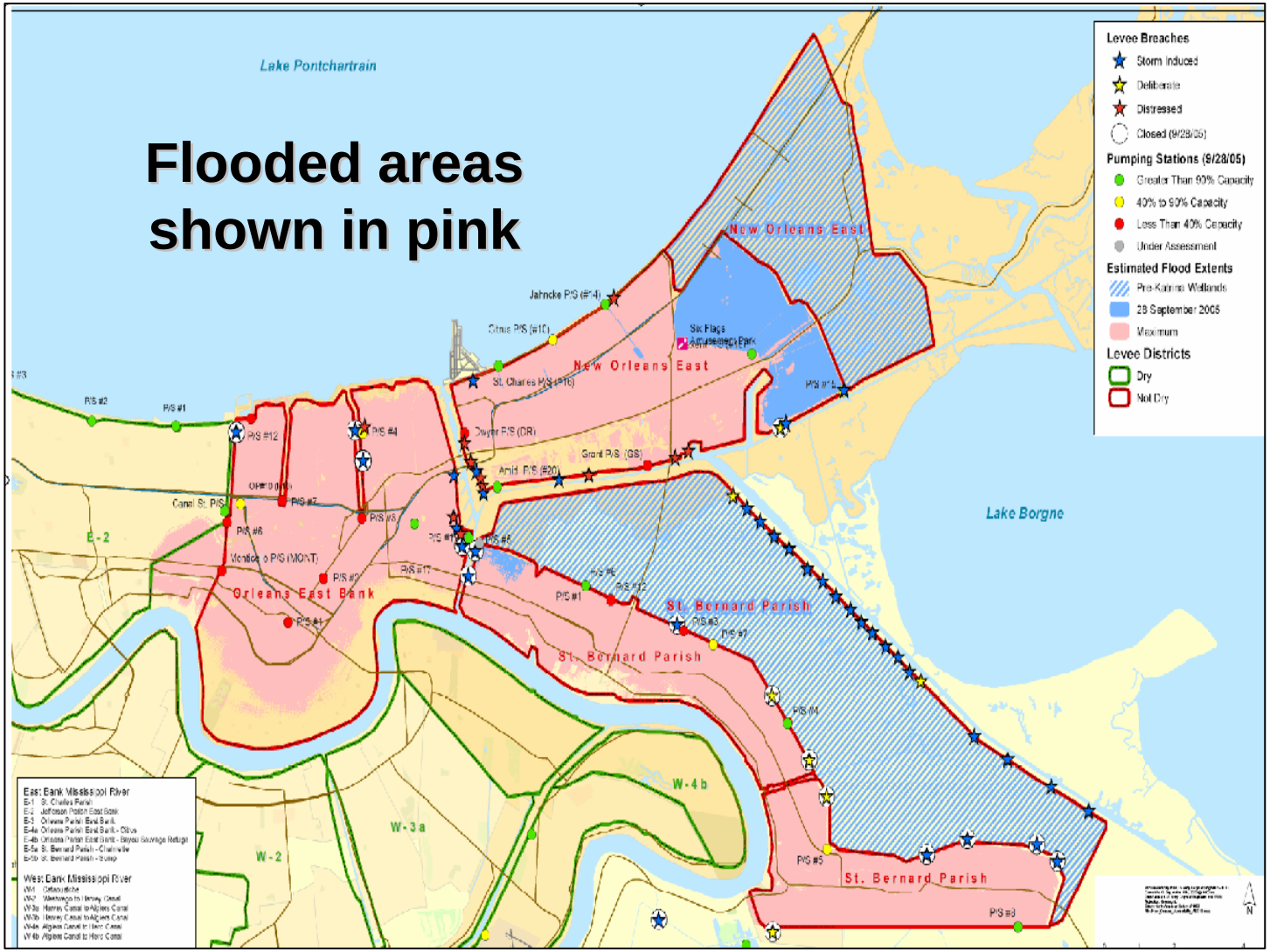
Part 2

OVERTOPPING OF FLOOD CONTROL STRUCTURES

UMR



- **Locations of breaks in the flood control system surrounding New Orleans caused by Katrina**

- **Overtopping:** Earthen levee being overtopped at the Entergy Power Plant, Inner Harbor Navigation Channel. This began around 6 AM on August 29th. 9 ft storm surge with crest heights up to 17 ft

UMR

- **Good performance:** some portions of the Mississippi River Gulf Outlet (MRGO) Channel survived waves as high as 17 feet, caused by a 9 foot storm surge off Lake Borgne (to the right)

