Asset-Liability Study: Planning Discussion

Colorado Public Employees' Retirement Association (PERA)

September 22, 2023

Table of Contents

1

Asset-Liability Study Overview

Asset-Liability Study Overview
Background

What?
- A comprehensive toolkit for making decisions on **strategic asset allocation** within the **context of the liabilities**

Why?
- Aon believes optimal decisions regarding pension risk management are made when they are based on a **clear understanding of the assets and liabilities** and how they interact

When?
- Aon suggests conducting asset-liability studies every **3 to 5 years**, or more frequently as circumstances dictate

How?
- **Identify future trends** in the financial health of the fund based on economic uncertainties that may not be evident from an actuarial valuation

Ultimate Retirement Benefit Cost Equation

The cost ultimately borne by the Plan will be represented by the financing equation shown below:

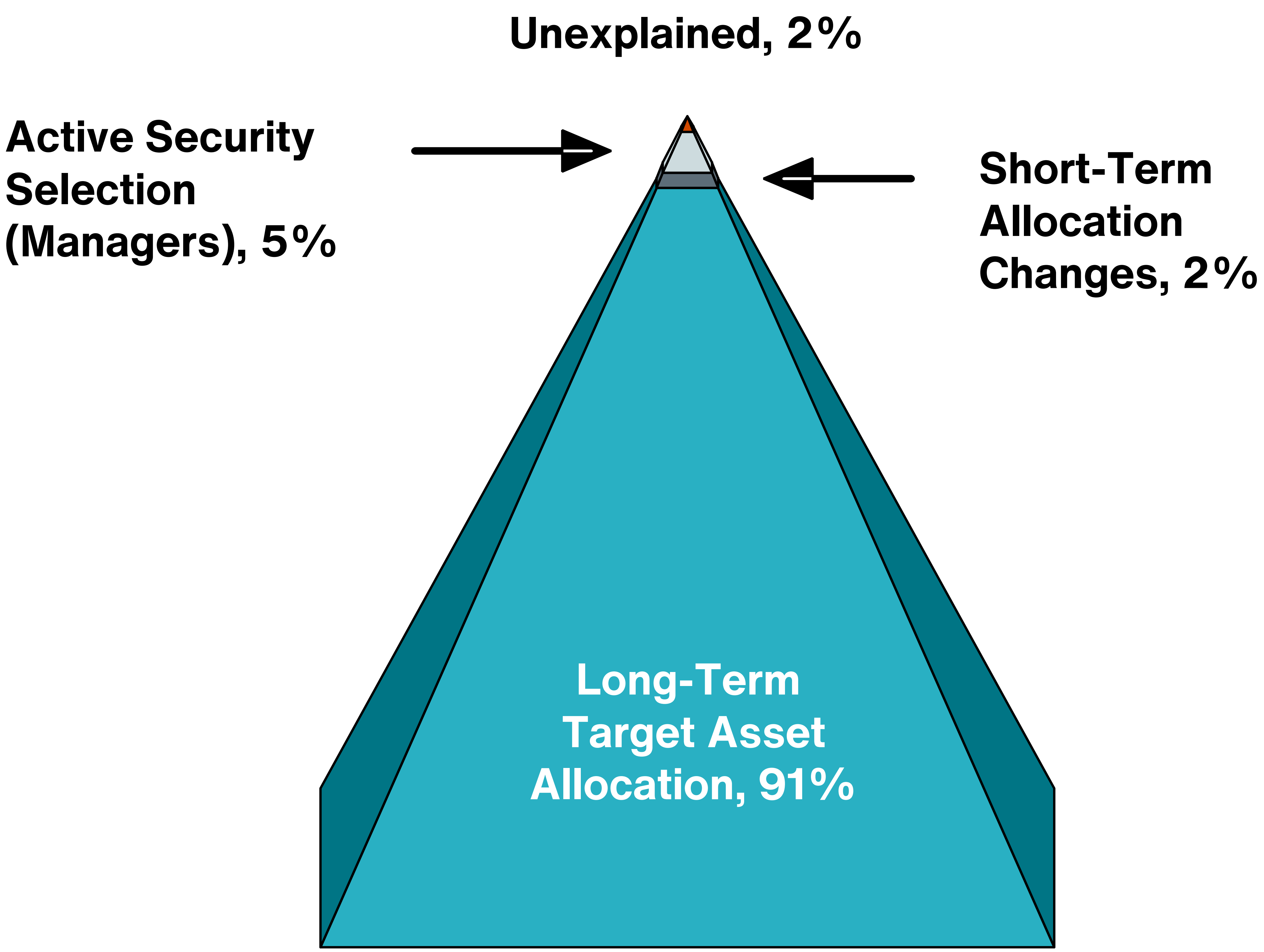
(Benefits Paid + Administrative Expenses) = (Investment Returns + Plan Funding (EE + ER))

The asset-liability study will analyze the variability of future investment returns on the Plan financials

Long-term Asset Allocation Is the Most Important Investment Decision

Policy Drives Results

- Long-term asset allocation (i.e., which asset classes to use and in what percent) explains more than 90% of the difference in returns between institutional funds
- Selecting investments that are appropriately diversified and consider the liability of the investment program is paramount



The chart outlines research done by Brinson, Singer and Beebower in their 1991 research paper "Determinants of Portfolio Performance II: An Update" outlines that 91% of the difference in returns among investors is driven by differences in the long-term target asset allocation.

Key Takeaways from Asset-Liability Study

The key takeaways from the asset-liability study are:

- **Risk Posture** (Return-seeking vs. Risk-reducing)
- **Asset Mix**
  - *Return-seeking*: intended to grow, outperform liabilities
  - *Risk-reducing:* protection, diversification, designed to withstand stressed markets

Colorado PERA Risk Posture

Long Term Policy

23%

Risk-Reducing
- Core Bonds

77%

Return-seeking
- 54% public equity
- 8.5% private equity
- 8.5% real estate
- 6.0% alternatives

Major factors affecting the ultimate mix are:

Time horizon (or amortization period of unfunded liability) to fund the liability: a longer time horizon supports more risk taking

Characteristics of plan participants: a growing population of active participants supports more risk taking; a mature population with significant retirees might need a more conservative policy

Funded status: a less funded plan can utilize additional returns from equity investments

Nature of plan benefits: a pension with sensitivity to wage inflation growth can benefit from equities in the long-term; an increased need in liquidity due to significant benefit payments in the near future can have a more conservative policy

Asset-Liability Study Steps

Collect plan-specific information, produce/review results, present for consumption

Typical Project Plan:

Step 1: Planning Meeting(s)

