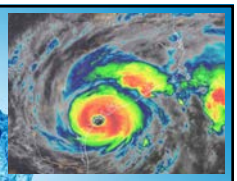
FLOOD EARLY WARNING IN TEXAS – CURRENT STATE OF AFFAIRS

TFMA FALL SUMMIT
AUGUST 28, 2019



Presenters:
1. Mr. Eric Scheibe, PE, CFM (Scheibe Consulting, LLC)
2. Mr. John Espinoza, PE, CFM (City of San Marcos)

History of Early Warning Systems

1. At the dawn of civilization, people used bonfires as early warning signals for natural disasters and enemy attack.
2. In the Middle Ages, bells were commonly used as an alert system. As Cities grew, the use of a central bell was no longer sufficient.
3. In the 20th Century, modern electronic sirens were implemented and still play a major role in early warning.

History of Flood Early Warning Systems

"Flood are among the most frequent and costly natural disasters in terms of human hardship and economic loss" [USGS/NWS, 1995]

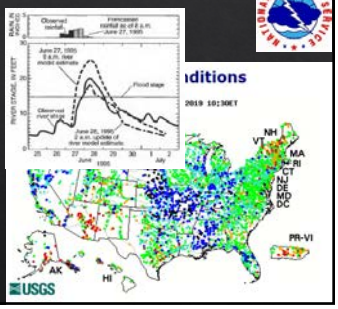
"The long-term (1925 – 88) annual average of lives lost is 95, mostly as a result of flash floods." [USGS/NWS, 1995]

History of Flood Early Warning Systems

The National Weather Service (NWS) is the Federal Agency in charge of weather forecasting and warning for the Nation.

The NWS is charged by law with **responsibility for issuing river forecasts and flood warnings** (as per the National Weather Bureau Organic Act of 1890)…which mandates:

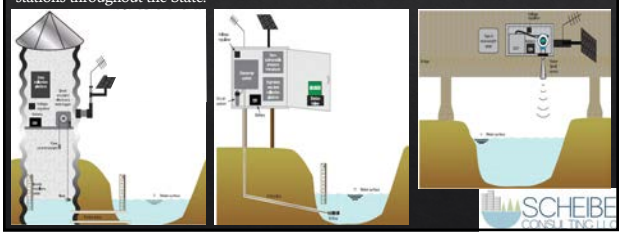
"the forecasting of weather, the issue of storm warnings, the display of weather and flood signals for the benefit of agriculture"



Stream Gauge Systems – A snap-shot

USGS science for a changing world

The USGS and many other entities have installed numerous gauge stations throughout the State.



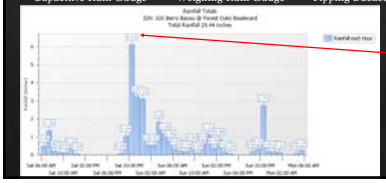
Rain Gauge Systems – A snap-shot

Capacitive Rain Gauge

Weighing Rain Gauge

Tipping Bucket Rain Gauge

Interesting Fact: Tipping Bucket Gauges are the most commonly used rain gauge in Texas. These gauges have a 20% error in excess of 5 inches/hr.



6.12 In./hr.…or was it 7.3 in./hr…or was it 4.9 in./hr ???

What effect does this have on ATLAS 14???

Current State of Flood Early Warning Systems

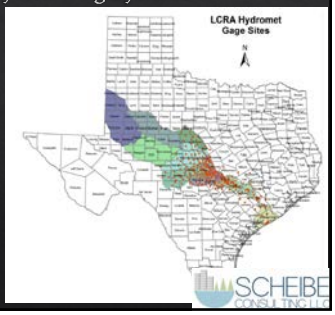
Over Time communities have developed robust "private" gauge networks in numerous locations.

LCRA

Hydromet System (circa 1980)
- Originally had 74 river gauges
- Now has 265 river gauges (17 jointly maintained by USGS and LCRA)

Data is transmitted to the NWS, West Gulf River Forecast Center, for flood forecasting purposes.

NWS Forecasts are published at select gauge stations.

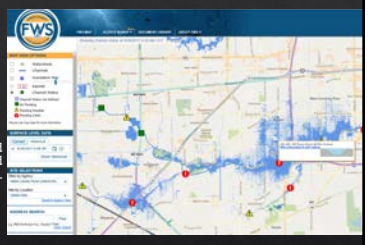


Current State of Flood Early Warning Systems

HCFCD

HCFCD FWS System (circa 1980)
- Network started with 13 gauges
- Network now has 177 gauges.

This system provides real-time flood stage and rainfall data at each gauge and has also evolved into an automated real-time inundation mapping system.

