



IMPACT AND INNOVATION FROM THE DELTA

NAS Marine Board



Mississippi River Watershed

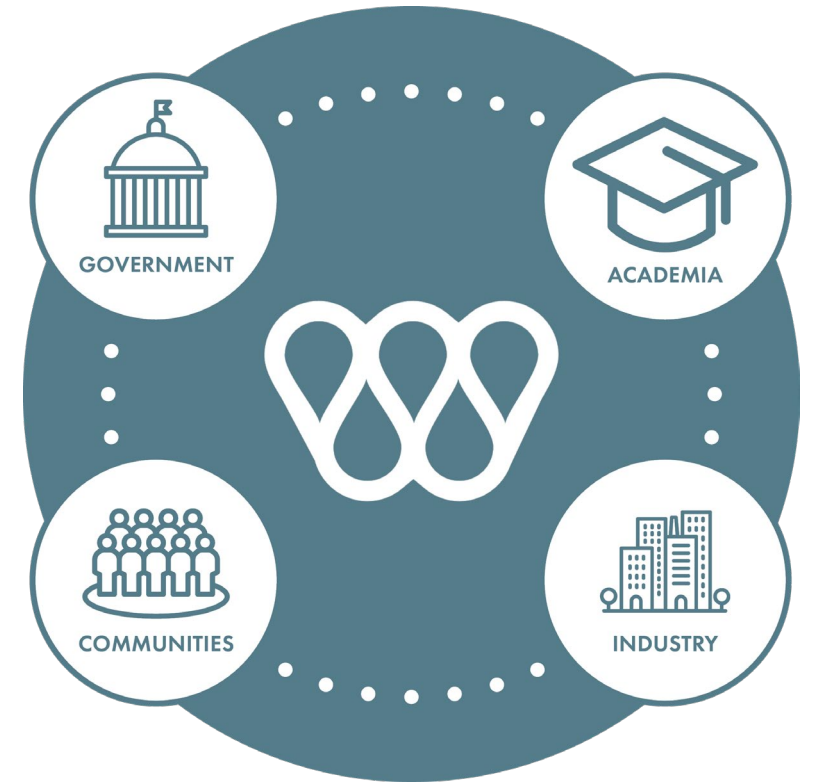
Gulf of Mexico
Watershed

INNOVATION FLOWS THROUGH
LOUISIANA

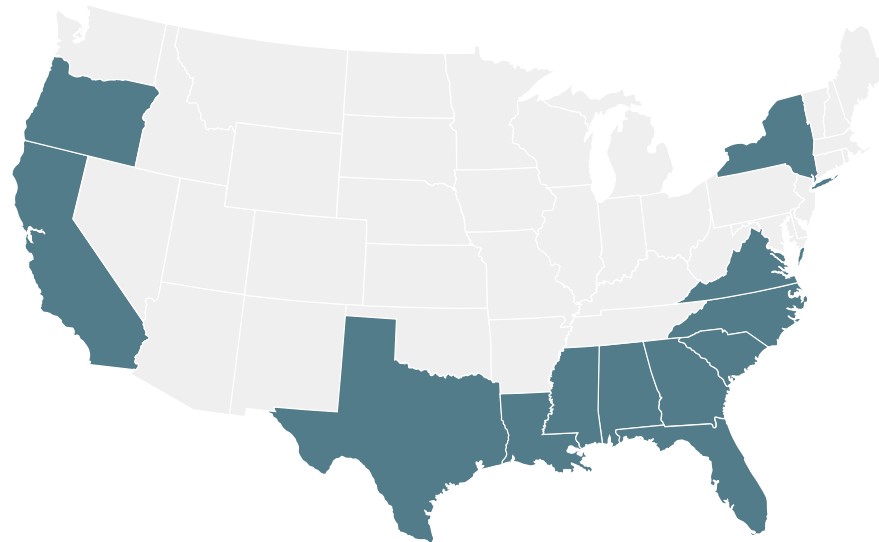
IMPACT

Providing the best available science and decision-making support to address some of the most pressing challenges facing Louisiana and other similarly situated communities

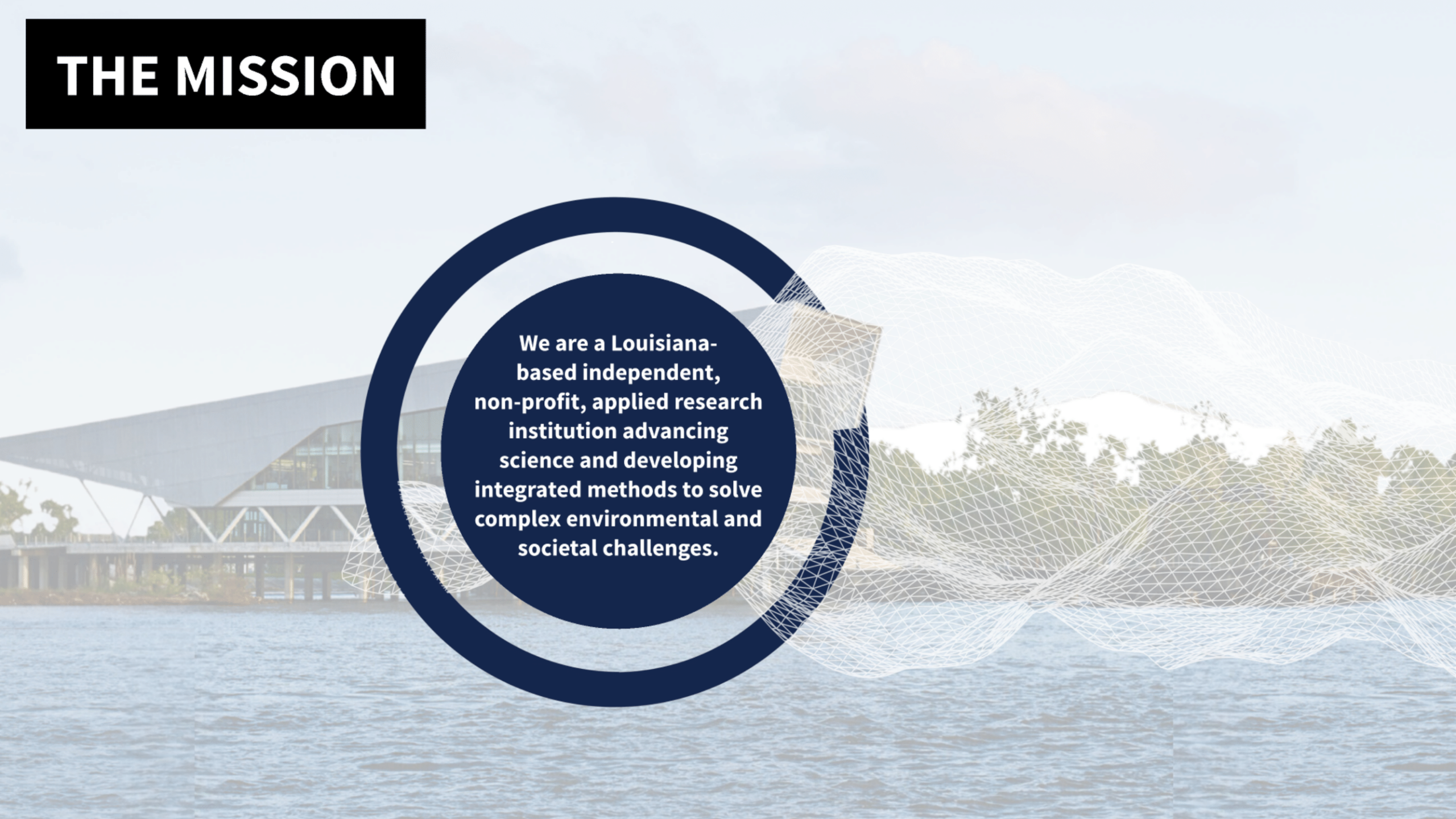
PARTNERS AND COLLABORATORS



WHERE WE WORK



THE MISSION

The background of the slide features a photograph of a modern, low-rise building with a dark, angular roof and large glass windows, situated on a waterfront. The building is partially obscured by a large, dark blue circular graphic element. Overlaid on the right side of the image is a white, semi-transparent wireframe mesh that follows the contours of the building and the water, creating a technical or architectural aesthetic.

We are a Louisiana-based independent, non-profit, applied research institution advancing science and developing integrated methods to solve complex environmental and societal challenges.

