COLORADO WATER CENTER
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Efficiency in Irrigated Agriculture Does It Save Water?

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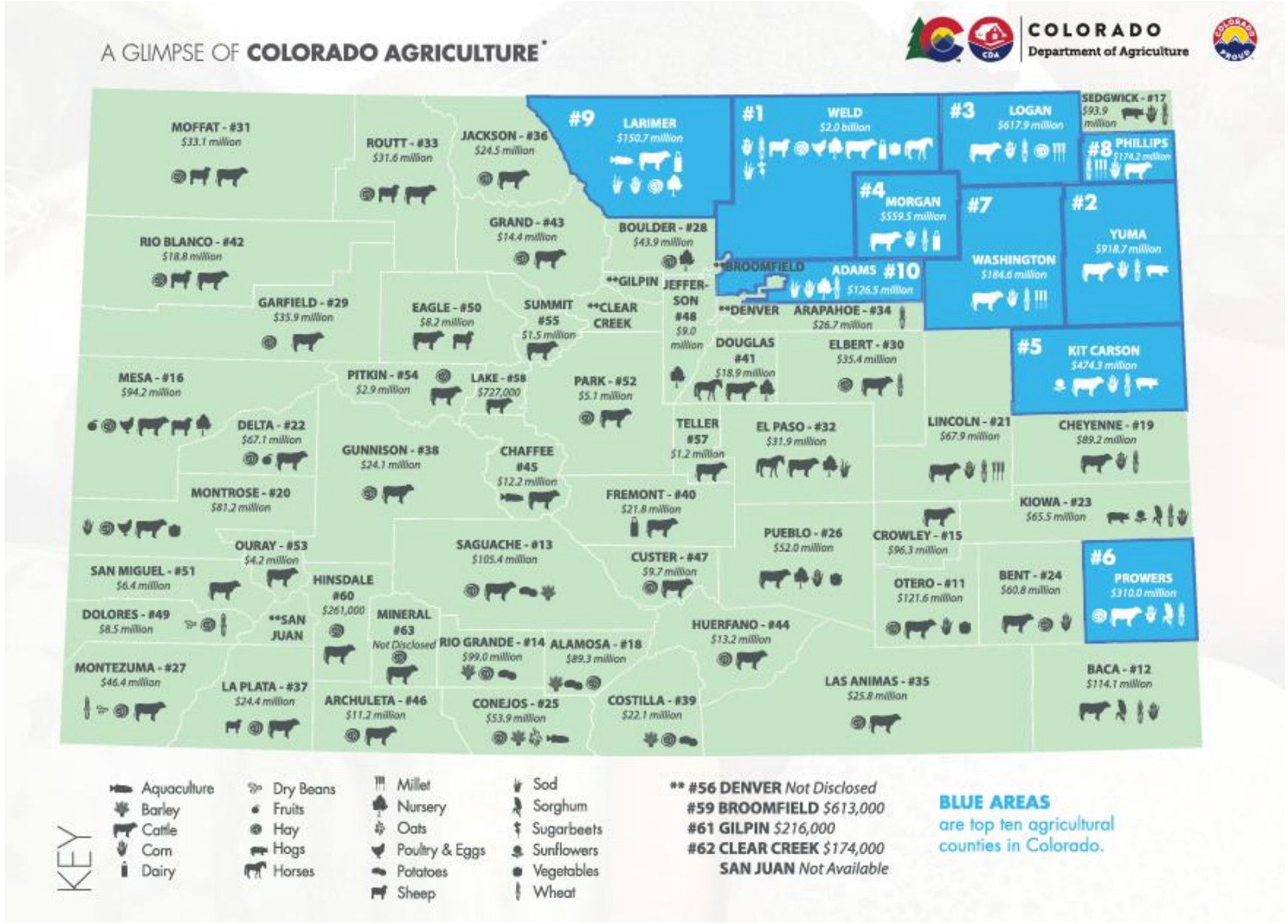
Agriculture in the South Platte Basin

- **Agriculture uses approximately 86% of the water in the South Platte Basin.**
  - **5 of the top 10 counties are within the South Platte Basin ($3.5 billion)**
  - **854,000 irrigated acres (2.4 to 2.8 million acres in Colorado)**
  - **80% of Colorado's population**

- **South Platte is net water short**
  - **Can increase efficiency help solve the problem?**



- Of the top 20 counties in Colorado
- 15 – Eastern Plains
- 3 – San Luis Valley
- 2 – Western Slope

