ULI Developing Resilience Toolkit

PROTECTING BUILDINGS AND SITES

Urban Land Institute

MILL CREEK™
PEOPLE · PLACES · RELATIONSHIPS

About the Urban Land Institute

The Urban Land Institute is a nonprofit education and research institute supported by its members. Its mission is to shape the future of the built environment for transformative impact in communities worldwide. Established in 1936, the Institute has more than 48,000 members worldwide representing all aspects of land use and development disciplines.

ULI's interdisciplinary membership represents all aspects of the industry, including developers, property owners, investors, architects, urban planners, public officials, real estate brokers, appraisers, attorneys, engineers, financiers, and academics.

Established in 1936, the Institute has a presence in the Americas, Europe, and Asia Pacific regions, with members in 84 countries.

The extraordinary impact that ULI makes on land use decision-making is based on its members sharing expertise on a variety of factors affecting the built environment, including urbanization, demographic and population changes, new economic drivers, technology advancements, and environmental concerns.

More information is available at uli.org. Follow ULI on Twitter, Facebook, LinkedIn, and Instagram.

About the ULI Urban Resilience Program

ULI's Urban Resilience program is focused on how buildings, cities, and communities can be more resilient to the impacts of climate change and other environmental vulnerabilities. The program works with ULI members to provide technical assistance, advance knowledge through research, and catalyze the adoption of transformative practices for real estate and land use policy.

The Urban Resilience program is organized within the ULI Randall Lewis Center for Sustainability in Real Estate, which also oversees ULI's Greenprint Center for Building Performance and the Building Healthy Places Initiative.

ULI is grateful to Mill Creek Residential for its support of this research.

About Mill Creek Residential

Mill Creek Residential specializes in the investment, development, construction, acquisition, and operation of high-quality rental communities in the best U.S. markets. Mill Creek Residential has participated in the development of over 275,000 rental homes in over three decades of service, executed over $25 billion in transactions since 1993, developing meaningful places where people thrive, and creating real and enduring value for residents, investors, and associates.

Cover: Modera Argyle Apartments (top) in Los Angeles, by Mill Creek Residential, uses overhangs and deep balconies to shade apartments and protect them from extreme heat. Mixed-use Clippership Wharf (bottom) in Boston, by Lendlease, uses a living shoreline that invites the tide to move in and out of the site naturally. With the lowest residential floors sitting 14 feet (4.3 m) above current high tides, the property can safely accommodate anticipated sea-level changes. Learn more about Clippership Wharf at ULI's Developing Urban Resilience site.

2001 L Street, NW | Suite 200 | Washington, DC 20036-4948

Recommended bibliographic listing:
Urban Land Institute. *ULI Developing Resilience Toolkit: Protecting Buildings and Sites*. Washington, DC: Urban Land Institute, 2023.

Contents

At Finch Cambridge in Massachusetts, exterior shading on the southern facade prevents solar heat gain in the summer while allowing passive heating in the winter. Sustainable design—including a solar array on the roof and airtight insulation—was fundamental to the development and helps protect residents from extreme heat and power outages. Learn more at ULI's Developing Urban Resilience site.

Introduction

As the real estate industry grapples with increasing physical climate risk, understanding risk reduction strategies and their implications for portfolio and property management is critical to protecting occupants, assets, and balance sheets.

The *ULI Developing Resilience Toolkit: Protecting Buildings and Sites,* created by the ULI Urban Resilience program in partnership with Mill Creek Residential aims to support real estate owners, developers, and investors with an initial, interactive search and reference tool for learning about risk reduction options, thereby enabling development, design, and sustainability teams or other stakeholders to quickly understand design and operational strategies that mitigate risks caused by natural hazards, their potential effects on costs and maintenance, and the co-benefits these strategies can bring.

The Business Case for Physically Resilient Assets

Real estate is exposed to significant and increasing risk from physical climate hazards. In the United States alone, damages from climate hazards from 1980 to 2022 totaled more than $2.5 trillion and caused 15,000 deaths, and hazard events are rising rapidly in frequency and intensity. This dollar figure is likely a significant undercount, as disasters causing under $1 billion in damages are not accounted for, nor are the more gradual impacts of climate change (e.g., increasing temperatures and precipitation) that increase operations and maintenance costs.

