



Investment Advisory Committee (IAC) Meeting

[VRS Board Room](#)
[Pavilion Bldg., 3rd Floor](#)

Thursday, 8/18/2022
9:00 AM - 12:30 PM ET

1. Approval of Minutes (April 13, 2022)

IAC Meeting Minutes 041322 - Final - Page 2

2. CIO Report

Asset Allocation Report 06-30-2022 - Page 5

Daily Asset Allocation Report 08-11-2022 - Page 6

Performance Summary 06-30-2022 - Page 7

Plan Tracking Error - Page 8

New Investments and Terminations 08-18-2022 - Page 9

3. Forward Returns & Stress Test Scenarios

Forward Returns & Scenario Analysis August 20220 FINAL - Page 11

4. Portfolio Solutions Group (PSG) Overview & Currency Management

Currency Management Aug 2022 FINAL - Page 43

5. Portfolio Solutions Group (PSG) Program Reviews

IAC DStrat Program Review Aug 2022 FINAL - Page 57

RBI Program Review Aug 2022 FINAL - Page 73

Minutes

A meeting of the Investment Advisory Committee of the Virginia Retirement System was held on April 13, 2022 with the following members present:

Larry Kochard, Chairperson
Michael Beasley
Theodore Economou
Deborah Allen Hewitt
Nancy Leake
Bryan Lewis
Rod Smyth
Hance West

The following Board members were present:

O'Kelly E. McWilliams, III
Brandon Bell
John Bennett
Michael Disharoon
William Garrett
Brett Hayes
Troilen Seward

The following staff members were in attendance:

Trish Bishop, Ron Schmitz, Jennifer Schreck, Stephen Adelaar, John Alouf, Advait Apte, Rory Badura, Parham Behrooz, Ryan Carlson, Jeanne Chenault, Perry Corsello, Sara Denson, Michael Desai, Valerie Disanto, Laurie Fennell, Josh Fox, Katherine Grawe, JT Grier, Mehtab Haleem, Greg Hines, Dane Honrado, K.C. Howell, Kristina Koutrakos, Matt Lacy, Chung Ma, Curt Mattson, Jennifer MacKnight, Moses Maxfield, Steve McClelland, Walker Noland, Greg Oliff, Steven Peterson, Vera Pleasants, Steven Ramirez, Mark Rein, Garret Rhodes, Jummai Sarki-Hurd, Dan Schlussler, Jennifer Schoeller, Kristy Scott, Viet Tran, Korey Turner, Lisa Turner, Daniel Whitlock, Cindy Wilkinson, Nick Zizzo.

Also in attendance was Lauren Albanese of Financial Investment News; Jamie Bitz of the Virginia Joint Legislative Audit and Review Commission; Andrea Cinkovic of Goldman Sachs; Brian Deveney of the Virginia Auditor of Public Accounts; Mc Cyril Espanol of Pageant Media; Gary Gammon of the Virginia Auditor of Public Accounts; Madeline Katz of Mandate Wire; Alex Meyer of Goldman Sachs; and Paul Schutzman of MSCI.

Mr. Kochard called the meeting to order at 9:00 a.m.

Minutes

A motion was made by Mr. Kochard and seconded by Mr. Beasley to approve the minutes for the November 10, 2021 Committee meeting. The motion was unanimously approved.

CIO Report

Mr. Schmitz opened his CIO report commenting on the Ukraine / Russia situation. Then Mr. Schmitz presented the Asset Allocation Report and Performance Summary as of February 28, 2022, and Total Fund Tracking Error Report as of December 31, 2021. Last, Mr. Schmitz reviewed the New Investments and Terminations Report.

**Public Market Asset
Program Reviews**

Mr. Grier provided a brief overview of the Public Market Asset Programs, provided a preview of the agenda items, and introduced the following Program reviews: Public Equity, Internal Equity Management, and Fixed Income.

Mr. Whitlock provided an annual review of the Public Equity program. Annual review topics included: an overview of team members, asset allocation, philosophy, manager evaluation framework, market updates, exposures, results, top five managers, manager terminations, diverse investment management engagement, and a look ahead. Mr. Whitlock concluded his review with a discussion regarding opportunities still in value investing and active management in areas of secular growth.

Mr. Schlussler provided an annual review of Internal Equity Management (IEM). Annual review topics included: an overview of team members, asset allocation, philosophy, research process, factor selection, portfolio management, market updates, exposures, results, and a look forward. Mr. Schlussler concluded his review with a discussion regarding the focus of the IEM program – where it began, where it is now, and where it will be in the future.

Mr. Behrooz and Mr. Oliff provided an annual review of the Fixed Income program. Annual review topics included: an overview of team members, asset allocation, philosophy, market updates, exposures, results, and a look forward. Mr. Behrooz and Mr. Oliff concluded their review with a discussion regarding market activities that could impact results.

**Portfolio Solutions
Group Functional Review**

Mr. Ma provided a general overview of the Portfolio Solutions Group (PSG) and introduced each functional area to be covered in the review.

Mr. Hines provided a review of the Risk Management area. Review topics included an overview of the team, risk management deliverables, risk

team synergies and priorities, and sample updates the team provides to the Investment Department.

Ms. Koutrakos provided a review of the Portfolio Strategy area. Review topics included an overview of the team, objective, process, process integration, recent engagement examples, and plans and priorities.

Dr. Peterson provided a review of the Research area. Review topics included an overview of the team, as well as case examples of manager selection and due diligence tools, and natural language processing.

Mr. Lacy provided a review of the Portfolio Integration area. Review topics included two different case studies, which highlighted the strategic advantages of collaboration across the various investment teams to benefit the fund.

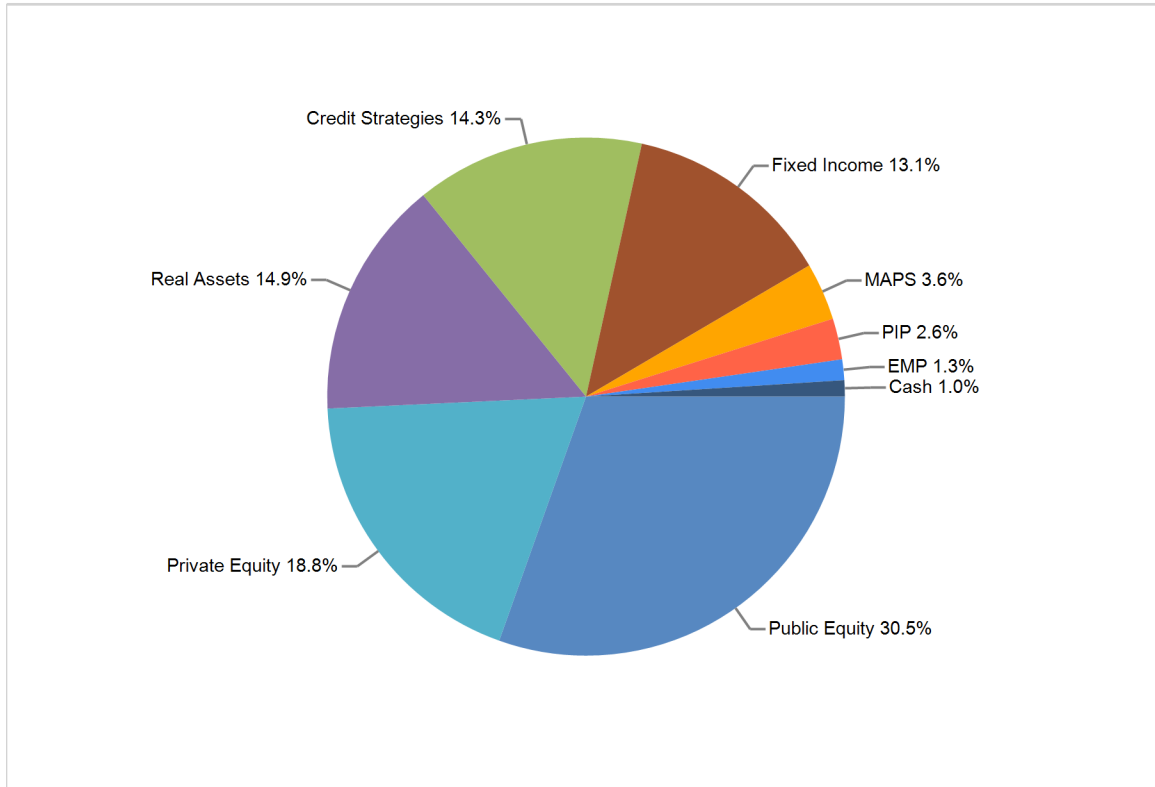
Adjournment

The Committee members engaged in general discussion throughout the reviews provided.

Mr. Economou made a motion to adjourn the meeting. Mr. West seconded the motion. Mr. Kochard asked for the Committee members to vote on the motion, and the motion passed unanimously.

The meeting was adjourned at 11:38 a.m.

Larry Kochard, Chairperson



	<u>Current \$Bil</u>	<u>Current Weight</u>	<u>Policy Weight</u>	<u>Variance</u>	<u>Allowable Range</u>		<u>Internal %</u>
Total Fund	101.2						26.6%
Public Equity	30.8	30.5%	36.0%	-5.5%	-5%	+5%	41.8%
Fixed Income	13.2	13.1%	15.0%	-1.9%	-3%	+5%	96.5%
Credit Strategies	14.5	14.3%	14.0%	0.3%	-5%	+5%	
RS Credit	4.5	4.5%	5.6%	-1.1%			
NRS Credit	9.9	9.8%	8.4%	1.4%			
Real Assets	15.1	14.9%	14.0%	0.9%	-5%	+5%	8.4%
Public RE	1.4	1.4%					89.1%
Private RE	9.1	9.0%					
Other RA	4.5	4.5%					
Private Equity	19.0	18.8%	14.0%	4.8%	-5%	+5%	
MAPS	3.6	3.6%	4.0%	-0.4%	-2%	+2%	
DSTRAT	1.8	1.8%					
RBI	1.8	1.8%					0.7%
PIP	2.6	2.6%	2.0%	0.6%	-2%	+2%	
EMP	1.3	1.3%	0.0%	1.3%		+3%	
Cash	1.0	1.0%	1.0%	0.0%	-1%	+4%	

	<u>Current \$Bil</u>	<u>Current Weight</u>	<u>Policy Limit</u>
Hedge Funds	9.9	9.8%	15.0%

<u>Tracking Error</u>	
3Yr-Total Fund:	1.98%
3Yr-Total Public:	1.73%
5Yr-Total Fund:	1.80%
5Yr-Total Public:	1.42%

*Total Fund includes the following amt held by the Treasurer of VA: \$ 353 million

• The values shown for each asset class on this report may differ from the VRS Monthly Performance Report due to adjustments related to derivative positions in the Rebalance Account, pending transactions, and certain accruals. The values on this report are a more descriptive representation of the Virginia Retirement System's true economic exposure to each asset class.(5 adjustments applied)

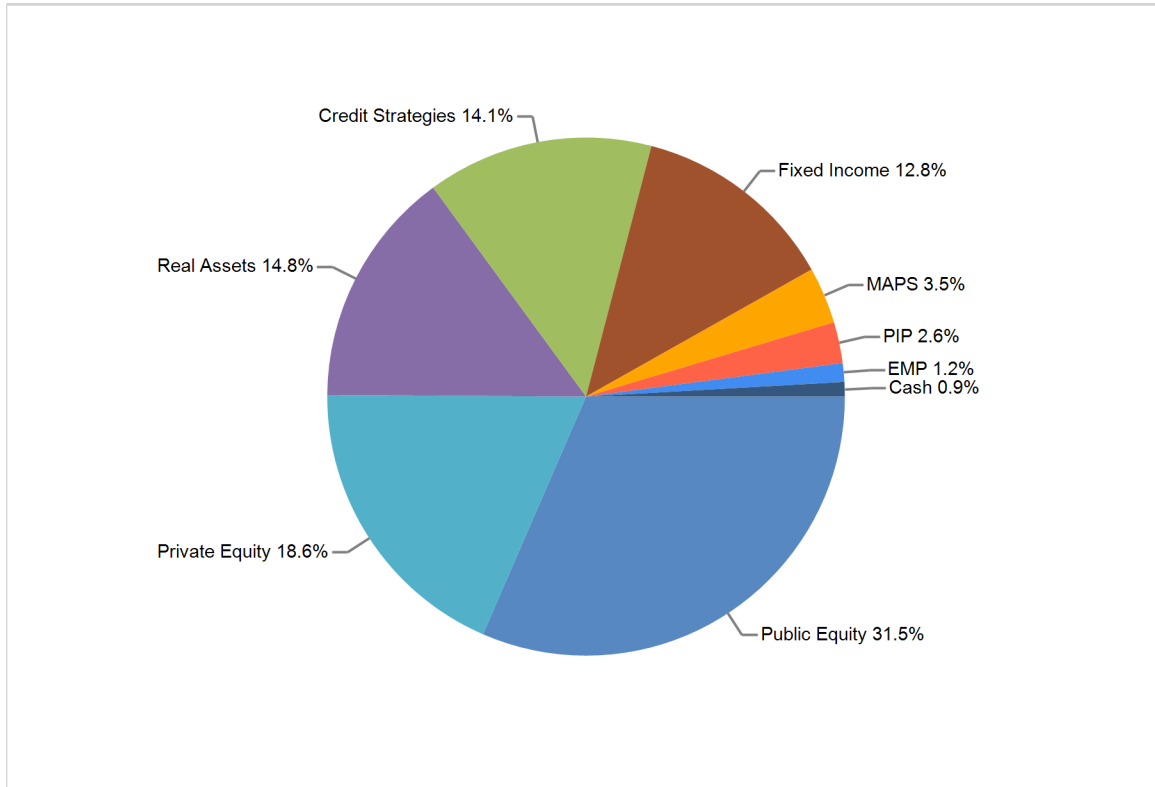
*Total Fund and Total Public annualized tracking error is calculated using compounded quarterly returns as of 6/30/2022

* Differences in totals are due to rounding.

Daily Asset Allocation Report

August 11, 2022

For Internal Investment Purposes Only



	<u>Current \$Bil</u>	<u>Current Weight</u>	<u>Policy Weight</u>	<u>Variance</u>	<u>Allowable Range</u>		<u>Internal %</u>
Total Fund	103.6						27.7%
Public Equity	32.6	31.5%	34.0%	-2.5%	-5%	+5%	43.9%
Fixed Income	13.2	12.8%	15.0%	-2.2%	-3%	+5%	96.2%
Credit Strategies	14.6	14.1%	14.0%	0.1%	-5%	+5%	
RS Credit	4.4	4.3%	5.6%	-1.3%			
NRS Credit	10.2	9.9%	8.4%	1.5%			
Real Assets	15.4	14.8%	14.0%	0.8%	-5%	+5%	10.1%
Public RE	1.6	1.5%					99.9%
Private RE	9.2	8.9%					
Other RA	4.6	4.4%					
Private Equity	19.3	18.6%	16.0%	2.6%	-5%	+5%	
MAPS	3.7	3.5%	4.0%	-0.5%	-2%	+2%	
DSTRAT	1.9	1.8%					5.3%
RBI	1.8	1.7%					0.6%
PIP	2.7	2.6%	2.0%	0.6%	-2%	+2%	
EMP	1.2	1.2%	0.0%	1.2%		+3%	
Cash	0.9	0.9%	1.0%	-0.1%	-1%	+4%	

	<u>Current \$Bil</u>	<u>Current Weight</u>	<u>Policy Limit</u>
Hedge Funds	10.0	9.7%	15.0%

<u>Tracking Error</u>	
3Yr-Total Fund:	1.98%
3Yr-Total Public:	1.73%
5Yr-Total Fund:	1.80%
5Yr-Total Public:	1.42%

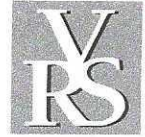
*Total Fund includes the following amt held by the Treasurer of VA: \$ 213 million

• The values shown for each asset class on this report may reflect adjustments related to derivative positions in the Rebalance Account, pending transactions and certain accruals, in order to provide a more descriptive representation of the true economic exposure to each asset class (6 adjustments applied)

*Total Fund and Total Public annualized tracking error is calculated using compounded quarterly returns as of 6/30/2022

* Differences in totals are due to rounding.

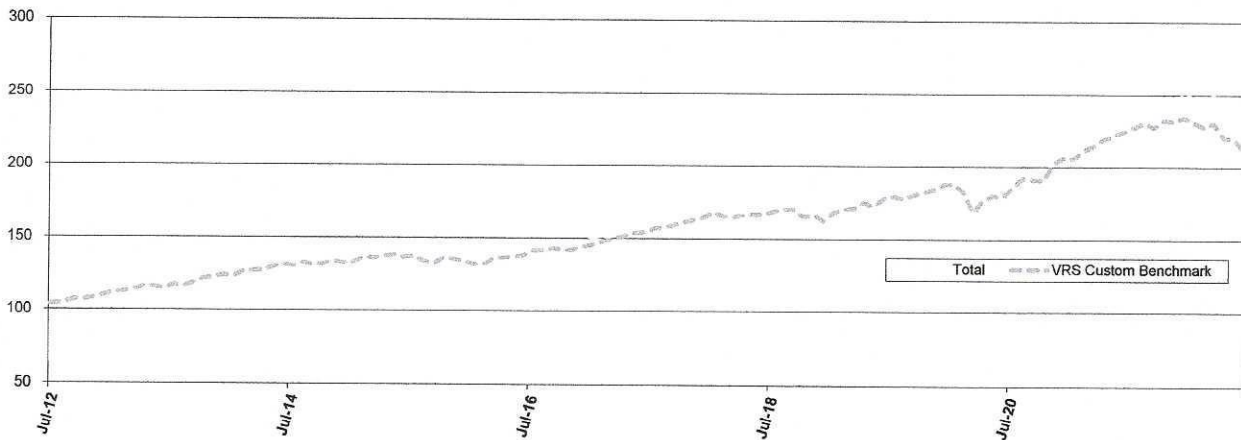
PERFORMANCE SUMMARY
Rolling Periods Ending
June 30, 2022



TOTAL FUND PERFORMANCE

	10 Yr	5 Yr	3 Yr	1 Yr	Qtr	Month	Fiscal YTD	Cal YTD	Market Value (\$MM)
Total Public Equity Strategies	9.0	6.3	6.1	-14.8	-13.5	-8.0	-14.8	-18.4	29,910
<i>Benchmark</i>	8.9	6.9	6.3	-16.2	-15.7	-8.6	-16.2	-20.3	
Total Fixed Income	2.3	1.8	0.3	-10.6	-5.3	-2.1	-10.6	-10.8	12,925
<i>Benchmark</i>	1.5	0.8	-1.1	-11.0	-5.3	-2.1	-11.0	-11.1	
Total Credit Strategies	6.6	6.3	6.4	1.5	-2.6	-1.6	1.5	-2.7	14,464
<i>Benchmark</i>	4.7	3.3	1.8	-6.5	-6.0	-3.5	-6.5	-8.0	
Total Real Assets	10.9	10.1	11.0	21.7	3.4	4.5	21.7	10.6	15,091
<i>Benchmark</i>	9.1	8.1	8.7	18.0	3.5	1.0	18.0	8.5	
Total Private Equity	17.5	21.2	25.5	27.4	0.3	0.6	27.4	5.2	19,049
<i>Benchmark</i>	13.7	14.4	15.7	6.7	-5.4	2.1	6.7	0.5	
Total Private Investment Partnerships	n/a	11.1	12.7	17.0	1.6	1.6	17.0	4.8	2,588
<i>Benchmark</i>	n/a	9.2	9.5	6.9	-2.1	-0.1	6.9	1.1	
Total Multi-Asset Public Strategies	n/a	n/a	3.6	-4.7	-6.6	-4.5	-4.7	-7.2	3,632
<i>Benchmark</i>	n/a	n/a	3.6	-8.2	-7.7	-4.2	-8.2	-10.8	
Total Fund	8.7	8.3	9.2	0.6	-5.1	-2.6	0.6	-5.9	101,185
<i>VRS Custom Benchmark</i>	7.5	6.6	6.1	-5.5	-8.0	-3.6	-5.5	-9.6	

10-Year Performance
Indexed to 100



Effective July 2013, the VRS Custom Benchmark is a blend of the Asset Class Benchmarks at policy weights.

The VRS Cash Account, the Treasurer Short-Term Investment Account, the VRS Rebalancing Account, transition activity and accounts with market values of less than \$1 million are included in the Total Fund's market value. Differences in market value totals are due to rounding.

