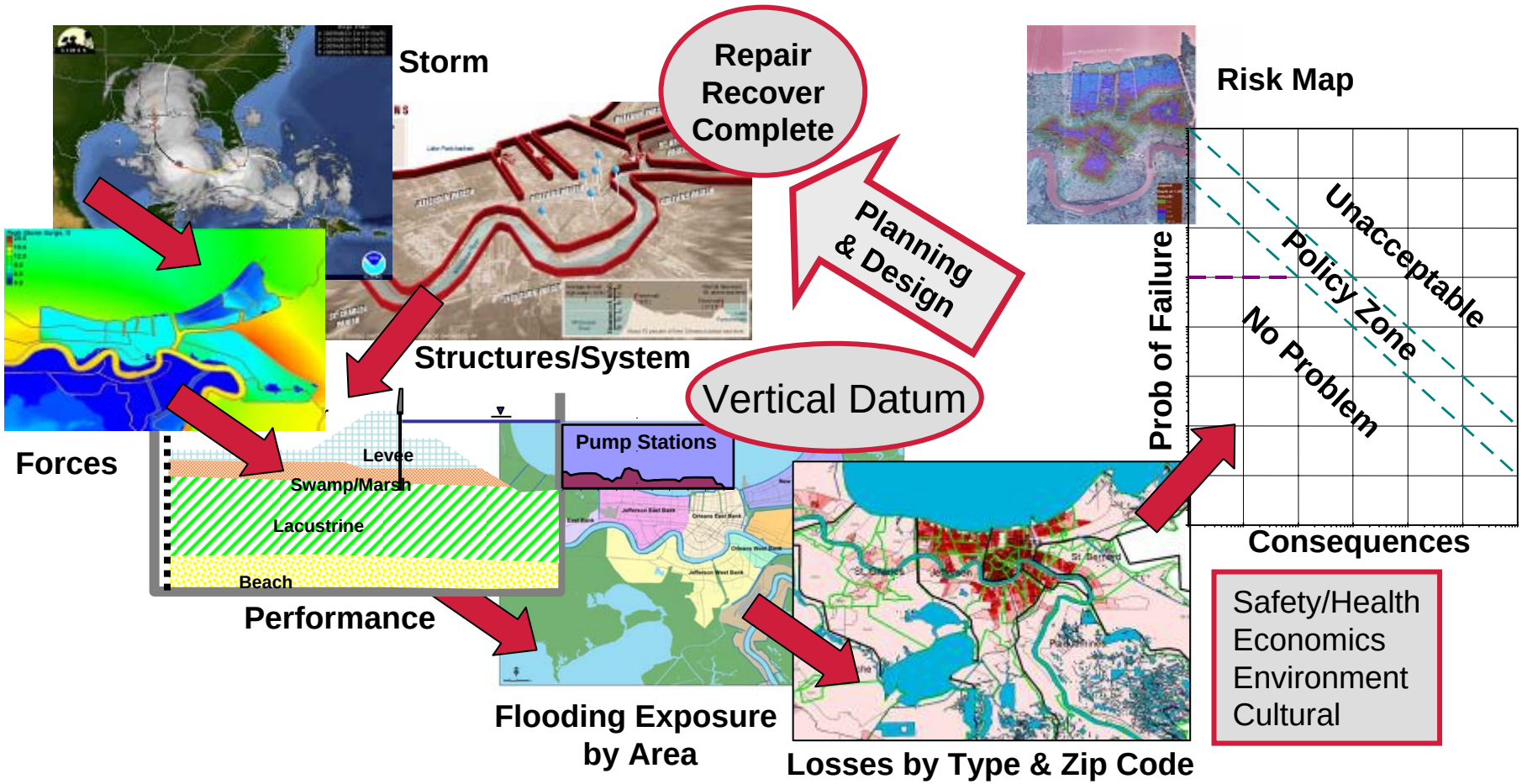
US Army Corps
of Engineers

Interagency Performance Evaluation Task Force

Strategic Overview
Performance Evaluation and Interim Results
for
ASCE External Review Panel
9-10 March, 2006

US Army Corps of Engineers

Systems / Spiral Approach



US Army Corps
of Engineers

IPET Mission

…"to provide credible and objective scientific and engineering answers to fundamental questions about the performance of the hurricane protection and flood damage reduction system in the New Orleans metropolitan area." Chief of Engineers

The Flood Protection System: What were the design criteria for the pre-Katrina hurricane protection system, and did the design, as-built construction, and maintained condition meet these criteria?

The Storm: What were the storm surges and waves used as the basis of design, and how do these compare to the storm surges and waves generated by Hurricane Katrina?

The Performance: How did the floodwalls, levees, pumping stations, and drainage canals, individually and acting as an integrated system, perform in response to Hurricane Katrina, and why?

The Consequences: What have been the societal-related consequences of the Katrina-related damage?

The Risk: Following the immediate repairs, what will be the quantifiable risk to New Orleans and vicinity from future hurricanes and tropical storms?

