

# Recovering from Katrina

GIS-based asset and maintenance management system helps Gulfport weather the storm.

**S**ince 1900, more than three dozen major hurricanes have hammered the Gulf Coast, from Texas to the Florida panhandle. Located in the middle of this troublesome zone is Gulfport, MS. The 64-square mile city, which is bordered to the south by seven miles of Gulf Coast, was severely damaged in 1969 by Hurricane Camille and most recently, in 2005, by Hurricane Katrina. Until then, Camille was considered the benchmark for destructive hurricanes in Gulfport, but in its wake, Katrina became the new standard.

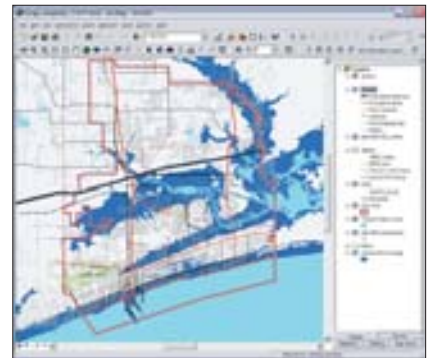
Hurricane Katrina hit Gulfport on the morning of Monday, August 29, 2005, with winds of up to 150 mph and a storm that left downtown streets under water, with surge levels of up to 30 ft. Nearly all structures within half a mile of the southern-facing Gulfport coastline were destroyed. The surge forced ships, casino barges, large dredging barges, and shipping containers inland, knocking down buildings and houses like a bowling ball knocks down pins.

A railroad line on an elevated berm that travels the length of the city and parallels the coastline from one-quarter to three-quarters of a mile inland served

as a makeshift levee for the storm surge and its dangerous drifting debris. Because of this elevated railroad berm, damage north of the railroad tracks was significantly less, but still catastrophic, due to the high winds, multiple tornadoes, flying debris, and pouring rain. Katrina hammered the Mississippi coastline for more than 17 hours, leaving Gulfport and its neighboring Gulf Coast cities in utter destruction. Some four years later, cleanup and rebuilding efforts are still taking place.

## A City Under Surge

Being prepared for a natural disaster the size of a category-five hurricane may sound like a paradox, but from an information services standpoint, Gulfport's public works department was as prepared as possible. The lengthy infrastructure recovery process that followed the storm was expedited by the city's GIS-based asset and work management system. The system helped to mitigate damages by generating crucial utility and street maps, locating assets under piles of debris more than ten ft high, and serving as a geospatial damage report depository. The latter was instrumental in gaining federal assistance and



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aid from the EPA and FEMA.

Gulfport's public works department actually became more prepared for such a storm in 2002. To improve its asset and work management system, the city implemented Azteca's Cityworks ([www.azteca.com](http://www.azteca.com)) software and supported it with ESRI's ArcGIS ([www.esri.com](http://www.esri.com)) technology. Cityworks is a GIS-centric software program used by public works, utilities, and other organizations tasked with managing capital assets and infrastructure. Utilizing the data stored in a GIS geodatabase, Cityworks gave Gulfport tools for creating a custom solution for man-



aging its public works infrastructure. With Cityworks in place, Gulfport began handling requests for service, conflict resolution, work orders, tests, and inspections in a GIS environment. The city and its 30,000 customers enjoyed the reliability and efficiency of the system, but no one could predict just how valuable the investment would turn out to be until after Hurricane Katrina had passed.

“When Katrina hit, it destroyed our infrastructure—water, sewer, storm drain—for about three to four blocks inland, all along our beachfront,” says Ron Smith, Gulfport’s assistant director of public works. “Almost everything south of the railroad tracks to the beach was destroyed. All the utilities that linked to all the businesses and homes in that area were completely wiped out. The storm wiped it all off the map, but it didn’t wipe it off our Cityworks.”

