JOINT ADDENDUM TO FINAL RISK SHARING VALUATION STUDY FOR FY 2025

Pursuant to §13B(f)(2)(B)(ii) of Texas Revised Civil Statutes 6243e.2(1), the Executive Director for the Houston Firefighters' Relief and Retirement Fund ("Fund") and the Interim Finance Director for the City of Houston (the "Municipality") do hereby execute this joint addendum to the respective Fund and Municipality final risk sharing valuation studies ("RSVS") reflecting the arithmetic average for fiscal year 2025 in which the difference between the Fund and Municipality's estimated contribution rate was greater than two percentage points.

Fiscal Year	Estimated Contribution Rate from the Fund	Estimated Contribution Rate from the Municipality	Arithmetic Average of Estimated Contribution Rates	Corridor Minimum
2025	26.11%	23.88%	25.00%	26.89%

HOUSTON FIREFIGHTERS' RELIEF AND RETIREMENT FUND

Executive Director

January 17, 2024

Date

CITY OF HOUSTON

DocuSigned by:

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Interim Finance Director

1/18/2024

Date

Houston Firefighters' Relief and Retirement Fund

Investing for Firefighters and Their Families

April 30, 2024

Amy Cardona
Texas Pension Review Board
300 West 15th Street, Suite 406
Austin, TX 78717

Re: HFRRF RSVS

Dear Ms. Cardona

Please find attached the Houston Firefighters' Relief and Retirement Fund's ("HFRRF") final Risk Sharing Valuation Study ("RSVS") as of July 1, 2023, which develops the estimated municipal contribution rate for FY 2025. HFRRF's and the City's estimated municipal contribution rate were not within two percentage points; therefore, HFRRF and the City executed a join addendum reflecting the arithmetic average of their respective rates resulting in an estimated contribution rate of 25.00% for FY 2025.

However, since the estimated municipal contribution rate for FY 2025 was less than the initial RSVS' minimum contribution rate of 26.89% and HFRRF's statutory funded ratio exceeded 90% (but was less than 100%), required adjustments under §13E(c) of HFRRF's governing statute have been implemented. Please note that (i) adjusting the actuarial value of assets equal to the current market value of assets under §13E(c)(1) would not have caused the municipal contribution rate to increase, and (ii) an agreement was not reached with the City under section §13E(c)(2) or (3) by April 30th. Consequently, HFRRF has accelerated the payoff year of the legacy liability to the extent required to increase its estimated municipal contribution rate to equal the minimum contribution rate in accordance with §13E(c)(4). Accordingly, the final RSVS attached includes an addendum to HFRRF's RSVS to demonstrate the accelerated payoff.

Sincerely,

Tim Schauer
Executive Director

4225 Interwood North Parkway • Houston, TX 77032-3866 • 281.372.5100 TEL • 281.372.5101 FAX • 1.800.666.9737 • www.hfrrf.org

BUCK
A Gallagher Company

110 West Berry Street
Suite 1300
Fort Wayne, IN 46802

April 30, 2024

Mr. Brett Besselman, Chairman of Board of Trustees
Mr. Tim Schauer, Executive Director
Houston Firefighters' Relief and Retirement Fund
4225 Interwood North Parkway
Houston, Texas 77032

Re: Addendum to the July 1, 2023 Proposed Risk Sharing Valuation Study

This addendum is incorporated and made part of the attached July 1, 2023 Proposed Risk Sharing Valuation Study (Proposed RSVS) for the Houston Firefighters' Relief and Retirement Fund (Fund). Unless otherwise stated, the results presented in this addendum were prepared using the same data, methods and actuarial assumptions that have been used for the Proposed RSVS. Please refer to the Proposed RSVS report for all the other assumptions, methods and caveats related to this addendum.

Buck published its Proposed RSVS on November 22, 2023 pursuant to our engagement to provide actuarial services to the Fund. The Proposed RSVS developed the estimated municipal contribution rate for fiscal year ending June 30, 2025 (FY 2025). The Proposed RSVS was prepared, as required under Senate Bill 2190, for the Fund as of July 1, 2023. The Proposed RSVS reflects the benefit provisions of the Fund as amended by and funding policies mandated by Senate Bill 2190, but without regard to Section 13E.

Since the Fund's and the City's estimated municipal contribution rates were different by more than two percentage points, the Executive Director for the Fund and the Interim Finance Director for the City executed a joint addendum to the respective Fund and Municipality final risk sharing valuation studies. This addendum noted that the arithmetic average of the estimated municipal contributions rates for the fiscal year stated by the municipal actuary and the fund actuary was 25.00%. However, since this rate was less than the initial RSVS' FY 2025 minimum contribution rate of 26.89% and the Fund's statutory funded level of 96.0% exceeded 90.0% (but was less than 100%), this addendum presents the implementation of the required adjustments under §13E(c) of HFRRF's governing statute, as follows:

i. Adjusting the actuarial value of assets equal to the current market value of assets under §13E(c)(1) does not cause the municipal contribution rate to increase;

ii. An agreement was not reached between the Fund and the City under §13E(c)(2) and §13E(c)(3) by April 30th;

iii. Consequently, the Fund has accelerated the payoff year of the legacy liability to the extent required to increase the estimated municipal contribution rate to equal the minimum contribution rate in accordance with §13E(c)(4).

The following sections of the Proposed RSVS have been revised, in accordance with §13E(c) of HFRRF's governing statute.

Revised Amortization Schedule as of July 1, 2023 ($000) (Original on page 3 of Proposed RSVS)

Plan Year Ending	Initial Liability Layer	Liability Layer as of July 1, 2023	Remaining Amortization Payments as of July 1, 2024	Payment for Fiscal Year 2025	As a % of Fiscal Year 2025 Payroll[1]
June 30, 2016	$ 900,223	$ 974,330	6.208	$ 163,191	56.60%
June 30, 2017	(19,325)	(20,682)	6.208[2]	(3,464)	(1.20)%
June 30, 2018	(32,368)	(34,293)	6.208[2]	(5,744)	(1.99)%
June 30, 2019	(61,676)	(64,759)	6.208[2]	(10,846)	(3.76)%
June 30, 2020	(190,421)	(198,405)	6.208[2]	(33,231)	(11.53)%
June 30, 2021	(342,733)	(354,841)	6.208[2]	(59,432)	(20.61)%
June 30, 2022	(79,662)	(85,239)	6.208[2]	(14,277)	(4.95)%
June 30, 2023	(2,931)	(2,931)	6.208[2]	(576)	(0.20)%
Total		$ 213,180		$ 35,621	12.36%

Revised Risk Sharing Valuation Results (Original on page 1 of Proposed RSVS)

($000)	2022 Risk Sharing Valuation Results	2023 Risk Sharing Valuation Results: Proposed RSVS (Published November 22, 2023)	2023 Risk Sharing Valuation Results: Adjustments in accordance with §13E(c)(4)
Present Value of Future Benefits	$ 5,774,144	$ 6,004,259	$ 6,004,259
Actuarial Accrued Liability	$ 5,075,516	$ 5,277,944	$ 5,277,944
Actuarial Value of Assets	$ 4,843,737	$ 5,064,764	$ 5,064,764
Unfunded Accrued Liability	$ 231,779	$ 213,180	$ 213,180
Funded Ratio	95.4%	96.0%	96.0%
City Normal Cost Rate[3]	14.75%	14.53%	14.53%
City Accrued Liability Rate	12.14%	11.58%	12.36%
Total City Contribution Rate[4]	26.89%	26.11%	26.89%
Estimated City Contribution for following Fiscal Year	$ 72,946	$ 75,277	$ 77,525
Employee Contribution Rate	10.50%	10.50%	10.50%

[1] Based on projected pensionable compensation of $288,305,000

[2] Per SB 2190, the amortization period for a new liability gain layer is equal to the remaining amortization period on the largest remaining liability loss layer.

[3] Contains an allowance for administrative expenses equal to 1.25% of payroll.

[4] As a percentage of pensionable compensation.

Actuarial Certification

We certify that the information contained in this addendum to the July 1, 2023 Proposed RSVS has been prepared in accordance with the appropriate Actuarial Standards of Practice. Unless otherwise stated, the results presented herein were prepared using the same data, methods and actuarial assumptions that have been used for the Proposed RSVS. A summary of the actuarial assumptions and methods, major Fund provisions, and Fund participant data used to calculate the results of this study can be found in the appendices of the attached July 1, 2023 Proposed RSVS report. Please refer to the same Proposed RSVS for the applicable disclosures under Actuarial Standards of Practice ("ASOPs") 4, 27, 35, 51 and 56.

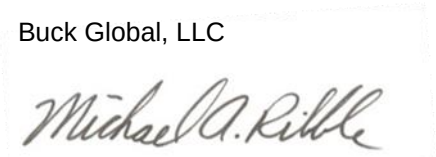
In addition to the ASOP 51 "Contribution risk" discussion, the implementation of Section 13E accelerates the amortization of the Fund's liability layers and establishes a contribution rate that is greater than determined by the Proposed RSVS and further exceeds the normal cost plus interest on the unfunded actuarial accrued liability. Assuming that city contributions meet or exceed the Total City Contribution Rate developed in this Addendum, the unfunded actuarial accrued liability is expected to be fully amortized within 6.208 years beginning July 1, 2024.

I am a Fellow of the Society of Actuaries and Member of the American Academy of Actuaries. I meet the Academy's Qualification Standards to issue this Statement of Actuarial Opinion. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and I am available to answer questions about it.

If you have any questions concerning this information, please let me know.

Respectfully submitted,

Buck Global, LLC



Michael A. Ribble, FSA, EA, MAAA, FCA
Principal, Consulting Actuary

Attached: July 1, 2023 Proposed Risk Sharing Valuation Study dated November 22, 2023

BUCK
A Gallagher Company

110 West Berry Street
Suite 1300
Fort Wayne, IN 46802

November 22, 2023

Mr. Brett Besselman, Chairman of Board of Trustees
Mr. Tim Schauer, Executive Director
Houston Firefighters' Relief and Retirement Fund
4225 Interwood North Parkway
Houston, Texas 77032

Re: Proposed Risk Sharing Valuation Study

Dear Brett and Tim:

Pursuant to our engagement to provide actuarial services to the Houston Firefighters' Relief and Retirement Fund (Fund), we have prepared this Risk Sharing Valuation Study, as required under Senate Bill 2190, for the Fund as of July 1, 2023. This reflects the benefit provisions of the Fund as amended by, as well as funding policies mandated by, Senate Bill 2190 without regard to Section 13E. For comparison purposes the 2022 Risk Sharing Valuation Results shown below are based on adjustments in accordance with §13E(c)(4) per our Addendum dated March 24, 2023.

Risk Sharing Valuation Results

($000)	2023 Risk Sharing Valuation Results	2022 Risk Sharing Valuation Results[1]
Present Value of Future Benefits	$ 6,004,259	$ 5,774,144
Actuarial Accrued Liability	$ 5,277,944	$ 5,075,516
Actuarial Value of Assets	$ 5,064,764	$ 4,843,737
Unfunded Accrued Liability	$ 213,180	$ 231,779
Funded Ratio	96.0%	95.4%
City Normal Cost Rate[2]	14.53%	14.75%
City Accrued Liability Rate	11.58%	12.14%
Total City Contribution Rate[3]	26.11%	26.89%
Estimated City Contribution for following Fiscal Year	$ 75,277	$ 72,946
Employee Contribution Rate	10.50%	10.50%

[1] As adjusted in accordance with §13E(c)(4).
[2] Contains an allowance for administrative expenses equal to 1.25% of payroll.
[3] As a percentage of pensionable compensation

As shown in the table above, the proposed Risk Sharing Valuation Study results in a funded ratio that exceeds 90% and a City contribution rate of 26.11%, which is less than the Initial Risk Valuation Study Corridor Minimum of 26.89%. In accordance with Section 13E of Senate Bill 2190, potential changes in the actuarial value of assets, assumed rate of return, benefit levels, or the acceleration of the amortization period to payoff liability loss layers may be required.

Development of the Actuarial Value of Assets ($000)

Actuarial Investment Gain (Loss)

	Fiscal Year End June 30, 2023
Fair Value of Assets at beginning of year	$ 5,093,736
Net Cash Flow	
Contributions	$ 104,448
Disbursements	288,676
Net Cash Flow	$ (184,228)
Expected Investment Return	$ 350,223
Expected Fair Value of Assets at end of year	$ 5,259,731
Fair Value of Assets at end of year	$ 5,109,178
Investment Gain / (Loss)	$ (150,553)

Schedule of Actuarial Investment Gains (Losses)

Plan Year Ending	Initial Actuarial Gain (Loss)	Current Year Recognized Gain (Loss)	Unrecognized Gain (Loss) As of July 1, 2023
June 30, 2019	(64,836)	$ (12,967)	$ 0
June 30, 2020	(204,992)	(40,998)	(40,998)
June 30, 2021	1,057,370	211,474	422,948
June 30, 2022	(361,824)	(72,365)	(217,094)
June 30, 2023	(150,553)	(30,111)	(120,442)
			$ 44,414

Actuarial Value of Assets

Fair Value as of July 1, 2023	$ 5,109,178
(Gain) / Loss to be Recognized in Future Years	(44,414)
Actuarial Value as of July 1, 2023	$ 5,064,764

Change in Key Results since the Prior Risk Sharing Valuation ($000)

Analysis of Change in Unfunded Liability	2022/2023
Unfunded at Beginning of Period	$ 231,779
Estimated Change Due to Normal Operation	
Normal Cost	$ 63,222
Contributions	(104,448)
Administrative Expenses	5,581
Interest	14,998
Net Change	$ (20,647)
Estimated Change due to Actuarial Experience	
Actuarial (gain) loss from asset sources	$ (72,532)
Actuarial (gain) loss from liability sources	74,580
Net change	$ 2,048
Unfunded Actuarial Accrued Liability at End of Period	$ 213,180

Development of Liability Layer for Plan Year Ending June 30, 2023

Source	Amount ($000)
Actuarial Value of Assets (Gain)/Loss	$ (72,532)
Actuarial Accrued Liability (Gain)/Loss	74,580
Impact of Assumption Changes	0
Contributions Different than Expected	(4,979)
Total	$ (2,931)

Amortization Schedule as of July 1, 2023 ($000)

Plan Year Ending	Initial Liability Layer	Liability Layer as of July 1, 2023	Remaining Amortization Payments as of July 1, 2024	Payment for Fiscal Year 2025	As a % of Fiscal Year 2025 Payroll[2]
June 30, 2016	$ 900,223	$ 974,330	6.68	$ 152,974	53.06%
June 30, 2017	(19,325)	(20,682)	6.68[1]	(3,247)	(1.13)%
June 30, 2018	(32,368)	(34,293)	6.68[1]	(5,384)	(1.87)%
June 30, 2019	(61,676)	(64,759)	6.68[1]	(10,167)	(3.53)%
June 30, 2020	(190,421)	(198,405)	6.68[1]	(31,150)	(10.80)%
June 30, 2021	(342,733)	(354,841)	6.68[1]	(55,712)	(19.32)%
June 30, 2022	(79,662)	(85,239)	6.68[1]	(13,383)	(4.64)%
June 30, 2023	(2,931)	(2,931)	6.68[1]	(540)	(0.19)%
Total		$ 213,180		$ 33,391	11.58%

[1] Per SB 2190, the amortization period for a new liability gain layer is equal to the remaining amortization period on the largest remaining liability loss layer.

