



**US Army Corps
of Engineers**

Performance Evaluation Status and Interim Results, Report 2 of a Series

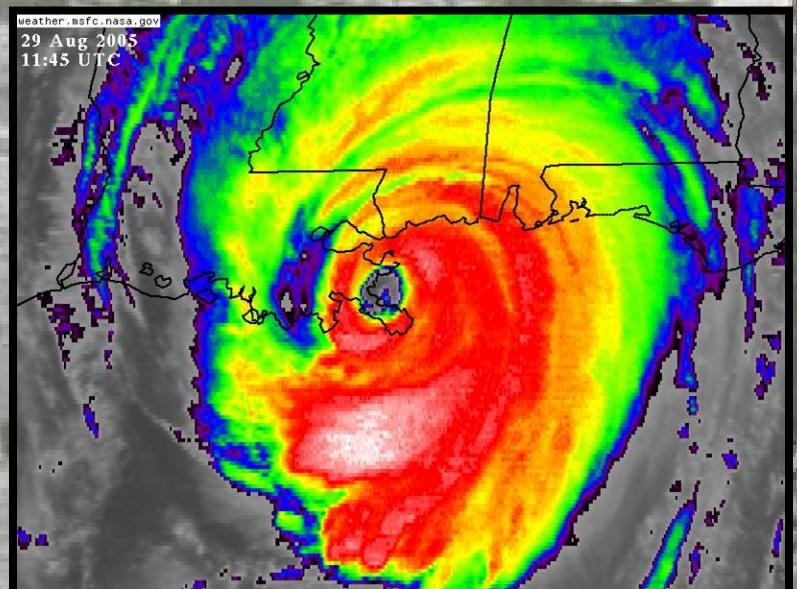
Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System

by Interagency Performance Evaluation Task Force

10 March 2006

FINAL DRAFT

(Subject to Revision)





**US Army Corps
of Engineers**

Performance Evaluation Status and Interim Results, Report 2 of a Series

Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System

**by Interagency Performance Evaluation Task Force
10 March 2006**

FINAL DRAFT

(Subject to Revision)

Contents

I. Executive Summary	I-1
II. Introduction.....	II-1
Background	II-1
Objective and Scope	II-2
Approach.....	II-3
III. Geodetic Vertical and Water Level Datum	III-1
Summary of Scope and Purpose	III-1
Background: (Education on Datums)	III-2
General Background on Southeastern Louisiana Elevation Datums	III-2
Subsidence and Louisiana Surface Levels.....	III-6
General background on the Low Water Reference Plane (LWRP).....	III-7
Data Collection and Processing for Tidal/Datum Relationships	III-8
Development of Phase 1 Survey Data Collection Network Design	III-8
Static Survey Phases	III-8
Contractor Data Collection and Processing Procedures	III-11
USACE processing of GPS data and network adjustments	III-12
NGS validating of Blue Booking/Publishing of phase 1 survey points	III-13
Processing of LMSL values & relationship between NAVD88 2004.65	III-13
Data Analysis and Impacts	III-13
Evaluation of Designed and Constructed Elevations on Flood Control & Hurricane Protection Structures	III-13
Preliminary Findings.....	III-46
Maps of datum/adjustment differences (project area with values)	III-46
Preliminary relationships between the LMSL and NAVD88 2004.65.....	III-48

Example Datum shifts & Local Mean Sea Level relationship to the datum over time	III-50
Preliminary Methodology (Procedures) for conversion of previous vertical datum/adjustments to NAVD88 2004.65.....	III-51
Summary of Findings and Recommendations	III-52
Dual Elevations on Flood Control and Hurricane Protection Structures	III-52
Geospatial Data Source Feature or Metadata Records	III-53
Epoch Designations of Published Topographic Elevations.....	III-53
Future Updates to NAVD88 in New Orleans Region.....	III-53
Additional Co-located CORS and NWLON Sites for Subsidence Monitoring	III-54
New Orleans District Water Level Gages.....	III-54
Local Mean Sea Level Epoch Updates and Relationships	III-55
Mean Sea Level and Local Mean Sea Level.....	III-55
Coordination of Topographic Survey Data Collection, Processing, and Management	III-55
Vertical Control Monumentation Requirements and Stakeout Procedures on Flood Control Construction Projects.....	III-55
LIDAR and Photogrammetric Mapping Calibration and Testing	III-56
USACE Policy and Manual on Maintaining Geodetic and Water Level Datums in High Subsidence Areas.....	III-56
Differential GPS Survey Standards for Establishing Construction Control.....	III-56
Supplemental Field Survey Support to Other IPET Teams	III-57
Field Survey Procedures and Specifications.....	III-59
Data Processing and Submittal	III-61
Quality Control and Quality Assurance Procedures	III-61
IV. The Hurricane Protection System.....	IV-1
Executive Summary	IV-1
Design Criteria for the System.....	IV-2
Design Criteria and Assumptions	IV-12
Standard Project Hurricane	IV-12
Probable Maximum Hurricane.....	IV-13
Design Hurricane, Lake Pontchartrain, LA, and Vicinity	IV-13
17th Street Design History.....	IV-22
Status of Remaining Efforts	IV-39
V. The Storm	V-1
Executive Summary	V-1
Hurricane Katrina Description and History	V-3

