



CITY WATER RESILIENCE ASSESSMENT
GREATER MIAMI AND THE BEACHES

WATER RESILIENCE PROFILE

ACKNOWLEDGEMENTS

The CWRA project team for Greater Miami and the Beaches includes Pilar Avello (SIWI), George Beane (Arup), James Bristow (Arup), Louise Ellis (Arup / The Resilience Shift), Sophie Fisher (Arup), Ricard Giné (SIWI), Rosemary Jenkinson (Arup), Alejandro Jiménez (SIWI), James Leten (SIWI), Iñigo Ruiz-Apilánez (Arup / The Resilience Shift), Panchali Saikia (SIWI), Martin Shouler (Arup) and Roman Svidran (Arup).

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FOREWORD



The global urban population is estimated to nearly double by 2050. This has serious implications for urban water demand, which is likely to increase from the current 15-20 percent of global consumption to 30 percent of the world's entire water demand. Such a rise in water use will also lead to an increase in wastewater generation and, consequently, water pollution. Climate change further exacerbates pre-existing water stresses and is already having a measurable effect on the urban water cycle, altering the amount, distribution, timing and quality of available water.

To address these challenges, we must mainstream resilience in the planning and implementation of water systems, within the context of the larger metropolitan landscape and the watersheds that supply cities with water. We need tools that enable cities to diagnose and design for resilience to anticipate water variability and uncertainty from climate and non-climatic stressors. The City Water Resilience Approach (CWRA) responds to this need. This novel approach allows cities to comprehensively assess and plan for urban water resilience across sectors and stakeholders, as well as across city boundaries. The CWRA was developed and tested, with a number of strategic partners, in cities across both the developed and developing world. The CWRA is fully aligned with the World Bank's strategic approach to water: sustaining water resources, delivering services and building resilience. The Bank stands ready, in collaboration with our partners, to scale up CWRA globally.

JENNIFER J. SARA

Global Director, Water Global Practice
The World Bank



The safety and well-being of millions, if not billions of people globally depends on the provision of safe, inclusive and resilient infrastructure systems. In the face of increasing urbanisation, population growth and uncertainty around climate and other natural and man-made hazards, those working across urban water systems need to recognise the three inherent parts of their complex systems: the technical (the physical and cyber components), the ecological (both naturally occurring and designed-in nature-based components) and the social (those who depend upon the system, as well as those who own, operate and maintain them). Furthermore, in cities, the interdependencies between different systems, different organisations, and public and private sectors are inescapable.

Within and between critical infrastructure sectors, there is a need to equip organisations and individuals across the entire value chain, with the tools and approaches they need to introduce resilience into their decision-making. People need to know what to do differently, and the City Water Resilience Approach fills that gap, taking city water stakeholders through the key stages from system mapping, resilience assessment to option identification and prioritisation, whilst recognising all of the complexities referred to above. The rigour and collaboration that sit behind it significantly enhance its value in practice.

The Resilience Shift believes that this approach has the potential to create genuine and lasting impact in cities globally, and is delighted to have supported this work.

A handwritten signature in black ink, appearing to read 'Juliet Mian'.

JULIET MIAN
Technical Director
The Resilience Shift



Global water crises – flooding, drought and poor water quality – are the biggest threat facing the planet over the next decade. As the world’s population grows larger and more urbanised, resilient urban water management is critical to ensuring safe, healthy and prosperous cities.

The City Water Resilience Approach (CWRA) responds to a demand for innovative approaches and tools that help stakeholders and communities involved in the water cycle collaboratively build water resilience at an urban scale. It was developed to help cities provide safer and more secure water resources for their citizens and protect communities and property from water-related shocks and stresses. It provides a globally applicable, transparent, objective and evidence-based approach to develop a shared understanding of water resilience of a city and collaboratively develop and implement a resilient action plan.

The CWRA is a joint effort developed in collaboration with our project partners, the Stockholm International Water Institute (SIWI) and 100 Resilient Cities, along with city partners in Amman, Cape Town, Greater Miami and the Beaches, Mexico City, Kingston upon Hull, Greater Manchester, Rotterdam and Thessaloniki, with contributions from the Organisation for Economic Co-operation and Development (OECD).

On behalf of the study team, I would like to thank The Rockefeller Foundation and The Resilience Shift for supporting this project.

This project would not have been possible without the valued guidance and support of the CWRA Steering Group. Our thanks to the following: Fred Boltz (Resolute Development Solutions), Casey Brown & Sarah Freeman (University of Massachusetts, Amherst), Katrin Bruebach & Andrew Salkin (100 Resilient Cities), Jo da Silva (Arup), Nancy Kete & Juliet Mian (The Resilience Shift) and Diego Rodriguez & Maria Angelica Sotomayor (World Bank).

MARK FLETCHER
Arup Global Water Leader
October 2019

ARUP

LETTER FROM GREATER MIAMI & THE BEACHES

Greetings from Greater Miami & the Beaches (GM&B), a unique partnership of Miami-Dade County and the cities of Miami and Miami Beach. We were selected together in 2016 to join the 100 Resilient Cities program pioneered by The Rockefeller Foundation. In May 2019, we were proud to announce the release of our Resilient305 Strategy, our blueprint to address the shocks and stresses challenging our region.

Greater Miami & the Beaches is a dense, multi-cultural urban area nestled between two unique and beautiful natural resources—Biscayne National Park to the east, and Everglades National Park to the west. The juxtaposition of approximately 2.7 million people amidst these exceptional natural areas is both a challenge and opportunity to balance economic and urban growth with the protection of our natural resources. In many ways these unique areas define us, and they are important to our community for many reasons. Our economy draws millions of tourists who come to enjoy our beaches and recreational fishing. Our quality of life depends on our water supply. We often say, “It’s all about water!” because we are literally surrounded by it, even below us with the Biscayne Aquifer, just a few feet below the ground surface, which serves as our primary source of drinking water.

At the same time we enjoy these tremendous benefits, we are also faced with many water-related challenges. We are a low-lying coastal community vulnerable to salt water intrusion, “sunny day” flooding from king tides, and storm surge. Flooding from intense rain events can overwhelm our gravity-based stormwater system and the drainage capacity of our porous substrate. These impacts are likely to become more intense and frequent over time from climate change and sea level rise. We are also aware of the challenges to our water supply and aging water and wastewater infrastructure. Our awareness of these challenges also makes us open to the solutions and opportunities for our future.

As we developed our Resilient305 Strategy, we were aware of the important role that water plays in our daily lives and the future of our community, as well as the need to address our water resources and management in a more holistic way. That is why we focused much effort on these issues, and why 17 of the 59 Resilient305 Actions are related to addressing water-related challenges and opportunities.

We are grateful to have been selected as one of the pilot communities for the City Water Resilience Framework, essential to implementing these water-related actions in Resilient305, particularly Action 54: Employ a One Water Approach. We are confident that it will provide a structure and path forward for continued learning, implementation, and improved resilience of our water systems and services. We look forward to working with our framework partners and city colleagues and sharing our experience and results to inform others worldwide.

Sincerely,



JIM MURLEY
Chief Resilience Officer,
Miami-Dade County



JANE GILBERT
Chief Resilience Officer,
City of Miami



SUSANNE M. TORRIENTE
Chief Resilience Officer, City of
Miami Beach

EXECUTIVE SUMMARY

Greater Miami and the Beaches (GM&B)—encompassing Miami-Dade County, the City of Miami, the City of Miami Beach and an additional thirty-two municipalities within the County’s boundaries—is home to nearly three million people, and acts as a cultural and economic driver for Florida and the region. With much of its population living at or near to sea-level, GM&B faces serious water-related risks that are expected to increase over the coming decades due to climate change and sea-level rise.

In response to these challenges, GM&B has embarked upon an ambitious program to improve its resilience to shocks and stresses that include sea level rise, hurricanes and storm surges, and threats to the region’s water supply in the forms of saltwater intrusion, pollution, and over-withdrawal of the Biscayne Aquifer. Building on previous and ongoing initiatives, the Greater Miami and the Beaches Water Resilience Profile represents a continuation of regional efforts to build resilience capacity and explore holistic strategies to improve the water security of the region.

The insights generated as part of this work will help bring together stakeholders to help protect the lives, livelihoods and well-being of the region’s inhabitants and environment.

WATER RESILIENCE

Water resilience describes the capacity of cities to function in the face of water-related shocks and stresses so that those living and working within the city can survive and thrive. A water resilient city is one that provides access to high-quality water services for all residents—including water supply, wastewater and sanitation services—and protects residents from water-related hazards. Assessing current strengths and

weaknesses is a critical first step in identifying and prioritizing future actions. The City Water Resilience Approach (CWRA) provides a model for urban water resilience based on consultation with over 700 individual stakeholders and field work in eight cities around the world. The approach recognizes that shocks and stresses on the water system can have cascading impacts on a range of other city systems. A systems-based approach is needed that considers water within the wider context of urban resilience, and that engages with the diverse stakeholders involved in a city’s water basin.

Arup and the Stockholm International Water Institute (SIWI) worked with the Miami-Dade County Resilience Office and Miami-Dade County Water and Sewer Department (WASD) to bring together regional stakeholders to diagnose the strengths and weaknesses of the water system using quantitative and qualitative indicators. These efforts were supported by workshops with community stakeholders to assess urban water resilience in the metropolitan area and identify actions that will promote resilience-building activities in GM&B.

RESILIENCE ASSESSMENT

Leadership and Strategy

- Political leadership is one of GM&B’s core strengths and leaders have supported partnerships around climate policy and action that build resilience in the region.
- Coordination between government agencies is generally good, especially around disaster response and recovery. Regular communication occurs between Miami-Dade Water and Sewer Department (WASD), South Florida Water Management District (SFWMD), and Army Corps of Engineers (USACE).

- Still, improved cooperation is needed between municipal, regional and state stakeholders, and organizations working in the water sector. More funding and stronger political commitments could help mainstream or institutionalize water resilience in government.
- As part of these efforts, more data should be shared around the quality and quantity of available water resources. Moreover, both politicians and department heads need better access to data for truly evidence-based decision-making.
- Recent programs have successfully reduced domestic and commercial water consumption and improved the level of public education around water resources.
- However, better engagement is needed with community stakeholders to ensure local voices are adequately represented in policy-making. GM&B's size and diverse population often make it difficult to communicate with all residents. As a result, some groups are less well-informed around best practices related to water use and water risks.

Planning and Finance

- Strong regulations exist around water management, but greater environmental protections are needed to ensure water quality and reduce or eliminate environmental degradation, specifically for the Biscayne Bay.
- Increased stress from climate change, combined with increased demand from a growing population will put additional stress on aging water infrastructure. More funding is needed for maintenance and asset replacement, and to ensure resources exist to finance new capital projects and programs.
- One potential avenue for increasing financial

resources is through raising water tariffs. However, higher water rates will require political support, and should be careful to avoid placing additional burdens on low-income groups.

- Stakeholders will need to enact sustainable water management policies to ensure supply of safe water for consumption in the face of climate change and increased population demands, which can impact the Biscayne Aquifer.
- Regular collaboration between agencies has helped GM&B prepare for, and respond to, hurricanes. However, improvements are needed to ensure collaboration across government, and between water and interrelated sectors such as energy.
- Government staff working in the water sector are well-trained and knowledgeable. A culture of innovation within the public sector is generally encouraged through continuing education webinars and courses, and partnerships exist to connect the water utility with local universities.
- Financial dealings and procurement processes are well-regulated, fair, and transparent. Decisions around procurement consider multiple objectives, including promotion of local firms, adequate benefits for employees in the supply chain, and cost-efficiency.

Infrastructure and Ecosystems

- High-quality data exist related to water resources, water infrastructure, and natural assets, but data remains siloed and are often collected in different formats and for different purposes.
- Similarly, more can be done to share information between government agencies (and between government and academia) and to align data to a common format to

address specific data gaps around water quality and ecosystems.

- Miami-Dade County (MDC) has good warning and monitoring systems in place to mitigate hazard risks, especially for known hazards such as hurricanes. Government agencies and residents are generally prepared for common hazards. More needs to be done, however, to prepare GM&B for future shocks and stresses, including sea level rise and coastal erosion.
- Sustainable funding for disaster response and recovery is a key challenge. Financial resources largely come from outside sources, may require onerous bureaucratic procedures, and cover only a limited range of shocks and stresses.
- Additionally, there are concerns about the sustainability of GM&B's water supplies, and a recognized need to decrease household, commercial and industrial demands on aquifers.
- More work is required to expand the use of green infrastructure throughout MDC and to ensure a comprehensive planning approach across multiple municipalities.

Health and Wellbeing

- Water is safe and affordable, and sanitation services are widely available. Water supply services are generally of high quality and widely available to reduce the likelihood and impact of water-related hazards or illness.
- Concerns remain about the prevalence of septic tanks throughout the region and the risks these might pose to public health and groundwater in the event of flood events and sea level rise.
- In part, reductions in water use and improved wastewater management can be

achieved by encouraging water-efficient design for buildings and neighborhoods, improving existing standards and enforcing existing regulations.

- The long-term sustainability of GM&B's water resources will require buy-in from key industries including real estate development and tourism, which rely heavily on the region's abundant natural water amenities. Moving forward, economic development must consider water resource management and protection of local ecosystems.
- Although policies exist to support populations during and immediately following a disaster, more is needed to help low-income populations cope with rising cost of living and increased climate risks, and to target vulnerable populations that are at long-term risk from water-related shocks and stresses.

OPPORTUNITY AREAS

Based on results from the assessment workshops, participants prioritized ten critical challenges confronting GM&B and identified twelve opportunities that respond directly to these challenges. Opportunities were developed through multi-stakeholder design exercises.

THE CHALLENGE

THE OPPORTUNITY

Engaged water communities

Community engagement around decision-making for water plans and programs

Institutionalizing and operationalizing community engagement

Engaging with communities through new human and financial resources dedicated to outreach and education around water resilience.

Institutionalizing Resilience

Embedding resilience principles into strategy and operations

Accessible knowledge action platform - *The One Water Platform*

Developing a platform for cross-sectoral knowledge exchange.

Mainstreaming a resilience culture

Integrating resilience into operations across departments and municipalities, including county-level strategic planning, infrastructure development planning, and staff training.

Coordinated planning for disaster management**Disaster planning for the most vulnerable**

Developing strategies for engaging and disseminating information to vulnerable, disenfranchised groups in GM&B before, during, and after disasters.

Build back smarter

Long-term planning for disaster recovery

Resilient post-disaster development

Helping delineate and prioritizing vulnerable areas to future risks to help guide planners to make well-informed infrastructure investments.

Evidence-based decision-making

Water and environmental data for decision-making

The One Water Portal

Improving data around water quality and quantity through critical evaluation of existing systems, knowledge platforms, coordinating monitoring and new technologies.

Saltwater intrusion: Acting on what we already know

Improving canal management and wetlands restoration efforts in the South Dade area to help manage risk through a two-phase study.

Silicon Valley? Everglades Alley

Greater Miami and the Beaches as a technology hub

The Resilience Innovation Hub

Bringing government, private sector, and universities together to incentivize innovation through business support, thought leadership, and convening of stakeholders.

Look up(stream)!

Improving coordination with upstream water users

The One Water Regional Collaborative (OWRC)

Creating a One Water Regional Collaborative (OWRC) to break down silos and promote common goals among stakeholders involved in managing the south Florida region; coordinating efforts for flood control, water supply management, and environmental restoration to maximize co-benefits.

Understanding water infrastructure

Data and monitoring

Data for Action: 7 Steps for Evaluating Infrastructure Asset Performance

Addressing data gaps through a seven-step approach.

Going Green

Comprehensive planning for green infrastructure

Integrated Miami Dade Green Infrastructure Plan

Developing a plan to coordinate an integrated and comprehensive approach for enhancing and increasing green infrastructure across the region.

Water sensitive design

Reducing the water footprint of businesses

The high cost of water

Developing a suite of activities to promote behavior change to reduce the water footprint of businesses.



1

INTRODUCTION



CONTEXT



Greater Miami and the Beaches (GM&B)—encompassing Miami-Dade County, the City of Miami, the City of Miami Beach, and an additional thirty-two municipalities within the County’s boundaries—is a cultural and economic driver for Florida and the Southeastern United States, and a hub that connects the United States with Latin America and the Caribbean.

With much of its population living at or near to sea-level, and a vibrant tourism economy dependent on access to world-class beaches, the Florida Everglades and other water amenities, GM&B faces serious challenges related to water; Miami-Dade County is among the most vulnerable urban areas in the world to coastal flooding, with an estimated \$416 billion of assets at risk and an exposed population of over 2 million (OECD, 2014). Climate forecasts suggest that over the next half century, levels of exposure to flooding and other climate risks will increase.

In response, GM&B has embarked upon an ambitious program to improve its resilience to shocks and stresses related to water, including sea level rise, hurricanes and storm surges, and threats to the region’s water supply, in the form of saltwater intrusion and the ability to balance flood control with residential, industrial, agriculture, and natural systems water demands, which are dependent on a dynamic hydrologic system, that directly influences the regions primary water source, the Biscayne Aquifer. GM&B is also susceptible to flooding from major rainfall events, and pollution from a combination of urban development and agriculture poses environmental risks to important natural resources such as the Biscayne National Park and Everglades National Park. Climate stresses are compounded by aging infrastructure, and social



factors such as income, unemployment levels, and varying English language abilities can make it difficult for communities to ‘bounce back’ from shocks.

Much work has already been undertaken to address these challenges. Miami-Dade County’s Sea Level Rise Strategy and the Resilient305 Strategy represent wide-ranging efforts to build the region’s resilience to current and future shocks and stresses. Meanwhile, Miami-Dade County Water and Sewer Department (WASD) has taken an active role in promoting resilience throughout the county, including through the Resilient Utility Coalition (RUC), which is a regional coalition made up of stakeholders from utilities, the professional

industry, academia, and the community, whose mission is to operationalize resilience through interdisciplinary and integrated planning to improve water quality, public health, the efficient use of resources, and ensure responsible investments. Regional partnerships, such as the Southeast Florida Regional Climate Change Compact promote collaboration between governments and organizations to advance climate mitigation and adaptation.

More remains to be done, however. The Greater Miami and the Beaches Water Resilience Profile represents an opportunity to continue regional efforts to build resilience capacity and explore strategies, through multiple lenses, to improve the water security of the region. The insights generated from this approach will ultimately help to protect the lives and health and well-being of the region’s inhabitants and environmental assets.



Water resilience describes a capacity to survive and thrive in the face of water-related shocks and stresses. Resilience allows cities to anticipate, adapt and respond to disruptions, with the goal of protecting the health, well-being and prosperity of the people living and working in the city. A water resilient city is one that provides high quality water and sanitation services to its residents during normal conditions and in the face of shock events related to water—including sudden shocks such as floods, storms and human-caused disruptions, slow onset events like drought and sea level rise and persistent stresses such as poor water quality, water scarcity or inadequate infrastructure. In this context, resilience means that the city exhibits the capacity to:

- **Provide** access to high-quality water-related services for all residents, including water supply and sanitation services, and access to water amenities
- **Protect** residents from water-related hazards, such as droughts, flooding and contaminated water

To achieve these objectives, all relevant stakeholders involved in the water cycle should be considered, and the interrelationships between water and other critical urban systems must be well understood. A holistic and wide-lens perspective is, therefore, key to building resilience.

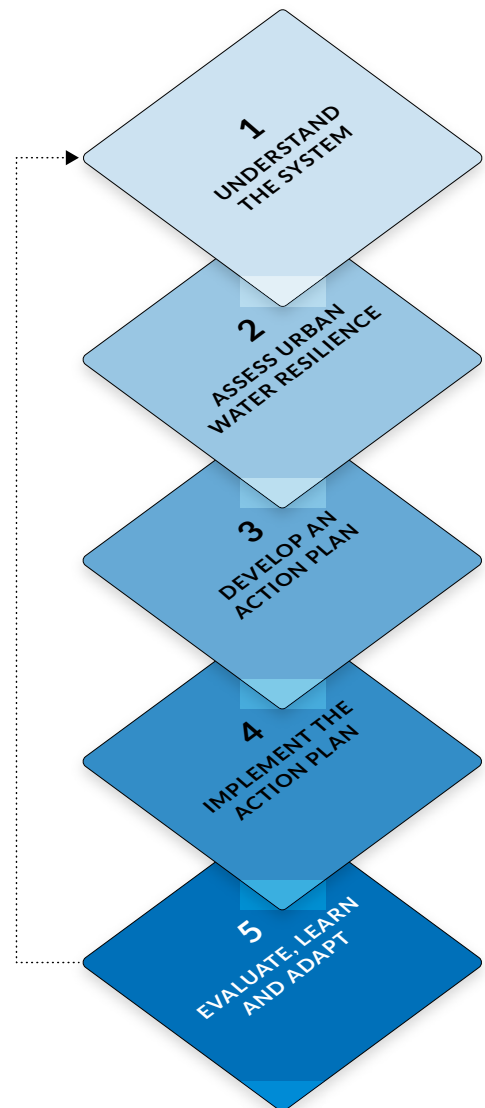
Evaluating urban water resilience means understanding the city's natural and hydrological setting, its built infrastructure and its unique human, social, political, and economic setting. It requires an understanding the full range of stakeholders involved in the water cycle, and the interrelationships between water and other critical urban systems; the water sector operates interdependently with energy, transport, waste management, public health, housing and a host of other systems. A systems approach also helps account for the important ways governance influences decisions around assets, how socio-cultural systems determine human behavior, and how these phenomena ultimately impact how physical systems are designed and used in the urban environment. A holistic approach and wide-lens perspective is therefore key to understanding and building water resilience.

THE CITY WATER RESILIENCE APPROACH

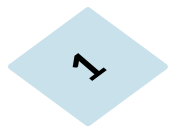
The City Water Resilience Approach (CWRA)

responds to a demand for new approaches and tools that help cities grow their capacity to provide high quality water resources for all residents, and to protect them from water-related hazards (“provide and protect”). The CWRA process outlines a path for developing urban water resilience, and provides a suite of tools to help cities survive and thrive in the face of water-related shocks and stresses.

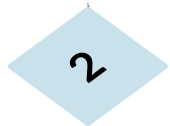
The CWRA is based on fieldwork and desk research, collaborative partnerships with subject matter experts, and direct engagement with city partners. The approach was developed through investigations in eight cities, and consultation with over 700 individual stakeholders, by Arup—working with the Stockholm International Water Institute (SIWI), 100 Resilient Cities (100RC), the Organization for Economic Co-Operation and Development (OECD) and in close collaboration with city partners from Cape Town, Amman, Mexico City, Greater Miami and the Beaches, Hull, Rotterdam, Thessaloniki, and Greater Manchester. Each partner city confronts persistent water-related shocks or suffer chronic water-related stresses and are committed to co-creating water resilience approaches. The cities represent diverse geographies, and face a range of shocks and stresses, in a variety of socio-political contexts.



The approach outlines five steps to guide partners through initial stakeholder engagement and baseline assessment, through action planning, implementation and monitoring of new initiatives that build water resilience:



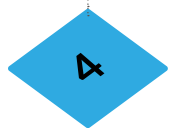
Understand the system - the city's unique context is appraised to understand shocks and stresses, identify system interdependencies, convene local stakeholders and map key infrastructure and governance processes. This first step of the CWRA process results in City Characterisation Reports that summarize the results of this research.



