Status Update on the Remediation Design of Upper Brownsville Levee and Floodplain Failure

Rafael Rubalcaba, Jr., P.E., R.P.L.S.
Civil Engineer

International Boundary and Water Commission
United States Section

Engineering Services Division

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Background

- In March 2014, the IBWC observed surficial cracking on the levee crest and toe and a partial slope failure on the newly rehabilitated levee section adjacent to the floodplain along the Rio Grande in Brownsville, TX.

- The rehabilitation included raising the height of the levee to meet the FEMA flood accreditation requirements and re-grading the levee slopes .

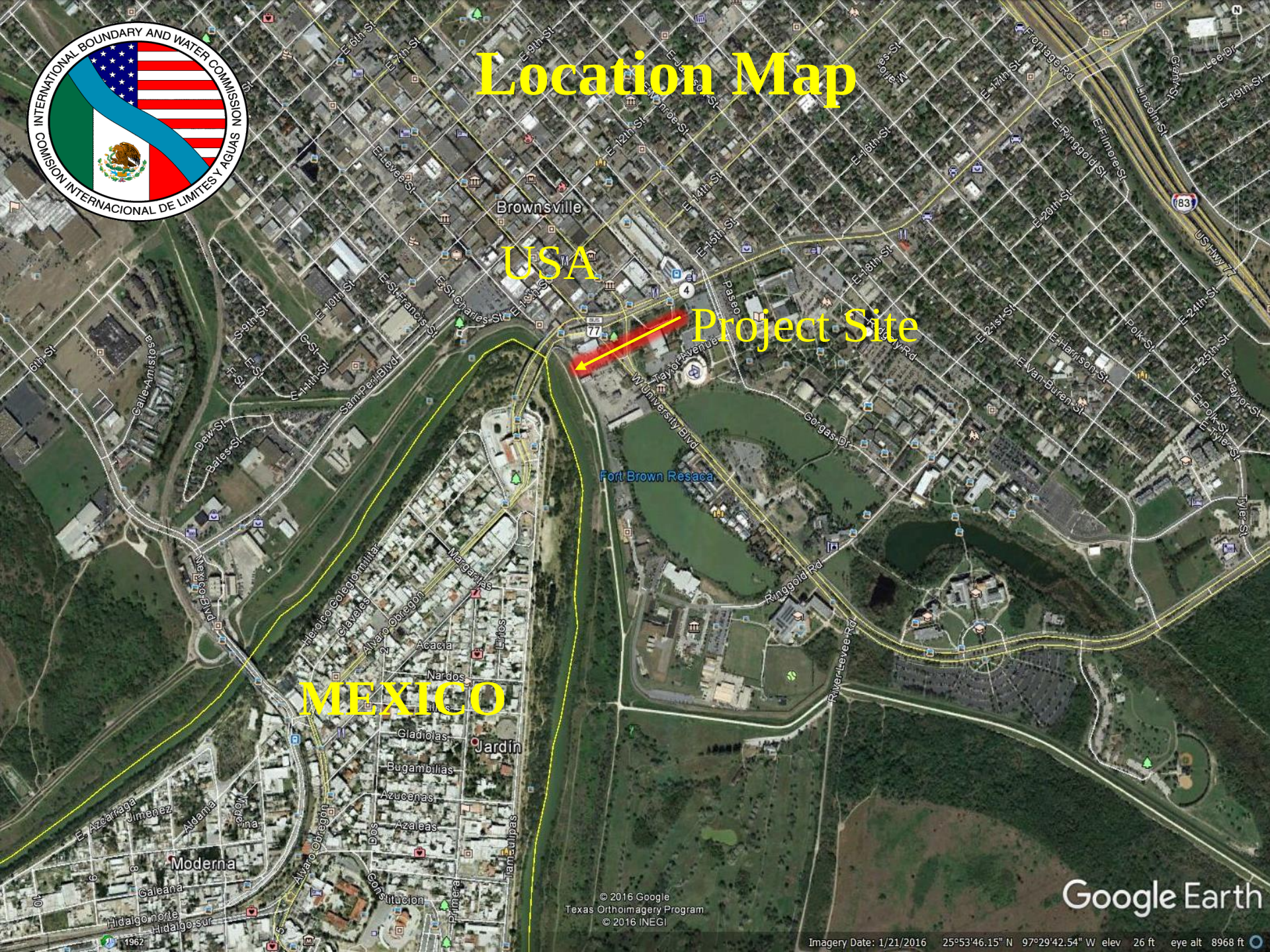
Project Location

- The area of interest is located on the U.S. side of the Rio Grande in Cameron County, Texas

- Extends from Station 1898+00 to Station 1904+85 on the left bank of the Rio Grande downstream of the Gateway International Bridge

- Important features to be noted are the Port-of-Entry parking lot and the port facility downstream of the Gateway International Bridge, as well as the prominent Rio Grande oxbow, or Resaca, known as Lake Brown

Location Map



Site Features

UPPER BROWNSVILLE - REACH FOUR
SITE REMEDEATION AREA FOR ALTERNATIVE I.
APPROXIMATE STATION RANGES ARE FROM:
STA. 1899+00 TO STA. 1904+85 (EAST SIDE OF INTERNATIONAL BRIDGE)