Total Fund Tracking Error

Figure 1: Policy Tracking Error Rolling Three Year - Plan (as of 6/30/2022)

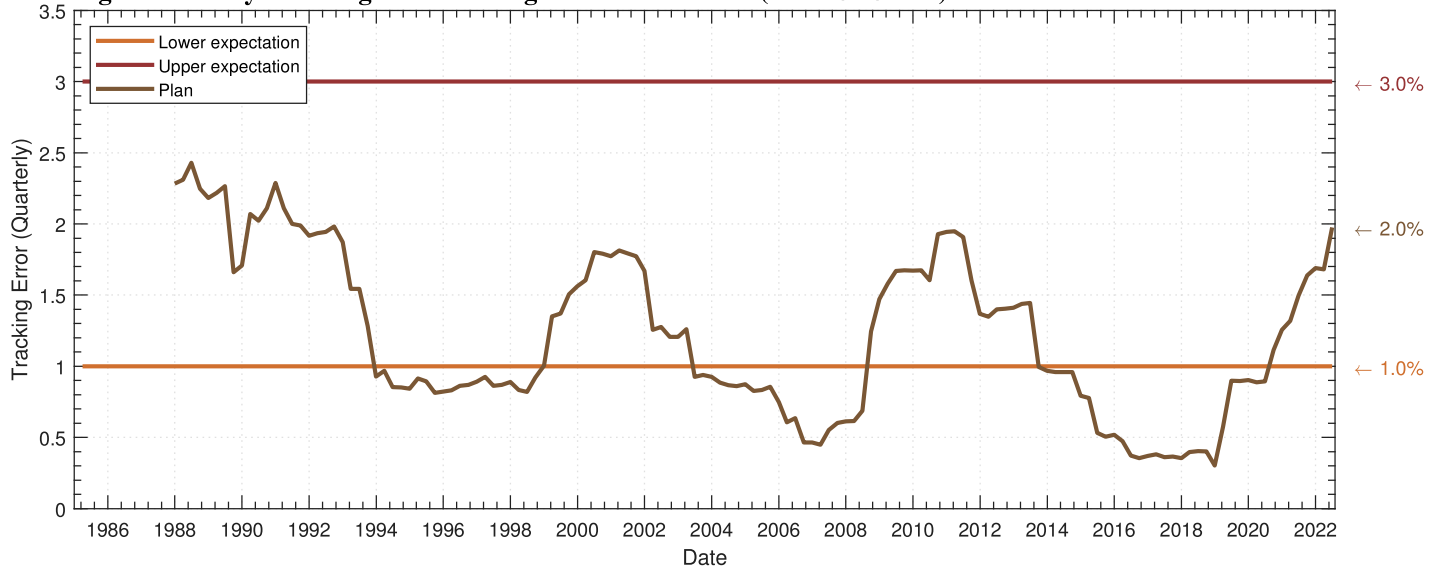
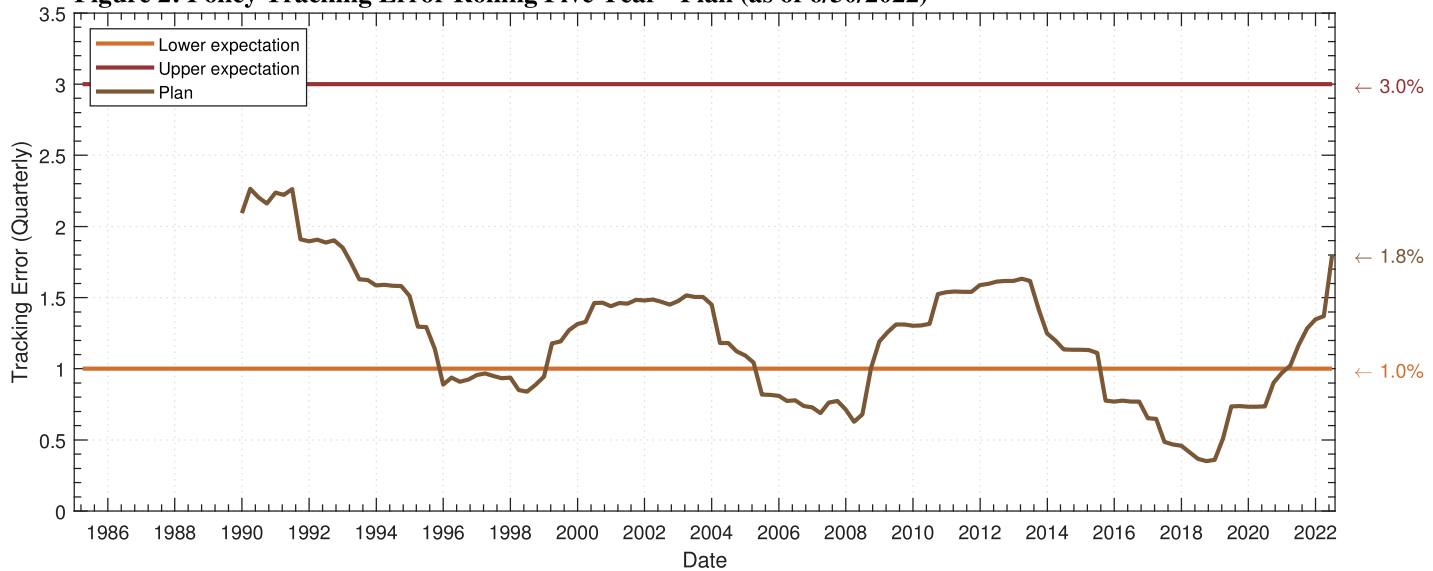


Figure 2: Policy Tracking Error Rolling Five Year - Plan (as of 6/30/2022)



The VRS Defined Benefit Plan Investment Policy Statement established the total fund tracking error range as the allowable observed tracking error calculated quarterly using 5 years of history.

Program	Action	Effective Date	Commitment/Current Value	Funding/Defunding Period	Description
Public Equities	Terminated	07/18/2022	\$270 Million	Immediate	Nordea EM – Long only emerging markets manager.
Public Equities	Hired	08/01/2022	\$250 Million	Immediate	CET Energy Dynamics Fund – Long/short equity hedge fund focused on the energy sector.
Public Equities	Terminated	08/04/2022	\$1,200 Million	Immediate	Nordea Global – Long only global markets manager.
Credit Strategies	Hired	05/26/2022	\$450 Million	3 Years	Magnetar Diversified Credit – A fund that will invest opportunistically across credit markets, with a focus on private credit investments.
Credit Strategies	Hired	06/30/2022	\$450 Million	3 Years	Värde Diversified Credit – A fund that will invest opportunistically across credit markets, with a focus on private credit investments.
Real Assets	Hired	05/26/2022	\$200 Million	5 Years	EIG River Energy Partners, LP – A closed-end fund investing in global natural resources.
Real Assets	Hired	05/31/2022	\$75 Million	5 Years	True Green Capital Fund IV, LP – A closed-end fund investing in renewable infrastructure.
Real Assets	Hired	06/01/2022	\$150 Million	6 Years	iCON Infrastructure Partners VI, LP – A closed-end fund investing in middle market infrastructure investments in Europe and North America.
Real Assets	Hired	06/30/2022	\$250 Million	5 Years	Blackstone Real Estate Partners X, LP – A closed-end fund investing in opportunistic global real estate.
Private Equity	Hired	06/21/2022	\$40 Million	6 Years	Matrix Partners XII – Early-stage, technology-focused venture capital fund where initial investments are in Seed/Series A financing rounds.
Private Equity	Hired	07/01/2022	\$200 Million	6 Years	Advent International GPE X – Mega buyout fund that targets North American and European companies across various industry sectors.

* The manager is considered DIME under the Commonwealth of Virginia definition, which defines ownership threshold of 51% or more.

** The manager is considered DIME under the definition that considers industry best practices and defines an ownership threshold of greater than or equal to 33% and less than 51% of firm ownership or carry.

Program	Action	Effective Date	Commitment/ Current Value	Funding/ Defunding Period	Description
Private Equity	Hired	07/01/2022	\$200 Million	5 Years	Apax XI – Large buyout manager that targets companies in market sub-sectors with substantial growth tailwinds but invests considerable effort to transform these into more complete assets.
Private Equity	Hired	07/01/2022	\$200 Million	5 Years	Audax Private Equity Fund VII – North American mid-market buyout fund that follows a buy and build strategy for control investments.
Private Equity	Hired	07/01/2022	\$175 Million	6 Years	Green Equity Investors IX – Large buyout fund targeting companies with market-leading franchises, defensible competitive positions, and successful track records.
Private Equity	Hired	07/01/2022	\$100 Million	6 Years	Thoma Bravo XV – Mega buyout manager that targets businesses that provide application, infrastructure and security software products, and/or technology enabled services.
Private Equity	Hired	07/01/2022	\$150 Million	5 Years	Veritas Capital Fund VIII** – Large buyout fund with a focus on investing in companies that provide critical products and services, primarily technology or technology-enabled solutions to government and commercial customers.
Private Equity	Hired	07/05/2022	\$200 Million	6 Years	Apollo Investment Fund X – Value-oriented mega buyout fund that has a flexible strategy for investments in opportunistic buyouts and build ups, corporate carve-outs, and distressed investments.
Private Equity	Hired	07/20/2022	\$150 Million	6 Years	HIG Advantage Buyout Fund II – Mid-market buyout fund that targets control investments in stable, high-quality companies in North America.
Private Equity	Hired	07/20/2022	\$100 Million	5 Years	Vista Equity Partners Fund VIII* – Mega buyout fund that makes control investments in enterprise software companies.
Private Equity	Hired	07/21/2022	€120 Million	5 Years	Bain Capital Europe VI – European mid-market buyout fund that makes control investments in businesses with sustainable competitive advantages, potential upside, and opportunities to drive transformational operational change.

* The manager is considered DIME under the Commonwealth of Virginia definition, which defines ownership threshold of 51% or more.

** The manager is considered DIME under the definition that considers industry best practices and defines an ownership threshold of greater than or equal to 33% and less than 51% of firm ownership or carry.

Forward Returns & Scenario Analysis

Steven Peterson
Research Director



Summary Forward Returns And Scenario Analysis



VRS Long Term Forward Returns

Forward Returns Attribution

External Managers' Forward Returns Comparison

Scenarios (Impact on Funded Status, Contribution Rates, Liquidity)

- Baseline
- Soft Landing
- Inflation Surprise
- Recession
- Stagflation

Forward Returns and Volatilities By Asset Class (20 year)



Asset Class	Current			Allowable	
	Wt.	E(r)	E(σ)	Min	Max
Public Equity	34.0%	6.8%	16.8%	-5.0%	5.0%
Fixed Income	15.0%	4.4%	4.7%	-3.0%	5.0%
Credit Strategies	14.0%	7.1%	5.4%	-5.0%	5.0%
Real Assets	14.0%	6.0%	14.0%	-5.0%	5.0%
Private Equity	14.0%	8.8%	26.2%	-5.0%	5.0%
MAPS	6.0%	5.9%	7.9%	-2.0%	2.0%
PIP	3.0%	7.3%	18.9%	-2.0%	2.0%
Cash	0.0%	0.0%	0.5%	-1.0%	4.0%
<i>Currency Return Addition</i>		0.1%			
Total Fund		6.7%	13.8%		

Asset Class and Strategy	Current		
	Wt.	E(r)	E(σ)
Public Equity	34.0%	6.8%	16.8%
Fixed Income	15.0%	4.4%	4.7%
Treasury	6.1%	3.2%	
Agency	0.1%	3.6%	
MBS	3.3%	4.5%	
CMBS	0.2%	4.9%	
ABS	0.2%	4.8%	
IG	3.4%	4.8%	
HY	0.6%	8.1%	
JPM EMBI Core	1.0%	8.6%	
Credit Strategies	14.0%	7.1%	5.4%
Rate Sensitive HY	4.2%	6.0%	
Rate Sensitive IG	1.4%	3.7%	
Non-Rate Sensitive	8.4%	7.8%	
Real Assets	14.0%	6.0%	14.0%
Private Real Estate	7.7%	5.6%	
Public Real Estate	2.1%	7.2%	
Other Real Assets	4.2%	6.5%	
Private Equity	14.0%	8.8%	26.2%
MAPS	6.0%	5.9%	7.9%
PIP	3.0%	7.3%	18.9%
Cash	0.0%	0.1%	0.5%
<i>Currency Return Addition</i>			
Total Fund		6.7%	13.8%

Forward Returns and Volatilities By Asset Class (20 year)



2022

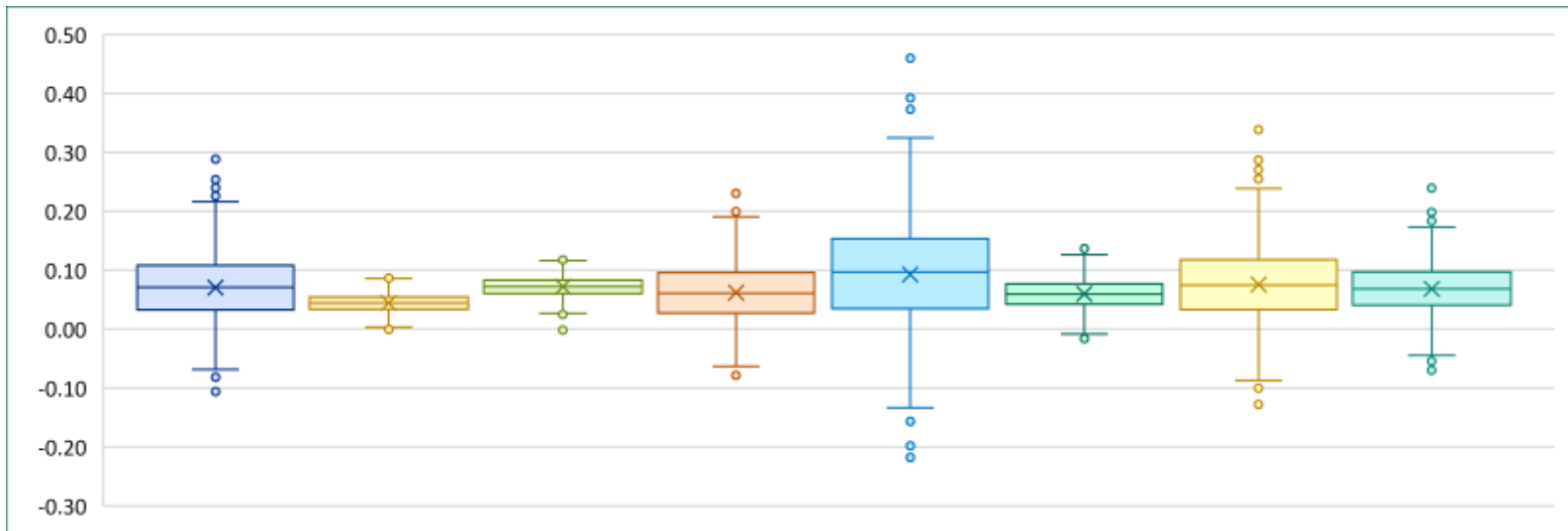
Asset Class	Wt.	Current		Allowable	
		E(r)	E(σ)	Min	Max
Public Equity	34.0%	6.8%	16.8%	-5.0%	5.0%
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PIP	3.0%	7.3%	18.9%	-2.0%	2.0%
Cash	0.0%	0.0%	0.5%	-1.0%	4.0%
<i>Currency Return Addition</i>		<i>0.1%</i>			
Total Fund		6.7%	13.8%		

2021

Asset Class	Wt.	Current		Allowable	
		E(r)	E(σ)	Min	Max
Public Equity	34.0%	6.6%	14.0%	-5.0%	5.0%
Fixed Income	15.0%	3.0%	4.0%	-3.0%	5.0%
Credit Strategies	14.0%	6.8%	6.5%	-5.0%	5.0%
Real Assets	14.0%	6.8%	10.0%	-5.0%	5.0%
Private Equity	14.0%	10.6%	20.0%	-5.0%	5.0%
MAPS	6.0%	5.5%	8.0%	-2.0%	2.0%
PIP	3.0%	8.3%	15.0%	-2.0%	2.0%
Cash	0.0%	0.0%	0.5%	-1.0%	4.0%
<i>Currency Return Addition</i>		<i>0.1%</i>			
Total Fund		6.8%	11.4%		

VRS Forward Returns By Asset Class

Annualized 20 Year E[r]



Quant	PubEq	FI	CS	RA	PvtEq	MAPS	PIP	Fund
P5	-0.0247	0.0198	0.0440	-0.0176	-0.0540	0.0172	-0.0250	0.0005
P25	0.0324	0.0335	0.0602	0.0271	0.0349	0.0422	0.0331	0.0403
P50	0.0710	0.0444	0.0718	0.0610	0.0971	0.0594	0.0744	0.0683
P75	0.1078	0.0546	0.0830	0.0957	0.1532	0.0766	0.1174	0.0969
P95	0.1612	0.0690	0.1002	0.1378	0.2290	0.1017	0.1756	0.1330

Macro Factor Impact on Forward Returns

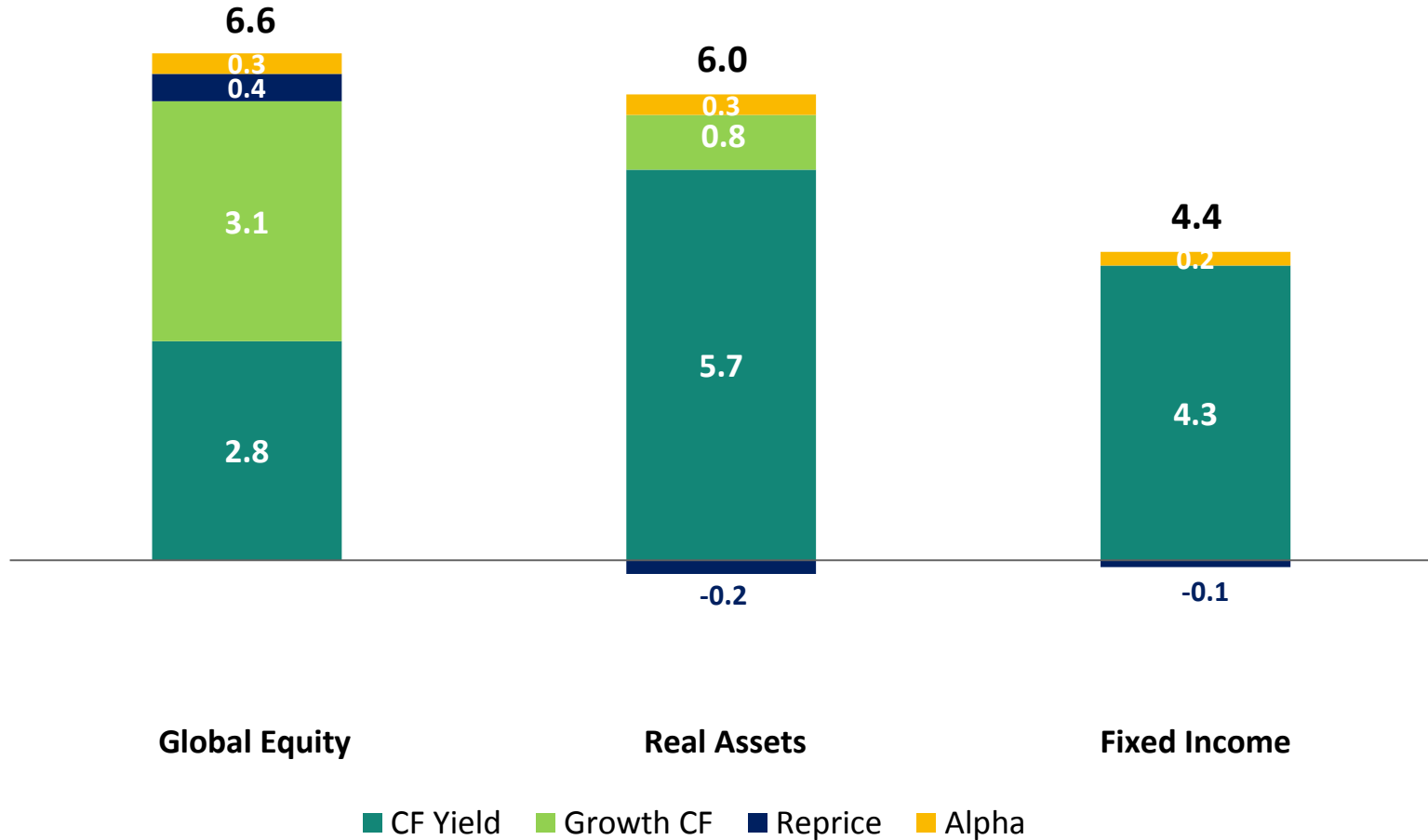
	Factor	Impact
Alpha	Rising Vol	+
Growth In Yield	Taxes	-
	Productivity	-
	De-Globalization	-
	Nominal Rates	+
Real Yield	Rates v Inflation	-
	Discount Factor	-
Inflation	Fed QT	-
	Commodity Prices	-
	Nominal Wage Growth	-
	Supply Chain	+
Revaluation	P/E Mean Reversion	-
	Risk Aversion	-

