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MAY 2020

Houston Police Officers' Pension System

Investment Program Review

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Introduction

Verus Advisory ("Verus") was recently retained by the Board of Trustees of the Houston Police Officers' Pension System ("HPOPS" or "the Plan") to conduct an investment program review in satisfaction of the requirements stated in Texas Government Code Section 802.109 Investment Practices and Performance Reports.

Verus is an institutional investment consulting firm acting as an independent reviewer of HPOPS' overall investment program. We conducted a thorough programmatic review, utilizing the aggregate experience of a team of investment professionals assigned to this project. We are not an audit firm and did not conduct our work from that perspective. Rather, we are an investment advisory firm with decades of experience implementing leading practice investment solutions for our institutional investor clients. We drew on that experience to form opinions and judgments about HPOPS' investment program in the following eight areas, as described in Section 10A of Article 6243g-4 of the Texas Civil Statutes:

- Policy compliance;
- Asset allocation;
- Portfolio structure;
- Investment manager due diligence and monitoring;
- Performance benchmarking;
- Fees and trading costs;
- Leverage and hedging; and
- Investment-related disclosures in the annual report.

Based on our experience, there exists no single set of best practices for all investors to follow in the development and implementation of a successful investment program. Therefore, we defined the scope of our mandate to be to assess the reasonableness of the practices associated with each program element listed above and to offer recommendations on identified areas of potential improvement.

In our view, HPOPS is a well-managed plan with a disciplined governance structure, a strong and ethical culture, clear decision-making processes, and a reasonable investment strategy. We found no critical-path practices which we believe would imperil the health and solvency of the Plan. We found HPOPS to be somewhat unique relative to many of its peers in that they do not utilize a general consultant to assist with program implementation. However, this has not hindered their long-term performance, which places them in the top decile among their public fund peers over the long-term. Through our detailed review, we identified a number of potential improvement opportunities for consideration by the HPOPS' Board and Staff. Of those we found, we have included the ones in this report most relevant to the topics listed above.

Methodology

In completing this report, we utilized three main approaches to evaluate the areas of focus: Trustee and Investment Staff interviews, document review, and quantitative portfolio analysis.

Interviews

Over two days, we met with the following Board and Staff members at HPOPS's offices:

- Trey Coleman – Chairman of the Investment Committee of the Board of Trustees
- George Guerroro – Trustee
- Pat Franey – Executive Director
- Stacey Ables – Chief Investment Officer
- Neal Wallach – Investment Officer
- Nick Dang – General Counsel

Broadly speaking, the interviews were conducted to uncover general concerns and identify improvement opportunities, as well as to identify areas for further investigation. We specifically asked about Board and Staff effectiveness with respect to culture, structure, resource sufficiency, decision-making processes, and policy compliance. We also initiated unstructured discussion with open-ended questions about what is currently working well and what improvement opportunities may exist.

Document Review

The Verus Project Team pored over reams of data, including:

- Investment Policy
- Ethics Policy
- Board education materials
- Performance reports
- Due diligence reports
- Comprehensive Annual Financial Reports (CAFR)
- Third-party work product

Observations made during our document review provided us with key insights into HPOPS' work processes and helped us identify improvement opportunities and develop recommendations.

Quantitative Analysis

Members of our Portfolio Analytics and Risk Advisory Services groups conducted the following quantitative analyses to assess the reasonableness of HPOPS' investment strategy:

- Mean Variance Analysis
- Risk Allocation Analysis
- Liquidity Analysis
- Performance Analysis

Policy Review

We reviewed HPOPS' Investment Policy Statement and Code of Ethics for reasonableness, structure, and compliance. Within the Investment Policy, there exist a number of requirements which dictate how the Plan shall be managed. We reviewed these requirements in detail and sought documentary evidence demonstrating compliance. Through our review, we found HPOPS takes compliance very seriously, and in most cases, we found that HPOPS closely follows the letter and spirit of its policies.

Investment Policy Statement (effective date: 6/13/19)

The investment policy statement (IPS) serves as a strategic guide in the planning and implementation of an investment program. When implemented successfully, the IPS anticipates issues related to governance of the investment program, planning for appropriate asset allocation, implementing an investment program with internal and/or external managers, monitoring the results, risk management, and appropriate reporting. The IPS also establishes accountability for the various entities that may work on behalf of an investor. Perhaps most importantly, the IPS serves as a policy guide that can offer an objective course of action to be followed during periods of market disruption when emotional or instinctive responses might otherwise motivate less prudent actions. The IPS is a highly customized document that is uniquely tailored to the preferences, attitudes, and situation of each investor.

With this in mind, we reviewed HPOPS's current IPS to assess compliance with its key provisions. Compliance was determined to be demonstrated via discussion with staff and/or review of supporting documentation, as appropriate. The following table lists key policy guidelines, whether or not the Plan was in compliance, and our recommendation to attain compliance for those areas where we determined non-compliance.

