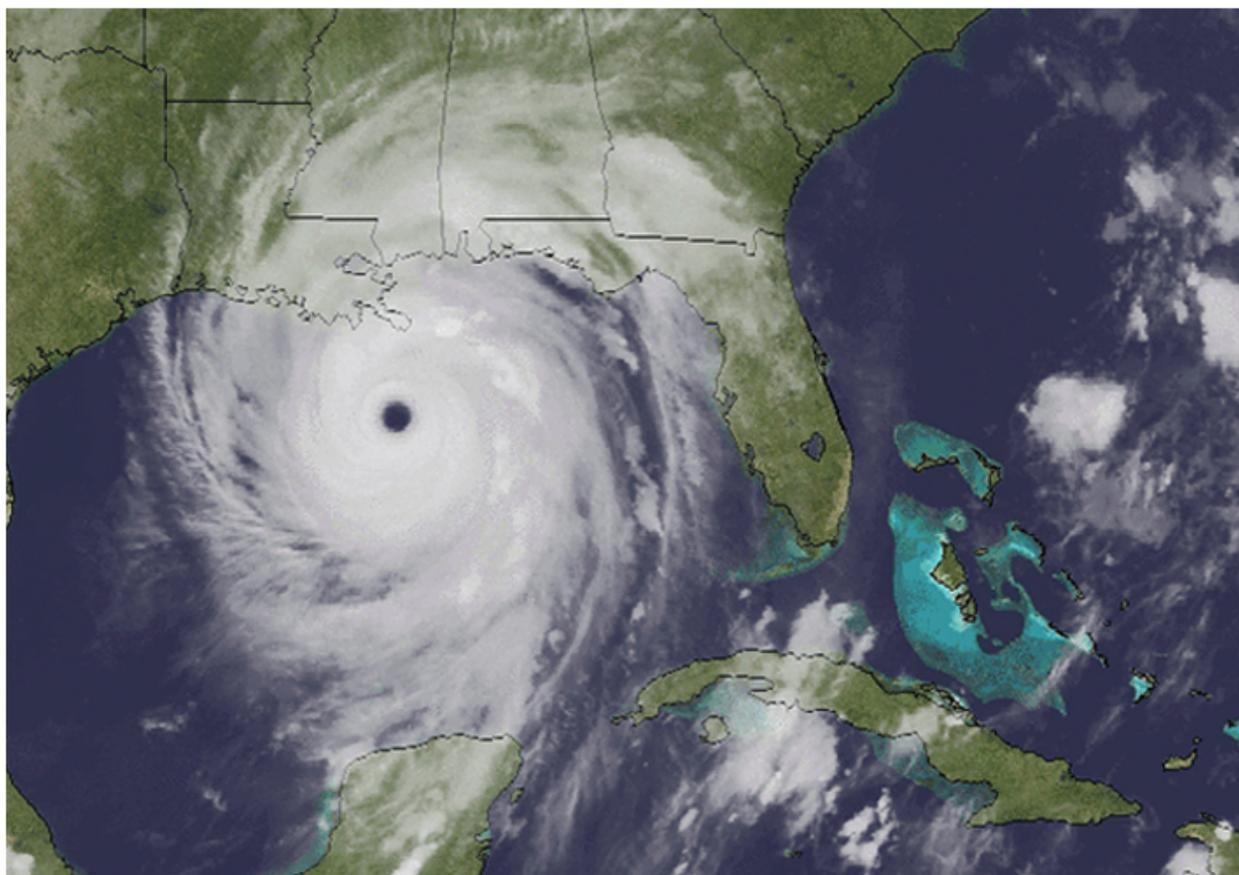
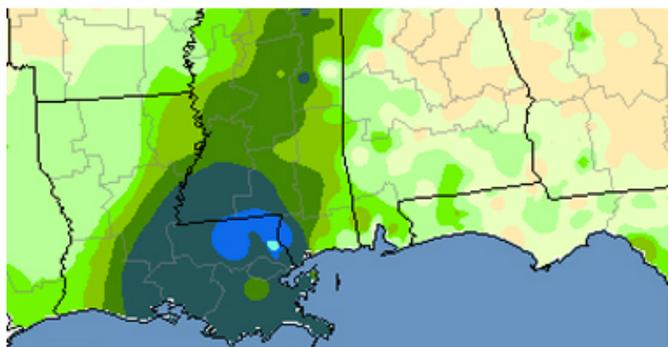


2005

LOUISIANA HURRICANE IMPACT ATLAS



LAGIC
Louisiana Geographic Information Center

Volume 1



2005 LOUISIANA
HURRICANE IMPACT ATLAS
Volume 1

by
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This document presents maps and graphics created by the Louisiana Geographic Information Center (LAGIC) during hurricanes Katrina and Rita occurring between August and September 2005. These products were generated by request for various purposes associated with Louisiana's hurricane response and recovery efforts.

For additional information, please visit:
<http://lagic.lsu.edu/hurricanes.htm>

LGISC-PUB-20051205_2005_HURRICANE_IMPACT_ATLAS_VOL1.



Hurricane Rita: GOES-12 Satellite Image September 22, 2005 (NOAA, 2005).



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Hurricane Katrina: August 28, 2005 MODIS True-color Satellite Image (LSU Earth Scan Lab, 2005).



HURRICANE QUICK FACTS

SOURCES: NOAA, FEMA, LAGIC, LDHH, LDOL, LDED, & ISO	HURRICANE KATRINA August 23 – 31, 2005	HURRICANE RITA September 2 – 31, 2005
US STATES IMPACTED	Florida, Louisiana, Mississippi, Alabama, and Tennessee.	Louisiana and Texas
STRENGTH <i>at landfall</i>	Category 4	Category 3
MINIMUM BAROMETRIC PRESSURE	902mb (32mile wide eye)	897mb
WINDS <i>at landfall</i>	140+ mph	120+ mph
RAINFALL	12in – 16in	6in – 12in
STORM SURGE	4 – 32 feet 30'+ in Biloxi, MS; 20'+ in Plaquemines, LA	4 – 16 feet 15'+ Storm Surge
AREA IMPACTED	Total: 108,456 sq. miles	Total: 85,729 sq. miles
CASUALTIES <i>as of 12/16/05</i>	Total: 1,321 Louisiana: 1,095	Total: 119 Louisiana: 0
PEOPLE IMPACTED	2,500,000 households request Individual Assistance	460,000 households request Individual Assistance
LEFT HOMELESS	Total: 527,000 Louisiana: 288,700	Total: 76,500 Louisiana: 76,500
BUSINESSES IMPACTED	71,000+ in Louisiana	10,000+ in Louisiana
JOB LOSSES	400,000+ in Louisiana	45,000+ in Louisiana
DAMAGE ESTIMATES	\$34.4 Billion Total; \$22 Billion in Louisiana <i>(source: ISO Properties Report 10/7/05)</i>	\$4.7 Billion Total; \$ 2.4 Billion in Louisiana <i>(source: ISO Properties Report 10/7/05)</i>



HURRICANE KATRINA

On August 29, 2005 at 6:10am CDT, Hurricane Katrina made landfall in Plaquemines Parish, Louisiana. Katrina was the eleventh named tropical storm, fourth hurricane, and first Category-5 hurricane of the 2005 Atlantic hurricane season (NOAA, 2005).

Katrina first made landfall as a Category-1 hurricane north of Miami, Florida on August 25, 2005. After passing through Florida and over the warm waters of the Gulf of Mexico, Katrina made its second landfall as a Category-4 hurricane on the morning of August 29, south of Buras, LA (between Grand Isle and the Mississippi River delta).

SAFFIR-SIMPSON HURRICANE INTENSITY SCALE	
CATEGORY	WIND SPEED
1	74 – 95 MPH
2	96 – 110 MPH
3	111 – 130 MPH
4	131 – 155 MPH
5	155+ MPH

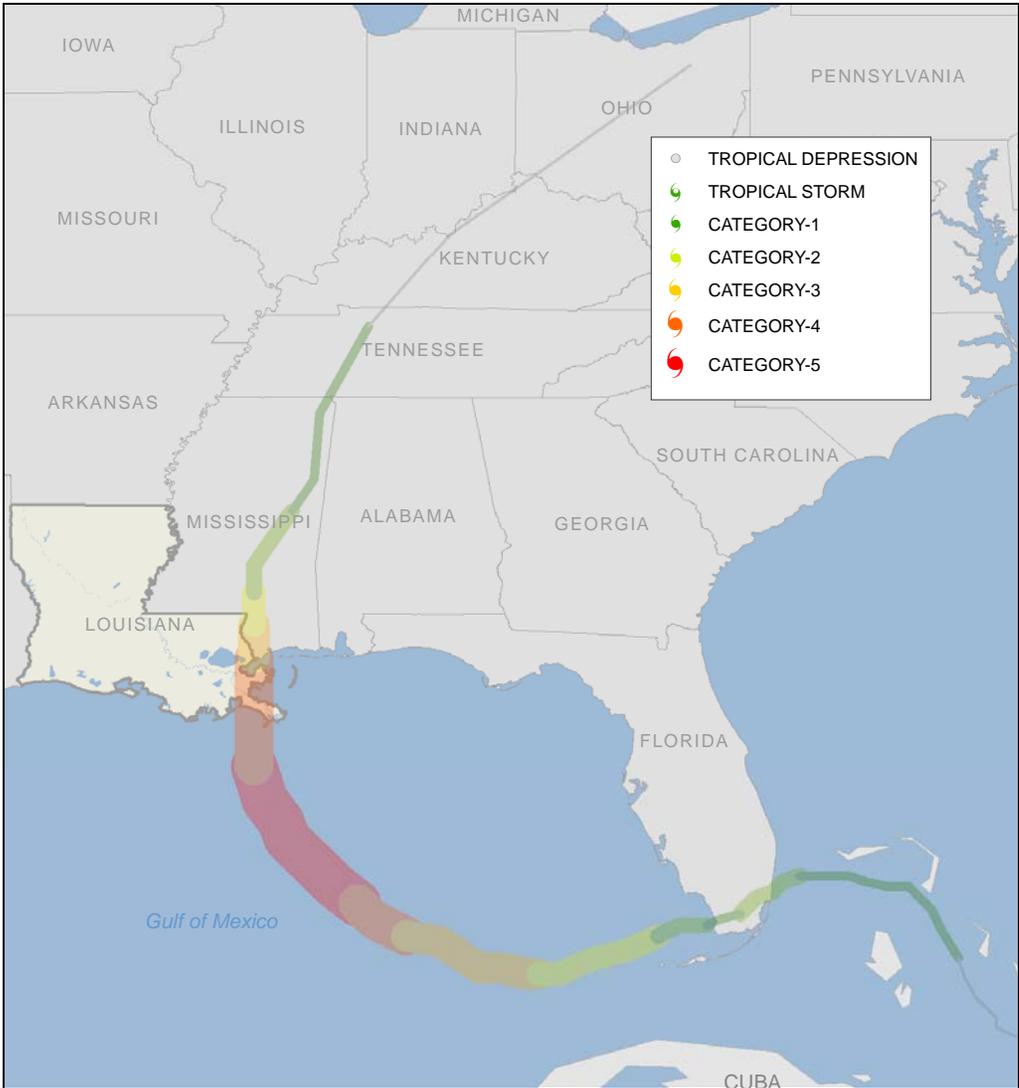


Figure 1: Hurricane Katrina Storm Track (NOAA, 2005).



STORM IMPACT

On Sunday August 28, shortly after hurricane Katrina was upgraded to Category-5, New Orleans mayor C. Ray Nagin ordered the first ever mandatory evacuation of the city. Mandatory evacuations were also ordered for numerous parishes along the storm’s predicted path.

Louisiana State Police implemented *Contraflow Lane Reversal* on Interstate 10 leading west and on Interstates 55 and 59 leading north from New Orleans. By Sunday evening, approximately 1 million people had evacuated the greater New Orleans area.

Despite the success of Contraflow evacuation, approximately 150,000 people, mostly poor and disabled, were unable to evacuate the city. Only by Friday September 2 were the remaining people evacuated to neighboring parishes and states.

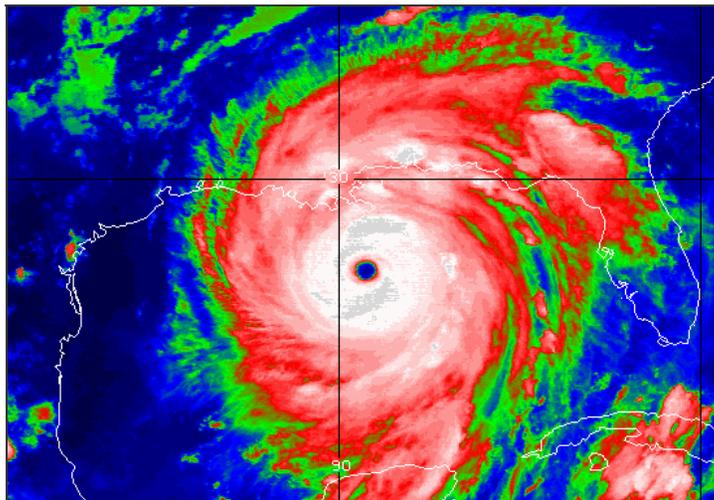


Figure 2: Hurricane Katrina GOES-12 Infrared Satellite Image (NOAA, 2005).

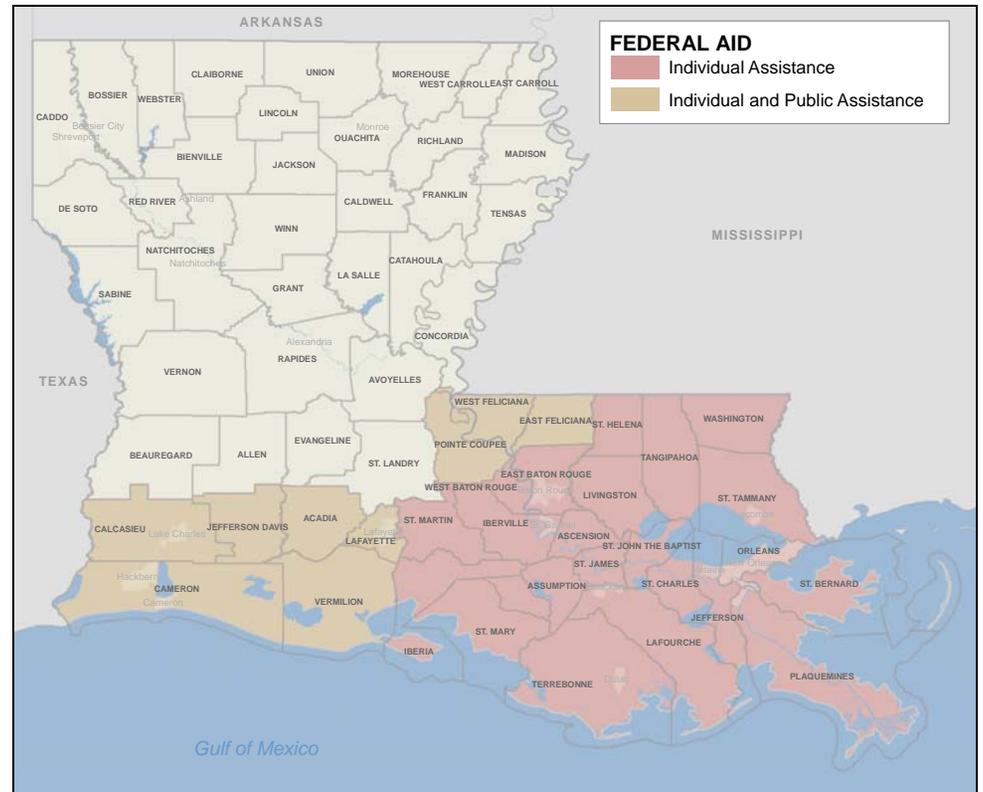


Figure 3: Request for Aid: Individual & Public Assistance Disaster Declarations by Parish (FEMA, 2005).