[2] Based on projected pensionable compensation of $288,305,000.

Historical Unfunded Actuarial Accrued Liability

Valuation Date		Actuarial Accrued Liability ($000)	Valuation Assets ($000)	Assets as Pct. of Actuarial Accrued Liability	Unfunded Actuarial Accrued Liability (UAAL, $000)	Active Member Payroll ($000)	UAAL as Pct. of Active Member Payroll
7/1/2013		3,963,082	3,430,437	86.6%	532,645	253,709	210%
7/1/2014	*	N/A	N/A	N/A	N/A	N/A	N/A
7/1/2015		4,397,007	3,929,988	89.4%	467,019	273,073	171%
7/1/2016		5,073,523	4,089,047	80.6%	984,476	288,136	342%
7/1/2017	**	4,827,721	3,883,807	80.4%	943,914	261,881	360%
7/1/2018	**	4,948,133	4,027,079	81.4%	921,054	264,747	348%
7/1/2019	**	5,057,759	4,190,934	82.9%	866,825	266,480	325%
7/1/2020	**	4,932,307	4,251,851	86.2%	680,456	252,974	269%
7/1/2021	**	4,881,608	4,550,468	93.2%	331,140	251,353	132%
7/1/2022	**	5,075,516	4,843,737	95.4%	231,779	263,374	88%
7/1/2023	**	5,277,944	5,064,764	96.0%	213,180	279,908	76%

Historical Solvency Test

		Actuarial Accrued Liability (AAL)				Portion of AAL Covered by Valuation Assets		
Valuation Date		(1) Active Member Contribution and DROP Balances ($000)	(2) Retirees, Beneficiary, and Vested Members Members ($000)	(3) Active and DROP Members Employer Financed ($000)	Valuation Assets ($000)	(1)	(2)	(3)
7/1/2013		469,528	2,361,270	1,132,284	3,430,437	100%	100%	53%
7/1/2014	*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7/1/2015		479,593	2,713,418	1,203,996	3,929,988	100%	100%	61%
7/1/2016		490,874	3,109,860	1,472,789	4,089,047	100%	100%	33%
7/1/2017	**	429,659	3,275,581	1,122,481	3,883,807	100%	100%	16%
7/1/2018	**	437,596	3,385,273	1,125,264	4,027,079	100%	100%	18%
7/1/2019	**	463,036	3,450,044	1,144,679	4,190,934	100%	100%	24%
7/1/2020	**	456,895	3,435,330	1,040,082	4,251,851	100%	100%	35%
7/1/2021	**	470,345	3,461,982	949,281	4,550,468	100%	100%	65%
7/1/2022	**	475,925	3,626,324	973,267	4,843,737	100%	100%	76%
7/1/2023	**	499,162	3,757,795	1,020,987	5,064,764	100%	100%	79%

* No valuation was performed as of 7/1/2014

** Results for July 1, 2017 and later years are based on Risk Sharing Valuation Studies

Actuarial Certification

We certify that the information contained in this Risk Sharing Valuation Study has been prepared in accordance with the appropriate Actuarial Standards of Practice. To the best of our knowledge, the information fairly presents the actuarial position of the Houston Firefighters' Relief & Retirement Fund as of July 1, 2023 on the basis of the actuarial assumptions, methods and Fund provisions set forth herein.

The Board of Trustees of the Fund may use this report for discussing and reaching consensus with the City of Houston on the City Contribution Rate. Use of this report for any other purpose or by anyone other than the Board or the City of Houston may not be appropriate and may result in mistaken conclusions because of failure to understand applicable assumptions, methods, or inapplicability of the report for that purpose. Because of the risk of misinterpretation of actuarial results, Buck, A Gallagher Company (Buck) recommends requesting an advance review of any statement, document, or filing to be based on information contained in this report. Buck will accept no liability for any such statement, document or filing made without prior review by Buck.

Future actuarial measurements may differ significantly from current measurements due to Fund experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in Fund provisions or applicable law. An analysis of the potential range of such future differences is beyond the scope of this Risk Sharing Valuation Study.

Where presented, references to "funded ratio" and "unfunded accrued liability" typically are measured on an actuarial value of assets basis. It should be noted that the same measurements using fair value of assets could result in different funded ratios and unfunded accrued liabilities. Moreover, the funded ratio presented is appropriate for evaluating the need and level of future contributions but makes no assessment regarding the funded status of the Fund if the Fund were to settle a portion or all of its liabilities.

In preparing the actuarial results, we have relied upon information provided by the Board of Trustees as of July 1, 2023 regarding Fund provisions, Fund participants, Fund assets, contribution rates and other matters used in the Risk Sharing Valuation Study. Specifically, a fair value of assets equal to $5,109,178,130 has been provided by the Fund representatives. Although we did not audit the data, we reviewed the data for reasonableness and consistency with the prior year's information. The accuracy of the results of this Risk Sharing Valuation Study is dependent on the accuracy of the data.

As required under Senate Bill 2190, experience studies are performed once in every four-year period. This Risk Sharing Valuation Study was prepared on the basis of the demographic and economic assumptions that were selected on the basis of the Fiscal Year Ending June 30, 2015 through Fiscal Year Ending June 30, 2019 Experience Review and adopted by the Board of Trustees at their October 20, 2020 meeting. This experience study is conducted to determine the assumptions that will serve as the basis for the Risk Sharing Valuation Studies from July 1, 2020 – July 1, 2023.

Except as prescribed in Senate Bill 2190 (as noted in Appendix A), the Board of Trustees has sole authority to determine the actuarial assumptions and has selected the actuarial methods and assumptions used in this Risk Sharing Valuation Study. In our opinion, those actuarial assumptions selected by the Board are reasonably related to the experience of the Fund and to reasonable long-term expectations. The actuarial assumptions prescribed by Senate Bill 2190 have been reflected in this Risk Sharing Valuation Study.

A summary of the actuarial assumptions, major Fund provisions, and Fund participant data used to calculate the results of this study can be found in the appendices.

The Total City Contribution Rate developed in this report exceeds the normal cost, plus interest on the unfunded actuarial accrued liability. Assuming that city contributions meet or exceed the Total City Contribution Rate developed in this report, the unfunded actuarial accrued liability is expected to be fully amortized within 6.68 years beginning July 1, 2024.

Based on the statutory requirements of Senate Bill 2190 it is our understanding that the actual City contribution rate may be established as an average of the contribution rates shown in this report and those shown in the Risk Sharing Valuation Study prepared by the City's actuary. If future contributions are established in this manner at levels below those presented in this report, the Fund may not be expected to achieve a fully funded position over the 30-year time horizon as contemplated in the statute based on the data, assumptions and methods set forth on the attached pages.

However, this proposed Risk Sharing Valuation Study results in a funded ratio that exceeds 90% and a City contribution rate of 26.11%, which is less than the Initial Risk Valuation Study Corridor Minimum of 26.89%. In accordance with Section 13E of Senate Bill 2190, potential changes in the actuarial value of assets, assumed rate of return, benefit levels, or the acceleration of the amortization period to payoff liability loss layers may be required.

I am a Fellow of the Society of Actuaries and Member of the American Academy of Actuaries. I meet the Academy's Qualification Standards to issue this Statement of Actuarial Opinion. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and I am available to answer questions about it.

If you have any questions concerning this information, please let me know.

Respectfully submitted,

Buck, A Gallagher Company

Michael A. Ribble, FSA, EA, MAAA, FCA
Principal, Consulting Actuary

Appendix A: Summary of Actuarial Methods and Assumptions

Basis for Assumptions

The economic and demographic assumptions used in the study (except for the investment return assumption) were adopted by the Board in consultation with Buck. Senate Bill 2190 requires that an actuarial experience study be performed in order to review the experience of the Fund at least once every four years to determine if any changes to the Risk Sharing Valuation Study assumptions are warranted. In general, the assumptions used in the Risk Sharing Valuation Study are based on recommendations made and approved by the Board as part of an Experience Study covering Fiscal Year Ending June 30, 2015 through Fiscal Year Ending June 30, 2019. Senate Bill 2190 requires the use of an investment return assumption of not more than 7.00%.

Actuarial Standards of Practice 27 and 35 require the actuary to identify the economic and demographic assumptions that have a significant effect on the measurement and, for those that the actuary has not selected, to provide the information and analysis the actuary performed to determine that the assumption does not significantly differ from what the actuary deems reasonable for the purpose of the measurement.

The material demographic assumptions are disclosed in this Appendix A. All demographic assumptions were based on an Experience Review covering the period July 1, 2014 to June 30, 2019. The Board of Trustees, at their October 20, 2020 meeting, approved the use of the Experience Review's recommended demographic assumptions. We reviewed the assumptions along with recent experience and the assumptions are still reasonable for the current measurement.

The material economic assumptions include the salary scale and expected return on assets ("EROA"). The Board of Trustees, at their October 20, 2020 meeting, approved the use of the Experience Review's recommended salary scale assumption. We reviewed the salary scale assumption along with recent experience and the assumptions are still reasonable for the current measurement.

In the case of the EROA, Senate Bill 2190 requires the use of an investment return assumption of not more than 7.00%. We used economic information and tools provided by Buck's Financial Risk Management ("FRM") practice. A spreadsheet tool created by the FRM team converts averages, standard deviations, and correlations from Buck's Capital Markets Assumptions ("CMA") that are used for stochastic forecasting into approximate percentile ranges for the arithmetic and geometric average returns. It is intended to suggest possible reasonable ranges for EROA without attempting to predict or select a specific best estimate rate of return. It takes into account the duration (horizon) of investment and the target allocation of assets in the portfolio to various asset classes. Based on our analysis, including consistency with other assumptions used in the valuation and the percentiles generated by the spreadsheet described above, we believe the EROA, in our professional judgment, is reasonable for the purpose of the measurement.

Use of Models

Actuarial Standard of Practice No. 56 ("ASOP 56") provides guidance to actuaries when performing actuarial services with respect to designing, developing, selecting, modifying, using, reviewing, or evaluating models. In addition to the EROA spreadsheet model disclosed above, Buck uses third-party software in the performance of annual actuarial valuations and projections. The model is intended to calculate the liabilities associated with the Fund provisions using data and assumptions as of the measurement date under the accounting standards specified in this report. The output from the third-party vendor software is used as input to an internally developed model that applies those accounting standards to the liabilities derived and other inputs to generate many of the exhibits found in this report. Buck has an extensive review process whereby the results of the liability calculations are checked using detailed sample output, changes from year to year are summarized by source, and significant deviations from expectations are investigated. Other accounting outputs and internal model are similarly reviewed in detail and at a high level for accuracy, reasonability and consistency with prior results. Buck also reviews the third-party model when significant changes are made to the software. The review is performed by experts within the company who are familiar with applicable accounting rules as well as the manner in which the model generates its output. If significant changes are made to the internal model, extra checking and review are completed. Significant changes to the internal model that are applicable to multiple clients are generally developed, checked and reviewed by multiple experts within the company who are familiar with the details of the required changes.

Appendix A: Summary of Actuarial Methods and Assumptions (continued)

Actuarial Methods

Actuarial Value of Assets

Senate Bill 2190 requires the use of an asset valuation method that recognizes gains and losses on the fair value of assets (based on the difference between the actual rate of return and the assumed rate of return) over five years. Past gains and losses were fully recognized in the Actuarial Value of Assets at July 1, 2016. New gains and losses will be recognized over five years beginning July 1, 2017. Unless otherwise specified, the fair value of assets is the market value of assets.

Actuarial Cost Method

Senate Bill 2190 requires the use of the Ultimate Entry Age Method with liabilities allocated from date of entry to expected payment of benefit. Under the Ultimate Entry Age Method, future normal cost for active employees is calculated based on the Fund provisions in effect for the most recently hired employees.

Senate Bill 2190 also requires the use of a 30-year, closed, level percent of payroll amortization period, in which new gain/loss amortization bases are established each year. The Unfunded Actuarial Accrued Liability at July 1, 2016 was amortized as a level percentage of payroll over a closed amortization period of 30 years with payments effective for fiscal year beginning July 1, 2017. Additional actuarial experience losses will be amortized over a closed amortization period of 30 years in future Risk Sharing Valuation Studies. If, in any given year, the Fund experiences an actuarial gain, any such gain will be used to offset the largest outstanding loss amortization base, if applicable.

Appendix A: Summary of Actuarial Methods and Assumptions (continued)

Key Economic Assumptions

Investment Return

Real Rate of Return	4.50%
Price Inflation	2.50%
Total Nominal Rate	7.00%

Expected future investment returns are assumed to be net of investment expenses.