Section	Description	In Compliance? (Y/N)
405.04	Periodic monitoring of identified risks	Y
405.05.A and B	Risk control policy: requires the Board to be informed of the level of pre-defined economic signals	Y
405.05.C	Allowable leverage	Y
405.06.C	Max leverage	Y
407.03.A	Avoid substantial loss in equity investments	N
Recommendation: Remove language related to avoidance of large losses, as this is an unrealistic expectation in the public markets equity portfolio.		
407.03.B	Single issue limit and cash holding limit	Y
407.11.F	Cash equitization program allocation changes based on market volatility	Y
407.11.G	Currency hedging targets	N
Recommendation: The use of the word "permanently" in this guideline implies a level of hedge ratio stability that has not existed in practice. To remedy this, change the verbiage to state the 50% hedge ratio is a "target" that Staff can adjust within the allowable range.		
407.11.H	Counterparty exposure monitoring	Y
408.01 to .05	Investment manager monitoring	Y
408.06	Manager meetings subsequent to hire (reference to Appendix G)	N
Recommendation: Conduct a thorough review of Appendix G to confirm continued relevance of specific requirements and the design and implementation of supporting documentation to demonstrate compliance		

with updated version (e.g., interview guide, meeting notes template). Solution may be different for traditional and alternative managers.		
410.04	Securities lending program risk	N
Change phrase "without assuming additional risk" to "without assuming excessive additional risk".		
410.05	Proxy voting (reference to Appendix H)	Y
410.08 to .12	Contractual limitations with managers	Y
411	Manager reporting	Y
415	Rebalancing (Appendix C)	Y
416	Manager selection criteria (Appendix D)	Y
417	Manager search procedure (Appendix E)	N
Recommendation: Conduct a thorough review of Appendix E to confirm continued relevance of specific requirements and the design and implementation of supporting documentation to demonstrate compliance with updated version (e.g., process checklist, RFI/RFP template, comparative assessment report template). Solution may be different for traditional and alternative managers.		
418	Manager performance presentation (Appendix F)	Y
421	Alternative investments	Y
422	Investment valuation	Y

Ethics Policy (effective date: 12/12/19)

Upon review, we found HPOPS's Ethics Policy to be thorough and comprehensive with sufficient requirements to effectively monitor compliance. The following table lays out the reporting requirements designed to enforce compliance and whether we were able to obtain demonstrative evidence of compliance.

Section	Description	Evidence obtained? (Y/N)
605.08	All business relationships with current or prospective vendors shall be reported to the Board on a signed document upon establishment of such relationship.	Y
606.01	System Representatives shall file a signed quarterly Ethics report on a form provided by the System disclosing the receipt by the System Representative or family member of the System Representative of any gift with a fair market value of greater than $25 (including applicable taxes) from any source which is a current or prospective consultant or vendor of the System.	Y
606.02	Each System Representative shall file a signed quarterly Ethics report of all gifts and intangibles as required by this policy. The form shall note the source of the gift, the dates received, and the estimated market value of the gift.	Y
609.01.A.1 to 4	All System contracts with consultants and vendors will include a requirement that thereafter records will be maintained and filed annually with the System which reflect: 1. Any finders fees, commissions or similar payments, made to anyone whomsoever as consideration for the placement of business with the consultant or vendor;	Y

	2. Any gifts, food, lodging, transportation, or entertainment expense which does not conform with the minimum reporting limitation contained in this policy for the recipient (See examples in Section 611 of this Policy.); 3. Any direct or indirect benefit to a System Representative other than food, lodging, transportation, entertainment or gifts; and, 4. The extent, amount and placement of any directed business, other than directed brokerage placed in accordance with a resolution adopted by the Board in open meeting which was in any way associated with the parties relationship with the System.	
609.01.B	Current or prospective consultants and vendors will file with the System a conflict of interest questionnaire adopted by the Texas Ethics Commission.	Y
612.02	The Ethics Committee will meet at least Quarterly to review the status of reporting as required by this Policy.	Y
613.01	System Representatives are required to file an annual form with the System acknowledging that they have read, understand and will comply with the provisions of this Ethics Policy.	Y
613.02	Trustees shall report all expenses related to System business in accordance with the provisions of Section 500 of the Employee Handbook.	Y

