Investment Section

COMMONWEALTH OF PENNSYLVANIA
PUBLIC SCHOOL EMPLOYEES' RETIREMENT SYSTEM

James H. Grossman Jr., CPA, CFA
Chief Investment Officer

November 7, 2018

Dear Members of The PSERS Board of Trustees:

It is a privilege to present to you the Investment Section of the Comprehensive Annual Financial Report for the fiscal year ended June 30, 2018.

Authority and Fiduciary Standard

The Board has the responsibility to invest funds of the System in accordance with guidelines and limitations set forth in the Code and other applicable state law. As fiduciaries, the members of the Board and professional staff must act solely in the interests of the members of the System and for the exclusive benefit of the System's members. In performance of their duties, the members of the Board and professional staff who have been delegated with investment authority shall be held to the Prudent Investor Standard.

The Prudent Investor Standard, as articulated in the Code, means "the exercise of that degree of judgment, skill, and care under the circumstances then prevailing which persons of prudence, discretion, and intelligence who are familiar with such matters exercise in the management of their own affairs not in regard to speculation, but in regard to the permanent disposition of the fund, considering the probable income to be derived therefrom as well as the probable safety of their capital."

The Prudent Investor Standard requires a trustee to act prudently and with caution, discretion, loyalty, and care but does not restrict the assets in which the Board can invest. Under the Prudent Investor Standard, which recognizes modern portfolio theory, the Board's investment and management decisions with respect to individual assets shall be considered in the context of the portfolio as a whole and as part of an overall investment strategy, and not in isolation. No specific investment or course of action, taken alone, shall be considered inherently prudent or imprudent. This Standard recognizes the trade-off between risk and return.

Policies and Objectives

The Board is responsible for the formulation of investment policies for the System. Professional staff is responsible for the implementation of those investment policies. The overall investment objectives of the System are as follows:

Return Objectives – the System has a return objective of meeting or exceeding the targeted actuarial rate of return of 7.25% over the long-term (i.e. 25 to 30 years). In addition, the Board has the following broad objectives:

1. The assets of the System shall be invested to maximize the returns for the level of risk taken, and
2. The System shall strive to achieve a net of fee return that exceeds the Policy Index (the Policy Index is a custom benchmark, based on the Board-established asset allocation structure that seeks to generate a return that meets the actuarial rate of return assumption).

Risk Objectives

1. The assets of the System shall be diversified to minimize the risk of losses at the portfolio level and within any one asset class, investment type, industry or sector distribution, maturity date, or geographic location. Failure to do so could impair the System's ability to achieve its funding and long-term investment goals and objectives; and,
2. The System's assets shall be invested so that the probability of investment losses (as measured by the Policy Index) in excess of 15% in any one year is no greater than 2.5% (or two standard deviations below the expected return).

To achieve these objectives, the Board meets during the second half of the calendar year to review the overall asset allocation plan and investment policies for the System. Implementation of investment policy decisions involves asset management, and is accomplished through the use of external investment management firms who act as agents for the System and through the use of internal investment managers. The Board also retains various investment consultants to assist with the formulation and implementation of investment policies.

Operations

The Board, via its Investment Committee, provides oversight of investment activities. The Investment Committee generally conducts six meetings per year and may meet more frequently as needed. Investment Office professionals, as well as external investment advisors, Investment Accounting professionals, and Internal Audit professionals, assist the Board in achieving investment objectives and monitoring compliance with investment policies. For the fiscal year ended June 30, 2018, Aon Hewitt Investment Consulting, Inc. (Aon Hewitt) served as the general investment consultant to assist the Board and professional staff in formalizing investment objectives, establishing an asset allocation plan, conducting investment advisor searches, reviewing performance, and commenting on compliance with investment policies. In addition, the Board retained Aksia, LLC as an absolute return consultant, Courtland Partners, Ltd. as a real estate consultant, and Hamilton Lane Advisors, L.L.C. as an alternative investment consultant. Alternative investments generally consist of investments in private debt, private equity, and venture capital limited partnerships. Investment Office professionals implement investment decisions within the guidelines established in the Investment Policy Statement, Objectives and Guidelines regarding asset allocation, manager selection, security selection, and other objectives directed by the Board.

The Board employs both external investment management firms and internal investment managers to manage the investment portfolio of the System. At fiscal year-end, 41 external public market investment management firms were managing \$16.8 billion in assets of the System, \$21.5 billion in assets were managed by the System's internal investment managers, and the remaining \$17.6 billion in assets were managed by numerous alternative investment and real estate investment managers. The performance of each external investment management firm and each internal manager is monitored quarterly against a pre-established benchmark as well as the performance of the manager's peer group.

Asset Allocation

The Board reviews the long-term asset allocation targets of the System annually. The Board consults with its actuary, consultants, Investment Office professionals, and other sources of information it deems appropriate in formulating the asset allocation plan. The level of risk assumed by the System is largely determined by the Board's strategic asset allocation plan. The Board, in determining its long-term asset allocation, takes the following factors into consideration:

- The System's investment time horizon;
- The demographics of the plan participants and beneficiaries;
- The cash flow requirements of the System;
- The actuarial assumptions approved by the Board;
- The funded status of the System;
- The Board's willingness and ability to take risk, and
- The employers' (Commonwealth and school districts) financial strength.

In approving the asset allocation for the System that is recommended by Investment Office professionals and PSERS' general investment consultant, the Board considers capital market expectations for expected return, volatility, and asset class correlations as prepared by its general investment consultant. The current long-term, top-down asset allocation targets of the Board, based on targeted exposures, are discussed in the following paragraphs. Targeted exposures include positions obtained through derivative exposure with minimal capital requirements.

The current target allocation as of June 30, 2018, included an equity target allocation of 34.0% consisting of publicly traded stocks (20.0%) and private markets (14.0%). Specific publicly traded stock targets have been established for U.S. equity (7.8%) and non-U.S. equity (12.2%). Within the U.S. equity target, the portfolios are diversified between large and small capitalization investment mandates. The non-U.S. equity exposure includes both developed and emerging markets portfolios as well as large and small capitalization investment mandates. The non-U.S. developed markets equity exposure is 75% currency-hedged back to the U.S. Dollar. The primary vehicle used to invest funds in private markets is the limited partnership. The partnerships are established by individual management groups that have been selected by the System for the purpose of investing in and managing private equity, venture capital, and debt positions on behalf of PSERS and other limited partners.

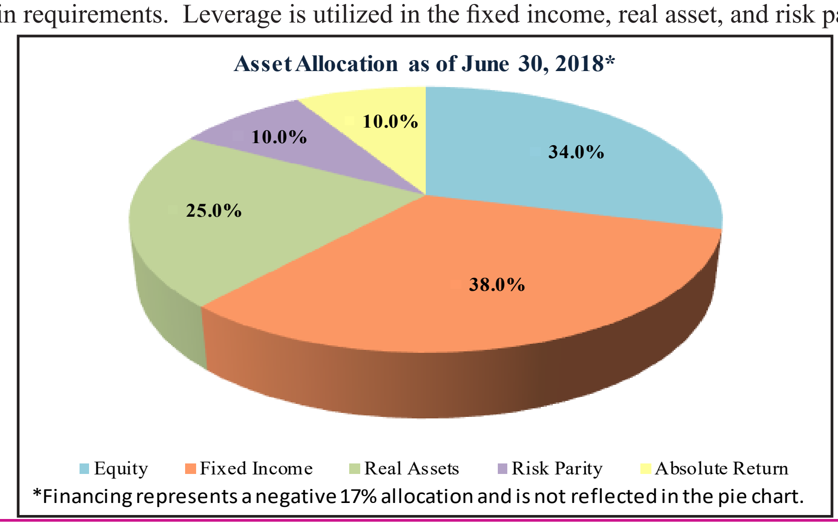
The fixed income target allocation of 38.0% consisted of investment grade exposure (9.0%), credit-related exposure (11.0%), inflation-protected exposure (15.0%), and cash (3.0%). Investment grade exposure consisted of U.S. core fixed income (5.0%), U.S. Long-term Treasuries (3.0%), and non-U.S. developed market fixed income (1.0%). Credit-related exposure consisted of high yield (10.0%) and emerging markets fixed income (1.0%). Inflation protected exposure consisted of U.S. and Non-U.S. inflation-linked bonds. Within these categories, all sectors of the fixed income market are represented. The high yield exposure is primarily private debt. The cash allocation consisted of short-duration, high quality government, and investment grade securities. The Board, Investment Office professionals, and Aon Hewitt deemed it prudent to have an allocation to cash given the known and potential cash flow requirements of the System.

