

City of Riverside

**WASTEWATER COLLECTION AND TREATMENT  
FACILITIES INTEGRATED MASTER PLAN**

**VOLUME 11: FINANCIAL PLAN AND USER RATES AND FEES  
CHAPTER 1: MASTER PLAN MANAGER™**

**FINAL**  
February 2008



**WASTEWATER COLLECTION AND TREATMENT  
FACILITIES INTEGRATED MASTER PLAN**

**VOLUME 11: FINANCIAL PLAN AND USER RATES AND FEES  
CHAPTER 1: MASTER PLAN MANAGER™**

**TABLE OF CONTENTS**

	<b><u>Page No.</u></b>
1.1	PURPOSE..... 1-1
1.2	CONCLUSIONS..... 1-1
1.3	INTRODUCTION..... 1-1
1.4	FUNCTIONALITY..... 1-4
1.4.1	Projected Years..... 1-4
1.4.2	Projected Flows and Loads..... 1-4
1.4.3	Existing Treatment Process and Capacity..... 1-15
1.4.4	Planned Projects and Costs..... 1-19
1.4.5	Flow and Solids Allocation..... 1-21
1.4.6	Treatment Train Summary..... 1-21
1.4.7	Capacity Evaluation..... 1-21
1.4.8	Pollutant Reduction..... 1-26
1.4.9	Pollutant Addition..... 1-26
1.4.10	Regulatory Requirements..... 1-29
1.4.11	Effluent Quality..... 1-29
1.4.12	Project Schedule..... 1-33
1.4.13	Costs..... 1-33
1.4.14	Scenario Summary..... 1-41
1.4.15	Graphs..... 1-41
1.4.16	Reports..... 1-41
1.4.17	Help Menu..... 1-41
1.5	EXISTING DATABASE..... 1-41

**LIST OF FIGURES**

Figure 1.1	Master Plan Manager™ Logic Diagram..... 1-3
Figure 1.2	Master Plan Manager Overview..... 1-5
Figure 1.3	Projected Years..... 1-6
Figure 1.4	Historical Domestic Flows and Loads..... 1-8
Figure 1.5	Projected Domestic Flows and Loads..... 1-9
Figure 1.6	Historical Industrial Flows and Loads..... 1-10
Figure 1.7	Projected Industrial Flows and Loads..... 1-11
Figure 1.8	Historical Other Pollutants..... 1-13
Figure 1.9	Projected Other Pollutants..... 1-14
Figure 1.10	Projected Water Conservation..... 1-16
Figure 1.11	Projected Flows and Loads..... 1-17
Figure 1.12	Existing Treatment Process and Capacity..... 1-18
Figure 1.13	Planned Projects and Costs..... 1-20

Figure 1.14	Flow and Solids Allocation .....	1-22
Figure 1.15	Treatment Train Summary .....	1-23
Figure 1.16	Capacity Evaluation .....	1-24
Figure 1.17	Capacity Evaluation for the 1.5% Growth Projected Domestic Data Option .....	1-25
Figure 1.18	Comparison of Project Schedules.....	1-27
Figure 1.19	Pollutant Reduction.....	1-28
Figure 1.20	Pollutant Addition .....	1-30
Figure 1.21	Regulatory Requirements .....	1-31
Figure 1.22	Effluent Quality.....	1-32
Figure 1.23	Projected Effluent Quality of Ibuprofen .....	1-34
Figure 1.24	Project Schedule.....	1-35
Figure 1.25	Standard S-Curve .....	1-36
Figure 1.26	Project Expansion Costs.....	1-37
Figure 1.27	Project Replacement/Improvement Costs .....	1-39
Figure 1.28	O&M Costs.....	1-40
Figure 1.29	Overall Projected Costs .....	1-42
Figure 1.30	Scenario Summary .....	1-43
Figure 1.31	Projected Population Graph.....	1-44
Figure 1.32	Projected Flows Graph .....	1-45
Figure 1.33	Projected Loads Graph .....	1-46
Figure 1.34	Project Schedule Graph.....	1-47
Figure 1.35	Projected Annual Costs Graph .....	1-48
Figure 1.36	Capacity Evaluation Graph - Flow .....	1-49
Figure 1.37	Capacity Evaluation Graph - TSS.....	1-50
Figure 1.38	Master Plan Manager™ Reports .....	1-51
Figure 1.39	Master Plan Manager™ Help Menu.....	1-52

## **1.1 PURPOSE**

The City of Riverside (City) is in the process of completing their Wastewater Collection and Treatment Facilities Integrated Master Plan (Integrated Master Plan). The Integrated Master Plan began with growth and regulatory assumptions that were used to develop alternatives. The alternatives were then evaluated based on their ability to meet the growth and regulatory needs. From there, alternatives were further developed to estimate implementation costs and schedules.

The Master Plan Manager™ (MPM™) software application allows growth and regulatory assumptions to be easily updated as changes occur in the future. The purpose of this chapter is to explain the overall functionality of the MPM™ software and how the City can use it in the future to meet their needs.

## **1.2 CONCLUSIONS**

MPM™ allows the user to create and easily update numerous options for growth and regulatory assumptions that can be combined in a variety of ways to create many scenarios. The software provides immediate scenario results that can then be compared and evaluated against one another. These analyses will help the City to identify and understand planned trigger points for various projects, the impacts to capacity and effluent quality from the different growth options, and the relative impacts to the Capital Improvement Program (CIP) in terms of cost and scheduling. All together, the City can understand potential future capacity bottlenecks, and potential failures to meet effluent quality requirements based on various growth options and selection of treatment processes. This information will allow the City to plan for flexibility, react to uncertainty, and implement projects just in time.

## **1.3 INTRODUCTION**

The master planning process involves developing wastewater flow and pollutant load projections based on population for the desired planning time frame. These projections are then compared with existing facilities or those that are in the midst of construction in order to determine where and when treatment capacity needs will be greater than the available capacity.

Projections are also compared with existing and future regulatory requirements to determine when and for which constituents the projected effluent quality will exceed National Pollutant Discharge Elimination System (NPDES) permit limits. Once a complete scenario is developed, the impact to the CIP, in terms of costs and the implementation

schedule must be calculated. When multiple scenarios have been developed, their outputs and impacts can be compared against one another to determine the sensitivity of the system to a range of parameters.

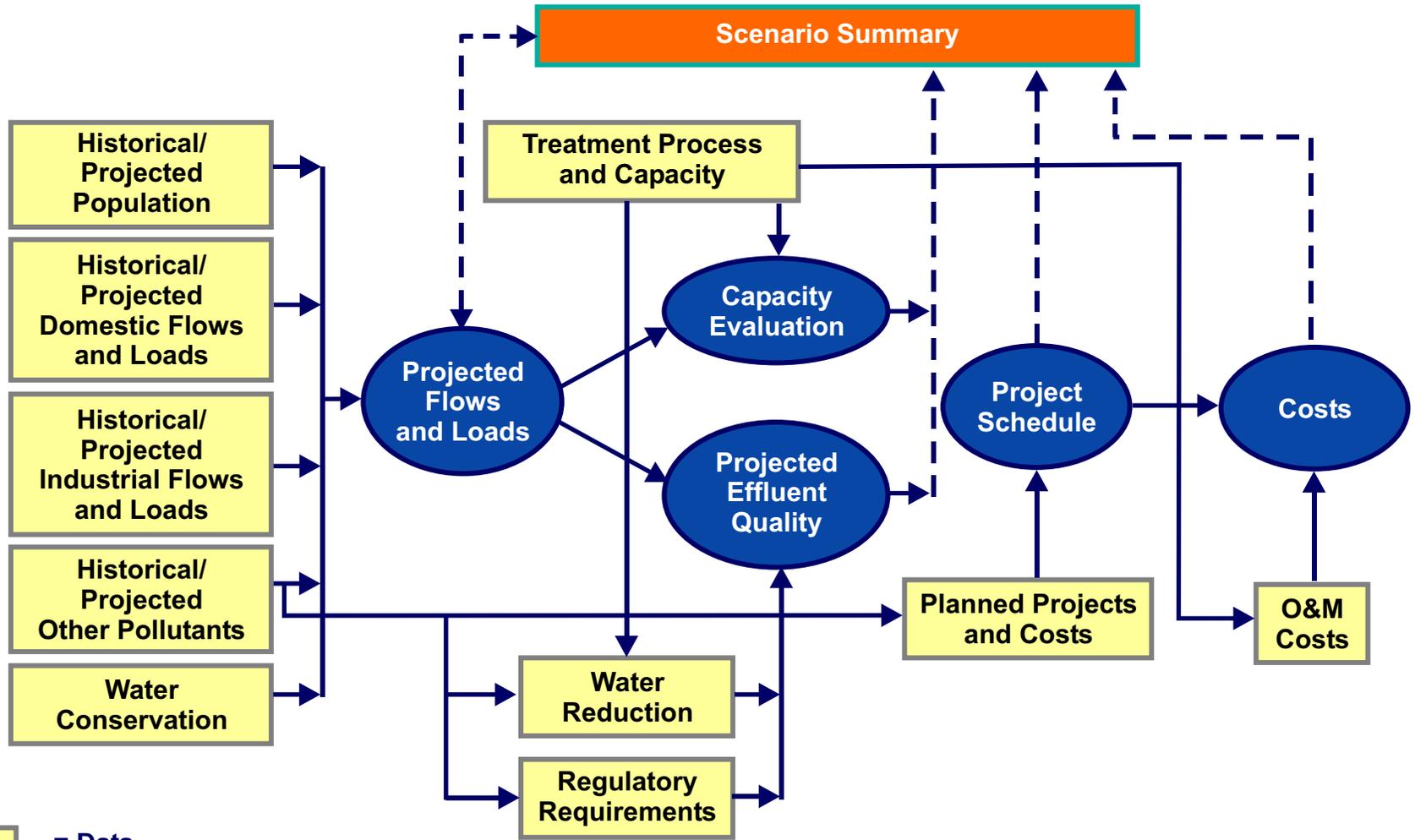
The traditional approach to master planning is limited by budget and time constraints to a limited number of projection options or combinations of options. Also, if a change is made to any of the inputs, the entire scenario must be reconfigured to determine its impacts. Developing each scenario is a time and labor-intensive process, as is performing a sensitivity analysis on the scenario.

By using a dynamic computerized planning tool, like MPM™, for the master planning process, instead of the “paper” approach, many more options and scenarios, can be developed for the same budget. In addition, sensitivity analyses can be performed for a large number of potential scenarios.

MPM™ computerizes and automates the master plan process by incorporating historical and projected flows and loads for domestic, industrial, and nontraditional pollutants; water conservation measures; treatment processes and capacities; pollutant reduction and addition; regulatory requirements; planned projects and estimated costs; and Operations and Maintenance (O&M) costs. These data are used to develop flow and load projections, perform capacity evaluations, determine effluent quality, develop project schedules, and develop overall costs. The MPM™ can produce numerous "what-if" scenarios in order to develop a sensitivity analysis.

Figure 1.1 shows the MPM™ logic diagram. Data inputs are shown in yellow, and calculations are shown in blue. Data and calculation links are denoted by solid and dashed lines, respectively. MPM™ takes historical population, flow, and load information, and using projected population, calculates projected flows and loads. In addition to traditional pollutants, MPM™ can model other pollutants including metals, pH, TDS, and trace organics. The model can also take into account water conservation in relation to projected flows and loads.

Once the projected flows and loads have been developed, MPM™ evaluates capacity and effluent quality. By comparing projected flows and loads to the existing treatment capacity, MPM™ identifies when capacity (for which major components in which year) is insufficient. By applying pollutant reduction percentages to projected flows and loads, effluent quality is calculated. When compared against the regulatory requirements, MPM™ identifies where effluent quality (for which pollutants in which years) is inadequate to meet permit needs. Based on the results of the two evaluations of capacity and effluent quality, future facilities and costs are identified through the development of the CIP, and along with O&M costs, are used by MPM™ to calculate a project schedule and overall costs per year.



- = Data
- = Calculations
- = Scenarios
- = Data Link
- = Calculation Link

**MASTER PLAN MANAGER™  
LOGIC DIAGRAM**

FIGURE 1.1

## 1.4 FUNCTIONALITY

MPM™ is a software application that uses a Microsoft Access database, accompanied by a graphical user interface that is programmed in C#. The screen is divided into three areas as shown in Figure 1.2. The three areas include:

- The toolbar along the top, which allows the user to add, copy, delete, save, and many other basic functions, including developing reports and graphing.
- The “tree” on the left hand side for navigation throughout the application.
- The main screen in the middle, which displays the data and results.

The tree structure is organized in layers - the topmost layer is the scenario layer. As many scenarios as needed can be created, and each scenario contains a full tree structure underneath it. Scenarios can easily be copied and then specific data can be modified. For the City, six scenarios were developed, one for each Growth option for the cases where the City would implement additional chlorine contact basins and one for each Growth option for the cases where the City would implement ozonation and UV disinfection. The next layer is the calculation layer - these are layers in which the software is calculating results and displaying them. The lowest layer is the data option, where the user enters in data that is then used for calculations. As many data options as needed can be created to model future possibilities. The Scenario Summary page is the screen from which the user can access all the data and see immediate results pertaining to the Capacity Evaluation and Effluent Quality components of MPM™.

### 1.4.1 Projected Years

The first step in customizing MPM™ is to develop the planning time frame. Each year of the planning time frame is entered into the grid as shown in Figure 1.3. The time frame can be set for any number of years. For the City, the years 2007/2008 (denoted as 2008 in MPM™) through 2024/2025 (denoted as 2025 in MPM™) are the assumed planning horizon.

### 1.4.2 Projected Flows and Loads

Projected population, flows, and loads are required for determining the influent concentrations as well as the capacity requirements. The projections provide information needed to size additional facilities, as well as determine if there are likely to be compliance issues with meeting NPDES permit requirements.

The flow and load portion of MPM™ is divided into four categories; *Domestic*, *Industrial*, *Other Pollutants*, and *Water Conservation*. Each of these four categories is a data option and, except for *Water Conservation*, have historical and projected data separated. All the

**Master Plan Manager**

File Edit View Tools Grid Help

carollo  
MPM  
MASTER PLAN MANAGER

Add Copy Delete Reports Graphs Add Pollutant Add Component

Riverside WWTP - Base Scenario

- Projected Years
- Projected Flows and Loads
  - Domestic Flows and Loads
  - Industrial Flows and Loads
  - Other Pollutants
  - Water Conservation
- Capacity Evaluation
  - Existing Treatment Process
- Treatment Train Summary
- Effluent Quality
  - Pollutant Reduction
  - Pollutant Addition
  - Regulatory Requirements
- Project Schedule
  - Alternative with Basin Cover
  - Alternative with Basin Cover
  - Alternative with Basin Liner
  - Base Alternative - .75%
- Costs
  - Standard S Curve
  - Project Expansion Costs
  - Project Replacement / Improvement Costs
  - O&M Costs

Riverside WWTP - Base Scenario  
Riverside WWTP - Base Scenario  
Riverside WWTP - Scenario 1 - .75%  
Riverside WWTP - Scenario 1 - 1.0%  
Riverside WWTP - Scenario 1 - 1.5%

### Scenario Summary

Save Data ? Help

**Scenario Name:** Riverside WWTP - Base Scenario - .75%

**Projected Flows and Loads**

Domestic Population, Flows and Loads: 75% Growth

Industrial Flows and Loads:

Other Pollutants: Other Pollutants - NH3, TDS, TIN

Water Conservation:

**Capacity Evaluation**

Existing Treatment Process and Capacity

Are all projected flow and load capacity needs met in this scenario? YES

**Treatment Train Summary**

Flow and Solids Allocation

**Effluent Quality**

Pollutant Reduction: Pollutant Reduction - Standard

Pollutant Addition: TDS Process Addition

Regulatory Requirements: Regulatory Requirements - Existing

Are all regulatory requirements met in this scenario? YES

**Project Schedule**

Planned Projects and Costs: Base Alternative - .75%

**Costs**

- O & M Costs
- Standard S Curve
- Project Expansion Costs
- Project Replacement / Improvement Costs

## MASTER PLAN MANAGER OVERVIEW

FIGURE 1.2

**Master Plan Manager**

File Edit View Tools Grid Help

carollo MPM MASTER PLAN MANAGER

Add Copy Delete Reports Graphs Add Pollutant Add Component

Riverside WWTP - Base Scenario

- Projected Years
- Projected Flows and Loads
  - Domestic Flows and Loads
  - Industrial Flows and Loads
  - Other Pollutants
  - Water Conservation
- Capacity Evaluation
  - Existing Treatment Process
- Treatment Train Summary
- Effluent Quality
  - Pollutant Reduction
  - Pollutant Addition
  - Regulatory Requirements
- Project Schedule
  - Alternative with Basin Cove
  - Alternative with Basin Cove
  - Alternative with Basin Line
  - Base Alternative - .75%
- Costs
  - Standard S Curve
  - Project Expansion Costs
  - Project Replacement / Imp
  - O&M Costs

Riverside WWTP - Base Scenario

Riverside WWTP - Base Scenario

Riverside WWTP - Scenario 1 - .75%

Riverside WWTP - Scenario 1 - 1.0

Riverside WWTP - Scenario 1 - 1.5

### Projected Years

Save Data Add Row Copy Paste Help

Projected Year
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027

Comments:

## PROJECTED YEARS

FIGURE 1.3

projected data is displayed on the *Projected Flows and Loads* calculations layer. For the City, data was entered for the *Domestic* and *Other Pollutant* portions.

#### **1.4.2.1 Domestic Flows and Loads**

For the *Historical Domestic* data option, the user enters any numbers of years worth of data for Flow (mgd), BOD (lbs/day), TSS (lbs/day), TN (lbs/day), and TP (lbs/day), from which MPM™ calculates average flow and concentration, as shown in Figure 1.4. For the City, data was entered for the years 2000 through 2006.

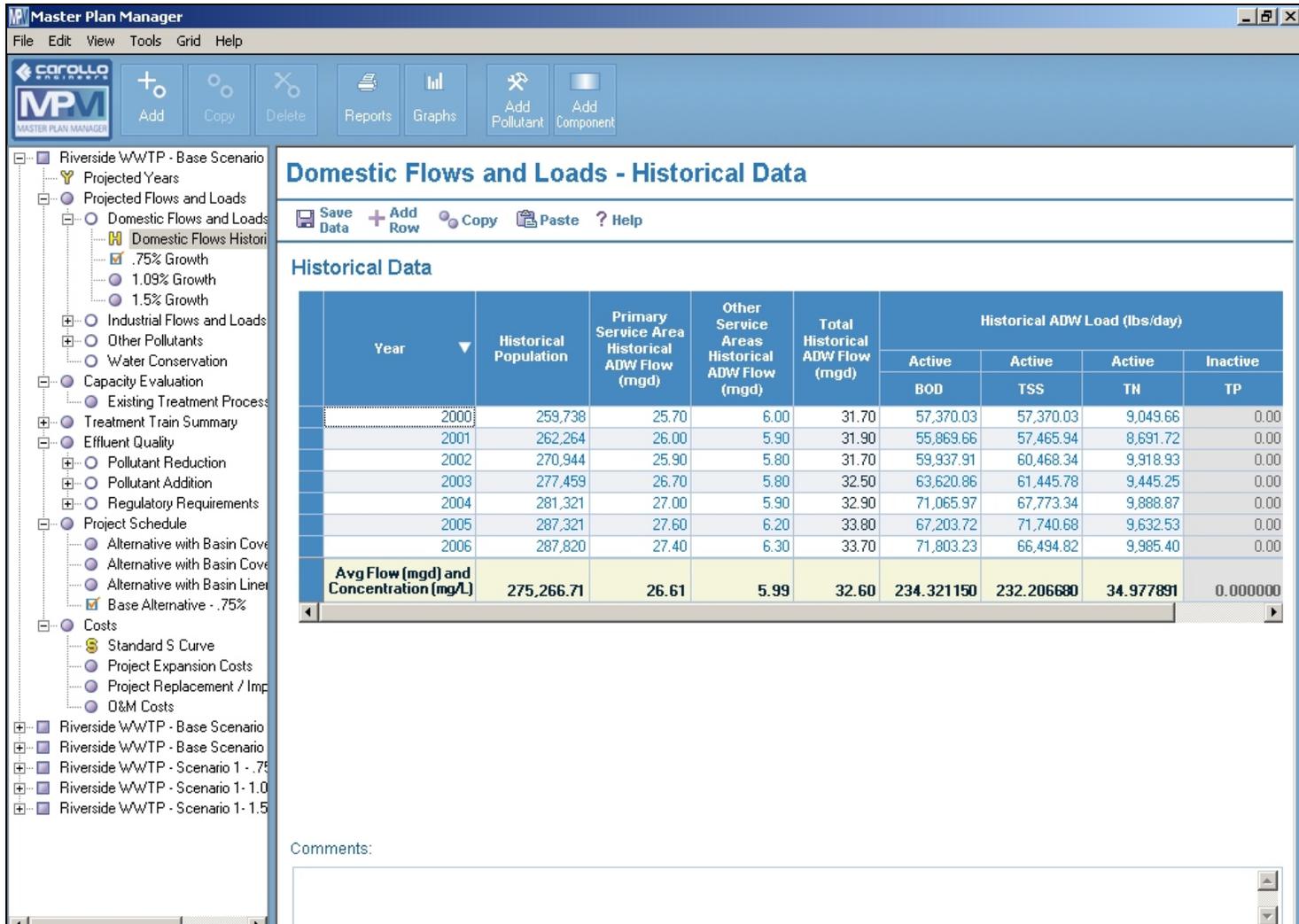
For *Projected Domestic* data options, the user enters in projected population for each projected year, and from that, and the historical averages and concentrations, MPM™ calculates projected flows and loads for Flow (mgd), BOD (lbs/day), TSS (lbs/day), TN (lbs/day), and TP (lbs/day), as displayed in Figure 1.5. For the City, projected population data was entered for 2008 through 2025. MPM™ calculated projected flows and loads for those years based on the historical per capita values.

