Chapter 10

Defining Physical Components of Reservoirs

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CHAPTER 10

Defining Physical Components of Reservoirs

The data that defines an individual reservoir element within the reservoir network consists of two conceptual types: **Physical** and **Operational**. This chapter describes the physical components of a reservoir that include the Pool, the Dam (and its Outlets), and any Diverted Outlets (commonly called diversions from the pool). ResSim represents these components using a "tree structure". As you add optional physical components to the reservoir, they will appear in the reservoir tree. This reservoir tree is more than just an illustration. It is the mechanism you will use to access the editors for the separate reservoir components. As you select a component in the reservoir tree, the edit panel to the right of the reservoir tree will display the editor you need to define the properties of that component.

An elevation-storage-area relationship describes the properties of the pool, while a crest elevation and length describes the dam, represented internally in the ResSim program as an uncontrolled spillway. You will need to add one or more outlets to the dam to enable water to pass through it into the downstream system. You can also add a power plant to an individual outlet in order to describe the hydropower generating capacity of the flow through that outlet. Within the Reservoir Editor, Diverted Outlets (or reservoir diversions) are separate outlet "groups". As with the dam, you will need to add one or more outlets to a diverted outlet group to enable the reservoir to allocate flow through the diversion.

The order in which you add physical components and edit their properties is flexible. You can add all the physical components to the reservoir then go back and define each component's properties, or you can define the properties of each component as you add it, before going on to add and edit the next component. Choose the style that works best for you. However, you should finish defining the physical representation of your reservoir before going on to define its operational data (see Chapter 11), as the definition of the operational zones depends on the physical definition of the pool, and the rules depend on the description of the outlet works.

10.1 Accessing the Reservoir Editor

In the Reservoir Network Module, you can access the Reservoir Editor from either the **Edit** menu in the menu bar or from the right-click shortcut menu of a reservoir in the map display.

- From the **Edit** menu, select **Reservoirs...**.
- From the map display, right-click on a reservoir with the **Reservoir Tool**  , then select **Edit Reservoir Properties**.

10.2 Using the Reservoir Editor to Define Physical Components

The **Physical** tab of the **Reservoir Editor** allows you to define the physical properties of reservoirs in your reservoir network. Figure 10.1 shows the **Reservoir Editor** with the **Physical** tab selected.

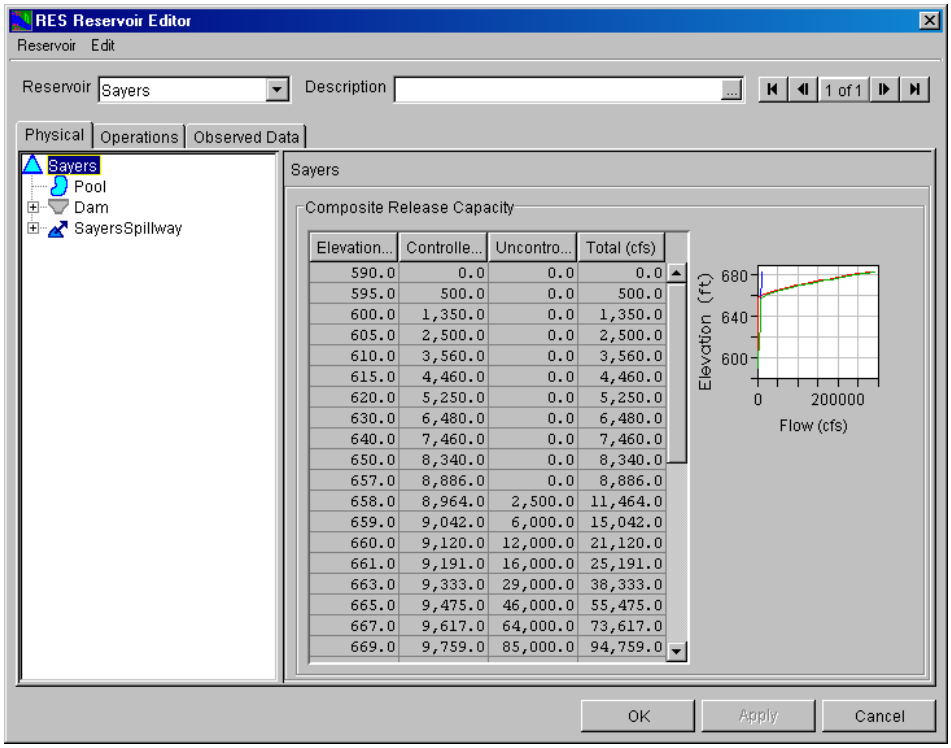

Figure 10.1 Reservoir Editor: Physical Tab

On the **Physical** tab, a reservoir tree appears in the left panel of the window. By default, the reservoir tree displays the reservoir and its primary components: the **Pool** and the **Dam**. Additionally, if you add a diversion to remove water from this reservoir's pool in the reservoir network, a **Diverted Outlet** appears in the reservoir tree. As you add components to the reservoir, such as outlets and losses, the reservoir tree will expand to show these components.

The area to the right of the reservoir tree is the Edit Panel. The content of this panel changes according to the component you select in the reservoir tree. Figure 10.1 shows the **Composite Release Capacity** summary for the reservoir because the reservoir is the selected component in the reservoir tree.

The menu bar of the Reservoir Editor also changes according to the component you select in the reservoir tree. For example, when you select the **Dam** in the reservoir tree, a **Dam** menu becomes available in the menu bar.

The **Reservoir** field at the top of the Editor contains a list of all of the reservoirs in your network, with the name of the current reservoir displayed. You can access all of the reservoirs both from this list and by using the VCR-style buttons to navigate through the available reservoirs. Below the Reservoir name list is the **Description** of the current reservoir; this field is editable.

The following sections describe how to use the **Physical** tab of the Reservoir Editor to define the physical components of the reservoir that appear in the reservoir tree.

10.3 Specifying Physical Components of a Reservoir

On the Physical tab of the Reservoir Editor, a reservoir tree appears in the left panel of the window. By default, the primary components for all reservoirs are a **Pool** and a **Dam**, as Figure 10.2 illustrates.

Figure 10.2 Reservoir Editor, Physical Tab: Default Reservoir Component Tree

A **Pool** reflects characteristics of reservoir storage, while a **Dam** reflects the reservoir dam and its outlets.

Additionally, if the individual reservoir has a diverted outlet, a **Diverted Outlet** will appear as a primary component of the reservoir, as illustrated in Figure 10.3.

Figure 10.3 Reservoir Editor, Physical Tab: Default Reservoir Component Tree with Diverted Outlet

The Reservoir and primary components that appear in the default reservoir tree are features of the reservoir network that you have setup previously using the map (mouse) tools. The following sections explain how to add details to the primary components of a reservoir and how to define secondary components such as outlets and losses.

10.4 Specifying Reservoir Pool Losses

You can specify both **Pool Evaporation** and **Pool Seepage**, as shown in Figure 10.4.

On the **Physical** tab, you may use either the **Pool** menu in the Reservoir Editor's menu bar (Figure 10.5) or the right-click shortcut menu (Figure 10.6) to specify **Losses** for a reservoir pool.

Figure 10.4 Reservoir Editor, Physical Tab: with Pool Losses

To add Pool Evaporation and/or Pool Seepage:

1. Select **Pool** in the reservoir tree.
2. Either click on **Pool** in the menu bar or right-click on **Pool** in the reservoir tree to access the shortcut menu.
3. Select **Add Pool Evaporation** or **Add Pool Seepage**.

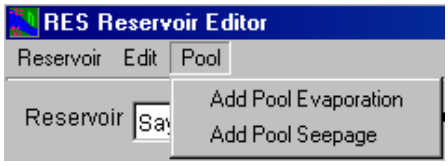

Figure 10.5 Reservoir Editor: Pool Menu

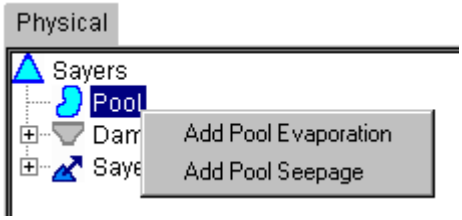

Figure 10.6 Reservoir Tree Shortcut Menu: Pool

You can also remove Pool Seepage and Pool Evaporation, as described in Section 10.12.3.

10.5 Defining Physical Features of a Dam

As Figure 10.7 shows, you can add **Leakage** (Section 10.6) and **Tailwater Elevation** (Section 10.10) to a dam, along with **Controlled Outlets** (Section 10.8), **Uncontrolled Outlets** (Section 10.9), and **Outlet Groups** (Section 10.7).

You can also rename Dams in the reservoir tree, as described in Section 10.12.1.

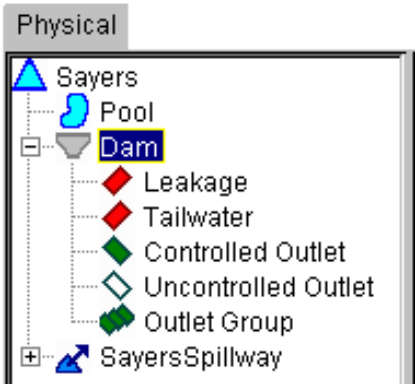

Figure 10.7 Reservoir Tree: Dam

On the Physical tab, you may use either the **Dam** menu in the Reservoir Editor's menu bar (Figure 10.8) or the right-click shortcut menu (Figure 10.9) to specify features of a dam.

10.6 Adding Leakage to a Dam

To add **Leakage** to a dam:

1. Select the dam by clicking on it in the reservoir tree.
2. Select **Add Leakage** from either the **Dam** menu in the Reservoir Editor's menu bar (Figure 10.8) or the right-click shortcut menu of the Dam (Figure 10.9).

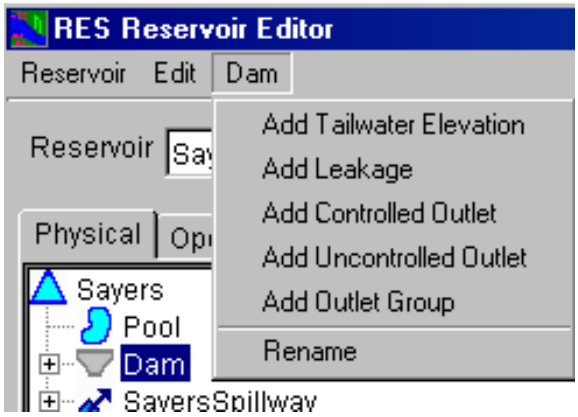

Figure 10.8 Reservoir Editor, Physical Tab: Dam Menu

Leakage will now appear as a "branch" of the reservoir tree, beneath the dam.

You can also remove Leakage from a dam (see Section 10.12.3).

