Reference:
Loren R. Anderson. 2554. เอกสารประกอบการอบรม "การวิเคราะห์เพื่อออกแบบและประเมินความปลอดภัยเขื่อน", ระหว่างวันที่ 5,7 และ 8 เมษายน 2554, จัดโดย ศูนย์วิจัยและพัฒนาวิศวกรรมปฐพีและฐานราก มหาวิทยาลัยเกษตรศาสตร์ ร่วมกับ Thai Geotechnical Society (TGS), ณ โรงแรมมิราเคิล แกรนด์ คอนเวนชั่น, กรุงเทพฯ.

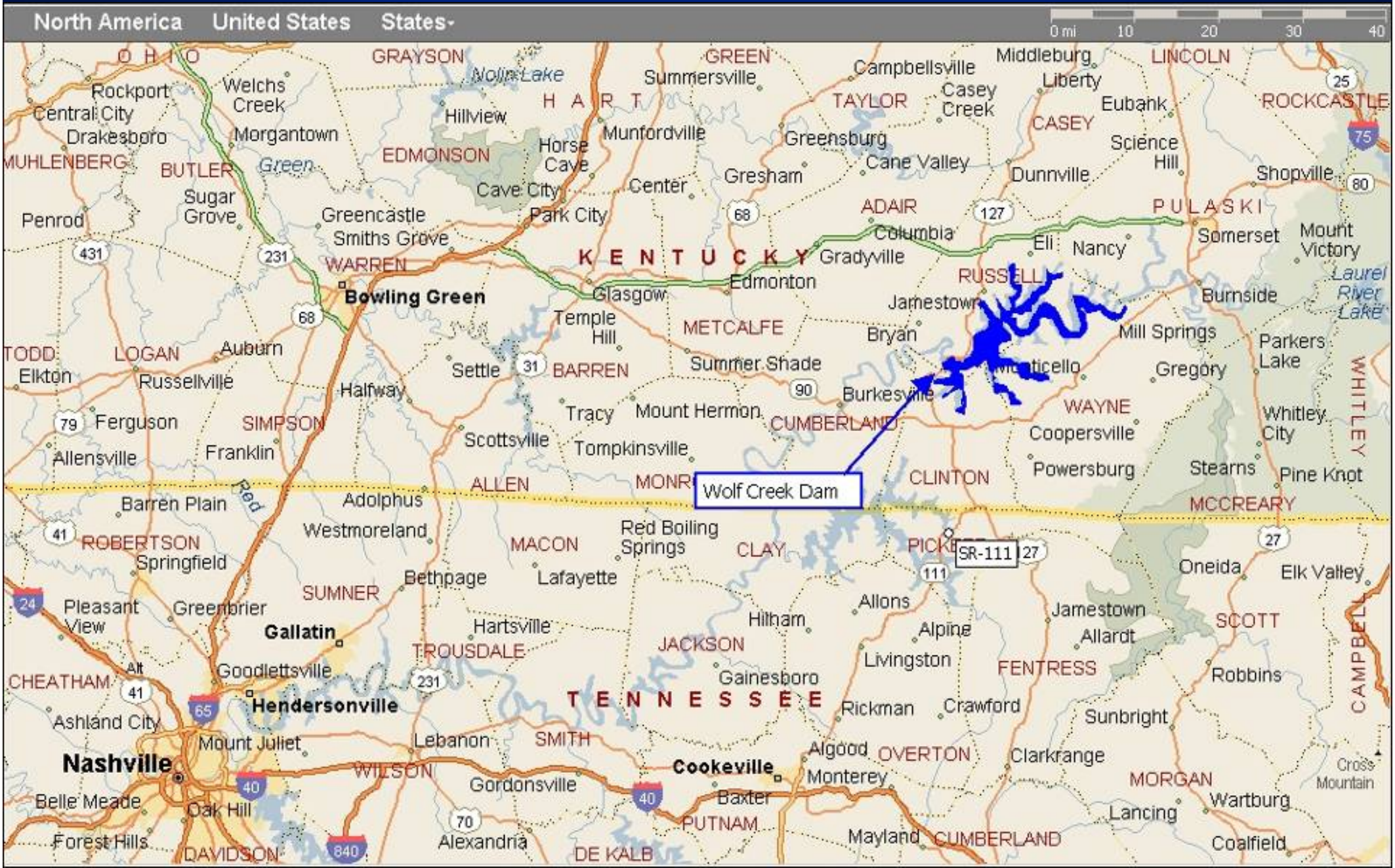
Wolf Creek Dam Seepage Major Rehabilitation Evaluation

US Army Corps of Engineers, Nashville District

Outline of Topics

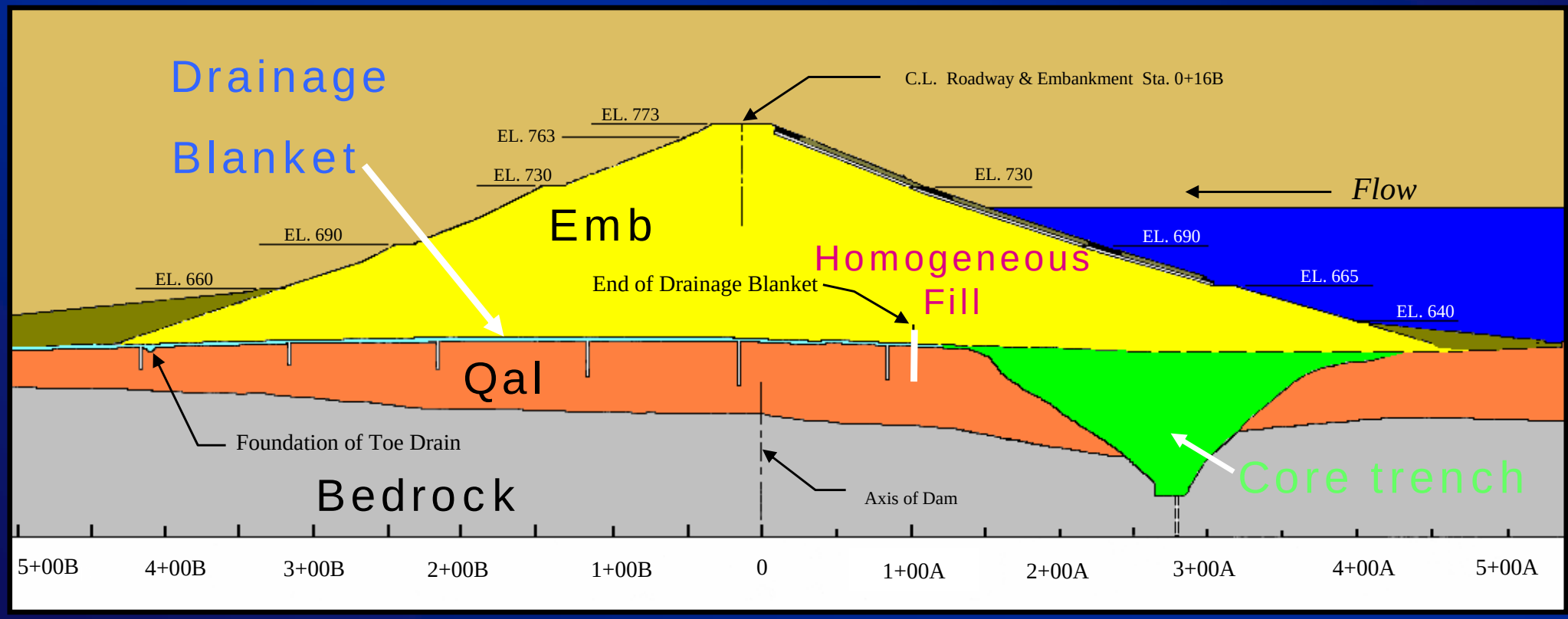
- **Project Features**
- **Foundation Problems**
- **1960’s Distress Indicators and Actions**
- **Post Wall Performance/Current Distress Indicators**
- **Proposed Remedy**

