

ASSET-LIABILITY STUDY

EMPLOYEES RETIREMENT SYSTEM
OF TEXAS

AUGUST 2022



EMPLOYEES RETIREMENT SYSTEM OF TEXAS

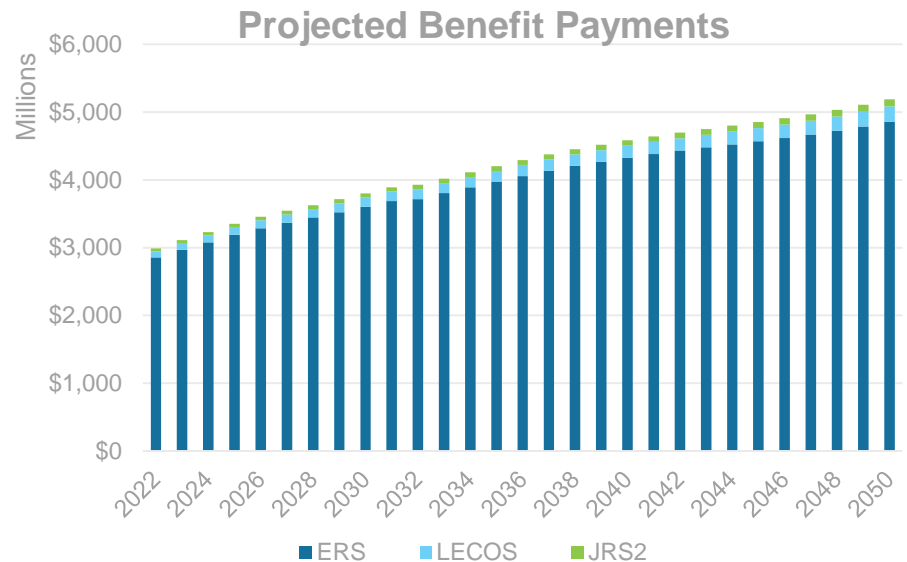
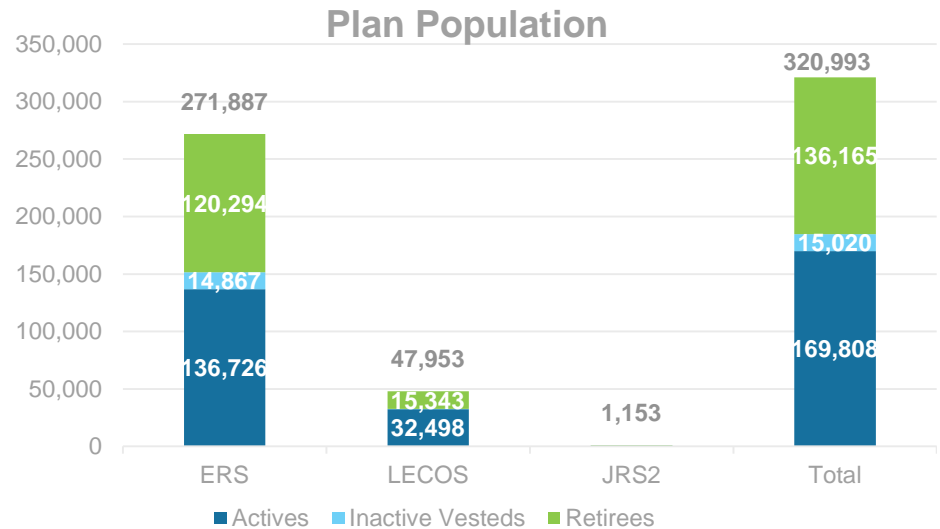
UPDATES SINCE PRELIMINARY RESULTS

- **Discussions and data provided by GRS was instrumental in improving Legacy Contribution projections**
 - Main adjustment was reduction in future normal cost that now allows for more of the unfunded liability to be paid down faster resulting in lower projected legacy contributions
- **Updating models to incorporate most recent NEPC capital market outlook**
 - Mean-variance assumptions were updated from 12/31/21 to 6/30/22
 - Interest rate outlook has changed significantly over this time frame
- **Run alternative mixes to provide comparative analysis alongside the Current Policy allocation**
 - Mix A & Mix B: realistic mixes that marginally adjusts current targets
 - Mix C: mix that illustrates the potential of maintaining higher current targets to private equity and adding to hedge funds
 - Lower Risk/Higher Risk: illustrative mixes that provide bookends in terms of risk/return

EMPLOYEES RETIREMENT SYSTEM OF TEXAS

PLAN CHARACTERISTICS

- **The Texas ERS administers 3 pension plans**
 - Employees Retirement System (ERS)
 - Law Enforcement and Custodial Officer Supplemental Retirement Fund (LECOS)
 - Judicial Retirement System Plan 2 (JRS2)
- **ERS is by far the main cost driver**
 - Consists of 85% of all participants and 95% of all liabilities
- **As of August 31, 2021 Texas ERS is 68.0% funded based on a smoothed asset value**
 - 76.0% funded on a market value basis
- **Due to recent legislative changes, ERS is now on a better path toward full funding**
 - “Legacy Payments” are now appropriated in order to reach full funding by 2054
- **Asset allocation has followed a diversified total return approach with a mix of public and private equity, debt and real estate along with hedge funds**
 - 30-yr expected return of 7.3% vs. 7.0% liability discount rate



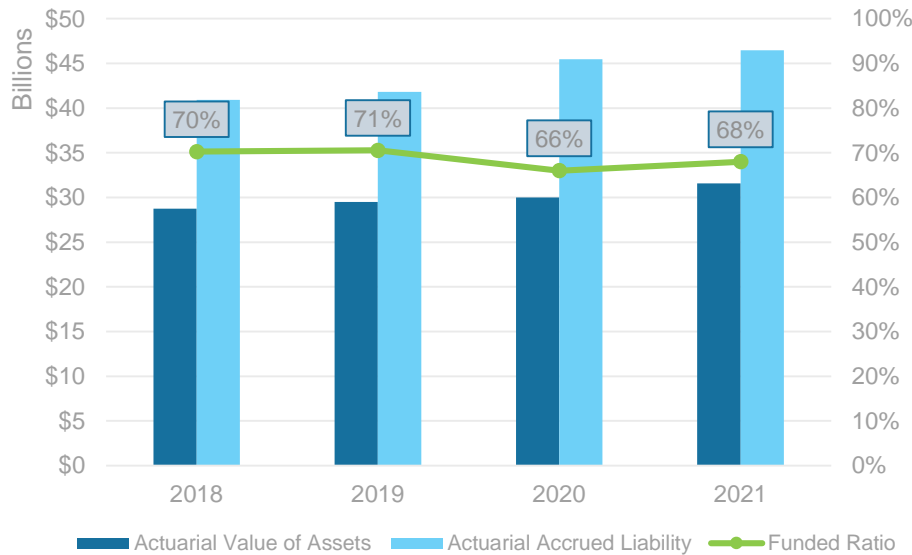
Notes:
Source: GRS



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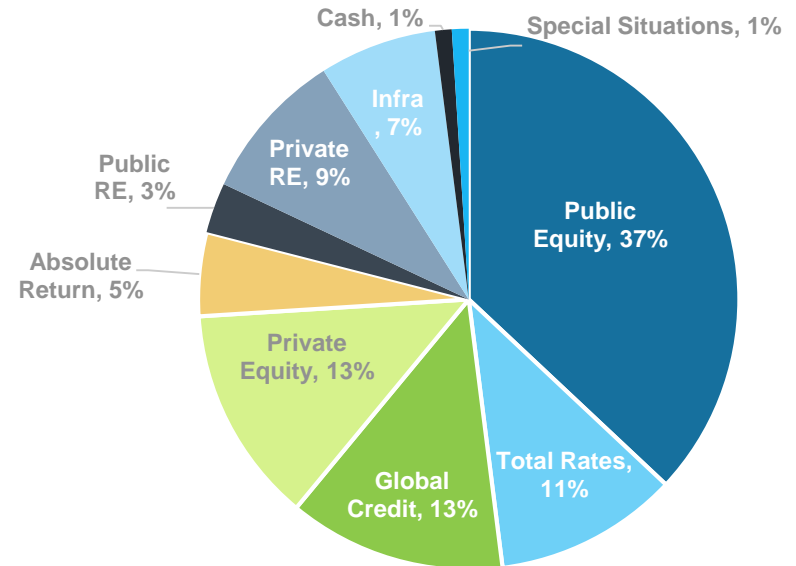
PLAN RISK PROFILE

Funded Status



Liability Discount Rate	7.0%
Funded Status	68.0%

Asset Allocation¹



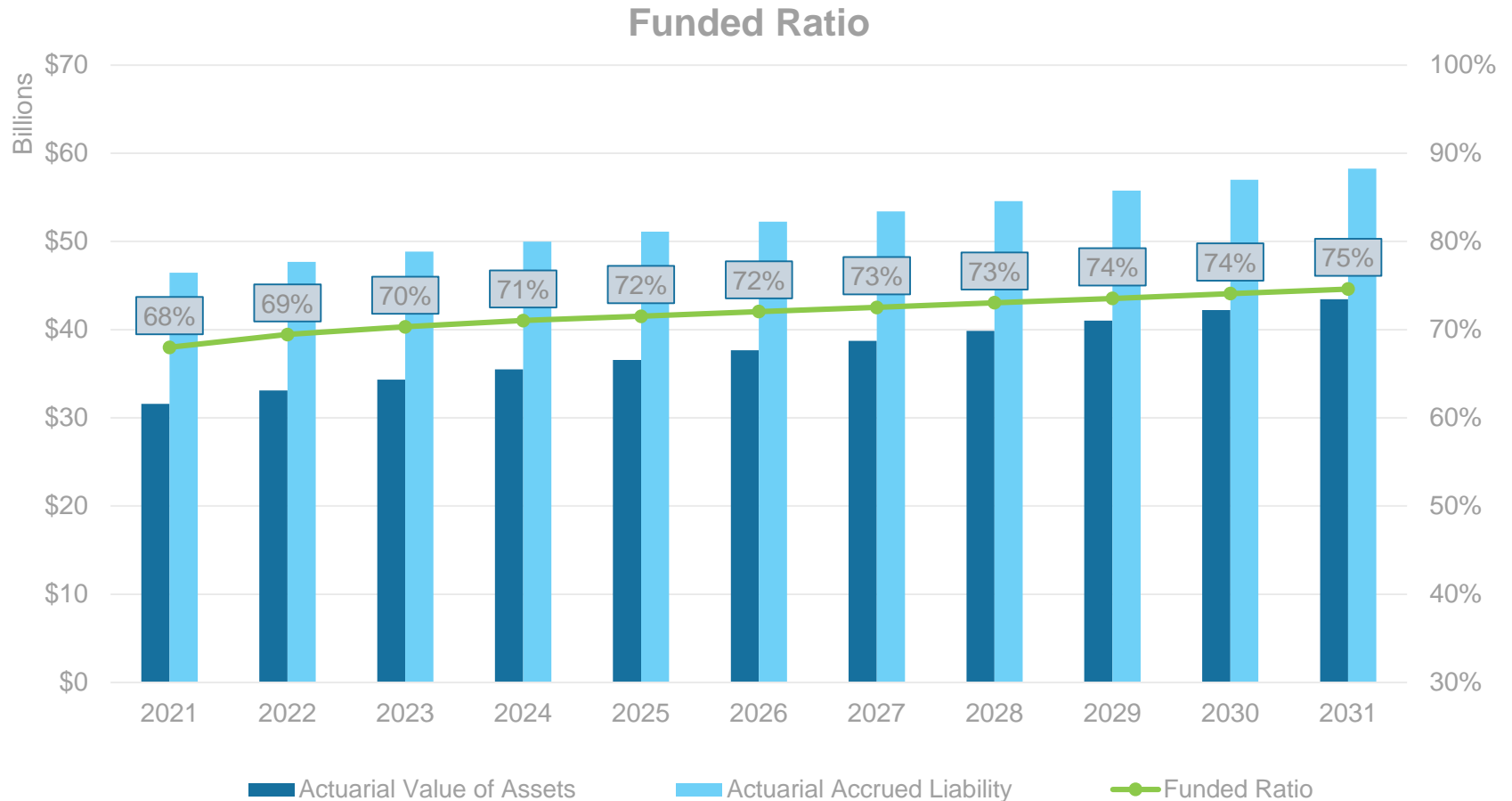
Expected Return on Assets (10 years)	6.8%
Expected Return on Assets (30 years)	7.3%
Asset Volatility	12.5%