The database structure is set up so that once historical data is entered, any number of *Projected Domestic* data options can be developed. However, the user can only create one *Historical Domestic* data option. In Figure 1.5, the main screen shown is the “0.75% Growth Domestic” data option. Three *Projected Domestic* data options are entered into MPM™, entitled “0.75% Growth”, “1.09% Growth”, and “1.5% Growth” as displayed in the tree part of the screen in Figure 1.5. Whichever data option is selected is the data that is carried forward to the Projected Flows and Loads calculations layer by simply clicking on the Selected box. This feature allows for modeling a range of outcomes. In addition, the user can easily copy and modify data options as changes occur.

#### **1.4.2.2 Industrial Flows and Loads**

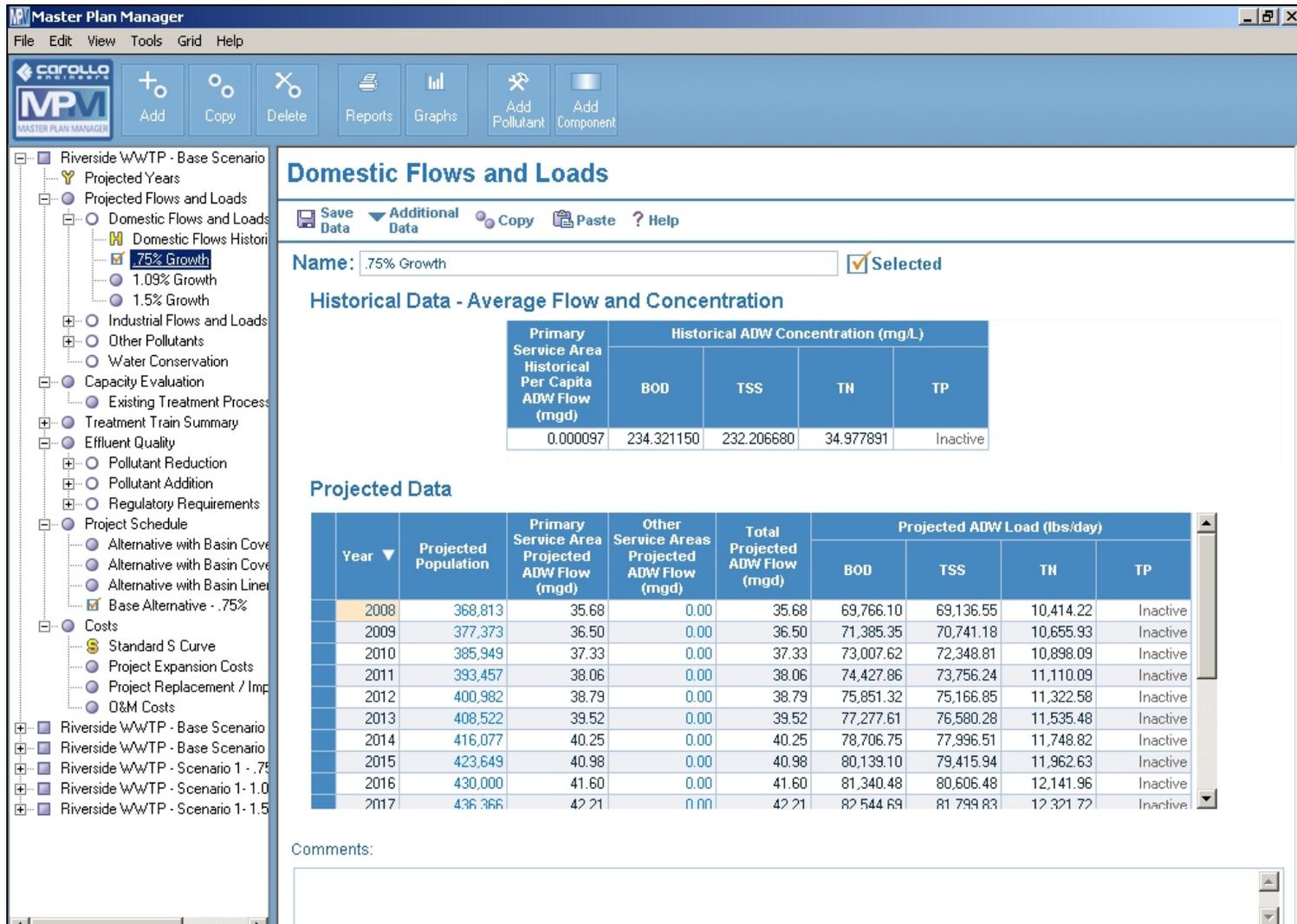
The *Industrial Flows and Loads* portion of MPM™ is used to separate industrial flows from residential/commercial flows, and model them separately. For the City, industrial flows and loads were not modeled separately in MPM™ because industries in the City do not contribute a significant percentage of the flow, nor do they contribute a significant concentration of any pollutant. The software has the ability to model industrial flows separately if conditions in the City change in the future.

The *Industrial* portion of flows and loads is similar to the *Domestic* portion in that there is a *Historical Industrial* data option where data is entered for historical flow (mgd) and load (lbs/day) data for BOD, TSS, TN, and TP, for any number of years, as shown in Figure 1.6. For the *Projected Industrial* data options, the user enters in all projected flow and load data for Flow (mgd), BOD (lbs/day), TSS (lbs/day), TN (lbs/day), and TP (lbs/day) for each projected year, rather than having MPM™ calculate projected flows and loads, as displayed in Figure 1.7.



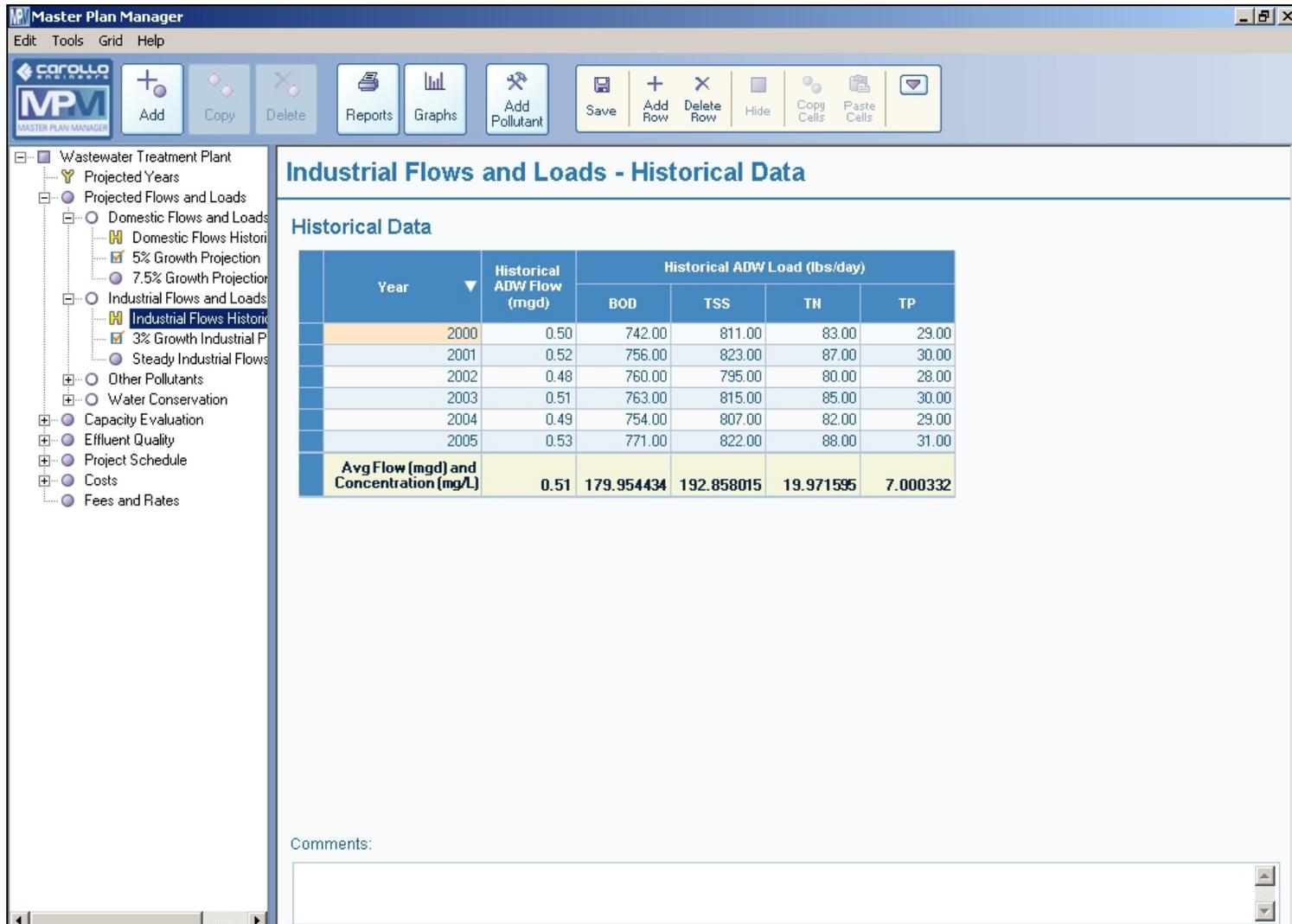
## HISTORICAL DOMESTIC FLOWS AND LOADS

FIGURE 1.4



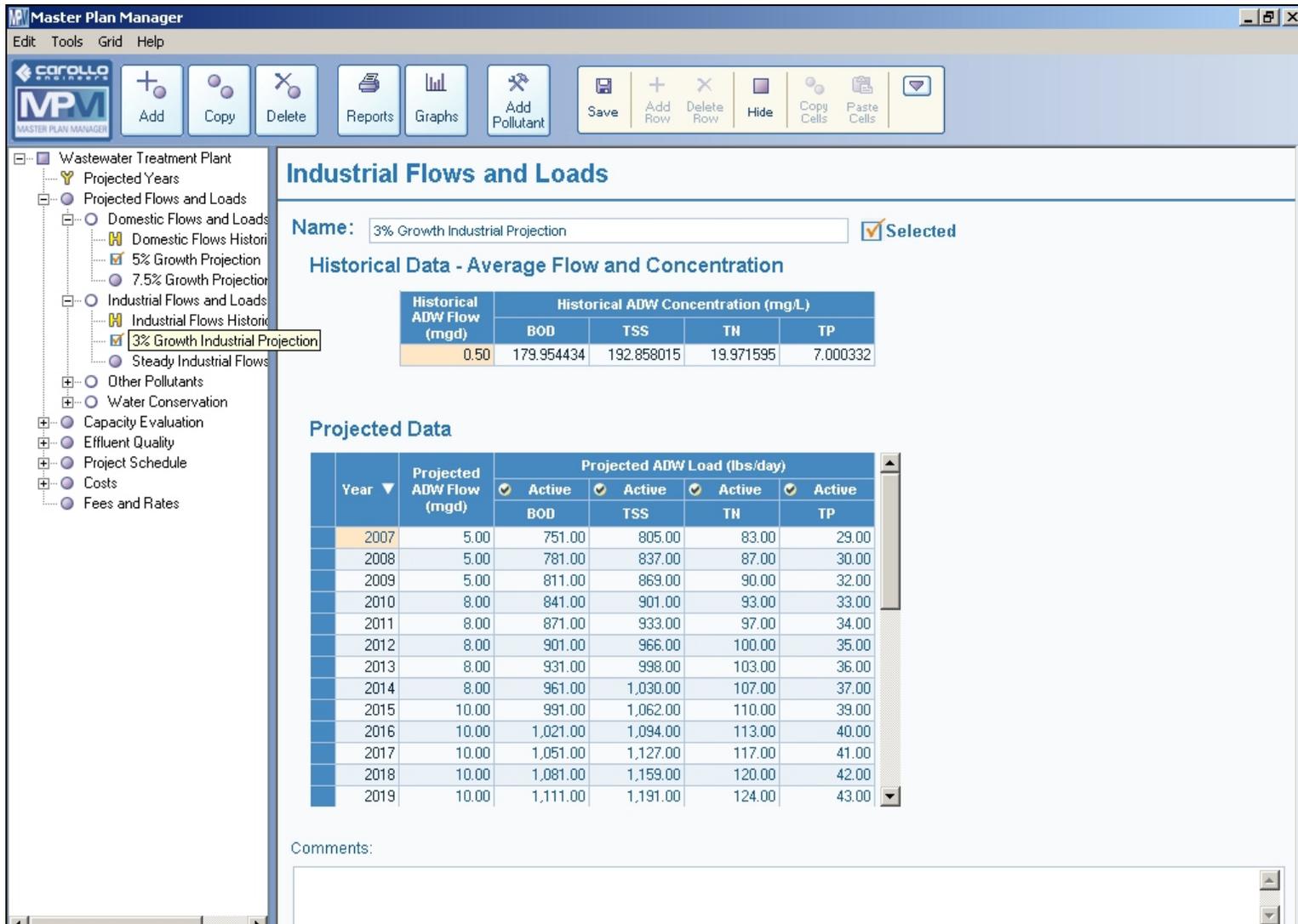
## PROJECTED DOMESTIC FLOWS AND LOADS

FIGURE 1.5



## HISTORICAL INDUSTRIAL FLOWS AND LOADS

FIGURE 1.6



## PROJECTED INDUSTRIAL FLOWS AND LOADS

FIGURE 1.7

Similarly to the *Domestic* data, the user can only create one *Historical Industrial* data option and as many *Projected Industrial* data options as needed. Whichever data option is selected is carried forward to the *Projected Flows and Loads* calculations layer by clicking on the Selected box.

### **1.4.2.3 Other Pollutants**

The *Other Pollutants* portion of MPM™ allows the user to address pollutants in addition to Flow, BOD, TSS, TN, and TP, including heavy metals and pharmaceuticals. The *Other Pollutant* portion has the same database structure as the *Domestic* and *Industrial Flows and Loads* portions, in which there is a *Historical Other Pollutant* data option with user entered data for as many years as desired, as shown in Figure 1.8.

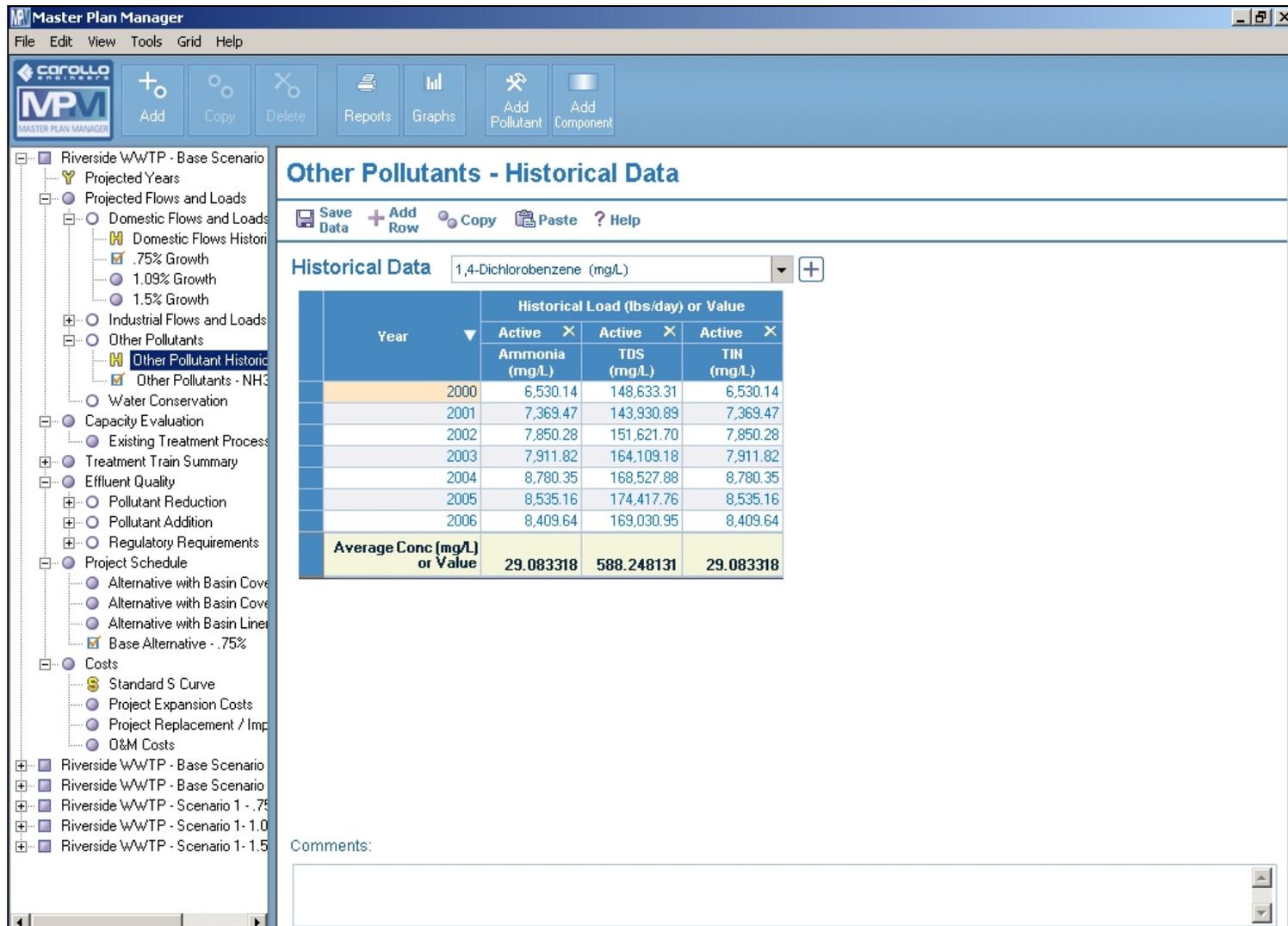
The difference in the *Other Pollutants* grid is that the pollutants in the grid are user customizable. The user selects a pollutant from the drop down menu and adds it to the grid. The user can also add pollutants that are not currently in the drop down menu. Once the grid has been created, the user enters historical data by year, as done previously for the other portions. MPM™ calculates average concentration or value. For the City, data was entered for ammonia, TDS, and TIN for the years 2000 through 2006.

For the *Projected Other Pollutants* data options, the user customizes the grid for the pollutants that are to be modeled in a fashion similar to the *Historical* data option. Here the user enters a concentration and along with the projected flow (for the data options that have been selected), MPM™ calculates the projected loads, as shown in Figure 1.9. Again, for the City, ammonia, TDS, and TIN were projected for the years 2008 through 2025.

The database structure is set up so that once historical data is entered, any number of *Projected Other Pollutant* data options can be developed, but only one *Historical Other Pollutant* data option can be created. Again, whichever data option is selected is carried forward to the *Projected Flows and Loads* calculations layer by clicking on the Selected box. This feature allows the user to model a range of outcomes and the user can easily copy and modify data options as changes occur.

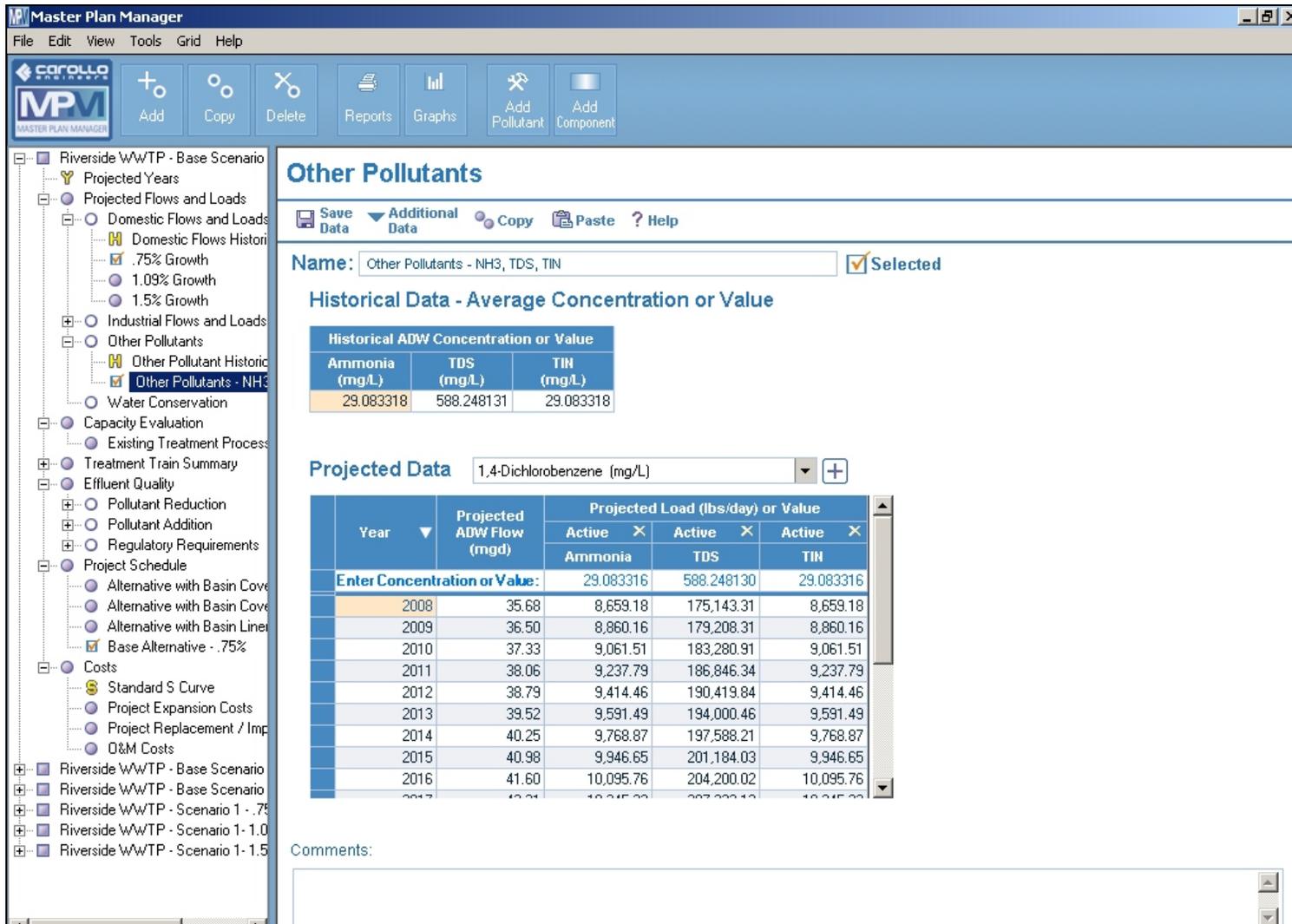
### **1.4.2.4 Water Conservation**

*Water Conservation* is used to model the impacts to the projected flows and loads if flows or TDS loads are reduced due to such activities as the installation of low flush toilets or waterless urinals. No water or TDS conservation was assumed at this time for the City. However, MPM™ has the ability to model this in the future, if necessary.