Assess urban water resilience - the city's current practices are assessed using the City Water Resilience Framework to identify areas of existing strength and weaknesses and establish a baseline against which progress is measured. This second step results in a City Water Resilience Profile, which summarizes the assessment process and outlines potential actions to build resilience.



Develop an action plan - based on the city assessment, an action plan is developed for realizing interventions that develop water resilience. The action plan is based on holistic evaluation of anticipated benefits and costs and prioritization of projects identified in the previous step.



Implement the action plan - actions agreed upon during the previous step are implemented according to best practices. In this step, the CWRA provides best practice guidance for how ongoing actions can be monitored to ensure objectives are met, and resources are used appropriately.



Evaluate, learn and adapt - implementation is evaluated. Adjustments are made to the implementation plan to account for new developments or changing circumstances in the city, and to align with updated objectives for the next period.

To guide cities through this process, the CWRA offers a suite of resources that target specific challenges identified by cities in their efforts to build water resilience:

- **OurWater** is a digital tool that helps cities better understand the types of shocks and stresses they confront, their impact on natural and man-made infrastructural systems, and the interaction between key stakeholders involved in urban water management. The OurWater tool is used in Step 1 of the CWRA to map the infrastructure and governance arrangements that define the urban water system.
- **The City Water Resilience Framework (CWRF)** assesses the resilience of a city to water-based shocks and stresses and allows the city to identify and prioritize future action. Understanding their re-silience helps cities formulate a clear vision of what urban water resilience means to them, including what specific conditions must be in place to achieve this vision, what efforts will be required to build resilience and what actors are involved. The CWRF is the primary tool used in Step 2 to assess urban water resilience, and the focal point for workshops conducted in the city.

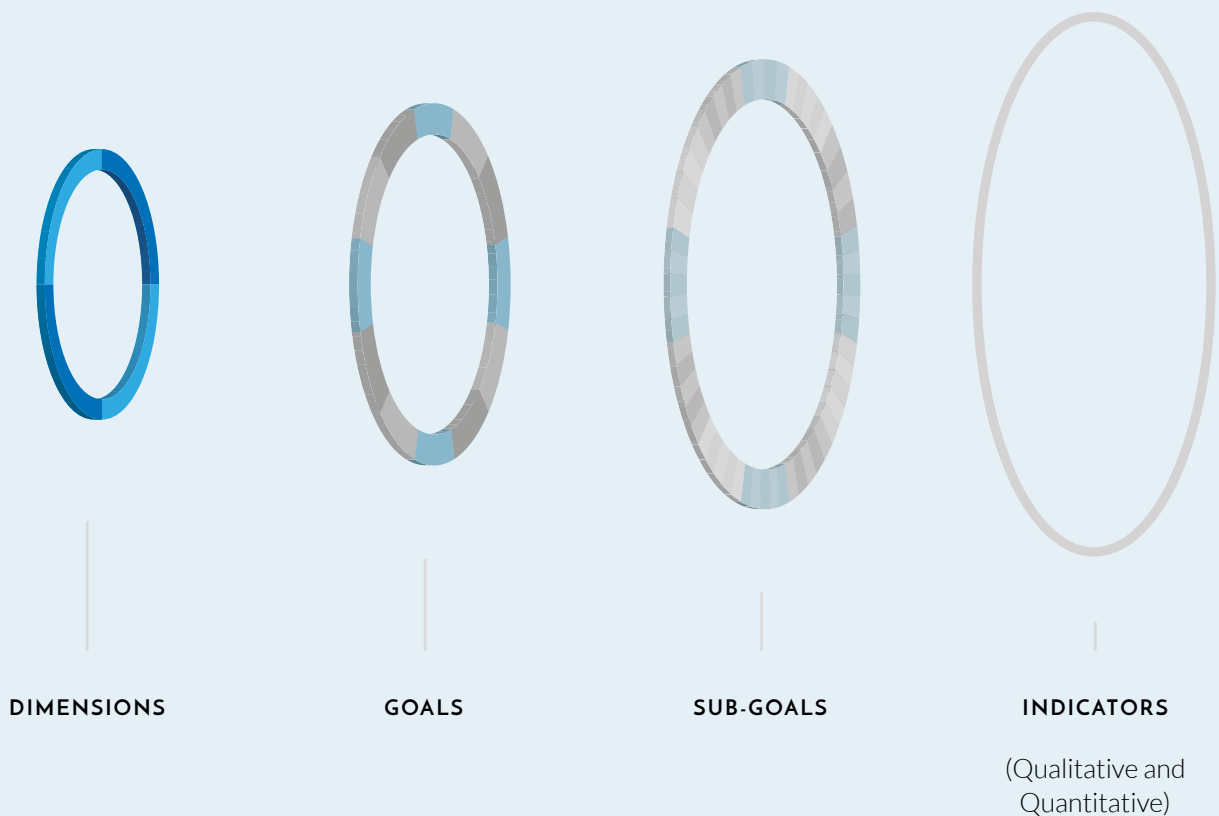
The CWRP is the primary tool used in evaluating the strengths and weaknesses of an urban water system, and the city’s overall resilience to water-related shocks and stresses. Workshops held in GM&B assessed the metropolitan area against a model of water resilience—comprising dimensions, goals, sub-goals, and indicators—that are described in the CWRP.

The innermost ring of the CWRP consists of four **dimensions**, critical areas for building resilience. Within each dimension are the resilience **goals** that cities should work towards to build resilience in that area. Hybrid goals, which are

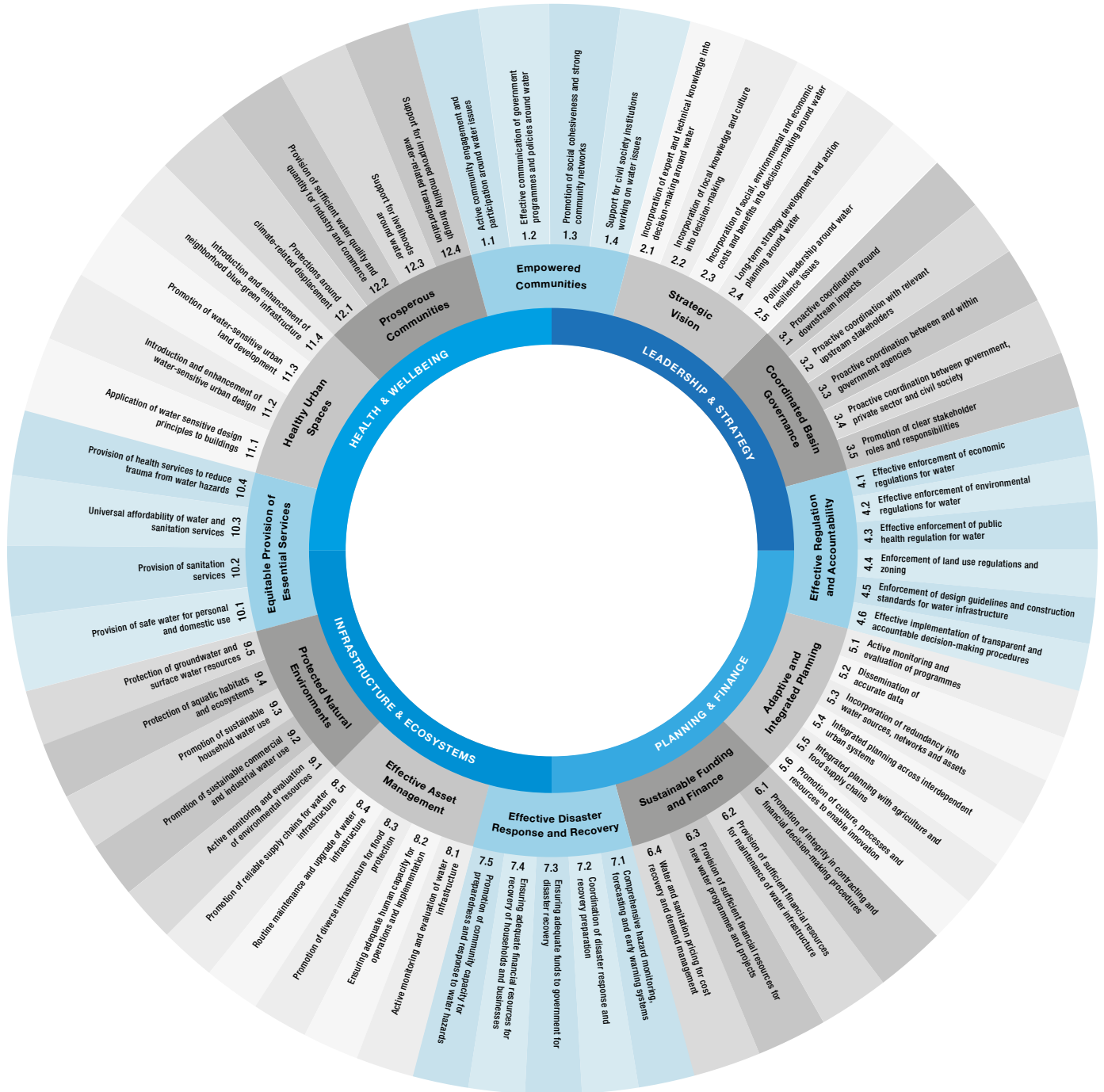
marked in a different color, refer to goals that can be placed in more than one dimension.

Resilience **sub-goals** identify the critical elements for realizing each goal. They provide additional detail and help guide the concrete actions that help realize each goal. Finally, the outermost layer of the CWRP wheel consists of **indicators**, which measure how the city performs according to each area.

The CWRP can be broken down into dimensions, goals, sub-goals and indicators.



The City Water Resilience Framework 2019



WORKSHOP METHODOLOGY

This section describes the approach taken to assess water resilience in Greater Miami and the Beaches (GM&B). Three workshops with community stakeholders assessed urban water resilience in the metropolitan area and helped identify actions that will promote resilience-building activities.

WATER RESILIENCE ASSESSMENT WORKSHOP

The objective of the assessment workshops was to evaluate the resilience of GM&B's water system using the City Water Resilience Framework (CWRF) tool. Results informed strategy development and action planning in the Visioning Workshop hosted later in the week.

STAKEHOLDERS

The Water Resilience Assessment workshops gathered subject matter experts from government, academia, civil society, and the private sector to participate in round-table discussions focusing on GM&B's resilience to water challenges.

WORKSHOPS

Two workshops were held, each covering two different resilience dimensions from the CWRF, with a different selected group of stakeholders.

Indicator Assessment Workshop 1 covered two dimensions of water resilience:

- Planning and Finance
- Infrastructure and Ecosystems

Indicator Assessment Workshop 2 covered an additional two dimensions of water resilience:

- Health and Wellbeing
- Leadership and Strategy

Stakeholders were organized according to their expertise relative to CWRF goals. Each group consisted of 4-7 participants and completed 1-2 CWRF goals, depending on how quickly the group answered each indicator question and the number of indicators they were assigned (on average 6-8 per workshop).

SESSION OUTLINE

The Assessment Workshop consisted of two sessions:

1. **Introduction to the CWRF** - The session began in plenary with a welcome address by Hardeep Anand, Deputy Director for the Miami-Dade Water and Sewer Department (WASD), and Debbie Griner, the Resilience Manager for WASD, followed by a short presentation of the CWRF and the day's agenda.
2. **Indicator Assessment** – During the second session, participants assessed each qualitative indicator.
 - Attendees were split into four groups based on their area of expertise and to reflect a range of perspectives in each group.
 - The facilitator introduced each new indicator by reading the name of the indicator out loud, then allowing time for participants to read guiding criteria and take notes.
 - The facilitator asked each participant to provide an initial score with minimal explanation for why they assigned that score.

- Once all participants had reported, the facilitator encouraged them to explain their scores.
- The facilitator then asked participants to provide a final score and, if the first and second score differed, to reflect on the reason for the updated score.
- A consensus score describing the level of agreement amongst participants was also recorded.
- Discussion of each indicator lasted approximately 15 minutes.

After the last indicator session, facilitators asked participants to provide feedback on the workshop process and summarize strengths and weaknesses of the water system based on discussions from the day.

Following the Assessment Workshops, facilitators convened to reflect on the workshop, and compile scores for preliminary analysis. Through analysis of these results, the project team then developed ten (10) statements that reflected the critical challenges identified by GM&B stakeholders.

MEASURING RESILIENCE

Indicators help measure complexity when direct measurement is difficult (or impossible). Responses to indicator questions help identify strengths and weaknesses, and measure progress over time.

The CWRP takes a pioneering approach to measuring resilience through collaborative workshops dedicated to discussing qualitative indicators, supplemented by quantitative indicators that provide additional detail and help validate qualitative results. This mixed approach has been adopted because elements of resilience—especially those related to water governance—can be difficult to measure quantitatively. For example, a quantitative indicator might suggest whether a long-term strategy exists, but not whether the strategy is a good one or if has been properly implemented.

The workshop approach adopted in Resilience Assessment allows for a diversity of views on the same subject, gauges general perception of system performance and creates an opportunity for capacity building and dialogue between stakeholders. This approach also reveals how much consensus exists between different city stakeholders on any given topic. The assessment can be conducted over a single week (with additional quantitative indicators gathered later) reducing the time and cost associated with the assessment.



VISIONING WORKSHOP

During the Visioning Workshop, participants from the previous two workshops reconvened to identify specific actions that can be incorporated into future strategies to improve resilience in GM&B.

The objective of the Visioning Workshop was to define and prioritize actions to improve the resilience of the GM&B's water systems based on initial findings of the resilience assessment.

During the Visioning Workshop, the project team presented preliminary results from the Resilience Assessment Workshops back to participants, highlighting key challenges facing GM&B. Responding to these challenges, participants identified areas of opportunity for building resilience in GM&B and then outlined specific actions that will help advance these visions.

STAKEHOLDERS

Having attended previous sessions, participants were familiar with the project objectives, and use of the CWRP "wheel" to identify strengths and resilience vulnerabilities in GM&B.

SESSION OUTLINE

The Visioning Workshop consisted of three sessions:

1. **Introduction** – The project team presented conclusions from the Resilience Assessment Workshops, including an overview of strengths and resilience vulnerabilities identified through the assessment. During introductory presentations, participants were reminded of the diverse shocks and stresses confronting GM&B, and they were asked to consider the full range of these shocks and stresses when developing actions to build resilience.

2. **Root Cause Analysis** – Following the introduction, participants were asked to identify critical challenges facing the region. These challenges were presented as Problem Statements developed by facilitators based on the two Assessment Workshops, through analysis of CWRP scores and comments provided by workshop participants. From fourteen Problem Statements, participants selected nine to work on throughout the day. They worked in tables to identify a range of underlying root causes for each problem, including social, technological, environmental, financial, political, and other underlying causes that contribute to the problem.
3. **Solutioning** – Participants were then asked to develop concrete actions based on the problems and visions identified in the previous step. The “solutioning” phase was broken down into two stages. In the first stage, participants developed a Design Brief that identified beneficiaries, needs, challenges, and assets and resources available to realize the resilience “vision.” In the second stage, participants worked in groups of 3-6 people to identify a specific Proposed Intervention that could help advance the vision. In this, participants were asked to identify the next steps in the short-to-long term, key decision-makers, and the shocks and stresses the action might respond to. Participants presented Proposed Interventions back to the full group in plenary and identified the actions they believed were most important for GM&B to pursue.

The workshop concluded with a short reflections session that identified ways to improve the workshop and to provide any additional comments that might guide the development of the Greater Miami and the Beaches Water Resilience Profile.

The project team also introduced OurWater, a digital tool developed by the CWRA team to support water resilience.

FOCUS SESSION

The Miami-Dade Water and Sewer Department (WASD) hosted a short reflections session at the WASD office. During the session, the project team presented results from the week to stakeholders, including representatives from WASD and Miami-Dade County Office of Resilience.

STAKEHOLDERS

The project team, consisting of the Arup / SIWI team and representatives from WASD and the Miami-Dade Office of Resilience attended the workshop.

SESSION OUTLINE

During the session, the project team reviewed the use of the CWRP in assessing the resilience of GM&B’s water systems, identified key lessons from the week using the completed CWRP “wheel” to identify areas of strength and weakness for GM&B, and planned next steps for progressing actions identified during the Visioning Workshop.

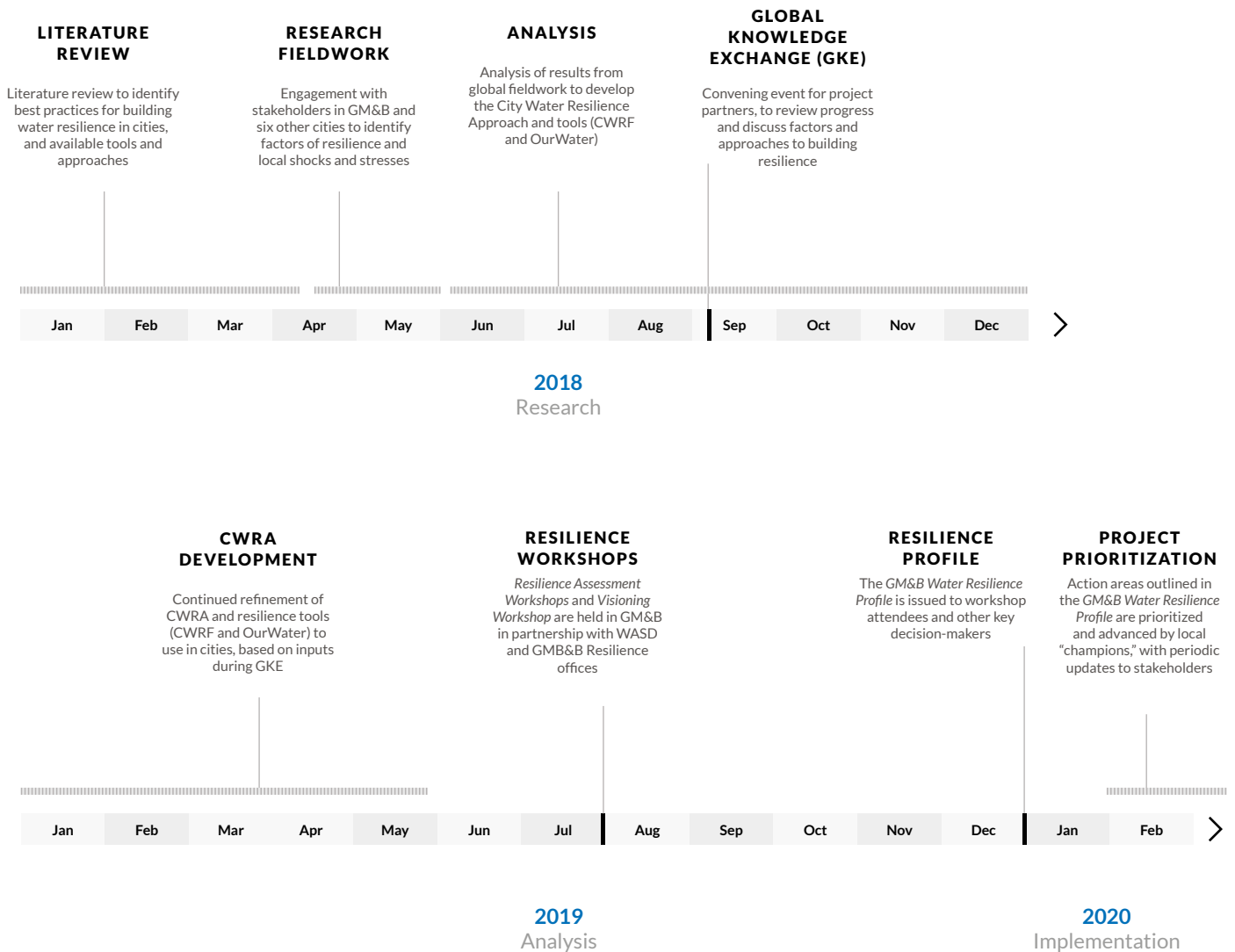
2

RESILIENCE ASSESSMENT

Water Resilience Assessment Workshops engaged subject matter experts from government, academia, civil society and the private sector in round-table discussions on the city's resilience to water challenges. The following section presents the results of the resilience assessment workshops, summarized for the four dimensions of resilience defined in the CWRF. It provides a summary of key themes identified for each indicator during round-table discussions, and scoring results for each indicator.

The Greater Miami Water Resilience Profile builds upon two years of research related to urban water resilience, shocks and stresses. Preliminary research was undertaken in GM&B and six other cities around the world, beginning in early 2018.

Assessment Workshops for Greater Miami were hosted in July 2019. The CWRA team then worked closely with the Miami-Dade County Water and Sewer Department (WASD), and with resilience offices from the City of Miami, Miami-Dade County and the City of Miami Beach, to develop the GM&B profile based on workshop findings.



INDICATOR SCORES

Indicators describe the ideal or best-case scenario, and the score provided for each indicator reflects how well the GM&B currently performs when compared against that best-case. For example, workshop participants were asked to reflect on whether the statement “a long-term strategy is in place to guide projects and programs that build water resilience over time” accurately describes current practice in GM&B.

To help guide discussions, a series of “guiding criteria” were provided to participants at each table. Guiding criteria have been based on desk research and expert inputs, and they identify important considerations for each indicator. They establish a common language and frame of reference for workshop participants, who often bring different perspectives, interests, and expertise to the conversation.

Where multiple indicators were required to assess a resilience sub-goal, each indicator was discussed by the group separately. All indicator questions are provided in the following section, organized according to sub-goal.

For each indicator, a qualitative score and consensus score are provided

INDICATOR SCORES

5 - Optimal



The indicator fully reflects conditions in the city. No improvement is required.

4 - Good



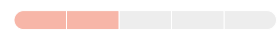
The indicator mostly reflects conditions in the city. Minimal improvement is required.

3 - Fair



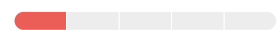
The indicator somewhat reflects conditions in the city. Some improvement is required.

2 - Low



The indicator mostly does not reflect conditions in the city. Significant improvement is required.

1 - Poor



The indicator does not at all reflect current conditions in the city.

N/A

The indicator is not relevant to the city.