Notes: ¹ Current Policy targets

EMPLOYEES RETIREMENT SYSTEM OF TEXAS

10-YR FUNDED STATUS PROJECTION – ALL PLANS

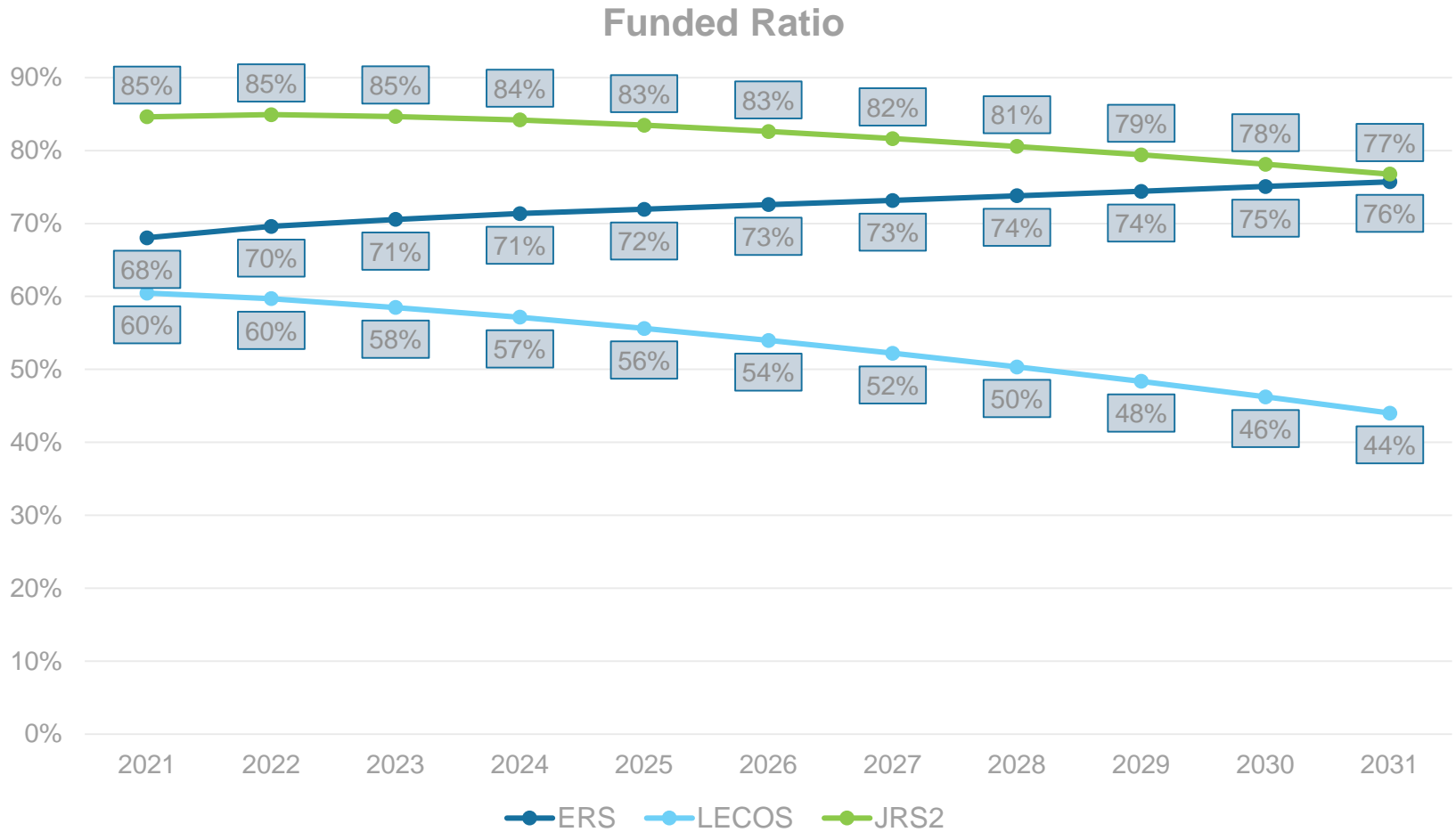


Notes: As of August 31; Reflects return of -3.2% thru 6/30/22, thereafter Current Policy allocation 10-yr expected return of 6.8% per annum



EMPLOYEES RETIREMENT SYSTEM OF TEXAS

10-YR FUNDED STATUS PROJECTION – PLAN LEVEL

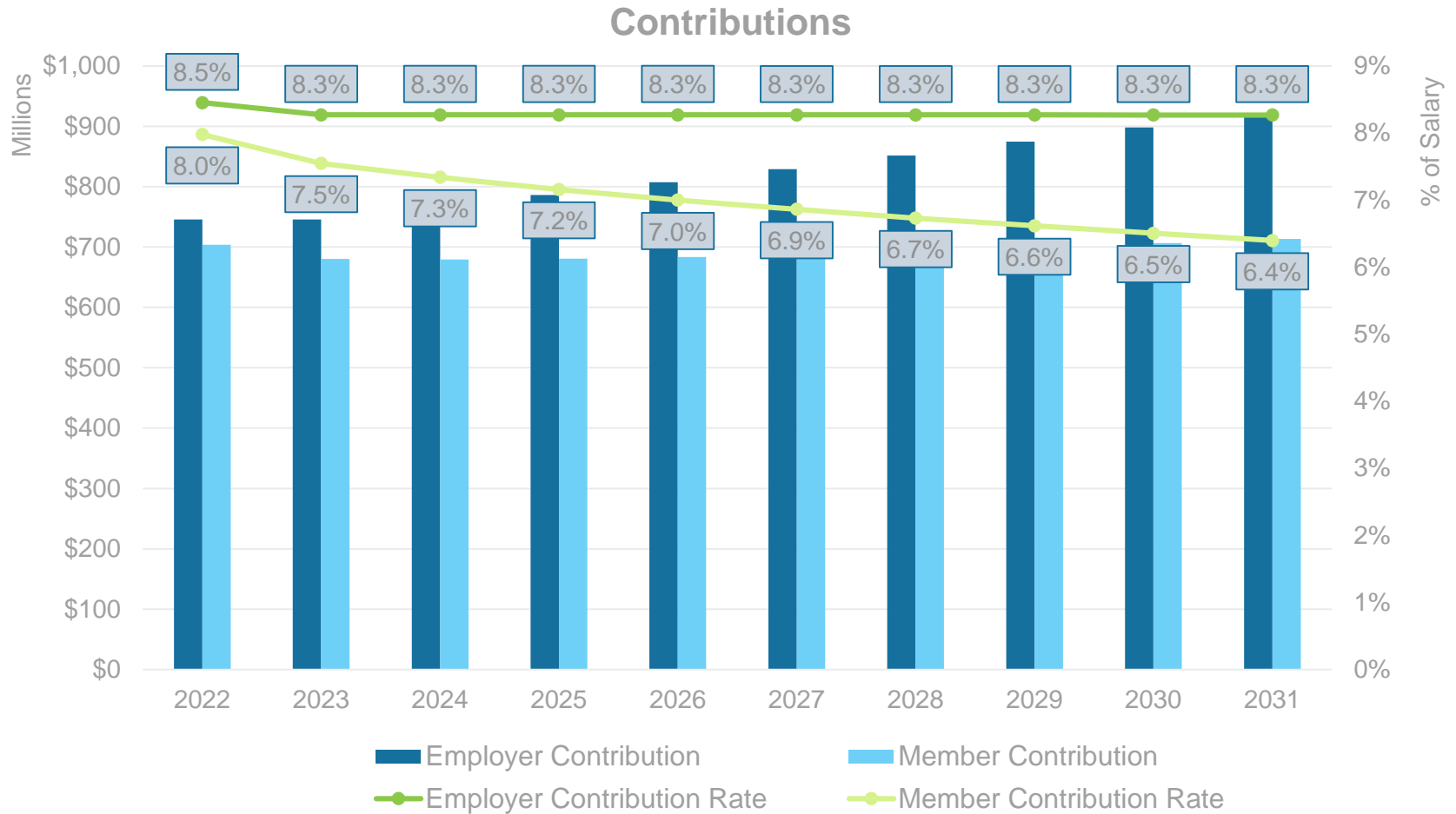


Notes: As of August 31; Reflects return of -3.2% thru 6/30/22, thereafter Current Policy allocation 10-yr expected return of 6.8% per annum



