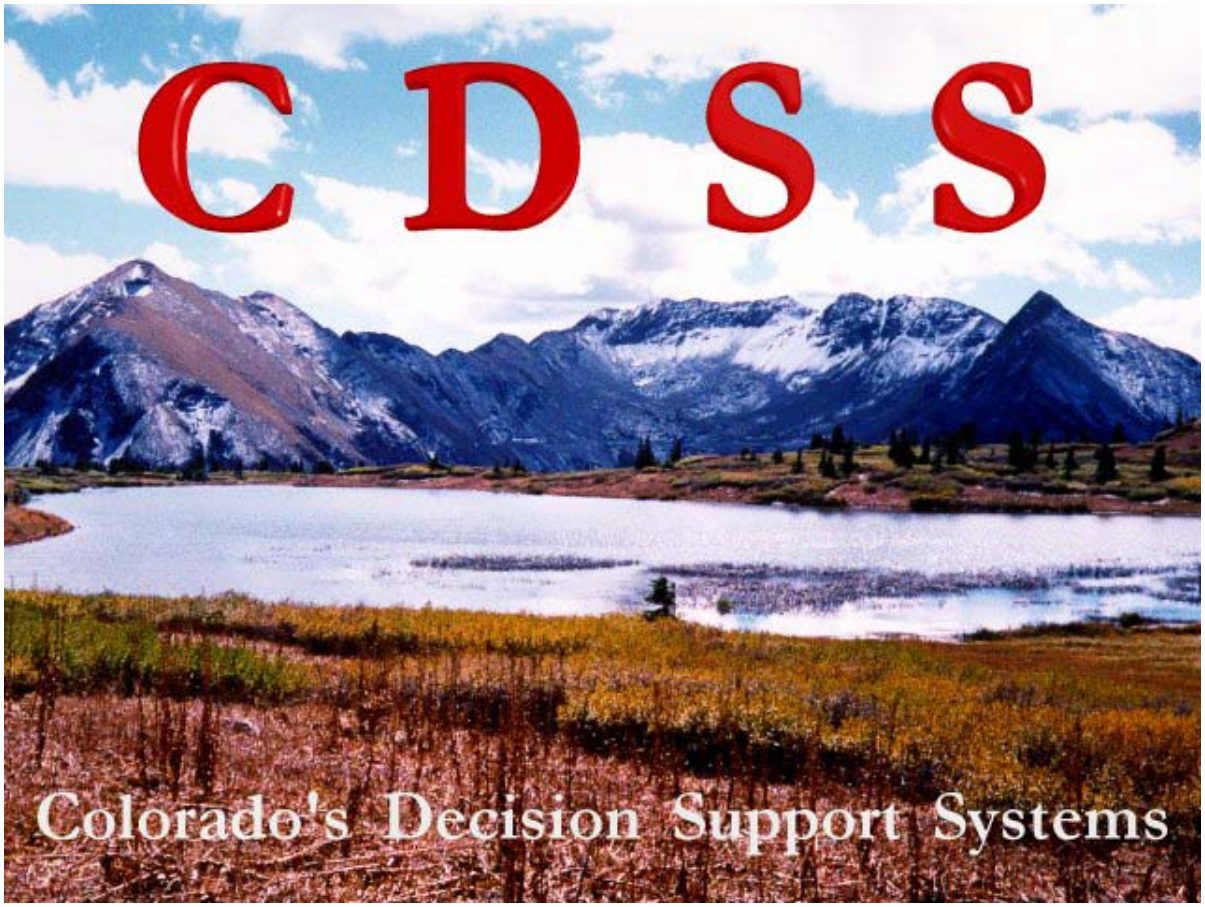
Colorado's Decision Support Systems
Workshop

August 25, 2010



www.cdss.state.co.us

Colorado Decision Support Systems
Overview and Training Session

Training Material Contents:

Workshop Goals

Colorado has invested considerable resources in developing decision support system planning tools. Through a series of feasibility studies and a sustained effort over nearly two decades, we now have decision support systems in many of our river basins. This workshop provides a review of water resource planning tools that are available and will provide to you with resources to learn how you can use them in your planning work.

What will you gain from this workshop?

You will gain an understanding of the various data and tools that are publically available from Colorado's Decision Support Systems. We will discuss what information is available, where to get that information, and provide examples of some ways to use the information. We will briefly discuss the tools that are useful in accessing and manipulating the information, and the models that are used to make water resources and planning decisions. Workshop information includes:

- Simple examples to illustrate sources of information and how to use tools
- More detailed applications using the data and tools, to illustrate how to answer real-world questions
- Reference information to provide more technical information.

How can you use the information from the workshop?

The workshop will provide you with step-by-step instructions that walk through how to access CDSS information. This allows you to follow through the workshop presentation as well as provides a resource you can use in the future. This workshop will show you some methods and techniques to efficiently access the CDSS data and tools. The examples that are described herein can then be modified and extended for use with your specific project.

How can you help us improve CDSS to your benefit?

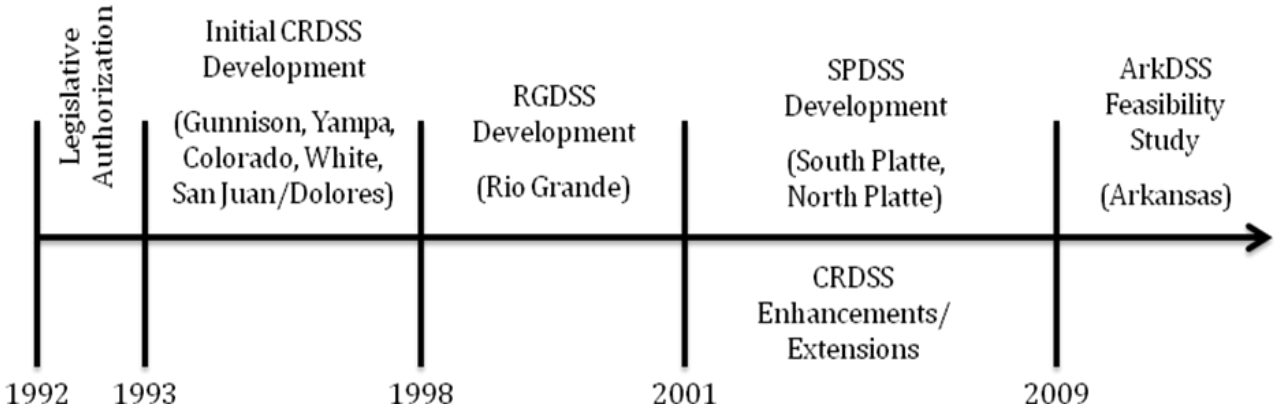
Ask questions during the workshop and contact presenters listed at the end of the handout. We understand first-hand how complex water resources data and modeling can be and are interested in overcoming challenges that you have in using CDSS data and tools. Your input will help the CDSS team to prioritize future work.

CDSS Overview

What is CDSS?

"Colorado's Decision Support Systems (CDSS) is a water management system developed by the Colorado Water Conservation Board and the Colorado Division of Water Resources. The goal of this system is to assist in making informed decisions regarding historical and future use of water." It is a framework that helps provide consistency in data management and processing, modeling, and sharing information.

When?



Why?

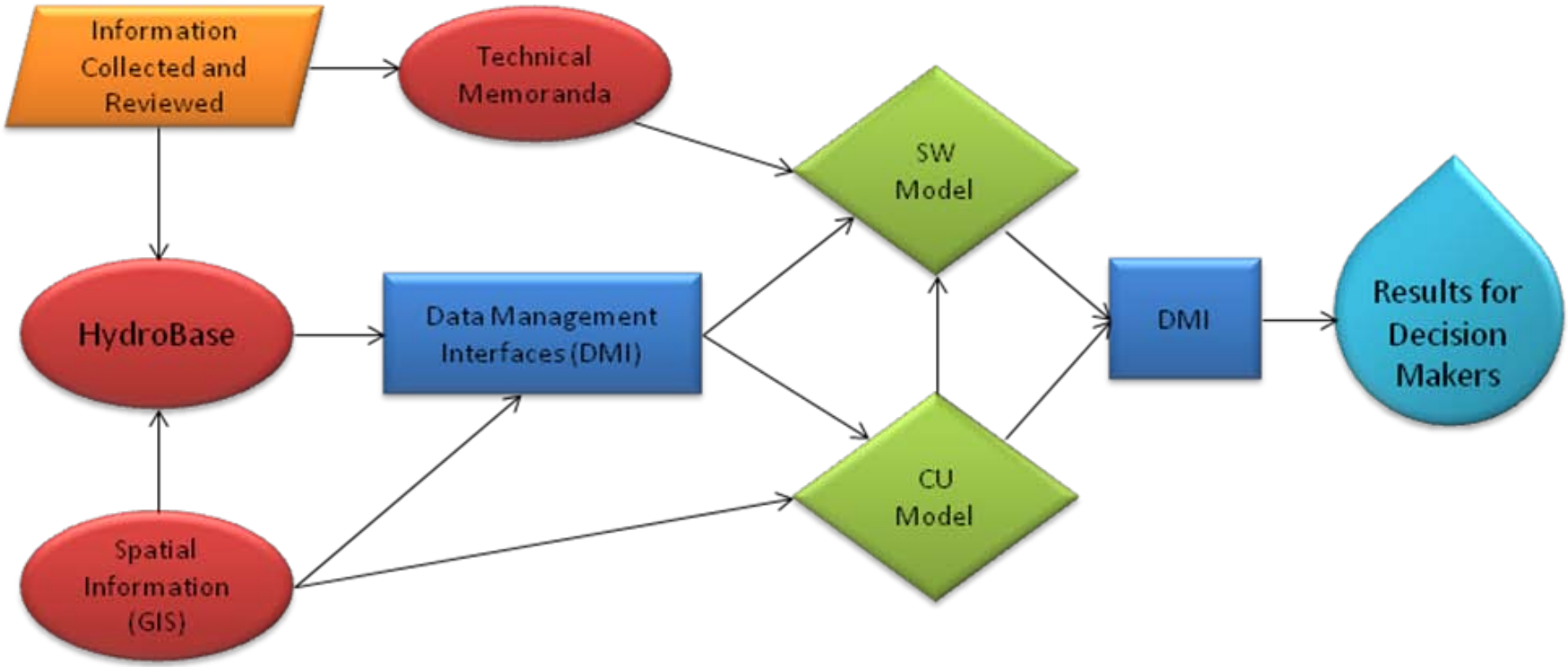
To provide the capability to develop credible information on which to base informed decisions concerning water resource management issues including:

- Water Resources Planning (e.g. response to population growth, drought and climate change, environmental issues)
- Interstate Compact Issues
- Water Rights Administration by DWR

How?

- Provide user-friendly access to quality controlled data and GIS coverages. Supports Data-Centered Approach and use of HydroBase data and Data Management Interfaces (DMIs) to produce reproducible, documented, quality-controlled products.
- Provide data and models to evaluate alternative water development and administration strategies.
- Have the capability to accurately represent current and potential federal and state administrative and operational policies and laws.
- Promote information sharing among governmental agencies and water users.

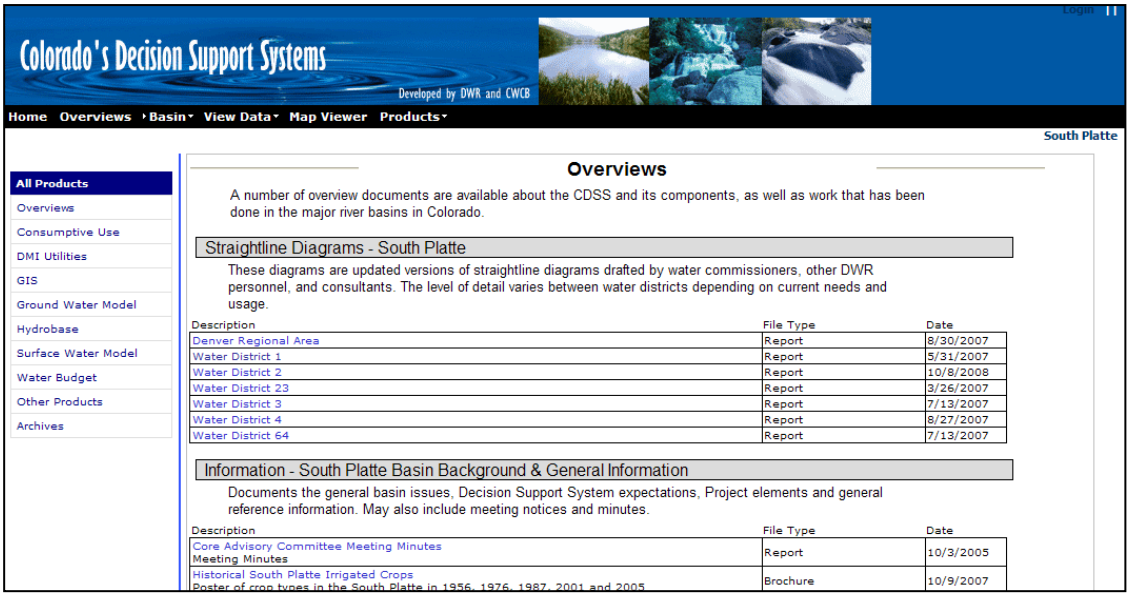
CDSS Information Management Schematic



CDSS Products

1. Basin Operation Information
    - Basin Fact Sheets
    - Straight-line Diagrams
    - Basin Information Reports
    - Water Resources Planning Model User's Manual
    - Supporting Technical Memoranda

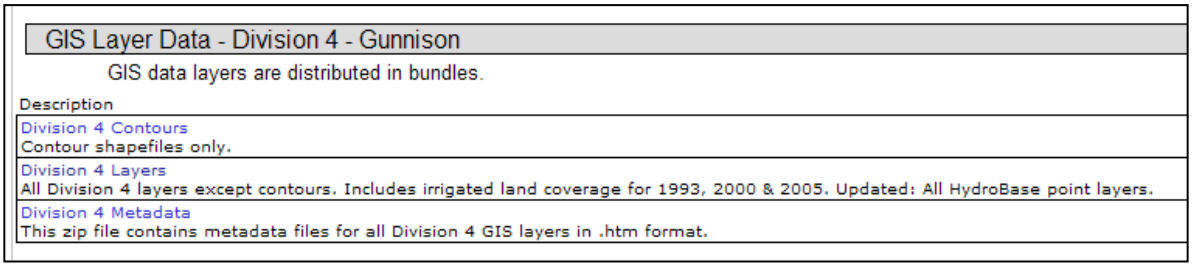
From the Colorado's Decision Support Systems home page (http://cdss.state.co.us/), select the basin of interest under the **Basin** menu, or use the links at the bottom of the home page. Scroll to review available information. Clicking the link to a document will open it in a new browser window, allowing the option to save in *.pdf format.



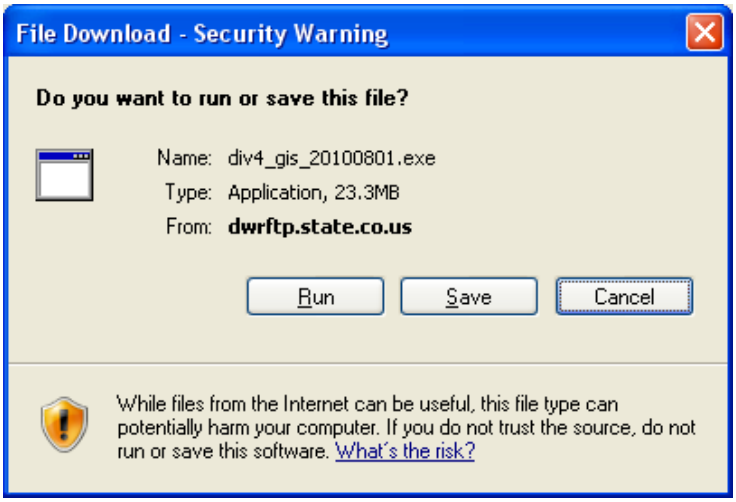
2. GIS Coverages

From the Colorado's Decision Support Systems home page (http://cdss.state.co.us/), select **GIS** under the **Products** menu.

Scroll down to the Division you are interested in and click on the Division *x* Layers link - Division 4 in this example.



The File Download window guides you through either running the program to extract and save the layers, or saving the self-extracting zip file on your computer - allowing you to extract the layers at a later time. You may also want to download the associated Metadata.

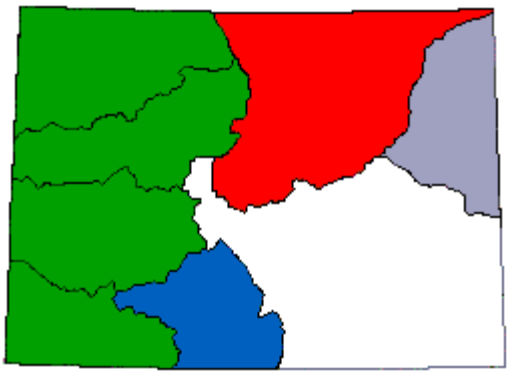


Available layers for each division include:

- Water division/district
- Rivers
- Diversion structures
- Streamflow stations
- Climate stations
- Irrigated acreage (snapshot
- Lakes/Reservoirs
- Soil Data (AWC for CU analysis)
- Contour Lines
- Cities
- Highways
- Counties
- Hydrologic Unit Codes (HUCs)
- Land Use
- PLSS (public land survey system)
- Wells

The GIS coverages can also be accessed and viewed online through the Map Viewer available on the CDSS website.

3. General Water Resources Data



Water resources data is stored in HydroBase; the amount of data varies depending on whether a DSS has been completed in a particular basin (i.e. more data is available in completed DSS basins). Data can be accessed through the CDSS Website (see examples) or through Data Management Interfaces (StateView, TSTool, StateDMI).

Available HydroBase data includes:

- Diversion records
- Streamflow measurements
- Water rights and well permits
- Climate data
- Call chronology
- Reservoir contents
- Groundwater levels
- Irrigated acreage
- Agricultural statistics
- Census data
- Owner/Operator information
- Structure physical information (headgate capacity, area/capacity tables)

4. Modeling Software and Datasets

- StateCU - Consumptive Use Model
- StateMod - Surface Water Model
- Datasets - DMI Command Files and Input Files

Model output for datasets are currently not available for download due to the large size of output files (can be hundreds of MB). Consequently, you must download the input files and software and run the models to create the output. Instructions on how to run StateCU and StateMod are available in the Reference section herein, and can also be found in the StateCU and StateMod User's Manuals available on the CDSS website.

