AIA NY COMMITTEE ON THE ENVIRONMENT

White Paper -***"Where Mitigation Meets Adaptation: An Integrated Approach to Addressing Climate Change in New York City"*** Recommendations following Hurricane Sandy

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A.) INTRODUCTION

In the wake of Hurricane Sandy AIA NY's Committee on the Environment wants to focus attention on the inextricable **interconnection between greenhouse gas emissions and changing weather events**. The purpose of this white paper is to highlight strategies that simultaneously address climate change adaptation and resilience and reduce greenhouse gas emissions. The implementation of sustainable design in consort with principles of resilient design is required to effectively address both the **cause and effects of climate change** over the long term. COTE believes that assiduous efforts on the part of the building community can result in a significant impact towards halting the damage of climate change.

The conversation has now shifted from sustainability to resilient design. Due to their interrelatedness, it is critical that adaptation strategies are not implemented at the expense of climate change mitigation - such that a negative "spiral" effect would be created, where adaptation strategies further contribute to climate change weather events, necessitating more acute adaptation strategies. Moreover, adaptation strategies that also address mitigation should be **prioritized** as creating the highest positive impact. We have outlined below potential points of overlap between adaptation and mitigation. Several scales are identified that are applicable to New York City, including the urban or city scale, the neighborhood or district scale and the building scale.

We cannot overstate the importance of implementing both mitigation policies and adaptation measures; adaptation alone cannot protect our city's residents from the anticipated effects of climate change. The Stern Review, conducted by the British government in 2006, concluded that the costs of mitigation to stabilize climate change would likely be about 1% of global GDP each year by 2050, while the cost of continuing inaction (business as usual) would likely be 5 to 20% in terms of loss of wealth worldwide.

B.) CLIMATE CHANGE IMPACTS

Climate change adaptation and mitigation must be addressed in response to multiple climate change events, which can be categorized as either extreme **high impact short term events**, or more **gradual** but equally impactful **long term events**. While climate change impacts tend to be perceived as developing slowly over a long period of time, both short term and long term events can create devastating consequences that New York City should prepare for.

SHORT TERM EVENTS

Short term climate change related events can be defined as events where an immediate impact can be identified that often has disastrous consequences. Hurricanes, Tsunamis, storm surges and rainstorms can be cited as examples. However, short term events can also include heat waves, such as the European heat wave of 2003 which resulted in an estimated 70,000 deaths. Other examples include brown or blackouts due to increased demand for cooling, droughts and wildfires. New York City has been exposed to heightened short term climate change risks which have had disruptive impacts on the day to day lives of residents and businesses. Particularly critical for New York are heavy rain events, storm surges, high wind events, brownouts, blackouts, and heat waves.

Heavy rain events can create an impact on existing infrastructure, including transportation and sewer systems. Combined sewer overflow has long been an issue in New York, and increased rainfall events will continue to exacerbate the negative public health impacts. As well, increased rain events could have impacts on individual buildings, where building enclosures and roof drains have been designed to manage lesser quantities of rainwater.

For years, scientists have predicted that rising sea levels surrounding the island of Manhattan and other boroughs will eventually disrupt the daily lives of inhabitants. While the rising sea level is gradual, short term extreme impacts have occurred (and will continue to occur) when a convergence of various conditions arise, as witnessed during Super storm Sandy in October 2012. Higher sea levels combined with astronomically high tides and an extreme **storm surge** caused the surrounding water to far surpass historical floodplain datum's, thereby disrupting infrastructure, transportation, businesses, hospitals, residential buildings and hospitals, causing severe damage.

High wind events have impacts at both building, district and urban scales. Most existing building enclosures have not been designed to consider such extreme events. At the district and urban scales, landscaping, signage, street furniture and other infrastructure may not be able to withstand high wind events, causing damage and potential danger to pedestrians, vehicles and buildings.

Brownouts and **Blackouts** may arise as a result of various circumstances. Severe storms and hurricanes could disable power stations, as was the case with Hurricane Sandy, leaving residents and businesses without electricity for heating, cooling, lighting and other equipment. An extreme and/or prolonged heat wave could also place additional burden on the city's electrical infrastructure.

In addition to loss of power supply, increased and prolonged heat waves may have an impact on **public health**, exacerbating effects of the **urban heat island**, which consequently could elevate **air pollution levels** and reduce **water supplies** or create periods of drought. Urban **biodiversity** could also be impacted by all of the scenarios listed above.