Forward Returns Attribution

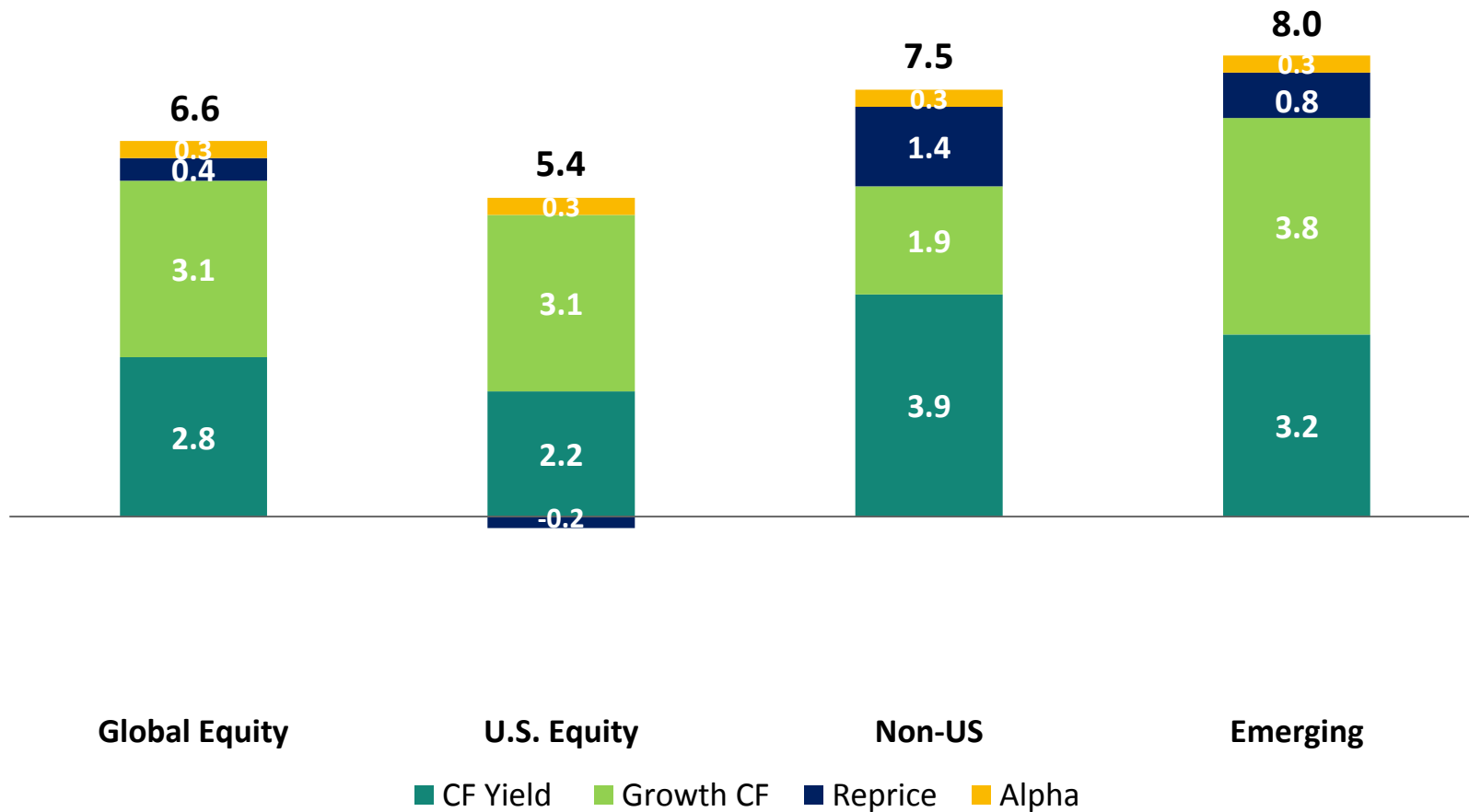
	Return	CF Yield	Growth in CF	Reprice	Alpha
Global Eq (10 yr)	6.6%	2.8%	3.1%	0.4%	0.3%
US Eq	5.4%	2.2%	3.1%	-0.2%	0.3%
Non-US Eq	7.5%	3.9%	1.9%	1.4%	0.3%
EM Eq	8.0%	3.2%	3.8%	0.8%	0.3%
Real Assets (20 yr)	6.0%	5.7%	0.8%	-0.2%	0.3%
Private RE	5.6%	3.8%	2.5%	-0.2%	0.3%
Global REITs	7.2%	2.8%	4.3%	-0.2%	0.3%
Infrastructure	5.8%	3.7%	2.3%	-0.1%	0.5%
Energy & Mining	8.3%	25.0%	-17.0%	0.0%	0.5%
Timberland	4.8%	3.0%	2.5%	-0.2%	0.5%
Farmland	6.8%	6.8%	0.7%	0.0%	0.5%
Tot. ORA	6.5%	10.2%	-3.6%	-0.1%	0.5%
Total IFI (20 yr)	4.4%	4.3%	0.0%	-0.1%	0.2%
BC Treasury	3.2%	3.2%	0.0%	-0.1%	0.1%
BC Agency	3.6%	3.5%	0.0%	-0.1%	0.2%
BC MBS	4.5%	4.2%	0.0%	-0.1%	0.4%
BC CMBS	4.9%	4.7%	0.0%	-0.2%	0.4%
BC ABS	4.8%	4.6%	0.0%	-0.1%	0.4%
BC IG Credit	4.8%	4.6%	0.0%	-0.2%	0.4%
BC HY Credit	8.1%	8.2%	0.0%	-0.5%	0.4%
JPM EMBI Core	8.6%	8.7%	0.0%	-0.4%	0.2%

Notes: RA is net of leverage; IFI CF Yield includes growth in CF

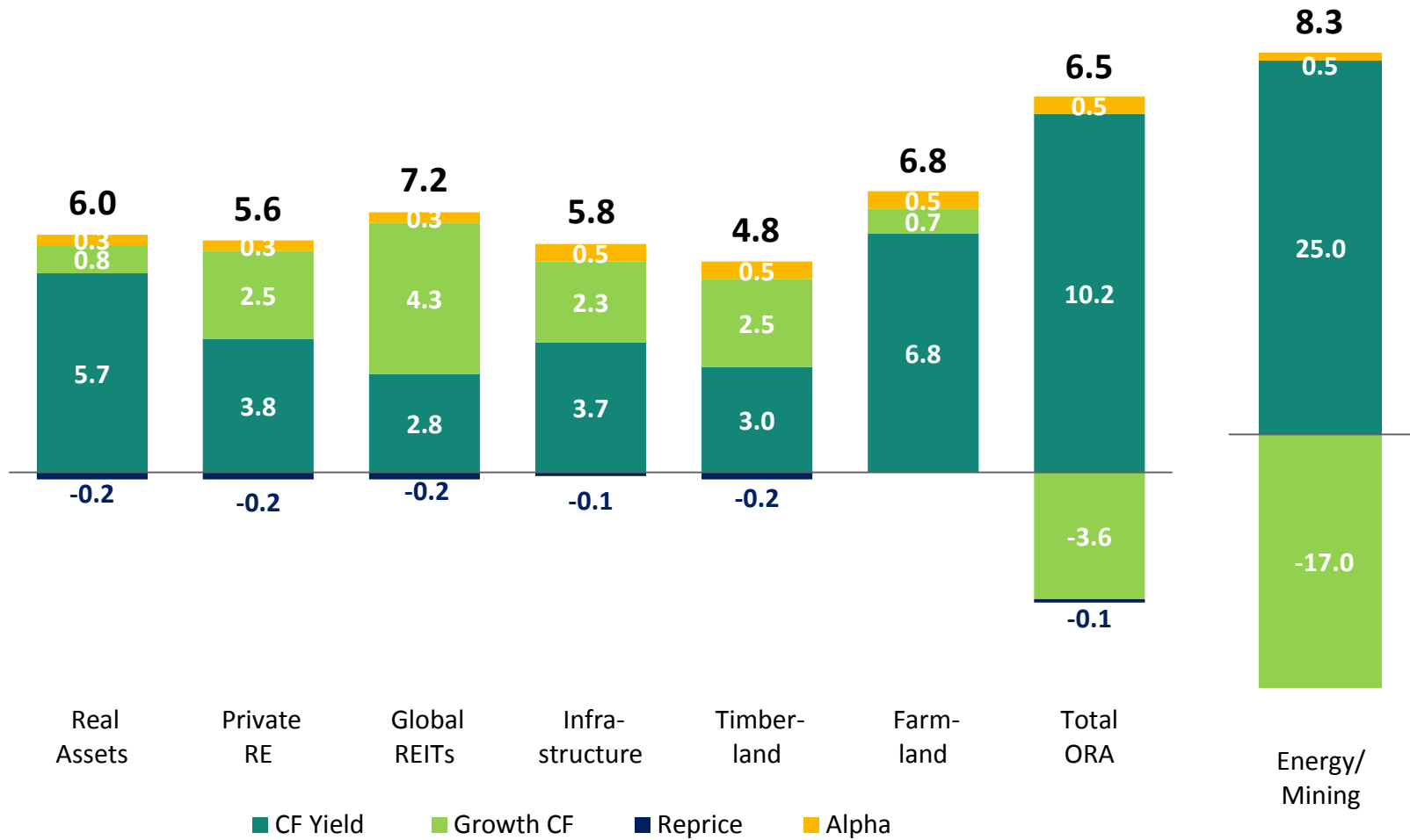
Total Fund – Selected Attribution (Percent)



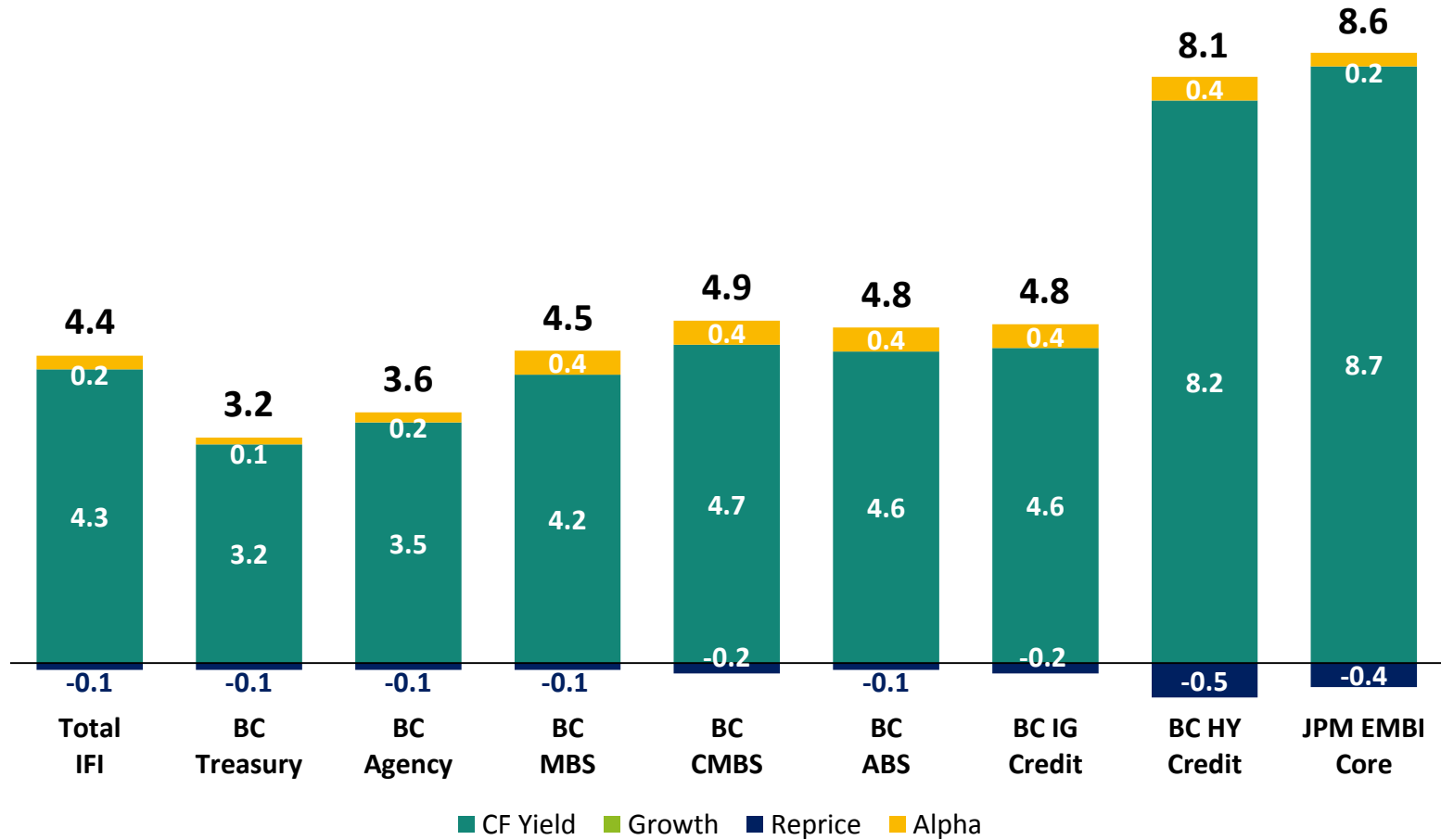
Global Equity Attribution (Percent)



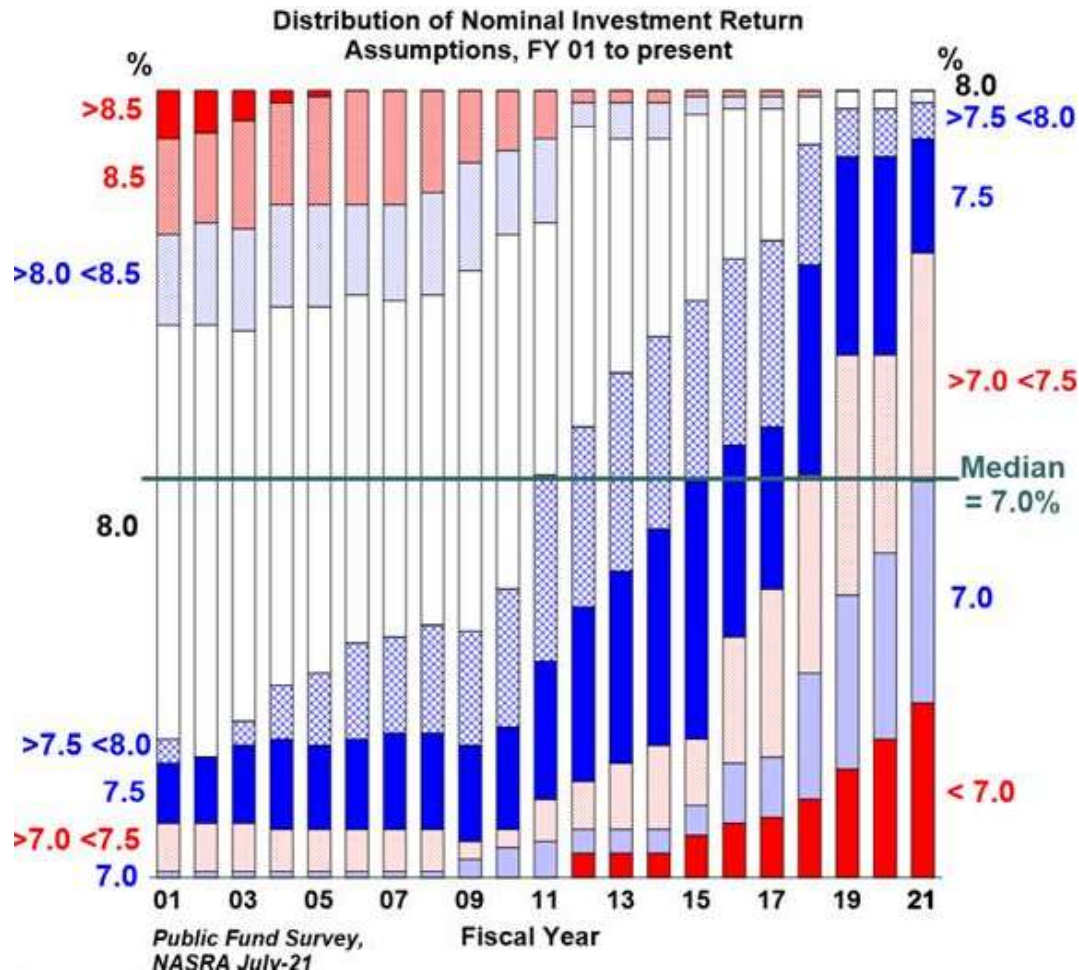
Real Assets Attribution (Percent)



Fixed Income Attribution (Percent)

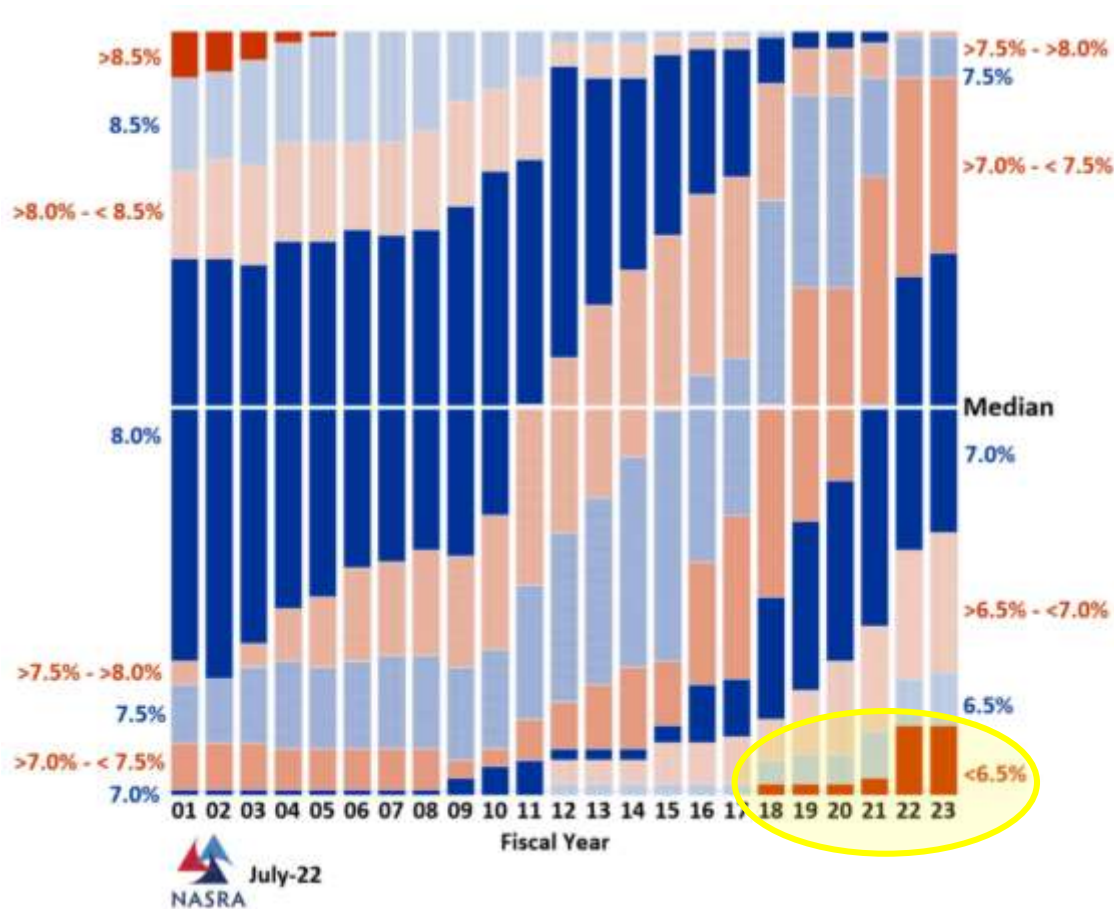


Public Pension Plan Discount Rate Through Time (2021)



Public Pension Plan Discount Rate Through Time (2022)

