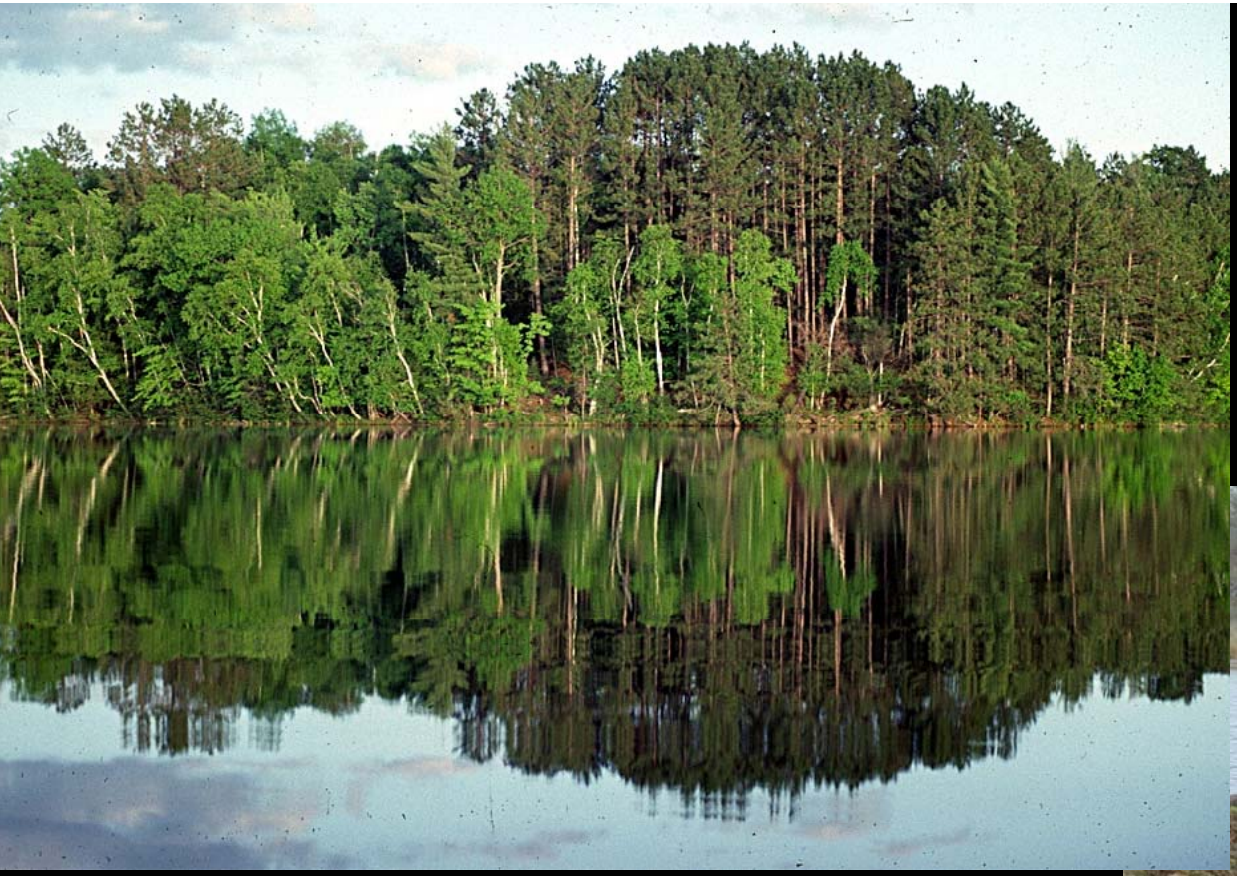
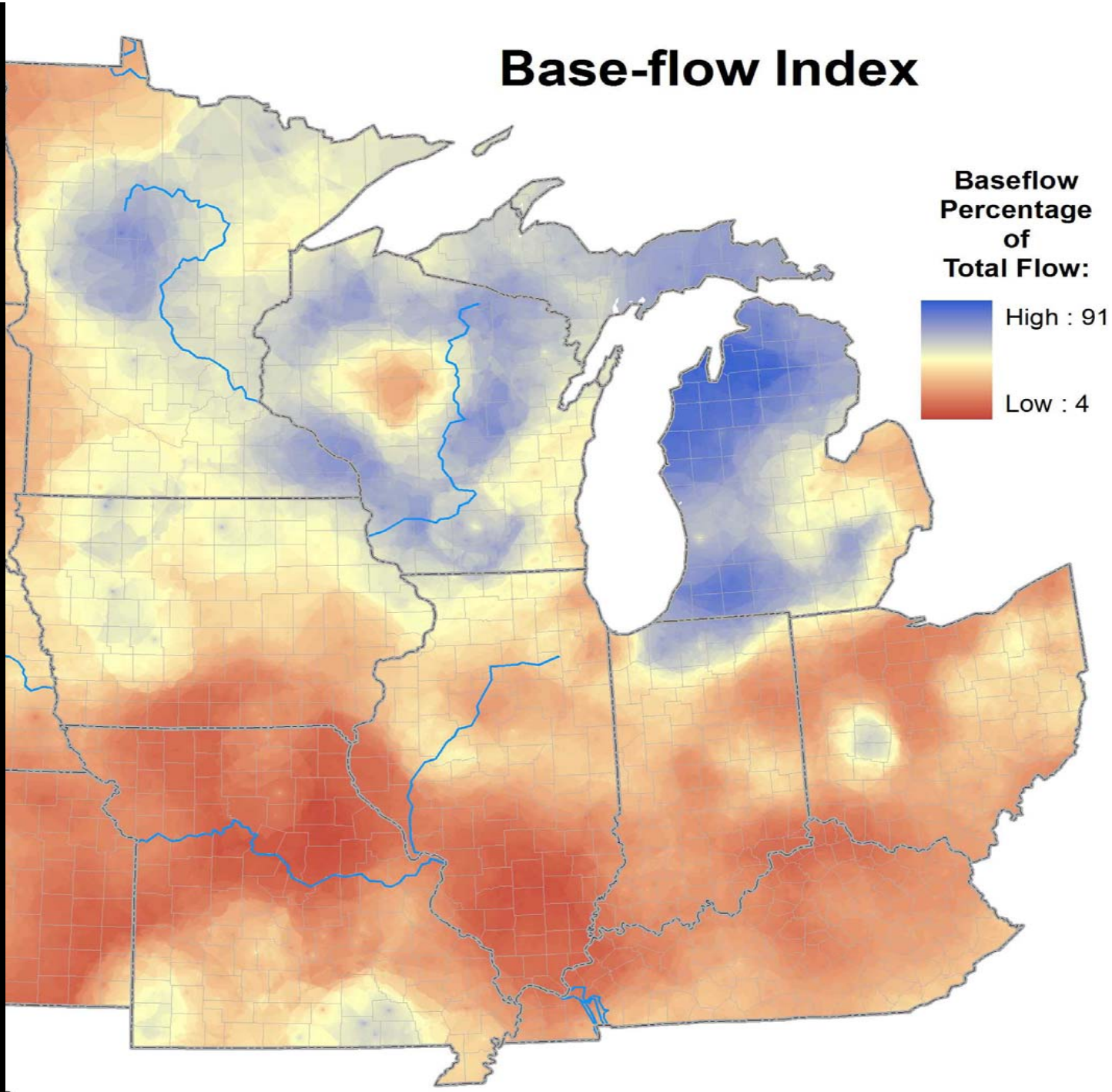
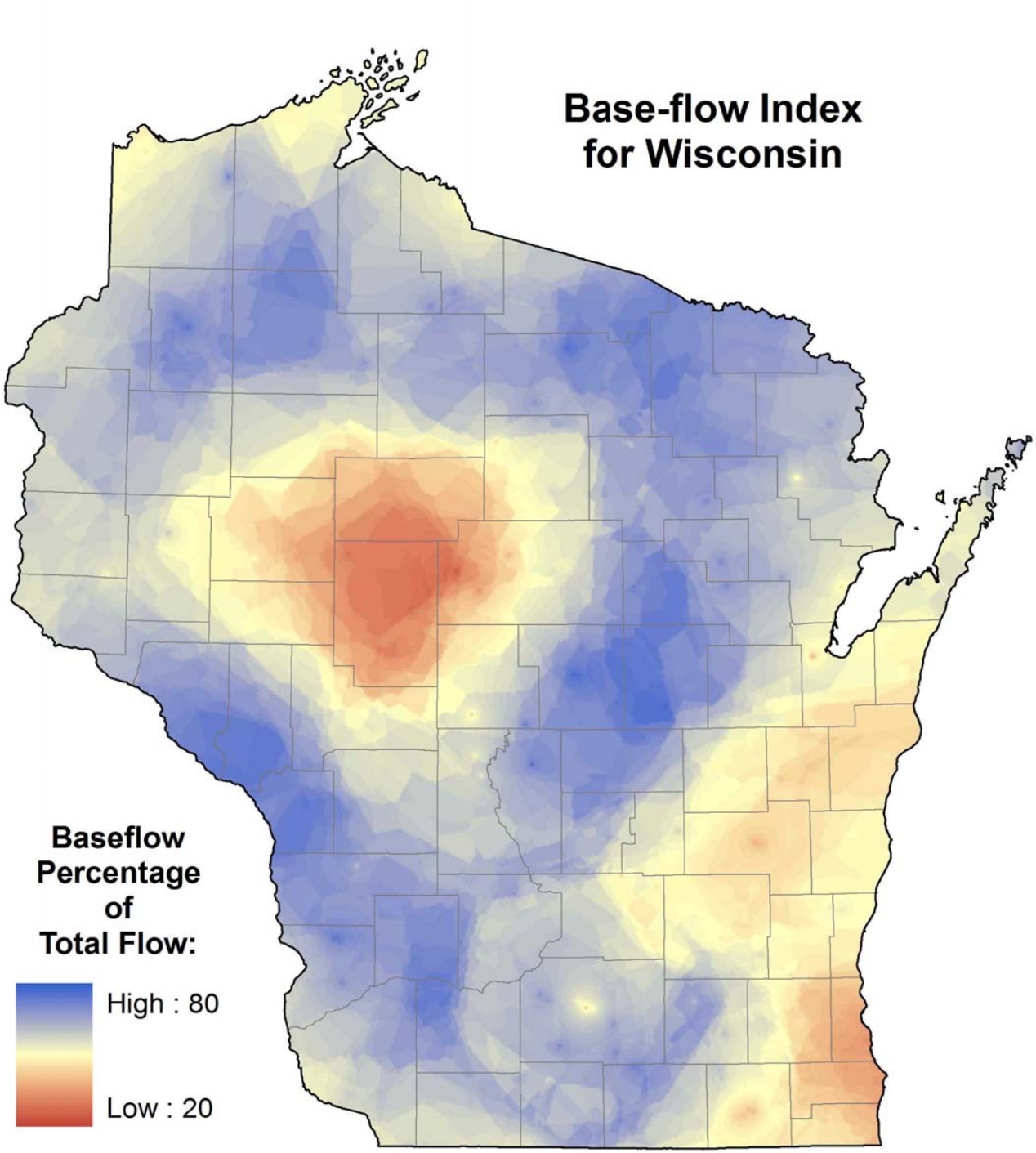
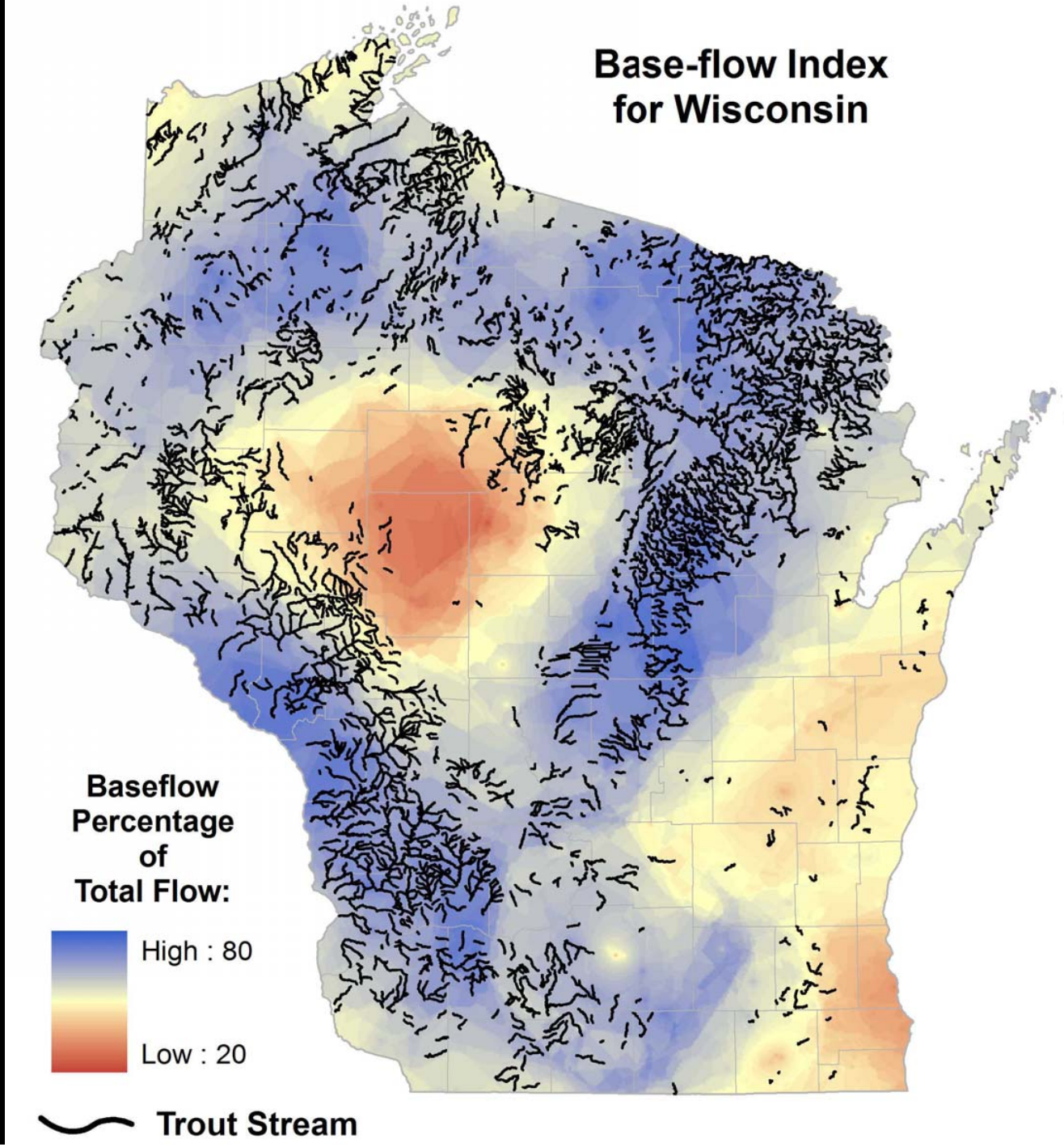
Irrigation Impacts in the Northern Lakes States the Wisconsin Central Sands as Case Study