The real asset exposure of 25.0% consisted of real estate (11.0%), master limited partnerships (4.0%), infrastructure (2.0%), and commodities (8.0%, including 3% to gold). The real estate allocation consisted primarily of limited partnerships. The types of partnerships the System invests in include core, value-added, and opportunistic real estate limited partnerships. The commodities allocation consisted primarily of commodity futures, commodity swaps, and commodity-related publicly traded stocks. Commodities are included in the allocation for inflation protection and to diversify the System's total portfolio risk. The Master Limited Partnership (MLP) allocation consisted of publicly traded partnerships that own and operate assets such as pipelines, processing facilities, and storage facilities for natural gas, crude oil, and refined products that are a vital part of the U.S. energy infrastructure. MLPs are included in the allocation due to their attractive current yields, reasonable growth potential, and ability to diversify the System's total portfolio risk. The Infrastructure allocation targets stable, defensive investments primarily within the energy, power, water, and transportation sectors. Infrastructure plays a strategic role within the System by providing steady returns and cash yields, defensive growth, inflation protection, capital preservation, and diversification benefits. The infrastructure allocation consists primarily of publicly-traded companies.

The absolute return target allocation of 10.0% consisted primarily of investment managers retained by the System to generate positive returns over time that are independent of how the equity, fixed income, and commodity markets perform. Strategies implemented to achieve this target include, but are not limited to, global macro, event-driven, and relative value strategies such as insurance-linked securities and long/short credit. The absolute return program is included in the allocation to generate returns equal to or greater than 3-month LIBOR plus 3.5% with low volatility and low correlation to the public financial markets to diversify the System's total portfolio risk.

The risk parity allocation of 10.0% consisted primarily of global equities, global nominal bonds, global inflation-linked securities, and commodities in an allocation that balances risk across these asset classes with structurally offsetting biases to the primary drivers of asset class returns - growth and inflation. Risk parity provides diversification and liquidity to the System.

Leverage was utilized at the asset allocation level to provide additional exposure to diversifying asset classes. The System utilized 17.0% leverage through the use of derivative instruments that allow the System to gain asset class exposure with minimal margin requirements. Leverage is utilized in the fixed income, real asset, and risk parity allocations.

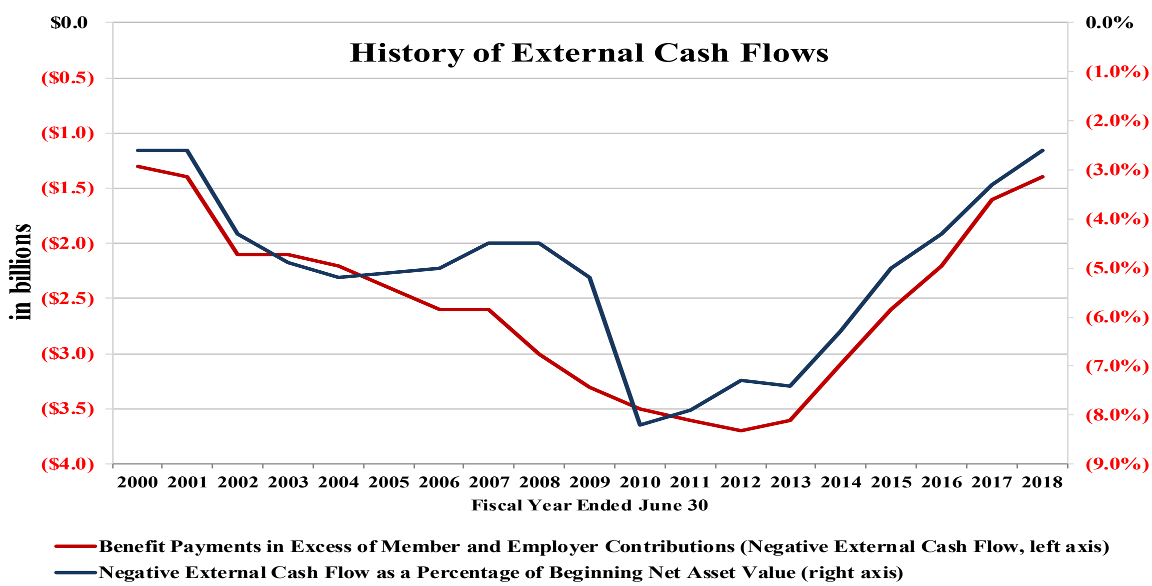


The System also participates in a securities lending program administered by Deutsche Bank AG. This program is designed to provide incremental income to the System by lending publicly traded securities in the System's portfolio held by the System's custodial bank, The Bank of New York Mellon, to securities dealers in exchange for cash collateral, which can be reinvested to generate income. This program generated $12.5 million in net income during the year.

Liquidity and Asset Allocation

The System's risk profile is, in part, driven by its liquidity needs. Over the past nineteen fiscal years, the System has paid out $48 billion more in benefits than it has received in member and employer contributions (i.e., the System has experienced negative external cash flow). The average negative external cash flow was approximately $2.7 billion per year during this period. This annual funding deficiency has amounted to 5.44% or more of beginning net assets each year and represents the amount of investment return needed each year to make up the shortfall (i.e., if the System earned 3.0% in a given year with a 3.0% external cash flow shortfall, then the net assets of the System will be unchanged). The large negative annual external cash flow has improved significantly since fiscal year 2012 due to the implementation of Act 120 in 2010 (see the History of External Cash Flows chart below). Act 120 provided for increased employer contributions to the actuarially required contribution levels. The annual external cash flow shortfall has significantly improved due to the employers increasing contributions over each of the past eight years and making the actuarially required contributions over the last two fiscal years. However, external cash flow is still projected to remain negative and necessitates a larger liquidity position and lower risk profile than a retirement system that has smaller liquidity requirements.

Given the significant net external cash outflows, the Board has prudently reduced the risk profile of the System since the financial crisis in 2008. It has done so by decreasing its return dependence on the equity markets and increasing its risk exposures to asset classes that are less correlated to equity markets such as inflation-linked bonds, commodities, and absolute return. The goal of such an allocation is to generate the desired return profile with less volatility. While such an allocation will not provide for a large upside in returns, it is expected to minimize downside risks to the System's assets in the event of a large equity market drawdown as experienced during the financial crisis in 2008.