Without sufficient action to prepare its buildings and sites for floods, fires, droughts, and other hazards, the real estate industry faces current and future risks from

- Increased property damages, operations costs, and business disruption; and
- Decreased property value, insurability, liquidity, marketability, market stability, access to development capital, and rental/sales income.

Conversely, using design and operations strategies that increase an asset's ability to withstand physical hazards with limited disruption to operations—in short, that boost an asset's resilience—is an opportunity to reverse the previous loss equation, reducing harms and creating worth across the real estate value chain, extending to communities and markets. In addition, resilience features create value beyond risk reduction through co-benefits such as increasing energy efficiency, creating amenities, improving health and well-being, and more.

Real estate leaders are increasingly acting to capture this resilience dividend. For example, an informal survey by the ULI Urban Resilience program of developers, owners, and investors across all real estate asset types and global regions found that over **80 percent of respondents are either already using design and operations strategies to mitigate risk or will do so in the next one to three years.**

Among respondents that had already begun implementation (43 percent), the following were the most common reasons for adopting risk reduction strategies:

- Anticipation that assets would experience hazard events;
- Investor demand for resilient assets;
- Anticipation that resilient assets would create financial gains; and
- Experience with hazard events that caused damage or disruption to assets.

Among those who planned to start implementation in the next one to three years, investor demand rose to the top as the most common driver for action to reduce risk.

Many aspects of the business case for resilient development are documented through project profiles on ULI's Developing Urban Resilience website and Risk Reduction Matrix (Part Two of this toolkit) and are covered briefly below.

Enhanced value, marketability, and access to capital. Resilient buildings stand out, creating a competitive advantage that can be seen through faster leasing and sale, ability to attract tenants and customers, higher resale values, and better financing. Indeed, enhanced access to capital is a critical value-add, as investors increasingly expect owners to disclose and address climate risk, for example, through reporting systems like GRESB or the Task Force on Climate-related Financial Disclosures (TCFD).

Reduced insurance premiums. As losses from climate events mount, insurance providers are offering discounts to customers that take proactive action to harden their properties. For example, the U.S. National Flood Insurance Program (NFIP) has long discounted premiums to owners for various flood mitigation measures. In 2022, FM Global began offering a 5 percent "resilience credit" to owners who apply risk reduction strategies to their assets, and California became the first state to require insurers to reduce premiums for wildfire-hardened properties.

Avoided losses from damage and disruption. Climate impacts cause property damages, raise maintenance expenses, and disrupt continuity for commercial and residential buildings. However, proactive risk reduction investments can often cost far less than the damages that would have been incurred to an unprepared building. Although cost/benefit analyses vary significantly by hazard type and likelihood, risk reduction measure, and building type, FM Global found that "for every $1 a company spends to protect structures from hurricane, wind, and flood damage, estimated loss exposures decrease by an average $105 due to reduction in risk of property loss and business disruption." Analyses completed by the National Institute of Building Sciences also find benefits of certain risk reduction strategies consistently outweigh costs, by ratios of up to 13:1.

Lower costs of compliance with regulation. Resilience-related requirements are accelerating, whether from increased support in the U.S. Securities Exchange Commission for adopting the recommendations of the TCFD or through local legislation. For example, some localities such as Boston have implemented resilience requirements for buildings in high-risk areas, while cities like Oakland are passing new seismic retrofit ordinances in earthquake-prone regions in the western United States. Because a risk reduction and resilience strategy program should begin with risk and vulnerability assessments (see Part One: Risk Assessment and Resilient Design Process of this toolkit), owners and companies that take this step early to understand their risk profile will be able to integrate needed upgrades into their planned capital expenditures and be better positioned for compliance.

FM Global found that "for every $1 a company spends to protect structures from hurricane, wind, and flood damage, estimated loss exposures decrease by an average $105 due to reduction in risk of property loss and business disruption."

Returns for multiple stakeholders. A broad view of return on investment, like that recommended in the National Institute of Building Science's *Roadmap to Resilience Incentivization*, also includes the returns that accrue to tenants, who want safe and reliable places to live and work that create less stress and disruption and who may pay a premium for them; lenders, investors, and insurers, who want to ensure that their capital is protected; and governments and the wider public, who bear increased costs of climate impacts.