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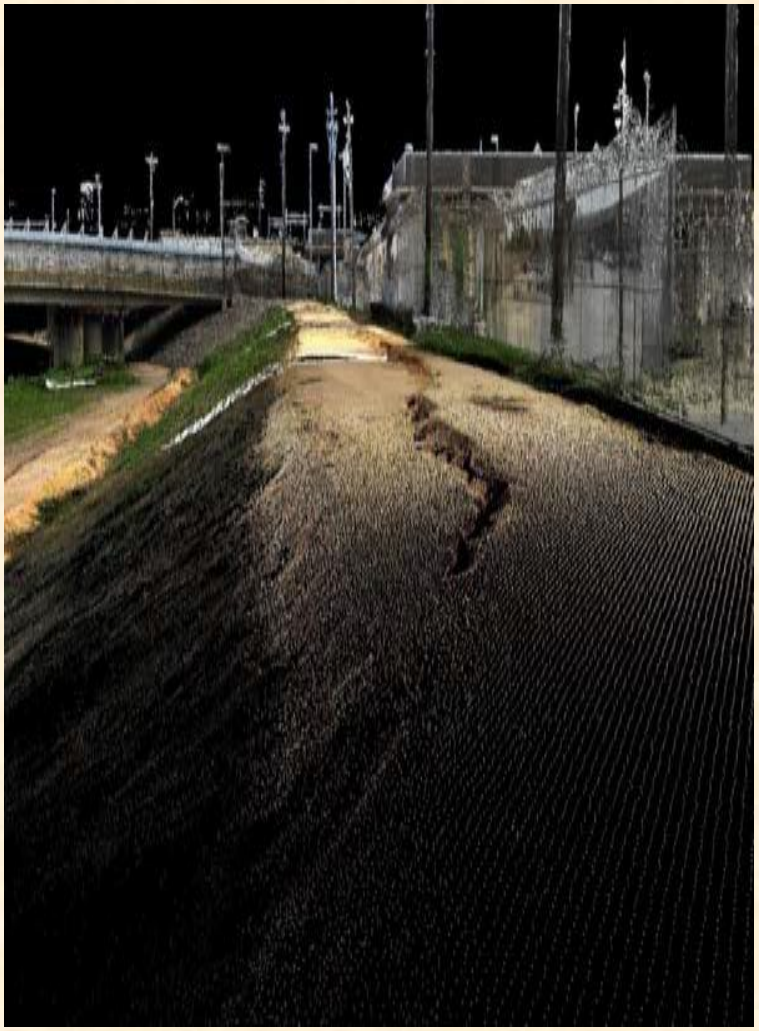
Existing Site Conditions



Existing Site Conditions

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Prior USACE Geotechnical Investigation

- In July 2014, the USIBWC solicited a contract with the USACE Engineering Research and Development Center (ERDC), and conducted a geotechnical investigation to determine the following:

1. The cause(s) of the partial levee failure

2. Provide potential engineering alternatives for the remediation of the levee section to stabilize the bank and levee

Cause(s) of the Levee Failure from USACE Investigation

- The exact cause of the slope movement appears to be a combination of circumstances that is difficult to directly qualify and/or quantify, however, it was determined that a series of events, combined with the local geologic conditions led to the partial slope failure:

  1. The levee improvements

  2. Fluctuation and rapid changes in water surface elevations in the Rio Grande

  3. Higher elevation of Lake Brown relative to the river

  4. Soft alluvial sediments with low shear strength

USACE Study Recommendations

- USACE provided short term and long term recommendations.

- Short term included instrument monitoring, visual inspection, elevation surveys, vegetation control and regrading of levee profile.

- Long term included risk assessment, modifying floodplain geometry, sheetpile wall and improving the shear strength of the soft alluvial sediments.

Arcadis Geotechnical Assessment and Design

- USIBWC contracted Arcadis in September 2015 to continue monitoring and develop design alternatives.

- Arcadis determined a deeper failure surface from the data obtained in the inclinometers and as a result, the monitoring period has been extended to mid 2017.

- Additionally, design alternatives are being formulated and evaluated.

Monitoring & Inclinometer Locations

Arcadis Geotechnical Assessment and Design (contd)

- Three (3) alternatives to remediate the failure are being evaluated by Arcadis to arrest the soil movement/displacement:

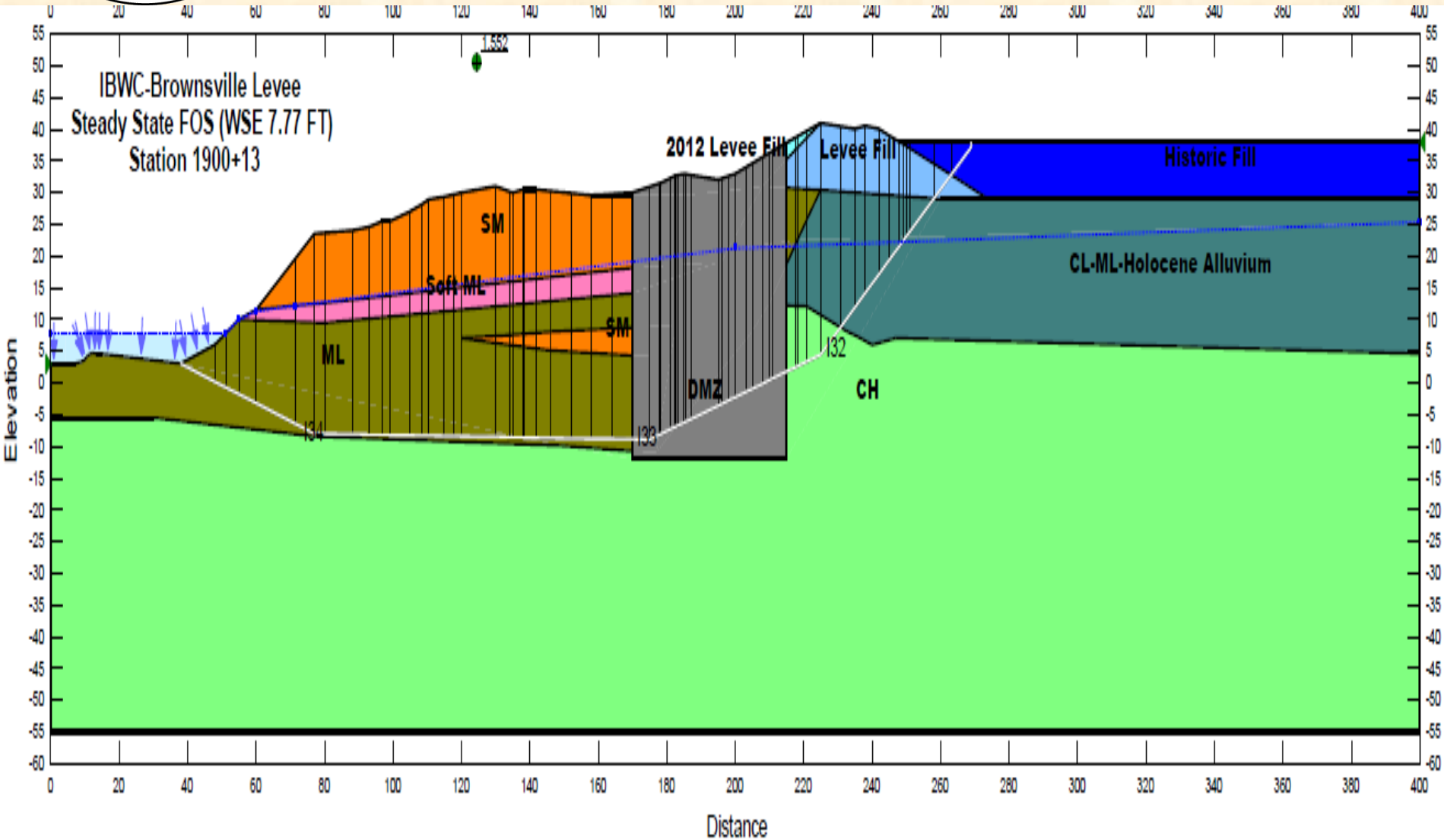
  1. Deep Soil Mixing Columns

  2. Stone Columns

  3. Deep Soil Mixing and Stone Columns

- In addition to the above alternatives, armoring the bank of the Rio Grande to help protect against erosion is recommended

Remediation Alternative 1



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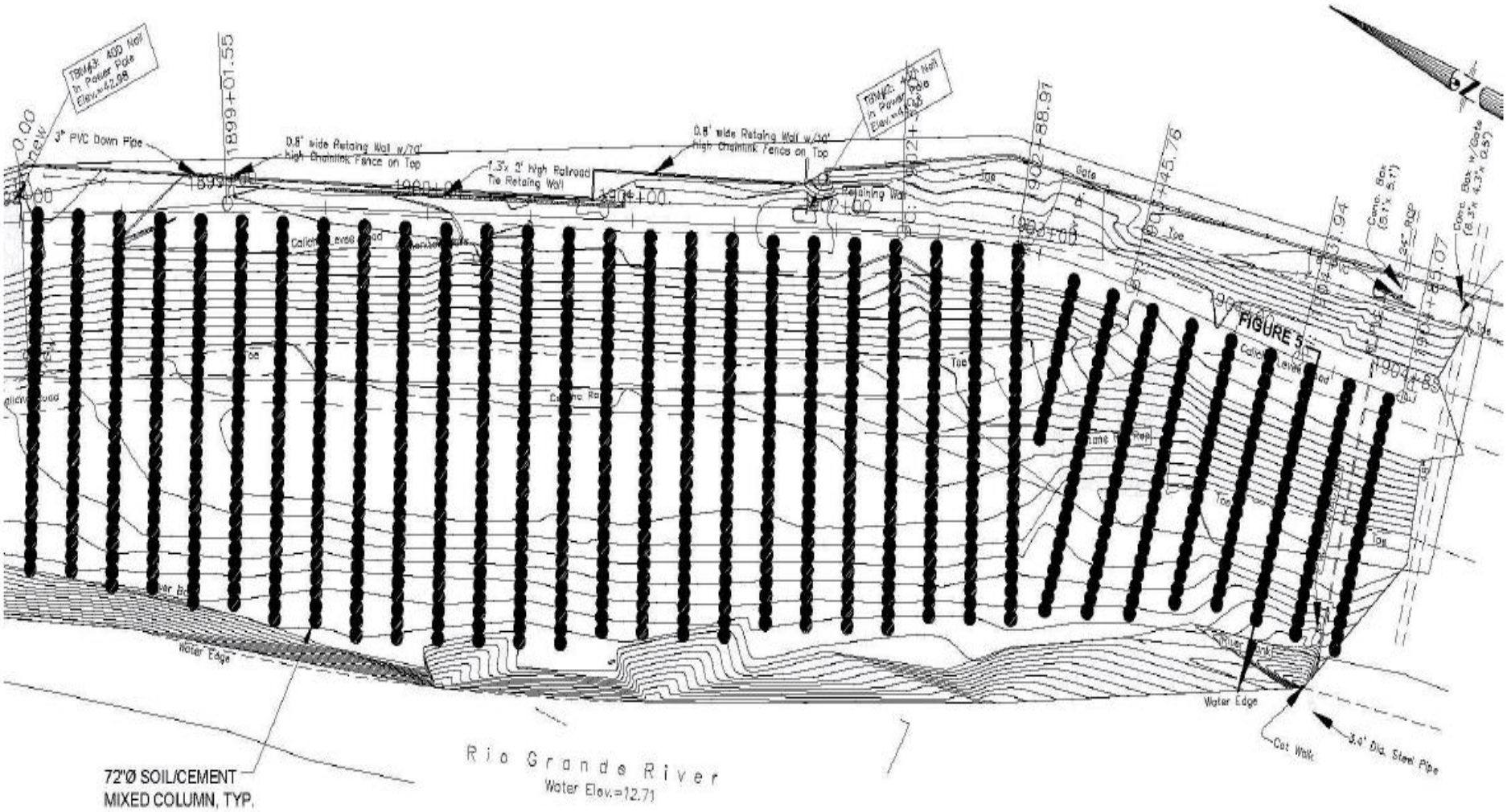

