



COMMONWEALTH OF PENNSYLVANIA  
PUBLIC SCHOOL EMPLOYEES' RETIREMENT SYSTEM

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Public Investment Memorandum

Nimbus Weather Fund, Ltd.  
Absolute Return Program

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Senior Portfolio Manager, Non-Traditional Investment Strategies

August 28, 2017



### **Recommendation:**

Staff, together with Aksia, recommends that PSERS invest \$150 million (split between Class X Shares and Class F Shares) in the Nimbus Weather Fund, Ltd. (Fund). This recommendation is based on our assessment of the investment strategy and our evaluation of Nephila Capital Ltd.'s (Nephila or Investment Manager) capabilities.

### **Firm Overview:**

Founded in 1997 by Frank Majors and Greg Hagood, Nephila was originally part of Willis Ltd. (one of the world's largest reinsurance brokers). Nephila was purchased from Willis by the co-founders in 2003. Man Group plc and KKR & Co. LP purchased a minority equity ownership position in the firm in 2008 and 2013, respectively. Nephila's co-founders and partners retain a majority of the equity ownership and control of the Board. Nephila is one of the largest investment managers dedicated to investing in the natural catastrophe industry, an asset class offering the potential for strong returns uncorrelated to other asset classes. The investment manager's platform provides a wide range of natural catastrophe products to meet various risk/return profiles by investing across all sectors of the insurance-linked securities industry.

Nephila employs over 120 professionals, of which the majority are located in Bermuda (the center of the property catastrophe reinsurance industry). Nephila also has offices located in Nashville, San Francisco, and London.

### **Market Opportunity / Investment Strategy:**

A 2011 study led by the National Center for Atmospheric Research estimated that routine weather events such as rain and cooler-than-average temperatures can impact the economy by as much \$485 billion per year in the United States. The impact is felt in every sector of the economy and every state.

The Nimbus Weather Fund strategy is focused on weather risk transfer, targeting weather events such as temperature, precipitation (rainfall and snowfall), solar (sunshine), and wind speed. Weather risk impacts both private and public institutions across many economic sectors such as traditional energy, renewable energy, agriculture, construction, transportation, sports and leisure, retail, mining, water, and local municipalities. These institutions look to hedge weather risks outside of their control (energy supply, agricultural yields, construction delays, operational disruptions, etc.) so they can focus on risks they can control. Weather risk transfer contracts are customized to address specific issues and protect businesses from the financial consequences of weather events. These contracts can provide revenue and earnings stability or make it feasible to obtain project financing.

The Nimbus Weather Fund has evolved over time. When initially launched in 2005, the strategy employed two staff people. Deal sourcing was more reactive than proactive focusing primarily on the energy markets. In 2015, Nephila noticed an increasing demand for weather risk transfer products with limited competition from other insurers/reinsurers. Having the ability to construct a diversified portfolio of weather risks drove Nephila to build out their weather business. Their research has shown that adding additional weather risks to the portfolio will improve capital efficiency. Now, there are eight investment staff and four support staff dedicated to this strategy. Deal sourcing has become proactive with direct origination combined with exclusive marketing and distribution relationships. Today, risk exposures are more diverse in terms of weather type, economic sector, and geographical area. Return volatility has decreased while the expected returns have remained stable. Direct origination and exclusive broker agreements provide increased portfolio diversity. In the past, opportunities were seasonal. Now, increased demand allows for the utilization of capital throughout the year. For the first time in three years, Nephila has opened the strategy to new investors.

The growing opportunity in the weather risk transfer market is being driven by a number of factors:

- Increasing financial and regulatory requirements
- Increasing impact of wind and solar energy providers on energy systems



- Increasing focus on weather risk management to improve project financing
- Increasing awareness of the availability of customized weather risk transfer solutions
- Increasing desire to reduce the influence of weather on financial performance
- The limited number of counterparties willing to assume customized weather risks

The Fund's objective is to build a diverse portfolio of weather-linked instruments that are priced to generate an acceptable rate of return in light of the risk being assumed. The growing weather risk transfer market has provided an increased opportunity to diversify weather exposures within the portfolio. Nephila has executed weather transactions in a larger number of sectors across a larger number of geographical regions which enables the returns to compound while the risks decrease.

The Fund targets a net rate of return of the 3-month U.S. Treasury bill interest rate plus 10% per annum. Through a diverse portfolio, the investment manager will attempt to limit the ultimate exposure to any one geographic region or weather event during the exposure period of the investment. Assets not used to purchase or establish weather-linked transactions will be invested in short-term, highly liquid debt instruments such as those issued by the U.S. government and U.S. agencies. Hedging strategies to manage the weather risk exposures will be employed within the overall objectives of the Fund. These weather-linked instruments are not ordinarily classified as insurance as the risk transfer does not provide protection against economic loss resulting from property insurance risk.

