



# RESILIENCE & Real Assets



## GRESB Special Report

**Chris Pyke, Ph.D.**  
Editor

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The world is changing. Population growth, urbanization, climate change, technological disruption, digitalization and pervasive connectivity present new challenges and opportunities for the global real asset industry.

Property and infrastructure companies find themselves on the frontlines of these changes. They are drivers of change. They shape the physical fabric of cities and communities, contribute to the use of natural resources and to global greenhouse gas emissions, and influence the determinants of human health and well-being. They are also particularly vulnerable to change. Their long-term, immobile, and often illiquid investments are subject to a myriad of physical and social shocks and stressors. Institutional investors increasingly recognize the materiality of these risks and opportunities. As a result, real asset managers are expected to be more transparent about how they manage and mitigate risks, and more accountable about their efforts to seize opportunities.

This report illustrates the beginning of a global effort to make the built environment stronger, safer, and more resilient. More resilient places are better for people, protective of the environment, and, ultimately, superior long-term investments. GRESB's new resilience-focused data from property and infrastructure companies and funds around the world describes a dynamic, forward-leaning industry. It shows that leading companies and funds are taking action on the Task Force on Climate-related Financial Disclosures recommendations for governance, risk management, business strategy, and performance measurement. It also indicates significant areas for improvement, particularly with respect to the use of forward-looking scenarios and the collection of relevant, comparable performance metrics.

We are looking forward to progress on these issues in the year ahead, and we believe that this important report will inform our work as we strive to create sustainable real assets and strong, resilient, and prosperous communities around the world.



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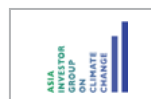
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# RESILIENCE & Real Assets

## EXECUTIVE SUMMARY

Global weather-related disasters cost a record US\$344 billion in 2017, including US\$212 billion in uninsured losses.<sup>2</sup> At the same time, the global economy emitted a record total of 9.8 gigatons of greenhouse gas emissions, and the atmospheric concentration of carbon dioxide reached 405 parts per million, higher than at any time over the last 800,000 years.<sup>3</sup> These new high-water marks put people and properties at risk. Real asset investors are particularly exposed to these issues, as the value of their long-term, often illiquid physical assets is intrinsically linked to energy systems, transportation infrastructure, and social and environmental circumstances.

*Earth's climate is now changing faster than at any point in the history of modern civilization, primarily as a result of human activities.*

**Jay et al. (2018)**

Impacts, Risks, and Adaptation in the United States:  
Fourth National Climate Assessment<sup>4</sup>

High-profile environmental and social shocks have helped raise awareness among institutional investors, and new tools have given companies guidance on how to assess and communicate the associated risks. Most notably, in 2017, the Financial Stability Board's Task Force on Climate-related Financial Disclosures (TCFD) provided recommendations for reporting on climate risk and resilience. This included an emphasis on disclosure of information about climate governance, risk management, business strategy, and performance metrics.

These events, combined with increased investor awareness about the materiality of climate risk and resilience, motivated GRESB, the leading environmental, social, and governance (ESG) benchmark for real assets, to add a Resilience Module to its long-standing Real Estate and Infrastructure Assessments. The new Resilience Module was broadly aligned with TCFD recommendations, and it included eight new resilience-related indicators.

In its first year, more than 125 real estate and infrastructure organizations elected to report on these indicators, providing a snapshot of practices in North America, Europe, Asia, and Oceania. These participants include 113 real estate companies and funds and 37 infrastructure assets. These entities represent approximately 13% of all 2018 GRESB Real Estate and Infrastructure respondents. The participating entities are self-selected, and they may have more interest and expertise in resilience than other organizations. Their size, location, and composition are roughly comparable to the overall GRESB universe.

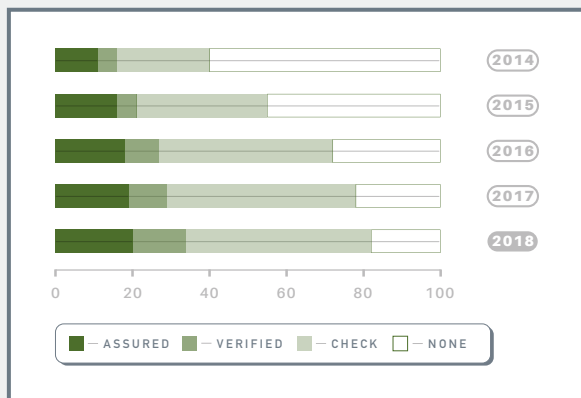
Information reported by participating companies provides the first global snapshot of resilience-related governance, risk management, business strategy, and performance measurement by the real asset sector (Figure 2).

The governance of resilience starts with leadership, and 90% of Module participants reported having a specific senior employee with responsibility for the issue. This individual often has responsibility to organize and lead a cross-departmental team or working group. Most participating organizations report conducting climate-related risk assessments, most often focusing on physical risks to asset value and business continuity. More than 80% of respondents report assessing physical risks, while only 50% report systematic evaluation of social risks.

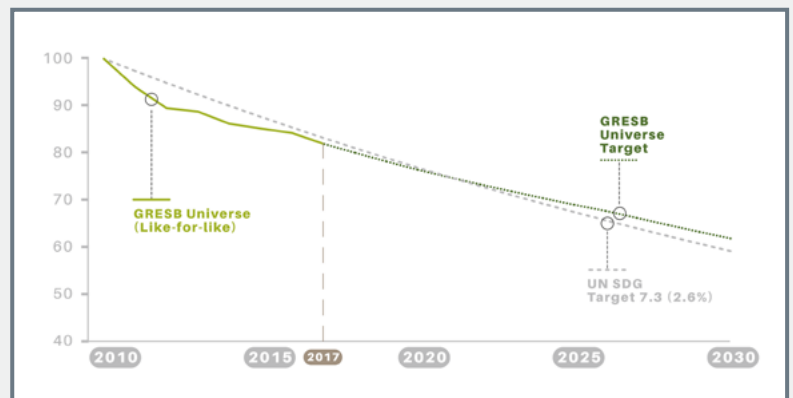
Transition risk is an important aspect of TCFD reporting. However, transition risks are dependent on a range of factors and circumstances. While it is difficult to analyze these risks at the level of companies and funds, it is possible to evaluate the overall market activity. Collectively, GRESB participants continue to expand data coverage, improve efficiency, and reduce emissions on a year-over-year basis (Figure 1a). This is one indication of action to reduce transition risk through the adoption of efficient, low-carbon technologies. In 2018, the GRESB universe reduced its average energy intensity by more than 4%, and it has sustained a comparable level of year-over-year performance for more than five years. These targets and rates of improvement are broadly consistent with UN Sustainable Development Goal 7.3 (Figure 1b).

**Figure 1.** Indicators of transition risk for GRESB participants.

(a) Trends in energy disclosure. The x-axis indicates the average percentage of floor area covered by energy data reporting for GRESB participants.



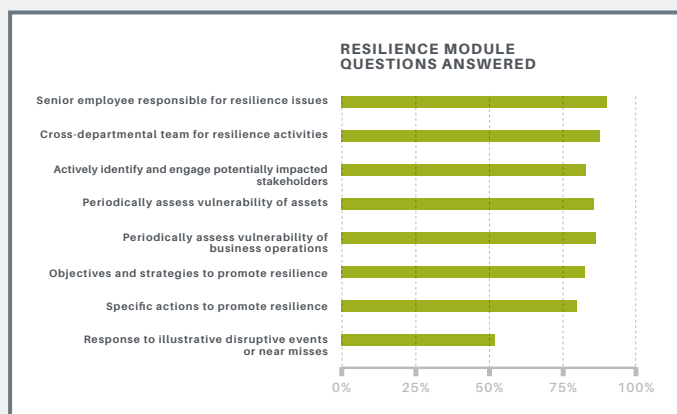
(b) Trends in energy efficiency. Improvements in energy efficiency for real estate participants with respect to UN Sustainable Development Goal 7.3.



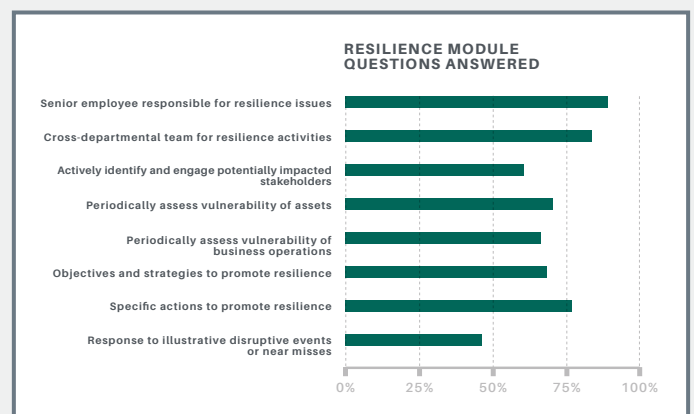
A large fraction of participants report addressing climate-related risks in their business strategies and operations. Examples of tangible actions include installation of flood barriers, elevation of building systems, and steps to enhance and harden sites against environmental or social disruption. Action on TCFD recommendations for scenario analysis remains limited in the property and infrastructure sectors; however, anecdotal evidence indicates that this type of analysis is underway and is likely to be more prominent in 2019 GRESB reporting.

**Figure 2.** Responses for the eight indicators in the GRESB Resilience Module.

(a) Real Estate



(b) Infrastructure



Responses to individual indicators in the new Resilience Module are important, and they provide a useful snapshot of common market practices. However, effective management requires coordination of all of these elements simultaneously. Analysis of responses across indicators shows significant differences between respondents.

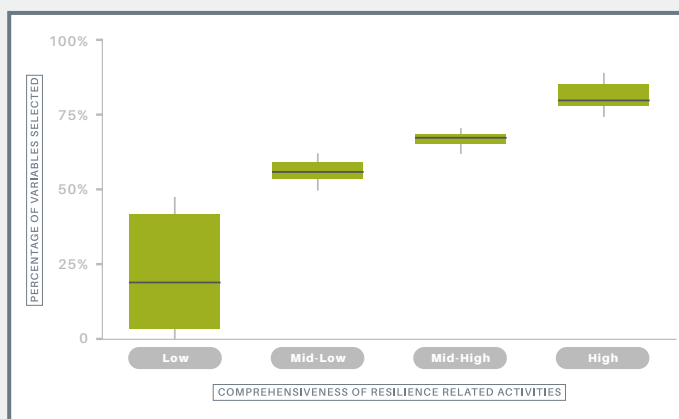
For real estate companies and funds, the top quartile of respondents -- organizations with the most comprehensive responses -- reported on an average of 81% of resilience elements. The bottom quartile of respondents -- organizations with the least comprehensive responses -- reported on an average of 22% of elements with high variance among responses (Figure 2a).

The distribution of responses is more even for the smaller set of infrastructure organizations. The top quartile of respondents reported on an average of 75% of resilience elements. The bottom quartile of respondents reported on an average of 15% of resilience elements.

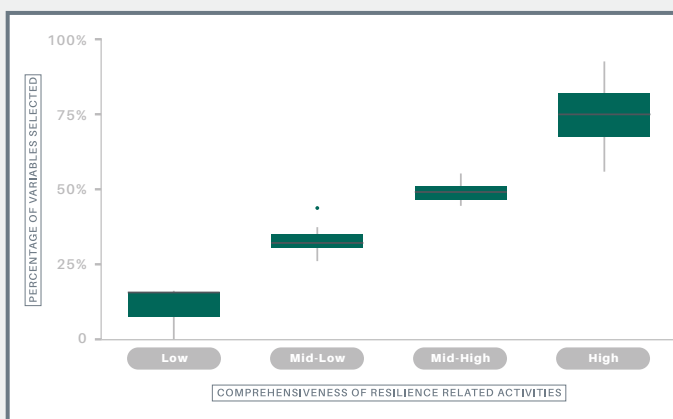
This suggests that resilience-related practices are widespread across this sample of real asset investments. However, it also illustrates that there is significant variation between organizations, even in this self-selected group of GRESB participants.

**Figure 3.** Comparison of comprehensiveness of responses for four market segments. Each box represents approximately 25% of respondents. The vertical position of the box indicates the comprehensiveness of the responses; higher values are more comprehensive and bigger boxes indicate more variability within the segment.

(a) Real Estate



(b) Infrastructure



Results show that real estate and infrastructure companies and funds around the world are beginning to pay attention to resilience. Most Resilience Module respondents have:

- Established clear internal leadership;
- Conducted social and environmental risk assessments;
- Begun implementing strategies during development, operations, and acquisition; and
- Started collecting data about shocks, stressors, impacts, and near-miss events.

The quality and impact of these actions is difficult to evaluate. Organizations report that these practices exist, and many provided GRESB with clear supporting evidence. However, it is not yet possible to evaluate if these practices work as intended. This situation will change as disclosure about resilience-related management and practice is combined with outcome measures, such as insurance claims, changes in asset value, and variance in operating income.

Efforts to reduce or mitigate climate risk and enhance resilience are not surprising given rising interest from institutional investors around the world. Moving forward, market participants can expect even greater focus on climate risk and resilience from investors, governments, customers and other stakeholders. Some real asset organizations are already turning this interest into competitive advantage by offering risk management and resilience as essential features during competitive bidding processes or as differentiating amenities. For example, companies may promote features such as backup power or flood-resistant designs. Many other companies are conducting comprehensive risk assessments and applying this information to inform plans for capital investment and operations.

The results also show that resilience-related practices vary significantly among real estate and infrastructure companies and funds. Today, this means that investors will need to ask more questions about how their investments are identifying potential risks and integrating these considerations into business strategies. Over time, the focus of this engagement is likely to shift from qualitative statements toward more objective and quantitative measurements, including scenario analysis.

Over the next several years, this is likely to include greater applications of geospatial risk models and the use of third-party certifications and ratings. The GRESB Resilience Module and core assessments will evolve to drive and support these important steps to enhance and protect shareholder value.

*Concerns about real asset resilience are increasingly driving capital allocation decisions made by institutional investors. That's why there is a fast-growing demand for reliable, standardized resilience data on which to assess and compare investments.*

**Sander Paul Van Tongeren**  
Co-founder and Managing Director, GRESB

## RECOMMENDATIONS

### Real Asset Investors

Results from the GRESB Assessments and Resilience Module provide the basis for practical guidance for institutional real asset investors:

1. Resilience-related management practices vary significantly between reporting companies and funds. Publicly available information about the climate risk and resilience-related practices and performance of individual organizations is limited and inconsistent. Consequently, investors should ask specific questions regarding climate-risk and resilience during their engagement process.
2. Some companies and funds have already developed comprehensive climate-risk and resilience programs. For these organizations, engaged investors should ask about the quality of management actions and request information about realized outcomes (e.g., losses, business disruptive, near-miss events, etc.).
3. Some companies and funds have not yet developed programs. For these organizations, engaged investors should begin by asking about the presence or state of development of fundamental management systems, including leadership, risk management, business strategy, and performance measurement.
4. The highest performing companies and funds in regard to climate risk and resilience combine experienced and empowered leadership, high quality risk assessment, integrated business strategy, and relevant, timely performance measurement. Investors can and should expect organizations with these qualities to be able to readily communicate their work in each area and connections across areas of work. Based on results from the Resilience Module, it is plausible that such high-performing organization represent a small fraction of the industry. The balance of the industry is likely to be characterized by less comprehensive, more fragmented activity.
5. These circumstances create a situation where fiduciary responsibility is likely to compel engaged, responsible investors to ask more questions about the management of resilience. These questions should begin with fundamental issues of management structure and process. Over time, questions should focus on measurable outcomes with respect to risk and vulnerability, risk reduction and business performance.

## Real Asset Companies and Funds

Results from the GRESB Assessments and Resilience Module also provide insights for real asset companies and funds:

1. Most companies and funds have designated a qualified and empowered internal leader with responsibility for climate-risk and resilience. This individual may or may not be part of the sustainability and ESG team.
2. Most companies and funds have conducted risk assessments to evaluate physical climate- and resilience-related threats to asset value and business continuity. The assessment of non-physical risks, such as social change, is much less common.
3. Most companies and funds have begun to address climate- and resilience-related risks through specific business strategies. The nature of these strategies varies widely between organizations.
4. Most companies and funds are reporting energy consumption and greenhouse gas emissions as one dimension of climate-related transition risk. However, most entities are not yet capable of systematically reporting measures of social or physical climate risk. Only a fraction of companies can report on climate- or resilience-related disruptive events or near misses. This type of information will ultimately be critical in evaluating the efficacy of management strategies.
5. Real asset companies and funds can expect increasing interest in these issues from institutional investors, rising expectations and stricter regulations for transparency aligned with the TCFD recommendations, and greater concern for the quality and effectiveness of management strategies.

