



**THE WATER INSTITUTE  
OF THE GULF®**

# **Written Response and Firm Profile for Integrated Master Planning RFI**

*Sewerage & Water Board of New Orleans*

**SUBMITTED BY:**

The Water Institute of the Gulf  
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February 18, 2020





# Lake Pontchartrain







**THE WATER INSTITUTE  
OF THE GULF™**

February 18, 2020

Attn: Patti Wallace, Purchasing Director  
Sewerage and Water Board of New Orleans  
625 St. Joseph Street, Room 131  
New Orleans, LA 70165

**Subject: Written Response and Firm Profile for Integrated Master Planning RFI**

Dear Review Committee,

The Water Institute of the Gulf (the Institute) enthusiastically applauds SWBNO's Integrated Master Planning initiative and is honored to submit the attached Written Response and Firm Profile for Integrated Master Planning RFI.

The Institute is a Louisiana-based not-for-profit, independent applied research and technical services institution established to provide key decision-making support to public agencies like SWBNO confronting complex, long-term water management challenges. Our skilled and experienced technical staff offers multidisciplinary scientific rigor and an integrated methodology that engages engineering, scientific, and policy and planning expertise. The Institute is an essential technical asset for the Louisiana Coastal Master Plan development and is leading both planning and modeling work in support of the state's Louisiana Watershed Initiative. Institute staff have been intimately involved with past award-winning citywide planning initiatives in New Orleans, including the development of the *Greater New Orleans Urban Water Plan*, the *Resilient New Orleans* strategy, and the National Disaster Resilience Competition Gentilly Resilience District projects. The Institute served as the Lead Strategy Partner for the just-released *Resilient Houston* strategy and led essential, successful, planning and community visioning efforts across Louisiana, along the Texas coast, and in Charleston, SC. Skills and lessons learned in those endeavors can be leveraged for SWBNO's vision and planning goals.

The Institute can support SWBNO with a unique and structured consensus-building and decision-making process that engages experts, stakeholders, residents, key staff, and decisionmakers. We also offer innovative and proven collaborative modeling and stakeholder engagement processes to integrate community, social, economic, and physical-system goals. This process will enable SWBNO, its customers, and leadership to jointly create a 50-year vision and goals and a strategy to achieve them. Success here will advance public support and resources for implementation and improve public understanding of problem complexity, trade-offs, and physical system constraints.



SWBNO's Integrated Master Planning vision is important, extensive, and ambitious. The Institute desires to be a trusted, local knowledge resource and partner for SWBNO in this endeavor. We stand ready to provide SWBNO and City leadership with proven, interdisciplinary, and strategic advice that will underpin and advance SWBNO's integrated planning goals, with a focus on the Stormwater Adaptation Plan component. We would be honored and excited to participate in any upcoming workshops to share more about the processes and approaches described in our response, and to work collaboratively to support SWBNO in further developing this strategic planning process. On a final note, because many Institute staff and a key Institute Office are based in New Orleans, we also will bring—in addition to our technical and planning capabilities—a deep and lasting personal commitment to the city, this project, and SWBNO's success.

Sincerely,

A handwritten signature in black ink, appearing to read 'Justin R. Ehrenwerth', with a stylized flourish at the end.