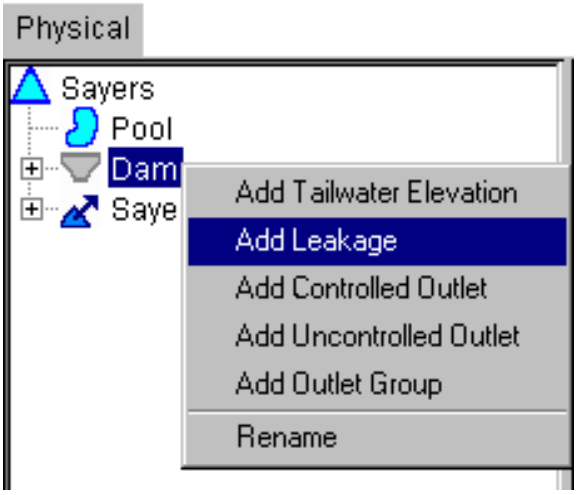

Figure 10.9 Reservoir Tree Shortcut Menu: Dam

10.7 Adding Outlet Groups

You can add **Outlet Groups** as components of Dams, Diverted Outlets, and other Outlet Groups, as shown in Figure 10.10.

An Outlet Group allows you to define subsets of a reservoir component. An Outlet Group can include **Tailwater Elevation** (Section 10.10), **Controlled Outlets** (Section 10.8), **Uncontrolled Outlets** (Section 10.9), and other **Outlet Groups** as components.

On the Physical tab, you may use either the component-specific menus in the Reservoir Editor's menu bar or the right-click shortcut menus (Figure 10.11) to add an Outlet Group as a component of a Dam, Diverted Outlet, or other Outlet Group.

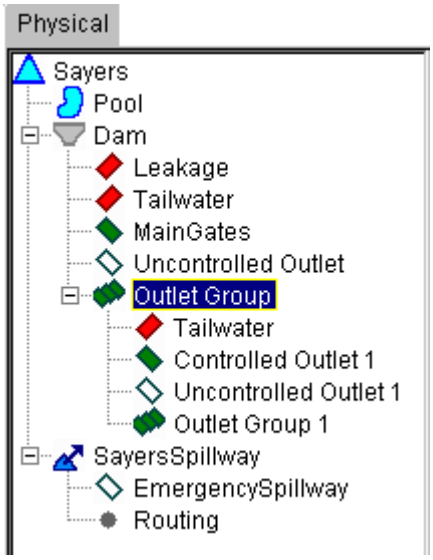

Figure 10.10 Reservoir Tree: Outlet Groups

To add an Outlet Group:

1. Select the Dam, Diverted Outlet, or Outlet Group to which you want to add the new Outlet Group.
2. Choose **Add Outlet Group** from the shortcut menu (Figure 10.11) or from the component's menu in the Reservoir Editor's menu bar.

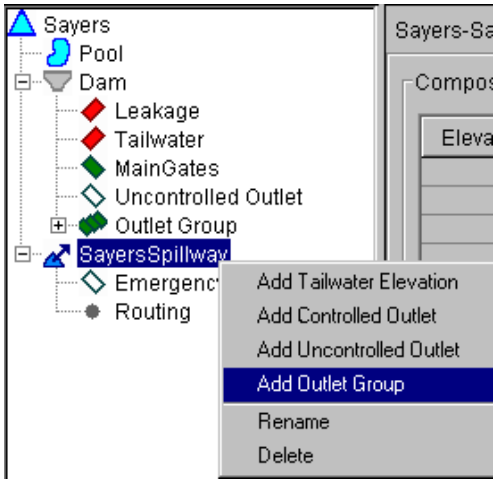

Figure 10.11 Diverted Outlet Shortcut Menu: Add Outlet Group

The new Outlet Group will appear in the reservoir tree as a branch beneath the component you selected.

You can also rename and delete Outlet Groups in the reservoir tree, as described in Section 10.12.

10.8 Defining Controlled Outlets

You can add **Controlled Outlets** to Dams, Diverted Outlets, and Outlet Groups, as shown in Figure 10.12.

Additionally, as shown in Figure 10.15 you can add **Tailwater Elevation** (Section 10.10) and **Power Plants** (Section 10.8.2) as components of Controlled Outlets.

You can also rename and delete Controlled Outlets in the reservoir tree (see Section 10.12).

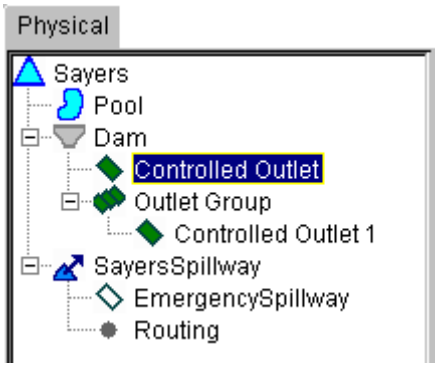

Figure 10.12 Reservoir Tree: Controlled Outlets

10.8.1 Adding Controlled Outlets

On the Physical tab, you may use either the component-specific menus in the Reservoir Editor's menu bar or the right-click shortcut menus (Figure 10.13) to add a **Controlled Outlet** as a component of a **Dam**, **Diverted Outlet**, or **Outlet Group**.

To add a Controlled Outlet:

1. Select the Dam or Outlet Group to which you want to add the new Controlled Outlet.
2. Choose **Add Controlled Outlet** from the shortcut menu (Figure 10.13) or from the component's menu in the Reservoir Editor's menu bar.

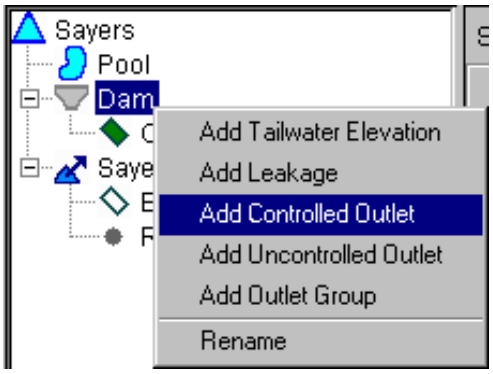

Figure 10.13 Dam Shortcut Menu: Add Controlled Outlet

The new Controlled Outlet will appear in the reservoir tree as a branch beneath the dam or outlet group you selected.

10.8.2 Adding a Power Plant to a Controlled Outlet

To add a **Power Plant** to a Controlled Outlet:

1. Select the Controlled Outlet by clicking on it in the reservoir tree.
2. Select **Add Power Plant** from either the **Outlet** menu in the Reservoir Editor's menu bar (Figure 10.14) or the right-click shortcut menu (Figure 10.15).

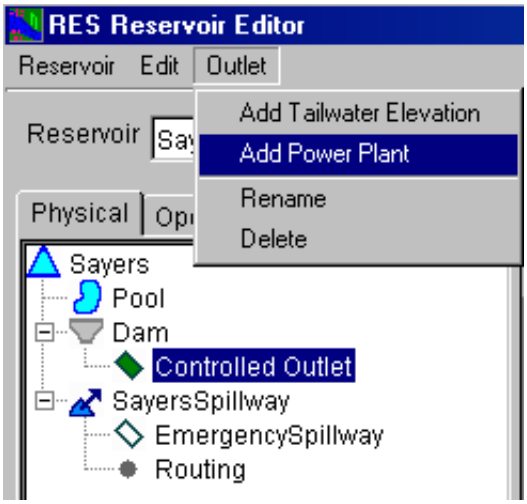

Figure 10.14 Reservoir Editor, Physical Tab: Outlet Menu - Add Power Plant

The Power Plant will now appear as a branch of the reservoir tree, beneath the Controlled Outlet.

You can also remove a Power Plant from the reservoir tree, as described in Section 10.12.3.

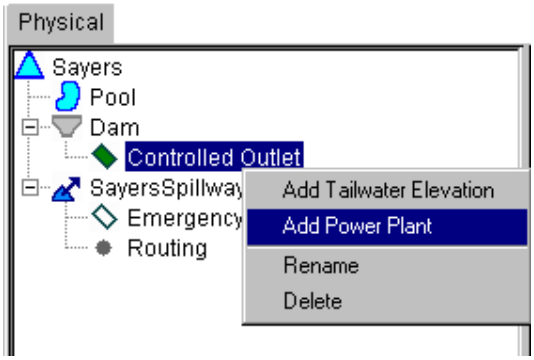

Figure 10.15 Controlled Outlet Shortcut Menu: Add Power Plant

10.9 Adding Uncontrolled Outlets

You can add **Uncontrolled Outlets** to Dams, Diverted Outlets, and Outlet Groups, as shown in Figure 10.16.

On the Physical tab, you may use either the component-specific menus in the Reservoir Editor's menu bar or the right-click shortcut menus (Figure 10.17) to add an Uncontrolled Outlet as a component of a Dam, Diverted Outlet, or Outlet Group.

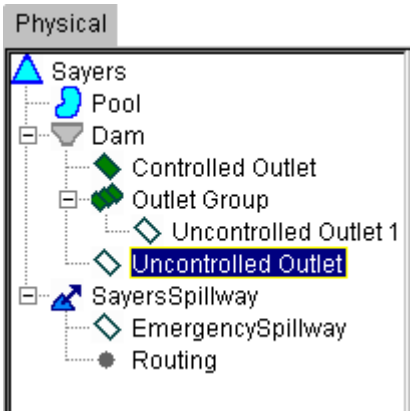

Figure 10.16 Reservoir Tree: Uncontrolled Outlets

To add an Uncontrolled Outlet:

1. Select the Dam, Diverted Outlet, or Outlet Group to which you want to add the new Uncontrolled Outlet.
2. Choose **Add Uncontrolled Outlet** from the shortcut menu (Figure 10.17) or from the component's menu in the Reservoir Editor's menu bar.

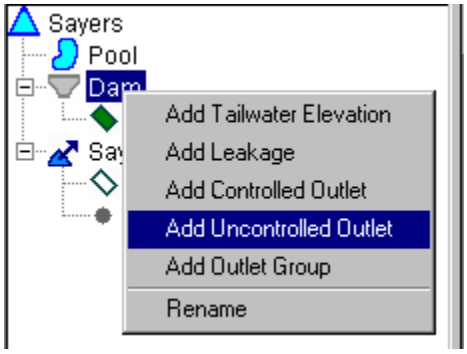

Figure 10.17 Dam Shortcut Menu: Add Uncontrolled Outlet

The new Uncontrolled Outlet will appear in the reservoir tree as a branch beneath the component you selected.

You can also rename and delete Uncontrolled Outlets in the reservoir tree, as described in Section 10.12.

10.10 Adding Tailwater Elevation

You can add **Tailwater Elevation** to Dams, Diverted Outlets, and Outlet Groups, as shown in Figure 10.18.

On the Physical tab, you may use either the component-specific menus in the Reservoir Editor's menu bar or the right-click shortcut menus (Figure 10.19) to add Tailwater Elevation to a Dam, or Diverted Outlet.

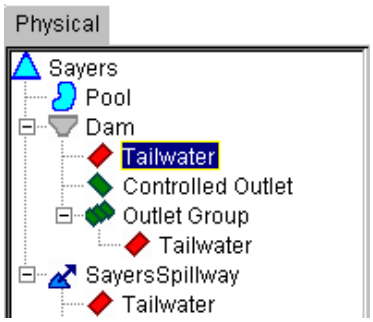

Figure 10.18 Reservoir Tree: Tailwater Elevation

To add Tailwater Elevation:

1. Select the Dam, Diverted Outlet, or Outlet Group to which you want to add Tailwater Elevation.
2. Choose **Add Tailwater Elevation** from the shortcut menu (Figure 10.19) or from the component's menu in the Reservoir Editor's menu bar.

