FUND EVALUATION REPORT

Plymouth County
Retirement Association

Investment Review
September 24, 2019

1. **Estimated Retirement Association Performance**
2. **Interim Update as of July 31, 2019**
3. **Rebalancing Recommendation**
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Estimated Retirement Association Performance

Estimated Aggregate Performance[1]

	August[2] (%)	QTD (%)	YTD (%)	1 YR (%)	3 YR (%)	5 YR (%)	10 YR (%)
Total Retirement Association	**-1.6**	**-1.5**	**9.6**	**-0.4**	**6.2**	**4.8**	**7.9**
60% MSCI ACWI/40% Barclays Global Aggregate	*-0.6*	*-0.5*	*11.4*	*3.2*	*6.5*	*4.1*	*6.4*
Policy Benchmark	*-1.2*	*-0.9*	*9.2*	*1.8*	*7.3*	*5.5*	*8.3*

Benchmark Returns

	August (%)	QTD (%)	YTD (%)	1 YR (%)	3 YR (%)	5 YR (%)	10 YR (%)
Russell 3000	*-2.0*	*-0.6*	*18.0*	*1.3*	*12.2*	*9.6*	*13.4*
MSCI EAFE	*-2.6*	*-3.8*	*9.7*	*-3.3*	*5.9*	*1.9*	*5.0*
MSCI Emerging Markets	*-4.9*	*-6.0*	*3.9*	*-4.4*	*5.8*	*0.4*	*4.1*
Barclays Aggregate	*2.6*	*2.8*	*9.1*	*10.2*	*3.1*	*3.4*	*3.9*
Barclays TIPS	*2.4*	*2.7*	*9.1*	*7.5*	*2.9*	*2.2*	*3.8*
Barclays High Yield	*0.4*	*1.0*	*11.0*	*6.6*	*6.2*	*4.9*	*8.5*
JPM GBI-EM Global Diversified	*-2.6*	*-1.7*	*6.8*	*11.9*	*3.4*	*-0.7*	*2.7*
S&P Global Natural Resources	*-6.5*	*-8.8*	*3.9*	*-10.4*	*6.7*	*-0.9*	*1.8*

Estimated Total Fund Assets

	August Estimate
Total Retirement Association	**$991,284,163**

[1] The August performance estimates are calculated using index returns as of August 31, 2019 for each asset class. No performance estimate was included for private equity, real estate, infrastructure, and private natural resources asset classes.
[2] As of August 31, 2019

Interim Update
As of July 31, 2019

Total Retirement Association

As of July 31, 2019

Asset Class Net Performance Summary

	Market Value ($)	% of Portfolio	1 Mo (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	15 Yrs (%)	Inception (%)	Inception Date
Total Retirement Association	**1,057,612,462**	**100.0**	**0.2**	**11.5**	**1.9**	**6.9**	**5.6**	**8.4**	**6.5**	**7.8**	**Nov-89**
60% MSCI ACWI / 40% Barclays Global Aggregate			*0.1*	*12.1*	*4.4*	*6.7*	*4.6*	*6.8*	*6.1*	*6.6*	*Nov-89*
Custom Benchmark - Policy Benchmark (Net)			*0.3*	*10.5*	*3.6*	*7.9*	*6.1*	*8.7*	*7.3*	*--*	*Nov-89*
Domestic Equity Assets	**235,618,037**	**22.3**	**1.3**	**22.8**	**4.2**	**13.3**	**--**	**--**	**--**	**13.4**	**Jan-16**
Russell 3000			*1.5*	*20.5*	*7.0*	*13.1*	*11.0*	*14.0*	*9.3*	*13.2*	*Jan-16*
International Developed Market Equity Assets	**114,314,917**	**10.8**	**-1.5**	**10.5**	**-7.7**	**5.4**	**--**	**--**	**--**	**4.7**	**Jan-16**
MSCI EAFE			*-1.3*	*12.6*	*-2.6*	*6.9*	*2.4*	*5.8*	*5.5*	*5.8*	*Jan-16*
International Emerging Market Equity Assets	**107,501,198**	**10.2**	**-1.4**	**8.7**	**-4.7**	**6.9**	**--**	**--**	**--**	**8.3**	**Jan-16**
MSCI Emerging Markets			*-1.2*	*9.2*	*-2.2*	*8.4*	*1.8*	*4.6*	*8.7*	*10.4*	*Jan-16*
Global Equity Assets	**103,720,148**	**9.8**	**0.5**	**16.9**	**5.5**	**--**	**--**	**--**	**--**	**1.6**	**Feb-18**
MSCI ACWI			*0.3*	*16.6*	*2.9*	*10.2*	*6.5*	*9.3*	*7.3*	*0.0*	*Feb-18*
Core Fixed Income	**88,252,923**	**8.3**	**0.3**	**6.5**	**7.6**	**2.4**	**--**	**--**	**--**	**3.8**	**Jan-16**
75% Bbg Barclays Aggregate/25% Bbg Barclays US TIPs 1-10 year			*0.2*	*6.1*	*7.4*	*2.1*	*2.7*	*3.5*	*--*	*3.4*	*Jan-16*
Value Added Fixed Income	**121,144,674**	**11.5**	**0.9**	**8.1**	**6.0**	**5.9**	**--**	**--**	**--**	**7.3**	**Jan-16**
Custom Benchmark (1)			*0.9*	*9.8*	*7.4*	*5.8*	*--*	*--*	*--*	*7.6*	*Jan-16*
Hedge Funds (2)	**61,988,458**	**5.9**	**0.6**	**11.6**	**1.6**	**5.9**	**3.9**	**--**	**--**	**4.6**	**Feb-10**
HFRI Fund of Funds Composite Index			*0.3*	*6.5*	*1.2*	*3.8*	*2.3*	*3.1*	*3.1*	*2.8*	*Feb-10*
Real Estate (3)	**87,631,716**	**8.3**	**0.0**	**5.5**	**7.2**	**4.0**	**--**	**--**	**--**	**5.2**	**Jan-16**
80% NCREIF ODCE / 20% Wilshire REIT			*0.3*	*5.8*	*7.7*	*6.8*	*--*	*--*	*--*	*7.6*	*Jan-16*
Private Equity (4)	**54,019,860**	**5.1**	**0.0**	**1.4**	**0.5**	**5.4**	**--**	**--**	**--**	**3.7**	**Jan-16**
Cambridge Associates Fund of Funds Composite 1-Quarter Lag			*0.0*	*3.5*	*12.5*	*12.2*	*11.0*	*12.1*	*11.0*	*11.0*	*Jan-16*
Real Assets (5)	**50,989,152**	**4.8**	**-0.1**	**1.9**	**2.1**	**0.2**	**--**	**--**	**--**	**-1.6**	**Jan-16**
CPI + 3%			*0.6*	*3.1*	*4.8*	*5.2*	*4.5*	*4.8*	*5.0*	*5.1*	*Jan-16*
Cash and Cash Equivalent	**32,431,379**	**3.1**									

(1) The custom benchmark is comprised of 33% BBgBarc US High Yield/ 33% Credit Suisse Leveraged Loans/ 33% JP Morgan EMBI Global diversified.
(2) EntrustPermal Special Opportunities Evergreen and Entrust Special Opportunities III is lagged as of June 30, 2019.
(3) The market value and performance is one quarter lagged.
(4) The market value and performance is one quarter lagged.
(5) The market value and performance is one quarter lagged.

Trailing Net Performance

	Market Value ($)	% of Portfolio	% of Sector	1 Mo (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
Total Retirement Association	**1,057,612,462**	**100.0**	**--**	**0.2**	**11.5**	**1.9**	**6.9**	**5.6**	**8.4**	**7.8**	**Nov-89**
60% MSCI ACWI / 40% Barclays Global Aggregate				*0.1*	*12.1*	*4.4*	*6.7*	*4.6*	*6.8*	*6.6*	*Nov-89*
Domestic Equity Assets	**235,618,037**	**22.3**	**22.3**	**1.3**	**22.8**	**4.2**	**13.3**	**--**	**--**	**13.4**	**Jan-16**
Russell 3000				*1.5*	*20.5*	*7.0*	*13.1*	*11.0*	*14.0*	*13.2*	*Jan-16*
Rhumbline Russell 1000 Value	35,941,465	3.4	15.3	0.8	17.1	5.2	9.3	7.9	--	9.9	Apr-13
Russell 1000 Value				*0.8*	*17.2*	*5.2*	*9.4*	*8.0*	*12.4*	*10.0*	*Apr-13*
Rhumbline Russell 1000 Growth	35,354,871	3.3	15.0	2.3	24.2	10.8	17.0	14.2	15.6	15.6	Jul-09
Russell 1000 Growth				*2.3*	*24.2*	*10.8*	*17.1*	*14.3*	*15.7*	*15.7*	*Jul-09*
Fisher Midcap Value	44,461,094	4.2	18.9	0.7	23.0	3.1	12.8	9.5	13.9	7.7	Apr-07
Russell MidCap Value				*0.8*	*19.0*	*1.8*	*7.7*	*7.5*	*13.6*	*6.9*	*Apr-07*
Boston Company Small Cap Growth	52,241,847	4.9	22.2	2.0	33.5	13.7	20.5	15.8	--	15.6	Aug-09
Russell 2000 Growth				*1.0*	*21.5*	*-1.2*	*12.7*	*10.2*	*13.7*	*13.7*	*Aug-09*
LMCG Small Cap Value	67,596,285	6.4	28.7	1.0	17.1	-5.5	6.4	7.4	--	7.9	Mar-11
Russell 2000 Value				*0.2*	*13.6*	*-7.7*	*8.0*	*6.7*	*11.2*	*8.1*	*Mar-11*
International Developed Market Equity Assets	**114,314,917**	**10.8**	**10.8**	**-1.5**	**10.5**	**-7.7**	**5.4**	**--**	**--**	**4.7**	**Jan-16**
MSCI EAFE				*-1.3*	*12.6*	*-2.6*	*6.9*	*2.4*	*5.8*	*5.8*	*Jan-16*
KBI Master Account	49,303,218	4.7	43.1	-1.6	6.8	-9.0	3.5	-0.7	4.2	3.2	Jul-05
MSCI EAFE				*-1.3*	*12.6*	*-2.6*	*6.9*	*2.4*	*5.8*	*4.5*	*Jul-05*
HGK TS International Equity	29,767,737	2.8	26.0	-1.0	12.0	-6.0	8.9	3.5	--	5.8	Feb-11
MSCI EAFE				*-1.3*	*12.6*	*-2.6*	*6.9*	*2.4*	*5.8*	*3.9*	*Feb-11*
Copper Rock International Small Cap	35,243,962	3.3	30.8	-1.6	15.0	-7.9	--	--	--	-6.0	Nov-17
MSCI EAFE Small Cap				*-0.7*	*11.7*	*-7.6*	*6.7*	*4.7*	*8.8*	*-3.5*	*Nov-17*