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# RESILIENCE & Real Assets

## INTRODUCTION

Resilience is the ability of an organization or asset to survive and, ideally, thrive in the face of shocks and stressors. Shocks are commonly understood to be short-term, acute events, such as fires, floods, or earthquakes. Stressors are long-term, chronic conditions, including sea level rise, population growth, or income inequality. Shocks and stressors combine to create risks and, in some cases, opportunities for real asset investors. As relatively illiquid, physical investments, real assets are particularly vulnerable to changing conditions, as their value is intrinsically linked to their location, surrounding community, and circumstances.

### **OPERATIONAL DEFINITION OF RESILIENCE:**

***Resilience is the ability to survive and thrive when subjected to acute shocks and chronic stressors<sup>5</sup>.***

This special report leverages a unique global dataset to address three important issues:

1. What is the state of practice for resilience among real estate and infrastructure organizations?
2. How can institutional investors use this information to effectively engage with their investments?
3. What are the gaps, limitations, and opportunities for improvement in current reporting on resilience?

The special report is organized in two parts. The first part reviews a global sample of real estate companies and funds. The second focuses on infrastructure assets, typically operating companies. Both sections follow a similar structure, including overview of participants followed by insights about the four major categories identified by the Financial Stability Board's Task Force on Climate-related Financial Disclosures (TCFD):

1. Governance
2. Risk management
3. Business strategy
4. Performance metrics

Each section ends with a "leaderboard"-style summary of the highest scoring participants and practical recommendations for the sector.

# REAL ESTATE

## 1. Real Estate Participation

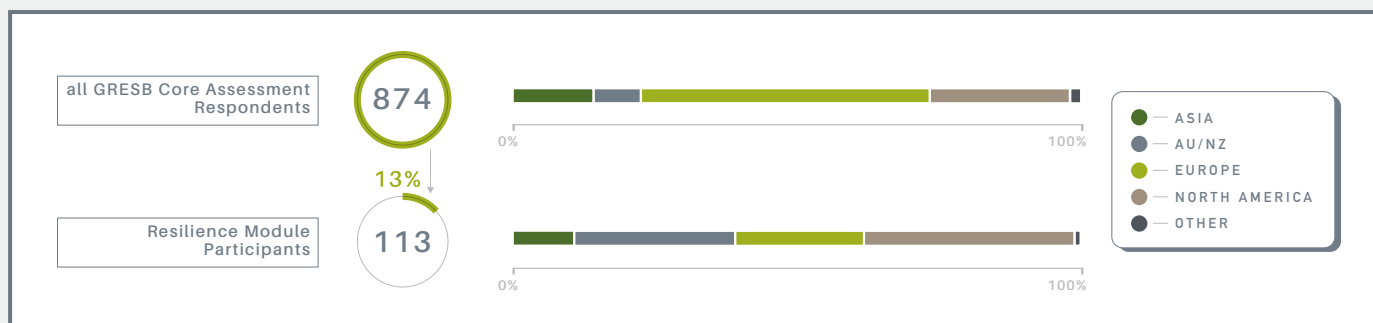
GRESB is the preeminent environmental, social, and governance (ESG) benchmark for real asset investors. Since 2009, GRESB has provided information and tools to help engaged, responsible investors work with property companies and funds to improve practices and measure operational performance.

The GRESB Real Estate Assessment is a set of 45 indicators providing a comprehensive picture of ESG practices and performance for investable entities, including companies, funds, and joint ventures. Participation in the GRESB Real Estate Assessment is typically requested by institutional investors, and, in 2018, 903 entities responded.

GRESB periodically creates optional supplements to the core Real Estate Assessment. These supplements, called modules, address emerging issues. The modules allow GRESB to explore indicators, while giving participants flexibility as they address new issues. For 2018, GRESB launched the Resilience Module. This tool added eight indicators to the core Assessment, including indicators for leadership, risk assessment, business strategy, and experience and learning. Of the 874 participants in the core Real Estate Assessment, 113 (13%) elected to participate in the Resilience Module.

Core real estate participants are distributed around the world with 25% North America, 8% Oceania, 50% Europe, 14% Asia, and 2% Other. North American (19%) and Oceania (44%) participants were more likely to participate in the Resilience Module, while European (6%) and Asian (10%) entities were relatively less likely.

**Figure 1.** Geographic distribution of all GRESB Real Estate respondents and Resilience Module participants. Core participants include all respondents to the GRESB Real Estate Assessment and Resilience Module.



The combination of the Real Estate Assessment and the Resilience Module provide a rich, multi-layer dataset (Table 1). The data can be aggregated into binary responses to high level indicators (i.e., “yes or no” responses to basic questions). Conversely, they can be broken down into 164 discrete answer choices, 24 open text boxes, and a potentially significant amount of supporting evidence (e.g., documents, files, etc. uploaded by participants).

**Table 1.** Overview of resilience-related data collected in the core Assessments and Resilience Module

RESPONSE TYPE	DESCRIPTION	NUMBERS OF INDICATORS
"Top level" indicator responses	A high-level "yes or no" answer for each question	Resilience Module: 8 indicators Core Assessment + Resilience Module: 15 indicators
Indicator answer choices	A sub-level response that refines the answer to each question	Resilience Module: 97 resilience-related answer choices  Core Assessment + Resilience Module: 164 resilience-related answer choices
Indicator open text boxes	A free response narrative associated with selected questions	Number of open text boxes in the Resilience Module: 24
Performance Indicators	Quantitative, measured information about operational performance, such as energy, emissions, water  Qualitative description of reporting on significant events and near misses	TCFD-related metrics in the main assessment: GHG emissions (Scope 1, 2, 3), energy, water, waste  Resilience Module: 1 metric

## 2. State of the Market

Results from the 2018 GRESB Real Estate Assessment and the Resilience Module can provide a partial snapshot of the state of the market as represented by GRESB participants. This sample does not capture the entire industry, and it reflects regional and property-type biases associated with GRESB participation generally. However, despite these limitations, we believe that these new data provide the best available, industry-wide view of conditions across the industry through the end of 2017 (the end of the GRESB reporting period).

The following findings are presented using categories recommended by the Task Force on Climate-Related Financial Disclosure (TCFD), including governance, risk management, strategy, and performance metrics.

### # 1. Governance

The first and most fundamental questions for organizations is, "Who is responsible for resilience? How is this responsibility carried out?" Answers to these questions are important, as the presence of a qualified, empowered leader is a prerequisite for effective action.

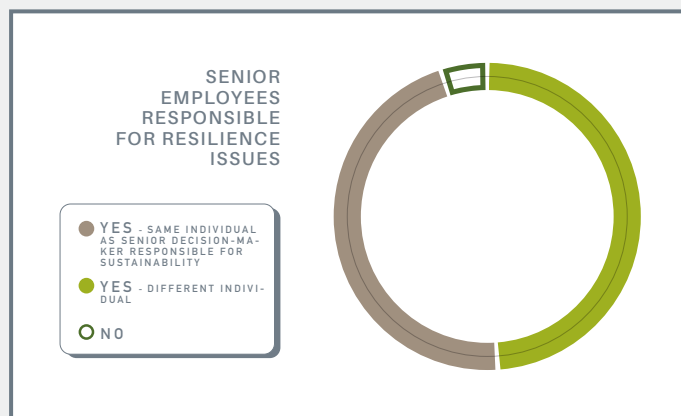
Over 90% of Module participants indicated that they have a senior employee with specific responsibility for resilience. ESG or sustainability leaders are often on the forefront of new and emerging issues, such as resilience. In this case, there is an approximately even split in the allocation of responsibility, 43% of organizations indicated that the sustainability staff member has responsibility for resilience and 47% report a different leader for resilience. Common titles for non-sustainability resilience leaders include:

- Risk Management Director (11)
- Executive Vice President (10)
- Chief Commercial and Risk Officer (6, but all under Lendlease)
- Chief Operating Officer (4, but 3 under The Crown Estate)
- Portfolio Manager (4)
- Head of Real Estate (3)
- President/CEO/Principal (3)

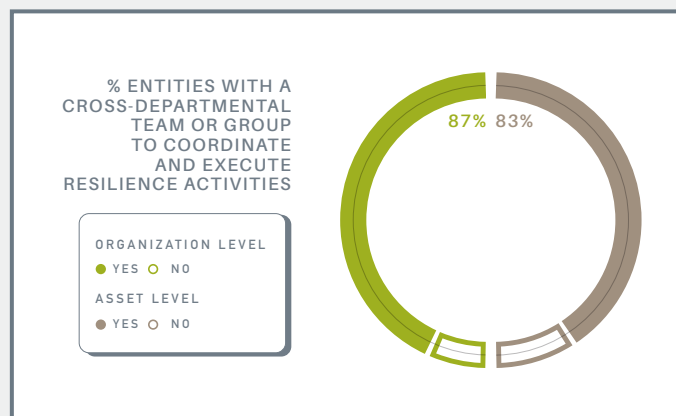
The interdisciplinary nature of resilience requires communication and action across traditional organizational divisions. The Module asked participants about the presence of such teams at the organization and asset level. The results show that 87% of organizations and 83% of assets reported the presence of a cross-department team or working group.

**Figure 2.** Resilience leadership and coordination.

(a) Senior employee



(b) Organization and asset-level teams



## #2. Risk Management

After leadership, the next essential step in promoting resilience is risk assessment. This provides the basis for objective, prioritized risk management. TCFD focuses on “climate-related” risks. In 2018, GRESB took a broader perspective, asking participants to examine both acute shocks and long-term stressors. GRESB’s framing overlaps TCFD and reflects concepts used by local governments involved in the 100 Resilient Cities program. One point of distinction, the GRESB Resilience Module did not explicitly ask participants about their use of scenario analysis, an important TCFD recommendation.

Responses to the Resilience Module provide information about risk assessment processes for individual assets and entire organizations (Figure 3). This is an important distinction for real asset-based organizations. The assessment of asset-level risks informs capital planning and facility management, such as the elevation of electrical systems or installation of flood control structure. The assessment of organization-level risks informs overall business strategy and helps identify and prioritize high-level risks to enterprise financial performance.

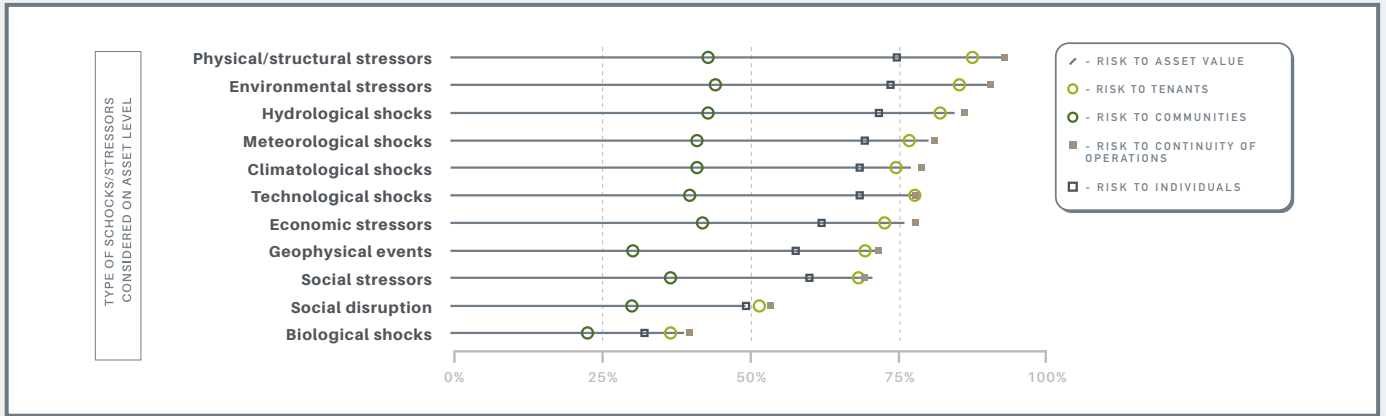
Figure 3(a) illustrates the types of shocks and stresses reported for asset-level risk assessments. Overall, entities report risk to continuity of operations, asset value, and tenants as major concerns. Risks to individuals and communities are considered at significantly lower rate. More than 90% of respondents reported considering physical or environmental risks, including hydrological and meteorological shocks. Notably, less than 80% of respondents reported considering risks from social stressors or disruption.

Figure 3(b) illustrates the types of shocks and stressors reported for organizational-level risk assessments. Again, organizational risk assessments prioritized physical and environmental factors, with modestly lower rates of risk assessment for social and community factors. Among the types of shocks and stressors, physical/structural stressors, environmental stressors, hydrological shocks, and climatological shocks received most attention.

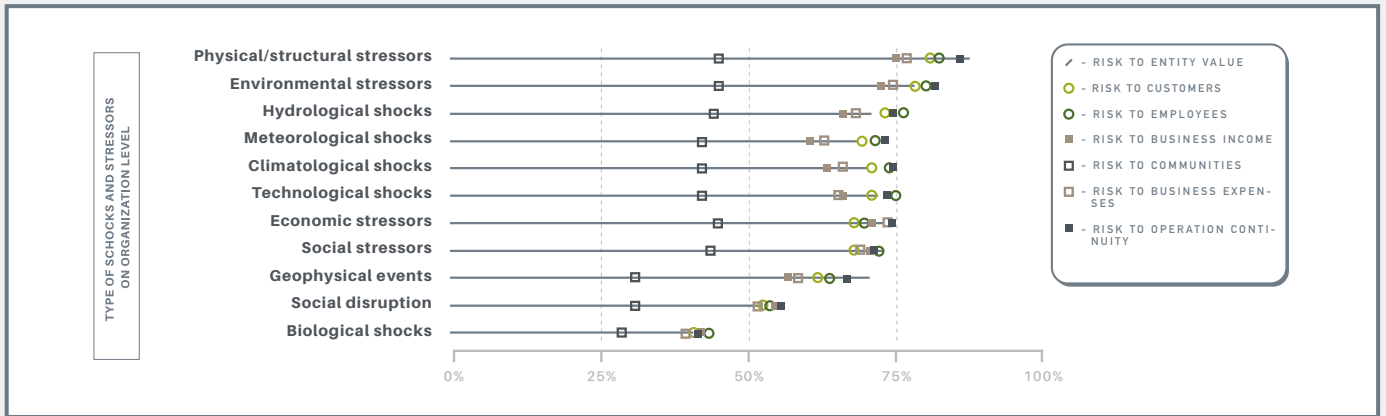
Figure 3(c) shows large differences in consideration for different stakeholder groups in organization- and asset-level risk assessments. Employees and tenants are almost always considered. Community groups and environmental organizations are considered in less than 50% of risk assessments. Notably, emergency services are only considered in approximately 60% of assessments by reporting entities.

**Figure 3.** Frequency of asset and organizational risk assessment.

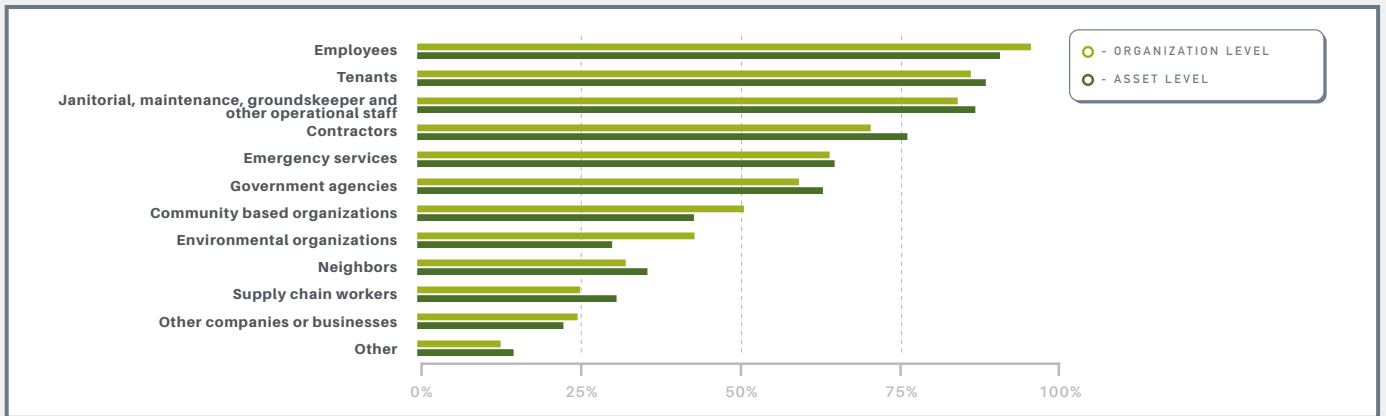
**(a)** Asset-level risk assessment



**(b)** Organization-level risk assessment



**(c)** Types of stakeholders considered in organizational and asset-level risk assessments



## Leadership in Climate Risk Assessment FOUR TWENTY SEVEN AND GEOPHY

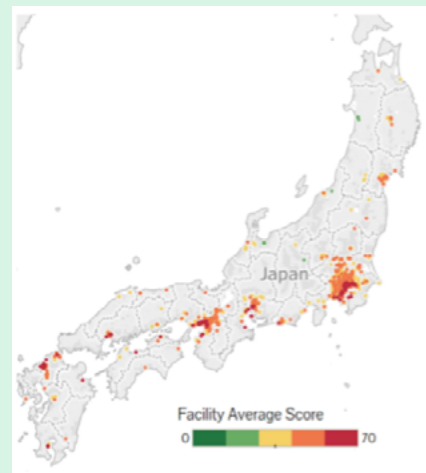
**Real estate properties in the U.S. exposed to climate risks, such as sea level rise, already sell at a discount relative to unexposed properties<sup>6</sup>.**

Market intelligence provider Four Twenty Seven and real estate technology company GeoPhy have partnered to assess exposure in the real estate investment market to the physical impacts of climate change. Bringing together risk-driven analytics on physical climate risk exposure with in-depth structured data on real estate investment trusts (REITs)' holdings globally, they created the first global, science-driven assessment of REITs' exposure to climate risk, covering over 73,500 properties owned by 321 REITs.

