

State Police Retirement System of New Jersey

Actuarial Valuation Report as of July 1, 2018

Produced by Cheiron

April 2019

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LETTER OF TRANSMITTAL

April 25, 2019

Board of Trustees
State Police Retirement System of New Jersey
State of New Jersey
Department of the Treasury
Division of Pension and Benefits, CN 295
Trenton, NJ 08625-0295

Dear Board Members:

At your request, we have performed the July 1, 2018 Actuarial Valuation of the State Police Retirement System of New Jersey (SPRS or System).

In preparing our report, we relied on information (some oral and some written) supplied by the Division of Pensions and Benefits. This information includes, but is not limited to, plan provisions, employee data, and financial information. We performed an informal examination of the obvious characteristics of the data for reasonableness and consistency in accordance with Actuarial Standard of Practice No. 23.

The results of this report are only applicable to the System's contribution for Fiscal Year Ending 2020. Future results may differ significantly from the current results presented in this report due to such factors as the following: plan experience differing from that anticipated by the assumptions; changes in assumptions; and changes in plan provisions or applicable law.

The actuarial assumptions are the same as those used by the prior actuary. Cheiron has reviewed the assumptions. While we consider these assumptions to be generally reasonable, we have not yet performed our own actuarial experience study.

This report and its contents have been prepared in accordance with generally recognized and accepted actuarial principles and practices and our understanding of the Code of Professional Conduct and applicable Actuarial Standards of Practice set out by the Actuarial Standards Board as well as applicable laws and regulations. Furthermore, as credentialed actuaries we meet the Qualification Standards of the American Academy of Actuaries to render the opinion contained in this report. This report does not address any contractual or legal issues. We are not attorneys, and our firm does not provide any legal services or advice.



State Police Retirement System of New Jersey

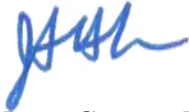
April 25, 2019

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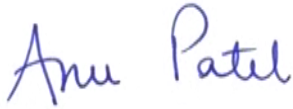
This actuarial valuation report was prepared exclusively for the State Police Retirement System of New Jersey for the purposes described herein and for the plan auditor in completing an audit related to the matters herein. Other users of this report are not intended users as defined in the Actuarial Standards of Practice, and Cheiron assumes no duty or liability to such other users.

Sincerely,

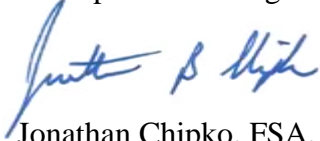
Cheiron



Janet Cranna, FSA, FCA, MAAA, EA
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cc: Kenneth Kent, FSA, FCA, MAAA, EA

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION I – BOARD SUMMARY

The primary purpose of the actuarial valuation and this report is to disclose the following as of the valuation date:

- The financial condition of the State Police Retirement System of New Jersey,
- Past and expected future trends and risks to the System’s financial condition,
- The State’s Pension Contribution for the Fiscal Year Ending (FYE) 2020.

In this Section we present a summary of the principal valuation results. This includes the basis upon which the July 1, 2018 valuation was completed and an examination of the current financial condition of the System. In addition, we present a review of the key historical trends followed by stress testing the System’s projected financial outlook in accordance with the requirements set out in Chapter 277, P. L. 2017.

This report does not include reporting requirements under GASB Statements No. 67 and 68 which were provided in separate reports.

Results shown in this report for years prior to July 1, 2018 are based on the prior actuary’s valuation reports.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION I – BOARD SUMMARY

Valuation Basis

The July 1, 2018 valuation results are based on the same actuarial methods and assumptions as used in the July 1, 2017 valuation produced by the prior actuary. The demographic assumptions were based on the July 1, 2011 – June 30, 2014 Experience Study prepared by the prior actuary, which was approved by the Board of Trustees on January 26, 2016. The valuation is based on a 7.50% interest rate and annual salary increases that are 0.5% lower than the rates shown in the experience study, which were recommended by the State Treasurer. Cheiron has reviewed the demographic and economic assumptions. While we consider these assumptions to be generally reasonable, we have not yet performed our own actuarial experience study.

This report was prepared using census data and financial information as of July 1, 2018 provided by the Division of Pensions and Benefits and does not reflect any subsequent changes in the membership or the assets.

The Appropriations Act of Fiscal Year 2018 reduced the State pension contribution of \$144,208,823 to \$72,104,000. The potential impact of the Appropriations Act of 2019 reduces the State pension contribution for Fiscal Year 2019 from \$159,162,729 to \$95,497,637 (60% of the Statutory contribution). This valuation reflects the potential impact of the Appropriations Act of 2019.

Chapter 83, P.L. 2016 requires the State to make the required pension contributions on a quarterly basis in each fiscal year according to the following schedule: at least 25% by September 30, at least 50% by December 31, at least 75% by March 31, and at least 100% by June 30. As such, contributions are assumed to be made on a quarterly basis.

The valuation excludes assets and liabilities under the Non-Contributory Group Insurance Premium Fund. The Non-Contributory Group Insurance premiums are separately funded on a pay-as-you-go basis.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION I – BOARD SUMMARY

Key Results

The following Table I-1 summarizes the key results of the valuation with respect to the System’s membership, assets and liabilities, and contributions. The results are presented and compared for both the current and prior year.

Table I-1 Summary of Key Valuation Results			
Valuation Date Fiscal Year Ending (FYE)	July 1, 2018 2020	July 1 2017 2019	% Change
<u>Member Data</u>			
Contributing Actives	2,661	2,762	-3.7%
Non-Contributing Actives	52	50	4.0%
Deferred Vested Members	0	0	N/A
Retirees and Beneficiaries ¹	3,404	3,341	1.9%
Total Members	6,117	6,153	-0.6%
Appropriation Payroll ²	\$ 275,790,087	\$ 289,022,222	-4.6%
Annual Retirement Allowances	222,196,734	215,773,680	3.0%
<u>Assets and Liabilities</u>			
Actuarial Liability	\$ 3,430,821,762	\$ 3,346,082,274	2.5%
Actuarial Value of Assets (AVA) ³	1,939,304,839	1,923,127,122	0.8%
Unfunded Actuarial Liability/(Surplus)	\$ 1,491,516,923	\$ 1,422,955,152	4.8%
Funded Ratio (AVA)	56.5%	57.5%	-1.0%
Market Value of Assets (MVA) ³	\$ 1,881,340,538	\$ 1,830,429,239	2.8%
Unfunded Actuarial Liability/(Surplus)	\$ 1,549,481,224	\$ 1,515,653,035	2.2%
Funded Ratio (MVA)	54.8%	54.7%	0.1%
<u>Contribution Amounts</u>			
State Normal Cost at End of Year	\$ 39,287,598	\$ 38,679,357	1.6%
Amortization Payment of UAL	126,288,581	120,483,372	4.8%
Total Statutory Contribution for FYE	\$ 165,576,179	\$ 159,162,729	4.0%
Percent Appropriated	70.0%	60.0%	10.0%
Net State Contribution	\$ 115,903,326	\$ 95,497,637	21.4%

¹ Retiree and Beneficiary counts do not include QDROs

² Annual compensation for contributing actives only as of July 1, 2018 and for contributing and non-contributing actives as of July 1, 2017

³ Includes discounted State appropriations receivable

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION I – BOARD SUMMARY

The key results of the July 1, 2018 actuarial valuation are as follows:

- The Statutory contributions increased from \$159.2 million for fiscal year ending 2019 to \$165.6 million for fiscal year ending 2020.
- The unfunded actuarial liability increased from \$1,423.0 million as of July 1, 2017 to \$1,491.5 million as of July 1, 2018 on an actuarial asset value basis.
- The funded ratio, the ratio of actuarial asset value over liabilities, decreased from 57.5% as of July 1, 2017 to 56.5% as of July 1, 2018.
- During the year there was a total actuarial experience loss of \$12 million, consisting of an asset loss of \$15 million, offset by a liability gain of \$3 million.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION I – BOARD SUMMARY

Recent Trends

Although most of the attention given to the valuation reflects the most recently computed unfunded actuarial liability, funded ratio, and contribution amounts, each valuation is merely a snapshot of the long-term progress of a pension fund. It is important to take a step back from these latest results and view them in the context of the System's recent history. Below, we present a series of graphs which display key factors in the valuations of the last 10 years. Additionally, in Appendix D we provide the numerical values of the historical unfunded actuarial liability, funded ratio, and contribution amounts.

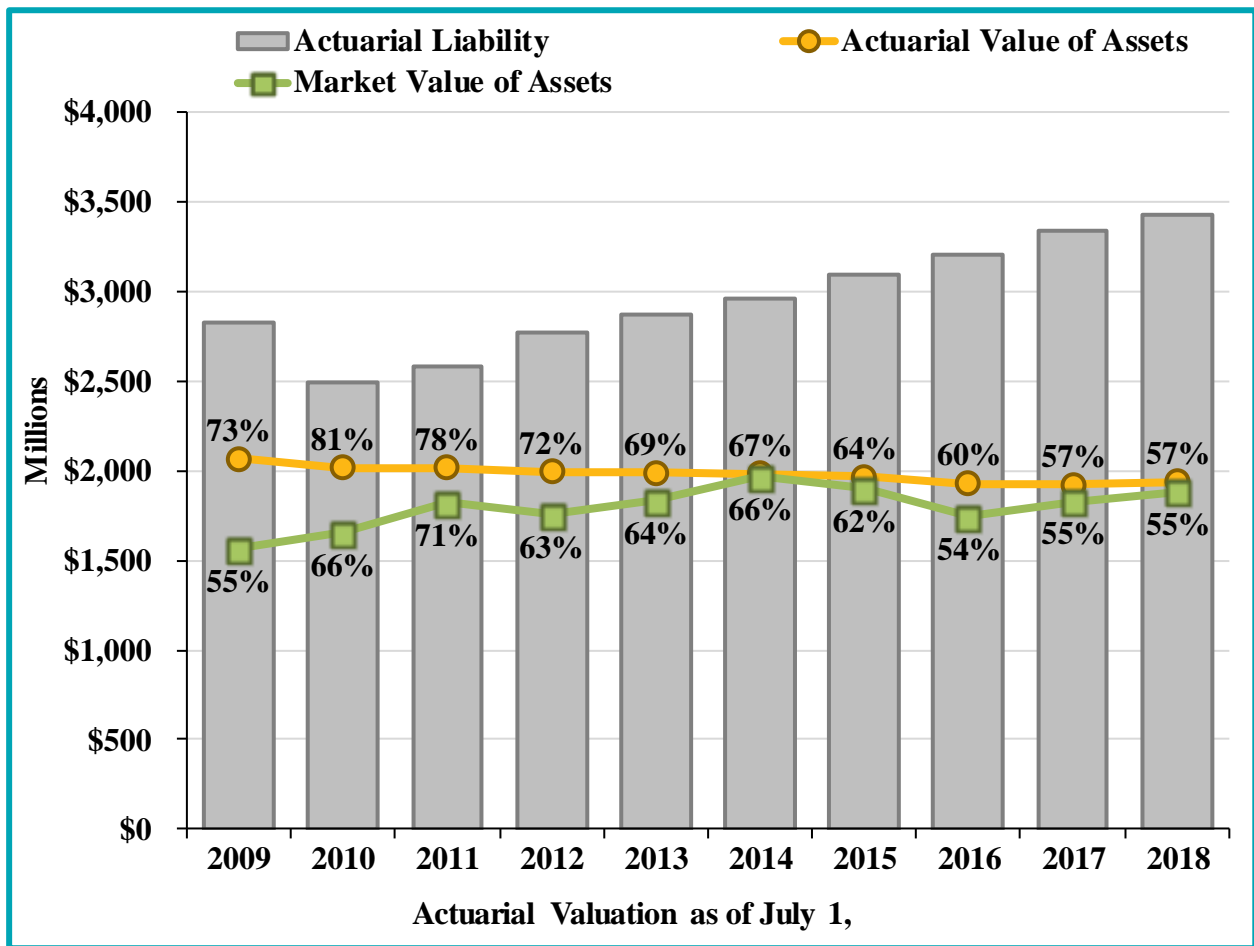
In reviewing the historic trends over the 10 year period, the System's declining funded status coupled with significant negative net cash flow highlights the potential risk of running out of assets to pay benefits unless the State consistently contributes the full amount of the Statutory required contributions.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION I – BOARD SUMMARY

Assets and Liabilities

The grey bars represent the Actuarial Liability (AL). The green line is the Market Value of Assets (MVA) and the gold line is the Actuarial Value of Assets (AVA). The System’s funded ratio (ratio of assets to actuarial liability) on both a MVA basis and an AVA basis, is shown next to the respective assets lines. The liability has been increasing over time in part due to additional benefit accruals but also due to decreases in the discount rate. The funded ratio has been decreasing over time in part due to decreases in the discount rate, recognition of the 2008/2009 market losses reflected in the large gap between the MVA and AVA in 2009 and because the State has not been making the full Statutory contribution for the entire period shown.



The information above is based on the final actuarial valuation reports for the given years. The amounts do not reflect differences between the discounted State appropriations receivable and the actual State contribution amounts that became known after the issuance of the reports.

