



# LOWER RIO GRANDE CITIZENS FORUM

## AMISTAD DAM SAFETY MITIGATION PLAN

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International Boundary and Water Commission  
United States Section



# AMISTAD DAM SAFETY MITIGATION PLAN

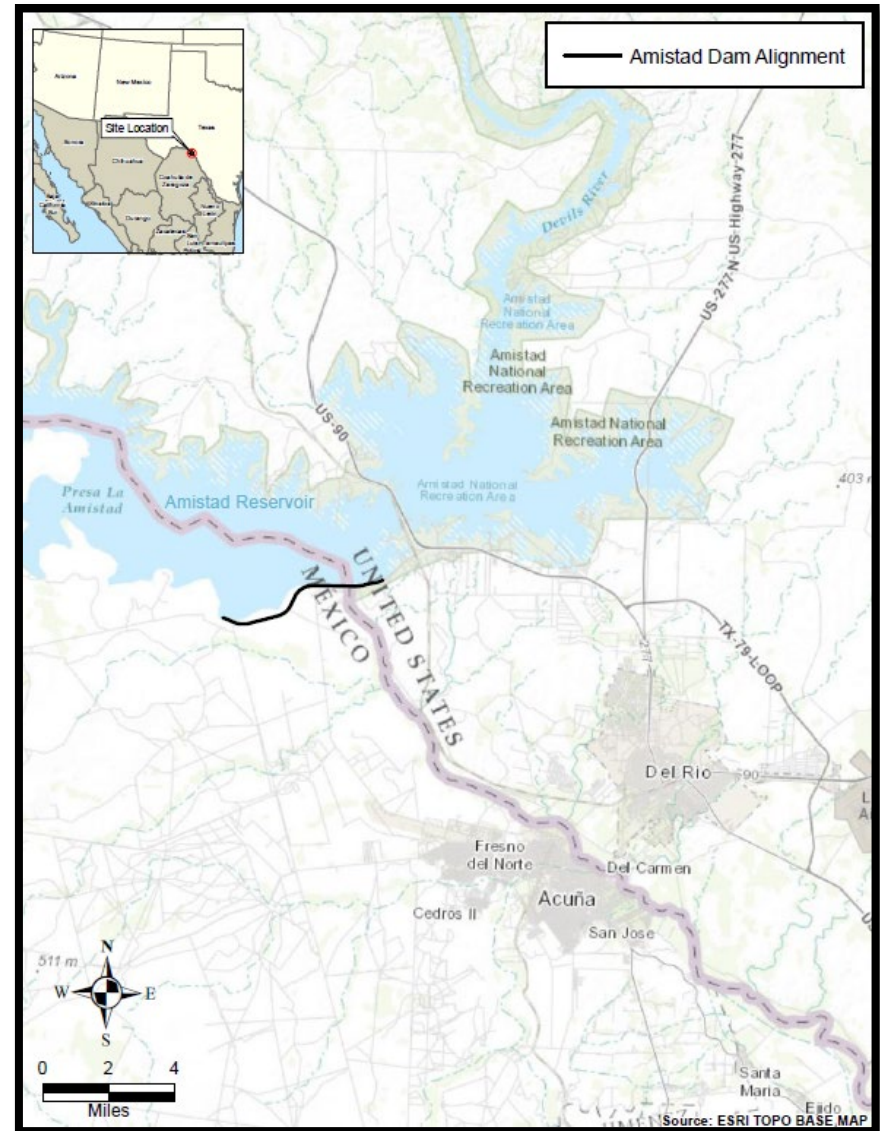
## Background

Located on the Rio Grande 11.81 miles (19 kilometers) north of the cities of Del Rio, Texas and Ciudad Acuña, Coahuila. It is the second international storage dam built jointly by the United States and Mexico, pursuant to the 1944 Water Treaty.

Construction began in 1963 and was completed in 1969.

The total length of the damming surface is approximately 32,200 feet (9,815 meters).

Reservoir capacity is 5.6 Million acre-ft (12th largest in the US).