US Army Corps of Engineers

Architecture of Report 2

Data Repository

QA/QC

Vertical and Water Level Datum and DEM

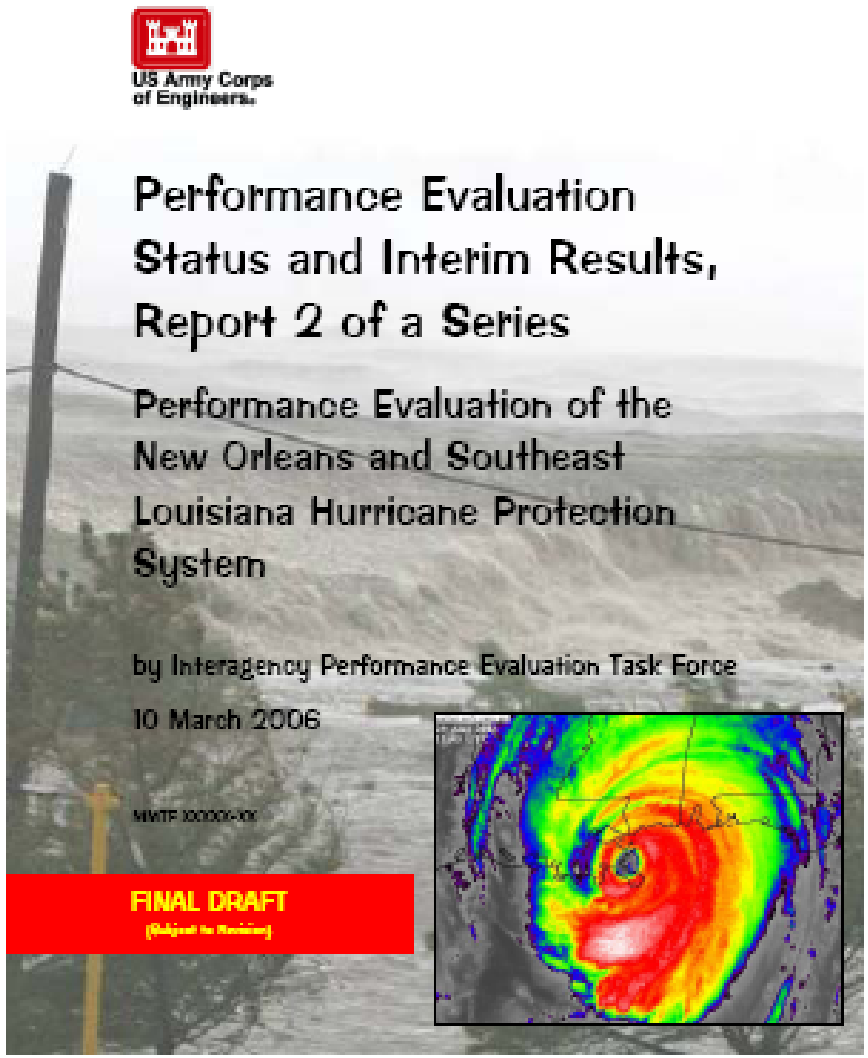
System
- ** Baseline*
- ** SPH*
- ** Design*

Storm
- ** Hydrodynamics*
- ** Time Line*
- ** MRGO*

Performance
- ** 17th Street breach*

Consequences
- ** Interior Flooding*
- ** Pump Stations*
- ** Losses*

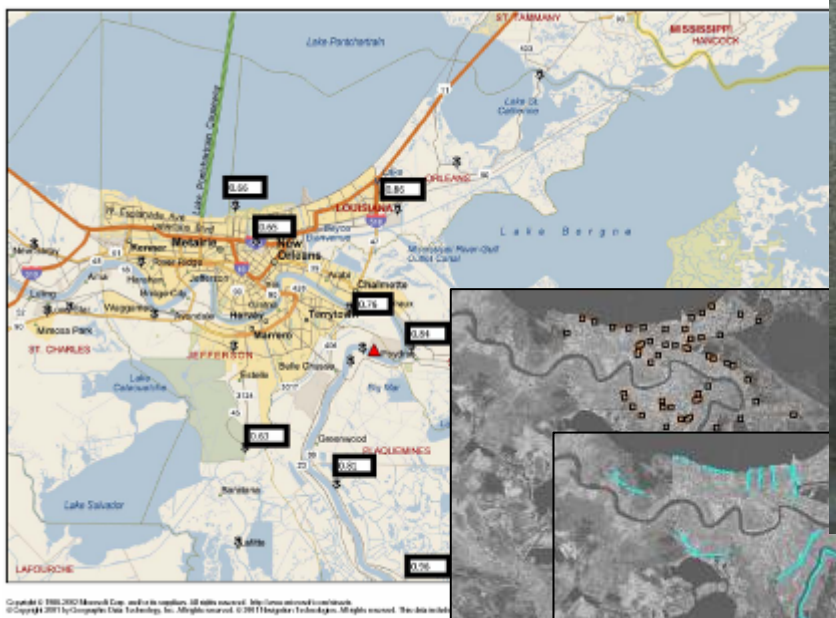
Risk & Reliability
- ** New Orleans East*