Distribution of Nominal Investment Return Assumptions
FY 01 to Latest



NASRA July-22

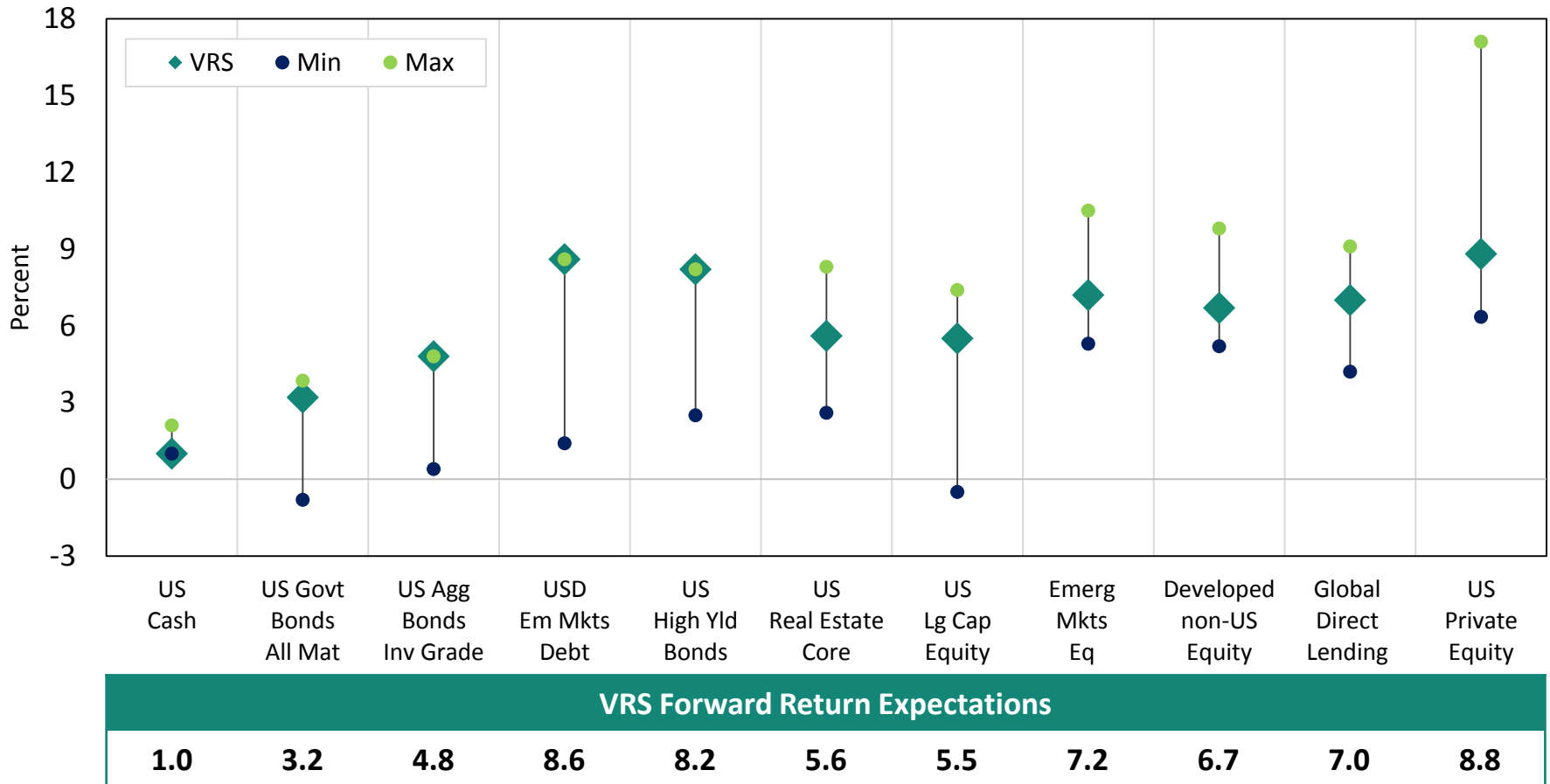
External Managers' 10-Yr Forward Return History



	2015	2017	2018	2019	2020	2021	2022
U.S. Core Fixed	3.0	3.1	3.1	3.4	1.5	1.6	2.7
Credit (HY)	5.0	4.6	4.4	5.0	4.8	3.5	4.8
Core Real Estate	5.4	5.5	5.2	5.7	5.3	5.9	5.2
U.S. Stocks	6.2	6.0	5.5	5.7	5.5	4.0	5.2
Int'l Developed Stocks	6.9	6.4	6.8	6.7	6.2	6.2	6.6
Emerging Stocks	8.4	7.5	7.1	8.2	7.6	6.6	7.5
Private Equity	8.9	7.2	7.7	9.2	8.9	9.5	9.3

Long Term Forward Return Expectations

Long Term Forward Return Expectations External Manager & VRS



Scenario Analysis



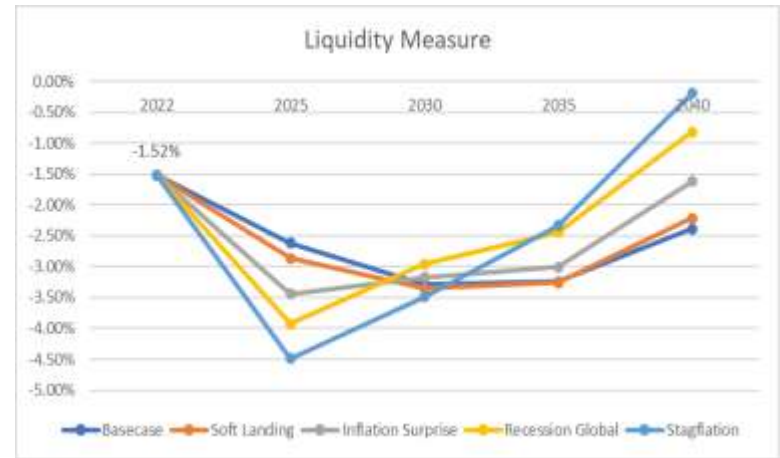
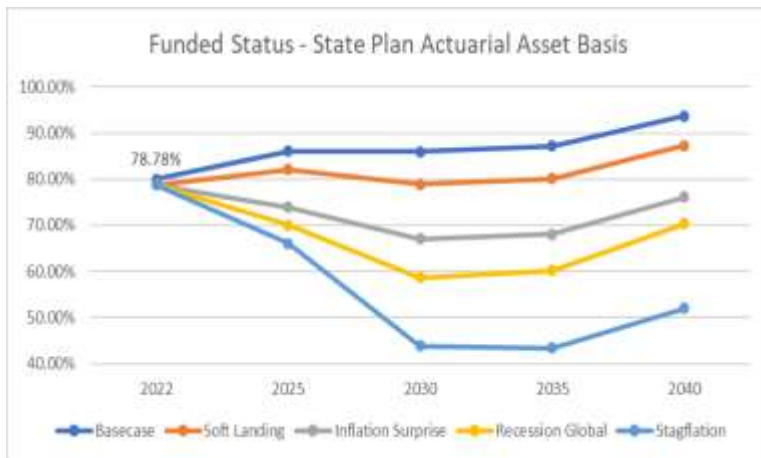
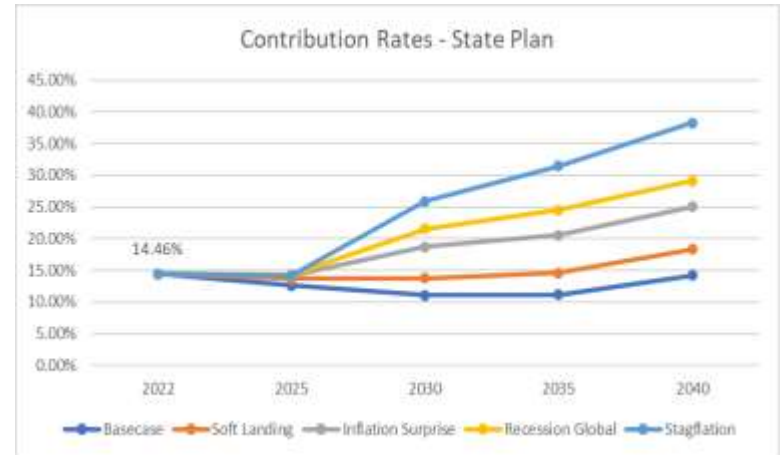
Stagflation – We begin by drawing from the 1969-1988 experience, extrapolating inflation rates from this period and working with real returns (to the S&P using Shiller). So, while nominal returns are relatively high for equity, real returns reflect much slower growth and are negative for years 1-5 in this scenario, implying that this period of stagflation is front loaded and then tapers off and reverts to the baseline thereafter. Fixed income is hit hardest initially in years 1-4 but then stagnates slightly below the baseline for the remainder of the scenario. Private equity and MAPS are tied to equity, and CS rate-sensitive exposure is affected adversely.

Inflation surprise/Rate hike – We assume that wage and commodity inflation continue their upward trends with some spiking along the way for years 1-2 and remain sticky as Fed policy misses inflation targets. As a result, inflation is followed by elevated interest rates which negatively affect discounted cash flows. Inflation is under control after two years and all asset classes return to the baseline scenario. The timeline is shallow (1-2 years).

Recession (Base Case) – The Fed fails to achieve a soft landing. While the first half of 2022 was largely about downward revisions in equity valuations, the second half was about downward revisions in (real) earnings forecasts. Growth expectations retracted, weakening oil prices, and higher nominal rates (e.g. mortgages) resulted in a significant slowdown in housing sales and valuations. Households continue to spend down savings inventoried during the pandemic while real incomes continue to fall off. The economy contracts by fourth quarter 2022 reaching bottom in 2023. The recovery in asset valuations extends through 2024. Risk assets hit hardest in years 1-3.

Soft Landing – This is a Goldilocks case in which inflation responds immediately to Fed policy moves and is back to a targeted 2.5% by the end of 2023.

Scenarios – Median Paths (State)



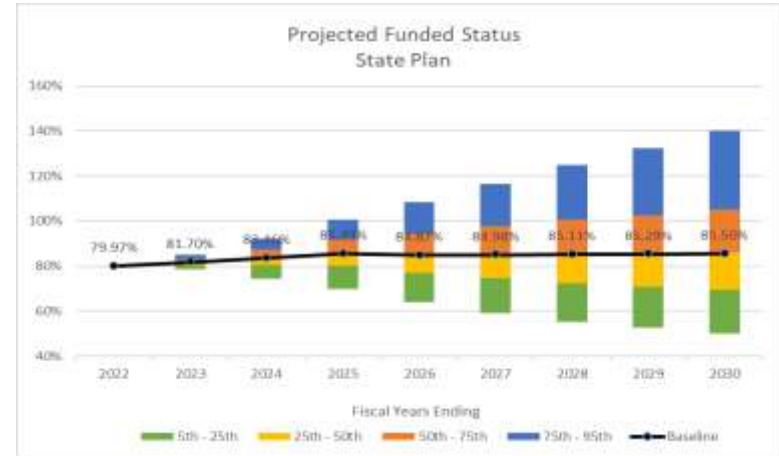
- Results include 2022 investment return of 0.6%.
- Projections reflect measures from 2022 Appropriation Act which include additional contributions made in June 2022 and maintaining of prior employer rates for State and Teacher plans.

Baseline - State Plan

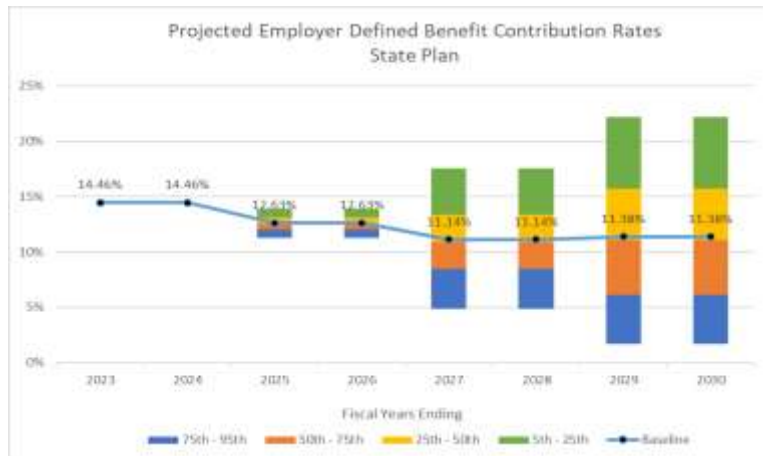
Rates of Return



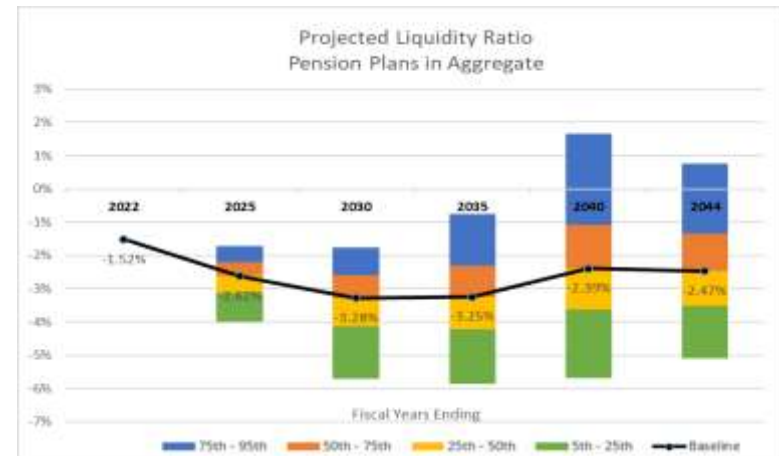
Funded Status – Actuarial Asset Basis



Contribution Rates



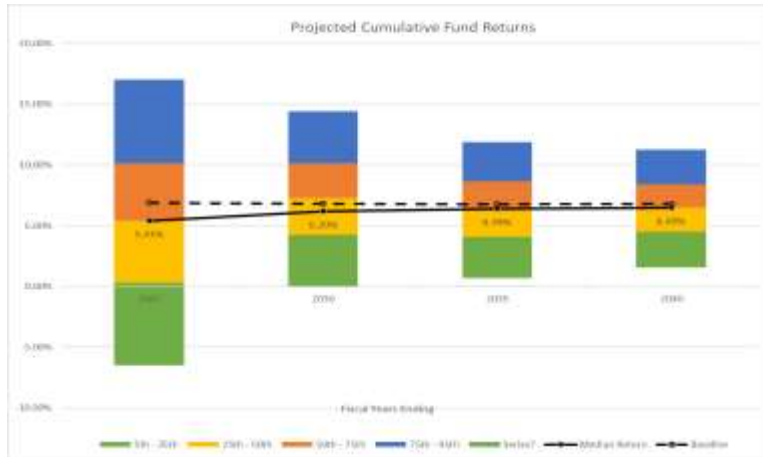
Liquidity



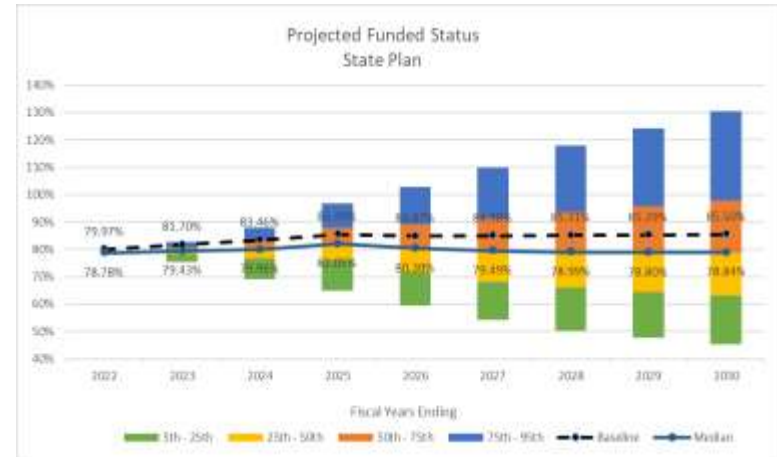
- Results include 2022 investment return of 0.6%.
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Soft Landing – State Plan

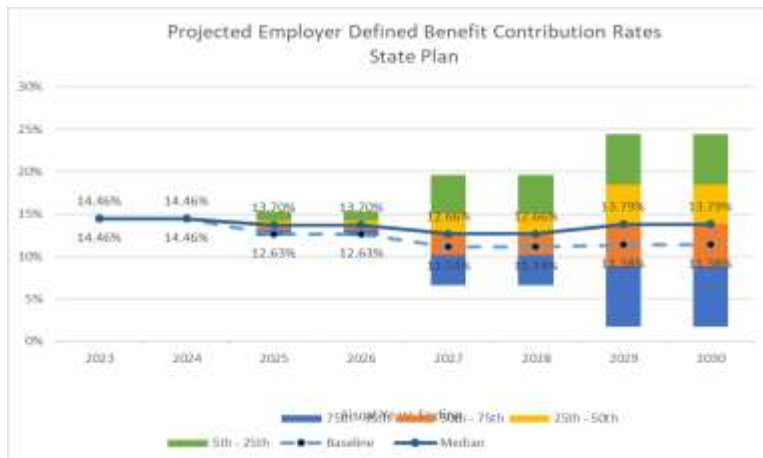
Rates of Return



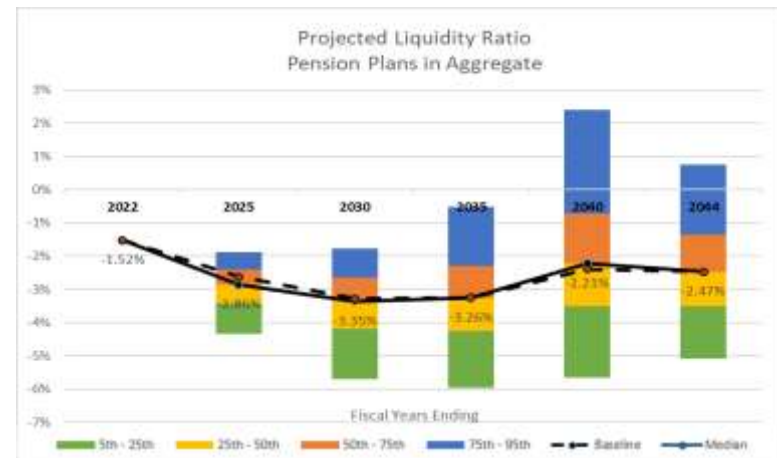
Funded Status – Actuarial Asset Basis



Contribution Rates



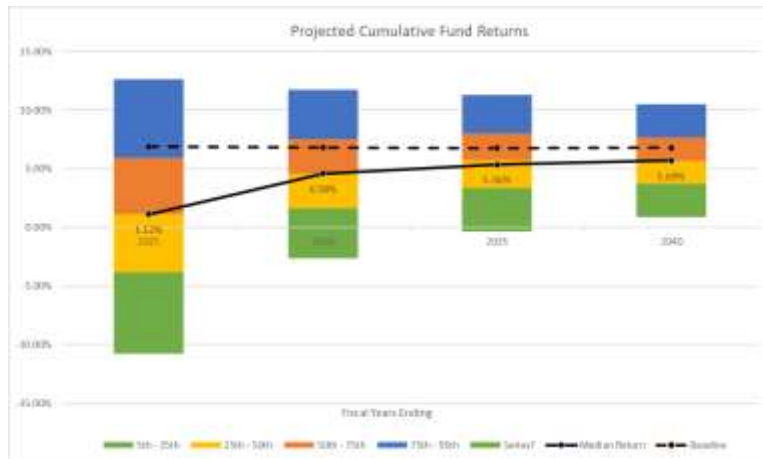
Liquidity



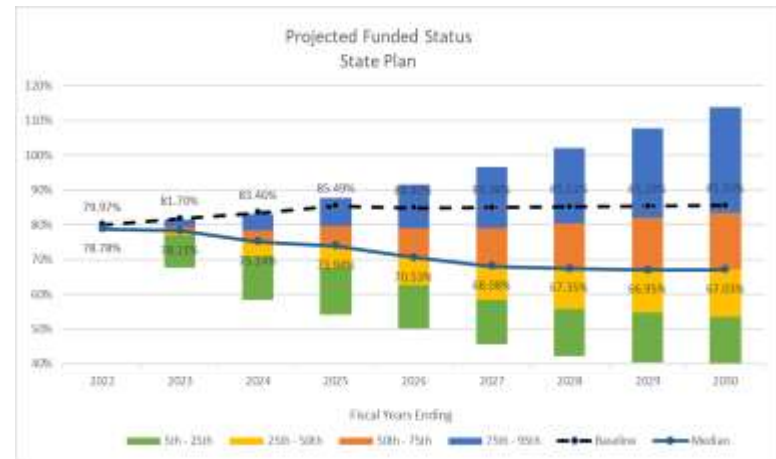
- Results include 2022 investment return of 0.6%.
- Projections reflect measures from 2022 Appropriation Act which include additional contributions made in June 2022 and maintaining of prior employer rates for State and Teacher plans.

