Improving the Pohnpei Island Water Distribution System Using Hydraulic Modeling and Geographic Information Systems

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ABSTRACT

Water hours and low delivery pressure have long been a part of the daily lives of the people in the Micronesian Islands. The problems with delivery of adequate supplies of water to the customers at appropriate pressure have become more and more of a challenge to public utilities throughout these islands. One of the causes for these problems is the high growth rates occurring in the island centers. This is particularly true on the island of Pohnpei in Pohnpei State, Federated States of Micronesia (FSM).

Over the years the Pohnpei Public Utility Commission's (PUC) water distribution system has grown without adequate documentation as to the extent and size of supply and transmission resources and where these resources are located. In 1987 investigators from the University of Guam Water and Environmental Research Institute (WERI) developed a partial model of the water distribution system using the Kentucky Pipe Network Model. Since then many changes and additions have been made to the delivery system.

This project resulted in the development of a set of management and engineering tools, which the planning, operation, and engineering staffs at PUC can use to better plan, operate, and maintain the water delivery system. These tools will assist PUC develop a water system that can deliver adequate water to all the households in Pohnpei on a continuous basis with sufficient pressure.

The first management tool that was developed was a computerized water system network model. This model was developed using information gathered from previous studies and additional information documenting changes and additions to the system since the original data was gathered. Other information such as system pressure and flows was gathered as part of the calibration process for this model. The model will be available to the PUC engineering and planning staffs to help in pinpointing problems areas and to explore operational options for improving system performance. The model was developed using the free water distribution modeling program "EPANET".

The second tool developed was a Geographic Information System (GIS) based inventory of system resources. This GIS system describes the water sources available, the well systems in place, water storage facilities and major transmission lines in the distribution system. The GIS system consists of maps showing the location of the various components of the water transmission system and ancillary equipment. The GIS will be available to managers and engineers so that they can explore various scenarios for long range planning for system maintenance and improvements. The GIS will also be available to operations personnel so that they can maximize their resources for responding to emergencies, planning repairs, and purchasing the inventory of spare parts needed by the utility.

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INTRODUCTION

Water hours and low delivery pressure have long been a part of the daily lives of the people in the Micronesian Islands. The problems with delivery of adequate supplies of water to the customers at appropriate pressure have become more and more of a challenge to public utilities throughout these islands. One of the causes for these problems is the high growth rates occurring in the island centers. This is particularly true on the island of Pohnpei in Pohnpei State, Federated States of Micronesia (FSM).

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The EPANET program, user manuals and Pohnpei water system input files, and the GIS data are available from WERI.

STUDY AREA

As shown in Figure 1, the Island of Pohnpei is located in the Western Pacific approximately 2300 miles south east of the Island of Japan. Pohnpei is an Island located in Pohnpei State in the Federated States of Micronesia (FSM). The more detailed map in Figure 2 shows the village boundaries and hydraulic model water delivery zones for the island. The land area of the island is approximately 133.2 square miles. Rainfall on the island averages 120 inches per year at the airport with much higher amounts in the interior mountains. (Lander, 2004)

As of the year 2010, the population of the island was approximately 34,574 (2010 census). The island is served by the Pohnpei Public Utility Corporation (PUC). The PUC provides both water and power to the island.

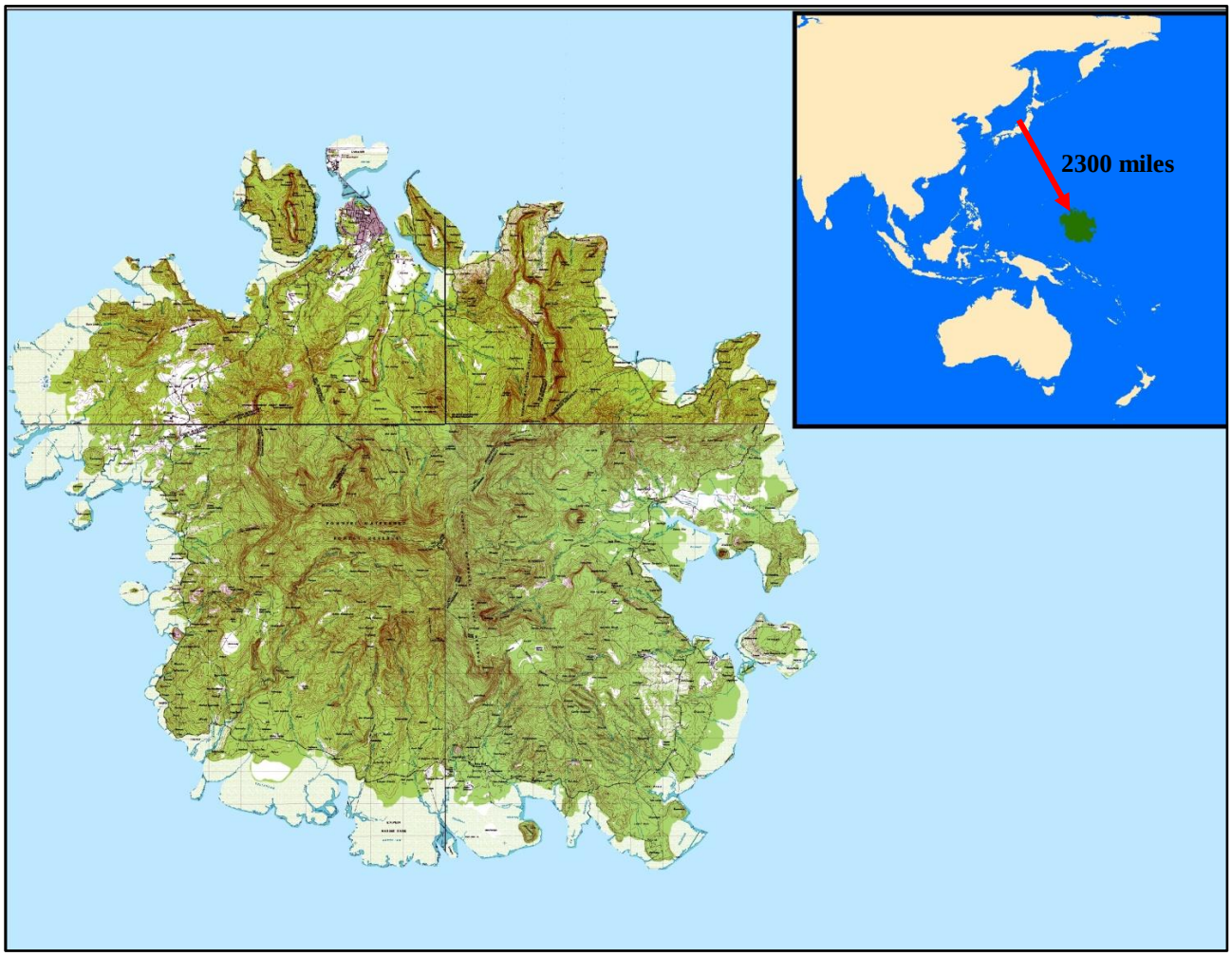


Figure 1 Pohnpei Island, Pohnpei State, FSM location map

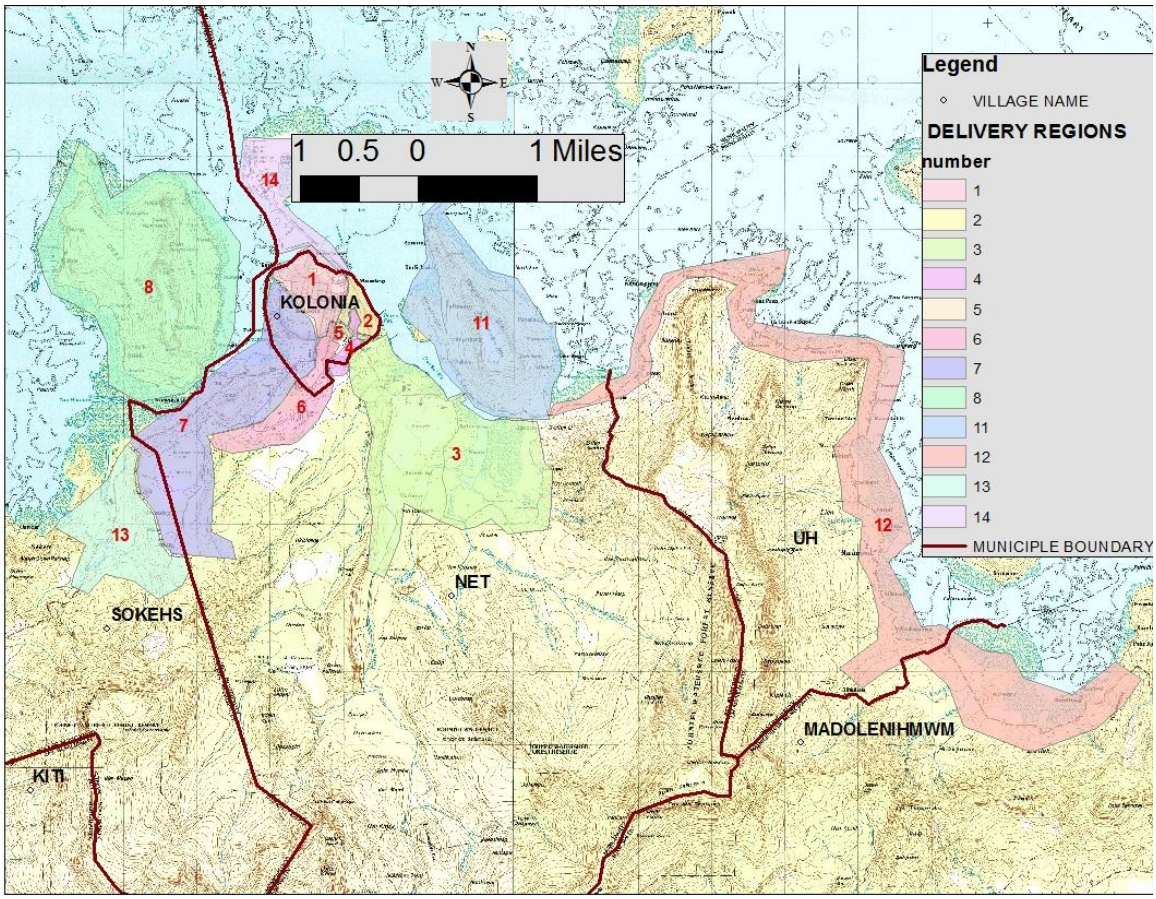


Figure 2. North Pohnpei Island study area showing village boundaries, and distribution system model water delivery zones

GOALS AND OBJECTIVES

The goal of this project was to gather the required data for and develop a hydraulic model and a GIS database of the water distribution system for Pohnpei Island, Pohnpei State, FSM. In order to achieve this goal the following objectives were carried out:

1. Gather data on the complete physical and hydraulic description of the Pohnpei water distribution system.
2. Develop a hydraulic model of the system using the information developed in objective 1.
3. Develop a GIS database using the information developed in objectives 1and 2.

RELATED RESEARCH

Researchers from WERI completed a networked hydraulic model for portions of the Pohnpei water systems in 1987. (Khosrowpanah, 1987) The model used was an early version of the Kentucky Pipe Network Model. This model was a non-graphical user interface based model. Data files of pipe lengths, network connectivity and water demands were developed for the system. The model predicted flows and pressures in the system. The data files and maps for the 1987 study were used as a starting point for this study.

WERI researchers carried out similar studies for the Island of Weno in Chuuk State, FSM, (Heitz, 1986), (Heitz and Khosrowpanah, 2013) and have completed two modeling projects in Guam using the Haestad Cybernet model. They have also developed a hydraulic model using WaterCAD for AutoCAD and a GIS database using ARCGIS for the Saipan Water Distribution System. (Heitz et al, 2008), (Heitz and Khosrowpanah, 2011)

METHODOLOGY

This proposed project was divided into three phases.

Phase I. Gather a complete physical and hydraulic description of the Pohnpei water distribution system

Information gathered during the 1987 study (Khosrowpanah, 1987) was used as the starting point for this phase. Since the EPANET model used in this study is a graphics based model it was necessary to secure a high quality base map to use as the basis for mapping the locations of the pipes, pumps, and tanks that were part of the system. Digital Data Services, from Lakewood, Colorado, USA, was retained to purchase a clean fresh US Geological Survey Quadrangle Topographic Map of Pohnpei Island. After procuring the map they made a high resolution digital scan of the map. This digitized map served as the base map for all of the future work that was done on the project. Along with digitizing the base map, they also created separations of the contour lines that were included on the map. These separations, which are shown in Figure 3, were later used to develop a digital elevation model (DEM) of Pohnpei. The DEM, which is shown in Figure 4, was used to determine the required ground elevations that were used as input to the model.

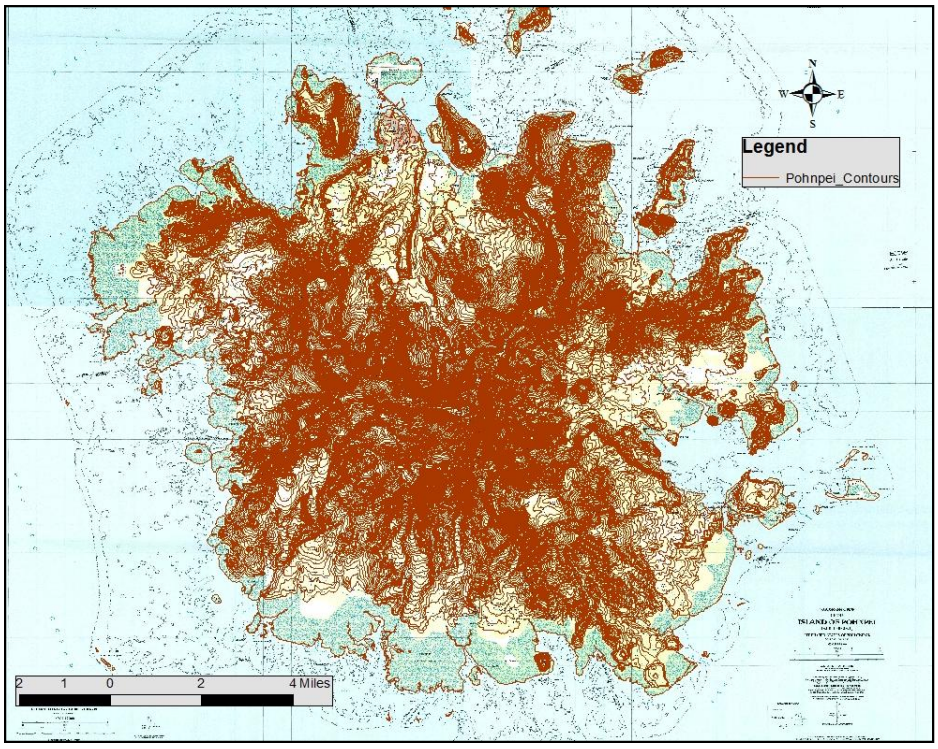


Figure 3. Contour line separations for Pohnpei Island

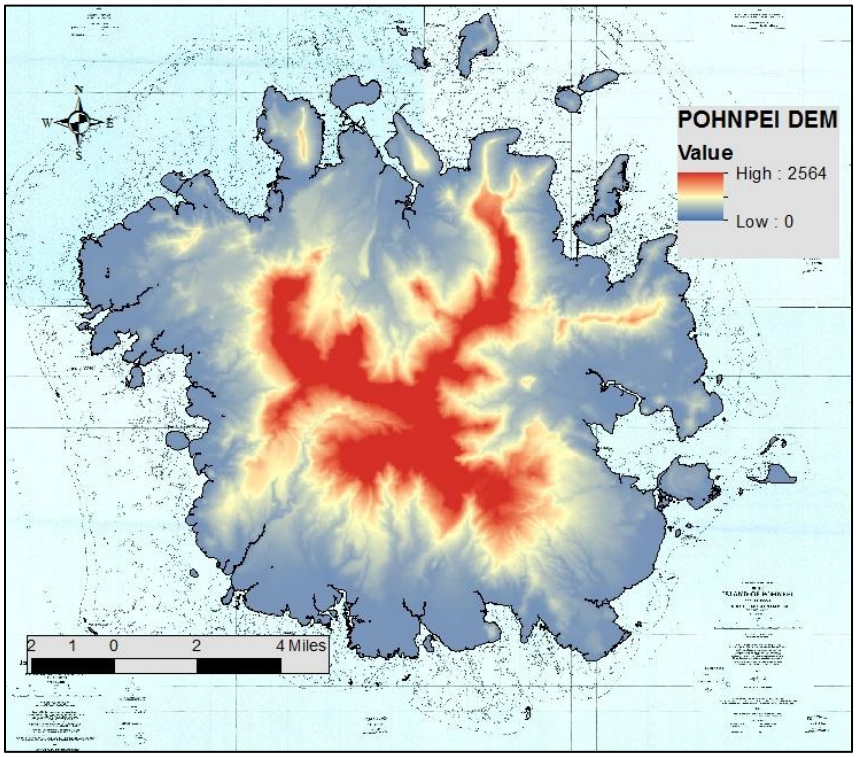


Figure 4. Digital Elevation Model for Pohnpei Island

WERI researchers spent a week on Pohnpei Island working with PUC staff in order to be sure that the system maps were accurately drawn and that the system component were properly characterized. PUC staff also provided information on the locations and consumption rate of the high use customers in the system. The PUC's staff was also invaluable in identifying system operation and updating all the system description information to present day conditions. The water model was split into water delivery zones. These zones were determined by the WERI investigators and the PUC based on previously used delivery zones and the latest meter reader routes. The delivery zones are shown in Figure 5. These zones were used to develop the residential demands that served as usage input to the model.

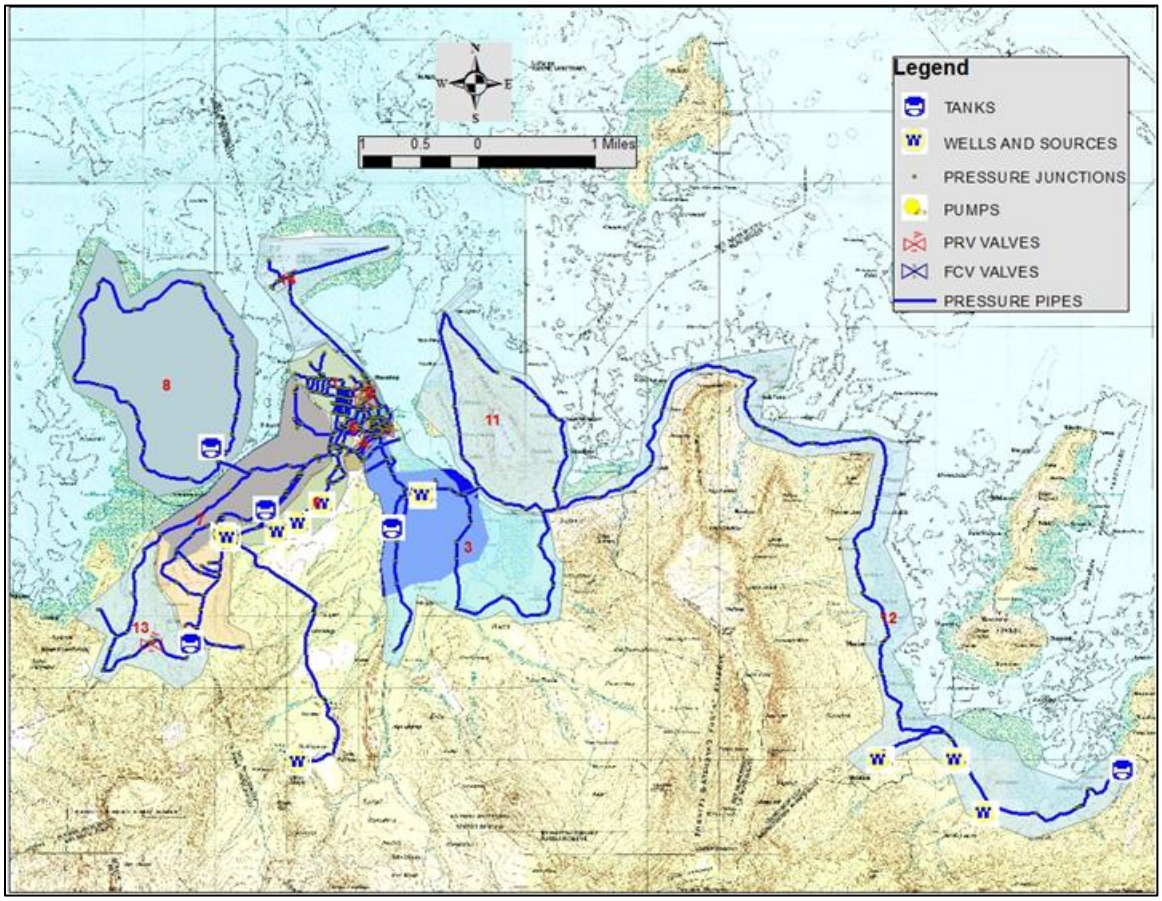


Figure 5. Water delivery zones, Pohnpei water system

Phase II. Develop a Hydraulic Network Model of the PUC Water Transmission System

Phase II involved the development of a hydraulic network model of the PUC system using the hydraulic modeling program EPANET. This public domain (and at no cost) program was developed by the US Environmental Protection Agency (EPA) and is available on the EPA web site http://www.epa.gov/nrmrl/wswrd/dw/epanet.html . The model has been used worldwide to simulate water distribution systems. A complete listing of the input data for the Pohnpei water system model is contained in Appendix I. The EPANET program, user manuals, and Pohnpei water system input files are available from WERI. Figure 6 shows the EPANET user interface. The interface is very simple and easy to use, but is cleverly designed to provide easy access even to the more complex functions.