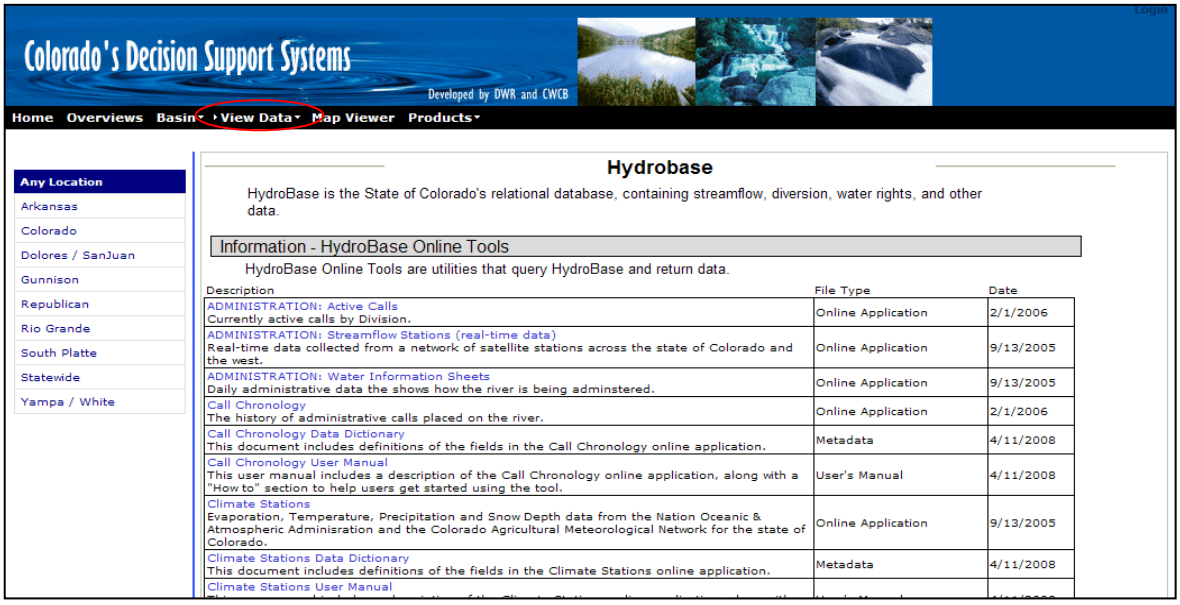
Alternatives are being evaluated to allow users to download model results for "official" datasets. For example, the recent Colorado River Water Availability Study resulted in thousands of model runs and large amounts of information, which presents challenges for data management and access.

CDSS Online Data & Map Viewer Examples

Example: What are the conditional direct diversion rights for energy use in the White River basin?

Step 1 – Find the water rights for a specific district with use type "Industrial". Note that "industrial" includes manufacturing, energy and mining uses.

Select **View Data** tab on the menu bar of the CDSS home page. ****You will need to turn off the Popup blocker**** The **HydroBase** overview window will be opened. Note that this window can also be enabled by selecting **HydroBase** under the **Products** tab. The HydroBase overview window provides the option to view Data Dictionaries to better understand the information in HydroBase and view User Manuals for instructions to query and extract data through the CDSS website.

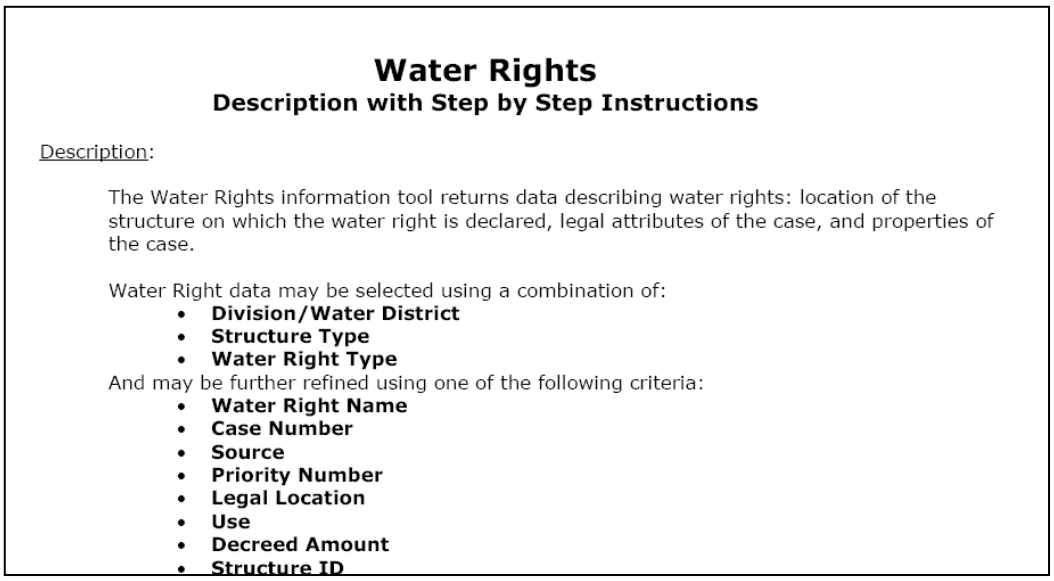


Scroll down to select and open the **Water Rights Data Dictionary** window. Description of water rights information stored in HydroBase, including use types, is enabled to view or print.

Water Rights
Data Dictionary

Column Name	Description	Datatype
Action Comment	This comment describes any issues worth noting for the particular water right action	Character
Action Update	The date the record was inserted/modified	Datetime
Adj Date	Date the water right was settled by judicial procedure, i.e. date that the court awarded a water right o Pre-1969 adjudications: The day the Judge signed the decree o Post-1969 adjudications: The last day of the year of filing	Datetime
Adj Type	Adjudication type coding. AB - abandoned AP - alternate point C - conditional CA - conditional made absolute EX - exchange O - original	Character

Minimize the **Water Rights Data Dictionary** window and select the **Water Rights User Manual** link. **Water Rights Description with Step by Step Instructions** is enabled to view or print.



Water Rights
Description with Step by Step Instructions

Description:

The Water Rights information tool returns data describing water rights: location of the structure on which the water right is declared, legal attributes of the case, and properties of the case.

Water Right data may be selected using a combination of:

- **Division/Water District**
- **Structure Type**
- **Water Right Type**

And may be further refined using one of the following criteria:

- **Water Right Name**
- **Case Number**
- **Source**
- **Priority Number**
- **Legal Location**
- **Use**
- **Decreed Amount**
- **Structure ID**

Other options, which include Data Dictionaries and User's Manuals to view or print as demonstrated for Water Rights, available from the **HydroBase** overview window are:

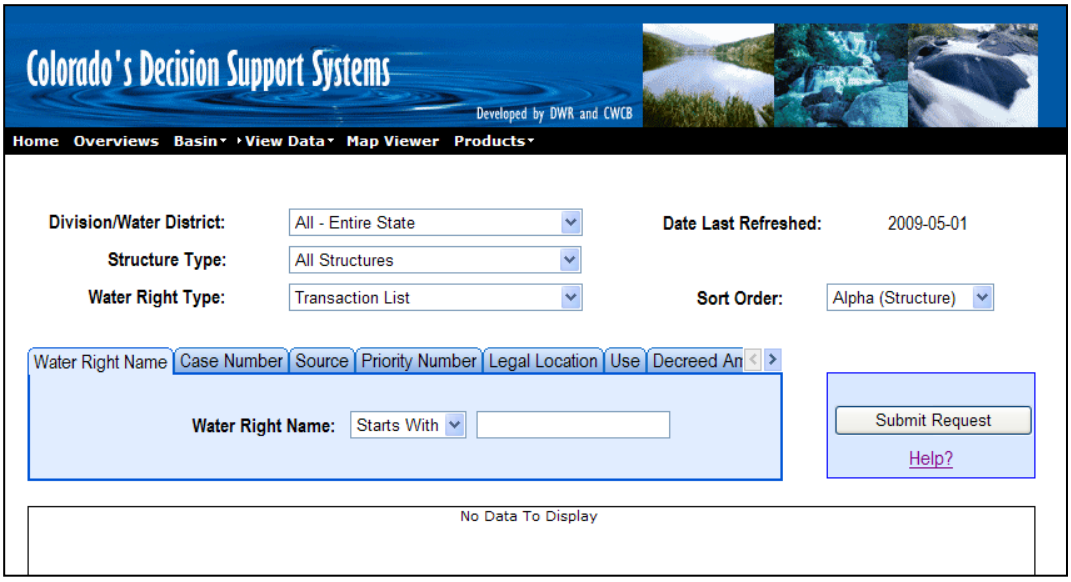
- Call Chronology
- Climate Stations
- Groundwater – Other Data
- Groundwater – Water Levels
- Streamflow Stations
- Structures
- Well Permits

Other options available under the **View Data** menu include:

- **Aquifer Determination Tools:** allows the user to extract aquifer characteristics consistent with the Denver Basin Rules based on a user-input location. Output also identifies whether the aquifer is tributary or non-tributary at a given location.
- **Other Data**: allows access to agricultural statistics acreage and livestock census data.

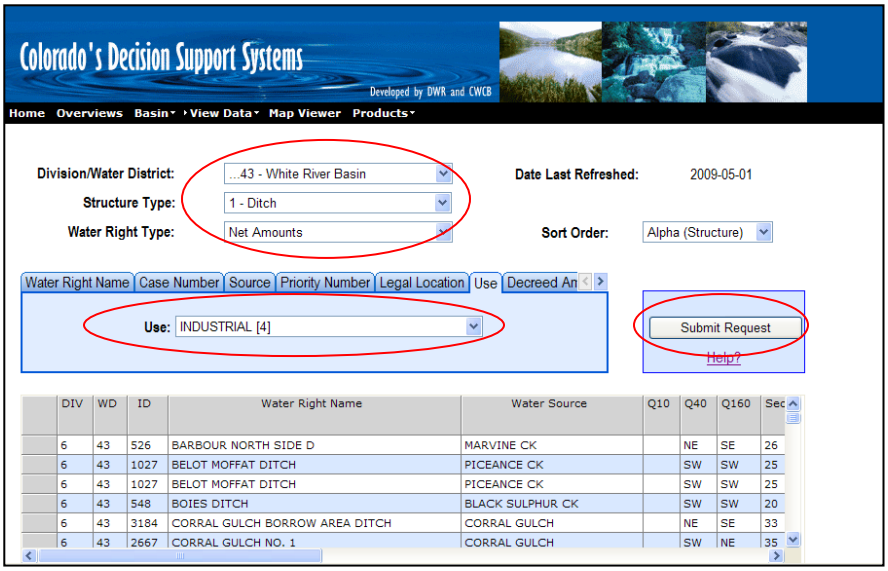
For this example, we are going to look at water rights in the White River basin. To access water rights data, select **Water Rights** from the **HydroBase** overview window, or you can

mouse-over the **View Data** tab on the menu bar, then click *Water Rights*. Both these options open the **CDSS Water Rights Data Selector** screen.



Select the Water District *43 - White River Basin* from the drop down list labeled **Division/Water District**. Further refine the search by selecting *Ditch* from the **Structure Type** drop down list and *Net Amounts* from the **Water Right Type** drop down list.

To define the rest of the search options, select a search tab. For this example, highlight the **Use** tab and select *Industrial* from the **Use** drop down list. Click on **Submit Request** to display the 73 records stored in HydroBase that match the search criteria. Note that the Help? Option will also display the Step by Step Instructions for using this form.

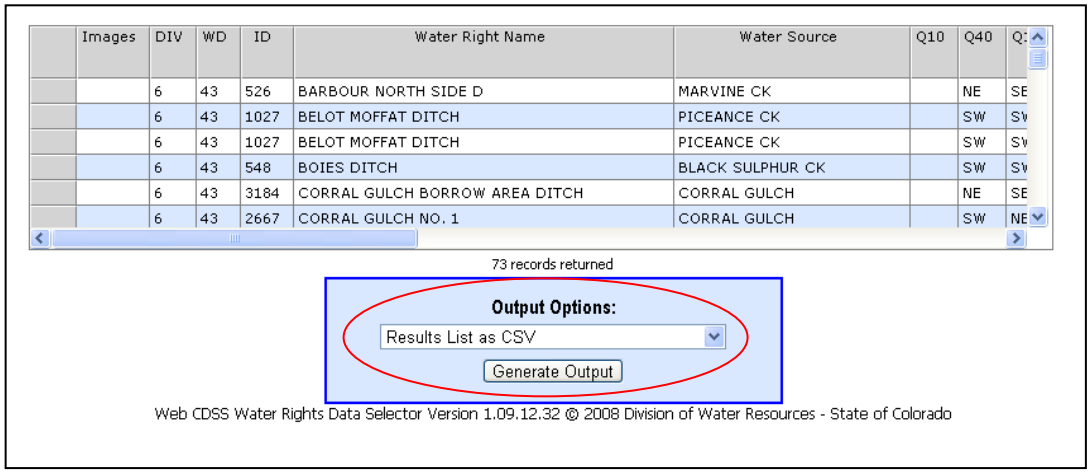


Tip: There is a limit to the number of search results that can be provided when querying information online. If request for information is submitted that yields a large number of results, a warning will be provided to the user (" Search results limited to 500 records. Please refine search for better results"). There are several options to narrow down the search of water rights in HydroBase. The tabs that refine searches cannot currently be used in conjunction, so choose a narrowing search then use Excel to sort and categorize further. For example, this search could be refined by Decreed Amount instead of Use, requesting Decree Type - Cond Rate > 0. Conditional rights for all uses would be selected (instead of the just the Industrial Use defined above), and Excel could be used to further sort and categorize by use.

Step 2 – Output the information to Excel for further analysis

The water rights selected can be output into a standard Tabulation Report by Administration number (Adobe) or the Results List shown in the form can be output in several formats, including Adobe, HTML, Excel, CSV, or Tab Delimited.

Select *Results List as CSV* from the **Output Options** drop-down list and click **Generate Output**. A **File Download** dialogue box will allow the file to be opened in Excel or saved. Choose *Open*.



Tip: Decreed and conditional water right rates are stored in HydroBase as a text field. If you choose the *Export as Excel* option when querying HydroBase, you will need to convert text columns to values to be able to use arithmetic functions, such as summing or averaging. If you save the output as a CSV file, it automatically brings rates and other numbers into Excel as a value field.

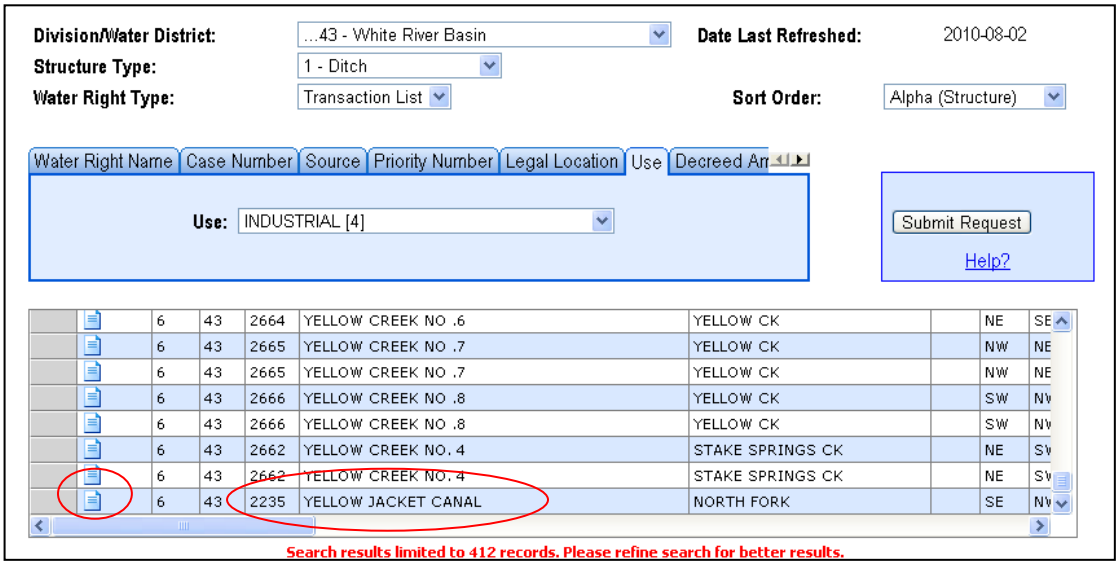
Step 3 – Sum conditional water rights in Excel

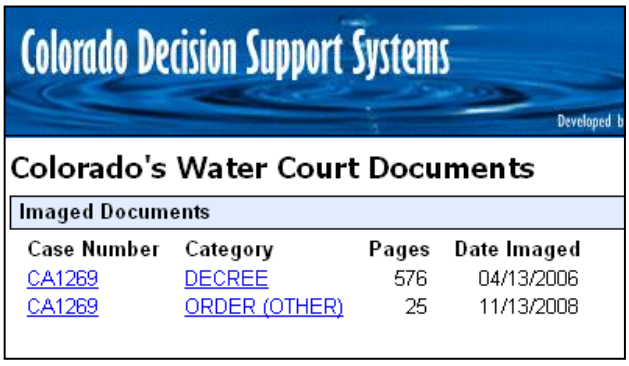
In Excel, sum the Conditional Rates column. There are 35 conditional water rights with a use type of industrial assigned to ditches in the White River basin, for a total diversion rate of 1,412.36 cfs.

Step 4 – View decree for conditional water right on Yellow Jacket Canal

One of the larger conditional rights in the basin is for 500 cfs in Yellow Jacket Canal. The decree for said water right can viewed through the **Water Rights Data Selector** screen. Using the previous search criteria from Step 1, change the **Water Right Type** from *Net Amounts* to *Transaction Amounts*. Click on **Submit Request** to display the 412 transactions stored in HydroBase that match the search criteria. Scroll to the bottom of the transaction list to locate the Yellow Jacket Canal record that corresponds with the conditional water right. To access the scanned decree and associated water court documents, click on the file icon in the left-most column of the Yellow Jacket Canal transaction row.

This will open the **Water Court Documents** window that lists the water court documents that have been scanned and provides links to download the scanned documents. Click on each link to download the water court documents in .pdf format, which you can then save or print.

