CHAPTER 2 - QUICK START TUTORIAL

This chapter provides a tutorial on how to use EPANET. If you are not familiar with the components that comprise a water distribution system and how these are represented in pipe network models you might want to review the first two sections of Chapter 3 first.

2.1 Installing EPANET

EPANET Version 2 is designed to run under the Windows 95/98/NT operating system of an IBM/Intel-compatible personal computer. It is distributed as a single file, **en2setup.exe**, which contains a self-extracting setup program. To install EPANET:

1. Select **Run** from the Windows Start menu.
2. Enter the full path and name of the **en2setup.exe** file or click the **Browse** button to locate it on your computer.
3. Click the **OK** button type to begin the setup process.

The setup program will ask you to choose a folder (directory) where the EPANET files will be placed. The default folder is **c:\Program Files\EPANET2**. After the files are installed your Start Menu will have a new item named EPANET 2.0. To launch EPANET simply select this item off of the Start Menu, then select EPANET 2.0 from the submenu that appears. (The name of the executable file that runs EPANET under Windows is **epanet2w.exe**.)

Should you wish to remove EPANET from your computer, you can use the following procedure:

1. Select **Settings** from the Windows Start menu.
2. Select **Control Panel** from the Settings menu.
3. Double-click on the **Add/Remove Programs** item.
4. Select EPANET 2.0 from the list of programs that appears.
5. Click the **Add/Remove** button.

2.2 Example Network

In this tutorial we will analyze the simple distribution network shown in Figure 2.1 below. It consists of a source reservoir (e.g., a treatment plant clearwell) from which water is pumped into a two-loop pipe network. There is also a pipe leading to a storage tank that floats on the system. The ID labels for the various components are shown in the figure. The nodes in the network have the characteristics shown in Table 2.1. Pipe properties are listed in Table 2.2. In addition, the pump (Link 9) can deliver 150 ft of head at a flow of 600 gpm, and the tank (Node 8) has a 60-ft diameter, a 3.5-ft water level, and a maximum level of 20 feet.

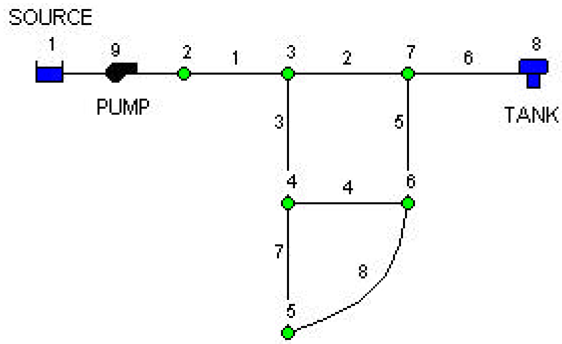


Figure 2.1 Example Pipe Network

Table 2.1 Example Network Node Properties

Node	Elevation (ft)	Demand (gpm)
1	700	0
2	700	0
3	710	150
4	700	150
5	650	200
6	700	150
7	700	0
8	830	0

Table 2.2 Example Network Pipe Properties

Pipe	Length (ft)	Diameter (inches)	C-Factor
1	3000	14	100
2	5000	12	100
3	5000	8	100
4	5000	8	100
5	5000	8	100
6	7000	10	100
7	5000	6	100
8	7000	6	100

2.3 Project Setup

Our first task is to create a new project in EPANET and make sure that certain default options are selected. To begin, launch EPANET, or if it is already running select **File** >> **New** (from the menu bar) to create a new project. Then select **Project** >> **Defaults** to open the dialog form shown in Figure 2.2. We will use this dialog to have EPANET automatically label new objects with consecutive numbers starting from 1 as they are added to the network. On the ID Labels page of the dialog, clear all of the ID Prefix fields and set the ID Increment to 1. Then select the Hydraulics page of the dialog and set the choice of Flow Units to GPM (gallons per minute). This implies that US Customary units will be used for all other quantities as well (length in feet, pipe diameter in inches, pressure in psi, etc.). Also select Hazen-Williams (H-W) as the headloss formula. If you wanted to save these choices for all future new projects you could check the **Save** box at the bottom of the form before accepting it by clicking the **OK** button.