Wage Inflation

3.00%

Payroll Growth Rate

3.00%

Normal Cost Load for Administrative Expenses

1.25% of pensionable payroll[1]

Individual Pay Increase Rate

	(Nominal = Merit + Wage Inflation)	
Age	Nominal	Merit
20	7.00%	4.00%
25	6.25%	3.25%
30	5.50%	2.50%
35	5.00%	2.00%
40	4.00%	1.00%
45	3.70%	0.70%
50	3.40%	0.40%
55	3.00%	0.00%

[1] required by Senate Bill 2190

Appendix A: Summary of Actuarial Methods and Assumptions (continued)

Key Demographic Assumptions

Retirement Rates

Number of Years of Service	Probability of Retiring Within One Year
Less than 25	2.0%[1]
25	2.0%
26	5.5%
27	5.5%
28	5.5%
29	5.5%
30	13.0%
31	15.0%
32	20.0%
33	20.0%
34	20.0%
35	30.0%
36	30.0%
37	40.0%
38	40.0%
39	40.0%
40+	100.0%

DROP Duration

Duration of DROP at Retirement	Percentage of Participants Electing Retirement at the Specified Duration
0	0%
3	0
5	10
8	20
10	45
13	25

[1] participants eligible to enter the DROP in the future are not assumed to retire with less than 25 years of service before age 55

Appendix A: Summary of Actuarial Methods and Assumptions (continued)

Sample Rates

Number of Years of Service at Actual Retirement	Percentage of Participants Retiring with Specific Drop Durations				
	3 yrs.	5 yrs.	8 yrs.	10 yrs.	13 yrs.
20-24	0.0%	0.0%	0.0%	0.0%	0.0%
25-27	0.0%	100.0%	0.0%	0.0%	0.0%
28-29	0.0%	33.3%	66.7%	0.0%	0.0%
30-32	0.0%	13.3%	26.7%	60.0%	0.0%
33-40	0.0%	10.0%	20.0%	45.0%	25.0%

DROP balances for active members are assumed to be paid out over 15 years upon exiting the DROP. DROP balances of members who have left active service are assumed to be paid out over 7.5 years. Future DROP payments are discounted based on the difference between the assumed investment rate of return and the assumed DROP interest crediting rate.

Mortality Rates

Service Retirees and Contingent Annuities

SOA Public Safety (Below-Median, base year 2010) amount weighted tables generationally projected with Mortality Improvement Scale MP-2019. The base table for males is adjusted by 97.2% to reflect credible plan experience.

Survivor Beneficiaries

SOA Public Contingent Survivor (Below-Median, base year 2010) amount weighted tables generationally projected with Mortality Improvement Scale MP-2019. The base table for females is adjusted by 106.0% to reflect credible plan experience.

Disabled Retirees

SOA Public Safety Disabled Retiree (base year 2010) amount weighted tables generationally projected with Mortality Improvement Scale MP-2019.

All others, including active and vested terminated participants

SOA Public Safety (Below-Median, base year 2010) amount weighted tables generationally projected with Mortality Improvement Scale MP-2019.

Appendix A: Summary of Actuarial Methods and Assumptions (continued)

Disability Rates

Graduated rates.

	Sample Rates per 100 Participants
Age	Disability
20	0.45
25	0.45
30	0.45
35	1.00
40	1.00
45	1.00
50	1.00
55	1.00
60	1.00

Percentage of Deaths and Disabilities in the Line of Duty

Age	Death	Disability[1]
25	80%	80%
35	80	80
45	40	80
55	20	80

Termination Rates

Age	Termination Rate
20	2.40%
25	2.40
30	2.40
35	1.50
40	0.75
45	0.75
50	0.00

For members hired prior to July 1, 2017 who are terminating with at least 10 years but less than 20 years of service:

- 80% will elect a contribution refund
- 20% will elect a deferred monthly pension benefit

[1] Percentage of disabilities in the line of duty is assumed to be a flat 80% for all ages. 50% of firefighters who become disabled in the line of duty are assumed to be incapable of performing any substantial gainful activity.

Appendix A: Summary of Actuarial Methods and Assumptions (continued)

Marital Status at Benefit Eligibility

Percentage married

82% of male participants are assumed to be married, and 85% of female participants are assumed to be married.

No beneficiaries other than the spouse assumed.

Age difference

Male participants are assumed to be two years older than wives, and female participants are assumed to be six years younger than their husbands.

Development of Risk Sharing Valuation Study Pay

The Risk Sharing Valuation Study pay is developed by increasing the prior year's pay with the nominal individual pay increase rate. For participants reported with compensation less than $10,000, their compensation is set equal to their most recent annual compensation amount in excess of $10,000.

Age at which Benefits End for Child Beneficiaries

Benefits are assumed to end once the child beneficiary reaches age 23.

Future DROP Returns

Future DROP interest crediting rates are assumed to be equal to 65% of the assumed asset return (currently 65% of 7% equals 4.55%).

Future Cost-of-Living Adjustments

COLAs are assumed to be equal to the assumed asset return less 4.75% (currently 7% minus 4.75% equals 2.25%).

Census Dates

All dates in the census used to calculate liabilities are set as July 1st in the year of the event.

Missing Data Assumptions

Pay for New Hires

None were missing.

Employee Contributions

Based on the prior year's contributions.

Benefits Not Valued

The proportional retirement program between the Houston municipal, police and fire pension funds which allows for combining service credit from two or more City of Houston pension plans was not valued because its impact is expected not to be material.

Summary of Changes from the July 1, 2022 Risk Sharing Valuation Study

None.

Appendix B: Summary of Plan Provisions

Membership

Any firefighter who has not reached the age of 36 at the time he or she first enters employment shall automatically become a participant in the Fund upon completing the training period. Before October 1, 1990, the eligibility age was age 31. Before 1984, participants entered the Fund on January 1 or July 1.

Average Salary

For members hired prior to July 1, 2017, the average of the highest 36 months of pensionable pay (or 78 pay periods). For members hired on or after July 1, 2017, the average of the final 36 months of pensionable pay (or 78 pay periods).

Pensionable Pay

Pensionable pay prior to July 1, 2017 includes base pay and overtime, before reduction for pre-tax employee contributions and salary deferrals. Pensionable pay after July 1, 2017 includes base pay, before reduction for pre-tax employee contributions and salary deferrals.

Standard Service Pension – Members hired prior to July 1, 2017

Eligibility

20 years of service

Benefit

For retirement on or after November 1, 1997 and applicable for service accrued prior to July 1, 2017, 50% of average monthly salary; plus 3% of average monthly salary per year of service in excess of 20 years. For service accrued after July 1, 2017, 2.75% of average monthly salary per year of service for the member's first 20 years of service; plus 2.00% of average monthly salary per year of service in excess of 20 years.

For retirement on or after November 1, 1996 and prior to November 1, 1997, 48.334% of average monthly salary, plus 2.834% of average monthly salary per year of service in excess of 20 years.

For retirement on or after November 1, 1995 and prior to November 1, 1996, 46.667% of average monthly salary, plus 2.667% of average monthly salary per year of service in excess of 20 years.

For retirement on or after September 1, 1991 and prior to November 1, 1995, 45% of average monthly salary, plus 2.5% of average monthly salary per year of service in excess of 20 years, up to 30 years, plus 1.0% of average monthly salary in excess of 30 years.

For retirement on or after September 1, 1989 and prior to September 1, 1991, 45% of average monthly salary, plus 2.5% of average monthly salary per year of service in excess of 20 years.

For retirement on or after September 1, 1987 and prior to September 1, 1989, 45% of average monthly salary, plus 2% of average monthly salary per year of service in excess of 20 years.

For retirement on or after July 1, 1986 and prior to September 1, 1987, 40% of average monthly salary plus 2% of average monthly salary per year of service in excess of 20 years.

For retirement on or after January 1, 1970 and prior to July 1, 1986, 35% of average monthly salary plus 3% of average monthly salary per year of service in excess of salary per year of service in excess of 25 years.

Maximum

For retirement on or after July 1, 2017, none.

For retirement on or after September 1, 1991, 80% of average monthly salary.

For retirement on or after September 1, 1989 and prior to September 1, 1991, 70% of average monthly salary.

For retirement on or after September 1, 1987 and prior to September 1, 1989, 65% of average monthly salary.

For retirements on or after January 1, 1970 and prior to September 1, 1987, 60% of average monthly salary.

In addition, a member will receive a $5,000 lump sum payment upon retirement.

Appendix B: Summary of Plan Provisions (continued)

Standard Service Pension – Members hired on or after July 1, 2017

Eligibility

Age at which the sum of the member's age and service equals 70.

Benefit

2.25% of average monthly salary per year of service for the member's first 20 years of service; plus 2.00% of average monthly salary per year of service in excess of 20 years.

Maximum

80% of average monthly salary.

In addition, a member will receive a $5,000 lump sum payment upon retirement.

Alternate Service Pension

Eligibility

Firefighters who became participants prior to September 1, 1987 and who attain age 50 with 20 years of service will receive the greater of the standard or alternate pension.

Benefit

50% of average monthly salary plus 1% of average monthly salary per year of service after becoming eligible to retire on an alternate pension.

Maximum

65% of average monthly salary.

Supplemental Bonus Check

Supplemental payments totaling up to $5 million will be payable on a prorated basis determined by the Board of Trustees to all retirees and survivors.

Deferred Retirement Option Plan (DROP)

Eligibility

20 years of service. Members hired on or after July 1, 2017 are not eligible to enter DROP.

Benefit

Effective July 1, 2000, eligible participants may elect to participate in the DROP. The member's standard or alternate service pension (whichever is greater) will be calculated based on service and earnings at the time the DROP is elected.

A notional account will be maintained for each DROP participant. This account will be credited with the following amounts while the member is a participant of the DROP:

- The member's monthly retirement pension, including applicable cost-of-living adjustments (no cost-of living adjustments will be granted while a member is a participant in DROP after July 1, 2017),
- The member's contributions to the Retirement Fund contributed prior to July 1, 2017, and
- Investment earnings/losses at the rate of the Retirement Fund's earnings/losses averaged over a five-year period. Effective July 1, 2017, investment earnings will be contributed to a member's DROP account at the rate of 65% of the Retirement Fund's earnings/losses averaged over a five-year period.

A benefit equal to the DROP account balance would be paid at the time the member leaves active service. The payment would be made as a single lump sum or as the member chooses.

Effective on July 1, 2000, a three-year back DROP is available for all eligible participants. The DROP account would be recalculated based on what the account balance would have been had the participant elected the DROP up to 3 years earlier than he/she actually did. The initial DROP entry date cannot be backdated prior to September 1, 1995, or prior to completion of 20 years of credited service, and must be on the first day of the month selected.

Appendix B: Summary of Plan Provisions (continued)

The monthly benefit at actual retirement will increase 2% for every year of DROP participation, not to exceed 10 years, for a participant who has at least 20 years of service as of July 1, 2017.

Members can remain in the DROP for 13 years. If a member remains in active service after 13 years in DROP, no further deposits other than unused leave pay will be made to the DROP account, but the DROP account will continue to accrue interest.

If a DROP participant suffers an on-duty disability resulting in the inability to perform any gainful activity or dies in the line of duty, the death or disability annuity benefit would be calculated as though the participant had not entered the DROP. In addition, the DROP account would be payable to the participant or beneficiary.

Service-Connected Disability Pension

Eligibility

No age or service requirements.

Benefit

50% of average monthly salary, or service pension if greater and eligible. Firefighters who are not capable of performing any substantial gainful activity will receive 75% of average monthly salary, or service pension, if greater and eligible.

In addition, a member will receive a $5,000 lump sum.

Non-Service-Connected Disability Pension

Eligibility

No age or service requirements.

Benefit

25% of average monthly salary, plus 2.5% of average monthly salary per year of service.

Maximum

50% of average monthly salary or service pension, if greater and eligible.

In addition, a member will receive a $5,000 lump sum.

Vested Pension

Eligibility

For members hired prior to July 1, 2017, at least 10 but less than 20 years of service.

Benefit

For members hired prior to July 1, 2017, 1.7% of average monthly salary per year of service payable beginning at age 50. Members receive a refund of contributions without interest in the event of termination before 10 years of service. Members who elect a refund of contributions after attaining 10 years of service receive interest only on contributions made prior to July 1, 2017.

Members hired on or after July 1, 2017 are entitled to a refund of contributions without interest in the event of their termination of employment for any reason other than death.

Death Benefits

Payable as specified below if survived by a spouse, dependent children, or dependent parents. Effective November 1, 1997 dependent children can continue to receive benefits between the ages of 18 and 22 if they are in college.

Non-service-connected

Monthly benefit that would have been payable had the participant retired for non-service-connected disability on the date of his or her death (or service pension if greater).

Appendix B: Summary of Plan Provisions (continued)

Postretirement

Monthly benefit payable to the participant prior to his or her death. Effective July 1, 1998, a "graded" postretirement death benefit is payable to a surviving spouse if the retiree was not married at the time of retirement. This "graded" benefit is equal to 20% of the postretirement death benefit for each year of marriage to a maximum 100% after five years of marriage.

Preretirement

In the case of the death of an active firefighter in the line of duty, eligible survivor will receive a benefit equal to 100% of the decedent's average monthly salary. Refund of contributions made if no eligible survivors. If death occurs after 10 years of service, interest is credited on the contributions at the flat rate of 5% not compounded. If death occurs before 10 years of service, no interest is credited.

Lump sum

A one-time $5,000 lump sum death benefit for any active or retired firefighter. This benefit applies to active members, current retirees, and disabled participants.

Additional Benefit

Effective on or after July 1, 2001, an extra monthly benefit of $150 is payable for life to any retired or disabled member or to an eligible survivor of a deceased member. This benefit is not subject to the postretirement adjustment.

Excess Benefit

Benefit equal to the excess of any members' standard service pension benefit over the limit imposed by Section 415 of the code.

Postretirement Adjustment

Prior to October 1, 1990

Pensions adjusted each year based on changes in the CPI-U, but not below original amount or above original amount increased 3% each year, not compounded.

