ACTUARIAL

- SECTION 4 -

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HMEPS
HOUSTON MUNICIPAL EMPLOYEES PENSION SYSTEM

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November 20, 2020

Board of Trustees
Houston Municipal Employees Pension System
1201 Louisiana
Suite 900
Houston, TX 77002

Subject: Actuarial Valuation as of July 1, 2020 with RSVS

Dear Members of the Board:

This actuarial valuation, which includes the Risk Sharing Valuation Study (RSVS, or sometimes referred to as the actuarial valuation or valuation in the report) describes the current actuarial condition of the Houston Municipal Employees Pension System (HMEPS), determines the City Contribution Rate, and analyzes changes in this calculated contribution rate. The results presented herein may not be applicable for other purposes. Valuations are prepared annually, as of July 1, the first day of the HMEPS plan year. This report was prepared at the request of the Board and is intended for use by the HMEPS staff and those designated or approved by the Board. This report may be provided to parties other than HMEPS staff only in its entirety and only with the permission of the Board, or as required by law.

FINANCING OBJECTIVES AND FUNDING POLICY

Based on the changes to the HMEPS statute (revised statute), the employer contribution is now comprised of two pieces. The first piece is the amortization of the Legacy Liability as of July 1, 2016 determined as part of the July 1, 2016 Initial Risk Sharing Valuation Study (Initial RSVS). The Legacy Liability is amortized over a 30-year period beginning on July 1, 2017. These amortization payments are fixed and grow at the assumed payroll growth rate of 2.75%. The second part of the contribution is the City Contribution Rate determined by the valuation. The City Contribution Rate becomes effective twelve months after the valuation date, i.e., the rate determined by this July 1, 2020 actuarial valuation will be used by the Board when establishing the City Contribution Rate for the year beginning July 1, 2021 and ending June 30, 2022.

The contribution rate for fiscal year 2020 was determined by the July 1, 2018 actuarial valuation. In addition to the Legacy Liability payment of $130,945,824, the City contributed 8.32% of payroll in fiscal year 2020. The contribution rate for fiscal year 2021 was determined by the July 1, 2019 actuarial valuation. The City will contribute a Legacy Liability payment of $134,546,835 and 8.36% of payroll in fiscal year 2021.

5605 North MacArthur Boulevard | Suite 870 | Irving, Texas 75038-2631

Based on the revised statute, the City contribution rate for FY 2022 is 8.41% of pay, which is estimated to be $55.5 million based on an estimated payroll of $659.9 million. The City contribution amount for FY 2022 for the Legacy Liability amortization payment as determined in the Initial RSVS is $138.2 million.

Each future valuation will establish either a liability gain layer or a liability loss layer. These layers will represent unexpected increases/decreases in the unfunded actuarial accrued liability (after subtracting out any remaining Legacy Liability or any remaining prior years' liability layers). Liability loss bases will be amortized over a 30-year period beginning one year after the valuation date. Liability gain bases will be amortized over the same period as the largest liability loss base, or 30 years if there is no liability loss base. All bases are amortized using a level percentage of payroll amortization method. This year a liability loss layer of $38.1 million is being established. It will be amortized over a 30-year period beginning one year after the valuation date.

The contribution rate and liabilities are computed using the Entry Age Normal actuarial cost method. The employer contribution is the sum of two pieces: the Legacy Liability amortization payment (City Contribution Amount), and the City Contribution Rate. The City Contribution Rate is comprised of two pieces: (i) the employer normal cost rate and (ii) the amortization of the liability gain/loss layers. Both the normal cost rate and the amortization of the liability gain/loss layers are determined as a level percentage of pay. Except as discussed above, each liability gain/loss layer is amortized over a 30-year period beginning one year after the valuation date for which the layer was established. The amortization rate is adjusted for the one-year deferral in contribution rates.

PROGRESS TOWARD REALIZATION OF FINANCING OBJECTIVES

The funded ratio (the ratio of the actuarial value of assets to the actuarial accrued liability) is a standard measure of a plan's funded status. In the absence of benefit improvements, it should increase over time, until it reaches 100%. The funded ratio as of July 1, 2020 is 59.2%. This is a decrease from the 59.3% funded ratio from the prior year's valuation. However, the funded status alone is not appropriate for assessing the need for or the amount of future contributions and is not appropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations.

The calculated City Contribution Rate for FY 2022 is 7.89%. However, because the System is less than 90% funded, the actual City Contribution Rate for FY 2022 will be the corridor midpoint of 8.41% of payroll as shown on page 2 of the Risk Sharing Valuation section of the valuation report. This rate is five basis points greater than the prior year rate as established in the Initial RSVS. Please see Table 6 for a detailed analysis of the change in the calculated employer contribution rate from the prior year to this year. This rate does not include the separate contribution for the Legacy Liability amortization payment discussed above.

PLAN EXPERIENCE

As part of each valuation, we examine the System's experience relative to the assumptions. The aggregate results of these analyses are disclosed in Tables 5 & 6. This past fiscal year the System had an experience liability gain of approximately $0.0 million and an experience loss on the actuarial value of assets of approximately $48.1 million. The loss on the actuarial value of assets was due to the poor investment performance (relative to the return assumption) during the just concluded fiscal year.

BENEFIT PROVISIONS

The benefit provisions reflected in this valuation are those in effect following the passage and signing into law of SB 2190 in 2017. These changes were reflected in the prior valuation and there have been no changes to the benefit provisions since the prior valuation.

The benefit provisions are summarized in Appendix B.

ASSUMPTIONS AND METHODS

Except as noted below, the actuarial assumptions and methods are set by the Board of Trustees, based upon recommendations made by the plan's actuary and the current assumptions were adopted by the Board in 2016 following a regularly scheduled experience study. The rationale for the current assumptions is included in that report, dated February 25, 2016.

As part of the legislation enacting the benefit changes, the investment return assumption (7.0%) was set into the revised statute (Article 6243h, Vernon's Texas Civil Statutes). This assumption is now considered a prescribed assumption under the actuarial standards of practice. With the lowering of the investment return assumption from 8.0% to 7.0% it was appropriate to make changes to other economic assumptions that are correlated with the investment return assumption. In particular, the inflation assumption was decreased from 2.50% to 2.25% and corresponding decreases in the salary increase assumptions and payroll growth assumptions were also made. These changes were all reflected in the prior actuarial valuation. There have been no changes to the actuarial assumptions since the prior valuation.

The actuarial assumptions represent estimates of future experience and are not market measures. The results of the actuarial valuation are dependent on the actuarial assumptions used. Actual results (and future measures) can and almost certainly will differ, as actual experience deviates from the assumptions. Even seemingly minor changes in the assumptions can materially change the liabilities, calculated contribution rates and funding periods. The actuarial calculations are intended to provide information for rational decision making.

This report does not include a more robust assessment of the risks of future experience not meeting the actuarial assumptions. Additional assessment of risks was outside the scope of this assignment.

All assumptions and methods are described in Appendix A.

This report was prepared using our proprietary valuation model and related software which in our professional judgment has the capability to provide results that are consistent with the purposes of the valuation. We performed tests to ensure that the model reasonably represents that which is intended to be modeled.

GASB 67

The System was required to begin complying with Governmental Accounting Standards Board Statement No. 67 with the fiscal year ending June 30, 2014. The GASB No. 67 information for the fiscal year ending June 30, 2020 was provided to HMEPS in a separate report dated October 5, 2020 and is not contained in this report.

DATA

Member data for retired, active and inactive members was supplied as of July 1, 2020 by the HMEPS staff. We did not audit this data, but we did apply a number of tests to the data, and we concluded that it was reasonable and consistent with the prior year's data.

Asset information as of July 1, 2020 was taken from the audited Financial Statements for the Year Ended June 30, 2020.

CERTIFICATION

We were asked to determine if an unanticipated actuarial cost occurred in the administration of the Deferred Retirement Option Plan (DROP). It is our opinion that the administration of the DROP had no material unanticipated actuarial costs during the prior fiscal year.

All of the tables contained in this actuarial valuation report were prepared by Gabriel, Roeder, Smith & Company. The trend data schedules shown in the Notes section of the HMEPS Financial Statements are based on our valuation reports, but were prepared by HMEPS staff. We certify that the information presented herein is accurate and fairly portrays the actuarial position of HMEPS as of July 1, 2020.

All of our work conforms with generally accepted actuarial principles and practices, and the Actuarial Standards of Practice issued by the Actuarial Standards Board. In our opinion, our calculations also comply with the requirements of state law and, where applicable, the Internal Revenue Code, ERISA, and the Statements of the Governmental Accounting Standards Board. The undersigned are independent actuaries and consultants. Mr. Newton is an Enrolled Actuary and also a Member of the American Academy of Actuaries, and meets the Qualification Standards of the American Academy of Actuaries. Both of the undersigned are experienced in performing valuations for large public retirement systems.

Sincerely,
Gabriel, Roeder, Smith & Company

Joseph P. Newton, FSA, EA, MAAA
Pension Market Leader and Actuary

Lewis Ward
Consultant

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Section I

Risk Sharing Valuation Study

RSVS Discussion

The purpose of the Risk Sharing Valuation Study (RSVS) is to determine the City Contribution Rate for the fiscal year beginning one year after the valuation date.

The first exhibit in this section shows the RSVS Corridor which was created from the Initial RSVS. Column 3 shows the Corridor Midpoint for each fiscal year. Columns 2 and 4 show the Corridor Minimum and Corridor Maximum respectively. Column 5 shows the actual City Contribution Rate for the fiscal year. As shown on the table the actual City Contribution Rate for FY 2022 is 8.41% of pay.

The next exhibit shows the individual pieces and total calculated City Contribution Rate. As shown on the table the calculated City Contribution Rate from this valuation is 7.89% of pay. Because The System is less than 90% funded, the actual City Contribution Rate will be set equal to the Corridor Midpoint of 8.41% of pay.

The third exhibit shows the Liability Gain/Loss Layers established by each RSVS. Columns 2 and 3 show the original liability layer and any remaining liability layer respectively. Column 4 is the payment on that particular layer for the fiscal year beginning one year after the valuation date. The payment is determined using a level percentage of payroll and the remaining amortization period as shown in column 5. The payments reflect the one year delay between the determination of the payment and the beginning of the fiscal year in which the payment is made. The dollar amounts of the payments are summed and then converted to a percentage of payroll based on the projected payroll for the fiscal year beginning one year after the valuation date. As shown on the table the current year’s payment is negative which means it is a credit toward the contribution rate. The credit is determined to be 0.55% of projected payroll.

The next exhibit is the Legacy Liability schedule. This table shows the amortization schedule of the Legacy Liability for each of the 30 years over which it is scheduled to be paid. Column 2 shows the remaining Legacy Liability as of that measurement date while Column 3 shows the payment on the Legacy Liability for the fiscal year beginning one year after the valuation date.

The unfunded actuarial accrued liability is equal to the sum of the Remaining Layer column on the Liability Gain/Loss Layers exhibit and the Remaining Legacy Liability column as of the valuation date.