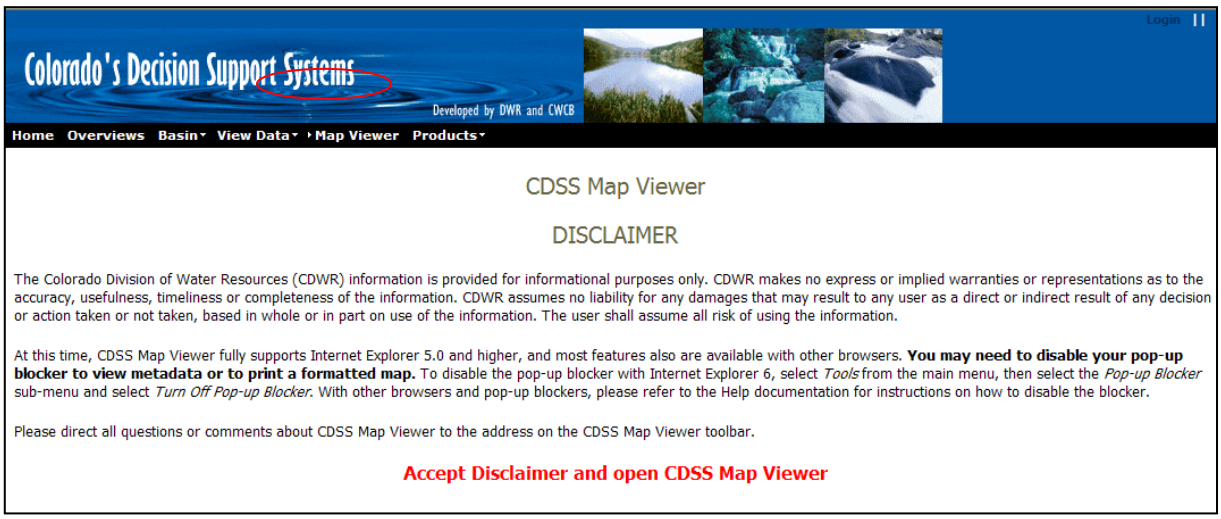


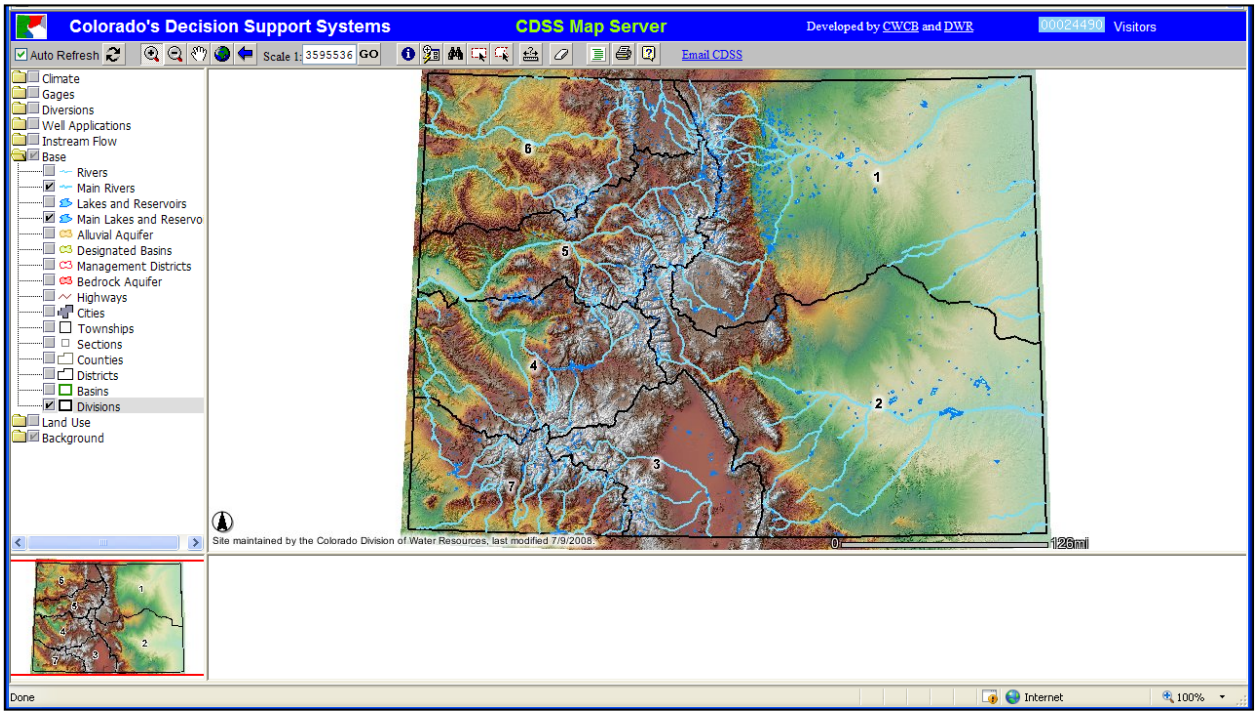


Example: What information is available to help determine available flow for an instream flow request on Tabeguache Creek?

Step 1 – What stream gages and diversion structures can help with the analysis? Diversion records and comments can provide clues and help determine the "right questions" to ask the water commissioner.

If you are a GIS user, you can use the CDSS GIS layers to identify stream gages and diversion structures. If you are not a GIS user, or want to quickly identify nearby features, use the CDSS Map Viewer. Select the **Map Viewer** tab on the CDSS homepage and click on **Accept Disclaimer and open CDSS Map Viewer**. * ***You will need to turn off the Popup blocker** **



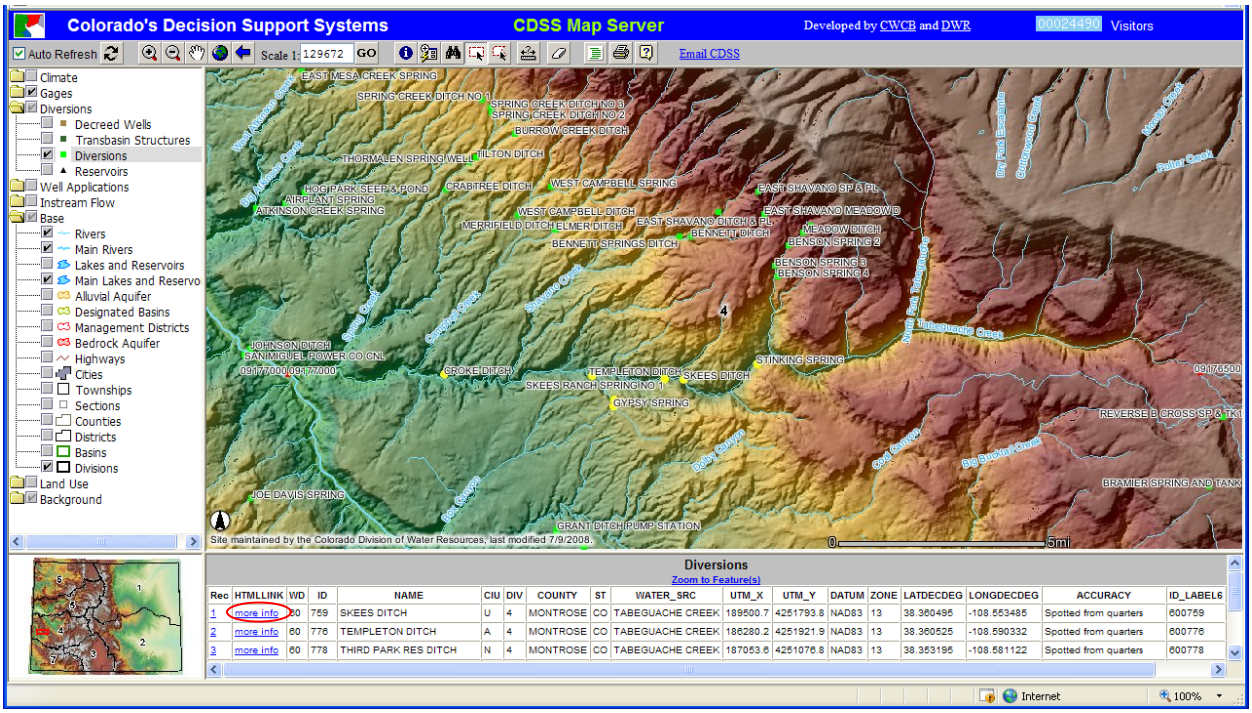


Similar to other map viewer programs, you can zoom, pan, and identify information. The StateIMS User Manual, which includes instructions to zoom, pan, display specific GIS layers, and select features, is available on-line by selecting the [?] button.

Display the **Diversions.. Diversions** layer, the **Base..Rivers** layer and the **Gages** layer by clicking the check box next to the layer name. You can also use the find button  to select a specific diversion or gage station in the area of interest.

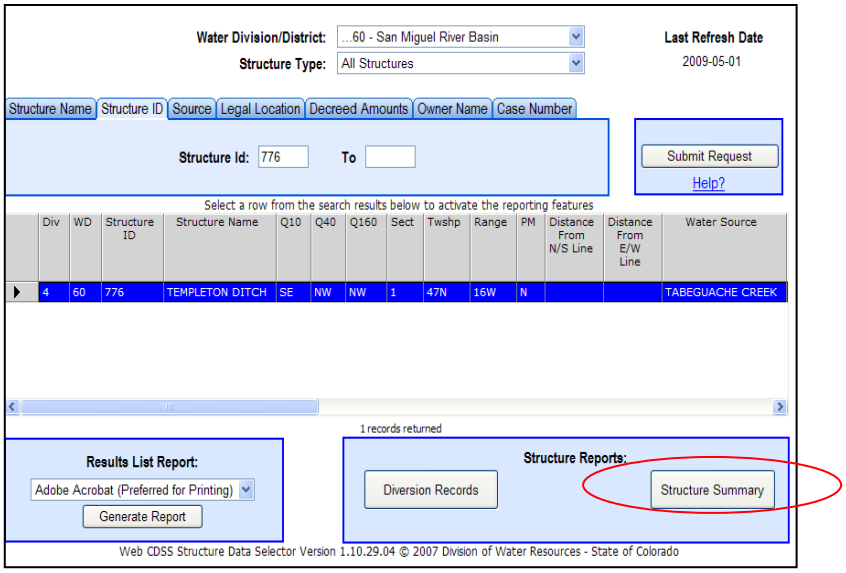
Step 2 – View diversion information available in HydroBase

To select specific features, the layer name in the layer list must be active – click the layer name, making sure it is highlighted gray. Activate the **Diversions** layer and select diversions, using the *select by rectangle* button, graphically select diversions located in the instream flow reach.

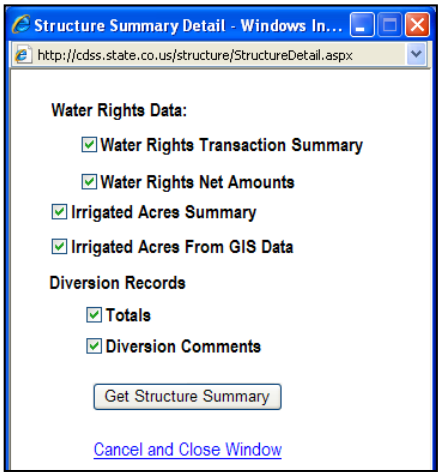


View more about a Feature by selecting more info. This takes you to the CDSS Structure Data Selector window. Highlight the structure and select the **Structure Summary** button to view all information about the structure.

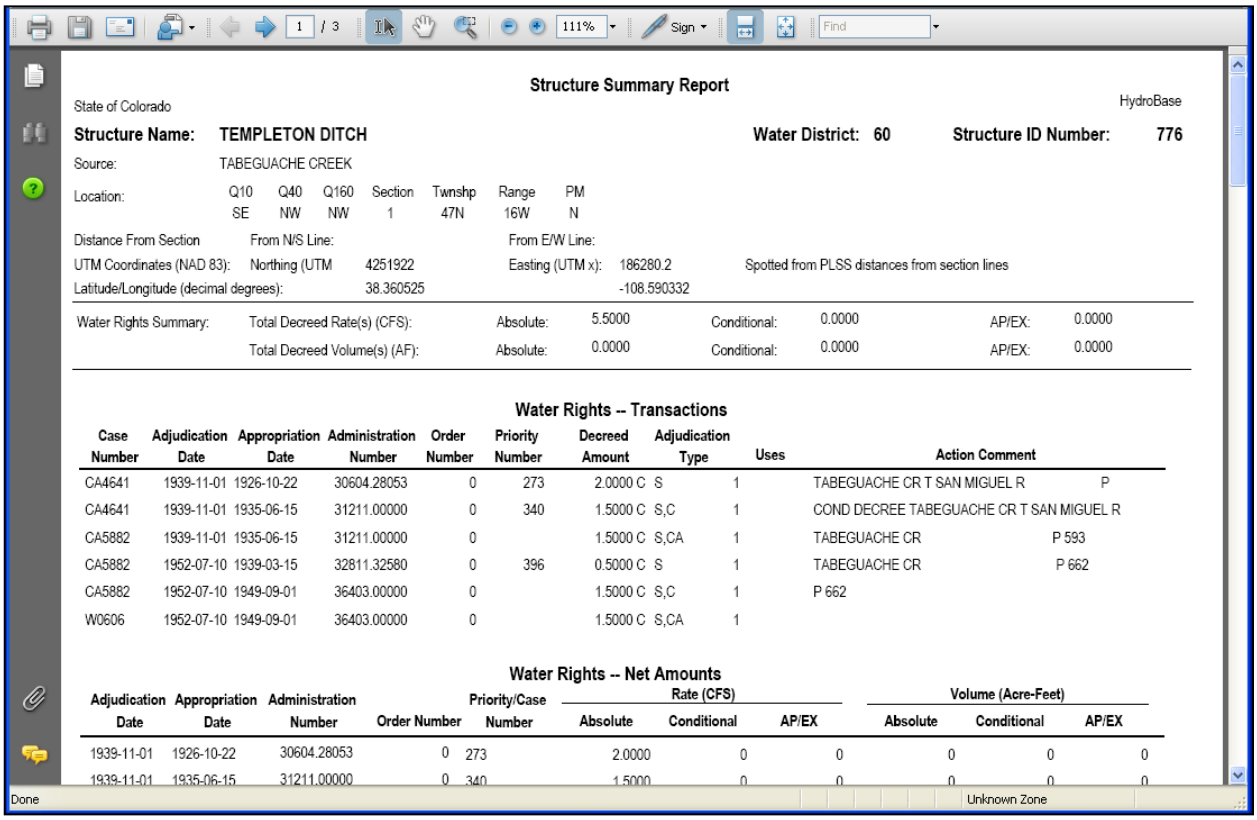
Tip: Start with the Structure Summary when investigating diversions. The summary reports all available information, including source, legal locations, water rights information, monthly diversions, and water commissioner comments.



Specify the information you want to review, and select the **Get Structure Summary** button.



Review the **Structure Summary Report** for information regarding water available to the instream flow right. Note the relative seniority of the ditch water rights and if the water commissioner comments include *No water available*. If *No water available* for a junior ditch, may still be water in the reach. If *No water available* for a senior ditch, likely means the reach is dry.



Structure Summary Report

State of Colorado — HydroBase

Structure Name: TEMPLETON DITCH — **Water District:** 60 — **Structure ID Number:** 776

Source: TABEGUACHE CREEK

Location:	Q10	Q40	Q160	Section	Twnshp	Range	PM
	SE	NW	NW	1	47N	16W	N

Distance From Section — From N/S Line: — From E/W Line:

UTM Coordinates (NAD 83): Northing (UTM 4251922) Easting (UTM x): 186280.2 — Spotted from PLSS distances from section lines

Latitude/Longitude (decimal degrees): 38.360525 -108.590332

Water Rights Summary:						
Total Decreed Rate(s) (CFS):	Absolute:	5.5000	Conditional:	0.0000	AP/EX:	0.0000
Total Decreed Volume(s) (AF):	Absolute:	0.0000	Conditional:	0.0000	AP/EX:	0.0000

Water Rights -- Transactions

Case Number	Adjudication Date	Appropriation Date	Administration Number	Order Number	Priority Number	Decreed Amount	Adjudication Type	Uses	Action Comment
CA4641	1939-11-01	1926-10-22	30604.28053	0	273	2.0000 C	S	1	TABEGUACHE CR T SAN MIGUEL R P
CA4641	1939-11-01	1935-06-15	31211.00000	0	340	1.5000 C	S,C	1	COND DECREE TABEGUACHE CR T SAN MIGUEL R
CA5882	1939-11-01	1935-06-15	31211.00000	0		1.5000 C	S,CA	1	TABEGUACHE CR P 593
CA5882	1952-07-10	1939-03-15	32811.32580	0	396	0.5000 C	S	1	TABEGUACHE CR P 662
CA5882	1952-07-10	1949-09-01	36403.00000	0		1.5000 C	S,C	1	P 662
W0606	1952-07-10	1949-09-01	36403.00000	0		1.5000 C	S,CA	1	

Water Rights -- Net Amounts

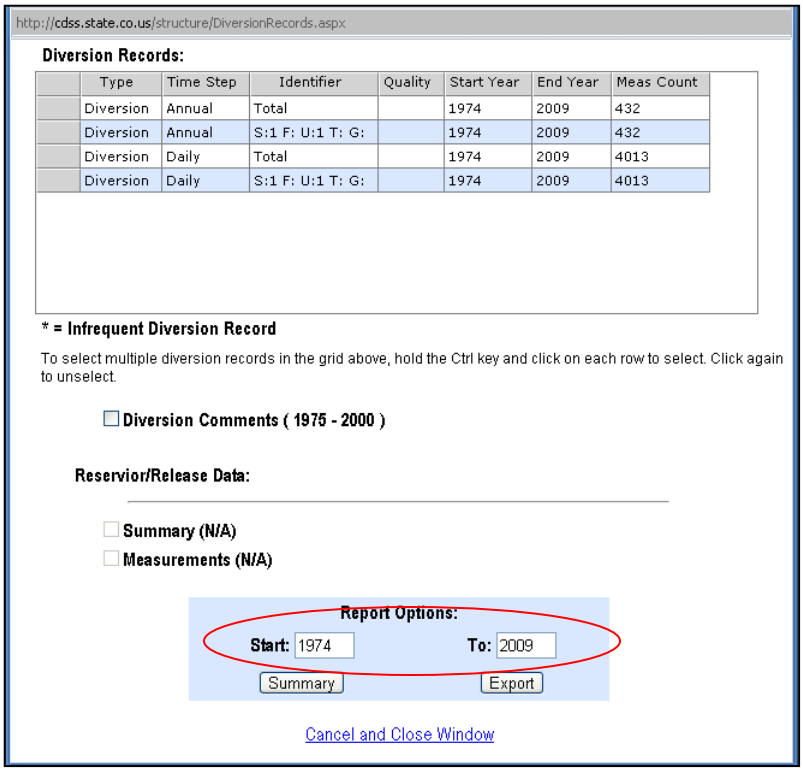
Adjudication Date	Appropriation Date	Administration Number	Order Number	Priority/Case Number	Rate (CFS) Absolute	Rate (CFS) Conditional	Rate (CFS) AP/EX	Volume (Acre-Feet) Absolute	Volume (Acre-Feet) Conditional	Volume (Acre-Feet) AP/EX
1939-11-01	1926-10-22	30604.28053	0	273	2.0000	0	0	0	0	0
1939-11-01	1935-06-15	31211.00000	0	340	1.5000	0	0	0	0	0

Done — Unknown Zone

Close the **Structure Summary Report** and choose the **Diversion Records** button. Available diversion classifications and time-steps will be presented, as outlined in the Water Commissioners Handbook.

Tip: Daily records for senior ditches can provide an indication of the minimum flow in a reach during the irrigation season on streams with no gaged data. Diversions classes can identify how much flow in the river is non-native (from reservoir releases or transbasin diversions). If senior ditches routinely divert less than decree, questions to ask the Water Commissioner include "Are they taking less than their decree because they don't have the demand for the water? Is there a physical water limitation? Is there a legal water limitation?" Infrequent diversion records often include annual totals for ditches infrequently visited by the water commissioner.

Highlight the Diversion Record of interest (in this example select Diversion Daily Total), chose the **Summary** button to review daily diversions or chose **Export** to save in text file or to open in Microsoft Excel.