THE MISSION + THE METHOD

SCIENCE

Solving complex societal and environmental challenges with transdisciplinary research

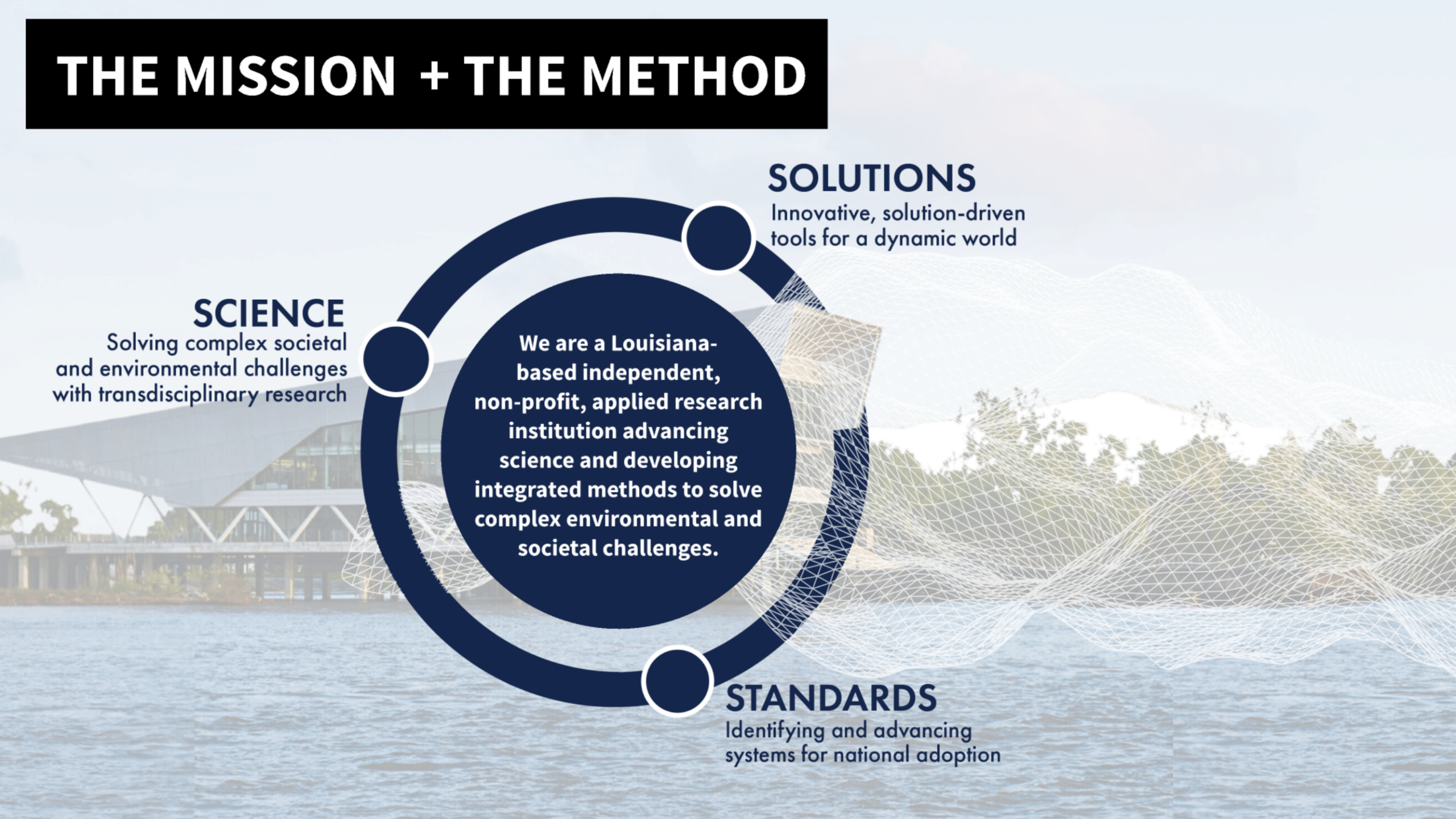
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SOLUTIONS

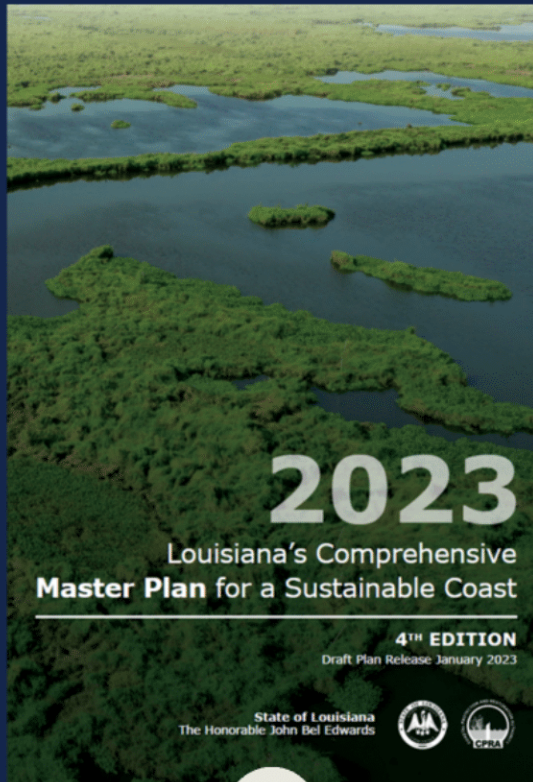
Innovative, solution-driven tools for a dynamic world

STANDARDS

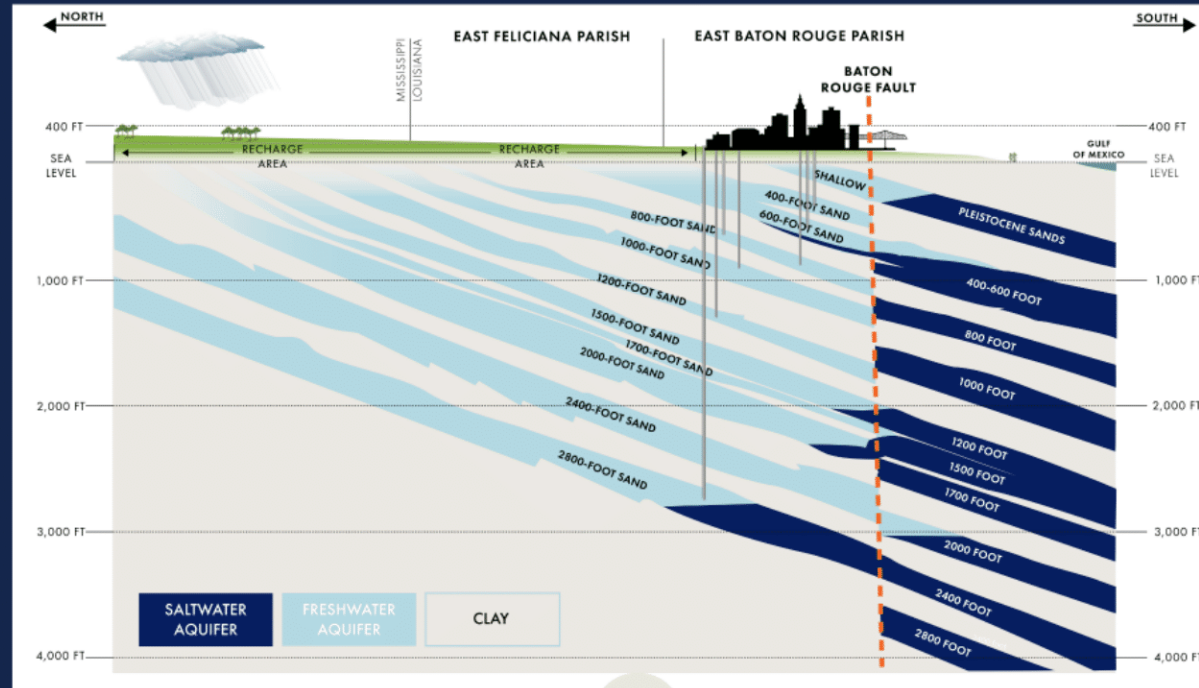
Identifying and advancing systems for national adoption