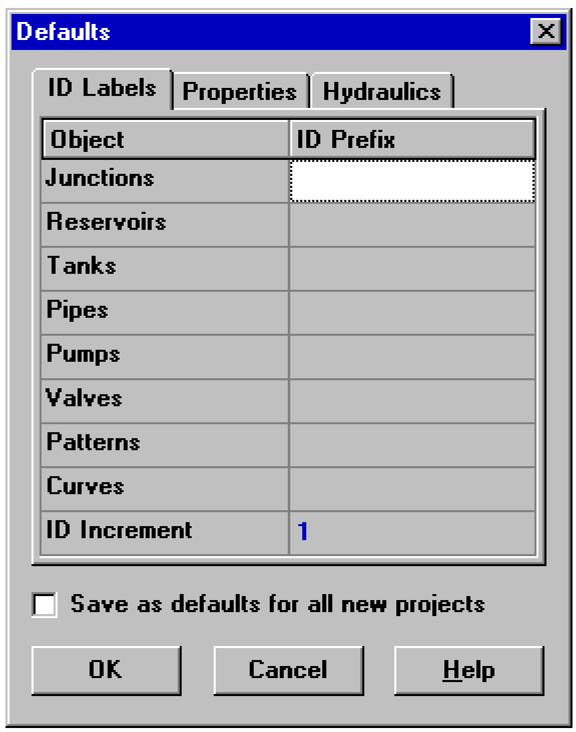


Figure 2.2 Project Defaults Dialog

Next we will select some map display options so that as we add objects to the map, we will see their ID labels and symbols displayed. Select **View** >> **Options** to bring up the Map Options dialog form. Select the Notation page on this form and check the settings shown in Figure 2.3 below. Then switch to the Symbols page and check all of the boxes. Click the **OK** button to accept these choices and close the dialog.

Finally, before drawing our network we should insure that our map scale settings are acceptable. Select **View** >> **Dimensions** to bring up the Map Dimensions dialog. Note the default dimensions assigned for a new project. These settings will suffice for this example, so click the **OK** button.

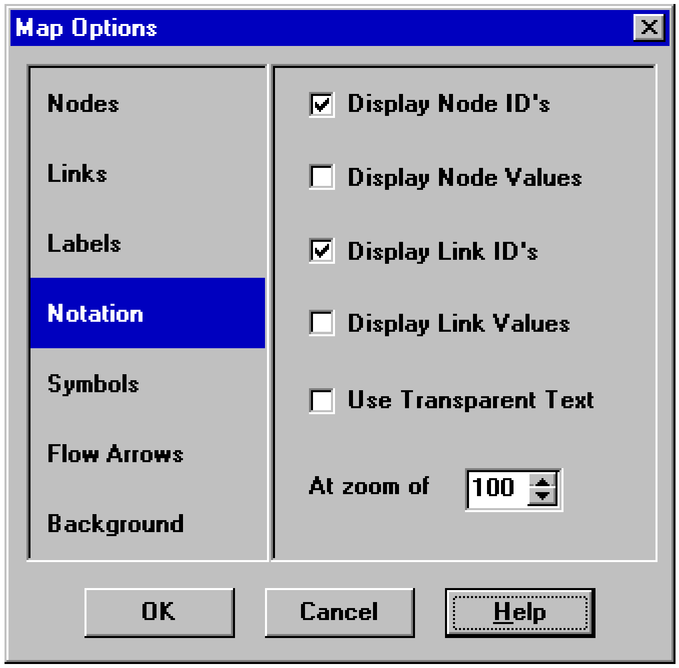
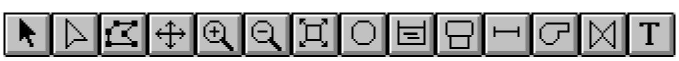
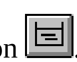


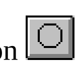
Figure 2.3 Map Options Dialog

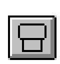
2.4 Drawing the Network

We are now ready to begin drawing our network by making use of our mouse and the buttons contained on the Map Toolbar shown below. (If the toolbar is not visible then select **View** >> **Toolbars** >> **Map**).