George J. Kraft
University of Wisconsin – Extension / Stevens Point

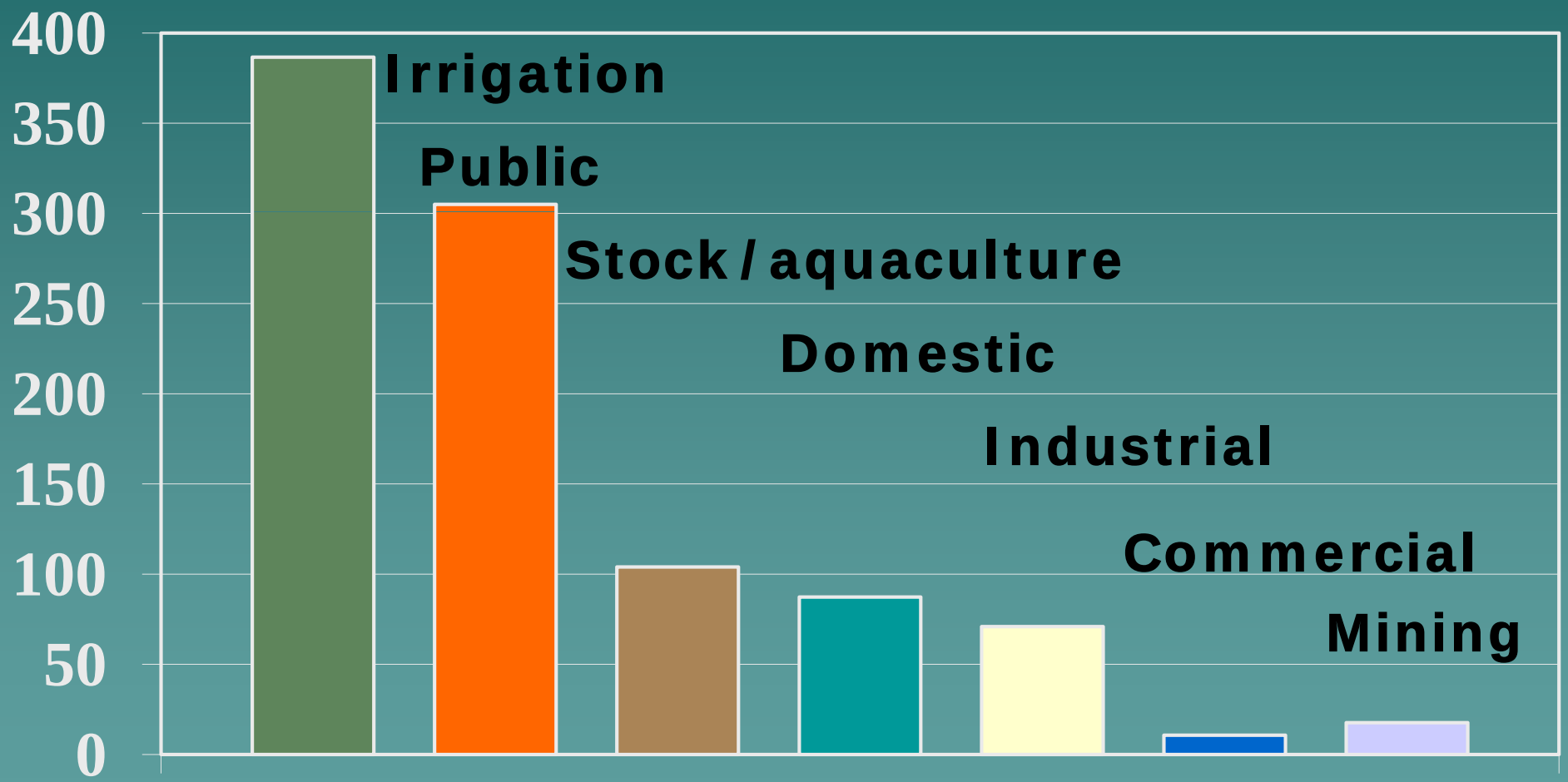



Base-flow Index
Baseflow Percentage of Total Flow:
High : 91
Low : 4


Base-flow Index
for Wisconsin
Baseflow
Percentage
of
Total Flow:
High : 80
Low : 20


Base-flow Index
for Wisconsin
Baseflow
Percentage
of
Total Flow:
High : 80
Low : 20
Trout Stream

Wisconsin Groundwater Use
985 Million GPD (USGS, 2009)