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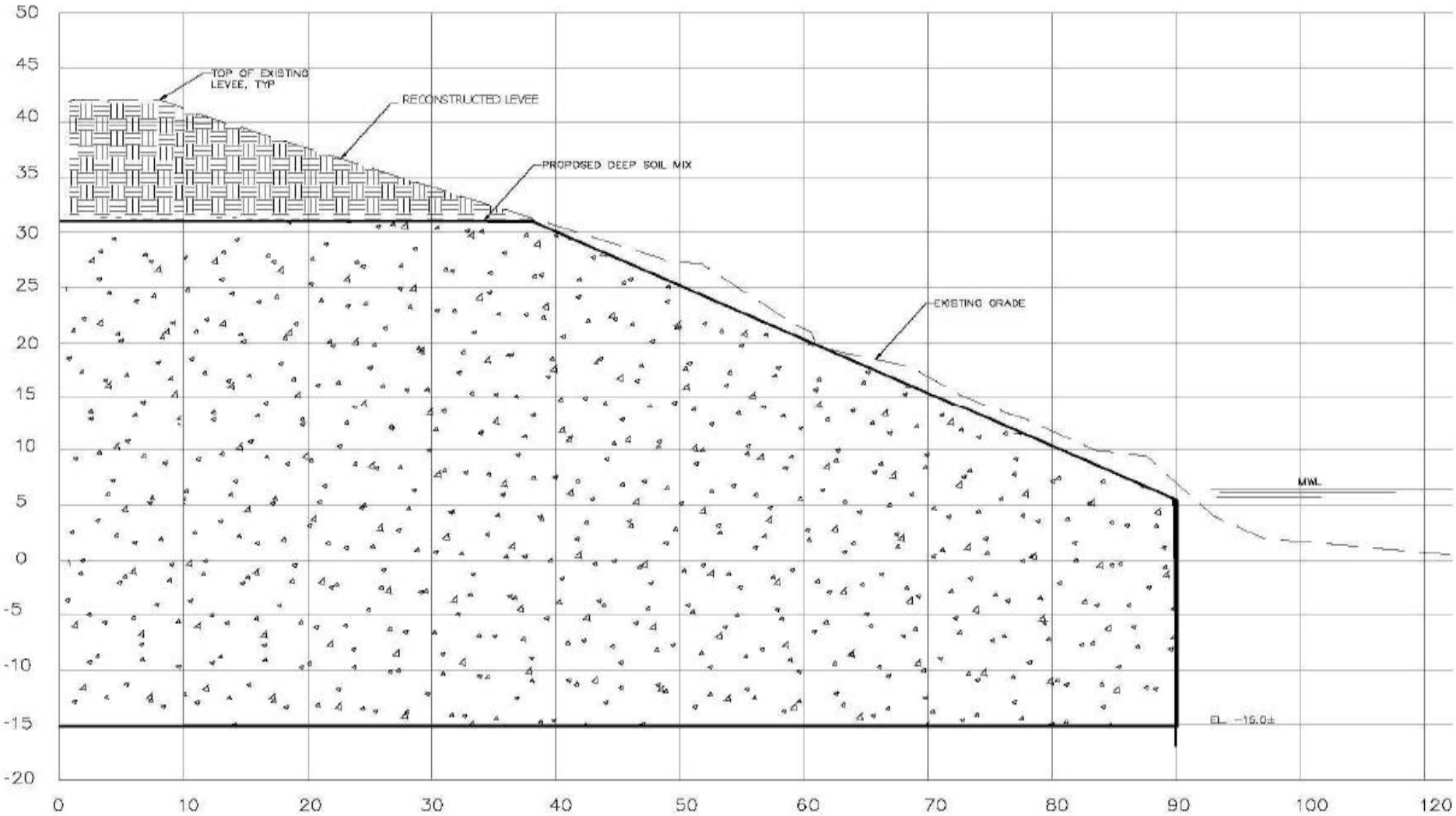
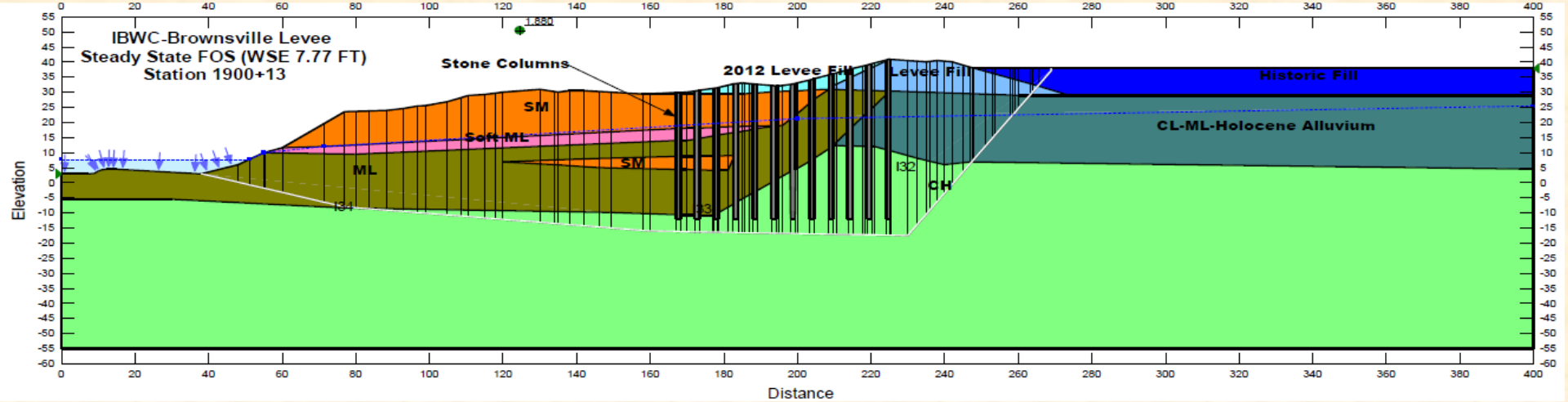
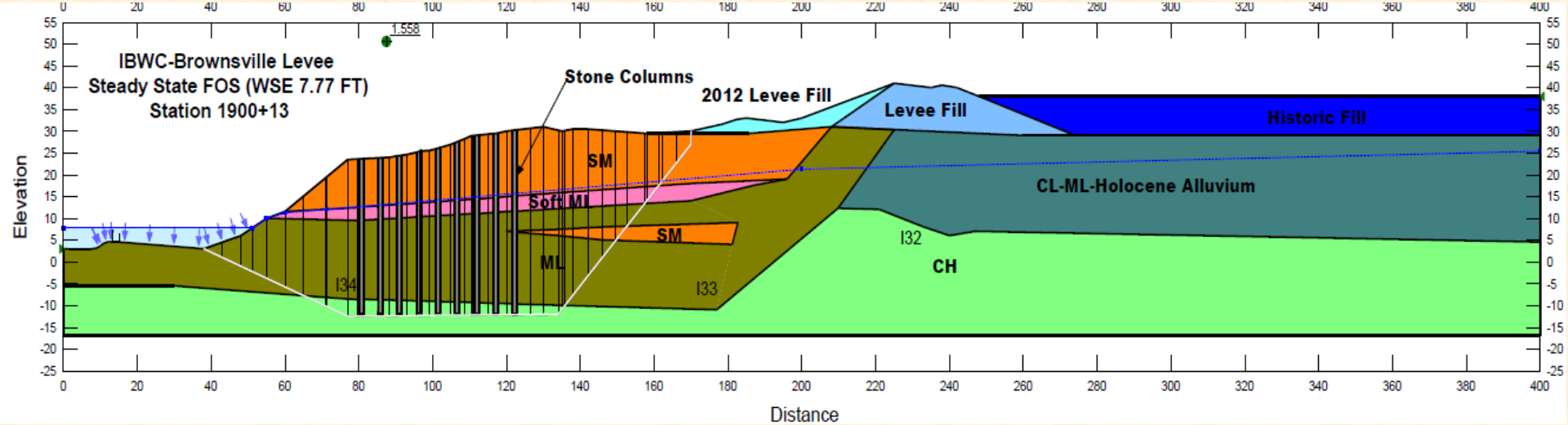