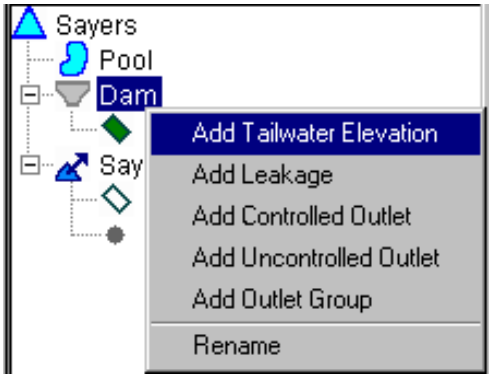

Figure 10.19 Dam Shortcut Menu: Add Tailwater Elevation

The Tailwater Elevation you have added will appear in the reservoir tree as a branch beneath the component you selected.

You can also remove Tailwater Elevation from the reservoir tree, as described in Section 10.12.3.

10.11 Defining Physical Components of a Diverted Outlet

As Figure 10.20 shows, you can add **Tailwater Elevation** (Section 10.10), **Uncontrolled Outlets** (Section 10.9), **Controlled Outlets** (Section 10.8), and **Outlet Groups** (Section 10.7) to a Diverted Outlet.

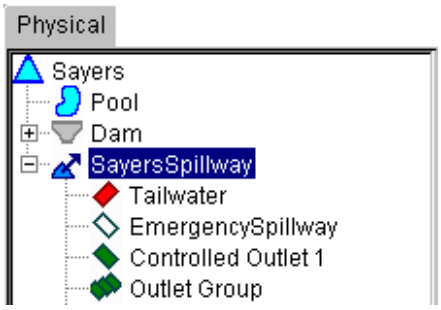

Figure 10.20 Reservoir Tree: Diverted Outlet

On the Physical tab, you may use either the **Outlet** menu in the Reservoir Editor's menu bar (Figure 10.21) or the right-click shortcut menu to specify features of a Diverted Outlet.

You can also rename and delete Diverted Outlets in the reservoir tree, as described in Section 10.12.

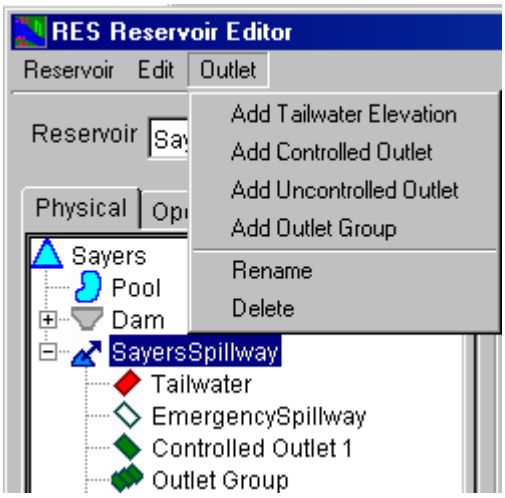

Figure 10.21 Reservoir Editor: Outlet Menu for Diverted Outlet

10.12 Renaming, Deleting, and Removing Reservoir Components

The following sections explain how to rename and delete or remove reservoir components.

10.12.1 Renaming Reservoir Components

ResSim assigns default names to reservoir components you have created in the Reservoir Network Module. You can rename Dams, Diverted Outlets, Outlet Groups, and Uncontrolled Outlets.

To rename a reservoir component:

1. Select the component by clicking on it in the reservoir tree.
2. Using either the right-click shortcut menu (Figure 10.22) or the component menu in the Reservoir Editor's menu bar, choose **Rename**. The **Rename Reservoir Component** dialog box will open (Figure 10.23).

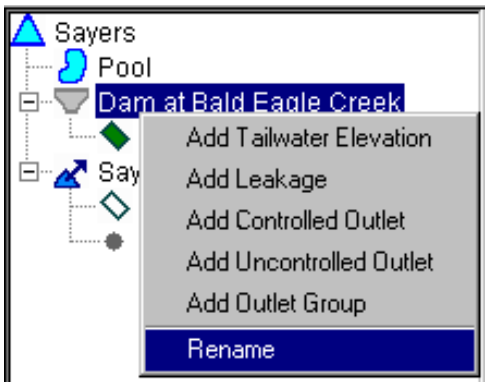

Figure 10.22 Reservoir Component Shortcut Menu: Rename Component

Figure 10.23 Rename Reservoir Component Dialog Box

3. Type the new name for the component in the **Name** field. You may also enter a new description in the **Description** field.
4. Click **OK** to close the dialog box. The new name will appear in the reservoir tree.

10.12.2 Deleting Reservoir Components

When you delete components from the reservoir tree, you *permanently remove them from the reservoir network*. You can delete Outlet Groups, Diverted Outlets, Controlled Outlets, and Uncontrolled Outlets.

To delete a reservoir component:

1. Select the component by clicking on it in the reservoir tree.
2. Using either the right-click shortcut menu (Figure 10.24) or the component menu in the Reservoir Editor's menu bar, choose **Delete**.
3. A confirmation window will appear (Figure 10.25). Click **Yes** to verify the deletion.

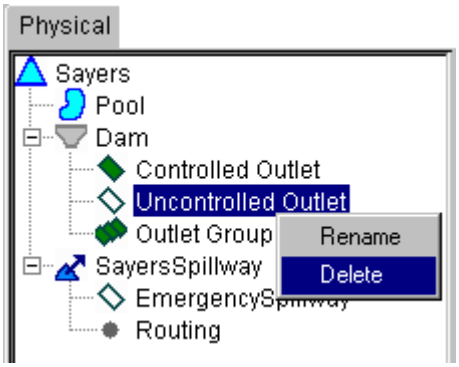

Figure 10.24 Reservoir Component Shortcut Menu: Delete Component

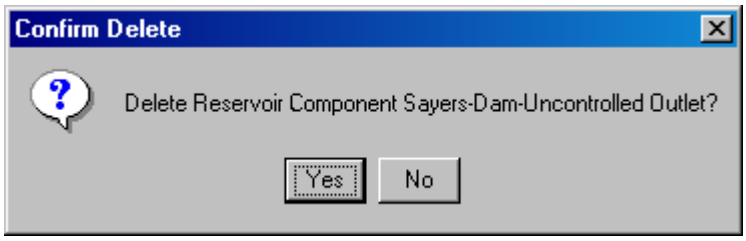

Figure 10.25 Confirm Deletion of Reservoir Component

When you delete a reservoir component, it will no longer appear in the reservoir tree.

Additionally, when you delete a Diverted Outlet, it will no longer appear in the map display of the Reservoir Network Module. To replace a Diverted Outlet, you will need to re-draw it in the map display area.

10.12.3 Removing Reservoir Parameters

You may remove Dam Leakage, Pool Evaporation and Seepage, Tailwater Elevation, and Power Plants from the reservoir tree without losing the associated data.

To remove these parameters:

1. Select the parameter by clicking on it in the reservoir tree.
2. Using either the right-click shortcut menu (Figure 10.26) or the primary component's menu in the Reservoir Editor's menu bar, choose **Remove**.
3. A confirmation window will appear (Figure 10.27). Click **Yes** to verify the removal.

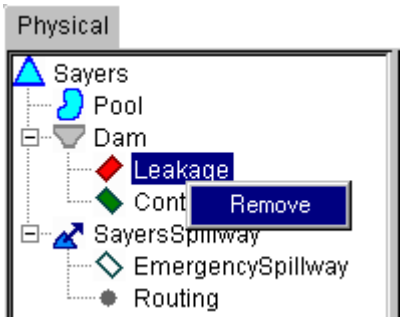

Figure 10.26 Reservoir Parameter Shortcut Menu: Remove Parameter

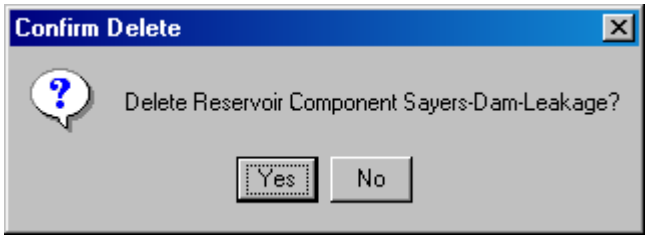

Figure 10.27 Confirm Removal of Reservoir Parameter

The parameter you have removed will no longer appear in the reservoir tree. However, if you re-add this parameter, the previously entered values will be restored.

10.13 Editing Reservoir Physical Data

To edit the physical data associated with a reservoir component, select the component in the reservoir tree in the Reservoir Editor. The appropriate data editor will appear in the area to the right of the reservoir tree.

In most cases, you will want to copy and paste tabular data from a spreadsheet application into the data editors, rather than typing the data manually.

10.14 Editing Pool Physical Data

To edit physical data for a reservoir Pool, select the **Pool** in the reservoir tree.

Figure 10.28 shows the Reservoir Editor's Pool data editor. The table in this Editor allows you to choose either **Linear** or **Conic** Interpolation and enter the **Elevation** vs. **Storage** vs. **Area** data. Two plots visually represent Storage and Area values in relation to Elevation.

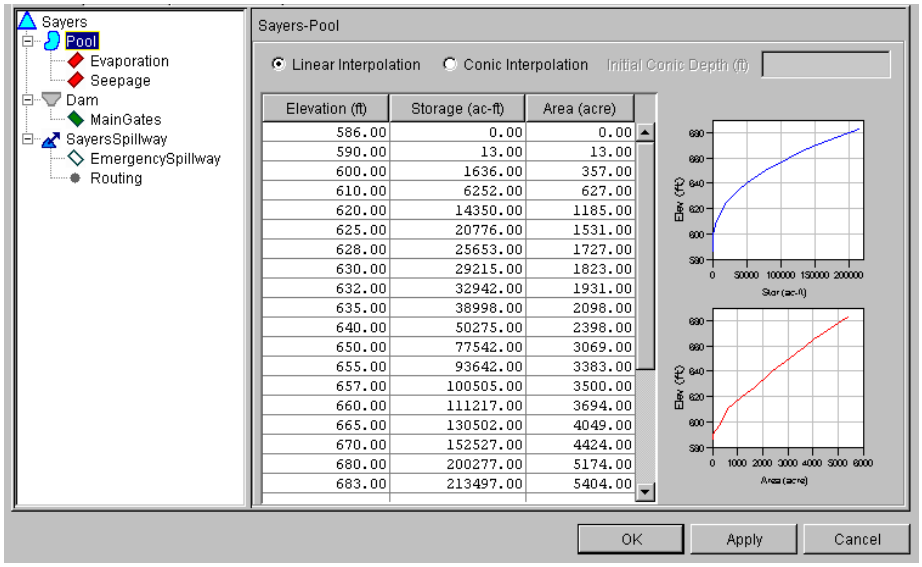

Figure 10.28 Reservoir Editor: Physical Data--Pool

To enter data into the table, either copy and paste it from a spreadsheet application or type in the data manually.