EMPLOYEES RETIREMENT SYSTEM OF TEXAS

10-YR CONTRIBUTION PROJECTION – ALL PLANS

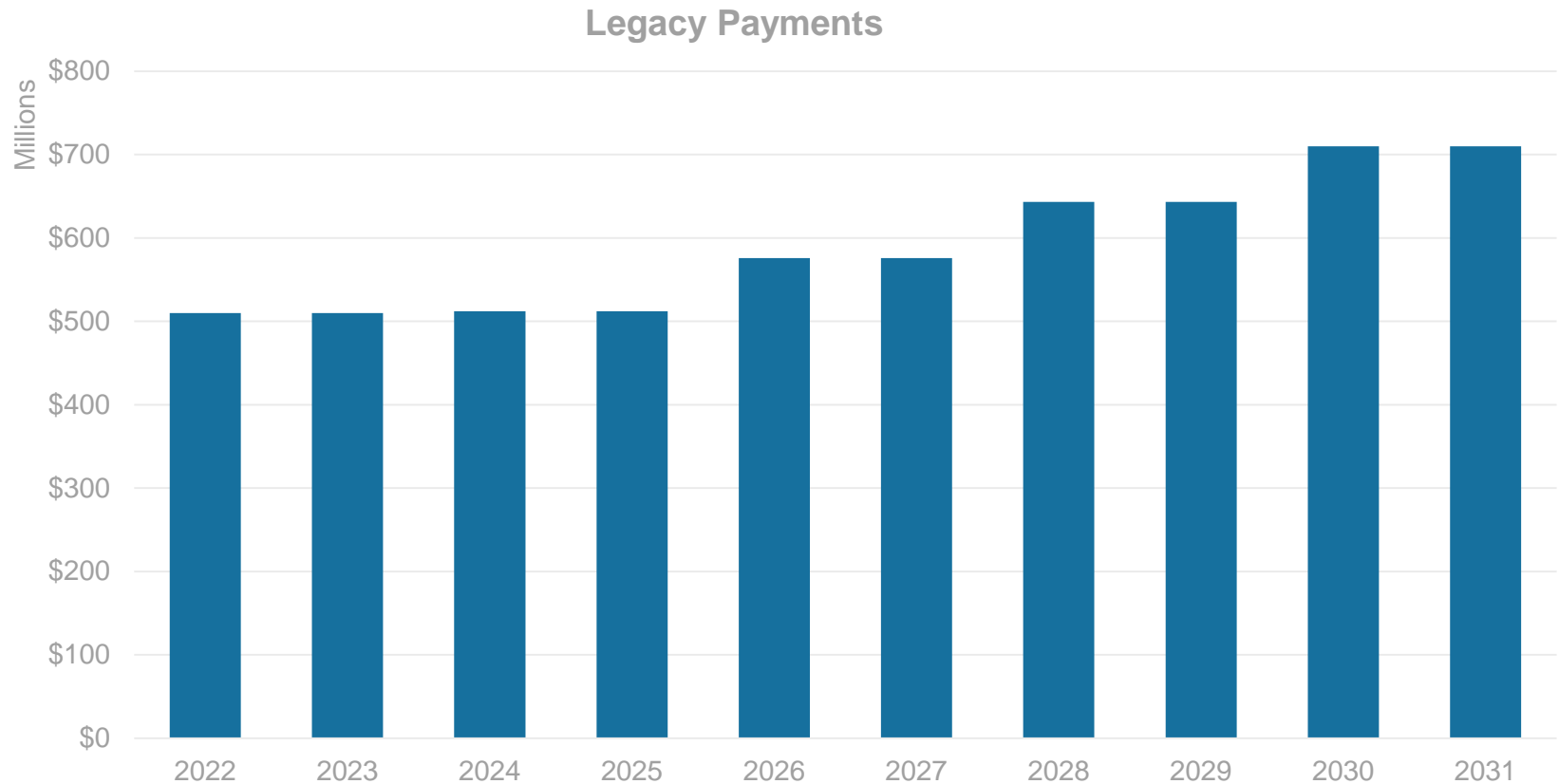


Notes: For the fiscal year ending August 31; Reflects return of -3.2% return thru 6/30/22, thereafter Current Policy allocation 10-yr expected return of 6.8% per annum



EMPLOYEES RETIREMENT SYSTEM OF TEXAS

10-YR CONTRIBUTION PROJECTION – ERS LEGACY PAYMENTS

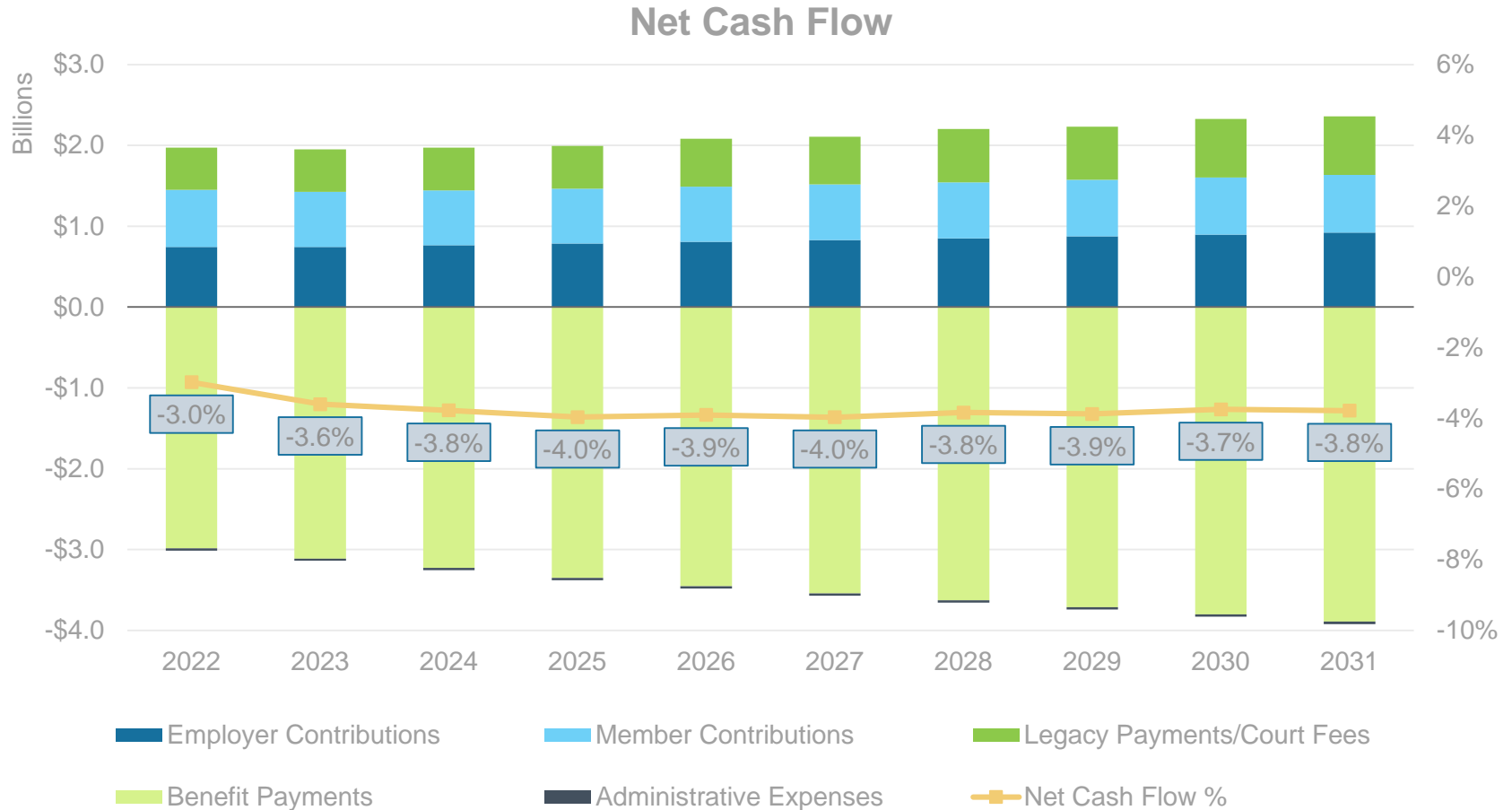


Notes: For the fiscal year ending August 31; Reflects return of -3.2% return thru 6/30/22, thereafter Current Policy allocation 10-yr expected return of 6.8% per annum



EMPLOYEES RETIREMENT SYSTEM OF TEXAS

10-YR NET CASH FLOW – ALL PLANS

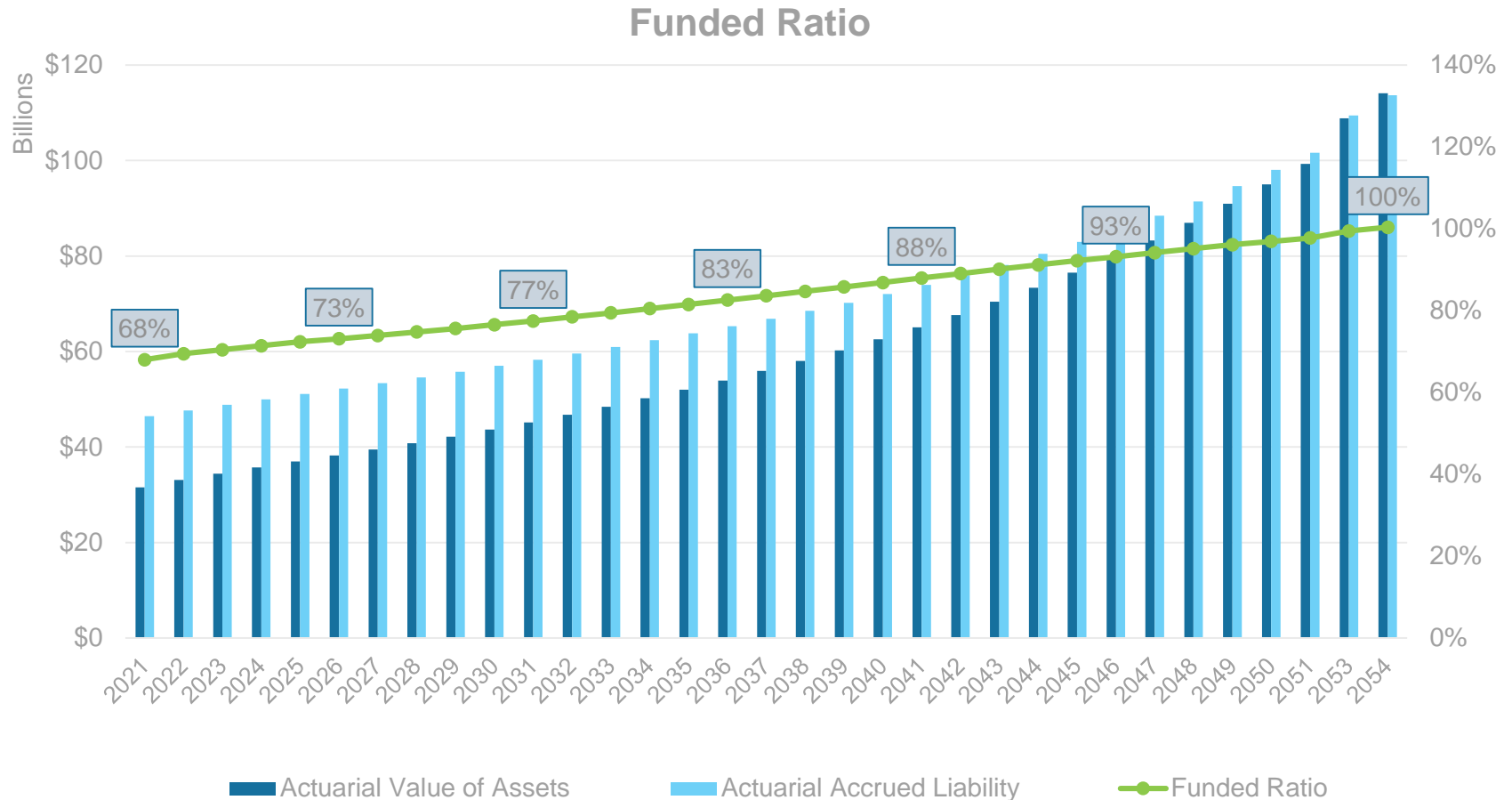


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EMPLOYEES RETIREMENT SYSTEM OF TEXAS

