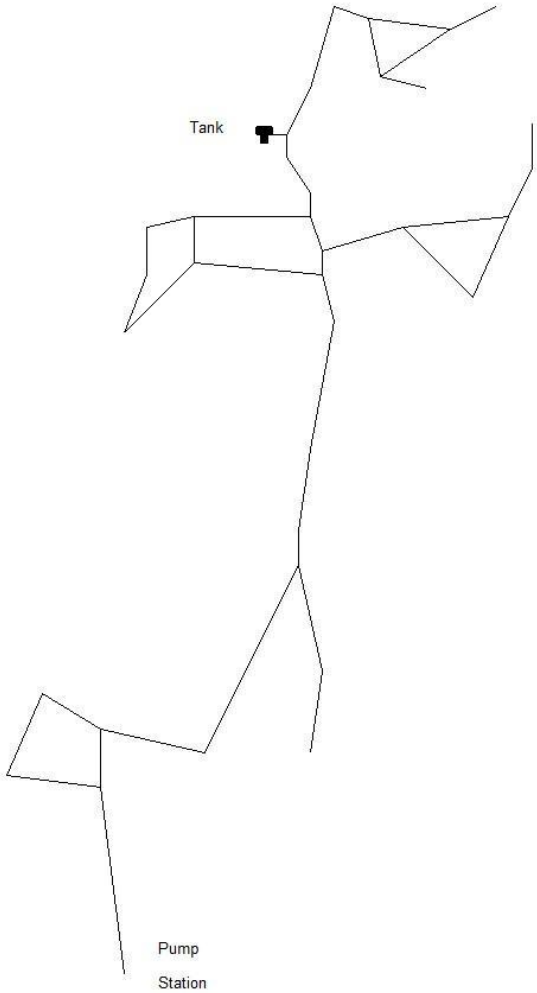
SYSTEM ID: EPANET Net 2

NARRATIVE DESCRIPTION

The EPANET Net 2 system is based on the Cherry Hill/Brushy Plains area. The system has a daily demand of 0.90 MGD. The system was originally used in a chlorine decay study by Rossman et al. (1994) as an example for EPANET. A general schematic of the system is shown below. The system receives water from the SCCRWA's Saltonstall treatment plant. Water is pumped in from the Cherry Hill pump station. There is also storage at the end of the service area at the Brushy Plains Tank. The system covers an area of 2.0 square miles and contains both 8-inch and 12-inch mains.

NETWORK SCHEMATIC:



HISTORY OF THE NETWORK FILE

The network was first published by Rossman et al (1994). Since then, it has been used as a training tool for those using EPANET and its expansions. The original citation and abstract are listed below.

ORIGINAL REFERENCE:

Rossman, Lewis A., Robert M. Clark, and Walter M. Grayman. "Modeling chlorine residuals in drinking-water distribution systems." Journal of environmental engineering 120.4 (1994): 803-820.

ABSTRACT: A mass transfer-based model is developed for predicting chlorine decay in drinking-water distribution networks. The model considers first-order reactions of chlorine to occur both in the bulk flow and at the pipe wall. The overall rate of the wall reaction is a function of the rate of mass transfer of chlorine to the wall and is therefore dependent on pipe geometry and flow regime. The model can thus explain field observations that show higher chlorine decay rates associated with smaller pipe sizes and higher flow velocities. It has been incorporated into a computer program called EPANET that can perform dynamic water-quality simulations on complex pipe networks. The model is applied to chlorine measurements taken at nine locations over 53 h from a portion of the South Central Connecticut Regional Water Authority's service area. Good agreement with observed chlorine levels is obtained at locations where the hydraulics are well characterized. The model should prove to be a valuable tool for managing chlorine-disinfection practices in drinking-water distribution systems.

ADDITIONAL REFERENCES:

Rossman, L, L A. EPANET USERS MANUAL. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-94/057 (NTIS PB94-165610), 1994.

