



## Preliminary Report on New York City Emergency Response and Evacuation Plans in the Event of a Weather-Related Emergency

“People would stop evacuating simply because they were unable to evacuate.”

-New York Hurricane Evacuation Study, April 2005<sup>1</sup>

Richard L. Brodsky  
Chairman  
Committee on Corporations,  
Authorities, and Commissions  
September 15, 2005

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<sup>1</sup> Hurricane Evacuation Study Program, (April 2005) *New York City Hurricane Evacuation Study Behavioral Analysis Findings* [online] Available: [http://chps.sam.usace.army.mil/USHESdata/NY/NY\\_city\\_behave\\_report.htm](http://chps.sam.usace.army.mil/USHESdata/NY/NY_city_behave_report.htm) [September 8, 2005].

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## **I. Introduction**

The Hurricane Katrina disaster makes clear how truly vulnerable we are to weather-related disasters, and how many government agencies with legal responsibility for emergency and evacuation planning may be unprepared and ineffective. The disproportionate impacts on the poor, the disabled, and minority communities are especially unacceptable in a society which proclaims that human life and property can and will be protected by government regardless of income, race, or disability. That experience requires an immediate and thorough public review of existing plans. This Preliminary Report is the first step in that process.

Emergency and evacuation planning for New York City are the responsibilities of the City's Office of Emergency Management (OEM) under the supervision of the Mayor, and depend heavily on mass transit, the Metropolitan Transportation Authority (MTA), the Port Authority and other state and local authorities and agencies. The MTA strongly asserts that their role is to provide transportation assets to OEM and the State Emergency Management Office (SEMO) and to participate in the OEM evacuation plan, which was developed and approved solely by OEM.

There are two kinds of evacuation and emergency response plans for New York City. The first plan is weather-related, focusing on low lying areas, with the assumption of significant lead time for the evacuation. The second is an "area evacuation," in which specific areas and eventually the entire city may be evacuated because of a serious disaster, including accidents or security related attacks, for which there may or may not be any advance notice. According to emergency response professionals, while weather-related evacuations do not raise significant security related issues, area evacuation plans are more security-sensitive and there is a reluctance to disclose specific area evacuation assets and plans.<sup>2</sup> This inquiry will focus exclusively on weather-related evacuations.

It should be noted that many of the questions and concerns raised in this preliminary analysis may have been considered by the responsible agencies. The decision by the Office of the Mayor not to release any documents, nor to permit the Assembly Committee on Corporations, Commissions and Authority (the "Committee") to review the

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<sup>2</sup> Commissioner Joseph Bruno in a conversation with Chairman Richard Brodsky, September 7, 2005

plans, and the cumbersome and unnecessary processes it has attempted to impose on the Committee's inquiry have limited this initial review to public documents. The MTA has repeatedly responded in a prompt manner to requests for information and has promised the Committee documents in its control.<sup>3</sup> The Committee is continuing its efforts to improve public awareness of these matters, and to review all relevant documents.

## **II. History of New York Hurricanes**

New York City and the Long Island region have been directly hit by 11 hurricanes over the last 120 years, for an approximate frequency of one hurricane every 10 years.<sup>4</sup> The most severe hurricane to hit the New York coastal region has been a Category 3 hurricane. According to historical records, since 1815 there have been four Category 3 hurricanes that have hit the New York City region: 1815, 1821, 1893, and 1938. Experts believe that a Category 3 hurricane will hit New York once every eighty years.<sup>5</sup>

In addition to Category 3 storms, New York has been regularly hit by hurricanes and tropical storms capable of requiring evacuation and shelter. Hurricane Carol in 1954 struck Eastern Long Island and Southeastern Connecticut with sustained winds over 100 mph. In 1985 residents braced for Hurricane Gloria which, although originally was considered a Category 3 hurricane, dramatically decreased in strength as the storm ran ashore. Hurricanes Felix (1995), Bertha (1996), Edouard (1996), Floyd (1999), and Isabel (2003), all were eventually downgraded to tropical storms before hitting the City and caused heavy rain and at times flooding in the region. In fact Floyd forced the closure of the New York City schools and required the city to take prudent measures by opening up emergency storm shelters.

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<sup>3</sup> These requests and responses came in repeated conversations between Chairman Richard Brodsky and senior MTA personnel.

<sup>4</sup> New York State Emergency Management Office, Federal Emergency Management Agency, U.S. Army Corps of Engineers (1993) *New York State Hurricane Evacuation Study* pg 7.

<sup>5</sup> Mandia, Scott A. , (No date). *The Long Island Express, The Great Hurricane of 1938*, [online]. Available: <http://www2.sunysuffolk.edu/mandias/38hurricane/index.html> [September 8, 2005].

### **III. Weather-Related Evacuations**

New York City is the third most vulnerable major American city to a hurricane disaster, behind New Orleans and Miami.<sup>6</sup> In a preliminary review of published documents a number of significant issues concerning the mass evacuation and shelter of City residents were identified, including but not limited to: reliability of evacuation plans, public awareness of hurricane and flood threats, and sufficient shelter space for residents who cannot evacuate.

