



January 21, 2016

## **North Dakota Teachers' Fund for Retirement**

Asset Allocation and Liability  
Study

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# Agenda

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- Goal of the study
- Callan's asset-liability process
- Capital market expectations
- Develop asset mix alternatives
- Build actuarial liability model
- Deterministic projections
- Simulate financial condition (stochastic projections)
- Making a decision
- Asset allocation recommendation
- Appendix

# Goal of the Study

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- The goal of this asset-liability study is to identify an appropriate long-term strategic asset allocation policy for the Teachers' Fund for Retirement (TFFR).
- An appropriate asset allocation will depend on the Plan Sponsor's investment objectives.
  - Minimize costs over the long run (long-term goal).
    - *How much return generation (from beta and alpha) is necessary to lower costs and/or improve funded status?*
  - Minimize funded status volatility (short-term goal).
    - *How much risk reduction is necessary to reduce funded status volatility?*
- The appropriate asset allocation should strike a balance between sustainable funded status volatility and minimization of costs over the long run.
- The appropriate asset allocation will vary by each Plan Sponsor's unique circumstances, preferences, and priorities.
  - No "one-size-fits-all" solution exists.

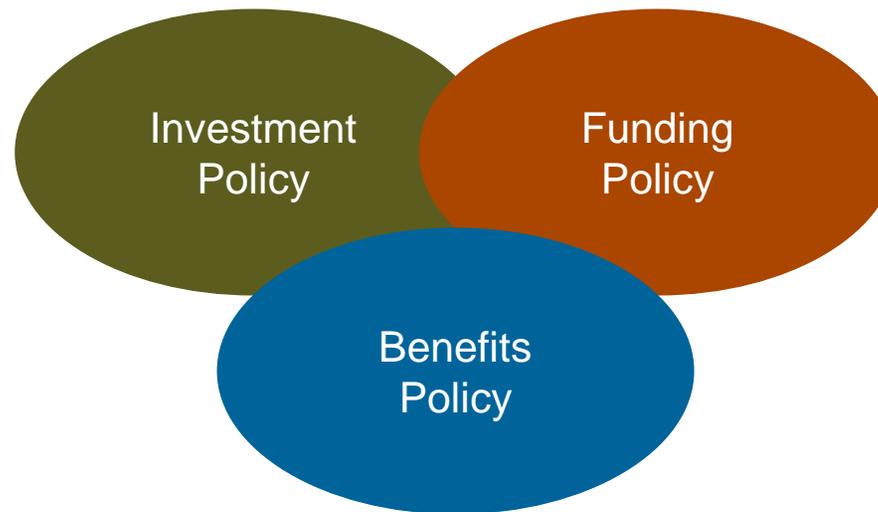
# Where Does Asset Allocation Fit In?

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*We evaluate the interaction of the three key policies that govern TFFR with the goal of establishing the best investment policy.*

## Investment Policy

- How will the assets supporting the benefits be invested?
- What risk and return objectives?
- How to manage cash flows?



## Funding Policy

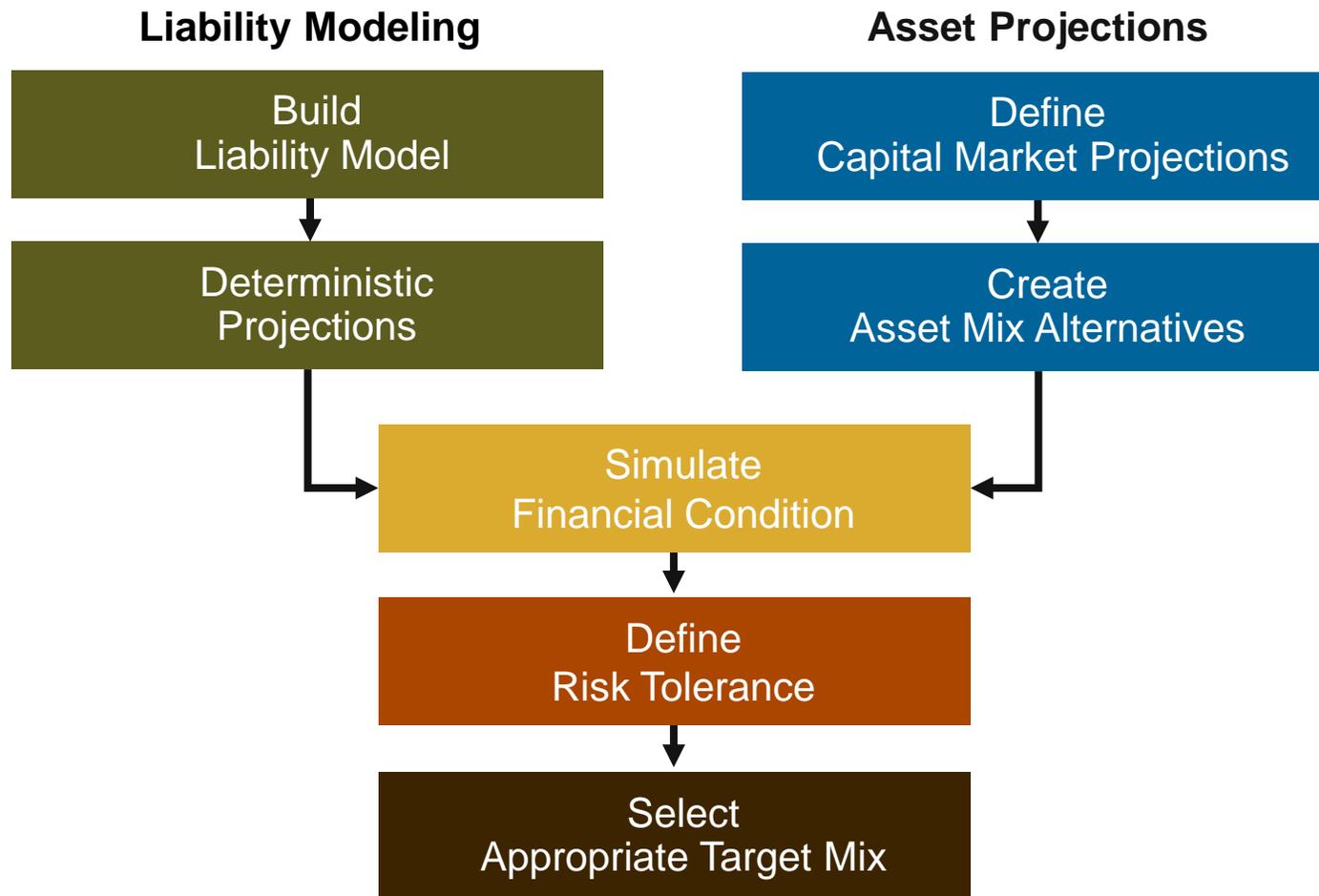
- How will the benefits be paid for (funded)?
- What actuarial assumptions?
- How are unfunded liabilities amortized/recognized?
- What are expected inflows (contributions)?

## Benefits Policy

- What type/kind of benefits?
- What level of benefit?
- When and to whom are they payable?

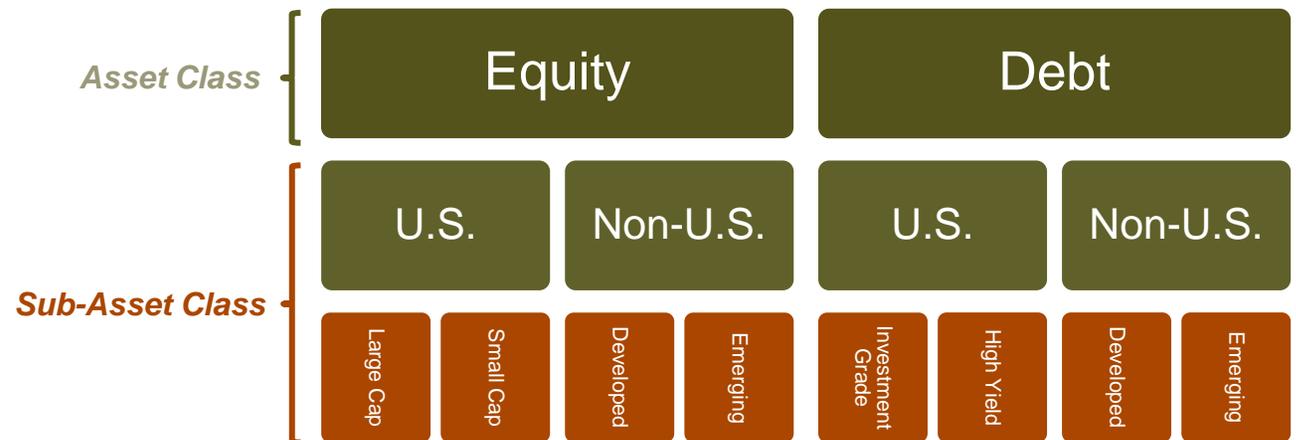
# Asset Allocation and Liability Process

- Liabilities and assets are evaluated and tested separately, then integrated into a single model.