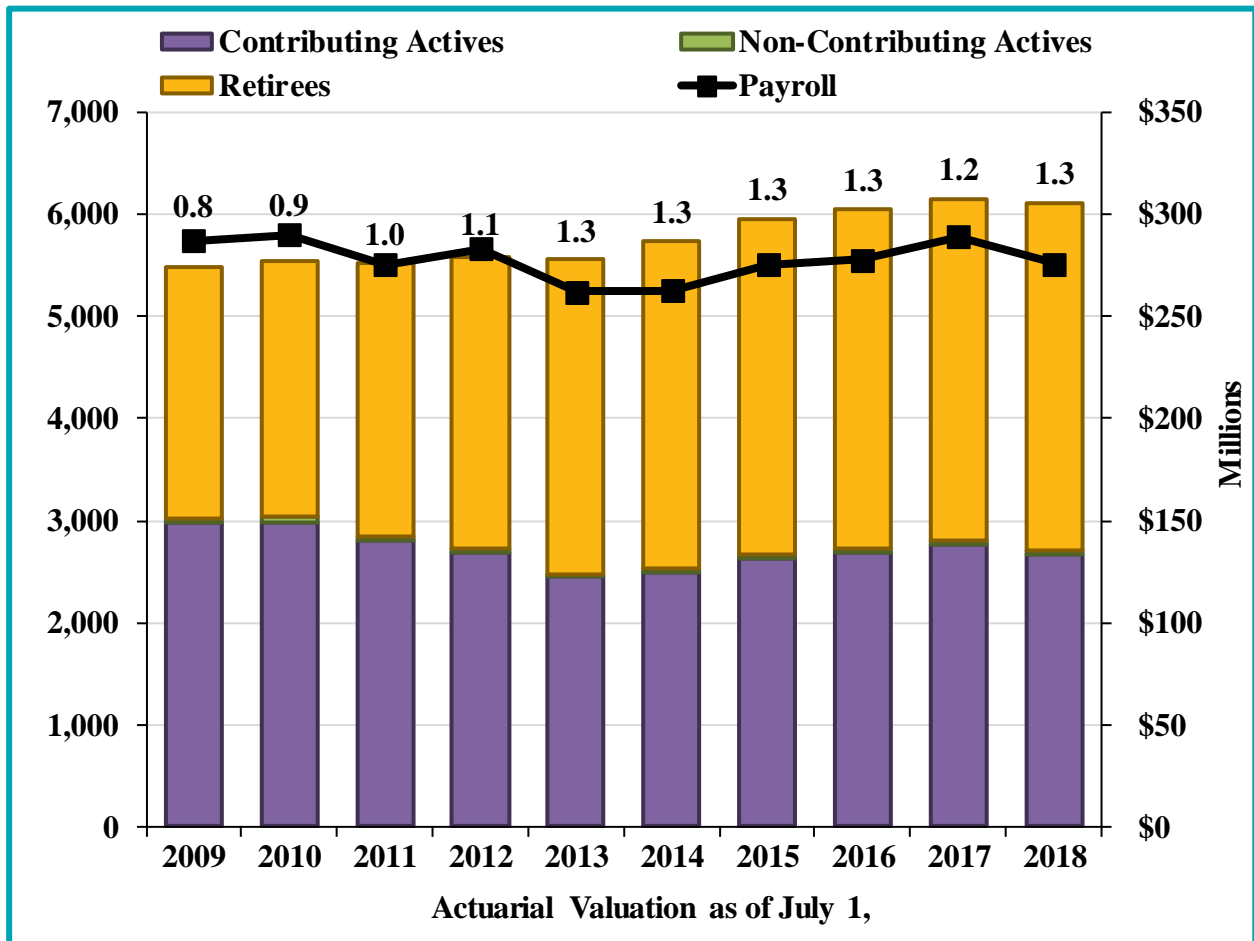
**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION I – BOARD SUMMARY

Membership Trends

The graph below shows the membership counts of the System for the last ten valuations. The numbers which appear above each bar represent the ratio of the number of inactive members to active members at each valuation date, and provides a measure of the maturity of the System. The inactive-to-active ratio has generally increased over the period. As more of the liability moves from actives to inactive, the System will experience more volatility in contribution rates when actuarial gains and losses are recognized.

The black line represents the appropriation payroll over the period, and corresponds with the scale on the right. For valuation years prior to 2018, appropriation payroll includes payroll for non-contributing actives and the appropriation payroll for 2018 excludes the payroll for non-contributing actives.

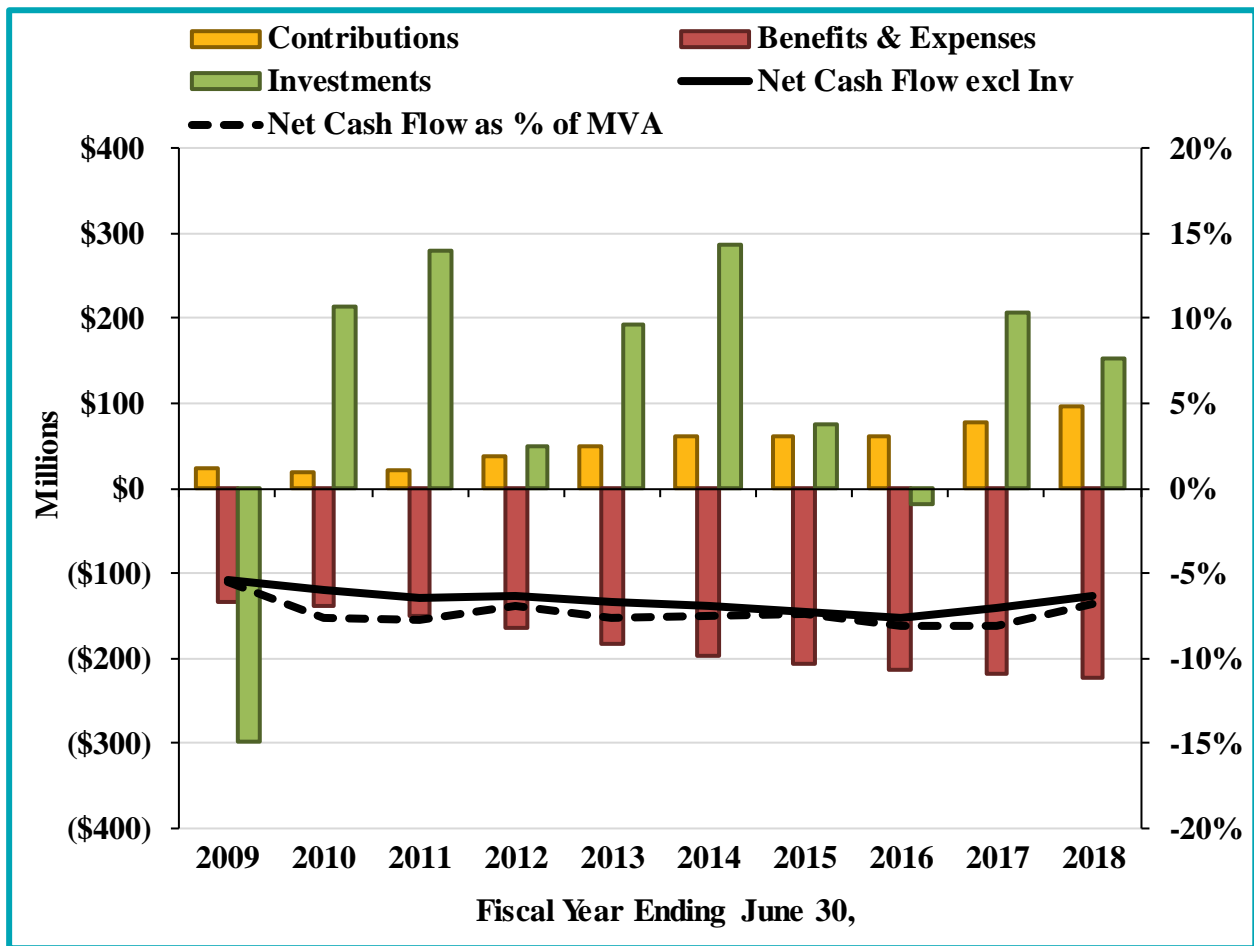


**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION I – BOARD SUMMARY

Cash Flows

The following graph shows the System net cash flow (contributions less benefit payments and expenses) at the end of each fiscal year. For the entire period shown, the net cash flow excluding investments has been negative. This illustrates that contributions have not been sufficient to cover benefits and expenses in any years over the past decade. A major implication of a negative cash flow is that the difference each year must be met first from cash generated by investments and then be paid out of the principal assets, representing additional risk for the System if investments need to be sold in a down market to cover benefit payments. The black dotted line shows the net cash flow as a percent of the market assets and goes with the axis on the right.



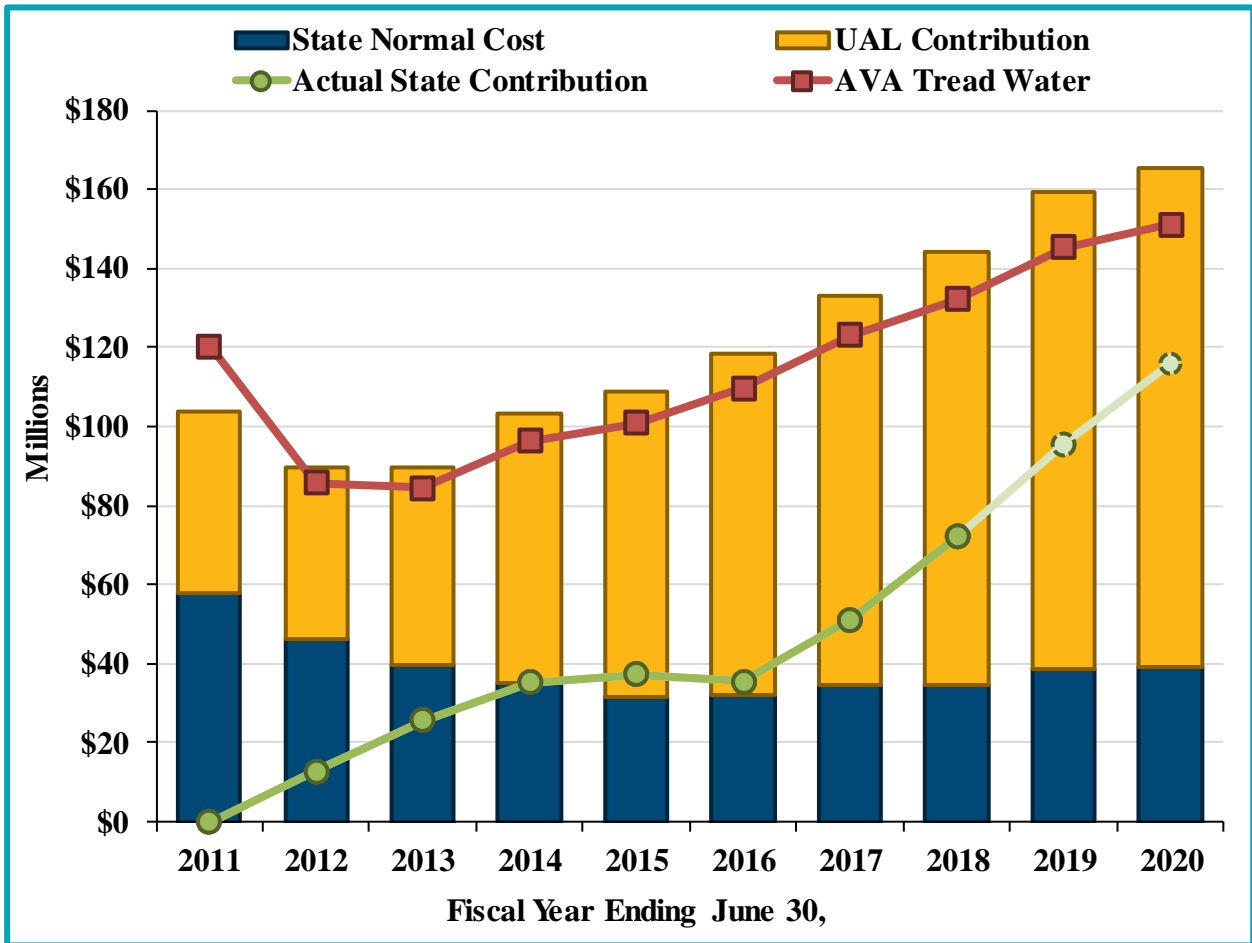
**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION I – BOARD SUMMARY

Contributions

This graph shows the historical trends for the State contributions. The Statutory contributions are comprised of the State normal cost (blue bars) and the amortization of the UAL (gold bars). The green line shows the actual State contributions over the period. For FYE 2019 and 2020, the green line has a lighter shade to indicate that these are expected, rather than actual, contributions. The expected contributions are based on the anticipated appropriations shown in Table I-1.

The red line is the **tread water line**, which is the State normal cost plus the interest on the UAL. The tread water line shows the minimum contributions needed to avoid an increase in the UAL. The graph shows that not only has the State been making contributions less than required by Statute, but that the State contributions are significantly below the tread water line. When contributions are lower than the normal cost plus interest on the UAL, the UAL is expected to grow from one year to the next.



SECTION I – BOARD SUMMARY

Projected Future Outlook

The analysis of projected financial trends is perhaps the most important component of the valuation. This has been recognized by the State Legislature in their adoption of Chapter 277, P.L. 2017 requiring the System to have stress testing performed annually. The graphs presented in this section show the expected progress of the System’s funded status over the next 30 years, measured in terms of the expected funded ratios and State contributions assuming that the System is ongoing.

While experience will not conform exactly to the assumptions every year, the trends reflect reasonable expectations. As a result, in addition to the baseline projection, we provide additional **stress testing** based on varying investment returns in the future. It is our opinion that the stress testing analyses shown in this section meet the requirements of Chapter 277, P. L. 2017.

The projections assume a constant active population. As members retire, terminate and die based on the current valuation assumptions, it is assumed that new members will replace them based on characteristics (age/gender/salary) similar to recent new members.

Additional assumptions used for these projections, including the investment rate of return for each subsequent valuation as recommended by the State Treasurer, as well as the anticipated appropriation percentages, are shown in Appendix B.

Baseline Scenario

The baseline projection shows the outcome if all actuarial assumptions, including the ultimate long-term rate of return assumption of 7.00%, as recommended by the State Treasurer, are exactly met. For each scenario we show two graphs.

The top graph compares the Market Value of Assets (green line) and the Actuarial or smoothed Value of Assets (gold line) to the System’s Actuarial Liabilities (gray bars). In addition, at the top of the graph, we show the System’s funded ratio on an Actuarial Value of Assets basis (ratio of Actuarial Value of Assets to Actuarial Liabilities). The years shown in the graph signify the valuation date as of July 1 of the labeled year.

The System’s funded ratio on an Actuarial Value of Assets basis is projected to drop slightly over the next few years, as the State appropriates less than the Statutory amount and the valuation investment rate of return assumption gradually decreases from 7.50% to 7.00%, before beginning a slow but steady increase to 91% by 2048.

