Board of Retirement Regular Meeting
Sacramento County Employees' Retirement System

Agenda Item 13

MEETING DATE: September 18, 2024

SUBJECT: Liquidity Study

		Deliberation	Receive
SUBMITTED FOR:	__ Consent	___ and Action	__X__ and File

RECOMMENDATION

Receive and file the liquidity study and cash-flow profile of SCERS' portfolio, as presented by Verus.

PURPOSE

This agenda item supports SCERS' Cash Management Policy, which calls for Staff and SCERS' general investment consultant to update the Board on SCERS' liquidity profile annually.

DISCUSSION:

Verus will be presenting the results of the annual liquidity study for SCERS. A liquidity study provides an understanding of the plan's overall cash flow profile, and insight into how the plan can address future cash flow needs. The analysis is particularly useful given SCERS' meaningful private markets exposure, which is illiquid. Past studies have determined that while SCERS has negative cash flows, due to benefit payments exceeding contributions, its overall liquidity profile remains healthy.

Verus' approach to liquidity studies analyzes a plan's liquidity by comparing a plan's liquid assets and cash inflows to a plan's cash outflows. Within the study, Verus measures SCERS' liquidity over a 5-year period.

Cash inflows include:
- Liquid financial assets
- Employer and employee contributions
- Investment income
- Distributions from illiquid assets (i.e., private equity; private credit; real assets; real estate)

Cash outflows include:
- Member benefit payments

- Capital calls for illiquid assets
- Plan expenses

Verus generates two measures for liquidity, a (1) Liquidity Coverage Ratio (LCR) and a (2) Modified Liquidity Coverage Ratio (MLCR). Both ratios measure whether an institutional investor has sufficient cash flows over a 5-year period. The MLCR is a more conservative measure, as it includes only liquid diversifying assets in its measure, whereas the LCR includes both liquid risk assets and liquid diversifying assets (page 3 of the Verus presentation). The results of the liquidity study show that SCERS has an LCR of 2.47, compared to the 2023 measure of 2.50. The MLCR of 1.34 compares to the 2023 measure of 1.38.

The analysis demonstrates that SCERS is in a healthy liquidity position. The LCR is above the preferred target of 2.0, and the MLCR is above the preferred target of above 1.0. The measures should not be viewed in isolation, as both the LCR and MLCR complement one another. SCERS' LCR rating of 2.47 means that SCERS has ample liquidity within liquid risk assets that can be accessed through rebalancing to account for any potential deterioration in the MLCR if there was an insufficient level of liquid diversifying assets.

The data from the liquidity study will be used as an input in the upcoming asset liability modeling (ALM) study, which will help determine the level of illiquid private market assets the plan can maintain while ensuring sufficient liquidity to meet fund obligations.

ATTACHMENTS

- Board Order
- Verus Liquidity Assessment Presentation

Prepared by: Reviewed by:

/s/   /s/

_____   _____
Steve Davis   Eric Stern
Chief Investment Officer   Chief Executive Officer

Before the Board of Retirement
September 18, 2024

AGENDA ITEM:

Liquidity Study

THE BOARD OF RETIREMENT hereby accepts the recommendation of staff to receive and file the liquidity study and cash-flow profile of SCERS' portfolio, as presented by Verus.

I HEREBY CERTIFY that the above order was passed and adopted on September 18, 2024 by the following vote of the Board of Retirement, to wit:

AYES:

NOES:

ABSENT:

ABSTAIN:

ALTERNATES:
(Present but not voting)

_____
Board President

_____
Eric Stern
Chief Executive Officer and
Board Secretary

Verus

Introduction

Annual Liquidity Study

— SCERS' Cash Management Policy calls for an annual update on the Plan's liquidity profile

— Liquidity study is conducted by general investment consultant, Verus

Purpose

— Understanding of the Plan's overall cash flow profile

■ Investment and actuarial data as inputs

— Insight into how the Plan can address future cash flow needs

Verus

SCERS Objectives and Characteristics

Defined Benefit Plan

OBJECTIVES

1. Achieve 6.75% Long Term Rate of Return Assumption

2. Achieve the return as efficiently as possible

3. *Always have enough cash and available liquidity on hand to fund benefit payments and plan commitments*

PLAN CHARACTERISTICS

1. Cash flow negative (benefit payments > contributions)

2. Meaningful exposure to illiquid private market investments

Managing liquidity risk is a primary imperative for the trustees

SCERS' liquidity assumptions
By asset class

Liquidity Grouping	Asset Class	Policy Allocation	Days to Convert to Cash
Liquid Diversifying Assets	Cash	2.0	1
	US Treasury	4.0	1-3
	Core Plus Fixed Income	12.0	3
	Liquid Real Return	1.0	3
	Total Liquid Diversifying	**19.0**	
Liquid Risk Assets	US Large	18.0	3
	US Small	2.0	3
	International Developed	9.0	3
	International Developed Small	2.0	3
	Emerging Markets	5.0	3
	Global Equity	4.0	3
	High Yield Corp. Credit	1.0	30
	Bank Loans	1.0	30
	Hedge Funds	7.0	30-90
	Total Liquid Growth	**49.0**	
Illiquid Risk Assets	Core Real Estate	6.0	90+
	Private Equity	11.0	Illiquid
	Private Credit	5.0	Illiquid
	Value Add Real Estate	1.5	Illiquid
	Opportunistic Real Estate	1.5	Illiquid
	Private Real Assets	7.0	Illiquid
	Total Illiquid	**32.0**	