CONSENSUS SCORE

Consensus score of indicators is shown in detailed results later in this section

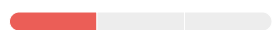
High consensus



Medium consensus



Low consensus

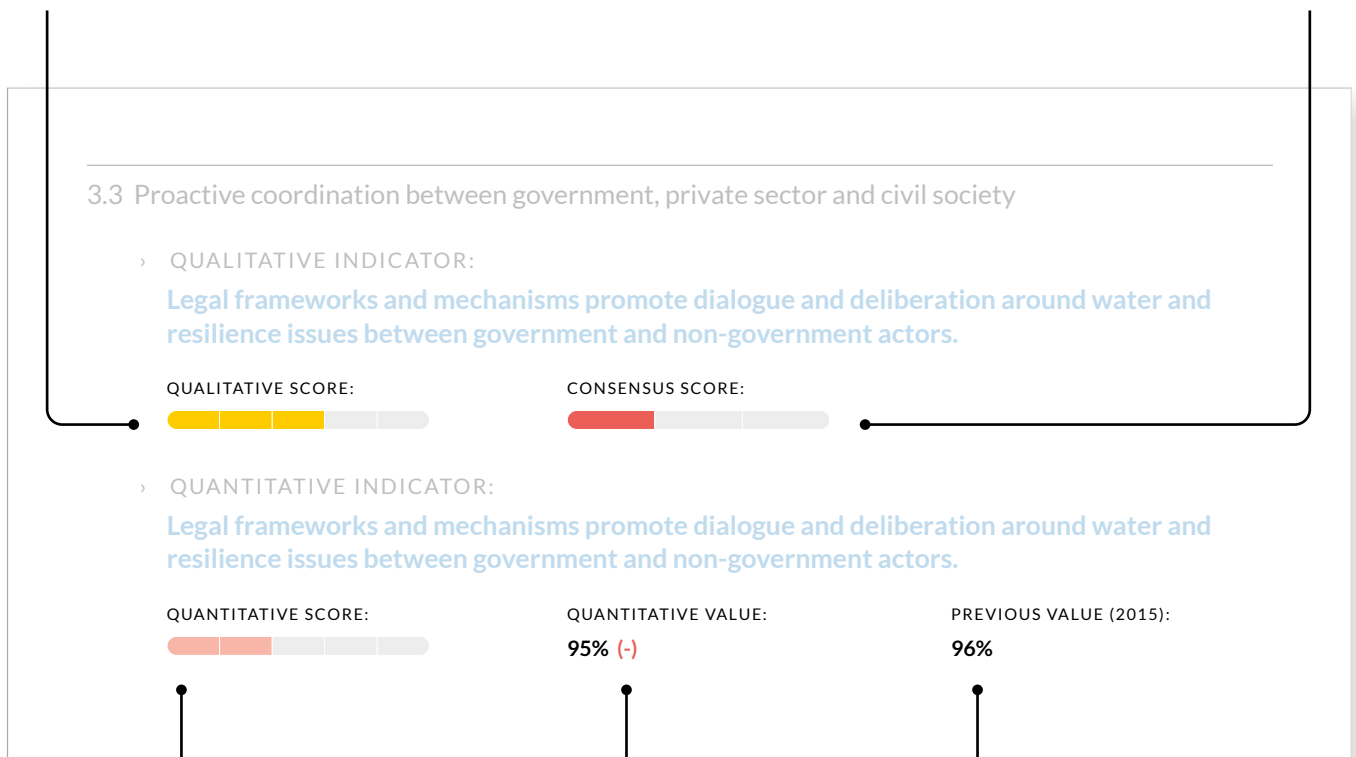


Qualitative score

The score shown here reflects the median score for the table, taken from all participants at the end of each round-table discussion. They range from 1 (poor – “significant improvement is needed”) to 5 (optimal – “no improvement is needed”).

Qualitative consensus score

This number indicates the level of agreement between stakeholders. The consensus score is expressed as High (3), Medium (2) and Low (1). This metric indicates the degree to which different stakeholders understand and assess challenges similarly. The consensus score is derived by measuring the standard deviation between the answers provided. A lower standard deviation—expressing a smaller difference between individual members of a group and the group’s mean value—translates as high agreement (3) and a higher deviation suggesting low agreement (1).



Quantitative indicator score

Quantitative indicators are provided where possible, though not all sub-goals can be measured quantitatively. For clarity, raw values are translated into 1-5 (poor-optimal) scores using standard thresholds. For more information, see Appendix.

Previous value

A ‘previous value’ shows the quantitative value for an earlier year. This number indicates whether progress has been made from the last recorded period.

Quantitative value

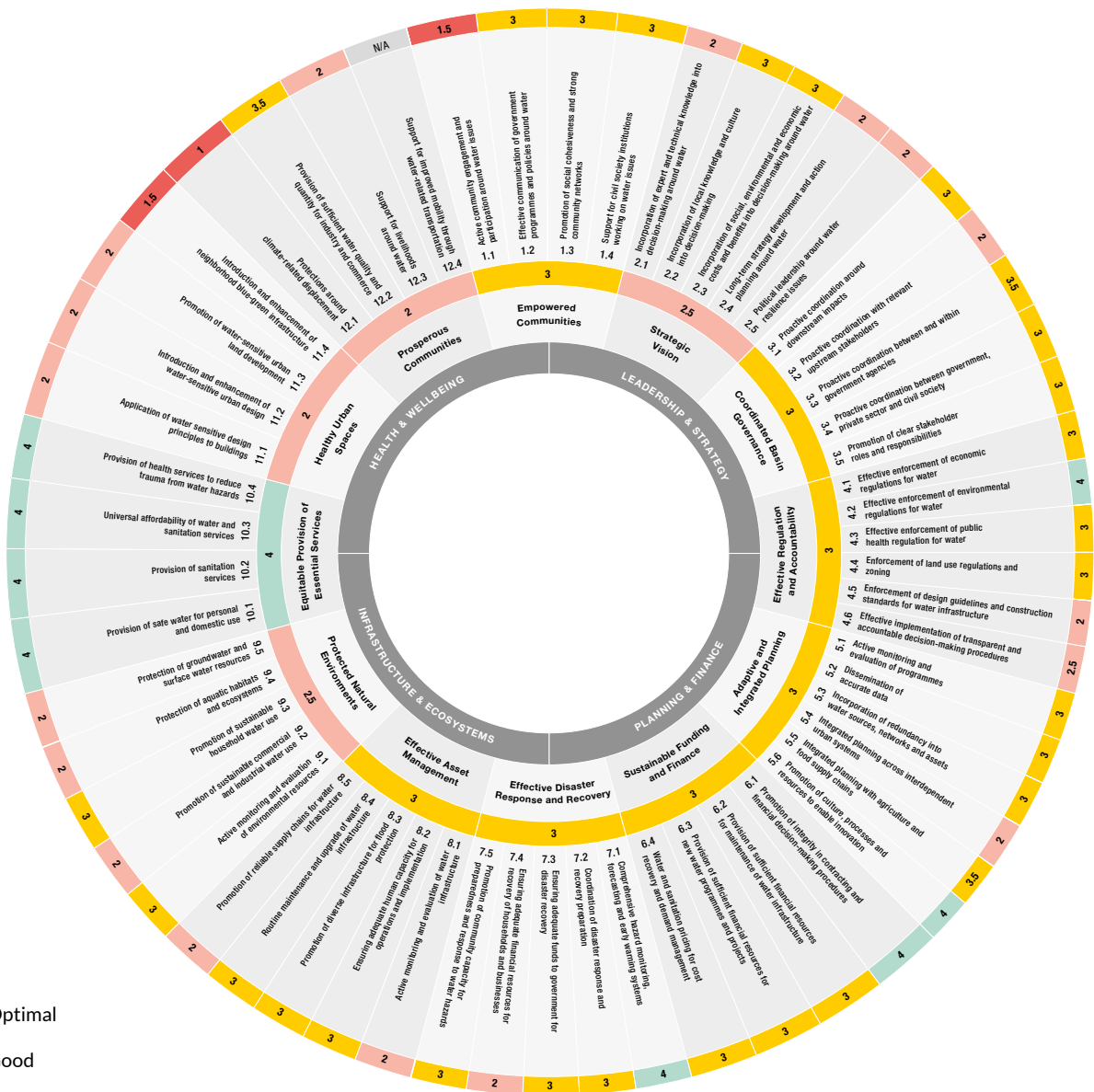
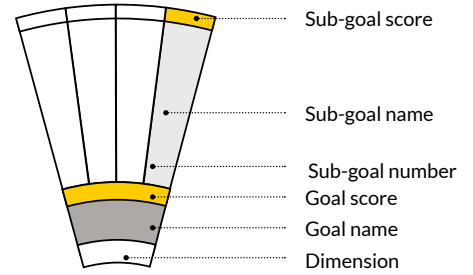
The ‘value’ is the raw figure provided before it is translated into a 1-5 score. A plus or minus mark indicates whether the value is higher or lower than previously recorded.



An example of indicator scores for resilience sub-goal 3.3

INTERPRETING RESULTS

The wheel provides a snapshot of strengths and weaknesses for GM&B in building its resilience to water-related shocks and stresses. It describes how the area performs against a best-case scenario for each of the 62 sub-goals. Scores for all resilience sub-goals are provided along the outer edge of the CWRf wheel, while averaged scores for resilience goals are shown in the inner ring.



- 5 Optimal
- 4 Good
- 3 Fair
- 2 Low
- 1 Poor

Results from the GM&B Water Resilience Assessment, qualitative scoring

Detailed results for each resilience indicator are provided in the next section, along with a summary of key points identified during roundtable discussions. The themes identified in each discussion, and qualitative scoring results for indicators reflect the opinions of individual participants. A strong effort was made to bring together participants with diverse and technical expertise and knowledge of the subject areas.



LEADERSHIP & STRATEGY

Throughout Greater Miami and the Beaches (GM&B), leadership around water resilience has translated into coalitions of partners including the Southeast Florida Regional Climate Change Compact, the Resilient Utility Coalition and individual initiatives such as the Resilient305 Building Efficiency305 Program, which contain key provisions to enhance local water resilience. Miami Dade County (MDC), led by the Department of Regulatory and Economic Resources' Division of Environmental Resources Management (RER-DERM), has strong rules and regulations aimed at protecting water quality, drinking water supply, and natural resources through monitoring, education, restoration, regulatory and land management programs across surface water, drinking water wellfields, wetlands and more. Initiatives like the Miami-Dade Water and Sewer Department's (WASD) Water Conservation Program have sought to encourage residents and businesses to take an active role in reducing water consumption, a key element in improving regional resilience. Regular communication between key government agencies – including WASD, RER-DERM, South Florida Water Management District (SFWMD), Army Corps of Engineers (USACE) – has improved coordination. WASD and RER-DERM continue to play a key role in improving coordination, helping to break down silos and improve cross-departmental and agency collaboration. Municipalities are also leading innovative programs in climate adaptation, flood management, green infrastructure, and more.

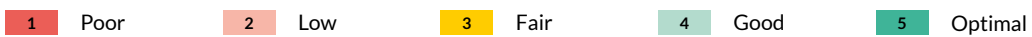
Still, increased funding and political commitment are needed to address critical long-term needs and to promote water resilience as a key principle of public policy. Resilience planning should be institutionalized through firm commitments in the form of funds and personnel. At the same time, there is a need to operationalize resilience in government, ensuring it is factored into daily operations at all levels of city government. While

communication between major government agencies is generally good, better communication is needed between GM&B authorities and external stakeholders, including upstream agricultural groups that impact the quality and quantity of water available in GM&B. Improved collaboration can help stakeholders build consensus around appropriate water uses, and new policies that will protect regional water resources. Decisions around government policy and operations should be evidence-based, and yet concerns exist that decision-making does not always reflect current science. While high quality data is collected, more resources are needed to ensure information is comprehensive and shared widely, and that technical information is channeled up to leadership at the county and/or departmental level.

Public authorities regularly share information with residents on existing programs and policies related to water use. However, GM&B's size and diverse population can make it difficult to identify and reach all residents. In part, due to language barriers and socioeconomic disparities among communities, some communities are less well-informed around best practices related to water use. The number of public agencies involved in managing different aspects of the water system results in a complex and fragmented system, with the result that individual residents and businesses may struggle to identify whom to approach with concerns or questions. Approximately 16 million gallons per day has been saved with the implementation of the county's Water Conservation Program. Further improving water efficiency at the household or business level will require additional public outreach efforts that engage communities around new policies, identify community needs and local partners, increase awareness of water-related risks, and reduce water consumption.

Quantitative score for Leadership & Strategy

Qualitative score for Leadership & Strategy





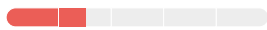
EMPOWERED COMMUNITIES

1.1 Active community engagement and participation around water issues

› QUALITATIVE INDICATOR:

Legal and institutional frameworks and mechanisms promote active, free, and meaningful participation around issues related to water supply, sanitation, drainage, and flooding.

QUALITATIVE SCORE (1.5/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Significant improvement is required to enhance community engagement around water issues within GM&B. While Miami-Dade County (MDC) government often meets with communities, these meetings do not always encourage broad community participation (perhaps due to inconvenient timing or location for residents). To improve community engagement, government can make efforts to host meetings at a time that is convenient to prospective participants, and that community needs and challenges identified through outreach efforts are well-understood, recorded, and incorporated into plans. Government can also work to ensure that technical information is made accessible, and disseminated in user-friendly ways and clear language. Supporting awareness-building programs and promoting community education around water issues will generate interest and motivate communities to participate in planning for water-related issues, such as water and sanitation supply, sustainable water use, and community preparedness for water shocks and stresses.

1.2 Effective communication of government programmes and policies around water

› QUALITATIVE INDICATOR:

Mechanisms ensure that comprehensive information on government programmes and policies are disseminated to all stakeholders

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Public authorities regularly share information with relevant stakeholders on existing programs and policies. For instance, the Miami-Dade Water and Sewer Department (WASD) hosts periodic meetings among government stakeholders to disseminate information and discuss current initiatives and challenges. However, these processes can be improved by engaging all relevant stakeholders from the start, including working with community residents at the project design phase. Prior notice for events should be given through different platforms (social media, email, websites, mailers) to provide information on meeting schedules and agendas. Information should be easy to understand and avoid overly technical language.

1.3 Promotion of social cohesiveness and strong community networks

› QUALITATIVE INDICATOR:

Inclusive and participatory social networks (formal and informal) enable communities to learn from each other, self-organize, and act collectively in times of need.

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Community-based organizations such as local churches often play an active role in helping residents recover from disasters, and can support community preparedness activities. However, small or informal networks may not be recognized by public authorities and are therefore not always supported with government resources. A step towards addressing this challenge will be mapping all social networks and organizations, and providing them with support and resources. Government can also work directly with community to improve local capacity. For example, the Community Emergency Response Team (CERT) program strengthens community capacity to respond to disaster by providing education and training around disaster preparedness and response. While communication around hurricane events is generally good, an inclusive and widespread communication mechanism is needed to improve communication around other common shocks and stresses such as flooding and poor surface water quality.

1.4 Support for civil society institutions working on water issues

› QUALITATIVE INDICATOR:

Mechanisms ensure that financial, institutional and technical support is provided to civil society institutions working on water issues

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Financial support is needed for local volunteers and civil society, and more technical and institutional support could improve community organizations' capacity to actively participate in public meetings and build awareness around water resilience. Currently, due to lack of funds and resources, many civil society organizations may not be able to send staff to attend public meetings or facilitate meetings with communities. Additionally, greater transparency is needed around financial processes, for instance, in regularly sharing information with community members to inform them of decisions that have been made and to ensure decision-makers are held accountable for providing institutional, technical, and financial support to address water issues. More engagement with universities and schools could also encourage research into water issues and build community awareness.



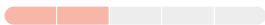
STRATEGIC VISION

2.1 Incorporation of expert and technical knowledge into decision-making around water issues

› QUALITATIVE INDICATOR:

Technical knowledge is available, understood, and continuously incorporated into decision-making around water issues.

QUALITATIVE SCORE(2/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

The quantity of technical knowledge and data currently collected is generally good, although some gaps exist, in part due to lack of resources for data collection. More importantly, information is not always disseminated and incorporated into decision-making. This is partially due to a lack of clear processes and tools for transferring timely information to relevant decision-makers, and partially because data is not prioritized by political leadership in Miami-Dade County (MDC). Better systems are needed to link research and data collection between different fields and government, to be applied to solving problems. Currently there is no 'innovation pipeline' around data generation and dissemination. Agencies often face pressure from residents to investigate certain matters, but data is often not often collected in a manner that allows issues to be addressed. One key question relates to the impact of septic systems on ground and surface water quality.

2.2 Incorporation of local knowledge and culture into decision-making

› QUALITATIVE INDICATOR:

Local knowledge and cultural values of all population groups are referred to in decision-making around water issues.

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Efforts are being undertaken to engage various communities in water planning and policies. However, this is made difficult by the sheer size of the county, socio-economic disparities among communities in Greater Miami and the Beaches (GM&B) and language barriers, as well as a lack of knowledge throughout some communities about water-related issues. While the outreach attempts are present, greater effort could be made to engage communities and to include the opinions of the most vulnerable and affected by decisions into policy. Public information is not always disseminated in user-friendly formats or all common languages. For example, most workshops and meetings are held in English and not translated into Spanish or other languages.

2.3 Incorporation of social, environmental and economic costs and benefits into decision-making around water

› QUALITATIVE INDICATOR:

The social, environmental, and economic impacts of increased water resilience are understood and incorporated into short, medium, and long-term decision-making around water issues.

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Water resilience is often considered in water management decisions, and social, economic and environmental impacts are considered in decision-making. Small scale workshops and meetings have been organized by Miami-Dade County (MDC) to discuss these impacts, and to share knowledge throughout the county. However, recommendations made are not always integrated into plans, and more effort is needed to incorporate water resilience into long term planning and policy. The level of community engagement and prioritization by political leaders remain a challenge to long-term decision-making and policy development.

2.4 Long-term strategy development and action planning around water

› QUALITATIVE INDICATOR:

A long-term strategy is in place to guide projects and programs that build water resilience over time.

QUALITATIVE SCORE(2/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

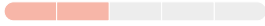
There are many efforts completed and underway in Greater Miami and the Beaches (GM&B) to address climate change, including the development of a Rapid Action Plan for County departments to address sea level rise; a county-wide Sea Level Rise Strategy; requirements, guidelines and projects that incorporate sea level rise into infrastructure design; efforts by municipalities and other stakeholders to reduce and design for impacts; and other water supply planning. Still, there is opportunity to increase the funding, political commitment and pace of incorporating water resilience into policy. In particular, the southern area of Miami-Dade County (MDC) requires more attention. A truly holistic approach and political vision for the full area of GM&B will enhance policies and planning to address how GM&B will be impacted by changing climates and rising sea level in the long-run.

2.5 Political leadership around water resilience issues

› QUALITATIVE INDICATOR:

Political leadership promotes resilience as a priority issue in government decision-making.

QUALITATIVE SCORE (2/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Greater Miami and the Beaches (GM&B) leadership acknowledges the importance of water resilience, but this recognition is not always translated into long-term planning and policies. There is a disconnect among the political leadership and communities regarding support from the top level of government around water resilience issues. Political leadership can focus on generating awareness and motivating people, employing both a top-down and bottom-up approach. New mechanisms can be established, such as instituting training programs for new officials and political leaders on water resilience, ensuring that water resilience is a priority issue that survives electoral cycles and changes in leadership. Institutionalizing and operationalizing resilience into government will be key to building an effective water resilience strategy, and securing commitment from political leadership in Miami-Dade County (MDC).



COORDINATED BASIN GOVERNANCE

3.1 Proactive coordination around downstream impacts

› QUALITATIVE INDICATOR:

Coordination between city stakeholders and relevant downstream stakeholders minimize downstream impacts.

QUALITATIVE SCORE (3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

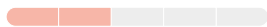
The Lower East Coast Water Supply System is a complex, integrated system that provides water supply and flood protection for the south Florida regions including Greater Miami and the Beaches (GM&B), as well as agricultural users in South Dade and the Turkey Point Nuclear Generating Station. Many stakeholders are involved, but coordination between them often suffers due to limited resources. The South Florida Water Management District (SFWMD) is principally responsible for managing the water system in the region but has insufficient resources to coordinate between all stakeholders. For instance, the agricultural community's water management needs during the growing season may conflict with the needs of other users. Similarly, better coordination with the Turkey Point power plant is needed to address environmental concerns related to the plant's cooling canal system and to ensure the plant is adequately protected from sea level rise and storm surges. Engagement with household water users is proactive through multiple channels including schools, information leaflets included with bills, National Public Radio (NPR), and the Miami-Dade Water and Sewer Department (WASD) website. However, these efforts focus on reducing water use and encouraging responsible sewer use rather than creating wider awareness of the water system in GM&B. Engagement with businesses is improving through the Building Efficiency 305 strategy, but it will take time to assess the effectiveness of this program, which is in its initial stages.

3.2 Proactive coordination between government, private sector and civil society

› QUALITATIVE INDICATOR:

Frameworks and mechanisms promote coordination between city stakeholders and relevant upstream stakeholders on water issues.

QUALITATIVE SCORE (2/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Greater Miami and the Beaches (GM&B) obtains its water from the Biscayne Aquifer which is part of the Lower East Coast water supply system, managed by South Florida Water Management District (SFWMD) with assistance from the Army Corps of Engineers (USACE). There is a governing body, steering groups, and working groups between stakeholders led by SFWMD. However, these lack the necessary resources to monitor, coordinate, and enforce regulation. Upstream agricultural areas have unequal influence on the management of the water system due to their economic importance in the state, and this has resulted in negative environmental consequences (e.g. algae blooms) in The Everglades and the water system in the southeast Florida region. Environmental impacts may affect tourism and recreation.

3.3 Proactive coordination between and within government agencies

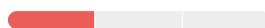
› QUALITATIVE INDICATOR (3.3A):

Coordination exists between different government agencies operating at various administrative levels to define and implement water priorities.

QUALITATIVE SCORE (4/5):



CONSENSUS SCORE (1/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

There is a clear governance structure, a governing body, and working groups that coordinate between key government agencies – Miami-Dade Water and Sewer Department (WASD), South Florida Water Management District (SFWMD), Army Corps of Engineers (USACE) and the state. For example, the Comprehensive Everglades Restoration Plan, managed by SFWMD, is a multi-agency plan developed by the South Florida Ecosystem Restoration Taskforce and includes twenty-four representatives from the federal, state and local government as well as non-governmental organizations and community organizations. Similarly, the Southeast Florida Regional Climate Action Plan (RCAP) was developed by technical experts and other representatives from the four counties, and other key agencies such as the SFWMD, the South Florida Regional Planning Council, the U.S. Geological Survey (USGS), academic institutions, The Nature Conservancy and other not-for-profit organizations. The Resilient305 Strategy process engaged over 2000 people. Low consensus within the indicator discussion group may indicate that coordination varies significantly depending on which government agencies are considered. Day-to-day collaboration between government agencies remains challenging, in part due to a lack of dedicated resources, and there is a need for an integrated long-term regional plan for water and increased communication between agency staff at all levels.

› QUALITATIVE INDICATOR (3.3B):

Coordination exists within government agencies to define and implement water priorities.

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Coordination within government the Miami-Dade Water and Sewer Department (WASD) is generally good during emergencies but could be further improved for “business-as-usual” or everyday operations. Increased funding and more human resources are needed to build consensus between entities and break down silos within government agencies, to ensure that various missions align. Better knowledge-sharing within government agencies is needed to align missions and ensure different groups are aware of ongoing work being undertaken within departments. To improve internal motivation and promote a culture change, positive reinforcement of the benefits of proactive approaches may be required.

3.4 Proactive coordination between government, private sector and civil society

› QUALITATIVE INDICATOR:

Frameworks and mechanisms promote dialogue and deliberation around water and resilience issues between government and non-government actors.

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Frameworks and mechanisms are in place to communicate between government and non-government actions. There are good examples of specific issues such as the Miami-Dade Water and Sewer Department (WASD) Water Conservation Program, Resilient305 Strategy and emergency communications during hurricanes. However, there is insufficient ongoing communication and deliberation with non-government stakeholders and citizens, and limited deliberation during the development and implementation of water-related initiatives.

3.5 Promotion of clear stakeholder roles and responsibilities

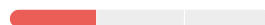
› QUALITATIVE INDICATOR:

Frameworks and mechanisms clearly define the roles and responsibilities of water stakeholders.

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (1/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Roles and responsibilities of water stakeholders are sometimes confused due to the fragmentation and complexity of the system. Residents are often unclear about which entity has responsibility for a certain aspect of the water system and as a result they may not know whom to approach. Roles and responsibilities around drinking water are established in the law, though clearer regulations around identifying and regulating contaminants are needed. A general lack of data makes compliance and enforcement difficult. Elected officials become myopic and are distracted from the long-term strategy due to engagement from single-issue NGOs.