Economics of Agriculture in Colorado

- **Agriculture Direct and Indirect:**
  - **$47 Billion**
  - **195,000 jobs**

- **Tourism Direct and Indirect:**

  $60 Billion

  370,000 jobs

  – **Add Induced and Investment**

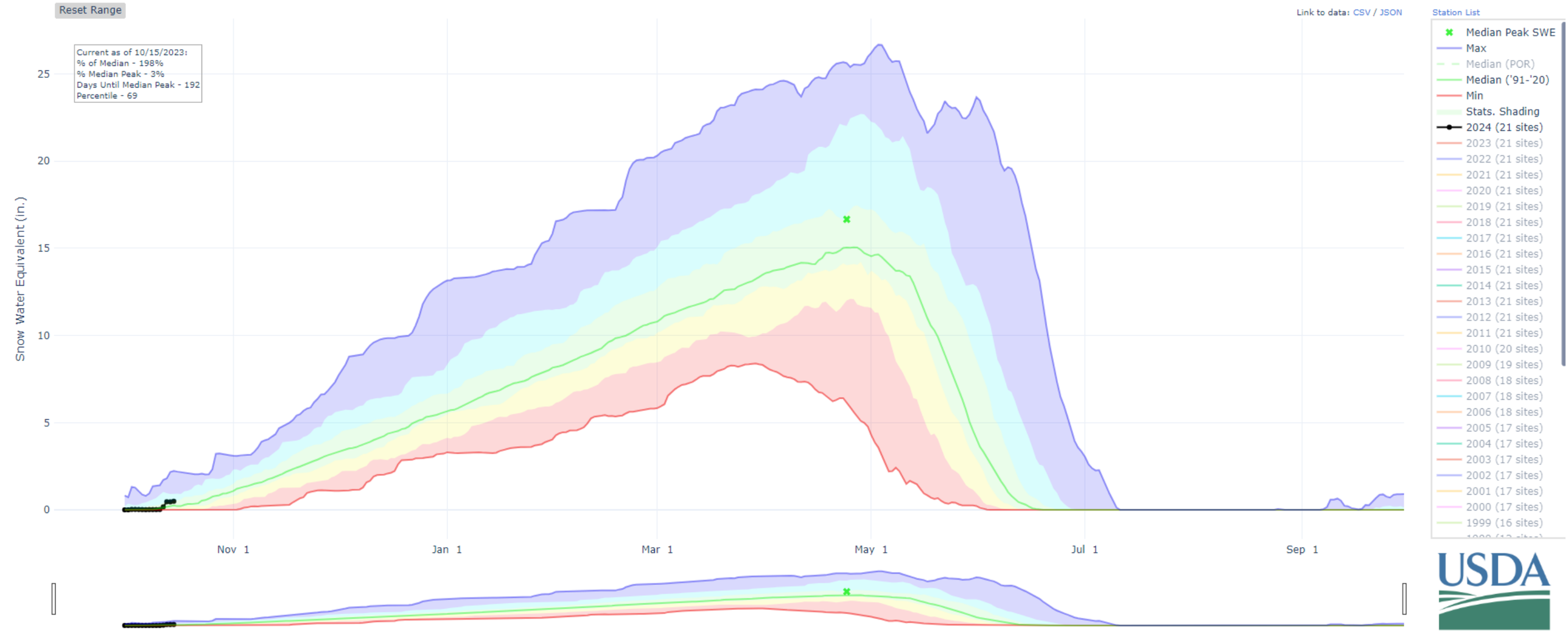
  $99.5 Billion

  623,000 jobs

South Platte River

- Prior to development
  - Raging river from snow melt
  - Dry during summer due to lack of snow melt
- Beginning of development
  - Development of irrigation
    - Near river as well as ditches farther from the river
  - River began to flow more consistently in summer in regions
    - Leads to more irrigation development
- Increased Storage in the Alluvial Aquifer
  - Rivers are a drainage system for the basin

SNOW WATER EQUIVALENT IN SOUTH PLATTE



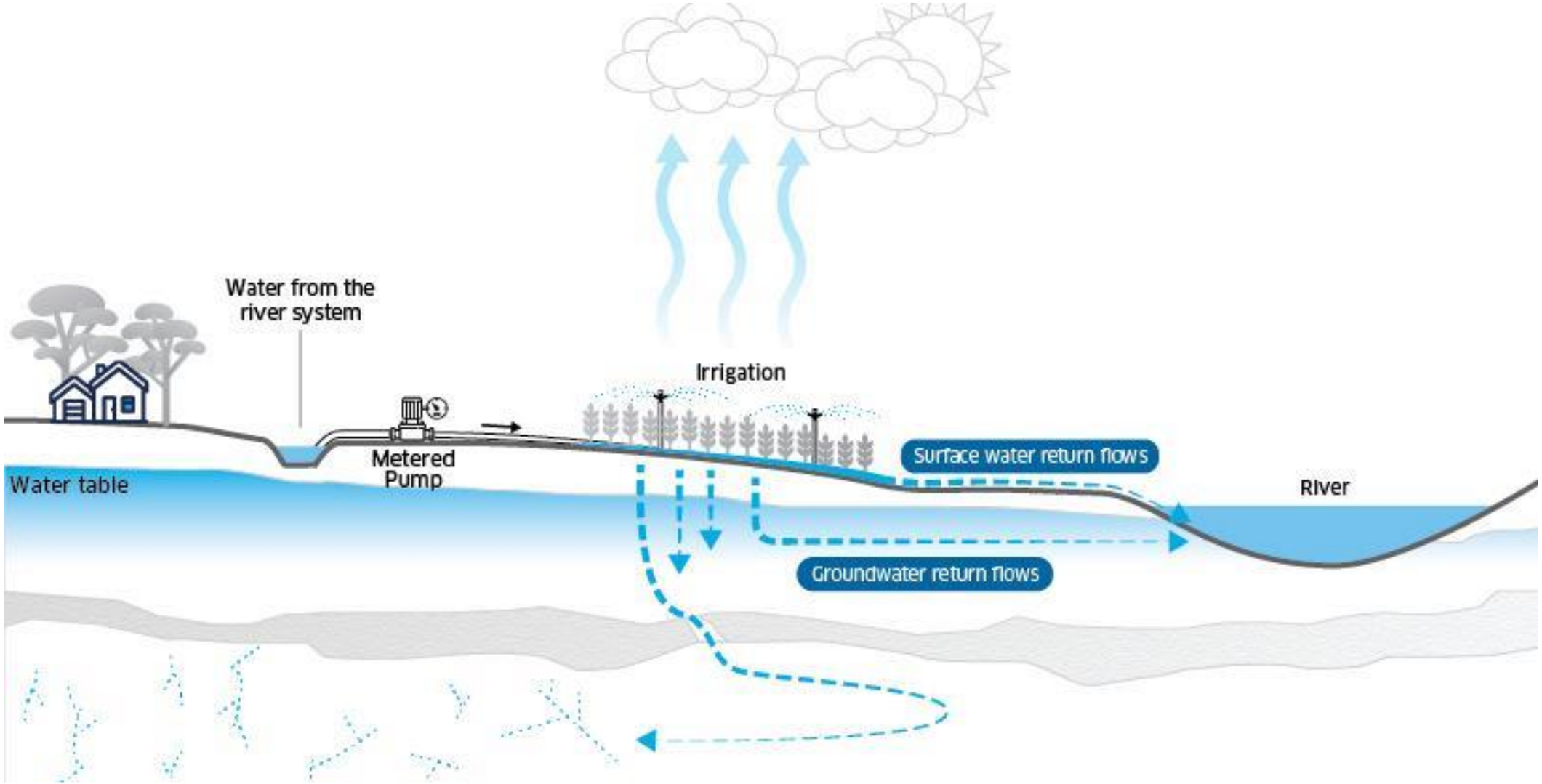
Statistical shading breaks at 10th, 30th, 50th, 70th, and 90th Percentiles
For more information visit: 30-Year Hydroclimatic Normals

Reservoir Storage in the South Platte

Table 8.1. Summary Table by Water District in Division 1, South Platte Basin.