The white paper, "[Climate Risk, Real Estate, and the Bottom Line](#)" summarizes the key findings of the initial analysis, which found exposure globally. A key observation was that the most exposed REITs are primarily concentrated in Asia. In Japan, 27 percent of REIT-owned real estate market is exposed to flood and 15 percent exposed to sea level rise by 2040. Thirty-seven Japanese REITs have their entire portfolio exposed to the highest risk for typhoon globally, representing \$264.5 billion at risk.

The impacts of climate change are already affecting real estate markets, but the widespread, long-term consequences for economies, economic growth and equity are just starting to emerge. Four Twenty Seven and GeoPhy's partnership brings science-driven analytics to support efforts to understand REIT-level financial vulnerability to climate change and can be leveraged as a starting point for more robustly informed investing.

Learn more at [www.427mt.com](http://www.427mt.com) and [www.GeoPhy.com](http://www.GeoPhy.com)



*Today, the largest uncertainty in projecting future climate conditions is the level of greenhouse gas emissions going forward. Future global greenhouse gas emissions levels and resulting impacts depend on economic, political, and demographic factors that can be difficult to predict with confidence far into the future.*

**Jay et al. (2018)**

Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment<sup>4</sup>

### #3. Business Strategies

Information about organization- and asset-level risks provides the basis to establish resilience-related business objectives and strategies. There are no well-established standards or benchmarks for the description of these objectives or strategies. Consequently, the GRESB Resilience Module allowed respondents to describe their activities in open text boxes, supported by evidence. A three-stage methodology was used to analyze these unstructured responses, including:

1. Analysis of count and frequency within open text boxes
2. Comparative multivariate analysis of the co-occurrence of words
3. Qualitative review of outliers from the multivariate analysis

The first stage provides an aggregated overview of how companies are describing resilience-related objectives and strategies. The second stage compares responses between entities. The third stage provides a deep dive into specific responses from entities distinguished by their scores in the multivariate analysis.

Results from the first stage provide a consistent, general picture about the frequency of words used by describe business objectives (Table 2) and strategies (Table 3). The most common words include risk, climate, social, and community.

**Table 2.** Word frequency in resilience objectives open text box responses\*

<b>(A) NEW ACQUISITIONS</b>	<b>(B) NEW CONSTRUCTION</b>	<b>(C) STANDING INVESTMENTS</b>
<ol style="list-style-type: none"> <li>1. Risk</li> <li>2. Resilient/ce/cy</li> <li>3. Invest</li> <li>4. Climate</li> <li>5. Social</li> <li>6. Change</li> <li>7. Environmental</li> <li>8. Community</li> <li>9. Acquisition</li> <li>10. Business continuity</li> </ol>	<ol style="list-style-type: none"> <li>1. Resilience/t/cy</li> <li>2. Risk</li> <li>3. Climate</li> <li>4. Development</li> <li>5. Community</li> <li>6. Construction</li> <li>7. Energy</li> <li>8. Design</li> <li>9. Project</li> <li>10. Social</li> </ol>	<ol style="list-style-type: none"> <li>1. Risk</li> <li>2. Climate</li> <li>3. Resilience/t/cy</li> <li>4. Social</li> <li>5. Ensure</li> <li>6. Environmental</li> <li>7. Asset</li> <li>8. Management</li> <li>9. Plan</li> <li>10. Business</li> </ol>

\* Word frequencies combine responses from real estate and infrastructure

**Table 3.** Word frequency in resilience strategies open text box responses\*

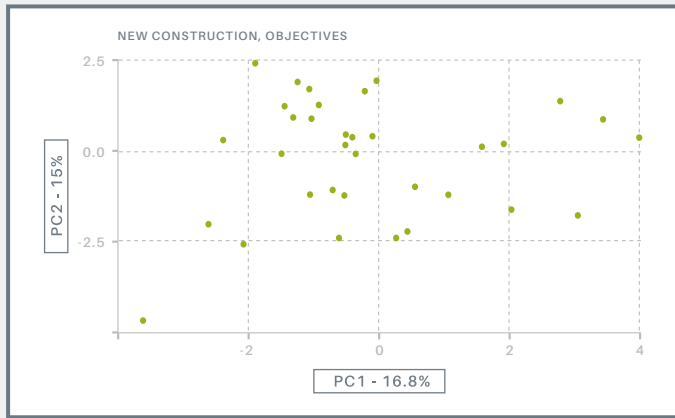
<b>(A) ACQUISITIONS</b>	<b>(B) NEW CONSTRUCTION</b>	<b>(C) OPERATIONS</b>
<ol style="list-style-type: none"> <li>1. Risk</li> <li>2. Acquisition</li> <li>3. Resilience/t/cy</li> <li>4. Invest/investment</li> <li>5. Building</li> <li>6. Asset</li> <li>7. Due diligence</li> <li>8. Process</li> <li>9. Climate</li> <li>10. Property</li> </ol>	<ol style="list-style-type: none"> <li>1. Building</li> <li>2. Risk</li> <li>3. Design</li> <li>4. Development</li> <li>5. Resilience/t/cy</li> <li>6. Construction</li> <li>7. Green</li> <li>8. Project</li> <li>9. Achieve</li> <li>10. Climate</li> </ol>	<ol style="list-style-type: none"> <li>1. Risk</li> <li>2. Asset</li> <li>3. Plan</li> <li>4. Management</li> <li>5. Building</li> <li>6. Climate</li> <li>7. Property</li> <li>8. Assessment</li> <li>9. Resilience/t/cy</li> <li>10. Change</li> </ol>

\* Word frequencies combine responses from real estate and infrastructure

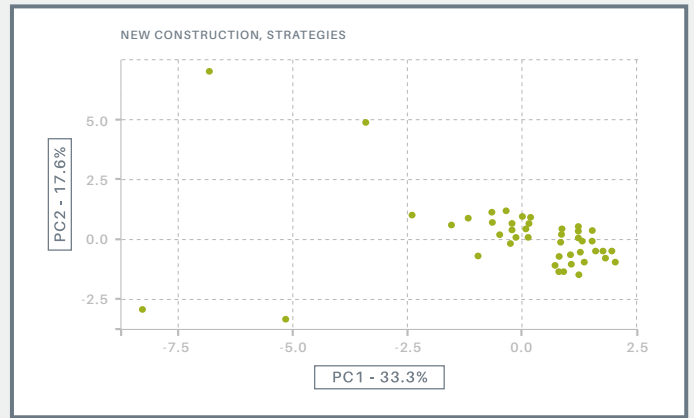
The second-stage used Principal Components Analysis (PCA) to compare the use of terms across companies. This exploratory analysis provides a quantitative methodology to compare composite similarity of responses based on the use of any of 15 keywords. Entities using similar words appear close together, while entities describing their activities differently appear far apart. Figure X shows that there is significant variation in the description of objectives and strategies between respondents. At this point, there is no objective standard to evaluation whether this variation is "better or worse". However, it does provide a quantitative indication that there are differences between entities, and, in turn, future work may provide ways to categorize, rank, or score this variation to provide more insight into the quality of objectives and strategies.

**Figure 4.** Illustrative analysis of variation in open text responses for resilience objectives and strategies.

(a) Multivariate ordination of resilience-related new construction objectives based on word frequency. Entities with similar responses are close together. Points represent individual entities.



(b) Multivariate ordination of resilience-related construction strategies based on word frequency. Points represent individual entities.



The third-stage of the analysis builds on the multivariate analysis with the qualitative investigation of outliers. This stage seeks to understand more about the responses from entities at the edges of the graphs in Figure 4. These entities represent extremes, presumably contrasting examples of objectives and strategies. Given the priority of protecting the confidentiality of individual participants, Table 4 describes three illustrative sets of responses for resilience objectives and strategies. Note that the details of these responses have been edited and combined to illustrate typical patterns. The examples do not reflect responses from any particular entity.

**Table 4.** Illustrative examples of business objectives and strategies for real estate companies.

		EXAMPLE 1	EXAMPLE 2	EXAMPLE 3
Entity characteristics		Large, office, Oceania	Large, industrial, globally diversified	Large, office, North America
New Construction	Objectives	Promote community resilience Prioritize clean energy adoption	Prioritize seismic and flood resilience Establish resilient construction specifications	Select resilient buildings and locations
	Strategies	Plan for climate change adaptation Promote health and safety during construction Design to reduce GHG emissions	Seismic-risk reduction feature Stormwater management Green building standards for new construction	Prepare for natural disaster Apply analytical tools to evaluate flooding risks
New Acquisition	Objectives	Apply Responsible Investment concepts to acquisitions Contribute to community resilience	Prioritize resilient buildings and locations	Assess climate, water, and energy risks Promote energy efficiency Track operational energy use



New Acquisition	Strategies	Pursue a "triple bottom line" approach to investment  Provide public disclosure  Plan for climate change adaptation	Establish high building standards  Promote energy and water efficiency  Conduct site assessments	Collect climate data  Install backup power  Periodically assess social and environmental risks
Standing Investments	Objectives	Give equal consideration to social, environmental, and economic outcomes  Promote community resilience  Encourage collaboration with industrial bodies and government agencies	Promote building resilience  Promote resilience to natural disasters	Assess climate, water, and energy risks  Promote energy efficiency  Track operational energy use
	Strategies	Plan for climate change adaptation  Consider environmental, social, and economic factors when evaluating investment opportunities	Promote energy efficiency  Establish and test natural disaster response systems	Collect climate data  Install backup power  Periodically assess social and environmental risks

## Case Study: Seismic resilience for 181 Fremont Street, San Francisco

### URBAN LAND INSTITUTE

A 57-story tower, 181 Fremont in San Francisco's East Cut neighborhood is the third-tallest mixed-use building west of the Mississippi River. It combines more than 435,000 square feet (40,400 sq m) of class A office space with 67 luxury condominiums on the upper floors and retail space on the first and seventh floors. Located in San Francisco's East Cut neighborhood downtown, the building is one of two that connect to the city's new Transbay Transit Center by a seventh-floor skybridge to the center's elevated 5.4-acre (2.2 ha) park. Developer and owner Jay Paul Company teamed with Heller Manus Architects and Arup to design and complete the 800-foot-tall (244 m) tower.

The San Francisco area is among the most earthquake-prone regions in the United States. More than 7 million people live in the metropolitan area, with more than 2.4 million of those living near the Hayward fault line, which runs east of San Francisco, through the East Hills of San Jose, Oakland, Berkeley, and Richmond. Historically, most high-rise buildings in earthquake-prone areas have been designed to life safety guidelines, which ensure that in the event of an earthquake, occupants can exit the building quickly and safely. However, such guidelines do not consider how quickly and inexpensively a building can recover from a seismic event and return to operation.

The Resilience-based Earthquake Design Initiative (REDi) Rating System was developed by engineering and design firm Arup and a coalition of external collaborators from academia, federal agencies, and the private sector with an eye toward increasing resilience to earthquakes. The criteria encourages delivery of buildings that enable owners to resume building operations quickly after an earthquake and that reduce the associated costs of building repairs. The standard includes elements that address structural and substructure capacity design, resilience and business continuity planning, safer egress, and other operational strategies to reduce risks for the building and its occupants.

Though pursuing REDi certification was not part of the original plan for the site, developer Jay Paul Company saw an opportunity to connect what was already a cutting-edge, resilient design concept to this new standard. “After reviewing the design concept with Arup, we found that we were already set to achieve REDi Silver,” said Jake Albini, director of real estate development at Jay Paul. “We felt that pursuing REDi Gold would not only help send a signal to the market that this was an innovative building, but it would also encourage [the design team] to get creative as the design process progressed.” REDi certification contributed to the value proposition for high value tenants and condominium buyer.

Innovative design elements and the value of resilience in attracting and retaining tenants and buyers helped justify the cost of pursuing REDi Gold and inspired the developer to pursue REDi in other projects.

Read the full project brief [here](#), and learn about real estate development projects showcasing best practices in resilient design at [developingresilience.uli.org](http://developingresilience.uli.org).

## #4. Metrics

TCFD recommends that organizations track and report on quantitative performance metrics. The recommendations suggest a core focus on measures of greenhouse gas emissions and related factors as indicators of transition risk. Higher absolute and relative levels of greenhouse gas emissions are a proxy for exposure to transition risks, such as potential regulation needed to reach economy-wide emissions reduction targets. The TCFD recommendations provide limited guidance on the selection of metrics related to social or environmental resilience.

In line with the TCFD recommendations, the GRESB Real Estate Assessment emphasizes core environmental performance indicators, including Scope 1, 2, and 3 greenhouse gas emissions, annual energy use, water consumption, and waste generation. The measures provide a degree of transparency about entity-level performance; however, they are difficult to interpret with respect to transition risk. This reflects the fact that transition risks are most often the result of local or national factors, such as policy or competitive factors. For example, UK regulation limiting leasing opportunities for the least efficient properties is an obvious transition risk. However, this risk is difficult to assess when indicators are aggregated to the entity level.

The Resilience Module adds a new indicator asking participants about their experience with social and physical shocks and stressors during the reporting period. The guidance for this indicator asks for examples of events or near-misses, along with perspective on how the entity learns from these events.

**Table 5.** Examples of resilience-related shocks and stressors experienced by entities during the reporting period.

	EXAMPLE 1	EXAMPLE 2	EXAMPLE 3
General entity characteristics	Small, retail, Oceania	Large, industrial, globally diversified	Large, office, North America
Illustrative events	Fire	Hurricane; Earthquake	Hurricane; Fire; Bomb threat

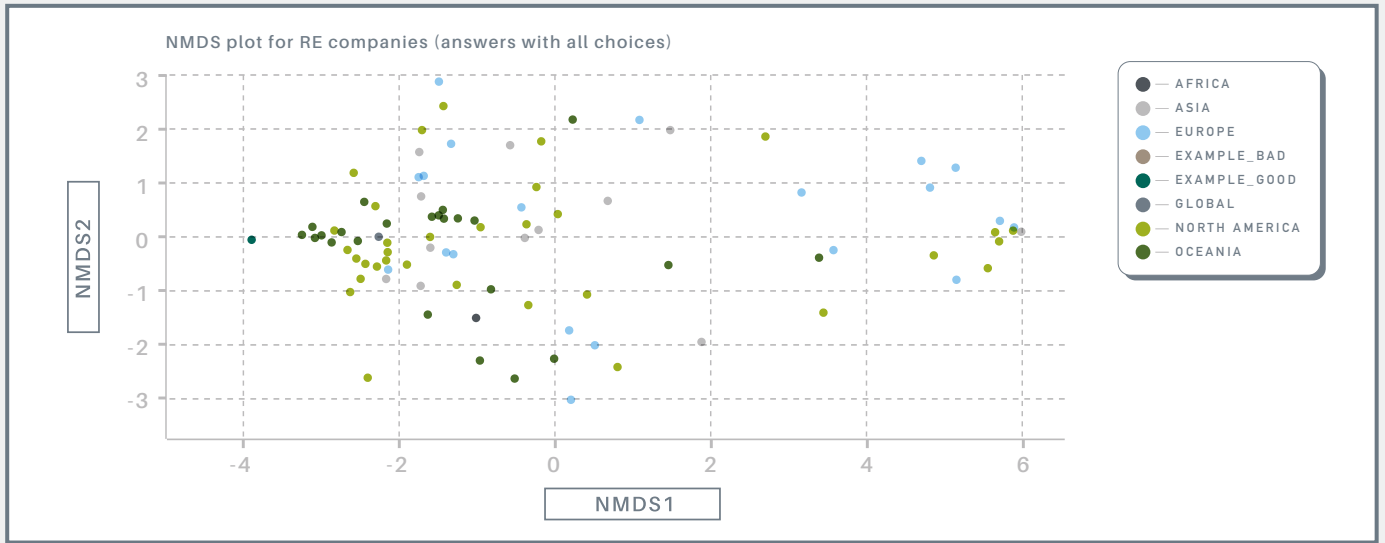
## 3. Overall Industry Performance

The previous sections examine results for individual variables. This section looks at the co-occurrence of responses (i.e., responses for combinations of variables).