Risk Sharing Valuation - Corridor

Fiscal Year Ending	Corridor Minimum	Corridor Midpoint	Corridor Maximum	Actual City Contribution Rate
(1)	(2)	(3)	(4)	(5)
June 30, 2018	3.17%	8.17%	13.17%	8.17%
June 30, 2019	3.27%	8.27%	13.27%	8.27%
June 30, 2020	3.32%	8.32%	13.32%	8.32%
June 30, 2021	3.36%	8.36%	13.36%	8.36%
June 30, 2022	3.41%	8.41%	13.41%	8.41%
June 30, 2023	3.44%	8.44%	13.44%	
June 30, 2024	3.48%	8.48%	13.48%	
June 30, 2025	3.51%	8.51%	13.51%	
June 30, 2026	3.54%	8.54%	13.54%	
June 30, 2027	3.57%	8.57%	13.57%	
June 30, 2028	3.59%	8.59%	13.59%	
June 30, 2029	3.61%	8.61%	13.61%	
June 30, 2030	3.63%	8.63%	13.63%	
June 30, 2031	3.65%	8.65%	13.65%	
June 30, 2032	3.67%	8.67%	13.67%	
June 30, 2033	3.69%	8.69%	13.69%	
June 30, 2034	3.70%	8.70%	13.70%	
June 30, 2035	3.71%	8.71%	13.71%	
June 30, 2036	3.72%	8.72%	13.72%	
June 30, 2037	3.73%	8.73%	13.73%	
June 30, 2038	3.74%	8.74%	13.74%	
June 30, 2039	3.74%	8.74%	13.74%	
June 30, 2040	3.75%	8.75%	13.75%	
June 30, 2041	3.76%	8.76%	13.76%	
June 30, 2042	3.77%	8.77%	13.77%	
June 30, 2043	3.78%	8.78%	13.78%	
June 30, 2044	3.79%	8.79%	13.79%	
June 30, 2045	3.79%	8.79%	13.79%	
June 30, 2046	3.80%	8.80%	13.80%	
June 30, 2047	3.81%	8.81%	13.81%	

Risk Sharing Valuation – Calculated City Contribution Rate

Fiscal Year Ending	Employer Normal Cost	Amortization Payment	Calculated City Contribution Rate
(1)	(2)	(3)	(4)
June 30, 2018	8.17%	0.00%	8.17%
June 30, 2019	8.27%	0.00%	8.27%
June 30, 2020	8.32%	-0.37%	7.95%
June 30, 2021	8.40%	-0.90%	7.50%
June 30, 2022	8.44%	-0.55%	7.89%

Risk Sharing Valuation - Liability (Gain)/Loss Layers

Valuation Year Base Established	Original Layer	Remaining Layer	Year's Payment[1]	Remaining Payments
(1)	(2)	(3)	(4)	(5)
July 1, 2020	$ 38,069,638	$ 38,069,638	$ 2,378,814	30
July 1, 2019	(51,252,094)	(54,839,740)	(3,480,190)	26
July 1, 2018	(36,414,848)	(39,250,827)	(2,490,899)	26
July 1, 2017	(388,530)	(422,258)	(26,802)	26
Total		$ (56,443,288)	$ (3,619,077)	
Projected Payroll for Fiscal Year +1			$ 659,906,575	
Amortization Payments as % of Projected Pay			-0.55%	
Single Equivalent Amortization Period from the Valuation Date[2]			27.1	

1 This is the payment to be made for the fiscal year beginning one year after the valuation date.
2 The single equivalent amortization period includes all liability layers including the Legacy Liability.

Risk Sharing Valuation – Legacy Liability

Fiscal Year End	Remaining Legacy Liability	Current Year's Payment[1]
(1)	(2)	(3)
June 30, 2017	$ 2,123,880,499	$ 124,030,357
June 30, 2018	2,144,254,135	127,441,192
June 30, 2019	2,162,525,731	130,945,824
June 30, 2020	2,178,451,118	134,546,835
June 30, 2021	2,191,766,369	138,246,872
June 30, 2022	2,202,186,338	142,048,661
June 30, 2023	2,209,403,104	145,955,000
June 30, 2024	2,213,084,295	149,968,762
June 30, 2025	2,212,871,302	154,092,903
June 30, 2026	2,208,377,355	158,330,458
June 30, 2027	2,199,185,471	162,684,546
June 30, 2028	2,184,846,251	167,158,371
June 30, 2029	2,164,875,526	171,755,226
June 30, 2030	2,138,751,826	176,478,494
June 30, 2031	2,105,913,679	181,331,653
June 30, 2032	2,065,756,717	186,318,273
June 30, 2033	2,017,630,566	191,442,026
June 30, 2034	1,960,835,534	196,706,682
June 30, 2035	1,894,619,048	202,116,115
June 30, 2036	1,818,171,846	207,674,309
June 30, 2037	1,730,623,900	213,385,352
June 30, 2038	1,631,040,048	219,253,449
June 30, 2039	1,518,415,320	225,282,919
June 30, 2040	1,391,669,929	231,478,199
June 30, 2041	1,249,643,912	237,843,850
June 30, 2042	1,091,091,395	244,384,556
June 30, 2043	914,674,442	251,105,131
June 30, 2044	718,956,486	258,010,522
June 30, 2045	502,395,281	265,105,812
June 30, 2046	263,335,367	272,396,221
June 30, 2047	-	-

1 Contribution amount for fiscal year that begins one year after valuation date

Section II

Discussion

Executive Summary

Item	July 1, 2020	July 1, 2019
Membership		
• Number of:		
-Active members	11,594	11,507
-Retirees and beneficiaries	11,373	11,110
-Inactive members	7,059	6,652
-Total	30,026	29,269
• Covered payroll (annualized)	$ 657,876	$ 636,463
City Contribution rates	8.41%[1]	8.36%[1]
Assets		
• Market value	$ 2,881,788	$ 3,100,999
• Actuarial value	3,074,339	3,019,255
• Estimation of return on market value	-3.8%	6.8%
• Estimation of return on actuarial value	5.4%	8.3%
• Employer contribution	$ 176,430	$ 176,261
• Member contribution	$ 32,582	$ 32,537
• Ratio of actuarial value to market value	106.7%	97.4%
• External cash flow as % of market value assets	-3.6%	-2.9%
Actuarial Information		
• Unfunded actuarial accrued liability (UAAL)	$ 2,122,008	$ 2,071,890
• GASB funded ratio	59.2%	59.3%
• Employer normal cost %	8.44%	8.40%
• Amortization rate[2]	-0.55%	-0.90%
• Calculated City Contribution Rate	7.89%	7.50%
Estimated Total City Contribution for Fiscal Year	2022	2021
• Estimated City Contribution Rate Payment	$ 55,498,143	$ 54,232,221
• Legacy Liability Payment (City Contribution Amount)	$ 138,246,872	$ 134,546,835
• Total	$ 193,745,015	$ 188,779,056

Note: Dollar amounts in $000, unless otherwise noted

1 This rate is the City Contribution Rate determined in accordance with the State statute.
2 See Risk Sharing Valuation - Liability (Gain)/Loss Layers table for determination of rate.

Contribution Requirement

- The Executive Summary shows the estimated total City Contribution for fiscal year 2022
  - Comprised of the known Legacy Liability payment (City Contribution Amount) of $138.2 million, and
  - City Contribution Rate times estimated payroll of $659.9 million = $55.5 million
- The calculated City Contribution Rates shown on the Executive Summary are calculated rates for the twelve-month period beginning one year after the valuation date, based on statute
- Table 6 reconciles the calculated City Contribution Rates from the prior valuation to the current valuation
- Legacy Liability is $2,178 million as of July 1, 2020
  - Schedule of Legacy Liability contribution amounts shown in RSVS section

Amortization of liability gain/loss layers are as follows

- Liability loss layers are amortized over a 30-year funding period beginning one year after the valuation date using level percentage of payroll amortization based on 2.75% payroll growth rate
- Liability gain layers are amortized over the remaining period of the largest liability loss layer (if no loss layer exists then over a 30-year funding period beginning one year after the valuation date) using level percentage of payroll amortization based on 2.75% payroll growth rate
- Amortization payment for layers is the sum of all payments divided by the projected payroll for the fiscal year beginning one year after the valuation date
- No future growth in the number of active members is taken into account

Calculation of Contribution Rates

The funds available to pay benefits come from two sources, contributions and investment income on those contributions (the majority of the funds available to pay benefits come from investment income). HMEPS receives contributions from two sources, employer contributions and member contributions. The employer contribution is comprised of two pieces. The first piece is a fixed dollar amount to amortize the Legacy Liability as of July 1, 2016 over a 30-year beginning on July 1, 2017. The second piece is the City Contribution Rate.

As shown in Table 1, the Calculated City Contribution Rate has two components:

- The employer normal cost percentage (NC%)
- The amortization percentage (Liability Layers%)

The NC% is the theoretical amount which would be required to pay the members' benefits, based on the plan provisions for new employees, if this amount had been contributed from each member's entry date and if the fund's experience exactly followed the actuarial assumptions. This is the amount it should cost to provide the benefits for an average new member. The employer NC% includes a provision for administrative expenses and is net of member contributions. The NC% is shown in Table 4.

The actuarial accrued liability (AAL) is the difference between (i) the actuarial present value of all future benefits for all current participants of the fund, including active, inactive and retired members, and (ii) the actuarial present value of future normal costs. Thus the AAL represents the liability associated with past years. The unfunded actuarial accrued liability (UAAL) is the difference between the AAL and the actuarial value of assets (AVA). It is the shortfall/excess between the liability associated with prior years (the AAL) and the assets actually accumulated (the AVA). This shortfall/excess can arise from several sources, including actuarial gains and losses which are caused by differences between actual experience and the plan's assumptions, changes to the plan's actuarial assumptions, and amendments to the benefit provisions.

As of July 1, 2016, the UAAL was partitioned off into the Legacy Liability which has its own amortization schedule. For all valuations after July 1, 2016, any unexpected gains or losses will be set up as new liability gain/loss layers. These layers will be amortized over 30 years (see previous discussion for liability gain layers) using level percentage of payroll amortization beginning on the July 1st one year after the valuation date the layer is determined. The sum of any such layers' payments will be aggregated and converted to a percentage of projected payroll for the fiscal year beginning one year after the valuation date. This percentage is the Liability Layers' %.

In addition to these two pieces, the City Contribution Rate also includes a provision for administrative expenses which is equal to 1.25% of payroll as of July 1, 2020. The maximum addition to the City Contribution Rate for administrative expenses is 1.25%, unless the City agrees to a higher rate.

Calculation of Contribution Rates (Continued)

If the addition to the City Contribution Rate for administrative expenses is capped at 1.25%, then administrative expenses in excess of 1.25% of payroll (if any) will become part of the next year's liability gain/loss layer.

The calculated City Contribution Rate necessary to meet the funding policy specified by statute for the twelve-month period beginning July 1, 2021 is 7.89%. Since the System is less than 90% funded and the calculated City Contribution rate is less than the Corridor Midpoint, the actual City Contribution Rate will be the Corridor Midpoint of 8.41% of projected payroll. Therefore, the FY 2022 City Contribution is estimated to be approximately $193.7 million. The contribution is comprised of the fixed Legacy Liability payment of $138.2 million and the estimated payment of $55.5 based on the City Contribution Rate of 8.41% and a projected FY 2022 payroll of $659.9 million.

Financial Data and Experience

As of July 1, 2020, HMEPS has a total market value of about $2.88 billion. Financial information was gathered from the audited financial statements as of June 30, 2020.

This report includes a number of exhibits related to plan assets. Table 8 shows how the total market value is distributed among the various classes of investments. Current investment policy allocates 49.5% of invested assets to equities, 15% of invested assets to fixed income, and 35.5% of invested assets to alternative investments including real estate.

Table 9 shows a reconciliation of the market values between the beginning and end of FY2020.

As shown on Table 11, the dollar-weighted return net of investment expenses for FY2020 was -3.76%.

In determining the contribution rates and funded status of the System, an actuarial value of assets (AVA) is used, rather than the market value of assets. This “smoothing method” is intended to help reduce the volatility of the contribution rates from year to year. The method used to compute the AVA takes the difference between the actual market value of assets and the expected actuarial value of assets (based on the prior year’s assumed investment return rate), and establishes a base each year which is equal to this difference less any unrecognized bases from prior years. If the current year’s base is of opposite sign from the prior years’ bases then it is offset dollar for dollar against the prior years’ bases (oldest bases first) until either the prior years’ bases or the current year’s base is reduced to zero. Any remaining bases are then recognized over the remaining period for the base (5 less the number of years between the base year and the valuation year) in equal dollar amounts.

However, as part of the legislation enacted by the 2017 Legislature, all prior years’ bases have been fully recognized as of July 1, 2016. In other words, the actuarial value of assets has been “marked to market” as of that date. Therefore, there are only four “smoothing” bases included in the determination of the actuarial value of assets in this valuation.

