



THE POLICE PENSION TRUST FUND OF THE CITY OF STAMFORD

**Actuarial Valuation as of July 1, 2019
To Determine Funding For Fiscal Year 2020-21**

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Certification

We have performed an actuarial valuation of the Plan as of July 1, 2019 to determine funding for fiscal year 2020-21. This report presents the results of our valuation.

The ultimate cost of a pension plan is the total amount needed to provide benefits for plan members and beneficiaries and to pay the expenses of administering the plan. Pension costs are met by contributions and by investment return on plan assets. The principal purpose of this report is to set forth an actuarial recommendation of the contribution, or range of contributions, which will properly fund the plan, in accordance with applicable government regulations. In addition, this report provides:

- A valuation of plan assets and liabilities to review the year-to-year progress of funding.
- Information needed to meet disclosure requirements.
- Review of plan experience for the previous year to ascertain whether the assumptions and methods employed for valuation purposes are reflective of actual events and remain appropriate for prospective application.
- Assessment of the relative funded position of the plan, i.e., through a comparison of plan assets and projected plan liabilities.
- Comments on any other matters which may be of assistance in the funding and operation of the plan.

This report may not be used for purposes other than those listed above without Milliman's prior written consent. If this report is distributed to other parties, it must be copied in its entirety, including this certification section.

Milliman's work is prepared solely for the internal business use of the City of Stamford ("City"). To the extent that Milliman's work is not subject to disclosure under applicable public records laws, Milliman's work may not be provided to third parties without Milliman's prior written consent. Milliman does not intend to benefit or create a legal duty to any third party recipient of its work product. Milliman's consent to release its work product to any third party may be conditioned on the third party signing a Release, subject to the following exceptions: (a) the City may provide a copy of Milliman's work, in its entirety, to the City's professional service advisors who are subject to a duty of confidentiality and who agree to not use Milliman's work for any purpose other than to benefit the City; and (b) the City may provide a copy of Milliman's work, in its entirety, to other governmental entities, as required by law. No third party recipient of Milliman's work product should rely upon Milliman's work product. Such recipients should engage qualified professionals for advice appropriate to their own specific needs.

In preparing this report, we relied on employee census data and financial information as of the valuation date, furnished by the City. We performed a limited review of the data used directly in our analysis for reasonableness and consistency and have found them to be reasonably consistent and comparable with data used for other purposes. If the underlying data or information is inaccurate or incomplete, the results of our analysis may likewise be inaccurate or incomplete and our calculations may need to be revised. If there are material defects in the data, it is possible that they would be uncovered by a detailed, systematic review and comparison of the data to search for data values that are questionable or for relationships that are materially inconsistent. Such a review was beyond the scope of our assignment.

Certification

The calculations reported herein have been made on a basis consistent with our understanding of ERISA and the related sections of the tax code. Additional determinations may be needed for purposes other than meeting funding requirements, such as judging benefit security at plan termination or meeting employer accounting requirements. On the basis of the foregoing, we hereby certify that, to the best of our knowledge, this report is complete and accurate and all costs and liabilities were determined in conformance with generally accepted actuarial principles and practices. Figures for periods prior to July 1, 2018 have been obtained from actuarial valuation reports prepared by Hooker & Holcombe and from the City's Comprehensive Annual Financial Reports.

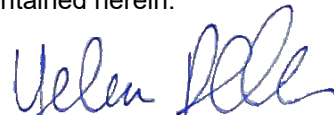
I further certify that, in my opinion, each actuarial assumption, method and technique used is reasonable taking into account the experience of the Plan and reasonable expectations. Future actuarial measurements may differ significantly from the current measurements presented in this report due to factors such as, but not limited to, the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; 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. Due to the limited scope of the actuarial assignment, we did not perform an analysis of the potential range of such future measurement.

The consultants who worked on this assignment are pension actuaries. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel.

We are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.



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Section I - Executive Summary Changes Since the Prior Valuation

Plan Changes

None.

Changes in Actuarial Methods and Assumptions

In order to better anticipate future plan experience, we lowered the interest rate assumption from 7.10% to 7.05% and we updated the mortality assumption from the RP-2000 Blue Collar table with generational projection per Scale BB to the PubS-2010 table with generational projection per the Ultimate MP scale. We also modified the calculation of the timing adjustment, which previously added interest to the net normal cost based on the rate of inflation (2.60%). The new calculation applies interest to both the net normal cost and past service cost based on the valuation interest rate.

These changes in combination caused the Unfunded Accrued Liability to increase by about \$4,921,700 and the Actuarially Determined Contribution to increase by about \$1,230,000.

Other Significant Changes

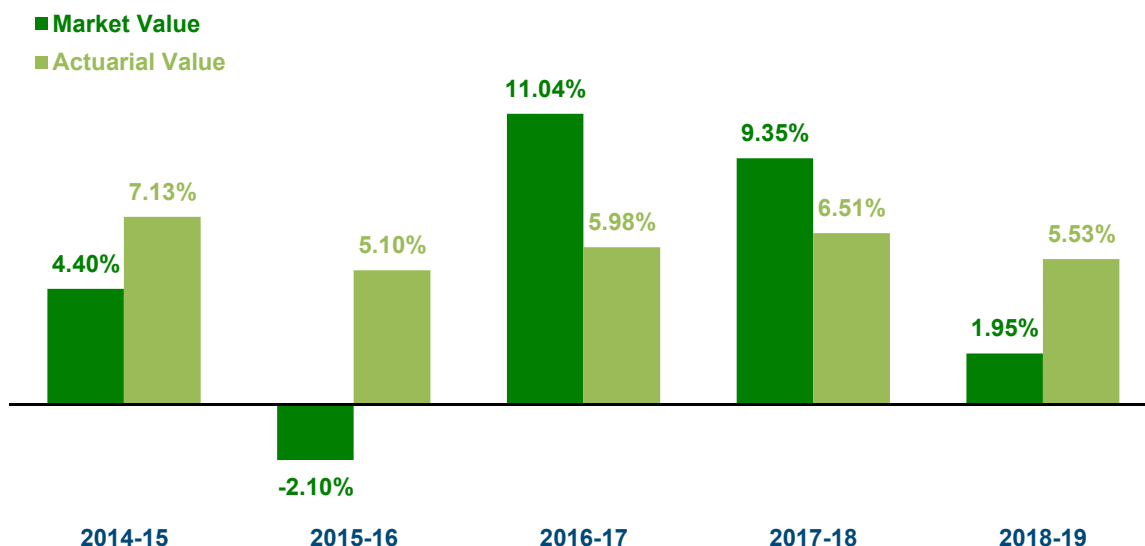
None.

Section I - Executive Summary Assets

There are two different measures of the plan's assets that are used throughout this report. The Market Value is a snapshot of the plan's investments as of the valuation date. The Actuarial Value is a smoothed asset value designed to temper the volatile fluctuations in the market by recognizing investment gains or losses asymptotically over five years.

	Market	Actuarial
Value as of July 1, 2018	\$216,109,348	\$222,457,678
City and Member Contributions	10,116,434	10,116,434
Investment Income	4,166,104	12,296,436
Benefit Payments and Administrative Expenses	<u>(15,646,059)</u>	<u>(15,646,059)</u>
Value as of July 1, 2019	214,745,827	229,224,489

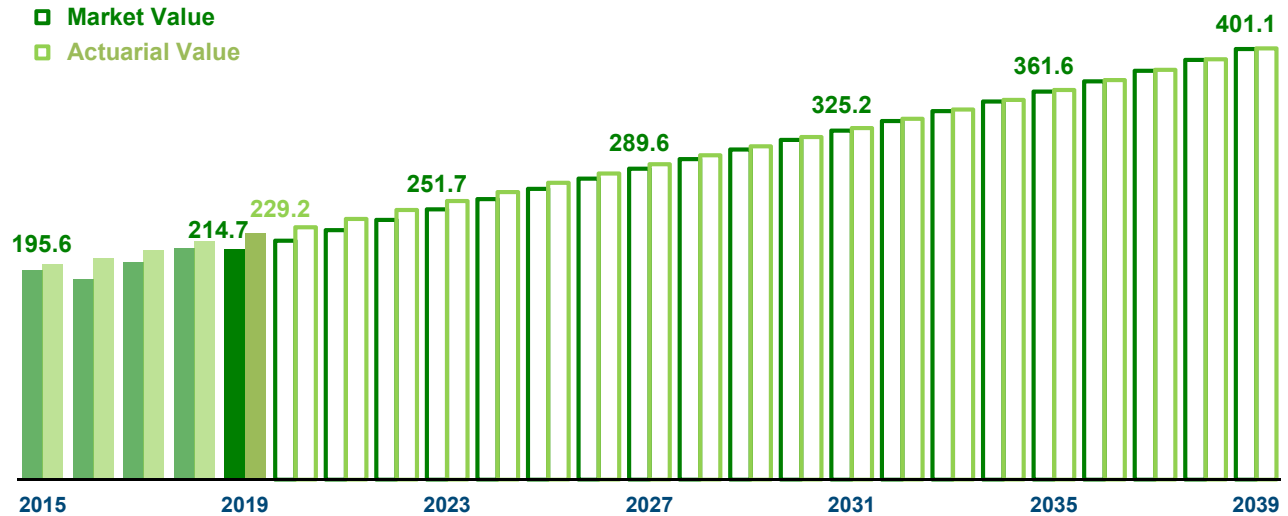
For fiscal year 2018-19, the plan's assets earned 1.95% on a Market Value basis and 5.53% on an Actuarial Value basis. The actuarial assumption for this period was 7.10%; the result is an asset loss of about \$11.0 million on a Market Value basis and a loss of about \$3.6 million on an Actuarial Value basis. Historical rates of return are shown in the graph below.