By mid-September, federal disaster declarations covered 31 parishes, consisting of approximately 26,000 square miles of the State. Katrina left an estimated five million people without power, which took more than two months to stabilize. By November, many parts of New Orleans remained without power.

Storm damage caused by Katrina was significant. However, it was the devastating storm surge and subsequent flooding that has made Katrina the most costly storm in U.S. history.



MAXIMUM SUSTAINED WINDS

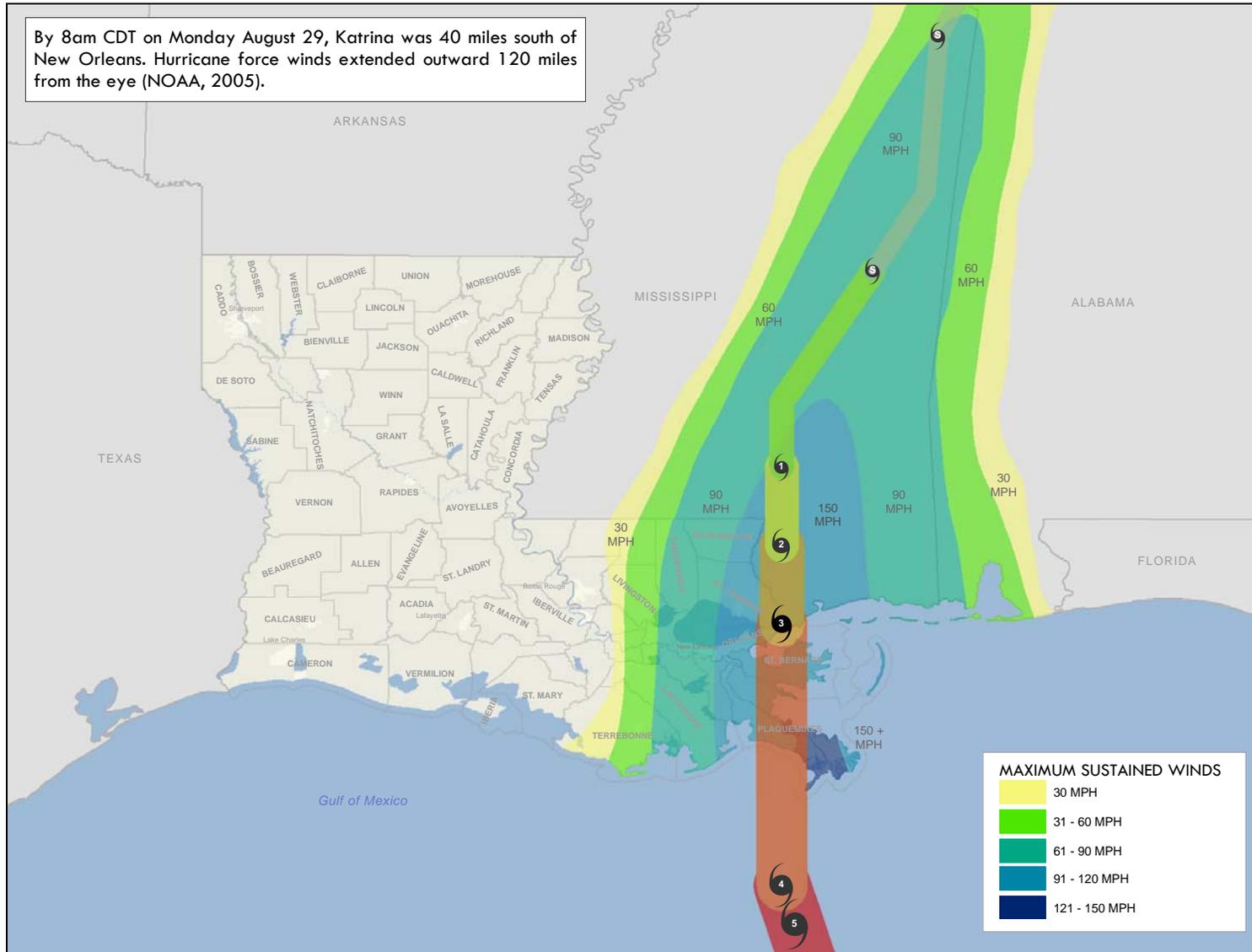


Figure 4: Hurricane Katrina Maximum Sustained Wind Field (NOAA, 2005; FEMA, 2005).



MAXIMUM WIND GUSTS

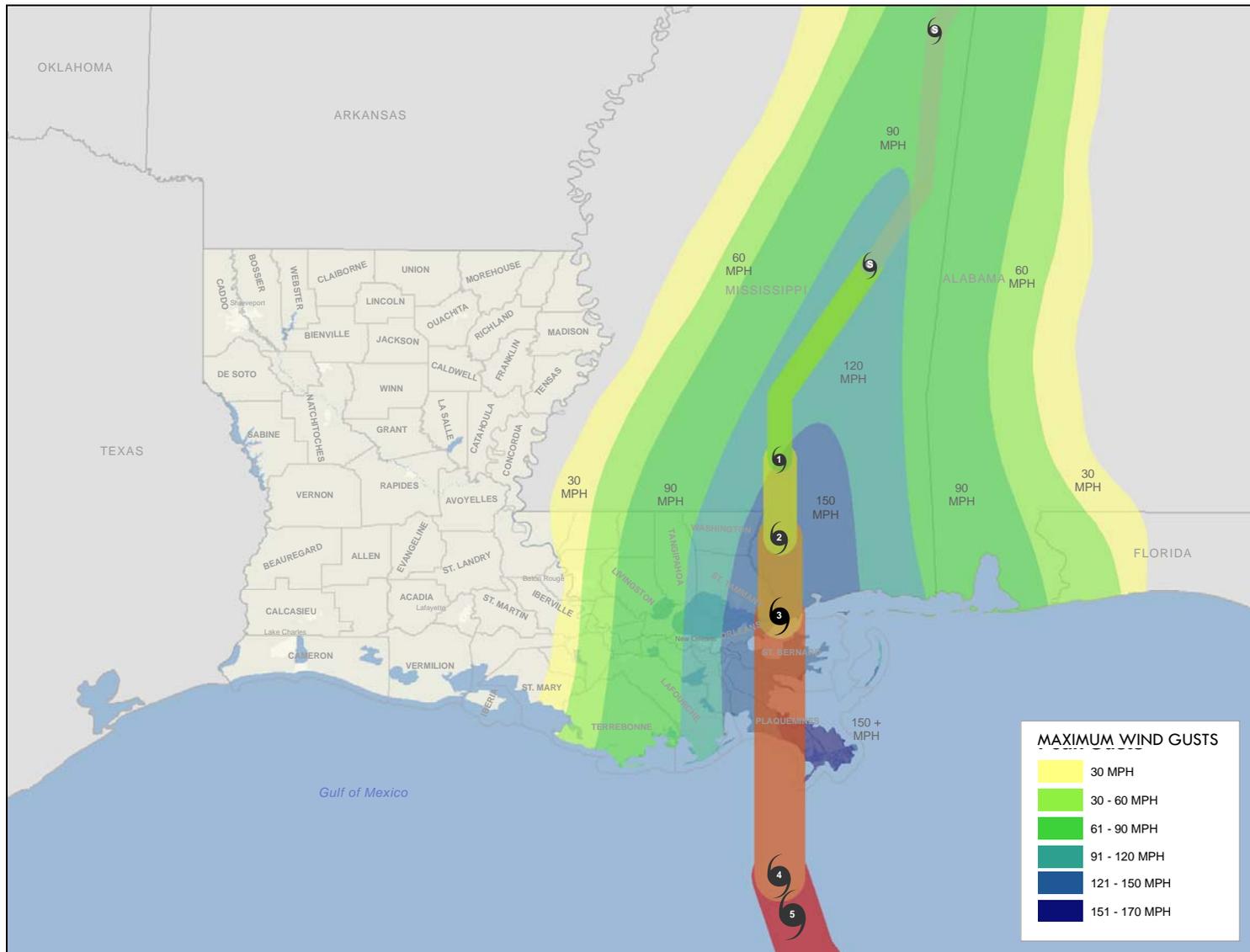
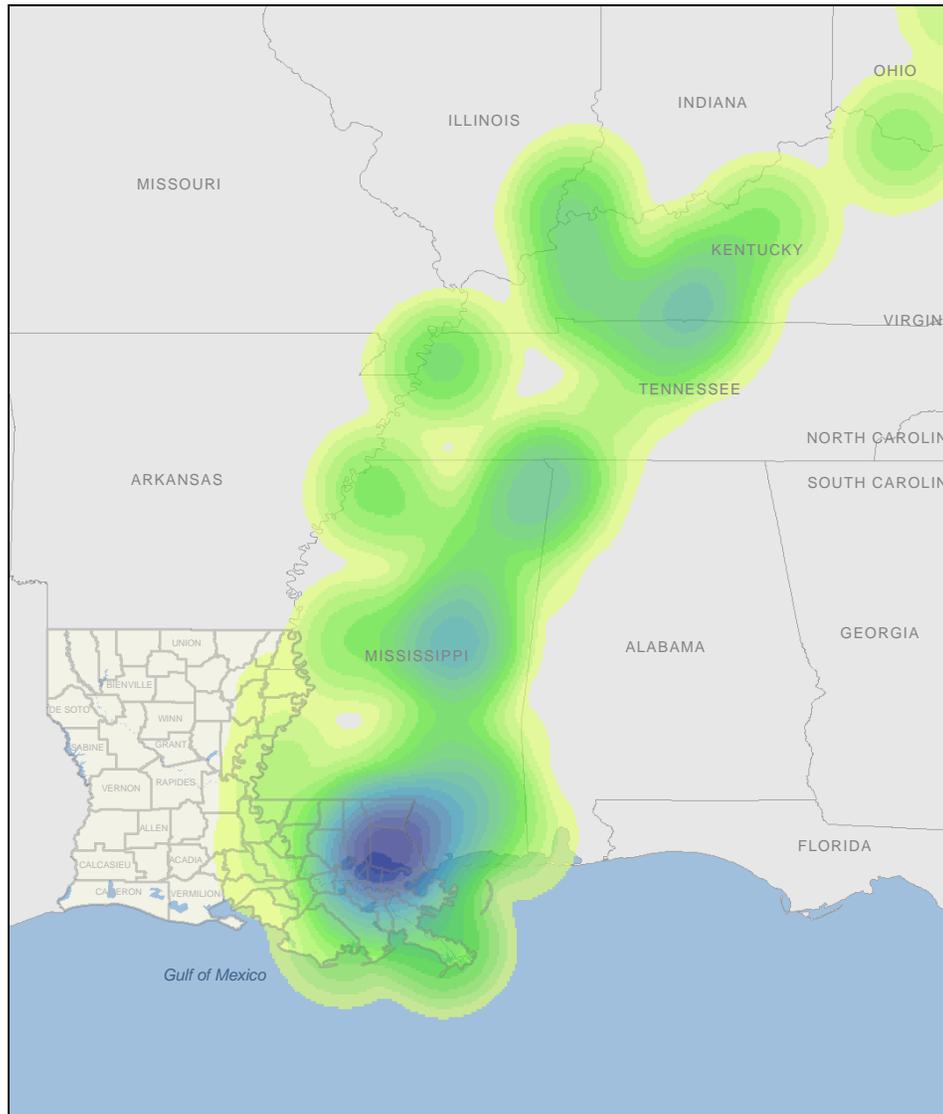


Figure 5: Hurricane Katrina Maximum Wind Gusts (NOAA, 2005; FEMA, 2005).



RAINFALL ESTIMATES



Rainfall amounts for Hurricane Katrina, though considerable in many places, were not the primary impact of the storm. This map illustrates the preliminary rainfall totals (in inches) for the period attributed to Katrina (August 28-30, 2005), for locations with at least two-inches of rain (NOAA, 2005).

Please note: totals are incomplete due to storm damage experienced at many stations along the immediate Gulf coast.

RAINFALL ESTIMATES

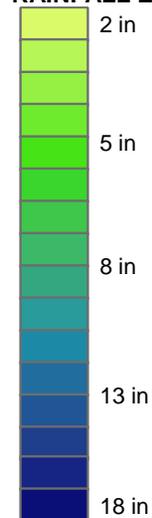


Figure 6: Hurricane Katrina Rainfall Estimates (NOAA, 2005).



ESTIMATED STORM SURGE

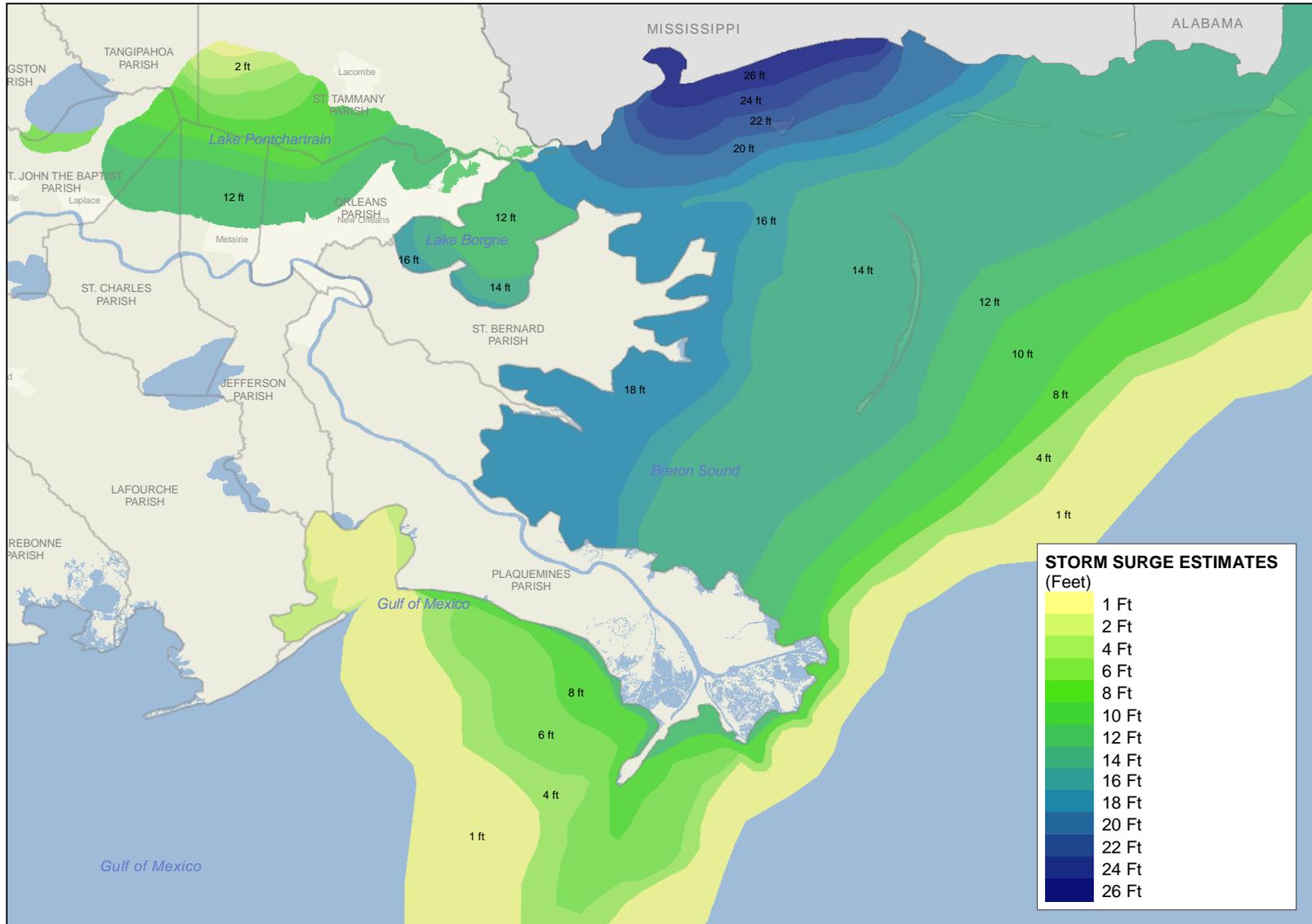
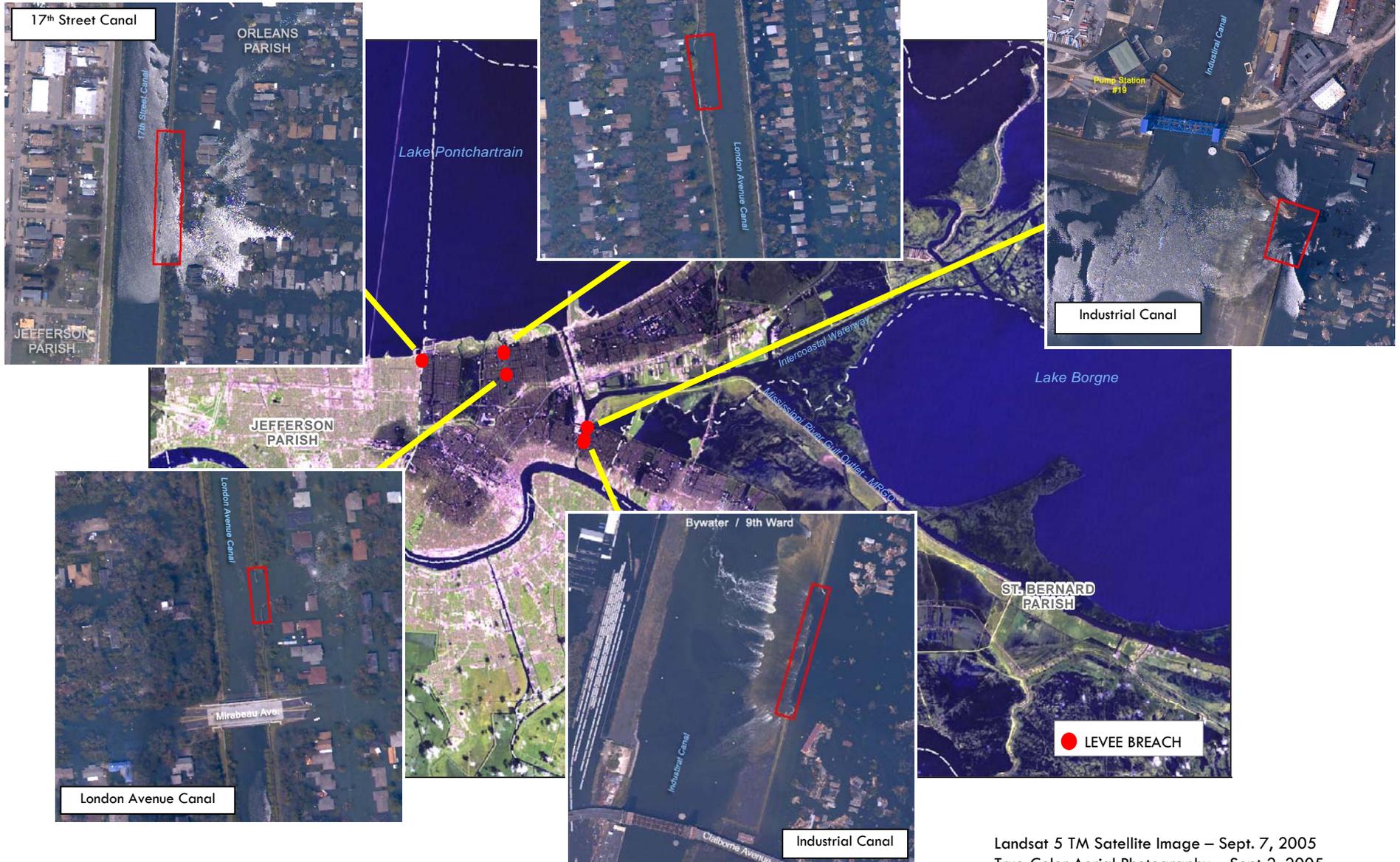