First we will add the reservoir. Click the Reservoir button . Then click the mouse on the map at the location of the reservoir (somewhere to the left of the map).

Next we will add the junction nodes. Click the Junction button  and then click on the map at the locations of nodes 2 through 7.

Finally add the tank by clicking the Tank button  and clicking the map where the tank is located. At this point the Network Map should look something like the drawing in Figure 2.4.

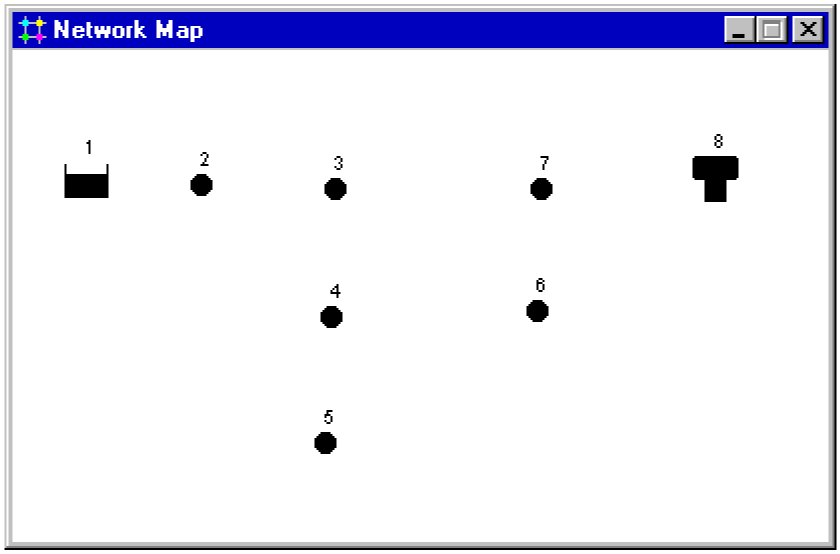
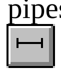
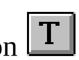


Figure 2.4 Network Map after Adding Nodes

Next we will add the pipes. Let's begin with pipe 1 connecting node 2 to node 3. First click the Pipe button  on the Toolbar. Then click the mouse on node 2 on the map and then on node 3. Note how an outline of the pipe is drawn as you move the mouse from node 2 to 3. Repeat this procedure for pipes 2 through 7.

Pipe 8 is curved. To draw it, click the mouse first on Node 5. Then as you move the mouse towards Node 6, click at those points where a change of direction is needed to maintain the desired shape. Complete the process by clicking on Node 6.

Finally we will add the pump. Click the Pump button , click on node 1 and then on node 2.

Next we will label the reservoir, pump and tank. Select the Text button  on the Map Toolbar and click somewhere close to the reservoir (Node 1). An edit box will appear. Type in the word SOURCE and then hit the **Enter** key. Click next to the pump and enter its label, then do the same for the tank. Then click the Selection button  on the Toolbar to put the map into Object Selection mode rather than Text Insertion mode.

At this point we have completed drawing the example network. Your Network Map should look like the map in Figure 2.1. If the nodes are out of position you can move them around by clicking the node to select it, and then dragging it with the left mouse button held down to its new position. Note how pipes connected to the node are moved along with the node. The labels can be repositioned in similar fashion. To re-shape the curved Pipe 8:

1. First click on Pipe 8 to select it and then click the  button on the Map Toolbar to put the map into Vertex Selection mode.

2. Select a vertex point on the pipe by clicking on it and then drag it to a new position with the left mouse button held down.

3. If required, vertices can be added or deleted from the pipe by right-clicking the mouse and selecting the appropriate option from the popup menu that appears.

4. When finished, click  to return to Object Selection mode.

2.5 Setting Object Properties

As objects are added to a project they are assigned a default set of properties. To change the value of a specific property for an object one must select the object into the Property Editor (Figure 2.5). There are several different ways to do this. If the Editor is already visible then you can simply click on the object or select it from the Data page of the Browser. If the Editor is not visible then you can make it appear by one of the following actions:

- Double-click the object on the map.
- Right-click on the object and select **Properties** from the pop-up menu that appears.
- Select the object from the Data page of the Browser window and then click the Browser's Edit button .