Please note that the Actuarial Value currently exceeds the Market Value by \$14.5 million. This figure represents investment losses that will be gradually recognized in future years. This process will exert upward pressure on the City's contribution, unless there are offsetting market gains.

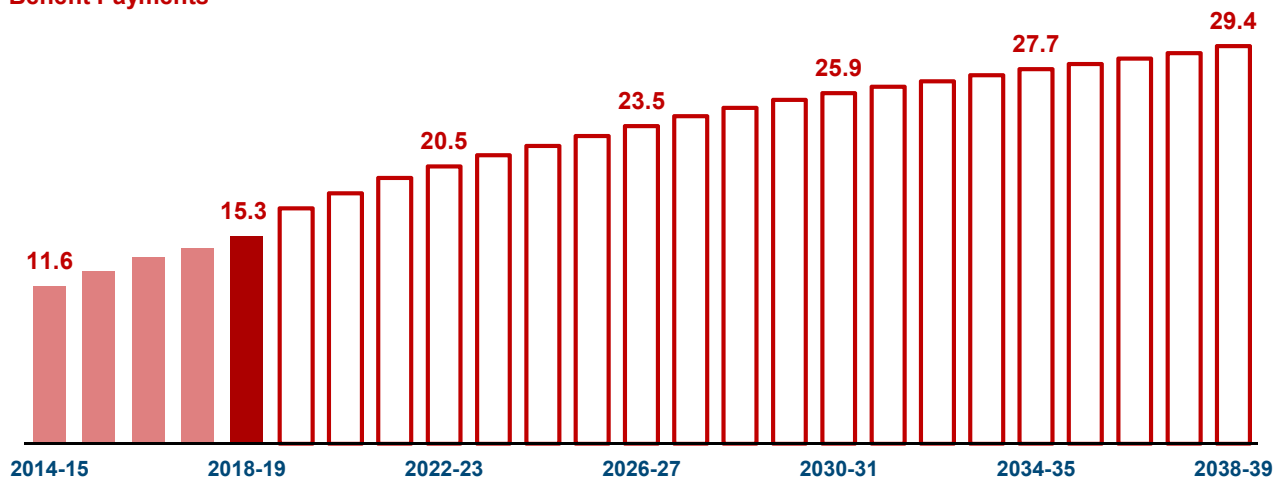
Section I - Executive Summary Assets (continued)

The graph below shows how this year's asset values compare to where the plan's assets have been over the past several years and how they are projected to change over the next 20 years. For purposes of this projection, we have assumed that the City always contributes the Actuarially Determined Contribution and the investments always earn the assumed interest rate each year.



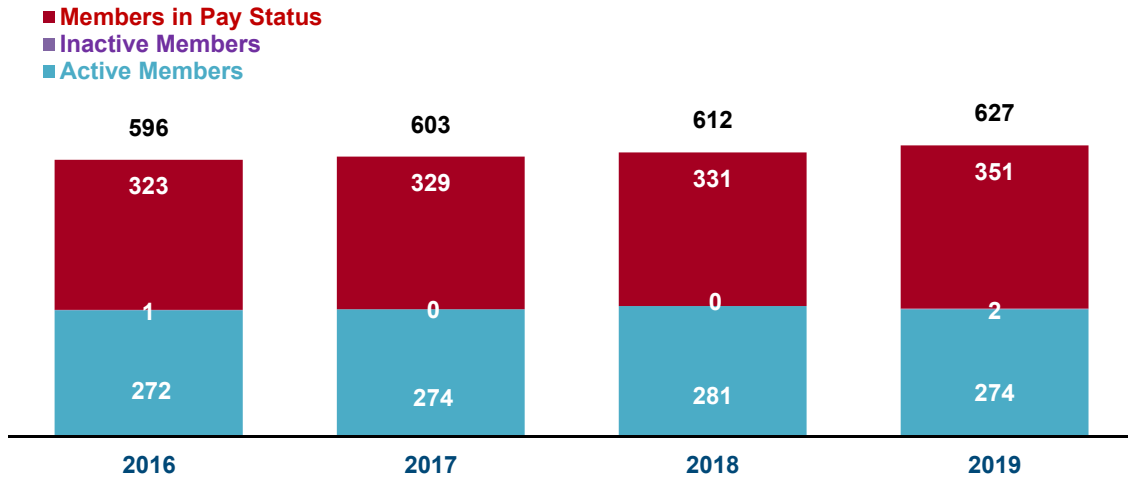
In 2018-19, the plan paid out \$15.3 million in benefits to members. Over the next 20 years, the plan is projected to pay out a total of \$489 million in benefits to members.

Benefit Payments



Section I - Executive Summary Membership

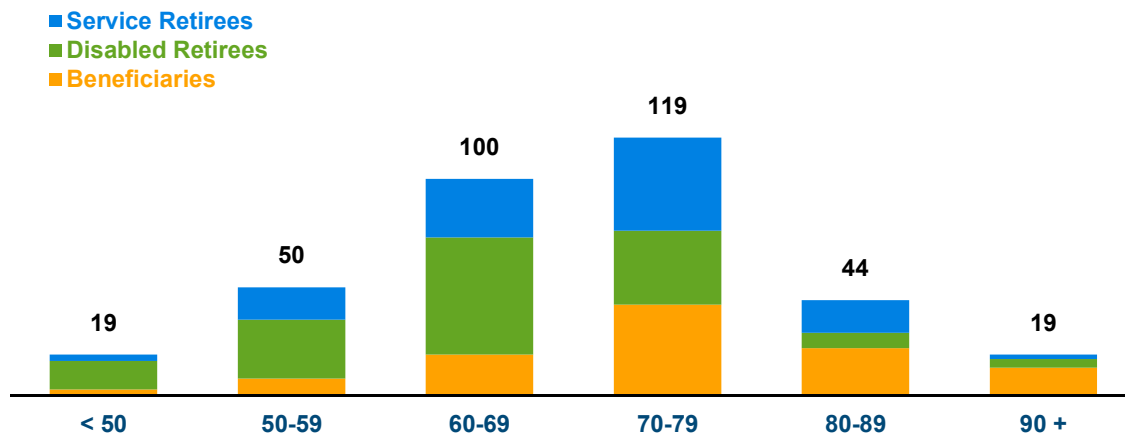
There are three basic categories of plan members included in the valuation: (1) members who are receiving monthly pension benefits, (2) former employees who have a vested right to benefits but have not yet started collecting, and (3) active employees who have met the eligibility requirements for membership.



Members in Pay Status on July 1, 2019

Service Retirees	105	Average Age	69.5
Disabled Retirees	139	Total Annual Benefit	\$16,225,647
Beneficiaries	107	Average Annual Benefit	46,227
Total	351		

The members in pay status fall across a wide distribution of ages:



Section I - Executive Summary Membership (continued)

Terminated Vested Members on July 1, 2019

Count	0
Average Age	0.0
Total Annual Benefit	\$0
Average Annual Benefit	0

Nonvested Members Due Refunds on July 1, 2019

Count	2
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Active Members on July 1, 2019

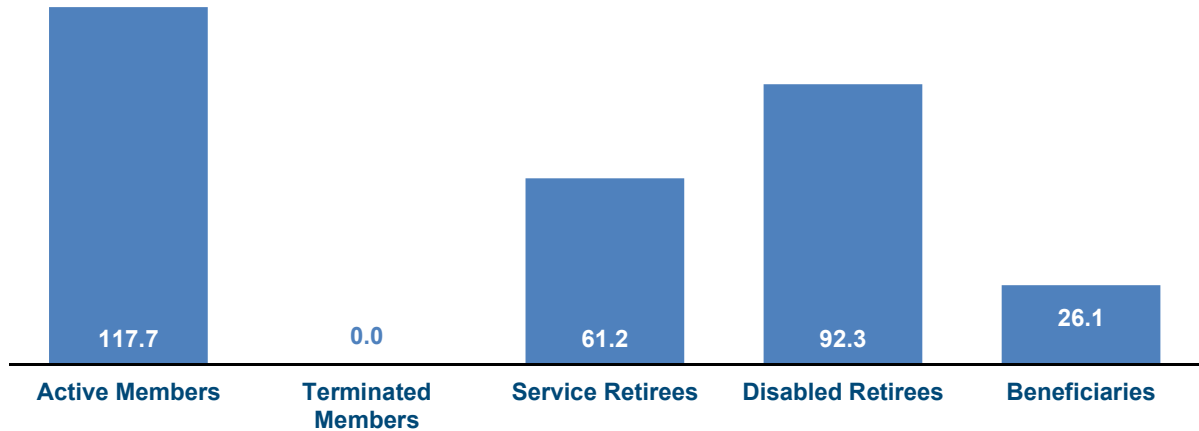
Count	274
Average Age	43.5
Average Service	15.6
Payroll	\$24,244,956
Average Payroll	88,485

The table below illustrates the age and years of service of the active membership:

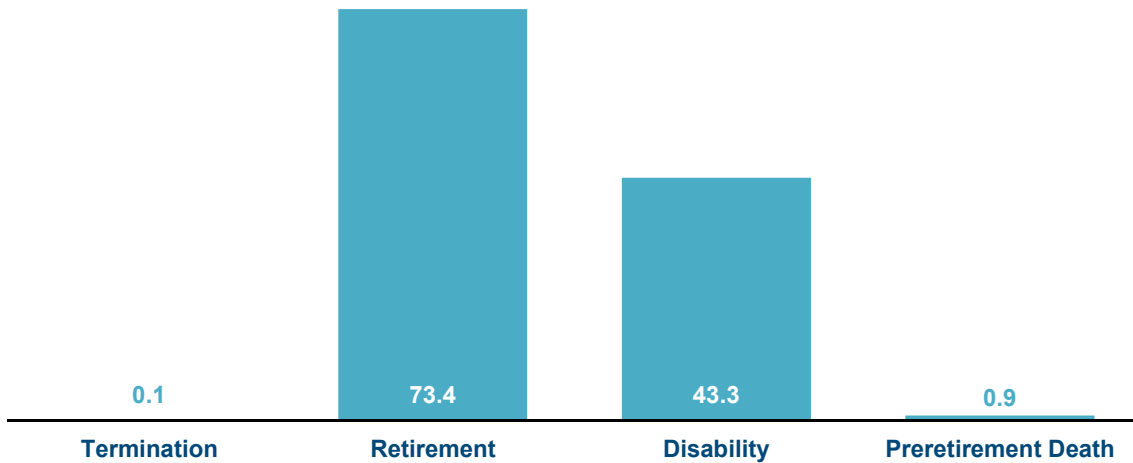
Age	Years of Service							Total
	0-4	5-9	10-14	15-19	20-24	25-29	30+	
< 25	7							7
25-29	29	5						34
30-34	20	17	5					42
35-39	4	9	12	1				26
40-44	2	5	11	5	7			30
45-49	1	2	7	13	22			45
50-54			2	9	22	7	6	46
55-59				1	5	4	11	21
60-64			1		1	3	11	16
65+					1		6	7
Total	63	38	38	29	58	14	34	274

Section I - Executive Summary Accrued Liability

The Accrued Liability as of July 1, 2019 is \$297,255,906 and consists of the following pieces (in \$ millions):



The Accrued Liability for active members can be broken down further by the different types of benefits provided by the plan:

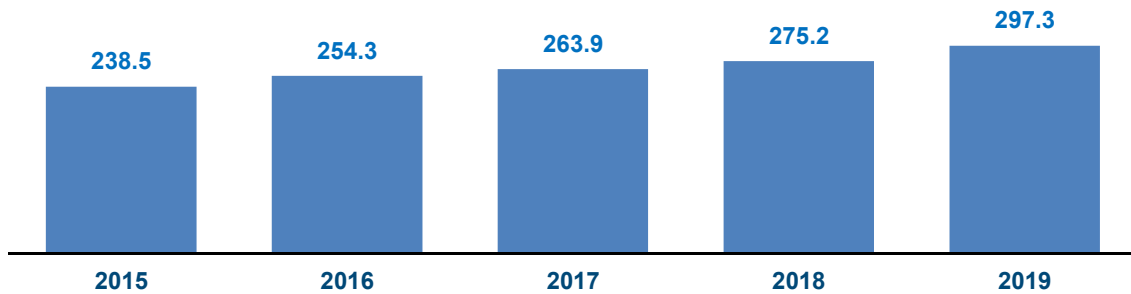


For purposes of determining the City's contribution, the Accrued Liability is measured using the Projected Unit Credit actuarial cost method. A different actuarial cost method, Entry Age Normal, is required to be used to measure liability for financial reporting purposes per GASB 67/68. As of July 1, 2019, the Entry Age Normal Accrued Liability is \$289,165,461.

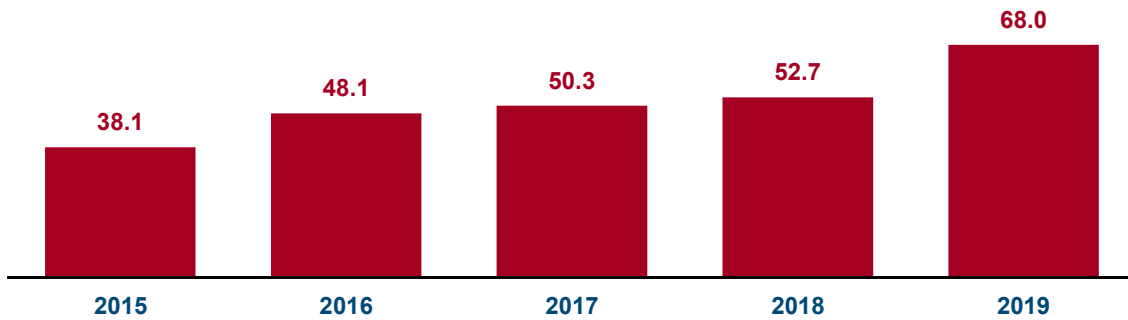
Section I - Executive Summary Funded Status

The Accrued Liability grows over time as active members earn additional benefits, and goes down over time as members receive benefits; it may also change when there are changes to the plan provisions or changes in the actuarial assumptions. The Unfunded Accrued Liability is the dollar difference between the Accrued Liability and the Actuarial Value of Assets; the Funded Ratio is the ratio of the two.

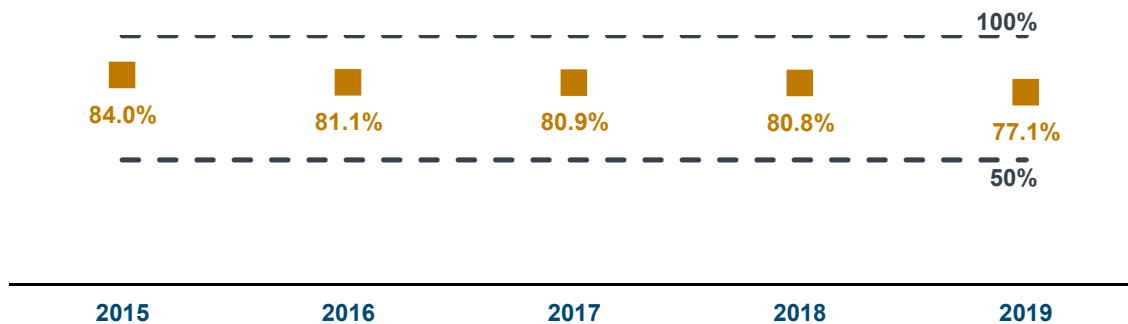
Accrued Liability (\$ millions)



Unfunded Accrued Liability (\$ millions)