Project Location

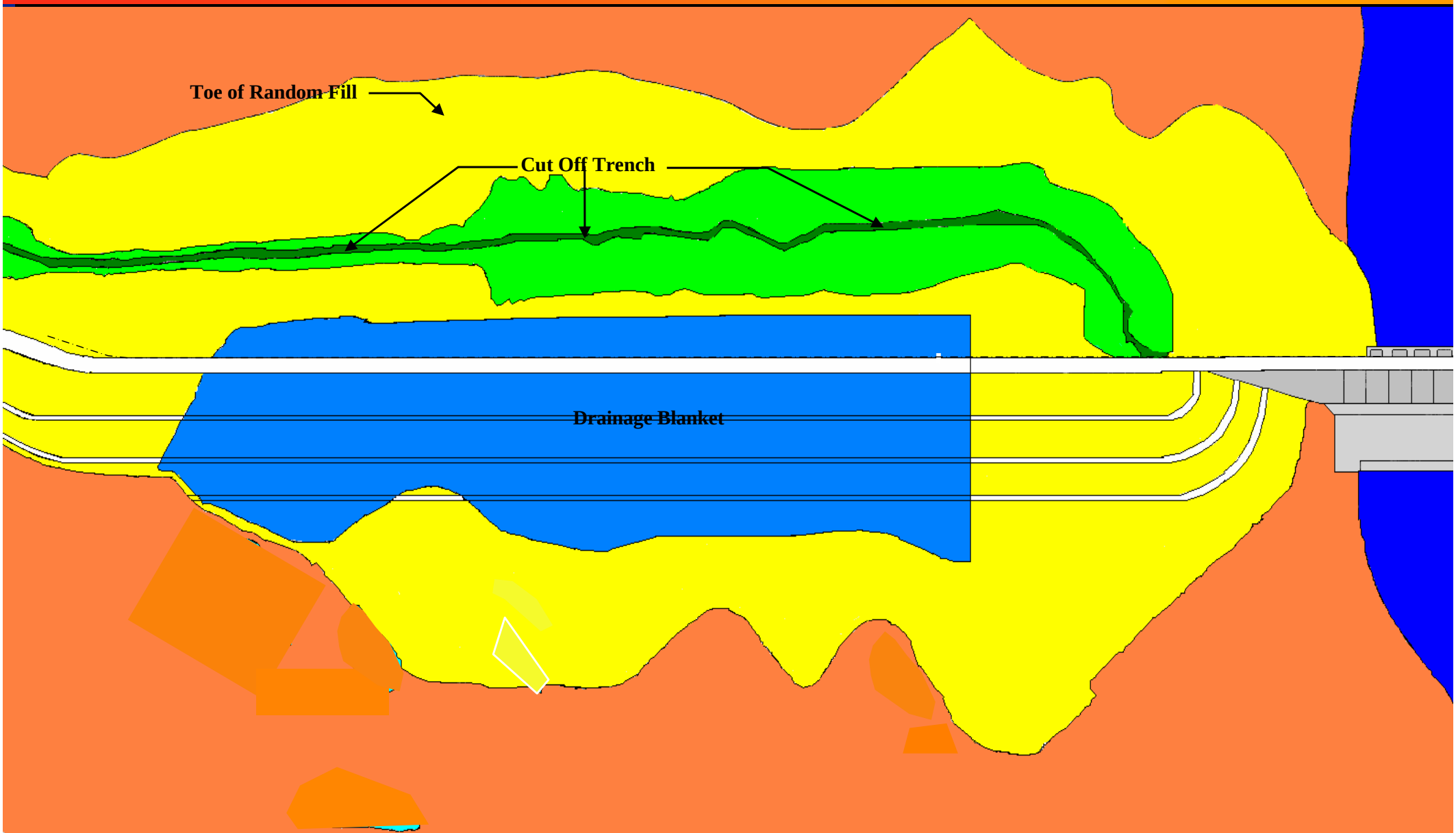


Project Features

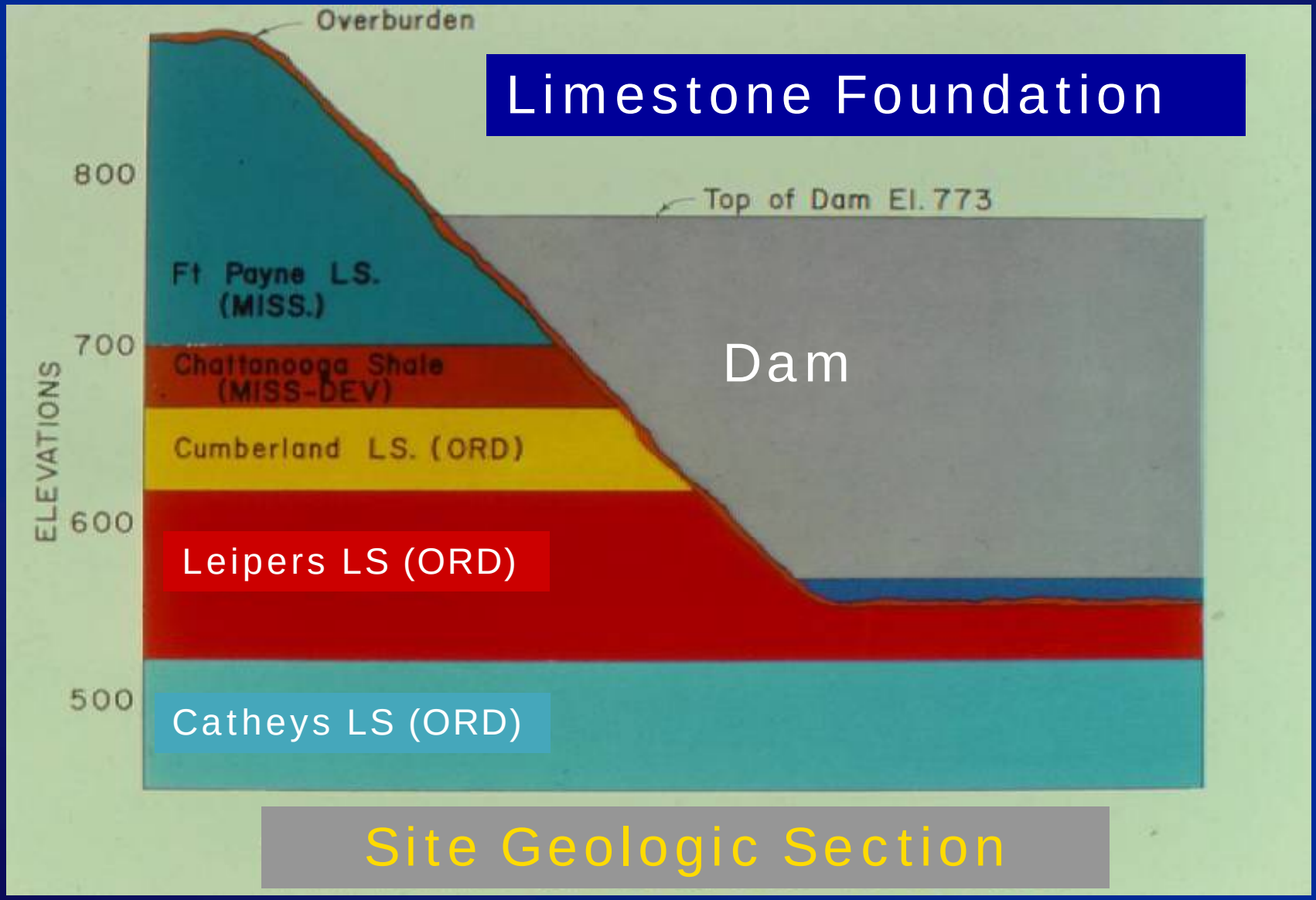
EMBANKMENT SECTION STA. 44+50L



EMBANKMENT PLAN



Geology



Site Geologic Section

Foundation Treatment Problems

- **Treatment techniques inadequate for this geology**
- **Most of the alluvium left in place**
- **Except for cut-off trench, no embankment foundation treatment**
- **Cutoff trench design and construction inadequate**

I-F, -B, and -E. The bottom of this section of trench, at this stage of excavation, is still in overburden except for a few narrow areas where the rock salients showing in the overburden slopes were connected across the trench line. It is proposed to excavate the floor of the trench to continuous sound rock for the grout curtain. Overhangs and loose rock

8-27-42. Looking SE in trench from sta. 5+50.

I-E

will be removed only where they cross the line of the trench, since the earthfill in the sides of the trench will have the function only of stability and not of an absolutely uniform tight contact with the trench walls. Tamping will supplement the regular rolling of the fill as required under the overhangs and irregular salients.

8-22-42/Looking S in trench from vicinity embankment sta.3641O.

I-G

I-G. Note rock channel between points W and T, with abrupt ledge floor at level of T. This floor was undercut by solution weathered rock and was not continuous (see photo I-H). Above the floor, the walls were extremely irregular, with overhanging ledges. These were knocked off and weathered rock removed to condition shown in photo I-F.

8-21-42/Looking S in trench from vicinity embankment sta.3641O.

I-F

I-F. Note final condition of rock channel between points W and T (see photo I-G). This channel is along line X of Exhibit J. Note tapering continuation of the channel across intersecting channel.

Before

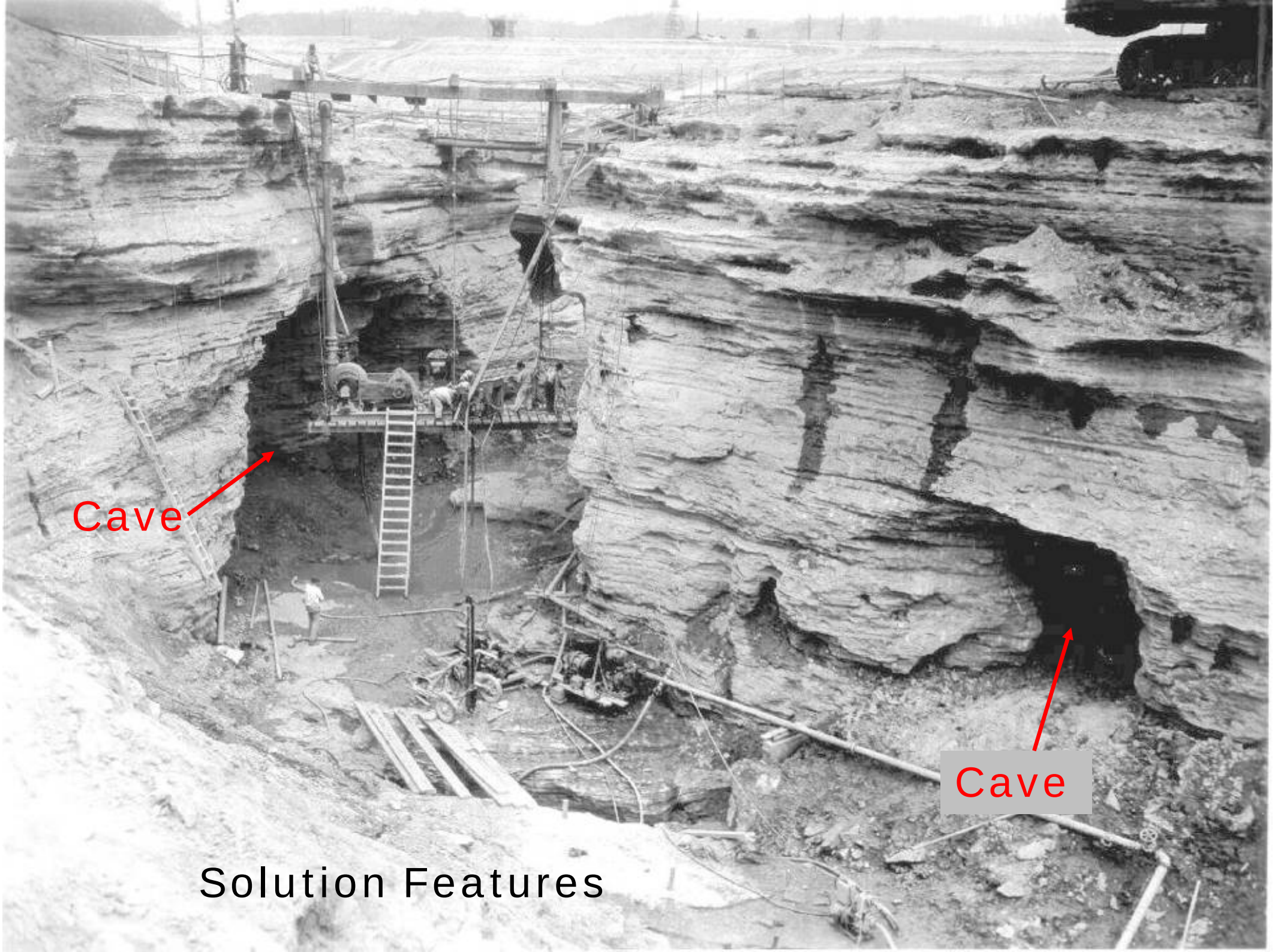
After

4-2-42. Looking SE along hole at trench sta. 27+95. IV-A

4-2-42. Looking E across hole at trench sta. 27+95. IV-B

IV-A and -B. The hole is a solution widened joint, crossing the trench at right angles. Note differential solution and resulting overhangs in rock faces. These re-entrants were apparently well filled with silt.

