

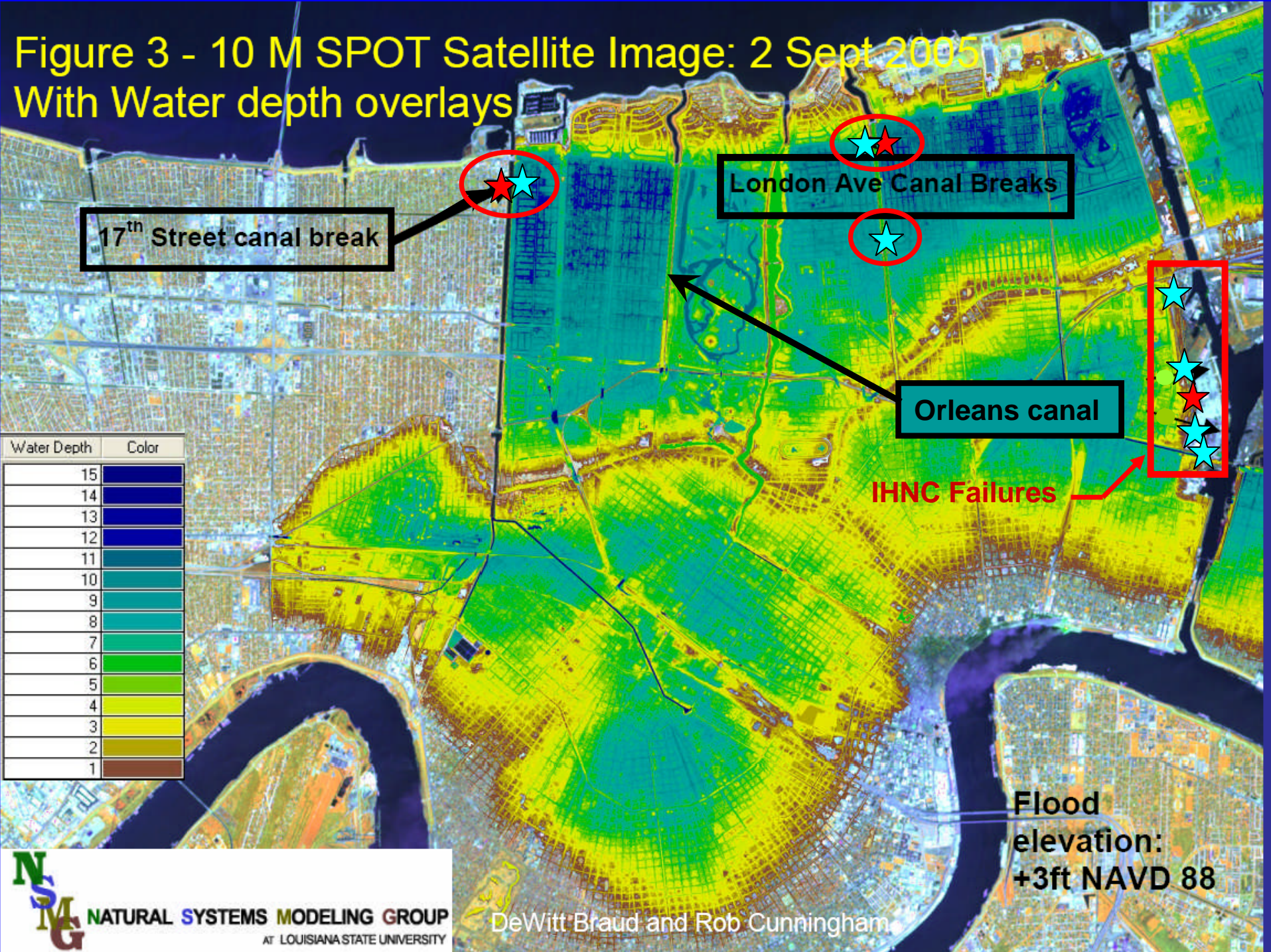
Part 3

SYSTEMIC FAILURES OF FLOOD CONTROL INFRASTRUCTURE



- **New Orleans neighborhoods were filled with as much as 12 feet of water, for up to 6 weeks**

Figure 3 - 10 M SPOT Satellite Image: 2 Sept 2005
 With Water depth overlays



17th Street canal break

London Ave Canal Breaks

Orleans canal

IHNC Failures

Flood elevation:
 +3ft NAVD 88

Water Depth	Color
15	Dark Blue
14	Blue
13	Dark Teal
12	Teal
11	Light Teal
10	Greenish Teal
9	Green
8	Light Green
7	Yellow-Green
6	Yellow
5	Light Yellow
4	Yellow
3	Light Yellow
2	Yellow
1	Brown