LONG TERM EVENTS

Longer term climate change related events can be defined as events where a gradual and often incremental impact can be demonstrated and/or projected. In many ways, responding to longer terms events is more challenging, per the analogy of the boiling frog used by Al Gore in "An Inconvenient Truth." Because impacts are more gradual and less extreme that those of short term events, establishing the political will and financing for long term adaptation requires a different strategy that for events such as Hurricane Sandy. Long term events can include increasing annual temperatures, air pollution, sea level rise, annual/monthly precipitation, drought, and changes in flora/fauna/biodiversity. These affect issues such as available energy supply for cooling, water supply, waterfront development, sewer infrastructure design and capacity, and public health.

Increasing annual temperatures will impact both existing and new buildings, as well as the overall urban environment. Building enclosures and systems for cooling, heating and ventilation have been designed for temperatures and heating/cooling degree days that are no longer applicable to current and future circumstances. Systems may no longer be able to meet increased peak loads for cooling for example.

As a result of increasing temperatures and prolonged heat waves, **air quality** may decline due to increased smog. This could impact interior as well as exterior environments, requiring measures to reduce pollutants contributing to smog, as well as requiring increased air filtration in buildings.

Sea level rise will affect both existing buildings and new developments in waterfront and low lying areas. Increased rainfall events will require long-term urban storm water management strategies and infrastructure upgrades, as well as reconsideration of how storm water is managed on building sites. Periods of drought will impact water supply, both for potable water requirements, landscaping and water required for cooling.

Long term changes in temperature and precipitation will eventually impact the city's **ecosystems**, affecting landscape elements, birds, bees and other habitat.

C.) APPROACH/SOLUTIONS: POLICY, DISTRICTS AND BUILDINGS

In order to successfully manage both short and long term climate change events, the intersection between adaptation and mitigation must be addressed at multiple scales. **Urban policy and legislation** are critical to ensuring ongoing solutions that can be put in place over the long term. **District systems and strategies** not only provide more resilient infrastructure solutions, but are often more efficient in providing energy and water, and reducing greenhouse gas emissions. Finally, there are multiple opportunities at the **individual building scale** to reduce energy and water demand, and ensure survivability during extreme weather events.

URBAN POLICY

At the city scale, it is critical that leadership take a **two-pronged** approach to address the uncertainty and potential hazards associated with climate change. Policy initiatives should simultaneously address mitigation measures and adaptation strategies.

New York City has already taken a leadership position in GHG reduction, through initiatives such as PlaNYC 2030, the Green Codes Task Force, and the Greener, Greater Buildings Plan. It is critical that city government commitment to these and other programs will continue in future mayoral administrations.

The city should continue in its efforts to reduce energy demand by strengthening energy and water efficiency standards, in particular **mandating requirements** or facilitating implementation of strategies that fulfill both mitigation and adaptation objectives. These include items such as increased insulation values, optimized glazing-to-wall ratios, operable windows, rainwater harvesting, and black water treatment and reuse. Measures should also **be incentivized** through rebates, tax-based incentives, and streamlining the approval and permitting process.

On a district scale, the city should focus on **removing the barriers** to implementation of **decentralized infrastructure** projects such as district energy, water, waste and even food systems that are both often more efficient and autonomous than centralized models. Partnership with utilities will be critical to the success of this effort. Moreover, policies should continue to be developed to promote the implementation of less carbon intensive and increased renewable energy at the urban scale.

City-wide master planning and landscape strategies must also address mitigation and adaptation.
Natural, **'green infrastructure'** approaches emphasize flexibility rather than rigidity to absorb the energy of storm events and limit damage. Wetlands, coastal ecosystems, permeable pavement, and rain gardens are examples of alternatives to the traditional, engineered approach of concrete, pipes, and sewers. Stormwater management approaches should not be confined to city limits; these require watershed-scale planning.

Green infrastructure also points to the role of landscape in mitigating climate change through carbon sequestration, reduction of heat island effect and providing for increased biodiversity. This begs the question of whether it makes sense to rebuild in place following catastrophic climate events such as Hurricane Sandy. We advocate for **smart rebuilding** which may also consider potentially retreating from certain coastal areas to allow natural systems to reestablish, which can act as a resilient buffer to future storms and also provide for increased opportunities for carbon sequestration.

DISTRICT STRATEGIES

By expanding the planning approach beyond the confines of individual building lots, greater efficiencies, economies of scale, and resilience can be achieved, to reduce carbon footprint and enhance response to climate events.

Until recently the focus in sustainable design has primarily been on individual buildings. Generally speaking, rating systems as well as building codes and zoning regulations generally do not fully recognize the potential for **interdependency** of buildings on a city block or neighborhood.