As soon as it was humanly possible, the city had people in the field repairing its severely damaged water and sewerage system. The recovery effort began in the middle of the storm and went around the clock amid chaos as workers labored to plug and cap holes and shut off valves to keep Gulfport’s water tanks from completely draining. Much of the damaged lines were underwater or beneath rubble and debris, making their exact location difficult to pinpoint and access. The city’s normal water pressure, 60 psi, was down as low as 25 psi for a week after the storm hit landfall. In addition to its water system, debris had clogged and crippled the city’s storm drain and sewerage system, which only intensified its flooding problem. “You couldn’t have packed concrete into our storm drains any tighter,” says Smith.

## GIS to the Rescue

Five days after the storm had passed, the Cityworks server, which had been taken offline and stored in a secure area as Katrina approached, was back up and running. “We immediately started entering and documenting all the waterline breaks, plugs, and caps into Cityworks,” says Smith. “We were also very busy tracking, mapping, and documenting the damage done after the storm.”

Not all the destruction in Gulfport was done by Katrina. Before Cityworks was rebooted, the city was unable to provide cleanup crews and contractors with accurate locations of its assets. This became a big problem because contractors were frequently destroying waterlines, valves, gas meters, and fire hydrants with the bulldozers and excavators used for the cleanup effort. Each time a waterline or fire hydrant was broken, water pressure would once again drop and public works crews would be dispatched to make the necessary repairs. The problem finally came to a head when the city was able to provide contractors with GIS-based printed maps marking the locations of fire hydrants, valves, and waterlines.

Crews worked around the clock, and within a week of the storm, most of Gulfport’s major roads were cleared and water pressure was restored to 90 percent of the city. The other ten percent of the city’s waterlines were damaged beyond repair. By the third week, the public works department was able to lift the “boil water” notice, and by the fourth week, the sewer system and traffic signals were restored to working order. As cleanup and rebuilding progressed, it was determined that nearly 15,000 traffic signs needed to be replaced. The GIS functionality of Cityworks helped public works justify sign replacement by identifying the attributes and original locations of the destroyed signs.

Replacing traffic signs was a small task compared to the estimated three million cubic yards of debris that needed clearing from Gulfport’s coastal area and the 50 miles of water, sewer, and drainage pipe that needed to be replaced. Early on, EPA had representatives in Gulfport to advise on environmental issues and concerns. Seven months into the recovery process, EPA brought in a team to analyze the entire impact the storm had on the city’s public works infrastructure.

“We used Cityworks to show the EPA all the areas in our lines that were destroyed and had water leaks and damage and where they had been fixed or needed repairs,” explains Smith. “When we looked at all the points on the map,

it looked like a shotgun blast. From our GIS maps, the EPA [representatives] determined that there was no way we could just repair it. They recommended that we replace all our lines near the beach.”

The plotting that the city did in cityworks provided EPA with a highly detailed geospatial platform for visualizing the entire scope of damages. From the city’s analysis, EPA made a recommendation to FEMA that Gulfport receive the funding to rebuild its water, sewer, and storm drain infrastructure near its coast. Such a project also required new sidewalks, curbs, guttering, and asphalt roadwork. With EPA’s recommendation, FEMA approved the multiyear project at an estimated overall cost of more than \$100 million. EPA’s endorsement came as a huge relief for the city because, prior to its analysis, Gulfport was having difficulty justifying the need for FEMA funds. “The EPA came in and, using our maps, communicated with FEMA to get the issue handled,” quips Smith.

Gulfport’s GIS also served the role of an expert witness, helping residents file insurance claims and receive federal funding for damage done to private property. The mapping functionality in its GIS was used to generate lists and identify the addresses that fell in the flooded areas.

As recovery and reconstruction continues some four years later, the GIS component of Cityworks is still paying off. Because accurate data exists regarding public works assets prior to Hurricane Katrina, Cityworks has helped show contractors and planners where new valves, hydrants, waterlines, and meters should be placed. Smith points out, however, “In construction, nothing ever goes exactly the way that you want it to go. Something always needs to be rerouted or redesigned, and when that happens, its new location, size, and material type is getting plotted in Cityworks.”

As of summer 2009, completion of Gulfport’s public works infrastructure repairs is expected by fall 2011, more than six years after Hurricane Katrina made its permanent imprint on the city and the minds of its citizens. 