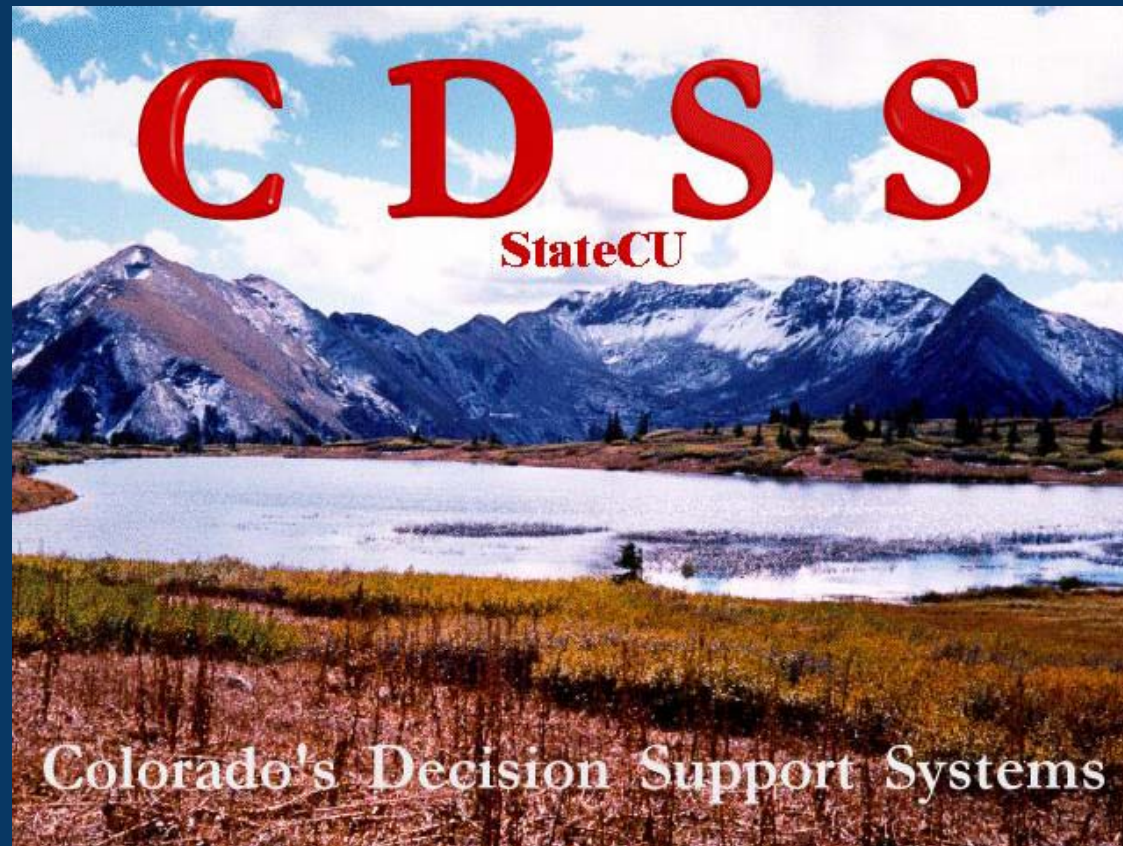


# Using the Best Science to Estimate Consumptive Use



March 12, 2010



# Colorado's Decision Support Systems

Developed by DWR and CWCB

## CDSS Goal

*“Provide the capability to develop credible information on which to base informed decisions concerning water resource management issues.”*

# Colorado's Decision Support Systems

Developed by DWR and CWCB

How does Colorado's Decision Support System Help Colorado Water Planners use the Best Science?