#### **1. Reliability of Evacuation Plans**

The reliability and success of evacuation plans is dependent on the number of people being evacuated, the available evacuation resources, the amount of lead time before the storm hits, the distance to which people need to be evacuated, the accessibility of evacuation locations, the disruptive effects of flooding on roadways and mass transit, the role of public employees, the needs of special populations, and several technical factors such as “self evacuation” and coordination of plans between agencies and municipalities.

##### ***a. Number of People Needing Evacuation***

OEM estimates that a Category 4 hurricane could force the evacuation of over one million residents, and require shelter for up to 224,000 stranded evacuees.<sup>7</sup> OEM predicts that 25% of residents would seek city shelter even though, as discussed in more detail below, its own survey indicates that 45% of residents would seek shelter. Furthermore, according to one hurricane expert who participated in the drafting of a significant U.S. Army Corps of Engineers Study of storms and evacuations in New York City, a Category 3 hurricane could cause 30-foot storm surges,<sup>8</sup> flood hundreds of miles of the city’s coast, and force the evacuation of over 2.5 million residents.<sup>9</sup> On the one hand the City assumes 25% of residents will seek shelter, on the other hand the raw data from the City’s own survey

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<sup>6</sup> New York City Office of Emergency Management, (2004). *Hazard Overview*, pg 4. Available: <http://www.nyc.gov/html/oem/html/readynewyork/home.html> [September 8, 2005].

<sup>7</sup> New York City Office of Emergency Management, (2004). *Hazard Overview*, pg 4. Available: <http://www.nyc.gov/html/oem/html/readynewyork/home.html> [September 8, 2005].

<sup>8</sup> Larson, Erik, (September 7, 1998). *Hurricane X. TIME*, pg 64-66.

<sup>9</sup> New York State Emergency Management Office, Federal Emergency Management Agency, U.S. Army Corps of Engineers (1993) *New York State Hurricane Evacuation Study* pg 38.

revealed that 45% of evacuees would seek shelter.<sup>10</sup> There are large discrepancies between the City's assumptions and the survey results which could lead to as many as 450,000 seeking shelter in a 1,000,000 person evacuation, or in the case of 2,500,000 person evacuation, 600,000 to 1,000,000 may require emergency shelter (*see page 14 for additional information*). Significant variations in these calculations will dramatically alter the amount of lead time, required resources and shelter, and congestion calculations for a safe and secure evacuation. These conflicting calculations need further discussion and clarification.

### *b. Available Evacuation Resources*

It is unclear from public documents what assumptions have been made about road use, road congestion, and the amount of time needed for successful evacuations, except that the plan now directs people to buses and trains running on their regular routes, absent specific information otherwise made public at the time of emergency. The OEM relies heavily on the use of public transportation, arguing that public transportation is the most efficient and effective means to moving residents from flood zones to higher ground. OME has stated:

“In a coastal storm, plan to use mass transit as much as possible, as it offers the fastest way to reach your destination. Using mass transit reduces the volume of evacuees on the roadways, reducing the risk of dangerous and time-consuming traffic delays.”<sup>11</sup>

“The City advises against car travel during an evacuation. The City will be working hard to keep roads clear, but traffic is unavoidable in any evacuation. Driving will increase your risk of becoming stranded on a roadway during an evacuation.”<sup>12</sup>

However, according to the Hurricane Survey, 65% of respondents in Manhattan, Brooklyn, and the Bronx with cars would take mass transit if advised to do so by City officials. Just under 50% of residents with vehicles in Queens and Staten Island would take mass transit. Unfortunately the study does not estimate the total number or percentage of

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<sup>10</sup> Hurricane Evacuation Study Program, (April 2005) *New York City Hurricane Evacuation Study Behavioral Analysis Findings* [online] Available:

[http://chps.sam.usace.army.mil/USHESdata/NY/NY\\_city\\_behave\\_report.htm](http://chps.sam.usace.army.mil/USHESdata/NY/NY_city_behave_report.htm) [September 8, 2005].

<sup>11</sup> New York City Office of Emergency Management, (no date). *Ready New York*. Available:

[http://www.nyc.gov/html/oem/html/readynewyork/hazard\\_hurricane\\_evacuate.html](http://www.nyc.gov/html/oem/html/readynewyork/hazard_hurricane_evacuate.html) [September 9, 2005].

<sup>12</sup> Id.

evacuating residents with cars. According to the NYS Department of Motor Vehicles (DMV), in 2004 there were 1,848,570 registered vehicles and 1,669,948 standard vehicle registrations in force for New York City. The number of vehicle registrations in force for each borough is the following: 232,990 in Bronx County, 401,795 in Kings County, 240,388 in New York County, 719,289 in Queens County, and 254,108 in Richmond County.

