

# Select Committee on Capital Financing and Investments Potential Statutory Changes

September 14, 2016



## Key Questions:

1.

- What long-term expected return is desired for the Permanent Mineral Trust Fund (“PMTF”)?

2.

- What constraints are appropriate for the program? Should the 55% equity cap be removed or reinterpreted?

3.

- Should the current spending policy framework be amended for PMTF?

## Long-Term Return Expectation versus Selected Peers

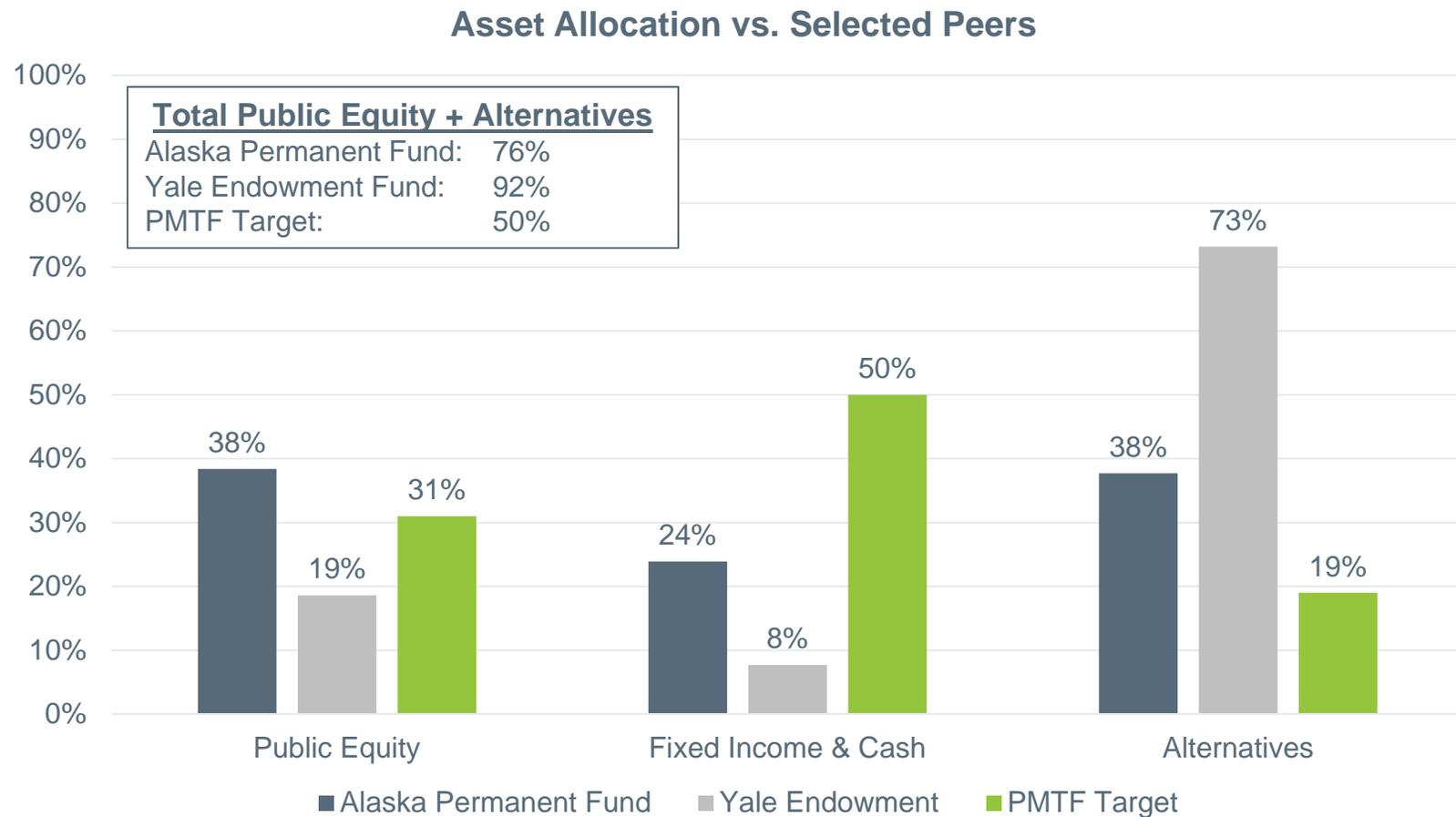
The Permanent Mineral Trust Fund (“PMTF”) has a lower long-term return expectation than the selected peers. However, the PMTF’s annual spending policy cap of 5.0% is more aligned with the selected peers.

	Return Expectation (After Inflation)	Annual Spending Policy
Alaska Permanent Fund	5.0%	Rolling five-year average realized earnings, which excludes unrealized gains and losses <i>(FY 15 effective spending rate was 2.73%)</i>
Yale Endowment Fund	6.7%	80% of the previous year’s spending / 20% of 5.25% applied to the market value two years prior <i>(inflation adjusted and subject to a range of 4.5% - 6.0%)</i>
Permanent Mineral Trust Fund	4.0%	5.0% of the trailing five-year market value

The effective spending rate for the Alaska Permanent Fund is calculated using \$1.4 billion for FY 2015 and a beginning fund balance of \$51.2 billion.

# Asset Allocation versus Selected Peers

Relative to the selected peers below, PMTF's allocation to fixed income and cash is significantly higher. PMTF allocation to "risk assets" (equity and alternatives) however is also much lower.



# Frontier 1:

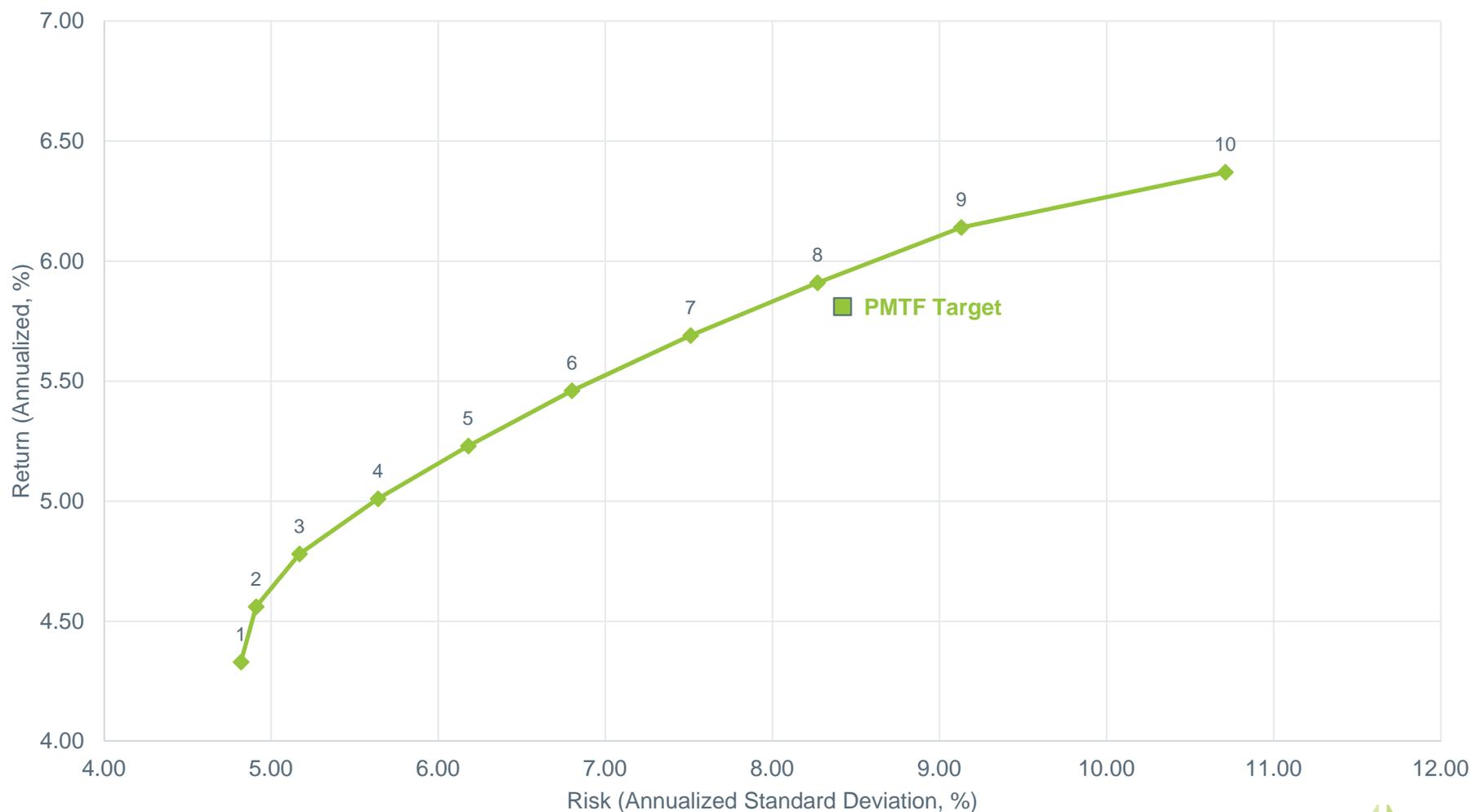
## *Current Interpretation of 55% Equity Cap*

- Per Wyoming Statute § 9-4-715, not more than 55% of monies of the permanent funds may invest in common stocks. This is referred to throughout this presentation as the “Equity Cap”.
- The 55% Equity Cap is currently interpreted to include all public equity and alternative investments.
- The efficient frontier includes all existing asset classes in which PMTF currently invests.
- The PMTF Target allocation is expected to fall short of the long-term return expectation of  $CPI + 4\%$ .

