Case Study

Toho Water Authority

Business Continuity: Post Storm, Lift Stations

Background

Established in October 2003 by a special act of the Florida legislature, Toho Water Authority (TWA) is the largest provider of water, wastewater, and reclaimed water services in Osceola County. TWA currently serves over 100,000 accounts in Kissimmee, Poinciana and unincorporated areas of Osceola County.

TWA owns and operates 13 water plants and 8 wastewater plants. With a 300+ person workforce, TWA treats and distributes approximately 37.5 million gallons of potable water and reclaims 27 million gallons of wastewater each day.

TWA is governed by a five-member board of supervisors responsible for approving all its operating policies, its $124 million operating budget, and nearly half a billion dollar five-year capital improvement plan. TWA was established for the sole purpose of providing regional stewardship over water resources in Osceola County.

Being in central Florida brings many advantages: climate, stability in customer composition, and a relatively young infrastructure to name a few; after all TWA is located adjacent to a world-renowned resort area. But as the saying goes, every silver lining has its cloud. The "clouds" associated with this case study include the following:

1. Due to the flat topology of TWA's service area, pumping stations (lift stations) are necessary to convey wastewater from its customers to one of the eight Water Reclamation Facilities for treatment. Approximately 430 lift stations are currently in service and as development continues this number increases. If these lift stations are not operating, then Sanitary Sewer Overflows (SSOs) will occur.
2. In the Northern Atlantic Ocean, a distinct hurricane season occurs from June 1 to November 30 and each year TWA prepares for the potential occurrence of hurricanes. If tropical storms or hurricanes occur then TWA must be ready to monitor, assess, and recover in ways that minimize the impacts of these storms on customers.

On September 11, 2017 Hurricane Irma impacted TWA's service area with sustained winds of 64 mph and gusts of more than 79 mph. This storm, although mild, was substantial enough to leave over 100 lift stations without power. Power restoration for some of these stations took over a week.

TWA has a documented Emergency Preparation Plan. This plan includes actions that are taken prior to, during, and after a storm event. This plan relies on stationary and mobile emergency power generators, a route list developed based on the lift station tributary configuration, SCADA to provide feedback on functioning locations, and a means of communication to provide updates on assessment and as-needed restoration.

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Case Study Description

Prior to the 2018 hurricane season, the Leadership Team requested that staff consider a storm scenario that would stress the current Emergency Preparation Plan. Staff was assigned a scenario that included a prolonged loss of power to more than 200 lift stations and rain levels significant enough to result in a 100-year flood. Staff was asked to develop a response plan that would minimize customer outages and impacts to the environment (SSOs).

The team tasked with developing a response plan followed the Utility Analysis & Improvement Methodology (UAIM) methodology to develop its recommendation. This methodology led the team from the existing process as defined in the Emergency Response Plan and implemented during Hurricane Irma, through analysis of what changes were necessary to address the magnitude of the scenario and its focus areas, and address shortcomings of the existing process. The following sections outline the steps that were completed.

Define and Measure

- Understand the team's objective as defined by the storm scenario laid out by the Leadership Team. This defined the requirements for the To-Be process model.
- Discuss the existing process as outlined in the Emergency Response Plan as well as its implementation during Hurricane Irma.
- Recognize that the outcome of this effort should be a defined, repeatable process that moves TWA's ability to respond to significant storm events forward.
- Represent the existing or As-Is process using Business Process Modeling & Notation (BPMN) as shown in Figure 1. This model represents the initial post-storm assessment that is performed, the communication of results to staff at the Emergency Command Center, and the transition to the business continuity portion of the process. Business continuity continues until all lift stations have been restored to operating condition.
    - Initial post-storm assessment relies on the tributary configuration of the lift stations as well as flow data to develop a routing list or the order in which the 430 lift stations will be visited and assessed. The Work Management System is used to document all maintenance requirements and a list is created for any lift stations without electrical power.
    - A status report is provided to staff at the Emergency Command Center and is used by staff to assess the significance of the event, communicate system condition, and reach out to the power companies serving these lift stations to notify and obtain estimated times for the restoration of power.
    - Business continuity consists of two primary activities: refueling stationary emergency power generators; and pumping down lift stations without alternate power. The lift station list is maintained through this process and provided to the Emergency Command Center.

