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sarah J. adams-schoen
Touro Law Center

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By Sarah Adams-Schoen

"Adapt or perish, now as ever, is Nature's inexorable imperative."[1]

Introduction

Natural disasters like Super Storm Sandy bring the confluence of environmental and municipal law into sharp focus. Although natural disasters almost inevitably take us by surprise, the fact that they will occur and recur is in fact foreseeable. Global temperatures are increasing and the rate of increase is accelerating—with accelerating increases in sea levels, acidification of oceans, and losses of flood-mitigating wetlands. Storms and other extreme weather events are increasing in frequency and severity. We can predict that New York's future holds more massive storm surges, heavy rains and winds, major heat waves, and other extreme weather conditions.

Nor are environmental disasters simply uncontrollable acts of nature. Rather, they are at least in part attributable to failures of the legal system to effectively assess and mitigate risks. As Berkeley Law Professor Daniel Farber observes, "environmental disasters stem from gaps in environmental regulation: weak protection of wetlands, badly planned infrastructure, and, above all, climate change."[2]

As a result, state and local governments must continue to work toward a more resilient[3] future by implementing climate change[4] mitigation[5] and adaptation[6] measures. Local decision makers, resource managers, planners, and attorneys must evaluate the most current data and ask themselves whether their municipalities are doing enough to mitigate and adapt to climate change. Failure to do so will continue to be costly in terms of property and lives.

Super Storm Sandy

New York is experiencing the impacts of climate variability and change in the form of increasing annual air temperature, more frequent and intense flooding events, and more frequent and intense coastal storms. Almost one year ago today, "Super Storm Sandy" combined with a storm that was traveling west to east, striking the East Coast at high tide. The barometric pressure in Sandy was one of the lowest ever recorded. The storm completely devastated the coastline from Cape May, New Jersey, to New York Harbor, Seagate and Staten Island, and the coastline from New York to Connecticut.

The impact on New York was devastating. Forty-three New Yorkers lost their lives. The tidal surge from Super Storm Sandy flooded the New York Port Authority Trans-Hudson subway tunnels, the New York subways, and the Brooklyn Battery Tunnel. The storm shut down access to New York City by highway, rail and air for almost a week; related power outages lasted for weeks in some areas. Sandy was the most expensive storm in U.S. history, estimated to cost approximately $71 billion in damages.[7]

These and other climate-related impacts are expected to continue to manifest and increase in intensity as a result of the accumulation of greenhouse gases in the atmosphere.

Climate Change: The New Normal

Although scientists debate whether climate change *caused* Super Storm Sandy, scientists tend to agree that climate change contributes to the severity of storms and will lead to more extreme storms in the future. Columbia University Professor Cynthia Rosenzweig, a noted climate scientist, and co-chairwoman of the New York City Panel on Climate Change (NPCC),[8] identified compelling areas of linkage between Super Storm Sandy and climate change, including rising sea levels that made storm surges higher.[9] According to the IPCC,[10] "it is likely that future tropical cyclones (typhoons and hurricanes) will become more intense, with larger peak wind speeds and more heavy precipitation associated with ongoing increases of tropical sea surface temperatures."[11] In a recent study, researchers, including NASA climatologist James Hansen, explained, "[w]e can state, with a high degree of confidence, that extreme anomalies were a consequence of global warming because their likelihood in the absence of global warming was exceedingly small."[12] In 2006, underwriters at Lloyd's of London issued a report entitled "Climate Change: Adapt or Bust," in which they concluded that "[f]ailure to take climate change into account will put companies at risk of future legal actions from their own shareholders, their investors and clients." According to a United Nations Environment Program Finance Initiative report, climate-change-driven natural disasters may lead

to economic losses of $150 billion per year within the next decade.