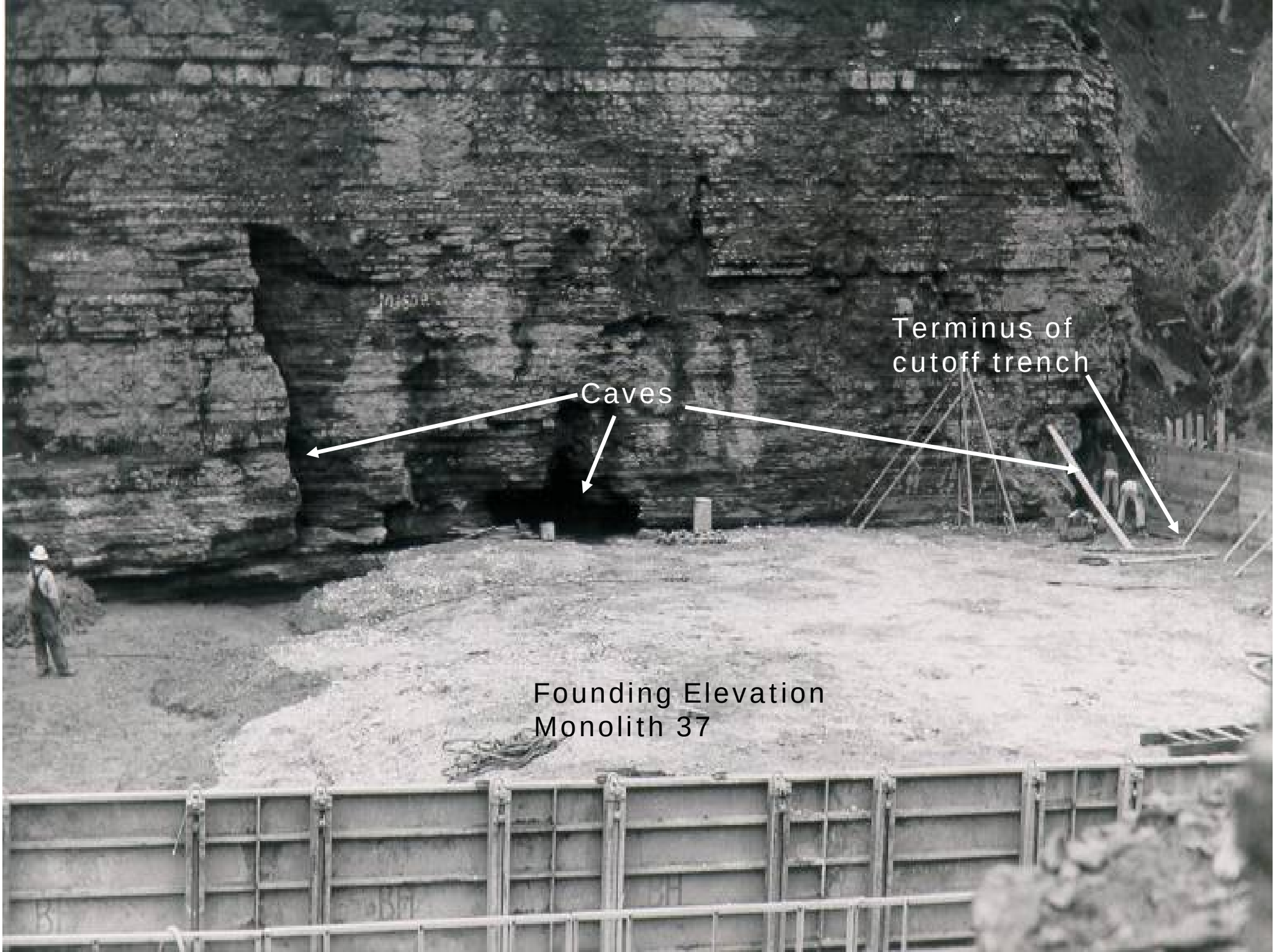
31,822 19 November 1942
View of backfilling operations in cavity at
Sta. 50+00 on cutoff trench

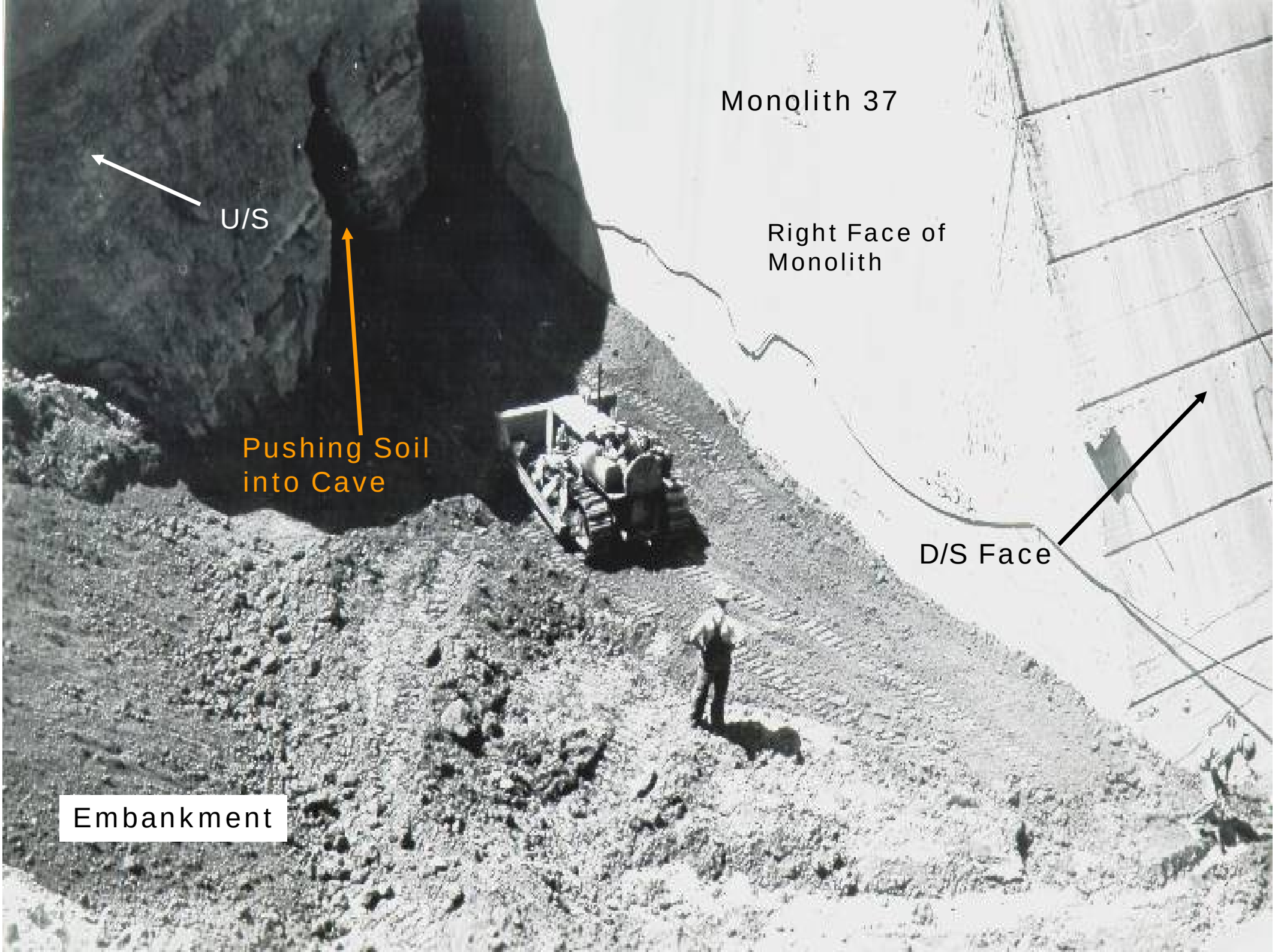


Solution Features

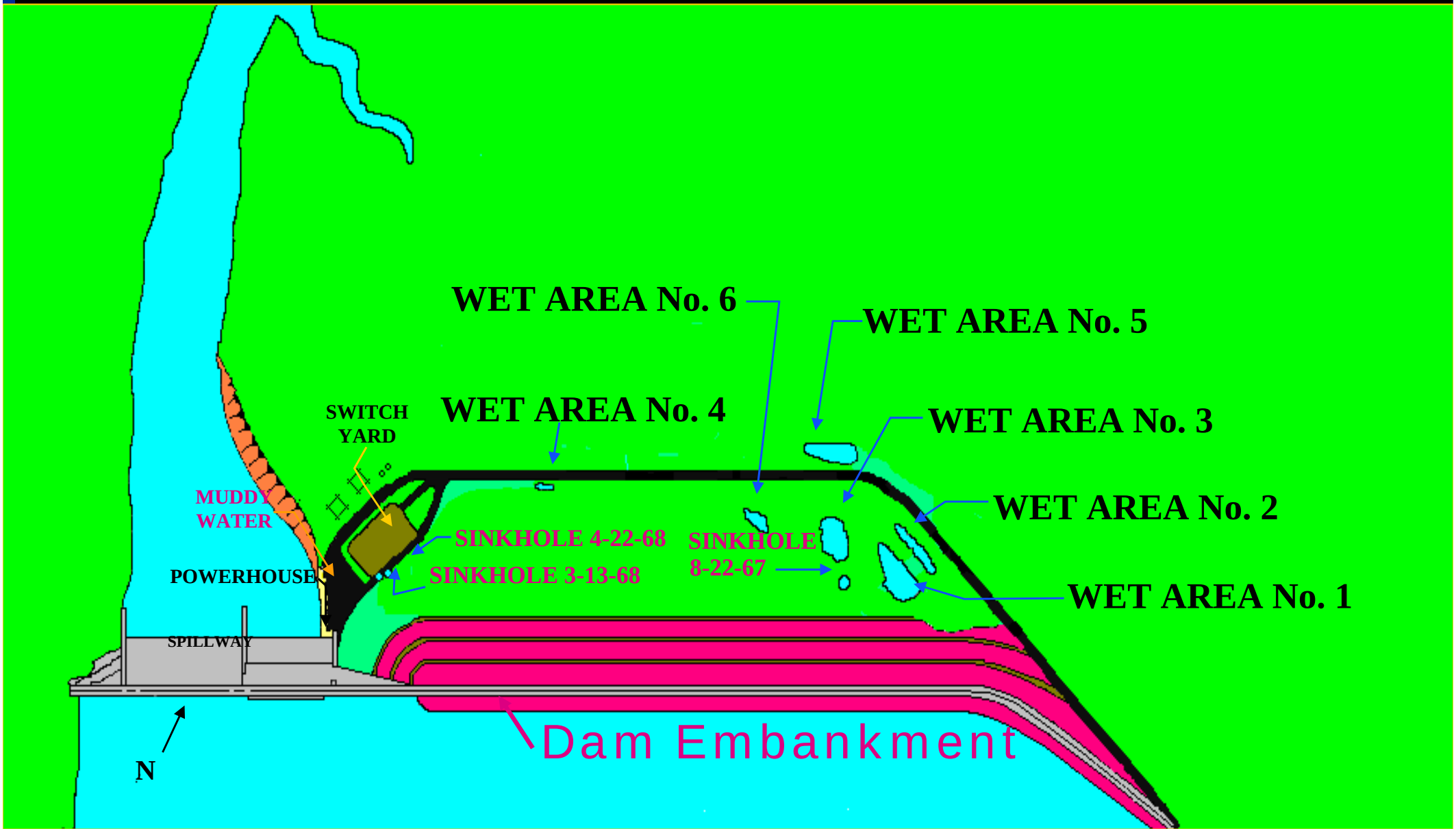

Looking from
monolith 36 into
cutoff trench
where it ties
into monolith 37
37
Cave
End Monolith (37)