Asset Allocation

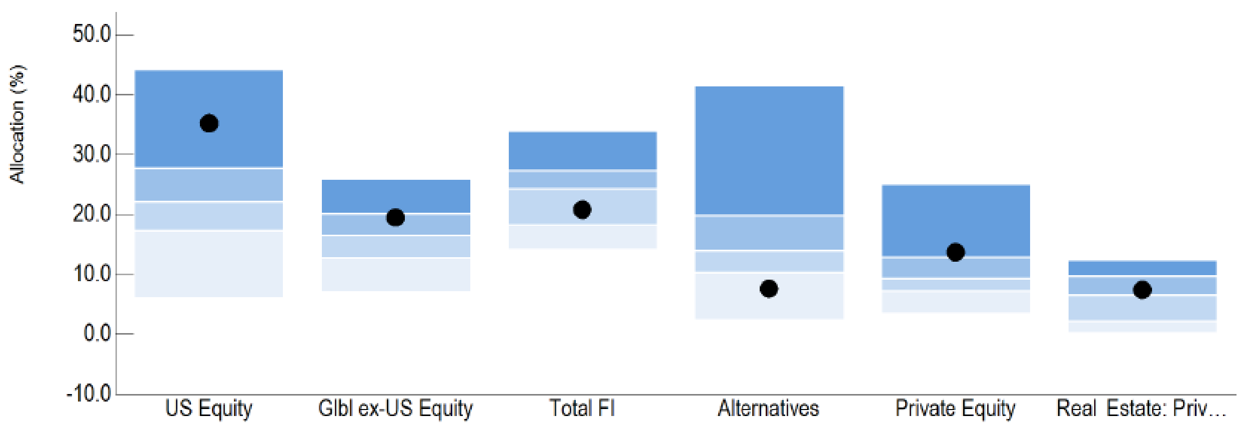
Asset allocation is broadly recognized as the primary tool institutional investors have at their disposal to meet risk and return objectives. HPOPS' risk and return objectives are to achieve its actuarial investment rate, currently set at 7.0% net of fees and expenses, within the risk parameters established by the Board.

HPOPS follows a specific and disciplined process to determine the strategic asset allocation targets for the investment portfolio. The process relies primarily on a mean-variance optimization approach with inputs (expected returns, risk, and correlation) derived from a survey of well-known capital markets participants. The quantitative modeling output is overlaid with the Plan's liquidity profile to help determine appropriate exposure to illiquid assets. Staff conducts scenario analysis on the policy portfolio against historical market conditions in addition to stress testing high and low capital market assumptions as additional lenses through which to judge the reasonableness of strategic asset allocation. The asset allocation is reviewed frequently in light of current and expected market conditions.

HPOPS current (12/31/19) strategic asset allocation targets are shown below.

Asset Class	Policy Target
Domestic Equity	33.65%
International Equity	18.1%
Fixed Income	10.5%
Credit Strategies	11.0%
Real Estate	10.0%
Liquid Alternatives	6.5%
Private Equity	20.0%
Cash	-9.75%
Total Fund	**100%**

The chart below compares HPOPS' current allocation in each asset class (represented by the dot) to the quartiled allocation range for each asset class in a peer group of public funds with assets above $1B (represented by the floating boxes).



Source: Verus, InvestmentMetrics

HPOPS' current allocation is tilted toward heavier equity exposure and lower fixed income exposure than its peers, which has served it well as higher risk exposures have been steadily increasing since the Global Financial Crisis.

We conducted a mean-variance analysis on HPOPS' current policy allocation, using our proprietary capital market assumptions to determine a range of potential outcomes within which the Plan's performance could reasonably be expected to fall.

	Policy	Return (g)	Return (a)	Standard Deviation	Sharpe Ratio (a)
US Large	33.7	*5.5*	*6.6*	*15.4*	*0.31*
Total Domestic Equity	***34***				
International Developed	8.4	*7.0*	*8.4*	*17.5*	*0.37*
Intl Developed Hedged	8.4	*8.8*	*10.1*	*17.5*	*0.47*
Emerging Markets	1.6	*7.6*	*10.4*	*25.6*	*0.33*
Total Int'l Equity	***18***				
Total Equity	***52***				
Core Fixed Income	7.8	*2.2*	*2.4*	*6.3*	*0.08*
Short-Term Gov't/Credit	2.0	*1.7*	*1.8*	*3.6*	*-0.03*
High Yield Corp. Credit	3.5	*3.3*	*4.0*	*11.3*	*0.18*
Emerging Market Debt (Hard)	0.35	*5.0*	*5.7*	*12.4*	*0.31*
Emerging Market Debt (Local)	0.35	*5.7*	*6.4*	*12.0*	*0.37*
Total Fixed Income	***14***				
Value Add Real Estate	10.0	*8.6*	*10.0*	*17.7*	*0.46*
Total Real Assets	***10***				
Hedge Fund	6.5	*4.0*	*4.3*	*7.7*	*0.31*
Private Equity	20.0	*8.5*	*11.3*	*25.3*	*0.37*
Private Credit	7.5	*7.0*	*7.5*	*10.0*	*0.56*
Total Non-Public Investments	***34***				
Cash	-10.0	*1.9*	*1.9*	*1.2*	-
Total Allocation	**100**				

Mean Variance Analysis	
Forecast 10 Year Return	***7.3***
Standard Deviation	14.1
Return/Std. Deviation	*0.5*
1st percentile ret. 1 year	*-20.7*
Sharpe Ratio	0.44

Based on this analysis, the Plan's expected average annualized return for the next 10 years is 7.3% with a 14.1% standard deviation and a Sharpe Ratio of 0.44. These metrics indicate a strategic asset allocation that is well-aligned with HPOPS' return objectives.

