# REON/RGV

Innovative
Sustainable
Replicable
Extensible
Comprehensive

Andrew N.S. Ernest, Ph.D., P.E., BCEE, D.WRE
President & CEO

Ivan Santos Chavez, M.S.
Research Engineer

Rebeca Santos Chavez
Communications and Outreach Associate

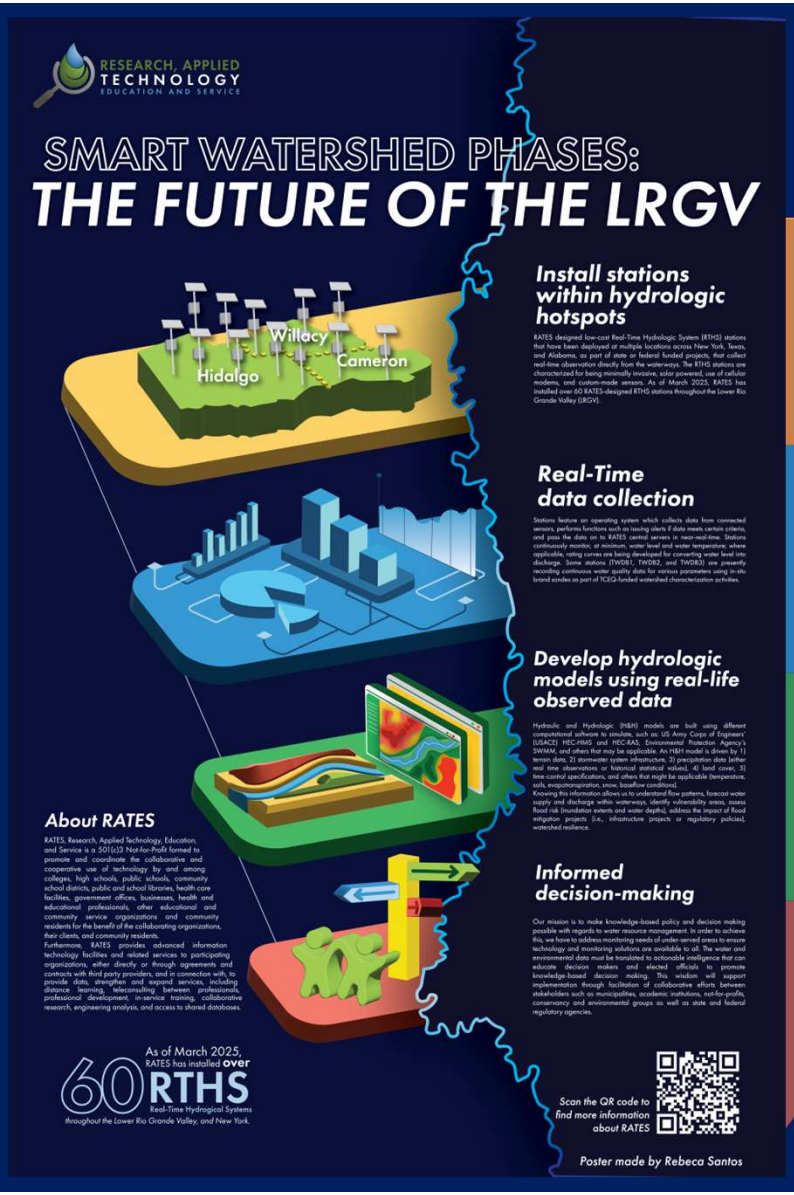
Rio Grande Valley Stormwater Management

RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE

# CONTENTS

- About Research, Applied Technology, Education, and Service (RATES, Inc)
- About River & Estuary Observation Network (REON)
- LRGV Flood Management
- REON/RGV Innovation in Practice:
  - Current
  - Pending
  - Planned
- Water Wizard

RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE




# A hydro-Informatics Centered Capacity Development Non-Profit Corporation

## DATA

Address monitoring needs of under-served areas to ensure technology and monitoring solutions are available to all.

## INFORMATION

Translate water & environmental data into actionable intelligence.

## KNOWLEDGE

Educate decision makers and elected officials to promote knowledge-based decision making.

## WISDOM

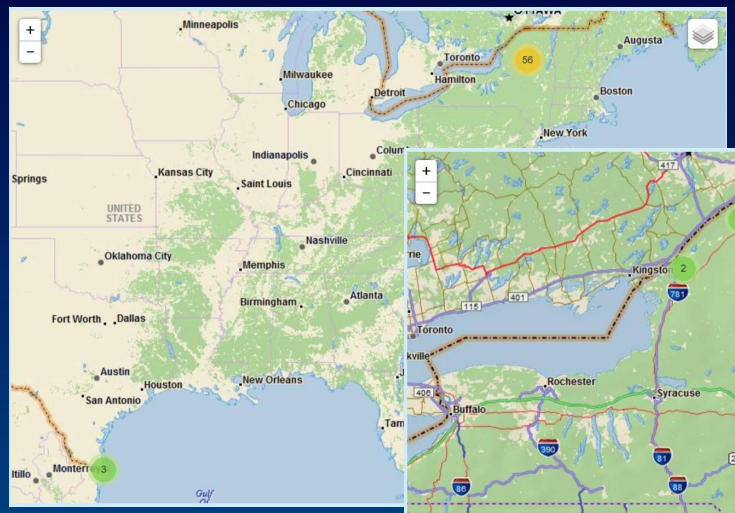
Support implementation through facilitation of collaborative efforts between stakeholders such as municipalities, academic institutions, not-for-profits, conservancy & environmental groups as well as state and federal regulatory agencies.


# RIVER & ESTUARY OBSERVATION NETWORK

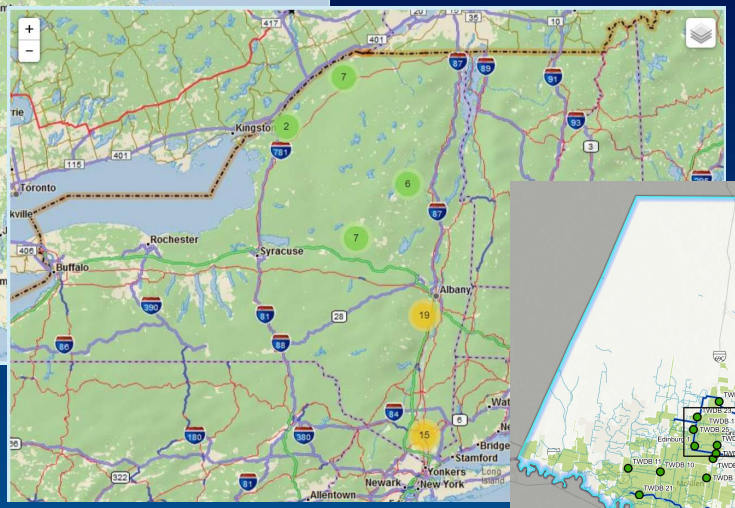
DEMOCRATIZING WATER INTELLIGENCE

THE RIVER AND ESTUARY OBSERVATION NETWORK IS A A COMMUNITY NETWORK OF REAL-TIME DATA PROVIDERS AND USERS COMMITTED TO THE PHILOSOPHY OF ENABLING LOCAL AND REGIONAL WATER RESOURCE MANAGEMENT THROUGH SHARING OF WATER DATA AND OPEN EXCHANGE OF WATER INFORMATION.

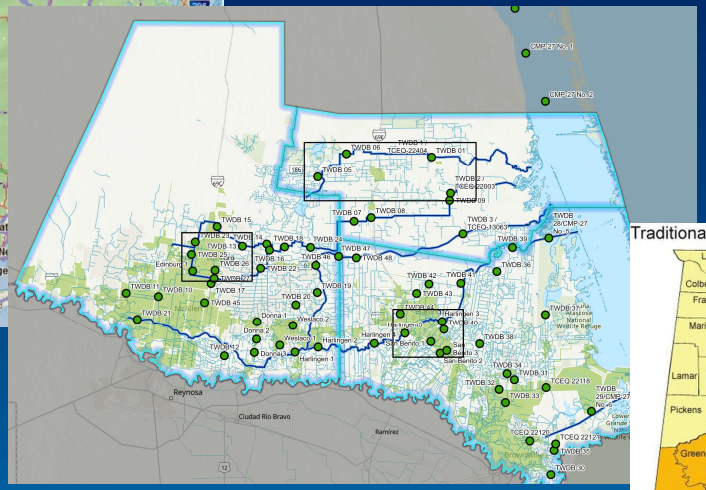
National: 138 (and counting)




New York (66)




South Texas (67)



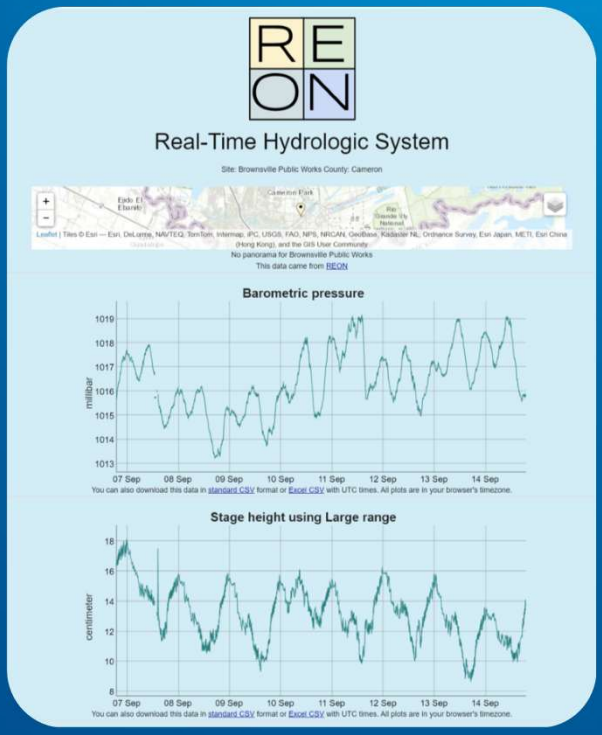

Alabama (5)


# The Growing REON

# REAL TIME HYDROLOGIC SYSTEM (RTHS) STATIONS

LOW COST, HIGH FIDELITY





# LRGV: REGIONAL FLOOD MANAGEMENT

## CONCEPTION & INSTANTIATION


Conceived by RATES & Stormwater Taskforce

Established Regional Watershed Coordinator

Established the Regional Water Resource Advisory Committee (RWRAC)

Counties Committed $1M Cost Share

LRGVDC Selected Fiscal Vehicle

RE ON

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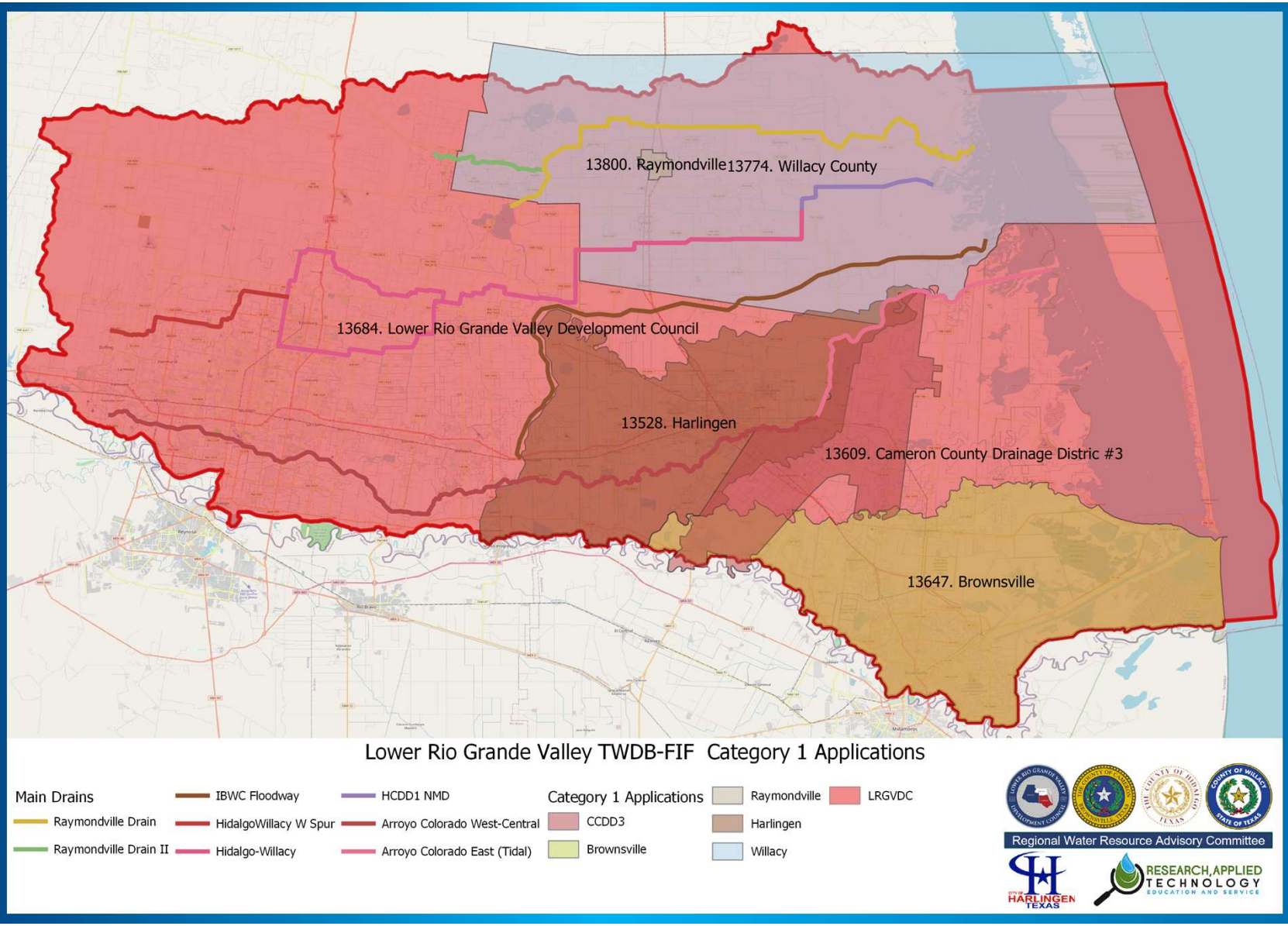
Photo courtesy of Cameron County Constable PCT 5

