INTERAGENCY FRAMEWORK FOR LOW-COST FLOOD SENSOR NETWORKS

SOUTHEAST TEXAS
URBAN INTEGRATED FIELD LAB

Engineering, Surveying, and Best Practices for Flood Early Warning Systems

WHY NOW?

Flood sensor networks are increasingly used across the United States to support early warning, infrastructure monitoring, and emergency response; however, their development and long-term operation remain highly fragmented and inconsistent across jurisdictions. Many agencies face challenges related to sensor placement, surveying accuracy, data interoperability, maintenance responsibilities, staffing, and sustained funding. Smaller agencies often lack the technical capacity or financial resources to independently design and maintain robust flood monitoring systems, while large agencies struggle with scalability, maintenance logistics, and data coordination. There is a clear need for a replicable, interagency framework that integrates engineering design, surveying standards, governance structures, and operational best practices.

WHAT WE DID

Findings from three complementary research efforts conducted as part of a coordinated flood resilience initiative: (1) field surveying and geospatial documentation supporting flood sensor deployment, (2) development and operation of a shared, low-cost interagency flood sensor network, and (3) a nationwide survey of flood sensor network practices across government organizations in the United States. Together, these efforts document how flood sensors are selected, surveyed, installed, maintained, and integrated into decision-making workflows. The research combines detailed field measurements of sensor elevations and critical infrastructure, evaluation of network governance and operational models, and structured interviews with agencies operating flood sensor networks of varying scale. The synthesis emphasizes engineering workflows, surveying requirements, communication protocols, data management practices, maintenance strategies, and funding models that support reliable flood early warning systems.

WHO WAS INVOLVED?

This framework was developed through extensive collaboration with local, regional, state, and federal partners. In Southeast Texas, multiple counties, cities, river authorities, drainage districts, emergency management offices, and transportation agencies participated in deploying and maintaining a shared flood sensor network. A university-based research team served as technical advisor, asset manager, and data integrator, providing surveying expertise, installation guidance, training, and coordination among partners. Nationally, insights from flood control districts, city and county governments, river authorities, and state emergency agencies informed the broader best-practices framework. This interagency engagement ensured that the resulting guidance reflects real-world constraints, operational needs, and institutional diversity.

FINDINGS

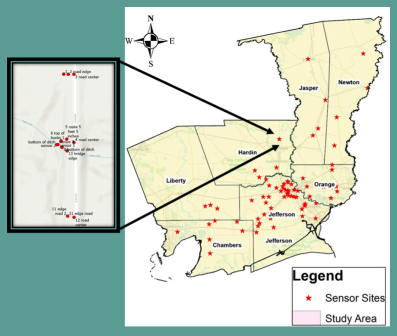
• Interagency collaboration is essential for developing sustainable flood sensor networks, enabling broader geographic coverage, shared costs, and coordinated operations when roles and responsibilities are clearly defined.

• Accurate surveying and geospatial documentation are foundational, as precise sensor and infrastructure elevations enable reliable flood-stage thresholds, roadway impact assessments, and engineering decision-making.

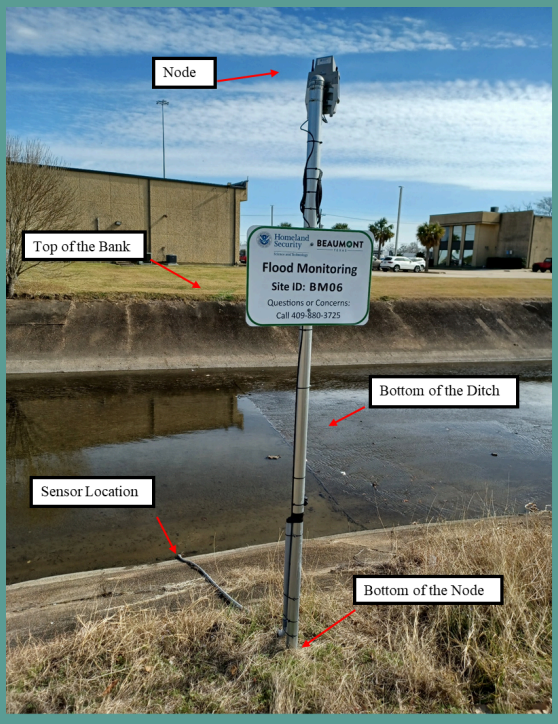
• Flood sensor data are primarily used for real-time monitoring and infrastructure planning, supporting drainage performance evaluation, capital improvement prioritization, and long-term resilience strategies.

• Network reliability depends on maintenance capacity and funding, with agency scale influencing staffing models, preventative maintenance practices, and system uptime.