- Project overview (education)
- Pension-related goals and objectives
- Evaluation of risk tolerance and risk preference
- Asset and liability assumptions to be used in study
- Preliminary efficient frontier analysis; hurdle rate analysis
- Review investment strategies and determine policies to model

Step 2: Review Asset-Liability Study Results

- Meet to discuss the pension asset-liability study results
- Review results for a variety of investment strategies studied, using the following pension financial metrics:
  - Contributions, funded status, economic cost, liquidity, net outflow
- Discuss initial recommendations on investment strategy
- Complete revisions and updates as needed

Step 3: Implementation Discussion

- Discuss options and issues for implementation
- Discuss Investment Policy Statement
- Discuss potential impact on active risk and incentive compensation

Key Inputs For Asset Liability Study

Planning meetings help determine following inputs

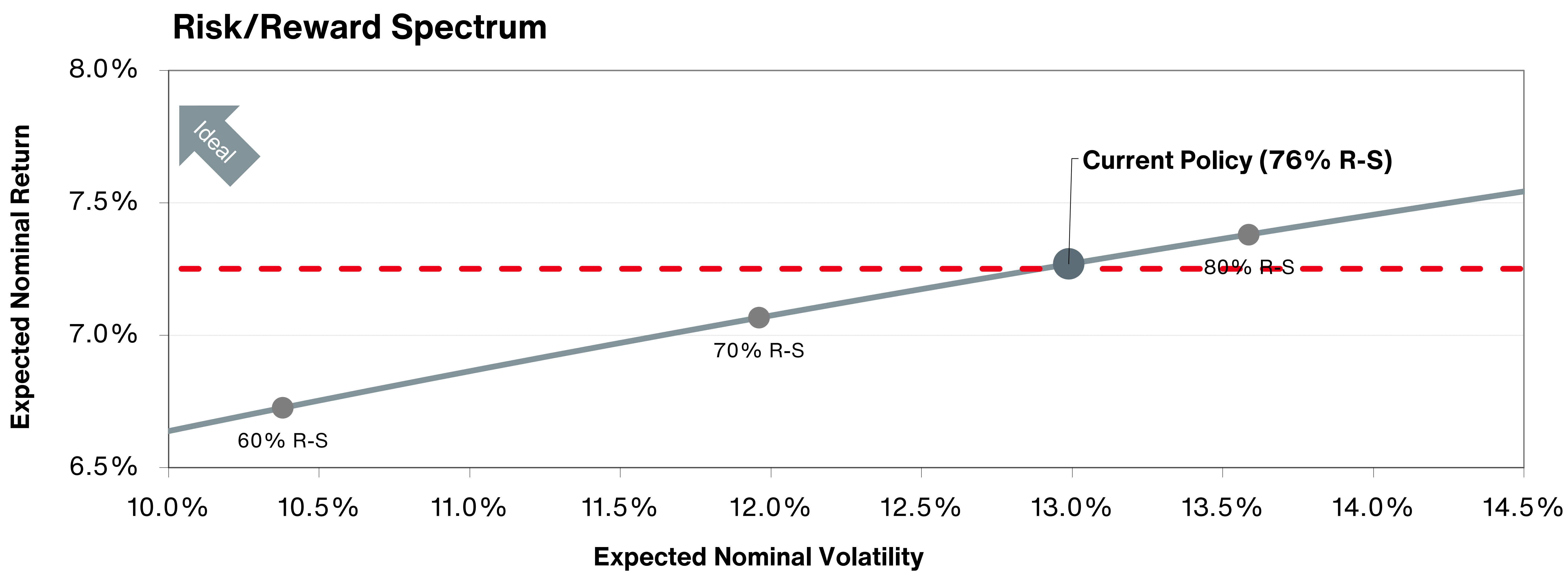
Timeline	• Timeline is fluid and helps set expectations
Key metrics	• Helps interpret results and inform recommendations • Ex. Funded ratio goals, contribution considerations
Board objectives	• How to determine success of study • Ex. Reduced likelihood of setting automatic adjustment provision (AAP) events
Portfolio allocations	• Determine asset classes to include (or exclude) for consideration • Determine any constraints on asset classes
Asset class assumptions	• Confirm long-term risk, return and correlation assumptions

Objective Setting

Discussion guide of potential objectives, constraints, and measures of success

Objectives	• Achieve expected return threshold or expect plan(s) to reach fully funded within certain number of years • Illiquid assets do not reach set allocation percentage in stressed market environment • Reduced likelihood of setting automatic adjustment provision (AAP) events
Constraints	• Restrict which asset classes to use in portfolio analysis • Minimum/maximum allocation to certain asset classes • Set a threshold of return-seeking assets
Key Metrics	• Set importance to key metrics such as portfolio expected return/volatility, projected funded ratio, likelihood of setting AAP events, liquidity analysis • Establish any other important metrics to include in study results

Illustrative Portfolio Analysis
Sample Output



Observations

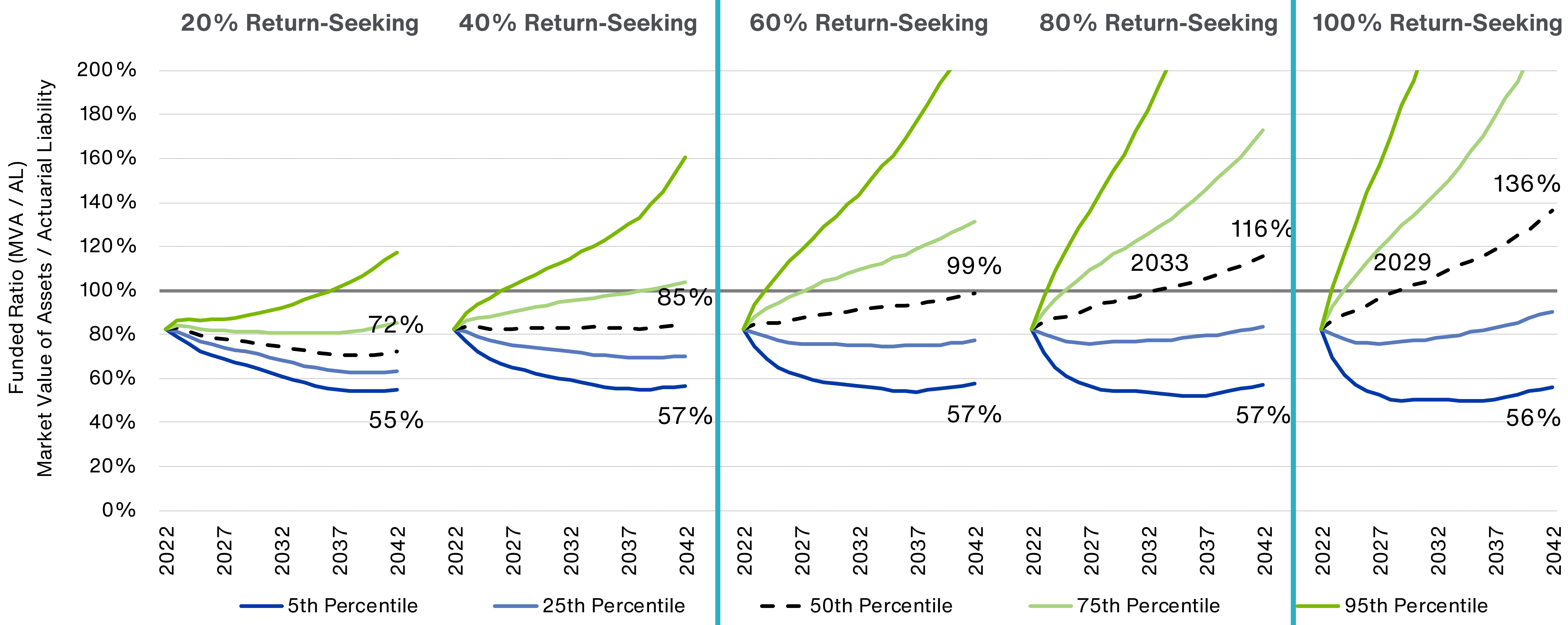
- Current portfolio expected return of **7.27% is** in-line with the 7.25% actuarial assumed rate of return
- Portfolio analysis exercise will include determining what asset classes to include and any constraints around them (i.e., min allocation to public equity, max allocation to private equity, etc.)