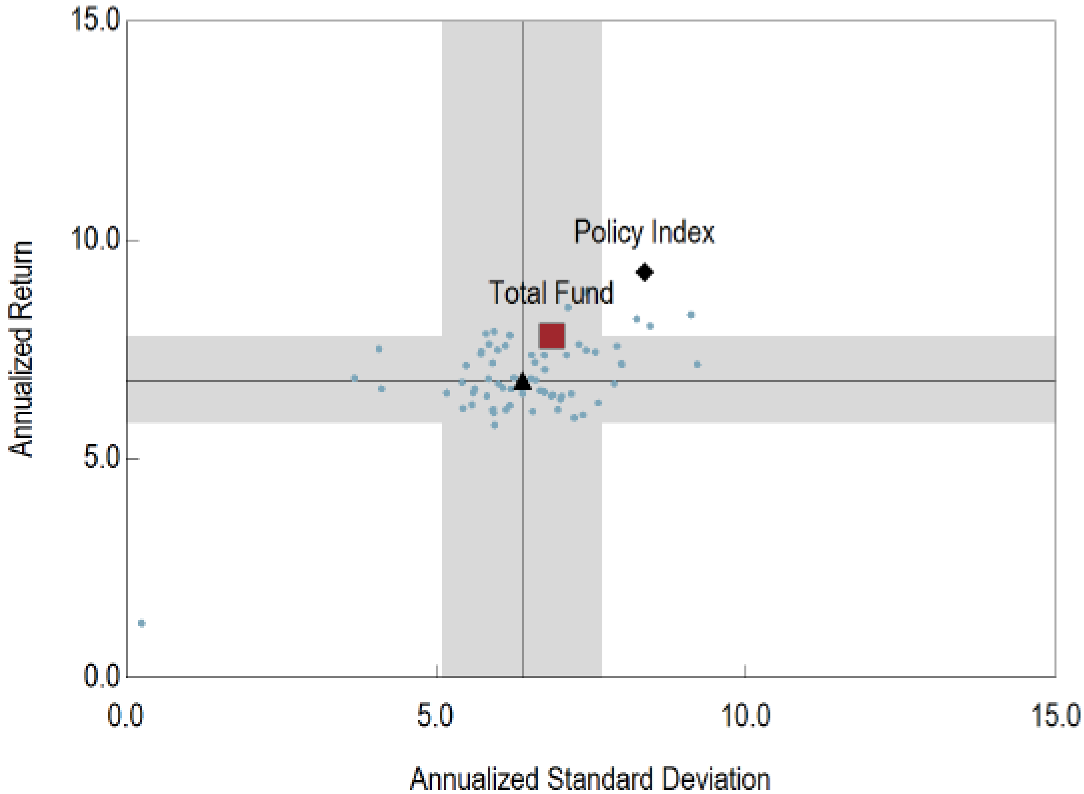
A mean-variance optimization modeling exercise provides highly precise analytical output that specifies an "optimal" asset mix for any given target rate of return or level of risk. However, it is broadly recognized that the quality of the output is only as good as the quality of the forecasted inputs, and forecasted inputs have historically been notoriously inaccurate. Therefore, MVO output should not be the only standard by which the reasonableness of a strategic asset allocation is measured. With that in mind, we further assessed the reasonableness of HPOPs' asset allocation decisions using historical performance (provided by HPOPS Staff) relative to stated investment objectives and to peers (public pension funds with assets >$1 billion).

	1 Yr	3 Yr	5 Yr	10 Yr	15 yr	20 Yr
Total Fund	18.6%	10.7%	7.8%	8.6%	7.2%	6.5%
Policy Index	23.4%	11.9%	9.3%	9.0%	7.3%	6.0%
Percentile Peer Ranking	21	8	13	34	12	10

Performance as of 12/31/19.

Based on these performance metrics, HPOPS actual allocation as implemented has been highly effective in meeting its return objectives over most historical periods and showing strong performance relative to its peers.

While the Plan has not performed as well relative to its policy benchmark, particularly over the past five years, the investment portfolio has been more conservatively positioned than the policy allocation, leading to less risk and return in a secularly strong equity bull market, as shown in the exhibit below.