CUTTING EDGE AND DISRUPTIVE SCIENCE



COASTAL MASTER
PLANS



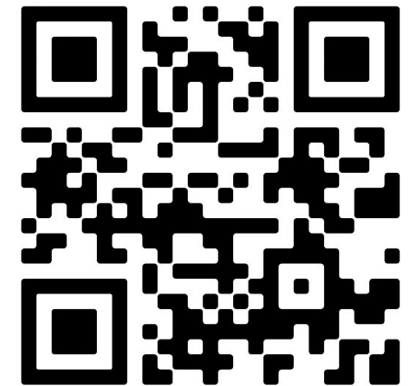
SOUTHERN HILLS
AQUIFER



LOWERMOST MISSISSIPPI
RIVER MANAGEMENT
PROGRAM

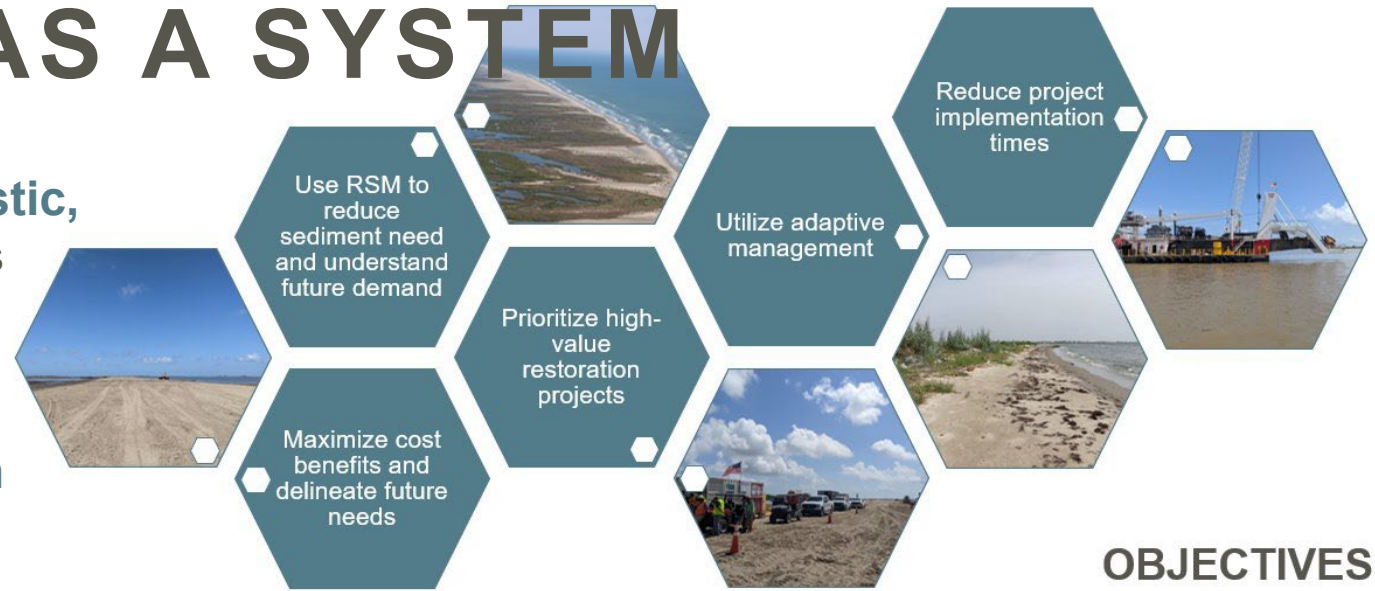
SAND IS THE CURRENCY OF A DELTA

- Growing national and international recognition of a growing “**sand crisis**” where there is simply not enough **supply** of raw material to meet the **demands** of society
- Largest challenge to success of the Coastal Master Plan is **finding enough sand and sediment that is economically viable**
- **New ways of managing sediment and coastal systems required. Business as usual completely unsustainable and breaking down**



BARRIER ISLANDS AS A SYSTEM

- TWI is working with CPRA to advance **holistic, innovative, portable** approaches and tools to **regional sediment management**
- BISM: A **system-wide approach** guiding when, where to place sediment to **maintain barrier island integrity**.
- Rather than complex models for individual island, start with the decision balancing multiple islands, borrow locations, objectives
-



THE MISSION + THE METHOD

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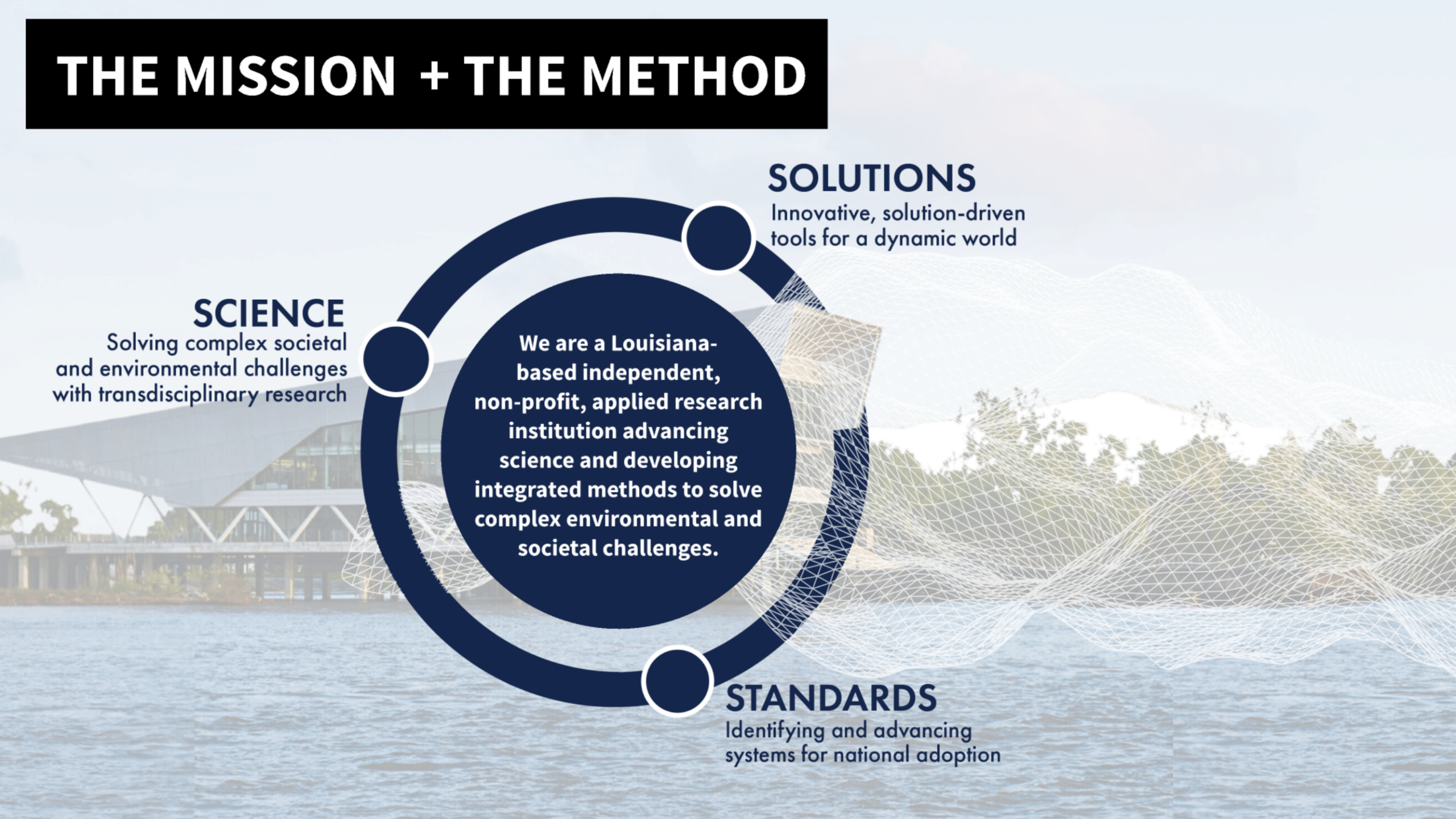
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SOLUTIONS