# Efficient Frontier

## Current Interpretation of 55% Equity Cap

The current long-term target for PMTF is allocated efficiently under the current interpretation of the 55% equity cap, which includes public and private equity, real estate and hedge funds – essentially every asset class aside from bonds and cash.



# Asset Allocation

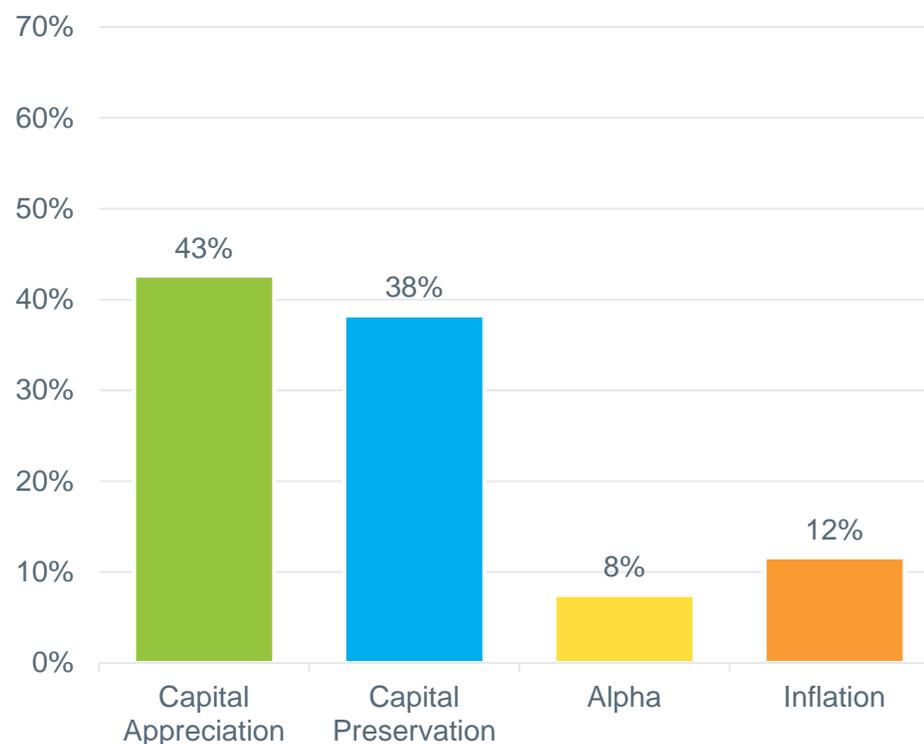
## Current Interpretation of 55% Equity Cap

The current PMTF Target has 50% allocated to fixed income and cash. From a thematic perspective, 38% is allocated to capital preservation investments.

### Asset Allocation (%)

	PMTF Target
<b>Total Public Equity</b>	<b>31.0</b>
Broad US Equity	15.1
Small Cap US Equity	1.3
Global Equity	3.1
Broad International Equity	11.5
<b>Total Alternatives</b>	<b>19.0</b>
Private Equity	4.0
Core Real Estate	5.1
Non-Core Real Estate	2.4
Diversified Hedge Funds	7.5
<b>Total Fixed Income &amp; Cash</b>	<b>50.0</b>
Convertibles	2.0
Custom Fixed Income	45.0
Cash Equivalents	3.0
<b>Total</b>	<b>100.0</b>

### Thematic Allocation (%)



Allocations may not sum to 100% exactly due to rounding.

Capital Appreciation includes Broad US Equity, Small Cap US Equity, Global Equity, Broad International Equity, Private Equity, Non-Core Real Estate, EMD (Local), and High Yield Fixed Income. Capital Preservation Includes Int. Duration Fixed Income and Cash Equivalents. Alpha includes Diversified Hedge Funds. Inflation includes Core Real Estate, TIPS, and Bank Loans.

# Monte Carlo Results

## Current Interpretation of 55% Equity Cap

Although the current PMTF Target is allocated efficiently given the existing interpretation of the constraints, the probability of achieving the long-term expected return target of 4% after inflation is only 37% over the next 10 years.

	PMTF Target
Expected Return (%)	5.81
Risk (Standard Deviation, %)	8.42
Return (Compound, %)	5.48
Return/Risk Ratio	0.69
1 Year Max Drawdown (%)	-20.03
<b>Median Monte Carlo Real Return (%)</b>	
1 Year	3.63
5 Years	3.18
10 Years	3.09
<b>Probability of Achieving 4% Real Return</b>	
1 Year	48
5 Years	41
10 Years	37

### Range of Monte Carlo Stress Test Results

1<sup>st</sup> to 99<sup>th</sup> Percentiles = Darker Color

5<sup>th</sup> to 95<sup>th</sup> Percentiles = Lighter Color



Expected returns do not assume active manager alpha.

1 Year Max Drawdown represents the 1<sup>st</sup> percentile expected return over a one year period.

# Frontier 2:

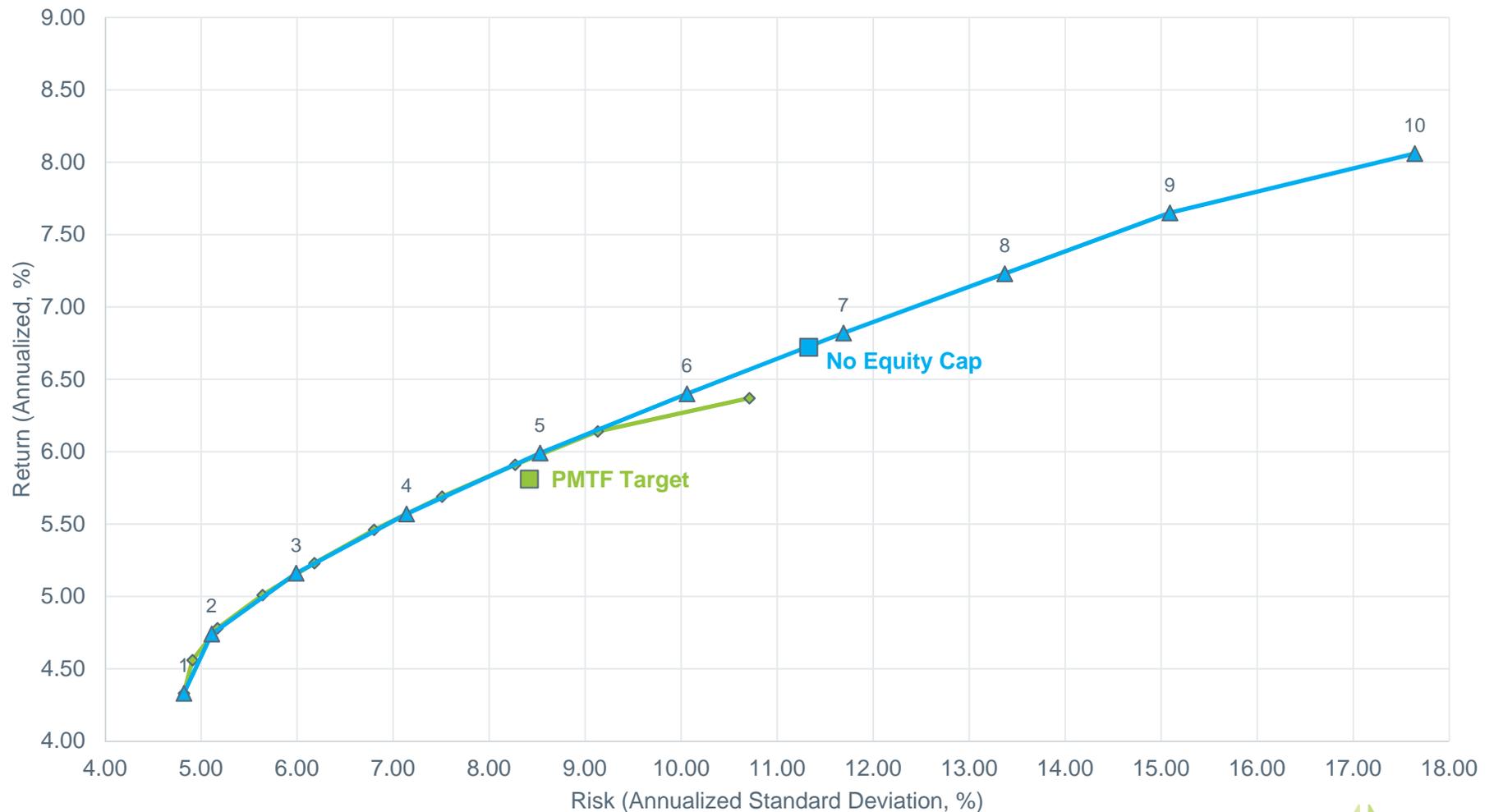
## *Removal of 55% Equity Cap*

- The 55% equity cap is removed from existing constraints.
- The frontier includes all existing asset classes in which PMTF currently invests.
- The “No Equity Cap” portfolio is expected to increase the probability of achieving the long-term return expectation of CPI + 4%.