MILL CREEK RESIDENTIAL

MODERA REVERE BEACH IN REVERE, MASSACHUSETTS

Mill Creek Residential conducted extensive shoreline, sea-level rise, and flood risk analysis on its Modera Revere Beach development with the aim of mitigating future coastal storm and flood risk and minimizing the impact on future water flows through adjacent properties and roadways to protect them from additional flood risk. The community is designed with ground-level pass-throughs (shown in red in the rendering above) to sequester any incoming coastal storm floodwaters via an at-grade drainage system across 74 percent of the linear building frontage. The system is designed to receive incoming high-velocity floodwaters and direct them through at-grade storm drainage grates to the lowest level of the garage below to minimize storm wave reflection and avoid concentrating or redirecting flow onto adjacent properties or roadways. The elevation of the garage aligns with the lowest adjacent grade and will feature wet floodproofing, flood vents on all lowest-level interior walls, and large openings along the exterior to allow for the free flow of water out of the garage. To enhance the protection of neighboring properties, pass-throughs will be placed near the ends of each building closest to the property lines.

How to Use This Toolkit

This toolkit is divided into two parts, as shown in the chart on the following page.

Part One: Risk Assessment and Resilient Design Process (this document) provides guidance on understanding the exposure of a portfolio to physical climate hazards and outlines principles on incorporating resilience thinking into asset design and operations.

Part Two: Risk Reduction Matrix (a downloadable spreadsheet, accessible on ULI's Knowledge Finder) provides a filterable screening tool of over 140 risk reduction strategies, including information regarding the following:

- Nine hazards and associated strategies:
  - Extreme heat;
  - Drought;
  - Flooding – coastal (including storm surge, wave action, sea-level rise, high tide);
  - Flooding – heavy rain;
  - Flooding – riverine;
  - Seismic activity/earthquakes;
  - Wildfire (includes smoke impacts);
  - Windstorms (includes hurricanes, cyclones, tornadoes, other storms); and
  - Winter storms (includes extreme cold, heavy snow, ice, freezing rain);
- Strategy type (design or operations and maintenance);
- Applicable project types (new construction, existing buildings, and/or sites/landscapes);
- Asset type–specific considerations (e.g., considerations for multifamily vs. office buildings);
- Operations and maintenance considerations;
- Co-benefits (added amenity space, potentially reduced insurance premiums, energy/carbon emissions reductions, health and wellness, biodiversity, etc.);
- Applicable examples; and
- Further references and technical guidance.

Part Two is intended for use by real estate development, design, and sustainability teams, property and asset management teams, investment committees, or other stakeholders seeking information on what strategies are available to reduce risk from specific or multiple hazards and their implications.

The filters can help surface example strategies fitting various criteria highlighted in the preceding list, after which companies may conduct further investigation into feasibility and implementation for their specific portfolios or assets.

This tool is intended to provide an overview of the strategies real estate may use to reduce risk. **It is not intended to provide an exhaustive list of risk reduction strategies, recommend any specific strategy, or replace the expertise of architects, engineers, construction (AEC) or other professionals who specialize in hazard risk reduction.** The aim is to assist investigation and assessment of risk reduction strategies for various hazards and foster enhanced collaboration between real estate owners, developers, and investors and design teams when implementing risk reduction strategies.

1450 Brickell in Miami, a 35-story class A office tower, uses impact-resistant glass windows that can withstand winds approaching 300 miles per hour to reduce risk from hurricane winds and debris. Learn more at ULI's Developing Urban Resilience site.

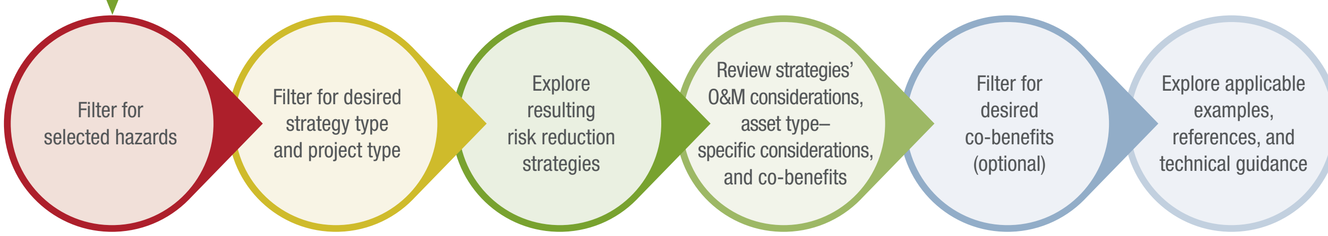
ULI Developing Resilience Toolkit

PART ONE
Risk Assessment and Resilient Design Process

Provides guidance on understanding the exposure of a portfolio to physical climate hazards, and principles for incorporating resilience thinking into asset design and operations. Click the circles below to learn more.