## HISTORICAL OTHER POLLUTANTS

FIGURE 1.8



## PROJECTED OTHER POLLUTANTS

FIGURE 1.9

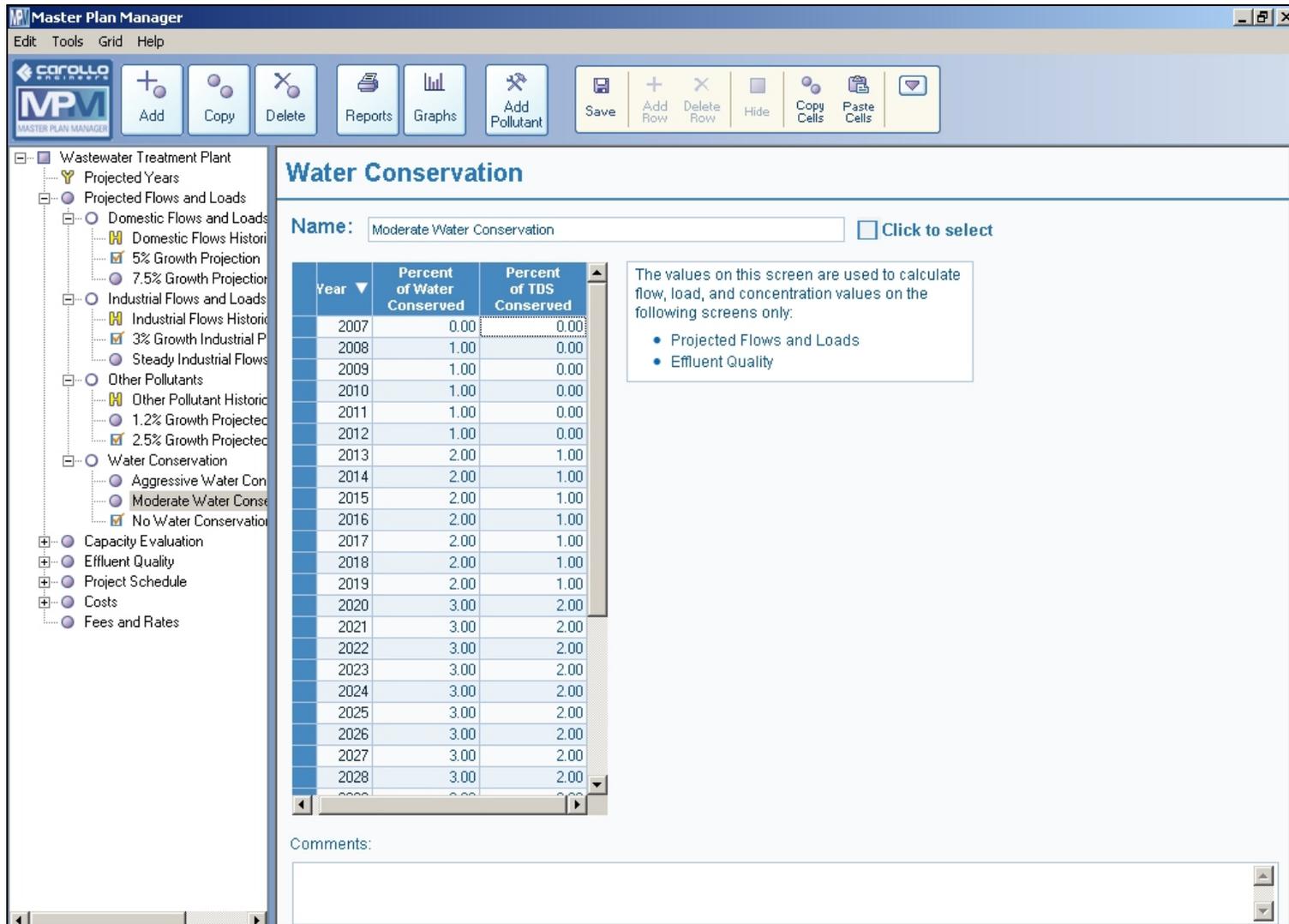
For *Water Conservation*, there is no *Historical* data in the model because historical data for water conservation is not used for any projection calculations. For the *Water Conservation* data options, as shown in Figure 1.10, the user enters overall percentages of water and TDS conservation by year which are applied to the overall *Projected Flows and Loads* calculations layer. The user can create as many *Water Conservation* data options as needed and, the selected data option is carried forward to the *Projected Flows and Loads* calculations layer by clicking on the Selected box.

#### **1.4.2.5 Projected Flows and Loads**

MPM™ integrates the data from the four portions of *Projected Flows and Loads* on the *Projected Flows and Loads* calculations layer, as shown in Figure 1.11. The grid shows all the pollutants for which there is projected data from the selected *Projected Other Pollutant* data option, and integrates the selected projected flow and load data options from both the *Projected Domestic* and *Industrial* data options. In addition, the percentages of water and TDS conserved are applied to the grid as well. The overall projected flows and loads are then used throughout MPM™. The user can enter peaking factors for maximum month, peak hour, and equalized flow peak, and these factors are used for calculating the flow or load that is handled by the facilities in the evaluation of capacity.

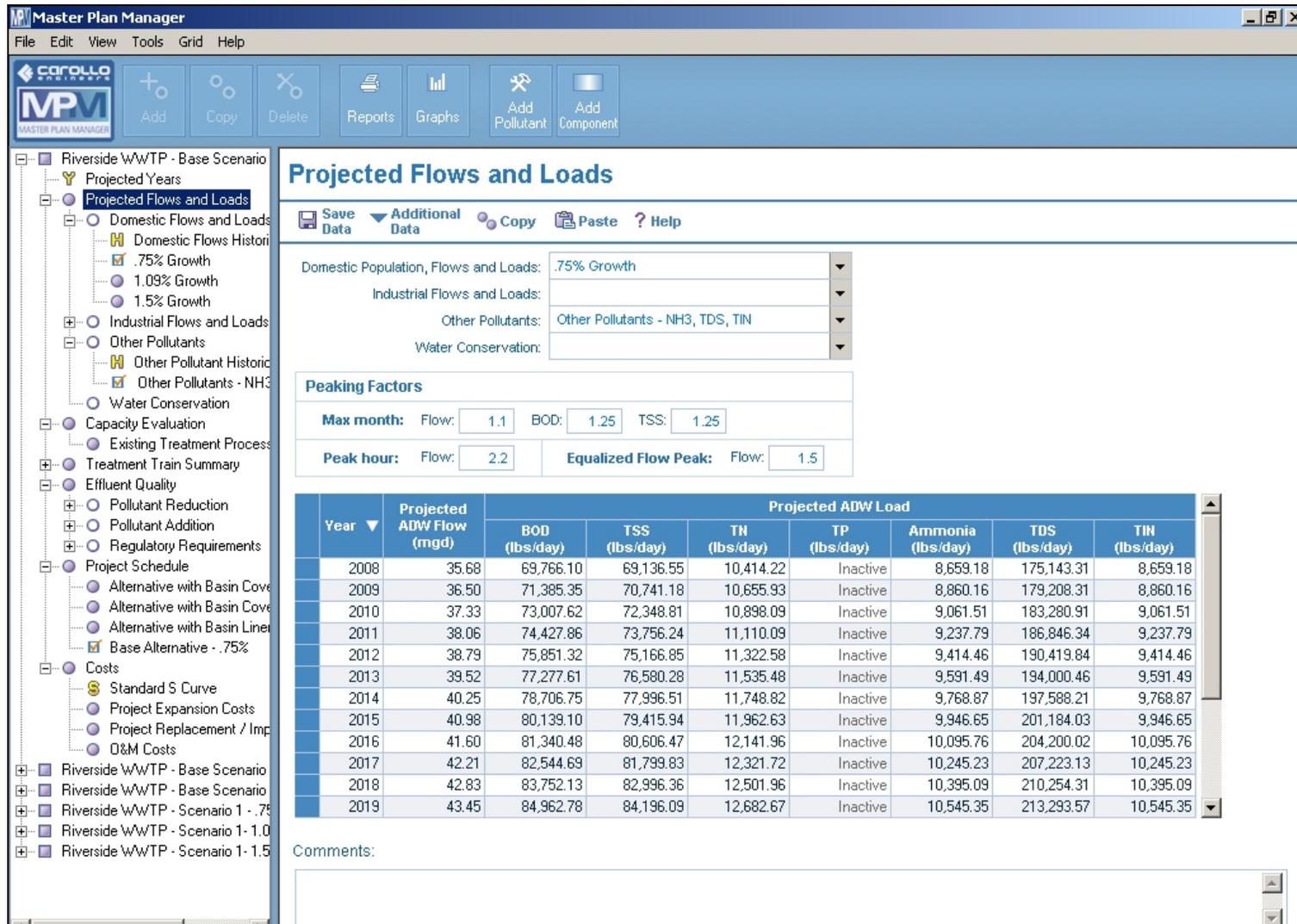
#### **1.4.3 Existing Treatment Process and Capacity**

Once flows and loads have been addressed, the existing treatment facilities need to be entered into MPM™, and this is handled on the *Existing Treatment Process and Capacity* data option. While *Existing Treatment Process and Capacity* is a data option, the user cannot create more than one as any existing facility only has one overall treatment train. A database of major components (clarifier, filter, chlorine contact basin) is provided, and new major components can be added as well. Each major component in the treatment process is “dragged” into the grid from the database, and then its associated influent capacity, capacity type, and units, averaging period, design criteria and units, number of units, and year and capacity offline (if applicable) is entered, as shown in Figure 1.12. If there are major components that do not provide treatment but do have costs associated with them, such as sodium hypochlorite disinfection, then only the Included in Costs checkbox is checked, otherwise Included in Treatment is also checked. Major components are then positioned correctly and linked together in the train. The grid then displays train and flow order. For the City, the existing treatment train information was entered and can be seen in Figure 1.12.



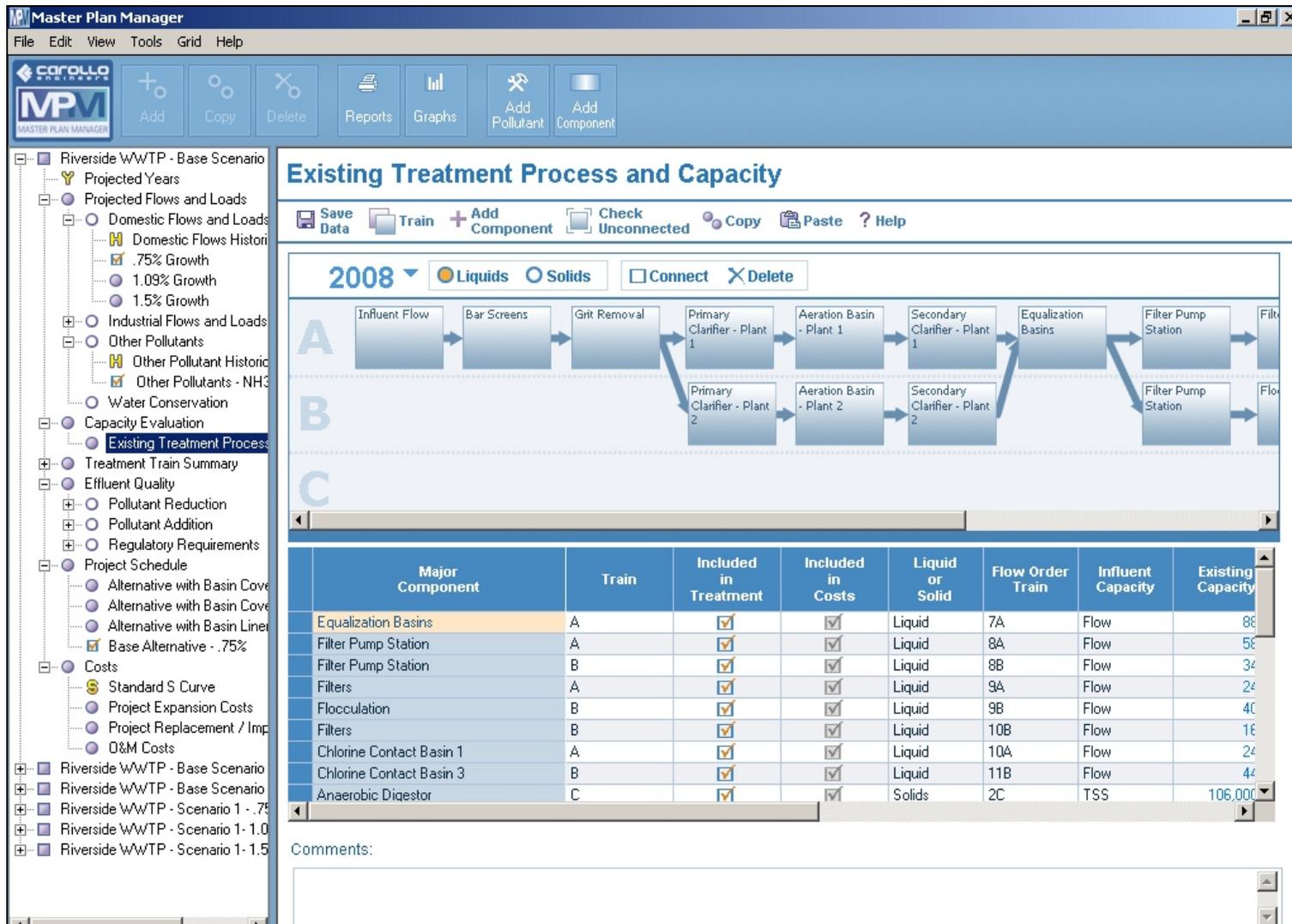
## PROJECTED WATER CONSERVATION

FIGURE 1.10



## PROJECTED FLOWS AND LOADS

FIGURE 1.11



## EXISTING TREATMENT PROCESS AND CAPACITY

FIGURE 1.12

#### 1.4.4 Planned Projects and Costs

The CIP is developed in the *Planned Projects and Costs* data options. Here each major component is “dragged” into the grid from the existing database, similarly to the *Existing Treatment Process and Capacity* data option. For each major component, as shown in Figure 1.13, the following information is entered:

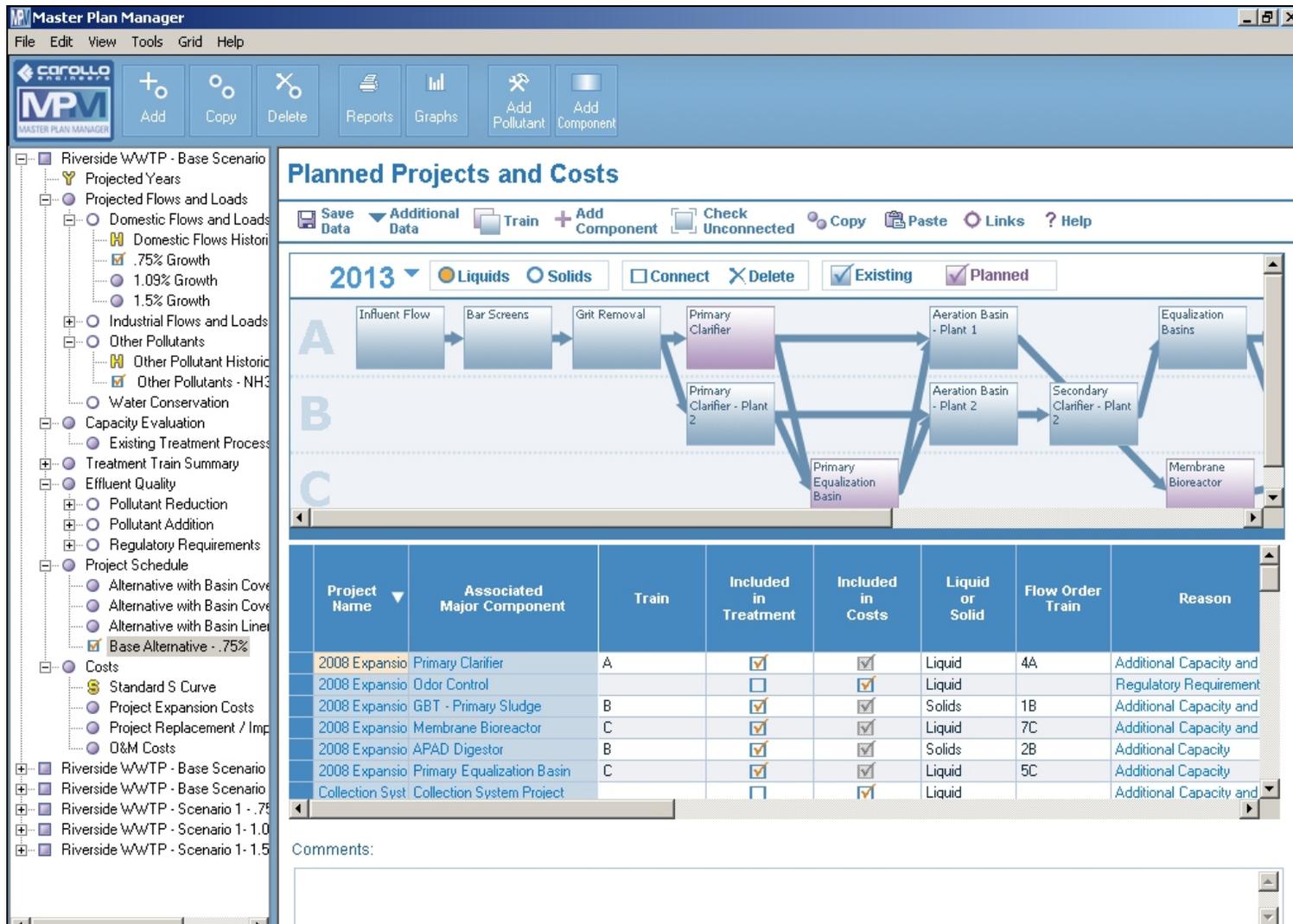
- Associated project name.
- Reason for implementation (Rehab, Regulatory Requirement, Additional Capacity, Additional Major Component, or combinations thereof).
- Capacity, type, and units.
- Number of units.
- Design length (years).
- Construction length (years).
- Year online.
- Estimated construction costs.
- Percentage allocated to expansion.
- Percentage allocated to replacement/improvement.

An Engineering, Administrative, Legal, Construction Management (EALC) factor is entered and multiplied by the estimated construction cost to calculate the total project cost for each major component. In the case of the City, an EALC factor of 1.3 was used. Major components are then positioned correctly alongside existing major components and linked together in the train. The grid then displays train and flow order.

Similar to the *Existing Treatment Process and Capacity* data option, if there are major components that do not provide treatment but do have costs associated with them, such as the Collection System Project listed in Figure 1.13, then only the Included in Costs checkbox is checked. If the major component provides treatment, then the Included in Treatment is also checked.

The projects listed in Figure 1.13 have been developed in accordance with City needs for the “0.75% Growth Domestic” data option.

*Planned Projects and Costs* is a data option, so as many data options as needed can be developed. In the tree structure of Figure 1.13, a total of four CIPs (*Planned Projects and Costs* data options) are displayed for the City’s growth rate of 0.75 percent. The four CIPs are: 1) “Base Alternative”, 2) “Alternative with Basin Cover”, 3) “Alternative with Basin Liner”, and 4) “Alternative with Basin Cover and Liner.”



## PLANNED PROJECTS AND COSTS

FIGURE 1.13

### 1.4.5 Flow and Solids Allocation

The *Flow and Solids Allocation* data option is used to route projected flows and loads to each major component, both existing and planned. There is only one data option per *Planned Projects and Costs* data option. The software has the ability to model multiple flow and solids allocations in order to understand the impacts to the capacity evaluation. Modeling various allocations can be done by copying the entire scenario, and changing the percentages on the new *Flow and Solids Allocation* data option. For each linkage between major components in the treatment train, the user enters the percentage of total flow that link receives for each projected year in the grid and the percentages are displayed in the train, as shown in Figure 1.14. For the City, the existing and future flow allocation percentages among the treatment trains, including Plant 1 and 2 and the two filters, were entered into the grid.