Pension adjustments for participants who retire after March 1, 1982 begin at age 55.

Pension adjustments begin immediately for participants whose benefits become payable on or after July 1, 1986 and are based upon 30 or more years of service.

On or after October 1, 1990 and prior to November 1, 1997

Pensions adjusted each year based on changes in the CPI-U. The adjustment is based on the amount of benefits payable at the time of adjustment. The maximum annual increase shall be 3% of the benefits payable at the time of adjustment.

Pension adjustments begin immediately for participants whose benefits become payable on or after July 1, 1986 and are based upon 30 or more years of service.

On or after November 1, 1997 and prior to October 1, 2017

Pensions adjusted each year at a fixed rate of 3%. The adjustment is based on the amount of benefits payable at the time of adjustment.

Pension adjustments for participants who retire or terminate with a vested benefit after March 1, 1982 begin at age 48. Pension adjustments begin immediately for participants who become disabled and cannot perform any substantial gainful activity (current and future) and qualify for general on-duty disability benefits. Participants whose benefits become payable on or after July 1, 1986 and are based upon 30 or more years of service are also eligible for pension adjustments to begin immediately.

On or after October 1, 2017 and prior to October 1, 2019

Pensions adjusted each year at a rate equal to the Fund's most recent five fiscal years' smoothed return minus 5% (but not less than 0% nor greater than 4%). The adjustment is based on the amount of benefits payable at the time of adjustment. Pension adjustments only paid to members who are at least 70 years old.

Appendix B: Summary of Plan Provisions (continued)

On or after October 1, 2019

Pensions adjusted each year at a rate equal to the Fund's most recent five fiscal years' smoothed return minus 4.75% (but not less than 0% nor greater than 4%). The adjustment is based on the amount of benefits payable at the time of adjustment. Pension adjustments only paid to members who are at least 70 years old in October 2019. Pension adjustments only paid to members who are at least 55 years old after October 2019.

Contribution Rates

Members

10.5% of salary effective July 1, 2017.

City

Effective for fiscal year ending 2018, city contribution rates will be made in accordance with the annual Risk Sharing Valuation Study. The city contribution rate in any fiscal year will not be greater than the city contribution rate projected in the initial Risk Sharing Valuation Study for that fiscal year plus 5%. The city contribution rate in any fiscal year will not be less than the city contribution rate projected in the initial Risk Sharing Valuation Study for that fiscal year minus 5%.

Appendix C: Participant Information

Summary of Active Participants as of July 1, 2023

Attained Age	Under 1	1 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 & up	Total
Under 25	24	55	-	-	-	-	-	-	-	-	79
Avg. Pay	51,493	53,477	-	-	-	-	-	-	-	-	52,874
25 to 29	38	158	53	-	-	-	-	-	-	-	249
Avg. Pay	52,441	54,716	67,545	-	-	-	-	-	-	-	57,099
30 to 34	19	134	259	61	-	-	-	-	-	-	473
Avg. Pay	48,006	55,442	69,163	76,021	-	-	-	-	-	-	65,310
35 to 39	5	50	284	176	96	2	-	-	-	-	613
Avg. Pay	44,748	56,058	67,807	75,602	80,755	82,476	-	-	-	-	70,974
40 to 44	-	1	111	132	297	94	-	-	-	-	635
Avg. Pay	-	59,394	67,169	75,559	81,441	84,527	-	-	-	-	78,146
45 to 49	-	-	1	69	298	235	15	-	-	-	618
Avg. Pay	-	-	76,782	73,238	81,159	83,315	97,084	-	-	-	81,474
50 to 54	-	-	-	4	131	169	16	-	-	-	320
Avg. Pay	-	-	-	79,406	79,617	83,267	91,601	-	-	-	82,141
55 to 59	-	-	-	-	2	43	6	-	1	-	52
Avg. Pay	-	-	-	-	104,111	79,784	75,715	-	107,120	-	80,776
60 to 64	-	-	-	-	-	-	1	-	-	-	1
Avg. Pay	-	-	-	-	-	-	84,460	-	-	-	84,460
65 to 69	-	-	-	-	-	-	-	-	-	-	-
Avg. Pay	-	-	-	-	-	-	-	-	-	-	-
70 & up	-	-	-	-	-	-	-	-	-	-	-
Avg. Pay	-	-	-	-	-	-	-	-	-	-	-
Total	86	398	708	442	824	543	38	-	1	-	3,040
Avg. Pay	50,749	54,970	68,196	75,313	81,024	83,227	91,069	-	107,120	-	73,466
		Average Age:	40.03			Average Service:	12.60				

Appendix C: Participant Information (continued)

Summary of DROP Participants as of July 1, 2023

Attained Age	Under 1	1 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 & up	Total
Under 25	-	-	-	-	-	-	-	-	-	-	-
Avg. Pay	-	-	-	-	-	-	-	-	-	-	-
25 to 29	-	-	-	-	-	-	-	-	-	-	-
Avg. Pay	-	-	-	-	-	-	-	-	-	-	-
30 to 34	-	-	-	-	-	-	-	-	-	-	-
Avg. Pay	-	-	-	-	-	-	-	-	-	-	-
35 to 39	-	-	-	-	-	-	-	-	-	-	-
Avg. Pay	-	-	-	-	-	-	-	-	-	-	-
40 to 44	-	-	-	-	-	4	-	-	-	-	4
Avg. Pay	-	-	-	-	-	83,632	-	-	-	-	83,632
45 to 49	-	-	-	-	-	32	28	-	-	-	60
Avg. Pay	-	-	-	-	-	81,771	85,390	-	-	-	83,460
50 to 54	-	-	-	-	-	45	176	37	1	-	259
Avg. Pay	-	-	-	-	-	82,871	89,099	95,661	85,623	-	88,941
55 to 59	-	-	-	-	-	29	130	68	11	-	238
Avg. Pay	-	-	-	-	-	82,245	86,195	90,401	93,168	-	87,238
60 to 64	-	-	-	-	-	-	35	25	10	5	75
Avg. Pay	-	-	-	-	-	-	85,931	87,756	98,159	92,700	88,621
65 to 69	-	-	-	-	-	-	-	4	-	4	8
Avg. Pay	-	-	-	-	-	-	-	93,988	-	80,340	87,164
70 & up	-	-	-	-	-	-	-	-	-	1	1
Avg. Pay	-	-	-	-	-	-	-	-	-	86,520	86,520
Total	-	-	-	-	-	110	369	134	22	10	645
Avg. Pay	-	-	-	-	-	82,414	87,494	91,467	95,094	87,138	87,707
			Average Age:	54.71			Average Service:	27.73			

Appendix C: Participant Information (continued)

Summary of Active and DROP Participants as of July 1, 2023

Attained Age	Under 1	1 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 & up	Total
Under 25	24	55	-	-	-	-	-	-	-	-	79
Avg. Pay	51,493	53,477	-	-	-	-	-	-	-	-	52,874
25 to 29	38	158	53	-	-	-	-	-	-	-	249
Avg. Pay	52,441	54,716	67,545	-	-	-	-	-	-	-	57,099
30 to 34	19	134	259	61	-	-	-	-	-	-	473
Avg. Pay	48,006	55,442	69,163	76,021	-	-	-	-	-	-	65,310
35 to 39	5	50	284	176	96	2	-	-	-	-	613
Avg. Pay	44,748	56,058	67,807	75,602	80,755	82,476	-	-	-	-	70,974
40 to 44	-	1	111	132	297	98	-	-	-	-	639
Avg. Pay	-	59,394	67,169	75,559	81,441	84,490	-	-	-	-	78,180
45 to 49	-	-	1	69	298	267	43	-	-	-	678
Avg. Pay	-	-	76,782	73,238	81,159	83,130	89,469	-	-	-	81,650
50 to 54	-	-	-	4	131	214	192	37	1	-	579
Avg. Pay	-	-	-	79,406	79,617	83,184	89,308	95,661	85,623	-	85,183
55 to 59	-	-	-	-	2	72	136	68	12	-	290
Avg. Pay	-	-	-	-	104,111	80,775	85,733	90,401	94,331	-	86,079
60 to 64	-	-	-	-	-	-	36	25	10	5	76
Avg. Pay	-	-	-	-	-	-	85,890	87,756	98,159	92,700	88,566
65 to 69	-	-	-	-	-	-	-	4	-	4	8
Avg. Pay	-	-	-	-	-	-	-	93,988	-	80,340	87,164
70 & up	-	-	-	-	-	-	-	-	-	1	1
Avg. Pay	-	-	-	-	-	-	-	-	-	86,520	86,520
Total	86	398	708	442	824	653	407	134	23	10	3,685
Avg. Pay	50,749	54,970	68,196	75,313	81,024	83,090	87,828	91,467	95,617	87,138	75,959
Average Age: 42.60							Average Service: 15.25				

Historical Active and DROP Participant Data

Valuation Date	Number of Active and DROP Participants	Annual Payroll ($000)	Average Annual Pay ($)	% Increase in Average Pay
7/1/2013	3,745	253,709	67,746	1.7%
7/1/2014 *	N/A	N/A	N/A	N/A
7/1/2015	3,938	273,073	69,343	N/A
7/1/2016	4,094	288,136	70,380	1.5%
7/1/2017	4,094	261,881	63,967	-9.1%
7/1/2018	3,975	264,747	66,603	4.1%
7/1/2019	3,933	266,480	67,755	1.7%
7/1/2020	3,703	252,974	68,316	0.8%
7/1/2021	3,671	251,353	68,470	0.2%
7/1/2022	3,660	263,374	71,960	5.1%
7/1/2023	3,685	279,909	75,959	5.6%

* No valuation was performed as of 7/1/2014

Appendix C: Participant Information (continued)

Summary of Inactive Participants as of July 1, 2023

	Number	Average Age	Annual Benefits ($000)	Average Annual Benefits
Benefits in Pay Status				
Retirees	2,534	68.7	$ 149,547	$ 59,016
Beneficiaries	703	70.8	35,984	51,187
Disabled Participants	292	66.2	16,930	57,979
Total	3,529		$ 202,461	$ 57,371
Deferred Benefits				
Vested Terminated Participants	155	38.5	$ 456[1]	$ 13,020[2]
Beneficiaries	N/A	N/A	N/A	N/A
Disabled Participants	N/A	N/A	N/A	N/A
Total	155		$ 456	$ 13,020

[1] Does not include $3,731,085 in pending refunds.

[2] Average is over 35 members not due pending refunds

Appendix C: Participant Information (continued)

Participant Data Reconciliation

	Active	DROP	Deferred Vested	Retired	Total
Number of members as of July 1, 2022	3,029	631	144	3,490	7,294
Change in status during the plan year:					
Actives who retired	(22)	(58)		80	0
Actives who terminated	(32)		32		0
Actives who entered DROP	(74)	74			0
Inactives who returned to service		1	(1)		0
Inactives who retired			(3)	3	0
Participants who became disabled	(4)	(1)		5	0
No longer members due to:					
Death	(4)	(1)		(102)	(107)
Non-vested terminations					0
Child attained cut-off age				(8)	(8)
Benefits no longer due	(29)		(17)		(46)
New member due to:					
Initial membership	176			5	181
Death of another member				55	55
Correction		(1)		1	0
Number of members as of July 1, 2023	3,040	645	155	3,529	7,369

Appendix C: Participant Information (continued)

Retiree and Beneficiaries Added to and Removed from Rolls

Period Ended	Added to Rolls		Removed from Rolls		Rolls at the End of the Year			
	Number	Annual Benefits ($000)	Number	Annual Benefits ($000)	Number	Annual Benefits ($000)	Percentage Increase in Annual Benefits	Average Annual Benefit
December 31, 1978	72	719	23	76	794	4,294	15.8%	5,408
December 31, 1979	67	719	21	83	840	5,008	16.6	5,962
December 31, 1980	33	473	23	84	850	5,498	9.8	6,468
December 31, 1981	61	862	38	159	873	6,097	10.9	6,983
December 31, 1982	63	644	26	171	910	6,772	11.1	7,442
December 31, 1983	54	605	39	207	925	7,403	9.3	8,003
June 30, 1984[1]	41	619	17	98	949	3,952	6.8	8,328
June 30, 1985	75	968	53	290	971	8,432	6.7	8,684
June 30, 1986	54	752	38	243	987	9,550	13.3	9,676
June 30, 1987	76	1,101	33	235	1,030	10,522	10.2	10,215
June 30, 1988	121	2,002	38	311	1,113	12,754	21.2	11,459
June 30, 1989	74	1,306	42	299	1,145	14,032	10.0	12,255
June 30, 1990	111	1,996	37	288	1,219	16,428	17.1	13,477
June 30, 1991	129	1,784	38	401	1,310	17,888	8.9	13,665
June 30, 1992	78	1,588	44	401	1,344	19,866	11.1	14,781
June 30, 1993	82	1,717	48	585	1,378	21,516	8.3	15,614
June 30, 1994	112	2,006	58	660	1,432	23,297	8.3	16,269
June 30, 1995	87	1,728	28	353	1,491	25,142	7.9	16,863
June 30, 1996	67	1,402	56	660	1,502	26,379	4.9	17,563
June 30, 1997	56	1,050	37	487	1,521	27,581	4.6	18,133

[1] Six-month period

Appendix C: Participant Information (continued)

Retirees and Beneficiaries Added to and Removed from Rolls (continued)