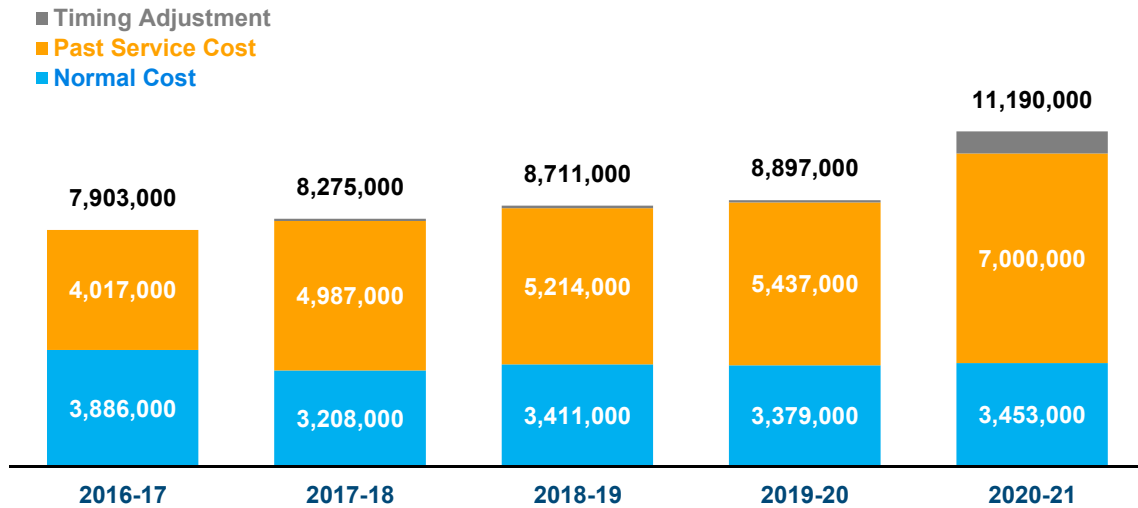
Funded Ratio



Section I - Executive Summary Actuarially Determined Contribution

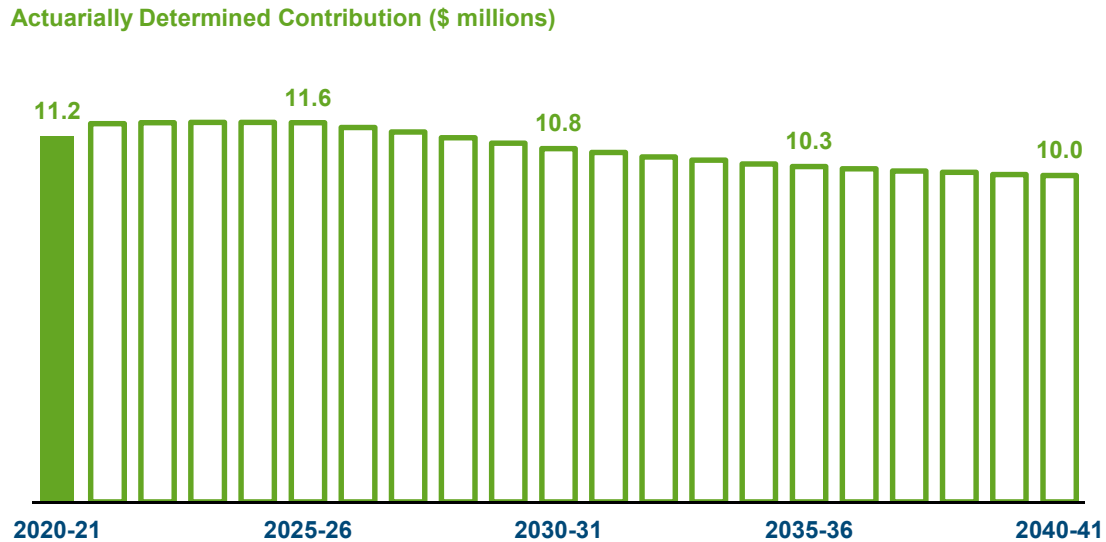
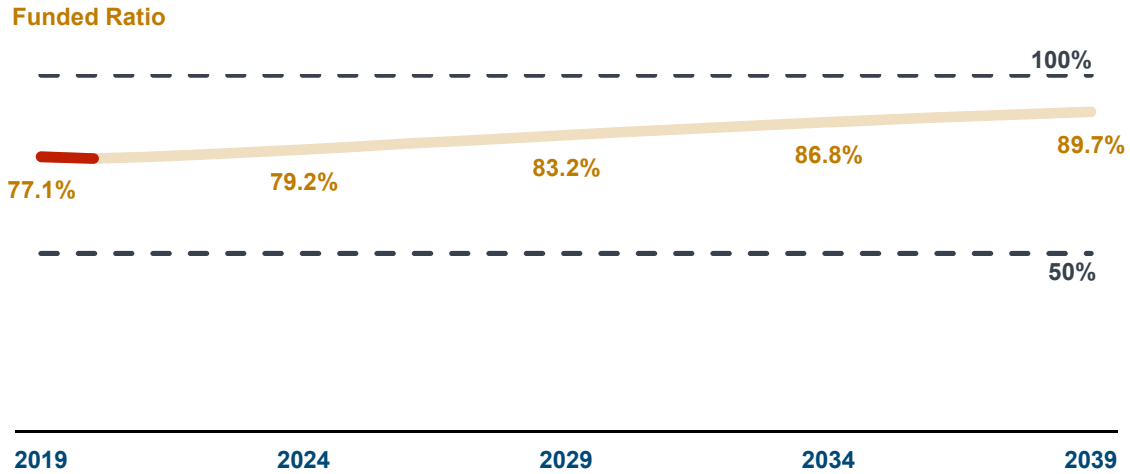
The Actuarially Determined Contribution consists of three pieces: a Normal Cost payment to fund the benefits earned each year, a Past Service Cost to gradually reduce any unfunded or surplus liability, and a Timing Adjustment to reflect the timing of the contribution relative to the valuation date.

The Actuarially Determined Contribution for fiscal year 2020-21 is shown graphically below, along with the comparable figures for the preceding four fiscal years. Note that the Normal Cost is relatively consistent from year to year, whereas the Past Service Cost tends to be more volatile since it reflects the impact of asset performance.



Section I - Executive Summary Long-Range Forecast

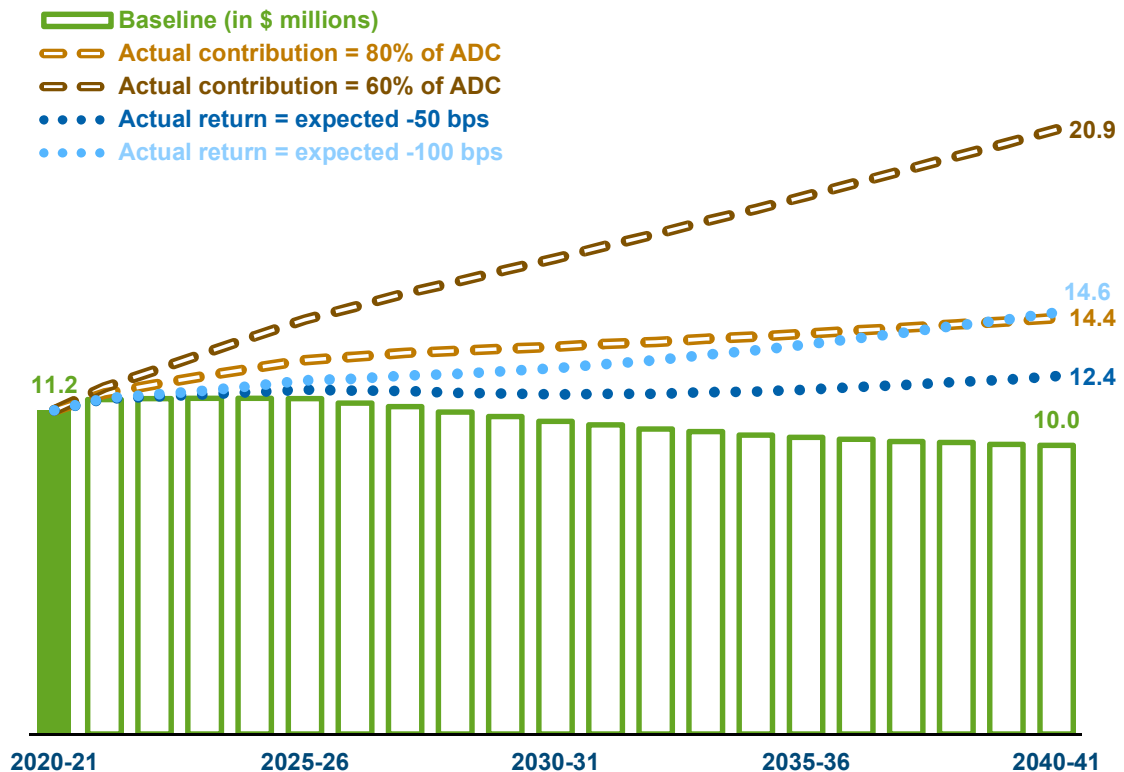
If the City pays the Actuarially Determined Contribution each year, the investments earn exactly the assumed interest rate each year, and there are no changes in the plan provisions or in the actuarial methods and assumptions, then we project the following changes in the plan's funded status and the long-range contribution levels:



To the extent that there are future investment or liability gains or losses, changes in the actuarial assumptions or methods, or plan changes, the actual valuation results will differ from these forecasts. Please see Section III C for more details of the long range forecast.

Section I - Executive Summary Long-Range Forecast (continued)

Pension benefits are paid for through a combination of contributions from the City and from employees, and from investment income. If the City pays less than the Actuarially Determined Contribution each year, or if the investments persistently earn less than the assumed interest rate, then the plan's funded status would suffer, and to compensate, the City's contribution levels would be pushed higher. The risks of underfunding and underearning are illustrated in the hypothetical scenarios below:



The scenarios illustrated above are based on deterministic projections that assume emerging plan experience always exactly matches the actuarial assumptions; in particular that actual asset returns will be constant in every year of the projection period. Variation in asset returns, contribution amounts, and many other factors may have a significant impact on the long-term financial health of the plan, the liquidity constraints on plan assets, and the City's future contribution levels. Stochastic projections could be prepared that would enable the City to understand the potential range of future results based on the expected variability in asset returns and other factors. Such analysis was beyond the scope of this engagement.

Section I - Executive Summary Summary of Principal Results

Membership as of	July 1, 2019	July 1, 2018
Active Members	274	281
Inactive Members	2	0
Members in Pay Status	351	331
Total Count	627	612
Payroll	\$24,244,956	\$24,435,134
Assets and Liabilities as of	July 1, 2019	July 1, 2018
Market Value of Assets	\$214,745,827	\$216,109,348
Actuarial Value of Assets	229,224,489	222,457,678
Accrued Liability for Active Members	117,690,217	119,440,135
Accrued Liability for Inactive Members	9,280	0
Accrued Liability for Members in Pay Status	179,556,409	155,720,619
Total Accrued Liability	297,255,906	275,160,754
Unfunded Accrued Liability	68,031,417	52,703,076
Funded Ratio	77.1%	80.8%
Actuarially Determined Contribution for Fiscal Year	2020-21	2019-20
Normal Cost	\$3,453,000	\$3,379,000
Past Service Cost	7,000,000	5,437,000
Timing Adjustment	737,000	81,000
Actuarially Determined Contribution	11,190,000	8,897,000