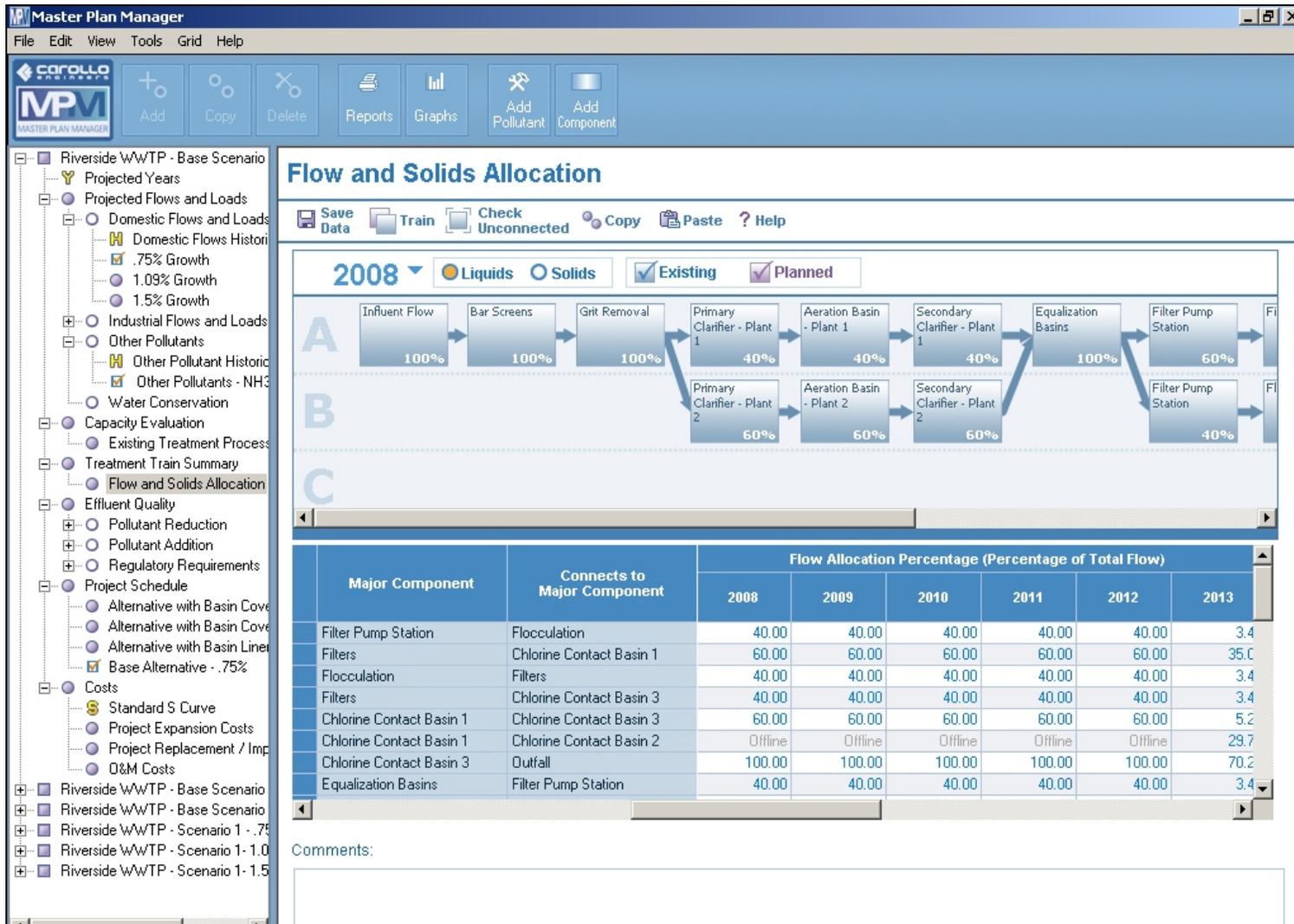
### 1.4.6 Treatment Train Summary

*Treatment Train Summary* is a calculation layer that applies the percentages for each major component link (existing and planned) from the *Flow and Solids Allocation* data option to the projected flows from the *Projected Flows and Loads* calculation layer. The result of this is that MPM™ calculates and displays the routed projected flow to each major component for each projected year, as shown for the City in Figure 1.15.

### 1.4.7 Capacity Evaluation

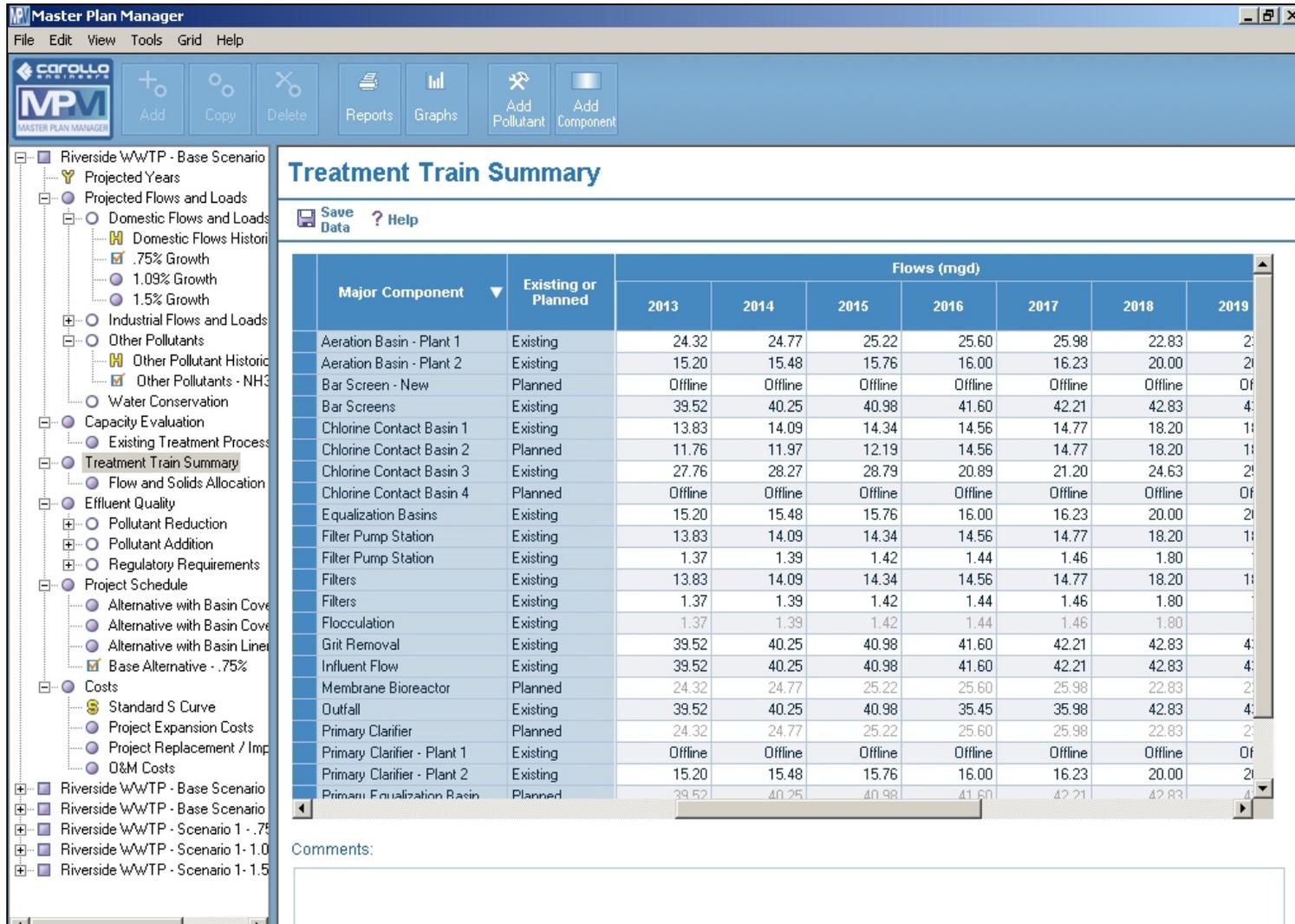
For the *Capacity Evaluation* calculation layer, MPM™ compares the *Projected Flows and Loads* values, multiplied by the respective flow and load peaking factors, if applicable, against the existing and planned major components capacity. As shown in Figure 1.16, each major component is listed, along with its capacity information, averaging period, and peaking factor. For each major component, the routed projected flow or load (adjusted by peaking factor) is displayed for each projected year. If the major component is offline, Offline is displayed instead of the flow or load. The capacity evaluation for the City's existing and planned major components for the "0.75% Growth Domestic" data option and "Base Alternative CIP" is shown in Figure 1.16.

For each major component, a YES or NO in the "Requirements Met" column indicates whether the existing or planned capacity is adequate to handle the routed projected flow or load. The *Capacity Evaluation* calculation layer for the "1.5% Growth Domestic" data option and "0.75% Base Alternative" CIP is shown in Figure 1.17, and as indicated, the requirements are not met. The red font indicates for which year a capacity issue exists in the grid.



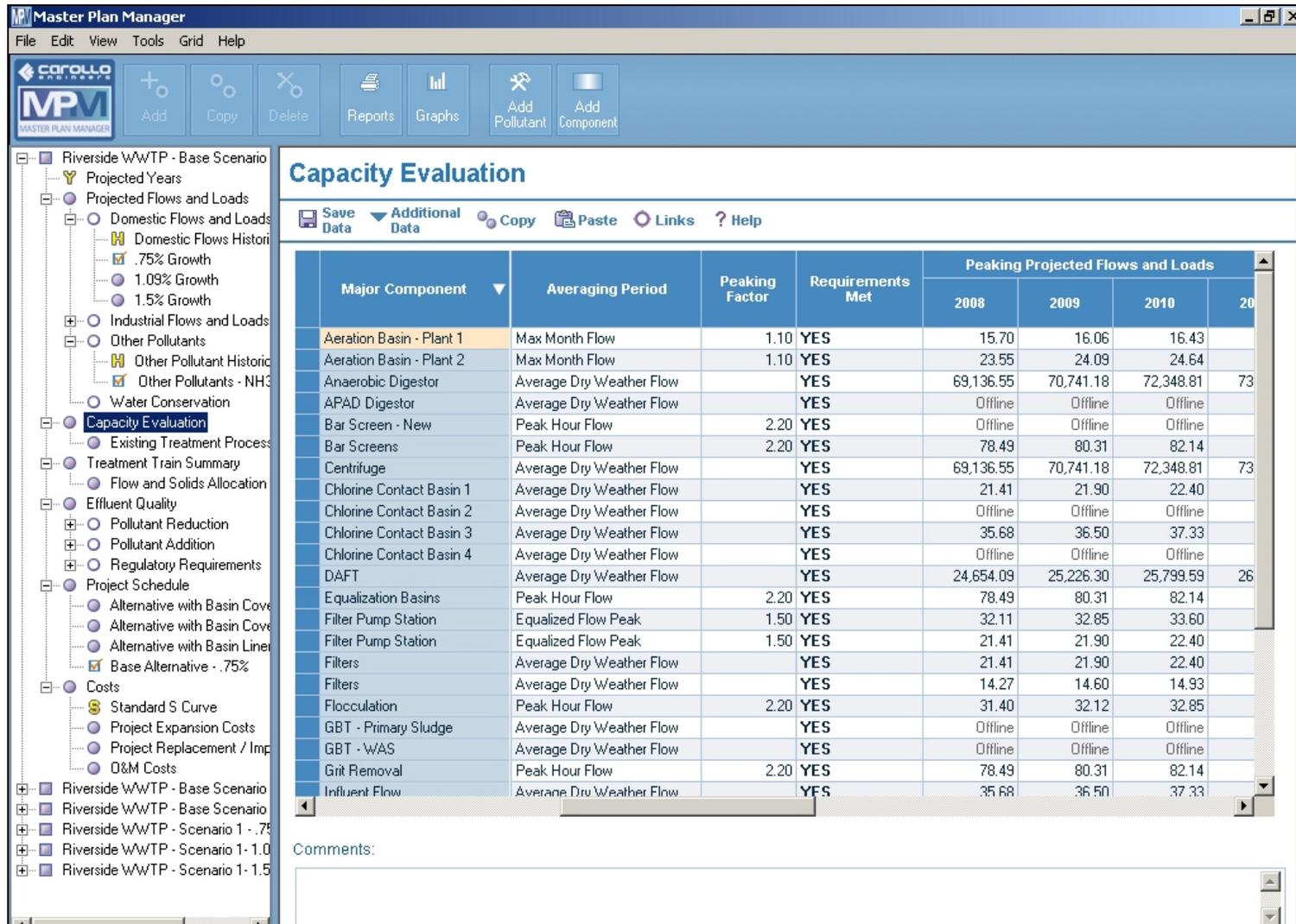
## FLOW AND SOLIDS ALLOCATION

FIGURE 1.14



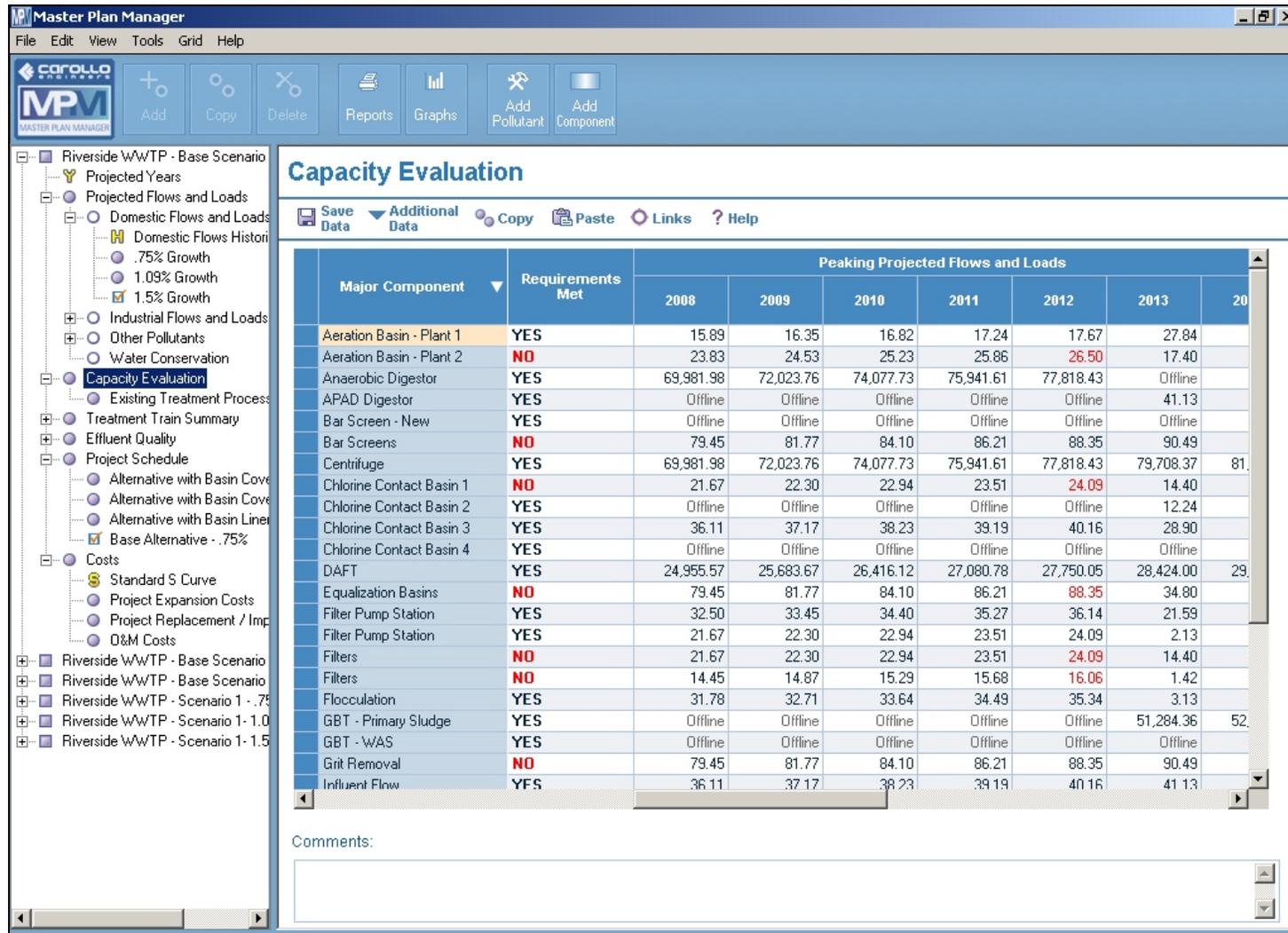
## TREATMENT TRAIN SUMMARY

FIGURE 1.15



## CAPACITY EVALUATION

FIGURE 1.16



### CAPACITY EVALUATION FOR THE "1.5% GROWTH PROJECTED DOMESTIC" DATA OPTION

FIGURE 1.17

If capacity needs are not met, the user can compare the routed flow against the capacity to determine the extent of the capacity deficiency, and then has two options. The first is to change the percentage in the *Flow and Loads Allocation* data option for the respective major component linkages, while still ensuring that all flows add to 100 percent. The second is to add additional capacity via a *Planned Projects and Costs* data option. Adding additional capacity translates to adding a new project, or if the new project has already been planned for, either increasing the actual capacity listed for the planned major component, or changing the year online to an earlier year, so that the major component and its associated capacity comes online earlier. By clicking on different data options for *Projected Domestic, Industrial, Other Pollutants, and Water Conservation*, MPM™ will immediately display the results so that the user understands the impacts to capacity needs throughout the planning horizon. CIPs can then be adjusted as needed to meet the various needs.

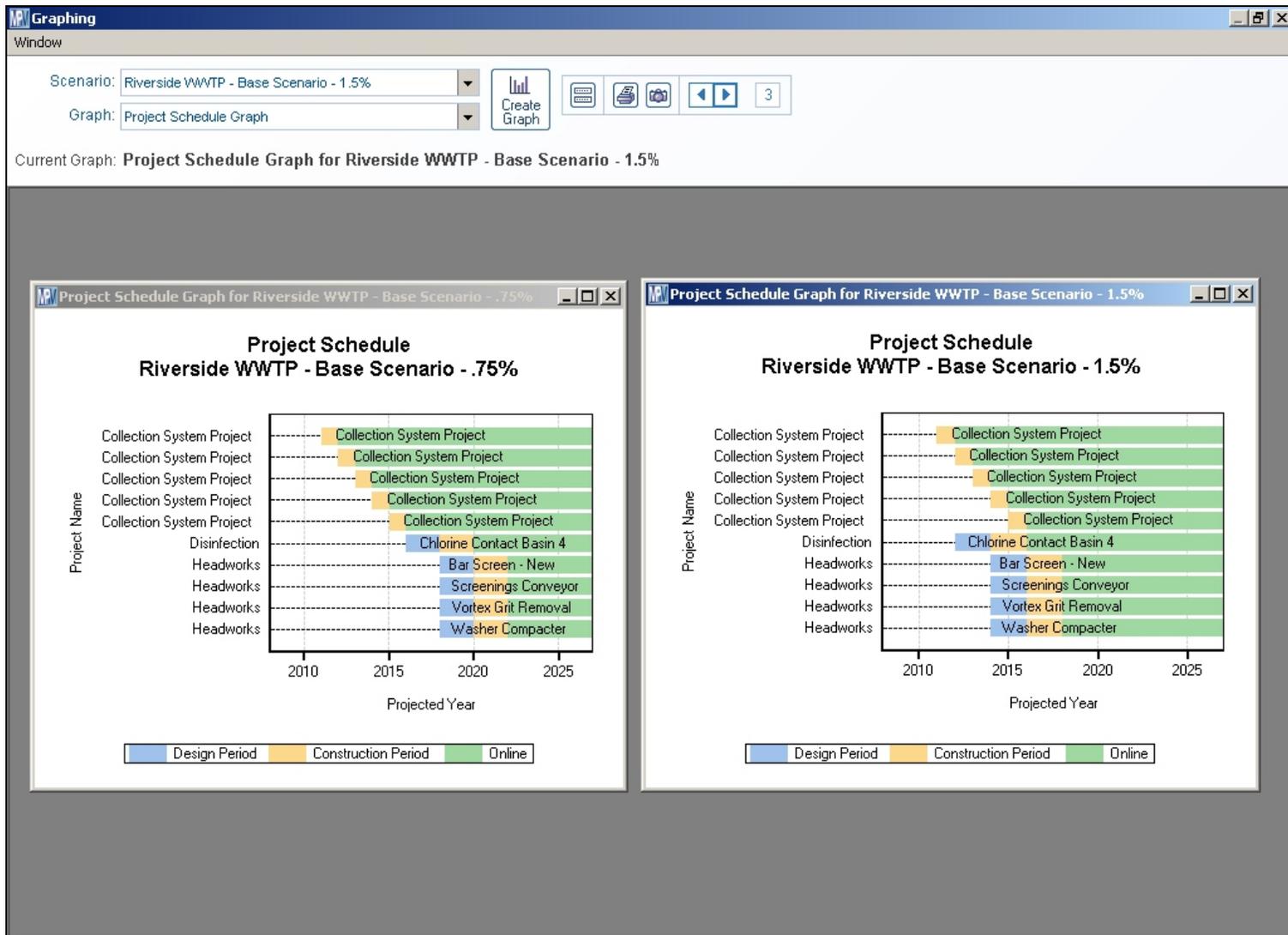
In the case of Figure 1.17, the City's planned projects need to come online in an earlier year, as the years online for the planned projects for the "0.75% Growth" *Projected Domestic* data option are not suitable for the "1.5% Growth" *Projected Domestic* data option. The user can adjust the year online in the *Planned Projects and Costs* data options. In Figure 1.18, the project schedules for the respective *Projected Domestic* data options, for both the 0.75 percent and 1.5 percent growth options, are shown; and as an example, the user can see the delay in the implementation of the Headworks project. For the 0.75 percent growth option the headworks project starts design in 2010 and in 2014 for the 1.5 percent growth option.