30-YR FUNDED STATUS PROJECTION – ALL PLANS

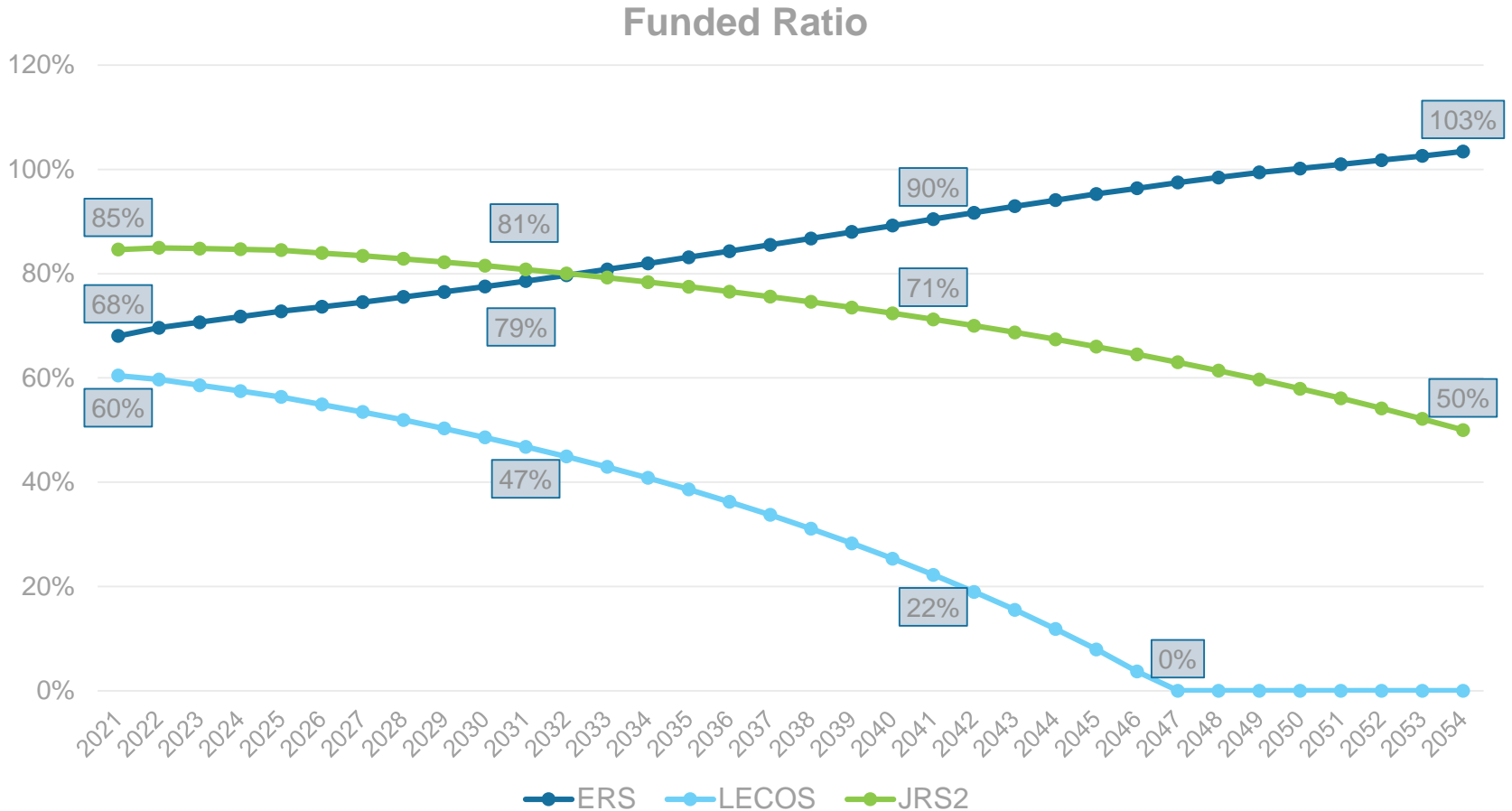


Notes: As of August 31; Reflects return of -3.2% return thru 6/30/22, thereafter Current Policy allocation 30-yr expected return of 7.3% per annum



EMPLOYEES RETIREMENT SYSTEM OF TEXAS

30-YR FUNDED STATUS PROJECTION – PLAN LEVEL



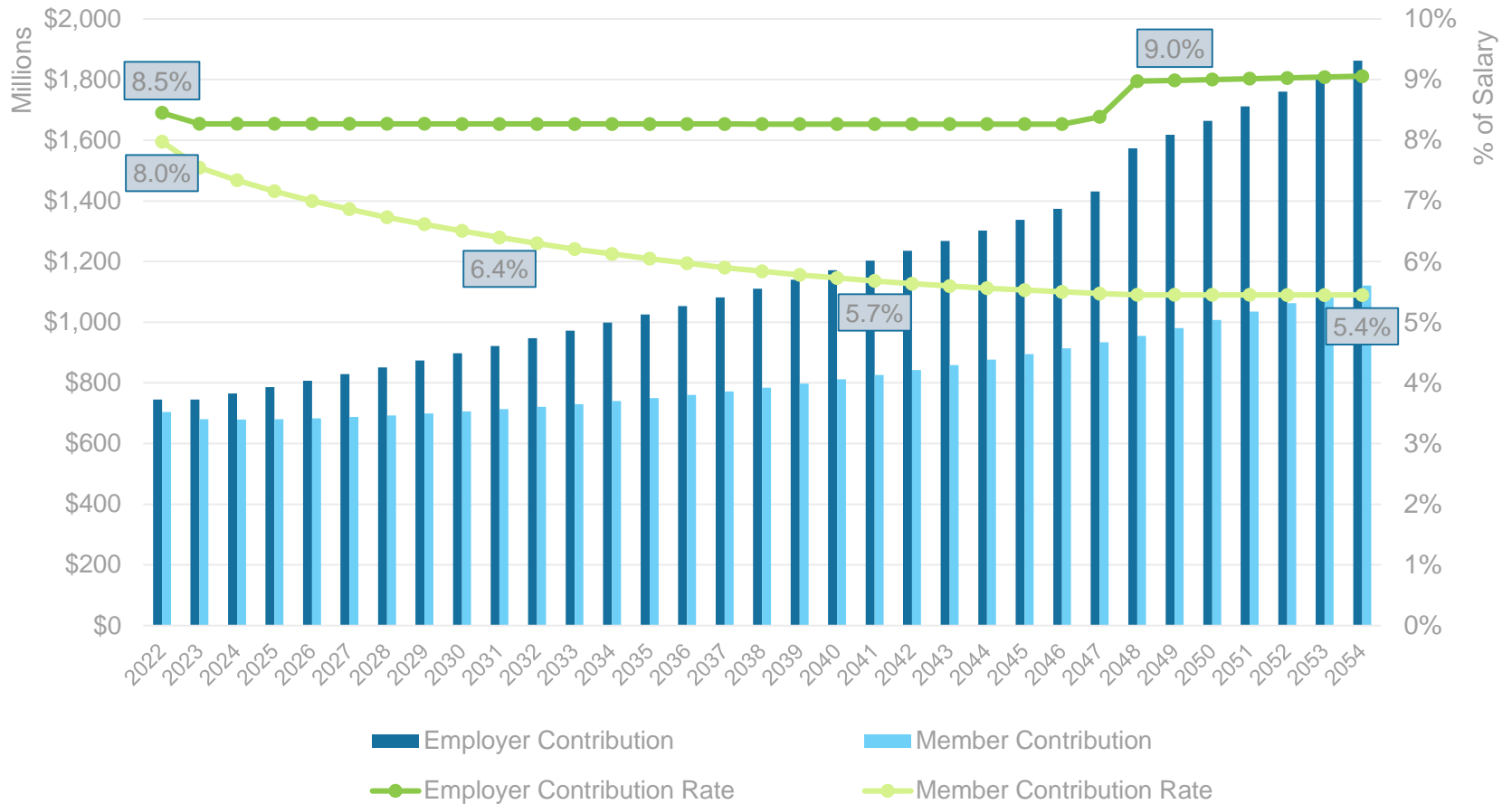
Notes: As of August 31; Reflects return of -3.2% thru 6/30/22, thereafter Current Policy allocation 30-yr expected return of 7.3% per annum



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30-YR CONTRIBUTION PROJECTION – ALL PLANS

Contributions

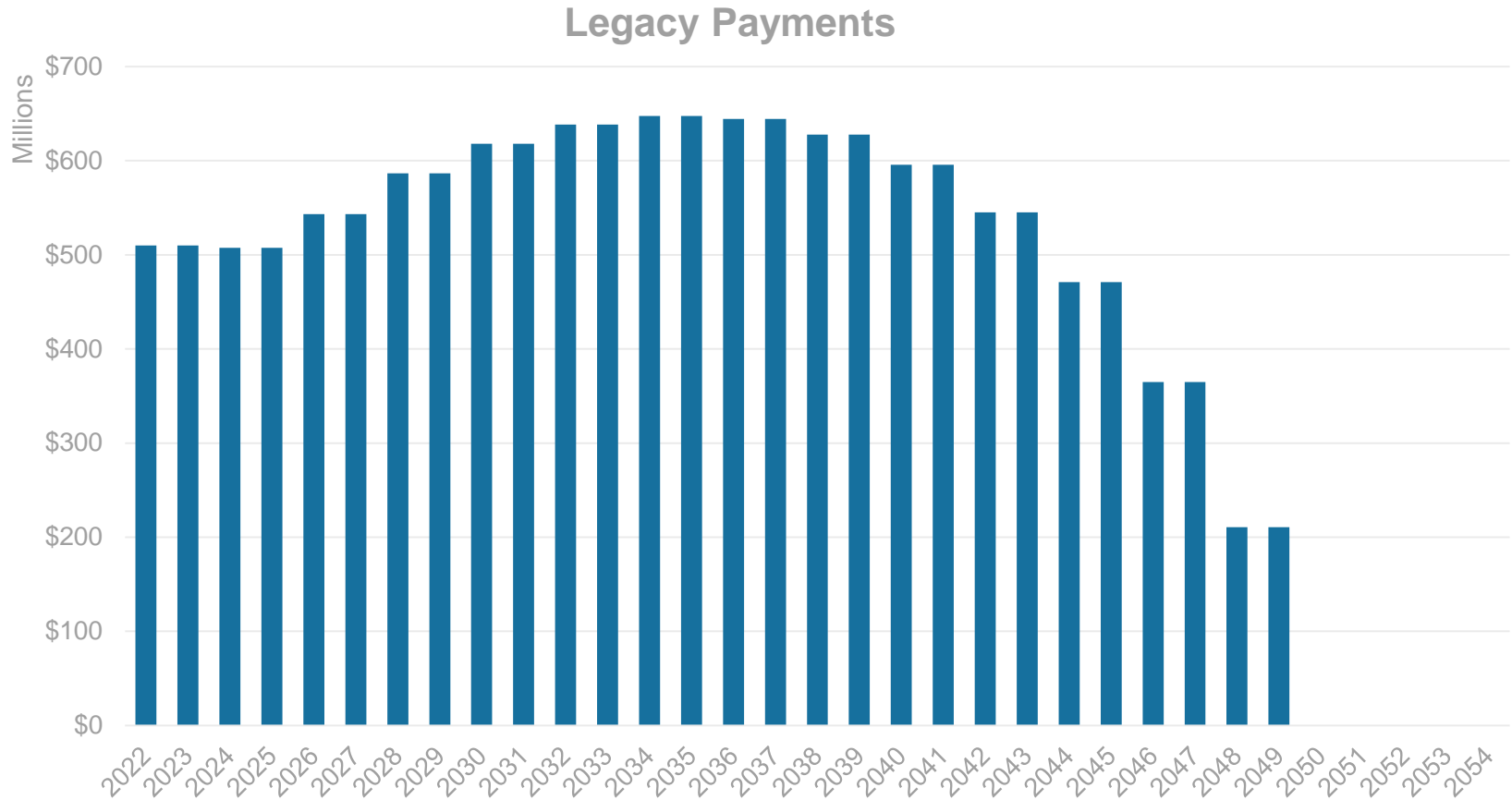


Notes: For the fiscal year ending August 31; Reflects return of -3.2% return thru 6/30/22, thereafter Current Policy allocation 30-yr expected return of 7.3% per annum



