



STANDARDS AND FINANCE TO SUPPORT COMMUNITY RESILIENCE

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OVERVIEW

Despite significant U.S. investments in preparedness and resilience, extreme-weather-related losses and costs in lives, property, and natural resources continue to mount. Risk models indicate that the annual likelihood of severe weather causing at least \$1 billion in insured losses in the U.S. is 92%, or almost certain to occur every year.ⁱ From 1980 to 2016, land falling tropical cyclones have caused the most damage (\$550.1 billion, CPI-adjusted) and have the highest average event cost (\$16.2 billion per event, CPI-adjusted).ⁱⁱ An estimated \$10 trillion in insured property is located along the Atlantic and Gulf Coasts that are vulnerable to tropical storms.ⁱⁱⁱ Risk analysts estimate that insured losses in the U.S. from Hurricane Matthew alone will fall between \$1.5 and \$5 billion, with approximately 70% of the loss to residential lines of insurance.^{iv} Every natural disaster underscores our exposure to future hazards in existing homes, businesses, public buildings, and infrastructure, and of the need to build and rebuild smarter, applying land use policies, building codes, and development standards.

Investments in resilience and preparedness for natural hazards strengthen the places we live, learn, work and come together at communities. Long-term physical infrastructure resilience requires upfront capital investments in order to realize future savings in the form of reduced losses, lower insurance costs, and enhanced market value, among other economic benefits. The Administration has worked to boost investment of this kind. For example:

- In October 2012, the President convened a Task Force to develop the Hurricane Sandy Rebuilding Strategy to support resilient recovery in the Sandy-affected region;^v the Strategy included recommendations to address insurance challenges and called for states and localities to adopt and enforce the most current version of the model building codes.^{vi}
- In June 2013, the President’s Climate Action Plan called for continued engagement between the Federal government and the insurance industry “to explore best practices for private and public insurers to manage their own processes and investments to account for climate change risks and incentivize policyholders to take steps to reduce their own exposures to these risks.”^{vii}
- In November 2013, Executive Order 13653, *Preparing the United States for the Impacts of Climate Change*,^{viii} established the interagency Council on Climate Preparedness and Resilience (Resilience Council) to coordinate Federal resilience efforts. It also created the nonpartisan State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience – a group of 26 governors, mayors, county officials, and tribal leaders convened to provide recommendations on what they most need from the Federal government to support their efforts to be more resilient to future disasters and climate impacts.^{ix} Both the interagency Council and the Task Force made recommendations to boost recommended public-private partnerships around data and tools in support of better management of risk and reduction of disaster costs.^{xi}
- In June 2014, the White House hosted a meeting of the Treasury Department, the National Oceanic and Atmospheric Administration, the Federal Emergency Management Agency, and insurance and reinsurance industry leaders to discuss the economic consequences of increasingly frequent and severe extreme weather and opportunities to reduce risk while lowering costs. After the roundtable, industry representatives released a joint statement expressing support for “resilience and pre-event property loss mitigation” and the goal of “[s]upporting and utilizing research and targeted incentives (such as tax credits, loans, or grants)

to promote effective loss mitigation, in order to reduce current and future risk to people, property, natural features, ecosystems, and critical infrastructure.”^{xii}

In all this, Federal collaboration with state and local leaders – as well as private sector leaders in insurance, catastrophe modeling, and building science – have resulted in actions to increase the sharing of risk data, develop approaches to better communicate risk, and support innovations to buy down the risks and public costs of disasters and finance investments in resilience.^{xiii} This report is designed to identify opportunities for continued collaboration and help ensure that future investments will be climate smart from the start, that damaged communities build back smarter, and that both public and private sectors are poised to seize new opportunities to achieve resilience.

The Value of Investments in Resilience

Investments in resilience can take many forms, including resilient design and construction of buildings and infrastructure, development of risk data and information to inform decisions, and projects to restore and preserve natural resources that provide protective services. Investments in resilience have the potential to pay dividends through reduced direct losses when disasters strike, as well as reduced or avoided disaster-related costs such as humanitarian relief, alternative housing, and business disruption. Additionally, resilience can decrease day-to-day carrying costs through reduced insurance premiums, while enhancing property values. Co-benefits may be achieved when improvements that build resilience also support sustainability and resource efficiency. At a community or regional scale, resilience can help state and local governments avoid credit rating downgrades as the effects of climate change are increasingly felt across the U.S. in more frequent and severe events.

While the most effective policy is to initially site and design assets in a manner that is appropriate to the landscape and natural hazards, we must also address the existing portfolio of homes, community assets, businesses, and infrastructure that are already at risk. Federal policies to ensure greater resilience for newly planned, rebuilt, and rehabilitated Federal structures and facilities are already being implemented across the range of Federal authorities. Innovative approaches to retrofit existing homes, public buildings, and infrastructure assets can be informed by a better understanding of the value of resilience in reducing risks and costs, making the business case for improvements in advance of the next disaster.

Resilience Investments Reduce Disaster Costs

There is a strong analytical basis to conclude that resilience investments reduce disaster costs. In 2005, the National Institutes for Building Sciences (NIBS) Multihazard Mitigation Council conducted a study, which found that Federal hazard mitigation investments could realize a four-fold return, on average.^{xiv} Another study by the Insurance Institute for Business and Home Safety (IBHS), a scientific research organization, found that codes and standards adopted at the state and local level since 1992, the year that Hurricane Andrew struck, resulted in fewer and less expensive insurance claims during Hurricane Charley in 2004. The number of claims for damage from Hurricane Charley to houses built using modern building codes was reduced by 60%, and the severity of damage and cost of claims was reduced by 42% for homes built after modern codes took effect.^{xv}

Additional Federal studies identify ways in which flood hazard mitigation, in particular, reduces losses to individual structures and facilities, as well as broadly across communities and regions when floods strike. For example, a 2008 FEMA report found that applying “freeboard,” an additional elevation as a margin

for safety,^{xvi} in the construction of new residential structures in coastal areas produced a net benefit.^{xvii} Preliminary research published by FEMA in 2016 found that constructing new critical facilities, such as police stations and hospitals, 3 feet above base flood elevation (the height of the 1%-annual-chance or “100-year” flood) produced significant net benefits in reduced damage with benefit-cost ratios of more than 7 to 1 for police stations and more than 14 to 1 for hospitals.^{xviii}

In 2016, the Economist Intelligence Unit issued a report on flood hazard mitigation investments for specific communities, which found significant returns on those investments, both in the near term and in ways that will continue to pay future dividends.^{xix} For example, Jefferson Parish, Louisiana invested nearly \$2.4 million in elevating 23 homes following Hurricane Katrina. When Hurricane Isaac struck the parish in 2012, none of these homes was flooded, resulting in an estimated \$2.2 million in avoided losses just from that flood event. If the 23 homes had not been elevated prior to Hurricane Isaac, each would have flooded above the main floor level. Such avoided losses can be expected to accumulate over the useful life of these homes, paying dividends for decades in a storm-prone area.