Thus, not surprisingly, former New York City Mayor Michael Bloomberg recently lamented, "we are sobered by the 'new normal' that climate change is producing in our city, including more frequent and intense summer heat waves and more destructive coastal storms like Hurricane Sandy."[13] And, these sobering predictions are backed up by the most recent scientific assessments. The Fourth Assessment Report of the IPCC concluded that evidence of global warming is "unequivocal" and is caused primarily by human activities.[14] The Fifth Assessment Report of the IPCC (AR5) closely examined the uncertainties in the science. Despite numerous recognized uncertainties, AR5 confirmed that:

> Warming of the climate system is *unequivocal*, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased.[15]

Specifically, AR5 reported that there is "unequivocal" evidence of increased atmospheric concentrations of greenhouse gases including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O);[16] that it is "certain" global surface temperatures have increased since the late 19th century and are steadily increasing, with each successive decade being the warmest on record;[17] and, the evidence provides "very high confidence" that sea ice, ice sheets and glaciers are "persistently shrinking."[18]

Local data is equally alarming. According to the NPCC, sea level in New York City has risen 1.1 feet since 1900, and we can predict that it will continue to rise, at an increasing pace.[19] According to the most recent projections, higher sea levels are "extremely likely," with projected sea-level rises of as much as 2.5 feet by 2050.[20] In addition to increasing the height of storm surges, sea-level rise also causes dramatic losses in coastal wetlands, which buffer storm surges, thereby increasing exposure to flood damage as well as other harms such as saltwater intrusion into estuaries and drinking-water supplies.[21] Severe storms also result in further loss of coastal lands.[22]

By the 2050s, the middle-range projections suggest that coastal flood levels that currently occur an average of once per decade may occur once every three to six years. With the high-range projections, today's 1-in-100 year flood may occur approximately 5 times more often by the 2050s.[23] For New York City and other low-lying municipalities, if sea levels continue to rise as predicted, another storm like Sandy will result in more lost lives, more evacuations, more lost homes and businesses, and greater disruptions of critical infrastructure.[24] In economic terms, former-Mayor Bloomberg recently predicted that "while Sandy caused about $19 billion in [economic] losses for [New York City], rising sea levels and ocean temperatures mean that by the 2050s, a storm like Sandy could cause an estimated $90 billion in losses (in current dollars)— almost five times as much."[25] And, this estimate may be conservative.[26]

The data also strongly suggests that New York's future will include increasing annual air temperatures, heavier rains and stronger winds, more major heat waves, more frequent and intense coastal storms, and other more frequent and extreme weather conditions.[27] For example, the most recent NPCC report predicts that, by 2050, New York City could have as many days at or above 90 degrees annually as Birmingham, Alabama currently has. Heat waves are also predicted to more than triple in frequency and last on average one and a half times longer than they do today. Compounding this, "heat indices are very likely to increase, both directly due to higher temperatures and because warmer air can hold more moisture. The combination of high temperatures and high humidity can produce severe additive effects by restricting the human body's ability to cool itself and thereby induce heat stress."[28] Given that heat waves kill more Americans each year than all other natural disasters combined, the need to address the causes of increasing temperatures and heat indices is great.[29] The predictions certainly are sobering.

The Role of Municipalities: "Adapt or Perish"

Climate-induced weather extremes pose serious considerations for the core responsibilities of municipalities. According to some researchers, Sandy revealed how poor land-use decisions can exacerbate already destructive coastal storms.[30]

With global temperatures increasing—and resulting increases in sea levels, acidification of oceans, and losses of flood-mitigating wetlands—intense storms and other extreme weather events are increasing in frequency and severity. Nor are environmental disasters simply uncontrollable acts of nature. Rather, they are at least in part attributable to failures of the legal system to effectively assess and mitigate risks.

Local land use planning and development controls offer one of the most powerful tools for achieving natural-disaster resilient communities as well as communities that contribute to a decreased incidence of natural disasters.[31] As Touro Law Center Dean Patricia Salkin explains, local governments are on the "front line":

> Across the country, local governments maintain day-to-day responsibility and control over the use of the vast majority of lands that abut the nation's edge and other environmentally sensitive areas. Land use patterns are determined, infrastructure is designed and provided, and many other development issues are decided at the local level, where natural hazards are experienced and losses are suffered most directly.[32]

Pace Law Professor and Director of the Pace Land Use Law Center John Nolan echoes these sentiments, observing that "[l]ocal land use authority is the foundation of the planning that determines how communities and natural resources are developed and preserved, and how disaster resilient communities are created."[33] Local governments have an array of tools in their toolbox that can mitigate against and adapt their communities to climate change-related conditions—including building codes; land use, zoning, and subdivision regulations; comprehensive, capital improvement, transportation, floodplain management, stormwater management, and open space plans; facilities needs studies; population growth and future development studies; and economic development plans.[34]

