SPDSS

Consumptive Use Component

Ground Water
Technical Peer Review Committee

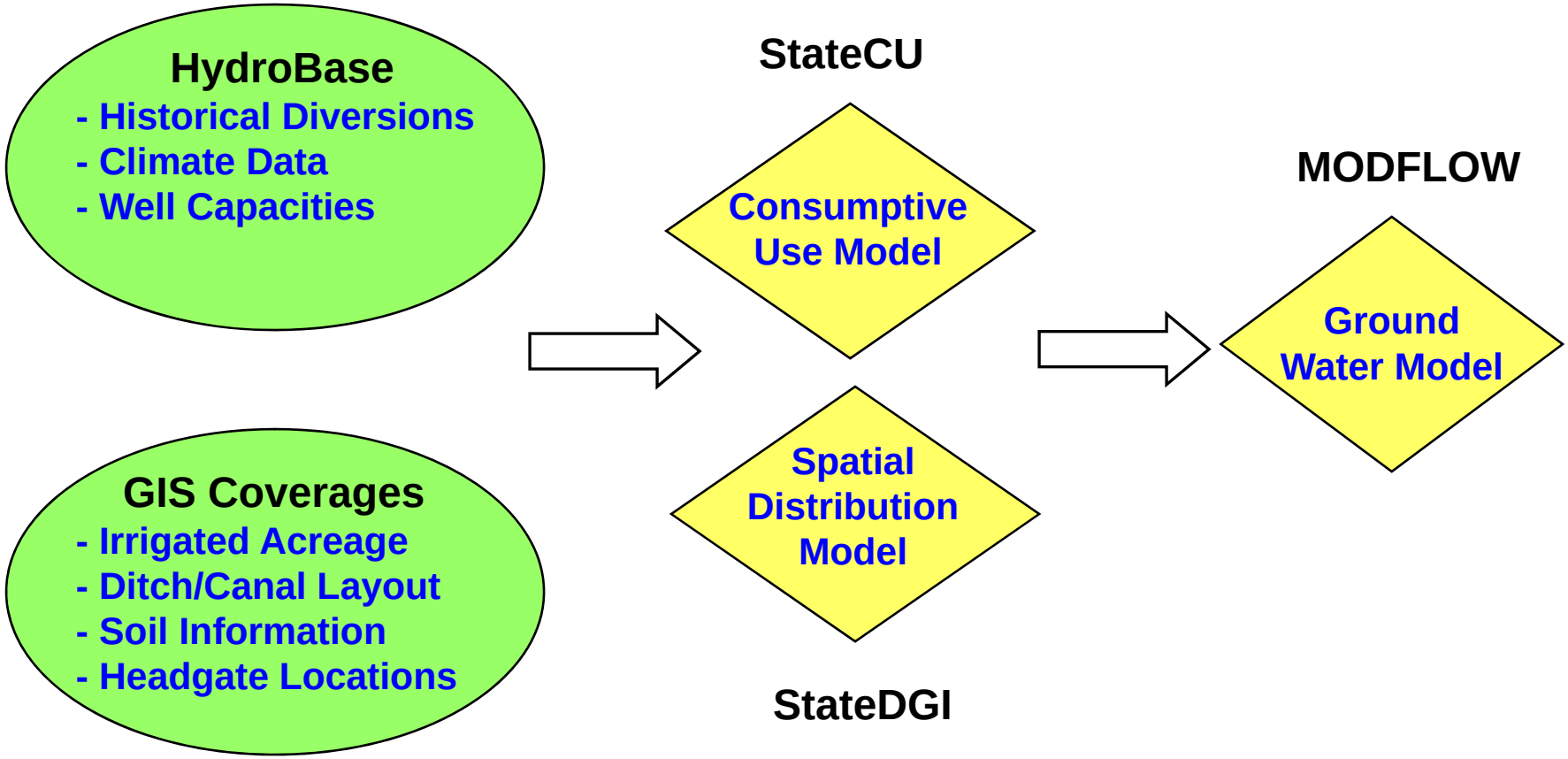
December 18, 2008

LEONARD RICE ENGINEERS, INC.

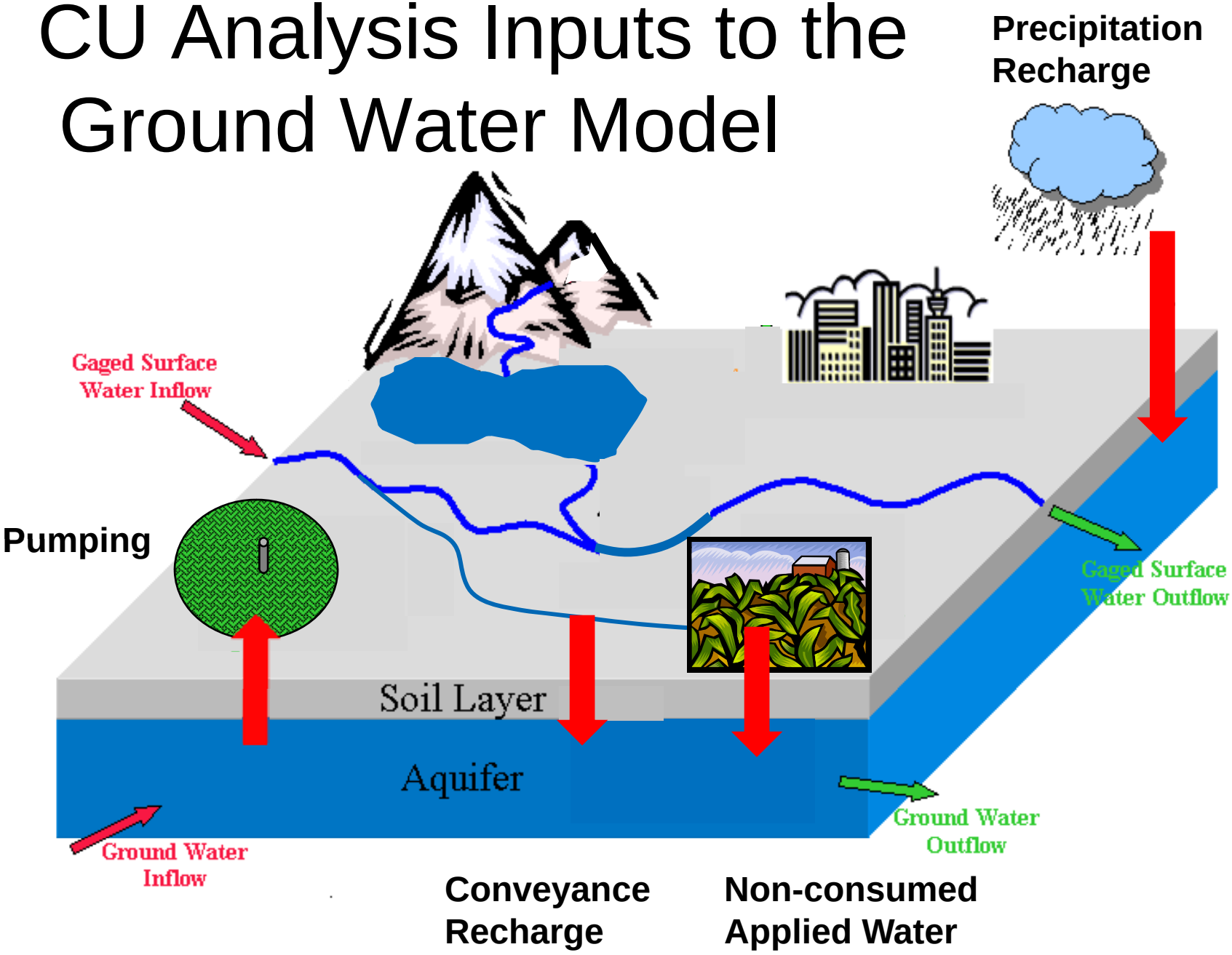
Consumptive Use Analysis Overview

- Consumptive Use Analysis Inputs to the Ground Water Model
- StateCU Data Input Requirements
- Historical Consumptive Use Results
- Ground Water Model Input Results

Data-Centered Approach

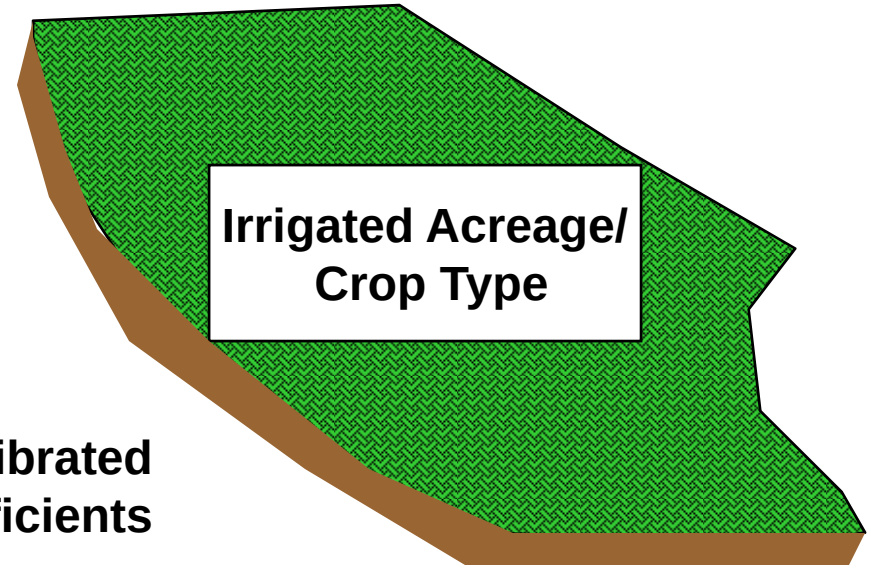


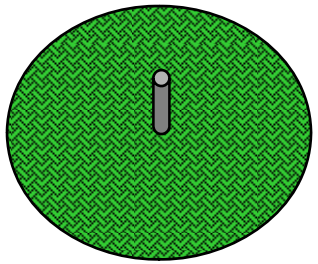
CU Analysis Inputs to the Ground Water Model