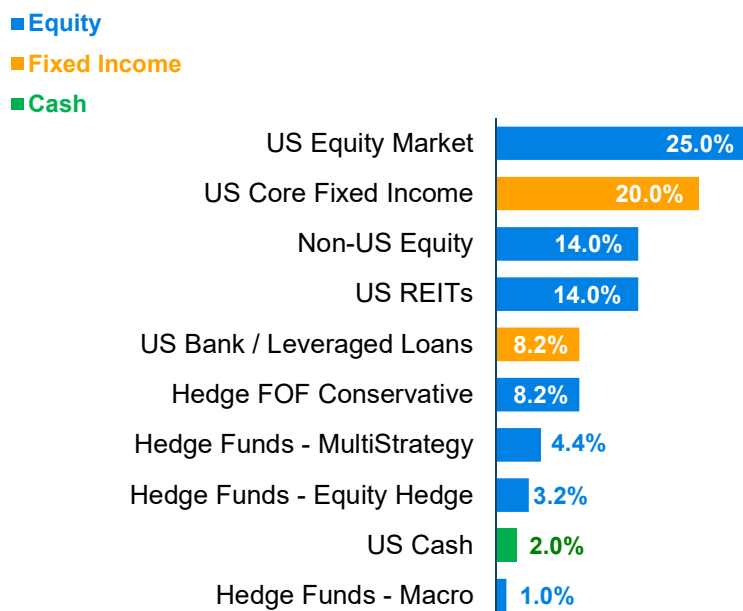
Section II - Plan Assets

A. Summary of Fund Transactions

Market Value as of July 1, 2018	\$216,109,348
City Contributions	8,711,000
Member Contributions	1,405,434
Net Investment Income	4,166,104
Benefit Payments	(15,342,795)
Administrative Expenses	(303,264)
 Market Value as of June 30, 2019	 214,745,827
Expected Return on Market Value of Assets	15,168,891
Market Value (Gain)/Loss	11,002,787
Approximate Rate of Return *	1.95%

* The rate shown here is not the dollar or time weighted investment yield rate which measures investment performance. It is an approximate net return assuming all activity occurred on average midway through the fiscal year.

Target Asset Allocation as of June 30, 2019



Section II - Plan Assets

B. Development of Actuarial Value of Assets

In order to minimize the impact of market fluctuations on the contribution level, we use an Actuarial Value of Assets that recognizes gains and losses asymptotically over a five year period. The Actuarial Value of Assets as of July 1, 2019 is determined below.

1.	Expected Actuarial Value of Assets:	
	a. Actuarial Value of Assets as of July 1, 2018	\$222,457,678
	b. City and Member Contributions	10,116,434
	c. Benefit Payments and Administrative Expenses	(15,646,059)
	d. Expected Earnings Based on 7.10% Interest	15,916,102
	e. Expected Actuarial Value of Assets as of July 1, 2019	232,844,155
2.	Market Value of Assets as of July 1, 2019	214,745,827
3.	Unrecognized Gains/(Losses): (2) - (1e)	(18,098,328)
4.	Amount Recognized as of July 1, 2019: 20% of (3)	(3,619,666)
5.	Preliminary Actuarial Value of Assets as of July 1, 2019: (1e) + (4)	229,224,489
6.	Preliminary Actuarial Value of Assets as a % of Market Value: (5) / (2)	106.7%
7.	Actuarial Value of Assets as of July 1, 2019: (5), within +/- 30% of (2)	229,224,489
8.	Actual Earnings on Actuarial Value of Assets: (7) - [(1a) + (1b) + (1c)]	12,296,436
9.	Approximate Rate of Return on Actuarial Value of Assets	5.53%
10.	Actuarial Value (Gain)/Loss: (1d) - (8)	3,619,666

Section III - Development of Contribution

A. Past Service Cost

In determining the Past Service Cost, the Unfunded Accrued Liability is amortized as a level dollar amount over 15 years.

	July 1, 2019	July 1, 2018
1. Accrued Liability		
Active Members	\$117,690,217	\$119,440,135
Inactive Members	9,280	0
Service Retirees	61,237,094	48,254,736
Disabled Retirees	92,255,746	82,367,061
Beneficiaries	26,063,569	25,098,822
Total Accrued Liability	297,255,906	275,160,754
2. Actuarial Value of Assets (see Section IIB)	229,224,489	222,457,678
3. Unfunded Accrued Liability: (1) - (2)	68,031,417	52,703,076
4. Funded Ratio: (2) / (1)	77.1%	80.8%
5. Amortization Period	15	15
6. Amortization Growth Rate	0.00%	0.00%
7. Past Service Cost: (3) amortized over (5)	6,999,617	5,437,084

Section III - Development of Contribution

B. Actuarially Determined Contribution

	2020-21	2019-20
1. Total Normal Cost	\$4,598,266	\$4,515,298
2. Expected Member Contributions	1,447,243	1,410,892
3. Expected Administrative Expenses	302,000	275,000
4. Net Normal Cost: (1) - (2) + (3)	3,453,023	3,379,406
5. Past Service Cost (see Section IIIA)	6,999,617	5,437,084
6. Interest on (4) + (5) to start of the fiscal year*	737,000	81,000
7. Actuarially Determined Contribution: (4) + (5) + (6), rounded to \$1,000	11,190,000	8,897,000

**Previously the timing adjustment added interest to the net normal based on the rate of inflation.*

Section III - Development of Contribution

C. Long Range Forecast

This forecast is based on the results of the July 1, 2019 actuarial valuation and assumes that the City will pay the Actuarially Determined Contribution each year, the assets will return the assumed interest rate on a market value basis each year, and there are no future changes in the actuarial methods or assumptions or in the plan provisions. Actual results at each point in time will yield different values, reflecting the actual experience of the plan membership and assets.

Valuation Date	Values as of the Valuation Date				Fiscal Year	Cash Flows Projected to the Following Fiscal Year			
	Accrued Liability	Actuarial Value of Assets	Unfunded Accrued Liability	Funded Ratio		City Contributions	Member Contributions	Benefit Payments	Net Cash Flows
7/1/2019	\$297,255,906	\$229,224,489	\$68,031,417	77.1%	2020-21	\$11,190,000	\$1,482,515	(\$18,492,954)	(\$5,820,439)
7/1/2020	306,710,000	234,990,000	71,720,000	76.6%	2021-22	11,564,000	1,555,000	(19,643,000)	(6,524,000)
7/1/2021	315,270,000	242,948,000	72,322,000	77.1%	2022-23	11,597,000	1,649,000	(20,489,000)	(7,243,000)
7/1/2022	323,289,000	251,125,000	72,164,000	77.7%	2023-24	11,602,000	1,729,000	(21,324,000)	(7,993,000)
7/1/2023	330,918,000	259,450,000	71,468,000	78.4%	2024-25	11,604,000	1,813,000	(21,994,000)	(8,577,000)
7/1/2024	338,361,000	267,856,000	70,505,000	79.2%	2025-26	11,594,000	1,837,000	(22,731,000)	(9,300,000)
7/1/2025	345,735,000	276,479,000	69,256,000	80.0%	2026-27	11,447,000	1,907,000	(23,455,000)	(10,101,000)
7/1/2026	352,984,000	285,155,000	67,829,000	80.8%	2027-28	11,317,000	1,896,000	(24,203,000)	(10,990,000)
7/1/2027	360,084,000	293,772,000	66,312,000	81.6%	2028-29	11,133,000	1,963,000	(24,807,000)	(11,711,000)
7/1/2028	366,847,000	302,212,000	64,635,000	82.4%	2029-30	10,974,000	2,046,000	(25,399,000)	(12,379,000)
7/1/2029	373,441,000	310,610,000	62,831,000	83.2%	2030-31	10,809,000	2,127,000	(25,899,000)	(12,963,000)
7/1/2030	379,979,000	319,001,000	60,978,000	84.0%	2031-32	10,689,000	2,212,000	(26,375,000)	(13,474,000)
7/1/2031	386,546,000	327,455,000	59,091,000	84.7%	2032-33	10,551,000	2,289,000	(26,780,000)	(13,940,000)
7/1/2032	393,283,000	336,040,000	57,243,000	85.4%	2033-34	10,456,000	2,373,000	(27,232,000)	(14,403,000)
7/1/2033	400,207,000	344,798,000	55,409,000	86.2%	2034-35	10,338,000	2,436,000	(27,672,000)	(14,898,000)
7/1/2034	407,434,000	353,737,000	53,697,000	86.8%	2035-36	10,256,000	2,494,000	(28,059,000)	(15,309,000)
7/1/2035	414,829,000	362,826,000	52,003,000	87.5%	2036-37	10,190,000	2,580,000	(28,444,000)	(15,674,000)
7/1/2036	422,532,000	372,155,000	50,377,000	88.1%	2037-38	10,118,000	2,627,000	(28,860,000)	(16,115,000)
7/1/2037	430,574,000	381,783,000	48,791,000	88.7%	2038-39	10,078,000	2,704,000	(29,377,000)	(16,595,000)
7/1/2038	439,104,000	391,648,000	47,456,000	89.2%	2039-40	10,010,000	2,795,000	(29,876,000)	(17,071,000)