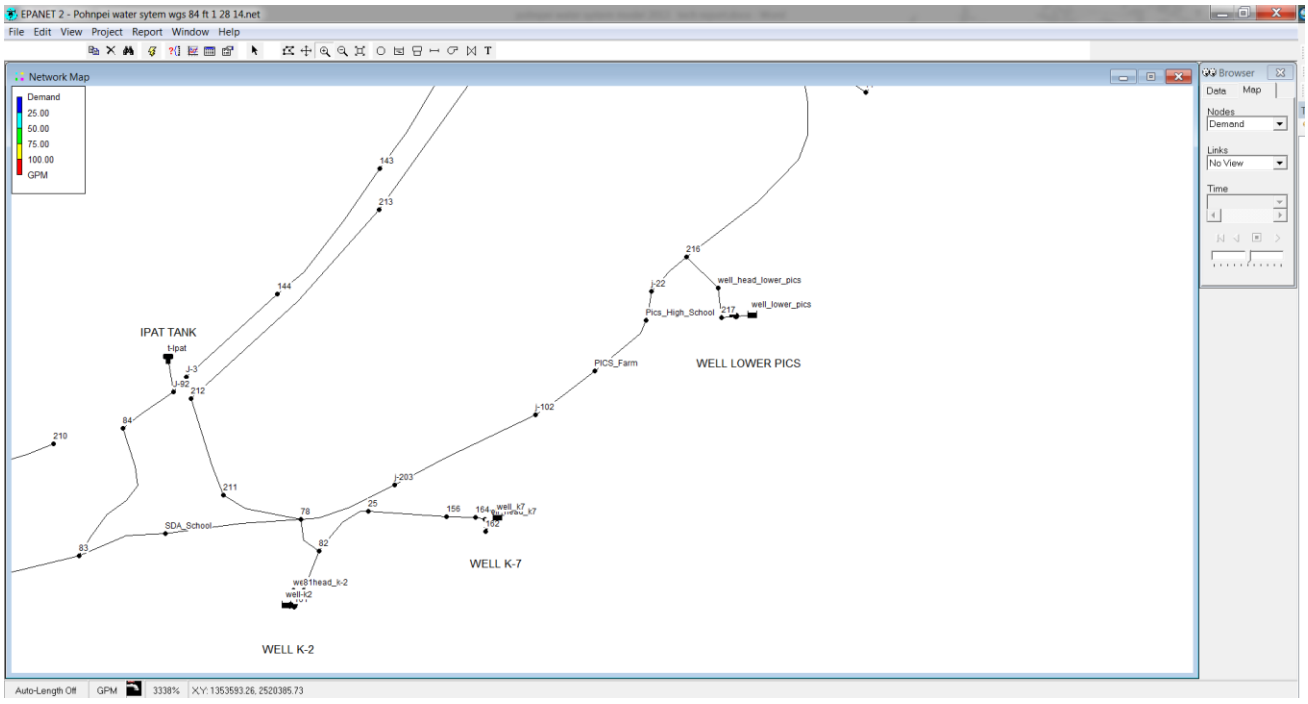


Figure 6. User interface for the EPANET model showing a portion of the Pohnpei water supply system

The model is relatively easy to use and yet very sophisticated. It can be used to model systems from the very simple to the very complex looped piping systems. It has the capability to do time simulations and therefore can model a system over days, months, or even years. By using what is called patterns the model is able to change customers'

demands in order to simulate real time changing use rates in a real world environment. The model can also simulate changing water quality parameters throughout a water system, although we did not implement these capabilities in the Pohnpei model. This capability could be easily added in the future since the basic hydraulic model will already be in place. Although there are more sophisticated and more costly water system modeling programs, this program will be able to provide PUC with all the computational capabilities required for them to analyze and hopefully improve the operation of their system. Another plus for the program is the capability of other modeling programs to read the input files created by EPANET. Therefore, in the future if PUC should decide to move up to a more sophisticated model, the time and expense invested in developing the EPANET model will not be lost.

Functionality of the EPANET Model

A complete operational manual for the model (Rossman, 2002) is available on the USEPA Web site http://www.epa.gov/nrmrl/wswrd/dw/epanet.html . In this model all of the components of a water system are simulated using two basic element types. These two elements are nodes and links.

Node elements include junctions, tanks and reservoirs. Junctions are always connected to link elements. Junctions are the points in the system where pressure and hydraulic head are calculated and where demands are input to the system. Tanks are node point where water can be stored for later release into the system. It is possible to model various shapes of tanks. Floor elevation, diameter, maximum and minimum levels, and starting elevations are the most commonly used input variables for a tank node. Reservoirs are a special kind of node which serve as an infinite source of water. The water surface elevation of the reservoir always remains at a user provided elevation. Water cannot be stored in a reservoir node.

Link elements include pipes, valves and pumps. Pipe elements are described by their two connecting nodes. Other commonly used pipe variables include diameter, length, hydraulic roughness, minor losses, and pipe flow control conditions such as the existence of a check valve or whether the pipe is closed or open for flow. Valve elements are used to model control elements in a system such as pressure reducing, pressure breaker, flow control, throttle control and general purpose valves. The operational manual referenced above and the on-line help files describe each of these valves in detail and how to implement the valves in the model. Pump links are used to implement pumps in the system. In order to implement a well in the model the pump link is connected between a reservoir node and a normal junction node. All of the well pumps in the Pohnpei model were implemented using either a defined pump curve or an operating point. A sample of the curves used in the Pohnpei system is contained in Figure 7. Pump curves were unavailable for the lift station pumps. The operating points listed on the pump name plates were used as input. The model fits a typical characteristic equation to the data when only a single operating point is provided.

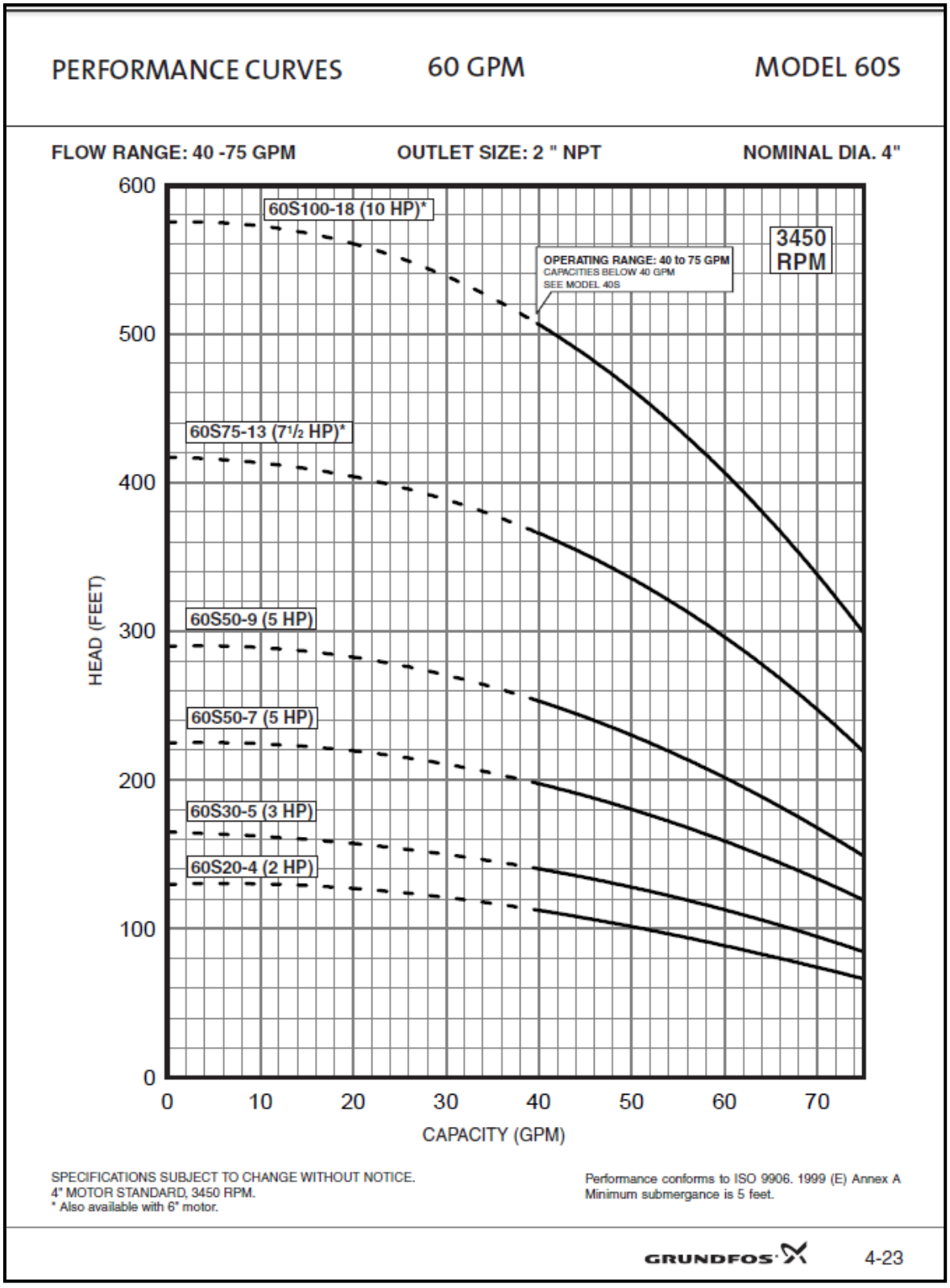


Figure 7. Pump curves used in the Pohnpei water system model

Before assembling the node and link system elements in the model we provided a backdrop graphic on which to digitize the elements. This graphic was created in ArcGIS using the digitized topographic map shown in Figure 3. The map was exported using the Metafile graphics (.emf) format and stored in the same folder as the EPANET data (.net) file. The file was imported to EPANET using the (View-Backdrop-Load) menu. It is important to get the scale and coordinate zero values adjusted if the model data is to be used later with other programs such as Geographic Information Systems (GIS). This is accomplished using an option contained in the (View-Dimensions) menu. The help menu and software manual explain the procedure to use to get proper alignment of the graphics backdrop file. We aligned our backdrop so that it matched the Universal Transverse Mercator (UTM) Grid 57N projection, using a geographic coordinate system of WGS 84 with units of feet. Figure 8. shows the backdrop file. The required dimensioning for the back drop graphics that is provided with the model is contained in the last eight lines of the input file shown in Appendix I. The EPANET (.net) input file provided already has the correct dimensions and units and reference to the proper ".emf" file. If a new EPANET file is desired with the same scaling simply load the same ".emf" file and provide the dimensions and units shown in the last lines of the ".inp" file for the Pohnpei system. The dimension values are simply the corner coordinates of the backdrop file.

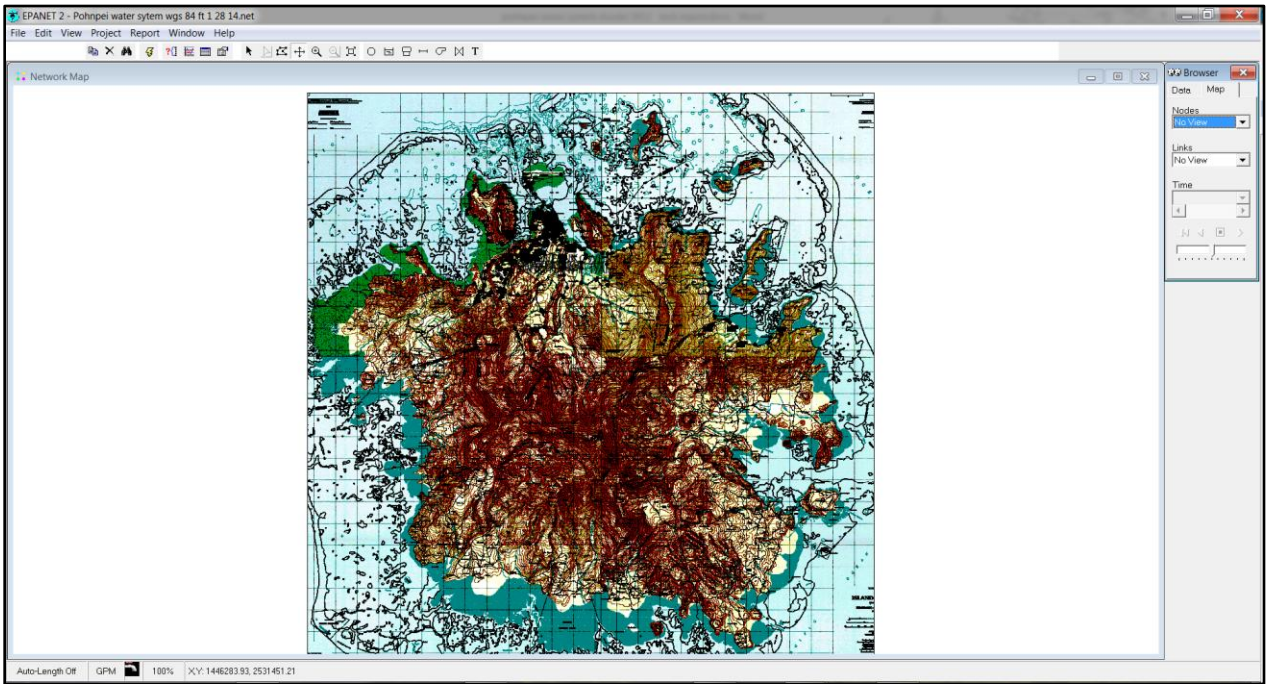


Figure 8. Pohnpei Island backdrop scaled to the UTM Zone 57 N, WGS 1984, Feet coordinate system

The data gathered in Phase I of the study was then input to the model. The Map Tool Bar, as shown in Figure 9, was used to input the water system elements onto the topographic map backdrop. Also included in the Figure is a help screen showing the function of each of the Map Tool Bar buttons. To input an element the user simply chooses the correct button for the desired element and moves to the point on the backdrop where the element is to be placed. Pressing the mouse select button will place the element at that location. The location of the element can be changed by selecting the element with the up-arrow button and holding the button down while moving to a new location. It is important to note that when entering pipe elements the Auto-Length toggle in the lower left corner of the screen should be on in order for the program to automatically compute the correct pipe lengths based on the dimensions provided for the backdrop file. Pipes, valves, and pumps are always connected between node points. Once all the elements are in place they are selected one by one and the data describing that element are added. Means are included for providing default variables and for group editing in order to speed up the input process.

Figure 10. shows the entire water system network map for the Pohnpei water delivery system. Figure 11. shows the entire system without the topographic map background. Figure 12. shows a close up of the water system network in the central hospital region. Figure 13. shows the same region without the topographic map background.

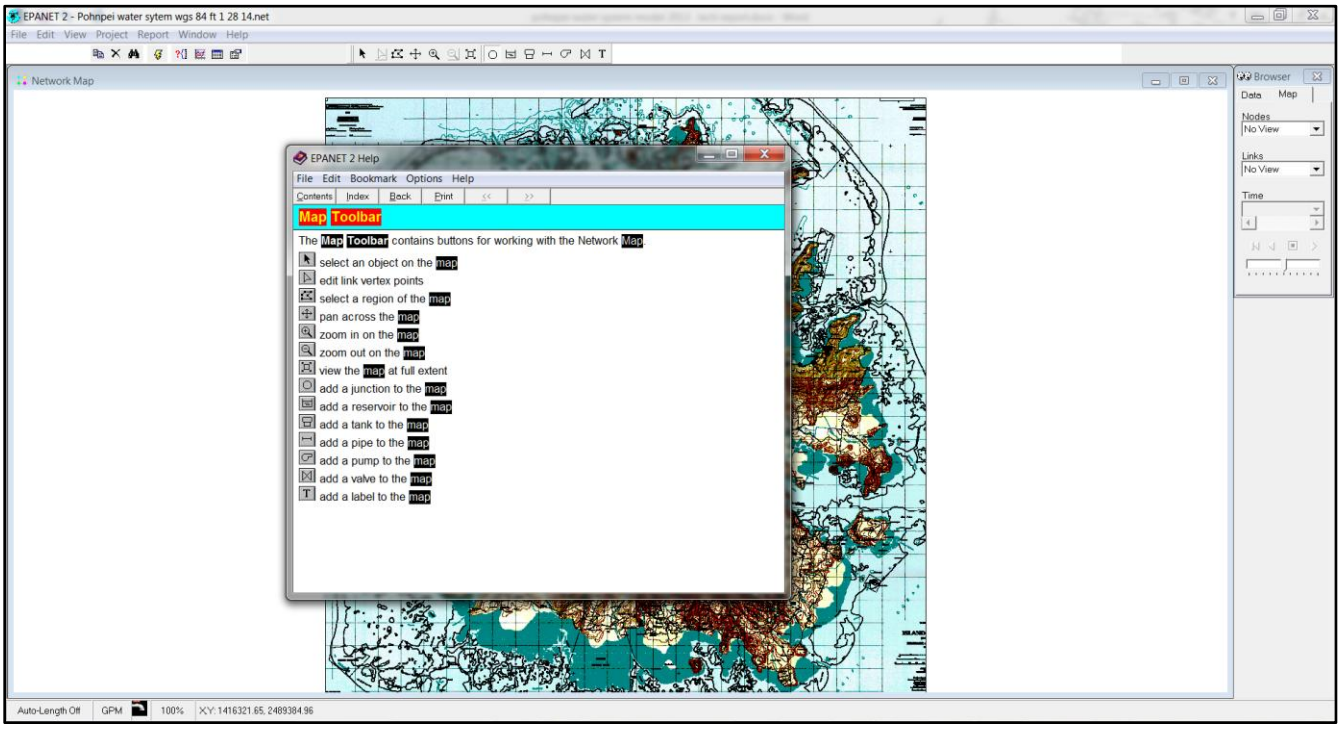


Figure 9. EPANET Map Toolbar, and Help Screen showing the function of the Map Toolbar buttons