Remediation Alternative 2





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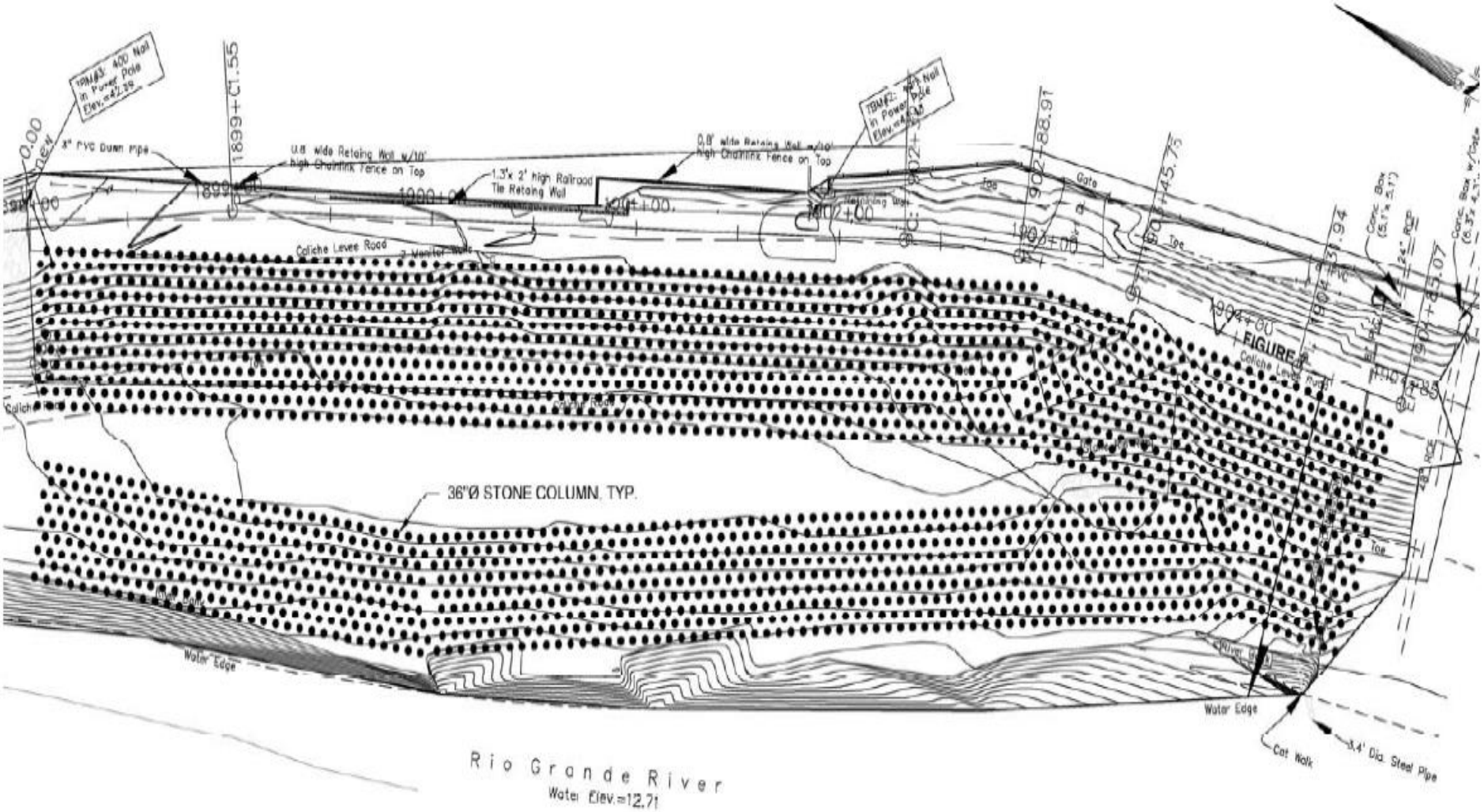