# The Focus is on Broad Asset Classes

- Breakdowns between investment styles within asset classes (growth vs. value, large cap vs. small cap) are best addressed in a manager structure analysis.
  - Asset allocation assumes a net-of-fee investment in the relevant index fund (passive management).
  - Manager structure reflects the investor’s decision about the use of active and/or passive management within an asset class; the number of different mandates within the asset class; the styles within the asset class; and whether or not to implement “tilts” that differ from the asset class benchmark (i.e.– the asset class’s index).
- Primary asset classes and important sub-asset classes include:
  - U.S. stocks
  - U.S. bonds
  - Non-U.S. stocks
  - Non-U.S. bonds
  - Alternative investments
    - Real estate
    - Private equity
    - Absolute return
  - Cash



# How are Capital Market Projections Constructed?

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- An annual internal process at Callan to update 10-year projections.
  - Evaluate current environment and economic outlook.
  - Examine relations between economy and historical asset class performance.
  - Create 10-year risk, return, and correlation projections.
  - Test projections for reasonable results.
  - Typically released in January each year
- Projections cover most broad asset classes and inflation:
  - Broad domestic equity
    - *Large cap*
    - *Small cap*
  - International equity
    - *Developed markets*
    - *Emerging markets*
  - Domestic fixed income
  - International fixed income
  - Real estate
  - Alternative investments
  - Cash
  - Inflation
- Incorporates both advanced quantitative modeling as well as qualitative feedback and expertise contributed by Callan consulting professionals.

# 2015 versus 2016 Capital Market Expectations

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- Callan's 2015 capital market expectations are employed in the asset-liability study given the timeframe for the analysis.
- We are not expecting significant changes to our expectations in 2016, at least none that would likely make a material difference in the results of the study given they are 10-year forecasts.
- We will run the return and risk numbers using 2016 projections to assess the difference versus 2015 and discuss the likely impact on the study.

# 2015 Capital Market Expectations

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- Bond returns raised to 3.0%.
  - We expect interest rates to rise, especially if the economy continues to expand and the Fed executes on its stated unemployment-rate-linked monetary policy. Bonds will suffer capital loss before higher yields kick in. We expect cash yields to move toward 3.0% and 10-year Treasury yields to reach 5% over the ten-year projection – a reversion to mean.
  - Project an upward sloping yield curve, but a very slim risk premium for bonds over cash (1.0%).
- Domestic equity held at 7.60%, non-U.S. equity at 7.80%.
  - US markets enjoyed robust returns, but the US economic outlook is now stronger and fundamentals remain reasonable.
  - Building equity returns from long-term fundamentals, we can build an expectation to just shy of 8%:
    - *2.5-3.0% real GDP growth, which means 5-6% nominal earnings growth*
    - *2.5 % dividend yield*
    - *Expect something more from return on free cash flow, besides dividends (The “buyback yield” has been exceptional, one good use of all that cash), perhaps 50-100 bps*
    - *Small premium for non-US over domestic, largely due to emerging markets*
- Real estate return reduced slightly to 6.15% from 6.2%.
  - Reflects downward pressure on income returns at 4-5% with increased competition for investment.
  - Asset class increasingly eyed by those hungering for yield.
- Hedge fund return held at 5.1%.
  - Expectations of T-bill plus 3% suggests a return in the neighborhood of 5%.

# 2015 Capital Market Expectations: Return and Risk

## Summary of Callan's Long-Term Capital Market Projections (2015-2024)

- Most capital market expectations represent passive exposure (beta only); however, return expectations for private market investments such as real estate and private equity reflect active management premiums.
- Return expectations are net of fees.
- Shaded rows represent current asset classes.

### Summary of Callan's Long-Term Capital Market Projections (2015 - 2024)

Asset Class	Index	Projected Return*	Projected Risk
<b>Equities</b>			
Broad Domestic Equity	Russell 3000	7.60%	19.00%
Large Cap	S&P 500	7.50%	18.30%
Small/Mid Cap	Russell 2500	7.85%	22.95%
International Equity	MSCI World ex USA	7.50%	20.20%
Emerging Markets Equity	MSCI Emerging Markets	7.90%	27.95%
Global ex-US Equity	MSCI ACWI ex USA	7.80%	21.45%
<b>Fixed Income</b>			
Short Duration	Barclays 1-3 Yr G/C	2.40%	2.25%
Domestic Fixed	Barclays Aggregate	3.00%	3.75%
Long Duration	Barclays Long G/C	3.20%	11.40%
TIPS	Barclays TIPS	3.00%	5.30%
High Yield	Barclays High Yield	5.00%	11.10%
Non-US Fixed	Barclays Global Aggregate ex-USD	2.30%	9.40%
Emerging Market Debt	EMBI Global Diversified	4.70%	10.00%
<b>Other</b>			
Private Equity	TR Post Venture Capital	8.50%	33.05%
Hedge Funds	Callan Hedge FoF Database	5.25%	9.30%
Real Estate	Callan Real Estate Database	6.15%	16.50%
Timberland	NCREIF Timberland	6.30%	17.50%
Infrastructure	S&P Global Infr/JPM Infr	6.65%	19.00%
Real Assets (Private)	60 Real Est, 15 Timber, 25 Infrastr	6.60%	15.60%
Commodities	Bloomberg Commodity	2.75%	18.50%
Cash Equivalents	90-Day T-Bill	2.25%	0.90%
<b>Inflation</b>	CPI-U	2.25%	1.50%

\* Geometric returns are derived from arithmetic returns and the associated risk (standard deviation).

# 2015 Capital Market Expectations: Correlation

## Key to Constructing Efficient Portfolios

2015 Correlation Matrix

	Broad	Lg Cap	Sm/Mid	Int'l Eq	Emerge	GlobxUS	Dom Fix	TIPS	Hi Yield	NUS Fix	EMD	Pvt Eq	Hedge Fd	Real Est	Timber	Infrastr	Real Asts	Comm	Cash Eq	
Broad Domestic Equity	1.000																			
Large Cap	0.997	1.000																		
Small/Mid Cap	0.965	0.940	1.000																	
International Equity	0.852	0.850	0.820	1.000																
Emerging Markets Equity	0.861	0.855	0.840	0.860	1.000															
Global ex-US Equity	0.882	0.879	0.853	0.986	0.933	1.000														
Domestic Fixed	-0.107	-0.100	-0.125	-0.100	-0.145	-0.118	1.000													
TIPS	-0.050	-0.045	-0.065	-0.045	-0.060	-0.051	0.580	1.000												
High Yield	0.605	0.605	0.575	0.570	0.565	0.586	0.040	0.030	1.000											
Non-US Fixed	0.014	0.050	-0.100	0.060	-0.090	0.013	0.510	0.340	0.120	1.000										
Emerging Market Debt	0.587	0.590	0.550	0.530	0.550	0.553	0.030	0.170	0.390	0.010	1.000									
Private Equity	0.943	0.940	0.910	0.900	0.895	0.927	-0.180	-0.090	0.610	-0.060	0.560	1.000								
Hedge Funds	0.764	0.760	0.740	0.700	0.725	0.730	0.095	0.070	0.540	-0.080	0.510	0.735	1.000							
Real Estate	0.764	0.760	0.740	0.670	0.660	0.688	-0.020	0.005	0.540	-0.050	0.450	0.715	0.585	1.000						
Timberland	0.584	0.580	0.570	0.520	0.510	0.533	-0.020	0.000	0.430	-0.040	0.400	0.570	0.460	0.800	1.000					
Infrastructure	0.781	0.780	0.750	0.690	0.680	0.709	-0.020	0.010	0.580	0.060	0.590	0.760	0.620	0.650	0.500	1.000				
Real Assets (60 Real Est, 15 Timb, 25 Infr)	0.822	0.819	0.795	0.724	0.713	0.743	-0.022	0.006	0.593	-0.020	0.533	0.782	0.638	0.969	0.829	0.802	1.000			
Commodities	0.162	0.160	0.160	0.160	0.170	0.168	-0.120	0.100	0.100	0.050	0.190	0.180	0.210	0.200	0.180	0.240	0.231	1.000		
Cash Equivalents	-0.042	-0.030	-0.080	-0.010	-0.100	-0.040	0.100	0.070	-0.110	-0.090	-0.070	0.000	-0.070	-0.060	-0.050	-0.080	-0.071	0.070	1.000	

- Relationships between asset classes are as important, or more important, than the level of individual asset class assumptions.
- These relationships will have a large impact on the generation of efficient asset mixes using mean-variance optimization.
- Correlations are what define the diversification benefit – or lack thereof – of asset combinations.