In another example, Elkader, Iowa, which sits on the banks of the Turkey River, faced record floods in 1999 that damaged the sewage treatment plant, lagoons, and main sanitary lift station, causing untreated sewage to flow into the river. The city used a FEMA grant and local funds to fund projects to increase the resilience of the facility, including increasing the height of the berm around the plant and aeration lagoons, and constructing a floodwall to protect the lift station. During subsequent flooding, the new infrastructure prevented further damage and kept water systems running throughout the storms. In 2010, the city built a new \$3.2 million wastewater treatment facility. The berm, which cost the city less than \$70,000 with FEMA’s funding, now protects that multi-million-dollar investment for a 543% return on the investment.^{xx}

While these retrospective analyses are helpful in building the intuition around savings, catastrophe modeling has helped identify how specific mitigation measures can reduce losses under certain conditions. For example, using the highest risk county (defined as the highest loss-causing county) in each state, catastrophe modeling firm AIR Worldwide studied the vulnerability of residential and commercial risks depending on construction types, presence of a basement, elevated first floors, protected service equipment, and if these structures meet FEMA flood standards.^{xxi} They found that elevating residential structures 2 feet would decrease flood losses from 5% to 24% depending on geographic location. Elevating 6 feet would reduce losses from 18% to 76%. Constructing residential buildings without a basement could lower the loss potential from 3% to 16%. Reduced losses for commercial structures ranged from 25% to 48%. Raising service equipment (such as mechanical, electrical plumbing equipment) or flood proofing could reduce losses for residential structures by 10%, and for commercial structures by 30%.

In addition to adjustments to the built environment, intact and functioning natural systems can provide protective and buffering services against sea level rise and damage from coastal storms. According to a new study supported by Lloyd's of London, coastal wetlands provide important natural protection during hurricanes, reducing property damage by about \$625 million in the Northeast during Hurricane Sandy in 2012. Where wetlands remain, the average damage reduction from Sandy was greater than 10%, with wetlands in Maryland reducing property damages by nearly 30%. In New Jersey, wetlands prevented \$425 million in property damages, according to the study. The study also found that the conservation of salt marshes in Ocean County, N.J., is expected to reduce average annual coastal property losses by more than 20%.^{xxii}

Investments in hazard mitigation can reduce disaster losses in quantifiable and verifiable ways across a range of asset types, from homes and businesses to infrastructure. Investments to restore and enhance natural resources that provide protective services against natural hazards can also help reduce impacts to the built environment. Combining reduced losses with benefits such as reduced insurance cost and enhanced market performance, makes an even stronger business case for proactive investments in resilience.

Strengthening Insurability and Market Performance

Investments in resilience can pay dividends in the form of savings on insurance costs, which can enhance community insurability by making insurance more available and affordable. Insurance and related risk transfer devices can also reduce the need for Federal disaster assistance. When priced appropriately, insurance can provide a clear price signal of risk, driving policyholders and even entire markets toward more resilient siting and design, prompting investments in resilience in advance of a disaster.

Recognizing the importance of insurance in identifying and reducing risks associated with natural hazard, coastal Southeastern and Gulf States have created quasi-governmental insurers that serve as primary insurers against wind damage. Between 1990 and 2012, the number of policies underwritten by state wind pools increased from 930,000 to 3.2 million. The insured value of properties covered by these wind pools increased more than 1500% over the same period.^{xxiii} These state-sponsored mechanisms are designed to provide consumers with another way to obtain insurance coverage for insurable property, when that coverage is not available or not affordable through traditional private sector insurance companies.

At the Federal level, the National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements, helping to reduce flood losses and promote hazard mitigation. Flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) Reduce risk of flood damage to insurable property; (2) Strengthen and support the insurance aspects of the NFIP, and (3) Encourage a comprehensive approach to floodplain management. Under the Community Rating System of the NFIP, policyholders in participating communities can get premium discounts on their flood insurance ranging from 5%-45% based on community actions to reduce flood risk and losses.

FEMA recently published preliminary research on the insurance savings that can result when elevating new or retrofitting structures above the base flood elevation, finding significant savings for important critical community assets, including schools, police stations, and hospitals. For example, FEMA calculated that floodproofing an existing 2-3 story hospital against flood risk could produce a benefit-cost ratio of more than 4 to 1; floodproofing an existing elementary school to 3 feet above the base flood elevation can produce an annual flood insurance premium savings of more than 60%.^{xxiv} FEMA notes that:

Incorporating freeboard into new construction is extremely cost effective. The up-front costs are generally only about 0.25% to 1.5% of the total construction costs for each foot of freeboard. However, the long-term savings on flood insurance will more than offset these costs. For example, adding 2 feet of freeboard to a new home might add \$20 a month to the mortgage payment, or \$240 per year. The resulting flood insurance savings could be more than \$1,000 a year for a building in Zone AE [for instance, in a riverine

flood zone not affected by wave action] and \$2,000 a year in Zone VE [subject to velocity hazards and wave action].^{xxv}

These savings can help justify the marginal additional cost of building smart the first time and rebuilding stronger after a disaster.

Insurance savings can also be achieved through application of measures to mitigate against seismic risks, damaging winds, wildfire, and severe convective storms that produce large sized hail and tornadoes:

- **Winds and Hail:** FORTIFIED Home™^{xxvi} is a third party-validated resilient building and retrofitting program developed by IBHS for mitigation of risks to single- and two-family homes from hurricane, high wind and hail events. The program provides best practice engineering and building techniques that strengthen new and existing homes, which are above-code for most locations. Policyholders in homes that are designated FORTIFIED can receive insurance discounts and other benefits.

In June 2016, the White House worked with FEMA and IBHS to establish the use of pre-determined benefits to demonstrate the cost-effectiveness of wind retrofit projects like FORTIFIED that comply with FEMA P-804 Wind Retrofit Guide for Residential Buildings, eliminating the requirement for applicants to conduct a separate benefit-cost analysis for a hurricane retrofit project. This streamlined process for approval of wind retrofit projects funded through FEMA helps reduce the administrative burden on applicants.