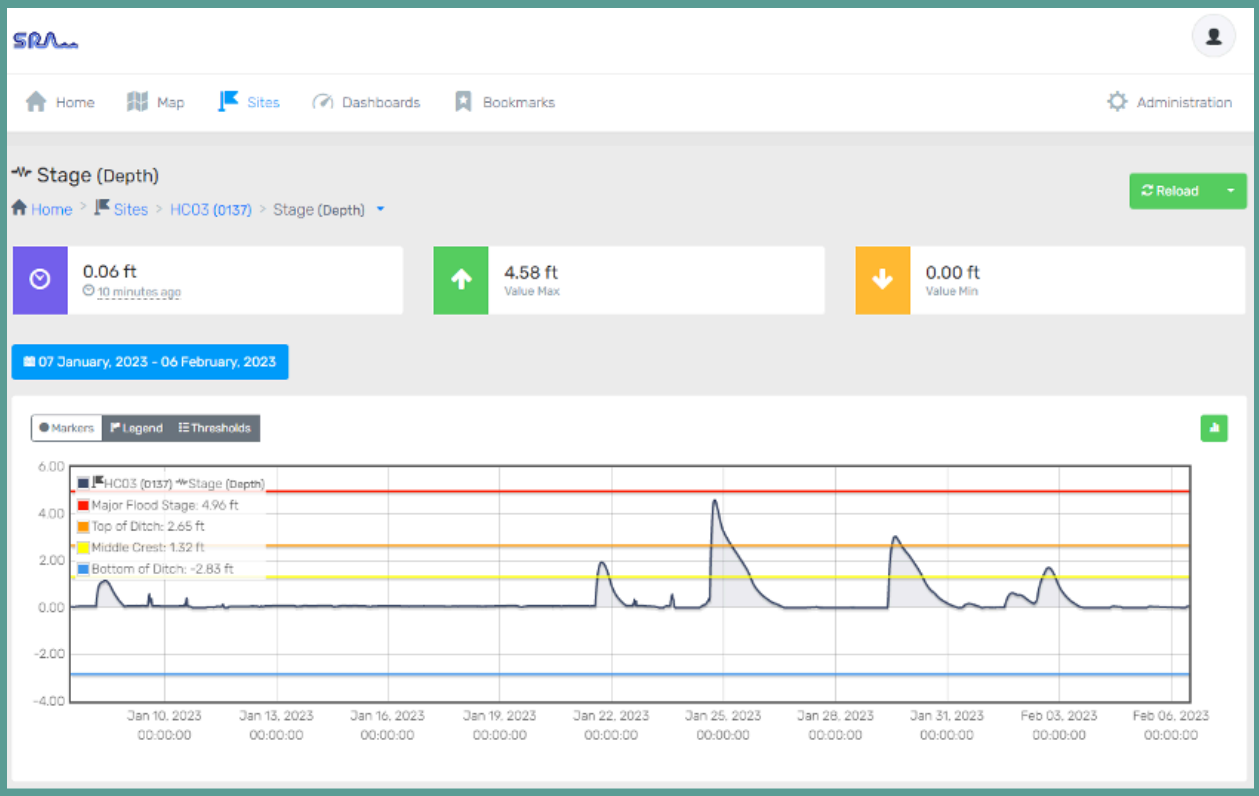
• Centralized online display platforms, such as the OneRain portal, significantly enhance system value by providing real-time visualization, standardized data access, alerting capabilities, and seamless data sharing among agencies, emergency managers, and the public.



Sensor site locations across Southeast Texas, and an example site measurement points (shows field survey output in a map).



Site photo showing labeled points used to set thresholds (sensor, bank, road, node, etc.).



Example dashboard plot showing water level over time with flood thresholds (how users interpret the data).

MORE ABOUT SETX-UIFL

The Southeast Texas Urban Integrated Field Lab (SETx-UIFL) is one of four projects funded in 2022 by the U.S. Department of Energy to study how climate, environment, and urban changes affect cities. A team of over 80 researchers from UT, Lamar University, Texas A&M, Prairie View A&M, Oak Ridge National Lab, and Los Alamos National Lab has collected data and conducted modeling across hazards including flooding, hurricanes, heat stress, and air quality. Our Why: Southeast Texas faces numerous hazards, yet smaller communities like this one have often felt forgotten compared to larger cities. The SETx-UIFL was designed to explore the complex dynamics of disaster vulnerability for this economically and culturally vibrant region. We believe Southeast Texas is a bellwether for the entire Gulf Coast, and an exemplar for strategies that protect people and places. We hope this effort supports your path toward lasting resilience.

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