Innovative, solution-driven tools for a dynamic world

STANDARDS

Identifying and advancing systems for national adoption



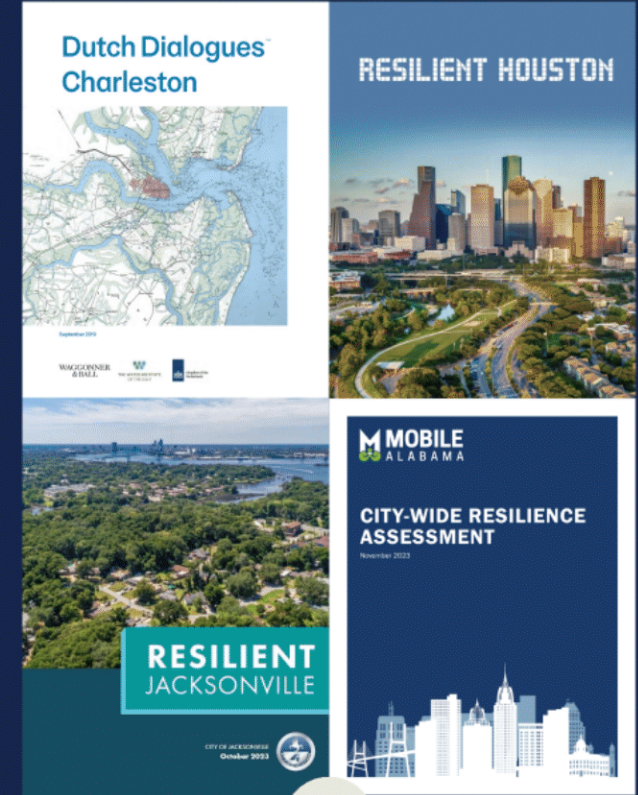
ADAPTABLE AND SCALABLE STANDARDS



COMPOUND FLOODING



COASTAL CARBON



RESILIENCY PLANS

THE MISSION + THE METHOD

SCIENCE

Solving complex societal and environmental challenges with transdisciplinary research

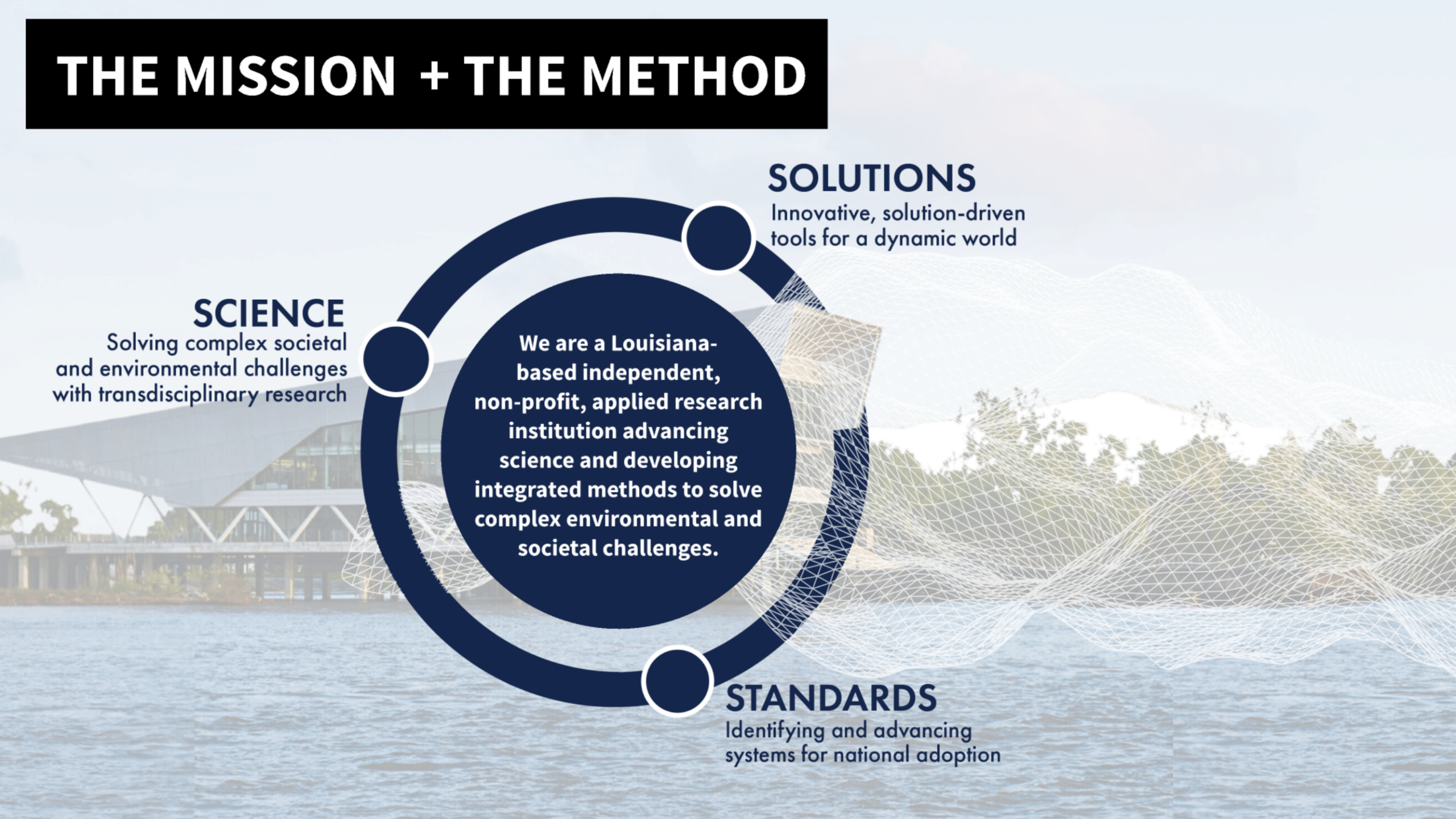
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SOLUTIONS