**Project Location Map  
Amistad Dam**





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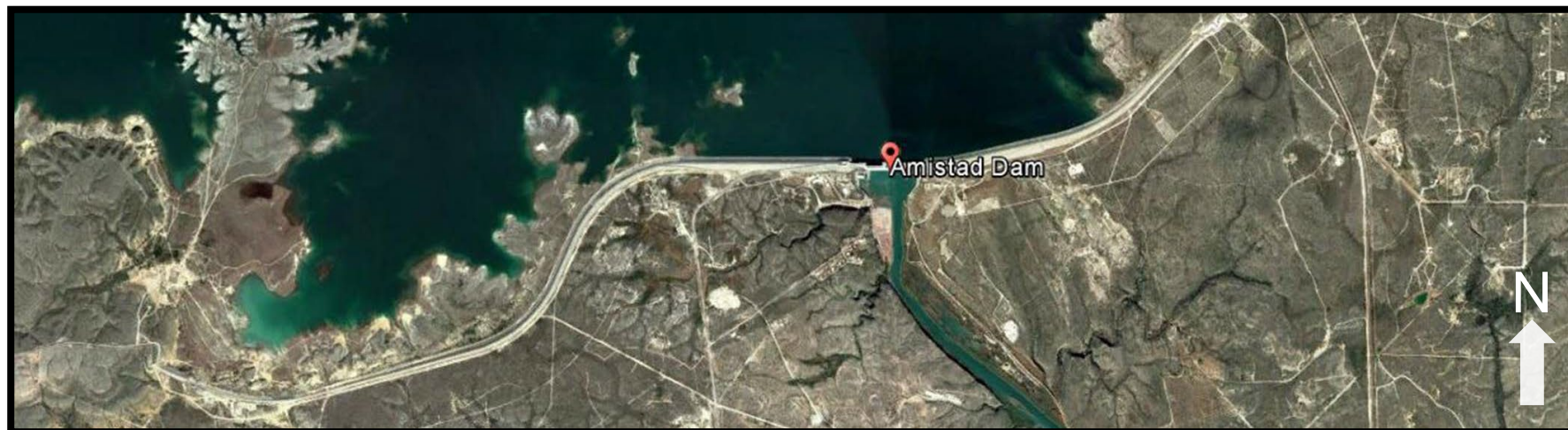
## Benefits

- Flood Risk Management, Hydropower Generation, Water Supply, Flood Control, Water Quality, Fish and Wildlife Enhancement, and Recreation
- \$76M annually
- \$79B annually in commercial trade between the U.S. and Mexico\*
- \$820M (U.S)\*\* and \$232M (Mexico)\*\*\* value of irrigation-fed agriculture in the Rio Grande Valley

\* 2016 dollars

\*\* 2012, Economic Impact Estimate of Irrigation Water Shortages on the Lower Rio Grande Valley Agriculture by Luis A. Ribera and Dean McCorkle

\*\*\*Agricultural statistics from the Irrigation Districts, 2015-2016 agricultural cycle, CONAGUA





# AMISTAD DAM SAFETY MITIGATION PLAN

## Amistad Dam Timeline of Events

Project Milestone	Commenced	Completed
Construction of the dam	1963	1969
Deliberate impoundment to conservation pool	1969	1972
Pool of record = 346.15 m (as of 30-Jan-2017)	--	Sept -1974
Construction of the hydropower facilities	1980	1983
Severe drought period, which led to discovery of numerous upstream sinkholes	1994	2004
Circular depression found and backfilled on Mexican embankment near station 7+000	--	1996
Remedial centerline grouting plus supplemental upstream Toe grouting on the Mexican embankment	1995	1998
US Geological Survey (USGS) investigations: surface geophysics plus monitoring well installation	2005	2006
Periodic inspection leading to joint technical advisor group formation	--	2007
Rated DSAC II	--	2007
Interim Risk Reduction Measures (IRRM) implemented	2007	2011
Expert Panel Review of Amistad Dam Document	2008	2009 revised 2011
Historical low pool since first filling = 321.0 m (as of 30-Jan-2017)	--	May-2013
Quantitative Risk Assessments	2010	2016
AECOM Investigation – Geophysical survey, dye-testing survey, drilling, observation well installation, and automated instrumentation system installation.	2015	2016
Dam Safety Modification Report written	2012	2019