The Economy During The Past Fiscal Year

The U.S. Economy

The U.S. economy showed improvement this past fiscal year, driven by continued easy monetary conditions and optimism from individual and corporate tax cuts signed into law on December 22, 2017. Monetary conditions in the U.S. tightened this past year as the Federal Reserve increased interest rates three times and announced that it will be shrinking its $4.5 trillion balance sheet at an initial rate of $6 billion per month and culminating at a rate of $30 billon a month after 12 months. The Federal Funds target rate increased by 0.75% during the past fiscal year and has a range of 1.75% to 2.00% as of June 30, 2018. While interest rates increased, they continue to be historically low which have provided a low cost of borrowing so that broad economic conditions can continue to improve. The U.S. real Gross Domestic Product (GDP) increased year-over-year an average of 2.9% per quarter during the past fiscal year with a range of 2.2% to 4.1%. The official unemployment rate (otherwise known as the U3 unemployment rate) fell during the fiscal year from 4.4% as of June 2017 to 4.0% as of June 2018, approaching what the Fed would consider full employment. The more encompassing U6 unemployment rate, which measures not only people without work seeking full-time employment (U3 unemployment rate) but also counts "marginally attached workers and those working part-time for economic reasons" fell to levels last seen in 2001 at 7.8% as of fiscal year end, down from 8.5% at the end of the last fiscal year. However, the U.S. Labor Participation Rate (LPR), which measures the total labor force as a percentage of the working age population, remains depressed relative to historical levels. The LPR modestly increased from 62.8% in June 2017 to 62.9% in June 2018. The LPR was as high as 67.3% in March 2000. If the LPR were at 2000 levels today, the official unemployment rate would probably be significantly higher.

The U.S. economy showed increasing momentum during the fiscal year as measured by the manufacturing Institute of Supply Management (ISM) Purchasing Managers Index (PMI), an indicator of activity in the sector. During the fiscal year, the ISM PMI increased by 3.5 points to 60.2 at June 30, 2018, solidly in expansionary territory (a contraction/expansion is indicated whenever the index is below 50/above 50). Concurrently, U.S. consumer confidence, as measured by the Conference Board's Consumer Confidence Index increased from 117.3 at June 2017 to 127.1 at June 2018.

Inflation in the United States, after years of being below the Fed's target inflation rate of 2.0%, has shown steady year-over-year increases this past fiscal year as low interest rates, tight labor markets, and fiscal expansion in the form of tax cuts have started to have an impact. The past fiscal year saw inflation steadily grind higher, with the U.S. Core Consumer Price Index (CPI) increasing 2.9% year-over-year as of June 2018, an increase from the 1.6% year-over-year increase as of June 2017.

Select Non-U.S. Economies

Significant headwinds affecting many non-U.S. economies include political uncertainty in Europe, specifically the rise of populism as evidenced by the formation of a populist coalition government in Italy and Great Britain's planned exit from the European Union (Brexit), and protectionist policies as evidenced by President Donald Trump's administration pulling the U.S. from the Trans-Pacific Partnership, renegotiating the North American Free Trade Agreement with Canada and Mexico, and the imposition of billions of dollars of tariffs on goods imported into the U.S. from Europe and China. These uncertainties manifested themselves over the past couple of years and are worthy of watching during the next fiscal year, specifically the populist government in Italy and the trade policies of the U.S.

The Euro Area economy continues showing modest growth, similar to last year. As of the second quarter 2018, the Euro Area was growing at a 2.2% annual pace, slightly less than the 2.5% pace one year earlier. The unemployment rate continues to normalize and improved to 8.3% as of June 2018 from 9.2% a year earlier. Inflation, while at the European Central Bank (ECB) target of 2.0%, also significantly improved from a year earlier. Inflation during the past year was 2.0% versus 1.3% in the previous year and only 0.1% at June 2016. While modestly weakening during the past fiscal year, the Euro Area economy is still expanding as evidenced by the Markit Eurozone Manufacturing PMI print of 55.1 (a contraction/expansion is indicated whenever the index is below 50/above 50). Aggressive actions by the ECB have generated improvements in economic growth, employment, and inflation. The ECB has continued its policy of very accommodative overnight interest rates (negative 0.4%) but has slightly tightened monetary conditions by reducing monthly purchases of euro-denominated sovereign and corporate debt from $68 billion last year to $35 billion as of fiscal year end. In addition, the ECB has only committed to quantitative easing through September 2018 which, if ended, would result in a further tightening of monetary conditions.

Japan's economy has slowed during the past fiscal year. As of the second quarter 2018, Japan's real GDP increased by a year-over-year rate of 1.0% versus a 1.6% year-over-year rate as of June 2017. Japan's demographics are poor as the population ages which generally means that robust growth will be difficult to sustain over the long term. However, since the size of the working age population is decreasing, unemployment has been very low and was 2.4% in June 2018, down from 2.8% last year. The inflation rate in Japan was positive 0.7% over the past year, up from 0.4% at the end of last year. Japanese policy makers continue to aggressively attempt to stimulate their economy through a combination of low interest rates (the Bank of Japan policy rate is negative 0.1%), the purchase of higher risk assets by the Bank of Japan, coordinated diversification into higher risk assets by large public investors, and fiscal spending policies to encourage liquidity to move into riskier assets. Economic conditions continue improving as evidenced by the Nikkei Japan Manufacturing PMI increasing 0.6 points from 52.4 at June 2017 to 53.0 at June 2018 (a contraction/expansion is indicated whenever the index is below 50/above 50). Time will tell if the necessary economic and structural reforms can be put in place for a sustained period of economic prosperity.

China had robust growth compared to the other developed regions of the world. China's real GDP increased by 6.7% over the past year, slightly slower than the 6.9% pace for the year-ended June 2017. Inflation in China has remained relatively stable over the past year at 1.9% compared to 1.5% last year. Economic conditions have been relatively stable as evidenced by the China Manufacturing PMI decreasing 0.2 from 51.7 at June 2017 to 51.5 at June 2018 (a contraction/expansion is indicated whenever the index is below 50/above 50). As noted in previous years, China is continuing its struggle to rebalance its economy from an investment-oriented economy to a consumer-oriented economy, while maintaining political stability. The Chinese government is continuing to target economic growth of between 6.5% and 7.0% over the foreseeable future.

Investment Results

Aon Hewitt calculates the total investment return of the System as well as the performance of each external investment management firm and each internal investment manager retained by the Board to invest the System's assets. Performance is calculated using a time-weighted return methodology.

For the one-year period ended June 30, 2018, the System generated a total net of fee return of 9.27%. This return exceeded not only the actuarial required return of 7.25%, but also the total fund Policy Index return of 7.95% by 132 basis points. Annualized total net of fee returns for the three-, five-, and ten-year periods ended June 30, 2018 were 6.84%, 7.62% and 5.03%, respectively. The three-, and five-year returns ended June 30, 2018 exceeded the total fund Policy Index returns by 39, and 32 basis points, respectively.

Significant positive contributors to performance this past fiscal year included:
- U.S. Equity, as represented by the MSCI USA Investible Market Index (IMI), was up by 14.9% and Non-U.S. Equity, as represented by the MSCI All-Country World Indexed ex. U.S. IMI was up 7.8%. Returns in equities were driven by improving growth, improving company earnings, and tax cuts in the U.S.;
- Private Equity, as represented by the Burgiss Total Return Index, a customized benchmark of return from Burgiss Private iQ, was up 15.9%;
- Commodities, as represented by the Bloomberg Commodity Index, were up 7.4%, led by an increase in oil prices, and
- Real Estate, as represented by a blended benchmark consisting of the National Council of Real Estate Investment Fiduciaries (NCREIF) – Open End Diversified Core Equity (ODCE) Index and Burgiss Private iQ (for Value-Added Real Estate and Opportunistic Real Estate), was up 12.8%, as fundamentals were strong and capitalization rates fell driving real estate prices higher.