61/421 14 August 1947
Filling core trench, Mon. 37

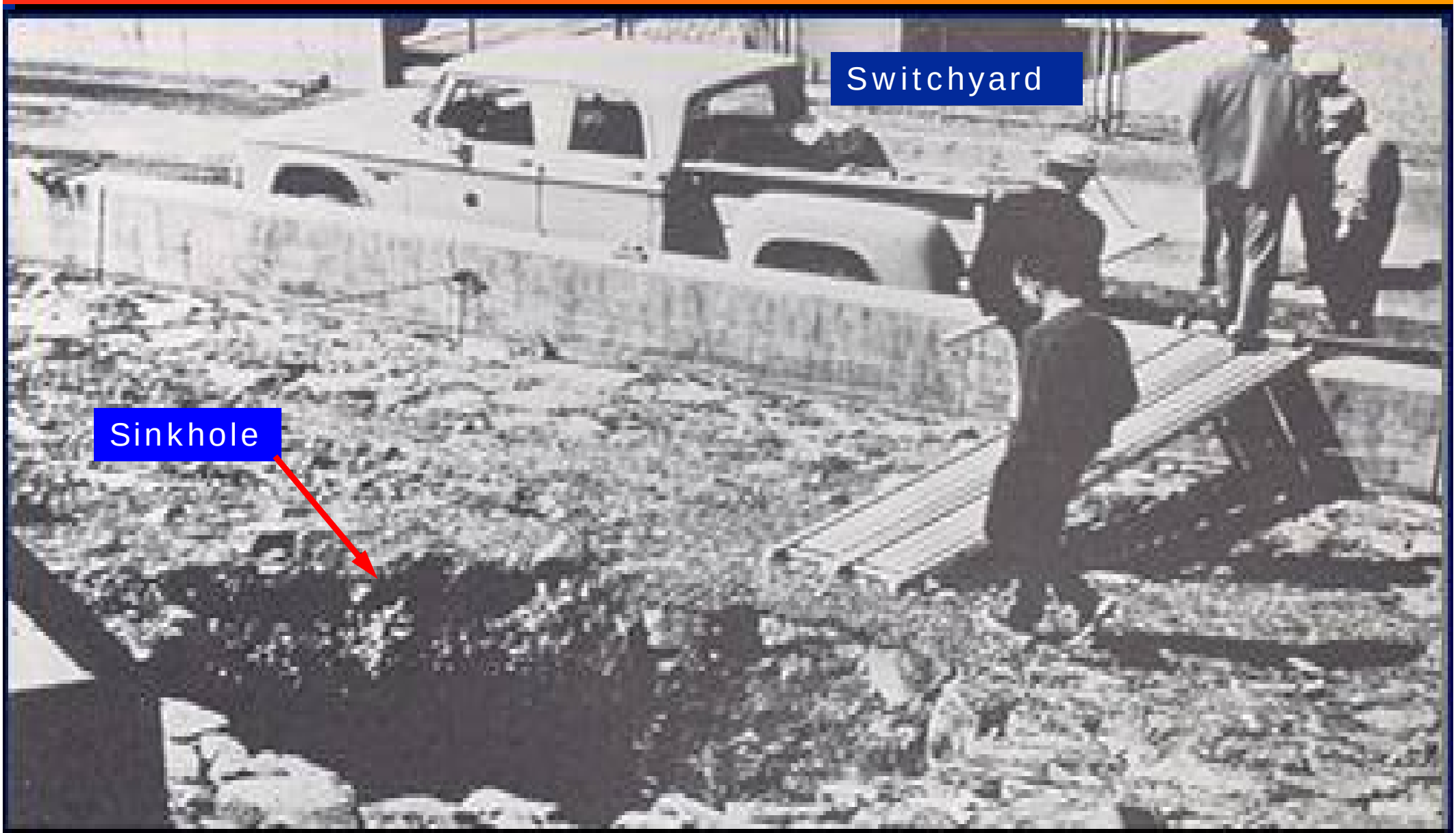

Terminus of
cutoff trench
Caves
Founding Elevation
Monolith 37


Monolith 37
U/S
Right Face of
Monolith
Pushing Soil
into Cave
D/S Face
Embankment