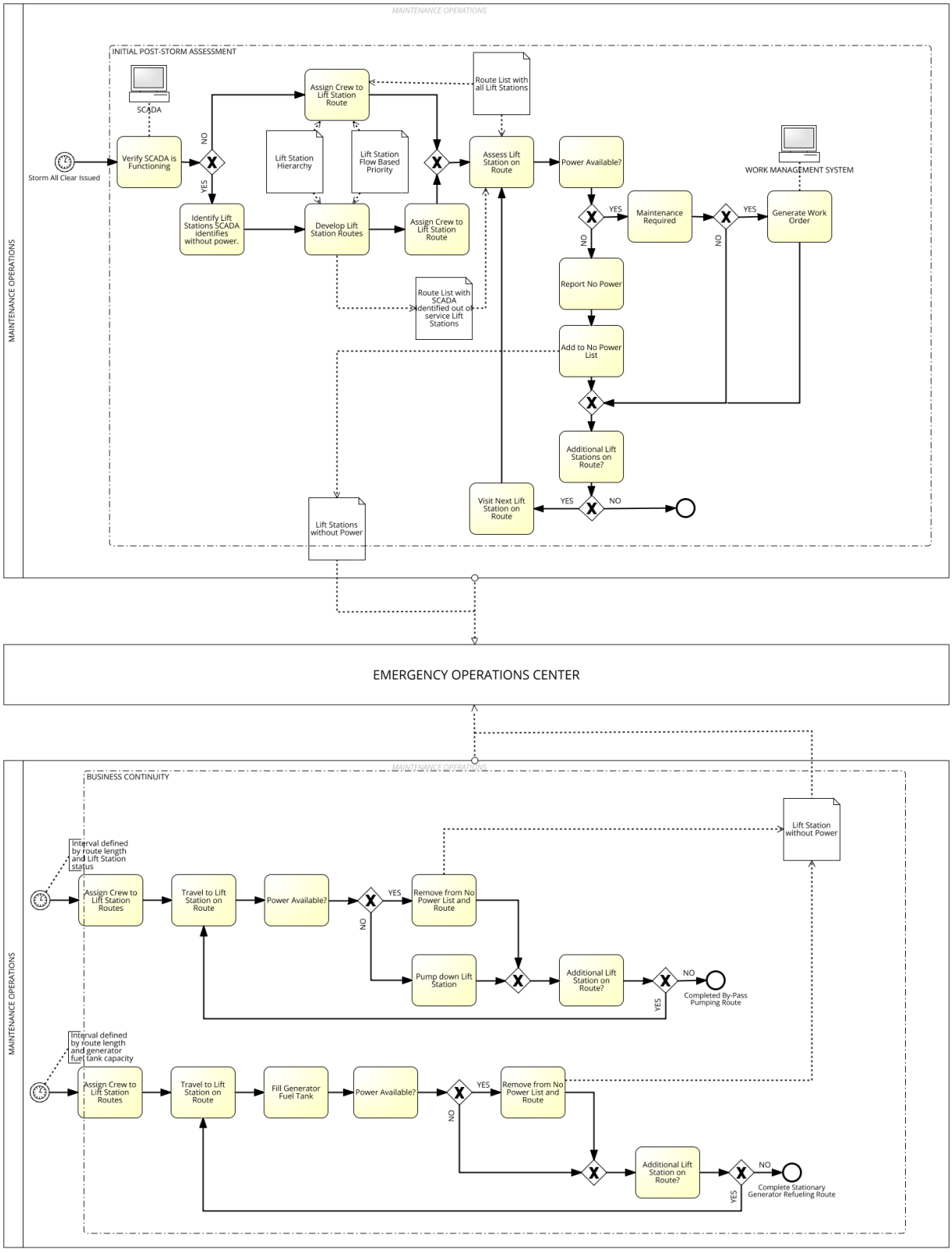

Figure 1. Lift Stations - Post Storm Continuity As-Is BPMN model

Analyze and Improve

Analysis of the As-Is process and its capability to meet the additional requirements of the storm scenario identified several areas requiring attention, including:

- Association of priority customers to a lift station;
- Determination of the number of customers served not only by a specific lift station, but also by the cumulative number of customers served by upstream locations;
- Spatial location of lift stations to environmentally sensitive lands;
- Power meter and account information for each of the lift stations; and
- Improved communication of lift station operational status and impact analysis.