Some Examples of Local Mitigation and Adaptation

Adopting a Local Hazard Mitigation Plan—Local hazard mitigation plans enable local governments to, among other things, secure hazard mitigation project grants. The local plans represent "the jurisdiction's commitment to reduce risks from natural hazards, serv[e] as a guide for decision makers as they commit resources to reducing the effects of natural hazards [, and]…serve as the basis for the State to provide technical assistance and to prioritize project funding."[35] The Disaster Mitigation Act of 2000 provides that, in order to qualify for federal hazard mitigation grants, state and local governments must "develop and submit for approval to the President a mitigation plan that outlines processes for identifying the natural hazards, risks, and vulnerabilities of the area under the jurisdiction of the government."[36]

Among other things, a local plan must include documentation of the planning process, including how the public was involved, and a risk assessment with "sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards." Moreover, the risk assessment must identify: (1) the type, location, and extent of all natural hazards that can affect the jurisdiction; (2) information on previous occurrences of hazard events and on the probability of future hazard events; (3) the jurisdiction's vulnerability to the hazards; and, (4) National Flood Insurance Program insured structures that have been repetitively damaged by floods. In identifying vulnerabilities, the plan must, among other things, describe land uses and development trends within the community so that mitigation options can be considered in future land use decisions.[37]

In January 2014, the New York City Office of Emergency Management (OEM), in partnership with the Department of City Planning, released the draft 2014 New York City Hazard Mitigation Plan (HMP). The HMP identifies the range of hazards facing the City and strategies to reduce the effects of these hazards. The 2014 draft HMP serves as an update to the 2009 New York City Natural Hazard Mitigation Plan. The public comment period for the draft HMP closed on January 15, 2014. The draft HMP is now awaiting review by New York State Division of Homeland Security and Emergency Services and approval by FEMA.[38]

Other municipalities that have incorporated climate-change-related hazards into their local HMPs include the City of New Rochelle, New York, and the Village of Larchmont, New York.[39] The Disaster Mitigation Act also provides for the creation of multi-jurisdictional HMPs, such as Nassau County's HMP.[40]

Setting Clear GHG Emission Reduction Targets—One significant step localities can take is to set quantifiable greenhouse gas emission reductions targets. Lewis & Clark Law Professor Melissa Powers argues that city climate action plans that fail to require *quantifiable* emissions reductions exalt the concept of "sustainability" over the governmental accountability necessary to have any hope of decreasing global CO_2 concentrations to 350 parts per million (ppm) or below, a level arguably necessary to avoid catastrophic temperature increases.[41]

Both the State of New York and New York City have set quantifiable emissions reductions targets.[42] In 2007, the New York City Mayor's Office laid out the city's climate change mitigation and adaptation goals, including reducing the city's greenhouse gas emissions by more than 30 percent by 2030.[43] The city recently reported that, in the last six years, the city's annual greenhouse gas emissions have dropped 16%.[44] The city's recent progress report attributes this success in part to the integration of sustainability goals into all the city's agencies and their operations. According to the progress report, the city "now spend[s] 10% of [its] annual energy budget—approximately $80 million—on funding energy efficiency measures in City government buildings."[45]

Revising Zoning, Building and Construction Codes to Prioritize Climate-Change Mitigation and Adapta-

tion—Protecting residents from natural disasters is a fundamental value and goal of local land use control.[46] As discussed above, many local land use zoning tools can protect communities from the effects of climate change and decrease communities' contributions of greenhouse gases, including land use, zoning, and subdivision regulations; comprehensive, capital improvement, transportation, floodplain management, stormwater management, and open space plans; facilities needs studies; population growth and future development studies; and economic development plans.[47]

The design and construction of buildings also plays a major role in resiliency. For example, in New York City, buildings account for nearly 75% of the city's total greenhouse gas emissions, 94% of the city's electrical consumption, 85% of its water usage, and much of the city's rainwater catchment area.[48] In response to this, Mayor Bloomberg and City Council Speaker Christine Quinn asked the New York Chapter of the U.S. Green Building Council to convene the NYC Green Codes Task Force to review current building and construction codes and make recommendations on how they could be amended to promote more sustainable practices, including specifically: (1) examining construction, fire, water and sewer, and zoning codes; (2) identifying impediments to incorporation of green technologies, (3) identifying opportunities to promote energy efficiency and other sustainable practices, and (4) recommending ways to incorporate climate adaptation measures into the codes.[49]