US Army Corps of Engineers

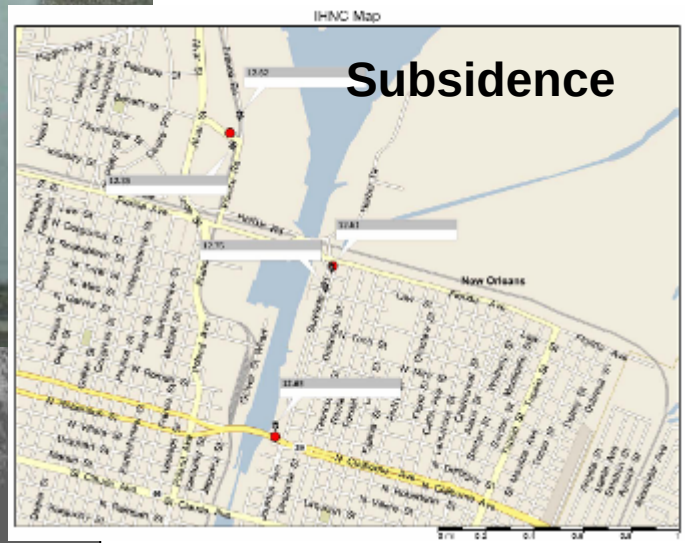
Geodetic Vertical Datum and DEM

Updated Reference Datum

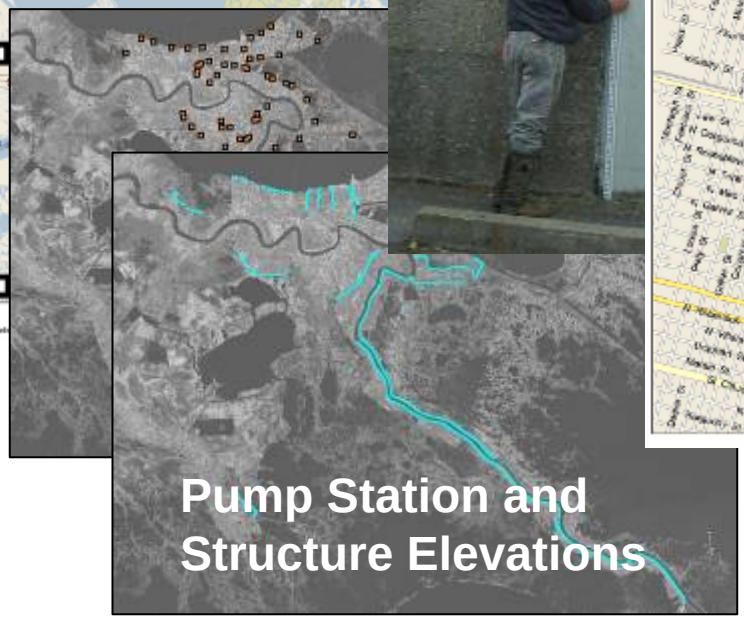


Relation to old datums and LMSL

High Water Mark Surveys



Subsidence



Pump Station and Structure Elevations

US Army Corps of Engineers

The Hurricane Protection System

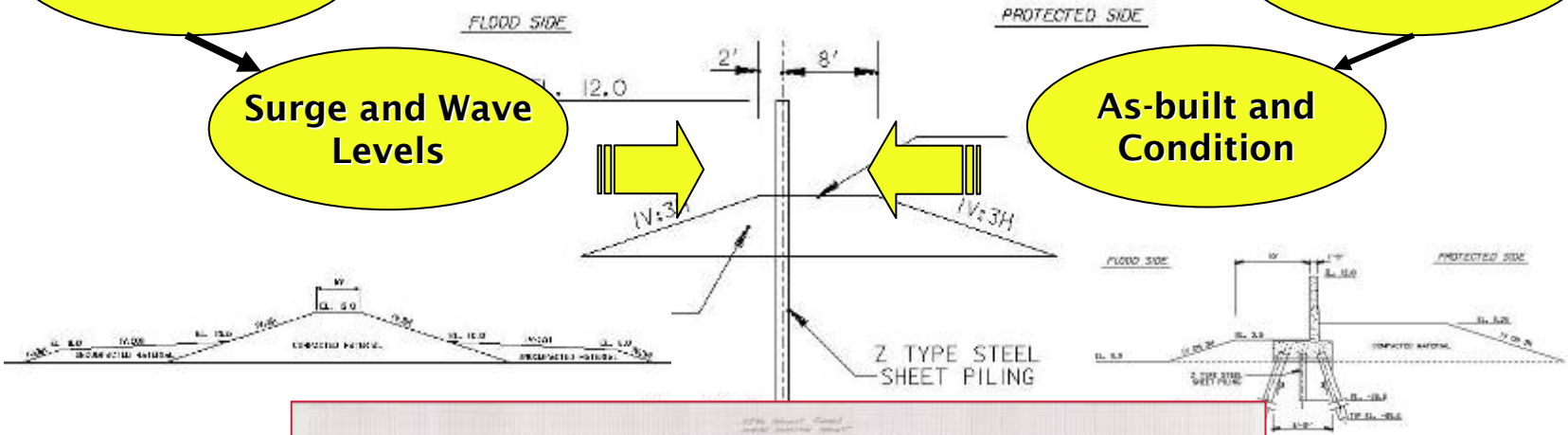
What forces were the structures designed and built to withstand?