Certain state laws and regulations provide incentives (insurance, tax, or both) to lower premiums for resilient buildings, including in coastal areas. For example, the State of Mississippi requires insurance companies to provide discounts to homeowners in specified coastal counties whose houses receive an IBHS FORTIFIED Home™ designation. The South Carolina Wind & Hail Underwriting Association provides a 20% credit for the dwelling and contents coverages for policyholders whose homes are designated FORTIFIED™. The Georgia Underwriting Association adopted a mitigation program that recognizes the FORTIFIED Home™ program by providing credits for the wind peril under the homeowners program. And the State of Alabama has mandated insurance credits for policyholders whose homes are designated as FORTIFIED™.

- **Wildfire:** The National Fire Protection Association (NFPA) Firewise Communities/USA® Recognition Program reaches more than 1.5 million residents of 1,300 communities in 40 states. This voluntary program engages residents in their own safety and is the only national, standardized program of its kind. NFPA collects annual data on community actions and local investments in wildfire safety. This data has become increasingly valuable to private sector partners including the insurance and realty industries, who must balance business growth against risk and uncertainty.

For example, USAA, a major insurer, analyzed the loss profile of its policyholders in Firewise communities in California against its policyholders in other California communities and found a favorable difference in loss experience for those living in Firewise communities. USAA has now demonstrated the same difference for its policyholders in five more states (Arizona, Colorado, Texas, Oregon, and Utah), enabling them to file with state insurance regulators to provide discounts on homeowners insurance. In short, this analysis demonstrates that residents of communities where Firewise actions are occurring are less likely to experience property damage and loss than others.

NFPA is working to expand participation in this voluntary program and to engage more private sector interest in supporting local wildfire mitigation action, not only as part of Firewise Communities/USA, but also with such opportunities as Wildfire Community Preparedness Day, designated in 2014 as the first Saturday in May. This call-to-action event was recognized by President Obama in 2015 in a Presidential Message.^{xxvii}

In addition to insurance savings, resilience can boost market value as prospective buyers become aware of the insurance cost savings and safety benefits that more resilient buildings can provide. As more sustainable and resilient residential housing stock is bought and sold, more evidence is accumulating which affirms the greater desirability and market performance of those assets. For example, a University of California, Berkeley study of a large sample of 1.6 million homes sold in California between 2007 and early 2012 documented that a green certification label such as Energy Star or LEED for Homes could add an average of 9% to its resale value.^{xxviii} Research by Resources for the Future found that the benefits of a green infrastructure investment in Missouri on the Meramec Greenway not only reduced flood damage in quantifiable ways, but also enhanced property values by amounts three times greater than the flood damage reduction benefits.^{xxix} In addition, a study from the University of Alabama found that the IBHS FORTIFIED designation could increase resale value by nearly 7%, based on analysis in Mobile and Baldwin counties in Alabama.^{xxx}

As insurance data, products, and underwriting become more widely available to quantify and monetize the benefits of making insurable assets more resilient – and of making communities more insurable – investors and consumers alike may demand greater resilience in the places where we live, learn, work, and come together as communities.

Mitigating Credit Downgrades

Over the past two years, major credit rating agencies released reports on the emerging risks associated with climate change, warning that financial institutions should prepare for the “multilayered and significant impacts” of climate change.^{xxxi} Credit rating agencies have taken notice, adding “resiliency” to rating criteria. Standard & Poor’s has indicated that its evaluation of environmental, social and governance risks is a key part of its ratings methodology and now regularly publishes research on the implications of environmental and climate-related risks. Given that municipal bonds are one of local government’s primary means of securing project funding, it is important for community resilience to factor more directly into municipal credit rating, both to drive state and local action to achieve long-term resilience with less dependence on Federal funds and to assure transparency and protect investor interests.

Favorable credit ratings can help states and communities take advantage of traditional municipal bonds as well as new facilities and risk-rated products to finance resilient community development. Louisiana, for example, was hard hit in 2005 by Hurricane Katrina, where a number of local communities were financially under-prepared to deal with the impacts from the natural disaster. In the immediate aftermath of the storm, S&P rated the City of New Orleans bonds as “speculative grade” BB. And despite heavy investments in flood control, Moody’s has cited the city’s vulnerability to flooding as an ongoing credit challenge.^{xxxii} In 2008, Galveston, Texas was hit by Hurricane Ike, which wiped out a significant part of the tax base and caused uncertainty about the resilience of the local workforce and employers, leading to a downgrade from Standard & Poor’s to BBB on the city’s general obligation and water and sewer ratings. Following Superstorm Sandy, the credit rating for Seaside Heights, New Jersey was downgraded, and the infrastructure sector across the region experienced several actions involving large

amounts of debt, including the downgrade of the Long Island Power Authority's \$7 billion in debt because of the utility's weak liquidity and reliance on unpredictable reimbursements from the Federal government from the storm. Ratings analysts can be expected increasingly to factor resilience and vulnerability to extreme weather and climate change into their rating methodologies.

Local governments can avail themselves of more diverse finance tools beyond traditional municipal bonds. For example, catastrophe bonds are just one of a number of innovative risk transfer products that have emerged as a supplement or alternative to traditional insurance and reinsurance products. Catastrophe bonds may not be suitable for every circumstance or community working to balance liquidity, debt, and risk transfer. Catastrophe bonds function largely as insurance policies obtained through the capital markets and attract investors because they are not correlated with other financial risks. For example, the New York Metropolitan Transit Authority issued \$200 million MetroCat Re Ltd. Series 2013-1 bonds, the first catastrophe bonds that cover storm-surge risk arising from named storms.^{xxxiii} Increasing interest in such catastrophe bonds demonstrates the challenges that large insurance holders in catastrophe-prone regions are facing in securing adequate insurance coverage, as well as the ability of insurance-linked securities to augment or even replace traditional insurance and reinsurance coverages.^{xxxiv} At the same time, the market in green bonds has accelerated rapidly, with \$42 billion issued in 2015, almost four times the 2013 issuance of \$11 billion.^{xxxv} Additionally, the emerging concept of resilience bonds would link insurance coverage and catastrophe bonds that public sector entities can already purchase with capital investments in projects that reduce the risks and costs of future disasters. These projects could include community-scale flood risk reduction through buyouts of flood-prone properties and floodplain restoration, combined where necessary with barrier-style controls like berms and levees.^{xxxvi}

Two communities are on the forefront of leveraging diverse financing options to increase resilience and help to maintain creditworthiness. Miami-Dade County has a \$13.5 billion Multi-Year Capital Improvement Plan for flood risk management, including sea-level rise.^{xxxvii} And among many locally driven initiatives in Norfolk, Virginia, the city is undertaking flood mitigation actions. With support from 100 Resilient Cities, an initiative of the Rockefeller Foundation that provides technical assistance to local governments, Norfolk is devoting a portion of its budget surplus to risk reserves as well as strategic investments in community and infrastructure resilience projects. The city was able to attain a bond rating of AA+ in the fall of 2015 due to the ongoing economic diversification and increased resilience of its downtown area, anticipated continued financial performance, and the economic stability of a military presence.^{xxxviii}