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30-YR CONTRIBUTION PROJECTION – ERS LEGACY PAYMENTS

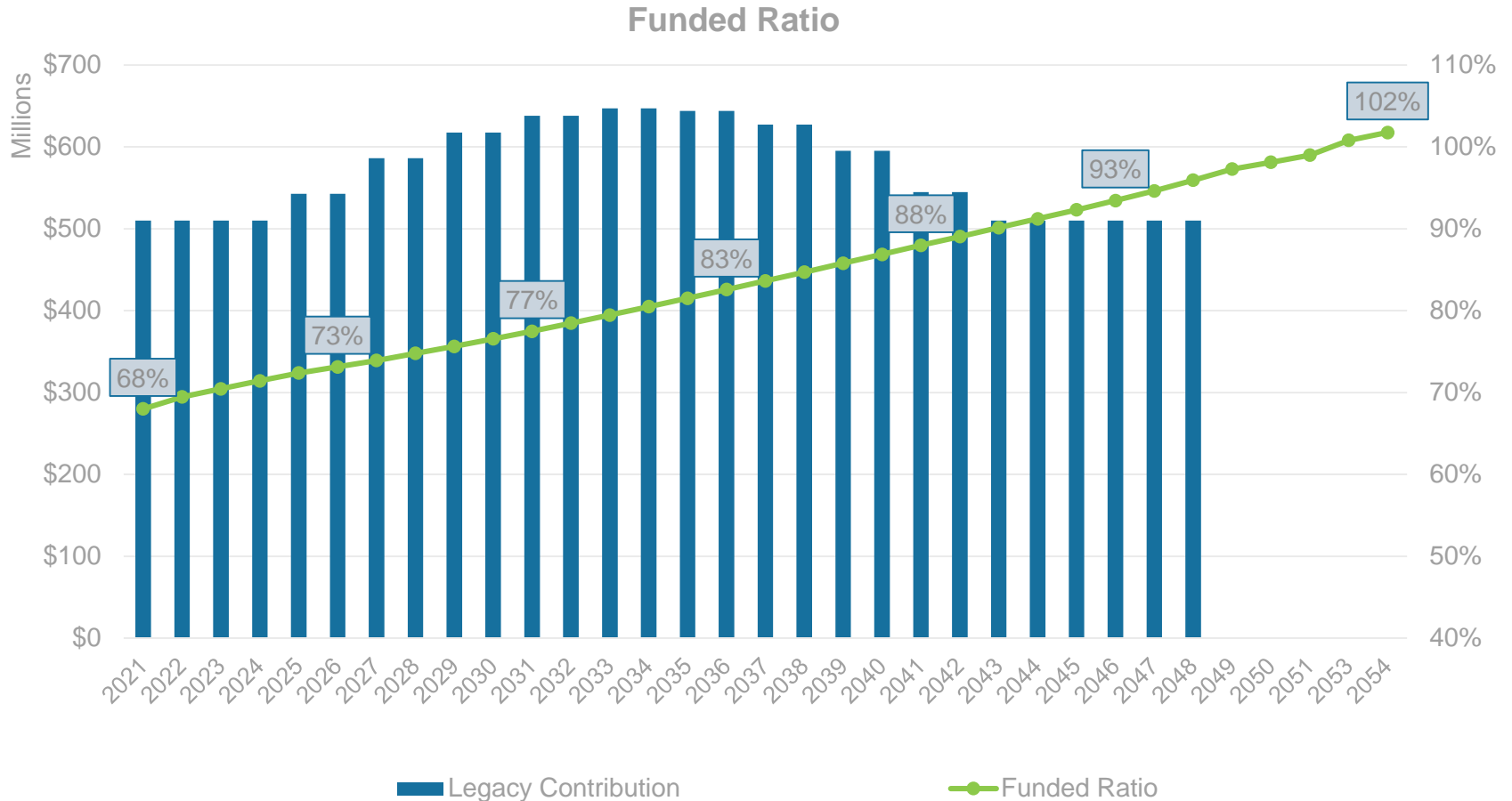


Notes: For the fiscal year ending August 31; Reflects return of -3.2% thru 6/30/22, thereafter Current Policy allocation 30-yr expected return of 7.3% per annum



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\$510 MILLION FLOOR ON LEGACY PAYMENTS

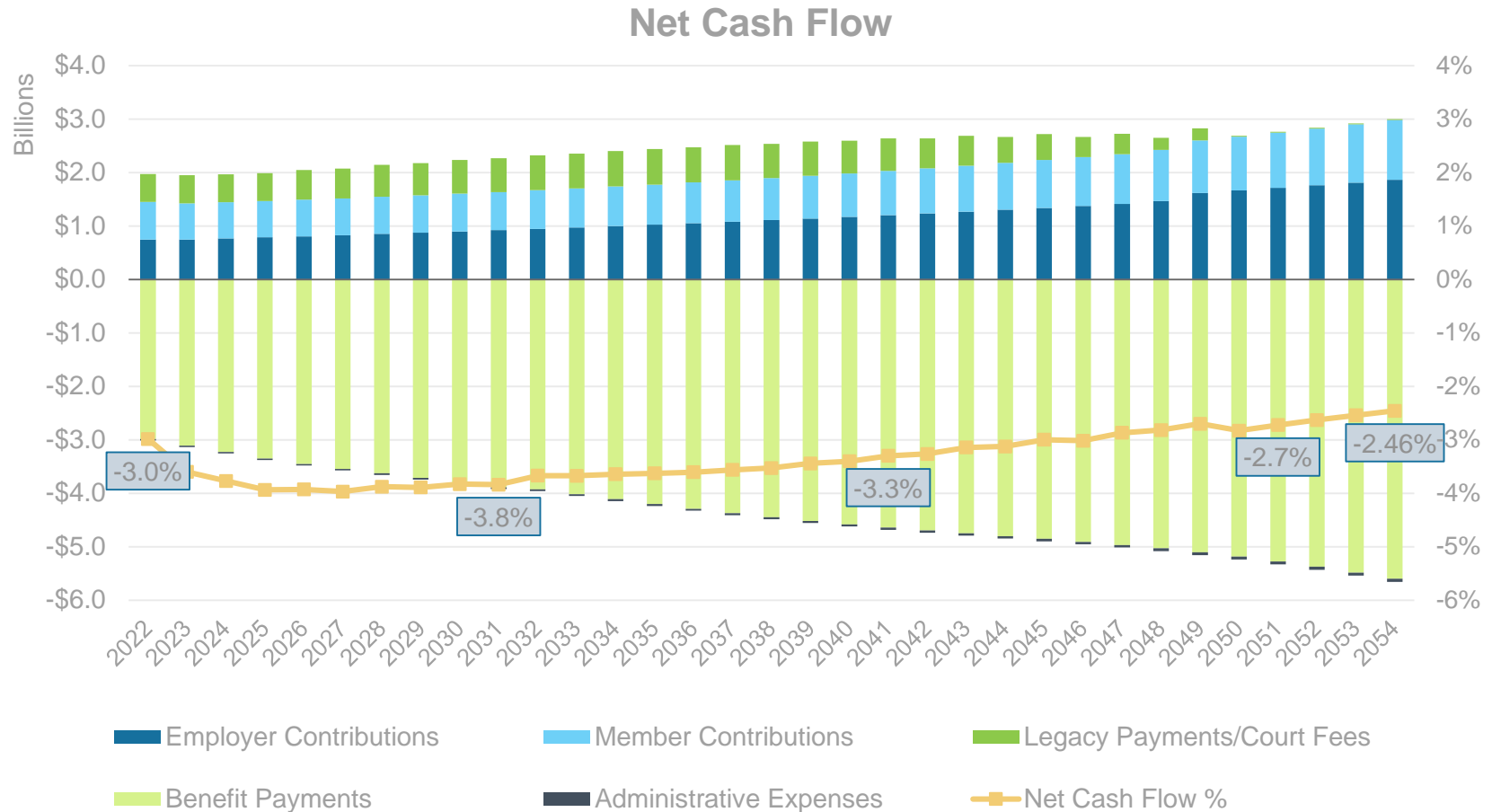


Notes: As of August 31; Reflects return of -3.2% thru 6/30/22, thereafter Current Policy allocation 30-yr expected return of 7.3% per annum



EMPLOYEES RETIREMENT SYSTEM OF TEXAS

30-YR NET CASH FLOW – TOTAL SYSTEM



Notes: For the fiscal year ending August 31; Reflects return of -3.2% return thru 6/30/22, thereafter Current Policy allocation 30-yr expected return of 7.3% per annum



ALTERNATIVE ASSET ALLOCATION PROFILES



EMPLOYEES RETIREMENT SYSTEM OF TEXAS

ALTERNATIVE ASSET ALLOCATIONS

	Current Policy	Mix A	Mix B	Mix C	Lower Risk	Higher Risk
Cash	1%	1%	2%	1%	1%	1%
Public Equity	37%	37%	35%	32%	30%	45%
Private Equity	13%	13%	16%	19%	13%	13%
Rates	11%	13%	12%	11%	19%	3%
Global Credit	13%	11%	12%	11%	10%	15%
Absolute Return	5%	6%	6%	8%	7%	3%
Public Real Estate	3%	3%	3%	3%	3%	3%
Private Real Estate	9%	9%	9%	9%	9%	9%
Infrastructure	7%	6%	5%	5%	7%	7%
Special Situations	1%	1%	0%	1%	1%	1%