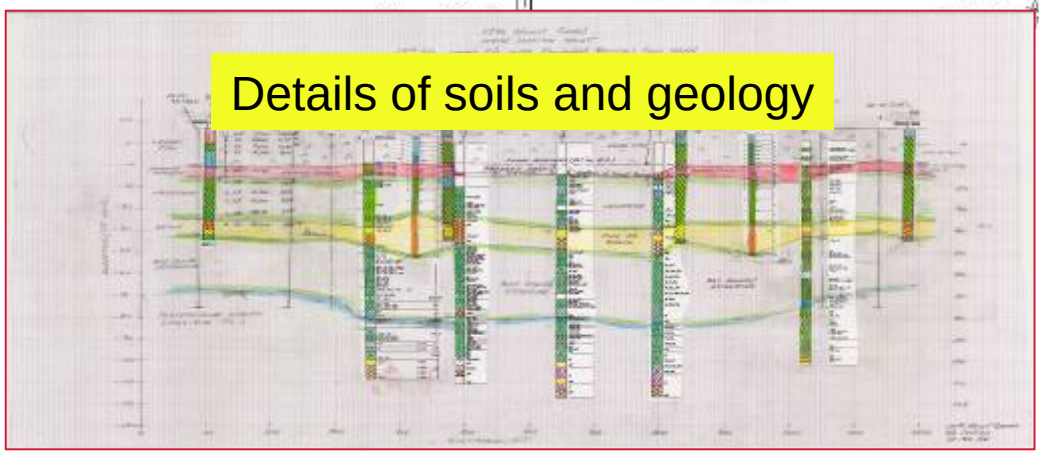
SPH & Auth Protection

Design & Intent

Surge and Wave Levels

As-built and Condition





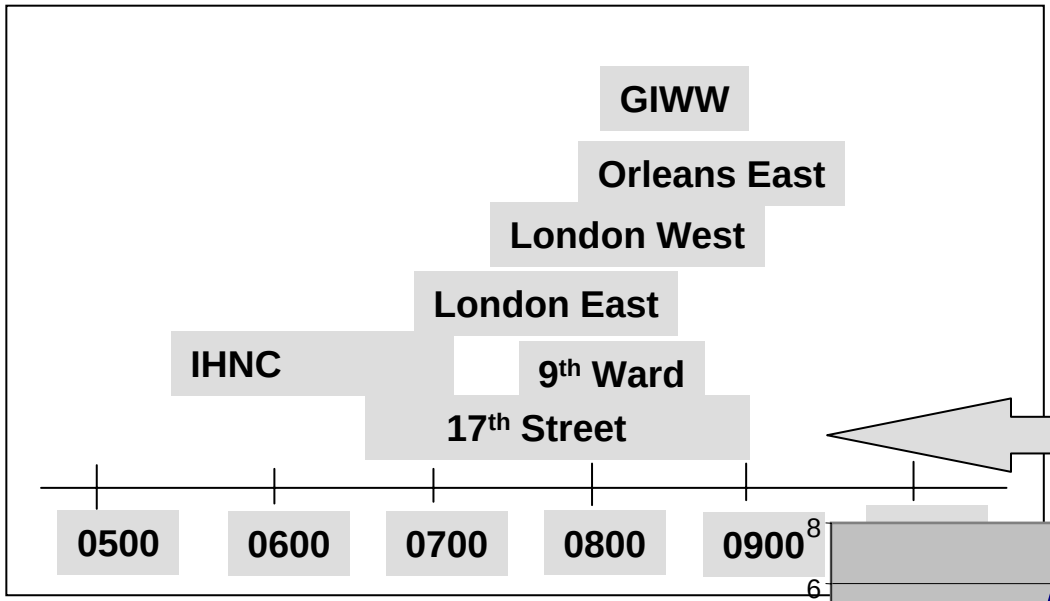
Details of soils and geology

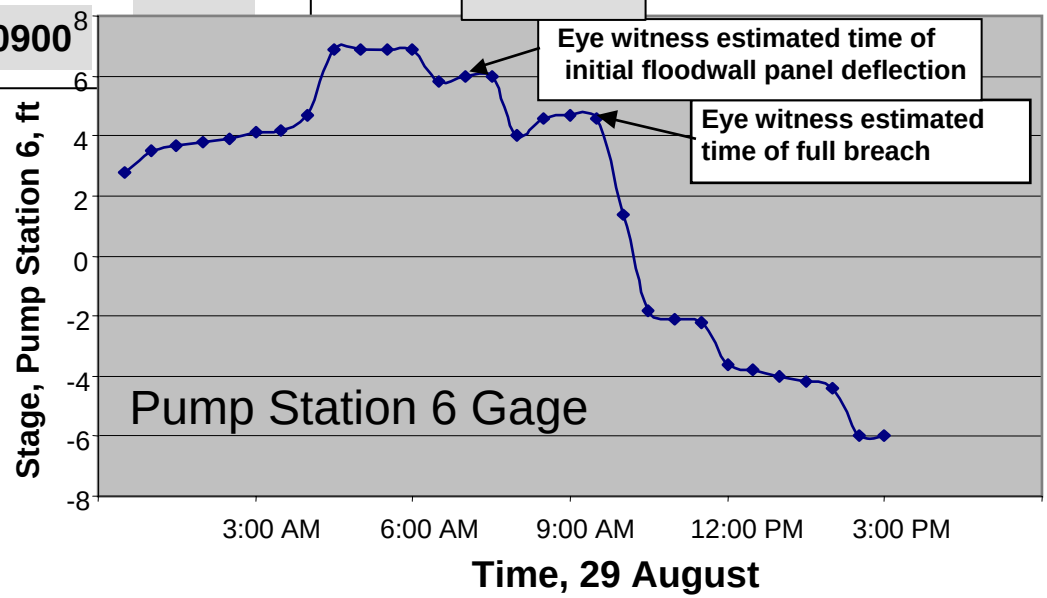
US Army Corps of Engineers

Storm

Development of Event Timeline