The development of the AVA is shown on Table 10. The AVA as of the valuation date is $3.07 billion. The AVA is 106.7% of the MVA, compared to 97.4% last year.

In addition to the market return, Table 11 also shows the return on the actuarial value of assets for HMEPS. For FY2020, this return was 5.38%. Because this is less than the assumed 7.0% investment return, an actuarial loss occurred increasing the unfunded actuarial accrued liabilities of the plan. Table 12 shows a summary of market and actuarial return rates in recent years.

Member Data

Member data as of July 1, 2020 was supplied electronically by HMEPS staff. While we did not audit this data, we did perform various tests to ensure that it was internally consistent, consistent with the prior year's data, and was reasonable overall.

Tables 15 and 16 show the summaries of certain historical data, including membership statistics. Table 17 shows the number of members by category (active, inactive, retired, etc.). Table 18 shows the active member statistics.

The number of active members increased from 11,507 to 11,594, a 0.8% increase.

The total annualized salaries shown on Table 2 and on the statistical tables is the amount that was supplied by HMEPS, annualized or adjusted for number of hours reported if necessary. For the cost calculations, the pays were adjusted in accordance with the actuarial assumptions to reflect one year's salary increase. The annualized salaries for active members increased 3.4% over last year.

We also show the projected payroll in Item 2 of Table 2. This is the payroll used for determining the expected amortization payments (amortization percentage) on liability (gain)/loss layers. The projected pay is determined by summing all pensionable pay for the just ended fiscal year for anyone who received pensionable pay during the year (actives, terminated members, retirees, etc.) and increasing this sum by the payroll growth rate. We believe this provides a better expectation of the upcoming year's actual payroll than the annualized salaries described above.

The overall trend in payroll is less significant than in prior years due to the creation of the Legacy Liability. The payments to amortize the Legacy Liability were determined in a manner that is consistent with the payroll growth assumption, but those payment amounts are now fixed and will be contributed whether payroll grows slower or faster than assumed. The current and future liability gain/loss layers will be amortized using level percentage of payroll amortization. Because the methodology used in amortizing these layers assumes a growing payroll into the future, if the payroll grows at a rate lower than the assumed 2.75% a year on average, the amortization payments (as a percentage of pay) will need to increase in order to keep the contribution dollars that amortize the UAAL growing at 2.75%. However, these layers are expected to be much smaller in magnitude than the Legacy Liability and therefore, the impact of the payroll growing slower or faster than expected is anticipated to be much less for many years into the future.

Benefit Provisions

SB 2190 passed by the 2017 Legislature made a few but very significant changes to the benefit provisions of HMEPS. All of these changes were reflected in the July 1, 2016 valuation. However, the changes were significant enough that we have shown them again in this year's valuation as a reminder.

Prior to the legislation members hired prior to January 1, 2005 were eligible for a cost of living adjustment (COLA) each year equal to 3% of their base benefit. Members hired on or after January 1, 2005 and prior to January 1, 2008 were eligible for a COLA based on 2% of their base benefit. Group D members were not eligible for any COLA. Effective with the 2018 COLA, all current and future retirees and their eligible survivors (except as noted below) will be eligible for the same COLA. The COLA will be equal to 50% of the average five-year net investment return rate less five percentage points, with a minimum of 0% and a maximum of 2%. Group D members who are entitled to an annuity but who terminated employment prior to the effective date of the 2017 legislation will not be eligible for any COLA.

Active members in DROP will not be eligible for a COLA on their DROP account until they have attained the age of 62 as of January 1 of the year in which the increase is made.

The member contributions for all groups have changed. The Group A member contribution rate increased from 5.0% of pay to 8.0% of pay. The Group B member contribution rate increased from no contributions to 4% of pay. The Group D member contribution rate increased from no contributions to 3% of pay. One-third of the Group D member contribution rate is attributed to a notional cash balance account. The contribution increases for Groups A and B were phased-in over a two year period.

The interest credit rate on DROP accounts and the notional cash balance accounts will be based on 50% of the five-year average of the net rate of return on the market value of assets, but not less than 2.5% or more than 7.5%.

Survivor benefits:

- Effective July 1, 2017, if an active Group A, Group B or Group D member with at least 5 years of credited service dies while still in service with the City (off-duty death), the spousal survivor benefit will be 80% of the normal accrued pension, payable immediately, provided that the spouse was married to the participant for at least one continuous year as of the date of death. If such spouse was married less than one continuous year as of the date of death, the survivor benefit is 50% of the normal accrued pension.

- Effective July 1, 2017, if a Group A or Group B retiree dies, the spousal survivor benefit will be 80% of the retirement benefit being received by the retiree at the time of death, payable immediately, provided that the spouse was married to the retiree at the time of death and for at least one continuous year as of the date of separation from service (the marriage requirement applies for separations from service on or after July 1, 2017). If such spouse was married less than one continuous year as of the date of separation from service (the marriage

Benefit Provisions (Continued)

requirement applies for separations from service on or after July 1, 2017), the spousal survivor benefit is 50% of the retirement benefit being received by the retiree at the time of death.

- Effective July 1, 2017, if a Group A or Group B deferred participant (not yet receiving a pension benefit) dies, the spousal survivor benefit is 50% of the normal accrued pension, payable at the participant's eligibility date. However, the surviving spouse can elect an earlier actuarially equivalent benefit.
- Effective July 1, 2017, if an active Group A, Group B or Group D member dies from a service-related (on-duty) death, the spousal survivor benefit is 80% of the participant's final average salary, payable immediately.

This valuation reflects all benefits offered to members.

There have been no changes to the benefit provisions since the prior valuation.

Appendix B of our Report includes a summary of the benefit provisions for HMEPS.

Actuarial Methods and Assumptions

Except as noted below, the actuarial assumptions and methods are set by the Board of Trustees, based upon recommendations made by the plan's actuary. Except as noted below, the Board adopted the actuarial assumptions used in this valuation in connection with an actuarial experience study performed by GRS. Please see our report dated February 25, 2016 for a complete description of the changes in assumptions and for the rationale behind the current assumption set. These assumptions were used beginning with the July 1, 2015 valuation. It is anticipated that the next experience study will be conducted during the spring of 2021.

As part of the legislation enacting the benefit changes, the investment return assumption (7.0%) was set into statute (Article 6243h, Vernon's Texas Civil Statutes). In addition the actuarial cost method was also set into statute. This assumption and method are now considered prescribed assumptions and methods under the actuarial standards of practice.

Liabilities are determined using the Entry Age Normal actuarial cost method. The assumed investment return rate is 7.00%.

With the lowering of the investment return assumption from 8.0% to 7.0% it was appropriate to make changes to other economic assumptions that are correlated with the investment return assumption. In particular, we recommended and the Board adopted a decrease in the inflation assumption from 2.50% to 2.25% and the corresponding decreases in the salary increase assumptions and payroll growth assumptions. These changes were reflected in the July 1, 2016 actuarial valuation.

There have been no changes in the actuarial assumptions and methods since the prior valuation.

Please see Appendix A of our Report for a complete description of these assumptions.

Funding Progress

As you are aware, the Governmental Accounting Standards Board Statements (GASB) that apply to the System have changed. In prior years, GASB Statement No. 25 applied to the System. Beginning with the 2014 fiscal year GASB Statement No. 67 applies to the System. The GASB No. 67 disclosure information has been provided in a separate report.

Although GASB No. 25 no longer applies to HMEPS, there are certain schedules from GASB No. 25 which we believe provide useful information and therefore we are continuing to include these in our report. In particular, we are continuing to show the Schedule of Funding Progress (Table 14).

Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions

The determination of the accrued liability and the actuarially determined contribution requires the use of assumptions regarding future economic and demographic experience. Risk measures, as illustrated in this report, are intended to aid in the understanding of the effects of future experience differing from the assumptions used in the course of the actuarial valuation. Risk measures may also help with illustrating the potential volatility in the accrued liability and the actuarially determined contribution that result from the differences between actual experience and the actuarial assumptions.

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions due to changing conditions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period, or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law. The scope of an actuarial valuation does not include an analysis of the potential range of such future measurements.

Examples of risk that may reasonably be anticipated to significantly affect the plan's future financial condition include:

1. Investment risk – actual investment returns may differ from the expected returns;

2. Asset/Liability mismatch – changes in asset values may not match changes in liabilities, thereby altering the gap between the accrued liability and assets and consequently altering the funded status and contribution requirements;

3. Contribution risk – actual contributions may differ from expected future contributions. For example, actual contributions may not be made in accordance with the plan's funding policy or material changes may occur in the anticipated number of covered employees, covered payroll, or other relevant contribution base;

4. Salary and Payroll risk – actual salaries and total payroll may differ from expected, resulting in actual future accrued liability and contributions differing from expected;

5. Longevity risk – members may live longer or shorter than expected and receive pensions for a period of time other than assumed;

6. Other demographic risks – members may terminate, retire or become disabled at times or with benefits other than assumed resulting in actual future accrued liability and contributions differing from expected.

Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions (Continued)

The effects of certain trends in experience can generally be anticipated. For example if the investment return since the most recent actuarial valuation is less (or more) than the assumed rate, the cost of the plan can be expected to increase (or decrease). Likewise, if longevity is improving (or worsening), increases (or decreases) in cost can be anticipated.

The City Contribution Rate shown in the Executive Summary may be considered as a minimum contribution rate that complies with HMEPS' Statute. The timely receipt of the actuarially determined contributions is critical to support the financial health of the plan. Users of this report should be aware that contributions made at the actuarially determined rate do not necessarily guarantee benefit security.

PLAN MATURITY MEASURES

Risks facing a pension plan evolve over time. A young plan with virtually no investments and paying few benefits may experience little investment risk. An older plan with a large number of members in pay status and a significant trust may be much more exposed to investment risk. Several generally accepted plan maturity measures are described below and are followed by a table showing a history of the measurements.

RATIO OF MARKET VALUE OF ASSETS TO PAYROLL

The relationship between assets and payroll is a useful indicator of the potential volatility of contributions. For example, if the market value of assets is 2.0 times the payroll, a return on assets 5% different than assumed would equal 10% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in plan sponsor contributions as a percentage of payroll.

RATIO OF ACTUARIAL ACCRUED LIABILITY TO PAYROLL

The relationship between actuarial accrued liability and payroll is a useful indicator of the potential volatility of contributions for a fully funded plan. A funding policy that targets a funded ratio of 100% is expected to result in the ratio of assets to payroll and the ratio of liability to payroll converging over time.

Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions (Continued)

The ratio of liability to payroll may also be used as a measure of sensitivity of the liability itself. For example, if the actuarial accrued liability is 2.5 times the payroll, a change in liability 2% other than assumed would equal 5% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in liability (and also plan sponsor contributions) as a percentage of payroll.

RATIO OF ACTIVES TO RETIREES AND BENEFICIARIES

A young plan with many active members and few retirees will have a high ratio of actives to retirees. A mature open plan may have close to the same number of actives to retirees, resulting in a ratio near 1.0. A super-mature or closed plan may have significantly more retirees than actives, resulting in a ratio below 1.0. For the purposes of this measurement, members of DROP were counted as active members.

RATIO OF NET CASH FLOW TO MARKET VALUE OF ASSETS

A positive net cash flow means contributions exceed benefits and expenses. A negative cash flow means existing funds are being used to make payments. A certain amount of negative net cash flow is generally expected to occur when benefits are prefunded through a qualified trust. Large negative net cash flows as a percent of assets may indicate a super-mature plan or a need for additional contributions.

DURATION OF PRESENT VALUE OF BENEFITS

The duration of the actuarial accrued liability may be used to approximate the sensitivity to a 1% change in the assumed rate of return. For example, a duration of 10 indicates that the liability would increase approximately 10% if the assumed rate of return were lowered 1%.