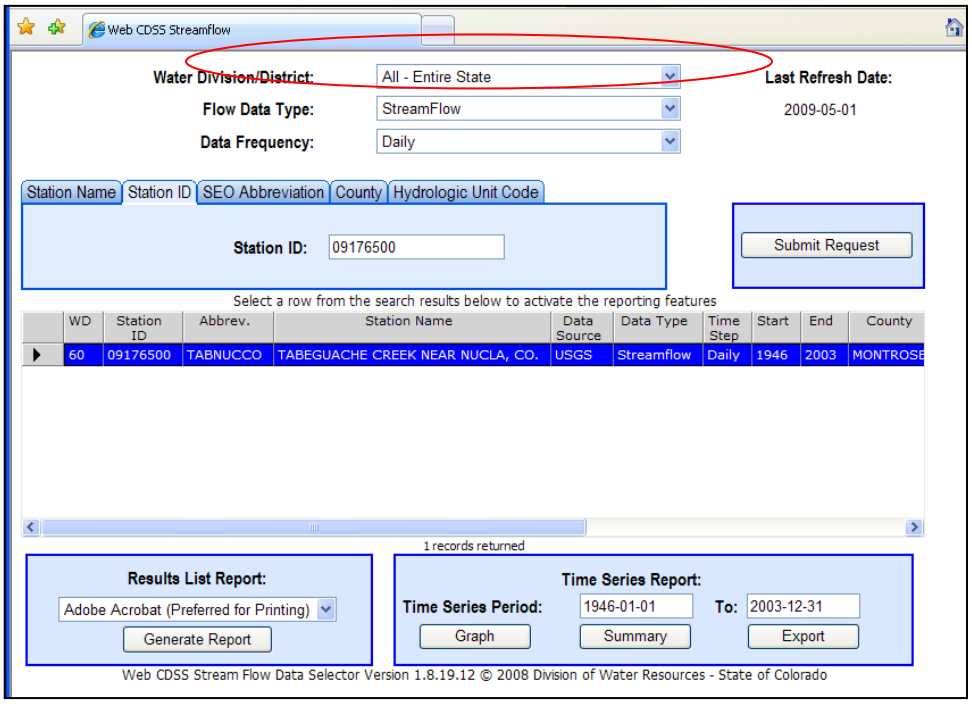
Step 3 – View stream gage information available in HydroBase

Using the CDSS Map Server, activate the **Gage-Historic** layer and select diversions, using the *select by rectangle* button, graphically select nearby stream gages located near the instream flow reach. For this example, it may be useful to view the historic flow at the gage in the upstream reaches of Tabeguache Creek to get a sense of physical flows. Because several tributaries contribute flows before the instream flow segment, this could be considered the minimum flow likely to be seen in the reach.

View more about the Tabeguache Creek near Nucla gage Feature by selecting more info. This takes you to the CDSS Stream flow Data Selector window. Highlight the station and select the **Summary** button to view information about the structure and get a sense of data availability. In this example, data is only available from April 1946 through September 1953.

Tip: When investigating tributaries with limited historic streamflow measurements, the information is valuable especially if you understand the types of years and/or months (wet, dry, average) it represents. Use a long-term gage in the same basin to 'rank' flow years and extend those categories to your limited gage. This can be done easily using TSTool.

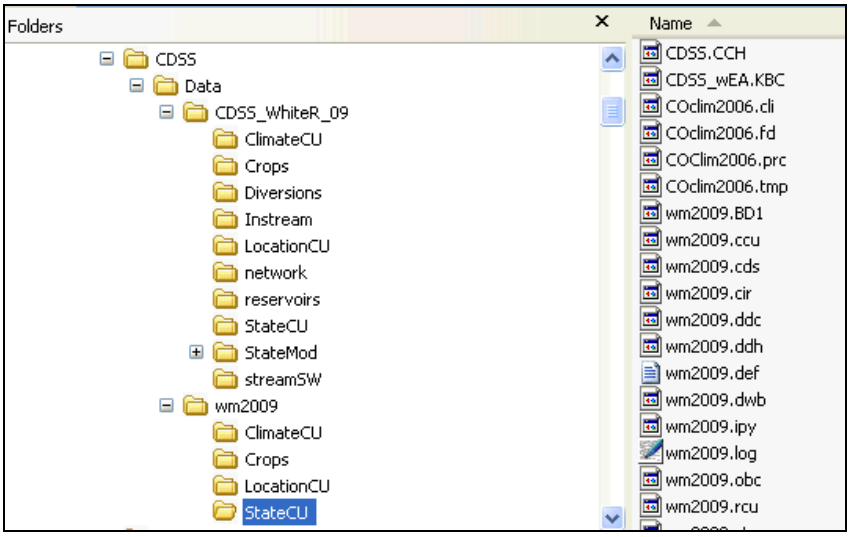
To view or export daily data, change the **Data Frequency** drop-down menu to “Daily” and hit the **Submit Request** button.



StateCU and StateMod Model Dataset Files – Organization and File Creation Overview

One of the primary outcomes of CDSS is quality-controlled baseline datasets that can be used in specific applications such as statewide and basin water supply planning, climate change evaluation, etc. Consequently, it is useful to understand the end result of modeling efforts in order to provide context for discussions of data and tools. If you are not a modeler, you may still find value in using the model results for additional analysis and decision-making.

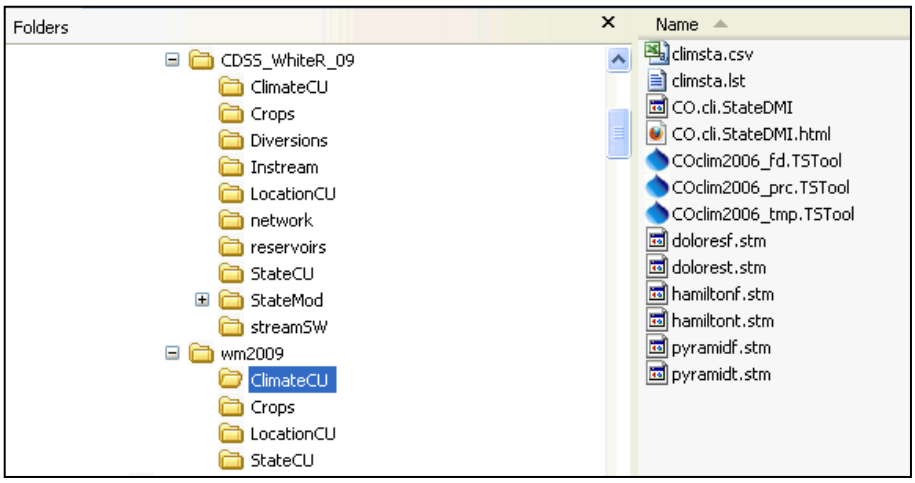
StateCU and StateMod datasets are available for download on the CDSS web site (see http://cdss.state.co.us Products links for "Consumptive Use" and "Surface Water Model"). The default location for files when installed is C:\CDSS\data, and will result in an organization similar to the following:



StateCU and StateMod File Organization within CDSS

The intent is to allow each StateCU and StateMod dataset to be distributed and run independently of each other. Consequently, any dependency requires that files are copied from one dataset to the other.

Final dataset files are accumulated in a folder that matches the model name (e.g., wm2009\StateCU). The files in this folder, as illustrated on the right side of the above figure, are the minimum set of files necessary to run the model. Data processing necessary to create the final input files occurs in parallel folders that have names indicating the data category (e.g., ClimateCU contains climate station data), as illustrated in the following figure:



StateCU File Organization for Climate Station Data

Each supporting folder contains initial data files (e.g., lists of locations to be processed), data that does not exist in HydroBase, command files for TSTool (*.TSTool) and StateDMI (*.StateDMI) , and other files used by modelers (such as quality control checks). Running the command files results in the creation of artifacts such as reports, and model files, which are written to the main model folder. The sequence of data processing is described in dataset documentation. Additionally, each model file has comments at the top that indicate how the file was created, as illustrated in the following figures:

```
#HeaderRevision 0
#
# File generated by...
# program:     TSTool 9.01.01 (2009-03-10)
# user:        Kara
# date:        Thu Jul 02 15:27:52 MDT 2009
# host:        Ltkara
# directory:   C:\Projects\CRWAS\Structure Scenarios\wm2006\ClimateCU
# command line: TSTool
#----
# -----------------------------------------------------------------------
# Command file name: "C:\Projects\CRWAS\Structure Scenarios\wm2006\ClimateCU\COclim2006_tmp.TSTool"
# Commands:
# SetOutputPeriod(OutputStart="01/1950",OutputEnd="12/2006")
# SetOutputYearType(OutputYearType=Calendar)
# #
# # Fill Altenbern (0214) with Grand Junction (3488)
# 0214.NOAA.TempMean.Month~HydroBase
# 3488.NOAA.TempMean.Month~HydroBase
# FillRegression(TSID="0214.NOAA.TempMean.Month",
   IndependentTSID="3488.NOAA.TempMean.Month",NumberOfEquations=OneEquation,
   Transformation=Linear)
# Free(TSList=LastMatchingTSID,TSID="3488.NOAA.TempMean.Month")
# # Fill Baggs (0484) with filled Hayden (3867)
# # Note Baggs is a Wyoming Station, read from HB
# 0484.NOAA.TempMean.Month~HydroBase
# 3867.NOAA.TempMean.Month~HydroBase
... commands omitted...
# SortTimeSeries()
```

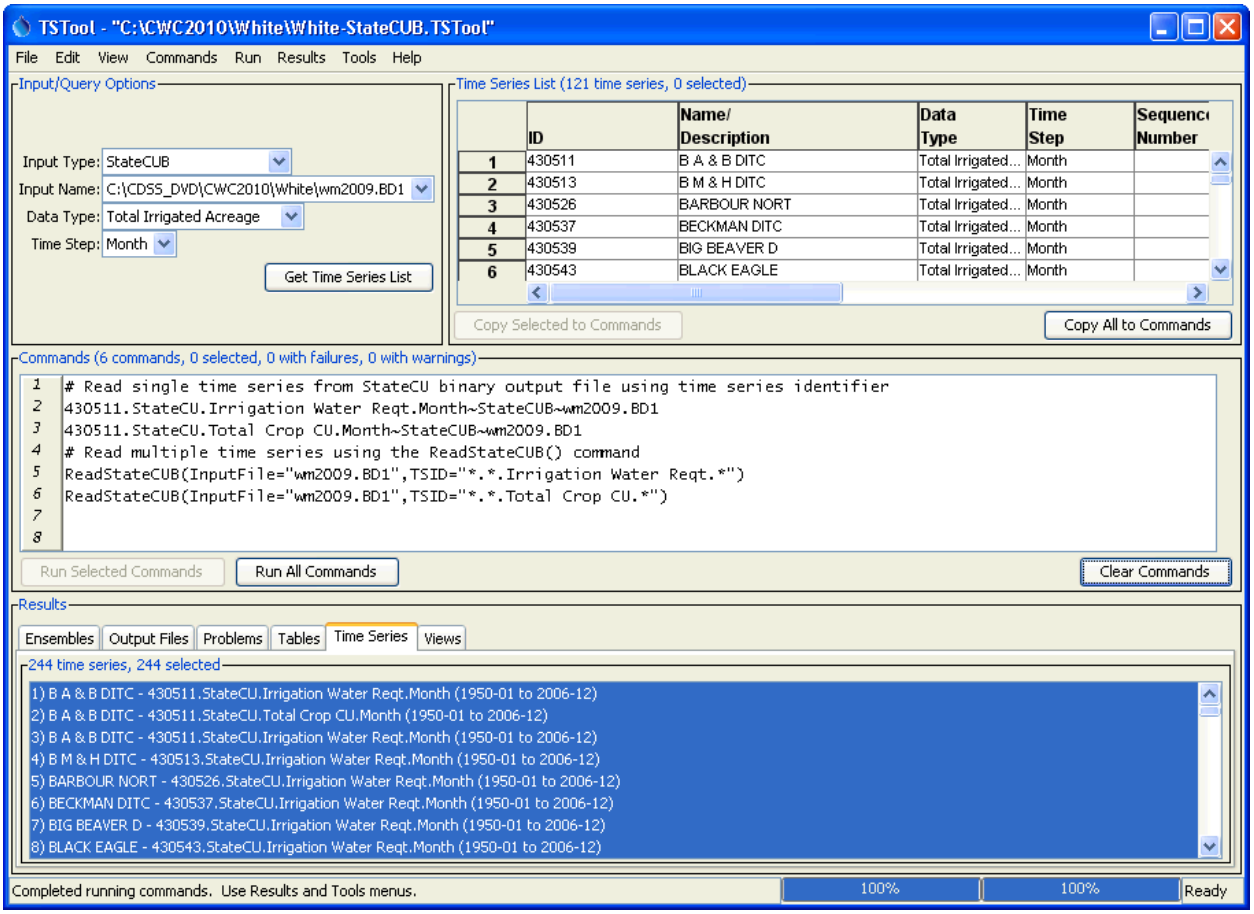
```
# WriteStateMod(TSList=AllTS,OutputFile="..\StateCU\COclim2006.tmp",Precision=2)
#
# ------------------------------------------------------------------------------
# HydroBase database is: HydroBase_CO_20080901 on Ltkara
# HydroBase.db_version:  design version: 20080701  last data change: 20080901
# HydroBase table structure for software is at least 2007052520070525
# HydroBase input name is "".
# Stored procedures are being used.
# ------------------------------------------------------------------------------
#
#-------------------------------------------------
#
#>EndHeader
#>
#> Yr ID        Jan    Feb    Mar    Apr    May    Jun    Jul    Aug    Sep    Oct    Nov    Dec    Average
#>-e-b----------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb--------e
  1/1950  -    12/2006   F  CYR
1950 0214        20.24  30.17  36.34  46.43  52.12  62.52  66.17  65.12  58.40  53.60  36.58  31.11    46.57
1950 0484        17.12  24.23  31.02  41.59  45.70  56.96  62.07  60.96  54.66  48.99  34.62  24.33    41.85
```

Example StateCU Input File Created by TSTool Illustrating Header Comments

Consequently, with information in model input file headers, it is possible to determine the following about its creation: the software version, date, user, computer and folder, HydroBase version, and commands. Using the DMI software such as TSTool and StateDMI allows creation of a dataset to be automated and repeated, which consequently reduces the amount of time that modelers spend on data manipulation tasks. TSTool processes time series and StateDMI processes other model files such as stations and rights.

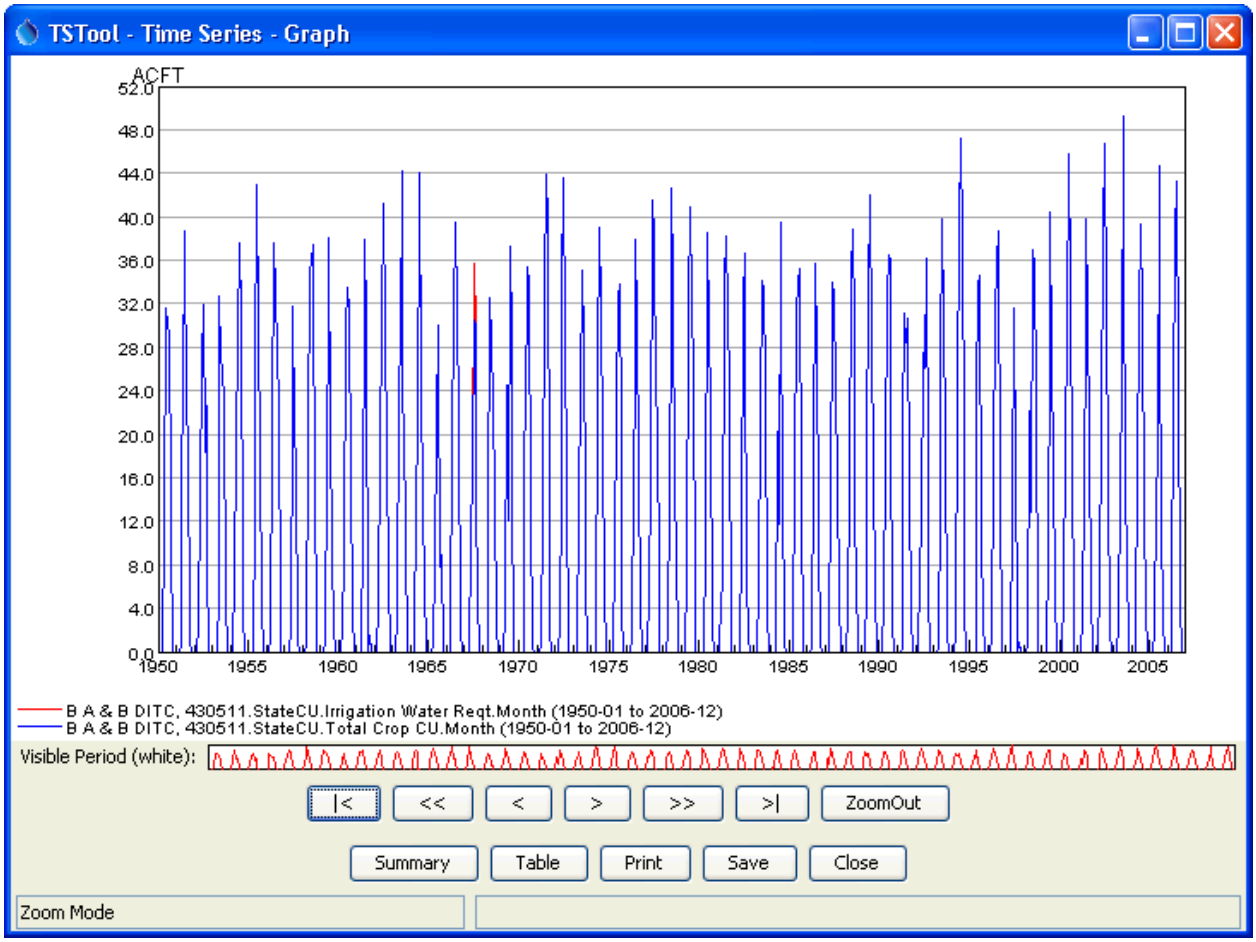
Example: Viewing Consumptive Use Model (StateCU) Data and Results

The complete White River StateCU dataset is provided in the C:\Data folder on the HydroBase DVD. However, to simplify this example, model results have been copied to the CWC2010\White folder. StateCU creates text report files and stores its results in a binary output file. The following figures illustrate how TSTool commands can be used to read the binary results for graphing and data processing:



Example TSTool Command File to Read StateCU Binary Output File

After running the commands, to view the time series, select one or more time series in the Results area, right click, and select "Graph – Line", which will result in a graph as shown in the following figure.



Example TSTool Graph Created from StateCU Binary Output File

This simple example illustrates how TSTool can be used to efficiently extract model results. The example can be updated to select other data types. Refer to the TSTool training presentations and documentation for additional information.

What type of information is available from StateCU?

The detailed water balance output file (*.dwb) is created during the simulation of the StateCU consumptive use model program. The water balance summary for each ditch provides information on a monthly time step for each component of the consumptive use calculation. The following example is the detailed water balance for Sizemore Ditch (Structure ID 430929) in the White River basin.