The significant reliance on public transportation, including trains, subways, and buses, places great responsibility in the hands of the MTA, the Port Authority and other government agencies. Successful and sufficient evacuations can not take place without plans that are clearly coordinated between agencies, and as appears more fully below, between neighboring municipalities that may have competing calls on public pathways and assets. The MTA asserts that they do not, nor need not have their own evacuation plan, and that they will marshal and deliver transportation assets as directed by OEM. It is unclear as to whether or not MTA assets are sufficient to move the number of people who may need to be evacuated in a weather-related evacuation. It does not appear that the MTA has done an assessment of its maximum evacuation capacity given the full use of its resources.

In order to sufficiently plan a mass evacuation that is so heavily reliant on public transportation, there must be a comprehensive inventory of MTA assets, the number of people each asset can transport, how many people can be transported per hour, and how assets are to be marshaled and delivered.

### *c. Lead Time*

The City's, MTA's, and Port Authority's ability to accomplish any of these goals is directly dependent upon the amount of advanced notice given to city residents. It is difficult to estimate precisely how much time the City would have to evacuate in advance of a hurricane, but since flooding and high winds can occur several hours before the storm runs ashore the actual amount of time to evacuate may be less than expected.<sup>13</sup> According to the US Army Corps of Engineers, some hurricanes have been preceded by over 20 inches of rain 24 hours before the hurricane makes land fall.<sup>14</sup> It should be noted that Atlantic coast

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<sup>13</sup> Id.

<sup>14</sup> New York State Emergency Management Office, Federal Emergency Management Agency, U.S. Army Corps of Engineers (1993) *New York State Hurricane Evacuation Study* pg 54.

storms move at a greater velocity than those hurricanes in the southern region of the United States.<sup>15</sup> It is unclear what impact reduced advance warning will have on the plan's ability to successfully evacuate.

***d. Process, Accessibility, and Distance of Evacuation Routes and Shelters***

***i. Process.*** The OEM has divided the City into "solar systems", each containing a reception center and several shelters for those who are unable to evacuate the city. However, OEM's evacuation plan does not allow people to directly go to the shelters. Instead OEM has developed a system for processing stranded evacuees, whereby each resident seeking emergency shelter is required to first appear at a "reception center."

"To ensure the most efficient use of resources and to make necessary parking available, the City will ask all evacuees seeking public shelter to report to a Reception Center. These centers are located in all boroughs, are easily reached via public transportation and many provide parking facilities."<sup>16</sup>

There are currently 23 such systems ("solar systems") in the City, each of which can accommodate between 3,000 and 12,000 people. There is little or no information available about whether people know of this requirement, or whether they will proceed directly to shelters, or how they are to be informed.

***ii. Accessibility and Distance.*** Not all reception centers are available by public transportation, furthermore bus and subway routes may be disrupted due to flooding or storm surges. According to the OEM *NYC Hurricane Evacuation Zones map*,<sup>17</sup> there are three reception centers that are not accessible by public transportation, five reception centers that are accessible by bus or car only, one reception center is accessible by subway or car only, and 14 reception centers which can not accommodate parking. Practically speaking, in the event of an emergency, persons who are not easily mobile and rely on public transportation may have serious difficulty traveling from their homes to a safe shelter.

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<sup>15</sup> Mandia, Scott A. , (No date). *The Long Island Express, The Great Hurricane of 1938*, [online]. Available: <http://www2.sunysuffolk.edu/mandias/38hurricane/index.html> [September 8, 2005].

<sup>16</sup> <sup>16</sup> New York City Office of Emergency Management, (no date). *Coastal Storms and Hurricanes: Sheltering in New York City*. Available: [http://www.nyc.gov/html/oem/html/readynewyork/hazard\\_hurricane\\_shelters.html](http://www.nyc.gov/html/oem/html/readynewyork/hazard_hurricane_shelters.html) [September 14, 2005].

<sup>17</sup> Map available at <http://www.nyc.gov/html/oem/> [September 14, 2005]



For example, people residing in and around the Staten Island Botanical Garden are directed by the plan<sup>18</sup> to drive or to take the S54 bus to the nearest reception center, which is the Michael J. Petrides High School. However, residents near the Botanical Garden are one mile from the bus stop, and another 1.4 miles from the bus stop to the reception center. Once the individual reaches the reception center it is unclear how far and by what means they will travel to the emergency shelter. Traveling nearly 2.5 miles to and from the bus stop, in order to reach the reception center, would be arduous for any individual, much less for those with physical limitations.

#### *e. Special Populations*

As was seen in the Hurricane Katrina disaster, disabled, poor, and elderly communities were the least able to successfully evacuate during an emergency. That experience is a powerful warning to New York to assure that evacuation plans provide for the needs of persons with a variety of physical and health limitations. The plan's ability to deal with physically non-mobile populations such as nursing home residents or the home-bound disabled is unclear from published documents. Nor is it clear that non-English speaking populations will be adequately educated and contacted by OEM, the MTA, and other authorities.