Based on this analysis, we expect the Plan to outperform peers but underperform the Policy Index during risk-on environments and vice versa.

Portfolio Structure

Active vs. Passive Management

Philosophically, HPOPS believes excess returns produced by active management to be fleeting and difficult to identify in advance. They further recognize the behavioral biases faced by most investors that often lead to hiring a manager at the peak of cyclical performance and terminating at the trough. For these reasons, the Plan utilizes predominantly passive exposure in its public markets investment portfolio, obtained through a combination of index funds, ETFs, and futures positions. The following table provides an accounting of the total portfolio broken down into active and passive positions.

Passive

Asset Class	Market Value	% of Total Exposure
Domestic Equity	1,878,394,065	31.6%
International Equity	1,043,955,557	17.6%
Fixed Income	577,108,086	9.7%
Total Passive	3,499,457,708	58.9%

Active

Asset Class	Market Value	% of Total Exposure
Fixed Income	139,376,970	2.3%
Credit Strategies	523,080,257	8.8%
Private Equity	812,959,376	13.7%
Private Real Estate	439,665,832	7.4%
Liquid Alternatives	451,271,688	7.6%
Total Active	2,366,354,123	39.8%

Cash

Asset Class	Market Value	% of Total Exposure
Cash	76,527,338	1.3%

Combined

	Market Value	% of Total Exposure
Total Fund	5,942,339,169	100.0%

HPOPS commitment to passive investing is high relative to that of other public pension funds. That said, we find the rationale behind their decision sound and their position reasonable.

Liquidity

HPOPS Investment Staff monitors liquidity and cash needs closely and reports on the topic regularly to the Investment Committee and the Board of Trustees. The following reports are reviewed by Staff on a monthly basis:

— Liquidity Profile – report on how long it will take to turn each investment into cash;
— FYTD Cash Flow Review – reconciliation of beginning and ending cash for the last six months and fiscal year-to-date; and
— Cash Flow Forecasts – sources and uses report that contains two years of actual and two years of forecasted cash flows

The following reports are presented to the Investment Committee and the full Board on a monthly basis:

— Portfolio Liquidity Schedule – report of how long it will take to turn each investment into cash, summarized by asset class; and
— Cash Flows and Concentrations – historical report on components of annual net cash flow for last eight years and current fiscal year-to-date

In order to assess liquidity sufficiency, we conducted an analysis of the Plan’s cash flow needs and the liquid financial assets that can be used to meet them. Through this analysis, we answer the question, “Will the plan be forced to sell illiquid assets to cover cash outflows in the next 5 years?”. We quantify this dynamic using a liquidity coverage ratio (LCR), which is defined as follows:

$$Liquidity\ Coverage\ Ratio\ (LCR) = \frac{\begin{matrix} Liquid\ Financial\ Assets\ (stressed\ market\ condition) \\ \sum(Distributions\ from\ Illiquid\ Assets) \\ \sum\left(\frac{Employer}{Employee}\ Contributions\right) \\ \sum(Investment\ Income) \end{matrix}}{\begin{matrix} \sum(Benefit\ Payments) \\ \sum(Capital\ Calls\ for\ Illiquid\ Assets) \\ \sum(Plan\ Expenses) \end{matrix}}$$

LCR Value	Implication
<1	The plan will need to sell illiquid assets to cover cash flows
1	The plan has sufficient liquidity to cover all cash flows
>1	The plan will not be required to sell illiquid assets to cover liquidity needs

Our analysis, shown below, and based on cash flow projections provided by HPOPS, shows that even under extreme market conditions, the Plan maintains sufficient liquidity to cover net cash outflows.

	Baseline	20% Drawdown	25% Drawdown	30% Drawdown	35% Drawdown	40% Drawdown
Liquid Financial Assets	3,935,099,532	3,148,079,626	2,951,324,649	2,754,569,672	2,557,814,696	2,361,059,719
Illiquid asset Distributions	1,208,000,000	1,208,000,000	1,208,000,000	1,208,000,000	1,208,000,000	1,208,000,000
Contributions (Employee + Employer)	755,336,350	755,336,350	755,336,350	755,336,350	755,336,350	755,336,350
Any Additional Income						
Benefit Payments + Lump Sums	2,006,112,808	2,006,112,808	2,006,112,808	2,006,112,808	2,006,112,808	2,006,112,808
Illiquid asset Capital Calls	1,757,000,000	1,757,000,000	1,757,000,000	1,757,000,000	1,757,000,000	1,757,000,000
Additional plan expenses	17,984,199	17,984,199	17,984,199	17,984,199	17,984,199	17,984,199
Liquidity Coverage Ratio	**1.56**	**1.35**	**1.30**	**1.25**	**1.20**	**1.14**

Manager Evaluation

HPOPS has developed robust processes for assessing manager suitability for hire (Appendix E) and for conducting periodic on-site due diligence after a manager has been hired (Appendix G), which are described in detail in the Investment Policy Statement. In addition, HPOPS' Investment Staff monitors each manager on an ongoing basis, utilizing a performance report that is reviewed with the Investment Committee and the Board of Trustees on a monthly basis.