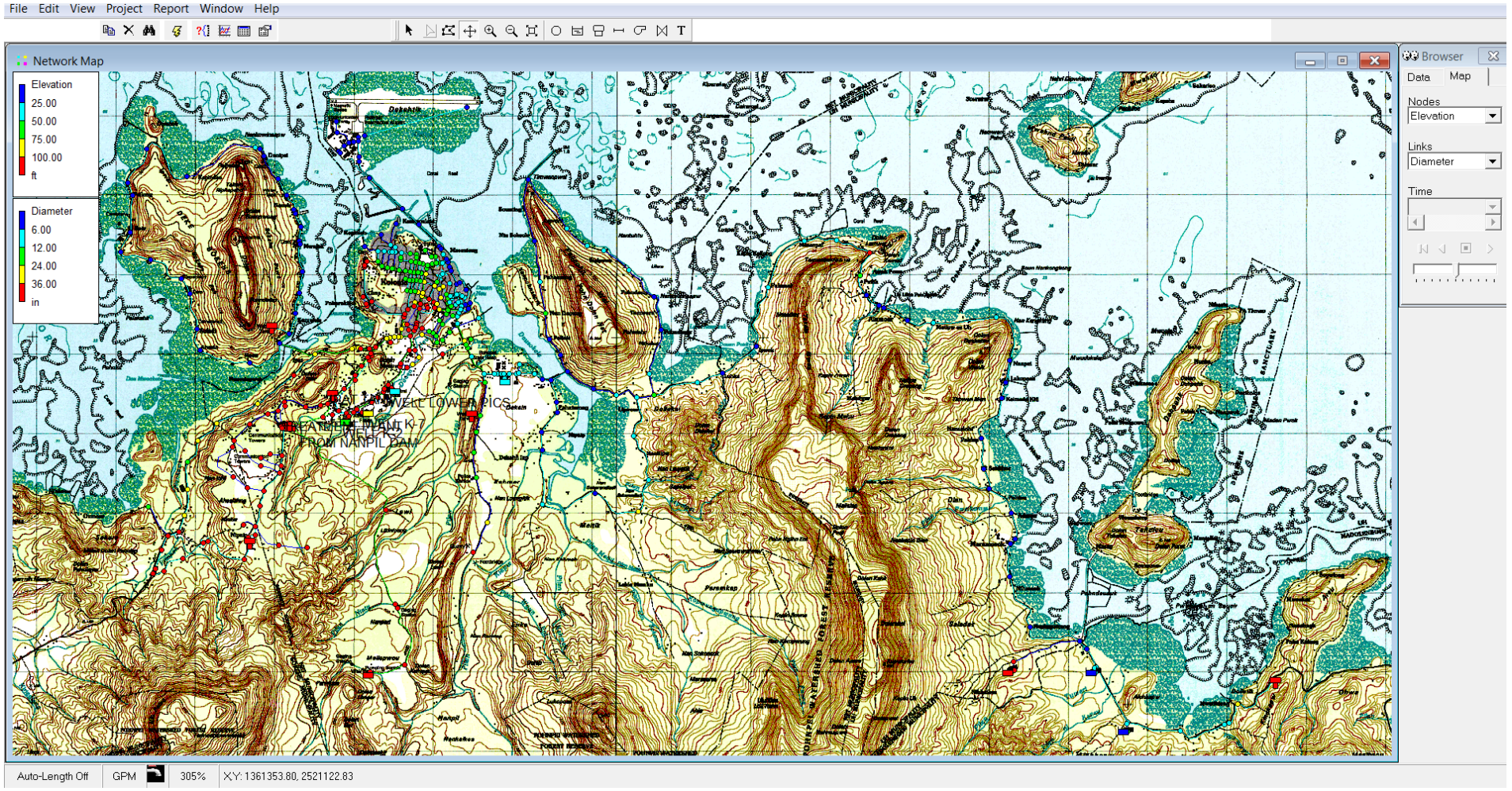


Figure 10. Entire EPANET water system network map for the Pohnpei water delivery system

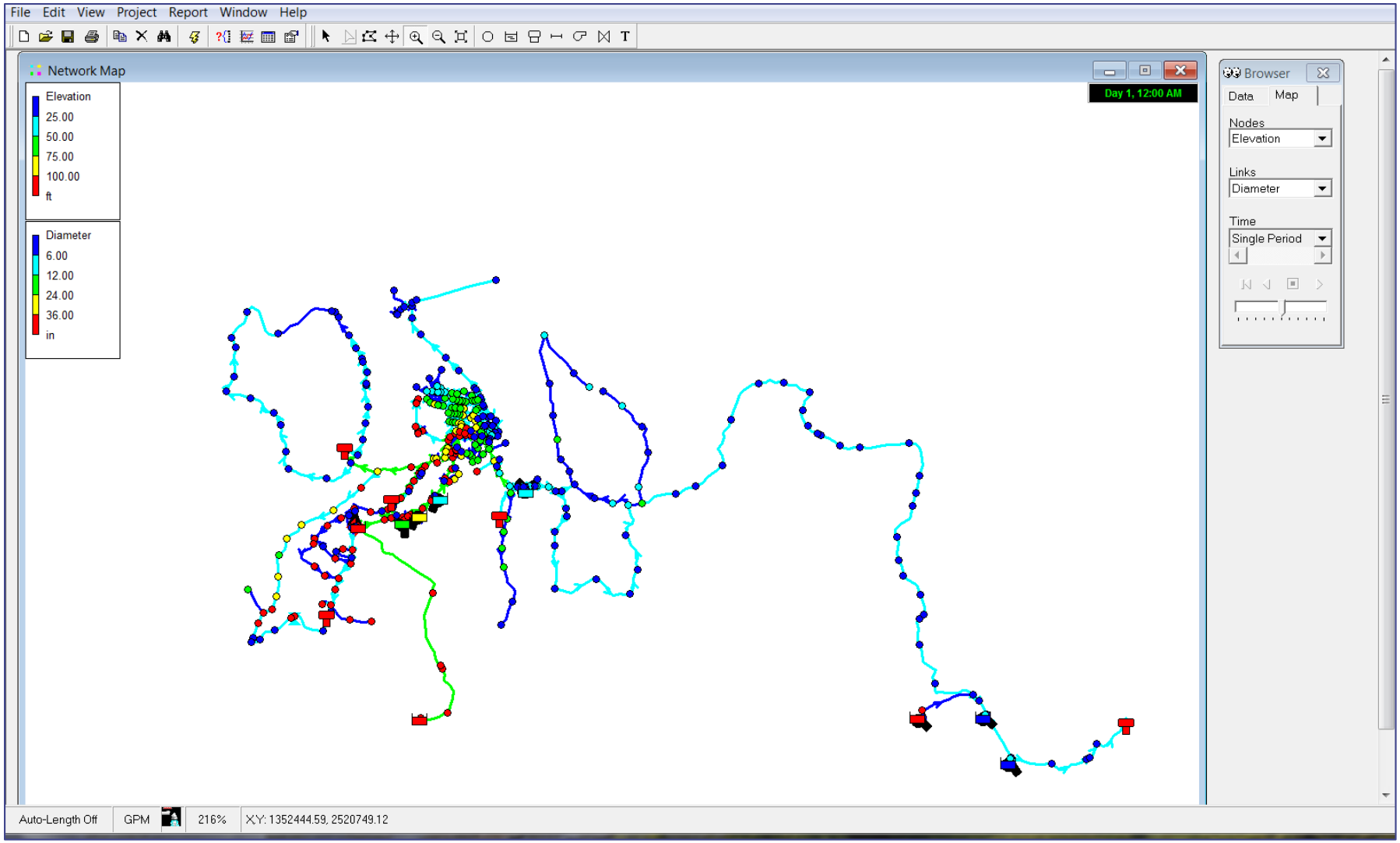


Figure 11. Entire EPANET water system network map for the Pohnpei system without the backdrop map

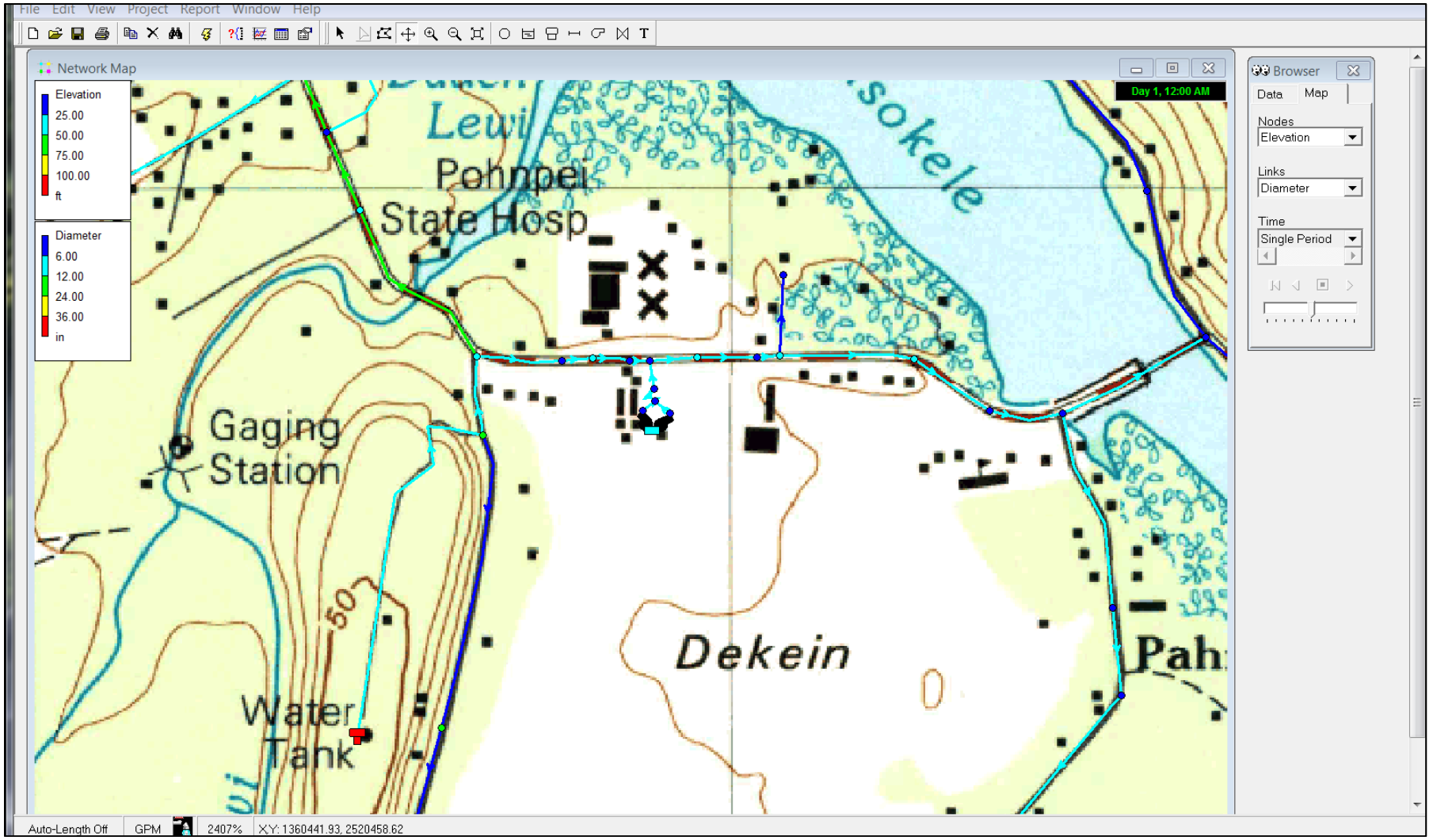


Figure 12. Expanded view of the water system network in the central hospital region

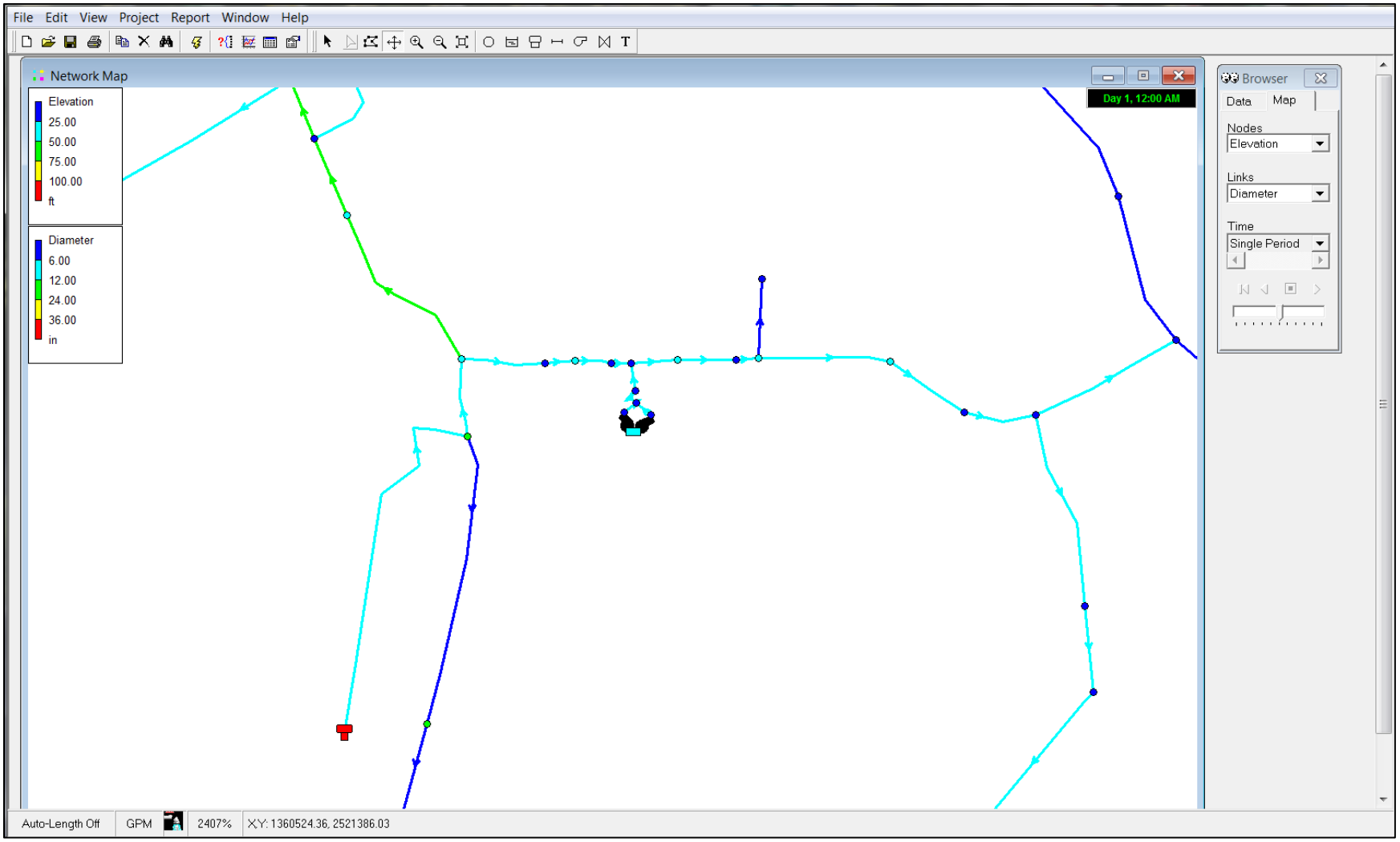


Figure 13. Expanded view of the water system network in the central hospital region without the backdrop map

Input Data for EPANET model

The next major effort came in assigning demands to the junction nodes where users require the delivery of water. The delivery junctions were assigned a unique identifier in order to make the junctions easier to edit later. The variable initial quality was used as the identifier. A value of XX.Y was input for the initial quality parameter for each delivery junction. XX is the water delivery region of the junction. Y is either blank for residential junctions, "1" for higher user junctions or "2" for junctions located at well heads.
def
A spreadsheet was developed to do all the water use rate calculations. We began first with the higher use rate customers. PUC provided data on the location and monthly consumption by the high use customers. The consumption rates were taken from monthly billing records. Table 1 shows the actual use values that were assigned to each of the high users. A junction was provided in the water system model at the location provided by PUC for each of the high users. The computed value in gallons per minute (gpm) for that user was assigned as the base demand for the junction.

The Pohnpei water delivery system was divided into 12 water delivery zones as shown in Figure 3. These zones were determined by the WERI investigators and the PUC based on previously used delivery zones and the latest meter reader routes. The PUC provided a listing for the total monthly deliveries for each of the routes in the distribution system that were included in the model. These totals are shown in Column 2 of Table 2 along with the water delivery zone (shown in column 5) that each route was assigned. The original plan was to total all high users (shown in Table 1) for each zone (shown in column 3 of Table 1) and then subtract that value from the total delivered amount (shown in column 2 of Table 2). The results would be the amount of water delivered to each Zone to non hi user customers (as shown in Column 4 of Table 2). This amount was to be distributed equally to all the non-high-user junctions in each of the model zones.

Problems arose when trying to apply the PUC provided customer billing data to the distribution plan outlined in the previous paragraph. It turned out that for some of the routes, there was a negative result when the high users were subtracted from the total deliveries to the route. This indicated that there was either an error in the high user amount or the totals for the routes. The PUC acknowledged that there must be an error, but were unable to provide corrected copies of the data.

An alternative strategy was adopted in order to make the model operational. The non-high-user nodes were assigned a system wide average. This average was calculated by subtracting the total for all high users (shown at the bottom of column 4 of Table 1) from the total for all the billing routes (shown at the bottom of column 2 of Table 2). This remaining total was assigned equally to all of the 299 non-high user junction nodes in the model. This resulted in an average value of 2.47 gpm for each non-high-user junction.

HIGH USER	BILLING ROUTE	ZONE	METERED AMOUNT GAL/MONTH FROM PUC	GPM FOR JUNCTION
Pohnpei State Hospital	22	3	383,570	8.76
				0.00
				0.00
Seker Elementary School	50	13	49,789	1.14
Sokehs Pah Elementary School	59	8	74,125	1.69
Sokehs Powe Elementary School	59	8		0.00
COM Kolonia 1	36	6	98,750	2.25
COM Kolonia 2		6		0.00
Ohmine School	6	1	62,070	1.42
Kolonia Elementary	24	3	278,595	6.36
Nett School	22	3	58,000	1.32
Awark School	40	12	49,871	1.14
ESDM School		12		0.00
Saladak Elementary School		12		0.00
Sports Center	31	6	3,089,730	70.54
				0.00
Hotels				0.00
South Park Hotel (Region1)	8	7	431,700	9.86
Cliff Rainbow Hotel	8	7	400,485	9.14
Joy Hotel	4	1	57,833	1.32
Yvonnes Hotel		2		0.00
China Star Hotel	15	14	72,860	1.66
Sea Breeze Hotel		2		0.00
PCR Hotel	23	3	160,680	3.67
Ocean View Hotel	30	7	68,471	1.56
Pacific Sky Lite	30	7	79,140	1.81
Private Schools				0.00
PICS School	31	6	1,043,970	23.83
PICS farm	31	6	219,390	5.01
Pohnpei Catholic Schoool	2	1	29,546	0.67
Baptist School	6	1	81,012	1.85
SDA School	30	6	37,975	0.87

Table 1. Actual use rates assigned to high rate users in the Pohnpei system

HIGH USER	BILLING ROUTE	ZONE	METERED AMOUNT GAL/MONTH FROM PUC	GPM FOR JUNCTION
Laundromats & Commercial Stores				0.00
YTY Laundramat	36	3	88,187	2.01
Nett Laundry		3		0.00
Maupuwsi laundramat	12	7	89,147	2.04
Robys Lanundry (Etchiet)	20	3	234,000	5.34
Judy Laundramat	36	6	143,160	3.27
yashidas Enterprises		2		0.00
Adams Construction	20	3	138,144	3.15
Genesis	22	3	220,245	5.03
EDA Dock Meter	15	14	642,500	14.67
Palm Terrace	26	7	66,850	1.53
Wall Mart	12	1	64,251	1.47
Isamu Nkaaonw (1 and 2)	5	1	113,390	2.59
Caroline Fisheries 1	15	14	217,995	4.98
FSM Petroleum	15	14	230,505	5.26
Hawleys Ice Plant		2		0.00
True Value		2		0.00
Ace construction Company	20	3	103,485	2.36
Luen Thai	15	14	48,590	1.11
Penda Ocean	15	14	3,643,800	83.19
H & K Main Meter	19	1	166,275	3.80
Rumors Bar	26	7	111,705	2.55
Flamingo Club	26	7	50,090	1.14
Best Buy (Same as True Value)	26	7	10,780	0.25
Ambros Bakery	5	1	46,790	1.07
Caroline Fisheries 2	15	14	197,160	4.50
Linda Carl	33	7	208,365	4.76
Heigenberger Bellarmin	18	2	121,500	2.77
Pohnpei Port Authority (PPA)	15	14	151,020	3.45
Neime Preston	15	2	219,975	5.02
Pacific Food	19	2	134,940	3.08
Pohnpei Water Company	26	7	119,310	2.72