The Task Force responded with 111 proposed code additions or revisions.[50] The proposals primarily affect new buildings under construction and existing buildings that are being renovated; but, in some cases, the Task Force also proposed targeting upgrades to existing buildings to correct widespread problems.[51]

Currently, 48 of the 111 proposals have been enacted.[52] The enacted codes include new laws or amendments to existing law that: (1) add environmental protection as a fundamental principle of construction codes,[53] (2) streamline approvals for green technologies and projects,[54] (3) increase resiliency of buildings to natural disasters,[55] (4) increase energy efficiency[56] and decrease carbon emissions,[57] (5) remove impediments to alternative energy,[58] (6) increase indoor health and safety,[59] (7) increase resource conservation,[60] (8) manage stormwater more sustainably,[61] (9) promote sustainable urban ecological practices,[62] and (10) enhance water efficiency.[63] A list of enacted proposals, corresponding legal language, and detailed proposals is available at http://www.nyc.gov/html/gbee/html/codes/enacted.shtml.

Integrating Climate-Change Resiliency and Adaptation Priorities into Comprehensive Plans and Other Related Plans and Programs—Integration is a key challenge for local governments facing climate change risks. Because the impacts of climate change and the strategies to adapt to those impacts do not happen in isolation, municipalities must take care that a particular adaptation strategy, which may reduce vulnerability in one area, does not increase risk and vulnerability in another area. For example, as municipalities consider smart growth (efforts to create more compact communities in order to minimize carbon emissions from transportation), they must consider whether increased population densities increase vulnerability to disasters. Similarly, municipalities considering infill development (efforts to channel growth into existing cities), must consider the potential for increased disaster risks, given the locations of some cities and the tendency for redevelopment to favor waterfront locations.[64]

One way to facilitate integration is to address climate change resiliency and adaptation in local comprehensive plans and other overarching plans and programs. The American Planning Association's (APA's) 2002 Growing Smart Legislative Guidebook provides a list of recommended, required, and optional elements of a local comprehensive plan, including a natural hazards element, explaining:

> States and communities across the country are slowly, but increasingly, realizing that simply responding to natural disasters, without addressing ways to minimize their potential effect, is no longer an adequate role for government. Striving to prevent unnecessary damage from natural disasters through proactive planning that characterizes the hazard, assesses the community's vulnerability, and designs appropriate land use policies and building code requirements is a more effective and fiscally sound approach to achieving public safety goals related to natural hazards.[65]

In June 2013, New York City published its most recent comprehensive coastal protection plan—incorporating into the new plan climate change mitigation and adaptation as a primary focus.[66] The plan proposes a broad, diverse range of discrete coastal protection measures.[67]

> Some of the proposed measures mimic existing coastal features that performed well during Sandy. Others have been proven to be successful elsewhere. Where possible, the City has derived inspiration from the historic natural features that once protected the coastline throughout the city. Elsewhere, both traditional and newly developed technologies have been considered.[68]

For example, the plan proposes the use of augmented wetlands, reefs and living shorelines in some areas,[69] and the use of protective infrastructures, including local storm surge barriers, in other areas.[70] The array of proposed coastal measures are intended to be both complementary and capable of independent implementation over time.[71] Although the report notes that "ultimately the City will be best served by implementing the entire suite of options," the report claims that implementation of the 37 "Phase I" measures could reduce expected losses in a Sandy-like storm in the 2050s by up to 25 percent, or more than $22 billion.[72]

New York City is also in the process of updating its Waterfront Revitalization Program (WRP) to include climate change resiliency and adaptation as primary objectives.[73] The WRP is the city's "principal coastal zone management tool"; it "establishes the city's policies for development and use of the waterfront."[74] Despite this, nowhere in the current 46-page program was climate change or sea-level rise even mentioned. Addressing this deficiency, on October 30, 2013, the city approved a series of revisions to the WRP in order to advance the long-term goals laid out in *Vision 2020: the New York City Comprehensive Waterfront Plan*.[75] *Vision 2020* is organized around eight goals, one of which is climate resilience.[76] Specifically, *Vision 2020* proposes to use stormwater management and protection and restoration of wetlands, beaches, and natural shorelines to improve the ecological health of the city's water bodies. The plan recognizes the connection between these measures and protection of coastal neighborhoods from flooding and storm surges.[77] The revised WRP is now pending state and federal approval.[78]

Keeping Abreast of Current Scientific Analyses and Projections—Simply reviewing the vast quantity of data and analyses currently available can be a formidable task unto itself. However, municipalities cannot mitigate and adapt to risks if they do not understand the risks. Thus, municipalities must have a plan for continuing to evaluate and understand the available current scientific information on climate change.