ADDITIONAL RISK ASSESSMENT

Additional risk assessment is outside the scope of the annual actuarial valuation. Additional assessment may include scenario tests, sensitivity tests, stochastic modeling, stress tests, and a comparison of the present value of accrued benefits at low-risk discount rates with the actuarial accrued liability.

Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions (Continued)

	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Ratio of the market value of assets to total payroll	4.38	4.87	4.79	4.17	3.95	4.21	4.33	3.99	3.79	3.91
Ratio of actuarial accrued liability to payroll	7.90	8.00	7.98	7.80	7.79	8.16	7.54	7.51	7.42	6.96
Ratio of actives to retirees and beneficiaries	1.02	1.04	1.10	1.14	1.18	1.18	1.23	1.25	1.29	1.42
Ratio of net cash flow to market value of assets*	-3.6%	-2.9%	5.3%	-3.4%	-3.6%	-3.4%	-3.4%	-4.2%	-4.6%	-4.3%
Duration of the actuarial present value of benefits**	11.62	11.56	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

* The 2018 net cash flow reflects receipt of $250 million in net Pension Obligation Bond proceeds

**Duration measure not available prior to 2019

Summary and Closing Comments

This year's valuation has both positives and negatives. On the negative side, the investment performance during fiscal year 2020 created a loss on the actuarial value of assets which resulted in the unfunded actuarial accrued liability increasing more than expected. However, on the positive side the amortization piece of the City Contribution Rate is still a credit resulting in a total rate less than the corridor midpoint.

The System's funded status decreased from 59.3% to 59.2%.

The calculated City Contribution Rate is less than the normal cost and less than the Corridor Midpoint. However, because the System is less than 90% funded the City Contribution Rate is set equal to the Corridor Midpoint determined by the Initial RSVS at 8.41% of pay.

There was a small actuarial liability experience gain mostly due to a lower than assumed cost of living adjustment (to be paid in 2021). However, there was an actuarial loss on assets. Combined these resulted in a liability loss layer being established for fiscal year end 2020. The liability loss layer from this year's valuation in combination with the liability gain layers from the prior years' valuations, produce a net annual amortization credit of 0.55%.

Given the plan's contribution policy, if all actuarial assumptions are met (including the assumption of the plan earning 7.00% on the actuarial valuation of assets), it is expected that:

a. The employer normal cost as a percentage of pay will remain relatively level over time (upward drift will likely occur due to generational mortality),

b. The funded ratio will increase slowly,

c. The UAAL will grow in nominal dollars until the amortization period on the Legacy Liability is reduced to approximately 20 years, at which point the UAAL will begin to decrease and be expected to be fully amortized by the July 1, 2048 valuation, or 28 years from the current July 1, 2020 valuation date.

It should be noted that the investment shortfall from fiscal year 2020 has only partially been recognized. The shortfall completely offset the $82 million in deferred gains from the 2019 valuation and we are still deferring $193 million in deferred investment losses. If these deferred losses are not offset with future gains, then it is likely that in the near future new liability layers will be loss layers.

Section III

Supporting Exhibits

Table 1
Summary of Cost Items

	Valuation as of July 1, 2020		Valuation as of July 1, 2019	
	Cost Item	Cost as % of Pay	Cost Item	Cost as % of Pay
	(1)	(2)	(3)	(4)
1. Participants				
a. Actives	11,594		11,507	
b. Retirees	9,070		8,853	
c. Disabled retirees	280		289	
d. Beneficiaries	2,023		1,968	
e. Inactive, deferred vested	3,661		3,609	
f. Inactive, nonvested	3,398		3,043	
g. Total	30,026		29,269	
2. Covered payroll	$ 657,876		$ 636,463	
3. Averages for active members				
a. Average age	47.9		47.9	
b. Average years of service	11.3		11.5	
c. Average pay ($)	$ 56,743		$ 55,311	
4. Present value of future pay	$ 4,765,456		$ 4,613,211	
5. Employer normal cost rate	8.44%		8.40%	
6. Present value of future benefits	$ 5,742,083	872.8%	$ 5,625,699	883.9%
7. Present value of future normal costs	$ 545,736	83.0%	$ 534,554	84.0%
8. Actuarial accrued liability (6 - 7)	$ 5,196,347	789.9%	$ 5,091,145	799.9%
9. Present actuarial assets	$ 3,074,339	467.3%	$ 3,019,255	474.4%
10. Unfunded actuarial accrued liability (UAAL) (8 - 9)	$ 2,122,008	322.6%	$ 2,071,890	325.5%
11. Calculated City Contribution Rate				
a. Employer normal cost	8.44%		8.40%	
b. Amortization charge[1]	-0.55%		-0.90%	
c. Total	7.89%		7.50%	
12. City Contribution Rate[2]	8.41%		8.36%	
13. Average estimated return				
a. Based on market value	-3.76%		6.83%	
b. Based on actuarial value	5.38%		8.26%	
14. Funded ratio (9 ÷ 8)	59.2%		59.3%	
15. Legacy Liability payment for fiscal year beginning one year after valuation date	$ 138,247		$ 134,547	

Note: Dollar amounts in $000

1 This is the layered amortization payment excluding the Legacy Liability payment
2 This is the payment to be made for the fiscal year beginning one year after the valuation date.

Table 2
Calculation of Annual Required Contribution Rate

		July 1, 2020	July 1, 2019
		(1)	(2)
1.	Annualized salaries on valuation date	$ 657,876	$ 636,463
2.	Projected payroll for upcoming fiscal year[1]	$ 642,245	$ 631,349
3.	Present value of future pay	$ 4,765,456	$ 4,613,211
4.	Employer normal cost rate	8.44%	8.40%
5.	Actuarial accrued liability for active members		
	a. Present value of future benefits for active members	$ 2,520,961	$ 2,466,596
	b. Less: present value of future normal costs	(461,396)	(444,700)
	c. Less: present value of additional employee contributions[2]	(84,340)	(89,854)
	d. Actuarial accrued liability	$ 1,975,225	$ 1,932,042
6.	Total actuarial accrued liability for:		
	a. Retirees and beneficiaries	$ 3,035,094	$ 2,982,277
	b. Inactive participants	$ 186,028	176,826
	c. Active members (Item 5d)	$ 1,975,225	1,932,042
	d. Total	$ 5,196,347	$ 5,091,145
7.	Actuarial value of assets	$ 3,074,339	$ 3,019,255
8.	Unfunded actuarial accrued liability (UAAL) (Item 6d - Item 7)	$ 2,122,008	$ 2,071,890

Note: Dollar amounts in $000

1 The projected payroll is the actual pay received for the just completed fiscal year (including pay for any member who received pay during the year: i.e. active, terminated, retired, etc.). This pay is then increased by the payroll growth rate.

2 Additional employee contributions in excess of the 3.00% employee rate used to determine the normal cost.

Table 3
Actuarial Present Value of Future Benefits

		July 1, 2020 (1)	July 1, 2019 (2)
1.	Active members		
	a. Retirement benefits	$ 2,285,447	$ 2,234,403
	b. Deferred termination benefits	128,827	128,811
	c. Refunds	14,917	14,194
	d. Death benefits	81,314	78,547
	e. Disability benefits	10,456	10,641
	f. Total	$ 2,520,961	$ 2,466,596
2.	Members in Pay Status		
	a. Service retirements	$ 2,707,714	$ 2,659,050
	b. Disability retirements	31,639	32,517
	c. Beneficiaries	295,741	290,710
	d. Total	$ 3,035,094	$ 2,982,277
3.	Inactive members		
	a. Vested terminations	$ 181,228	$ 172,531
	b. Nonvested terminations	4,800	4,295
	c. Total	$ 186,028	$ 176,826
4.	Total actuarial present value of future benefits	$ 5,742,083	$ 5,625,699

Note: Dollar amounts in $000

Table 4
Analysis of Normal Cost

		July 1, 2020	July 1, 2019
		(1)	(2)
1.	Gross normal cost rate		
	a. Retirement benefits	7.65%	7.59%
	b. Deferred termination benefits	1.41%	1.40%
	c. Refunds	0.57%	0.59%
	d. Disability benefits	0.13%	0.13%
	e. Death benefits	0.43%	0.44%
	f. Administrative expenses	1.25%	1.25%
	g. Total	11.44%	11.40%
2.	Employee Contribution rate[1]	3.00%	3.00%
3.	Employer Normal Cost (including Administrative Expenses)	8.44%	8.40%

1 Normal cost is determined using Ultimate Entry Age method. Therefore, Employee Contribution rate is the rate for a Group D new hire.

Table 5
Calculation of Total Actuarial Gain or Loss

1.	Unfunded actuarial accrued liability (UAAL) as of July 1, 2019	$	2,071,890
2.	Total normal cost and administrative expense for year	$	82,163
3.	Employer and Employee Contributions during year ending June 30, 2019	$	(209,012)
4.	Interest on UAAL for one year	$	145,032
5.	Interest on Item 2 and Item 3 for one-half year	$	(4,365)
6.	Expected UAAL as of July 1, 2020 (1+2+3+4+5)	$	2,085,708
7.	Actual UAAL as of July 1, 2020	$	2,122,008
8.	Actuarial gain/(loss) for the period (6 - 7)	$	(36,300)
	SOURCE OF GAINS/(LOSSES)		
9.	Asset gain/(loss) (See Table 10)	$	(48,138)
10.	Plan changes		0
11.	Assumption changes		0
12.	Method change		0
13.	Next Year's COLA different than assumed		11,860
14.	Liability experience gain/(loss) for the period		(22)
15.	Actuarial gain/(loss) for the period	$	(36,300)

Note: Dollar amounts in $000

Table 6

Change in Calculated Contribution Rate Since the Prior Valuation

1.	Calculated City Contribution Rate as of July 1, 2019		7.50%
2.	Change in Contribution Rate During Year		
a.	Change in Employer Normal Cost	0.04%	
b.	Recognition of prior years' asset (gains)	(0.34%)	
c.	Actuarial loss from current year asset performance	0.80%	
d.	Actuarial gain from COLA	(0.11%)	
e.	Actuarial gain from liability sources	(0.01%)	
f.	Effect of projected payroll growing slower than expected	0.01%	
g.	Change in Actuarial Assumptions and Methods	0.00%	
h.	Total Change		0.39%
	Calculated City Contribution Rate as of July 1, 2020		7.89%

Table 7
Near Term Outlook

Valuation as of July 1,	Unfunded Actuarial Accrued Liability (UAAL, in 000s)	Funded Ratio	Calculated City Contribution Rate[1]	Corridor Midpoint[1]	Actuarial Value of Fund (in 000s)	For Fiscal Year Ending June 30,	Estimated Payroll	Employer Contributions	Employee Contributions	Benefit Payments[2]	Net External Cash Flow
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
2020	$ 2,122,009	59.2%	7.89%	8.41%	$ 3,074,339	2021	$ 642,245	$ 188,239	$ 26,123	$ 345,760	$ (131,399)
2021	2,131,904	59.7%	7.88%	8.44%	3,153,622	2022	659,907	193,745	32,371	366,273	(140,156)
2022	2,138,612	60.2%	7.87%	8.48%	3,229,397	2023	678,054	199,276	31,994	387,120	(155,850)
2023	2,141,869	60.6%	7.88%	8.51%	3,294,242	2024	696,700	205,035	31,662	407,533	(170,835)
2024	2,141,328	61.0%	7.87%	8.54%	3,348,126	2025	715,860	210,888	31,378	427,415	(185,148)
2025	2,136,610	61.3%	7.88%	8.57%	3,390,976	2026	735,546	216,909	31,152	446,729	(198,669)
2026	2,127,387	61.7%	7.86%	8.59%	3,422,839	2027	755,773	223,100	30,981	465,593	(211,512)
2027	2,113,151	62.0%	7.85%	8.61%	3,443,649	2028	776,557	229,391	30,860	483,897	(223,646)
2028	2,093,512	62.3%	7.84%	8.63%	3,453,363	2029	797,913	235,859	30,788	446,332	(179,685)
2029	2,067,973	62.9%	7.82%	8.65%	3,509,230	2030	819,855	242,509	30,778	454,233	(180,946)
2030	2,035,999	63.7%	7.80%	8.67%	3,567,704	2031	842,401	249,346	30,818	459,414	(179,250)

These projections are based on the HMEPS statute as amended by SB 2190 of the 2017 Legislature.