PLANNING & FINANCE

Greater Miami and the Beaches (GM&B) is reliant on the Biscayne Aquifer, with limited options to diversify its water source. As a result, government will need to enact sustainable water management policies that ensure high-quality water in the face of climate change and increased population demands. Ultimately, long term sustainability of these resources will depend on GM&B's ability to manage withdrawals, reduce consumption and discourage excessive water use.

Adequate funding is a critical challenge confronting GM&B. More funding is needed for maintenance and asset replacement, and to ensure resources exist to finance new capital projects and programs. Ultimately, ensuring adequate financial resources to maintain and improve GM&B's water system will rely on setting water utility rates that ensure sufficient revenue. Separately, government financial procedures and procurement processes are fair and transparent, though they can be slow and may discourage collaboration with the private sector.

Overall, regulation within GM&B is good, though more can be done to understand and communicate public health risks around water quality and ensure protections for key environmental resources, such as the Biscayne Aquifer. Additional regulations around land-use can help reduce and manage growth in high-risk areas and limit the amount of groundwater withdrawn by new residential development. At the same time, updated design guidelines are needed to improve performance of buildings and ensure sustainable land-use practices. Coordination between municipal governments will ensure consistent design guidelines across GM&B.

Currently, collaboration between stakeholders within the water sector occurs in the form of regular meetings between organizations and emergency coordination across government agencies to prepare for, and in response to disaster events. Regular collaboration between agencies, and technical proficiencies around hazard modelling, forecasting and early warning systems, have helped GM&B prepare for and respond to hurricanes. However, improvements are needed to ensure that collaboration occurs between water utilities and other domains, such as energy—and that these efforts extend to other common shock and stress events.





EFFECTIVE REGULATION AND ACCOUNTABILITY

4.1 Effective enforcement of economic regulations for water

› QUALITATIVE INDICATOR:

Economic regulation of water and sanitation services and water resources is performed independently and effectively, resulting in adequate provision of key services, and high customer satisfaction.

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Households tend to spend money on bottled water rather than relying on city tap water, perhaps due to a perception that tap water is low quality. Customers are resistant to paying higher water rates, but the system faces significant challenges—including flooding, Everglades restoration, and rising ground and sea levels. Additionally, the cost of connecting to the public water and sewer network impacts both property owners and local governments.

4.2 Effective enforcement of environmental regulations for water

› QUALITATIVE INDICATOR:

Environmental regulation is performed independently and effectively, resulting in high quality, protected water environments.

QUALITATIVE SCORE(4/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

The Biscayne Aquifer is well-protected through Wellfield Protection Areas and land use regulations. Several agencies with regulatory functions, including Miami-Dade County (MDC), the South Florida Water Management District (SFWMD), the Florida Department of Environmental Protection (FDEP), and the United States Environmental Protection Agency (USEPA) ensure protections, but better communication is needed to ensure communication between organizations. County government must also adjust to dynamic changes and re-evaluate legacy regulatory policies. At the municipal level, greater clarity is needed over which organizations are responsible for different environmental functions.

4.3 Effective enforcement of public health regulation for water

› QUALITATIVE INDICATOR:

Public health regulations for water is performed independently and effectively, resulting in water that is safe to consume and wastewater that can be returned to the water cycle with minimal environmental impact.

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

More focus is needed on public health for all aspects of water and wastewater services. The Miami-Dade County Health Department (MDCHD) suffers needed resources and capacity gaps, and only issues advisories when there may be a threat. Miami-Dade County (MDC) has raised concerns over how water quality is maintained. The Biscayne Bay environment is particularly sensitive to runoff and other point and non-point sources of pollution.

4.4 Enforcement of land use regulations and zoning

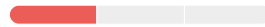
› QUALITATIVE INDICATOR:

A sound regulatory framework controls land use and urban expansion and reduces growth in high-exposure and water-poor areas.

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (1/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

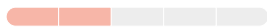
A regulatory framework exists to control land use, though better policies are needed to significantly reduce and manage growth in high-risk areas. Policies are in place for dealing with developments in high-risk areas and for determining how much water can be drawn from the aquifer. Amendments to these plans are carefully reviewed. When population growth is imminent, how the water supply will be managed with this growing population is also considered. Still, there are challenges and concerns over continued growth in coastal areas due to the area being prime real estate despite the higher risk to coastal flooding, sea level rise and storm surge. If continuing to build in high-risk areas such as Edgewater, Miami, higher costs may become necessary (e.g. for sea walls). State law and the Strategic Regional Policy Plan for South Florida currently encourage local governments to prohibit density increases in areas vulnerable to destructive storm surge. NB: Low consensus within the indicator discussion group indicates disagreement around assessment of this indicator.

4.5 Enforcement of design guidelines and construction standards for water infrastructure

› QUALITATIVE INDICATOR:

Technical standards and design guidelines define best practice for critical infrastructure.

QUALITATIVE SCORE(2/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

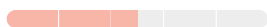
Design guidelines are often out of date, and current design standards are insufficient, or too flexible, to address anticipated effects from climate change and sea level rise, or to store or manage water according to best practice. Stronger regulations and better enforcement is required to ensure property owners properly manage on-site water use, drainage, and wastewater. Guidance from professional institutions could help upgrade design standards appropriately. Better coordination and integration around design guidelines from different government agencies is needed. In terms of planning and design for impacts from sea level rise and storm surge, the Miami-Dade Water and Sewer Department (WASD) has developed design elevation standards for new and existing wastewater infrastructure based on Southeast Florida Regional Climate Change Compact sea level rise projections, and in response to the Miami-Dade County (MDC) resolution to factor sea level rise and climate change considerations into infrastructure projects.

4.6 Effective implementation of transparent and accountable decision-making procedures

› QUALITATIVE INDICATOR:

Decision-making procedures around water resource management, water, and wastewater services are made clear and open to all stakeholders.

QUALITATIVE SCORE(2.5/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Decision-making procedures within Miami-Dade County (MDC) are transparent. While the rule-making process is guided by strict regulations, it can sometimes limit flexibility in approach. Within the water sector, there is a lack of a holistic vision or a "one-water" approach; for example, management of water and stormwater remains bifurcated. This is exacerbated by the fact that most of the stakeholders in the county system still work within functional teams, which creates silos and limits collaboration and partnership approaches to implementing solutions or holistic decision-making.



ADAPTIVE AND INTEGRATED PLANNING

5.1 Active monitoring and evaluation of programmes

› QUALITATIVE INDICATOR:

Monitoring and evaluation mechanisms and frameworks measure how programs have achieved intended outcomes and disseminate lessons learned.

QUALITATIVE SCORE (3/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Improvement is required for the monitoring and evaluation mechanisms of programs, and funding is highlighted as a significant challenge moving forward. There is a lack of uniform and effective data sharing between stakeholders, with data-sets shelved or not utilized effectively. This is compounded by limited structured coordination between organizations. Generally, monitoring of infrastructure is not uniform across all areas. Bright spots exist, however: Miami-Dade County Parks and Recreation Department is highlighted an example of good regular monitoring, due to the higher level of regular maintenance provided and increased involvement of the community and decision-makers.

5.2 Dissemination of accurate data

› QUALITATIVE INDICATOR:

Accurate data is used by key decision-makers in government, private sector, and civil society to promote urban water resilience.

QUALITATIVE SCORE (3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Data is collected by many organizations in the water sector. While some data is widely available, other data is siloed, discrete, and used to inform specific studies. There is a need to share non-sensitive data on an integrated data platform among public sector organizations (a 'one data' approach) so that it can be used to inform decisions and increase collaboration to solve water-related problems.

5.3 Incorporation of redundancy into water sources, networks and assets

› QUALITATIVE INDICATOR (5.3A):

Redundancy exists in the networks and assets responsible for water supply, treatment, and sanitation.

QUALITATIVE SCORE (3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Some redundancy has been built into water assets to improve Greater Miami and the Beaches' (GM&B) response to hurricanes. For example, back-up generators are in place at water and wastewater plants and have been provided at many pump stations. However, there is little to no redundancy in private assets—septic systems are particularly vulnerable to shocks and stresses, and many residents do not connect to municipal sewer systems because of cost. There is a need to improve building codes and asset standards to incorporate redundancy in new assets and buildings and during renovations where feasible and cost effective.

› QUALITATIVE INDICATOR (5.3B):

Redundancy exists in the sources that supply water to the city.

QUALITATIVE SCORE (3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Greater Miami and the Beaches (GM&B) relies on a primary water source, the Biscayne Aquifer. Unsustainable water withdrawals, saltwater intrusion, and contamination of the aquifer are therefore risks to the region. Saltwater intrusion is closely monitored and modelled by a United States Geological Survey (USGS)-Miami Dade County Water and Sewer Department (WASD) team, and water conservation programs for residents (Every Drop Counts) and businesses (BE305) are encouraging and incentivizing reductions in water use. In the case of a severe drought, there is reservoir storage capacity (e.g. the C50 reservoir) that can provide up to a year's supply of water. There is a need to explore a medium-term diversification of water supply, for example, additional reservoirs and desalination, to ensure maximum use of water supplies and to provide redundancy of supply sources.

5.4 Integrated planning across interdependent urban systems

› QUALITATIVE INDICATOR:

Coordination exists between public sector water agencies, water utilities, and organizations working in related domains such as energy, telecommunications, waste management, and transportation.

QUALITATIVE SCORE (2/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Coordination in response to common shocks is generally good. For instance, utilities co-locate to the Emergency Operations Center (EOC) to work together to respond to hurricanes. Still more could be done to share lessons between agencies after a disaster event occurs, however. Furthermore, there is a lack of coordination during normal operations towards common goals (i.e. a 'one water perspective'), and critical assets need better-integrated control and protection measures, which should be discussed by all utilities. Coordination exists between agencies charged with water planning and waste management, but efforts can be made to ensure key functions such as telecommunication and energy generation are incorporated into planning initiatives. For example, increase coordination with Florida Light and Power (FLP), which should increase the number of staff members made available to improve collaboration with Miami-Dade Water and Sewer Department (WASD) and other water stakeholders in Greater Miami and the Beaches (GM&B).

5.5 Integrated planning with agriculture and food supply chains

› QUALITATIVE INDICATOR:

Coordination exists between water agencies and organizations involved in food supply and production

QUALITATIVE SCORE(3.5/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Coordination between water agencies and the agricultural community is facilitated through monthly meetings between the agricultural community, Miami-Dade Water and Sewer Department (WASD) and the South Florida Water Management District (SFWMD). There is some contention between the organizations due to a need to reduce water table levels during the growing season, which conflicts with the needs of the Everglades National Park. Generally, however, communication is good. During disaster events, there are risks to food security, particularly as road transport corridors are flooded and there is a need for some additional contingency planning to be undertaken.

5.6 Promotion of culture, processes and resources to enable innovation

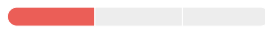
› QUALITATIVE INDICATOR:

Resources and processes reinforce a culture of innovation within the water sector.

QUALITATIVE SCORE(4/5):



CONSENSUS SCORE (1/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

A culture of innovation is generally encouraged within Greater Miami and the Beaches (GM&B) through workshops, continuing education webinars and other courses, university partnerships and exchanges between utilities. Public sector employees suggest ideas to improve approaches and technologies in the water sector. However, the path to progressing these ideas can be complicated and can take years to complete. Efforts by the public sector to engage with the private sector can be challenging, as the government is obligated to follow robust, competitive and transparent procurement processes that can be slow and may discourage innovation. An expedited approach for vetting and progressing innovation should be explored. NB: Low consensus within the indicator discussion group may indicate that coordination varies significantly depending on which government agencies are considered.



SUSTAINABLE FUNDING AND FINANCE

6.1 Promotion of integrity in contracting and financial decision-making procedures

› QUALITATIVE INDICATOR:

Financial procedures promote transparency, minimize risk and ensure that procurement processes are implemented fairly and efficiently.

QUALITATIVE SCORE (4/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Procurement processes are well-regulated, fair, and transparent. Procurement is often evaluated according to multiple objectives, including promotion of local firms, adequate benefits for employees in the supply chain, and cost-efficiency. There is good synchronicity between the procurement processes in the public sector and private sector. However, these processes can take a long time, and it can be difficult to achieve innovation due to the need for transparency, competition, and limited risk.

6.2 Provision of sufficient financial resources for maintenance of water infrastructure

› QUALITATIVE INDICATOR:

Adequate funding exists to maintain existing water infrastructure and to support ongoing programmes.

QUALITATIVE SCORE (3/5):



CONSENSUS SCORE (2/3):



Funding is lacking for maintenance and existing work programs, or else provided on a limited basis for specific purposes. Historically, the Miami-Dade Water and Sewer Department (WASD) has not undertaken the level of preventative maintenance and asset replacement needed, resulting in a backlog of maintenance. Alongside this, there is no political will to raise water utility rates (in part due to affordability concerns for poor residents) and bonds will be insufficient to make up the shortfall. As a result, significant investment will be required to meet future infrastructure needs.

6.3 Provision of sufficient financial resources for new water programmes and projects

› QUALITATIVE INDICATOR:

Adequate funding exists to finance new capital projects and programmes that support water resilience.

QUALITATIVE SCORE (3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Funding for new capital projects and programs that support water resilience is insufficient. For example, some Resilient305 actions remain unfunded and existing funding—such as Miami-Dade Water and Sewer Department's (WASD) Capital Improvement Program—often does not provide for the longer term. However, there is no political will to raise water utility rates, in part due to affordability concerns for poor communities within Greater Miami and the Beaches (GM&B). Financial markets have capital available for resilience projects using new vehicles such as catastrophe and resilience bonds. However, at a state and local government level, there is lack of institutional capacity to access the financing, and there are constraints on what they can raise revenue for. For example, WASD cannot issue a revenue bond for connecting new customers. In the medium-term, there is a fear that future credit ratings of utilities in high-risk areas are likely to be downgraded, making capital more difficult and costlier to raise.

6.4 Water and sanitation pricing for cost recovery and demand management

› QUALITATIVE INDICATOR:

Water tariffs are sustainable and equitable.

QUALITATIVE SCORE (3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Miami-Dade County (MDC) uses a four-tiered rising block tariff that applies to all customers. Although recent changes have reduced the consumption volume for the lowest block tier (i.e. more users pay a higher water tariff), water fees remain low and unsustainable: the lowest rate does not cover the cost of water treatment and conveyance, and because monthly costs to most customers are low, the fee does not encourage water conservation. Additionally, the fee should be updated to reflect new demographics in MDC. Utility fees were designed to ensure affordability for low-earning households with few members (e.g. single retirees or couples), but large low-income households that consume relatively little water per capita may find themselves in higher brackets due to household size. However, fee increases are politically unpopular and would be unlikely to be approved by the Board of County Commissioners. Agricultural users pay pumping costs but do not pay for the water that they abstract from the aquifer, which does not incentivize water-sensitive irrigation practices.



INFRASTRUCTURE & ECOSYSTEMS

Government, private sector organizations and universities generate high-quality data related to water resources and water-related shocks and stresses affecting Greater Miami and the Beaches (GM&B). Data remains siloed, however, and more can be done to align data to a common format and share information across stakeholders, making it available to technicians and decision-makers working across the water sector. Specific data gaps exist in water quality and the health of environmental resources; although extensive monitoring is performed, relatively little is known about key topics such as the impact of septic systems on water and groundwater supply, sources of water pollution, and potential impacts of agricultural activities on water quality and aquatic ecosystems.

Protecting GM&B's natural environment will require programs or incentives that encourage sustainable water use for households and businesses. For example, new 'green' building standards have the potential to reduce water use and control run-off. These should be actively promoted, alongside new on-site water reuse standards and water capture requirements that improve sustainable water use for households and businesses.

Existing infrastructure is generally adequate to meet current needs for water and sanitation services within GM&B. Regular maintenance of infrastructure occurs, and utility staff is well-trained and knowledgeable. Enhanced data management systems and practices are needed to improve the effectiveness of asset management. Efforts are needed to ensure institutional knowledge is not lost when skilled staff retire—in particular, workforce for Miami-Dade Water and Sewer Department (WASD) and South Florida Water Management District (SFWMD)—and that new staff have the necessary skills. Although traditional 'grey'

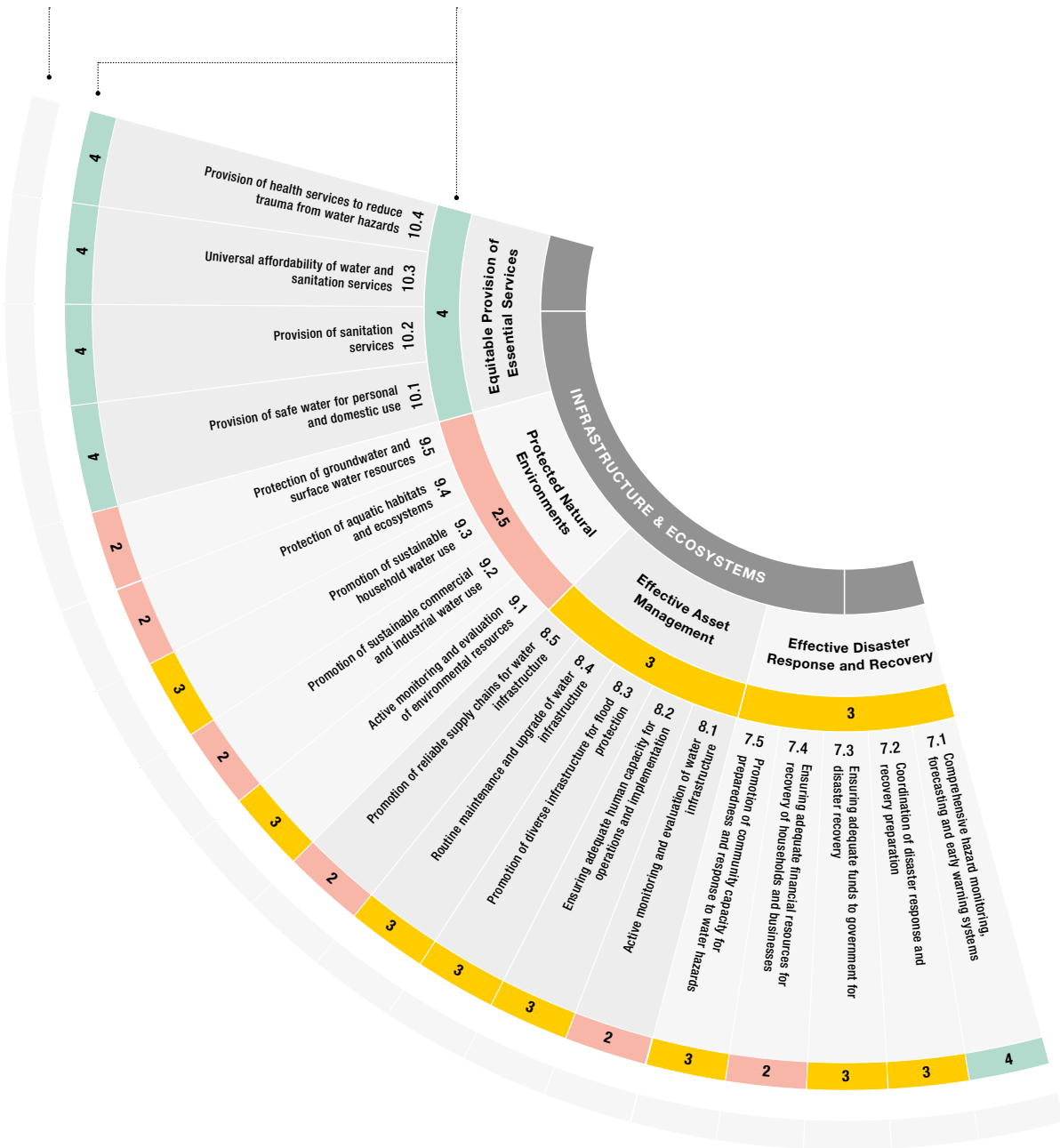
infrastructure is common within GM&B, moving forward, green infrastructure can assume a larger role in providing protections for flooding, while bringing multiple other benefits in the form of social, recreational and environmental services.

Disaster planning and recovery are generally good as they relate to known hazard events such as hurricanes. Government agencies and residents are prepared for common hazards, and processes exist for mitigating the short-term impacts of natural disasters. Still, planning efforts – including modelling, scenario planning, and rehearsal—generally address hazards common to the region, including tidal events and hurricanes. More needs to be done to prepare GM&B for new shocks and stresses, including sea level rise and coastal erosion and rain from heavy rain events and hurricanes. Similarly, more is needed to promote long-term planning around post-disaster preparedness. Future initiatives should seek to improve coordination across departments and stakeholders, strengthen outreach to communities, incorporate new learning, and ensure post-disaster planning evolves to reflect new challenges and new norms.

Funding for disaster response and recovery presents another serious challenge. Access to disaster recovery funds is difficult, with more frequent hazards, greater demand for funds and longer delays in receiving reimbursement. Local governments are not always financially self-sufficient and often depend heavily on federal funds for disaster recovery. Moreover, funds are available for some events but not others (e.g. costs associated with persistent stresses or response to epidemics like Zika), leaving municipal or county government burdened with high costs. For both immediate disaster response and long-term recovery efforts, attention should be paid to lower-income communities and small business owners, who are often affected disproportionately by shocks and stresses.

Quantitative score for Infrastructure & Ecosystems

Qualitative score for Infrastructure & Ecosystems



1 Poor 2 Low 3 Fair 4 Good 5 Optimal



EFFECTIVE DISASTER RESPONSE AND RECOVERY

7.1 Comprehensive hazard monitoring, forecasting and early warning systems

› QUALITATIVE INDICATOR:

Monitoring, modelling and early warning systems mitigate hazard risks.

QUALITATIVE SCORE (4/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Overall, Miami-Dade County (MDC) has good warning and monitoring systems in place to mitigate hazard risks such as hurricanes, but improvement is needed for even more effective hazard modelling. Moreover, the current modelling planning focuses predominantly on hazards that the region has been experiencing for years, such as tidal events and hurricanes, but not on shocks that are less visible, less predictable, and less frequent. For instance, a comprehensive response to sea level rise is largely missing, and coastal erosion and rain from hurricanes are becoming equally problematic. At the local level, recovery plans are working well, but at the state level plans and procedures could be improved. Government is taking efforts to improve communication channels, but there is still a large segment of the population that does not have the capacity to create or receive timely messages. Use of different platforms such as mobile phones, through text messages, emails, and apps could be explored to this end.

7.2 Coordination of disaster response and recovery preparation

› QUALITATIVE INDICATOR:

Disaster response and recovery coordination plans and procedures are current, collaborative, well-rehearsed and properly funded.

QUALITATIVE SCORE (3/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Government excels in responding to specific shocks, such as hurricanes, and coordination for disaster response is generally good. Disaster preparedness planning helps to maintain or restore services to households, hospitals, and critical facilities immediately following a disaster event. Still, Greater Miami and the Beaches (GM&B) needs to do more to promote long-term planning around post-disaster preparedness. Efforts are needed to improve coordination across departments and stakeholders, strengthen outreach to communities, incorporate new learning, and ensure post-disaster planning evolves to reflect new challenges. Funding for disaster response and recovery is another challenge. Local governments are not financially self-sufficient and are dependent on federal funds, often facing the challenges of federal fund reimbursements for recovery (i.e. FEMA reimbursements) which can be delayed. Moreover, funds are only available for certain shocks such as hurricanes.