ID: 430929 SIZEMORE DIT

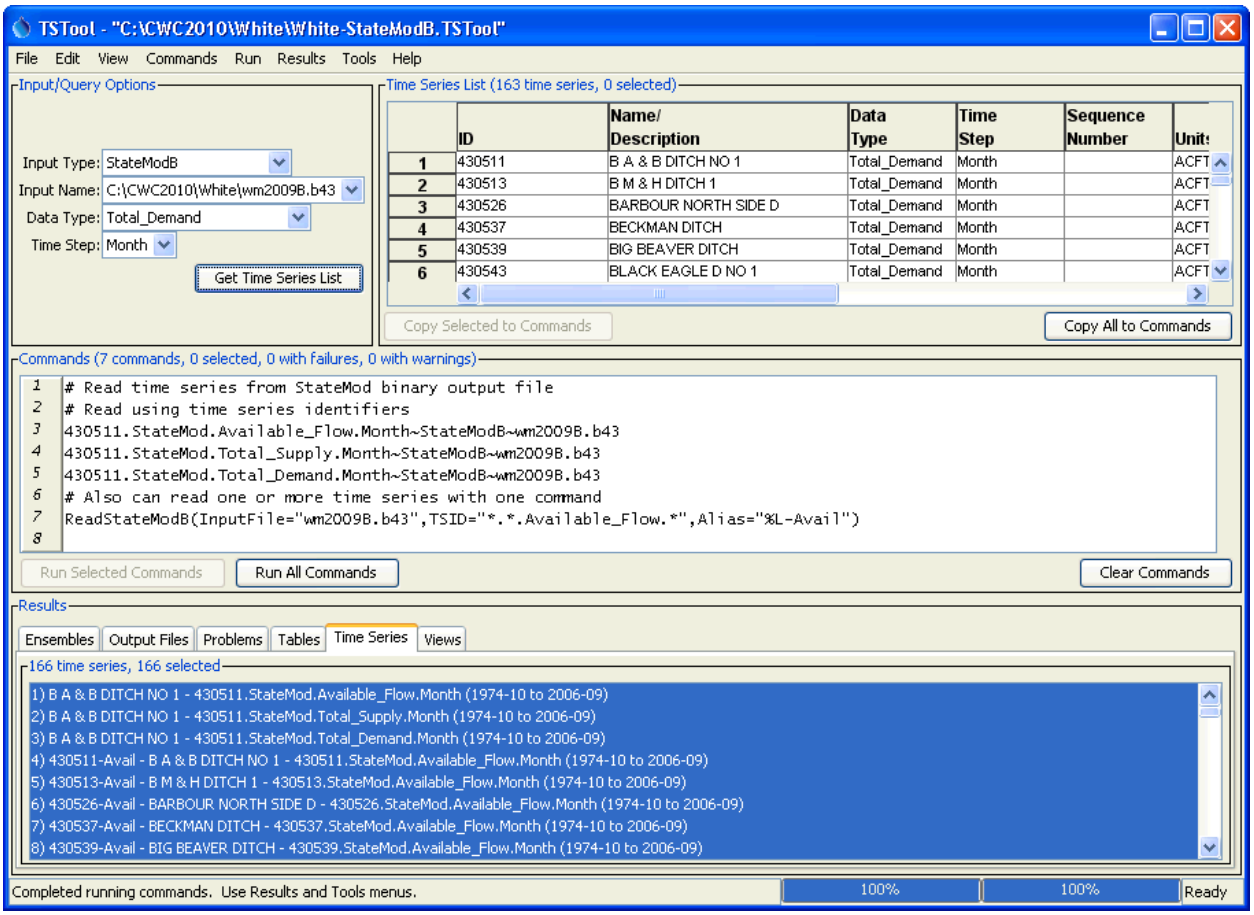
Soil Moisture Capacity: 13.39 af
Starting Soil Moisture: 6.69 af
Maximum Irrigation Efficiency: 0.54

Yearly Totals 1950 - 2006

Year/ Month	Analysis Method	Potential Crop ET	Effect Precip	Irrigation Water Requirement (IWR)	River Diversion Accounting					Soil Moisture Contents	Estimated Crop CU		
					Historic Diversion	River Diversion To			Efficiency Calc.		From Diversion	From Soil Moisture	Total
						CU	Soil Zone	Non-Consumed	Div to CU and SM	System Effic (%)			
1998													
Crops	GRASS_PAST	Total											
Acres	26.	26.											
Jan	Calculated	0.	0.	0.	0.	0.	0.	0.	0.	0.	11.	0.	0.	0.
Feb	Calculated	0.	0.	0.	0.	0.	0.	0.	0.	0.	11.	0.	0.	0.
Mar	Calculated	0.	0.	0.	0.	0.	0.	0.	0.	0.	11.	0.	0.	0.
Apr	Calculated	2.	1.	1.	0.	0.	0.	0.	0.	0.	10.	0.	1.	1.
May	Calculated	13.	1.	12.	0.	0.	0.	0.	0.	0.	0.	0.	10.	10.
Jun	Calculated	17.	6.	11.	192.	11.	13.	168.	24.	13.	13.	11.	0.	11.
Jul	Calculated	18.	4.	14.	184.	14.	0.	170.	14.	8.	13.	14.	0.	14.
Aug	Calculated	11.	2.	9.	0.	0.	0.	0.	0.	0.	4.	0.	9.	9.
Sep	Calculated	9.	2.	8.	0.	0.	0.	0.	0.	0.	0.	0.	4.	4.
Oct	Calculated	5.	3.	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Nov	Calculated	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Dec	Calculated	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

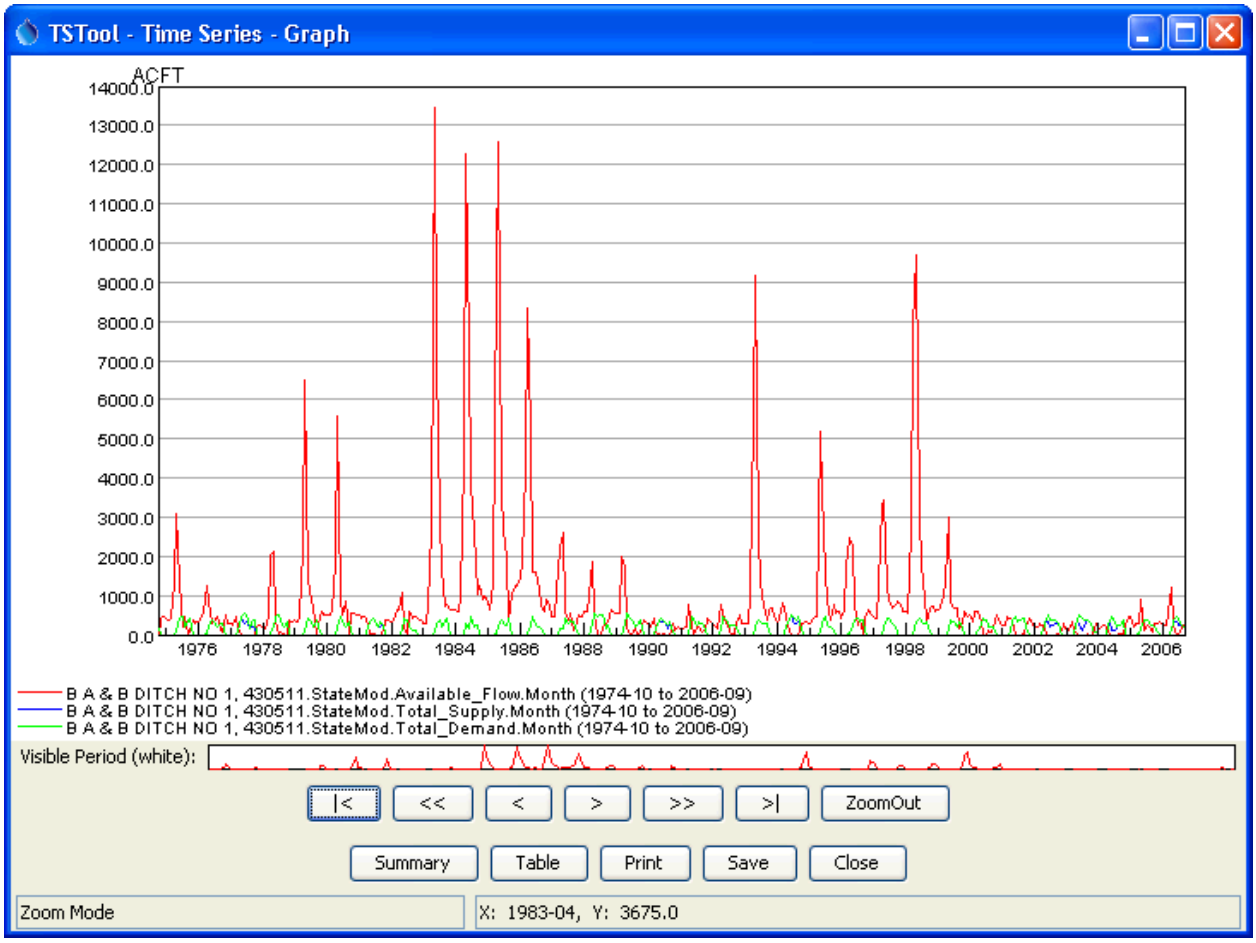
Example: Viewing StateMod Model Data and Results

The complete White River StateMod dataset is provided in the C:\Data folder on the HydroBase DVD. However, to simplify this example, model results have been copied to the CWC2010\White folder. StateMod creates text report files and stores its results in multiple binary output files, depending on model station type and time step. The following figures illustrate how TSTool commands can be used to read the binary results for graphing and data processing:



Example TSTool Command File to Read StateMod Binary Output File

After running the commands, to view the time series, select one or more time series in the Results area, right click, and select "Graph – Line", which will result in a graph as shown in the following figure.



Example TSTool Graph Created from StateMod Binary Output File

This simple example illustrates how TSTool can be used to efficiently extract model results. The example can be updated to select other data types. Refer to the TSTool training presentations and documentation for additional information.

What type of information is available from StateMod?

The detailed diversion output file (*.xdd) is created during the simulation of the StateMod surface water model program. The diversion summary for each ditch provides information on a monthly time step for each component of the surface water model simulation. The following example is the detailed diversion summary for Sizemore Ditch (Structure ID 430929) in the White River basin.

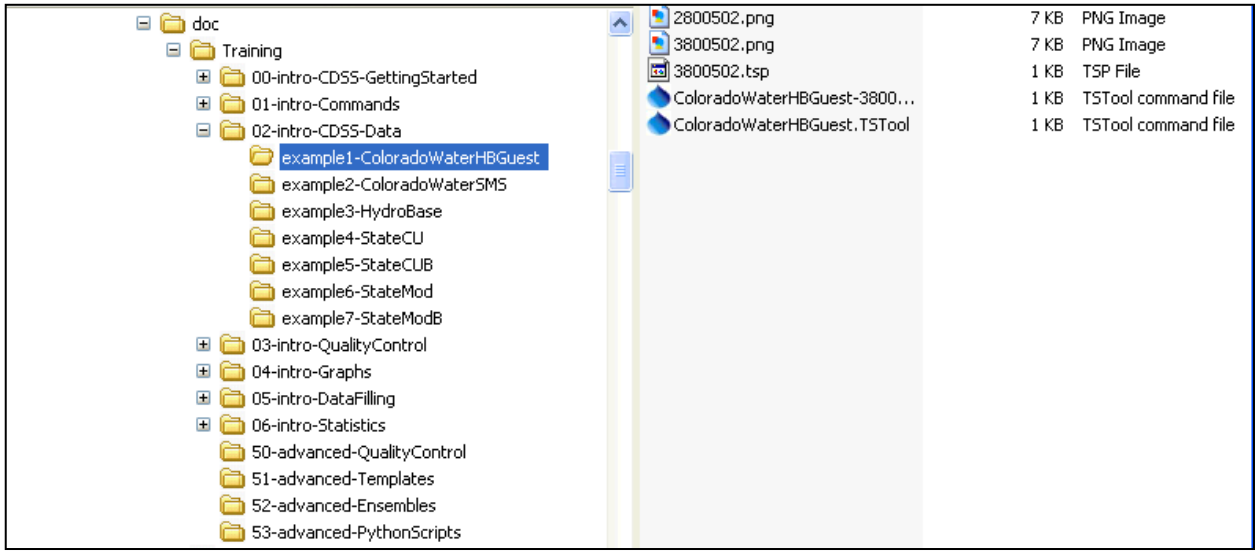
```
   Diversion Summary  ACFT
    WHITE RIVER BASIN
    Historic Diversions

    STRUCTURE ID (0 = total)   : 430929             84
    STRUCTURE ACCT (0 = total): 0
    STRUCTURE NAME             : SIZEMORE DITCH 1
    RIVER LOCATION - FROM      : 430929       SIZEMORE DITCH 1    _DIV
    RIVER LOCATION - TO        : 430929       SIZEMORE DITCH 1    _DIV


    STRUCTURE DATA             :     #       cfs     af@30     af@31
                                   _____ _________ _________ _________
      Diversion Capacity       :     1        5.       298.      307.
      Diversion Rights         :     2     1001.     59565.    61550.
      Well Capacity            :     1        0.        0.        0.
      Well Rights              :     0        0.        0.        0.
```

				Demand		From River By					From Carrier By							Shortage		Water Use			
Structure ID	River ID	Year	Mo	Total NA (1)	CU NA (2)	Priorty (+) (3)	Storage (+) (4)	Exc_Pln (+) (5)	Loss (-) (6)	From Well (+) (7)	Priorty (+) (8)	Sto_Exc (+) (9)	Loss (-) (10)	Carried Exchang Bypass (+) (11)	From SoilM NA (12)	Total Supply NA (13)	Total Short NA (14)	CU Short NA (15)	CU NA (16)	To SoilM NA (17)	Total Return NA (18)	Loss NA (19)
430929	430929	1997	OCT	6.	1.	6.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	0.	0.	1.	0.	5.	0.
430929	430929	1997	NOV	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
430929	430929	1997	DEC	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
430929	430929	1998	JAN	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
430929	430929	1998	FEB	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
430929	430929	1998	MAR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
430929	430929	1998	APR	3.	1.	3.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.	0.	0.	1.	0.	2.	0.
430929	430929	1998	MAY	55.	12.	55.	0.	0.	0.	0.	0.	0.	0.	0.	0.	55.	0.	0.	12.	0.	42.	1.
430929	430929	1998	JUN	192.	11.	192.	0.	0.	0.	0.	0.	0.	0.	0.	0.	192.	0.	0.	11.	0.	176.	5.
430929	430929	1998	JUL	184.	14.	184.	0.	0.	0.	0.	0.	0.	0.	0.	0.	184.	0.	0.	14.	0.	165.	5.
430929	430929	1998	AUG	75.	9.	75.	0.	0.	0.	0.	0.	0.	0.	0.	0.	75.	0.	0.	9.	0.	64.	2.
430929	430929	1998	SEP	53.	8.	0.	0.	0.	0.	0.	0.	0.	0.	0.	8.	8.	45.	0.	8.	0.	0.	0.
430929	430929	1998	TOT	568.	56.	515.	0.	0.	0.	0.	0.	0.	0.	0.	8.	523.	45.	0.	56.	0.	453.	14.

Station In/Out					Station Balance						
Upstrm Inflow (+) (20)	Reach Gain (+) (21)	Return Flow (+) (22)	Well Deplete (-) (23)	From/To GW Stor (+) (24)	River Inflow (+) (25)	River Divert (-) (26)	River by Well (-) (27)	River Outflow (+) (28)	Avail Flow NA (29)	Control Location NA (30)	Control Right NA (31)
10991.	0.	0.	0.	0.	10991.	6.	0.	10985.	6680.	NA	-1.000
7974.	0.	0.	0.	0.	7974.	0.	0.	7974.	3809.	NA	-1.000
7214.	0.	0.	0.	0.	7214.	0.	0.	7214.	2910.	NA	-1.000
6530.	0.	0.	0.	0.	6530.	0.	0.	6530.	2226.	NA	-1.000
5523.	0.	0.	0.	0.	5523.	0.	0.	5523.	1619.	NA	-1.000
6765.	0.	0.	0.	0.	6765.	0.	0.	6765.	2461.	NA	-1.000
10954.	0.	0.	0.	0.	10954.	3.	0.	10951.	6786.	NA	-1.000
36317.	0.	0.	0.	0.	36317.	55.	0.	36262.	31958.	NA	-1.000
28882.	0.	0.	0.	0.	28882.	192.	0.	28690.	24524.	NA	-1.000
16662.	0.	0.	0.	0.	16662.	184.	0.	16478.	12174.	NA	-1.000
9476.	0.	0.	0.	0.	9476.	75.	0.	9401.	5097.	NA	-1.000
7326.	0.	0.	0.	0.	7326.	0.	0.	7326.	0.	430694	999.000
154614.	0.	0.	0.	0.	154614.	515.	0.	154099.	100244.	NA	-1.000

Additional Examples of Reading CDSS Data

Other CDSS data types can be accessed by TSTool, using HydroBase, model files, or web services as the source of the data. TSTool examples are provided with training materials when TSTool software is installed (see the C:\CDSS\TSTool-Version\doc\Training folder), as shown in the following figure:



Each top level folder (e.g., 02-intro-CDSS-Data) includes a presentation as a PDF, which provides background information and step-by-step instruction for using TSTool features. Working command files are also provided in example folders and can opened and run in TSTool. Examples that use web services for input require internet, and HydroBase is required for the HydroBase examples. Note that examples may use abbreviated data inputs in order to minimize the size of the TSTool software distribution.

Examples include:

- Diversion record retrieval using TSTool with an online HydroBase web service
- Real-time streamflow data retrieval using TSTool with an online HydroBase web service
- Accessing historical streamflow data using TSTool and locally installed HydroBase
- Accessing StateCU input data using TSTool
- Accessing StateCU results using TSTool
- Accessing StateMod input data using TSTool
- Accessing StateMod results using TSTool

Similar training examples are available for StateDMI.

References

Historical Crop Consumptive Use Analysis - Review

Definitions

1. Monthly **P**otential **C**onsumptive **U**se (**PCU**) = *crop evapotranspiration*

- **Modified Blaney-Criddle** – outlined in SCS Technical Release 21
  (*most common*)

$$\mathbf{PCU = k * f}$$

$f = t * p/100$
$k = k_t * k_c$

where:
t = mean monthly air temperature
p = mean monthly percentage of annual daylight hours
k_t = temperature coefficient
k_c = crop coefficient

- **Original Blaney-Criddle** – outlined in FAO-24
  (*typically used w/ calibrated coefficients developed from lysimeter data*)

- **Pochop Method** – outlined in Elevation – A Bias Error in SCS Blaney-Criddle ET Estimates
  (*for bluegrass*)

Input Data:

- **Climate** – monthly temperature and frost dates
- **Latitude** – used to calculate daylight hours
- **Crop Type**
- **Crop Coefficients/Growing Season Triggers**

2. Monthly Effective Precipitation (Re) = *amount of monthly precipitation effective at serving crop needs*

Methods:

- **SCS** – outlined in SCS Technical Release 21
  (*dependent on net depth of application and average monthly PCU*)

- **USBR**
  (*linearly related to the monthly precipitation*)

Input Data:

- **Climate** – monthly total precipitation

- **Net Application Depth**

Adjustments to Climate Data:

- **Orographic Adjustment**– outlined in ASCE Manual 70

  User Supplied adjustments, typical values:

  Temperature – Adjust the climate station temperature down by 3.6 degrees per 1,000 feet rise in elevation between the irrigated acreage and the climate station location (based on the standard meteorological Environmental Lapse Rate)

  Precipitation – Compute the ratio of the annual precipitation at the location of the irrigated acreage (using average annual Isohyetal maps) divided by the average annual precipitation at the climate station. Monthly values at the climate station are then multiplied by the ratio to estimate monthly values at the irrigated lands.