PART TWO
Risk Reduction Matrix

Provides a filterable screening tool of over 140 risk reduction strategies with additional information to support initial investigation and conversation between teams. Download Part Two: Risk Reduction Matrix via ULI's Knowledge Finder.



Part One: Risk Assessment and Resilient Design Process

This document is Part One of the ULI Developing Resilience Toolkit, *created by the ULI Urban Resilience program in partnership with Mill Creek Residential. The entire toolkit can be accessed on ULI's [Knowledge Finder](#).*

Designing new construction or building retrofit projects that are prepared to withstand physical climate risks is the foundation of protecting buildings and occupants, company reputation, and long-term value.

Although the specifics of design and operational strategies are often determined on an asset-by-asset basis, what follows is a process that real estate owners, developers, investors, and their design and property management teams (collectively referred to as "design and management teams" below) may use to prepare assets for current and future hazards, such as floods, storms, wildfires, and more. This process uses the following steps:

1. Understand hazards and exposure
2. Assess vulnerability and risk
3. Investigate risk reduction strategies
4. Prioritize and plan implementation
5. Implement and refine

This process is based on the *U.S. Climate Resilience Toolkit*'s Steps to Resilience. Similar resilient design frameworks include:

- American Institute of Architects' *Resilient Project Process Guide;* and
- Local or other government design guidelines, such as the following:

  Boston's *Coastal Flood Resilience Design Guidelines;*

  New York City's *Climate Resiliency Design Guidelines;*

  Massachusetts's Climate Resilience Design Standards & Guidance;

  San Francisco's Sea Level Rise Guidance; and

  Washington, D.C.'s *Resilient Design Guidelines*.

Modera Riverside in Miami, Florida, by Mill Creek Residential, uses a raised ground-floor platform to reduce flood impacts, and high ceilings on the ground floor allow the interior floor elevation to be raised in the future to keep up with potential raising of municipal infrastructure and streets.

Understand Hazards and Exposure

Building more resilient assets begins with the question, *resilient to what?* Development, design, sustainability, or other teams must first identify which (if any) hazards the asset or portfolio in question may be exposed to, based on the asset(s) geographic location and useful life. This process can be described more specifically as identifying the likelihood of experiencing a given hazard at a given intensity over specific return periods; for example, by determining that an asset has a 10 percent chance of experiencing one foot or more of flooding in the next 10, 30, or 50 years.

Determining exposure then requires ascertaining what effects the asset might experience during each hazard at various intensities and can be categorized through various metrics (which specific properties may be affected, their asset value or revenue generated, their number of occupants, the criticality of functions they provide, etc.).

Hazards covered in this toolkit include the following:

- Extreme heat;
- Drought;
- Flooding – coastal (including storm surge, wave action, sea level rise, high tide);
- Flooding – heavy rain;
- Flooding – riverine;
- Seismic activity/earthquakes;
- Wildfire (includes smoke impacts);
- Windstorms (includes hurricanes, cyclones, tornadoes, other storms); and
- Winter storms (includes extreme cold, heavy snow, ice, freezing rain).

This assessment can draw on historical hazards the asset or area has experienced but should also incorporate projections of future risk, as a changing climate will intensify the severity and frequency of many hazards or change their recurrence cycle.

In addition, many assets and portfolios will be exposed to multiple hazards over their lifetime, sometimes simultaneously and sometimes in ways that exacerbate each other. For example, extended heat waves can cause drought, which can exacerbate flooding because dry soil is less able to absorb stormwater.

Hazard information can be found in publicly available sources, such as the following:

- State, county, or city hazard mitigation plans (required in the United States by the Federal Emergency Management Agency [FEMA] to qualify for various funding sources);
- Local or regional climate adaptation or resilience plans;
- FEMA's The National Risk Index (NRI) (U.S. only, historical data);
- Climate Explorer;
- Climate Central's Coastal Risk Screening Tool; and
- Climate Mapping for Resilience and Adaptation (CMRA).

More detailed information can be gathered for a fee through various climate risk analytics providers. Guidance on using this information can be found in ULI's report *How to Choose, Use, and Better Understand Climate-Risk Analytics*.

