# Development of Real-Time Drainage Monitoring System & SWMM Model for the UNO Lakefront Campus

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**Abstract:**
The vision for this project is to develop a cost-effective, real-time stormwater management modeling system that can be scaled and implemented in larger urban environments. Using the University of New Orleans (UNO) Lakefront Campus drainage system as a case study, our team's goal is to develop a Storm Water Management Model (SWMM) that integrates real-time NEXRAD rainfall data to drive the model, remotely monitors stormwater flows, and forecasts potential stormwater flooding. Development of this system will allow investigators to assess the condition of the stormwater drainage systems, identify the source of local flooding problems, and design and analyze the efficiency of low impact development (LID) alternative solutions.

This project is an interdisciplinary effort between the Civil Engineering and Electrical Engineering departments at the University of New Orleans. The poster summarizes the project development plan for the UNO Campus SWMM model. Our work on the project was initiated in November 2019, beginning with the design and construction of the sensor network to collect storm event flows in the drainage system. We have begun collection of data for model development and plan to begin this phase of the work in Summer 2020 followed by the integration of NEXRAD data with the system.

## 1. Objectives

- Develop and calibrate cost-effective wireless sensor network for monitoring pipe flows throughout the study area
- Develop automated integration of NEXRAD rainfall data with the UNO Campus SWMM Model
- Develop and calibrate the SWMM model for the UNO Lakefront campus study area.

## 2. Research Methodology

The following figure represents the proposed Real-Time Drainage Monitoring System and integration of NEXRAD and GIS spatial data to UNO Campus SWMM Model.

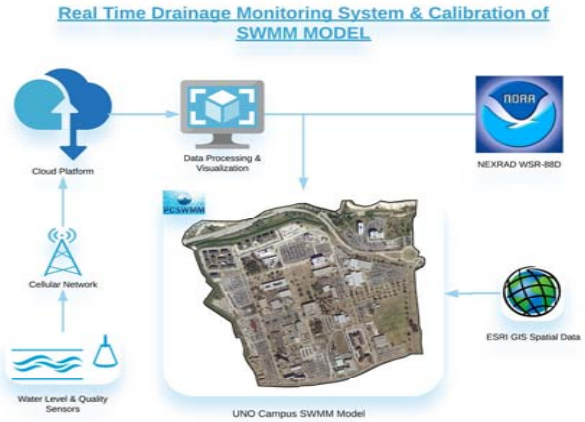


*Figure 1. UNO Campus Stormwater Model Diagram*

### 2.1 Working Principle of the Real-Time Drainage Monitoring System:

The sensor nodes will be deployed at street manhole locations in areas prone to flooding during severe rainfall events (See Fig. 2). The sensor nodes capture the water level underneath the manhole and send the data to the "back-end" cloud server where it is stored. The collected data is processed and directed to the "front-end" where the results are visualized and displayed on the website

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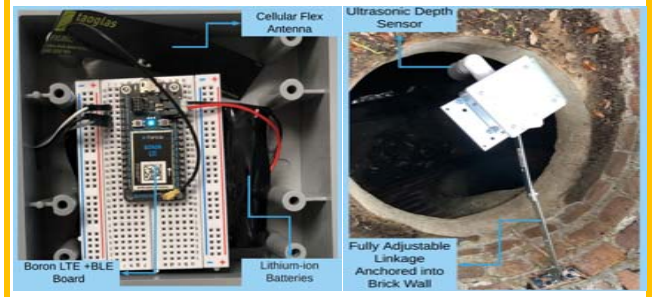


*Figure 2. Installation of Sensor Nodes*

Each sensor node contains a microcontroller, an ultrasonic distance sensor, a battery pack, a water-resistant container, and an adjustable linkage. (See Fig. 2)

The battery pack is made from four lithium-ion batteries. Based on preliminary data, we estimate that the battery will last 3 weeks on a single charge. With software optimization the battery may last even longer.

Because the sensors are measuring water level in flood prone areas, it is important for them to be able to survive a severe flooding event. The water-resistant container helps achieve this desired result.

Since each manhole is different, adjustable linkages are used to mount the sensor nodes. The linkages allow the installer to position the sensor node in the optimal position for taking measurements.

### SWMM Data Development Requirements:

The EPA Storm Water Management Model (SWMM) is a versatile tool used extensively for urban drainage design and simulation.

| Hydrologic Characteristics | Infiltration Parameters | Sub-catchment characteristics | |
|---|---|---|---|
| Land use | Hydraulic conductivity | Area | |
| Soil type | Initial moisture deficit | % Imperviousness | |
| Streets | Suction | % Directly Connected Impervious Area | |
| Storm sewer network | | | |
| **Depression Storage** | **Rainfall Data** | Width | Slope |

*Figure 3. UNO Drainage Network*

## 3. Expected Results

- Observed flows for SWMM calibration (Fig. 4)
- Real-time observed water levels early warning
- Calibrated & Validated UNO Campus SWMM model
- Integration of NEXRAD rainfall data
- Simulated scenarios for the design of low impact
- Future development practices

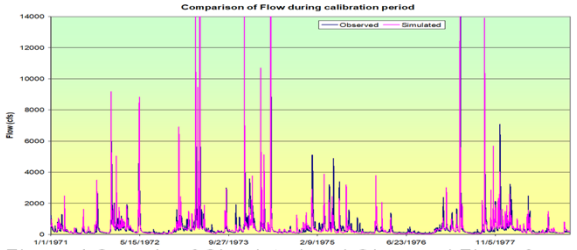


*Figure 4.Sample of Simulated and Observed Flows for the Tickfaw River watershed for calibration.*

**References:**

Esri-GIS (1969). [Esri-GIS Logo] Retrieved from https://www.esri.com/en-us/home
PCSWMM (n.d.) [PCSWMM Logo] Retrieved from https://www.pcswmm.com/