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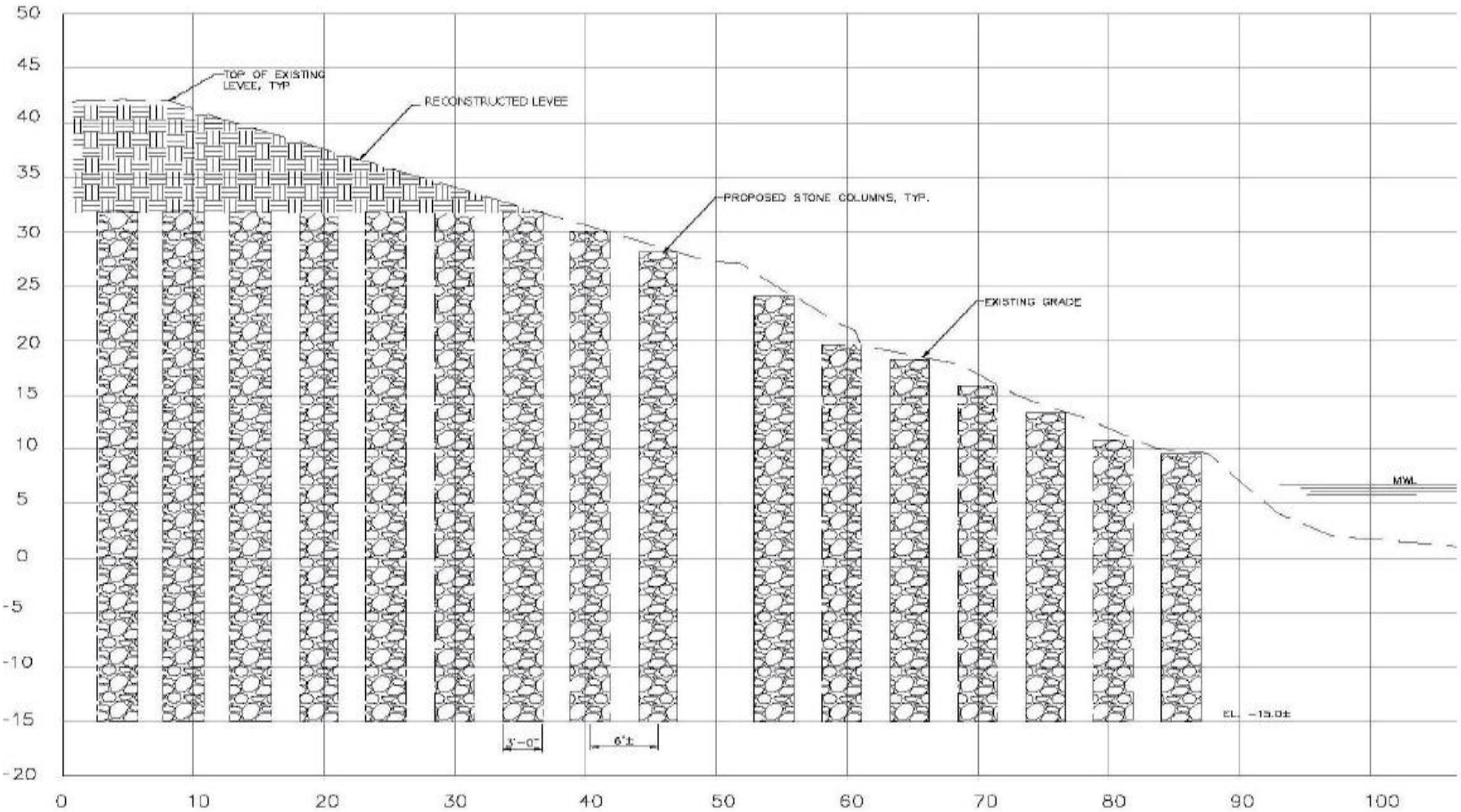
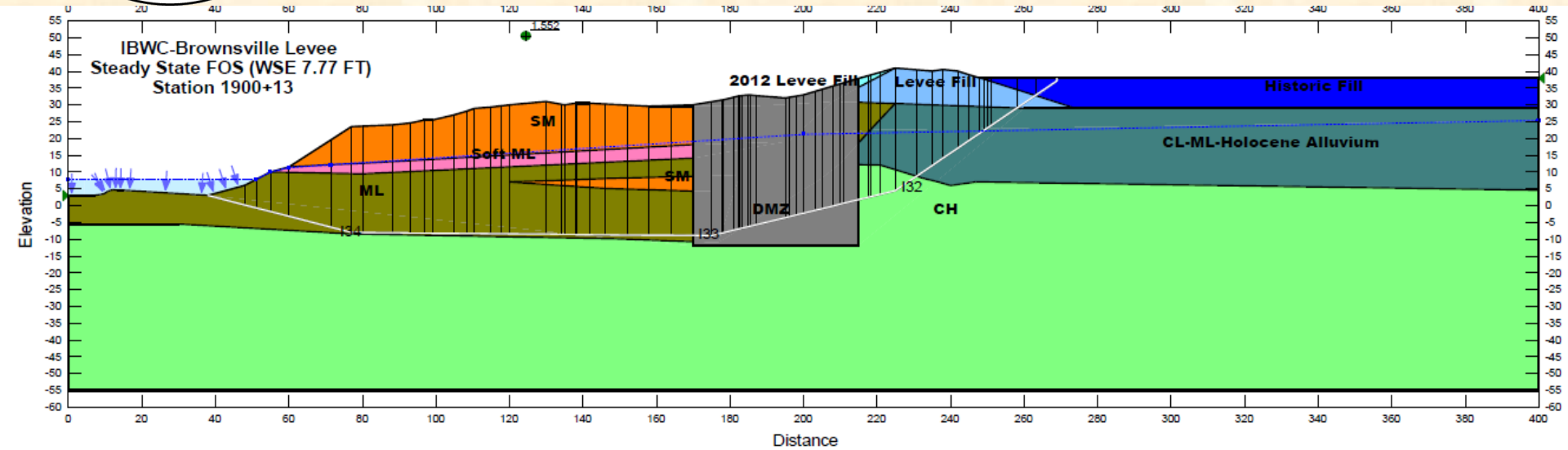
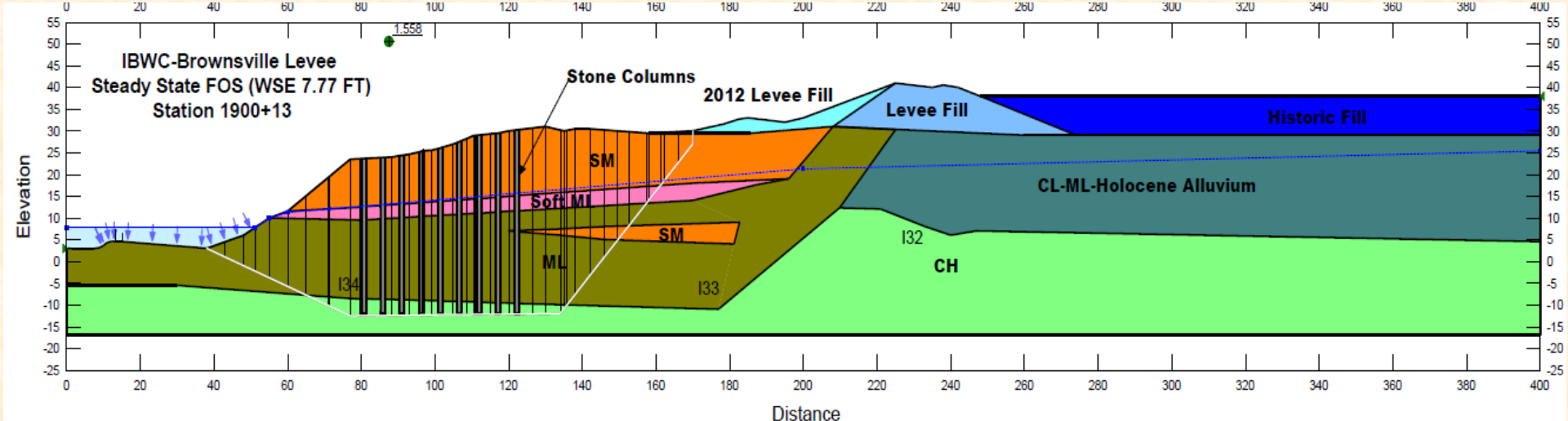


