Board of Retirement Regular Meeting

Sacramento County Employees' Retirement System

Agenda Item 17

MEETING DATE: September 17, 2025

SUBJECT: Liquidity Study

SUBMITTED FOR: ___ Action __X__ Information

RECOMMENDATION

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

PURPOSE

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

DISCUSSION

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 10-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 5 of the Verus presentation).

Verus made a change to their liquidity analysis for this year's report by measuring the liquidity profile and cash flows over a 10-year period, compared to over a 5-year period for prior studies. The move from a 5-year period to a 10-year measurement period is a more conservative measure, and as a result, it does decrease the liquidity ratio for both the LCR and MLCR. The results of the liquidity study show that SCERS has an LCR of 1.84 over a 10-year measurement period, which is the same as the 2024 measure of 1.84 over the same 10-year period. The MLCR of 1.11 compares in line with the 2024 measure of 1.12 over a 10-year measurement period. For comparison, the 2024 LCR and MLCR measures using the 5-year measurement period were 2.47 and 1.34, respectively.

The analysis demonstrates that SCERS is in a healthy liquidity position. The LCR is well above the 1.0 threshold, and the more conservative MLCR is also above the 1.0 target. The measures should not be viewed in isolation, as both the LCR and MLCR complement one another. SCERS' LCR rating of 1.84 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, such as within the 'adverse private market cash flow' scenario modeled on page 10 of the Verus presentation, in which Verus assumes that private market distributions are 50% lower than expected over a five-year period during a distressed market environment.

The data from the liquidity study incorporates the recent changes to SCERS' strategic asset allocation, which saw a 2% increase in Credit combined with a 1% reduction in Global Equity and a 1% reduction in Real Estate. While the Credit asset class can contain up to 40% Liquid Credit exposure, most of the Credit exposure is expected to be comprised of Illiquid (Private) Credit in the form of drawdown vehicles. Verus took a more conservative approach in modeling all of Credit as illiquid risk assets, especially since Liquid Credit can take the form of a drawdown vehicle similar to a private credit fund, in addition to more liquid open-end funds and vehicles.

ATTACHMENTS

- Board Order
- Verus Liquidity Assessment Presentation

Prepared by:

/S/

Steve Davis
Chief Investment Officer

Reviewed by:

/S/

Eric Stern
Chief Executive Officer

Retirement Board Order

Sacramento County Employees' Retirement System

Before the Board of Retirement
September 17, 2025

AGENDA ITEM:

Liquidity Study

THE BOARD OF RETIREMENT hereby approves the Staff recommendation 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 17, 2025, by the following vote of the Board of Retirement, to wit:

AYES:

NOES:

ABSENT:

ABSTAIN:

ALTERNATES (Present but not voting):

_____	_____
Chris Giboney Board President	Eric Stern Chief Executive Officer and Board Secretary

Verus

PERSPECTIVES THAT DRIVE ENTERPRISE SUCCESS

SEPTEMBER 2025

Liquidity Risk Assessment

Sacramento County Employees' Retirement System

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

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***

Managing liquidity risk is a primary imperative for the trustees

Plan Characteristics

1. Cash flow negative (benefit payments > contributions)
2. Meaningful exposure to illiquid private market investments

Liquidity assessment overview

Verus uses the **Liquidity Coverage Ratio (LCR)** to quantify liquidity risk.

The LCR is the ratio of liquidity available to the liquidity needed over a specified time-period. The calculation reflects SCERS' specific asset allocation and cashflow profile.

$$Liquidity\ Coverage\ Ratio\ (LCR) = \frac{\begin{matrix} Starting\ Liquid\ Financial\ Assets \\ \sum(Distributions\ from\ Illiquid\ Assets) \\ \sum(Employer\ and\ Employee\ Contributions) \\ \sum(Liquid\ Investment\ Return) \end{matrix}}{\begin{matrix} \sum(Benefit\ Payments) \\ \sum(Capital\ Calls\ for\ Illiquid\ Assets) \end{matrix}}$$

LCR Value	Implication
<1	Insufficient liquidity
>1	Sufficient liquidity

We have applied a variety of lenses to the LCR calculation:

- **Calculation methods**: Deterministic and Monte Carlo
- **Private market cashflow scenarios:** Baseline private market cashflows and adverse private market cashflows with distributions cut to 50% of expected for last 5 years of the 10-year projection
- **Liquidity scenarios:** Baseline LCR which includes all liquid asset classes and modified LCR which includes only diversifying liquid asset classes as a source of liquidity

SCERS' liquidity assumptions

By asset class

Liquidity Grouping	Asset Class	Policy Allocation	Days to Convert to Cash
Liquid Diversifying Assets	Cash	2	1
	US Treasury	4	1-3
	Core Plus Fixed Income	12	3
	Liquid Real Return	1	3
	Total Liquid Diversifying	**19**	
Liquid Risk Assets	Global Equity	39	3
	Hedge Funds	7	30-90
	Total Liquid Growth	**46**	
Illiquid Risk Assets	Core Real Estate	5	Illiquid
	Private Equity	11	Illiquid
	Private Credit	9	Illiquid
	Value Add Real Estate	1	Illiquid
	Opportunistic Real Estate	1	Illiquid
	Private Real Assets	7	Illiquid
	Total Illiquid	**35**	

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

The fund's actual private market's allocation at 12/31/24 is 32%, relative to the 35% target allocation.

SCERS' baseline cash flow projection

DETERMINISTIC CASHFLOW PROJECTION ($M)

Year Beginning January 1,	Market Value of Assets (BOY)			Total Fund Cashflows		Total Fund Net Cashflow		Private Market Cashflows		Liquid Fund Net Cashflow	
	Liquid	Illiquid	Total	Contributions	Benefit Payments & Admin Expenses	Net Cash Flow (%)	Net Cash Flow ($)	Private Market Distributions	Private Market Capital Calls	Net Cash Flow (%)	Net Cash Flow ($)
2025	9,503	4,380	13,883	547	-806	-1.9%	(259)	685	(498)	-0.5%	(72)
2026	9,972	4,567	14,539	552	-838	-2.0%	(286)	947	(623)	0.3%	38
2027	10,580	4,627	15,207	556	-878	-2.1%	(322)	946	(708)	-0.6%	(84)
2028	11,098	4,782	15,880	569	-918	-2.2%	(349)	879	(710)	-1.1%	(180)
2029	11,546	5,022	16,568	585	-960	-2.3%	(375)	863	(734)	-1.5%	(246)
2030	11,953	5,324	17,277	593	-1,002	-2.4%	(409)	899	(761)	-1.6%	(271)
2031	12,356	5,645	18,001	602	-1,044	-2.5%	(442)	970	(782)	-1.4%	(254)
2032	12,800	5,942	18,742	613	-1,087	-2.5%	(474)	1,025	(795)	-1.3%	(244)
2033	13,281	6,219	19,500	619	-1,129	-2.6%	(510)	1,060	(801)	-1.3%	(251)
2034	13,781	6,490	20,271	635	-1,170	-2.6%	(535)	1,106	(805)	-1.2%	(234)

Under the forecasted return, SCERS annual net cash flow position is expected to grow increasingly negative, from (1.9%) to (2.6%) over the next ten years

The cashflow position is expected to improve when including private market investments but remains slightly negative.

Reflects 2025 CMA return assumptions of 5.7% and 8.7% for liquid and illiquid portfolio respectively. See appendix for additional details

SCERS' 10-Year LCR: 2025 vs. 2024

Deterministic scenario

2025 LCR ($M)

Liquidity Available	Starting Liquid Assets	9,503
	10-Year Contributions	5,870
	10-Year Private Market Distributions	9,380
	10-Year Liquid Investment Return	6,623
	10-Year Liquidity Available	**31,376**
Liquidity Needs	10-Year Benefit Payments & Admin Expenses	9,831
	10-Year Private Market Capital Calls	7,217
	10-Year Liquidity Needed	**17,048**
	10-Year Liquidity Coverage Ratio	**1.84**

2024 LCR ($M)

Liquidity Available	Starting Liquid Assets	8,819
	10-Year Contributions	5,715
	10-Year Private Market Distributions	10,003
	10-Year Liquid Investment Return	7,218
	10-Year Liquidity Available	**31,755**
Liquidity Needs	10-Year Benefit Payments & Admin Expenses	9,381
	10-Year Private Market Capital Calls	7,890
	10-Year Liquidity Needed	**17,271**
	10-Year Liquidity Coverage Ratio	**1.84**

The 2025 10-year LCR is in-line with prior year and shows the Plan has 1.8 times the needed liquidity under baseline return assumptions over the next ten years.