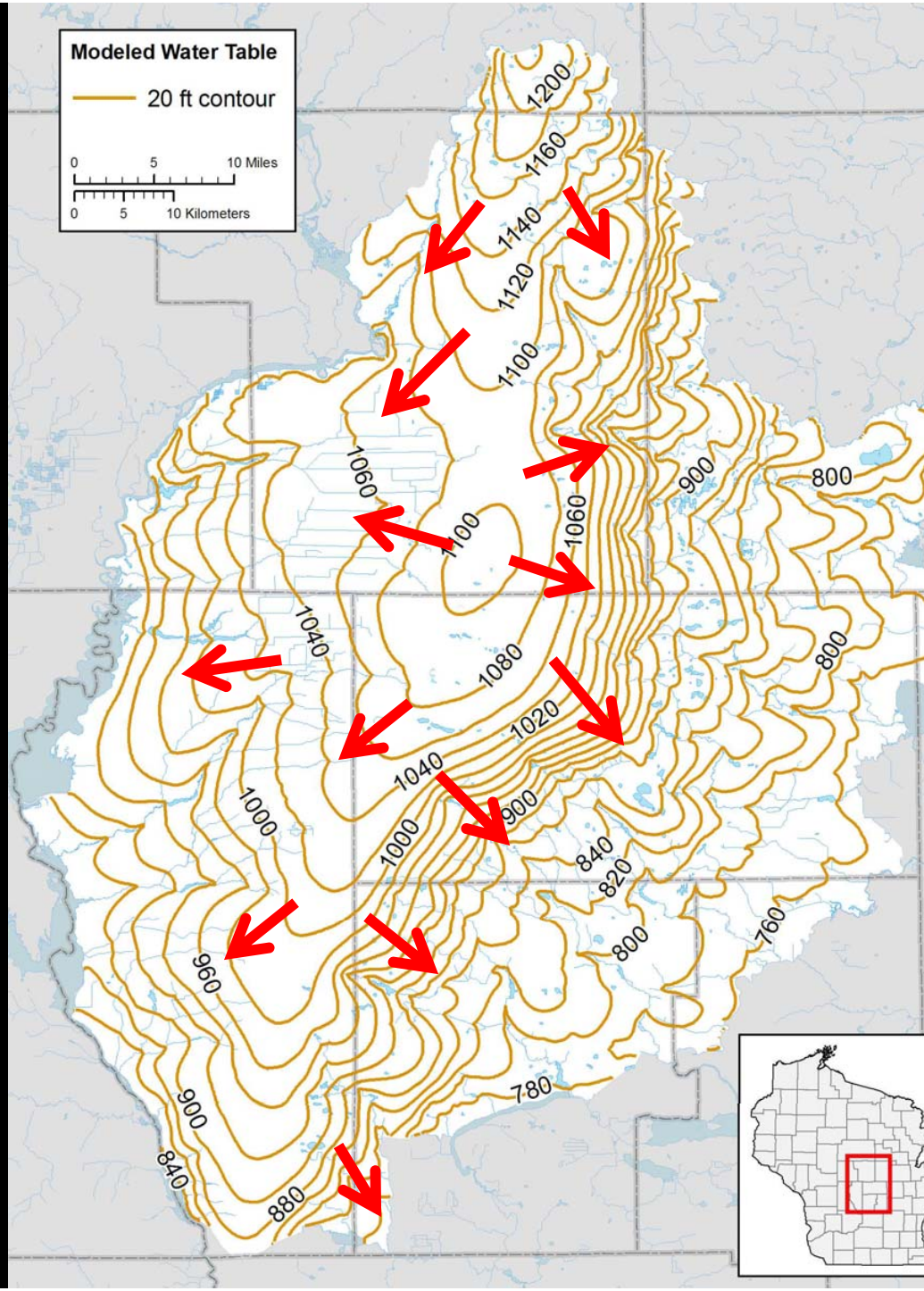
Irrigation in the Northern Lake States

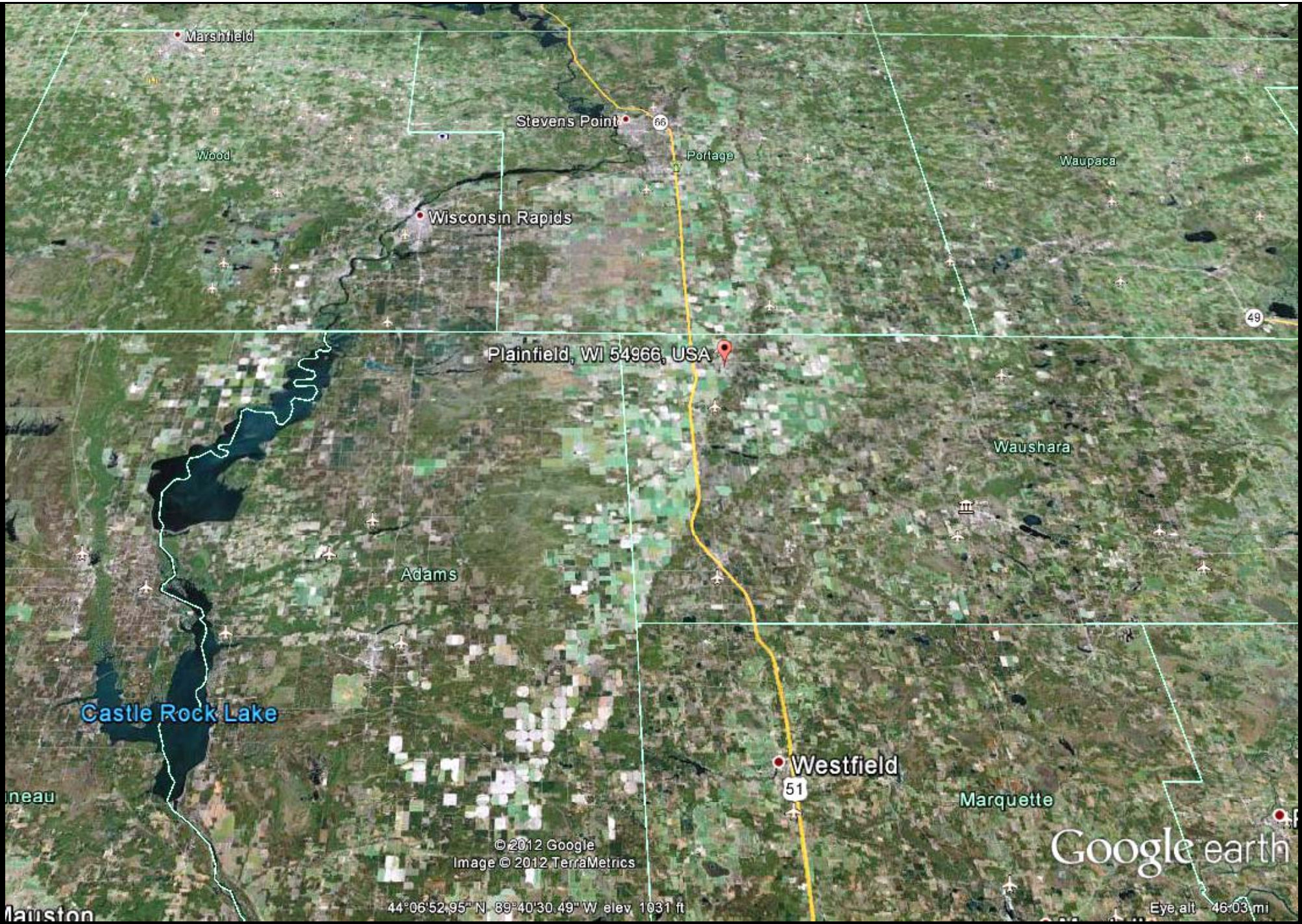
1950s - Negligible

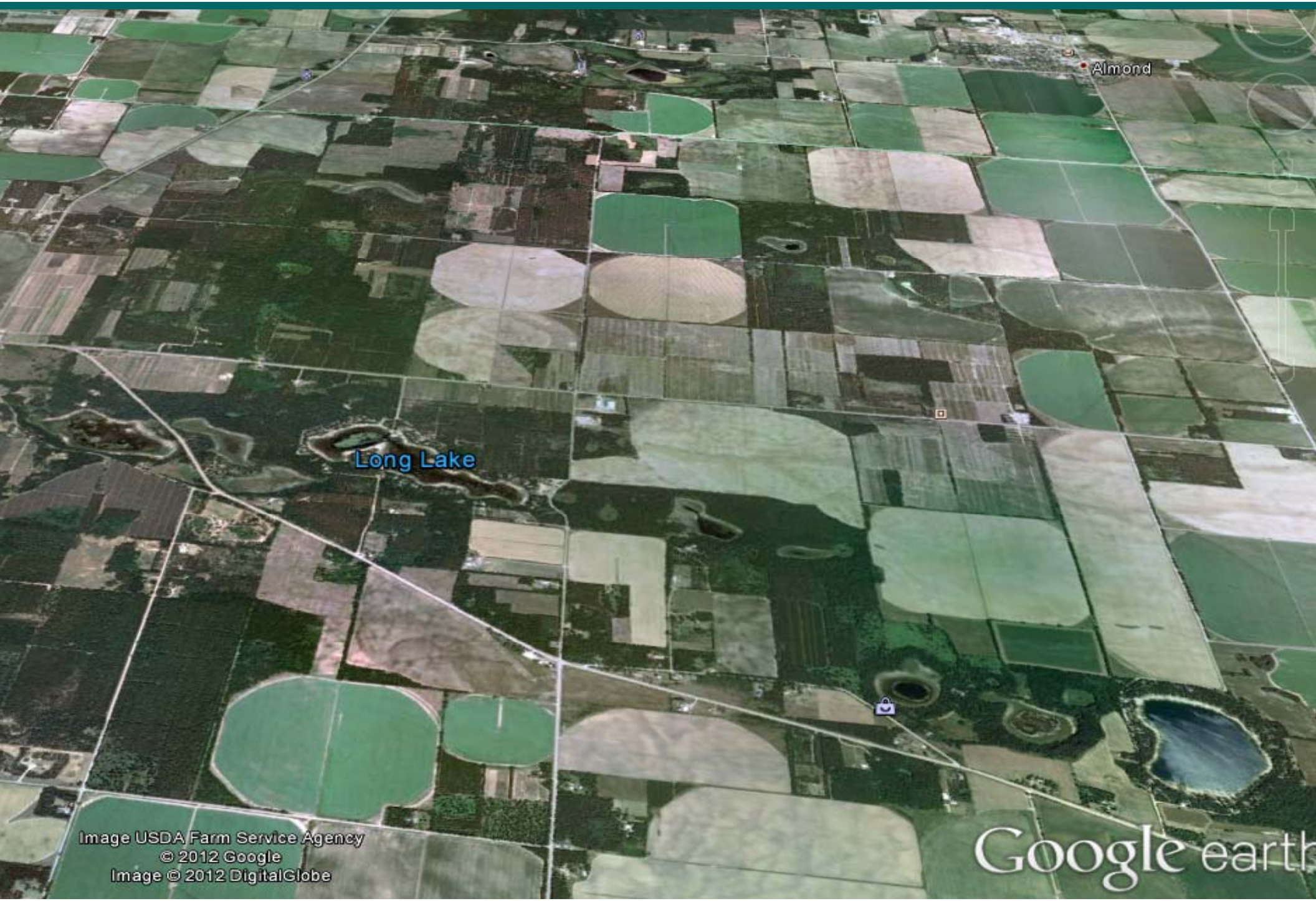
1978 - 290,000 ha

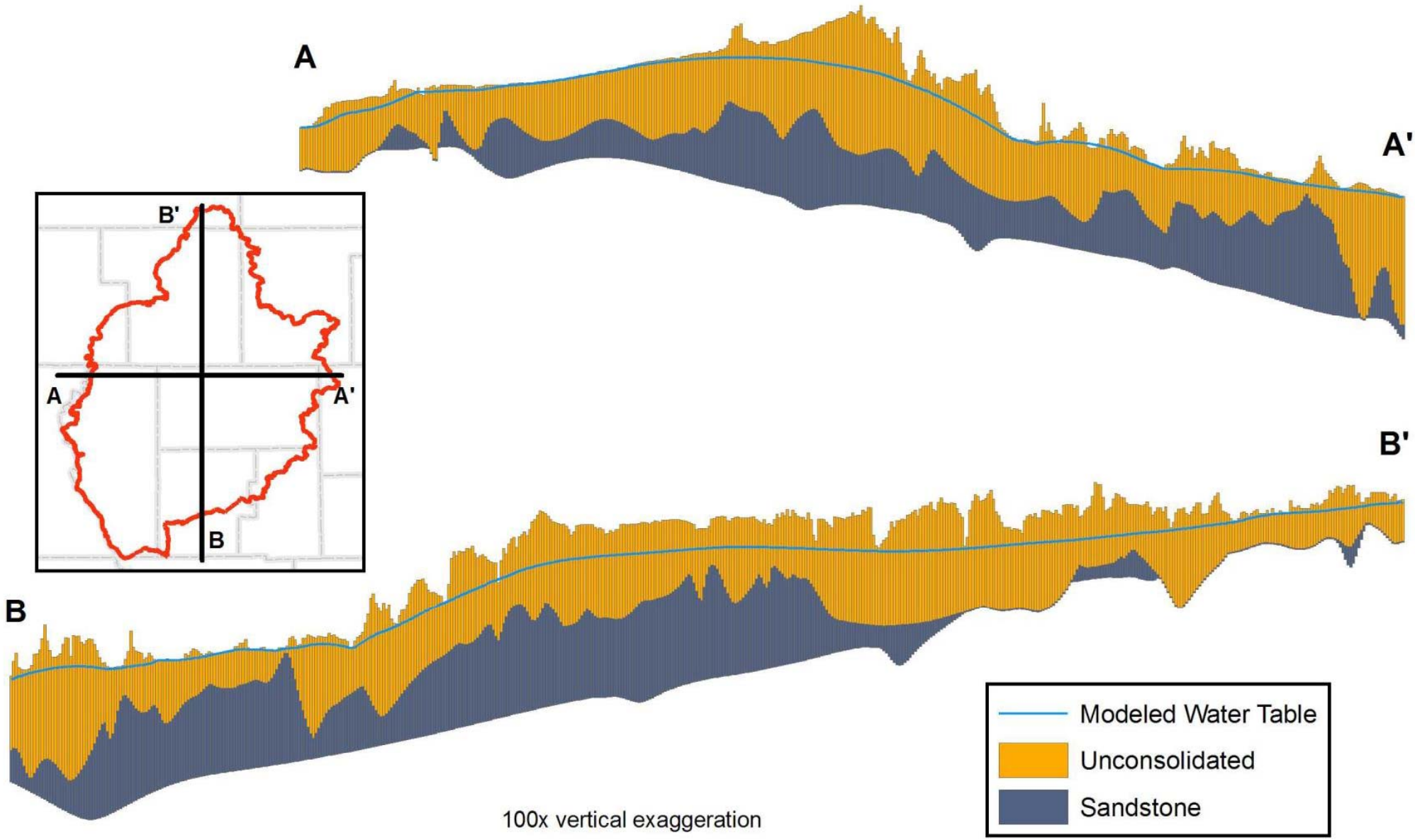
2005 - 567,000 ha


Little Wolf River
Hay Meadow Cr
Plover River
Little Wolf River
S Branch Little Wolf River
Tomorrow River
Wisconsin River
Little Plover River
Buena Vista Cr
Waupaca River
Fivemile Cr
Tenmile Cr
Crystal River
Walla Walla Cr
Wolf River
Fourteenmile Cr
Pine River
L Poygan
Willow Creek
Big Roche a Cri Cr
Lit Roche a Cri Cr
Castle Rock
White River
Fox River
Mecan River
Montello River
Wisconsin River
Neenah Cr
Buffalo Lake
Fox River
S Br Neenah Cr
Marsh
Central Sands Region
0 10 20 Kilometers
0 5 10 Miles


Modeled Water Table
20 ft contour
0 5 10 Miles
0 5 10 Kilometers
1200
1160
1140
1120
1100
1060
1100
1060
900
800
1040
1080
800
1020
1040
1000
900
1000
840
820
800
760
960
900
840
880
780


Marshfield
Stevens Point
66
Wood
Portage
Waupaca
Wisconsin Rapids
49
Plainfield, WI 54966, USA
Waushara
Adams
Castle Rock Lake
Westfield
51
Marquette
© 2012 Google
Image © 2012 TerraMetrics
Google earth
44°06'52.95" N 89°40'30.49" W elev 1031 ft
Eye alt 46.03 mi


Almond
Long Lake
Image USDA Farm Service Agency
© 2012 Google
Image © 2012 DigitalGlobe
Google earth


A
A'
B'
A
A'
B
B'
B
Modeled Water Table
Unconsolidated
Sandstone
100x vertical exaggeration

A Little History

- **1930's** – Irrigation starts. Water from surface water and pits

- **1949 –** "What we need is to regulate withdrawal of water and put on the books legal recognition of irrigation, establishing what the farmer can use, how much, and when."
  - O.I. Birge Wisconsin College of Agriculture

- **Late 1950's** –Surface water irrigation almost disappears.

