Asset Allocation and Implementation

Wyoming State Loan & Investment Board

Table of Contents

RVK

Introduction

Introduction

Periodic review of strategic asset allocation is an important fiduciary duty as investment objectives, constraints and market conditions may change over time.

In 2017, the Wyoming State Loan and Investment Board ("SLIB") reviewed the asset allocations of each investment pool, with consideration of the following:

- Investment Pool Characteristics

- New Statutory and Constitutional Amendments

- Long-Term Investment Return Objectives

- Impact of the Above on Future Purchasing Power of Permanent Funds

RVK

Summary of 2017 Asset Allocation Enhancements

Permanent Funds *(PMTF, PLF, UPLF, CSPLF, Hathaway, and Higher Ed)*
- Improved the likelihood of achieving each pool's long-term return objectives, focusing on long-term total return or income generation based on respective spending policy goals and needs.

Increased allocations to public equity and alternatives for pools with a long-term total return focus, increased allocations to higher yielding assets for pools with an income focus.

State Agency Pool
- Focused on aligning the risk profile appropriately with the needs of the constituent investors. Emphasized risk reduction and capital preservation to help mitigate significant short-term draw downs.

Introduced low duration fixed income to reduce portfolio interest rate risk.

Workers' Compensation Fund
- Examined risk in terms of surplus volatility to help preserve the fund's fiscal health with a healthy funded status.

Introduced a modest allocation to long duration fixed income to help reduce funded status volatility.

Pool A Investment Account *(formerly Tobacco Settlement Fund)*
- Introduced public equity and alternative investments in a thoughtful manner such that the overall risk profile remains appropriate.

Gradually introduce allocations to risk assets when better entry points are available.

RVK

2018 Capital Markets Assumptions

Capital Markets Assumptions

Philosophy

- Each year, RVK's general consulting and research teams collaborate to review the capital market environment and update long-term, forward-looking capital market (CM) expectations for each asset class utilized by our clients.

- The forecast horizon is for long-term periods over multiple market cycles, typically 10 years or more.

- The components we estimate include:
  – Return
  – Risk (volatility of returns)
  – Correlation (relationship of asset class returns with all other asset classes)

- Return assumptions are generally index-based and assume no investment manager alpha.

- Annual updates are typically gradual and incorporate historical performance, current valuations, as well as the overall economic environment.

RVK

What does it mean to get CM Assumptions *"right"*?

Relative accuracy is most important…

- **Relative Accuracy:** Assumptions capture the relative relationships between asset classes – particularly closely related ones.
  - Having some assumptions that are spot on and others that are far off will produce unbalanced and poorly diversified portfolios.

But "absolute" accuracy matters too—just not as much.

- **Absolute Accuracy:** Assumptions reflect the absolute values actually experienced in future long-term market environments.
  - Having CM assumptions that are too high or too low across the board can cause a Fund to believe it can spend more than it can afford or restrict spending more than necessary.

RVK

Themes for 2018 Capital Markets Assumptions

- Past and future inflation levels are studied and considered given market conditions, break-even indications, sovereign intervention, and inflation component pricing behavior. *2018 assumption is for a 2.5% long-term expected increase (no change from 2017 assumption).*

- Mean reversion is considered for asset classes demonstrating strong recent returns and pricing environments. *US and Non-US equity return assumptions were reduced.*

- Return decomposition models are run and examined in light of current and possible future market conditions.

- Yield history, current environment, and prospective environments are considered. *US low duration fixed income return assumption has increased, given the rise in short-term yields. Long duration return assumption was reduced, as longer-term yields have decreased.*

- Hybrid asset classes are examined for impact from underlying asset classes. *Hedge fund assumptions reflect underlying exposure to asset class trends including equity and fixed income, along with structural characteristics.*

Asset Class	Return Expectation	Rationale
US Equity	⬇	Valuations Expensive
Non-US Equity	⬇	Lower Growth Forecasts
Fixed Income	=	Yields Generally Unchanged

RVK

Factors to keep in mind when evaluating assumptions…

- While excessively high capital market assumptions provide the hope of higher rates of expected return, this prospect may not actually materialize if the market environment does not support them and can often lead to suboptimal portfolio structures.

- A well-structured and executed investment program will be best positioned to benefit from the available market returns ***regardless of the forecasts for total return***.

- Well-structured asset allocations (and the resulting outcomes) are largely produced by the relative accuracy of assumptions, not simply by forecasting higher absolute returns.

RVK

RVK 2018 Capital Markets Assumptions

Year-over-Year Changes

Asset Class	2018				2017				Change (2018 - 2017)			
	Return (Arithmetic)	Standard Deviation	Return (Compound)	Return/Risk Ratio	Return (Arithmetic)	Standard Deviation	Return (Compound)	Return/Risk Ratio	Return (Arithmetic)	Standard Deviation	Return (Compound)	Return/Risk Ratio
Large/Mid Cap US Equity	6.75%	17.75%	5.30%	0.38	7.00%	17.75%	5.56%	0.39	-0.25%	--	-0.25%	-0.01
Small Cap US Equity	7.25%	21.25%	5.20%	0.34	7.50%	21.25%	5.46%	0.35	-0.25%	--	-0.25%	-0.01
Broad US Equity	6.80%	17.80%	5.35%	0.38	7.05%	17.80%	5.60%	0.40	-0.25%	--	-0.25%	-0.01
Broad Int'l Equity	8.60%	20.80%	6.66%	0.41	8.85%	20.65%	6.94%	0.43	-0.25%	0.15%	-0.28%	-0.02
Global Equity	7.65%	18.35%	6.12%	0.42	7.90%	18.30%	6.38%	0.43	-0.25%	0.05%	-0.26%	-0.01
MLPs	8.50%	22.00%	6.34%	0.39	8.50%	22.00%	6.34%	0.39	--	--	--	--
Preferred Stock	5.75%	13.25%	4.93%	0.43	5.75%	13.25%	4.93%	0.43	--	--	--	--
Low Duration Fixed Income	3.00%	3.50%	2.94%	0.86	2.50%	3.50%	2.44%	0.71	0.50%	--	0.50%	0.14
Intermediate Duration Fixed Income	3.50%	6.00%	3.33%	0.58	3.50%	6.00%	3.33%	0.58	--	--	--	--
Long Duration Fixed Income	3.50%	11.50%	2.87%	0.30	4.00%	11.50%	3.37%	0.35	-0.50%	--	-0.50%	-0.04
TIPS	3.75%	6.25%	3.56%	0.60	3.75%	6.25%	3.56%	0.60	--	--	--	--
Bank Loans	5.25%	10.00%	4.78%	0.53	5.25%	10.00%	4.78%	0.53	--	--	--	--
EMD (Local Currency)	5.75%	12.50%	5.02%	0.46	6.75%	12.50%	6.03%	0.54	-1.00%	--	-1.01%	-0.08
Convertibles	5.60%	13.70%	4.72%	0.41	5.80%	13.70%	4.92%	0.42	-0.20%	--	-0.20%	-0.01
Core Real Estate	6.25%	12.50%	5.52%	0.50	6.25%	12.50%	5.52%	0.50	--	--	--	--
Non-Core Real Estate	9.00%	22.50%	6.75%	0.40	9.25%	22.50%	7.00%	0.41	-0.25%	--	-0.25%	-0.01
Diversified Hedge Funds	5.75%	9.50%	5.33%	0.61	6.25%	9.50%	5.83%	0.66	-0.50%	--	-0.50%	-0.05
Private Equity	9.75%	25.50%	6.90%	0.38	10.00%	25.50%	7.16%	0.39	-0.25%	--	-0.26%	-0.01
Commodities	5.75%	19.75%	3.95%	0.29	5.75%	19.75%	3.95%	0.29	--	--	--	--
US Inflation	2.50%	3.00%	2.46%	0.83	2.50%	3.00%	2.46%	0.83	--	--	--	--
Cash Equivalents	2.50%	3.00%	2.46%	0.83	2.25%	3.00%	2.21%	0.75	0.25%	--	0.25%	0.08

Indicates a favorable change to the assumption from 2017 to 2018
Indicates an unfavorable change to the assumption from 2017 to 2018

Blue highlighted cells indicate values are being calculated based on a roll up of underlying asset classes.
Broad US Equity is a combination of 91.5% Large/Mid Cap US Equity and 8.5% Small Cap US Equity.
Broad International Equity is a combination of 64.4% Dev'd Large/Mid Cap Int'l Equity, 11.2% Dev'd Small Cap Int'l Equity, and 24.4% Emerging Markets Equity.
Global Equity is a combination of 51.7% Broad US Equity and 48.3% Broad International Equity.
Convertibles is a combination of 65% Broad US Equity and 35% Intermediate Duration Fixed Income.

RVK

RVK 2018 Correlation Matrix
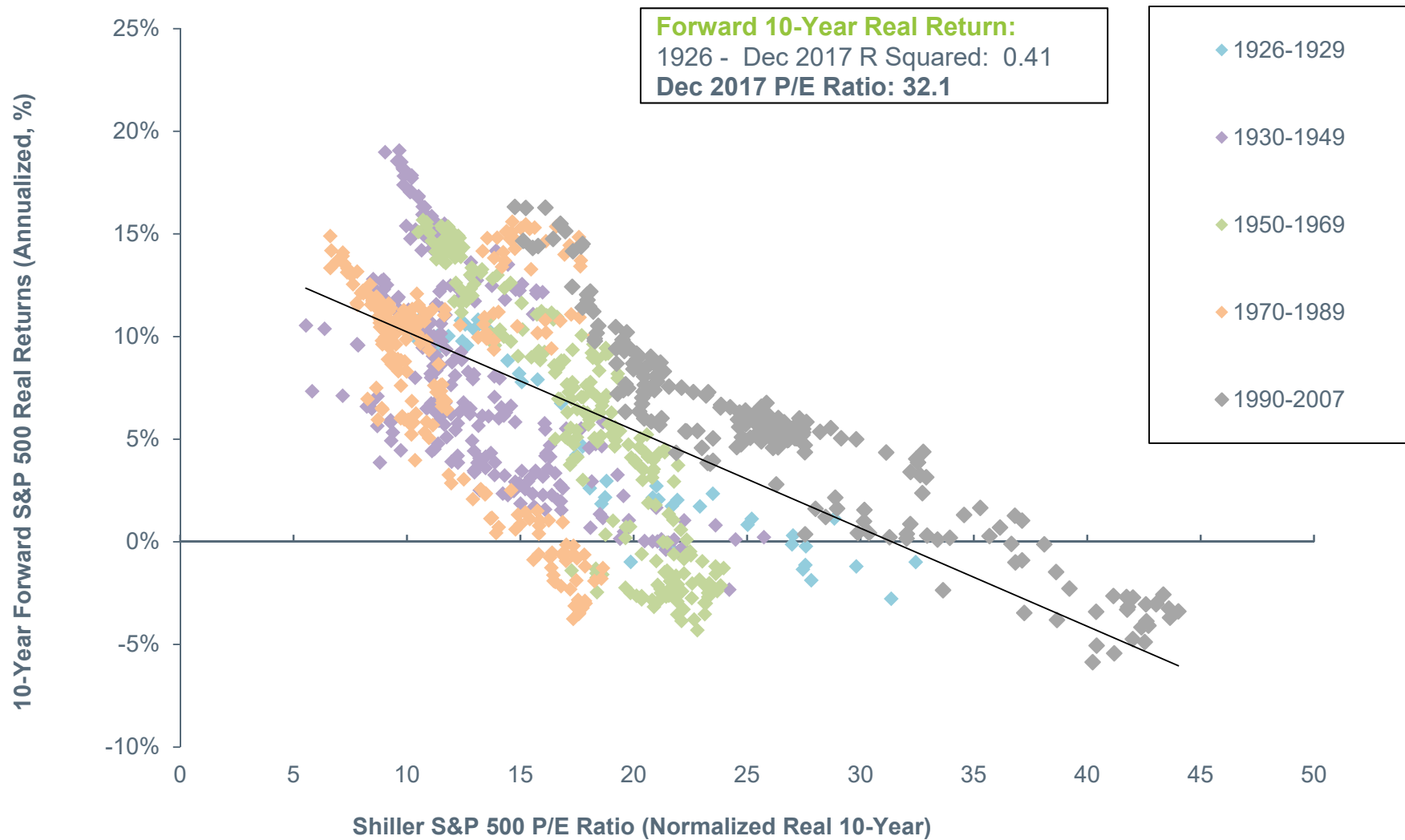
Interrelationship of Various Asset Class Pairings

	Small Cap US Equity	Broad US Equity	Broad Int'l Equity	Global Equity	MLPs	Preferred Stock	Int. Dur. Fixed Income	TIPS	Bank Loans	EMD (LC)	Low Duration Fixed Income	Long Duration Fixed Income	Converts.	Core Real Estate	Non-Core Real Estate	Div. Hedge Funds	Private Equity	Cash Equiv.	US Inflation
Small Cap US Equity	1.00	0.88	0.73	0.83	0.39	0.32	0.07	-0.03	0.43	0.49	0.03	0.06	0.85	0.18	0.07	0.58	0.73	0.00	-0.01
Broad US Equity	0.88	1.00	0.82	0.94	0.42	0.39	0.16	0.02	0.45	0.59	0.10	0.15	0.83	0.25	0.13	0.59	0.78	0.03	-0.01
Broad International Equity	0.73	0.82	1.00	0.97	0.44	0.48	0.02	0.16	0.52	0.77	-0.05	0.03	0.76	0.27	0.07	0.71	0.74	-0.04	0.07
Global Equity	0.83	0.94	0.97	1.00	0.45	0.46	0.00	0.10	0.51	0.72	-0.08	0.00	0.83	0.30	0.09	0.72	0.79	-0.03	0.06
MLPs	0.39	0.42	0.44	0.45	1.00	0.39	0.04	0.13	0.47	0.40	0.09	-0.02	0.43	0.21	0.08	0.39	0.48	0.03	0.18
Preferred Stock	0.32	0.39	0.48	0.46	0.39	1.00	0.45	0.41	0.44	0.52	0.35	0.44	0.36	0.29	-0.04	0.36	0.33	-0.05	0.01
Intermediate Duration Fixed Income	0.07	0.16	0.02	0.00	0.04	0.45	1.00	0.78	-0.01	0.42	0.89	0.93	0.10	-0.06	-0.04	0.06	-0.29	0.26	-0.11
TIPS	-0.03	0.02	0.16	0.10	0.13	0.41	0.78	1.00	0.17	0.51	0.61	0.72	0.10	0.09	0.04	0.11	-0.01	0.08	0.08
Bank Loans	0.43	0.45	0.52	0.51	0.47	0.44	-0.01	0.17	1.00	0.38	-0.06	-0.03	0.52	0.19	0.02	0.48	0.59	-0.02	0.31
Emerging Markets Debt (LC)	0.49	0.59	0.77	0.72	0.40	0.52	0.42	0.51	0.38	1.00	0.37	0.35	0.53	0.08	-0.12	0.48	0.45	0.08	0.12
Low Duration Fixed Income	0.03	0.10	-0.05	-0.08	0.09	0.35	0.89	0.61	-0.06	0.37	1.00	0.72	0.03	-0.06	-0.09	0.06	-0.35	0.49	0.04
Long Duration Fixed Income	0.06	0.15	0.03	0.00	-0.02	0.44	0.93	0.72	-0.03	0.35	0.72	1.00	0.08	-0.04	-0.02	0.04	-0.28	0.14	-0.18
Convertibles	0.85	0.83	0.76	0.83	0.43	0.36	0.10	0.10	0.52	0.53	0.03	0.08	1.00	0.19	0.04	0.71	0.77	-0.01	0.06
Core Real Estate	0.18	0.25	0.27	0.30	0.21	0.29	-0.06	0.09	0.19	0.08	-0.06	-0.04	0.19	1.00	0.71	0.26	0.57	0.01	0.16
Non-Core Real Estate	0.07	0.13	0.07	0.09	0.08	-0.04	-0.04	0.04	0.02	-0.12	-0.09	-0.02	0.04	0.71	1.00	0.13	0.40	0.06	0.03
Diversified Hedge Funds	0.58	0.59	0.71	0.72	0.39	0.36	0.06	0.11	0.48	0.48	0.06	0.04	0.71	0.26	0.13	1.00	0.78	0.14	0.13
Private Equity	0.73	0.78	0.74	0.79	0.48	0.33	-0.29	-0.01	0.59	0.45	-0.35	-0.28	0.77	0.57	0.40	0.78	1.00	-0.21	0.31
Cash Equivalents	0.00	0.03	-0.04	-0.03	0.03	-0.05	0.26	0.08	-0.02	0.08	0.49	0.14	-0.01	0.01	0.06	0.14	-0.21	1.00	0.37
US Inflation	-0.01	-0.01	0.07	0.06	0.18	0.01	-0.11	0.08	0.31	0.12	0.04	-0.18	0.06	0.16	0.03	0.13	0.31	0.37	1.00

Correlation greater than 0.50
Correlation between 0.00 and 0.50
Correlation less than 0.00

RVK

Equity:
Shiller P/E vs. Forward Returns

Trendline at 12/31/2017 = -0.4%

Fixed Income:
Current Yield vs. Forward Returns

Trendline at 12/31/2017 = 3.4%

Forward 10-Year Return:
1976-2007 R Squared: 0.85
Dec 2017 YTW: 2.7%

Legend:
- 1976-1979
- 1980-1989
- 1990-1999
- 2000-2007

Y-axis: 10-Year Forward Bloomberg US Aggregate Bond Index Returns (Annualized, %)

X-axis: Bloomberg US Aggregate Bond Index YTW (Annualized, %)