1 Actual City Contribution Rate will be set to Corridor Midpoint if Fund is less than 90% funded. Contribution rate goes into effect 12 months after the valuation date

2 Includes refunds taken by terminating members and plan administrative expenses

Note: Dollar amounts in $000.

Table 8
Statement of Plan Net Assets

	July 1, 2020 (1)	July 1, 2019 (2)
A. ASSETS		
1. Current Assets		
a. Cash and short term investments		
1) Cash on hand	$ 4,746	$ 11,797
2) Short term investments	34,311	44,272
b. Accounts Receivable		
1) Sale of investments	5,533	6,493
2) Other	18,883	19,581
c. Total Current Assets	$ 63,473	$ 82,142
2. Long Term Investments		
a. US. Government securities	$ 46,657	$ 100,319
b. Corporate bonds	211,421	198,302
c. Capital stocks	602,368	805,238
d. Commingled Funds	608,648	646,384
e. LP's, real estate trusts, loans and mortgages	1,356,746	1,279,417
f. Total long term investments	$ 2,825,839	$ 3,029,660
3. Other Assets		
a. Collateral on securities lending	$ 13,246	$ 60,246
b. Net OPEB Asset	$ 2,257	-
c. Furniture, fixtures and equipment, net	307	185
d. Total other assets	$ 15,810	$ 60,430
4. Total Assets	$ 2,905,122	$ 3,172,233
5. Deferred outflow of resources	$ 227	
B. LIABILITIES		
1. Current Liabilities		
a. Amounts due on asset purchases	$ 5,105	$ 7,030
b. Accrued liabilities	3,176	3,958
c. Collateral on securities lending	13,246	60,246
2. Total Liabilities	21,526	71,234
3. Deferred inflows of resources	2,035	0
Net Assets Held in Trust	$ 2,881,788	$ 3,100,999
C. TARGET ASSET ALLOCATION FOR CASH & LONG TERM INVESTMENTS		
1. Cash	0.0%	0.0%
2. Fixed Income	15.0%	15.0%
3. Real Estate	12.5%	12.5%
4. Private Equity	17.0%	17.0%
5. Global Equity	32.5%	32.5%
6. Inflation-Linked Asset Class	15.%	15.%
7. Absolute Return	8.0%	8.0%
8. Total	100.0%	100.0%

Note: Dollar amounts in $000

Columns may not add due to rounding

Table 9
Reconciliation of Plan Net Assets

			Year Ending	
			June 30, 2020	June 30, 2019
			(1)	(2)
1.	Market value of assets at beginning of year		$ 3,100,999	$ 2,988,864
	a.	Prior year adjustment	0	0
	b.	Restated Market value	$ 3,100,999	$ 2,988,864
2.	Revenue for the year			
	a.	Contributions		
		i. Member contributions	$ 32,582	$ 32,537
		ii. Employer contributions	176,430	176,261
		iii. Total	$ 209,012	$ 208,798
	b.	Net investment income		
		i. Interest	$ 14,831	$ 15,881
		ii. Dividends	26,416	28,780
		iii. Earnings from LP's and real estate trusts	238	1,605
		iv. Net appreciation (depreciation) on investments	(148,411)	161,926
		v. Net proceeds from lending securities	171	272
		vi. Less investment expenses	(8,410)	(8,019)
		vii. Other	484	710
	c.	Total revenue	$ 94,331	$ 409,953
3.	Expenditures for the year			
	a.	Refunds	$ 650	$ 1,394
	b.	Benefit payments	308,002	291,061
	c.	Administrative and miscellaneous expenses	4,890	5,363
	d.	Total expenditures	$ 313,542	$ 297,818
4.	Increase in net assets (Item 2c - Item 3d)		$ (219,211)	$ 112,135
5.	Market value of assets at end of year (Item 1 + Item 4)		$ 2,881,788	$ 3,100,999

Note: Dollar amounts in $000

Columns may not add due to rounding

Table 10
Development of Actuarial Value of Assets

		July 1, 2020
1.	Actuarial value of assets at beginning of year	$ 3,019,255
2.	Net new investments	
	a. Contributions [1]	$ 209,012
	b. Benefits and refunds paid	(308,652)
	c. Administrative Expenses	(4,890)
	d. Subtotal	(104,530)
3.	Assumed investment return rate for fiscal year	7.00%
4.	Assumed investment income for fiscal year	$ 207,752
5.	Expected actuarial value at end of year (1+ 2 + 4)	$ 3,122,477
6.	Market value of assets at end of year	$ 2,881,788
7.	Difference (6 - 5)	$ (240,689)

8. Development of amounts to be recognized as of July 1, 2020:

Fiscal Year End	Remaining Deferrals of Excess (Shortfall) of Investment Income	Offsetting of Gains/(Losses)	Net Deferrals Remaining	Years Remaining	Recognized for this valuation	Remaining after this valuation
	(1)	(2)	(3) = (1) + (2)	(4)	(5) = (3) / (4)	(6) = (3) - (5)
2016	$ 0	$ 0	$ 0	1	$ 0	$ 0
2017	50,905	(50,905)	0	2	0	0
2018	28,441	(28,441)	0	3	0	0
2019	2,398	(2,398)	0	4	0	0
2020	(322,433)	81,744	(240,689)	5	(48,138)	(192,551)
Total	$ (240,689)	$ 0	$ (240,689)		$ (48,138)	$ (192,551)

9.	Final actuarial value of plan net assets, end of year (Item 6 - Item 8 Column 6)	$ 3,074,339
10.	Asset gain (loss) for year (Item 9 - Item 5)	$ (48,138)
11.	Asset gain (loss) as % of actual actuarial assets	(1.57%)
12.	Ratio of actuarial value to market value	106.7%

Notes: Remaining deferrals in Column (1) for prior years are from last year's report column (6) of Table 10. The number in the current year is the difference between the remaining deferrals for prior years and the total Excess/(Shortfall) return shown in Item 7. Column 2 is a direct offset of the current year's excess/(shortfall) return against prior years' excess/(shortfall) of the opposite type.

Table 11
Estimation of Investment Return Yield (Net of Expenses)

Item	July 1, 2020	July 1, 2019
(1)	(2)	(3)
A. Market value yield		
1. Beginning of year net market assets	$ 3,100,999	$ 2,988,864
2. Net Investment income (net of investment expenses)	(114,681)	201,155
3. End of year market assets	2,881,788	3,100,999
4. Estimated market value yield	-3.76%	6.83%
B. Actuarial value yield		
1. Beginning of year actuarial assets	$ 3,019,255	$ 2,874,585
2. Net Investment income (net of investment expenses)	159,614	233,690
3. End of year actuarial assets	3,074,339	3,019,255
4. Estimated actuarial value yield	5.38%	8.26%

Note: Dollar amounts in $000

Table 12
History of Investment Returns

For Fiscal Year Ending	Market Value	Actuarial Value
(1)	(2)	(3)
June 30, 2007	17.85%	21.51%
June 30, 2008	(0.25%)	8.97%
June 30, 2009	(20.14%)	2.60%
June 30, 2010	11.21%	3.54%
June 30, 2011	21.56%	6.27%
June 30, 2012	(0.89%)	4.46%
June 30, 2013	13.02%	5.39%
June 30, 2014	16.04%	7.95%
June 30, 2015	2.78%	6.82%
June 30, 2016	1.21%	(3.81%)
June 30, 2017	12.41%	8.08%
June 30, 2018	8.68%	8.30%
June 30, 2019	6.83%	8.26%
June 30, 2020	(3.76)%	5.38%
Average Compound Return - last 5 years	4.92%	5.13%
Average Compound Return - last 10 years	7.52%	5.65%

Note: Investment returns are estimations made by the actuary. Prior to June 30, 2016 these are dollar-weighted returns net of administrative and investment expenses. Beginning with June 30, 2016 the returns are net of investment expenses only.

Table 13
Historical Solvency Test

Valuation Date	Aggregated Accrued Liabilities for: Active Members Contributions	Retirees Beneficiaries and Vested Terminations[1]	Members (City Financed Portion)	Actuarial Value of Assets	Portions of Accrued Liabilities Covered by Reported Assets: (5)/(2)	[(5)-(2)]/(3)	[(5)-(2)-(3)]/(4)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
July 1, 2001	$ 36,449	$ 804,901	$ 1,114,456	$ 1,490,179	100.0%	100.0%	58%
July 1, 2002	35,888	893,568	1,585,733	1,519,717	100.0%	100.0%	37%
July 1, 2003	44,388	1,115,801	2,118,063	1,510,264	100.0%	100.0%	17%
July 1, 2004	62,062	1,355,157	1,216,599	1,501,235	100.0%	100.0%	7%
July 1, 2005	48,150	1,577,345	1,099,777	1,777,656	100.0%	100.0%	14%
July 1, 2006	58,043	1,729,863	1,106,389	1,867,293	100.0%	100.0%	7%
July 1, 2007	69,544	1,824,992	1,234,178	2,193,745	100.0%	100.0%	24%
July 1, 2008	81,182	1,904,333	1,310,855	2,310,384	100.0%	100.0%	25%
July 1, 2009	95,268	1,974,714	1,381,428	2,284,442	100.0%	100.0%	16%
July 1, 2010	107,421	2,058,813	1,466,236	2,273,142	100.0%	100.0%	7%
July 1, 2011	118,202	2,154,959	1,517,167	2,328,804	100.0%	100.0%	4%
July 1, 2012	124,848	2,312,548	1,529,468	2,344,128	100.0%	96.0%	0%
July 1, 2013	132,238	2,431,950	1,565,395	2,382,585	100.0%	92.5%	0%
July 1, 2014	139,203	2,538,225	1,611,151	2,490,521	100.0%	92.6%	0%
July 1, 2015	143,097	2,832,860	1,789,762	2,582,510	100.0%	86.1%	0%
July 1, 2016	146,407	2,894,489	1,694,103	2,625,896[2]	100.0%	85.7%	0%
July 1, 2017	149,190	2,993,101	1,723,740	2,742,539	100.0%	86.6%	0%
July 1, 2018	162,180	3,093,196	1,726,632	2,874,585	100.0%	87.7%	0%
July 1, 2019	176,988	3,159,103	1,755,054	3,019,255	100.0%	90.0%	0%
July 1, 2020	191,620	3,221,122	1,783,605	3,074,339	100.0%	89.5%	0%

Note: Dollar amounts in $000

1 Column (3) included AAL for DROP participants until 2003, thereafter in Column (4)
2 Actuarial value of assets includes $250 million in future pension obligation bond proceeds as a receivable.