#### *f. Vulnerable Tunnels, Roadways, and Bridges*

OEM's reliance on public transportation obviously assumes the physical and timely availability of the system. Although the City's evacuation plan considers the impact of hurricanes up to a Category 4, OEM states that some subway and rail tunnels may flood during a Category 1 hurricane.<sup>19</sup> In 1992, a strong nor'easter forced the closing of the FDR Highway and the L train.

Given the extreme vulnerability of tunnels during a flood, and the importance of subways in moving residents out of dangerous storm zones, the MTA, the Port Authority, OEM, and the City must have a comprehensive contingency plan for operating roads,

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<sup>18</sup> Office of Emergency Management Online Locator: <http://gis.nyc.gov/oem/emols/he/address.jsp>

<sup>19</sup> New York City Office of Emergency Management, (2004). *Hazard Overview*, pg 4. Available: <http://www.nyc.gov/html/oem/html/readynewyork/home.html> [September 8, 2005].

bridges, tunnels, trains, and subways during rising flood waters and a mass evacuation. It is unclear whether the MTA is aware of which subway lines are most susceptible to flooding and which lines are most reliable in the instance of a hurricane storm. Furthermore, according to a study conducted by the US Army of Corps of Engineers, the Verrazzano Narrows and George Washington Bridges would experience the effects of hurricane force winds long before high speed winds are measured at street-level.<sup>20</sup> Given the overall importance of these bridges in evacuating the City, the City, MTA, and other Authorities should further review how much lead time would be needed to safely shut down high hanging bridges, and what impact this would have on the overall evacuation plan. It is unclear as to whether the City, MTA, and Port Authority systems are coordinated amongst themselves and with neighboring states, to what extent the plans rely on the continued availability of roads, tunnels, and bridges, and the extent to which weather conditions would substantially impact the effectiveness of the plans. In the event that the George Washington Bridge, which is operated by the Port Authority, would need to be shut down, it is unclear what procedures would govern this decision.

#### ***g. Participation and Training of Public Employees***

Successful evacuation depends as much on the public employees who operate the subways, trains and buses as it does on the physical pathways and other assets required by the plans. It appears that neither the City nor the MTA has reached out to their employees or organizations about their responsibilities in a weather-related evacuation. It is unclear if the City assumes the ability and willingness of MTA and Port Authority Employees to return to evacuated areas, of if employees have been informed or trained for these extraordinary responsibilities. Public employee participation has been a significant issue in other evacuation and emergency response plans.<sup>21</sup>

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<sup>20</sup> Mandia, Scott A. , (No date). *The Long Island Express, The Great Hurricane of 1938*, [online]. Available: <http://www2.sunysuffolk.edu/mandias/38hurricane/index.html> [September 8, 2005].

<sup>21</sup> Assemblyman Richard Brodsky and Assemblyman Paul Tonko. *Interim Report on the Evacuation Plan for the Indian Point Nuclear Facility*, (February 20, 2002). Available: New York State Assembly]

#### *h. "Self Evacuation"*

Maintaining safe and reliable evacuation routes is as much about comforting and educating the residents who are not in danger as it is about informing the residents who are in danger. In any emergency, numbers of people in areas not designated for evacuations by the authorities will evacuate. This phenomenon is known as "self evacuation." In fact according to the New York City Hurricane Evacuation Study funded by FEMA, 40% of residents surveyed who lived in 'safe regions of the city' would leave the city if there was an evacuation anywhere in the city.<sup>22</sup> The Committee's 2002 investigation into the evacuation plan for the Indian Point Nuclear Facility concluded that based on expert testimony, emergency officials must factor in "self evacuation" when planning for evacuations.<sup>23</sup> The extent to which the City, MTA, and other Authorities have considered "self evacuation" outside of the designated evacuation areas is unclear. Failure to consider such a scenario could cause a major strain on the transit system and evacuation routes potentially leading to absolute gridlock. In a disturbing admission about the practical limitations of the City's plan, the plan dismisses the history and impact of self-evacuation in emergencies without explanation or basis in experience or expert analysis.

"The clogging of streets and public transportation facilities and the jamming of evacuation reception centers would be so great and occur so early that the condition would probably remedy itself. People would stop evacuating simply because they were unable to evacuate."<sup>24</sup>

The plan acknowledges the possibility of over-evacuation, mass congestion, and confusion, but fails to explain what will happen to individuals who do not evacuate because of such obstructions.

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<sup>22</sup> Hurricane Evacuation Study Program, (April 2005) *New York City Hurricane Evacuation Study Behavioral Analysis Findings* [online] Available:

[http://chps.sam.usace.army.mil/USHESdata/NY/NY\\_city\\_behave\\_report.htm](http://chps.sam.usace.army.mil/USHESdata/NY/NY_city_behave_report.htm) [September 8, 2005].