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**Reservoir Sinkhole Upstream of Amistad Dam  
Marly Limestone Overlayed  
with 6 or 8 inches of Lake Silt (DSMR, 2019)**





# AMISTAD DAM SAFETY MITIGATION PLAN



## Issues

- Sink holes endanger dam
  - Potential risk to the structure's stability
  - Categorized Class II DSAC
  - Population at risk (PAR)
    - During a high pool (elev. 1,145 ft/349 m) approx. 300k to 400k people impacted
- DSAC = Dam Safety Action Classification*

## Final Structural Alternatives selected from DSMS study:

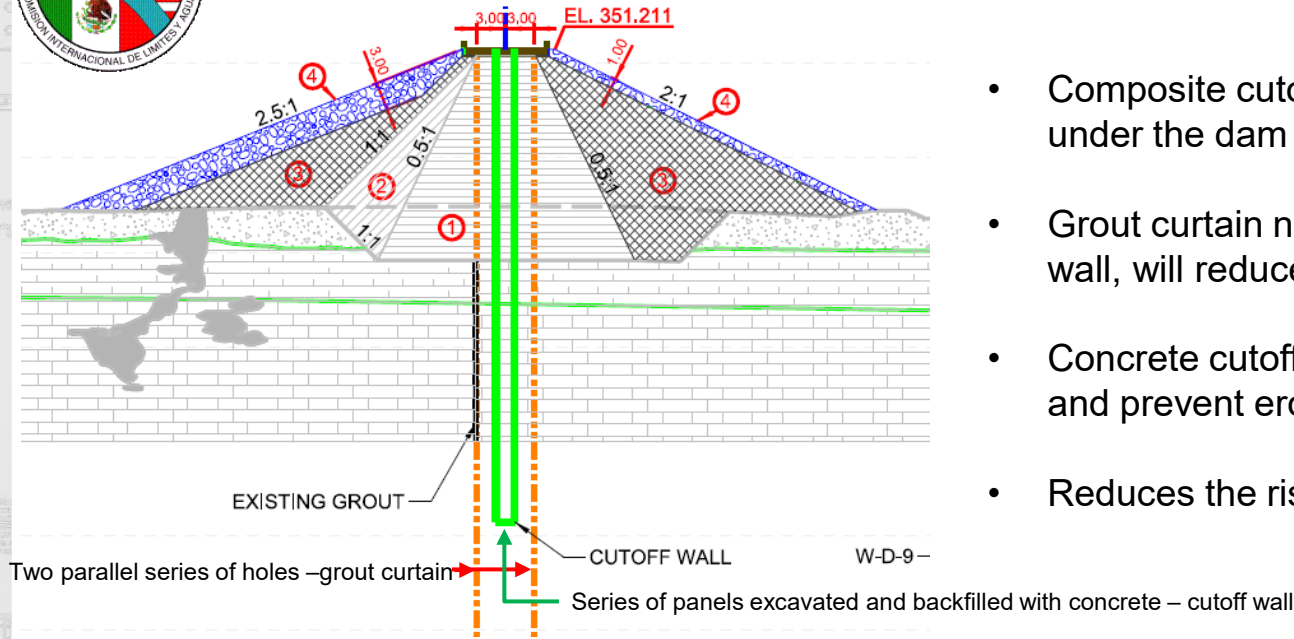
1. (Alt. 1) Composite Seepage Barrier (two-line grout curtain + concrete cutoff wall) ✓ Meets all tolerable risk guidelines
2. (Alt.4) Downstream Overbuild + downstream filter
3. (Alt. 6) Upstream overbuild





# COMPOSITE SEEPAGE BARRIER (CUTOFF WALL)

7



- Composite cutoff wall works by cutting off flow under the dam
- Grout curtain necessary first step in building wall, will reduce flow
- Concrete cutoff wall will act as barrier to flow and prevent erosion under and through dam
- Reduces the risk of failure to a tolerable level

## Grout curtain

- Two parallel lines of holes, drilled from the crest, backfilled with pressurized cement grout
- Fills cavities in the karstic bedrock
- Allows for refinement of the concrete cutoff wall depths and lateral extents
- Reduces flow in the bedrock, serves as a flow barrier upstream and downstream of the cutoff wall alignment, creates exploration profiles of the dam to characterize the rock, and serves as a guide to the design of the (future) cutoff wall.