JULIENNE SCHAER 2019

Governors Island, a former military base in New York City's harbor, was redesigned and reopened as a 172-acre public open space. The design raised the site above 2100 flood projections to reduce risk from sea-level rise, added riprap revetments on the western edge to dissipate wave forces, used large and heavy natural rock seating to further reduce wave action throughout the park, and incorporated significant impervious surfaces to enhance stormwater management. Significant green infrastructure also supports heat island reduction and biodiversity. Learn more at ULI's Developing Urban Resilience site.

Step 2 Assess Vulnerability and Risk

After asset exposure to hazards has been identified, the next step is to determine the vulnerability and risk that the asset's structure and occupants face from each hazard.

Vulnerability increases when an asset or occupant

- is exposed to a hazard,
- is likely to experience damage from that hazard (often called *sensitivity* or *fragility),* and
- has limited ability to respond to/recover from the hazard *(adaptive capacity).*

The greater the damage and disruption an asset or occupant would experience from a hazard based on its exposure, sensitivity, and adaptive capacity (e.g., whether a structure has flood barriers, or whether occupants have the financial resources to repair damages), the more vulnerable the building, organization, or individual is.

Vulnerability for structures is often determined by relating a specific hazard intensity metric (for example, flood depth) to a particular level of damage to a building or building system/component.

Social vulnerability is a key consideration to account for in addition to physical vulnerability. Low-income communities and communities of color often have fewer resources to recover from hazards and therefore may have reduced adaptive capacity. Other populations with heightened vulnerability can be found through the NRI's Social Vulnerability Index.

Other considerations that can inform vulnerability assessment can be found in the table on the following page.

Once vulnerability has been determined, levels of risk should be assessed for assets with medium to high vulnerability. Risk to an asset can be calculated by determining the likelihood of a hazard event occurring within the asset's lifetime and quantifying the consequences of the hazard event to the occupants and structure (e.g., severity of damage, repair costs, downtime, and casualties).

The risk rating matrix from New York City's *Climate Resiliency Design Guidelines* (below) illustrates this relationship.

After assets (or building systems) with highest risk are identified, investigation of risk reduction strategies (Step 3) and prioritization/implementation of strategies for these assets/ systems can be carried out (Step 4 and Step 5).

Risk Rating Matrix

Consequence rating	Likelihood rating: Rare	Possible	Probable	Expected	Nearly certain
Severe	Low	Medium	High	High	High
Moderate	Low	Low	Medium	Medium	High
Minor	Low	Low	Low	Medium	Medium

Risk can be determined by identifying the likelihood of a hazard event occurring within an asset or building component's lifetime, and assessing the consequences of the hazard event. Risk increases as likelihood and consequences increase. Likelihood ratings should be sure to use current and future projections for climate and hazard probability because many hazards are increasing in frequency and severity.

Source: Adapted from New York City Climate Resiliency Design Guidelines.

Additional Considerations for Assessing Vulnerability

Consideration	Questions to ask during planning
Service life of building: As climate change accelerates, the past and present climate of the building's location may not be indicative of future conditions. Understanding the intended service life of the building and applying applicable climate scenarios will provide insight into the hazards the building may be exposed to and will need to withstand.	• How long will this building be in use, and how will exposure to hazards change over its lifetime? • How will that affect the level of protection needed, or the durability of materials, capacity of mechanical systems, etc.? • For existing buildings, how does the remaining service life affect whether and how the building should be retrofitted?
Site conditions and long-term viability: A site's location and the frequency or intensity of hazards it is exposed to, now or in the future, will affect whether proposed or existing assets will be viable to maintain over their service life.	• Is the site at such a high risk of hazards over the asset's lifetime that building-level risk mitigation will not achieve the level of protection needed, or is the cost or effort required too great to achieve feasible protection? • If so, this finding should inform site selection strategy for new construction and retrofit planning for existing buildings. For example, a buyout or relocation strategy may be appropriate in areas subject to frequent flooding.
Anticipated performance of building components: Structure sensitivity is a function of design and characteristics; for example, a concrete and masonry building may not be very sensitive to impacts from high winds, but an unanchored mobile home may be quite sensitive. The structure's adaptive capacity to respond to these hazards, such as whether it can be raised or receive flood barriers or enhanced insulation, will reduce sensitivity and consequences from experiencing hazards.	• How long are building components expected to last, and are they designed to withstand conditions they may face now or in the future? • What is the likelihood of failure of critical systems, and what consequences would that cause?
Criticality of building function(s): A senior living center or a health care facility whose residents rely on medical equipment is more sensitive to disruption and more critical to protect than an industrial distribution center whose occupants have fewer dependencies.	• How essential is continued operation for this building? • What consequences would disruption to operations cause if a hazard occurred?