**Justin R. Ehrenwerth**

President and CEO

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## Organization Profile

### OVERVIEW

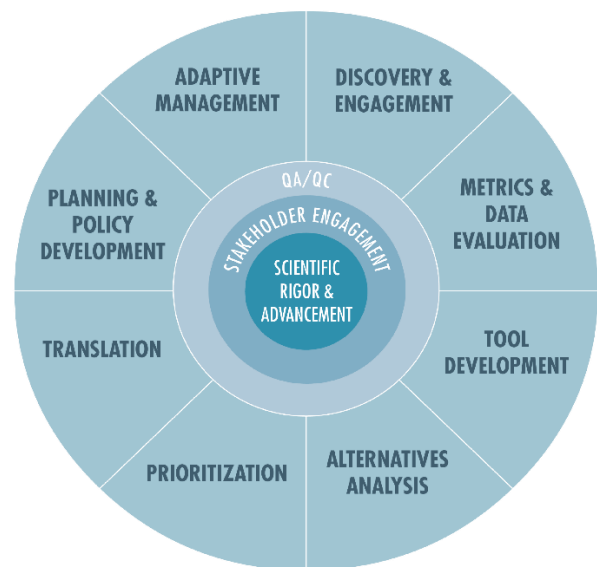
The Water Institute of the Gulf is an independent, non-profit applied research organization that works across disciplines to advance science and develop integrated methods used to solve complex environmental and societal challenges. Our technical team strives to improve our collective understanding of natural and human aspects of coastal, riverine, and urban water management systems; to develop methods, models, and tools to aid in the restoration of communities and ecosystems; and to reduce risk for habitats, people, and infrastructure. The Institute's applied research is rooted in the lessons born from the challenges facing Louisiana and the Gulf Coast and grows through collaborative partnerships to exchange knowledge and implement innovative approaches and solutions. We welcome the opportunity to partner with mission-driven organizations that share our passion for advancing resilient communities and sustainable water management systems and ecosystems.

The Institute connects researchers across disciplines to support governmental, private sector, and NGO partners in planning for an uncertain future. Our integrated and interdisciplinary team's methodology is founded on engaging scientific, engineering, and planning experts to provide the technical rigor and framing necessary to support robust decision making.

The Institute approaches near- and long-term planning with a recognition that each challenge is unique, requiring site-specific context and perspective; however, engaging and learning from peer communities is often a common thread in successful initiatives. Innovation and collaboration are mutually *inclusive*, cascading in the lifecycle of research and discovery, testing, implementation, and adaptive management.

To bring the state-of-the-science to bear in the Institute's applied research initiatives, our team leads the development and application of leading-edge, problem-specific tools and approaches to inform a range of implementation and policy decisions including:

- customized data collection efforts, ranging from environmental monitoring to engagement processes tailor-made to provide in-depth analysis of vulnerabilities, risks, inequities, and community specific challenges critical to robust decision making;
- world-class numerical models and tools to assess short- and long-term dynamics of complex natural and designed systems; and
- differentiated exploration and decision-making processes, organized as appropriate around community- and stakeholder-driven approaches and science-based, structured decision making.



**Figure 1: The Institute's approach to using advanced science to help communities make decisions and plan for an uncertain future.**



## KEY PERSONNEL

The Institute has specific technical expertise grounded in New Orleans. Our team has collectively spent decades working to understand the city and region's water management, environmental, societal, funding, and governance challenges. Some of our key personnel are listed below.

**Hugh Roberts, P.E., Vice President of Engineering**, has led flooding and drainage studies throughout US and Louisiana. Hugh was the storm surge and wave modeling team lead for the 2012 and 2017 Louisiana Coastal Master Plans (CMP) and is currently leading the 2023 CMP efforts in coordination with the Louisiana Coastal Protection and Restoration Authority (CPRA). Concurrent with the 2023 CMP, Hugh is an advisor to state agencies as part of the Louisiana Watershed Initiative (LWI) on a range of policy and technical issues, including the development of statewide methodologies to assess compound coastal, fluvial, and pluvial flood risk. He brings over 15 years of experience designing and facilitating multi-day, interdisciplinary workshops and leading visioning exercises as the program and project manager for urban resilience plans and risk assessments in Louisiana, New York, Boston, and San Francisco.

**Brett McMann, P.E.**, has worked on projects ranging from the municipal scale to statewide scale, including planning, engineering and design, master planning, and cost estimation. He has served as a design engineer for projects within New Orleans's Paths to Progress program and the Baton Rouge Sanitary Sewer Overflow program. Additionally, he led the coastal and green infrastructure design for the City of Norfolk's National Disaster Resilience Ohio Creek Watershed Green Infrastructure and flood protection project and is currently the project manager for Dryvable, a city-wide app being developed for the Houston metro area to inform drivers of impending flood risk along their routes to work and school. Brett is currently standing up the data and modeling program within LWI and served on the CPRA Master Plan delivery team, where he developed project attributes and cost estimates for multiple iterations of the CMP.