Significant detractors from performance this past fiscal year included:
- Investment grade bonds, as represented by the Bloomberg Barclays U.S. Aggregate Bond Index, were down 0.4% driven by increasing interest rates;
- U.S. Long-term Treasuries, as represented by the Bloomberg Barclays Capital U.S. Treasury Long Index, were down 0.1%, driven by increasing interest rates;
- Emerging Market bonds, as represented by the Bloomberg Barclays Emerging Market 10% Country Cap Index, were down 1.4%, driven primarily by weakening currencies vs. the U.S. dollar, and
- Master Limited Partnerships, as represented by the S&P MLP Index, were down 1.8%, driven by a confluence of issues both positive (increasing oil volumes) and negative (Federal Energy Regulatory Commission's proposed changes).

The fiscal year can be characterized as a risk-on period where taking concentrated equity risk, specifically U.S. equity risk, paid off as opposed to holding a diversified portfolio of assets. Improving economic fundamentals, improving global growth, low but rising inflation, U.S. tax cuts, and improving corporate profitability were all contributors to strong equity performance. Threats of trade sanctions imposed by the U.S. on imports and rising political uncertainty in Europe weighed on Non-U.S. equity performance vs. U.S. equity performance. Central banks globally remained generally very accommodative with the European Central Bank and the Bank of Japan keeping short-term interest rates in negative territory and the Federal Reserve Bank in the U.S. increasing interest rates at a measured pace.

Diversification is Undeniably Effective

Diversification into asset classes such as investment grade bonds, U.S. Long-term Treasuries, emerging market bonds, and Master Limited Partnerships were a drag on overall performance this past fiscal year. As noted by Ben Hunt in his newsletter Epsilon Theory, "Diversification isn't a pretty bird. Diversification doesn't make my heart skip a beat like a flock of goldfinches in July. Diversification, by design, is going to have winners and losers simultaneously. Diversification, by design, is never going to look pretty doing its job, because if your portfolio is all working in unison, swooping through the market in a beautiful glint of gold…well, you may be making money, but you sure aren't diversified. Diversification is undeniably effective…" Many investment professionals discuss diversification using terms such as standard deviation, correlation, and co-variance. However, at its most basic level, diversification is insurance against bad future outcomes. The System diversifies simply because it doesn't know how actual events in the future will transpire relative to what is priced into the market. Diversification is a very humble approach to investing. If an investor knew with certainty which asset class would perform best the next month, quarter, or year, the investor would simply invest in that one asset class. However, without such perfect foresight, the downside risk of such a strategy could be devastating. As Peter Bernstein, the late American financial historian, economist, and educator once wrote, "Diversification is the only rational deployment of our ignorance."

Accomplishments

The Investment Office received approval to increase its professional complement by seven during the past fiscal year. We were pleased to have all positions filled with very capable investment professionals by the fiscal year end with all but one starting prior to June 30, 2018. The complement increase allowed the Investment Office to support a large increase in assets managed in-house at a significantly lower cost than if those assets were managed externally. Over the past three years, the Investment Office increased the amount of assets managed internally from 30% to 38%, or by $6.9 billion. The estimated savings from managing those assets in-house is over $39 million per year.

Summary

This past fiscal year was solid with a net of fee return of 9.27%. However, pension plans like PSERS are built to generate long-term returns, so one good (or bad) year is not going to make (or break) the Fund. The System focuses on long-term returns. Since the first quarter after the Great Recession (9 years), the Fund's annualized net of fee return was 9.28%, comfortably above the actuarial assumed rate of return of 7.25%. Looking forward, even with cash rates having risen to around 2%, the System still needs to take prudent risks to achieve its long-term goal of 7.25%. The System has built a diversified allocation to allow it to collect risk premiums over the long-term. In the short-term, no one knows what will happen and the System should expect to go through years where returns are below 7.25%, perhaps significantly below. The System continues to believe the best way to achieve its long-term objectives is to maintain a very diversified portfolio which includes all asset classes available to the Fund, such as public and private equities, fixed income, real assets, risk parity and absolute return. In any given year, the System expects some assets to perform well, such as U.S. and non-U.S. equities did this past fiscal year, and some to not do as well, such as Master Limited Partnerships and emerging market bonds this past fiscal year. However, over the long run, the System expects each of its asset classes to generate a positive return commensurate with the risks taken. The future is uncertain, but we believe we are well positioned to accomplish our objectives.

James H. Grossman Jr., CPA, CFA
Chief Investment Officer

The following table provides the System's total time-weighted investment returns for each major asset class and the total portfolio, including, where applicable and available, respective benchmark indexes used by asset class and median performance by asset class:

	Annualized Total Returns (%) Net of Fees Ended June 30, 2018			
	1 Year	**3 Years**	**5 Years**	**10 Years**
PSERS Total Portfolio	9.27	6.84	7.62	5.03
Total Fund Policy Index	7.95	6.45	7.30	5.06
Median Public Defined Benefit Plan (DBP) Fund Universe (Aon Hewitt Database)	8.17	6.55	7.79	6.50
PSERS U.S. Equity Portfolios	14.02	12.19	13.51	10.21
U.S. Equity Policy Index (1)	14.93	11.65	13.34	10.17
PSERS Non-U.S. Equity Portfolios	10.44	7.55	9.91	6.10
Non-U.S. Equity Policy Index (2)	8.48	6.34	9.12	4.76
PSERS Fixed Income Portfolios (10)	6.42	6.07	5.97	7.21
Fixed Income Policy Index (3)	2.18	3.85	3.34	5.35
PSERS Commodity Portfolios (10)	5.36	0.11	-2.10	-5.76
Commodity Policy Index (4)	4.67	-2.22	-4.04	-7.90
PSERS Absolute Return Portfolios	4.85	3.34	4.20	5.01
Absolute Return Policy Index (5)	5.34	4.62	5.02	6.47
PSERS Risk Parity Portfolios (11)	6.76	4.60	6.02	N/A
Risk Parity Policy Index (6)	6.11	5.68	6.40	6.77
PSERS Master Limited Partnership (MLP) Portfolios	0.27	-5.31	0.73	N/A
Standard & Poor's MLP Index	-1.76	-6.32	-3.03	7.20
PSERS Real Estate (7) (10)	13.63	10.26	12.20	2.50
Blended Real Estate Index (8)	12.80	9.69	11.20	6.40
PSERS Alternative Investments (7)	16.26	11.21	10.03	7.48
Burgiss Median, Vintage Year Weighted Index (9)	15.87	11.47	12.41	8.71