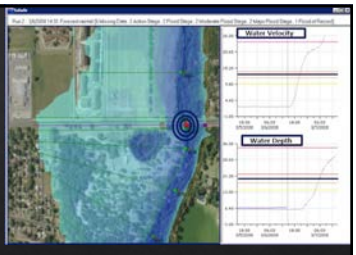


Current State of Flood Early Warning Systems

SARA

SARA FloodWorks System (circa 2008)
- An InfoWorks based flood warning system that links NWS rainfall data to a real-time inundation model/mapping software.
- The system continuously runs every 15 minutes, and during peak rainfall events, can re-run every 6 minutes.

The model platform had all the bridges removed in order to meet the run-time schedules of 15 minutes and 6 minutes.

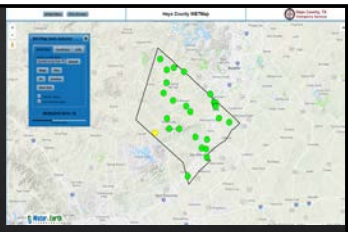


Current State of Flood Early Warning Systems

HAYS COUNTY

Hays Co. FEWS (Circa 2016)

- System and web interface managed by Water & Earth Technologies.
- System includes stage and rain gauge network.
- System links LCRA and USGS gauge information.
- System focused on low-water crossings and road closure protocols.
- County staff knowns gauge height readings whereby road closures must occur.



Current State of Flood Early Warning Systems

NWS

The Advanced Hydrologic Prediction Service provides stage and flow forecast points at select USGS gauges.

Points report up to a 4-day forecast.

Managed locally by the West Gulf River Forecast Center.

Inundation map library (6" interval) is available for ~1 mile upstream and downstream of the gauge.

Advances in State of Flood Early Warning Systems

NWS/USGS/USACE/FEMA (aka INFRM TEAM)

The InFRM Team advancements:

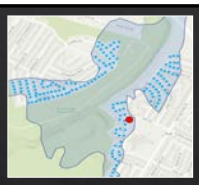
- On-going projects to develop inundation library and mapping system for reaches well beyond the current one (1) mile upstream/downstream limit.
- InFRM is also updating hydrology on major watersheds in the State.

Advances in State of Flood Early Warning Systems

UT Austin – Pin2Flood System (*Dr. David Maidment*)

APP allows first responders to physically locate a flooding limit and transmit the x/y data back to a database that will instantaneously develop an inundation map based on known LiDAR data and predeveloped inundation map libraries.

This system could supplement other automated or manual flood warning systems.



Pin2Flood

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US National Water Model

(Courtesy: *Dr. David Maidment*)

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Advances in State of Flood Early Warning Systems

National Water Model - Advancements

Efforts are underway to develop methods to link detailed hydraulic model rating curves and/or detail study inundation map libraries (even 2D modeling) back to the National Water Model framework.

Goal is to further enhance the accuracy of the National Water Model where deficiencies exist.

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City of San Marcos - FEWS

DRAFT Goals:

1. Join existing Hays Co. FEWS Network
   - Including web-interface and reporting system.
2. Begin Gauge Implementation Program:
   - Phase 1 - add 3 new stream gauges & link existing rain gauges
   - Phase 2 – add an additional 13 new stream gauges (coupled with real-time inundation mapping system).
3. Begin FEWS Inundation Mapping Program:
   - Phase 1 - Develop inundation map library for studies streams (to InFRM Standards)
   - Phase 2 - Consider long-term real-time inundation mapping system.

City of San Marcos – FEWS

Real-Time Inundation Mapping Tool

(developed by: Scheibe Consulting & Alan Plummer Associates)

Pilot Project focused on a reach of the Blanco River upstream of the City of San Marcos, between two (2) USGS gauges.

Automated System uses Stage-Frequency curves from pre-developed hydraulic models and links these curves at each model cross-section to bounding stage gauges, resulting in a frequency/distance interpolation for the mapping.

Other On-Going Regional Effort

Lower Colorado River FEWS
(Funded by TWDB)

Project involves 2D model enhancements to Lower Colorado River and overflows (Colorado/Fayette Co. – West Matagorda Bay)

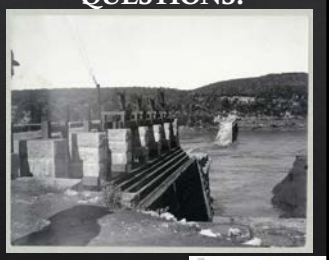
Project will result in updated inundation library for incorporation into the InFRM FIM Viewer.

InFRM Team is eager to work with other communities that have detailed hydraulic models and inundation libraries available. This data, once reviewed and approved, can be incorporated into their system.

Scheibe Consulting has been working with the following communities on FEWS, since 2017:

1. City of Killeen,
2. City of Harker Heights,
3. City of Belton,
4. City of Nolanville,
5. Cameron Co. DD #5,
6. Matagorda Co.,
7. Wharton Co.,
8. Colorado Co., &
9. City of San Marcos

QUESTIONS?



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