**Figure 5.** Multivariate analysis of all Resilience Module answer choices.

X-axis: left = higher degree of breadth; right = lower degree of breadth;

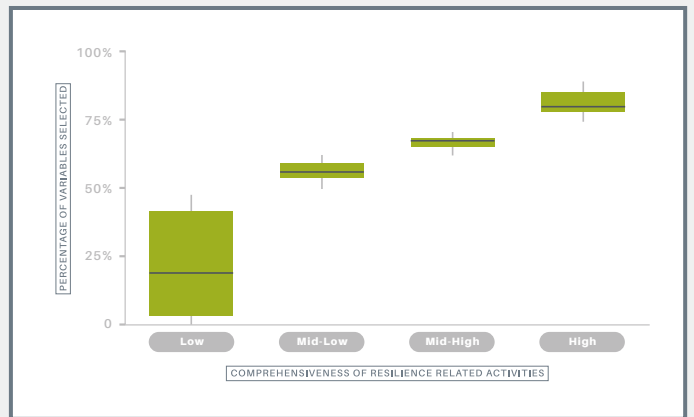
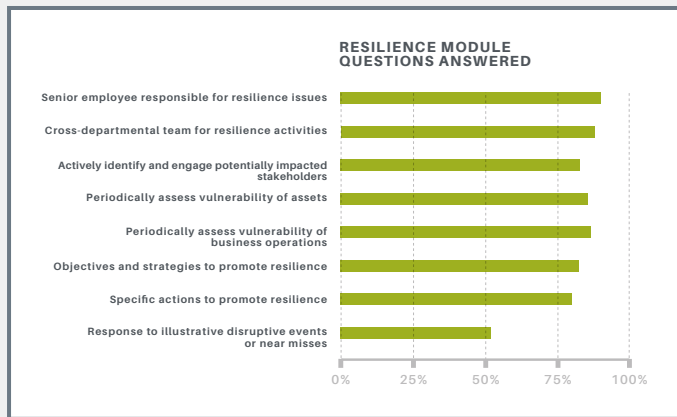
Y-axis: variations based on which indicator choices were selected



**Figure 6.** Summary of responses for Resilience Module indicators.

(a) Percentage of entities answering “yes” to individual indicators. 100% is the highest possible response rate.

(b) Percentage of answer options selected by entities. Higher values indicate more comprehensive responses.



**Table 6.** Characteristics of property companies by segment.

SEGMENT	DESCRIPTION	SEGMENT RESPONSES
Top 25%	Entities are more likely to be large or globally diversified organizations with comprehensive programs	Average = 81% choices selected Stdev = 5%
Middle 50%	A small group of entities with intermediate scope of activities	Average = 62% Stdev = 6%
Bottom 25%	Entities are more likely to be smaller, regional organizations with partial or limited activities	Average = 22% Stdev = 19%

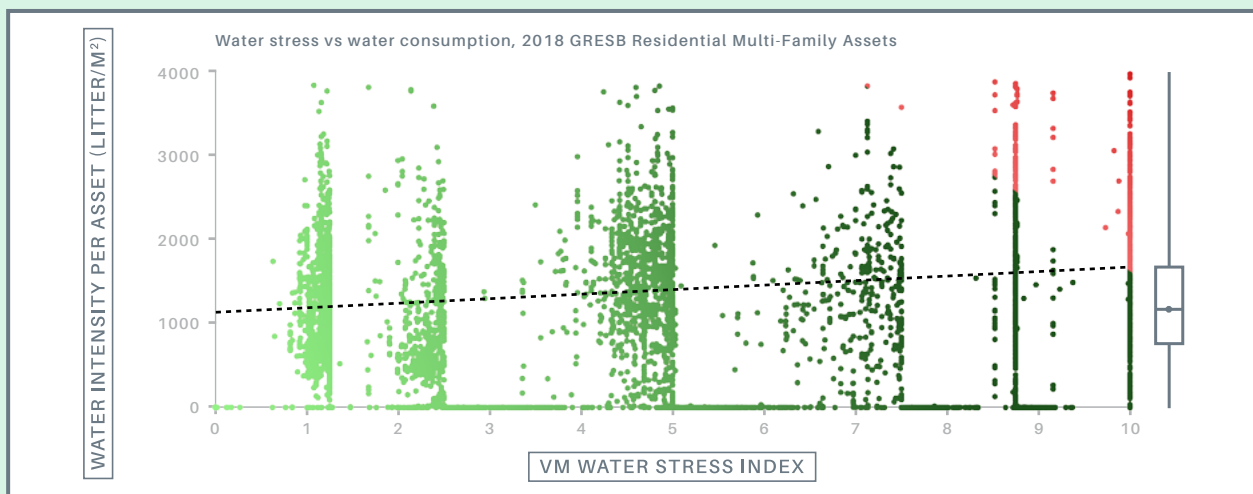
# Leadership in Water Risk Assessment and Management

## VERISK MAPLECROFT AND GRESB

In April 2018, the City of Cape Town announced “Day Zero”, the day municipal water supply would be shut off as water reservoirs neared critical levels. Significant water use restrictions followed which, combined with a change in weather, meant Day Zero was averted – for now.

Cape Town is not the only city facing significant water stress. Many core real estate markets from Melbourne to New York face significant water scarcity risks. The global trend in urbanization, coupled with growing levels of economic development, contributes to higher [per-capita water use](#), while climate change is increasing the frequency and duration of droughts in many areas.

Freshwater scarcity is increasingly perceived as a global systemic risk: [4 billion people](#) live under conditions of extreme water scarcity at least one month of the year, and the threat of a water crisis ranks in the top 5 global risks identified in the [2018 World Economic Forum Global Risks Report](#). Prudent real estate investors must be responding to this challenge...



GRESB and Verisk Maplecroft have jointly mapped the water consumption intensities of residential multi-family properties with complete consumption data against the Verisk Maplecroft (VM) Water Stress Index. The VM Water Stress Index evaluates total water use relative to total annual available flow, accounting for upstream consumptive use and excluding access to aquifers.

Combining both datasets shows that residential multi-family assets reported to GRESB at an asset level in 2018 are less water-efficient in water-stressed cities. Although these intensities have not been normalized for climate zones, weather factors, occupancy rates, or operating hours, the expectation would be that industry’s adaptation efforts be targeted to those areas under greatest stress. Instead, GRESB and Verisk Maplecroft data suggest a reverse relationship for multi-family portfolios, advancing the idea that potable water is underpriced in many regions.

### Adequate adaptation of real estate portfolios to water stress

Multi-family portfolios in water stressed areas face a multitude of risks, ranging from increased cost or restrictions on water supply, water-related regulation and codes, or community opposition. To provide disclosure on these risks, the TCFD recommends building and construction related companies to report on the “percent of fresh water withdrawn in regions with high or extremely high baseline water stress” (see [p60](#)).

Aggregating these risks up to a portfolio level by floor area also provides insights into the adequacy of managerial efforts undertaken to improve water efficiency. The results show that residential multi-family funds that manage properties in lower water stress areas (VM Risk < 3) on average have more water related measures in place as compared to portfolio in more water stressed areas (VM Risk > 7). This highlights an opportunity for managerial adaptation and investor engagement.

Overview of adaptation measures implemented by 2018 GRESB Residential Multi-Family participants.

WHAT	ADAPTATION MEASURE	INDICATOR	% IN PLACE	
			VM RISK < 3 (N = 18)	VM RISK > 7 (N = 19)
Policy that addresses:	Water consumption/management	PD1	100%	84%
Long term reduction targets set for:	Water consumption	PI5	44%	58%
Due diligence risk assessment that covers:	Water efficiency	RO3.1	94%	58%
Due diligence risk assessment that covers:	Water supply	RO3.1	56%	68%
Technical building assessments performed for:	Water efficiency	RO4	100%	63%
Employee training on:	Water	SE1	56%	79%
<b>AVERAGE NUMBER OF WATER MANAGEMENT MEASURES IN PLACE</b>			<b>12/15</b>	<b>11/15</b>

**Next steps: integrating geography into ESG performance analysis**

In real estate, location is not only a key determining factor shaping risk-adjusted returns, it is also fundamental for understanding ESG-related risks and opportunities. To integrate geography into ESG performance analysis, Verisk Maplecroft and GRESB have mapped over 20 real estate adaptation categories against 45 national and sub-national VM risks, covering risks ranging from climate change, to child labour, bribery and corruption, and natural hazards.

Combining various data sets provides unique data-driven insights on how real estate managers and investors can understand and mitigate ESG-related risks relevant for their geographies.

## 4. Real Estate Leadership Case Studies

### Leadership in Investment Management

#### HEITMAN



Investment in property requires an accurate assessment of the possible risks and the potential for return. In the era of climate change, investors need to create methods to manage the asset- and portfolio-level risk stemming from such new realities as sea-level rise, more-frequent and more-severe storms, and increasing heat stress. Greater transparency regarding climate risk and the extent to which an asset (and its location) are resilient in the face of such change are essential elements for investment decision-making.

**Considering Risk and Resilience** – The standard approach to climate-risk assessment today involves reliance on insurance models and public datasets, where historical occurrences are the basis for modelling the risk of natural disasters. Data availability, accuracy and transparency vary globally. The limitation with the insurance industry data is that insurance companies take a short view, pricing risk only one year out, based on probable weather and environmental risk. Institutional investors in property must consider longer-term risk that span holding periods as long as ten to twenty years. Scientific climate models project long-term, global climate change impact, including extreme precipitation, heat waves, drought and sea level rise. These models help to understand changing exposure for both acute, extreme weather events, and chronic, industry-disrupting fluctuations, such as rising seas. However, scientific models can be challenging to access and apply to a large portfolio of real assets.

**Taking Action** – Environmental, social and governance (ESG) principles have been integrated into Heitman’s investment process. On the environmental side, Heitman evaluates each asset’s exposures to environmental change over its expected holding period and develops a plan to improve resource use through operational best practices and innovative technologies and strategies. An asset’s exposure to risks related to weather and natural disasters is developed by using such inputs as flood zone maps and historical experience. To enhance this aspect of our analysis, Heitman retained Four Twenty Seven, a provider of market intelligence on the economic risk of climate change, to screen assets currently in the portfolio and potential new acquisitions globally. Applying historical weather and environmental risk data and forward-looking climate models, Four Twenty Seven provided Heitman with a view of climate-related risks for its properties, encompassing both acute and chronic risks. They scored each asset on multiple dimensions, including risk related to cyclones, floods, earthquakes, sea-level rise, heat stress, and water stress. These scores are used to assess a potential investment’s and the client’s portfolio exposure to long-term climate risk, perform on-site inspections and investigate potential risks, local mitigating factors, and adaptive capacity.

**Going Forward** – Being able to size climate risk at the property level allows Heitman to calculate risks related to climate change at the portfolio level. This understanding positions the firm to make better investment decisions on behalf of its clients.

**ABOUT HEITMAN** – Heitman is a global real estate investment management firm with approximately \$43.5 billion in AUM. Heitman’s real estate investment strategies include direct investments in the equity or debt capitalization of a property or in the securities of listed and publicly traded real estate companies. At Heitman, we seek to improve the world in which we live and work, while delivering the investment outcomes our investors require.

Learn more about Heitman’s work to support [sustainable operations and resilience](#).

## Leadership in Large-scale Property Development

### LENLEASE AND THE GREEN BUILDING COUNCIL OF AUSTRALIA



**Preparing for change** - Resilience was a key consideration in the development of Lendlease's 6 Star Green Star rated Barangaroo South precinct. The precinct's sustainability performance was assessed across five impact categories - Governance, Innovation, Liveability, Economic Prosperity and the Environment, to be awarded its Green Star rating, representing world leadership. Named after a prominent aboriginal woman, Barangaroo is a harbourside extension of Sydney's CBD and consists of residential, retail and commercial space, but is most commonly associated with its three skyscrapers, known as International Towers. The three towers, originally conceived as siblings, have fast become prominent figures on the Sydney skyline, identifiable by their staggered heights, and coloured panels adorning the facade of each tower.

**Energy and environmental performance** - The Barangaroo Development authority has actively taken steps to offset the development's environmental footprint. The project was one of only 19 places worldwide chosen to be part of the C40 Cities Climate Positive Development Program, and it has committed to achieving carbon neutral, water positive and zero waste status. The strategy is summarized in its Climate Positive Roadmap, including an emphasis on efficiency, impact reduction, and community-based or sequestration-based carbon offsets.

Lendlease Group Chief Executive Officer and Managing Director Steve McCann said resilient urban communities are one of the most sustainable responses a society can make to economic growth.

**Adaptation and resilience** - The LendLease team recognized that the impacts of climate change in Australia are already visible, including more frequent and intense storms, bushfires, and other extreme weather events. Consequently, the team intentionally designed and built Barangaroo to anticipate and adapt to future climate events. Their work emphasized both the built environment (buildings, roads, utilities, etc.) and community (residents, visitors, and workers). The resulting Climate Change Adaptation and Community Plan is based on the belief that these two main elements can interact in positive ways to create good levels of adaptation and resilience.

"As the world's population urbanizes, there is a greater emphasis placed on the role of the built environment, including place, sustainability and community outcomes. People want to live and work in cities that are liveable, connected, accessible and beautiful. This fits into our company's ethos - at Lendlease our culture is all about innovating to deliver authentic places that ultimately enrich the lives of people."

This sustainable approach has been carried through all stages of the Barangaroo development with 97% of waste created during construction recycled or reused, and in its first 2 years of operation more than 2,400 tons of waste was prevented from going to landfill.

Learn more about in the Barangaroo's [Climate Change Adaptation Plan](#) and [Climate Positive Roadmap](#).

## Leadership in Risk Assessment and Management

### SWIRE PROPERTIES LIMITED



Swire Properties Limited (SPL) recognizes that climate change poses different types of risks and opportunities to our business. Apart from physical risks, such as rising sea levels, extreme weather events and consistently increasing temperatures, which cause disruption or negative impact to the environment, employees, assets and supply chain; climate change also presents transition risks such as regulatory and financial risks. We, therefore, need to build up our capacity to assess and anticipate these risks to ensure effective mitigation and adaptation.

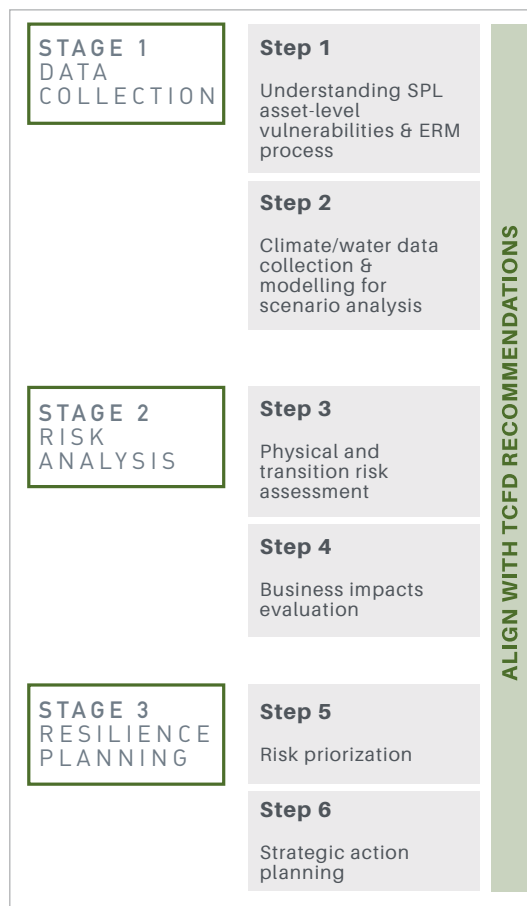
**Risks to assets and business operations** - To help us develop long-term strategies to future-proof our business against climate change, enhance our climate-related risk disclosure to the market, and strengthen climate resilience, in 2018 we launched a comprehensive study to help us identify the key risks posed by climate change to our assets and business operations in Hong Kong, Mainland China and Miami, U.S. We are equally identifying the business opportunities arising from new climatic conditions. Exacerbated by climate change, we also recognize that water management is an emerging risk in many of the cities in which we operate. This is particularly true in Mainland China. To better understand our risk exposure to this highly complex and localized issue, we invested in an additional, separate study to assess our water-related risks across our global portfolio.