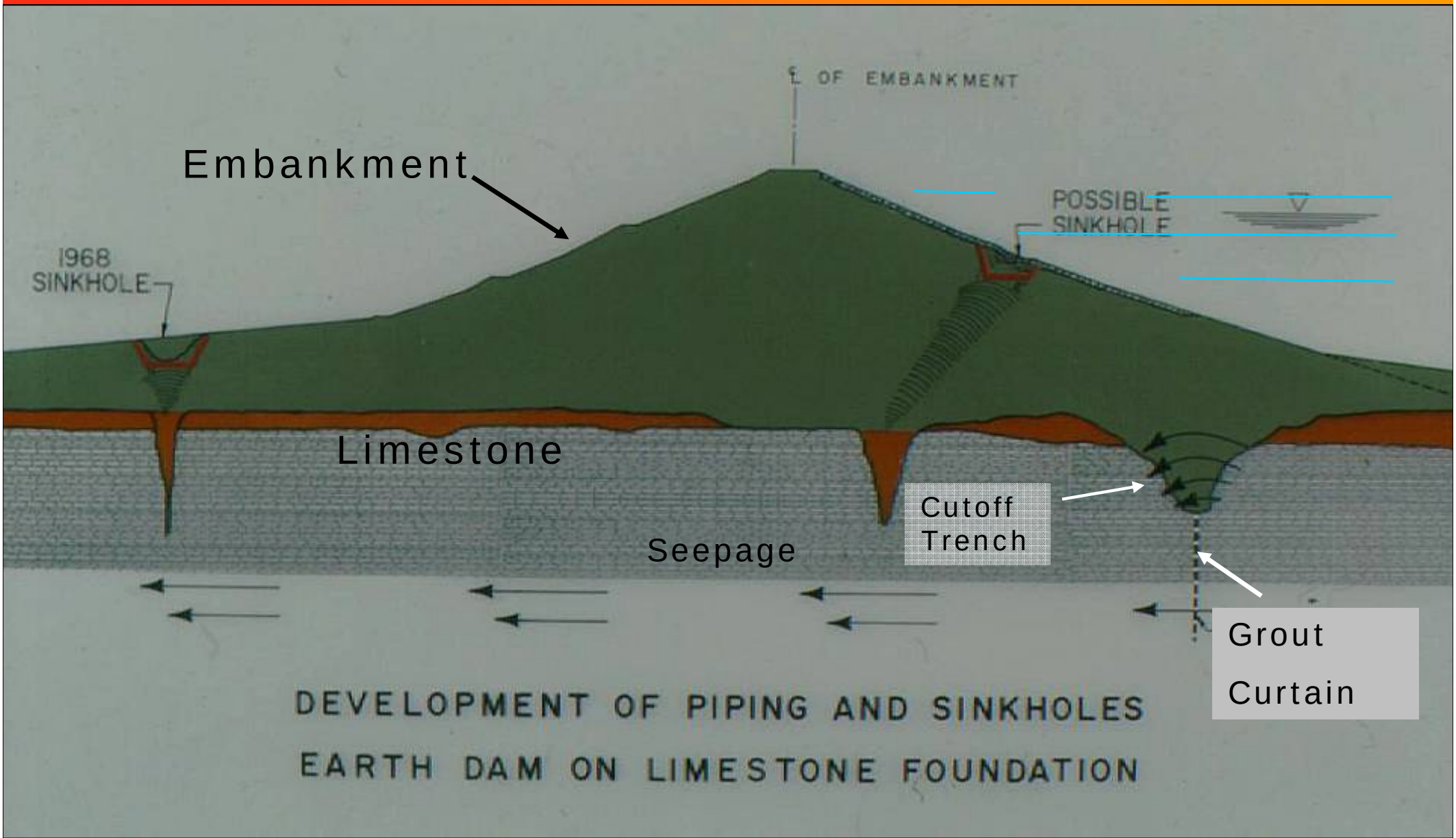
Initial Distress Indicators 1960's



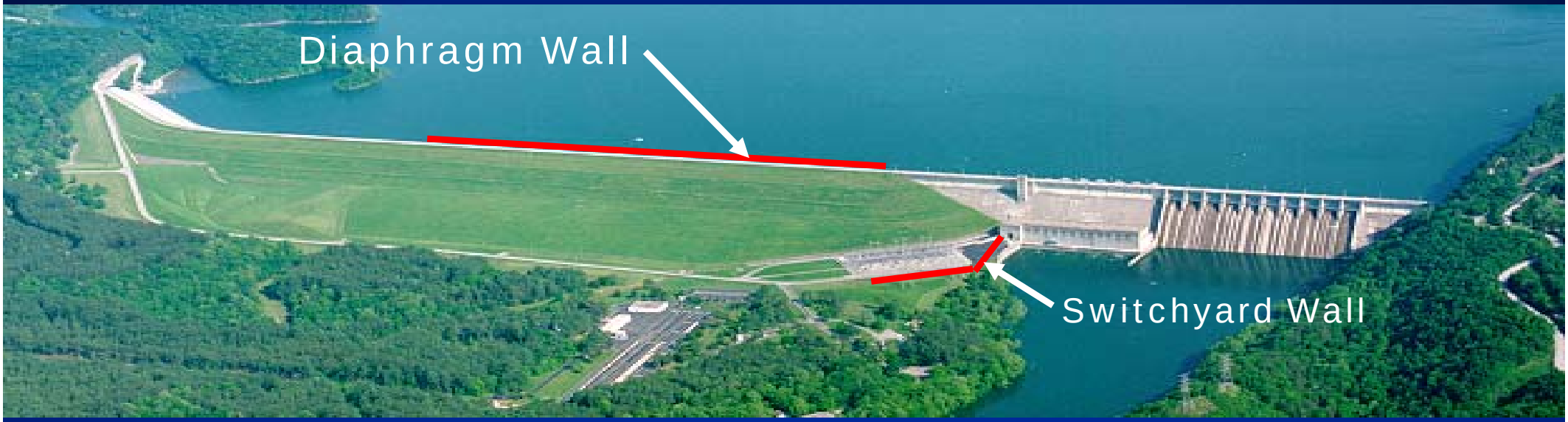
1968 Sinkhole

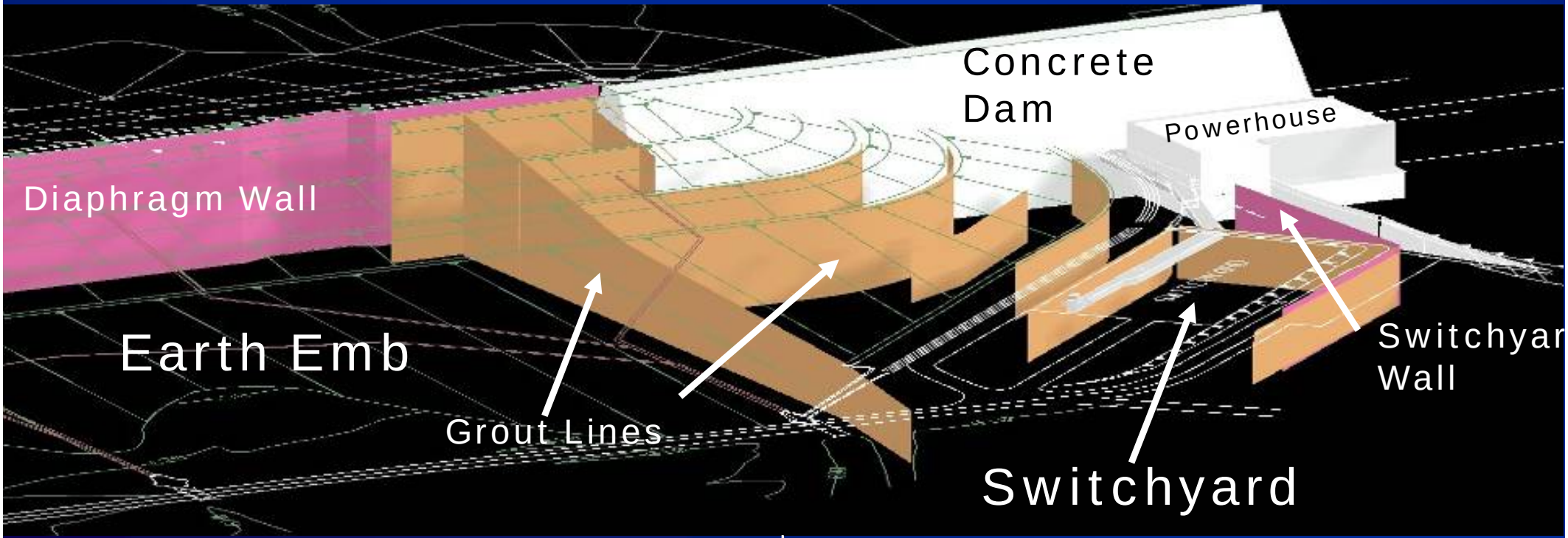


Piping and Sinkhole Development

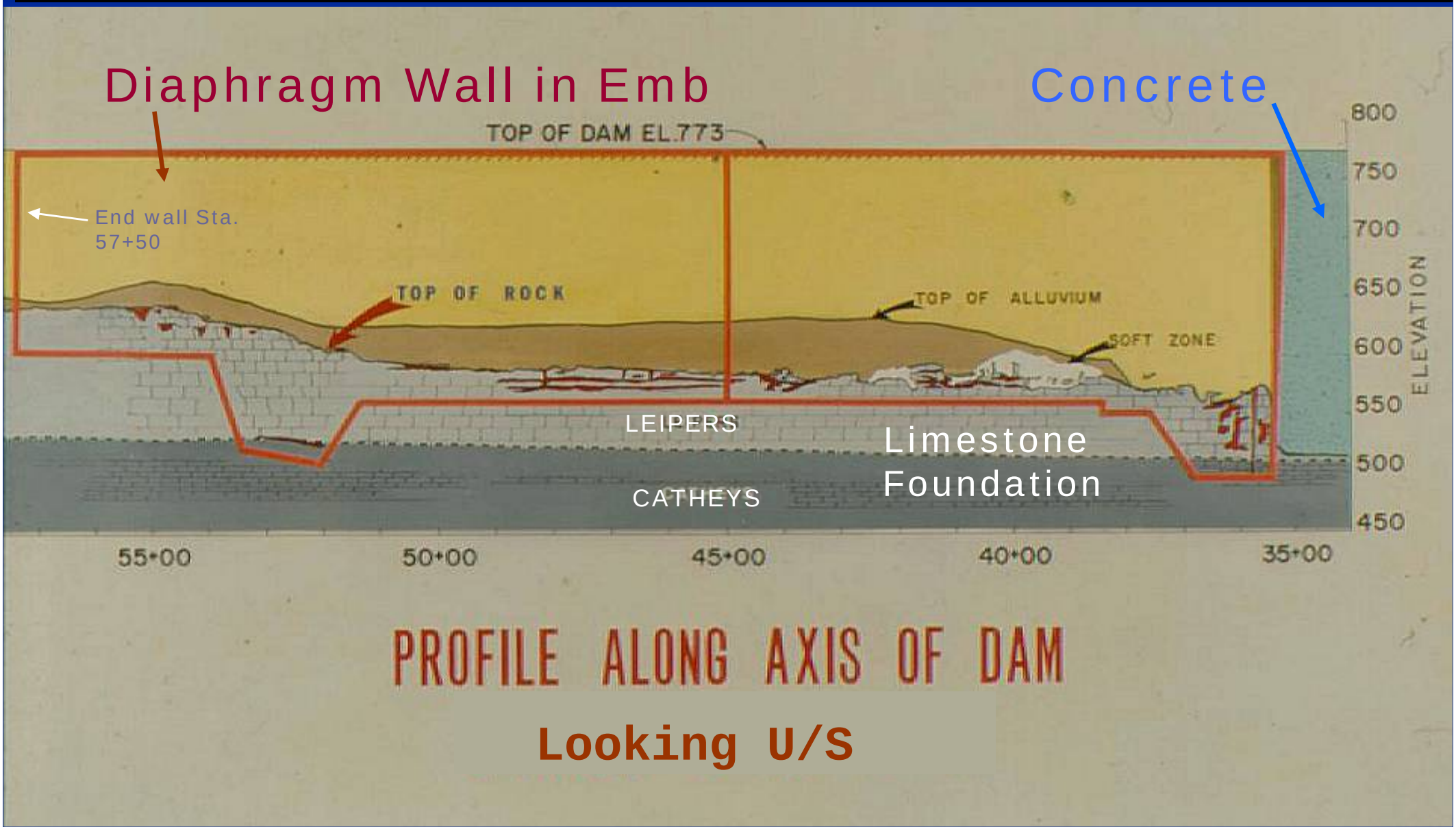


1960's and 70's Remedial Features

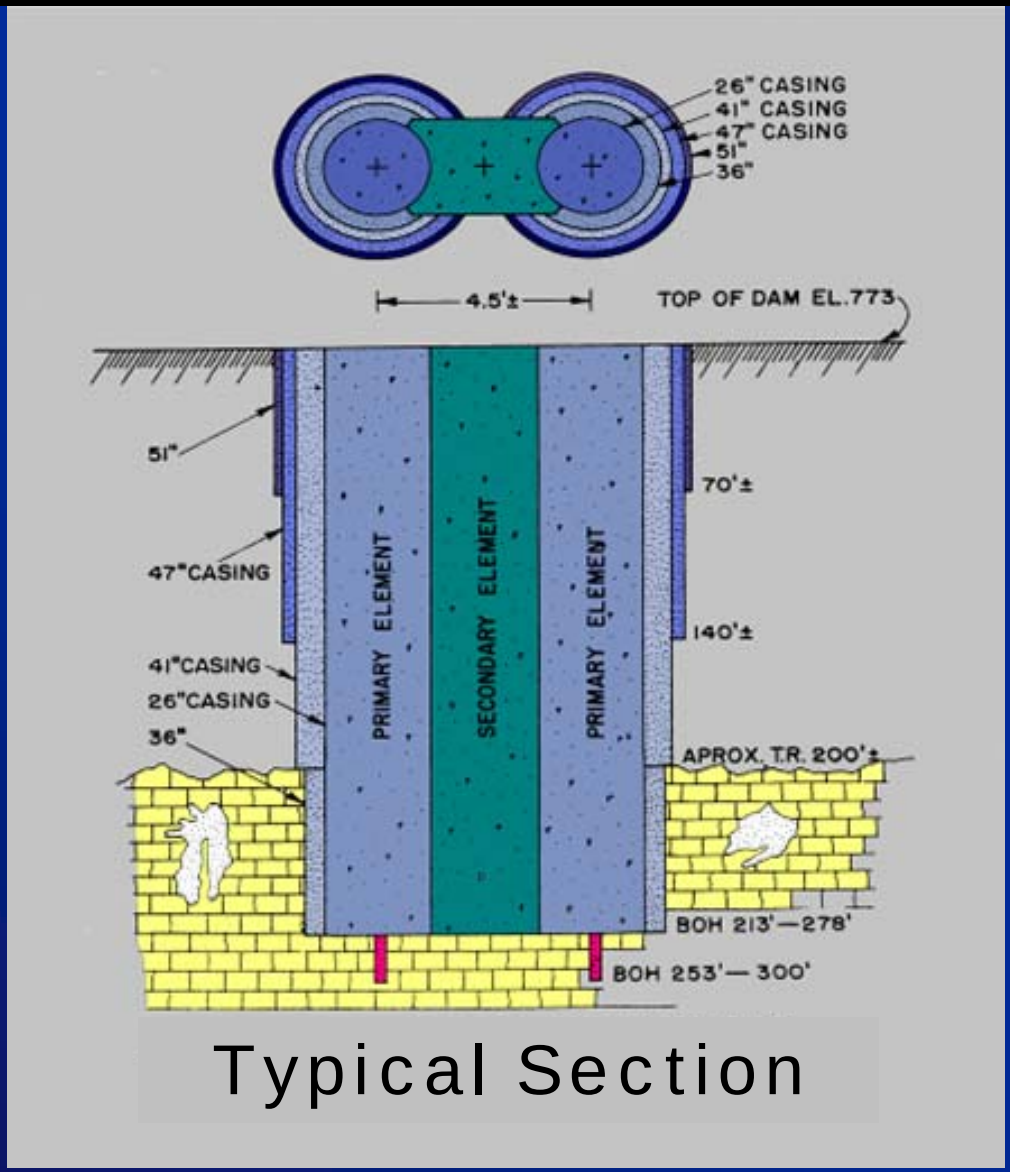