# TWDB FIF Cat 1 Projects

| | |
|---|---|
| Brownsville | $1.2M |
| CCDD#3 | $1.5M |
| Harlingen | $5.6M |
| LRGVDC | $7.9M |
| Raymondville | $400K |
| Willacy County | $1.6M |

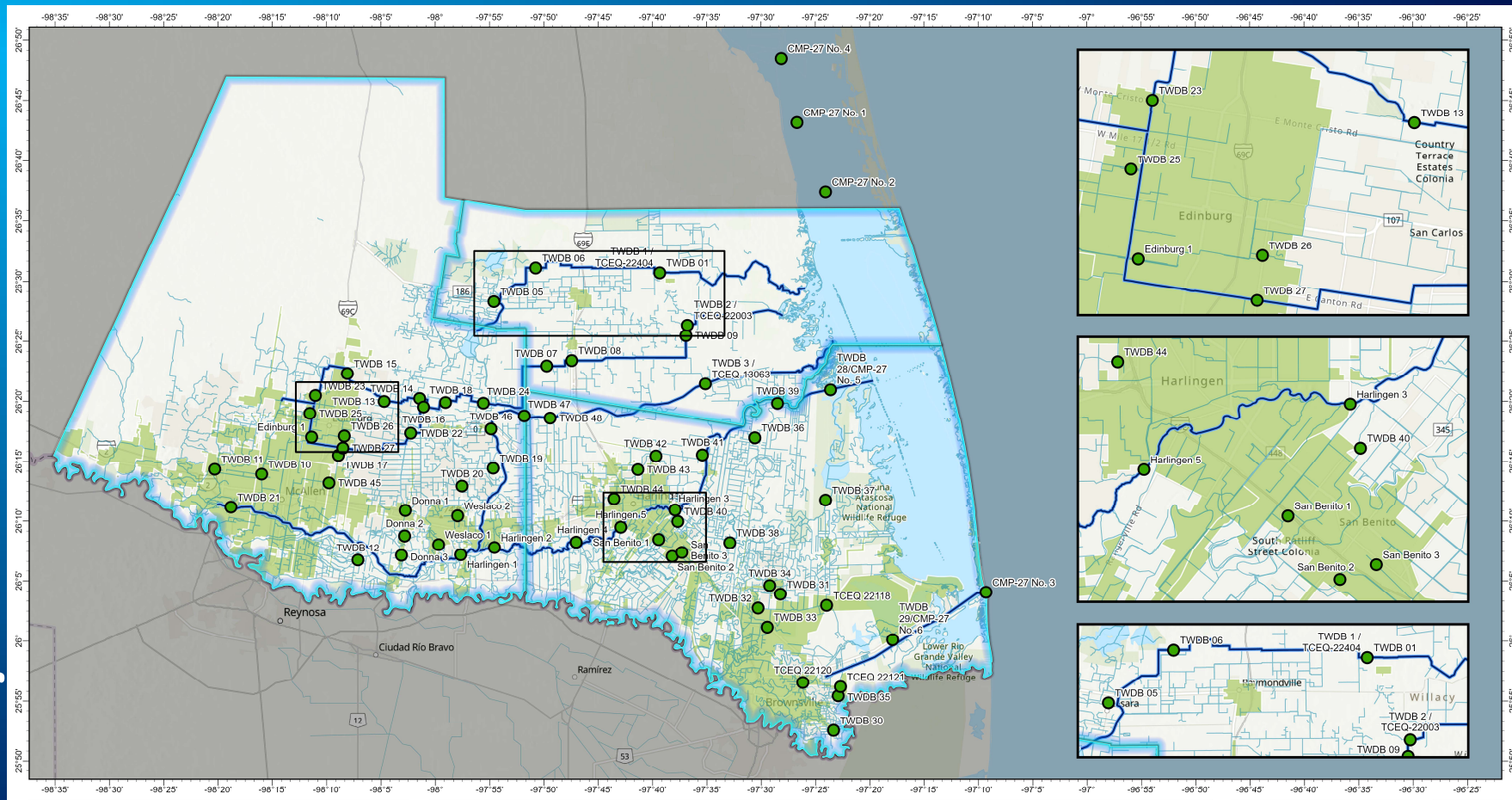


# LRGVDC FLOOD STUDY

- **RTHS**: 44 **R**eal **T**ime **H**ydrologic **S**tations
- **REON.cc**: **R**iver & **E**stuary **O**bservation **N**etwork **C**yber **C**ollaboratory
- **REON/WM**: **R**iver & **E**stuary **O**bservation **N**etwork **W**ater **M**odel
  - LRGV Regional Real Time Hydrologic Model
  - On-Demand Sub-Regional Hydraulic Models
  - Selected Urban Stormwater Models
- Coordination of Regional Projects
- Selected Feasibility Assessments
  - Cameron County
  - Hidalgo County

| Total | $8.9M |
|---|---|
| Grant | $7.9M |
| Cost-Share (Counties) | $1.0M |
| LRGVDC | $0.4M |
| RATES | $5.5M |
| Cameron County | $1.0M |
| Hidalgo County | $1.0M |

# REON/RGV




**TITLE:**
River and Estuary Observation Network (REON) Rio Grande Valley (RGV)

**PRODUCED BY:**
RESEARCH, APPLIED TECHNOLOGY EDUCATION AND SERVICE
Rio Grande Valley

**SYMBOLOGY**
- RTHS Stations
- Major Waterways
- Canals
- LRGV Counties
- LRGV Cities

**Real-Time Hydrologic System (RTHS) stations per project in the RGV**

TWDB FIF: 44 stations
TxGLO CMP-27: 6 stations
Harlingen/CSE: 5 stations
-TCEQ LLM/BSC : 3 stations
-TCEQ N&C II: 3 stations
-City of Donna: 3 stations
-City of San Benito: 3 stations
-City of Weslaco: 2 stations
-City of Edinburg: 1 station