**Scenario analysis** - For the climate risk assessment, with reference to the Task Force on Climate-related Financial Disclosures (TCFD) recommendations, we have included an asset-level analysis of the acute and chronic physical risks associated with various IPCC climate scenarios projections. We collate historical data and project climate variables such as temperature and precipitation from suitable Global Climate Models (GCM), coupled with downscaling of the climate data to suitable local context, to evaluate the exposure of our assets/operations in selected time frames from immediate term to distant future (year 2030, 2050 and 2100). Upon completion of the deep physical risk analysis, we will conduct scenario-based assessment of our exposure to any transition risks associated with a 2-degree C scenario.

**Business strategy** - The findings of the full assessment will be used to develop a targeted action plan for mitigating risks and building resilience across our portfolios, as well as to inform our Enterprise Risk Management (ERM) system for continuous management of material climate and water-related risks. The climate and water risk assessment is an important part of our broader approach to managing sustainable development (SD) at SPL. In 2016, we launched a SD strategy called, SD 2030. This strategy is supported by measurable goals and well-defined pathways for progress. To support the objectives defined in our SD 2030 plan, in 2018, we issued our maiden green bond (US\$500M) and we also formally committed to set science-based targets (SBTs) for long-term decarbonization. These actions both contribute to our overall resilience strategy development.

Combined, we believe that these efforts will help us create a stronger, more competitive business, and support our efforts to develop and maintain healthy and resilient places that support communities and enhance people's lives.

Learn more about Swire Properties approach to [climate mitigation, adaptation, and resilience](#).



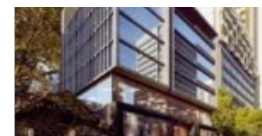
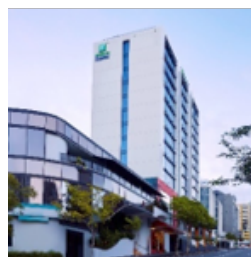


Pro-invest Group (Pro-invest) is one of the largest hotel investment platforms in Australasia. With people positioned in Australia, the Middle East and Europe, Pro-invest's Australian Headquarters are located in central Sydney and operates as an integrated private equity real estate business combining hotel investment, development and operational capabilities. In line with strategic objectives, Pro-invest is dedicated to optimizing the financial and social returns of its hotel investment portfolio for its investors and takes a holistic approach to resilience through ESG initiatives throughout the lifecycle of its assets. Pro-invest has master agreements with InterContinental Hotels Group (IHG) to develop, operate and manage Select Service and Lifestyle hotels under the Holiday Inn Express (HIE) and EVEN Hotels brands across Australia and New Zealand.

**Environmental performance** - Select Service hotels typically feature a smaller overall building footprint, providing a hotel with greater operational efficiency and is less expensive to develop, operate and manage. Pro-invest actively manages its portfolio, striving for significant reductions in energy expenses for operating assets, which results in increased distributions and higher exit valuations. In an environment of rising energy costs, such initiatives also assist in de-risking the exposure to volatility in energy prices. Moreover, all Pro-invest's HIE hotels are designed and operated with considerations derived from Green Engage. Aligned to ISO Standards and LEED, Green Engage is a sustainable platform developed exclusively for IHG-branded hotels. Fundamentally, the platform functions as a sustainability guide, offering c. 200 initiatives to implement throughout development, refurbishment and operation phases, and as an Energy Management System and Data Management System. Pro-invest is currently working with IHG to prepare its operating assets for Green Engage's new Carbon Reduction Baseline. Additionally, during the design phase of all assets, Pro-invest contracts Environmentally Sustainable Design consultants to permit the incorporation of sustainable design features from the ground-up. Moreover, Pro-invest's first operational asset, HIE Sydney Macquarie Park, has achieved a 4.5-Star Energy and 4.5-Star Water rating under the National Australian Built Environmental Rating System (NABERS), with the asset currently holding the highest NABERS rating for hotel assets in Australia. NABERS assessments are performed by third-party consultants to calculate and rate the performance of real estate assets on a particular environmental indicator at a certain point in time based on retrospective consumption using a 6-Star rating scale, with 6-Stars demonstrating market leading performance.

Further, Pro-invest is working closely with the Clean Energy Finance Corporation (CEFC). CEFC is a statutory authority established by the Australian Government to invest in projects demonstrating robust potential in decarbonation and ambitious energy efficiency. The CEFC has committed A\$39 million to a construction and term loan facility as part of a co-financing for the 345-room A\$140 million HIE Melbourne Southbank. CEFC is supporting in lifting the hotel's initial 4.5-Star NABERS target to a 5-Star Energy rating, which will deliver substantial energy savings, providing ongoing benefits for the hotel, carbon conscious guests and the environment. Initiatives for HIE Melbourne Southbank will include high performance glazing, high efficiency air-cooled chillers and condensing boilers and solar photovoltaic systems on the hotel's roof. Regenerative lift drives rather than standard lift motors will be included, permitting the hotel to recycle energy, coupled with integrated building management and guestroom energy management systems to both monitor and drive building performance. The involvement of CEFC marks the institution's first investment into hotel real estate, enabling Pro-invest to continue developing, operating and owning assets that are industry-leading in respect to sustainability.

Learn more about [Pro-invest's commitment to environmental, social, and governance performance.](#)



## Leadership in Physical Risk Analysis

### NUVEEN REAL ESTATE AND VERISK MAPLECROFT



Which cities are best positioned to deliver the greatest total return for real estate investors over the long term? Nuveen Real Estate believe that factoring the physical effects of climate change is a key part of the answer.

Nuveen's Global Resilient Cities Series, focused on investing in those cities well-positioned to take advantage of long-term structural trends, utilizes a climate change screen to ensure that the physical risks of climate change are fully accounted for. The Series, which uses a proprietary model to assess the future impact of factors including demographic change, urbanization, and technology, on the real estate market, leverages the additional use of Verisk Maplecroft's Climate Change Vulnerability Index, in order to provide a climate-sensitive rank of cities.

Richard Hamilton-Grey, Nuveen Real Estate's Sustainability Manager, states that 'the Global Resilient Cities Series is designed to offer investors access to future-proof and resilient cities. We believe that any long-term investment approach must consider the physical impacts of climate change to help protect against long term value erosion.'

The Climate Change Vulnerability Index brings together physical data on changing climate means, extremes and variability, adjusted by existing local exposure to hydrometeorological hazards, at a spatial resolution of approximately 22km<sup>2</sup>; subnational data on the sensitivity of human populations to climate change; and national data on countries' adaptive capacities.

Nuveen Real Estate also integrates Verisk Maplecroft's Heat Stress Index to understand which cities will be exposed to rising temperatures over the next 30 years. From an asset-underwriting perspective, this top-down approach is complemented with an appraisal of resilience measures in place at the asset-level. For example, in those areas exposed to heat stress, in-depth due diligence is undertaken to assess the technical capacity of an asset to deliver increased cooling loads in the future. Integrating this level of due diligence into the underwriting process enables the long-term impacts of heat stress to be factored into capital planning and cashflow forecasts. This assessment is included in a Sustainability paper which is presented at Investment Committee; something which Nuveen Real Estate require for all transactions.

The Asia Pacific Fund strategy, part of the Global Resilient Cities Series, additionally accounts for air quality in its city-selection process and asset-underwriting on the basis that dangerous levels of airborne pollution in some Asian cities is rising up the agenda of the corporate occupier market.

'Adopting a more holistic approach which accounts for non-traditional environmental factors, alongside a discipline to look beyond market cycles, enables a strategy that can both help protect capital and uncover opportunities for value creation.' Hamilton-Grey says. 'As a global asset manager, delivering global solutions for our clients, we need to be confident that the environmental factors we consider follow a robust and standardized methodology at a global scale. Through working in partnership with Verisk Maplecroft, we were able to achieve this'.

Learn more about [Nuveen Real Estate](#) and [Verisk Maplecroft](#).

## Leadership in Commercial Development

### URBAN LAND INSTITUTE



Located at the Southern Gateway to downtown Miami's Brickell financial district, 1450 Brickell is a 35-story, 586,000-square-foot Class A office tower that features panoramic views of the city and Biscayne Bay one block away. It was Miami's first LEED Gold-certified private office building and is one of the city's most resilient. Planning for the project began in 2005 when attention was focused on heavy damage caused by Hurricane Wilma.

This powerful storm caused expensive damage and business disruption for many high-rise buildings in Miami. Completed in 2010, the building was constructed beyond code with a poured-in-place reinforced concrete structural system that uses post-tensioned one-way slabs and beams. The entrance, lobby, and elevator corridors are elevated eight feet above grade to reflect the slope of the site, which is higher on the north side, and to raise the lobby base above the floodplain to avoid potential flooding impacts during hurricanes. The ground level also includes a breezeway, two retail banks, and spaces for two restaurants; one restaurant is at street level within the floodplain, but it includes a system of glass panels that can be put in place for protection during storms.

The development team, made up of Rilea Group, NBWW, Blanca Commercial Real Estate, and Coastal Construction Group, researched impact-resistant glass and structural framing systems and to redesign the building to withstand the extra weight of heavier, more resilient glass and framing. The curtain wall consists of tempered blue glass that is nine-sixteenths of an inch thick, laminated, and constructed of layers that can resist extreme heat and withstand the force of large projectiles approaching 300 miles per hour. The curtain wall was strengthened with heavy bolts, thick aluminum framing, and silicon to hold the glass in place. Wind tunnel tests ensured that the resulting structure could withstand a Category 5 hurricane, in which winds can exceed 157 miles per hour, without experiencing major breaches to the building's exterior.

Another risk following hurricanes is large-scale power outages. The building has a second backup generator that exceeds code requirements, able to run the air conditioning and lighting systems and to provide electrical power for tenants during power outages. The backup system includes a 2,200-kilowatt emergency power generator and a 2,000-kilowatt standby power generator, capable of supplying about 50 percent of the power for air conditioning during a recovery period. The electrical vault is a "throw-over" vault with two primary feeds; if one feed loses power, the vault automatically switches to the other primary feed for continuous power.

The developer estimates that the tandem sustainability and resilience efforts increased the construction cost by 6 to 8 percent, but that these costs have been "recouped several-fold." Beyond the protection the glass will provide during a severe storm, the gamble has paid off already in more competitive insurance bids and lower operating expenses. The window glass, for example, deflects heat better and has reduced the need for air conditioning, which in Miami consumes about 60 percent of a building's electricity. The owner estimates that the glass and other measures have contributed to annual electricity cost savings of about \$1 million. The building's resilience has also become a key marketing point and provided an edge in being able to fully lease the building by 2013, compared with the 40% lease-up rates of two comparable commercial properties that came to the market at the same time.

The developer believes that the building's LEED Gold certification and resilience measures, among other factors, were assets that drew high-profile tenants who shared the team's commitment to sustainability.

Read the full project brief [here](#), and learn about real estate development projects showcasing best practices in resilient design at [developingresilience.uli.org](http://developingresilience.uli.org).

## Leadership in Resilient Building Operations

### **VERDANI PARTNERS, PARKWAY AND JAMESTOWN**



Verdani Partners' leading Building Resilience program focuses on key strategies for identifying and mitigating building level and regional risks for real estate portfolios. Verdani has been implementing resilience programs for their clients for the past four years, including comprehensive risk assessments, resilience plans and strategies, such as improving building structures, sites, systems, operations and creating disasters preparedness plans

to mitigate key risks identified. These initiatives have helped two clients, Jamestown Properties and Parkway, achieve a perfect score of 100 on GRESB's 2018 Resilience Module.

Jamestown's and Parkway's global leadership in this area is the result of many factors, including actively identifying and engaging stakeholders potentially impacted by social and environmental stressors, and working with the organization's leadership to ensure that resiliency and physical risks are identified and addressed on an ongoing basis. Verdani Partners' standard portfolio-wide risk assessments are comprised of 46 indicators to evaluate the vulnerability of the companies' real estate assets, including physical, social, environmental and economic risks, such as building safety, sea level rise, flooding, and other major risks.

In Parkway's case, flooding from hurricanes is a major risk for their 19 office buildings in Houston, Texas. In response to lessons learned from previous hurricanes, Parkway established a Building Resilience and Climate Change policy in 2016 and incorporated several physical measures to proactively mitigate flood damage for their Houston portfolio. Ultimately, these physical measures, including flood gates, dewatering pumps, and an extended emergency staffing plan with 24/7 on-site maintenance teams, were integral in helping Parkway survive the Category 4 Hurricane Harvey in 2017 without incurring any major damage to any of their buildings or major flood insurance claims.

Learn more at from [Verdani Partners](#).

## Leadership in Resilient Retail Development SIEMENS BUILDING TECHNOLOGIES

SIEMENS

Building Technologies

**Sello shopping center: more than a building** - Sello is Finland's most visited and most sustainable shopping center. Its 102,000 square meters of gross leasable area welcome 24 million visitors per year from all over the world. There are over 170 shops as well as a concert hall, a library, hypermarkets and entertainment attractions. Sello was the first shopping center in Europe to become LEED EB Gold-certified in 2010. It was also the first shopping center - and one of only nine such buildings in Europe - to achieve the LEED EB Platinum certification in 2015. Sello aims to remain the greenest shopping center in Europe, providing its over 170 tenants with a sustainable business environment. To secure an ongoing LEED certification, the shopping center had to undergo energy efficiency improvements.

**Establishing resilience for a brighter future** - Leveraging data from energy efficiency and HVAC systems, air quality and temperature sensors, occupancy rates and weather data, Siemens identified areas for improvement and delivered a comprehensive optimization program for Sello's building systems, focused on energy consumption and air quality. A Siemens Energy Saving Performance Contract (EPC), which guarantees energy savings, was used to finance the investment over the period of the agreement and repay these costs in four years. The Sello building was modernized with an updated HVAC system and including the Desigo building automation and control system from Siemens, as well as over 100 new control actuators, temperature sensors and CO<sub>2</sub> sensors all designed to help lower energy consumption and ensure operational resiliency. An Advanced Service Center (ASC) continuously monitors energy consumption online and makes it possible to constantly optimize the measured quantities and adjust the settings via a secure remote connection. Via Siemens Navigator - the cloud-based energy and sustain-

### A PERFECT PLACE IN NUMBERS

€125,000

heat and electricity  
cost savings

1,500

energy and HVAC  
data points



1

shopping center

24,000,000

visitors in 2017

102,000

square meters of  
gross leasable area

1st

shopping center in  
Europe with LEED EB  
Platinum certification

nability platform - fault detection and diagnostics was applied to optimize the buildings spaces and individual pieces of equipment. The services were delivered on site by a Siemens energy manager who was fully dedicated to Sello and a team of building automation maintenance experts, as well as remotely through a connection to the Digital Service Center. In addition, the deployment of distributed energy systems and micro-grid controlling capabilities provided Sello with resilience against grid disruptions and external infrastructure risks, while increasing Sello's robustness and adaptability to unexpected changes.

**A long tradition of working together** - The relationship between Sello and Siemens started over 25 years ago and led to the shopping center's first LEED certification as well as a 50 percent reduction in energy consumption and savings of €133,000 per year (25%). The current efficiency program sees energy savings of €110,000 per year, a 20 percent reduction in CO2, and a 50 percent reduction in district heating. The measures put in place have led to better air flow in certain areas, including restaurants where people spend the most time in a static position. When snow is predicted, district heating can be used to proactively heat entrances and reduce ice buildup. All of this helps provide a high-quality visitor experience and keeps emissions, operating costs and rents for shop owners as low as possible.

Learn more about [intelligent, resilient buildings from Siemens](#).

## 5. Tools and Insights

A wide variety of industry associations and research organizations have focused on climate risk and resilience. These efforts have provided a growing set of tools and practical insights. The following resources provide an illustrative sample of some of the most recent and important products for the property and infrastructure industry.

