TCEQ Dam Safety Program Activities

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Presentation items

• LiDAR
• Dam Owners and Engineers
• PMP Study
• Dam Failures
• Dam Safety reports
LiDAR

TCEQ
4674 Square Miles
Through Partnerships
9783 Square Miles
1022 Dams

LiDAR
Improved Accuracy:
- Hazard Classifications
- H & H Analyses
- Breach Analyses

LiDAR
Dam Owners and Engineers
Owner Responsibilities

• Owner responsible for operating and maintaining dam in a safe manner
• Owner responsible for addressing all maintenance and safety concerns identified during an inspection
• Owner shall ensure that necessary maintenance, repairs, alterations, or modifications are initiated and completed in a timely manner
Owner Responsibilities

- Owner has the legal duties, obligations, and liabilities incident to ownership or operation

- Dam Owner is liable

- 30 TAC §299.41
Will TCEQ Enforce?

• TCEQ will not require the dam owner to breach the dam or drain the lake simply because they do not meet all of the requirements.

• TCEQ will execute our enforcement powers if the dam presents an unacceptable threat to public safety and dam owner is making no attempt to alleviate the threat - Failure to act.
What should the Owner do?

• Evaluate and prioritize
• Look at phased approach to needs of the dam

For example:
• Possibly making structural upgrades; and
• Correcting serious deficiencies from maintenance neglect over the years.

Instead of hiring an engineer to perform a hydrologic and hydraulic analysis, which could result in an expensive study and costly modifications, especially if the dam passes more than 50% of the PMF.
What should the Owner do?

• In other cases, the hydrologic and hydraulic study may need to be first if the dam passes only a small percentage of the PMF, or if the spillways are damaged and need to be repaired.

• In other words, prepare a plan of action and time line that is reasonable, financially feasible, and produces the safest dam.
What should the Owner do?

- Educate yourselves
- Ask us for assistance if you need help
- Solicit options from engineers when seeking proposals
- Seek out engineers experienced in dam design
- Seek out more than one engineer. Research the engineering firms
Owners and EAP Requirements

• If you cannot afford a breach analysis, develop a draft EAP that may be overly conservative
• Have analysis done later
• Ask for assistance from us if you need help
Engineers

• Texas Board of Professional Engineers rule §137.63.(b)(1):
  “endeavor to meet all of the applicable professional practice requirements of federal, state and local statutes, codes, regulations, ordinances or standards in the performance of engineering services.”

• Read and understand our rules
Why does an Owner need an Engineer

- Dams are deteriorating due to age and lack of maintenance in some cases
- Downstream development increasing, resulting in change of hazard classification
- Inspections, maintenance, repair, and rehabilitation needed over time
- Engineer needed to evaluate and undertake corrective action
What can an Engineer Perform?

- Recommend course of action
- Prepare plans and specifications
- Perform hydrologic and hydraulic studies
- Perform inundation mapping
- Assist in selecting a contractor
- Provide construction inspection services
What Engineer should I hire?

• A professional engineer licensed in Texas
• An engineering firm with an active TBPE Firm Registration number
• An engineer knowledgeable with the TCEQ Dam Safety rules and regulations
• An engineer with experience in the problem area (hydrology, hydraulics, structural, or geotechnical)
What does an Owner need to do?

• Request references from engineer and contact references to discuss performance
• If possible, look at other projects completed under engineer’s design
• Keep in touch with us to verify that the proposed work will meet the rules
• Become knowledgeable in the basics of dam safety and the rules
• Know what you are asking the engineer to do
What does an Owner need to do?

• Carefully consider the selection of an engineer. It may save you money in the future.
• Request options for addressing the problem
Sponsors of NRCS Watershed dams

- Water rights
- Fill out maintenance needs surveys when sent by the TSSWCB
- We recognize that SWCDs do not have funds for EAPs. We can assist with writing EAPs.
- Contact will be made before any inspections
Other Issues

• 401/404 permits from COE if dam is to be modified
• Aquatic resources transfer
Probable Maximum Precipitation (PMP) Study for Texas
PMP Study

• Started August 2014
• Completion August 2016
• Contractor – Applied Weather Associates, Bill Kappel, Project Manager
• Peer Review Committee
PMP Study Peer Reviewers

- Dr. William Asquith, USGS and Texas Tech
- Dr. John Nielsen-Gammon, State Climatologist and Texas A&M
- George Bomar, Texas Department of Licensing and Regulation and author of *Texas Weather*
PMP Study Peer Reviewers

- Todd Marek, P. E., NRCS, Temple
- Simeon Benson, USCOE, Fort Worth
- Charles McWilliams, USCOE, Omaha, Neb.
- Debra Rankin, P. E., TCEQ Dam Safety
- Warren Samuelson, P. E., TCEQ Dam Safety
Probable Maximum Precipitation (PMP)