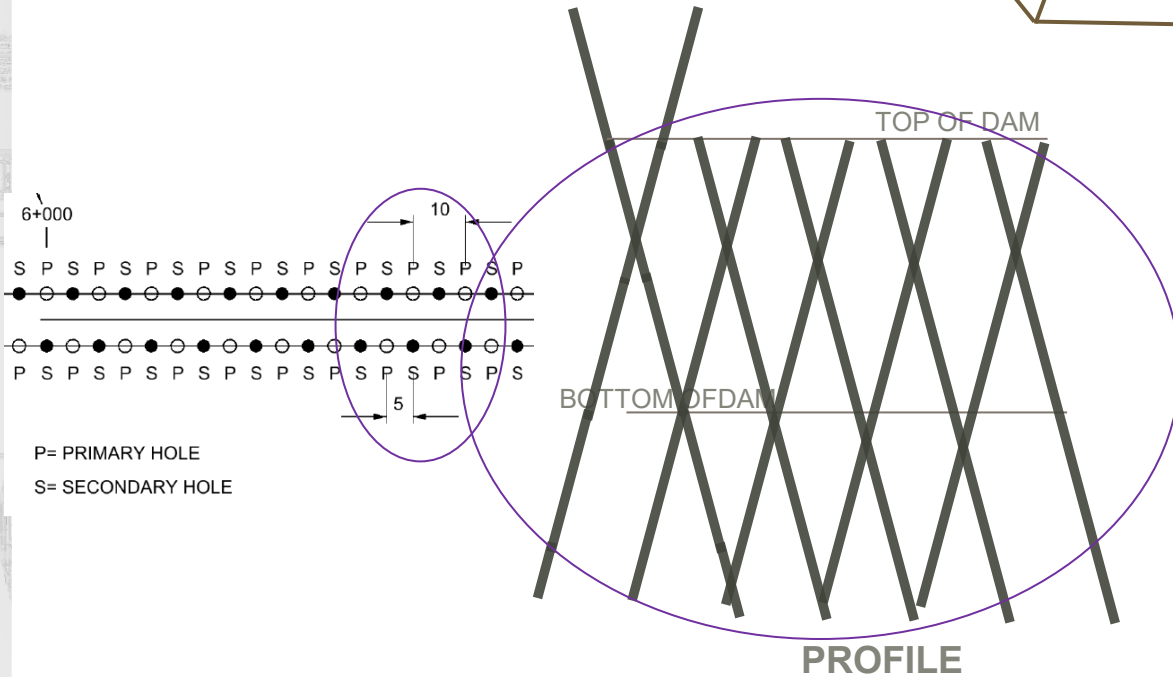
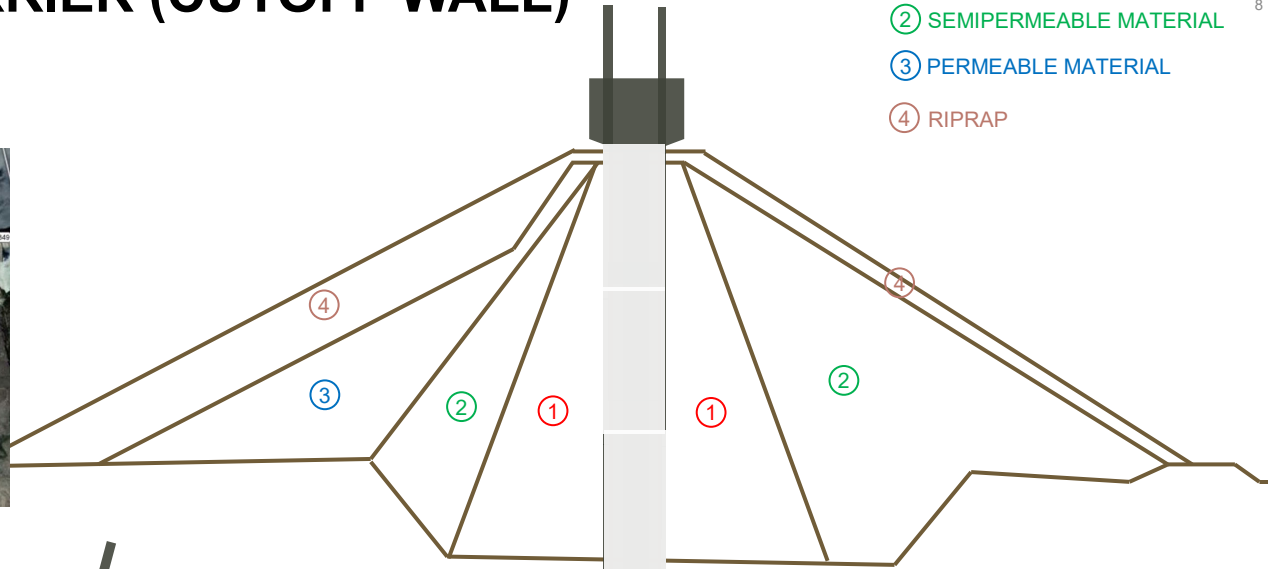
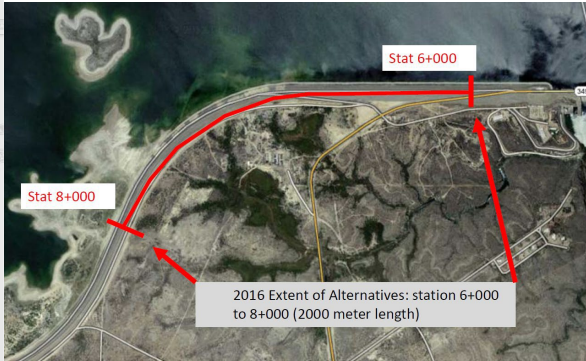
## Cutoff wall