Table 1. (Continued) Actual use rates assigned to high rate users in the Pohnpei system

HIGH USER	BILLING ROUTE	ZONE	METERED AMOUNT GAL/MONTH FROM PUC	GPM FOR JUNCTION
Other Government Buildings				0.00
Airport		14		0.00
Airport Fire	15	14	0	0.00
ARF	15	14	59,494	1.36
Power Plant NPP	31	7	98,255	2.24
Tuna Commision Headquarters	18	2	227,700	5.20
Telecom AGR	18	2	15,180	0.35
US Embassy	22	3	19,360	0.44
FSM Surveilance	15	14	79,275	1.81
State Legislature building		5		0.00
GRAND TOTAL ALL HIGH DEMAND USAGE			14,908,985	340.39

Table 1. (Continued) Actual use rates assigned to high rate users in the Pohnpei system

ROUTE	TOTAL DELIVERED PER MONTH (GAL)	HI USERS (GAL/MONTH)	MINUS HI USER (GAL/MONTH)	ZONE
1				
2	1,160,210.97	29,546	1,130,665	1
3	399,822.78	0	399,823	1
4	1,607,814.35	57,833	1,549,981	1
5	698,139.24	160,180	537,959	1
6	2,112,202.53	143,082	1,969,121	1
7				
8	559,345.99	832,185	-149,518	7
9				
10	682,666.67	0	682,667	1
11				
12	661,367.09	153,398	507,969	1
13				
14	538,033.76	0	538,034	14
15	457,654.01	5,563,174	-5,105,520	14
16	682,223.63	0	682,224	4
17				
18	602,945.15	364,380	238,565	2
19	9,845,213.25	301,215	9,543,998	1
20	342,282.70	475,629	-133,346	3
21				
22	1,172,827.00	681,175	491,652	3
23	698,785.45	160,680	538,105	3
24	1,103,025.32	278,595	824,430	6
25	500,041.23	0	500,041	6
26	1,507,409.28	358,735	1,148,674	7
27				7
28	1,578,257.38	0	1,578,257	7
29	1,756,741.22	0	1,756,741	7
30	669,185.65	185,586	483,600	6
31	1,447,966.24	4,451,345	-3,003,379	6
32	1,046,257.38	0	1,046,257	7
33				7
34				6
35				
36	734,042.19	330,097	403,945	3
37				8
38	1,846,721.52	0	1,846,722	8
39				
40	755,063.29	49,871	705,192	12
41				12
42	983,789.03	0	983,789	12
43				11
44	1,897,919.83	0	1,897,920	11
45				12
46	245,227.85	0	245,228	12
47				12
48	800,156.12	0	800,156	12
49				13
50	3,571,902.95	49,789	3,522,114	13
51				
52	2,429,873.42	0	2,429,873	
53				
54				
55				
56	819,881.86	0	819,882	
57				8
58	604,122.36	0	604,122	8
59	746,151.90	74,125	672,027	8
60				
TOTALS	**47,265,271**	**14,700,620**	**32,687,971**	

Table 2. Customer route billing data provided by PUC

The portion of the PUC pumping system that was modeled consists of 6 well pumps and two lift stations. Some of the description information was obtained by field visits by WERI investigators, but the majority of the information was supplied directly by PUC.
With the exception of the lift pumps at the treatment plant all pumps were manufactured by Grundfos. Pump characteristic curves were available for all of the well pumps and were used in the model. The lift station pumps at the treatment plant are manufactured by Lane Pumps. These were in the process of being replaced at the time the project was carried out. New pump characteristic curves, similar to those shown in Figure 7, should be input to the model for these pumps as soon as the curves are available. The pump curve for the old treatment plant pumps were represented by a single operating point taken form the pump name plates. The pumps at the Hospital MO plant were manufactured by Grundfos. We were unable to obtain pump characteristic curves for these pumps from either PUC or the pumps manufacturer. We used the operating point provided on the name plate as the pump characteristic curve input for these pumps. Other important parameters that were input to the model are ground elevation at the well heads, location of the pump in the well, static water elevation, and a description of the piping system from the pump to the distribution system main.

PUMP LOCATION	MODEL WELL NAME	PUMP MODEL *	PUMP SIZE HP
WELL K-2	well_k-2	60S75-13	7.5
WELL K-7	well_k-7	135S150-9	15
WELL LOWER PICS	well_lower_pics	60S75-13	7.5
WELL NAM WELLIN ROHI	well_nam_wellin_rohi	75S30-5	3
WELL NAM KOPOTOMEN	well_namkopotomen	75S30-5	3
WELL ENRINALS	well_enrinals	75S30-5	3
TREATMENT PLANT	TREATMENT PLANT	LANE 30 HP SERIAL NUMBER 6G5-01269	30
HOSPITAL MO-PLANT	MO PLANT 1 AND 2	GRUNDFOS TYPE CR32-3-3 A-G-A-EKUBE MODEL A96419551P113070621	10
		* ALL WELL PUMPS ARE GRUNDFOS	

Table 3. Wells and lift station pumps in the Pohnpei Water System

There are five tanks located in the Pohnpei system. These are shown in Table 4. It should be noted that there is a large discrepancy between the elevations shown on the PUC system diagrams and the elevations at the tank locations shown on the USGS quad maps. This could be explained by locational differences of the tanks on the quad map or local variations in elevations due to construction at the tank locations. The PUC was notified of these elevation discrepancies and were to check on the actual base elevations of the tanks. We received no updating on tank elevations from PUC at the time of publication of this report. The tank elevations are extremely important in the model as they set the controlling hydraulic head and pressures throughout the system and strongly affect the pumping rates at the wells and at the pumps located at the two treatment plants. The existing model now is set to the USGS quad map DEM elevations throughout.

TANK NAME	BASE ELEVATION FT FROM PUC	OVERFLOW ELEVATION FT FROM PUC	SIZE FROM PUC MG	ELEVATION FT FROM DEM
NAMPOHNMAL	370		0.5	398.3
IPAT	177	217	1.0	188.97
SOKEHS	170	210	1.0	179.59
NETT	170	210	1.0	184.42
KINAKAPW	170		0.5	259.28

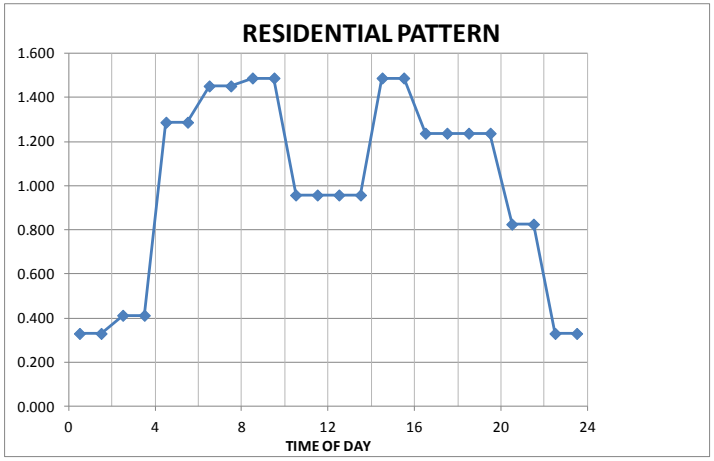
Table 4. Water storage tanks in the Pohnpei water system

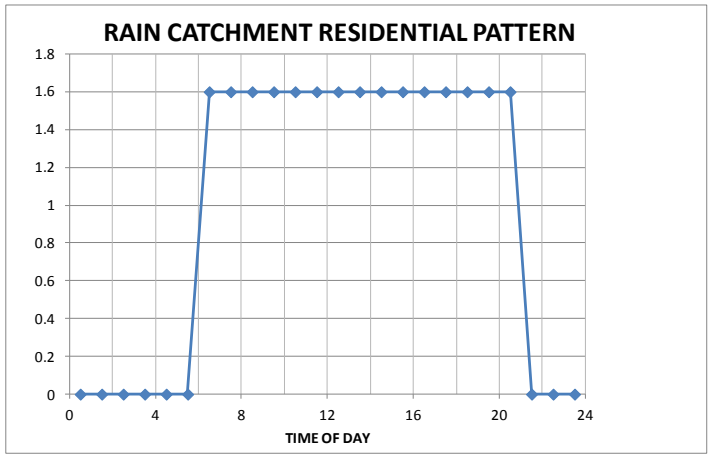
The tank elevations should be verified with actual surveyed elevations and the correct elevations should be applied to the tank bases in the model. Consistent and correct elevations should be used throughout the model.

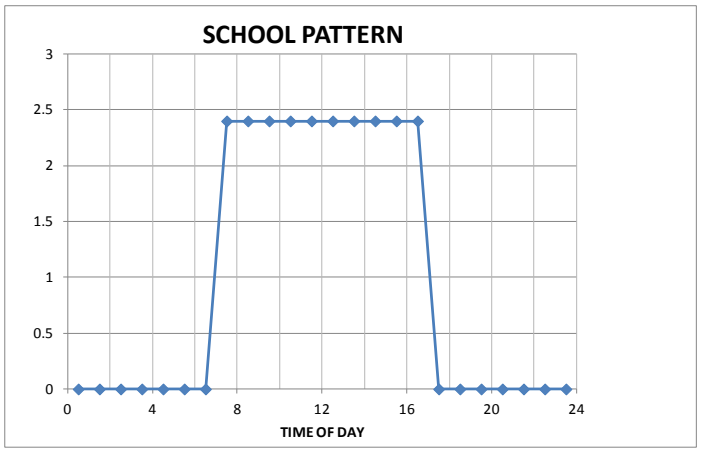
Patterns of demand use changes during the day were developed in order that time simulations could be run using the EPANET model. These patterns provide a multiplying factor (to be multiplied by the average base flow) in order to get the correct flow value for a particular time interval. Table 5 and Figure 14 show the values that were developed for the Pohnpei system. The residential pattern is similar to that which was used for previous studies in Saipan. (Heitz and Khosrowpanah, 2008) The other patterns are best estimates of reasonable values to use. We are presently performing a study in Saipan where we are actually using digital water meters to refine these water use pattern estimates. As data from this study becomes available it can be easily added to the Pohnpei water system model.

START TIME	END TIME	AVERAGE TIME	RESIDENTIAL PATTERN	SCHOOLS PATTERN	COMMERCIAL PATTERN	GOVERNMENT PATTERN	DOMESTIC RAIN CATCH PATTERN
0	1	0.5	0.330	0	0	0	0
1	2	1.5	0.330	0	0	0	0
2	3	2.5	0.412	0	0	0	0
3	4	3.5	0.412	0	0	0	0
4	5	4.5	1.287	0	0	0	0
5	6	5.5	1.287	0	0	0	0
6	7	6.5	1.452	0	2.000	0	1.6
7	8	7.5	1.452	2.400	2.000	2.182	1.6
8	9	8.5	1.488	2.400	2.000	2.182	1.6
9	10	9.5	1.488	2.400	2.000	2.182	1.6
10	11	10.5	0.957	2.400	2.000	2.182	1.6
11	12	11.5	0.957	2.400	2.000	2.182	1.6
12	13	12.5	0.957	2.400	2.000	2.182	1.6
13	14	13.5	0.957	2.400	2.000	2.182	1.6
14	15	14.5	1.488	2.400	2.000	2.182	1.6
15	16	15.5	1.488	2.400	2.000	2.182	1.6
16	17	16.5	1.237	2.400	2.000	2.182	1.6
17	18	17.5	1.237	0	2.000	2.182	1.6
18	19	18.5	1.237	0	0	0	1.6
19	20	19.5	1.237	0	0	0	1.6
20	21	20.5	0.825	0	0	0	1.6
21	22	21.5	0.825	0	0	0	0
22	23	22.5	0.330	0	0	0	0
23	24	23.5	0.330	0	0	0	0

Table 5. Water use patterns for the Pohnpei water system







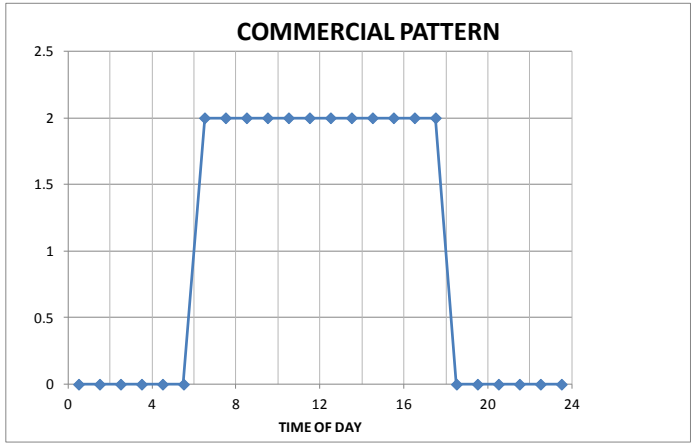


Figure 14. Plots of the use patterns provide for the Pohnpei water system model

Model Calibration

The completed EPANET model was run several times in order to insure that all components were properly sized and described. This "calibration" process uncovered some short comings in the existing data available to the modelers. The problems uncovered are grouped by topic area.

DEMANDS:

Correct junction demands are key to operation of the entire model. From the beginning of the project it was felt that the PUC had adequate billing data so that high demand users and normal residential demands could be predicted using the PUC billing data. The billing data that was provided by the PUC could not be reconciled. In some cases the total of the high user rates in a route were higher than the total amount reported for the entire route. These discrepancies were acknowledged by PUC, but updated route and high user data were never provided. Attempts were made to use what data were available but until realistic route usage and high user data are input to the model the model cannot be considered as calibrated. Since the usage values provided are metered usage to the customer, no distribution system losses are included. These losses will have to be estimated and input to the model. Losses to the model can be easily input either junction by junction or through a single demand multiplier for all the junctions.

ELEVATIONS:

Another critical parameter for the model is elevation. Correct junction elevations are essential for computing pressures throughout the system. Tank elevations serve to set the system pressure and pumping capabilities throughout the system. The elevation of reservoirs used as well sources must be set as the drawdown elevation of the well being represented. If the reservoir elevations are set wrong then the well pumping rates will be in error. All of the elevations must be referenced to the same datum. There appears to be some problems when comparing the tank elevations that were provided by the PUC with elevations shown on the topographic maps. The actual tank base elevations should be rechecked by survey techniques to insure that they are correct. The elevations shown on the topographic map should also be rechecked for compatibility with the local datum. This is essential if the model is ever to produce realistic results.

PUMP CHARACTERISTIC CURVES

Pump characteristic curves were available for all of the well pumps but were unavailable for the lift station at the treatment plant and the hospital MO plant. The lift station pumps were characterized using the name plate operating points. While this allows the model to run, the pumping outputs predicted by the model are much more accurate if actual pump curves are used. Every effort should be made to input the correct pump curves for the new pumps installed at the treatment plant and to obtain the pump curves for the pumps at the hospital MO plant.

Again we stress that the model is not completely calibrated at this point and will require further work by the PUC if it is to be a useful operations and management tool.

Phase III. Development of a GIS database of the water system resources

Using the data developed in Phases I and II, GIS maps and databases describing the Pohnpei water system were developed. The GIS database developed consists of the physical location descriptions of the pumps, pipes, tanks, and valves in the system. System component attributes included parameters such as size, pipe length and diameter, materials, and connectivity to other components of the system. Parameters such as date of installation and condition of the component can be added at a later date wherever available. Most of the data for the GIS was obtained through exportation of the EPANET water system model data. This was accomplished by first inputting the EPANET data files into the Haestad Water system modeling software. The Haestad model has a means of directly exporting the water system component data to ARCGIS shape files. Figure 15 shows the ARCGIS program with the basic system components visible. A sample of the kind of data that is included in the database is shown in Table 6. In this case we have added links to the attribute table for the pump shape file. These links are to graphics showing the pump curves and a picture of the pump site. Maintenance items such as when scheduled maintenance is required could easily be added to the data base. Figure 16 shows linked pictures of the pump station and a linked copy of the pump performance curves. The GIS data files developed are available from WERI.

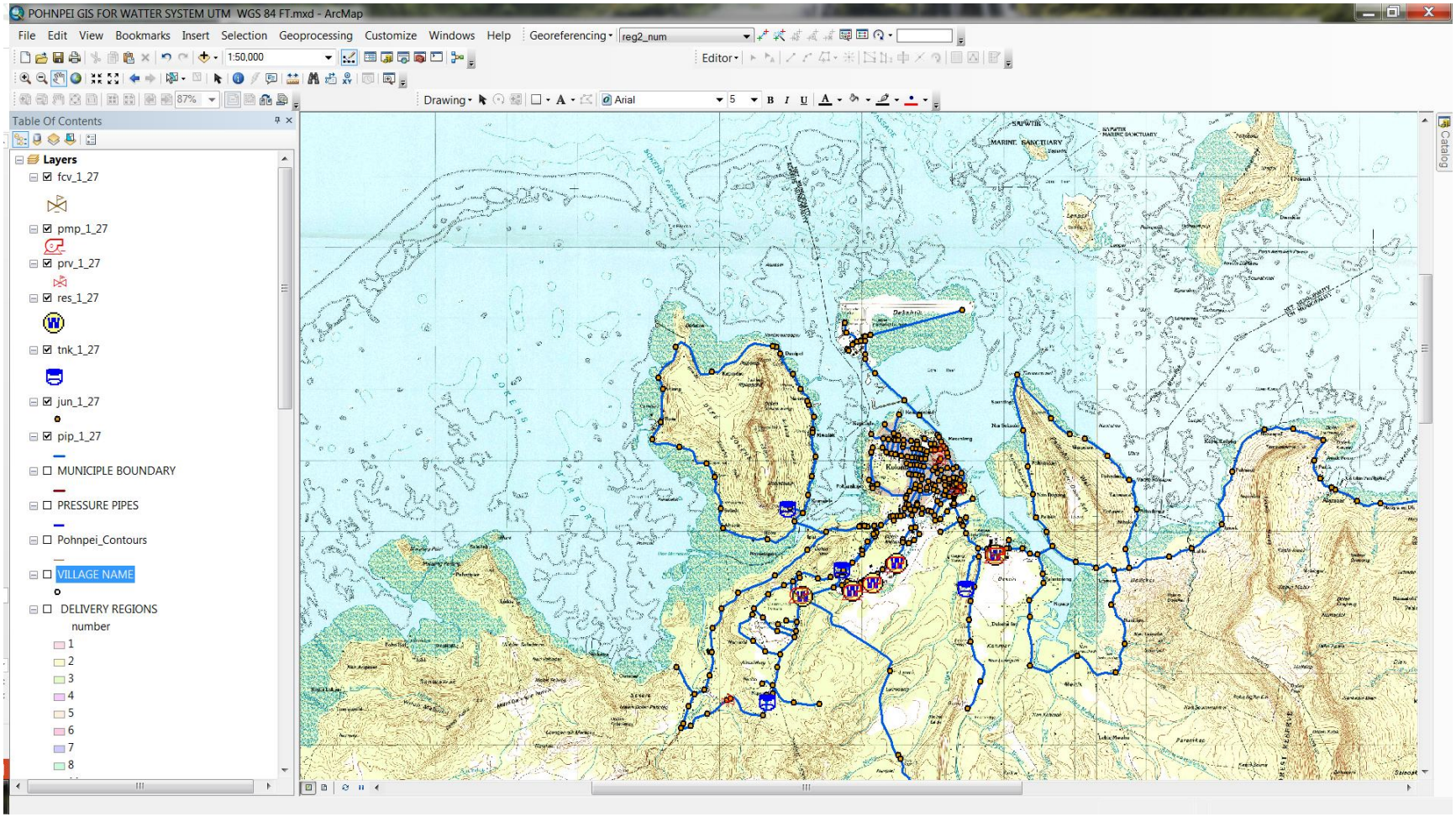


Figure 15. ARCVIEW GIS program showing the basic components of the Pohnpei water system

pmp_1_27

FID	Shape *	LABEL	LABEL_1	PUMP_DEFIN	WELL_SITE	PUMP_CURVE	
0	Point	PMP-pump_k7		well_k7-162 (PMP-pump_k7)			135S150-9
1	Point	PMP-pump_k2		well-k2-161 (PMP-pump_k2)		GRUNDFOS 60S PUMP CURVE.jpeg	60S75-13
2	Point	PMP-pump_eorinals		well_enrinals-200 (PMP-pump_eorinals)	nan eorinais well.JPG	GRUNDFOS 75S PUMP CURVE.jpeg	75S30-5
3	Point	PMP-pump_namkopotomen		well_namkopotomen-198 (PMP-pump_namkopotomen)	namkoporamen well.JPG	GRUNDFOS 75S PUMP CURVE.jpeg	75S30-5
4	Point	PMP-186		205-204 (PMP-186)			
5	Point	PMP-197		hospital_MO_plant-207 (PMP-197)			
6	Point	PMP-224		hospital_MO_plant-209 (PMP-224)			
7	Point	PMP-pump_nam_wellin_rohi		well_nam_welin_rohi-193 (PMP-pump_nam_wellin_rohi)	nam welin rohi.JPG	GRUNDFOS 75S PUMP CURVE.jpeg	75S30-5
8	Point	PMP-pump_lower_pics		well_lower_pics-217 (PMP-pump_lower_pics)		GRUNDFOS 60S PUMP CURVE.jpeg	60S75-13