RVK
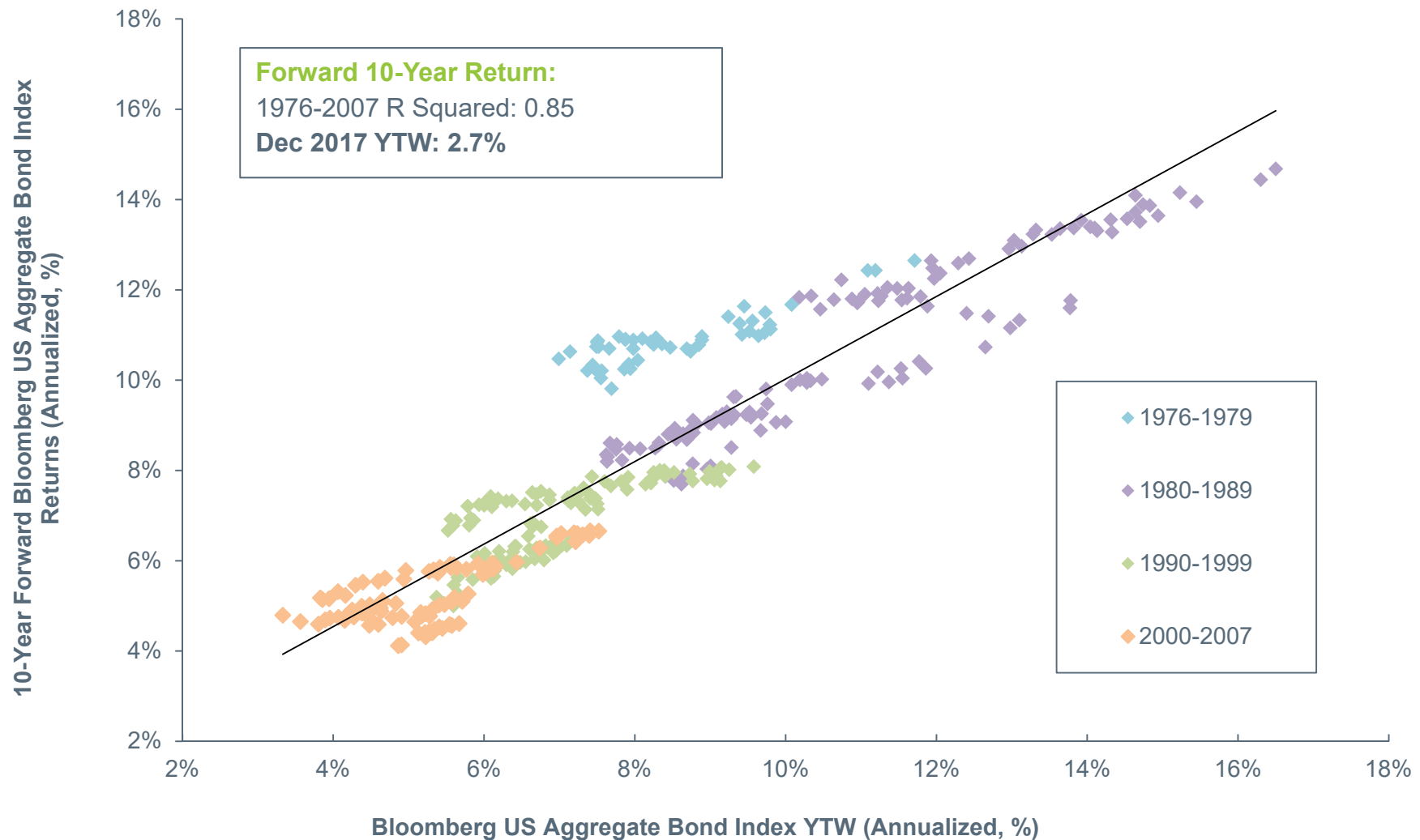
Decomposition Models

Global Equity Summary Statistics

	Yield	Inflation	Growth	Total	Valuation Change	Total
Large/Mid Cap US Equity	1.89%	2.50%	2.17%	6.56%	-1.34%	5.22%
Small Cap US Equity	1.34%	2.50%	3.08%	6.92%	-1.76%	5.16%
Dev'd Large/Mid Cap Int'l Equity	3.01%	2.50%	2.19%	7.70%	-0.74%	6.96%
Dev'd Small Cap Int'l Equity	2.65%	2.50%	3.00%	8.15%	-0.79%	7.36%
Emerging Markets Equity	2.22%	2.50%	3.27%	7.99%	0.20%	8.19%

Growth component consists of GDP growth and profit margin growth.

Fixed Income Summary Statistics

	Yield to Worst (YTW)				Option-Adjusted Spread (OAS)				Duration			
	YTW 2016	YTW 2017	YTW Average	YTW 10-Yr Avg	OAS 2016	OAS 2017	OAS Avg	OAS 10-Yr Avg	Duration 2016	Duration 2017	Duration Average	Duration 10-Yr Avg
Intermediate Duration Fixed Income	2.61	2.71	6.73	2.77	0.43	0.36	0.55	0.70	5.89	5.98	4.75	5.13
Non-US Dev'd Sov. Fixed Income	0.66	0.77	2.27	1.63	0.23	0.21	0.15	0.26	8.56	8.61	5.80	7.37
Emerging Markets Debt (Hard)	5.80	5.27	7.11	6.03	3.42	2.85	3.92	3.53	6.51	6.85	6.54	6.89
Emerging Markets Debt (Local)	6.79	6.14	6.76	6.72	4.90	3.96	4.34	5.09	4.91	5.09	4.45	4.63
TIPS	0.18	0.34	0.77	2.39	N/A	N/A	N/A	N/A	4.87	5.84	5.07	5.66
Low Duration Fixed Income	1.45	2.03	5.62	1.19	0.26	0.14	0.35	0.38	1.92	1.91	1.80	1.88
Long Duration Fixed Income	3.95	3.49	7.58	4.42	1.04	0.83	0.73	1.20	14.97	15.42	11.24	13.80
High Yield	6.12	5.72	10.16	8.06	4.09	3.43	5.14	6.07	4.11	3.86	4.42	4.21

Below 10-Yr Average
Above 10-Yr Average

RVK

Review of Individual Investment Pools

Investment Pool Summary Matrix

	Permanent Mineral Trust Fund	Permanent Land Fund	University Permanent Land Fund	Hathaway Scholarship Fund	Common School Permanent Land Fund	Higher Education Endowment Fund	Workers' Compensation Fund	Pool A Investment Account	State Agency Pool
Fund Type									
Fund Horizon	Permanent Fund (Perpetual)	Permanent Fund (Perpetual)	Permanent Fund (Perpetual)	Permanent Fund (Perpetual)	Permanent Fund (Perpetual)	Permanent Fund (Perpetual)	Permanent Fund (Perpetual)	Non-Permanent Fund	Non-Permanent Fund
Market Value as of 12/31/17	$8,036,242,525	$198,156,964	$23,400,273	$607,661,896	$4,053,520,427	$125,491,052	$2,047,755,439	$237,009,537	$5,368,532,817
Percentage of the Total Fund MV	38.8%	1.0%	0.1%	2.9%	19.6%	0.6%	9.9%	1.1%	25.9%
Permanent Fund Asset Allocation Grouping	Total Return Focus	Total Return Focus	Total Return Focus	Total Return Focus	Income Focus	Income Focus	N/A	N/A	N/A
Liquidity and Investment Objectives									
Long-Term Return Expectation	CPI + 3%	CPI + 3%	CPI + 3%	CPI + 3%	CPI + 3%	CPI + 3%	CPI + 3%	CPI + 2%	CPI + 2%
Primary Investment Goal	Capital appreciation, total return, and protection against inflation. Capital preservation and liquidity are important secondary goals.	Capital appreciation, total return, and protection against inflation. Capital preservation and liquidity are important secondary goals.	Capital appreciation, total return, and protection against inflation. Capital preservation and liquidity are important secondary goals.	Capital appreciation, total return, and protection against inflation. Capital preservation and liquidity are important secondary goals.	Income generation, capital appreciation, total return, and protection against inflation. Capital preservation and liquidity are important secondary goals	Income generation, capital appreciation, total return, and protection against inflation. Capital preservation and liquidity are important secondary goals	Long-term return, safety of capital, yield, and capital appreciation	Pool A is intended to be moderately liquid and safely invested, but also be invested for return and growth.	Safety of capital, yield, and liquidity
Treatment of Income and Capital Gains	The corpus must be held inviolate and cannot be spent but only invested for income and capital gains.	The corpus must be held inviolate and cannot be spent but only invested for income and capital gains.	The corpus must be held inviolate and cannot be spent but only invested for income and capital gains.	The corpus must be held inviolate and cannot be spent but only invested for income and capital gains.	The corpus must be held inviolate and cannot be spent but only invested for income and capital gains.	The corpus must be held inviolate and cannot be spent but only invested for income and capital gains.	This fund retains income and capital gains.	This fund dispenses income and capital gains.	This fund dispenses income and capital gains.
Maximum Equity and Alternatives Allocation	70%	70%	70%	70%	70%	70%	70%	60%	0%
Liquidity Constraints	Liquidity must be maintained to move income and capital gains generated during the year out of the fund.	Liquidity must be maintained to move income and capital gains generated during the year out of the fund.	Liquidity must be maintained to move income and capital gains generated during the year out of the fund.	Liquidity must be maintained to move income and capital gains generated during the year out of the fund.	Liquidity must be maintained to move income and capital gains generated during the year out of the fund.	Liquidity must be maintained to move income and capital gains generated during the year out of the fund.	Liquidity must be maintained to facilitate trading, to move money between asset classes and to meet cash needs.	Liquidity must be maintained to facilitate trading, to move money between asset classes and to meet cash needs as determined by the State Treasurer's Office.	Liquidity must be maintained to facilitate trading, to move money between asset classes and to meet cash needs as determined by the State Treasurer's Office.
Spending Policy									
Funding Source	Constitutional and statutory mineral severance tax revenues, and occasional direct legislative appropriations.	Royalties, leases, fees and permits, and other revenue generated from State lands.	Royalties, leases, fees and permits, and other revenue generated from State lands.	Federal mineral royalties.	Royalties, leases, fees and permits, and other revenue generated from State lands.	Federal mineral royalties.	Employer premiums.	Monies from various State funds pooled for investment.	Monites from a diverse array of individual funds ranging from agency budgets to reserve accounts.
Spending Policy	5% of the trailing 5-year average market value (commencing FY 2021: 4.75%; commencing FY 2022: 4.5%)	Not available to RVK	Not available to RVK	The amount necessary to fully fund scholarships awarded under W.S. 21-16-1301 *et seq.*	5% of the trailing 5-year average market value (commencing FY 2021: 4.75%; commencing FY 2022: 4.5%)	5% of the trailing 5-year average market value (commencing FY 2021: 4.75%)	The exact cash level shall be determined by the staff of the Wyoming Department of Workforce Services and dependent on the liquidity needs of the Fund.	Investment income is deposited as prescribed by statute.	Investment income is distributed back to a specific State agency or to the State General Fund.
Guaranteed Annual Spending Policy Amount	2.50%	N/A	N/A	N/A	2.50%	N/A	N/A	N/A	N/A
Current Policy Target									
Current Equity and Alternatives Target Allocation	56%	56%	56%	56%	44%	44%	27%	23%	0%
Probability of Achieving Long-Term Return Expectation Over 10 Years	55%	55%	55%	55%	49%	49%	37%	55%	28%
Median Real Return Over 10 Years	5.9%	5.9%	5.9%	5.9%	5.5%	5.5%	4.8%	4.8%	3.8%
Estimated Yield	3.2%	3.2%	3.2%	3.2%	4.0%	4.0%	3.3%	3.4%	3.0%

RVK

Grouping of Permanent Funds

The Permanent Funds are grouped into two buckets for purposes of asset allocation, based on each fund's unique objectives and constraints.

1. Total Return Focus

- Emphasis on maximizing total return over the long-term with an appropriate level of risk, while meeting annual spending needs.

- Higher long-term total return and corpus growth.

- Permanent Funds:
  – Permanent Mineral Trust Fund
  – Permanent Land Fund
  – University Permanent Land Fund
  – Hathaway Scholarship Fund

2. Income Focus

- Emphasis on generating sufficient levels of income to meet annual spending needs.
  – Secondary focus on maximizing total return over the long-term with an appropriate level of risk.

- Lower long-term total return and corpus growth.

- Permanent Funds:
  – Common School Permanent Land Fund
  – Higher Education Endowment Fund

RVK

Permanent Funds: Total Return Focus

-Permanent Mineral Trust Fund
-Permanent Land Fund
-University Permanent Land Fund
-Hathaway Scholarship Fund

Permanent Funds – Total Return Focus

Permanent Mineral Trust Fund, Permanent Land Fund, University Permanent Land Fund, and Hathaway Scholarship Fund

Combined Assets (12/31/17):	$8,850 million
Fund Description:	The corpus must be held inviolate and cannot be spent but only invested for income and capital gains.
Fund Horizon:	Permanent Fund (Perpetual)
Return Objective:	CPI + 3%
Primary Investment Goal:	Capital appreciation, total return, and protection against inflation. Capital preservation and liquidity are important secondary goals.
Spending Policy:	**Permanent Mineral Trust Fund:** 5% of the trailing 5-year average market value of the fund, calculated on the first day of the fiscal year (commencing FY 2021: 4.75% of the trailing 5-year average market value; commencing FY 2022 and thereafter: 4.5% of the trailing 5-year average market value). - Amounts must be sourced from investment income (interest and dividends) and realized capital gains. - Earnings in excess of the spending policy are appropriated to the reserve account. Reserve account balance must exceed 150% of the current fiscal year's spending policy before transferring any excess funds to the corpus. **Hathaway Scholarship Fund:** The amount necessary to fully fund scholarships awarded under W.S. 21-16-1301 *et seq*. - Amounts must be sourced from investment income (interest and dividends) and realized capital gains. - Earnings in excess of the spending policy are appropriated from the Hathaway expenditure account to the Hathaway Fund reserve account. Reserve account balance must exceed $12 million or an amount equal to 4.5% of the previous 5-year average market value before transferring any excess funds to the corpus.
Liquidity Requirements:	Liquidity must be maintained to move income and capital gains generated during the year out of the fund.
Investment Constraints:	Maximum of 70% of the total book value of permanent funds may be invested in equities and alternative investments.

RVK

Permanent Funds: Total Return Focus

Long-Term Asset Class Targets	Asset Classes	Current Allocation (%)	Long-Term Target (%)
Public Equity (30.5%)	Broad US Equity	13.43	10.00
	Small Cap US Equity	1.57	3.00
	Global Equity	3.16	--
	Broad International Equity	12.79	13.00
	MLPs	--	4.50
Alternatives (25.5%)	Private Equity	4.50	8.00
	Core Real Estate	4.39	6.00
	Non-Core Real Estate	2.19	4.00
	Diversified Hedge Funds	3.59	7.50
Fixed Income & Cash (44%)	Convertibles	1.79	--
	Int. Duration Fixed Income	23.96	29.00
	Internal Fixed Income	5.96	--
	Bank Loans	3.47	5.00
	EMD (Local)	1.24	5.00
	TIPS	2.26	5.00
	Opportunistic Fixed Income	1.04	--
	Cash Equivalents	13.20	--
	Public Purpose Investments	1.47	--

Key Observations:

- Increased the allocation to alternatives, primarily to private equity and non-core real estate.

- Exposure to inflationary assets was increased though the introduction of MLPs and a larger allocation to core real estate and bank loans.

- Exposure to capital preservation assets was reduced.

Thematic Allocation (%)

Category	Value
Capital Appreciation	43
Capital Preservation	29
Alpha	8
Inflation	21

Current Allocation is a weighted average of the underlying investment pools as of December 31, 2017. Bank Loans within the current allocation represents the custom credit mandate, which includes high yield, bank loans, and investment-grade credit. Cash Equivalents within the current allocation represents assets invested in the Sate Agency Pool.

RVK

Permanent Funds: Total Return Focus

Efficient Frontier

Current Allocation is a weighted average of the underlying investment pools as of December 31, 2017.
Current Allocation expected return and risk excludes Opportunistic Fixed Income and Public Purpose Investments.

RVK

Permanent Funds: Total Return Focus

Efficient Frontier Table

	Min	Max	1	2	3	4	5	6	7	8	9	10	TR Focus Target
Broad US Equity	0	50	0	0	0	2	6	9	12	16	19	24	10
Small Cap US Equity	0	10	0	0	0	1	1	2	3	4	5	6	3
Broad International Equity	0	50	0	0	0	3	7	11	16	20	24	31	13
MLPs	0	5	0	3	5	5	5	5	5	5	5	5	4.5
Private Equity	0	8	2	5	8	8	8	8	8	8	8	8	8
Core Real Estate	0	10	10	7	6	6	6	6	6	6	6	0	6
Non-Core Real Estate	0	4	0	3	4	4	4	4	4	4	4	4	4
Diversified Hedge Funds	0	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Int. Duration Fixed Income	0	100	65	60	53	48	41	32	23	15	6	0	29
Bank Loans	0	5	5	5	5	5	5	5	5	5	5	5	5
Emerging Markets Debt (Local)	0	5	0	0	2	5	5	5	5	5	5	5	5
TIPS	0	5	5	5	5	5	5	5	5	5	5	5	5
Cash Equivalents	0	5	5	5	5	1	0	0	0	0	0	0	0
Total			100	100	100	100	100	100	100	100	100	100	100
Total Fixed Income & Cash			*80*	*75*	*70*	*64*	*56*	*47*	*38*	*30*	*21*	*15*	*44*
Capital Appreciation			2	7	14	22	31	40	48	57	65	78	43
Capital Preservation			70	65	58	49	41	32	23	15	6	0	29
Alpha			8	8	8	8	8	8	8	8	8	8	8
Inflation			20	20	21	21	21	21	21	21	21	15	21
Expected Return			**4.14**	**4.51**	**4.87**	**5.24**	**5.61**	**5.97**	**6.34**	**6.71**	**7.07**	**7.44**	**6.10**
Risk (Standard Deviation)			**4.85**	**5.04**	**5.54**	**6.39**	**7.46**	**8.72**	**10.09**	**11.54**	**13.03**	**14.99**	**9.21**
Return (Compound)			4.03	4.39	4.72	5.05	5.35	5.61	5.86	6.09	6.29	6.41	5.70
Return/Risk Ratio			0.85	0.89	0.88	0.82	0.75	0.68	0.63	0.58	0.54	0.50	0.66
RVK Expected Eq Beta (LCUS Eq = 1)			0.12	0.15	0.20	0.27	0.35	0.43	0.51	0.58	0.66	0.77	0.46
RVK Liquidity Metric (T-Bills = 100)			73	70	67	66	66	67	67	68	68	73	67
Estimated Yield (%)			*2.97*	*3.09*	*3.19*	*3.31*	*3.30*	*3.23*	*3.20*	*3.18*	*3.11*	*2.98*	*3.20*
1 Year Max Drawdown (%)			*-11.95*	*-12.05*	*-12.64*	*-13.98*	*-15.99*	*-18.24*	*-20.50*	*-24.47*	*-28.05*	*-32.10*	*-19.20*

Group constraints: (i) Broad US equity must be at least 80% of total equity. (ii) Total US equity must be at least 50% of total public equity. (iii) Total equity (including MLPs, private equity, real estate, and diversified hedge funds) must not exceed 70% of the total portfolio. (iv) Real estate must not exceed 10% of the total portfolio. (v) Core real estate must be at least 50% of total real estate.