Table 14
Schedule of Funding Progress

Date	Actuarial Value of Assets (AVA)	Actuarial Accrued Liability (AAL)	Unfunded Actuarial Accrued Liability (UAAL) (3) - (2)	Funded Ratio (2)/(3)	Annualized Salaries	UAAL as % of Salaries (4)/(6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
July 1, 2001	$ 1,490,179	$ 1,955,806	$ 465,627	76.2%	$ 418,234	111.3%
July 1, 2002	1,519,717	2,515,189	995,472	60.4%	399,794	249.0%
July 1, 2003	1,510,264	3,278,251	1,767,987	46.1%	390,314	453.0%
July 1, 2004	1,501,235	2,633,817	1,132,582	57.0%	366,190	309.3%
July 1, 2005	1,777,656	2,725,272	947,616	65.2%	404,565	234.2%
July 1, 2006	1,867,293	2,894,295	1,027,002	64.5%	422,496	243.1%
July 1, 2007	2,193,745	3,128,713	934,968	70.1%	448,925	208.3%
July 1, 2008	2,310,384	3,296,370	985,986	70.1%	483,815	203.8%
July 1, 2009	2,284,442	3,451,410	1,166,968	66.2%	539,023	216.5%
July 1, 2010	2,273,142	3,632,470	1,359,328	62.6%	550,709	246.8%
July 1, 2011	2,328,804	3,790,328	1,461,524	61.4%	544,665	268.3%
July 1, 2012	2,344,128	3,966,864	1,622,736	59.1%	534,394	303.7%
July 1, 2013	2,382,585	4,129,583	1,746,998	57.7%	549,971	317.7%
July 1, 2014	2,490,521	4,288,579	1,798,058	58.1%	568,992	316.0%
July 1, 2015	2,582,510	4,765,719	2,183,209	54.2%	584,025	373.8%
July 1, 2016	2,625,896	4,734,999	2,109,103	55.5%	608,210	346.8%
July 1, 2017	2,742,539	4,866,031	2,123,492	56.4%	623,577	340.5%
July 1, 2018	2,874,585	4,982,008	2,107,424	57.7%	624,266	337.6%
July 1, 2019	3,019,255	5,091,145	2,071,890	59.3%	636,463	325.5%
July 1, 2020	3,074,339	5,196,347	2,122,008	59.2%	657,876	322.6%

Note: Dollar amounts in $000

Table 15
Historical Active Participant Data

Valuation Date	Active Count	Average Age	Average Svc	Annualized Salaries	Average Salary	Percent Changes
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1993	13,112	40.9	N/A	$340,249	$25,949	6.5%
1994	14,027	40.9	N/A	$366,561	$26,133	0.7%
1995	14,364	41.3	N/A	$378,511	$26,351	0.8%
1996	14,067	41.8	N/A	$367,610	$26,133	(0.8%)
1998[1]	13,764	42.8	9.8	$394,919	$28,692	9.8%
1999[1]	13,286	42.9	9.8	$396,617	$29,852	4.0%
2000[1]	13,126	43.7	10.3	$421,591	$32,119	7.6%
2001[1]	12,928	43.9	10.3	$413,021	$31,948	(0.5%)
2002	12,527	44.7	11	$399,794	$31,915	(0.1%)
2003	12,120	45.2	11.2	$390,314	$32,204	0.9%
2004	11,856	45.1	10.3	$366,190	$30,886	(4.1%)
2005[2]	11,974	44.8	9.6	$404,565	$33,787	9.4%
2006	12,145	44.84	9.3	$422,496	$34,788	3.0%
2007	12,376	45.2	9.3	$448,925	$36,274	4.3%
2008	12,653	45.2	9.3	$483,815	$38,237	5.4%
2009	13,333	45.1	9.2	$539,023	$40,428	5.7%
2010	12,913	45.8	10.0	$550,709	$42,648	5.5%
2011	12,345	46.5	10.6	$544,665	$44,120	3.5%
2012	11,670	46.8	11.1	$534,394	$45,792	3.8%
2013	11,781	46.9	11.1	$549,971	$46,683	1.9%
2014	11,949	46.9	11.1	$568,992	$47,618	2.0%
2015	11,827	47.1	11.2	$584,025	$49,381	3.7%
2016	12,103	47.1	11.1	$608,210	$50,253	1.8%
2017	12,066	47.3	11.1	$623,577	$51,681	2.8%
2018	11,880	47.5	11.3	$624,266	$52,548	1.7%
2019	11,507	47.9	11.5	$ 636,463	$ 55,311	5.3%
2020	11,594	47.9	11.3	$657,876	$56,743	2.6%

Note: Dollar amounts in $000

1 Excludes DROP participants
2 Beginning with the 2005 valuation, a change in methodology now annualizes payroll for new entrants. If the methodology had not been changed, the covered payroll for 2005 would have been $376,208,345 and the average payroll would have been $31,419.

Table 16
Retirees, Beneficiaries, and Disabled Participants Added to and Removed from Rolls

	Added to Rolls		Removed from Rolls		Rolls-End of Year			
Valuation July 1,	Number	Annual Allowances	Number	Annual Allowances	Number	Annual Allowances	% Increase in Annual Allowances	Average Annual Allowances
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2001	652	$ 8,937	299	$ 1,030	5,457	$ 57,877	15.8%	$ 10,606
2002	777	15,061	306	2,476	5,928	72,256	24.8%	12,189
2003	598	11,497	311	1,873	6,215	84,519	17.0%	13,599
2004	942	25,189	279	2,624	6,878	107,084	26.7%	15,569
2005	861	18,054	216	1,926	7,523	123,212	15.1%	16,378
2006	654	14,722	397	2,246	7,780	135,688	10.1%	17,441
2007	440	10,280	249	3,007	7,971	142,961	5.4%	17,935
2008	464	11,052	280	3,420	8,155	150,592	5.3%	18,466
2009	474	11,430	289	3,667	8,340	158,356	5.2%	18,988
2010	476	12,040	290	3,938	8,526	166,458	5.1%	19,524
2011	502	13,202	311	4,451	8,717	175,210	5.3%	20,100
2012	654	16,299	293	3,993	9,078	187,515	7.0%	20,656
2013	695	15,566	346	5,051	9,427	198,030	5.6%	21,007
2014	619	15,370	361	5,717	9,685	207,683	4.9%	21,444
2015	771	17,334	433	5,534	10,023	219,484	5.7%	21,898
2016	590	17,295	324	5,842	10,289	230,937	5.2%	22,445
2017	659	19,402	347	6,285	10,601	244,054	5.7%	23,022
2018	607	19,691	374	9,929	10,834	253,816	4.0%	23,428
2019	634	15,297	358	6,815	11,110	262,297	3.3%	23,609
2020	579	13,011	337	6,455	11,352*	268,854	2.5%	23,683

Note: Dollar amounts in $000

* Count excludes 21 deceased participants whose beneficiaries are still entitled to a DROP account payment.

Table 17
Membership Data

	July 1, 2020	July 1, 2019	July 1, 2018
	(1)	(2)	(3)
1. Active members			
a. Number	11,594	11,507	11,880*
b. Number vested	7,605	7,590	7,745
c. Annualized salaries	$ 657,876,000	$ 636,463,000	$ 624,266,000
d. Average salary	56,743	55,311	52,548
e. Average age	47.9	47.9	47.5
f. Average service	11.3	11.5	11.3
2. Inactive participants			
a. Vested	3,661	3,609	3,457
b. Total annual benefits (deferred)	$ 24,431,701	$ 23,282,032	$ 24,477,164
c. Average annual benefit	6,674	6,451	7,080
d. Nonvested	3,398	3,043	2,587
3. Service retirees			
a. Number	9,070	8,853	8,614
b. Total annual benefits	$ 231,668,750	$ 225,931,390	$ 218,548,693
c. Average annual benefit	25,542	25,520	25,371
d. Average age	70.6	70.2	69.8
4. Disabled retirees			
a. Number	280	289	298
b. Total annual benefits	$ 3,259,056	$ 3,322,286	$ 3,369,633
c. Average annual benefit	11,639	11,496	11,307
d. Average age	68.8	68.6	67.7
5. Beneficiaries and spouses			
a. Number	2,023	1,968	1,922
b. Total annual benefits	$ 33,925,711	$ 33,043,788	$ 31,897,751
c. Average annual benefit	16,946**	16,791	16,596
d. Average age	71.1	70.6	70.3

* Counts include the additional 170 Group D members.

** Average benefits adjusted for 21 beneficiaries only entitled to DROP balance.

Table 18
Distribution of All Active Members by Age and by Years of Service

Attained Age	0 No. & Avg. Comp.	1 No. & Avg. Comp.	2 No. & Avg. Comp.	3 No. & Avg. Comp.	4 No. & Avg. Comp.	5-9 No. & Avg. Comp.	10-14 No. & Avg. Comp.	15-19 No. & Avg. Comp.	20-24 No. & Avg. Comp.	25-29 No. & Avg. Comp.	30-34 No. & Avg. Comp.	35 & Over No. & Avg. Comp.	Total No. & Avg. Comp.
Under 25	85 $35,717	45 $34,188	24 $35,769	10 $39,693	4 $45,355								168 $35,781
25-29	232 $41,857	126 $42,485	86 $43,005	69 $40,467	55 $42,614	100 $42,742	4 $57,923						672 $42,268
30-34	195 $46,213	133 $48,458	125 $49,350	119 $47,345	130 $48,055	288 $50,157	81 $47,985	1 *					1,072 $48,404
35-39	191 $52,476	124 $50,548	105 $53,479	82 $56,136	108 $49,581	325 $56,718	291 $57,233	64 $50,213	1 *				1,291 $54,414
40-44	146 $52,182	112 $55,323	90 $54,331	88 $50,785	72 $55,223	279 $58,703	325 $61,889	158 $62,629	63 $57,937	2 *			1,335 $57,899
45-49	132 $52,592	90 $58,445	61 $48,322	78 $61,952	79 $54,615	271 $59,996	290 $63,354	187 $60,391	167 $56,959	68 $ 60,180	1 *		1,424 $58,921
50-54	103 $52,064	92 $52,649	60 $55,104	71 $54,952	69 $50,613	221 $59,108	316 $61,243	230 $60,686	234 $59,274	222 $60,639	71 $60,914	4 $53,565	1,693 $58,565
55-59	82 $54,916	53 $52,713	55 $61,167	57 $60,045	83 $56,632	246 $58,597	334 $58,479	253 $59,335	215 $59,227	215 $63,041	157 $61,173	56 $62,205	1,806 $59,343
60-64	34 $53,333	34 $53,374	41 $62,516	39 $61,430	54 $63,633	192 $60,148	257 $60,910	192 $57,841	150 $62,441	183 $66,023	81 $68,851	76 $68,462	1,333 $62,037
65 & Over	13 $48,227	8 $76,885	14 $62,445	18 $62,442	13 $67,600	106 $61,689	187 $65,181	134 $61,823	105 $61,403	96 $61,553	68 $69,735	38 $75,658	800 $63,881
Total	1,213 $48,406	817 $50,423	661 $51,870	631 $53,204	667 $52,362	2,028 $56,881	2,085 $60,425	1,219 $59,731	935 $59,531	786 $62,605	378 $64,353	174 $67,999	11,594 $56,743

Average: Age: 47.87 Number of participants: Fully vested: 7,605 Males: 6,365

Service: 11.33 Not Vested: 3,989 Females: 5,229

* Detailed pay data is not shown if there are 3 or fewer members, but the pay is included in the Total column.

APPENDIX A

SUMMARY OF ACTUARIAL ASSUMPTIONS AND METHODS

APPENDIX A

Summary of Actuarial Assumptions and Methods

The following methods and assumptions were used in preparing the July 1, 2020, actuarial valuation. Most of these assumptions were adopted by the Board effective for the July 1, 2015 valuation. Several economic assumptions were adopted effective July 1, 2016 to reflect the investment return assumption becoming a prescribed assumption under state statute.

1. Valuation Date

   The valuation date is July 1st of each plan year. This is the date as of which the actuarial present value of future benefits and the actuarial value of assets are determined.