The bottom graph shows the contributions by fiscal year. The member contributions are in purple and the State contributions are in gold. The gold outline shows the State’s full Statutory contributions with the shaded portion showing the anticipated appropriated amount. The projection assumes the State appropriates 70% of the Statutory contribution in FYE 2020, and increases the percent by 10% a year, until reaching 100% of the Statutory contribution beginning with FYE 2023. Both the appropriated State contributions and the member contributions are also shown in dollar amounts.

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SECTION I – BOARD SUMMARY

The dashed black line in the bottom graph shows the gross normal cost. The difference between the dashed black line and the purple bar is the State portion of the normal cost.

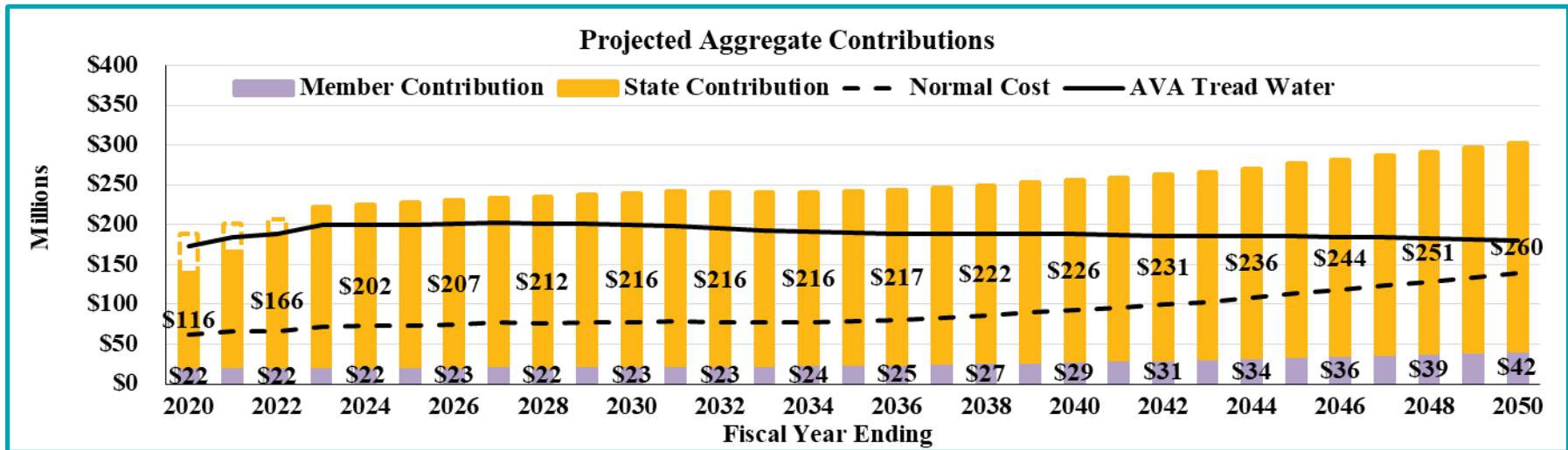
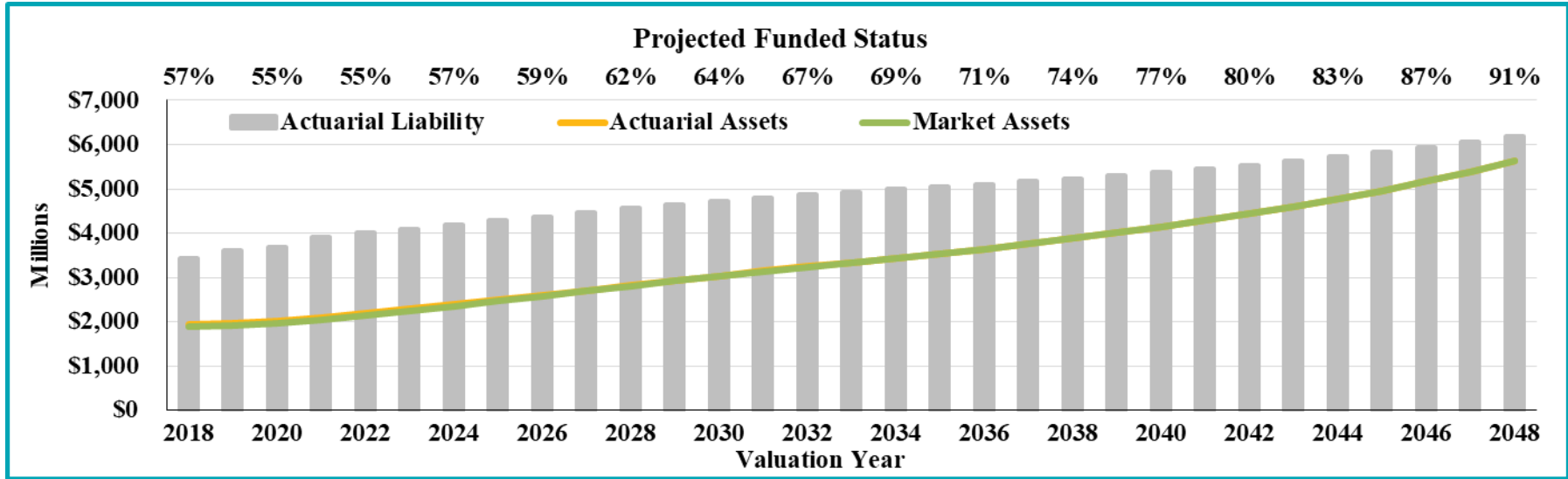
The solid black line is the tread water line based on the Actuarial Value of Assets. Because the tread water metric equals the normal cost plus interest on the UAL, the difference between the solid black line and the dashed black line is the interest on the UAL. When contributions fall below the solid black line, as is the case through FYE 2022, the UAL grows and the funded ratio falls. When the contributions exceed the solid line, as is the case beginning in FYE 2023, the UAL decreases and the funded ratio increases.

The Statutory contributions increase steadily through FYE 2023 as the State appropriates less than the Statutory amount and the valuation investment rate of return assumption gradually decreases from 7.50% to 7.00%. Thereafter, the Statutory contributions remain relatively steady for some years before gradually increasing again. Once the appropriated amount equals the Statutory contribution, beginning in FYE 2023, the contributions reach the level necessary to pay down the UAL and the tread water line begins to decrease relative to the Statutory contribution.

STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
 JULY 1, 2018 ACTUARIAL VALUATION

SECTION I – BOARD SUMMARY

Baseline: 7.0% return for all years



**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
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SECTION I – BOARD SUMMARY

Stress Testing

The Baseline projections shown on the previous page assume all assumptions are met each and every year in the future. We know that will not be the case. We developed six hypothetical scenarios to illustrate the impact actual investment returns may have on future funded status and contribution amounts. The scenarios are balanced between positive and negative scenarios and are based on a lognormal distribution of one and five year expected returns as shown in the table below using the capital market assumptions from the New Jersey Division of Investments (Geometric return of 7.14%, standard deviation of 12.27%).

Distribution of Expected Average Annual Returns		
Percentile	1 Year	5 Year
5%	-11.1%	-1.4%
25%	-0.8%	3.5%
50%	7.1%	7.1%
75%	15.7%	10.9%
95%	29.1%	16.5%

The scenarios include: a one-year shock using the 5th and 95th percentile returns for one year; a 5-year moderate scenario using the 25th and 75th percentile returns for five years; and a 5-year significant scenario using the 5th and 95th percentile returns for five years. The table below summarizes the theoretical scenarios.

FYE	Theoretical Scenarios					
	1-Yr Shock		5-Yr Moderate		5-Yr Significant	
	Neg	Pos	Neg	Pos	Neg	Pos
2019	-11.1%	29.1%	3.5%	10.9%	-1.4%	16.5%
2020	7.0%	7.0%	3.5%	10.9%	-1.4%	16.5%
2021	7.0%	7.0%	3.5%	10.9%	-1.4%	16.5%
2022	7.0%	7.0%	3.5%	10.9%	-1.4%	16.5%
2023	7.0%	7.0%	3.5%	10.9%	-1.4%	16.5%
2024+	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%

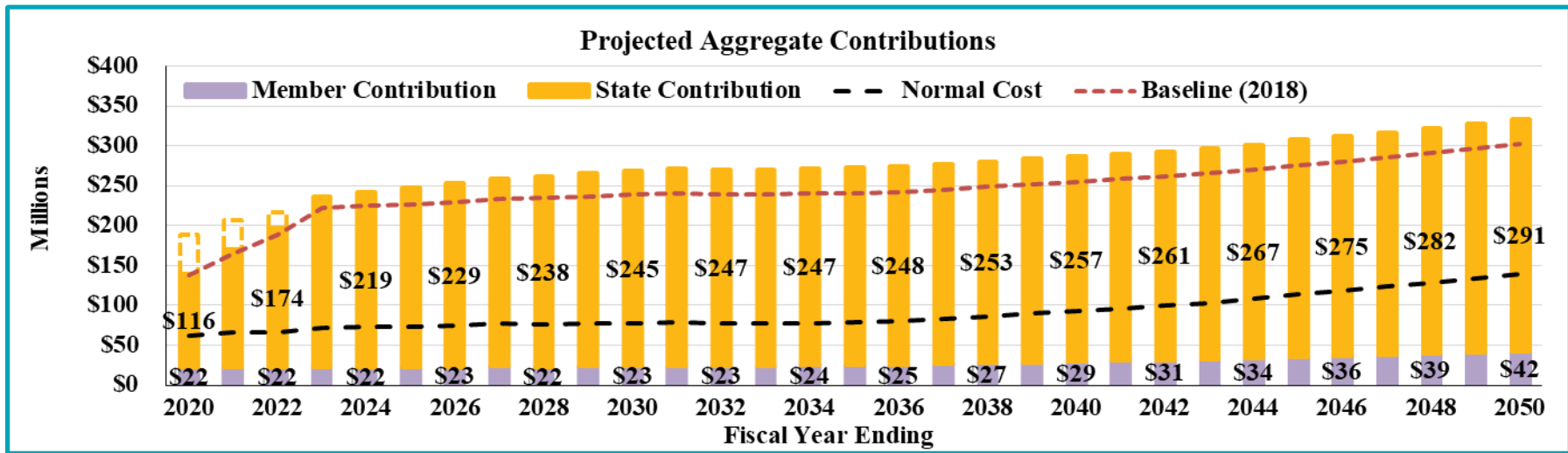
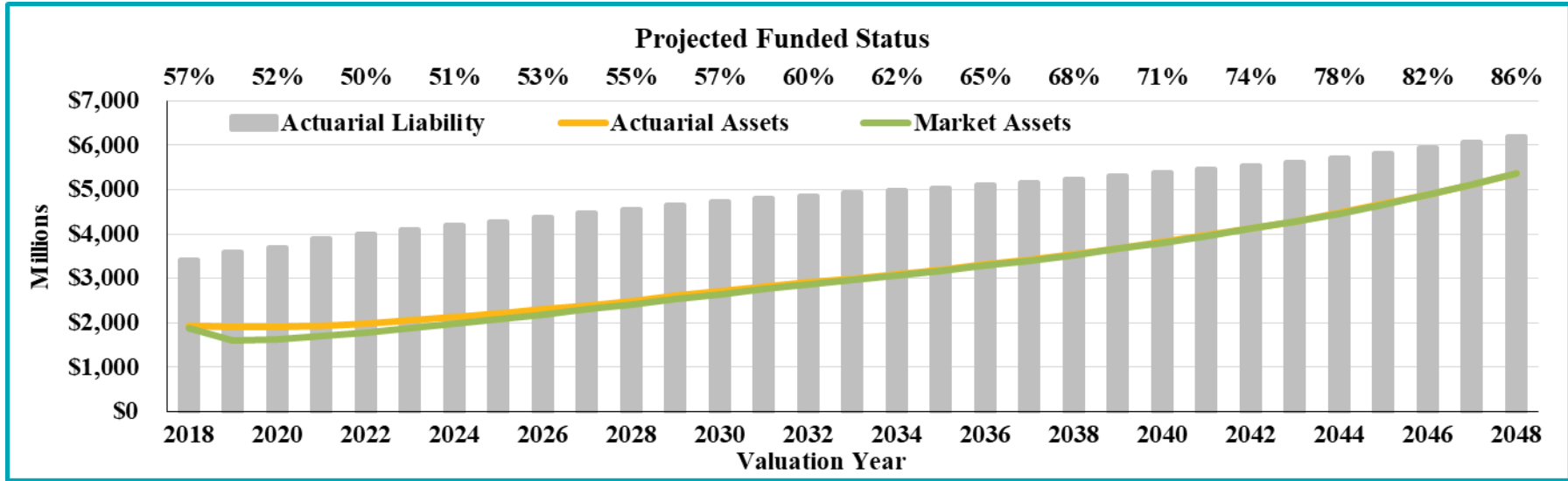
In reviewing each of these projections, it is the future trends, not necessarily the actual values, that are important to observe in consideration of the risks of the System and the potential volatility of future funded ratios and Statutory contribution levels.

The graphs on the following pages show the projections under each of these theoretical scenarios. Instead of the tread water line shown for the baseline projection, the contribution graphs include a dashed red line representing the expected contributions under the baseline projections shown above to facilitate the comparison between the particular scenario and the baseline projections assuming all assumptions are met.