Whenever the Property Editor has the focus you can press the F1 key to obtain fuller descriptions of the properties listed

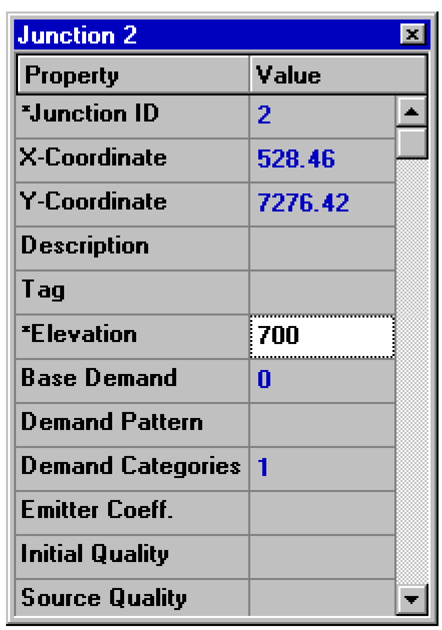
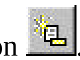


Figure 2.5 Property Editor

Let us begin editing by selecting Node 2 into the Property Editor as shown above. We would now enter the elevation and demand for this node in the appropriate fields. You can use the **Up** and **Down** arrows on the keyboard or the mouse to move between fields. We need only click on another object (node or link) to have its properties appear next in the Property Editor. (We could also press the **Page Down** or **Page Up** key to move to the next or previous object of the same type in the database.) Thus we can simply move from object to object and fill in elevation and demand for nodes, and length, diameter, and roughness (C-factor) for links.

For the reservoir you would enter its elevation (700) in the Total Head field. For the tank, enter 830 for its elevation, 4 for its initial level, 20 for its maximum level, and 60 for its diameter. For the pump, we need to assign it a pump curve (head versus flow relationship). Enter the ID label 1 in the Pump Curve field.

Next we will create Pump Curve 1. From the Data page of the Browser window, select Curves from the dropdown list box and then click the Add button . A new Curve 1 will be added to the database and the Curve Editor dialog form will appear (see Figure 2.6). Enter the pump's design flow (600) and head (150) into this form. EPANET automatically creates a complete pump curve from this single point. The curve's equation is shown along with its shape. Click **OK** to close the Editor.

