2014, the Organization for Economic Co-operation and Development (OECD) published *Mortality Assumptions and Longevity Risk: Implications for Pension Funds and Annuity Providers*, in which they examined “the mortality tables commonly used by pension funds and annuity providers against several well-known mortality projection models with the purpose of assessing the potential shortfall in provisions.”¹⁰ Specifically, the OECD examined the RP-2000 Mortality Table as well as projected mortality improvements using Scale AA. The OECD concluded that scale AA does not “sufficiently reflect the fact that mortality improvements have been increasing”, and the use of the RP-2000 Mortality Table with a fully generational projection utilizing Scale AA is likely to result in a shortfall of around 4-5%. While this impact is more pronounced for women and white-collar workers, it illustrates the importance of continually monitoring, and regularly updating, all assumptions.

For the Fund, while the actual cost will always be the benefits actually paid, if the liabilities are understated, the contributions necessary to fund the actual costs could be larger than anticipated and could exacerbate the Fund's already precarious actuarial condition. It is sometimes useful to incorporate a level of conservatism in a plan's assumptions to help avoid the difficulties associated with significant underfunding.

Governance Risk

Governance is essentially decision-making, and decision-making for public pension plans must balance the competing interests of plans and their sponsors and should feature collaboration between the two. One primary source of governance risk is the lack of involvement of key parties or stakeholders in important areas of decision-making for a pension plan including plan design (benefits) and funding (contributions). When a key party, such as the board of trustees or the plan sponsor, is not engaged in important decisions, the risk increases that benefit levels and the contributions required to fund them will diverge, potentially putting the plan's funding stability at risk.

For example, TLFFRA allows boards of trustees to make prospective benefit modifications, both increases and reductions. These changes must be approved by an actuary and a majority of participating

members and may not deprive an eligible participant of vested accrued benefits. Although jointly responsible for funding the retirement plan along with plan members, the sponsoring city may have limited involvement in benefit decision-making, a structure which generates the risk that benefit levels adopted could be unsustainable. While Greenville Fire has not increased benefits to speak of in recent years, this potential risk remains in the future, given the statutory structure.

Benefit increases are not the only potential risk related to a potential lack of sponsor involvement under TLFFRA; unwillingness to reduce benefits prospectively when necessary to address funding challenges can be an obstacle to getting things back on track. It should be noted that even plans with very engaged boards and sponsors can be susceptible to increasing benefits to unsustainable levels in good times or failing to lower them when necessary in bad times. Governance risk related to an imbalance in decision-making can only exacerbate these risks. Governance risk must also be managed on the contribution side, with both parties working together to provide sufficient contributions and to avoid lowering contributions in good times.

State law recognizes these risks and imposes cooperation between the system and sponsoring governmental entity by requiring retirement systems having trouble meeting their long-term obligations to work with their sponsors to develop a restoration plan for addressing those issues.¹¹ This framework helps ensure that both the system and its sponsoring employer are involved in pension plan reform decisions, but it comes at a point when actuarial health is already threatened. Prior to and throughout the funding soundness restoration plan process, Greenville Fire and the City have made incremental contribution increases since 2006 in response to deteriorating conditions, but these changes have not been enough to put the plan on a solid path to sustainability.

Conclusions

Funding and Governance Risk

When retirement systems and their sponsors wait too long to address them, the funding challenges compounding over time can reach a point where small, incremental improvements such as those made for Greenville Fire simply do not have enough effect to achieve sustainability. As required by state law to jointly formulate a funding soundness restoration plan, the City increased its contribution rate to 19.30% beginning in October 2018; however, Greenville Fire and the City have yet to make difficult decisions on additional needed changes to benefit or contribution levels to address potential investment and funding risks in the future. If necessary changes are ultimately made, they will certainly right the ship, but they will be made under less than ideal conditions.

Thus, another model is called for. Plans and their sponsors can develop policies that proactively manage risk in the future by laying out a formal risk-sharing plan in advance. To proactively manage governance and funding risk, retirement plans and their sponsors should work together to adopt written policies far in advance, before they incur adverse experience, that can guide them through both good and bad years and shield against the risk of either party's exclusion or disengagement from decision-making. Funding and benefit policies can be adopted that provide a framework for how benefit and contribution levels may be modified under different conditions. An advantage of such policies is that changes to plan

benefits and costs are known and understood by all parties in advance, rather than negotiated under difficult circumstances.