The "modified LCR" reflects only the liquid diversifying asset classes

Verus

SCERS' baseline cash flow projection

Calendar Year Beginning	Market Value of Assets (BOY)	Contributions	Benefit Payments & Admin Expenses	Net Cash Flow (w/o Private Markets)		Illiquid Distributions	Illiquid Capital Calls	Net Cash Flow (w/ Private Markets)	
				Net Cash Flow %	Net Cash Flow ($)			Net Cash Flow %	Net Cash Flow ($)
2024	12,917,000,000	526,000,000	761,000,000	-1.82%	-235,000,000	816,000,000	630,000,000	-0.38%	-49,000,000
2025	13,620,000,000	531,000,000	795,000,000	-1.94%	-264,000,000	988,000,000	803,000,000	-0.58%	-79,000,000
2026	14,344,000,000	539,000,000	835,000,000	-2.06%	-296,000,000	994,000,000	869,000,000	-1.19%	-171,000,000
2027	15,088,000,000	546,000,000	875,000,000	-2.18%	-329,000,000	996,000,000	768,000,000	-0.67%	-101,000,000
2028	15,851,000,000	562,000,000	915,000,000	-2.23%	-353,000,000	934,000,000	801,000,000	-1.39%	-220,000,000
2029	16,644,000,000	581,000,000	956,000,000	-2.25%	-375,000,000	946,000,000	802,000,000	-1.39%	-231,000,000
2030	17,473,000,000	592,000,000	998,000,000	-2.32%	-406,000,000	1,019,000,000	810,000,000	-1.13%	-197,000,000
2031	18,330,000,000	603,000,000	1,040,000,000	-2.38%	-437,000,000	1,068,000,000	807,000,000	-0.96%	-176,000,000
2032	19,217,000,000	615,000,000	1,082,000,000	-2.43%	-467,000,000	1,103,000,000	803,000,000	-0.87%	-167,000,000

Under the forecasted return assumption of 7.4%, SCERS annual net cash flow position is expected to grow increasingly negative, from (1.8%) to (2.4%) over the next nine years
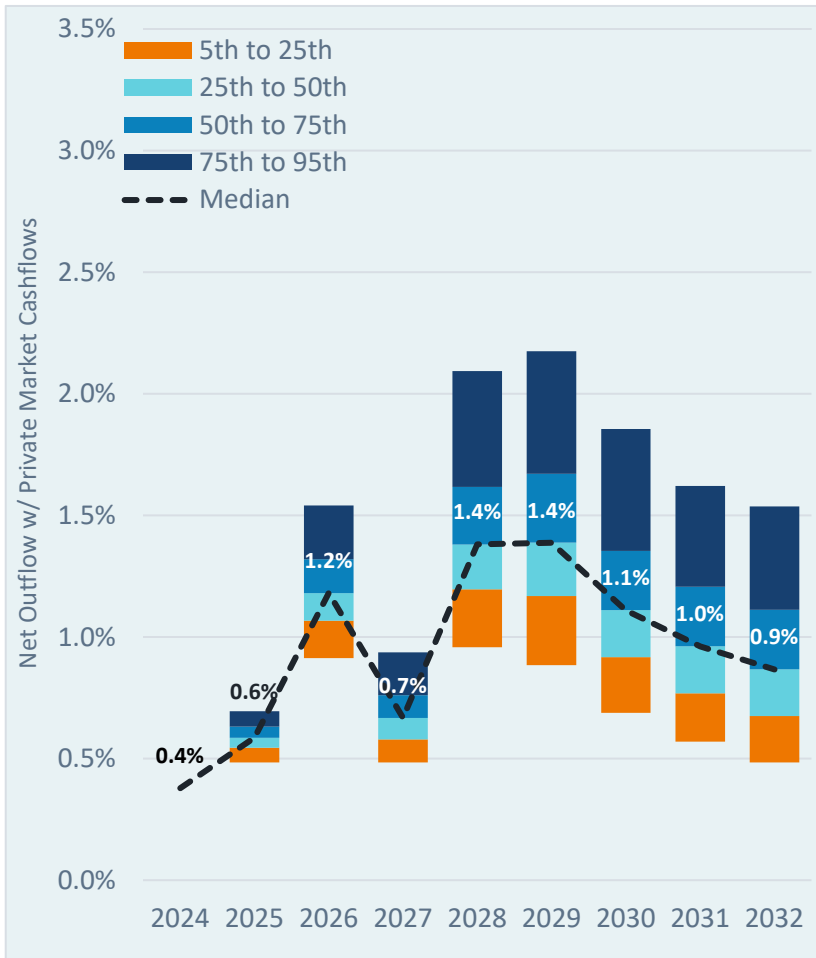
The cashflow position is expected to improve when including private market investments but remains slightly negative.

