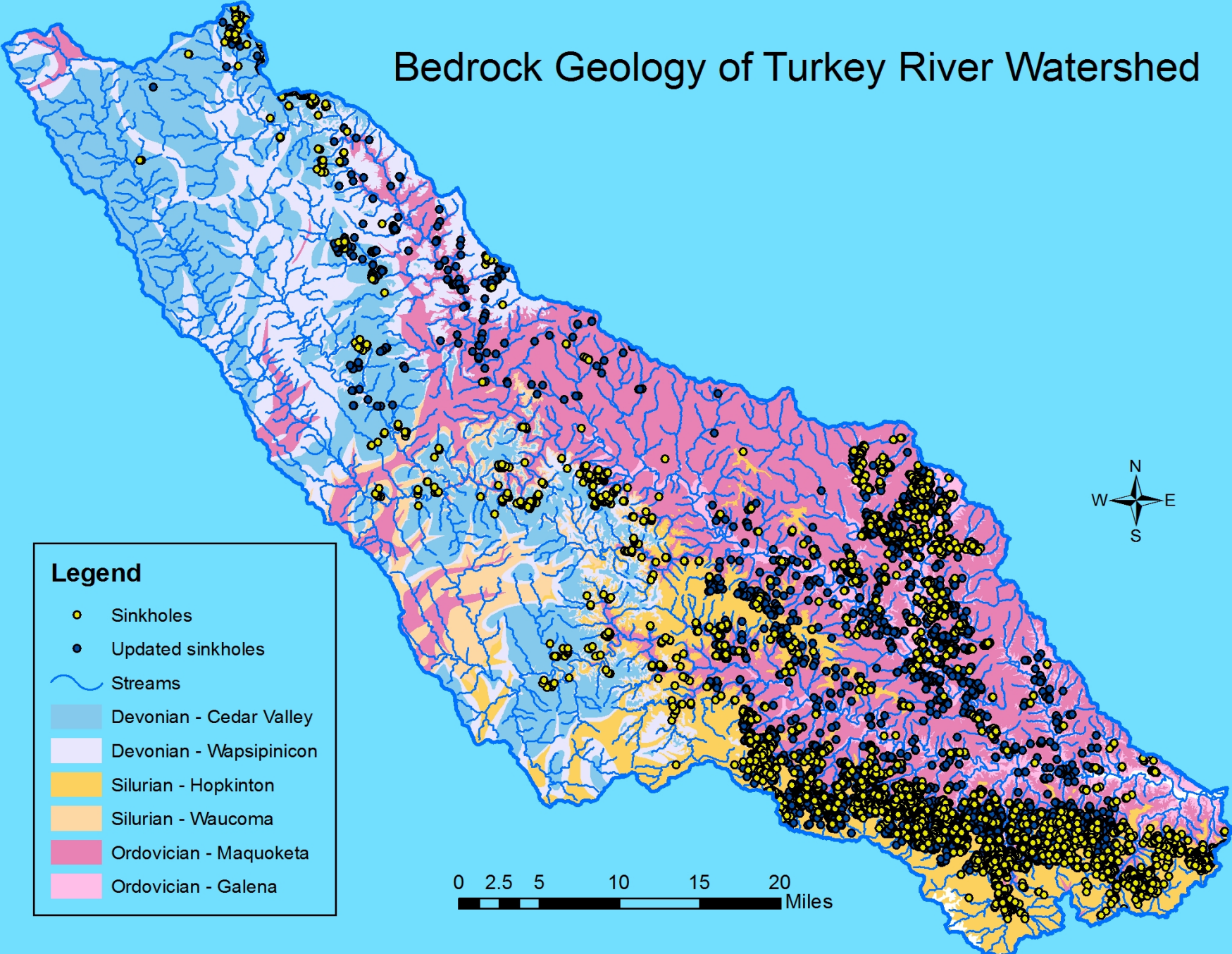


Geology, Land-use, and Water Quality: Lessons from Big Spring



**Bob Libra - State Geologist of Iowa
Iowa Geological & Water Survey
Iowa D.N.R.**