**Colleen McHugh, Senior Adaptation Planner**, has 10 years of resilience and urban planning experience. She was instrumental in the development of New Orleans' award-winning Resilience Strategy, the city's first-ever Climate Action Plan, and the design and implementation of green infrastructure and nature-based solutions. Colleen focused on long-term visioning, strategy and integrated planning, and successfully translated those efforts into proven implementation and cross-departmental collaboration. Colleen's work engaging engineering and design technicians, and forming partnerships with community organizations, has produced positive, lasting impacts on the city's resilience and associated projects. Since joining the Institute, Colleen has worked closely with public-sector clients such as the City of Houston, the City of Charleston, the State of Louisiana, FEMA, and the U.S. Army Corps of Engineers (USACE) to convene and facilitate interdisciplinary workshops, craft visions and actions for advancing resilience and adapting to environmental change, provide technical and programmatic support, and develop long-term strategic plans for future investments.

**Allison DeJong, AICP**, has more than 10 years of planning experience in New Orleans, working with the public and private sectors to advance resilient design practices, projects, and business development. She was a key part of initiatives such as implementation of the City's National Disaster Resilience Competition award and developing ProsperityNOLA, the city's first-ever economic development strategy. Allison also spent three years working with small businesses and entrepreneurs in the coastal and urban



stormwater sectors, connecting them to city and state projects and working to grow the sector through regulatory requirements and private demand. Through this work, Allison holds relationships with many of the stakeholders who will be most interested and impacted by a long-term stormwater master plan and will be key partners in engagement.

**Dale Morris, Director of Strategic Partnerships**, spent decades working at the intersection of water management, science, and policy at the Royal Netherlands Embassy. Dale brought Netherlands expertise to New Orleans and Louisiana through the original “Dutch Dialogues” process post-Katrina, which Dale founded with David Waggoner, of local firm Waggoner & Ball. Dale led and managed Dutch Dialogues processes across the country, including in St. Louis, Norfolk, Houston, Bridgeport, and, most recently, Charleston. These planning, visioning, design, and community engagement efforts have yielded lasting, dynamic impacts in those cities, unlocking millions of dollars and enabling city leaders and stakeholders to increase support for long-term planning efforts and investment strategies to create a more resilient, sustainable, and adaptatively-managed future.

**Alyssa Dausman, Ph.D., Vice President for Science**, has more than 20 years of experience working in hydrology, research plan development, and restoration project science and monitoring. She has approximately 10 years of experience working with decisionmakers to integrate science into planning processes. She is currently leading a large-scale long-term water resources planning effort in Louisiana using structured decision making.

**Scott Hemmerling, Ph.D., Director of Human Dimensions**, focuses on research related to climate adaptation and community resilience, investigating anthropogenic alterations to the landscape and the impacts of development on coastal communities. Scott leads a team of anthropologists and analysts who excel in GIS analytics that visualize complex coastal community issues and connect the social and physical dimensions of risk and resilience.

**Mike Miner, Ph.D., P.G. Director of Applied Geosciences**, has more than 20 years of experience in Gulf coastal plain geology and geomorphology. Mike leads a team of experienced scientists with expertise in surficial processes, landscape evolution, subsidence, sediment management, dredging, wetland restoration, subsurface geology, and groundwater.