RVK

Permanent Funds: Total Return Focus

Similar to the prior year's assumptions, the probability of achieving the long-term expected return target over a 10 year period remains modestly above 50%.

	Total Return Focus Target
Expected Return (%)	6.10
Risk (Standard Deviation, %)	9.21
Return (Compound, %)	5.70
Return/Risk Ratio	0.66
Estimated Yield (%)	3.20
Portfolio Stress Testing (Monte Carlo Results)	
1 Year Max Drawdown (2008-Like Event)	-$1,543 M (-19.20%)
Median 1 Year Return	+$510 M (+6.35%)
Probability of Achieving Various Real Return Targets	
2.5% Real Return Over 10 Years	62%
3.0% Real Return Over 10 Years	**55%**
3.5% Real Return Over 10 Years	48%

2017 Assumptions:
Expected Return = 6.29%
Risk (St. Dev.) = 9.22%
Return (Compound) = 5.89%

Range of Monte Carlo Stress Test Results
1st & 99th Percentiles = Darker Color
5th to 95th Percentiles = Lighter Color

Total Return Focus Target

- - - Long-Term Return Expectation

RVK

Permanent Funds: Income Focus
   -Common School Permanent Land Fund
   -Higher Education Endowment Fund

Permanent Funds – Income Focus

Common School Permanent Land Fund and Excellence in Higher Education Endowment Fund

Combined Assets (12/31/17):	$4,179 million
Purpose:	The corpus must be held inviolate and cannot be spent but only invested for income and capital gains.
Fund Horizon:	Permanent Fund (Perpetual)
Return Objective:	CPI + 3%
Primary Investment Goal:	Income generation, capital appreciation, total return, and protection against inflation. Capital preservation and liquidity are important secondary goals.
Spending Policy:	**Common School Permanent Land Fund:** 5% of trailing 5-year average market value of the fund, calculated on the first day of the fiscal year (commencing FY 2021: 4.75% of the trailing 5-year average market value; commencing FY 2022 and thereafter: 4.5% of the trailing 5-year average market value). - Amounts must be sourced from investment income (interest and dividends) and realized capital gains. - Earnings in excess of the spending policy are appropriated to the reserve account. Reserve account balance must exceed 150% of the current fiscal year's spending policy before transferring any excess funds to the corpus. **Excellence in Higher Education Endowment Fund:** 5% of trailing 5-year average market value of the fund, calculated on the first day of the fiscal year (commencing FY 2019 and thereafter: 4.75% of the trailing 5-year average market value). - Amounts must be sourced from investment income (interest and dividends) and realized capital gains. - Earnings in excess of the spending policy are appropriated to the reserve account. Reserve account balance must exceed 150% of the current fiscal year's spending policy before transferring any excess funds to the corpus.
Liquidity Requirements:	Liquidity must be maintained to move income and capital gains generated during the year out of the fund.
Investment Constraints:	Maximum of 70% of the total book value of permanent funds may be invested in equities and alternative investments.

RVK

Permanent Funds: Income Focus

Long-Term Asset Class Targets	Asset Classes	Current Allocation (%)	Long-Term Target (%)
Public Equity (27%)	Broad US Equity	12.77	8.00
	Small Cap US Equity	1.49	2.00
	Global Equity	3.02	--
	Broad International Equity	12.15	9.00
	Preferred Stock	--	2.00
	MLPs	--	6.00
Alternatives (17%)	Private Equity	4.26	--
	Core Real Estate	3.94	15.00
	Non-Core Real Estate	1.66	2.00
	Diversified Hedge Funds	3.22	--
Fixed Income & Cash (56%)	Convertibles	1.67	--
	Int. Duration Fixed Income	20.41	37.00
	Internal Fixed Income	4.38	--
	Bank Loans	2.95	12.00
	EMD (Local)	1.06	7.00
	TIPS	1.78	--
	Opportunistic Fixed Income	1.00	--
	Cash Equivalents	23.80	0.00
	Public Purpose Investments	0.44	--

Key Observations:

- Reduced exposure to public equities and introduced a modest allocation to preferred stock.

- Exposure to inflationary assets was increased though the introduction of MLPs and a higher allocation to core real estate and bank loans.

- Exposure to alpha thematic allocation was eliminated through the removal of hedge funds.

Thematic Allocation (%)

Capital Appreciation	Capital Preservation	Alpha	Inflation
30	37	0	33

Current Allocation is a weighted average of the underlying investment pools as of December 31, 2017. Bank Loans within the current allocation represents the custom credit mandate, which includes high yield, bank loans, and investment-grade credit. Cash Equivalents within the current allocation represents assets invested in the Sate Agency Pool.

RVK

Permanent Funds: Income Focus

Efficient Frontier

Current Allocation is a weighted average of the underlying investment pools as of December 31, 2017.
Current Allocation expected return and risk excludes Opportunistic Fixed Income and Public Purpose Investments.

RVK

Permanent Funds: Income Focus

Efficient Frontier Table

	Min	Max	1	2	3	4	5	6	7	8	9	10	Income Focus Target
Broad US Equity	0	30	0	1	2	4	5	7	9	12	15	23	8
Small Cap US Equity	0	10	0	0	1	1	2	2	3	4	5	8	2
Broad International Equity	0	30	0	1	3	5	7	9	12	15	21	30	9
Preferred Stock	0	10	0	0	0	0	2	6	10	10	5	0	2
MLPs	0	7	0	2	6	7	7	7	7	7	7	7	6
Core Real Estate	0	15	14	15	15	15	15	15	15	15	15	0	15
Non-Core Real Estate	0	2	0	2	2	2	2	2	2	2	2	2	2
Int. Duration Fixed Income	0	100	66	59	52	45	41	30	21	13	8	8	37
Bank Loans	0	15	15	15	15	15	15	15	15	15	15	15	12
Emerging Markets Debt (Local)	0	7	0	0	0	2	4	7	7	7	7	7	7
Cash Equivalents	0	5	5	5	5	5	0	0	0	0	0	0	0
Total			100	100	100	100	100	100	100	100	100	100	100
Total Fixed Income & Cash			86	79	72	67	60	52	43	35	30	30	56
Capital Appreciation			0	4	7	14	22	33	42	50	55	70	30
Capital Preservation			71	64	57	49	41	30	21	13	8	8	37
Alpha			0	0	0	0	0	0	0	0	0	0	0
Inflation			29	32	36	37	37	37	37	37	37	22	33
Expected Return			4.11	4.43	4.74	5.06	5.38	5.70	6.01	6.33	6.65	6.97	5.53
Risk (Standard Deviation)			4.62	4.79	5.22	5.89	6.74	7.70	8.75	9.89	11.18	13.70	7.30
Return (Compound)			4.01	4.32	4.61	4.90	5.17	5.42	5.65	5.87	6.07	6.10	5.28
Return/Risk Ratio			0.89	0.92	0.91	0.86	0.80	0.74	0.69	0.64	0.59	0.51	0.76
RVK Expected Eq Beta (LCUS Eq = 1)			0.10	0.13	0.18	0.23	0.29	0.34	0.40	0.47	0.55	0.70	0.33
RVK Liquidity Metric (T-Bills = 100)			72	70	70	70	69	68	69	69	70	80	69
Estimated Yield (%)			3.49	3.66	3.86	3.96	4.11	4.34	4.47	4.41	4.20	3.64	4.03
1 Year Max Drawdown (%)			-14.56	-14.59	-15.01	-16.38	-17.79	-19.56	-22.57	-24.24	-25.67	-30.28	-17.84

Group constraints: (i) Broad US equity must be at least 75% of total US equity. (ii) Total US equity must be at least 50% of total public equity. (iii) Total equity (including preferred stock, MLPs, and real estate) must not exceed 70% of the total portfolio. (iv) Core real estate must be at least 50% of total real estate.
*Assumes interest and service costs are approximately equal to expected return.

RVK

Permanent Funds: Income Focus

Similar to the prior year's assumptions, the probability of achieving the long-term expected return target over a 10 year period remains near 50%.

	Income Focus Target
Expected Return (%)	5.53
Risk (Standard Deviation, %)	7.30
Return (Compound, %)	5.28
Return/Risk Ratio	0.76
Estimated Yield (%)	4.03
Portfolio Stress Testing (Monte Carlo Results)	
1 Year Max Drawdown (2008-Like Event)	-$723 M (-17.84%)
Median 1 Year Return	+$248 M (+6.11%)
Probability of Achieving Various Real Return Targets	
2.0% Real Return Over 10 Years	64%
3.0% Real Return Over 10 Years	**49%**
3.5% Real Return Over 10 Years	41%

2017 Assumptions:
Expected Return = 5.66%
Risk (St. Dev.) = 7.36%
Return (Compound) = 5.40%
Estimated Yield = 4.12%

Range of Monte Carlo Stress Test Results
1st & 99th Percentiles = Darker Color
5th to 95th Percentiles = Lighter Color

Income Focus Target

- - - Long-Term Return Expectation

Expected returns do not assume active manager alpha. Estimated yields are a weighted average of the underlying asset class benchmarks as of 12/31/17. 1 Year Max Drawdown reflects the 1st percentile nominal return. Dollar amounts are based on an initial portfolio value of $4,054 M (CSPLF).

RVK

Permanent Funds: Risk Analysis

Risk Analysis

At RVK, we believe successful risk measurement is much more than simply measuring volatility.

Risk measurement is used to measure, understand and manage all types of risks present in a portfolio, rather than attempt to eliminate it.

- Risk measurement should not be confused for management, but the former is a large component of the latter.

Types of Risk:

Qualitative Risk	*Quantitative Risk*
• Operational	• Standard Deviation
• Regulatory	• Value at Risk (VaR)
• Legal	• Tail Risk
• Liquidity	• Factor Modeling
• Counterparty	• Surplus Risk
• Reputational	• Tracking Error
• Fiduciary	• Attribution Analysis

The following risk analysis is a tool utilized to help measure additional quantitative risks in a portfolio, beyond traditional asset allocation and Monte Carlo analysis.

RVK

Risk Analysis: Total Return Focus

Target Allocation Risk Summary
January 1, 2008 to December 31, 2017

Total Portfolio Summary

Volatility	6.3%
Value at Risk (VaR)*	12.9%
Expected Tail Loss (ETL)*	17.3%
Expected Tail Return (ETR)*	12.3%
Rachev Ratio (ETR/ETL)*	0.7
STARR Performance (Excess Return/ETL)**	0.1

*Calculated with a 99% Confidence Interval.
**Similar to the Sharpe Ratio which is a standard deviation-based performance measure, but STARR (stable tail-adjusted return ratio) uses the ETL in the denominator as a risk measure. STARR can be seen as a more effective indicator of risk-adjusted performance because it penalizes only for downside risk, while the standard deviation does not distinguish between upside and downside risk.

Percent Contribution to Risk and ETL

Categories (top to bottom): US Equity, Small Cap US…, International Equity, MLPs, Private Equity, Core Real Estate, Non-Core Real…, Div. Hedge Funds, Int. Duration…, Bank Loans, Emerging Market…, TIPS

Legend: ■ Percent Contribution to ETL ■ Percent Contribution to Risk ■ Target Allocation

Factor Contribution to Risk

Factor	Value
Volatility	-2%
Interest Rate Risk	8%
Size Risk	1%
Style Risk	0%
Fixed Income Risk	19%
FX Risk	3%
Equity Risk	63%
Commodity Risk	0%
Specific Risk	9%

Scenario Analysis

Scenario	Value
Oil +25%	2.0%
Oil -25%	-1.9%
Russell 3000 +20%	5.3%
Russell 3000 -20%	-5.1%
10 Year Treasury +200 bps	3.4%
10 Year Treasury -200 bps	-5.8%
2008 Sept - Oct Crash	-16.7%
HY Spreads Compress 50%	8.0%
HY Spreads Widen 50%	-2.3%

Analysis provided by PerTrac RiskPlus powered by FinAnalytica. All values are annual.

RVK

Risk Analysis: Income Focus

Target Allocation Risk Summary
January 1, 2008 to December 31, 2017

Total Portfolio Summary

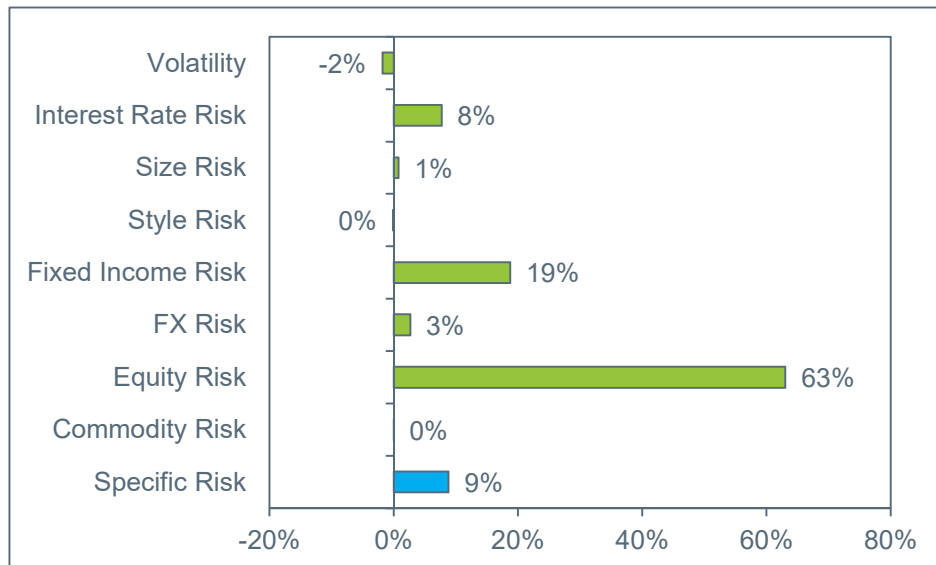|	
Volatility	5.3%
Value at Risk (VaR)*	9.5%
Expected Tail Loss (ETL)*	12.7%
Expected Tail Return (ETR)*	10.8%
Rachev Ratio (ETR/ETL)*	0.9
STARR Performance (Excess Return/ETL)**	0.1

*Calculated with a 99% Confidence Interval.
**Similar to the Sharpe Ratio which is a standard deviation-based performance measure, but STARR (stable tail-adjusted return ratio) uses the ETL in the denominator as a risk measure. STARR can be seen as a more effective indicator of risk-adjusted performance because it penalizes only for downside risk, while the standard deviation does not distinguish between upside and downside risk.

Percent Contribution to Risk and ETL

Chart — categories with Percent Contribution to ETL (green), Percent Contribution to Risk (blue), Target Allocation (yellow):

Category	ETL	Risk	Target Allocation
US Equity	21%	19%	8%
Small Cap US...	5%	5%	2%
International Equity	29%	29%	9%
Preferred Stock	3%	3%	2%
MLPs	12%	14%	6%
Core Real Estate	8%	5%	15%
Non-Core Real...	0%	0%	2%
Int. Duration...	2%	6%	37%
Bank Loans	7%	7%	12%
Emerging Market...	13%	12%	7%

Legend: ■ Percent Contribution to ETL ■ Percent Contribution to Risk ■ Target Allocation

Factor Contribution to Risk

Factor	Value
Volatility	-8%
Interest Rate Risk	3%
Size Risk	-1%
Style Risk	0%
Fixed Income Risk	13%
FX Risk	2%
Equity Risk	84%
Commodity Risk	0%
Specific Risk	7%

Scenario Analysis

Scenario	Value
Oil +25%	1.5%
Oil -25%	-1.4%
Russell 3000 +20%	3.9%
Russell 3000 -20%	-3.6%
10 Year Treasury +200 bps	1.9%
10 Year Treasury -200 bps	-2.2%
2008 Sept - Oct Crash	-15.2%
HY Spreads Compress 50%	10.3%
HY Spreads Widen 50%	-9.0%

Analysis provided by PerTrac RiskPlus powered by FinAnalytica. All values are annual.

RVK

Permanent Funds: Intergenerational Equity Analysis

Intergenerational Equity

Key Principles:

1. Strives for egalitarian equity between present and future generations in the State of Wyoming.

2. Aims to ensure citizens of tomorrow have the same opportunities and purchasing power as the citizens of today.

Components:

Each plays an important role in maintaining Intergenerational Equity.

1. Sustainable Spending Policy
2. Investment Returns (After Inflation)
3. Contribution Policy
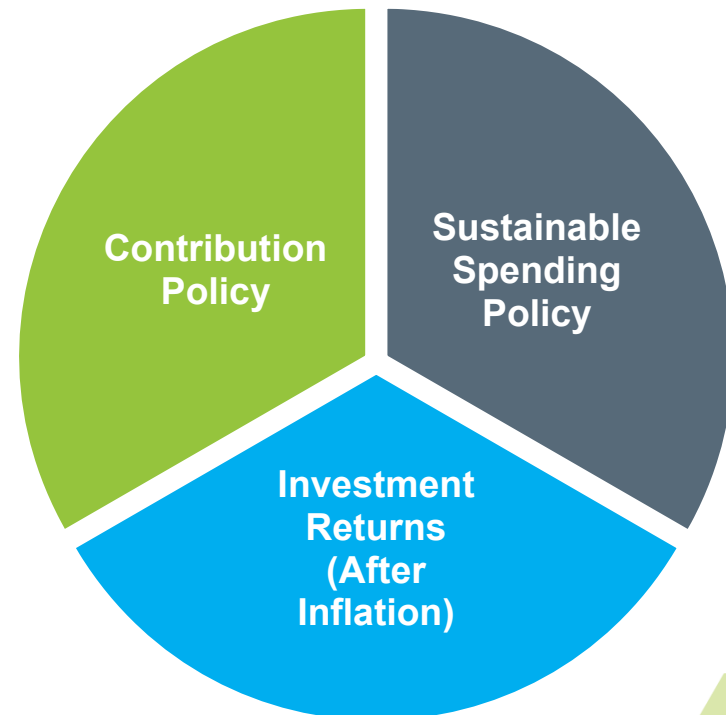
Permanent Funds and Intergenerational Equity

Maintaining intergenerational equity or attaining the "Full Objective" is defined as:

1. Preserving economic value after inflation
2. Achieving 1% annual real growth to account for increasing resource demands (e.g. population growth)

Probability of Attaining Full Objective

Funds should strive to reach and maintain a 50% probability of attaining the Full Objective in order to provide equitable opportunities across all generations.