Bedrock Geology of Turkey River Watershed

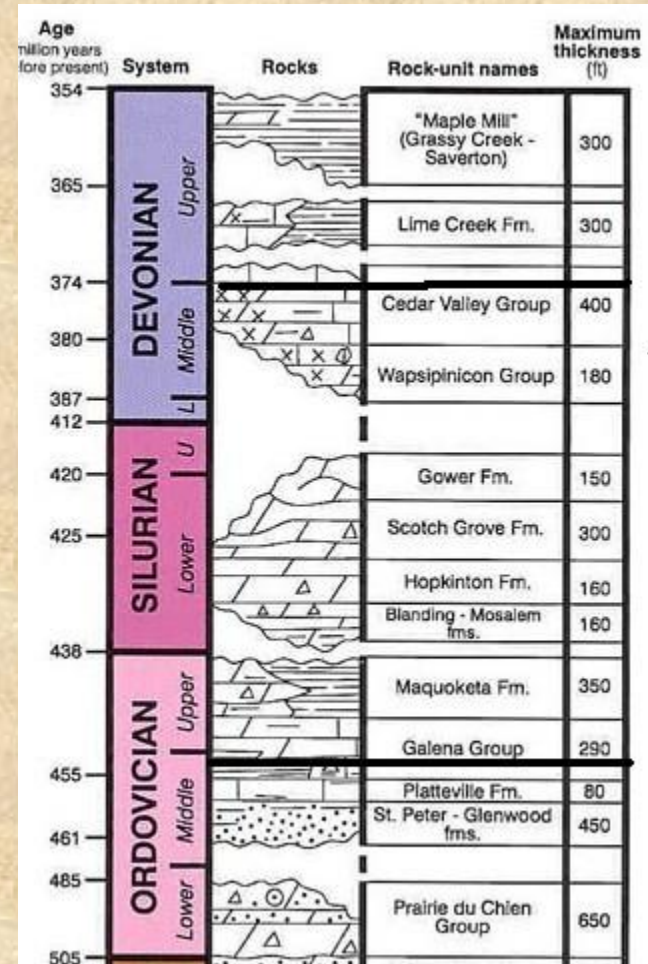


The rock sequence in the Turkey River Watershed:

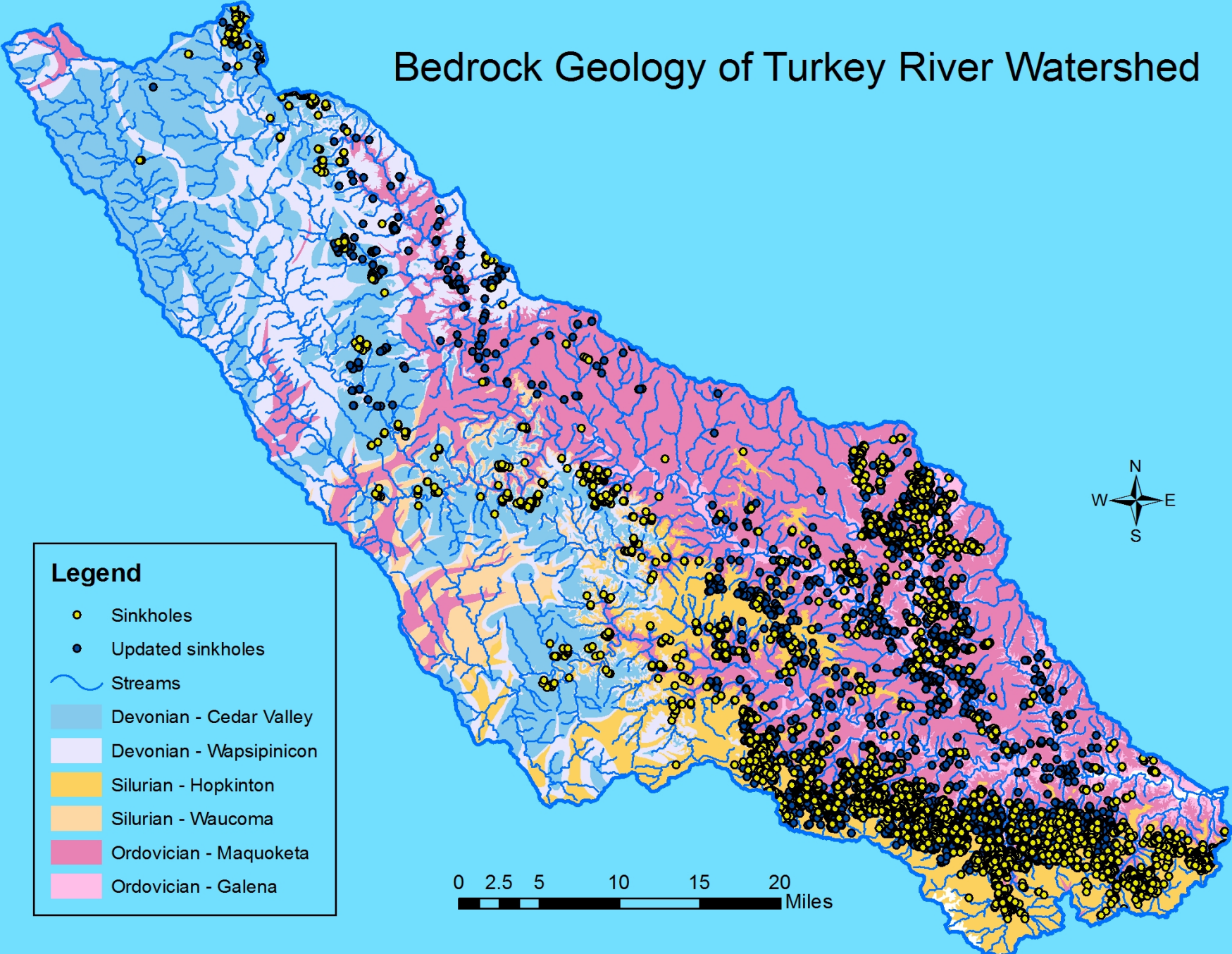
All units are aquifers except the Maquoketa Shales.