Irrigation Water Requirement Input Data

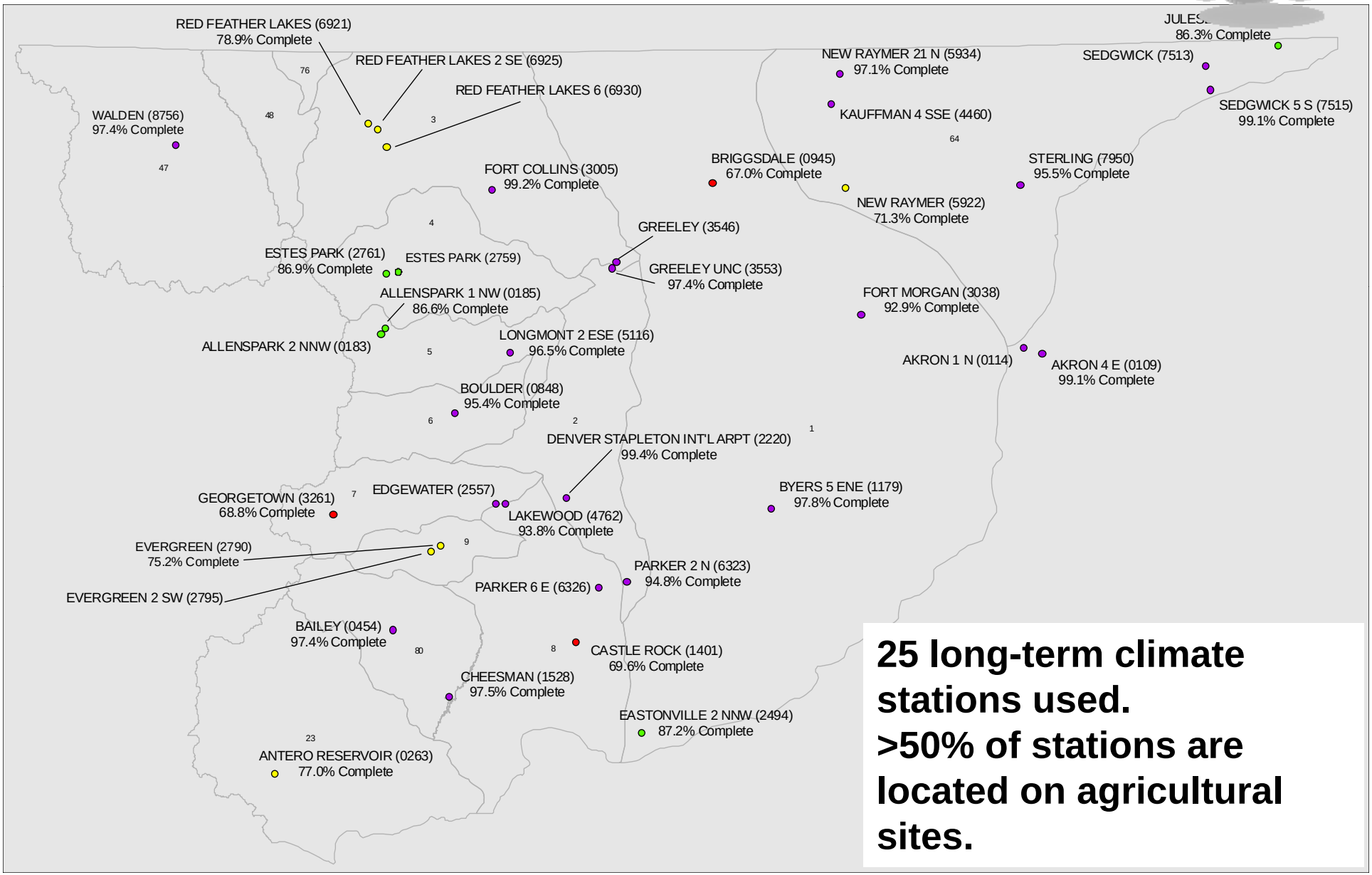
Climate Data





Locally Calibrated Crop Coefficients

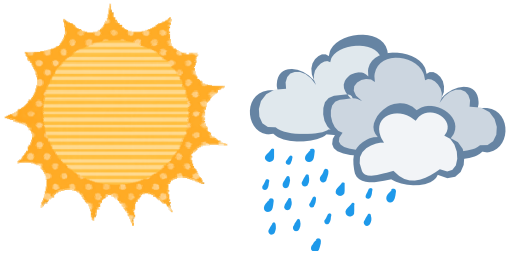
Climate Data

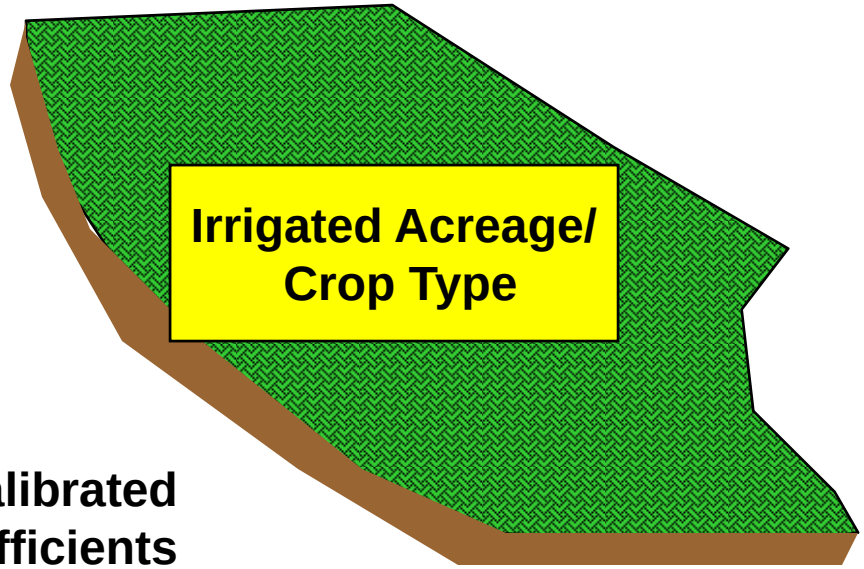


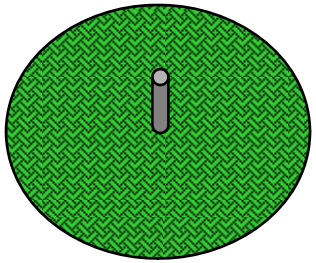
25 long-term climate stations used.
>50% of stations are located on agricultural sites.