Probability	Interpretation
0% - 49%	Value of benefits available to future generations is eroding relative to generations of today
50%	Value of benefits available to future generations is equal relative to generations of today
51% - 100%	Value of benefits available to future generations is greater relative to generations to today

Full Objective for Permanent Funds

For the following Funds, attaining the Full Objective would mean growing Fund assets from today's market value to the following in Year 50:

	PMTF	CSPLF	Hathaway	Higher Ed
Beginning Fund Value (6/30/17)	$7,666 M	$3,860 M	$589 M	$121 M
Full Objective Value in Year 50	$12,608 M	$6,667 M	$968 M	$200 M

Since the Full Objective is to achieve real growth, all subsequent data shown is in real terms (after inflation).

RVK

Intergenerational Equity Analysis: PMTF

Under the new policy target portfolio and spending policy, the median probability of achieving the Full Objective (preserving long-term purchasing power) in Year 50 is **52.9%.**

The projected market value at year 50 is **$13.0 Billion**.
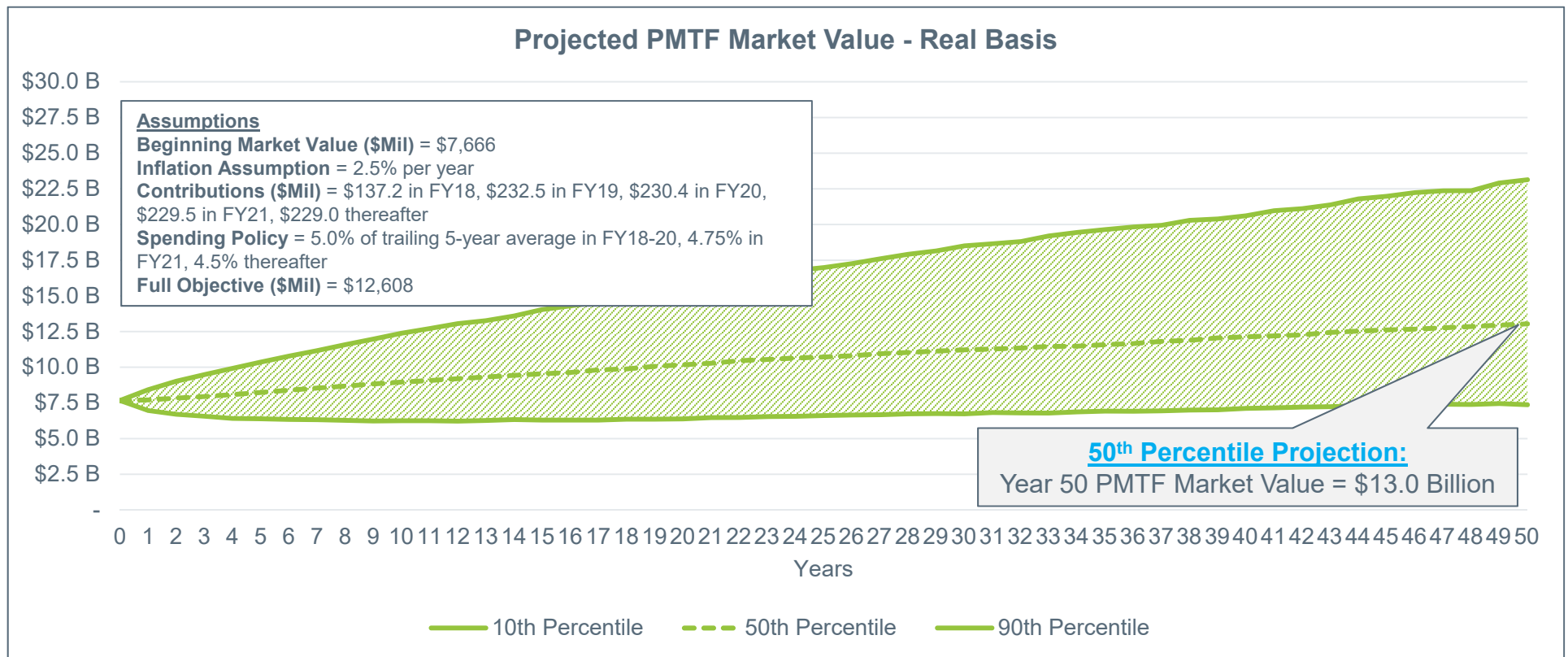
Projected PMTF Market Value - Real Basis

Assumptions
Beginning Market Value ($Mil) = $7,666
Inflation Assumption = 2.5% per year
Contributions ($Mil) = $137.2 in FY18, $232.5 in FY19, $230.4 in FY20, $229.5 in FY21, $229.0 thereafter
Spending Policy = 5.0% of trailing 5-year average in FY18-20, 4.75% in FY21, 4.5% thereafter
Full Objective ($Mil) = $12,608

50th Percentile Projection:
Year 50 PMTF Market Value = $13.0 Billion

Legend: 10th Percentile — 50th Percentile — 90th Percentile

All data is shown in real terms (after 2.50% annual inflation). Model assumes investment earnings always meet or exceed annual spending policy amount. Contribution assumptions were provided by the Consensus Revenue Estimating Group.

RVK

Intergenerational Equity Analysis: PMTF

Current Framework

	PMTF – Total Return Focus Target
Cumulative 50 Year Distributions ($B)	$23.6
Volatility of Annual Spending Changes (% YoY St. Dev.)	4.31%
Projected 50 Year Market Value ($B)	$13.0
Probability of Achieving Full Objective	52.9%

Sensitivity Analysis

	Inflation	Contributions	Distributions
Baseline (Probability of Achieving Full Objective)	2.5% per year **(52.9%)**	$137.2M in FY18, $232.5M in FY19, $230.4M in FY20, $229.5M in FY21, $229.0M thereafter **(52.9%)**	5.0% spending rate in FY18-20, 4.75% spending rate in FY21, 4.5% spending rate thereafter **(52.9%)**
Impact of **UP** move to assumption	3.5% per year **(25.0%)**	$137.2M in FY18, $232.5M in FY19, $230.4M in FY20, $229.5M in FY21, $229.0M in FY22, *growing by 1%/year thereafter* **(70.2%)**	5.0% spending rate in FY18-20, 4.75% spending rate in FY21, 5.5% spending rate thereafter **(25.3%)**
Impact of **DOWN** move to assumption	1.5% per year **(76.7%)**	$137.2M in FY18, $232.5M in FY19, $230.4M in FY20, $229.5M in FY21, $229.0M in FY22, *declining by 1%/year thereafter* **(39.2%)**	5.0% spending rate inFY18-20, 4.75% spending rate in FY21, 3.5% spending rate thereafter **(77.2%)**

All data is shown in real terms (after 2.50% annual inflation). Model assumes investment earnings always meet or exceed annual spending policy amount. Contribution assumptions were provided by the Consensus Revenue Estimating Group.

RVK

Intergenerational Equity Analysis: CSPLF

Under the new policy target portfolio and spending policy, the median probability of achieving the Full Objective (preserving long-term purchasing power) in Year 50 is **75.2%.**

The projected market value at year 50 is **$8.4 Billion**.

Projected CSPLF Market Value - Real Basis

Assumptions
Beginning Market Value ($Mil) = $3,860
Inflation Assumption = 2.5% per year
Contributions ($Mil) = $202.1 in FY18, $196.3 in FY19, $193.8 in FY20, $192.5 in FY21, $191.5 thereafter
Spending Policy = 5.0% of trailing 5-year average in FY18-20, 4.75% in FY21, 4.5% thereafter
Full Objective ($Mil) = $6,667

50th Percentile Projection:
Year 50 CSPLF Market Value = $8.4 Billion

Years

——— 10th Percentile   ----- 50th Percentile   ——— 90th Percentile

All data is shown in real terms (after 2.50% annual inflation). Model assumes investment earnings always meet or exceed annual spending policy amount. Contribution assumptions were provided by the Consensus Revenue Estimating Group.

RVK

40

Intergenerational Equity Analysis: CSPLF

Current Framework

	CSPLF – Income Focus Target
Cumulative 50 Year Distributions ($B)	$14.3
Volatility of Annual Spending Changes (% YoY St. Dev.)	4.04%
Projected 50 Year Market Value ($B)	$8.4
Probability of Achieving Full Objective	75.2%

Sensitivity Analysis

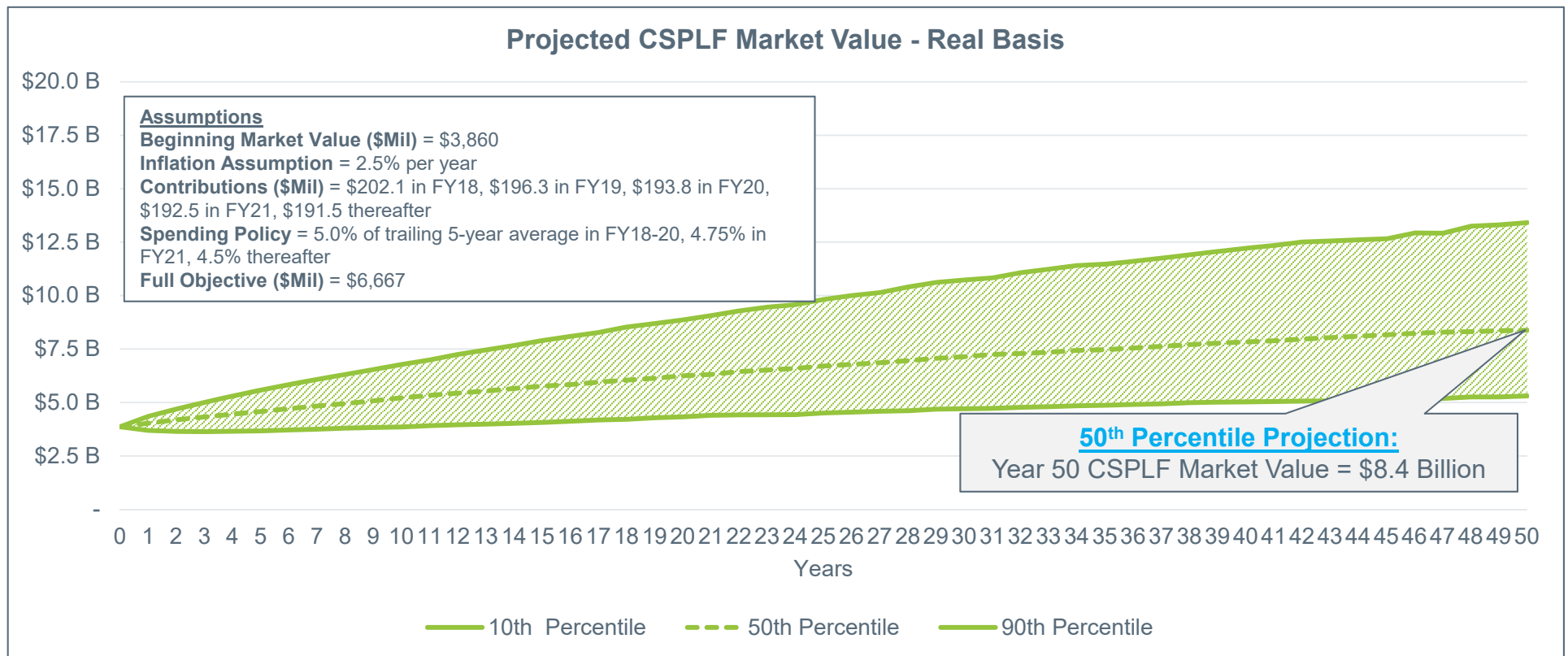|	Inflation	Contributions	Distributions
Baseline (Probability of Achieving Full Objective)	2.5% per year **(75.2%)**	$202.1M in FY18, $196.3M in FY19, $193.8M in FY20, $192.5M in FY21, $191.5M thereafter **(75.2%)**	5.0% spending rate in FY18-20, 4.75% spending rate in FY21, 4.5% spending rate thereafter **(75.2%)**
Impact of **UP** move to assumption	3.5% per year **(44.9%)**	$202.1M in FY18, $196.3M in FY19, $193.8M in FY20, $192.5M in FY21, $191.5M in FY22, *growing by 1%/year thereafter* **(91.0%)**	5.0% spending rate in FY18-20, 4.75% spending rate in FY21, 5.5% spending rate thereafter **(46.1%)**
Impact of **DOWN** move to assumption	1.5% per year **(91.4%)**	$202.1M in FY18, $196.3M in FY19, $193.8M in FY20, $192.5M in FY21, $191.5M in FY22, *declining by 1%/year thereafter* **(54.4%)**	5.0% spending rate in FY18-20, 4.75% spending rate in FY21, 3.5% spending rate thereafter **(90.7%)**

All data is shown in real terms (after 2.50% annual inflation). Model assumes investment earnings always meet or exceed annual spending policy amount. Contribution assumptions were provided by the Consensus Revenue Estimating Group.

RVK

Intergenerational Equity Analysis: Hathaway

Under the new policy target portfolio and spending policy, the median probability of achieving the Full Objective (preserving long-term purchasing power) in Year 50 is **17.2%.**

The projected market value at year 50 is **$190.3 Million**.
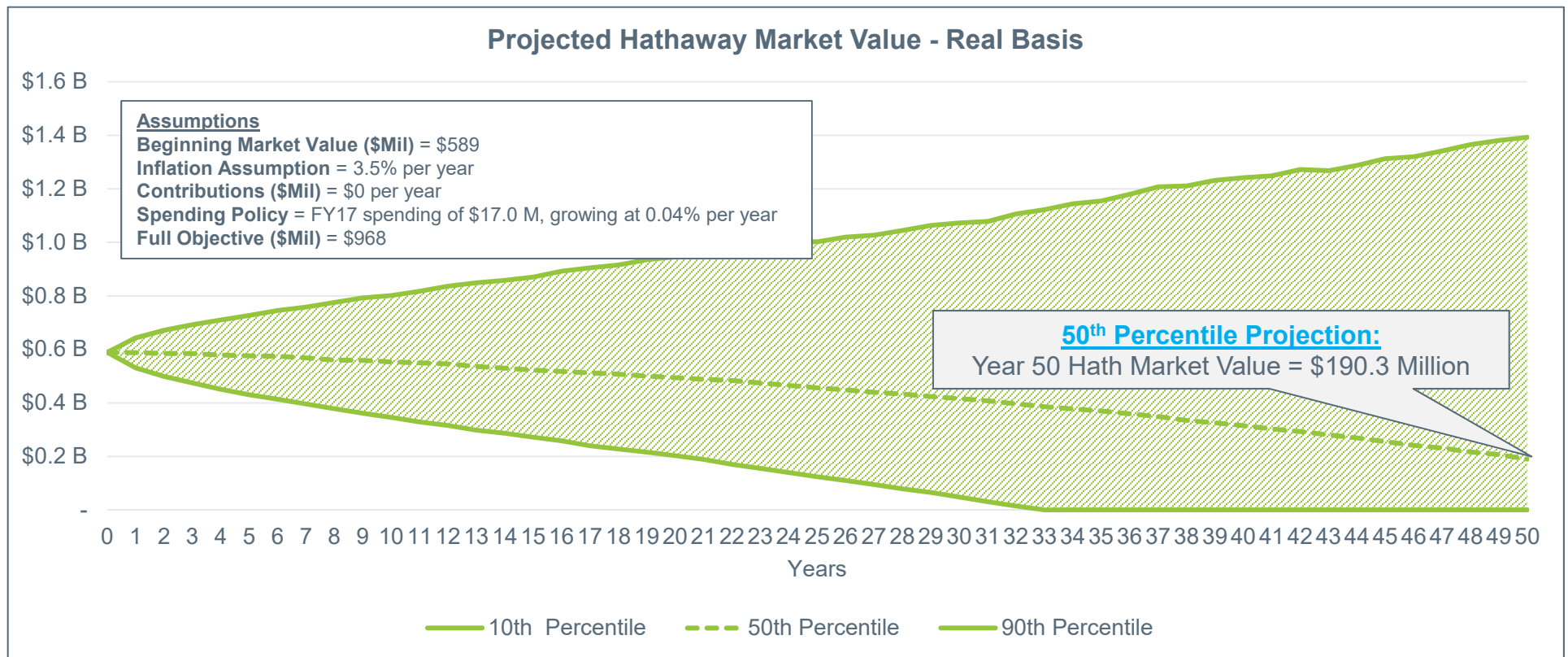
Projected Hathaway Market Value - Real Basis

Assumptions
Beginning Market Value ($Mil) = $589
Inflation Assumption = 3.5% per year
Contributions ($Mil) = $0 per year
Spending Policy = FY17 spending of $17.0 M, growing at 0.04% per year
Full Objective ($Mil) = $968

50th Percentile Projection:
Year 50 Hath Market Value = $190.3 Million

Years

—— 10th Percentile   - - - 50th Percentile   —— 90th Percentile

All data is shown in real terms, after 3.50% annual inflation (2.50% standard assumption + 1.00% additional inflation of higher education prices).
Spending growth rate reflects the Wyoming Economic Analysis Division's forecasted annualized population growth rate for ages 18-24 through 2040.
Model assumes investment earnings always meet or exceed annual spending policy amount.

42

RVK

Intergenerational Equity Analysis: Hathaway

Current Framework

	Hathaway – Total Return Focus Target
Cumulative 50 Year Distributions ($M)	$858.6
Volatility of Annual Spending Changes (% YoY St. Dev.)	8.42%
Projected 50 Year Market Value ($M)	$190.3
Probability of Achieving Full Objective	17.2%

Sensitivity Analysis

	Inflation	Contributions	Distributions
Baseline (Probability of Achieving Full Objective)	3.5% per year (2.50% standard + 1.0% higher education expenses) **(17.2%)**	$0 per year **(17.2%)**	FY17 spending of $17.0 M, growing at 0.04% per year **(17.2%)**
Impact of **UP** move to assumption	4.5% per year **(4.0%)**	$10 M per year **(56.8 %)**	FY17 spending of $17.0 M, *growing* at 1.00% per year **(9.5%)**
Impact of **DOWN** move to assumption	2.5% per year **(42.9%)**	N/A	FY17 spending of $17.0 M, *declining* at 1.00% per year **(26.9%)**

All data is shown in real terms, after 3.50% annual inflation (2.50% standard assumption + 1.00% additional inflation of higher education prices).
Model assumes investment earnings always meet or exceed annual spending policy amount.