1. MSCI USA Investable Market Index effective April 1, 2009; previously was the Dow Jones Wilshire 5000 Index.
2. MSCI ACWI ex USA IMI with DM 75% Hedged to USD (Net) Index effective April 1, 2016. From October 1, 2014 to March 31, 2016, the index was the MSCI ACWI ex USA IMI with DM 100% Hedged to USD (Net) Index. From July 1, 2008 to September 30, 2014, the index was the MSCI All Country World (ACW) ex. USA Investable Market Index. Before July 1, 2008, the MSCI ACW ex. U.S. Index was used. The benchmark was 30% hedged to the U.S. dollar from July 1, 2006 to March 31, 2009.
3. Returns presented are a blend of the Barclays Capital U.S. Aggregate Index (17.5%), Barclays Capital Global Aggregate GDP Weighted Dev x U.S. (Unhedged) Index (3.5%), Barclays Capital Emerging Mkt 10% Country Cap Index (7.0%), Barclays Capital U.S. Treasury Long Index (8.8%), Barclays Capital U.S. High Yield Index (21.1%), and Barclays Capital U.S. TIPS Index (42.1%) effective April 1, 2016. Prior to July 1, 2013, the blend was Barclays Capital U.S. Universal Index (24.7%), JP Morgan GBI EM Global Diversified Index (9.4%), Barclays Capital U.S. High Yield Index (28.2%), Barclays Capital Multiverse Index (14.1%), and Blended Policy (Net Levered TIPS) (23.6%).
4. Returns presented are a blend of the Bloomberg Commodity Gold Index (37.5%) and the Bloomberg Commodity Index (62.5%). On July 1, 2014, the indices names were changed from DJ/UBS to Bloomberg. The returns have been adjusted for leverage.
5. Three month LIBOR +3.50% effective July 1, 2014. Previously, it was based on the assumed actuarial rate of return for the Fund which was 8.0% from July 1, 2009 through June 30, 2011. The assumed rate changed to 7.5% on July 1, 2011 and was used as the Absolute Return Policy Index through June 30, 2014.
6. Effective July 1, 2014 returns presented are a blend of MSCI ACW Index ($Net) (50%); Barclays Capital U.S. Treasury Index (75%); Barclays Capital World Inflation Linked Bond Index Hedged (55%); Bloomberg Commodity Index (Total Return) (15%); Bloomberg Gold Subindex (5%); and 3-Month LIBOR (-100%). The weights to these indices have varied in previous quarters. The returns have been adjusted for volatility.
7. Returns reported on a one-quarter lag, except for publicly traded real estate security investments.
8. Effective April 1, 2015, comprised of a blended benchmark consisting of the National Council of Real Estate Investment Fiduciaries (NCREIF) – Open End Diversified Core Equity (ODCE) Index and Burgiss Private iQ (for Value-Added Real Estate and Opportunistic Real Estate) reported on a one-quarter lag. For periods between April 1, 2010 and March 31, 2015, the benchmark was comprised of a blended benchmark of NCREIF-ODCE (core) and various private real estate benchmarks for Value-Added and Opportunistic (including NCREIF-Closed-End Value-Added (CEVA), NCREIF/Townsend and NCREIF-NPI) reported on a one-quarter lag. For all prior periods, the benchmark was comprised of a blended benchmark strategically split between public/private using various public REIT indices (FTSE EPRA/NAREIT Global Real Estate, Wilshire Real Estate Securities and Wilshire REIT) and NCREIF-NPI (for all non-core) reported on a one-quarter lag.
9. Burgiss Median, Vintage Year Weighted Index effective January 1, 2011. Previously, the Thompson ONE, Vintage Year Weighted Index was used. Returns reported on a one-quarter lag.
10. Returns are presented on an unleveraged basis for comparability purposes to the Policy Index.
11. Returns are presented on a volatility-adjusted basis for comparability purposes to the Policy Index.

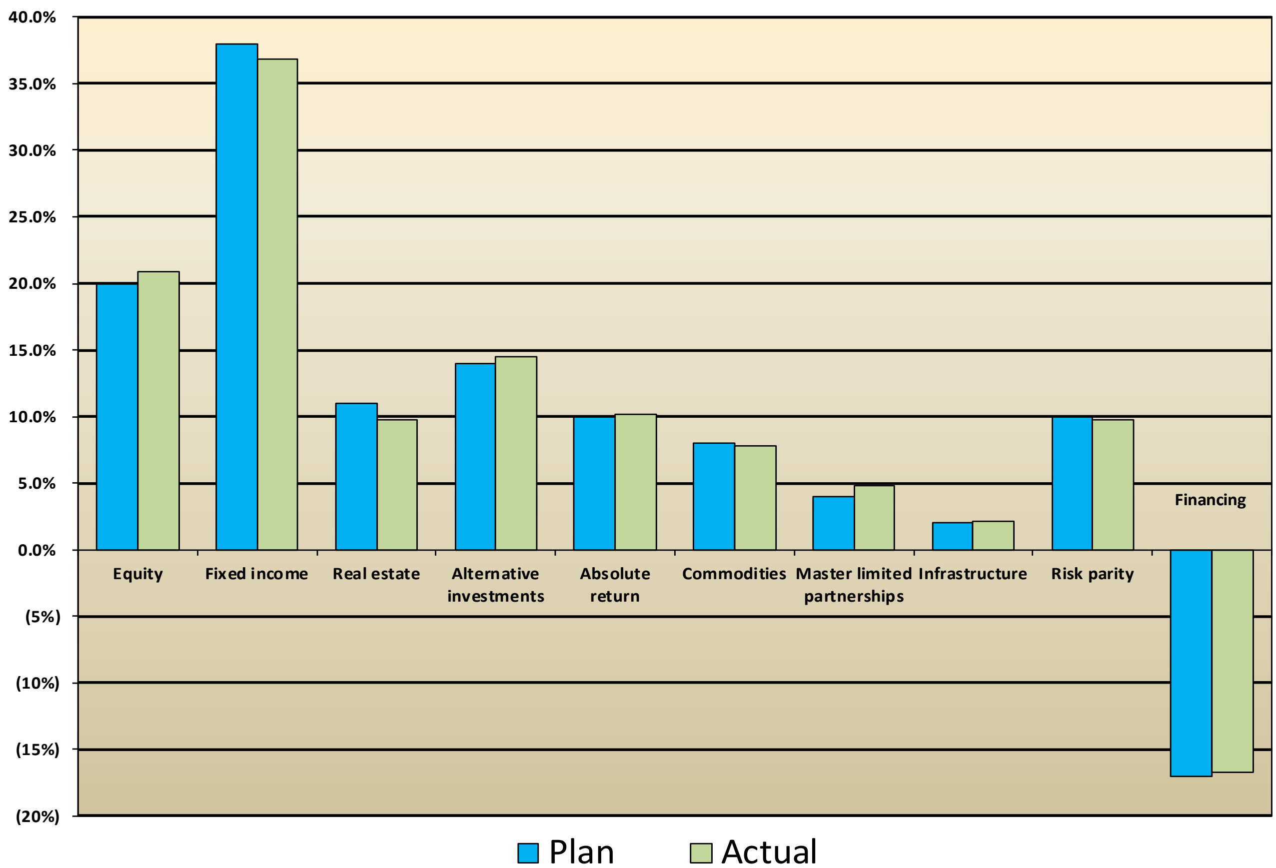
Portfolio Summary Statistics
Asset Allocation
As of June 30, 2018
(Dollar Amounts in Thousands)