Irrigation Water Requirement Input Data

Climate Data



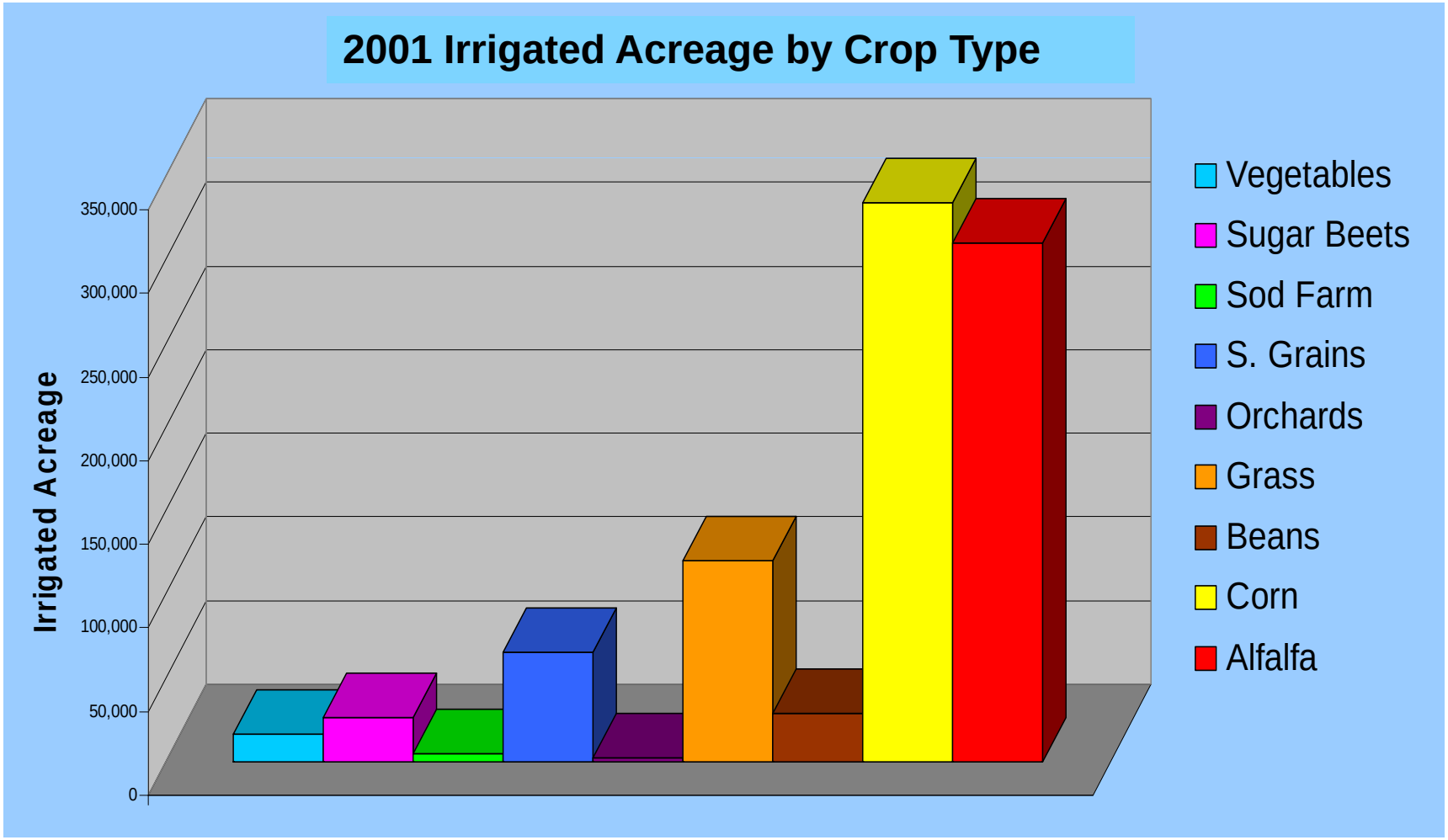




Locally Calibrated Crop Coefficients

Irrigated Acreage

- Represents 100 % of the irrigated acreage



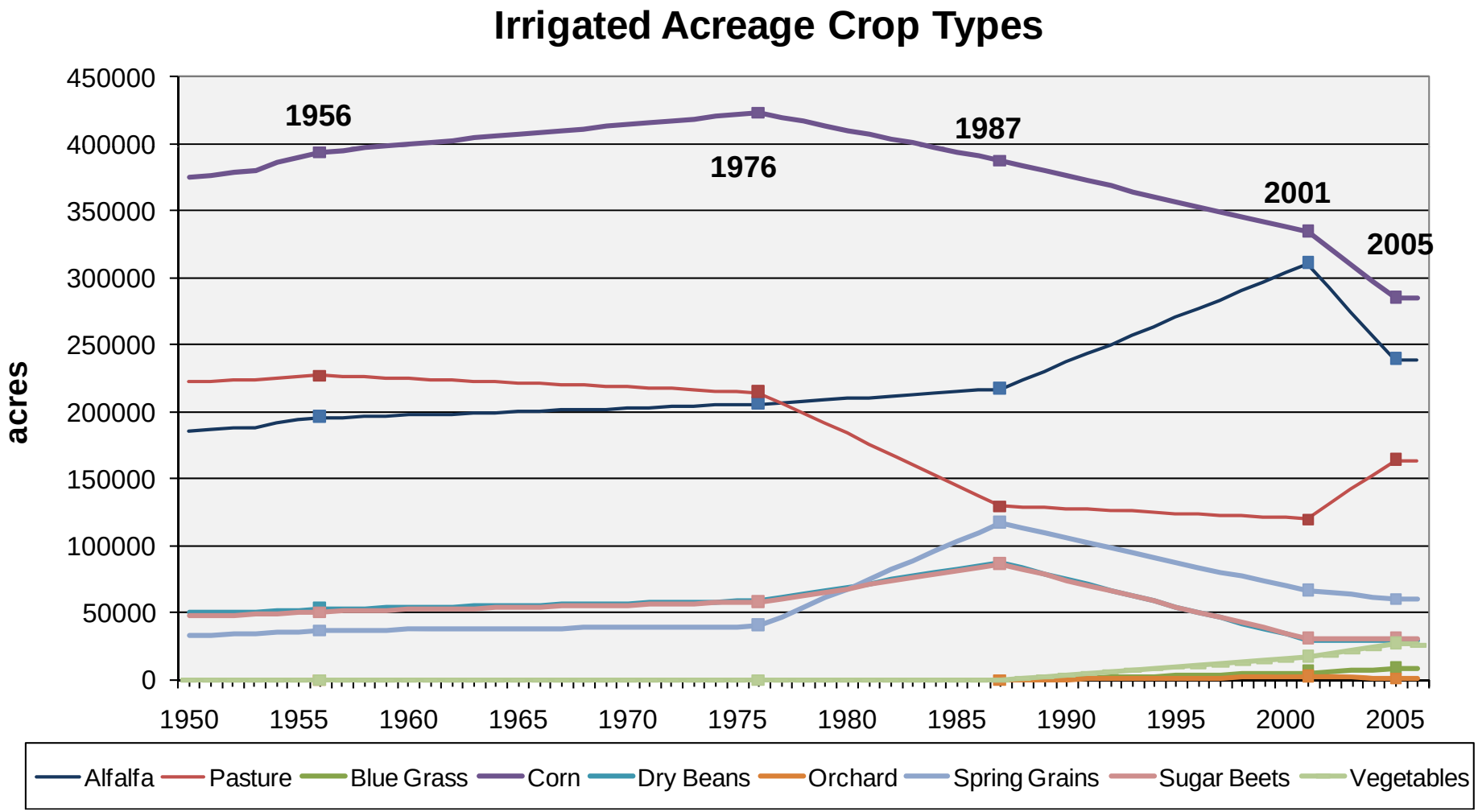
2001 Irrigated Acreage

Crop	Acreage
Corn	335,878
Alfalfa	312,320
Pasture Grass	120,769
Spring Grains	66,230
Dry Beans	29,572
Sugar Beets	27,060
Vegetables	16,438
Orchard	2,252
Blue Grass	0
Total Acreage	**910,518**

Water District	Acreage
01	254,331
02	166,853
03	199,795
04	68,586
05	54,329
06	40,455
07	6,212
08	3,743
09	2,031
23	7,604
48 & 76	3,738
64	101,915
80	926
Total Basin	**910,518**