- **Linear Interpolation**: By default, the interpolation method ResSim uses to compute values for elevations and storages between those specified in the table is linear.
- **Conic Interpolation**: The pool definition detailed in the regulation manual for most reservoirs was originally developed using the assumption that the volume of water between two elevations can be described by the same equation as that used to compute the volume of a section of a cone. The area of the pool surface at each elevation can be computed based on the topography of the land and the change in elevation. Using this information, ResSim can compute the storage between the two elevations. This method of computing storage is available with the conic interpolation option. This option requires you to input an elevation vs. area relationship and a starting storage value at the lowest elevation in the table. ResSim will then compute the storage values using the conic assumption. Conic interpolation will also

be used to obtain intermediate storage values for elevations between those explicitly entered in the table.

The following are requirements for **Elevation, Storage**, and **Area** data:

- You must enter at least two rows, with values increasing down the columns.
- You may not enter duplicate values.
- The maximum elevation should not exceed the Elevation at top of Dam.

Be sure to click the **Apply** button before moving on to edit the next component.

10.14.1 Editing Pool Evaporation Data

To edit Evaporation data, select **Evaporation** in the reservoir tree. Figure 10.29 shows the Reservoir Editor's Evaporation data editor and its corresponding mini-plot. The mini-plot will reflect the values you enter and can be viewed in full size when you double-click on it.

You may choose either Monthly Average Evaporation or Evaporation Time-Series data.

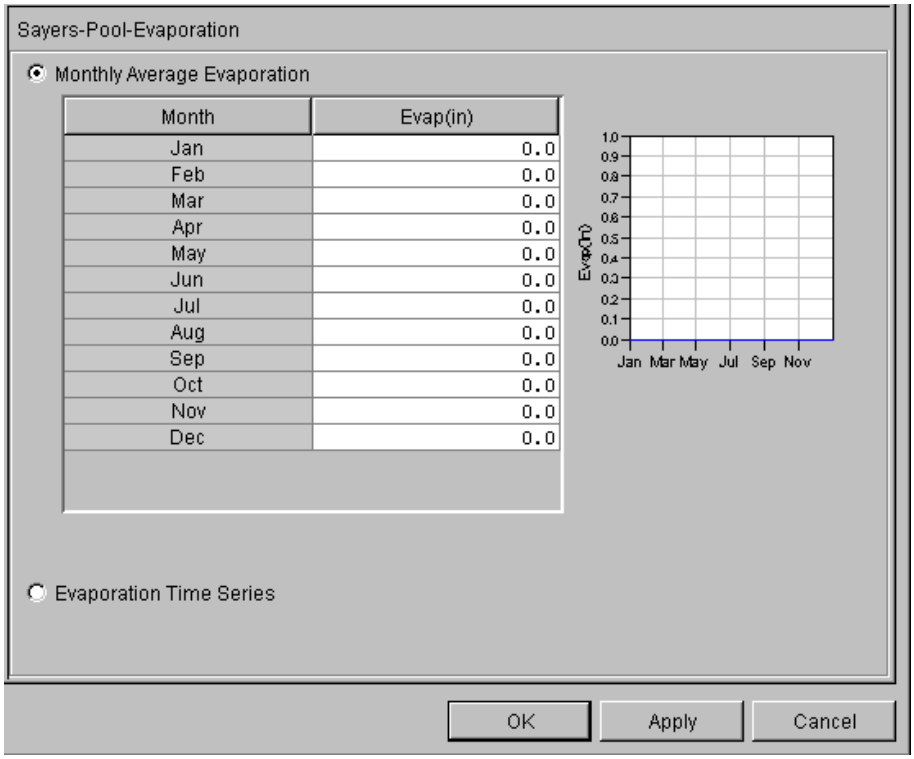

Figure 10.29 Reservoir Editor: Physical Data--Pool Evaporation

- **Monthly Average Evaporation:** Enter Evaporation values by month. To enter data into the table, either copy and paste it from a spreadsheet application or type in the values manually.
- **Evaporation Time Series:** If you select this option, you will need to specify the time-series data source when you create an Alternative (see Chapter 13).

Be sure to click the **Apply** button before moving on to edit the next component.

10.14.2 Editing Pool Seepage

To edit Seepage data, select **Seepage** in the reservoir tree. Figure 10.30 shows the Reservoir Editor's Seepage data editor and its corresponding mini-plot. The mini-plot will reflect the values you enter and can be viewed in full size when you double-click on it.

You may choose either **Constant Seepage** or **Seepage as a function of Reservoir Elevation**.

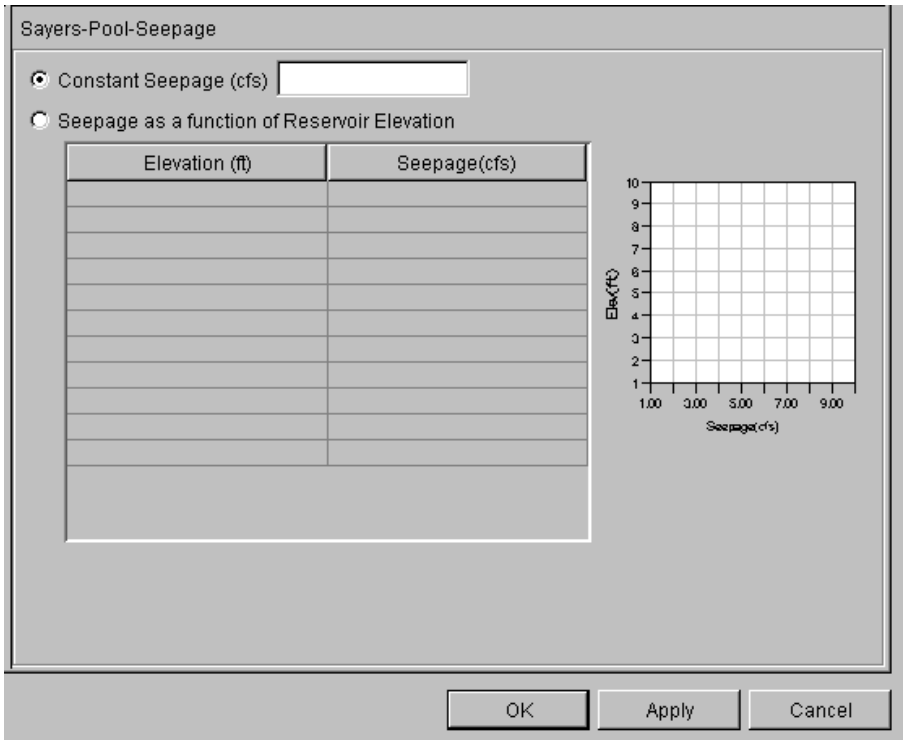

Figure 10.30 Reservoir Editor: Physical Data--Pool Seepage

- **Constant Seepage:** Enter the constant value in the field provided.
- **Seepage as a Function of Reservoir Elevation:** Enter **Elevation** and **Seepage** values into the table. To enter data into the table, either copy and paste it from a spreadsheet application or type in the values manually.

Be sure to click the **Apply** button before moving on to edit the next component.

10.15 Editing Dam Leakage

To edit Leakage data for a dam, select **Leakage** in the reservoir tree. Figure 10.31 shows the Reservoir Editor's Leakage data editor and its corresponding mini-plot. The mini-plot will reflect the values you enter and can be viewed in full size when you double-click on it.

The Leakage data editor allows you to define **Leakage** as a function of pool **Elevation**. Leakage, although referred to as a "loss," is not a true loss of flow to the system. In fact, leakage effectively passes through the dam into the downstream system at the downstream (or tailwater) junction.

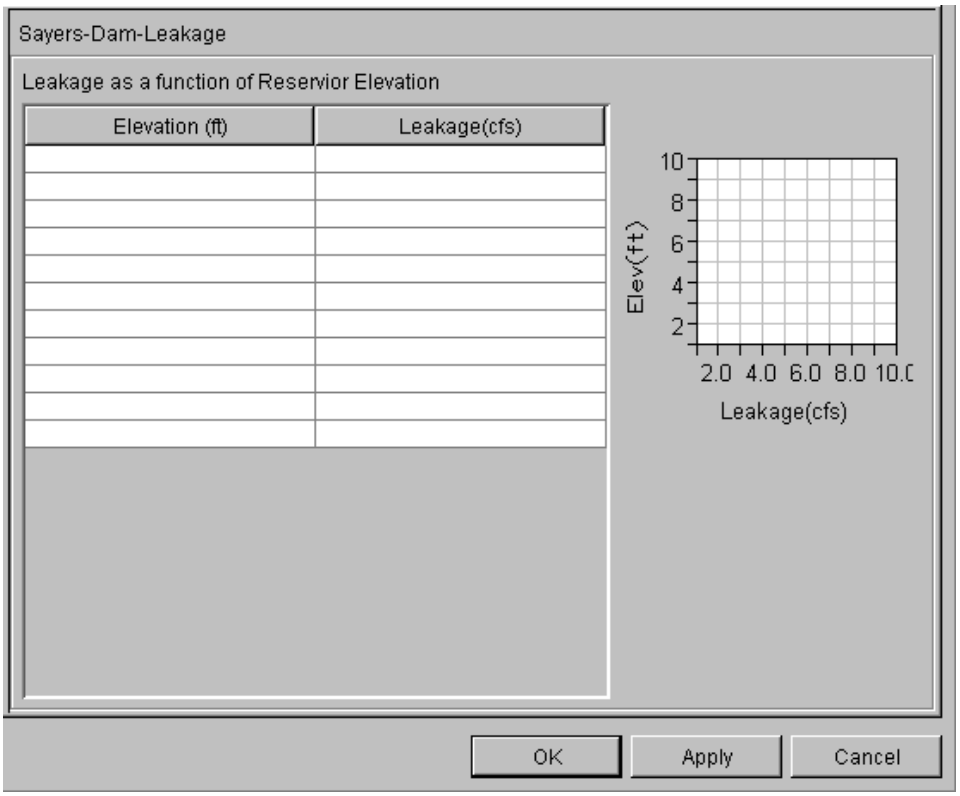

Figure 10.31 Reservoir Editor: Physical Data--Dam Leakage

To enter data into the table, either copy and paste it from a spreadsheet application or type in the data manually.

Be sure to click the **Apply** button before moving on to edit the next component.

10.16 Editing Controlled Outlet Physical Data

A **Controlled Outlet** can be a component of a Dam, Diverted Outlet, or Outlet Group. Additionally, a Controlled Outlet may have its own components Tailwater Elevation and Power Plants.

To edit data for the primary Controlled Outlet, select the name of the Controlled Outlet in the reservoir tree.

Figure 10.32 shows the Reservoir Editor's Controlled Outlet data editor and its corresponding mini-plot. The mini-plot will reflect the values you enter and can be viewed in full size when you double-click on it.