Nephila's proprietary model allows them to analyze, model, and track all weather risk deals in a market that lacks standardized third party weather risk modeling tools. The weather strategy leverages resources of the broader Nephila platform. Given their ability to gather, analyze, and model historical weather data, Nephila is well positioned to take advantage of an expanding weather risk transfer market.

The investment manager has extensive experience structuring and trading securities related to natural catastrophes. The weather strategy is a natural extension of that experience. The portfolio focuses on maximizing returns and minimizing risk in a market that has been uncorrelated to traditional financial markets. The manager's investment process combines their experience with quantitative portfolio construction techniques and integrated risk management tools to focus on a relatively unexplored marketplace. At this time, the weather marketplace is subject to much inefficiency. Nephila's relationships, experience, and size provide them with an advantage over their competition.

Research efforts are focused on climate modeling and analysis, risk modeling, portfolio construction and pricing, exposure analysis and accumulation, and settlement systems. The objective of these research efforts is to better understand risk at the point of underwriting, improve the modeling process, better manage risk accumulation during portfolio construction, and streamline the settlement process after an event. Portfolio Management and Analytics work together to analyze each transaction from a risk/return standpoint on a stand-alone basis and relative to the entire portfolio. Trading decisions are based on the contribution to the portfolio return that improve the portfolio on a risk-adjusted basis.

Key differences between Weather Risk and Natural Catastrophe Risk are:

<b>Weather Risk</b>	<b>Natural Catastrophe Risk</b>
Continuous weather events (temperature, precipitation, solar, wind speed)	Discrete, binary events (hurricane, earthquake, windstorm)
Risk transfer contracts protect against cash flow variability	Insurance protects against property damage
Two-sided return distribution (for example, contracts can be written to protect against high temperature or low temperature)	One-sided return distribution (for example, insurance is only written to protect against property damage)
Returns are more volatile (weather can fluctuate daily)	Returns are less volatile (catastrophes can be less frequent)



Portfolio diversification by geography, economic sector, event, and event direction (i.e. +/- temperature, +/- precipitation)	Portfolio diversification by geography and event
Driven by a focus on company cash flows	Driven by a focus on the industry regulatory requirements
High quality, relevant data is available	Less frequent natural catastrophe events, therefore less data is available
Limited models provides a greater opportunity for differentiation among capital providers	Three specialized modeling firms provide baseline industry analytics, capacity providers make adjustments to these vendor models

**Portfolio Fit:**

The investment in the Fund will be part of the Absolute Return Program.

**Investment Instruments:**

The Fund will invest in various weather-based investment instruments (including notes, swaps, futures, or other derivative instruments). The return or performance on the instrument is based on the occurrence or non-occurrence of a given weather event or circumstance. Weather variables to which instruments can be linked include but are not limited to temperature, precipitation (rainfall and snowfall), streamflow, solar (sunshine), and wind speed as measured at objective, third-party operated recording stations. In addition, weather-linked instruments with a primary exposure to these weather variables may have a secondary or contingent exposure to other variables such as energy prices. Payments to or from counterparties related to the risk transfer contracts are generally settled at the end of a defined contractual period, however in some cases there may be agreed upon settlement dates throughout the contract term.

These weather-linked instruments are attractive to institutions wanting to hedge weather risks because they allow the buyer to focus on their core (controllable) business risks and potentially achieve economic efficiencies through the structured distribution of weather risk.

**Investment Team:**

Richard Oduntan, PhD, leads the weather team and serves as the Portfolio Manager on the Fund. Richard joined Nephila in 2008 after previously working for a power generation facility in various roles. He is supported directly by a team of seven individuals that have a wide range of educational and professional experience that includes weather research; structuring insurance products; quantitative financial modeling and engineering for risk analysis, portfolio optimization, and pricing; risk transfer modeling; index structuring for new weather markets; and financing renewable energy projects. In addition, the weather strategy is supported by over 100 professionals that work on research and modeling, software development, forecasting, risk management, and portfolio analysis with Nephila's overall platform.