Lake Pontchartrain

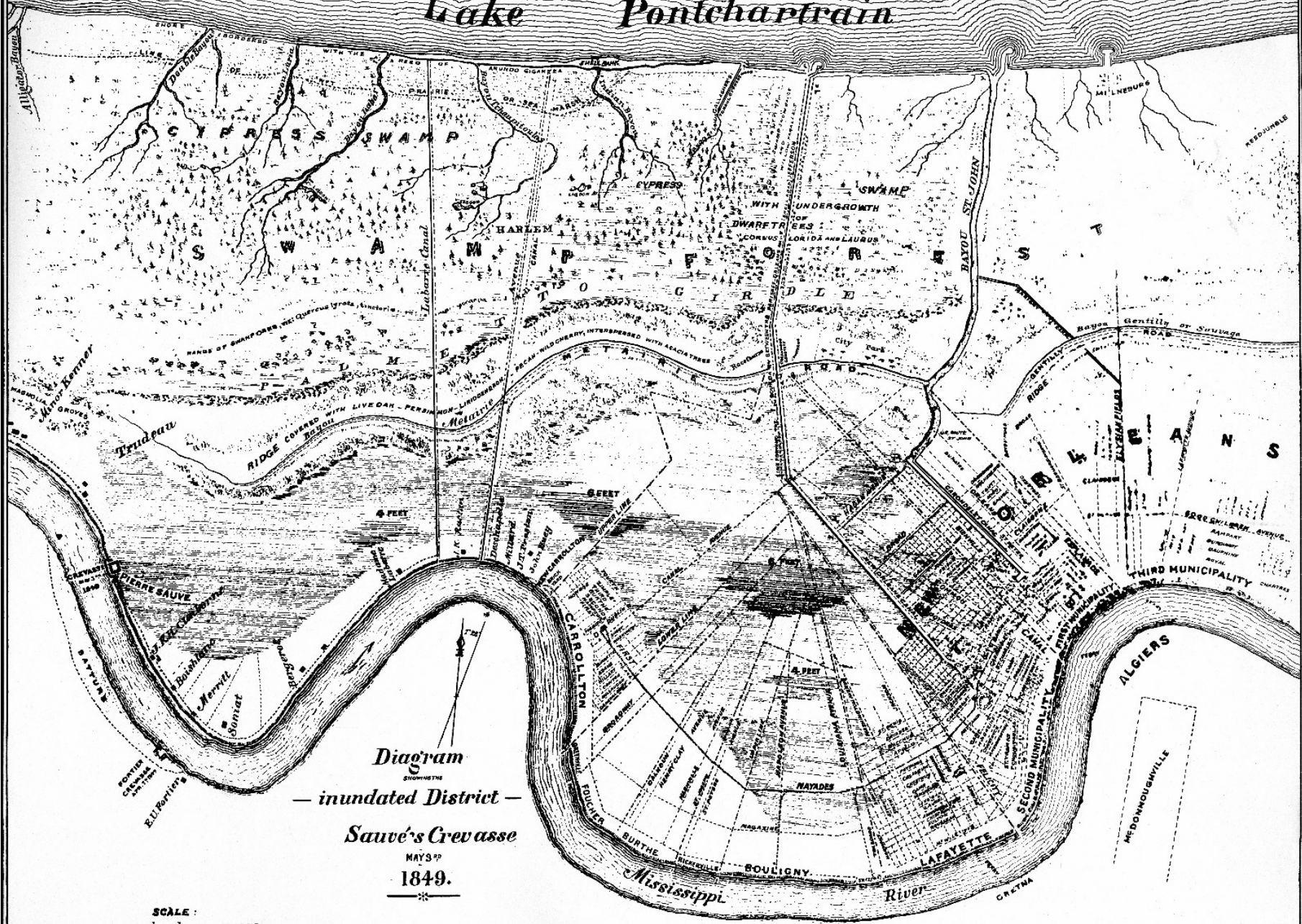