1 (0 out of 9 Selected)

Table 6. Pump attribute table for the Pohnpei water system GIS

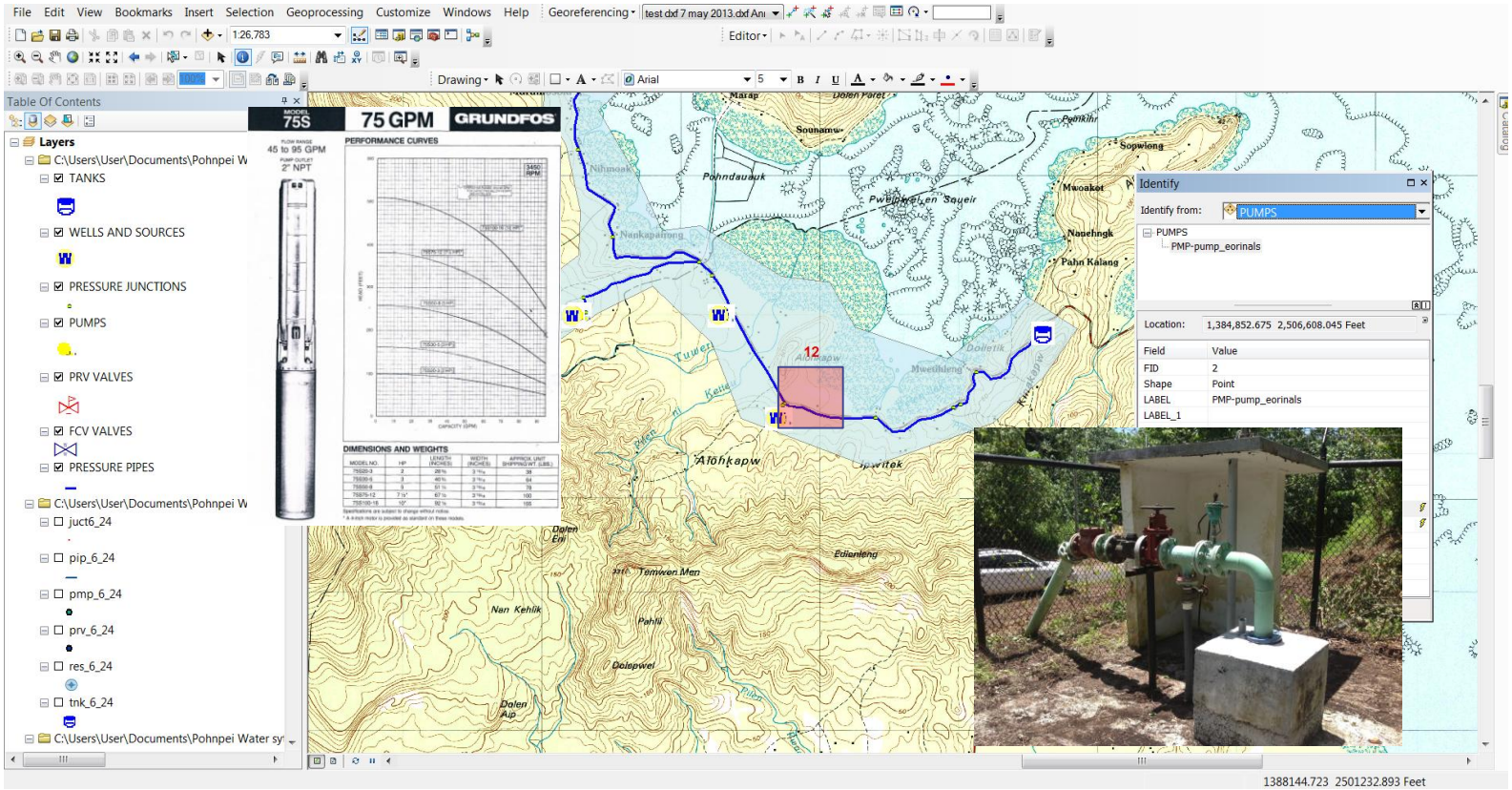


Figure 16. Useful graphical links that have been added to the GIS pump attribute data file

RESULTS AND DISCUSSION

A complete water system hydraulic model and GIS database of water system components were developed for the Pohnpei Island water system in Pohnpei State, Federated States of Micronesia. The EPANET program, user manuals and Pohnpei water system input files and the GIS data are available from WERI. The hydraulic model is running but requires further calibration because of lack of accurate and consistent elevations throughout the system. There are large differences in elevations shown on PUC's system maps and the topographic maps used to set the elevations of all components in the system. These differences need to be investigated and a common accurate elevation system applied to all components of the system. These inconsistencies should be remedied to insure accurate model calibration.

A second area of concern is with two of the new wells pumps located in the east end of the system. In the model neither Well "Enrinals" nor Well "Nam Kopotomen" can produce water. The head required is greater than can be produced by the pumps. This could be due to pumping water surface elevations in the wells set to incorrect levels or the elevation at the Kinakapw tank being incorrect. It could also be that the wrong size pump is installed in these wells. These discrepancies should be rectified.

A third area of concern is with the estimates of customer water use and loss rates within the piping system. The metered route usage provided by PUC is not internally consistent at this time. In some cases the sum of the metered high users' rates exceed the total for a particular route. This means that there were errors made in developing the data. PUC needs to recalculate all of the use rates for at least one month and these rates need to be input to the model. It is also essential to model calibration that estimates of losses because of leakage in the system are included in the model. The model can easily account for losses as a percentage of total delivery. At this time loss rates are unknown for the Pohnpei system. As time goes by and leak detection studies are carried out, better loss rate values can be estimated. Hopefully these loss rates will be reduced over time.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the valuable assistance of the PUC. Mr. Lierenson Ahrens and the staff of the PUC water division provided maps and vital data that were used in developing the water system model and the GIS. Their intimate knowledge of the water delivery system was invaluable in fine tuning the location and sizing of system components. They were also essential in developing use rates for residential and high use customers. Without their assistance, the study could not have been completed.

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APPENDIX I
LISTING OF INPUT FILE FOR THE POHNPEI EPANET WATER SYSTEM MODEL

```
[TITLE]
Project:
Scenario: Base
Date: 01/28/14 01:06:19 PM

[JUNCTIONS]
;ID                              Elev            Demand          Pattern
 118                             19.87           2.47                    ;
 218                             101.09          2.47                    ;
 151                             170.79          2.47                    ;
 j-36                            60.01           2.47                    ;
 177                             23.33           2.47                    ;
 j-30                            44.89           2.47                    ;
 100                             21.75           2.47                    ;
 200                             56.88           0                       ;
 Caroline_Fisheries_1_2          5.34            9.48                    ;
 126                             298.86          0                       ;
 226                             63.58           2.47                    ;
 Best_Buy                        109.2           0.25                    ;
 Wall_Mart                       73.23           1.47                    ;
 Pacific_Food                    20.98           3.08                    ;
 j-553                           75.93           2.47                    ;
 j-25                            63.72           2.47                    ;
 185                             15.69           2.47                    ;
 17                              31.94           2.47                    ;
 27                              27.41           2.47                    ;
 37                              97.22           2.47                    ;
 47                              25.97           2.47                    ;
 57                              17.3            2.47                    ;
 134                             22.16           2.47                    ;
 67                              51.13           2.47                    ;
 77                              104.85          2.47                    ;
 87                              240.35          2.47                    ;
 97                              348.29          2.47                    ;
 1                               16.26           2.47                    ;
 2                               50.75           2.47                    ;
 3                               0.27            2.47                    ;
 4                               0.04            2.47                    ;
 5                               0.27            2.47                    ;
 6                               64.38           2.47                    ;
 102                             16.03           2.47                    ;
 j-84                            30.77           2.47                    ;
 j-14                            88.02           2.47                    ;
 202                             45.13           2.47                    ;
 COM_Kolonia_1                   118.84          2.25                    ;
 7                               283.06          2.47                    ;
 128                             380.32          2.47                    ;
 228                             26.91           2.47                    ;
 109                             11.75           2.47                    ;
 161                             155.97          0                       ;
 Port_Authority                  5.81            3.45                    ;
```

209	38.22	0	;
234	27.6	2.47	;
8	282.34	0	;
9	152.42	2.47	;
ACE_Construction	36.33	2.36	;
j-79	68.14	2.47	;
187	21.07	2.47	;
110	14.02	2.47	;
j-73	53.0	2.47	;
210	220.52	2.47	;
136	363.14	2.47	;
236	7.5	2.47	;
Adams_Construction	35.24	3.15	;
j-5	99.84	2.47	;
104	12.69	2.47	;
195	46.55	2.47	;
204	286.26	0	;
j-62	24.25	2.47	;
State_Legislature	136.78	0	;
18	11.68	2.47	;
28	8.89	2.47	;
38	100.85	2.47	;
48	29.75	2.47	;
58	0.2	2.47	;
144	167.95	2.47	;
68	52.69	2.47	;
78	162.99	2.47	;
98	19.21	2.47	;
88	20.44	2.47	;
j-99	165.19	9.11	;
j-57	36.97	2.47	;
163	85.36	2.47	;
244	35.24	2.47	;
Palm_Terrace	96.39	1.53	;
FSM_Surveylance	1.78	1.81	;
j-51	70.61	2.47	;
112	383.45	2.47	;
212	177.48	2.47	;
138	360.98	0	;
J-71	96.64	2.47	;
119	393.69	2.47	;
171	25.97	2.47	;
j-12	98.35	2.47	;
219	22.63	2.47	;
j-7	132.8	2.47	;
j-46	64.97	2.47	;
j-82	35.36	2.47	;
120	29.48	2.47	;
220	3.96	2.47	;
146	7.73	2.47	;
Telecom_AGR	78.67	0.35	;
Ambros_Bakery	65.81	1.07	;
j-77	63.3	2.47	;
j-35	65.56	2.47	;

```
114                             18.57           2.47                            ;
South_Park_Hotel                103.16          9.86                            ;
214                             160.2           2.47                            ;
Sokehs_Pah_Elementary_School    19.85           1.69                            ;
19                              6.92            2.47                            ;
29                              97.69           2.47                            ;
39                              78.61           2.47                            ;
49                              28.1            2.47                            ;
well_head_k7                    145.03          0                               ;
j-203                           156.3           2.47                            ;
154                             50.29           2.47                            ;
59                              34.22           2.47                            ;
99                              13.95           2.47                            ;
69                              74.45           2.47                            ;
89                              284.93          2.47                            ;
j-66                            17.75           2.47                            ;
173                             43.46           2.47                            ;
COM_Kolonia_2                   102.81          0                               ;
j-60                            17.85           2.47                            ;
122                             0.11            2.47                            ;
222                             67.97           0                               ;
True_Value                      7.94            0                               ;
79                              393.86          2.47                            ;
148                             99.4            2.47                            ;
129                             264.61          2.47                            ;
181                             14.4            2.47                            ;
229                             82.14           2.47                            ;
Pics_High_School                133.25          23.83                           ;
j-55                            53.96           2.47                            ;
230                             47.52           2.47                            ;
156                             148.64          2.47                            ;
Airport                         6.82            0                               ;
j-86                            52.5            2.47                            ;
j-44                            78.66           2.47                            ;
124                             9.31            2.47                            ;
224                             41.82           0                               ;
105                             14.0            2.47                            ;
205                             279.88          0                               ;
j-39                            58.87           2.47                            ;
183                             13.58           2.47                            ;
164                             145.86          2.47                            ;
j-75                            66.87           2.47                            ;
j-33                            63.61           2.47                            ;
AIRPORT_FIRE_(ARF)              0.91            1.36                            ;
well_head_lower_pics            126.9           0                               ;
132                             113.24          2.47                            ;
232                             70.07           2.47                            ;
well_head_k-2                   158.73          0                               ;
Sea_Breeze_Hotel                13.73           0                               ;
Pohnpei_State_Hospital          34.38           8.76                            ;
j-28                            48.48           2.47                            ;
139                             5.88            2.47                            ;
191                             22.03           2.47                            ;
239                             112.65          2.47                            ;
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j-64                        25.52          2.47                          ;
j-22                        133.52         2.47                          ;
Nett_Laundry                34.72          0                             ;
J-3                         179.12         2.47                          ;
seker_school                115.61         1.14                          ;
107                         9.15           2.47                          ;
207                         38.42          0                             ;
140                         91.81          2.47                          ;
Judy_Laundramat             101.18         3.27                          ;
j-59                        41.51          2.47                          ;
j-17                        99.3           2.47                          ;
166                         34.72          2.47                          ;
j-11                        110.49         2.47                          ;
H&E_Apartments              23.73          0                             ;
j-499                       47.85          2.47                          ;
115                         11.08          2.47                          ;
215                         157.44         2.47                          ;
Heigenburger_Bellarim       27.36          2.77                          ;
j-48                        71.1           2.47                          ;
10                          6.1            2.47                          ;
20                          120.17         2.47                          ;
193                         238.99         0                             ;
40                          51.18          2.47                          ;
50                          11.51          2.47                          ;
j-42                        78.44          2.47                          ;
70                          55.76          2.47                          ;
80                          21.25          2.47                          ;
90                          326.38         2.47                          ;
174                         74.94          2.47                          ;
60                          294.46         2.47                          ;
30                          177.89         0                             ;
PICS_Farm                   138.29         5.01                          ;
142                         154.39         2.47                          ;
Joy_Hotel                   69.74          1.32                          ;
Neime_Preston               11.41          5.02                          ;
j-37                        60.29          2.47                          ;
168                         13.2           2.47                          ;
149                         75.1           2.47                          ;
Maupuwsi_laundramat         99.28          2.04                          ;
j-31                        41.42          2.47                          ;
H_and_K_Main_Meter          68.83          3.8                           ;
Tuna_Commision              72.78          5.2                           ;
Cliff_Rainbow_Hotel         117.05         9.14                          ;
117                         16.19          2.47                          ;
217                         127.07         0                             ;
150                         56.41          2.47                          ;
EDA                         1.53           14.67                         ;
Luen_Thai                   0.84           1.11                          ;
j-26                        65.64          2.47                          ;
Rumours_Bar                 93.79          2.55                          ;
176                         18.91          2.47                          ;
j-20                        109.77         2.47                          ;
125                         197.29         0                             ;
225                         36.92          0                             ;
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J-74                          56.26          2.47                          ;
Catholic_Elementary_School    66.24          0.67                          ;
j-15                          124.96         2.47                          ;
FSM_Petroleum                 6.19           5.26                          ;
11                            4.51           2.47                          ;
21                            108.79         2.47                          ;
31                            4.11           2.47                          ;
41                            70.83          2.47                          ;
51                            22.24          2.47                          ;
61                            65.04          2.47                          ;
71                            102.96         2.47                          ;
j-85                          44.09          2.47                          ;
81                            156.91         2.47                          ;
91                            291.3          2.47                          ;
184                           3.07           2.47                          ;
152                           168.75         2.47                          ;
178                           29.01          2.47                          ;
Bernards_Apt                  30.55          0                             ;
j-40                          65.91          2.47                          ;
159                           43.1           2.47                          ;
101                           341.41         2.47                          ;
201                           98.33          2.47                          ;
127                           297.25         0                             ;
227                           25.6           2.47                          ;
J-94                          294.06         2.47                          ;
160                           16.6           2.47                          ;
186                           15.29          2.47                          ;
ESDM_School                   33.47          0                             ;
Linda_Carl                    93.04          4.76                          ;
135                           324.77         2.47                          ;
235                           27.37          2.47                          ;
j-24                          62.93          2.47                          ;
j-58                          51.82          2.47                          ;
22                            107.21         2.47                          ;
32                            71.99          2.47                          ;
52                            42.03          2.47                          ;
103                           10.39          2.47                          ;
72                            72.38          2.47                          ;
82                            159.36         2.47                          ;
92                            321.41         2.47                          ;
194                           31.09          2.47                          ;
well_head__namkopotomen       32.74          0                             ;
j-19                          109.51         2.47                          ;
203                           219.36         2.47                          ;
162                           144.94         0                             ;
62                            323.82         2.47                          ;
42                            36.67          2.47                          ;
j-13                          105.05         2.47                          ;
j-89                          29.84          9.71                          ;
188                           16.58          2.47                          ;
169                           18.1           2.47                          ;
111                           321.53         2.47                          ;
Yoshita_Enterprises           25.23          0                             ;
j-83                          38.69          2.47                          ;
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211                          172.54          2.47                          ;
j-100                        10.0            2.47                          ;
137                          365.32          0                             ;
170                          32.33           2.47                          ;
j-6                          103.46          2.47                          ;
j-78                         50.89           2.47                          ;
196                          28.49           2.47                          ;
J-92                         181.98          2.47                          ;
4tx_apt                      127.42          0                             ;
145                          129.51          2.47                          ;
Ocean_View_Hotel             99.88           1.56                          ;
j-67                         16.81           2.47                          ;
13                           70.79           2.47                          ;
23                           65.69           2.47                          ;
33                           78.82           2.47                          ;
43                           7.27            2.47                          ;
53                           31.01           2.47                          ;
j-61                         37.02           9.71                          ;
73                           70.16           2.47                          ;
Yvonnes_Hotel                74.5            0.78                          ;
83                           171.16          2.47                          ;
93                           336.79          2.47                          ;
j-102                        143.66          2.47                          ;
Ohmine_Elementary_School     66.4            1.42                          ;
113                          125.73          2.47                          ;
172                          122.94          2.47                          ;
63                           333.09          2.47                          ;
213                          164.58          2.47                          ;
Awark_School                 1.41            1.14                          ;
j-8                          117.82          2.47                          ;
j-98                         7.11            2.47                          ;
j-56                         101.71          2.47                          ;
198                          32.5            0                             ;
179                          27.43           2.47                          ;
Baptist_School               55.71           1.85                          ;
j-50                         73.26           2.47                          ;
121                          30.16           2.47                          ;
sports_center                106.05          70.54                         ;
Saladak_elmentary_School     18.36           2.47                          ;
147                          83.28           2.47                          ;
180                          13.65           2.47                          ;
j-87                         45.03           2.47                          ;
j-45                         70.4            2.47                          ;
Penda_Ocean                  6.53            83.19                         ;
Nett_School                  34.1            1.32                          ;
j-81                         138.76          2.47                          ;
155                          137.53          2.47                          ;
j-76                         73.41           2.47                          ;
j-34                         74.64           2.47                          ;
Power_Plant_NPP              393.22          2.24                          ;
14                           37.23           2.47                          ;
24                           31.26           2.47                          ;
j-70                         94.8            2.47                          ;
123                          439.49          2.47                          ;
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34                          60.42       2.47                        ;
44                          20.54       2.47                        ;
54                          31.93       2.47                        ;
74                          101.9       2.47                        ;
94                          34.04       2.47                        ;
84                          199.61      2.47                        ;
SDA_School                  174.15      0.87                        ;
64                          150.91      2.47                        ;
223                         41.79       0                           ;
j-29                        47.47       2.47                        ;
182                         8.75        2.47                        ;
YTY_Laundry                 36.41       2.01                        ;
j-23                        67.5        2.47                        ;
Pohnpei_Water_Company       103.84      2.72                        ;
189                         20.59       2.47                        ;
131                         193.02      0                           ;
231                         32.17       2.47                        ;
157                         29.58       2.47                        ;
j-18                        122.22      2.47                        ;
Kolonia_Elementary_School   87.08       6.36                        ;
190                         4.52        2.47                        ;
j-54                        58.29       2.47                        ;
J-2                         269.03      2.47                        ;
106                         393.48      2.47                        ;
206                         34.69       2.47                        ;
j-49                        66.74       2.47                        ;
Pacific_Sky_Lite_Hotel      124.53      1.81                        ;
165                         11.11       2.47                        ;
j-43                        89.66       2.47                        ;
China_Star_Hotel            1.21        1.66                        ;
15                          48.75       2.47                        ;
25                          158.17      2.47                        ;
35                          116.64      2.47                        ;
133                         114.9       2.47                        ;
45                          18.59       2.47                        ;
55                          10.91       2.47                        ;
75                          98.76       2.47                        ;
85                          87.98       2.47                        ;
95                          325.7       2.47                        ;
well_head_nam_wellin_rohi   251.83      0                           ;
65                          328.92      2.47                        ;
j-38                        60.95       2.47                        ;
233                         68.59       2.47                        ;
well_head_enrinals          49.63       0                           ;
192                         262.37      2.47                        ;
Etchiet_Laundry             48.44       5.34                        ;
j-32                        50.37       2.47                        ;
j-9                         115.71      2.47                        ;
108                         21.89       2.47                        ;
208                         37.53       0                           ;
141                         91.89       2.47                        ;
241                         6.84        2.47                        ;
j-27                        46.22       2.47                        ;
167                         25.01       2.47                        ;
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 Flamingo_Club                 93.44          1.14                            ;
 Isamu_Nakasone_1_and_2        51.8           2.59                            ;
 j-63                          2.79           2.47                            ;
 j-21                          104.42         2.47                            ;
 Genesis                       34.15          3.15                            ;
 PCR_Hotel                     31.36          3.67                            ;
 j-599                         53.57          2.47                            ;
 116                           21.84          2.47                            ;
 216                           128.36         2.47                            ;
 j-4                           106.73         2.47                            ;
 j-16                          105.31         2.47                            ;
 12345                         37.1           2.47                            ;
 175                           21.73          2.47                            ;
 j-52                          67.98          2.47                            ;
 j-10                          110.97         2.47                            ;
 16                            48.4           2.47                            ;
 26                            99.53          2.47                            ;
 36                            74.46          2.47                            ;
 sokehs_powe_elementary_school 13.92          0                               ;
 56                            64.4           2.47                            ;
 66                            99.05          2.47                            ;
 46                            19.28          2.47                            ;
 86                            105.85         2.47                            ;
 76                            92.83          2.47                            ;
 Hawleys_Ice_Plant             17.04          0.78                            ;
 96                            344.03         2.47                            ;
 143                           164.69         2.47                            ;
 j-47                          76.68          2.47                            ;
 j-41                          71.1           2.47                            ;
 US_Embassy                    73.88          0.44                            ;

[RESERVOIRS]
;ID                   Head         Pattern
 treatment_plant      250.0                          ;
 well_k7              85.2                           ;
 well_enrinals        -4.8                           ;
 hospital_MO_plant    39.2                           ;
 well_lower_pics      26.6                           ;
 well-k2              60.3                           ;
 158                  500.0                          ;
 well_nam_welin_rohi  191.0                          ;
 well_namkopotomen    -17.6                          ;
```