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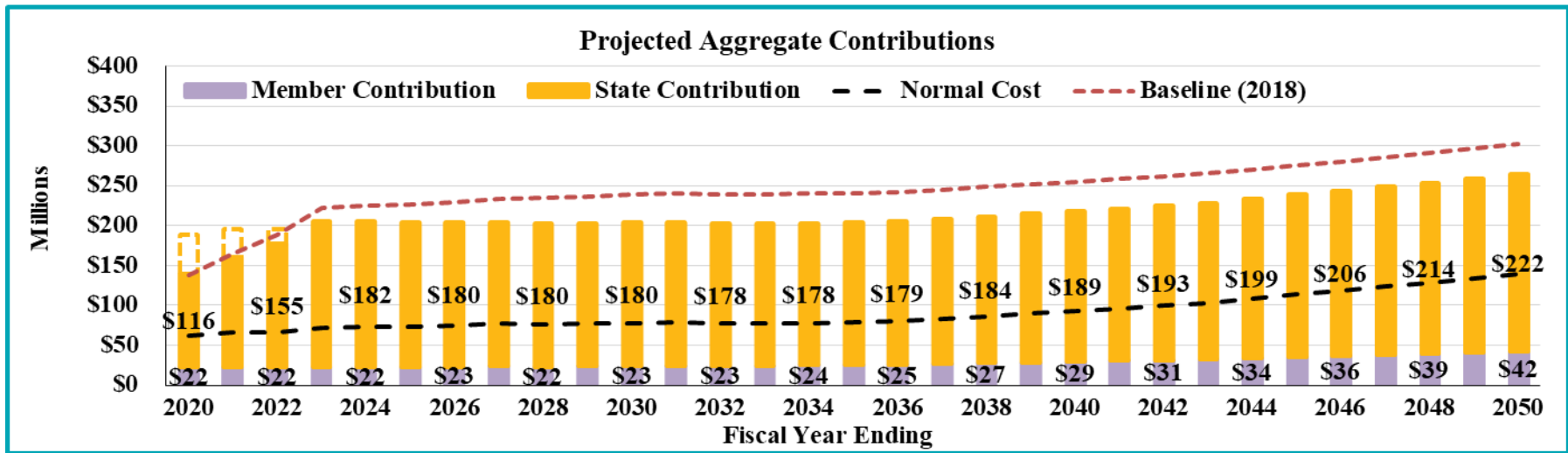
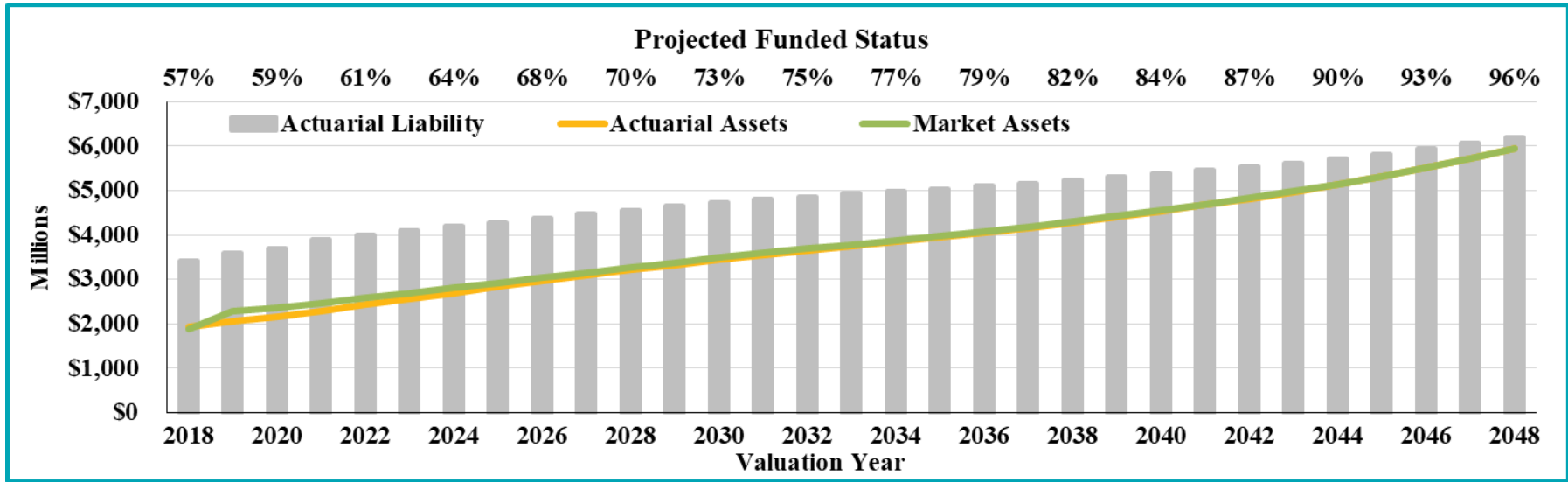
One-Year Negative Shock Scenario: -11.1% return FYE 2019, 7.0% after



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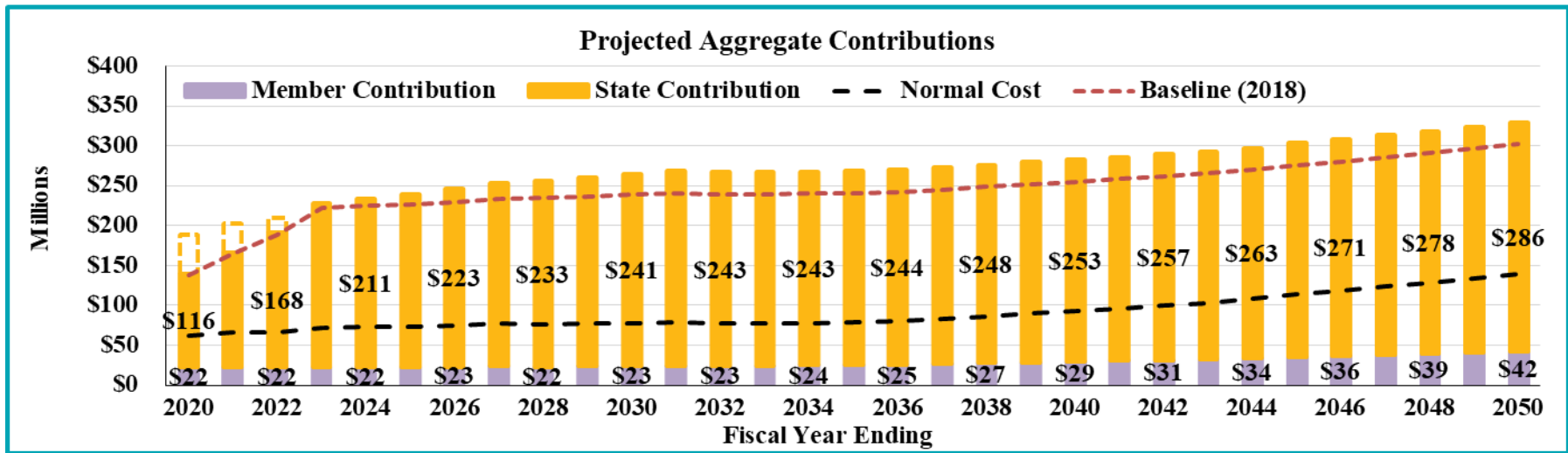
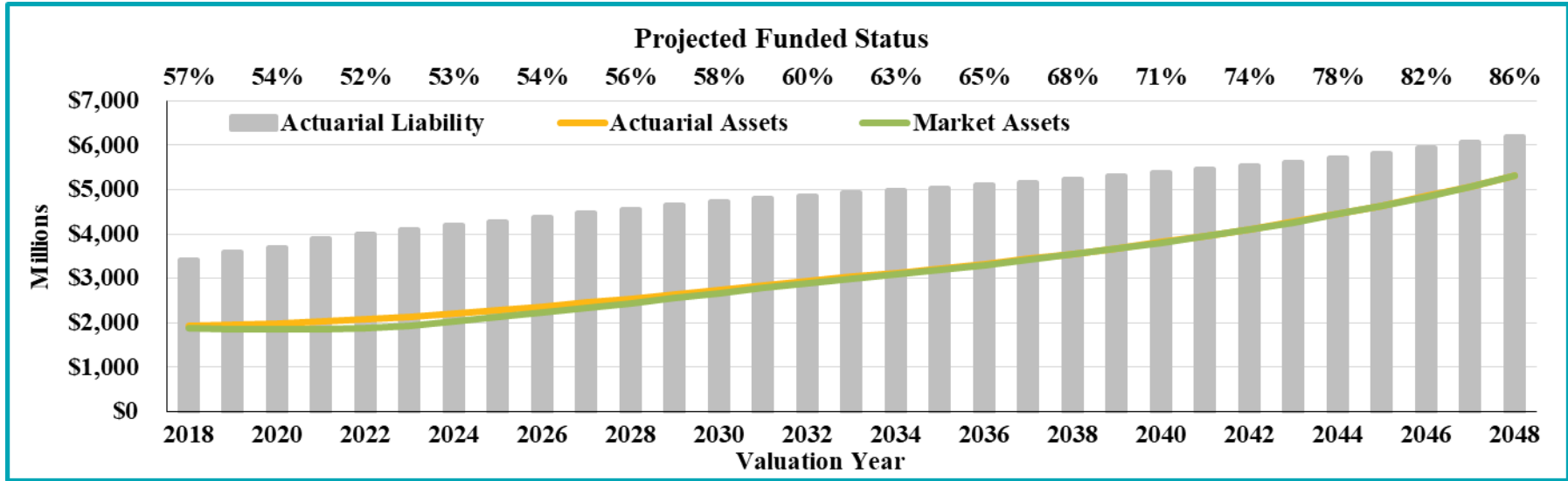
One-Year Positive Shock Scenario: 29.1% return FYE 2019, 7.0% after



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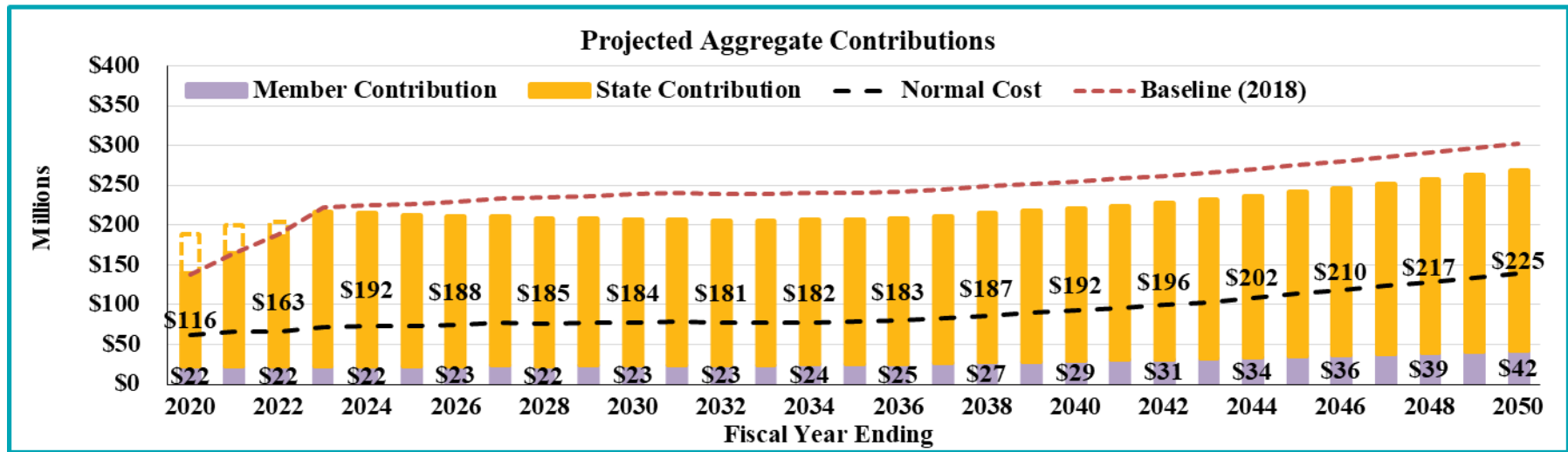
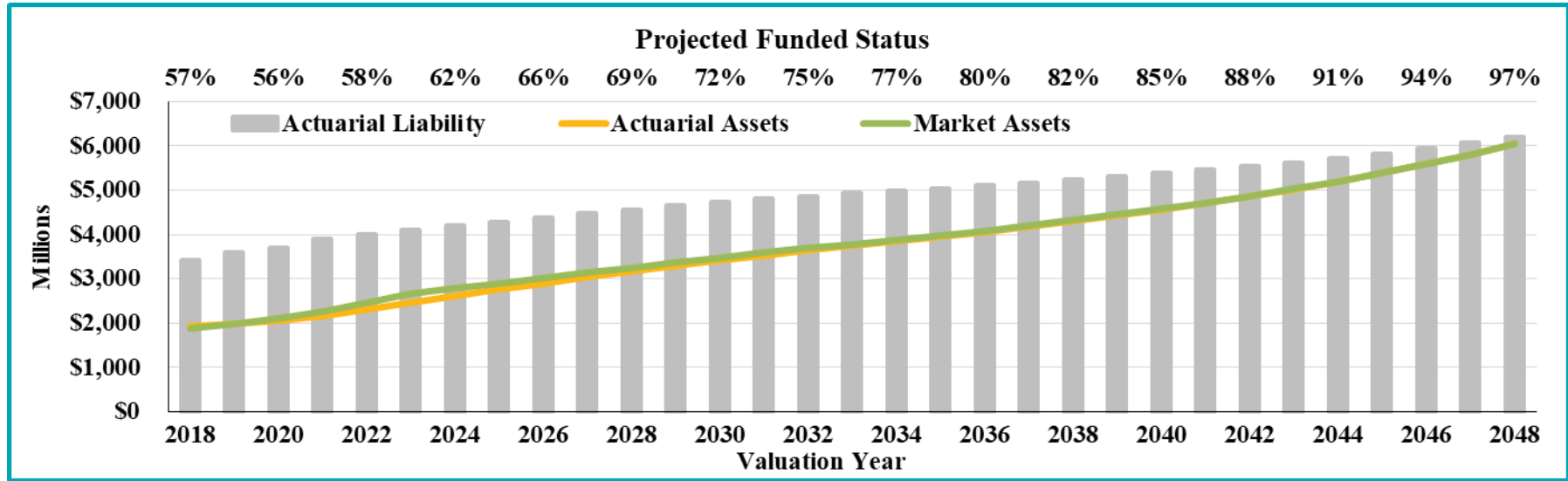
Five-Year Moderate Negative Scenario: 3.5% return FYE 2019-2023, 7.0% after