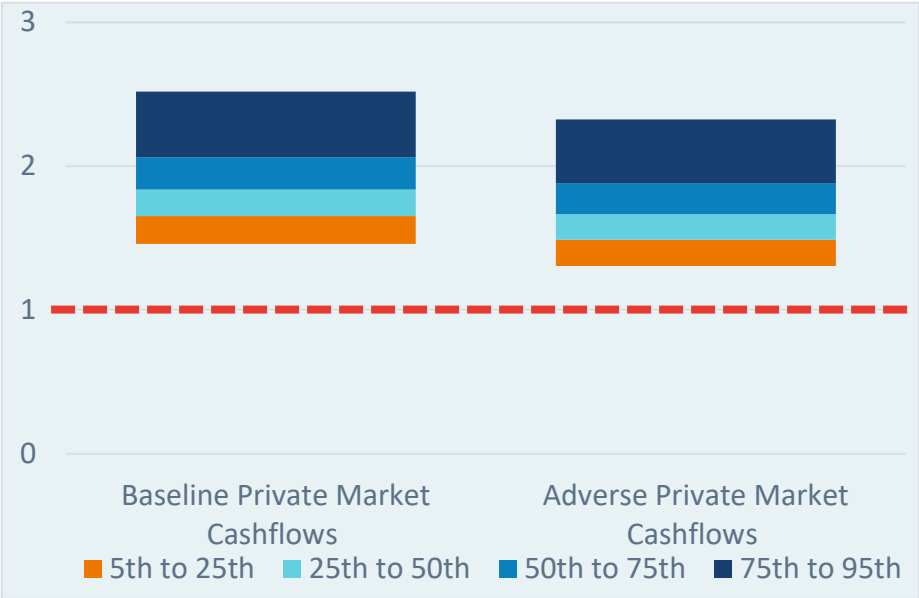
The table shows the LCR under a deterministic scenario where the liquid portfolio earns the forecasted return annually.[1]

2025 LCR reflects Verus 2025 CMA liquid return assumption of 5.7% and new policy allocation. 2024 LCR reflects Verus 2024 CMA liquid return assumption of 6.5% and old policy allocation. See appendix for additional details.

SCERS' 10-Year LCR

Stochastic analysis

DISTRIBUTION OF 10-YEAR LCR OUTCOMES



10-Year LCR	Baseline Private Market Cashflows	Adverse Private Market Cashflows
Percentile		
95% Percentile	2.5	2.3
75% Percentile	2.1	1.9
50% Percentile	1.8	1.7
25% Percentile	1.7	1.5
5% Percentile	**1.5**	**1.3**
Probability of Liquidity Event	**<0.02%**	**<0.02%**

The *'baseline private market cashflow'* scenario assumes the private market cashflows are as expected. The *'adverse private market cashflow'* scenario assumes the private market distributions are 50% lower than expected for the last five years of the ten-year projection.

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

Based on 5,000 simulations of liquidity coverage ratio. See appendix for additional details.

SCERS' 5-Year Modified LCR: 2025 vs. 2024

Deterministic scenario

2025 MODIFIED LCR

Liquidity Available	Starting Liquid Assets	2,638
	10-Year Contributions	5,870
	10-Year Private Market Distributions	9,380
	10-Year Liquid Investment Return	1,095
	10-Year Liquidity Available	**18,983**
Liquidity Needs	10-Year Benefit Payments & Admin Expenses	9,831
	10-Year Private Market Capital Calls	7,217
	10-Year Liquidity Needed	**17,048**
	10-Year Liquidity Coverage Ratio	**1.11**

2024 MODIFIED LCR

Liquidity Available	Starting Liquid Assets	2,454
	10-Year Contributions	5,715
	10-Year Private Market Distributions	10,003
	10-Year Liquid Investment Return	1,195
	10-Year Liquidity Available	**19,367**
Liquidity Needs	10-Year Benefit Payments & Admin Expenses	9,381
	10-Year Private Market Capital Calls	7,890
	10-Year Liquidity Needed	**17,271**
	10-Year Liquidity Coverage Ratio	**1.12**

The 2025 10-year modified LCR is in-line with prior year and shows the Plan has 1.1 times the needed liquidity under baseline return assumptions over the next ten years in diversifying liquidity asset classes alone.