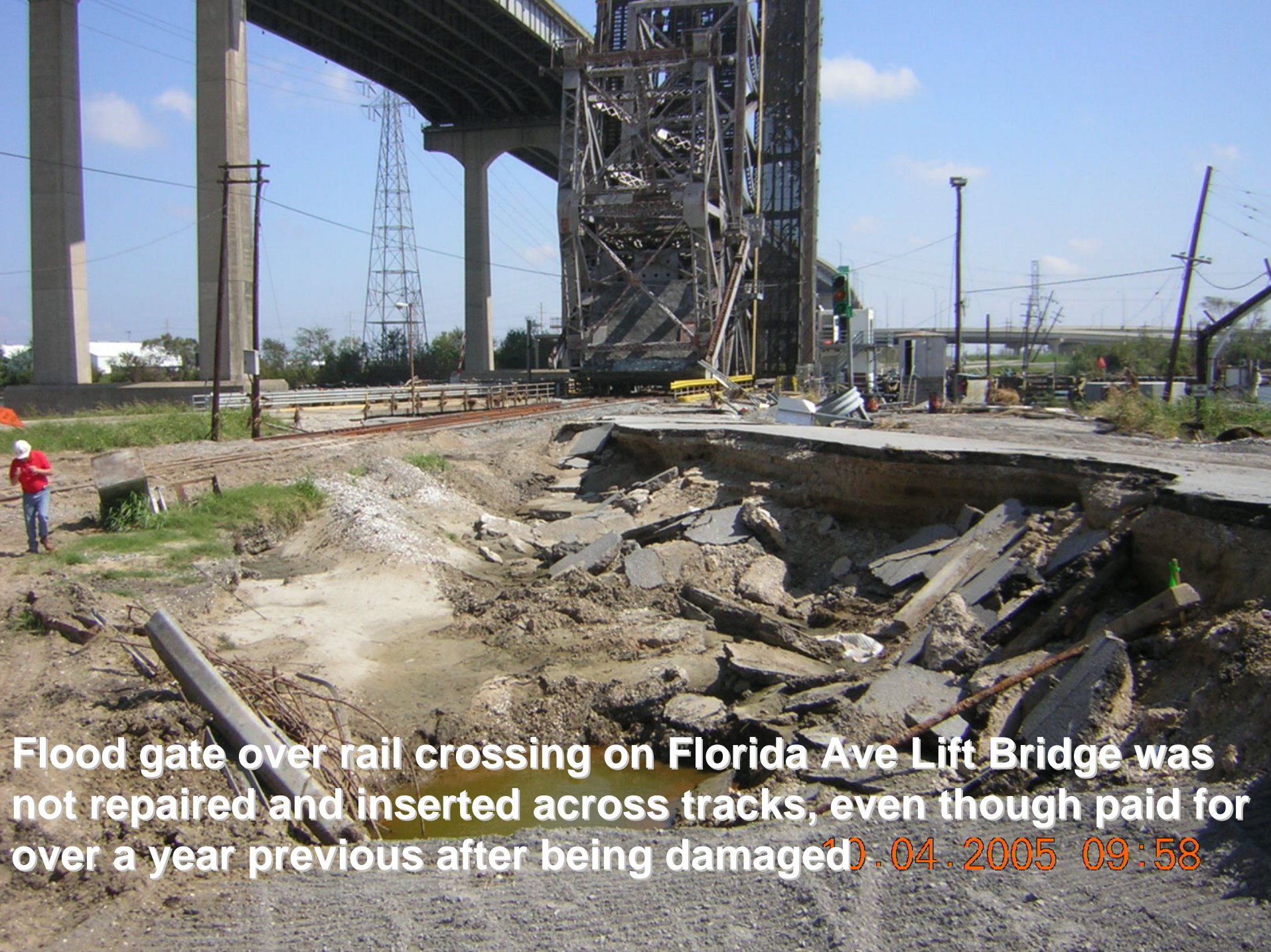
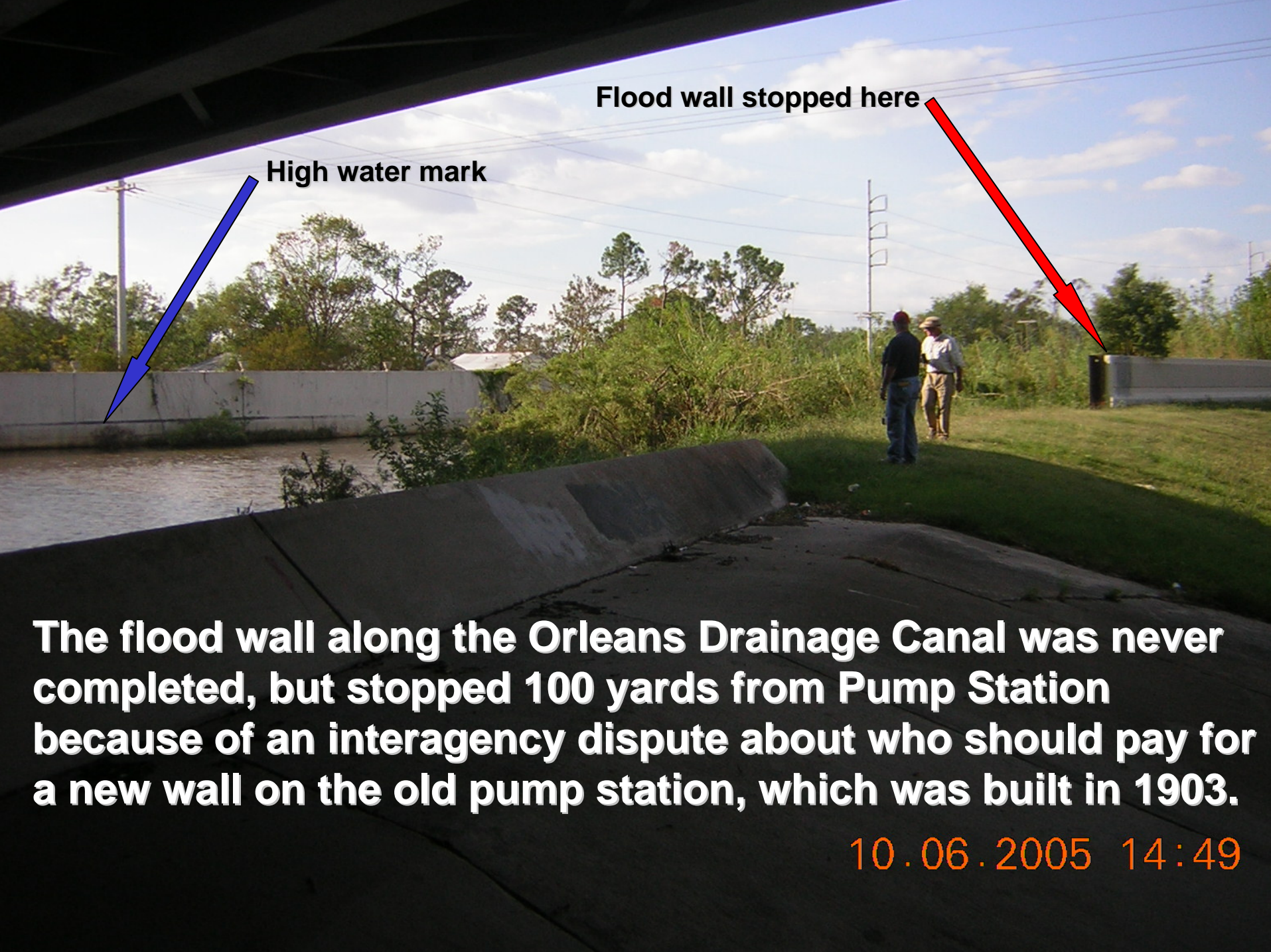