“Blind Spots” Remain

Despite rapid progress, “blind spots” where data is inadequate to provide a complete and accurate assessment of risk over the life of an asset or the true costs and complete benefits of all resilience investments continue to mask the true nature of risk, undervalue resilience, and dampen investment interest. One of the tenets of the Critical Infrastructure Security and Resilience National Research and Development Plan developed by the Department of Homeland Security is to “create a critical infrastructure environment that is secure and resilient to all hazards, particularly considering the scale and complexity of climate change.”^{xxxix} Research efforts should continue to develop data and analytic methodologies to support robust calculations of the full range of benefits across the range of hazards and mitigation actions, addressing reduced losses in disasters as well as reduced insurance costs, enhanced market value, and credit and bond rating benefits. Numerous Federal reports and studies,

including the DHS Development Plan, recommend the establishment of resilience metrics to clarify desired outcomes. Such metrics can also act as incentives for investment by supporting measurement of progress toward achieving those desired outcomes.^{xi} FEMA is also taking feedback on new national-level community resilience indicators.^{xii} Federal programs and regulatory action can be informed by comprehensive benefit-cost analyses that better account for the range of costs and the benefits associated with enhanced resilience, including foreseeable and quantifiable reductions in vulnerability and insurance costs.

Building Climate Smart from the Start: Resilience-Based Codes and Standards

Resilient design and construction of buildings reduces loss of life and property during and after natural disasters, minimizes Federal disaster resource demands and, in some cases, increases property values. Energy efficiency, water efficiency, renewable energy, and power storage are each mitigation strategies that also make properties less dependent upon utilities and more likely to be habitable during and after natural disasters, power outages, or other system interruptions.

Through programs it administers, the Federal government can and should promote sustainability and resilience in the built environment and set an example for non-Federal sectors. The primary governance of buildings, however, is administered at the state and local levels through land use and zoning requirements and building codes. The Federal government's challenge and opportunity is to ensure that what we build today through Federal programs maximizes cost-effective investments that make properties as energy and water efficient, and as natural hazard resilient as is feasible.

Gaps in Current Building Governance

Building codes tell us what can be built, and how, but generally do not address the question of where to build. Even the highest quality design and building construction does not make sense in areas most prone to coastal surge, inland flooding, or wildfires, for example. Local and regional land use planning, zoning, siting, density and scaling decisions are critical to the responsible development of the buildings where we live, learn and gather, shaping how resilient our buildings and homes and communities will be in the face of natural hazard events. However, these land use decisions primarily fall within state and local jurisdiction, outside the purview of the Federal government (except on land owned by the Federal government), and therefore outside the scope of this report. The Federal government can nonetheless influence what is built and how, when Federal land, money, or programs are involved in the building, substantial rehabilitation or rebuilding of structures and homes after a disaster. In some cases, post-disaster buyout and relocation may make more economic sense than rebuilding in the same location if the location is likely at risk for future disasters, yet the focus of this section of this report is on the nature of how homes are built rather than where.

In addition, gaps in building code adoption, weaknesses in the enforcement of codes and lack of effective governance and regulation of buildings can result in construction of buildings that are less resilient than they could or should be in some areas of the country. Buildings of smaller scale and complexity, and in particular single-family homes, are most vulnerable.

Of deep concern are the 50 million single family homes located in high wind hazard areas, which make up around 40% of the existing housing market.^{xliii} Because the majority of existing homes are older and not built to a sufficient level of the International Residential Code (IRC) to benefit from the American Society of Civil Engineers (ASCE)-7 wind maps and design requirements that are embedded into the current versions of the IRC, the majority of existing single family homes in wind hazard locations are especially vulnerable.

Building Codes and Above-Code Standards and Programs

Almost all Federal housing programs that fund home production, purchase, and repair require compliance with local building codes and rely upon local enforcement mechanisms to ensure compliance with these codes, such as building permits and inspections. Model building codes that are adopted by states and localities are developed and updated triennially by an independent, non-governmental organization, the International Code Council (ICC), through a consensus process with representation from various stakeholders that began with the publication of the I-codes in 2000. Codes existed long before this, but they were not consolidated into a consistent format, focusing on regional differences. While the majority of the U.S. now uses the I-codes to ensure a basic degree of safety, they are adopted locally on widely varying schedules, with adaptations or omissions by state and local governments creating gaps and inconsistencies.

The Building Code Effectiveness Grading System (BCEGS), which evaluates the robustness of code adoption and enforcement illustrates the wide variation across the nation.^{xliiii} Of all building types, single-family homes are the least likely to be required or to have licensed and professionally insured architects, engineers, and builders responsible for design, construction, and renovation. In addition, enforcement of building codes at the level of a single family home is more challenging in many parts of the country, especially rural areas.

It is possible to improve building safety through improved guidance and requirements for building design and construction attached to programs that utilize Federal, and ultimately taxpayer dollars. In addition to human health, safety and welfare, Federal financing programs need to reduce financial risk of investing in poorly constructed assets. Broad adoption and consistent enforcement of the most current model codes, without modification, can make our housing more efficient and resilient.

Executive action has been taken to address the hazard resilience of facilities with Federal involvement by creating standards that may be code in some locations but are above code in many locations, including: EO 13690, Establishing a Federal Flood Risk Management Standard (January, 2015), which applies to Federally funded projects; EO 13717, Establishing a Federal Earthquake Risk Management Standard, (February, 2016), which applies to new Federally owned buildings, improvements to existing Federal buildings, and Federally leased, financed, or regulated buildings; and, EO 13728, Wildland-Urban Interface Federal Risk Mitigation (May, 2016), which applies to new Federal buildings on Federal land within the wildland-urban interface. These EOs address hazards to our building and housing stock, and the Agency implementation plans currently in development will shape the Federal resilience footprint for a generation. The National Institute of Standards and Technology, in coordination with FEMA and other Federal agencies, is developing state-of-the-science tornado hazard maps, which will underpin a new performance-based standard for design of buildings and other structures to better resist tornadoes, and the impacts of high winds and debris. At the same time, reaching a more resilient environment of buildings and infrastructure, particularly housing and even more specifically single family housing,

requires attention to wind hazard resilience in building design and construction requirements within agencies' policies and regulations around the funding of properties in wind hazard vulnerable locations.