Actuarial information provided by Segal. Private market projections for capital calls and distributions provided by Cliffwater and Townsend.
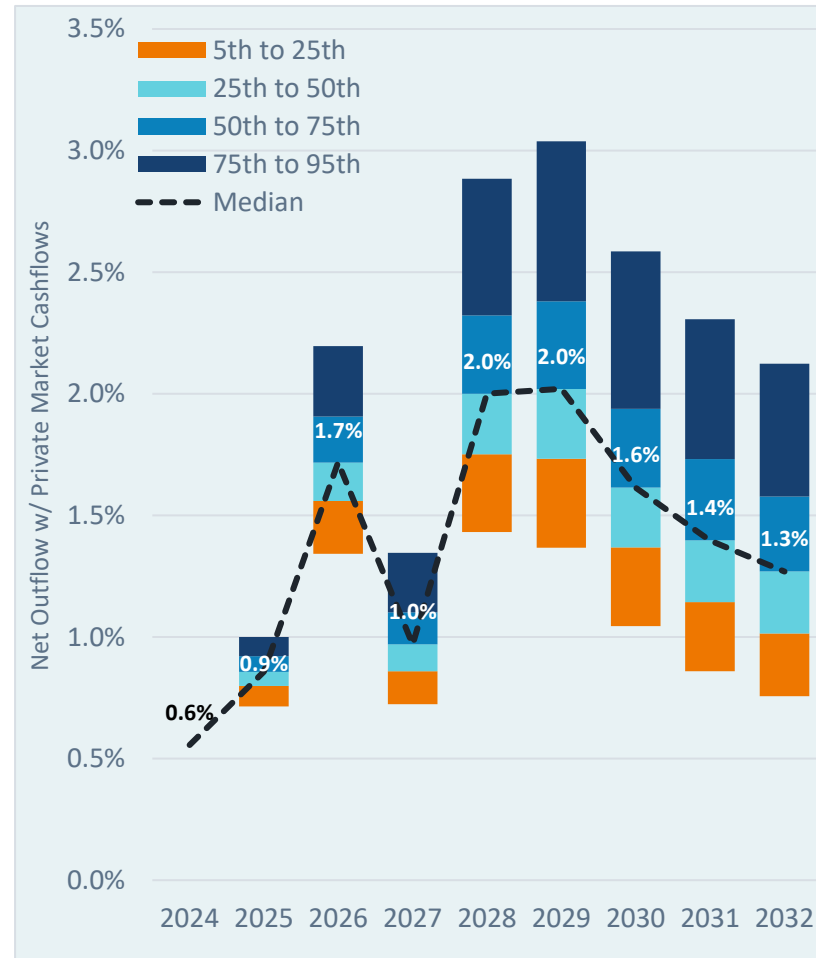
Liquidity needed to meet cash flow needs

% OF <u>TOTAL</u> PORTFOLIO LIQUIDATED FOR CF NEEDS

% OF <u>LIQUID</u> PORTFOLIO LIQUIDATED FOR CF NEEDS

In the most adverse return scenarios, net outflows grow to 2.2% of the total portfolio and 3.0% of the liquid portfolio, when reflecting private market cashflows.

Actuarial information provided by Segal. Private market projections for capital calls and distributions provided by Cliffwater and Townsend. Stochastic projections based on Verus 2024 CMAs' and SCERS' policy allocation.

Liquidity coverage ratio (LCR)

Will a plan need to sell illiquid assets to cover cash outflows?

$$Liquidity\ Coverage\ Ratio\ (LCR) = \frac{\begin{array}{c} Starting\ Liquid\ Financial\ Assets \\ \sum(Distributions\ from\ Illiquid\ Assets) \\ \sum(Contributions) \\ \sum(Liquid\ Investment\ Return) \end{array}}{\begin{array}{c} \sum Benefit\ Payments \\ \sum Administrative\ Expenses \\ \sum(Capital\ Calls\ for\ Illiquid\ Assets) \end{array}}$$

Modeled stochastically

LCR Value	Implication
<1	Yes
>1	No

Verus

SCERS' LCR: 2024 vs. 2023
Deterministic scenario

LCR 2024

Liquidity Available	Liquid Assets	8,783,000,000
	Private Market Distributions	4,728,000,000
	Employer + Employee Contributions	2,703,000,000
	Investment Income	3,648,000,000
	Total 5-Year Available Liquidity	**19,862,000,000**
Liquidity Needs	Benefit Payments + Plan Expenses	4,181,000,000
	Private Market Capital Calls	3,870,000,000
	Total 5-Year Liquidity Needs	**8,051,000,000**
	5-Year LCR	**2.47**

LCR 2023

Liquidity Available	Liquid Assets	8,240,000,000
	Private Market Distributions	4,686,000,000
	Employer + Employee Contributions	2,467,000,000
	Investment Income	3,487,000,000
	Total 5-Year Available Liquidity	**18,880,000,000**
Liquidity Needs	Benefit Payments + Plan Expenses	3,973,000,000
	Private Market Capital Calls	3,583,000,000
	Total 5-Year Liquidity Needs	**7,556,000,000**
	5-Year LCR	**2.50**

The 5-year LCR is generally in-line with the prior year and shows the Plan continues to have sufficient liquidity.