# Asset Mix Alternatives

## Mean-Variance Optimization

Asset Class	Target	Optimal Mixes				
		Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
US Broad Equity	29%	22%	25%	27%	29%	32%
Global ex-US Equity	23%	18%	20%	22%	24%	26%
Domestic Fixed	12%	34%	28%	22%	15%	8%
High Yield	5%	4%	4%	4%	4%	4%
Non-US Fixed	5%	0%	0%	0%	0%	0%
Private Equity	5%	6%	6%	7%	8%	8%
Real Assets*	0%	15%	16%	17%	19%	21%
Real Estate	10%	0%	0%	0%	0%	0%
Timberland	5%	0%	0%	0%	0%	0%
Infrastructure	5%	0%	0%	0%	0%	0%
Cash Equivalents	1%	1%	1%	1%	1%	1%
Totals	100%	100%	100%	100%	100%	100%
Expected Return	7.1%	6.5%	6.7%	7.0%	7.3%	7.5%
Standard Deviation	14.7%	11.9%	13.0%	14.3%	15.6%	16.9%
Public Equity	52%	40%	45%	49%	53%	58%
Fixed Income + Cash	23%	39%	33%	27%	20%	13%
Alternatives	25%	21%	22%	24%	27%	29%

\*Real Assets = 60% Real Estate + 15% Timberland + 25% Infrastructure

# Asset Mix Alternatives

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## Mean-Variance Optimization

- While the Fund's expected return over the next 10 years falls short of the 7.75% return assumption, there are a few key items not factored into the 7.1% projection.
  - Callan's public market return projections do not incorporate active management premiums.
    - *Active management premiums accrue when investment firms selected by the State Investment Board outperform their passive benchmarks. It is important to note, though, that investment firms will at times underperform their passive benchmarks. The Plan's returns have benefitted from active management by approximately 50 basis points over the past five years.*
  - Callan's 10-year numbers are below longer-term expectations due to the current economic environment and the forecast for the next several years.
    - *Callan's 10-year return projections are approximately 50 to 200 basis points below longer-term (30+ years) expectations depending on the asset class.*
  - The actuary assumes 2.75% price inflation versus Callan's 2.25% assumption which means the liability return is closer to 7.4% rather than 7.75%.
    - *The 7.75% return is not reduced by a full 50 basis points since retirees do not receive an automatic COLA (100% CPI) every year.*
  - The Plan still has a reasonable chance of achieving a 7.75% return over 10 years (46% probability).
- In general, the efficient mixes suggest greater allocations to private equity and fixed income in lieu of real assets.
- Finally, Callan's 2015 capital market assumptions result in the model not "liking" non-US fixed income from a pure beta standpoint. Models are a tool, not a substitute for informed human judgement. To that end, we believe that the historical "alpha" available through implementation makes a compelling case to override the simple "beta" assessment embedded in our optimization model.

# Build Actuarial Liability Model

- For purposes of asset-liability modeling, Callan built an actuarial liability model which initially matches actuarial liabilities within 5%.
  - Results are then scaled to match the actuarial report exactly.
- Liability model is based on the July 1, 2015 actuarial valuation report provided by Segal Consulting.
  - Member and employer contribution rates of 11.75% and 12.75%, respectively.
  - Contribution rates revert to 7.75% when the Plan becomes 100% funded on an actuarial basis.

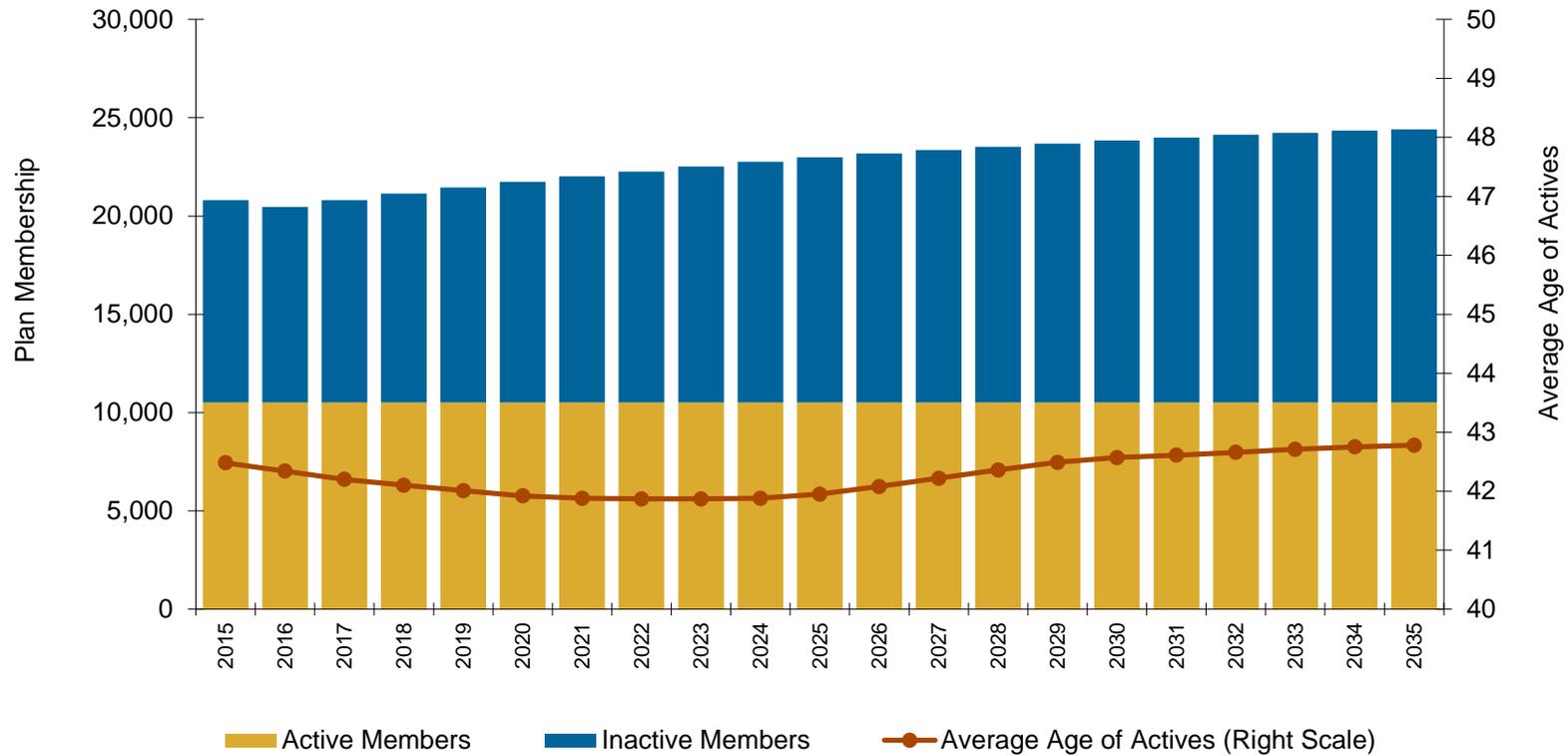
## July 1, 2015 Financial Position

Actuarial Accrued Liability	\$3,450 Million
Market Value of Assets	\$2,142 Million
Actuarial Value of Assets	\$2,125 Million
Funded Status (MVA/AL)	62.1%
Funded Status (AVA/AL)	61.6%

Key Assumptions	Actuarial	Callan
Investment Return	7.75%	7.1%
Price Inflation	2.75%	2.25%
Salary Growth	4.25% + Promotion	3.75% + Promotion