Water District	Approx. Storage Capacity	Approx. Decreed Volume Absolute	Total Volume Lost from Dam Restrictions of Major Reservoirs
	Acre-Feet		
WD 1	161,828	332,511	0
WD 2	67,243	100,732	0
WD 3	490,223	344,454	2,650
WD 4	216,173	214,925	0
WD 5	150,365	87,785	0
WD 6	79,472	104,428	0
WD 7	42,734	41,565	0
WD 8	620,770	50,365	0
WD 9	23,100	19,995	0
WD 23	296,873	403,725	6,500
WD 64	108,768	124,657	9,495
WD 80	87,227	158,128	0
TOTAL	**2,344,776**	**1,983,270**	**18,645**

- **Storage not only captures spring runoff but is a drought mitigation tool.**



Source: Murry-Darling Basin

Furrow Irrigation

Center Pivot

Water Use in a Water Short Environment

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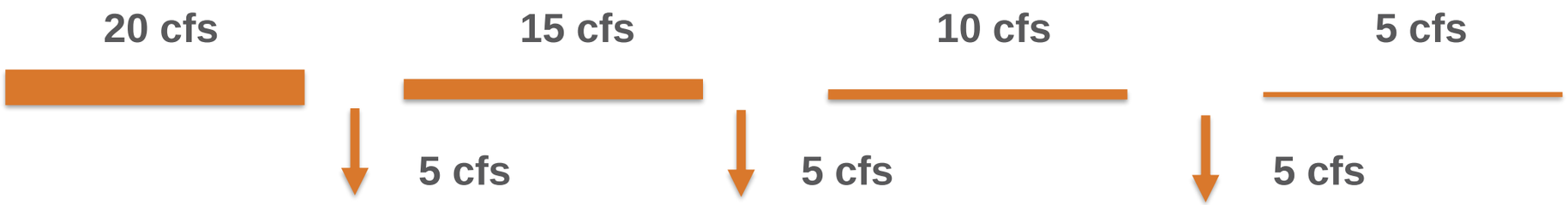
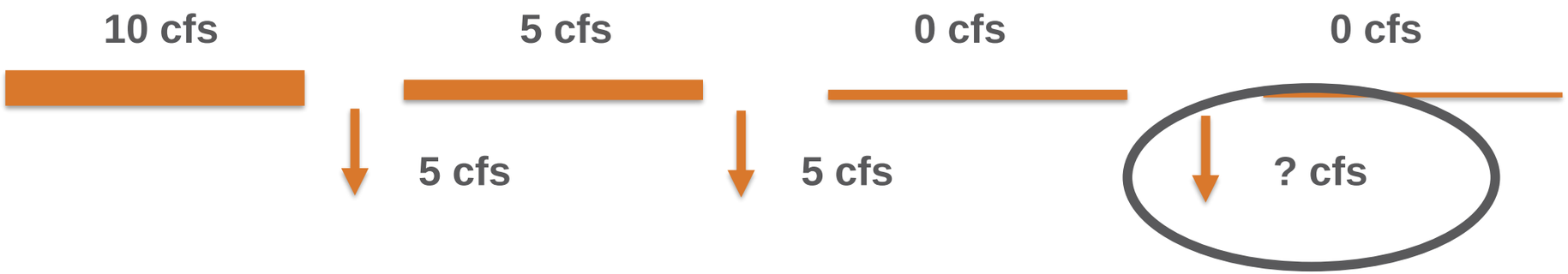
Water Conservation

- Irrigation Efficiency
- Actual Consumptive Water Use

How does efficiency impact stream flows?

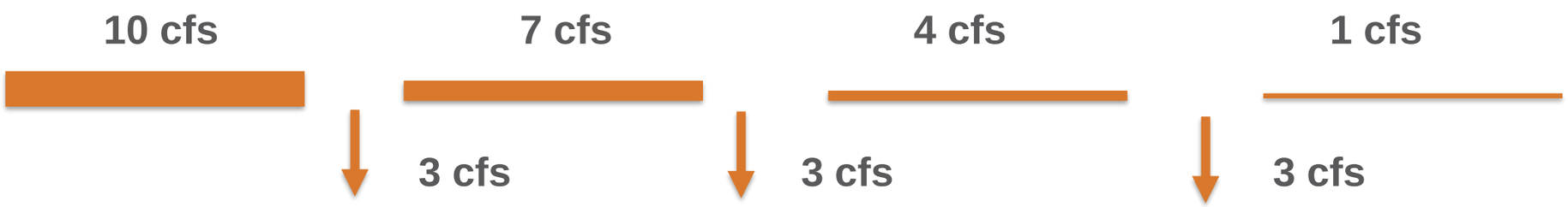
How the river works





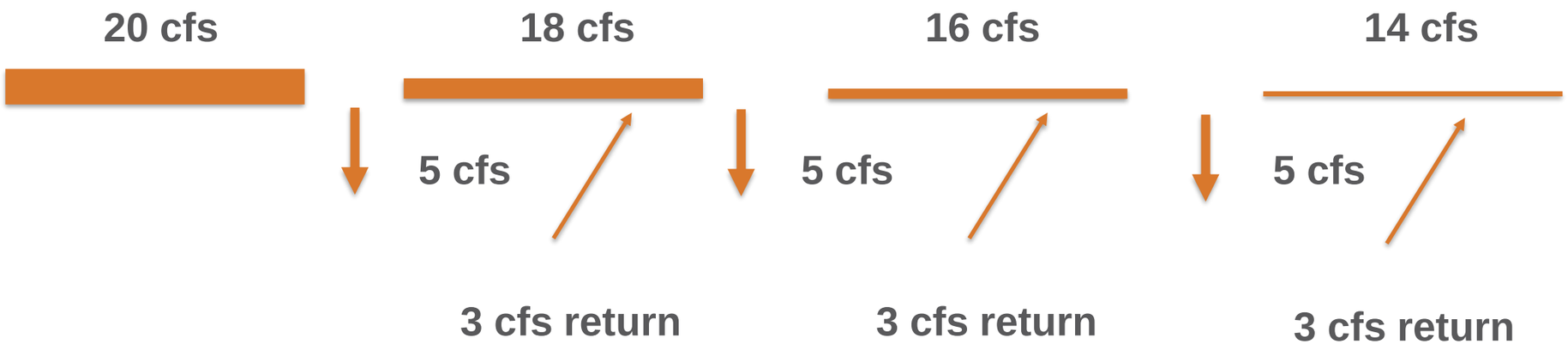
Senior water rights – shut off junior rights to get his water