Profile along Diaphragm Wall



Diaphragm Wall

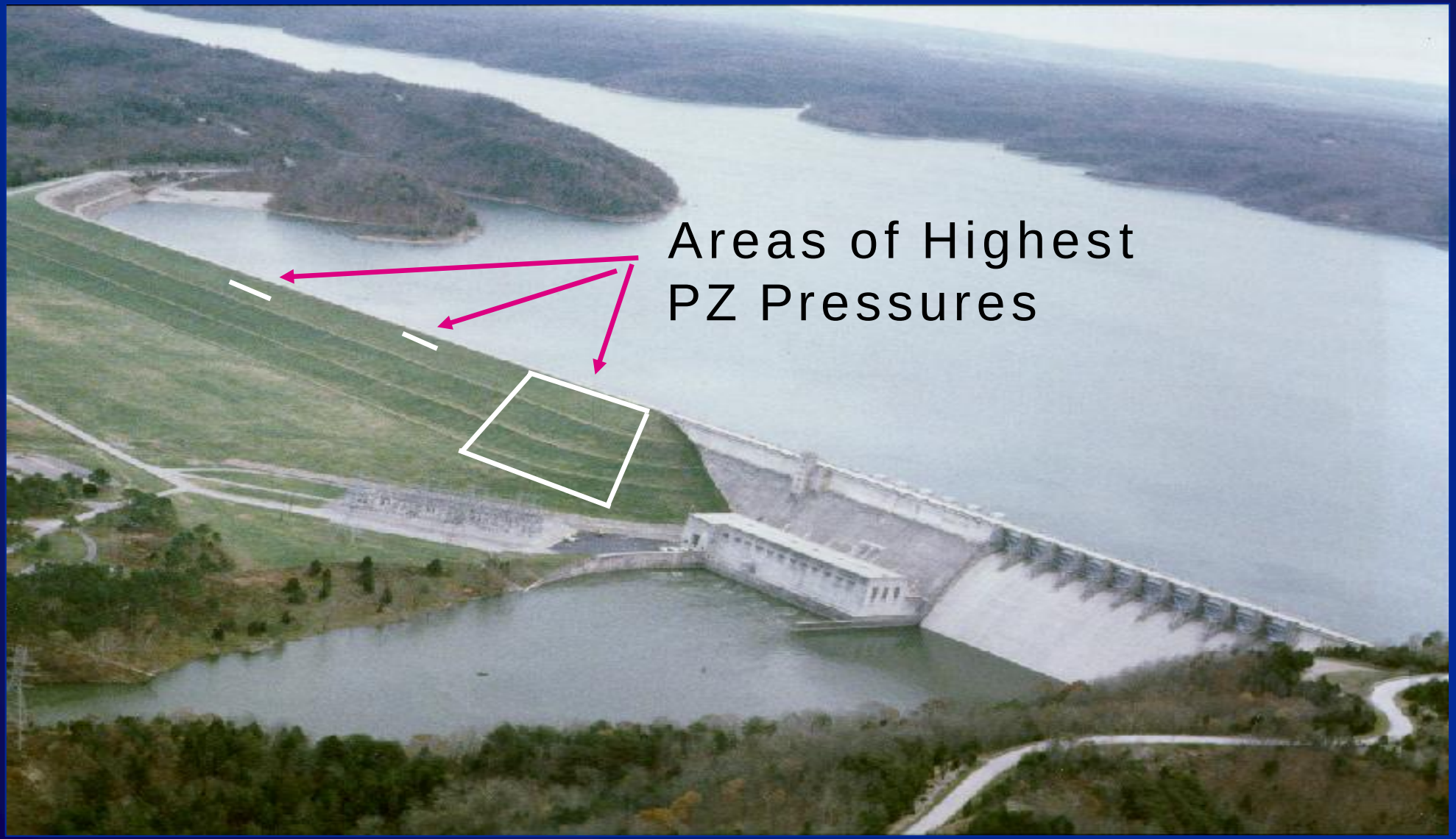


Typical Section

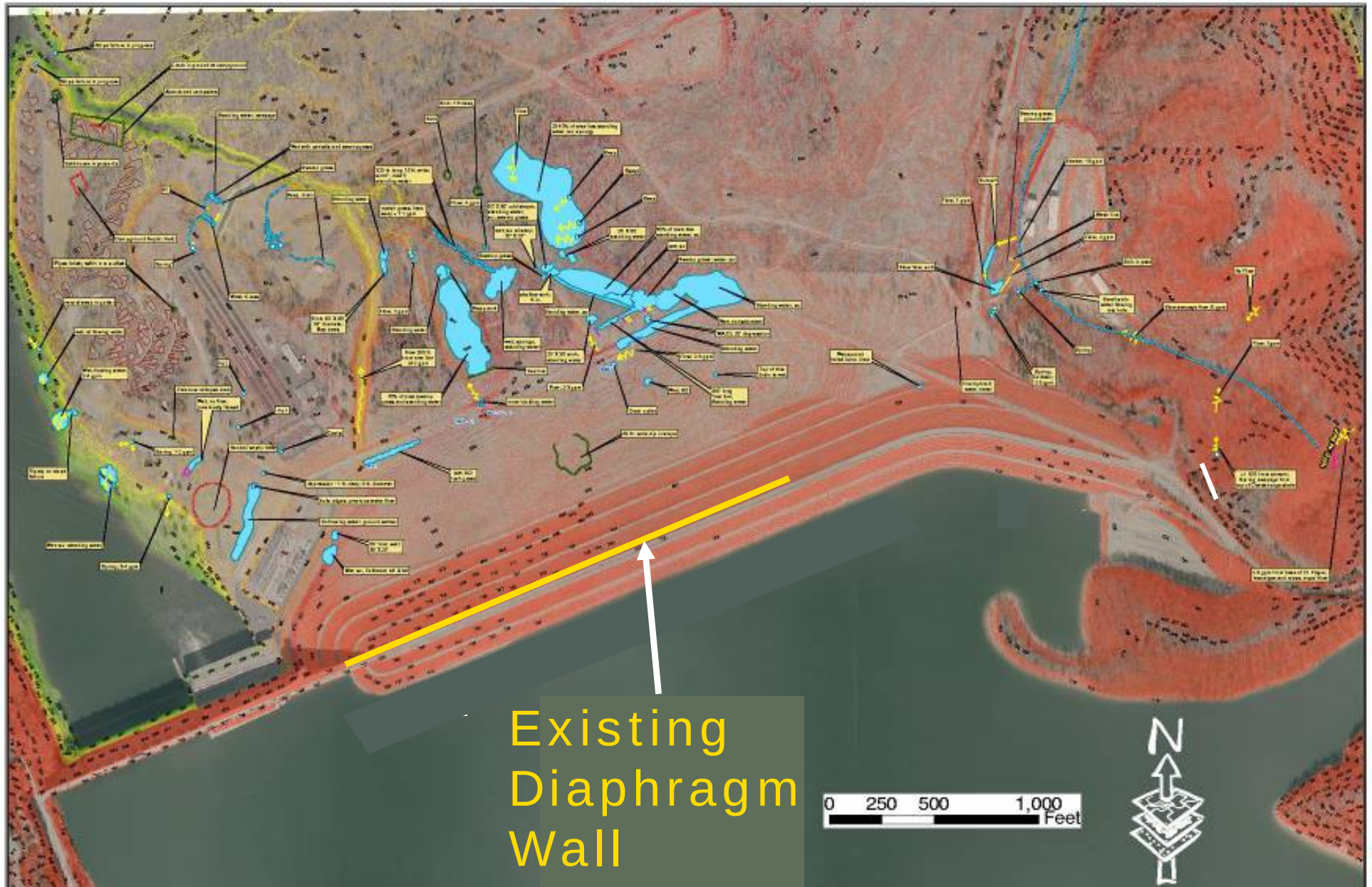
Post Wall Performance/Current Distress Indicators

- **Piezometers**
- **Wet Areas**
- **Settlement**
- **Soft Zones**
- **Temperature Survey**
- **Other**

