

SYSTEM ID: NJ1

NARRATIVE DESCRIPTION

The NJ1 system is based on the Dover Township, NJ water distribution system. The system has an average demand of 7.7 MGD. The network was developed as part of an epidemiological study in the area by Maslia et al. (2000). A general schematic of the system is shown below. The system has eight tanks, twelve pumps, and 483 miles of pipe.

NETWORK SCHEMATIC:



HISTORY OF THE NETWORK FILE

The NJ1 system was originally used by Maslia et al. (2000) as part of an article “Using Water-Distribution System Modeling to Assist Epidemiologic Investigations” which was published in 2000 in the *Journal of Water Resources Planning & Management*. It reported on a study between 1979 and 1996 and explored the risk factors of environmental exposure for leukemia and nervous system cancers.

ORIGINAL REFERENCE:

Maslia, M.L., Sautner, J.B., Aral, M.M., Reyes, J.J., Abraham, J.E. and Williams, R.C., 2000. Using water-distribution system modeling to assist epidemiologic investigations. *Journal of Water Resources Planning and Management*, 126(4), pp.180-198.

ABSTRACT: An epidemiologic study of childhood leukemia and central nervous system cancers that occurred in the period 1979 through 1996 in Dover Township, N.J., is being conducted. Because groundwater contamination has been documented historically in public- and private-supply wells, there is the possibility of exposure through this pathway. The Dover Township area has been primarily served by a public water supply that relies solely on groundwater; therefore, a protocol has been developed for using a water-distribution model such as EPANET as a tool to assist the exposure assessment component of epidemiologic investigation. The model is being used to investigate the question of human exposure to groundwater contaminants. Because of the unavailability of historical data, the model was calibrated to the present-day (1998) water-distribution system characteristics. Pressure data were gathered simultaneously at 25 hydrants throughout the distribution system using continuous recording pressure data loggers during 48 h tests in March and August 1998. Data for storage tank water levels, system demand, and pump and well status (on/off) were also obtained. Field data gathering procedures, calibration results, and water-quality simulation using a naturally occurring element (barium), as well as an analysis indicating the percent of water originating from points of entry to the water-distribution system for 1998 conditions, are presented.

ADDITIONAL CITATIONS:

The original publication of Maslia et al. (2000) and by inference the NJ1 system has been cited by 52 additional authors. These may be accessed by moving your cursor over the following link while simultaneously depressing the CTRL key on your keyboard: [52 Citations](#).

AVAILABLE INFORMATION

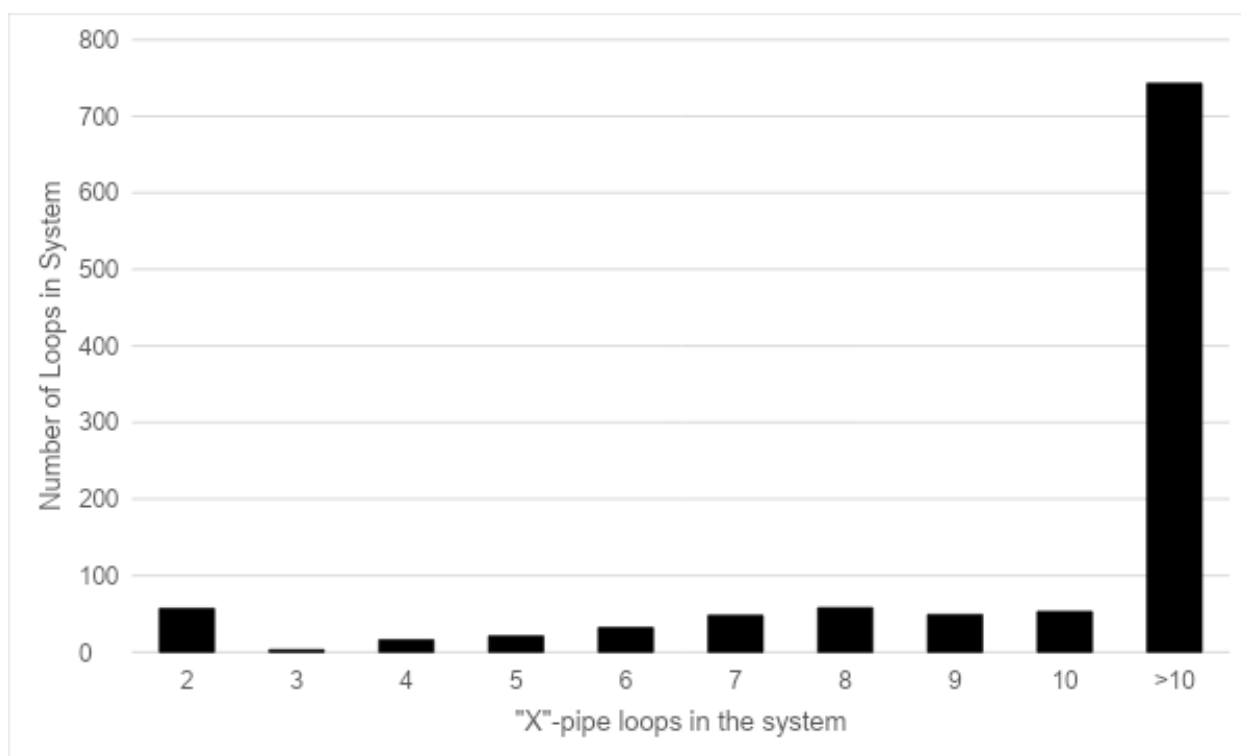
Physical attributes	Yes
Schematic diagram	Yes
Network geometry data	Yes
GIS data file	No
Background map	No
Elevation data	Yes
Pipe data	Yes
<i>Pipe material</i>	Yes
<i>Pipe age</i>	Yes
<i>Pipe pressure class</i>	No
<i>Nominal or actual diameters</i>	Nominal
Pump data	Yes
<i>Useful horsepower</i>	No
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

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 NJ1 system is provided below. Using this information, Hoagland et al., classified this system as being a LOOPED system.