- Series of panels excavated from the crest between the two grout curtains
- Constructed in primary and secondary sequence
- Allows for blockage of water flow through the rock foundation



# SEEPAGE BARRIER (CUTOFF WALL)

- ① IMPERMEABLE MATERIAL
- ② SEMIPERMEABLE MATERIAL
- ③ PERMEABLE MATERIAL
- ④ RIPRAP



P= PRIMARY HOLE  
S= SECONDARY HOLE





# AMISTAD DAM SAFETY MITIGATION PLAN

## **Preliminary Project Schedule** - Tentative and subject to change

- IBWC to hire an A/E to develop the Cutoff Wall Scope of Work (SOW)
- A/E to develop the Cutoff Wall SOW
- 11 months – Design for Grout Curtain and Cutoff Wall
- 18 month – Construction (Target start date: June 2024)

## **Phase I – Grout Curtain (Upstream/Downstream)**

- Planning, Engineering and Design
- Geotechnical Analysis
- Procurement Process
- Construction Grout Curtains

## **Phase II Cutoff Wall**

- Planning, Engineering and Design
- Procurement Process (Included in Phase I or separate, dependent on Contract method and funding)
- Construction Cutoff Wall

## **Factors Impacting Cost**

- Required Depth of Grout Curtains
- Required Depth of Cutoff Wall
- Starting and Ending Limits \*\*\*\*

\*\*\*\*Phase I will help refine estimated costs



# AMISTAD DAM SAFETY MITIGATION PLAN

## Recommendations/Path Forward

- Implement phased composite cutoff wall approach
- Mexico to contract with specialized private companies/consultants for the design and construction
- Commence Phase I (Grout Curtains) with existing funds
- Secure additional funds for total project as soon as practical
- Share total cost in accordance with Minutes 210 and 235
  - 56.2% for the United States
  - 43.8% for Mexico
- Commence Phase II (Cutoff Wall) during Phase I or as soon as practical, depending on contract method and funding, to ensure that the complete composite cutoff wall alternative will be constructed
- Continue routine monitoring programs of the dam's automated and conventional instrumentation
- Continue binational data exchange
- Update and maintain list of the officials identified in the Amistad Dam Emergency Action Plan