	Market Value ($)	% of Portfolio	% of Sector	1 Mo (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
International Emerging Market Equity Assets	**107,501,198**	**10.2**	**10.2**	**-1.4**	**8.7**	**-4.7**	**6.9**	**--**	**--**	**8.3**	**Jan-16**
MSCI Emerging Markets				*-1.2*	*9.2*	*-2.2*	*8.4*	*1.8*	*4.6*	*10.4*	*Jan-16*
LMCG Emerging Markets	48,549,285	4.6	45.2	-1.9	5.8	-7.8	5.8	-0.3	--	1.0	Sep-13
MSCI Emerging Markets				*-1.2*	*9.2*	*-2.2*	*8.4*	*1.8*	*4.6*	*3.3*	*Sep-13*
ABS Emerging Markets	22,147,567	2.1	20.6	-1.2	10.7	--	--	--	--	10.7	Dec-18
MSCI Emerging Markets				*-1.2*	*9.2*	*-2.2*	*8.4*	*1.8*	*4.6*	*6.3*	*Dec-18*
Copper Rock Emerging Markets Small Cap	10,592,611	1.0	9.9	-2.3	6.2	--	--	--	--	6.2	Dec-18
MSCI Emerging Markets Small Cap				*-1.5*	*5.1*	*-7.7*	*3.5*	*0.1*	*4.5*	*3.4*	*Dec-18*
Driehaus Emerging Markets Growth	26,211,735	2.5	24.4	-0.3	--	--	--	--	--	4.6	Mar-19
MSCI Emerging Markets				*-1.2*	*9.2*	*-2.2*	*8.4*	*1.8*	*4.6*	*0.2*	*Mar-19*
Global Equity Assets	**103,720,148**	**9.8**	**9.8**	**0.5**	**16.9**	**5.5**	**--**	**--**	**--**	**1.6**	**Feb-18**
MSCI ACWI				*0.3*	*16.6*	*2.9*	*10.2*	*6.5*	*9.3*	*0.0*	*Feb-18*
First Eagle Global Value Fund	20,067,562	1.9	19.3	0.1	13.6	3.8	--	--	--	0.2	Feb-18
MSCI ACWI				*0.3*	*16.6*	*2.9*	*10.2*	*6.5*	*9.3*	*0.0*	*Feb-18*
Kopernik Global All Cap Fund	18,964,126	1.8	18.3	-0.3	9.8	3.6	--	--	--	-3.5	Feb-18
MSCI ACWI				*0.3*	*16.6*	*2.9*	*10.2*	*6.5*	*9.3*	*0.0*	*Feb-18*
Lee Munder Global Multi-Cap Strategy	28,794,213	2.7	27.8	-0.5	14.1	-1.2	--	--	--	0.6	Mar-18
MSCI ACWI				*0.3*	*16.6*	*2.9*	*10.2*	*6.5*	*9.3*	*3.0*	*Mar-18*
Wellington Durable Enterprises, L.P.	35,894,247	3.4	34.6	2.1	25.8	14.0	--	--	--	13.5	Mar-18
MSCI ACWI				*0.3*	*16.6*	*2.9*	*10.2*	*6.5*	*9.3*	*3.0*	*Mar-18*
Core Fixed Income	**88,252,923**	**8.3**	**8.3**	**0.3**	**6.5**	**7.6**	**2.4**	**--**	**--**	**3.8**	**Jan-16**
75% Bbg Barclays Aggregate/25% Bbg Barclays US TIPs 1-10 year				*0.2*	*6.1*	*7.4*	*2.1*	*2.7*	*3.5*	*3.4*	*Jan-16*
IR&M Core Bonds	58,164,166	5.5	65.9	0.3	6.5	7.6	2.3	2.7	4.0	4.2	Nov-04
75% Bbg Barclays Aggregate/25% Bbg Barclays US TIPs 1-10 year				*0.2*	*6.1*	*7.4*	*2.1*	*2.7*	*3.5*	*4.0*	*Nov-04*
Lord Abbett Short Duration Credit Trust II	30,088,757	2.8	34.1	--	--	--	--	--	--	--	Aug-19
BBgBarc US Credit 1-3 Yr TR				*0.1*	*3.3*	*4.7*	*2.1*	*1.9*	*2.5*	--	*Aug-19*

Total Retirement Association

As of July 31, 2019

	Market Value ($)	% of Portfolio	% of Sector	1 Mo (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
Value Added Fixed Income	**121,144,674**	**11.5**	**11.5**	**0.9**	**8.1**	**6.0**	**5.9**	**--**	**--**	**7.3**	**Jan-16**
Custom Benchmark				*0.9*	*9.8*	*7.4*	*5.8*	*--*	*--*	*7.6*	*Jan-16*
Eaton Vance High Yield	21,680,474	2.0	17.9	0.5	10.1	6.8	5.9	5.1	8.4	7.0	Apr-06
ICE BofAML US High Yield TR				*0.5*	*10.8*	*7.0*	*6.9*	*5.1*	*8.6*	*7.3*	*Apr-06*
THL Bank Loan Select Fund	36,500,495	3.5	30.1	0.6	5.6	3.7	4.8	4.2	--	5.4	Sep-10
Credit Suisse Leveraged Loans				*0.8*	*6.2*	*4.1*	*5.2*	*4.0*	*5.9*	*4.9*	*Sep-10*
Franklin Templeton Emerging Market Bonds	32,949,606	3.1	27.2	1.6	9.2	8.0	7.1	4.4	7.6	7.1	May-06
JP Morgan EMBI Global Diversified				*1.2*	*12.7*	*11.0*	*5.3*	*5.5*	*7.6*	*7.4*	*May-06*
Manulife Strategic Fixed Income	30,014,100	2.8	24.8	--	--	--	--	--	--	0.0	Jul-19
BBgBarc Multiverse TR				*-0.2*	*5.5*	*5.8*	*1.6*	*1.5*	*2.9*	*-0.2*	*Jul-19*
Hedge Funds	**61,988,458**	**5.9**	**5.9**	**0.6**	**11.6**	**1.6**	**5.9**	**3.9**	**--**	**4.6**	**Feb-10**
HFRI Fund of Funds Composite Index				*0.3*	*6.5*	*1.2*	*3.8*	*2.3*	*3.1*	*2.8*	*Feb-10*
ABS Offshore SPC - Global Segregated Portfolio	21,821,885	2.1	35.2	1.4	9.4	-0.1	5.4	3.5	--	5.2	Aug-10
HFRI Fund of Funds Composite Index				*0.3*	*6.5*	*1.2*	*3.8*	*2.3*	*3.1*	*3.0*	*Aug-10*
Entrust Special Opportunities Fund III, Ltd.	27,352,278	2.6	44.1	0.0	13.4	2.3	--	--	--	12.6	Oct-16
HFRI Fund of Funds Composite Index				*0.3*	*6.5*	*1.2*	*3.8*	*2.3*	*3.1*	*3.8*	*Oct-16*
Old Farm Partners Master Fund, L.P.	5,004,695	0.5	8.1	0.7	6.6	--	--	--	--	0.1	Oct-18
HFRI Fund of Funds Composite Index				*0.3*	*6.5*	*1.2*	*3.8*	*2.3*	*3.1*	*1.2*	*Oct-18*
EnTrustPermal Special Opportunities Evergreen Fund, Ltd.	7,809,600	0.7	12.6	0.0	15.3	--	--	--	--	15.3	Jan-19
HFRI Fund of Funds Composite Index				*0.3*	*6.5*	*1.2*	*3.8*	*2.3*	*3.1*	*6.5*	*Jan-19*

Entrust Special Opportunities Fund III, Ltd: Performance and market value is lagged as of June 30, 2019.
EnTrustPermal Special Opportunities Evergreen Fund, Ltd: Performance and market value is lagged as of June 30, 2019.

Total Retirement Association

As of July 31, 2019

	Market Value ($)	% of Portfolio	% of Sector	1 Mo (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
Real Estate	**87,631,716**	**8.3**	**8.3**	**0.0**	**5.5**	**7.2**	**4.0**	**--**	**--**	**5.2**	**Jan-16**
80% NCREIF ODCE / 20% Wilshire REIT				*0.3*	*5.8*	*7.7*	*6.8*	*--*	*--*	*7.6*	*Jan-16*
Core Real Estate	**55,259,481**	**5.2**	**63.1**	**0.1**	**5.8**	**7.3**	**5.7**	**--**	**--**	**7.2**	**Jan-16**
NCREIF-ODCE				*0.0*	*2.4*	*6.4*	*7.6*	*9.8*	*9.9*	*7.6*	*Jan-16*
Invesco Equity Real Estate Securities Trust	781,121	0.1	1.4	1.4	21.2	13.6	4.9	8.4	13.8	11.4	Dec-02
Wilshire REIT				*1.6*	*19.8*	*11.6*	*3.2*	*8.2*	*14.7*	*10.6*	*Dec-02*
TA Realty Core Property Fund, L.P.	27,153,280	2.6	49.1	0.0	3.9	7.9	--	--	--	10.6	Apr-18
NCREIF ODCE				*0.0*	*2.4*	*6.4*	*7.6*	*9.8*	*9.9*	*6.4*	*Apr-18*
JPMorgan Strategic Property	27,325,080	2.6	49.4	0.1	--	--	--	--	--	0.8	Apr-19
NCREIF-ODCE				*0.0*	*2.4*	*6.4*	*7.6*	*9.8*	*9.9*	*1.0*	*Apr-19*
Non-Core Real Estate	**32,372,235**	**3.1**	**36.9**	**0.0**	**4.7**	**7.3**	**-1.4**	**--**	**--**	**-1.2**	**Jan-16**
Private Equity	**54,019,860**	**5.1**	**5.1**	**0.0**	**1.4**	**0.5**	**5.4**	**--**	**--**	**3.7**	**Jan-16**
Cambridge Associates Fund of Funds Composite 1-Quarter Lag				*0.0*	*3.5*	*12.5*	*12.2*	*11.0*	*12.1*	*11.0*	*Jan-16*
Private Equity	**47,068,827**	**4.5**	**87.1**	**0.0**	**2.5**	**-0.7**	**3.9**	**--**	**--**	**2.1**	**Jan-16**
Venture Capital	**6,951,033**	**0.7**	**12.9**	**0.0**	**-4.0**	**4.0**	**9.4**	**--**	**--**	**8.3**	**Jan-16**
Real Assets	**50,989,152**	**4.8**	**4.8**	**-0.1**	**1.9**	**2.1**	**0.2**	**--**	**--**	**-1.6**	**Jan-16**
CPI + 3%				*0.6*	*3.1*	*4.8*	*5.2*	*4.5*	*4.8*	*5.1*	*Jan-16*
IFM Global Infrastructure	21,727,505	2.1	42.6	-0.3	6.3	--	--	--	--	9.3	Oct-18
CPI+5% (1q Lagged)				*0.0*	*3.2*	*--*	*--*	*--*	*--*	*4.6*	*Oct-18*
Cash and Cash Equivalent	**32,431,379**	**3.1**	**3.1**								
Cash	32,431,379	3.1	100.0								

Core Real Estate: The market value and performance is one quarter lagged.
Non-Core Real Estate: The market value and performance is one quarter lagged.
Private Equity: The market value and performance is one quarter lagged.
Real Assets: The market value and performance is one quarter lagged.
Invesco REIT: Data is as of July 31, 2019.