ADDITIONAL CITATIONS:

The original publication of Rossman et. al. (1994) and by inference the EPANET Net 2 system have been cited by 546 additional authors. These may be accessed by moving your cursor over the following link while simultaneously depressing the CTRL key on your keyboard: 546 Citations

AVAILABLE INFORMATION

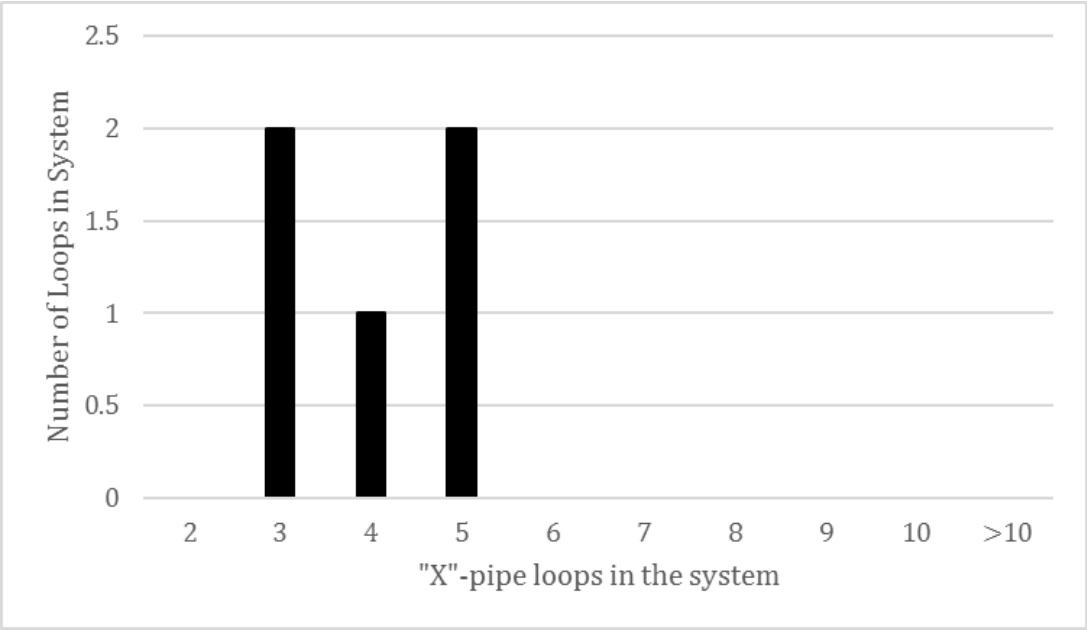
Physical attributes	Yes
Schematic diagram	Yes
Network geometry data	Yes
GIS data file	No
Background map	No
Elevation data	Yes
Pipe data	Yes
Pipe material	No
Pipe age	No
Pipe pressure class	No
Nominal or actual diameters	Actual
Pump data	NA
Useful horsepower	
Pump operating curves	
Tank data	Yes
Elevation data	Yes
Stage storage curves	
Water quality information	
Valve data	NA
PRV/FCV data	
Isolation valve data	
Hydrant data	
Demand data	Yes
Total system demand	Yes
Nodal demand data	Yes
Temporal data demands	Yes
System leakage	No
Hydraulic data	No
Hydraulically calibrated model	
Field hydraulic calibration data	
Water quality data	No
Disinfection method	
Chlorine residual data	
Booster station data	
Fluoride/Chloride field data	
Water quality calibrated model	
Operational data	No
SCADA datasets	
Operational rules	

SYSTEM CLASSIFICATION:

PIPE/LOOP HISTOGRAM:

Hoagland et al. (2015) designed a network classification algorithm for use in classifying water distribution systems as either “branched,” “looped,” or “gridded” based on the observed frequency of network loops with different numbers of distinct pipe segments. The frequency distribution for the Net 2 system is provided below. Using this information, Hoagland et al., classified this system as being a BRANCHED system.