[TANKS]

;ID	Elevation	InitLevel	MinLevel	MaxLevel	Diameter	MinVol	VolCurve	
tank_Kinakapw	249.28	15.72	0.0	30.0	50.0	0.0		;
t-NPP	398.31	22.69	0.0	40.0	48.0	0.0		;
t-Nett	184.42	20.18	0.0	40.0	65.23	0.0		
;								
t-Ipat	188.97	13.53	0.0	40.0	66.0	0.0		;
t-sokehs	179.59	12.11	0.0	40.0	65.23	0.0		;

[PIPES]

;ID	Node1	Node2	Length	Diameter	Roughness	MinorLoss	Status	
p-503	3	4	1854.59	6.0	140.0	0.0	Open	;
p-504	4	5	948.99	6.0	140.0	0.0	Open	;
p-97	5	Pacific_Food	1235.77	6.0	140.0	0.6	Open	;
P-102	j-67	j-89	351.35	8.0	140.0	0.5	Open	;
p-75	j-50	j-51	199.33	8.0	140.0	0.5	Open	;
p-76	j-51	j-52	150.23	8.0	140.0	0.5	Open	;
p-77	j-52	j-26	152.73	8.0	140.0	0.5	Open	;
p-78	j-26	j-54	200.8	8.0	140.0	0.5	Open	;
p-60	j-54	j-55	430.49	8.0	140.0	0.5	Open	;
p-34	j-27	j-28	233.86	8.0	140.0	0.5	Open	;
p-36	j-29	j-30	238.2	8.0	140.0	0.5	Open	;
p-37	j-30	j-31	253.12	8.0	140.0	0.5	Open	;
p-40	j-33	j-34	252.32	8.0	140.0	0.5	Open	;
p-42	j-35	j-36	250.51	8.0	140.0	0.5	Open	;
p-47	j-48	j-47	170.46	8.0	140.0	0.5	Open	;
p-74	j-52	j-49	410.22	6.0	140.0	0.5	Open	;
p-65	j-30	j-33	609.49	4.0	140.0	0.5	Open	;
p-64	j-29	j-34	648.93	4.0	140.0	0.5	Open	;
p-63	j-28	j-35	686.75	4.0	140.0	0.5	Open	;
p-59	j-54	j-37	426.85	6.0	140.0	0.0	Open	;
p-73	j-51	j-48	411.95	6.0	140.0	0.5	Open	;
P-49	j-45	j-46	170.68	8.0	140.0	0.5	Open	;
P-50	j-46	j-24	147.1	8.0	140.0	0.5	Open	;
P-51	j-24	j-38	141.71	8.0	140.0	0.5	Open	;
p-52	j-38	j-39	193.72	8.0	140.0	0.5	Open	;
P-54	j-42	j-41	160.99	6.0	140.0	0.5	Open	;
P-55	j-41	j-23	158.18	6.0	140.0	0.5	Open	;
45	j-23	j-40	164.56	6.0	140.0	0.0	Open	;
p-57	j-40	j-38	430.49	6.0	140.0	0.0	Open	;
p-30	j-24	j-23	444.36	8.0	140.0	0.5	Open	;
p-68	j-46	j-41	463.14	6.0	140.0	0.5	Open	;
p-67	j-45	j-42	453.12	6.0	140.0	0.5	Open	;
p-15	j-12	j-11	164.15	4.0	140.0	0.4	Open	;

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P-14            j-11            j-10            296.91      12.0        140.0       0.4         Open      ;
P-98            j-70            j-56            577.73      8.0         140.0       0.2         Open      ;
J-99            j-70            j-44            455.56      8.0         140.0       0.2         Open      ;
p-69            j-47            j-44            337.63      12.0        140.0       0.5         Open      ;
P-48            j-44            j-45            167.38      8.0         140.0       0.5         Open      ;
p-95            j-67            j-66            611.4       8.0         140.0       0.5         Open      ;
p-94            j-66       Yoshita_Enterprises  438.83      8.0         140.0       1.2         Open      ;
p-9     Yoshita_Enterprises     j-82            330.05      8.0         140.0       1.2         Open      ;
p-92            j-82            j-61            209.82      8.0         140.0       0.6         Open      ;
p-87            j-61            j-62            178.69      6.0         140.0       0.5         Open      ;
p-88            j-62            j-63            193.97      6.0         140.0       0.5         Open      ;
p-89            j-64            j-62            296.96      6.0         140.0       0.6         Open      ;
P-110           j-75            j-76            395.8       4.0         140.0       0.6         Open      ;
P-79            j-56            j-14            304.04      12.0        140.0       0.5         Open      ;
P-112           j-78            j-77            548.0       4.0         140.0       1.8         Open      ;
p-19            j-13            j-15            202.63      12.0        140.0       0.4         Closed    ;
p-27            j-5             j-21            395.47      12.0        140.0       0.6         Open      ;
p-26            j-21            j-19            269.58      12.0        140.0       0.2         Open      ;
p-588           66              j-4             594.61      12.0        140.0       0.4         Open      ;
P-589           j-77            61              568.52      4.0         140.0       1.1         Open      ;
p-591           j-58            j-553           716.44      12.0        140.0       0.33        Open      ;
p-597           121             139             431.13      8.0         140.0       0.04        Open      ;
p-598           139             122             348.48      8.0         140.0       0.04        Open      ;
p-599           122             j-60            781.95      6.0         120.0       0.04        Open      ;
100             122             124             961.62      6.0         135.0       0.0         Open      ;
101             146             124             412.18      6.0         135.0       0.0         Open      ;
p-136           j-102           j-203           694.21      12.0        130.0       1.1         Open      ;
p-123           J-92            t-Ipat          148.61      12.0        100.0       0.4         Open      ;
p-612           145             142             463.62      12.0        140.0       0.1         Open      ;
p-613           142             143             465.97      12.0        140.0       0.1         Open      ;
p-622           J-2             125             5874.19     12.0        111.0       0.0         Closed    ;
p-623           125             127             4187.75     12.0        111.0       0.0         Open      ;
p-624           127             126             208.68      12.0        111.0       0.0         Open      ;
p-625           126             137             2658.26     12.0        111.0       0.0         Open      ;
p-626           137             138             1530.43     12.0        111.0       0.0         Open      ;
j-629           85              j-98            1548.94     12.0        140.0       1.2         Open      ;
p-630           j-98            102             575.84      12.0        140.0       1.3         Open      ;
p-631           102             103             900.75      8.0         100.0       1.3         Open      ;
p-632           103             104             897.96      8.0         100.0       1.2         Open      ;
p-633           104             105             900.87      8.0         100.0       1.3         Open      ;
p-634           105 sokehs_powe_elementary_school 1179.34   8.0         140.0       1.2         Open      ;
p-638           109             110             766.28      6.0         140.0       1.2         Open      ;
p-639           110             j-100           1147.3      4.0         135.0       1.3         Open      ;
p-642           114             115             1555.91     8.0         140.0       0.2         Open      ;
p-643           115             134             904.23      8.0         140.0       0.2         Open      ;
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p-644	134	116	1374.34	8.0	140.0	0.2	Open	;
p-645	116	117	1689.83	8.0	140.0	0.2	Open	;
p-646	117	118	728.99	8.0	140.0	0.0	Open	;
p-647	118	98	1518.38	8.0	140.0	0.2	Open	;
p-648	98	99	977.8	8.0	140.0	0.2	Open	;
p-649	99	100	2162.57	8.0	140.0	0.2	Open	;
p-650	100	j-98	1812.82	8.0	140.0	0.2	Open	;
p-38	j-31	j-32	430.17	8.0	140.0	0.5	Open	;
p-39	j-32	j-33	246.68	8.0	140.0	0.5	Open	;
p-116	j-82	j-83	108.68	4.0	140.0	0.6	Open	;
p-117	j-83	j-84	305.46	4.0	140.0	1.8	Open	;
p-23	j-15	j-16	889.79	4.0	140.0	0.6	Open	;
p-21	j-16	j-18	384.71	4.0	140.0	0.5	Open	;
P-114	j-15	j-81	368.05	4.0	140.0	1.2	Open	;
159	j-7	j-6	1546.97	8.0	140.0	1.6	Open	;
p-661	j-499	j-59	921.19	12.0	140.0	0.33	Open	;
p-662	143	144	719.45	12.0	140.0	0.1	Open	;
p-61	j-55	j-36	421.73	8.0	140.0	0.0	Open	;
p-44	j-37	j-25	152.17	8.0	140.0	0.5	Open	;
p-45	j-25	j-49	160.19	8.0	140.0	0.5	Open	;
p-32	j-26	j-25	421.64	8.0	140.0	0.5	Open	;
p-31	j-25	j-24	345.04	8.0	140.0	0.5	Open	;
p-58	j-37	j-38	347.55	6.0	140.0	0.5	Open	;
p-70	j-48	j-45	332.58	6.0	140.0	0.0	Open	;
p-71	j-49	j-46	329.44	6.0	140.0	0.5	Open	;
p-66	j-44	j-43	471.66	12.0	140.0	0.5	Open	;
P-53	j-43	j-42	172.69	6.0	140.0	0.5	Open	;
p-18	j-43	j-14	135.93	12.0	140.0	0.2	Open	;
p-17	j-14	j-13	313.99	12.0	140.0	0.5	Open	;
p-22	j-17	j-16	107.24	4.0	140.0	0.5	Open	;
p-13	j-23	j-10	784.17	8.0	140.0	0.5	Open	;
P-12	j-10	j-6	234.56	12.0	140.0	0.2	Open	;
p-84	j-599	t-Nett	1829.54	8.0	140.0	0.0	Open	;
P-25	j-19	j-20	232.67	4.0	140.0	0.5	Open	;
p-682	j-99	t-sokehs	93.12	8.0	100.0	0.0	Open	;
P-683	135	J-94	1154.38	8.0	140.0	0.0	Open	;
P-505	j-27	2	355.81	8.0	140.0	0.4	Open	;
P-510	2	6	281.7	8.0	140.0	0.4	Open	;
p-16	j-11	j-13	262.85	12.0	140.0	0.4	Open	;
p-501	j-59	j-599	374.37	8.0	140.0	0.0	Open	;
p-118	j-83	j-85	130.21	4.0	140.0	0.6	Open	;
p-119	j-85	j-86	193.55	4.0	140.0	0.6	Open	;
p-120	j-85	j-87	264.07	4.0	140.0	0.6	Open	;
P-113	j-75	j-78	267.4	4.0	140.0	1.2	Open	;
P-5	J-92	J-3	85.48	12.0	140.0	0.0	Open	;

P-515	J-3	144	543.73	12.0	140.0	0.0	Open	;
P-100	j-70	Telecom_AGR	163.47	8.0	140.0	0.5	Open	;
P-115	j-70	J-71	239.08	4.0	140.0	0.6	Open	;
1	j-31	1	654.43	2.0	130.0	0.0	Open	;
3	FSM_Surveylance	10	644.72	6.0	140.0	0.0	Open	;
5	Port_Authority	11	252.53	6.0	140.0	0.0	Open	;
9	11	EDA	302.47	6.0	140.0	0.0	Open	;
10	j-79	13	282.6	8.0	140.0	0.0	Open	;
16	j-28	15	31.32	8.0	140.0	0.0	Open	;
18	15	14	213.73	4.0	140.0	0.0	Open	;
19	j-29	16	82.01	8.0	140.0	0.0	Open	;
20	16	15	122.77	8.0	140.0	0.0	Open	;
21	16	17	307.38	3.0	120.0	0.0	Open	;
22	17	18	612.12	3.0	120.0	0.0	Open	;
23	17	19	914.36	3.0	120.0	0.0	Open	;
24	j-7	j-8	239.58	4.0	140.0	0.0	Open	;
25	j-8	20	302.92	4.0	140.0	0.0	Open	;
26	j-8	21	94.97	4.0	140.0	0.0	Open	;
27	j-15	22	831.46	6.0	100.0	0.0	Open	;
29	23	j-73	153.19	6.0	140.0	0.0	Open	;
30	j-73	J-74	195.8	6.0	140.0	0.0	Open	;
32	j-73	24	164.3	4.0	140.0	0.0	Open	;
33	J-71	26	628.75	4.0	140.0	0.0	Open	;
34	23	29	286.58	2.0	130.0	0.0	Open	;
36	12345	j-57	43.02	8.0	140.0	0.0	Open	;
37	12345	31	387.79	4.0	140.0	0.0	Open	;
38	61	32	206.52	4.0	140.0	0.0	Open	;
39	32	j-76	582.69	4.0	140.0	0.0	Open	;
40	32	34	473.96	2.0	130.0	0.0	Open	;
42	35	j-19	167.09	12.0	140.0	0.0	Open	;
43	32	36	169.04	4.0	130.0	0.0	Closed	;
46	36	33	382.99	2.0	130.0	0.0	Open	;
17	j-99	102	661.11	8.0	100.0	0.0	Open	;
49	37	66	143.73	12.0	140.0	0.0	Open	;
50	38	37	218.34	4.0	140.0	0.0	Open	;
53	44	41	1114.07	4.0	130.0	0.0	Open	;
54	41	47	1312.75	4.0	130.0	0.0	Open	;
55	47	45	1719.81	4.0	130.0	0.0	Open	;
56	45	43	2644.1	4.0	130.0	0.0	Open	;
57	j-60	55	1303.69	4.0	130.0	0.0	Open	;
58	55	54	1018.61	4.0	130.0	0.0	Open	;
59	54	53	1013.39	4.0	130.0	0.0	Open	;
60	53	40	713.54	4.0	130.0	0.0	Open	;
61	40	52	902.11	4.0	130.0	0.0	Open	;
62	52	51	1948.05	4.0	130.0	0.0	Open	;

63	51	50	1579.95	4.0	130.0	0.0	Open	;
64	50	49	1558.74	4.0	130.0	0.0	Open	;
67	146	57	1052.07	6.0	135.0	0.0	Open	;
68	57	58	753.87	6.0	135.0	0.0	Open	;
75	j-553	71	1079.95	8.0	140.0	0.0	Open	;
76	j-58	73	433.85	4.0	130.0	0.0	Open	;
77	73	72	445.74	4.0	130.0	0.0	Open	;
78	j-21	74	630.46	12.0	140.0	0.0	Open	;
79	74	86	642.96	12.0	140.0	0.0	Open	;
81	76	75	378.96	4.0	130.0	0.0	Open	;
82	75	77	287.06	4.0	130.0	0.0	Open	;
83	77	86	304.83	4.0	130.0	0.0	Open	;
84	j-203	78	442.84	12.0	130.0	0.0	Open	;
87	82	81	187.12	4.0	130.0	0.0	Open	;
89	82	78	177.06	4.0	130.0	0.0	Open	;
90	J-92	84	275.4	12.0	100.0	0.0	Open	;
92	87	129	946.7	4.0	135.0	0.0	Open	;
93	78	SDA_School	600.8	8.0	140.0	0.0	Open	;
94	SDA_School	83	399.11	12.0	100.0	0.0	Open	;
95	83	J-2	1426.06	12.0	100.0	0.0	Open	;
98	89	91	855.28	2.0	130.0	0.0	Open	;
99	91	90	942.27	2.0	130.0	0.0	Open	;
102	135	92	489.61	2.0	130.0	0.0	Open	;
105	93	95	853.05	4.0	135.0	0.0	Open	;
106	93	97	1034.89	8.0	140.0	0.0	Open	;
107	97	136	632.87	8.0	140.0	0.0	Open	;
108	97	96	709.09	4.0	130.0	0.0	Open	;
109	96	101	754.73	4.0	130.0	0.0	Open	;
110	101	111	1902.15	4.0	130.0	0.0	Open	;
111	136	128	881.71	8.0	140.0	0.0	Open	;
113	128	112	603.15	2.0	130.0	0.0	Open	;
114	128	119	1347.07	2.0	130.0	0.0	Open	;
115	119	123	1194.76	2.0	130.0	0.0	Open	;
116	85	133	1256.0	8.0	135.0	0.0	Open	;
117	133	140	1934.7	8.0	135.0	0.0	Open	;
118	140	141	1887.74	8.0	135.0	0.0	Open	;
119	141	149	1102.9	8.0	135.0	0.0	Open	;
120	149	150	1054.52	8.0	135.0	0.0	Open	;
121	150	147	1139.09	8.0	135.0	0.0	Open	;
122	147	148	1096.97	8.0	135.0	0.0	Open	;
127	132	154	1508.71	4.0	135.0	0.0	Open	;
128	132	155	621.63	8.0	135.0	0.0	Closed	;
129	44	46	797.0	4.0	140.0	0.0	Open	;
130	46	j-60	759.46	4.0	130.0	0.0	Open	;
131	j-599	67	1414.97	2.0	130.0	0.0	Open	;