Inflation Surprise – State Plan

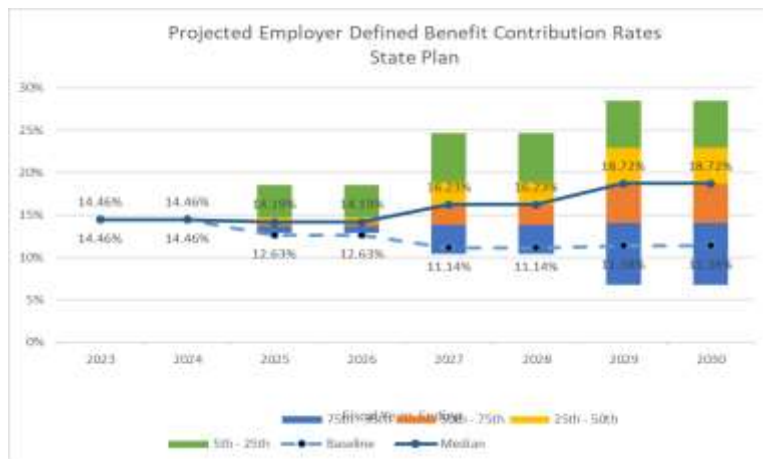
Rates of Return



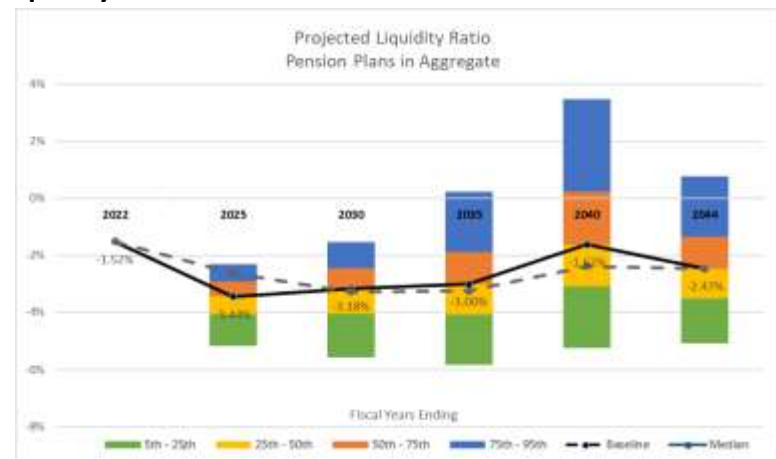
Funded Status – Actuarial Asset Basis



Contribution Rates



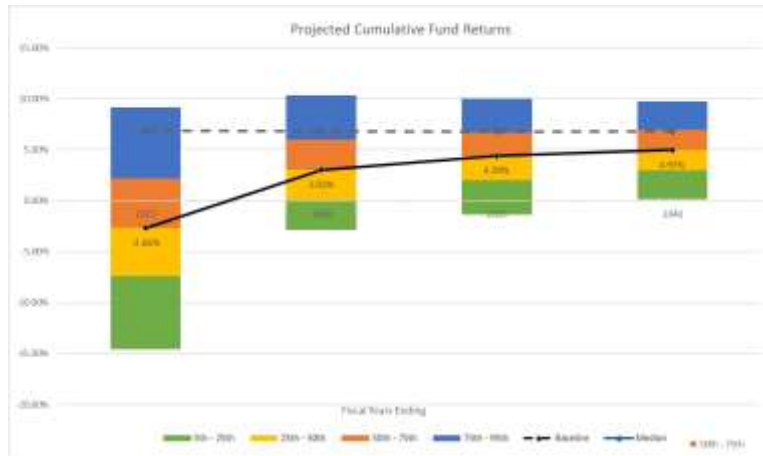
Liquidity



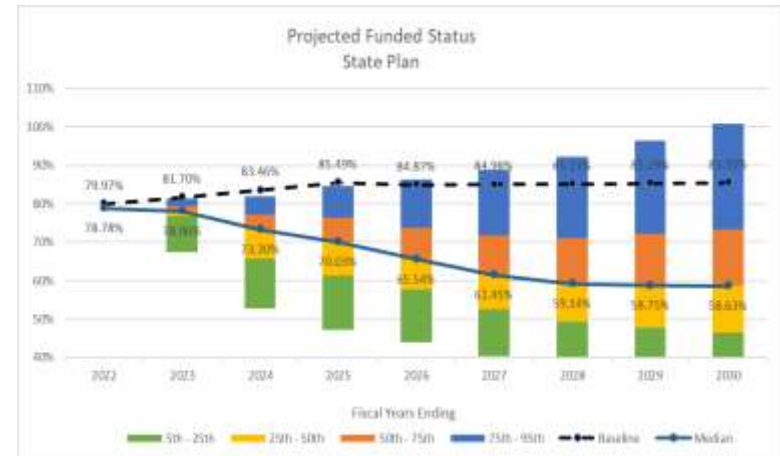
- Results include 2022 investment return of 0.6%.
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Recession Global – State Plan

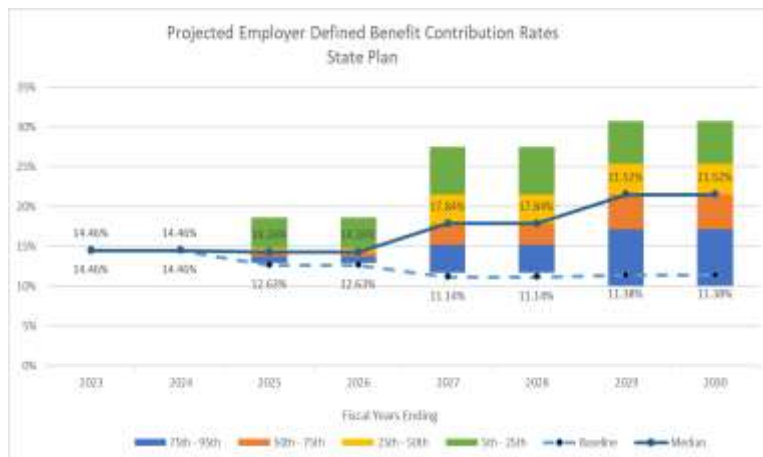
Rates of Return



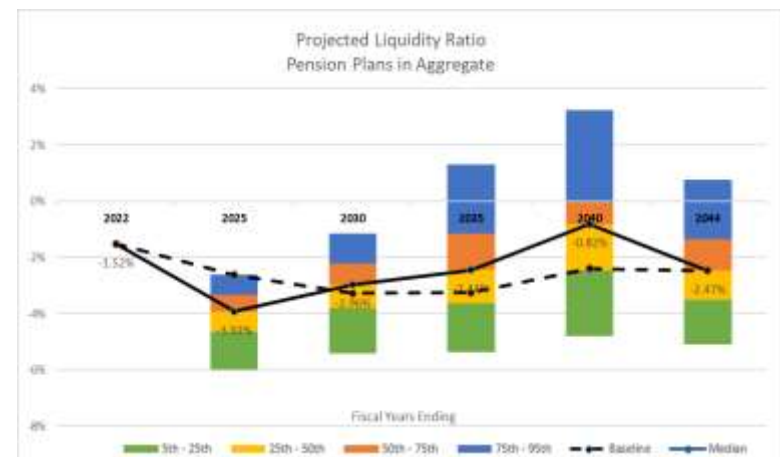
Funded Status – Actuarial Asset Basis



Contribution Rates



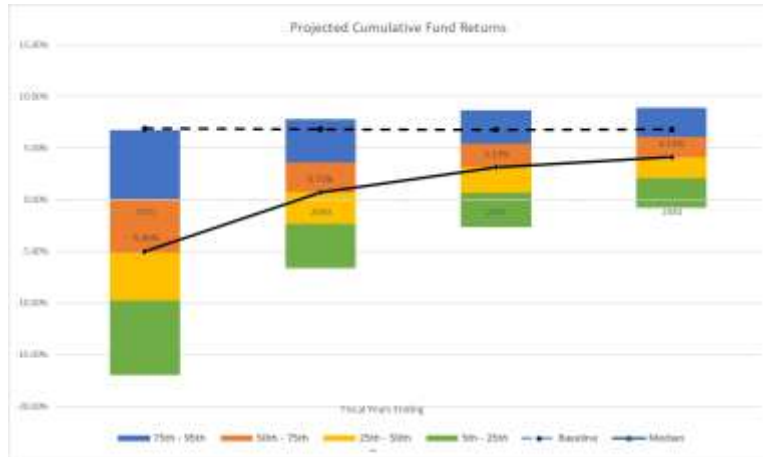
Liquidity



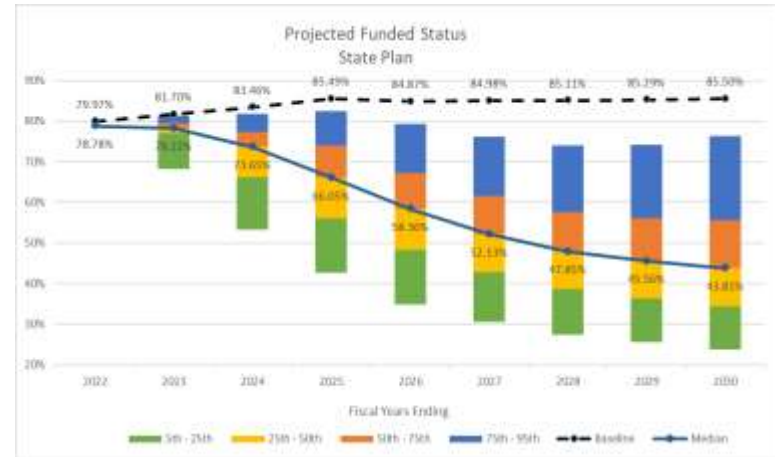
- Results include 2022 investment return of 0.6%.
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Stagflation – State Plan

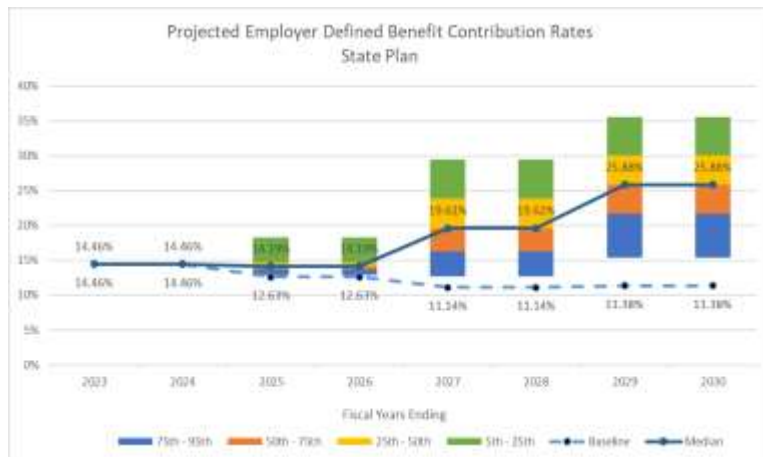
Rates of Return



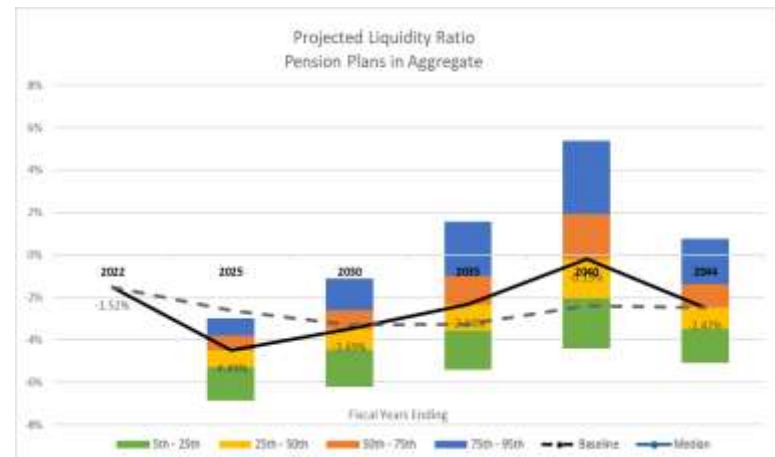
Funded Status – Actuarial Asset Basis



Contribution Rates

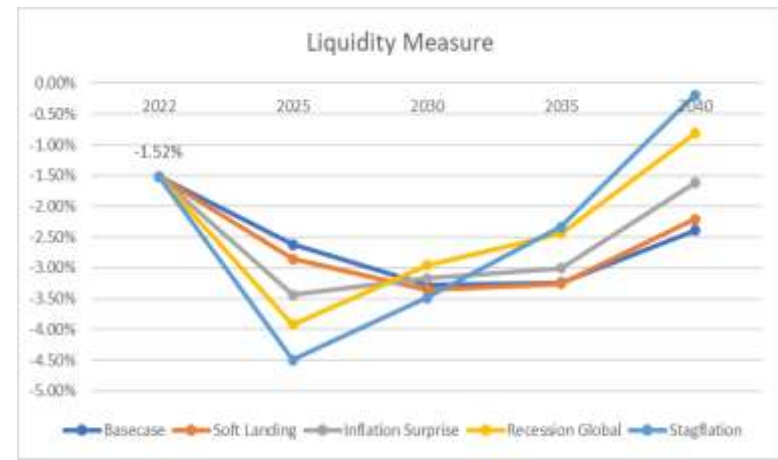
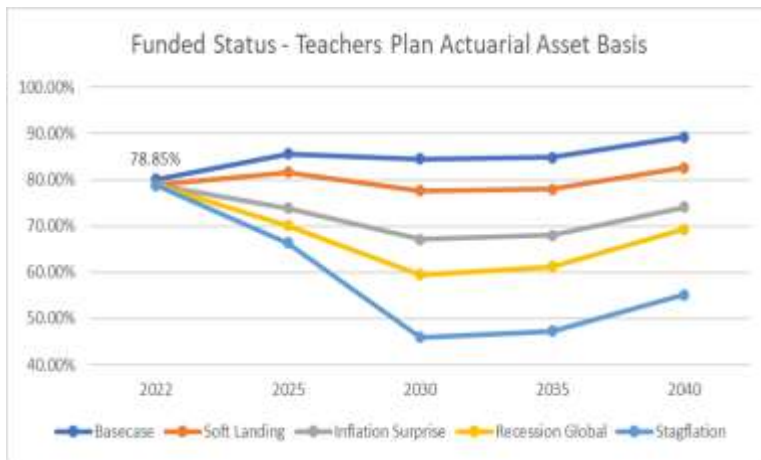
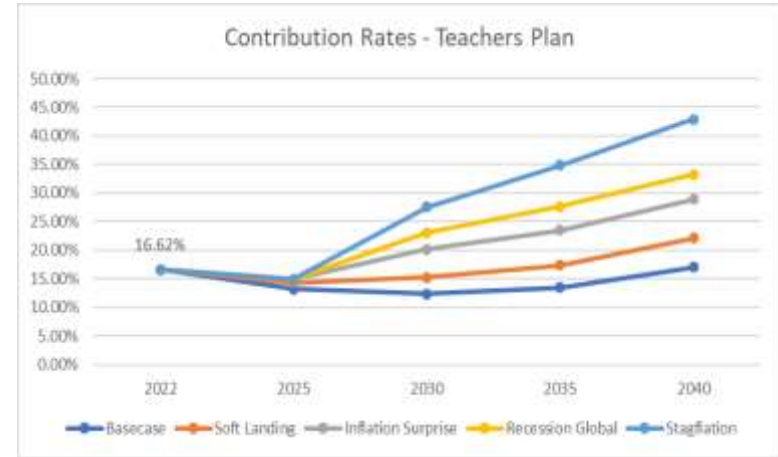


Liquidity



- Results include 2022 investment return of 0.6%.
- Projections reflect measures from 2022 Appropriation Act which include additional contributions made in June 2022 and maintaining of prior employer rates for State and Teacher plans.

Scenarios – Median Paths (Teachers)



- Results include 2022 investment return of 0.6%.
- Projections reflect measures from 2022 Appropriation Act which include additional contributions made in June 2022 and maintaining of prior employer rates for State and Teacher plans.

Appendix

I am using Damodar Data.xlsx, Shiller Annual.xlsx, and Shiller LT. xlsx (monthly), Comparative Statics Workspace.xlsx, and Macro Worksheets.xlsx (Pulse). These sources are available upon request. Growth rate in real C is my proxy for economic growth using monthly frequency and GDP Gap is used for quarterly frequency. I also have Inflation, real returns to equity (S&P 500) and bonds (1-year Treasury, 10-year Treasury), IG and HY indexes (Damodar). Finally, I anchor on historic VRS total Fund and asset classes (PE, FI, CS and RA).

Historically, the great depression lines up with the deflation/contractionary numbers that are the deepest followed by the GFC which was much milder by comparison. Both have either Inflation < 0 or close to zero and growth negative (contracting). For pure growth contraction/shocks I looked at the GFC. For stagflation, I focus on the 1969-1988 period to model the only simultaneous inflation/growth decline episode we've had. Beginning with stagflation, I want inflation and slower growth. The period beginning in 1969 has data points consistent with this scenario (Shiller LT). Then, I focus on 1978-1981 for high inflation, low growth, negative returns to bonds. (These are very consistent state 4 cases - from our 4-factor state-space modeling).

Changes in the Policy Mix – Impact on Scenario Mean Returns



	Pub Eq	FI	CS	RA	Pvt Eq	MAPS	PIP
Aggressive	0.4	0.1	0.11	0.15	0.15	0.06	0.03
Policy	0.34	0.15	0.14	0.14	0.14	0.06	0.03
Conservative	0.25	0.35	0.11	0.1	0.1	0.06	0.03

	Pub Eq	FI	CS	RA	Pvt Eq	MAPS	PIP	Policy	Aggressive	Conservative
Baseline	5.6%	3.6%	6.8%	6.7%	9.7%	5.6%	7.8%	6.4%	6.5%	5.7%
Soft Landing	5.0%	3.2%	7.0%	7.1%	9.1%	5.4%	8.0%	6.2%	6.3%	5.5%
InflSurprise	5.0%	2.7%	5.6%	5.7%	9.1%	4.8%	5.7%	5.6%	5.8%	4.9%
Recession	4.0%	2.5%	5.5%	5.0%	8.1%	3.6%	5.9%	4.9%	5.0%	4.4%
Stagflation	3.4%	1.6%	4.1%	4.3%	7.4%	3.3%	4.8%	4.1%	4.2%	3.5%

Global Annualized Sensitivity

GLOBAL ANNUALIZED FORWARD RETURNS SENSITIVITY

Terminal Global Div. Yield	1.8%	7.2%	8.3%	9.3%	10.4%	11.4%	12.5%	13.5%	Terminal Global P/E	25x
	2.0%	6.5%	7.5%	8.5%	9.6%	10.6%	11.7%	12.7%		23x
	2.2%	5.6%	6.6%	7.7%	8.7%	9.7%	10.8%	11.8%		21x
	2.4%	4.7%	5.7%	6.7%	7.8%	8.8%	9.8%	10.8%		19x
	2.7%	3.7%	4.7%	5.7%	6.7%	7.7%	8.7%	9.8%		17x
	3.0%	2.6%	3.6%	4.6%	5.6%	6.6%	7.6%	8.6%		15x
	3.5%	1.4%	2.3%	3.3%	4.3%	5.3%	6.3%	7.3%		13x
	4.1%	0.0%	0.9%	1.9%	2.9%	3.8%	4.8%	5.7%		11x
	0.0%	1.0%	2.0%	3.0%	4.0%	5.0%	6.0%			
10-year Annualized Nominal Global Earnings Growth										

US Annualized Sensitivity

U.S. ANNUALIZED FORWARD RETURNS SENSITIVITY

Terminal U.S. Div. Yield	1.8%	4.9%	5.9%	6.9%	7.9%	9.0%	10.0%	11.0%	Terminal U.S. P/E
	2.0%	4.1%	5.1%	6.1%	7.1%	8.2%	9.2%	10.2%	
	2.1%	3.2%	4.2%	5.3%	6.3%	7.3%	8.3%	9.3%	
	2.4%	2.3%	3.3%	4.3%	5.3%	6.3%	7.3%	8.3%	
	2.6%	1.3%	2.3%	3.3%	4.3%	5.3%	6.3%	7.3%	
	3.0%	0.2%	1.2%	2.2%	3.2%	4.1%	5.1%	6.1%	
	3.5%	-1.0%	-0.1%	0.9%	1.9%	2.8%	3.8%	4.8%	
	4.1%	-2.4%	-1.5%	-0.5%	0.4%	1.4%	2.3%	3.3%	
	0.0%	1.0%	2.0%	3.0%	4.0%	5.0%	6.0%		
10-year Annualized Nominal U.S. Earnings Growth									

25x
23x
21x
19x
17x
15x
13x
11x

Terminal U.S. P/E

Developed Markets (non-US) Annualized Sensitivity

NON-U.S. ANNUALIZED FORWARD RETURNS SENSITIVITY

Terminal Dev. Non-U.S. Div. Yield	2.0%	9.3%	10.4%	11.5%	12.5%	13.6%	14.7%	15.8%	Terminal Dev. Non-U.S. P/E
	2.2%	8.6%	9.6%	10.7%	11.8%	12.8%	13.9%	14.9%	
	2.4%	7.7%	8.8%	9.8%	10.9%	12.0%	13.0%	14.1%	
	2.6%	6.8%	7.9%	8.9%	10.0%	11.0%	12.1%	13.1%	
	2.9%	5.9%	6.9%	7.9%	9.0%	10.0%	11.0%	12.1%	
	3.3%	4.8%	5.8%	6.9%	7.9%	8.9%	9.9%	10.9%	
	3.8%	3.6%	4.6%	5.6%	6.6%	7.6%	8.6%	9.7%	
	4.5%	2.3%	3.3%	4.2%	5.2%	6.2%	7.2%	8.2%	
		-1.0%	0.0%	1.0%	2.0%	3.0%	4.0%	5.0%	
	10-year Annualized Nominal Dev. Non-U.S. Earnings Growth								

Developed Markets Annualized Sensitivity

EM ANNUALIZED FORWARD RETURNS SENSITIVITY

Terminal EM Div. Yield	1.8%	9.7%	10.7%	11.8%	12.8%	13.9%	15.0%	16.0%	Terminal EM P/E
	1.9%	8.7%	9.7%	10.8%	11.8%	12.9%	13.9%	15.0%	
	2.2%	7.6%	8.6%	9.6%	10.7%	11.7%	12.8%	13.8%	
	2.5%	6.3%	7.4%	8.4%	9.4%	10.5%	11.5%	12.5%	
	2.9%	5.0%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	
	3.5%	3.4%	4.4%	5.4%	6.4%	7.4%	8.3%	9.3%	
	4.4%	1.5%	2.5%	3.5%	4.4%	5.4%	6.4%	7.3%	
	5.8%	-0.8%	0.1%	1.1%	2.0%	3.0%	3.9%	4.9%	
	0.8%	1.8%	2.8%	3.8%	4.8%	5.8%	6.8%		
	10-year Annualized Nominal EM Earnings Growth								