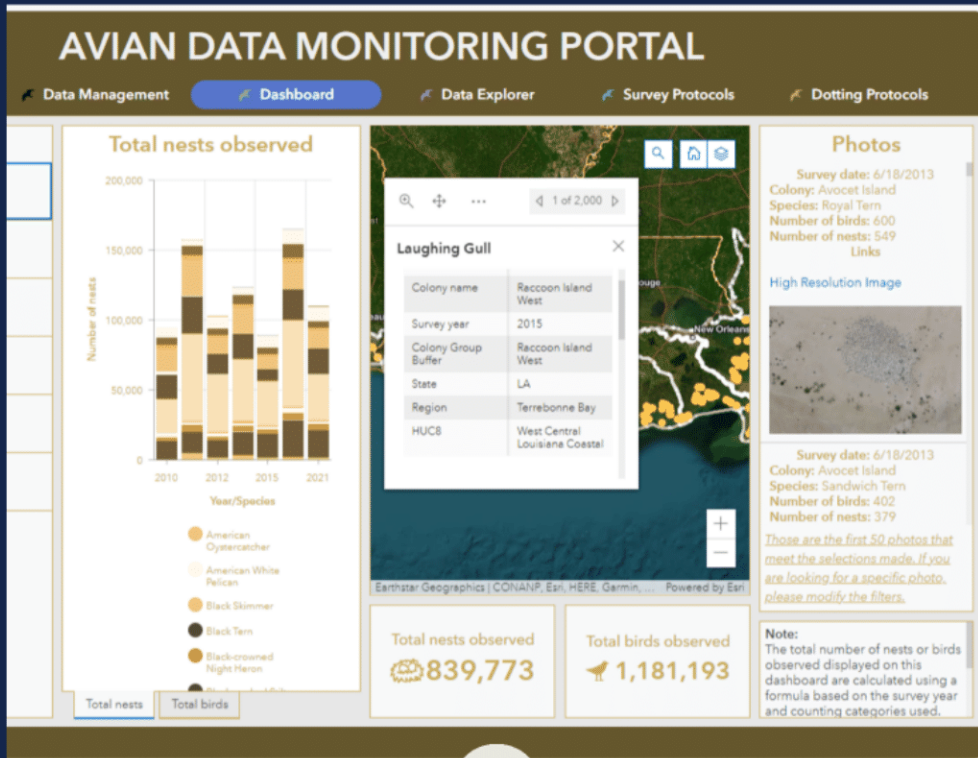
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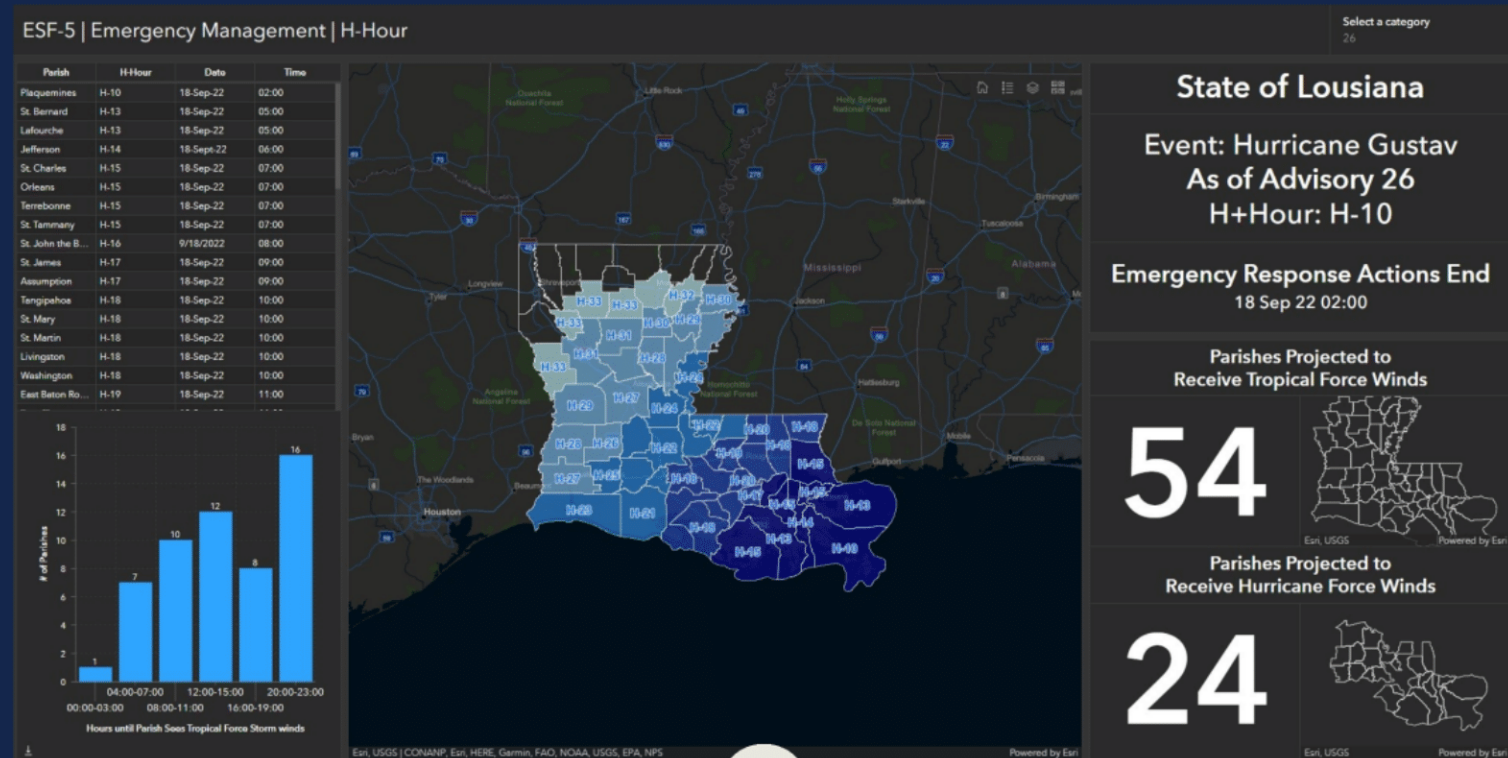
Identifying and advancing systems for national adoption



ACCESSIBLE AND REPLICABLE SOLUTIONS



AVIAN MONITORING



REAL TIME FORECASTING



THE WATER
INSTITUTE

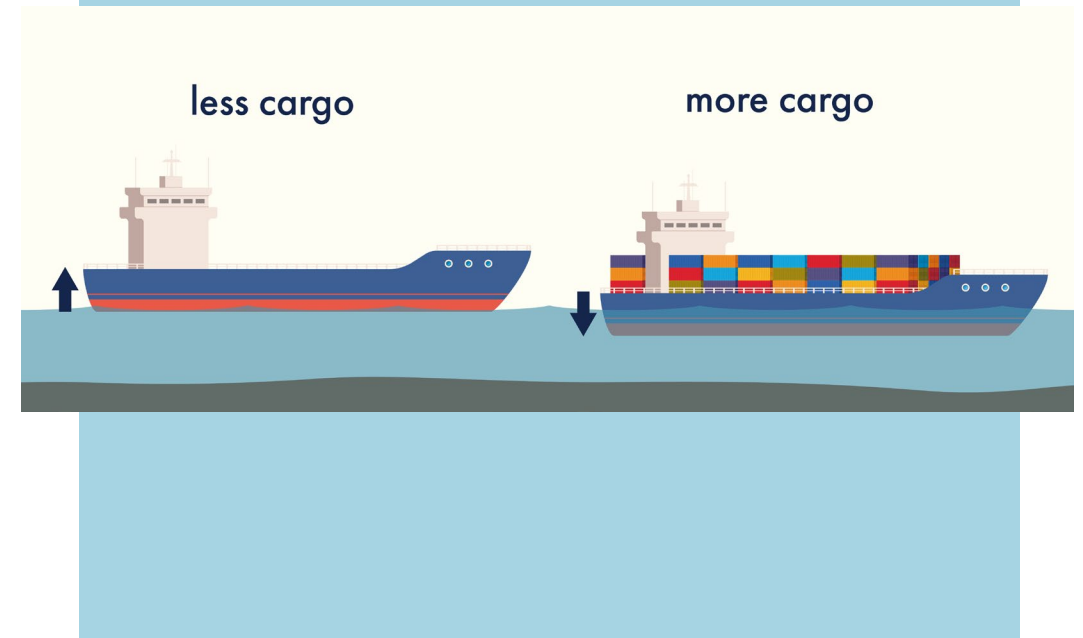
SMARTPORT & CROWDSOURCE BATHYMETRY UPDATE

MISS. RIVER ECONOMICS

- The five ports of the Lower MR comprise the largest port complex in the world.
- More than 500 million tons of cargo handled annually.
- More than 60% of nation's grain and 20% of petroleum and energy commodities are handled by Louisiana ports each year.

Ports Assoc. of Louisiana

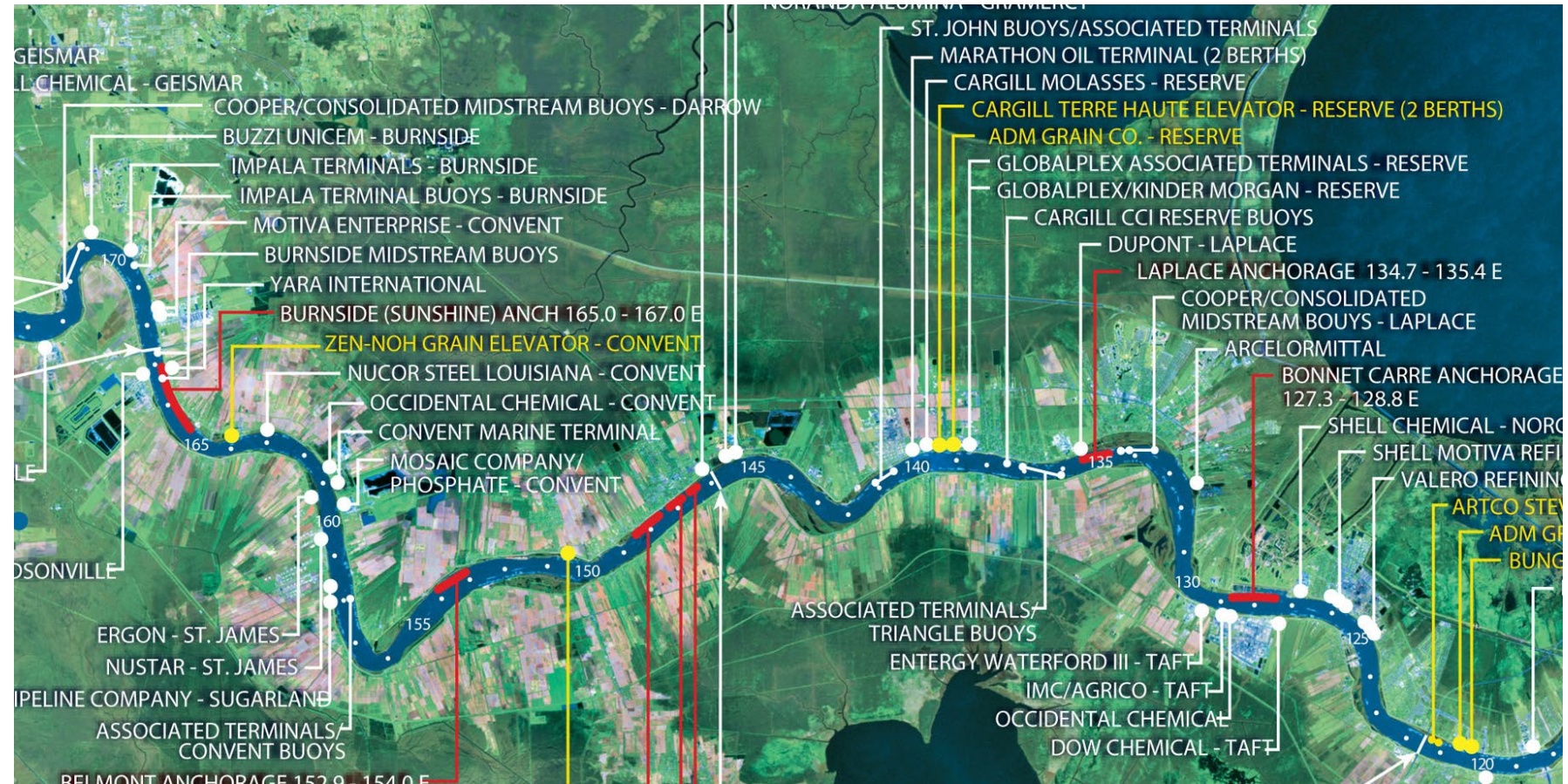
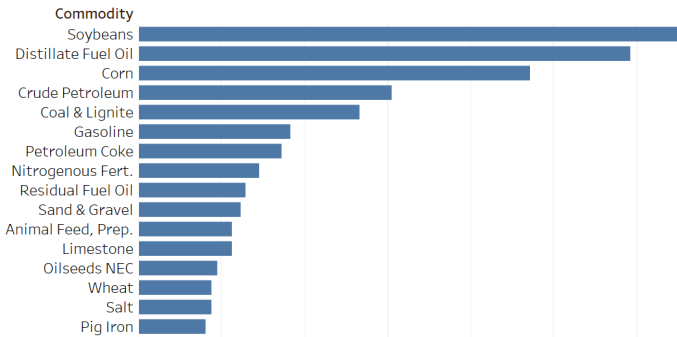
On a constantly changing river:
How much can we load onto our ships?



