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White Paper

Advancing Flood Preparedness and Response in Texas

A Multi-Temporal Flood Risk and Response Management Solution Proven in North Carolina

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About the Author

John Dorman is Vice President for Strategy with AECOM's Government group and a nationally recognized expert in strategic policy, funding, and hazard risk management. His more than 37 years of experience has been across public, private, and non-profit sectors, focused primarily on advancing federal and state policy, programs, funding, and hazard risk management. Prior to joining AECOM, he served in senior roles with North Carolina state government, including Planning Administrator in the Office of State Budget, Planning, and Management and Assistant State Emergency Management for Risk Management, where he founded and led the state's Floodplain Mapping Program, Flood Inundation Mapping and Alert Network, and Risk Management Program. He also crafted and constructed the State Emergency Response Application, and the School Risk and Response Management System. He advises clients on policy, strategic funding, disaster response and recovery, and flood risk management.

Executive Summary

Flooding represents one of the most persistent and devastating natural hazards affecting Texas communities. At present, there are gaps and challenges that negatively impact Texas communities' ability to avoid, prepare for, respond to, recover from, and mitigate against future flooding, specifically the July 4th flooding. Recognizing this, the Texas Legislature convened the Senate and House Committees on Disaster Preparedness and Flooding to examine ongoing challenges and chart a path toward modernizing the state's approach to flood preparedness and response.

This white paper outlines identified challenges in Texas and presents a proven solution as a starting point to overcome the challenges. This solution, manifested in the North Carolina Flood Inundation Mapping and Alert Network (FIMAN)[1], represents a tested solution that can be quickly and efficiently be tailored to meet the unique flood risk and response management challenges facing Texans.

FIMAN is an operational, tested platform that has been deployed statewide in North Carolina since 2012 and has proven effective during numerous major flooding events. While other approaches may exist, FIMAN is a demonstrated, adaptable, and scalable solution that offers a more comprehensive foundation upon which Texas can build. It integrates multi-temporal flood intelligence—including real-time, forecasted, and scenario-based data—with structure- and asset-specific information, impact modeling, and robust communication tools. The platform supports a streamlined and efficient implementation strategy by leveraging existing modeling, LiDAR, and gage data resources, while remaining fully interoperable with other flood warning systems.

[1] https://fiman.nc.gov/

Key Issues Identified by the Texas Legislature Hearings

The hearings convened by the Texas Legislature highlighted a series of long-standing and recurring deficiencies in the state's flood preparedness and response framework.

- **Communication Interoperability Gaps** – Emergency communications systems between state, local, and federal entities lacked full compatibility, delaying critical information sharing.
- **Ambiguity in Roles and Responsibilities** – Unclear delineation of agency duties during flood events, leading to overlaps or missed actions.
- **Protocol and Process Weaknesses** – Inconsistent or outdated procedures for flood warning issuance and response coordination.
- **Technology and Data Limitations** – Inadequate integration of real-time hydrologic data, modeling, and geospatial tools for situational awareness.
- **Delayed or Insufficient Public Alerts** – Warning systems were not always timely, targeted, or redundant, reducing their effectiveness for at-risk populations.
- **Resource Shortfalls** – Limited availability of specialized equipment (e.g., helicopters, high-water vehicles) and trained personnel during peak response.
- **Lack of Pre-Event Planning, Drilling and Exercises** – Insufficient community and state-level scenario planning, drilling and exercises to prepare for extreme flood events.
- **Funding Constraints** – Gaps in sustained funding for flood risk mapping, infrastructure hardening, and mitigation projects.
- **Under-utilization of Available Data** – Existing topographic, floodplain, and historical data not fully leveraged for pre-incident planning or real-time decision-making.

One of the most pressing issues spoken of was the absence of a unified, foundational statewide flood warning system feeding actionable on-the-ground real-time and forecasted intelligence to key stakeholders, law enforcement and emergency management. Texas currently relies on a fragmented network of outdated hydrological tools and data sources that are not integrated or capable of providing real-time, forecasted flood impact modeling. This significantly hinders both preparedness and response.