A strong funding policy that ensures a healthy amortization period is maintained by requiring payment of an actuarially determined contribution is encouraged. Numerous actuarial methods can be utilized to help mitigate contribution volatility, including directly smoothing contribution rates or adding “guardrails” that require the stakeholders to come back to the table if the contribution rate falls outside a specified range. If funding according to an actuarially determined contribution is not adopted, a funding and benefit policy should, at a minimum, codify how adverse experience will be addressed and how future changes will be made.

For example, a funding policy might state that future benefit enhancements, cost of living adjustments, and/or contribution rate reductions can only be considered or made if the system's funded ratio remains greater than a particular threshold. A funding policy can also state that if the funded ratio falls below a certain threshold, the stakeholders would be required to come back to the table to make necessary contribution and benefit adjustments. Greenville Fire in conjunction with the City can consider utilizing the FSRP requirement to develop a long-term funding policy for the Plan.

Assumption Risk

Public retirement systems must monitor actuarial assumptions continually through their actuarial valuations and make appropriate adjustments to mitigate bias in the assumptions that result in consistent actuarial gains or losses. Actuarial gains and losses occur when the plan's actual experience does not match expected experience. Over time, without required changes, pension funds such as Greenville Fire whose assumptions consistently diverge from actual experience in the same direction (i.e. consistently seeing actuarial gains or consistently seeing actuarial losses) can exacerbate the issue of intergenerational inequity, causing one group of members and taxpayers to over- or under-pay. Boards of trustees should work with their actuaries to ensure assumptions are neither too aggressive nor too conservative, while striving to maintain (or achieve) sound fiscal health to secure existing accrued benefits. PRB's *Pension Funding Guidelines* recommend systems to monitor, review, and report the impact of actual plan experience on actuarial assumptions at least once every five years.

Investment Risk

Whatever the investment return assumption used, investment returns should be closely monitored, and investment managers' performance should be assessed regularly and compared to appropriate asset class benchmarks. Benchmarks should be reviewed to see if they have been met or exceeded, and should be viewed in light of the risk taken to achieve those returns. Best practices also include revisiting investment manager selection periodically, with boards of trustees evaluating managers' performance, fees, and whether their current managers are providing the highest possible value at the lowest possible cost. The asset allocation should also be assessed from a risk perspective to provide insight into how the fund would weather a market correction.

¹ The theoretical minimum threshold, or actuarially determined contribution (ADC), is a target or recommended contribution "to the plan as determined by the actuary using a contribution allocation procedure," as defined in Actuarial Standards of Practice No 4. If contributions to the plan are made as a fixed rate based on statutory or contractual requirements, the ADC for this purpose is the contribution needed to fund the benefits accrued in the current year and maintain an amortization period that does not exceed 30 years, as required to be reported under Texas Government Code §802.101(a).

² https://www.ccactuaries.org/Portals/0/pdf/CCA_PPC_White_Paper_on_Public_Pension_Funding_Policy.pdf

³ Unless otherwise specified, employer contributions are assumed to increase to 17.30% as of January 1, 2018 and 19.30% as of October 1, 2018. Total benefit payments are assumed to grow at 3.50%, as provided by John M. Crider, Jr. Consulting Actuary. All other current and projected assets and liabilities reflect the actuarial accrued liabilities, actuarial value of assets, plan provisions, and actuarial assumptions and methods as reported in the 12/31/2016 Actuarial Valuation prepared by John M. Crider, Jr. Consulting Actuary.

⁴ http://www.rockinst.org/pdf/government_finance/2017-02-01-Risk_Taking_Appropriateness.pdf

⁵ Governmental Accounting Standards Board Statement No. 67, Financial Reporting for Pension Plans, p. 30.

⁶ <https://fred.stlouisfed.org/>

⁷ https://www.ssa.gov/oact/TR/2017/2017_Long-Range_Economic_Assumptions.pdf

⁸ <https://am.jpmorgan.com/us/institutional/our-thinking/lcma-2017>

⁹ <http://www.horizonactuarial.com/blog/2017-survey-of-capital-market-assumptions>

¹⁰ http://www.oecd-ilibrary.org/finance-and-investment/mortality-assumptions-and-longevity-risk_9789264222748-en

¹¹ Texas Government Code 802.2015 and 802.2016 require public retirement systems whose amortization period exceeds 40 years for 2 or 3 consecutive actuarial valuations to develop, with their sponsor, a funding soundness restoration plan designed to bring their amortization period within 40 years over 10 or fewer years.