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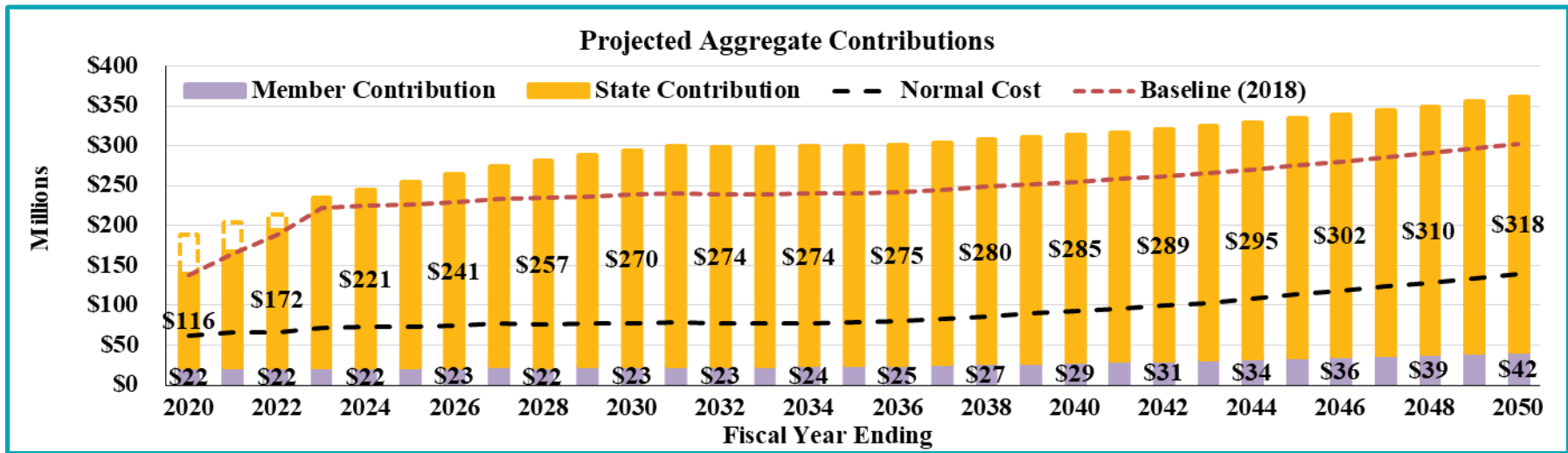
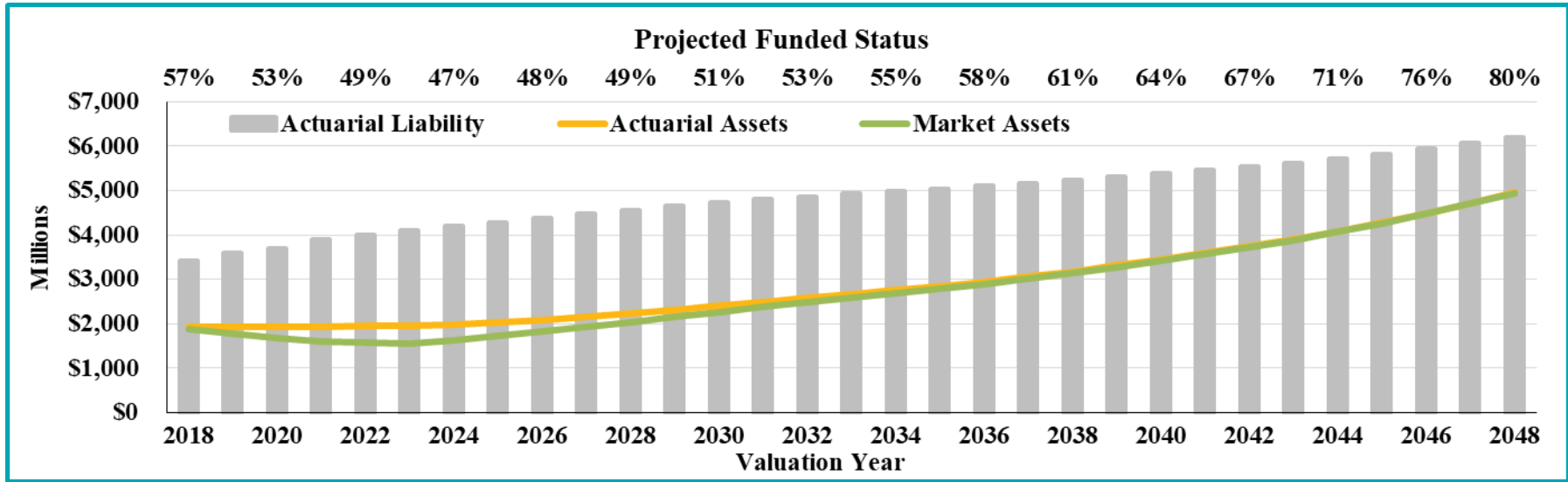
Five-Year Moderate Positive Scenario: 10.9% return FYE 2019-2023, 7.0% after



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SECTION I – BOARD SUMMARY

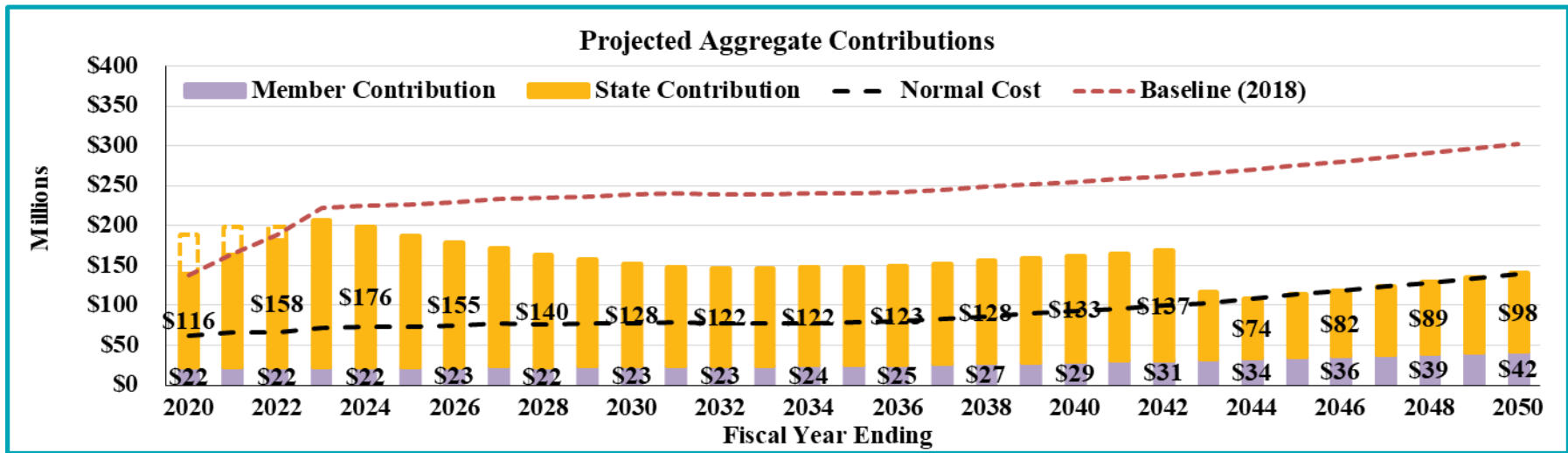
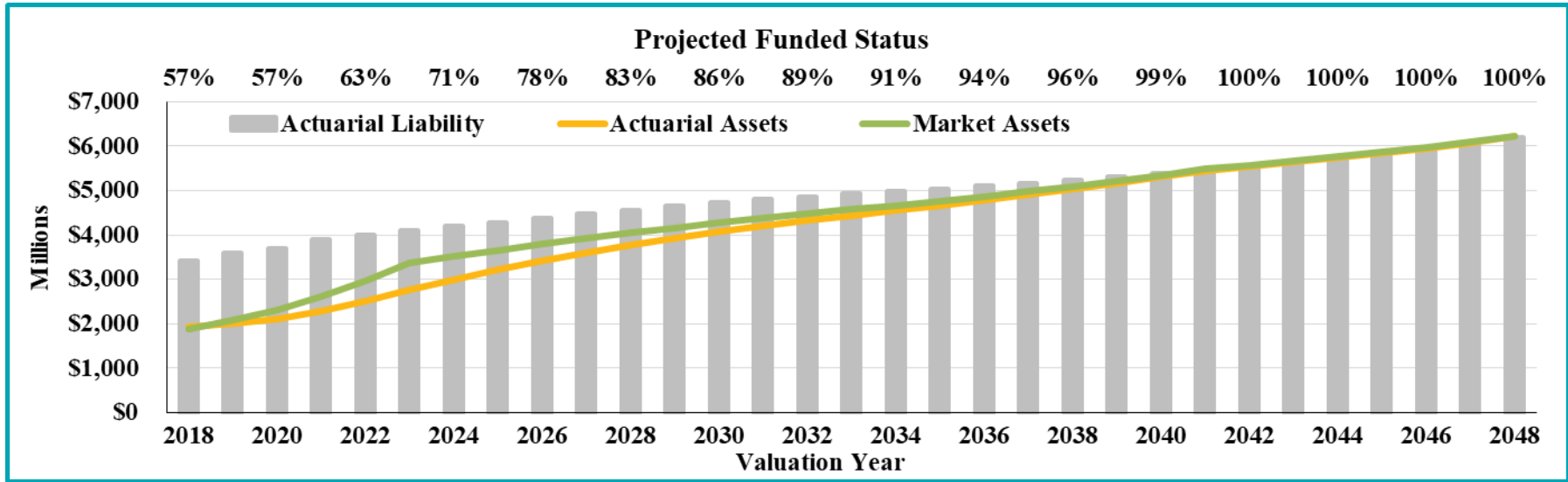
Five-Year Significant Negative Scenario: -1.4% return FYE 2019-2023, 7.0% after



STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
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Five-Year Significant Positive Scenario: 16.5% return FYE 2019-2023, 7.0% after



**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION II – ASSETS

The System uses and discloses two different asset measurements for funding, which are presented in this section of the report: market value and actuarial value of assets. The market value represents the value of the assets if they were liquidated on the valuation date. The actuarial value of assets is a value that smooths annual investment returns to reduce annual investment volatility and is used in determining contribution levels. In compliance with New Jersey Statute, the method used to calculate the actuarial value of assets recognizes 20% of the difference between the market value of assets and the expected actuarial value of assets each year.

Actuarial Standards of Practice (ASOP) No. 44 states that the asset valuation method should produce an actuarial value of assets that falls within a reasonable range of market value, recognizes the difference between the market value and actuarial value of assets within a reasonably short period of time, and is likely to produce actuarial value of assets that are sometimes greater than and sometimes less than the corresponding market values. The asset method required under N. J. Statute does not meet the requirements of ASOP No. 44 because this method has produced actuarial value of assets which have consistently been greater than the market value of assets and recognizes investment losses slowly over time. Additionally, the method may produce an actuarial value of assets that falls outside of a reasonable range of the market value.

On the following pages, we present detailed information on the System’s assets:

- Disclosure of assets at July 1, 2017 and July 1, 2018,
- Statement of cash flows during the year,
- Development of the actuarial value of assets, and
- Disclosure of investment performance for the year.

Disclosure

The market value of assets represents a “snap-shot” value as of the last day of the fiscal year that provides the principal basis for measuring financial performance from one year to the next. Market values, however, can fluctuate widely with corresponding swings in the value of the investments. Because these fluctuations would cause volatility in employer contributions, an actuarial value of assets is developed. Table II-1 on the following page presents the market value as of June 30, 2017 and June 30, 2018. Table II-2 presents the System’s net cash flows from June 30, 2017 to June 30, 2018. Table II-3 presents the development of the Actuarial Value of Assets as of July 1, 2018.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
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SECTION II – ASSETS

Table II-1		
Statement of Assets at Market Value		
	June 30, 2018	June 30, 2017
Assets		
Cash	\$ 17,904,920	\$ 18,969,605
Securities Lending Collateral	19,294,715	22,234,804
Investment Holdings	1,775,794,796	1,742,513,412
Accrued Interest on Investments	3,102	2,024
Interest Receivable on Loans	647,651	670,282
Employer Contributions Receivable		
State NGCI	385,181	80,304
Members' Contributions Receivable	1,086,870	1,094,446
Loans Receivable	13,118,653	14,809,672
Accounts Receivable	50,580	273,507
Total Assets	<u>\$ 1,828,286,468</u>	<u>\$ 1,800,648,056</u>
Liabilities		
Pension Payroll Payable	\$ (14,104,667)	\$ (13,302,063)
Pension Adjustment Payroll Payable	(1,727,275)	(1,763,135)
Death Benefits Payable	(385,181)	(80,304)
Withholdings Payable	(2,621,074)	(2,657,371)
Securities Lending Collateral and Rebate Payable	(19,294,168)	(22,228,240)
Administrative Expense Payable	(31,494)	0
Accounts Payable - Other	(77,927)	880,392
Total Liabilities	<u>\$ (38,241,786)</u>	<u>\$ (39,150,721)</u>
Preliminary Market Value of Assets	\$ 1,790,044,682	\$ 1,761,497,335
Discounted State Appropriations Receivable	91,295,856	68,931,904
Market Value of Assets	<u>\$ 1,881,340,538</u>	<u>\$ 1,830,429,239</u>

STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION

SECTION II – ASSETS

System Cash Flows as of June 30, 2018

Table II-2 Changes in Market Values for FYE June 30, 2018	
Additions	
Pension Contributions	
Members' Contributions	\$ 22,416,571
Transfers from Other Systems	234,765
Employers' Contributions	
State Appropriations	72,104,000
Non-Contributory Group Insurance	2,499,780
Transfers from Other Systems	13,714
Administrative Fee Loans	5,850
Income	
Per Statement	154,029,009
Total Additions	\$ 251,303,689
Deductions	
Benefits Provided by Members	
Withdrawal of Members' Contributions - Regular	\$ 197,545
Withdrawal of Members' Contributions - Transfer	57,576
Adjustment - Member Account Loans - State	529
Benefits Provided by Employers and Members	
Retirement Allowances	198,710,925
Benefits Provided by Employers	
Benefit Expense - Pension Adjustment	20,906,944
Administrative Expense	337,730
Transfer Withdrawal - Employer Benefits	0
Administrative Expense Loans	5,111
Adjustment - Member Accounts Expense - State	40,202
NCGI Premium Expense	2,499,780
Total Deductions	\$ 222,756,342
Net Increase/(Decrease)	\$ 28,547,347
Preliminary Market Value of Assets Beginning of Year	\$ 1,761,497,335
Preliminary Market Value of Assets End of Year	\$ 1,790,044,682
Discounted State Appropriations Receivable	91,295,856
Market Value of Assets	\$ 1,881,340,538
Approximate Return	9.11%

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION II – ASSETS

Actuarial Value of Assets

To determine on-going funding requirements, most pension systems utilize an actuarial value of assets that differs from the market value of assets. The actuarial value of assets represents an asset value based on averaging or smoothing year-to-year market value returns for purposes of reducing contribution volatility. Each year, 20% of the difference between the market value of assets and the expected actuarial value of assets is added to the expected actuarial value of assets.