7.3 Ensuring adequate funds to government for disaster recovery

› QUALITATIVE INDICATOR:

Public authorities have access to funds for disaster recovery.

QUALITATIVE SCORE (3/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

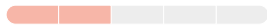
Access to funds for disaster recovery is increasingly difficult with more frequent hazards and greater demand for disaster funds. Funding comes from federal sources, which makes Greater Miami and the Beaches (GM&B) dependent on outside funding sources and national level politics. Administrative hurdles include documentation that can make the process of securing funds cumbersome and slow, and unrealistic timeframes may be imposed to put together proposals for funding through grants. Balanced budget requirements cause a halt to some services until additional funding and accounting are reconciled. Mechanisms are needed to ensure that recovery funding may be provided to the public authorities in advance to help disaster preparation efforts. Clear processes and frameworks for post-disaster funding and planning are required so that when funds become available, there is a clear division of roles and responsibilities.

7.4 Ensuring adequate financial resources for recovery of households and businesses

› QUALITATIVE INDICATOR:

Households and businesses have access to sufficient financial resources for recovery and continuity following shock events or persistent stresses.

QUALITATIVE SCORE(2/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Lower-income communities and small business owners in Greater Miami and the Beaches (GM&B) are often affected disproportionately by shocks and stresses. Large portions of the population live at or near the poverty line, making them especially vulnerable. Insurance is expensive, making it unaffordable to many residents and adding to already high housing costs in GM&B. Fraudulent insurance claims also raise rates. Following a shock event, it can be time-consuming and difficult for people to navigate bureaucratic hurdles to access funds. Additionally, requirements to qualify for certain available funds are not communicated well. Disaster events can be devastating to local economies, and loss of productivity and bankruptcies are common, with further impacts on economic opportunity.

7.5 Promotion of community capacity for preparedness and response to water hazards

› QUALITATIVE INDICATOR:

Mechanisms promote community preparedness for water-related shocks and stresses.

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Efforts around creating awareness among communities (including programs and campaigns that target vulnerable elderly, Haitian Creole and Spanish populations) has promoted community awareness around water-related shocks. However, the focus of such campaigns and awareness-building programs are limited to certain shocks, such as hurricanes and flooding, tides and sewer breakages, and community preparedness efforts often do not focus on stresses such as aging infrastructures, water quality, sea level rise, and other stresses currently faced by Miami. Funds from state and federal level are dispersed only after hazard event, while the money would be more efficiently and effectively used to build resilience beforehand rather than responding to an event years later. Funding at the local level should be more consistent across years and budget cycles.



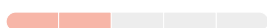
EFFECTIVE ASSET MANAGEMENT

8.1 Active monitoring and evaluation of water infrastructure

› QUALITATIVE INDICATOR:

Active monitoring and evaluation of water infrastructure and networks ensures data is current and accurate.

QUALITATIVE SCORE(2/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

More data should be shared across organizations and there is a need to align agencies through a common asset standard across all organizations (e.g. ISO 55001). At a municipal level, asset data must be digitized to ensure good data exists for all assets. At a county level, an ISO55000 asset management review has been completed to identify data gaps, with asset data collated and increasingly monitored. Greater Miami and the Beaches (GM&B) needs to improve integration and interpretation of data, for example, to improve understanding of asset deterioration and the long-term impact of shocks and stresses on assets. The South Florida Water Management District (SFMWD) has good asset data for primary canal, pumps, and structures but limited asset data for secondary systems. Environmental data is often collected for specific studies but not widespread, and may be split among multiple organizations, including academic institutions and Miami-Dade County’s Division of Environmental Resources Management (DERM). Insufficient and uncoordinated data management can make it difficult to justify recommendations to decision-makers.

8.2 Ensuring adequate human capacity for operations and implementation

› QUALITATIVE INDICATOR:

Technical and managerial staff are trained and knowledgeable in areas related to the operation of key infrastructure and project implementation.

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

High turnover rates and an aging workforce are challenges for both Miami-Dade Water and Sewer Department (WASD) and South Florida Water Management District (SFWMD) presenting a risk of losing institutional knowledge. Succession planning has occurred within some departments but has not been implemented widely. In the public sector, it is difficult to hire technical and managerial staff as the process is time-consuming and rigid: hiring takes between four months and one year. Remuneration, benefits, and training opportunities are also not competitive with the private sector. There is also a disconnect between the knowledge and skills of graduates and the needs of the workplace; it can take years of development for new hires to understand the water sector. Internships help to bridge this gap, and opportunities exist to connect with universities to match training with public sector needs. Within government agencies, training budgets are limited and technical training has traditionally been provided by professional organizations such as the American Society of Civil Engineers (ASCE), American Water Works Association (AWWA) and others. However, they are not keeping up to speed with innovations in the water sector, and their format of training is not keeping up with demands for more flexible learning, such as webinars and e-courses.

8.3 Promotion of diverse infrastructure for flood protection

› QUALITATIVE INDICATOR:

‘Grey’ and ‘green’ infrastructure provide protection from flooding and ensure adequate urban drainage.

QUALITATIVE SCORE(3/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Due to property development in more vulnerable coastal locations, and rising sea levels that cause sunny day flooding, there is insufficient protection from flooding and inadequate drainage in some areas of Greater Miami and the Beaches (GM&B). Existing infrastructure is outdated, and large investments are needed to update infrastructure to meet current needs. Current conditions will worsen as sea levels rise and extreme rainfall events become more frequent and intense. Insufficient funding exists to address flood risk. Design guidelines are being updated to ensure that future conditions are considered in new infrastructure and when replacing or repairing current infrastructure, although these need to be integrated and unified across municipalities and organizations. Green infrastructure pilots have been implemented in GM&B, but there is a need for an overall integrated green infrastructure masterplan that includes community input and maximizes the resources of private developers.

8.4 Routine maintenance and upgrade of water infrastructure

› QUALITATIVE INDICATOR:

Existing infrastructure is regularly maintained and upgraded to reduce likelihood of failure.

QUALITATIVE SCORE (3/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

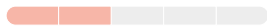
There are regular maintenance plans in place for most assets, though gaps exist in preventative maintenance, leading to a 'run-to-failure' approach for some assets, whereby maintenance is only performed when equipment has failed. Maintenance procedures for before and after a storm are executed well. Upgrading assets is limited, however. There is a need to adopt an asset management approach that is aligned with ISO55000 and improves the scheduling and management of maintenance using appropriate technologies.

8.5 Promotion of reliable supply chains for water infrastructure

› QUALITATIVE INDICATOR:

Supply chains for key water and sanitation infrastructure are reliable during normal conditions and in the face of shocks and stresses.

QUALITATIVE SCORE (2/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

In normal conditions, the supply chain is able to provide the required resources and provides good value-for-money through approaches such as cost-sharing. In the face of a shock, the supply chain is at-risk, however. For example, fuel supplies and chlorination supplies have been disrupted during past shock events. A complete analysis of the resilience of the supply chain, including scenario planning and critical component analysis, should be undertaken.



PROTECTED NATURAL ENVIRONMENTS

9.1 Active monitoring and evaluation of environmental resources

› QUALITATIVE INDICATOR (9.1A):

Environmental monitoring is conducted to assess the quality of water used for human consumption

QUALITATIVE SCORE (4/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Miami-Dade Water and Sewer Department (WASD) and Miami-Dade Division of Environmental Resources Management (DERM) within the Regulatory and Economic Resources (RER) Department produce and own high-quality data related to water for human consumption to residents, and monitoring is robust to ensure that water quality meets a stricter standard in Miami-Dade County (MDC) than state or federal standards. The monitoring network is extensive, and testing looks at many parameters. However, data is not well disseminated across agencies. No health data exists for private well users, and there are no requirements for private users to monitor the quality of wells. Gaps also exist around the understanding of potential groundwater impacts from septic systems.

› QUALITATIVE INDICATOR (9.1B):

Environmental monitoring is conducted to assess the health of environmental systems.

QUALITATIVE SCORE (2/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Few programs or incentives are in place to promote sustainable water use for commercial and industrial users. Green building standards show promise in reducing water use and controlling run-off but are not widely adopted. Few on-site water reuse standards exist, and the government should do more to capture water on-site for both commercial and household users. More aggressive actions are needed to control pollutants associated with agriculture and to address agriculture’s role in drawing down the water table, which can put the aquifer at unsustainable levels. Some technologies are currently in use to promote sustainable water use, but it is unclear whether these are used widely, and they could be promoted more aggressively. Another concern relates to how water is treated once it is discharged, including by the Turkey Point Nuclear Generating Station.

9.2 Promotion of sustainable commercial and industrial water use

› QUALITATIVE INDICATOR:

Mechanisms encourage sustainable water use for commercial and industrial users.

QUALITATIVE SCORE (2/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Few programs or incentives are in place to promote sustainable water use for commercial and industrial users. Green building standards show promise in reducing water use and controlling run-off but are not widely adopted. Government should do more to develop standards that promote the capture of water on-site for both commercial and household users and non-potable reuse practices. More aggressive actions are needed to control pollutants associated with agriculture and to address agriculture’s role in drawing down the water table, which can put the aquifer at unsustainable levels. Some technologies are currently in use to promote sustainable water use, but it is unclear whether these are used widely, and they could be promoted more aggressively. Another concern relates to how water is treated once it is discharged, including by the Turkey Point Nuclear Generating Station.

9.3 Promotion of sustainable household water use

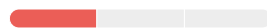
› QUALITATIVE INDICATOR:

Mechanisms encourage sustainable water use for households

QUALITATIVE SCORE (3/5):



CONSENSUS SCORE (1/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

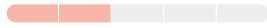
County government has developed and implemented plans for engaging households, with the result that more people are aware of the need for sustainable water use. Outreach programs are generally shown to be effective in the state, and these could be implemented more widely. Water-efficient design features and water reuse can be promoted in homes. Ultimately, however, the cost of water is too low, which encourages excessive water use.

9.4 Protection of aquatic habitats and ecosystems

› QUALITATIVE INDICATOR:

Policies and programs protect aquatic habitats and ecosystems

QUALITATIVE SCORE (2/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

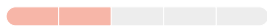
Existing regulations and standards are inadequate to protect aquatic habitats and ecosystems, and the policies that are in place are not effectively funded or enforced and should be updated. A wider awareness of dire ecological and human health circumstances is required, and high-level decision-makers should recognize these critical issues and act accordingly. More coordination is needed between county and state agencies to break down silos, and better data is needed to inform policies. Specifically, new standards are needed that regulate fertilizer for household use in urban areas and for farmers, as current standards often do not prevent against potential pollutants such as nitrogen or ammonia, which may be toxic to aquatic life. Additional protections are needed to address harmful impacts of real estate development on the natural environment, to limit effects of the Port of Miami expansion, and to prevent overfishing. Coral reefs have depleted significantly, and mangroves have been impacted which may be a result of inadequate policies and/or enforcement.

9.5 Protection of groundwater and surface water resources

› QUALITATIVE INDICATOR (9.5A):

Protections exist to prevent over-abstraction and eliminate pollution of surface water sources

QUALITATIVE SCORE (2/5):



CONSENSUS SCORE (2/3):

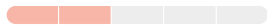


Existing laws do not adequately protect surface water, and current surface water standards should be re-evaluated and updated. A siloed agency approach discourages effective response to problems related to pollution and over-withdrawal of the aquifer, resulting in over-tapped water supplies, over-draining of the Everglades, harm to ecological systems (e.g., seagrass and algal bloom) and even limits to public access to some surface waters for recreational purposes due to poor water quality. There is a gap in monitoring the quality of inland surface waters that are used for recreational purposes, which poses a risk to human health and ecosystems. Pollution needs to be addressed at the source to protect water sources including nutrients from urban areas that are damaging to ecosystems.

› QUALITATIVE INDICATOR (B):

Protections exist to prevent over-abstraction and eliminate pollution of groundwater sources

QUALITATIVE SCORE (2/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

A better understanding of groundwater quality is needed. Additionally, while there are policies in place that limit how much water users can withdraw from aquifers, more needs to be done to prevent over-withdrawal of groundwater resources and to prevent pollution of groundwater sources. To limit withdrawals, water can be re-used, for instance by finding new uses for wastewater beyond injecting or disposing it (e.g. potentially for construction). To limit pollution, better regulation of fertilizer use and other non-point sources is needed. Septic tanks that are vulnerable to rising groundwater, which may result in insufficient treatment of wastewater and increased transmission of nutrients and pathogens should be addressed. Saltwater intrusion is another critical threat to groundwater sources and is being closely monitored and modelled by a United States Geological Survey (USGS)-Miami Dade County Water and Sewer Department (WASD) team. Updated policies should be communicated widely to multi-lingual local populations to increase their understanding of groundwater vulnerability and sources of pollution.



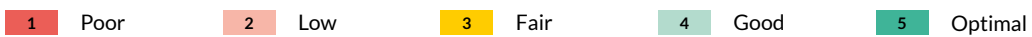
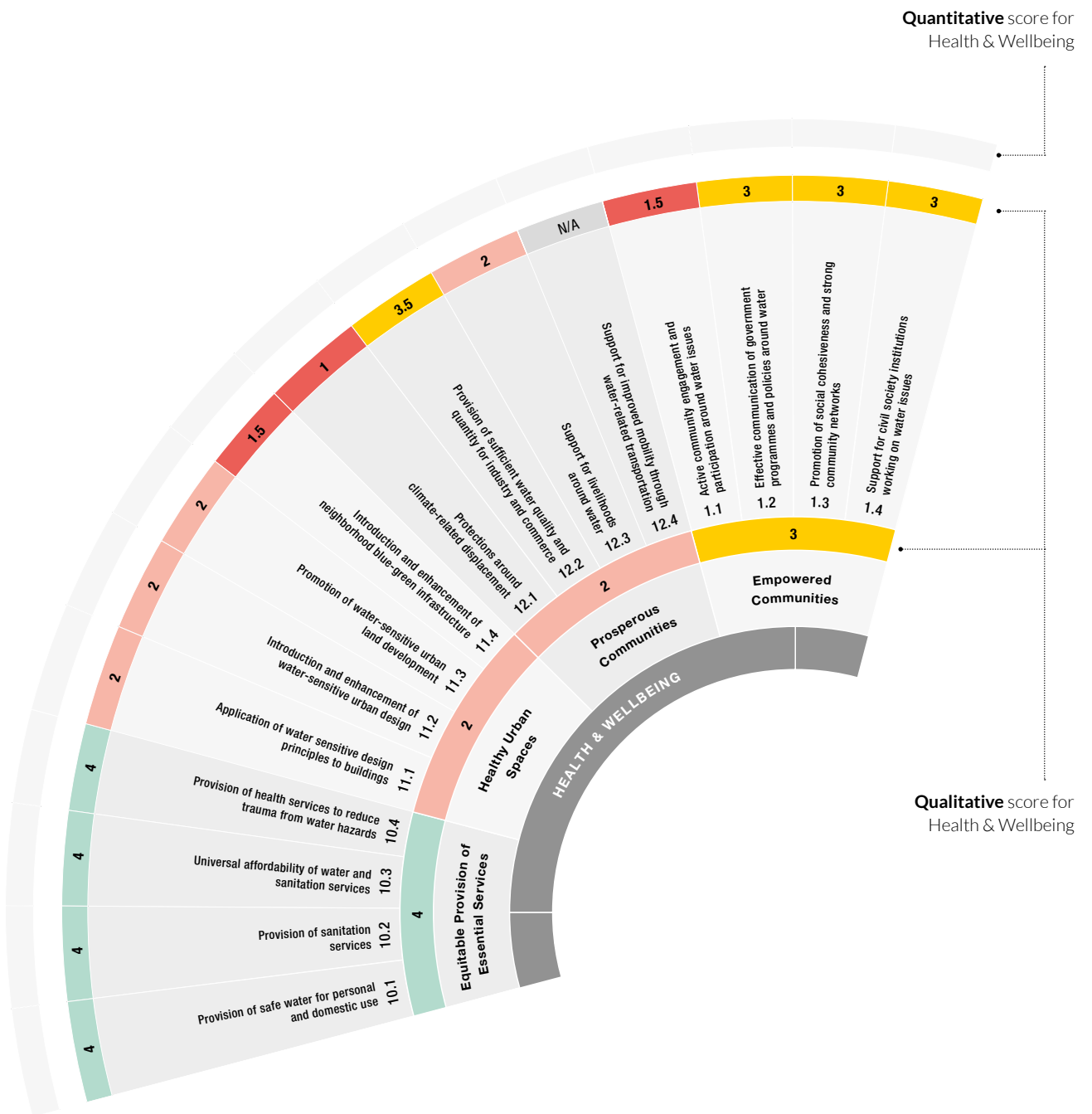
HEALTH & WELLBEING

Drinking water in Greater Miami and the Beaches (GM&B) is safe and affordable, and most residents have reliable access to public water supply and sanitation networks. However, the sustainability of GM&B's water supplies will be tested by growing water demand and stresses such as saltwater intrusion. The high prevalence of septic tanks throughout the region, combined with rising groundwater levels and incidents of flooding, also raises public health concerns.

To ensure the long-term sustainability of water resources, new approaches to economic development will be needed. GM&B's economy is supported by property development and tourism, which rely heavily on the region's abundant natural water amenities, including beaches, open water, and the Everglades National Park. However, these industries are at high risk from water-related shocks and stresses—including pollution, sea level rise, beach erosion, storm surges, and flooding. At the same time, potential harmful impacts from economic development, related to increased demand on water sources and infrastructure, will need to be managed sustainably. Opportunities exist to promote sustainable approaches to tourism and real estate development, and to promote new knowledge-based industries around water, including by leveraging the intellectual capital, and technological skills available through Greater Miami's world-class universities.

To improve water efficiency, decrease stress on aquifers and reduce the costs associated with drinking and wastewater treatment processes, more can be done to encourage water-efficient design for buildings and neighborhoods. While some standards are already in place, new rules and incentives could improve water efficiency and encourage best practice around stormwater management. Improved zoning and land use planning processes, coupled with smarter building design and wide implementation of blue-green infrastructure can reduce water demand, improve stormwater management, and reduce the impacts of coastal and inland flooding.

Finally, although policies exist to protect and provide for populations during and immediately following a disaster, better long-term strategies are required to help low-income populations remain in the region in the face of rising costs of living and increased climate risks. Questions around the cost of living are related to access to housing and transport and relate broadly to resilience building in GM&B.





PROTECTED NATURAL ENVIRONMENTS

10.1 Provision of safe water for personal and domestic use

› QUALITATIVE INDICATOR:

All people have access to sufficient, safe and accessible water for personal and domestic use

QUALITATIVE SCORE (4/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Most people have access to safe drinking water as part of the public network, except for those connected to private wells, whose water quality is less well known. Quality of groundwater is generally high. However, there are concerns about the sustainability of Greater Miami and the Beaches (GM&B) water supplies in the face of future shocks, such as depleted aquifers and saltwater intrusion. Future water provision will need to balance the need for sufficient water to preserve ecosystems such as the Everglades. Population growth will increase water services demands, but these demands might be mitigated by increased water efficiency and decreased consumption. Additionally, for low-income households, even low water bills may pose a high burden on household finances.

10.2 Provision of sanitation services

› QUALITATIVE INDICATOR:

All people have access to sanitation that is safe, hygienic, secure, and socially and culturally acceptable

QUALITATIVE SCORE (4/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

In general, sanitation is accessible and affordable within Miami, though there is concern regarding the prevalence of septic tanks throughout the region, including around the level of treatment of wastewater provided by septic systems before the effluent enters the natural environment. Additionally, a hydraulic failure of the system can lead to untreated wastewater backing up into a home. Groundwater levels may reach the surface or mix with saturated soils from rainwater and result in the presence of bacteria in floodwaters. In the future, considerable public and private financial resources may be needed to ensure septic systems are adequately protected from sea level rise and flood events.

10.3 Universal affordability of water and sanitation services

› QUALITATIVE INDICATOR (A):

Safe water for consumption is made affordable to all users.

QUALITATIVE SCORE (4/5):



CONSENSUS SCORE (2/3):



QUALITATIVE SCORE:

Water is safe and generally affordable to all residents in Greater Miami and the Beaches (GM&B). However, low consensus around the indicator indicates concern around affordability for low-income users; water bills may be a burden to low-income households, leaving very little money for families for other expenses. Additional support from government could be provided through water-efficient fixtures. Also, threats such as saltwater intrusion may increase the cost of providing clean water in the future, as alternative sources and treatment methods may have higher associated costs.

› QUALITATIVE INDICATOR (B):

Safely managed sanitation services are made affordable to all users.

QUALITATIVE SCORE (4/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Sanitation services are affordable for most users. Septic systems are a concern, however. Costs to property owners for connecting a household septic system may discourage connections to the sewer system. Significant funding may be needed to repair, upgrade, or provide new sewer infrastructure. Stormwater management can impact sewer infrastructure (e.g. increasing flows and the risk of flooding) and should be considered in conjunction with any maintenance or upgrade of the sewer and sanitation system.

10.4 Provision of health services to reduce trauma from water hazards

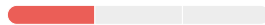
› QUALITATIVE INDICATOR:

High-quality health services are made available to residents to reduce impacts from water-related shocks and stresses, including water-borne diseases

QUALITATIVE SCORE (4/5):



CONSENSUS SCORE (1/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Greater Miami and the Beaches (GM&B) is generally well prepared to provide health services in the case of a water-related disaster, although assisted living populations remain particularly vulnerable. Improved coordination is required between regulators, utilities, and public health authorities to help agencies better communicate (and respond to) incidents of poor water quality. Poor water quality poses a range of public health risks (including illness such as gastro-intestinal sicknesses) and contact with contaminated surface water, resulting from discharge of polluted waters into coastal waters (which may also lead to beach closures). Public health concerns remain around sanitation services and septic systems. NB: Low consensus within the indicator discussion group may indicate that the quality of health services vary by population group.



HEALTHY URBAN SPACES

11.1 Application of water-sensitive design principles to buildings

› QUALITATIVE INDICATOR:

Design principles are promoted to improve water performance for buildings

QUALITATIVE SCORE (2/5):



CONSENSUS SCORE (3/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Florida state building codes include provisions for water-efficient design feature in buildings, but codes and incentives could be both stricter and more comprehensive to include design features that improve water efficiency, and to separate and store stormwater for potential reuse. In fact, Greater Miami and the Beaches (GM&B) building codes discourage or may even prevent the use of greywater for any uses. Other cities can be looked to as models – for example, San Francisco's integrated stormwater collection from buildings, Washington D.C.'s Stormwater Retention Credits (SRC) trading policy, and municipal incentives for water-efficient appliances. Additionally, there is some uncertainty around who is responsible for enforcing existing codes.

11.2 Introduction and enhancement of water-sensitive urban design

› QUALITATIVE INDICATOR:

Water is incorporated as a design element in urban place-making

QUALITATIVE SCORE (2/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

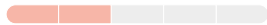
The region benefits from high-quality water amenities, including beaches and wetlands. However, flooding and poor water quality can restrict access to these areas, which frequently need to be shut down. Additionally, wetland areas, particularly those beyond the Everglades National Park, are not adequately valued or protected. Better access to a variety of water amenities – including wetlands, and introduction of urban design features such as water parks, water playgrounds, and water plazas that store or slow water after a heavy rain or flood event – should be encouraged. Generally, there is an opportunity for additional blue and green infrastructure that provides new neighborhood amenities while also supplying ecosystem services.