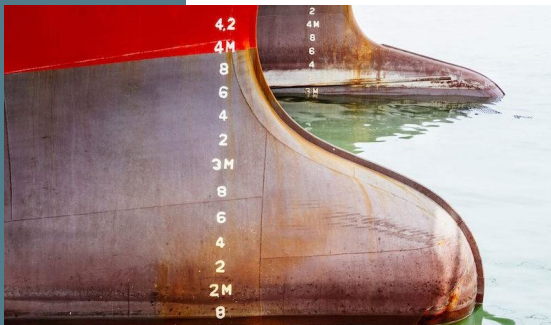
MISS. RIVER IS AN ECONOMIC SUPERHIGHWAY



Commodity Short Tons on the Mississippi River: 2019
(Minneapolis, MN to Mouth of Passes, LA)



CHALLENGES & IMPACTS



- Dynamic changes in water and sediment create a myriad of issues for the maritime industry, such as:
 - Air draft
 - Extreme high/low water
 - **Shoaling**
 - Increased Current Velocity
- Shoaling negatively impacts vessel scheduling, berthing, maneuvering, loading/unloading, and terminal project depth. All resulting in **supply chain disruption, increased costs, and diminished competitiveness for doing business on the River.**



PRESENT CIRCUMSTANCES

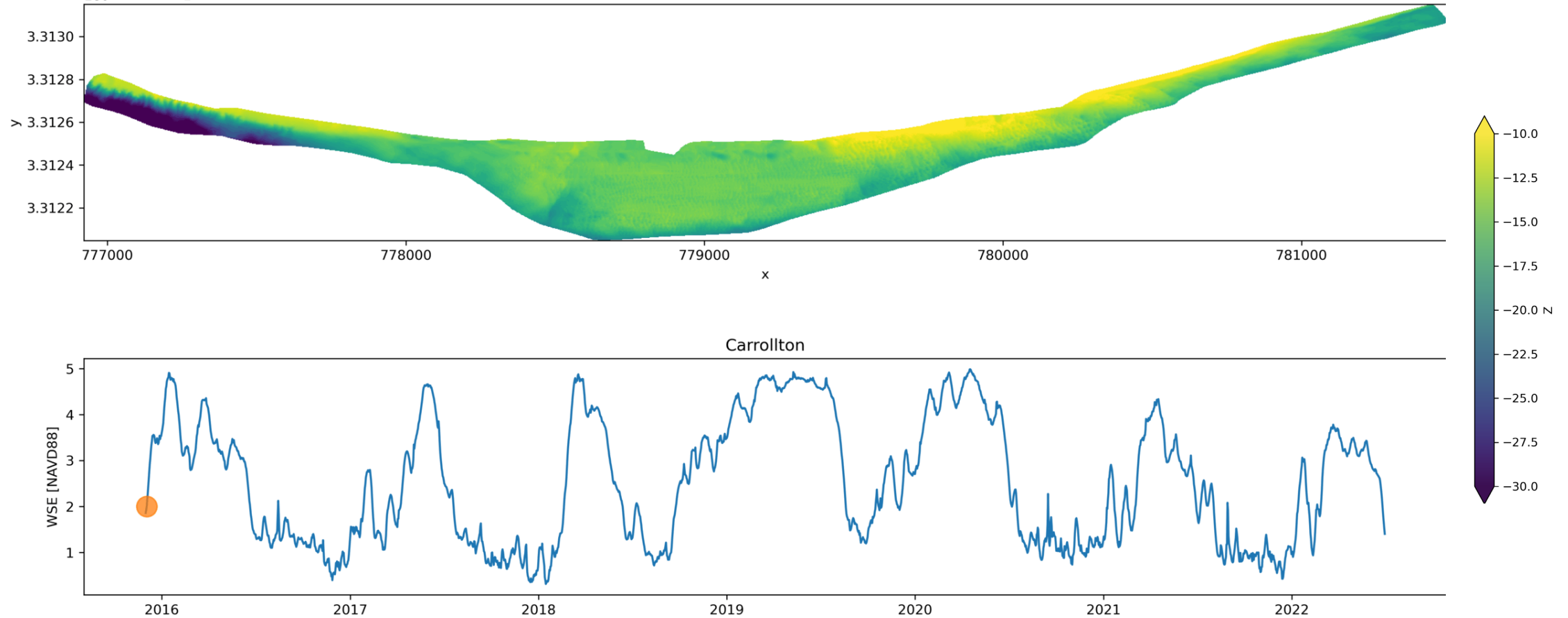
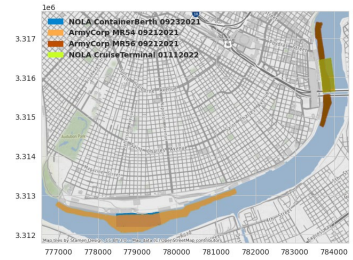


- Vessel calls are scheduled months in advance, often with inaccurate, outdated, or incomplete information about both current and future River conditions.
- Poor data results in conservative decision making (loading capacity), and often times, vessel omissions.
- Limited data results in responsive actions instead of proactive decisions.

CRITICAL ISSUE

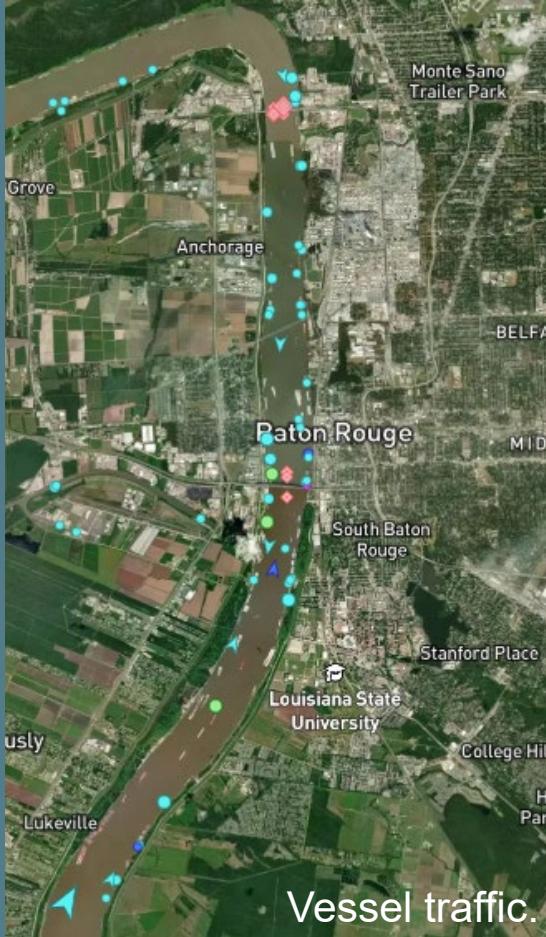
Water fluctuations influence **sediment dynamics**.