The routing list previously used by staff for post-storm assessment and business continuity was based on flow and tributary configuration of the lift stations. Although this method approximated the "number of customers served," it failed to acknowledge the priority customer component as well as provide clear customer impact data to be used in decision making and communications. Staff polled the Emergency Management organizations in the counties served to obtain the priority customer list. This ensured data consistency when assessing impact to these customers. TWA's geographic information system (GIS) was used to spatially relate not only the priority customers to lift stations, but to also accurately total the number of customers served per station.

The current routing list also did not consider environmental impact should a lift station fail; therefore, proximity to environmentally sensitive lands was also determined using GIS. Each lift station was provided with a score to represent the level of risk to the surrounding sensitive lands.

Number of customers, priority customers, and proximity to environmentally sensitive lands were combined to provide a weighted score for each lift station. This information is provided to the GIS Team to produce a route list optimized using the calculated weighting factor.

The **Lift Station Restoration Planning Tool** was developed to encapsulate the findings described above. In addition to revising how route lists were developed, this tool also addressed the communication issues associated with this process. Communications were improved by providing three standard reports that could be emailed to the necessary parties. These standard reports include the following:

1. **Generated Optimized Routing List** – This is a report that is sent to the GIS staff to indicate the lift stations that need to be included in the routing list. It includes spatial location as well as the weighting score to drive the routing based on the GIS system's least cost path algorithm.
2. **Generate Status Report** – This is a standard outage report intended for internal communications to the Leadership Team and staff at the Emergency Command Centers.
3. **Generate Power Outage Report** – This report has been formatted to provide the power companies with the information that is required to record the power outage and provide an estimated restoration date/time.

These reports were created to address gaps in the completeness and consistency of communications.

The improvements identified above were included in the To-Be process, illustrated in Figure 2. The processes and components added to this model are shown in red.