RVK

Intergenerational Equity Analysis: Higher Ed

Under the new policy target portfolio and spending policy, the median probability of achieving the Full Objective (preserving long-term purchasing power) in Year 50 is **0.0%.**

The projected market value at year 50 is **$21.4 Million**.
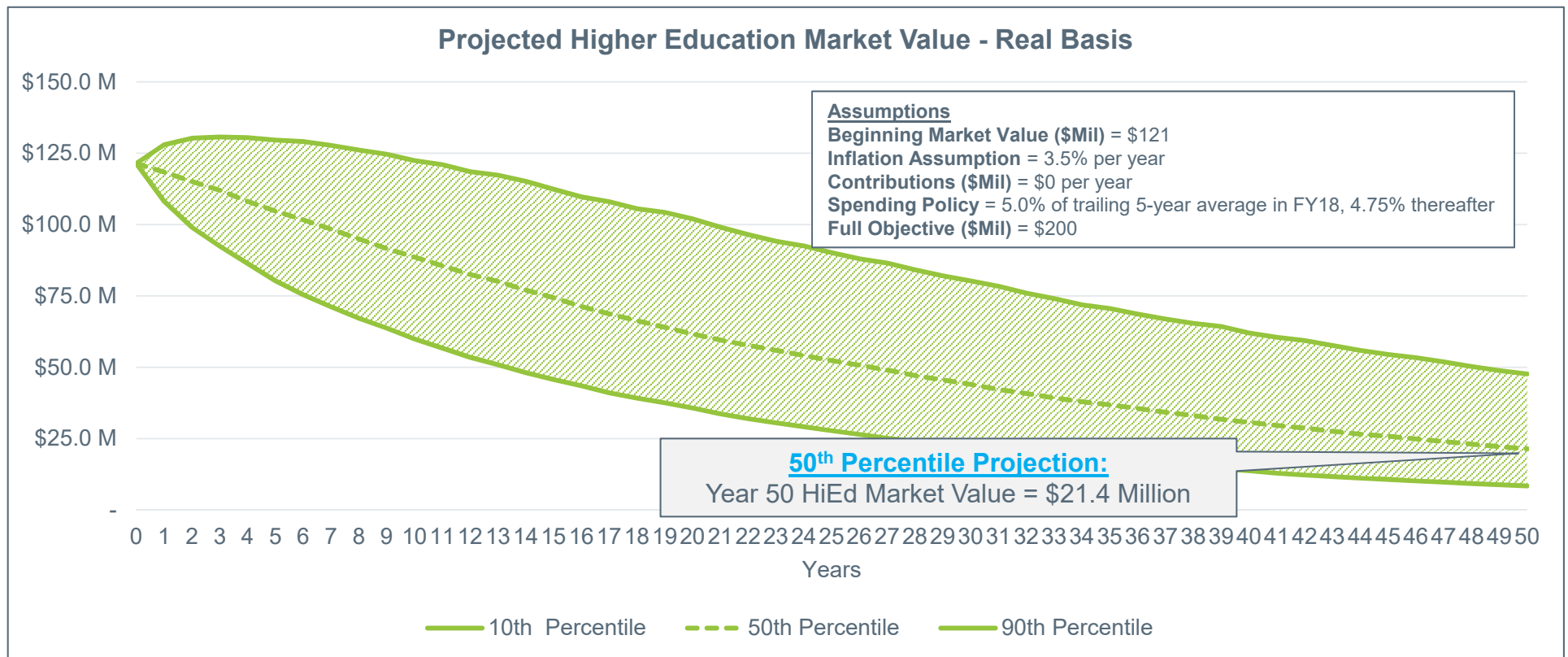
Projected Higher Education Market Value - Real Basis

Assumptions
Beginning Market Value ($Mil) = $121
Inflation Assumption = 3.5% per year
Contributions ($Mil) = $0 per year
Spending Policy = 5.0% of trailing 5-year average in FY18, 4.75% thereafter
Full Objective ($Mil) = $200

50th Percentile Projection:
Year 50 HiEd Market Value = $21.4 Million

Years

——— 10th Percentile   – – – 50th Percentile   ——— 90th Percentile

All data is shown in real terms, after 3.50% annual inflation (2.50% standard assumption + 1.00% additional inflation of higher education prices).
Model assumes investment earnings always meet or exceed annual spending policy amount.

RVK

Intergenerational Equity Analysis: Higher Ed

Current Framework

	Higher Ed – Income Focus Target
Cumulative 50 Year Distributions ($M)	$156.5
Volatility of Annual Spending Changes (% YoY St. Dev.)	4.65%
Projected 50 Year Market Value ($M)	$21.4
Probability of Achieving Full Objective	0.0%

Sensitivity Analysis

	Inflation	Contributions	Distributions
Baseline (Probability of Achieving Full Objective)	3.5% per year (0.0%)	$0 per year (0.0%)	5.0% spending rate in FY18, 4.75% spending rate thereafter (0.0%)
Impact of **UP** move to assumption	4.5% per year (0.0%)	$6.5M per year (51.3%)	5.0% spending rate in FY18, 5.75% spending rate thereafter (0.0%)
Impact of **DOWN** move to assumption	2.5% per year (0.2%)	N/A	5.0% spending rate in FY18, 3.75% spending rate thereafter (0.3%)

All data is shown in real terms, after 3.50% annual inflation (2.50% standard assumption + 1.00% additional inflation of higher education prices). Model assumes investment earnings always meet or exceed annual spending policy amount.

RVK

Asset Allocation: State Agency Pool

State Agency Pool

Total Assets (12/31/17):	$5,369 million
Purpose:	This fund dispenses income and capital gains. The State Agency Pool is one of two pools holding a diverse array of individual funds ranging from agency budgets to reserve accounts.
Fund Horizon:	Non-Permanent Fund
Return Objective:	CPI + 2%
Primary Investment Goal:	Safety of capital, yield and liquidity.
Spending Policy:	Investment income is distributed back to a specific state agency or to the state general fund.
Liquidity Requirements:	Liquidity must be maintained to facilitate trading, to move money between asset classes and to meet cash needs as determined by the State Treasurer's Office.
Investment Constraints:	Cannot invest in equities or alternative investments.

RVK

State Agency Pool

Long-Term Asset Class Targets	Asset Classes	Current Allocation (%)	Long-Term Target (%)
Fixed Income & Cash (100%)	Convertibles	2.72	5.00
	Int. Duration Fixed Income	22.15	10.00
	Internal Fixed Income	22.14	20.00
	Low Duration Fixed Income	--	30.00
	Bank Loans	16.71	15.00
	EMD (Local)	2.80	5.00
	TIPS	4.66	5.00
	Opportunistic Fixed Income	1.78	--
	Cash Equivalents	23.85	10.00
	Public Purpose Investments	3.19	--

Key Observations:

- Replaced some of the exposure to intermediate duration fixed income with low duration fixed income and internally managed fixed income

- Exposure to inflationary assets increased, while exposure to capital preservation thematic allocation declined.

Thematic Allocation (%)
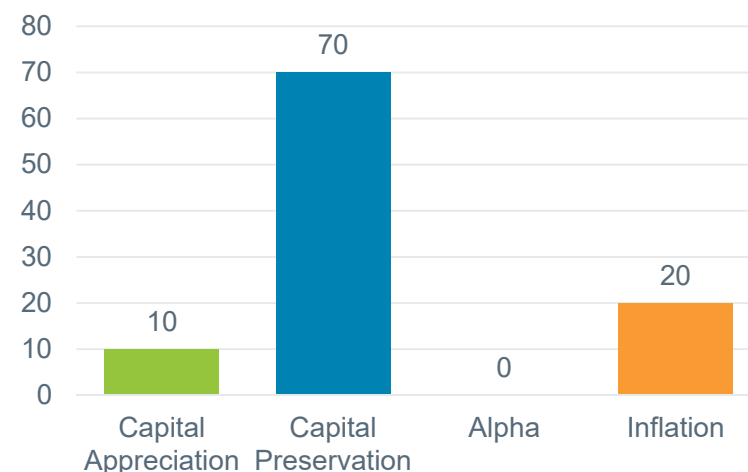
Category	Value
Capital Appreciation	10
Capital Preservation	70
Alpha	0
Inflation	20

Current Allocation is as of December 31, 2017. Bank Loans within the current allocation represents the custom credit mandate, which includes high yield, bank loans, and investment-grade credit.

RVK

State Agency Pool

Efficient Frontier

Chart: Efficient Frontier. X-axis: Risk (Annualized Standard Deviation, %), ranging 3.00 to 5.50. Y-axis: Return (Annualized, %), ranging 2.50 to 4.25. Data points labeled 1 through 10 along the green frontier curve. "SAP Target" shown as green square and "Current Allocation" shown as blue square.

Current Allocation is as of December 31, 2017.
Current Allocation expected return and risk excludes Opportunistic Fixed Income and Public Purpose Investments.

RVK
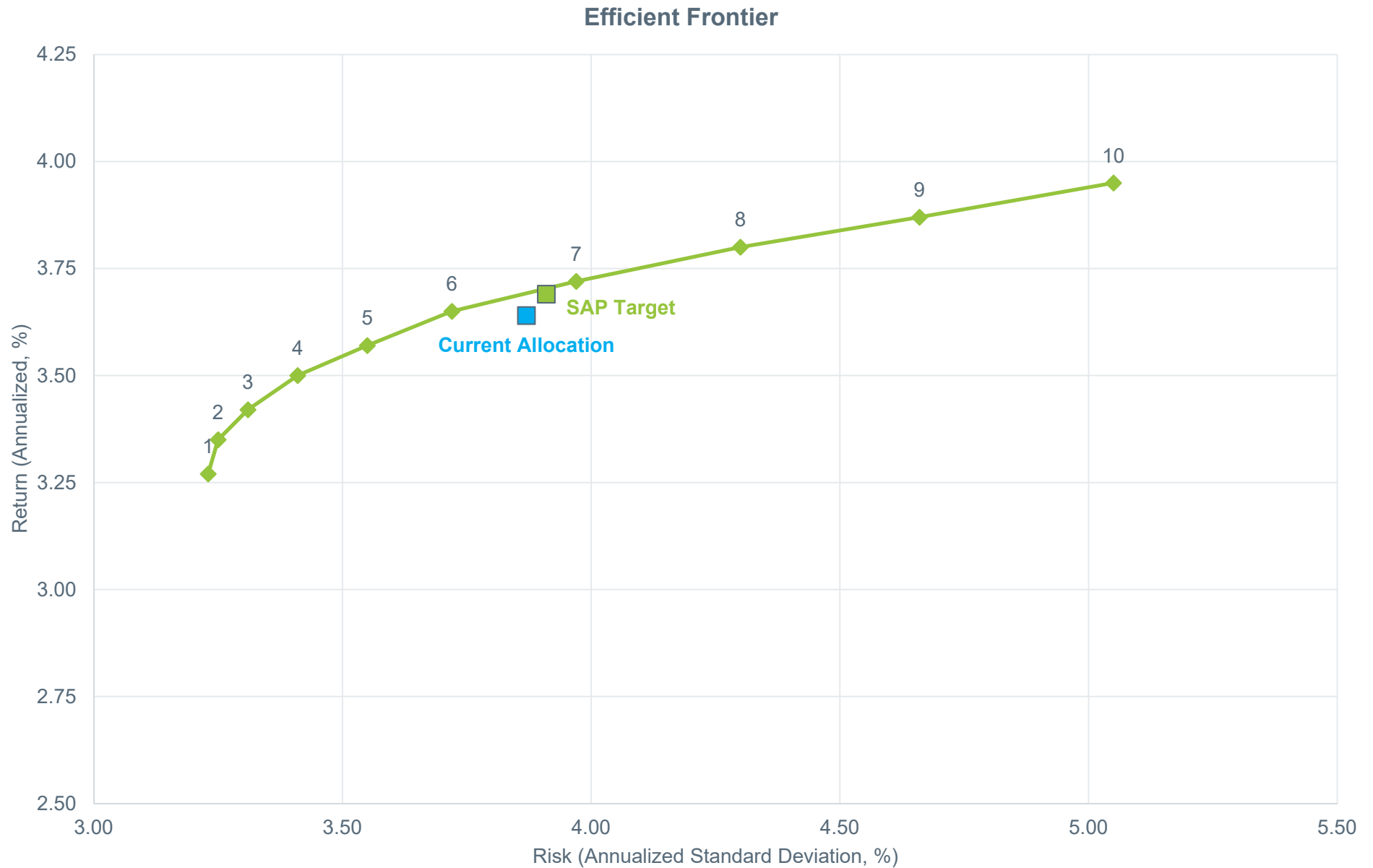
State Agency Pool

Efficient Frontier Table

	Min	Max	1	2	3	4	5	6	7	8	9	10	SAP Target
Convertibles	0	5	0	1	3	5	5	5	5	5	5	5	5
Int. Duration Fixed Income	0	100	0	0	0	0	0	0	3	18	33	48	10
Custom Internal Fixed Income	20	60	20	20	20	20	20	20	20	20	20	20	20
Low Duration Fixed Income	0	60	58	55	52	47	43	39	45	30	15	0	30
Bank Loans	0	15	12	14	15	15	15	15	15	15	15	15	15
Emerging Markets Debt (Local)	0	5	0	0	0	0	3	5	5	5	5	5	5
TIPS	0	7	0	0	0	2	4	6	7	7	7	7	5
Cash Equivalents	0	10	10	10	10	10	10	10	0	0	0	0	10
Total			100	100	100	100	100	100	100	100	100	100	100
Total Fixed Income & Cash			100	100	100	100	100	100	100	100	100	100	100
Capital Appreciation			0	1	3	5	8	10	10	10	10	10	10
Capital Preservation			88	85	82	77	73	69	68	68	68	68	70
Alpha			0	0	0	0	0	0	0	0	0	0	0
Inflation			12	14	15	17	19	21	22	22	22	22	20
Expected Return			**3.27**	**3.35**	**3.42**	**3.50**	**3.57**	**3.65**	**3.72**	**3.80**	**3.87**	**3.95**	**3.69**
Risk (Standard Deviation)			**3.23**	**3.25**	**3.31**	**3.41**	**3.55**	**3.72**	**3.97**	**4.30**	**4.66**	**5.05**	**3.91**
Return (Compound)			3.22	3.30	3.37	3.44	3.51	3.58	3.64	3.71	3.77	3.83	3.62
Return/Risk Ratio			1.01	1.03	1.03	1.03	1.01	0.98	0.94	0.88	0.83	0.78	0.94
RVK Expected Eq Beta (LCUS Eq = 1)			0.05	0.06	0.07	0.09	0.09	0.10	0.11	0.11	0.12	0.12	0.11
RVK Liquidity Metric (T-Bills = 100)			82	81	81	81	80	80	78	78	78	78	80
Estimated Yield (%)			2.57	2.66	2.69	2.67	2.82	2.90	2.99	3.10	3.20	3.30	2.97
1 Year Max Drawdown (%)			-5.33	-6.04	-6.39	-6.45	-6.31	-6.09	-6.29	-7.59	-8.85	-10.02	-6.80
Estimated Duration			1.72	1.68	1.68	1.79	2.02	2.20	2.52	2.86	3.20	3.54	2.37

RVK

State Agency Pool

Similar to the prior year's assumptions, the target portfolio is expected to significantly reduce downside and interest rate risk, while earning a similar yield.

	SAP Target
Expected Return (%)	3.69
Risk (Standard Deviation, %)	3.91
Return (Compound, %)	3.62
Return/Risk Ratio	0.94
Estimated Duration (Int. Rate Risk)	2.37
Estimated Yield (%)	2.97
Portfolio Stress Testing (Monte Carlo Results)	
1 Year Max Drawdown (2008-Like Event)	-$365 M (-6.80%)
Median 1 Year Return	+$213 M (+3.97%)
Probability of Achieving Various Real Return Targets	
1.5% Real Return Over 10 Years	42%
2.0% Real Return Over 10 Years	**28%**
2.5% Real Return Over 10 Years	17%

2017 Assumptions:
Expected Return = 3.53%
Risk (St. Dev.) = 3.92%
Return (Compound) = 3.46%

Range of Monte Carlo Stress Test Results
1st & 99th Percentiles = Darker Color
5th to 95th Percentiles = Lighter Color

SAP Target

Return (%, Annualized) — axis: 15.0, 10.0, 5.0, 0.0, -5.0, -10.0, -15.0

1 Year   3 Years   5 Years   10 Years

--- Long-Term Return Expectation

Expected returns do not assume active manager alpha. Estimated yields are a weighted average of the underlying asset class benchmarks as of 12/31/17.
1 Year Max Drawdown reflects the 1st percentile nominal return. Dollar amounts are based on an initial portfolio value of $5,369 M.

RVK

Risk Analysis: State Agency Pool

Target Allocation Risk Summary
January 1, 2008 to December 31, 2017

Total Portfolio Summary

Volatility	2.1%
Value at Risk (VaR)*	2.6%
Expected Tail Loss (ETL)*	3.9%
Expected Tail Return (ETR)*	4.4%
Rachev Ratio (ETR/ETL)*	1.1
STARR Performance (Excess Return/ETL)**	0.2

*Calculated with a 99% Confidence Interval.
**Similar to the Sharpe Ratio which is a standard deviation-based performance measure, but STARR (stable tail-adjusted return ratio) uses the ETL in the denominator as a risk measure. STARR can be seen as a more effective indicator of risk-adjusted performance because it penalizes only for downside risk, while the standard deviation does not distinguish between upside and downside risk.