#### **1.4.8 Pollutant Reduction**

One step in determining the projected effluent quality is to develop the *Pollutant Reduction* data option(s). *Pollutant Reduction* is where the performance of the treatment process in terms of removing pollutants is developed. Each major component, both existing and planned, is displayed in the grid, as shown in Figure 1.19. All pollutants displayed in the *Projected Flows and Loads* calculation layer are shown in the grid as well. The user then enters the pollutant reduction percentage that applies for each major component for each pollutant. Multiple data options can be created, such that a treatment process with low, mid, and high performance can all be modeled. The selected option is then applied to the data from the *Projected Flows and Loads* calculation layer to, in part, calculate the projected effluent quality. Pollutant reduction values as determined for the City's treatment processes are displayed in Figure 1.19.

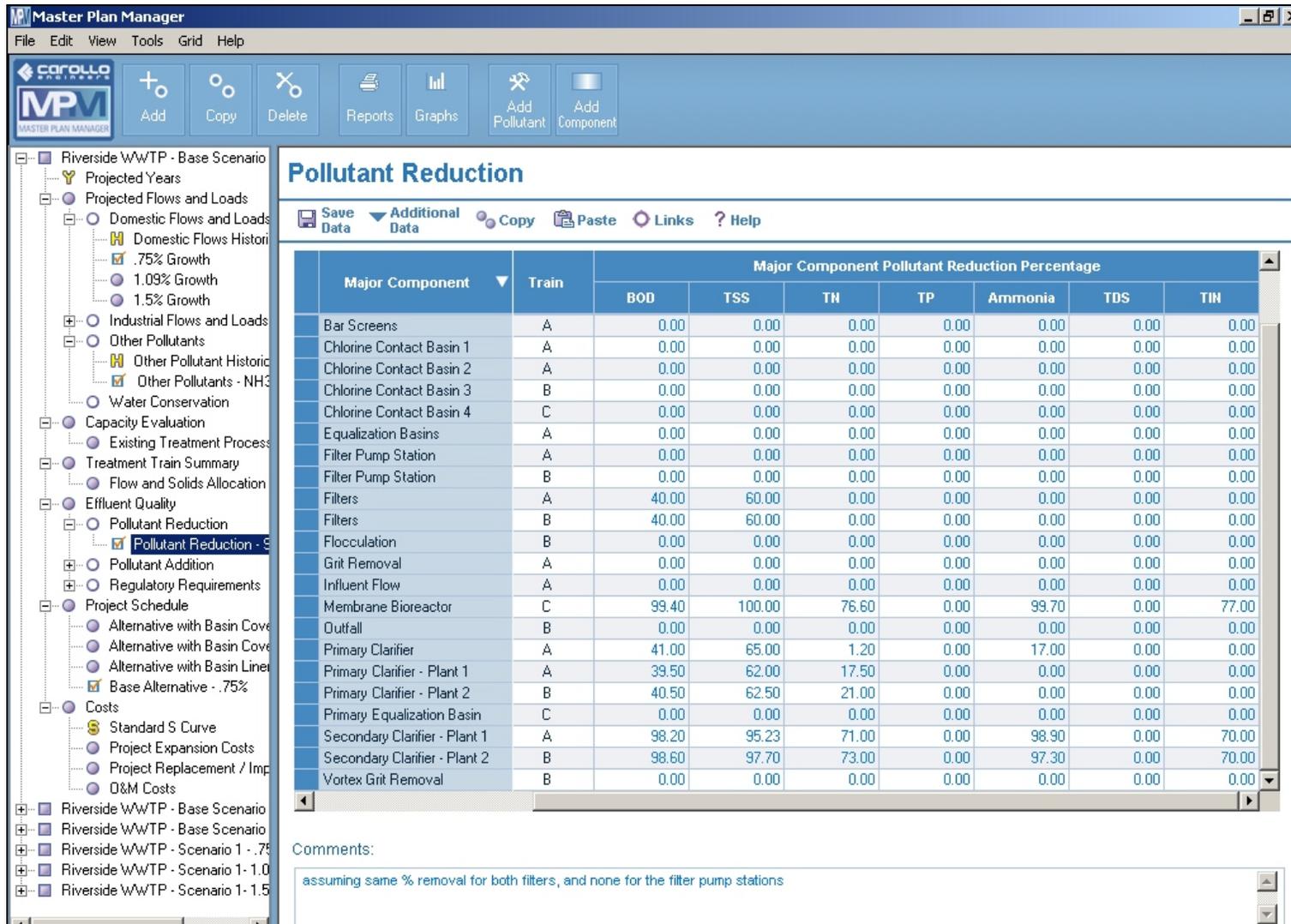
#### **1.4.9 Pollutant Addition**

Another step in determining projected effluent quality is to address the circumstances under which the treatment process actually adds constituents (pollutants) into the flow. One common example is that chlorination with sodium hypochlorite or dechlorination with



## COMPARISON OF PROJECT SCHEDULES

FIGURE 1.18



## POLLUTANT REDUCTION

FIGURE 1.19

sodium bisulfite introduces TDS. *Pollutant Addition* is a data option, as shown in Figure 1.20, where the grid shows each major component and each pollutant, and the user enters into the grid the pollutant addition concentration from each major component for each pollutant as applicable. The City's addition of TDS to their flow from the chlorination process is displayed in Figure 1.20. Since *Pollutant Addition* is a data option, as many options as needed can be developed.

#### **1.4.10 Regulatory Requirements**

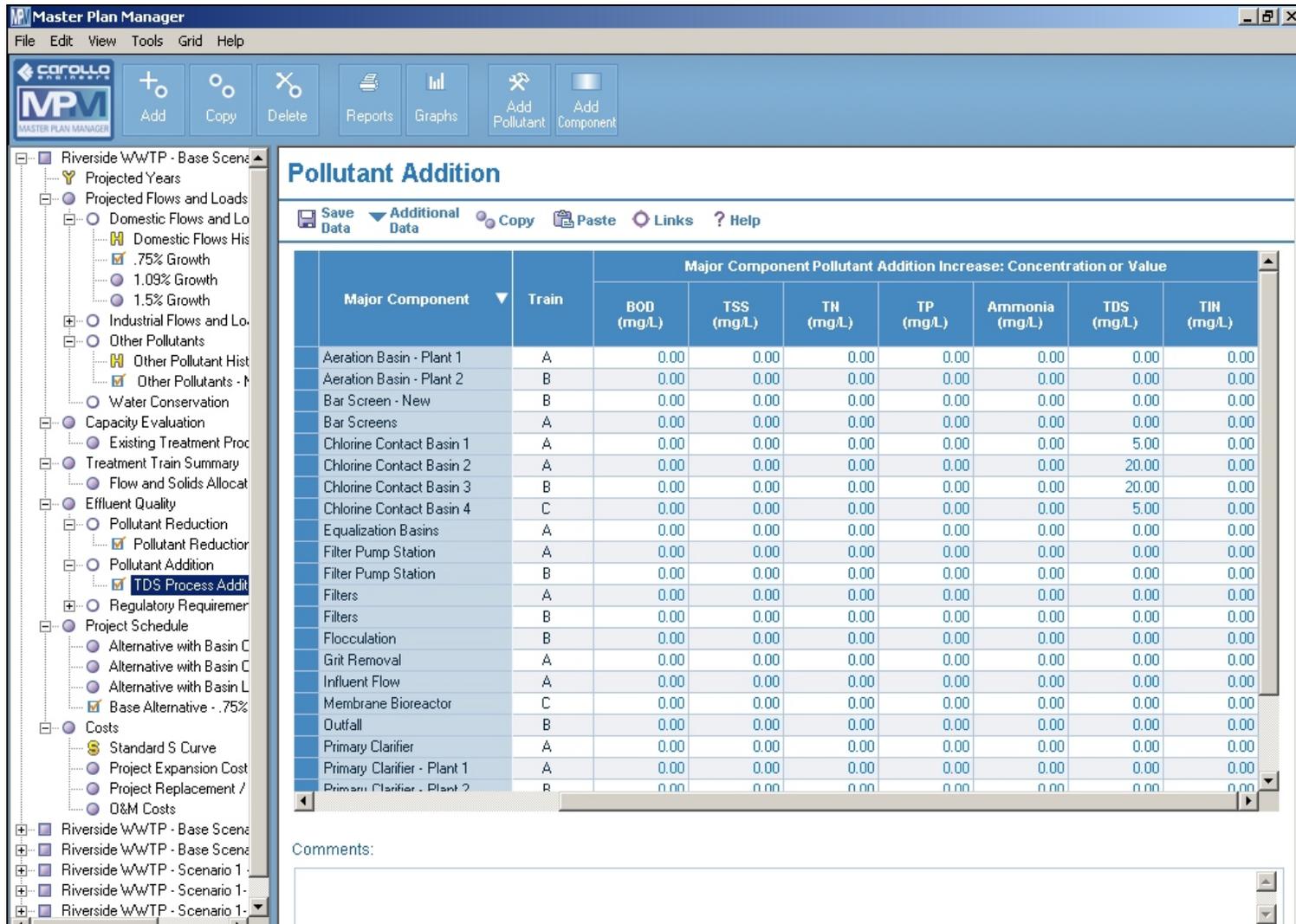
The last step needed to evaluate effluent quality is regulatory requirements. The *Regulatory Requirements* data option(s) is used to enter the NPDES permit requirements. This data can then be compared against the projected effluent quality to see if the requirements are being met. As shown in Figure 1.21, each pollutant is listed, and then for each projected year, the user enters the requirement for effluent quality. The City's effluent quality requirements for flow, TSS, BOD, ammonia, TDS, and TIN are displayed in Figure 1.21. *Regulatory Requirements* is a data option, so the user can create as many options as needed to model all future outcomes.

#### **1.4.11 Effluent Quality**

The *Effluent Quality* calculation layer compares the projected effluent quality against the effluent quality requirements that come from the selected *Regulatory Requirements* data option. The projected effluent quality is calculated by MPM™ by applying the pollutant reduction percentages from the selected *Pollutant Reduction* data option to the *Projected Flows and Loads* values, and then adding any *Pollutant Addition* data option concentrations.

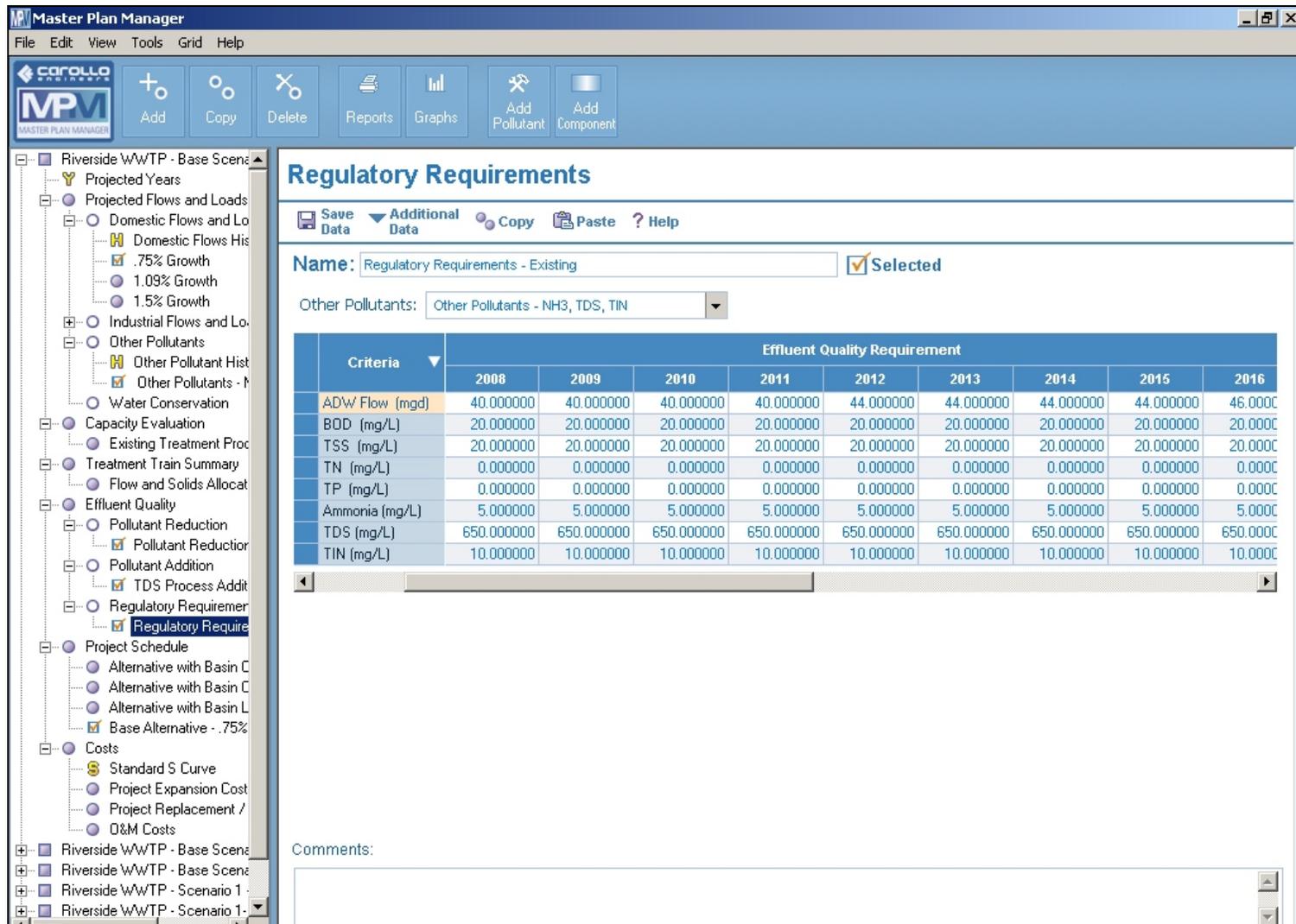
As shown in Figure 1.22, each pollutant is listed and for each projected year, the projected effluent quality value is calculated and displayed by the software. The comparison of the projected effluent quality values to the regulatory requirements is addressed by "Requirements Met". Here MPM™ displays either YES or NO as appropriate. Red font in the grid indicates for which pollutant in which year the requirements are not being met. The data shown in Figure 1.22 is the City's projected effluent quality based on the selected data options that can be seen in the tree structure.

If the requirements are not being met, the user has two choices, either to improve the estimated efficiency of the treatment process or add additional levels of treatment. The estimated performance of the treatment process can be improved through increasing the pollutant removal percentages on the *Pollutant Reduction* data option(s) (this is where multiple data options can help display the extent of the impact of pollutant removals on the projected effluent quality) or conversely decreasing pollutant addition concentrations on the *Pollutant Addition* data option(s). In order to add additional levels of treatment to get more pollutant reduction, the user can add new major components to the CIP on the *Planned Projects and Costs* data options.



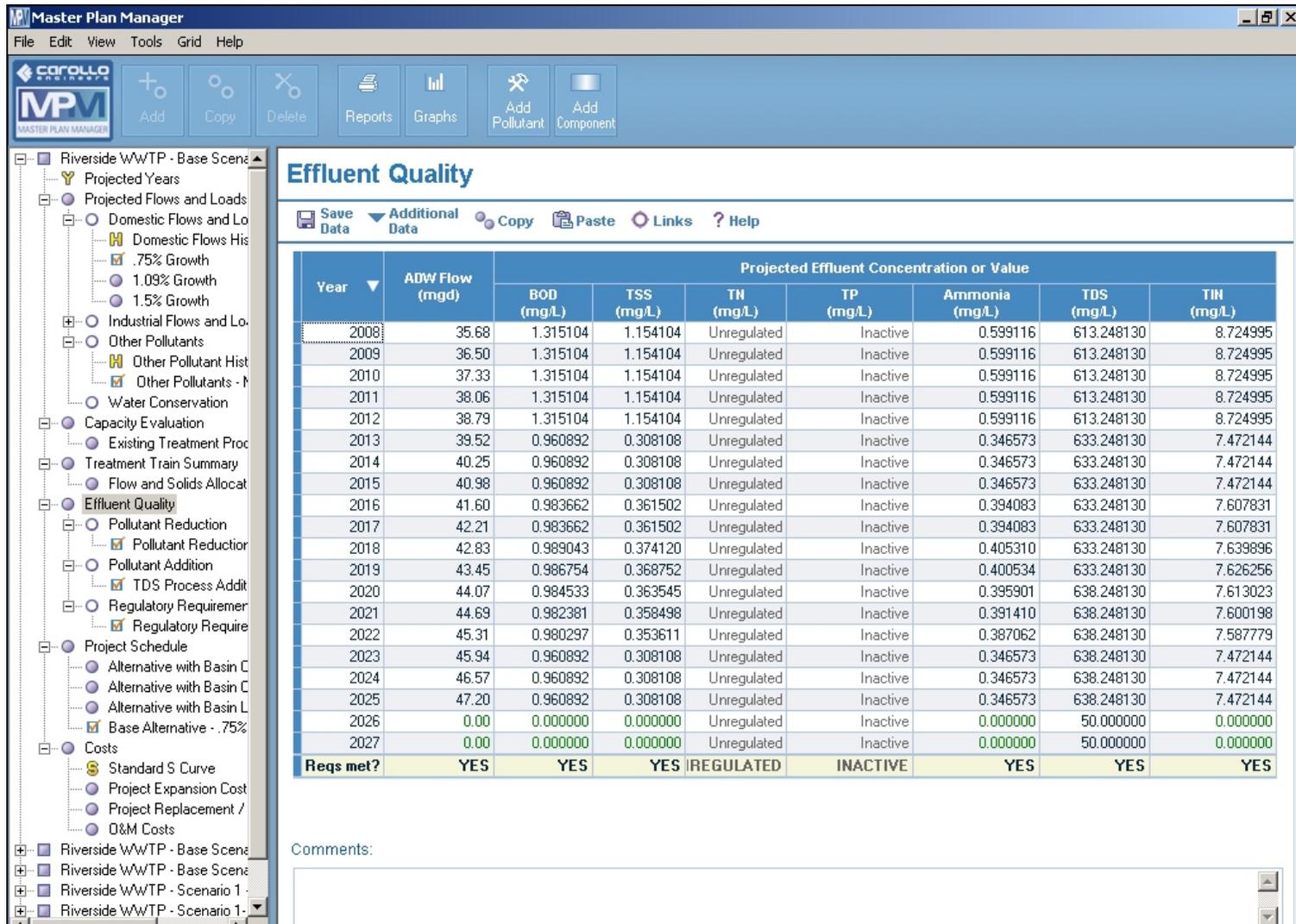
## POLLUTANT ADDITION

FIGURE 1.20



## REGULATORY REQUIREMENTS

FIGURE 1.21



## EFFLUENT QUALITY

FIGURE 1.22

If the user chooses to address the impacts of other additional pollutants, (for example, ibuprofen) they can add it to the *Other Pollutant* data options, provide a pollutant reduction percentage (for example, 65 percent) on the *Pollutant Reduction* data options, and provide an effluent quality requirement in the *Regulatory Requirement* data options (such as 20 mg/L). By returning to the *Effluent Quality* calculation layer, they can determine if the effluent quality requirements are met, as shown in Figure 1.23. In this example, the projected effluent quality for ibuprofen, displayed in the right hand column of the grid is 14 mg/L, and therefore the permit requirements are met.

#### **1.4.12 Project Schedule**

Once all of the appropriate projects have been created and selected on the selected *Planned Projects and Costs* data option, the *Project Schedule* calculation layer displays the overall list of projects, major components, added capacity, capacity unit, design length (years), construction length (years), year design starts, year construction starts, and year online as shown in Figure 1.24. The data that is displayed is the City's project schedule for the selected data options.

#### **1.4.13 Costs**

The MPM™ divides costs into three different categories; *Project Expansion Costs*, *Project Replacement/Improvement Costs*, and *Operations and Maintenance (O&M) Costs* data options. There is a data option entitled *S-Curve* that contains a grid that assigns a percentage of the capital costs spent in each year, depending on the length of the project.