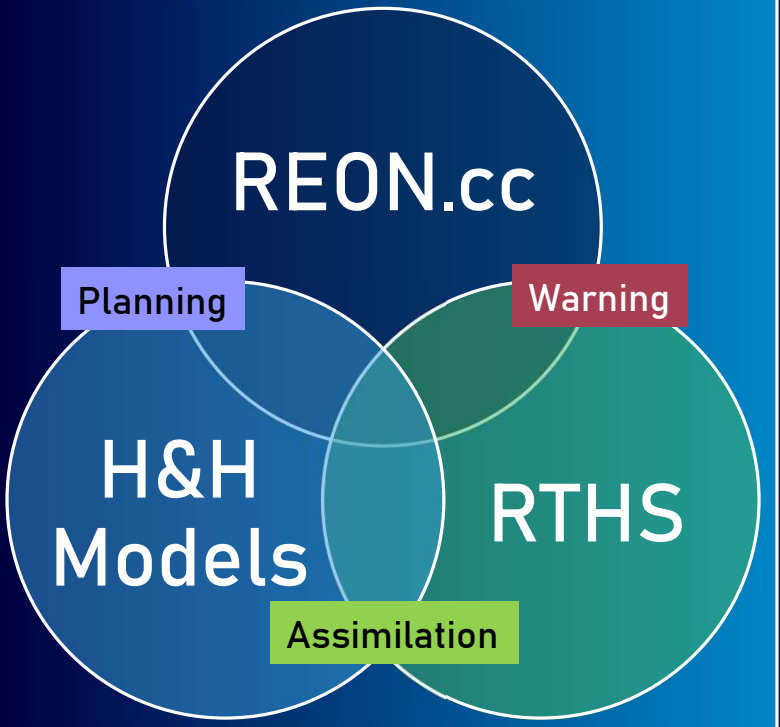
**GRAPHIC SCALE:**
0 3 6 12
Miles

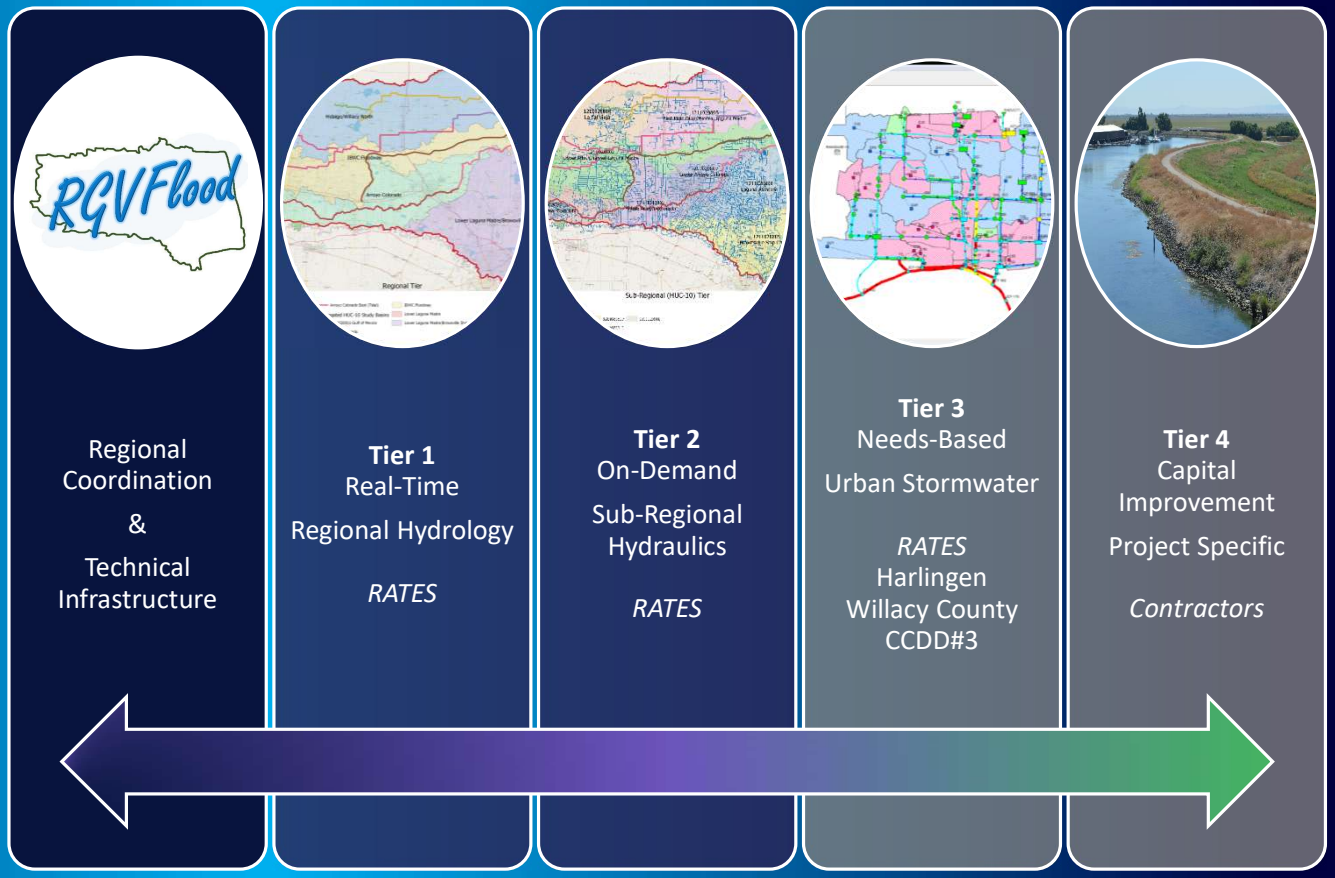
**SCALE:**
1 : 600,000

N

AE1

# Multi-Tiered Model Calibration & Validation

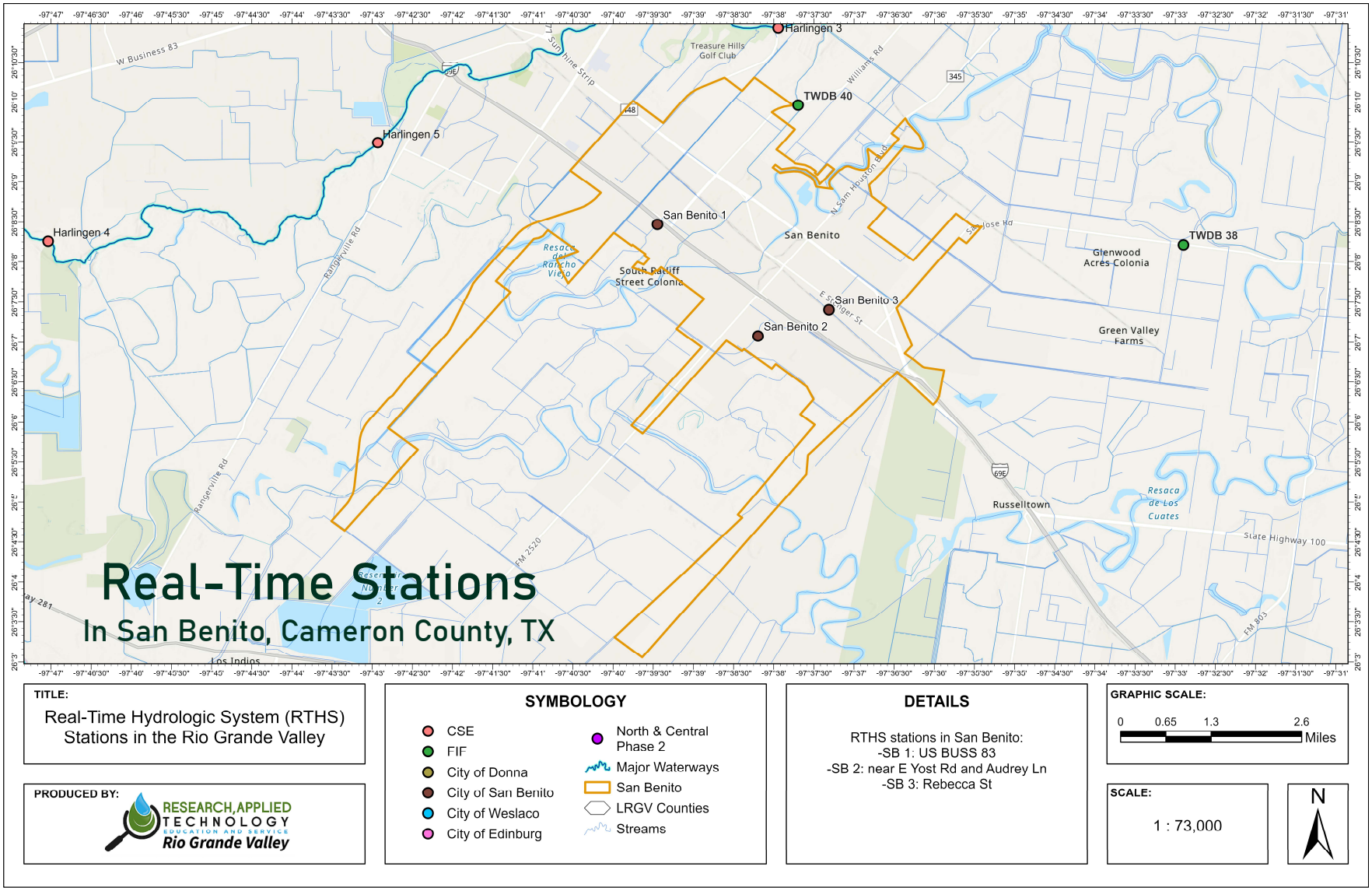


**Slide 11**

**AE1** [@Rebeca Santos] need a FEWS slide before tihis,  modeling on. The FEWS slide should demonstrate the unique value of our approach vs weather-based sirens
Andrew Ernest, 2026-04-12T16:42:02.370

**MRSC1 0** Sure! Can I get a few points of what is our unique proposition value?
Maria Rebeca Santos Chavez, 2026-04-12T23:41:10.413




**TITLE:**

Real-Time Hydrologic System (RTHS) Stations in the Rio Grande Valley

**PRODUCED BY:**

RESEARCH, APPLIED TECHNOLOGY EDUCATION AND SERVICE Rio Grande Valley

**SYMBOLOGY**

- CSE
- FIF
- City of Donna
- City of San Benito
- City of Weslaco
- City of Edinburg
- North & Central Phase 2
- Major Waterways
- San Benito
- LRGV Counties
- Streams

**DETAILS**

RTHS stations in San Benito:
-SB 1: US BUSS 83
-SB 2: near E Yost Rd and Audrey Ln
-SB 3: Rebecca St

**GRAPHIC SCALE:**

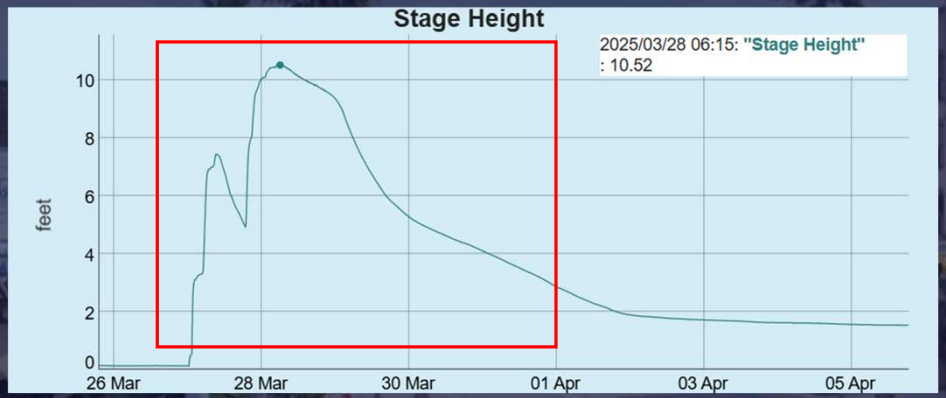
0 0.65 1.3 2.6 Miles

**SCALE:**

1 : 73,000

N

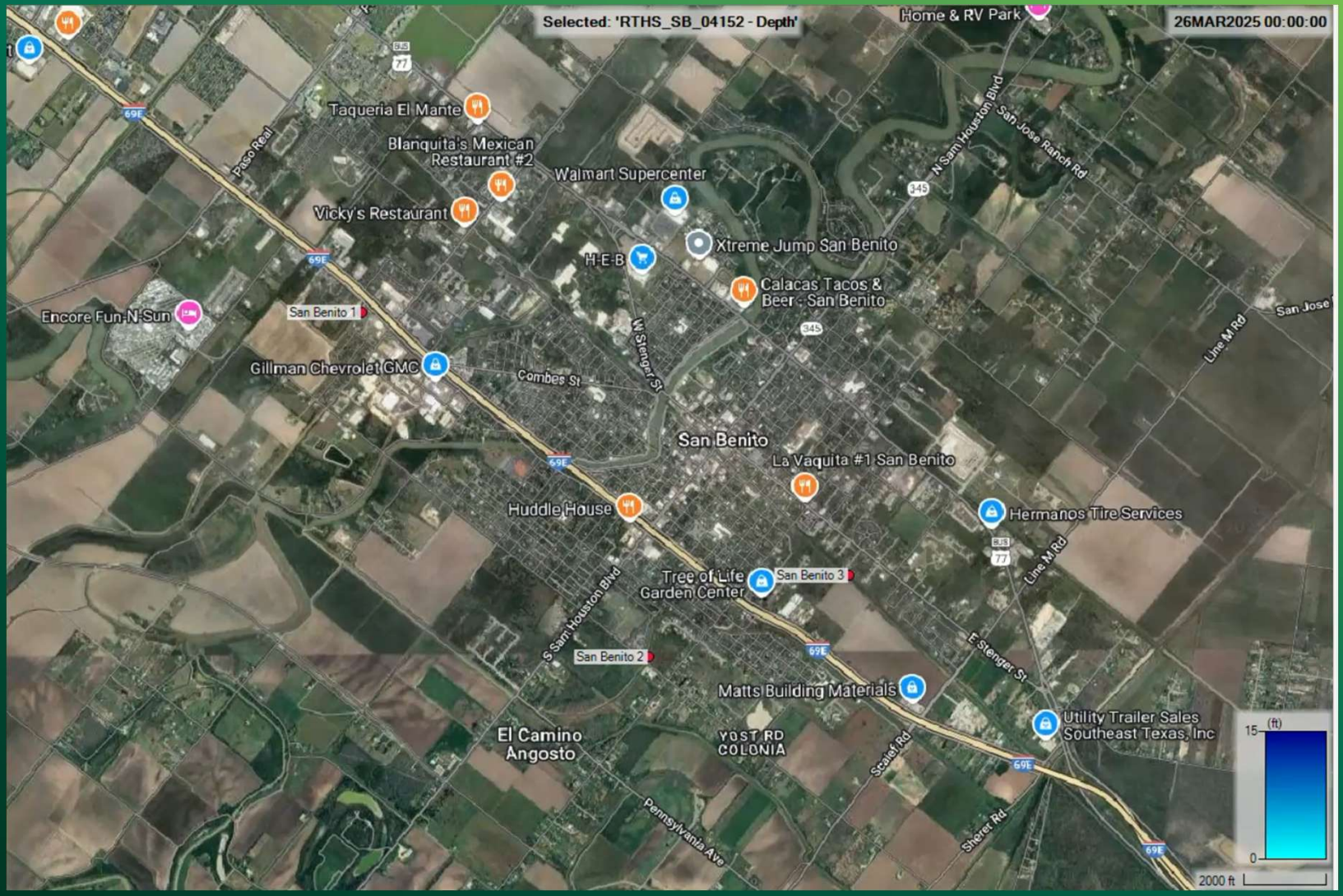
# Real-Time Stations
# March 28th, 2025, Storm




**Station “San Benito 2".**
Maximum stage height was 10.52' at 06:15 AM on March 28, 2025.


**Station “San Benito 3"**
Maximum stage height was 8.55' at 05:30 AM on March 28, 2025.

# FLOOD MITIGATION PROJECT DEVELOPMENT



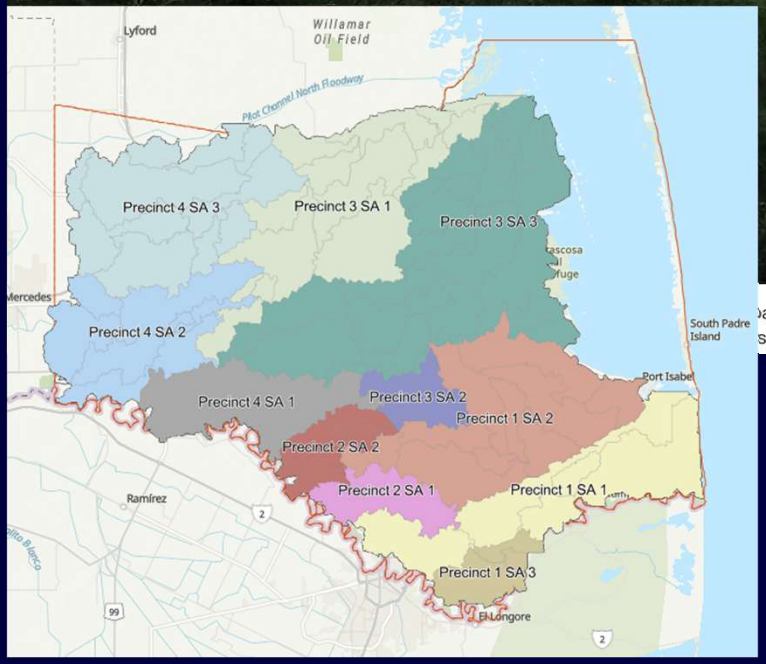
Research Applied Technology Education Services, Inc

RATES Homepage

Sign In

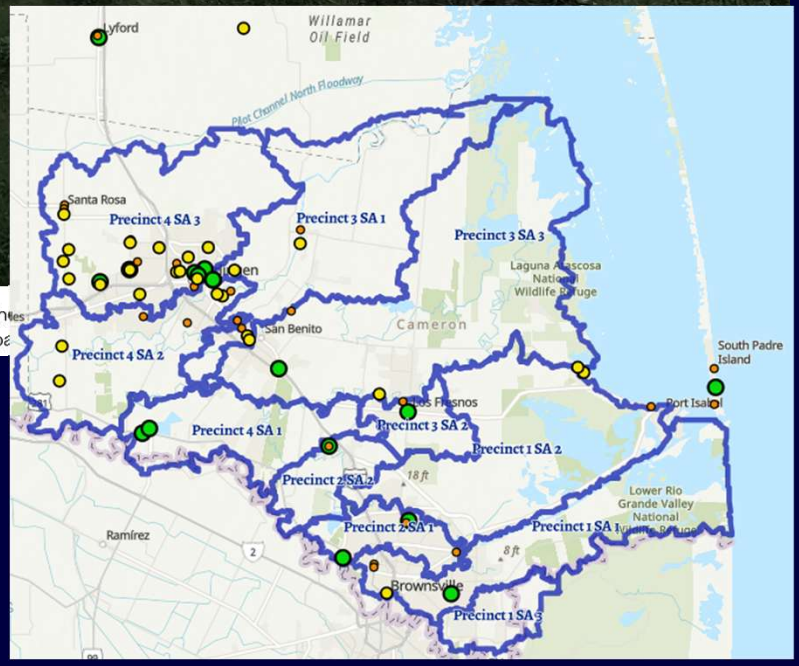
# Cameron and Willacy County

## Task 2 Data Portal




...ading GIS data, discovering and building apps, and engaging oth...
...s develop new web and mobile applications. Let's achieve our goa...