29 AUG Breaching Time Line (notional)

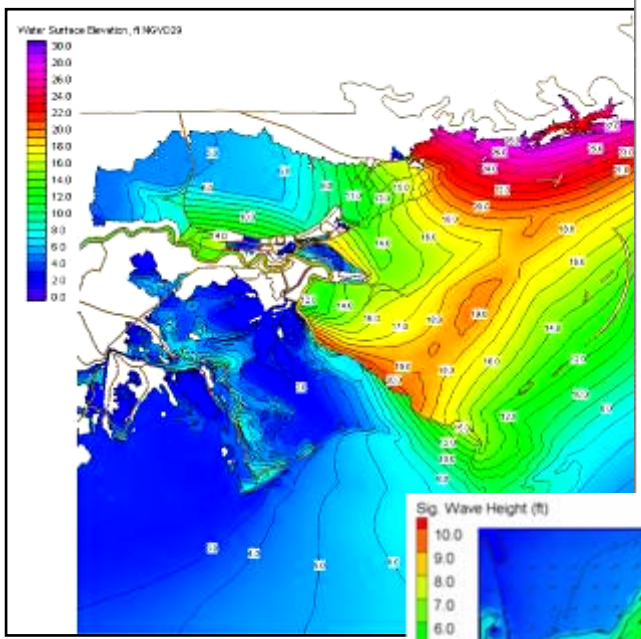


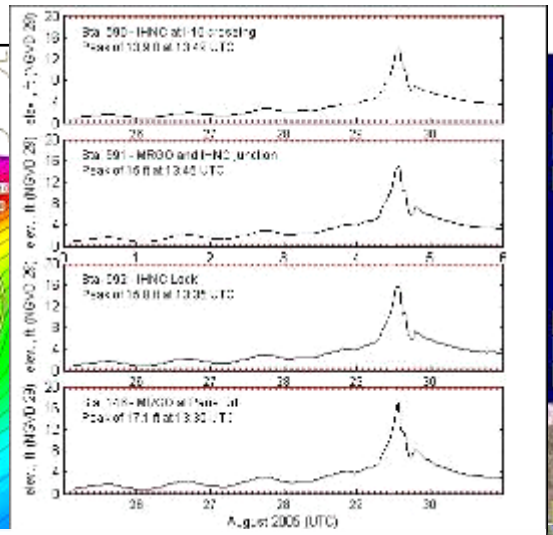


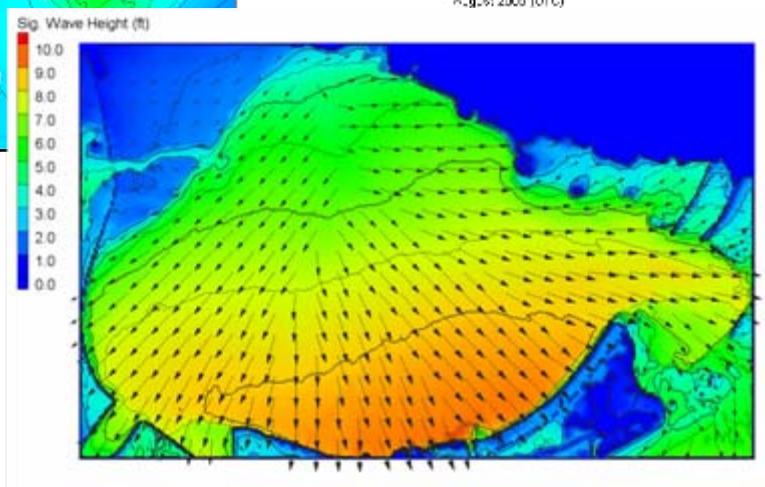
US Army Corps of Engineers

The Storm

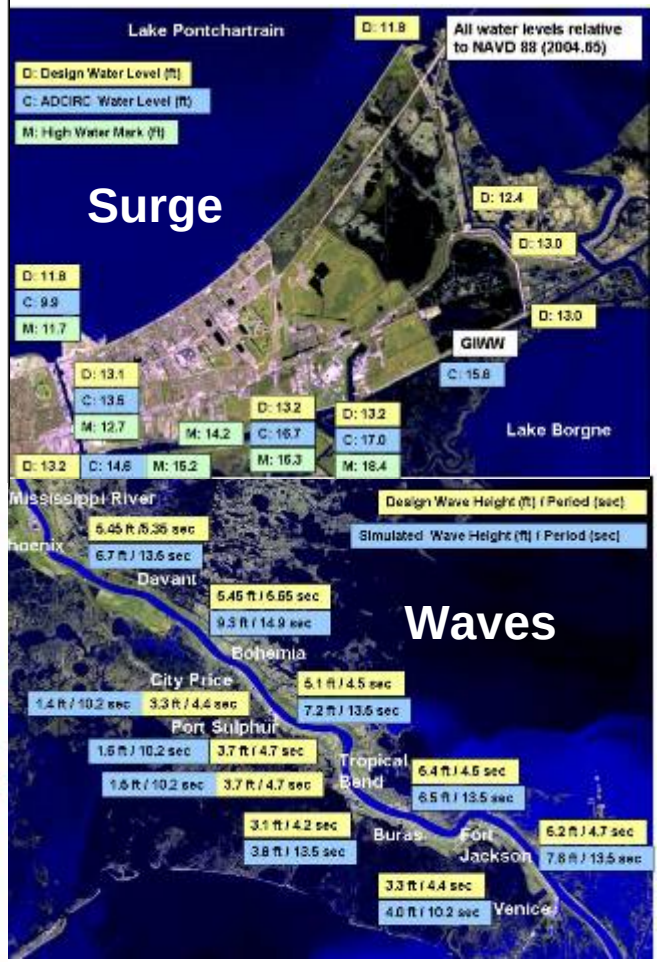
What surge and waves did the levees and floodwalls experience?