# Plan Membership

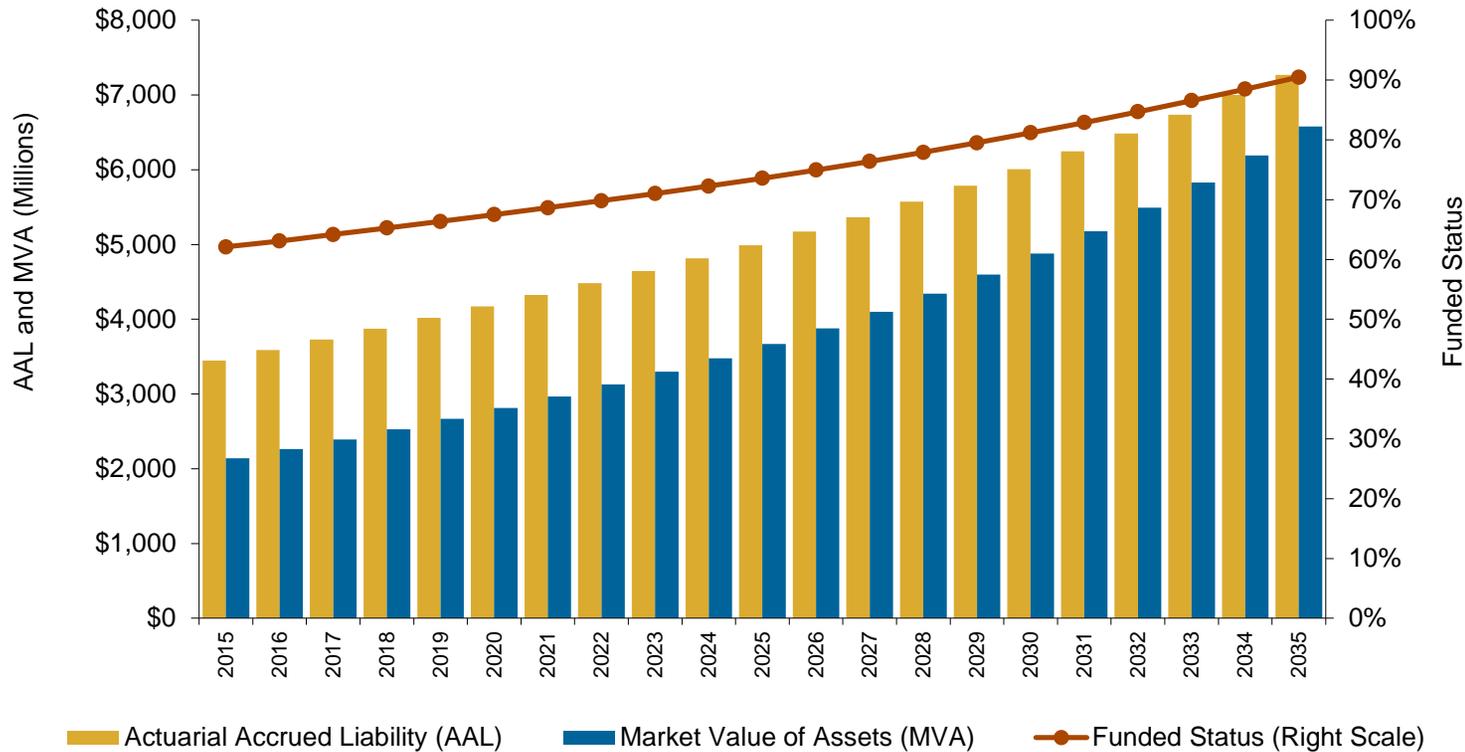
## 20 Year Projection (2015 to 2035)



- The number of active members is held constant at 10,514 (0% workforce growth).
  - Future new hires replace exits due to retirement, death, disability, and withdrawal.
- Average age of active members remains fairly steady, hovering in the 42-43 year range.

# Liabilities, Assets and Funded Status

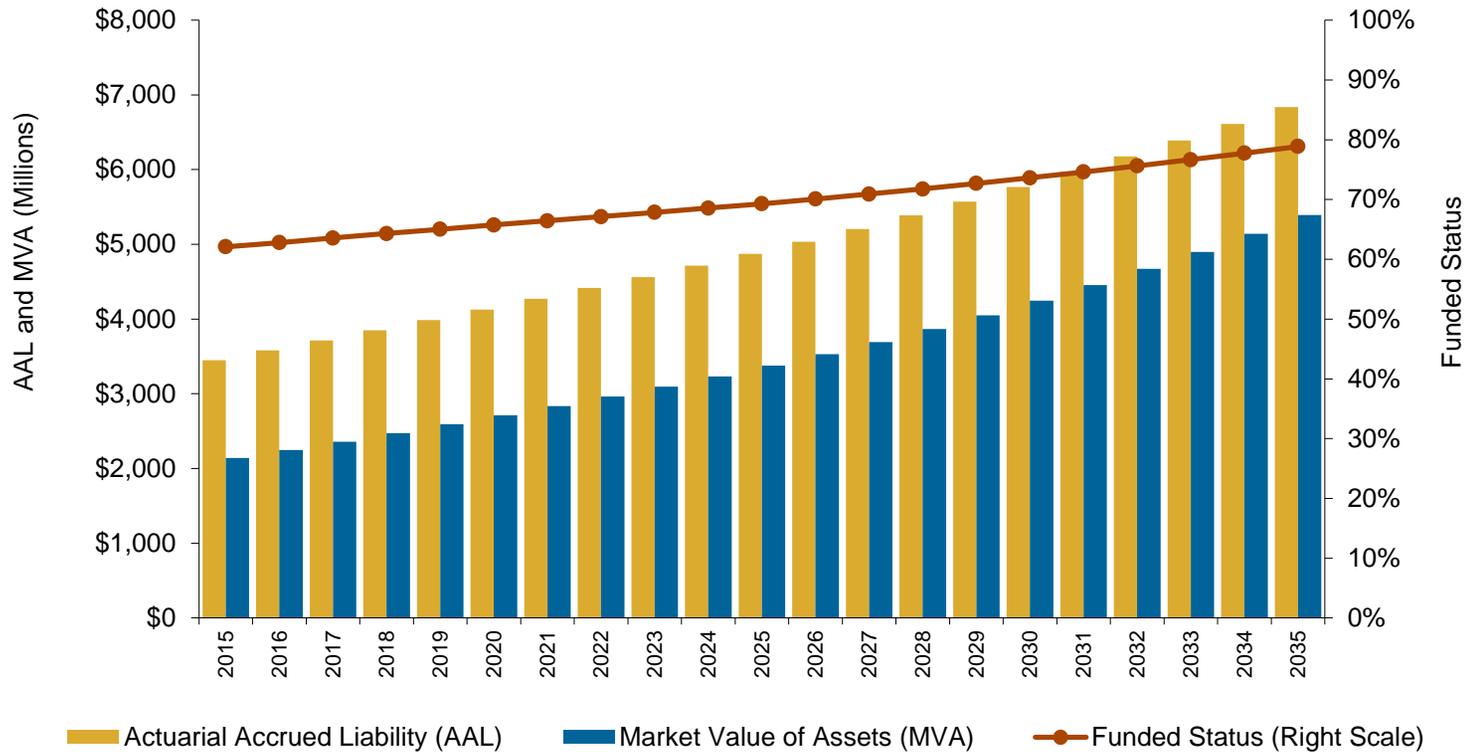
## 20 Year Projection (2015 to 2035): Actuarial Assumptions



- The above graph represents the baseline projection for the current target mix and current funding policy using actuarial assumptions.
  - Current target mix is assumed to return 7.75% each year with price inflation of 2.75%.
  - Assumed salary growth of 4.25% + promotion each year.
- Funded status is expected to rise to 90% by 2035 under a combined contribution rate of 24.5%.

# Liabilities, Assets and Funded Status

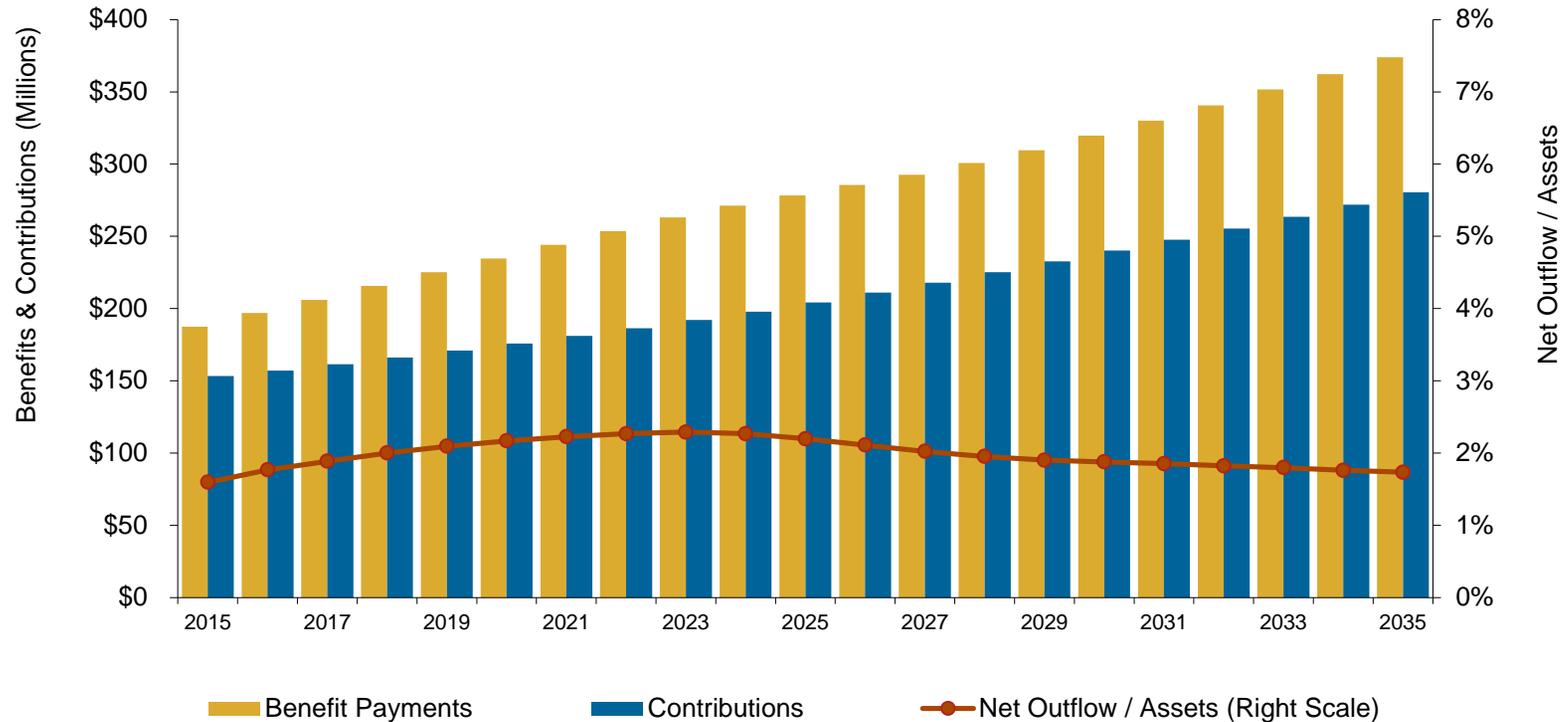
## 20 Year Projection (2015 to 2035): Callan Assumptions



- The above graph represents Callan’s baseline projection for the current target mix and current funding policy.
  - Current target mix is assumed to return 7.1% each year with price inflation of 2.25%.
  - Assumed salary growth of 3.75% + promotion each year.
- Funded status is expected to rise to 79% by 2035 under a combined contribution rate of 24.5%.