How the river works

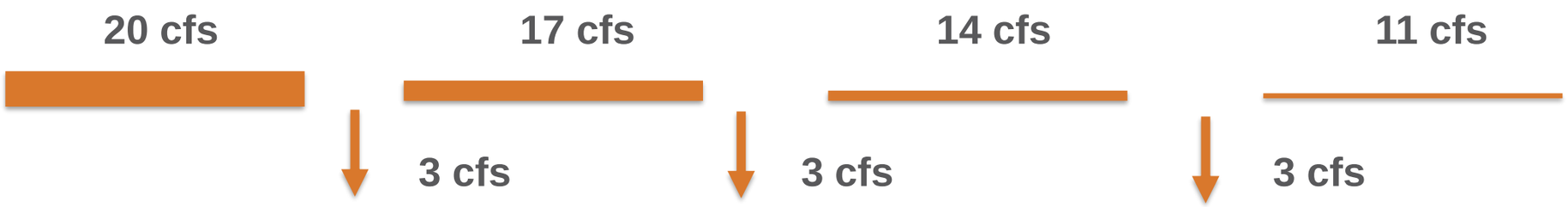


How the river works

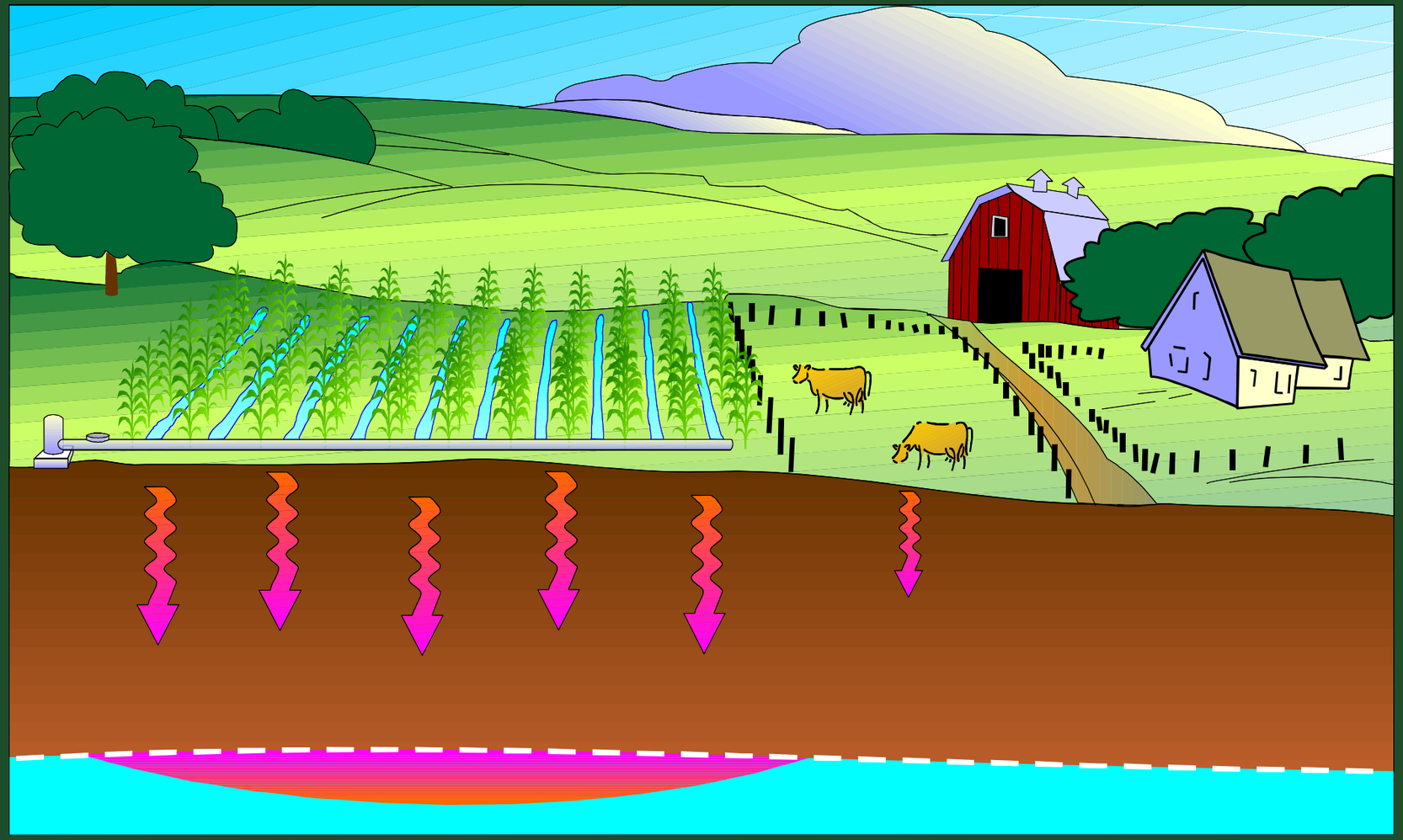
Low Efficiency



High Efficiency



Typical Irrigation of South Platte Basin

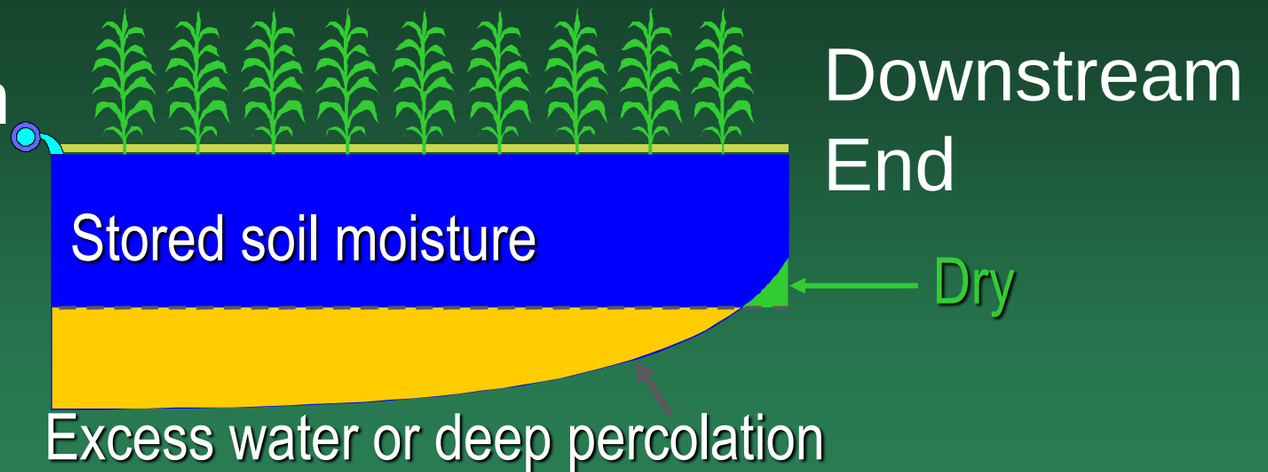


Recharge of the alluvial aquifer was from the deep percolation or leaching that occurred in the fields as well as the ditches and laterals that feed the irrigation systems.