  Well drilling becomes more common.

- **1957-1959** – Heavy debate and discussion on water and groundwater pumping with much emphasis on irrigation.

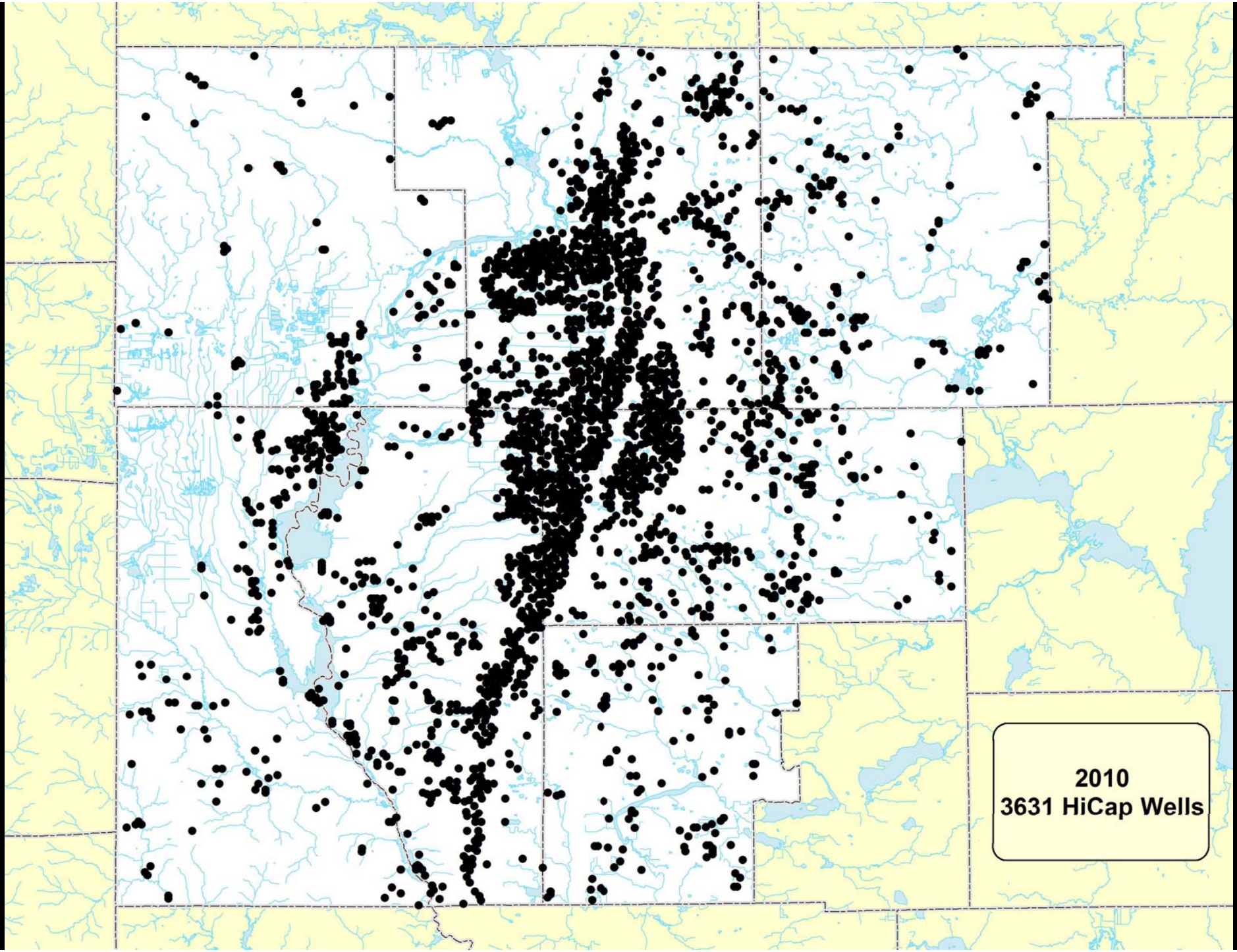
- **1957** – "… water levels … after irrigation showed no significant lowering of ground water levels …."
  - George Hanson - WI State Geologist and William J. Drescher
- **1957** –"There is just too much water there … to have a serious effect."
  - George Hanson – WI State Geologist.

- **1959 -** “Wisconsin has vast water resources…

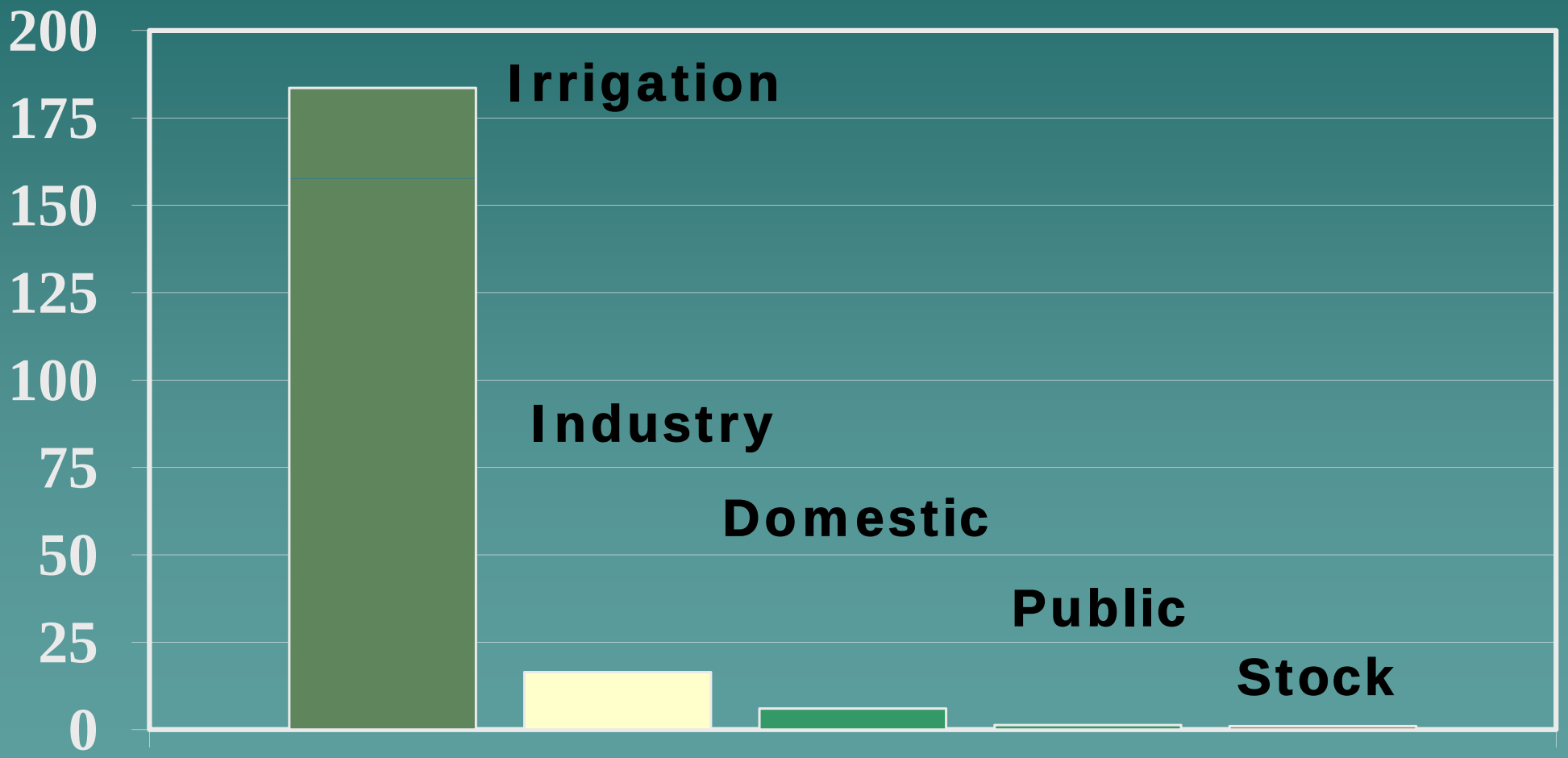
“Irrigation … has no permanent effect on the ground or surface water levels”