# Liquidity Needs

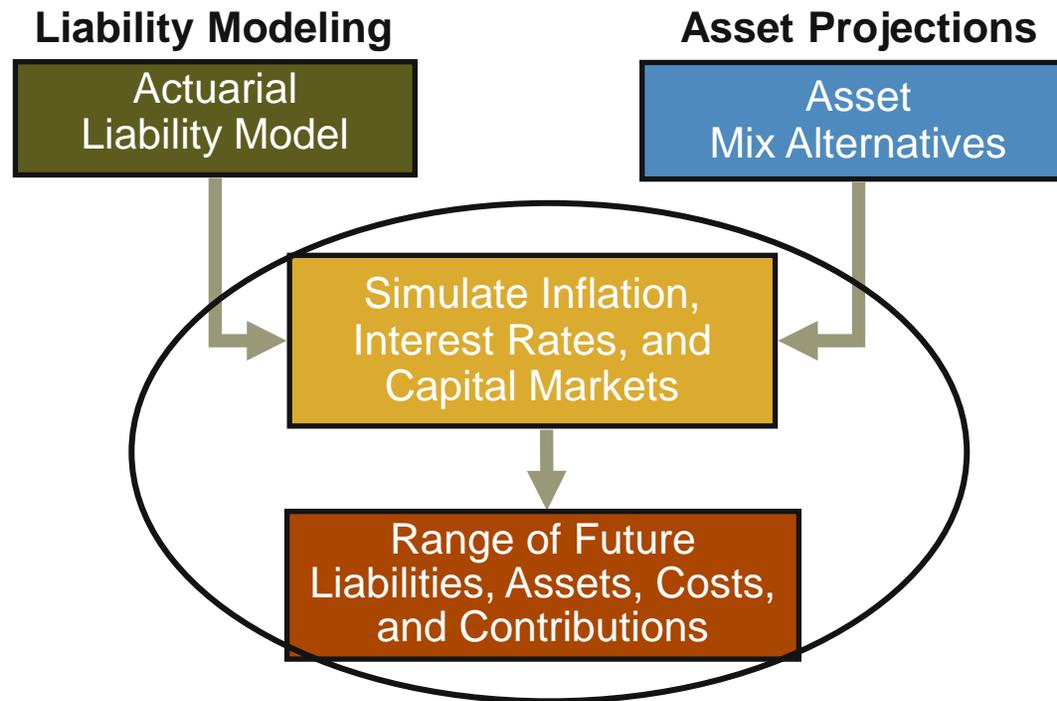
## 20 Year Projection (2015 to 2035)



- Net Outflow = Benefit Payments – Employer Contributions – Employee Contributions
- Net outflow as a percentage of assets under 5% should be manageable as long as TFFR adheres to the current funding policy.
- Liquidity needs peak at 2.3% of assets in the early 2020's before declining over the remainder of the projection period due in large part to a combined contribution rate of 24.5%.

# Simulate Financial Condition

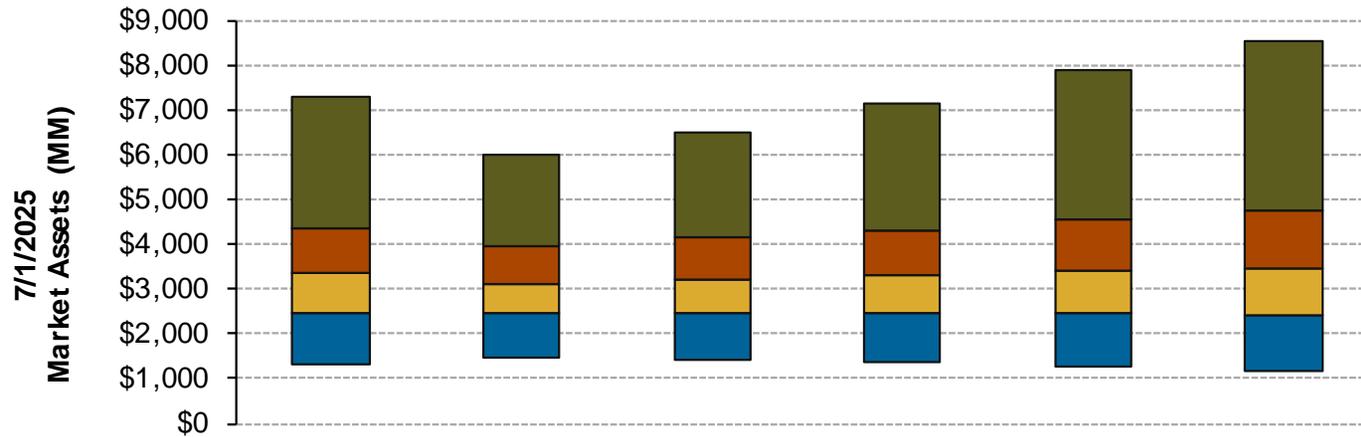
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- Generate 2,000 simulations per year, per asset mix to capture a broad range of possible future economic scenarios and their impact on the Fund.
- Focus on the 10-year planning horizon (July 1, 2015 – July 1, 2025).

# Market Value of Assets

Projection Date: July 1, 2025

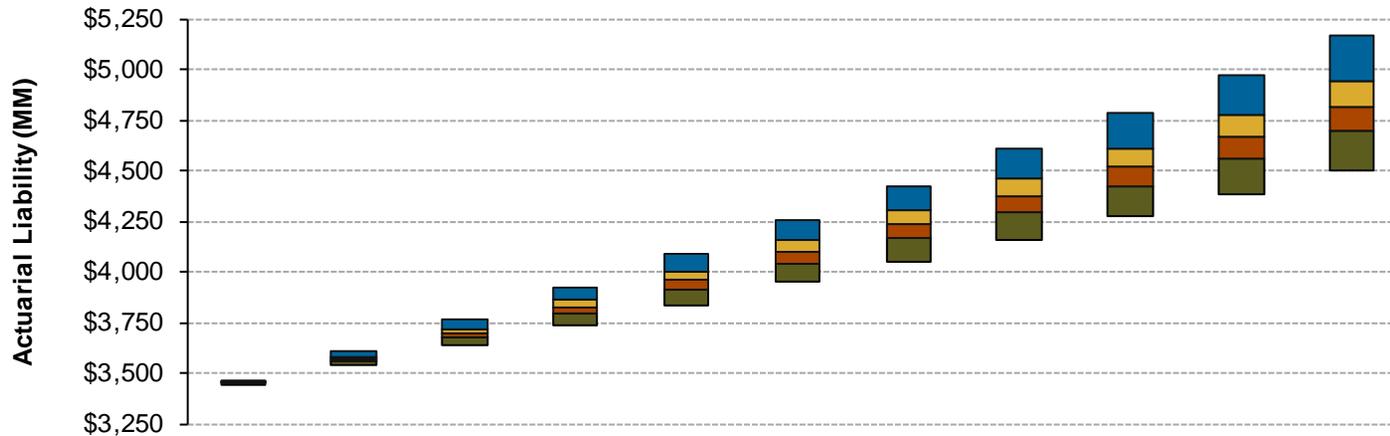


Percentile	Target	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
2.5th	\$7,265	\$5,982	\$6,504	\$7,137	\$7,866	\$8,517
25th	\$4,361	\$3,938	\$4,131	\$4,322	\$4,537	\$4,745
50th	\$3,334	\$3,127	\$3,216	\$3,299	\$3,388	\$3,472
75th	\$2,446	\$2,441	\$2,452	\$2,451	\$2,441	\$2,429
97.5th	\$1,322	\$1,486	\$1,417	\$1,348	\$1,263	\$1,186
Range	\$5,942	\$4,495	\$5,086	\$5,789	\$6,604	\$7,331

- Moving from left to right (Mix 1 to Mix 5), the range of results widens as one takes on more risk (greater equity exposure).
- More aggressive mixes have larger expected values (50<sup>th</sup> percentile) but lower worse-case (97.5<sup>th</sup> percentile) outcomes.
  - The 50<sup>th</sup> percentile is the expected case – half of the outcomes are higher and half lower.
  - The 97.5<sup>th</sup> percentile is a worse case scenario – a 2.5% probability that assets will be the value shown or lower. This represents a two standard deviation event.

