REQUEST FOR PROPOSAL
RFP #: HK – F3.H1

TITLE: HURRICANE READINESS PROJECT – PHASE 1
CLOSING DATE AND TIME: NOVEMBER 5. 2020 @ 5:00 PM

Hurricane Readiness Project – Phase 1: HK – F3.H1

Purpose

By responding to this Request for Proposal (RFP), the Proposer agrees that s/he has read and understood all documents within this RFP package.

Submission Details

Responders to this RFP should supply:

- A business report **up to 5 pages** (not including cover page, table of contents, or any needed appendix), including any supporting plots and tables.
- The commented code used to produce the results in separate file(s).

The report should address **all points described in the "Objective" section** below.

The report should be returned in the following way:

- Electronic – Moodle submission on AA502 website

Background

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 project will be broken down into 3 phases:

- Phase 1 – Data Understanding Around Pumps and Failures
- Phase 2 – Upgrade Analysis for Predicted Flood Failures
- Phase 3 – Model Motor Failures in Pumps

Objective

The scope of services in this first phase includes the following:

- For this phase use **the entire** data set.
- Provide the following summary statistics for each of the types of pump station failure:
    - Percentage of pumps that survived the hurricane.
    - Percentage of pumps in each type of failure and average failure time for each failure type.
    - Statistical tests if these averages for each type of failure are different.
        - (HINT: This is just simple differences of averages between more than two groups. Think back to summer on how to do this.)
        - (HINT: Averages probably aren't the best way to summarize survival. This gives you a chance to practice how to **tactfully** (not in a teaching way) recommend to a client a different approach to compare "typical" failure time as well as provide that analysis.)
- Provide the following graphs as well as any meaningful insights from the graphs that you see:
        - Survival probability across time for all pumps together – not broken down by failure type.
        - Survival probability across time for pumps broken down by failure type overlaid into one graph.
        - Conditional failure probabilities across time for all pumps together – not broken down by failure type.
        - Conditional failure probabilities across time for pumps broken down by failure type overlaid into one graph.
        - (HINT: Some of these can be put into the appendix. Only include the ones in the main report you feel provide the meaningful insights.)
- Provide a statistical test if the major types of failure have similar survival probabilities across time.
    - Currently, the Committee groups failures into two groups – water-based (flood/surge) and mechanical (motor/jammed). Do you agree with this grouping? If not, please provide your own groupings (if any).
    - (HINT: Use the help of your plots here as well. Statistical tests can only compare curves as long as both curves exist. If one curve stops before another then the tests will stop there as well due to sample size.)

Data Provided

The following data set is provided for the proposal:

- 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).
- (HINT: If you are using R, use the `haven` package and the `read_sas()` function to open the `.sas7bdat` files.

Name	*Model Role*	*Description*
AGE	Input	Difference between the installation and the current date
BACKUP	Input	Redundant system used to protect the station from flooding when the main pump is not operating (UPGRADE AVAILABLE – $100K)
BRIDGECRANE	Input	Allow vertical access to equipment and protecting materials (UPGRADE AVAILABLE – $50K)
ELEVATION	Input	Elevation of the pump station that can be altered by 1 foot by maintenance (MAINTANENCE AVAILABLE – $10K/FT)
GEAR	Input	Gear box used to make the pumps stronger and faster (UPGRADE AVAILABLE – $75K)
H1 – H48	Input	Pumping status during a 48 hour emergency reported by pump stations – accuracy of pump status not guaranteed to be error free
HOUR	Target	Hour that the pump failed or was censored
REASON	Strata	Reason for pump failure (recorded as 0, 1, 2, 3, or 4)
SERVO	Input	Servomechanism is used to provide control of a desired operation through the Supervisory control and data acquisition (SCADA) system (UPGRADE AVAILABLE – $150K)
SLOPE	Input	Surrounding ravine slope of the pump station
SURVIVE	Target	If the pump survived the hurricane without failure
TRASHRACK	Input	Used for protecting hydraulic structures against the inlet of debris, of vegetation, urban or industrial trash (UPGRADE AVAILABLE – $80K)