Section III - Development of Contribution
D. History of Funded Status

Valuation Date	Actuarial Value of Assets	Accrued Liability	Unfunded Accrued Liability	Funded Ratio
July 1, 2019	\$229,224,489	\$297,255,906	\$68,031,417	77.1%
July 1, 2018	222,457,678	275,160,754	52,703,076	80.8%
July 1, 2017	213,613,510	263,886,403	50,272,893	80.9%
July 1, 2016	206,260,036	254,339,167	48,079,131	81.1%
July 1, 2015	200,353,566	238,471,000	38,117,434	84.0%
July 1, 2014	190,899,353	225,233,000	34,333,647	84.8%
July 1, 2013	180,800,365	213,642,000	32,841,635	84.6%
July 1, 2012	174,748,070	204,563,000	29,814,930	85.4%
July 1, 2011	171,079,371	192,260,000	21,180,629	89.0%
July 1, 2010	166,770,165	183,963,000	17,192,835	90.7%

Section III - Development of Contribution E. History of City Contributions

Fiscal Year	Actuarially Determined Contribution	Actual City Contribution	Payroll	Actual Contribution as a Percent of Payroll
2020-21	\$11,190,000	TBD	\$24,244,956	TBD
2019-20	8,897,000	TBD	24,435,134	TBD
2018-19	8,711,000	\$8,711,000	22,344,105	39.0%
2017-18	8,275,000	8,275,000	22,958,568	36.0%
2016-17	7,903,000	7,903,000	22,320,912	35.4%
2015-16	7,158,000	7,158,000	23,328,220	30.7%
2014-15	6,645,000	6,645,000	22,648,757	29.3%
2013-14	6,230,000	6,230,000	21,994,000	28.3%
2012-13	4,885,000	4,885,000	21,378,237	22.9%
2011-12	4,341,000	4,341,000	21,378,237	20.3%

Section IV - Membership Data

A. Reconciliation of Membership from Prior Valuation

Details of the changes in the Plan membership since the last valuation are shown below. Additional details on the Plan membership are provided in the remainder of Section IV.

	Active Members	Terminated Vested Members	Nonvested Members Due Refunds	Service Retirees	Disabled Retirees	Beneficiaries	Total
Count July 1, 2018	281	0	0	94	132	105	612
Terminated							
- no benefits due	(2)	-	2	-	-	-	0
- paid refund	-	-	-	-	-	-	0
- vested benefits due	-	-	-	-	-	-	0
Retired	(24)	-	-	14	10	-	0
Died							
- with beneficiary	-	-	-	(2)	(2)	-	(4)
- no beneficiary	-	-	-	(1)	(1)	(1)	(3)
Benefits expired	-	-	-	-	-	(1)	(1)
New member	19	-	-	-	-	4	23
Rehired	-	-	-	-	-	-	0
New Alternate Payee	-	-	-	-	-	-	0
Correction	-	-	-	-	-	-	0
Count July 1, 2019	274	0	2	105	139	107	627

Section IV - Membership Data
B. Statistics of Active Membership

	As of July 1, 2019	As of July 1, 2018
Number of Active Members	274	281
Average Age	43.5	44.7
Average Service	15.6	16.9
Total Payroll	\$24,244,956	\$24,435,134
Average Payroll	88,485	86,958

Section IV - Membership Data

C. Statistics of Inactive Membership

	As of July 1, 2019	As of July 1, 2018
Terminated Vested Members		
Number	0	0
Total Annual Benefit	\$0	\$0
Average Annual Benefit	0	0
Average Age	0.0	0.0
Nonvested Members Due Refunds		
Number	2	0
Service Retirees		
Number	105	94
Total Annual Benefit	\$5,436,462	\$4,477,749
Average Annual Benefit	51,776	47,636
Average Age	69.8	70.9
Disabled Retirees		
Number	139	132
Total Annual Benefit	\$7,757,108	\$7,028,941
Average Annual Benefit	55,807	53,250
Average Age	65.1	64.7
Beneficiaries		
Number	107	105
Total Annual Benefit	\$3,032,077	\$2,921,680
Average Annual Benefit	28,337	27,826
Average Age	75.1	73.6

Section IV - Membership Data
D. Distribution of Inactive Members as of July 1, 2019

	Age	Number	Annual Benefits
Terminated Vested Members	< 50	0	\$0
	50 - 59	0	0
	60 - 69	0	0
	70 - 79	0	0
	80 - 89	0	0
	90 +	0	0
	Total	0	0
Service Retirees	< 50	3	\$173,671
	50 - 59	15	950,322
	60 - 69	27	1,635,444
	70 - 79	43	2,054,127
	80 - 89	15	518,987
	90 +	2	103,910
	Total	105	5,436,462
Disabled Retirees	< 50	13	\$781,429
	50 - 59	27	1,731,081
	60 - 69	54	3,348,876
	70 - 79	34	1,586,222
	80 - 89	7	243,124
	90 +	4	66,375
	Total	139	7,757,108
Beneficiaries	< 50	3	\$54,169
	50 - 59	8	193,638
	60 - 69	19	654,832
	70 - 79	42	1,303,205
	80 - 89	22	504,329
	90 +	13	321,904
	Total	107	3,032,077

Section V - Analysis of Risk

A. Introduction

The results of this actuarial valuation are based on one set of reasonable assumptions. However, it is almost certain that future experience will not exactly match these assumptions. As an example, the plan's investments may perform better or worse than assumed in any single year and over any longer time horizon. It is therefore important to consider the potential impacts of these likely differences when making decisions that may affect the future financial health of the plan, or of the plan's members.

In addition, as plans mature they accumulate larger pools of assets and liabilities. The increase in size in turn increases the potential magnitude of adverse experience. As an example, the dollar impact of a 10% investment loss on a plan with \$1 billion in assets and liabilities is much greater than the dollar impact for a plan with \$1 million in assets and liabilities. Since pension plans make long-term promises and rely on long-term funding, it is important to consider how mature the plan is today, and how mature it may become in the future.

Actuarial Standard of Practice No. 51 (ASOP 51) directs actuaries to provide pension plan sponsors with information concerning the risks associated with the plan:

- Identify risks that may be significant to the plan.
- Assess the risks identified as significant to the plan. The assessment does not need to include numerical calculations.
- Disclose plan maturity measures and historical information that are significant to understanding the plan's risks.

This section of the report uses the framework of ASOP 51 to communicate important information about significant risks to the plan, the plan's maturity, and relevant historical plan data.

Please see Section III C for more information on the basis for the projected results shown on the following pages.

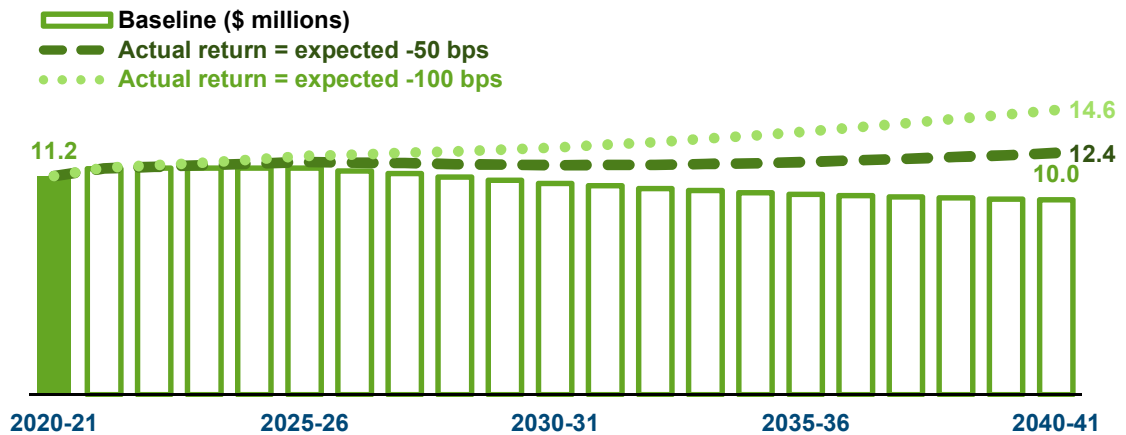
Section V - Analysis of Risk

B. Risk Identification and Assessment

Investment Risk

Definition: This is the potential that investment returns will be different than expected.

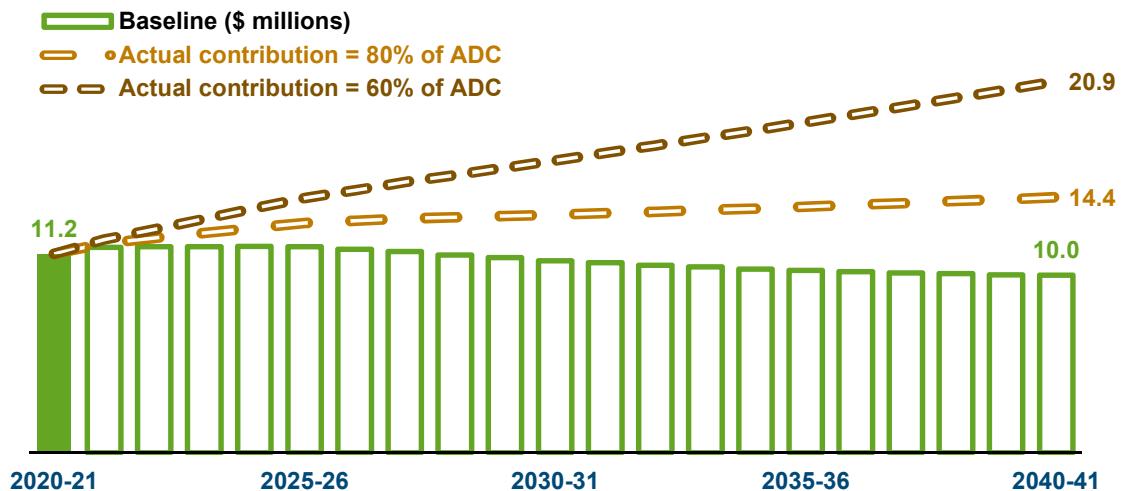
Identification: To the extent that actual investment returns differ from the assumed investment return, the plan's future assets, Actuarially Determined Contributions, and funded status may differ significantly from those presented in this valuation. The consequences of persistent underperformance on future Actuarially Determined Contribution levels are illustrated below:



Contribution Risk

Definition: This is the potential that actual future contributions will be less than the Actuarially Determined Contribution.