# Task 2: Flood Mitigation Projects



# FLOOD MANAGEMENT STRATEGY

LRGV

FEWS

Planning

Deployment

Cameron County

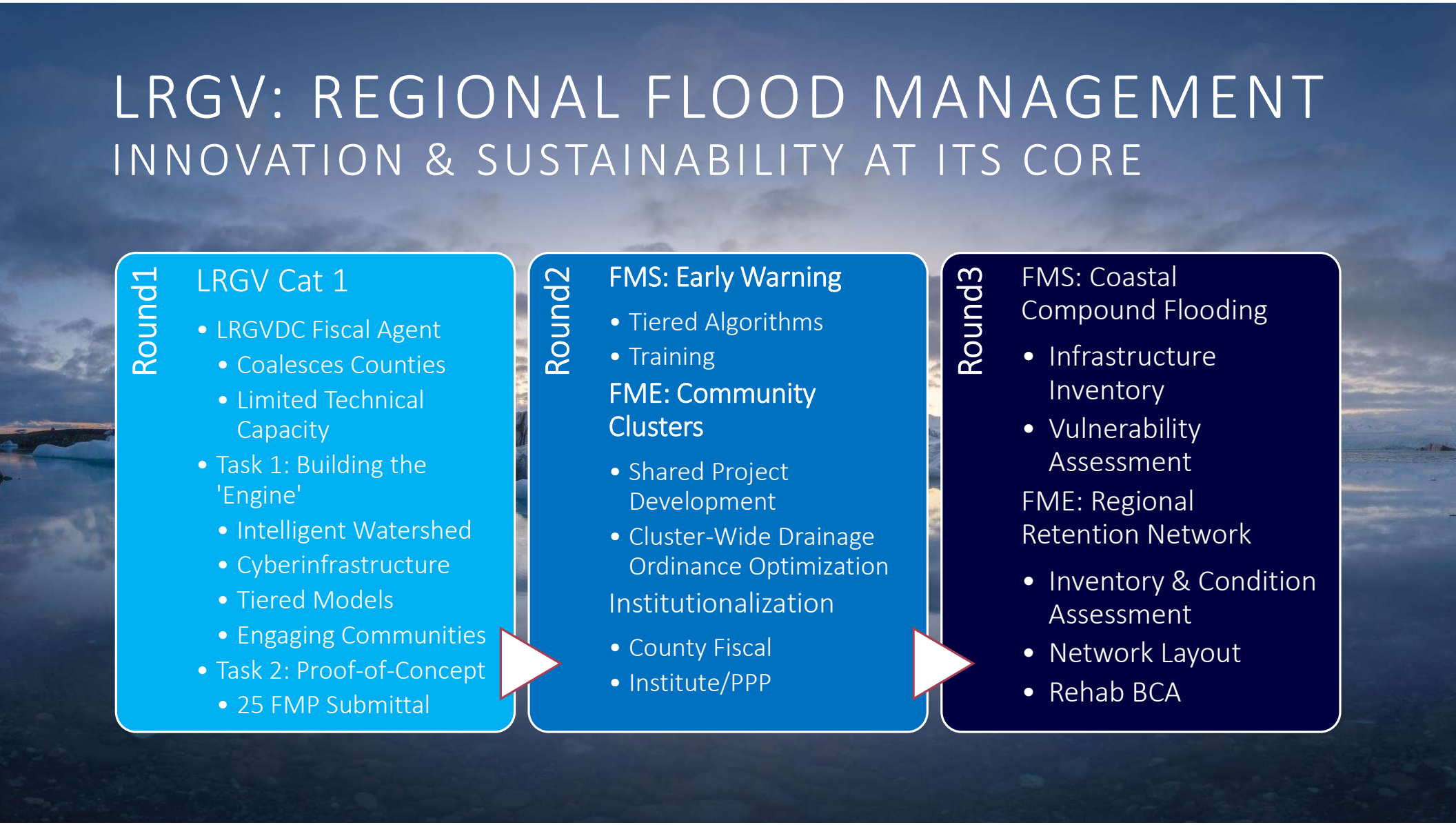
Andrew N.S. Ernest, Ph.D., P.E., BCEE, D.WRE
President & CEO

Rio Grande Valley Stormwater Management

RESEARCH, APPLIED TECHNOLOGY EDUCATION AND SERVICE

# LRGV: REGIONAL FLOOD MANAGEMENT

## INNOVATION & SUSTAINABILITY AT ITS CORE



# PENDING FIF SFY 2023-2024 FMS PROJECT:

RESEARCH, APPLIED TECHNOLOGY EDUCATION AND SERVICE

## LRGV REGIONAL FLOOD EARLY WARNING SYSTEM: PLANNING, DEPLOYMENT, OPERATION & MAINTENANCE

**Goal:**
Integrate Flood Warning Capabilities into the Existing REON-RGV Monitoring Network

Rationale for adapting REON-RGV for FEWS:

REON-RGV is a fully operational network, which can simultaneously be used for technology R&D

The monitoring network is already in place; integrating FEWS capability into this network will be much less costly than creating a standalone network

The design of the FEWS system will be done in coordination with regional stakeholders

# REON-RGV -> FEWS: PROJECT TASKS

**Administration and Regional Coordination**

- Cameron County will administer the project

**Stakeholder Engagement**

- Solicit participation from local entities in project activities
- Outreach to stakeholders for ideas/feedback on FEWS design and implementation
- Key stakeholders: First Responders, Public Works Personnel

**RTHS Commissioning**

- Collecting on-site data for characterizing flows, and for system quality control

**Additional RTHS Stations**

*Install 18 additional RTHS stations, selected based on:*

- Support from local entities / stakeholders (for both installation and long-term sustainability)
- Significance of location for FEWS

**Cyberinfraestructure**

- Involves integration, testing, and refinement of FEWS capability into the existing REON cyberinfrastructure
- Includes development of an O&M manual for the FEWS system designed for use by regional and local stakeholder participants

The following slides provide some examples of recent REON-RGV R&D

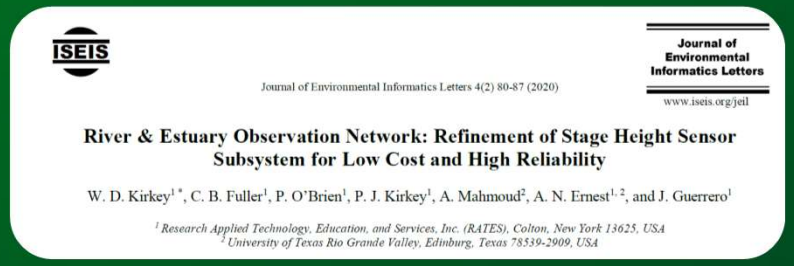
# REON-RGV Cost-Effective Design Example

RATES-Designed "Shell" Water Level Sensor vs. Commercial Alternative: Costs

## SHELL Assembly Costs:

Sensor: $60 parts + 2hrs Labor

Cable: $60 parts + 1hr Labor



ISEIS

Journal of Environmental Informatics Letters

Journal of Environmental Informatics Letters 4(2) 80-87 (2020)

www.iseis.org/jeil

**River & Estuary Observation Network: Refinement of Stage Height Sensor Subsystem for Low Cost and High Reliability**

W. D. Kirkey[1 *], C. B. Fuller[1], P. O'Brien[1], P. J. Kirkey[1], A. Mahmoud[2], A. N. Ernest[1, 2], and J. Guerrero[1]

[1] *Research Applied Technology, Education, and Services, Inc. (RATES), Colton, New York 13625, USA*
[2] *University of Texas Rio Grande Valley, Edinburg, Texas 78539-2909, USA*

## LevelTROLL 400 Retail Prices:

Sensor: $800

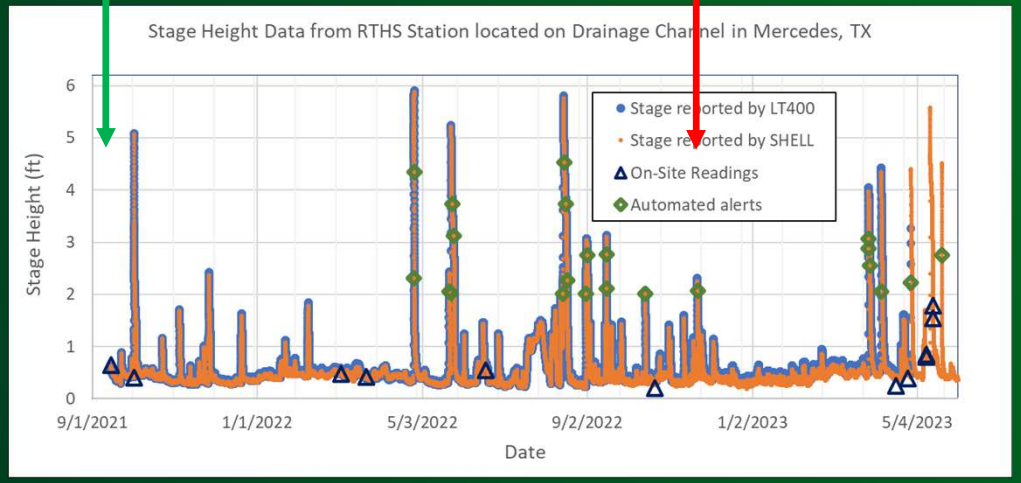
Cable: $475

**September 2021:**

- Mercedes, TX commissioned RATES to install RTHS in local drainage channel, to provide water-level alerts for city staff.
- *RATES co-deployed both sensors to compare performance*

# RATES-Designed "Shell" Water Level Sensor vs. Commercial Alternative: Performance Assessment

**September 2021:**
- Mercedes, TX commissioned RATES to install RTHS in local drainage channel, to provide water-level alerts for city staff.
- RATES co-deployed both sensors in order to compare performance



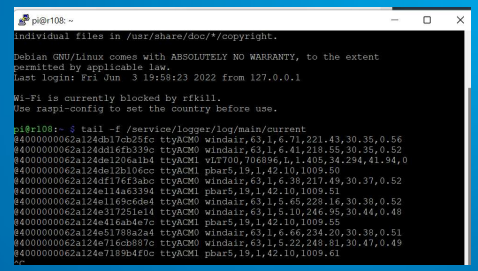

**May 2023:**
- LevelTROLL 400 Stopped Functioning
- SHELL sensor continued to operate

| Date | 9/14/2021 | 10/1/2021 | 3/3/2022 | 3/22/2022 | 6/18/2022 | 10/21/2022 | 4/17/2023 | 4/26/2023 | 5/10/2023 | 5/15/2023 |
|---|---|---|---|---|---|---|---|---|---|---|
| On-site readings (ft) | 0.64 | 0.40 | 0.48 | 0.42 | 0.55 | 0.21 | 0.25 | 0.39 | 0.80 | 1.79 |
| SHELL-reported (ft) | 0.64 | 0.42 | 0.51 | 0.43 | 0.60 | 0.27 | 0.37 | 0.52 | 0.91 | 1.91 |
| LT400-reported (ft) | 0.64 | 0.43 | 0.54 | 0.42 | 0.63 | 0.33 | 0.46 | 0.60 | None | None |

Both sensors gradually developed error over time, but SHELL drift was smaller than LevelTROLL 400 drift

# REON BACK-END CYBERINFRASTRUCTURE

## Secure Remote Access to Linux OS

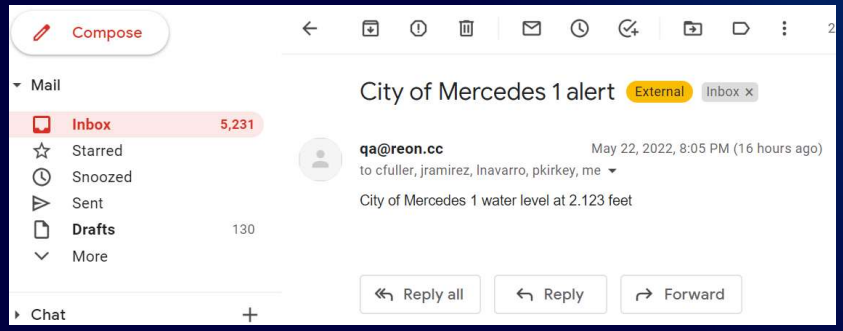


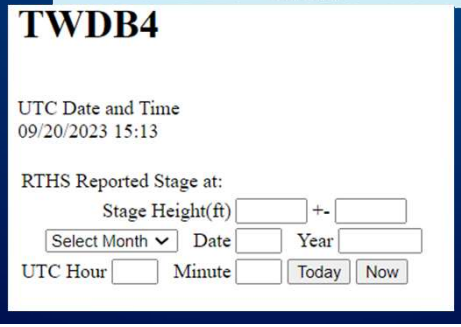

## rths.us database

- ODM database
- Stores 5-minute averages for time-series data
- Stores timestamped spot readings
- Data visualization/download pages (http://rths.us/reonrgv.cgi )