- **Definition:** The *theoretically* greatest depth of precipitation for a given duration that is *physically possible* over a given storm area at a particular *geographic location* at a certain time of year (HMR 59, 1999)

- **Types of PMP studies:**
  - Generalized (Hydrometeorological Reports)
    - Provides PMP values for a region
    - HMR 51 - East of the 105\textsuperscript{th} Meridian from Canada to Mexico
  - Regional/Statewide
    - Provide PMP values over regions with varying topography
    - Individual basins are included in the regional/statewide results
  - Site-Specific
    - Provides PMP values for individual drainage basins
    - Considers unique meteorology and topography
How Do Site-Specific, Statewide, Regional PMP Studies Provide Improved PMP Values?

• More storms considered
• New technologies used
• Problems/Unknowns in the HMRs corrected
• Topographic features addressed
• Updated climatologies used
Method for Computing PMP Values

- Observed extreme rainfall events are used
- Storm based approach
- Identify extreme storms in Texas and regions that are considered transpositionable
- Identify recent extreme storms since publication of the appropriate HMRs
- Review older rainfall data records
- Identify extreme storm types
  - Local storms (thunderstorms/Mesoscale Convective Systems (MCS))
  - General storms (frontal systems)
  - Hurricanes/Tropical Systems
Method for Computing PMP Values

• Identify unique topography
• Precipitation enhancement/decrease
  • Orographics
• Effects on rainfall center location
  • Physically possible storm centering / orientation

• Review previous procedures
  • Identify inconsistent assumptions
  • Apply new technologies and data
  • Apply new/updated methods
PMP Study for Texas

Project Overview

• Comprehensive evaluations of extreme rainfall storm events
  • Extreme rainfall storm identification
  • Storm analyses
  • Storm maximization
  • Storm transpositioning
• Synoptic extreme rainfall (General Storms/ Tropical Storms)
• Thunderstorms and MCS
PMP Study for Texas

Background

• PMP values as provided in HMRs are overdue for updating
  • Storm data base grossly out of date (1970s)
  • Procedures used to analyze storms outdated
  • PMP values usually compound conservatism unrealistically

• Provide greater confidence, credibility, and more accurate/reliable values
• Apply updated meteorological understanding and techniques
PMP Study for Texas

Procedure

• Update the storm database
  • Produce Depth-Area-Duration (DAD) analyses for all major storm events
• Use updated dew point analyses to maximize storms
  • Storm representative & maximum dew points
• Use of state-of-the-science procedures and tools
  • GIS & Orographic Transposition Factor
• Provide PMP values for all locations within Texas
  • All locations considered in this study
  • All durations and area sizes as required
• Utilize PMP Evaluation Tool to produce PMP on a gridded basis (~2.5sqmi grid)
PMP Study for Texas

Procedure

• Follow the basic procedures used in previous AWA studies
  • Nebraska, Arizona, Ohio, Wyoming statewide PMP studies
  • Numerous individual basin PMP studies (Tarrant Regional Water District)
  • Michigan and Wisconsin, Texas regional PMP
• Incorporated storms through 2015
• Used GIS to provide efficient and effective distributions of PMP values across the Texas
• PMP to provide continuity of PMP values across the region in space and time while taking into considerations differences in topography and climate
Task 1

Review of previous studies for applicability

1. AWA PMP studies (e.g. Nebraska, Ohio, Arizona, Wyoming, Tarrant, Arkansas Nuclear One, Quad Cities, etc)

2. HMRs 33, 51, 52, 53, etc

3. USACE and USGS storm and flood analyses
Probable Maximum Precipitation Study for Texas

Applied Weather Associates PMP Coverage and Project Locations

Projects (by Regulatory Agency):
- Red: State Regulated
- Yellow: Federal Energy Regulatory Commission
- Green: Nuclear Regulatory Commission
- Blue: Forensic/Expert Witness

See accompanying project list
PMP Study for Texas

Task 2
Storm Search and Short List Development

• Complete a storm search to identify the most significant storms that could have occurred over the region where storms are transpositionable to Texas

• Identify storms used in HMRs and other PMP studies

• Identify the most significant flood events that have occurred in region

• Identify extreme rainfall-producing storm types and seasons associated with those storms

• Use the Storm Precipitation Analyses System (SPAS) to analyze extreme rainfall events that have not previously been analyzed

• Use SPAS to reanalyze extreme rainfall events
Intermediate Storm List - All Storms
Example Results

• Alvin storm has been reported to be 43 inches in 24 hours. From handwritten notes, the storm appears to have been more like 45 inches in 24 hours

• Frontal system in Holt, Missouri resulted in a 12 inch rainfall in 42 minutes
Recent Examples
Week of May 4, 2015

• Tahoka coop station – 9.1 inches in 24 hours. The 2\textsuperscript{nd} highest 24 hour rainfall total recorded in this area of the state.
• Weather observer near Coupland – 7.93 inches overnight
• Weather observer near Thrall – 7.90 inches overnight
The Precipitation Generation Process is currently running and began at 2015/05/21 15:30.