# Efficient Frontier

## Removal of 55% Equity Cap

Removing the 55% equity cap altogether will significantly expand the opportunity set available to increase the probability of achieving the long-term return expectation.



# Asset Allocation

## Removal of 55% Equity Cap

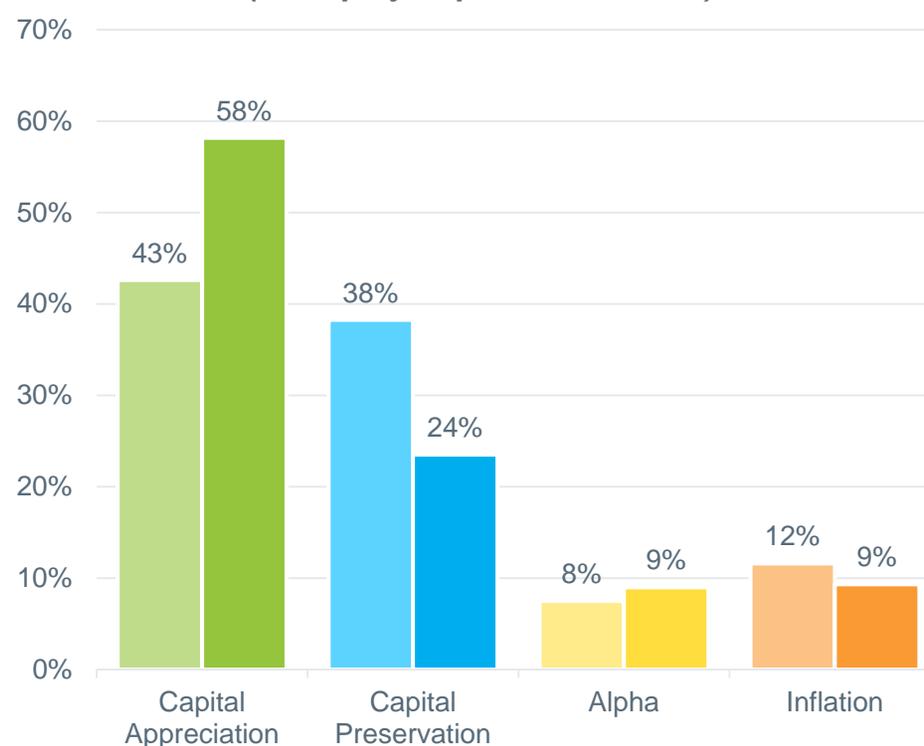
The “No Equity Cap” portfolio increases the allocation to risk assets from 50% under the current target to 70%. Exposure to capital appreciation and alpha thematic allocations increases and exposure to capital preservation and inflation decreases.

### Asset Allocation (%)

	PMTF Target	No Equity Cap	Difference
<b>Total Public Equity</b>	<b>31.0</b>	<b>48.0</b>	<b>+17.0</b>
Broad US Equity	15.1	19.0	+3.9
Small Cap US Equity	1.3	5.0	+3.7
Global Equity	3.1	--	-3.1
Broad International Equity	11.5	24.0	+12.5
<b>Total Alternatives</b>	<b>19.0</b>	<b>22.0</b>	<b>+3.0</b>
Private Equity	4.0	5.0	+1.0
Core Real Estate	5.1	5.0	-0.1
Non-Core Real Estate	2.4	3.0	+0.6
Diversified Hedge Funds	7.5	9.0	+1.5
<b>Total Fixed Income &amp; Cash</b>	<b>50.0</b>	<b>30.0</b>	<b>-20.0</b>
Convertibles	2.0	--	-2.0
Custom Fixed Income	45.0	30.0	-15.0
Cash Equivalents	3.0	--	-3.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>--</b>

### Thematic Allocation (%)

(No Equity Cap = Darker Color)



Allocations may not sum to 100% exactly due to rounding.

Capital Appreciation includes Broad US Equity, Small Cap US Equity, Global Equity, Broad International Equity, Private Equity, Non-Core Real Estate, EMD (Local), and High Yield Fixed Income. Capital Preservation Includes Int. Duration Fixed Income and Cash Equivalents. Alpha includes Diversified Hedge Funds. Inflation includes Core Real Estate, TIPS, and Bank Loans.

# Monte Carlo Results

## Removal of 55% Equity Cap

If the 55% equity cap were to be removed, the “No Equity Cap” portfolio would increase the probability of achieving the long-term expected return target to 47% over a 10 Year period, but also introduces the potential for outcome uncertainty in the near term.

	PMTF Target	No Equity Cap	Difference
Expected Return (%)	5.81	6.72	+0.91
Risk (Standard Deviation, %)	8.42	11.33	+2.91
Return (Compound, %)	5.48	6.12	+0.64
Return/Risk Ratio	0.69	0.59	-0.10
1 Year Max Drawdown (%)	-20.03	-25.93	-5.90
<b>Median Monte Carlo Real Return (%)</b>			
1 Year	3.63	4.54	+0.91
5 Years	3.18	3.83	+0.65
10 Years	3.09	3.71	+0.62
<b>Probability of Achieving 4% Real Return</b>			
1 Year	48	52	+4
5 Years	41	48	+7
10 Years	37	47	+10

Expected returns do not assume active manager alpha.  
1 Year Max Drawdown represents the 1<sup>st</sup> percentile expected return over a one year period.

## Range of Monte Carlo Stress Test Results

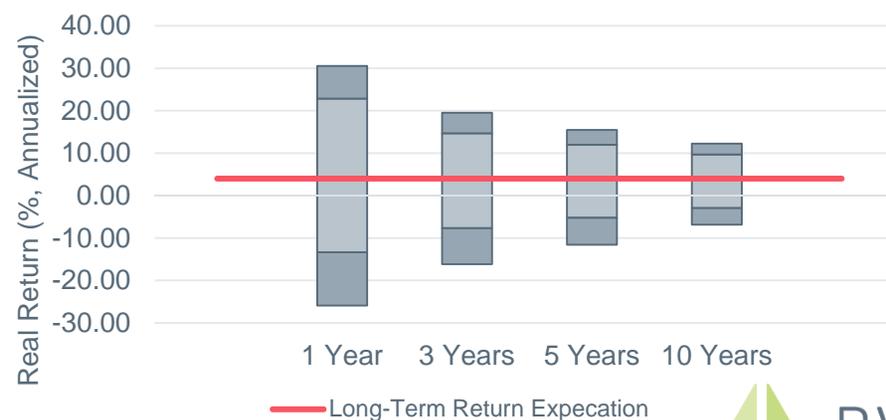
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PMTF Target