## Visualization of Continuous and QC data


## Real-Time Alerts



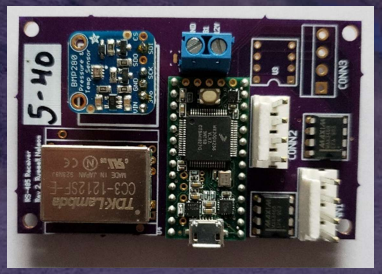



# RTHS Expansion Example: Water Quality

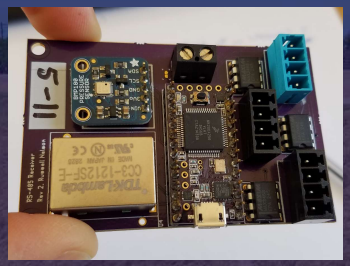
Instrumentation: In-Situ AquaTROLL 500

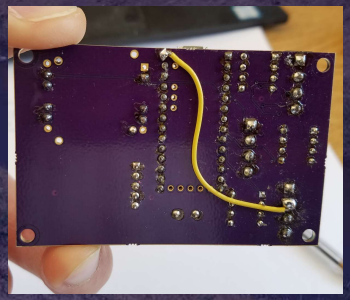


Interface – Modified RS-422 Interface Board:

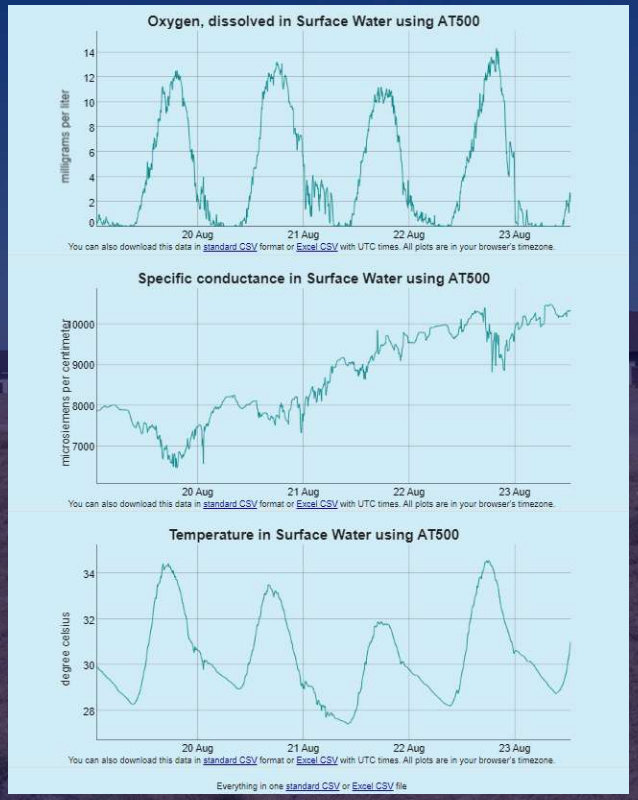


- Wiring adjustments
- Expanded program

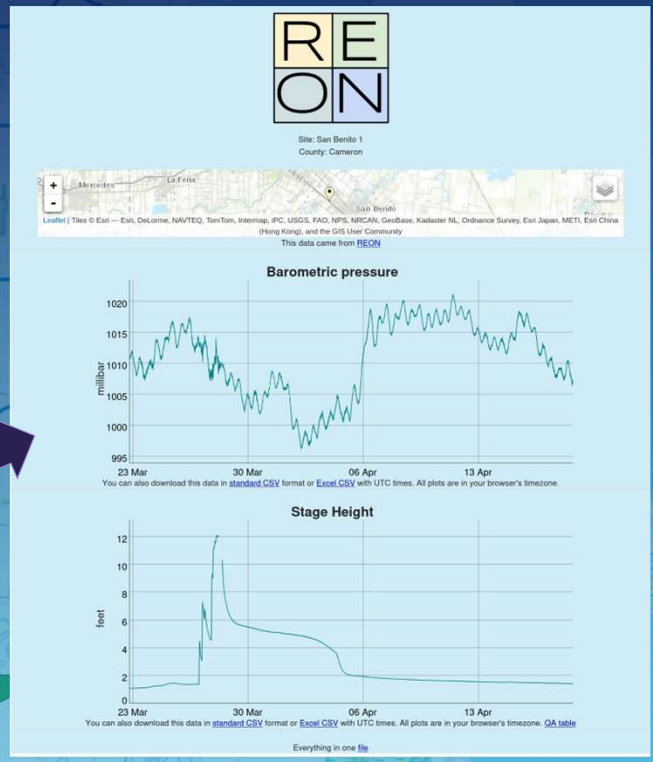




Example Data (CCD1D2, August 2021)