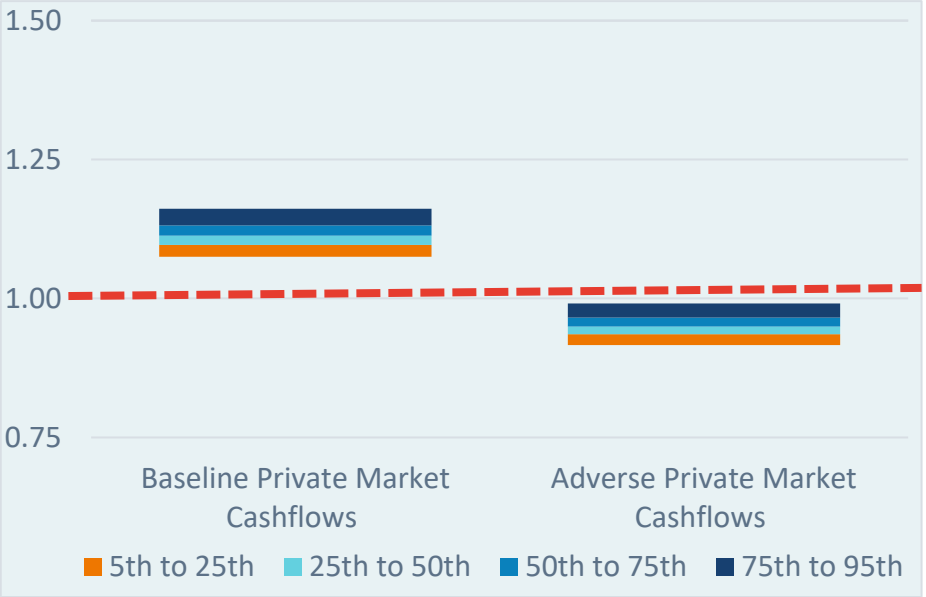
The table shows the LCR under a deterministic scenario where the liquid portfolio earns the forecasted return annually.[1]

2025 modified LCR reflects Verus 2025 CMA diversifying liquid return assumption of 4.4% and new policy allocation. 2024 modified LCR reflects Verus 2024 CMA diversifying liquid return assumption of 5.1% and old policy allocation. See appendix for additional details.

SCERS' Modified 10-Year LCR

Stochastic analysis

DISTRIBUTION OF 10-YEAR MODIFIED LCR OUTCOMES



10-Year Modified LCR	Baseline Private Market Cashflows	Adverse Private Market Cashflows
Percentile		
95% Percentile	1.16	0.99
75% Percentile	1.13	0.97
50% Percentile	1.11	0.95
25% Percentile	1.10	0.94
5% Percentile	**1.08**	**0.92**
Probability of Insufficient Diversifying Liquidity	**<0.02%**	**97%**

The *'baseline private market cashflow'* scenario assumes the private market cashflows are as expected. The *'adverse private market cashflow'* scenario assumes the private market distributions are 50% lower than expected for the last five years of the ten-year projection.

The fund is expected to have sufficient liquidity in diversifying liquidity assets alone to cover ten-years of outflows, including in adverse return scenarios. However, under adverse private market scenarios, the fund may need to fund outflows through liquid risk assets towards the end of the projection.

Probability of Insufficient Diversifying Liquidity	Baseline	Adverse
7 years and under	<.02%	<.02%
8 years	<.02%	1%
9 years	<.02%	58%
10 years	<.02%	97%

Based on 5,000 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 10-year period.

— 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	$13.883B as of 12/31/2024
Capital market assumptions	Verus' 2025 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.
Cashflows	All cashflows are assumed to be fixed and to occur at the middle of each projection year

CASHFLOW ASSUMPTIONS[1]

	Contributions	Benefit Payments	Illiquid Distributions	Illiquid Capital Calls
2025	547,027,369	805,626,913	685,246,407	497,832,678
2026	552,477,759	838,158,813	946,692,072	623,094,068
2027	555,906,437	878,002,908	945,809,559	707,640,507
2028	568,536,027	918,485,610	879,080,965	710,292,496
2029	584,665,660	959,550,078	863,358,036	733,993,287
2030	592,874,406	1,001,587,610	898,721,833	761,145,709
2031	602,120,281	1,044,033,756	969,995,753	782,470,218
2032	613,123,168	1,086,787,225	1,024,954,800	794,611,317
2033	618,891,655	1,129,034,588	1,059,767,626	800,970,533
2034	634,518,085	1,170,022,423	1,105,952,059	804,503,279

