Cris Parker, PE, CFM - HDR
Brandon Hilbrich, PE, CFM - HDR
Steve Gerdes, ECWSD Board President

Background

- Lake Leon Dam Impounds the Leon River
- 258 sq. mi. Watershed in Eastland County, TX
- Water Supply for Over 70% of the Population in Eastland County

Lake Leon Dam

- Large (90-ft) High Hazard Dam
- Primary Spillway – Morning Glory w/ 11-ft Dia. Conduit
- Auxiliary Spillway – 1200-ft Wide Earthen Cut
- TCEQ 1978 Ph1 Report – Pass 65% PMF (75% PMF required)
Historical Background

- Approximately 5 slope failures since 1975
- Multiple homes flooded around lake

2015 FEMA HMGP Grant Project Objectives

- Earthen Dam Potential Failure Modes (PFMs)

2015 FEMA HMGP Grant Project Objectives

- Earthen Dam Potential Failure Modes (PFMs)
2015 FEMA HMGP Grant Project Objectives

- Repetitive Flooding of Homes in the Flood Pool

2015 FEMA HMGP Grant Process

- Experienced Grant Writing & Administration Help is Key
- Experienced Engineering Expertise is Key
- Time – 18 months from application to approval

FEMA HMGP Project - Phase 1

- Preliminary Engineering/30% Design (Sept. 2017 - May 2018)
Failure occurred on March 28, 2018
- Enacted Emergency Action Plan
- Engaged the Grant Team immediately for emergency funding

April 2018 - HDR presented permanent stabilization alternatives to District
- Sheet Pile

Secured Two Grants
- USDA RD Emergency Community Water Assistance Grant (ECWAG) - $500,000
- TDA Grant - $350,000
- Total funding - $850,000
- Required 2 bid packages
- Project cost - $812,567
- Grant Award Time ~ 4 months
Emergency Repair – Final Design & Construction
- Feb. 2019 Construction start
- Complete Nov. 2019

FEMA HMGP Project – Continuation to Final Design
- Phase 2 Final Design (June 2018 – May 2020)
  - 60% and 100% Design
  - TCEQ Review/Approval
  - Bid Documents

FEMA HMGP Project – Design
- Design
  - Emergency Spillway revisions
  - Cut/Fill Balance
  - DS slope stability modifications
  - Increased safety factor
FEMA HMGP Project – Design

Spillway Hydraulic Analysis (2D Model Approach)
• Ability to capture detailed underlying terrain
• Full Momentum Computation
• Detailed Outputs
  • Depths
  • Velocities
  • Shear Stress
• Assess downstream impacts

FEMA HMGP Project – Design

• Project flood mitigation improvements
  • Removed 17 homes from 100 yr inundation lake levels.
  • 2007 storm similar to 25 yr event – Removed 35 homes.
• Coordinated with TxDOT into an Advanced Funding Agreement (AFA) for FM 2461 roadway improvements within project area.
  • $660k construction cost transfer
• Final BCA – 1.6
• Final Estimated Total Project Cost – $3.5M

FEMA HMGP Project – Construction

• Ground Breaking – June 2020
• Contract Substantial Completion – Dec. 2020
  • Actual Substantial Completion – Nov. 2020
• Final Completion – Jan. 2021
  • Actual Final Completion – Spring 2021 pending TxDOT road completion
• Original Grant Construction Budget – $2.5M
  • Actual Construction Cost = $2.2M
• ECWSD Portion (25% Local Match) = $550k

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HB [2]1  make this a video
Hilbrich, Brandon, 3/20/2021
FEMA HMGP Project - Construction

- https://www.youtube.com/watch?v=HQJ0unE9U

FEMA HMGP Project – Dam Slope Benefits

- Reduced risk of future slides along 79% of the main dam embankment
- Increased slope stability F/S by flattening d/s slope and installing sheet pile on u/s slope
- Reduced risk of future desiccation cracking by removing surficial fat clays from dam crest
- Reduced concentration of drainage from the road into cracks

Other Benefits:
- Increased roadway safety by widening FM 2461, adding new guardrail
- Removed trees and vegetation, increased ability to mow and keep clear
FEMA HMGP Project – Before and After

Before

After

FEMA HMGP Project – Spillway Benefits

- Reduced flood risk to homes around lake
- Reduced risk of erosion damage to FM 2461

May 31-June 1 Flood

https://www.youtube.com/watch?v=bfagqebxhGQ
NOAA Atlas 14 Rainfall Return Interval

- 3.2" 12 hours ~ 5-year ARI (20% annual chance of exceedance)

May 31-June 1 Flood

Comparison to Project Design

- Design Flood Recurrence Interval - Elevations (NGVD29)
  - 2-yr design flood – 1376.58 ft-msl
  - Observed flood – 1379.55 ft-msl
  - 10-yr design flood – 1380.80 ft-msl
  - 25-yr design flood – 1382.57 ft-msl
  - 50-yr design flood – 1383.66 ft-msl
  - 100-yr design flood – 1384.59 ft-msl

* Design storms are 24-hour duration storms per FEMA

May 31-June 1 Flood

Design Flood Channel Flow Depth

- ~260 cfs at 1.8 feet deep

May 31-June 1 Flood

Observed Flood Channel Flow Depth

- ~1.5 feet deep
Risk Associated with Principal Spillway

- Lack of Filter Diaphragm to Prevent Internal Erosion
CDBG-MIT Grant Project

- $9.8M Funding Awarded
- Local Match is 1% = $98,000
- Grant Objectives
  - Complete ski slope stability
  - Primary spillway rehabilitation
  - Auxiliary spillway erosion mitigation
  - New raw water PS and water line

Total Lake Leon Investment

- FEMA HMGP Grant – $4.4M
- Emergency Grant – $850k
- CDBG-MIT Grant – $9.8M
- Total Grant Funding – $15.0M
- Total Cost to ECWSD – $1.9M

Project Benefits

- Flood risk reduction
- Dam safety risk reduction
- Roadway safety improvements
- Roadway flood/erosion risk reduction
- Improved O&M of dam
- Extending life of 66-year old dam for decades to come!

Grant Application/Process Lessons Learned

- Experienced grant writing & administration help is key
- Experienced engineering expertise is key
- Be aware of (and not afraid of) grant funding opportunities
- Forward thinking leadership

Key Project Leadership

Steve Gerdes – ECWSD Board President
Judge Rex Fields – Eastland County Judge
Judy Langford – Langford Community Management Services
Scott Hay, PE – eHT
Other Grant Opportunities

- Texas Freeze FEMA HMGP
- FEMA High Hazard Potential Dam (HHPD)
- FEMA
- FEMA ERPIC
- HUD CDBG Mitigation

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References