Above-code standards for energy efficiency and green building, such as EnergyStar, LEED, National Green Building Standard, Passive House and others, are mature and widely used, including by numerous Federal programs across multiple agencies. Some aspects of resilience in the face of natural hazards directly overlap with energy-efficiency and green building techniques such as the ability of a highly energy-efficient and healthy building to provide livable shelter in the event of extended loss of power, heat, cooling, or water (often called "passive survivability"). This is best achieved when building new, as the site and orientation on the site are critical to achieving maximum performance. Gaps in resilience result from the current inconsistent adoption and enforcement of building codes across the nation, the lack of inclusion of structural resilience as a specific focus within major green building standards, and the fact that these programs also do not always offer a path for small scale renovations of small buildings. For these reasons, this report focuses on potential adoption or use of resilience specific programs and standards that are available in the market today, particularly for single-family housing.

Above-Code Resilience Programs Appropriate for the Housing Sector Today

For an above-code building program to be considered for inclusion in guidance to lenders, borrowers, and agency staff of Federal housing programs, it would need to be 1) science-based and tested, 2) independent and objective, 3) independently verified or certified, 4) applicable at the residential scale including single-family homes, and 5) based on clear, specific, and achievable measures. Of the programs considered, two were determined to be readily adoptable by Federal programs: U.S. Environmental Protection Agency's (EPA) WaterSense®, which can be used in all housing, and IBHS FORTIFIED Home™, which can be used for single-family home programs.

Although other programs operate in the market, they are less suitable for integration with Federal housing programs for any one of several reasons. They may lack of a measurement and certification process that assists in mitigating the challenges described above related to code adoption and enforcement at a local level. They may operate at the community or regional scale or focus on non-structural qualities of homes such as location, maintenance, or exterior landscape conditions. Unlike the mature energy-efficiency green building programs that exist, resilience-focused, stand-alone programs are still nascent in development. As consumer demand grows for resilient homes and communities, perhaps these programs will analogously grow as the green building programs have grown over many years.

Significant progress has been made over the past six months to increase resilience through building codes and standards. On May 10, 2016, the White House National Security Council convened top industry, academic, and government leaders to discuss resilient building codes and standards. A concurrent Fact Sheet highlights resilience-related announcements from a number of Federal agencies and private sector entities.^{xiv}

In addition, the Department of Housing and Urban Development (HUD), Department of Agriculture (USDA), and Veterans Administration (VA) published communications in October 2016 for home buyers, homeowners, lenders and other stakeholders of single family properties utilizing Federal loan programs, encouraging the use of more resilient strategies, like FORTIFIED Home™ and WaterSense® in homes financed by their programs.^{xiv} Agencies highlighted opportunities to monetize future savings from

increased efficiency (utility savings) and resilience (insurance premiums) to help pay for upgrades. Because these three agencies together generate nearly \$400 billion in loan activity on 1.9 million homes every year (more than 20% of the US single family home mortgage market) the recent agency communications to stakeholders could have a significant impact on raising consumer awareness. The anticipated results of these communications include generating greater awareness on the demand side of the housing market of the need for greater efficiency and resilience through more informed homebuyers, and the lenders, real estate agents, and housing advocates that represent them. On the supply side, these communications can increase awareness among homebuilders, renovators, and policymakers.

The Federal government can and should continue to build on this progress increasing the resilience of the residential sector through agency programs; seven agencies administer more than 75 programs that fund, finance, guarantee, subsidize, or regulate more than seven million housing units annually, representing over 5% of all American homes, and \$400 billion in economic activity. Of that, more than \$10 billion supports the new construction, substantial rehabilitation, or post-disaster rebuilding of nearly 300,000 housing units every year.

As appropriate and cost-effective, the following actions in five key areas can increase resilience in the nation's housing stock:

Data Collection, Research, and Mapping

- Improving coordination across public and private sectors in the collection, sharing, and transparency of data, including mapping and geocoding, will help improve data-driven policy- and decision-making;
- Improving accuracy in valuation and appraisal impacts of property sustainability and resilience;
- Improving risk assessment and financial security of resilient properties;
- Improving historic and modeled, projected hazard mapping, and data sharing.^{xlvi}

Building Codes and Standards Evolution, Tracking, and Adoption

- Continued Federal participation on consensus bodies that develop building codes and standards;
- Alignment of Federal programs with the latest model building codes, even if the locality has not adopted the latest model codes or has modified those model codes;^{xlvii}
- Adoption of robust and proven above-code efficiency and resilience standards for use by Federal housing programs as they come to market.^{xlviii}

Policy Making and Regulatory Actions

- Regulatory changes to require improved efficiency and resilience standards for all newly constructed housing, new construction, substantial rehabilitation, and disaster rebuilding.^{xlix}
- Use of appropriate incentives for energy and water efficiency, solar and other renewable energy and on-site storage, and natural hazard resilience in building construction or retrofits;^l
- Recognition and incentivization for states and localities with strong and timely adoption and enforcement of building codes and use of above-model code standards appropriate to the hazards;^{li}
- Promotion of sustainable and resilient design through innovation competitions and awards in collaboration with other agencies, academic institutions, private industry, and foundations.

Agency and Public Awareness, Communications

- Notification of program participants of need, and opportunities for greater efficiency and resilience in the housing market, with recommendations for appropriate codes and standards.^{lii}
- Engage educational institutions to embed rigorous resilience curriculum in vocational schools, community colleges, colleges and universities, adult education and extension programs, and trainings for specific subjects through industry associations including appraisers, contractors, insurance professionals, local planners, and building code inspectors.^{liii}

Federal Disaster Recovery

- Incentivization of state, local, and private sector program participants to reduce the risks and costs of disasters,^{liv} including creation of state mitigation and disaster recovery funds, and support for private insurance to increase community insurability.^{lv}
- Coordination across agencies with hazard mitigation and disaster recovery programs to ensure consistency among programs' treatment of damage, and building and rebuilding requirements;^{lvi} Review of Federal hazard mitigation and disaster recovery program results achieved after natural disasters to drive continuous improvement and progress toward resilient outcomes and permanent risk reduction.^{lvii}

Retrofit for Resilience through Savings-Based Finance

Progress in promoting the adoption and consistent enforcement of resilience-based codes and standards should help adjust the trajectory towards broader community-wide resilience adoption, reducing costs and losses over time as new construction is sited and designed smarter. However, a significant existing portfolio of U.S. building stock remains at risk from natural hazards including earthquakes, floods, tropical storms, hail, and wildfire.