**Alex McCorquodale, Ph.D., P.E., Senior Technical Advisor**, has more than 50 years of experience in hydrology and is Professor Emeritus in the Department of Civil and Environmental Engineering at the University of New Orleans. He has extensive experience in understanding the stormwater and drainage challenges of New Orleans, including developing the SWMM-GIS model for DPS #4 and supervising a multi-year study of cross flows from sanitary to storm sewers in Orleans, Jefferson, and St. Tammany Parishes (1996-2000). Most recently, he was a subconsultant to the Institute on the study of the high intensity rainfall on August 5<sup>th</sup>, 2017, assessing SWBNO’s hydrologic and hydraulic modeling capacity with respect to extreme rainfall and making recommendations for model improvements and monitoring.

## SELECTED EXPERIENCE

The Institute’s value to this strategic planning process is its unique ability to **connect** across disciplines, projects, and organizations; **convene** partners and stakeholders in productive, facilitated processes to inform decision making; and **translate** between scientific and technical language and concepts, public sector programs and policies, and community and stakeholder values.



## Connect

The Institute's role of connecting across disciplines, projects, and organizations is represented through our work on the **Louisiana Watershed Initiative**. LWI includes a \$1.2 billion investment of federal mitigation funds to fundamentally change how Louisiana addresses overall flood risk. LWI commits the state to use watershed science and watershed-based planning to improve flood risk decision-making across all parishes and governance structures to improve statewide flood protection, flood risk planning, and mitigation efforts.

The Institute is providing programmatic and technical support across many LWI activities, including the watershed modeling program. Many areas of the state have never been modeled, and the complexities of the overlapping conditions in these areas—such as extreme rainfall, coastal surges, wet soils, and tidal cycles—are not easily incorporated into an H&H model. The Institute is leading the methodology development and associated modeling guidance for assessing these phenomena, known as compound flooding, by connecting national experts with our Louisiana expertise. The Institute is also connecting the modeling program to the rest of LWI, including issues of governance and decision support. This work, for the Louisiana Office of Community Development, will provide lasting value over the 12-year initiative.

## Convene

The Institute specializes in convening diverse sets of partners, experts, community members, and public sector partners on a wide variety of projects. The Institute has successfully organized and facilitated multidisciplinary visioning workshops with participants from a range of governmental agencies, academia, NGOs, and the private sector. We have collaborative, ongoing partnerships with every university in the state and countless academic and research partners nationally and internationally. The Institute led visioning processes in 2019 in Houston and Charleston, and over the past decade Institute personnel have led or been instrumental in the development of numerous major resilience programs nationally, including Climate Ready Boston, Rebuild by Design, National Disaster Resilience Competition proposals (New Orleans, New York, Norfolk, Bridgeport), San Francisco Waterfront Resilience Program, Norfolk Vision 2100, and more.

In February 2020, the City of Houston released the ***Resilient Houston*** strategy. As Lead Strategy Partner for the City of Houston, the Institute directly advised Houston's Chief Resilience Officer throughout the 18-month strategy development process. The Institute supported the City in assessing and prioritizing Houston's shocks (such as extreme weather events) and stresses (such as health and mobility), convening hundreds of stakeholders through workshops and working group meetings, designing resilience-building projects and programs, and developing the final strategy document.

A companion document, *Living with Water Houston*, was developed concurrently with the *Resilient Houston* strategy. Living With Water (modeled after the Dutch Dialogues) convened Dutch, Louisiana, national, and local experts during two multi-day design workshops to develop flood risk reduction recommendations at the regional, city, bayou, and neighborhood scales. Houston is the first place where these two planning processes have occurred concurrently and informed each other. The *Resilient Houston* strategy and *Living with Water Houston* report can be viewed on the City's website:

<https://www.houstontx.gov/mayor/chief-resilience-officer.html>.