Time Line of Performance Events	V-5
Hurricane protection system timeline	V-5
Regional Hydrodynamics.....	V-12
Summary of Work Accomplished.....	V-12
Status of Remaining Efforts.....	V-63
References.....	V-63
High Resolution Hydrodynamics.....	V-65
Summary of Accomplishments.....	V-65
Interim Results	V-72
Interim Results Summary	V-101
Status of Efforts Remaining.....	V-104
VI. The Performance	VI-1
Executive Summary	VI-1
Floodwall and Levee Performance Analysis	VI-2
Outfall Canals	VI-3
Summary of Work Accomplished.....	VI-3
Interim Results – Assessment of 17th Street Canal Breach.....	VI-3
Geology of the Area.....	VI-13
Soil Stratification	VI-16
I-Wall Section	VI-25
Assessment of Soil Properties and Shear Strengths.....	VI-27
Limit Equilibrium Analysis of 17th Street Canal Breach	VI-30
Drainage Canals – Physical Centrifuge Modeling.....	VI-32
17th Street Canal Levee Model	VI-33
Interim Results	VI-35
Floodwall and Levee Performance System Wide Assessment	VI-35
General description of the New Orleans East Basin and hurricane protection system	VI-37
NOE Basin Components	VI-37
Hurricane Protection Features	VI-38
IPET Investigation of Hurricane Protection Project	
Performance	VI-39
Levee/Floodwall damage categories.....	VI-39
Summary of Damages from Hurricane Katrina	VI-39
VII. The Consequences.....	VII-1
Executive Summary	VII-1
Pumping Station Performance	VII-2
Summary of Work Accomplished.....	VII-2
Interim Results	VII-2
Status of Remaining Efforts.....	VII-5
Interior Drainage Analysis.....	VII-5
Summary	VII-5
Background	VII-6

Summary of Accomplished Work.....	VII-7
Interim Results	VII-8
RAS Interior Modeling	VII-8
HMS Interior Modeling	VII-14
Status of Remaining Effort	VII-18
Final Report	VII-19
Losses Analysis.....	VII-20
Summary of Work Accomplished.....	VII-22
Interim Results	VII-23
Status.....	VII-25
Activities to Complete	VII-26
Social, Cultural and Historic Consequences.....	VII-26
The Social Problem and Objectives.....	VII-26
Summary of Work Accomplished.....	VII-27
Interim Results	VII-27
Status of Remaining Efforts.....	VII-28
Human Health & Safety Consequences.....	VII-28
Purpose.....	VII-28
Summary of Work Accomplished.....	VII-29
Interim Results	VII-30
Status of Remaining Efforts.....	VII-30
Environmental Subtask	VII-30
Summary of Work Accomplished.....	VII-30
Interim Results	VII-33
Status of Remaining Efforts.....	VII-37
VIII. The Risk	VIII-1
Executive Summary	VIII-1
Summary of Work Accomplished.....	VIII-3
Risk Model.....	VIII-3
System/Polder definitions	VIII-4
Polder Geotechnical Subsurface Information	VIII-7
Hurricane Hazard Modeling	VIII-8
Reliability Modeling	VIII-10
Consequences Modeling	VIII-13
Risk Communication	VIII-15
Status of Remaining Efforts	VIII-16
System Definition	VIII-16
Risk Model.....	VIII-16
Hurricane Modeling	VIII-16
Reliability Modeling	VIII-16
Consequences.....	VIII-16

IX. Appendices

Appendix A — Glossary and Definition of Terms	A-1
Appendix B — IPET Public Website	B-1
Appendix C — Data Repository – Organization and Content.....	C-1
Appendix D — Summary of Key References.....	D-1
Appendix E — Note on the Influence of the Mississippi River Gulf Outlet on Hurricane Induced Storm Surge in New Orleans and Vicinity	E-1
Appendix F — Data Requirements for the IPET Study	F-1
Appendix G — IPET Communications Effort.....	G-1
Appendix H — Task Force Guardian Inputs	H-1
Appendix I — Pump Station Technical and Detailed Report.....	I-1
Appendix J — Engineering and Operational Risk and Reliability Analysis.....	J-1
Appendix K — The Performance – Flood Wall and Levee Performance Analysis	K-1
K1 – Soil Data Report – 17th Street Canal	K-3
K2 – Limit Equilibrium (Slope Stability) Analysis of 17th Street Canal	K-121
K3 – Physical Modeling	K-153
K4 – Concrete I-Wall and Sheet Piling Material Recovery, Sampling and Testing: 17th Street Canal Levee Breach	K-174