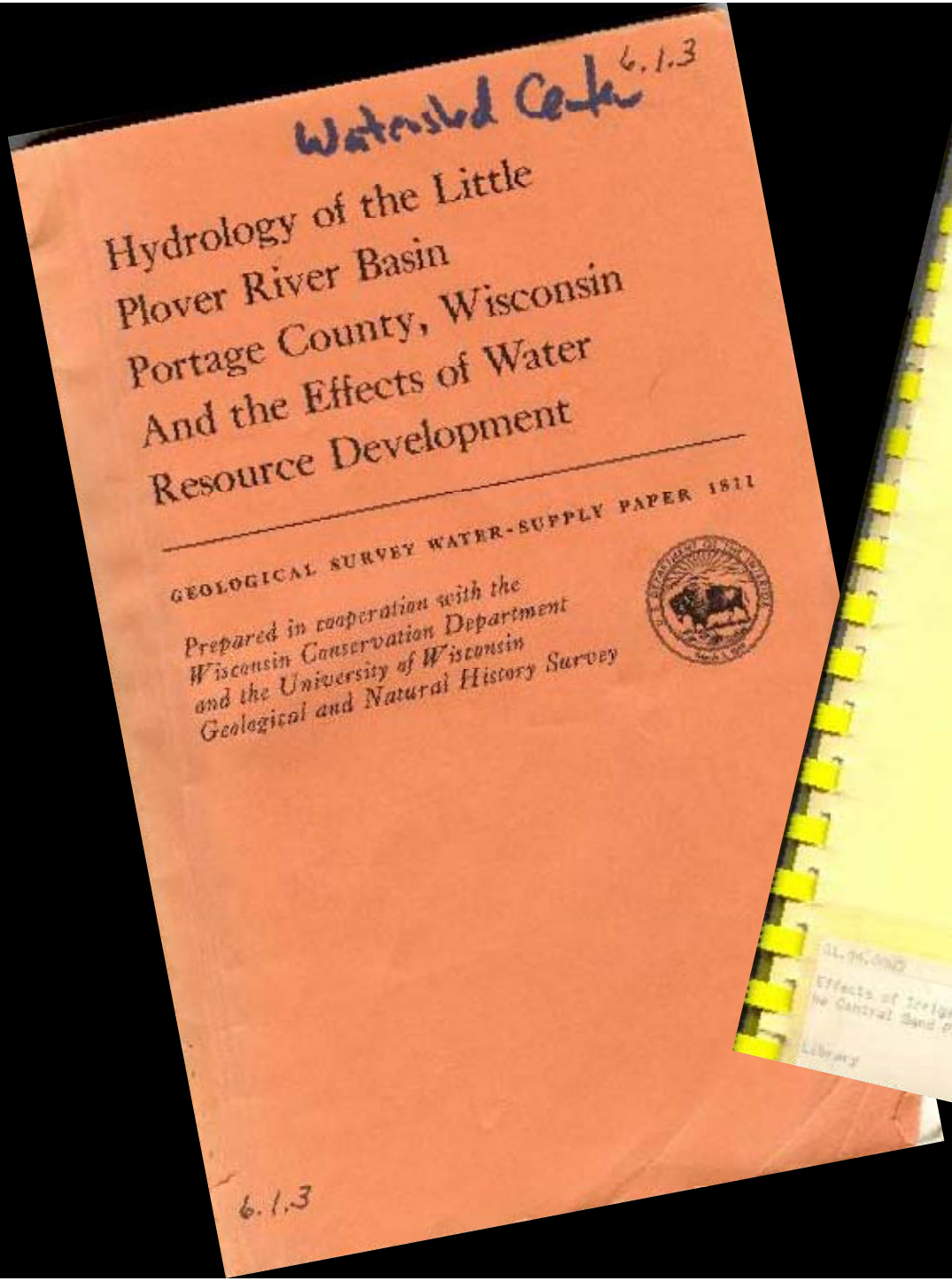
“No reasonable person is concerned about this….”

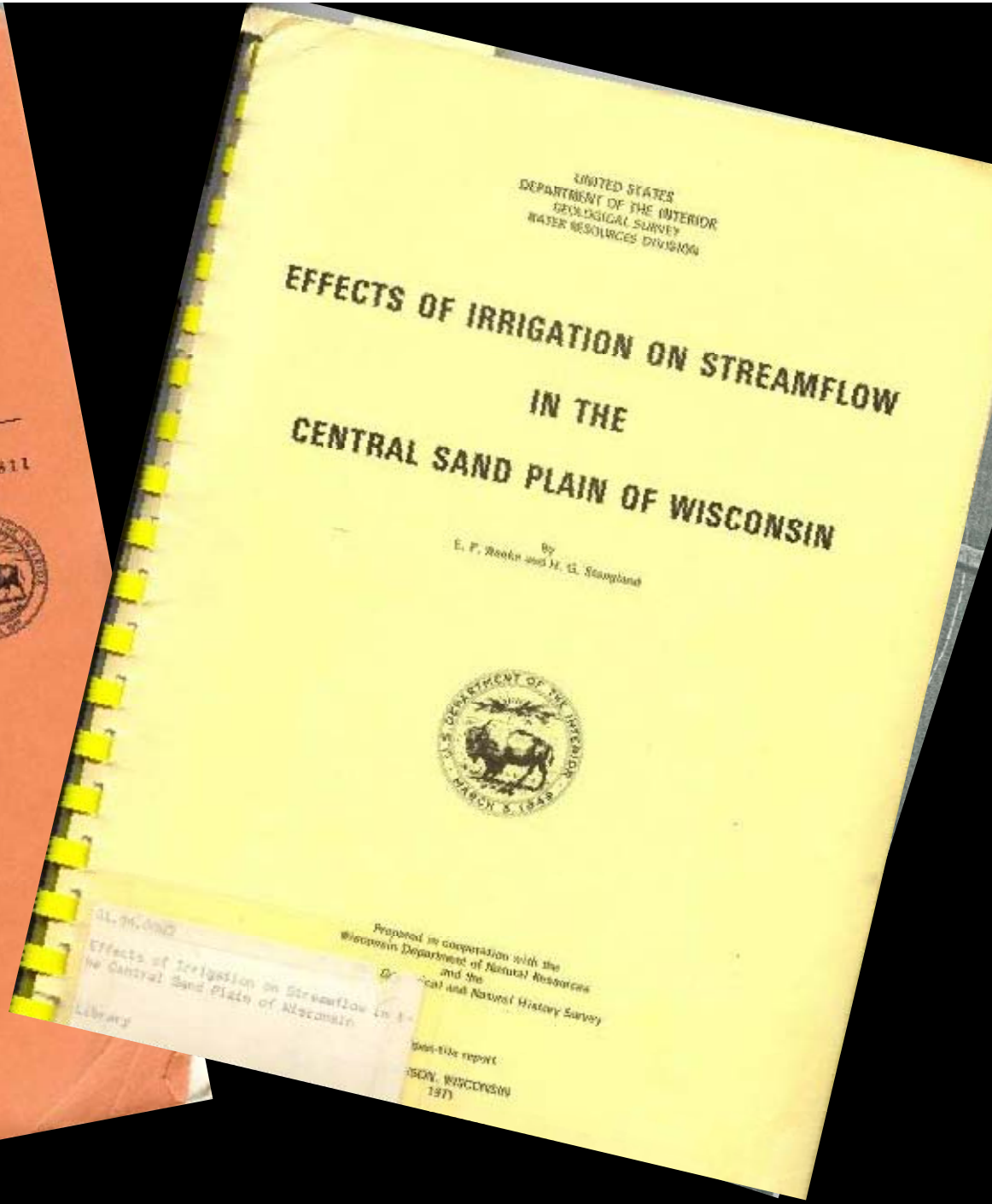
- Wisconsin Agricultural Water Conservation Committee


2010
3631 HiCap Wells

Central Counties Groundwater Use 213 MGPD (78 BGPY, USGS 2009)




Watershed Cards 6.1.3
Hydrology of the Little Plover River Basin Portage County, Wisconsin And the Effects of Water Resource Development
GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1811
Prepared in cooperation with the Wisconsin Conservation Department and the University of Wisconsin Geological and Natural History Survey
6.1.3