# Total Pipes:	16090
# Branch Pipes:	4677
Ratio (Branch Pipes / Total Pipes):	0.29



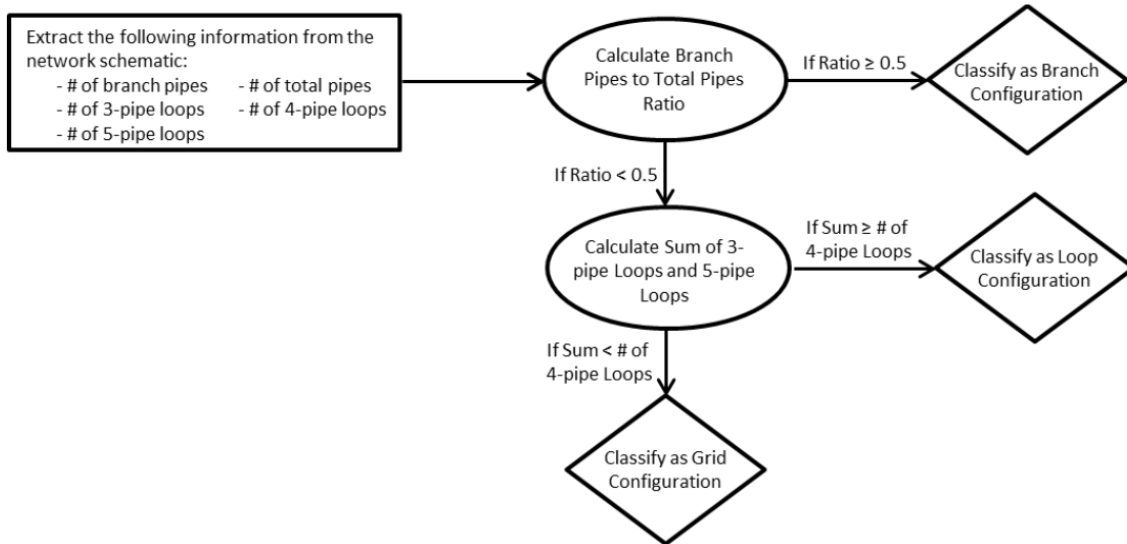


Figure 3.4. Classification Algorithm (Hoagland et al., 2015)

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	16078
Pipes	16066
Nodes	14999
Average Diameter	8.1
Reduced Nodes	10708
Reduced Edges	11787
Branched Edges	4291
Branched Index	0.3
Meshed Connectedness	0.1
Reduced Meshed Connectedness	0.16
Link Density	0
Average Node Degree	2.2
Hwang & Lansey Classification	Distribution Sparse-Grid

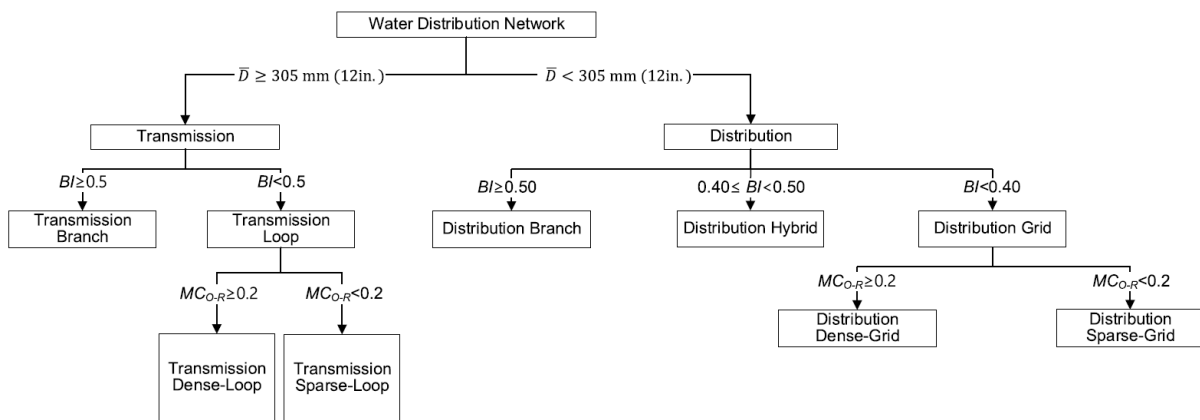


Figure 7. Water Distribution System Classification Flowchart (Hwang & Lansey, 2017)

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](https://doi.org/10.1061/(ASCE)WR.1943-5452.0000850)

DETAILED DATA SUMMARIES

PHYSICAL ASSETS:

Asset Type:	# of Assets
Master Meters	0
Tanks	8
Pumps	12
Water Sources	0

NETWORK CHARACTERISTICS:

# Total Pipes:	16090
# Junctions	14991
# Reservoirs	0
# Tanks	8
# Regulating Valves	0
# Isolation Values	Unknown
# Hydrants	Unknown
Elevation Data	YES

PIPE DATA:

Diameter (in)	Length (ft)
2	61,293
4	76,741
6	807,995
8	938,214
10	10,206
12	622,171
16	32,842

PUMP DATA:

Pump Horsepower	NO
Pump Curves:	YES

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	X	Feet
Tank Volume		
PRVs		
WTP		
WTP Capacity		
Pump Data		