Pension investments	Fair Value	% Fair Value
Common and preferred stock (Equity):		
Large and mid cap stocks	$ 4,888,001	8.8
Small cap stocks	748,191	1.3
Emerging markets stocks	1,228,073	2.2
Total Non-U.S. equity	**6,864,265**	**12.3**
Large cap stocks	3,366,331	6.1
Mid, small, and microcap stocks	1,323,292	2.5
Total U.S. equity	**4,689,623**	**8.6**
Total Common and preferred stock - Asset Allocation Basis	**11,553,888**	**20.9**
Fixed income:		
Investment grade fixed income	8,025,795	14.6
High yield fixed income	5,024,047	9.0
Total U.S. Fixed income	**13,049,842**	**23.4**
Non-U.S. developed markets fixed income	4,755,377	8.5
Emerging markets fixed income	343,507	0.6
Total Non-U.S. Fixed income	**5,098,884**	**9.1**
Cash and cash equivalents	**2,371,532**	**4.3**
Total Fixed income - Asset Allocation Basis	**20,520,258**	**36.8**
Real estate	**5,431,068**	**9.8**
Alternative investments:		
Private equity	5,941,215	10.7
Special situations (Private debt)	1,102,225	2.0
Venture capital	1,050,797	1.8
Total Alternative investments - Asset Allocation Basis	**8,094,237**	**14.5**
Absolute return	**5,677,710**	**10.2**
Commodities	**4,316,005**	**7.8**
Master limited partnerships	**2,639,291**	**4.8**
Infrastructure	**1,143,607**	**2.1**
Risk parity	**5,438,446**	**9.8**
Financing	**(9,263,777)**	**(16.7)**
Total Pension investments - Asset Allocation Basis	**55,550,733**	**100.0**
Net Asset Allocation Adjustment*	15,659	
Pension investments per Statement of Fiduciary Net Position	**55,566,392**	
Postemployment Healthcare investments	**$ 329,203**	**100.0**
Defined Contribution plan investments	**$ 6,735**	**100.0**

* Includes reclassifications of certain investments between asset classes and investment receivables/payables to adjust the Statement of Fiduciary Net Position classification to the basis used to measure Asset Allocation. See the table and graph which follow.

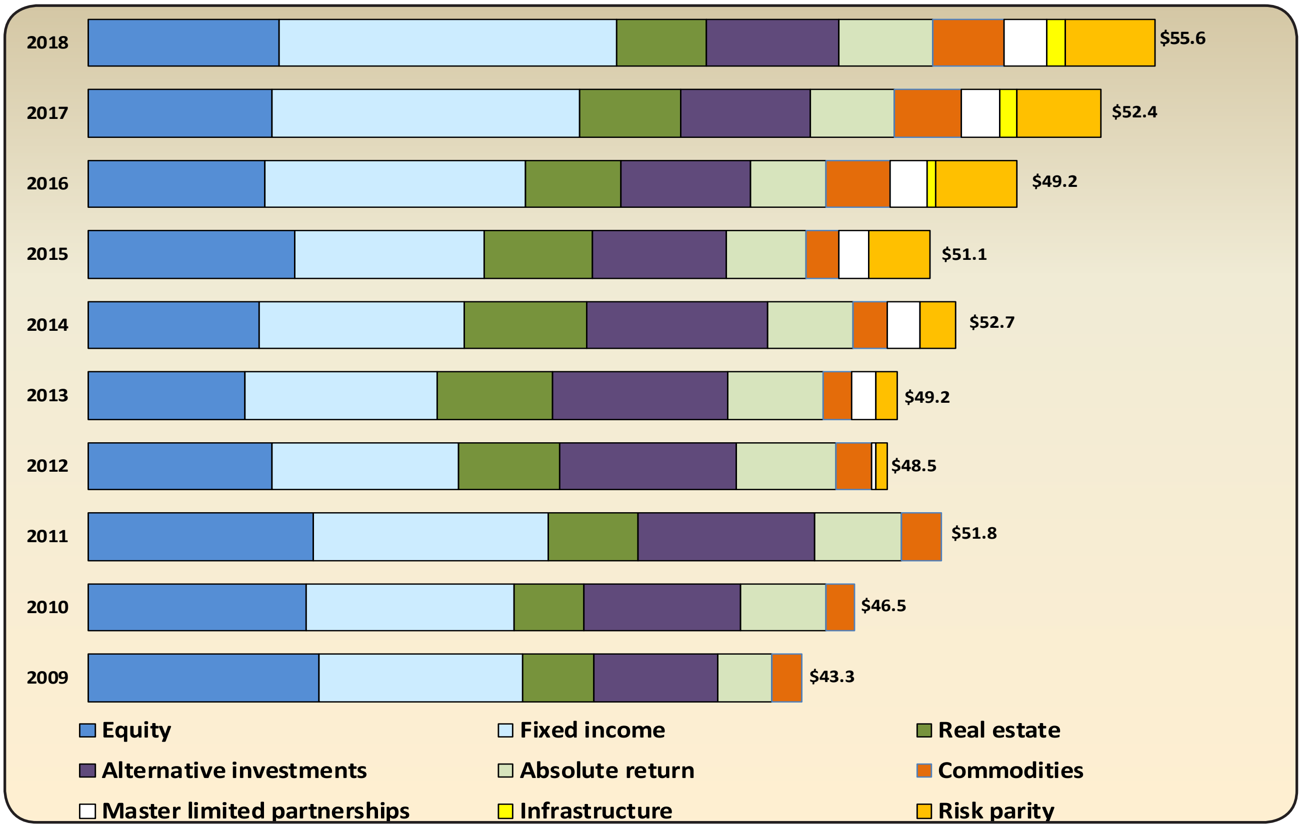
Comparison of Actual Portfolio Distribution to Asset Allocation Plan As of June 30, 2018

Asset Category	Plan	Actual
Common and preferred stock (Equity)	20.0%	20.9%
Fixed income	38.0	36.8
Real estate	11.0	9.8
Alternative investments	14.0	14.5
Absolute return	10.0	10.2
Commodities	8.0	7.8
Master limited partnerships	4.0	4.8
Infrastructure	2.0	2.1
Risk parity	10.0	9.8
Financing	(17.0)	(16.7)
Total	**100.0%**	**100.0%**



Portfolio Capital Distribution 10 Year Trend*

(Fair Value - Dollar Amounts in Billions)



*Financing is not reflected in the Portfolio Capital Distribution 10 Year Trend Chart.

The following lists of portfolio detail statistics present the ten largest holdings by descending order of fair value for the largest public market asset classes. Information on the complete holdings of the System can be downloaded from the PSERS website at www.psers.pa.gov.

Common and Preferred Stock - Non-U.S. Equity

10 Largest Holdings in Descending Order by Fair Value

As of June 30, 2018

(Dollar Amounts and Shares in Thousands)

Description	No. of Shares	Fair Value
BlackRock Emerging Markets Alpha Advantage Fund Ltd.- Class D	319	$ 471,783
BlackRock Emerging Markets Alpha Advantage Fund Ltd.- Class P	35	155,998
iShares MSCI ETF	2,884	151,428
Taiwan Semiconductor Manufacturing Company	14,330	99,846
Nestle SA	767	59,386
The Children's Investment Fund LP	50,000	57,725
Samsung Electronics Co., Ltd	1,146	47,984
SAP SE	408	47,148
Rio Tinto PLC	779	43,220
Naspers Ltd.	163	41,324
Total of 10 Largest Holdings		**$ 1,175,842**

Common and Preferred Stock - U.S. Equity
10 Largest Holdings in Descending Order by Fair Value
As of June 30, 2018
(Dollar Amounts and Shares in Thousands)

Description	No. of Shares	Fair Value
SPDR Trust Unit Series 1	1,800	$ 488,420
Enterprise Products Partners, L.P.	12,068	333,913
Energy Transfer Partners, L.P.	12,644	240,750
Energy Transfer Equity, L.P.	13,278	229,053
Williams Partners, L.P.	5,213	211,609
Altaba Inc.	2,860	209,414
Security Capital Preferred Growth	13,039	190,767
Plains All American Pipeline, L.P.	7,599	179,640
MPLX, L.P.	150	175,694
Magellan Midstream Partners, L.P.	1,731	119,556
Total of 10 Largest Holdings		**$ 2,378,816**