Katrina Surge and Wave Time Histories

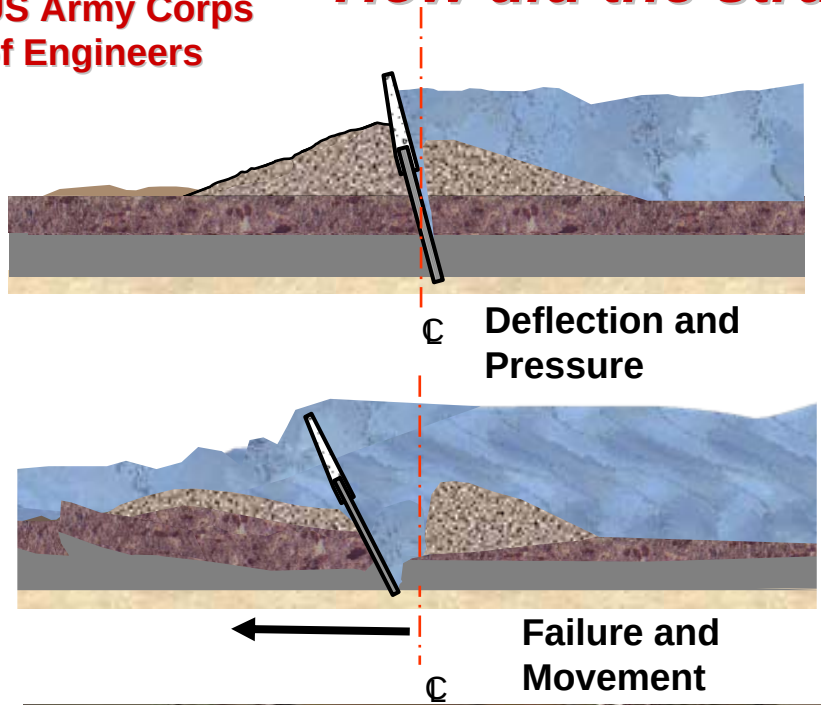


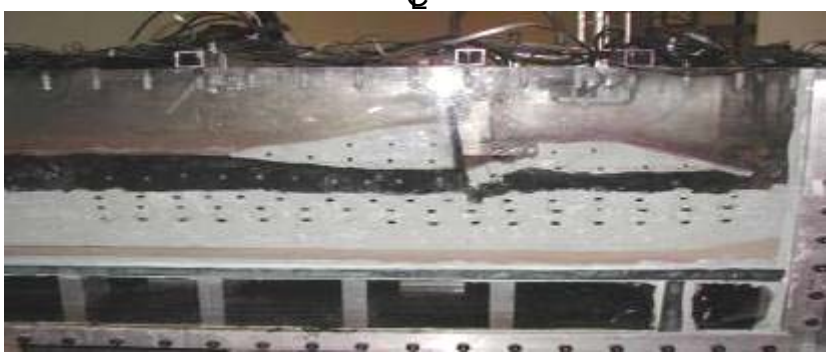
Katrina vs Design

US Army Corps of Engineers

Performance

How did the structures perform and why?





Confirmation in Centrifuge

17th Street Canal Breach

- Deflection of I–Wall by surge/waves
- Full hydrostatic pressure along wall
- Weak clay at levee toe causes failure in subsurface clay layer
- Soil block from wall back displaced