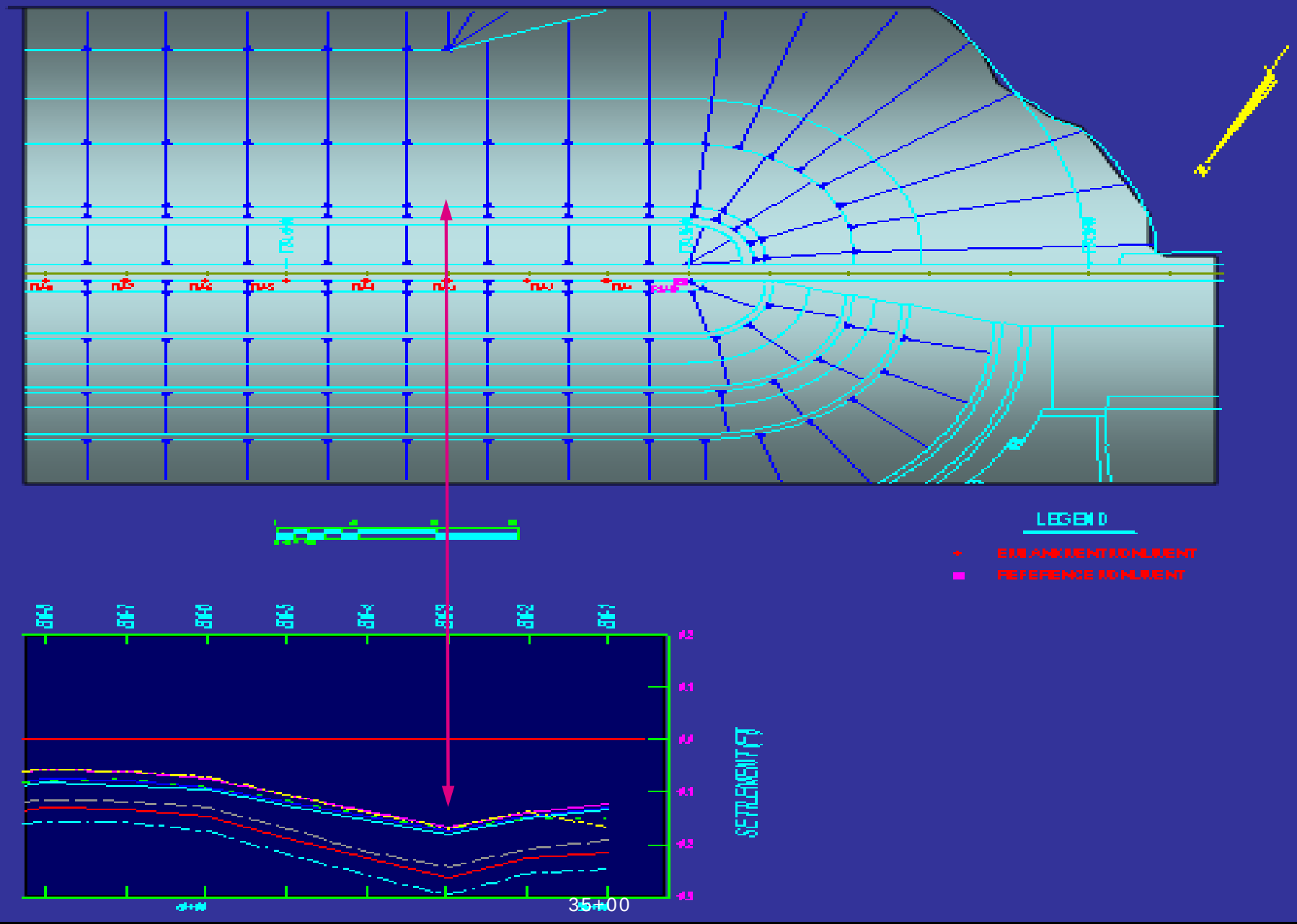
High PZ Pressures



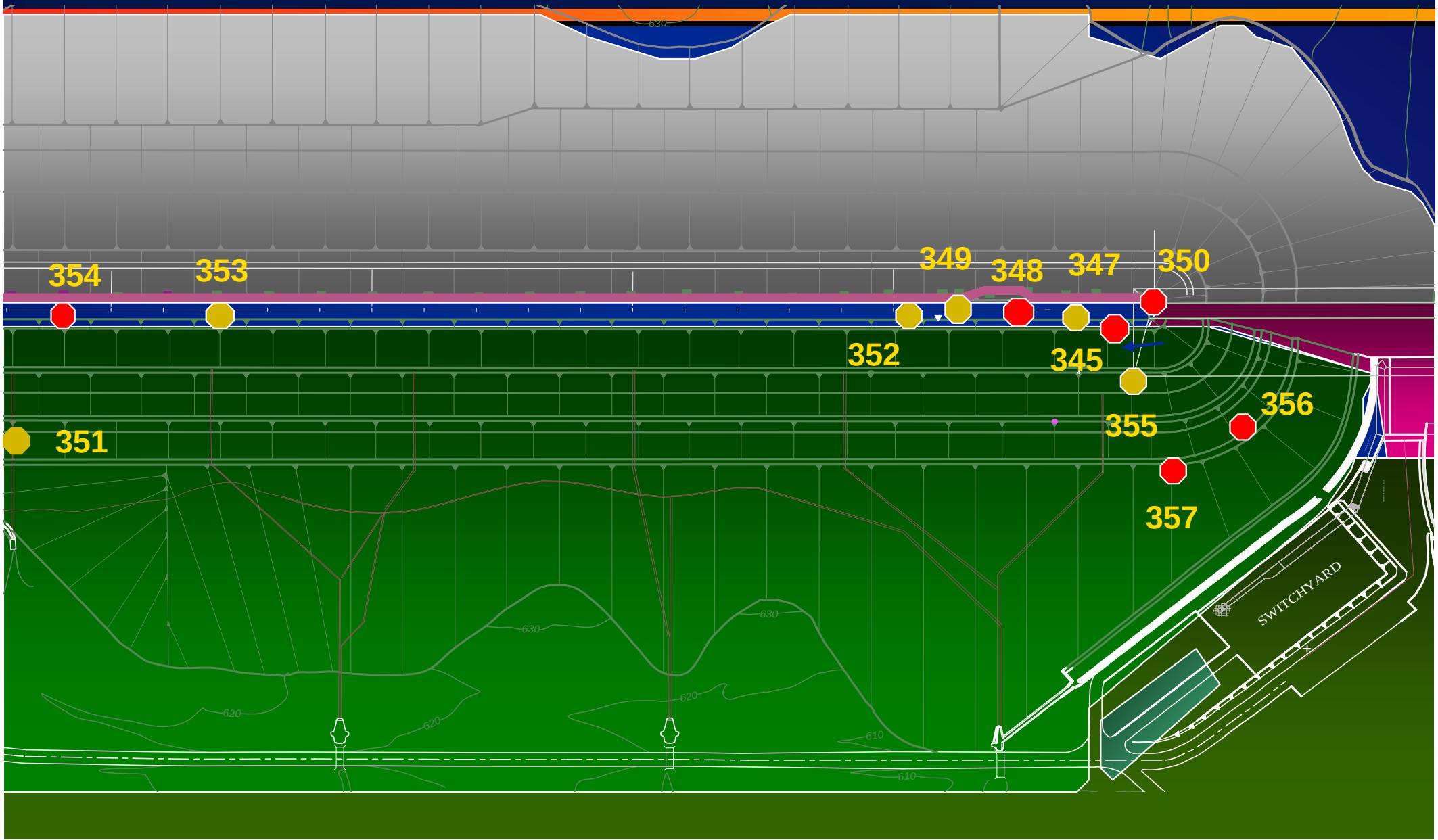
Post Wall Performance – Wet Areas



Post Wall Performance - Settlement



2002-2003 Resonant Sonic Investigations



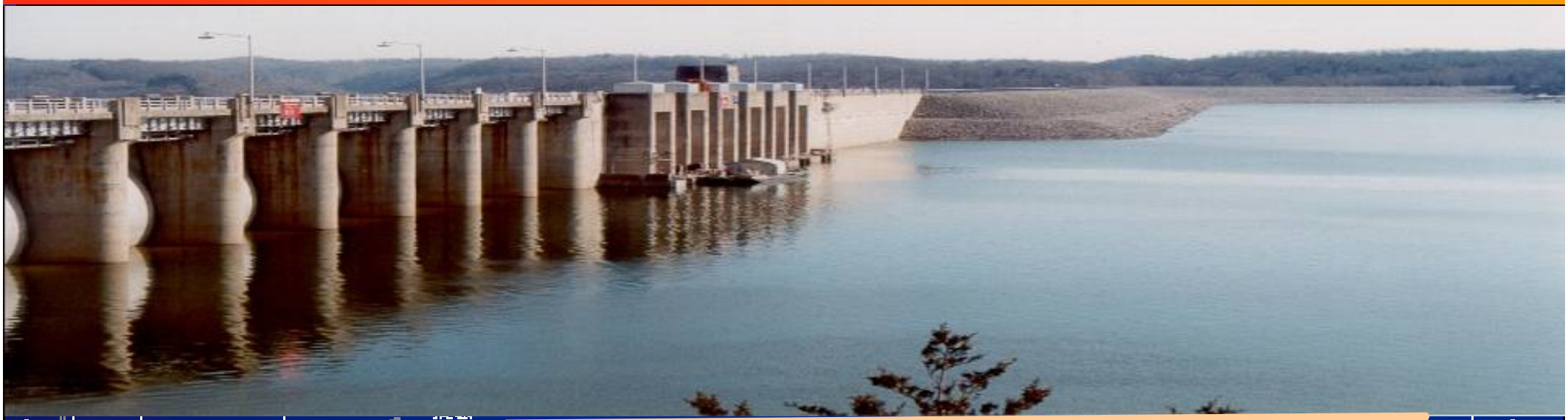
Other Concerns/Distress Indicators

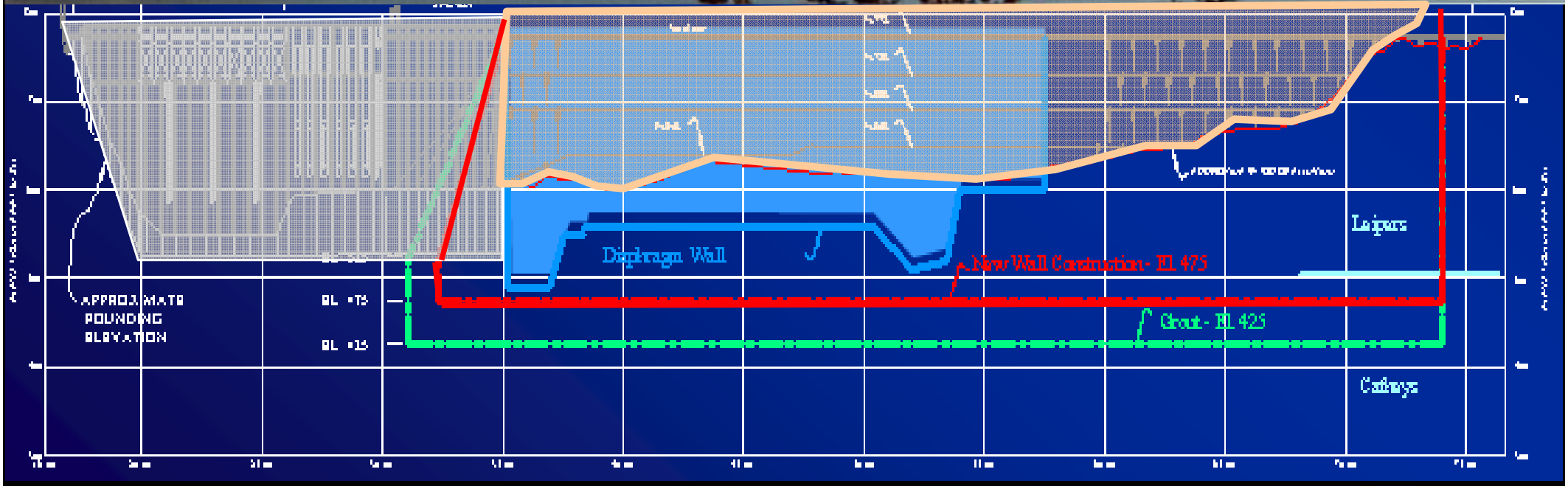
- **Cool Spots from Piezometer Temp. Survey**
- **Cable Tunnel Seepage and Cracking**
- **Increased Seepage and Instability Problems in the D/S Riverbank**
- **Structural Integrity of Existing Wall**