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

Methodology

SUMMARY OF THE VERUS APPROACH

— We use a fundamental building block approach to forecast asset class returns, based on several inputs. These include practitioner best-in-class thinking, historical data, and academic research. Each year Verus conducts an in-depth review of our methodology, analyzing new industry research findings and evaluating alternative forecasting approaches to determine whether an improvement to our methodology might be warranted. We maintain flexibility and openness to adjusting our approach if strong evidence suggests change is appropriate.
— 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	Implied annualized volatility, using actual historical private equity performance distribution
Commodities	Collateral return (cash) + spot return (inflation forecast) + roll return (assumed to be zero)	Long-term volatility
Hedge Funds	Return coming from traditional market betas + historical idiosyncratic/alpha 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	5.3%	6.4%	15.5%	0.10	0.17	0.77	0.80
U.S. Small	Russell 2000	6.3%	8.4%	21.3%	0.12	0.22	0.35	0.44
International Developed	MSCI EAFE	6.7%	8.1%	17.5%	0.17	0.25	0.27	0.33
International Small	MSCI EAFE Small Cap	8.8%	10.8%	21.4%	0.23	0.33	0.27	0.35
Emerging Markets	MSCI EM	7.0%	9.6%	24.2%	0.13	0.24	0.14	0.22
Global Equity	MSCI ACWI	6.0%	7.3%	16.7%	0.13	0.21	0.52	0.57
Global Equity ex USA	MSCI ACWI ex USA	7.0%	8.7%	19.3%	0.17	0.25	0.24	0.31
Private Equity	CA Private Equity	8.0%	10.9%	26.0%	0.16	0.27	-	-
Private Equity Direct	CA Private Equity	9.0%	11.9%	26.0%	0.20	0.31	-	-
Private Equity (FoF)	CA Private Equity	7.0%	10.0%	26.0%	0.12	0.23	-	-
Fixed Income								
Cash	30 Day T-Bills	3.8%	3.8%	1.1%	-	-	-	-
U.S. TIPS	Bloomberg U.S. TIPS 5-10	4.0%	4.2%	5.5%	0.04	0.07	0.18	0.20
Non-U.S. Inflation Linked Bonds	Bbg World Govt. Inflation Linked ex U.S.	3.4%	3.7%	7.4%	-0.05	-0.01	-0.03	0.01
U.S. Treasury	Bloomberg Treasury 7-10 Year	3.8%	4.0%	7.1%	0.00	0.03	-0.02	0.01
Long U.S. Treasury	Bloomberg Treasury 20+ Year	4.1%	4.9%	13.4%	0.02	0.08	-0.06	0.01
Global Sovereign ex U.S.	Bloomberg Global Treasury ex U.S.	2.2%	2.7%	10.0%	-0.16	-0.11	-0.30	-0.26
Global Aggregate	Bloomberg Global Aggregate	3.4%	3.6%	6.7%	-0.06	-0.03	-0.17	-0.14
Core Fixed Income	Bloomberg U.S. Aggregate Bond	4.3%	4.4%	4.7%	0.11	0.13	0.04	0.06
Core Plus Fixed Income	Bloomberg U.S. Universal	4.4%	4.5%	4.7%	0.13	0.15	0.10	0.13
Investment Grade Corp. Credit	Bloomberg U.S. Corporate IG	4.6%	4.9%	8.4%	0.10	0.13	0.19	0.22
Short-Term Gov't/Credit	Bloomberg U.S. Gov't/Credit 1-3 Year	3.9%	3.9%	3.6%	0.03	0.03	0.00	0.00
Short-Term Credit	Bloomberg Credit 1-3 Year	4.2%	4.3%	3.6%	0.11	0.14	0.28	0.29
Intermediate Credit	Bloomberg U.S. Intermediate Credit	4.3%	4.5%	5.9%	0.08	0.12	0.19	0.25
Long-Term Credit	Bloomberg Long U.S. Credit	4.6%	5.2%	11.1%	0.07	0.13	0.13	0.19
High Yield Corp. Credit	Bloomberg U.S. Corporate High Yield	5.6%	6.1%	10.8%	0.17	0.21	0.45	0.47
Bank Loans	S&P/LSTA Leveraged Loan	6.9%	7.3%	8.8%	0.35	0.40	0.58	0.59
Global Credit	Bloomberg Global Credit	4.1%	4.4%	7.8%	0.04	0.08	0.07	0.10
Emerging Markets Debt (Hard)	JPM EMBI Global Diversified	7.7%	8.2%	10.5%	0.37	0.42	0.18	0.22
Emerging Markets Debt (Local)	JPM GBI-EM Global Diversified	5.8%	6.5%	12.1%	0.17	0.22	-0.10	-0.04
Securitized Credit	Bloomberg U.S. Securitized	4.7%	4.8%	4.0%	0.23	0.25	-0.03	-0.01