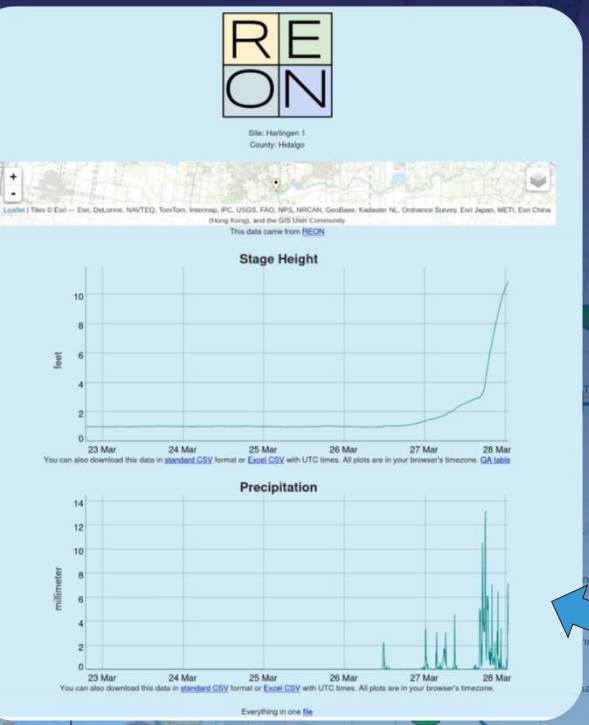


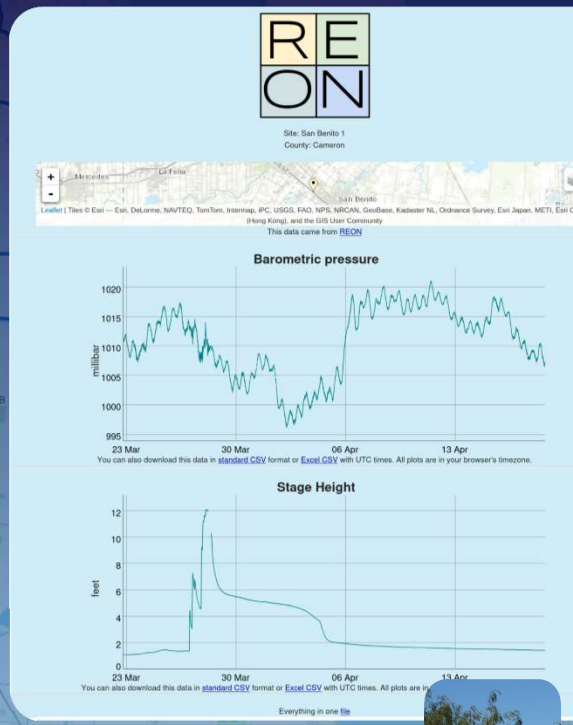
# Current State:
## Manual Observations




Passive Early Warning

# Current State:
## Neighbor Knowledge and Trajectory Tracking



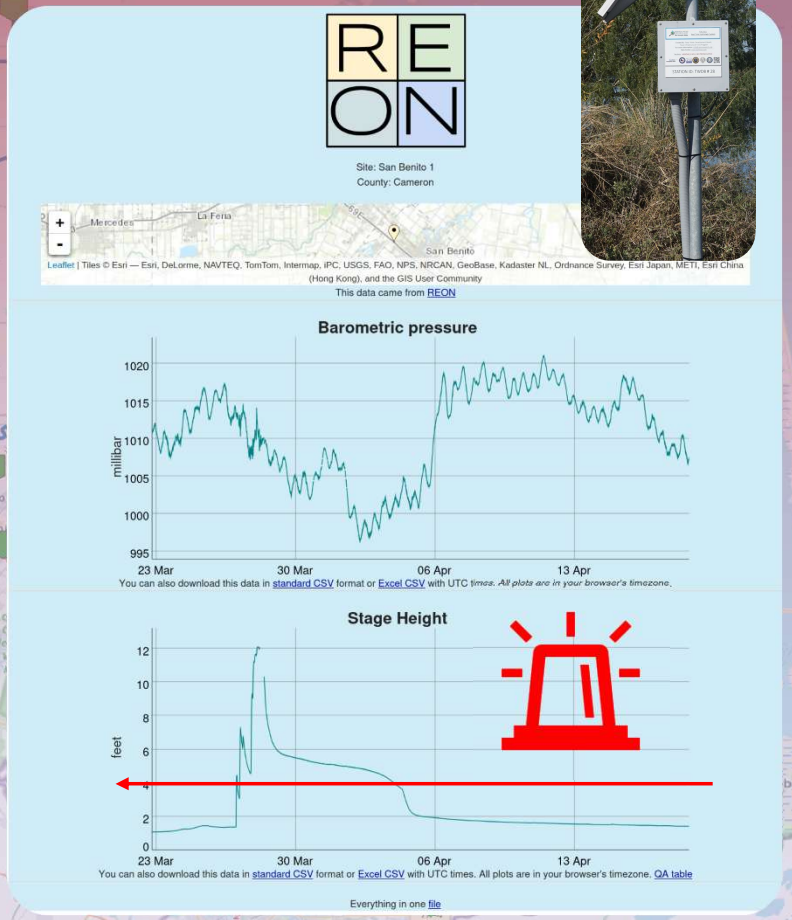

Information Exchange

Flood front

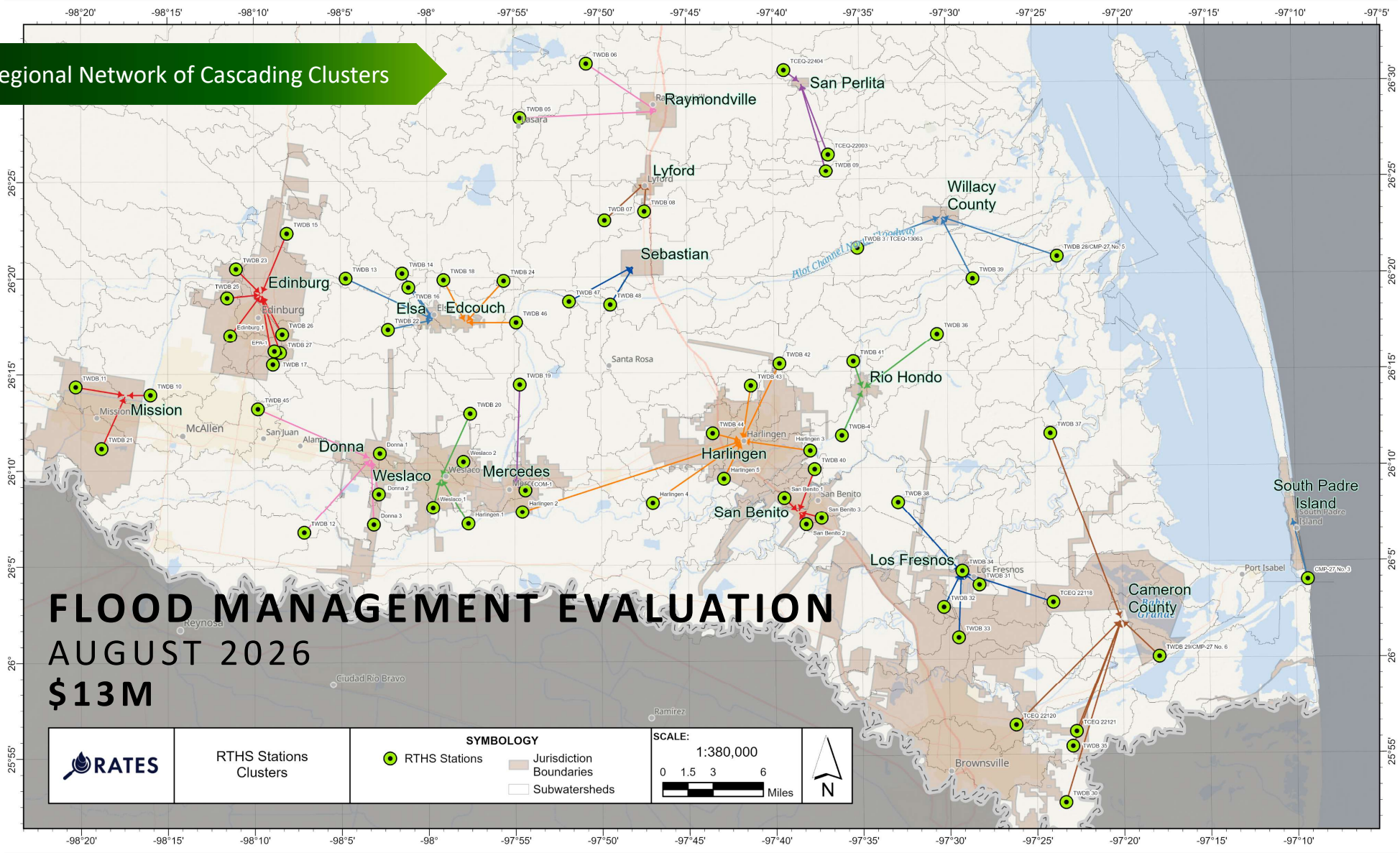
INFORMED
Early Warning

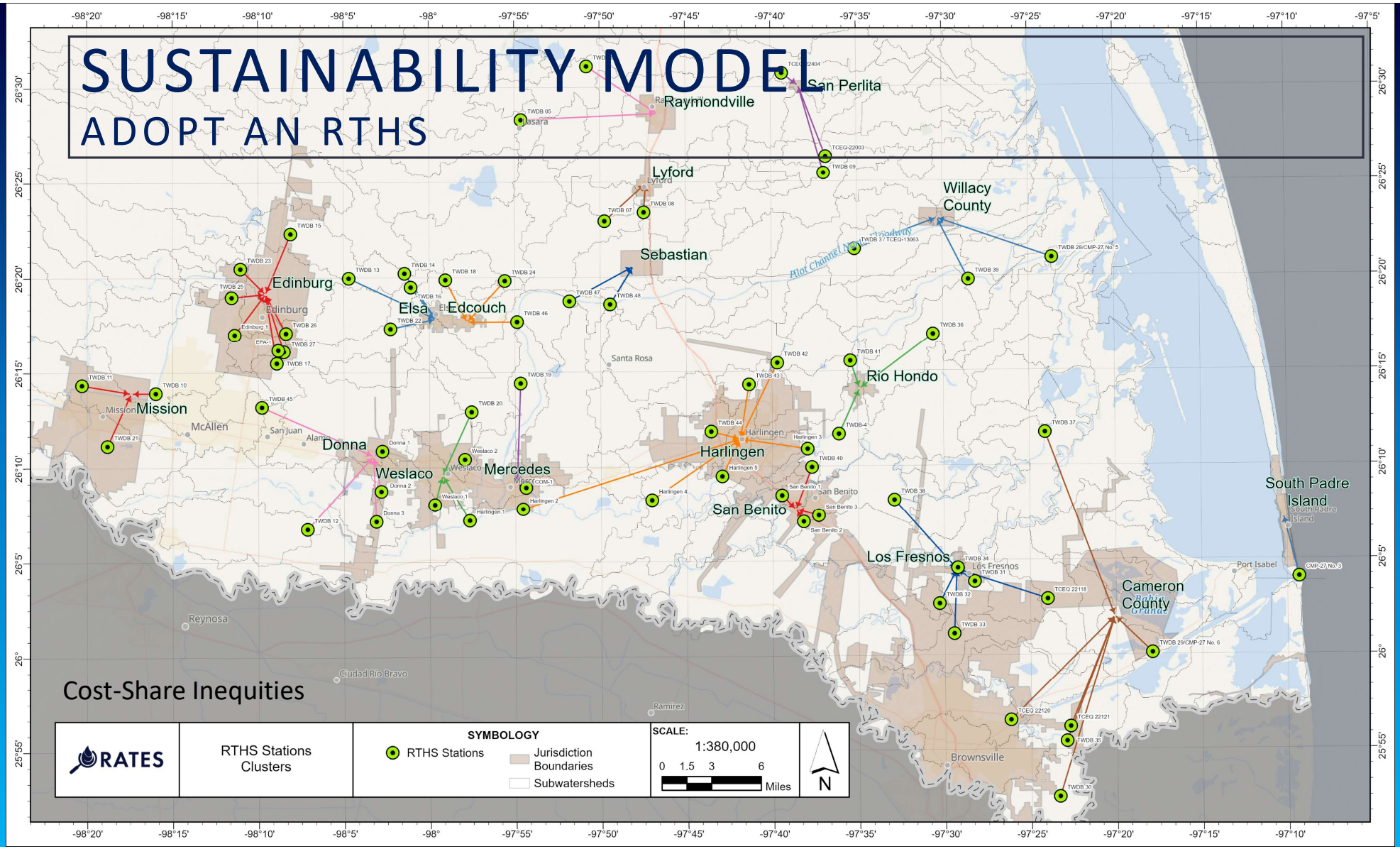
# Upcoming Applications:

## Rate-of-Rise and Water Surface Elevation thresholds



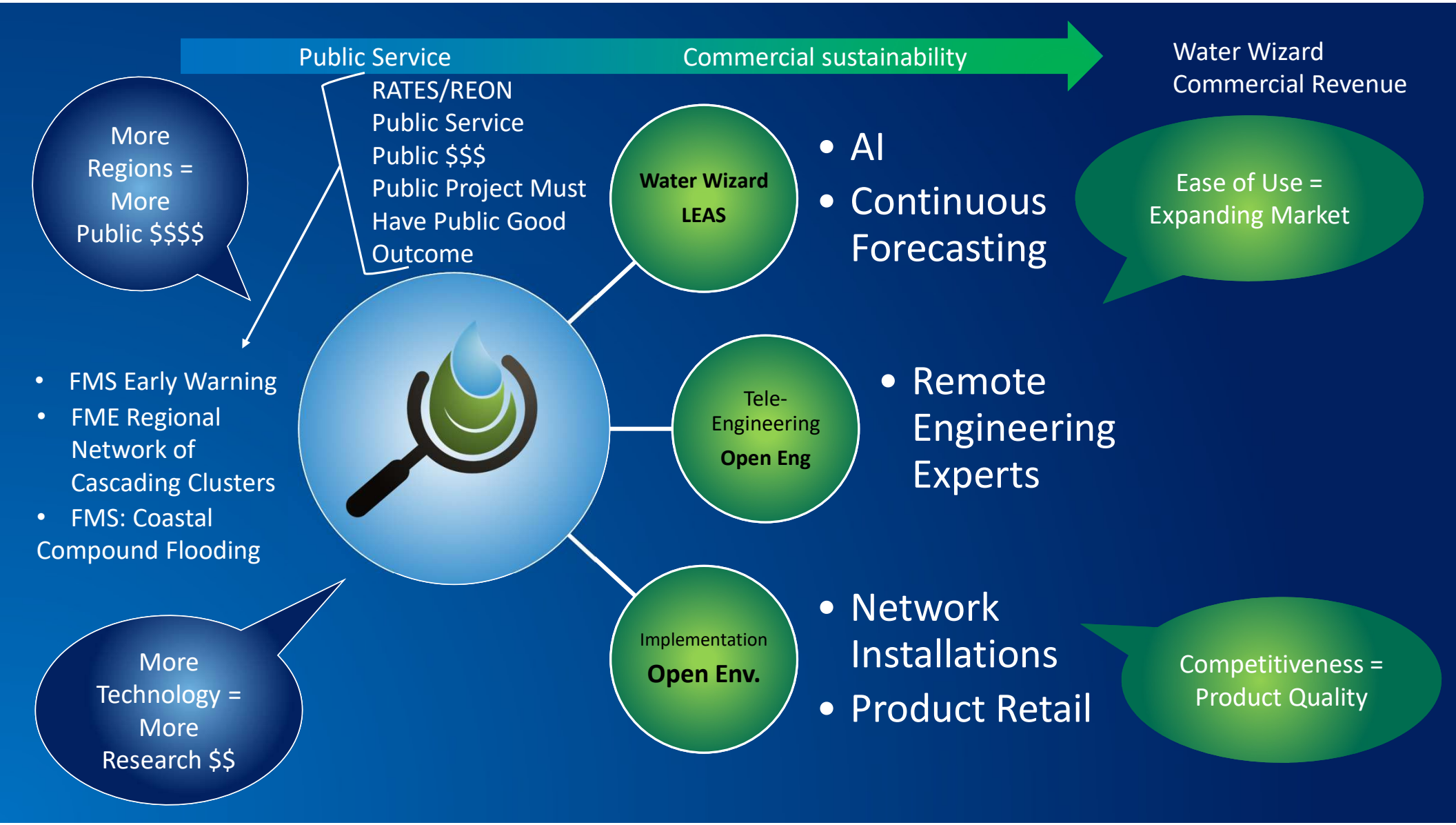
## Regional Network of Cascading Clusters



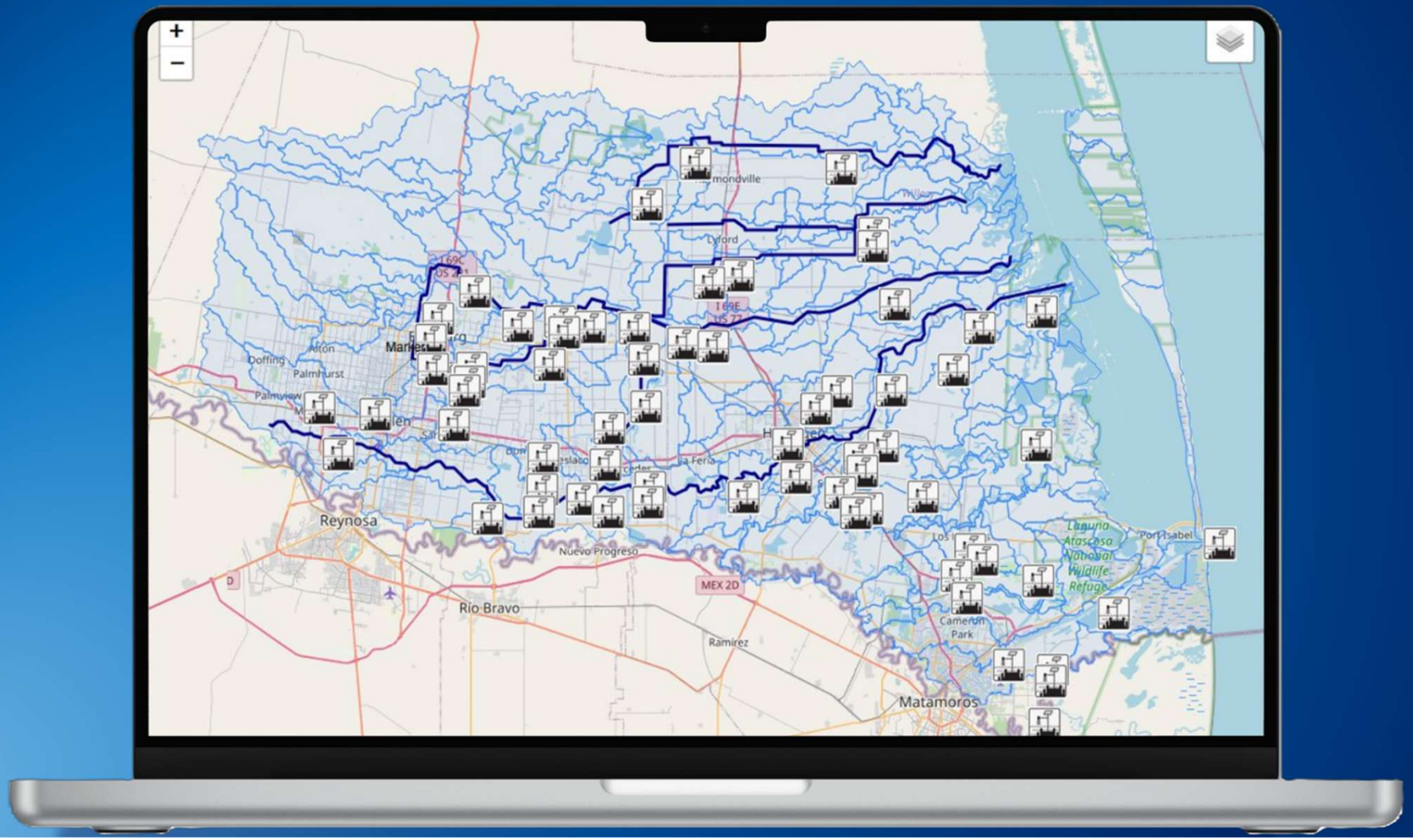

SUSTAINABILITY MODEL
ADOPT AN RTHS
Cost-Share Inequities
RATES
RTHS Stations
Clusters
SYMBOLOGY
RTHS Stations
Jurisdiction Boundaries
Subwatersheds
SCALE:
1:380,000
0 1.5 3 6
Miles
N
San Perlita
Raymondville
Lyford
Willacy County
Sebastian
Edinburg
Elsa
Edcouch
Santa Rosa
Rio Hondo
Mission
McAllen
Donna
Weslaco
Mercedes
Harlingen
San Benito
Los Fresnos
South Padre Island
Port Isabel
Cameron County
Reynosa
Ciudad Rio Bravo
Ramirez
Brownsville