Figure 7: Hurricane Katrina Estimated Storm Surge – Computer Model (LSU – A HEF, 2005).



NEW ORLEANS LEVEES BREACHED



Landsat 5 TM Satellite Image – Sept. 7, 2005
True-Color Aerial Photography – Sept 2, 2005



GREATER NEW ORLEANS FLOODED



Figure 9: Landsat 5 TM Satellite Image Revealing Flooded Land Located Around the Greater New Orleans Area on September 07, 2005 (LSU-CSI, 2005).



NEW ORLEANS FLOOD DEPTH ESTIMATES

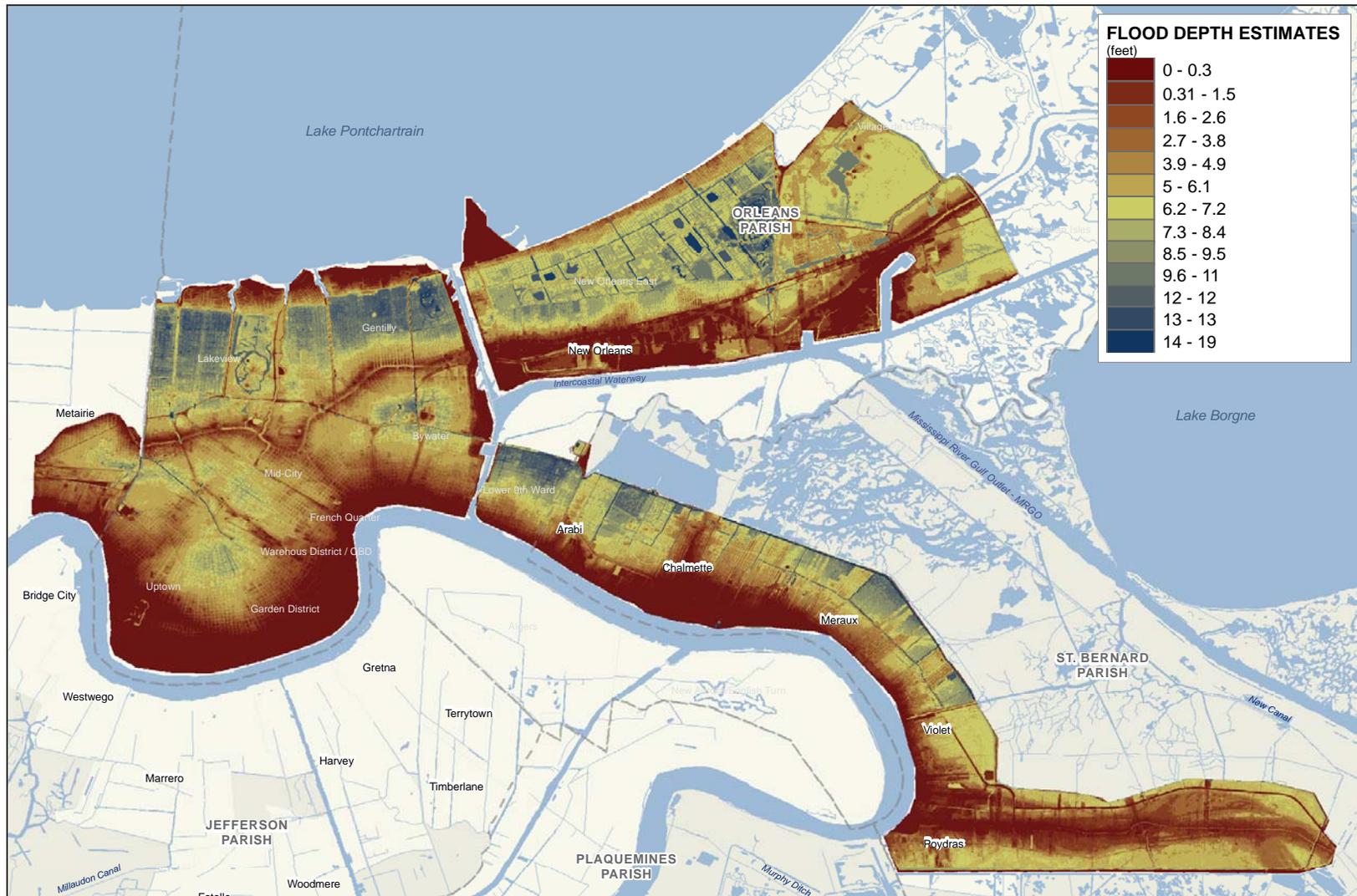


Figure 10: Estimated Flood Depths Based on LIDAR Elevation Data Collected in 2004 (LSU-CSI, 2005).



DAMAGE ESTIMATES

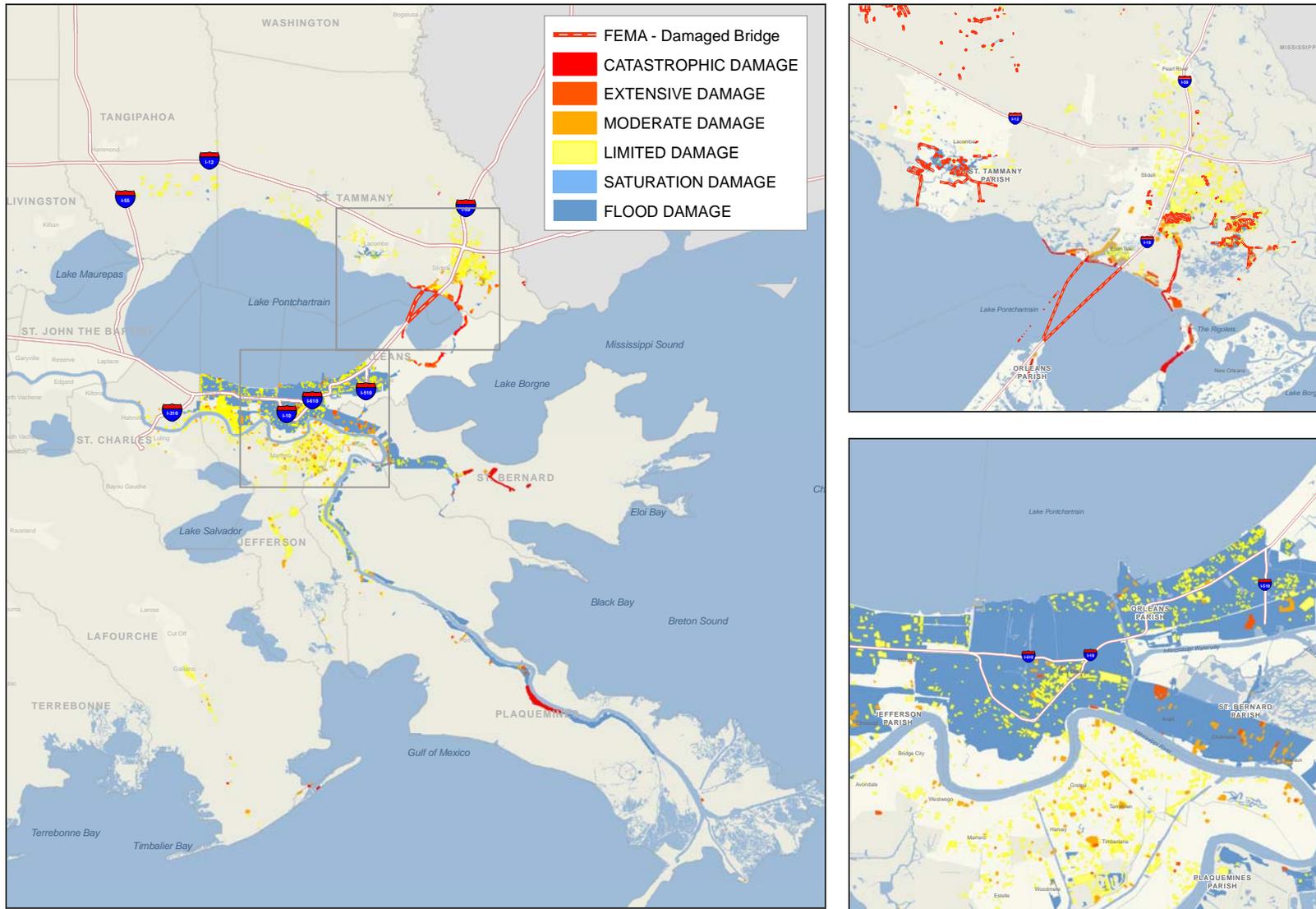


Figure 11: FEMA Damage Assessments – September 21, 2005 (FEMA, 2005).



LOUISIANA DIASPORA

The number of people displaced by Hurricane Katrina is staggering. Using information collected by the Federal Emergency Management Agency, the map below depicts the evacuated location (by ZIP code) of approximately 800,000 Louisiana citizens requesting federal assistance as of September 20, 2005 (FEMA, 2005).