Identification: Over the past 8 years, actual contributions have been 100.0% of the Actuarially Determined Contribution in total. The consequences of persistent underfunding on future Actuarially Determined Contribution levels are illustrated below:



Section V - Analysis of Risk

B. Risk Identification and Assessment

Liquidity Risk

Definition: This is the potential that assets must be liquidated at a loss earlier than planned in order to pay for the plan's benefits and operating costs. This risk is heightened for plans with negative cash flows, in which contributions are not sufficient to cover benefit payments plus expenses.

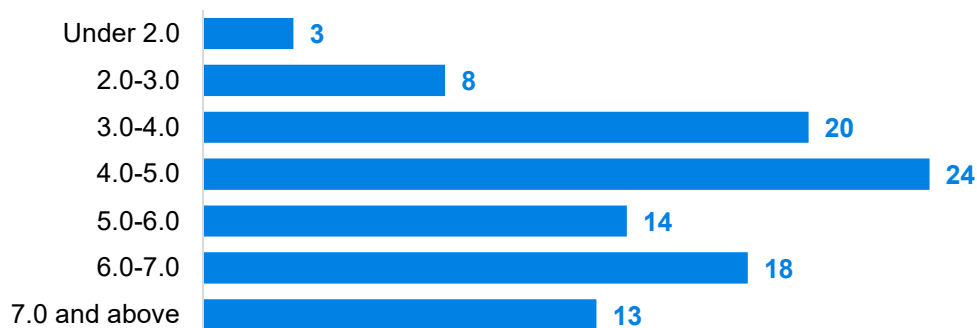
Identification: In 2018-19, the plan had negative cash flow, with city and member contributions to the plan of \$10,116,434 compared to \$15,646,059 of benefit payments and administrative expenses paid out of the plan. We suggest that you consult with your investment advisors with respect to the liquidity characteristics of the plan's investment holdings.

Maturity Risk

Definition: This is the potential for total plan liabilities to become more heavily weighted toward inactive liabilities over time, and for plan assets and/or liabilities to become larger relative to the active member liability.

Identification: The plan is subject to maturity risk because as plan assets and liabilities continue to grow, the dollar impact of any gains or losses on the assets or liabilities also becomes larger.

Assessment: As of July 1, 2019, the plan's Asset Volatility Ratio (the ratio of the market value of plan assets to payroll) is 8.9. According to Milliman's 2018 Public Pension Funding Study, the 100 largest US public pension plans have the following range of Asset Volatility Ratios:



Inflation Risk

Definition: This is the potential for a pension to lose purchasing power over time due to inflation.

Identification: The members of pension plans without fully inflation-indexed benefits are subject to the risk that their purchasing power will be reduced over time due to inflation.

Assessment: This plan does not contain a mechanism to regularly increase benefits after retirement, so members bear all of the inflation risk.

Section V - Analysis of Risk

B. Risk Identification and Assessment

Insolvency Risk

Definition: This is the potential that a plan will become insolvent; that is, assets will be fully depleted.

Identification: If a plan becomes insolvent, contractually required benefits must be paid from the plan sponsor's other remaining assets.

Assessment: Under the GASB 68 depletion date methodology, the plan is not projected to become insolvent. Please see the GASB 68 report for more details on the underlying analysis.

Demographic Risks

Definition: This is the potential that mortality, turnover, retirement, or other demographic experience will be different than expected.

Identification: The pension liabilities reported herein have been calculated by assuming that members will follow patterns of demographic experience as described in Appendix B. If actual demographic experience or future demographic assumptions are different from what is assumed to occur in this valuation, future pension liabilities, Actuarially Determined Contributions, and funded status may differ significantly from those presented in this valuation. Formal Experience Studies performed on a regular basis are helpful in ensuring that the demographic assumptions reflect emerging plan experience.

Retirement Risk

Definition: This is the potential for members to retire and receive subsidized benefits that are more valuable than expected.

Identification: This plan permits members to retire with unreduced benefits at young ages. If members retire at earlier ages than are anticipated by the actuarial assumptions, this will put upward pressure on subsequent Actuarially Determined Contributions.

Additional Pension Credit Risk

Definition: This is the potential for active members to trade in unused sick and/or vacation days and receive pension benefits that are higher than expected.

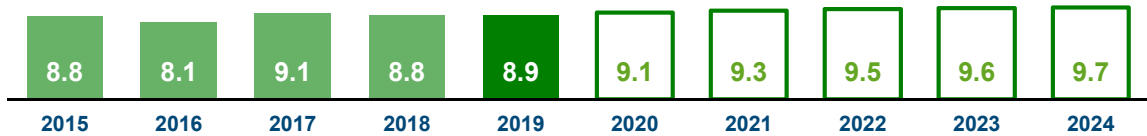
Identification: This plan permits some members to trade in unused sick and/or vacation days to increase their total pension multiplier. We assume that on average members elect to receive 34% of the maximum additional pension credit. If members elect to receive more than 34% of the maximum additional pension credit on average, this will put upward pressure on subsequent Actuarially Determined Contributions.

Section V - Analysis of Risk

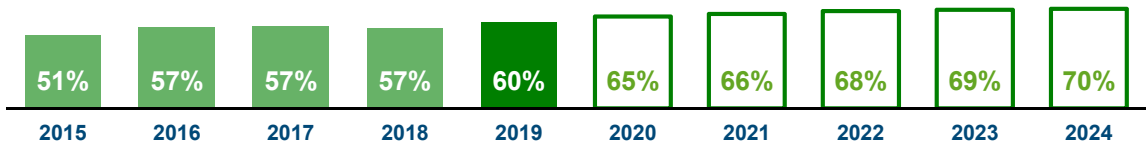
C. Maturity Measures

The metrics presented below are different ways of understanding the plan's maturity level, both in the past and as it is expected to change in the coming years.

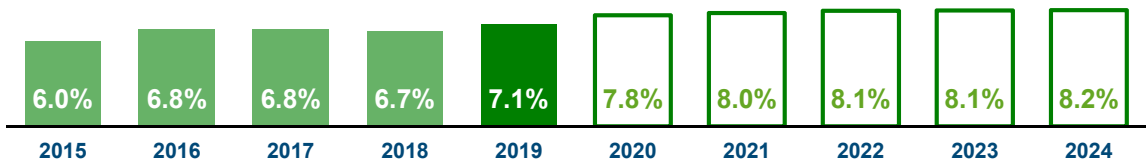
Asset Volatility Ratio: Market Value of Assets compared to Payroll



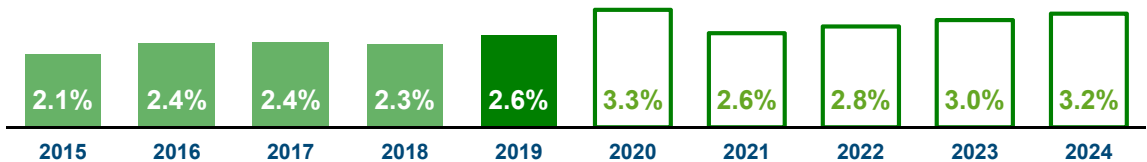
Accrued Liability for members in pay status compared to total Accrued Liability



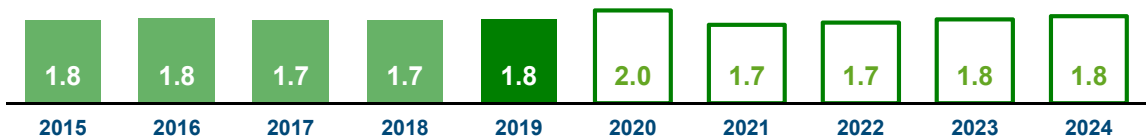
Benefit Payments compared to Market Value of Assets



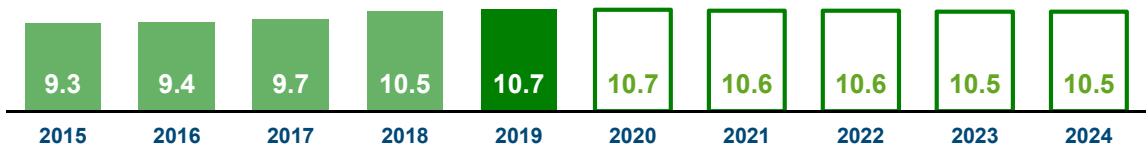
Net Cash Flows compared to Market Value of Assets



Benefit Payments compared to City Contributions



Duration of Accrued Liability (based on GASB 68 sensitivity disclosures)



Appendix A - Actuarial Funding Method

The actuarial funding method used in the valuation of this Plan is known as the Projected Unit Credit Cost Method. The Actuarially Determined Contribution consists of three pieces: Normal Cost plus a Past Service Cost payment to gradually eliminate the Unfunded Accrued Liability plus a Timing Adjustment to reflect the timing of the contribution relative to the valuation date.