20x
18x
16x
14x
12x
10x
8x
6x

Terminal EM P/E

Portfolio Solutions Group (PSG)
Chung Ma
Managing Director



Overview: PSG Team Members



Professional	Position	Highest Degree	Professional Certifications	Investment Experience	VRS Tenure
Chung Ma	Managing Director	MA	CFA	26	8
Audrey Manley	PT Portfolio Assistant			<1	<1
Matt Lacy	Program Director, Port. Integration	MA	CFA	23	23
Kristina Koutrakos	Director, Portfolio Strategy	MBA	CAIA	23	6
Katie Grawe	Sr. Investment Officer	MBA		23	4
Steven Peterson	Program Director, Research	PhD		42	14
Dane Honrado	Research Director, IDS	MS/MBA	FRM	19	6
Advait Apte	Sr. Investment Officer	PhD	CFA	4	4
Lisa Davis	Decisions Systems Analyst III	BS	PMP, CSM CFA Foundations	6	6
Quynh Phuong	Decision Systems Principal	BS	CFA Foundations	3	2
Demory Williamson	Decision Data Analyst	BS	CFA Foundations	1	1
Melanie Zaremba	Decision Systems Analyst	BS	Microsoft SQL	3	3
Ross Kasarda	Director, Risk Management	MA	CFA	18	18
Moses Maxfield	Investment Officer	MBA	CFA, CAIA	17	17
Greg Hines	Investment Officer	MA	CFA	11	9

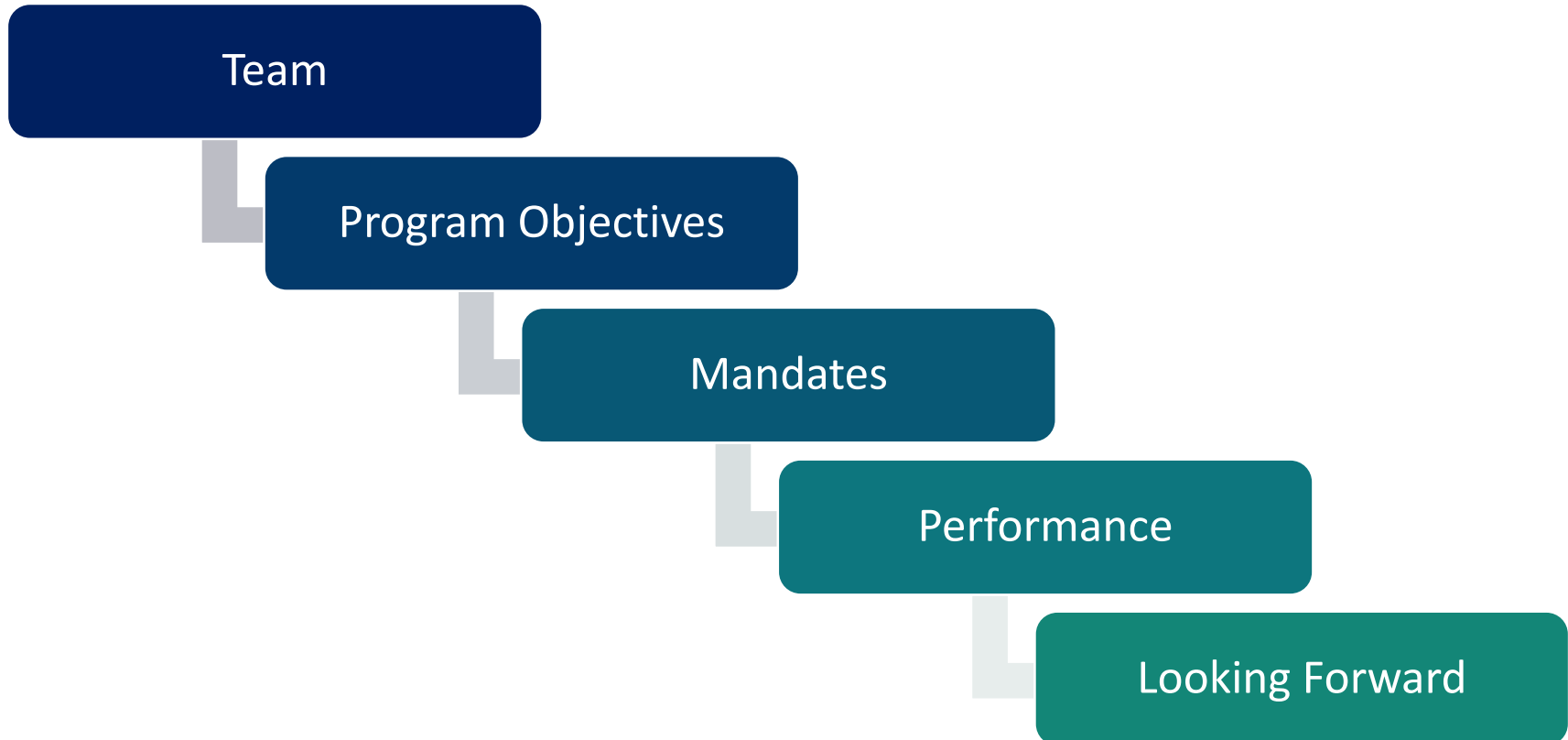
Currency Management

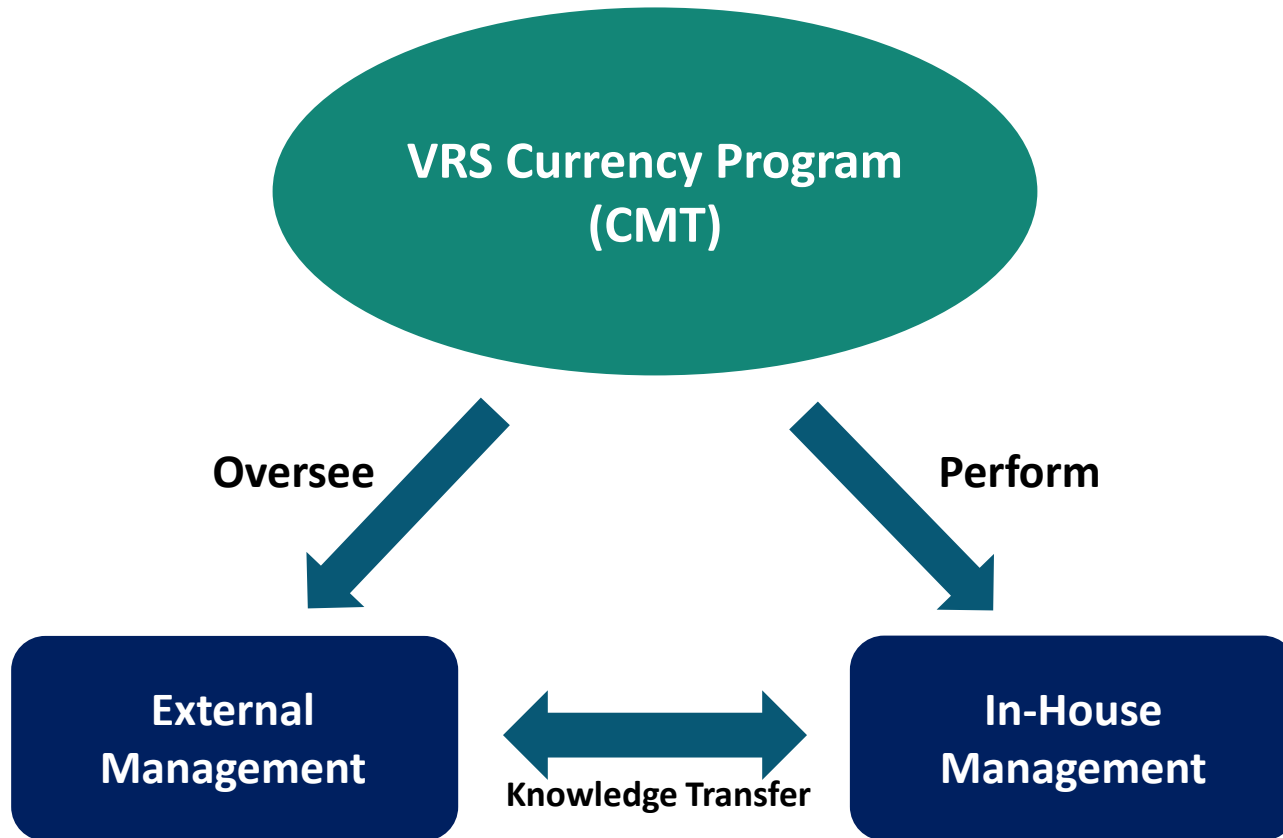
Chung Ma

Managing Director, PSG

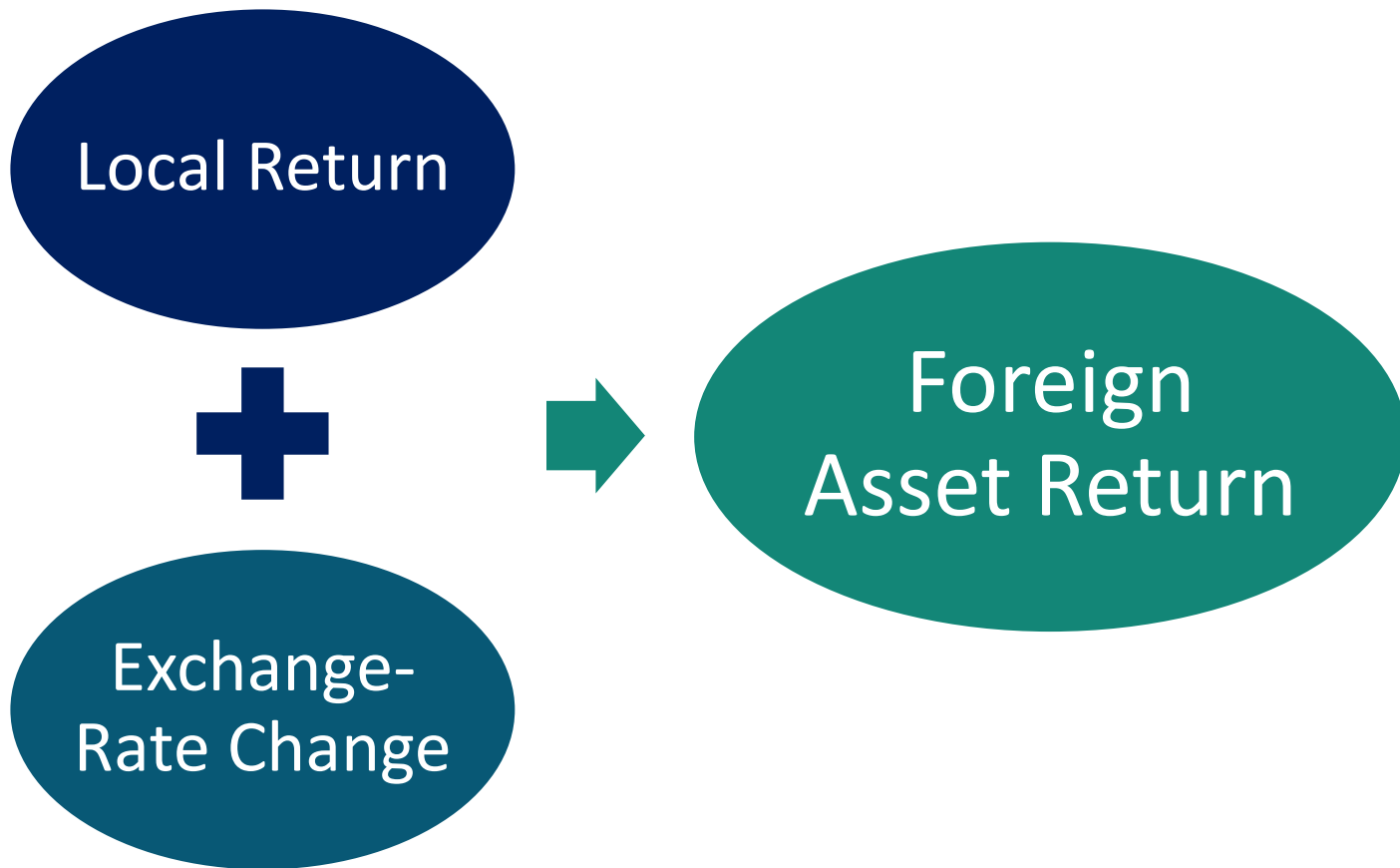


Annual Review Topics





Objective - Managing Currency Risk





External FX Performance

Challenging year as volatility increases

External FX Program: 1, 3, 5 Year Performance

	<u>Inception</u>	<u>5 Year</u>	<u>3 Year</u>	<u>1 Year</u>
Ret (ann.)	0.0%	-0.2%	0.7%	-1.7%
Vol (ann.)	1.6%	1.9%	2.2%	2.1%

But low correlation of returns is desirable

Low Correlation to Fund

<u>Corr. to Fund</u>	<u>Inception</u>	<u>5 Year</u>	<u>3 Year</u>	<u>1 Year</u>
Absolute	-0.2	-0.4	-0.5	-0.2
Excess	0.1	0.1	0.1	0.3

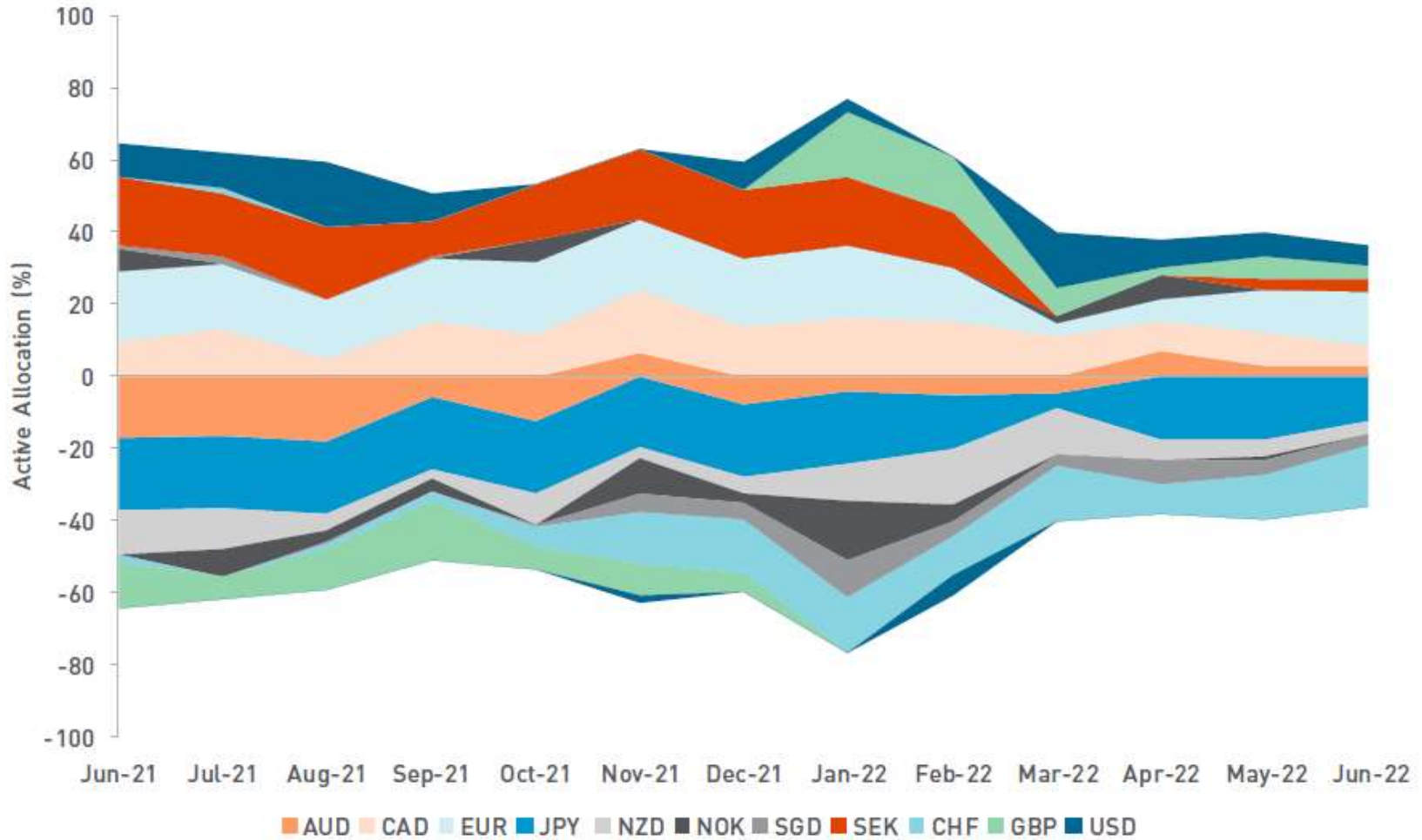
Fund-level internal hedging

CMT: Collaborative Decisions

- Navigating macro environment and dollar reaction
- Examples: short yen position in 2022 (see graph later)

As of June 30, 2022
Source: VRS

First Quadrant - Positioning



Hedging Sub-committee Currency Management Team

Gather
Exposures

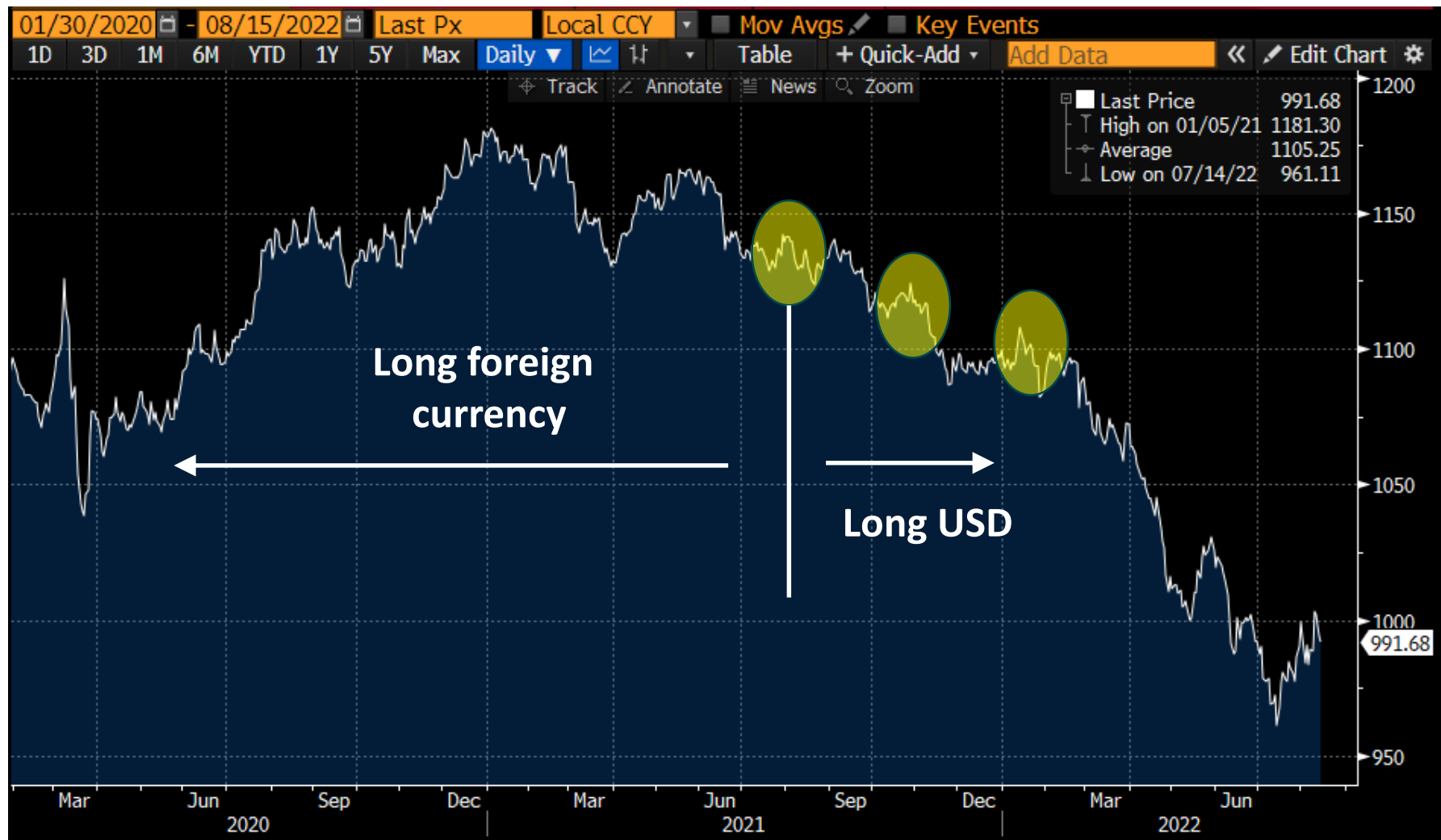
Separate into
Unintended
and Intended

Discuss
Quarterly*

Determine and
Implement
Hedges

** Normally quarterly, but may discuss intra-quarter as necessary*

Foreign Currency vs Dollar



Through August 15, 2022

Fully-Hedged Performance (Illustrative)

Shows performance attributable to active currency exposures to benchmark
Translated to US dollars, millions