# Actuarial Liability Growth Projection

July 1, 2015 to July 1, 2025

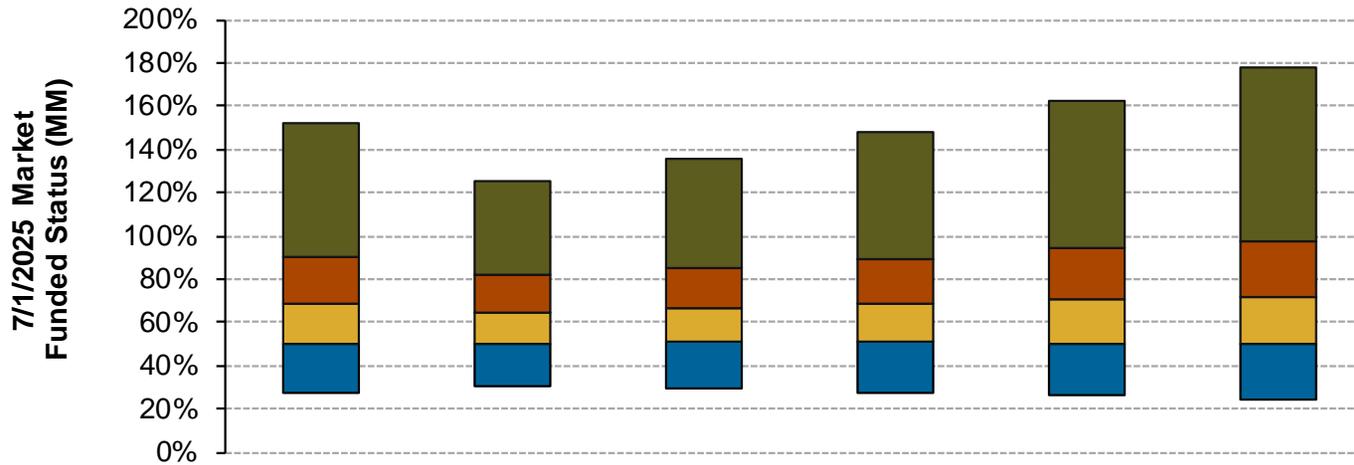


Percentile	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
97.5th	\$3,450	\$3,604	\$3,763	\$3,926	\$4,088	\$4,256	\$4,424	\$4,605	\$4,781	\$4,968	\$5,166
75th	3,450	3,582	3,718	3,860	4,003	4,152	4,303	4,456	4,611	4,772	4,937
50th	3,450	3,572	3,698	3,827	3,960	4,095	4,232	4,371	4,516	4,663	4,813
25th	3,450	3,561	3,675	3,793	3,915	4,043	4,167	4,294	4,424	4,562	4,696
2.5th	3,450	3,539	3,636	3,736	3,836	3,947	4,051	4,162	4,271	4,381	4,496
Range	0	65	127	190	252	309	373	443	511	587	670

- Plan liabilities are increasing at a steady pace which is typical for an open plan.
  - The actuary assumes 2.75% price inflation versus Callan’s 2.25% assumption which means the liability return is closer to 7.4% rather than 7.75%.
    - The 7.75% return is not reduced by a full 50 basis points as retirees do not receive an automatic COLA (100% CPI) every year.
- The Plan’s liabilities are fairly sensitive to changes in inflation and the resulting impact on salaries.

# Funded Status

Projection Date: July 1, 2025

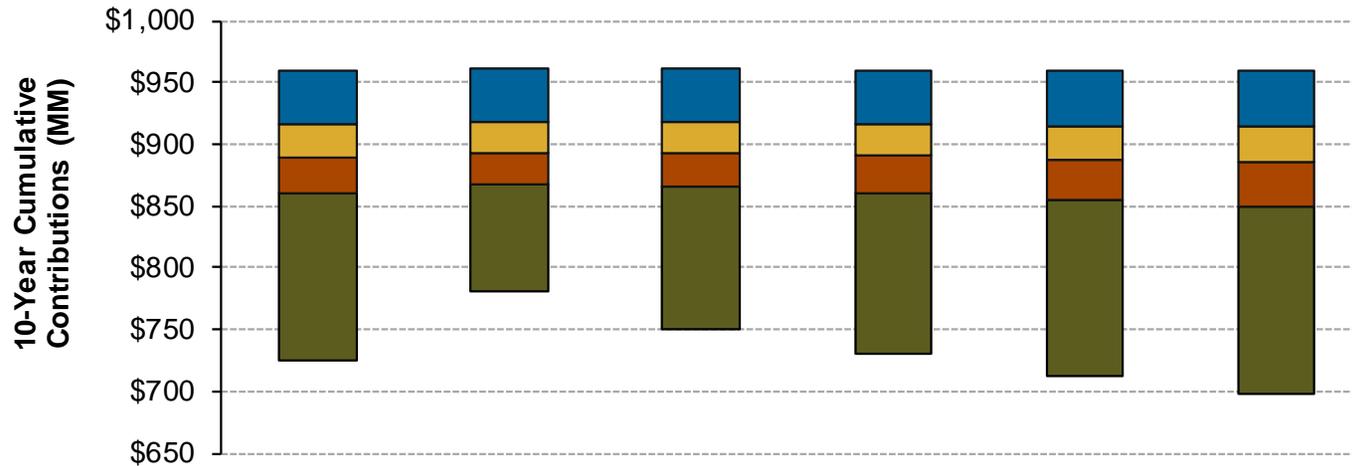


Percentile	Target	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
2.5th	152%	126%	136%	148%	163%	178%
25th	90%	81%	85%	89%	94%	98%
50th	69%	65%	66%	68%	70%	72%
75th	51%	50%	51%	51%	51%	50%
97.5th	28%	31%	29%	28%	26%	24%

- Funded Status = Market Value of Assets / Accrued Liability
  - 7/1/2015 funded status = 62.1% (\$2,142 / \$3,450)
- While the Plan’s funded status is expected (50<sup>th</sup> percentile) to gradually improve under the current funding policy, none of the mixes are expected to be fully funded in ten years.
- More aggressive mixes are expected to have a higher funded status at the end of 10 years but will have a lower funded status in a worse-case scenario (97.5<sup>th</sup> percentile).

# Cumulative Employer Contributions

2015 to 2024



Percentile	Target	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
97.5th	\$960	\$962	\$961	\$960	\$960	\$960
75th	\$915	\$918	\$917	\$916	\$915	\$914
50th	\$890	\$893	\$892	\$890	\$888	\$885
25th	\$859	\$868	\$865	\$861	\$855	\$849
2.5th	\$725	\$780	\$750	\$729	\$712	\$697
Range	\$235	\$182	\$211	\$231	\$248	\$263

- Contribution variability across the asset mixes is muted due to the statutory percentage of pay policy (12.75% until the Plan is fully funded on an actuarial basis and the contribution rate reverts to 7.75%).
  - Investment gains/losses are mostly absorbed into the unfunded liability (funded status).
- Contribution volatility (from best- to worse-case) within an asset mix stems from simulated inflation which impacts salaries and in the better-case scenarios the reflection of a move to a 7.75% contribution rate.