Reasons for Continuing Distress

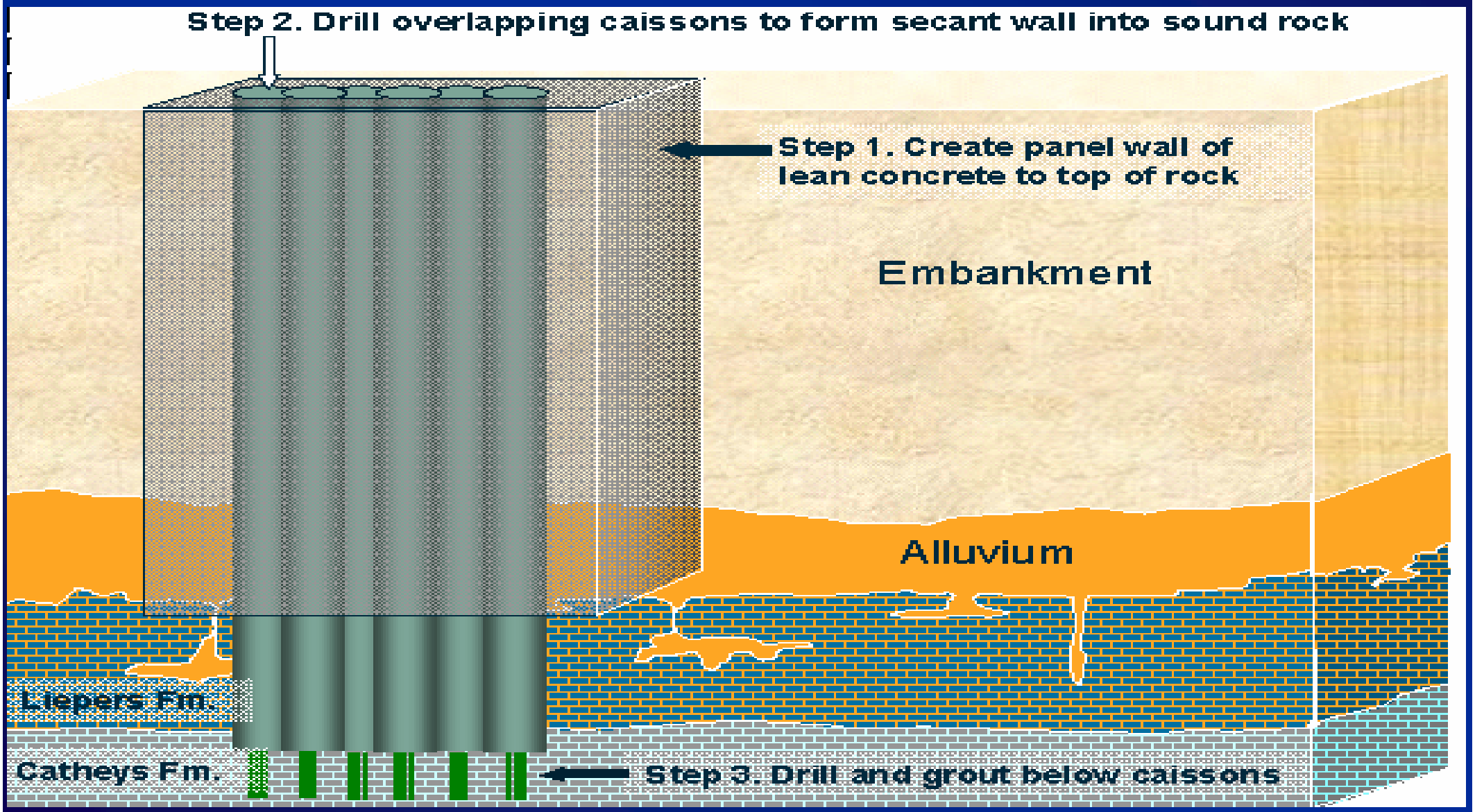
- **Seepage coming around ends of wall**
  - **Through features untreated beneath monoliths**
  - **Around right end where no wall exists**
- **Below wall through features untreated or partially treated by previous grouting**
- **Through defects in wall itself**

Proposed Remedy

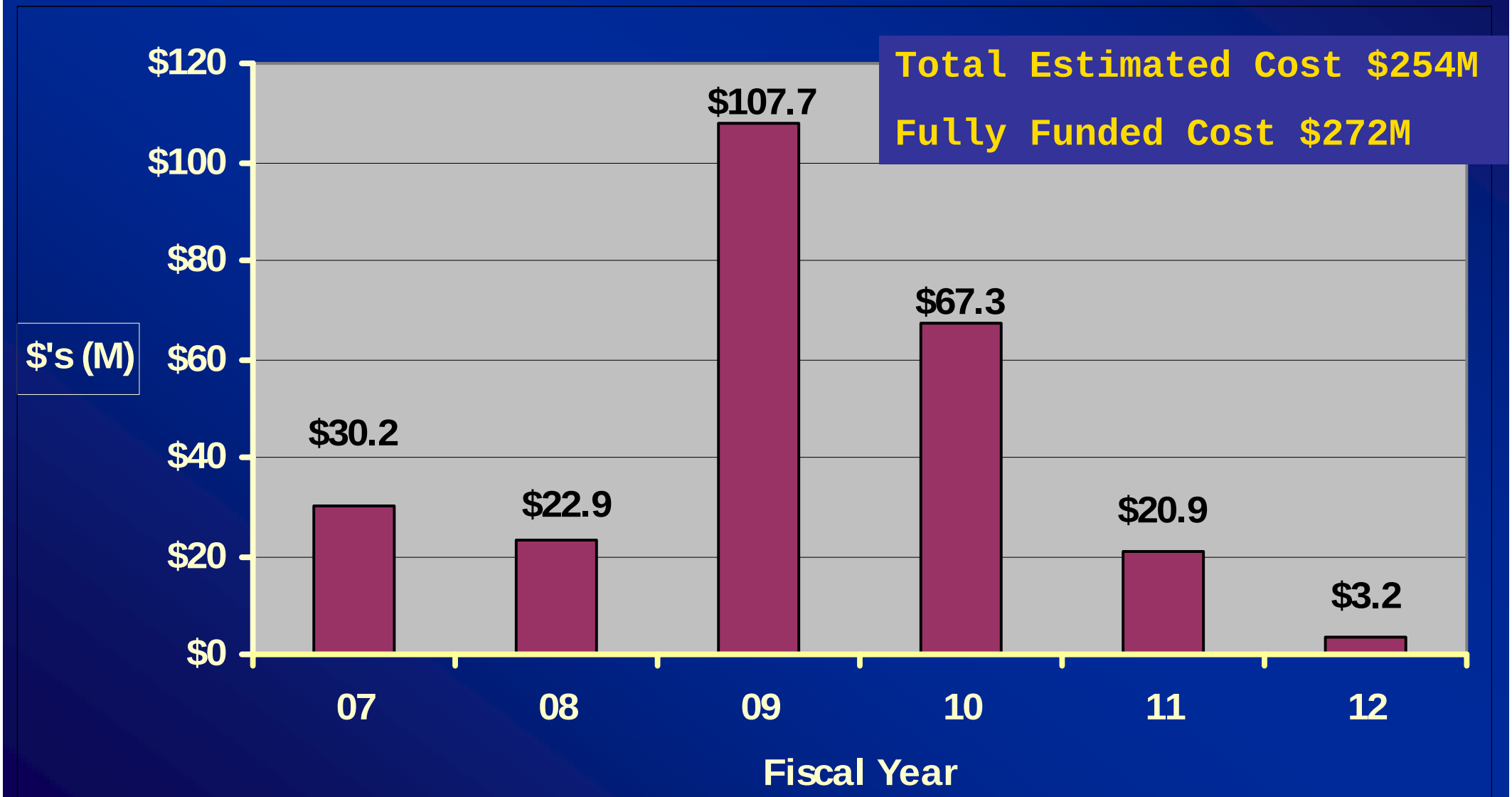




Proposed Secant Wall

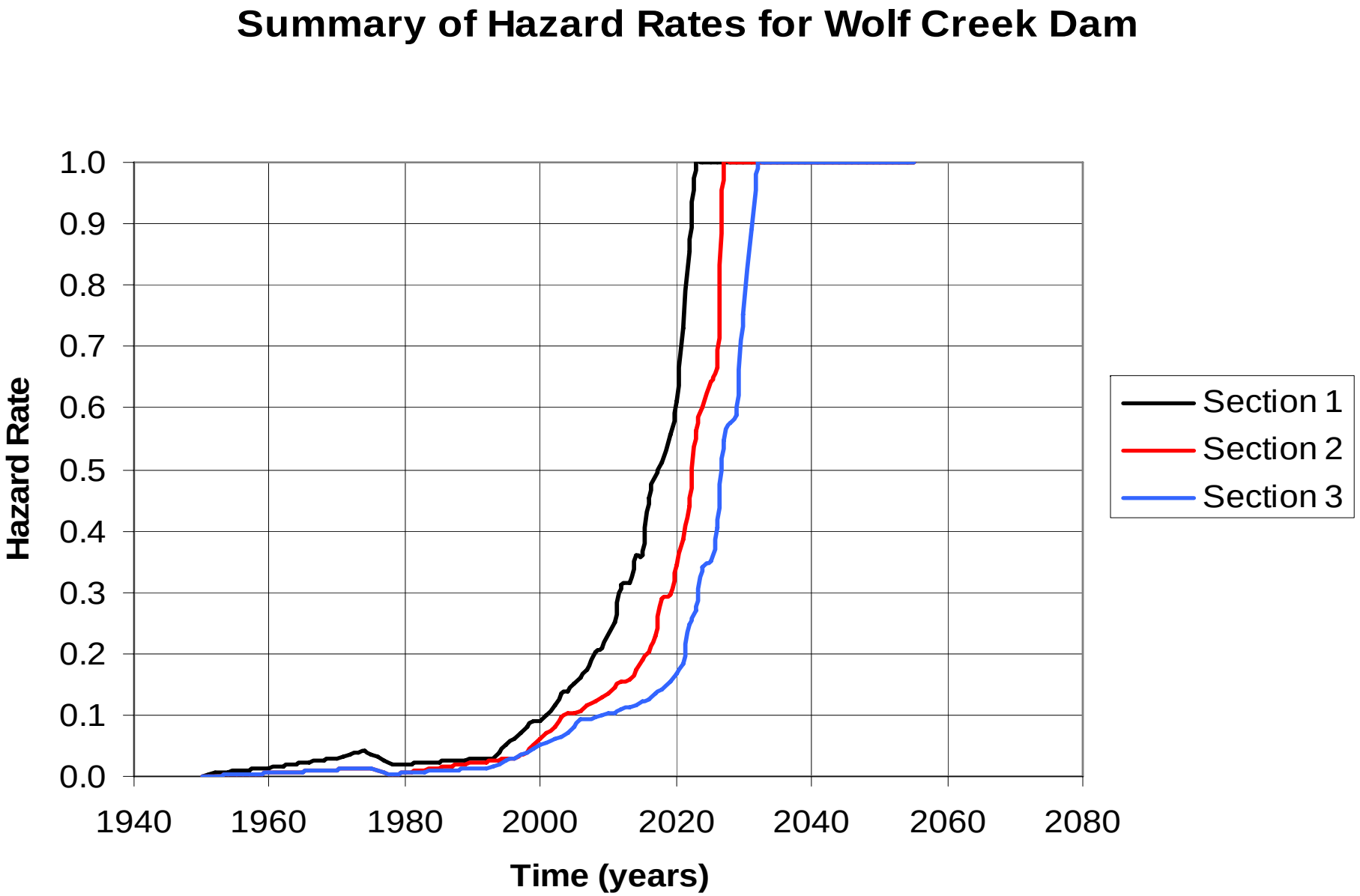


Unconstrained Construction Cost By FY



Reliability Analysis

Hazard Rates



Questions?

Speaker Info. Slide

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