Manager Selection

Currently, HPOPS' process for conducting manager searches contains the following key steps, as generally defined in the IPS:

- Establish search criteria
- Identify list of candidates meeting criteria
- Review list with Board
- Identify subset of managers to complete RFI/RFP
- Identify short-list of preferred managers
- Interview short-list candidates
- Conduct on-site due diligence, as appropriate
- Make final recommendation to Investment Committee
- Gain Board approval
- Document process throughout

Because HPOPS utilizes mostly passive management for its public markets investments, the opportunities to follow the above-described process have been limited. One example occurred in 2013, when the Plan was seeking an "Alternative Beta" manager to help diversify portfolio risk. Based on our review of search documents, this search was not conducted in strict compliance with Investment Policy. The key areas of divergence were:

- No clear search criteria were established; and
- The search focused on a single candidate rather than a comparative evaluation of a field of candidates (although it should be noted the single candidate was recognized at the time as a clear leader in the space).

Further, in our view actively managed traditional investments, and alternatives each require different approaches to due diligence, including varying degrees of rigor. HPOPS' established search process does not explicitly address these differences.

To remediate potential deficiencies in the manager selection process, as currently defined, we recommend the following:

1. Specify separate requirements for active and passive traditional investments, as well as for alternative investments.
2. Simplify the process description, providing high-level guidelines for flexibility with specificity on required rigor only where necessary. For example, it may not be necessary to have candidate

managers complete an RFP for every search, but it may be necessary to obtain Investment Committee and Board approval every time.

3. Prepare adequate documentation to ensure/demonstrate process has been followed.

Manager Monitoring

Once a manager is hired, the focus shifts to ensuring they are meeting established performance expectations and can be expected to continue to do so. Typically, this is accomplished by tracking investment performance through time and periodically reviewing qualitative factors such as style drift and organizational stability. HPOPS has established procedures for both.

<u>Performance Review</u>

HPOPS prepares monthly performance reports that lists all managers compared to a passive benchmark over multiple periods, from latest month through to since inception. These reports are presented to the Investment Committee and the Board of Trustees in advance of their monthly meetings.

<u>On-Site Due Diligence</u>

Currently, HPOPS' Investment Policy Statement specifies that Staff shall meet with each manager annually to review a comprehensive set of topics listed in Appendix G of the IPS. Through discussions with Staff, we confirmed that annual meetings occur as mandated but that the reviews are unstructured and not well documented.

In addition, and similar to the procedures for manager selection, ongoing monitoring procedures are different for traditional active managers and alternative investments. For example, passive investments should require very little to no monitoring, and private markets investments may only require a review upon renewal.

To remediate potential deficiencies in the monitoring process, as currently defined, we recommend the following:

1. Include peer rankings in periodic performance reports, as appropriate.
2. Clarify the level of due diligence required by type of investment.
3. Reduce the specificity of the coverage topics in Appendix G to provide Staff with flexibility.
4. Prepare adequate documentation to ensure/demonstrate process has been followed.

Benchmarking

HPOPS utilizes a combination of benchmarking approaches to help measure the ongoing effectiveness of its investment program, as described below.

Public Markets

The Plan's public markets investments are predominately passive and benchmarked against the broad market indexes they are designed to replicate. Public markets benchmarks are listed below

Investment Strategy	*Benchmark*
BlackRock Equity Index Fund	S&P 500 Index
NT Russell 3000 Index Fund Parametric US Futures	Russell 3000 Index
BlackRock ACWI ex-US Index Fund NT MSCI ACWI ex-US Index Fund Parametric Non-US Futures	MSCI ACWI ex-US Index
BlackRock US Debt Fund NT Investment Grade Debt Fund	BC US Aggregate Bond Index
Shenkman Short Duration Bond Fund	ICE BofA ML 0-2Yr DTW BB-B US Const Index
Parametric EMLC Fund	JPMorgan EMLI+
Shenkman High Yield Bond Fund Northern Trust HY Bond Fund Credit Portfolio	FTSE HY Market TR Index

We believe these benchmarks are broadly appropriate. We further believe additional useful information could be obtained by comparing each fund to a relevant peer universe of actively managed strategies.