The Cedar Valley, Silurian, and Galena rocks are particularly karst-prone.

Karst Aquifers move LOTS of water!



Bedrock Geology of Turkey River Watershed

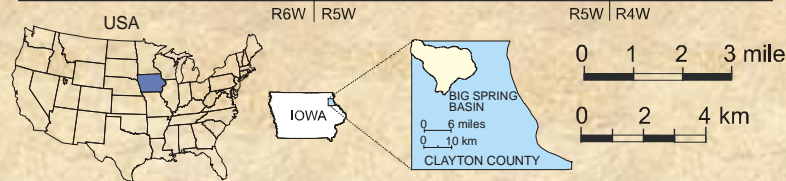
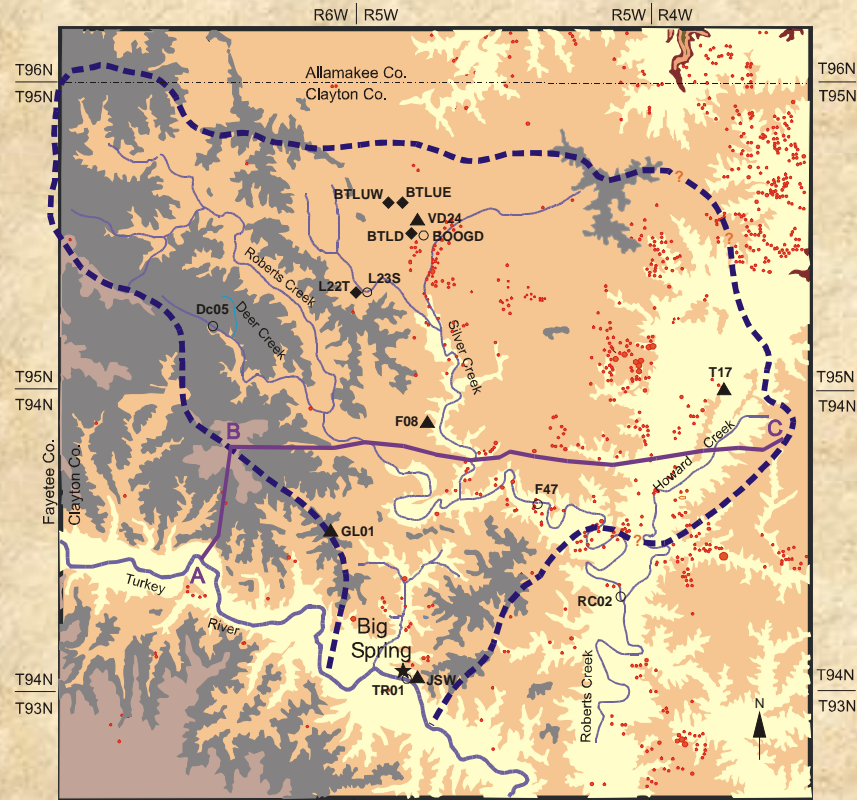