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					
Fixed Income (continued)								
Private Credit	S&P LSTA Leveraged Loan Index	8.2%	8.8%	11.8%	0.37	0.42	-	-
Private Credit (Direct Lending - Unlevered)	S&P LSTA Leveraged Loan Index	7.1%	7.5%	8.8%	0.38	0.42	-	-
Private Credit (Direct Lending - Levered)	S&P LSTA Leveraged Loan Index	8.3%	8.9%	11.8%	0.38	0.43	-	-
Private Credit (Credit Opportunities)	S&P LSTA Leveraged Loan Index	8.8%	9.6%	13.4%	0.37	0.43	-	-
Private Credit (Junior Capital / Mezzanine)	S&P LSTA Leveraged Loan Index	8.6%	9.4%	12.9%	0.37	0.43	-	-
Private Credit (Distressed)	S&P LSTA Leveraged Loan Index	9.1%	12.7%	29.1%	0.18	0.31	-	-
Other								
Commodities	Bloomberg Commodity	6.3%	7.4%	16.0%	0.16	0.23	-0.11	-0.04
Hedge Funds	HFRI Fund Weighted Composite	5.0%	5.3%	7.5%	0.16	0.20	0.55	0.56
Hedge Fund of Funds	HFRI Fund of Funds Composite	4.0%	4.3%	7.5%	0.03	0.07	0.39	0.41
Hedge Funds (Equity Style)	Custom HFRI Benchmark Mix*	5.4%	6.3%	13.9%	0.12	0.18	0.37	0.42
Hedge Funds (Credit Style)	Custom HFRI Benchmark Mix*	5.2%	5.6%	9.2%	0.15	0.20	0.61	0.62
Hedge Funds (Assymetric Style)	Custom HFRI Benchmark Mix*	5.4%	5.6%	6.3%	0.25	0.29	0.55	0.56
Real Estate Debt	Bloomberg CMBS IG	6.8%	7.1%	7.4%	0.41	0.45	0.20	0.22
Core Real Estate	NCREIF Property	7.2%	7.9%	12.5%	0.27	0.33	-	-
Value-Add Real Estate	NCREIF Property + 200bps	9.2%	10.3%	15.4%	0.35	0.42	-	-
Opportunistic Real Estate	NCREIF Property + 300bps	10.2%	12.1%	21.2%	0.30	0.39	-	-
REITs	Wilshire REIT	7.2%	8.8%	19.2%	0.18	0.26	0.34	0.41
Global Infrastructure	S&P Global Infrastructure	8.1%	9.4%	16.8%	0.26	0.33	0.24	0.31
Risk Parity**	S&P Risk Parity 10% Vol Index	6.3%	7.1%	10.0%	0.25	0.33	0.40	0.44
Currency Beta	MSCI Currency Factor Index	2.2%	2.3%	3.3%	-0.48	-0.45	-0.30	-0.28
Inflation		2.4%	-	-	-	-	-	-
60/40 Portfolio	MSCI ACWI / Bbg U.S. Agg	5.5%	6.0%	10.9%	0.16	0.20	0.50	0.53

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

Note: as of 9/30/24 - Correlation assumptions are based on the last ten years. Private Equity and Real Estate correlations are especially difficult to model due to appraisal-based pricing and lag problems that exist in the data – we have therefore used BarraOne correlation data to strengthen these correlation estimates.

Range of likely 10-year outcomes

10-YEAR RETURN 90% CONFIDENCE INTERVAL

Source: Verus 2025 Capital Market Assumptions, MPI