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
EFFECTS OF IRRIGATION ON STREAMFLOW IN THE CENTRAL SAND PLAIN OF WISCONSIN
By
E. F. Hasler and H. G. Stangland
Prepared in cooperation with the
Wisconsin Department of Natural Resources
and the
Geological and Natural History Survey
WISCONSIN
1971
Effects of Irrigation on Streamflow in t
he Central Sand Plain of Wisconsin
Library

Little Plover

(Dried up part of year from 2005-2009)


Long Lake, Waushara County

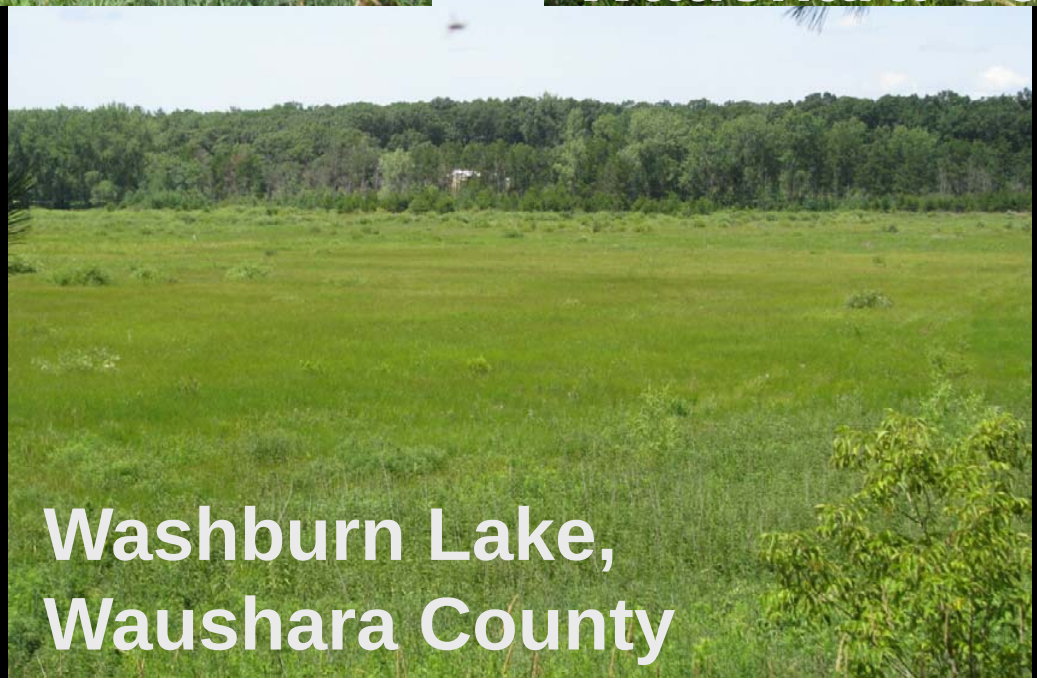

Pickerel Lake, Portage County


Wolf Lake


Stoltenberg Cr., Portage Co

Plainfield Lk, Waushara Co

Pumpkinseed Lk,
Waushara Co



Washburn Lake,
Waushara County

Record Drought!
Climate Change!!

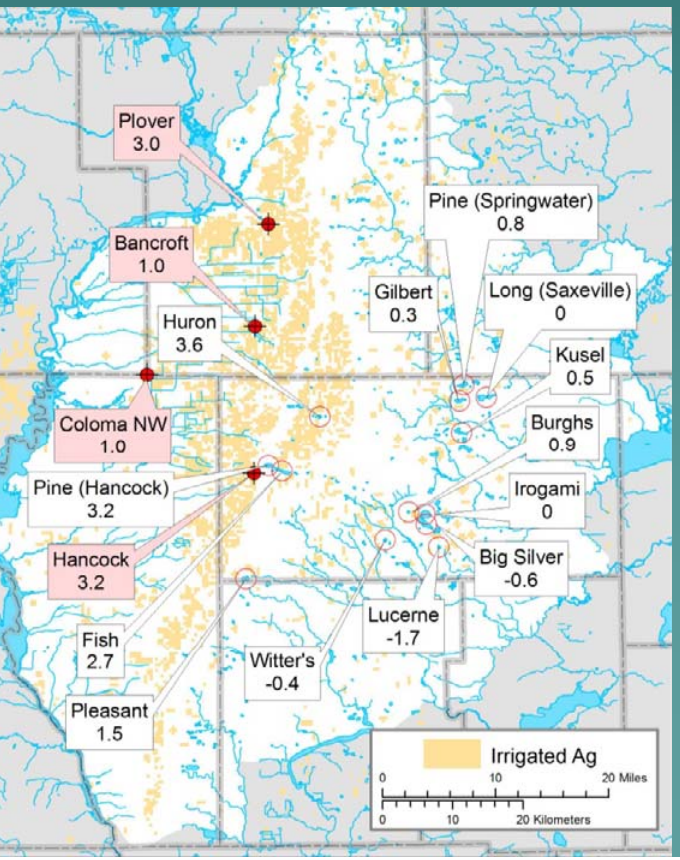
Weather average to middling-dry in 2000-9

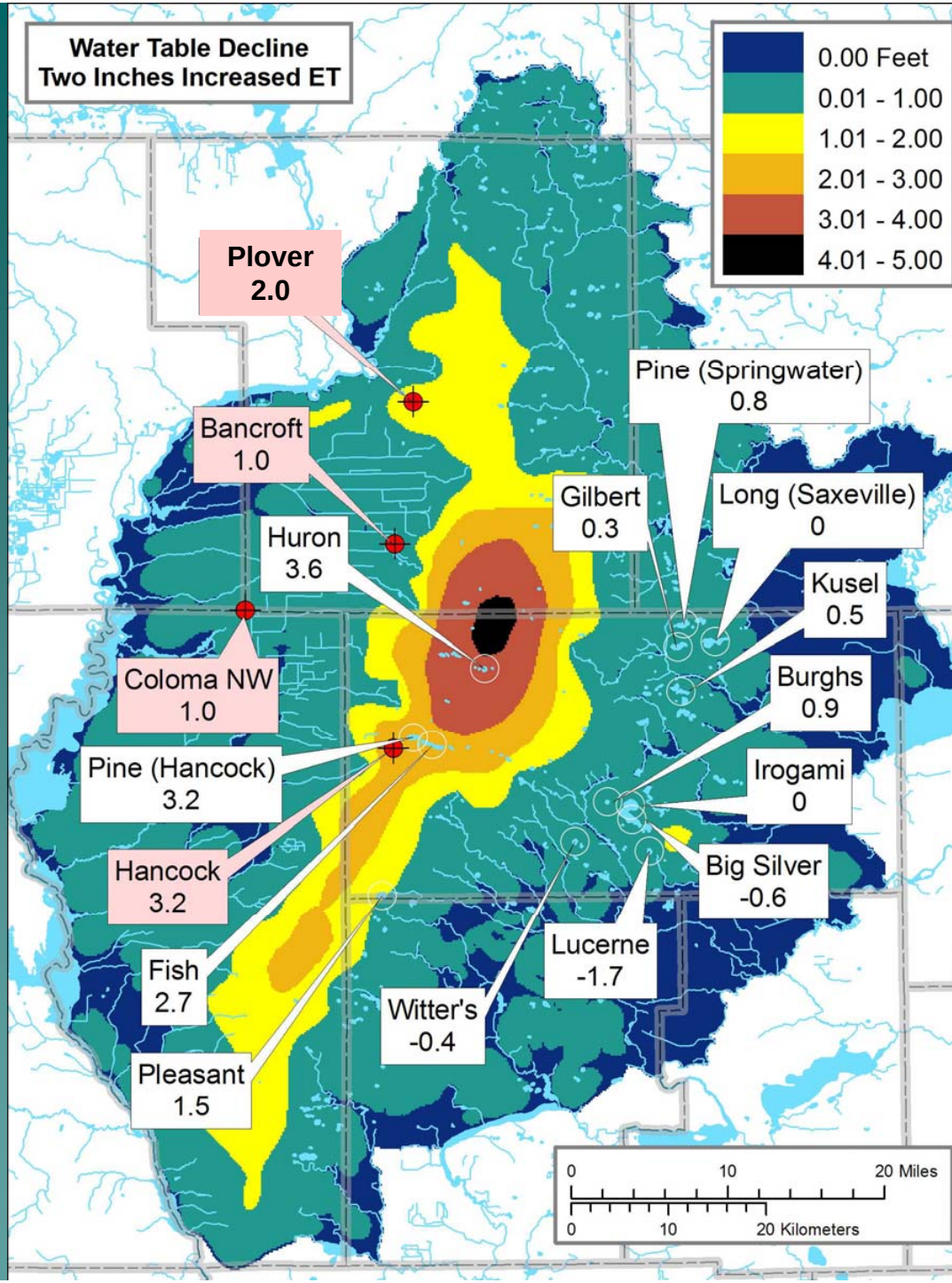
Climate has gotten wetter over last 30 years!