				Return-Seeking (R-S) Assets							Risk-Reducing / Safety Assets
	Expected Nominal Return[1]	Expected Nominal Volatility	Sharpe Ratio	Public Equity	Private Equity	Liquid Alts	Liquid R-S Fixed Income	Illiquid R-S Fixed Income	Open-End Real Assets	Closed-End Real Assets	Core / Core Plus Bonds
Current Policy (76% R-S)	7.27%	12.99%	0.31	56%	9%	2%	0%	0%	4%	6%	24%

[1] Expected returns are using AIUSA Q3 2023 30-Year Capital Market Assumptions (CMAs) as of 6/30/2023. CMAs contain projections about future returns on asset classes. Our CMA projections are designed to reflect the typical cost of implementing an investment program. Expected returns are calculated using weighted allocations of the underlying CMAs. Expected Returns are geometric (long-term compounded; rounded to the nearest decimal) assuming portfolio weights are rebalanced annually. Expected returns presented are models and do not represent the returns of an actual client account. Your actual returns may differ from model returns presented based on your plan's individual fees/expenses. Aon's advisory fees are described in Part 2A of Aon's Form ADV. Not a guarantee of future results. See appendix for capital market assumptions disclosure pages.
Percentages may not sum to 100% due to rounding.

Illustrative Funded Ratio Projections

Sample Output



Strategy	20% Return-Seeking			40% Return-Seeking			60% Return-Seeking			80% Return-Seeking			100% Return-Seeking		
Year	2022	2032	2042	2022	2032	2042	2022	2032	2042	2022	2032	2042	2022	2032	2042
5th Percentile	82%	61%	55%	82%	59%	57%	82%	57%	57%	82%	54%	57%	82%	51%	56%
25th Percentile	82%	68%	63%	82%	72%	70%	82%	75%	77%	82%	77%	84%	82%	78%	90%
50th Percentile	82%	74%	72%	82%	83%	85%	82%	91%	99%	82%	99%	116%	82%	107%	136%
75th Percentile	82%	81%	85%	82%	95%	104%	82%	110%	132%	82%	126%	173%	82%	144%	>200%
95th Percentile	82%	92%	117%	82%	114%	161%	82%	143%	>200%	82%	182%	>200%	82%	>200%	>200%

* Projections assume a constant discount rate for pension liabilities for all investment policies studied based on the latest actuarial valuation data.

Sample Observations:

- In the example out shown, portfolios between 60%-80% return-seeking are projected to reach full funding over the projection period in the central expectations
- Portfolios below 60% return-seeking are not expected to generate enough earnings and fall short of full funding
- Portfolios above 80% return-seeking are expected to have their central expectation far exceed full funding

Illustrative Liquidity Analysis

Sample Output

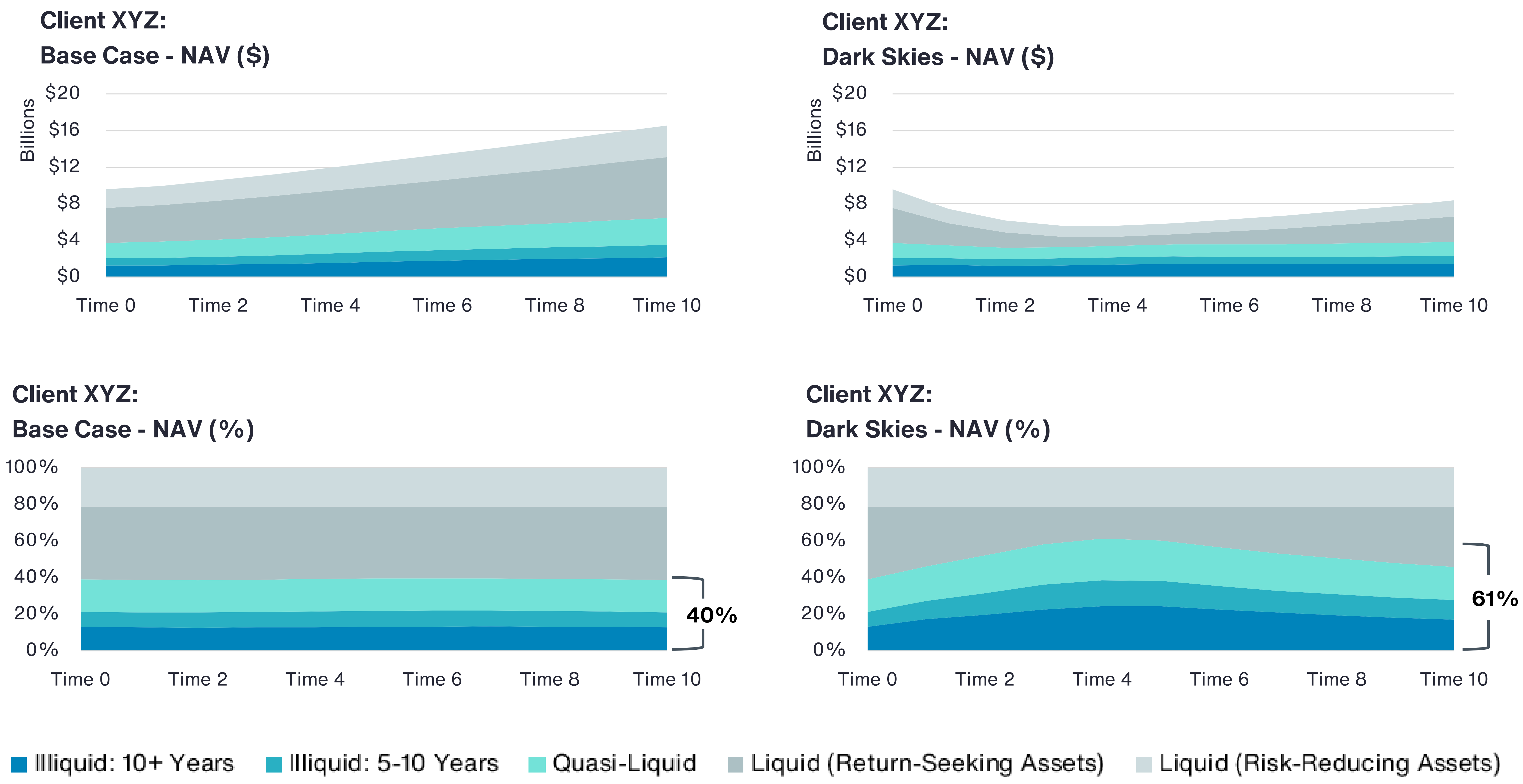
Longer time horizons incentivize higher levels of risk and alternative assets can play a key role in the portfolio construction

