

Several hurricanes struck the gulf area and resulted in severe casualty and property damage. One of the major defenses is to maintain and coordinate the pump operations during a critical 48 hour period (or over 4 high tides). The Steering Committee of the Center for Risk Management (hereafter the "Committee") is conducting an analysis for the pump stations in the gulf coast area to help better prepare for future hurricanes.

Pumps may or may not fail during a hurricane. If they fail, flood waters begin to rise too quickly which leads to catastrophic damage to homes and businesses in the area and severe loss of life. Pumps can fail for a variety of reasons during a hurricane. The four currently tracked by the Committee are the following:

1. Flood – overflow or accumulation of an expanse of water that submerges the pump station.
2. Motor – mechanical failure of the pump motor.
3. Surge – onshore gush of water usually associated with levee or structural failure.
4. Jammed – accumulation of trash or landslide materials which leads to water not getting to the pump.

For further information on how New Orleans specifically has adjusted since hurricane Katrina with the upgrades of such pumps please see the following article from the Wall Street Journal: <https://www.wsj.com/articles/how-new-orleans-fortified-itself-against-water-11562981176>

The data set **hurricane** contains 770 observations and 59 variables.

All of the pumps have a reason for failure in the variable **reason**:

- 0 – no failure
- 1 – flood failure
- 2 – motor failure
- 3 – surge failure

4 – jammed failure

There are 56 variables describing the pump's factors that potentially influence the survivability of the pump stations (not all pumps have each characteristic, but some characteristics are available through upgrade or maintenance).

<i>Name</i>	<i>Model Role</i>	<i>Description</i>
<i>AGE</i>	Input	Difference between the installation and the current date
<i>BACKUP</i>	Input	Redundant system used to protect the station from flooding when the main pump is not operating
<i>BRIDGECRANE</i>	Input	(UPGRADE AVAILABLE – \$100K) Allow vertical access to equipment and protecting materials
<i>ELEVATION</i>	Input	(UPGRADE AVAILABLE – \$50K) Elevation of the pump station that can be altered by 1 foot by maintenance
<i>GEAR</i>	Input	(MAINTANENCE AVAILABLE – \$10K/FT) Gear box used to make the pumps stronger and faster
<i>H1 – H48</i>	Input	(UPGRADE AVAILABLE – \$75K) Pumping status during a 48 hour emergency reported by pump

		stations – accuracy of pump status not
<i>HOUR</i>	Target	guaranteed to be error free Hour that the pump failed or was censored
<i>REASON</i>	Strata	Reason for pump failure (recorded as 0, 1, 2, 3, or 4)
<i>SERVO</i>	Input	Servomechanism is used to provide control of a desired operation through the Supervisory control and data acquisition (SCADA) system
<i>SLOPE</i>	Input	(UPGRADE AVAILABLE – \$150K) Surrounding ravine slope of the pump station
<i>SURVIVE</i>	Target	If the pump survived the hurricane without failure
<i>TRASHRACK</i>	Input	Used for protecting hydraulic structures against the inlet of debris, of vegetation, urban or industrial trash (UPGRADE AVAILABLE – \$80K)