The table shows the LCR under a deterministic scenario where the liquid portfolio earns the 7.4% expected return of the total portfolio.[1]

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[1]*Median LCRs shown on stochastic analysis page are below deterministic LCR on this page because it reflects only liquid asset classes, which have a lower expected return than the overall portfolio.*

LCR analysis

DISTRIBUTION OF 5-YEAR LCR OUTCOMES
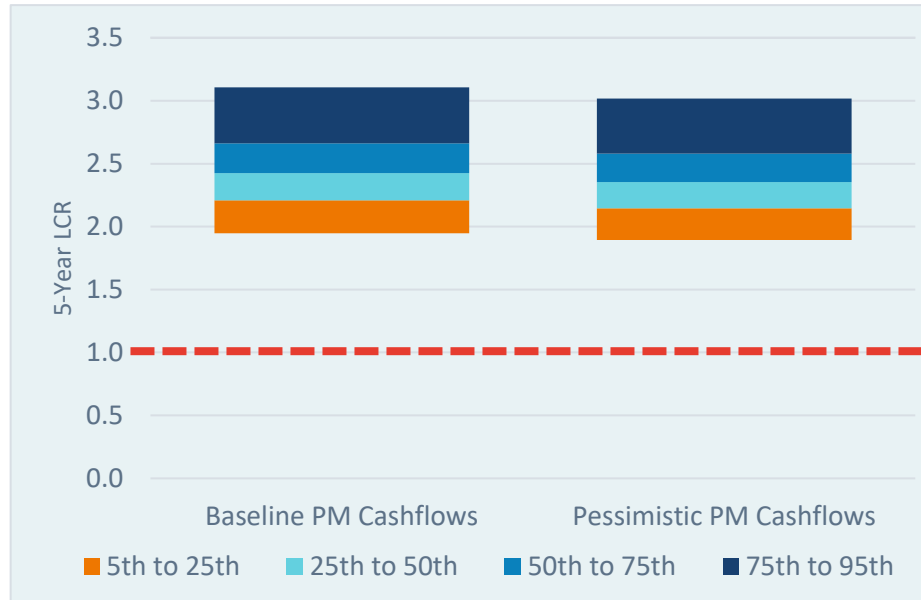
The "baseline private market cashflow" scenario assumes the illiquid net cashflows are as expected. The "pessimistic private market cashflow" scenario assumes the illiquid distributions are 10% lower than expected.

The Plan is expected to have sufficient liquidity to meet cashflow needs over the next 10 years, even in adverse return and private market cashflow scenarios.

5-Year LCR	Baseline PM Cashflows	Pessimistic PM Cashflows
Percentile		
95% Percentile	3.11	3.02
75% Percentile	2.66	2.58
50% Percentile	2.43	2.35
25% Percentile	2.21	2.14
5% Percentile	1.95	1.89
Probability of Liquidity Event	**<0.1%**	**<0.1%**

Based on 1,000 simulations of liquidity coverage ratio. See appendix for additional details.

Verus

SCERS' Modified LCR: 2024 vs. 2023

Deterministic scenario

LCR 2024

Diversifying Liquidity Available	Liquid Assets	2,454,000,000
	Private Market Distributions	4,728,000,000
	Employer + Employee Contributions	2,703,000,000
	Investment Income	933,000,000
	Total 5-Year Available Liquidity	**10,818,000,000**
Liquidity Needs	Benefit Payments + Plan Expenses	4,181,000,000
	Private Market Capital Calls	3,870,000,000
	Total 5-Year Liquidity Needs	**8,051,000,000**
	5-Year Modified LCR	**1.34**

LCR 2023

Diversifying Liquidity Available	Liquid Assets	2,302,000,000
	Private Market Distributions	4,686,000,000
	Employer + Employee Contributions	2,467,000,000
	Investment Income	940,000,000
	Total 5-Year Available Liquidity	**10,395,000,000**
Liquidity Needs	Benefit Payments + Plan Expenses	3,973,000,000
	Private Market Capital Calls	3,583,000,000
	Total 5-Year Liquidity Needs	**7,556,000,000**
	5-Year Modified LCR	**1.38**

The 5-year modified LCR is generally in-line with the prior year and shows the Plan continues to have sufficient liquidity, even when only considering the portfolio's most defensive asset classes.

The table shows the LCR under a deterministic scenario where the liquid diversifying portfolio earns the 7.4% expected return of the total portfolio.[1]

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[1]*Median LCRs shown on stochastic analysis page are below deterministic LCR on this page because it reflects only diversifying liquid asset classes, which have a lower expected return than the overall portfolio.*