The question becomes **"What level of alternative assets is too much?"**

- As alternative assets have various degrees of lock-ups or illiquidity, it is important to understand how much the portfolio could evolve in the future under different economic conditions and whether there is appropriate liquidity within the Plan

Base Case

Dark Skies



Note: Year 0 represents a starting point of June 30, 20XX

Recap of 2019 Asset-Liability Study

Summary of analysis and findings

Strategy Component	Analysis Performed	Key Findings
Overall Asset Allocation	• Studied higher and lower allocations to return-seeking / risk-reducing assets	• Higher return-seeking allocations can provide attractive risk/reward characteristics given a sufficiently long-term time horizon • Strategies with at least 70% return-seeking assets were projected to attain full funding within 30 years in the expected case
Return-Seeking Portfolio	• Studied adjustments to the return-seeking portfolio, reflecting Colorado PERA's investment objectives and constraints	• Diversification can mitigate downside risk in stressed economic environments • Quantitative benefits of diversification should be weighed against liquidity needs, implementation considerations, and governance objectives/circumstances
Risk-Reducing Portfolio	• Studied adjustments to the risk-reducing portfolio, including the mix of core, credit, and government bonds	• Modifying the target mix of government/credit bonds can incrementally improve risk/return profile

The existing asset allocation was determined to still largely be appropriate at the time of the 2019 study; modest enhancement was approved that moved the dedicated 1% Cash allocation to Global Equity

2

Capital Market Assumptions

Capital Market Assumptions
Background

- Long-term (10- and 30-year forecasts) forward-looking assumptions (asset class geometric return, volatility, and correlations)
- Building Block approach, primarily based on consensus expectations and market-based inputs
- Best estimates of annualized returns (50/50 better or worse)
- Market returns: no active management value added (except for certain assets classes, such as hedge funds)
- Net of investment fees
- Updated quarterly
- We show Aon's long-term (i.e., 30-year) capital market assumptions throughout this material

Capital Market Assumptions

Summary as of June 30, 2023

	10-Year CMAs				30-Year CMAs			
	Expected Real Return[1]	Expected Nominal Return[1]	Expected Nominal Volatility	Assumed Global Equity Beta	Expected Real Return[1]	Expected Nominal Return[1]	Expected Nominal Volatility	Assumed Global Equity Beta
Equity								
1 Large Cap U.S. Equity	3.8%	6.2%	17.0%	0.91	4.4%	6.8%	17.4%	0.91
2 Small Cap U.S. Equity	4.0%	6.4%	23.0%	1.18	4.9%	7.3%	23.7%	1.18
3 Global Equity IMI	4.3%	6.7%	18.1%	1.00	5.0%	7.4%	18.6%	1.00
4 International Equity (Developed)	4.4%	6.8%	20.3%	1.01	4.9%	7.3%	20.8%	1.01
5 Emerging Markets Equity	4.7%	7.1%	24.0%	1.09	5.3%	7.7%	24.5%	1.09
Fixed Income								
6 Cash (Gov't)	1.4%	3.7%	1.6%	0.01	1.0%	3.3%	2.2%	0.01
7 Cash (LIBOR)	2.1%	4.4%	1.6%	0.01	1.7%	4.0%	2.2%	0.01
8 Core Fixed Income	2.2%	4.5%	5.0%	0.00	1.8%	4.1%	5.2%	0.00
9 Multi-Asset Credit[2]	4.6%	7.0%	8.9%	0.32	4.5%	6.9%	9.1%	0.32
Alternatives								
10 Direct Hedge Funds[2,3]	3.8%	6.2%	9.0%	0.32	3.7%	6.1%	9.6%	0.33
11 Core Real Estate	3.4%	5.8%	15.0%	0.30	3.2%	5.6%	15.4%	0.30
12 Non-Core Real Estate	5.5%	7.9%	25.0%	0.66	5.3%	7.7%	25.5%	0.65
13 Private Equity	6.4%	8.8%	25.0%	0.87	7.3%	9.8%	25.6%	0.87
14 Infrastructure	4.7%	7.1%	14.5%	0.29	4.7%	7.1%	15.0%	0.29
15 Closed-End Real Assets	5.8%	8.2%	15.7%	0.47	5.8%	8.2%	16.1%	0.47
16 Farmland	3.1%	5.5%	15.0%	0.01	3.1%	5.5%	15.5%	0.01
17 Timber	2.4%	4.8%	12.0%	0.02	2.4%	4.8%	12.3%	0.02
18 Private Debt	5.9%	8.3%	16.5%	0.35	5.3%	7.7%	17.5%	0.36
Inflation								
19 Inflation	0.0%	2.3%	1.7%		0.0%	2.3%	1.7%	