Percent Contribution to Risk and ETL

Asset	Percent Contribution to ETL	Percent Contribution to Risk	Target Allocation
Convertibles	23%	20%	5%
Int. Duration Fixed Income	6%	9%	10%
Internal Fixed Income	9%	10%	20%
Low Duration Fixed Income	3%	6%	30%
Bank Loans	22%	23%	15%
Emerging Market Debt	25%	22%	5%
TIPS	11%	10%	5%
Cash	0%		10%

Legend: ■ Percent Contribution to ETL ■ Percent Contribution to Risk □ Target Allocation

Factor Contribution to Risk

Factor	Value
Volatility	-1%
Interest Rate Risk	9%
Size Risk	1%
Style Risk	1%
Fixed Income Risk	66%
FX Risk	1%
Equity Risk	15%
Commodity Risk	1%
Specific Risk	7%

Scenario Analysis

Scenario	Value
Oil +25%	0.2%
Oil -25%	-0.1%
Russell 3000 +20%	0.5%
Russell 3000 -20%	-0.3%
10 Year Treasury +200 bps	-1.0%
10 Year Treasury -200 bps	4.2%
2008 Sept - Oct Crash	-6.2%
HY Spreads Compress 50%	1.2%
HY Spreads Widen 50%	-0.2%

Analysis provided by PerTrac RiskPlus powered by FinAnalytica. All values are annual.

RVK

Asset Allocation: Workers' Compensation Fund

Workers' Compensation Fund

Total Assets (12/31/17):	$2,048 million
Purpose:	This fund retains income and capital gains. The funds are to be invested for the long-term to provide for a return that assures the Fund will be self-funding or nearly self-funding in order to substantially reduce or eliminate the need for employer contributions.
Fund Horizon:	Permanent Fund (Perpetual)
Return Objective:	CPI + 3%
Actuarial Discount Rate:	2.5%
Duration of Liabilities	11.4 years
Primary Investment Goal:	Long-term return, safety of capital, yield, and capital appreciation.
Spending Policy:	The exact cash level shall be determined by the staff of the Wyoming Department of Workforce Services and dependent on the liquidity needs of the Fund. Those cash estimates shall be presented to the State Treasurer's Office on an annual basis.
Liquidity Requirements:	Liquidity must be maintained to facilitate trading, to move money between asset classes and to meet cash needs.
Investment Constraints:	Maximum of 70% of the total book value of permanent funds may be invested in equities and alternative investments.

Actuarial discount rate and duration of liabilities are as of the most recent report.

RVK

Workers' Compensation Fund

Broad Asset Class Targets	Asset Classes	Current Allocation (%)	Long-Term Target (%)
Public Equity (23%)	Broad US Equity	8.16	9.00
	Small Cap US Equity	0.93	1.00
	Global Equity	1.84	--
	Broad International Equity	7.65	10.00
	MLPs	--	3.00
Alternatives (4%)	Core Real Estate	2.67	3.00
	Non-Core Real Estate	1.03	1.00
	Diversified Hedge Funds	3.29	--
Fixed Income & Cash (73%)	Long Duration Fixed Income	--	27.00
	Int. Duration Fixed Income	40.03	33.00
	Internal Fixed Income	2.43	--
	Bank Loans	5.66	3.00
	EMD (Local)	2.01	5.00
	TIPS	3.46	5.00
	Opportunistic Fixed Income	1.43	--
	Cash Equivalents	16.69	--

Key Observations:

- Added exposure to long duration fixed income to help protect the relatively healthy funded status.

- Allocations to growth assets remain such that the fund remains self-funding or nearly self-funding.

- Exposure to inflationary assets was increased primarily from the introduction of MLPs, while exposure to hedge funds was eliminated.

Thematic Allocation (%)
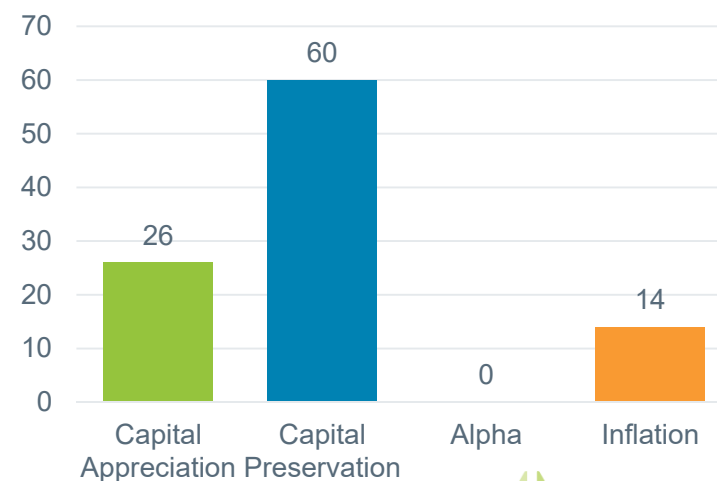
Category	Value
Capital Appreciation	26
Capital Preservation	60
Alpha	0
Inflation	14

Current Allocation is as of December 31, 2017. Bank Loans within the current allocation represents the custom credit mandate, which includes high yield, bank loans, and investment-grade credit. Cash Equivalents within the current allocation represents assets invested in the Sate Agency Pool.

RVK

Workers' Compensation Fund

The current allocation is closer to the efficient frontier than the policy target, when considering return and risk in terms of standard deviation of returns.

Efficient Frontier: Return and Risk (Standard Deviation)
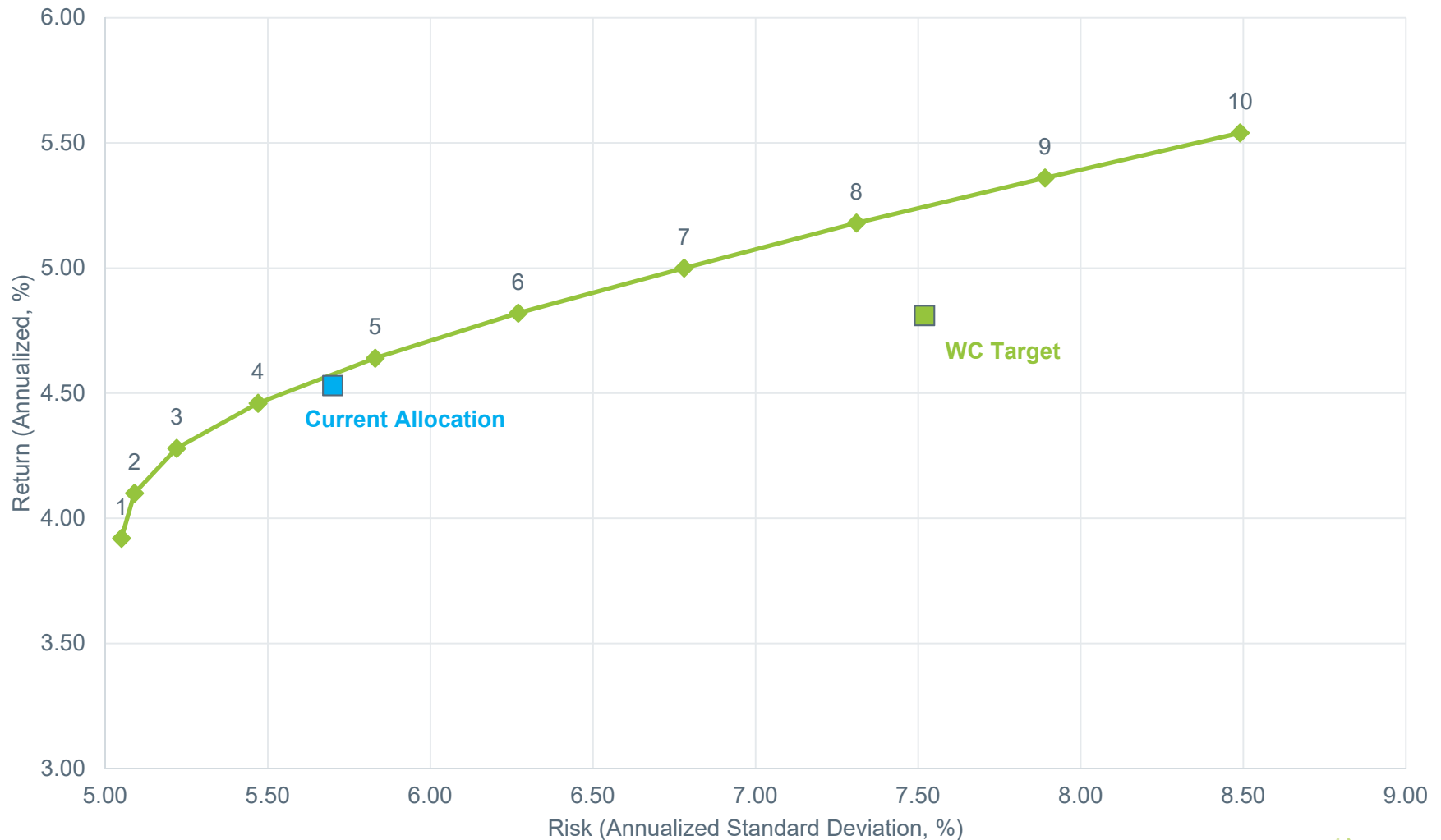
Current Allocation is as of December 31, 2017.
Current Allocation expected return and risk excludes Opportunistic Fixed Income and Public Purpose Investments.

RVK

Workers' Compensation Fund

However, the policy target is significantly closer to the efficient frontier when considering return and risk in terms of surplus volatility (changes in funded status).

Efficient Frontier: Return and Risk (Surplus Volatility)

Current Allocation is as of December 31, 2017.
Current Allocation expected return and surplus volatility excludes Opportunistic Fixed Income and Public Purpose Investments.

57

RVK

Workers' Compensation Fund

Efficient Frontier Table

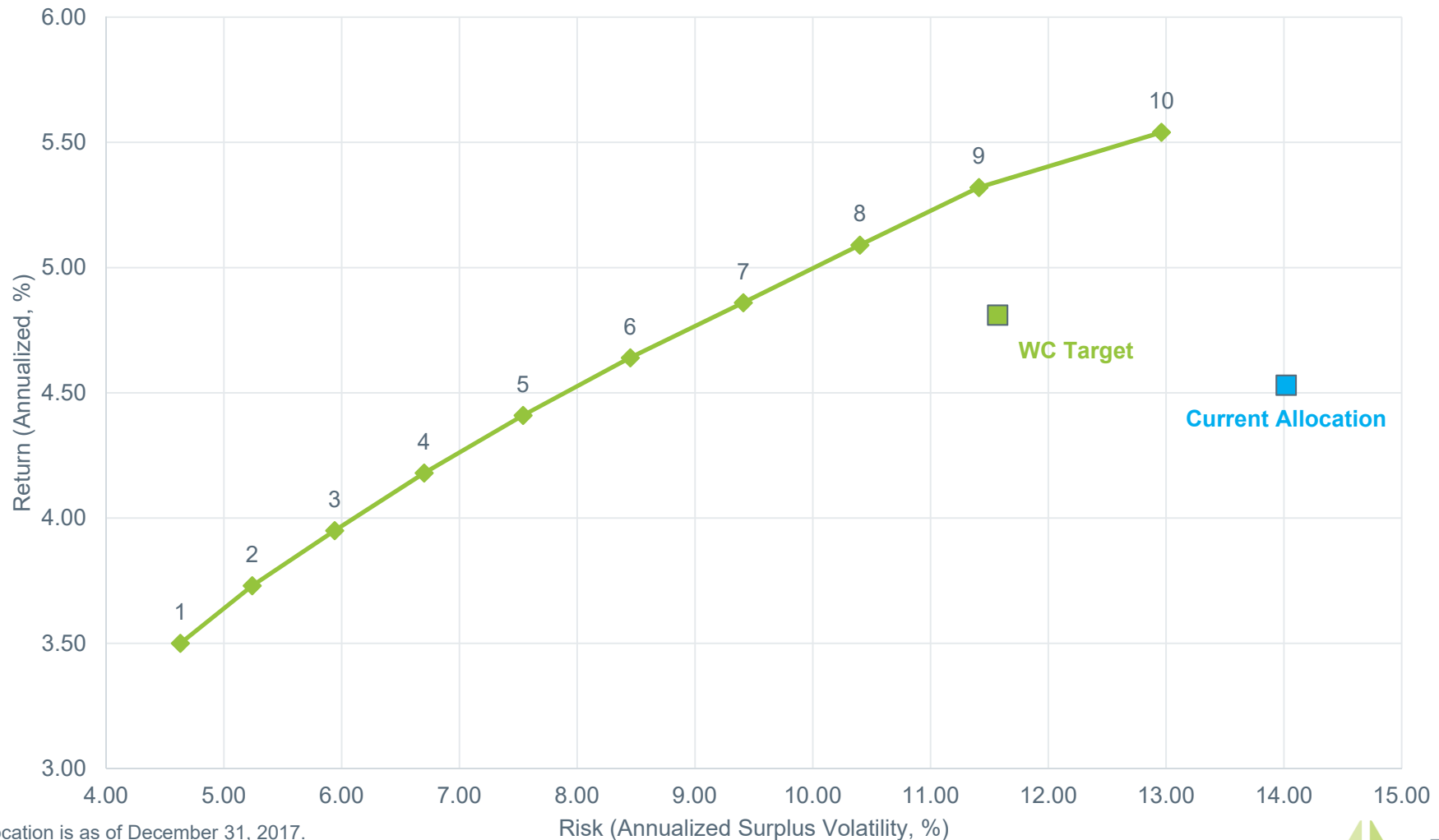|	Min	Max	1	2	3	4	5	6	7	8	9	10	WC Target
Broad US Equity	0	30	0	1	2	4	6	8	10	12	14	13	9
Small Cap US Equity	0	5	0	0	0	0	1	2	2	3	4	4	1
Broad International Equity	0	30	0	1	2	4	7	10	12	15	17	18	10
MLPs	0	3	0	2	3	3	3	3	3	3	3	3	3
Core Real Estate	0	5	0	0	1	2	2	2	2	2	3	3	3
Non-Core Real Estate	0	2	0	0	1	2	2	2	2	2	2	2	1
Long Duration Fixed Income	0	100	100	95	90	84	79	74	68	63	57	42	27
Int. Duration Fixed Income	0	100	0	0	0	0	0	0	0	0	0	0	33
Bank Loans	0	5	0	0	0	0	0	0	0	0	0	5	3
Emerging Markets Debt (Local)	0	5	0	0	0	0	0	0	0	0	0	5	5
TIPS	0	5	0	0	0	0	0	0	0	0	0	5	5
Cash Equivalents	0	5	0	0	0	0	0	0	0	0	0	0	0
Total			100	100	100	100	100	100	100	100	100	100	100
Total Equity			0	5	10	16	21	26	32	37	43	43	27
Expected Equity Beta (LC US Eq = 1)			0.13	0.16	0.18	0.22	0.26	0.31	0.35	0.40	0.44	0.45	0.30
RVK Liquidity Metric (Cash = 100)			85	85	84	83	83	84	84	84	84	81	82
Expected Return (Arithmetic)			3.50	3.73	3.95	4.18	4.41	4.64	4.86	5.09	5.32	5.54	4.81
Risk (Surplus Volatility)			4.63	5.24	5.94	6.70	7.54	8.45	9.41	10.40	11.41	12.96	11.57
Return (Compound)			2.87	3.15	3.43	3.70	3.95	4.20	4.42	4.64	4.86	5.10	4.54
Risk (Standard Deviation)			11.50	11.00	10.48	10.05	9.79	9.64	9.63	9.75	9.91	9.64	7.52
Est. Interest Hedge Ratio			129%	123%	116%	109%	102%	95%	88%	81%	74%	59%	56%
Est. Funded Status -2 STDEV Event (Current = 100%)*			91%	90%	88%	87%	85%	83%	81%	79%	77%	74%	77%
Estimated Yield (%)			3.50	3.52	3.57	3.56	3.52	3.48	3.36	3.32	3.26	3.50	3.34
1 Year Max Drawdown			-19.07	-19.00	-18.77	-17.89	-17.76	-18.40	-19.03	-20.23	-21.58	-20.06	-14.41

Group constraints: (i) Broad US equity must be at least 75% of total US equity. (ii) Total US equity must be at least 50% of total public equity. (iii) Total public equity must not exceed 35% of the total portfolio. (iv) Total real estate must not exceed 5% of the total portfolio. (v) Core real estate must be at least 50% of total real estate. *Assumes interest and service costs are approximately equal to expected return.

RVK

Workers' Compensation Fund

As the expected return has decreased, the probability of achieving the long-term expected return target over a 10 year period has fallen below 50%.

	WC Target
Expected Return (%)	4.81
Risk (Standard Deviation, %)	7.52
Return (Compound, %)	4.54
Return/Risk Ratio	0.64
Assumed Funded Status (%)	100.00
Risk (Surplus Volatility,%)	11.57
Estimated Yield (%)	3.34
Portfolio Stress Testing (Monte Carlo Results)	
1 Year Max Drawdown (2008-Like Event)	-$295 M (-14.41%)
Median 1 Year Return	+$108 M (+5.27%)
Probability of Achieving Various Real Return Targets	
2.5% Real Return Over 10 Years	46%
3.0% Real Return Over 10 Years	**37%**
3.5% Real Return Over 10 Years	29%

2017 Assumptions:
Expected Return = 5.05%
Risk (St. Dev.) = 7.50%
Return (Compound) = 4.78%

Range of Monte Carlo Stress Test Results
1st & 99th Percentiles = Darker Color
5th to 95th Percentiles = Lighter Color

WC Target

Return (%, Annualized) — axis: 20.0, 15.0, 10.0, 5.0, 0.0, -5.0, -10.0, -15.0, -20.0

Categories: 1 Year, 3 Years, 5 Years, 10 Years

- - - Long-Term Return Expectation

Expected returns do not assume active manager alpha. Estimated yields are a weighted average of the underlying asset class benchmarks as of 12/31/17.
1 Year Max Drawdown reflects the 1st percentile nominal return. Dollar amounts are based on an initial portfolio value of $2,048 M.