Remediation Alternative 3





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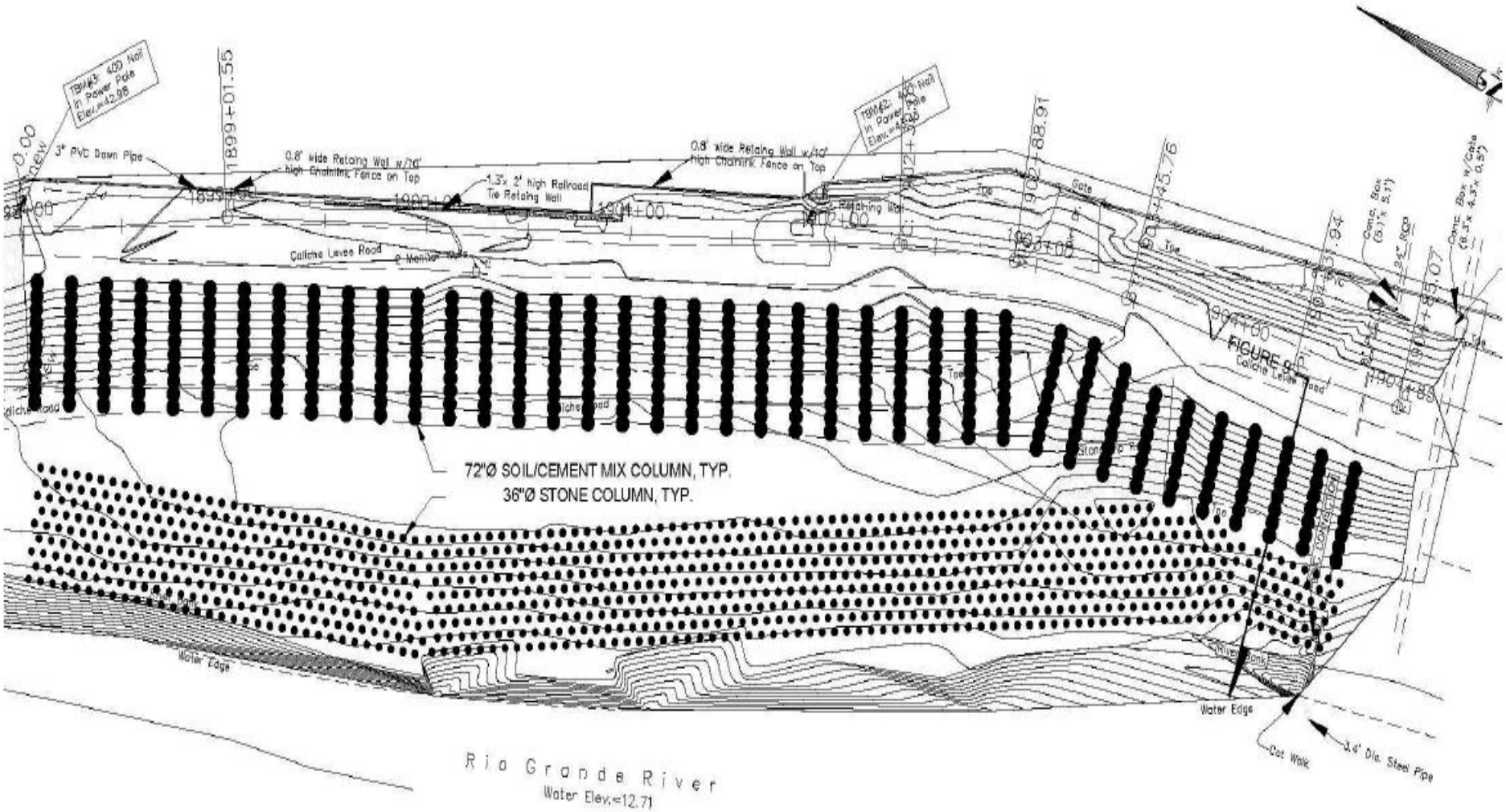