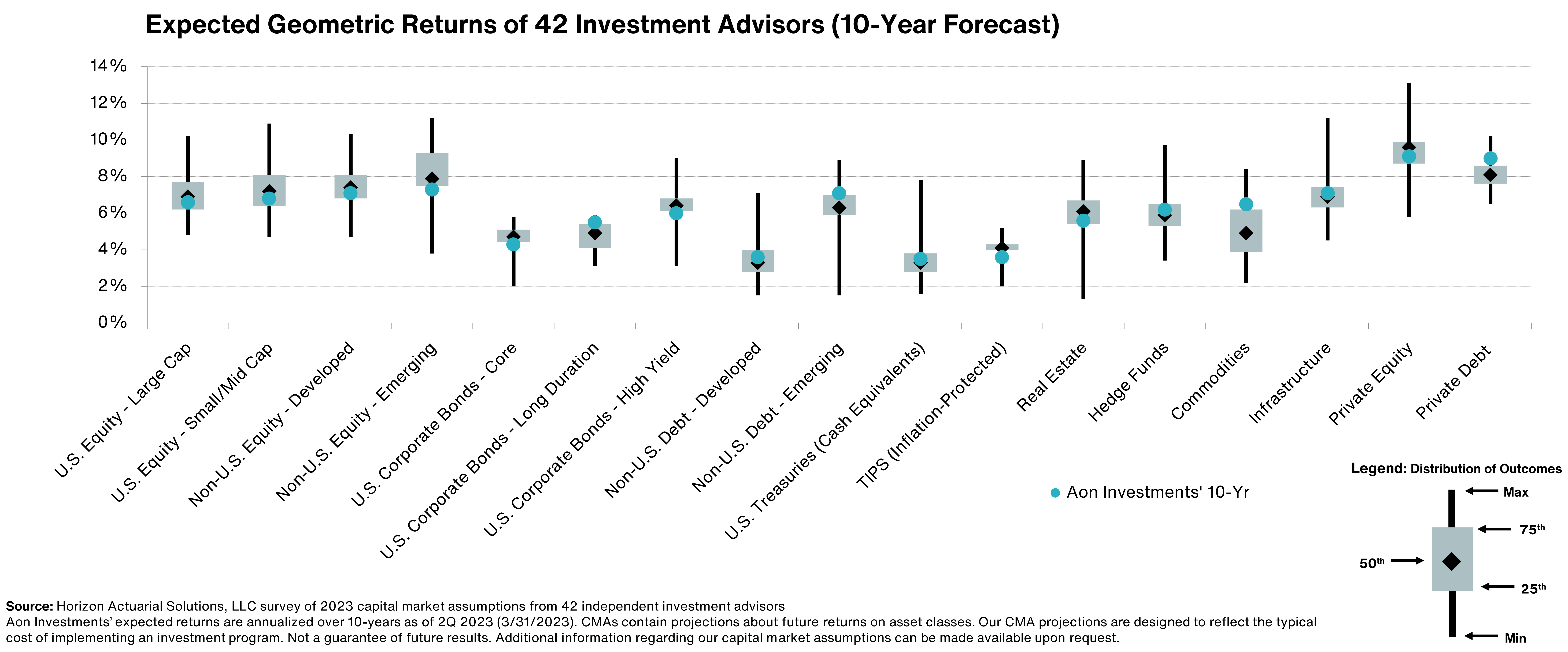
1 Expected returns are using Aon's 10/30-Year Capital Market Assumptions as of 6/30/2023. CMAs contain projections about future returns on asset classes. Our CMA projections are designed to reflect the typical cost of implementing an investment program. Expected returns are calculated using weighted allocations of the underlying CMAs. Expected Returns are geometric (long-term compounded; rounded to the nearest decimal) assuming portfolio weights are rebalanced annually. Expected returns presented are models and do not represent the returns of an actual client account. Your actual returns will be reduced by your advisory fees and other expenses you may incur as a client. Aon's advisory fees are described in Part 2A of Aon's Form ADV. Not a guarantee of future results.

2 Alpha incorporated in Expected Nominal Return

3 Represents diversified portfolio of Direct hedge fund investments.

Aon Investments Capital Market Assumptions vs. Horizon Survey

10-Year forecast



Source: Horizon Actuarial Solutions, LLC survey of 2023 capital market assumptions from 42 independent investment advisors
Aon Investments' expected returns are annualized over 10-years as of 2Q 2023 (3/31/2023). CMAs contain projections about future returns on asset classes. Our CMA projections are designed to reflect the typical cost of implementing an investment program. Not a guarantee of future results. Additional information regarding our capital market assumptions can be made available upon request.

Colorado PERA: 30-Year Capital Market Assumptions

As of 6/30/2023

	Long-Term Asset Allocation	Expected Nominal Return	Expected Risk
Global Equity	*54.0%*	7.4%	18.6%
Fixed Income[1]	*23.0%*	4.1	5.2
Real Estate	*8.5%*	6.8	20.3
Private Equity	*8.5%*	9.8	25.6
Alternatives[2]	*6.0%*	6.8	9.2
Cash	*0.0%*	3.3	2.2
Inflation		2.3	
Total Fund:			
Expected Return		***7.27%***	
Expected Risk		***12.99%***	
Sharpe Ratio		***0.306***	

[1] Modeled 100% to core fixed income
[2] Reflects allocation of 27.5% CPI+4% / 27.5% HFRI FOF Defensive Index / 45% PERA Public Market + 1.5%. Modeled as 9.2% each to Timber, Infrastructure and Farmland, 27.5% to Direct Hedge Funds, and 34.2% to Global Equity and 10.8% to Fixed Income.

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3

Next Steps

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Next Steps

Next Steps

- Aon will work with the PERA investment team to review the key inputs for the A-L analysis including the capital market assumptions and asset class constraints to include in the portfolio analysis
- Aon anticipates providing an update and initial analysis at the November Board meeting to gather feedback on the results, as well as the Board's objectives and key metrics for the study
- Timeline is fluid based on the feedback and needs of PERA, but preliminary expectations are for initial round of recommendations and asset-liability results to be presented in March 2024

Recap of Key Decision Points

1. Timeline for study
2. Key metrics for study
3. Board objectives
4. Portfolio allocations to further study
5. Asset class assumptions

Tentative Timeline for Study*

Meeting	Key Decision Points	Participants	Target Dates	
Planning Meeting(s)	▪ Set timeline ▪ Define key metrics ▪ Discuss Board objectives	▪ Aon ▪ PERA Staff ▪ PERA Board	*September 2023*	✓
Portfolio Meeting(s)	▪ Assess initial portfolio ideas ▪ Discuss assumptions ▪ Define constraints ▪ Determine portfolios for further study	▪ Aon ▪ PERA Staff	*October – November 2023*	
Review Initial Results	▪ Review/confirm inputs with Board ▪ Highlight initial analysis ▪ Identify “best ideas” ▪ Specify additional analysis	▪ Aon ▪ PERA Staff ▪ PERA Board	*November – February 2024*	
Board of Trustees Presentation	▪ Present initial results ▪ Potential asset allocation recommendations and rationale ▪ Implementation considerations ▪ Determine any potential additional analysis	▪ Aon ▪ PERA Staff ▪ PERA Board	*March 2024*	
Post-Study Process	▪ Review active risk management and incentive compensation ▪ Implementation details ▪ Transition portfolio	▪ Aon ▪ PERA Staff	*Post-Study*	