<i>Expected Return 10 yrs</i>	6.8%	6.7%	6.9%	7.0%	6.5%	7.0%
<i>Expected Return 30 yrs</i>	7.3%	7.3%	7.5%	7.5%	7.0%	7.6%
<i>Standard Deviation</i>	12.5%	12.3%	13.0%	12.8%	11.1%	13.9%
<i>Sharpe Ratio (10 years)</i>	0.31	0.31	0.31	0.32	0.33	0.30
<i>Sharpe Ratio (30 years)</i>	0.36	0.36	0.35	0.36	0.37	0.34

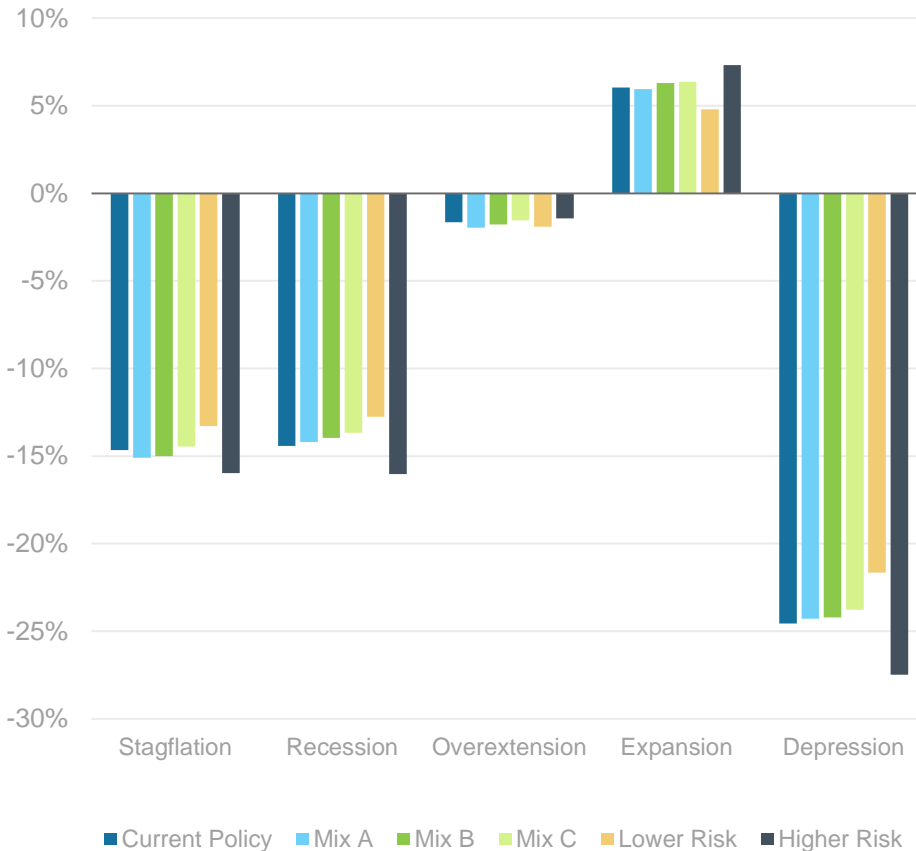
Notes: Based on NEPC's 6/30/22 capital market assumptions; Allocations may not sum to 100% due to rounding



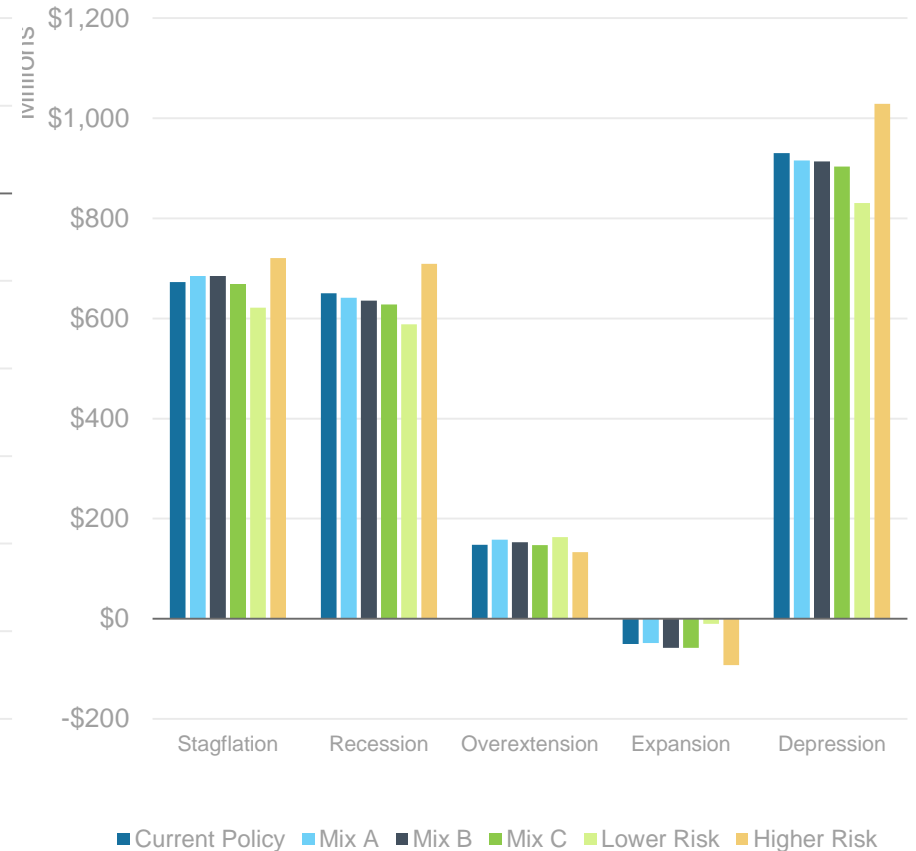
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SCENARIO ANALYSIS

5-yr Change in Funded Ratio



Changed in Legacy Contribution

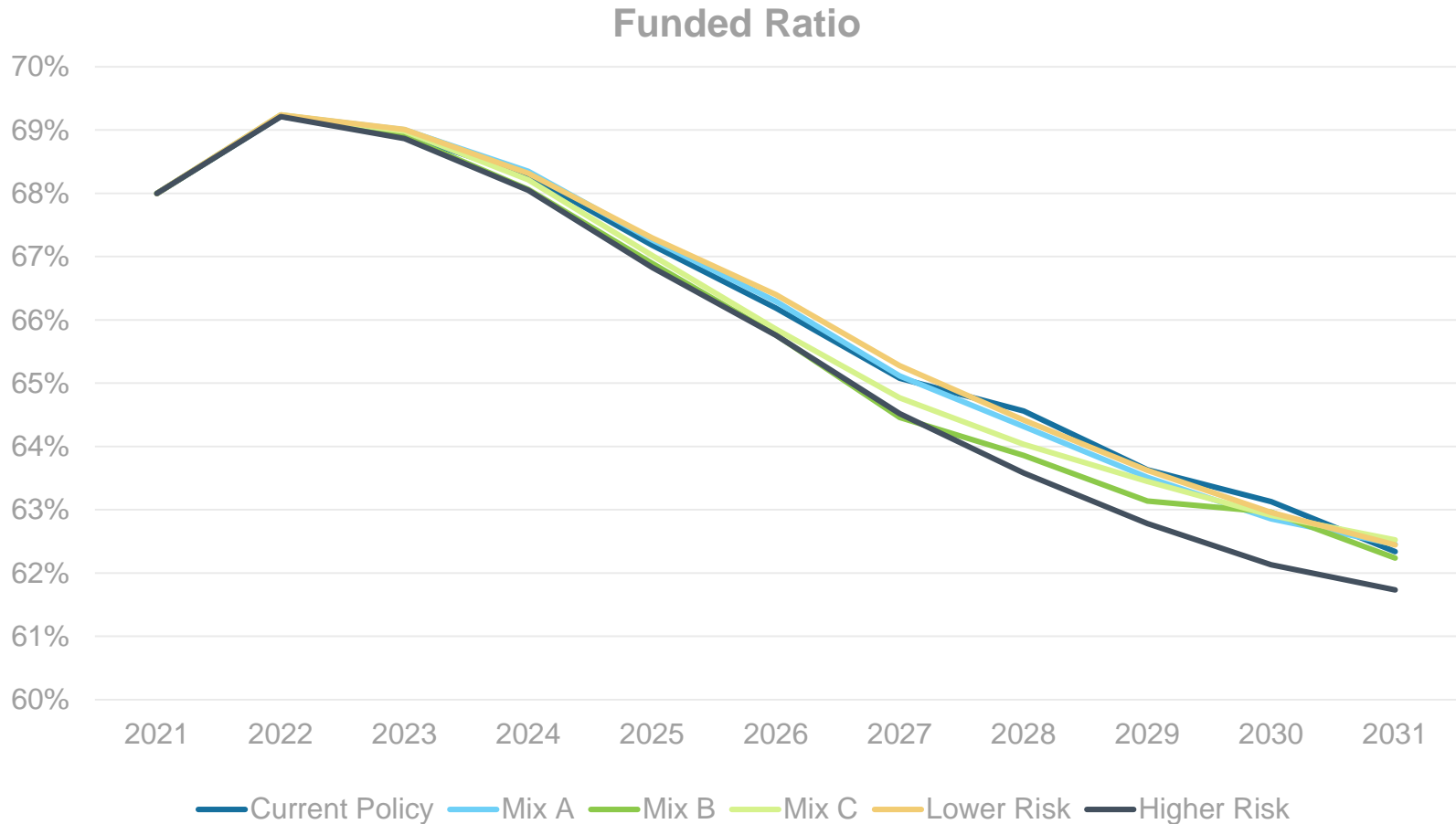


Notes: Scenarios reflect a 5-yr time horizon; Funded status change is relative to 68.0% as of August 31, 2021; Legacy Contribution change is relative to \$510 million for the year ending August 31, 2022