Fixed Income
10 Largest Holdings in Descending Order by Fair Value
As of June 30, 2018
(Dollar Amounts and Shares in Thousands)

Description	No. of Shares	Fair Value
Bridgewater International Inflation-Linked Bond Fund	389	$ 1,461,226
BlackRock US Extended Core Global Alpha Bond Fund Ltd.	448	945,196
Bridgewater Pure Alpha Fund II Ltd.	138	631,025
PIMCO Multi-Sector Strategy Fund Ltd.	346	415,411
Bain Capital Credit Managed Account, L.P.	N/A	387,595
TAO Partners Parallel Fund, L.P.	N/A	334,088
Garda Inflation Opportunity Fund Class B	323	305,766
iShares TIPS Bond ETF	2,625	296,306
Bridgewater Short Term Investment Fund	200	288,996
Brigade Structured Credit Offshore Fund Ltd.	200	273,357
Total of 10 Largest Holdings		**$ 5,338,966**

Absolute Return
10 Largest Holdings in Descending Order by Fair Value
As of June 30, 2018
(Dollar Amounts and Shares in Thousands)

Description	No. of Shares	Fair Value
Bridgewater Pure Alpha Fund II, Ltd.	240	$ 961,032
Capula Global Relative Value Fund, Ltd.	3,000	439,359
Garda Fixed Income Relative Value Opportunity Fund Ltd.	291	413,025
Capula Tail Risk Fund Ltd.	4,466	359,205
Aeolus Property Catastrophe Keystone PF Fund, L.P.	367	340,918
Brigade Leveraged Capital Structures Offshore Ltd.	170	316,558
BlackRock Capital Structure Investments Offshore Fund Ltd.	198	302,997
PIMCO Global Credit Opportunity Offshore Fund Ltd.	280	295,730
Oceanwood Opportunities Fund	1,998	242,615
PIMCO Multi-Asset Volatility Offshore Fund	235	231,584
Total of 10 Largest Holdings		**$ 3,903,023**

Postemployment Healthcare Investments
10 Largest Holdings in Descending Order by Fair Value
As of June 30, 2018
(Dollar Amounts in Thousands)

Description	Maturity Date	Interest Rate (%)	Par Value	Fair Value
Wilmington US Government MM	N/A	Various	$ 116,418	$ 116,418
PSERS Short-Term Investment Fund	Various	Various	96,659	96,659
Dell Equipment Financial	06/24/19	2.45%	5,000	5,000
Fifth Third Auto Trust	04/15/20	1.59%	4,225	4,212
World Omni Auto	12/15/20	1.49%	3,820	3,807
Valet 2018	07/22/19	2.42%	3,750	3,750
Ford Credit Floor Plan	08/15/20	1.77%	3,435	3,432
Ford Credit Auto Lease	05/15/19	2.30%	3,076	3,076
CarMax Auto Owner Trust	05/15/19	2.30%	2,875	2,875
GM Financial	03/16/20	1.51%	2,636	2,629
Total of 10 Largest Holdings				**$ 241,858**

Comparison of Investment Activity Income
Fiscal Years Ended June 30, 2018 and 2017
(Dollar Amounts in Thousands)

Investment Activity		**2018**		2017
Net appreciation in fair value of investments	**$**	**3,710,567**	$	4,204,248
Short-term		**88,600**		69,422
Fixed income		**193,759**		156,837
Common and preferred stock		**321,547**		295,427
Collective trust funds		**5,166**		3,379
Real estate		**367,526**		236,650
Alternative investments		**485,718**		493,426
Total investment activity income	**$**	**5,172,883**	$	5,459,389

Brokers' fees on equity investment transactions for the fiscal year ended June 30, 2018 were $4.5 million. The System has commission recapture contracts with several brokers. These contracts generally stipulate that the brokers rebate a percentage of commissions earned on investment transactions directly to the System. During the fiscal year ended June 30, 2018, the System earned $45,000 from the commissions recapture program. A list of the brokers receiving fees in excess of $100,000 during the fiscal year follows:

Summary Schedule of Brokers' Fees
(Cumulative Fiscal Year Amounts Exceeding $100,000)
Fiscal Year Ended June 30, 2018

Broker Name		**Fees Paid**	**Broker Name**		**Fees Paid**
Citigroup Inc.	$	350,763	Macquarie Bank Ltd	$	154,317
Instinet Corporation		334,699	FBR Capital Markets		144,911
UBS Securities		227,825	FBN Securities		137,692
Fimat USA		222,426	Credit Suisse		130,680
Liquidnet Inc.		219,310	Bloomberg Tradebook LLC		119,233
Morgan Stanley & Company		185,179	Jones Trading		117,050
Daiwa Securities		166,018	JP Morgan Chase & Company		114,980
Bank of America Merrill Lynch		156,424			

Professional Consultants

External Investment Advisors

As of June 30, 2018

Absolute Return Managers

- Aeolus Capital Management, Ltd.
- BlackRock Financial Management, Inc.
- Bridgewater Associates, Inc.
- Brigade Capital Management
- Capula Investment Management, LLP
- Caspian Capital, LP
- Garda Asset Management, LLC
- HS Group Sponsor Fund II, Ltd.
- Independence Reinsurance Partners, LP
- Nephila Capital, Ltd.
- Nimbus Weather Fund
- Oceanwood Capital Management, Ltd.
- One William Street Capital Management, LP
- Pacific Investment Management Company
- Perry Capital, LLC
- Sciens Aviation Special Opportunities Investment Fund II, III & IV, LP
- Two Sigma Risk Premia Enhanced Fund
- Venor Capital Offshore Fund

Publicly-Traded Real Estate Securities Manager

- Security Capital Research & Management, Inc.

Non-U.S. Equity Managers

- Acadian Asset Management, Inc.
- Baillie Gifford Overseas, Ltd.
- BlackRock Financial Management, Inc.
- Marathon Asset Management, LLP
- Oberweis Asset Management, Inc.
- QS Investors, LLC
- The Children's Investment Fund
- Wasatch Advisors, Inc.

Commodity Managers

- Gresham Investment Management, LLC
- Pacific Investment Management Company
- Wellington Management Company, LLP

U.S. Core Plus Fixed Income Managers

- BlackRock Financial Management, Inc.
- Pugh Capital Management, Inc.
- SEI Investment Management Corporation

High Yield Fixed Income Managers

- Apollo Management International, LLP
- Avenue Capital Group
- BlackRock Financial Management, Inc.
- Brigade Capital Management
- Cerberus Institutional Partners, LP
- Galton Onshore Mortgage Recovery Fund III & IV, LP
- Haymarket Financial, LLP
- Intermediate Capital Group, PLC
- International Infrastructure Finance Company Fund, LP
- Latitude Real Estate Investors, Inc.
- LBC Credit Partners
- Mariner Investment Group, LLC
- Oaktree Capital Management, LP
- Park Square Capital, LLP
- Radcliffe Capital Management, LP
- Sankaty Advisors, LLC
- Summit Partners
- The Carlyle Group
- TOP NPL (A), LP
- TPG Partners, LP
- Varde Partners

Non-U.S. Developed Markets Fixed Income Manager

- AllianceBernstein, LP

Emerging Markets Debt Manager

- Franklin Templeton Investments

Multi-Sector Fixed Income Manager

- Pacific Investment Management Company

Global Treasury Inflation - Protected Securities Managers

- Bridgewater Associates, Inc.
- Garda Asset Management, LLC

Passive Currency Hedging Overlay Program Manager

- Pareto Investment Management, Ltd.