# Total Pipes:	40
# Branch Pipes:	21
Ratio (Branch Pipes / Total Pipes):	0.53



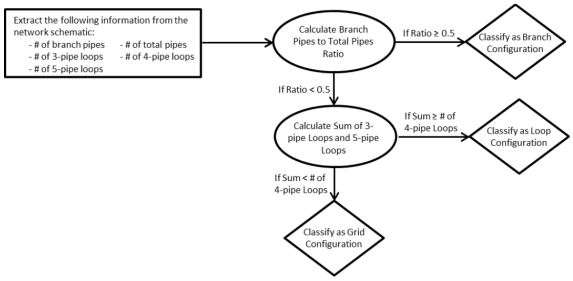


Figure 3.4. Classification Algorithm (Hoagland et al., 2015)

Hoagland, Steven & Schal, Stacey & Ormsbee, Lindell & Bryson, Lindsey. (2015). Classification of Water Distribution Systems for Research Applications. 696-702. 10.1061/9780784479162.064.

NETWORK STRUCTURE METRICS:

Building on the work of Hoagland et al., (2015), Hwang & Lansey (2017) created an expanded classification system that allows for further classification of a system as being either a transmission or distribution branched, looped, gridded, or hybrid system. Their algorithm streamlines the classification system by removing unnecessary nodes that do not contribute to the structure of the system while still retaining their use as intermediate points for demand data entry. A full description of the algorithm can be found in the cited reference.

Application of the Hwang and Lansey classification algorithm to the system yields the following statics and associated classification:

Parameter	**Value**
Edges	40
Pipes	40
Nodes	36
Average Diameter	10
Reduced Nodes	14
Reduced Edges	18
Branched Edges	8
Branched Index	0.3
Meshed Connectedness	0.1
Reduced Meshed Connectedness	0.22
Link Density	0.1
Average Node Degree	2.2
Hwang & Lansey Classification	Distribution Dense-Grid

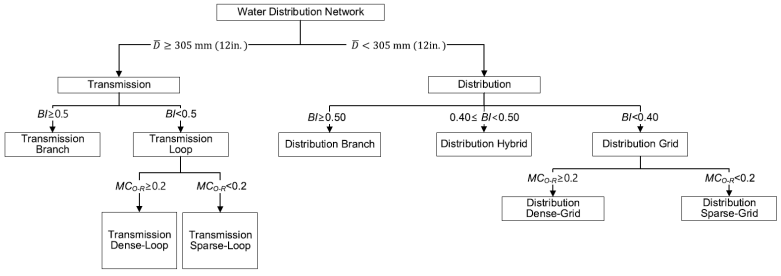


Figure 7. Water Distribution System Classification Flowchart (Hwang & Lansey, 2017)

Hwang H. & Lansey, K. (2015) “Water distribution system classification using system characteristics and graph theory metrics.” *Journal of water resource planning and management* 143(12) https://doi.org/10.1061/(ASCE)WR.1943-5452.0000850

DETAILED DATA SUMMARIES

PHYSICAL ASSETS:

Asset Type:	# of Assets
Master Meters	0
Tanks	1
Pumps	0
Water Sources	0

NETWORK CHARACTERISTICS:

# Total Pipes:	40
# Junctions	35
# Reservoirs	0
# Tanks	1
# Regulating Valves	Unknown
# Isolation Values	Unknown
# Hydrants	Unknown
Elevation Data	YES

PIPE DATA:

Diameter (in)	Length (ft)
8	18300
12	17700

PUMP DATA:

Pump Horsepower	NO
Pump Curves:	NO

DATA FILE ATTRIBUTES:

ATTRIBUTE		UNITS
Pipe Length & Diameter	X	Feet & inches
Pipe Age		
Node Elevation	X	Feet
Node Demand	X	GPM
Valves		
Hydrants		
Tank Levels		
Tank Volume		
PRVs		
WTP		
WTP Capacity		
Pump Data		