<sup>23</sup> Assemblyman Richard Brodsky and Assemblyman Paul Tonko. *Interim Report on the Evacuation Plan for the Indian Point Nuclear Facility*, (February 20, 2002). pg 23-25. Available: New York State Assembly

<sup>24</sup> Hurricane Evacuation Study Program, (April 2005) *New York City Hurricane Evacuation Study Behavioral Analysis Findings* [online] Available:

[http://chps.sam.usace.army.mil/USHESdata/NY/NY\\_city\\_behave\\_report.htm](http://chps.sam.usace.army.mil/USHESdata/NY/NY_city_behave_report.htm) [September 8, 2005].

### *i. Coordination between Municipalities and Agencies*

The coordination of plans between neighboring municipalities and agencies must be clarified. At least one recent report revealed that evacuation routes for the Far Rockaways interfere with evacuation routes for neighboring Nassau County.<sup>25</sup> It is unclear, in fact, whether the MTA will be able to rely on the systems operated simultaneously in all the boroughs and Long Island without incurring many difficulties. The problem of evacuation routes crossing paths could cause serious congestion and confusion in the time of great emergency. At the present time, it is unclear whether officials have resolved this issue. SEMO is the coordinating and decision making entity in the event of a multiple municipality evacuation, otherwise the role of FEMA and SEMO is unknown. Given the failures of FEMA in New Orleans, and the failures of SEMO and FEMA with respect to the Indian Point Evacuation Plans, these relationships should be immediately clarified.<sup>26</sup>

## **2. Public Awareness and Education**

No evacuation plan can succeed without a vigorous and ongoing public education campaign, as well as effective communication and leadership at the time of emergency. As was seen in the Hurricane Katrina disaster, a substantial percentage of the public lacks the general knowledge of how, where, or when to evacuate. The City of New York has conducted a study to scientifically measure the awareness level among city residents. The New York City Hurricane Evacuation Study, Behavioral Analysis Findings, showed just how uninformed the residents of New York are when it comes to a hurricane. For example when residents were presented with the scenario of a Category 3 hurricane, 33% of the respondents in Zone A (the lowest lying coastal zone with greatest vulnerability) were unaware of any flooding risks, and nearly 50% of residents in “non-surge areas” (the safest zones) believed they would be in immediate danger, a significant finding for the issue of

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<sup>25</sup> New York City Office of Emergency Management, (no date). *How New York City's Hurricane Evacuation Zones Were Developed*. Available: [http://www.nyc.gov/html/oem/html/emols/oem\\_zones.html](http://www.nyc.gov/html/oem/html/emols/oem_zones.html) [September 12, 2005].

<sup>26</sup> Assemblyman Richard Brodsky and Assemblyman Paul Tonko. *Interim Report on the Evacuation Plan for the Indian Point Nuclear Facility*, (February 20, 2002). pg 47. Available: New York State Assembly

“self evacuation”.<sup>27</sup> Most residents are unaware how to behave during a hurricane or an evacuation. At least 75% of the residents surveyed by the City’s own Hurricane Evacuation Study said they were not aware of the evacuation zones.<sup>28</sup> More than 85% of all New Yorkers had never seen “Ready New York”, the OEM’s official public handbook for surviving disasters.<sup>29</sup> Questions concerning whether residents were familiar with how to seek out the nearest shelter or reception center in the event of an evacuation were not addressed in the survey.

While OEM has created a flood zone map, and the Assembly Committee on Corporations Authorities and Commissions was able to obtain a version of the map from the OEM website, the Committee’s request for a large scale map that is readable was denied by the Office of the Mayor.<sup>30</sup>

The map divides the City into three distinct hurricane zones: Zone A would face the highest risk of flooding from any type of hurricane, Zone B indicates areas at risk of storm surge flooding from a moderate hurricane – category 2 and 3, Zone C indicates areas at risk of flooding from a major hurricane – category 3 and 4 (see Appendix B for communities most at risk of coastal flooding).<sup>31</sup> The map also illustrates reception centers where people need to evacuate to in case of emergency and whether the centers are accessible by subway, bus or car.

The City will communicate specific evacuation instructions to the public through the local media. Residents may also call 311 to find out if they should evacuate. However, studies have indicated that certain evacuation routes are not clearly marked, there are no evacuation sirens in case of a power outage, and the public is not sufficiently aware of the

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<sup>27</sup> Hurricane Evacuation Study Program, (April 2005) *New York City Hurricane Evacuation Study Behavioral Analysis Findings* [online] Available:

[http://chps.sam.usace.army.mil/USHESdata/NY/NY\\_city\\_behave\\_report.htm](http://chps.sam.usace.army.mil/USHESdata/NY/NY_city_behave_report.htm) [September 8, 2005].

<sup>28</sup> Hurricane Evacuation Study Program, (April 2005) *New York City Hurricane Evacuation Study Behavioral Analysis Findings* [online] Available:

[http://chps.sam.usace.army.mil/USHESdata/NY/NY\\_city\\_behave\\_report.htm](http://chps.sam.usace.army.mil/USHESdata/NY/NY_city_behave_report.htm) [September 8, 2005].