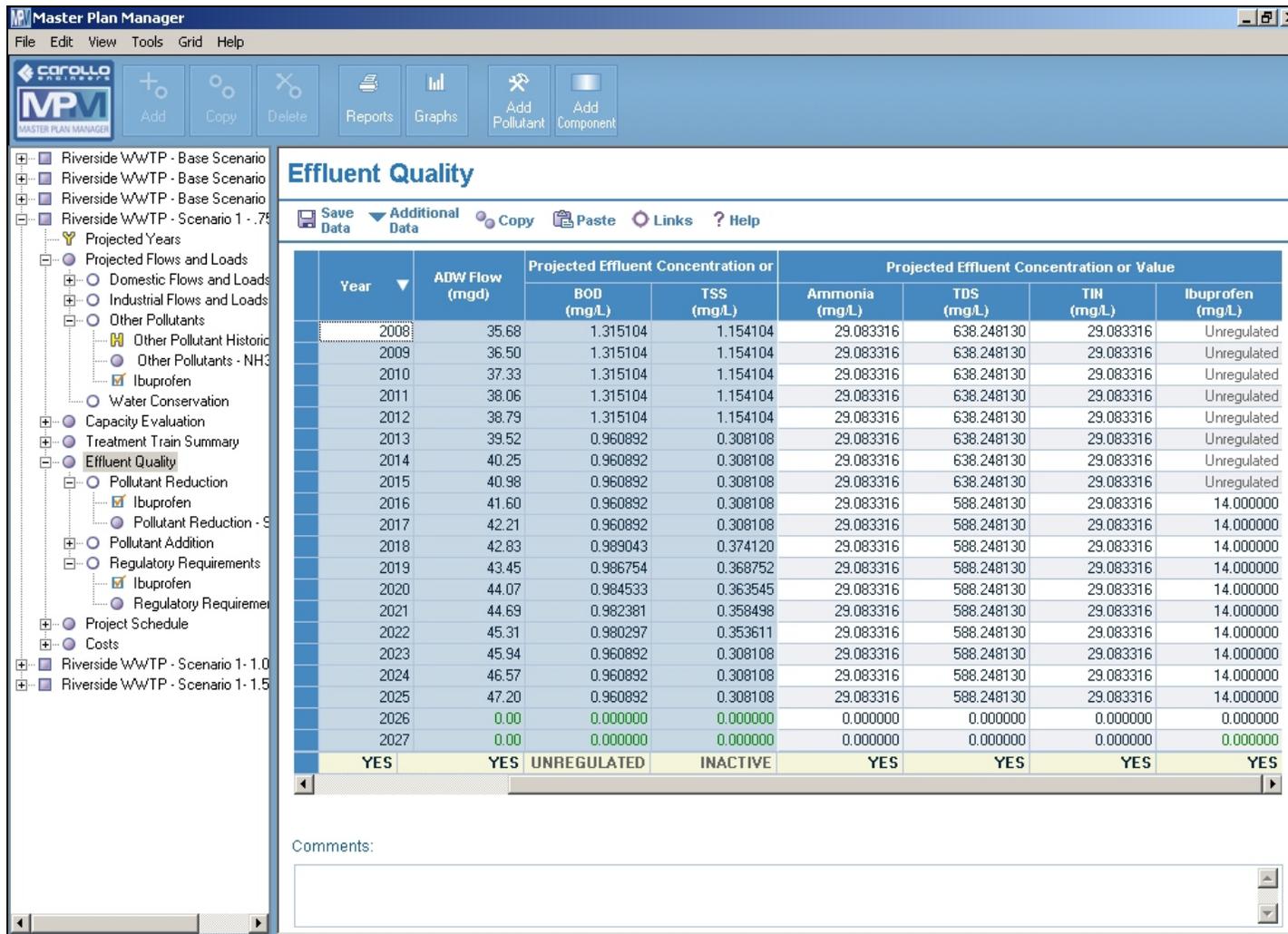
##### **1.4.13.1 Standard S-Curve**

The *Standard S-Curve* data option, as shown in Figure 1.25, lists the project duration in years and the percent by year. The grid indicates for a project of X years, the percentage of the total project cost that is spent in each year and is non-editable. MPM™ applies the *S-Curve* percentages to all the costs of the CIP projects listed on the selected *Planned Projects and Costs* data option in order to distribute costs over the appropriate years for the *Project Expansion Costs* and *Project Replacement/Improvement Costs* data options.

##### **1.4.13.2 Project Expansion Costs**

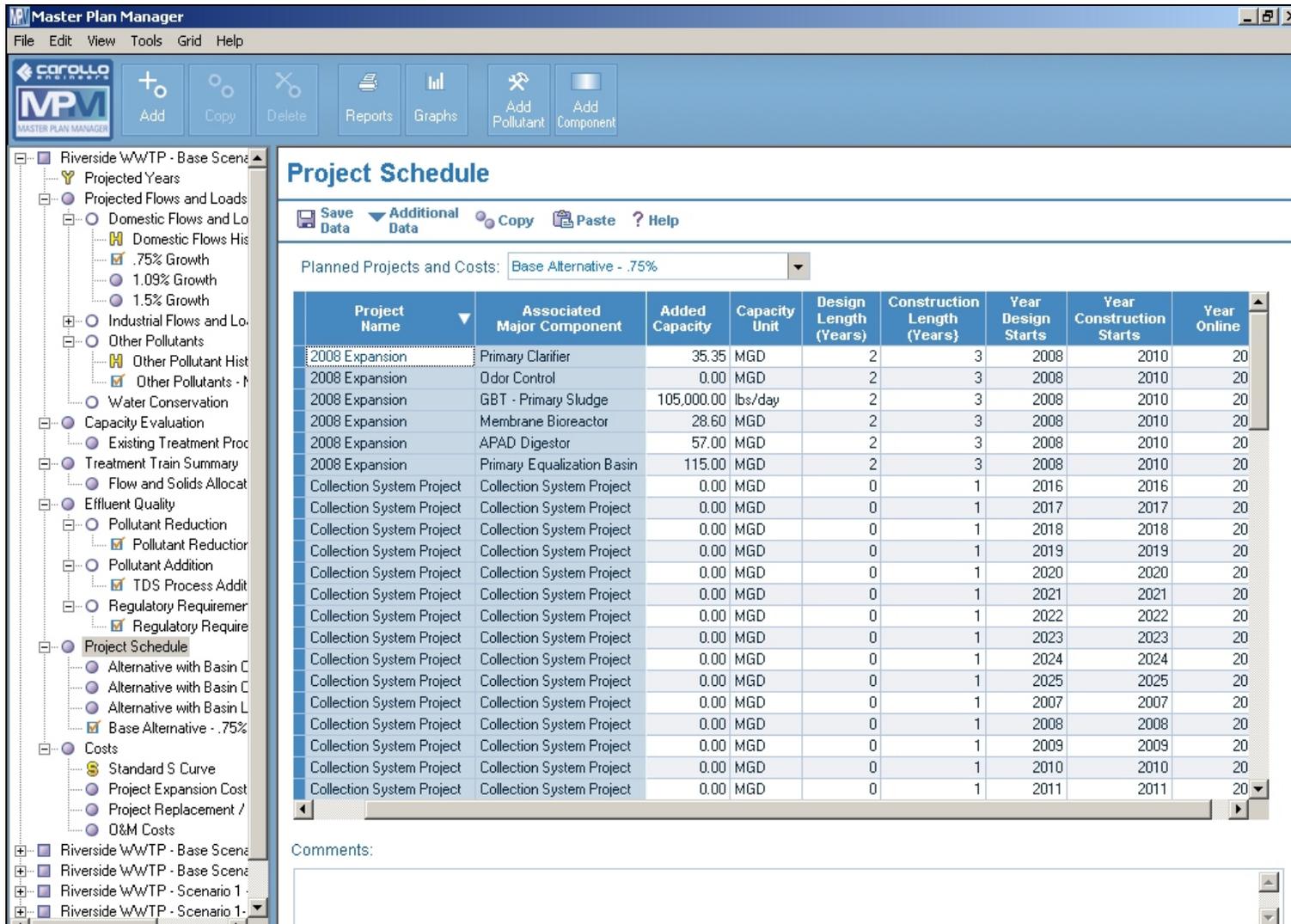
The *Project Expansion Costs* data option, as shown in Figure 1.26, displays the project name and associated major component, project duration, start date, year online, and total expansion costs for the selected *Planned Projects and Costs* data option. The City's project expansion costs per year are displayed in Figure 1.26. Expansion costs refer to the costs associated with the portion of the project that is allocated to serve additional wastewater customers.

MPM™ calculates the total expansion costs for each major component by multiplying the total project costs by the expansion cost percentages on the selected *Planned Projects and*



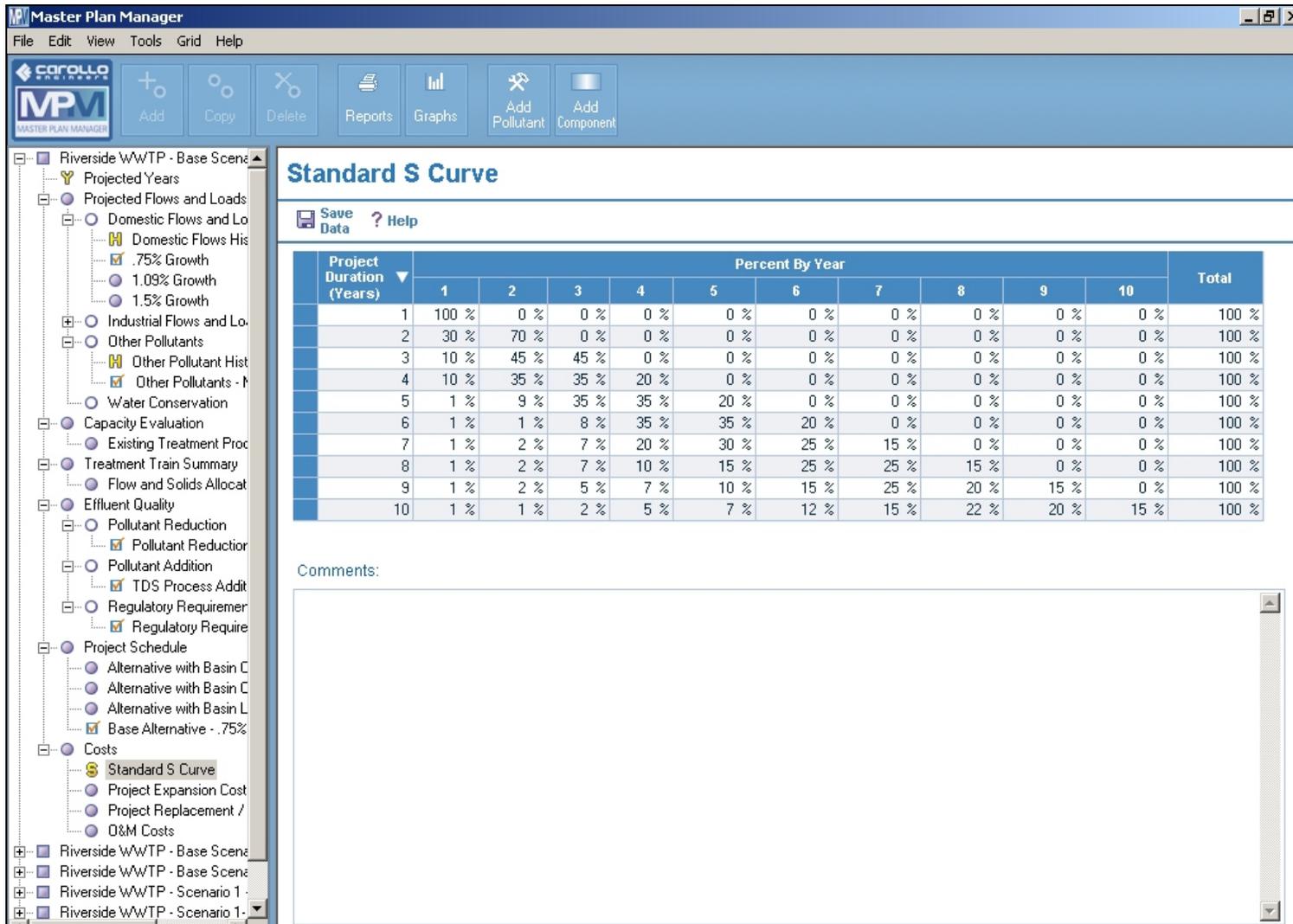
## PROJECTED EFFLUENT QUALITY OF IBUPROFEN

FIGURE 1.23



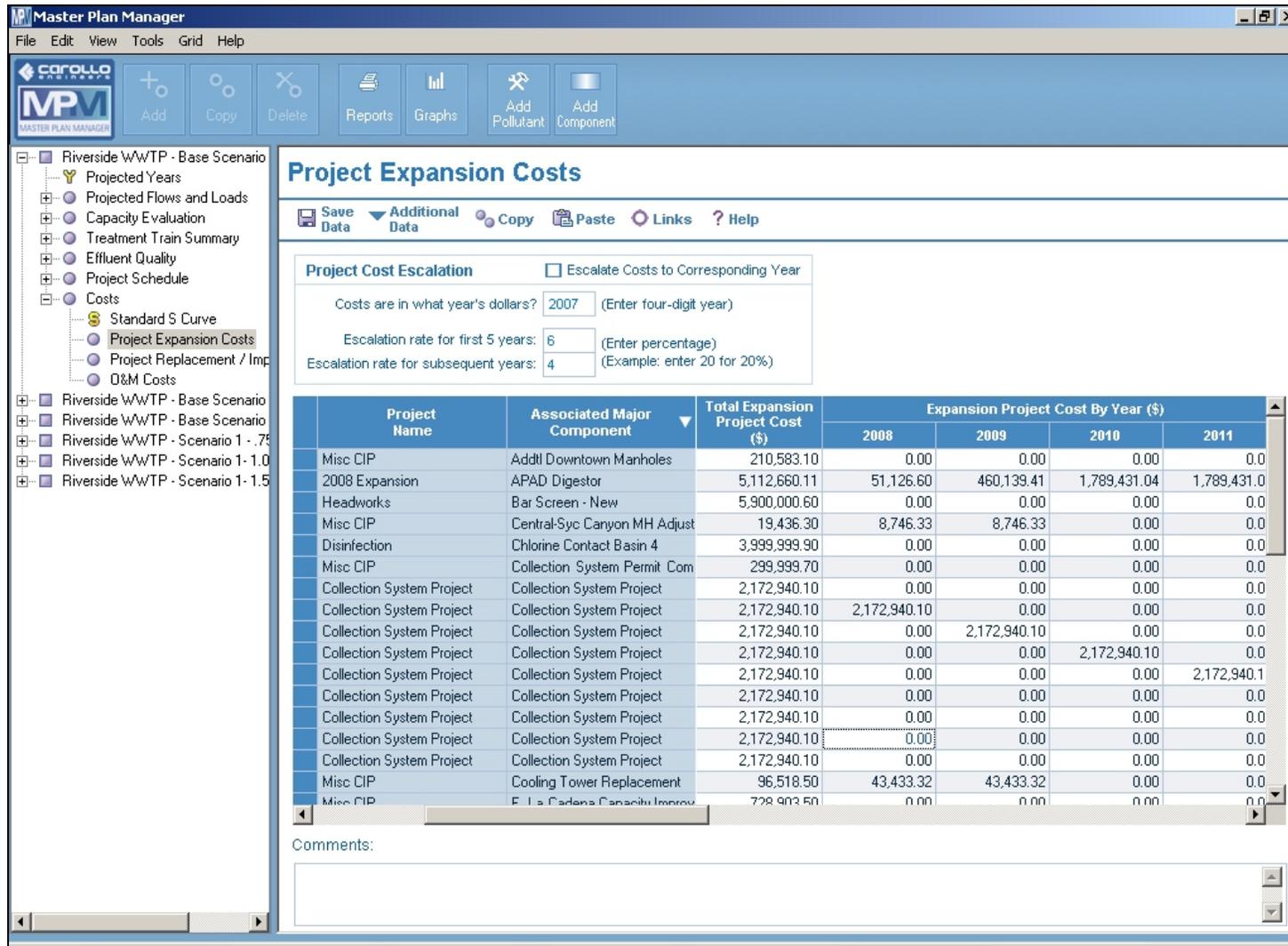
## PROJECT SCHEDULE

FIGURE 1.24



## STANDARD S-CURVE

FIGURE 1.25



## PROJECT EXPANSION COSTS

FIGURE 1.26

*Costs* data option. The total expansion costs per major component are then multiplied by the appropriate percentages for the respective years from the *Standard S-Curve* data option, and MPM™ displays them for each projected year. Then the expansion costs per year are totaled at the bottom. MPM™ can escalate the costs by percentages the user enters. In the case of the City, escalation factors of 6 percent for the first 5 years and 4 percent for the subsequent years were used.

#### **1.4.13.3 Project Replacement/Improvement Costs**

The *Project Replacement/Improvement Costs* data option, as shown in Figure 1.27, displays the project name and associated major component, project duration, start date, year online, and total replacement/improvement costs for the selected *Planned Projects and Costs* data option. The City's project replacement/improvement costs per year are displayed in Figure 1.27. Replacement/improvement costs refer to the costs associated with the portion of the project that is used to serve existing wastewater customers.

MPM™ calculates the total replacement/improvement costs for each major component by multiplying the total project costs by the replacement/improvement cost percentages on the selected *Planned Projects and Costs* data option. The total replacement/improvement costs per major component are then multiplied by the appropriate percentages for the respective years from the *Standard S-Curve* data option, and MPM™ displays them for each projected year. Then the overall amount of money spent on replacement/improvement per projected year is totaled at the bottom. Similarly to the *Project Expansion Cost* data option, MPM™ can escalate the costs by percentages the user enters. In the case of the City, escalation factors of 6 percent for the first five years and 4 percent for the subsequent years were used.

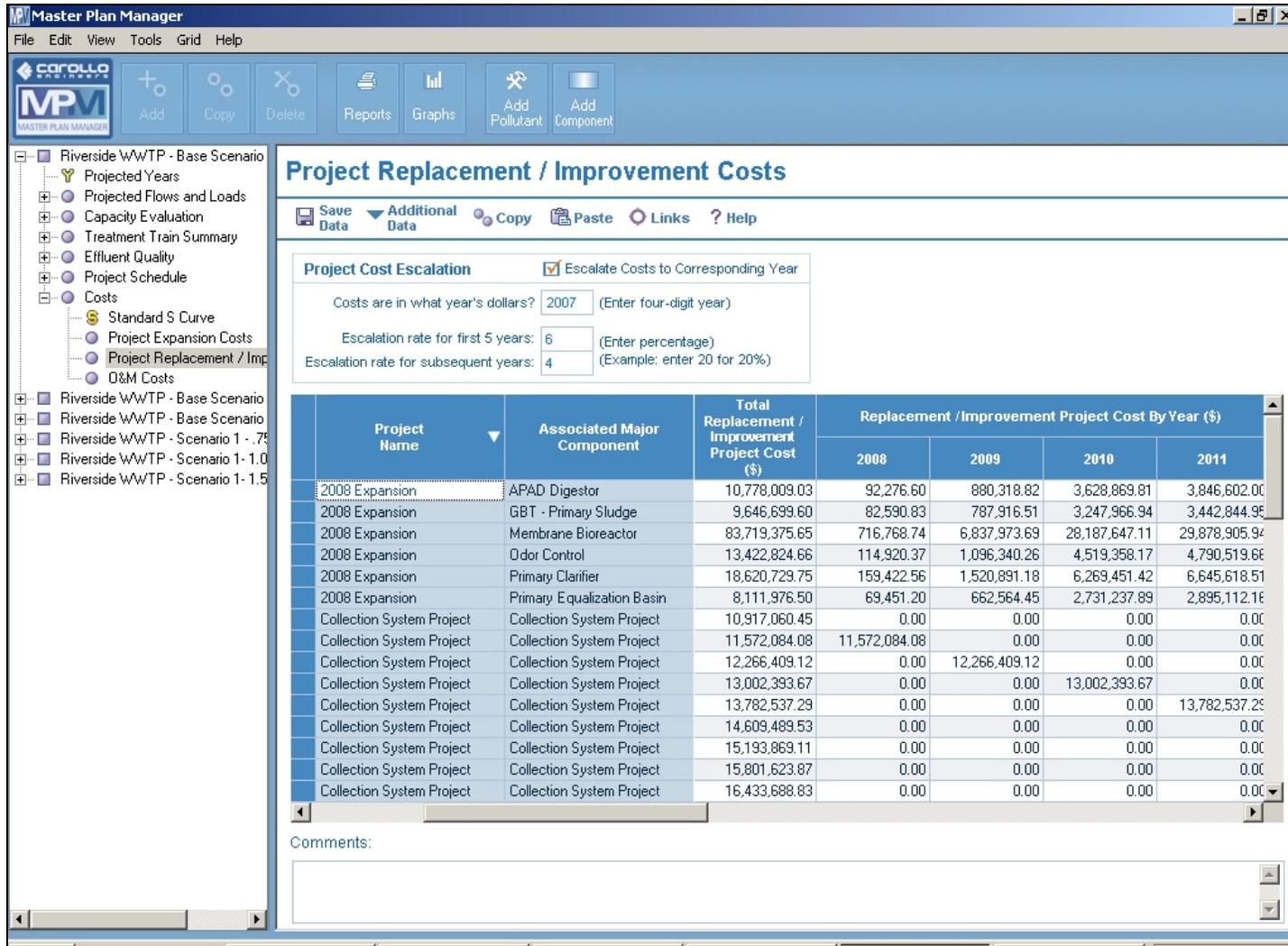
#### **1.4.13.4 O&M Costs**

The *O&M Costs* data option allows the user to enter in maintenance and operations costs for each major component (existing and planned), as well as labor and disposal costs, for each year in the planning period. As shown in Figure 1.28, the City's projected O&M costs have been entered for the selected *Planned Projects and Costs* data option.

MPM™ automatically updates each year so that if a new major component is planned to go online in a certain year, that major component will appear in the O&M grid in the right year, as well as the subsequent years. MPM™ displays the total O&M costs per projected year in the grid on the left. The costs can be escalated as well based on user-entered percentages or based on an ENR ratio. For the City, O&M costs are escalated at 3 percent a year.