Total Retirement Association

As of July 31, 2019

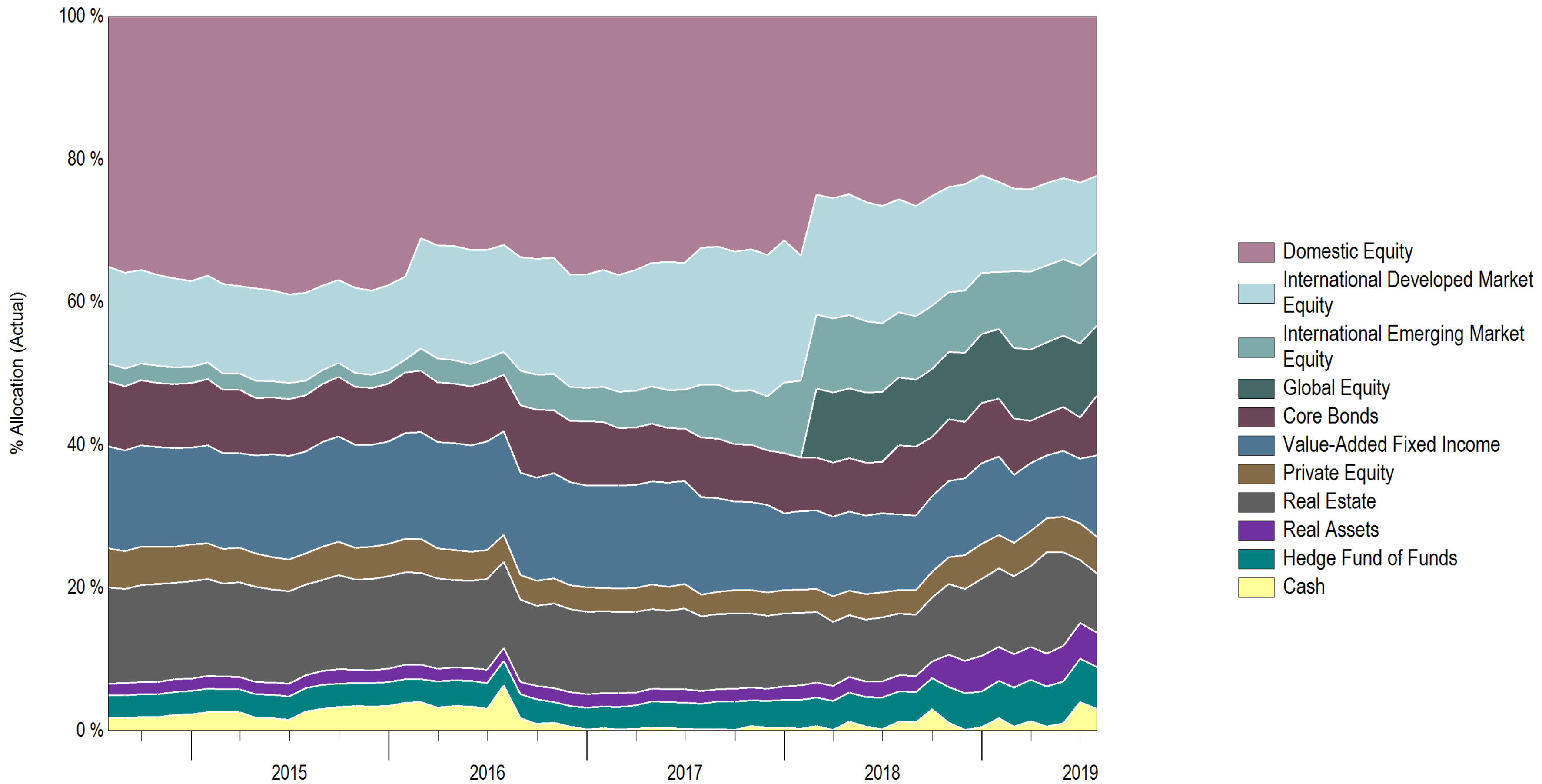
Allocation vs. Target

	Current Balance	Current Allocation	Policy	Policy Range	Within IPS Range?
Domestic Equity	$235,618,037	22%	26%	21% - 36%	Yes
International Developed Market Equity	$114,314,917	11%	6%	1% - 16%	Yes
International Emerging Market Equity	$107,501,198	10%	10%	5% - 20%	Yes
Global Equity	$103,720,148	10%	10%	5% - 20%	Yes
Core Bonds	$88,252,923	8%	9%	4% - 14%	Yes
Value-Added Fixed Income	$121,144,674	11%	6%	2% - 12%	Yes
Private Equity	$54,019,860	5%	13%	4% - 18%	Yes
Real Estate	$87,631,716	8%	10%	5% - 15%	Yes
Real Assets	$50,989,152	5%	6%	2% - 10%	Yes
Hedge Fund of Funds	$61,988,458	6%	4%	2% - 8%	Yes
Cash	$32,431,379	3%	0%	0% - 3%	No
Total	**$1,057,612,462**	**100%**	**100%**		

	Current Balance	Current Allocation	Policy	Policy Range	Within IPS Range?
Total Equity	$677,162,618	64%	69%	60% - 80%	Yes
Total Fixed Income	$209,397,597	20%	15%	5% - 25%	Yes
Total Real Assets and Real Estate	$138,620,868	13%	16%	13% - 19%	Yes
Cash	$32,431,379	3%	0%	0% - 3%	No

Plymouth County Retirement Association adopted a new asset allocation as of December 2018.

Asset Allocation History
5 Years Ending July 31, 2019



Annual Investment Expense Analysis
As Of July 31, 2019

Name	Fee Schedule	Market Value	Estimated Fee Value	Estimated Fee
Domestic Equity Assets		**$235,618,037**		
Rhumbline Russell 1000 Value	0.05% of First 25.0 Mil, 0.04% of Next 25.0 Mil, 0.03% Thereafter	$35,941,465	$16,877	0.05%
Rhumbline Russell 1000 Growth	0.05% of First 25.0 Mil, 0.04% of Next 25.0 Mil, 0.03% Thereafter	$35,354,871	$16,642	0.05%
Fisher Midcap Value	0.80% of First 25.0 Mil, 0.75% of Next 25.0 Mil, 0.67% Thereafter	$44,461,094	$345,958	0.78%
Boston Company Small Cap Growth	0.45% of Assets	$52,241,847	$235,088	0.45%
LMCG Small Cap Value	0.90% of Assets	$67,596,285	$608,367	0.90%
International Developed Market Equity Assets		**$114,314,917**		
KBI Master Account	0.65% of Assets	$49,303,218	$320,471	0.65%
HGK TS International Equity	1.00% of Assets	$29,767,737	$297,677	1.00%
Copper Rock International Small Cap	0.85% of Assets	$35,243,962	$299,574	0.85%
International Emerging Market Equity Assets		**$107,501,198**		
LMCG Emerging Markets	0.64% of Assets	$48,549,285	$310,715	0.64%
ABS Emerging Markets	0.35% Management Fee and 10% Performance/Incentive Fee.	$22,147,567		
Copper Rock Emerging Markets Small Cap	0.85% of Assets	$10,592,611	$90,037	0.85%
Driehaus Emerging Markets Growth	0.55% of Assets	$26,211,735	$144,165	0.55%
Global Equity Assets		**$103,720,148**		
First Eagle Global Value Fund	0.75% of Assets	$20,067,562	$150,507	0.75%
Kopernik Global All Cap Fund	0.80% of First 50.0 Mil, 0.75% of Next 150.0 Mil, 0.70% of Next 250.0 Mil, 0.65% of Next 350.0 Mil	$18,964,126	$151,713	0.80%
Lee Munder Global Multi-Cap Strategy	0.45% of Assets	$28,794,213	$129,574	0.45%
Wellington Durable Enterprises, L.P.	0.60% of Assets	$35,894,247	$215,365	0.60%

Investment Expense Analysis

As of July 31, 2019

Name	Fee Schedule	Market Value	Estimated Fee Value	Estimated Fee
Core Fixed Income		**$88,252,923**		
IR&M Core Bonds	0.25% of First 50.0 Mil, 0.20% of Next 50.0 Mil, 0.15% Thereafter	$58,164,166	$141,328	0.24%
Lord Abbett Short Duration Credit Trust II	0.19% of Assets	$30,088,757	$57,169	0.19%
Value Added Fixed Income		**$121,144,674**		
Eaton Vance High Yield	0.42% of Assets	$21,680,474	$1,092,696	5.04%
THL Bank Loan Select Fund	0.40% of Assets	$36,500,495	$146,002	0.40%
Franklin Templeton Emerging Market Bonds	0.99% of Assets	$32,949,606	$326,201	0.99%
Manulife Strategic Fixed Income	0.40% of Assets	$30,014,100	$120,056	0.40%

Note: The adjusted value is based on March 31, 2019 FMV adjusted for subsequent cash flows.