<sup>29</sup> Id.

<sup>30</sup> Letters from Ms. Kelly MacMillan, Chief of Staff to Chairman Brodsky, to Danelle Leidner, Office of Mayor Bloomberg, September 7, 2005; and to Ms. Leidner and Ms. Christina Farrell, September 8, 2005.

<sup>31</sup> New York City Office of Emergency Management, (no date). *How New York City’s Hurricane Evacuation Zones Were Developed*. Available: [http://www.nyc.gov/html/oem/html/emols/oem\\_zones.html](http://www.nyc.gov/html/oem/html/emols/oem_zones.html) [September 12, 2005].

evacuation plans.<sup>32</sup> Although there have been sporadic attempts by City, Authorities, and community leaders to begin a public awareness campaign it is clear that the majority of City residents know little or nothing about the evacuation process, and that a systematic public education campaign does not exist.

### **3. Sufficient Shelter Space and Services**

The City estimates that in the event one million residents need to be evacuated (the City's estimate for a Category 4 hurricane) 224,000 or approximately a quarter would need emergency shelter. However as was discussed above, a Category 3 hurricane, according to the "New York State Hurricane Evacuation Study,"<sup>33</sup> could force the mass evacuation of over 2.5 million residents – requiring shelter for as many as 600,000 stranded residents. Given this scenario, the city would be unable to accommodate an estimated 330,000 residents in the available shelters.

Although the Hurricane Survey initially found that 45% of respondents would seek shelter in an evacuation, the plan assumes that 40% of those respondents would subsequently find shelter outside of the City's system. According to the survey, the sharp decline in shelter participation from 45% to 25% occurred after respondents learned of the reception center process. "During an evacuation, many evacuees become more aware of some of the less desirable aspects of hurricane shelters and decide on other alternatives."<sup>34</sup> This may or may not be a desirable way to reduce the use of public shelters. The plan also states, without explanation that people try to avoid public shelters.

It is unclear what "these less desirable aspects" are, but they can be guessed at after the events in New Orleans. The plan's fundamental commitment to the 25% assumption ought to be publicly discussed and reviewed. Any increase in the percentage of residents seeking shelter, above OEM's assumed 25%, would leave thousands, potentially hundreds of thousand without safe and secure shelter.

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<sup>32</sup> Office of Congressman Anthony D. Weiner. (October 7, 2003). No Way Out, [online]. Available: <http://www.house.gov/weiner/report031007.htm> [September 8, 2005]

<sup>33</sup> New York State Emergency Management Office, Federal Emergency Management Agency, U.S. Army Corps of Engineers (1993) *New York State Hurricane Evacuation Study*.

<sup>34</sup> Hurricane Evacuation Study Program, (April 2005) *New York City Hurricane Evacuation Study Behavioral Analysis Findings* [online] Available: [http://chps.sam.usace.army.mil/USHESdata/NY/NY\\_city\\_behave\\_report.htm](http://chps.sam.usace.army.mil/USHESdata/NY/NY_city_behave_report.htm) [September 8, 2005].

#### *a. Services to Those Who Can Not or Do Not Evacuate*

One immediate lesson of the Hurricane Katrina disaster is that simple needs like food, water, medical care, and communications may need to be provided to significant numbers of people. The plan's ability to deal with those who remain in a zone after the storm hits is unclear.

### **IV. Conclusion**

Serious and significant questions regarding the City of New York's, MTA's, and Port Authority's evacuation plans need public review and discussion. Whatever answers, explanations, and clarifications that may be available from the MTA, OEM, the Port Authority and others have not been subject to review and oversight, a process which can only strengthen the plans and public awareness of evacuation procedures. The decision by the Office of the Mayor to restrict and limit such discussion at this time is unwarranted and unhelpful in assuring that the plans and the public's awareness of them are improved. The MTA's initial cooperation is important and appreciated. The following questions about weather-related evacuations, the issue of area evacuations, and clarification of the role of local, state and federal agencies are all being pursued by the Committee.

#### **1. Questions Under Continuing Inquiry**

This Preliminary Report including the following questions have been forwarded to OEM, the MTA, the Port Authority, FEMA, SEMO and other related agencies for response.

1. What are the most reliable estimates for the number of people needing to be evacuated and the number of people seeking public shelters?
2. What level of public transportation and shelter resources are needed to evacuate up to 2.5 million residents and 1 million persons seeking shelters?
3. What levels of resources are currently available and how many persons will be able to be evacuated with those resources?
4. What estimates are known for the number of people using cars and people using public transportation?