# Colorado Water Rights and Supply Planning Background

- ▣ Water right changes require extended period analysis of historical crop CU (~ 50 years)
- ▣ Planners make decisions based on long-term hydrology and climate data that represents wet, dry, hot, cool periods

# Colorado Limitations

- ▣ Higher elevations and western slope areas do not have climate stations recording daily data required for methods incorporating better science (ex. ASCE Penman)
- ▣ Daily data required for detailed methods in other areas of the State only available in recent periods
- ▣ Historical satellite imagery may not be available for Energy-Balance Methods

## **As a Result:**

Colorado water right consultants and water planners rely heavily on less data intensive monthly methods, generally Blaney-Criddle

## **However:**

Colorado's Decision Support System helps mitigate limitations of those monthly methods

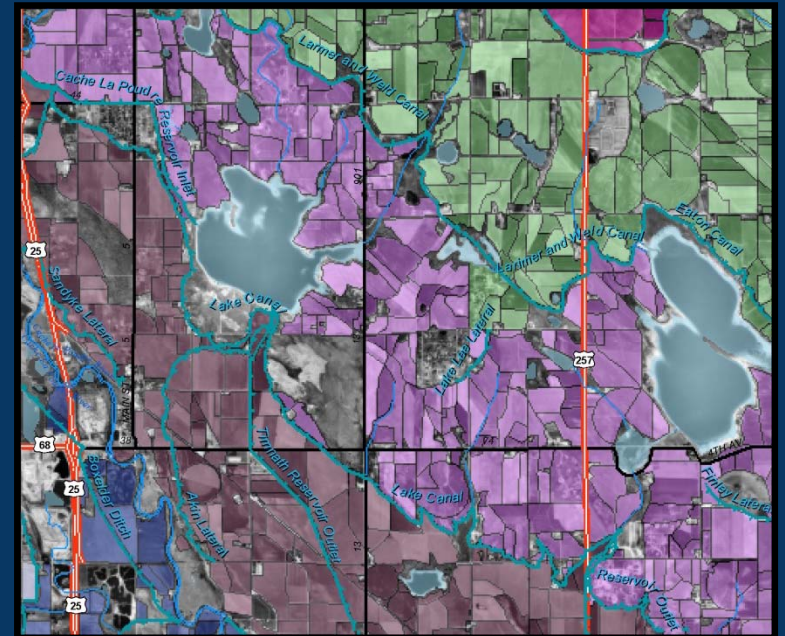
# CDSS – Development and Management of “Best Data”

## ▣ State-wide Irrigated Acreage Assessments

- Crop Type
- Irrigation Method
- Source (Ditch and/or Well)
- Goal 5-year Snapshots
- GIS and Stored in HydroBase