Where borrowers can anticipate reductions in energy costs or insurance premiums as a result of resilience enhancement, such as elevating a home, retrofitting a roof, or improving a home's energy efficiency, financial and insurance data quantifying reductions in risk and market enhancements need to be more available in ways that consumers and Federal credit program managers alike can understand. The following represents a few ways (some with Federal support) in which innovative resilience finance can be structured:

Property-Assessed Clean Energy (PACE) financing mechanisms provide opportunities for energy efficiency and renewable energy improvements, often for water efficiency upgrades, and increasingly for resilience retrofits on a variety of commercial and residential buildings depending upon the state. Such improvements are repaid on a predetermined schedule through a special assessment on the property's real estate tax bill. California now allows seismic upgrades under PACE, and Florida allows wind resilience under its program.

Energy Savings Performance Contracting (ESPC)^{lviii} can incorporate a number of benefits in addition to energy savings that can boost resilience on a facility and community-wide scale. Such an approach has been achieved in both public and private sectors^{lix}, with the Administration successfully pipelining nearly \$4 billion in Federal ESPCs that not only provide significant energy savings, infrastructure investments,

and new energy efficiency jobs, but also reduced carbon emissions as well as increased water conservation and efficiency. Furthering this goal, the Administration seeks an additional \$2 billion in ESPCs, providing 2 billion gallons of water savings, and removing approximately 300,000 cars worth of carbon emissions in the process.

The Department of Energy Loan Program Office's August 2015 Title XVII Supplement clarifies that state-affiliated financial entities, including state green banks, may submit applications for eligible projects, including distributed energy projects, providing another opportunity to bolster resilience for critical community spaces such as school and hospitals. Already pioneered at the state level by New Jersey's Energy Resilience Bank, this supplement seeks to expand on New Jersey's example^{ix} by adding to communities' toolbox the opportunity for Federal financing of microgrids and distributed clean energy resources. When combined with existing toolkit pieces that enhance deployment of such systems through smart program and policy development, allows states and municipalities to improve community resilience, protecting human life and property.

Water Infrastructure Resilience. The repair, rehabilitation, and replacement of aging water infrastructure can support climate change adaptation – for instance, by improvements to increase the flood resilience of facilities and components, including helping to assure accessibility, uninterrupted operations, and maintaining public services during and following extreme weather events. Improvements to enhance the resilience of water systems can reduce disaster losses and insurance costs. Moreover, reduced cost for facility operations, maintenance, and insurance can help support loan repayment. Through a new program authorized under the Water Infrastructure Finance and Innovation Act of 2014 (WIFIA), the Environmental Protection Agency will be providing direct credit assistance for resilience and innovative water infrastructure projects. Among the criteria for selection for the new finance opportunity, projects will be evaluated for resilience against extreme weather events, such as floods or hurricanes, as well as the impacts of climate change.

Small Business Administration (SBA) Disaster Loans to Support Businesses and Homes. SBA is responsible for providing affordable, timely, and accessible financial assistance to businesses of all sizes, private nonprofit organizations, homeowners, and renters following a declared disaster. SBA's disaster loans are primary principal form of Federal assistance for the repair or replacement of uninsured, private sector disaster losses. Since its inception in 1953, SBA has approved over 2 million disaster loans for more than \$54.6 billion. In a typical year, the SBA approves about 20,000 loans totaling about \$1 billion. SBA's disaster loan program is the agency's only direct lending program and is not limited to small businesses. Following a declaration, SBA provides disaster loans up to \$200,000 to homeowners to repair or replace their damaged or destroyed primary residence. Businesses of all sizes and private nonprofit organizations may borrow up to \$2 million (with the potential to borrow more if the business is considered a major employer for the damaged area) to repair or replace damaged or destroyed real estate, machinery and equipment, inventory and other business assets.

SBA also supports resilient rebuilding, making additional funds available for as much as 20% of the verified losses – up to \$200,000 for home loans – to protect against damages from possible future disasters of the same kind. Under this approach, loans can be used to finance improvements to mitigate against future flood, wind, hail, earthquake, or wildfire perils. Loans may also be used to make upgrades to comply with building codes and standards. SBA and a third party project management and insurance entity can combine forces to leverage future reductions in insurance cost that can help support loan repayment or unlock additional financing for improvements that may not be eligible under the SBA disaster assistance program. For example, where a homeowner is using an SBA disaster loan to repair

damage from a flood, they may wish to elevate their home higher than the minimum local code requirements. They may wish to invest in a more wind resilient roof system, or address vulnerabilities to wildfire. Combining SBA disaster loans with additional capital available through a third-party project management entity may help support those retrofits.

Enabling and Accelerating Resilience

Conditions suggest that we are near a tipping point in market-driven resilience finance with insurance markets heavily capitalized,^{lxi} bond issuers moving innovative facilities to market,^{lxii} and widespread recognition that the current approach that relies heavily on post-disaster public finance is needlessly wasteful, inefficient, and unsustainable.^{lxiii} As more data and more powerful models, metrics, and analytics become available, more accurate and precise assessments of risk and benchmarks of resilience can enable and accelerate innovation. Improved economic modeling informing policies and programs at all levels of government can drive decisions toward more resilient outcomes.

Risk managers across the private and public sectors are increasingly recognizing the business opportunity that resilience can provide in stronger, safer, and more resilient communities, contributing to improved business conditions, providing a more stable workforce, reducing business interruptions, and generating more consistent tax revenues. Risk managers across sectors will benefit from deepening collaborations with the financial sector as well as technical experts across other disciplines, including the architectural and engineering community, real estate developers, retailers, utilities, and product developers looking to innovate products and services to increase sustainability and resilience.

Advances in Data Collection and Assessment

States, communities, risk managers, and consumers rely on the availability of reliable and actionable information on natural hazards to inform decisions about where and how to build and rebuild following disasters. Decision makers across sectors and at all levels of government rely on accurate and precise economic data to analyze the costs and benefits of policies, programs, and projects. The more accessible, discoverable, and usable data are, the more impact they can uncover innovations in risk management that are currently obscured and drive defensible action that reduces disaster risks and costs. However, the lack of precise, accurate, and complete information about risks, costs, and benefits has served to drive unsustainable policies and practices with costly consequences to the U.S. Treasury, taxpayers, businesses, and the nation. In response, Federal agencies are taking steps to develop data and tools to support community resilience and platforms to increase the sharing of data, information, models, and analytic tools across agencies and sectors.

The U.S. Geological Survey (USGS) operates a national network of more than 8,100 stream gages providing critical and trusted data on streamflow and other parameters to Federal, state, local, tribal, and private stakeholders, many of whom provide funding for this network. To build on existing capacity and capability, the USGS and Department of the Interior are initiating a public-private partnership with insurance representatives and other stakeholders' efforts to develop new and innovative ideas to meet streamflow information needs across the United States -- kicking off in 2017.