# Employer Contribution Rate Probabilities

2015 to 2024

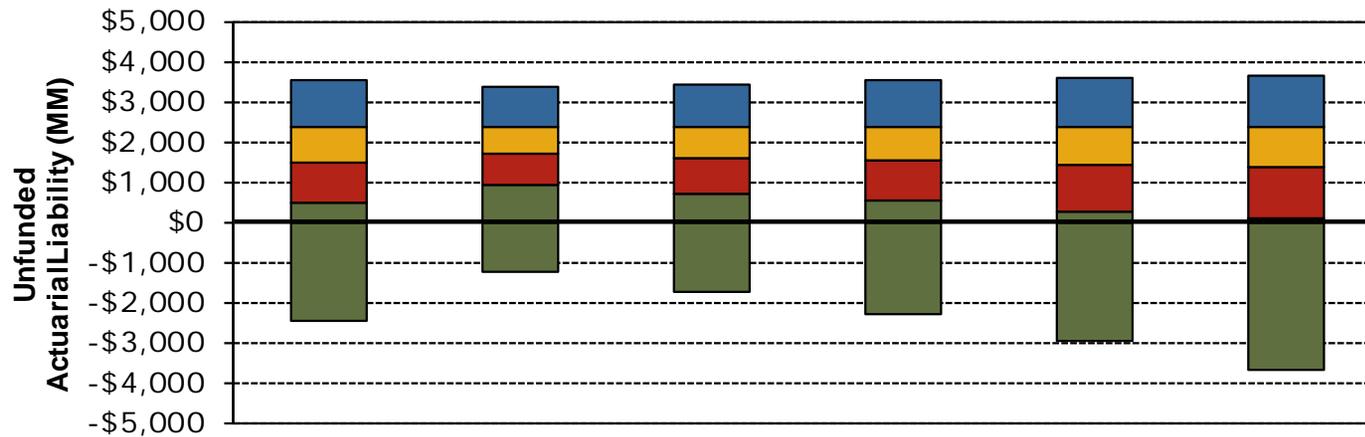
## Probability Employer Contribution Rate = 7.75%

Asset Mix	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Target	0%	0%	0%	0%	0%	2%	5%	8%	11%	15%
Mix 1	0%	0%	0%	0%	0%	0%	1%	3%	5%	7%
Mix 2	0%	0%	0%	0%	0%	1%	3%	5%	8%	10%
Mix 3	0%	0%	0%	0%	0%	2%	5%	8%	10%	14%
Mix 4	0%	0%	0%	0%	1%	3%	7%	10%	14%	17%
Mix 5	0%	0%	0%	0%	1%	5%	9%	13%	17%	20%

- The current contribution policy sets employer and employee rates at 12.75% and 11.75%, respectively.
- The rates will remain in effect until the Fund is 100% funded on an actuarial basis at which point both rates will revert to 7.75%.
- The table above shows the probability of rates reverting to 7.75% over the next 10 years for the target and efficient asset mixes.
- If the funded status falls substantially, contribution rates above those reflected in this study are possible.

# Unfunded Actuarial Liability

Projection Date: July 1, 2025

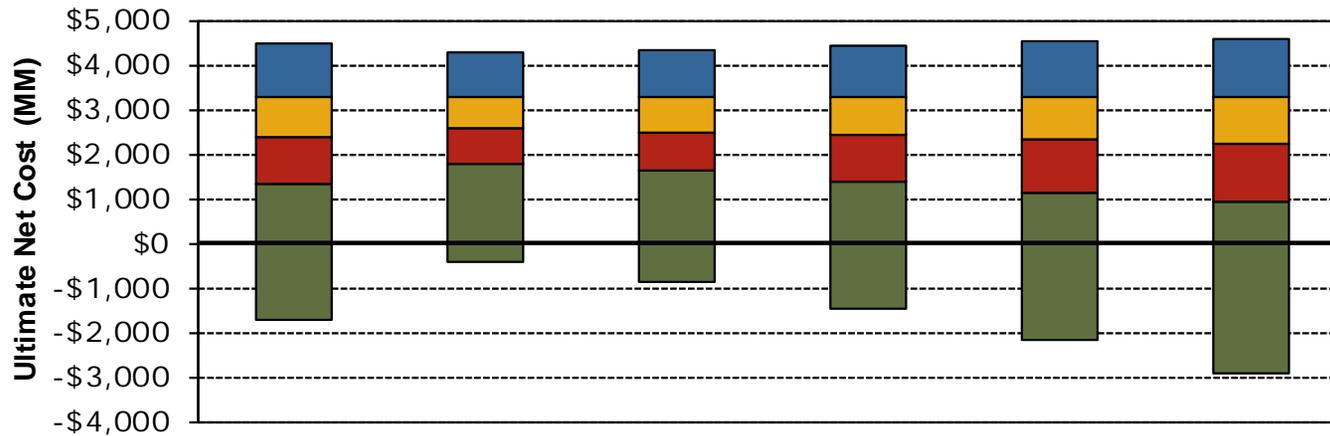


Percentile	Target	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
97.5th	\$3,552	\$3,355	\$3,424	\$3,514	\$3,599	\$3,672
75th	\$2,396	\$2,390	\$2,389	\$2,385	\$2,391	\$2,393
50th	\$1,507	\$1,698	\$1,618	\$1,534	\$1,434	\$1,348
25th	\$464	\$911	\$722	\$517	\$286	\$103
2.5th	-\$2,448	-\$1,240	-\$1,730	-\$2,279	-\$2,949	-\$3,674
Range	\$6,000	\$4,595	\$5,154	\$5,793	\$6,548	\$7,346

- Unfunded Actuarial Liability = Actuarial Liability - Market Value of Assets
  - The unfunded liability is being amortized over a closed 30-year period that began July 1, 2013.
- The 7/1/2015 actuarial unfunded liability of \$1,308 million is expected to rise between \$40 million and \$390 million over the next 10 years depending on the asset mix employed.
  - The funded status, however, is expected to improve as assets are expected to grow at a faster pace than liabilities over the 10-year period.
- More aggressive asset mixes result in a lower unfunded liability in the expected case but result in a greater unfunded liability in worse-case scenarios.

# Ultimate Net Cost

Projection Date: July 1, 2025



Percentile	Target	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
97.5th	\$4,471	\$4,267	\$4,348	\$4,421	\$4,522	\$4,593
75th	\$3,287	\$3,293	\$3,286	\$3,283	\$3,285	\$3,282
50th	\$2,388	\$2,584	\$2,505	\$2,427	\$2,332	\$2,249
25th	\$1,355	\$1,803	\$1,626	\$1,407	\$1,156	\$949
2.5th	-\$1,698	-\$391	-\$847	-\$1,466	-\$2,163	-\$2,917
Range	\$6,169	\$4,658	\$5,195	\$5,886	\$6,685	\$7,510

- Ultimate Net Cost (UNC) = 10-Year Cumulative Contributions + 7/1/2025 Unfunded Actuarial Liability
- UNC is a more complete measure of the cost to the Plan since it captures what is expected to be paid over 10 years plus what is owed at the end of the 10-year period.
  - Negative numbers indicate the Plan is in a surplus position at 7/1/2025.
- More aggressive mixes lower UNC in the expected case but result in greater UNC in a worse-case scenario.

# Making a Decision

Factor	Description
<b>Return Objective</b>	<ul style="list-style-type: none"> <li>Meet or exceed a liability return of approximately 7.4% over the next 10 years (7.75% over the next 30 years)</li> </ul>
<b>Time Horizon</b>	<ul style="list-style-type: none"> <li>Indefinite (plan is open)</li> </ul>
<b>Liquidity Needs</b>	<ul style="list-style-type: none"> <li>Liquidity needs are low under the current funding policy which allows for a meaningful allocation to illiquid investments</li> </ul>
<b>Actuarial Methodology</b>	<ul style="list-style-type: none"> <li>Fixed contribution rate contingent on funded status</li> <li>Assets are smoothed over 5 years</li> <li>30 year closed amortization of the unfunded liability</li> </ul>
<b>Contribution Risk</b>	<ul style="list-style-type: none"> <li>Contribution variability across asset mixes is muted due to the statutory contribution policy</li> </ul>
<b>Risk Tolerance</b>	<ul style="list-style-type: none"> <li>Risk tolerance is the ability and willingness to take risk</li> <li>What is comfort level in taking more risk?</li> <li>Consider worse-case funded status and/or worse-case deficit at the end of 10 years</li> </ul>
<b>Liability Growth</b>	<ul style="list-style-type: none"> <li>Liabilities are growing</li> <li>At 2.25% inflation, liability return is approximately 7.4% (At 2.75% inflation, liability return is 7.75%)</li> </ul>
<b>Funded Status*</b>	<ul style="list-style-type: none"> <li>Plan is underfunded but funded status is expected to gradually improve going forward</li> <li>7/1/2015 funded status (MVA) = 62%</li> </ul>

\* Many plan sponsors select a more aggressive asset allocation to assist with closing a plan deficit over the long run. However, a more aggressive asset allocation can make the financial situation worse, if investment performance is below average.

# Asset Allocation Recommendation

Asset Class	Target	Change from		Change from		Change from	
		Target	Mix 3	Target	Mix 3A	Target	Mix 3B
US Broad Equity	29%	-2%	27%	-1%	28%	0%	29%
Global ex-US Equity	23%	-1%	22%	0%	23%	0%	23%
Domestic Fixed	12%	10%	22%	7%	19%	4%	16%
High Yield	5%	-1%	4%	-1%	4%	-1%	4%
Non-US Fixed	5%	-5%	0%	-5%	0%	-2%	3%
Private Equity	5%	2%	7%	2%	7%	1%	6%
Real Estate	10%	0%	10%	1%	11%	0%	10%
Timberland	5%	-2%	3%	-2%	3%	-2%	3%
Infrastructure	5%	-1%	4%	-1%	4%	0%	5%
Cash Equivalents	1%	0%	1%	0%	1%	0%	1%
<b>Totals</b>	<b>100%</b>	<b>0%</b>	<b>100%</b>	<b>0%</b>	<b>100%</b>	<b>0%</b>	<b>100%</b>
Expected Return	7.1%	-0.1%	7.0%	0.0%	7.1%	0.0%	7.1%
Standard Deviation	14.7%	-0.4%	14.3%	0.1%	14.8%	0.0%	14.7%
Public Equity	52%	-3%	49%	-1%	51%	0%	52%
Fixed Income + Cash	23%	4%	27%	1%	24%	1%	24%
Alternatives	25%	-1%	24%	0%	25%	-1%	24%

Note: Real Assets allocation broken out into the component pieces (Real Estate, Timberland and Infrastructure) for ease of comparison.