*Subject to change

4

Appendix

Aon Investments Capital Market Assumptions

Average Correlations—06/30/2023

	Nominal Correlations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Large Cap U.S. Equity	**1.00**	0.93	0.97	0.81	0.73	0.10	0.10	0.00	0.60	0.65	0.35	0.46	0.62	0.35	0.52	0.02	0.02	0.35	0.09
2	Small Cap U.S. Equity	0.93	**1.00**	0.93	0.75	0.69	0.09	0.09	0.00	0.56	0.61	0.33	0.43	0.60	0.34	0.50	0.01	0.02	0.34	0.09
3	Global Equity IMI	0.97	0.93	**1.00**	0.90	0.82	0.09	0.09	0.00	0.64	0.64	0.37	0.48	0.63	0.35	0.54	0.02	0.02	0.38	0.11
4	International Equity (Developed)	0.81	0.75	0.90	**1.00**	0.76	0.06	0.05	-0.01	0.60	0.55	0.35	0.44	0.56	0.31	0.50	0.02	0.02	0.36	0.11
5	Emerging Markets Equity	0.73	0.69	0.82	0.76	**1.00**	0.08	0.08	0.00	0.63	0.47	0.33	0.41	0.53	0.30	0.46	0.01	0.02	0.38	0.09
6	Cash (Gov't)	0.10	0.09	0.09	0.06	0.08	**1.00**	0.99	0.45	0.06	-0.02	0.17	0.16	0.10	0.15	0.20	0.06	0.09	-0.25	0.44
7	Cash (LIBOR)	0.10	0.09	0.09	0.05	0.08	0.99	**1.00**	0.44	0.06	-0.02	0.17	0.16	0.10	0.15	0.19	0.06	0.09	-0.24	0.44
8	Core Fixed Income	0.00	0.00	0.00	-0.01	0.00	0.45	0.44	**1.00**	0.18	-0.01	0.05	0.05	0.01	0.05	0.06	0.00	0.00	-0.07	0.01
9	Multi-Asset Credit	0.60	0.56	0.64	0.60	0.63	0.06	0.06	0.18	**1.00**	0.70	0.22	0.29	0.39	0.22	0.33	0.01	0.02	0.67	0.10
10	Direct Hedge Funds	0.65	0.61	0.64	0.55	0.47	-0.02	-0.02	-0.01	0.70	**1.00**	0.21	0.29	0.41	0.22	0.33	0.01	0.01	0.58	0.06
11	Core Real Estate	0.35	0.33	0.37	0.35	0.33	0.17	0.17	0.05	0.22	0.21	**1.00**	0.96	0.32	0.19	0.85	0.02	0.02	0.11	0.10
12	Non-Core Real Estate	0.46	0.43	0.48	0.44	0.41	0.16	0.16	0.05	0.29	0.29	0.96	**1.00**	0.38	0.22	0.89	0.02	0.02	0.16	0.11
13	Private Equity	0.62	0.60	0.63	0.56	0.53	0.10	0.10	0.01	0.39	0.41	0.32	0.38	**1.00**	0.33	0.45	0.01	0.02	0.27	0.08
14	Infrastructure	0.35	0.34	0.35	0.31	0.30	0.15	0.15	0.05	0.22	0.22	0.19	0.22	0.33	**1.00**	0.64	0.01	0.02	0.13	0.09
15	Closed-End Real Assets	0.52	0.50	0.54	0.50	0.46	0.20	0.19	0.06	0.33	0.33	0.85	0.89	0.45	0.64	**1.00**	0.02	0.02	0.19	0.13
16	Farmland	0.02	0.01	0.02	0.02	0.01	0.06	0.06	0.00	0.01	0.01	0.02	0.02	0.01	0.01	0.02	**1.00**	0.33	-0.01	0.14
17	Timber	0.02	0.02	0.02	0.02	0.02	0.09	0.09	0.00	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.33	**1.00**	0.00	0.21
18	Private Debt	0.35	0.34	0.38	0.36	0.38	-0.25	-0.24	-0.07	0.67	0.58	0.11	0.16	0.27	0.13	0.19	-0.01	0.00	**1.00**	-0.01
19	Inflation	0.09	0.09	0.11	0.11	0.09	0.44	0.44	0.01	0.10	0.06	0.10	0.11	0.08	0.09	0.13	0.14	0.21	-0.01	**1.00**

Aon Investments Capital Market Assumptions

Explanation of Capital Market Assumptions—06/30/2023

The following capital market assumptions were developed by Aon's Global Asset Allocation Team and represent the long-term capital market outlook (i.e., 30 years) based on data at the end of the second quarter of 2023. The assumptions were developed using a building block approach, reflecting observable inflation and interest rate information available in the fixed income markets as well as Consensus Economics forecasts. Our long-term assumptions for other asset classes are based on historical results, current market characteristics, and our professional judgment. Expected returns are using Aon 30 Year Capital Market Assumptions as of 06/30/2023. CMAs contain projections about future returns on asset classes. Our CMA projections are designed to reflect the typical cost of implementing an investment program. Expected returns are calculated using weighted allocations of the underlying CMAs. Expected Returns are geometric (long-term compounded; rounded to the nearest decimal) assuming portfolio weights are rebalanced annually. Expected returns presented are models and do not represent the returns of an actual client account. Your actual returns will be reduced by your advisory fees and other expenses you may incur as a client. Aon's advisory fees are described in Part 2A of Aon's Form ADV. Not a guarantee of future results.

Inflation – Expected Level (2.3%)

Based on Consensus Economics long-term estimates and our near-term economic outlook, we expect U.S. consumer price inflation to be approximately 2.3% during the next 30 years.

Real Returns for Asset Classes

Fixed Income		
Cash	1.0%	Over the long run, we expect the real yield on cash and money market instruments to produce a real return of 1.0% in a moderate to low-inflationary environment.
TIPS	1.5%	We expect intermediate duration Treasury Inflation-Protected Securities to produce a real return of about 1.5%.
Core Fixed Income (i.e., Market Duration)	1.8%	We expect intermediate duration Treasuries to produce a real return of about 1.1%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 0.7%, resulting in a long-term real return of 1.8%.