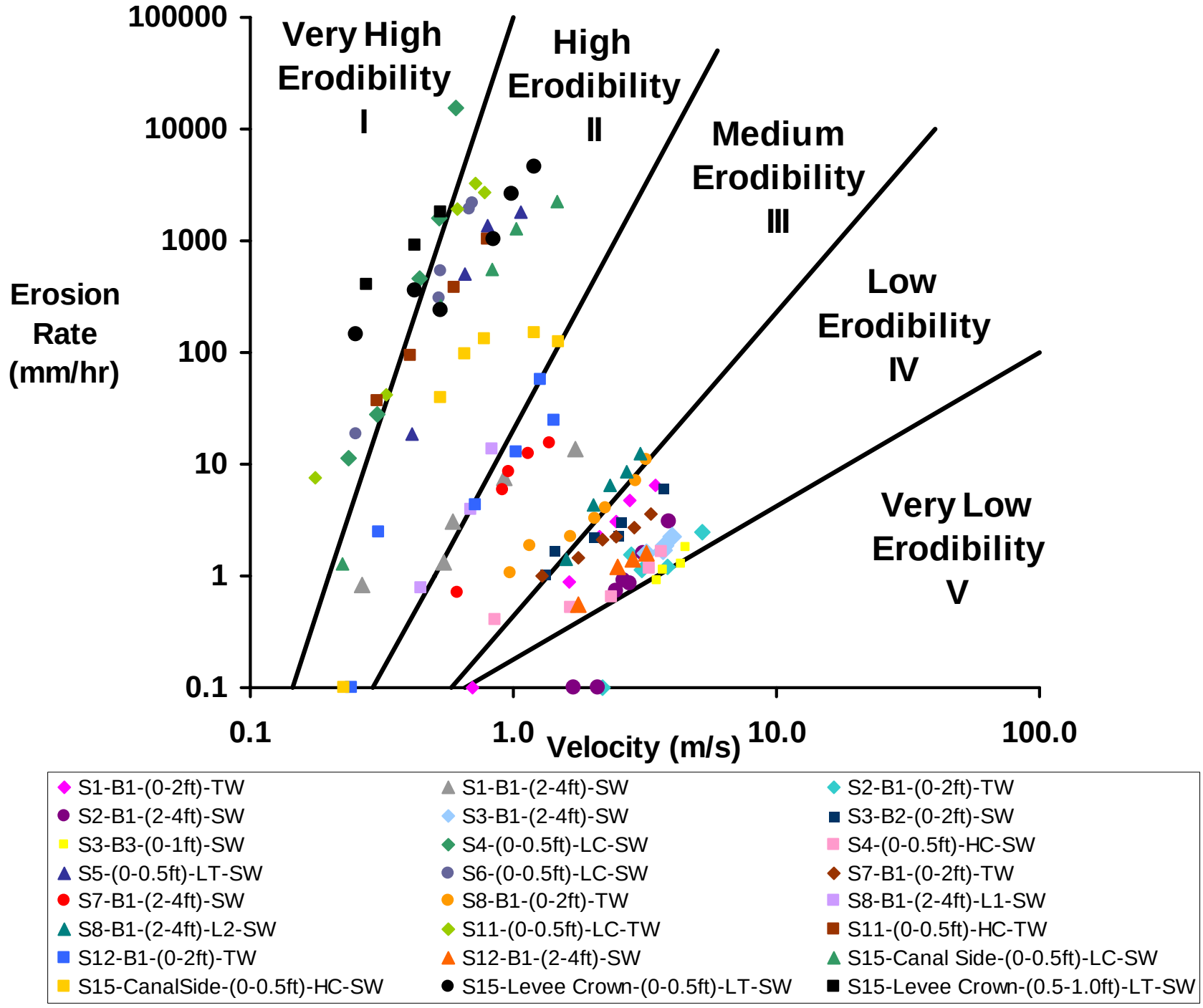
- **Survivable levee:** The storm surge pushed houses up on top of some levees, leaving them scattered about