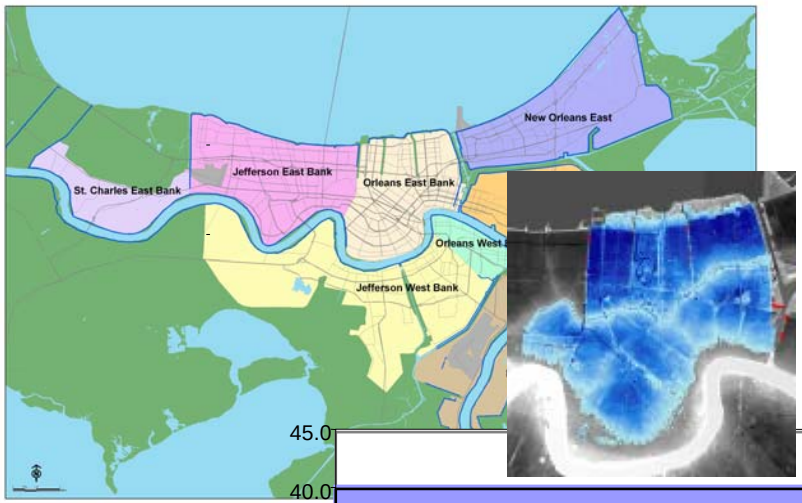
Displacement of wall and part of levee

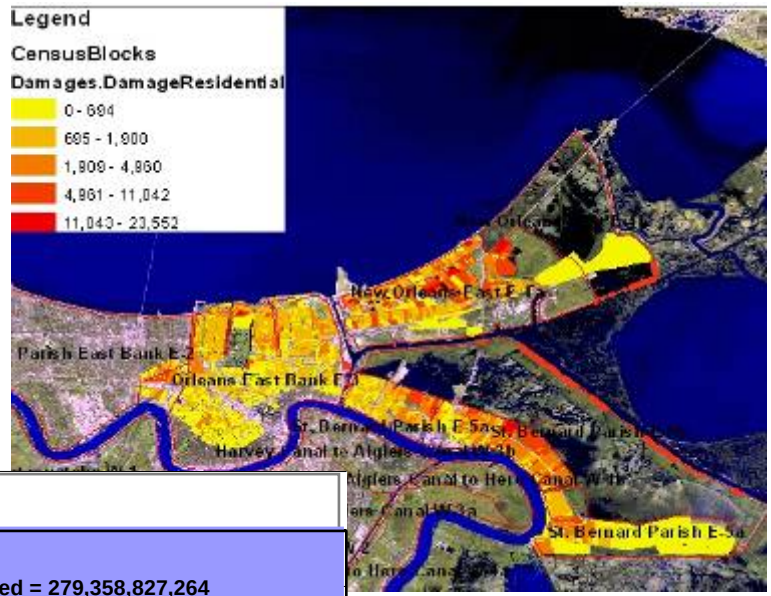
US Army Corps of Engineers

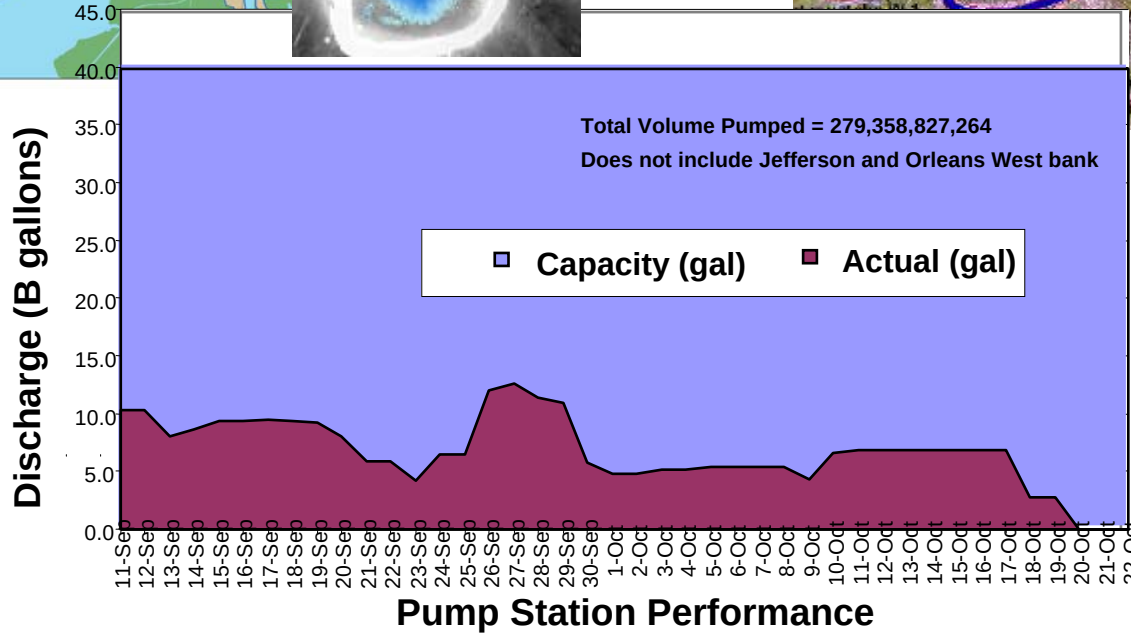
Consequences

What were the consequences of Katrina?

Flooding Exposure by Polder







Losses

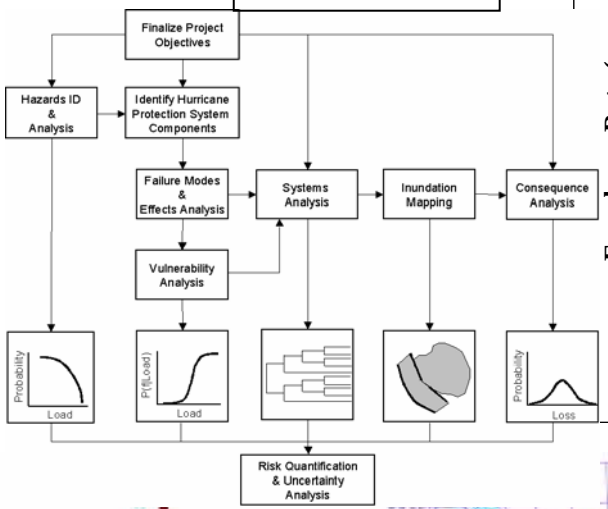
- Economic
- Historical/Cultural
- Environment
- Safety and Health