Aon Investments Capital Market Assumptions

Explanation of Capital Market Assumptions—06/30/2023

Fixed Income		
Core Plus Bonds	2.2%	Modeled as 20% 5 duration gov't with real return of 1.1% and 80% 5 duration corporate bonds with real return of 2.5%.
Long Duration Bonds – Government and Credit	2.3%	We expect Treasuries with a duration of ~14 years to produce a real return of 1.9%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 0.4%, resulting in an expected real return of 2.3%.
Long Duration Bonds – Credit	3.0%	We expect Treasuries with a duration of ~12 years to produce a real return of 1.9%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 1.1%, resulting in an expected real return of 3.0%.
Long Duration Bonds – Government	1.9%	We expect Treasuries with a duration of ~16 years to produce a real return of 1.9% during the next 30 years.
High Yield Bonds	3.5%	We expect intermediate duration Treasuries to produce a real return of about 1.1%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 2.4%, resulting in an expected real return of 3.5%.
Bank Loans	3.6%	We expect LIBOR to produce a real return of about 1.7%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults) to be 1.9%, resulting in an expected real return of 3.6%.
Non-U.S. Developed Bonds: 50% Hedged	1.4%	We forecast real returns for non-US developed market bonds to be 1.4% over a 30-year period after adjusting for a 50% currency hedge. We assume a blend of one-third investment grade corporate bonds and two-thirds government bonds. We also produce assumptions for 0% hedged and 100% hedged non-US developed bonds.
Emerging Market Bonds (Sovereign; USD)	3.7%	We forecast real returns for emerging market sovereign bonds denominated in US dollars to be 3.7% over a 30-year period.
Emerging Market Bonds (Corporate; USD)	3.2%	We forecast real returns for emerging market corporate bonds denominated in US dollars to be 3.2% over a 30-year period.

Aon Investments Capital Market Assumptions

Explanation of Capital Market Assumptions—06/30/2023

Emerging Market Bonds (Sovereign; Local)	3.3%	We forecast real returns for emerging market sovereign bonds denominated in local currency to be 3.3% over a 30-year period.
Multi-Asset Credit (MAC)	4.5%	We assume real returns from beta exposure to high yield, bank loans and emerging market debt to add 3.7% plus 0.8% from alpha (net of fees) over a 30-year period.
Private Debt-Direct Lending	5.3%	The base building block is bank loans 3.6% + spread 1.1% (net of management fees and performance incentives). There is 100% leverage included in the assumption with the nominal cost of financing at LIBOR + 2.5%.
Equities		
Large Cap US. Equity	4.4%	This assumption is based on our 30-year outlook for large cap U.S. company dividends and real earnings growth. Adjustments are made for valuations as needed.
Small Cap U.S. Equity	4.9%	Adding a 0.5% return premium for small cap U.S. equity over large cap U.S. equity results in an expected real return of 4.9%. This return premium is theoretically justified by the higher risk inherent in small cap U.S. equity versus large cap U.S. equity and is also justified by historical data.
Global Equity (Developed & Emerging Markets	5.0%	We employ a building block process similar to the U.S. equity model using the developed and emerging markets that comprise the MSCI All-Country World Index. Our roll-up model produces an expected real return of 5.0% for global equity.
International (Non-U.S.) Equity, Developed Markets	4.9%	We employ a building block process similar to the U.S. equity model using the non-U.S. developed equity markets that comprise the MSCI EAFE Index.
Emerging Market Stocks	5.3%	We employ a building block process similar to the U.S. equity model using the non-U.S. emerging equity markets that comprise the MSCI Emerging Markets Index.
Equity Risk Insurance Premium Strategies-High Beta	3.5%	We expect real returns from 50% equity + 50% cash beta of 3.0% plus 0.5% insurance risk premium over the next 30 years.

Aon Investments Capital Market Assumptions

Explanation of Capital Market Assumptions—06/30/2023

Alternative Asset Classes		
Hedge Fund-of-Funds Universe	2.2%	The generic category “hedge funds” encompasses a wide range of strategies accessed through “fund-of-funds” vehicles. We also assume the median manager is selected and also allow for the additional costs associated with Fund-of-Funds management. A top-tier portfolio of funds (hedge fund-of-funds buy-list) could add an additional 1.2% in return at similar volatility based on alpha, lower fees and better risk management.
Hedge Fund-of-Funds Buy List	3.5%	The generic category of top-tier “hedge funds” encompasses a wide range of strategies accessed through “fund-of-funds” vehicles. We assume additional costs associated with Funds-of-Funds management. To use this category the funds must be buy rated or we advise on manager selection.
Broad Hedge Funds Universe	3.7%	Represents a diversified portfolio of direct hedge fund investments. This investment will tend to be less diversified than a typical “fund-of-funds” strategy as there will be fewer underlying managers and will not include the extra layer of fees found in a Fund-of-Funds structure.
Broad Hedge Funds Buy List	5.1%	Represents a diversified portfolio of top-tier direct hedge fund investments. This investment will tend to be less diversified than a typical “fund-of-funds” strategy as there will be fewer underlying managers and will not include the extra layer of fees found in a Fund-of-Funds structure. To use this category the funds must be buy rated or we advise on manager selection.
Core Real Estate	3.2%	Our real return assumption for core real estate is based a gross income of about 3.5%, management fees of roughly 1%, 25% leverage and future capital appreciation near the rate of inflation during the next 30 years. We assume a portfolio of equity real estate holdings that is diversified by property and by geographic region.
Non-Core Real Estate	5.3%	Core real estate is levered approximately 100% as the base building block for this assumption. We subtract financing costs for the leverage and 2% management costs. We also assume nominal alpha of 2% over core real estate. We assume a 50/50 mix of value-add and opportunistic investments.
U.S. REITs	4.4%	Our real return assumption for U.S. REITs is based on income of about 4.1% and future capital appreciation near the rate of inflation during the next 30 years. REITs are a sub-set of U.S. small/mid cap equity universe.