Modified LCR analysis

DISTRIBUTION OF 5-YEAR MODIFIED LCR OUTCOMES
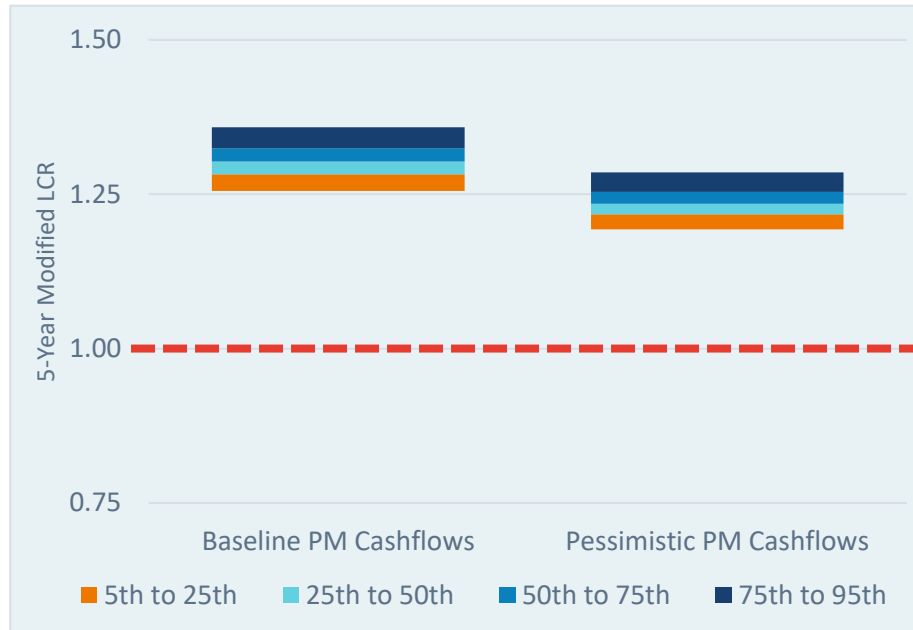
The modified LCR measures the ability of the diversifying liquidity allocations to meet cashflow needs.

The diversifying liquidity allocations are expected to provide sufficient liquidity over the next ten years, even in adverse return and private market cashflow scenarios.

5-Year Modified LCR	Baseline PM Cashflows	Pessimistic PM Cashflows
Percentile		
95% Percentile	1.36	1.29
75% Percentile	1.32	1.25
50% Percentile	1.30	1.23
25% Percentile	1.28	1.22
5% Percentile	1.26	1.19
Probability of Liquidity Event	**<0.1%**	**<0.1%**

Based on 1,000 simulations of liquidity coverage ratio. See appendix for additional details.

Summary

— SCERS has a healthy liquidity profile that is in line with the prior year assessment

- The analysis shows that SCERS should expect to have sufficient liquidity in its defensive asset classes alone to meet cashflow needs over a 5-year period.

- This remains true in adverse return and private market cashflow scenarios.

— The cash flow projections show an increasingly negative cashflow position which we expect to continue as the demographics of the Plan matures and approaches full funding.

- Therefore, monitoring liquidity annually remains prudent.

Appendix

Liquidity assessment documentation

GENERAL INPUTS, ASSUMPTIONS, AND METHODS

Starting Asset Value	$12.916.830,147 as of 12/31/2023
Capital market assumptions	Verus' 2024 CMAs (details in Appendix)
Rebalancing methodology	The liquid portfolio is rebalanced after every projection year so that each liquid asset class makes up its target weight of the total liquid portfolio.

CASHFLOW ASSUMPTIONS[1]

	Contributions	Benefit Payments	Illiquid Distributions	Illiquid Capital Calls
2024	525,657,746	761,079,891	499,064,639	724,203,599
2025	530,803,643	795,184,316	498,122,007	755,010,380
2026	539,102,075	834,881,530	489,461,016	792,793,551
2027	545,924,874	874,931,988	487,306,527	831,116,879
2028	561,797,001	915,310,906	492,978,019	869,862,323
2029	581,017,604	956,284,027	497,592,272	908,956,013
2030	592,329,083	998,058,413	511,417,950	948,307,594
2031	603,350,111	1,039,975,696	529,605,089	988,094,933
2032	614,607,020	1,082,060,454	540,598,279	1,028,023,369
2033	620,590,176	1,123,519,879		

Actuarial information provided by Segal. Private market projections for capital calls and distributions provided by Cliffwater and Townsend.

Methodology

CORE INPUTS

— We use a fundamental building block approach based on several inputs, including historical data and academic research to create asset class return forecasts.
— For most asset classes, we use the long-term historical volatility after adjusting for autocorrelation.
— Correlations between asset classes are calculated based on the last 10 years. For illiquid assets, such as private equity and private real estate, we use BarraOne correlation estimates.

Asset	Return Methodology	Volatility Methodology*
Inflation	25% weight to the University of Michigan Survey 5-10 year ahead inflation expectation and the Survey of Professional Forecasters (Fed Survey), and the remaining 50% to the market's expectation for inflation as observed through the 10-year TIPS breakeven rate	-
Cash	1/3 * current federal funds rate + 1/3 * U.S. 10-year Treasury yield + 1/3 * Federal Reserve long-term interest rate target	Long-term volatility
Bonds	Nominal bonds: current yield; Real bonds: real yield + inflation forecast	Long-term volatility
International Bonds	Current yield	Long-term volatility
Credit	Current option-adjusted spread + U.S. 10-year Treasury – effective default rate	Long-term volatility
International Credit	Current option-adjusted spread + foreign 10-year Treasury – effective default rate	Long-term volatility
Private Credit	Levered gross return (SOFR + spread + original issuance discounts) – management fees – carried interest	Estimated volatility
Equity	Current yield + real earnings growth (historical average) + inflation on earnings (inflation forecast) + expected P/E change	Long-term volatility
Intl Developed Equity	Current yield + real earnings growth (historical average) + inflation on earnings (intl. inflation forecast) + expected P/E change	Long-term volatility
Private Equity**	US large cap domestic equity forecast * 1.85 beta adjustment	1.2 * Long-term volatility of U.S. small cap
Commodities	Collateral return (cash) + spot return (inflation forecast) + roll return (assumed to be zero)	Long-term volatility
Hedge Funds	Return coming from traditional betas + 15-year historical idiosyncratic return	Long-term volatility
Core Real Estate	Cap rate + real income growth – capex + inflation forecast	65% of REIT volatility
REITs	Core real estate	Long-term volatility
Value-Add Real Estate	Core real estate + 2%	Volatility to produce Sharpe Ratio (g) equal to core real estate
Opportunistic Real Estate	Core real estate + 3%	Volatility to produce Sharpe Ratio (g) equal to core real estate
Infrastructure	Current yield + real income growth + inflation on earnings (inflation forecast)	Long-term volatility
Risk Parity	Modeled as the 10-year return expectations of a *representative selection of Risk Parity strategies*	Target volatility