### BOMA Canada 2019 Resilience Brief

#### BOMA CANADA

The Building Owners and Managers Association of Canada (BOMA Canada) is proud to present its brand new Resilience Brief - an important document to help building owners and managers begin to consider the potential risks posed to commercial real estate by extreme weather events.

Following several significant extreme weather events, BOMA Canada convened industry leaders to undertake this initiative. The result was our 2019 Resilience Brief, which we expect to update annually. Hundreds of individuals downloaded the document in the first few days alone.

BOMA Canada's Resilience Brief includes an overview of the key issues as well as helpful tips for making your building more resilient. From floods to wildfires, the Resilience Brief will help building owners and managers take steps today to prepare for extreme weather events tomorrow.

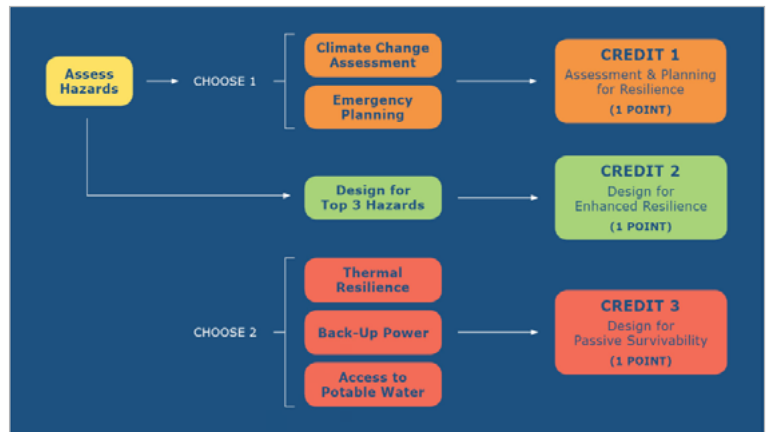
Access the brief [here](#).



### LEED Resilience Pilot Credits

#### US GREEN BUILDING COUNCIL

There are LEED pilot credits focused on resilient design. These fall into the Integrative Process category of LEED (thus the IP in the credit identities), and they are pilot credits (pc in the identities). In the LEED Rating System, they are applicable to all Building Design and Construction (BD+C) rating systems, along with Homes and Mid-Rise Residential rating systems. These three credits are designed to ensure that a design team is aware of vulnerabilities and addresses the most significant risks in the project design, including functionality of the building in the event of long-term interruptions in power or heating fuel.



Access the [LEED Resilience Pilot Credits](#).

## Resilience Backgrounder

### REALPAC

REALPAC is the national real estate leadership association dedicated to advancing the long-term vitality of Canada's real property sector. Its membership includes chief executives of Canada's leading real estate investment companies. Released in October 2018, REALPAC's first Resilience Backgrounder provides commercial real estate owners and managers with an overview of the climate change risks they face and the associated resilience measures they can use to protect against them, both on an asset and entity level. REALPAC will continue to conduct resilience research and update this document over time.

Access [the Backgrounder here](#).



## Climate Adaptation with Green Star

### GREEN BUILDING COUNCIL OF AUSTRALIA

The Australia property industry is a long-standing leader in environmental, social, and governance performance. The Green Building Council of Australia's Green Star rating tool is an important part of this success, and Green Star the Adaptation and Resilience credit recognizes projects teams taking specific, coordinated actions to reduce climate risk and promote resilience. The credit requires projects to:

1. Develop a Climate Adaptation Plan
2. Consider climate change scenarios
3. Conduct risk assessment
4. Implement elements identified in the Climate Adaptation Plan

Projects with these important elements have taken tangible steps to protect value under changing climatic conditions.

Learn more about resilience and adaptation in [Green Star](#).



## Future-proofing Real Estate from Climate Risks

### URBAN LAND INSTITUTE

Many assets held by real estate investors are in cities vulnerable to the effects of climate change – ranging from more intense and frequent weather events such as hurricanes, typhoons, and wildfires to more gradual changes such as sea-level rise or shifting weather patterns. ULI is partnering with Heitman, a global real estate investment management firm, to assess the potential impacts of climate change on the long-term viability of real estate assets. Derived from a series of interviews with leading institutional investors, investment managers, investment consultants and others, the report provide an inside look at how real estate investors are factoring climate risk into their investment decision-making and management processes.

Preliminary findings for this research initiative have been summarized in this [document](#). The Final report will be published in February 2019.

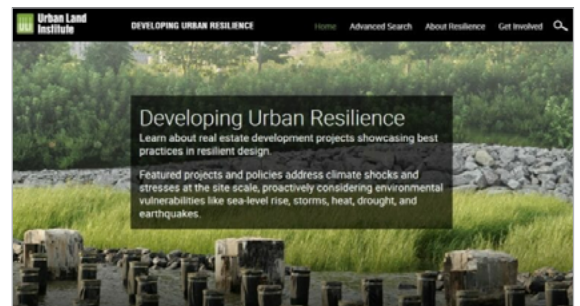


## Developing Urban Resilience

### URBAN LAND INSTITUTE

This brand new website features real estate development projects that showcase best practices in resilient design. Included projects and city policies/programs address climate shocks and stresses at the site scale, proactively considering environmental vulnerabilities like sea-level rise, storms, heat, drought, and earthquakes.

Learn more and nominate a project for inclusion on the website at [developingresilience.uli.org](http://developingresilience.uli.org).



## A Canadian Standard for Flood Resistant Communities

### INTACT CENTRE FOR CLIMATE ADAPTATION, UNIVERSITY OF WATERLOO

This report profiles 20 best practices to be incorporated into the design and construction of new flood-resilient residential communities in Canada. Ensuring that new communities are built under the direction of these practices is necessary to combat ever-worsening extreme weather that, if not addressed, will result in costly and unremitting flood damage.

Access the [report](#).



# INFRASTRUCTURE

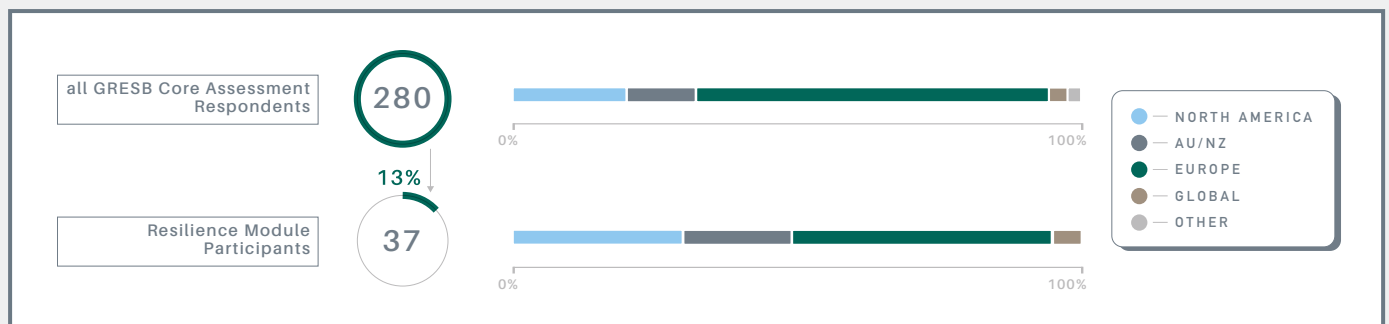
## 1. Infrastructure Participation

The GRESB Infrastructure Assessment covers a universe of infrastructure companies and funds. Participants belong to a wide-range of infrastructure sectors, such as airports, railways, toll roads, pipelines, and energy generation.

In 2018, 280 entities reported to the core Infrastructure Assessment, and 37 entities (13%) participated in the optional Resilience Module (Figure 7). The size and composition of these self-selected entities is broadly comparable with overall participation; however, entities from North America and Oceania are modestly over-represented in the sample and European entities are relatively under-represented.

The information available for infrastructure participants has the same characteristics as those described in the Real Estate section of this document.

**Figure 7.** Geographic distribution of all GRESB Infrastructure respondents and Resilience Module participants.



## 2. State of the Market

Results from the Infrastructure Assessment and the Resilience Module provide a snapshot of the state of the market as represented by GRESB participants. This sample does not capture the entire industry, and it reflects regional and sectoral biases associated with GRESB participation generally. As with the preceding section, the following categories follow recommendations of the TCFD, including governance, risk management, strategy, and performance metrics.



## # 1. Governance

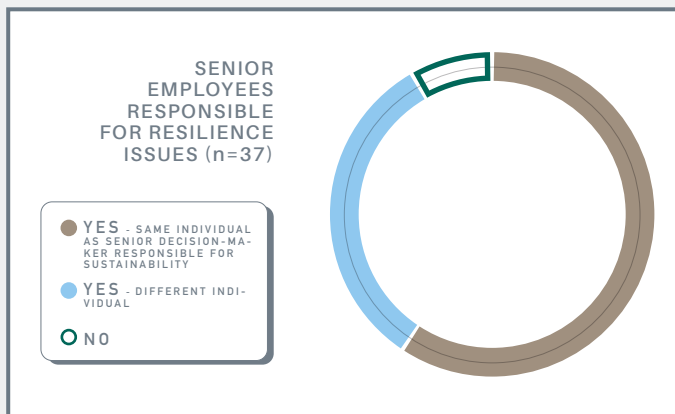
The first question for engaged investors is the same for real estate and infrastructure investors, “Who is responsible for climate risk and resilience? How is this responsibility carried out?” GRESB Infrastructure participants report that a variety of high-level personnel have responsibility for these issues, including:

- CEO
- Asset Manager
- Director, Compliance
- Manager, Enterprise Risk and Environment
- Head of Business Resilience & Security
- Head of Risk
- Operators Management
- Vice President, Operations

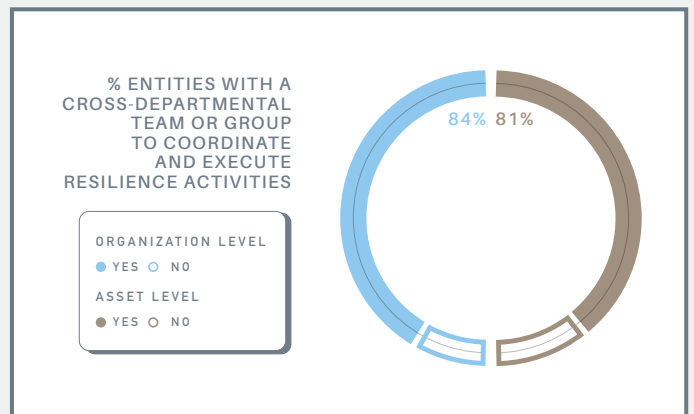
The interdisciplinary nature of climate risk and resilience creates a requirement for communication and action across traditional organizational divisions. The Module asked participants about the presence of such interdisciplinary teams at the organization and asset level. The results show that 59% of entities have specifically assigned responsibility to a senior employee. The majority of these individuals also have responsibility for overall sustainability activities.

**Figure 8.** Resilience leadership and coordination.

**(a)** Senior employee



**(b)** Organization and asset-level teams



## # 2. Risk Assessment

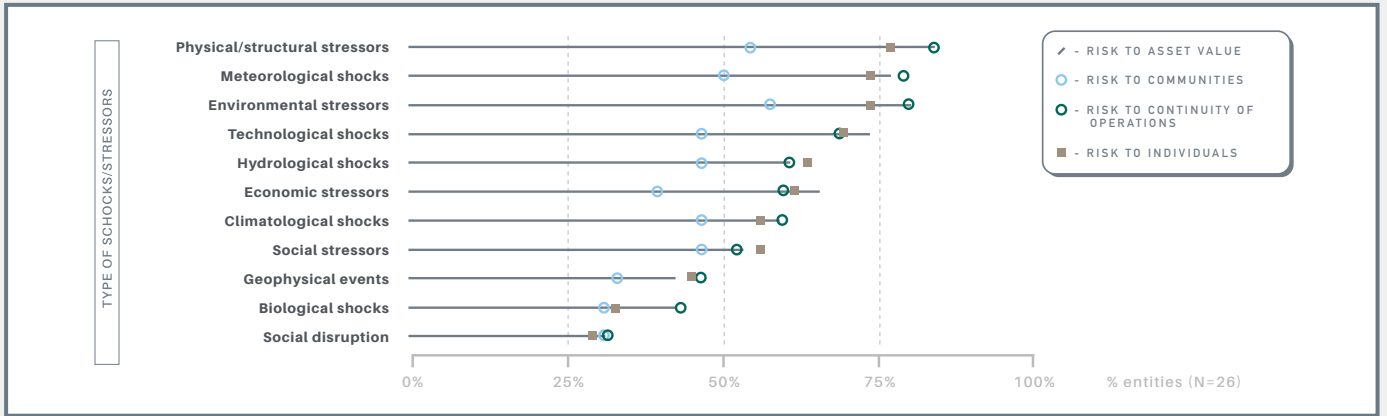
High quality, multi-criteria risk assessment is the foundation for efforts to address climate-risk and resilience. Figure 9(a) illustrates the types of shocks and stresses reported for asset-level infrastructure risk assessments. Overall, infrastructure assets report risk to continuity of operations, asset value, and tenants as major concerns. Risks to individuals and communities are considered at significantly lower rate. More than 90% of respondents reported considering physical or environmental risks, including hydrological and meteorological shocks. Notably, less than 80% of respondents reported considering risks from social stressors or disruption.

Figure 9(b) illustrates the types of shocks and stresses reported for organizational-level risk assessments. Again, organizational risk assessments prioritized physical and environmental factors, with modestly lower rates of risk assessment for social and community factors. Among the types of shocks and stressors, physical/structural stressors, environmental stressors, hydrological shocks, and climatological shocks received most attention.

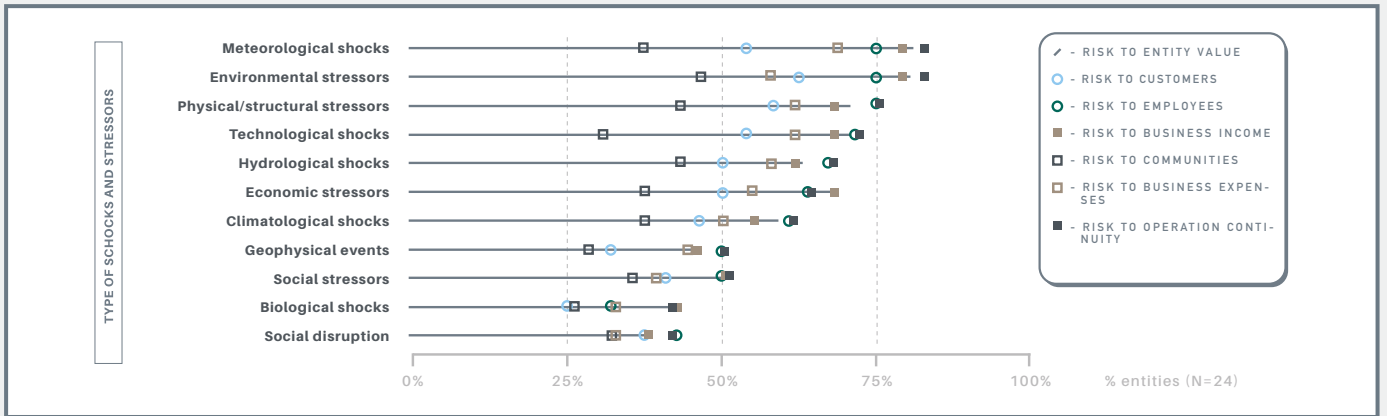
Figure 9(c) shows large differences in consideration for different stakeholder groups in organization- and asset-level risk assessments. Employees and customers are almost always considered. Community groups, neighbors, and environmental organizations are considered in less than 50% of risk assessments. Notably, emergency services are only considered in approximately 60% of assessments by reporting entities.