Compounding this problem is the lack of consistent and effective communication before, during, and immediately following emergencies. Many communities receive insufficient notice or unclear messaging about imminent flood threats. Emergency managers across jurisdictions often follow different protocols, leading to delays and confusion in alert dissemination and coordination.

The hearings also underscored a need for better-defined roles and responsibilities among the multiple agencies involved in flood response. Jurisdictional overlaps and gaps, unclear protocols, and inconsistent data-sharing practices make it difficult to mount a unified and timely response to major flooding events.

Finally, there are gaps in Texas' enabling technology, modeling capacity, and data infrastructure. There is limited use of high-resolution LiDAR and real-time sensor networks, and existing GIS tools are insufficiently deployed or connected to support dynamic hazard risk visualization. Moreover, data platforms remain siloed, and the lack of integration across agencies diminishes the effectiveness of predictive analytics and operational decision-making.

These systemic issues create vulnerabilities that can be overcome through the adoption of an operational, modernized flood intelligence and alerting solution, modeled after the one implemented in North Carolina.

Overview: Multi-Temporal Flood Risk and Response Solution

The proposed solution for Texas is a multi-temporal flood risk management, and response system. Multi-temporal refers to the capability of delivering real-time, forecasted, and scenario-based information for decision-making before, during, and after a flood event. This Texas solution can be modeled after an existing proven platform successfully deployed working in North Carolina. The North Carolina Flood Inundation Mapping and Alert Network (FIMAN) is a statewide, operational flood inundation mapping and warning system that integrates multiple data sources to support emergency managers, responders, and the public. FIMAN delivers real-time, forecasted, and scenario-based flood inundation mapping, built environment impact calculations, and trigger / threshold-based warning functionality. FIMAN provides actionable information and reporting seamlessly through the state's crisis information management systems, accessible to all county and municipal law enforcement and emergency management. Key features of the system that can be tailored to address identified Texas challenges include:

- **Rain and stream gages:** Over 500 gages are deployed statewide. These gages include both cost efficient state-operated sensors and integrated data from federal (e.g., USGS, NWS) and local partners. Rain and stream gage data is gathered and uniformly formatted by gage software (contrails).
- **Inundation libraries:** Available for over 250 gages within the FIMAN network, each gage has inundation layers pre-calculated and stored in a digital library. Inundation layers are generated for every ½-foot on a gage, from below bank full to the 500-year flood or flood of record. These inundation layers are intersected with all structures and infrastructure to assess and calculate depth of flooding, estimated percent of damage, and financial loss estimates.
- **Multi-Temporal Intelligence and Analysis:** FIMAN provides three views: real-time (gage reading), forecasted (NWS feed), and scenario-based (pre-calculated). For each view, flood elevations are provided with pre-calculated inundation, percent of damage on color coded structures and infrastructure, financial loss, and alerting.
- **Asset-specific data**: including LiDAR-derived elevations, hydrologic and hydraulic modeling, building, road and bridge information such as first-floor, road surface, and bridge deck elevations, structural and cadastral attributes, and pre-modeled damage/loss estimates.
- **Automated alerting**: available to the public and integrated in the Crisis Information Management System for emergency management and law enforcement. Users of the system can set and receive specific email and or text alerts for gages near them or that may impact them.
- **Hazard and Impact Modeling:** Leverages flood hazard modeling (hydrologic and hydraulic or H&H), USACE-compliant flood damage impact models, and detailed road and bridge impact assessments. These models use LiDAR-derived surface data, road and bridge inventories, low/high chord elevations, and structural attributes to estimate inundation depth, duration, access limitations, and infrastructure vulnerability during different flood scenarios.
- The FIMAN platform also **integrates and shares data** from gages owned and operated by multiple federal, state, and local agencies, including the US Geological Survey (USGS) and the National Weather Service (NWS). This multi-source approach ensures the most comprehensive and reliable flood intelligence available.

The FIMAN solution has proven to be a vital tool for both the public and emergency stakeholders during major flood events. During Hurricane Florence in 2018, usage of the FIMAN platform spiked dramatically as people sought real-time information and emergency managers relied on the system to inform decision-making. Between September 6 and September 26, the platform recorded over 7.1 million page views and nearly 60 million hits. The busiest days, September 15 and 16, saw 1.58 million views and 12.88 million hits—underscoring the public's trust in and dependence on the system during critical moments.