Diagram
 SHOWING THE
 — inundated District —
Sauvé's Crevasse
 MAY 3RD
 1849.

SCALE : 1 MILE



Flood gate over rail crossing on Florida Ave Lift Bridge was not repaired and inserted across tracks, even though paid for over a year previous after being damaged 10.04.2005 09:58



Flood wall stopped here

High water mark

The flood wall along the Orleans Drainage Canal was never completed, but stopped 100 yards from Pump Station because of an interagency dispute about who should pay for a new wall on the old pump station, which was built in 1903.

10.06.2005 14:49

Lower Ninth Ward



- **Aerial view of the south breach of the Inner Harbor Navigation Channel (IHNC) in the Lower Ninth Ward of New Orleans.**

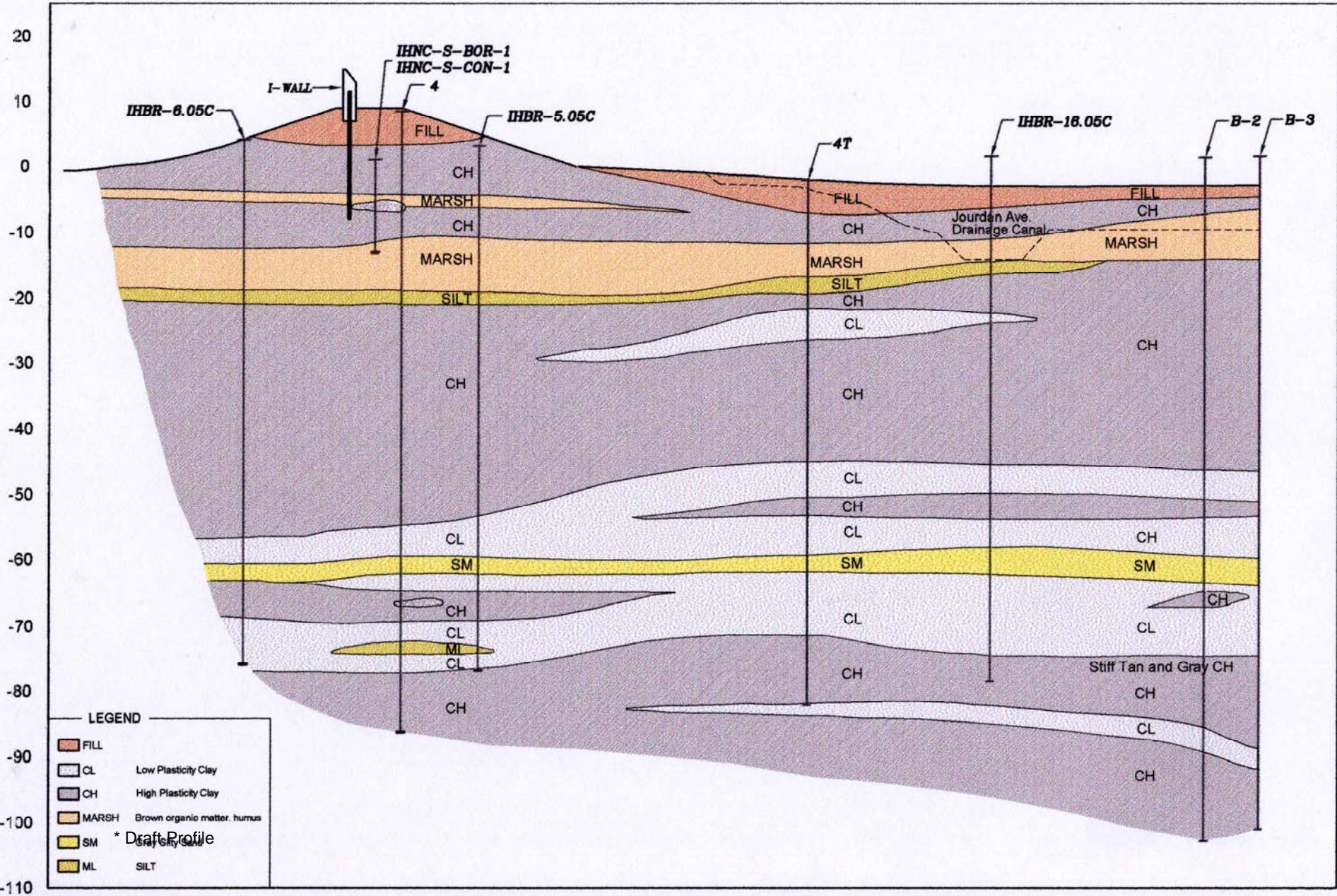


- **ING 4727 was built in 1990 as a dry cargo cover-top barge with a steel hull. It was 200 feet long, 35 feet wide, and 12 ft high, with a cargo volume of 84,659 ft³ (1877 tons). It was being leased to Lafarge North America, and was tied up along the MRGO channel.**

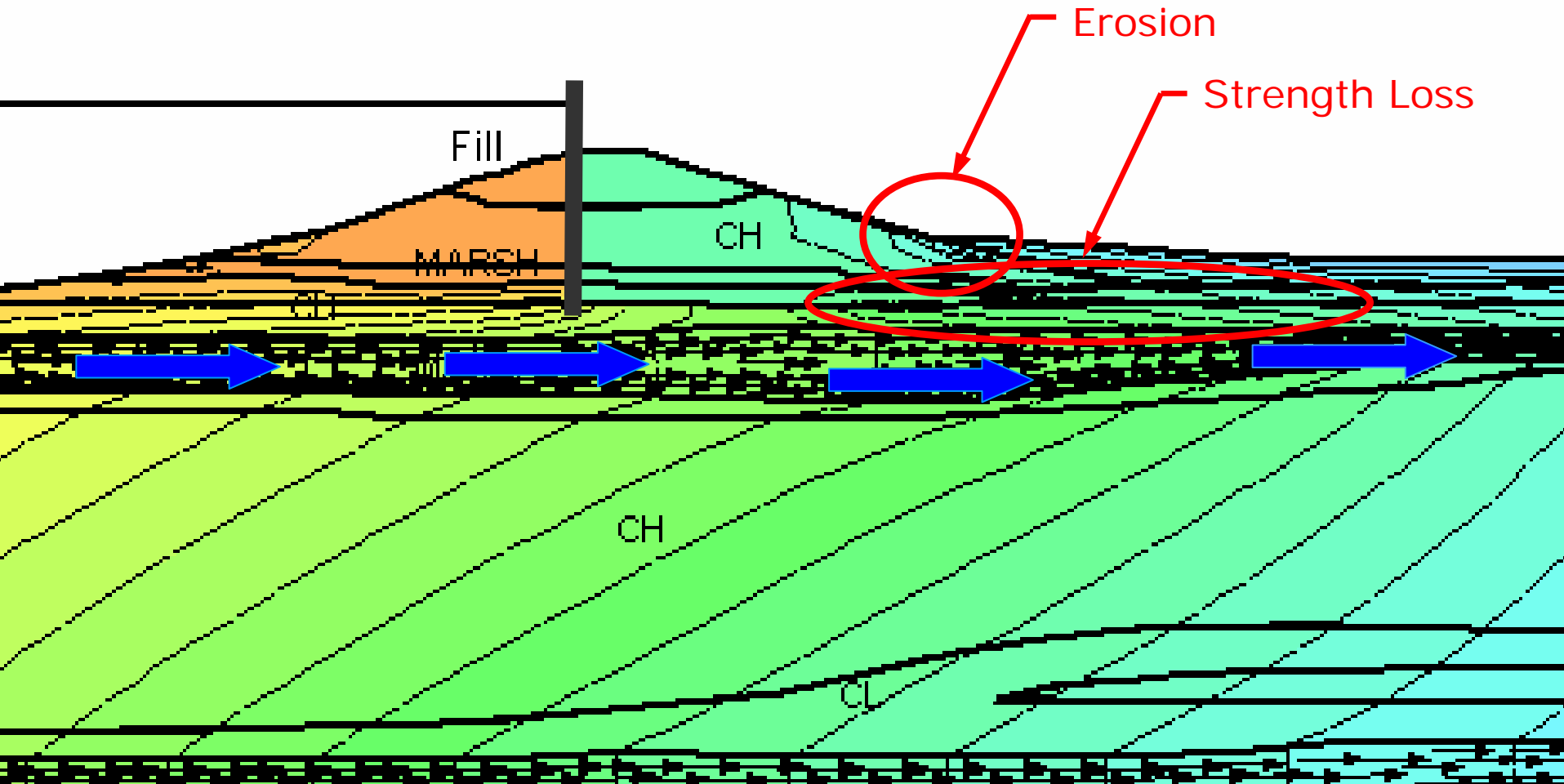


- **Damage to concrete flood wall where ING 4727 Barge collided with it, along the south side of the IHNC adjacent to the Lower Ninth Ward**

LOWER NINTH WARD, IHNC EAST BANK
 SOUTH OF SOUTHERN BREACH
 ELEVATION, FT (N.A.V.D.88)