**Figure 9.** Frequency of asset and organizational risk assessment for infrastructure entities.

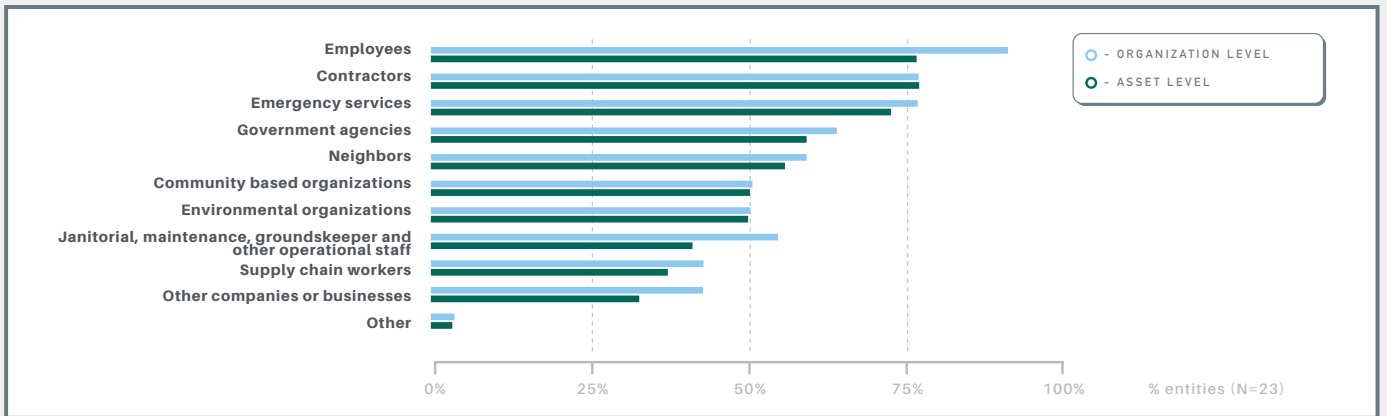
**(a) Asset-level risk assessment**



**(b) Organization-level risk assessment**



**(c) Types of stakeholders considered in organizational and asset-level risk assessments**



### #3. Business Strategy

Infrastructure assets are clearly highly variable in their scope, operations, and business processes. Their resilience-related business strategies are equally diverse. The 2018 Resilience Module did not attempt to quantitatively benchmark business strategies; however, responses were analyzed and organized to identify patterns and provide qualitative comparisons. Table 8 illustrates common resilience-related business strategies reported by infrastructure assets.

**Table 8.** Illustrative examples of business objectives and strategies for infrastructure assets.

	EXAMPLE 1	EXAMPLE 2	EXAMPLE 3
Entity characteristics	Large, public, Oceania	Small, private, Europe	Small, other, Europe
Objectives	Provide effective risk and resilience governance Conduct risk and resilience assessment Provide risk and resilience training	Promote fire resilience Promote resilience to sewage overflow	Promote fire resilience
Strategies	Public disclosure of risk management policy Integration of risk management into business activities and processes Annual trainings on resilience and risks plans	Training and technical improvements for fire protection systems Leak-proofing control systems Remote, automated control system monitoring	Upgraded fire control and prevention design strategies

Clearly, reported business strategies vary widely, and they represent different interpretations of climate-risk and resilience. For some entities, resilience is interpreted as a part of routine risk management, such as fire protection or system monitoring. For other entities, resilience is understood to encompass emerging issues, such as transition risk and exposure to climate-related stressors. The heterogeneous nature of responses underscores the need for GRESB and institutional investors to be more explicit and direct in questions regarding climate-risk and resilience.

*Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence). These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options.*

**Intergovernmental Panel on Climate Change**  
 Summary for Policymakers, [Special Report on Global Warming of 1.5°C](#)

## #4. Performance Metrics

Ultimately, efforts to improve the management of climate-risks and resilience will be judged on delivery of measured outcomes. TCFD recommendations call for “performance metrics”; however, they do not provide specific guidance beyond encouraging reporting on greenhouse gas emissions.

The core GRESB Infrastructure Assessment includes a range of performance indicators, including measures of energy use, greenhouse gas emissions, water consumption, and water generation. The Infrastructure Assessment uses this information to provide high-level information about productivity and efficiency, such as greenhouse gas emissions intensity. These performance indicators provide some information about transition risks facing infrastructure assets. For example, entities with high emissions intensities relative to peer within their sub-sector may have higher transition.

These long-standing performance indicators do not provide insights about risks from social or physical change, and TCFD does not provide specific guidance. The Resilience Module attempts to fill this gap by asking entities about their ability to report on climate-related shocks and near miss events. This type of information is essential to evaluate risks and the effectiveness of risk management strategies. A relatively small fraction of entities indicated that they currently systematic track and report this type of information. Available information varies widely, and there are no widely accepted standards for reporting definitions or thresholds (Table 9).

**Table 9.** Illustrative examples of information about climate-related shocks and near miss events reported by infrastructure participants.

	EXAMPLE 1	EXAMPLE 2	EXAMPLE 3
General entity characteristics	Large, public, Oceania	Small, private, Europe	Small, other, Europe
Illustrative events	Extreme winter weather Climate risk	Fire Outage of production	Power failure on site Generator backup failure

These results clearly indicate that performance measurement and reporting is an underdeveloped area for many infrastructure assets. Progress on these issues will require new guidance and definitions for reportable events and adjustments to internal information systems and procedures.

## 3. Overall Industry Performance

The previous sections examine the achievement rate of individual indicators. This section looks at achievement against multiple indicators. While the achievement rate for individual indicators is high, the conjoint analysis shows significant variation in the achievement of multiple indicators. Figure 10 presents results from non-metric multidimensional scaling of all 167 potential answer choices. Consequently, variation in the plot reflects different combinations of responses.

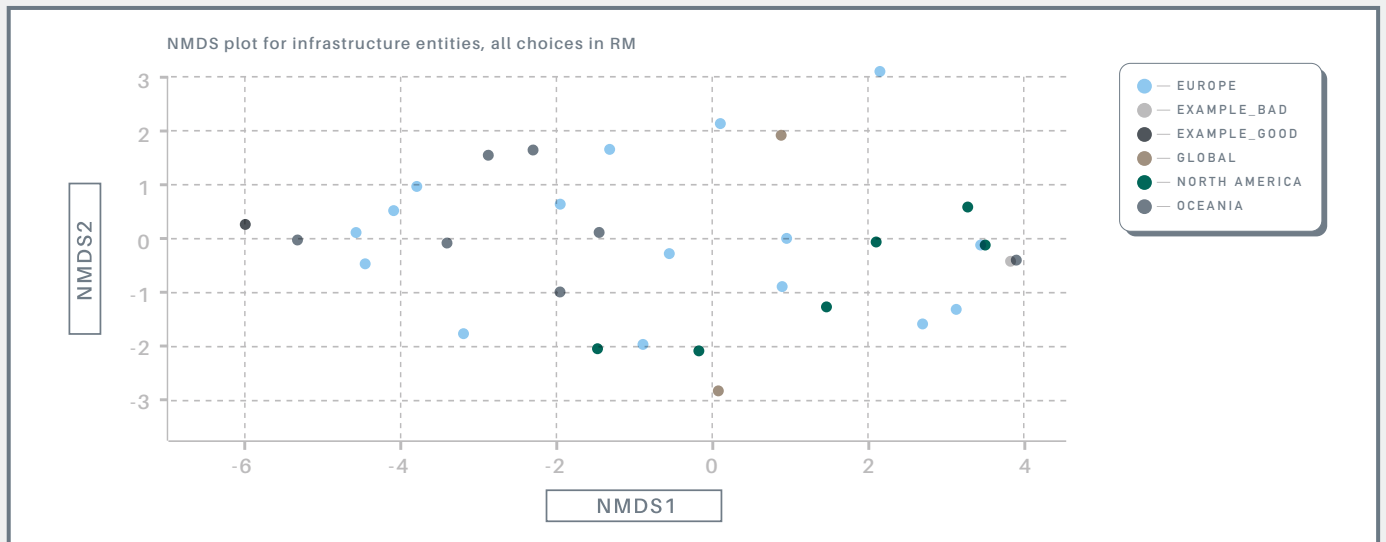
Entities with the most comprehensive responses are on the left side of the x-axis, and entities with least comprehensive responses are on the right side. Entities at the same position on the x-axis have the same overall response rate, but they differ in the specific combination of responses used to achieve the response rate. The green triangle on the far left illustrates the position of an entity providing a positive response to all possible answer choices. The green circle on the right illustrates the position of an entity that does not provide any responses. Note that no entities are coincident with these extremes.

This variation does not imply the quality of the responses. It reveals significant levels of variation in overall response rate and in the diversity of answers underlying a given response rate. Broadly speaking, Oceania and European entities are more likely to appear on the comprehensive side of the diagram (negative values on the x-axis), while North American entities are over-represented on the less comprehensive end (positive values for the x-axis). The distance between entities in the Figure provides a relative measure of dissimilarity.

**Figure 10.** Multivariate analysis of all Resilience Module answer choices.

X-axis: left = higher degree of breadth; right = lower degree of breadth;

Y-axis: variations based on which indicator choices were selected

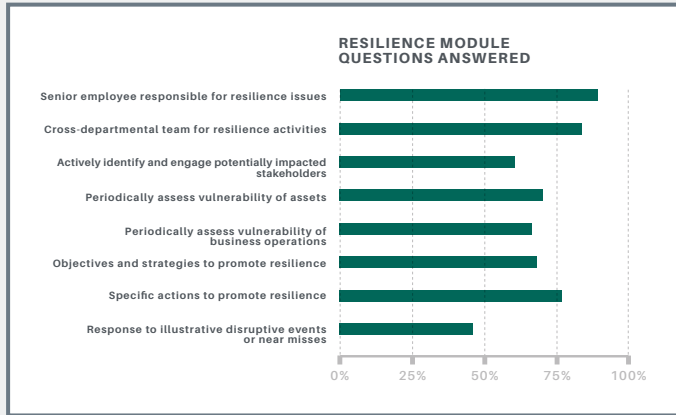


These overall responses can be aggregated into different combinations. Figure 11(a) summarizes achievement for each of the eight individual Resilience Module indicators. Note that the indicators for leadership and “specific actions” have the highest overall response rate. Stakeholder identification and performance measurement have the lowest response rates.

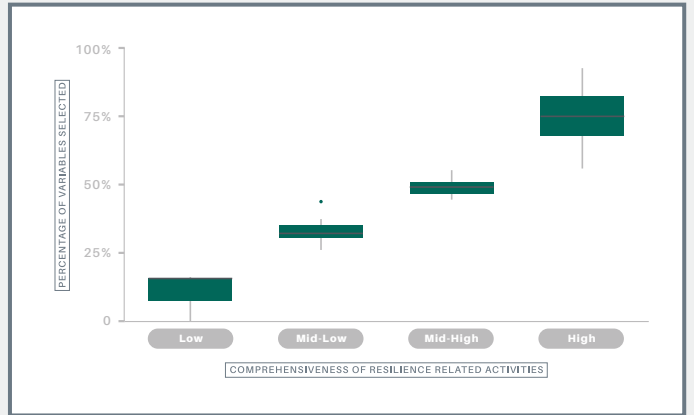
Figure 11(b) divides the results into quartiles. Each box represents 25% of reporting entities. It is important to note that the most comprehensive 25% of participants (right hand box) report on 74% of potential variables. In contrast, the least comprehensive 25% of participants report an overage of 12% of potential variables. The distribution of reporting is less skewed (more statistically normal) than real estate, but still noticeably biased toward high and low scoring entities.

**Figure 11.** Summary of responses for Resilience Module indicators.

(a) Percentage of entities answering “yes” to individual indicators. 100% is the highest possible response rate.



(b) Percentage of answer options selected by entities. Higher values indicate more comprehensive responses.



**Table 10.** Comparison of responses for infrastructure entities. High response rates indicate more comprehensive reporting. More comprehensive programs have more functions elements and address more issues; however, they are not necessarily more effective in addressing climate risk or promoting resilience.

SEGMENT	DESCRIPTION	SEGMENT RESPONSES
Top 25%	Entities are more likely to be large or globally diversified organizations with comprehensive programs	Average = 74% choices selected Stdev = 11%
Middle 50%	A small group of entities with intermediate scope of activities	Average = 41% Stdev = 10%
Bottom 25%	Entities are more likely to be smaller, regional organizations with partial or limited activities	Average = 12% Stdev = 6%

## 4. Tools and Insights

### Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures

#### FINANCIAL STABILITY BOARD

The Financial Stability Board aims to help identify the information needed by investors, lenders, and insurance underwriters to appropriately assess and price climate-related risks and opportunities. The Task Force developed four widely adoptable recommendations on climate-related financial disclosures that are applicable to organizations across sectors and jurisdictions. The recommendations are designed to be adoptable by all organizations, included in financial filings, intended to solicit decision-useful, forward-looking information, and provide a strong focus on risks and opportunities related to transition to a lower-carbon economy. The Task Force's 12 key recommendations are divided into four categories, including governance, strategy, risk management, and metrics and targets.

Access the [report](#).

Access the [TCFD Knowledge Hub](#).



### Implementing the Task Force on Climate-related Financial Disclosures (TCFD) Recommendations: A Guide for Asset Owners

#### UN PRINCIPLES FOR RESPONSIBLE INVESTMENT

Financial markets require high quality and timely data on climate-related risks to operate efficiently through the energy transition. The recommendations from the TCFD provide a common international framework through which investors and companies can make informed decisions about their exposure to climate-related risks and opportunities in their businesses and future capital allocation plans. UN PRI recommends six specific priority actions, including:

- Governance: Review governance arrangements to ensure there is effective board level oversight and internal management processes are in place to effectively manage the climate-related risks and opportunities.
- Strategy: Begin the process of analysing portfolio resilience to climate-related scenarios, including a degree or less outcome.
- Risk management: Assess the potential financial materiality of climate-related risks on the investment portfolio and evaluate the actions that need to be taken to mitigate these risks, as well as capturing new opportunities.
- Metrics: Measure GHG emissions where data are available or can be reasonably estimated, for each fund or investment strategy.
- Engagement: Engage with companies and external fund



managers, to encourage greater transparency and alignment with the TCFD recommendations.

- Disclose: publicly disclose all of the above actions and outcomes in annual reports and the climate risk in PRI's reporting framework.

Access the [guide](#).

## Navigating Climate Scenario Analysis: A Guide for Institutional Investors

### INSTITUTIONAL INVESTORS GROUP ON CLIMATE CHANGE

The Institutional Investors Group on Climate Change key recommendation of the TCFD was for organisations to conduct scenario analysis in order to understand how different possible climate futures would affect their business. This guide serves as a 'how-to guide' for institutional investors (asset owners and asset managers), who are beginning to construct and conduct scenario analysis. The guide's aim is to go deeper into the options available for investors looking to undertake this type of analysis, with a focus on how to make it relevant to investment and ownership decisions. Based on insight gained through extensive workshops and interviews with investors, the guide helps to close the knowledge gap on scenario analysis. It sets out a five-step framework to help asset owners and managers use scenario analysis, and understand how climate changes drives financial impact across their portfolios.

Access the [guide](#).



## Investing in Resilience: Tools and Frameworks for Managing Physical Climate Risk

### INVESTOR GROUP ON CLIMATE CHANGE

This guide provides a snapshot of the tools and frameworks emerging to help investors assess and manage physical climate risk at both the portfolio and the asset level. It lays out some of the key concepts, issues and challenges associated with adaptation and provides a snapshot of emerging resources to help manage for resilience. It forms part of a series of guides that the Investor Group on Climate Change has developed in recent years to assess key climate risks across major industry sectors and identify means of investing in adaptation. It has been shaped and framed by investors and the finance community to accelerate the management of resilience across the Australian economy.

Access the [guide](#).





## Winning Climate Strategies: Practical Solutions and Building Blocks for Asset Owners from Beginner to Best Practice

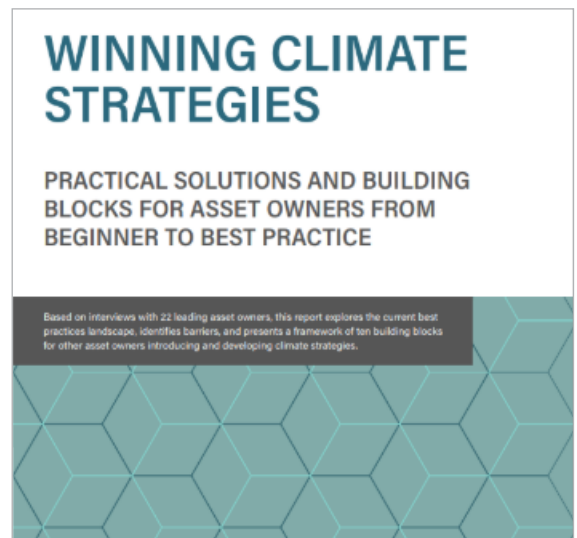
### SHAREACTION / ASSET OWNERS DISCLOSURE PROJECT

This report explores the climate strategy journeys of leading asset owners and presents a range of key findings covering the current best practices landscape, common barriers, and a practical framework of ten building blocks relevant for asset owners including large and small pension funds, sovereign wealth funds, charities, and foundations, at earlier stages of their climate strategy journeys. The findings are drawn from in-depth interviews with a selection of asset owners, covering a range of themes including the TCFD framework, culture, purpose, education, engagement, investment strategies, barriers, priorities looking forward, and practical advice for other asset owners.