Name	Title	Years' Experience Firm / Total	Prior Experience	Education
Richard Oduntan, PhD	Portfolio Manager	9 / 16	Ontario Power Generation	PhD, Financial Engineering
Barney Schauble	Managing Principal	13 / 24	XL Capital, Goldman Sachs, Guy Carpenter, Marsh	BA, Economics
D. Matthew Coleman	Portfolio Analyst	6 / 14	Citadel, National Center for Atmospheric Research	MBA, Finance / MS, Meteorology / BS, Chemistry and Environmental Sciences
Ali Ouaiissi	Quantitative Financial Engineer	5 / 7	Oddo & Cie Investment Banking and Capital Management, BNP Paribas Securities Services	MSc, Quantitative Finance / MSc, Mathematical Engineering / BS, Mathematics and Computer Science
Grant Cavanaugh, PhD	Portfolio Analyst	2 / 8	Praedicat, GlobalAgRisk	PhD, Agricultural Economics / BS, Foreign Service
Dan Stillwell	Portfolio Originator	2 / 12	SunEdison	MBA, Finance / BA, Psychology
Hans Tuentner, PhD	Senior Quantitative Developer	2 / 18	Ontario Power Generation, Algorithmics Inc.	PhD, Operations Research
Ryan Dawe	Quantitative Analyst	1 / 4	Aon UK Ltd.	MMath, Mathematics / ACII, Chartered Insurance Institute

**Investment Highlights:**

<p><b>Track Record</b></p> <p>Nephila has a long track record of successfully launching and managing model-based catastrophe strategies. In addition, the investment manager has been disciplined in monitoring capacity so that the funds do not grow too large and negatively impact performance.</p>
<p><b>Human Capital</b></p> <p>Nephila employs over 120 professionals with education and experience in weather, modeling, financial instruments, and quantitative strategies. These diverse backgrounds promote the development of customized, innovative solutions to address the varied needs of businesses. Since the initiation of our relationship with Nephila in 2011, we have noted that the investment manager is willing to add staff as needed.</p>
<p><b>Infrastructure</b></p> <p>Nephila has developed a proprietary weather risk transfer system for deal modeling and portfolio optimization. The infrastructure and investment team has been built out over the years with dedicated resources being added as the opportunity increased. This approach to business expansion was a similar approach as was followed with their successful catastrophe strategy.</p>



<b>Relationships</b>
Nephila's relationships with their existing broker network in addition to their relationship with KKR are providing increased access to businesses in need of weather risk transfer products. Nephila has seen a steady increase in inquiries and portfolio transactions. The level of interest should continue to increase as sensitivity to weather risks continues to increase.
<b>First Mover Advantage</b>
Nephila is among a small number of firms pursuing a weather risk transfer strategy. Being first to the market should offer Nephila the chance to develop products for specific target markets and take advantage of market inefficiencies to generate strong returns.
<b>Uncorrelated Returns</b>
Weather risk is an asset class that is uncorrelated to traditional financial markets.

**Investment / Risk Considerations:**

<b>Reliance on Technology</b>
All aspects of the investment program (data gathering, research, forecasting, pricing, portfolio construction, order execution, risk management, and all back office functions) are dependent on technology and proprietary software. The investment manager has safeguards in place to detect and prevent any coding errors, technology malfunctions, or security breaches.
<b>Restricted Liquidity and Transferability of Shares</b>
There is no market for Fund shares, and no market is expected to develop. Given the liquidity restrictions and potential redemption limitations, PSERS may not be able to liquidate its investment in the Fund for a period of time.
<b>Possibility of Government or Market Regulation</b>
Recent financial market activities have led to increased governmental and regulatory scrutiny of the hedge fund industry. It is impossible to predict any future changes in laws or regulations that may be imposed on the Fund, the investment manager, the markets in which they trade and invest, or the counterparties with which they do business.
<b>Track Record</b>
While the strategy has a long track record, the current version of this strategy (driven by the increasing demand and the improved ability to diversify risk in the portfolio) has a limited history. However, we believe that the investment manager's history in the natural catastrophe market justifies our consideration of the weather risk transfer strategy.
<b>Credit Risk</b>
Nephila will take into account the general credit quality of the counterparty, issuer, and structure of the transaction. The Investment Manager will be allowed to purchase unrated weather-linked instruments if they otherwise meet the investment parameters.
<b>Reliance on Third-Party Data</b>
Nephila may maintain agreements with other third-party vendors. Through these agreements, Nephila will have access to historical weather data, weather modeling, actuarial analysis, real time information on weather trends and forecasts, market trading data, and general weather intelligence to assist in the valuation of the weather risk investments. There is no guarantee that the data used is the most accurate data available or is free of errors. The investment manager will use its discretion to determine what data to gather and use in their models. Adjustments are made to the data to account for known biases.
<b>Lack of Volume of Weather-Linked Investments</b>
The volume of deals involving weather-linked investments may not be sufficient for the Fund to invest the optimal amount of funds in such investments. In such case, funds will be invested in short-term, highly liquid instruments discussed above. Under this scenario, the potential return of the Fund will be limited.