Industrial Canal at the Ninth Ward



17th Street Drainage Canal breach



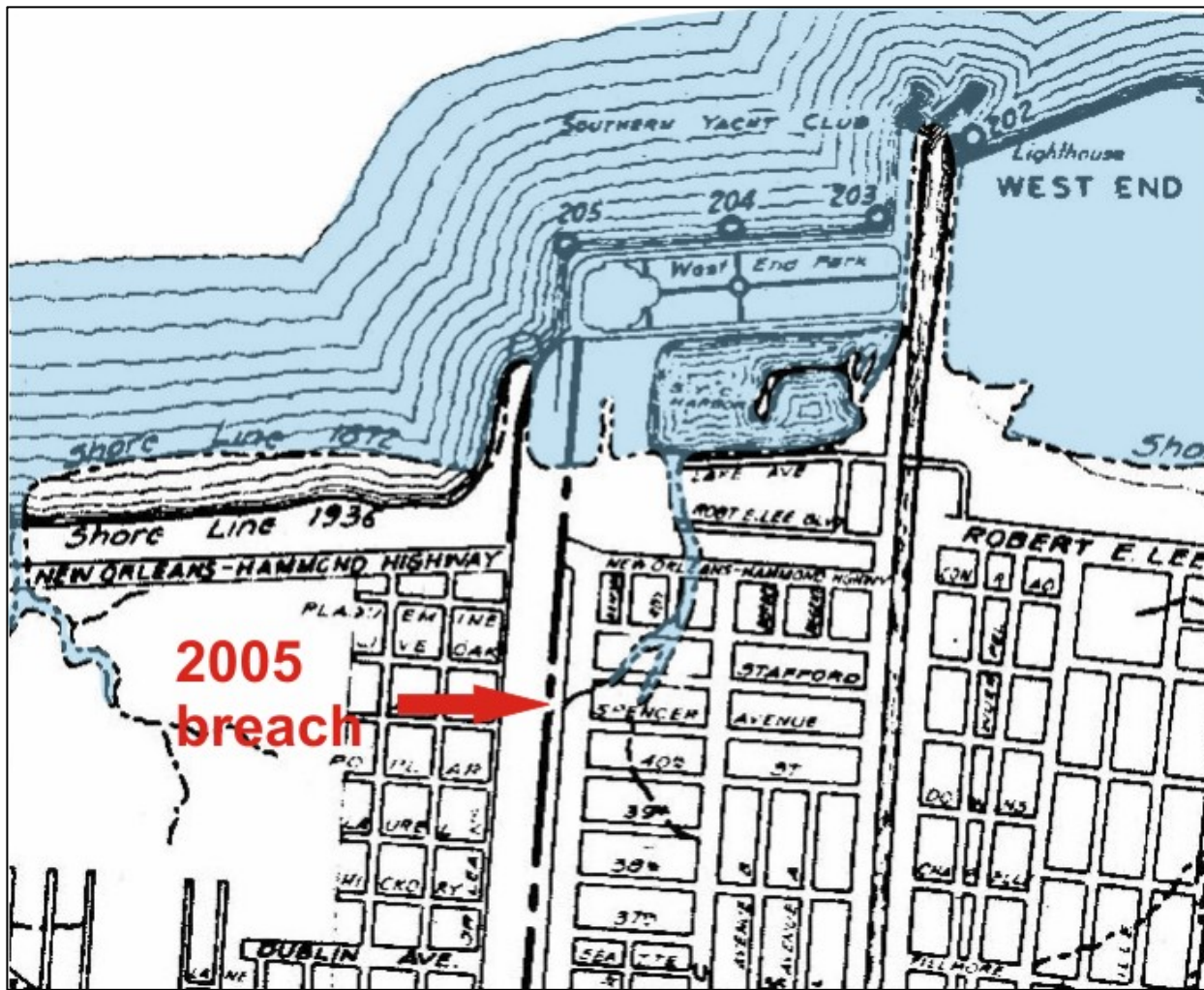
- The 17th Street canal had walls 14 ft above MGL
- The highest flow it had ever experienced was between 6 and 7 ft
- It began failing when water got to 8.5 ft.



Embankment moved 51 ft

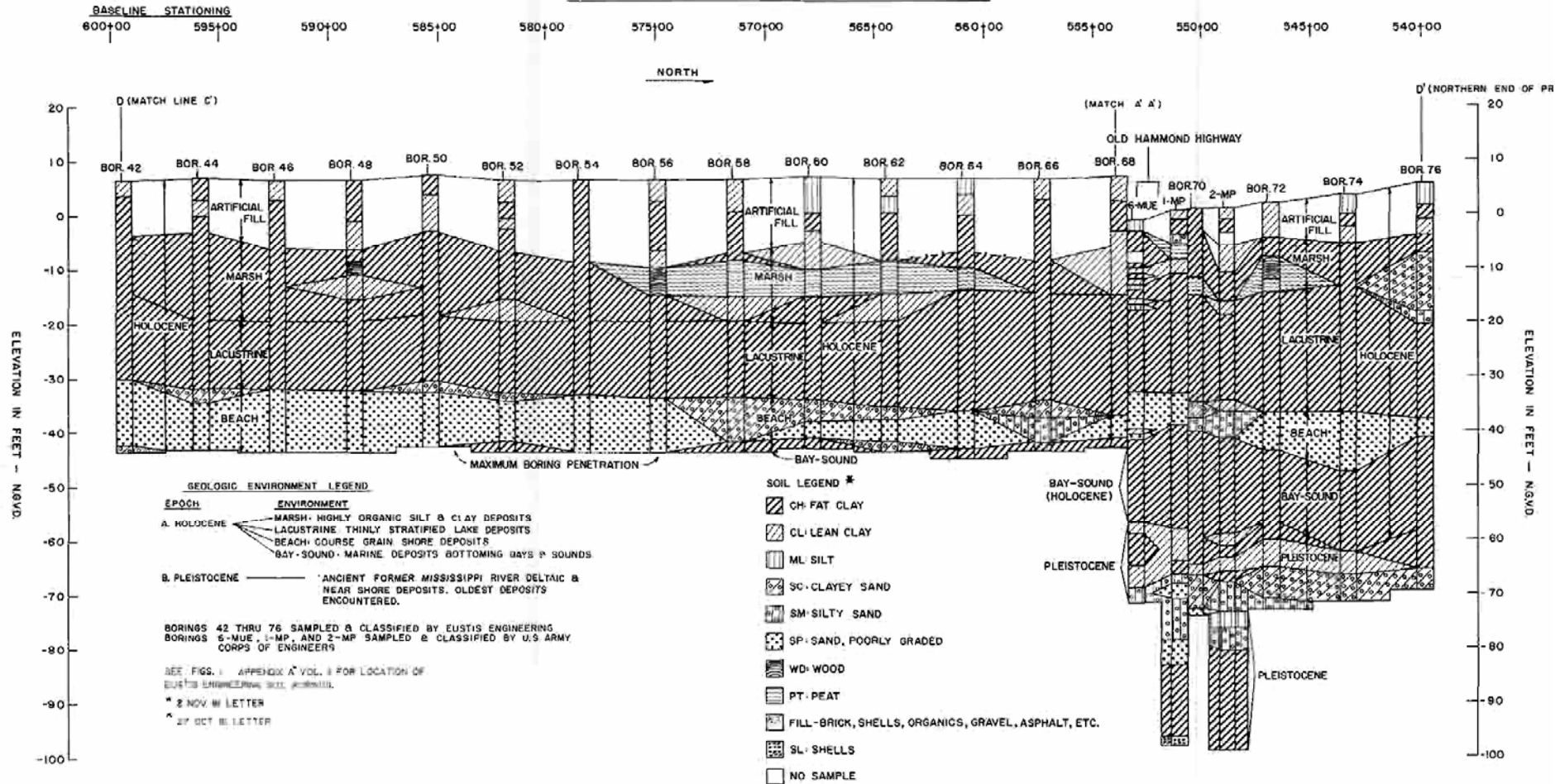


- **Army helicopters and contractors worked for weeks to fill the enormous gaps in the levee system, BEFORE pumping could begin.**