Legend

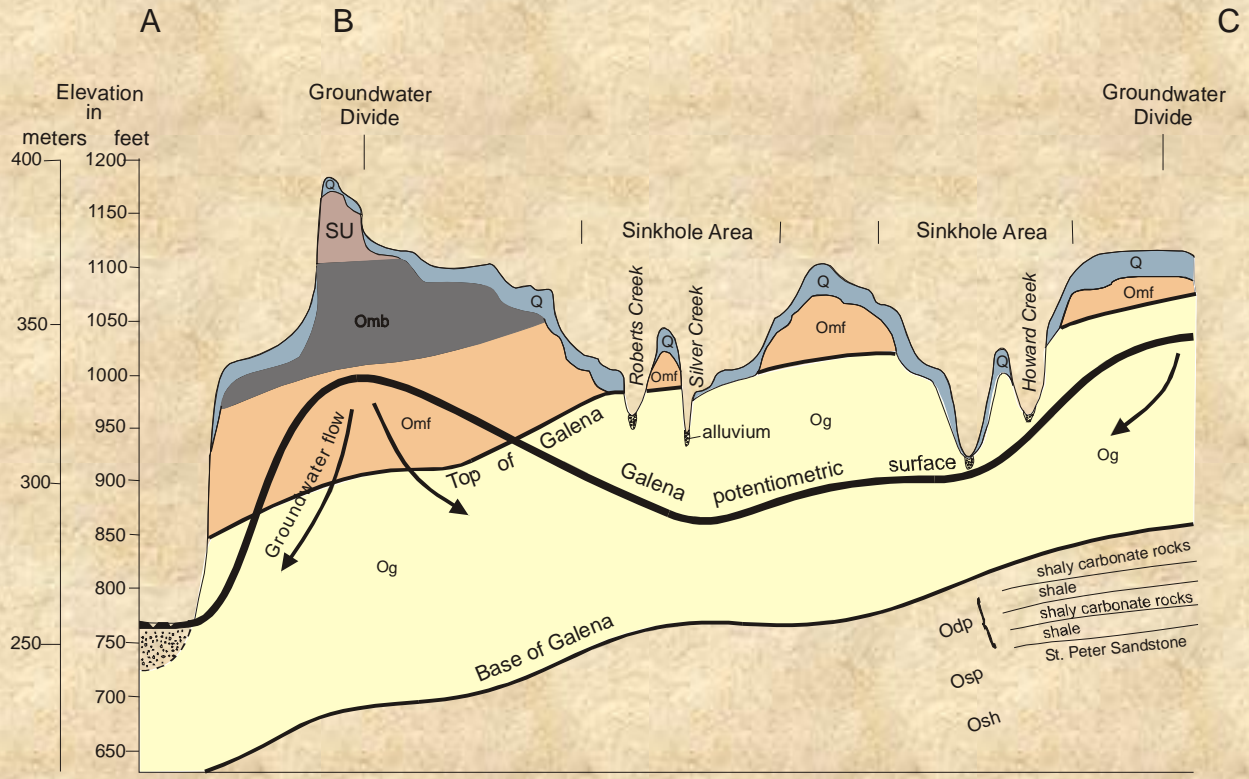
- Sinkholes
- Updated sinkholes
- ~ Streams
- Devonian - Cedar Valley
- Devonian - Wapsipinicon
- Silurian - Hopkinton
- Silurian - Waucoma
- Ordovician - Maquoketa
- Ordovician - Galena


0 2.5 5 10 15 20 Miles

Geography and Geology of Big Spring



GEOLOGIC MAP UNITS		EXPLANATION
SILURIAN	Silurian dolomites (Blanding, Tete des Morts, Mosalem Fms.)	● Sinkholes
ORDOVICIAN	Maquoketa Formation (Brainard Shale Member)	▲ Private well
	Maquoketa Formation (Ft. Atkinson, Clermont, Elgin Members)	○ Surface-water site
	Galena Carbonates (Dubuque, Wise Lake, Dunleith Fms.)	◆ Gaged tile-line site
		★ Big Spring
		--- Groundwater-basin divide
		A B Cross section



Holocene alluvium (stream deposits) 

Q Quaternary deposits undifferentiated loess, till, etc.

SU Silurian dolomites

Omb Maquoketa Formation Brainard Shale Member

Omf Maquoketa Formation Ft. Atkinson, Clermont, and Elgin Members

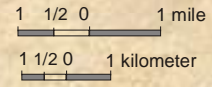
Og Galena carbonate rocks

Odp Decorah, Platteville, and Glenwood Fms.