## Translate

The Institute is designed to translate among and between stakeholders. We support improved decision making, using applied research within planning processes to support resilient cities and delta systems. Our ongoing work for the **USACE Galveston District** (USACE SWG) showcases this translation function. USACE SWG asked the Institute to develop their Civil Works Strategic Plan (CWSP). Prior to intensive on-site engagement, Institute staff developed five- and 20-year visions to define the District's Civil Works mission and develop a USACE Southwestern Division (SWD) Strategic Response Plan. The goal was to inform USACE stakeholders on SWG's proposed strategies and actions to develop Value to the Nation civil works planning opportunities in Texas across Navigation, Flood Risk Management, and Ecosystem Restoration Business Lines. The Institute identified immediate- and near-term priorities and strategies for USACE to meet its mission, including budget development, workforce development and capacity assessment, stakeholder engagement, and regional and national governance. The Risk Analysis and Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis were compiled and synthesized for the District in preparation for incorporation into a Division-wide analysis, which will be components of a Division-wide Strategic Plan developed by the Institute and USACE in 2020.

The Institute has used specialized methods to convene community members alongside scientific researchers and translate between them. As part of the implementation of visioning exercises, the Institute has piloted a novel participatory modeling process in which community experience is directly integrated into a planning process. For example, with the Louisiana Coastal Master Plans, participatory modeling was built into the plan development process to both improve the assumptions underlying the scientific analysis and substantially increase public confidence in the plan and the methodologies applied. The Institute established competency sub-groups, containing technical researchers and community members, which formulated a set of "desirable" projects, identified project locations, established desirable outcomes, and developed processes to quantify those outcomes and a range of project challenges and benefits.

The Institute is applying a similar participatory modeling process for the Partnership for Our Working Coast initiative. This Public-Private Partnership (P3), with the Greater Lafourche Port Commission and energy sector partners, is using material from the Belle Pass dredging project for nature-based defenses to reduce coastal erosion, lower flood risk, improve community resilience, and evaluate blue carbon sequestration. The Institute has developed the participatory modeling process to incorporate public and social inputs that are not as easily quantified as engineering or economic analyses.

The Institute's role as convener, connector, and translator is demonstrated through our pioneering use of Structured Decision Making (SDM) in environmental planning. This technique, originally used by the Department of the Interior, structures conversations about complex decisions, using value-focused thinking that links scientific and engineering expertise with management factors like stakeholders, competing objectives, deadlines, and regulatory requirements. The Institute's researchers are some of the first to bring SDM to a water resources context, using it with the Baton Rouge Capital Area Groundwater Conservation Commission to analyze how to best manage the Southern Hills Aquifer resources that provide drinking water for the Capital region. Informed by a community-driven process, this technique can be applied to the Sewerage and Water Board's strategic planning process to balance the competing and conflicting objectives that will arise when planning across a long time horizon.



## Written Response

### What will be New Orleans' biggest stormwater/drainage challenges in 50 years and what is the best approach to integrated, long-range planning to address those challenges?

New Orleans' stormwater and drainage challenges over the next 50 years are complex, interrelated, and will demand more innovation, investment, adaptive management, and revised governance. These challenges—from external forces like environmental and demographic trends, and from internal sources like aging infrastructure and governance—are made more difficult by the need for a skeptical public to fully commit to adaptation. To plan for the system's long-term needs, with an eye toward building public trust, requires a deeply collaborative approach that understands the uncertainties involved while assessing internal and external risk.

#### EXTERNAL RISKS

The external challenges to New Orleans' stormwater system are considerable. The environmental factors alone, and their compounding uncertainty and magnitude over decades, require an adaptive management approach to both risk assessment and implementation planning. These environmental factors include, but are not limited to:

- The **increasing probability of tropical events**, and their changing intensities and patterns, owing to climate-induced changes in the jet stream, Gulf of Mexico water temperatures, and other factors;
- The **increasing intensity and frequency of precipitation events** and the associated challenge of managing higher volumes of stormwater in shorter time periods with less advance notice;
- The growing impacts of **eustatic and relative sea level rise** in our dynamic coastal environment;
- The **increasingly dynamic river levels** in the Mississippi and its tributaries and distributaries, impacting flood control and influenced by upriver conditions;
- The complex challenges of **groundwater management**, including salinity and subsidence, and its associated infrastructure maintenance and operations costs.