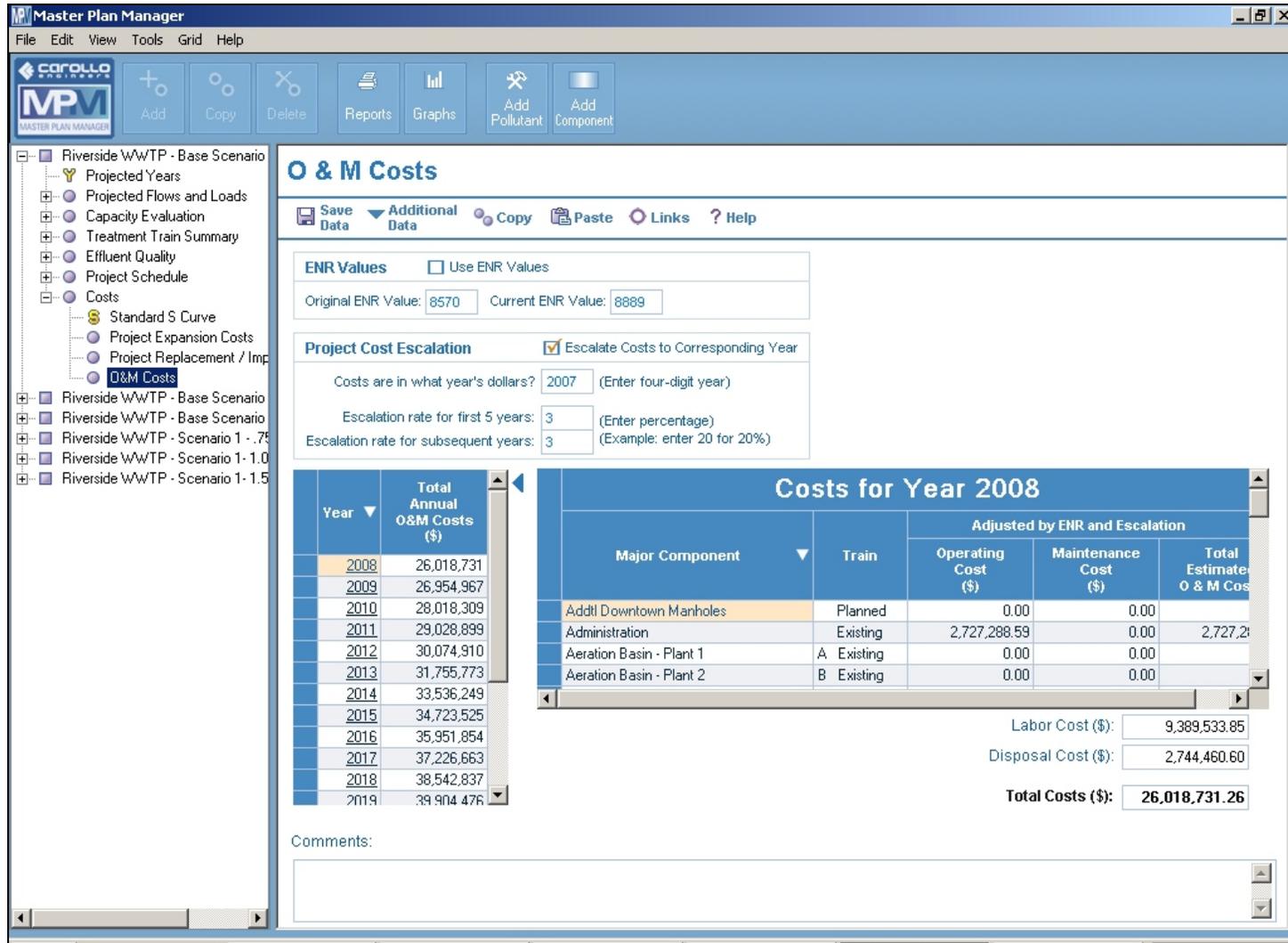
#### **1.4.13.5 Costs**

The overall expansion, replacement/improvement, and O&M costs per projected year from their respective data options are displayed on the *Costs* calculation layer, and summed for



## PROJECT REPLACEMENT / IMPROVEMENT COSTS

FIGURE 1.27



## O&M COSTS

FIGURE 1.28

overall total costs per projected year. The City's total costs per year for the selected data options are shown in Figure 1.29.

#### **1.4.14 Scenario Summary**

The *Scenario Summary* is the scenario layer that is used to select different data options and see at the same time that capacity and effluent quality needs are met. The user can also navigate through MPM™ from the *Scenario Summary* scenario layer as shown on Figure 1.30.

#### **1.4.15 Graphs**

MPM™ has the ability to create a variety of graphs. The graphs can be created for any scenario and any data option. The user can print or export the graphs as well. In Figures 1.31, 1.32, 1.33, 1.34, and 1.35, Domestic Population, Projected Flows, Projected Loads, Project Schedule, and Costs based on the City's data are shown, respectively. In Figures 1.36 and 1.37 graphs for Flow and TSS capacities for the City's facilities are shown, respectively. MPM™ can also create capacity graphs for BOD, TN, and TP. These graphs can be useful for visually displaying the data, for reports, presentations, etc.

#### **1.4.16 Reports**

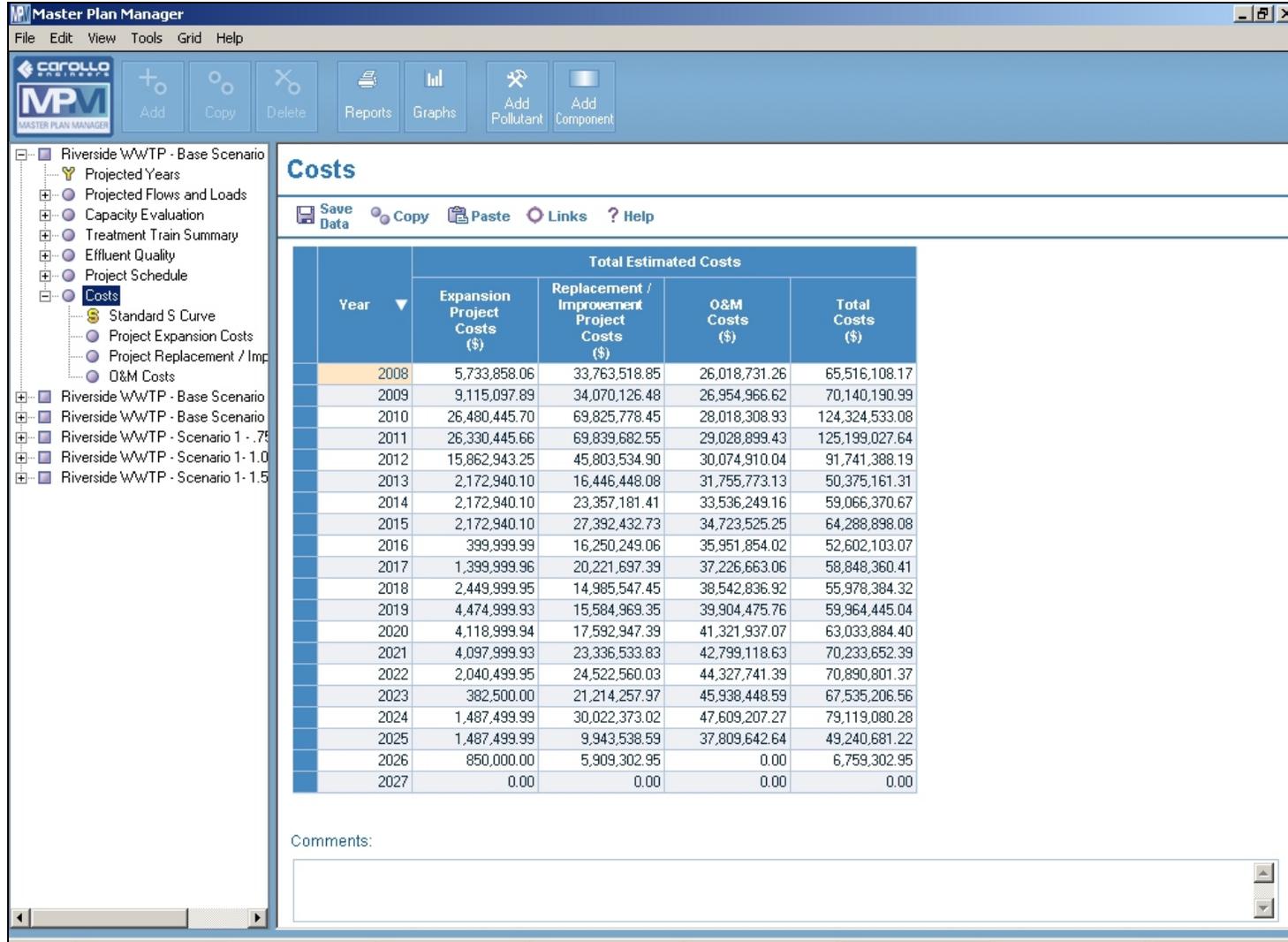
MPM™ can create reports for any layer within the tree structure - scenario, calculation, or data options, as shown in Figure 1.38. The reports can be printed or exported via either a PDF or a Comma-Separated Values file (text file). The reports are useful for doing additional analysis with the data, communicating with others, using in reports, etc.

#### **1.4.17 Help Menu**

MPM™ has a Help Menu for help understanding a function or how to perform a certain task. As shown in Figure 1.39, the user can navigate through the Help Menu based on their needs, and print as necessary.

### **1.5 EXISTING DATABASE**

An existing database has been developed for the City. This database contains the City's data that goes along with the rest of the Master Plan deliverables. To date, six scenarios have been created with one scenario per growth rate (0.75 percent, 1.09 percent, and 1.5 percent) per disinfection option (additional chlorine contact basins or ozonation and UV). In addition, each of the six scenarios has an option to include the Levee project in the cost calculations. To include the Levee, a box needs to be checked and the CIP for that scenario is automatically updated. The default setting for each scenario is not to include the Levee project.



## OVERALL PROJECTED COSTS

FIGURE 1.29

**Master Plan Manager**

File Edit View Tools Grid Help

carollo MPM MASTER PLAN MANAGER

Buttons: Add, Copy, Delete, Reports, Graphs, Add Pollutant, Add Component

**Scenario Summary**

Save Data ? Help

**Scenario Name:** Riverside WWTP - Base Scenario - .75%

**Projected Flows and Loads**

- Domestic Population, Flows and Loads: .75% Growth
- Industrial Flows and Loads:
- Other Pollutants: Other Pollutants - NH3, TDS, TIN
- Water Conservation:

**Capacity Evaluation**

Existing Treatment Process and Capacity

Are all projected flow and load capacity needs met in this scenario? YES

**Treatment Train Summary**

Flow and Solids Allocation

**Effluent Quality**

- Pollutant Reduction: Pollutant Reduction - Standard
- Pollutant Addition: TDS Process Addition
- Regulatory Requirements: Regulatory Requirements - Existing

Are all regulatory requirements met in this scenario? YES

**Project Schedule**

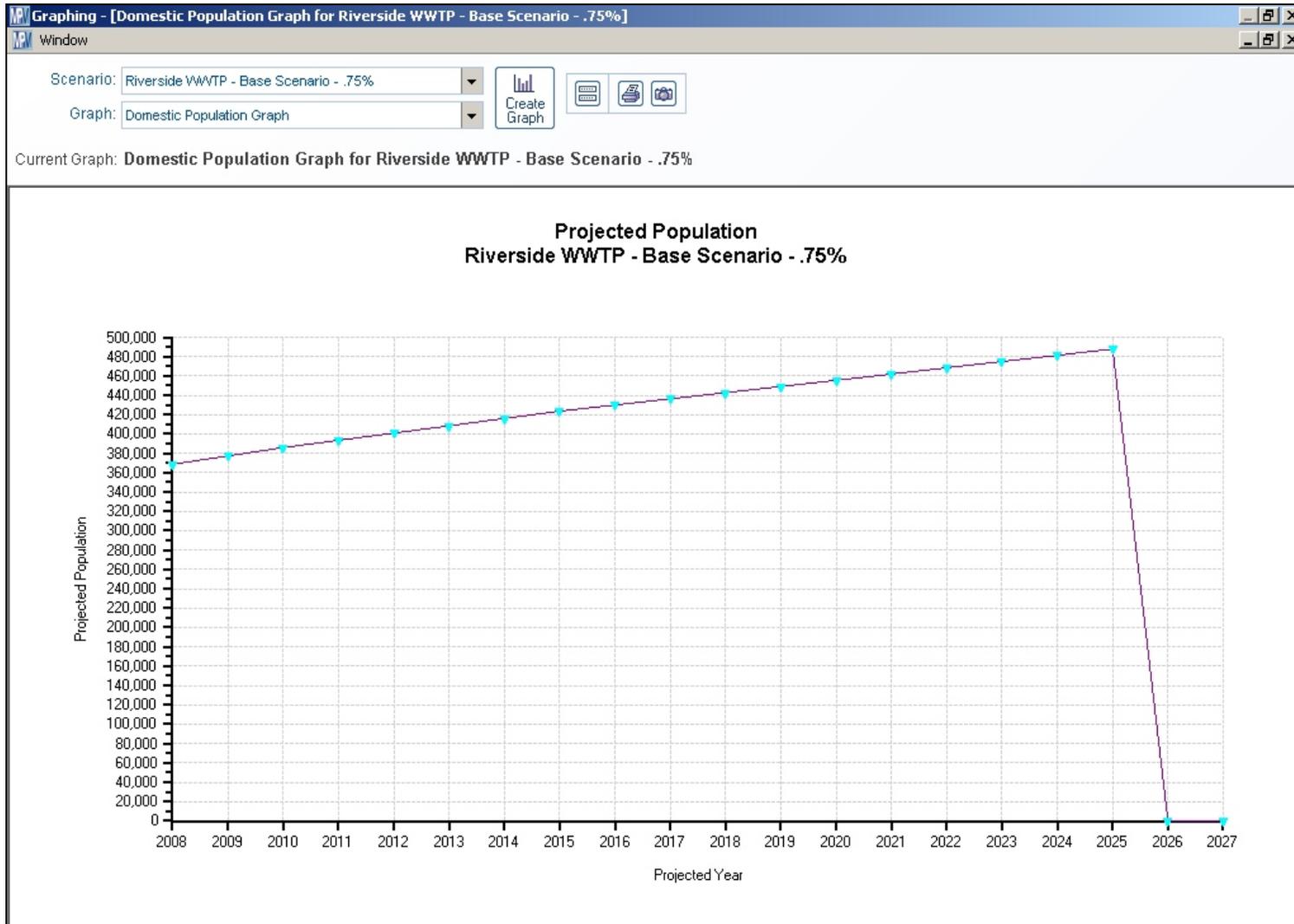
Planned Projects and Costs: Base Alternative - .75%

**Costs**

- O & M Costs
- Standard S Curve
- Project Expansion Costs
- Project Replacement / Improvement Costs