Under this cost method a projected retirement benefit at assumed retirement age is computed for each member. The Normal Cost for each member is computed as the present value of the pro-rata portion of the member's projected benefit which is accrued or earned during the plan year being valued. The normal cost of the plan is the total of the individually computed normal costs for all members. The Accrued Liability at any point in time for an active member is the present value of that portion of the projected benefit which has been accrued up to the valuation date. For members receiving benefits or entitled to a deferred benefit, the accrued liability is equal to the present value of their future benefit payments. The accrued liability for the plan is the total of individually computed accrued liability amounts for all members.

The funding cost of the Plan is derived by making certain specific assumptions as to rates of interest, mortality, turnover, etc. which are assumed to hold for many years into the future. Since actual experience may differ somewhat from the assumptions, the costs determined by the valuation must be regarded as estimates of the true costs of the Plan.

The Unfunded Accrued Liability is the excess of the Accrued Liability over the assets which have been accumulated for the plan. This Unfunded Accrued Liability is amortized as a level dollar amount over an open period of 15 years.

The Actuarial Value of Assets is determined by recognizing market gains and losses asymptotically over a five year period; the result is constrained to within +/- 30% of the market value of assets as of the valuation date.

The long-range forecasts included in this report have been developed by assuming that members will terminate, retire, become disabled, and die according to the actuarial assumptions with respect to these causes of decrement, and that pay increases, cost of living adjustments, and so forth will likewise occur according to the actuarial assumptions. For those unions whose new employees are eligible to participate in this plan, members who are projected to leave active employment are assumed to be replaced by new active members with the same age, service, gender, and pay characteristics as those hired in the past few years, as well as incorporating the characteristics of the current active employees as a whole.

Appendix B - Actuarial Assumptions

Each of the assumptions used in this valuation was set based on a formal study of the plan's experience for the period July 1, 2008 to June 30, 2015 which reflected industry standard published tables and data, the particular characteristics of the plan, relevant information from the plan sponsor or other sources about future expectations, and our professional judgment regarding future plan experience. We believe the assumptions are reasonable for the contingencies they are measuring, and are not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

Interest Rate 7.05% (prior: 7.10%)

Inflation Rate 2.60%

Expenses The average of the prior year two year's administrative expenses, rounded to the nearest \$1,000.

Salary Scale	Service	Rate
	0-1	15.00%
	2-5	6.00%
	6+	2.75%

Turnover	Age	Rate
	20	1.81%
	25	1.63%
	30	1.23%
	35	0.78%
	40+	0.00%

Retirement	Service	Rate	Service	Rate
	20	13%	36	21%
	21	11%	37	17%
	22	8%	38	16%
	23-26	7%	39	18%
	27-29	8%	40-41	24%
	30	11%	42	27%
	31	13%	43	21%
	32	14%	44	25%
	33	13%	45	22%
	34	19%	46	35%
	35	20%	47	50%

Retirement rate at age 65 is 100%.

Appendix B - Actuarial Assumptions

Disability	Age	Rate
	20	0.30%
	25	0.30%
	30	0.30%
	35	0.36%
	40	0.54%
	45	1.08%
	50	2.40%
	55	5.10%
	60	10.44%

Disability benefits are assumed to be service connected and equal to 75% of pay.

Mortality PubS-2010 Mortality Table with generational projection per the MP Ultimate scale, with employee rates before benefit commencement and healthy, disabled and contingent annuitant rates after benefit commencement. This assumption includes a margin for mortality improvement beyond the valuation date. (Prior: RP-2000 Blue Collar Combined Table, with separate tables for males and females and generational projection per Scale BB.)

Pre-retirement deaths are assumed to be not service connected.

Marital Status 80% of active participants are assumed to be married. Female spouses are assumed to be 4 years younger than male spouses.

Sick/Vacation Bank Retiring members are assumed to elect 34% of the maximum additional pension credit as an annuity from the fund.

Post-Retirement Life Insurance 100% of active and retired employees are assumed to have a \$4,000 life insurance policy beginning at retirement.

Appendix C - Summary of Plan Provisions

This exhibit summarizes the major provisions of the Plan. It is not intended to be, nor should it be interpreted as a complete statement of all plan provisions. All eligibility requirements and benefit amounts shall be determined in strict accordance with the plan document itself. To the extent that this summary does not accurately reflect the plan provisions, then the results of this valuation may not be accurate.

Pension Earnings	<p>Base salary in the final year of employment plus 14 paid holidays for employees hired before April 11, 2016.</p> <p>Average of 3 highest base salaries (including 14 paid holidays) for employees hired after April 11, 2016.</p>
Normal Retirement Eligibility	20 years of service.
Normal Retirement Benefit	<p>2.50% of Pension Earnings multiplied by years of service up to 20 plus an additional 3.00% of Pension Earnings for each additional year of service up to 25 plus an additional 2.33% of Pension Earnings for each year of service up to 30 for employees hired before April 11, 2016. The maximum benefit is 76.65% of Pension Earnings.</p> <p>2.25% of Pension Earnings multiplied by years of service for employees hired after April 11, 2016. The maximum benefit multiplier is 100% for these employees.</p>
Disability Eligibility:	No service requirement.
Disability Benefit	100% or 75% of salary depending on the extent of the disability.
Non-Service Preretirement Death Eligibility	10 years of service.
Non-Service Preretirement Death Benefit	50% of salary.
Service Preretirement Death Eligibility	No service requirement.
Service Preretirement Death Benefit	50% of salary but not less than the accrued benefit.
Postretirement Spouse's Benefit	100% of the benefit the retiree was receiving for employees hired before April 11, 2016. Employees may elect a reduced joint & survivor annuity at retirement if hired after April 11, 2016.
Postretirement Lump Sum at Death	\$4,000.

Appendix C - Summary of Plan Provisions

Termination Benefit	If the member is not vested, the member is paid a refund of their accumulated contributions.
Vesting	100% after 10 years of service.
Termination Benefit	<p>If the member is not vested, the member is paid a refund of their accumulated contributions.</p> <p>If the member is vested, the member can elect to receive the member's accrued benefit beginning when the member would have reach the 20th anniversary of date of hire.</p>
Employee Contributions	<p>Active members contribute 7.0% of salary:</p> <p>Contributions cease at 30 years of service for employees hired before April 11, 2016.</p> <p>Contributions cease at 35 years of service for employees hired after April 11, 2016.</p>
Sick/Vacation Exchange	<p>Employees can trade in 50% of sick leave for additional pension credit. If an officer's sick bank has less than 200 days, unused vacation time may be added, subject to a maximum of 200 days total. Each 20 days grants an additional 1.5% of salary up to a maximum of 7.5%.</p> <p>Employees hired after April 11, 2016 are not eligible for this additional retirement benefit.</p>
Deferred Retirement Option Plan ("DROP")	An active employee may elect the DROP upon reaching 20 years of service. They will continue to work while receiving their pension benefit. The DROP election period is 1-3 years.

Appendix D - Glossary

Actuarial Cost Method - This is a procedure for determining the Actuarial Present Value of Benefits and allocating it to time periods to produce the Actuarial Accrued Liability and the Normal Cost.

Accrued Liability - This is the portion of the Actuarial Present Value of Benefits attributable to periods prior to the valuation date by the Actuarial Cost Method (i.e., that portion not provided by future Normal Costs).

Actuarial Assumptions - With any valuation of future benefits, assumptions of anticipated future events are required. If actual events differ from the assumptions made, the actual cost of the plan will vary as well. Some examples of key assumptions include the interest rate, salary scale, and rates of mortality, turnover and retirement.

Actuarial Present Value of Benefits - This is the present value, as of the valuation date, of future payments for benefits and expenses under the Plan, where each payment is: a) multiplied by the probability of the event occurring on which the payment is conditioned, such as the probability of survival, death, disability, termination of employment, etc.; and b) discounted at the assumed interest rate.

Actuarial Value of Assets - This is the value of cash, investments and other property belonging to the plan, typically adjusted to recognize investment gains or losses over a period of years to dampen the impact of market volatility on the Actuarially Determined Contribution.

Actuarially Determined Contribution (“ADC”) - This is the employer’s periodic contributions to a defined benefit plan, calculated in accordance with actuarial standards of practice.

Attribution Period - The period of an employee’s service to which the expected benefit obligation for that employee is assigned. The beginning of the attribution period is the employee’s date of hire and costs are spread across all employment.

Interest Rate - This is the long-term expected rate of return on any investments set aside to pay for the benefits. In a financial reporting context (e.g., GASB 68) this is termed the Discount Rate.

Normal Cost - This is the portion of the Actuarial Present Value of Benefits allocated to a valuation year by the Actuarial Cost Method.

Past Service Cost - This is a catch-up payment to fund the Unfunded Accrued Liability over time (generally 10 to 30 years). A closed amortization period is a specific number of years counted from one date and reducing to zero with the passage of time; an open amortization period is one that begins again or is recalculated at each valuation date. Also known as the Amortization Payment.

Return on Plan Assets - This is the actual investment return on plan assets during the fiscal year.

Unfunded Accrued Liability - This is the excess of the Accrued Liability over the Actuarial Value of Assets.