11.3 Promotion of water-sensitive urban land development

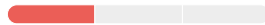
› QUALITATIVE INDICATOR:

Water is incorporated as a key consideration in land-use planning and development

QUALITATIVE SCORE (2/5):



CONSENSUS SCORE (1/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

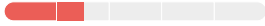
Real estate development and intensive land use increase demand natural water resources and drainage systems. Green development will be integral to responsible land development going forward. Generally, Greater Miami and the Beaches (GM&B) promotes development at higher elevations, and government does a good job planning for areas that are vulnerable to storm surge (though less well planning for areas vulnerable to other types of flooding). Further effort is needed to understand and promote the protections that natural systems can provide to communities, and to integrate natural features into land-use planning. Better coordination in planning and improved implementation of existing plans are needed. GM&B should strive to incorporate not only the economic value of land development but also account for the social and ecological impacts of land development schemes.

11.4 Introduction and enhancement of neighbourhood blue-green infrastructure

› QUALITATIVE INDICATOR:

Blue and green infrastructure is adopted in neighborhoods.

QUALITATIVE SCORE (1.5/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

The benefits of blue-green infrastructure are increasingly well recognized in Greater Miami and the Beaches (GM&B), but significant work is needed to promote the use of blue-green infrastructure throughout the region, which still heavily favors grey infrastructure. When blue and green infrastructure is included in buildings, it is often seen as a special feature rather than standard infrastructure. Some municipalities, such as Miami Beach, are more advanced in pursuing these ideas, but county government needs to work to implement blue-green infrastructure consistently throughout the region. Institutionalizing blue-green infrastructure, providing training to staff, and encouraging better communication across agencies will help this effort. Opportunities exist to implement blue-green infrastructure on public land, including blue-green roofs on municipal buildings, and permeable paving for parking lots and sidewalks. Small projects can be introduced in the short-term to demonstrate positive impacts. Multiple sectors can be enlisted to implement blue and green infrastructure projects, which bring multiple additional benefits to local economies, recreation, and public health.



PROTECTED NATURAL ENVIRONMENTS

12.1 Protections around climate-related displacement

› QUALITATIVE INDICATOR:

Policies exist that protect vulnerable populations from displacement as a result of water-related shocks and stresses.

QUALITATIVE SCORE (1/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Greater Miami and the Beaches (GM&B) has policies that protect and provide for populations during and immediately following a disaster, including providing hurricane shelters for vulnerable populations. However, there are significant challenges related to the displacement of populations in the face of stresses. Because the region's economy depends heavily on real estate development, low-income populations are often pressured to leave their homes or are unable to pay rising living costs. Developers lack incentives to build housing that support higher population density, and high insurance rates increase financial burdens on homeowners. Climate gentrification pressures vulnerable populations to leave protected neighborhoods. Few or no policies exist to protect these groups, and more impactful effort is needed to promote mass transit, affordability, and zoning or land-use policies that might help local populations stay in place.

12.2 Provision of sufficient water quality and quantity for industry and commerce

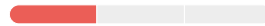
› QUALITATIVE INDICATOR:

Businesses and industry have access to sufficient water of appropriate quality.

QUALITATIVE SCORE (3.5/5):



CONSENSUS SCORE (1/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

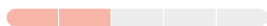
Businesses and industry have access to sufficient water of appropriate quality, but there are concerns about the future of their water supply. Many businesses have failed to adequately plan for future scenarios, including water futures in which water supplies are more fragile or more expensive.

12.3 Support for livelihoods around water

› QUALITATIVE INDICATOR:

Jobs and skills are developed, and new opportunities created for developing livelihoods around water

QUALITATIVE SCORE (2/5):



CONSENSUS SCORE (2/3):



SUMMARY OF ROUNDTABLE DISCUSSION:

Currently, the economy of Greater Miami and the Beaches (GM&B) is heavily reliant on tourism, yet service sector jobs do not always provide sufficient pay to support the cost of living, and large numbers of Miami-Dade County (MDC) residents do not earn a living wage. Tourism is also at risk from shocks and stresses. For example, Hurricane Irma severely impacted tourism in the Florida Keys. More can be done to create new economic opportunities in GM&B around water. Currently, jobs, skills and other resource are not being developed to ensure high-paying jobs that leverage water as a resource, and fully exploit the value of ecological resources such as Biscayne Bay in a sustainable way. Doing so will mean rethinking the role and nature of the service economy in the area.

12.4 Support for improved mobility through water-based transportation

› QUALITATIVE INDICATOR:

All communities have access to safe and reliable water-related transport, where it is feasible to operate.

QUALITATIVE SCORE:

N/A

CONSENSUS SCORE:

N/A

The indicator is not applicable to Greater Miami and the Beaches (GM&B). Water-related transport is not feasible due to the dispersed nature of the metropolitan region and the lack of suitable hubs to locate water taxis or ferries. Additionally, the Manatees Protection Plan limits where boats can dock, and speed restrictions around the Miami River reduce the practicality of ferries or water taxis.

3

OPPORTUNITY AREAS

The Resilience Assessment identified fourteen critical challenges currently confronting GM&B (“Problem Statements”). Ten of these were selected as critical challenges by workshop participants.

The following section presents opportunities developed during the workshop in response to each challenge. Each opportunity summary presents an overview of intended outcomes, approximate costs, anticipated benefits and potential performance indicators for measuring success. Resilience “champions”—stakeholders that can help realize key actions—have been suggested for each opportunity.

Workshop participants also identified short, medium and long-term actions associated with each opportunity. These refer to initiatives taken within one year (short-term), between one and three years after inception (medium-term) and beyond three years (long-term). Timeframes refer to time elapsed after an opportunity has been initiated, rather than after the workshop date.

The project team developed fourteen problem statements based on analysis of qualitative indicators. From these, stakeholders identified *ten problem statements to address* during the Vision Workshop.

1	Engaged water communities	How can GM&B engage a broader range of communities in decision-making around water programs and infrastructure?
2	Institutionalizing Resilience	How can GM&B further institutionalize and ensure continuity of this approach to withstand changes in electoral processes and leadership?
3	Coordinated planning for disaster management	How can GM&B improve planning across sectors and agencies to improve disaster preparedness, response and recovery?
4	Build back smarter: Long-term planning for disaster recovery	How can GM&B ensure that post-disaster planning takes a comprehensive long-term approach to disaster recovery that improves resilience and ensures safe and prosperous communities?
5	Evidence-based decisions: Water and environmental data for decision-making	How can GM&B ensure that data better informs policy-making?
6	Silicon Valley? Everglades Alley: Greater Miami and the Beaches as a technology hub	How can GM&B encourage new technologies and innovation that addresses the shocks and stresses facing the region?
7	Look up(stream)! Improving coordination with upstream water users	How can coordination be improved to bring GM&B closer to a One Water approach?
8	Understanding water infrastructure: Data and monitoring	How can Greater Miami and the Beaches (GM&B) make data current, accurate, and shared between relevant users?
9	Going green	What can be done by the government to develop a coordinated approach to green infrastructure and encourage its adoption by communities and businesses?
10	Water sensitive design: Reduce the water footprint of businesses	How can GM&B encourage tenants and owners to improve the design of large buildings and encourage the adoption of water reuse and recycling technologies to reduce water use?
	Triple-bottom line policies and planning.	What can be done to encourage a triple-bottom line approach to planning that evaluates economic, social, and environmental impacts?
	Resilient funding for disasters	What can GM&B do to increase the money available to prepare for and respond to disasters, diversify its funding sources, and decrease its dependence on national sources?
	Financial resilience for households and small businesses	What can be done to help households and businesses get the financial resources they need to prepare for and recover from disasters?
	Balancing affordability and financial resilience of water services	How can GM&B raise sufficient investment for water and sanitation service, while ensuring water remains affordable?

THE CHALLENGE

THE OPPORTUNITY

OPPORTUNITY
AREA

1

Engaged water communities

More effort is needed to engage with communities around decision-making for water plans and programs. Initiatives should target vulnerable populations such as the elderly, non-English speakers, and economically disadvantaged populations, providing information about where water comes from and where wastewater goes. Better engagement with local communities will encourage water efficiency and water savings, improve wastewater management and develop community preparedness and response to disasters.

Building awareness within communities is crucial to help them be water resilient, but there are hurdles to be overcome in disseminating information to all residents in Greater Miami and the Beaches (GM&B). For instance, although much public information is only available in English, approximately three-quarters of Miami-Dade County (MDC) residents speak a non-English language. This factor likely contributes to some communities' lack of awareness and education around water issues. Additional challenges relate to the geographic size of the GM&B, social segregation and isolation of neighborhoods, disparity of knowledge and awareness among the communities, varying risk levels, and complex (changing) climatic conditions.

Within government, existing institutional mechanisms can be improved to facilitate broad community engagement processes. There are

few public agencies or departments dedicated to increasing community engagement around water issues and decision-making. At the same time, many technical experts do not have the capacity or proper training to engage with communities. Another root cause related to governance is the absence of prior jurisdictional commitments that limit community role and engagement in water decision-making.

This challenge relates to the following resilience indicators:

- 1.1** – Legal and institutional frameworks and mechanisms promote active, free, and meaningful participation around issues related to water supply, sanitation, drainage, and flooding.
 - 1.2** – Mechanisms ensure that comprehensive information on government programs and policies are disseminated to all stakeholders.
 - 2.2** – Local knowledge and cultural values of all population groups are referred to in decision-making around water issues.
 - 4.6** – Decision-making procedures around water resources management, water, and wastewater services are made clear and open to all.
-

THE CHALLENGE

THE OPPORTUNITY

Institutionalizing and operationalizing community Engagement

Engagement with communities can be improved by increasing human and financial resources dedicated to outreach and education around water resilience. Training can target government offices that manage water resources or provide water and sanitation services. Miami-Dade Water and Sewer Department (WASD) can be the convening organization for appointing champions on water resilience and community engagement, working with the Miami-Dade County (MDC) Office of Resilience and Resilient305 Strategy to enhance focus around water issues.

WASD and the Office of Resilience can work with MDC Community Advisory Committees (CACs) located in sixteen targeted areas of MDC. CACs are elected by community residents to help foster community engagement in the County and may be enlisted to improve government-resident relations around the issue of water resilience.

With stronger institutional arrangements in place to promote an 'enabling environment,' core training programs and protocols can be developed for localized projects.

Programs will train water managers on participatory processes for engaging with communities around water resilience. These programs will help officials disseminate technical information in a more user-friendly manner, in multiple languages and using communication tools (e.g. mobile or web apps) to reach people where appropriate. Champions will help advocate and facilitate programs on awareness-building and water resilience to promote behavioral change and programs that grow community capacity and awareness.

Relevant assets and resources

- Miami-Dade Community Advisory Committees
 - Resilient305 Strategy
 - Action 10 – Strengthen Resilience Planning
 - Action 40 – Create a K-12 Plan for Resilience Literacy
 - Action 41- See it to Believe it
 - Action 46 – Resilient305 in the 305 Network
 - Action 48 – Rise to the Rescue
-

Shocks and stresses

- Storm surge
 - Sea level rise
 - Aging infrastructure
 - Ecosystem degradation
 - Long-term stress on agriculture
-

Champions

Lead Organization(s)

- Miami-Dade County Water and Sewer Department (WASD)
- Chief Resilience Officers (CROs)

Supporting Organization(s)

- Research-based organization, universities, CSOs
-

NEXT STEPS

Short

Short-term steps including securing commitment from local leadership, including support from mayors to prioritize community engagement in the context of municipal water resilience planning, committed financial resources, and dedicated institutional arrangements to facilitate such processes.

Medium

Medium-term actions include identifying champions and working with internal experts, consultants and researchers to develop protocols and guidelines. Training programs will be initiated for water officials, program champions, and with communities around water resilience.

Long

Institutionalizing community engagement will entail translating protocols into policy and long-term planning, including establishing institutional bodies dedicated to working on community engagement in water governance. Training programs and community outreach efforts continue.

Approximate Cost

Phase 1
\$50k - \$500k

Resilience Value

- More informed and engaged public results in a resilient society, making processes participatory and inclusive.
 - Improved capacity development of authorities around resilience concepts will help integrate resilience concepts in their work, programs, and policies.
 - Capacity development for government authorities around participatory processes and community engagement will help foster improved trust with local communities and encourage multi-stakeholder engagement.
-

Indicators of success:

- Open and upfront dialogues between community and government authorities
 - Increased participation of communities in public participatory meetings around water
 - Smoother decision-making processes
 - More water resilience champions across different departments in the city water system
-

THE CHALLENGE

THE OPPORTUNITY

OPPORTUNITY
AREA

2

Institutionalizing resilience

The need for water resilience is recognized by the current political leadership in Greater Miami and the Beaches (GM&B), which has resulted in the establishment of Chief Resilience Officers (CROs), the development of the Resilient305 Strategy, and the adoption of the Regional Climate Action Plan, among other individual governance initiatives. However, these commitments may be impacted by changes in leadership or leadership priorities as a result of electoral processes, leading to fragmented governance and decision-making processes that discourage collaborative problem-solving.

Institutionalizing resilience means embedding resilience principles and practices into the structure and operations of government and other organizations—so that resilience becomes a long-term feature of planning within Miami-Dade County (MDC) that transcends short-term political cycles. Achieving this will require increasing the accountability of elected officials. It will also require increasing availability and accessibility of resources to promote training, outreach and education around water resilience, to build understanding of resilience on the part of both government decision-makers and the general public.

This challenge relates to the following resilience indicators:

- 2.4** – A long-term strategy is in place to guide projects and programs that build water resilience over time
 - 2.5** – Political leadership promotes resilience as a priority issue in government decision-making
 - 3.5** – Frameworks and mechanisms clearly define the roles and responsibilities of water stakeholders
 - 4.6** – Decision-making procedures around water resources management, water, and wastewater services are made clear and open to all stakeholders.
-

THE CHALLENGE

THE OPPORTUNITY

Accessible Knowledge Action Platform: *The One Water Platform*

An opportunity exists to develop a platform for cross-sectoral knowledge exchange that is easily accessible by a large and diverse audience engaged in water issues. *The One Water Platform* will generate and share knowledge around water management, disaster preparedness and recovery, blue-green infrastructure and other issues that impact the water resilience of GM&B. It will discuss and celebrate success stories, best practices and learning from around the globe; promote networking through different media, including events and online discussions; provide a platform for storytelling and sharing with NGOs and community organization ('One Water Ambassadors'); and showcase research. Information generated through the platform can be communicated with local government, which will have the opportunity to engage in brainstorming, feedback and discussions around priority issues. *The One Water Platform* will contribute to a culture of information-sharing and collaboration across government departments and between government and non-government stakeholders.

The One Water Platform is similar in approach and objectives to the Resilience Innovation Hub (Opportunity Area 6). The two opportunities may be combined in a later stage or revised to reduce overlap.

Relevant assets and resources

- Resilient305 Strategy
 - Action 8 – Develop a Sea Level Rise Checklist for Capital Projects
 - Action 9 – Create a Development Review Checklist
 - Action 10 – Strengthen Resilience Planning
 - Action 45 - Send Your Boss to Bootcamp
 - Action 47 - Train Employees to Be Resilient

Shocks and stresses

- Aging workforce, succession planning, political transitions, sustainable and actionable water resilience conversations
- Platform will help better operationalize all water resilience shocks and stresses

Champions

Lead Organization(s)

- A neutral entity which will collaborate with individuals and small or medium-sized enterprises (SMEs)

Supporting Organization(s)

- Non-profit organizations, universities, community leaders
-

NEXT STEPS

Short

Initial steps include conceptualizing the One-Water Platform from best practices, engaging with scientific and research communities, and financial planning to develop a sustainable platform.

Medium

In the medium-term, the platform will be built.

Long

After one year, the platform will be launched. One-Water Ambassadors are identified to showcase research and development, and to communicate information generated within regional, national and international platforms.

Approximate Cost

\$1-5m

Resilience Value

- Long term awareness on wider issues and challenges faced by GM&B
 - Improved engagement and knowledge sharing
 - Creating an environment of accountability, which is crucial to improve the quality of processes and further build sustainability and resilience
-

Indicators of success:

- Community success stories and lessons learned
 - Targeted research resulting from the platform
 - Site visits and new members
 - The number of participations in the One Water conferences and the webinars
 - The number of One Water Ambassadors
 - One Water referenced and adopted by local, state and federal institutions
 - One Water becoming part of the community and political agenda
-

THE CHALLENGE

THE OPPORTUNITY

Mainstreaming a resilience culture

Mainstreaming a resilience culture means integrating resilience into operations across departments and municipalities, including county-level strategic planning, infrastructure development planning, and employee training strategies. Efforts needed to achieve this goal include promoting education around resilience; investing resources in programs to educate leadership on why resilience matters and how it can be promoted; integrating resilience into laws, codes, and standards; and developing integrated plans that link resilience initiatives across multiple sectors.

Initiatives designed to mainstream resilience will rely on better communication between government agencies. They will require leadership from different government agencies that commit to integrating and reflecting resilience in daily work, and that looks beyond election cycles.

Relevant assets and resources

- County Strategic Planning
- Existing Infrastructure Planning
- Current Employee Training

Shocks and stresses

- Resistance to change
- Natural and man-made disasters (various)
- Financial stress (and workforce stress) with changing priorities

Champions

Lead Organization(s)

- Miami Dade County (Budget Directorate)

Supporting Organization(s)

- National Organization of Counties (NACo)
 - International City/County Management Association (ICMA)
 - American Society of Civil Engineers (ASCE)
 - Florida Section of the American Water Works Association (FS AWWA)
 - Academic organizations
 - American Society of Adaptation Professionals (ASAP)
-

NEXT STEPS

Short

Immediate steps entail establishing county champions and working with municipalities on new budget planning that integrates water resilience as a priority component.

Medium

Medium-term steps include mobilizing and educating key decision-makers, managers, and staff to increase commitments to resilience activities, including in the form of financial support. Additionally, champions will partner with professional organizations who can help facilitate training programs for other stakeholders, departments, and elected officials.

Long

The long-term goal should be to enact changes to laws, codes, and standards (including the Miami-Dade County Charter) that promote resilience and change operational processes to include resilience best practices. Education programs for professionals, government staff, managers, department heads, and directors can encourage behavior change and ultimately change culture. A Fully Integrated Resilience Master Plan (FIRM) will be developed that links resilience-building efforts across water, transport, energy, and other related sectors.

Approximate Cost

\$500k-1m

Resilience Value

Optimizing County budget bottom line, which impacts residents, ratepayers, businesses, employees, elected officials, tourists

Indicators of success:

- *Fully Integrated Resilience Masterplan* has been developed
 - Staff and stakeholders understand and demonstrate investment in resilience goals
 - *Resilient Report Card* has been developed to measure a continuous path of resilience
-

THE CHALLENGE

THE OPPORTUNITY

OPPORTUNITY
AREA

3

Coordinated planning for disaster management

Managing risk from hurricanes, flooding, and other shock events is complex and requires planning across sectors and organizations. Within organizations such as Florida Light and Power (FP&L), Miami-Dade Water and Sewer Department (WASD), AT&T, Miami-Dade Department of Transportation and Public Works (DTPW), Florida Department of Transportation (FDOT) and various municipalities, there is growing recognition that integrated planning, coordination, and communications can improve preparedness, response, and recovery. Greater commitment and dedicated resources are needed to improve coordination around disaster planning within Greater Miami and the Beaches (GM&B).

Challenges lie in communicating appropriate information at the right time, both during and after a disaster. The socio-cultural diversity of GM&B, along with the diversity of languages spoken in the region, can make it difficult to disseminate information to all population groups.

Disaster preparedness planning must also ensure that critical facilities like hospitals and nursing homes are equipped with resources to cope with disasters, and that preparedness strategies have been developed. WASD has a well-established pre-disaster preparedness plan to ensure continuity of services by hospitals and other critical facilities, but comprehensive initiatives are needed to ensure critical facilities within the County are fully prepared for disaster events.

This challenge relates to the following resilience indicators:

- 3.4** – Frameworks and mechanisms promote dialogue and deliberation around water and resilience issues between government and non-government actors.
 - 5.4** – Coordination exists between public sector water agencies, water utilities, and organizations working in related domains such as energy, telecommunications, waste management, and transportation.
 - 7.2** – Disaster response and recovery coordination plans and procedures are current, collaborative, well-rehearsed, and properly funded.
-

THE CHALLENGE

THE OPPORTUNITY

Disaster planning for the most vulnerable

New approaches are required to engage and communicate with disenfranchised and vulnerable populations in GM&B. An opportunity exists to develop a new strategy for engaging and disseminating information to target groups before, during, and after disaster events. Existing county-level strategies and education can be built upon to promote training on resilience and disaster management for elected officials (e.g. commissioners and city managers) and ensure information is widely communicated. For instance, shock events may result in power failures and service disruption in critical facilities such as nursing homes. Therefore, responsible agencies should be engaged and informed to make the necessary arrangements in such facilities, including installing generators, ensuring consistent water supply (and water quality), and creating grant funds to improve the preparedness of assisted living facilities, nursing homes, and adult development centers.

Relevant assets and resources

- Resilient305 Strategy Actions
 - Action 42 – Pre-planning for Post Disaster Toolkit
 - Action 43 – Roll-out 5 step Recovery Guide to Innovative Recovery Financing
 - Action 46 – Resilient305 in the 305 Network
-

Shocks and stresses

- Hurricanes, storms, severe weather
 - Extreme power failure
-

Champions

Lead Organization(s)

- Private philanthropic foundations

Supporting Organization(s)

- County, municipal government, faith-based organization, community-based organization
-

NEXT STEPS

Short

The initial step is to identify vulnerable and target population and engage with key stakeholders, including community-based organizations (CBOs), county emergency management, municipal emergency management, and the Agency for Health Care Administration (AHCA) to raise the awareness around the needs of target groups.

Medium

In the medium-term, project champions work to better understand the strengths, weaknesses and needs of target groups, while continuing efforts to identify vulnerable groups in GM&B. Local community organizations will be engaged to promote dialogue and facilitate community participation. Champions will work with CBOs to pursue grant funding for assisted living facilities (ALFs) nursing homes and adult developmental centers, to ensure that emergency resources such as generators are in place for post-disaster emergencies.

Long

In the long-term, an effective and coordinated communication strategy is needed to improve collaboration among different stakeholders, including government, private sectors and residents including government, private sectors, and residents.

Approximate Cost

\$5m+

Resilience Value

- Provide sustained and optimal living conditions for disenfranchised members of the community so that they can sustain, cope and adapt to different shocks
 - Ensuring healthcare benefits
-

Indicators of success

- The number of critical facilities funded to improve their resilience capacity
 - The number of generators installed in such critical facilities to ensure there is no disruption of services in general and during emergency
 - The quantity and quality of supplies and services distributed to people, including the vulnerable groups
-

THE CHALLENGE

THE OPPORTUNITY

OPPORTUNITY
AREA

4

Build back smarter: Long-term planning for disaster recovery

After a disaster, communities often rebuild back the same as before, repeating mistakes and failing to address vulnerabilities.

Within Greater Miami and the Beaches (GM&B), stronger policies and incentives are required to ensure that infrastructure is climate resilient and built according to best practice, and that property development does not occur in vulnerable areas. Updated policies are needed that discourage development in high-risk areas while also improving access to affordable housing in low-risk areas in GM&B. Additional incentives for private developers and businesses can encourage investment in green infrastructure and development in areas that are best positioned for sustainable and/or smart growth.