This data demonstrates the importance of these platforms for real-time decision-making and public safety but also shows the technological capacity during a flood event.

Recommended Features for a Texas Flood Risk Platform

A Texas system built from a proven platform would be tailored to include the following features:

- **Real-Time, Forecasted, and Scenario-Based Flood Impact Visualization**: Integration of real-time gage data with forecast models and pre-calculated inundation libraries at every ½-foot stage, supporting high-resolution visualization of flood extent and depth at the parcel, structure, and infrastructure levels. The platform should support dynamic scenario analysis, ranging from below bank full to the 500-year event or flood of record.
- **Unified Alerting and Communication Platform**: A centralized alerting system integrated with emergency management software and crisis information management systems. The system should support role-based alerts (public, emergency management, law enforcement) and trigger thresholds based on real-time water levels, rainfall rates, or forecasted flood stage.
- **Flood Risk Prioritization and Mitigation Planning**: GIS-enabled access to building footprints with first-floor elevations, parcel ownership data, and damage/loss impact modeling. This allows for targeted mitigation planning based on structure-level risk, enabling pre- and post-disaster resource allocation.
- **Pre-Storm and Post-Storm Capabilities:** Tools to visualize forecasted flood extent and impact before an event occurs and automate structure-level and financial loss assessments after the event. These capabilities support time-sensitive evacuation planning and accelerate post-disaster recovery workflows.
- **Support for Policy, Insurance, and Business Continuity:** Integration of structure-level flood risk data with NFIP and commercial risk metrics to support insurance uptake, business continuity strategies, and informed public zoning and policy decisions.
- **Integrated Communication:** Enables seamless data sharing and real-time alerting across agencies and systems. The platform integrates intelligence and information into Crisis Information Management Systems (CIMS) and other alerting frameworks, supporting coordinated situational awareness. It also serves as a foundation for tabletop exercises, training, and operational procedure refinement through simulated scenarios and planning tools.

Transformative Benefits

Realizing these features in Texas would provide a wide range of transformative benefits:

- **Proactive and Targeted Response:** Structure-specific flood assessments, both real-time and forecasted, empower emergency managers to respond to flooding with pinpoint accuracy, improving safety and reducing loss of life and property.
- **Coordinated Communication:** Centralized display and alerting enhance interagency coordination and public messaging through consistent, role-specific alerting and visualization tools.
- **Prioritization and Cost-Effective Mitigation:** Enables actionable and knowledgeable strategic investment of resources by identifying the most vulnerable structures and populations.
- **Faster Recovery:** Accelerates federal and state disaster funding access through timely, accurate post-storm assessments and pre-positioned mitigation projects.
- **Community Resilience:** Supports better insurance decisions, zoning, and business continuity planning through accessible risk insights.
- **Future-Ready Planning and Preparation:** Foundational scenario-based tool enabling process and protocol drills and tabletops between and among law enforcement and emergency management.

Implementation Considerations for Texas

Effective implementation of a Texas flood risk and response solution will require strategic coordination, thoughtful governance, and phased deployment. Below are key considerations:

Governance and Management

- Implementation may best function under the Texas Division of Emergency Management (TDEM), as the primary user of the system.
- A Texas Flood Risk and Response Management Committee might be formally established to coordinate cross-agency and cross-governments collaboration, implementation oversight, and strategic planning. This committee should include representatives from TDEM, TXDOT, TWDB, emergency management districts, regional flood planning groups, and local governments. As these entities (e.g., modify existing systems, there will need to be close coordination).
- Texas universities and research institutions involved in hydrologic and hydraulic modeling, GIS, flood risk analysis, and emergency management might be integrated into the committee structure. Their role could include supporting technical development, evaluating system performance, conducting independent validation, and participating in stakeholder engagement and training.

Robust Education and Outreach

- Texas might deploy a coordinated communication strategy for educating the public, local governments, and private-sector stakeholders about flood risk, system tools, and how to use flood intelligence to improve preparedness, response, recovery, and overarching resilience.