Private Equity	Commitment	Total Contributions	Total Distributions	Adjusted Value
Ascend Ventures II, L.P.	2,500,000	2,324,355	925,962	61,532
Ascent Venture Partners IV, L.P.	2,500,000	2,502,219	388,970	40,167
Ascent Venture Partners V, L.P.	5,000,000	5,104,731	3,432,862	4,255,389
Audax Mezzanine Fund IV, L.P.	10,000,000	4,537,168	1,328,097	3,465,317
Charles River Partnership XI, L.P.	1,839,000	1,820,323	1,996,788	145,022
Charlesbank Technology Opportunities Fund, L.P.	12,000,000	0	0	0
DN Partners II, L.P.	5,000,000	2,375,841	0	1,641,786
Euro Choice V, L.P.	5,042,904	5,688,459	2,167,976	5,000,943
FS Equity Partners VIII, L.P.	12,000,000	0	0	0
Globespan Capital Partners V, L.P.	5,000,000	4,852,500	8,008,564	2,593,945
HarbourVest Partners Co-Investment Fund V, L.P.	12,000,000	1,200,000	0	1,200,000
Ironsides Direct Investment Fund V, L.P.	12,000,000	9,444,261	871,982	8,726,286
Landmark Equity Partners XIV, L.P.	6,000,000	6,288,437	6,612,813	1,028,077
Leeds Equity Partners IV, L.P.	5,185,562	5,089,327	6,224,435	10,302
Leeds Equity Partners V, L.P.	2,500,000	3,573,083	3,980,028	2,139,649
Lexington Capital Partners VII, L.P.	10,000,000	10,556,021	12,927,006	2,523,640
LLR Equity Partners V, L.P.	12,000,000	4,800,000	433,003	4,543,057
Mesirow Financial Capital Partners IX, L.P.	4,000,000	3,840,731	1,897,056	223,454
Ridgemont Equity Partners III, L.P.	12,000,000	0	0	0
Rimco Production Company, Inc	2,000,000	2,000,000	7,486,401	1
Searchlight Capital III, L.P.	12,000,000	0	0	0
Siguler Guff Distressed Opportunities Fund III, L.	6,000,000	5,820,000	8,197,030	922,575
Summit Partners Growth Equity Fund IX, L.P.	10,000,000	8,405,000	997,650	8,555,948
TRG Growth Partnership II, L.P.	7,500,000	7,450,399	7,463,445	1,181,037
Trilantic Capital Partners VI (North America), L.P.	12,000,000	2,734,239	0	2,592,603
Wellspring Capital Partners VI, L.P.	12,000,000	3,402,317	0	3,169,101
Total Plymouth County - PE	**198,067,465**	**103,809,412**	**75,340,068**	**54,019,860**

Note: The adjusted value is based on March 31, 2019 FMV adjusted for subsequent cash flows.

Real Assets	Commitment	Total Contributions	Total Distributions	Adjusted Value
Basalt Infrastructure Partners II *	10,000,000	6,500,879	49,561	6,374,650
BTG Pactual Global Timberland Resources Fund, LLC	4,338,966	5,043,536	229,998	3,043,232
Global Infrastructure Partners III, L.P.	10,000,000	8,343,667	788,954	8,407,375
IFM Global Infrastructure (US), L.P.	20,000,000	20,000,000	119,615	21,727,505
JPMorgan Global Maritime Investment	10,000,000	9,186,014	938,504	6,344,048
Timbervest Partners III, L.P. *	5,000,000	5,000,000	1,179,000	5,092,342
Total Plymouth County - RA	**59,338,966**	**54,074,095**	**3,305,633**	**50,989,152**

Real Estate	Commitment	Total Contributions	Total Distributions	Adjusted Value
1921 Realty, Inc. *	5,000,000	5,378,194	0	765,556
AEW Partners Real Estate Fund VIII, L.P.	25,000,000	13,762,297	2,840,603	11,622,503
Berkshire Value Fund V, L.P.	9,000,000	0	0	0
Carlyle Realty Partners VIII, L.P.	18,000,000	2,756,156	1,650	2,309,686
DSF Capital Partners IV, L.P.	5,000,000	5,000,000	5,997,885	16,359
DSF Multi-Family Real Estate Fund III, L.P.	15,000,000	15,499,746	1,229,341	15,344,826
Invesco Equity Real Estate Securities Trust	22,000,000	23,908,825	44,000,000	781,121
JPMorgan Strategic Property	27,000,000	27,000,000	0	27,325,080
New Boston Institutional Fund VII, L.P.	5,000,000	3,012,998	3,893,905	124,296
Real Estate International Partnership Fund I, L.P.	15,000,000	12,674,617	10,772,161	2,189,009
Rockpoint Real Estate Fund VI, L.P.	9,000,000	0	0	0
TA Realty Core Property Fund, L.P.	25,000,000	25,000,000	322,844	27,153,280
Total Plymouth County - RE	**180,000,000**	**133,992,834**	**69,058,389**	**87,631,716**

* The adjusted value is based on December 31, 2018 FMV adjusted for subsequent cash flows.

Note: The values for Invesco Equity Real Estate Securities Trust, IFM Global Infrastructure and JPMorgan Strategic Property are as of July 31, 2019.

Rebalancing Recommendation

Rebalancing Recommendation

- As discussed at the August Board Meeting, we recommend moving to target in international developed equities, core bonds, real estate, and infrastructure as described below.
- Specifically, we recommend moving:
  - 5% out of international developed equities (currently 11% invested vs. 6% target), using KBI and HGK as the primary funding sources ($50 million).
  - 1.5% into core bonds (currently 8% invested vs. 9% target in core bonds), going into IR&M ($15 million).
  - 2% into core real estate (currently 8% invested vs. 10% target), to be split between JP Morgan and TA Realty ($10 million each).
  - 1.5% into core infrastructure (currently 5% invested in real assets vs. 6% target), to be invested with IFM ($15 million).

Appendices

Asset Allocation Review and Risk Analysis

Introduction

- This document evaluates Plymouth County Retirement Association's asset allocation policy and compares it to the current allocation, PRIT's current target allocation, and the median allocation of the public defined benefit peer group[1].
- We provide various approaches to assessing risk in order to provide a "mosaic" of the risks faced by the Association.
- The goal of this review is not to declare one policy the "right" choice or the only prudent choice, but to highlight the risk and return tradeoffs of different policy portfolios.
- The asset allocation review process highlights the natural tension between long-term goals and short-term risks, and should allow the Association to make more informed decisions regarding portfolio positioning.

[1] Public Defined Benefit Peer group represents the InvMetrics Public DB Net Universe as of June 30, 2019. Includes 241 observations.

Asset Allocation Overview

Asset Allocation

What is Asset Allocation?

- Asset allocation refers to the distribution of assets across a number of asset classes that exhibit different correlations with each other. Each asset class exhibits a unique combination of risk and reward. The expected and realized long-term returns vary by asset class, as does the interim volatility of those returns. Some asset classes, like equities, exhibit high degrees of volatility, but also offer high returns over time. Other asset classes, like cash, experience very little volatility, but offer limited return potential.

Why is Asset Allocation important?

- The distribution of assets across various asset classes exerts a major influence on the return behavior of the aggregate pool over short and long time periods.

How does Asset Allocation affect aggregate performance?

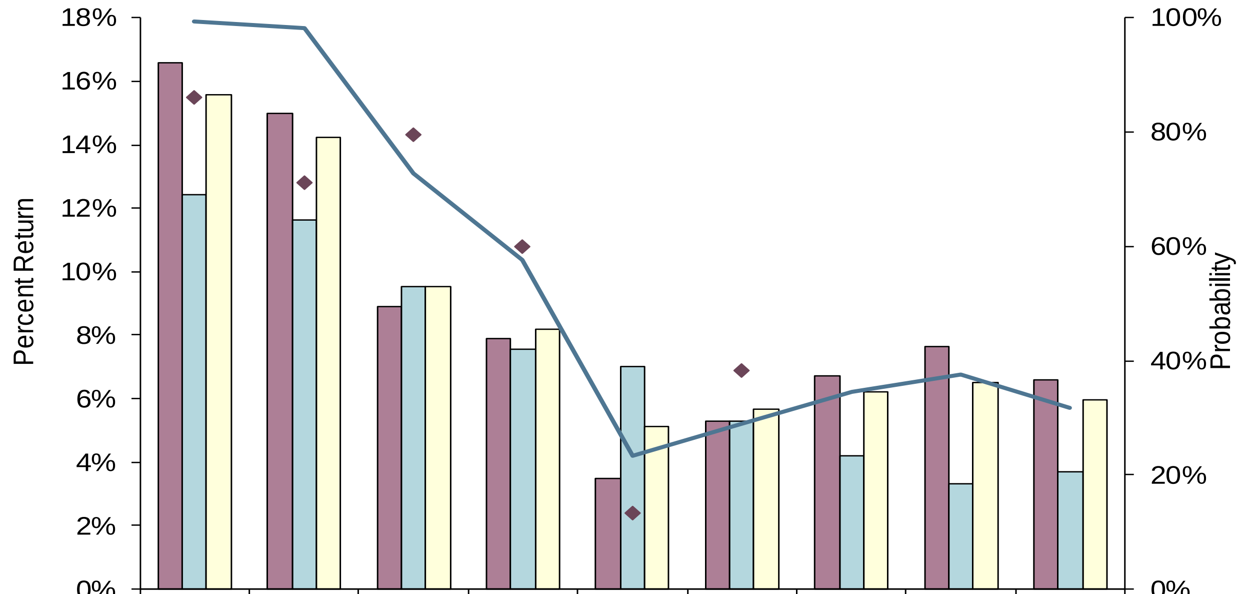
- In addition to exhibiting unique characteristics, each asset class interacts differently with other asset classes. Because of low correlations, the likelihood that any two asset classes will move together in the same direction is limited, with the movement of one asset class often offsetting another's. Combining asset classes allows investors to control more fully the aggregate risk and return of their portfolios, and to benefit from the reduction in volatility that stems from diversification.

Asset Allocation Review Process

- Review the current asset allocation and policy targets and how they compare to PRIT's current target allocation and the median allocation of the public defined benefit peer group[1].
- Analyze the expected returns and risk that accompany each portfolio, and revisit whether the current positioning is appropriate for the financial position of the Association.
- Accept equity risk as means of achieving an acceptable long-term return, or consider lower returns and higher contributions that come with less equity risk.
- Understand the risks in a portfolio predominantly invested in equities and equity-like assets.

[1] Public Defined Benefit Peer group represents the InvMetrics Public DB Net Universe as of June 30, 2019. Includes 241 observations.