More public investment is needed for studies examining the potential impact of different shocks and stresses on current and future development plans and identify projected demand for groundwater. A holistic assessment of vulnerable populations is needed to ensure that new initiatives address underlying socio-economic vulnerabilities and promote long-term resilience.

This challenge relates to the following resilience indicators:

7.4 – Households and businesses have access to sufficient financial resources for recovery and continuity following shock events or persistent stresses.

7.5 – Mechanisms promote community preparedness and response to water-related shocks and stresses.

12.1 – Policies exist that protect the vulnerable population from displacement as a result of water-related shocks and stresses

THE CHALLENGE

THE OPPORTUNITY

Resilient post-disaster development

This intervention will help delineate and prioritize the most vulnerable areas to future seas level rise, groundwater, and storm surge, to help planners make well-informed infrastructure investments. The intervention will update and strengthen regulatory frameworks and mechanisms to ensure high standards for all future infrastructure development. It will help ensure that re-construction and re-development in disaster-affected areas occurs to the highest standards and codes. Along with these, county government will develop new strategies to implement a comprehensive education and awareness campaign that empowers residents to participate in the discussion and urban planning decisions.

Relevant assets and resources

- Resilient305 Actions
 - Action 42: Pre-planning for a post-disaster toolkit
 - Action 43: Roll-Out 5 Step Guide to Innovative Recovery Financing
 - Current infrastructure developments and capital improvements (WASD, SFWMD, municipalities)
 - Update of municipal/county Stormwater Master Plan
 - The Miami Dade County's Comprehensive Development Master Plan (CDMP)
 - Update of zoning codes
-

Shocks and stresses

- Tropical storms, hurricanes, flood events
 - Poverty, seas level rise and ageing infrastructure
-

Champions

Lead Organization(s)

- Miami Dade County (MDC)
- South Florida Water Management District (SFWMD)
- Municipalities

Supporting Organization(s)

- Utility providers, universities, federal and state agencies-FEMS, DEP
 - Chamber of commerce
 - NGOs and religious organization
 - Media
-

NEXT STEPS

Short

The first step will be to develop an outreach and communication plan to engage with communities and identify concerns and challenges associated with the most vulnerable areas of the County.

Medium

Medium-term steps include designating new adaptation action areas and creating low impact development guidelines and incentives programs. It is critical to integrate community inputs in these decisions, and outreach and education strategies to engage with communities will help achieve this objective. Additionally, direct engagement with the private sector can help inform guidelines and incentives. Outputs from this outreach should be integrated into action plans and existing strategies and policies. For instance, discussions can inform the review and updates to zoning strategies and plans, and Miami-Dade County's Comprehensive Development Master Plan (CDMP), based on the recommendations and inputs from the multi-stakeholder group.

Long

Long term steps include adopting and investing in high standard mapping data and systems to predict and analyze future sea level rise, groundwater withdrawals and storm surge. These studies will provide additional inputs and guidance for urban planners to make resilient infrastructural investments. Design standards will be reviewed in light of these studies to ensure that they are adaptive to current and future challenges.

Approximate Cost

\$5m+

Resilience Value

- Economic benefits include resilient investments that result in reduced economic loss from shocks and stresses
 - Post-recovery measures will be effective with less impact on assets and infrastructure
 - Insurance savings
-

Indicators of success

- Resilience based policies and regulations are established
 - Price value of vulnerable assets is reduced
 - Active participation of vulnerable communities in decision-making and planning of infrastructure developments
-

THE CHALLENGE

THE OPPORTUNITY

OPPORTUNITY
AREA

5

Evidence-based decisions: Water and environmental data for decision-making

Water quality data should inform policies and regulation around the protection of the water environment, the safety of private supplies and recreational water use. Good data should be made available, and information relayed to (and understood by) decision-makers to support robust, evidence-based decisions.

Within Greater Miami and the Beaches (GM&B), however, fragmentation exists between the agencies responsible for monitoring water quality. Monitoring is performed for different purposes and using different standards, which sometimes leads to divisions of responsibility and may reduce cooperation. At the same time, limited financial resources exist to support water quality monitoring, and ensure that high-quality data quality is shared. Water quality sensors are expensive, more efficient technology is needed to bring down monitoring costs, and procurement processes can be cumbersome. Legal frameworks are needed to ensure adequate resources to support monitoring programs, and to ensure monitoring efforts are not reduced when government budgets are cut.

More specifically, two key needs have been identified to ensure that good data around water quality and aquatic ecosystems informs policy-making:

1. **Good data is not always available.** GM&B lacks basic information on pollutant sources. Where this data exists, it is gathered by multiple agencies, testing for different water quality standards. This can result in inconsistent data on water quality and quantity. When good data exists, it is not always shared between different agencies.¹ Data should cover both historical and current conditions and be employed to model future scenarios/conditions.

2. **Available data is not always used appropriately.** Critical information is often not conveyed to decision-makers, and decisions are not always supported by robust data and technical inputs from experts.² Links between water quality and health impacts are not well-communicated. All relevant trade-offs, benefits, and costs are not always quantified or well-understood and communicated to decision-makers.

This challenge relates to the following resilience indicators:

2.3 – Technical knowledge is available, understood, and continuously incorporated into decision-making.

5.1 – Monitoring and evaluation mechanisms and frameworks measure how programs have achieved intended outcomes, and disseminate lessons learned.

5.2 – Accurate data is used by key decision-makers in government, private sector, and civil society to promote urban water resilience.

8.1 – Active monitoring and evaluation of water infrastructure and networks ensure data is current and accurate.

9.1 – Environmental monitoring is conducted to assess the health of environmental systems.

¹ Specific data needs that have been identified include 1) attribution of pollution sources, 2) tidal effects on groundwater levels near shoreline, and 3) cumulative impact of multiple projects or developments on local water quality (including cascading and combined impacts of multiple projects).

² Two examples of this are the Bird Drive Basin and challenges related to South Dade Water Intrusion.

THE CHALLENGE

THE OPPORTUNITY

The One Water Portal

An opportunity exists to improve data around water quality and quantity to ensure the accuracy and resolution required for making sound decisions. This can be achieved through a critical evaluation of the existing network, identifying gaps, creating better data sharing platforms between agencies, coordinating monitoring between agencies, and promoting efficient technologies for water quality monitoring. Training for decision-makers and different levels of government should target elected officials, department heads, and staff. Citizen science can be employed to expand GM&B's water quality monitoring capacity. Finally, consolidating existing data and making it open and accessible and available to all agencies and universities. Indirect benefits would be to tourism industry and academics doing relevant research.

MDC will implement this vision in two steps:

1. Conduct an evaluation of the existing monitoring network that a) identifies gaps, b) identify new ways for better data sharing across agencies, c) coordinates monitoring efforts between agencies and d) identify new water quality technologies that improve efficiency and reduce costs
2. Develop a *One Water Portal* that consolidates and visualizes data around water quality and quantity to ensure that scientists, planners, engineers, and government agencies have better access to data. The portal will consolidate existing water management data into a single platform that is open and accessible to all agencies and universities. It will link with research efforts to integrate water quality information with public health impacts. A key element in the portal will be to create a data visualization that makes information around water quality/quantity understandable to decision-makers.

Relevant assets and resources

- DBHYDRO – South Florida Water Management District environmental database
 - Resilient305 Strategy
 - Action 1 – Preserve & Restore Biscayne Bay
 - Action 49 – Collaborate with Universities
 - Action 50 – Create an Actionable Science Panel
 - Action 52 – Create a Resilient305 ArcGIS Hub
 - Action 53 – Share Bold Integrated Water Models
 - Action 54 – Employ a One Water Approach
 - Action 55 – Planning Efficiently & Effectively Together
-

Shocks and stresses

- Declining water quality
 - Flooding
-

Champions

Lead Organization(s)

- Miami Dade County (MDC)

Supporting Organization(s)

- South Florida Water Management District (SFWMD)
 - Universities
-

NEXT STEPS

Short

Immediate steps include developing a scope of work, led by Miami Dade County (MDC). A Steering Committee can oversee the scope and explore potential funding sources. It will coordinate with Miami Dade County Information Technology Department (ITD) to identify existing resources that might help set up and administer the portal. Finally, a Stakeholder Support Letter would indicate support for the portal from organizations within the GM&B.

Medium

Medium-term steps include identifying funding. During this phase, the management structure will be consolidated and defined. Dedicated staff from government agencies and/or outside consultants would be hired for establishing the portal.

Long

The long-term steps entail completing a critical evaluation of the existing network, including a gap analysis. This phase entails developing the data portal. In the long-term, training and public outreach will be conducted on how to use the information and portal. Finally, staff will be assigned to manage the portal.

Approximate Cost

Phase 1
\$500,000 – \$1m

Phase 2
\$1m – \$5m

Resilience Value

- Water quality
- Ecosystem health
- Drinking water quality
- Public health

Indicators of success

- Water quality information can be easily accessed by agencies and researchers
 - Water quality information is accessible to the general public
 - New studies are conducted linking groundwater and surface water and “connecting the dots” between the system
-

THE CHALLENGE

THE OPPORTUNITY

Saltwater intrusion: Acting on what we already know

Information about saltwater intrusion and its linkage to water levels in South Dade is available, and the challenge is well understood. Still, there is an opportunity to improve canal management and wetlands restoration efforts in the South Dade area to help manage risk.

The proposed action consists of a two-phase study to reduce saltwater intrusion that is threatening drinking water sources (i.e. MDC's Newton Wellfield and Florida Keys Aqueduct) in South Dade:

1. In Phase 1, a study will be conducted to show how much capacity there is to restore more natural water levels in one or more canals without increasing flood risks to any developed properties. In this phase, pilot projects are identified that the County can implement on County-owned canals or land. An opportunity exists to reduce drainage of the Everglades from the secondary canal system constructed along Tallahassee Road in the Model Lands Basin. This opportunity is based on the premise that at least a portion of the current drainage of the Everglades wetlands in this basin being provided by the MDC canal system is not necessary, since the area is undeveloped wetlands located outside the urban development boundary. Additionally, the Comprehensive Everglades Restoration Plan (CERP) Everglades Restoration Project calls for restoring water levels in this area of wetlands by reducing over-drainage provided by the canal system on the order of 0.5 ft. A pilot project would partially plug or fill the canal or develop a water control structure.
2. As part of Phase 2, a comprehensive plan for the basin will be developed across

Relevant assets and resources

- Existing WASD saltwater monitoring / modelling
 - Existing USGS saltwater monitoring / modelling
 - Existing SFWMD studies in the area
 - Preliminary restoration plans for the area
 - DERM precedent projects in the broader area
 - Project Delivery Team for C-111 western spreader canal (Phase 1)
 - Resilient305 Strategy
 - Action 1 – Preserve & Restore Biscayne Bay
 - Action 49 – Collaborate with Universities
 - Action 50 – Create an Actionable Science Panel
 - Action 52 – Create a Resilient305 ArcGIS Hub
 - Action 53 – Share Bold Integrated Water Models
 - Action 54 – Employ a One Water Approach
 - Action 55 – Planning Efficiently & Effectively Together
-

Shocks and stresses

- Storm surge
 - Saltwater intrusion
 - Sea level rise
 - Ecosystem degradation
 - Long-term stress on agriculture
-

Champions

Lead Organization(s)

- Miami-Dade County (MDC)
- South Florida Water Management District (SFWMD)

Supporting Organization(s)

- Army Corps of Engineers (USACE)
 - Florida Keys Aqueduct Authority (FKAA)
 - Environmental stakeholders (various)
 - University of Florida Institute of Food and Agricultural Sciences (IFAS)
-

agencies to promote projects that address saltwater intrusion. In this second phase, capital projects will be identified that can be introduced at the basin level. Potential areas for exploration would be buyouts for areas that would be at risk of flooding, allowing for more flexibility for water management in that area. Aquifer Storage and Recovery (ASR) wells can also be introduced in the South Dade area to store water for dry season mitigation of saltwater intrusion.

Successful implementation will require building consensus between agencies, including MDC, the Army Corps of Engineers (USACE) and South Florida Water Management District (SFWMD). These agencies would all benefit from coordinated planning and resources, as would end users, including WASD customers in South Dade, and the Florida Keys Aqueduct Authority (FKAA).

Potential barriers to success include ingrained cultural attitudes and organizational roles: organizations and individuals may expect that the South Florida Water Management District (SFWMD) and USACE are responsible for addressing saltwater intrusion. More generally, efforts will be needed to shift organizational culture and improve inter-agency coordination. Additionally, agriculture may be concerned with decreasing drainage volume of the canal, and any actions with the potential to increase the flood risk of agricultural areas would need to be addressed and mitigated.

Approximate Cost

Phase 1
\$1m – \$5m

Phase 2
\$5m+

Resilience Value

- Benefits to drinking water quality
 - Reduced storm surge risks up the canal
 - Reduced risk to agriculture
-

Indicators of success

- Saltwater intrusion is slowed, extending the life of drinking water wells
 - Saltwater intrusion is slowed, extending the life of agriculture in the area
 - Increased hydro-periods in the wetlands enhance ecosystem health
-

NEXT STEPS

Short

Immediate next steps include clarifying that revenue from the utility service fee can be used to support saltwater intrusion mitigation projects. The study will be included in the Local Mitigation Strategy (LMS), and a scope of work will be identified. In this phase, potential funding sources (potentially including grants) can be identified. Finally, MDC can reach out to the SFWMD to raise the topic as an area of concern and expedite the study, including the study in their list of future projects.

Medium

In the medium term, the study should be included in future proposed agency budgets for all relevant agencies, including DERM, WASD and FKAA. The County, working with SFWMD, will invite other agencies for a discussion of the proposed scope of work and ask for feedback on feasibility. During this phase, stakeholders will identify what MDC staff and other resources are available to implement the process.

Long

Long term steps include implementation of one or more projects to reduce over-drainage of wetlands. Implementation should be monitored for five years to judge efficiency.

THE CHALLENGE

THE OPPORTUNITY

OPPORTUNITY
AREA

6

Silicon Valley? Everglades Alley: Greater Miami and the Beaches as a technology hub

Innovative applied technologies are needed to address the various shocks and stresses confronting Greater Miami and the Beaches (GM&B), including sea level rise, saltwater intrusion, hurricanes and storm surges, groundwater withdrawal, and ecological damage to critical ecosystems. Barriers to development of such technologies relate to funding, data availability, organizational culture and regulation.

Secure funding from the private sector, foundations, and government can support pilot projects and prototypes that help test and validate new technologies before broad adoption. However, fragmentation within the current 'innovation ecosystem' results in multiple organizations operating individually without coordinating or sharing resources, while competing for the same funding sources. Gaps in data and research around critical areas of interest to GM&B –ranging from seagrass to septic tanks—may also frustrate advancement of new ideas and technologies.

At the same time, the public sector does not always provide consistent and sustainable support for innovation. Cultural barriers and a lack of close coordination between government, universities and the private sector may discourage applied science that can be readily and widely adopted. Government can improve and streamline regulations, adopt new standards and otherwise incentivize innovation.

A coordinated approach is therefore needed to support technological development and adoption in GM&B.

This challenge relates to the following resilience indicators:

- 5.6** – Resources and processes reinforce a culture of innovation within the water sector.
 - 8.2** – Technical and managerial staff are trained and knowledgeable in areas related to the operation of key infrastructure and project implementation.
 - 12.3** – Jobs and skills are developed and new opportunities created for developing livelihoods around water.
-

THE CHALLENGE

THE OPPORTUNITY

Resilience Innovation Hub

An opportunity exists to develop partnerships between government, private sector, and universities to incentivize innovation. Greater Miami and the Beaches (GM&B) is already home to world-class universities and a thriving private sector that can develop and deploy new technologies to help cope with the challenges confronting GM&B and the wider region.

The Resilience Innovation Hub (RIH) will provide business support and thought leadership, and convene stakeholders to support new technologies that help Miami respond to urgent issues related to climate change. A non-profit organization, it will convene actors to work against fragmentation. It responds to specific problems faced by GM&B, and uses GM&B's unique geographic location as a central point in the Latin American / North American region to export the wisdom gained outwards in the region.

The RIH will bring together research groups that currently compete for similar funds, to achieve funding at scale and consolidate efforts that advance new technologies in the region. It will work with universities to build new approaches into curricula and attract funding for innovation, build off existing university programs, and develop or sponsor new educational programs and degrees. The hub will work with government to ensure new technology is considered, understood and adopted where appropriate, and that slow or inflexible procurement processes do not pose unnecessary burdens on developing and deploying innovative technology.

The RIH is similar in approach and objectives to the One Water Platform (Opportunity Area 2). The two opportunities may be combined in a later stage, or revised to reduce overlap.

Relevant assets and resources

- Resilient305 Strategy
 - Action 49 – Collaborate with Universities
 - Action 50 – Create an Actionable Science Panel
 - Action 51 - Resilience Accelerator Workshops
 - One Water Academy
 - University of Miami Laboratory of Integrated Knowledge (U-LINK)
-

Shocks and stresses

- Multiple
-

Champions

Lead Organization(s)

- Universities
- Non-profit organizations

Supporting Organization(s)

- Adrienne Arsht-Rockefeller Foundation Resilience Center
 - Miami Foundation
 - DiCaprio Foundation
 - Florida International University
 - Metropolitan Center
 - Urban Land Institute
 - Beacon Council
-

NEXT STEPS

Short

In the short term, next steps include planning for a task force that can bring together partners for the RIH. This means identifying individuals to lead the taskforce, aligning stakeholders, and reaching out to potential partners. Ultimately the task force is responsible for speeding innovation by identifying institutional changes required.

Medium

Medium-term actions include establishing the task force through three parallel channels: private, government, and university outreach. The task force will explore the institutional changes needed to create a resilience hub and the procedures and pathways required to develop new technology that help build resilience in Miami.

Long

Actions include developing a Resilience Innovation Hub Accord that records commitments to principles and financial commitment from local organizations committed to supporting the RIH. Organizations will signal a commitment to the venture by pledging financial resources to the initiative.

Approximate Cost

\$1m - \$5m

Resilience Value

- Knowledge dissemination and technical development
 - Improved coordination across sectors
-

Indicators of success

- Successful delivery of outcomes defined around community engagement, education, and training
 - Technologies are deployed and adopted
 - Funding sources have been acquired
-

THE CHALLENGE

THE OPPORTUNITY

OPPORTUNITY
AREA

7

Look up(stream)! Improving coordination with upstream water users

The quality and quantity of water used in Greater Miami and the Beaches (GM&B) depends on upstream authorities and users such as the South Florida Water Management District (SFWMD), United States National Park Service, United States Army Corps of Engineers (USACE), agricultural users and various municipalities in South Florida. Coordination between these stakeholders is vital to addressing new threats and managing multiple stakeholders' interests, but management of the Lower East Coast (LEC) Water Supply Planning Area is complex. Better coordination and communication are needed across stakeholders, but collaboration is often lacking.

Specifically, coordination challenges relate to governance, organizational culture, financing, and technology. A variety of stakeholders (and users) are involved in managing water resources in the area, and each stakeholder may have its own agenda, priorities, and data needs. High levels of staff turnover, lack of continuity in roles and expertise, staff shortages and lack of knowledge and expertise all reduce the institutional knowledge available for solving problems and can reduce informal communication channels between individuals. Few formal communication channels exist, and poor coordination contributes to silos. A lack of financial resources also contributes to the challenge, as coordination efforts are not supported or accounted for in organizations' budgets.

To meet organizations' different data needs, a variety of models, and monitoring exists. Agencies often have their own data management systems, and standards vary across users and organizations. All of these factors can make it difficult to share information across different users. Because information is not easily shared across organizations, decisions are often made without necessary data or operational knowledge.

This challenge relates to the following resilience indicators:

- 3.2** – Proactive coordination with relevant upstream stakeholders.
 - 5.5** – Coordination exists between water agencies and organizations involved in food supply and production.
-

THE CHALLENGE

THE OPPORTUNITY

One Water Regional Collaborative (OWRC)

A *One Water Regional Collaborative (OWRC)* will promote coordination towards common goals among stakeholders involved in managing water in the south Florida region. The OWRC will serve as a vehicle for defining and realizing water planning priorities: it will break down departmental silos, improve stakeholder collaboration around multiple (sometimes conflicting) priorities and goals, lead on education and training efforts for best management practice and user needs assessment, and establish joint funding mechanisms including from grants and contributions from individual organizations.³

Additionally, the OWRC will advance research and lead on developing integrated models and real-time data sharing platforms to support system operations and improve response to shocks and stresses, such as flooding.

The OWRC will provide benefits to all agencies by sharing information and coordinating resources. Better coordination will improve service for residents, and result in enhanced warnings that benefit residents and industry (including agriculture and real estate), alerting them to impending impacts from water shocks and stresses.

Relevant assets and resources

- Utility Coalitions – e.g., Resilient Utility Coalition (RUC)
 - Lower East Coast Water Supply Planning Area
 - Stormwater Master Planning
 - University of Florida / University of Florida Institute of Food and Agricultural Sciences (IFAS) Extension program
 - Resilient305 Strategy
 - Action 53 – Share Bold Integrated Water Models
 - Action 54 – Employ a One Water Approach
 - Action 55 – Planning Efficiently & Effectively Together
-

Shocks and stresses

- | | |
|------------------------|-------------------------|
| • Aging infrastructure | • Sea level rise (SLR) |
| • Lack of expertise | • Groundwater depletion |
| • Conflicting goals | • King Tide flooding |
| • Budget restrictions | • Saltwater intrusion |
-

Champions

Lead Organization(s)

- One Water Regional Collaborative (OWRC)
- South Florida Water Management District (SFWMD)
- County government(s)
- Municipal government(s)
- United States Army Core of Engineers (USACE)
- Industry (agriculture, etc.)

Supporting Organization(s)

- Technical advisors (staff from city, county, state, academia)
 - Community advisors (industry representatives, residents)
 - Community members
-

³ Examples of such collaborative approaches be found around the world, including in the Netherlands water governance models, but also from local cases such as the Miami Dade Transportation Planning Organization (TPO) which coordinate for transportation planning

NEXT STEPS

Short

Within the first three months, key players and supporting organizations will be identified and engaged. These may include utility coordination groups and assigned leads of Resilient305 Strategy actions. Key players will help drive medium and long-term actions.

Medium

Within the first year, a scope for the data-sharing platform will be established, and preliminary steps will be taken to establish the platform. The governance and organizational structure for the OWRC will be finalized.

Long

One year after the initiative begins, the OWRC “champions” will continue to fill membership so that all major stakeholders are included in the collaborative. At this point, the Collaborative can begin coordinated capital planning and engage in coordinated regional water operations.

Approximate Cost

Phase 1
\$500k – \$1m (annual cost)

Resilience Value

- Improve regional water quality best management practices
 - Manage the regional system to prevent impacts to abutting downstream stakeholders
 - Protect properties
 - Extend asset life
 - Level of service improvements beyond physical boundaries
 - Create a regional “one water culture”
-

Indicators of success:

- Number of coordinated capital projects (planning and construction)
 - Improved stormwater system responsiveness to shocks and stressors
 - Decrease in flooding events caused by segmented operations
 - Decrease in public health exposures to floodwaters
-

THE CHALLENGE

THE OPPORTUNITY

OPPORTUNITY
AREA

8

Understanding water infrastructure: Data and monitoring

Better data is needed to evaluate the performance of water, stormwater, and wastewater infrastructure assets. The level of detail, format, and ownership of data should be consistent across agencies and aligned with international best practices for asset management (e.g. ISO55001). Data should be validated according to general best practice and should be accessible across water systems operators, including Miami-Dade County (MDC), City of Miami, City of Miami Beach and the South Florida Water Management District (SFWMD). A better understanding of the needs of these and other end users is required to ensure the right data is collected and disseminated, and that data gaps are identified. Ultimately, conclusions from data should be communicated to decision-makers to ensure that decision-making is evidence-based.