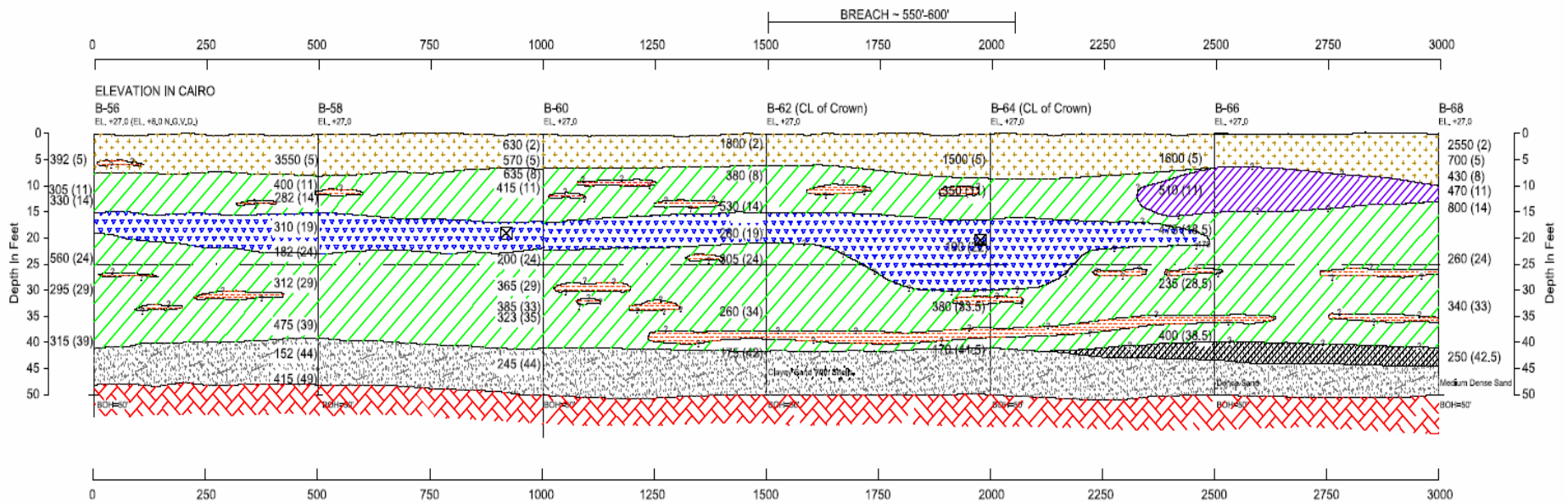


- Overlay of 1872 map by Valery Sulakowski on the 1937 WPA map, showing the 1872 shoreline and sloughs (in blue) along Lake Pontchartrain. The position of the 2005 breach along the east side of the 17th Street Canal is indicated by the red arrow.

17TH STREET OUTFALL CANAL - EAST LEVEE (NORTHERN HALF)



Geologic profile for the 17th St Canal flood wall prepared by Corps' New Orleans District office in 1990. Three of four holes in vicinity of the 2005 failure had zero sample recovery. These contacts were projected and sheet pile tips designed accordingly.

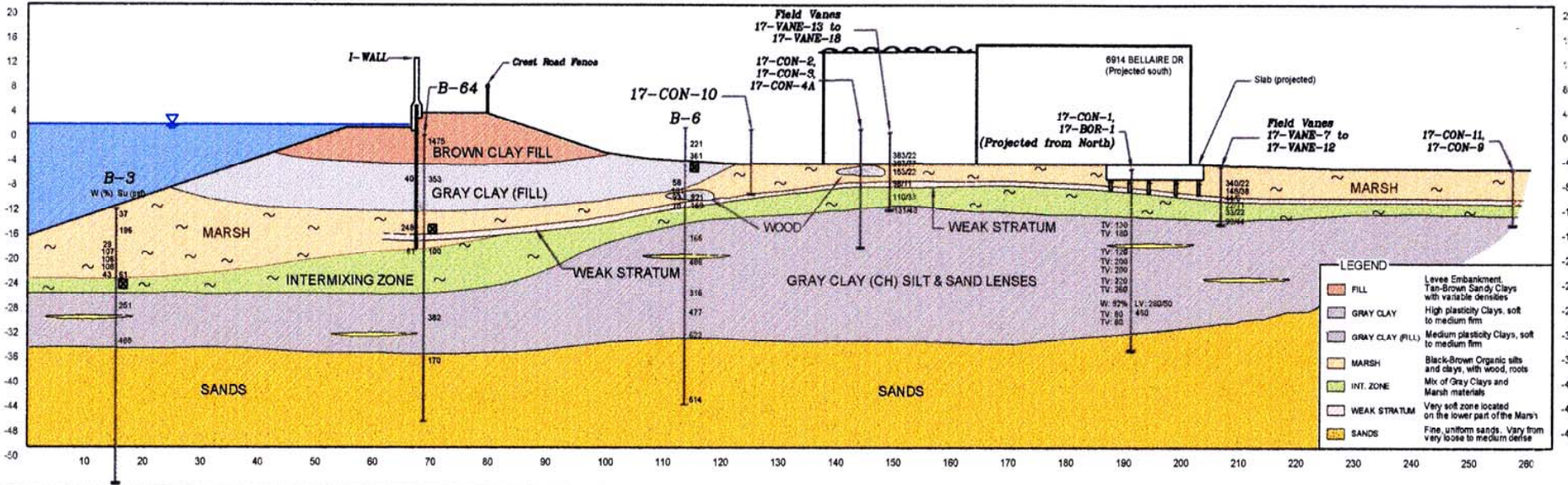


17th Street Canal East Levee- Draft Soil Profile
New Orleans, Louisiana

- Alternative interpretation of the Eustis 1982 borings for the 17th Street Canal East Levee, near the 2005 break. In this case the swamp deposits would extend beneath the sheetpile tips over a zone 300 feet long, where the break occurred.