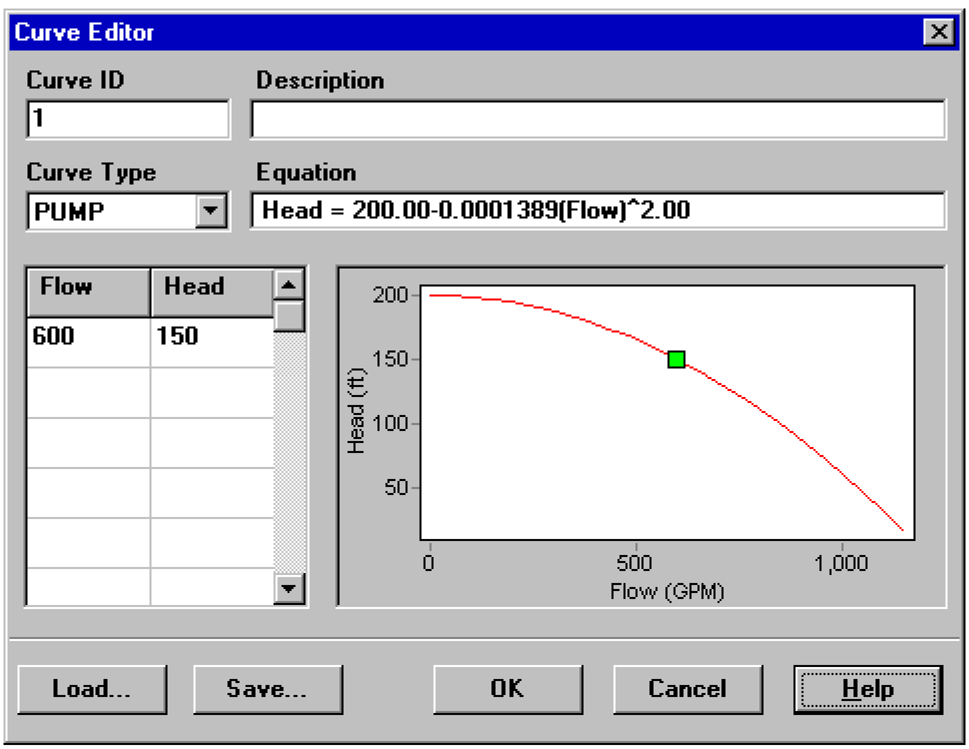


Figure 2.6 Curve Editor

2.6 Saving and Opening Projects

Having completed the initial design of our network it is a good idea to save our work to a file at this point.

1. From the **File** menu select the **Save As** option.
2. In the Save As dialog that appears, select a folder and file name under which to save this project. We suggest naming the file **tutorial.net**. (An extension of **.net** will be added to the file name if one is not supplied.)
3. Click **OK** to save the project to file.

The project data is saved to the file in a special binary format. If you wanted to save the network data to file as readable text, use the **File** >> **Export** >> **Network** command instead.

To open our project at some later time, we would select the **Open** command from the **File** menu.

2.7 Running a Single Period Analysis

We now have enough information to run a single period (or snapshot) hydraulic analysis on our example network. To run the analysis select **Project** >> **Run Analysis** or click the Run button  on the Standard Toolbar. (If the toolbar is not visible select **View** >> **Toolbars** >> **Standard** from the menu bar).

If the run was unsuccessful then a Status Report window will appear indicating what the problem was. If it ran successfully you can view the computed results in a variety of ways. Try some of the following:

- Select Node Pressure from the Browser's Map page and observe how pressure values at the nodes become color-coded. To view the legend for the color-coding, select **View** >> **Legends** >> **Node** (or right-click on an empty portion of the map and select Node Legend from the popup menu). To change the legend intervals and colors, right-click on the legend to make the Legend Editor appear.
- Bring up the Property Editor (double-click on any node or link) and note how the computed results are displayed at the end of the property list.
- Create a tabular listing of results by selecting **Report** >> **Table** (or by clicking the Table button  on the Standard Toolbar). Figure 2.7 displays such a table for the link results of this run. Note that flows with negative signs means that the flow is in the opposite direction to the direction in which the pipe was drawn initially.

Network Table - Links

Link ID	Flow GPM	Velocity fps	Headloss ft/Kft	Status
Pipe 1	617.42	1.29	0.80	Open
Pipe 2	382.51	1.09	0.69	Open
Pipe 3	159.91	1.02	1.00	Open
Pipe 4	29.34	0.19	0.04	Open
Pipe 5	-90.09	0.57	0.34	Open
Pipe 6	292.42	1.19	1.03	Open
Pipe 7	55.58	0.63	0.57	Open
Pipe 8	-44.42	0.50	0.38	Open

Figure 2.7 Example Table of Link Results

2.8 Running an Extended Period Analysis

To make our network more realistic for analyzing an extended period of operation we will create a Time Pattern that makes demands at the nodes vary in a periodic way over the course of a day. For this simple example we will use a pattern time step of 6 hours thus making demands change at four different times of the day. (A 1-hour pattern time step is a more typical number and is the default assigned to new projects.) We set the pattern time step by selecting Options-Times from the Data Browser, clicking the Browser's Edit button to make the Property Editor appear (if its not already visible), and entering 6 for the value of the Pattern Time Step (as shown in Figure 2.8 below). While we have the Time Options available we can also set the duration for which we want the extended period to run. Let's use a 3-day period of time (enter 72 hours for the Duration property).

Times Options

Property	Hrs:Min
Total Duration	72
Hydraulic Time Step	1:00
Quality Time Step	0:05
Pattern Time Step	6
Pattern Start Time	0:00

Figure 2.8 Times Options