Table II-3 Development of Actuarial Value of Assets for July 1, 2018		
1. Preliminary Actuarial Value of Assets as of 7/1/2017 ¹	\$	1,854,195,218
2. Net Cash Flow excluding Investment Income	\$	(125,481,662)
3. Expected Investment Income ²	\$	133,786,502
4. Expected Actuarial Value of Assets as of 7/1/2018: (1+2+3)	\$	1,862,500,058
5. Preliminary Market Value as of 6/30/2018	\$	1,790,044,682
6. 20% of Difference from MVA = (5-4) x 0.2	\$	(14,491,075)
7. Preliminary Actuarial Value of Assets as of 7/1/2018: (4+6)	\$	1,848,008,983
8. Discounted State Appropriations Receivable	\$	91,295,856
9. Actuarial Value of Assets as of 7/1/2018: (7+8)	\$	1,939,304,839
10. Rate of Return on Actuarial Value of Assets		6.69%

¹ Excludes discounted State appropriations receivable

² Refer to Appendix B, Actuarial Methods, for details on the assumed timing of contributions

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION II – ASSETS

Investment Performance

The market value of assets rate of return was 9.11% for the year ending June 30, 2018. This is compared to an assumed return of 7.50% for the same period. On an actuarial value of assets basis, the return for FYE 2018 was 6.69%. Table II-4 shows the historical asset returns and the investment return assumption for the last ten years.

The prior actuary did not calculate a market value return prior to 2017.

Table II-4 Annual Rates of Return			
Year Ended June 30	Investment Return Assumption	Market Value	Actuarial Value
2009	8.25%		2.18%
2010	8.25%		3.72%
2011	8.25%		5.75%
2012	7.95%		4.83%
2013	7.90%		5.77%
2014	7.90%		7.64%
2015	7.90%		6.91%
2016	7.90%		5.32%
2017	7.65%	12.77%	6.26%
2018	7.50%	9.11%	6.69%
10-Year Compound Average		N/A	5.5%
5-Year Compound Average		N/A	6.6%

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION III – LIABILITIES

In this section, we present detailed information on the liabilities of the System, including:

- Disclosure of liabilities at July 1, 2017 and July 1, 2018,
- Active liabilities broken down by Tier, and
- The development of the actuarial gain and loss.

Disclosure

The Actuarial Liability is used for determining employer contributions. For SPRS, the funding method employed is the Projected Unit Credit (PUC) Actuarial Cost Method. Under this funding method, the actuarial liability is calculated as the actuarial present value of the projected benefits allocated to periods prior to the valuation year.

This liability is determined for funding purposes and is not appropriate for measuring the cost of settling plan liabilities by purchasing annuities or paying lump sums.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION III – LIABILITIES

Table III-1 shows the actuarial liability as of July 1, 2018 and July 1, 2017 for the System.

Table III-1 Actuarial Liability		
	July 1, 2018	July 1, 2017
Actuarial Liability		
Contributing Actives	\$ 909,324,086	\$ 889,209,167
Non-Contributing Actives	8,974,136	11,506,421
Deferred Vested	0	0
Retirees	2,214,517,629	2,162,584,078
Disabled	165,943,307	159,390,752
Beneficiaries	132,062,604	123,391,856
Total	\$ 3,430,821,762	\$ 3,346,082,274
Actuarial Value of Assets	\$ 1,939,304,839	\$ 1,923,127,122
Unfunded Actuarial Liability/(Surplus)	\$ 1,491,516,923	\$ 1,422,955,152
Funded Ratio	56.5%	57.5%

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION III – LIABILITIES

Tables III-2 and III-3 show the Actuarial Liability of active members by Tier as of July 1, 2018.

Table III-2 Contributing Active Liabilities by Tier				
	Number of Members	Appropriation Payroll	Actuarial Liability	Gross Normal Cost
Tier 1	1,877	\$ 218,229,434	\$ 869,924,604	\$ 48,083,648
Tier 2	784	57,560,653	39,399,482	9,182,329
Total	<u>2,661</u>	<u>\$ 275,790,087</u>	<u>\$ 909,324,086</u>	<u>\$ 57,265,977</u>

Table III-3 Non-Contributing Active Liabilities by Tier				
	Number of Members	Last Reported Payroll	Actuarial Liability	Gross Normal Cost
Tier 1	29	\$ 2,640,041	\$ 8,228,698	\$ 0
Tier 2	23	1,700,650	745,438	0
Total	<u>52</u>	<u>\$ 4,340,691</u>	<u>\$ 8,974,136</u>	<u>\$ 0</u>

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION III – LIABILITIES

Table III-4 presents the change in the actuarial liabilities, actuarial assets, and unfunded actuarial liability during the plan year. In general, the unfunded actuarial liability (UAL) of any retirement system is expected to change at each subsequent valuation for a variety of reasons. In each valuation, we report on those elements of change in the UAL which are of particular significance, potentially affecting the long-term financial outlook of the System.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION III – LIABILITIES

Table III-4 Development of 2018 Experience (Gain)/Loss			
	Actuarial Liability	Actuarial Value of Assets	Unfunded Actuarial Liability
1. Value as of July 1, 2017	\$ 3,346,082,274	\$ (1,923,127,122)	\$ 1,422,955,152
2. Additions			
a.) Normal Cost	\$ 57,662,030	\$ 0	\$ 57,662,030
b.) Statutory State Contributions	0	(159,162,729)	(159,162,729)
c.) Exp. Member Contributions	0	(22,479,581)	(22,479,581)
3. Decreases			
a.) Benefit Payments	\$ (219,815,943)	\$ 219,815,943	\$ 0
b.) Exp. Admin. Expenses	0	0	0
4. Net Transfers from Other Systems			
a.) Employer Contributions	\$ 13,714	\$ (13,714)	\$ 0
b.) Member Contributions	177,189	(177,189)	0
5. Expected Interest	\$ 247,193,775	\$ (136,975,231)	\$ 110,218,544
6. Expected Value as of July 1, 2018: (1+2+3+4+5)	\$ 3,431,313,039	\$ (2,022,119,623)	\$ 1,409,193,416
7. Impact of:			
a.) Appropriation Adjustment	\$ 0	\$ 63,665,515	\$ 63,665,515
b.) Contribution Timing	0	4,201,782	4,201,782
c.) Actual Member Contributions	0	65,330	65,330
d.) Conversion from Prior Actuary	2,791,271	0	2,791,271
e.) Change in Methods/Assumptions	0	0	0
f.) Change in Benefits	0	0	0
8. Expected Value after Changes: (6+7)	\$ 3,434,104,310	\$ (1,954,186,996)	\$ 1,479,917,314
9. Actual Value as of July 1, 2018	\$ 3,430,821,762	\$ (1,939,304,839)	\$ 1,491,516,923
10. Actuarial (Gain)/Loss: (14-13)	\$ (3,282,548)	\$ 14,882,157	\$ 11,599,609

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION III – LIABILITIES

Table III-5 shows the components of the Actuarial (Gain)/Loss for the System as of July 1, 2018.

Table III-5 Actuarial (Gain)/Loss Analysis	
Components	July 1, 2018
Actuarial Value of Assets	
Investment Return	\$ 14,491,075
Administrative Expenses	391,082
Total	<u>\$ 14,882,157</u>
Actuarial Liability	
Salary Increases	\$ (12,102,861)
New Entrants	0
Demographic Experience	
Contributing Actives	4,662,735
Non-Contributing Actives	(622,963)
Inactives	4,978,473
Sub-Total	<u>\$ (3,084,616)</u>
Impact of Net Transfers from Other Systems	(197,932)
Total	<u>\$ (3,282,548)</u>
Actuarial (Gain)/Loss	\$ 11,599,609

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION IV – CONTRIBUTIONS

In the process of evaluating the financial condition of any pension plan, the actuary analyzes the assets and liabilities to determine what level (if any) of contributions is needed to properly maintain the funded status of the Plan. Typically, the actuarial process will use a funding technique that will result in a pattern of contributions that are both stable and predictable.

Under the current funding policy, the State funding requirement contains two components: the employer normal cost and an amortization of the unfunded actuarial liability (UAL). The funding methodology prescribed by NJ State Statute does not include a cost component for administrative expenses, and therefore administrative expenses are implicitly covered by the investment rate of return assumption. Because the investment rate of return assumption is recommended by the State Treasurer, we provide no opinion on the reasonableness of the assumption and we are unable to evaluate whether the investment rate of return assumption includes an appropriate adjustment for administrative expenses.

For SPRS, the funding method employed is the Projected Unit Credit (PUC) Actuarial Cost Method. Under this funding method, the actuarial liability is calculated as the actuarial present value of the projected benefits allocated to periods prior to the valuation year. The unfunded actuarial liability is the actuarial liability on the valuation date less the actuarial value of assets.

In accordance with Chapter 78, P. L. 2011, the unfunded actuarial liability as of July 1, 2018 was amortized over an open 30 year period as a level dollar amount. Beginning with the July 1, 2019 valuation, the unfunded actuarial liability will be amortized over a closed 30 year period as a level dollar amount.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

SECTION IV – CONTRIBUTIONS

Table IV-1 shows the development of the Statutory Pension Contribution for the current and prior year. Table IV-2 summarizes the contributions as a percentage of appropriation payroll.

Table IV-1		
Development of Statutory Pension Contribution		
Valuation Date Fiscal Year Ending	July 1, 2018 2020	July 1, 2017 2019
1. Actuarial Liability	\$ 3,430,821,762	\$ 3,346,082,274
2. Actuarial Value of Assets	1,939,304,839	1,923,127,122
3. Unfunded Actuarial Liability: (1-2)	<u>\$ 1,491,516,923</u>	<u>\$ 1,422,955,152</u>
4. Amortization Period (years)	30	30
5. Amortization of UAL payable Beginning of Fiscal Year (Level Dollar)	\$ 126,288,581	\$ 120,483,372
6. a. Gross Normal Cost	\$ 57,265,977	\$ 57,662,030
b. Expected Member Contributions	<u>20,719,374</u>	<u>21,681,233</u>
c. State Normal Cost: (a.-b.)	\$ 36,546,603	\$ 35,980,797
d. State Normal Cost payable Beginning of Fiscal Year: (c.)*1.075	\$ 39,287,598	\$ 38,679,357
7. Total Statutory Pension Contribution as of Beginning of Fiscal Year: (5+6d.)	\$ 165,576,179	\$ 159,162,729

Table IV-2		
Statutory Contributions as a Percent of Appropriation Payroll		
Valuation Date Fiscal Year Ending	July 1, 2018 2020	July 1, 2017 2019
Statutory Contribution		
State Normal Cost	14.25%	13.38%
UAL Amortization Payment	<u>45.79%</u>	<u>41.69%</u>
Total Statutory Pension Contribution	60.04%	55.07%

Rates as of July 1, 2017 are based on contributing and non-contributing active compensation while the July 1, 2018 rates are based only on contributing active compensation

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

APPENDIX A – MEMBERSHIP INFORMATION

The data for this valuation was provided by the New Jersey Division of Pensions and Benefits as of July 1, 2018. Cheiron did not audit any of the data. However, we did perform an informal examination of the obvious characteristics of the data for reasonableness and consistency in accordance with Actuarial Standard of Practice No. 23. The following is a list of data charts contained in this section:

- A-1: Contributing Active Member Data by Tier
- A-2: Non-Contributing Active Member Data by Tier
- A-3: Inactive Member Data, Total Annual and Average Retirement Allowances by Status
- A-4: Reconciliation of Plan Membership
- A-5 through A-6: Contributing Active Member Data by Age and Service
- A-7 through A-8: Inactive Member Data by Age and Status

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

APPENDIX A – MEMBERSHIP INFORMATION

Table A-1				
Contributing Active Member Data by Tier				
	July 1, 2018	July 1, 2017	% Change	
<u>Tier 1</u>				
Count	1,877	1,964	-4.4%	
Average Age	42.6	42.1	1.3%	
Average Service	16.4	15.8	3.7%	
Average Appropriation Pay	\$ 116,265	\$ 115,226	0.9%	
Total Appropriation Payroll	\$ 218,229,434	\$ 226,304,033	-3.6%	
<u>Tier 2</u>				
Count	784	798	-1.8%	
Average Age	31.1	30.1	3.3%	
Average Service	4.1	3.0	38.0%	
Average Appropriation Pay	\$ 73,419	\$ 73,191	0.3%	
Total Appropriation Payroll	\$ 57,560,653	\$ 58,406,303	-1.4%	
<u>Total</u>				
Count	2,661	2,762	-3.7%	
Average Age	39.2	38.6	1.6%	
Average Service	12.8	12.1	5.5%	
Average Appropriation Pay	\$ 103,642	\$ 103,081	0.5%	
Total Appropriation Payroll	\$ 275,790,087	\$ 284,710,336	-3.1%	

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

APPENDIX A – MEMBERSHIP INFORMATION

Table A-2				
Non-Contributing Active Member Data by Tier				
	July 1, 2018		July 1, 2017	% Change
<u>Tier 1</u>				
Count	29		33	-12.1%
Average Age	47.8		47.0	1.6%
Average Service	11.7		11.9	-1.6%
Average Last Reported Pay	\$ 91,036	\$	92,327	-1.4%
Total Last Reported Pay	\$ 2,640,041	\$	3,046,787	-13.3%
<u>Tier 2</u>				
Count	23		17	35.3%
Average Age	31.5		32.6	-3.6%
Average Service	2.7		2.7	-0.4%
Average Last Reported Pay	\$ 73,941	\$	74,418	-0.6%
Total Last Reported Pay	\$ 1,700,650	\$	1,265,099	34.4%
<u>Total</u>				
Count	52		50	4.0%
Average Age	40.5		42.1	-3.8%
Average Service	7.7		8.8	-12.0%
Average Last Reported Pay	\$ 83,475	\$	86,238	-3.2%
Total Last Reported Pay	\$ 4,340,691	\$	4,311,886	0.7%