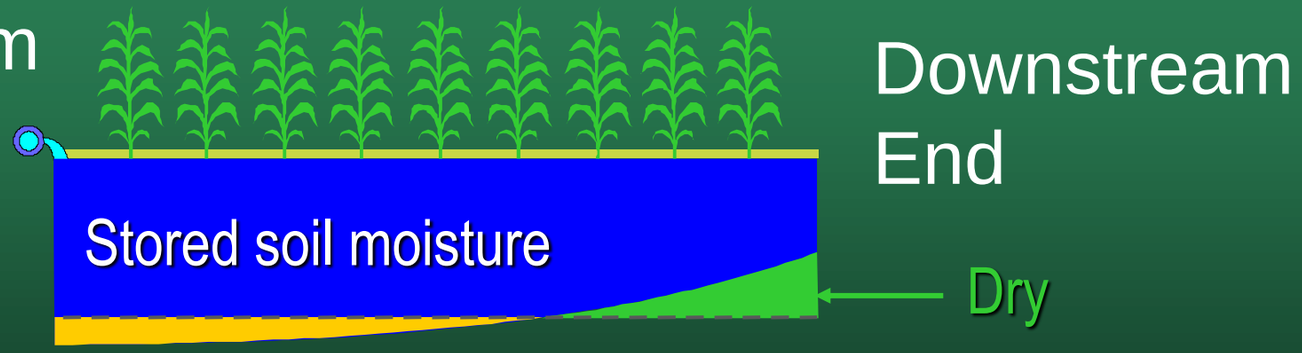
Very little was from the non-irrigated fields.

Uniformity

POOR

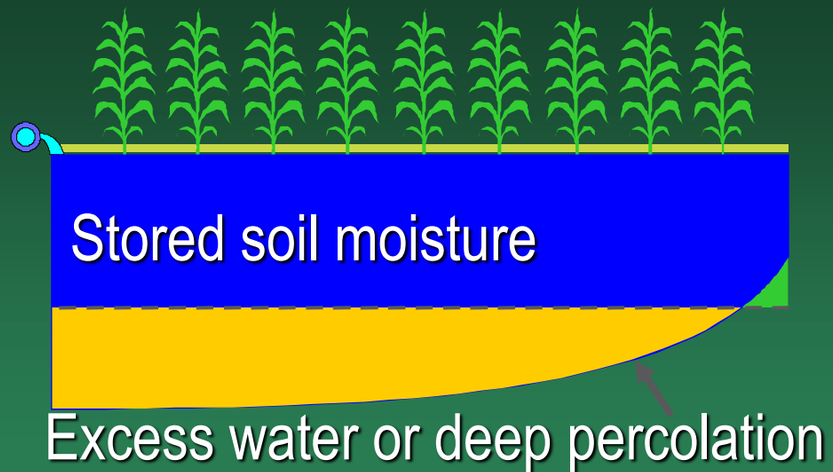


GOOD



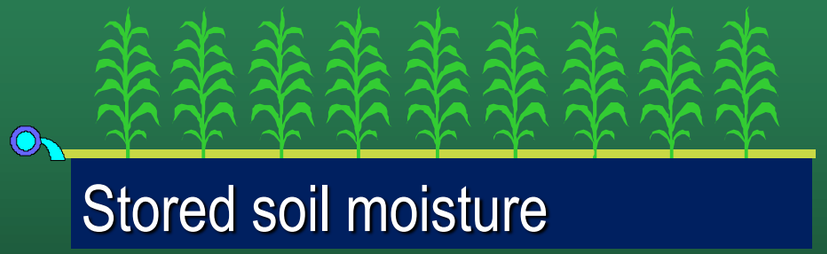
Uniformity

Furrow



Furrow irrigation is dependent upon many factors as to how much water infiltrates the soil.