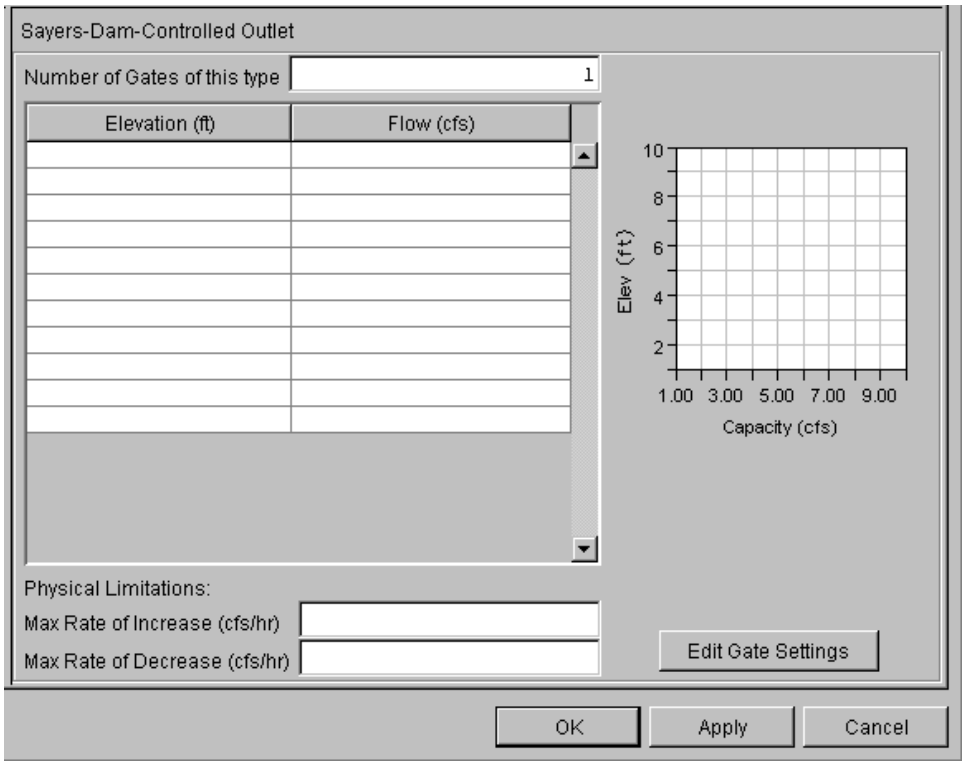

Figure 10.32 Controlled Outlet (no Gate Settings)

To enter Controlled Outlet data:

1. Specify the **Number of Gates** of this type.
2. Enter **Elevation** and **Flow** values into the table. You can either copy and paste data from a spreadsheet application or type in the values manually.
3. Specify **Max Rate of Increase** and **Max Rate of Decrease** limitations.

4. Click the **Edit Gate Settings** button to access the **Gate Settings** dialog box (Figure 10.33). Gate settings are sometimes known as "cranks."
5. Choose either **Specify Maximum Capacity Only** or **Specify Capacity at Specific Gate Openings**.
   To **Specify Capacity at Specific Gate Openings:**
   - Select the **Number of Gate Settings** (or "cranks") and the **Gate Setting Units** (Length or Percent).
   - Enter the **Setting** for each gate.
6. Click **OK** to close the Gate Settings dialog box.

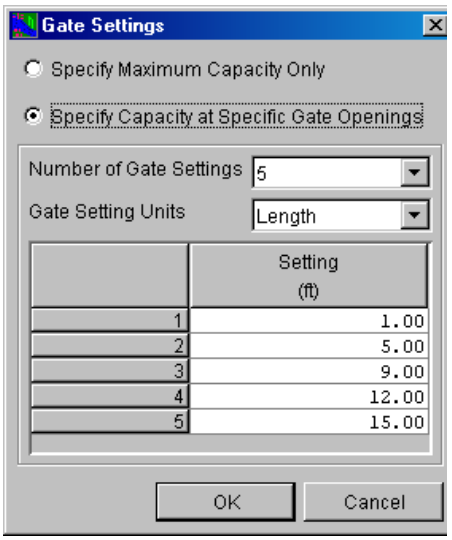

Figure 10.33 Gate Settings Dialog Box

Figure 10.34 shows the Reservoir Editor's Controlled Outlet data editor with Gate Settings specified.

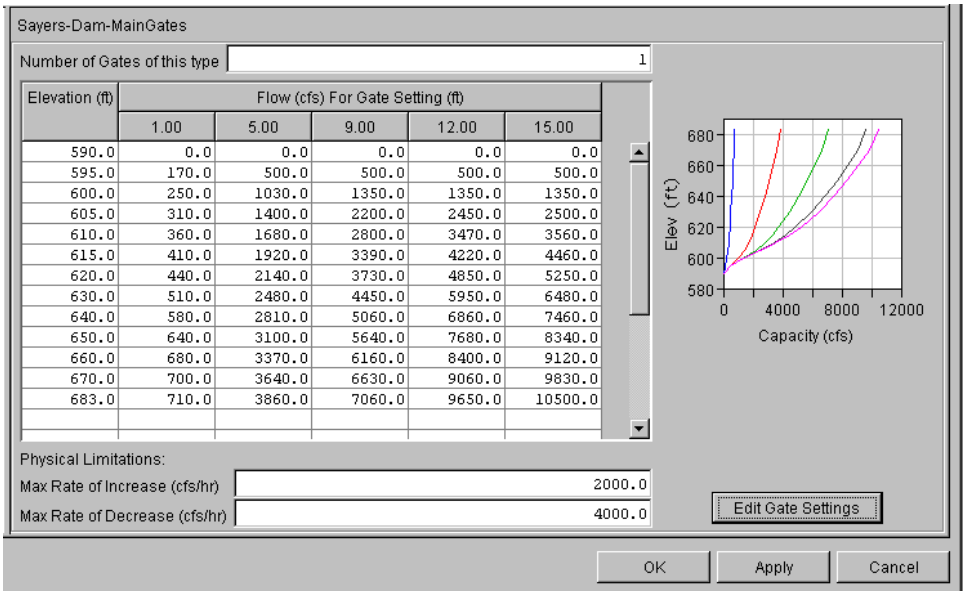

Figure 10.34 Controlled Outlet (with Gate Settings)

When you are done entering Controlled Outlet data, be sure to click the **Apply** button before moving on to edit the next component.

10.17 Editing Power Plant Physical Data

A Power Plant is a component of a Controlled Outlet. To edit data for a Power Plant, select the **Power Plant** in the reservoir tree.

The Reservoir Editor's Power Plant data editor has four tabs that allow you to edit data for **Capacity**, **Efficiency**, **Station Use**, and **Hydraulic Losses**, as described in the following sections.

10.17.1 Editing Capacity Data for a Power Plant

On the **Capacity** tab, you can enter **Installed Capacity** and **Overload Factor** (Figure 10.35). The Installed Capacity is entered in megawatts (MW) and represents the nameplate capacity. The Overload Factor is used in conjunction with the Installed Capacity to determine the maximum energy the power plant can produce in a time interval.

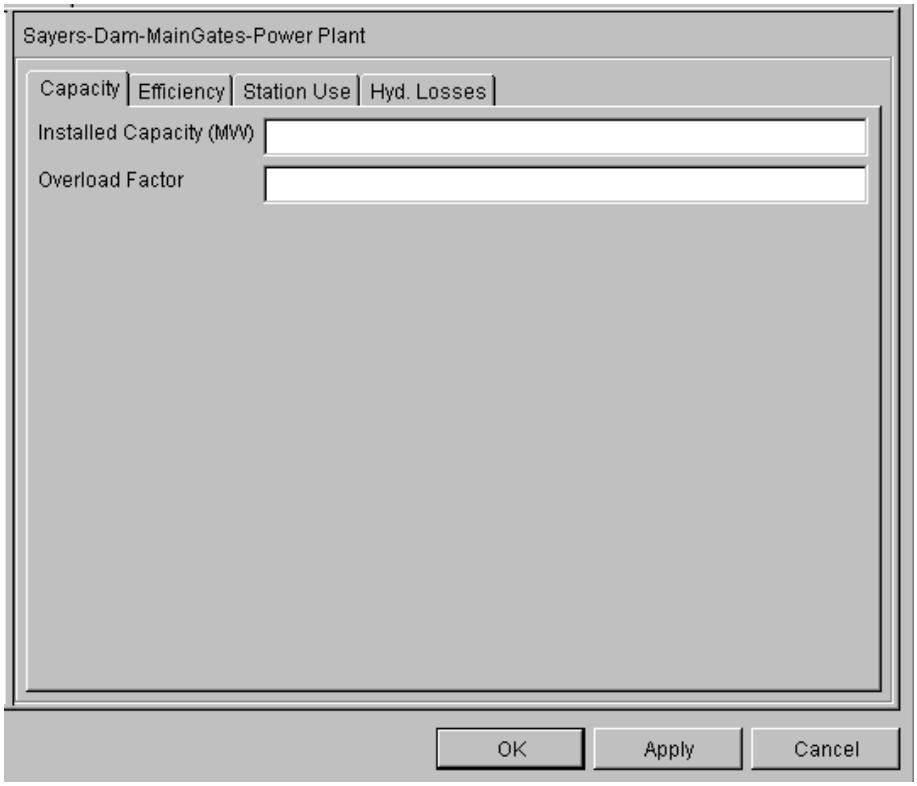

Figure 10.35 Power Plant Physical Data Editor: Capacity Tab

10.17.2 Editing Efficiency Data for a Power Plant

Power efficiency is the total efficiency (generator efficiency x turbine efficiency) of the power plant. On the **Efficiency** tab, you can specify an **Efficiency Method** from a list of four options: Constant, Function of Reservoir Elevation, Function of Release, or Function of Operating Head. Each Efficiency Method has its own data editor, as described in the following sections.

10.17.2.1 Constant Efficiency Method

For the **Constant** efficiency method (Figure 10.36), enter a percentage value for **Constant Efficiency**. A constant turbine-generator efficiency of 86% is often used. In actual operation, however, the turbine-generator efficiency varies throughout its range of operation (subsequent sections describe efficiency as a function of elevation, release or operating head).

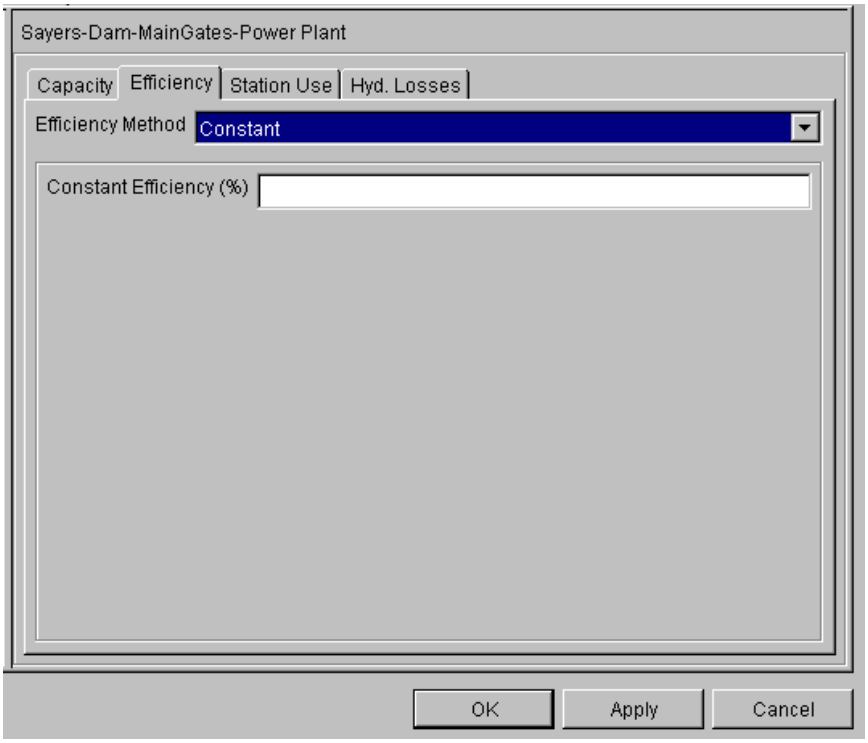

Figure 10.36 Power Plant Physical Data Editor: Efficiency Tab - Constant Efficiency Method

When you have finished entering Efficiency data, be sure to click the **Apply** button before moving on to the next tab.