Risk Parity Managers

- BlackRock Financial Management, Inc.
- Bridgewater Associates, Inc.
- D.E. Shaw Investment Management, LLC

Master Limited Partnership Advisors

- Atlantic Trust Private Wealth Management
- Harvest Fund Advisors, LLC
- Salient Capital Advisors, LLC

Real Estate Advisors

- Charter Oak Advisors, Inc.
- GF Management, Inc.
- Keystone Orlando LLC
- Keystone Parkland LLC
- Keystone Miramar LLC
- L&B Realty Advisors, LLP

Real Estate Partnerships

- AG Core Plus Realty Fund III, & VI LP
- Almanac Realty Securities V, VI, & VII LP

Professional Consultants (Continued)

- Apollo Real Estate Finance Corp.
- Ares European Real Estate Fund III, LP
- Ares U.S. Real Estate Fund VII, LP
- Avenue Real Estate Fund, LP
- Bell Institutional Fund IV, V, & VI, LP
- BlackRock Asia Property Fund III, LP
- BlackRock Europe Property Fund III, LP
- Blackstone Real Estate Debt Strategies II, & III LP
- Blackstone Real Estate Partners V, VI, & VII, LP
- Blackstone Real Estate Partners Europe III & IV, LP
- BPG/PSERS Co-Investment Fund, LP
- Brookfield Strategic Real Estate Partners I & II, LP
- Cabot Industrial Core Fund, L.P.
- Cabot Industrial Value Fund IV LP
- Carlyle Realty Partners III, IV, V, VI, & VII LP
- Centerline High Yield CMBS III - Loan/Stock
- DRA Growth and Income Fund VI, VII, VIII, & IX LLC
- Exeter Core Industrial Club Fund II, LP
- Exeter Industrial Value Fund II, III & IV, LP
- Fortress Investment Fund I, IV, & V, LP
- JP Morgan Strategic Property Fund
- LAI Real Estate Investors, LLC
- Latitude Management Real Estate Capital III, Inc.
- Legg Mason Real Estate Capital I & II, Inc.
- LEM Multifamily Senior Equity IV, LP
- LEM Real Estate High Yield Debt and Preferred Equity Fund III, LP
- LEM Real Estate Mezzanine Fund II, LP
- Paramount Group, Inc.
- Pramerica Real Estate Capital VI, LP
- PRISA
- Prudential Agricultural Group
- RCG Longview Debt Fund IV, V, & VI, LP
- RCG Longview Equity Fund, LP
- Senior Housing Partnership Fund IV, & V LP
- Silverpeak Legacy Partners I, LP
- Stockbridge Real Estate Fund II, & III, LP
- Strategic Partners II, III, & IV RE, LP
- UBS (US) Trumbull Property Fund, LP

Farmland Advisor

- Prudential Agricultural Group

Private Equity/Venture Capital Partnerships

- ABS Capital Partners II, LP
- Actis Emerging Markets 3, LP
- Actis Global 4, LP
- Adams Capital Management, LP
- Aisling Capital Partners II, III & IV, LP
- Allegheny New Mountain Partners, LP
- Apax Europe VII, LP
- Bain Capital Asia Fund II & III, LP
- Bain Capital Fund XI, LP
- Baring Asia Private Equity Fund III, IV, V, & VI, LP
- Blue Point Capital Partners I, II, & III, LP
- Bridgepoint Capital II, LP
- Bridgepoint Europe I, II, III, IV & V, LP
- Capital International Private Equity Fund V & VI, LP
- Catterton Growth Partners I, II & III, LP
- Catterton Partners V, VI, & VII, LP
- Co-Investment Fund 2000, LP
- Co-Investment Fund II, LP
- Coller International Partners VI & VII, LP
- Crestview Partners I & II, LP
- Cross Atlantic Technology Fund I & II, LP
- CVC Capital Partners Asia Pacific III, LP
- CVC European Equity Partners V, LP
- DCPF VI Oil and Gas Co-Investment Fund, LP
- Denham Commodity Partners VI, LP
- Equistone Partners Europe Fund VE, LP
- Evergreen Pacific Partners I & II, LP
- First Reserve Fund XI & XII, LP
- Goldpoint Partners Co-Investment Fund V, LP
- HgCapital 7, LP
- HGGC Fund II
- Incline Equity Partners III, LP
- Irving Place Capital Partners II & III, LP
- KBL Healthcare Ventures, LP
- Landmark Equity Partners V, XIII, & XIV, LP
- Lexington Capital Partners I, LP
- Lindsay, Goldberg & Bessemer, LP
- LLR Equity Partners I, II, III, & IV, LP
- Milestone Partners II, III, & IV, LP
- Morgan Stanley Dean Witter Capital Partners IV, LP
- North Haven Private Equity Asia Fund IV, LP
- NEPA Venture Fund II, LP
- New Mountain Partners I & III, LP
- New York Life Capital Partners I, II, III, & IV, LP
- NGP Natural Resources X, & XI, LP
- Novitas Capital I & II, LP
- Odyssey Investment Partners, LLC
- Orchid Asia V, LP
- PAI Europe IV & V, LP
- Palladium Equity Partners II-A & IV, LP
- Partners Group Secondary 2008, 2011 & 2015, LP
- Permira IV, LP
- Perseus-Soros Bio-Pharmaceutical Fund, LP
- Platinum Equity Capital Partners I, II, III, & IV, LP
- PNC Equity Partners I & II, LP
- Psilos Group Partners III, LP
- Quaker BioVentures I & II, LP
- SCP Private Equity Partners I & II, LP
- StarVest Partners I & II, LP
- StepStone International Investors III, LP
- Sterling Capital Partners, LP
- Sterling Venture Partners, LP
- Strategic Partners II, III, III-B, & III-VC, IV, IV-VC, V, VI, & VII, LP
- Summit Partners Growth Equity Fund VIII & IX, LP
- Summit Partners Venture Capital Fund III & IV, LP

Professional Consultants (Continued)

- Tenaya Capital IV-P , V-P, & VI, LP
- The Energy & Minerals Group
- The Fifth Cinven Fund No. 1, LP
- The Fourth Cinven Fund
- The Sixth Cinven Fund
- Trilantic Capital Partners IV, LP
- Trilantic Capital Partners V (North America), LP

Special Situations (Private Debt) Partnerships

- Apollo Investment Fund VIII, LP
- Avenue Asia Special Situations Fund II, III, & IV, LP
- Avenue Special Situations Fund IV, V, & VI, LP
- Cerberus Institutional Partners, II, III, IV, V & VI, LP
- Clearlake Capital Partners IV, LP
- Gleacher Mezzanine Fund I & II
- Gold Hill Venture Lending, LP
- GSC Recovery III, LP
- New York Life Investment Management Mezzanine Partners I & II, LP
- OCM Opportunities Fund VII & VII-B, LP
- Searchlight Capital II, LP
- Venor Special Situations Fund II, LP
- Versa Capital Fund I, II & III, LP
- Windjammer Senior Equity Fund III & IV, LP

Alternative Investment Consultant

- Hamilton Lane Advisors LLC

Custodian Bank

- The Bank of New York Mellon Corporation

Securities Lending Agent

- Deutsche Bank AG

Absolute Return Consultant

- Aksia, LLC

Investment Accounting Application Service Provider

- STP Investment Services, LLC

Investment Evaluator and General Investment Consultant

- Aon Hewitt Investment Consulting, Inc.

Proxy Voting Agent

- Glass, Lewis & Co., LLC

Real Estate Investment Consultant

- Courtland Partners, Ltd.