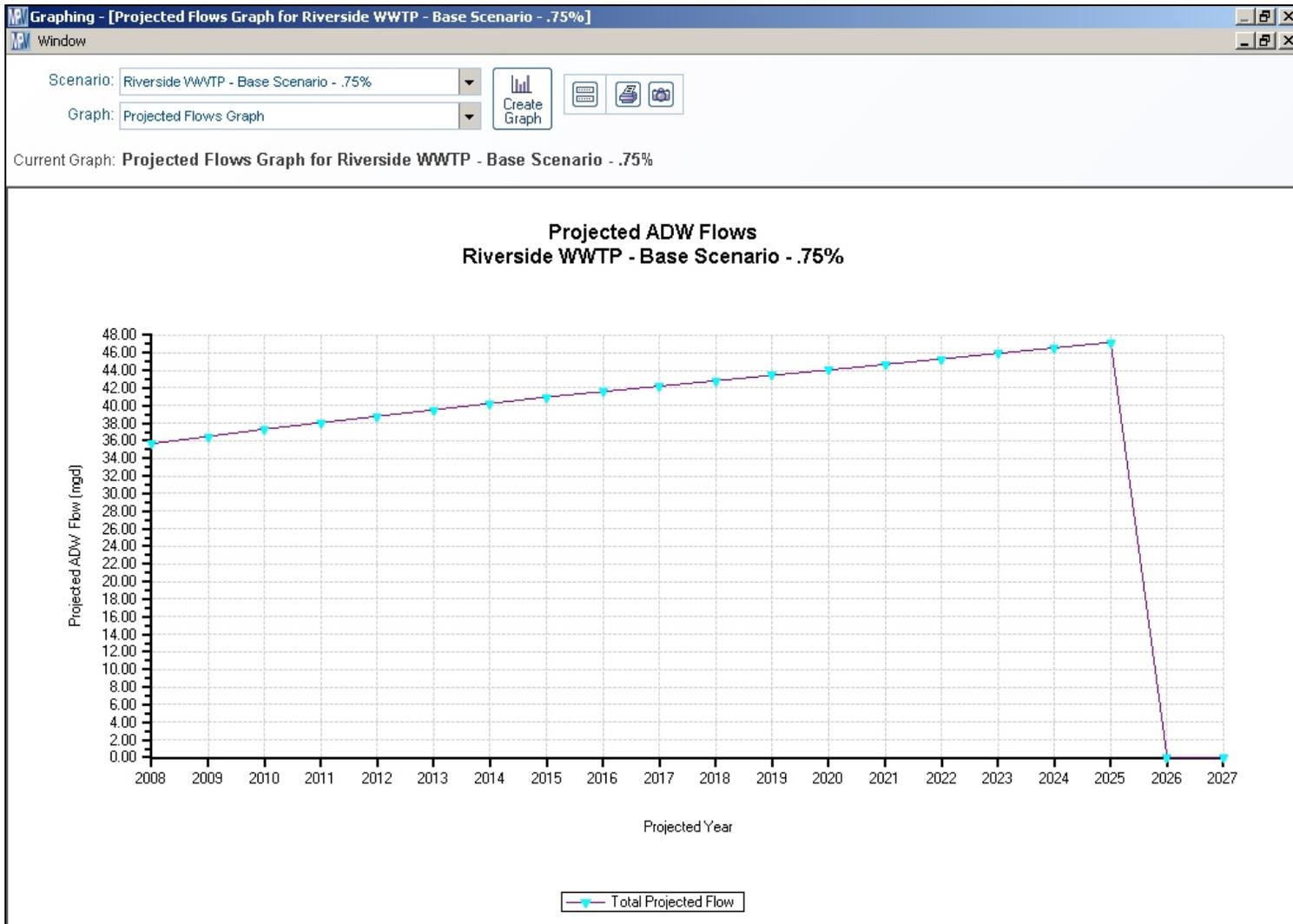
## SCENARIO SUMMARY

FIGURE 1.30



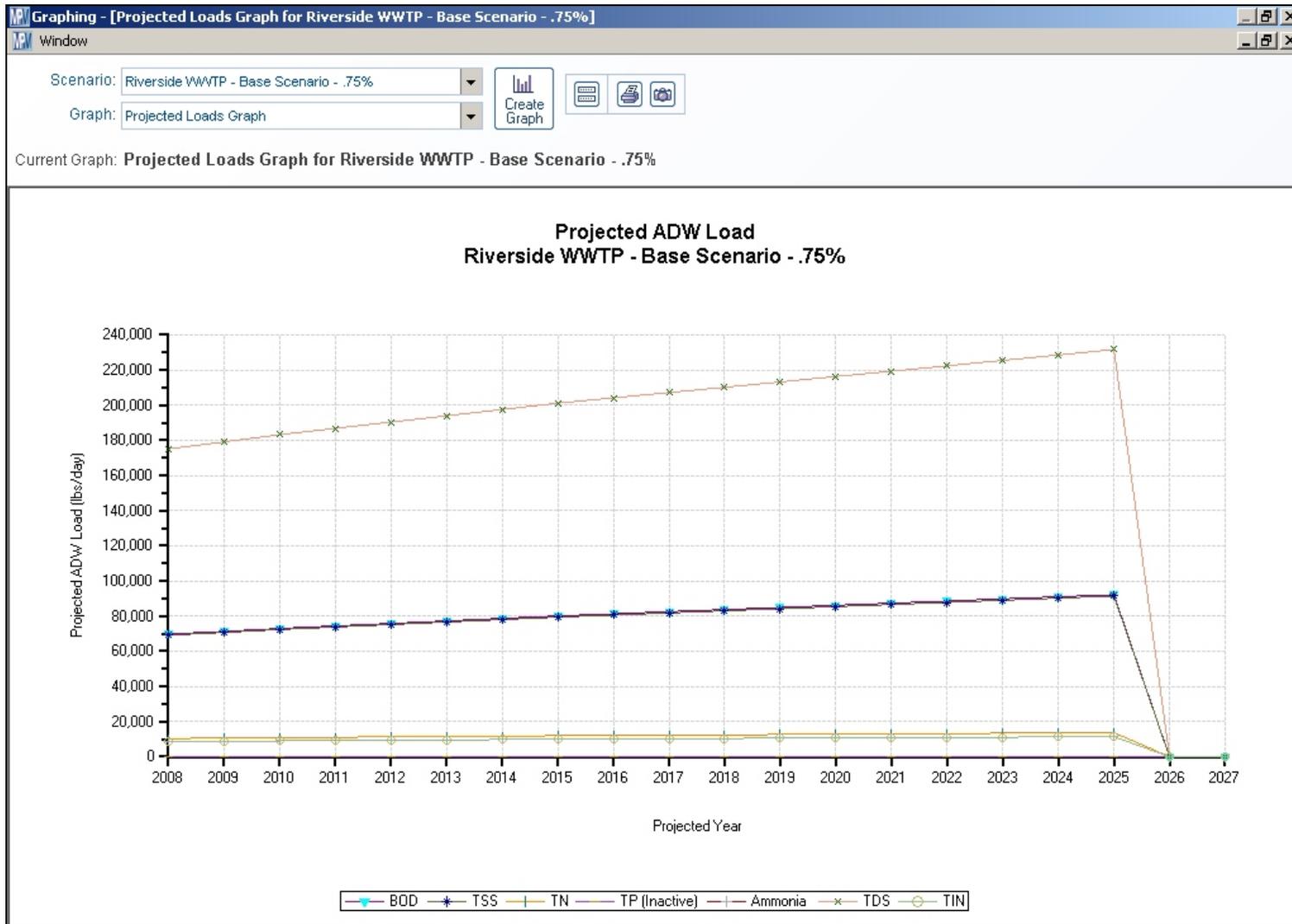
## PROJECTED POPULATION GRAPH

FIGURE 1.31



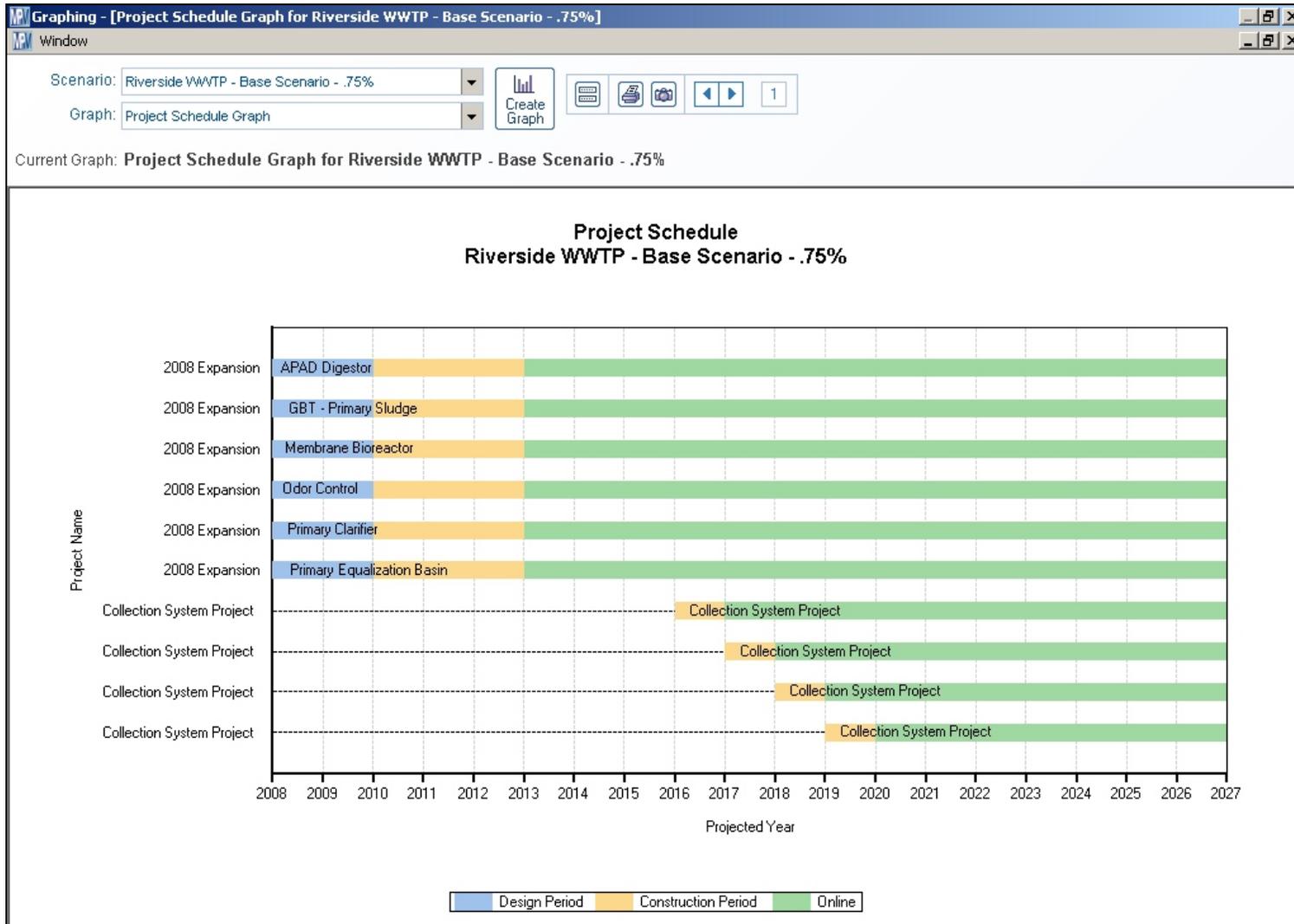
### PROJECTED FLOWS GRAPH

FIGURE 1.32



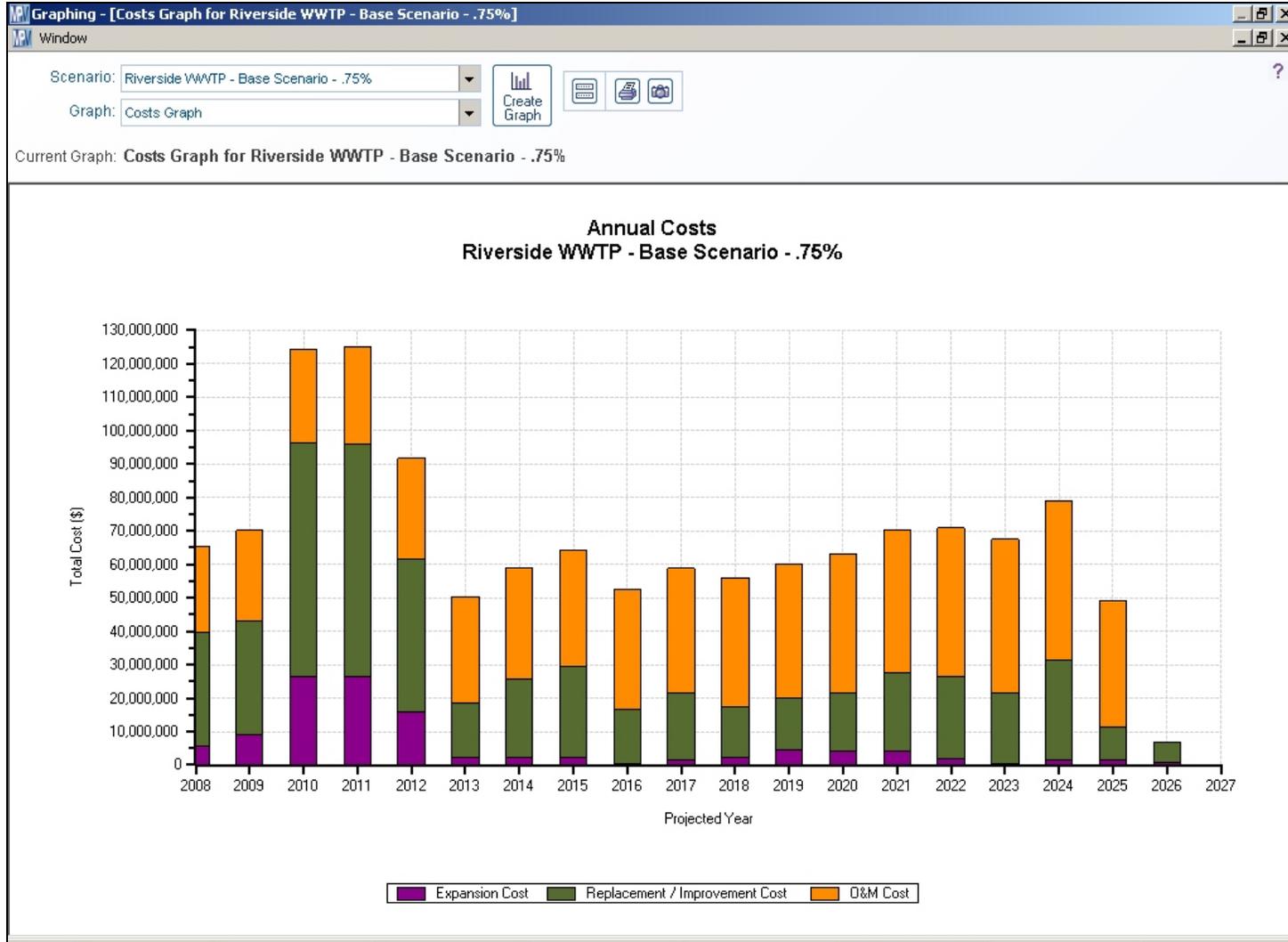
## PROJECTED LOADS GRAPH

FIGURE 1.33



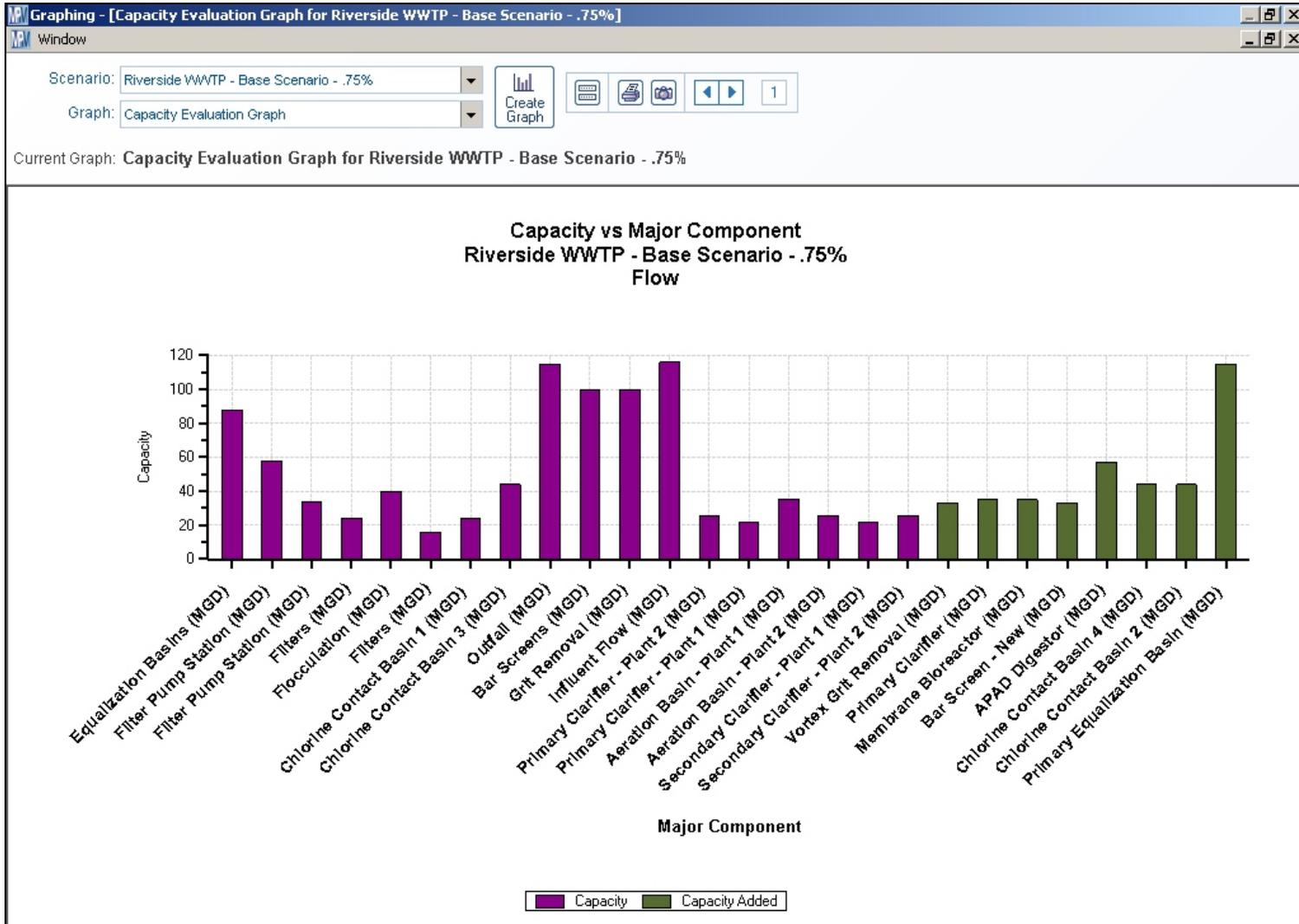
## PROJECT SCHEDULE GRAPH

FIGURE 1.34



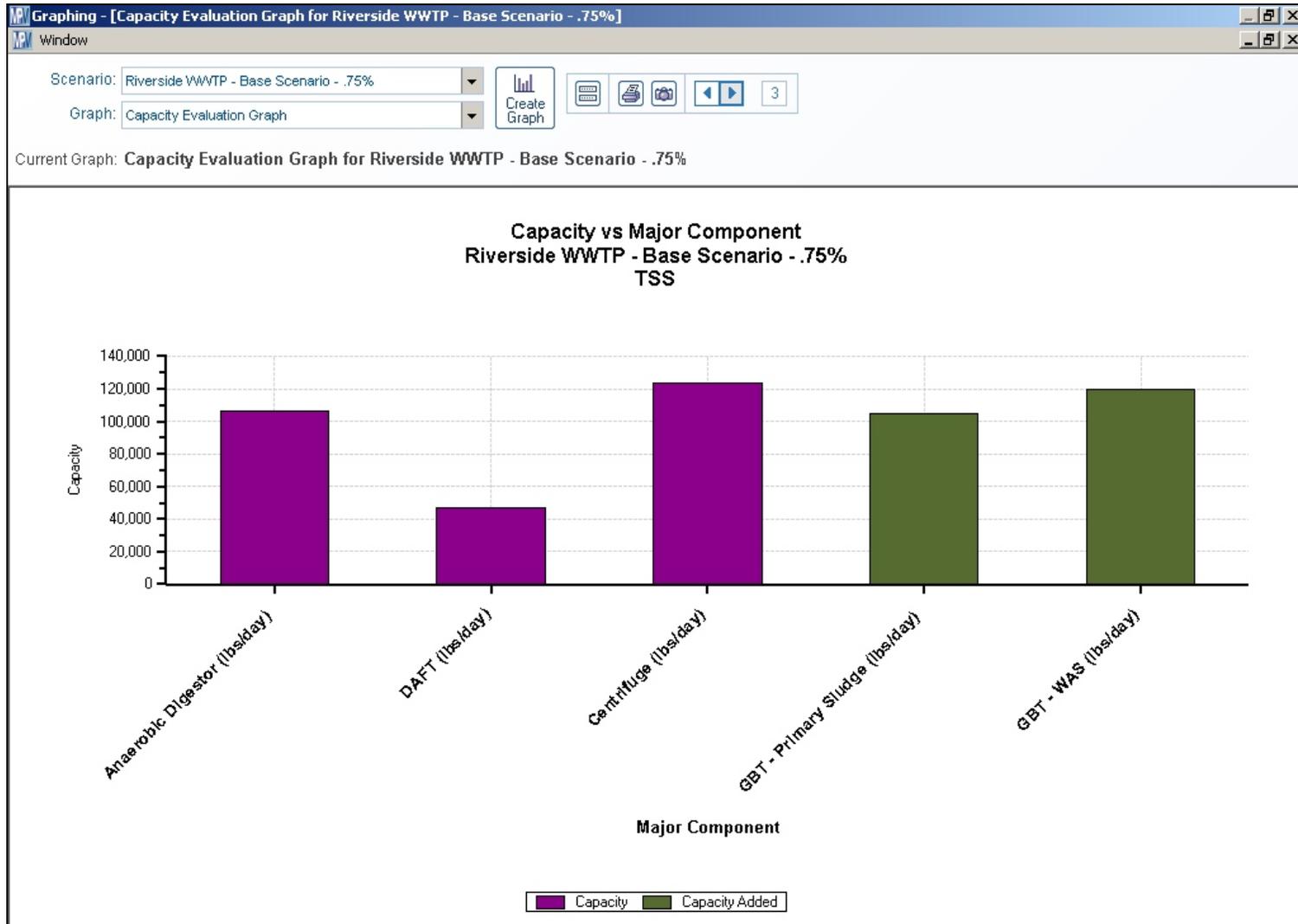
### PROJECTED ANNUAL COSTS GRAPH

FIGURE 1.35



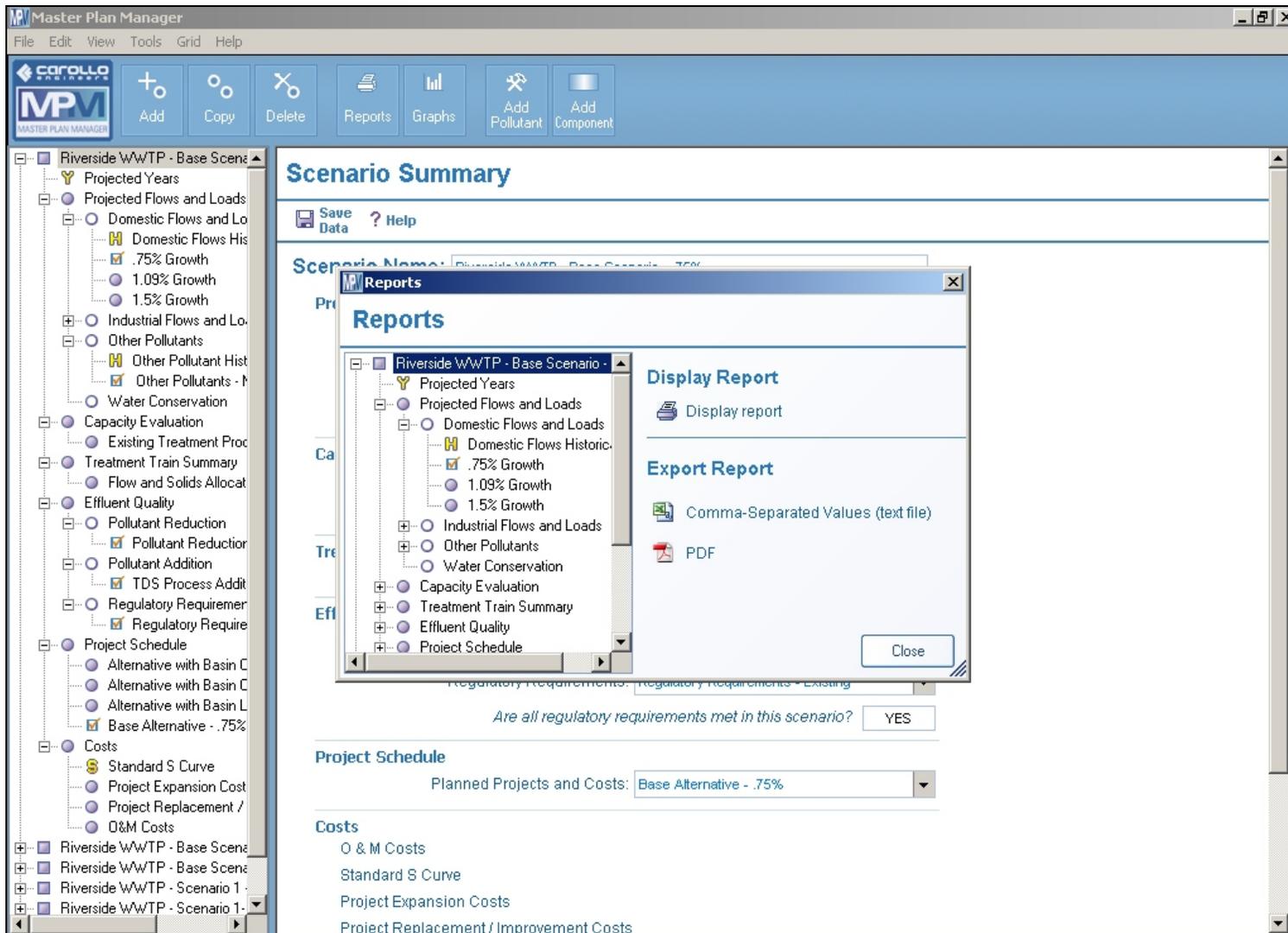
**CAPACITY EVALUATION  
GRAPH - FLOW**

FIGURE 1.36



### CAPACITY EVALUATION GRAPH - TSS

FIGURE 1.37



## MASTER PLAN MANAGER™ REPORTS

FIGURE 1.38

**Projected Flows and Loads**

The Projected Flows and Loads screen displays the flows and loads for the system.

Year	Projected ADW Flow (mgd)	Projected ADW Load				
		BOD (lbs/day)	TSS (lbs/day)	TN (lbs/day)	TP (lbs/day)	Ammonia (lbs/day)
2008	35.68	69,766.10	69,136.55	10,414.22	Inactive	8,659.18
2009	36.50	71,385.35	70,741.18	10,655.93	Inactive	8,860.16
2010	37.33	73,007.62	72,348.81	10,898.09	Inactive	9,061.51
2011	38.06	74,427.86	73,756.24	11,110.09	Inactive	9,237.79
2012	38.79	75,851.32	75,166.85	11,322.58	Inactive	9,414.46
2013	39.52	77,277.61	76,580.28	11,535.48	Inactive	9,591.49
2014	40.25	78,706.75	77,996.51	11,748.82	Inactive	9,768.87
2015	40.98	80,139.10	79,415.94	11,962.63	Inactive	9,946.65
2016	41.60	81,340.48	80,606.47	12,141.96	Inactive	10,095.76
2017	42.21	82,544.69	81,799.83	12,321.72	Inactive	10,245.23
2018	42.83	83,752.13	82,996.36	12,501.96	Inactive	10,395.09
2019	43.45	84,962.78	84,196.09	12,682.67	Inactive	10,545.35
2020	44.07	86,176.45	85,398.81	12,863.84	Inactive	10,695.99

Comments:

**Year**  
The Year column contains the years that exist in the [Projected Years](#) screen.

**Projected ADW Flow**

## MASTER PLAN MANAGER™ HELP MENU

FIGURE 1.39