Exercise and Drilling

- Texas might engage emergency management professionals early in development through workshops, tabletop exercises, and pilot deployments. These efforts help validate alert protocols, improve emergency action plans and operational workflows, and user roles while fostering local familiarity with the tools and procedures necessary for effective use of the system during real events.

Suggested Phased Implementation Strategy for Texas

1. Year 1 – Core Development and Pilot Implementation (Eight (8) counties)
    - Aggregate, standardize and acquire where necessary foundational data: LiDAR, hydrologic models, cadastral and structure-level attributes.
    - Develop and validate pre-calculated inundation libraries for pilot counties.
    - Build the core cloud-based application architecture and modeling engine.
    - Define flood alert triggers, state and local flood risk and response roles, protocols, and reporting workflows.
    - Conduct tabletop exercises and drills to validate the interface, workflows, roles and responsibilities.
    - Deploy initial operational capability in 8 counties affected by the July 4th flooding: Harris, Liberty, Montgomery, Walker, San Jacinto, Polk, Hardin, and Jefferson. These counties were selected based on observed flood severity, population vulnerability, infrastructure exposure, and proximity to major watersheds that experienced high flows and flash flooding.
2. Year 2 – Expansion to High-Risk Counties and Adjacent Regions
    - Add the next 26 high-risk counties, focusing on those with high NFIP claim histories, frequent flash flood warnings, vulnerable populations, and critical infrastructure exposure. Recommended counties for Year 2 could include: Bexar, Fort Bend, Brazoria, Galveston, Chambers, Orange, Jasper, Newton, Tyler, Angelina, Nacogdoches, Trinity, Grimes, Washington, Waller, Austin, Matagorda, Wharton, Colorado, Fayette, Bastrop, Travis, Williamson, Hays, Caldwell, and Comal.
    - Refine modeling and operational tools using insights from Year 1.
    - Conduct training, outreach, roles and responsibilities, tabletops, and drills for new counties.
3. Year 3 – Regional Integration and Multi-Hazard Expansion
    - Expand platform access to an additional 40 counties, with a focus on regional clusters within the Brazos, Trinity, and Guadalupe River basins. Recommended counties for Year 3 include: Bell, McLennan, Milam, Robertson, Brazos, Burleson, Lee, Gonzales, Lavaca, DeWitt, Victoria, Goliad, Bee, Refugio, Aransas, San Patricio, Nueces, Jim Wells, Kleberg, Atascosa, Medina, Uvalde, Bandera, Kerr, Gillespie, Blanco, Burnet, Llano, Mason, San Saba, Mills, Lampasas, Coryell, Hamilton, Bosque, Hill, Limestone, Freestone, Navarro, Ellis, and Johnson.
    - Refine modeling and operational tools using insights from Years 1 and 2.
    - Conduct training, outreach, roles and responsibilities, tabletops, and drills for those new to the emergency management workforce.

- Integrate additional hazard overlays, including dam breach and coastal inundation (e.g., hurricane surge), to support counties with complex flood risk profiles and enhance predictive capabilities.
- Enable regional coordination tools and multi-county situational dashboards.

4. Year 4 and Beyond – Full Statewide Rollout and Optimization

- Reach full coverage across all 254 Texas counties.
- Optimize performance and interface usability.
- Formalize the system of record status for FEMA and HUD grant reporting.
- Refine modeling and operational tools using insights from Years 1, 2, and 3.
- Conduct training, outreach, roles and responsibilities, tabletops, and drills for those new to the emergency management workforce.
- Initiate phased operations and maintenance schedules.

This phased strategy allows Texas to start with an actionable pilot focused on recent high-impact flooding, while scaling based on risk, readiness, and impact potential.

Conclusion

The recent tragic events in Texas highlight vulnerabilities that can be overcome by improving flood response using a data-driven approach to flood risk management. North Carolina's integrated approach, anchored by FIMAN, FRIS, and flood.nc.gov—is a proven technology that can be tailored to meet the unique challenges faced by Texans and improve response and recovery outcomes. Leveraging existing proven technology, as proven with NC FIMAN, will quickly and directly address the gaps identified by Texas stakeholders, supports integration with other technologies and agency systems, and enables the reuse of existing data and modeling investments. Texas can customize this strategy to its unique landscape while aligning with national best practices and interagency standards.

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