## ▣ Water Supply Data

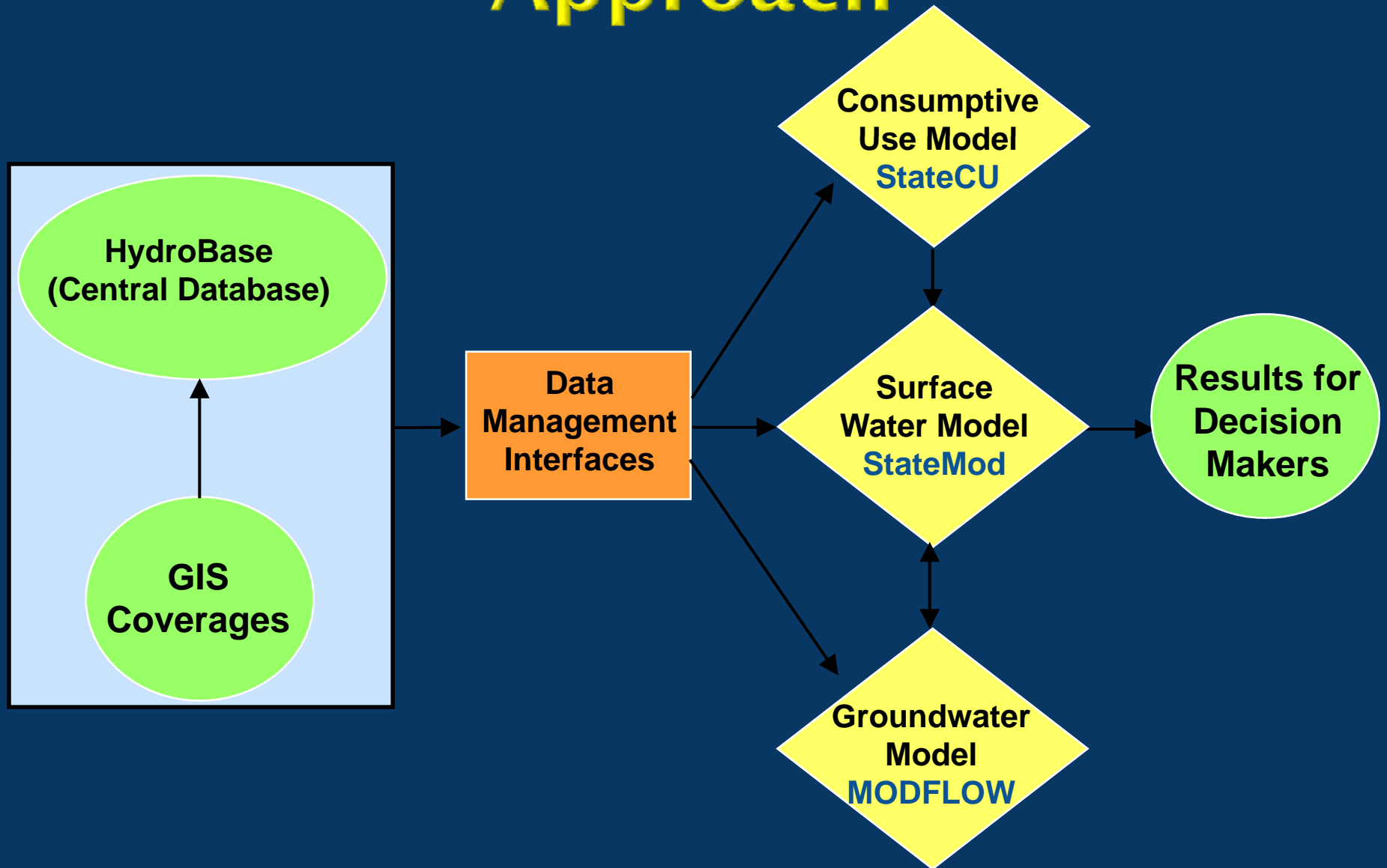
- Daily Diversion Records, Pumping Data
- Stored in HydroBase



# CDSS – Development and Management of “Best Data”

- ▣ Climate Data “Managed” in HydroBase
  - NOAA Stations
  - CoAgMet Stations
  
- ▣ Planning-Level Estimates
  - Specific Conveyance Efficiencies
  - Maximum Application Efficiencies
  - Available Water Content
  - Technical Documents Describing Estimate Procedures and Results

# CDSS Data-Centered Approach



# CDSS – Development and Management of “Best Data”

- ▣ Development/Review of Locally Calibrated Blaney-Criddle Crop Coefficients
  - Based on Lysimeter Studies, where available
  - Upper South Platte Basin, Gunnison Basin, Rio Grande
  - Based on ASCE Penman
  - Lower South Platte

# CDSS – Development and Management of “Best Data”

- ▣ Coefficient Development Documented, Peer Reviewed, and Stored in HydroBase
- ▣ Basin-Wide Crop Irrigation Requirements and Supply-limited CU Datasets Available
  - Yampa River Basin
  - Colorado River Basin
  - San Juan River Basin
  - South Platte Basin
  - White River Basin
  - Gunnison River Basin
  - Rio Grande Basin
  - North Platte River Basin
- ▣ Basin-Wide Datasets are Structure Based