WATER
WIZARD

RESEARCH, APPLIED
TECHNOLOGY
EDUCATION AND SERVICE

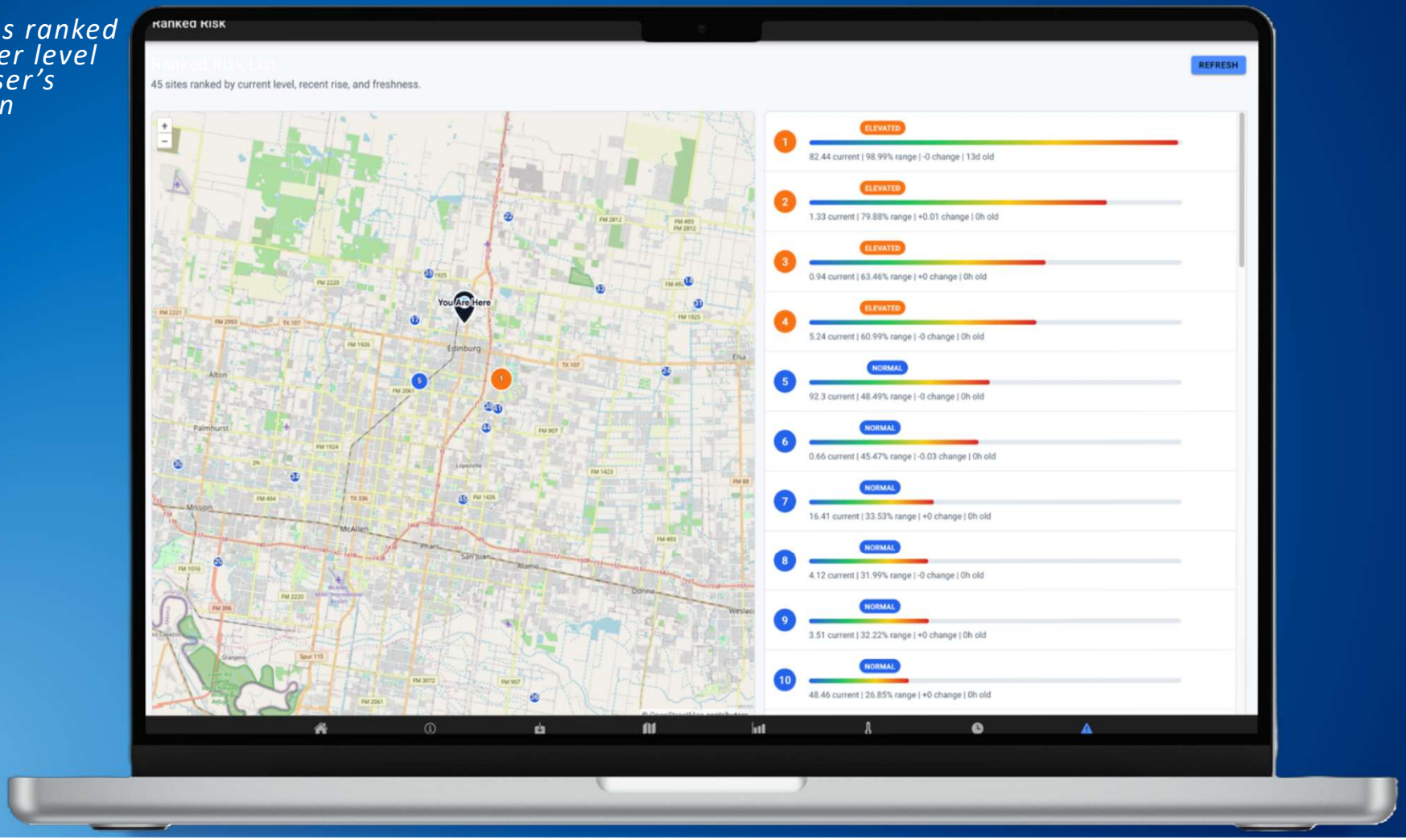

Public Service
Commercial sustainability
Water Wizard
Commercial Revenue
More Regions = More Public $$$$
RATES/REON
Public Service
Public $$$
Public Project Must Have Public Good Outcome
Water Wizard
LEAS
• AI
• Continuous Forecasting
Ease of Use = Expanding Market
• FMS Early Warning
• FME Regional Network of Cascading Clusters
• FMS: Coastal Compound Flooding
Tele-Engineering
Open Eng
• Remote Engineering Experts
More Technology = More Research $$
Implementation
Open Env.
• Network Installations
• Product Retail
Competitiveness = Product Quality

# INTERACTIVE MAP OF THE STATIONS



# RANKED RISK BASED ON LOCATION

*Stations ranked by water level near user's location*



# WATER LEVEL HEATMAP

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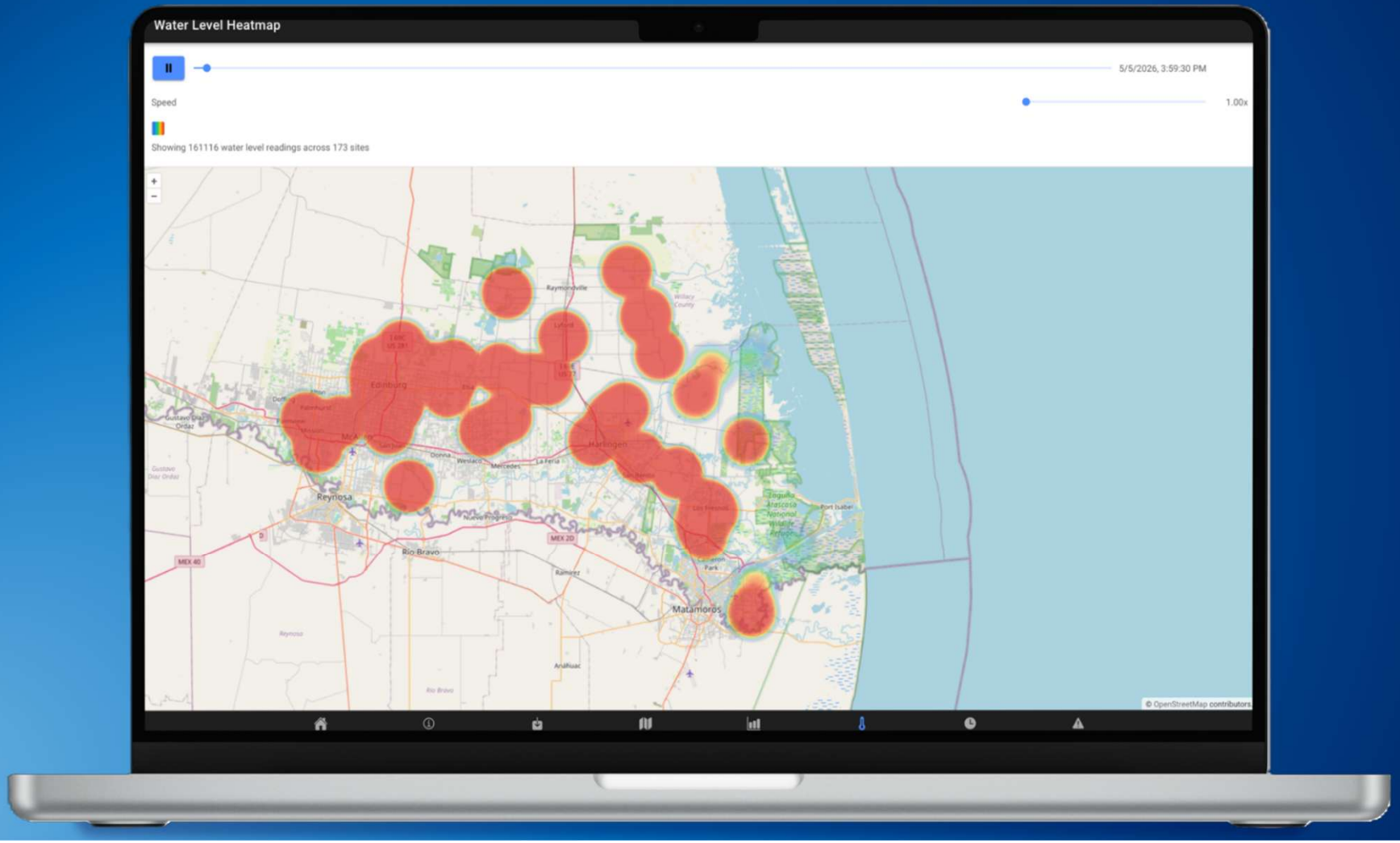
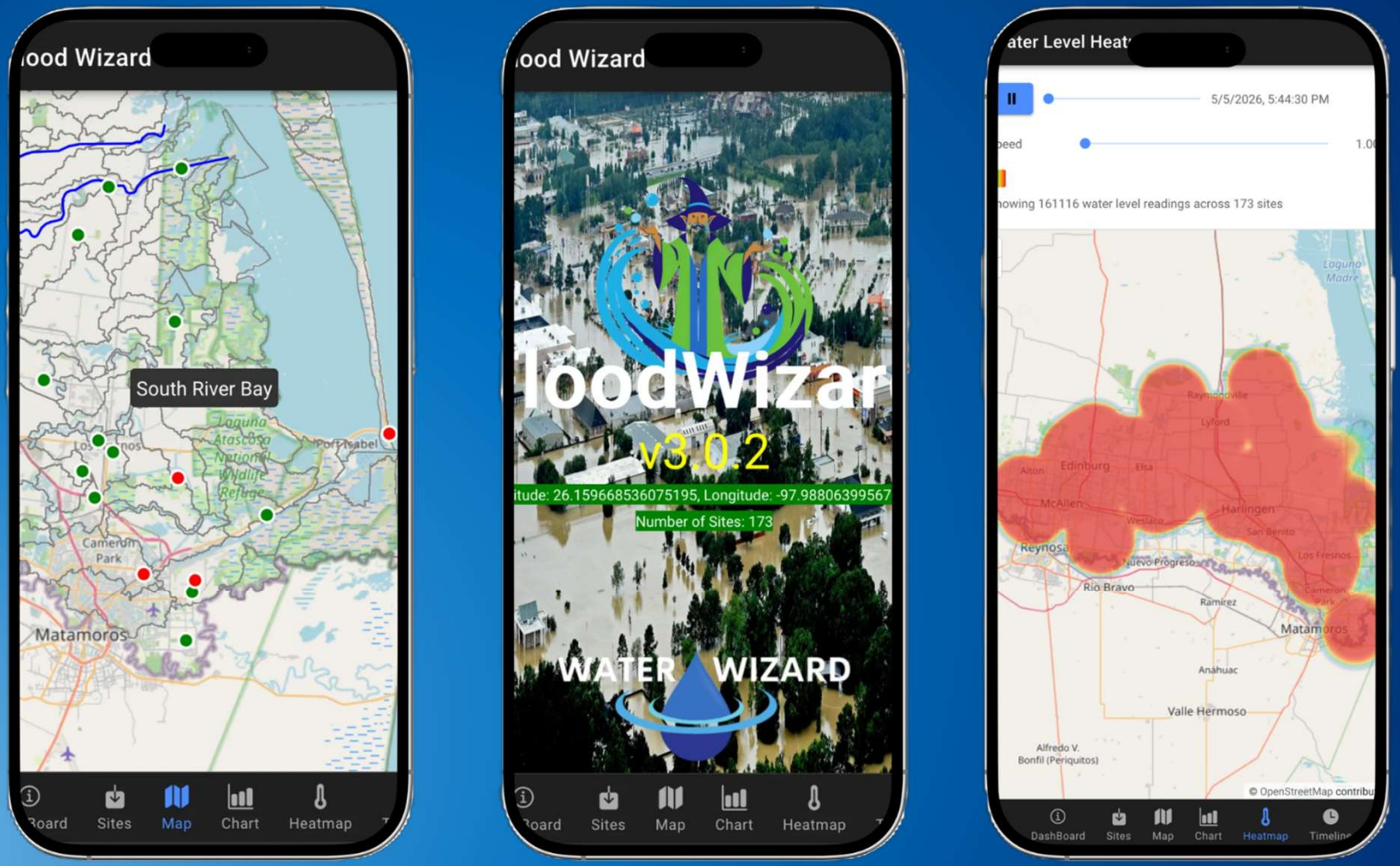