The Federal Emergency Management Agency (FEMA) and Department of Homeland Security are exploring and developing for 2017 a new cooperative research and development agreement with re/insurance and academia to refine industry owned flood modeling software and increase the sharing

of data, modeling software, and analytic products. This new public-private partnership can drive development of more precise and accurate flood risk analyses to inform decision makers of the current and anticipated risks of flood under future conditions and better anticipate the effects of climate change. FEMA is also taking feedback on new national-level community resilience indicators.^{lxiv}

The National Institute for Building Sciences announced it is updating the widely cited 2005 *Mitigation Saves* study that calculated a four-fold return for Federal hazard mitigation investments. The updated study is a public-private partnership with funds being contributed by the Insurance Institute for Business and Home Safety and the International Codes Council, along with Federal partners, including the Federal Emergency Management Agency. The first study outcomes are anticipated in mid-2017.

Further, the Institute is building off its recent efforts to identify holistic approaches that marry public and private incentive strategies to support cost-effective implementation of mitigation measures. The Institute will work with representatives from the housing, mortgage and insurance community to establish a framework for resilience mortgages that supports recognition of resilience-focused attributes and associated risk reductions in the loan and underwriting process. The framework will be available in the summer of 2017. Also in 2017, the Institute will engage two communities in identifying and piloting incentivization strategies that package incentives from federal, state and local government; utilities; community financial institutions; and insurers.

The Department of Housing and Urban Development published in the Federal Register in October 2016 the intent to require energy benchmarking reporting via EPA's Portfolio Manager for more than 2.2 million units of public, assisted, and multifamily housing insured through the Federal Housing Administration. After a public comment period, HUD can finalize its requirements. The Department of Energy is working to assist HUD and the Department of Agriculture efforts to analyze benchmarking data collected in EPA's Portfolio Manager Tool for these 2.2 million units of multifamily housing for use in decision-making.

Mechanisms for Incentivizing Resilience

Each year, the Federal government obligates billions of dollars through assistance to State and local governments, tribes, organizations, and individual that have suffered injury or damage from major disasters.^{lxv} Recognizing that the current approach focuses investments post-disaster, recent Federal efforts have identified the need to enhance incentives for investments in resilience.^{lxvi} In response, FEMA has pursued two opportunities to provide incentives for private investment in resilience, through reinsurance and use of a Disaster Deductible.

NFIP Reinsurance. Due to large-scale flood disasters, the cost of flood insurance policy claims has far exceeded the amount of premiums and fees received by the National Flood Insurance Program (NFIP). As a result, the NFIP has incurred debt of \$23 billion to the U.S. Treasury.^{lxvii} In the wake of recent large flood events, FEMA was authorized by Congress to launch a Reinsurance Initiative to more actively manage its financial risk. Through the Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12) and the Homeowner Flood Insurance Affordability Act of 2014 (HFIAA 2014), FEMA received the authority to secure reinsurance from the private reinsurance and capital markets. The NFIP Reinsurance Initiative has the primary objective of enabling the Federal Insurance and Mitigation Administration (FIMA) to diversify the tools it uses to manage the financial consequences of its catastrophic flood risk. The FEMA 2016 Reinsurance Initiative started by acquiring \$1 million in reinsurance to prepare for a larger purchase early next year. The pilot purchase is allowing FEMA to operationalize that reinsurance and

begin to resolve any administrative barriers or technical issues in advance of more expansive implementation in 2017.

Developing a Federal Disaster Deductible. In response to calls from Members of Congress, the Government Accountability Office, and the Department of Homeland Security’s Office of the Inspector General for FEMA to reform how the Federal government supports states following disasters, FEMA has requested public comment on approaches to reform its Public Assistance grant program, including through the establishment of a potential deductible policy similar in concept to that of private insurance policies. Such an approach has the potential to incentivize mitigation strategies and promote risk-informed decision-making to build resilience, including to catastrophic events; reduce the costs of future events for both states and the Federal government; and facilitate state and local government planning and budgeting for enhanced disaster response and recovery capability through greater transparency.

This concept could include the establishment of a predetermined level of state disaster funding or investment in resilience before FEMA provides additional assistance through the Public Assistance program following a disaster declaration. In addition to building resilience to catastrophic events, a disaster deductible could incentivize States and local communities to create, adopt, and implement programs that increase their resilience for recurring, routine events by providing them with a credit for such programs against their deductible requirement. Such state initiatives could include adoption of resilience-based codes and standards, establishments of State-level mitigation and disaster recovery funds, and promoting the use of private insurance for States to reduce dependence on Federal disaster assistance.

State, Local, and Private Sector Innovation

In addition to the sorts of state incentives for resilience-based standards that produce insurance savings, states are moving to create mitigation funds to support retrofits of existing homes and other assets. Third parties are also undertaking innovative ways to combine finance, construction, and insurance of home retrofits, for the long-term benefit of the consumer. Examples of these innovations include:

The North Carolina Insurance Underwriting Association (NCIUA) is the state's coastal "insurer-of-last-resort" and the state's single largest coastal insurer -- in 2015 insuring approximately 76% of the properties on North Carolina's Outer Banks and Barrier Islands, and approximately 50% of the properties in the State's other coastal counties. The NCIUA is announcing a new six-month pilot program beginning January 2017. All policyholders in rating territories comprising the Outer Banks and Barrier Islands of North Carolina will receive an endorsement on their homeowner’s policy. If the policyholder suffers a covered cause of loss during the pilot program that damages their roof more than 50 percent, the policyholder may elect to upgrade their roof to IBHS Bronze Level Fortified-Roof standards at no cost to the policyholder.

Separately, the NCIUA is continuing to research plans that are more ambitious as preliminary modelling evidence suggesting that for a \$51 million mitigation investment in covered properties in the most exposed areas could generate reinsurance savings of \$58 million over a ten-year period and \$9 million of prevented losses from a single one-in-ten-year weather event. For a \$104 million mitigation investment in properties in the most exposed areas, the preliminary evidence suggests the possibility of \$132 million in reinsurance savings over ten years, plus additional savings of \$33 million in prevented losses from a one-in-ten-year weather event.

The State of Alabama has mandated insurance credits for FORTIFIED, created the Strengthen Alabama Homes Trust Fund to fund residential mitigation,^{lxviii} and enacted a PACE-type program to encourage commercial resilience. The Alabama coastal building code supplement requires construction to meet the FORTIFIED Bronze level. Orange Beach (Baldwin County), Alabama adopted FORTIFIED Gold standard equivalent community wide, and provides permit rebates and local tax credit. Additionally, coastal Alabama Multiple Listing Service (MLS) includes notice where the home is certified as FORTIFIED.