RVK

Risk Analysis: Workers' Compensation Fund

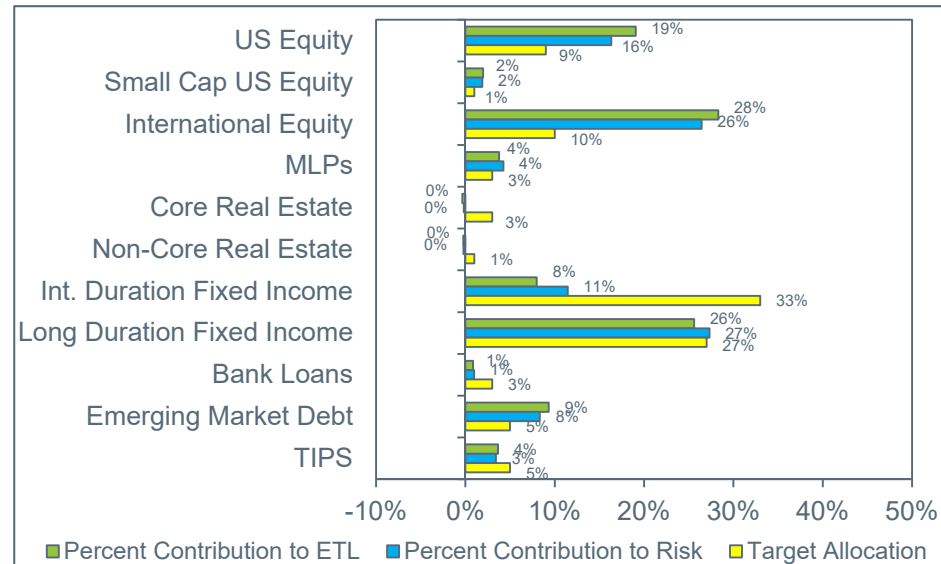**Target Allocation Risk Summary**
January 1, 2008 to December 31, 2017

Total Portfolio Summary

Volatility	5.5%
Value at Risk (VaR)*	9.5%
Expected Tail Loss (ETL)*	13.2%
Expected Tail Return (ETR)*	12.6%
Rachev Ratio (ETR/ETL)*	1.0
STARR Performance (Excess Return/ETL)**	0.1

*Calculated with a 99% Confidence Interval.
**Similar to the Sharpe Ratio which is a standard deviation-based performance measure, but STARR (stable tail-adjusted return ratio) uses the ETL in the denominator as a risk measure. STARR can be seen as a more effective indicator of risk-adjusted performance because it penalizes only for downside risk, while the standard deviation does not distinguish between upside and downside risk.

Percent Contribution to Risk and ETL

Chart showing Percent Contribution to ETL (green), Percent Contribution to Risk (blue), and Target Allocation (yellow):

Category	Percent Contribution to ETL	Percent Contribution to Risk	Target Allocation
US Equity	19%	16%	9%
Small Cap US Equity	2%	2%	1%
International Equity	28%	26%	10%
MLPs	4%	4%	3%
Core Real Estate	0%	0%	3%
Non-Core Real Estate	0%	0%	1%
Int. Duration Fixed Income	8%	11%	33%
Long Duration Fixed Income	26%	27%	27%
Bank Loans	1%	1%	3%
Emerging Market Debt	9%	8%	5%
TIPS	4%	3%	5%

Factor Contribution to Risk

Factor	Value
Volatility	-1%
Interest Rate Risk	17%
Size Risk	1%
Style Risk	0%
Fixed Income Risk	27%
FX Risk	0%
Equity Risk	55%
Commodity Risk	0%
Specific Risk	2%

Scenario Analysis

Scenario	Value
Oil +25%	0.9%
Oil -25%	-0.8%
Russell 3000 +20%	2.6%
Russell 3000 -20%	-2.3%
10 Year Treasury +200 bps	-2.4%
10 Year Treasury -200 bps	14.0%
2008 Sept - Oct Crash	-14.2%
HY Spreads Compress 50%	0.8%
HY Spreads Widen 50%	9.2%

Analysis provided by PerTrac RiskPlus powered by FinAnalytica. All values are annual.

60

RVK

Asset Allocation: Pool A Investment Account

Pool A Investment Account
(formerly the Tobacco Settlement Fund)

Total Assets (12/31/17):	$237 million
Purpose:	This fund dispenses income and capital gains. Pool A is one of two pools holding a diverse array of individual funds from agency budgets to reserve accounts.
Fund Horizon:	Non-Permanent Fund
Return Objective:	CPI + 2%
Primary Investment Goal:	Pool A is intended to be moderately liquid and safely invested, but also be invested for return and growth.
Spending Policy:	Investment income (interest and dividends) are deposited as prescribed by statute.
Liquidity Requirements:	Liquidity must be maintained to facilitate trading, to move money between asset classes and to meet cash needs as determined by the State Treasurer's Office.
Investment Constraints:	Maximum of 60% of the total book value of Pool A may be invested in equities and alternative investments.

RVK

Pool A Investment Account

Long-Term Asset Class Targets	Asset Classes	Current Allocation (%)	Long-Term Target (%)
Public Equity (23%)	Broad US Equity	--	7.50
	Small Cap US Equity	--	1.00
	Broad International Equity	--	7.50
	Preferred Stock	--	2.00
	MLPs	--	5.00
Fixed Income & Cash (77%)	Convertibles	3.39	--
	Int. Duration Fixed Income	42.64	49.00
	Internal Fixed Income	21.00	--
	Bank Loans	18.19	10.00
	EMD (Local)	4.83	5.00
	TIPS	6.40	8.00
	Opportunistic Fixed Income	2.52	--
	Cash Equivalents	1.03	5.00

Key Observations:

- Introduced exposure to public equity, preferred stock, and MLPs.

- Exposure to inflationary and capital appreciation assets was increased.

- Exposure to capital preservation was reduced, primarily through a lower intermediate duration fixed income allocation (-25%).

Thematic Allocation (%)
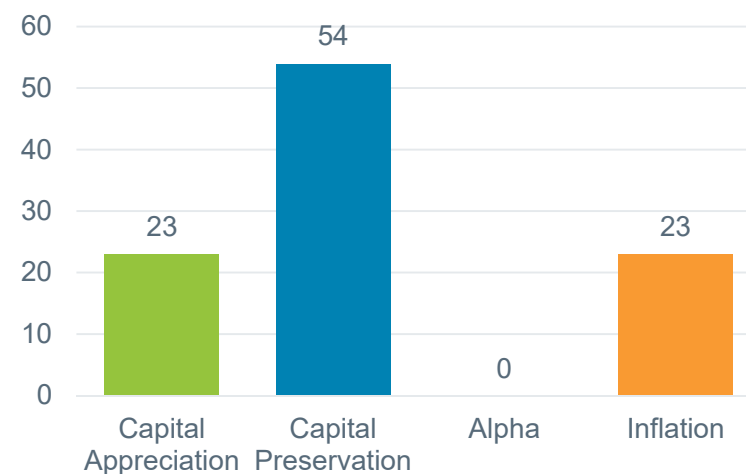
Category	Value
Capital Appreciation	23
Capital Preservation	54
Alpha	0
Inflation	23

Current Allocation is as of December 31, 2017. Bank Loans within the current allocation represents the custom credit mandate, which includes high yield, bank loans, and investment-grade credit. Cash Equivalents within the current allocation represents assets invested in the Sate Agency Pool.

RVK

Pool A Investment Account

The current allocation was developed under the prior guidelines and objectives of the Tobacco Settlement Fund. The efficient frontier and policy target shown below reflects the current investment guidelines and objectives of Pool A.

Efficient Frontier
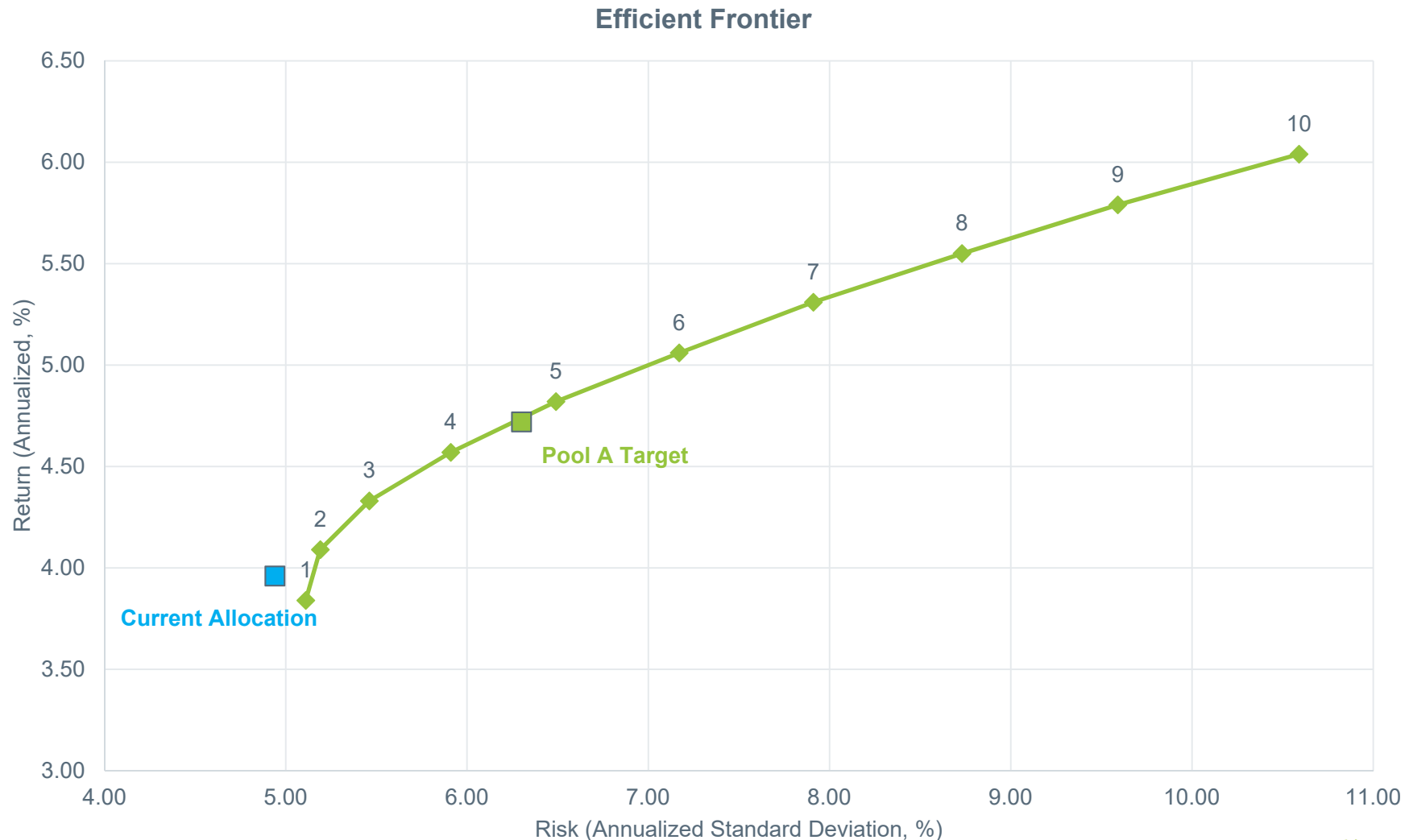
Current Allocation is as of December 31, 2017. The Current Allocation falls above of the efficient frontier largely due to an above maximum allocation to bank loans and a significant allocation to internal fixed income. Current Allocation expected return and risk excludes Opportunistic Fixed Income and Public Purpose Investments.

Pool A Investment Account

Efficient Frontier Table

	Min	Max	1	2	3	4	5	6	7	8	9	10	Pool A Target
Broad US Equity	0	20	1	2	4	6	7	9	11	13	14	20	7.5
Small Cap US Equity	0	5	0	1	1	2	2	3	4	4	5	5	1
Broad International Equity	0	20	1	3	5	8	10	12	15	17	19	20	7.5
Preferred Stock	0	5	0	0	0	1	5	5	5	5	5	5	2
MLPs	0	5	2	4	5	5	5	5	5	5	5	5	5
Int. Duration Fixed Income	0	100	73	67	62	55	48	46	43	36	29	22	49
Bank Loans	0	10	10	10	10	10	10	10	10	10	10	10	10
Emerging Markets Debt (Local)	0	5	0	0	0	0	0	0	0	2	5	5	5
TIPS	0	8	8	8	8	8	8	8	8	8	8	8	8
Cash Equivalents	0	5	5	5	5	5	5	2	0	0	0	0	5
Total			100	100	100	100	100	100	100	100	100	100	100
Total Fixed Income & Cash			*96*	*90*	*85*	*78*	*71*	*66*	*61*	*56*	*52*	*45*	*77*
Capital Appreciation			3	6	10	17	24	29	34	41	48	55	23
Capital Preservation			78	72	67	60	53	48	43	36	29	22	54
Alpha			0	0	0	0	0	0	0	0	0	0	0
Inflation			20	22	23	23	23	23	23	23	23	23	23
Expected Return			**3.84**	**4.09**	**4.33**	**4.57**	**4.82**	**5.06**	**5.31**	**5.55**	**5.79**	**6.04**	**4.72**
Risk (Standard Deviation)			**5.11**	**5.19**	**5.46**	**5.91**	**6.49**	**7.17**	**7.91**	**8.73**	**9.59**	**10.59**	**6.30**
Return (Compound)			3.71	3.96	4.19	4.40	4.62	4.82	5.01	5.19	5.36	5.52	4.53
Return/Risk Ratio			0.75	0.79	0.79	0.77	0.74	0.71	0.67	0.64	0.60	0.57	0.75
RVK Expected Eq Beta (LCUS Eq = 1)			0.10	0.14	0.19	0.24	0.28	0.33	0.38	0.43	0.48	0.54	0.26
RVK Liquidity Metric (T-Bills = 100)			83	83	84	84	84	84	84	84	83	84	82
Estimated Yield (%)			*3.09*	*3.17*	*3.20*	*3.21*	*3.34*	*3.35*	*3.37*	*3.40*	*3.48*	*3.42*	*3.41*
1 Year Max Drawdown (%)			*-11.01*	*-11.27*	*-12.53*	*-13.97*	*-15.65*	*-17.03*	*-18.99*	*-20.46*	*-21.75*	*-24.92*	*-13.63*

Group constraints: (i) Broad US equity must be at least 75% of total US equity. (ii) Total US equity must be at least 50% of total public equity.

RVK

Pool A Investment Account

Similar to the prior year's assumptions, the probability of achieving the long-term expected return target over a 10 year period remains modestly above 50%.

	Income Focus Target
Expected Return (%)	4.72
Risk (Standard Deviation, %)	6.30
Return (Compound, %)	4.53
Return/Risk Ratio	0.75
Estimated Yield (%)	3.41
Portfolio Stress Testing (Monte Carlo Results)	
1 Year Max Drawdown (2008-Like Event)	-$32 M (-13.63%)
Median 1 Year Return	+$12 M (+5.16%)
Probability of Achieving Various Real Return Targets	
1.5% Real Return Over 10 Years	65%
2.0% Real Return Over 10 Years	**55%**
3.0% Real Return Over 10 Years	34%

2017 Assumptions:
Expected Return = 4.80%
Risk (St. Dev.) = 6.31%
Return (Compound) = 4.61%

Range of Monte Carlo Stress Test Results
1st & 99th Percentiles = Darker Color
5th to 95th Percentiles = Lighter Color

Pool A Target

- - - Long-Term Return Expectation

Expected returns do not assume active manager alpha. Estimated yields are a weighted average of the underlying asset class benchmarks as of 12/31/17. 1 Year Max Drawdown reflects the 1st percentile nominal return. Dollar amounts are based on an initial portfolio value of $237 M.

RVK

Risk Analysis: Pool A Investment Account

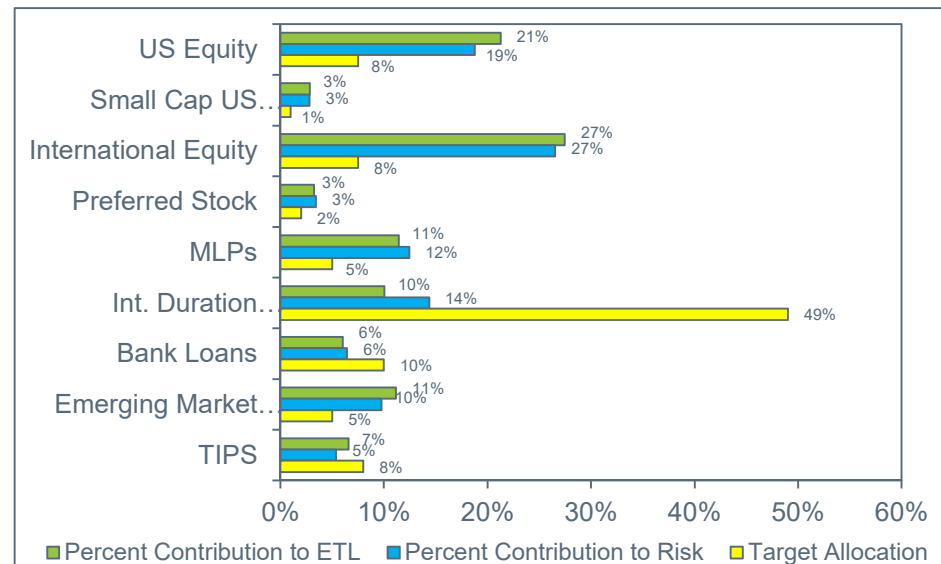## Target Allocation Risk Summary
January 1, 2008 to December 31, 2017

Total Portfolio Summary

Volatility	4.7%
Value at Risk (VaR)*	8.0%
Expected Tail Loss (ETL)*	10.8%
Expected Tail Return (ETR)*	10.4%
Rachev Ratio (ETR/ETL)*	1.0
STARR Performance (Excess Return/ETL)**	0.1

*Calculated with a 99% Confidence Interval.
**Similar to the Sharpe Ratio which is a standard deviation-based performance measure, but STARR (stable tail-adjusted return ratio) uses the ETL in the denominator as a risk measure. STARR can be seen as a more effective indicator of risk-adjusted performance because it penalizes only for downside risk, while the standard deviation does not distinguish between upside and downside risk.

Percent Contribution to Risk and ETL

Category	Percent Contribution to ETL	Percent Contribution to Risk	Target Allocation
US Equity	21%	19%	8%
Small Cap US..	3%	3%	1%
International Equity	27%	27%	8%
Preferred Stock	3%	3%	2%
MLPs	11%	12%	5%
Int. Duration..	10%	14%	49%
Bank Loans	6%	6%	10%
Emerging Market..	11%	10%	5%
TIPS	7%	5%	8%

- Percent Contribution to ETL
- Percent Contribution to Risk
- Target Allocation

Factor Contribution to Risk

Factor	Value
Volatility	-2%
Interest Rate Risk	2%
Size Risk	1%
Style Risk	1%
Fixed Income Risk	26%
FX Risk	1%
Equity Risk	68%
Commodity Risk	0%
Specific Risk	3%

Scenario Analysis

Scenario	Value
Oil +25%	1.1%
Oil -25%	-1.1%
Russell 3000 +20%	2.7%
Russell 3000 -20%	-2.6%
10 Year Treasury +200 bps	0.0%
10 Year Treasury -200 bps	3.0%
2008 Sept - Oct Crash	-14.3%
HY Spreads Compress 50%	7.0%
HY Spread Widen 50%	-4.6%

Analysis provided by PerTrac RiskPlus powered by FinAnalytica. All values are annual.