  - Adjusts climate station data to location of irrigated lands

  - Used when representative climate station data not available (e.g. high altitude irrigated areas)

  - General "weight" climate station data if irrigated lands are located between multiple climate stations, in lieu of adjusting raw data

Adjustments to PCU:

- **Use Crop Coefficients Representing Local Conditions**
- **Elevation Adjustment** – outlined in ASCE Manual 70

  10% upward for each 1,000 meters increase in elevation above MSL

  - Corrects for lower mean temp at higher elevations that do not reflect crops' reaction to warm daytime temp and cool nights
  - Applies to Modified B-C and Original B-C method (Pochop has separate built-in altitude adjustment)
  - Applies to any crop type

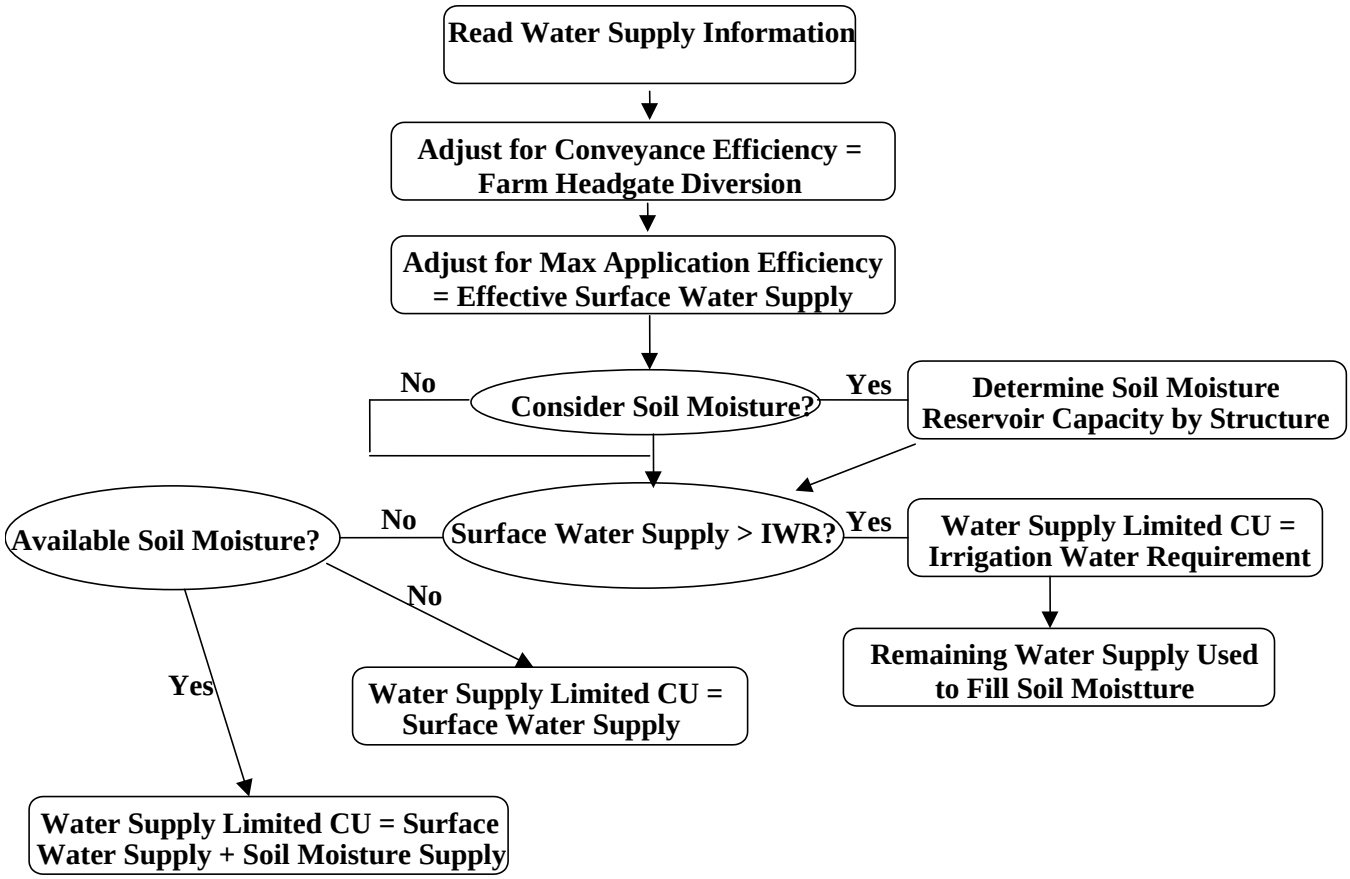
3. Monthly Crop Irrigation Requirement = the amount of water the crops could use from a full irrigation supply

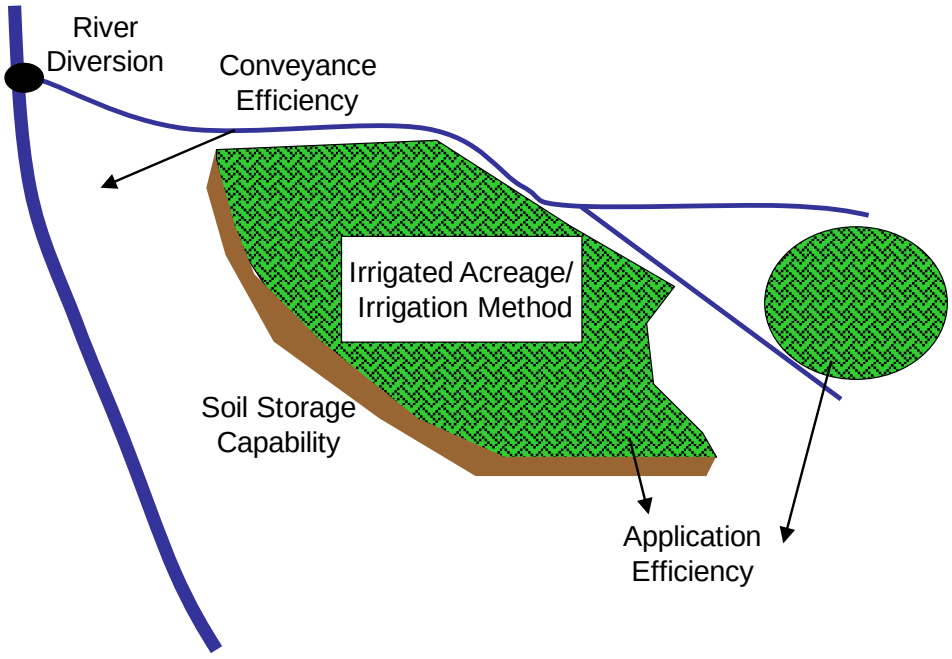
   CIR = PCU – Re

4. Supply-Limited Crop CU = Actual Crop Consumptive Use = Historical Crop Consumptive Use = Total Crop CU

The actual amount of water the crops consumed from irrigation supplies. This is the amount that can be transferred to another use or another location. The amount of water historical diverted (surface or ground water) but not-consumed by the crop due to conveyance and application losses is the *unlagged or total return flow obligation*. As a "Term and Condition" of the water right change or transfer, this amount must continue to be available to the river based on historical lagged patterns to assure junior uses are not injured.

Monthly Supply to the crop is compared to monthly CIR estimates based on a ditch-level water balance approach as follows:


Read Water Supply Information
Adjust for Conveyance Efficiency = Farm Headgate Diversion
Adjust for Max Application Efficiency = Effective Surface Water Supply
No
Consider Soil Moisture?
Yes
Determine Soil Moisture Reservoir Capacity by Structure
Available Soil Moisture?
No
Surface Water Supply > IWR?
Yes
Water Supply Limited CU = Irrigation Water Requirement
No
Remaining Water Supply Used to Fill Soil Moistture
Yes
Water Supply Limited CU = Surface Water Supply
Water Supply Limited CU = Surface Water Supply + Soil Moisture Supply


River Diversion
Conveyance Efficiency
Irrigated Acreage/ Irrigation Method
Soil Storage Capability
Application Efficiency

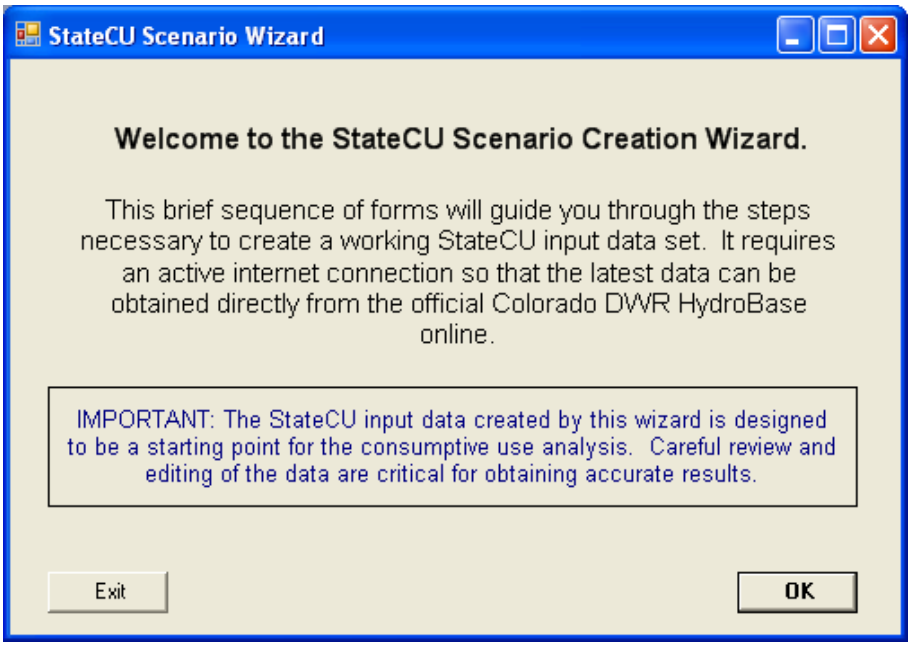
How to Run the StateCU Wizard

Using Templeton Ditch in Division 4 as an example, the following steps walk through the process of creating a crop consumptive use scenario using the StateCU Wizard. The scenario is then simulated using the StateCU to estimate crop consumptive use for the ditch over time. The StateCU model, and associated Documentation, is available on the CDSS website under the **Products** menu. Open **StateCU** by clicking on the application on your desktop or through an explorer window by clicking on the **StateCUI.exe** executable installed in the \cdss\statecu\bin\ subdirectory.

The HydroBase Wizard is an interactive tool that guides the user step-by-step through the development of a new monthly scenario and pulls required input data directly from HydroBase through an internet connection. The HydroBase Wizard can be used to create a new monthly *Climate Station Scenario* or a *Structure Scenario*. Required data (e.g. climate data, diversion records, crop characteristics) is pulled directly from HydroBase via an active internet connection and formatted into the correct input files.

Note that the purpose of the Wizard is to create a complete and operational scenario based on HydroBase data; it is the user's responsibility to review and edit specific data in the input files through the GUI to obtain accurate results.

Activate the Wizard by selecting the **Create new StateCU scenario using HydroBase Wizard** command through the **File** menu. The following figure displays the introductory screen to the Wizard. All screens in the Wizard have an **Exit** button. Select the **OK** button to proceed to Step 1.

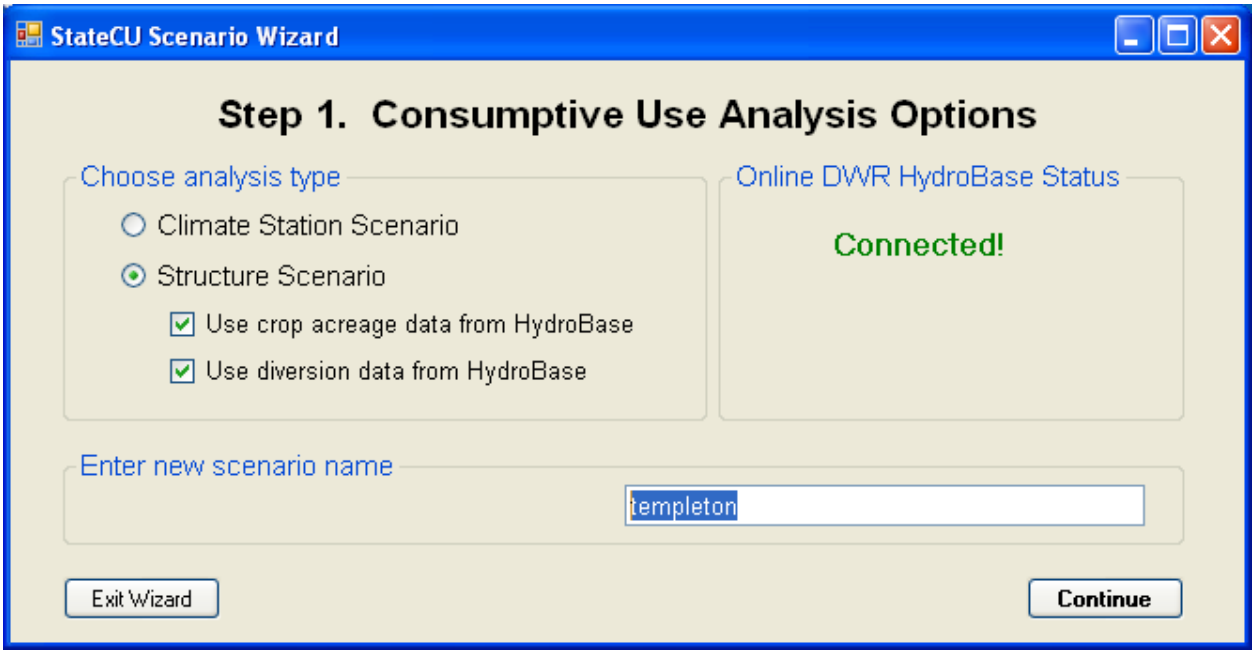


Step 1 – Select Consumptive Use Options

Step 1 of the Wizard identifies the analysis as a *Climate Station Scenario* or a *Structure Scenario.* Using the radio controls, select the **Structure Scenario**. Select the option to use crop and acreage data from the data source and to use diversion data from the data source. The crop, acreage and diversion data loaded in HydroBase for the specific structure will be used when creating the input files. If either of these options is unchecked, the Wizard will ask for crop and acreage data to be manually entered in Step 3 and diversion data to be manually entered by the user in the GUI.

Note that the message of **Connected** will appear if there is an active internet connection. If an internet connection is not available, the message will state Not Connected!.

Enter a new scenario name avoiding special characters, spaces or periods in the file name. All input files will receive the same scenario 'base' name. The Wizard saves all new scenarios to the C:\CDSS\Data\StateCUWizard directory. Name this scenario *Templeton*. Click on the **Continue** button to move to the next step.

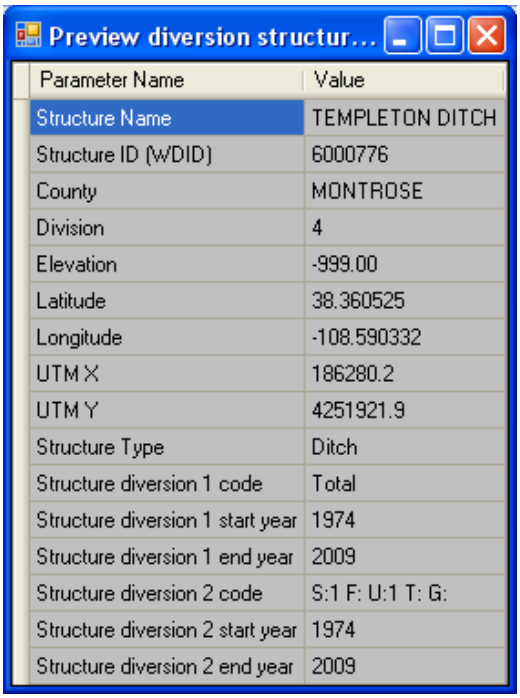


Step 2 – Select the structure for the analysis

A *Structure Scenario* created in the Wizard will determine the potential crop consumptive use, irrigation water requirement and water supply limited consumptive use for one or more crops at a specific diversion structure. Step 2 of the Wizard determines the consumptive use location (ditch) that will be used in the analysis. Select the radial button to Search by Name, and enter Templeton in the Search by window. The search can be

narrowed, if desired. Narrow the search by Division, and select Division 4 for the Gunnison Basin. Select the green Refresh List button.

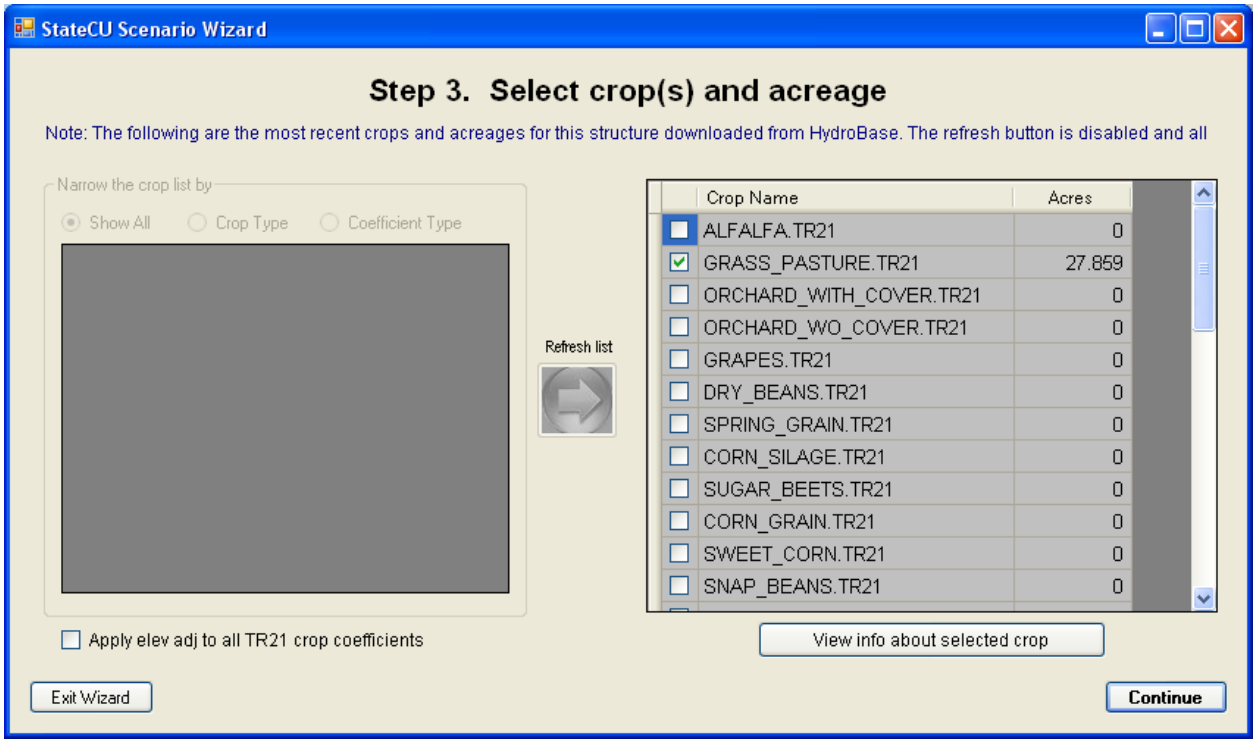
Highlight the Templeton Ditch in Water District 60 – San Miguel River basin. Click on the **View structure info** to view structure and diversion class information. Templeton Ditch has only one diversion class, S:1 F: U1 T: G:, indicating the structure only diverts Source 1 (river) for Use 1 (irrigation). Therefore, when performing the historical crop consumptive use analysis for Templeton Ditch, it is appropriate to use DivTotal through the headgate.