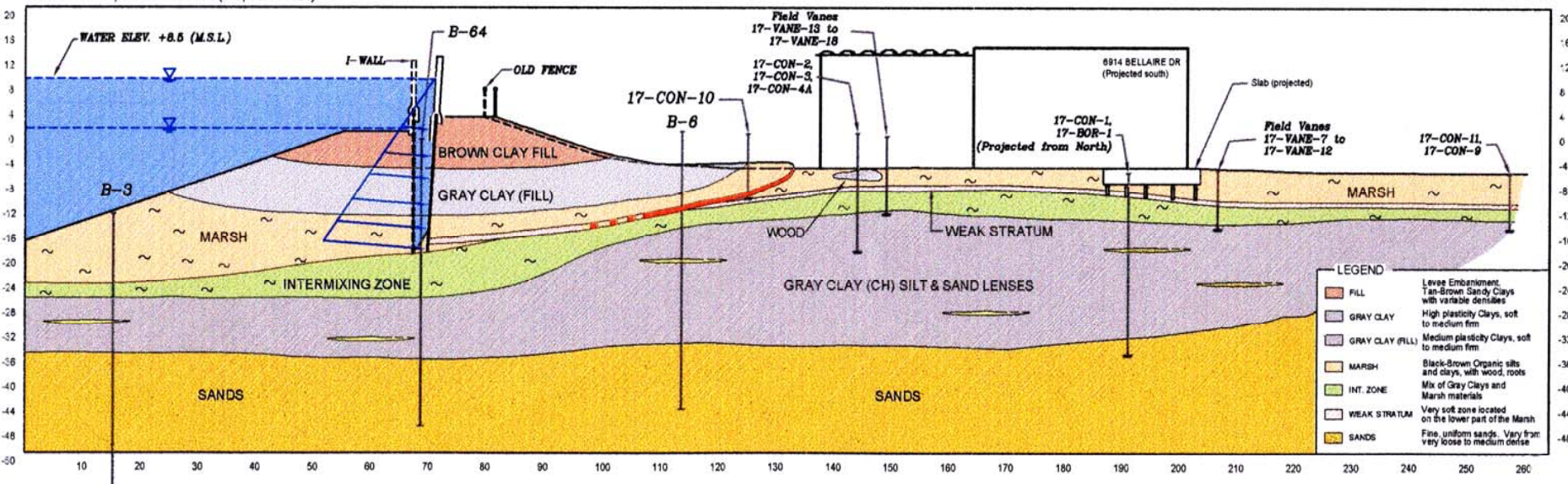
17th STREET CANAL EAST BANK BREACH
SECTION 1, ELEVATION (FT, N.A.V.D.)

ANALYSIS SECTION



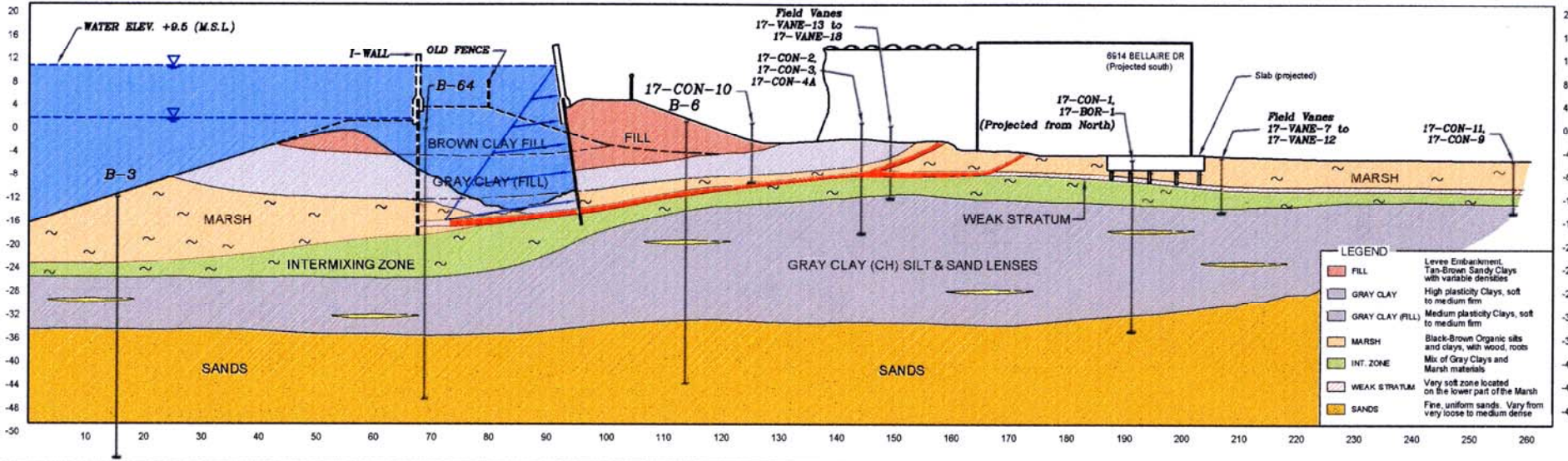
17th STREET CANAL EAST BANK BREACH
SECTION 1, ELEVATION (FT, N.A.V.D.)

OPENING OF THE GAP



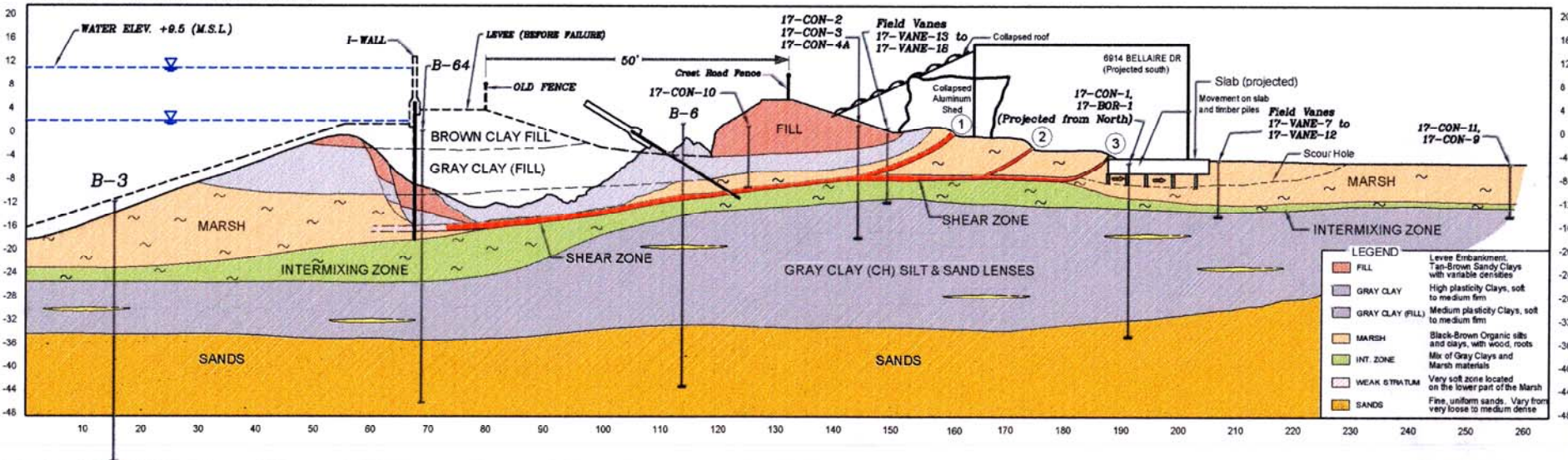
17th STREET CANAL EAST BANK BREACH
SECTION 1, ELEVATION (FT. N.A.V.D.)