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

APPENDIX A – MEMBERSHIP INFORMATION

Table A-3 Inactive Member Data by Status			
	July 1, 2018	July 1, 2017	% Change
Retirees			
Count	2,694	2,665	1.1%
Annual Retirement Allowances	\$ 191,956,729	\$ 187,291,821	2.5%
Average Retirement Allowance	\$ 71,253	\$ 70,278	1.4%
Beneficiaries			
Count	432	408	5.9%
Annual Retirement Allowances	\$ 16,133,043	\$ 15,045,517	7.2%
Average Retirement Allowance	\$ 37,345	\$ 36,876	1.3%
Ordinary Disability			
Count	125	122	2.5%
Annual Retirement Allowances	\$ 5,058,044	4,877,728	3.7%
Average Retirement Allowance	\$ 40,464	\$ 39,981	1.2%
Accidental Disability			
Count	153	146	4.8%
Annual Retirement Allowances	\$ 9,048,918	8,558,614	5.7%
Average Retirement Allowance	\$ 59,143	\$ 58,621	0.9%
In-Pay Total			
Count	3,404	3,341	1.9%
Annual Retirement Allowances	\$ 222,196,734	\$ 215,773,680	3.0%
Average Retirement Allowance	\$ 65,275	\$ 64,584	1.1%
Deferred Vested Members			
Count	0	0	N/A
Annual Retirement Allowances	\$ 0	\$ 0	N/A
Average Retirement Allowance	\$ 0	\$ 0	N/A

QDRO benefits included with member records for valuation purposes.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

APPENDIX A – MEMBERSHIP INFORMATION

Table A-4 Reconciliation of Plan Membership from July 1, 2017 to July 1, 2018							
	Contributing Actives	Non-Contrib. Actives	Deferred Vested	Retired	Disabled	Beneficiaries	Total
1. July 1, 2017	2,762	50	0	2,665	268	408	6,153
2. Additions							
a. New entrants							0
b. New dependent						1	1
c. Data Correction						6	6
d. Total	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>7</u>	<u>7</u>
3. Reductions							
a. Withdrawal	(2)	(5)					(7)
b. Died without beneficiary				(23)		(13)	(36)
c. Payments ceased							0
e. Total	<u>(2)</u>	<u>(5)</u>	<u>0</u>	<u>(23)</u>	<u>0</u>	<u>(13)</u>	<u>(43)</u>
4. Changes in Status							
a. Contributing Active	2	(2)					0
b. Non-Contributing Active	(11)	11					0
c. Deferred Vested							0
e. Retired	(78)	(1)		79			0
f. Disabled	(10)	(1)			11		0
g. Died with beneficiary	(2)			(27)	(1)	30	0
h. Total	<u>(99)</u>	<u>7</u>	<u>0</u>	<u>52</u>	<u>10</u>	<u>30</u>	<u>0</u>
5. July 1, 2018	2,661	52	0	2,694	278	432	6,117

QDRO benefits included with member records for valuation purposes.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

APPENDIX A – MEMBERSHIP INFORMATION

**Table A-5
Counts by Age and Service of Contributing Active Members**

Attained Age	Years of Service								Total
	Under 1	1 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 & up	
Under 30	1	294	18	0	0	0	0	0	313
30 to 34	0	271	135	96	1	0	0	0	503
35 to 39	0	47	68	441	82	0	0	0	638
40 to 44	0	0	11	196	304	32	0	0	543
45 to 49	0	0	0	47	161	256	12	0	476
50 to 54	0	0	0	0	24	101	40	22	187
55 & up	0	0	0	0	0	1	0	0	1
Total	1	612	232	780	572	390	52	22	2,661

**Table A-6
Average Appropriation Pay by Age and Service of Contributing Active Members**

Attained Age	Years of Service								Total
	Under 1	1 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 & up	
Under 30	\$ 71,879	\$ 72,431	\$ 73,815	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 72,509
30 to 34	0	72,809	79,438	95,223	95,944	0	0	0	78,912
35 to 39	0	73,112	83,566	104,996	116,062	0	0	0	101,785
40 to 44	0	0	88,522	108,683	119,563	122,771	0	0	115,196
45 to 49	0	0	0	113,111	122,838	133,372	133,336	0	127,807
50 to 54	0	0	0	0	126,705	134,621	134,307	132,860	133,331
55 & up	0	0	0	0	0	142,506	0	0	142,506
Total	\$ 71,879	\$ 72,651	\$ 80,642	\$ 105,208	\$ 120,241	\$ 132,849	\$ 134,083	\$ 132,860	\$ 103,642

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

APPENDIX A – MEMBERSHIP INFORMATION

Table A-7 Counts by Age and Status of Inactive Members					
Attained Age	Status				Total
	Retiree	Beneficiary	Ordinary Disability	Accidental Disability	
Under 45	0	12	9	25	46
45 to 49	11	3	9	21	44
50 to 54	493	8	31	39	571
55 to 59	592	16	29	31	668
60 to 64	406	23	17	12	458
65 to 69	296	41	8	7	352
70 to 74	375	68	9	6	458
75 to 79	309	77	12	10	408
80 to 84	104	57	1	2	164
85 & up	108	127	0	0	235
Total	2,694	432	125	153	3,404

Table A-8 Average Retirement Allowances by Age and Status of Inactive Members					
Attained Age	Status				Total
	Retiree	Beneficiary	Ordinary Disability	Accidental Disability	
Under 45	\$ 0	\$ 46,356	\$ 39,627	\$ 63,962	\$ 54,608
45 to 49	79,645	71,652	41,049	62,537	63,040
50 to 54	83,560	54,879	40,886	65,123	79,582
55 to 59	82,075	49,491	42,318	60,047	78,547
60 to 64	77,285	49,000	53,413	56,795	74,442
65 to 69	71,179	43,054	35,367	54,196	66,751
70 to 74	61,379	39,594	35,109	43,137	57,389
75 to 79	53,489	38,453	25,918	31,892	49,311
80 to 84	47,763	33,565	19,311	48,352	42,662
85 & up	40,166	28,915	0	0	34,085
Total	\$ 71,253	\$ 37,345	\$ 40,464	\$ 59,143	\$ 65,275

QDRO benefits included with member records for valuation purposes.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
JULY 1, 2018 ACTUARIAL VALUATION**

APPENDIX B – SUMMARY OF ACTUARIAL ASSUMPTIONS AND METHODS

A. Actuarial Assumptions

- 1. Investment Rate of Return** 7.50% per annum, compounded annually.

- 2. Administrative Expenses** No explicit assumption is made for administrative expenses for funding purposes per the funding methodology prescribed by NJ State Statute.

- 3. Cost-of-Living Adjustments (COLAs)** No future COLAs are assumed. Previously granted COLAs are included in the data.

- 4. Salary Increases** Salaries are assumed to increase by 2.95% per year through fiscal year 2025 and 3.95% per year for fiscal years 2026 and thereafter.

Salary increases are assumed to occur on January 1.

- 5. 401(a)(17) Pay Limit** \$275,000 in 2018 increasing 3.00% per annum, compounded annually.

- 6. Social Security Wage Base** \$128,400 in 2018 increasing 4.00% per annum, compounded annually.

- 7. Termination** Representative termination rates are as follows:

Age	Less Than 5 Years of Service	Between 5 and 19 Years of Service
25	0.375%	0.000%
30	0.375	0.200
35	0.825	0.140
40	0.000	0.075
45	0.000	0.100
50	0.000	0.000

No termination is assumed after attainment of retirement eligibility.

All members with 10 or more years of service at termination are assumed to elect a deferred retirement benefit.

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APPENDIX B – SUMMARY OF ACTUARIAL ASSUMPTIONS AND METHODS

8. Disability

Representative disability rates are as follows:

Age	Ordinary Disability	Accidental Disability
25	0.041%	0.025%
30	0.061	0.053
35	0.169	0.194
40	0.172	0.208
45	0.218	0.214
50	0.375	0.220

No ordinary disability is assumed after attainment of special retirement eligibility at 25 years of service.

Accidental disability rates apply at all ages until the mandatory retirement age of 55.

Members retiring under the ordinary disability decrement with less than four years of service are assumed to receive a return of aggregate contributions.

Members retiring under the ordinary disability decrement with 20 or more years of service are assumed to receive the involuntary disability retirement benefit.

Members are assumed to receive the greater of the applicable disability benefit or the service or special retirement benefit, depending on eligibility.

9. Mortality

Healthy Mortality: RP-2000 Combined Healthy Mortality Tables (unadjusted for females and set back 3 years for males) projected on a generational basis from the base year of 2000 to 2013 using Projection Scale BB and the Conduent Modified 2014 Projection scale thereafter. These tables are also used for purposes of the pre-retirement ordinary death benefit.

Disabled Mortality: RP-2000 Combined Healthy Mortality Tables (set forward 5 years for males and females) without projection.

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APPENDIX B – SUMMARY OF ACTUARIAL ASSUMPTIONS AND METHODS

Representative mortality rates for purposes of the pre-retirement accidental death benefit are as follows:

Age	Rates
25	0.040%
30	0.050
35	0.050
40	0.050
45	0.060
50	0.090

No mortality improvement is assumed for purposes of the pre-retirement accidental death benefit.

For purposes of pre-retirement accidental death benefits based on Adjusted Final Compensation, the benefit is assumed to increase at the same rate as active salaries.

10. Retirement

For those with 25 years of service or less:

Service	Rates
20	2.000%
21	0.500
22	0.000
23	0.000
24	0.000
25	50.000

For those with more than 25 years of service:

Age	Rates
42 or younger	5.000%
43-47	28.000
48-53	33.000
54	61.000

Mandatory retirement at age 55.

**11. Family
Composition
Assumptions**

For members not currently in receipt, 83.3% of members are assumed married to spouses of the opposite sex. Males are assumed to be three years older than females.

For purposes of the post-retirement death benefit for members currently in receipt, beneficiary status is based on the beneficiary allowance reported. If no beneficiary date of birth is provided, the beneficiary is assumed to be the member's spouse of the opposite sex with males assumed to be three years older than females.

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APPENDIX B – SUMMARY OF ACTUARIAL ASSUMPTIONS AND METHODS

No additional dependent children or parents are assumed.

For current dependents receiving a pre-retirement accidental death benefit, those under age 24 are assumed to receive a benefit until age 24 while those over age 24 are assumed to receive a benefit for the remainder of their lifetime.

For current dependents receiving a benefit other than a pre-retirement accidental death benefit, those under age 18 are assumed to receive a benefit until age 18 while those over age 18 are assumed to receive a benefit for the remainder of their lifetime.

12. Data

Information provided by the prior actuary was relied upon for the purposes of setting the status of and valuing non-contributing active records.

For current beneficiaries with missing data, reasonable assumptions were made based on the information available in prior years.

Inactives receiving benefits according to the 2017 data but omitted from the 2018 data are assumed to have died without a beneficiary.

13. Rationale for Assumptions

The demographic assumptions used in this report reflect the results of the July 1, 2011 – June 30, 2014 Experience Study prepared by the prior actuary, which was approved by the Board of Trustees on January 26, 2016. The valuation is based on a 7.50% interest rate and annual salary increases that are 0.5% lower than the rates shown in the experience study, which were recommended by the State Treasurer. Cheiron has reviewed the demographic and economic assumptions. While we consider these assumptions to be generally reasonable, we have not yet performed our own actuarial experience study.

14. Changes in Assumptions Since Last Valuation

None

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APPENDIX B – SUMMARY OF ACTUARIAL ASSUMPTIONS AND METHODS

B. Projection Assumptions

- 1. Investment Rate of Return**
 - July 1, 2019 valuation: 7.30% per annum, compounded annually.
 - July 1, 2020 valuation: 7.30% per annum, compounded annually.
 - July 1, 2021 and later valuations: 7.00% per annum, compounded annually.

- 2. Appropriation Percentages**

The State is assumed to appropriate 70% of the Statutory contribution in FYE 2020, and to increase the percent by 10% a year, until reaching 100% of the Statutory contribution beginning with FYE 2023.

- 3. Administrative Expenses**

0.17% of expected pension benefit payments for the year.

- 4. New Entrants**
 - Contributing active population assumed to remain at 2018 levels.
 - Assumed to join mid-year.
 - Age/sex distributions based on the last three years of new hires.
 - Salary based on salary for most recent hires reported on 2018 data.

- 5. Demographic Assumptions**

Same as those used for valuation purposes.

APPENDIX B – SUMMARY OF ACTUARIAL ASSUMPTIONS AND METHODS

C. Actuarial Methods

The actuarial methods used for determining State contributions are described as follows.

1. Actuarial Cost Method

The actuarial cost method for funding calculations is the Projected Unit Credit Cost Method.

The actuarial liability is calculated as the actuarial present value of the projected benefits linearly allocated to periods prior to the valuation year based on service. The unfunded actuarial liability is the actuarial liability on the valuation date less the actuarial value of assets.

In accordance with Chapter 78, P.L. 2011:

- Beginning with the July 1, 2010 actuarial valuation, the accrued liability contribution shall be computed so that if the contribution is paid annually in level dollars, it will amortize the unfunded accrued liability over an open 30 year period.
- Beginning with the July 1, 2019 actuarial valuation, the accrued liability contribution shall be computed so that if the contribution is paid annually in level dollars, it will amortize the unfunded accrued liability over a closed 30 year period (i.e., for each subsequent actuarial valuation the amortization period shall decrease by one year).
- Beginning with the July 1, 2029 actuarial valuation, when the remaining amortization period reaches 20 years, any increase or decrease in the unfunded accrued liability as a result of actuarial losses or gains for subsequent valuation years shall serve to increase or decrease, respectively, the amortization period for the unfunded accrued liability, unless an increase in the amortization period will cause it to exceed 20 years. If an increase in the amortization period as a result of actuarial losses for a valuation year would exceed 20 years, the accrued liability contribution shall be computed for the valuation year using a 20 year amortization period.