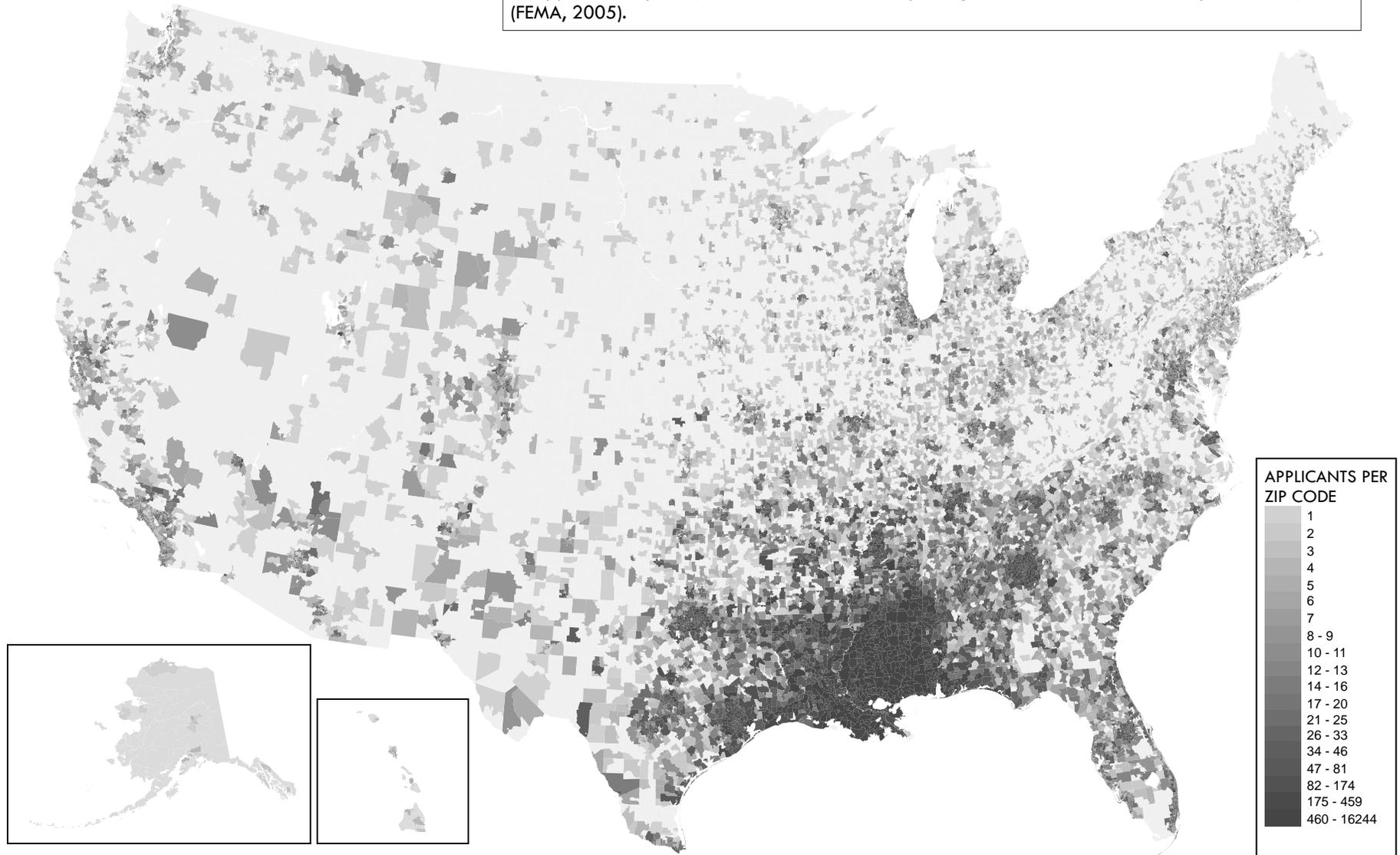
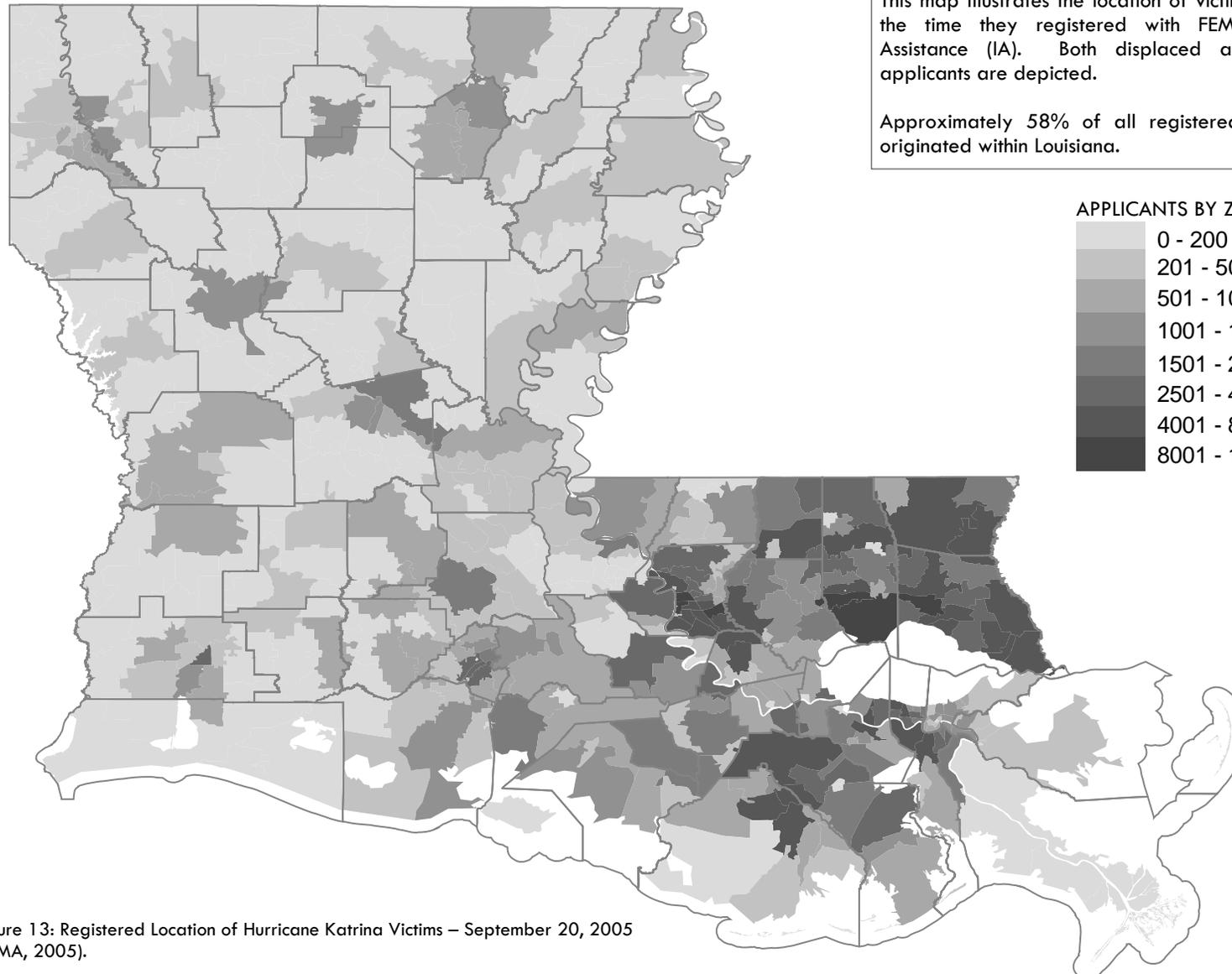


Figure 12: Hurricane Diaspora: Location of 800,000 Displaced Louisiana Residents Requesting Federal Assistance (FEMA, 2005).



POPULATION RE-DISTRIBUTED



This map illustrates the location of victims by ZIP code at the time they registered with FEMA for Individual Assistance (IA). Both displaced and non-displaced applicants are depicted.

Approximately 58% of all registered requests for IA originated within Louisiana.

Figure 13: Registered Location of Hurricane Katrina Victims – September 20, 2005 (FEMA, 2005).



HURRICANE RITA

Hurricane Rita was the seventeenth named tropical storm, ninth hurricane, fifth major hurricane, and second Category-5 hurricane of the 2005 Atlantic hurricane season. As of October 19, it was the second-most powerful hurricane of the season.

Hurricane Rita is on record as being the second-strongest measured hurricane to ever have entered the Gulf of Mexico after Hurricane Wilma (2005), and the fourth most intense hurricane in the Atlantic Basin.



Figure 14: Hurricane Rita Storm Track (NOAA-NHC, 2005).



Figure 15: Hurricane Rita MODIS Satellite Image September 21, 2005 (NOAA, 2005).



STORM IMPACT

After peaking as a Category-4 hurricane, Rita made landfall between Sabine Pass, Texas, and Johnson's Bayou, Louisiana, at 02:38 CDT on September 24, 2005 as a Category-3 hurricane, with wind speeds of 120 mph and a storm surge of 10 feet.

Damage in south-western Louisiana was extensive. In Cameron Parish, the communities of Hackberry, Cameron, and Holly Beach were heavily damaged or entirely destroyed. Many homes of the surrounding areas also experienced damaged and extensive vegetative debris.

Lake Charles experienced severe flooding, with reports of water rising 6-8 feet in areas around the lake. Additionally, there were reports of water reaching the second floor of buildings.

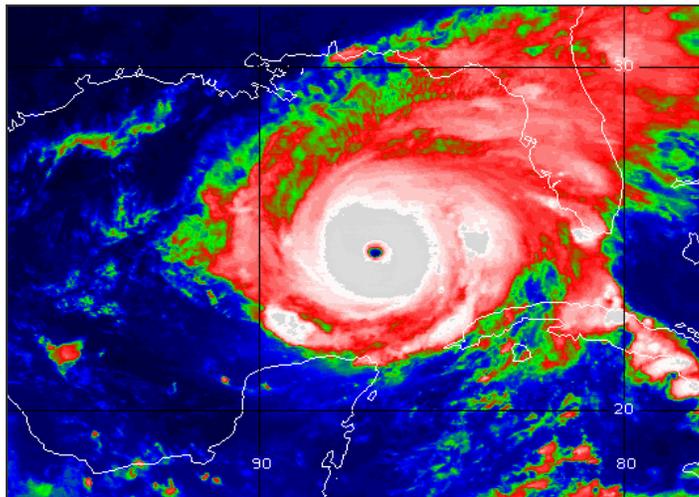


Figure 16: Hurricane Rita GOES-12 Infrared Satellite Image (NOAA, 2005).

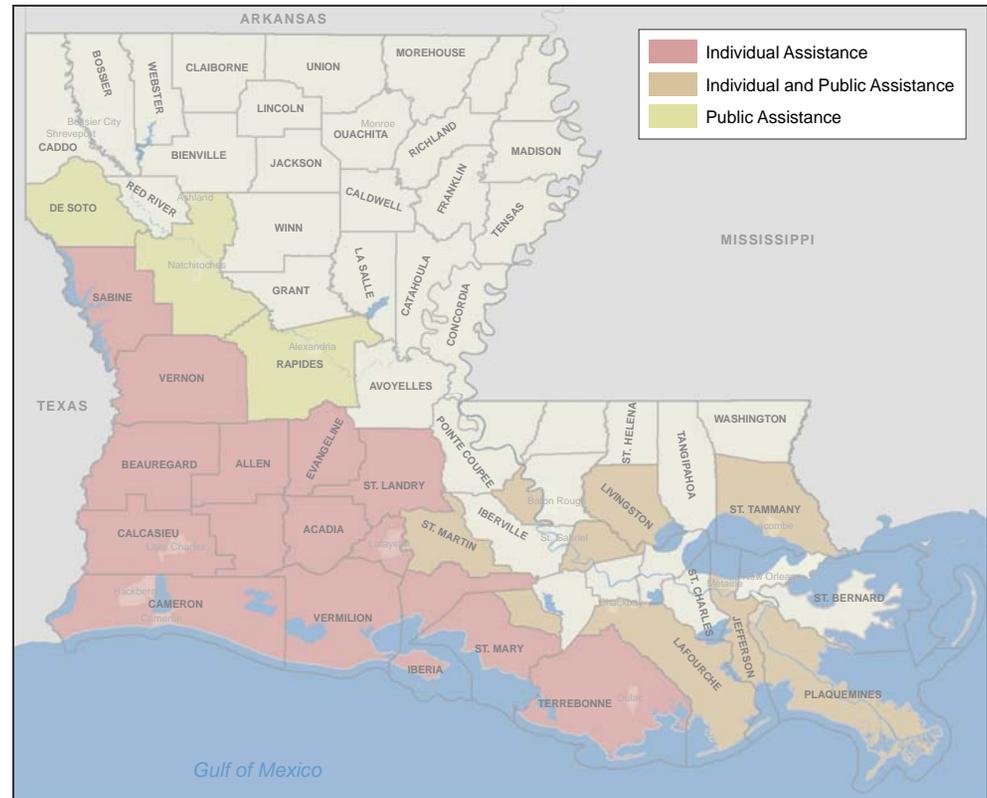


Figure 17: Individual & Public Assistance Disaster Declarations by Parish (FEMA, 2005).

Damage to the region's electrical system was severe. Approximately 700,000 homes had lost power in 41 of 64 parishes because of Hurricane Rita.

Widespread flooding was reported in coastal parishes. Terrebonne Parish, experienced numerous levee breaches, leaving many residents stranded in flooded communities. In Vermilion Parish, rescue efforts were undertaken for up to 1,000 people stranded by local flooding south of Abbeville, LA.

There were no deaths reported in Louisiana as a direct result of hurricane Rita.



MAXIMUM WIND GUSTS

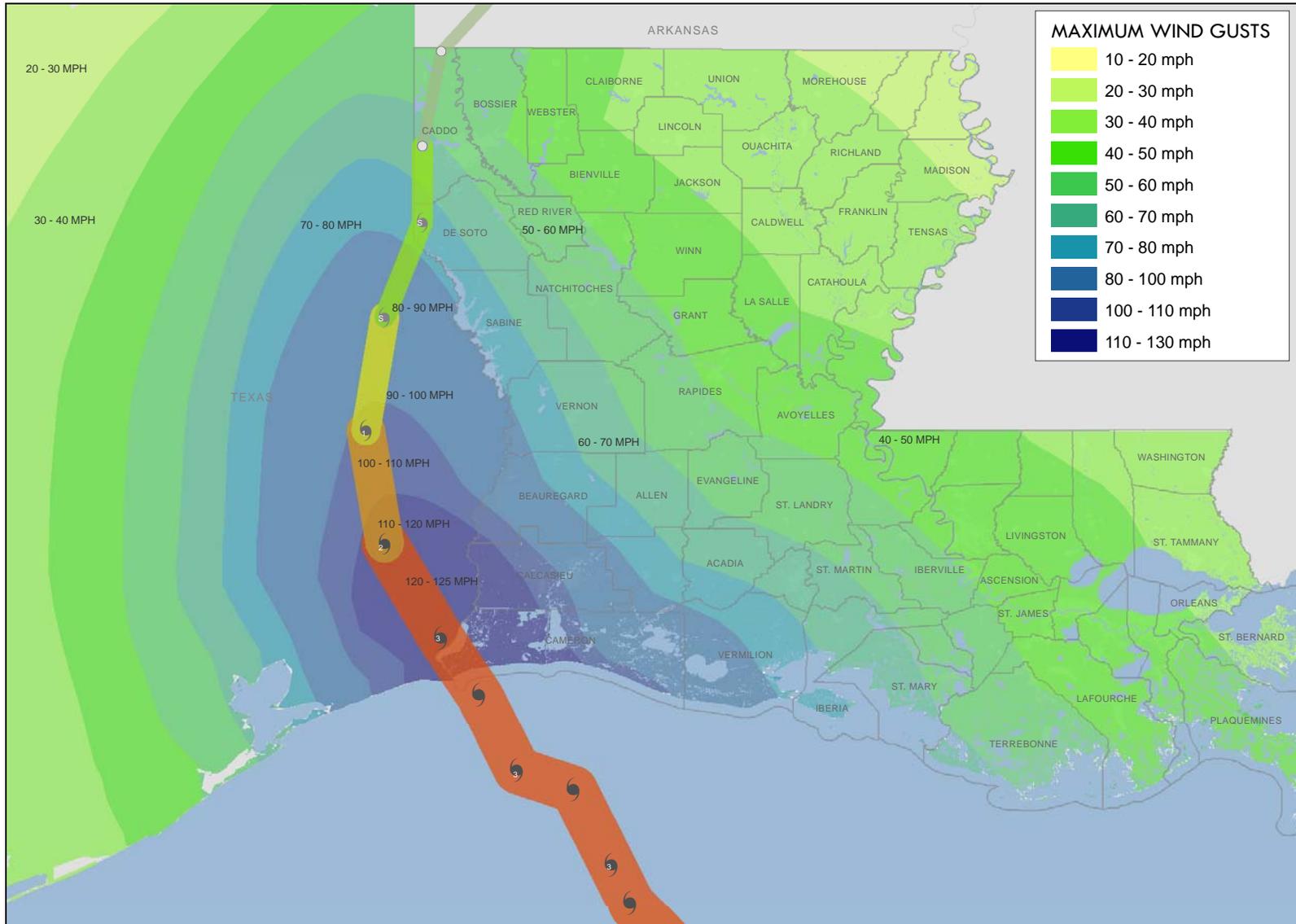


Figure 18: Hurricane Rita Maximum Wind Gusts (NOAA, 2005; FEMA, 2005).