No Equity Cap



# Frontier 3:

## *Removal of 55% Equity Cap*

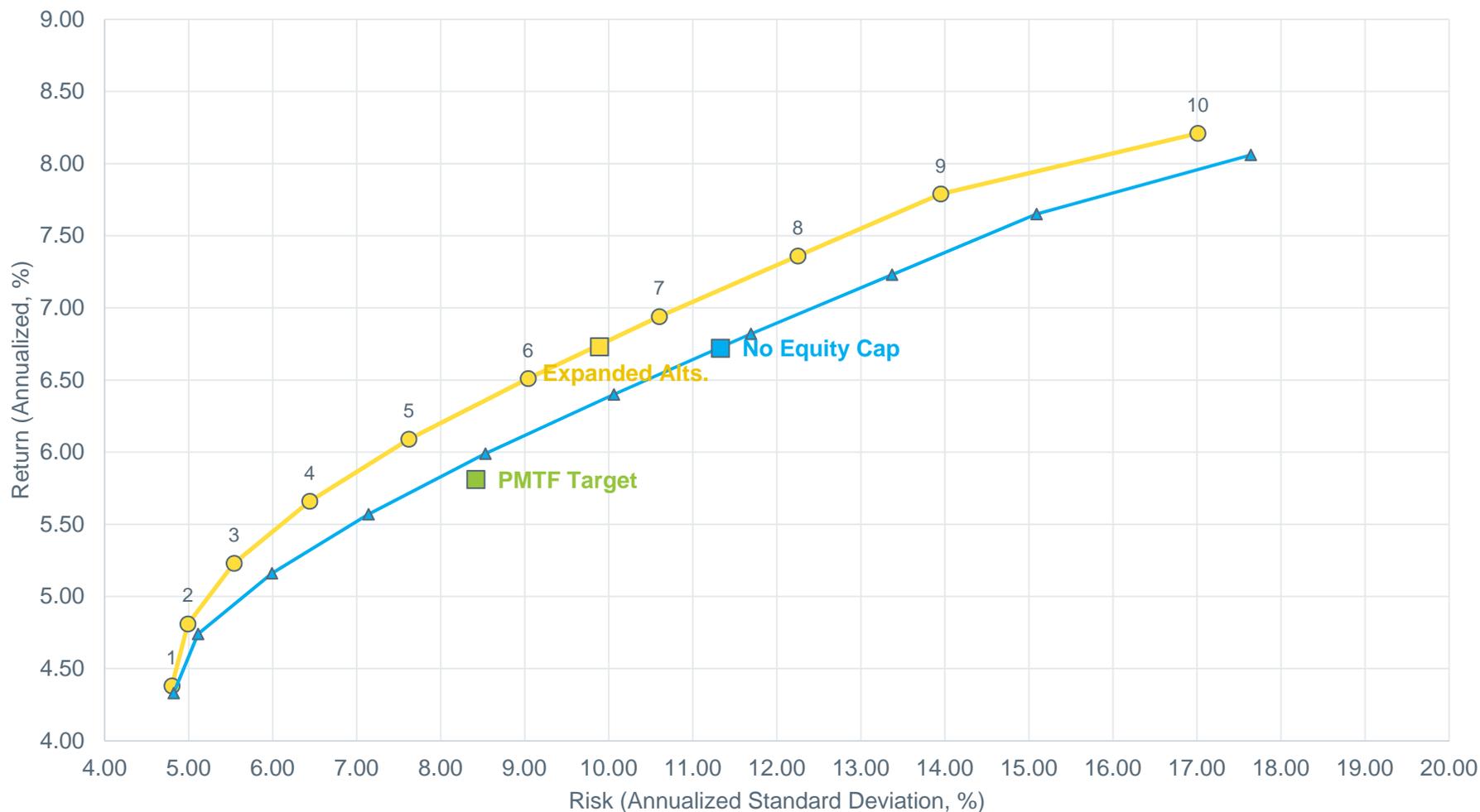
### *+ Expanded Alternatives*

- The 55% equity cap is removed from existing constraints, and constraints to risk assets are relaxed.
- The frontier introduces MLPs to the opportunity set, along with all existing asset classes in which PMTF currently invests.
- The Expanded Alts. allocation is expected to increase the probability of achieving the long-term return expectation of CPI + 4%.

# Efficient Frontier

## Removal of 55% Equity Cap + Expanded Alternatives

Relaxing some additional portfolio constraints to risk assets, combined with the addition of MLPs improves the risk-and-return opportunities available to PMTF, as well as increases the estimated yield.



# Asset Allocation

## Removal of 55% Equity Cap + Expanded Alternatives

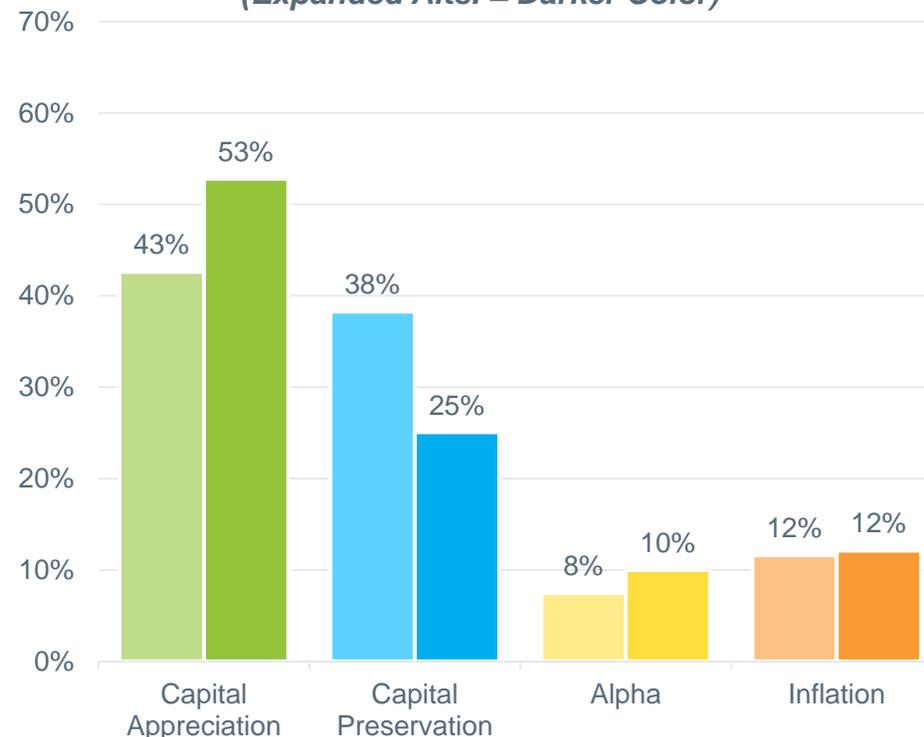
The Expanded Alternatives portfolio increases the allocation to alternatives from 19% to 31%. Exposure to inflationary assets remains similar, while exposure to capital appreciation and alpha thematic allocation increases.

### Asset Allocation (%)

	PMTF Target	Expanded Alts.	Difference
<b>Total Public Equity</b>	<b>31.0</b>	<b>37.0</b>	<b>+6.0</b>
Broad US Equity	15.1	12.0	-3.1
Small Cap US Equity	1.3	4.0	+2.7
MLPs	--	4.0	+4.0
Global Equity	3.1	--	-3.1
Broad International Equity	11.5	17.0	+5.5
<b>Total Alternatives</b>	<b>19.0</b>	<b>31.0</b>	<b>+12.0</b>
Private Equity	4.0	6.0	+2.0
Core Real Estate	5.1	7.5	+2.4
Non-Core Real Estate	2.4	7.5	+5.1
Diversified Hedge Funds	7.5	10.0	+2.5
<b>Total Fixed Income &amp; Cash</b>	<b>50.0</b>	<b>32.0</b>	<b>-18.0</b>
Convertibles	2.0	--	-2.0
Custom Fixed Income	45.0	32.0	-13.0
Cash Equivalents	3.0	--	-3.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>--</b>

### Thematic Allocation (%)

(Expanded Alts. = Darker Color)



Allocations may not sum to 100% exactly due to rounding.

Capital Appreciation includes Broad US Equity, Small Cap US Equity, Global Equity, Broad International Equity, Private Equity, Non-Core Real Estate, EMD (Local), and High Yield Fixed Income. Capital Preservation Includes Int. Duration Fixed Income and Cash Equivalents. Alpha includes Diversified Hedge Funds. Inflation includes MLPs, Core Real Estate, TIPS, and Bank Loans.

# Monte Carlo Results

## Removal of 55% Equity Cap + Expanded Alternatives

The Expanded Alternatives portfolio allocation would increase the probability of achieving the long-term expected return target to 49% over a 10 Year period.

	PMTF Target	Expanded Alts.	Difference
Expected Return (%)	5.81	6.73	+0.92
Risk (Standard Deviation, %)	8.42	9.89	+1.47
Return (Compound, %)	5.48	6.27	+0.79
Return/Risk Ratio	0.69	0.68	-0.01
1 Year Max Drawdown (%)	-20.03	-22.07	-2.04
<b>Median Monte Carlo Real Return (%)</b>			
1 Year	3.63	4.42	+0.79
5 Years	3.18	3.93	+0.75
10 Years	3.09	3.89	+0.80
<b>Probability of Achieving 4% Real Return</b>			
1 Year	48	52	+4
5 Years	41	49	+8
10 Years	37	49	+12

Expected returns do not assume active manager alpha.