The Secular Decline in Investment Returns[1]



	1980	1985	1990	1995	2000	2005	2010	2015	2019
Equity Expected Return	16.6%	15.0%	8.9%	7.9%	3.5%	5.3%	6.7%	7.6%	6.6%
Bond Expected Return	12.4%	11.6%	9.6%	7.6%	7.0%	5.3%	4.2%	3.3%	3.7%
65/35 Eq/Bond Exp. Ret.	15.6%	14.2%	9.5%	8.2%	5.1%	5.7%	6.2%	6.5%	6.0%
Actual 10-year Return	15.5%	12.8%	14.3%	10.8%	2.4%	6.9%			
Probability of earning 7.5%	99%	98%	73%	58%	23%	29%	35%	38%	32%

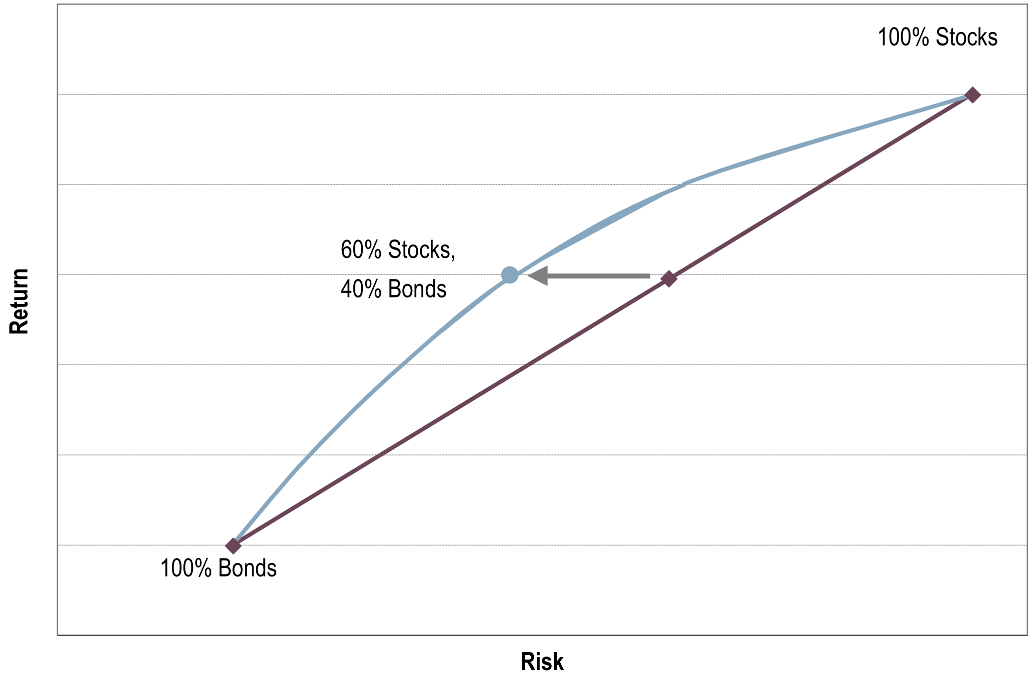
- The chart above illustrates that a portfolio comprising of 65% domestic stocks and 35% investment grade bonds has produced diminishing expected returns as well as actual returns over the past 30 years.

[1] Expected return assumptions for 1) Bonds equals the yield of the ten-year Treasury plus 100 basis points, and 2) Equities equals the dividend yield plus the earnings yield of the S&P 500 index (using the inflation-adjusted trailing 10-year earnings). Probability calculation is for the subsequent ten years.

Mean Variance Optimization

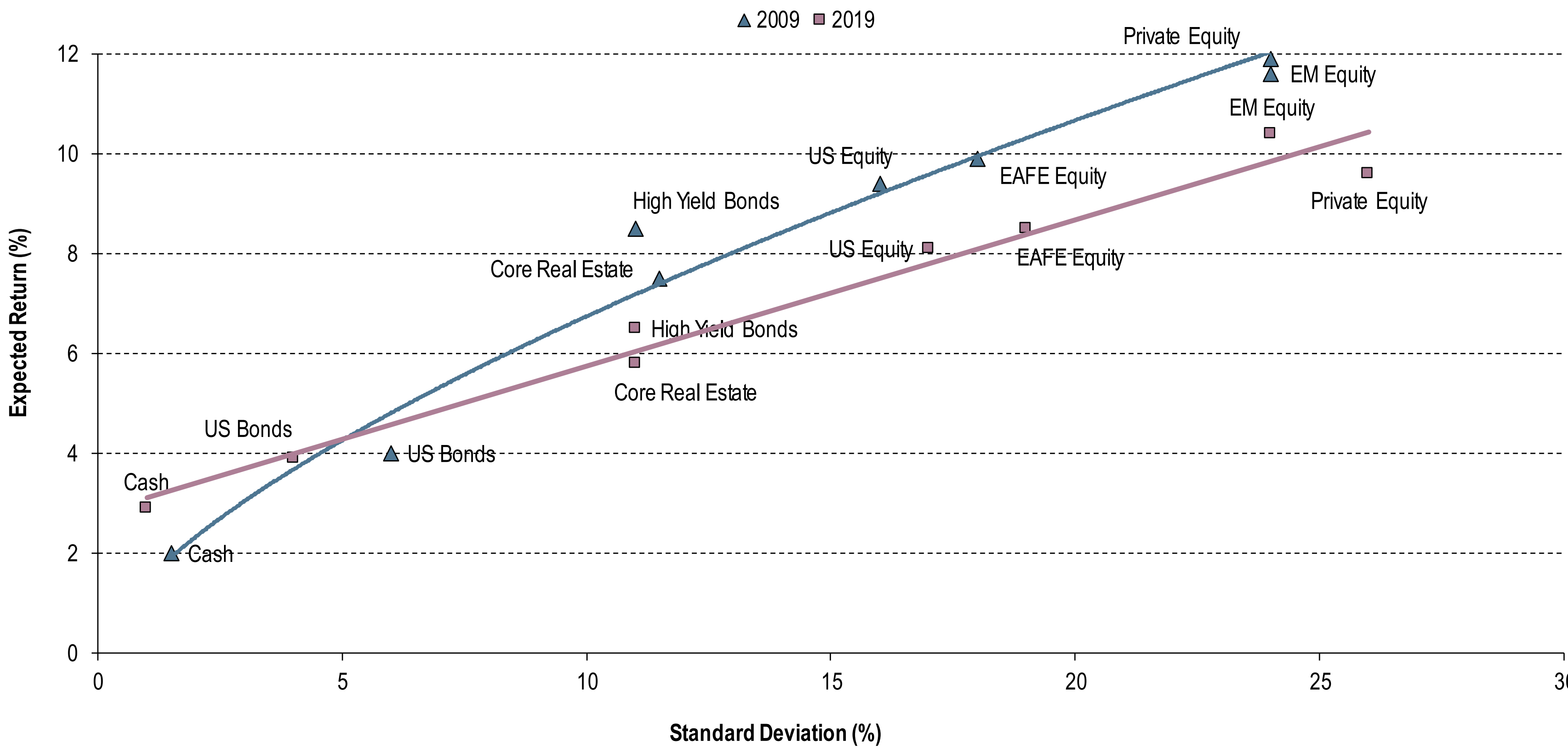
- MVO is the traditional starting point for determining asset allocation.
- MVO mathematically determines an “efficient frontier” of policy portfolios with the highest risk-adjusted returns.
- All asset classes exhibit only three characteristics, which serve as inputs to the model:
  - Expected return
  - Expected volatility
  - Expected covariance with all other assets
- The model assumes:
  - Normal return distribution
  - Stable volatility and covariances over time
  - Returns are not serially correlated
- The MVO model tends to underestimate the risks of large negative events.

The Efficient Frontier



- Combining uncorrelated assets produces an “efficient frontier.” Different combinations of assets (e.g., 60% stocks & 40% bonds) will lie along this efficient frontier.
- By combining assets that are not highly correlated with each other, the Fund can produce a higher return for a given level of risk than it could by investing in perfectly correlated assets. Alternatively, it can experience lower risk for a given level of return.

Investable Universe over Time: Less Return for the Same or More Risk[1]



- A positive relationship exists between long-term return expectations and the level of risk accepted.
- However, this relationship is not static.

[1] Expected return and standard deviation are based upon Meketa Investment Group's Annual Asset Study.

Current Policy Comparison

Asset Allocation Comparison[1]

	PCRA Policy (%)	PCRA Current (%)	PRIT (%)	Public DB[2] (%)
Equities	**65**	**61**	**52**	**60**
US Equity	26	23	13	28
Developed Market Equity (non-US)	6	12	13	7
Emerging Market Equity	10	11	5	5
Global Equity	10	10	0	12
Long-Short	0	0	8	0
Private Equity	13	5	13	8
Credit	**6**	**9**	**8**	**3**
High Yield Bonds / Bank Loans	4	6	5	0
Distressed Debt	0	0	2	0
Emerging Market Bonds	2	3	2	3
Rate Sensitive	**9**	**10**	**15**	**20**
Short-term Investment Grade Bonds / Cash	2	4	2	0
Investment Grade Bonds	5	6	6	20
Long-term Strips	0	0	3	0
TIPS	2	0	4	0
Real Assets	**16**	**14**	**14**	**12**
Real Estate	10	9	10	9
Natural Resources / Timber	2	2	4	3
Core Infrastructure	4	3	0	0
Hedge Funds	**4**	**6**	**11**	**5**
Expected Return (20 years)	*8.58*	*8.20*	*7.65*	*7.88*
Standard Deviation	*14.4*	*13.5*	*11.6*	*12.6*
Probability of Achieving 7.88% over 20 Years	*58.3*	*53.8*	*46.1*	*49.6*

[1] Expected return and standard deviation are based upon Meketa Investment Group's 2019 Annual Asset Study. Throughout this document, returns for periods longer than one year are annualized.
[2] Public Defined Benefit Peer group represents the InvMetrics Public DB Net Universe as of June 30, 2019. Includes 241 observations

Review of Asset Allocation Comparison

- In revisiting the Association's current portfolio and current targets, it may make sense to evaluate in the context of both the PRIT and public peers.
- While it is smart to be aware of how peers are allocated, it is also imperative to be mindful that peers have different constraints and objectives than the Plymouth County Retirement Association.
- From the above data, we can conclude that PRIT is positioned rather defensively, with the lowest expected return and lowest standard deviation amongst the four portfolios.
  - PCRA's policy produces the highest expected return and standard deviation.
- Note that the peer average is constantly changing as other Systems make changes to their asset allocation targets. Each fund in the peer group is unique and differs in some way from the average of the peer group.
  - Over the past five years, we observe some general trends in the peer group data:
    - A slight decrease in developed non-US equity exposure, offset by an increase in emerging market equity exposure.
    - Fixed income has decreased slightly.
    - The use of private equity has increased.
    - Hedge funds and GTAA strategies have declined.
- The following pages provide an in-depth analysis on factors to consider while evaluating the Association's policy targets and current portfolio.