A nascent trend has been establishment of **Eco-districts** -- led by cities such as Portland, Seattle, and San Francisco -- which integrate sustainable and smart buildings, water and waste management approaches, open space and nature, transportation alternatives, and even food production. New York City has its own model -- Battery Park City -- for a sustainably designed, constructed, and operated district.

One of the most important district opportunities is creation of neighborhood district**energy plants**, that serve multiple buildings or a neighborhood or campus. District plants can utilize larger and more efficient equipment than individual buildings, to provide hot and chilled water services to surrounding buildings and make use of waste heat for uses such as steam generation.

Water infrastructure can also benefit from a district approach. Many municipalities are looking at 'purple pipe' systems, which use reclaimed water from stormwater and runoff, which is then stored, treated, and distributed within the district for non-potable uses. For added resilience, a reserve of potable water can be stored in local cisterns for emergency use during post-disaster recovery. The district approach allows shared investment and benefit for expensive technologies and systems.

Districts also allow great opportunities for **'closed loop' systems**, which utilize waste (e.g., energy or solid waste) as a resource which is not merely discharged but actually cycled back into the process as an input. For example, lab buildings, due to stringent ventilation requirements, exhaust tremendous amounts of conditioned air, from which heat and/or energy can be recovered and shared with adjacent buildings. Another example is the practice of 'sewer mining', first developed in Australia, which uses municipal wastewater as a resource by siphoning off effluent from the system and reclaiming the water and nutrients for reuse.

We argue that sustainability and resiliency can work best in **small collective pockets**, particularly for disaster planning and post-disaster recovery. Districts can often be more nimble than government agencies, allowing them to make decisions and mobilize more quickly without getting bogged down in bureaucratic processes. Accessing funding and supplies, creating distribution chains, and organizing volunteers can often be more readily achieved by neighborhood organizations than by national, state, or local government.

BUILDING SCALE

At the building scale, there are ample opportunities to implement strategies that address resilience and adaptation, while reducing the impact on climate change. Unfortunately, as the LL84 benchmarking reports indicate, newer buildings use more energy, often due to design and systems. This greater dependence on fossil fuels translates into decreased autonomy or survivability in events such as Hurricane Sandy when infrastructure, whether energy or water, is cut off from the building.

Passive Survivability is a phrase first used by Alex Wilson, writing in Environmental Building News in December of 2005. It is defined as "the ability of a building to maintain critical life-support conditions for its occupants if services such as power, heating fuel, or water are lost for an extended period." **Passive survivability** is not achieved by the addition of back-up generators. Rather, it depends on the type of building self-sufficiency that was inherent in all buildings prior to the 20th century, when mechanical heating and cooling technologies were less readily available. By reducing reliance on fossil fuels for heating, cooling and electricity, passive survivability inherently serves as both a powerful adaptation and mitigation strategy for buildings.

Passive survivability can be achieved by incorporating the sustainable design features that have been used to address climate change mitigation: proper building form and orientation, optimized glazing percentages, high performance building enclosures, passive solar gain, daylight harvesting and natural ventilation. In addition, **on-site renewable energy** can provide for heating, cooling and/or electricity without reliance on the grid. Examples include solar heating for domestic hot water, Photovoltaics or Co-generation, ground and water source heat pumps and wood/pellet burning stoves. In addition to providing for autonomy and resilience, each of these strategies reduces the release of greenhouse gases, helping to reduce the destructive forces contributing to global climate change.

When water management, supply and use is considered through the lens of passive survivability, it is clear that it is critical to building design from both a mitigation and adaptation perspective. Building in high risk flood areas should be avoided if at all possible. **Storm water collection and treatment** should be handled locally, in many cases within the footprint of the building property, or a small local district. Rainwater should be collected, filtered and stored for reuse. Composting toilets and district grey/black water treatment plants are alternatives that should be encouraged in local codes, which currently discourage the use of these technologies. In addition to water harvesting for reuse, green roofs and building landscaping can help soften the impact of storm events while contributing to reduced heat island effects.

D.) CONCLUSION

Responding to the increasing presence of climate change in New York City requires strategies that focus on multiple scales, address the short and long terms, and tackle adaptation and mitigation simultaneously. Through a mechanism similar to the NYC Green Codes Task Force, AIA NY COTE recommends implementation of government mandates, code and zoning changes, and financial incentives for solutions that address climate change from this holistic perspective. By implementing the strategies recommended above, New York City will serve as a leader in support of a new global model focusing on passive survivability.