Environmental factors are but one external challenge to the stormwater system. The city faces demographic and economic challenges: population growth has plateaued since the post-Katrina repopulation without ever reaching pre-Katrina heights, much less the city's population peak of the 1960s. Similarly, the city's economy is no longer rapidly growing, either in new business formations, business receipts, or wage growth. In short, New Orleans does not face growth pressures seen or experienced in other U.S. cities. SWBNO's funding model is predicated on growth: the utility's services are funded by ratepayers and by property tax millages, as well as bonds backed by those collections. Thus, the city's low overall growth weakens the utility's ability to fund operations, maintenance, and capital improvements. New Orleans lacks a parcel fee for drainage, a funding mechanism common across the country, that brings new revenue into the system from properties that otherwise may be exempt from ad valorem tax collections.

The main source of infrastructure funding in New Orleans over the last 15 years has been post-disaster appropriations from FEMA and HUD. The \$2B FEMA settlement for Katrina-related damage to New Orleans roads and subsurface infrastructure, including a \$1.2B lump sum, offers a one-time opportunity to



improve aging infrastructure and extend its useful life. New Orleans cannot, however, depend upon disasters and related federal appropriations to make the system whole. That is a losing battle, as federal post-disaster appropriations are decreasing relative to disaster impacts.

## INTERNAL CHALLENGES

In the face of these external risks to the system, there are also considerable internal challenges to overcome. The drainage system's age, condition, and maintenance are acute challenges. Reliance on internal power generation from the Carrollton Power Plant has impacted the depth and duration of stormwater during flood events over the last several years. Maintaining the operating condition of subsurface and conveyance infrastructure—including pipes, culverts, catch basins, and canals—to meet the adequate level of service presents its own challenge for the agency, as well as for the city's Department of Public Works (DPW).

These internal challenges are compounded by the utility's governance structures. SWBNO is a political subdivision established by state law, but it does not maintain the entire conveyance system. Much of the physical system is under the purview of DPW. The Mayor serves as the chair of the board, and the board's composition is determined by Louisiana state law. A recent Task Force was put in place by 2018 Louisiana House Resolution 193 to develop findings and recommendations regarding the best management options for SWBNO's service lines. This Task Force determined that while wholesale changes to system governance would be more disruptive than beneficial, several short- to medium-term efforts could greatly improve the system. Many of these are underway, including developing system master plans and establishing a citizen advisory committee. Others, like consolidating management of the drainage system under SWBNO (removing responsibility from DPW), have not yet occurred. The Task Force also recommended that, in the long term, the Legislature initiate a study of the state and local responsibilities, statutes, and codes related to governance of the agency, so that these questions can be revisited.

Another key internal challenge for the agency is maintaining staffing levels while many skilled workers are nearing retirement. Civil Service Commission rules, established to protect city workers from political interference, have hampered hiring efforts at SWBNO, leaving the agency understaffed. Additionally, while employees are adept at managing the intricate details of the drainage system, morale has been a concern since the 2017 floods, and their working conditions should be a consideration in this planning process.

Finally, the drainage system faces the challenge of managing both chronic and acute risks. Chronic risk arises from deferred maintenance, aging system components, insufficient drainage capacity, power generation, and other ongoing issues that impact daily or frequent operations. Acute risk, for instance peak rainfall from a tropical event, exacerbates chronic risk and associated service delivery limitations and also weakens public and stakeholder confidence in the system and SWBNO's ability to manage both types of risk.

These external and internal challenges must be contextualized in the public understanding of the system. Adaptation is a community challenge and it requires community participation informed by a common, shared understanding of risks and the costs of mitigation. A successful strategic planning process can and will develop a long-term shared understanding and commitment to adaptation.



## RECOMMENDED APPROACH TO INTEGRATED, LONG-RANGE PLANNING

The city’s resilience strategy, *Resilient New Orleans*, and the *Greater New Orleans Urban Water Plan* set a long-term aspirational vision for the future of New Orleans—a city that lives with water, adapts to thrive, connects to opportunity, and transforms city systems. New Orleans must adapt its stormwater management approaches and systems for the city to have a long-term future. The “future without action” scenario is no future at all.