Rebuild Northwest Florida^{lxix} is a not for profit corporation that helps repair and strengthen homes to better resist high wind events, funded through the Florida Department of Emergency Management using allocations from the Hazard Mitigation Grant Program. In addition to grants for up to 75% of the costs for repairs, applicants may also be eligible for a discount on their windstorm insurance premium.

Shore Up Connecticut^{lxx} is a State of Connecticut funded low-interest loan program that provides financing for property owners in coastal municipalities located in Flood Zones VE or AE to finance or refinance property elevations. Additional retrofitting for flood protection and wind proofing activities can also be financed.^{lxxi} Loans are available at competitive terms and the borrower must maintain property, hazard, and flood insurance for the life of the loan.

MyStrongHome^{lxxii} combines insurance, specialty finance, and construction services to retrofit homes at low or no upfront cost to homeowners. Construction is certified by IBHS FORTIFIED program, SageSure Insurance Managers, LLC provides property insurance repriced to reflect the lower risk of mitigated homes, and MSH is a registered premium finance company. After receiving a retrofit, the homeowner pays MSH the reduced premium plus construction payment over a period of 5 to 7 years, after which the homeowner reaps the benefit of the reduced premium. MSH has successfully piloted its model for 35 homes in Louisiana, Alabama, and South Carolina, with plans to launch as a public benefit corporation in Q4 of 2016 towards the goal of retrofitting 10,000 homes over the next five years with an expanding network of public, private, and non-profit partners.

Tax Incentives for Resilience

Taxpayers exclude from taxable income qualified disaster mitigation payments (section 139(g)(1) of the Tax Code). The term "qualified disaster mitigation payment" is defined as any amount paid under the Robert T. Stafford Disaster and Emergency Assistance Act (Stafford Act) or the National Flood Insurance Act (NFIA) to a property owner for hazard mitigation for the property (section 139(g)(2) of the Code). The Tax Code, however, does not provide a comparable exclusion for any other receipts on the grounds that the funds received are for disaster mitigation. State or private grants to support hazard mitigation that continue to be included in taxable income for purposes of income tax, should account not only for the funding necessary to support the improvement but also for funding to address the tax consequences for beneficiaries.

Additionally, legislation to create resilience retrofit tax credits similar to energy-efficiency and renewable energy tax credits should be pursued. In addition to addressing current Federal tax consequences that operate as disincentives for mitigation, opportunities exist to explore tax credits that can support resilience retrofits against multiple hazards. States provide state income tax credits for a portion of the cost of retrofits;^{lxxiii} one measure to support state initiatives would be for state tax credits to trigger Federal tax relief as well.

CONCLUSION AND FUTURE OPPORTUNITIES

The past eight years have seen significant advancements in efforts to better identify and buy down risk in advance of disasters, and leverage nonfederal authorities and resources to reduce dependence on the Federal Treasury for disaster recovery. Through a robust collaboration among leaders in insurance, finance, and building science, and in response to specific recommendations from State, Tribal, and local leaders, Federal policies and practices have advanced in mapping, data, and standards.

At every level of government and across the public and private sectors, we are striving to better define the current state of risk and quantify and monetize the benefits of improvements that increase resilience in ways that drive markets. In addition, we continue to support and leverage state and local leadership to manage risk informed by their local knowledge, capacities, and risk tolerance. However, challenges remain in translating a rapidly maturing understanding of risk into financial and underwriting practices that crisply quantify degrees of vulnerability and reward investments in resilience.

Through sustained commitment from government and private sector leaders, the places we live, work, and gather will better withstand the more frequent and intense weather events and other impacts of climate change that are already underway and those that can no longer be avoided.

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APPENDIX A

Programs included in recent guidance to HUD, USDA and VA Single Family Housing Programs:

FORTIFIED Home™ (IBHS) is a resilient building and retrofitting standard, developed by the Insurance Institute for Business & Home Safety (IBHS): <https://disastersafety.org/fortified/>. Fortified Home is a third-party validated designation for mitigation of risks to single- and two-family homes from hurricane, high wind and hail events. The standard is a set of best practice, tested engineering and building techniques that strengthen new and existing homes), which are above-code for most locations. (For hurricanes, these are the same standards outlined in FEMA P-804.)

U.S. Environmental Protection Agency's (EPA) WaterSense® helps consumers save water and money, and encourages innovation in manufacturing. Products with the [WaterSense label](#) have been independently certified to be at least 20% more efficient than average, without sacrificing performance. An average household will save 17,000 gallons and \$210 per year in a home with WaterSense fixtures compared to an average home. WaterSense fixtures are widely available and generally no more costly than builder's standard fixtures.

Programs that warrant further consideration for possible alignment with Federal programs to achieve risk reductions and insurance savings:

Earthquake Brace + Bolt (California Earthquake Authority) – a California-based seismic retrofit program for specific types of single family structures. This program has insurance reduction benefits. Seismic insurance is not mandatory, however and many homeowners do not have this insurance. There are also no tax credits or deductions for this type of work to date for the majority of homeowners. <https://www.earthquakebracebolt.com/>

Firewise (National Fire Protection Association) – a wildfire-focused program dealing with exterior landscaping and building maintenance that is currently in place in limited locations. This program may have insurance reduction benefits but does not translate directly into a quantifiable or mandated reduction program. <http://www.firewise.org/>

Rain Ready (Center for Neighborhood Technology) – this program addresses increased intensity of rain storms through exterior building maintenance. There is currently low market penetration and no identified insurance or tax incentives at this time. <http://rainready.org/>

RELi (Perkins + Will) – this community development standard embeds other green, energy-efficiency and resilience standards, making reference to other programs like LEED. It also has a financial resilience track that credits the use of resilience-based financial instruments in project financing. It is not yet a certification. http://c3livingdesign.org/?page_id=5110

FORTIFIED Commercial™ (Institute for Building and Home Safety (IBHS)) – Building upon the work of Fortified Home, Fortified Commercial seeks to reach small businesses. It is more challenging because building types for commercial get more customized the larger the scale. For this reason, it is not yet a certification, although it has been considered for pilot credits in the LEED BD+C track of USGBC. <https://disastersafety.org/fortified/commercial/>

REDi (Arup & Partners) – this is a commercial buildings focused program that focuses on earthquake resilience and in particular, post-earthquake collapse and safety prevention. http://publications.arup.com/publications/r/redi_rating_system

Strategies for Multifamily Building Resilience (Enterprise Community Partners) - collection of 19 strategies to make properties more resilient; not a certification program.

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