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132             67              68              705.5       2.0         130.0       0.0         Open      ;
133             68              70              853.66      2.0         130.0       0.0         Open      ;
134             70              69              1028.51     2.0         130.0       0.0         Open      ;
135             148             seker_school    707.68      8.0         135.0       0.0         Open      ;
136             seker_school    132             502.35      8.0         135.0       0.0         Open      ;
7               25              156             346.48      4.0         130.0       0.0         Open      ;
137             161             well_head_k-2   74.18       3.0         120.0       0.0         Open      ;
138             well_head_k-2   81              44.19       4.0         120.0       11.0        Open      ;
140             162             well_head_k7    53.41       3.0         120.0       0.0         Open      ;
143             well_head_k7    164             41.9        4.0         120.0       11.0        Open      ;
144             164             156             128.0       2.0         120.0       0.0         Open      ;
145             82              25              289.84      4.0         130.0       0.0         Open      ;
2               EDA             China_Star_Hotel 100.69     2.0         130.0       0.0         Open      ;
15          Hawleys_Ice_Plant   28              142.29      8.0         140.0       0.0         Open      ;
88              Yvonnes_Hotel   Telecom_AGR     42.03       8.0         140.0       0.0         Open      ;
139             10              Airport         184.25      8.0         135.0       0.0         Open      ;
141             j-81            State_Legislature 86.97     2.0         130.0       0.0         Open      ;
142             j-18            COM_Kolonia_1   56.95       12.0        140.0       0.0         Open      ;
146             COM_Kolonia_1   35              38.97       12.0        140.0       0.0         Open      ;
148         Maupuwsi_laundramat j-5             343.58      12.0        140.0       0.0         Open      ;
149             j-4         Pacific_Sky_Lite_Hotel 367.51   12.0        140.0       0.0         Open      ;
150       Pacific_Sky_Lite_Hotel 145              186.26      12.0        140.0       0.0         Open      ;
151             109             108             715.0       8.0         140.0       0.0         Open      ;
152             108   Sokehs_Pah_Elementary_School 181.51   8.0         140.0       0.0         Open      ;
153       Sokehs_Pah_Elementary_School            107                     601.39      8.0         140.0
                0.0             Open            ;
154             j-9             South_Park_Hotel 197.49     8.0         140.0       0.0         Open      ;
155             j-9           Cliff_Rainbow_Hotel 59.3      8.0         140.0       0.0         Open      ;
156          Cliff_Rainbow_Hotel j-7             1528.73     8.0         140.0       0.0         Open      ;
157             j-48            Joy_Hotel       45.88       8.0         140.0       0.0         Open      ;
158             Joy_Hotel       j-49            122.85      8.0         140.0       0.0         Open      ;
160             j-22            Pics_High_School 129.99     12.0        140.0       0.0         Closed    ;
165             j-35     Ohmine_Elementary_School 39.35     8.0         140.0       0.0         Open      ;
166     Ohmine_Elementary_School j-34           202.85      8.0         140.0       0.0         Open      ;
41              155             64              830.36      8.0         135.0       0.0         Open      ;
168             114             80              563.24      8.0         140.0       0.0         Open      ;
169             j-100           88              359.04      4.0         135.0       0.0         Open      ;
47              69              39              2054.39     2.0         135.0       0.0         Open      ;
66              39              113             1408.6      2.0         135.0       0.0         Open      ;
171             120             49              1308.15     2.0         130.0       0.0         Open      ;
172             53              157             1783.07     6.0         135.0       0.0         Open      ;
173             157             159             2078.43     6.0         135.0       0.0         Open      ;
174             159             163             1445.93     6.0         135.0       0.0         Open      ;
175             163             165             2157.46     6.0         135.0       0.0         Open      ;
176             165             166             2489.12     6.0         135.0       0.0         Open      ;
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177             166             58              2300.37     6.0         135.0       0.0         Open    ;
178             40              167             1958.35     8.0         135.0       0.0         Closed  ;
179             167             168             1142.75     8.0         135.0       0.0         Open    ;
180             168             169             1824.91     8.0         135.0       0.0         Open    ;
181             169             170             2719.64     8.0         135.0       0.0         Open    ;
182             170             171             2626.33     8.0         135.0       0.0         Open    ;
183             171             173             1375.16     8.0         135.0       0.0         Open    ;
184             173             172             1527.55     8.0         135.0       0.0         Open    ;
185             172             174             1090.33     8.0         135.0       0.0         Open    ;
187             176             177             1142.33     8.0         135.0       0.0         Open    ;
188             177             178             1143.5      8.0         135.0       0.0         Open    ;
189             178             179             2628.36     8.0         135.0       0.0         Open    ;
190             179             180             2218.34     8.0         135.0       0.0         Open    ;
191             180             181             925.36      8.0         135.0       0.0         Open    ;
192             181             182             682.47      8.0         135.0       0.0         Open    ;
193             182             183             2120.56     8.0         135.0       0.0         Open    ;
194             183             184             1277.95     8.0         135.0       0.0         Open    ;
195             184             186             881.66      8.0         135.0       0.0         Open    ;
196             186             187             1454.9      8.0         135.0       0.0         Open    ;
198             185             188             1440.98     8.0         135.0       0.0         Open    ;
199             188             189             2524.11     8.0         135.0       0.0         Open    ;
200             189             191             2591.77     8.0         135.0       0.0         Open    ;
201             191             190             440.34      8.0         135.0       0.0         Open    ;
202             193     well_head_nam_wellin_rohi 347.75    3.0         120.0       0.0         Open    ;
203   well_head_nam_wellin_rohi 191             2944.24     4.0         135.0       11.0        Open    ;
204             185     Saladak_elmentary_School  282.16     8.0         135.0       0.0         Open    ;
205   Saladak_elmentary_School  187             1118.38     8.0         135.0       0.0         Open    ;
206             174             175             939.04      8.0         135.0       0.0         Open    ;
208             190             194             837.68      8.0         135.0       0.0         Open    ;
209             194             195             2648.19     8.0         135.0       0.0         Open    ;
210             195             196             2224.62     8.0         135.0       0.0         Open    ;
211             198      well_head__namkopotomen  197.8      3.0         120.0       0.0         Open    ;
212     well_head__namkopotomen 194               74.56      4.0         135.0       11.0        Open    ;
213             200             well_head_enrinals          336.35      3.0         120.0       0.0
                Open            ;
214         well_head_enrinals  195               55.15      4.0         135.0       11.0        Open    ;
215             196             ESDM_School     2109.68     8.0         135.0       0.0         Open    ;
216             ESDM_School     202             203.91      8.0         135.0       0.0         Open    ;
217             202             201             950.4       8.0         135.0       0.0         Open    ;
218             201             203             2203.45     8.0         135.0       0.0         Open    ;
219             203             tank_Kinakapw   165.28      8.0         135.0       0.0         Open    ;
220             J-2             205             118.13      12.0        140.0       0.0         Open    ;
221             204             J-94            131.2       12.0        140.0       0.0         Open    ;
223             206             59              222.38      8.0         140.0       0.0         Open    ;
225             207             208             71.04       8.0         100.0       0.0         Open    ;
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226                209                208                93.26         8.0           100.0          0.0           Open       ;
69                 J-94               60                 64.6          4.0           135.0          0.0           Open       ;
71                 60                 7                  747.25        4.0           135.0          0.0           Open       ;
72                 7                  89                 445.25        4.0           135.0          0.0           Open       ;
73                 111                90                 278.0         2.0           130.0          0.0           Open       ;
74                 95                 62                 921.0         2.0           135.0          0.0           Open       ;
96                 62                 90                 612.91        2.0           135.0          0.0           Open       ;
103                63                 65                 894.92        2.0           130.0          0.0           Open       ;
228                7                  129                486.62        4.0           135.0          0.0           Open       ;
229                60                 192                936.43        2.0           130.0          0.0           Open       ;
231                87                 210                612.17        4.0           135.0          0.0           Open       ;
232                83                 84                 668.87        12.0          100.0          0.0           Open       ;
233                78                 211                360.8         8.0           135.0          0.0           Open       ;
234                211                212                449.32        8.0           135.0          0.0           Open       ;
235                212                213                1176.54       8.0           135.0          0.0           Open       ;
236                213                214                1005.22       8.0           135.0          0.0           Open       ;
237                214                215                193.62        8.0           135.0          0.0           Open       ;
238                j-22               216                217.9         12.0          140.0          0.0           Open       ;
240    well_head_lower_pics           216                194.59        4.0           135.0          11.0          Open       ;
241                93                 63                 293.83        8.0           135.0          0.0           Open       ;
242                63                 135                425.69        8.0           135.0          0.0           Open       ;
243                217          well_head_lower_pics     131.98        3.0           120.0          0.0           Open       ;
244                76                 218                363.07        4.0           135.0          0.0           Open       ;
245                80                 219                1703.29       8.0           140.0          0.0           Open       ;
248                13                 222                147.08        8.0           140.0          0.0           Open       ;
249                223                28                 225.44        8.0           140.0          0.0           Open       ;
250                Yvonnes_Hotel      224                293.23        8.0           140.0          0.0           Open       ;
251                12345              225                77.48         8.0           140.0          0.0           Open       ;
252                J-74               226                240.7         6.0           140.0          0.0           Open       ;
253                j-57               56                 499.22        12.0          140.0          0.0           Open       ;
254                j-75               56                 185.44        4.0           140.0          0.0           Open       ;
255                24                 228                84.56         4.0           140.0          0.0           Open       ;
256                228                227                130.91        2.0           130.0          0.0           Open       ;
257                Telecom_AGR        229                325.59        6.0           140.0          0.0           Open       ;
258                229                23                 358.13        6.0           140.0          0.0           Open       ;
259                229                230                294.4         2.0           130.0          0.0           Open       ;
260                35                 COM_Kolonia_2      269.94        8.0           140.0          0.0           Open       ;
261                COM_Kolonia_2      36                 298.65        4.0           130.0          0.0           Open       ;
262                j-58               231                957.96        4.0           140.0          0.0           Open       ;
263                232                233                510.88        6.0           135.0          0.0           Open       ;
265                232                j-499              397.63        12.0          140.0          0.0           Open       ;
266                94                 PCR_Hotel          376.55        4.0           130.0          0.0           Open       ;
267                43                 234                2594.76       2.0           140.0          0.0           Open       ;
268                234                48                 1134.33       2.0           130.0          0.0           Open       ;
28               treatment_plant      8                  99.53         36.0          135.0          0.0           Open       ;
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35              206             42                133.36      8.0         100.0         0.0          Open      ;
51              158             138               157.46      12.0        111.0         0.0          Open      ;
13              treatment_plant J-2               178.26      36.0        135.0         0.0          Closed    ;
85              219             160               2685.53     8.0         140.0         0.0          Open      ;
86              160             235               3375.66     4.0         130.0         0.0          Open      ;
91              235             88                181.14      4.0         135.0         0.0          Closed    ;
97              107             236               591.22      8.0         140.0         0.0          Open      ;
104             236sokehs_powe_elementary_school  127.31      8.0         140.0         0.0          Open      ;
123             216             sports_center     1005.04     12.0        140.0         0.0          Open      ;
164             sports_center   86                131.14      12.0        140.0         0.0          Open      ;
170             j-18            4tx_apt           82.87       12.0        140.0         0.0          Open      ;
227             4tx_apt         j-15              607.41      12.0        140.0         0.0          Open      ;
269         Hawleys_Ice_Plant   27                234.29      8.0         140.0         0.0          Open      ;
271             Pacific_Food    H&E_Apartments    140.88      8.0         135.0         0.0          Open      ;
272             H&E_Apartments  27                237.03      8.0         135.0         0.0          Open      ;
273             56     Kolonia_Elementary_School  369.16      12.0        140.0         0.0          Open      ;
274    Kolonia_Elementary_School 239              393.36      12.0        140.0         0.0          Open      ;
275             239             j-56              261.45      12.0        140.0         0.0          Open      ;
276             j-66            True_Value        168.6       8.0         135.0         0.0          Open      ;
277             True_Value      241               481.27      8.0         135.0         0.0          Open      ;
278             241             j-64              511.68      8.0         135.0         0.0          Open      ;
279             j-64            Bernards_Apt      140.7       8.0         135.0         0.0          Open      ;
282             244          Adams_Construction   73.32       12.0        140.0         0.0          Open      ;
284             YTY_Laundry     j-57              103.81      12.0        140.0         0.0          Open      ;
285             j-59            Genesis           401.84      8.0         135.0         0.0          Open      ;
286             Genesis    Pohnpei_State_Hospital 143.08      8.0         135.0         0.0          Open      ;
287             94              121               631.04      8.0         140.0         0.0          Open      ;
288             59              Nett_School       280.68      8.0         140.0         0.0          Open      ;
289             Nett_School     94                109.16      8.0         140.0         0.0          Open      ;
290             176             Awark_School      215.76      8.0         135.0         0.0          Open      ;
291             Awark_School    175               703.32      8.0         135.0         0.0          Open      ;
6          Pohnpei_State_Hospital Nett_Laundry    174.77      8.0         135.0         0.0          Open      ;
8               Nett_Laundry    206               95.46       8.0         135.0         0.0          Open      ;
14              128             79                372.66      8.0         140.0         0.0          Open      ;
70              79              t-NPP             432.89      8.0         140.0         0.0          Open      ;
124             106             131               1895.14     6.0         135.0         0.0          Open      ;
126             151             152               1017.97     6.0         135.0         0.0          Open      ;
162             152             9                 489.19      6.0         135.0         0.0          Open      ;
163             9               64                229.58      8.0         135.0         0.0          Open      ;
125             30              151               1099.51     6.0         135.0         0.0          Open      ;
207       Port_Authority   Caroline_Fisheries_1_2 730.81      2.0         130.0         0.0          Open      ;
222       Caroline_Fisheries_1_2 220              452.04      2.0         130.0         0.0          Open      ;
230             Port_Authority  FSM_Petroleum     178.22      6.0         140.0         0.0          Open      ;
246             FSM_Petroleum   10                213.21      6.0         135.0         0.0          Open      ;
247             Airport         Penda_Ocean       243.12      6.0         135.0         0.0          Open      ;
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 292           Penda_Ocean     AIRPORT_FIRE_(ARF)   4382.25      8.0          135.0          0.0          Open      ;
 293              3                Luen_Thai         827.38       6.0          140.0          0.0          Open      ;
 294              Luen_Thai        FSM_Surveylance   198.03       6.0          140.0          0.0          Open      ;
 295              j-79          H_and_K_Main_Meter   165.82       3.0          120.0          0.5          Open      ;
 296 H_and_K_Main_Meter  Catholic_Elementary_School 402.84       3.0          120.0          0.5          Open      ;
 297              j-26             Ambros_Bakery     183.32       8.0          140.0          0.4          Open      ;
 298              Ambros_Bakery    6                 146.19       8.0          140.0          0.4          Open      ;
 299              j-37             Baptist_School    205.03       8.0          140.0          0.5          Open      ;
 300              Baptist_School   j-36              263.36       8.0          140.0          0.5          Open      ;
 301              13               Tuna_Commision    162.82       8.0          140.0          0.0          Open      ;
 302              Tuna_Commision   j-50              204.88       8.0          140.0          0.0          Open      ;
 303              j-50             Wall_Mart         133.06       12.0         140.0          0.5          Open      ;
 304              Wall_Mart        j-47              242.07       12.0         140.0          0.5          Open      ;
 305              28               Neime_Preston     213.41       6.0          135.0          0.0          Open      ;
 306              Neime_Preston    Sea_Breeze_Hotel  80.67        6.0          135.0          0.0          Open      ;
 307          Bernards_Apt    Heigenburger_Bellarim 129.07       8.0          135.0          0.0          Open      ;
 308    Heigenburger_Bellarim   Yoshita_Enterprises 116.23       8.0          135.0          0.0          Open      ;
 309              244              Etchiet_Laundry   287.17       12.0         140.0          0.0          Open      ;
 310              Etchiet_Laundry  j-58              85.72        12.0         140.0          0.0          Open      ;
 311              j-553            US_Embassy        149.62       12.0         140.0          0.0          Open      ;
 312              US_Embassy       232               159.32       12.0         140.0          0.0          Open      ;
 280              j-6              Judy_Laundramat   129.96       12.0         140.0          0.0          Open      ;
 281      Judy_Laundramat    Maupuwsi_laundramat    481.19       12.0         140.0          0.0          Open      ;
 313              j-5              Palm_Terrace      113.71       12.0         140.0          0.0          Open      ;
 314              Palm_Terrace     Linda_Carl        164.61       12.0         140.0          0.0          Open      ;
 315              Linda_Carl       37                179.49       12.0         140.0          0.0          Open      ;
 316              j-4              Best_Buy          292.03       12.0         140.0          0.0          Open      ;
 317              Best_Buy    Pohnpei_Water_Company 334.74       12.0         140.0          0.0          Open      ;
 318       Pohnpei_Water_Company   Ocean_View_Hotel  129.28       12.0         140.0          0.0          Open      ;
 320              Flamingo_Club    85                1605.7       12.0         140.0          0.0          Open      ;
 321              Ocean_View_Hotel Rumours_Bar       190.66       12.0         140.0          0.0          Open      ;
 322              Rumours_Bar      Flamingo_Club     79.45        12.0         140.0          0.0          Open      ;
 323              Pics_High_School PICS_Farm         323.93       12.0         140.0          0.0          Open      ;
 324              PICS_Farm        j-102             325.3        12.0         140.0          0.0          Open      ;
 325              j-27             Isamu_Nakasone_1_and_2         178.74       8.0          140.0        0.5
                  Open             ;
 326      Isamu_Nakasone_1_and_2   j-55               115.12       8.0          140.0          0.5          Open      ;
 327              79               Power_Plant_NPP   287.47       6.0          135.0          0.0          Open      ;
 328              Power_Plant_NPP  106               983.32       6.0          135.0          0.0          Open      ;
 329              YTY_Laundry      ACE_Construction  40.58        12.0         140.0          0.0          Open      ;
 330      ACE_Construction      Adams_Construction   64.13        12.0         140.0          0.0          Open      ;

[PUMPS]
;ID                      Node1                Node2            Parameters
 PMP-pump_k2             well-k2              161              HEAD PMP-pump_k2   SPEED 1.0   ;
```

```
 PMP-pump_k7               well_k7               162              HEAD PMP-pump_k7   SPEED 1.0   ;
 PMP-pump_nam_wellin_rohi  well_nam_welin_rohi   193              HEAD PMP-pump_nam_wellin_rohi SPEED 1.0   ;
 PMP-pump_namkopotomen     well_namkopotomen     198              HEAD PMP-pump_namkopotomen    SPEED 1.0   ;
 PMP-pump_eorinals         well_enrinals         200              HEAD PMP-pump_eorinals  SPEED 1.0   ;
 TREATMENT_PLANT           205                   204              HEAD PMP-186 SPEED 1.0   ;
 MO_Plant_1                hospital_MO_plant     207              HEAD PMP-197 ;
 MO_PLANT_2                hospital_MO_plant     209              HEAD PMP-224 SPEED 1.0   ;
 PMP-pump_lower_pics       well_lower_pics       217              HEAD PMP-pump_lower_pics SPEED 1.0   ;

[VALVES]
;ID              Node1           Node2           Diameter        Type  Setting         MinorLoss
 PRV-12          222             223             8.0             PRV   40.0            0.0             ;
 PRV-52          224             j-89            8.0             PRV   40.0            0.0             ;
 PRV-80          225             j-61            8.0             PRV   40.0            0.0             ;
 FCV-44          208             42              8.0             FCV   173.6           0.0             ;
 FCV-31          8               J-2             36.0            FCV   1527.78         0.0             ;
 PRV-65          131             30              6.0             PRV   30.0            0.0             ;