Long-term historical volatility data is adjusted for autocorrelation (see Appendix)

**Private Equity is modeled assuming an 8.0% floor for expected return, and a 3% return premium ceiling over U.S. Large Cap Equity. These adjustments are in place to recognize that higher interest rates (cost of leverage) act as a drag on expected Private Equity returns but that this drag has had limits historically, and to recognize that future Private Equity total universe performance is likely to be more anchored to public equity performance than in past times, given a more competitive market environment*

10-year return & risk assumptions

Asset Class	Index Proxy	Ten Year Return Forecast		Standard Deviation Forecast	Sharpe Ratio Forecast (g)	Sharpe Ratio Forecast (a)	10-Year Historical Sharpe Ratio (g)	10-Year Historical Sharpe Ratio (a)
		Geometric	Arithmetic					
Equities								
U.S. Large	S&P 500	5.9%	7.0%	15.5%	0.12	0.19	0.72	0.75
U.S. Small	Russell 2000	6.2%	8.2%	21.4%	0.10	0.19	0.28	0.37
International Developed	MSCI EAFE	8.1%	9.5%	17.6%	0.23	0.31	0.18	0.25
International Small	MSCI EAFE Small Cap	8.8%	10.9%	21.7%	0.22	0.31	0.20	0.27
Emerging Markets	MSCI EM	8.8%	11.4%	24.6%	0.19	0.30	0.06	0.14
Global Equity	MSCI ACWI	6.9%	8.2%	16.7%	0.17	0.25	0.44	0.50
Global Equity ex USA	MSCI ACWI ex USA	8.5%	10.2%	19.5%	0.23	0.31	0.15	0.22
Private Equity	CA Private Equity	8.0%	10.9%	25.6%	0.15	0.27	-	-
Private Equity Direct	CA Private Equity	9.0%	11.8%	25.6%	0.19	0.30	-	-
Private Equity (FoF)	CA Private Equity	7.0%	9.9%	25.6%	0.11	0.23	-	-
Fixed Income								
Cash	30 Day T-Bills	4.1%	4.1%	1.1%	-	-	-	-
U.S. TIPS	Bloomberg U.S. TIPS 5-10	4.7%	4.8%	5.5%	0.11	0.13	0.13	0.15
Non-U.S. Inflation Linked Bonds	Bbg World Govt. Inflation Linked Bond ex U.S.	3.9%	4.2%	7.4%	(0.03)	0.01	(0.15)	(0.11)
U.S. Treasury	Bloomberg Treasury 7-10 Year	4.6%	4.8%	7.1%	0.07	0.10	(0.05)	(0.02)
Long U.S. Treasury	Bloomberg Treasury 20+ Year	4.7%	5.5%	13.2%	0.05	0.11	0.00	0.25
Global Sovereign ex U.S.	Bloomberg Global Treasury ex U.S.	2.7%	3.2%	9.9%	(0.14)	(0.09)	(0.40)	(0.36)
Global Aggregate	Bloomberg Global Aggregate	4.1%	4.3%	6.6%	0.00	0.03	(0.27)	(0.24)
Core Fixed Income	Bloomberg U.S. Aggregate Bond	4.9%	5.0%	4.8%	0.17	0.19	0.00	0.02
Core Plus Fixed Income	Bloomberg U.S. Universal	5.2%	5.3%	4.5%	0.24	0.27	0.07	0.09
Investment Grade Corp. Credit	Bloomberg U.S. Corporate Investment Grade	5.7%	6.0%	8.4%	0.19	0.23	0.17	0.20
Short-Term Gov't/Credit	Bloomberg U.S. Gov't/Credit 1-3 Year	4.7%	4.8%	3.6%	0.17	0.19	(0.07)	(0.07)
Short-Term Credit	Bloomberg Credit 1-3 Year	5.1%	5.2%	3.6%	0.28	0.31	0.23	0.24
Long-Term Credit	Bloomberg Long U.S. Credit	5.7%	6.3%	10.9%	0.15	0.20	0.15	0.20
High Yield Corp. Credit	Bloomberg U.S. Corporate High Yield	6.6%	7.2%	11.0%	0.23	0.28	0.42	0.44
Bank Loans	Morningstar LSTA Leveraged Loan	8.0%	8.4%	9.0%	0.43	0.48	0.58	0.59
Global Credit	Bloomberg Global Credit	5.1%	5.4%	7.7%	0.13	0.17	0.01	0.04
Emerging Markets Debt (Hard)	JPM EMBI Global Diversified	8.7%	9.2%	10.6%	0.43	0.48	0.15	0.20
Emerging Markets Debt (Local)	JPM GBI-EM Global Diversified	6.5%	7.2%	12.2%	0.20	0.25	(0.17)	(0.12)
Private Credit	Morningstar LSTA Leveraged Loan	9.2%	9.8%	11.9%	0.43	0.48	-	-
Private Credit (Direct Lending - Unlevered)	Morningstar LSTA Leveraged Loan	8.0%	8.4%	9.0%	0.43	0.48	-	-
Private Credit (Direct Lending - Levered)	Morningstar LSTA Leveraged Loan	9.5%	10.2%	12.6%	0.43	0.48	-	-
Private Credit (Credit Opportunities)	Morningstar LSTA Leveraged Loan	9.6%	10.3%	12.8%	0.43	0.48	-	-
Private Credit (Junior Capital / Mezzanine)	Morningstar LSTA Leveraged Loan	9.0%	9.6%	11.4%	0.43	0.48	-	-
Private Credit (Distressed)	Morningstar LSTA Leveraged Loan	9.1%	12.7%	29.1%	0.17	0.30	-	-