Risk

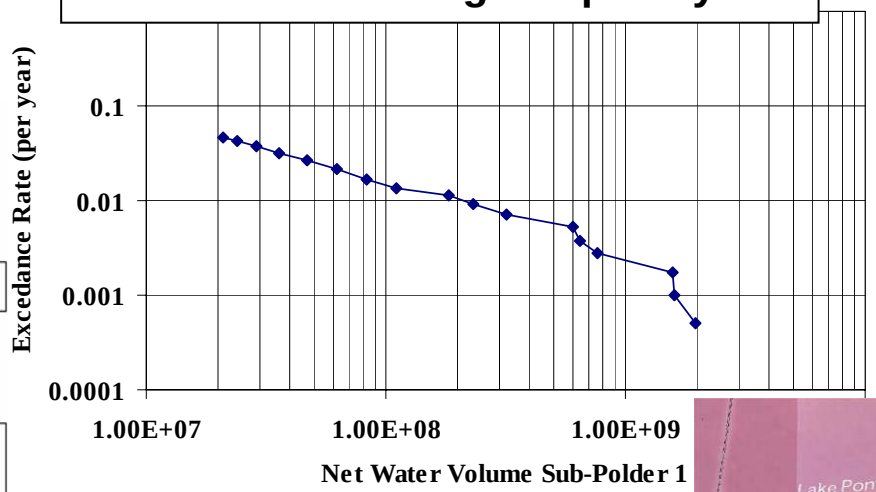
What is the risk for the future?

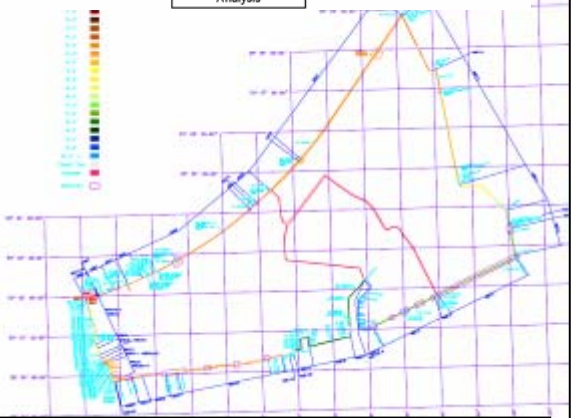
US Army Corps of Engineers

Risk Model

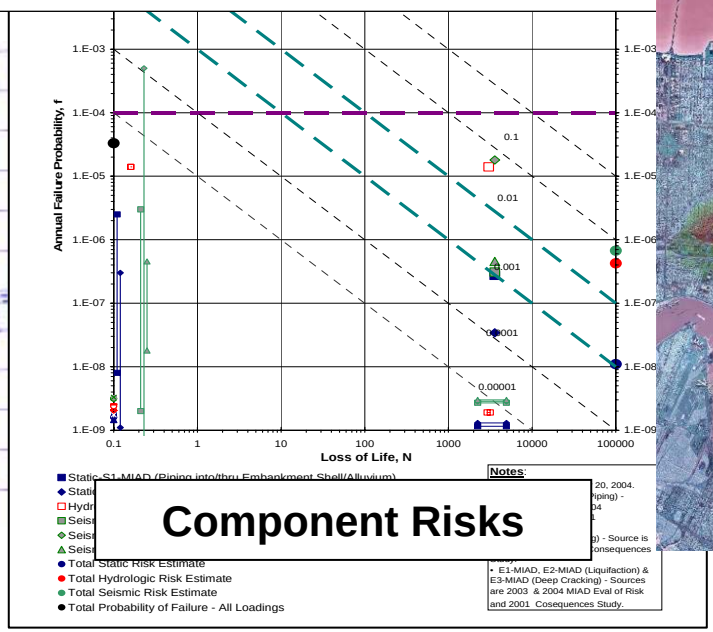


Polder Flooding Frequency

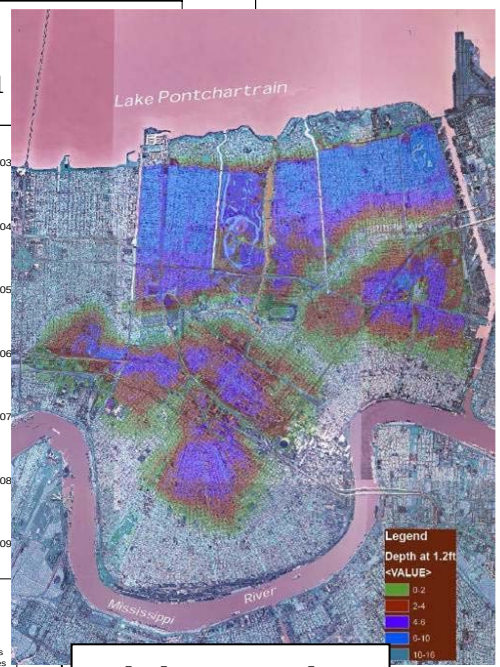




System Characterization



Component Risks



Risk Mapping

US Army Corps of Engineers

Summary of NRC Committee Comments

- More emphasis on evaluating strengths and vulnerabilities of the entire HPS (HPS characterization, performance evaluation of structures and pump plants, risk and reliability analysis)
- More emphasis on gathering regional and detailed in-situ soils and geologic data (regional data base, additional bore holes and CPT data)
- Greater emphasis on characterizing foundation conditions and the properties of the entire HPS (Bore holes and CPT, Risk and Reliability geotechnical analysis)
- Use ensemble approach to modeling impacts of future hurricanes (1000+ storms for Risk and Reliability)
- Use GIS for descriptions and display (GIS Information repository and application team)
- Clarification of SPH and authorized protection levels (Integral to description of design criteria and assumptions)
- Portray accuracies and uncertainties in data (component of risk and reliability analysis, rigorous QA/QC of data in repository, validation of all analyses)
- Time may be insufficient for scope of study efforts (reasonable product will be accomplished, follow-on requirements identified and being considered)