## Range of Monte Carlo Stress Test Results

1<sup>st</sup> to 99<sup>th</sup> Percentiles = Darker Color

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PMTF Target

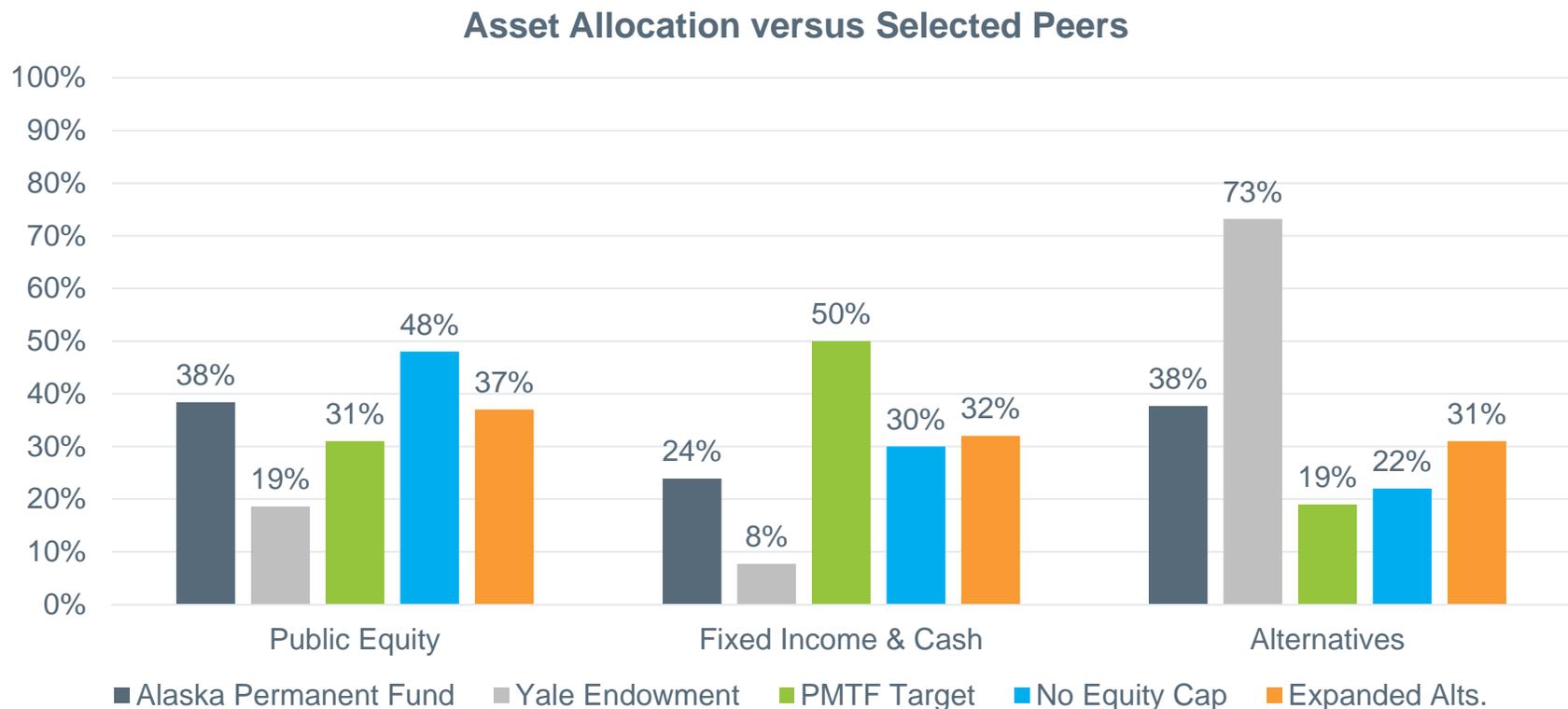


Expanded Alts.



# Asset Allocation versus Selected Peers

The No Equity Cap and Expanded Alternatives portfolio allocations are more in line with the selected peer allocations below.



# Correlation Analysis

Larger exposure to risk assets modestly increases the correlation of the No Equity Cap portfolio to Wyoming's Mineral Income. The addition of MLPs and increased exposure to alternatives modestly increases the correlation of the Expanded Alternatives allocation as well.

Correlation Matrix	Total Fund	PMTF	No Equity Cap	Expanded Alts.	Wyoming Mineral Income						Current Asset Classes			MLPs		
					Total Minerals	Crude Oil	Natural Gas	Coal	Trona <sup>1</sup>	Others <sup>2</sup>	Russell 3000	MSCI ACW Ex US	B US Agg Bond	Alerian MLP		
<b>Total Fund</b>	1.00															
<b>Permanent Mineral Trust</b>	0.96	1.00														
<b>No Equity Cap</b>	0.85	0.93	1.00													
<b>Expanded Alts.</b>	0.88	0.94	0.99	1.00												
<b>Total Minerals</b>	0.19	0.31	0.47	0.49	1.00											
<b>Crude Oil</b>	0.22	0.50	0.53	0.60	0.74	1.00										
<b>Natural Gas</b>	0.16	0.27	0.44	0.44	0.92	0.53	1.00									
<b>Coal</b>	0.12	-0.03	0.04	0.03	0.31	0.08	0.16	1.00								
<b>Trona<sup>1</sup></b>	-0.03	0.27	0.23	0.29	0.24	0.55	0.00	0.13	1.00							
<b>Others<sup>2</sup></b>	0.06	0.23	0.31	0.30	0.06	-0.03	0.15	0.19	-0.17	1.00						
<b>Russell 3000</b>	0.59	0.75	0.91	0.87	-0.01	-0.03	-0.01	-0.05	0.14	0.21	1.00					
<b>MSCI ACW Ex US</b>	0.46	0.72	0.94	0.90	0.16	0.26	0.13	-0.11	0.16	0.23	0.70	1.00				
<b>B US Agg Bond</b>	0.33	0.05	-0.27	-0.19	-0.01	-0.12	0.04	0.20	0.08	0.14	-0.06	-0.43	1.00			
<b>Alerian MLP</b>	0.74	0.75	0.68	0.69	0.43	0.28	0.45	0.18	-0.02	-0.18	0.31	0.27	0.38	1.00		

## Footnotes:

<sup>1</sup>Trona: Sodium Carbonate, Washing Soda, Soda Ash.

<sup>2</sup>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.

2016 mineral data is projected by the CREF as of January 2016.

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":	1997-2016	-MSCI ACW Ex US:	1989-2016
-PMTF:	2002-2016	-Alerian MLP Index:	1997-2016
-No Equity Cap:	2004-2016		
-Expanded Alts.:	2004-2016		

Correlation less than zero.



# Summary of Portfolio Characteristics

	PMTF Target (Current Policy)	No Equity Cap (Change from Current Policy)	Expanded Alts. (Change from Current Policy)
<b>Asset Allocation and Expected Return</b>			
Allocation to Fixed Income & Cash	50%	30% <i>(-20%)</i>	32% <i>(-18%)</i>
Expected Return (Compound)	5.48%	6.12% <i>(+0.64%)</i>	6.27% <i>(+0.79%)</i>
Return / Risk Ratio	0.69	0.59 <i>(-0.10)</i>	0.68 <i>(-0.01)</i>
Max Drawdown Over a 1 Year Period (1 <sup>st</sup> Percentile)	-20.03%	-25.93% <i>(-5.90%)</i>	-22.07% <i>(-2.04%)</i>
Probability of Achieving 4% Real Return Over 10 Year Period	37%	47% <i>(+10%)</i>	49% <i>(+12%)</i>
Expected Yield (%)	2.70%	2.61% <i>(-0.09%)</i>	2.96% <i>(+0.26%)</i>
<b>Spending Policy Analysis (Current Framework)</b>			
Cumulative 50 Year Distributions (\$B)	\$23.1	\$25.9 <i>(+2.8)</i>	\$26.6 <i>(+3.5)</i>
Volatility of Annual Spending Changes (% YoY St. Dev.)	4.2%	5.6% <i>(+1.4%)</i>	4.8% <i>(+0.6%)</i>
Projected 50 Year Market Value (\$B)	\$11.0	\$13.2 <i>(+2.2)</i>	\$13.8 <i>(+2.8)</i>
Probability of Achieving Full Objective Over a 50 Year Period	41.4%	56.7% <i>(+15.3%)</i>	61.5% <i>(+20.1%)</i>

All data shown in real terms (after 2.50% annual inflation). Model assumes investment earning always meet or exceed annual spending policy amount. Contribution assumptions provided by the Consensus Revenue Estimating Group. Estimated yields are a weighted average of the forecasted yields for FY 2017.

# Conclusion

1.

- **What long-term expected return is desired for the Permanent Mineral Trust Fund (“PMTF”)?**

The long-term return expectation should be **in line with the spending policy limit.**

2.

- **What constraints are appropriate for the program? Should the 55% equity cap be removed or reinterpreted?**

**Removing or reinterpreting** the equity cap would provide better opportunities for PMTF to achieve the current long-term return expectation.