10.17.2.2 Function of Reservoir Elevation Efficiency Method

For the **Function of Reservoir Elevation** efficiency method (Figure 10.37), enter values for **Elevation** and **Efficiency**. The mini-plot will reflect the values you enter and can be viewed in full size when you double-click on it.

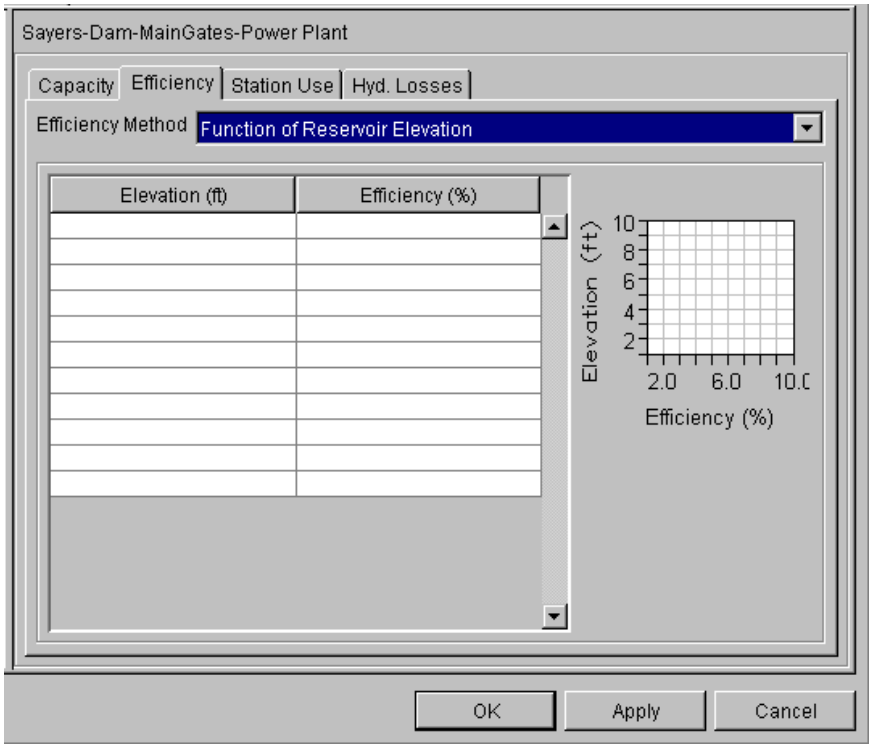

Figure 10.37 Power Plant Physical Data Editor: Efficiency Tab - Function of Reservoir Elevation

When you have finished entering Efficiency data, be sure to click the **Apply** button before moving on to the next tab.

10.17.2.3 Function of Release Efficiency Method

For the **Function of Release** efficiency method (Figure 10.38), enter values for **Release** and **Efficiency**. The mini-plot will reflect the values you enter and can be viewed in full size when you double-click on it.

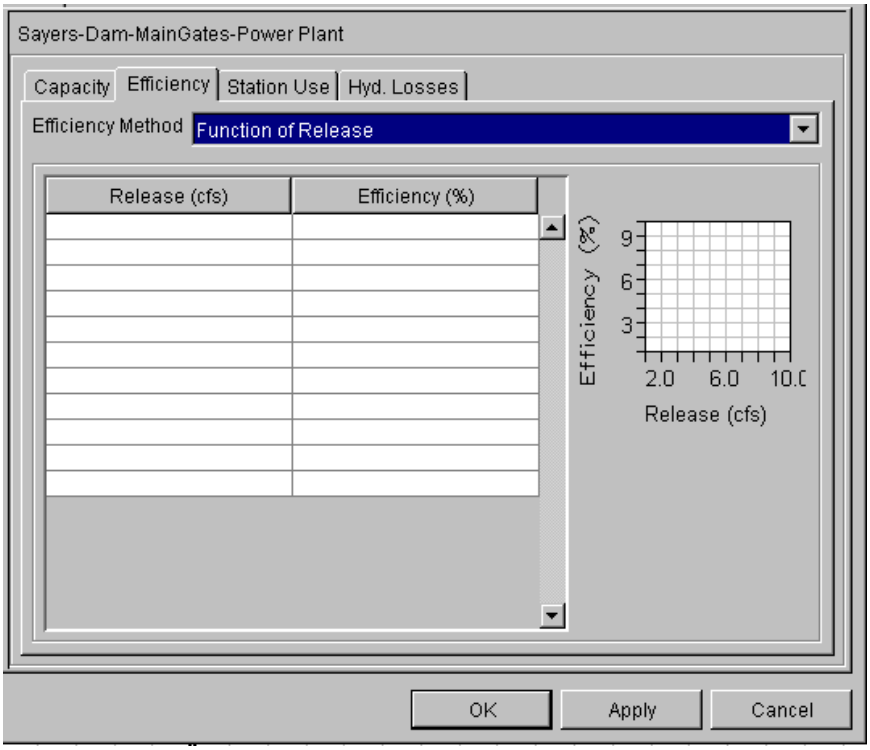

Figure 10.38 Power Plant Physical Data Editor: Efficiency Tab - Function of Reservoir Release

When you have finished entering Efficiency data, be sure to click the **Apply** button before moving on to the next tab.

10.17.2.4 Function of Operating Head Efficiency Method

For the **Function of Operating Head** efficiency method (Figure 10.39), enter values for **Head** and **Efficiency**. The mini-plot will reflect the values you enter and can be viewed in full size when you double-click on it.

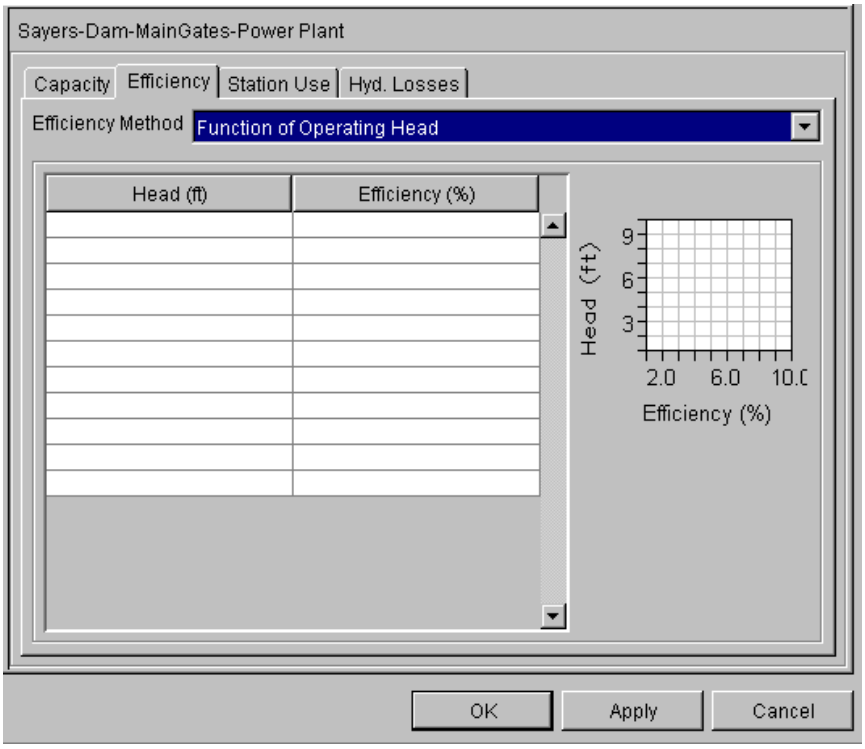

Figure 10.39 Power Plant Physical Data Editor: Efficiency Tab - Function of Operating Head

When you have finished entering Efficiency data, be sure to click the **Apply** button before moving on to the next tab.

10.17.3 Editing Station Use Data for a Power Plant

Station Use is a portion of the flow that passes through the outlet but is not used to generate power for the "grid." On the **Station Use** tab, you can define the **Station Use Method** as Constant or as a Function of Release. Each method has its own data editor, as described in the following sections.

10.17.3.1 Constant Station Use Method

The **Constant** station use method (Figure 10.40) simply means that the flow "loss" is not affected by any parameter.

Enter a value for **Constant Station Use**.

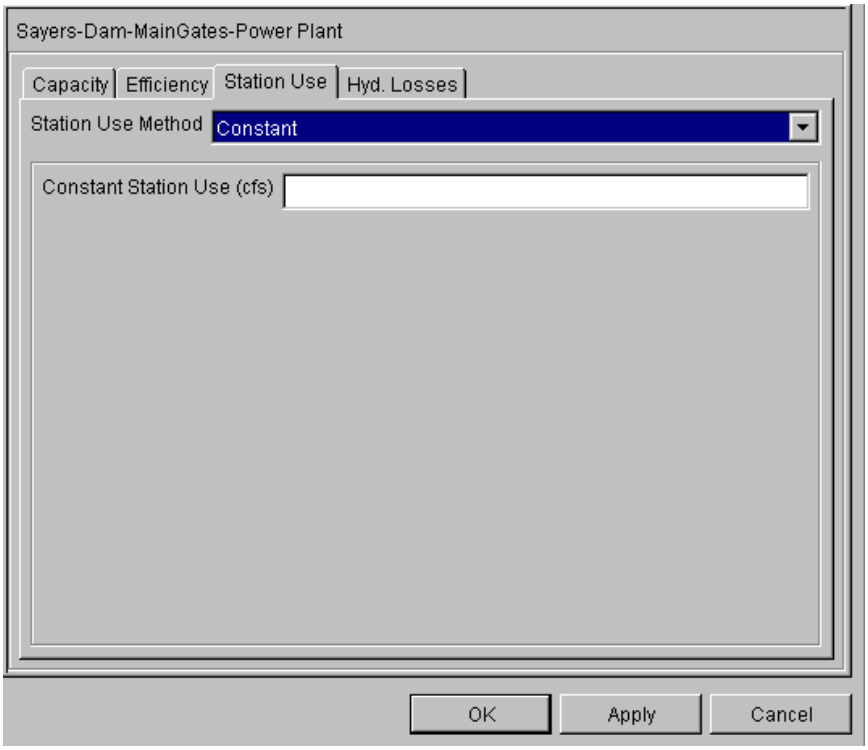

Figure 10.40 Power Plant Physical Data Editor: Station Use Tab - Constant Method

When you have finished entering Station Use data, be sure to click the **Apply** button before moving on to the next tab.

10.17.3.2 Function of Release Station Use Method

The loss of flow for generating hydropower through station use can also be defined as a function of flow entering the outlet. For the **Function of Release** station use method (Figure 10.41), enter values for **Release** (flow) and **Use** (the loss in flow units). The mini-plot will reflect the values you enter and can be viewed in full size when you double-click on it.