These relationships can be **learned, understood, and predicted.**





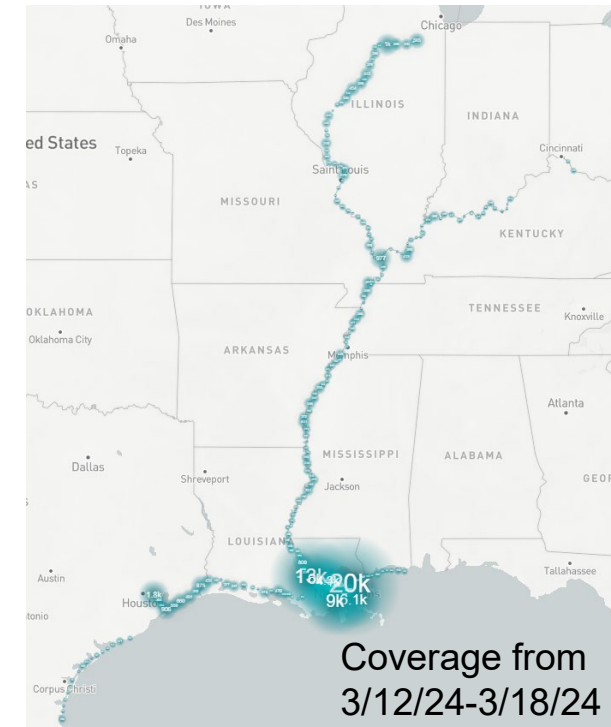
TECHNOLOGY + SCIENCE= SOLUTION



- A large fleet of vessels operate on the river daily, constantly collecting valuable data.
Crowdsourcing data provides virtually real-time information, which can be used for real-time decision making.
- Predictive models to **forecast draft conditions** can be developed utilizing this same data.

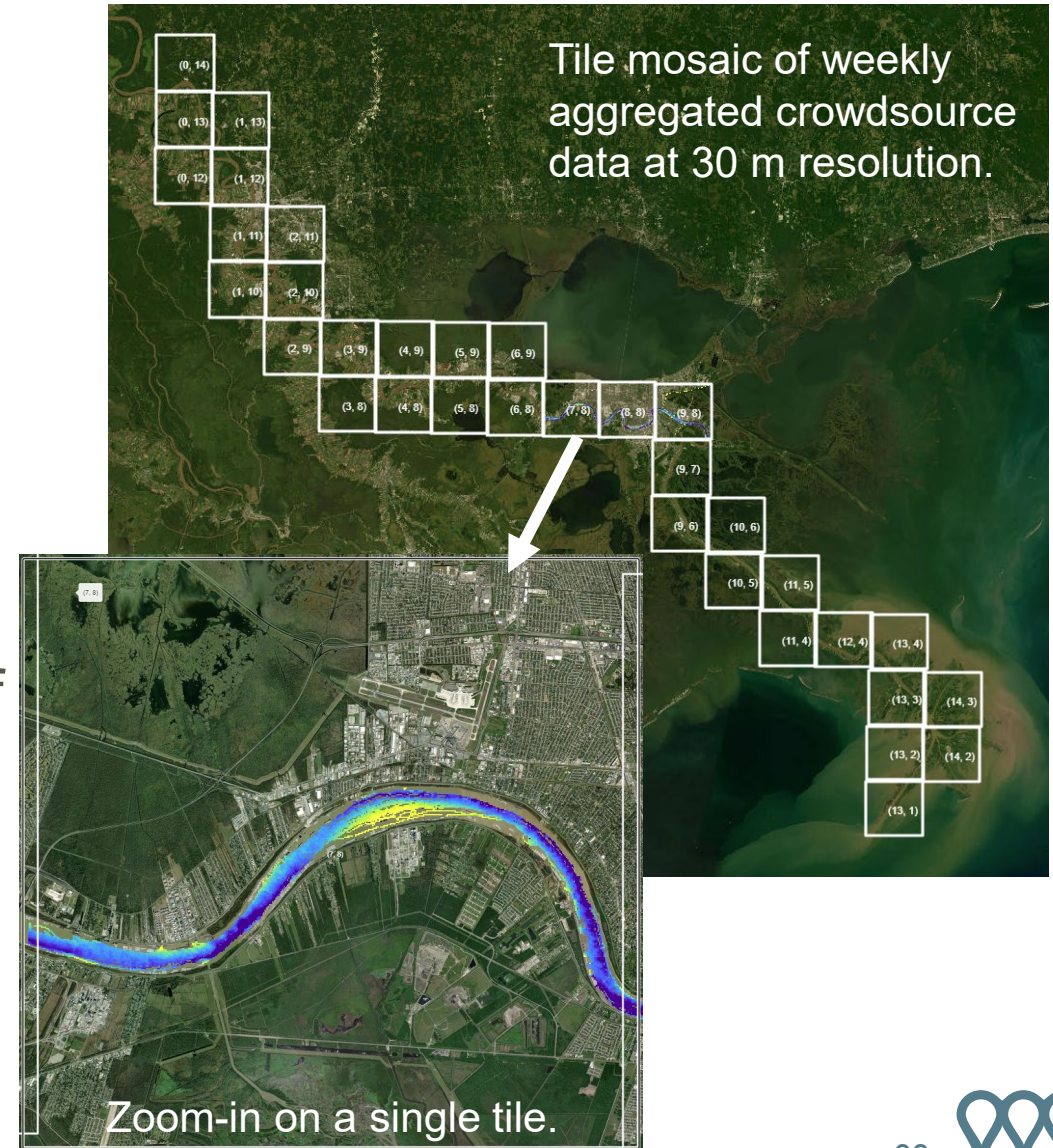
CROWDSOURCE PARTNERS

- Fleet of approximately 60 vessels.
- Data collection throughout Upper and Lower MR, GIWW, Ohio River, and Illinois River.
- Over 1 billion data points collected.



MAPPING THE RIVER- EVERYDAY

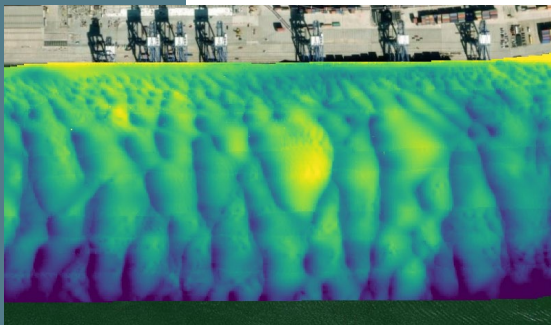
- Crowdsource data is collected, cleaned, and processed in near real-time to produce daily bathymetry.
- Significant channel coverage from Baton Rouge to Plaquemines.
- The result is a time-series of sequences to map the River and be used as model input.