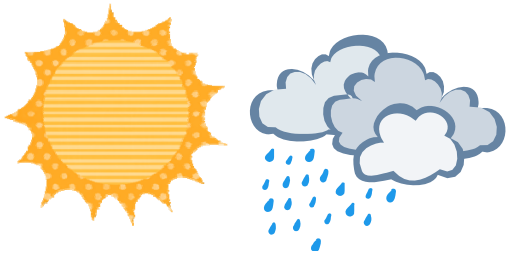
Irrigated Acreage

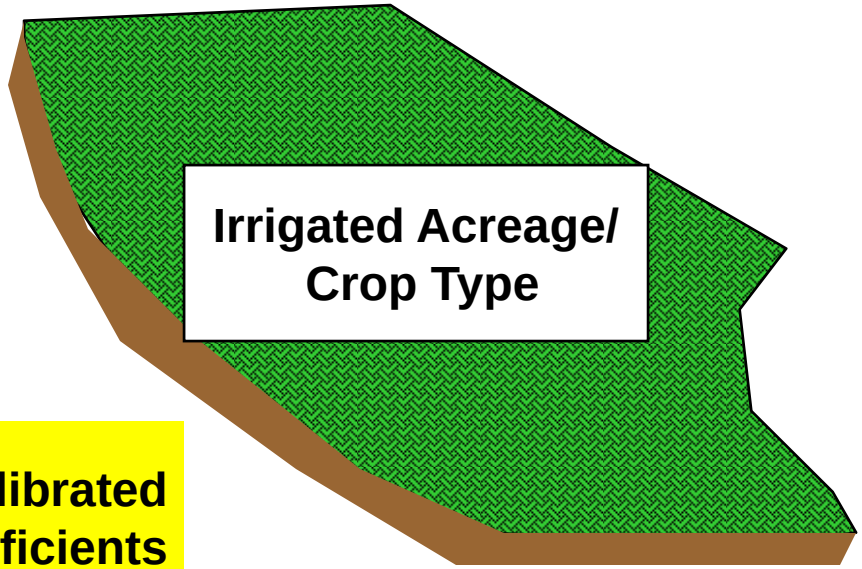
- Five “snapshots” over study period

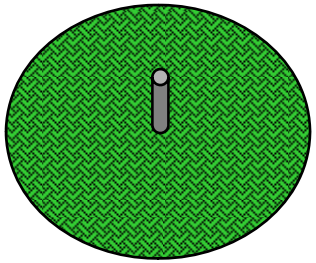


Irrigation Water Requirement Input Data

Climate Data

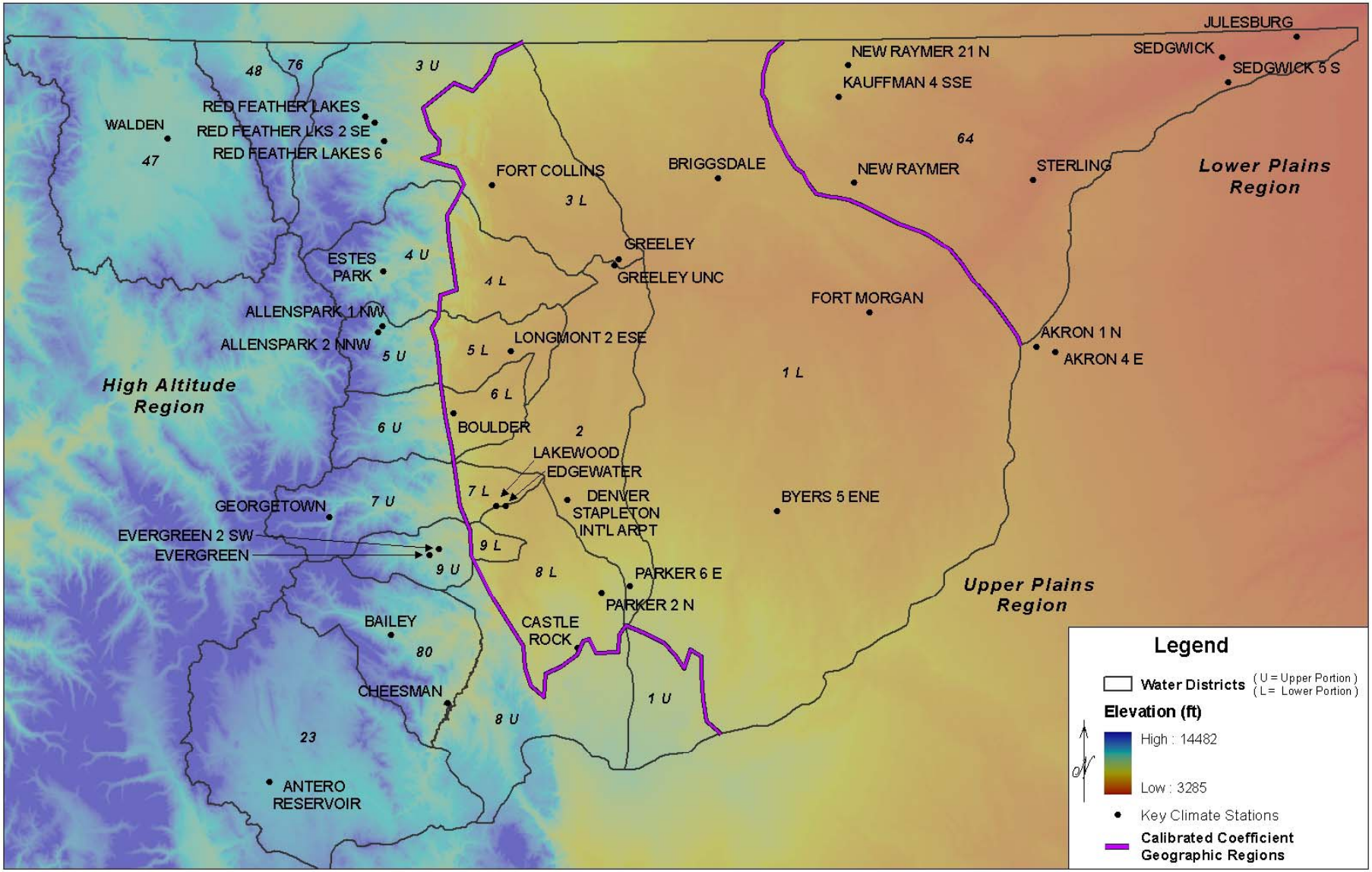




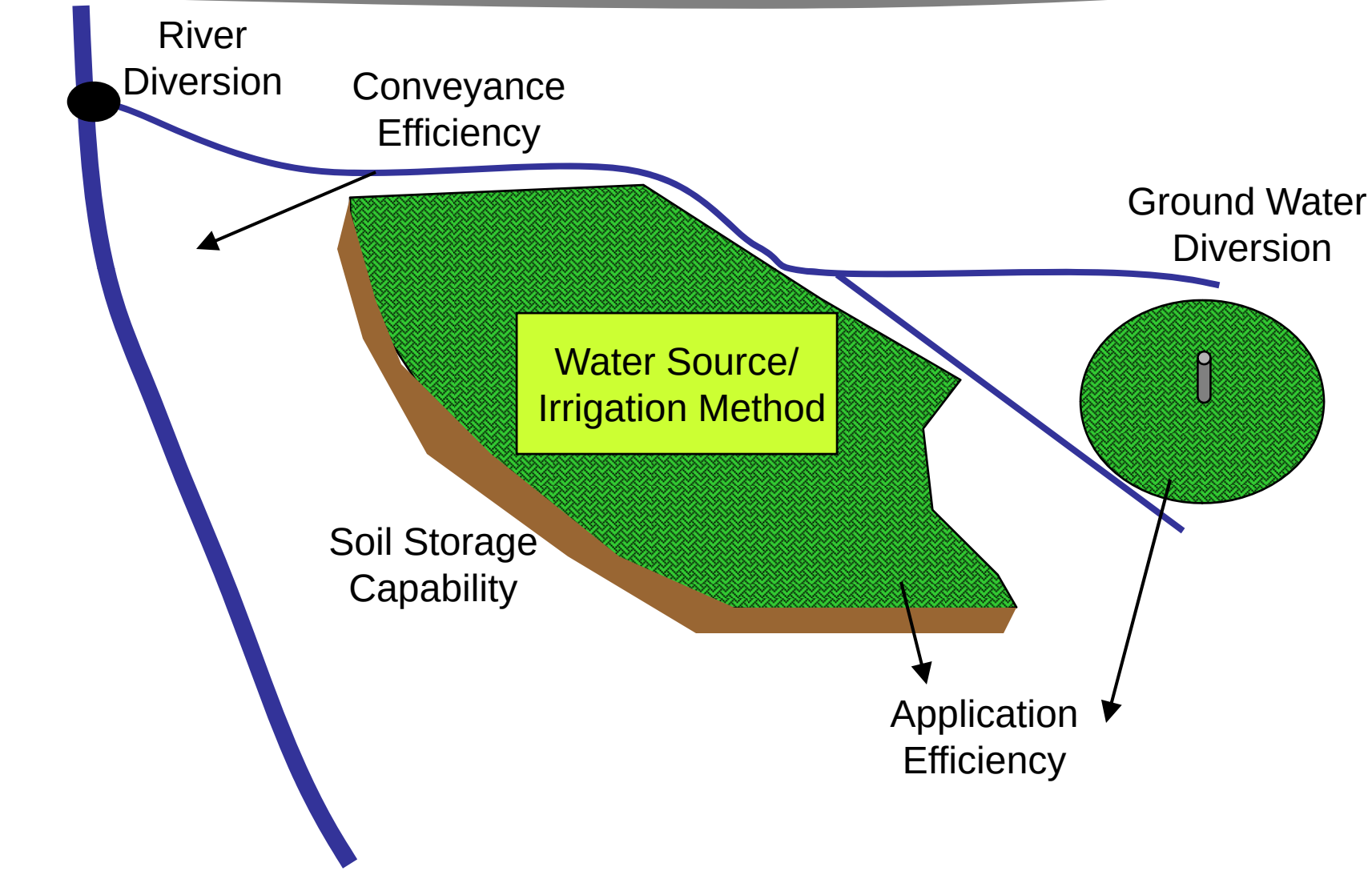


Locally Calibrated Crop Coefficients

Locally Calibrated Coefficients



Supply-Limited CU Input Data

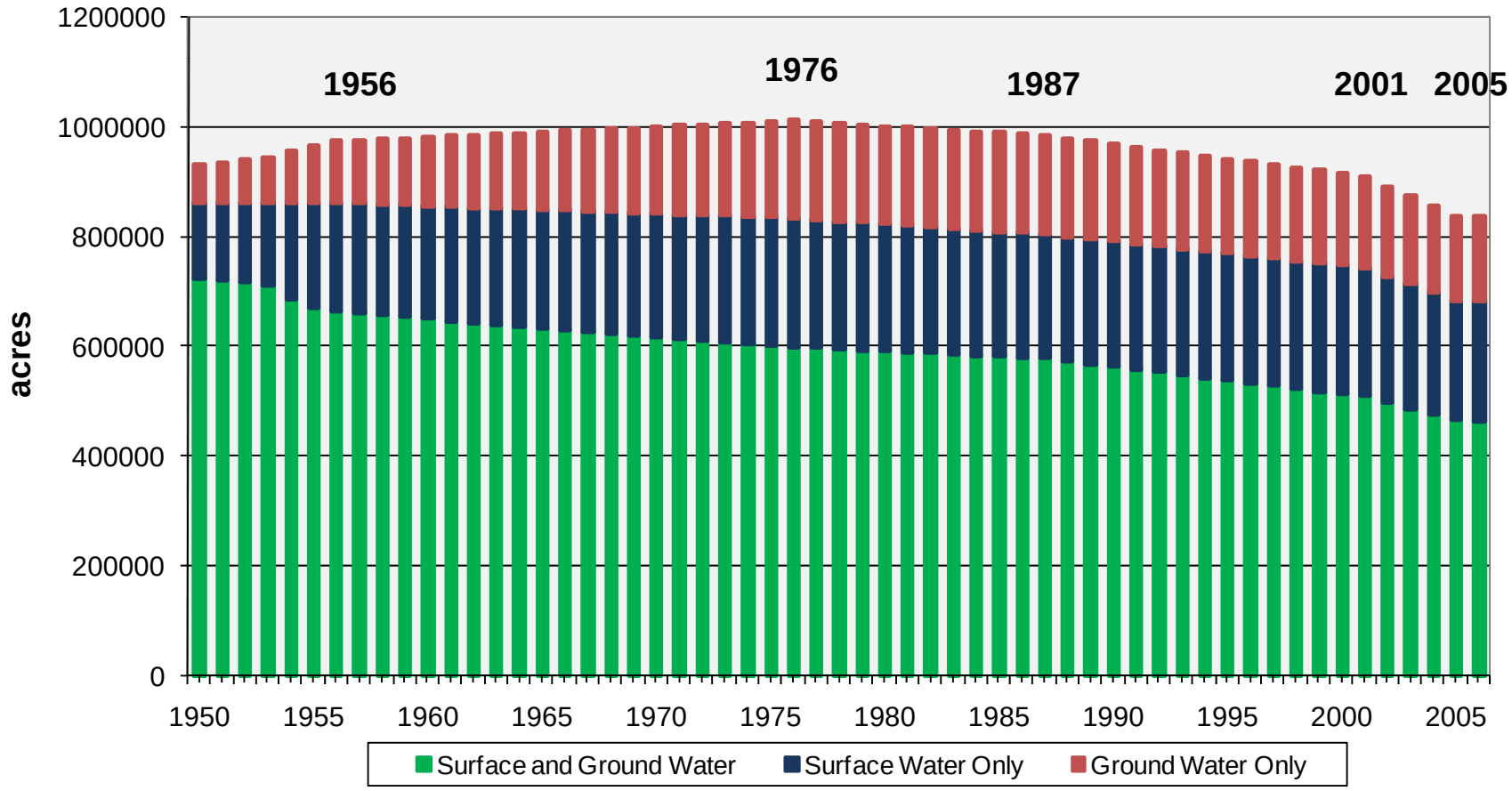


Water Source

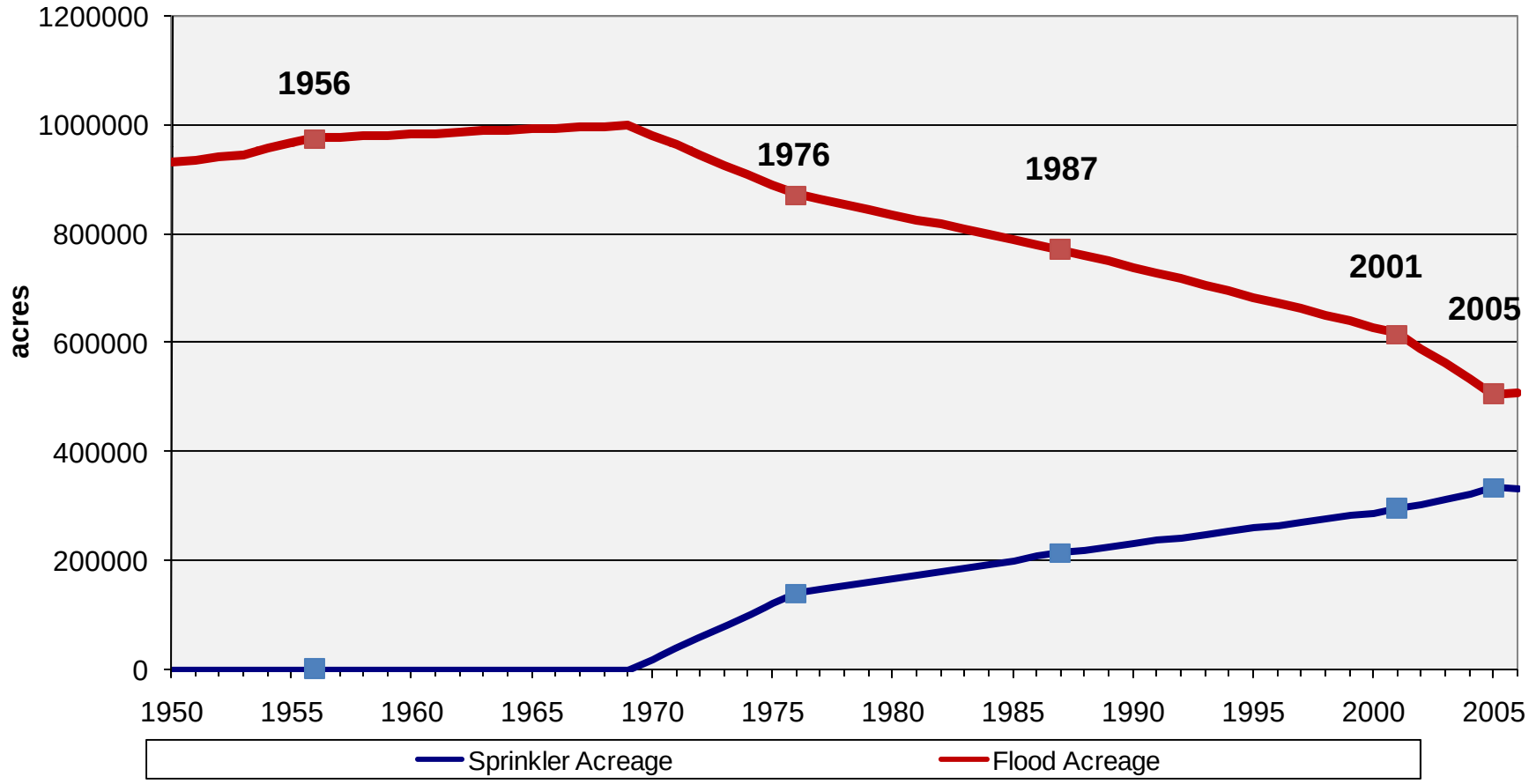
Structures with Surface Water Only = 218