2. Actuarial Cost Method (Prescribed Method under Actuarial Standards of Practice)

   The actuarial valuation uses the Entry Age Normal actuarial cost method. Under this method, the employer contribution rate is the sum of (i) the employer normal cost rate, and (ii) a rate that will amortize the unfunded actuarial accrued liability.

   a. The valuation is prepared on the projected benefit basis, under which the present value, at the investment return rate assumed to be earned in the future (7.0 percent), of each participant's expected benefit payable at retirement or death is determined, based on his/her age, service, sex and compensation. The calculations take into account the probability of a participant's death or termination of employment prior to becoming eligible for a benefit, as well as the possibility of his/her terminating with a service, disability, or survivor's benefit. Future salary increases are also anticipated. The present value of the expected benefits payable on account of the active participants is added to the present value of the expected future payments to retired participants and beneficiaries to obtain the present value of all expected benefits payable from the Plan on account of the present group of participants and beneficiaries.

   b. The employer contributions required to support the benefits of the Plan are determined using a level funding approach, and consist of a normal cost contribution and an accrued liability contribution.

   c. The normal contribution is determined using the "entry age normal" method. Under this cost method, a calculation is made to determine the average uniform and constant percentage rate of employer contribution which, if applied to the compensation of each participant during the entire period of his/her anticipated covered service, would be required to meet the cost of all benefits payable on his behalf based on the benefits provisions for new employees hired on or after the valuation date.

   d. The actuarial accrued liability (AAL) for each member is the difference between their present value of future benefits (PVFB), based on the tier of benefits that apply to the member, and their present value of future normal costs determined using the normal cost rate described in item c above. For inactive and retired members their AAL is equal to their PVFB.

e. The Legacy Liability payments were established in the Initial RSVS valuation. Each subsequent valuation a liability (gain)/loss layer is established that is the difference between the sum of (i) the remaining Legacy Liability and (ii) the remaining liability (gain)/loss layers, and the unfunded accrued liability. The amortization payment for each liability (gain)/loss layer is determined by amortizing the layer over 30 years with the first payment made one year after the valuation in which the layer was established.

The contribution rate determined by this valuation will not be effective until one year later and the determination of the rate reflects this deferral. It is assumed that there will be no change in the employer normal cost rate due to the deferral, and it is assumed that payments are made uniformly throughout the year.

3. Actuarial Value of Assets

The actuarial value of assets is equal to the market value of assets less a five-year phase in of the excess (shortfall) between expected investment return and actual income. The actual calculation is based on the difference between actual market value and the expected actuarial value of assets each year, and recognizes the cumulative excess return (or shortfall) at a minimum rate of 20% per year. Each year a base is set up to reflect this difference. If the current year's base is of opposite sign to the deferred bases then it is offset dollar for dollar against the deferred bases. Any remaining bases are then recognized over the remaining period for the base (5 less the number of years between the base year and the valuation year). This is intended to ensure the smoothed value of assets will converge towards the market value in a reasonable amount of time.

Expected earnings are determined using the assumed investment return rate and the beginning of year actuarial value of assets (adjusted for receipts and disbursements during the year). The returns are computed net of investment expenses.

The actuarial value of assets was marked to market value as of July 1, 2016 by recognizing all deferred investment shortfalls on that date. The method described above begin again with the 2017 valuation.

4. Economic Assumptions

a. Investment return: 7.00% per year, compounded annually, composed of an assumed 2.25% inflation rate and a 4.75% net real rate of return. This rate represents the assumed return, net of all investment expenses.

b. Salary increase rate: A 2.25% inflation component, plus a 0.75% general increase, plus a service-related component as follows:

Years of Service	Service-related Component	Total Annual Rate of Increase Including 2.25% Inflation Component and 0.75% General Increase Rate
(1)	(2)	(3)
1	2.25%	5.25%
2	2.25	5.25
3	2.75	5.75
4	2.25	5.25
5	1.75	4.75
6	1.50	4.50
7	1.25	4.25
8	1.00	4.00
9	0.75	3.75
10-24	0.50	3.50
25+	0.00	3.00

c. Payroll growth rate: In the amortization of the unfunded actuarial accrued liability, payroll is assumed to increase 2.75% per year. This increase rate is solely due to the effect of inflation on salaries, with no allowance for future membership growth.

The investment return assumption is established in statute at 7.0% and therefore is considered a prescribed assumption under the Actuarial Standards of Practice.

5. Demographic Assumptions

a. Retirement Rates

	Expected Retirements per 100 Lives			
	Group A & B Members		Group D Members	
Age	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)
45-49	15	12	0	0
50-54	10	11	3	3
55	10	11	4	4
56	10	11	5	5
57	10	11	6	6
58	10	11	7	7
59	10	11	8	8
60	12	11	10	10
61	14	11	13	13
62	16	20	35	35
63	18	18	25	18
64	20	12	18	20
65	20	22	20	20
66-69	20	20	20	19
70-74	20	25	20	19
75+	100	100	100	100

b. DROP Participation

65% of eligible members are assumed to enter DROP.

c. DROP Entry Date

Those active members (not already in DROP) are assumed to enter DROP when first eligible. For members who have already entered DROP, the actual DROP entry date supplied in the data is used.

d. DROP Interest Credit

Interest is credited as 50% of the average five-year investment return, with a minimum of 2.5% and a maximum of 7.5%. Assumed to be 4.00% per year.

e. Mortality rates (active members)

Based on the Retired Pensioners 2000 Mortality Table (combined). Rates are scaled by 90% for male and 80% for female. 90% of the rates are assumed to be for non-service related deaths and 10% for service related deaths.

Sample rates are shown below:

Age	Rates			
	Non- service related Male	Non- service related Female	Service related Male	Service related Female
20	0.000279	0.000138	0.000031	0.000015
25	0.000305	0.000149	0.000034	0.000017
30	0.000360	0.000190	0.000040	0.000021
35	0.000626	0.000342	0.000070	0.000038
40	0.000874	0.000508	0.000097	0.000056
45	0.001221	0.000809	0.000136	0.000090
50	0.001732	0.001207	0.000192	0.000134
55	0.002935	0.001956	0.000326	0.000217
60	0.005465	0.003640	0.000607	0.000404
65	0.010317	0.006988	0.001146	0.000776
70	0.017987	0.012054	0.001999	0.001339
75	0.030646	0.020236	0.003405	0.002248

Mortality rates (retired members and beneficiaries):

Healthy Retirees and beneficiaries: Gender-distinct RP2000 Combined Healthy Mortality Tables with Blue Collar Adjustment. Male rates are multiplied by 125% and female rates are multiplied by 112%. The rates are projected on a fully generational basis by scale BB to account for future mortality improvements.

Disabled Retirees: Gender-distinct RP2000 Combined Healthy Mortality Tables with Blue Collar Adjustment. Male rates are multiplied by 125% and female rates are multiplied by 112%. The rates are projected on a fully generational basis by scale BB to account for future mortality improvements. Rates are set-forward five years. A minimum rate of 0.04 is applied to male and 0.03 to female.

Sample rates are shown below:

Attained Age in 2014	Rates			
	Healthy Male	Healthy Female	Disabled Male	Disabled Female
45	0.002149	0.001489	0.040000	0.030000
50	0.002891	0.002108	0.040000	0.030000
55	0.005029	0.002918	0.040000	0.030000
60	0.009369	0.004815	0.040000	0.030000
65	0.016403	0.009835	0.040000	0.030000
70	0.027069	0.017625	0.043632	0.030000
75	0.043632	0.029215	0.071367	0.046301
80	0.071367	0.046301	0.116414	0.078599
85	0.116414	0.078599	0.194603	0.131126
90	0.194603	0.131126	0.298126	0.198245
95	0.298126	0.198245	0.412954	0.255008
100	0.412954	0.255008	0.497358	0.328290

f. Termination Rates and Disability Rates

Termination rates (for causes other than death, disability or retirement):

Termination rates are a function of the member's age and service. Termination rates are not applied after a member becomes eligible for a retirement benefit. Rates at selected ages are shown below.

Probability of Decrement Due to Withdrawal – Male Members
Years of Service

Age	0	1	2	3	4	5	6	7	8	9	10+
20	0.3244	0.2682	0.2300	0.2060	0.1926	0.1824	0.1617	0.1507	0.1400	0.1278	0.0541
30	0.2585	0.2146	0.1808	0.1563	0.1396	0.1275	0.1143	0.1057	0.0985	0.0919	0.0449
40	0.2003	0.1645	0.1351	0.1124	0.0954	0.0832	0.0750	0.0683	0.0634	0.0603	0.0357
50	0.1559	0.1258	0.1013	0.0824	0.0681	0.0577	0.0510	0.0454	0.0411	0.0383	0.0265
60	0.1341	0.1083	0.0887	0.0740	0.0634	0.0557	0.0469	0.0407	0.0344	0.0277	0.0173

Probability of Decrement Due to Withdrawal – Female Members
Years of Service

Age	0	1	2	3	4	5	6	7	8	9	10+
20	0.2811	0.2574	0.2344	0.2123	0.1912	0.1711	0.1506	0.1282	0.1040	0.0784	0.1385
30	0.2155	0.1943	0.1736	0.1539	0.1356	0.1188	0.1032	0.0879	0.0730	0.0585	0.0795
40	0.1688	0.1460	0.1250	0.1063	0.0903	0.0770	0.0664	0.0581	0.0517	0.0472	0.0367
50	0.1510	0.1223	0.0984	0.0791	0.0645	0.0544	0.0481	0.0452	0.0453	0.0481	0.0339
60	0.1794	0.1373	0.1049	0.0812	0.0653	0.0570	0.0540	0.0552	0.0601	0.0682	0.0339

Rates of Decrement Due to Disability

Age	Males	Females	Service-related Males	Service-related Females
20	0.000004	0.000006	0.000000	0.000001
25	0.000009	0.000013	0.000001	0.000002
30	0.000073	0.000065	0.000005	0.000008
35	0.000318	0.000102	0.000022	0.000013
40	0.000650	0.000234	0.000045	0.000029
45	0.001259	0.000528	0.000087	0.000066
50	0.002195	0.001256	0.000151	0.000157
55	0.003171	0.002021	0.000219	0.000253
60	0.004188	0.002436	0.000289	0.000305

Rates of disability are reduced to zero once a member becomes eligible for retirement.

6. <u>Other Assumptions</u>

a. Projected payroll for contribution purposes: The aggregate projected payroll for the fiscal year following the valuation date is calculated by increasing the actual payroll paid during the previous fiscal year to all members (actives, terminated and retired) by the payroll growth rate and multiplying by the ratio of current active members to the average number of active members during the previous fiscal year.

b. Percent married: 70% of employees are assumed to be married. (No beneficiaries other than the spouse assumed). The 70% assumption is intended to provide sufficient margin to cover the costs of any surviving children benefits.

c. Age difference: Male members are assumed to be three years older than their spouses, and female members are assumed to be three years younger than their spouses.

d. Percent electing annuity on death (when eligible): All of the spouses of vested, married participants are assumed to elect an annuity.

e. Percent electing deferred termination benefit: Vested terminating members are assumed to elect a refund or a deferred benefit, whichever is more valuable at the time of termination.

f. There will be no recoveries once disabled.

g. No surviving spouse will remarry.

h. Assumed age for commencement of deferred benefits: Members electing to receive a deferred benefit are assumed to commence receipt at the first age at which unreduced benefits are available.

i. Administrative expenses: The administrative expenses of the plan are added into the employer contribution rate as a percentage of payroll.

j. Pay increase timing: Beginning of (fiscal) year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.

k. Decrement timing: Decrements of all types are assumed to occur mid-year.

l. Eligibility testing: Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.

m. Decrement relativity: Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.

n. Incidence of Contributions: Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made.

o. Benefit Service: All members are assumed to accrue 1 year of service each year. Fractional service is used to determine the amount of benefit payable.

p. Retiree DROP Balances Payout Duration: It is assumed that retirees will receive their DROP balances in equal installments over the eight years following retirement.

q. COLA is assumed to be 1.00% per year for almost all members effective 7/1/2017. Group D members who terminated prior to the effective date of the 2017 legislation are not eligible for a COLA.

7. <u>Participant Data</u>

Participant data was supplied on electronic files. There were separate files for (i) active members, (ii) inactive members, and (iii) members and beneficiaries receiving benefits.

The data for active members included birth date, sex, most recent hire date, salary paid during last fiscal year, hours worked by the employee, and employee contribution amounts. For retired members and beneficiaries, the data included date of birth, sex, amount of monthly benefit, and date of retirement. Also included was the member's Group and for members participating in DROP, their account balances and monthly DROP income.

Most healthy and disabled retirees are assumed to have an 80% joint and survivor form of payment (a small group of retirees is only eligible for a 50% joint and survivor annuity), prorated by the 70% marriage assumption and reflecting the 3 year spousal age differential. All non-children beneficiaries are assumed to have life only benefits and all children beneficiaries' annuities are assumed to stop at age 21.