The breadth of responses reveals a rich variety of innovative and creative approaches asset owners are currently pursuing to help manage both climate-related risks and opportunities in their investment practices. Key findings are presented across three main sections:

1. Current best practices landscape
2. Common barriers
3. Ten key building blocks for other asset owner

Access the [report](#).

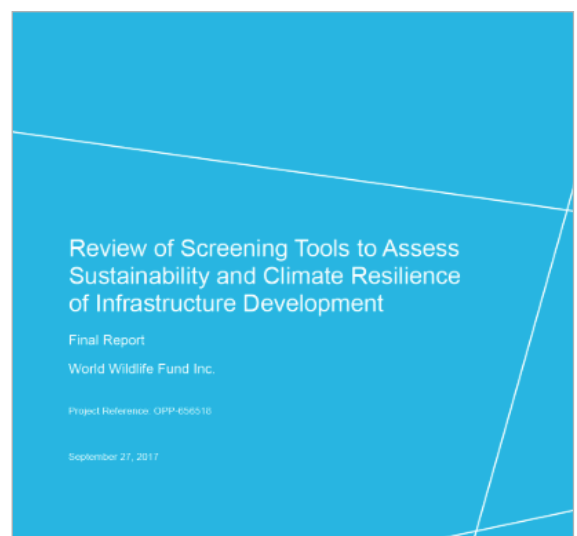


## Review of Screening Tools to Assess Climate Resilience

### AECOM FOR THE WORLD WILDLIFE FUND

The World Wildlife Fund engaged AECOM Technical Services, Inc. (AECOM) to undertake a desk-based review of publicly available guidance, standards, tools, methods and frameworks used to assess sustainability and climate resilience of infrastructure development projects. The purpose of the review was to understand what types of tools were being used in practice, the scale of their application and if any could be identified as best practice and thus promoted more widely. AECOM reviewed a range of tools used by key financial institutions and infrastructure sustainability assessment bodies.

Access the [report](#).



# Combating Canada's Rising Flood Costs: Natural Infrastructure is an Underutilized Option

**INTACT CENTRE, UNIVERSITY OF WATERLOO**

The key message of the report is Canada cannot afford to lose more natural infrastructure assets, like wetlands and ponds in its overall effort to limit the growing costs of floods, droughts and other natural disasters. Natural infrastructure can offer other valuable environmental and social benefits that are often not attainable through the implementation of traditional, grey-engineered solutions. A thorough cost-benefit analysis should measure all infrastructure options through a common cost-benefit lens.

Access the [report](#).



# Blending Climate Funds to Finance Low-Carbon, Climate-Resilient Infrastructure

**BROOKINGS INSTITUTION**

The world's core infrastructure—including our transport and energy systems, buildings, industry, and land-related activities—produce more than 60 percent of all greenhouse gas (GHG) emissions globally. By 2030 the world will need to build approximately \$85 trillion in low-carbon climate-resilient (LCR) infrastructure in order to meet the Paris climate change agreement's goal of keeping the global average temperature increase well below 2 degrees Celsius by 2050. Meeting this infrastructure investment need will require doubling today's global capital stock. This paper defines LCR infrastructure as including renewable energy, more compact cities, and suitable mass transit as well as energy efficiency measures. Combining sources of public finance—such as from multi-lateral development banks (MDBs) and climate funds—is a form of blended finance that can reduce risk, lower the cost of capital, and crowd-in private sector capital into LCR projects.

Access the [report](#).



# Leveraging Catastrophe Bonds as a Mechanism for Resilience Infrastructure Project Finance

## REBOUND

This paper offers a new approach for systematically linking catastrophe bonds and conventional project finance to support large-scale resilience projects. The following sections describe the RE.bound Program framework for catastrophe modeling, bond structuring, and bond sponsorship; summarize key insights and lessons for extending the approach to a range of resilience applications; and offer ideas for government and other public-interest entities seeking to build resilience and mitigate disaster risk.

Access the [report](#).



## 5. Infrastructure Leadership Case Studies

Efforts to understand and address climate-risk and resilience are growing quickly. It is useful to examine examples of leading practice among investor-owned organizations. The following case studies illustrate management practices for industry leaders that participated in the Resilience Module.

### Leadership in Road Transportation

#### TRANSURBAN



**About the organization** - By partnering with government, we build and operate effective toll roads that help solve transport challenges. Giving people back valuable time they'd otherwise spend in traffic, while easing demand on national budgets. Our approach to sustainability aligns with the United Nations Sustainable Development Goals and is underpinned by our vision to strengthen communities through transport.

In business since 1996, we are now a top 15 listed company on the Australian Securities Exchange with 14 roads in Australia and three in North America.

**Our position on climate change** - We accept and support the position of the Intergovernmental Panel on Climate Change and are committed to taking action towards the United Nations' Sustainable Development Goal 13.

Transport is the third largest source of greenhouse gas emissions in Australia and is also the highest growing source of emissions, increasing by 52% since 1990. Not surprisingly, road travel contributes 85% of total transport emissions with approximately half being generated by the fuel burnt during car travel[1].

As a large Australian company working in the transport sector, specifically in road construction and operations, with a strong commitment to sustainability, we are working diligently towards reducing our emissions, adapting to the impacts of climate change, and setting targets to measure success moving forward. We are also considering ways to support our road users to reduce their carbon impact and become more informed travellers.

**Our Approach** - We manage climate risks, including both threats and opportunities, via our Enterprise Risk Management Framework and have metrics in place to monitor and track our progress, including a science-based

greenhouse gas emissions reduction target to reduce Scope 1 and Scope 2 emissions by 52 per cent by 2030, compared to 2016 levels. Over the coming years, we will continue to take action against climate change, by reducing our ongoing emissions and managing impacts through the design and construction of major projects.

**Action so far** - In response to the TCFDs recommendations, we've kicked off a project to improve our approach to climate impact management and disclosures. During FY18, we ran workshops with our asset teams to take a 'fresh look' at climate-related impacts across our portfolio.

A range of potential physical and transitional risks were identified, including:

- workforce wellbeing during heat and weather events
- changing driver behavior and traffic flow in response to weather, policy changes and shifts in technology
- changing energy markets and pressure on electricity grids.

**Where to go from here** - Next steps are to complete detailed physical risk assessments, further investigate transitional risks and opportunities, analyse outcomes against three different climate scenarios, and disclose outcomes through the FY19 Annual Report. FY20 will see further development of our strategy and financial disclosures.

Learn more about [sustainability and Transurban](#).

[1] Australia's Emission Projections 2017 (December 2017), Department of Environment and Energy, Australian Government

## Leadership in Urban Design

### SHEFFIELD CITY COUNCIL AND BRE



The 'Grey to Green Phase 1' project is a radical project from Sheffield City Council to transform redundant roads in the city center into a network of sustainable drainage and rain gardens. Located in the Riverside Business District, the project has improved the city's resilience to climate change, enhanced the public realm, and increased connectivity in the city center. The project is now attracting investment in new and existing jobs.

**Background** - Located in the Riverside Business District of the city centre, the area is home to the Law and Family Courts, South Yorkshire Police West Bar offices, and several important regional businesses. It is surrounded by significant numbers of residential flats that overlook the River Don in the Riverside and Kelham Island parts of the City Centre. The area suffered catastrophic floods in 2007 and several large development sites within the area have largely been overlooked by developers due to the previously poor physical environment and facilities. The completion of the Inner Relief Road in 2008, which previously came through this area, offered an opportunity to address these issues in a new way.

The overall project transforms the area into attractive linear public spaces, improving the links between the Riverside Business District and the rest of the city centre. It includes innovative perennial meadows, an interlinked Sustainable Urban Drainage System (SUDS), rain gardens, eye catching public art totems exploring local history, and high quality paved footways and street furniture. The scheme has been designed to improve the environment, making it easier to walk and cycle. The completed Phase 1 scheme comprises around 0.5km.

**Water Environment** - The sustainable drainage system (SUDS) techniques in this project have been little used in UK city centers, and this scheme is said to be the longest SUDS retrofitted to an urban setting also creating new green infrastructure, modified as a series of swale cells to provide environments to capture, clean, infiltrate, move, and store water.

**Landscape** - The surface of the SUDS and other soft landscape areas has been used to create a meadow in the middle of the city center, through low maintenance perennial planting of 40 new trees, 45,000 bulbs, 665 evergreen plants and 26,000 herbaceous plants. The result is a striking urban meadow that Sheffield City Council believes is unique in a UK city center setting and will add economic value to this area.

**Going forward...** - This project demonstrates, how one intervention can enhance the experience of people using the city center, reduce flood risk, enhance resilience, improve water management, provide habitats for nature, boost the area's economy and so much more. This would be a considerable achievement for a new development but is all the more remarkable because Grey to Green is a retrofit project in a busy city center.

The scheme has raised a lot of national interest and achieved CEEQUAL 'Very Good' Construction Award and CEEQUAL Outstanding Achievement Awards in several categories.

Learn more about sustainable infrastructure and [CEEQUAL](#).

## Leadership in Safety and Security

**ALLEN & OVERY LLP AND BRE**

ALLEN & OVERY

**SABRE**  
delivered by **bre**

For most businesses, the financial costs of installing security measures such as bollards and access control are very apparent, whilst there is often a limited understanding of how such measures contribute to business resilience. This lack of transparency can lead to a reluctance to invest in security for fear of inefficient use of resources and the creation of a poor end user experience. Worryingly, this can leave businesses vulnerable to a range of malevolent threats; big events which may stop operations altogether or smaller incidents that go undetected over an extended period, damaging long term financial performance.

Allen & Overy LLP, an international law firm, avoid this problem by adopting a systems based approach to security risk management, where the firm is committed to managing risks and has established governance processes that facilitate effective oversight. Working with others across the business, the Global Security Team assess risks associated with a wide range of credible scenarios, implement a system of physical, technical and operational controls and proactively monitor performance using targets aligned to their strategic objectives. Proposed investments in protective security are assessed in terms of their impact on business risks i.e. the benefit to business resilience; and this allows management to take informed decisions that ensure resource efficiency.

The firm's HQ, home to 2500 staff, is located at One Bishops Square (London) and has recently achieved SABRE 'Excellent' certification for the quality of its security risk management.

Learn more about [BRE and SABRE](#).





Sydney Metro Northwest comprises the initial 36 kilometer North West Rail Link component of the wider Sydney Metro Project. The \$8.3 billion project was the first Transport for NSW project to undergo a comprehensive climate risk assessment from the earliest stages of the project's delivery. The findings of which informed a number of deliverables including route alignment and fleet specification.

The project's ISCA certification comprises numerous delivery packages, each required to review and reassess climate risk for their component during detailed design. This case study focuses on the approach adopted by the Tunnel, Stations, Civils (TSC) package.

The Transport for NSW, Sydney Metro Project Delivery Office developed a climate change risk assessment and adaptation strategy to identify climate risk mitigation measures associated with the predicted impacts of climate change on the design, construction and operation of the Sydney Metro Northwest project. A gap analysis review of the initial climate risk assessment was undertaken by the contractor team following project award. No extreme or highly ranked risks were identified for the project. Further, while a total of 16 risks with a medium residual risk rating were identified for the project as a whole, for the TSC works specifically the following risks were of relevance:

**1. Risk:** Climate change has potential to cause increased frequency and severity of extreme rainfall events leading to increased flooding of creeks and waterways and potential inundation of infrastructure - Increased rainfall intensities leading to increased stormwater runoff.

**a. Treatment:** Tunnel entrances designed to be above the Probable Maximum Flood level and additional mitigation measures were adopted in the project's design to reduce risk to a low/acceptable level.

**2. Risk:** Climate change causes extreme weather events leading to construction impacts.

**a. Treatment:** No specific treatment required. Although climate change impacts to construction was identified as an overall risk to the Project this finding did not change the environmental management approach required for the TSC Works as significant effects from even the most accelerated climate change projections are not predicted to occur prior to the completion of construction.

**3. Risk:** Risks associated with reduced annual rainfall – soil movements and cracking of tunnel walls.

**a. Treatment:** The impacts of reduced average rainfall represents a low level risk to the TSC Works and has been addressed in the design of the station boxes and cross-over cavern.

The importance of planning for climate change from the earliest stage of an assets lifecycle. The earlier climate change considerations are factored into the project, the easier and more cost effective it is to address. The following initiatives were factored into the project's concept design allowing material risks regarding extreme heat and precipitation respectively to be addressed.

- **Extreme Heat:** The provision of back up cooling for critical equipment at stations and the stabling yard using water-cooled chillers, which offer better reliability than air-cooled chillers in temperatures over 40°C.
- **Extreme Precipitation:** For design of drainage elements, a 10% increase in design rainfall intensities has been adopted to provide a nominal allowance for potential climate change impacts. Drainage related climate change provisions within the project design standards will need to be further developed in consultation with TfNSW and RailCorp.

Learn more about the [Sydney Metro North Tunnels and Station Civil Project](#).



Sydney Water has undergone a process of implementing an organization-wide Climate Adaptation Program. This was developed in specific response to three key Sydney Water challenges:

- Understanding the vulnerability of the business to climate change impacts
- Identifying current resilience to respond to events and where gaps may exist
- Developing costed and prioritized adaptation options for the business to consider.

Sydney Water is considered an industry leader in addressing climate adaptation to build the resilience and capacity of its network into the future.

In responding to its corporate challenges, Sydney Water implemented a range of options geared towards addressing and implementing climate change adaptation and resilience approaches. These have included:

- Identifying vulnerable facilities, assets, supply chains and customers using a detailed series of maps and schematics to highlight direct exposure to climate hazards and indirect exposure through its supply chain.
- Undertaking a benchmarking assessment of Sydney Water's resilience approach against other leading water utilities to identify opportunities for improvement.
- Using the AdaptWater™ tool to quantify climate change impacts and compare adaptation options against a range of climate hazards. Simple practical guidelines were also developed for planning appropriate adaptation measures for shared water infrastructure such as storm water systems.

The following insights have been shared by Sydney Water in terms of lessons learned to-date:

- Don't let uncertainty and incomplete data prevent decisions being made.
- Climate adaptation should not be treated as a standalone issue it must be integrated into Business-As-Usual practices.
- Need to focus on building capability and skills across our staff so we can continue to understand and manage adaptation planning for the next generations of workers.
- Engagement not just communication – this must be a two way process so we work with supply chain partners, customers and other stakeholders.

Learn more about the [Sydney Water Climate Adaptation Program](#).

## ABOUT THE EDITOR

This report was compiled and edited by **Dr. Chris Pyke**, Research Officer for the U.S. Green Building Council in collaboration with the GRESB team and its members. Dr. Pyke has experience in the private sector, nonprofits, and government, including service as Chief Operating Officer for GRESB, B.V., Chief Strategy Officer for Aclima, Inc., and a physical scientist with the U.S. Environmental Protection Agency. He is Chair of the Advisory Board for the Green Health Partnership, a 5-year research initiative supported by the Robert Wood Johnson Foundation. He has also represented the United States as a Lead Author for

the Intergovernmental Panel on Climate Change Fifth Assessment Report and served as an at large member and chair of the Scientific and Technical Advisory Committee to the U.S. Environmental Protection Agency Chesapeake Bay Program. Dr. Pyke is on the faculty of the Urban and Regional Planning Program at Georgetown University. He holds a Ph.D. and M.A. from the University of California, Santa Barbara and a B.S. from the College of William and Mary.

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<sup>1</sup> Recommended citation: Pyke, C.R. (ed.) (2018) [Resilience & Real Assets: Special Report](#). GRESB, Amsterdam, The Netherlands

<sup>2</sup> Aon Benfield (2017) [Weather, Climate & Catastrophe Insight](#)

<sup>3</sup> [U.S. National Oceanic and Atmospheric Administration \(2107\)](#)

<sup>4</sup> Jay, A., D.R. Reidmiller, C.W. Avery, D. Barrie, B.J. DeAngelo, A. Dave, M. Dzaugis, M. Kolian, K.L.M. Lewis, K. Reeves, and D. Winner, 2018: Overview. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA. doi: 10.7930/NCA4.2018.CH1

<sup>5</sup> This definition is based on the concept popularized by the Rockefeller Foundation's [100 Resilient Cities](#) program. 100 Resilient Cities defines resilience as the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow, no matter what kinds of chronic stresses and acute shocks they experience.

<sup>6</sup> Bernstein, A., M. Gustafson, and R. Lewis. [Disaster on the Horizon: The Price Effect of Sea Level Rise](#). 3 May 2018. Journal of Financial Economics (forthcoming).





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