To facilitate this, New York City convened the New York City Panel on Climate Change (NPCC) in 2008 and, in 2012, passed Local Law 42, which established the NPCC as an ongoing body.[79] In doing this, New York City became the first city to scale down the United Nation's IPCC global climate models to develop climate-related projections specific to a municipality.[80] Local Law 42 requires the NPCC to meet at least twice a year to review scientific data on climate change; recommend projections for the 2020s, 2050s, and 2080s within one year of the publication of the IPCC Assessment Reports, or, at a minimum once every three years; recommend a framework for stakeholders to incorporate climate change projections into their planning processes; and, advise the City's Office of Long-Term Planning and Sustainability on a communications strategy related to climate science.[81]

Local Law 42 also established a New York City climate change adaptation task force "consisting of city, state and federal agencies and private organizations and entities responsible for developing, maintaining, operating or overseeing the city's public health, natural systems, critical infrastructure, buildings and economy."[82] Local Law 42 requires the task force to create an inventory of potential climate-change-related risks to the city's communities, vulnerable populations, public health, natural systems, critical infrastructure, buildings and economy; develop adaptation strategies to address the risks; and, identify issues for further study.[83]

Conclusion

Notwithstanding municipalities' many impressive efforts, only a handful of which are discussed above, local land use laws are not yet being utilized sufficiently to create disaster-resilient or disaster-adaptive communities.[84] New York City has done substantially more than many other cities, including, critically, setting specific CO_2 emissions reduction targets and amending zoning and building codes. But, in light of the evidence of climate change and its impacts, local decision makers, resource managers, and planners throughout the state must ask whether we are doing enough. Failure to do so will continue to be costly in terms of property and public health, including lives.

Endnotes

1. Alejandro E. Camacho, *A Learning Collaboratory: Improving Federal Climate Change Adaptation Planning*, 2011 B.Y.U. L. Rev. 1821, 1821 (2011) (quoting Herbert George Wells, Mind at the End of Its Tether 19 (1945)).
2. Daniel Farber, *Symposium Introduction: Navigating the Intersection of Environmental Law and Disaster Law*, 2011 B.Y.U. L. Rev. 1783, 1786 (2011). Professor Farber is Co-Director of Berkeley Law's Center for Law, Energy & the Environment. *See* Daniel A. Farber, Faculty Profile, http://www.law.berkeley.edu/php-programs/faculty/facultyProfile.php?facID=1141 (last visited Feb. 3, 2014).
3. "Resilience" refers to "[t]he capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures." United Nations International Strategy for Disaster Reduction, Terminology: Basic Terms of Disaster Risk Reduction, http://www.unisdr.org/eng/library/lib-terminology-eng%20home.htm (last visited Feb. 3, 2014).
4. Some definitions of "climate change" focus on changes in climate caused by human activities only, while others include all changes in climate, whether caused by human activity or natural variability in climate. *See, e.g.*, Intergovernmental Panel on Climate Change (IPCC), Climate Change 2007

Impacts, Adaptation And Vulnerability: Contribution Of Working Group II To The Fourth Assessment Report Of The Intergovernmental Panel On Climate Change 6 (Martin Parry et al. eds., 2007) ("IPCC usage refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the Framework Convention on Climate Change, where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods." (emphasis omitted)), *available at* https://www.ipcc.ch/publications_and_data/ar4/wg2/en/contents.html.

5. The IPCC defines "mitigation" as "[a]n anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases." *Id.* at ch. 18.1.2.

6. The IPCC defines "adaptation" as "the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities." *Id.* at 6.

7. Insurance Coverage for Natural and Man-Made Disasters § 13:5 (WL Cat Claims database).

8. To help respond to climate change in New York City, the Mayor's Office convened the First New York City Panel on Climate Change in 2008. In January 2013, the Mayor's Office convened the Second New York City Panel on Climate Change (NPCC2). NPCC2 published a report in June 2013, which provided new climate change projections and future coastal flood risk maps for New York City. New York City Panel on Climate Change, Climate Risk Information 2013: Observations, Climate Change Projections, and Maps (C. Rosenzweig and W. Solecki eds., June 2013) (hereinafter "NPCC2"), *available at* http://www.nyc.gov/html/planyc2030/downloads/pdf/npcc_climate_risk_information_2013_report.pdf.