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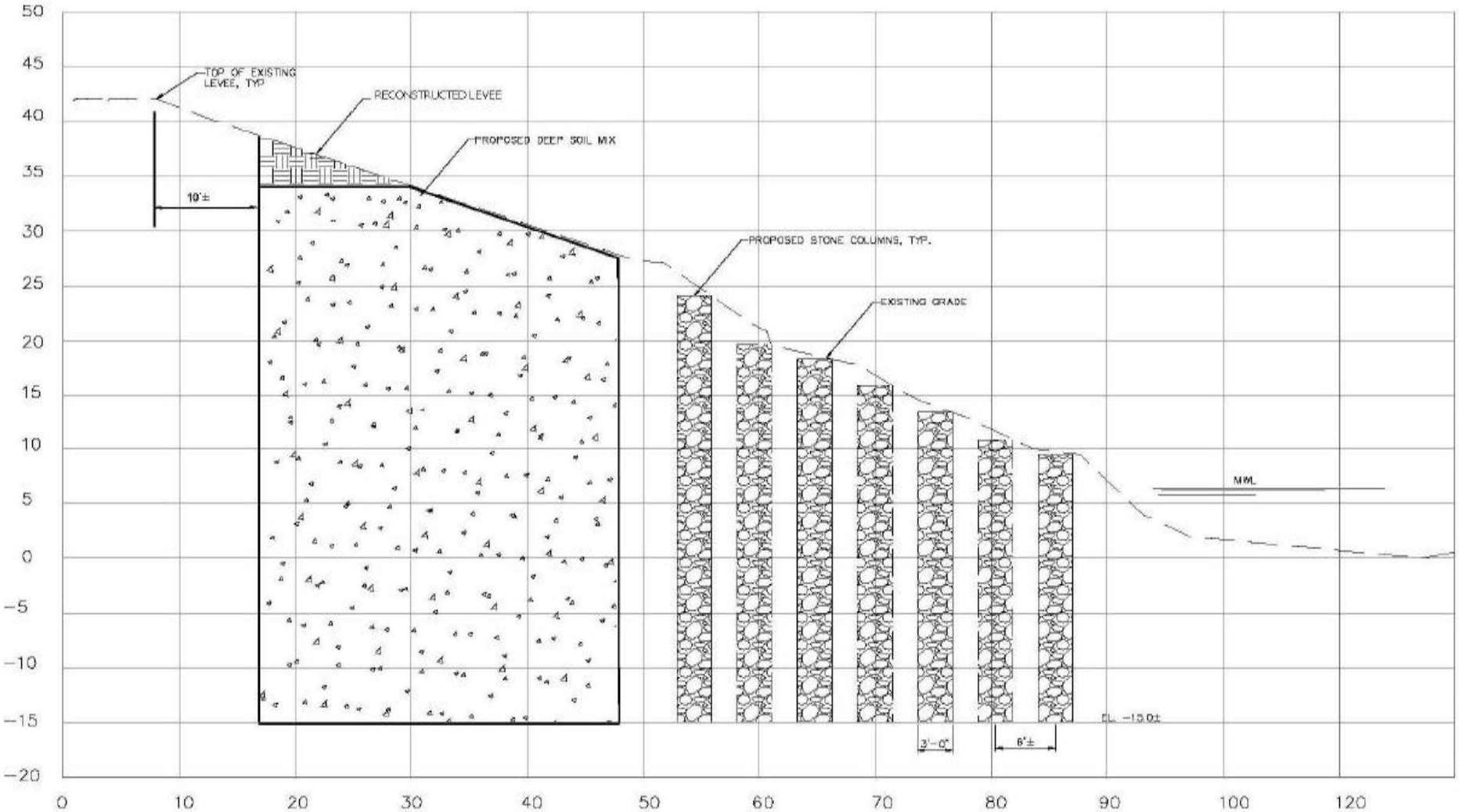

Summary

- The geotechnical study indicates that a combination of factors such as levee improvement, fluctuations of the river water surface elevation, combined with local geologic conditions contributed to the levee failure.

- Once the monitoring phase is completed and a preferred remediation alternative identified, a design will be developed for the preferred alternative.

- Construction can be accomplished in 7-9 months.

DISCUSSION/QUESTIONS