Diversification and Risk Analysis

Diversification

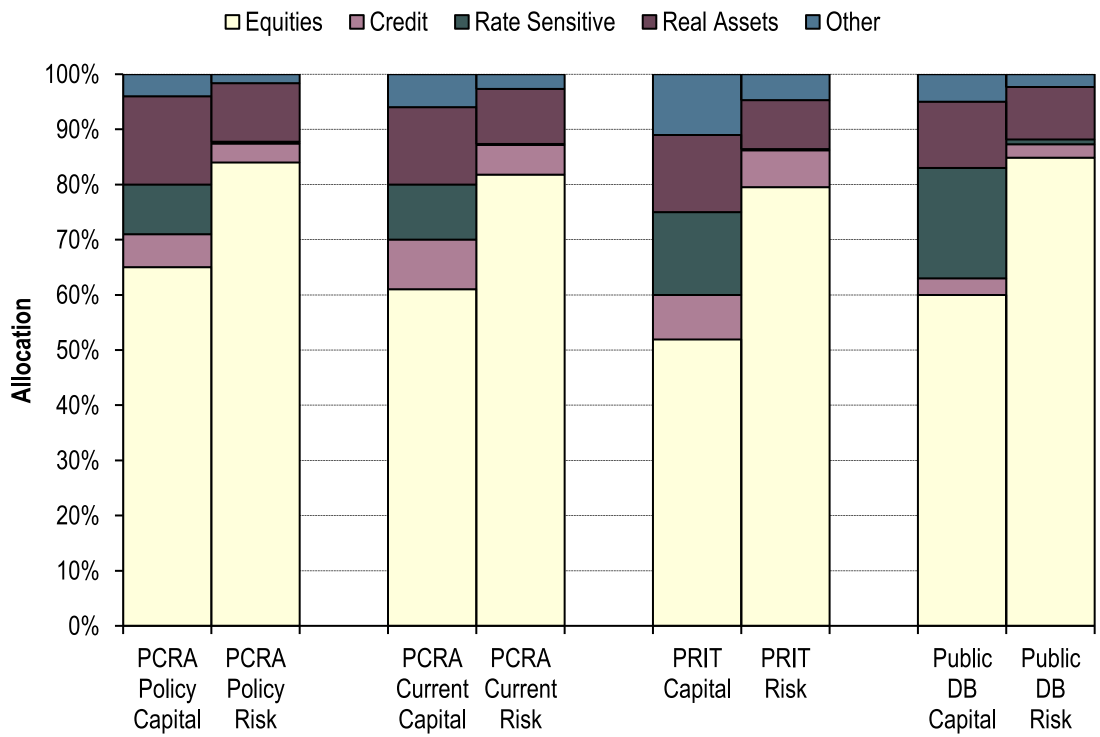
- The primary motive for diversifying a portfolio is to reduce risk.
- Diversification is the sole "free lunch" available to investors. That is, it represents the only way to reduce risk without reducing expected returns.
- Therefore, investments should be allocated across multiple classes of assets, based in part on the expected correlation of their returns.
- Within each asset type, investments should be distributed across strategies and risk factors to further reduce volatility.

Types of Risk Analysis Addressed

- Risk budgeting[1]
  - Attributes overall portfolio risks to specific asset classes
  - Highlights the source and scale of portfolio-level risk
- MVO-based risk analytics
  - Includes worst-case return expectations and Value at Risk (VaR)[2]
  - Relies on assumptions underlying MVO
- Scenario analysis
  - Stress tests policy portfolios using actual historical examples
  - Stress tests policy portfolios under specific hypothetical scenarios

[1] Risk budgeting seeks to decompose the aggregate risk of a portfolio into different sources (in this case, by asset class), with risk defined as standard deviation.
[2] VaR is a risk measure that estimates the maximum loss on a portfolio over a given time horizon and a given confidence level (usually 95% or 99%).

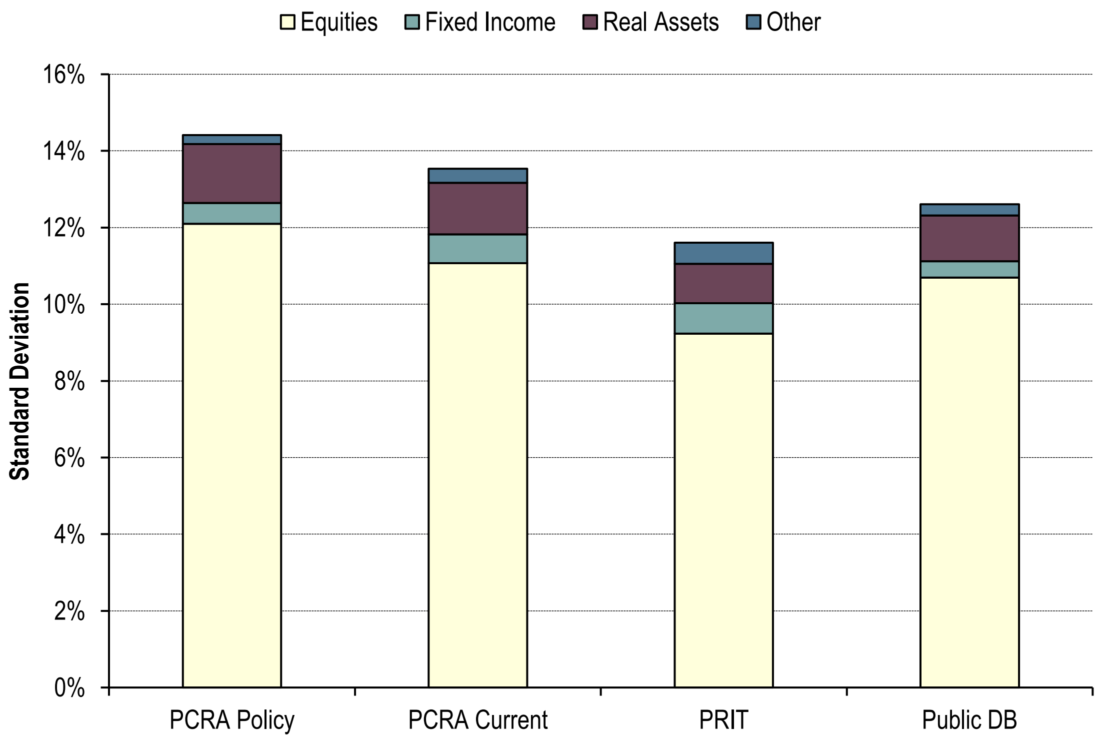
Risk Budgeting Analysis[1]
(Capital Allocation vs. Risk Allocation)



- Assets with low relative volatility, such as rate sensitive fixed income, contribute less to risk than their asset weighting implies.

[1] Other includes Hedge Funds. Risk allocation is calculated by multiplying the weight of the asset class by its standard deviation and its correlation with the total portfolio and then dividing this by the standard deviation of the total portfolio.

Risk Budgeting Analysis[1]
(Absolute Contribution to Risk)



- In each policy option, equity risk dominates the risk profile of the portfolio.

[1] Contribution to risk is calculated by multiplying the weight of the asset class by its standard deviation and its correlation with the total portfolio.

MVO-Based Risk Analysis

Scenario:	PCRA Policy (%)	PCRA Current (%)	PRIT (%)	Public DB (%)
Worst Case Returns (1)				
One Year	-20.0	-18.9	-16.1	-17.6
Three Years (annualized)	-9.0	-8.4	-6.8	-7.7
Five Years (annualized)	-5.3	-4.9	-3.7	-4.4
Ten Years (annualized)	-1.4	-1.2	-0.5	-1.0
Twenty Years (annualized)	1.4	1.4	1.8	1.5
Probability of Experiencing Negative Returns				
One Year	26.6	26.3	24.6	25.7
Three Years	13.9	13.6	11.7	12.9
Five Years	8.1	7.8	6.2	7.2
Ten Years	2.4	2.2	1.5	2.0
Twenty Years	0.3	0.2	0.1	0.2
Probability of Achieving at least an 7.88% Return				
One Year	51.9	50.9	49.1	49.9
Three Years	53.2	51.5	48.5	49.8
Five Years	54.2	51.9	48.0	49.8
Ten Years	55.9	52.7	47.2	49.7
Twenty Years	58.3	53.8	46.1	49.6

- PRIT is structured to be the most defensive portfolio. However, it is the least likely to reach the Association's target return over the long term.

Value at Risk[1]

Scenario	PCRA Policy	PCRA Current	PRIT	Public DB
VaR (%):				
1 month	-8.9	-8.4	-7.1	-7.8
3 months	-14.5	-13.6	-11.5	-12.6
6 months	-19.1	-17.9	-15.1	-16.6

Conditional Value at Risk[1]

Scenario	PCRA Policy	PCRA Current	PRIT	Public DB
CVaR (%):				
1 month	-10.3	-9.7	-8.2	-9.0
3 months	-16.8	-15.8	-13.4	-14.7
6 months	-22.4	-21.0	-17.8	-19.5

- According to the VaR model, the Association could lose up to 8.9% in a single month, based on the current policy targets.

[1] Calculated with a 99% confidence level and based upon Meketa Investment Group's Annual Asset Study. cVaR represents the average loss past the 99th percentile.

Historical Negative Scenario Analysis[1]
(*Cumulative* Return)

Scenarios	PCRA Policy (%)	PCRA Current (%)	PRIT (%)	Public DB (%)
Taper Tantrum (May - Aug 2013)	-0.1	-0.9	-0.5	-0.5
Global Financial Crisis (Oct 2007 - Mar 2009)	-33.1	-34.0	-22.8	-29.6
2008 Calendar Year	-29.5	-30.1	-21.3	-25.7
Popping of the TMT Bubble (Apr 2000 - Sep 2002)	-16.8	-17.9	-8.3	-17.1
LTCM (Jul - Aug 1998)	-10.5	-11.2	-6.9	-10.1
Asian Financial Crisis (Aug 1997 - Jan 1998)	1.0	-1.2	3.8	1.5
Rate spike (1994 Calendar Year)	2.2	1.7	3.0	1.6
Crash of 1987 (Sep - Nov 1987)	-13.9	-14.4	-7.9	-13.9
Strong dollar (Jan 1981 - Sep 1982)	0.2	-0.5	4.2	3.1
Stagflation (Jan - Mar 1980)	-3.7	-3.7	-3.9	-4.7
Stagflation (Jan 1973 - Sep 1974)	-25.7	-25.6	-18.8	-23.1

- The PRIT portfolio would have performed the best in environments of declining equity markets, due to its more conservative positioning.
- The public DB Median portfolio would have fared the worst during periods of rising rates; however, the losses in these environments are dwarfed by the losses during an equity downturn.

[1] See the Appendix for our scenario inputs. In periods where the ideal benchmark was not yet available we used the next closest benchmark(s) as a proxy.