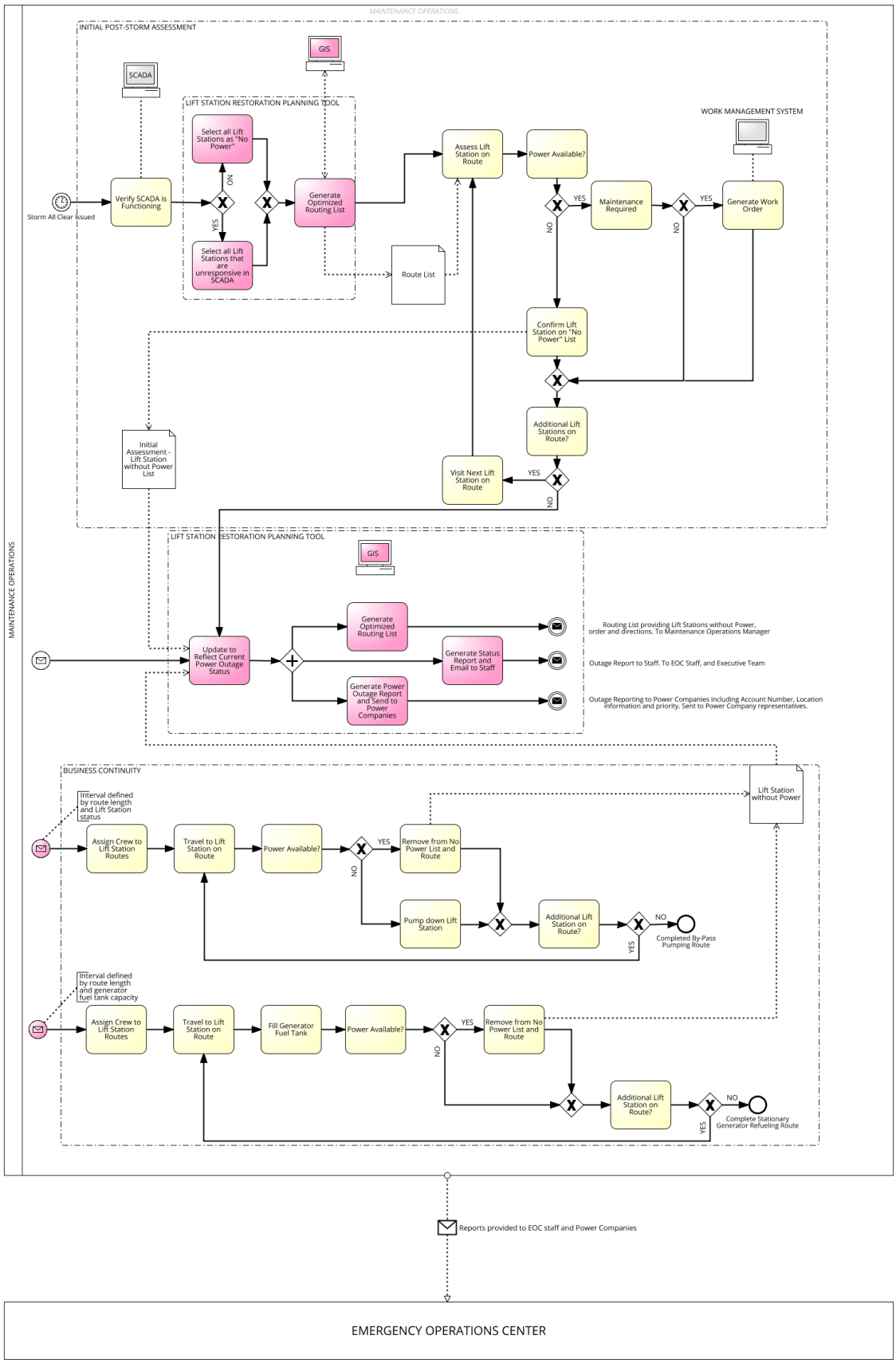

Figure 2. Lift Stations - Post Storm Continuity To-Be BPMN model

Improve & Execute

Prior to preparations for the 2019 hurricane season, staff plans to simulate the effectiveness of the changed process utilizing the actual impact of Hurricane Irma. The lift stations that lost power or required maintenance activities due to the storm will be entered into the Lift Station Restoration Planning Tool. The standard reports will be evaluated for effectiveness, completeness, and accuracy. The route list provided by the GIS Team will be compared against those currently in place to identify whether any further optimization can be achieved.

In summary, this effort achieved the following:

- Provided a standard prioritization method incorporating customer and environmental impact into the Post Storm Assessment and the Business Continuity routing lists.
- Enhanced the existing process to provide the ability to email standard reports to provide status and notification for those with a need to know.
- Addition of technology to provide:
    - Spatial relationships leveraged in GIS to associate wetland proximity, number of customers served and impacted by outage, and number of priority customers served for each lift station.
    - Hierarchical relationship modeled in the application to accumulate total impact attributed to upstream lift stations.
    - A single database was implemented to provide a central information source for current situations providing standard reports and direct email capabilities.
    - Integrated GIS routing capability to provide weighted route lists.

Successful Strategies

What is the right size for the team? Team composition is critically important and must include competent and willing participants. Team members immersed in the As-Is and demonstrating a desire to address shortcomings are ideal. If team members don't have "skin in the game," then learning curves and commitment may delay or derail the improvement effort.

Regardless of the size of the team, it is also possible that interested parties will find themselves outside of the team. To address this, it is important to put in place a communication plan that:

- Identifies processes being evaluated,
- Provides a status of team progress, and
- Publishes exhibits or end products (these should also include interim products that provide opportunities for outside feedback).

Lessons Learned & Ongoing Challenges

TWA is fortunate to have a service area that is still growing through new development. This growth presents the challenge of adding additional lift stations. It is important that the process to onboard new lift stations be provided to staff in order to update the Lift Station Restoration Planning Tool.

Not all staff members will be familiar with Business Process Modeling (BPM). It is important not to let BPM get in the way of process innovation or improvement. It should be introduced slowly as a documentation tool, then as a modelling tool, and finally as a simulation tool.