9. *Id.* at 7 ("While it is not possible to attribute any single extreme event such as Hurricane Sandy to climate change, sea level rise already occurring in the New York City area, in part related to climate change, increased the extent, and magnitude of coastal flooding during the storm.").

10. IPCC is the international advisory body on climate change, which was formed in 1988 by the World Meteorological Organization and the United Nations Environment Programme.

11. IPCC, Climate Change 2007: The Physical Science Basis: Contribution of Working Group I to the Fourth Assessment Report of the IPCC 15 (Susan D. Solomon et al. eds., 2007), *available at* https://www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html.

12. Monte Morin, *Some Climate Scientists, in a Shift, Link Weather to Global Warming*, L.A. Times, Oct. 12, 2012, http://articles.latimes.com/2012/oct/12/science/la-sci-weather-climate-change-20121013.

13. Mayor's Office of Long-Term Planning and Sustainability, City Hall, City of New York, PlaNYC Progress Report 2013: A Greener, Greater New York (June 2013) (hereinafter "Greener, Greater 2013 Progress Report"), *available at* http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/planyc_progress_report_2013.pdf.

14. Union of Concerned Scientists: Citizens and Scientists for Environmental Solutions, "Findings of the IPCC Fourth Assessment Report: Climate change Mitigation" (2007).

15. IPCC, Climate Change 2013: The Physical Science Basis: Working Group I Contribution to the Fifth Assessment Report of the IPCC 2 (T.F. Stocker et al. eds. 2013), *available at* http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf.

16. *Id.* at 121.

17. *Id.* at 37 ("Each of the past three decades has been successively warmer at the Earth's surface than any the previous decades in the instrumental record, and the decade of the 2000's has been the warmest.").

18. *Id.* at 40-41.

19. NPCC2, *supra* n. 8, at 4.

20. *Id.* at 4.

21. *See* Farber, *supra* n. 2, at 1801 & nn.86-90; Cat Lazaroff, *Climate Change Could Devastate U.S. Wetlands*, Env't News Serv., Jan. 29, 2002, http://www.ens-newswire.com/ens/jan2002/2002-01-29-06.asp.

22. Farber, *supra* n. 2, at 1803. Hurricane Katrina, for example, resulted in the loss of over two hundred square miles of wetlands. *Id.*

23. NPCC2, *supra* n. 8, at 20.

24. With only a 1.5 feet sea level rise, another storm like Sandy could require New York City to evacuate as many as 3 million people. With a 3-foot rise in sea level, major storms would inundate low-lying shore communities in Brooklyn, Queens, Staten Island, and Long Island, shut down the City's transportation system, flood the highways, and render the tunnels into the City impassable. An even greater sea-level rise, which appears possible by mid- to late-century given the continued pace of greenhouse gas emissions, "would place much of the city underwater—and beyond the reach of any protective measures." Bruce Stutz, *New York City Girds Itself for Heat and Rising Seas*, Yale Environment 360, Sept. 10, 2009, http://e360.yale.edu/content/feature.msp?id=2187 (discussing the results of the first NPCC report). The NPCC2 future flood maps illustrate how projected sea-level rises will expose additional areas of New York City to flooding during extreme storm events. *See* NPCC2, *supra* n. 8, at 27.

25. Greener, Greater 2013 Progress Report, *supra* n. 13.

26. The $90 billion estimate does not account for any damage to new construction because it assumes no further development in flood-prone areas. Mayor's Office of Long-Term Planning and Sustainability, City Hall, City of New York, PlaNYC: A Stronger, More Resilient New York 34 (June 2013) (hereinafter "Stronger, More Resilient 2013"), *available at* http://www.nyc.gov/html/sirr/html/report/report.shtml.

27. NPCC2, *supra* n. 8, at 4-5 & 18-21.

28. *Id.* at 22.

29. *See* Stronger, More Resilient 2013, *supra* n. 26, at 26 (reporting that a 2006 heat wave caused 140 deaths in New York).

30. *See, e.g.*, Maxine Burkett, *Duty and Breach in an Era of Uncertainty: Local Government Liability for Failure to Adapt to Climate Change*, 20 Geo. Mason L. Rev. 775, 780-81 (2013).