Historical Positive Scenario Analysis[1]
(Cumulative Return)

Scenarios	PCRA Policy (%)	PCRA Current (%)	PRIT (%)	Public DB (%)
Global Financial Crisis Recovery (Mar 2009 - Nov 2009)	39.6	42.1	27.3	37.9
Best of Great Moderation (Apr 2003 - Feb 2004)	33.5	34.9	26.0	30.7
Peak of the TMT Bubble (Oct 1998 - Mar 2000)	49.9	46.5	56.9	42.5
Pre-Recession (Jun - Oct 1990)	-6.8	-7.2	-2.2	-5.8
Plummeting Dollar (Jan 1986 - Aug 1987)	59.1	66.0	47.9	58.7
Volcker Recovery (Aug 1982 - Apr 1983)	34.4	34.0	25.7	36.5
Bretton Wood Recovery (Oct 1974 - Jun 1975)	32.5	32.4	23.3	32.2

- PCRA's current portfolio would have captured most of the upside in strongly positive markets.

[1] See the Appendix for our scenario inputs. In periods where the ideal benchmark was not yet available we used the next closest benchmark(s) as a proxy.

Stress Testing: Impact of Market Movements (Expected Return under Stressed Conditions)[1]

Scenarios	PCRA Policy (%)	PCRA Current (%)	PRIT (%)	Public DB (%)
10-year Treasury Bond rates rise 100 bps	6.2	6.0	4.4	5.2
10-year Treasury Bond rates rise 200 bps	3.7	4.0	1.3	2.1
10-year Treasury Bond rates rise 300 bps	1.9	2.3	-1.8	0.1
Baa Spreads widen by 50 bps, High Yield by 200 bps	-0.7	-1.2	0.4	-0.5
Baa Spreads widen by 300 bps, High Yield by 1000 bps	-23.9	-24.2	-18.1	-21.6
Trade Weighted Dollar gains 10%	-2.1	-2.6	-0.7	-1.2
Trade Weighted Dollar gains 20%	-2.5	-3.4	-1.0	-1.9
U.S. Equities decline 10%	-6.7	-6.6	-4.9	-6.0
U.S. Equities decline 25%	-18.3	-18.1	-13.6	-16.7
U.S. Equities decline 40%	-30.4	-30.7	-22.4	-28.0

- Each portfolio has a different sensitivity to four major risk factors: interest rates, credit spreads, currency fluctuations, and equity values.
- The Association's primary risk factors would continue to be an equity market decline and a widening of credit spreads, no matter the policy.

[1] Assumes that assets not directly exposed to the factor are affected nonetheless. See the Appendix for further details.

Stress Testing: Impact of Positive Market Movements (Expected Return under Stressed Conditions)[1]

Scenarios	PCRA Policy (%)	PCRA Current (%)	PRIT (%)	Public DB (%)
10-year Treasury Bond rates drop 100 bps	5.4	4.8	6.2	5.9
10-year Treasury Bond rates drop 200 bps	15.2	15.0	14.6	16.1
Baa Spreads narrow by 30bps, High Yield by 100 bps	9.0	8.7	7.4	8.4
Baa Spreads narrow by 100bps, High Yield by 300 bps	16.4	16.9	13.0	15.0
Trade Weighted Dollar drops 10%	7.8	8.2	6.8	7.3
Trade Weighted Dollar drops 20%	20.5	20.9	17.6	19.8
U.S. Equities rise 10%	7.9	7.5	6.8	7.4
U.S. Equities rise 30%	19.6	19.0	15.1	19.0

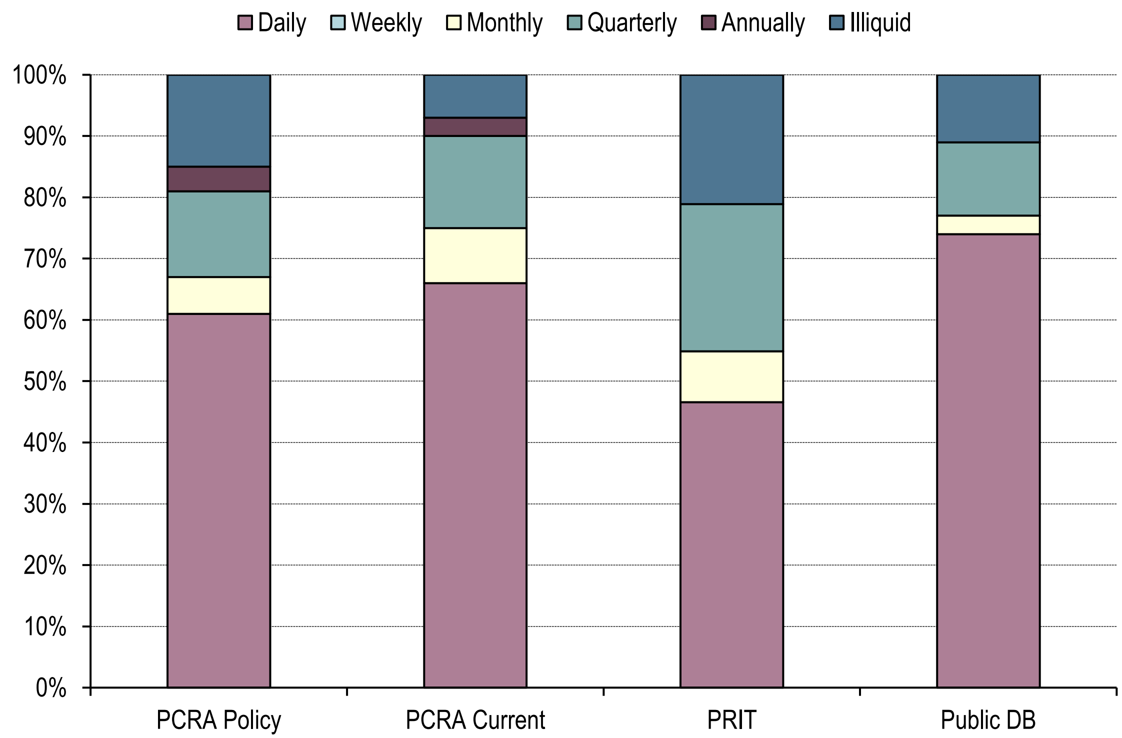
- The portfolio with the least downside risk is likewise the portfolio that participates least in upside scenarios.

[1] Assumes that assets not directly exposed to the factor are affected nonetheless. See the Appendix for further details.

Liquidity Analysis

- Liquidity risk is a meaningful risk that is generally not captured in traditional asset allocation processes.
- The Association must maintain adequate liquidity to satisfy benefit payments and to avoid having to sell illiquid assets at distressed prices if possible.

Liquidity Profile[1]



- PCRA's Policy has at least 60% allocated to daily-liquid assets.

[1] For this analysis, we assume that emerging market debt provides monthly liquidity; core real estate and core infrastructure provide quarterly liquidity; and private equity, opportunistic debt, non-core real estate, and non-core infrastructure are illiquid.

Recommendations

Considerations

- Meketa Investment Group has no recommendations related to the Association's investment policy targets.
- We do recommend the Board considers the Association's current policy and positioning compared to peers in order to ensure that the portfolio is in line with both the Association's current goals and constraints.

Appendices

Horizon Study

- Annually, Horizon Actuarial Services, LLC publishes a survey of capital market assumptions that they collect from various investment advisors.
  - In the 2019[1] survey there were 34 respondents.
- The Horizon survey is a useful tool for Board members to determine whether their consultant's expectations for returns (and risk) are reasonable.

Asset Class	10-Year Average (%)	20-Year Average (%)	MIG 20-Year (%)
U.S. Equity (large cap)	6.0	7.1	8.1
Non-U.S. – Developed	6.8	7.7	8.5
Non-U.S. – Emerging	7.8	8.7	10.4
U.S. Corporate Bonds – Core	3.6	4.3	4.6
U.S. Corporate Bonds – High Yield	5.1	5.8	6.5
Non-U.S. Debt – Developed	2.6	3.4	2.3
Non-U.S. Debt – Emerging	5.6	6.1	5.3
U.S. Treasuries (cash)	2.7	3.0	2.9
TIPS	3.1	3.5	3.6
Real Estate	5.8	6.8	7.0
Hedge Funds	5.3	6.2	5.4
Commodities	3.9	4.7	5.0
Infrastructure	6.8	7.2	6.5
Private Equity	9.0	10.1	10.1
Private Debt	7.4	7.8	7.3
Inflation	2.2	2.3	2.6

[1] The 10-year horizon includes all 34 respondents and the 20-year horizon includes 16 respondents.

Notes and Disclaimers

[1] The returns shown in the Policy Options and Risk Analysis sections rely on estimates of expected return, standard deviation, and correlation developed by Meketa Investment Group. To the extent that actual return patterns to the asset classes differ from our expectations, the results in the table will be incorrect. However, our inputs represent our best unbiased estimates of these simple parameters.

[2] The returns shown in the Policy Options and Risk Analysis sections use a lognormal distribution, which may or may not be an accurate representation of each asset classes' future return distribution. To the extent that it is not accurate in whole or in part, the probabilities listed in the table will be incorrect. As an example, if some asset classes' actual distributions are even more right-skewed than the lognormal distribution (i.e., more frequent low returns and less frequent high returns), then the probability of the portfolio hitting a given annual return will be lower than that stated in the table.

[3] The standard deviation bars in the chart in the Risk Analysis section do not indicate the likelihood of a 1, 2, or 3 standard deviation event—they simply indicate the return we expect if such an event occurs. Since the likelihood of such an event is the same across allocations regardless of the underlying distribution, a relative comparison across policy choices remains valid.