	Year	Total	Forwards	Active Pos
\$ weakness	2020	\$ -	\$ 146	\$ (146)
\$ strength	2021	\$ -	\$ (205)	\$ 205
\$ strength	2022	\$ -	\$ (223)	\$ 223
	Total	\$ -	\$ (283)	\$ 283

Through July 31, 2022
Performance calculated via spot returns and estimates of VRS currency exposures

Actual Performance

Shows performance attributable to active currency exposures to benchmark
Translated to US dollars, millions

	Year	Total	Forwards	Active Pos
\$ weakness	2020	\$ 64	\$ 105	\$ (41)
\$ strength	2021	\$ 83	\$ (61)	\$ 144
\$ strength	2022	\$ 223	\$ -	\$ 223
	Total	\$ 371	\$ 44	\$ 327

Through July 31, 2022
Performance calculated using spot returns and estimates of portfolio currency exposures

- Fund level currency management has made significant changes over the recent period to navigate FX environment
- Dollar is still fundamentally overvalued, but current market environment requires us to temper that view
- Possibility that Dollar can move against valuation - supported on higher volatility, expected monetary policy trajectory, and elevated geopolitical concerns
- But the environment remains fluid
- Continue disciplined process of managing currency risk. Balance of internal and external management continues to be an effective model

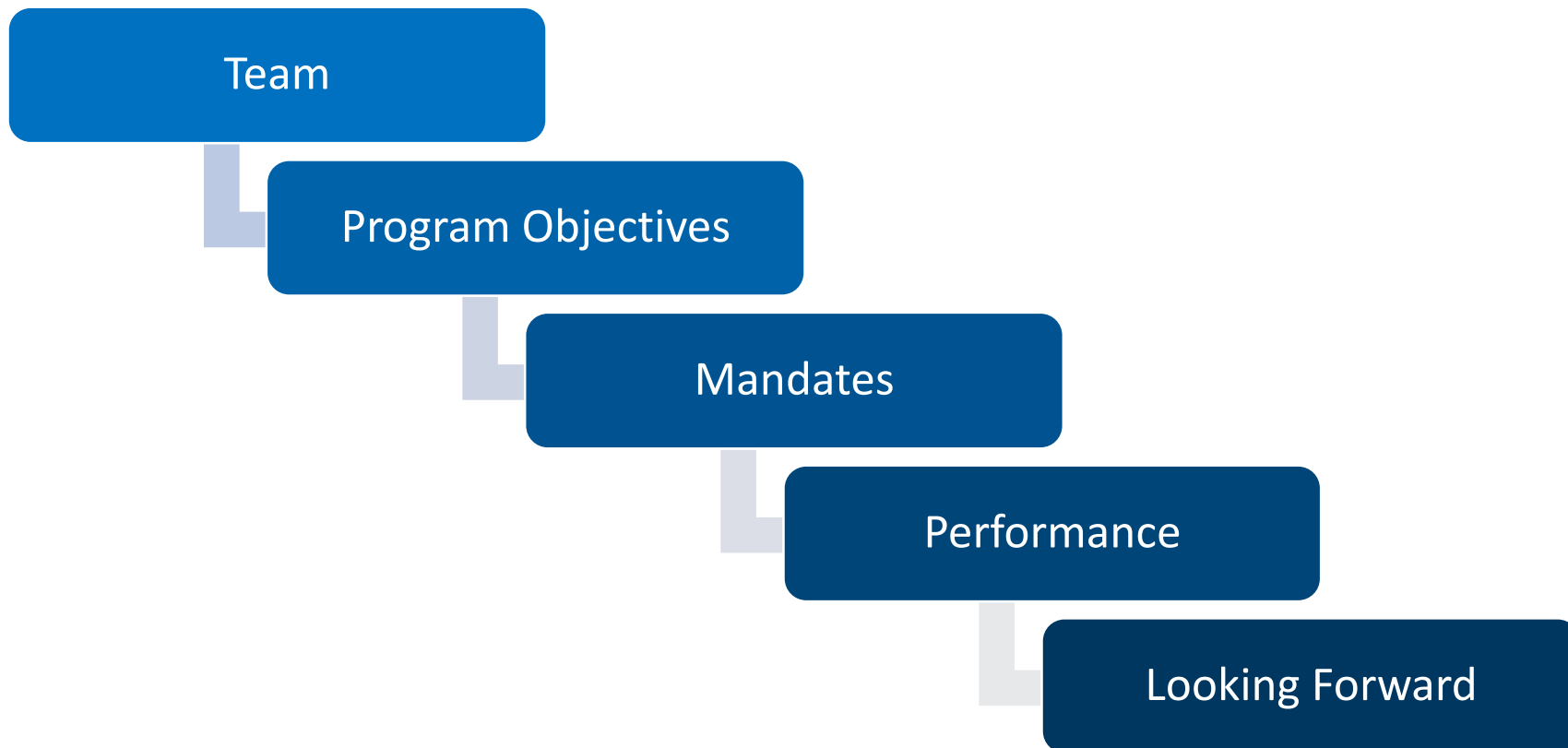
Dynamic Strategies

Kristina Koutrakos

Director, Portfolio Strategy



Annual Review Topics



Team Members

Professional	Position	Highest Degree / Credentials	Investment Experience	VRS Tenure
Kristina Koutrakos	Director, Portfolio Strategy	MBA, CAIA	23	6
Katherine Grawe	Portfolio Manager	MBA	23	4
Additional Resources	Portfolio Solutions Group VRS Investment Staff External Managers & Research Partners Investment Operations Department Portfolio Assistant			

VRS Strategic Advantages

- Access to a broad and flexible set of **investment insights** across asset classes, geographies, and time frames
- **Long-term** time horizon

Strategy Team Investment Objective

- Add **asset allocation alpha** and **diversify excess return** sources
- Identify long-term **thematic drivers** and consider ways to incorporate **structural change** into the portfolio
- Invest over **multiple time horizons** □

The Strategy team seeks to add value through active asset allocation management and the identification of opportunities across the investment landscape.

Dynamic Strategies Objectives

Generate returns that meet or exceed that of a broad, public market opportunity set with a similar risk profile focusing on active asset allocation and the consideration of structural drivers.



Diversify excess return sources

Asset allocation and thematic implementation

Tangible investment solutions

Knowledge transfer across the Plan

Dynamic Strategies Program

Asset Allocation Mandates

Shenandoah

Thematic Mandates

- **Incepted July 2018**
- \$1.5 billion, currently 80% of the program
- Objective to add asset allocation alpha
- Current implementation through externally managed and fully funded mandates
- Three key strategic partnerships seeking asset management and knowledge transfer

- Paper launch July 2019; **Incepted Dec 2020**
- \$95 million, currently 5% of the program
- Internally directed opportunistic asset allocation tilts

- **Incepted July 2021**
- \$271 million, currently 15% of the program
- Objective to invest ahead of broad, structural themes and the opportunities they create within financial markets

Program Performance

<i>As of June 30, 2022</i>	FY2022	2 Year (annualized)	3 Year (annualized)	Since Inception (July 2018, annualized)	<i>Long-term Expectations</i>
Dynamic Strategies Mandate	-15.0%	4.8%	3.2%	4.0%	
Dynamic Strategies Custom Benchmark	-15.1%	3.4%	3.4%	4.4%	
Total Excess Return	+5 bps	+145 bps	-26 bps	-38 bps	+100-120 bps
Active Risk	120 bps	170 bps	184 bps	173 bps	200 bps
Information Ratio	0.0	0.9	-0.1	-0.2	0.5 - 0.6

Active Return Correlations (ex-ante, Barra)

Portfolio	DStrat	RBI	Credit Strategies	Investment Grade Fixed Income	Private Equity	Public Equity	Real Assets	PIP	VRS Total Plan
DStrat Dynamic Strategies Program	1.00								
RBI Risk Based Investment Program	0.17	1.00							
Credit Strategies	-0.14	-0.07	1.00						
Investment Grade Fixed Income	0.58	0.05	-0.12	1.00					
Private Equity	0.18	-0.12	0.52	0.14	1.00				
Public Equity	-0.45	0.26	0.07	-0.42	-0.17	1.00			
Real Assets	0.72	0.26	-0.12	0.43	0.16	-0.52	1.00		
PIP Private Investment Partners	0.52	-0.06	0.36	0.36	0.85	-0.38	0.46	1.00	
VRS Total Plan	0.36	0.08	0.51	0.21	0.95	-0.14	0.38	0.89	1.00

Barra data as of May 2022

Fiscal Year 2022	Relative Performance
Positive Contributors	<ul style="list-style-type: none"> • Asset Allocation Mandates <ul style="list-style-type: none"> ✓ Underweight duration ✓ Value equities • Shenandoah <ul style="list-style-type: none"> ✓ Value equities
Negative Contributors	<ul style="list-style-type: none"> • Thematic Mandates <ul style="list-style-type: none"> – Stock selection – Industrial exposure – Growth exposure

Low conviction macro environment

- Heightened policy risk
- Uncertain geopolitical backdrop
- Environment skewed to favor security selection

Managers taking concentrated positions in small number of high conviction ideas

Pricing correction in thematic mandates

- Structural tailwinds, cyclical adjustment
- Entered high tracking error mandates in small size
- Increasingly attractive opportunity set on a forward-looking basis

Evaluating environment for redeployment opportunities

Asset Allocation Mandates

BLACKROCK

J.P.Morgan



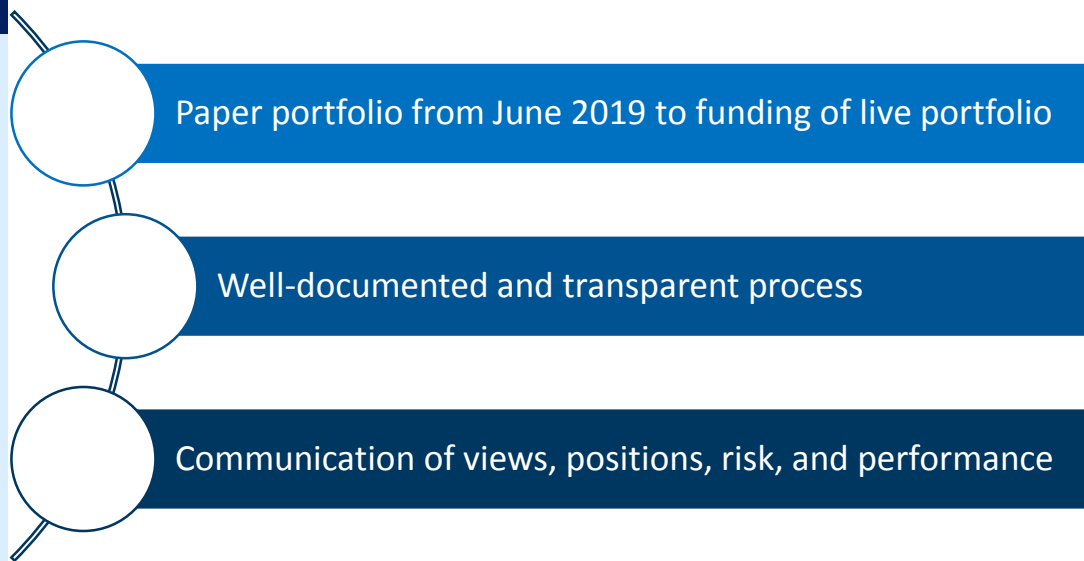
Morgan Stanley

<i>As of June 30, 2022</i>	FY2022	2 Year (annualized)	3 Year (annualized)	Since Inception (July 2018, annualized)	<i>Long-term Expectations</i>
Asset Allocation Mandates	-14.3%	5.2%	3.4%	4.1%	
Asset Allocation Custom Benchmark	-14.8%	3.5%	3.5%	4.5%	
Total Excess Return	+52 bps	+169 bps	-10 bps	-34 bps	+100-120 bps
Active Risk	166 bps	181 bps	192 bps	182 bps	200 bps
Information Ratio	0.3	0.9	-0.1	-0.2	0.5 - 0.6

<i>As of June 30, 2021</i>	FY2022	Since Inception (Nov 2020, annualized)	<i>Long-term Expectations</i>
Shenandoah	-14.4%	-3.0%	
Dynamic Strategies Custom Benchmark	-15.1%	-3.6%	
Total Excess Return	+75 bps	+66 bps	30-60 bps
Active Risk	85 bps	82 bps	100 bps
Information Ratio	0.9	0.8	0.3 - 0.6

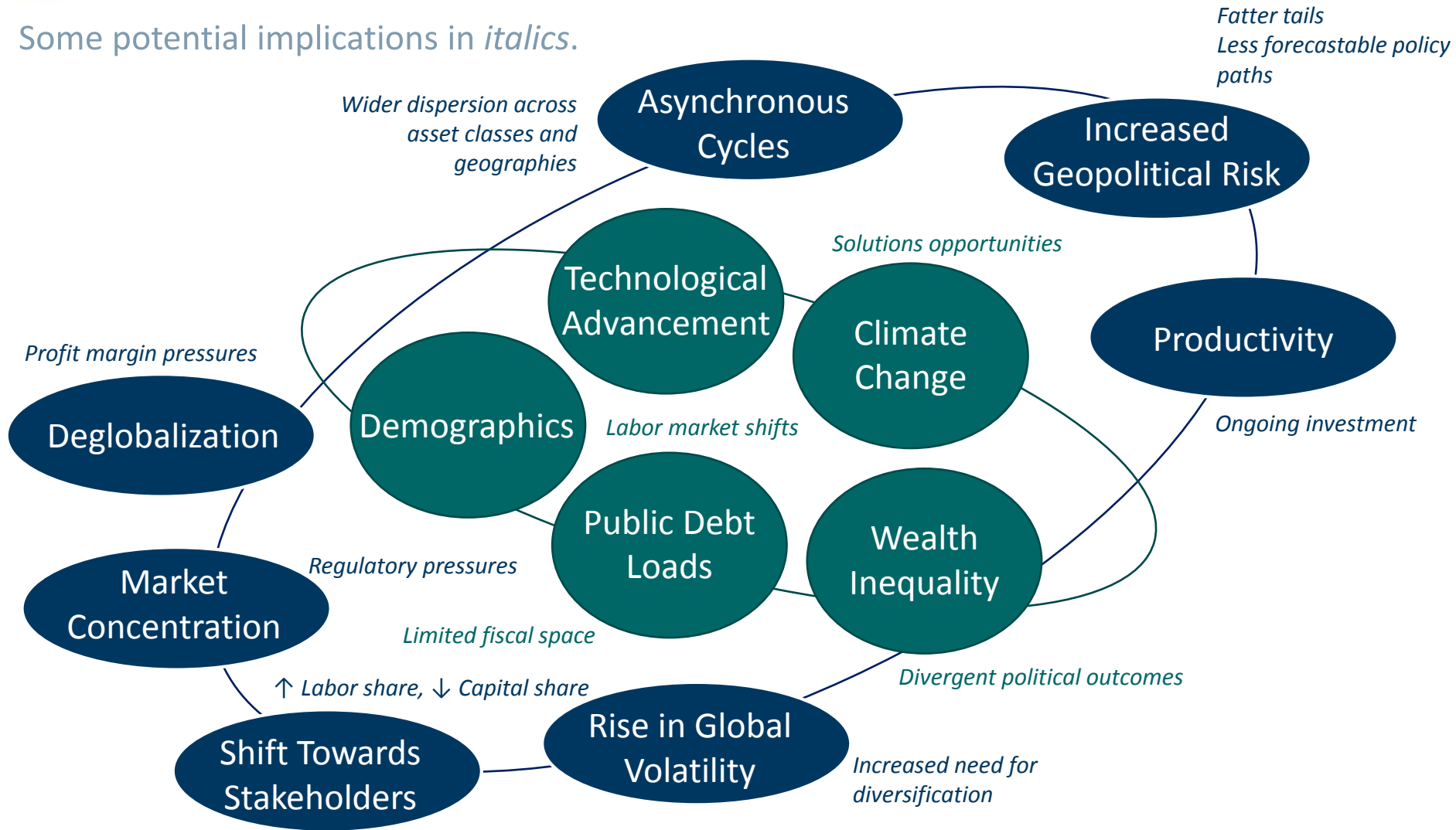
Shenandoah Philosophy

- Add **asset allocation alpha** and **diversification of excess return** sources
- Identify long-term **thematic drivers** and consider ways to incorporate **structural change** into the portfolio
- Invest over **multiple time horizons** □
- **Flexible and adaptive approach** taking the investment environment and VRS opportunity set into account

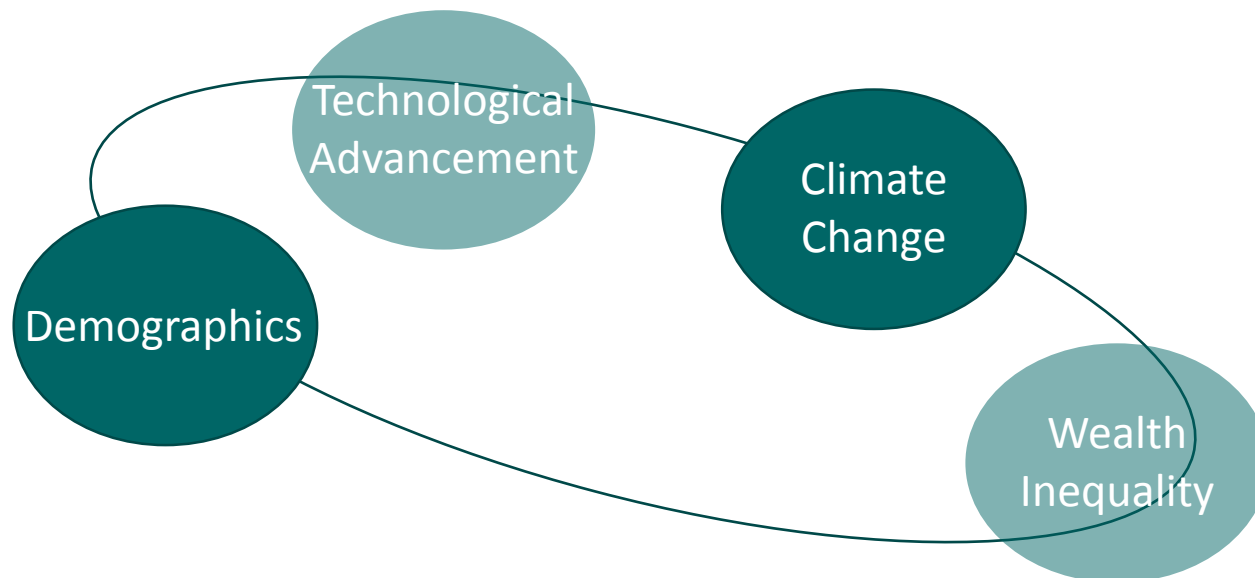


Thematic Drivers

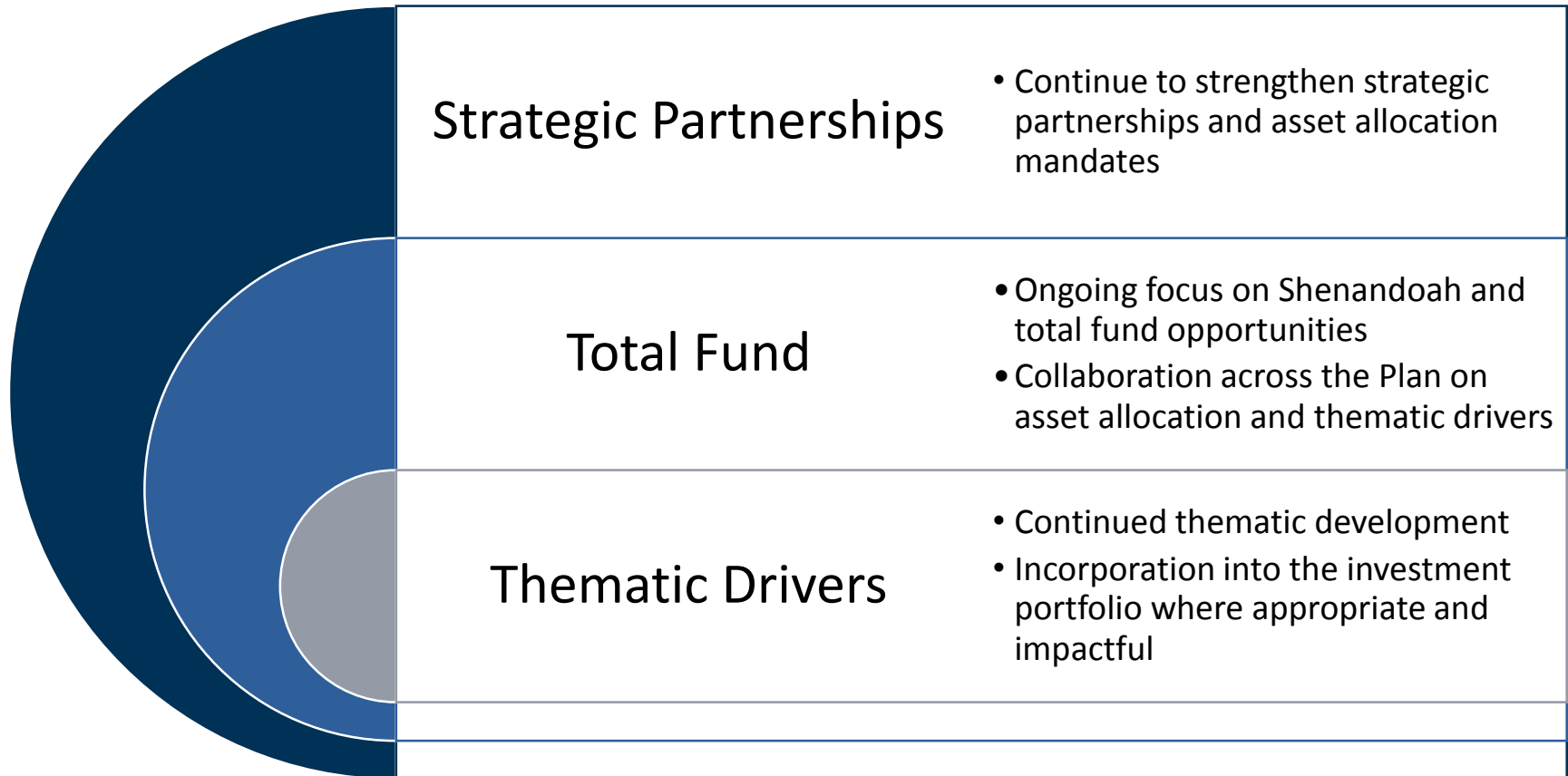
Some potential implications in *italics*.