A creative planning process is required to address the increasingly complex challenges noted above and develop a path forward for stormwater management and drainage in New Orleans that enables the city to achieve a more resilient future. We believe the following five components are central to this process:

### 1. Interdisciplinary planning

To properly address the complex and interrelated drainage and stormwater challenges, SWBNO’s planning process must be more than an engineering exercise. Successful stormwater adaptation that aligns with the aspirational visions of other city strategies like *Resilient New Orleans* must involve the adaptation of the city’s infrastructure (upgrading the drainage system and augmenting with nature-based solutions) and how New Orleanians live in this changing environment. It is likely to also require the transformation of governance structures, practices, policies, and procedures.

To be successful, this process should engage a wide range of technical experts in engineering, physical sciences, social sciences, design, planning, policy, and finance in a deeply collaborative effort. It will also be critical to engage key city departments, local and federal agencies, and neighboring jurisdictions—such as DPW, NORA, SLFPA, USACE, and Jefferson Parish—that have a role in aligning efforts and ultimately implementing the plan. This process should use an interdisciplinary planning approach, in collaboration with technical experts, public sector agencies, key local stakeholders, and the public.

Public involvement in determining the scope and shape of the drainage system is essential for creating the support, agency, and funding necessary for sustainable water management. New Orleans, like many other cities, confronts a journey through unknown climate risks in the coming decades, and it is almost certain that these risks will increase over time. SWBNO, along with its planning partners, stakeholders, and customers who will experience these changes, can engage on a deeper level that builds stewardship, care, and trust. Moreover, a successful, adaptively managed engagement process can serve as a model for other US cities confronting similar challenges.

### 2. Grounded in a science-based and transparent understanding of risk

The foundation of this trust is a shared understanding of risk. The Institute offers extensive experience in profiling and communicating risk—developing accurate depictions of what living in New Orleans will look like in 10, 20, 30 years or more, given internal and external challenges. This risk assessment must be a central focus of any long-range planning process to enable SWBNO, in partnership with the public, to properly frame and communicate the problem. For example, through this process, we may find that residents will accept a certain number of flooding events per year that limit transportation on the road network, but they may not accept repeated flooding over a certain depth that impacts buildings, vehicles, access, ingress, egress, and critical infrastructure reliability.

The Institute has developed several methods to increase community buy-in and ground truth the risk assessment developed as part of this planning process. The first, called participatory modeling, involves





establishing competency groups containing technical researchers and community members to co-conduct an analysis and evaluation of a set of potential mitigation projects. The Institute has done this with CPRA to investigate the benefits of different coastal restoration project typologies and locations. The second, called spatial video geonarratives, is used by the Institute’s Human Dimensions team to collect traditional ecological knowledge that is integrated with spatial analysis to inform planning and project development. Spatial video geonarratives are environmentally cued interviews conducted with residents using GPS-enabled video cameras during community site tours. The data is transcribed and coded to identify common themes. GPS coordinates retrieved from the video cameras are mapped and paired with the transcripts created from the audio. The final products are geospatial datasets and a series of locally-informed maps that reveal otherwise unknown and often surprising, useful patterns of community risks and resources for resilience and adaptation.

### 3. Aspirational yet pragmatic vision shared between SWBNO and its customers

Central to this stormwater adaptation planning process must be an agreement between the utility and its customers on the level of service SWBNO can provide over the long-term future, within the context of increasing and uncertain risk. Design professionals can play an important role in translating what alternative scenarios may mean for how New Orleanians can adapt to the uncertain future. A collaborative design process, as part of an overall planning approach, can lead to a suite of creative and comprehensive solutions and help to develop a shared long-term vision for how the city manages its stormwater—one that is aspirational yet grounded in a common understanding of risks and constraints.