5. What is the impact on the plan's effectiveness regarding the City's admission that "people would stop evacuating simply because they were unable to evacuate."<sup>35</sup>
6. How much lead time is necessary for the adequate evacuation of 2.5 million residents?
7. What lead times does the City assume they will have in the event of a severe Category 3 hurricane?
8. What plans are there for dealing with those who are unable or unwilling to evacuate, or otherwise stranded in an evacuation?
9. What provisions does the City have for special populations such as hospitals, nursing homes, assisted living facilities, group homes, and community shelters?
10. Which subway and bus lines are most vulnerable to flooding?
11. Do the City and respective Authorities have contingency plans in the event that bridges, including but not limited to the Verrazano Narrows or George Washington Bridge, must be closed due to high winds?
12. Have public employees been made aware of and trained in their participation in an evacuation plan?
13. Have the MTA, Port Authority, the City, FEMA, SEMO, and neighboring municipalities adequately coordinated their plans?
14. Are the Long Island, Westchester, and New Jersey evacuation routes coordinated with the New York City evacuation plans?
15. What steps can be taken to improve public information and education about flood zones, evacuation routes and locations, and the danger of hurricanes?
16. What services such as food, water, and medical care will be provided to residents who can not or do not evacuate?
17. What are the roles of FEMA and SEMO in approving or assisting in the evacuation plan for New York City?

*Francesca Alesi and Alex Monticello also contributed to this Preliminary Report.*

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<sup>35</sup> Hurricane Evacuation Study Program, (April 2005) *New York City Hurricane Evacuation Study Behavioral Analysis Findings* [online] Available: [http://chps.sam.usace.army.mil/USHESdata/NY/NY\\_city\\_behave\\_report.htm](http://chps.sam.usace.army.mil/USHESdata/NY/NY_city_behave_report.htm) [September 8, 2005].



# Appendix A

## Historic New York City Hurricanes and Storms

From the late 1800s, near 1,000 tropical cyclones have occurred within the Atlantic tropical cyclone basin.<sup>36</sup> Since the end of the seventeenth century, more than forty documented hurricanes and tropical storms have directly affected New York State.<sup>37</sup>

Following is a list of New York City hurricanes and tropical storms since the 19th century:

1. 1804 Hurricanes

Two tropical cyclones affected New York State that year, one in September 8, the Carolina Hurricane stroke eastern Long Island. Later, in October 9, the Snow Hurricane produced a pressure reading of 28.87 inches in New York City and caused about 8 inches of snow over western New York State regions.<sup>38</sup>

2. 1815 – Great September Gale Hurricane

One of the most powerful tropical cyclones – Category 3 – to have struck Long Island brought considerable damage across the entire New York City area.<sup>39</sup>

3. 1821 – Long Island Hurricane of September 1821

On September 3 this Category 3 hurricane hit southwestern Long Island, splintering pears along the East River, sinking more than 20 merchant ships, and inundating the Battery.<sup>40</sup>

4. 1846 – The Great Havana Hurricane

This Category 5 hurricane was reduced to a Category 1 before hitting New York, causing 82 mph winds.<sup>41</sup>

5. 1893 – Savannah-Charleston Hurricane

This Category 2 hurricane destroyed Hog Island and caused heavy rains and tropical storm-force winds over central New York.<sup>42</sup>

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<sup>36</sup> New York State Emergency Management Office, Federal Emergency Management Agency, U.S. Army Corps of Engineers (1993) *New York State Hurricane Evacuation Study*. p.7.

<sup>37</sup> Longshore, David. *Encyclopedia of hurricanes, typhoons, and cyclones*. p. 239

<sup>38</sup> Id. pp. 241-242

<sup>39</sup> Id. p. 242 and [http://www2.sunysuffolk.edu/mandias/38hurricane/hurricane\\_climatology.html](http://www2.sunysuffolk.edu/mandias/38hurricane/hurricane_climatology.html) [September 12, 2005]

<sup>40</sup> Id.

<sup>41</sup> Longshore, David, p. 242

6. 1934 – Morro Castle Hurricane  
This Category 2 hurricane hit eastern Long Island causing sustained winds and a barometric pressure of 28.56 inches.<sup>43</sup>
7. 1938 – Long Island Express  
It was the last major hurricane – Category 3 /4 hurricane – to hit NYC, causing the death of nearly 200 people in Long Island and New England. Large Category 3 storms such as this happen every 70-80 years.<sup>44</sup>
8. 1954 – Hurricane Carol  
It was the most destructive hurricane – Category 3 – since 1938, hitting Eastern Long Island and Southern Connecticut, delivering winds of up to 135 mph.<sup>45</sup>
9. 1955 – Hurricanes Connie & Diane  
These tropical storms caused severe floods in NYC and Long Island – During hurricane Connie, 12 inches of rain were recorded at LaGuardia Airport.<sup>46</sup>
10. 1960 – Hurricane Donna  
This Category 3 hurricane traveled across NYC and Long Island, producing 11 foot high storm tide in the NY Harbor causing extensive pier damage.<sup>47</sup>
11. 1971 – Hurricane Doria  
This Hurricane reached NYC as a Category 1 with 80 mph winds, forcing the closing of Kennedy Airport.<sup>48</sup>
12. 1972 – Hurricane Agnes  
This tropical storm flooded areas from North Carolina to New York State, causing 122 deaths.<sup>49</sup>
13. 1976 – Hurricane Belle  
On August 10, this Category 1 hurricane delivered winds of 105-mph and caused the death of one person in NYC.<sup>50</sup>