Liquid Alternatives

The Liquid Alternatives portfolio utilizes two primary benchmarks for comparative purposes. The first is an absolute return benchmark of 15% per annum; the second is the return of a domestic 60/40 (S&P 500/BC Agg) portfolio. Because of the high tracking error and long-term underperformance of the Liquid Alternatives Portfolio Relative to HPOPS' established benchmarks, we suggest a review of the risk and return objectives of the portfolio and re-assessment of the benchmarks. For example, for the absolute return benchmark a "t-bills plus" approach may make more sense given the cyclical nature of investment markets, and depending on the equity beta of the strategies within the portfolio, a blended benchmark with a lower equity component may be more appropriate.

Private Markets

Due to strategy heterogeneity, combined with lagged valuations, private market investment strategies are notoriously difficult to benchmark, particularly over shorter time periods. The Plan utilizes widely-used benchmarks that include, Cambridge Associates Private Equity, NCREIF, and S&P Energy Sector Index for its Private Equity, Real Estate, and Energy investments, respectively. We believe these are reasonable and appropriate, given a lack of better alternatives.

Total Fund

The Total Fund uses a blended benchmark based on the individual strategy benchmarks, weighted by the policy allocation to each. This is a typical approach that we believe is reasonable and appropriate.

Fees and Trading Costs

We utilized three data sources to evaluate the reasonableness of HPOPS's investment management fees: HPOPS fee schedule, external benchmarking study, and HPOPs CAFR.

The fee schedule below was pulled directly from the November 2019 Trustee Handbook, and a similar report is provided to Trustees on a monthly basis.

	Assets 11/30/19	Estimated Fees	Basis Points
Clifton Futures	673,418,499	360,655	5.4
NT Russell 3000	240,322,587	48,065	2.0
BlackRock S&P 500 Index Fund	915,501,254	183,100	2.0
Total Domestic Equity	1,829,242,340	591,819	3.2
Clifton Non-US Futures	456,146,180	244,293	5.4
BlackRock ACWI ex-US Index Fund	323,133,494	193,880	6.0
NT MSCI ACWI ex-US Index Fund	203,373,549	101,687	5.0
Clifton Currency Hedge	39,843,029	133,958	5.0
Total Int'l Equity	1,022,496,252	438,173	4.3
Shenkman Capital	169,595,969	668,586	39.4
Northern Trust HY	67,409,549	269,638	40.0
Silver Point Credit	25,300,176	506,004	150.0
Illiquid Credit Portfolio	247,025,857	3,705,388	150.0
Total Credit Strategies	509,339,312	5,149,615	101.1
Parametric EMLC	37,876,962	20,285	5.4
Shenkman SD	138,663,929	485,324	35.0
Blackrock BG Agg	449,251,771	179,701	4.0
NT Inv Grade Debt	113,313,610	33,994	3.0
Total Fixed Income	739,106,271	719,304	9.7
Mercer - Hedge Funds	879,461		
Franklin Park - Private Equity / Energy	803,207,406	400,000	5.0
Bridgewater Pure Alpha	94,343,242	1,382,574	146.5
Bridgewater Pure Alpha Major Markets	59,694,840	447,711	75.0
Mercer - Real Estate	407,384,014	400,000	9.8
Opportunistic Portfolio	288,065,475	4,176,949	145.0
Cash	104,796,364	94,317	0.1
Total	$ 5,858,554,977	8,419,683	14.6

Investment management fees illustrated in HPOPS' 2018 CAFR were higher at approximately $13.5 million or 25 basis points of total assets. The decrease in 2019 was primarily due to a reduction in assets allocated to more expensive hedge fund strategies.

Because of HPOPS' heavy usage of passively managed investment strategies, fees are low compared to peers. In our experience, we find a fee load of approximately 40 -60 basis points, not including private markets, to be reasonable for mid-sized plans with a typical mix of active and passive investments, and HPOPS' fees are well below this level.

In 2017, HPOPS commissioned a study by CEM Benchmarking to conduct a thorough review of the Plan's investment management cost. The study looked at all investment management fees, including fees for private markets investments, which are often not captured in standard fee schedules due to their complexity. The study included private markets base fees but not performance-based incentive fees. Including private markets investments, total investment management costs plus consulting fees was $42.7 million in 2017, or approximately 87 basis points of total fund assets.

Peer comparisons to assess reasonableness are difficult to make when including fees for private market investments because consistently produced comparative data is not readily available. The 2017 study conducted by CEM Benchmarking stated that HPOPS' all-in fee load was slightly higher than the average of similarly sized plans in its database. We believe this observation results from the impact of HPOPS' higher allocation to low-cost passive strategies being largely offset by its higher usage of high-cost alternative strategies.

In aggregate, we find HPOPS' fee structure to be reasonable and appropriate given its investment strategy.

Trading costs were not evaluated in our review for two primary reasons. First, HPOPS' emphasis on passive management means very little trading occurs in the Plan's investment portfolio, and trading cost is therefore a very small share of total plan cost. Second meaningful and accurate trading cost analysis requires highly specialized and technical analytical tools and capabilities. If HPOPS is interested in pursuing such a study, which we do not recommend, we would be happy to provide a referral to a well-regarded specialty firm we have worked with in the past.