### 4. Structured process for consensus building and decision making

Long-range planning for New Orleans’ stormwater and drainage system will be iterative. It will require navigating competing interests and priorities, encouraging the public to weigh in on alternatives and tradeoffs, managing expectations, building consensus, and making difficult decisions about future investments. The Institute has supported other public sector partners in navigating complex decision-making processes using a structured decision making (SDM) approach that integrates scientific data and engineering expertise with real-world constraints. We believe this will prove valuable as an overall framework or component of a long-range stormwater adaptation planning process.

SDM follows the following process (PrOACT):

- **Defining the Problem**

The process begins with clearly defining the problem and developing measurable fundamental objectives that reflect the vision of SWBNO and the community for where they want to be in 50 years. In a stormwater context, neighborhood residents saying, for example, that their property values are impacted by repeated flooding is not the same problem as residents not being able to get to work on time. To correctly prioritize the approaches and investments needed for a long-range plan, problem identification and agreement is key.

- **Determine the Objectives**

The fundamental objectives follow the problem: quantitative metrics for the vision of New Orleans over the 50-year horizon. Again, in a stormwater context, these could be related to depth, duration, and frequency of flooding events, but also could include geographic disparities. This problem and objectives scoping incorporates the future vision of New Orleans so that consequences and tradeoffs can be measured against those fundamental objectives and whether that vision is being achieved.



- **Identify Alternatives**

Then, a realistic set of alternatives and creative solutions can be developed that forecast consequences that are quantitatively assessed against the fundamental objectives.

- **Evaluating alternatives and forecasting the Consequences**

This represents the bulk of the scientific and engineering investigation. The many components of assessing risk and uncertainty, including H&H modeling and other investigations, are structured into a dynamic model, showing a framework with inputs, models, and final outputs, metrics, or values. Rather than analyzing components separately, such as surface water, groundwater, sea level rise, tropical event probabilities, etc., this process dynamically links them that is more reflective of how these systems interact. The models can also be linked probabilistically for the consequence analysis.

- **Evaluating the Trade-offs**

Alternatives are quantitatively assessed against the objectives (themselves rooted in community values and management constraints). Where there is uncertainty, additional data can be sought out or incorporated into the modeling framework.

- **Making the decision and taking action**

This iterative process results in a negotiated shared vision for adaptation between the utility, stakeholders, and the public, balancing science, community values, and real-world constraints.

Institute staff are experts in both facilitating SDM processes and performing the back-end analyses of tradeoffs and optimization. SDM places science in the service of decisionmakers who must ensure that funding, policy, and regulatory constraints are considered. Decisionmakers can co-develop these objectives with the community such that community values are reflected. This structured process is collaborative and transparent, and in which alternatives, forecasted consequences, and tradeoffs are measured against the agreed-upon objectives.

## 5. Committed partners who share in the vision

A long-term stormwater adaptation plan for New Orleans will require action beyond SWBNO authority and responsibility. This process will benefit from closely involving partners who will have supporting roles to advance implementation of the plan. These partnerships should be based in trust, shared understanding, and common goals. The Institute is committed to New Orleans. Working collaboratively across disciplines and with partners to help the city thoughtfully prepare for an uncertain future is central to our mission, and we look forward to being long-term partners in this effort.

This approach holds tremendous promise, making space for the scientific investigations that must underpin this process while giving SWBNO customers a clear way to be heard, participate, share their knowledge and have their experiences validated. In New Orleans, water management cannot be talked about in the abstract, since nearly everyone who lives here has experienced flooding of their home, car, workplace, neighborhood, or journey. The misinformation and confusion surrounding flooding events of the last several years has led to a widespread frustration that solutions are impossible. We reject that premise and the SWBNO planning process must too. While some amount of flooding will occur in perpetuity, this long-range planning process must prioritize open and transparent communication with the public—not just so they can be consulted, but so that they can have the confidence and the power to adaptively manage their future life in the city.