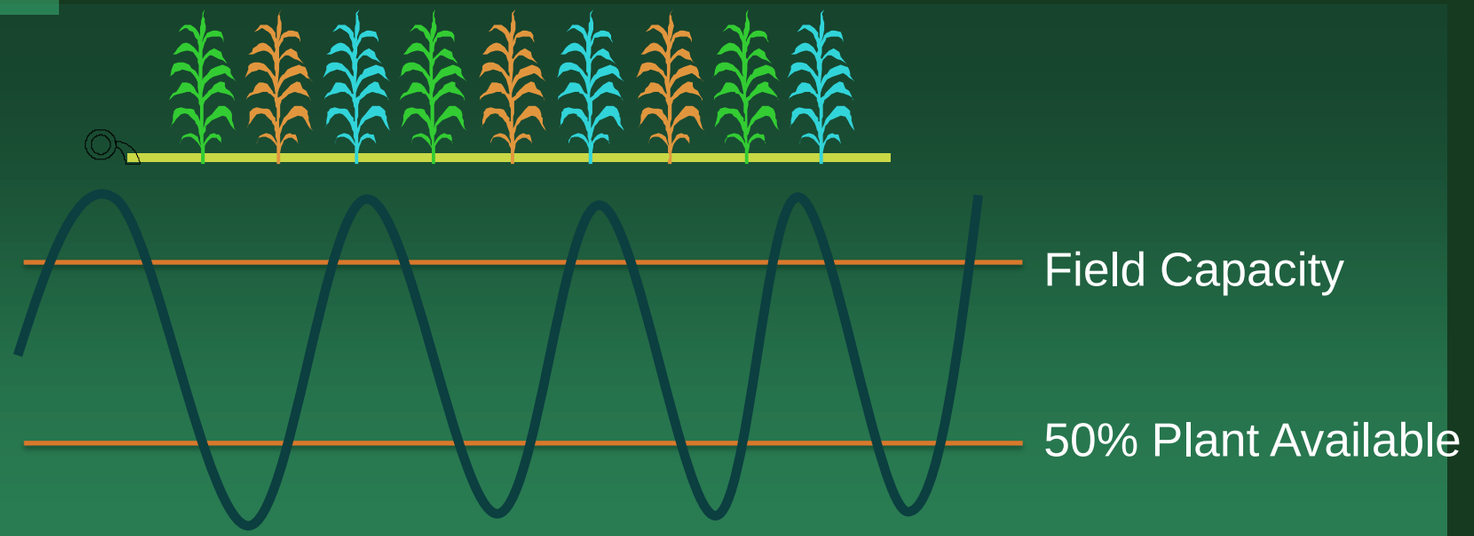
Center Pivot



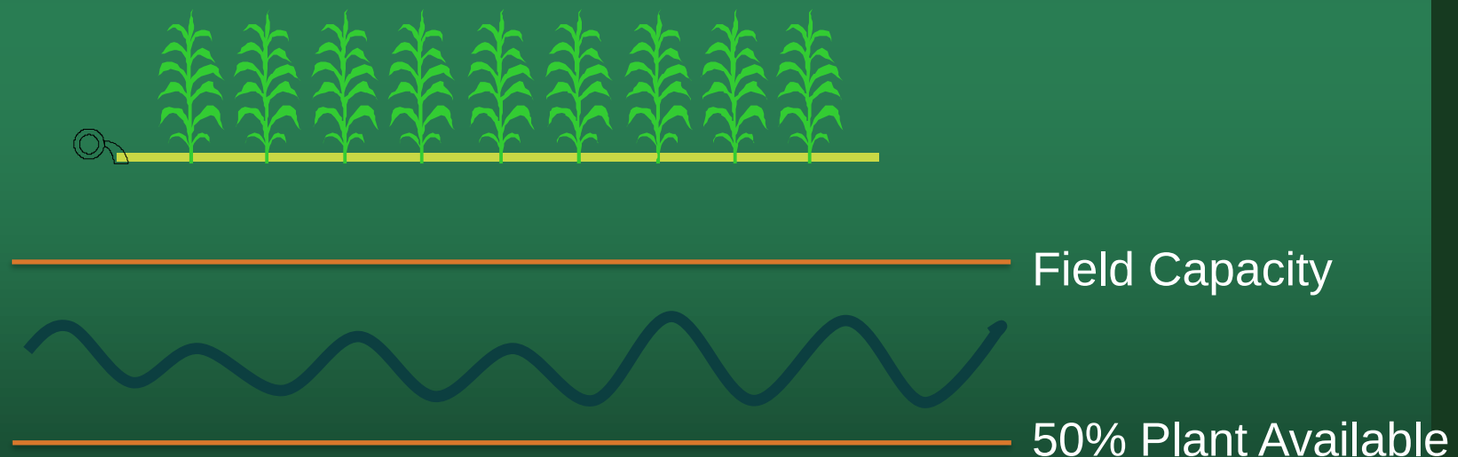
Center Pivot is designed to apply approximately the same amount to each area of the field. Greater frequency with smaller amounts.

Water Availability and Plant Stress

Furrow



Center Pivot



Stream Depletion Factor

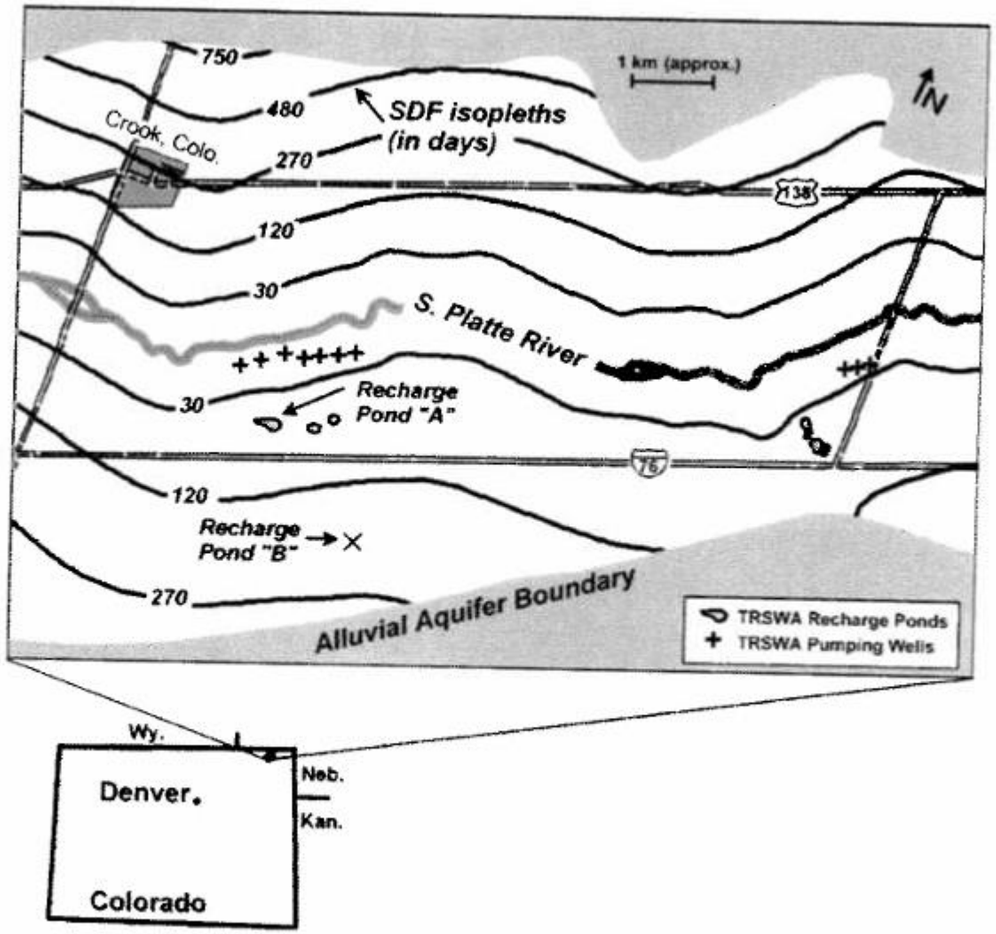
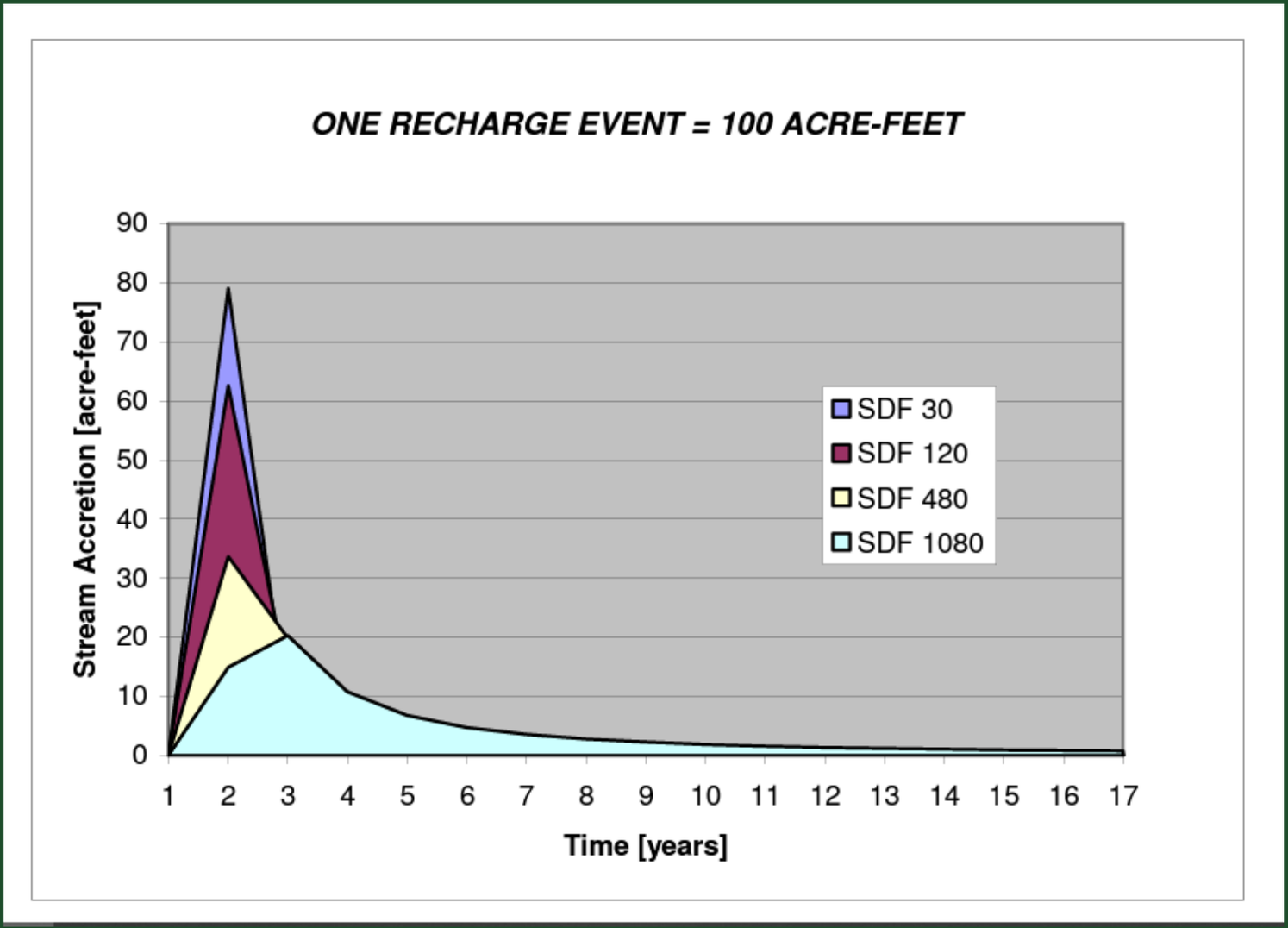