	Added to Rolls		Removed from Rolls		Rolls at the End of the Year			
Period Ended	Number	Annual Benefits ($000)	Number	Annual Benefits ($000)	Number	Annual Benefits ($000)	Percentage Increase in Annual Benefits	Average Annual Benefit
June 30, 1998	54	1,064	43	477	1,532	28,675	4.0	18,717
June 30, 1999	64	1,840	28	551	1,568	30,233	5.4	19,281
June 30, 2000	95	2,364	71	1,167	1,592	34,583	14.4	21,723
June 30, 2001	127	3,581	47	775	1,672	38,347	10.9	22,935
June 30, 2002	172	5,493	61	998	1,783	44,300	15.5	24,846
June 30, 2004[1]	377	N/A	109	N/A	2,051	57,676	30.2	28,121
June 30, 2005	135	4,353	53	1,107	2,133	62,882	9.0	29,481
June 30, 2006	195	7,231	60	1,437	2,268	70,420	12.0	31,050
June 30, 2007	106	3,822	59	1,407	2,315	74,948	6.4	32,375
June 30, 2008	166	9,334	21	828	2,460	98,216	31.0	39,925
June 30, 2009	133	3,369	43	2,081	2,550	94,536	-3.7	37,073
June 30, 2010	162	7,159	103	2,886	2,609	96,580	2.2	37,018
June 30, 2011	181	8,905	64	1,489	2,726	106,832	10.6	39,190
June 30, 2012	141	7,042	77	2,398	2,790	114,176	6.8	40,923
June 30, 2013	170	8,286	54	1,837	2,906	124,080	8.7	42,698
June 30, 2014	162	7,772	70	1,401	2,998	132,749	7.0	44,279
June 30, 2015	147	7,273	85	383	3,060	140,629	5.9	45,957
June 30, 2016	138	7,496	60	2,302	3,138	150,005	6.7	47,803
June 30, 2017	207	11,829	95	3,667	3,250	162,671	8.4	50,053
June 30, 2018	150	8,353	88	2,546	3,312	169,601	4.3	51,208
June 30, 2019	114	6,432	81	3,818	3,345	173,433	2.3	51,848
June 30, 2020	148	8,388	83	3,821	3,410	179,050	3.2	52,508
June 30, 2021	127	6,730	96	4,510	3,441	182,964	2.2	53,172
June 30, 2022	137	7,716	88	4,286	3,490	192,873	5.4	55,265
June 30, 2023	149	7,851	110	5,343	3,529	202,461	5.0	57,371

[1] Two-year period

Appendix D: Risk Information

Actuarial Standard of Practice No. 51 Disclosures

Funding future retirement benefits prior to when those benefits become due involves assumptions regarding future economic and demographic experience. These assumptions are applied to calculate actuarial liabilities and the corresponding funded status of the Fund. However, to the extent future experience deviates from the assumptions used, variations will occur in these calculated values. These variations create risk to the Fund. Understanding the risks to the funding of the Fund is important. Therefore, an Actuarial Standard of Practice (ASOP) has been adopted. Actuarial Standard of Practice No. 51 (ASOP 51) requires certain disclosures of potential risks to the Fund and provides useful information for intended users of actuarial reports that determine Fund contributions or evaluate the adequacy of specified contribution levels to support benefit provisions.

Under ASOP 51, risk is defined as the potential of actual future measurements deviating from expected future measurements resulting from actual future experience deviating from actuarially assumed experience.

It is important to note that not all risk is negative but all risk should be understood and accepted based on knowledge, judgment and educated decisions. Future measurements may deviate in ways that produce positive or negative financial impacts to the Fund.

In the actuary's professional judgment, the following risks may reasonably be anticipated to significantly affect the plan's future financial condition:

- Investment risk – the risk that assets will have a lower return than expected
- Contribution risk – the risk that the actual contribution made will be different than the recommended contribution in the Risk Sharing Valuation Study
- Salary increase risk – the risk that actual salary increases will be higher than expected
- Longevity and other demographic risk – the risk that mortality or other demographic experience will be different from expected

The following information is provided to comply with ASOP 51 and furnish beneficial information on potential risks to the Fund. This list is not all-inclusive; it is an attempt to identify the most significant risks and how those risks might affect the results shown in this report.

Note that ASOP 51 does not require the actuary to evaluate the ability or willingness of the Fund sponsor to make contributions to the Fund. In addition, this Risk Sharing Valuation Study report in not intended to provide investment advice or to provide guidance on the management or reduction of risk. Buck welcomes the opportunity to assist in such matters as part of a separate project or projects utilizing the appropriate staff and resources for those objectives.

Appendix D: Risk Information (continued)

Assessment of Risks

- Investment return - One type of investment risk is that assets materially underperform expected return.

    - Lower assets mean higher unfunded liability and larger contribution amounts. For example, if returns on assets at fair value were 1% less than actual, this would reduce the actuarial value of assets by approximately $10,200,000, which would increase the estimated City Contribution for Fiscal Year 2025 contribution by $1,874,000.

    - The five-year smoothing method used for the actuarial value of assets defers a portion of investment gain/loss in each of the previous five years. If the assumed return on assets consistently overestimates the actual return on assets, the actuarial value of assets will be consistently higher than the true fair value. Consistent underestimation of the unfunded liability can prevent the Fund from achieving anticipated funding goals even when all minimum required contributions are made timely.

  The Fund invests in a diversified portfolio with the objective of maximizing investment returns at a reasonable level of risk. However, Actuarial Standard of Practice No. 4 (“ASOP 4”) requires the actuary to disclose a Low-Default-Risk Obligation Measure (“LDROM”) of plan liabilities and provide commentary to help intended users of this report understand the significance of the measure with respect to funded status, contributions, and participant benefit security.

  The LDROM is to be based on “discount rates derived from low-default-risk fixed income securities whose cash flows are reasonably consistent with the pattern of benefits expected to be paid in the future.” The LDROM shown here represents what the Fund’s liability would be if the Fund invested its assets solely in a portfolio of high-quality bonds whose cash flows approximately match future benefit payments. Consequently, the difference between the LDROM and the Actuarial Accrued Liability can be thought of as representing the expected taxpayer savings from investing in the Fund’s diversified portfolio compared to investing only in high-quality bonds. It may also be thought of as the cost of reducing investment risk. In the case of this Fund, the net savings to taxpayer (or net cost of reducing investment risk) is the increase in liability due to the use of the lower discount rate offset by a decrease in liability due to expectation of lower benefit delivery (i.e., lower future cost-of-living adjustments and lower interest crediting to DROP accounts)

  As of July 1, 2023, the LDROM is $5.43 billion and is based on a 5.38% interest rate. Assumed future DROP returns and future cost-of-living adjustments are adjusted to reflect a 5.38% assumed asset return. Specifically, the assumed future Cost-of-Living Adjustments was changed from 2.25% to 0.63% and the assumed future DROP crediting rate from 4.55% to 3.50% for the LDROM. All other assumptions are the same as those used for funding as shown in this report.

  The interest rate used for the LDROM was determined by calculating a single equivalent discount rate using projected benefit payments based and the Buck Above Median Yield Curve as of June 30, 2023. For purposes of selecting the interest rate for the LDROM, the projected benefit payments are based on the assumed future DROP returns and future cost-of-living adjustments based on the Fund’s diversified portfolio. Note the interest rate used for the LDROM is based on bond yields applicable at the time of the measurement and will therefore vary for different measurement dates.

Appendix D: Risk Information (continued)

Actuaries play a role in helping determine funding methods and policies that can achieve affordable and appropriate contributions and risk management. The funded status based on Actuarial Accrued Liability and the Actuarially Determined Contributions are determined using the expected return on assets which reflects the actual investment portfolio. Since the assets are not invested in an all-bond portfolio, the LDROM does not indicate the Fund's funded status or progress, nor does it provide information on necessary plan contributions.

With respect to security of participant benefits, if this plan were to be funded on an LDROM basis, participant benefits currently accrued as of the measurement date may be considered more secure as investment risk may be significantly reduced. However, the assets being invested in a diversified portfolio does not mean the participant benefits are not secure. Security of participant benefits relies on a combination of the assets in the plan, the investment returns generated on those assets, and the promise of future contributions from the plan sponsors. Reducing investment risk by investing solely in bonds may significantly increase Actuarially Determined Contributions and therefore increase contribution risk by decreasing the ability of the plan sponsor to make necessary contributions to fund the benefits. Unnecessarily high contribution requirements in the near term may not be affordable and could imperil plan sustainability and benefit security. Participant benefits will remain secure if reasonable and appropriate contributions with managed risk are calculated and paid.

- Asset growth does not keep pace with liability increases over time - Another type of investment risk is that asset returns do not keep pace with liability growth over time. Fund liabilities are based on the discounted present value of anticipated future benefit payments. That present value grows at the discount rate as time passes and the future payouts move closer. If investment returns are lower than the rates used to discount liabilities, Fund liabilities will increase more rapidly than Fund assets. Over extended periods of time, such as those involved in pension obligations, these discrepancies can accumulate to significant shortfalls.

- Market shocks or regime changes - Invested assets are subject to significant disruptions from market shocks, such as the financial crisis of 2008/2009, or as a result of systemic regime changes that persist for years, such as historically low interest rates over the recent decade. These shocks or changes will increase the risk that investments will underperform the expected return. They may also lead to a need to lower the long-term return on assets assumption. Since the long-term return on asset assumption is also used for discounting liabilities a lower assumption will increase liabilities and recommended contributions. Currently the investment return assumption used for funding is set by Senate Bill 2190.

- Salary increases - Fund costs are sensitive to salary increases, with higher rates leading to higher obligations. This is because benefits at retirement are pay related, meaning that higher pay generates higher benefit levels at retirement. Compensation increases greater than assumed lead to actuarial losses since projected benefits are higher than predicted by assumed rates.

- The Fund provides certain eligible members to enter the Deferred Retirement Option Program (DROP). It allows members who elect DROP the option to continue to work beyond their standard or alternative service eligibility date and convert part of their retirement benefit into a lump sum.

Appendix D: Risk Information (continued)

- A DROP presents a risk due to large lump sums paid, particularly during economic downturns. Another investment consideration is the need for liquid assets to pay DROP lump sums as employees and retirees may elect to receive their DROP account at any time creating either the necessity to maintain larger allocations of cash to pay these large lump sum benefits or force the Fund to sell securities or other illiquid investments at inopportune times. These payments are less predictable than monthly retirement benefits and may cause some losses.

- The DROP provided by the Fund also presents risk due to investment return provided to the DROP account. The Fund provides DROP investment return at the rate of 65% of the Fund's earnings/losses averaged over a five-year period. When the average is a loss, the DROP account is only decreased by 65% of the loss rate and the Fund has to absorb the remaining 35%. However, this risk is also mitigated by the 65% factor - when the average is an earning, the Fund gets to keep the extra 35% earnings.

- Longevity and other demographic risks - Potential that mortality or other demographic experience (retirement, turnover, disability) may be different than expected. As the Fund matures and the majority of participants reach (or have reached) retirement eligibility, risks associated when participants retire can become significant. The Fund provides for unreduced early retirement benefits after meeting certain age and service conditions. These benefits are highly subsidized and thus can be significantly more valuable than normal retirement benefits and regular early retirement benefits. The demographic assumptions used to determine the Risk Sharing Valuation Study attempt to account for unreduced early retirement based on historical plan experience. However, due to the unpredictable nature of such benefits, future experience could differ significantly from past experience.

  In addition to the risk that participants will not retire as expected, the Fund is subject to longevity risk - the risk that participants will live longer (or shorter) than expected. Cost of living adjustments (COLA) provided by the Fund increase longevity risk because if a participant lives longer than expected more COLA will be provided.

- Declining active workforce - since the City's contributions are based on a percentage of participant's salaries, a declining active workforce will have the impact of the Fund potentially receiving lower contributions. In addition, if the required dollar amount of contributions remain level or increase, a declining active workforce will result in higher contribution rates in order to meet required contribution levels.

- Contribution risk – risk of not contributing an actuarially determined contribution. Based on the statutory requirements of Senate Bill 2190 it is our understanding that the actual City contribution rate may be established as an average of the contribution rates shown in this report and those shown in the Risk Sharing Valuation Study prepared by the City's actuary. If future contributions are established in this manner at levels below those presented in this report, the Fund may not be expected to achieve a fully funded position over the 30-year time horizon as contemplated in the statute based on the data, assumptions and methods set forth in this report.

Appendix D: Risk Information (continued)

- Ultimate Entry Age Normal Cost Method (Ultimate EANC) - The Ultimate EANC method is a variation of EANC, where the normal cost is calculated for each active member based on the Fund provisions applicable to new members of the Fund. As the Fund has a lower annual cost for new members hired on or after July 1, 2017, use of the Ultimate EANC method lowers the normal cost and increases the actuarial accrued liability, as compared to EANC. Since normal costs under the Ultimate EANC method are not directly related to the individual expected costs of accruing benefits, its use may lead to a higher likelihood of benefits being due prior to being fully funded than other methods, like the more traditional Entry Age Normal Cost Method (EANC). If the EANC method was used, and if the unfunded liability was amortized over 15 years beginning July 1, 2024, we estimate the City Contribution Rate would be 21.43%, compared to the 26.11% rate determined under the Ultimate EANC method. Additionally, the funded ratio under the EANC method would be 97.2%, compared to 96.0% under the Ultimate EANC method.

Historical Results

The following table shows selected historical values of key Risk Sharing Valuation Study measures. These items illustrate how actual volatility has impacted the Fund in recent years and gives additional context to the risks described above. Further information can be found in the RSVS reports for each year.