Step 3 Investigate Risk Reduction Strategies

At this stage, design and management teams can explore which strategies are available to reduce risks to assets from identified hazards. Strategies might include both physical design interventions and operations strategies, for example:

- High-performance building envelopes
- Enhanced tree planting and other green infrastructure;
- Wildfire-resistant, class A roof materials; or
- Adjusting indoor thermal comfort through use of fans/dehumidifiers.

Teams may construct as broad a list of strategies as possible at first, and then begin identifying additional factors such as cost, maintenance, and feasibility considerations; co-benefits; and applicability of solutions to other hazards. Designing solutions for multiple hazards is essential: many strategies can create synergies by reducing risks from multiple hazards or providing benefits such as energy or water efficiency or health and well-being.

Relevant risk reduction strategies will vary considerably across contexts of geography, climate, surrounding development, and more. They will also need to evolve and adjust continually in response to changing climate science and regional/local hazard projections. Incorporating flexibility in planning and design will help ensure strategies remain effective in the long term.

After this information is gathered, strategies that will clearly not apply or provide significant risk reduction can be screened out to create a list of promising approaches for deeper exploration with design and engineering professionals.

Part Two of the *ULI Developing Resilience Toolkit,* the Risk Reduction Matrix, is intended to support Step 3 of the resilient design process, offering over 140 strategies and supporting information as an initial, interactive search and reference tool for design and operational strategies. Part Two can be accessed on ULI's Knowledge Finder.

SWA GROUP/JONNU SINGLETON

Rancho Mission Viejo, a large residential development in California. The project combines a fire master plan, conservation of open space, building guidelines such as noncombustible material requirements, and strict landscaping and defensible space protocols to reduce risk from wildfire. Learn more at ULI's Developing Urban Resilience site.

Step 4

Prioritize and Plan Implementation

In this step, design and management teams will fully evaluate the cost/benefit, feasibility, and other information gathered in the previous step to determine which strategies will be implemented, over which time frames, and in which order.

PRIORITIZE

Prioritization is critical, as risk tolerance must be balanced with the opportunities available for risk reduction. It is likely all identified strategies cannot be implemented at once due to cost or feasibility constraints (or disruption concerns, for existing assets).

Risk tolerance is a central criterion in strategy prioritization and will significantly influence which strategies may be most relevant. For example, if a given asset cannot tolerate any floodwater entering the building, relevant strategies will differ significantly than if the asset can tolerate floodwater entering and exiting ground floors safely with minimal cleanup and repair.

During strategy prioritization, several other planning considerations may be helpful to consider:

- Which strategies best reduce vulnerability to anticipated hazard damage and disruption?
- Which strategies are most cost-effective, in terms of level of protection needed/provided versus upfront/lifetime cost or maintenance considerations?
- How many hazards can the strategy reduce risk from? Assets are rarely at risk from one hazard alone, and strategies that address multiple relevant hazards may be prioritized.
- How many or which co-benefits can the strategy create for owners, occupants, and local communities? Strategies that provide a greater number of, or specifically desired, co-benefits such as enhanced health and wellness or air and water quality, may be prioritized.
- Which strategies have a greater number of funding/financing opportunities?

CREDIT HUMAN

The Credit Human headquarters in San Antonio, Texas. A combination of rainwater capture, storage, and reuse systems such as these cisterns make the office building one of the most water-conscious developments in Texas, with demand for potable water reduced by 97 percent. Learn more in ULI's Water Wise: Strategies for Drought-Resilient Development *report.*

An informal survey by the ULI Urban Resilience program of developers, owners, and investors across all real estate asset types and global regions found that the most important decision-making factor when evaluating risk reduction strategies was the level of protection provided for cost, followed by the ease of funding/financing, and finally feasibility of implementation.