EMPLOYEES RETIREMENT SYSTEM OF TEXAS

STOCHASTIC ANALYSIS – PESSIMISTIC FUNDED RATIO

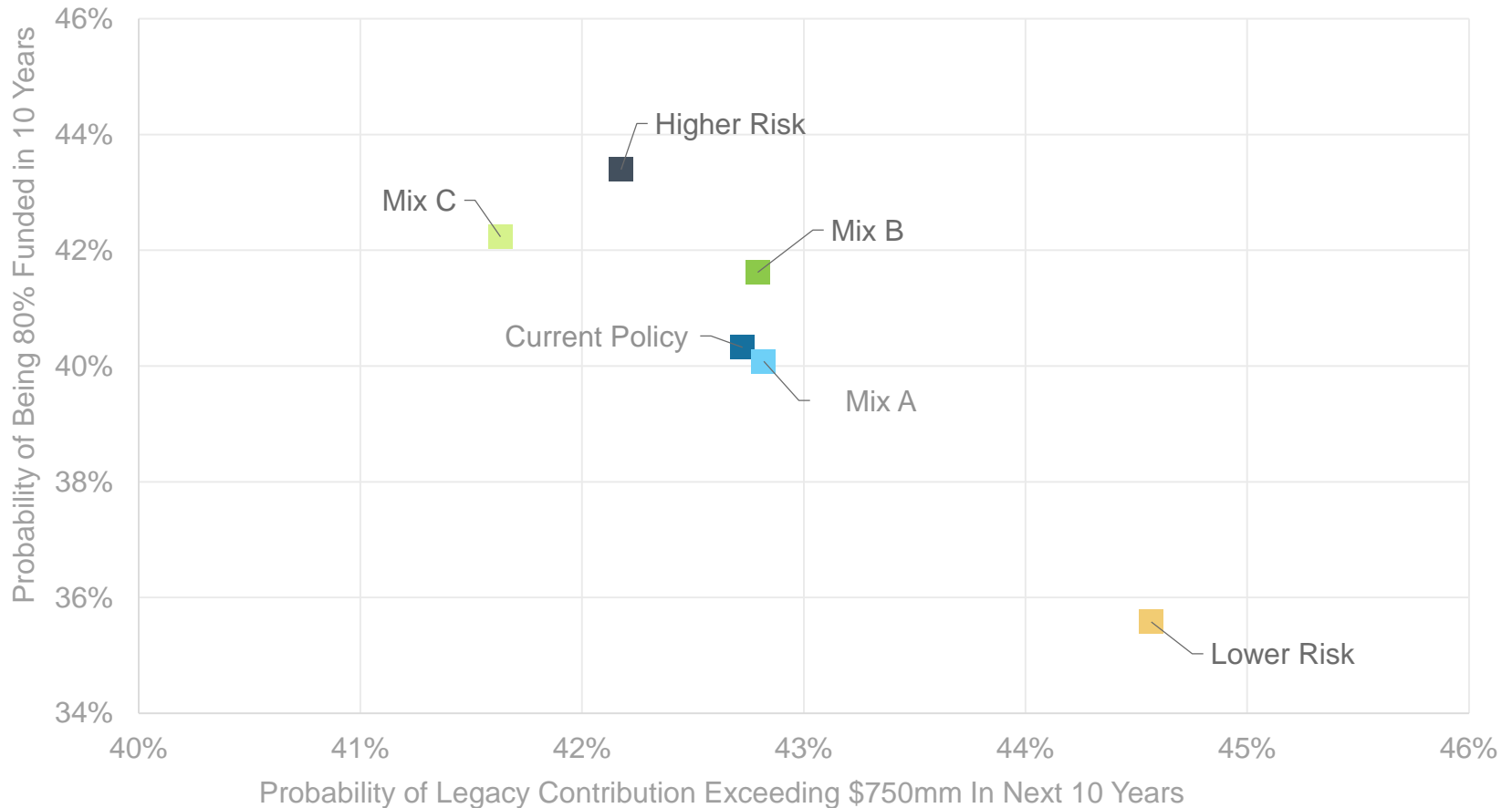


Notes: As of August 31; Reflects the 25th percentile funded ratio outcome



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STOCHASTIC ANALYSIS – RISK/REWARD TRADEOFF





APPENDIX



EMPLOYEES RETIREMENT SYSTEM OF TEXAS

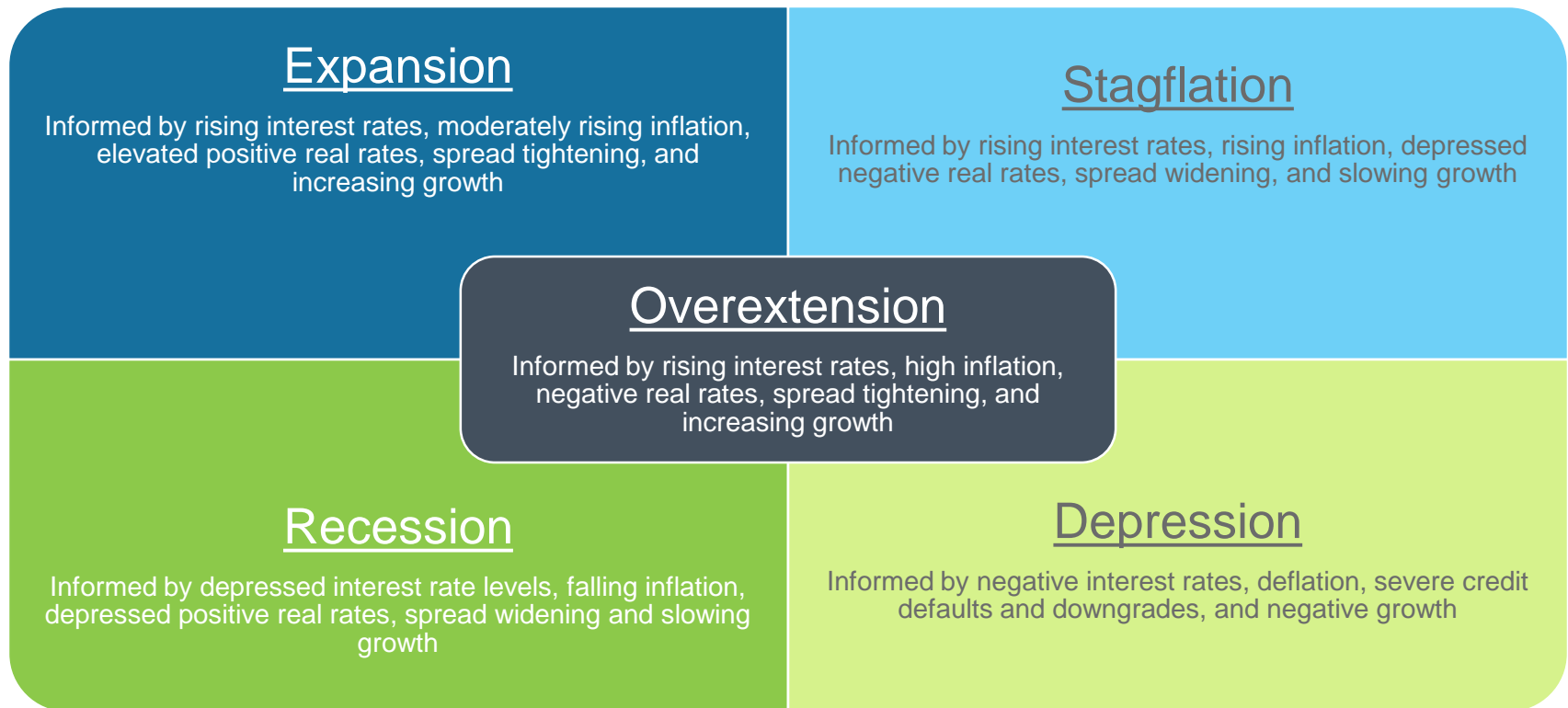
ASSUMPTIONS AND METHODS

- **Deterministic and stochastic return projections are based on NEPC's 6/30/2021 capital market assumptions**
 - NEPC's 10-year & 30-year return assumption used for asset return projections where applicable
- **Asset-liability projections follow a roll-forward methodology based on the August 31, 2021 Actuarial Valuation Report**
 - Benefit payment projections provided by GRS
 - Other than those described herein, all assumptions remain unchanged from the valuation
 - No gains or losses are assumed other than those attributed to investment experience
- **Assets, liabilities and cash flows were modeled for each individual plan and aggregated in the results noted "Total System"**
 - Individual plan results also provided for select outputs
- **Employer and member contribution projections provided by GRS**
 - Modeled as a level percent of pay
- **"Legacy Payments" for ERS assumed to change biennially based on a closed level dollar amortization**
 - Closed amortization period ends in 2054
 - Modeled as the amount required to fully fund the plan by 2054 on a level dollar basis net of future employer and member contributions

SCENARIO ANALYSIS: REGIME CHANGES

NEPC scenario analysis highlights the impact of shifting economic and market regimes on the portfolio and potential asset allocation mixes

- Risk asset returns are informed by credit returns which are based on changes in real rate, inflation, and credit spreads experienced across market regimes



SCENARIO ANALYSIS: REGIME RETURNS

Expansion Scenario Return*

Cash: 1.0%
Treasuries: 0.0%
Long Treasuries: -2.5%
US TIPS: 1.0%
US IG Credit: 1.6%
High Yield Bonds: 2.5%
US Large-Cap Equity: 7.7%
Emerging Market Equity: 13.7%
Commodities: -0.8%

Depression Scenario Return*

Cash: -0.3%
Treasuries: 1.9%
Long Treasuries: 5.0%
US TIPS: -0.9%
US IG Credit: 2.6%
High Yield Bonds: -6.3%
US Large-Cap Equity: -10.2%
Emerging Market Equity: -22.5%
Commodities: -21.9%

Overextension Scenario Return*

Cash: 1.6%
Treasuries: 1.4%
Long Treasuries: 0.0%
US TIPS: 2.5%
US IG Credit: 0.7%
High Yield Bonds: 0.3%
US Large-Cap Equity: -1.2%
Emerging Market Equity: -1.7%
Commodities: 3.3%

Recession Scenario Return*

Cash: 0.0%
Treasuries: 0.9%
Long Treasuries: 1.9%
US TIPS: -1.1%
US IG Credit: 2.4%
High Yield Bonds: 0.5%
US Large-Cap Equity: -2.7%
Emerging Market Equity: -6.2%
Commodities: -10.3%

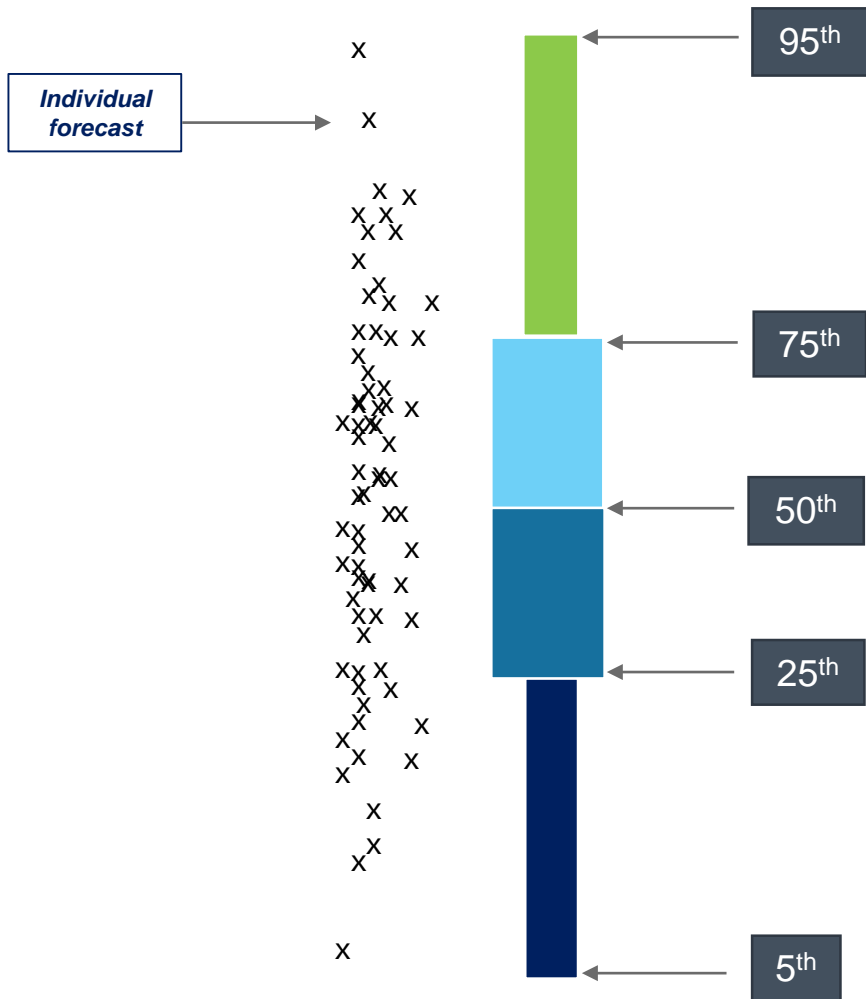
Stagflation Scenario Return*

Cash: 2.2%
Treasuries: -1.1%
Long Treasuries: -5.8%
US TIPS: 2.0%
US IG Credit: -1.4%
High Yield Bonds: 0.1%
US Large-Cap Equity: -4.9%
Emerging Market Equity: -12.3%
Commodities: 0.4%