($1,000) RSVS Date	07/01/19	07/01/20	07/01/21	07/01/22	Current RSVS 07/01/23
Liabilities and Assets at Valuation Date					
• Actuarial Accrued Liability (AAL)	5,057,759	4,932,307	4,881,608	5,075,516	5,277,944
- Normal Cost	70,345	61,078	60,907	63,222	66,552
• Actuarial Value of Assets (AVA)	4,190,934	4,251,851	4,550,468	4,843,737	5,064,764
- Funded Percent (AVA)	83%	86%	93%	95%	96%
• Market Value of Assets (MVA)	4,237,692	4,102,932	5,256,763	5,093,736	5,109,178
- Funded Percent (MVA)	84%	83%	108%	100%	97%
Contributions and Disbursements for Plan Year Ended	2019	2020	2021	2022	2023
• Actuarially Determined Contribution (ADC)	99,676	96,332	88,104	78,571	72,358
• Actual Contribution	89,897	83,837	77,495	81,351	72,475
• Disbursements	278,615	336,153	291,767	275,842	288,676
Rates of Return for Plan Year Ended	2019	2020	2021	2022	2023
• Assumed	7.00%	7.00%	7.00%	7.00%	7.00%
• AVA	8.10%	6.90%	11.60%	10.20%	8.50%
• MVA	5.40%	2.00%	33.40%	0.00%	4.00%
Maturity Measures at Valuation Date					
• Payroll	272,498	259,235	243,045	255,100	269,091
- Asset Volatility Ratio (AVA / Payroll)	15.4	16.4	18.7	19.0	18.8
- Liability Volatilty Ratio (AAL / Payroll)	18.6	19.0	20.1	19.9	19.6
• Retiree and Beneficiary (In-pay) Liability	3,445,240	3,428,579	3,454,553	3,618,126	3,748,695
- Percent of Total Liability	68%	70%	71%	71%	71%
• Contributions minus Disbursements in Prior Year	(188,718)	(252,316)	(214,272)	(194,491)	(216,201)
- Percent Market Value of Assets	-4.5%	-6.1%	-4.1%	-3.8%	-4.2%

Appendix D: Risk Information (continued)

Commentary on Plan Maturity Measures

The ratio of retired life actuarial accrued liability to total actuarial accrued liability

A mature plan will often have a ratio above 60 - 65 percent. A higher percentage will generally indicate an increased need for asset / liability matching due to inability to absorb volatility in future returns. Also, an increasing percentage may indicate a need for a less risky asset allocation which may lead to a lower long-term return on assets assumption and increased costs.

The ratio of cashflow to fair value of assets

The cashflow as a percentage of assets means the Fund may need to invest in more liquid assets to cover the benefit payments. More liquid assets may not garner the same returns as less liquid assets and therefore increase the investment risk. However, there may already be enough liquid assets to cover the benefit payments, less investment return is needed to cover the shortfall, or only a small portion of assets will need to be converted to cash. Therefore, the investment risk is likely not amplified at this time. This maturity measure should be monitored for continual upward trend with greater magnitude.

The ratio of actuarial value of assets to participant payroll

Plans that have higher asset-to-payroll ratios experience *more* volatile employer contributions (as a percentage of payroll) due to investment return. For example, if lower than expected asset return increases the unfunded liability of two plans by the same percent the plan with a higher assets-to-payroll ratio may experience higher contribution volatility than a plan with a lower asset-to-payroll ratio.

City of Houston
HFRRF
Final Risk Sharing Valuation Study
As of July 1, 2023

December 19, 2023

DEFINITI

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(281) 296-1107
definiti.com

December 19, 2023

Mr. William Jones
Director, Finance Department
City of Houston
611 Walker
Houston, TX 77002

Re: HFRRF Final Risk Sharing Valuation Study as of July 1, 2023

Dear Will:

Texas Revised Statutes article 6243e.2(1) (the Article) sets forth requirements for a Risk Sharing Valuation Study (RSVS) of the Houston Firefighters' Relief and Retirement Fund (HFRRF). The purpose of this study is to determine the City Contribution Rate for the following fiscal year. Definiti LLC was engaged by the City of Houston ("City") to perform this Risk Sharing Valuation Study as of July 1, 2023 as the Municipal Actuary. This report provides the results of the Study and is organized as follows:

- Section 1 – Risk Sharing Valuation Study Results
- Section 2 – Actuarial Exhibits
- Section 3 – Summary of Plan Provisions
- Section 4 – Actuarial Methods and Assumptions
- Section 5 – Summary of Valuation Data
- Section 6 – Data Sources
- Section 7 – ASOP 4 Measuring Pension Obligations and Contributions
- Section 8 – ASOP 51 Assessment and Disclosure of Risk

The HFRRF actuary published a proposed RSVS dated November 22, 2023. That report was then provided to Definiti on the same day by the HFRRF actuary. Definiti published the proposed RSVS, dated November 27, 2023, using the Actuarial Data provided and plan provisions described therein. As the City Contribution Rate from each RSVS differed by more than 2 percentage points, the 20 business-day reconciliation process began, and an attempt to determine the reason for difference and potentially close the gap between the two sets of results occurred.

During the reconciliation process, it was determined the primary reason for the difference in the results of the two 2023 Proposed Risk Sharing Valuation Studies was the assumed timing of the COLA with Definiti's model having the COLA occur at the end of the fiscal year and HFFRF's actuary reflecting the COLA on October 1st of each year.

While adjusting the timing of the COLA to be effective on October 1st of each year is expected to bring both results to within 2 percentage points, such a change would be considered an assumption change. Based on the statute, changes in the assumptions occur in conjunction with an experience study. Since the timing of the COLA was not one of the assumptions explicitly mentioned in the last experience study and it is common to assume a COLA occurs a year from the valuation date, no changes to the proposed RSVS were recognized at this time.

Based on the results of the two RSVS, the City Contribution Rates from the proposed RSVS will be averaged. Regardless of the averaging, the final City Contribution Rate will once again be less than the Corridor Minimum, and the City will contribute the Corridor Minimum for the fiscal year ending June 30, 2025.

Definiti received Actuarial Data as defined in Section 1-a of the Article and required by Section 13C(b) of the Article. Definiti conducted the RSVS using the Actuarial Data provided and plan provisions as summarized in this report. The analysis presented in this report is based on the interest rate assumption and actuarial cost and asset methods prescribed by the Article. All other actuarial methods and assumptions summarized in this report were adopted in conjunction with the 2021 HFRRF Experience Study.

Based on the results of the prior year's RSVS and §13E(b)(2)(B) of the Article, the City Contribution Rate for fiscal year ending June 30, 2024, determined in the prior year's RSVS, equals the Corridor Minimum rate of 26.89% of payroll. Per §13E(c)4 of the Article, the amortization bases in the prior year's RSVS were accelerated as needed to raise the prior year's calculated City Contribution Rate up to the Corridor Minimum. These adjustments are required to be made after the original RSVS report is published. For this reason, the accelerated bases created in prior years, shown in this year's RSVS report, do not align with the amounts expected based on the prior year's RSVS report.

The actual costs, City Contribution Rates, and other results could be materially different from those described in this report in the future if actual plan experience differs significantly from the underlying valuation basis. Differences could occur for a number of reasons such as plan experience differing from the underlying demographic and economic assumptions or changes in plan provisions. Due to the limited scope of this report, analysis of the potential range of such future measurements has not been performed.

The results in this report and any measures of funded status are predicated on the notion of the Fund's ongoing operation and should not be relied upon for assessing the sufficiency of plan assets for settlement of plan termination liabilities. The results are also based on Winklevoss' ProVal actuarial software.

Mr. William Jones
December 19, 2023

The information contained in this report was prepared as requested by the City of Houston and solely for the purpose of satisfying the RSVS requirements of the Article and should not be used for any other purpose. As significantly different results from those contained in this report may be needed for other purposes, this report should only be provided to other parties in its entirety.

The signing actuary for this report is a member of the Society of Actuaries and other professional actuarial organizations and meets the "Qualification Standards for Actuaries Issuing Statements of Actuarial Opinion." The undersigned is available to answer questions regarding the information contained in this report or to provide further explanations or details as needed.

Respectfully submitted by Definiti LLC

David A. Sawyer, FSA EA MAAA
Director of Actuarial Services

Risk Sharing Valuation Study Results

Risk Sharing Corridors

The table below contains the Corridor Midpoint, along with the corresponding Minimum and Maximum Contribution Rates using a 5-percentage point Corridor Margin as specified in the Article. Based on Definiti's proposed RSVS results, the City Contribution Rate for FY 2025 would be 23.88% of pensionable payroll, which is below the Corridor Minimum. However, the Final City Contribution Rate will be determined by averaging this result with the Fund Actuary's City Contribution Rate.

FY	Corridor Midpoint	Corridor Minimum	Corridor Maximum	Definiti Calculated City Contribution Rate	Final City Contribution Rate *
2018	31.89%	26.89%	36.89%	26.98%	31.89%
2019	31.89%	26.89%	36.89%	28.33%	32.99%
2020	31.89%	26.89%	36.89%	27.52%	32.34%
2021	31.89%	26.89%	36.89%	26.19%	31.89%
2022	31.89%	26.89%	36.89%	25.18%	31.89%
2023	31.89%	26.89%	36.89%	22.29%	26.89%
2024	31.89%	26.89%	36.89%	22.96%	26.89%
2025	31.89%	26.89%	36.89%	23.88%	
2026	31.89%	26.89%	36.89%		
2027	31.89%	26.89%	36.89%		
2028	31.89%	26.89%	36.89%		
2029	31.89%	26.89%	36.89%		
2030	31.89%	26.89%	36.89%		
2031	31.89%	26.89%	36.89%		
2032	31.89%	26.89%	36.89%		
2033	31.89%	26.89%	36.89%		
2034	31.89%	26.89%	36.89%		
2035	31.89%	26.89%	36.89%		
2036	31.89%	26.89%	36.89%		
2037	31.89%	26.89%	36.89%		
2038	31.89%	26.89%	36.89%		
2039	31.89%	26.89%	36.89%		
2040-2047	31.89%	26.89%	36.89%		
2048	15.92%	10.92%	20.92%		

* Final City Contribution Rates for FY 2018 – 2024 were based on an average of Municipal and Fund Actuaries' RSVS and then subjected to the Article's corridor. Please note that the amortization bases were accelerated after the July 1, 2022 RSVS report was published, as required by the Article, to raise the 2024 FY Final City Contribution Rate to the corridor minimum.

Risk Sharing Valuation Study Results

City Contribution Rate

The City Contribution Rate is equal to the sum of the Employer Normal Cost Rate and the Amortization Rate from any Liability Layers. The Employer Normal Cost Rate is equal to the Gross Normal Cost Rate plus Administrative Expense Rate less the Member Contribution Rate.

FY	Employer Normal Cost Rate	Liability Layer Amortization Rate *	Estimated City Contribution Rate
2018	14.74%	12.24%	26.98%
2019	14.72%	13.61%	28.33%
2020	14.68%	12.84%	27.52%
2021	14.67%	11.52%	26.19%
2022	15.10%	10.08%	25.18%
2023	15.58%	11.31%	26.89%
2024	15.31%	11.58%	26.89%
2025	14.95%	8.93%	23.88%
2026			
2027			
2028			
2029			
2030			
2031			
2032			
2033			
2034			
2035			
2036			
2037			
2038			
2039			
2040			
2041			
2042			
2043			
2044			
2045			
2046			
2047			
2048			

* The FY 2024 liability layer amortization rate was 7.65% in the prior year's RSVS report. After accelerating the amortization bases as required by the Article, this amount increased to 11.58% of payroll.

Actuarial Exhibits

2.1. Fair Value of Assets

	July 1, 2022	July 1, 2023
A. Fair Value of Plan Assets		
1. Cash & Short Term Investments	$ 186,629,043	$ 175,253,537
2. Fixed Income	585,130,674	871,062,907
3. Equity Securities	1,649,941,112	1,399,404,602
4. Alternative Investments	2,206,724,256	2,256,827,907
5. Real Estate	341,345,504	396,153,655
6. Land, Building, Etc.	3,711,416	3,420,819
7. Accrued Interest & Dividends	3,496,723	7,135,219
8. Accrued City Contributions	6,241,794	2,808,300
9. Accrued Member Contributions	2,310,227	1,096,507
10. Other	108,205,710	(3,985,323)
11. Total Fair Value	$ 5,093,736,459	$ 5,109,178,130

B. Change in Fair Value	Change
1. Contributions	
a. Members	$ 31,972,752
b. City	72,474,989
c. Total	$ 104,447,741
2. Disbursements	
a. Benefit Payments	$ (283,094,996)
b. Administrative Expenses	(5,580,983)
c. Total	$ (288,675,979)
3. Investment Return	
a. Interest and Dividends	$ 25,711,174
b. Realized and Unrealized Gain/(Loss)	183,013,606
c. Plan Investment Expenses	(9,054,871)
d. Total Return	$ 199,669,909
4. Net Change	$ 15,441,671
5. Average Rate of Return	
a. Average Asset Value	$5,001,622,340
b. Income Net of Investment Expenses	$ 199,669,909
c. Annual Rate of Return - Net of Investment Expenses	3.99%
d. Annual Rate of Return - Gross	4.18%

2.2. Actuarial Value of Assets

1. Market Value of Assets at beginning of year	$ 5,093,736,459
2. Net Cash Flow	
a. Contributions	$ 104,447,741
b. Benefit Disbursements	(283,094,996)
c. Administrative Expenses	(5,580,983)
d. Net Cash Flow [2.a. + 2.b. + 2.c.]	$ (184,228,238)
3. Expected Investment Return [1. x 0.07] + [2.d. x ((1.07)^.5-1)]	$ 350,222,619
4. Expected Market Value of Assets at end of year [1. + 2.d. + 3.]	$ 5,259,730,840
5. Market Value of Assets at end of year	$ 5,109,178,130
6. Investment Gain/(Loss) [5. - 4.]	$ (150,552,710)

7. Schedule of Actuarial Investment Gains (Losses)

Fiscal Year End	Initial Actuarial Gain (Loss)	Five-Year Recognition	Deferred Gain (Loss) As of July 1, 2023
2020	$ (204,992,393)	$(163,993,914)	$ (40,998,479)
2021	$1,057,369,547	$ 634,421,728	$ 422,947,819
2022	$ (361,823,483)	$(144,729,393)	$ (217,094,090)
2023	$ (150,552,710)	$ (30,110,542)	$ (120,442,168)
Total	$ 340,000,961	$ 295,587,879	$ 44,413,082

8. Market Value as of July 1, 2023	$ 5,109,178,130
(Gain) Loss to be Recognized in Future Years	(44,413,082)
Actuarial Value as of July 1, 2023 [5. - 7.]	$ 5,064,765,048
9. Actuarial Value of Assets, Prior Year	$ 4,843,737,612
10. Rate of Return on Actuarial Value of Assets (Net of Investment Expenses)	8.5%