[TAGS]
 NODE       Caroline_Fisheries_1_2 14.1

[DEMANDS]
;Junction        Demand          Pattern         Category

[STATUS]
;ID              Status/Setting
 MO_Plant_1      Closed

[PATTERNS]
;ID              Multipliers
;Household Daily Demand Multiplier
 household       .33             .33             .412            .412            1.287           1.287
 household       1.452           1.452           1.488           1.488           0.957           .957
 household       .957            .957            1.488           1.488           1.237           1.237
 household       1.237           1.237           .825            .825            .330            .330
;School daily demand multiplier
 school          0               0               0               0               0               0
 school          2.4             2.4             2.4             2.4             2.4             2.4
 school          2.4             2.4             2.4             2.4             0               0
 school          0               0               0               0               0               0
;commercial daily demand multipliers
 commercial      0               0               0               0               0               2.0
 commercial      2.0             2.0             2.0             2.0             2.0             2.0
```

```
 commercial      2.0             2.0             2.0             2.0             2.0             0
 commercial      0               0               0               0               0               0
;government daily demand multipliers
 government      0               0               0               0               0               0
 government      2.182           2.182           2.182           2.182           2.182           2.182
 government      2.182           2.182           2.182           2.182           2.182           0
 government      0               0               0               0               0               0

[CURVES]
;ID              X-Value         Y-Value
;PUMP:
 PMP-pump_k2     0.0             410.0
 PMP-pump_k2     40.0            368.0
 PMP-pump_k2     75.0            220.0
;PUMP:
 PMP-pump_k7     0.0             460.0
 PMP-pump_k7     100.0           390.0
 PMP-pump_k7     200.0           150.0
;PUMP:
 PMP-pump_nam_wellin_rohi    0.0             160.0
 PMP-pump_nam_wellin_rohi    50.0            140.0
 PMP-pump_nam_wellin_rohi    95.0            78.0
;PUMP:
 PMP-pump_namkopotomen 0.0             160.0
 PMP-pump_namkopotomen 50.0            140.0
 PMP-pump_namkopotomen 95.0            78.0
;PUMP:
 PMP-pump_eorinals     0.0             160.0
 PMP-pump_eorinals     50.0            140.0
 PMP-pump_eorinals     95.0            78.0
;PUMP:
 PMP-186         700.0           200.0
;PUMP:
 PMP-197         158.5           180.1
;PUMP:
 PMP-224         158.5           180.1
;PUMP:
 PMP-pump_lower_pics   0.0             410.0
 PMP-pump_lower_pics   40.0            368.0
 PMP-pump_lower_pics   75.0            220.0
```

[CONTROLS]

[RULES]

[ENERGY]
 Global Efficiency   75
 Global Price   0
 Demand Charge   0

[EMITTERS]
;Junction   Coefficient

[QUALITY]
;Node   InitQual
 118   8.0
 218   6.0
 j-36   1.0
 177   12.0
 j-30   1.0
 100   8.0
 Caroline_Fisheries_1_2   14.1
 226   4.0
 Best_Buy   7.1
 Wall_Mart   1.1
 Pacific_Food   2.1
 j-553   3.0
 j-25   1.0
 185   12.0
 17   1.0
 27   2.0
 37   7.0
 47   11.0
 57   3.0
 134   8.0
 67   3.0
 77   6.0
 87   7.0
 97   7.0
 1   1.0
 2   1.0
 3   14.0
 4   14.0
 5   14.0
 6   1.0
 102   8.0
 j-84   2.0
 j-14   6.0
 202   12.0
 COM_Kolonia_1   6.1
 7   7.0
 128   7.0
 228   4.0
 109   8.0
 Port_Authority   14.1
 234   11.0

ACE_Construction	3.1
j-79	1.0
187	12.0
110	8.0
j-73	4.0
210	7.0
136	7.0
236	8.0
Adams_Construction	3.1
j-5	7.0
104	8.0
195	12.0
j-62	2.0
State_Legislature	5.1
18	1.0
28	2.0
38	7.0
48	11.0
58	3.0
144	7.0
68	3.0
78	6.0
98	8.0
88	8.0
j-57	3.0
163	3.0
244	3.0
Palm_Terrace	7.1
FSM_Surveylance	14.1
j-51	1.0
112	7.0
212	7.0
J-71	2.0
119	7.0
171	12.0
j-12	1.0
219	8.0
j-7	7.0
j-46	1.0
j-82	2.0
120	11.0
220	14.0
146	3.0
Telecom_AGR	2.1
Ambros_Bakery	1.1
j-77	4.0
j-35	1.0
114	8.0
South_Park_Hotel	7.1
214	7.0
Sokehs_Pah_Elementary_School	8.1
19	1.0
29	4.0
39	3.0
49	11.0
well_head_k7	6.2
j-203	6.0
59	3.0

99	8.0
69	3.0
89	7.0
j-66	2.0
173	12.0
COM_Kolonia_2	6.1
j-60	11.0
122	3.0
True_Value	2.1
79	7.0
129	7.0
181	12.0
229	4.0
Pics_High_School	6.1
j-55	1.0
230	4.0
156	6.0
Airport	14.1
j-86	2.0
j-44	1.0
124	3.0
105	8.0
j-39	1.0
183	12.0
164	6.0
j-75	4.0
j-33	1.0
AIRPORT_FIRE_(ARF)	14.1
well_head_lower_pics	6.2
232	3.0
well_head_k-2	6.2
Sea_Breeze_Hotel	2.1
Pohnpei_State_Hospital	3.1
j-28	1.0
139	3.0
191	12.0
239	3.0
j-64	2.0
j-22	6.0
Nett_Laundry	3.1
J-3	7.0
seker_school	13.1
107	8.0
140	7.0
Judy_Laundramat	6.1
j-59	3.0
j-17	6.0
166	3.0
j-11	1.0
H&E_Apartments	2.1
j-499	3.0
115	8.0
215	7.0
Heigenburger_Bellarim	2.1
j-48	1.0
10	14.0
20	7.0
40	11.0

50	11.0
j-42	1.0
70	3.0
80	8.0
90	7.0
174	12.0
60	7.0
PICS_Farm	6.1
142	7.0
Joy_Hotel	1.1
Neime_Preston	2.1
j-37	1.0
168	12.0
Maupuwsi_laundramat	7.1
j-31	1.0
H_and_K_Main_Meter	1.1
Tuna_Commision	2.1
Cliff_Rainbow_Hotel	7.1
117	8.0
EDA	14.1
Luen_Thai	14.1
j-26	1.0
Rumours_Bar	7.1
176	12.0
j-20	6.0
J-74	4.0
Catholic_Elementary_School	1.1
j-15	6.0
FSM_Petroleum	14.1
11	14.0
21	7.0
31	2.0
41	11.0
51	11.0
61	4.0
j-85	2.0
81	6.0
91	7.0
184	12.0
178	12.0
Bernards_Apt	2.1
j-40	1.0
159	3.0
101	7.0
201	12.0
227	2.0
J-94	7.0
160	8.0
186	12.0
ESDM_School	12.1
Linda_Carl	7.1
135	7.0
235	8.0
j-24	1.0
j-58	3.0
22	5.0
32	4.0
52	11.0

103	8.0
72	3.0
82	6.0
92	7.0
194	12.0
well_head__namkopotomen	12.2
j-19	6.0
203	12.0
62	7.0
42	3.0
j-13	6.0
188	12.0
169	12.0
111	7.0
Yoshita_Enterprises	2.1
j-83	2.0
211	6.0
j-100	8.0
170	12.0
j-6	7.0
j-78	4.0
196	12.0
J-92	7.0
4tx_apt	6.1
145	7.0
Ocean_View_Hotel	7.1
j-67	2.0
13	1.0
23	4.0
33	4.0
43	11.0
53	11.0
73	3.0
Yvonnes_Hotel	2.1
83	6.0
93	7.0
j-102	6.0
Ohmine_Elementary_School	1.1
113	3.0
172	12.0
63	7.0
213	7.0
Awark_School	12.1
j-8	7.0
j-98	8.0
j-56	3.0
179	12.0
Baptist_School	1.1
j-50	1.0
121	3.0
sports_center	6.1
Saladak_elmentary_School	12.1
180	12.0
j-87	2.0
j-45	1.0
Penda_Ocean	14.1
Nett_School	3.1
j-81	5.0

j-76	4.0
j-34	1.0
Power_Plant_NPP	7.1
14	1.0
24	4.0
j-70	2.0
123	7.0
34	4.0
44	11.0
54	11.0
74	6.0
94	3.0
84	7.0
SDA_School	6.1
j-29	1.0
182	12.0
YTY_Laundry	3.1
j-23	1.0
Pohnpei_Water_Company	7.1
189	12.0
231	3.0
157	3.0
j-18	6.0
Kolonia_Elementary_School	3.1
190	12.0
j-54	1.0
J-2	7.0
206	3.0
j-49	1.0
Pacific_Sky_Lite_Hotel	7.1
165	3.0
j-43	1.0
China_Star_Hotel	14.1
15	1.0
25	6.0
35	6.0
133	7.0
45	11.0
55	11.0
75	6.0
85	7.0
95	7.0
well_head_nam_wellin_rohi	12.2
65	7.0
j-38	1.0
233	3.0
well_head_enrinals	12.2
192	7.0
Etchiet_Laundry	3.1
j-32	1.0
j-9	7.0
108	8.0
141	7.0
241	2.0
j-27	1.0
167	12.0
Flamingo_Club	7.1
Isamu_Nakasone_1_and_2	1.1

```
 j-63                                2.0
 j-21                                6.0
 Genesis                             3.1
 PCR_Hotel                           3.1
 j-599                               3.0
 116                                 8.0
 216                                 6.0
 j-4                                 7.0
 j-16                                6.0
 12345                               3.0
 175                                 12.0
 j-52                                1.0
 j-10                                1.0
 16                                  1.0
 26                                  3.0
 36                                  4.0
 sokehs_powe_elementary_school       8.1
 56                                  4.0
 66                                  7.0
 46                                  11.0
 86                                  6.0
 76                                  6.0
 Hawleys_Ice_Plant                   2.1
 96                                  7.0
 143                                 7.0
 j-47                                1.0
 j-41                                1.0
 US_Embassy                          3.1

[SOURCES]
;Node            Type              Quality          Pattern

[REACTIONS]
;Type       Pipe/Tank        Coefficient


[REACTIONS]
 Order Bulk                  1
 Order Tank                  1
 Order Wall                  1
 Global Bulk                 0
 Global Wall                 0
 Limiting Potential          0
 Roughness Correlation       0

[MIXING]
;Tank            Model

[TIMES]
 Duration             0
 Hydraulic Timestep   1:00
 Quality Timestep     0:05
 Pattern Timestep     1:00
 Pattern Start        0:00
 Report Timestep      1:00
 Report Start         0:00
 Start ClockTime      12 am
 Statistic            None
```

```
[REPORT]
 Status                 Full
 Summary                No
 Page                   0

[OPTIONS]
 Units                  GPM
 Headloss               H-W
 Specific Gravity       1.0
 Viscosity              1.00000004
 Trials                 40
 Accuracy               0.001
 CHECKFREQ              2
 MAXCHECK               10
 DAMPLIMIT              0
 Unbalanced             Continue 10
 Pattern                household
 Demand Multiplier      1.0
 Emitter Exponent       0.5
 Quality                None mg/L
 Diffusivity            1
 Tolerance              0.01

[COORDINATES]
;Node                           X-Coord            Y-Coord
 118                            1344873.69         2525402.88
 218                            1354159.85         2523088.80
 151                            1344558.51         2514463.53
 j-36                           1353517.34         2526397.12
 177                            1374540.79         2524295.45
 j-30                           1352902.73         2527164.43
 100                            1347325.38         2522541.46
 200                            1383640.48         2507302.63
 Caroline_Fisheries_1_2         1350952.99         2532099.14
 126                            1353456.48         2512397.82
 226                            1355545.53         2524796.43
 Best_Buy                       1352264.19         2523148.80
 Wall_Mart                      1354660.36         2526472.40
 Pacific_Food                   1355158.99         2527372.45
 j-553                          1356221.15         2523452.90
 j-25                           1354130.70         2526305.96
 185                            1378799.45         2515062.94
 17                             1353161.30         2527434.06
 27                             1355348.26         2527045.78
 37                             1353132.33         2523603.29
 47                             1359328.49         2525897.47
 57                             1359398.39         2519703.98
 134                            1341995.22         2527152.80
 67                             1356875.76         2520361.89
 77                             1353834.58         2522359.04
 87                             1349659.64         2520727.08
 97                             1347927.51         2517235.92
 1                              1352099.04         2527381.38
 2                              1353962.91         2527084.76
 3                              1352291.12         2530195.54
 4                              1353656.75         2528941.06
 5                              1354326.30         2528268.54
```

6	1354238.82	2527044.00
102	1348960.65	2523761.20
j-84	1355705.64	2525205.99
j-14	1354454.36	2525303.41
202	1387820.73	2507670.71
COM_Kolonia_1	1354201.97	2524065.98
7	1348490.15	2520578.59
128	1347550.82	2515799.77
228	1355720.45	2525327.07
109	1348851.89	2529482.10
161	1351312.01	2520092.12
Port_Authority	1351448.87	2531650.27
209	1357949.50	2521842.90
234	1360426.81	2528127.79
8	1348880.71	2519859.32
9	1343324.99	2513827.12
ACE_Construction	1355962.61	2524607.02
j-79	1355024.74	2526958.73
187	1378823.83	2516338.91
110	1348493.17	2530157.41
j-73	1355521.16	2525232.25
210	1350252.21	2520810.59
136	1347766.07	2516633.88
236	1349400.15	2527606.73
Adams_Construction	1355937.39	2524548.24
j-5	1353588.61	2523628.04
104	1349368.87	2525456.04
195	1383647.57	2507679.57
204	1348781.48	2519950.22
j-62	1356248.52	2524968.94
State_Legislature	1354667.88	2524919.47
18	1352751.59	2527847.45
28	1355537.02	2526720.32
38	1353161.30	2523386.88
48	1361275.19	2527399.94
58	1359421.58	2518950.47
144	1351238.60	2521470.29
68	1356689.21	2519681.51
78	1351342.89	2520479.14
98	1345169.51	2523964.86
88	1347753.80	2531411.56
j-99	1348346.56	2523990.20
j-57	1356039.56	2524728.83
163	1363387.46	2516403.20
244	1355917.25	2524477.75
Palm_Terrace	1353474.90	2523626.71
FSM_Surveylance	1351845.15	2531066.71
j-51	1354502.25	2526658.62
112	1347069.86	2515856.95
212	1350858.58	2521009.43
138	1352299.95	2509783.07
J-71	1355176.88	2525605.21
119	1348522.83	2514999.30
171	1370264.54	2527585.64
j-12	1354172.98	2525065.59
219	1343086.06	2531413.45
j-7	1352382.45	2525075.14
j-46	1354221.78	2525963.69

j-82	1356040.54	2525089.35
120	1361984.65	2527190.33
220	1350901.26	2532530.36
146	1360065.59	2520517.02
Telecom_AGR	1355061.50	2525868.87
Ambros_Bakery	1354227.78	2526901.77
j-77	1355312.62	2524147.98
j-35	1353273.02	2526452.47
114	1342478.27	2529489.70
South_Park_Hotel	1352174.82	2526754.08
214	1352272.95	2522659.53
Sokehs_Pah_Elementary_School	1349219.87	2528735.58
19	1353398.43	2528304.63
29	1355226.99	2525249.01
39	1357163.50	2515959.79
49	1363006.71	2526388.98
well_head_k7	1352154.23	2520479.00
j-203	1351755.13	2520628.79
154	1343133.49	2516616.66
59	1358075.67	2522105.95
99	1345283.70	2523061.22
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Pics_High_School	1352863.72	2521355.14
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Neime_Preston	1355602.42	2526517.26
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Luen_Thai	1351846.98	2530868.69
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268	1361096.92	2527472.25
85	1343307.90	2531674.70
85	1343705.43	2531424.40
85	1343911.56	2530894.36
85	1344058.79	2530452.66
85	1344235.47	2530187.64
85	1344529.94	2530172.92

86	1345074.70	2530290.71
86	1345354.44	2530614.62
86	1345855.03	2530776.57
86	1346414.52	2531453.85
86	1346708.98	2531586.36
86	1347121.24	2531512.74
86	1347371.53	2531483.29
97	1349410.46	2527957.31
97	1349393.28	2527782.02
104	1349413.90	2527524.24
123	1353355.88	2521875.44
123	1353537.15	2522061.75
123	1353577.44	2522172.53
123	1353577.44	2522313.52
164	1353557.30	2522474.65
227	1354291.32	2524485.59
227	1354331.42	2524690.50
273	1355338.19	2524739.58
274	1355056.21	2524820.15
274	1355005.85	2524966.18
275	1354824.58	2525137.38
276	1355967.61	2525807.08
277	1356093.49	2525897.72
277	1356179.09	2525877.58
277	1356214.34	2525731.55
277	1356239.52	2525635.88
278	1356395.61	2525520.07
278	1356380.51	2525384.11
278	1356345.26	2525268.30
278	1356279.80	2525243.12
279	1356148.88	2525293.47
285	1357156.26	2522106.47
285	1357300.56	2522084.56
287	1358652.25	2522113.78
287	1358988.34	2522119.26
291	1373132.78	2525001.10
291	1373017.60	2525044.30
291	1372909.61	2525213.48
6	1357710.15	2522101.72
124	1346624.86	2514447.81
124	1346224.16	2514589.23
124	1346098.45	2514667.80
124	1346004.17	2514950.65
124	1345980.60	2514997.79
124	1345909.89	2515131.36
124	1345799.89	2515225.64
124	1345650.61	2515209.92
126	1344307.10	2514392.81
126	1344118.53	2514353.53
126	1343984.97	2514306.39
126	1343914.25	2514204.25
126	1343874.97	2514070.68
162	1343607.84	2513842.84
162	1343489.99	2513819.27
125	1345167.96	2514914.43
125	1344952.44	2514698.91
125	1344764.15	2514537.84
125	1344623.49	2514492.47

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 207             1351292.64       2531990.20
 222             1350898.51       2532160.02
 246             1351747.65       2531708.22
 293             1352058.47       2530436.11
 293             1351927.09       2530593.12
 293             1351872.62       2530737.32
 296             1354810.96       2526956.25
 296             1354698.81       2527154.91
 296             1354669.97       2527190.16
 298             1354250.21       2526994.70
 302             1354788.53       2526645.43
 305             1355576.78       2526587.75
 307             1356057.43       2525382.94
 308             1355938.87       2525382.94
 309             1355911.60       2524296.35
 309             1355910.73       2524217.48
 310             1355919.49       2524153.51
 281             1353676.69       2524301.10
 281             1353639.52       2524194.90
 281             1353639.52       2524072.77
 316             1352412.88       2523170.04
 317             1352110.20       2523116.94
 317             1351993.37       2523122.25
 318             1351855.31       2523138.18
 320             1351308.37       2523042.60
 320             1351085.34       2522973.57
 320             1350941.97       2522947.02
 320             1350756.11       2522968.26
 320             1350649.91       2522978.88
 320             1350426.88       2523021.36
 320             1350331.30       2523037.29
 320             1350235.72       2523031.98
 320             1350129.51       2522994.81
 320             1350065.79       2522952.33
 321             1351759.67       2523167.06
 321             1351673.42       2523162.82
 322             1351575.86       2523140.20
 323             1352839.81       2521297.56
 323             1352749.58       2521221.76
 324             1352522.18       2521041.29
 324             1352435.56       2520976.32
 327             1347354.58       2515389.74
 328             1347225.21       2515203.88
 328             1347245.26       2514970.65
 328             1347261.66       2514737.43
 328             1347185.13       2514593.48
 328             1347137.75       2514467.75
 330             1355943.04       2524566.90

[LABELS]
;X-Coord           Y-Coord          Label & Anchor Node

[BACKDROP]
 DIMENSIONS      1317747.42       2459333.44       1404062.60       2545648.62
 UNITS           Feet
 FILE            C:\Users\User\Documents\Pohnpei Water sytem modeling\EPANET 4 for
elvs\POHNPEI GIS FOR WATTER SYSTEM UTM  WGS 84 FT 2  200.emf
 OFFSET          0.00             0.00
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[END]
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