<b>Leverage</b>
The Fund will from time to time borrow amounts and / or assume notional risk greater than the net assets of the Fund. Although there is no restriction on the amount of leverage, the investment manager does not anticipate using leverage in excess of 250%. Losses incurred on leveraged investments could be increased in direct proportion to the degree of leverage used.
<b>Unpredictability of Risk</b>
The frequency and severity of weather events are inherently unpredictable. Such events are difficult to model with any degree of accuracy, and therefore the expected return on an investment is difficult to calculate.

**Finance Committee Disclosure:**

Relationship with Aksia:	None Disclosed
Introduction Source:	PSERS has been invested with Nephila since July 2011 via our investment in the Palmetto Fund, Ltd.
Placement Agent:	None Used
PA Political Contributions:	None Disclosed
Potential Conflicts:	We are not aware of Nephila having any material investment conflicts.
PSERS History with the Investment Manager:	PSERS has been invested with Nephila since July 2011 via our investment in the Palmetto Fund, Ltd.
PSERS Allocation Implementation Committee Approval:	August 28, 2017

**Oversight Responsibility:**

Investment Office:	Charles J. Spiller Robert E. Little	Deputy CIO, Non-Traditional Investments Senior Portfolio Manager
External Consultant:	Aksia LLC	

**Manager Recommendation Memo**

August 21, 2017

Board of Trustees  
 Pennsylvania Public School Employees' Retirement System  
 5 North Fifth Street  
 Harrisburg, PA 17101

Re: Nimbus Weather Fund, Ltd.

Dear Trustees:

Aksia LLC, having been duly authorized by the Board of PSERS, has evaluated and hereby recommends a direct allocation to Nimbus Weather Fund, Ltd ("Nimbus") in line with PSERS Investment Policy Statement, Objectives, and Guidelines. It is further recommended that PSERS initially invest up to \$150 million in Nimbus.

Nephila Capital ("Nephila") was founded in 1997 by Frank Majors and Greg Hagood (both working for Willis Re at the time) and was initially known as Willis Corroon Catastrophe Management. In 1998, the firm relocated to Bermuda and the first fund, Willis Catastrophe Fund (now known as Nephila Catastrophe Fund), was subsequently launched. In October 2003, Frank and Greg bought out the remainder of the company and the firm was re-named as Nephila Capital. PSERS has been an investor in Nephila's Palmetto Fund, Ltd since July 2011.

Nimbus pursues a strategy focused on contractual weather risk transfer. For the purposes of this strategy, weather and climate risks exclude natural catastrophes, focusing instead on weather phenomena driven by the day-to-day state of the atmosphere, e.g.: temperature (heat waves, cold fronts); wind (low, high wind), excessive rainfall (or drought); snowfall; etc. Such contracts aim to protect businesses in the energy (traditional & renewable), agriculture, entertainment, municipalities, and construction sectors from the financial consequences of weather events based on predefined triggers, providing revenue and earnings stability or making it more feasible to procure debt financing. Nephila is among a handful of firms pursuing a weather derivative strategy, but it appears to be the sole firm offering a scalable, diversified product to investors.

Aksia's recommendation is based upon the following analytical factors and is made within the context of PSERS' investment guidelines:

- Due diligence of the investment process, including a review of their investment strategy, investment team personnel and structure, and risk management;
  - Most recent on-site investment due diligence visit conducted May 1, 2017 for the 2017 investment review update.
- Due diligence of operations, including a review of the firm's organizational structure, service providers, regulatory and compliance, trade flow process, PPM reviews, and financial statement review;
  - On-site operational due diligence visit conducted July 19, 2016 for the 2017 operational review update.
  - The following is a listing of the other relevant points of contact with the manager since the last onsite visit.

Date	Nature of Contact	Aksia Points of Contact
May 5, 2017	Update information obtained during onsite	Lawrence Canzoneri
July 12, 2017	Annual ODD Onsite for 2018 review update	Lawrence Canzoneri

- Evaluation of the Nimbus strategy within the context of the current investment environment; and
- Appropriateness of Nimbus as a component of the PSERS' portfolio.

This recommendation is given solely for the benefit of PSERS and cannot be relied upon by other investors considering an investment in Nimbus, since their needs, objectives, and circumstances may not be identical to those of PSERS. The scope of this recommendation is limited to the investment merits of Nimbus. In addition, please consult your tax, legal and/or regulatory advisors before allocating to any private investment fund.

Please feel free to contact us should you have any questions about this recommendation.

Respectfully,



Norman Kilarjian  
 Partner, Head of Macro and Quant Strategies



Simon Fludgate  
 Partner, Head of Operational Due Diligence