Actuarial Exhibits

2.3. Actuarial Accrued Liability

	July 1, 2022		July 1, 2023
A. Discount Rate	7.0%		7.0%
B. Actuarial Accrued Liability			
1. Active	$1,465,486,678		$1,508,841,211
2. Terminated Vested	$7,871,265		$8,798,584
3. Disabled	$234,250,307		$234,442,586
4. Retired	$3,328,874,359		$3,461,018,284
5. Total	$5,036,482,609		$5,213,100,665

C. Change in Actuarial Accrued Liability	2023 Fiscal Year
1. Benefits Accumulated	$64,693,570
2. Benefits Paid	($283,094,996)
3. Decrease in Discount Period	$345,039,017
4. Plan Experience (Gain) / Loss	$49,980,465
5. Net Change	$176,618,056

D. Actuarial Value of Assets	$ 4,843,737,612		$ 5,064,765,048
E. Unfunded Actuarial Liability	$192,744,997		$148,335,617
F. Total Normal Cost % of Payroll[1]	25.81%		25.45%
G. Member Contribution % of Payroll	10.50%		10.50%
H. Employer Normal Cost Rate [F - G]	15.31%		14.95%

[1] Includes administrative expense load

Actuarial Exhibits

2.4. Liability Layers

Valuation Date Base Established	Initial Amount of Liability Layer (BOY)	Remaining Liability to be Amortized as of 7/1/2023	Remaining Amortization Period as of 7/1/2023	Amortization Amount for FY 2025
07/01/2016	$601,731,984	$577,251,191	5	$126,537,956
07/01/2017	$47,533,433	$53,698,333	24	$3,347,360
07/01/2018	($47,351,521)	($49,495,877)	5	($10,847,029)
07/01/2019	($71,518,992)	($73,942,458)	5	($16,204,736)
07/01/2020	($98,576,898)	($100,939,710)	5	($22,121,583)
07/01/2021	($148,110,442)	($151,528,915)	5	($32,966,252)
07/01/2022	($73,926,171)	($79,101,003)	5	($15,377,945)
07/01/2023	($27,605,944)	($27,605,944)	5	($6,608,943)
Total		$148,335,617		$25,758,828
Projected Payroll for Fiscal Year +1				$288,305,421
Amortization Payments as a % of Projected Payroll				8.93%

Please note the Initial Liability Layer was accelerated, as required by §13E(c)4 of the Article, to raise the prior year's calculated Final City Contribution Rate to the corridor minimum. Because all subsequent gain layers are required to be treated the same as the Initial Liability Layer, those bases were accelerated as well. This process is done after the RSVS reports for a particular year are issued, so the adjusted bases shown above for years prior to July 1, 2023 differ from the amounts expected from the 2022 RSVS report. Similarly, because the City Contribution Rate is again less than the Corridor Minimum and the funded status is between 90% - 100%, the bases shown above may be accelerated prior to the next RSVS.

Summary of Plan Provisions

Eligibility and Participation	Any firefighter shall automatically become a participant in the plan upon completing the training period, as long as he or she has not reached age 36.
Final Average Pay (FAP)	For members hired prior to July 1, 2017, the average of the highest 78 bi-weekly payroll periods of salary, before reduction for pre-tax employee contributions and salary deferrals. Overtime and any excess of the salary earned on the basis of the member's appointed position over the salary of the member's highest tested rank are excluded for pay periods after July 1, 2017. For members hired after July 1, 2017, the average of the final 78 bi-weekly payroll periods of salary, before reduction for pre-tax employee contributions and salary deferrals, and excluding overtime and any excess of the salary earned on the basis of the member's appointed position over the salary of the member's highest tested rank.
Credited Service	Elapsed time from date of hire, for all periods of service classified as full-time, fully paid, active duty employment with the City of Houston Fire Department.
Retirement Benefit	
Eligibility	20 years of service if hired prior to July 1, 2017. Attainment of age plus service of at least seventy (Rule of 70) for those hired on or after July 1, 2017.
Amount	Prior to July 1, 2017, 2.5% of FAP times credited service up to 20 years of service, plus 3.0% of FAP for credited service in excess of 20 years, up to a maximum pension of 80% of FAP. In addition, the member will receive a $5,000 lump sum. On or after July 1, 2017, 2.75% per year prior to 20 years of service and 2.00% thereafter for those hired prior to July 1, 2017 (no maximum). For those hired on or after that date, 2.25% per year up to 20 years of service and 2.00% thereafter, up to a maximum of 80% of FAP. Percentages earned prior to July 1, 2017 are retained. $5,000 lump sum payable upon retirement if member has completed 20 years of service, regardless of date of hire.

Termination Benefit

Eligibility	Termination of employment prior to satisfying the retirement eligibility requirements.
Amount	Hired prior to July 1, 2017 with less than 10 years of service: Lump sum refund of member contributions without interest. Hired prior to July 1, 2017 with at least 10 but less than 20 years of service: Choice of • Refund of contributions (with 5% interest, not compounded, on contributions made prior to July 1, 2017), or • Monthly benefit of 1.7% of final average pay per year of service, payable at age 50 Hired on or after July 1, 2017: Lump sum refund of member contributions without interest.

On-Duty Disability

Eligibility	No age or service requirements.
Amount	Firefighters who are not capable of performing their normal and customary firefighter duties receive the greater of their accrued retirement benefit or 50% of FAP (75% of FAP for firefighters not capable of performing any substantial gainful activity). In addition, the member will receive a $5,000 lump sum. This benefit was assumed to be payable immediately, even if the member does not yet meet retirement eligibility.

Off-Duty Disability

Eligibility	No age or service requirements.
Benefit	Firefighters who are not capable of performing their normal and customary firefighter duties receive the greater of their accrued retirement benefit or 25% of FAP plus 2.5% of FAP per year of service (up to a maximum of 50% of FAP). In addition, the member will receive a $5,000 lump sum. This benefit was assumed to be payable immediately, even if the member does not yet meet retirement eligibility.

Active Member Death

Eligibility	No age or service requirements.
Duty Related Benefit	100% of FAP. In addition, the beneficiary will receive a $5,000 lump sum.
Non-Duty Related Benefit	Greater of the accrued retirement benefit or Off-Duty Disability benefit. In addition, the beneficiary will receive a $5,000 lump sum.
Allocation to Beneficiaries	The benefit amount above is payable to a surviving spouse, or allocated 50% to the surviving spouse with the remaining 50% divided equally among any eligible children, or if no surviving spouse divided equally among any eligible children, or otherwise paid to any eligible parents if no surviving spouse or eligible children. An eligible child enrolled in college must be unmarried.

Please Note: Members who become disabled or die from heart or lung disease or cancer must have at least six years of service to receive a disability or death benefit. They must also have passed a physical upon beginning employment or prior to the claimed disability or death which did not reveal evidence of the condition.

Retired Member Death

Eligibility	Retired and receiving monthly pension.
Benefit	100% of monthly pension the retired member was receiving plus a $5,000 lump sum death benefit.
Allocation to Beneficiaries	The annuity benefit above is payable to a surviving spouse, or allocated 50% to the surviving spouse with the remaining 50% divided equally among any eligible children, or if no surviving spouse divided equally among any eligible children, or otherwise paid to any eligible parents if no surviving spouse or eligible children. An eligible child enrolled in college must be unmarried.

Supplemental Annuity

An extra monthly benefit of $150 is payable for life to any retired or disabled member or to an eligible survivor of a deceased member.

Supplemental Bonus Checks

Annual payments of up to $5 million are provided to retirees and beneficiaries.

Cost of Living Adjustment

Beginning at age 55, a retired member or beneficiary will receive an adjustment reflecting the Fund's 5-year average investment return less 4.75%, with a floor of 0% and a cap of 4%. Prior to July 1, 2020, no COLA is provided to members under age 70. Notwithstanding the foregoing, prior to July 1, 2019, COLA provided to members who are at least 70 years of age is the Fund's 5-year average investment return less 5%, with a floor of 0% and a cap of 4%.

DROP

Hired prior to July 1, 2017: Upon reaching retirement eligibility, members may enter the Deferred Retirement Option Plan (DROP). The member's monthly annuity is added to a notional account. Interest is credited on the account using 65% of the 5-year average of the Fund's rate of return, with a minimum of 2.5%. COLAs are not applied to the monthly benefit until the member exits DROP, and member contributions are not credited to the DROP account.

For those eligible to retire prior to July 1, 2017, upon exiting the DROP for retirement, the member's monthly benefit is increased by 2% of the original monthly benefit for each year the member remained in DROP, up to 10 years.

Please note: for accumulation to July 1, 2017, DROP accounts include the value of COLAs after age 48 at 3.0% per year, as well as member contributions of 9% of total pay.

Hired on or after July 1, 2017: not available.

PROP

Prior to July 1, 2017, a member could elect to have all or a portion of his or her monthly annuity credited to the Post Retirement Option Plan (PROP) account, along with interest. On and after July 1, 2017, the interest credit is 65% of the 5-year average of the Fund's rate of return, with a minimum of 2.5% (same as DROP crediting rate). Additionally, no new amounts are eligible for deferral into the PROP.

Contribution Rates

Members	10.50% of pensionable pay.
City	The City Contribution Rate from the RSVS applied to pensionable payroll.

Actuarial Methods and Assumptions

Actuarial Cost Methods

Measurement Date	Census data as of July 1, 2023. Impact of plan changes measured on future accruals only; no impact to accruals through the valuation date, including for back-DROP accruals based on dates before the valuation date.
Actuarial Value of Assets	Five-year smoothing of future gains and losses. 20% of each gain or loss will be recognized each year. Gains and losses are based on the difference between the actual and expected fair market value each year. The expected value is based on the assumed rate of return on investments and is net of investment expenses.
Actuarial Cost Method	The Ultimate Entry Age Normal Actuarial Cost Method As used in the City Funding Policy, a method under which the actuarial present value of all potential future projected benefits of each individual included in the valuation is calculated, assuming continued service and pay increases. The *normal cost* is calculated as the average uniform percentage of payroll which, if applied to the compensation of each participant during the entire period of anticipated covered service, would meet the cost of all benefits payable based on benefits provisions for new hires. The portion of the actuarial present value of future benefits not provided for at the valuation date by the present value of future normal costs is called the *actuarial accrued liability*.

Key Economic Assumptions

Interest Rate	7.0%, as required by Senate Bill 2190
Inflation	2.50%
Wage Inflation	3.00%
Payroll Growth	3.00%
Cost of Living Adjustment	2.25%
Administrative Expenses	1.25% of payroll

Individual Pay Increase Rate

Age	*Assumed Increase*
20	7.00%
25	6.25%
30	5.50%
35	5.00%
40	4.00%
45	3.70%
50	3.40%
55	3.00%

DROP Interest Crediting Rate 4.55%.

Demographic Assumptions

Mortality Rates:

Active and Vested Terminated Members — SOA Public Safety below-median amount weighted tables with longevity improvement projected using Scale MP-2019.

Retired Members — SOA Public Safety below-median amount weighted tables with longevity improvement projected using Scale MP-2019. The base table for males is adjusted 97.2% to reflect credible plan experience.

Survivor Beneficiaries — SOA Public Safety below-median amount weighted tables with longevity improvement projected using Scale MP-2019. The base table for females is adjusted 106.0% to reflect credible plan experience.

Disabled Pensioners — SOA Public Safety Disabled Retiree amount weighted tables with longevity improvement projected using Scale MP-2019.

Retirement Rates

Years of Service	*Probability of Retiring Within One Year*
20 – 25	2.0%
26 - 29	5.5%
30	13.0%
31	15.0%
32 – 34	20.0%
35 - 36	30.0%
37 – 39	40.0%
40+	100.0%

DROP eligible members are assumed not to retire with less than 25 years of service.

Members currently in DROP are assumed to retire according to the retirement rates, with 100% retirement assumed after thirteen years in DROP.

The following table shows, for sample years of service, the assumed probability of the active members not currently in DROP having been in the DROP for a certain number of years at retirement:

	Percent Electing Specified DROP Period at Retirement				
Years of Service at Retirement	**3 Years**	**5 Years**	**8 Years**	**10 Years**	**13 Years**
20 – 24	0.0%	0.0%	0.0%	0.0%	0.0%
25 – 27	0.0%	100.0%	0.0%	0.0%	0.0%
28 -29	0.0%	33.3%	66.7%	0.0%	0.0%
30 – 32	0.0%	13.3%	26.7%	60.0%	0.0%
33 - 40	0.0%	10.0%	20.0%	45.0%	25.0%

Actuarial Methods and Assumptions

Disability Rates

Disability per 100	
Age	**All**
20	0.45
25	0.45
30	0.45
35	1.00
40	1.00
45	1.00
50	1.00
55	1.00
60	1.00

Percentage of Deaths and Disabilities in the Line of Duty

Age	Death	Disability *
25	80%	80%
35	80%	80%
45	40%	80%
55	20%	80%

* 50% of Line of Duty Disabilities are assumed to result in members being incapable of performing any substantial gainful activity.

Termination Rates

Sample Rates

Age	Termination Rate
20	2.40%
25	2.40%
30	2.40%
35	1.50%
40	0.75%
45	0.75%
50	0.00%

For participants hired prior to July 1, 2017 with at least 10 years of service but not yet eligible to retire, 80% are assumed to elect a contribution refund, and 20% are assumed to elect a deferred monthly benefit payable at age 50.

Actuarial Methods and Assumptions

Percentage married	82% of male and 85% of female participants are assumed to be married. No beneficiaries other than the spouse assumed.
Age difference	Female spouses are assumed to be two years younger than the retired male member and male spouses are assumed to be six years older than the retired female member.
Child Benefits	For children under the age of 23, the benefit was assumed to cease at age 23. Children over the age of 23 were assumed to be disabled and were measured assuming a lifetime annuity.
Development of Valuation Pay	Valuation pay is projected by increasing the prior year's pay with the individual pay increase rate.
Payment of DROP Balances	Installments over 15 years for active members and 7.5 years for inactive members.
Funding Policy	The City is assumed to contribute the City Contribution Rate, subject to the Corridor, from the prior year. The actuarially determined City Contribution Rate is measured as the normal cost rate, plus the administrative expenses rate, plus 30-year amortization rate of the Unfunded Actuarial Accrued Liability (UAAL) from the initial RSVS, plus the amortization rates of all subsequently-determined Liability Layers, less the member contribution rate, adjusted with interest to mid-year. The closed amortization rates for the Liability Layers are calculated as a level percent of pay. The initial amortization period for a Liability Loss Layer is 30 years. The initial amortization period for a Liability Gain Layer is equal to the remaining amortization period for the largest Liability Loss Layer.
Benefits Not Valued	Due to limitations of the data received, no adjustment has been made for the difference between pay based on the appointed position and pay based on the highest tested rank. Additionally, no marital status was provided for child beneficiaries, so the provision against married children in college receiving a survivor benefit was not valued.
Change in Assumptions	There were no changes to the assumptions since the prior year.