Leverage, FX, and Hedging

Leverage

HPOPS investment program seeks to increase risk-adjusted returns through the prudent use of leverage, and the Plan first began to utilize leverage at the total fund level in 2014. Current investment policy allows explicit leverage up to 9.75% of the total portfolio. As of January 2020, explicit total plan leverage was 6.1%.

Leverage is gained in the portfolio through the use of futures in the domestic and international equity portfolios. HPOPS' Staff monitors the Plan's leverage position daily as part of an internally-produced flash report, and the notional exposure/cash collateral ratio may not exceed 200%.

Based or mean-variance modeling using our 10-year capital market forecasts, adding approximately 10% of explicit leverage to the Plan's asset allocation (with a Sharpe Ratio of 0.44) increases the average annualized expected return from 6.9% to 7.3% and annualized volatility from 13.0% to 14.2%. The expected worst case (1st percentile) scenario goes from -19.1% to -20.8% (see table on next page).

	Policy	Policy w/o Leverage	Return (g)	Return (a)	Standard Deviation	Sharpe Ratio (a)
US Large	33.7	30.0	*5.5*	*6.6*	*15.4*	*0.31*
Total Domestic Equity	***34***	***30***				
International Developed	8.4	6.9	*7.0*	*8.4*	*17.5*	*0.37*
Intl Developed Hedged	8.4	6.9	*8.8*	*10.1*	*17.5*	*0.47*
Emerging Markets	1.6	1.4	*7.6*	*10.4*	*25.6*	*0.33*
Total Int'l Equity	***18***	***15***				
Total Equity	***52***	***45***				
Core Fixed Income	7.8	7.0	*2.2*	*2.4*	*6.3*	*0.08*
Short-Term Credit	2.0	1.8	*1.9*	*2.0*	*3.6*	*0.03*
High Yield Corp. Credit	3.5	3.2	*3.3*	*4.0*	*11.3*	*0.18*
Emerging Market Debt (Hard)	0.35	0.3	*5.0*	*5.7*	*12.4*	*0.31*
Emerging Market Debt (Local)	0.35	0.3	*5.7*	*6.4*	*12.0*	*0.37*
Total Fixed Income	***14***	***13***				
Value Add Real Estate	10.0	9.0	*8.6*	*10.0*	*17.7*	*0.46*
Total Real Assets	***10***	***9***				
Hedge Fund	7.5	6.8	*4.0*	*4.3*	*7.7*	*0.31*
Private Equity	20.0	20.0	*8.5*	*11.3*	*25.3*	*0.37*
Private Credit	6.5	6.5	*7.0*	*7.5*	*10.0*	*0.56*
Total Non-Public Investments	***34***	***33***				
Cash	-10.0	0.0	*1.9*	*1.9*	*1.2*	-
Total Allocation	**100**	**100**				

	Policy	Policy w/o Leverage
Mean Variance Analysis		
Forecast 10 Year Return	***7.3***	***6.9***
Standard Deviation	14.2	13.0
Return/Std. Deviation	*0.5*	*0.5*
1st percentile ret. 1 year	*-20.8*	*-19.1*
Sharpe Ratio	0.44	0.44

Notwithstanding tactical adjustments, HPOPS use of leverage will likely cause them to outperform their median peer during risk-on environments and underperform during risk-off environments.

We find HPOPS' policy on leverage to be intentionally considered, well-implemented, and sufficiently monitored.

Currency Hedging

HPOPS believes that exposure to foreign currencies is an uncompensated risk that should be managed and has been doing so since 2011. The policy is to hedge out Euro, Pound, and Yen exposure in the Plan's international equity portfolio with a target hedge ratio of 50%. Staff has the authority to tactically adjust the hedge ratio within a range of +/- 25 percentage points.

While over very long time periods, a hedging program would be expected to produce a slight negative return in line with the cost of the program, HPOPS' program has returned approximately 2.5% on an average annualized basis since program inception through fiscal year-end 2019, given the strengthening $US trend over the time period.

Disclosures

For all fiscal years from 2008 through 2018, HPOPS met the requirements to earn a Certificate of Achievement for Excellence in Financial Reporting, as established by the Government Finance Officers Association.

With respect to assessing investment-related disclosures, we reviewed a sample of recent annual reports for other public pension plans, including CalPERS, Texas Municipal, Contra Costa County, and Houston Firefighters. While there were variances in presentation style and format, each plan covered similar information within the following broad categories.

- Management discussion
- Summary of investments
- Investment returns
- Managers and investment fees
- Top holdings

In absolute and relative terms, we found HPOPS's disclosures to be a reasonable and sufficient representation of its investment program.