# What is StateCU

- ▣ The State of Colorado's Consumptive Use Model
- ▣ Developed to Estimate and Report Crop Consumptive Use within the State
- ▣ Publically Available
- ▣ Enhancements/ Additions are Peer Reviewed
- ▣ Comprehensive Documentation/ User Guide

# What is StateCU?

- ▣ StateCU ET Methods include:
  - Modified and Original Blaney-Criddle (monthly)
  - Pochop Bluegrass (monthly)
  - Penman Monteith, ASCE Penman, Modified Hargreaves (daily)
- ▣ StateCU Effective Precipitation Methods include:
  - TR-21 SCS Method (monthly)
  - USBR Method (monthly)
  - Maximum per Day, Fraction per Day, SCS NEH4 method (daily)

# What is StateCU?

- ▣ Includes Water Supply-Limited Options
  - Includes River Diversions, Well Pumping, Off-Channel Supplies (reservoirs, tail water)
  - Considers Conveyance, Application Efficiencies
  - Performs On-farm Soil Accounting
- ▣ Includes Water Rights Options
  - Historical CU senior, junior to specific water right (ex. Upper Gunnison CU subordinated to Aspinall Unit water right)
  - Historical CU senior, junior to daily call

# Why was StateCU Developed?

- ▣ CDSS Need for a Consumptive Use Analysis Tool
- ▣ Need for Tool that could be Applied State-wide
- ▣ Need to Standardize the Approach and Tools Used by CWCB and DWR

# How is StateCU Used by Consultants?

- ▣ Start with Basin-wide Dataset Developed for CDSS
  - Use CDSS Estimated Acreages, Efficiencies, AWC for initial estimates of Historical CU for Water Right transfers
  - Refine input files (through StateCU GUI) with site-specific or user-supplied detail
- ▣ Use StateCU HydroBase Wizard to build CU analysis directly
  - Acreage, Diversion Records, Climate Data

# StateCU Scenario Wizard

- ▣ The StateCU Scenario 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 StateCU Scenario 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.

# StateCU Scenario Wizard

StateCU Scenario Wizard

## Step 1. Consumptive Use Analysis Options

Choose analysis type

Climate Station Scenario

Structure Scenario

Use crop acreage data from HydroBase

Use diversion data from HydroBase

Online DWR HydroBase Status

**Connected!**

Enter new scenario name

Exit Wizard

Continue

# StateCU Scenario Wizard

**StateCU Scenario Wizard** [min] [max] [close]


## Step 2. Select a water supply structure

Select a water supply structure under which the CU analysis will be calculated.

Search by:  
 WDID or  Name  
  
Enter a partial name or leave blank for all structures.

Narrow the search by:  
 Show All  Division  District  County

WD	Name	Div
1	South Platte: Greeley ...	1
2	South Platte: Denver ...	1
3	Cache La Poudre River	1



WDID	Name	Div
0100503	RIVERSIDE CANAL	1
0100710	RIVERSIDE DITCH	1
0100698	RIVERSIDE EMBANKMENT DR	1
0100508	RIVERSIDE RES OUT D	1

Use structure DivTotal  
 Select individual DivClass

**Select HydroBase diversion data for structure 0100503** [min] [max] [close]

## Step 2A. Select structure diversion records to use:

Multiple selected DivClass time series are summed; DivTotal must be selected alone. \* = Infrequent Diversion Record

Type	Time Step	Identifier	Quality	Start Year	End Year	Meas Count
<input checked="" type="checkbox"/>	Diversion	Annual	Total	1950	2007	672
<input type="checkbox"/>	Diversion	Annual	S:4 F:0303732 U:Q T:3 G:0...	2006	2006	12
<input type="checkbox"/>	Diversion	Annual	S:4 F:0104620 U:Q T:3 G:	2004	2004	12
<input type="checkbox"/>	Diversion	Annual	S:4 F:0104620 U:1 T: G:	1962	1971	24
<input type="checkbox"/>	Diversion	Annual	S:1 F: U:Q T:3 G:	1988	2007	240
<input type="checkbox"/>	Diversion	Annual	S:1 F: U:Q T:0 G:	1983	1987	48
<input type="checkbox"/>	Diversion	Annual	S:1 F: U:1 T: G:	1950	2007	660
<input type="checkbox"/>	Diversion	Annual	S:1 F: U:0 T:0 G:	1985	1985	12
<input type="checkbox"/>	Diversion	Annual	S:1 F: U:0 T: G:	1970	1988	24