Considering hazard impacts on regions and systems that individual assets or sites depend on is also important during strategy prioritization. For example, if an asset's local energy or water utility shuts down after a Category 3 hurricane warning, the asset will either need to also shut down (if possible) or implement a greater level of backup energy or water onsite to maintain operations for storms Category 4 and higher.

PLAN IMPLEMENTATION

After priority strategies have been identified, teams will need to plan out when each strategy will be implemented for each at-risk asset (or building system), and in which order each asset will be addressed if they cannot be addressed simultaneously, based on available resources (e.g., staff and funding).

Financing and funding are critical elements of implementation and may be one of the more challenging aspects of integrating risk reduction features. This is especially true for retrofits, as they often incur higher costs than designing these features in from the start of new construction.

Cost can be a significant barrier, creating an access issue for low-income building owners; incentives and financing options that can lower the barrier to entry are critical to equitable implementation. Phased implementation of risk reduction strategies can help spread out costs over time, but upfront costs can remain daunting.

Incentives for hardening new and existing buildings against hazards are less common than energy efficiency incentives; projects that combine the two have a higher likelihood of securing financing. Tools such as Incentifind or the Database of State Incentives for Renewables & Efficiency (DSIRE) may also assist companies in identifying specific funding and financing opportunities.

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Fortunately, real estate has many methods to choose from for developing funding/financing for resilience and sustainability strategies, or otherwise recuperating upfront costs, including the following:

- **Capital expenses:** For owners with sufficient capital, as climate resilience in general becomes a more common aspect of risk management, risk reduction features in new construction or retrofits/renovations may become viewed as standard—paid for by capital expense budgets, based on the expectation that these features create more valuable buildings and reduce losses from damage or discounts at the time of sale. Most respondents to the ULI Urban Resilience program's informal global survey of real estate professionals indicated that risk reduction strategies were primarily funded through internal capital or operating budgets.

- **Reduced operating costs:** Though not a method of upfront financing, many risk reduction and energy resilience features reduce operating costs that can offset incremental construction cost increases. Insurance premiums may be chief among these in importance for buildings in high-risk areas, as without risk reduction features, insurance costs may be too high to successfully finance the project, or insurance may not be offered at all. Multiple insurers now offer reduced premiums for hardened properties. For example, FM Global offers a 5 percent "resilience credit" for all properties with risk reduction features; California now requires premium discounts for properties retrofitted for wildfire; and at least nine states offer discounts for properties that meet the Insurance Institute for Business & Home Safety (IBHS) FORTIFIED Standard that increases protection from multiple hazards. Similarly, features that reduce energy or water use can frequently pay for themselves within several years, as documented in ULI's Tenant Energy Optimization Program case studies.

- **Local or state incentives or rebate programs:** Many incentives are available at the state and local levels, such California's multiple earthquake retrofit grant programs; the Safe Home program in South Carolina and the Strengthen Alabama Homes program, which provide grants of $5,000 and $10,000, respectively, to owners for strengthening existing properties against wind and hurricane damage, or Charlotte-Mecklenburg's retroFIT floodproofing grant in North Carolina, which covers up to 95 percent of eligible mitigation project costs for commercial and residential owners with buildings in the floodplain, using stormwater utility fees. Incentives and rebate programs are often available for new construction or existing buildings, such as tax abatements or expedited permitting for green roofs in Houston, New York City, and Washington, D.C. Zoning incentives, such as density bonuses for construction that uses green infrastructure or maximizes low-carbon energy resilience, are also available in many municipalities and can offset increased construction costs.

- **PACE+R (Property Assessed Clean Energy + Resilience):** PACE+R (sometimes simply called PACE) financing programs, active and operating in over two dozen states, can provide 100 percent of upfront capital costs and low interest rates for new construction and retrofit projects with energy and resilience features. Unconventionally, this type of loan remains attached to the property as a tax assessment that transfers to new owners in case of sale. Eligible projects are broad and include elements ranging from HVAC or lighting replacements and electric vehicle charging to seismic hardening or wind and flood risk reduction.

- **Federal government grants, incentives, or rebate programs:** Some federal incentives may be able to assist with funding, financing, or recovering costs for risk reduction features, though these programs can be complex to apply for and property owners cannot always apply directly: for example, grants such as the Hazard Mitigation Grant Program (HMGP) are a cross-hazard risk reduction funding source, but states and local governments manage the funds and awards. However, some are available directly to property owners. For example, the Inflation Reduction Act has enabled multiple new rebates and tax credits for energy efficiency design features, many of which support risk reduction for multiple hazards, such as enhanced insulation, solar panels, backup power, or energy-efficient windows, and may be a promising avenue for reducing costs.