Structures with Surface and Ground Water = 112

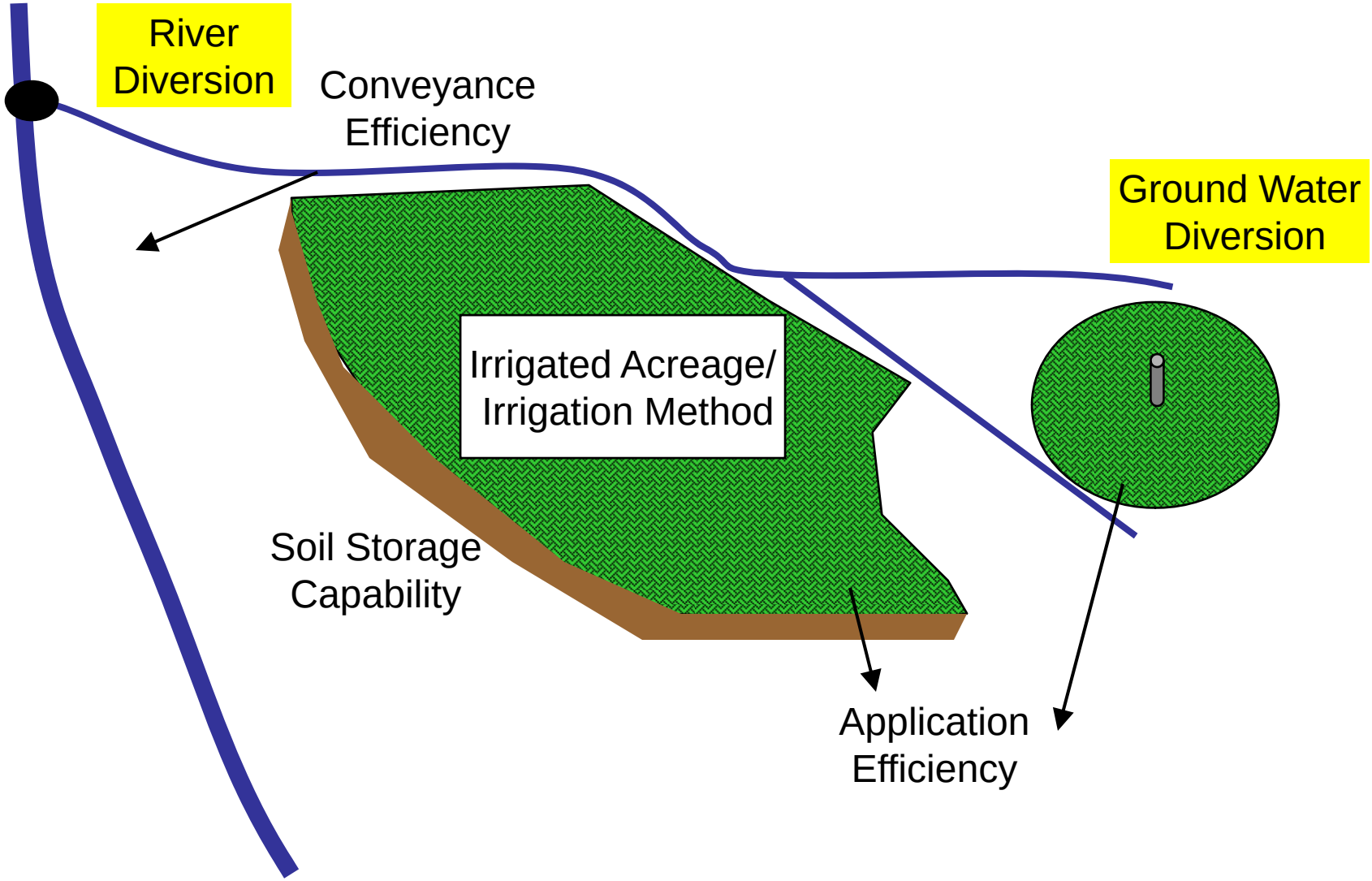
Ground Water Only Groups = 83



Irrigation Method



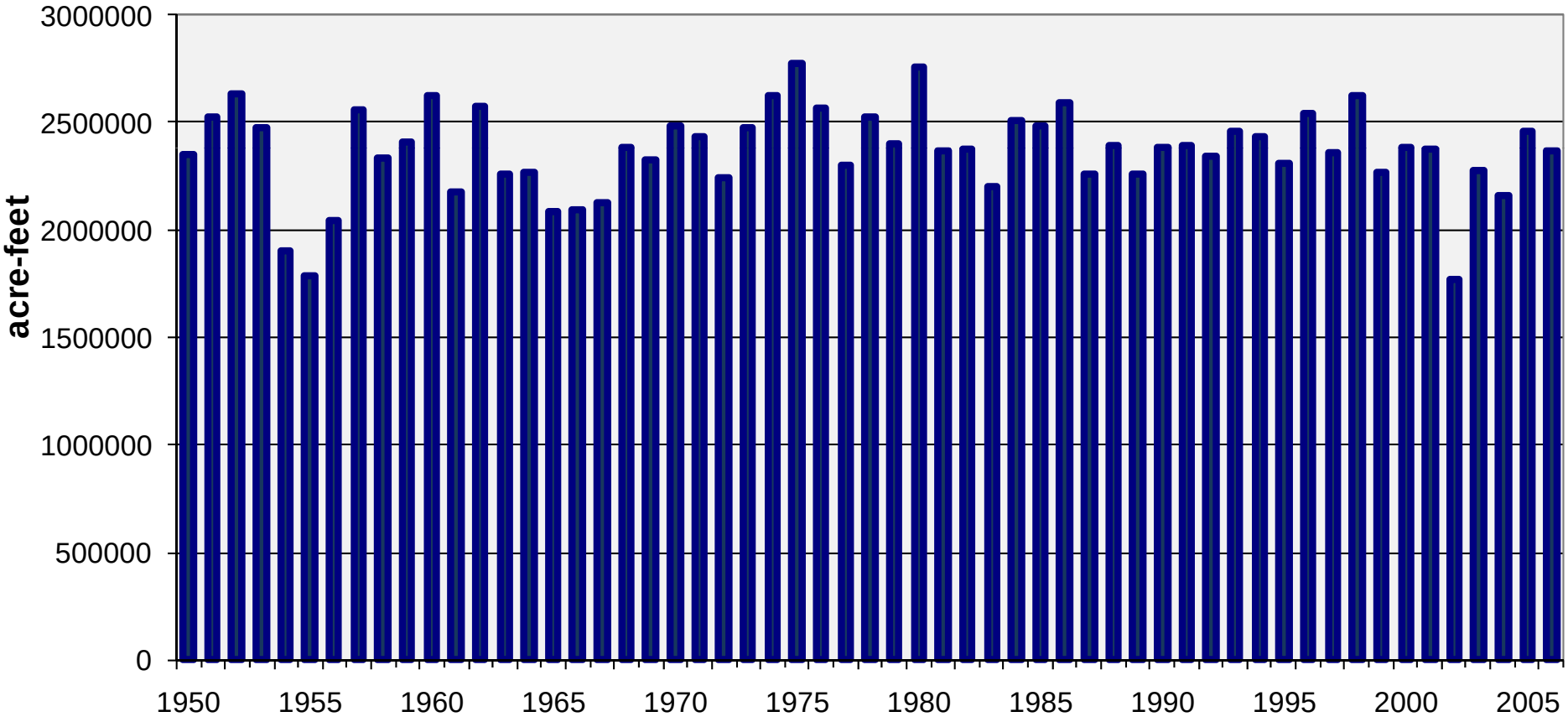
Supply-Limited CU Input Data



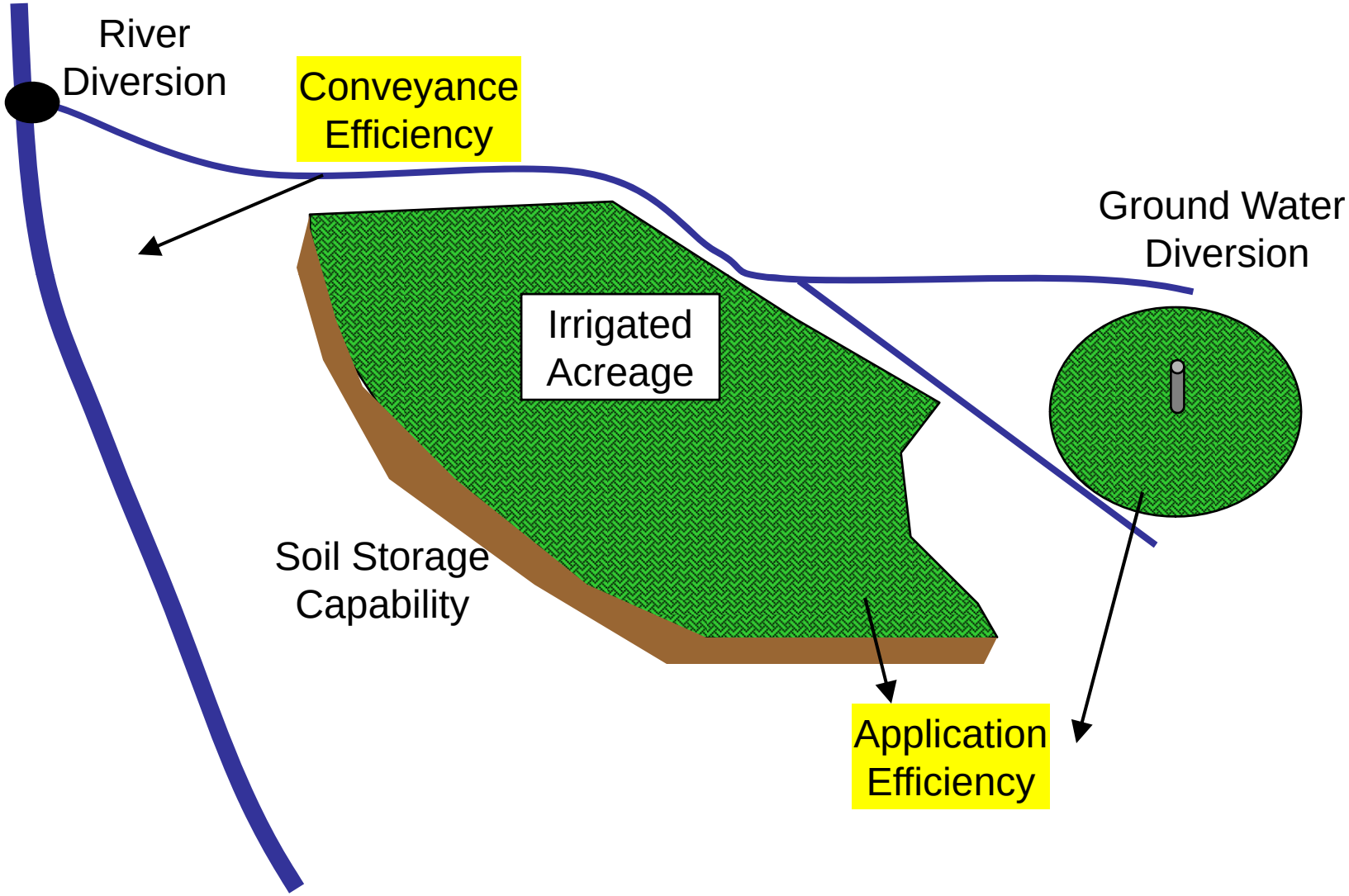
Water Supplies

- River Diversion Records
  - Headgate diversion records for irrigation use from HydroBase
  - Minor filling required
- Ground Water Pumping Records
  - Limited availability throughout study period
  - Specific acres served by meter readings or power records not available