ESTIMATED STORM SURGE

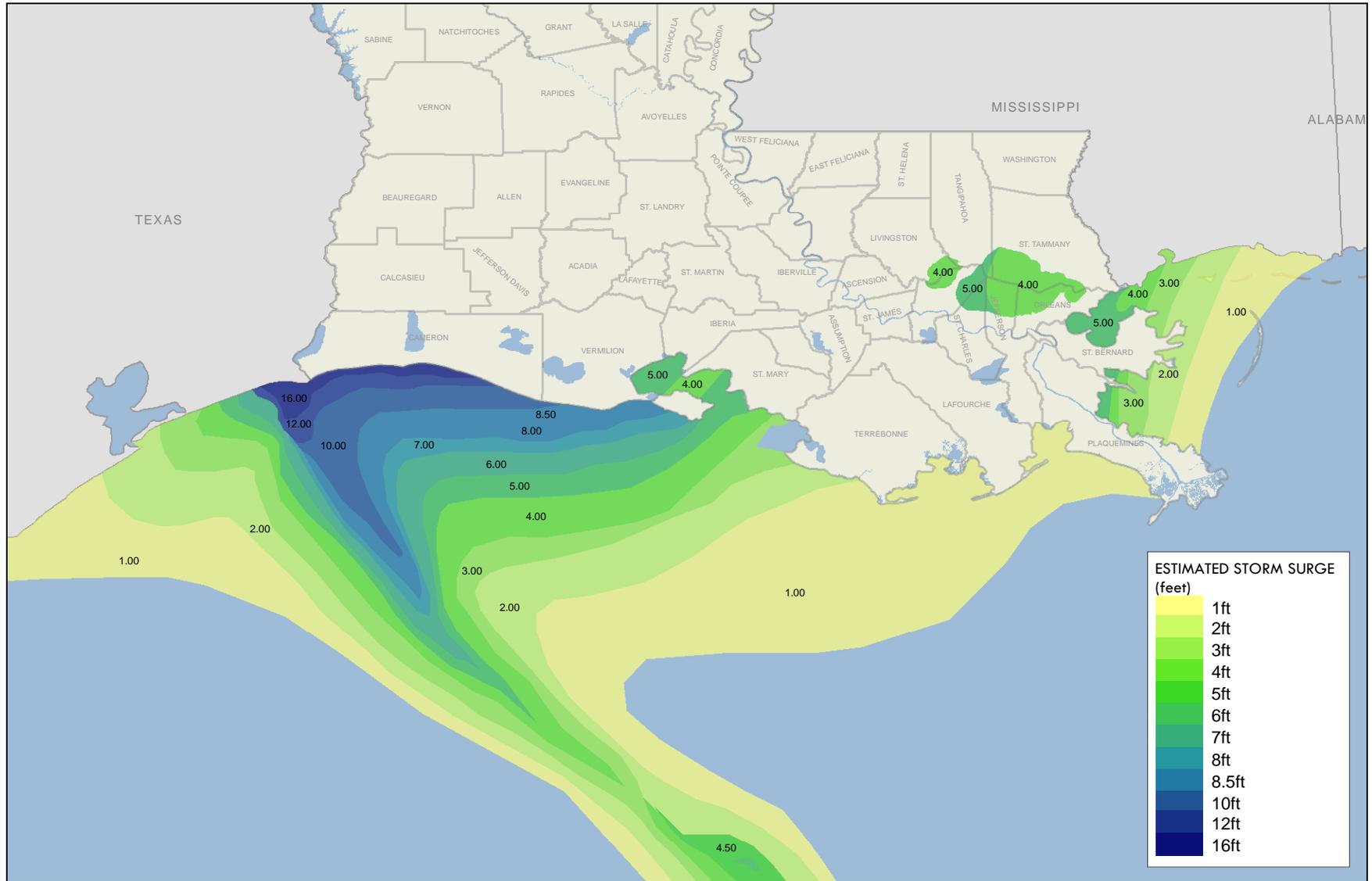


Figure 19: Hurricane Rita Estimated Storm Surge – Computer Model (LSU-A Hef, 2005).



DAMAGE ESTIMATES

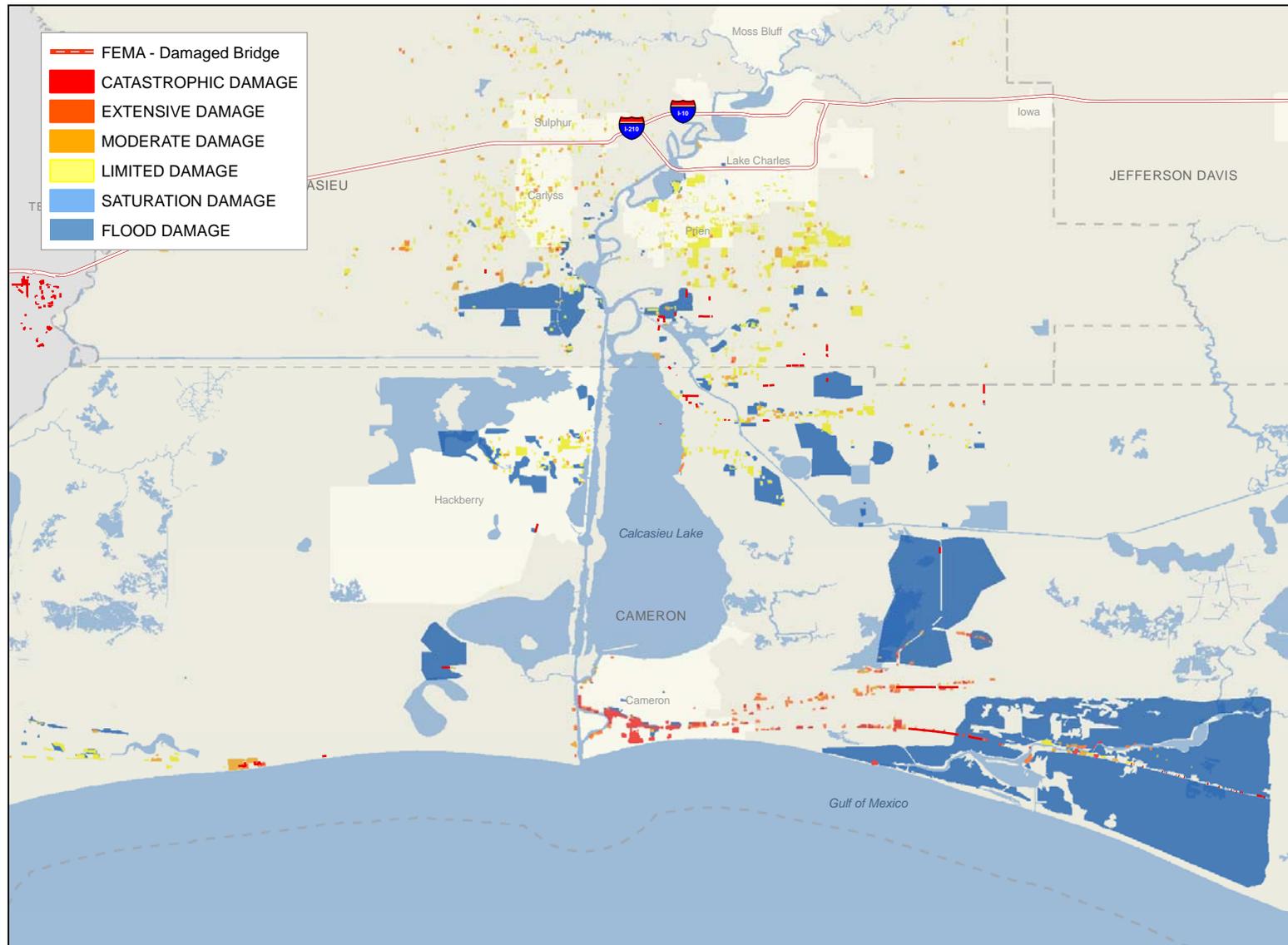


Figure 20: Hurricane Rita Damage Estimates (FEMA, 2005).



REQUESTS FOR FEDERAL ASSISTANCE

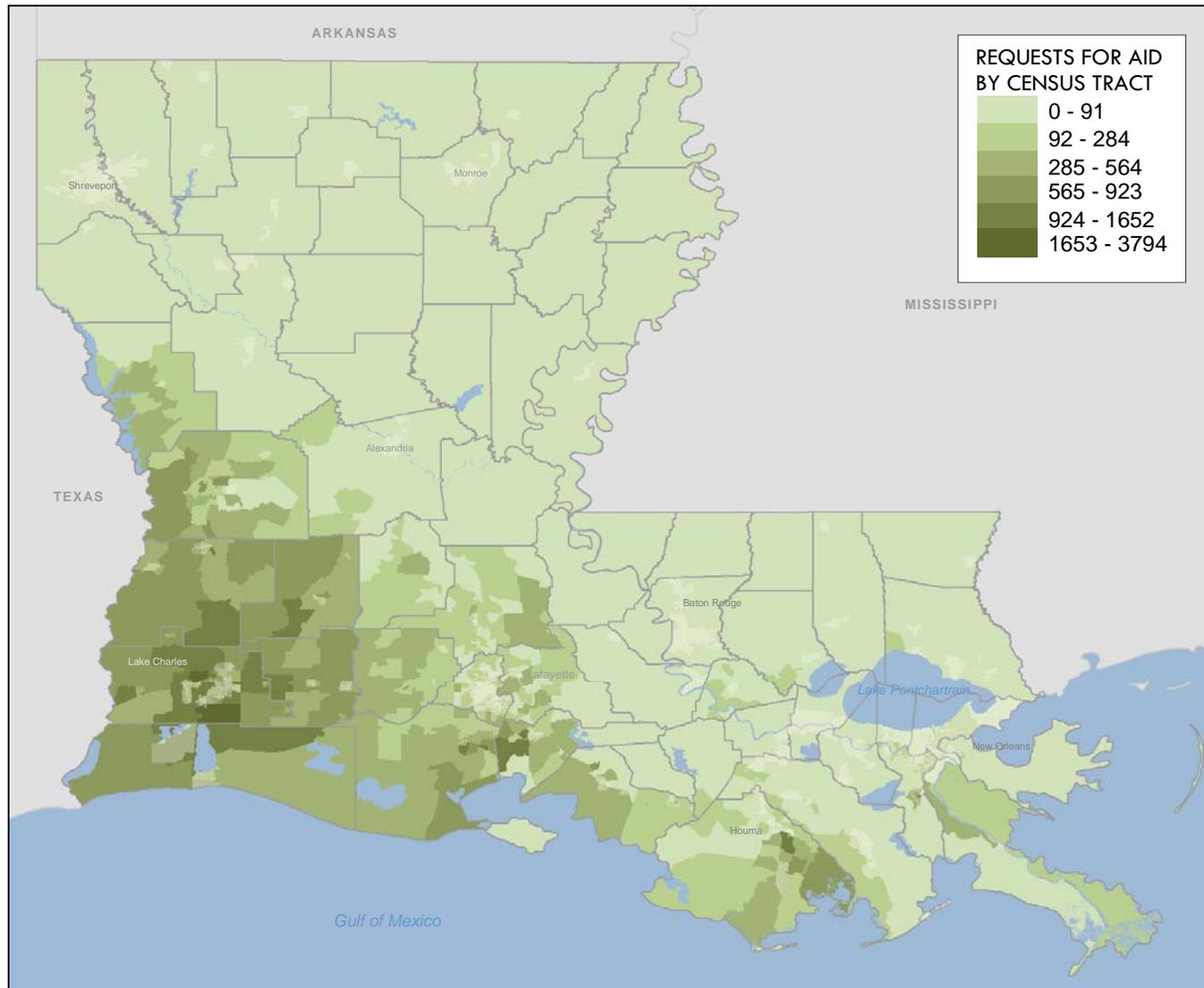


Figure 21: Location of Louisiana Applicants Registering for Federal Assistance following Hurricane Rita; organized by Census Tract (FEMA, 2005).



STATE WIDE ECONOMIC IMPACT NAICS CLASSIFIED BUSINESSES

The US Census Bureau maintains an annual report of key economic indicators organized by county. This map depicts the 2003 *County Business Patterns* (CBP) report detailing the number of businesses by Parish, per square mile.

The CBP report covers most of the nation's economic activity. The series excludes data on self-employed individuals, employees of private households, railroad employees, agricultural production employees, and most government employees.

The CBP program is tabulated on the North American Industry Classification System (NAICS).

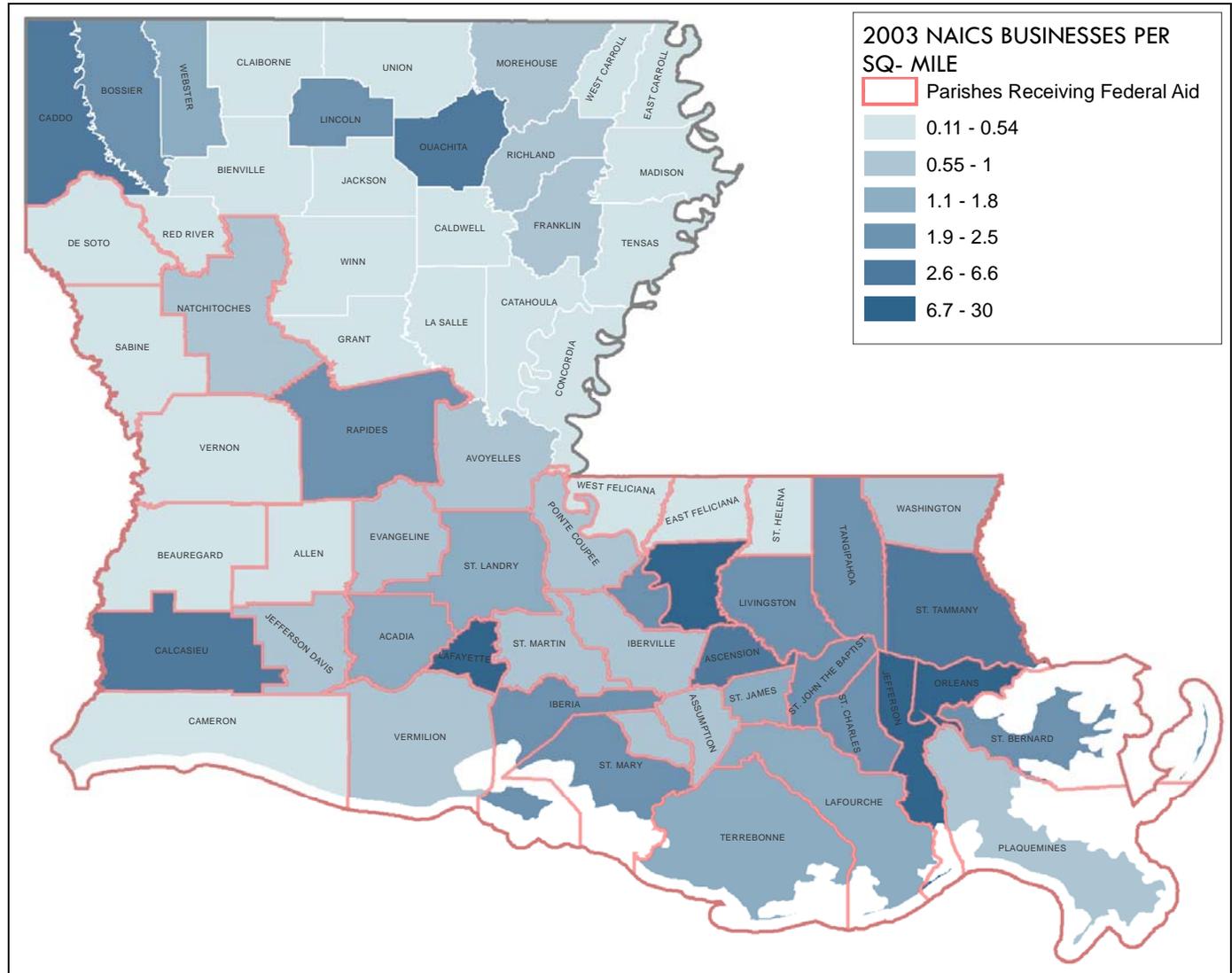


Figure 22: Number of NAICS Classified Businesses per Square Mile (US Census, 2003).