Summary of Valuation Data

	July 1, 2022	July 1, 2023
A. Active Members Not in DROP		
1. Number	3,029	3,040
2. Valuation payroll	$211,056,630	$223,337,436
3. Average pay	$69,679	$73,466
4. Average age	40.0	40.0
5. Average service	12.5	12.6
B. Active Members in DROP		
1. Number	631	645
2. Valuation payroll	$52,316,033	$56,570,740
3. Average pay	$82,910	$87,707
4. Average age	54.4	54.7
5. Average service	27.6	27.7
C. Terminated Vested		
1. Number	31	35
2. Total benefits	$409,000	$432,005
3. Average Annual benefits	$13,194	$12,343
D. Disabled		
1. Number	298	292
2. Total benefits	$16,656,000	$16,884,000
3. Average Annual benefits	$55,893	$57,822
E. Retired		
1. Number	2,521	2,534
2. Total benefits	$143,594,000	$149,760,004
3. Average Annual benefits	$56,959	$59,100
F. Beneficiaries		
1. Number	671	703
2. Total benefits	$32,668,500	$35,880,007
3. Average Annual benefits	$48,686	$51,038

Notes:

1. DROP Balance values not shown.
2. Terminated Vested count does not include 113 members due refunds totaling $3,338,000 for July 1, 2022 and 120 members due refunds totaling $3,734,000 for July 1, 2023.
3. Payroll and Pay values exclude overtime.
4. Date fields provided to Definiti by HFRRF only included the year (no month or day).
5. Benefits received for the valuation were rounded to the nearest $1,000.

Data Sources

Data and inputs used in this report were provided from the following sources:

- Census data for all members was provided on September 29, 2023. It is our understanding that this data is substantially the same as that used by the HFRRF actuary for their Risk Sharing Valuation Study. As the data provided to Definiti does not contain the month for any dates, we have assumed all dates are July 1st of the respective year. Because the benefit provisions differ by the date of hire, some members may be measured under the wrong provisions. In addition, the monthly benefits provided to Definiti were rounded to the nearest $1,000 which also creates a source of difference between the data. Definiti is following the provisions of the Article, but we are unable to determine the magnitude of this difference without more precise data.

- The DROP balances for active members were provided in the Actuarial Data. The aggregate DROP/PROP balance for inactive members was provided by the City in a draft of the FY2023 financial statements.

- The fair value of assets of $5,093,736,459 as of June 30, 2023 was provided in a draft of the HFRRF financial statements.

- The Fiscal Year 2024 payroll used was $279,908,176, which was based on the census data as of June 30, 2023 increased with one year of salary scale. The Fiscal Year 2025 payroll is equal to the Fiscal Year 2024 payroll increased with one year of payroll growth.

- The provisions of the Article are contained in the enrolled text of Senate Bill 2190, which was signed by the Governor on May 31, 2017.

ASOP 4 Measuring Pension Obligations and Determining Pension Plan Costs or Contributions

Actuarial Standards of Practice (ASOP) exist to provide guidance on the techniques, applications, procedures, and methods that reflect appropriate actuarial practices. Periodically, these ASOPs are updated\changed to meet changing times. ASOP No. 4 Measuring Pension Obligations and Contributions was recently amended to require additional calculations and disclosures. Based on the new requirements there are a few new disclosures required for this valuation including a new measure called the Low Default Risk Obligation Measure (LDROM), a reasonable Actuarially Determined Contribution (ADC), and commentary on the adequacy of the current funding policy. These new disclosures do not change the existing funding valuation measurements, but they are intended to provide additional information to the users of the report.

LDROM

The LDROM measure is a measurement of the Benefit Obligation using a low-default risk measure. One approach for this measure is to assume the investment policy was changed such that all assets were invested in instruments with a low probability of default. As the HFRRF COLA and DROP interest rate are linked to the investment returns, such a change in the investment policy would impact those assumptions as well.

For the LDROM measurement, it was assumed that the discount rate would be 4.9%, the COLA assumption would be 0.9%, and the DROP interest crediting rate would be 3.6%. The discount rate was based on the June 30, 2023 FTSE Pension Liability Index rounded to the nearest 5 basis point interval, and the other two assumptions are reasonable estimates based on the system earning 4.9%. Because of the risk sharing COLA and DROP provisions, the impact of the reduction in future investment returns is partially offset by a reduction in the future COLA and DROP interest crediting rate.

As expected, because a lower discount rate was used, the LDROM Actuarial Accrued Liability measure is higher than the one used for the Funding Valuation. As shown below, the LDROM is $0.591 billion higher (11.3% increase) than the AAL from the RSVS.

($000)

July 1, 2023	ASOP No. 4 LDROM	RSVS	Dollar Difference	Percent Difference
Actuarial Accrued Liability	$5,803,753	$5,213,101	$590,652	11.3%
Discount Rate	4.90%	7.00%		

As noted above, the LDROM measure is a required disclosure, but the funded status of the plan and contribution requirements are determined using the expected rate of return, currently 7.0%. As the 7.0% assumption is based on HFRRF's actual asset allocation as described in the investment policy statement, it is a more appropriate measure for assessing the long-term actuarial position. The security of the system's benefit promise is determined by current assets held in trust as well as future contribution and investment returns.

ASOP 4 Measuring Pension Obligations and Determining Pension Plan Costs or Contributions

Reasonable Actuarially Determined Contribution (ADC)

ASOP 4 defines a reasonable ADC and requires the disclosure of a separate ADC if the current ADC does not satisfy all the reasonability requirements. For this year's report, an ADC was determined using the same assumptions and methods used for the RSVS with the following modifications:

- Individual Entry Age Normal (EAN) Cost Method (rather than Ultimate EAN)
- 20 Year UAAL amortization period

Based on the above method, the City Contribution Rate would be 18% of payroll compared to 23.88% of payroll from the RSVS. If the application of the Corridor was then applied to these results, the City would still contribute the Corridor Minimum of 26.89% of payroll for the fiscal year ending June 30, 2025.

Adequacy of the Funding Policy

The current funding policy is based on a combination of the actuarially determined City Contribution Rate (CCR) and the Article's Corridor structure. As the City Contribution Rate is calculated to cover the normal cost plus fully amortize the Unfunded Actuarial Liability over a 5-year period, it is a reasonable calculation. In addition, the application of the Corridor which has resulted in contributions in excess of the CCR has contributed to a funded status that has been increasing in recent years. Based on its design as well as its application, the funding policy is expected to be adequate to satisfy the Pension Obligations.

ASOP 51 Assessment and Disclosure of Risk

The measurement of Pension Obligations and Actuarially Determined Contributions requires assumptions about future economic and demographic variables. The events and outcomes identified below are some of the risks associated with these measurements and how they may impact the pension obligations, funded status, and the adequacy of the funding policy. The assessment and disclosure of these risks and the actual future results may reasonably be expected to differ.

Investment Risk - As the return on the plan trust assets is subject to market return, should the actual rate of return be lower than the expected return the cost of the plan will rise and vice versa.

Asset/Liability Mismatch Risk - The changes in assets are not directly tied to the changes in the value of liabilities in magnitude or direction.

Longevity and other Demographic Risks - Cessation from employment due to termination, disability, death, or retirement may not directly align with the assumptions used to value the Actuarial Accrued Liability (AAL). Actual demographic experience of the plan population may increase or decrease the future measurement of the AAL.

Payroll Risk – The funded status and future Actuarially Determined Contributions Rates (ADCR) are subject to payroll risk. Payroll lower than expected can result in future increases in the ADCR required to amortize the Unfunded Actuarial Accrued Liability and vice versa.

Contribution Risk - The City and members are assumed to make the statutorily required contributions and this valuation has not considered the possibility of unpaid contributions. If contributions are less than expected, the funded status will likely decrease over time. Due to the all the risks mentioned above, even making the statutorily required contributions does not fully guarantee the benefit security.

Understand that the above risks may not be independent of one another. Thus, it is important to discuss any known upcoming changes in the City's financials and the impact on the Fund to better identify associated risks. Any impending changes should be discussed as soon as possible, so corresponding measures may be taken to align the pension plan liabilities with these variations.

Also understand that this valuation did not assess the likelihood or consequences of potential future changes in applicable law that would impact future benefits or funding of the plan. Should applicable law be changed, these changes will be addressed in separate actuarial communications.

ASOP 51 Assessment and Disclosure of Risk

Historical Results

The following information summarizes some of the historical RSVS measurements. This information may be helpful in better understanding the risks of sponsoring this defined benefit pension plan.

Actuarial Liabilities and Assets

The numerical results in this section provides funded status progress since July 1, 2017. Over this period, the favorable investment returns exceeded any unexpected growth in the Actuarial Accrued Liability (AAL) due to experience and assumption changes resulting in a reduction in the Unfunded AAL over this period.

Cash Flows

Negative cash flows indicate benefit payments and expenses exceed the contributions coming into the trust. Negative cash flows are common for mature plans like HFRRF, but this may require liquidation of higher returning investments at inopportune times impacting the investment return. As noted on the next page, the cash flows have been negative in each of the last four years.

Rates of Return

The trust assets are invested in a diversified portfolio. The results of the RSVS assume the trust earns 7% per year over the long-term future, but actual annual returns will differ from the 7% assumption. The historical returns provide information on how these returns have differed from the assumption in recent years. As noted above, returns above the 7% assumption reduce the long-term cost and vice versa.

Maturity Measures

This section summarizes several maturity measures related to payroll and the inactive members. The ratio of the asset measure to payroll provides information on contribution volatility as it relates to asset returns. The higher the ratio, the larger the increase/decrease in contributions (as a % of payroll) are for unfavorable/favorable investment experience compared to the 7% return assumption.

The ratio of the number of active members to the number of inactive members is an important measure of the plan maturity. This ratio will typically decrease as the plan matures over time. As the ratio of active to inactive members decreases, larger increases in contribution rates (as a % of payroll) are typically required to amortize the same percentage increase in UAAL. The ratio of inactive AAL to total AAL is a similar measure of the plan maturity. As the percentage of the inactive member AAL increases, larger increases in contribution rates are typically required to amortize the same percentage increase in UAAL. As plans mature, the contribution volatility for these mature plans becomes more dependent on the investment returns than contribution amounts.

ASOP 51 Assessment and Disclosure of Risk

Historical Results

The table below shows historical measures from the prior Risk Sharing Valuation Studies. This information demonstrates trends in the Plan's funded status, information on the cash flows, volatility of the asset returns and several maturity measures.

($1,000)

Actuarial Liabilities and Assets (BOY - 7/1)	2017	2018	2019	2020	2021	2022	2023
Fair Value of Assets (FVA)	$ 4,025,090	$ 4,170,354	$ 4,237,692	$ 4,102,932	$ 5,256,763	$ 5,093,736	$ 5,109,178
Actuarial Value of Assets (AVA)	$ 3,883,807	$ 4,027,078	$ 4,190,934	$ 4,251,850	$ 4,550,468	$ 4,843,738	$ 5,064,765
Actuarial Accrued Liability (AAL)	$ 4,513,234	$ 4,619,041	$ 4,714,719	$ 4,677,483	$ 4,825,083	$ 5,036,483	$ 5,213,101
Funded Status (AVA/AAL)	86.1%	87.2%	88.9%	90.9%	94.3%	96.2%	97.2%
Unfunded AAL (AAL - AVA)	$ 629,427	$ 591,963	$ 523,785	$ 425,633	$ 274,615	$ 192,745	$ 148,336
Total Normal Cost as % of Payroll	25.22%	25.18%	25.17%	25.60%	26.08%	25.81%	25.45%
Cash Flows (EOY - 6/30)							
Contributions (City + Member)	$ 119,061	$ 118,632	$ 124,178	$ 117,278	$ 107,368	$ 112,293	$ 104,448
Disbursements	$ (256,590)	$ (295,674)	$ (278,615)	$ (336,153)	$ (291,767)	$ (275,842)	$ (288,676)
Positive/(Negative) Cash Flows	$ (137,529)	$ (177,042)	$ (154,437)	$ (218,875)	$ (184,399)	$ (163,549)	$ (184,228)
- as % of Fair Value of Assets	-3.4%	-4.2%	-3.6%	-5.3%	-3.5%	-3.2%	-3.6%
Rates of Return (EOY - 6/30)							
Assumed Rate	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%
AVA	8.0%	8.4%	8.1%	6.9%	11.6%	10.2%	8.5%
FVA	11.8%	8.2%	5.4%	2.0%	33.4%	0.0%	4.0%
Maturity Measures (BOY - 7/1)							
Payroll	$ 289,947	$ 260,345	$ 272,498	$ 259,235	$ 243,008	$ 255,100	$ 269,524
- FVA/Payroll	13.9	16.0	15.6	15.8	21.6	20.0	19.0
- AVA/Payroll	13.4	15.5	15.4	16.4	18.7	19.0	18.8
- AAL/Payroll	15.6	17.7	17.3	18.0	19.9	19.7	19.3
- UAAL/Payroll	2.2	2.3	1.9	1.6	1.1	0.8	0.6
Inactive Member Measures							
- # of Actives/# of Inactives	125.5%	119.2%	116.8%	107.7%	105.8%	103.9%	103.4%
- Inactive AAL/Total AAL	68.5%	69.4%	69.3%	72.0%	70.3%	70.9%	71.1%