Aon Investments Capital Market Assumptions

Explanation of Capital Market Assumptions—06/30/2023

Commodities	3.9%	Our assumption is for a diversified portfolio of commodity futures contracts. Commodity futures returns are composed of three parts: spot price appreciation, collateral return, and roll return (positive or negative change implied by the shape of the future curve). We believe that spot prices will converge with CPI over the long run (i.e., 2.3%). Collateral is assumed to be LIBOR cash (1.7%). Also, we believe the roll effect will be near zero, resulting in a real return of about 3.9% for commodities.
Private Equity	7.3%	Our private equity assumption reflects a diversified fund of funds with exposure to buyouts, venture capital, distressed debt, and mezzanine debt.
Infrastructure	4.7%	Our infrastructure assumption is formulated using a cash flow-based approach that projects cash flows (on a diversified portfolio of assets) over a 30-year period. Income and capital growth as well as gearing levels, debt costs and terms, relevant tax and management expenses are all taken into consideration. Our approach produces an expected real return of 4.7% for infrastructure.
Equity Risk Insurance Premium Strategies-Low Beta	3.4%	We assume real returns from cash of 1.0% + 2.4% from alpha.
Alternative Risk Premia (ARP)	5.6%	Real return target LIBOR 1.7% plus 3.9% alpha (net of fees)
eLDI	3.2%	Combination of various long credit strategies (1/6 real estate debt, 1/3 securitized debt, 1/6 CMOs, 1/3 private placements)
Closed-end Real Assets	5.8%	Modeled as 50% Non-Core Real Estate and 50% Infrastructure

Volatility/Correlation Assumptions

Assumed volatilities are formulated with reference to implied volatilities priced into option contracts of various terms, as well as with regard to historical volatility levels. For asset classes which are not marked to market (for example real estate), we "de-smooth" historical returns before calculating volatilities. Importantly, we consider expected volatility trends in the future – in recent years we assumed the re-emergence of an economic cycle and a loss of confidence in central bankers would lead to an increase in volatility. Correlation assumptions are generally similar to actual historical results; however, we do make adjustments to reflect our forward-looking views as well as current market fundamentals.

2023 Horizon Survey Results

What is the Horizon Survey?

Since 2010, Horizon Actuarial Services, LLC has conducted a capital market assumption survey of investment firms to aid in determining reasonable assumptions for a pension plan's expected return on assets

- While Aon does not seek to change our approach based on how we stack up to peers, it is a helpful double-check to make sure we are not too far off from others in the industry

For the 2023 survey, 42 investment advisors participated.

How does Aon compare to the 2023 survey results?

Aon Investments' 2023 10-year forecast assumptions (as of March 31, 2023)

- ***Equities:*** approximately middle of the pack for U.S. and Non-U.S. Developed equities; lower for Non-U.S. Emerging equities
- ***Fixed Income:*** approximately middle of the pack relative to the survey's median level; lower for TIPS; higher for Long Duration Credit and Non-US Debt - Emerging
- ***Alternatives:*** approximately middle of the pack relative to the survey's median level; higher for Commodities and Private Debt

Aon Investments vs. Peers (2023 Horizon Survey)

10-Year Forecast

	Horizon Survey		Aon Investments		Difference	
	10 Year Horizon		10 Year Forecasts		Aon Investments – Horizon Survey	
Asset Class	**Expected Return**	**Expected Risk**	**Expected Return**	**Expected Risk**	**Expected Return**	**Expected Risk**
U.S. Equity - Large Cap	6.9%	16.4%	6.6%	17.0%	-0.3%	0.6%
U.S. Equity - Small/Mid Cap	7.2%	20.2%	6.8%	23.0%	-0.4%	2.8%
Non-U.S. Equity – Developed	7.4%	18.3%	7.1%	20.5%	-0.3%	2.2%
Non-U.S. Equity – Emerging	7.9%	24.3%	7.3%	24.0%	-0.6%	-0.3%
U.S. Fixed Income – Core	4.7%	5.5%	4.3%	5.0%	-0.4%	-0.5%
U.S. Fixed Income - Long Duration Corp	4.9%	10.4%	5.5%	10.5%	0.6%	0.1%
U.S. Fixed Income - High Yield	6.4%	9.9%	6.0%	10.5%	-0.4%	0.6%
Non-U.S. Fixed Income – Developed	3.3%	7.2%	3.6%	6.0%	0.3%	-1.2%
Non-U.S. Fixed Income – Emerging	6.3%	11.3%	7.1%	11.0%	0.8%	-0.3%
Treasuries (Cash Equivalents)	3.3%	1.3%	3.5%	1.5%	0.2%	0.2%
TIPS (Inflation-Protected)	4.1%	5.6%	3.6%	4.5%	-0.5%	-1.1%
Real Estate	6.1%	17.6%	5.6%	15.0%	-0.5%	-2.6%
Hedge Funds	5.9%	8.1%	6.2%	9.0%	0.3%	0.9%
Commodities	4.9%	17.3%	6.5%	17.0%	1.6%	-0.3%
Infrastructure	6.9%	17.0%	7.1%	14.5%	0.2%	-2.5%
Private Equity	9.6%	22.3%	9.1%	25.0%	-0.5%	2.8%
Private Debt	8.1%	11.4%	9.0%	16.5%	0.9%	5.1%
Inflation	2.5%	2.1%	2.3%	1.5%	-0.2%	-0.6%

Notes (Horizon Survey):

Source: Horizon Actuarial survey of 2023 capital market assumptions from 42 independent investment advisors

Expected returns are median annualized (geometric).

Notes (Aon Investments' Forecasts):

Aon Investments' Forecasts are for Q2 2023

- US Equity - Small/Mid Cap forecasts represents Aon Investments' forecasts for US Small Cap
- US Fixed Income - Long Duration forecasts represents Aon Investments' forecasts for Long Duration Credit
- Non-US Fixed Income - Developed forecasts represents Aon Investments' forecasts for Non-US Fixed Income - Developed (50% Hedged)
- Non-US Fixed Income - Emerging forecasts represents Aon Investments' forecasts for Emerging Market Bonds - Sovereign USD
- Real Estate forecasts represents Aon Investments' forecasts for Core Real Estate
- Hedge Fund forecasts represents Aon Investments' forecasts for Direct Hedge Funds (Universe)

Aon Investments' expected returns are annualized over 10-years as of 2Q 2023 (3/31/2023). CMAs contain projections about future returns on asset classes. Our CMA projections are designed to reflect the typical cost of implementing an investment program. Not a guarantee of future results. Additional information regarding our capital market assumptions can be made available upon request.

Leading Methodologies & Reasons for Differences

Leading Methodologies

- Building block
- Global capital asset pricing model (Global CAPM)
- Surveys
- Historical data (as a guide to future)
- Black-Litterman (combination of building block and CAPM)

Reasons for differences

- Methodology
- Time horizon
- Timing of assumptions
- Arithmetic vs. geometric forecasts*
- Alpha (active management)*
- Inflation
- Investment Fees*
- Asset class definition

* While some firms in the Horizon survey responded with arithmetic forecasts, the results have been converted to geometric forecasts for comparison purposes. Additionally, the return expectations included in the Horizon survey are generally market returns that do not reflect active management. Returns for asset classes where passive investments are not available (e.g., hedge funds and private equity) are net of fees.

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