# PHONE APP VIEW



# Station-Level AI

RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE

Model Trained on weather and water data

Water level forecasts using meteorological forecasts

Users can set their own trigger conditions in-app

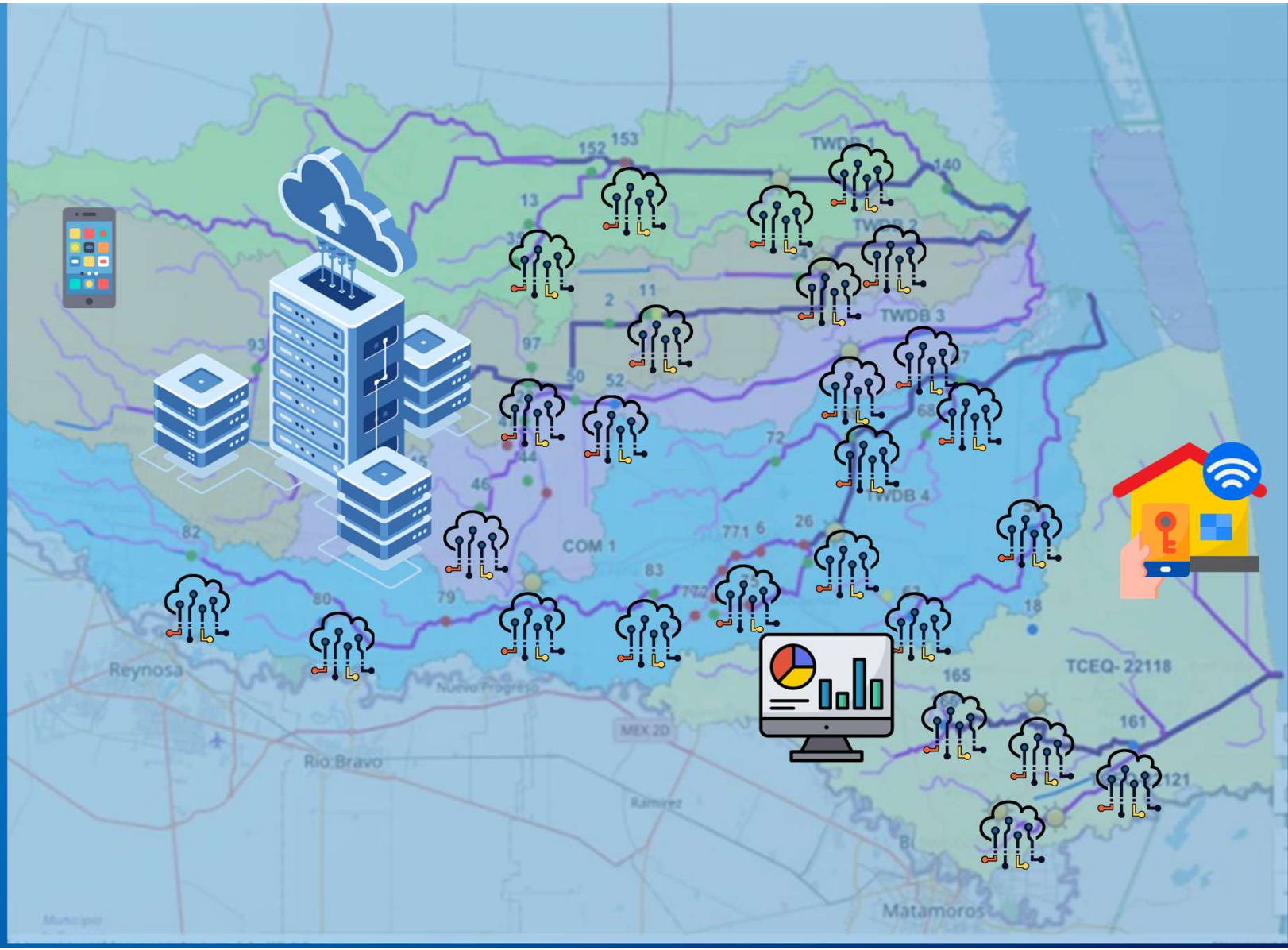
App provides monitoring and other value-added tools to subscribers and REON RGV members

# Network AI

*A True Intelligent Watershed*

Data Center HPC
Regional Intelligence

Intelligent RTHS
Local Intelligence



# ACWIRRED

AN INSTITUTE FOR

# APPLIED COASTAL WATER INTELLIGENCE FOR REGIONAL RESILIENCE AND ECONOMIC DEVELOPMENT

RE ON

RESEARCH, APPLIED TECHNOLOGY EDUCATION AND SERVICE

Rio Grande Valley Stormwater Management

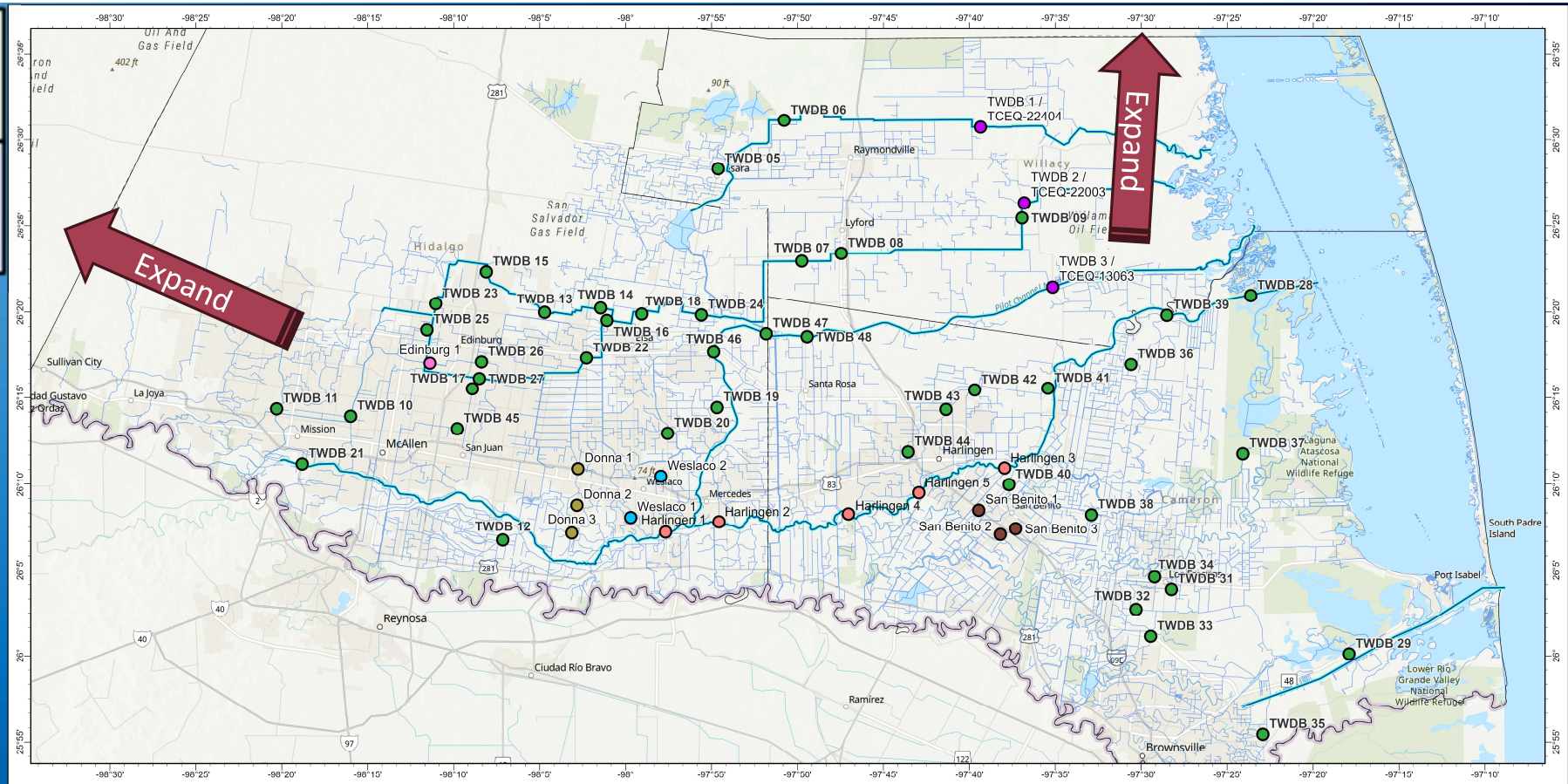
THE COUNTY OF CAMERON STATE OF TEXAS

RE
ON

# RGV

Coastal

Rio Grande Basin




**TITLE:**

Real-Time Hydrologic System (RTHS) Stations in the Rio Grande Valley

**PRODUCED BY:**

RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE
Rio Grande Valley

## SYMBOLOGY

- CSE
- FIF
- City of Donna
- City of San Benito
- City of Weslaco
- City of Edinburg
- North & Central Phase 2
- Major Waterways
- LRGV Counties
- Streams

## DETAILS

RTHS stations distributed in the Rio Grande Valley:
-CSE: 5 stations
-FIF: 44 stations
-Donna: 3 stations
-San Benito: 3 stations
-Weslaco: 2 stations
-Edinburg: 1 station
-N&C Phase II: 3 stations

**GRAPHIC SCALE:**

0 3.5 7 14 Miles

**SCALE:**

1 : 390,000

N

# INDUSTRIAL EVOLUTION


## 1784

Mechanization, steam power, weaving loom

## 1870

Mass production, assembly line, electrical energy

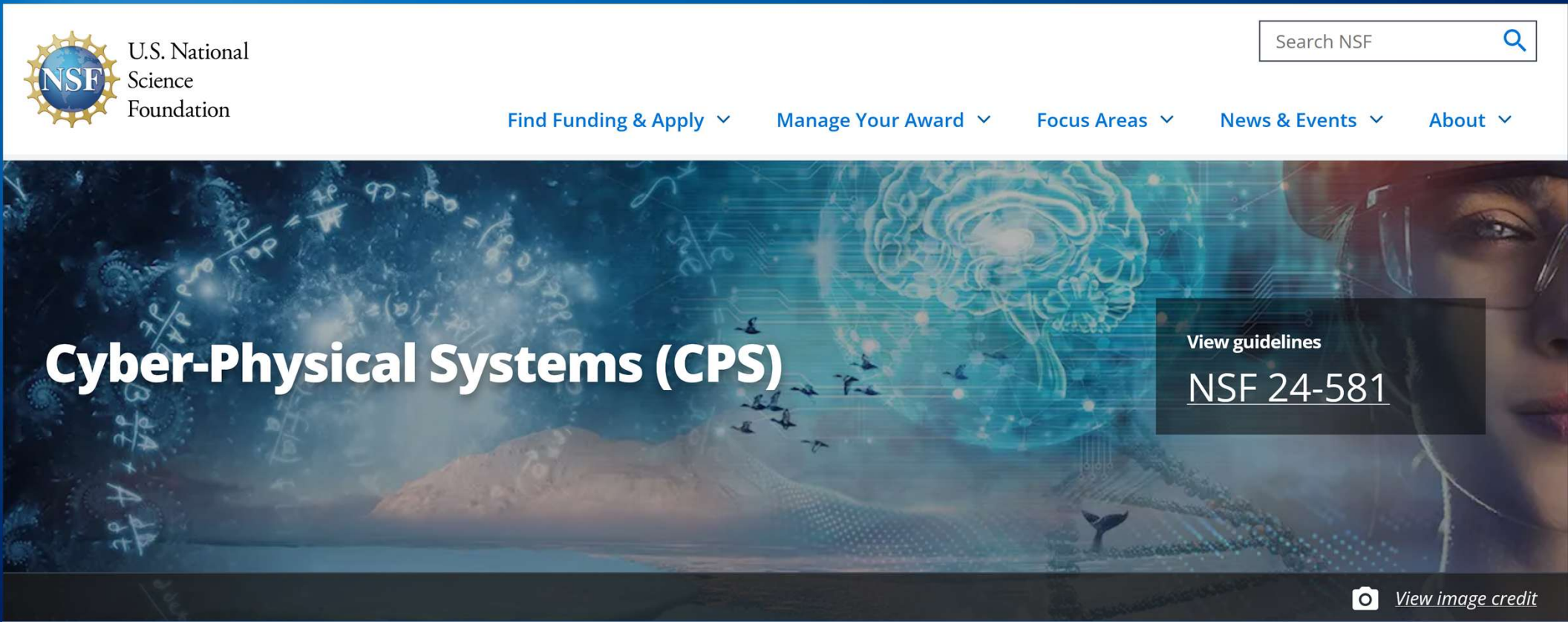
## 1969

Automation, computers, and electronics

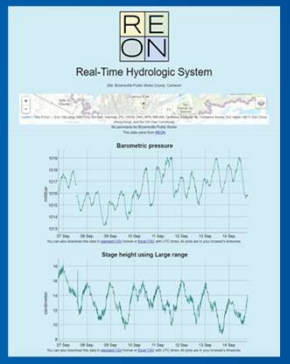
## Today

Cyber Physical Systems, Internet of Things, Networks

# CUTTING EDGE RESEARCH



# CYBER-PHYSICAL SYSTEMS




Big Data

Data Center HPC
Regional Intelligence

Internet of Things

Cloud Computing

Robotics

Artficial Intelligence

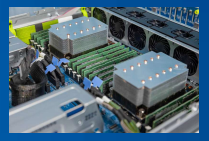
# 100AKER HIGH PERFORMANCE COMPUTE CLUSTER

## 750+ TERAFLOPS

## COMPUTE NODES

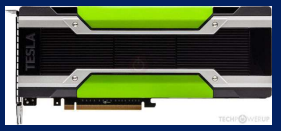
- 4x Dual-Socket Ampere Altra Q80-30 (320C)
- 1x Dual-Socket Ampere Altra Max M128-30 (128C)
- 2x Single Socket AMD EPYC (128C)
- 1x Dual Socket Xeon E5 2696 (36C)
- 1x Single Socket Xeon E5 2696 (18C)

630 Compute Cores



## DEEP LEARNING (AI)

- 2x Single Socket AMD EPYC (64C)
- 6x AMD Instinct Mi25 GPU Accelerators (24,576 ROCm C)
- 1x Nvidia RTX 4090 GPU (16,384 CUDA C)
- 1x Nvidia Tesla K80 GPU Accelerator (4992 CUDA C)
- 4x Xilinx Alveo U200 FPGA Accelerators (3.6M LUTS)
- RTHS/Edge Inference Options (~5W)
  - Rockchip RK3588 NPU (6 TOPS)
  - Google/Coral Edge TPU (4 TOPS)
  - Nvidia Jetson Nano GPU (472 GFLOPS)




# *Turning Research and Technology into Community Resilience*

**Andrew N.S. Ernest,**
Ph.D., P.E., BCEE, D.WRE
anernest@ratesresearch.org

**Ivan Santos Chavez, M.S.**
Research Engineer
isantos@office.ratesresearch.org

**Rebeca Santos Chavez**
Communications and Outreach Associate
rsantos@office.ratesresearch.org

***Scan to learn more!***