Investors wishing to produce expected geometric return forecasts for their portfolios should use the arithmetic return forecasts provided here as inputs into that calculation, rather than the single-asset-class geometric return forecasts. This is the industry standard approach, but requires a complex explanation only a heavy quant could love, so we have chosen not to provide further details in this document – we will happily provide those details to any readers of this who are interested.

10-year return & risk assumptions

Asset Class	Index Proxy	Ten Year Return Forecast		Standard Deviation Forecast	Sharpe Ratio Forecast (g)	Sharpe Ratio Forecast (a)	10-Year Historical Sharpe Ratio (g)	10-Year Historical Sharpe Ratio (a)
		Geometric	Arithmetic					
Other								
Commodities	Bloomberg Commodity	6.6%	7.8%	16.1%	0.16	0.23	(0.13)	(0.06)
Hedge Funds	HFRI Fund Weighted Composite	4.3%	4.6%	7.5%	0.03	0.07	0.48	0.49
Hedge Fund of Funds	HFRI Fund of Funds Composite	3.3%	3.6%	7.5%	(0.11)	(0.07)	-	-
Hedge Funds (Equity Style)	Custom HFRI Benchmark Mix*	7.2%	8.1%	14.1%	0.22	0.28	-	-
Hedge Funds (Credit Style)	Custom HFRI Benchmark Mix*	7.3%	7.7%	9.4%	0.34	0.38	-	-
Hedge Funds (Asymmetric Style)	Custom HFRI Benchmark Mix*	5.4%	5.6%	6.4%	0.20	0.23	-	-
Real Estate Debt	Bloomberg CMBS IG	7.4%	7.7%	7.5%	0.44	0.48	0.14	0.15
Core Real Estate	NCREIF Property	6.8%	7.5%	12.5%	0.22	0.27	-	-
Value-Add Real Estate	NCREIF Property + 200bps	8.8%	9.9%	15.4%	0.31	0.38	-	-
Opportunistic Real Estate	NCREIF Property + 300bps	9.8%	11.7%	21.1%	0.27	0.36	-	-
REITs	Wilshire REIT	6.8%	8.5%	19.2%	0.14	0.23	0.35	0.42
Global Infrastructure	S&P Global Infrastructure	8.4%	9.7%	16.9%	0.25	0.33	0.20	0.28
Risk Parity**	S&P Risk Parity 10% Vol Index	7.2%	7.8%	10.0%	0.31	0.37	-	-
Currency Beta	MSCI Currency Factor Index	2.3%	2.4%	3.4%	(0.52)	(0.49)	(0.06)	0.21
Inflation		2.5%	-	-	-	-	-	-

Investors wishing to produce expected geometric return forecasts for their portfolios should use the arithmetic return forecasts provided here as inputs into that calculation, rather than the single-asset-class geometric return forecasts. This is the industry standard approach, but requires a complex explanation only a heavy quant could love, so we have chosen not to provide further details in this document – we will happily provide those details to any readers of this who are interested.

*To represent hedge fund styles, we use a combination of HFRI benchmarks: Equity Style = 33% HFRI Fundamental Growth, 33% HFRI Fundamental Value, 33% HFRI Activist. Credit Style = 20% HFRI Distressed/Restructuring, 20% HFRI Credit Arbitrage, 20% HFRI Fixed Income-Corporate, 20% HFRI Fixed Income-Convertible Arbitrage, 20% HFRI Fixed Income-Asset Backed. Asymmetric Style = 50% HFRI Relative Value, 50% HFRI Macro

**The Risk Parity forecast shown here assumes a 10% target volatility strategy. We recommend customizing this forecast to the target volatility specifications of the risk parity strategy that an investor wishes to model. Please speak with your Verus consultant for customization needs.