RVK

Synopsis of 2017 Approved Asset Allocation Changes

Summary of Approved Asset Allocation Enhancements

Permanent Funds *(PMTF, PLF, UPLF, CSPLF, Hathaway, and Higher Ed)*
- Improved the likelihood of achieving each pool's long-term return objectives, focusing on long-term total return or income generation based on respective spending policy goals and needs.

Increased allocations to public equity and alternatives for pools with a long-term total return focus, increased allocations to higher yielding assets for pools with an income focus.

State Agency Pool
- Focused on aligning the risk profile appropriately with the needs of the constituent investors. Emphasized risk reduction and capital preservation to help mitigate significant short-term draw downs.

Introduced low duration fixed income to reduce portfolio interest rate risk.

Workers' Compensation Fund
- Examined risk in terms of surplus volatility to help preserve the fund's fiscal health with a healthy funded status.

Introduced a modest allocation to long duration fixed income to help reduce funded status volatility.

Pool A Investment Account *(formerly Tobacco Settlement Fund)*
- Introduced public equity and alternative investments in a thoughtful manner such that the overall risk profile remains appropriate.

Gradually introduce allocations to risk assets when better entry points are available.

RVK

Asset Class Implementation: Priorities and Timeline

Asset Class Implementation: Priorities and Timeline

Already Accomplished
- Selection of passive short duration credit manager
- Selection of initial MLP manager
- Selection Preferred Stock manager
- Conversion of Arrowstreet Global Equity to Non-US Mandate
- Decrease of US equity exposure via manager reduction
- Build out of low duration allocation within SAP

Manager Selections Needed with Suggested Higher Priority
- Long Duration Fixed Income (Workers Comp)
- EMD Local (including underwriting of current managers vs. other opportunities)
- Hedge Funds (administrative configuration and direct managers)
- Bank Loans (reconfiguration of current multi-sector credit mandates to bank loan only and selection of managers)

Manager Selections Needed with Suggested Medium Priority
- Small-Cap US Equity – Passive
- Non-Core Real Estate (additional commitments)
- Core Real Estate (manager selection for additional commitments)
- Second / Complementary MLP Manager

Manager Selections Needed with Suggested Lower Priority
- Private Equity (additional commitments)

Other Transitional Items
- Continued reduction of US equity in Funds where target is lower than current allocation
- Gradual establishment of initial public equity positions for funds where it will be added (Pool A)
- Transfer of Private Equity from funds with no target allocation (CPSLF) to funds with higher allocation targets than current allocations
- Reduce convertible bonds and remove from funds with no target allocation
- Remove TIPS from funds with no strategic target allocation

RVK

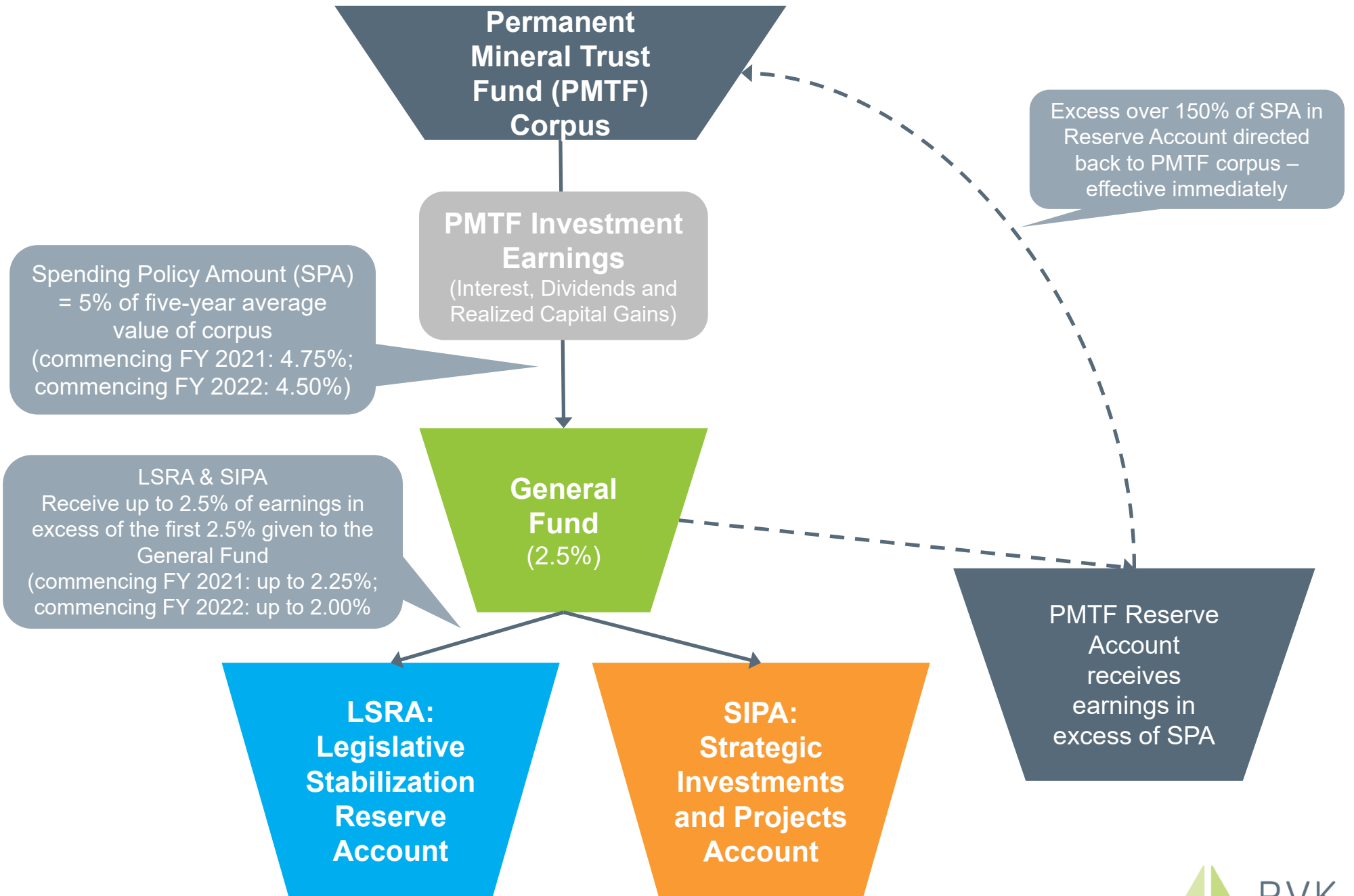# Appendix

Risk Analysis Summary Matrix

	Permanent Funds		State Agency Pool	Workers' Compensation Fund	Pool A Investment Account
	Total Return Focus	Income Focus			
Total Portfolio Summary					
Volatility	6.3%	5.3%	2.1%	5.5%	4.7%
Value at Risk (VaR)	12.9%	9.5%	2.6%	9.5%	8.0%
Expected Tail Loss (ETL)	17.3%	12.7%	3.9%	13.2%	10.8%
Expected Tail Return (ETR)	12.3%	10.8%	4.4%	12.6%	10.4%
Rachev Ratio (ETR/ETL)	0.7	0.9	1.1	1.0	1.0
STARR Performance (Excess Return/ETL)	0.1	0.1	0.2	0.1	0.1
Selected Factor Contributions to Risk					
Volatility	-2%	-8%	-1%	-1%	-2%
Interest Rate Risk	8%	3%	9%	17%	2%
Fixed Income Risk	19%	13%	66%	27%	26%
Equity Risk	63%	84%	15%	55%	68%
Commodity Risk	1%	0%	1%	0%	0%
Specific Risk	9%	7%	7%	2%	3%
Scenario Analysis					
Oil +25%	2%	2%	0%	1%	1%
Oil -25%	-2%	-1%	0%	-1%	-1%
Russell 3000 +20%	5%	4%	0%	3%	3%
Russell 3000 -20%	-5%	-4%	0%	-2%	-3%
10 Year Treasury +200 bps	3%	2%	-1%	-2%	0%
10 Year Treasury -200 bps	-6%	-3%	4%	14%	3%
2008 Sept - Oct Crash	-17%	-15%	-6%	-14%	-14%
HY Spreads Compress 50%	8%	10%	1%	1%	7%
HY Spreads Widen 50%	-2%	-9%	0%	9%	-5%

Total Portfolio Summary statistics are calculated with a 99% Confidence Interval.
**STARR Performance is similar to the Sharpe Ratio which is a standard deviation-based performance measure, but STARR (stable tail-adjusted return ratio) uses the ETL in the denominator as a risk measure. STARR can be seen as a more effective indicator of risk-adjusted performance because it penalizes only for downside risk, while the standard deviation does not distinguish between upside and downside risk.

RVK

Permanent Mineral Trust Fund Spending Policy

Permanent Mineral Trust Fund (PMTF) Corpus

PMTF Investment Earnings
(Interest, Dividends and Realized Capital Gains)

Spending Policy Amount (SPA) = 5% of five-year average value of corpus (commencing FY 2021: 4.75%; commencing FY 2022: 4.50%)

General Fund
(2.5%)

LSRA & SIPA
Receive up to 2.5% of earnings in excess of the first 2.5% given to the General Fund (commencing FY 2021: up to 2.25%; commencing FY 2022: up to 2.00%

Excess over 150% of SPA in Reserve Account directed back to PMTF corpus – effective immediately

LSRA: Legislative Stabilization Reserve Account

SIPA: Strategic Investments and Projects Account

PMTF Reserve Account receives earnings in excess of SPA

74

RVK

Hathaway Scholarship Fund Spending Policy

Hathaway Scholarship Fund (Hathaway) Corpus

Hathaway Investment Earnings (Interest, Dividends and Realized Capital Gains)

Hathaway Scholarship Expenditure Account pursuant to W.S. 21-16-1304 through 21-16-1306

If the Reserve Account balance exceeds the greater of $12M or 4.5% of the five-year average value of corpus, the excess is transferred back to Hathaway corpus.

Hathaway Reserve Account receives earning in excess of scholarships awarded during fiscal year. Insufficient funds in the income account are to be taken from the reserve account.

RVK

Common School Permanent Land Fund Spending Policy

Common School Permanent Land Fund (CSPLF) Corpus

CSPLF Investment Earnings
(Interest, Dividends and Realized Capital Gains)

Spending Policy Amount (SPA) = 5% of five-year average value of corpus (commencing FY 2021: 4.75%; commencing FY 2022: 4.50%)

Common School Land Income Fund

Excess over 150% of SPA in Reserve Account directed back to CSPLF corpus – effective immediately

Federal Mineral Royalties – Automatic appropriation to the CSPLF Reserve Account or the SFP-RA from Federal Mineral Royalties above of below the $200 million cap equal to the extent to which earnings exceed the SPA, or in the case of the SFP-RA exceed 3%

SFP: School Foundation Program

CSPLF Reserve Account

SFP Reserve Account receives the difference between investment earnings from CSLIF and SPA

Back flow – to ensure at least 2.5% is going to the SFP

RVK

Higher Education Endowment Fund Spending Policy

Excellence in Higher Education Endowment Fund (Higher Ed) Corpus

Higher Ed Investment Earnings
(Interest, Dividends and Realized Capital Gains)

Spending Policy Amount (SPA) = 5% of five-year average value of corpus (commencing FY 2021: 4.75%)

2/3 to University of Wyoming and 1/3 equally to 7 Community Colleges

Excess over 150% of SPA in Reserve Account directed back to Higher Ed corpus

Higher Ed Reserve Account receives earnings in excess of SPA. Insufficient funds in the income account are to be taken from the reserve account.

RVK

Correlation to Mineral Income

Correlation Matrix	Total Fund	PMTF	PMTF Policy Target	Wyoming Mineral Income						Current Asset Classes				MLPs
				Total Minerals	Crude Oil	Natural Gas	Coal	Trona[1]	Others[2]	Russell 3000	MSCI ACW Ex US	B US Agg Bond	NCREIF ODCE (AWA)	Alerian MLP
Total Fund	1.00													
Permanent Mineral Trust Fund	0.96	1.00												
PMTF Long-Term Policy Target	0.89	0.92	1.00											
Total Minerals	0.20	0.32	0.52	1.00										
Crude Oil	0.22	0.49	0.67	0.75	1.00									
Natural Gas	0.18	0.30	0.46	0.92	0.54	1.00								
Coal	0.15	0.03	0.11	0.36	0.15	0.21	1.00							
Trona[1]	-0.03	0.24	0.28	0.23	0.54	0.00	0.13	1.00						
Others[2]	0.09	0.22	0.27	0.09	0.00	0.16	0.23	-0.16	1.00					
Russell 3000	0.59	0.75	0.79	0.01	-0.03	0.01	-0.03	0.13	0.20	1.00				
MSCI ACW Ex US	0.45	0.72	0.83	0.17	0.26	0.15	-0.06	0.15	0.22	0.71	1.00			
B US Agg Bond	0.30	0.02	-0.05	-0.02	-0.11	0.02	0.20	0.09	0.17	-0.09	-0.45	1.00		
NCREIF ODCE (AWA)	0.56	0.68	0.74	0.27	0.30	0.20	0.01	0.10	0.13	0.47	0.48	-0.31	1.00	
Alerian MLP	0.73	0.73	0.69	0.44	0.29	0.45	0.26	-0.02	-0.07	0.28	0.24	0.41	0.20	1.00

Footnotes:
[1]Trona: Sodium Carbonate, Washing Soda, Soda Ash.
[2]Others: Uranium, Bentonite, Sand, Gravel and Quarried Rock.
Annual return calculations are based on fiscal years ending June 30.
Correlation calculated using annual periodicity of underlying data and longest common time period available.
Results of individual minerals may be impacted by increases or decreases in the taxation rates and production levels of a particular mineral.
Data is calculated from annual fiscal year returns for the period 1987-2015, with the following exceptions due to a lack of sufficient return history:
-Wyoming STO "Total Fund": 1997-2017   -MSCI ACW Ex US: 1989-2017
-PMTF (Historical): 2002-2017   -Alerian MLP Index: 1997-2017
-Current PMTF Target: 2004-2017

RVK

Fixed Income:
RVK Capital Market Assumptions and Index Characteristics

	Fixed Income						
	2018				**Index Characteristics**		
Asset Class	**Nominal Return (Arithmetic)**	**Risk (Standard Deviation)**	**Risk/Return Ratio**	**Nominal Return (Compound)**	**Duration**	**YTM**	**Avg. Quality**
Cash Equivalents	2.50%	3.00%	0.83	2.46%	0.24	1.36%	AAA
Low Duration Fixed Income	3.00%	3.50%	0.86	2.94%	1.91	2.03%	AA+
Int. Duration Fixed Income	3.50%	6.00%	0.58	3.33%	4.17	2.72%	AA+
Long Duration Fixed Income	3.50%	11.50%	0.30	2.87%	15.42	3.50%	AA-
TIPS	3.75%	6.25%	0.60	3.56%	7.67	2.34%	AAA
Bank Loans	5.25%	10.00%	0.53	4.52%	-	6.55%	BB
EMD (Local Currency)	5.75%	12.50%	0.46	5.02%	5.14	6.10%	BBB-
Convertibles	5.60%	13.70%	0.41	4.87%	2.64	1.45%	BB

As of December 31, 2017. Duration is not reported by the index provider for the bank loans index (CS Leveraged Loan Index).

RVK

Estimated Asset Class Yields

Asset Class	Yield (%)
Small Cap US Equity	1.26
Broad US Equity	1.79
Broad International Equity	2.86
MLPs	7.60
Preferred Stock	6.11
Low Duration Fixed Income	2.03
Intermediate Duration Fixed Income	2.72
Long Duration Fixed Income	3.50
TIPS	2.34
Bank Loans	6.55
Emerging Markets Debt (Local)	6.10
Convertibles	1.45
Core Real Estate	4.61
Non-Core Real Estate	5.69
Diversified Hedge Funds	3.04
Private Equity	0.00
Cash Equivalents	1.36

As of December 31, 2017.
Asset class yields are benchmark-specific, with the exception of real estate and diversified hedge funds, which are specific to Wyoming's current managers.

RVK

Risk Analysis Glossary

Volatility – Volatility (as measured by standard deviation) provides a statistical range of performance relative to the average expectations. With this measure, we can establish a level of "confidence" about the expected range of returns for the portfolios.

Value at Risk (VaR) – The highest possible loss over a certain period of time at a given confidence level.

Expected Tail Loss (ETL) – The average loss (at a given confidence level) expected during a left-tail event.

Expected Tail Return (ETR) – The average gain (at a given confidence level) expected during a right-tail event.

Rachev Ratio – The ratio of ETR to ETL. A value of greater that 1.00 implies a right tail that is larger than the left tail. A value of less than 1.00 implies a left tail that is larger than the right tail.

STARR Performance – Similar to the Sharpe Ratio, STARR (stable tail-adjusted return ratio) is a standard deviation-based performance measure that uses ETL in the denominator as a risk measure.

Robust Correlations – Computes the covariance matrix with the assumption that there may be outlier data points in the fund returns that are not representative of future behavior.

Implied Return – Represents the return a fund must deliver in order to justify the amount of risk it contributes to the overall portfolio.

RVK Liquidity Metric – is a RVK Liquidity a qualitative method for determining the relative amount of liquidity in a portfolio. The characteristics considered when determining relative liquidity include trading volume, gates for redemption, leverage, nature of transactions, and pricing mechanisms. The RVK Liquidity Metric is calculated using investment weights applied to each corresponding asset class liquidity rating.   See next page for more details.

Thematic Classification - Represents dedicated manager allocations; as such, thematic allocations are approximations. RVK categorizes asset classes as Alpha, Capital Appreciation, Capital Preservation, and Inflation as displayed in the table on the next page.

RVK

PORTLAND   CHICAGO   NEW YORK

RVK