Texas: Current 14-Day Observed Precipitation
Valid at 5/21/2015 1200 UTC - Created 5/21/15 14:30 UTC

1. Timeframe
   - Current Data
   - Archive: Month/Year
     - May 21, 2015 - Today
     - May 21, 2015 - Last 7 Days
     - May 21, 2015 - Last 30 Days
     - May 21, 2015 - Last 60 Days

2. Product
   - Observed
     - Departure from Normal
     - Percent of Normal

3. Location
   - States
   - NWS RFC/Regions
   - NWS WFOs

4. Units
   - English
   - Metric

Update URL for Bookmarking
Print/Save Map
View Yesterday's Analysis
Zoom Out to CONUS
PMP Study for Texas

Task 3

SPAS Storm Analysis

• All storms used for PMP develop analyzed with SPAS
• SPAS produces gridded rainfall analysis and required data sets
• USACE storms will need to be re-analyzed
PMP Study for Texas

Task 4
Storm Maximizations/Transpositioning/Orographics

• Utilize the updated maximum dew point climatology for use in storm maximization and transpositioning

• Maximum average dew point values
  - 6-hour
  - 12-hour
  - 24-hour

• Sea Surface Temperatures (SST) climatology for some events
Task 5

Orographics and Grid Domain Analysis

• Develop total adjustment factors on a gridded basis
  • 2.5-square miles
  • Utilize storm Depth-Area-Duration data
  • Each storm explicitly transpositioned to each grid as appropriate
  • Allows for differences across state to be quantified
  • Each adjustment known and reproducible
30-year Mean Annual Precipitation (1981-2010) in Inches
Texas Statewide PMP Study

Statewide Average: 28.67"
PMP Study for Texas

Task 6

Develop PMP
- Values will be provided on a gridded basis or other format
  - Not confined to 72-hrs
  - ~2.5mi²
- Appropriate durations, 1-hr, 6-hr….as needed
- Analyze the orographic effects of elevated terrain
- Transposition limits for each storm will be determined
  - Use the procedures developed in previous PMP studies
  - Precip frequency data to calculate the Orographic Transposition Factor
  - Corrects stippled region in HMR 51/52
Proposed PMP Analysis Domain
Texas PMP Study
PMP Study for Texas

Task 7
Storm Based Hydrology Application
• Work with users to provide PMP rainfall information as needed
• Updated temporal distributions
• Other rainfall characteristics
Task 8

Quality Control and Sensitivity
- Compare results
  - HMR PMP values
  - NOAA Atlas 14 precip frequency data
- Discuss sensitivity of various parameters and assumptions on the final PMP values
PMP Study for Texas

Task 9

Final Report

• A Draft final report will be submitted for review by the Peer Review Committee
• Review comments will be incorporated into a comprehensive final report as appropriate
• An appendix will be provided with all storm details and calculations used to determine the PMP values throughout Texas
• Maps of PMP values will be provided both in the report as well as in GIS format
PMP Study for Texas

Task 10

Review Meetings

• Meetings will be held with the peer Review committee to present and review the approach and procedures to be used as well as work completed
• Two have been held to date
• Additional data has been provided by the committee members
Task 11

Updated Precip Frequency

- Build from extensive previous work
  - Dr. William Asquith’s publications
  - Southern Regional Climate Center
- Follow same methodology as NOAA Atlas 14
- 6hr and 24hr data used for PMP calculations
Dam Failures
Dam Failures

• May, 2014. Spillway failure. Dam was not breached.

• August 2014. Dam failed during a significant rainfall event

• May 10, 2015. Dam overtopped and damaged. Dam did not breach.

• May 25, 2015. Dam overtopped and completely failed.
Dam Safety Reports
Reports

• If there are errors in the report, please let us know so we can correct the report and remove the incorrect report from the public file.
There have been delays in sending the reports
We apologize for this delay
There are several factors causing the delays
We are working to correct this issue
Reports

• We are attempting to provide you with a complete and professional engineering report

• If our delays are causing you budget or other problems, let me know so I can try to address the issue
Reports

• You are important
• Our desire is to help you protect your dam
• It may cost you dollars as a result of our inspection; however, it is for your benefit
Questions