To the extent that the amortization period remains an open period in future years and depending upon the specific circumstances, it should be noted that in the absence of emerging actuarial gains or contributions made in excess of the actuarially determined contribution, any existing unfunded accrued liability may not be fully amortized in the future.

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APPENDIX B – SUMMARY OF ACTUARIAL ASSUMPTIONS AND METHODS

2. Asset Valuation Method

For the purposes of determining contribution rates, an actuarial value of assets is used that dampens the volatility in the market value of assets, resulting in a smoother pattern of contributions.

The actuarial value of assets is adjusted to reflect actual contributions, benefit payments and administrative expenses and an assumed return on the previous year's assets and the current year's cash flow at the prior year's actuarial valuation interest rate, with a further adjustment to reflect 20% of the difference between the resulting value and the actual market value of Plan assets.

3. State Contribution Payable Dates

Chapter 83, P.L. 2016 requires the State to make the required pension contributions on a quarterly basis in each fiscal year according to the following schedule: at least 25% by September 30, at least 50% by December 31, at least 75% by March 31, and at least 100% by June 30. As such, contributions are assumed to be made on a quarterly basis.

4. Changes in Methods Since the Last Valuation

None.

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APPENDIX C – SUMMARY OF PLAN PROVISIONS

This summary of Plan provisions provides an overview of the major provisions of the SPRS used in the actuarial valuation. It is not intended to replace the more precise language of the NJ State Statutes, Title 53, Chapter 5A, and if there is any difference between the description of the plan herein and the actual language in the NJ State Statutes, the NJ State Statutes will govern.

1. Eligibility of Membership

All members of the former State Police and Benevolent Fund and full-time commissioned officers, non-commissioned officers or troopers of the Division of State Police. Membership is a condition of employment.

- a) Tier 1 Member: Any member hired on or before May 21, 2010.
- b) Tier 2 Member: Any member hired after May 21, 2010.

2. Plan Year

The 12-month period beginning on July 1 and ending on June 30.

3. Service Credit

Service rendered while a member as described above.

4. Credited Service

A year is credited for each year of service as an officer or trooper in the State Police.

5. Compensation

Base salary in accordance with established salary policies of the state for all employees in the same position. Compensation does not include individual salary adjustments granted primarily in anticipation of the retirement or for temporary or extracurricular duties beyond the regular work day or shift. Effective June 30, 1996, Chapter 113, P. L. 1997 provided that the amount of compensation used for employer and member contributions and benefits under the program cannot exceed the compensation limitation of Section 401(a)(17) of the Internal Revenue Code. Chapter 1, P. L. 2010 provides that for members hired on or after May 22, 2010, the amount of compensation used for employer and member contributions and benefits under the System cannot exceed the annual maximum wage contribution base for Social Security, pursuant to the Federal Insurance Contributions Act.

6. Final Compensation

Average compensation received by the member in the last 12 months of credited service preceding retirement or death. Such term includes the value of the member's maintenance allowance for the same period. Chapter 1, P. L. 2010 provides that for members hired on or after May 22, 2010, Final Compensation means the average annual compensation for service for which contributions are made during any three fiscal years of membership providing the largest possible benefit to the member or the member's beneficiary.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
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APPENDIX C – SUMMARY OF PLAN PROVISIONS

7. Aggregate Contributions

The sum of all amounts deducted from the compensation of a member or contributed by him or on his behalf.

8. Member Contributions

Each member contributes 9.0% of base salary. For contribution purposes, compensation does not include overtime, bonuses, maintenance or any adjustments before retirement.

9. Adjusted Final Compensation

For purposes of the pre-retirement accidental death benefit, the amount of compensation or compensation as adjusted, as the case may be, increased by the same percentage increase which is applied in any adjustments of the compensation schedule of active members after the member's death and before the date on which the deceased member of the retirement system would have accrued 25 years of service under an assumption of continuous service, at which time that amount will become fixed. Adjustments to compensation or adjusted compensation shall take effect at the same time as any adjustments in the compensation schedule of active members.

10. Benefits

a) Service and Special Retirement:

Mandatory retirement at age 55. Voluntary retirement prior to age 55.

- (1) Service Retirement: 20 years of service credit, or members as of August 29, 1985 who would not have 20 years of service credit at age 55.

Benefit is an annual retirement allowance equal to 50% of final compensation.

- (2) Special Retirement: 25 years of service credit.

Benefit is an annual retirement allowance equal to 65% of final compensation, plus 1% for each year of service credit in excess of 25 years, to a maximum of 70% of final compensation.

- (3) Members as of August 29, 1985 who would have 20 years of service credit but not 25 years at age 55.

Benefit is an annual retirement allowance equal to 50% of final compensation, plus 3% for each year of service credit in excess of 20 years.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
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APPENDIX C – SUMMARY OF PLAN PROVISIONS

b) Deferred Retirement:

Termination of service prior to age 55 with 10 years of service credit.

Benefit is either a refund of aggregate contributions, or a deferred life annuity beginning at age 55 equal to 2% of final compensation for each year of service credit up to 25 years.

For members who die during the deferral period, the benefit is a return of aggregate contributions.

c) Non-Vested Termination:

Termination of service prior to age 55 and less than 10 years of service credit.

Benefit is a return of aggregate contributions.

d) Death Benefits

(1) Ordinary Death Before Retirement: Death of an active member of the plan. Benefit is equal to:

- a. Lump sum payment equal to 350% of final compensation, also known as the noncontributory group life insurance benefit, plus
- b. Spousal life annuity of 50% of final compensation payable until spouse's death or remarriage. If there is no surviving spouse, or upon death or remarriage, a total of 20% (35%, 50%) of final compensation payable to one (two, three or more) dependent child(ren). If there is no surviving spouse or dependent child(ren), 25% (40%) of final compensation to one (two) dependent parent(s). If there is no surviving spouse, dependent child(ren) or parent(s), the benefit is a refund of accumulated contributions.

(2) Accidental Death Before Retirement: Death of an active member of the plan resulting during performance of duties. Benefit is equal to:

- a. Lump sum payment equal to 350% of final compensation, also known as the noncontributory group life insurance benefit, plus
- b. Spousal life annuity of 70% of final compensation or adjusted final compensation (if appropriate) payable until spouse's death. If there is no surviving spouse, or upon death of the surviving spouse, 70% of final compensation or adjusted final compensation (if appropriate) payable to surviving children in equal shares. If there is no surviving spouse or dependent children, 25% (40%) of final compensation or adjusted final compensation (if appropriate) to one (two) dependent parents. If there is no surviving spouse, dependent child(ren) or parent(s), the benefit is a refund of accumulated contributions.

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APPENDIX C – SUMMARY OF PLAN PROVISIONS

- (3) Death After Retirement: Death of a retired member of the plan. Benefit is equal to:
- a. Lump sum payment equal to 50% of final compensation for a member retired under service, special or deferred retirement. For a member receiving a disability benefit, lump sum payment of 350% of final compensation if death occurs prior to age 55 and 50% of final compensation if death occurs after age 55. This benefit is also known as the noncontributory group life insurance benefit, plus
 - b. Spousal life annuity of 50% of final compensation payable until spouse's death or remarriage. If there is no surviving spouse, or upon death or remarriage, a total of 20% (35%, 50%) of final compensation payable to one (two, three or more) dependent child(ren). Previously granted COLAs also apply.

e) Disability Retirement

- (1) Ordinary Disability Retirement: Four years of service credit and mentally or physically incapacitated for the performance of his usual duty and of any other available duty in the Division of State Police and such incapacity is likely to be permanent.

Benefit is an immediate life annuity equal to the greater of:

- a. 40% of final compensation, or
- b. 1.5% of final compensation for each year of service credit.

- (2) Involuntary Ordinary Disability Retirement: Ordinary Disability Retirement applied for by the employer.

Benefit is an immediate life annuity equal to:

- a. For members with 20 years of service credit but less than 25 years, 50% of final compensation plus 3% of final compensation for each year of service credit in excess of 20 years, to a maximum of 65% of final compensation.
- b. For all other members, the Ordinary Disability benefit.

- (3) Accidental Disability Retirement: Totally and permanently disabled as a direct result of a traumatic event occurring during and as a result of his regular or assigned duties and such member is mentally or physically incapacitated for the performance of his usual duties in the Division of State Police.

Benefit is an immediate life annuity equal to $\frac{2}{3}$ of annual rate of compensation, including the maintenance allowance, at the time of the traumatic event or retirement, whichever is greater.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
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APPENDIX C – SUMMARY OF PLAN PROVISIONS

11. Forms of Payment

No optional forms of payment available.

12. Changes in Plan Provisions since Last Valuation

None.

**STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
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APPENDIX D – HISTORICAL DATA

Table D-1 Historical Summary of Assets and Liabilities					
Valuation Date July 1,	Market Value of Assets	Actuarial Value of Assets	Actuarial Liability	Funded Ratio	
				Market Value	Actuarial Value
2018	\$ 1,881,340,538	\$ 1,939,304,839	\$ 3,430,821,762	54.8%	56.5%
2017	1,830,429,239	1,923,127,122	3,346,082,274	54.7%	57.5%
2016	1,744,462,405	1,931,131,875	3,209,386,033	54.4%	60.2%
2015	1,900,695,725	1,969,239,472	3,090,220,484	61.5%	63.7%
2014	1,967,141,815	1,981,376,495	2,963,182,120	66.4%	66.9%
2013	1,832,851,456	1,990,797,312	2,870,590,700	63.8%	69.4%
2012	1,755,429,511	1,995,388,133	2,767,768,813	63.4%	72.1%
2011	1,820,438,444	2,015,624,130	2,581,950,846	70.5%	78.1%
2010	1,656,194,924	2,019,350,048	2,497,094,137	66.3%	80.9%
2009	1,564,180,409	2,067,242,877	2,825,455,568	55.4%	73.2%

Table D-2 Historical Summary of Employer Contributions					
Fiscal Year Ending June 30,	Actuarially Determined Contribution	Actual Pension Contributions	Contribution Deficiency (Excess)	Percentage of Contribution Covered	
2019	\$ 159,162,729	\$ 95,497,637	\$ 63,665,092	60.00%	
2018	144,208,823	72,104,000	72,104,823	50.00%	
2017	133,217,662	51,038,000	82,179,662	38.31%	
2016	118,600,705	35,580,000	83,020,705	30.00%	
2015	108,904,703	37,358,000	71,546,703	34.30%	
2014	103,193,378	35,231,000	67,962,378	34.14%	
2013	89,535,903	25,582,000	63,953,903	28.57%	
2012	89,671,744	12,810,000	76,861,744	14.29%	
2011	103,745,281	0	103,745,281	0.00%	
2010	82,485,012	0	82,485,012	0.00%	

FYE 2019 actual contribution is based on the State’s anticipated appropriation of 60% of the Statutory Contribution.

The information above is based on the final actuarial valuation reports for the given years. The amounts do not reflect differences between the discounted State appropriations receivable and the actual State contribution amounts that became known after the issuance of the reports.

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APPENDIX E – GLOSSARY OF TERMS

1. Actuarial Assumptions

Assumptions as to the occurrence of future events affecting pension costs, such as: mortality, withdrawal, disability, and retirement; changes in compensation; inflation; rates of investment earnings, and asset appreciation or depreciation; and other relevant items.

2. Actuarial Cost Method

A procedure for determining the Actuarial Present Value of pension plan benefits and expenses and for developing an allocation of such value to each year of service, usually in the form of a Normal Cost and an Actuarial Liability.

3. Actuarial Gain/(Loss)

A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions during the period between two Actuarial Valuation dates, as determined in accordance with a particular Actuarial Cost Method.

4. Actuarial Liability

The portion of the Actuarial Present Value of Projected Benefits which will not be paid by future Normal Costs. It represents the value of the past Normal Costs with interest to the valuation date.

5. Actuarial Present Value (Present Value)

The value as of a given date of a future amount or series of payments. The Actuarial Present Value discounts the payments to the given date at the assumed investment return and includes the probability of the payment being made. As a simple example: assume you owe \$100 to a friend one year from now. Also, assume there is a 1% probability of your friend dying over the next year, in which case you won't be obligated to pay him. If the assumed investment return is 10%, the actuarial present value is:

$$\begin{array}{ccccccc} \text{Amount} & & \text{Probability of} & & \text{1/(1+Investment Return)} & & \\ \text{Payment} & & & & & & \\ \$100 & \times & (1 - .01) & \times & 1/(1+.1) & = & \$90 \end{array}$$

6. Actuarial Valuation

The determination, as of a specified date, of the Normal Cost, Actuarial Liability, Actuarial Value of Assets, and related Actuarial Present Values for a pension plan.

APPENDIX E – GLOSSARY OF TERMS

7. Actuarial Value of Assets

The value of cash, investments and other property belonging to a pension plan as used by the actuary for the purpose of an Actuarial Valuation. The purpose of an Actuarial Value of Assets is to smooth out fluctuations in market values. This way long-term costs are not distorted by short-term fluctuations in the market.

8. Actuarially Equivalent

Of equal Actuarial Present Value, determined as of a given date with each value based on the same set of Actuarial Assumptions.

9. Amortization Payment

The portion of the pension plan contribution which is designed to pay interest and principal on the Unfunded Actuarial Liability in order to pay for that liability in a given number of years.

10. Funded Ratio

The ratio of the Actuarial Value of Assets to the Actuarial Liabilities.

11. Investment Return Assumption

The assumed interest rate used for projecting dollar related values in the future.

12. Mortality Table

A set of percentages which estimate the probability of death at a particular point in time. Typically, the rates are annual and based on age and sex.

13. Normal Cost

That portion of the Actuarial Present Value of pension plan benefits and expenses, which is allocated to a valuation year by the Actuarial Cost Method.

14. Projected Benefits

Those pension plan benefit amounts which are expected to be paid in the future under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age and increases in future compensation and service credits.

STATE POLICE RETIREMENT SYSTEM OF NEW JERSEY
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APPENDIX E – GLOSSARY OF TERMS

15. Projected Unit Credit Cost Method

A method under which the Actuarial Liability is calculated as the Actuarial Present Value of the Projected Benefits allocated to periods prior to the valuation year.

16. Unfunded Actuarial Liability

The excess of the Actuarial Liability over the Actuarial Value of Assets.