Scenario Return Inputs

Asset Class	Benchmark Used
Investment Grade Bonds	Barclays Aggregate
TIPS	Barclays U.S. TIPS
Intermediate-term Government Bonds	Barclays Treasury Intermediate
Long-term Government Bonds	Barclays Long U.S. Treasury
EM Bonds (local)	JPM GBI-EM Global Diversified Composite
Bank Loans	CSFB Leveraged Loan
High Yield Bonds	Barclays High Yield
Direct Lending - First Lien	Cliffwater Direct Lending Index
Direct Lending - Second Lien	Cliffwater Direct Lending Index
Mezzanine Debt	Cambridge Associates Mezzanine
Distressed Debt	Cambridge Associates Distressed Debt Index
Core Real Estate	NCREIF Property
Value-Added RE	NCREIF Townsend Value Added
Opportunistic RE	NCREIF Townsend Opportunistic
REITs	NAREIT Equity
Infrastructure (private)	S&P Global Infrastructure
Natural Resources (private)	S&P Global Natural Resources
Timber	NCREIF Timberland
Commodities	Bloomberg Commodity Index
U.S. Equity	Russell 3000
Public Foreign Equity (Developed)	MSCI EAFE
Public Foreign Equity (Emerging)	MSCI Emerging Markets
Private Equity	Cambridge Associates Private Equity Composite
Long-short Equity	HFRI Equity Hedge
Global Macro	HFRI Macro
Hedge Funds	HFRI Fund Weighted Composite
Private Debt	Weighted average of Distressed Debt, Mezzanine Debt and Direct Lending (2nd Lien)

Meketa Investment Group 2019 Annual Asset Study
Twenty-Year Annualized Return and Volatility Expectations for Major Asset Classes

Asset Class	Annualized Compounded Return (%)	Annualized Average Return (%)	Annualized Standard Deviation (%)
Rate Sensitive			
Cash Equivalents	2.9	2.9	1.0
Investment Grade Bonds	3.9	4.0	4.0
Long-term Government Bonds	3.7	4.4	12.0
TIPS	3.6	3.8	7.0
Credit			
High Yield Bonds	6.5	7.1	11.0
Bank Loans	6.1	6.5	9.0
Emerging Market Bonds (major; unhedged)	5.2	5.8	11.0
Emerging Market Bonds (local; unhedged)	5.3	6.3	14.0
Direct Lending - First Lien	6.7	7.3	11.0
Direct Lending - Second Lien	7.9	9.0	15.0
Mezzanine Debt	7.2	8.3	15.0
Distressed Debt	7.3	9.3	20.0
Equities			
Public U.S. Equity	8.1	9.5	17.0
Public Developed Market Equity	8.5	10.3	19.0
Public Emerging Market Equity	10.4	13.3	24.0
Private Equity Composite	10.1	13.5	26.0
Real Assets			
REITs	7	10.4	26.0
Core Private Real Estate	5.8	6.4	11.0
Value Added Real Estate	7.5	9.1	18.0
Opportunistic Real Estate	9.1	12.0	24.0
High Yield Real Estate Debt	6.8	8.4	18.0
Natural Resources (Private)	9.5	11.7	21.0
Commodities	5	6.4	17.0
Infrastructure (Core)	6.5	7.5	14.0
Infrastructure (Non-Core)	8.8	11.2	22.0
Other			
Hedge Funds	5.4	5.7	7.0

Meketa Investment Group 2019 Annual Asset Study: Correlation Expectations

	Investment Grade Bonds	TIPS	High Yield Bonds	U.S. Equity	Developed Market Equity	Emerging Market Equity	Private Equity	Real Estate	Natural Resources (private)	Commodities	Core Infrastructure (private)	Hedge Funds
Investment Grade Bonds	1.00											
TIPS	0.80	1.00										
High Yield Bonds	0.20	0.30	1.00									
U.S. Equity	0.05	0.00	0.70	1.00								
Developed Market Equity	0.05	0.15	0.70	0.90	1.00							
Emerging Market Equity	0.05	0.15	0.70	0.80	0.90	1.00						
Private Equity	0.05	0.05	0.65	0.85	0.80	0.75	1.00					
Real Estate	0.20	0.10	0.50	0.50	0.45	0.40	0.45	1.00				
Natural Resources (private)	0.10	0.10	0.45	0.65	0.60	0.60	0.55	0.45	1.00			
Commodities	0.05	0.30	0.40	0.35	0.55	0.60	0.30	0.15	0.65	1.00		
Core Infrastructure (private)	0.30	0.30	0.60	0.55	0.55	0.50	0.45	0.60	0.60	0.35	1.00	
Hedge Funds	0.05	0.20	0.70	0.80	0.85	0.85	0.65	0.45	0.65	0.65	0.60	1.00

Disclaimer, Glossary, and Notes

Disclaimer

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PERFORMANCE DATA CONTAINED HEREIN REPRESENT PAST PERFORMANCE. PAST PERFORMANCE IS NO GUARANTEE OF FUTURE RESULTS.

Credit Risk: Refers to the risk that the issuer of a fixed income security may default (i.e., the issuer will be unable to make timely principal and/or interest payments on the security.)

Duration: Measure of the sensitivity of the price of a bond to a change in its yield to maturity. Duration summarizes, in a single number, the characteristics that cause bond prices to change in response to a change in interest rates. For example, the price of a bond with a duration of three years will rise by approximately 3% for each 1% decrease in its yield to maturity. Conversely, the price will decrease 3% for each 1% increase in the bond's yield. Price changes for two different bonds can be compared using duration. A bond with a duration of six years will exhibit twice the percentage price change of a bond with a three-year duration. The actual calculation of a bond's duration is somewhat complicated, but the idea behind the calculation is straightforward. The first step is to measure the time interval until receipt for each cash flow (coupon and principal payments) from a bond. The second step is to compute a weighted average of these time intervals. Each time interval is measured by the present value of that cash flow. This weighted average is the duration of the bond measured in years.

Information Ratio: This statistic is a measure of the consistency of a portfolio's performance relative to a benchmark. It is calculated by subtracting the benchmark return from the portfolio return (excess return), and dividing the resulting excess return by the standard deviation (volatility) of this excess return. A positive information ratio indicates outperformance versus the benchmark, and the higher the information ratio, the more consistent the outperformance.

Jensen's Alpha: A measure of the average return of a portfolio or investment in excess of what is predicted by its beta or "market" risk. Portfolio Return- [Risk Free Rate+Beta*(market return-Risk Free Rate)].

Market Capitalization: For a firm, market capitalization is the total market value of outstanding common stock. For a portfolio, market capitalization is the sum of the capitalization of each company weighted by the ratio of holdings in that company to total portfolio holdings; thus it is a weighted-average capitalization. Meketa Investment Group considers the largest 65% of the broad domestic equity market as large capitalization, the next 25% of the market as medium capitalization, and the smallest 10% of stocks as small capitalization.

Market Weighted: Stocks in many indices are weighted based on the total market capitalization of the issue. Thus, the individual returns of higher market-capitalization issues will more heavily influence an index's return than the returns of the smaller market-capitalization issues in the index.

Maturity: The date on which a loan, bond, mortgage, or other debt/security becomes due and is to be paid off.

Prepayment Risk: The risk that prepayments will increase (homeowners will prepay all or part of their mortgage) when mortgage interest rates decline; hence, investors' monies will be returned to them in a lower interest rate environment. Also, the risk that prepayments will slow down when mortgage interest rates rise; hence, investors will not have as much money as previously anticipated in a higher interest rate environment. A prepayment is any payment in excess of the scheduled mortgage payment.

Price-Book Value (P/B) Ratio: The current market price of a stock divided by its book value per share. Meketa Investment Group calculates P/B as the current price divided by Compustat's quarterly common equity. Common equity includes common stock, capital surplus, retained earnings, and treasury stock adjusted for both common and nonredeemable preferred stock. Similar to high P/E stocks, stocks with high P/B's tend to be riskier investments.

Price-Earnings (P/E) Ratio: A stock's market price divided by its current or estimated future earnings. Lower P/E ratios often characterize stocks in low growth or mature industries, stocks in groups that have fallen out of favor, or stocks of established blue chip companies with long records of stable earnings and regular dividends. Sometimes a company that has good fundamentals may be viewed unfavorably by the market if it is an industry that is temporarily out of favor. Or a business may have experienced financial problems causing investors to be skeptical about is future. Either of these situations would result in lower relative P/E ratios. Some stocks exhibit above-average sales and earnings growth or expectations for above average growth. Consequently, investors are willing to pay more for these companies' earnings, which results in elevated P/E ratios. In other words, investors will pay more for shares of companies whose profits, in their opinion, are expected to increase faster than average. Because future events are in no way assured, high P/E stocks tend to be riskier and more volatile investments. Meketa Investment Group calculates P/E as the current price divided by the I/B/E/S consensus of twelve-month forecast earnings per share.

Quality Rating: The rank assigned a security by such rating services as Fitch, Moody's, and Standard & Poor's. The rating may be determined by such factors as (1) the likelihood of fulfillment of dividend, income, and principal payment of obligations; (2) the nature and provisions of the issue; and (3) the security's relative position in the event of liquidation of the company. Bonds assigned the top four grades (AAA, AA, A, BBB) are considered investment grade because they are eligible bank investments as determined by the controller of the currency.

Sharpe Ratio: A commonly used measure of risk-adjusted return. It is calculated by subtracting the risk free return (usually three-month Treasury bill) from the portfolio return and dividing the resulting excess return by the portfolio's total risk level (standard deviation). The result is a measure of return per unit of total risk taken. The higher the Sharpe ratio, the better the fund's historical risk adjusted performance.

Standard Deviation: A measure of the total risk of an asset or a portfolio. Standard deviation measures the dispersion of a set of numbers around a central point (e.g., the average return). If the standard deviation is small, the distribution is concentrated within a narrow range of values. For a normal distribution, about two thirds of the observations will fall within one standard deviation of the mean, and 95% of the observations will fall within two standard deviations of the mean.

STIF Account: Short-term investment fund at a custodian bank that invests in cash-equivalent instruments. It is generally used to safely invest the excess cash held by portfolio managers.

Style: The description of the type of approach and strategy utilized by an investment manager to manage funds. For example, the style for equities is determined by portfolio characteristics such as price-to-book value, price-to-earnings ratio, and dividend yield. Equity styles include growth, value, and core.

Yield to Maturity: The yield, or return, provided by a bond to its maturity date; determined by a mathematical process, usually requiring the use of a "basis book." For example, a 5% bond pays $5 a year interest on each $100 par value. To figure its current yield, divide $5 by $95—the market price of the bond—and you get 5.26%. Assume that the same bond is due to mature in five years. On the maturity date, the issuer is pledged to pay $100 for the bond that can be bought now for $95. In other words, the bond is selling at a discount of 5% below par value. To figure yield to maturity, a simple and approximate method is to divide 5% by the five years to maturity, which equals 1% pro rata yearly. Add that 1% to the 5.26% current yield, and the yield to maturity is roughly 6.26%.

$$\frac{\text{5\% (discount)}}{\text{5 (yrs. to maturity)}} = \begin{array}{c}\text{1\% pro rata, plus}\\ \text{5.26\% (current yield)}\end{array} = \text{6.26\% (yield to maturity)}$$

Sources: Investment Terminology, International Foundation of Employee Benefit Plans, 1999.
The Handbook of Fixed Income Securities, Fabozzi, Frank J., 1991.

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Throughout this report, numbers may not sum due to rounding.

Returns for periods greater than one year are annualized throughout this report.

Values shown are in millions of dollars, unless noted otherwise.