Salary for the prior fiscal year as well as an annualized rate of pay is provided in the data. The annualized rate increased by one-year's salary increase is the rate of pay the member is assumed to earn in the upcoming fiscal year.

Except as noted below, assumptions were made to correct for missing or inconsistent data. These had no material impact on the results presented.

We received salary information on City of Houston employees employed by HFC, HFF, and CCSI. Where we had additional information because of prior HMEPS service, we added the salary information and treated the records as active employees. For the 170 records where we had no additional information, we assumed these records were Group D members and we grossed up the Group D liabilities and payroll to reflect these additions.

8. Group Transfers

   We assume no current Group B members will transfer to Group A.

9. Change in Assumptions Since Prior Valuation

   There have been no changes in the actuarial assumptions and methods since the prior valuation.

Appendix B

Summary of Plan Provisions

APPENDIX B

Summary of Plan Provisions

The provisions summarized in this section apply to persons who are members (active employees). Former members may have been covered under different plan provisions, depending on their dates of separation from service.

1. <u>Covered Members</u>

   Any person who is a participant of Group A, under the original act.

   Persons who became employees of the City of Houston after September 1, 1981 and prior to September 1, 1999, and elected officials of the City of Houston who assumed office after September 1, 1981 and prior to September 1, 1999, participate in Group B, but may make an irrevocable election to participate in Group A instead.

   Persons who become employees of the City and persons who are elected as City officials after September 1, 1999 and prior to January 1, 2008 become members of Group A. Certain persons who were or became a Director of a City Department, Chief Administrative Officer, or Executive Director of HMEPS on or after September 1, 1999 and prior to January 1, 2005 participate in Group C. Effective January 1, 2005, all Group C participation ceased and all Group C participants became Group A participants. Accruals earned by Group C participants prior to January 1, 2005 are retained, but all future accruals are based on the Group A formulas.

   All future references to Group C participants in this appendix are intended to reflect this change in the Group C status.

   Covered employees newly hired on or after January 1, 2008 are members of Group D.

   A former employee who is rehired on or after January 1, 2008 is a member of the group in which such employee participated at the time of his/her immediately preceding separation from service.

2. <u>Monthly Final Average Salary (FAS)</u>

   The sum of the seventy-eight highest biweekly salaries paid to a member during his period of credited service, divided by thirty-six. Salary includes base pay, longevity pay, and any shift differential pay. If there are fewer than seventy-eight biweekly salaries, the FAS is determined by multiplying the average of all biweekly salaries paid to the member during the period of credited service by 26 and dividing the product by 12.

3. <u>Credited Service</u>

   All services and work performed by an employee, including prior service. For members of Group A and former Group C, all services and work performed after September 1, 1943 must have been accompanied by corresponding contributions to HMEPS by the employee or legally authorized repayments must have been made. The contribution requirement applies to all Group B and Group D members effective with the first full pay period on or after July 1, 2017.

Credited service for former participants in Group C means the number of years of eligible service after the executive official's effective date of participation in Group C. A former Group C member receives two times the number of actual years of credited service in Group C solely for the purpose of fulfilling the eligibility requirements in Group C.

If former Group D and pre-1997 Group B members who forfeited their previous non-contributory credited service are rehired they will regain a year of forfeited non-contributory credited service for each year of service earned upon reemployment.

4. Normal Retirement

a. Eligibility

For participants in Group A or Group B, or, a former Group C member who became a Group A member as of January 1, 2005, the earliest of:

(i) age 62 and 5 years of Credited Service

(ii) 5 years of Credited Service, and age plus years of Credited Service equal 70 or more, provided that, prior to January 1, 2005, the participant had at least five years of credited service and the combination of age and years of credited service was equal to or greater than 68.

(iii) 5 years of Credited Service, and age plus years of Credited Service equal 75 or more with minimum age 50.

For participants in Group D
Age 62 and 5 years of Credited Service

b. Benefit

Prior to January 1, 2005:

Group A: 3.25% of FAS for each of the first 10 years of Credited Service plus 3.50% of FAS for Credited Service greater than 10 years but less than 20 years plus 4.25% of FAS for each year of Credited Service greater than 20 years (excludes period of DROP participation). Maximum benefit is 90% of FAS for all future retirees.

Group B: 1.75% of FAS for each of the first 10 years of Credited Service plus 2.00% of FAS for Credited Service greater than 10 years but less than 20 years, plus 2.75% of FAS for each year of Credited Service greater than 20 years (excludes period of DROP participation). Maximum benefit is 90% of FAS for all future retirees.

Group C: Double the rate for Group A

All accruals after January 1, 2005:

All accruals under the prior multipliers were frozen as of January 1, 2005 and the following benefit multipliers apply to service on or after that date:

Group A: 2.50% of FAS for each of the first 20 years of Credited Service plus 3.25% of FAS for each year of Credited Service greater than 20 years (excludes period of DROP participation). Maximum benefit is 90% of FAS for all future retirees.

Group B: 1.75% of FAS for each of the first 10 years of Credited Service plus 2.00% of FAS for Credited Service greater than 10 years but less than 20 years, plus 2.50% of FAS for each year of Credited Service greater than 20 years (excludes period of DROP participation). Maximum benefit is 90% of FAS for all future retirees.

Group D: 1.80% of FAS for each of the first 25 years of Credited Service, plus 1.00% of FAS for each year of Credited Service greater than 25 years. Maximum benefit is 90% of FAS for all future retirees.

5. Early Retirement (Group D only)

a.	Eligibility	(i)	at least ten years of Credited Service; or
		(ii)	at least five years of Credited Service and a combination of age and service equals or is greater than 75.
b.	Benefit	Accrued normal retirement benefit reduced by 0.25% for each month you are less than age 62.	

6. Vested Pension

a. Eligibility — 5 years of Credited Service.

b. Benefit — Group A and Group C: Either the accrued normal retirement benefit with payments beginning at the normal retirement eligibility date or a refund of employee contributions, if any, without interest.

Group B and Group D: Accrued normal retirement benefit payable at the normal retirement eligibility date.

If the actuarial present value of a pension is less than $20,000, a terminated participant who is not eligible to begin receiving a pension may request an early lump sum distribution of the pension. Such early lump sum distribution is irrevocable. Credited Service associated therewith can be reinstated after reemployment and pursuant to the rules of the plan.

7. Withdrawal Benefit

If a nonvested contributory member withdraws from service with less than 5 years, a refund of the member's contributions is made without interest, upon request.

8. Service-Connected Disability Retirement

a. Eligibility — Any age

b. Benefit — Group A: Accrued normal retirement benefit, but not less than 20% of final monthly salary at time of disability plus 1% of final monthly salary per year of Credited Service, to a maximum of 40% of final monthly salary.

Group B and Group D: Accrued normal retirement benefit, but not less than 20% of final monthly salary at time of disability.

9. Non-service-Connected Disability Retirement

a.	Eligibility	5 years of Credited Service.
b.	Benefit	Accrued normal retirement benefit payable immediately

10. Pre-retirement Survivor Benefits

A. Service-connected

a.	Eligibility	Any age or Credited Service
b.	Benefit	If there is a surviving spouse, 80% of FAS payable to the spouse. 10% of FAS is payable to each qualifying dependent to a maximum of 20% for all dependents. Surviving spouse's benefit will be reduced by the amount of dependent benefits. If no surviving spouse, dependent benefits are 50% of the amount a surviving spouse would have received for each dependent to a maximum of 80% of FAS for all dependents in the aggregate.

B. Non service-connected

a.	Eligibility	5 years of Credited Service
b.	Benefit	If an active Group A, Group B or Group D member with at least 5 years of credited service dies while still in service with the City (off-duty death), the spousal survivor benefit will be 80% of the normal accrued pension, payable immediately, provided that the spouse was married to the participant for at least one continuous year as of the date of death. If such spouse was married less than one continuous year as of the date of death, the survivor benefit is 50% of the normal accrued pension. If a Group A or Group B deferred participant (not yet receiving a pension benefit) dies, the spousal survivor benefit is 50% of the normal accrued pension, payable at the participant's eligibility date. However, the surviving spouse can elect an earlier actuarially equivalent benefit.

11. Postretirement Survivor Benefits

All Groups except Option-Eligible Participants:

If there is a surviving spouse, 80% of the retirement benefit the deceased retiree was receiving at the time of death payable immediately, provided that the spouse was married to the retiree at the time of death and for at least one continuous year as of the date of separation from service (the marriage requirement applies for separations from service on or after July 1, 2017). If such spouse was married less than one continuous year as of the date of separation from service (the marriage requirement applies for separations from service on or after July 1, 2017), the spousal survivor benefit is 50%

of the retirement benefit being received by the retiree at the time of death.

Option-Eligible Participants:

Life only to the retiree. Option-Eligible Participants may elect other options based on actuarial factors. Option-Eligible Participants are all Group D members, Group A & B members who terminate after June 30, 2011 eligible for a normal retirement benefit and who are not married at their termination of service, and Group B members who terminated prior to September 1, 1997 and who are eligible for a normal retirement benefit.

12. Benefit Adjustments

COLAs are calculated as half of the average five-year investment return less five percentage points, with a minimum of 0% and a maximum of 2%, not compounded. Group D retirees who terminated after the effective date of the 2017 Legislation will receive COLAs in the future. For employees who are participating in DROP, COLAs will be delayed until the earlier of their age at retirement or age 62 as of January 1 of the year in which the increase is made.

13. Contribution Rates (all rates occur as of the first full pay period on or after the applicable effective date)

a. Members — Effective July 1, 2017, 7% of salary for Group A members, 2% of salary for Group B members and 2% of salary for Group D members. For Group D, beginning January 1, 2018, in addition to the 2%, employees contribute 1% to a notional account that will be credited with the DROP Credit interest converted to a bi-weekly rate. Effective July 1, 2018, the total contribution increases to 8% of salary for Group A members and 4% of salary for Group B members.

b. City — Effective July 1, 2017, the City's contribution obligation is set by state statute as described in the RSVS Section.

14. Deferred Retirement Option

a. Eligibility — Participants (other than Group D) who are eligible to retire but who have not retired and who remain in service with the City may participate in the DROP.

b. Monthly DROP Credit

An amount equal to the accrued normal retirement benefit as of the effective date of DROP participation. The Monthly DROP Credit is credited to a notional account (DROP Account) on the last calendar day each month.

c. DROP Credit Interest

Interest is credited to the DROP Account at the beginning of each day based on the DROP Account balance at the end of the previous day and posted monthly on the last calendar day of each month. Effective

July 1, 2017, the annual interest rate effective beginning January 1 each year is half of the average five-year investment return, not less than 2.5% and not greater than 7.5%. The assumed DROP Credit interest is 4.0%.

d. DROP Credits-COLA

COLAs will not be given if the DROP participant is younger than age 62. When the DROP participant attains at least age 62 as of January 1 of the year of the increase, COLAs are calculated as half of the average five-year investment return less five percentage points, with a minimum of 0% and a maximum of 2%, not compounded.

e. DROP Account Balance

The sum of a participant's Monthly DROP Credits, applicable COLAs, applicable interest, and, prior to January 1, 2005, the employee contributions as applicable.

15. DROP Benefit Pay-out A terminated DROP participant may elect to:

a. Receive the entire DROP Account Balance in a lump sum.
b. Receive the DROP Account Balance in periodic payments as approved by the Pension Board.
c. Receive a portion of the DROP Account balance in a lump sum and the remainder in periodic payments as approved by the Pension Board.
d. Receive a partial payment of not less than $1,000, no more than once each ninety (90) days.
e. Defer election of a payout option until a future date.

16. Post DROP Retirement The Final Pension is the accrued normal retirement benefit as of the effective date of DROP participation, increased with COLAs since DROP entry.

Changes in Plan Provisions Since Prior Year

There have been no changes to the benefit provisions of the System since the prior valuation.