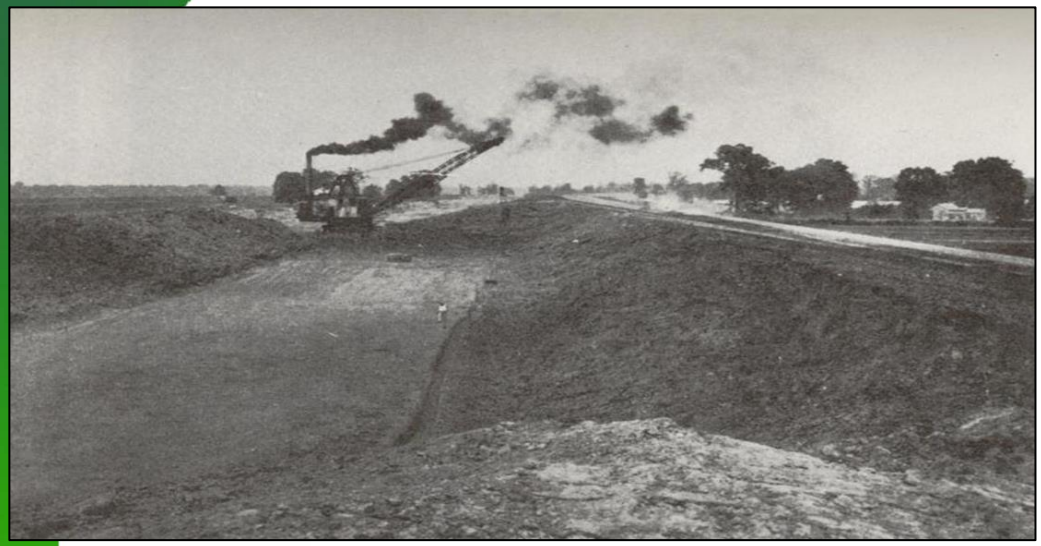
UMR

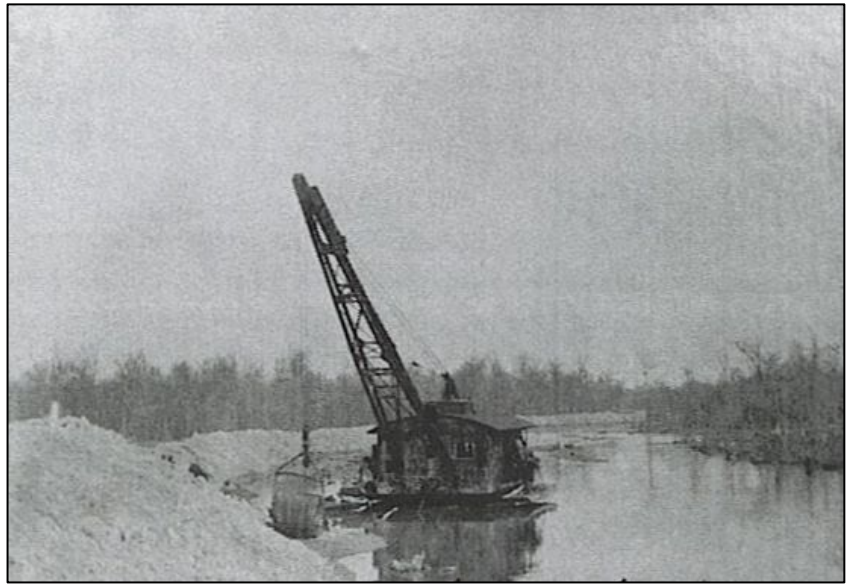
- **Poor performance: Skeleton of steel sheetpile cutoff walls is all that remains of the MRGO levee between Bayou Bienvenue and Bayou Dupree**

UMR

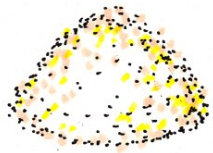
- **Poor performance: MRGO levee completely washed away about two miles southeast of Bayou Dupree.**

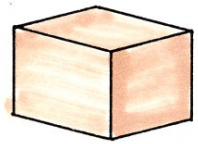

Very High Erodibility I
High Erodibility II
Medium Erodibility III
Low Erodibility IV
Very Low Erodibility V
Erosion Rate (mm/hr)
100000
10000
1000
100
10
1
0.1
0.1
1.0
10.0
100.0
Velocity (m/s)
S1-B1-(0-2ft)-TW
S1-B1-(2-4ft)-SW
S2-B1-(0-2ft)-TW
S2-B1-(2-4ft)-SW
S3-B1-(2-4ft)-SW
S3-B2-(0-2ft)-SW
S3-B3-(0-1ft)-SW
S4-(0-0.5ft)-LC-SW
S4-(0-0.5ft)-HC-SW
S5-(0-0.5ft)-LT-SW
S6-(0-0.5ft)-LC-SW
S7-B1-(0-2ft)-TW
S7-B1-(2-4ft)-SW
S8-B1-(0-2ft)-TW
S8-B1-(2-4ft)-L1-SW
S8-B1-(2-4ft)-L2-SW
S11-(0-0.5ft)-LC-TW
S11-(0-0.5ft)-HC-TW
S12-B1-(0-2ft)-TW
S12-B1-(2-4ft)-SW
S15-Canal Side-(0-0.5ft)-LC-SW
S15-CanalSide-(0-0.5ft)-HC-SW
S15-Levee Crown-(0-0.5ft)-LT-SW
S15-Levee Crown-(0.5-1.0ft)-LT-SW





COHESIONLESS **vs** **COHESIVE**





sand –
no glue
lots of friction

clay –
lots of glue
little friction

The key to levees surviving overtopping is the clay content. Much of the dredged material consisted of organic silt, which does not have substantive cohesion

UMR

Many of the problems along the MRGO Channel occurred at structural transitions, between dissimilar elements, such as earthen levees against concrete flood walls, shown here.

- **Some sections survived:** Evidence of sustained overtopping of concrete flood wall along the IHNC in the Lower Ninth Ward.

UMR

- **Overtopping scour holes along landside of flood wall on west side of the IHNC. Note broken wall in background. A splash pad on inboard side could have prevented this undercutting for less than 0.5% of the flood wall cost, making the structure "Class 3 survivable."**

Structures must be Class 3 survivable

- It is impossible to accurately predict actual flood surge heights, because of a number of unknown factors
- Engineers have to select a flood height commensurate with risk-consequence assessments and probabalistic analyses.
- Consequences in a densely populated urban areas never a factor previously
- Flood control infrastructure, such as levees and flood walls, must be designed to withstand sustained overtopping.

UMR