# StateCU Scenario Wizard

Climate stations, and their climate data, that are currently loaded in HydroBase are the only stations available for inclusion in the scenario through the Wizard. The user can either search by the name of the climate station or by the ID.

**Step 3. Select crop(s) and acreage**

Select crops using the check box and enter acres of each. Be sure to refresh the list so that it contains all the crops you will need before entering data.

Narrow the crop list by:

- Show All
- Crop Type
- Coefficient Type

Coef Type	Long Name
TR21	SCS TR21
CCRG	Rio Grande Calib Coef
UGHA	Upper Gunnison High Alt Calit
CCLP	Lower S Platte Calib Coef

Crop Name	Acres
<input checked="" type="checkbox"/> ALFALFA.TR21	0
<input type="checkbox"/> GRASS_PASTURE.TR21	0
<input type="checkbox"/> ORCHARD_WITH_COVER.TR21	0
<input type="checkbox"/> ORCHARD_WO_COVER.TR21	0
<input type="checkbox"/> GRAPES.TR21	0
<input type="checkbox"/> DRY_BEANS.TR21	0
<input type="checkbox"/> SPRING_GRAIN.TR21	0
<input type="checkbox"/> CORN_SILAGE.TR21	0

Apply elev adj to all TR21 crop coefficients

**StateCU: Crop information.**

Parameter Name	Value
Crop Name	ALFALFA.TR21
Planting Month	1
Planting Day	1
Harvest Month	12
Harvest Day	31
Days to Full Cover (not used by Blaney-Criddle, used by PM)	75
Length of Season	365
Temperature Early Moisture (F) (source: generally SCS TR-21)	50
Temperature Late Moisture (F) (source: generally SCS TR-21)	28
Management Allowable Deficit Level (source: ASCE Manual...	55
Initial Root Zone Depth (ft) (source: ASCE Manual 70)	4.9
Maximum Root Zone Depth (ft) (source: ASCE Manual 70)	4.9

# StateCU Scenario Wizard

**StateCU Scenario Wizard**

## Step 4. Select climate station(s)


Select one or more climate stations from the list below. If multiple climate stations are selected, they are equally weighted.

Search by  
 ID  Name

Enter partial name/id or leave blank for all stations.

Narrow the search by  
 Show All  Division  District  County

Div	Name
1	South Platte
2	Arkansas
3	Rio Grande

Refresh list 

ID	Name	Div	Dist	Prec. Start Year	Prec. End Year
0092	AGATE 3 SW	1	1	1948	1953
0620	BENNETT	1	1	1989	1995
0945	BRIGGSDALE	1	1	1948	2008
1179	BYERS 5 ENE	1	1	1948	2008
2162	DEER TRAIL	1	1	1948	2001
2211	DENVER INTL AP	1	1	1995	2008

# StateCU Scenario Wizard

**StateCU Scenario Wizard**

**Final Step. Choose time period and describe scenario.**

<b>New Scenario:</b>	Prec. Years	Temp. Years
Begin Year: 1948	1948	1948
End Year: 2008	2008	2008

Missing time series data filling options (str. scen. only):

- None
- Fill clim w/ hist avg & div w/ hist avg
- Fill div w/ avg shrt; do not fill cli
- Fill clim w/ hist avg & div w/ 0
- Fill div w/ 0 & do not fill clim
- Fill clim w/ hist avg & do not fill div

Choose a time period for the StateCU scenario above.