- **Incentives or rebates from utility companies:** Utility companies frequently offer rebates for purchase of energy-efficient equipment, assistance with weatherization, or implementation of other energy use reduction and resilience strategies for building envelopes and systems that improve grid stability in general and during disasters. For example, rebate programs available from Austin Energy cover existing and new construction for residential, multifamily, and commercial buildings. Some of these may be found in the Database of State Incentives for Renewables and Efficiency.

- **Green mortgages:** Mortgages for resilient and energy-efficient buildings may come with reduced interest rates and can also include support for risk reduction features. For example, Fannie Mae's HomeStyle Energy mortgage and Freddie Mac's GreenCHOICE mortgage allow borrowers to finance the costs of improvements when purchasing or refinancing, up to 15 percent of the home's value post upgrade. Eligible improvements include energy and heat resilience measures, such as solar panels, air sealing, insulation, high-efficiency windows and HVAC upgrades; water conservation measures, such as low-flow fixtures; and even wildfire, earthquake, and flood resilience measures, such as foundation retrofits or storm-surge barriers.

- **Loans from green banks:** Green banks, like the DC Green Bank, can finance projects that combine energy efficiency and climate resilience, such as the redevelopment of Faircliff Plaza East, an affordable and all-electric housing project by developer Jonathan Rose that will be targeting Passive House certification and incorporates a green roof to improve stormwater management and mitigate the urban heat island effect. Green banks exist in multiple states and in late 2022, the U.S. Environmental Protection Agency (EPA) began designing a national green bank. Green bank funds may be especially useful for projects with energy resilience or low-carbon features.

- **Issuance of green bonds:** Larger companies can issue green bonds to support resilient retrofits if the funds are dedicated broadly enough to cover multiple sustainability and resilience-related activities. Real estate companies are increasingly turning to green bonds to finance climate-related activities. For example, in early 2021, New World Development priced a sustainability-linked bond of 10 years and $200 million, allocated to long-term sustainability initiatives including addressing physical climate risks.

Step 5

Implement and Refine

This step is both the simplest and the most challenging: integrating design and operations strategies into action across a portfolio, according to the prioritization plan developed in Step Four, which may change as conditions evolve.

It is important to ensure this step is iterative. Successful design and management teams will monitor the performance of design interventions or operations strategies in new construction and retrofit projects to inform ongoing implementation, and change approach where necessary.

This step concludes Part One of the *ULI Developing Resilience Toolkit*. Part Two can be accessed on ULI's Knowledge Finder.

AVIMOR

Avimor is a 35-square-mile development in the foothills of Boise, Idaho. Expected to expand to 10,000 homes, it will become the largest development in the county over the next several decades. Avimor has centralized development within large expanses of open space, and it has recreational trail and road networks that act as fuel breaks and buffers. These transportation corridors also provide defined, easily accessible points for wildland firefighters and their equipment to access the surrounding foothills and open space. Residential units located on the development's periphery are required to have their landscape plan reviewed and approved by a certified Firewise USA specialist. Once units and landscapes are installed, the residents participate in an on-site review with the specialist, with a follow-up audit every five years. Learn more at ULI's Developing Urban Resilience site.

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Back cover: (Top) Modera Broadway in Seattle, by Mill Creek Residential, features a 46-kilowatt rooftop solar photovoltaic array, which provides low-carbon energy to residents and supports energy resilience during emergencies. (Bottom) SkySong is a partnership among the Arizona State University Foundation, the city of Scottsdale, and Plaza Companies, as master developer. The mixed-use center includes five class A four- and six-story office buildings, built from 2008 to 2019; 325 luxury rental apartments; a 157-bed hotel; retail shops; and several restaurants supported by an on-site urban garden. Organized in four quadrants around an iconic, 150-foot-tall shade structure covering a central plaza, SkySong's buildings are near one another, allowing the structures themselves to provide shade to neighboring buildings as well as the pedestrian circulation points around the site. The buildings are oriented to minimize solar heat gain and incorporate multiple facade improvements, including horizontal and vertical shade screens, high-performance window glazing, and small windows on the west- and east-facing sides. Learn more at ULI's Developing Urban Resilience site.

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