Irrigation Supply

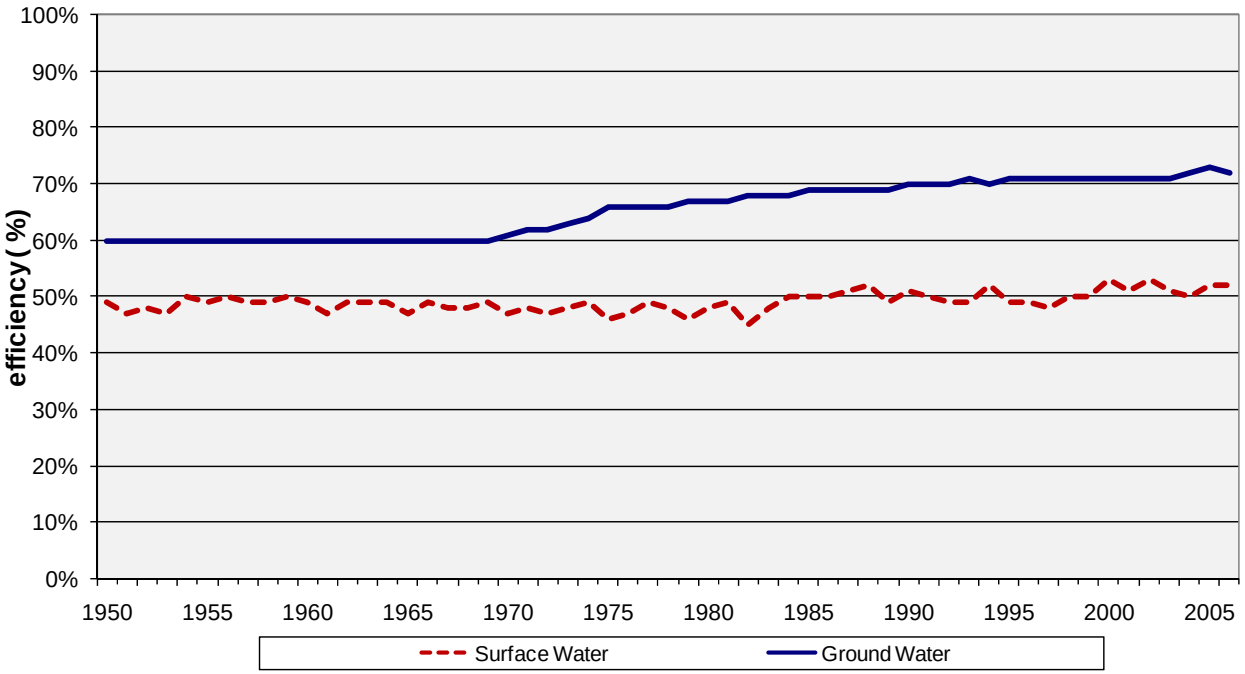


Supply-Limited CU Input Data



Efficiencies

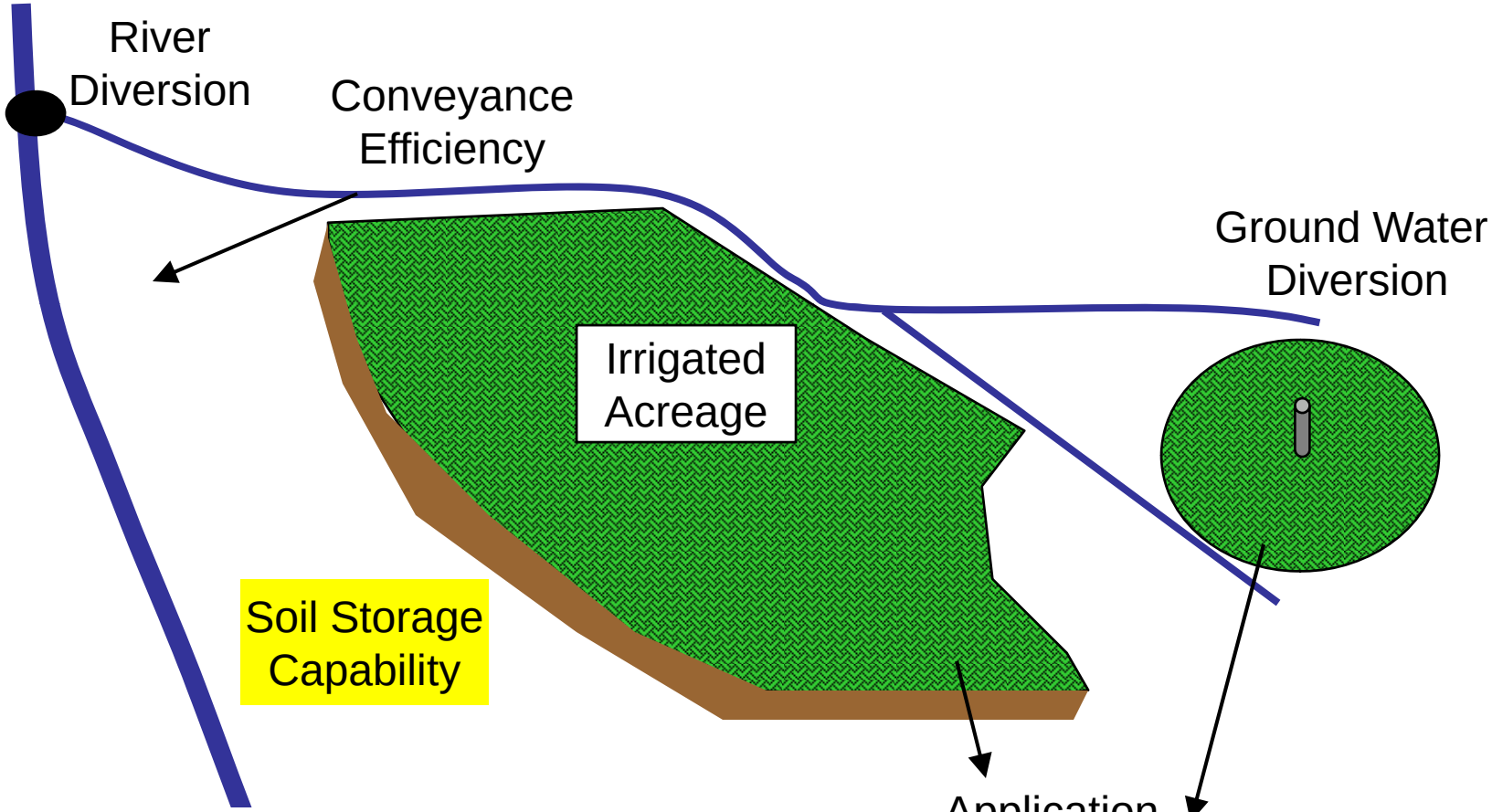
- Used available ditch efficiency information from decrees, user-interviews for 69 ditches
- 60% Max Flood, 80% Max Sprinkler Application Efficiency



Efficiency	Number of Structures
100%	105 1)
>90%	32
80 to 90 %	114
70 to 80 %	142
60 to 70 %	13
< 60%	7
Total	413

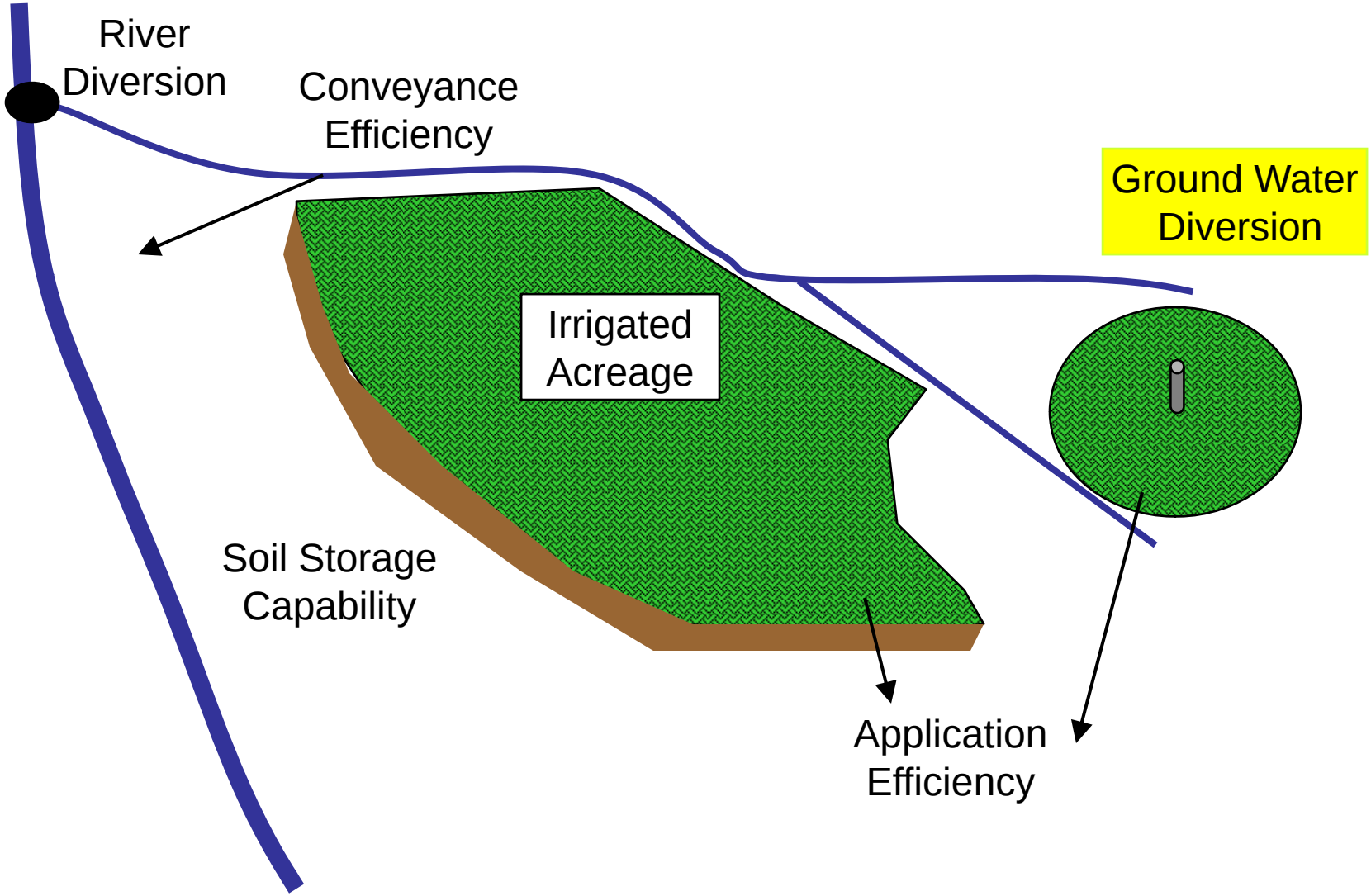
1) Structures with ground water source only

Supply-Limited CU Input Data



Soil Moisture Water Holding Capacity Ranges from 0.0850 to 0.1800 inches/inch

Supply-Limited CU Input Data



Mutual Ditch Methodology

1. Estimate farm headgate diversion = river diversion x conveyance efficiency (determines **Conveyance Loss**)
2. “Allocate” farm headgate diversion to each land use category based on acreage
3. Determine max SW available to meet IWR = farm headgate*max application eff.