Figure 1. Example SDF map (after Hurr and Schneider 1972a). The SDF is defined as the time when stream depletion volume reaches 28% of pumped volume.

Stream Depletion Factor

Utilized for determining timing of impact of pumping on stream flows. This also shows the impact of adding water (augmentation or leaching) in the aquifer.

Impact of Leaching or Augmentation



Smith et al

Time frame is dependent upon distance from river.

Short distance to the river means a short time to peak.

Longer distance from river means greater time frame for the water to return to the river.

Significant long term impacts to return flows.

Return Flows

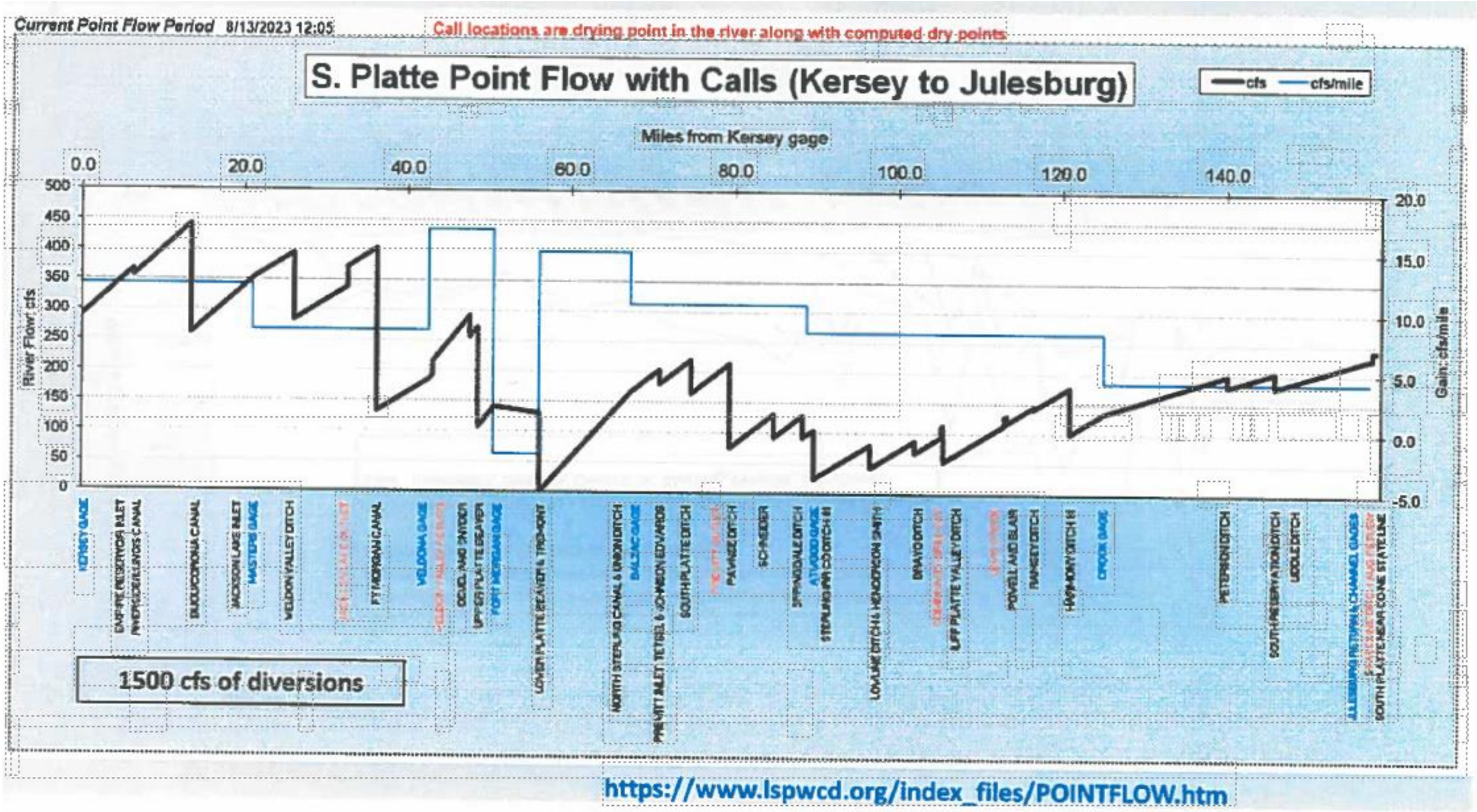
- Return flows are what built irrigation within the basin
  - Stabilized flows during the summer when flows were low
  - Retiming of water to low flow times