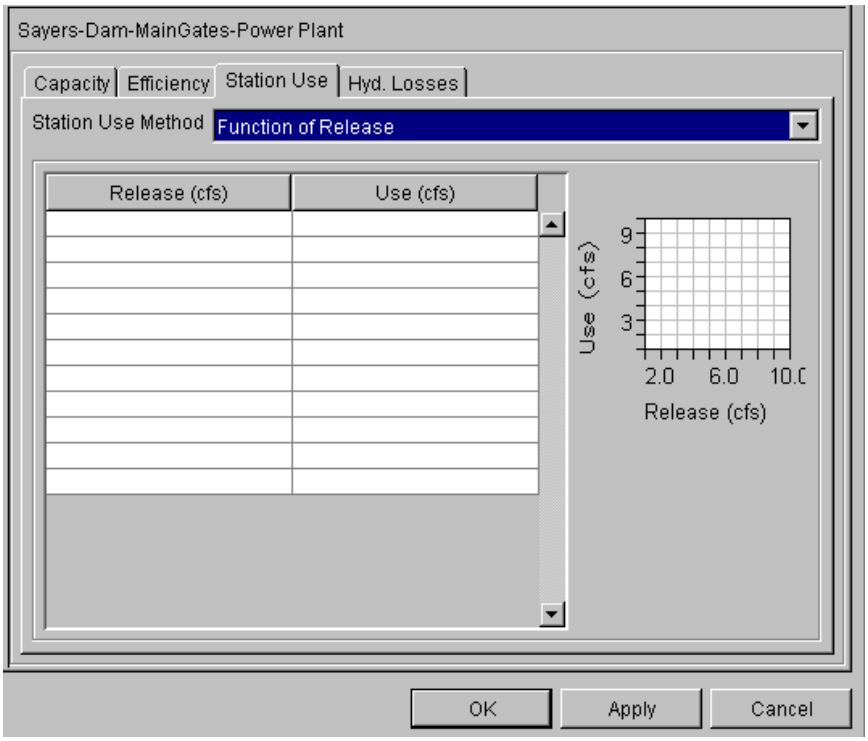

Figure 10.41 Power Plant Physical Data Editor: Station Use Tab - Function of Release Method

When you have finished entering Station Use data, be sure to click the **Apply** button before moving on to the next tab.

10.17.4 Editing Hydraulic Losses Data for a Power Plant

Hydraulic loss can also be referred to as head loss. ResSim uses the value of head (the difference between the pool elevation and the tailwater elevation) within the power equations to compute capacity. When you enter a hydraulic loss, you are describing a loss to the head, thereby reducing the plant's generating capacity.

You can choose one of two methods to describe hydraulic losses. On the **Hydraulic Losses** tab, you can specify the head loss as a Constant or as a Function of Release (flow through the outlet). Each method has its own data editor, as described in the following sections.

10.17.4.1 Constant Hydraulic Losses Method

For the **Constant** hydraulic losses method (Figure 10.42), enter a value for **Constant Hydraulic Loss**.

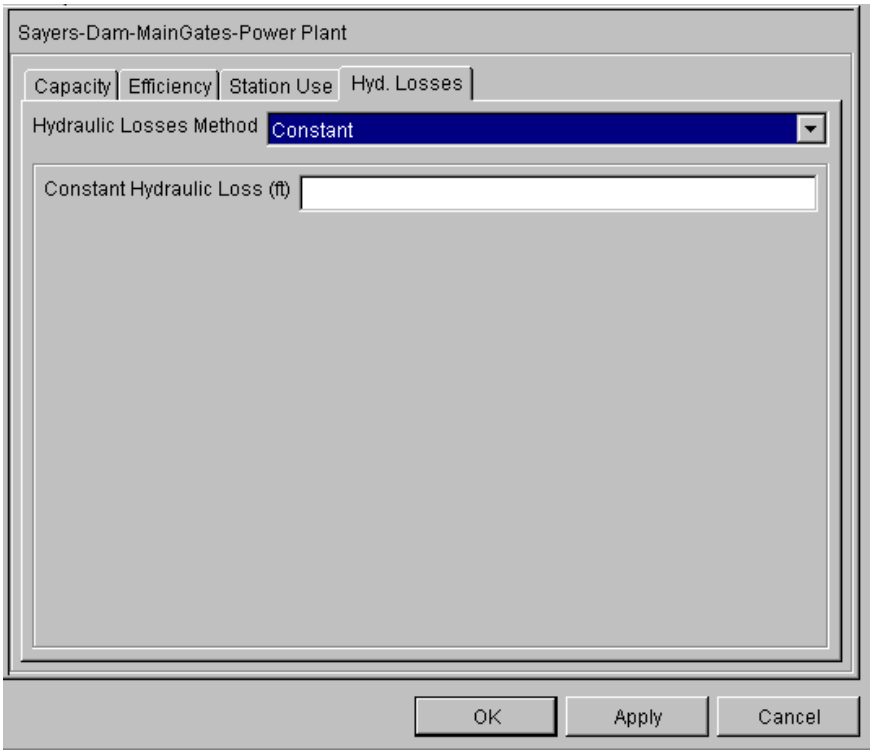

Figure 10.42 Power Plant Physical Data Editor: Hydraulic Losses Tab - Constant Method

When you have finished entering Hydraulic Losses data, be sure to click the **Apply** button before moving on.

10.17.4.2 Function of Release Hydraulic Losses Method

For the **Function of Release** hydraulic losses method (Figure 10.43), enter values for **Release** and **Loss** to describe the head loss as a function of flow through the outlet. The mini-plot will reflect the values you enter and can be viewed in full size when you double-click on it.

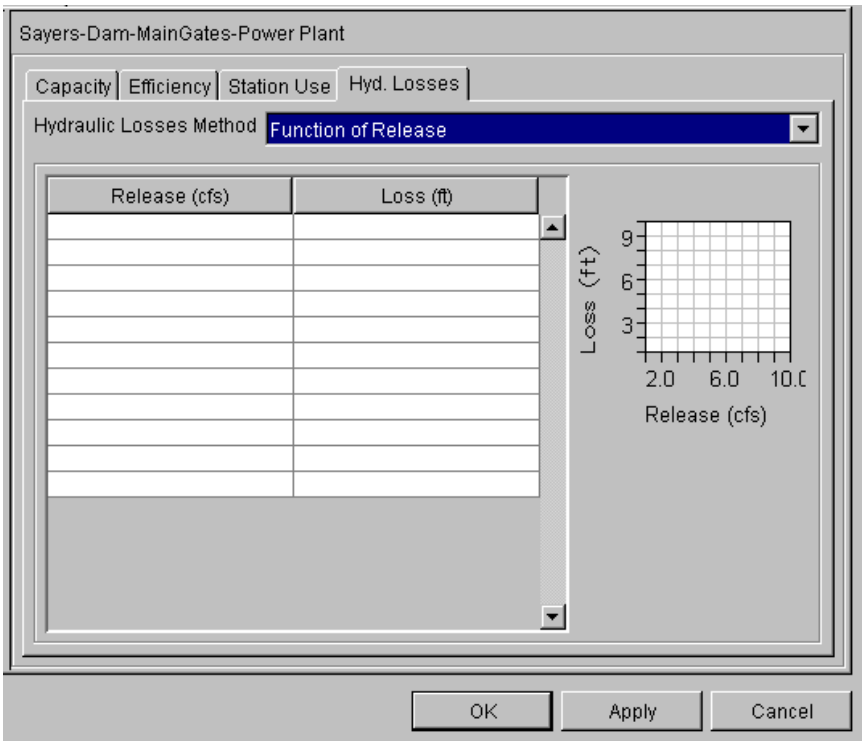

Figure 10.43 Power Plant Physical Data Editor: Hydraulic Losses Tab - Function of Release Method

- **Release:** Flow through the outlet.
- **Loss:** Head Loss, a unit of length to be removed from the head value used to compute generating capacity.

When you have finished entering Hydraulic Losses data, be sure to click the **Apply** button before moving on.

10.18 Editing Uncontrolled Outlet Physical Data

An **Uncontrolled Outlet** can be a component of a Dam, Diverted Outlet, or Outlet Group. The uncontrolled outlet is an uncontrolled spillway and you can use a weir equation to compute the flow over the spillway. Otherwise, the outlet can be defined by a simple rating curve that describes flow through the outlet.

Figure 10.44 shows the Reservoir Editor's Uncontrolled Outlet data editor and its corresponding mini-plot. The mini-plot will reflect the values you enter and can be viewed in full size when you double-click on it.

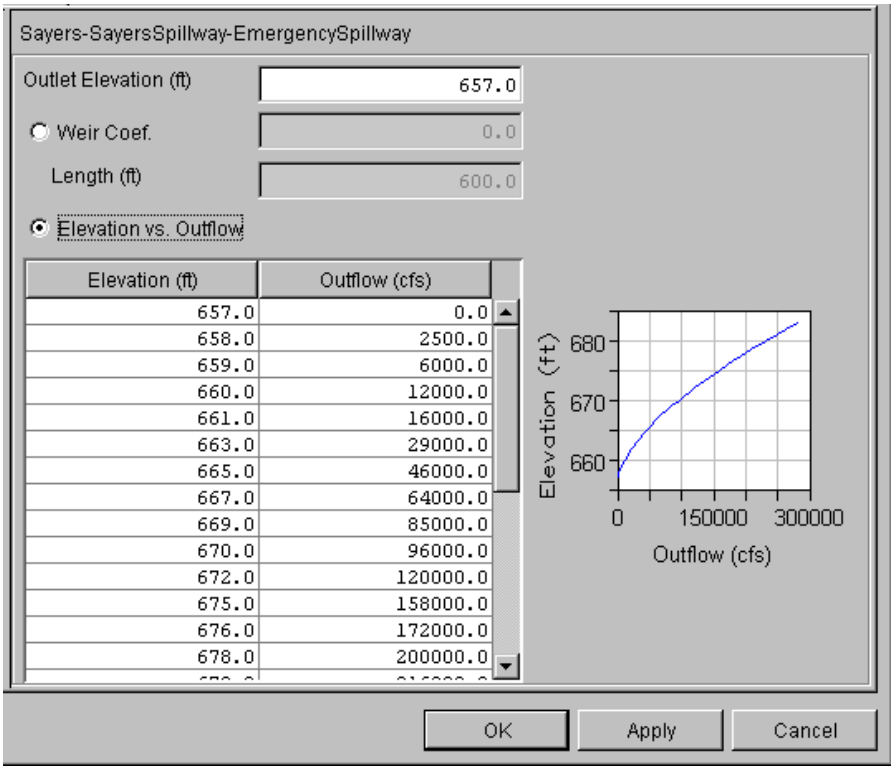

Figure 10.44 Reservoir Editor: Physical Data--Uncontrolled Outlet

In the Uncontrolled Spillway data editor you will specify **Outlet Elevation.** This elevation will serve as a trigger to determine when this outlet starts "flowing." Next, choose how you want to represent your uncontrolled outlet: as a spillway using the weir equation (**Weir Coefficient**) or as a rating curve (**Elevation vs. Outflow**). If you choose to define your uncontrolled outlet as a spillway, enter the spillway length and weir coefficient; otherwise, enter the rating curve's elevation and outflow values.