Correlation assumptions

	Cash	US Large	US Small	Intl Large	Intl Small	EM	Global Equity	PE	US TIPS	US Treasury	Global Sovereign ex-US	US Core	Core Plus	Short-Term Gov't/Credit	Short-Term Credit	Long-Term Credit	US HY	Bank Loans	Global Credit	EMD USD	EMD Local	Commodities	Hedge Funds	Real Estate	REITs	Infrastructure	Currency Beta	Risk Parity
Cash	1.0																											
US Large	-0.1	1.0																										
US Small	-0.2	0.9	1.0																									
Intl Large	-0.1	0.9	0.8	1.0																								
Intl Small	-0.1	0.9	0.8	1.0	1.0																							
EM	-0.1	0.7	0.6	0.8	0.8	1.0																						
Global Equity	-0.1	1.0	0.9	0.9	0.9	0.8	1.0																					
PE	-0.2	0.7	0.7	0.6	0.6	0.6	0.7	1.0																				
US TIPS	-0.1	0.4	0.3	0.4	0.4	0.4	0.5	0.2	1.0																			
US Treasury	0.0	0.1	-0.1	0.0	0.0	0.1	0.1	-0.1	0.7	1.0																		
Global Sovereign ex-US	0.1	0.3	0.2	0.4	0.4	0.5	0.4	0.1	0.7	0.6	1.0																	
US Core	0.0	0.3	0.2	0.3	0.3	0.4	0.3	0.0	0.8	0.9	0.7	1.0																
Core Plus	0.0	0.4	0.3	0.4	0.4	0.5	0.4	0.1	0.8	0.8	0.8	1.0	1.0															
Short-Term Gov't/Credit	0.2	0.2	0.0	0.2	0.2	0.3	0.2	0.1	0.7	0.8	0.6	0.8	0.8	1.0														
Short-Term Credit	0.2	0.4	0.3	0.4	0.4	0.4	0.4	0.2	0.6	0.5	0.7	0.7	0.8	0.7	1.0													
Long-Term Credit	0.0	0.5	0.4	0.5	0.5	0.5	0.6	0.2	0.8	0.7	0.7	0.9	0.9	0.6	0.8	1.0												
US HY	-0.1	0.8	0.8	0.8	0.8	0.7	0.8	0.5	0.6	0.1	0.5	0.4	0.6	0.3	0.6	0.7	1.0											
Bank Loans	-0.1	0.6	0.6	0.6	0.7	0.6	0.6	0.5	0.3	-0.2	0.2	0.1	0.3	0.0	0.5	0.4	0.8	1.0										
Global Credit	0.0	0.7	0.5	0.7	0.7	0.7	0.7	0.3	0.7	0.5	0.8	0.8	0.9	0.6	0.6	0.9	0.8	0.6	1.0									
EMD USD	-0.1	0.7	0.6	0.7	0.7	0.7	0.7	0.4	0.6	0.3	0.6	0.6	0.7	0.4	0.6	0.8	0.8	0.7	0.9	1.0								
EMD Local	0.0	0.5	0.4	0.7	0.6	0.8	0.7	0.4	0.4	0.2	0.6	0.4	0.5	0.4	0.5	0.6	0.7	0.5	0.8	0.8	1.0							
Commodities	-0.1	0.4	0.4	0.5	0.5	0.5	0.5	0.3	0.2	-0.2	0.2	0.0	0.1	0.0	0.2	0.1	0.5	0.5	0.3	0.4	0.4	1.0						
Hedge Funds	-0.1	0.8	0.9	0.8	0.9	0.8	0.9	0.6	0.3	-0.2	0.3	0.2	0.3	0.0	0.4	0.5	0.8	0.6	0.8	0.6	0.7	0.6	1.0					
Real Estate	-0.3	0.6	0.6	0.5	0.5	0.5	0.6	0.4	0.2	0.0	-0.1	0.1	0.2	0.0	-0.2	0.2	0.4	0.4	0.3	0.4	0.4	0.2	0.5	1.0				
REITs	-0.2	0.7	0.7	0.6	0.6	0.5	0.7	0.5	0.6	0.3	0.3	0.5	0.5	0.2	0.3	0.6	0.7	0.5	0.6	0.6	0.5	0.3	0.6	0.7	1.0			
Infrastructure	-0.2	0.8	0.7	0.8	0.8	0.7	0.8	0.6	0.5	0.1	0.5	0.4	0.5	0.2	0.5	0.6	0.8	0.7	0.7	0.8	0.7	0.6	0.8	0.6	0.7	1.0		
Currency Beta	-0.1	0.0	0.0	-0.2	-0.2	-0.2	-0.1	0.1	-0.2	-0.1	-0.3	-0.2	-0.2	-0.1	-0.3	-0.2	-0.1	-0.1	-0.3	-0.2	-0.2	-0.2	-0.1	0.1	0.0	-0.1	1.0	
Risk Parity	0.0	0.7	0.6	0.7	0.7	0.6	0.7	0.7	0.4	0.4	0.0	0.5	0.5	0.7	0.3	0.7	0.7	0.7	0.5	0.7	0.6	0.5	0.5	0.4	0.0	0.7	-0.2	1.0

Note: as of 9/30/23 - Correlation assumptions are based on the last ten years. Private Equity and Real Estate correlations are especially difficult to model – we have therefore used BarraOne correlation data to strengthen these correlation estimates.

Notices & disclosures