31. A national survey of public and private emergency managers, code specialists, and engineers found that building codes and land use planning ranked as the *most effective tool* to achieve hazards vulnerability reduction. Patricia Salkin, *Sustainability at the Edge: The Opportunity and Responsibility of Local Governments to Most Effectively Plan for Natural Disaster Mitigation*, 38 Envt'l L.R. 10158, 10158 & n.3 (July 8, 2008), *available at* SSRN: http://ssrn.com/abstract=1157153.

32. *Id.* at 10159.

33. John R. Nolon, *Disaster Mitigation Through Land Use Strategies*, 23 Pace Envtl. L. Rev. 959, 976-77 (2006).

34. *See* Salkin, *supra* n. 31, at 10162-69 (discussing sustainability tools in local government toolbox).

35. 44 C.F.R. § 201.6.

36. Disaster Mitigation Act of 2000, P.L. 106-390 (Oct. 30, 2000), *codified at* 42 U.S.C. § 5165(a).

37. 44 C.F.R. § 201.6(c). The rules provide an exception for some small, impoverished communities, *id.* § 201.6(a)(3), and also allows for the use of multi-jurisdictional plans (for example, watershed plans) "as long as each jurisdiction has participated in the process and has officially adopted the plan," *id.* § 201.6(a)(4).

38. New York City Office of Emergency Management, Emergency Planning: Hazard Mititgation Plan, http://www.nyc.gov/html/oem/html/planning_response/planning_hazard_mitigation_2014.shtml (last visited Feb. 7, 2014).

39. *See* City of New Rochelle Multi-Hazard Mitigation Plan (Sept. 2010), http://www.newrochelleny.com/DocumentCenter/Home/View/707; Village of Larchmont Hazard Mitigation Plan (Sept. 2013) (revised), http://villageoflarchmont.org/wp-content/uploads/2013/09/Hazard-Mitigation-Plan-0913-pdf.pdf.

40. Nassau Hazard Mitigation Plan (2007), http://www.nassaucountyny.gov/agencies/oem/hazmit/hazmitNHMP.html.

41. *See* Michael Burger et al., *Rethinking Sustainability to Meet the Climate Change Challenge*, 43 ENVTL. L. REP. NEWS & ANALYSIS 10342, 10346 (2013).

42. The New York State Department of Environmental Conservation (DEC) provides resources for local communities to decrease greenhouse gas emissions. *See* Climate Smart Communities Summary for Local Officials, *available at* http://www.dec.ny.gov/energy/50851.html (last visited Feb. 10, 2014).

43. Numerous related New York City publications, including the 2007 and 2011 *Greener, Greater New York* reports and annual progress reports, are available at http://www.nyc.gov/html/planyc2030/html/publications/publications.shtml.

44. GREENER, GREATER 2013 PROGRESS REPORT, *supra* n. 13, at 6.

45. *Id.*

46. *See* Salkin, *supra* n. 31, at 10162 nn.58-60 (citing cases).

47. *See* Salkin, *supra* n. 31, at 10162-69 (discussing sustainability tools in local government toolbox).

48. CITY OF NEW YORK, PLANYC: NEW YORK CITY LOCAL LAW 84 BENCHMARKING REPORT 5 (Sept. 2013), http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/ll84_year_two_report.pdf.

49. Letter from Michael Bloomberg, Mayor, and Christine Quinn, Speaker of the Council of the City of New York, to Russell Unger, USGBC New York, July 8, 2008, in Executive Summary, NYC GREEN CODES TASK FORCE: A REPORT TO MAYOR MICHAEL R. BLOOMBERG & SPEAKER CHRISTINE C. QUINN (Feb. 2010), *available at* http://www.nyc.gov/html/gbee/downloads/pdf/gctf_executive_summary.pdf.

50. Each proposal includes statutory language, a detailed explanation of the issues, an analysis of costs and savings, precedents from other jurisdictions, a comparison of the proposal to any related LEED credits, and information on implementation.

51. *See* NYC Local Law 85 of 2009.

52. PlaNYC, Green Buildings & Energy Efficiency, GCTF Enacted Proposals website, http://www.nyc.gov/html/gbee/html/codes/enacted.shtml (last visited Mar. 14, 2014); *see also* Sarah Adams-Schoen, *On the Waterfront: New York City's Climate Change Adaptation and Mitigation Challenge, Part 1*, 25 ENVTL. L. IN N.Y. 81, 87–89 (Apr. 2014).