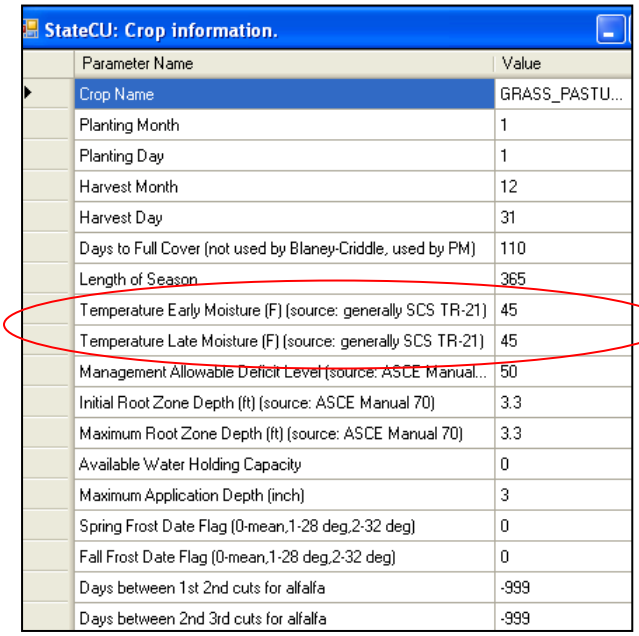
The diversion data can be previewed by clicking on the **View DivTotal.** Select the radial button for *Use structure DivTotal* and click the **Continue** button.

Step 3 – Select crop(s) and acreage

Step 3 of the Wizard determines which crop(s) will be used in the analysis. Note that although acreage and crops can vary over time, the Wizard uses the single 'snapshot' of the most current CDSS acreage assessment data in this step and applies them to all years in the scenario. This data can be edited in the GUI to represent changes in cropping practices.



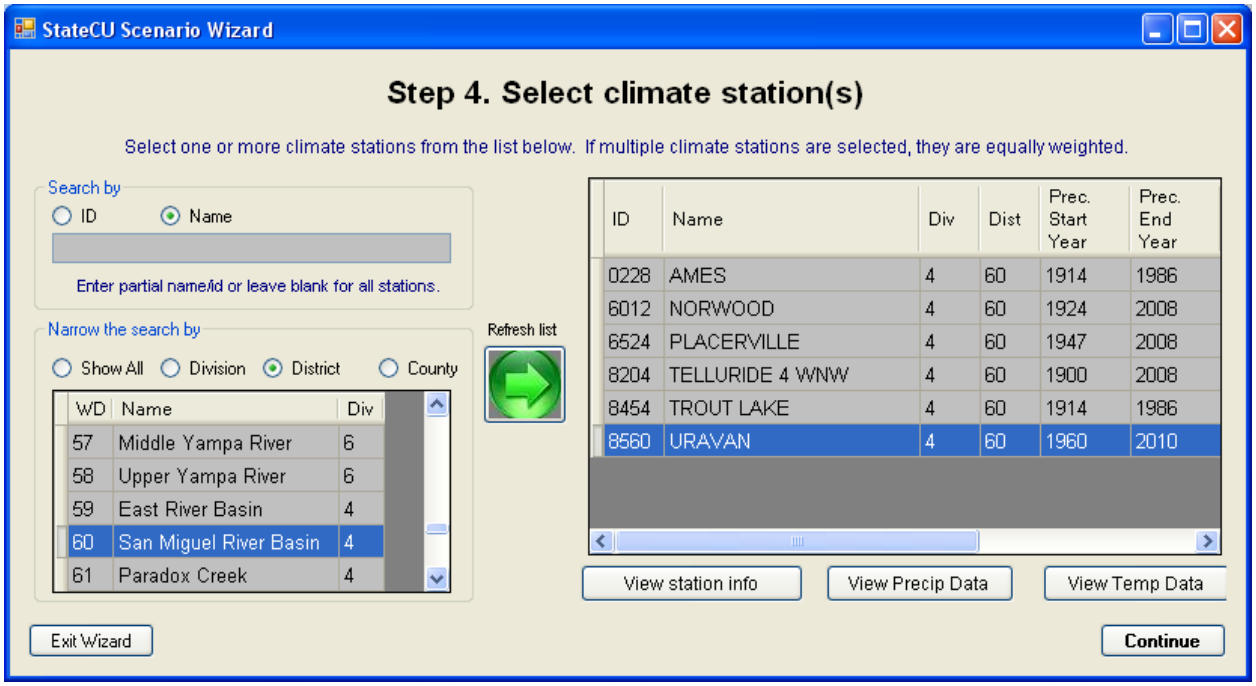
Based on the most recent CDSS Irrigated Acreage Assessment representing the year 2000, Templeton Ditch irrigates 27.859 acres of Grass Pasture. The Grass_Pasture.TR21 designation indicates that standard TR-21 coefficients will be used to estimate potential crop consumptive use. Highlight Grass_Pasture.TR21 and click the **View info about selected crop** button to see the parameters used to estimate growing season. The *Temperature Early Moisture* and *Temperature Late Moisture* indicate that the growing season will start when the mean monthly temperature reaches 45 deg F and end when it drops below 45 deg F. Note that these defaults are recommended in SCS TR-21, and can be revised by the user to reflect known irrigation practices.



The user can also revise the acreage and crop type, based on additional information by checking the boxes to select additional crops and entering or revising the associated acreage. The user can also choose to apply an elevation adjustment to all TR21 Crop Coefficients, using the check box in the lower left corner of the window. For this analysis, check the **Apply elev adj to all TR21 crop coefficients** and click on the **Continue** button to move to the next step.

Step 4 – Select climate station(s)

Step 4 of the Wizard determines which climate station(s) will be used in the analysis. The *Structure Scenario* will only include one consumptive use location, however data from multiple climate stations can be used to determine the consumptive use. If multiple climate stations are selected, the Wizard equally weights the climate data from the multiple climate stations for the analysis. Select the **District** radial button in the *Narrow the search* by window and select Water District 50 – San Miguel River Basin. Six climate stations are available; select Uravan to represent the climate of the irrigated lands.

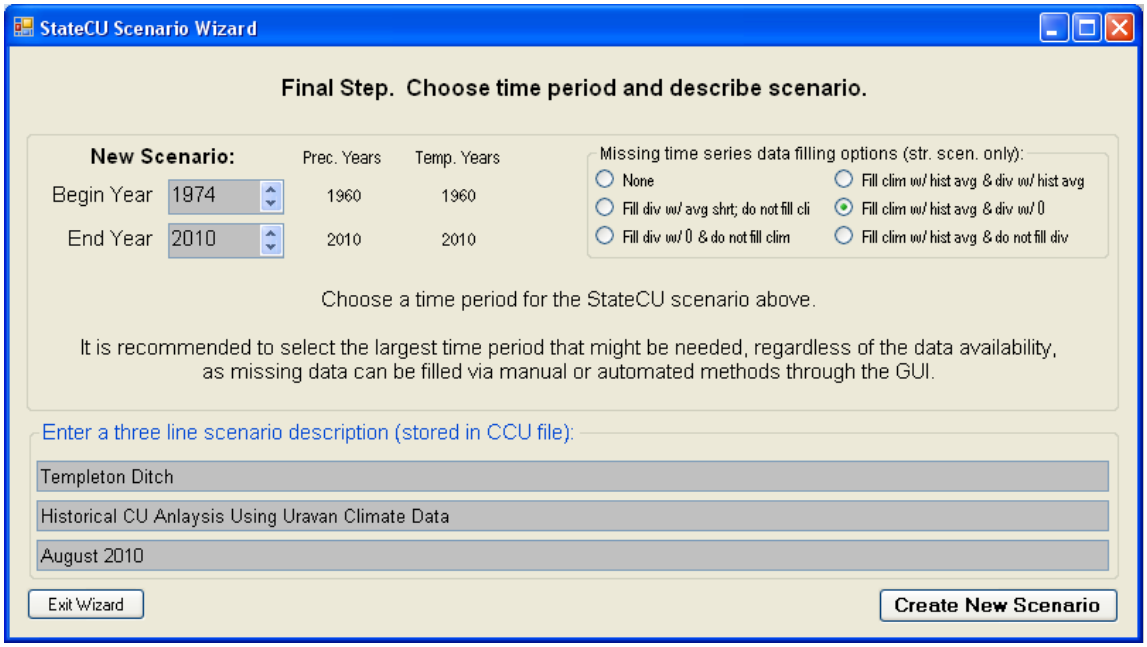


The **View station info** button displays physical information about the climate stations, including elevation and latitude. The **View Precip Data** and **View Temp Data** buttons provide monthly climate data and shows when/if data is missing. Review of the climate data indicates there is sufficient data for the analysis. Click on the **Continue** button to move to the next step.

Step 5 – Choose the time period and describe the scenario

After completing the climate station selection in Step 4 of the Wizard, the user has determined all of the input parameters necessary to create a *Structure Scenario.* The Final Step of the Wizard is to set the beginning and ending year of the analysis and enter a description of the scenario. Note that all time series data files will be created using these time period parameters. Through the GUI, an analysis can be adjusted to a smaller time period, but not a larger period, therefore it is recommended to define this period as large as available data can support.

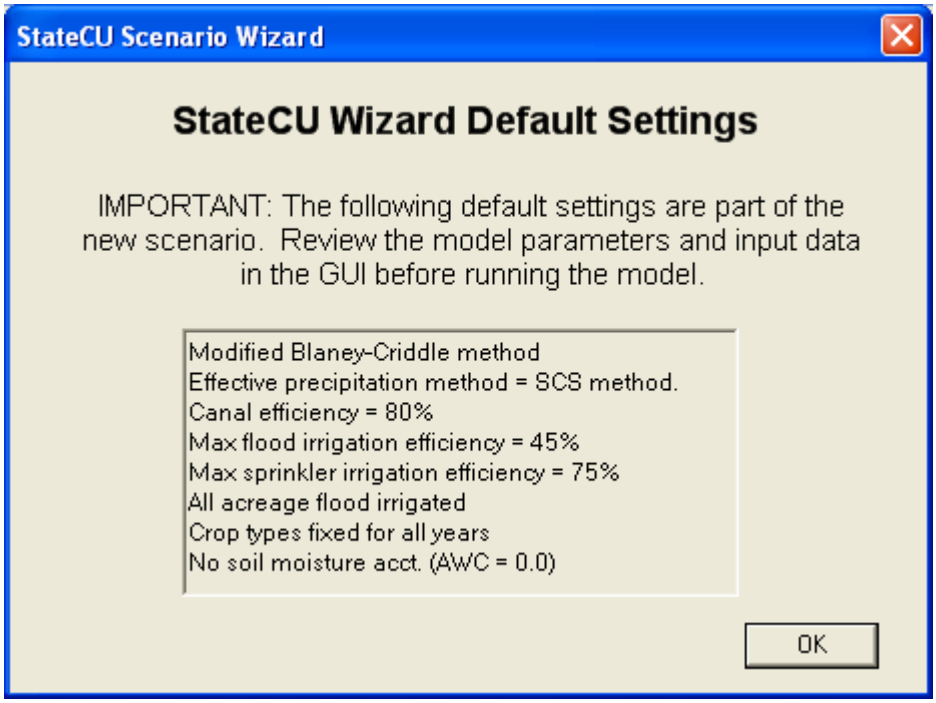
Missing data in the input files is indicated by -999. The user can choose to have StateCU fill missing data 'on-the-fly' with month averages or zeros through selecting **Missing time series data fill options** in the Final Step. Note that 'on-the-fly' filling will fill the missing data for the consumptive use calculations only; the original input file data will remain unchanged. Consumptive use calculations cannot be performed for years with any missing data. Edit the years by typing over the default or using the up and down arrows. When we reviewed available diversion records in Step 2 above, we noted that diversion records are available beginning in 1974. Set the **Begin Year** to 1974. In addition, we noted that there were a few months of missing climate data. Select the **Fill clim w/hist avg & div w/0** radial button. Enter a description of the scenario in the three allotted lines - this information is stored in the header of the model control options file and is included in certain output reports. Select the **Create New Scenario** to complete the creation of the scenario.



Several parameters and modeling options are not specifically input by the user into the Wizard, rather it is the responsibility of the user to review and edit these parameters through the GUI. The Wizard sets these parameters to defaults when creating the scenario.

The default settings are listed in a window that is activated once the scenario is created. The following is a list of these defaults settings:

- The Modified Blaney-Criddle consumptive use analysis method is set
- The effective precipitation method is set to the SCS method.
- Crop types and crop acreages is fixed for all years
- Canal efficiencies are set to 80%
- Acreage is all set to be flood irrigated and crop types are fixed for all years (non-variable)
    - The maximum flood irrigation efficiency is set to 45%
    - The maximum sprinkler irrigation efficiency is set to 75%
- No soil moisture accounting and structure available water capacity is set to zero



Once the Wizard scenario has been created, it is automatically 'loaded' into the StateCU program. Input data generated through the StateCU Wizard can be viewed and edited through the StateCU **Edit** menu. For more information and easy to follow instructions, including screen shots, see the StateCU Documentation.

Step 6 – Run the simulation

Select **Run Simulation** under the **Run** menu. When a run is initiated, the StateCU GUI shells out to a DOS window to execute the StateCU program. The process status and any warning or error messages are displayed in the DOS window during StateCU execution. If the execution is successful, the DOS window will either close automatically or prompt the user to press the Enter key, and the user will be returned to the GUI to view output. If the

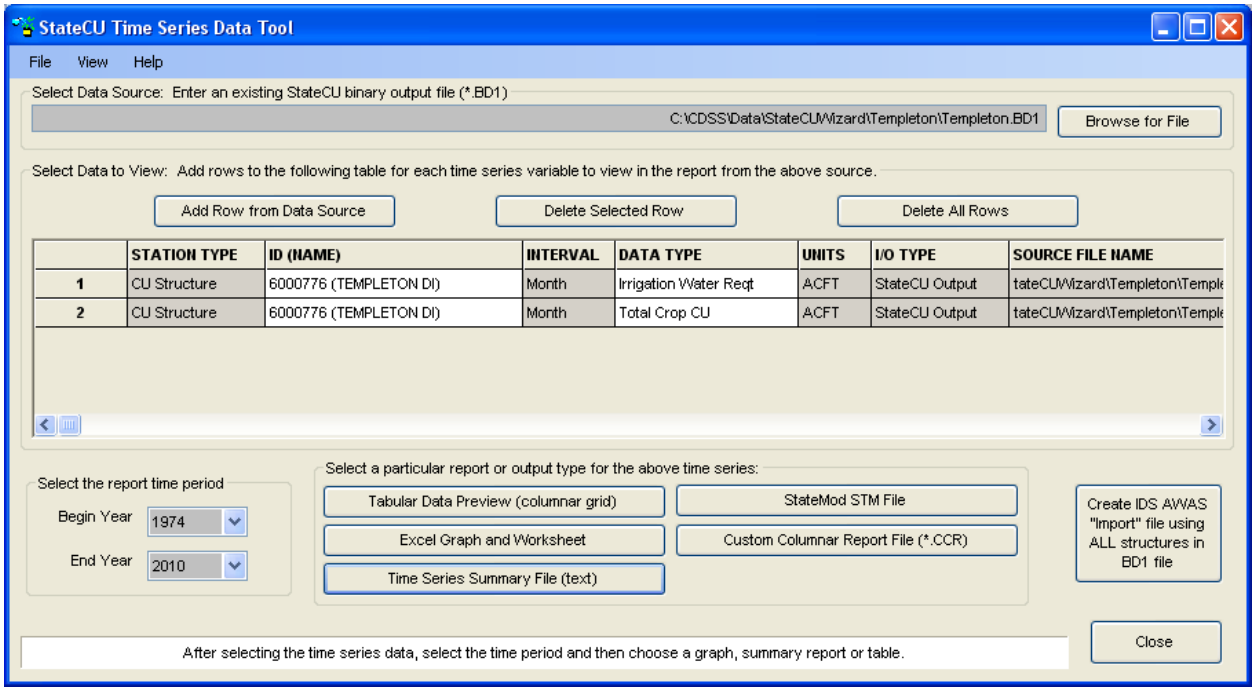
execution is unsuccessful, the StateCU generated log file will be displayed on the screen with a description of the error that caused the program to terminate.

Tip: The user should view the **StateCU Fortran Program Log File** located in the **Results** menu or through a text editor even with a successful execution, as it may contain warnings or other pertinent information. In addition, the log file summarizes much of the data input.

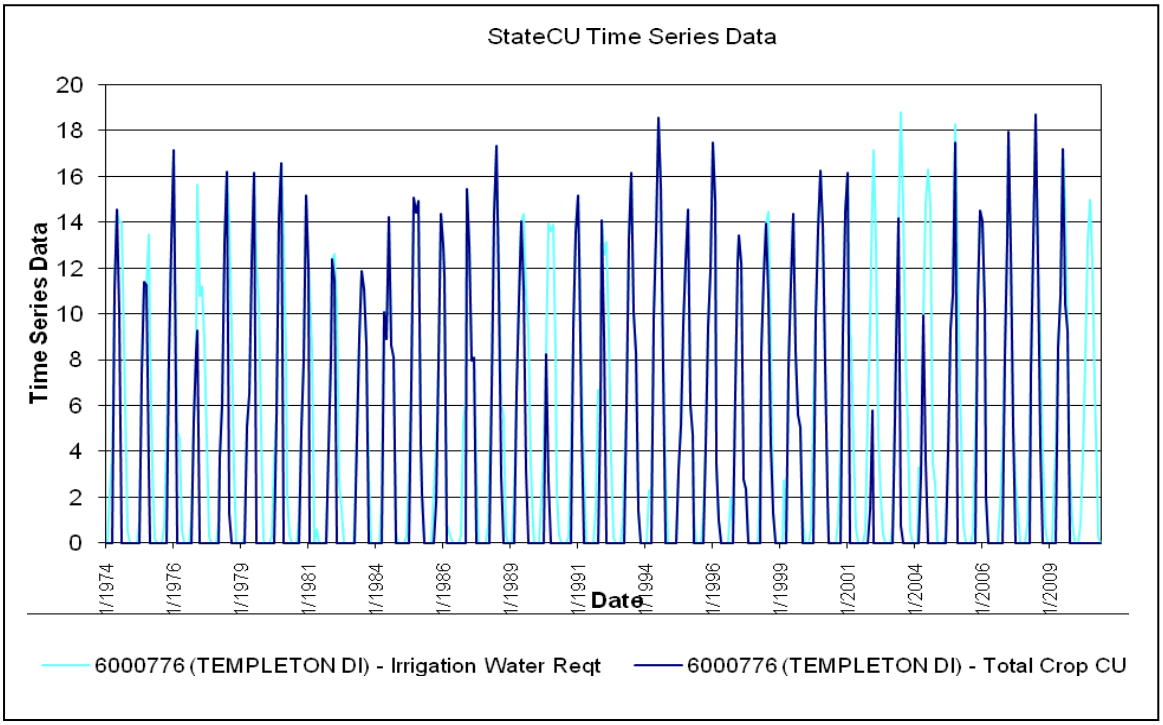
Step 7 – View the results

StateCU generates standard output reports that can be viewed through the GUI. Select the **Detailed Water Budget Output (*.dwb)** from the **Results** menu to view annual, average monthly, and monthly results for the analysis. As shown, on average the annual Irrigation Water Requirement for the Templeton Ditch, based on the acreage assigned in HydroBase, is 64 acre-feet. The average Total Estimated Crop CU is 43 acre-feet, indicating the ditch does not receive a full supply.