# Appendix



# Full Correlation Matrix

Correlation Matrix	Wyoming Mineral Income										Current Asset Classes											MLPs	
	Total Fund	PMTF	No Equity Cap	Expanded Alts.	Total Minerals	Crude Oil	Natural Gas	Coal	Trona <sup>1</sup>	Others <sup>2</sup>	Russell 3000	Russell 2000	MSCI ACW	MSCI ACW Ex US	B US Agg Bond	B US TIPS	BofA ML All Convertibles	NCREIF ODCE (AWA)	NCREIF Property	HFN Multi-Strat	Venture Econ All PE	Alerian MLP	
Total Fund	1.00																						
Permanent Mineral Trust	0.96	1.00																					
No Equity Cap	0.85	0.93	1.00																				
Expanded Alts.	0.88	0.94	0.99	1.00																			
Total Minerals	0.19	0.31	0.47	0.49	1.00																		
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Trona <sup>1</sup>	-0.03	0.27	0.23	0.29	0.24	0.55	0.00	0.13	1.00														
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Russell 2000	0.60	0.70	0.89	0.84	0.17	0.12	0.15	0.04	0.09	0.22	0.86	1.00											
MSCI ACW	0.72	0.77	0.97	0.93	0.37	0.41	0.30	-0.07	0.28	0.23	0.95	0.95	1.00										
MSCI ACW Ex US	0.46	0.72	0.94	0.90	0.16	0.26	0.13	-0.11	0.16	0.23	0.70	0.80	0.96	1.00									
B US Agg Bond	0.33	0.05	-0.27	-0.19	-0.01	-0.12	0.04	0.20	0.08	0.14	-0.06	-0.15	-0.47	-0.43	1.00								
B US TIPS	0.34	0.27	0.13	0.23	0.43	0.44	0.43	0.14	0.07	-0.10	-0.27	-0.24	-0.18	-0.24	0.74	1.00							
BofA ML All Convertibles	0.55	0.82	0.88	0.84	0.15	0.28	0.10	-0.18	0.37	0.22	0.88	0.84	0.89	0.76	-0.14	-0.15	1.00						
NCREIF ODCE (Gross) (AWA)	0.56	0.68	0.76	0.78	0.28	0.31	0.21	0.03	0.10	0.14	0.47	0.40	0.68	0.48	-0.32	0.07	0.44	1.00					
NCREIF Property	0.56	0.66	0.75	0.78	0.28	0.30	0.20	-0.08	0.08	0.18	0.41	0.34	0.67	0.46	-0.33	0.06	0.40	0.99	1.00				
HFN Multi-Strat	0.55	0.83	0.92	0.91	0.23	0.25	0.32	-0.24	0.21	0.17	0.45	0.45	0.80	0.55	0.14	0.03	0.65	0.30	0.26	1.00			
Venture Econ All PE	0.29	0.68	0.96	0.96	0.21	0.42	0.14	-0.09	0.43	0.01	0.65	0.60	0.93	0.66	-0.28	-0.15	0.77	0.45	0.41	0.49	1.00		
Alerian MLP	0.74	0.75	0.68	0.69	0.43	0.28	0.45	0.18	-0.02	-0.18	0.31	0.47	0.61	0.27	0.38	0.33	0.34	0.20	0.20	0.39	0.10	1.00	

## Footnotes:

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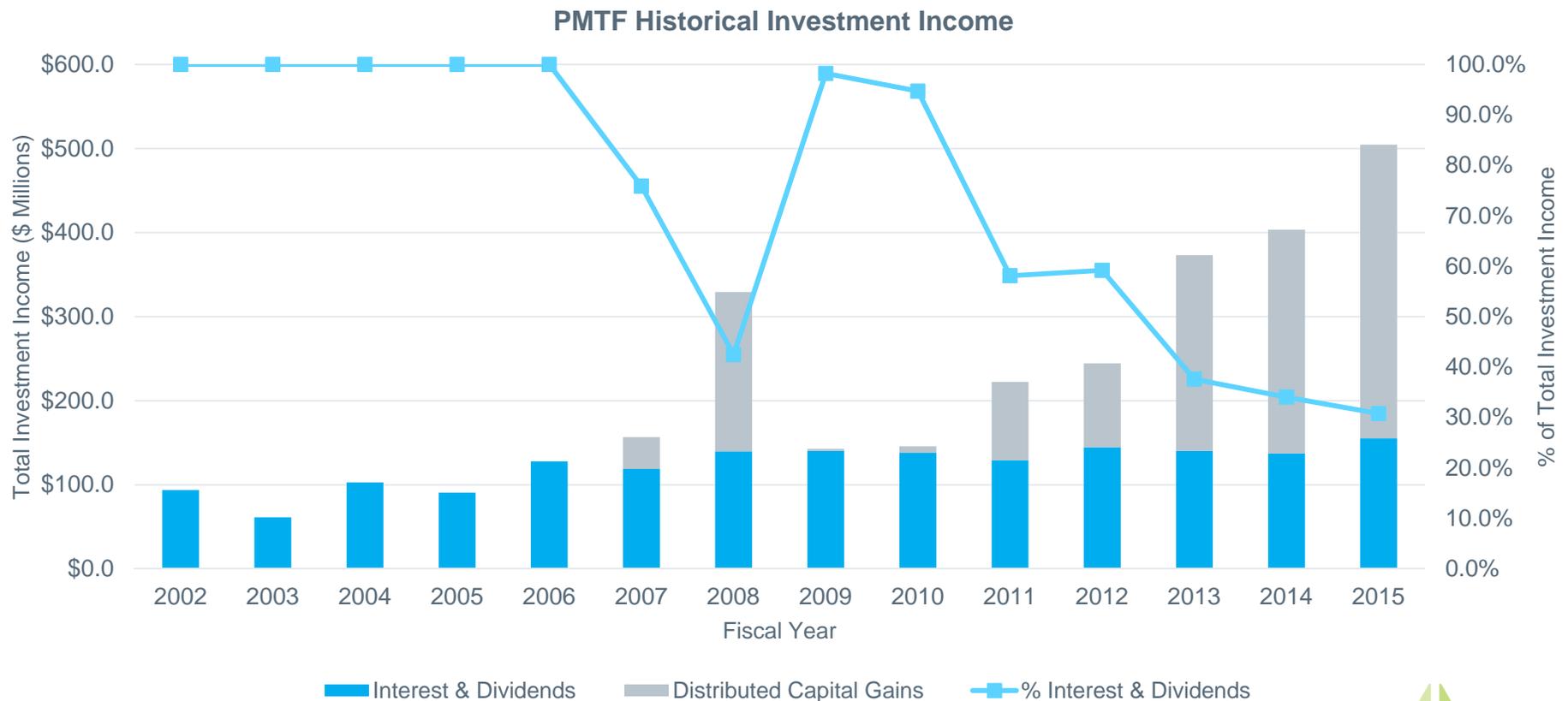
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-Wyoming STO "Total Fund":	1997-2016	-MSCI ACW Ex US:	1989-2016
-PMTF:	2002-2016	-B US TIPS:	1999-2016
-No Equity Cap:	2004-2016	-BofA ML All Convertibles:	1994-2016
-No Equity Cap + MLPs:	2004-2016	-Alerian MLP:	1997-2016
-MSCI ACW:	2002-2016		

# Importance of Yield

The inviolate nature of the Corpus means spending may only come from interest income, dividends, and net capital gains.