Factors contributing to this challenge include financial pressures that limit the extent or duration of data-collection activities and have resulted in a reactive, as opposed to pro-active, approach to data collection. A lack of long-term financial commitment to science and data-collection limits funding for primary data collection. Specific compounding issues relate to contractual obligations that mean data cannot be freely or publicly shared, as well as difficulties interpreting data in the context of a changing climate, and a lack of data-sources to support understanding demands on infrastructure.

This challenge relates to the following resilience indicators:

- 5.1** - Monitoring and evaluation mechanisms and frameworks measures how programs have achieved intended outcomes and disseminate lessons learned
 - 5.2** - Accurate data is used by key decision-makers in government, private sector, and civil society to promote urban water resilience.
 - 8.1** - Active monitoring and evaluation of water infrastructure and networks ensure data is current and accurate.
-

THE CHALLENGE

THE OPPORTUNITY

Data for action: 7 steps for evaluating infrastructure asset performance

Data gaps can be addressed through a collaborative approach that identifies missing data, defines a consistent approach for filling data gaps, and evaluates existing processes for collecting, storing, and managing data. Specific data 'gaps' this intervention could address include:

- Defining a baseline from which long-term trends can be monitored and assessed.
- Using community-level problem identification to inform data-collection.
- Performing high-resolution short-term analysis on specific areas of interest.

Seven steps were identified to address the challenge:

1. Defining the need – Definition of the question and user need using a common framework
2. Identification and collation of existing data-sources – Surveying of available data, resources, technologies and working with partners to understand what data already exists, what can be used and requirements for further data-collection
3. Development of a 'data work plan' – Definition of a plan which defines the data requirements and how it will be collected
4. Highlighting benefits – Communication of data needs and how this will address the problem identified or decision-maker.
5. Implementing the work plan - Implementation and refining of the work plan as appropriate based on need and ongoing requirements.
6. Data to inform decision making – Communication of data to ensure it is accessible and informs decision making processes.
7. Sharing and collaboration – Ensuring data collected is shared and the value articulated.

Relevant assets and resources

- Existing and individual databases
 - Engineering planning
 - Resilient305 Strategy
 - Action 1 – preserve & Restore Biscayne Bay
 - Action 49 – Collaborate with Universities
 - Action 50 – Create an Actionable Science Panel
 - Action 52 – Create a Resilience 305 ArcGIS Hub
 - Action 53 – Share Bold Integrated Water Models
 - Action 54 – Employ a One Water Approach
 - Action 55 – Planning Efficiently & Effectively Together
-

Shocks and stresses

- Sea Level Rise
 - Infrastructure failure and aging infrastructure
 - Saltwater intrusions
 - Water quality
 - Population change
 - Extreme weather events (e.g., storms)
-

Champions

Lead Organization(s)

- Miami Dade County (MDC)

Supporting Organization(s)

- South Florida Water Management District (SFWMD)
 - Cities/local governments
 - Academia
 - NGOs
 - Florida Department of Environmental Protection (FDEP)
 - United States Environmental Protection Agency (EPA)
-

NEXT STEPS

Short

Immediate steps include the identification of 'Data Champions' through the Resilience 305 strategy and municipality commitments by the Resilient305 Progress, Innovation and Vision for Our Tomorrow (PIVOT) team. This step will articulate the overall vision of MDC and the purpose of the intervention to strengthen wider support and ensure that stakeholders work towards a common goal.

Medium

In the medium-term, MDC will develop and establish the proposed 'Data for Action' Plan and develop key metrics to evaluate performance. Where feasible, parts of the plan (i.e. 'quick wins') will be implemented. Responsibilities for implementation will be shared across the champions and municipalities.

Long

Long-term steps involve implementation of the plan and evaluation of its performance, using this as an opportunity to refine and update the seven-step plan as appropriate. Key performance indicators should be reviewed.

Approximate Cost

Multiple: \$50k - \$5m

Resilience Value

- Multiple shocks and stresses addressed
 - Bouncing forward faster
 - Stronger communities
 - Improved leveraging of assets
-

Indicators of success

- Better placement of interventions and improved monitoring
 - Better management of key shocks and stresses
 - Is Step (1) trending in the right direction, or has there been an improvement?
-

THE CHALLENGE

THE OPPORTUNITY

OPPORTUNITY
AREA

9

Going green

While successful green infrastructure projects can be found at the neighborhood level, Greater Miami and the Beaches (GM&B) lacks a comprehensive plan to implement new green infrastructure at a larger scale. Better coordination between stakeholders is needed to mainstream green infrastructure, and new incentives will be required to encourage private developers to adopt green infrastructure.

At present, however, competing pressures for space, coupled with a lack of awareness, limit the extent to which green infrastructure is adopted in new and existing developments. Green infrastructure brings real benefits, but its wide-ranging benefits are not always easily articulated, and it can be complex to design, operate, and maintain. The result is that green infrastructure is often not considered as a potential solution.

This challenge relates to the following resilience indicators:

- 8.3** – ‘Grey’ and ‘green’ infrastructure provide protection from flooding and ensure adequate urban drainage
 - 11.2** – Water incorporated as a design element in urban place-making
 - 11.4** – Blue and green infrastructure is adopted in neighborhoods
-

THE CHALLENGE

THE OPPORTUNITY

Integrated Miami Dade Green Infrastructure Plan

An opportunity exists around coordinating an integrated and comprehensive approach to enhancing and increasing green infrastructure across the region. An Integrated Miami Green Infrastructure Plan can improve the management of water (both quality and quantity) through the implementation of green infrastructure solutions in existing spaces and for new developments. The intervention would establish a task force to address the issue and respond to existing financial barriers to implementation. It would act as a model for other municipalities in the region to promote and support Green Infrastructure uptake.

Relevant assets and resources

- Resilience 305 Strategy
 - Action 59 – Demonstrate the Cost Benefits of Resilience
 - Action 5 – Integrate Resilience into Parks and Open Spaces
 - Action 4 – Expand Nature-Based Infrastructure
 - Transportation investments
 - Miami-Dade County Parks and Open Spaces Masterplans
 - Municipal stormwater masterplans
 - Southeast Florida Regional Climate Action Plan (RCAP) 2.0
 - Governor’s budget and initiatives
 - Florida Department of Environmental Protection Resilience Coastal Funding
-

Shocks and stresses

- Water quality and air quality
 - Flooding
 - Extreme weather (including heatwaves)
 - Lack of greenspace and biodiversity
-

Champions

Lead Organization(s)

- Miami-Dade County (MDC)

Supporting Organization(s)

- Municipalities
 - South Florida Water Management District (SFWMD)
 - Florida Department of Environmental Protection (FDEP)
 - Florida Department of Transportation (FDOT)
 - Various NGOs
 - Various academic institutions
 - Various federal agencies
-

NEXT STEPS

Short

The initial step is a resolution by the Board of County Commissioners to create a Task Force with key stakeholders throughout GM&B within an established timeframe. Subsequently, nominations for the Task Force should be identified and selected, and potential Agency Partners and associated funding sources for the Plan and its potential outputs should be identified. The initial activity of the Task Force will be to coordinate the development of an inventory of existing Green Infrastructure projects, programs, and initiatives.

Medium

Over the medium term, a draft plan will be developed, which includes:

- The definition of vision and objectives
- Prioritization of activities
- Definition of strategies for government, public properties, and private spaces
- Outreach and marketing strategies (including promoting positive behavioral change)
- Definition of required support – e.g., modelling, data and gap analysis

Long

The long-term aim is for the plan to be approved, adopted, and implemented throughout GM&B. The initial focus of the plan will be on incorporating green infrastructure into all new and existing public properties.

Approximate Cost

Phase 1 (plan development): \$50k - \$1m

Phase 2 (implementation): \$5m+

Resilience Value

- Healthy and resilience communities
 - Improving ecosystem services and biodiversity
 - Reduced flooding and coastal erosion protection
 - Economic value
-

Indicators of success

- Improved water quality
 - Reduced flood risk to the region
 - Protection of assets
 - Adoption of Plan by Cities and Local Authorities
 - Restoration of uplands
 - Insurance cost reduction
 - Effectiveness of solutions and monitoring results
 - Reduction in local carbon emissions
 - Improved heat management in urban centers
 - Aquifer recharge and reduced saltwater intrusion
-

THE CHALLENGE

THE OPPORTUNITY

OPPORTUNITY
AREA

10

Water sensitive design: Reduce the water footprint of businesses

Buildings have a key role to play in reducing water consumption and mitigating risks from water shocks and stresses. Building standards can encourage water-efficiency, water re-use, and water recycling. Urban design features that store or clean water or hold and slow the flow of water after a storm can reduce stress of runoff on the urban drainage system. Though a massive opportunity exists, little is currently done to ensure that new and existing developments are designed with these considerations in mind.

Miami-Dade County (MDC) is collaborating with businesses to implement the BE305 Program, which will promote energy and water efficiency in large existing private and public buildings through initiatives such as benchmarking and training. Following BE305 audits, tenants and owners should be encouraged to improve the design of large residential, commercial, and industrial buildings and adopt water re-use and recycling technologies to reduce their water use.

Challenges to improving uptake and driving behavioral change relate to multiple factors. Existing lifestyle standards and expectations presently require a substantial water footprint. Changing behaviors and attitudes is a complex and challenging task – often requiring on-going educational programs with extensive reach across the region (to both large and small business and industries). Implementing water efficiency and reduction measures requires financial expenditure or external funding to maintain affordability for all. A lack of comprehensive monitoring and performance validation of water reduction measures can make it difficult to justify initial expenditures.

This challenge relates to the following resilience indicators:

9.2 – Mechanism promote sustainable water use for commercial and industrial users

11.1 – Design principles are promoted to improve water performance for buildings

THE CHALLENGE

THE OPPORTUNITY

The high cost of water

The economic, social, and environmental benefits from reducing water use are substantial in the face of a changing climate and limited water resources. A suite of activities can promote behavior change that reduces the water footprint of businesses:

- Modify local codes to incentivize going beyond Florida state code to reduce the water footprint for construction activities; for example: increasing development rights, reducing impact and permit-ting fees.
- Revise levels of water-related fees and tariffs to encourage water conservation to reward people that participate in water conservation and penalize those that do not.
- Implement BE305 to promote water conservation for existing buildings, using data to drive decision making and developing mechanisms for rewarding innovation.
- Promote ongoing education to stakeholders around the long-term implications of excessive water use and the best practices and technologies available to support a reduction. To improve the success and reach of an education program, partnering with professional associations such as Chambers of Commerce, Building Owners and Managers Association (BOMA), Hotel Association, etc. may be appropriate.

Relevant assets and resources

- BE305
- LEED, Envision and similar certification standards
- Miami-Dade County and cities' Comprehensive Development Master Plan (CDMP) / Masterplans
- Resilient305 Strategy
- Southeast Florida Regional Climate Action Plan (RCAP)

Shocks and stresses

- Depletion of potable water resources
- Protection against the effects of drought
- Improving social equity
- Improving resilience to extreme events and natural disasters

Champions

Lead Organization(s)

- Miami-Dade County (MDC)

Supporting Organization(s)

- Local governments and cities
 - Trade/professional organizations, NGOs and Environmental Organizations
 - State of Florida
 - South Florida Water Management District (SFWMD)
 - Compact and Resilient305 Pivot Group
-

NEXT STEPS

Short

A set of activities to reduce water use will be identified. These may include approval of building performance ordinances, development of code changes, and creation of an education program (and identification of potential partners for implementation). As project champion, MDC will lead research and collation of best practices related to pricing structures for water tariffs, and technological solutions to support water reduction and water reuse.

Medium

In the medium-term, short-term activities will be further developed and then implemented. This includes the development of incentives and certifications and local metrics for BE305; drafting of code changes; the initiation of the education program; conducting a social impact assessment for proposed tariff change and marketing strategy for communicating the justification of the tariffs.

Long

Any remaining activities identified in the initial action planning will be implemented, and all actions will be measured and validated through ongoing monitoring.

Approximate Cost

\$50k - 500k

Resilience Value

- Water re-use offers the opportunity to limit the use of potable water resources after extreme events (e.g., hurricanes).
 - Reduction of energy consumption at treatment plants
 - Helps to address water pressure issues
 - Supports the protection of the environment, particularly water resources
-

Indicators of success

- Compliance rate (target 90%)
 - Percentage of water saved
 - Percentage reduction of commercial and industrial water footprint (target 20% by 2030)
 - Percentage reduction in people facing financial hardship due to water costs
-

4

NEXT STEPS

Over the course of the assessment, more than 60 stakeholders in key government, business, academia and community roles assessed the strengths and weaknesses of GM&B's water system, considered the critical challenges revealed through the assessment process, and outlined twelve actions to address these challenges. The overarching themes of the actions include data, knowledge, innovation, preparation and collaboration. The work of these subject matter experts provides a sound foundation for a collective action plan that can be advanced through continued coordination.

Participants were careful to consider the actions established in the Resilient305 Strategy to avoid duplication, and they identified opportunities to leverage Resilient305 in their implementation phases. The Regional Climate Action Plan was also cross-referenced to ensure efforts aligned with the principles and direction provided through that guiding document.

Some key messages we heard from our stakeholders include the importance of coordination between water stakeholders, the need for catchment-level partnerships and water management projects and practices, and for better collaboration between water and related sectors such as energy, telecommunication and transport. We also heard a strong call for sharing data and technical information to ensure evidence-based decision-making. Finally, feedback focused on opportunities indicates that water-sensitive design, green infrastructure and proper valuing of ecosystem services will play a critical role in shaping a resilient GM&B.

The following page provides an initial list of priority actions, which incorporate key components from the twelve actions identified by our stakeholders. These actions provide a foundational architecture upon which stakeholders can build upon by means of policies, projects, and continued coordinated work.

Just as the development of actions to enhance the resilience of our systems and services required close coordination, so too will implementation; coordination is needed between the organizations leading resilience planning and action, and between the multitude of stakeholders that play various roles in GM&B's water systems and services, for timely, effective execution. That is why a collaboration pathway is one of the top three priority actions identified in the assessment.

THE ACTION**THE CHALLENGE**

Establish an open-data platform to improve data accessibility and sharing between key stakeholders to support sound decision-making.

Evidence-based decisions: Water and environmental data for decision-making

- 7 Resilient305 Action Connections
- RCAP Recommendation Alignment

Establish a One Water knowledge portal to improve capacity and knowledge sharing around water resilience including online training and seminars and case studies for water stakeholders.

Institutionalizing Resilience

- 5 Resilient305 Action Connections
- RCAP Recommendation Alignment

Build collaboration pathways between governmental, community, academia, and other stakeholder groups to monitor advancement of actions addressing areas of lower scoring quantitative and qualitative indicators, and to advance key joint projects to achieve social, environmental, and economic outcomes that benefit all.

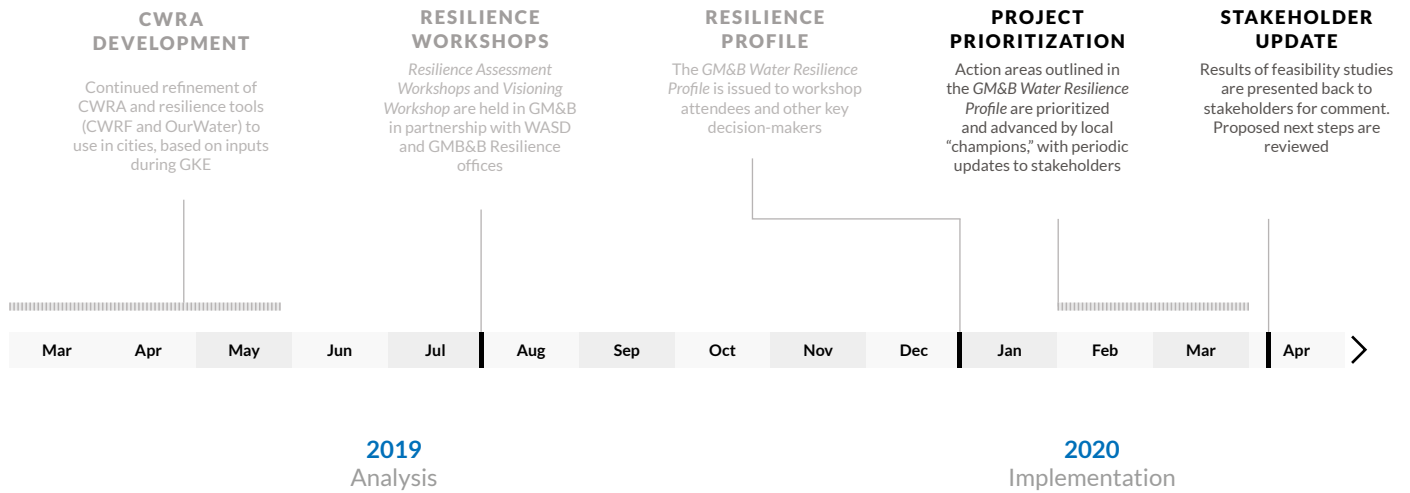
Look up(stream)! Improving coordination with upstream water users

- 3 Resilient305 Action Connections
- RCAP Recommendation Alignment

NEXT STEPS

In the coming months, key organizations and stakeholders will be convened to advance the top actions and to begin the work of integrating the concepts identified in this effort into other action plans, where appropriate. Key actions will be reviewed and refined by stakeholders to ensure they include all relevant perspectives, including those who may not have been able to participate in the week-long series of workshops.

This process will require time, resources, and effort from all stakeholders. It is expected to be an ever-evolving and improving blueprint of action - one that takes advantage of existing programs and relationships while building an enhanced network of people advancing change through their individual and collaborative efforts towards outcomes that enhance our water systems and services.



APPENDIX:

QUANTITATIVE INDICATOR SCORING THRESHOLDS

This appendix provides thresholds for any quantitative indicators for which a 1-5 score has been assigned. Ranges are based on best available data from global datasets and literature.

1 = Poor | 2 = Low | 3 = Fair | 4 = Good | 5 = Optimal

Indicator 5.3.a - Percentage of city population with regular solid waste collection

SCORING THRESHOLD:

(1) <40% | (2) 40-60% | (3) 60-80% | (4) 80-95% | (5) 95-100%

Source: Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development; Washington, DC: World Bank, 2018.

Indicator 6.2.a - Billing efficiency: Total number billed for water or sewerage / total number of known water and sewerage connections required to pay charge

SCORING THRESHOLD:

(1) <85% | (2) 85-90% | (3) 90-92% | (4) 93-95% | (5) 95-100%

Source: Andrews, Charles T., and Cesar E. Yñiguez. *Water in Asian cities: utilities performance and civil society views*. No. 10. Asian Development Bank, 2004.
Komives, Kristin, Vivien Foster, Jonathan Halpern, and Quentin Wodon. *Water, electricity, and the poor: Who benefits from utility subsidies? The World Bank*, 2005.
The Price of Water: Trends in OECD Countries, OECD Publishing, Paris. OECD, 1999.

Indicator 6.2.b - Percentage of non-residential metered connections: Customer meters / service connections

SCORING THRESHOLD:

(1) <40% | (2) 40-70% | (3) 70-90% | (4) 90-98% | (5) 98-100%

Source: Andrews, Charles T., and Cesar E. Yñiguez. *Water in Asian cities: utilities performance and civil society views*. No. 10. Asian Development Bank, 2004.

Indicator 8.1.a - Non-revenue water by volume (%)

SCORING THRESHOLD:

(1) <50% | (2) 25-50% | (3) 10-25% | (4) 5-10% | (5) <5%

Source: *International Comparisons of Water Sector Performance*. Global Water Intelligence, 2018.

Indicator 9.4. - Percentage wastewater effluent treated in compliance with local quality standards

SCORING THRESHOLD:

(1) <40% | (2) 40-60% | (3) 60-80% | (4) 80-95% | (5) > 90%

Source: Arup / 100 Resilient Cities

Indicator 9.5. - Percentage of bodies of water with good ambient water quality

SCORING THRESHOLD:

1 <40% | 2 40-50% | 3 50-75% | 4 75-90% | 5 > 90%

Source: *Progress on Ambient Water Quality: Piloting the monitoring methodology and initial findings for SDG indicator 6.3.2*. UN-Environment, 2018

Indicator 10.1a. -Under age five mortality per 1,000 live births

SCORING THRESHOLD:

(1) >100 | (2) 50-100 | (3) 15-50 | (4) 5-15 | (5) <5

Source: *Human Development Indices and Indicators 2018, Statistical Update*, UNDP, 2018.

Indicator 10.1b. -Number of physicians per 100,000 population**SCORING THRESHOLD:**

(1) <20 | (2) 20-50 | (3) 50-100 | (4) 100-150 | (5) >150

Source: *Human Development Indices and Indicators 2018, Statistical Update, UNDP, 2018.***Indicator 10.1c. -Number of mental health practitioners per 100,000 population****SCORING THRESHOLD:**

(1) <1 | (2) 1-5 | (3) 5-10 | (4) 10-140 | (5) >40

Source: "Psychiatrists and nurses working in mental health sector (per 100 000 population), 2014-2016" World Health Organization, Global Health Observatory data repository. Accessed 15 August 2019.

10.2b. -Percentage of population using safely managed drinking water services that is accessible on premises**SCORING THRESHOLD:**

(1) <50% | (2) 50-70% | (3) 70-90% | (4) 90-95% | (5) >95%

Source: *Progress on household drinking water, sanitation and hygiene 2000-2017. Special Focus on Inequalities. New York: United Nations Children's Fund *UNICEF) and World Health Organization. 2019.***10.2c. -Intermittent Water Supply (IWS): Population experiencing restrictions to water service****SCORING THRESHOLD:**

(1) 50% | (2) 10-50% | (3) 5-10% | (4) 2-5% | (5) <2%

Source: *Jacobsen, Michael, Michael Webster, and Kalanithy Vairavamoorthy, eds. The future of water in African cities: Why waste water?. The World Bank, 2012.***10.2e. Percentage of water quality compliant with local quality standards****SCORING THRESHOLD:**

(1) <40% | (2) 40-60% | (3) 60-80% | (4) 80-95% | (5) >95%

Source: *Arup / 100 Resilient Cities***Indicator 10.3a: Percentage of the population with household sewer connections****SCORING THRESHOLD:**

(1) <40% | (2) 40-60% | (3) 60-80% | (4) 80-95% | (5) >95%

Source: *Wastewater Report 2018: The Reuse Opportunity. International Water Association, 2018***Indicator 10.3b - Percentage of population using safely managed sanitation services****SCORING THRESHOLD:**

(1) <40% | (2) 40-60% | (3) 60-80% | (4) 80-95% | (5) >95%

Source: *Washdata.org. World Health Organization/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation. Accessed 15 August 2019.***Indicator 10.3b - Green area per 100,000 population (hectares)****SCORING THRESHOLD:**

(1) <50 | (2) 50-100 | (3) 100-200 | (4) 200-500 | (5) >500

Source: *Global Destination Sustainability Index 2018; Urban Green Spaces and Health: A Review of Evidence. World Health Organization, 2016.*







CONTACT INFORMATION

Debbie Griner | Miami-Dade County
Debbie.Griner@miamidade.gov

Louise Ellis | Arup
Louise.Ellis@arup.com