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<sup>42</sup><http://www.newyorkmetro.com/nymetro/news/people/columns/intelligencer/12908/> and [http://www2.sunysuffolk.edu/mandias/38hurricane/hurricane\\_climatology.html](http://www2.sunysuffolk.edu/mandias/38hurricane/hurricane_climatology.html) [September 12, 2005]

<sup>43</sup> Longshore, David, p. 242

<sup>44</sup> [http://www2.sunysuffolk.edu/mandias/38hurricane/hurricane\\_climatology.html](http://www2.sunysuffolk.edu/mandias/38hurricane/hurricane_climatology.html) [September 12, 2005]

<sup>45</sup> Longshore, David, p. 243,

<http://www.newyorkmetro.com/nymetro/news/people/columns/intelligencer/12908/> and

[http://longisland.about.com/cs/weather/a/hurricane\\_past\\_2.htm](http://longisland.about.com/cs/weather/a/hurricane_past_2.htm) [September 12, 2005]

<sup>46</sup> Longshore, David, p. 243 and <http://www.tpc.ncep.noaa.gov/HAW2/english/history.shtml#connie> [September 12, 2005]

<sup>47</sup> [http://longisland.about.com/cs/weather/a/hurricane\\_past\\_2.htm](http://longisland.about.com/cs/weather/a/hurricane_past_2.htm) [September 12, 2005]

<sup>48</sup> Longshore, David, p. 243

<sup>49</sup> New York City OEM:

[http://www.nyc.gov/html/oem/html/readynewyork/hazard\\_hurricane\\_history.html](http://www.nyc.gov/html/oem/html/readynewyork/hazard_hurricane_history.html) [September 12, 2005]

14. 1985 – Hurricane Gloria

This Category 3 hurricane weakened before it hit the coast, but causing gusts of 125 in central and western Long Island and killing tow people in NYC.<sup>51</sup>

15. 1992 – Nor'easter

This tropical cyclone forced the evacuation of coastal areas, the closure of the FDR Highway and the L Train. Three people were killed.<sup>52</sup>

16. 1995 – Hurricane Felix

This tropical storm lingered as a threat to NYC for nearly a week but never hit land.<sup>53</sup>

17. 1996 – Hurricane Bertha

This tropical storm caused heavy rain in the NYC region.<sup>54</sup>

18. 1999 – Hurricane Floyd

This tropical storm sustained winds of 60 mph, dumping 10-15 inches of rain over the NYC metro region in 24 hours. NYC schools were closed and emergency shelters were opened.<sup>55</sup>

19. 2003 – Hurricane Isabel

This tropical storm barely missed New York City, but caused coastal erosion in the Far Rockways.<sup>56</sup>

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<sup>50</sup> Longshore, David, p. 243

<sup>51</sup> Id.

<sup>52</sup> Aaron Naparstek, NY Press, [http://www.nypress.com/print.cfm?content\\_id=13427](http://www.nypress.com/print.cfm?content_id=13427) [September 13, 2005] and <http://icp.giss.nasa.gov/research/ppa/2002/impacts/results.html> [September 13, 2005]

<sup>53</sup> New York City OEM:

[http://www.nyc.gov/html/oem/html/readynewyork/hazard\\_hurricane\\_history.html](http://www.nyc.gov/html/oem/html/readynewyork/hazard_hurricane_history.html) [September 12, 2005]

<sup>54</sup> Id.

<sup>55</sup> Id.

<sup>56</sup> National Hurricane Center, <http://www.nhc.noaa.gov/2003isabel.shtml> [September 13, 2005]

## Appendix B

### Areas Most At Risk From Coastal Flooding<sup>57</sup>

1. Bronx:
  - a. Edgewater Park, Silver Beach, Locust Point, Classon Point, and Troggs Neck
2. Brooklyn:
  - a. Coney Island, Brighton Beach, Manhattan Beach, Sheepshead Bay
3. Manhattan:
  - a. Lower Manhattan – Battery Park and South Street Seaport Area
  - b. Lower West Side – Battery Park to Midtown
  - c. East Side – Entire FDR Drive
  - d. Lower East Side – East of Avenue C, East of 14<sup>th</sup> Street to Houston Street
4. Queens:
  - a. The Rockaway Peninsula, Broad Channel, Howard Beach and West Hamiton Beach
5. State Island:
  - a. New Dorp Beach, Oakwood Beach, Foxwood Beach, Great Kills, and Tottenville

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<sup>57</sup> New York City Office of Emergency Management, (2004). *Hazard Overview*, pg 13. Available: <http://www.nyc.gov/html/oem/html/readynewyork/home.html> [September 8, 2005].