Mutual Ditch Methodology

4. Store excess SW in soil reservoir up to available soil reservoir capacity (remaining is **Non-consumed Applied Surface Water**)
5. Apply ground water diversion (if available) based on max application efficiency (inefficient water is **Non-consumed Applied Ground Water**)
6. Meet IWR shortages from soil moisture reservoir

Mutual Ditch Methodology

7. Pump to meet shortages on SW&GW Lands

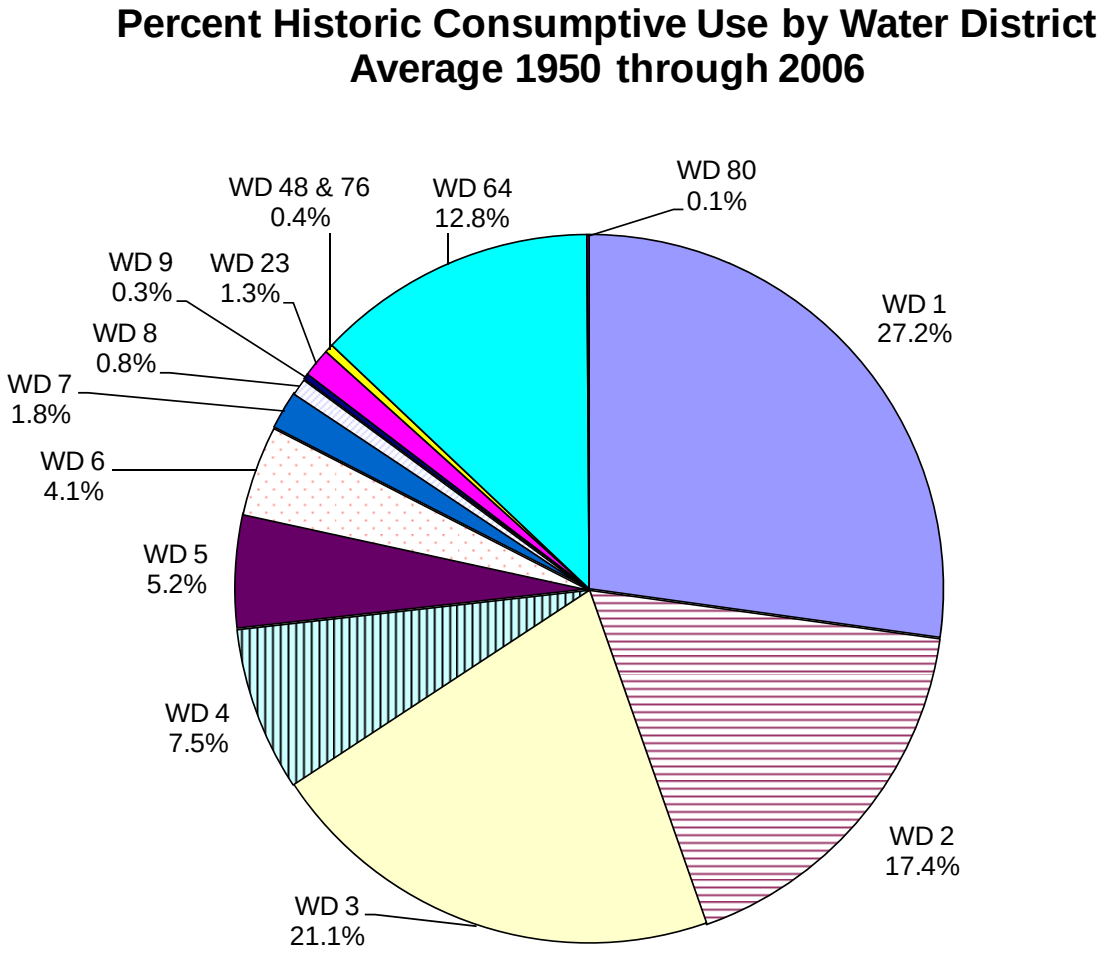
   Pumping = shortage/max app eff, limited by well capacity (Inefficient water is **Non-consumed Applied Ground Water**)

8. Pump to meet demand on GW-only Lands

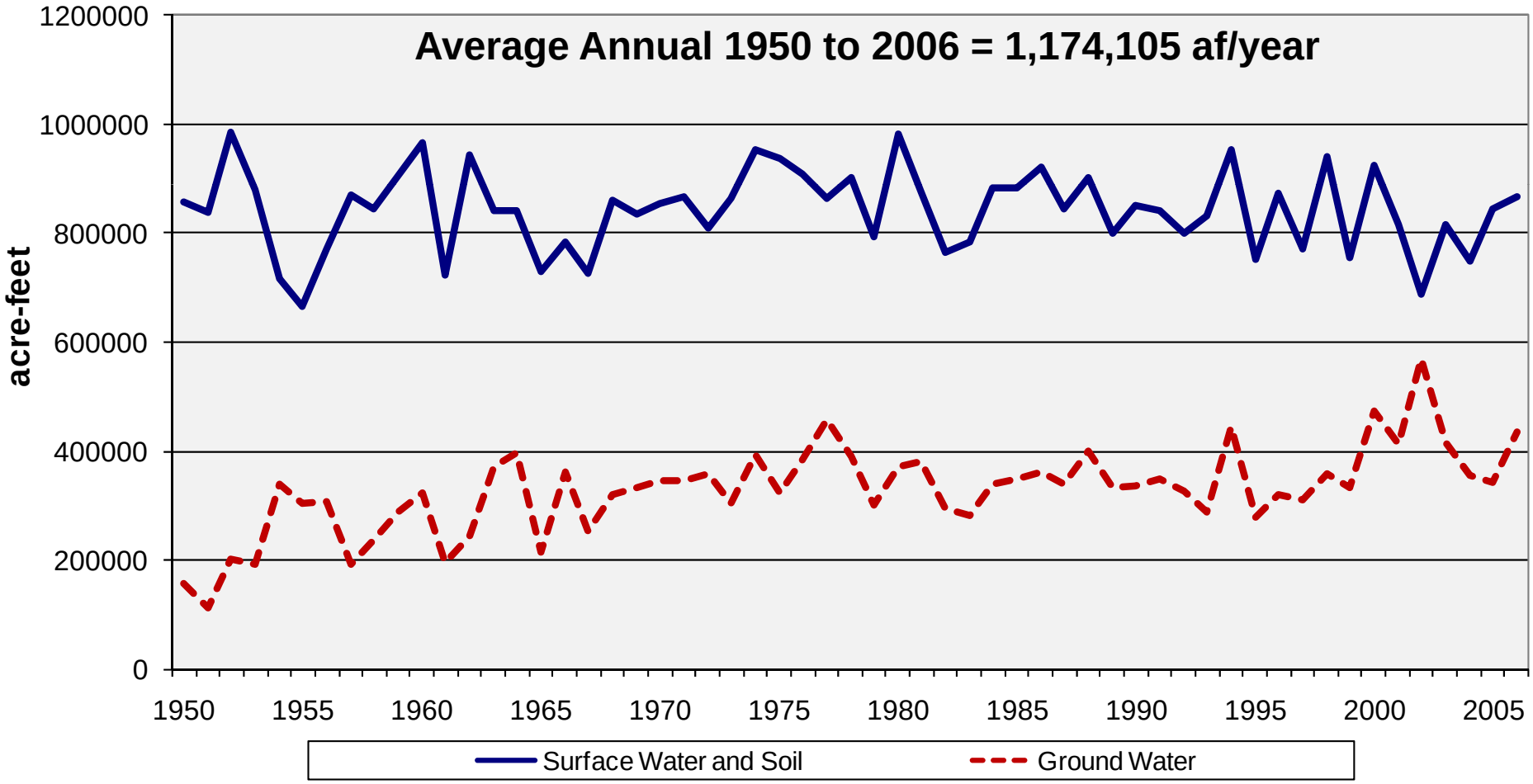
   Pumping = IWR/max app eff, limited by well capacity (Inefficient water is **Non-consumed Applied Ground Water**)

Basin-wide CU Results

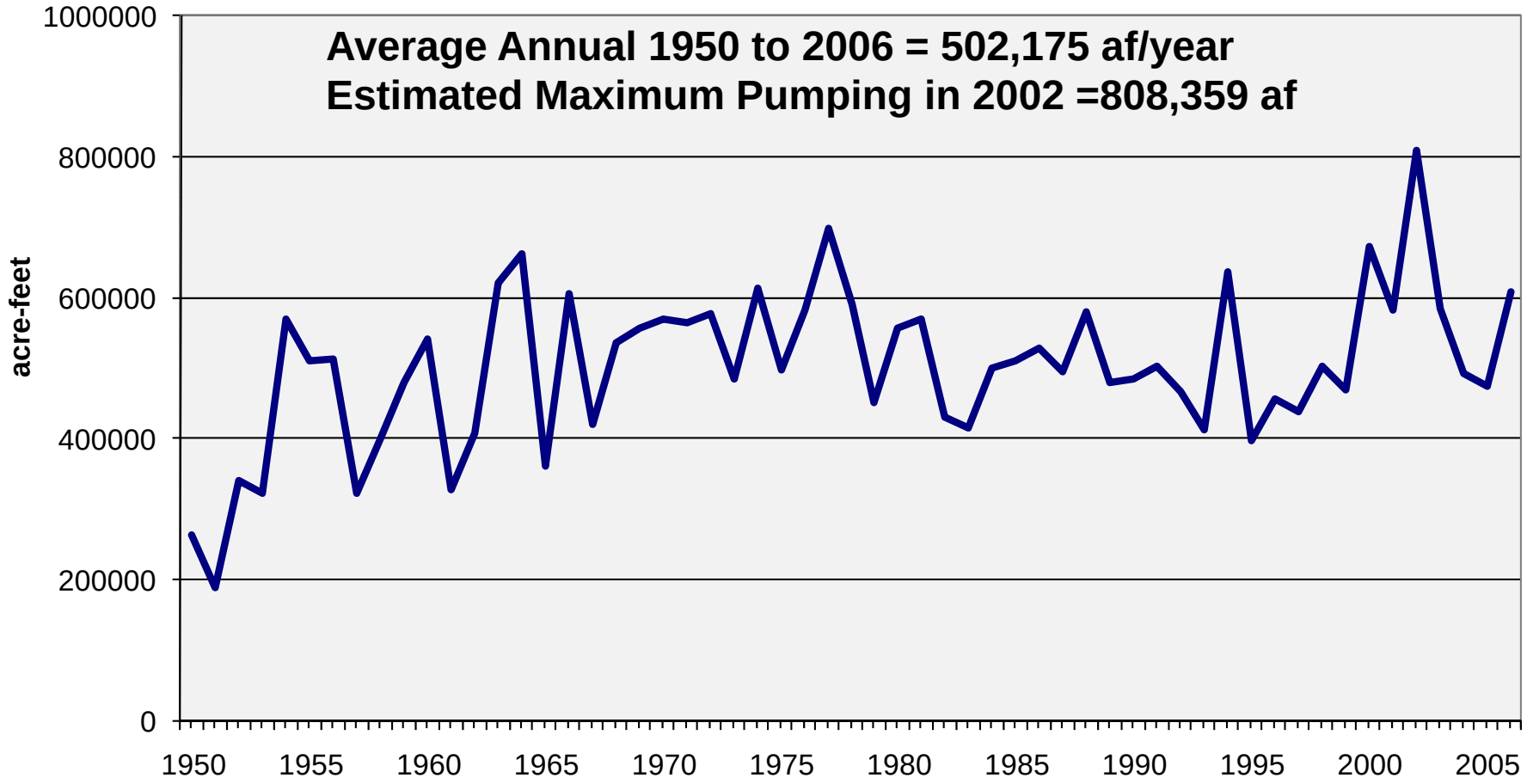
Water District	Supply-Limited CU (acre-feet)
1	319,265
2	204,674
3	247,906
4	87,898
5	60,980
6	48,443
7	21,048
8	8,998
9	3,053
23	15,318
48/76	4,621
64	150,648
80	1,253
Total	**1,174,105**