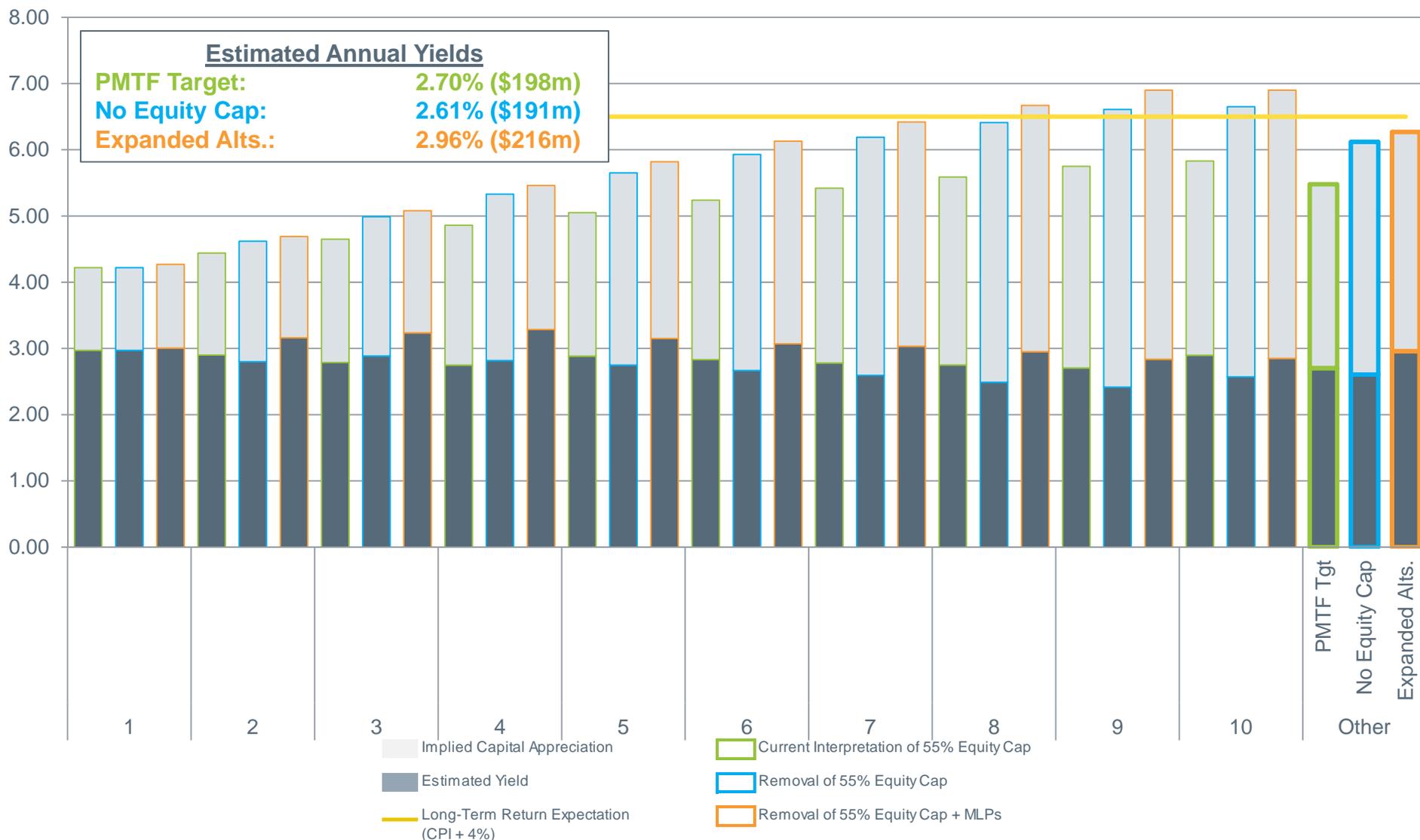
Interest income and dividends (yield) have historically been a significant component of total investment income generated. Although this significance has declined in recent years due to outsized realized capital gains, the importance and stability of interest income and dividends remains unchanged.



# Estimated Portfolio Yield & Return Breakdown

## Forecasted Yields

Portfolios on the less constrained frontiers are able to achieve the long-term return expectation, with similar levels of yield.

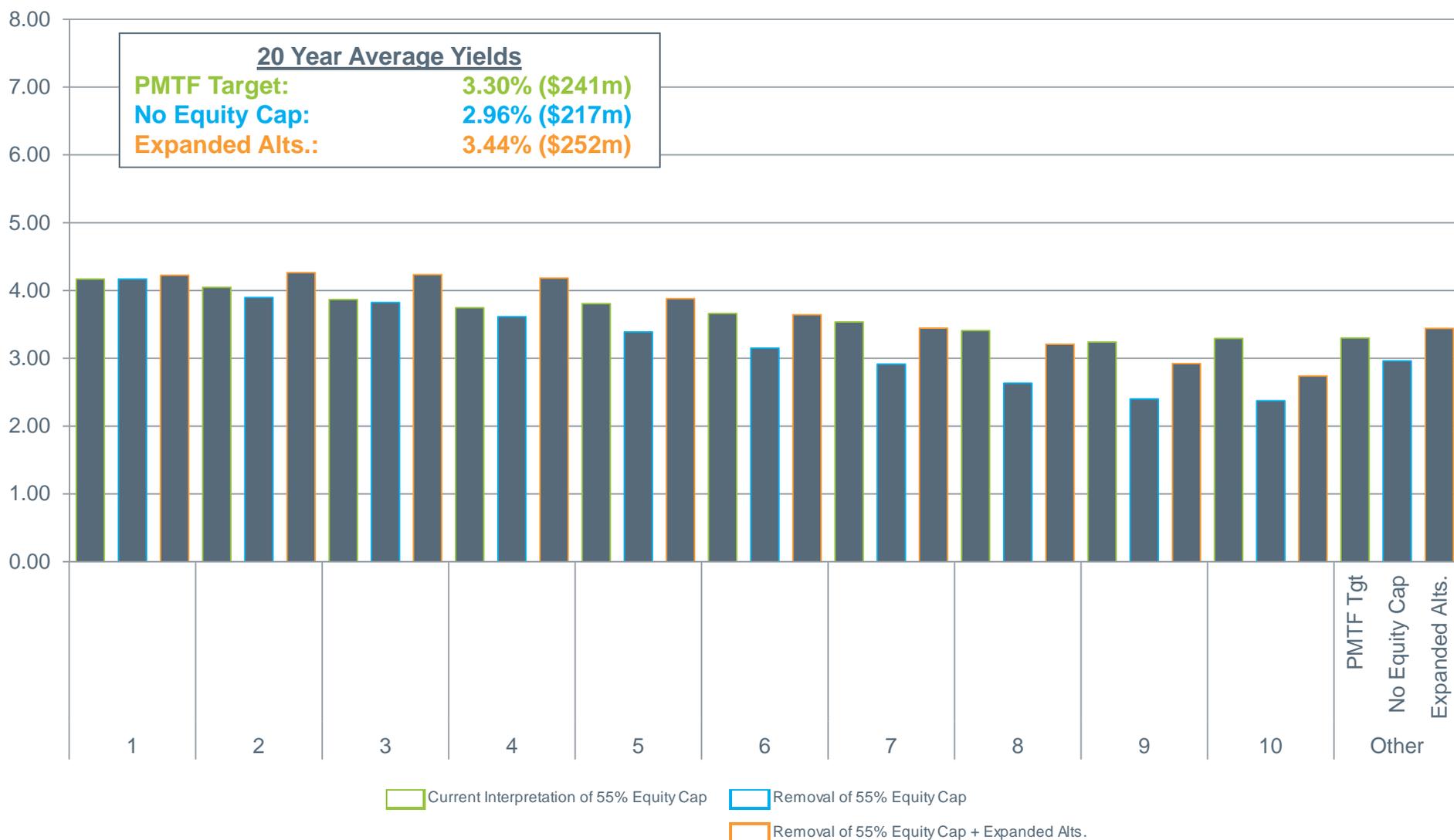


Expected returns do not assume active manager alpha. Equity yields are currently greater than fixed income yields, which is a departure from historical norms. Estimated yields are a weighted average of the forecasted yields for FY 2017. MV utilized for PMTF is \$7,312 million as of June 30, 2016.

# Estimated Portfolio Yield & Return Breakdown

## Historical Average Yields

In an environment more akin to historical averages, portfolios with larger allocations to fixed income would be expected to provide higher levels of yield.



Equity yields are currently greater than fixed income yields, which is a departure from historical norms. Estimated yields are a weighted average of the 20 Year average yields for each asset class. 10 year average yields are used for MLPs and EMD. MV utilized for PMTF is \$7,312 million as of June 30, 2016.

# Efficient Frontier 1 Table

## Current Interpretation of 55% Equity Cap

	Min	Max	1	2	3	4	5	6	7	8	9	10	PMTF Target
Broad US Equity	0	40	0	1	3	3	4	6	8	11	12	17	15
Small Cap US Equity	0	5	0	0	1	1	1	2	3	4	4	5	1
Global Equity	0	10	0	0	0	0	0	0	0	0	0	0	3
Broad International Equity	0	40	0	0	0	4	6	9	11	14	16	22	12
Private Equity	0	5	0	3	5	5	5	5	5	5	5	5	4
Core Real Estate	0	6	6	5	5	5	5	5	5	5	5	3	5
Non-Core Real Estate	0	3	2	3	3	3	3	3	3	3	3	3	2
Diversified Hedge Funds	0	10	10	10	10	10	10	10	10	10	10	0	8
Convertibles	0	5	0	0	0	0	0	0	0	0	2	5	2
Custom Fixed Income	0	100	77	74	69	64	66	60	55	49	43	40	45
Cash Equivalents	0	5	5	5	5	5	0	0	0	0	0	0	3
Total			100	100	100	100	100	100	100	100	100	100	100
Capital Appreciation			8	12	16	21	24	30	35	40	46	60	43
Capital Preservation			65	63	59	55	52	47	43	39	34	31	38
Alpha			10	10	10	10	10	10	10	10	10	0	8
Inflation			17	15	14	14	14	13	12	12	11	9	12
Expected Return			4.33	4.56	4.78	5.01	5.23	5.46	5.69	5.91	6.14	6.37	5.81
Risk (Standard Deviation)			4.82	4.91	5.17	5.64	6.18	6.8	7.51	8.27	9.13	10.71	8.42
Return (Compound)			4.22	4.44	4.65	4.86	5.05	5.24	5.42	5.59	5.75	5.83	5.48
Total Risk Assets			18	22	27	31	34	40	45	52	55	55	50
Return/Risk Ratio			0.90	0.93	0.92	0.89	0.85	0.80	0.76	0.71	0.67	0.59	0.69
RVK Expected Eq Beta (LCUS Eq = 1)			0.08	0.12	0.16	0.21	0.24	0.29	0.34	0.39	0.44	0.54	0.41
RVK Liquidity Metric (T-Bills = 100)			73	71	69	70	69	70	70	71	71	78	74
Estimated Yield (%)			2.97	2.90	2.79	2.75	2.88	2.83	2.78	2.75	2.70	2.90	2.70