- **Length:** Spillway length.
- **Outlet Elevation:** Minimum elevation at which the outlet will begin to release water.

- **Weir Coefficient:** Typically in the range 2.6-4.0 depending on the shape of the spillway crest. This value determines flow over the spillway in the weir equation.
- **Elevation vs. Outflow:** To enter data into the table, either copy and paste it from a spreadsheet application or type in the data manually.

Be sure to click the **Apply** button before moving on to edit the next component.

10.19 Editing Tailwater Elevation Physical Data

Tailwater Elevation can be a component of a Dam, Diverted Outlet, Outlet Group, and Controlled Outlet. You must add a Tailwater component to the dam or outlet if you have defined one or more power plants for this reservoir, so the head can be computed for the power computations. Three different methods for defining tailwater are available. If you define more than one, ResSim will compute all defined but will use only the highest to determine the head.

To edit Tailwater Elevation data, select the **Tailwater** component in the reservoir tree. Figure 10.45 shows the Reservoir Editor's Tailwater Elevation data editor. The mini-plot will reflect the rating curve values you enter and can be viewed in full size when you double-click on it.

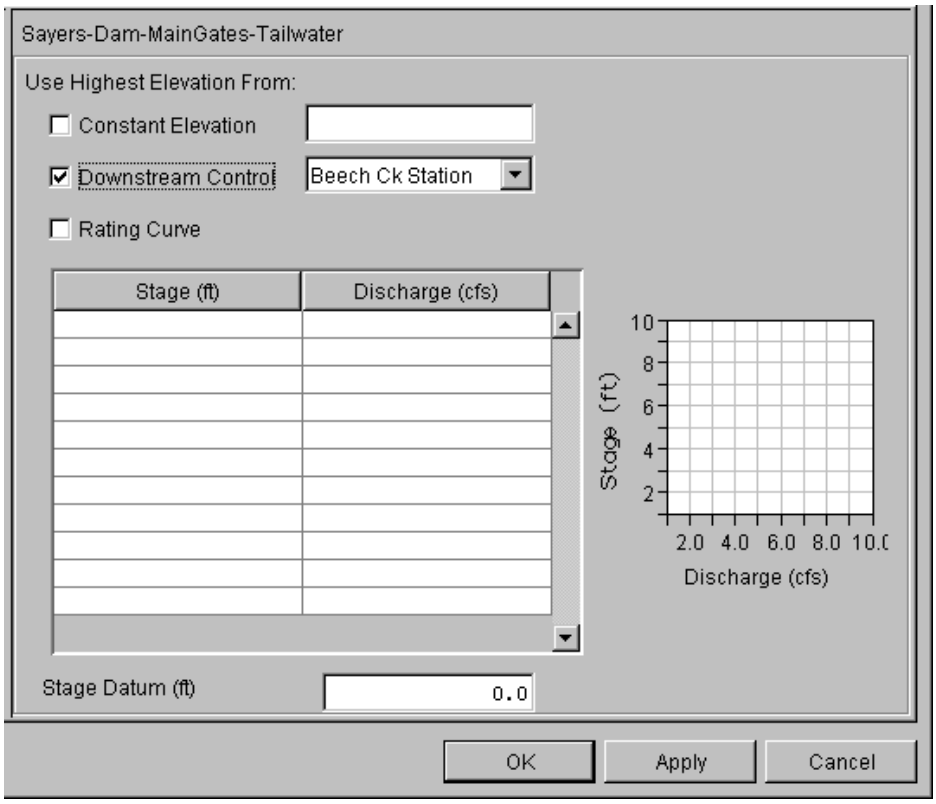

Figure 10.45 Reservoir Editor: Physical Data--Tailwater

- **Constant Elevation:** Enter a value for the tailwater elevation. If the reservoir has a stilling basin at the tailwater, a constant elevation may be an appropriate definition.
- **Downstream Control:** Select a junction from the list. The junction should represent the point of outflow of the power plant and contain a rating curve from which the elevation of the junction can be determined.
- **Rating Curve:** You can also apply a rating curve to represent the tailwater of the dam or outlet of the reservoir. You may either copy and paste the data from a spreadsheet application or type in the values manually.
  - ❖ **Stage:** The height from some datum, representing the water surface elevation.
  - ❖ **Discharge:** The flow passing that location that would produce the associated water surface elevation.

Stage Datum: The "zero" elevation against which stage is measured. This elevation must be in the same vertical reference as the elevations describing the reservoir.

Be sure to click the **Apply** button before moving on to edit the next component.

10.20 Viewing Composite Release Capacity Tables

Composite Release Capacity tables and their corresponding mini-plots provide a summary of outlet capacity data for Controlled and Uncontrolled Outlets of a reservoir. Figure 10.46 shows a Composite Release Capacity table for a reservoir. The mini-plot reflects the composite values and can be viewed in full size when you double-click on it.

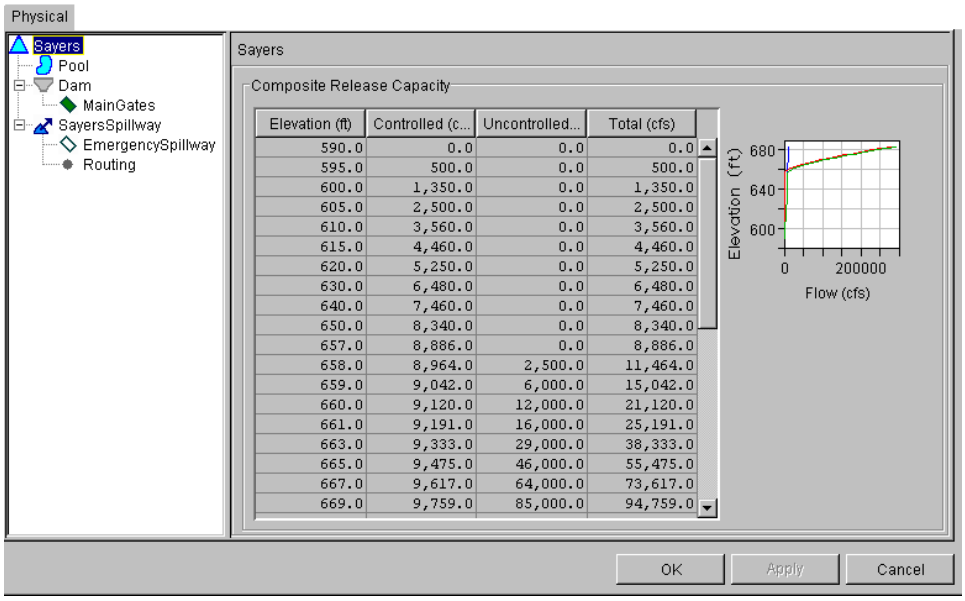

Figure 10.46 Composite Release Capacity Table

Composite Release Capacity tables are informational and are not editable. Instead, they fill in automatically as you add data for the individual components.

10.20.1 Reservoir Composite Release Capacity Table

To view the **Reservoir Composite Release Capacity** table, select the Reservoir's name at the top of the reservoir tree (corresponding to the △ symbol) as shown in Figure 10.46.

In ResSim, a reservoir consists of, minimally, a Pool and a Dam; it may also include Diverted Outlets. The dam (and diverted outlet) can then, in turn, include outlets and outlet groups. The dam, diverted outlet, and any outlet group will display Composite Release Capacity tables similar to that of the reservoir to represent the total outlet capacity of the components contained within each group.

10.20.2 Dam Composite Release Capacity Table

To access the **Dam Release Capacity** table, select the Dam in the reservoir tree (corresponding to the  symbol).

The components of a dam that influence the Composite Release Capacity table include controlled outlets, uncontrolled outlets, and outlet groups.

10.20.3 Diverted Outlet Composite Release Capacity Table

To access the **Diverted Outlet Composite Release Capacity** table, select the Diverted Outlet in the reservoir tree (corresponding to the  symbol).

The components of a diverted outlet that influence the composite release capacity table include controlled outlets, uncontrolled outlets, and outlet groups.

10.20.4 Outlet Group Composite Release Capacity Table

To access the **Outlet Group Composite Release Capacity** table, select the Outlet Group in the reservoir tree (corresponding to the  symbol).

An outlet group can be a component of a dam, diverted outlet, or another outlet group. The components that can influence the Outlet Group Composite Release Capacity table include controlled outlets, uncontrolled outlets, and outlet groups.

10.21 Reservoir Editor: Observed Data Tab

Use the **Observed Data** tab (Figure 10.47) to indicate that observed data is available for comparison purposes. If the **Observed** box in the table is checked, then there will be a corresponding entry in the Observed Time-Series mapping table when you create an Alternative (see Chapter 13).

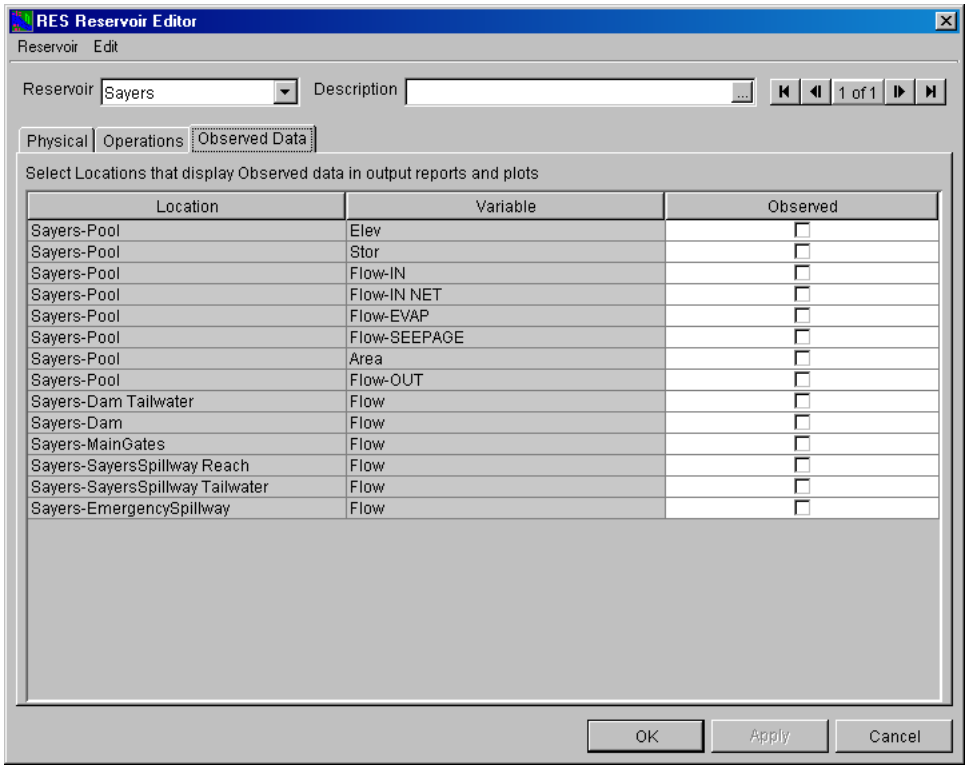

Figure 10.47 Reservoir Editor: Observed Data Tab

To edit another reservoir without exiting the Reservoir Editor, click the **Apply** button and then select another reservoir from the **Reservoir** name list or use the navigator buttons.