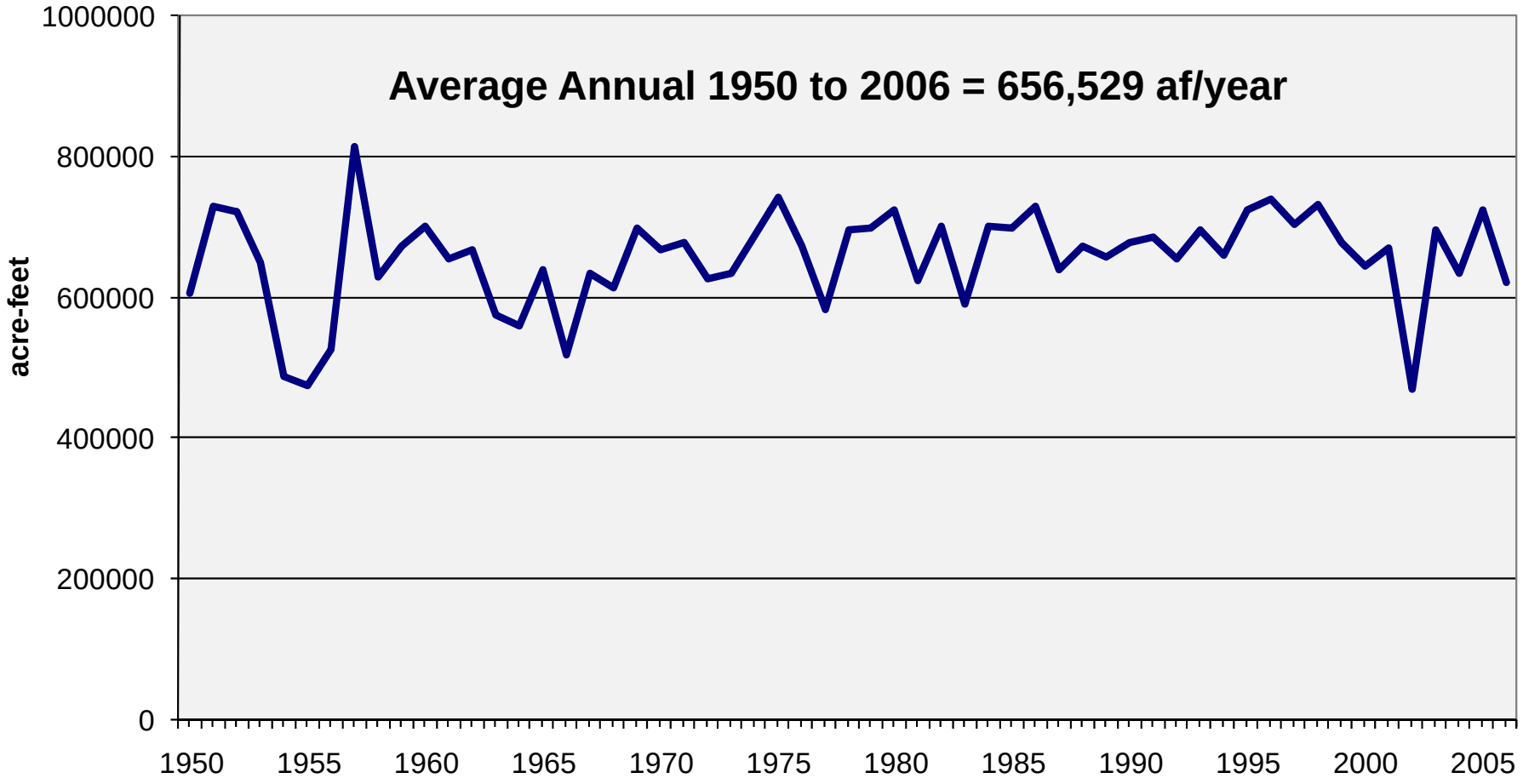
Basin-wide CU Results



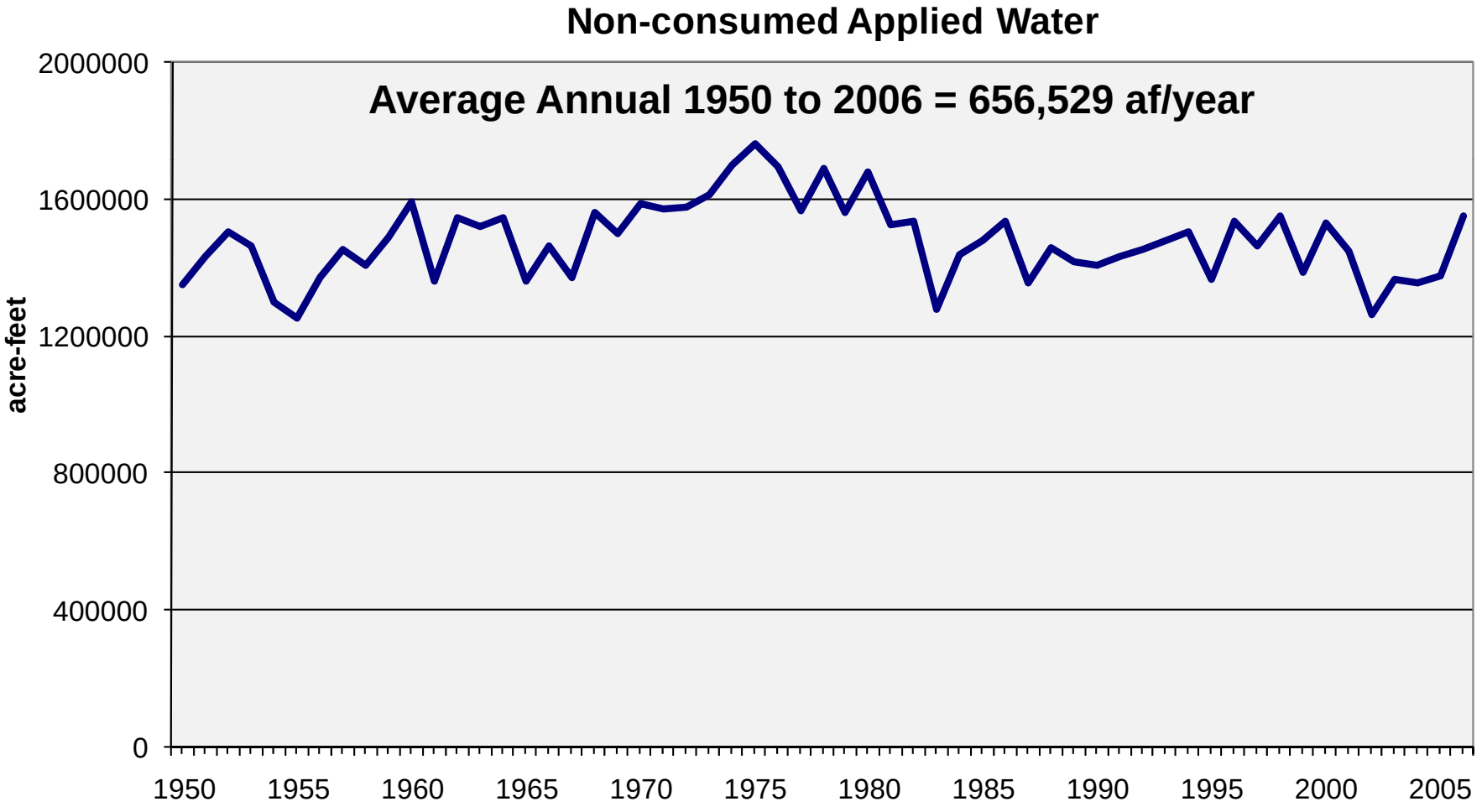
Irrigation Pumping Estimates

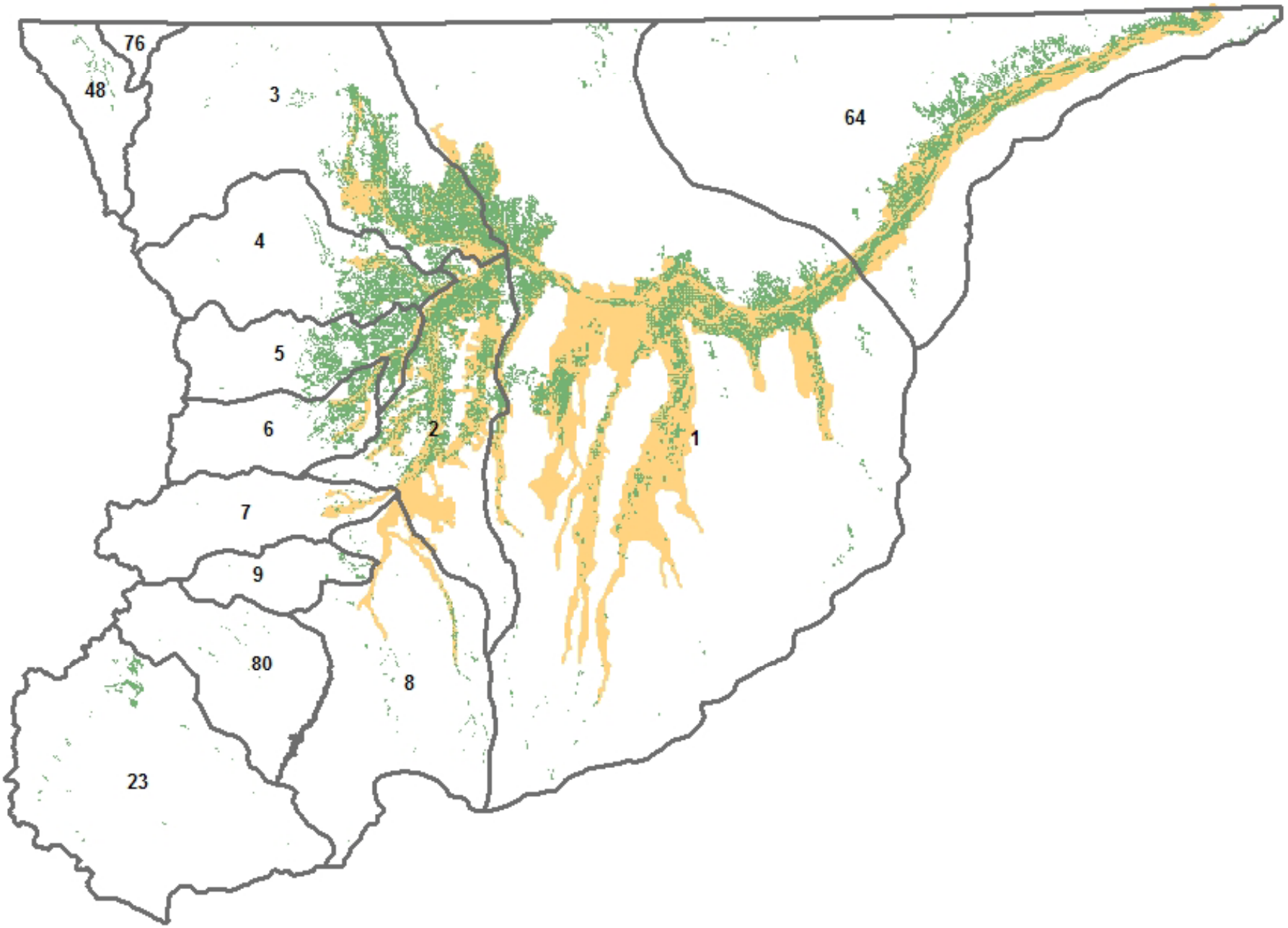


Conveyance Recharge



Non-Consumed Applied Water




76
48
3
64
4
5
6
2
1
7
9
80
8
23

SPDSS CU Documentation

- Irrigated Acreage Assessment Memorandum
- Historical Crop CU Report
  - Report summarizes model inputs and results
  - Detailed technical memoranda included as Appendices
  - Available at http://cdss.state.co.us/

Historic Crop CU Report

- Detailed technical memoranda in Appendices include:
  - Climate station selection and data filling
  - Irrigated acreage, source, method filling between GIS snapshots
  - Ditch system efficiency estimates
  - Development/selection of calibrated coefficients
  - Deficit irrigation investigation