EMPLOYMENT BY PARISH

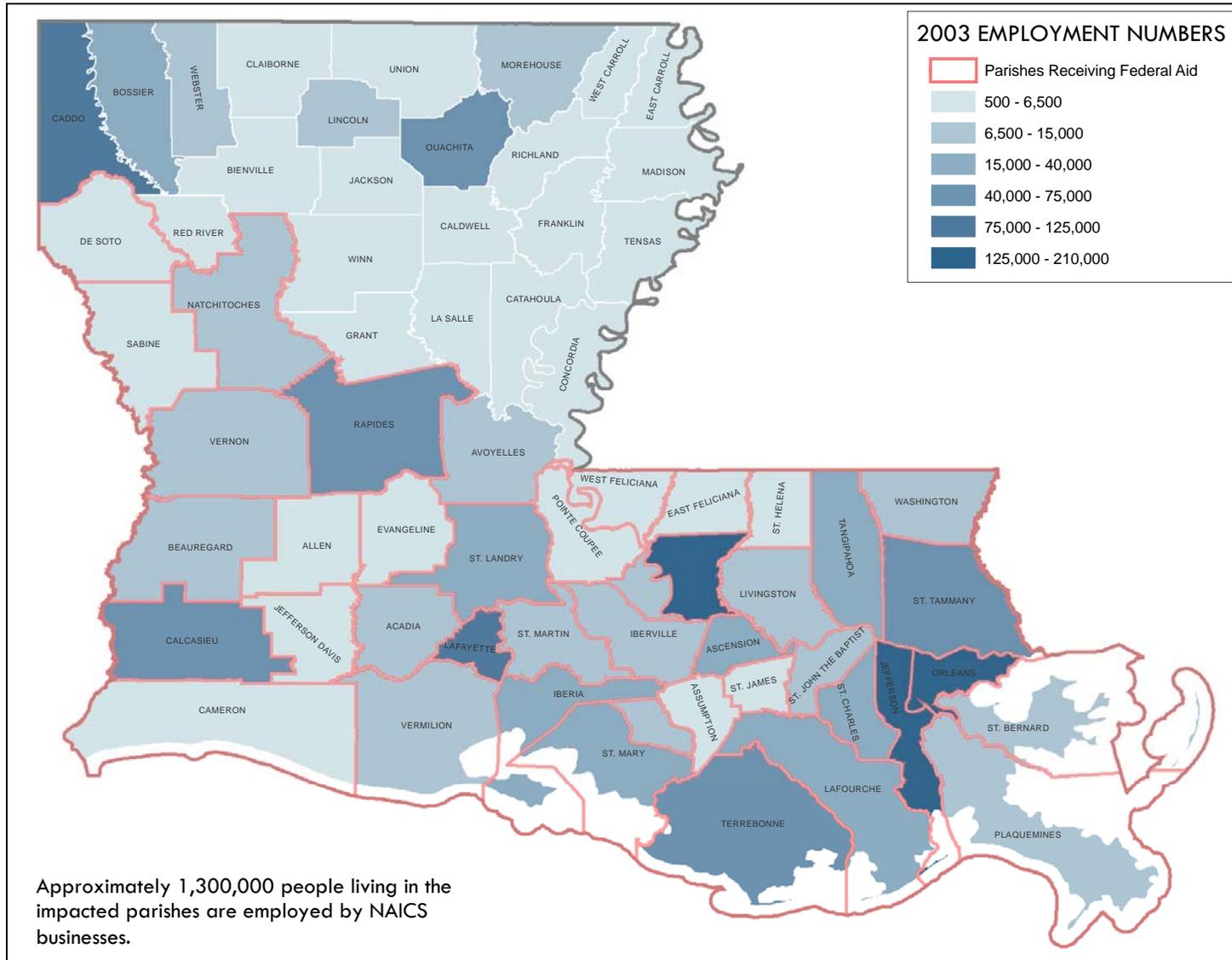


Figure 23: County Business Patterns Economic Profile: 2003 Employment Statistics by Parish (US Census, 2003).



ANNUAL PAYROLL BY PARISH

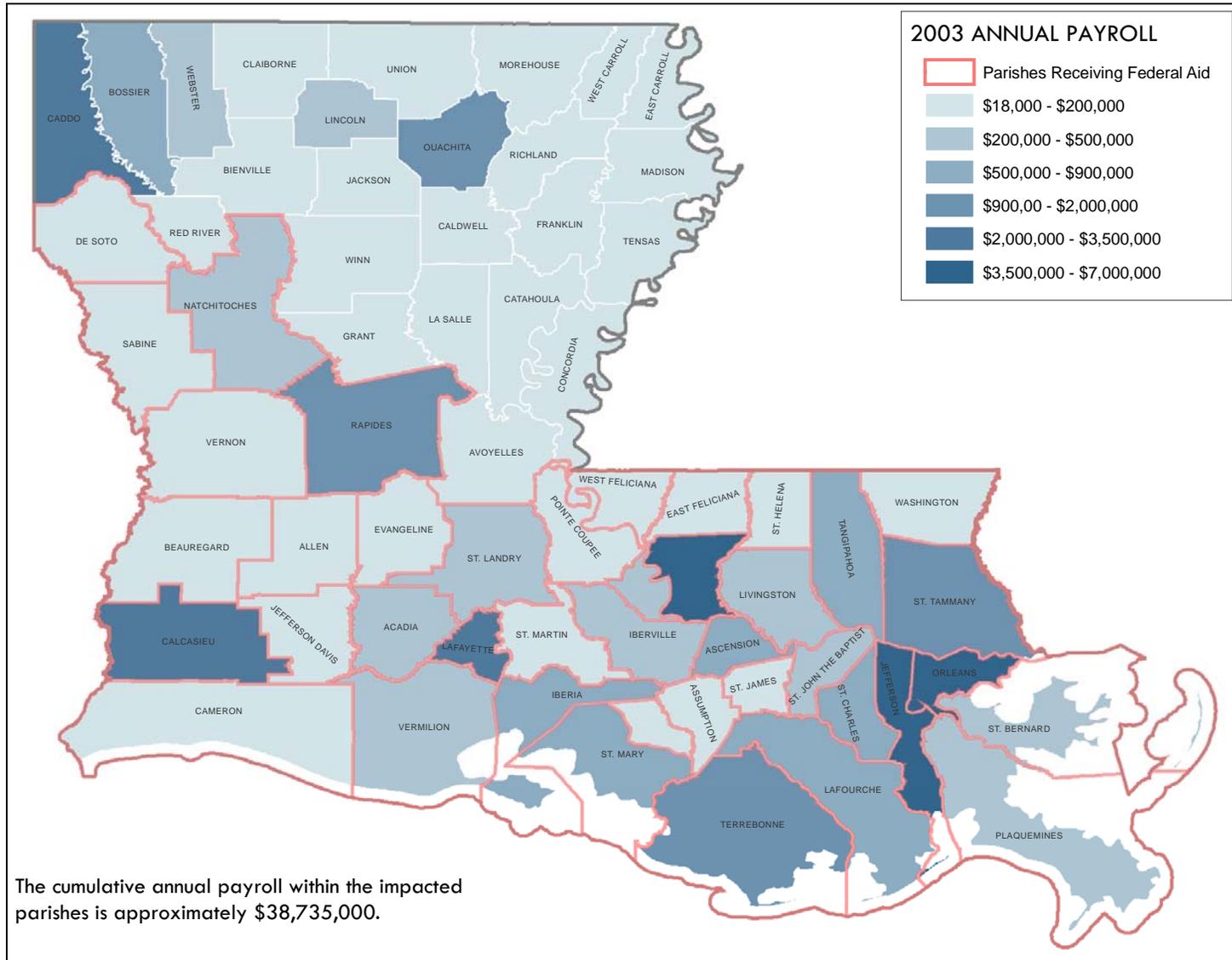


Figure 24: County Business Patterns Economic Profile: 2003 Annual Payroll Statistics by Parish (US Census, 2003).



PETROLEUM REFINING CAPACITY

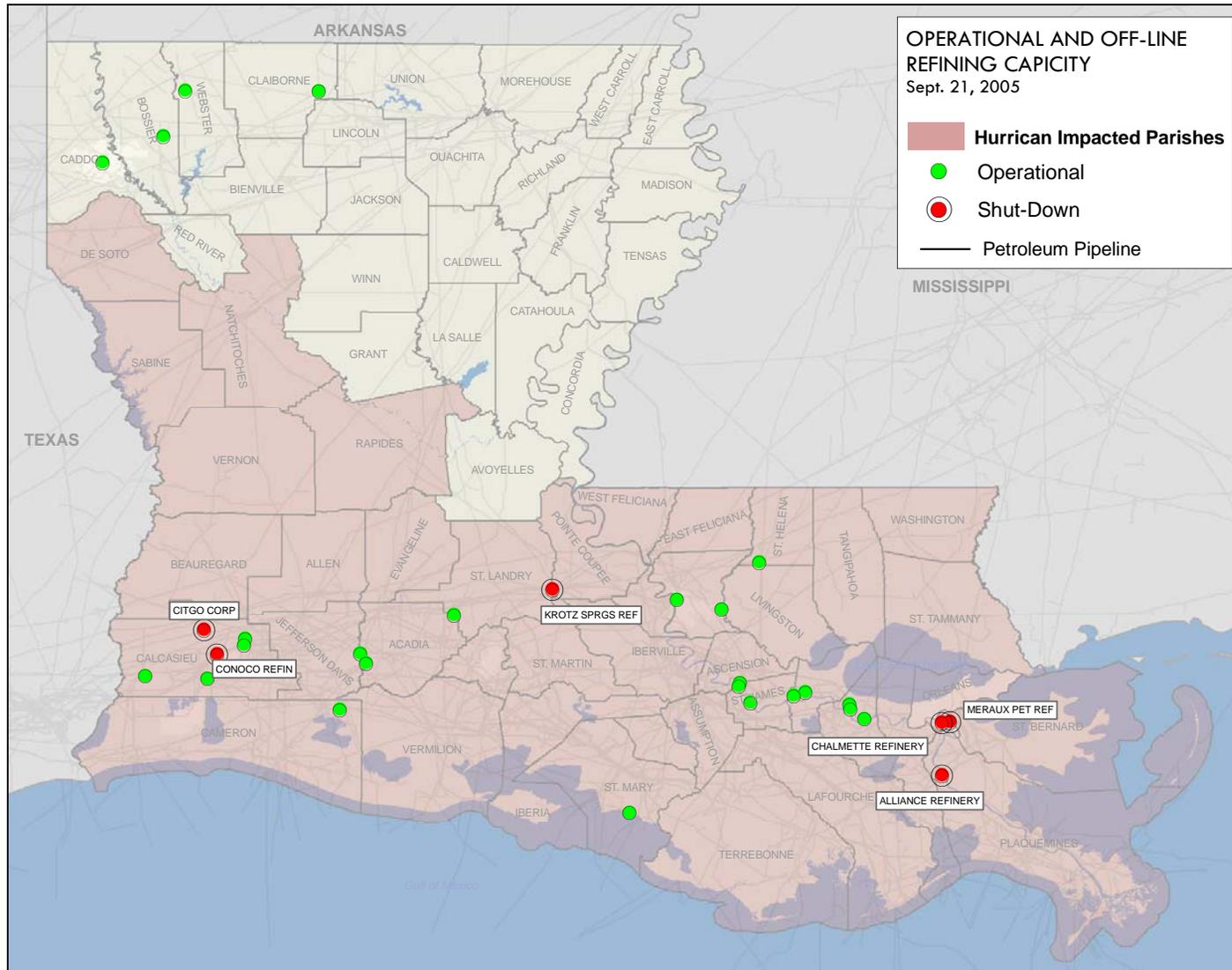


Figure 25: Impact on Oil Refining Capability – September 21, 2005 (LDNR, 2005).



IMPACT ON SERVICES
EMERGENCY ROOM HOSPITALS

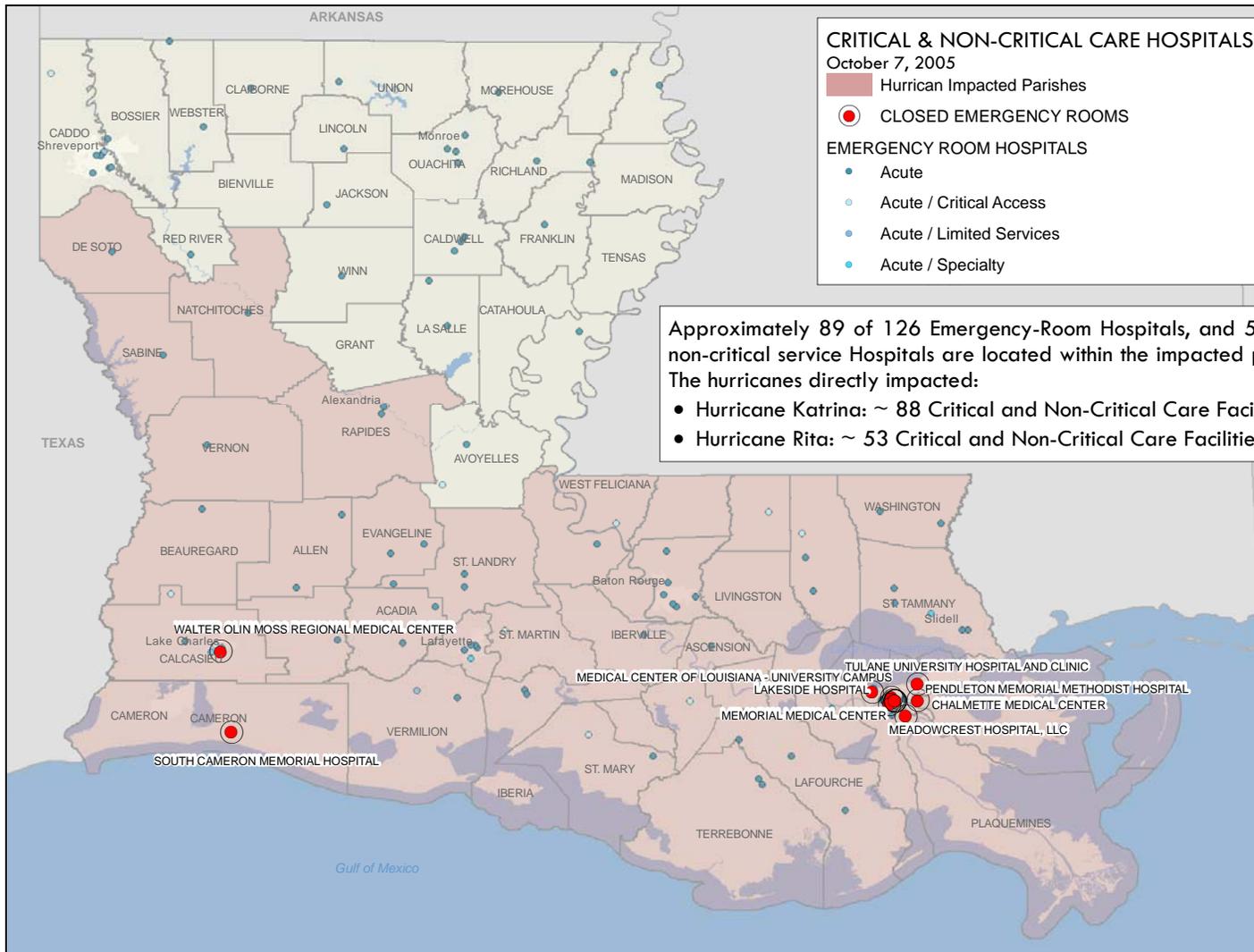
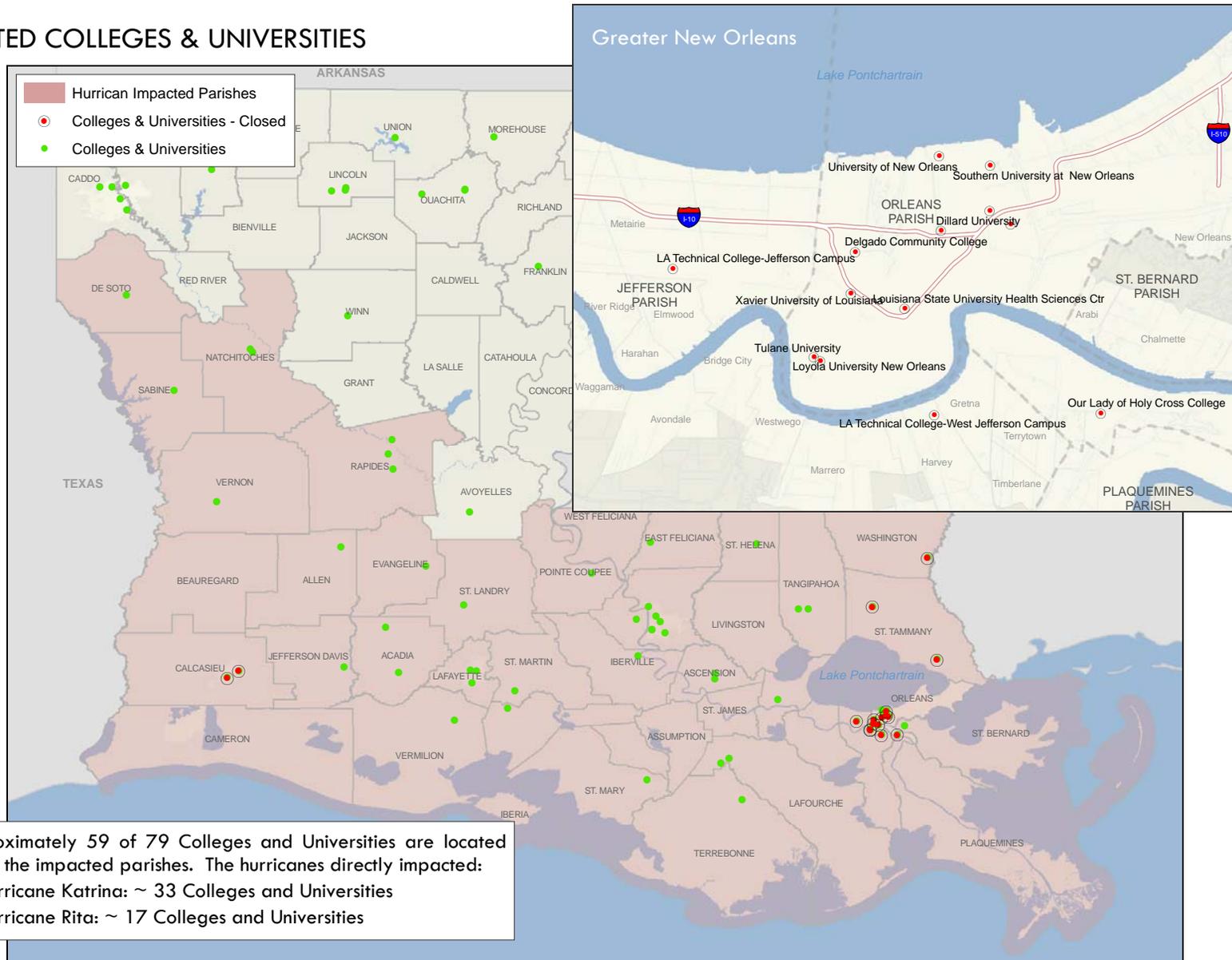


Figure 26: Emergency Room Hospitals Closed By Hurricanes (LDHH, 2005).