Thematic Mandates

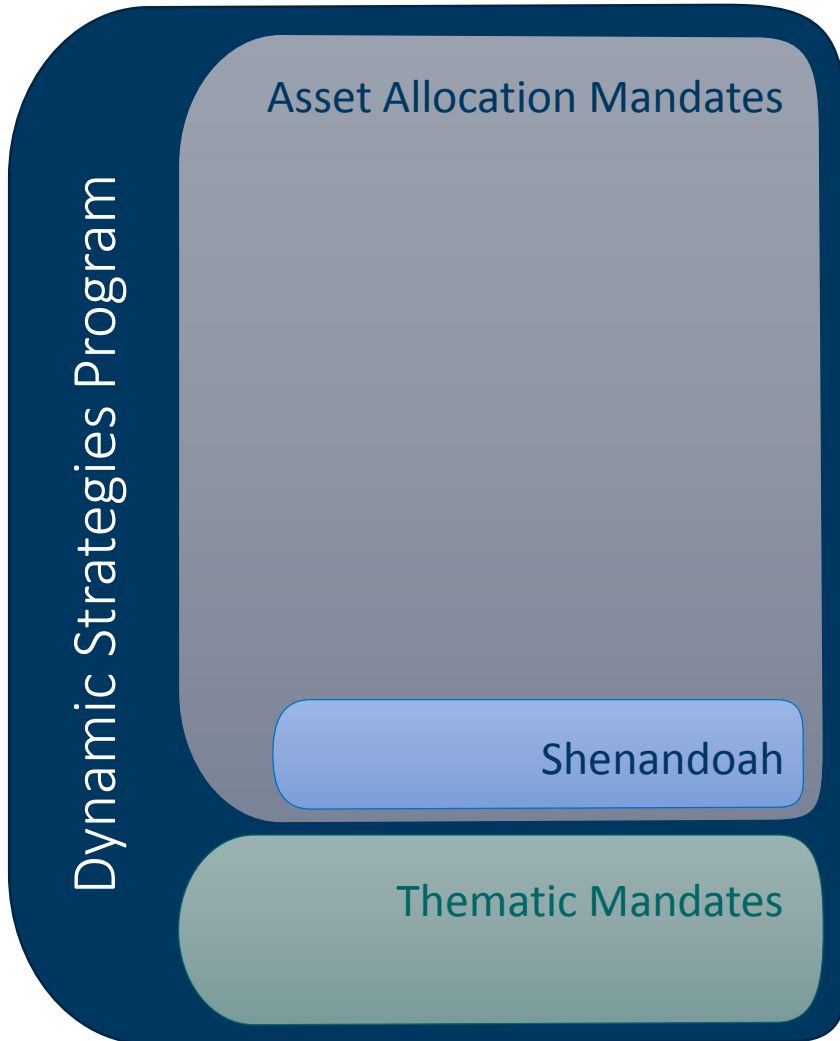


<i>As of June 30, 2022</i>	FY2022
Thematic Mandates	-19.5%
Thematic Custom Benchmark	-16.7%
Total Excess Return	-279 bps
Active Risk	603 bps



Appendix

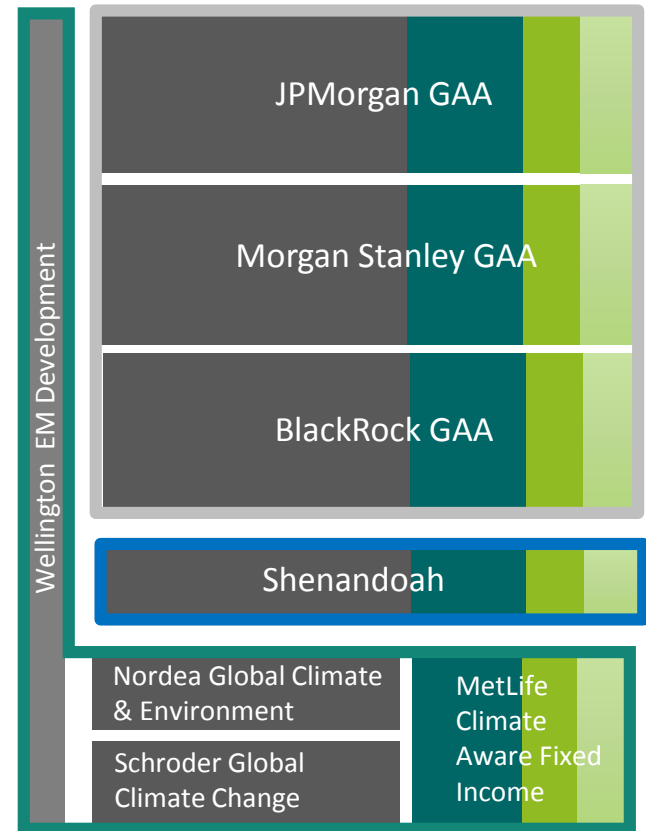
Portfolio Components / Benchmark



Dynamic Strategies Benchmark



DStrat 2021 Portfolio Construction



Dynamic Strategies Benchmark

- 60% MSCI ACWI IMI Index (Net VRS taxes)
- 20% Bloomberg Barclays U.S. Aggregate Index
- 10% Bloomberg Barclays US High Yield Ba/B 2% Issuer Cap Index
- 10% JPMorgan EMBI Global Core (Bloomberg ticker JPEICORE)

Asset Allocation Benchmark

- 57% MSCI World IMI Index (Net VRS taxes)
- 21% Bloomberg Barclays U.S. Aggregate Index
- 11% Bloomberg Barclays US High Yield Ba/B 2% Issuer Cap Index
- 11% JPMorgan EMBI Global Core

Thematic Benchmark

Component weighted based on underlying allocations to the following benchmarks

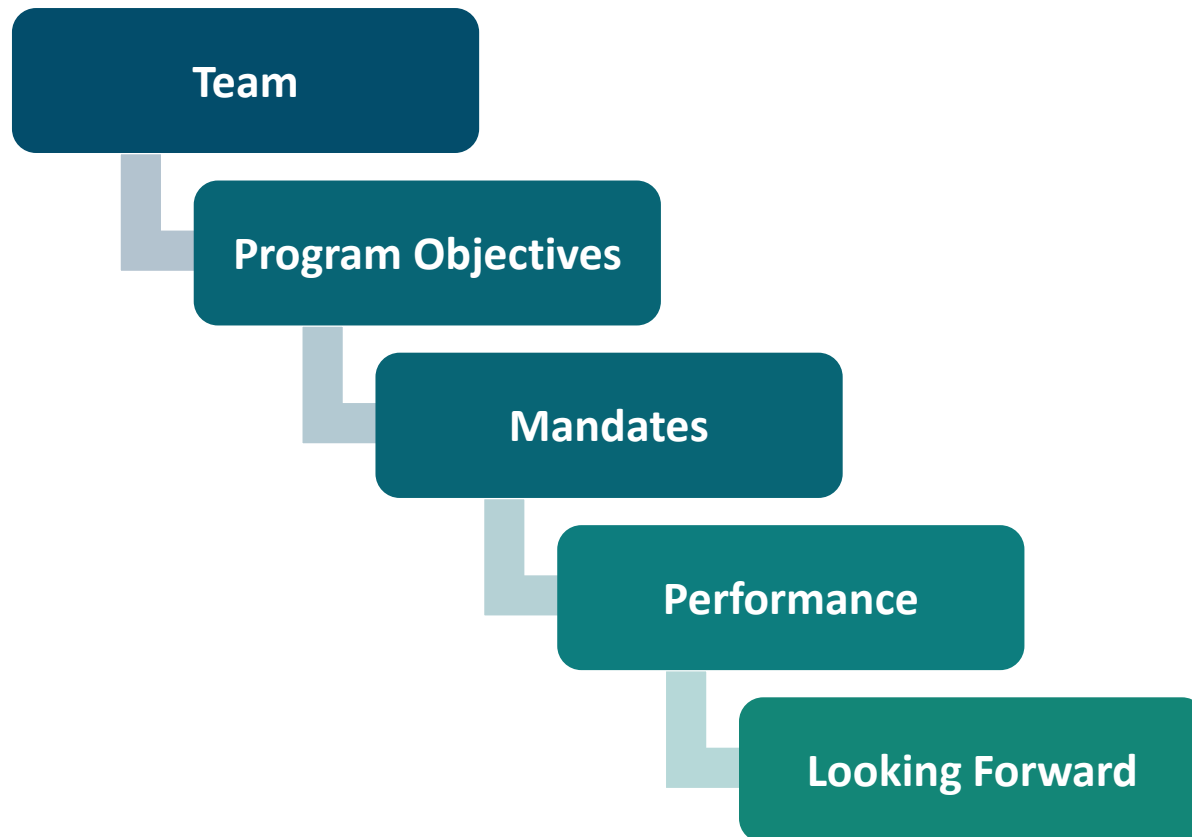
- MSCI EM IMI Index (Net VRS taxes)
- MSCI World IMI Index (Net VRS taxes)
- Dynamic Strategies Fixed Income Custom Benchmark

Risk Based Investments (RBI)

Ross Kasarda
Director, Risk



Annual Review Topics



Team Members

Professional	Position	Highest Degree	Professional Certifications	Investment Experience	VRS Tenure
Ross Kasarda	Director	MA	CFA	18	18
Moses Maxfield	Investment Officer	MBA	CFA, CAIA	17	17
Greg Hines	Investment Officer	MA	CFA	11	9

Other Resources

Director of Portfolio Integration

Executive Committee

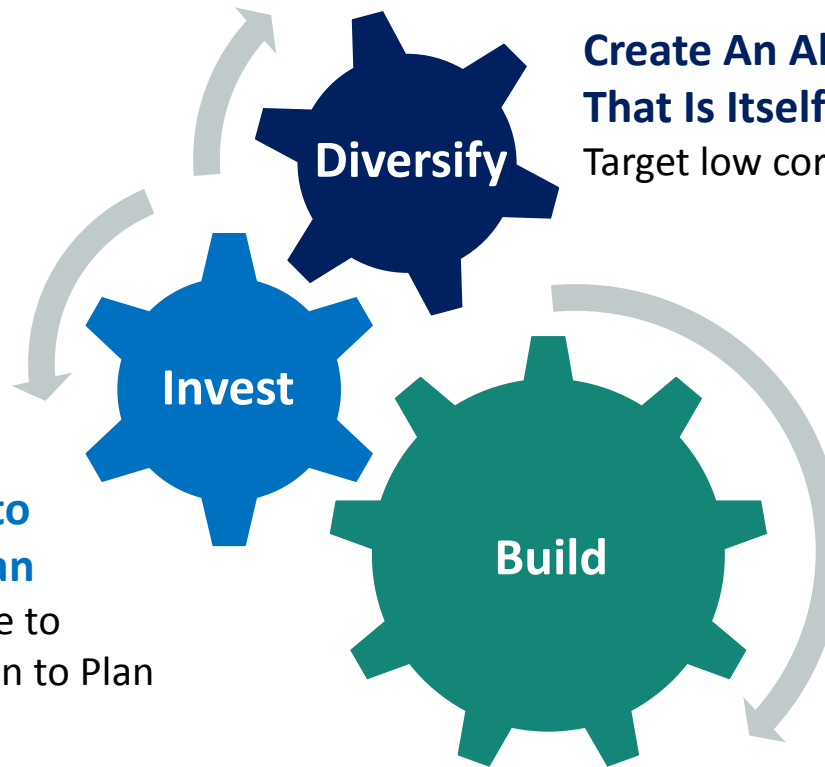
Investment Operations Department

Investment Advisory Committee

Portfolio Assistant

RBI Program Objectives

Create An Allocation To Diversifiers That Is Itself Diversified
Target low correlation within the program



Invest in Strategies to Complement the Plan
Target equity beta close to zero and low correlation to Plan

Build Strategic Partnerships To Help Achieve Plan's Goals
Leverage manager lineup for relevant and practical ideas

Identify Strategies That Offer Meaningful Diversification To The Plan

- ▶▶ Volatility over a cycle of 5%
- ▶▶ Tracking error over a cycle of 5%
- ▶▶ Equity beta over a cycle of zero
- ▶▶ Return over a full cycle of 5%

Mindshare Examples – Beyond Returns

- Frequent dialog and color regarding volatility and options markets
- Customized total plan equity tail risk hedging mandate
- Launched two standalone strategies within RBI

Capstone



- Manage EMP Value mandate for Plan
- Trend following “timing” indicators
- Frequent small group roundtable discussions with like minded investors

AQR Capital



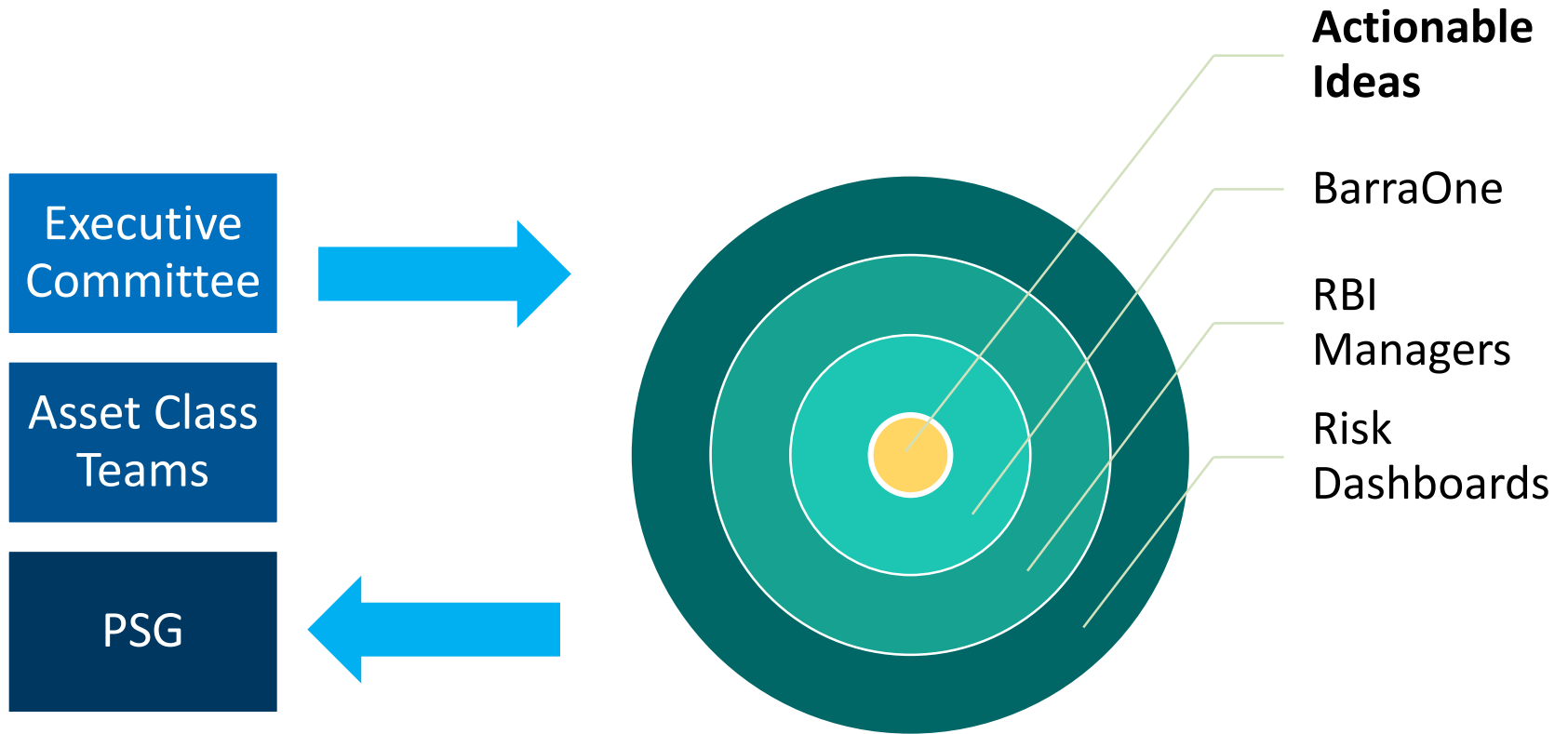
- Frequent discussions with Fixed Income and PSG teams on credit market dynamics
- Insights into high yield and macro environment

Orchard Global



Identify Managers That Offer Actionable Knowledge Transfer

Risk Team Synergies



Mandates as of June 30, 2022

AQR Capital

- 7 mandates
- Uncorrelated, factor and trend-based approaches
- Invested since 2013

Capstone Investment Advisors

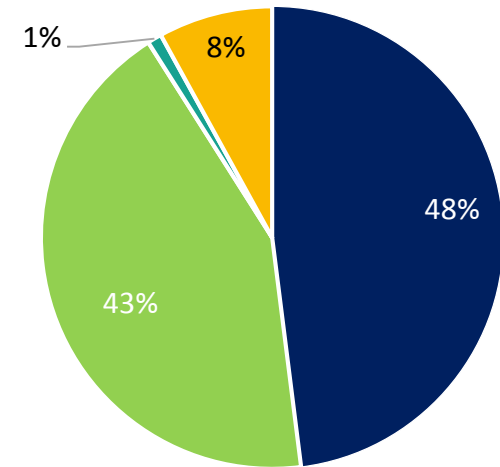
- 3 mandates
- Multi strategy volatility mandates
- Invested since 2019

Internal Fixed Income

- 1 mandate
- Long duration treasury strategy
- Invested since 2018

Orchard Liquid Credit Fund

- 1 mandate
- Long credit volatility strategy
- Invested since Sep 2021



■ AQR ■ Capstone ■ Internal Fixed ■ OLCF

RBI Mandates as of 6/30/2022

	\$MM	%
AQR	852	48
Capstone	773	43
OLCF	151	8
Internal Fixed	12	1
Total RBI	1,789	100

Performance as of June 30, 2022

	Since Inception	3 Year	1 Year
Risk Based Investments	3.6%	5.1%	9.8%
Benchmark	4.5%	4.3%	0.8%
Excess Return	-0.9%	0.8%	9.0%

*Benchmark for RBI is 80% Cash + 250 bps + 20% S&P Risk Parity Index effective January 2020. Prior years benchmark was a custom blend of peer-based and market-based benchmarks.

	2018	2019	2020	2021	2022
Risk Based Investments	-1.6%	2.8%	-0.2%	6.7%	7.1%
Benchmark	-3.2%	11.3%	6.3%	5.6%	-1.4%
Excess	1.5%	-8.5%	-6.5%	1.2%	8.5%

Inception July 2018

Risk as of June 30, 2022

Total Program	Since Inception	3 Year	1 Year
Volatility	5.4%	5.8%	6.0%
Tracking error	5.1%	5.3%	5.9%
Beta to MSCI ACWI	0.13	0.15	0.01

Diversifiers	Since Inception	3 Year	1 Year
Volatility	5.0%	5.2%	6.3%
Tracking error	5.4%	5.5%	6.3%
Beta to MSCI ACWI	0.03	0.05	-0.13

Risk Parity	Since Inception	3 Year	1 Year
Volatility	21.1%	24.0%	22.9%
Tracking error	12.5%	10.1%	4.7%
Beta to MSCI ACWI	0.96	1.13	1.27

Inception - July 2018

Positive Contributors

Trend Following

Systematic Macro

Equity Value

Equity Dispersion

Negative Contributors

Long Duration Treasuries

Volatility Arbitrage

Outlook – Volatility, Inflation vs. Recession

Volatility is likely to be higher and more persistent

- Increasing allocations to non-traditional trend following
- Increasing exposure to long volatility strategies

Inflation fears morphing to Stagflation vs.
Recession fears

- Watching Long Duration to find an entry point
- Transition points are tough on trend

- Evaluate the role of Risk Parity in RBI and Fund
- Enhance the synergies between RBI, risk management, and the Total Fund
- Increase mindshare with current and prospective RBI managers for rest of staff