Select the **Time Series Data Report Generator (*.bd1)** from the **Results** menu to select specific water budget components to view, graph, and save. Click twice on the **Add Row from Data Source** button. Double click on the **ID (Name)** and select *6000776 (TempletonDI)* from the drop-down list in both rows. Double click on the Data Type in row 1 and select *Irrigation Water Reqt* from the drop-down list. Double click on Data Type in row 2 and select *Total Crop CU* from the drop-down list.



The results can be viewed in several formats, described in the StateCU Documentation. Select the **Excel Graph and Worksheet** button. The data is loaded into a Data worksheet in Excel and a corresponding Graph worksheet is created. The Excel spreadsheet can be saved and the graphical presentation revised.


StateCU Time Series Data
Time Series Data
20
18
16
14
12
10
8
6
4
2
0
1/1974
1/1976
1/1979
1/1981
1/1984
1/1986
1/1989
1/1991
1/1994
1/1996
1/1999
1/2001
1/2004
1/2006
1/2009
Date
6000776 (TEMPLETON DI) - Irrigation Water Reqt
6000776 (TEMPLETON DI) - Total Crop CU

How to Run StateCU

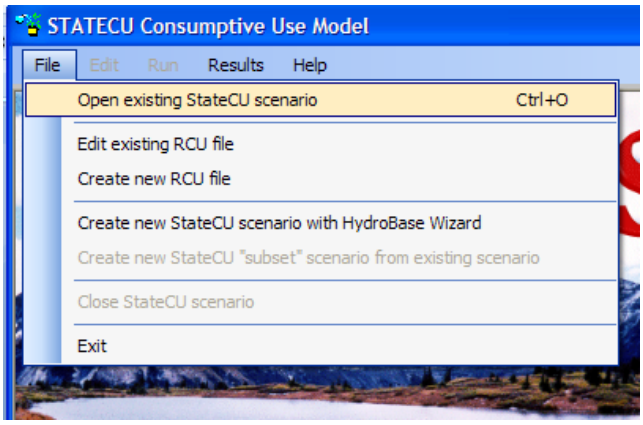
StateCU, the State's consumptive use model, can be simulated using a GUI interface. The StateCU GUI allows users to perform numerous tasks easily, including modifying data files, executing StateCU and visualizing data. The StateCU GUI refers to datasets described by a "response file" listing simulation input files (see Section 5 in the StateCU User's Manual for more information about response files). It is assumed that someone using the StateCU GUI is familiar with the StateCU model functionality. New input datasets can be created by:

1. Revising one of the base datasets provided with the StateCU GUI,
2. Rerunning the StateCU Data Management Interfaces (Section 9 in the StateCU User's Manual),
3. Building StateCU ASCII input files (Section 5 in the StateCU User's Manual), or
4. Using the StateCU HydroBase Wizard to create a scenario for a single structure or climate station (Section 3.4 in the StateCU User's Manual or the Example herein).

The user can execute the model program through the StateCU GUI using the following steps:

Step 1. Start the StateCU GUI through the Windows Programs Command (**Programs…CDSS…StateCU**) or by double-clicking on the StateCU icon on your desktop.

Step 2. Using the File menu, click on the **Open existing StateCU scenario** option. This will allow the user to browse to an existing StateCU response file (*.rcu). As summarized in the example above, a new dataset can also be created using the StateCU Wizard.



When prompted, navigate to the White River basin response file, wm2009.rcu located in the "C:\CDSS\Data\wm2009\StateCU" folder.

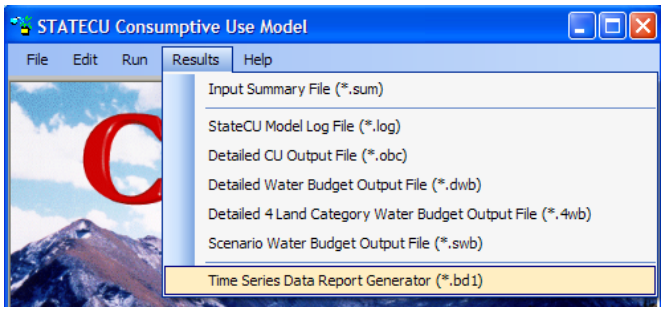
Click on **Open** to load the scenario into StateCU.

Step 3. Using the options in the **Edit** menu, review the data in the input files and the model control options. Modifications to data, including climate data, crop acreage, diversion records, and irrigation efficiencies, can be made directly through the GUI interface.

Although the GUI allows editing of input data, it performs minimal error checking of user-supplied data. It is important that the user understands the implications of editing data and realizes that changes in more than one display may be necessary for a working dataset. Incorrect or inconsistent input will result in an error when executing StateCU and are described in a log file. The log file is created in the dataset directory and can be viewed through the GUI. It is the responsibility of the user to read error messages and react accordingly. It is recommended that the user review the log file after every model run.

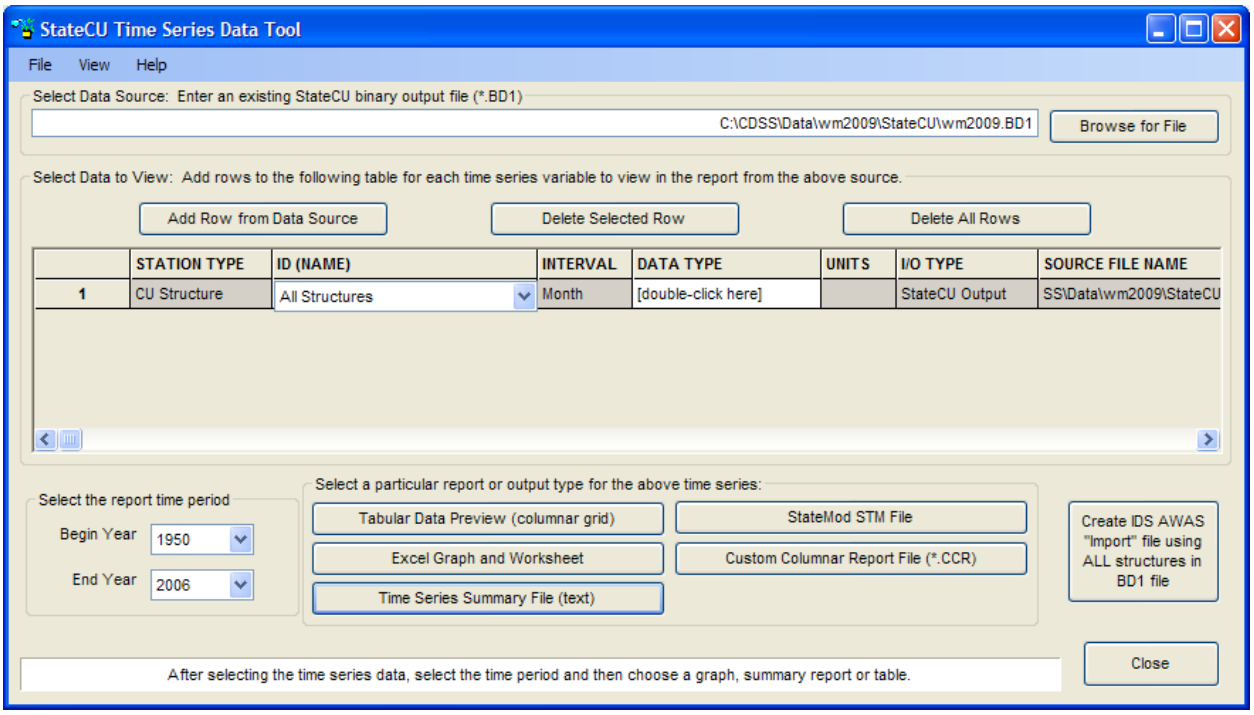
Step 4. Run the StateCU model using the **Run Simulation** option in the **Run** menu. The program will shell out to a MS-DOS window to perform the simulation. Review the log file, wm2009.log, for issues with the simulation. If the simulation is not successful, modification of input files may be necessary to correct issues. Warnings in the log file do not necessarily indicate serious issues but should be reviewed and documented.

Step 5. Model output can be accessed using the options in the **Results** menu. There are several standard output files created from the simulation, including summaries of the irrigation water requirement, water supply limited and the water balance for each ditch in the scenario. These output files can be



viewed through a text editor and are discussed in detail in Section 6 in the StateCU User's Manual.

In addition to the standard output files, StateCU creates a binary file (*.bd1) with the results. The StateCU **Time Series Data Report Generator**, which can be accessed through the **Results** menu, allows the user to view simulation results from this binary file in graphical, tabular, or summary format. This output option is discussed in detail in Section 3.7.1 in the StateCU User's Manual. Information from the binary file can also be accessed using TSTool.



Step 6. Close the StateCU scenario or exit the StateCU GUI using options under the **File** menu.

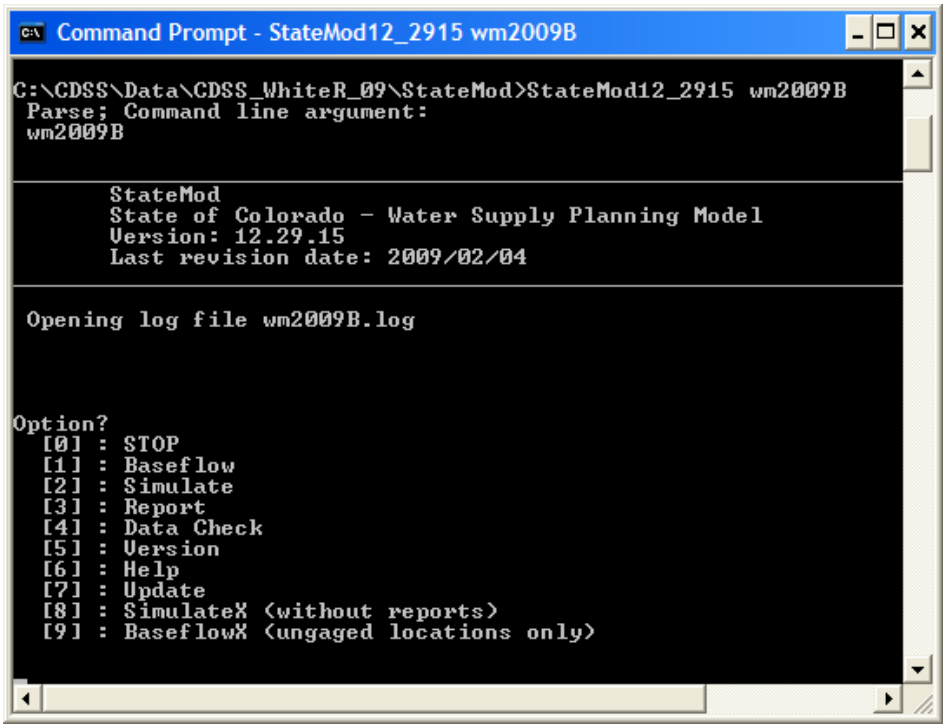
How to Run StateMod

The StateMod surface water model can be executed through a GUI based interface or through a MS-DOS window. As the documentation for the GUI is available on the CDSS website and walks through the execution of the model, instructions for the GUI are not provided here. The command line execution of the model can be more efficient for experienced modelers, in particular when used with automated data processing tools like TSTool. The following instructions summarize by step the process of executing the StateMod model using the MS-DOS window, with the White River basin model as an example. The StateMod User's Manual provides extensive information on the development of input files, model execution options and descriptions of output files.

Step 1. Open up MS-DOS window

Step 1a. Type "cd C:\CDSS\Data\CDSS_WhiteR_09\StateMod" to move to the StateMod directory that houses all the model input files.

Step 2. Type "StateMod12_2915 wm2009B". "StateMod12_2915" opens the model (Version 12.29.15) and "wm2009B" tells the model to start with the wm2009B.rsp file that lists the White River baseline dataset input files. See the StateMod User's Manual for information on the differences between a historical and baseline dataset. Once the scenario is loaded, the following figure shows the Modeling Options.



Step 3. Type in '4' to perform a Data Check of the model input files. StateMod will run through the input files making sure they are complete and without errors. If successful, review the Check file (wm2009B.chk). If unsuccessful, review errors in the Log file (wm2009B.log) in the StateMod folder and document any issues indicated in the Log file. Modification of input files may be necessary to correct issues. Warnings in the Log or Check files do not necessarily indicate serious issues but should be reviewed and documented.

The following summarizes the list of output files (*.x*) provided by the Data Check:

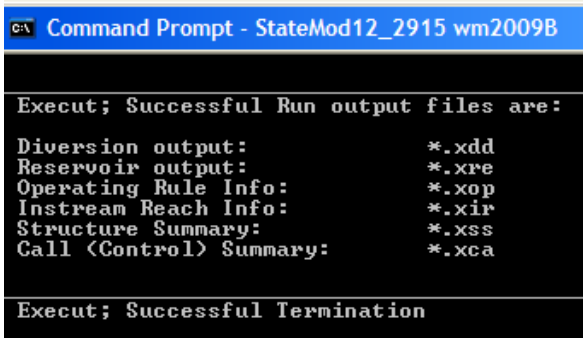
- Natural Flow File (*.xcb)
- Direct Demand File (*.xcd)
- Instream Demand File (*.xci)
- Well Demand File (*.xcw)
- Input Summary File (*.xtb)
- Water Rights List File (*.xwr)
- Log File (*.log)

Note that all of the output file names will have the same prefix as the prefix for the Response File. For example, the Baseline Scenario Response File (wm2009B.rsp) results in output file names wm2009B.x*.

Section 5 in the StateMod User's Manual provides information on all of the output files produced by Data Check and other Modeling Options.

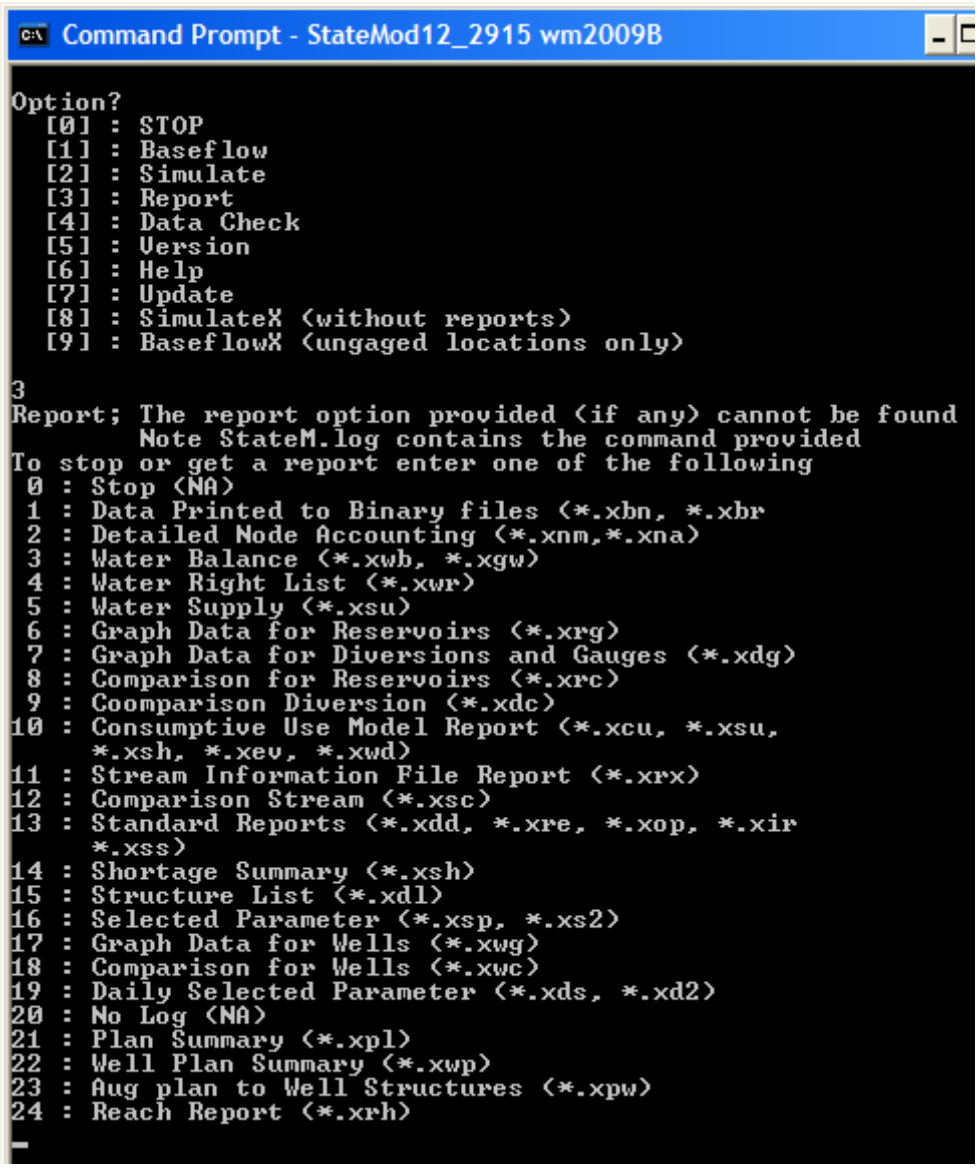
Tip: Always end all StateMod runs (e.g., Data Check, Simulation, Reporting) by typing in '0' to exit the Options menu. Type "StateMod wm2009B" in order to choose other options for the Baseline Scenario.

Step 4. Type in '2' to perform a Simulation of the model. StateMod will perform the simulation, then present the user with the Option list again. Be sure to review the Log File (*.log) for warnings and errors identified during the simulation. StateMod has already created basic output files based on the settings in the Control File (*.ctl), however move to Step 5 for more reporting options. The list of available output files from the Simulation execution is provided after the simulation is complete.



Step 5. Type in '3' to see Reporting options, as shown in the following figure. Section 5 in the StateMod User's Manual provides information on all of the reporting options in detail. Type in the number associated with the desired reporting

option. Output is written to the same folder (CDSS_WhiteR_09\StateMod) as the Response File (*.rsp) is located.



Acknowledgments

Ray Alvarado
Water Information Section Chief
Ray.Alvarado@state.co.us
303-866.3441
cwcb.state.co.us

Steve Malers
Senior Systems Engineer
Steve.Malers@riverside.com
970-484-7573
www.riverside.com

Kara Sobieski, P.E.
Water Resources Engineer
Kara.Sobieski@lrcwe.com
303-455-9589
www.lrcwe.com

Notes

Notes