IMPACTED COLLEGES & UNIVERSITIES



Approximately 59 of 79 Colleges and Universities are located within the impacted parishes. The hurricanes directly impacted:

- Hurricane Katrina: ~ 33 Colleges and Universities
- Hurricane Rita: ~ 17 Colleges and Universities

Figure 27: Colleges & Universities Impacted by Hurricanes Katrina and Rita (LDOE, 2005; LDSS, 2005).



DEMOGRAPHICS: GREATER NEW ORLEANS
POPULATION PER SQUARE MILE

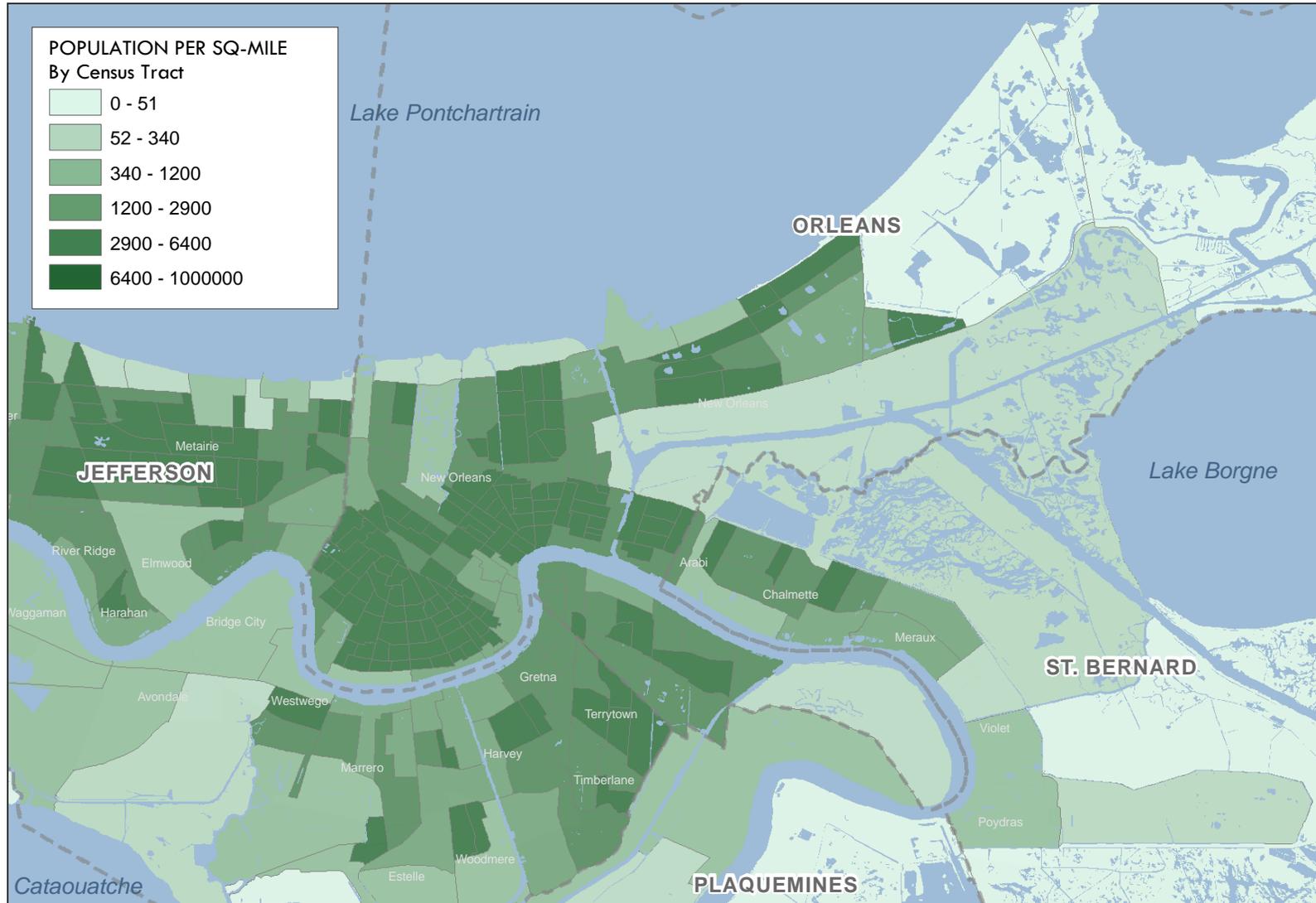


Figure 29: Population per-Square Mile by Census Tract (US Census, 2000).



HOUSING UNITS PER SQUARE MILE

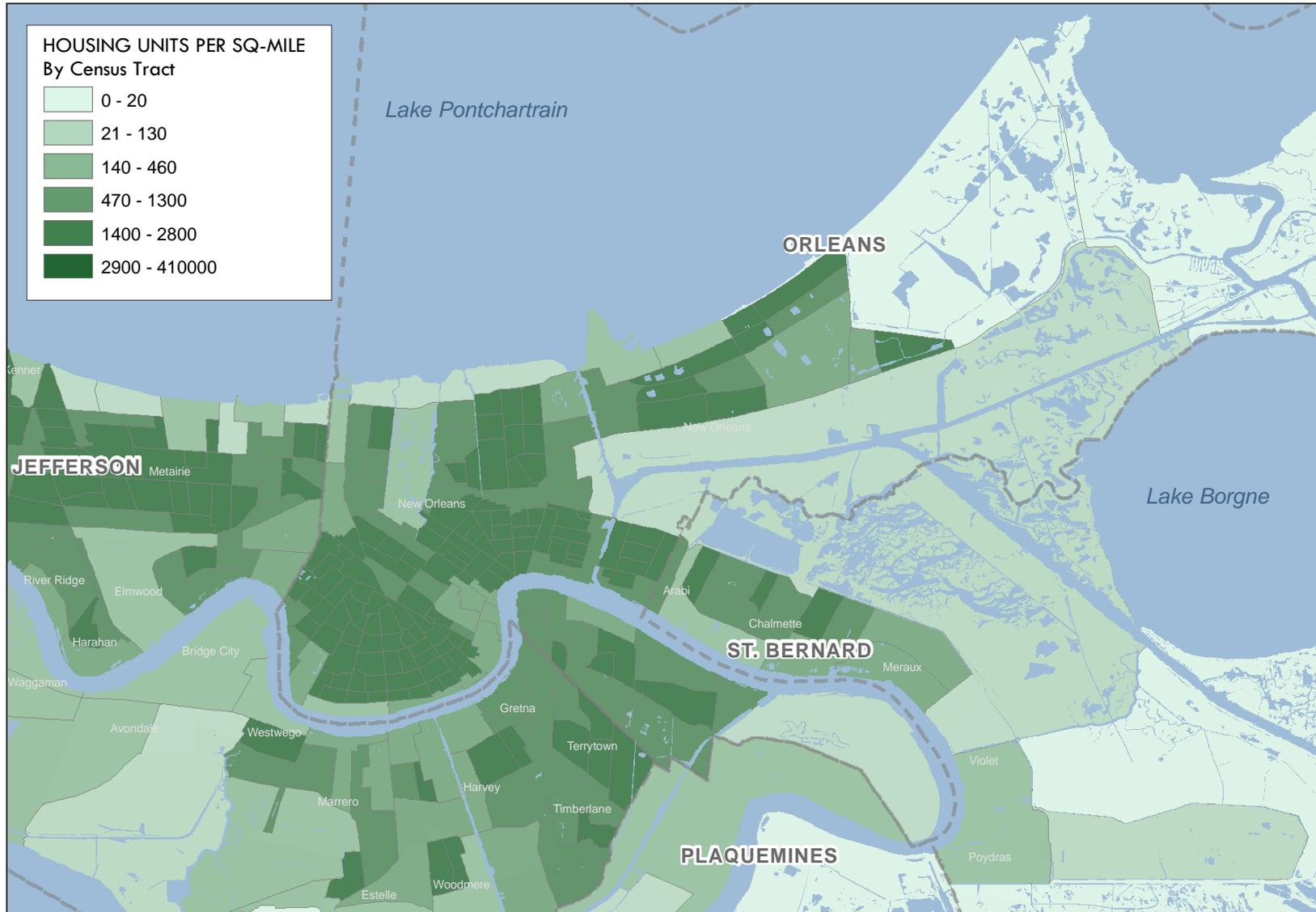


Figure 30: Number of Housing Units per Square Mile by Census Tract (US Census, 2000).



MEDIAN HOUSEHOLD INCOME



Figure 32: Median Income by Census Tract (US Census, 2000).



POPULATION LIVING IN POVERTY

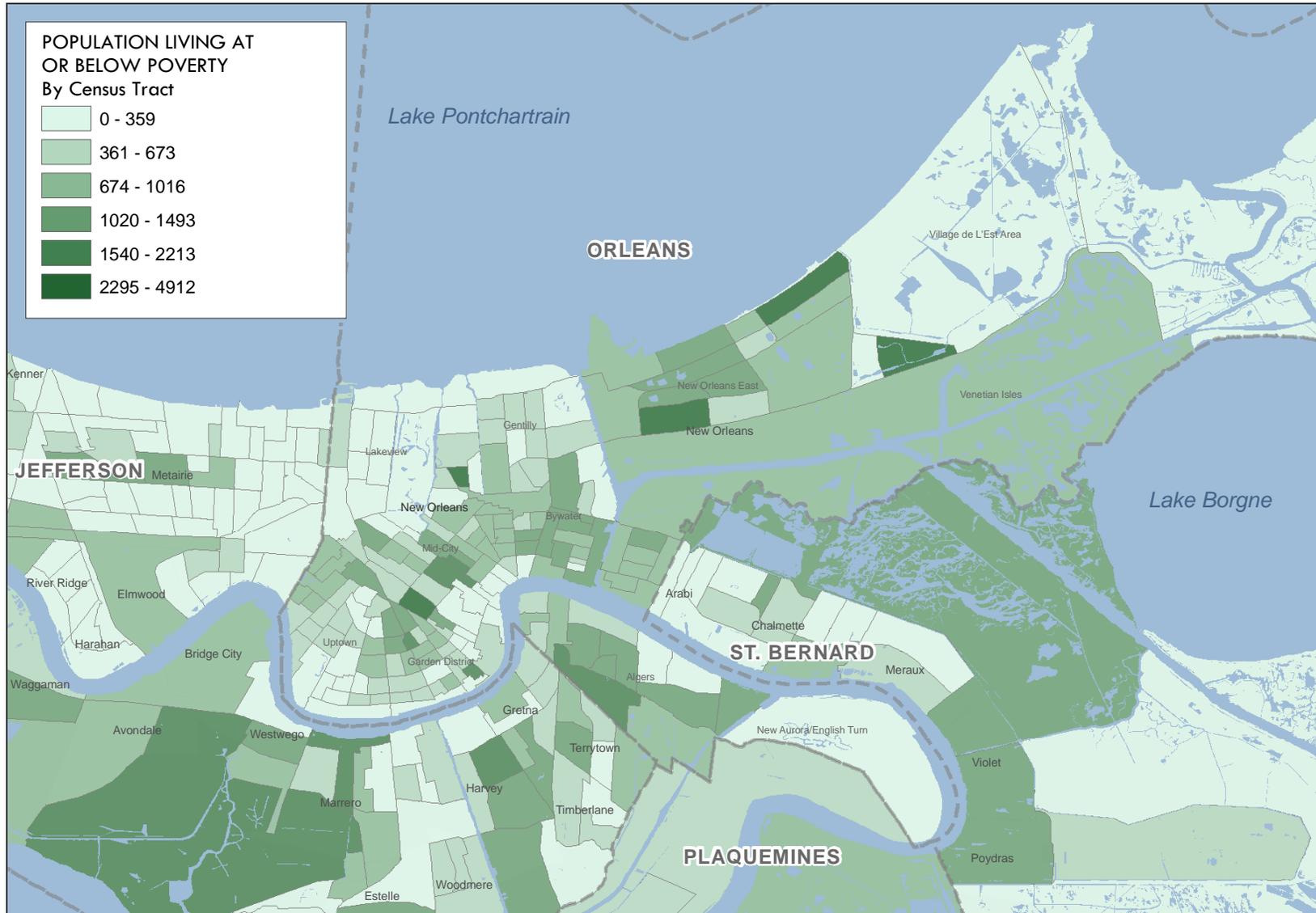


Figure 33: Population Living at or Below Poverty by Census Tract (US Census, 2000).