Group Constraints: (i) Broad US Equity must be at least three-fourths (3/4) of total US Equity. (ii) Total US Equity must be equal to or greater than the sum of Broad International and Global Equity. (iii) Total Equity (including private equity, core and value-added real estate, and diversified hedge funds) must not exceed 55% of the total portfolio. (iv) Total Real Estate must not exceed 7.5% of the total portfolio. (v) Core Real Estate must be at least one-half (1/2) of total Real Estate.

# Efficient Frontier 2 Table

## Removal of 55% Equity Cap

	Min	Max	1	2	3	4	5	6	7	8	9	10	PMTF Target	No Equity Cap
Broad US Equity	0	40	0	2	4	7	11	15	20	25	30	40	15	19
Small Cap US Equity	0	5	0	1	1	2	4	5	5	5	5	5	1	5
Global Equity	0	10	0	0	0	0	0	0	0	0	0	5	3	0
Broad International Equity	0	40	0	0	5	10	15	20	25	30	35	40	12	24
Private Equity	0	5	0	5	5	5	5	5	5	5	5	5	4	5
Core Real Estate	0	6	6	5	5	5	5	5	5	5	5	3	5	5
Non-Core Real Estate	0	3	2	3	3	3	3	3	3	3	3	3	2	3
Diversified Hedge Funds	0	10	10	10	10	10	10	10	10	10	10	0	8	9
Convertibles	0	5	0	0	0	0	0	0	0	0	0	0	2	0
Custom Fixed Income	0	100	77	70	67	58	48	38	28	17	7	0	45	30
Cash Equivalents	0	5	5	5	0	0	0	0	0	0	0	0	3	0
Total			100	100	100	100	100	100	100	100	100	100	100	100
Capital Appreciation			8	15	23	32	41	51	60	69	79	97	43	58
Capital Preservation			65	60	53	45	37	30	22	14	6	0	38	24
Alpha			10	10	10	10	10	10	10	10	10	0	8	9
Inflation			17	15	14	13	11	10	8	7	6	3	12	9
Expected Return			4.33	4.74	5.16	5.57	5.99	6.4	6.82	7.23	7.65	8.06	5.81	6.72
Risk (Standard Deviation)			4.82	5.11	5.99	7.14	8.53	10.06	11.69	13.37	15.09	17.64	8.42	11.33
Return (Compound)			4.22	4.62	4.99	5.33	5.65	5.93	6.19	6.41	6.61	6.65	5.48	6.12
Total Risk Assets			18	26	33	42	53	63	73	83	93	100	50	70
Return/Risk Ratio			0.90	0.93	0.86	0.78	0.70	0.64	0.58	0.54	0.51	0.46	0.69	0.59
RVK Expected Eq Beta (LCUS Eq = 1)			0.08	0.15	0.22	0.31	0.41	0.50	0.59	0.69	0.78	0.93	0.41	0.57
RVK Liquidity Metric (T-Bills = 100)			73	69	69	70	71	72	73	74	75	83	74	73
Estimated Yield (%)			2.97	2.80	2.89	2.82	2.75	2.67	2.59	2.49	2.42	2.57	2.70	2.61

Group Constraints: (i) Broad US Equity must be at least three-fourths (3/4) of total US Equity. (ii) Total US Equity must be equal to or greater than the sum of Broad International and Global Equity. (iii) Total Real Estate must not exceed 7.5% of the total portfolio. (iv) Core Real Estate must be at least one-half (1/2) of total Real Estate.

# Efficient Frontier 3 Table

	Min	Max	1	2	3	4	5	6	7	8	9	10	PMTF Target	Expanded Alts.
Broad US Equity	0	40	0	1	3	3	6	10	14	18	22	30	15	12
Small Cap US Equity	0	10	0	0	1	1	2	3	5	6	7	10	1	4
MLPs	0	5	0	3	5	5	5	5	5	5	5	5	0	4
Global Equity	0	10	0	0	0	0	0	0	0	0	0	0	3	0
Broad International Equity	0	40	0	0	1	3	8	13	19	24	29	40	12	17
Private Equity	0	6	0	0	2	6	6	6	6	6	6	6	4	6
Core Real Estate	0	10	10	8	8	8	8	8	8	8	8	5	5	8
Non-Core Real Estate	0	10	1	6	8	8	8	8	8	8	8	5	2	8
Diversified Hedge Funds	0	10	10	10	10	10	10	10	10	10	10	0	8	10
Convertibles	0	5	0	0	0	0	0	0	0	0	0	0	2	0
Custom Fixed Income	0	100	74	66	58	58	47	37	27	17	6	0	45	32
Cash Equivalents	0	5	5	5	5	0	0	0	0	0	0	0	3	0
Total			100	100	100	100	100	100	100	100	100	100	100	100
Capital Appreciation			6	12	18	24	33	43	52	62	71	91	43	49
Capital Preservation			63	57	51	45	37	29	21	13	5	0	38	25
Alpha			10	10	10	10	10	10	10	10	10	0	8	10
Inflation			21	21	21	21	19	18	16	15	13	10	12	16
Expected Return			4.38	4.81	5.23	5.66	6.09	6.51	6.94	7.36	7.79	8.21	5.81	6.73
Risk (Standard Deviation)			4.80	4.99	5.54	6.44	7.62	9.04	10.60	12.25	13.95	17.01	8.42	9.89
Return (Compound)			4.27	4.69	5.08	5.46	5.82	6.13	6.42	6.67	6.90	6.90	5.48	6.27
Total Risk Assets			21	28	38	44	53	63	75	85	95	101	50	68
Return/Risk Ratio			0.91	0.96	0.94	0.88	0.80	0.72	0.65	0.60	0.56	0.48	0.69	0.68
RVK Expected Eq Beta (LCUS Eq = 1)			0.08	0.12	0.17	0.23	0.33	0.42	0.51	0.61	0.70	0.88	0.41	0.47
RVK Liquidity Metric (T-Bills = 100)			71	69	67	63	64	65	66	67	68	79	74	65
Estimated Yield (%)			3.01	3.16	3.24	3.29	3.15	3.07	3.03	2.95	2.84	2.85	2.70	2.96

Group Constraints: (i) Broad US Equity must be at least three-fourths (3/4) of total US Equity. (ii) Total US Equity must be equal to or greater than the sum of Broad International and Global Equity. (iii) Total Real Estate must not exceed 15% of the total portfolio. (iv) Core Real Estate must be at least one-half (1/2) of total Real Estate.

# 2016 RVK Capital Market Assumptions

	Expected Return (Arithmetic)	Standard Deviation	Expected Return (Compound)
Broad US Equity	7.05%	17.80%	5.60%
Small Cap US Equity	7.75%	21.25%	5.71%
MLPs	9.00%	22.00%	6.85%
Global Equity	7.90%	18.35%	6.37%
Broad International Equity	8.85%	20.60%	6.95%
Private Equity	10.25%	25.50%	7.41%
Core Real Estate	6.50%	12.50%	5.77%
Non-Core Real Estate	9.50%	22.50%	7.26%
Diversified Hedge Funds	6.50%	9.50%	6.08%
Convertibles	5.80%	13.70%	4.92%
Custom Fixed Income	3.88%	5.59%	3.73%
Cash Equivalents	2.25%	3.00%	2.21%
US Inflation	2.50%	3.00%	2.46%

Assumptions for Broad US Equity, Global Equity, Broad International Equity and Convertibles are calculated based on a roll up of the underlying sub-asset classes. Custom Fixed Income assumption consists of 76.29% Int. Duration Fixed Income (Internal and External Fixed Income), 8.25% TIPS, 10.31% Custom Credit (60% Bank Loans, 20% High Yield, 20% Credit), and 5.15% Emerging Markets Debt (Local) and excludes opportunistic fixed income.

PORTLAND

CHICAGO

NEW YORK