It is recommended to select the largest time period that might be needed, regardless of the data availability, as missing data can be filled via manual or automated methods through the GUI.

Enter a three line scenario description (stored in CCU file):

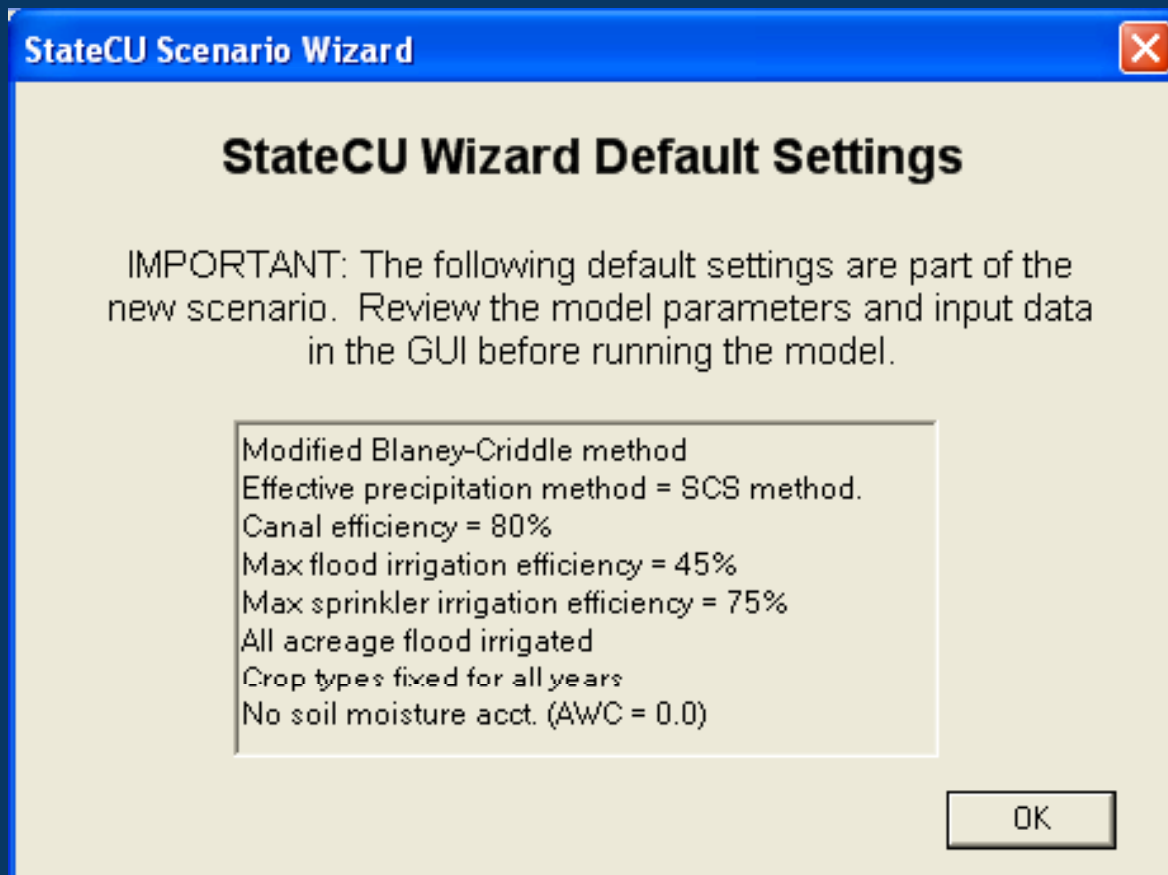
StateCU Scenario for Riverside Canal

August 2008

Exit Wizard      Create New 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.

# StateCU Scenario Wizard



# Contacts

## Website URL

[cdss.state.co.us](http://cdss.state.co.us)

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