LATERAL TRANSLATION IN PROGRESS



17th STREET CANAL EAST BANK BREACH
SECTION 1, ELEVATION (FT. N.A.V.D.)

DISPLACED



17th Street Outfall Canal East Bank Floodwall Construction

ca 1993 Floodwall Protection/Capping Project (High Level Plan)
Hammond Hwy to Veterans Blvd Sta. 8+50 to 80+00 (±) -- Typical

Existing floodwall elevations running ~12.1 ft
(LMSL 1983-2001) —from 2005 post-Katrina
field surveys

14.0 ft NGVD
Design
Elevation

Delta ≈ 1.9 feet

Contract plan “NGVD” (unspecified
epoch)-assumed ≈ MSL (LMSL) in 1993

elev 8.77 ft

LMSL (1983-1992 & 2005)
(from 2005 level line)

elev 6.81 ft

USACE Monument 14 used as reference
for floodwall construction

Elevations are referenced to an
estimated LMSL (1983-2001 epoch) at
Lake Pontchartrain

1.96 ft difference likely due to:

- Uncertain BM 14 elevation ... believed by MVN to be suspect/disturbed
- Uncertain BM 14 datum (1951 or ?)
- Settlement (probably < 0.3 ft)

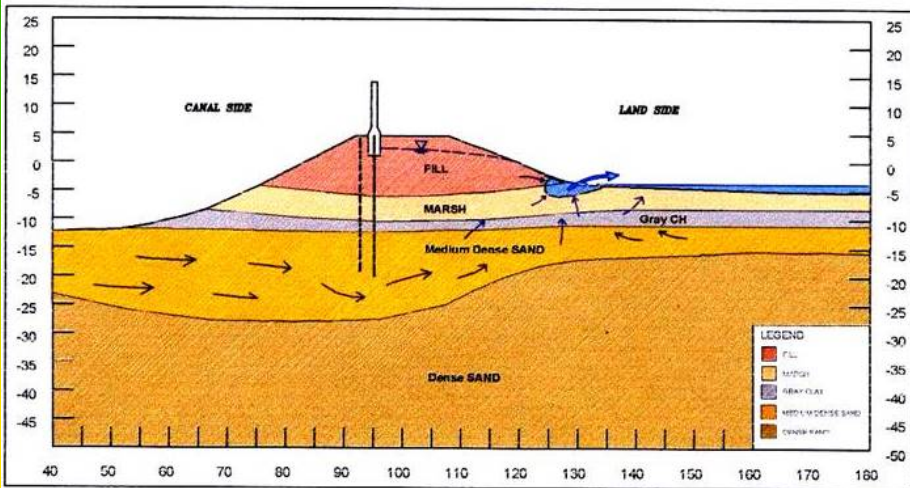
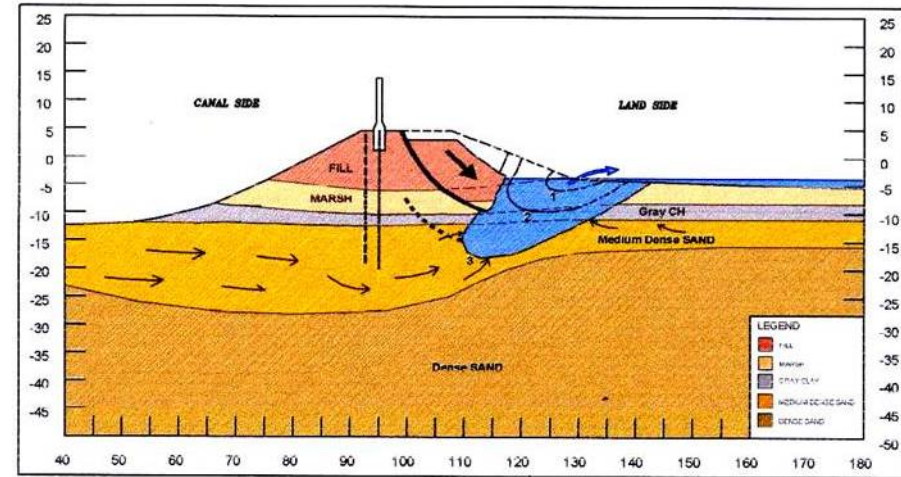
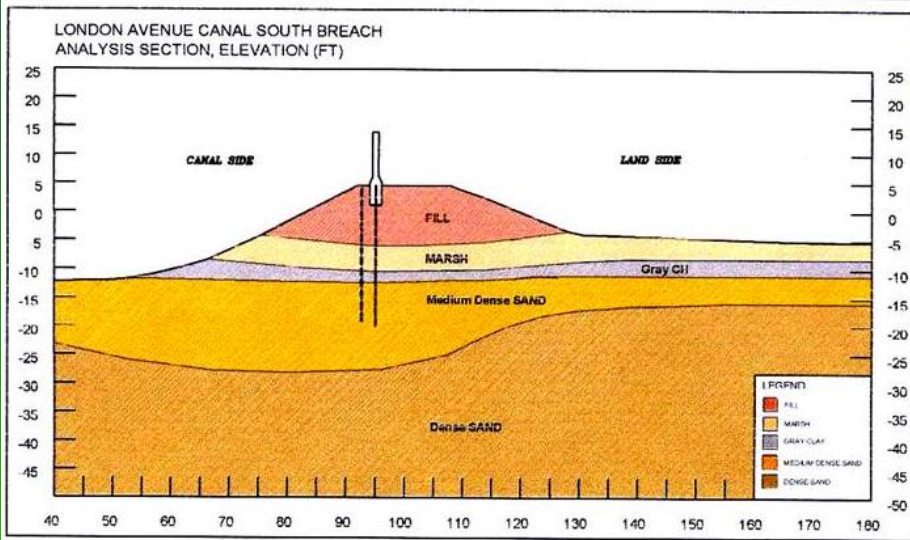
London Avenue (North) breach



Similar failure mechanism as 17th St Canal

London Avenue (South) breach





The South Breach of the London Avenue Canal was caused by **excess seepage pressures** developed in the sand underlying the canal, which had been dredged