Water Network Tool for Resilience Tutorials

The **Water Network Tool for Resilience (WNTR)** is an open-source Python package designed to simulate and analyze resilience of water distribution systems. WNTR can be used to estimate infrastructure damage, evaluate preparedness strategies, prioritize response actions, and identify worse case scenarios and best practices for maintenance and operations.

WNTR comes with Jupyter notebooks which provide interactive tutorials of key features of the software and analysis options. Instructions for setting up Jupyter are available in the WNTR documentation. The WNTR Jupyter notebooks cover the following uses:

Getting started: Create a hydraulic model of a drinking water distribution system from an EPANET input (INP) file, simulate hydraulics, and plot simulation results

WNTR basics: Use additional WNTR capabilities to compute resilience metrics, define fragility curves, skeletonize models, and integrate geographic information system (GIS) data

Model development: Create a water distribution system model from limited geospatial data (Figure 1)

Pipe break analysis: Run multiple hydraulic simulations to compute the impact of pipe breaks/closures on system pressure

Pipe segments analysis: Define isolation valves and pipe segments, then run multiple hydraulic simulations to compute the impact of segment closures on system pressure

Fire flow analysis: Run multiple hydraulic simulations with and without fire fighting flow demand at multiple fire hydrant nodes

Earthquake analysis: Compute water service availability and population impacted by low pressure conditions from earthquake damage

Saltwater intrusion analysis: Use storm surge geospatial data to estimate salt intrusion to a system after a hurricane and evaluate flushing response to remove contamination (Figure 2)

Landslide analysis: Use landslide geospatial data to quantify potential water service disruptions from pipes damaged in a landslide (Figure 3)

Multispecies water quality analysis: Run a chlorine decay analysis using advanced EPANET-MSX features

For more information visit, https://usepa.github.io/WNTR/

Figure 1: Model development. WNTR provides functions to create models from imperfect data

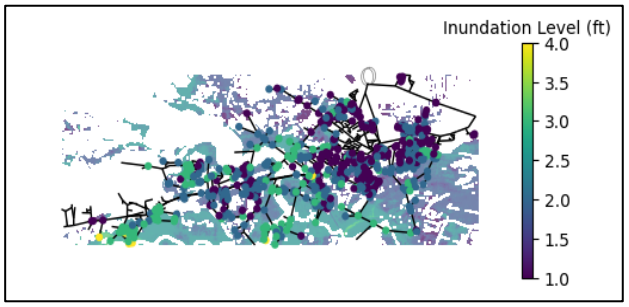

Figure 2: Saltwater intrusion. Storm surge data layers are intersected with the junctions of a model to develop saltwater intrusion scenarios

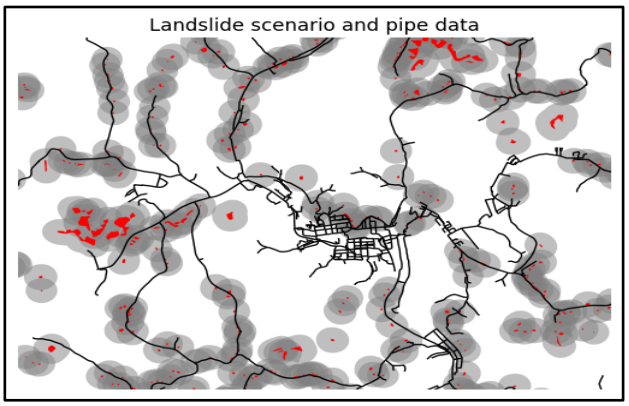

Figure 3: Landslide analysis. Landslide data are intersected with nearby pipes to determine potential system damage for each scenario