53. NYC Local Law 49 (2010).

54. NYC Local Law 5 (2010).

55. *See, e.g.,* NYC Building Code Appendix G and NYC Local Law 143 (safeguard toxic materials stored in flood zones); NYC Local Law 81 (2013) (forecast non-flood climatic hazards to 2080); NYC Local Law 79 (2013) (ensure toilets and sinks can operate during blackouts).

56. *See, e.g.,* NYC Local Law 52 of 2010 (lighting efficiency in apartment buildings); NYC Local Law 48 of 2010 (manual on-automatic off lighting); NYC Local Law 47 of 2010 (reduction of artificial lighting in sunlit lobbies and hallways).

57. *See, e.g.,* NYC Local Law 21 of 2011 (reduce summer heat with cool roofs); NYC Local Law 141 of 2013 (reduce CO2 emissions from specialized concrete); 2010 ECCCNYS, Ch. 5 and ASHRAE 90.1 2010 Ch. 5 (minimize air leakage building exteriors); NYC Rules, Title 1, Ch. 5000 (ensure lighting systems function properly).

58. *See, e.g.,* NYC Rules, Title 63, Ch. 1 (LPC) (remove landmarks impediments to alternative energy); NYC Local Law 20 of 2011 (allow large solar rooftop installations); NYC Local Law 28 of 2012 (increase allowable size of solar shades); NYC Local Law 43 of 2010 (allow use of biofuels).

59. *See, e.g.,* NYC Local Law 2 of 2012 (limit harmful emissions from carpets); Federal Formaldehyde Standards for Composite Wood Products Act (restrict cancer-causing formaldehyde in building materials); NYC Local Law 72 of 2011 (filter soot from incoming air); NYC Rules, Title 15, Ch.2 (phase out dirty boiler fuels); NYC LL 43 of 2010 (DEP) (phase out dirty boiler fuels); NYC Local Law 70 of 2011 (treat corrosive concrete wastewater); NYC Rules, Title 15, Chapter 1 (DEP) (reduce "red tape" for asbestos removal); NYC Local Law 55 of 2010 (increase availability of drinking fountains).

60. *See, e.g.,* NYC Local Law 60 of 2012 (provide recycling areas in apartment buildings); NYC Local Law 71 of 2011 (use recycled asphalt).

61. *See, e.g.,* NYC Rules, Title 15, Chapter 31 (DEP) (reduce stormwater runoff from new developments); NYC Rules, Title 15, Chapter 31 (DEP) (send rainwater to waterways); NYC Rules, Title 15, Chapter 31 (DEP) (encourage innovative stormwater practices); NYC Rules, Title 15, Chapter 31 (DEP) (maintain site-based stormwater detention systems).

62. *See, e.g.,* NYC Local Law 80 of 2013 (construct sustainable sidewalks).

63. *See, e.g.,* NYC Local Law 57 of 2010 (enhance water efficiency standards); NYC Local Law 56 of 2010 (catch leaks by measuring water use); NYC Local Law 54 of 2010 (stop wasting drinking water for cooling).

64. Lisa Grow Sun, *Smart Growth in Dumb Places: Sustainability, Disaster, and the Future of the American City*, 2011 B.Y.U. L. REV. 2157 (2011); *see also* Farber, *supra* n. 2, at 1803.

65. Salkin, *supra* n. 31, at 10163 & n.70 (citing and quoting GROWING SMART LEGISLATIVE GUIDEBOOK: MODEL STATUTES FOR PLANNING AND THE MANAGEMENT OF CHANGE chs. 7-142 & 7-143 (Stuart Meck ed., 2002)).

66. STRONGER, MORE RESILIENT 2013, *supra* n. 26, at 50-65.

67. *Id.* at 50-65.

68. *Id.* at 50.

69. *Id.* at 53.

70. *Id.* at 56.

71. *Id.* at 40.

72. *Id.*

73. New York City's local WRP is authorized by New York State's Waterfront Revitalization of Coastal Areas and Inland Waterway Act, McKinney's Exec. Law Ch. 18, Art. 42, which stems from the Federal Coastal Zone Management Act, 16 U.S.C. § 1452. The implementing regulations of the New York Act and coastal area policies can be found in the Department of State regulations, 19 N.Y.C.R.R. Part 600.