Scenario returns are a 5 year annualized returns

INTERPRETING STOCHASTIC RESULTS

Model ranks 10,000 forecasts each year



- **95th percentile**
 - Exceeds 95% of all forecasts
 - Overly optimistic outcome
- **75th percentile**
 - Exceeds 75% of all forecasts
 - Optimistic outcome
- **50th percentile**
 - Exceeds 50% of all forecasts
 - Median outcome
- **25th percentile**
 - Exceeds 25% of all forecasts
 - Pessimistic outcome
- **5th percentile**
 - Exceeds 5% of all forecasts
 - Overly pessimistic outcome

6/30/2022 CAPITAL MARKET ASSUMPTIONS

	Asset Class	10-Year Return	30-Year Return	Standard Deviation
MACRO	Inflation	2.4%	2.5%	—
	Cash	2.9%	2.9%	0.6%
	US Leverage Cost	3.2%	3.3%	0.6%
	Non-US Cash	1.5%	2.2%	0.6%
EQUITY	US Large-Cap Equity	5.8%	6.9%	16.6%
	US Small/Mid-Cap Equity	7.2%	7.5%	20.7%
	Non-US Developed Equity	6.4%	7.0%	19.6%
	Non-US Developed Equity (USD Hedge)	6.5%	7.2%	17.6%
	Non-US Developed Small-Cap Equity	7.4%	7.8%	24.2%
	Emerging Market Equity	9.6%	9.5%	28.3%
	Emerging Market Small-Cap Equity	9.3%	9.6%	34.4%
	<i>Global Equity*</i>	6.8%	7.7%	17.9%
	Hedge Fund – Equity	5.5%	5.9%	11.4%
	Private Equity – Buyout	8.3%	8.9%	19.0%
	Private Equity – Growth	9.3%	9.9%	31.5%
	Private Equity – Venture	10.5%	10.7%	45.0%
	Private Equity – Secondary	7.8%	8.3%	20.0%
	Non-US Private Equity	11.0%	11.0%	32.0%
	<i>Private Equity*</i>	9.83%	10.3%	25.2%
	China Equity	9.4%	9.3%	28.6%
US Microcap Equity	8.0%	8.4%	25.8%	



6/30/2022 CAPITAL MARKET ASSUMPTIONS

	Asset Class	10-Year Return	30-Year Return	Standard Deviation
CREDIT	US TIPS	3.0%	3.6%	5.8%
	US Treasury Bond	3.2%	3.4%	5.3%
	US Corporate Bond	5.2%	5.3%	7.3%
	US Mortgage-Backed Securities	3.4%	3.7%	6.5%
	<i>US Aggregate Bond*</i>	3.8%	4.0%	5.6%
	US High Yield Corporate Bond	6.9%	6.9%	11.2%
	US Leveraged Loan	6.6%	6.3%	9.1%
	Emerging Market External Debt	7.3%	6.5%	13.0%
	Emerging Market Local Currency Debt	6.9%	5.9%	13.0%
	Non-US Government Bond	2.1%	2.8%	9.3%
	Non-US Government Bond (USD Hedge)	2.3%	3.0%	4.0%
	<i>Global Government Bond*</i>	2.5%	3.0%	7.6%
	<i>Global Government Bond (USD Hedge)*</i>	2.6%	3.2%	4.0%
	Non-US Inflation-Linked Bond (USD Hedge)	1.7%	2.6%	5.9%
	<i>Global Multi-Sector Fixed Income*</i>	5.9%	5.8%	7.8%
	<i>Absolute Return Fixed Income*</i>	5.4%	5.3%	5.8%
	US Municipal Bond	4.0%	3.5%	6.0%
	US Municipal Bond (1-10 Year)	3.0%	3.1%	4.5%
	US High Yield Municipal Bond	5.0%	5.2%	12.0%
	Hedge Fund - Credit	6.5%	6.6%	10.2%
Private Debt - Credit Opportunities	7.9%	8.1%	14.4%	
Private Debt – Distressed	8.7%	9.1%	14.3%	
Private Debt - Direct Lending	7.6%	8.6%	10.5%	
<i>Private Debt*</i>	8.0%	8.7%	11.6%	

6/30/2022 CAPITAL MARKET ASSUMPTIONS

	Asset Class	10-Year Return	30-Year Return	Standard Deviation
CREDIT	US Short-Term TIPS (1-3 Year)	2.8%	3.2%	3.2%
	US Short-Term Treasury Bond (1-3 Year)	3.1%	3.2%	2.1%
	US Short-Term Corporate Bond (1-3 Year)	4.4%	4.3%	3.0%
	US Short-Term High Yield Corporate Bond (1-3 Year)	5.5%	5.0%	8.5%
	US Intermediate-Term TIPS (3-10 Year)	3.1%	3.7%	5.4%
	US Intermediate-Term Treasury Bond (3-10 Year)	3.2%	3.6%	5.5%
	US Intermediate-Term Corporate Bond (3-10 Year)	5.3%	5.4%	6.5%
	US Long-Term Treasury Bond (10-30 Year)	3.5%	3.8%	10.9%
	US Long-Term TIPS (10-30 Year)	3.2%	3.4%	11.6%
	US Long-Term Corporate Bond (10-30 Year)	5.4%	5.5%	10.7%
	20+ Year US Treasury STRIPS	3.1%	3.3%	20.9%
	<i>US Long-Term Government/Credit*</i>	4.4%	4.6%	10.2%
	US Corporate Bond - AAA	4.3%	4.4%	6.0%
	US Corporate Bond – AA	4.3%	4.4%	5.9%
	US Corporate Bond – A	4.8%	4.8%	7.2%
	US Corporate Bond – BBB	5.5%	5.5%	8.0%
	US Corporate Bond – BB	7.2%	7.3%	9.8%
	US Corporate Bond – B	7.4%	7.0%	11.7%
	US Corporate Bond - CCC/Below	2.3%	1.7%	20.6%
	US Securitized Bond	4.1%	4.5%	8.4%
	US Collateralized Loan Obligation	4.7%	4.6%	7.3%
	US High Yield Securitized Bond	6.6%	6.8%	11.2%
	US High Yield Collateralized Loan Obligation	7.3%	7.1%	10.8%
	US Taxable Municipal Bond	4.5%	5.2%	7.5%
	10 Year US Treasury Bond	3.4%	3.9%	7.4%
	10 Year Non-US Government Bond (USD Hedge)	1.4%	2.5%	5.1%

6/30/2022 CAPITAL MARKET ASSUMPTIONS

	Asset Class	10-Year Return	30-Year Return	Standard Deviation
REAL ASSETS	Commodity Futures	3.4%	3.3%	18.5%
	Midstream Energy	6.0%	6.7%	28.6%
	<i>Public Real Assets (Multi-Asset)*</i>	5.5%	5.9%	14.1%
	US REIT	6.1%	7.3%	21.4%
	Global Infrastructure Equity	6.1%	6.7%	20.3%
	Global Natural Resources Equity	6.4%	6.7%	23.2%
	Gold	4.4%	4.4%	16.3%
	Core Real Estate	4.4%	5.2%	15.0%
	Non-Core Real Estate	5.7%	6.7%	17.5%
	Private Debt - Real Estate	5.3%	5.7%	11.4%
	Private Real Assets - Natural Resources	7.9%	8.4%	32.5%
Private Real Assets – Infrastructure	6.1%	6.8%	12.6%	
MULTI-ASSET	Hedge Fund – Macro	5.4%	5.5%	9.2%
	<i>Hedge Fund*</i>	6.0%	6.3%	8.6%
	<i>60% S&P 500 & 40% US Aggregate Bond*</i>	5.3%	6.1%	10.3%
	<i>60% MSCI ACWI & 40% US Aggregate Bond*</i>	6.0%	6.6%	11.0%



PRIVATE MARKET COMPOSITES

Assumed public market beta composites for private market return assumptions:

Private Equity:

Private Equity – Buyout: 25% US Large Cap, 75% US Small/Mid Cap

Private Equity – Secondary: 25% US Large Cap, 75% US Small/Mid Cap

Private Equity – Growth: 50% US Small/Mid Cap, 50% US Microcap

Private Equity – Venture: 25% US Small/Mid Cap, 75% US Microcap

Private Equity – Non-US: 70% International Small Cap, 30% Emerging Small Cap

PE Composite: 34% Buyout, 34% Growth, 15 % Non-US, 8.5% Secondary, 8.5% Venture

Private Debt:

Private Debt – Direct Lending: 100% Bank Loans

Private Debt – Distressed: 20% US Small/Mid Cap, 60% US High Yield, 20% Bank Loans

Private Debt – Credit Opportunities: 24% US SMID Cap, 33% US High Yield, 33% Bank Loans

Private Debt Composite: 50% Direct Lending, 25% Credit Opportunities, 25% Distressed

Private Real Assets:

Private Real Assets – Energy: 30% Comm., 35% Midstream, 35% Public Resource Equity

Private Real Assets - Infra/Land: 30% Commodities, 70% Public Infrastructure

Private Real Estate Debt: 50% CMBS, 50% Core Real Estate

NEPC DISCLOSURES

Past performance is no guarantee of future results.

NEPC, LLC is an investment consulting firm. We provide asset-liability studies for certain clients but we do not provide actuarial services. Any projections of funded ratio or contributions contained in this report should not be used for budgeting purposes. We recommend contacting the plan's actuary to obtain budgeting estimates.

The goal of this report is to provide a basis for substantiating asset allocation recommendations. The opinions presented herein represent the good faith views of NEPC as of the date of this report and are subject to change at any time.

Information on market indices was provided by sources external to NEPC. While NEPC has exercised reasonable professional care in preparing this report, we cannot guarantee the accuracy of all source information contained within.

The projection of liabilities in this report uses standard actuarial projection methods and does not rely on actual participant data. Asset and liability information was received from the plan's actuary, and other projection assumptions are stated in the report.

All investments carry some level of risk. Diversification and other asset allocation techniques do not ensure profit or protect against losses.

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