No signal that ET has increased substantially

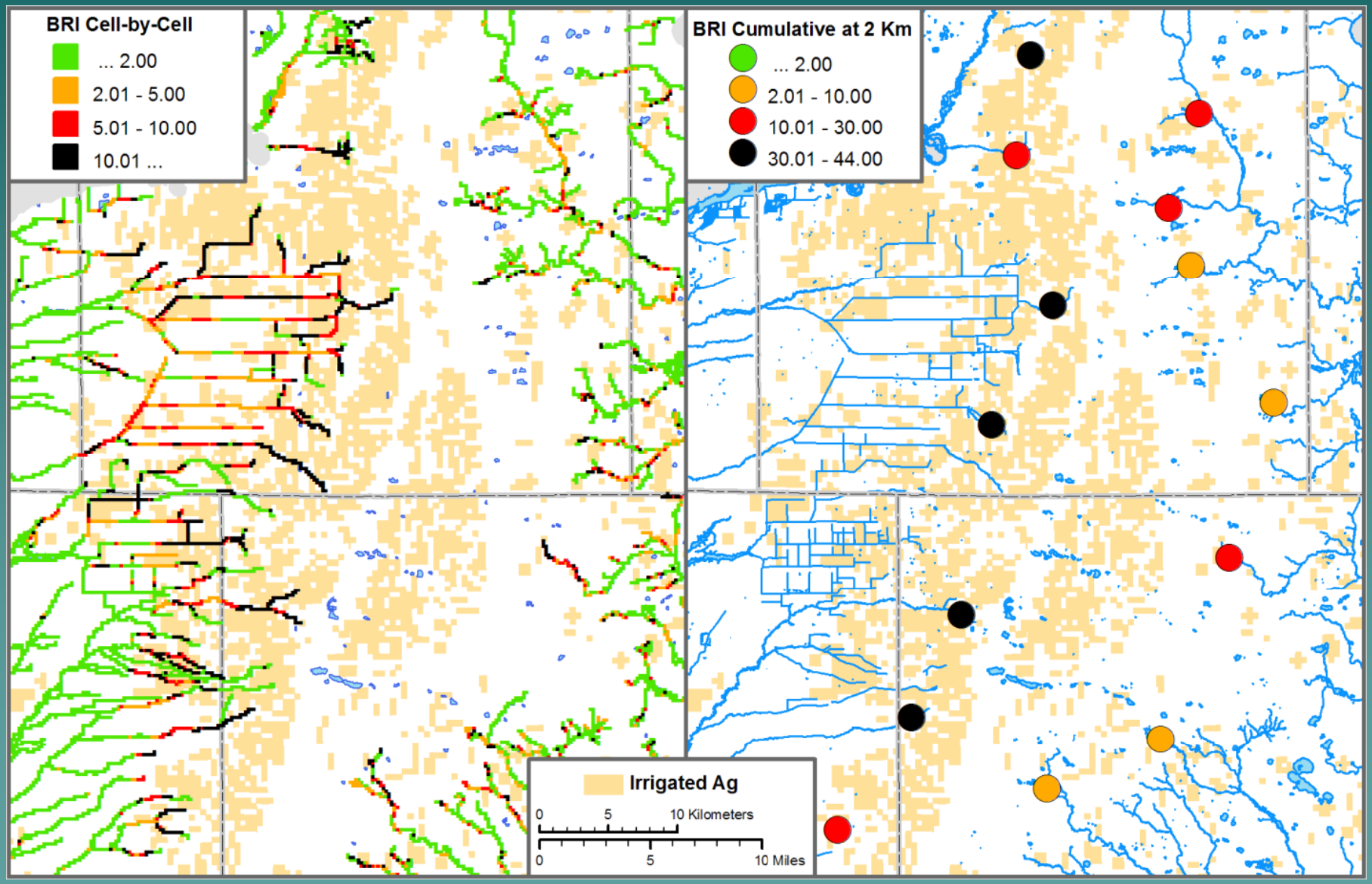
Assessing Apparent Water Level Drawdowns

Irrigation Drawdown





% Irrigation Baseflow Reduction



Impact of Irrigation

Conceptualize impact of groundwater pumping for irrigation as a change in evapotranspiration

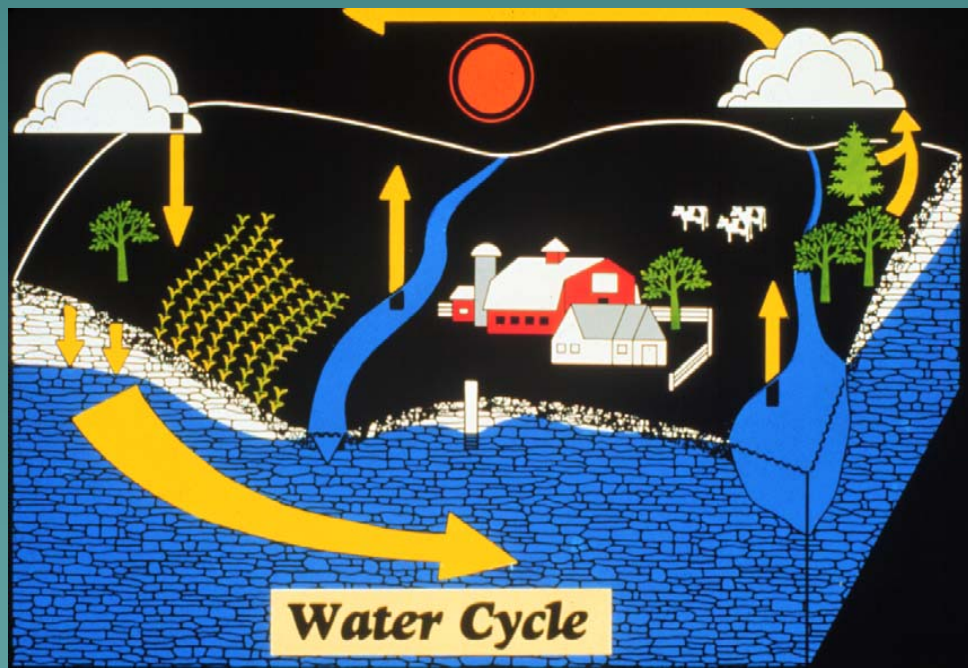
Precip – ET – Runoff

Rise / fall of the water table (also lakes and wetlands)

Water In – Water Out = ± Storage

Discharge to streams

Pumping from wells

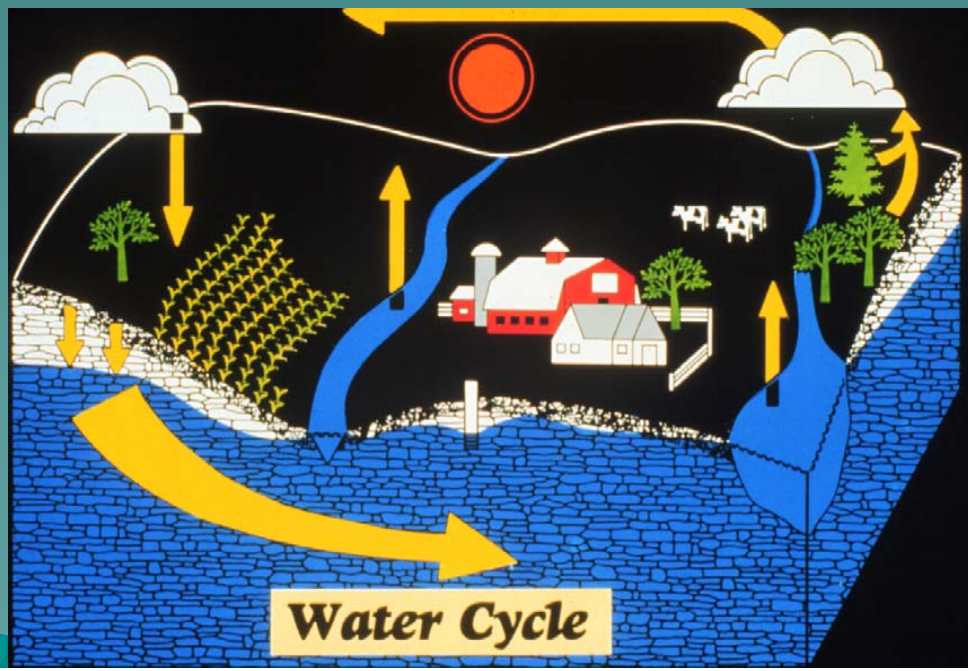


Precip – ***ET*** – *Runoff*

Rise / fall of the water table (also lakes and wetlands)

Water In – Water Out = ± Storage

Discharge to streams



The Offset

- Irrigation is not a gallon pumped – gallon lost situation, because . . .
- Irrigated has less ET and more recharge than native land in the shoulder season

Understanding the offset is our greatest research need

RULE #27 -

IF WE WORK TOGETHER WE CAN BE MORE EFFICIENT, MORE CREDIBLE, MORE LIKELY TO GET IT RIGHT.