- Water Supply
  - 1.4 million acre-ft of native water supplies
  - 0.4 million acre-ft of trans basin diversion

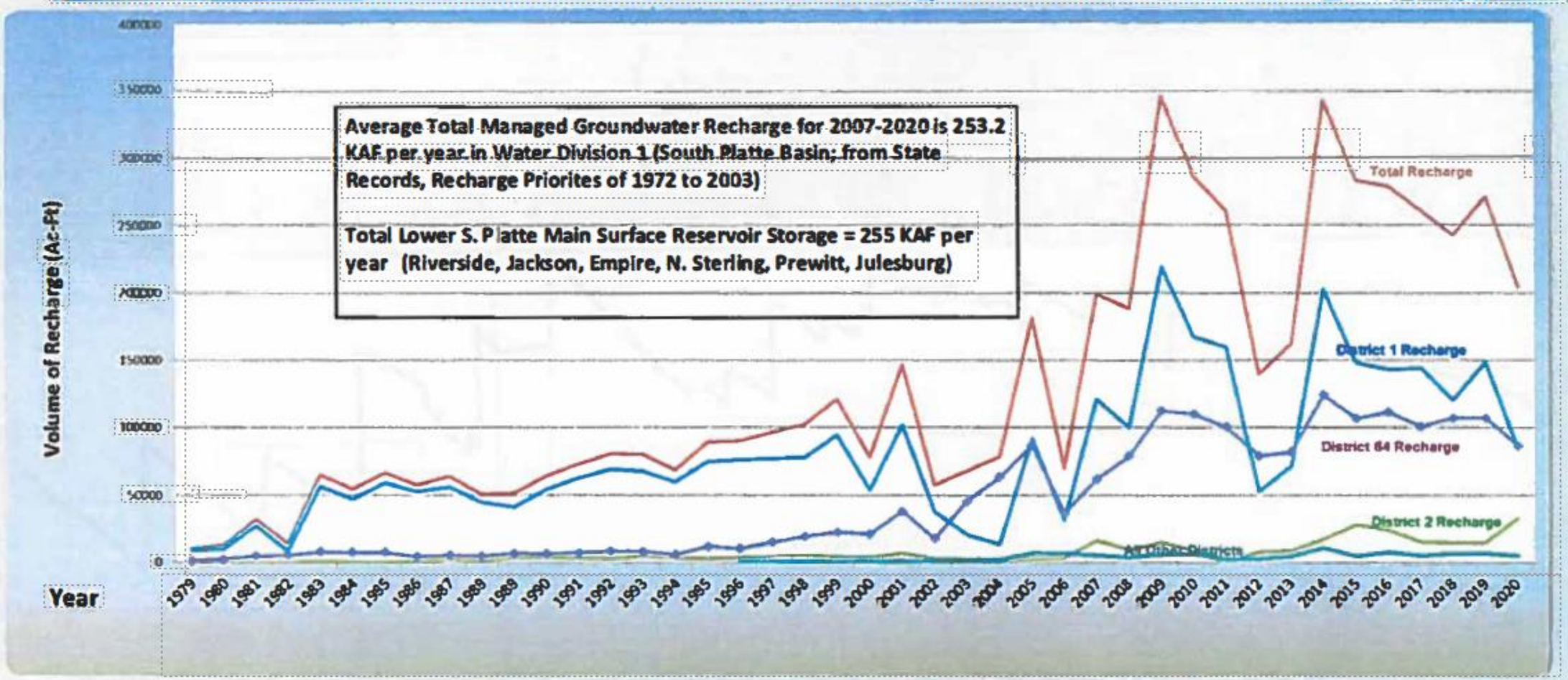
- Annual diversions on South Platte
  - **4 million acre-ft**

Efficiency – On Farm vs Basin

- On Farm Efficiency has many benefits
  - Greater yields
  - Reduced leaching of nutrients
  - Labor savings vs furrow irrigation
    - Management
- Downfall
  - Reduced return flows into system
  - Need for greater storage
    - Expensive
  - Greater issues with salinity


Current Point Flow Period 8/13/2023 12:05
Call locations are drying point in the river along with computed dry points
S. Platte Point Flow with Calls (Kersey to Julesburg)
cfs
cfs/mile
Miles from Kersey gage
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
River Flow cfs
Gain: cfs/mile
500
450
400
350
300
250
200
150
100
50
0
20.0
15.0
10.0
5.0
0.0
-5.0
KERSEY GAGE
EATON FEEDERS INLET
RIVERSIDE RESERVOIR CANAL
DUCUCOMONA CANAL
JACKSON LAKE INLET
MASTERS GAGE
WELDON VALLEY DITCH
FT MORGAN CANAL
WELDONA GAGE
OCOLO AND SNYDER
UPPER PLATTE BEAVER
FORT MORGAN GAGE
LOWER PLATTE BEAVER & TRIPOINT
NORTH STERLING CANAL & UNION DITCH
BALZAC GAGE
PREWITT ALLEN, TETSEL & JOHNSON EDWARDS
SOUTH PLATTE DITCH
PAWNEE DITCH
SCHNEIDER
SPRINGDALE DITCH
ATWOOD GAGE
STERLING #4 DITCH #1
LOVELAND DITCH & HENDRICKSON SMITH
BRAYO DITCH
LOFF PLATTE VALLEY DITCH
POWELL AND BLAIR
RAMSEY DITCH
HAVEMEYER DITCH #1
CROOK GAGE
PETERSON DITCH
SOUTH RESERVATION DITCH
UDDLE DITCH
SOUTH PLATTE NEAR COLO STATE LINE
1500 cfs of diversions
https://www.lspwcd.org/index_files/POINTFLOW.htm

Managed Groundwater Recharge is extensive in the South Platte River Basin to maintain aquifers and returnflows for well augmentation and endangered species



Impacts of Return Flows Changes

- As changes to greater efficiency happen, changes to the system will need to be made
  - Storage
- More water will remain in the river due to reduced diversions early in the year
- Less water will be in the river later in the season due to reduced return flows
- Additional storage will be needed to store early season flows

Recent Impacts on South Platte

2002 – Empire Lodge

- Impact on out of priority use of water
- Augmentation plans were enforced
- Created the shutdown of 1,000's of wells in the South Platte

- Creation of new augmentation plans that supply actual water
- Development to divert water when no call was on the river and allow that water to seep into the aquifer.
    - Time, amount and place

Perkins County Canal

- Nebraska has the right to develop a diversion and delivery system for up to 500 cfs during the off-season irrigation
- Will play out for years
- Threat to augmentation in the Lower Basin
- Potential impacts to the Endangered Species Act

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Questions?

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