DAILY BATHYMETRY



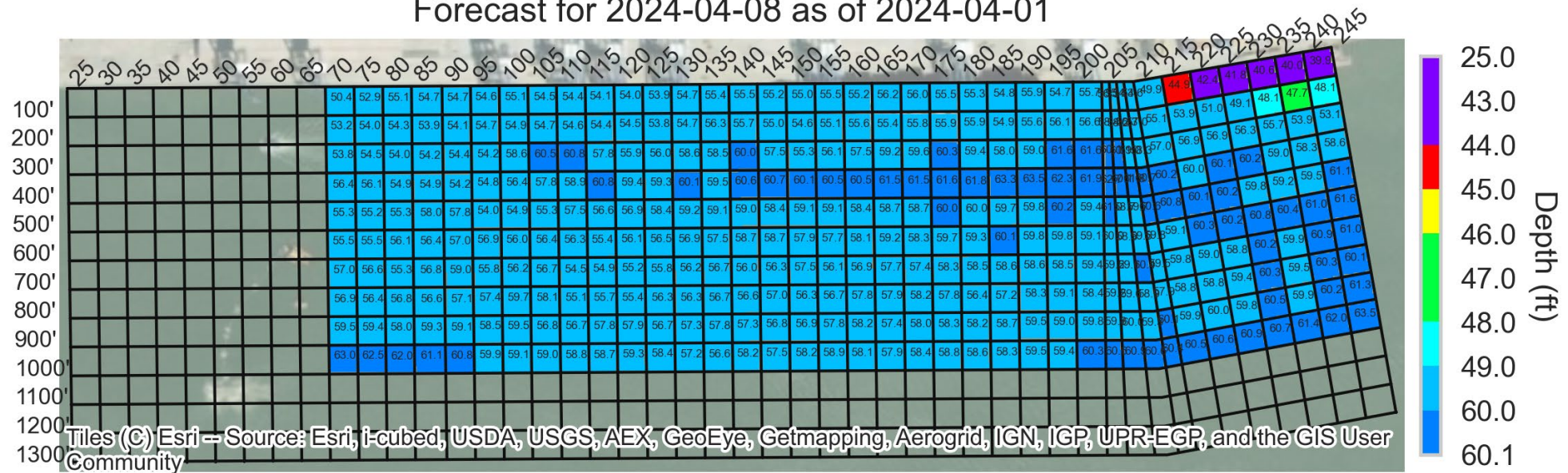
DRAFT & ELEVATION FORECASTS



- TWI crowdsource data is combined with a variety of datasets and used as inputs into machine learning (ML) models that can **forecast draft**.
- Models can be tailor fit to meet user requirements:
 - Forecast horizon (days, weeks, and months)
 - Spatial extent (berth, approaches, etc.) and resolution

BERTHING DEPT. 48 HR DRAFT FORECAST

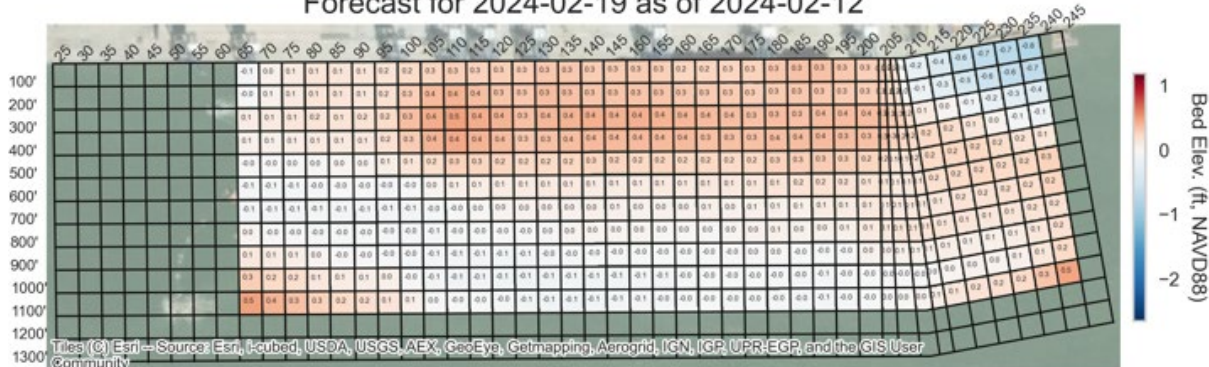
Forecast for 2024-04-08 as of 2024-04-01



ENGINEERING DEPT.

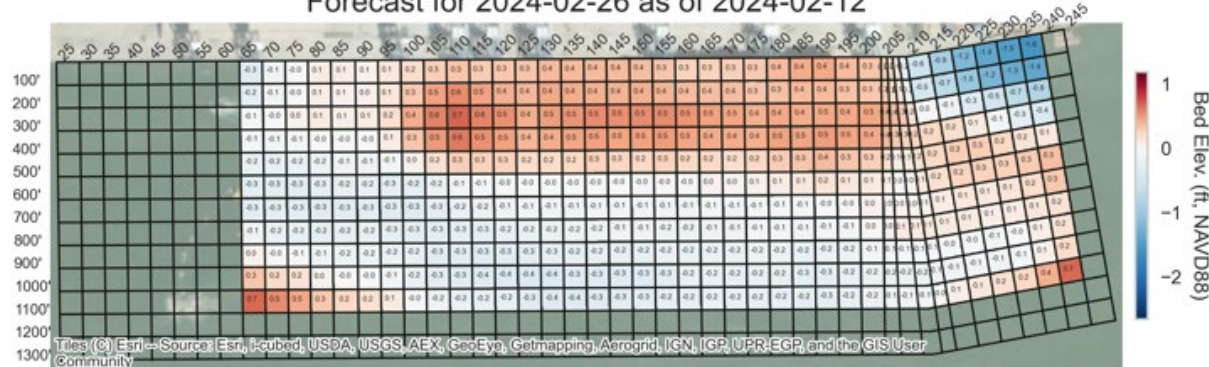
1 TO 4 WK ELEVATION CHANGE FORECASTS

Forecast for 2024-02-19 as of 2024-02-12



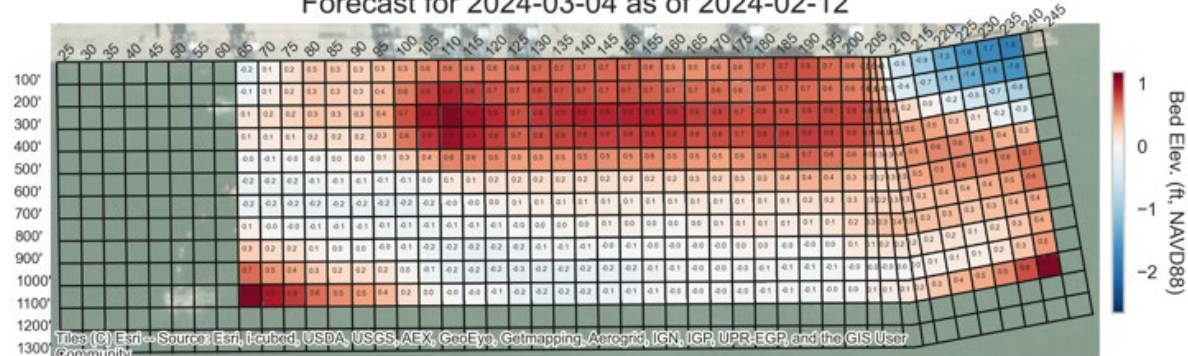
+ 1 week

Forecast for 2024-02-26 as of 2024-02-12



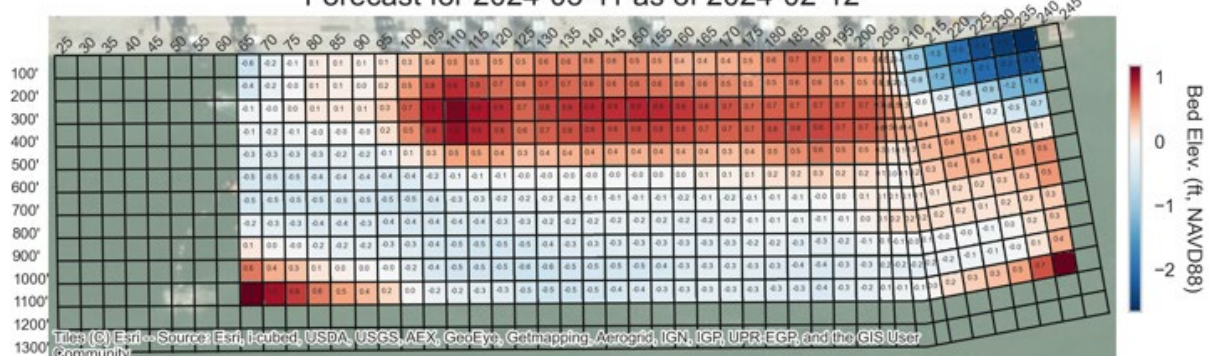
+ 2 week

Forecast for 2024-03-04 as of 2024-02-12



+ 3 week

Forecast for 2024-03-11 as of 2024-02-12



+ 4 week

Warm colors = Shoaling; Cool colors = Erosion.



BENEFITS



The knowledge of having near real-time and forecasted draft information has several benefits:

- Safety
- Proactive dredge scheduling.
- Informed vessel berthing.
- Increase cargo volume.
- Avoid dead freight and lightering.



THE WATER
INSTITUTE

THANK YOU

Baton Rouge

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