DEMOGRAPHICS: LAKE CHARLES
POPULATION PER SQUARE MILE

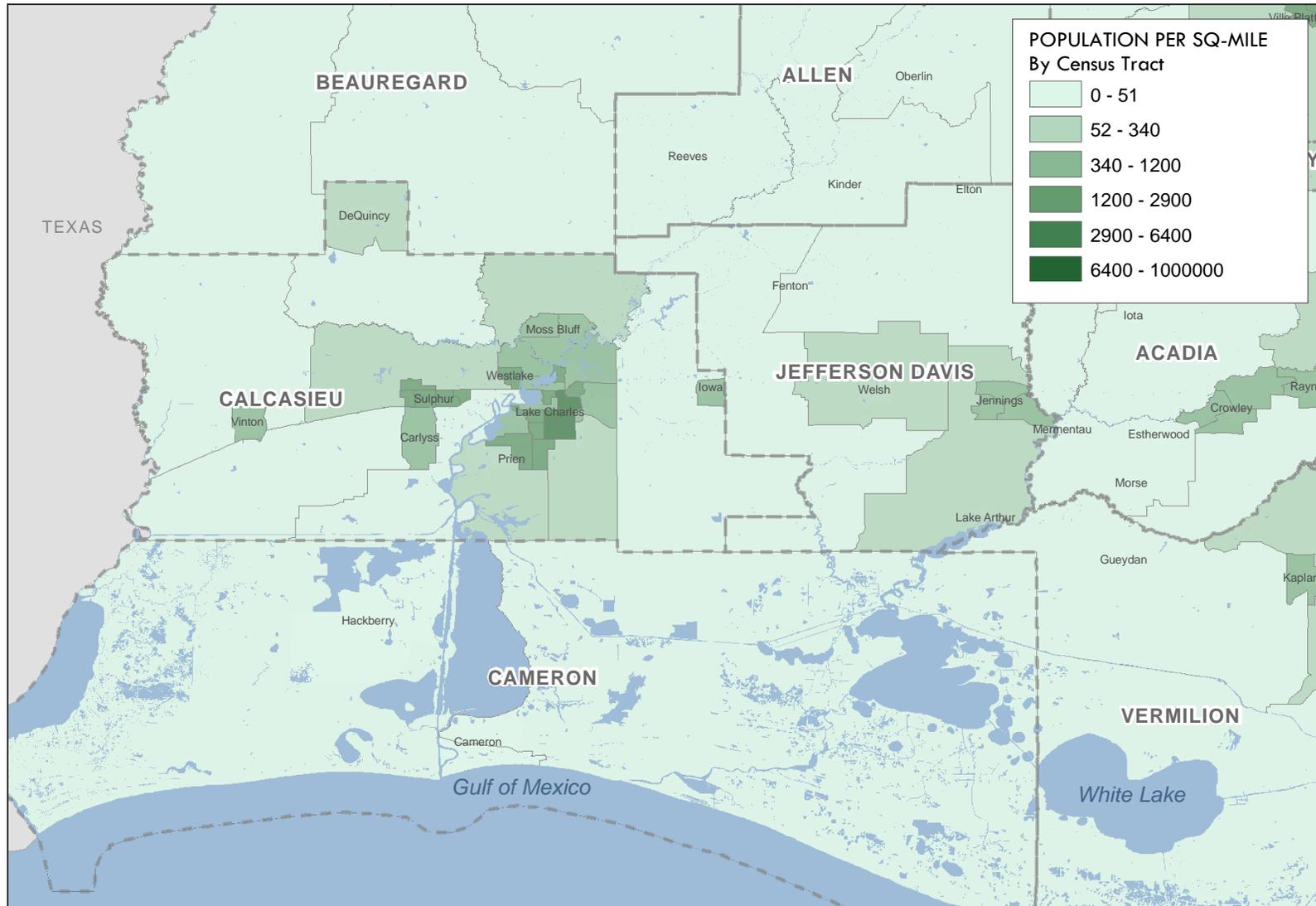


Figure 34: Population per Square Mile by Census Tract (US Census, 2000).



HOUSING UNITS PER SQUARE MILE

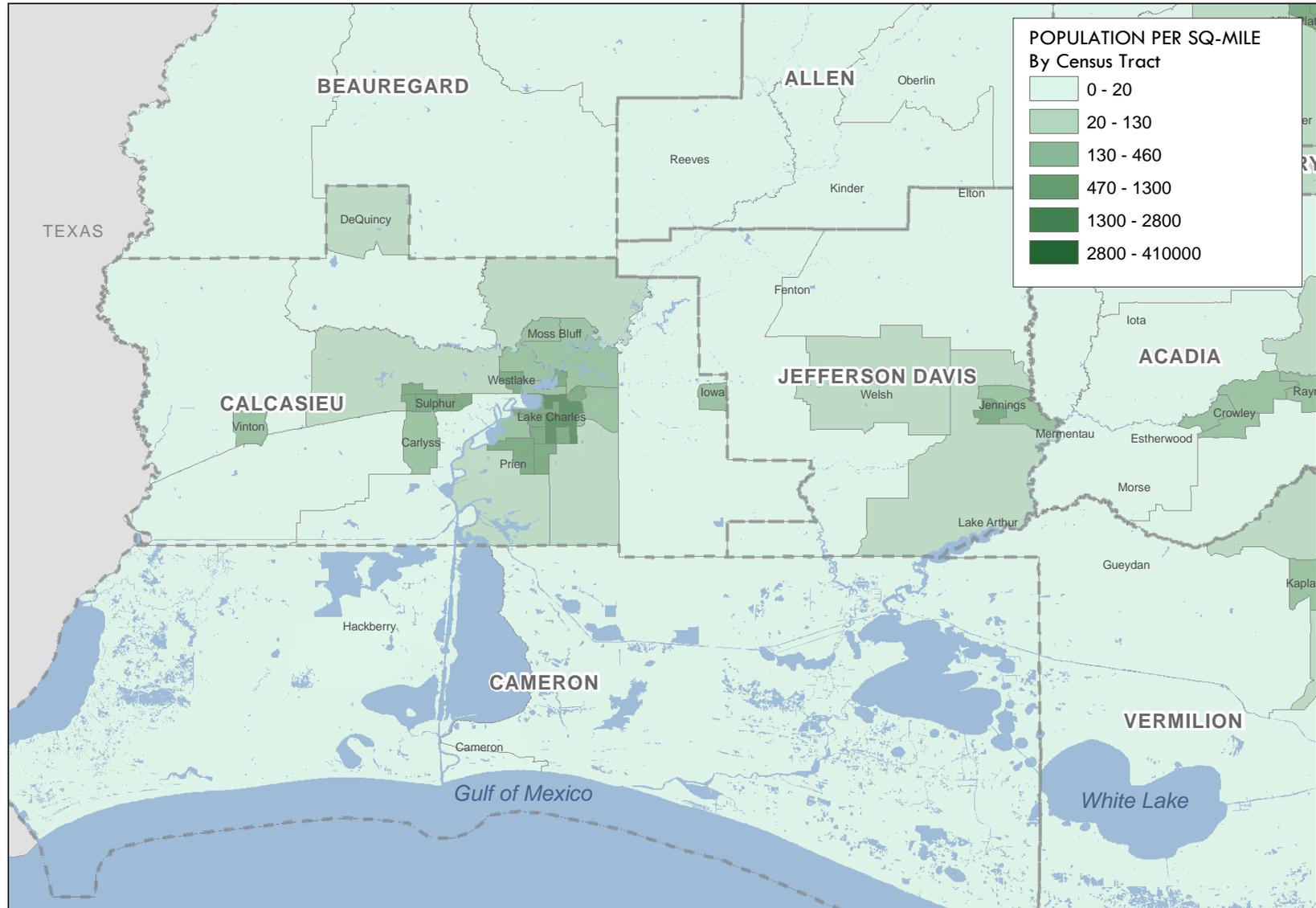


Figure 35: Housing Units Per Square Mile by Census Tract (US Census, 2000).



MEDIAN HOUSEHOLD INCOME

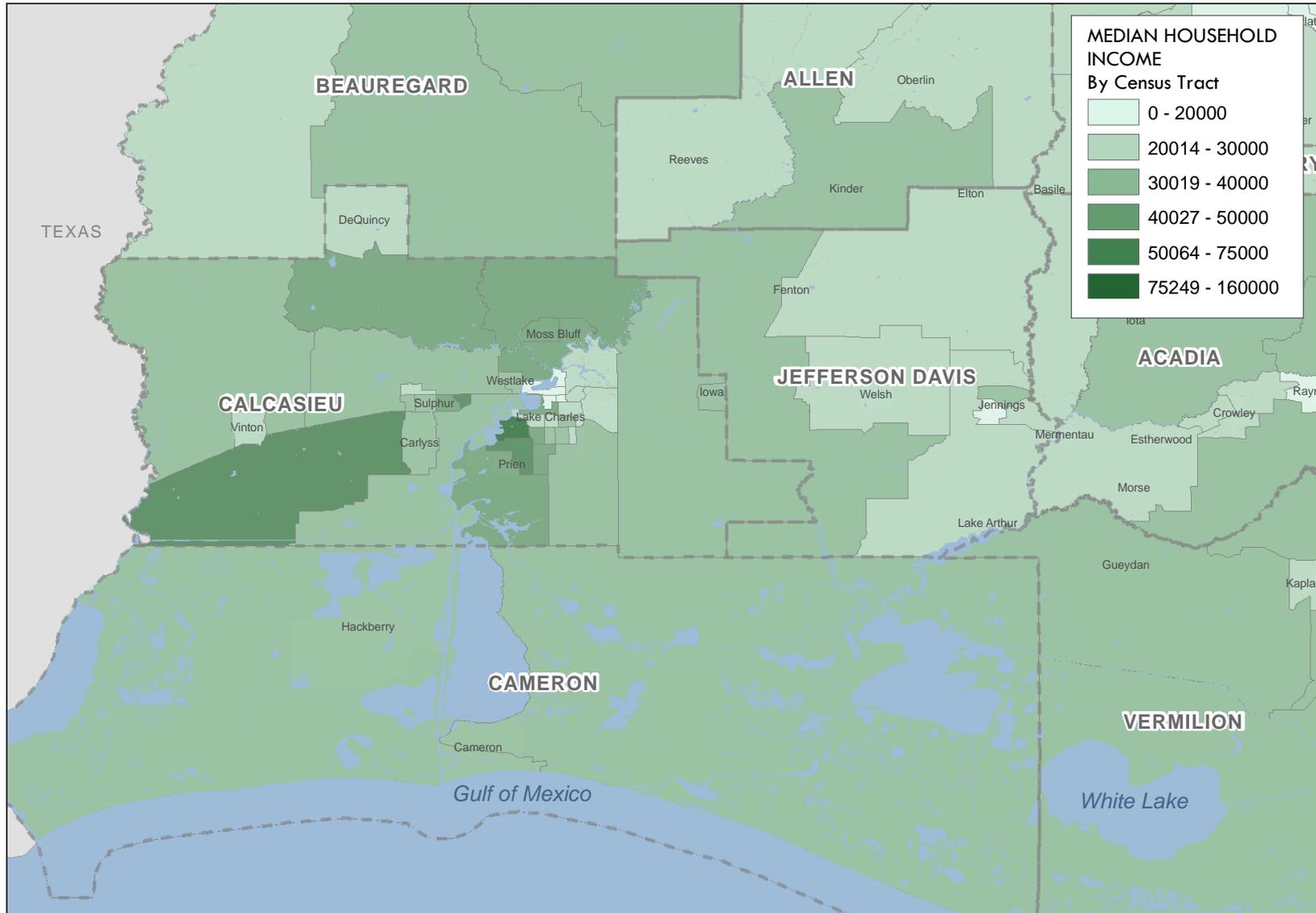


Figure 36 : Median Household Income by Census Tract (US Census, 2000).



POPULATION LIVING IN POVERTY

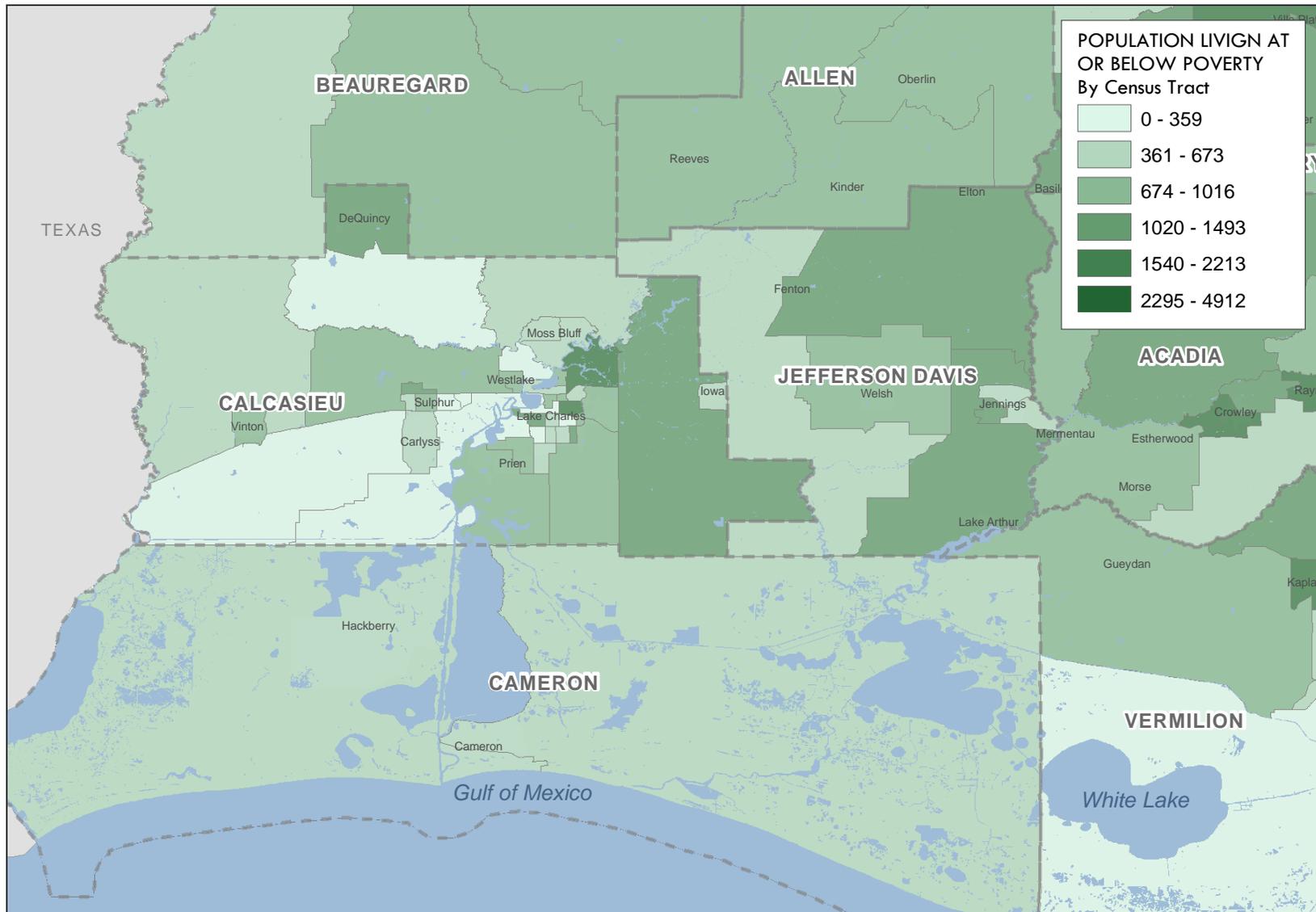


Figure 37: Population Living at or Below Poverty by Census Tract (US Census, 2000).



REFERENCES

FEMA, 2005. Federal Emergency Management Agency Disaster FEMA-1603-DR: Hurricane Katrina. On the Web: <http://www.fema.gov/news/event.fema?id=4808>

FEMA, 2005. Federal Emergency Management Agency Disaster FEMA-1607-DR: Hurricane Rita. On the Web: <http://www.fema.gov/news/event.fema?id=5025>

ISO, 2005. ISO's Property Claim Services. On the Web: <http://www.iso.com>

LDHH, 2005. Louisiana Department of Health and Hospitals, LA. On the Web: <http://www.dhh.louisiana.gov>.

LDNR, 2005. Louisiana Department of Natural Resources. Baton Rouge, LA. On the Web: <http://dnr.louisiana.gov>.

LDOE, 2005. Louisiana Department of Education. Baton Rouge, LA. On the Web: <http://doe.louisiana.gov>.

LDSS, 2005. Louisiana Department of Social Services. Baton Rouge, LA. On the Web: <http://dss.louisiana.gov>.

LSU – A HEF, 2005. Center for the Study of Public Health Impacts of Hurricanes: Experimental Storm Surge Flood Models. Louisiana State University, Baton Rouge, LA. On the Web: <http://hurricane.lsu.edu/floodprediction/>

LSU – CSI, 2005. Coastal Studies Institute. Louisiana State University, Baton Rouge, LA. <http://www.csi.lsu.edu>.

LSU – Earth Scan Lab, 2005. Earth Scan Lab, Coastal Studies Institute. Louisiana State University, Baton Rouge, LA. On the Web: <http://www.esl.lsu.edu>.

NOAA, 2005. Hurricane Katrina A Climatological Perspective – Preliminary Report. Technical Report 2005-01. NOAA National Climate Data Center, Asheville, NC.

US Census, 2000. United States Census Bureau Census 2000. On the Web: <http://www.census.gov>

US Census Bureau, 2005. County Business Patterns – US Census Economic Census, Census 2003. On the Web: <http://www.census.gov/epcd/cbp/view/cbpview.html>



Symbol of Hurricane Katrina's Aftermath: Messages Left for Rescue Workers – Photo: US Army Corps of Engineers (2005)



Levee Breach at the 17th Street Canal in New Orleans, LA – Photo: US Army Corps of Engineers (2005)