# Asset Allocation Recommendation

- The table to the right views the current target and proposed mixes through the asset allocation framework employed by TFFR.
- Relative to the current target:
  - Mix 3 increases fixed income at the expense of equity and real assets;
  - Mixes 3A and 3B increase equity and fixed income at the expense of real assets.

Asset Class	Target	Mix 3	Mix 3A	Mix 3B
Global Equity	57%	56%	58%	58%
Public	52%	49%	51%	52%
Private	5%	7%	7%	6%
Global Fixed Income	22%	26%	23%	23%
Investment Grade	17%	22%	19%	19%
Non-Investment Grade	5%	4%	4%	4%
Global Real Assets	20%	17%	18%	18%
Real Estate	10%	10%	11%	10%
Other	10%	7%	7%	8%
Global Alternatives	0%	0%	0%	0%
Cash Equivalents	1%	1%	1%	1%
Totals	100%	100%	100%	100%
Expected Return	7.1%	7.0%	7.1%	7.1%
Standard Deviation	14.7%	14.3%	14.8%	14.7%

# Asset Allocation Recommendation

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- Many factors support an asset allocation with a risk posture similar to the current target, including:
  - Pursuit of a 7.4% liability return;
  - Long time horizon; and
  - Actuarial methodology (static contribution rate and asset smoothing).
- It may be tempting to move to an asset allocation policy that has a higher expected return in order to close the Plan deficit and offset future benefit accruals. However, a more aggressive asset allocation policy also increases the risk of “bad investment outcomes” which in turn could result in deterioration of TFFR’s funded status and the need for higher contribution rates.
- The statutory contribution policy combined with the current target’s risk level leads us to recommend maintaining the current risk posture (Mix 3A) or moving to a slightly less aggressive asset allocation (Mix 3).
  - Mix 3B, a Retirement and Investment Office (RIO) recommendation, offers a practical and implementable solution. Mix 3B resulted from discussions between RIO staff and Callan.

# Asset Allocation Recommendation

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- Finally, while TFFR's expected return over the next 10 years falls short of the 7.75% return assumption, there are mitigating factors that offset Mix 3's projected 7.1% return.
  - Callan's public market return projections are based on passive (i.e., index fund) implementation and do not incorporate active management premiums
  - Callan's 10-year projections are cyclically lower than our longer-term (i.e., greater than 10 years) expectations.
  - The actuary assumes 2.75% price inflation versus Callan's 2.25% assumption. The implication of our lower inflation expectation, all things being equal, is that the corresponding liability return is closer to 7.4% than 7.75%.
  - TFFR has a 46% probability of achieving a 7.75% return over the next 10 years.



**Appendix**

Active Population Projection

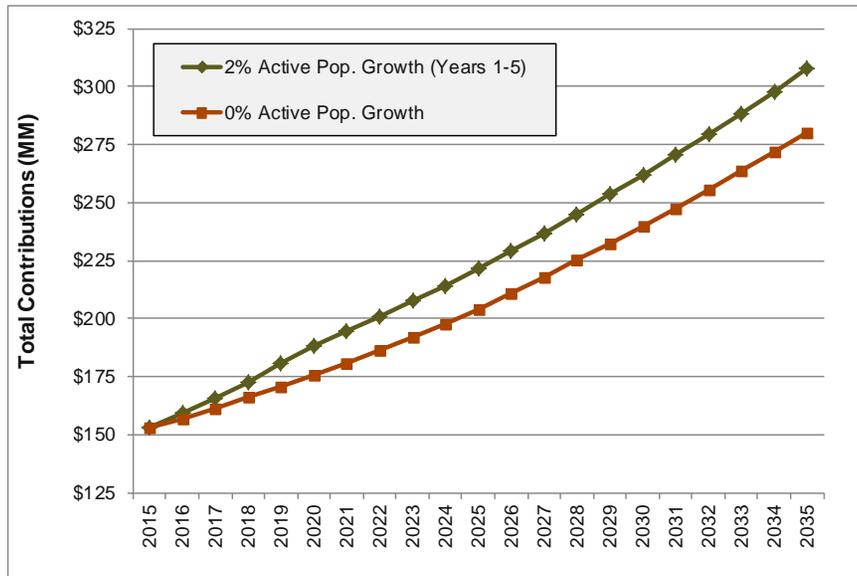
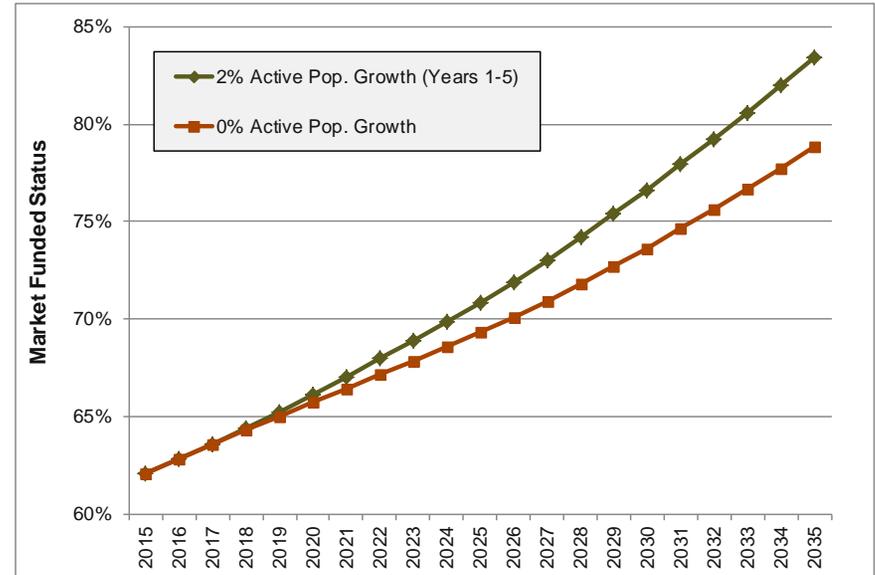
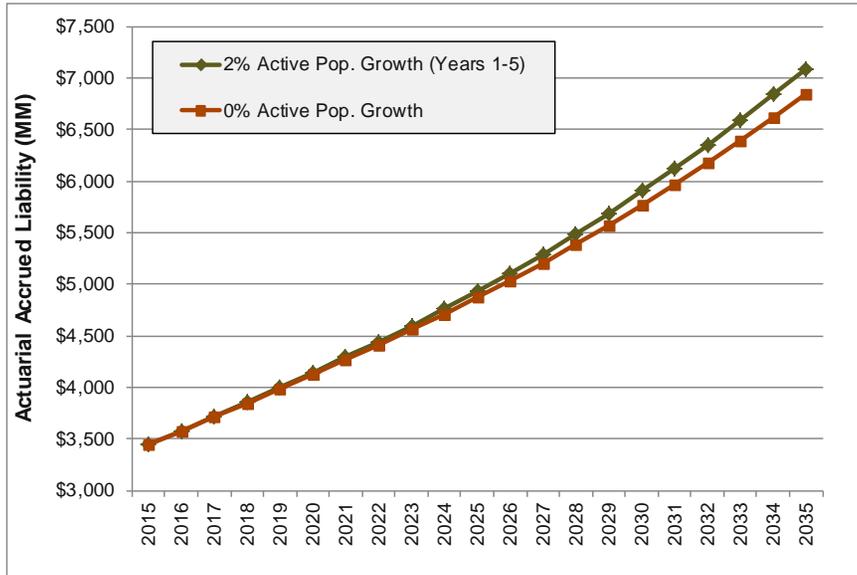
# Active Population Projection

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- The actuarial assumption employed in the valuation report is that the plan's active population remains constant (i.e., 0% growth).
- However, there is an expectation that the active member population may grow as the need for additional teachers and schools rises to meet a growing student population.
- Callan modeled a 2% increase in the active population from 2015 to 2020 to reflect this expectation.
  - Active population rises from 10,514 in 2015 to 11,608 by 2020, an increase of 1,094 members.
- The charts on the following page highlight the impact of an increase in the active population on liabilities, funded status and contributions.

# Active Population Projection

## Liabilities, Funded Status and Total (Employer + Employee) Contributions



- It is not surprising that an increase in the active population leads to an increase in the liability.
- What may be somewhat surprising though, is that an increased active population results in an improvement in the funded status.
- The funded status improvement is largely due to the increased contributions which flow into the Fund as a result of the additional active members.

# Disclaimers

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