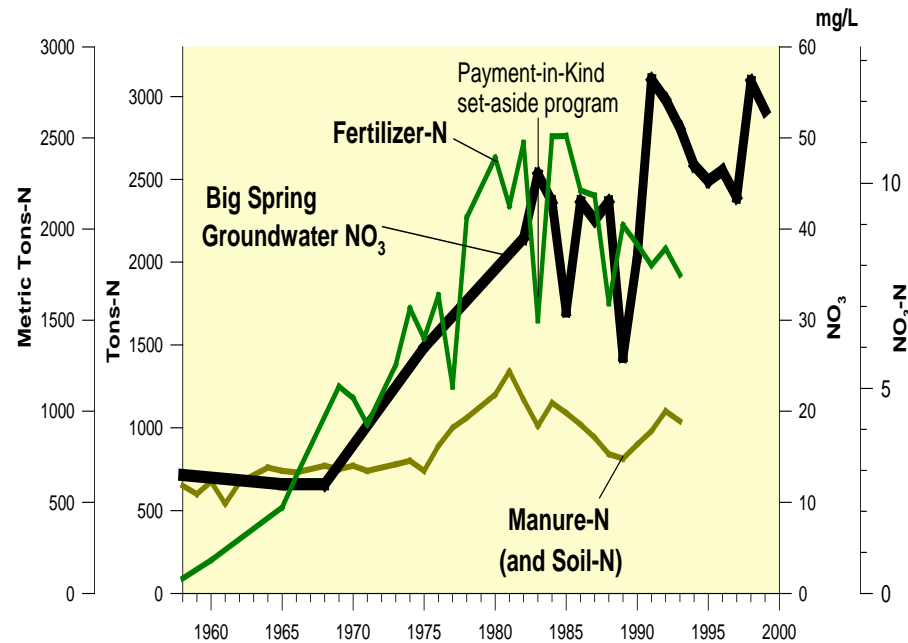
Osp St. Peter Sandstone

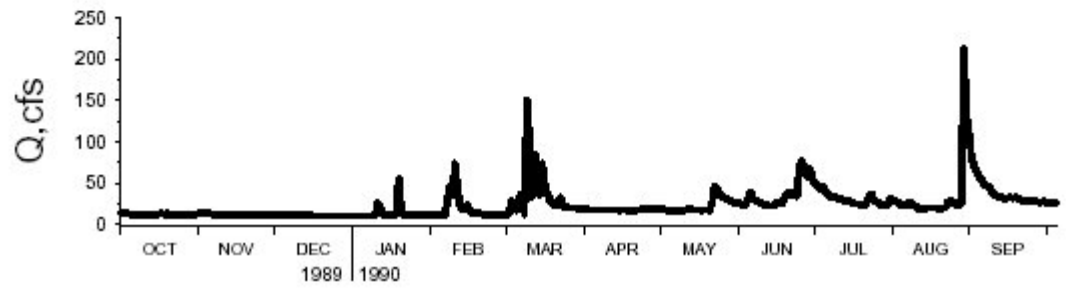
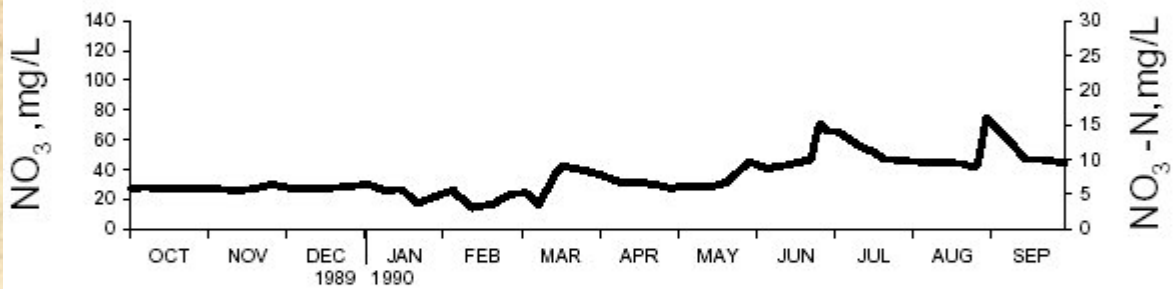
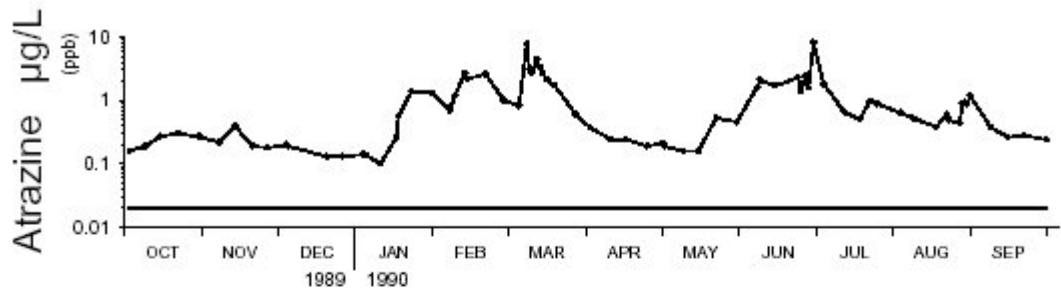
Osh Shakopee Formation

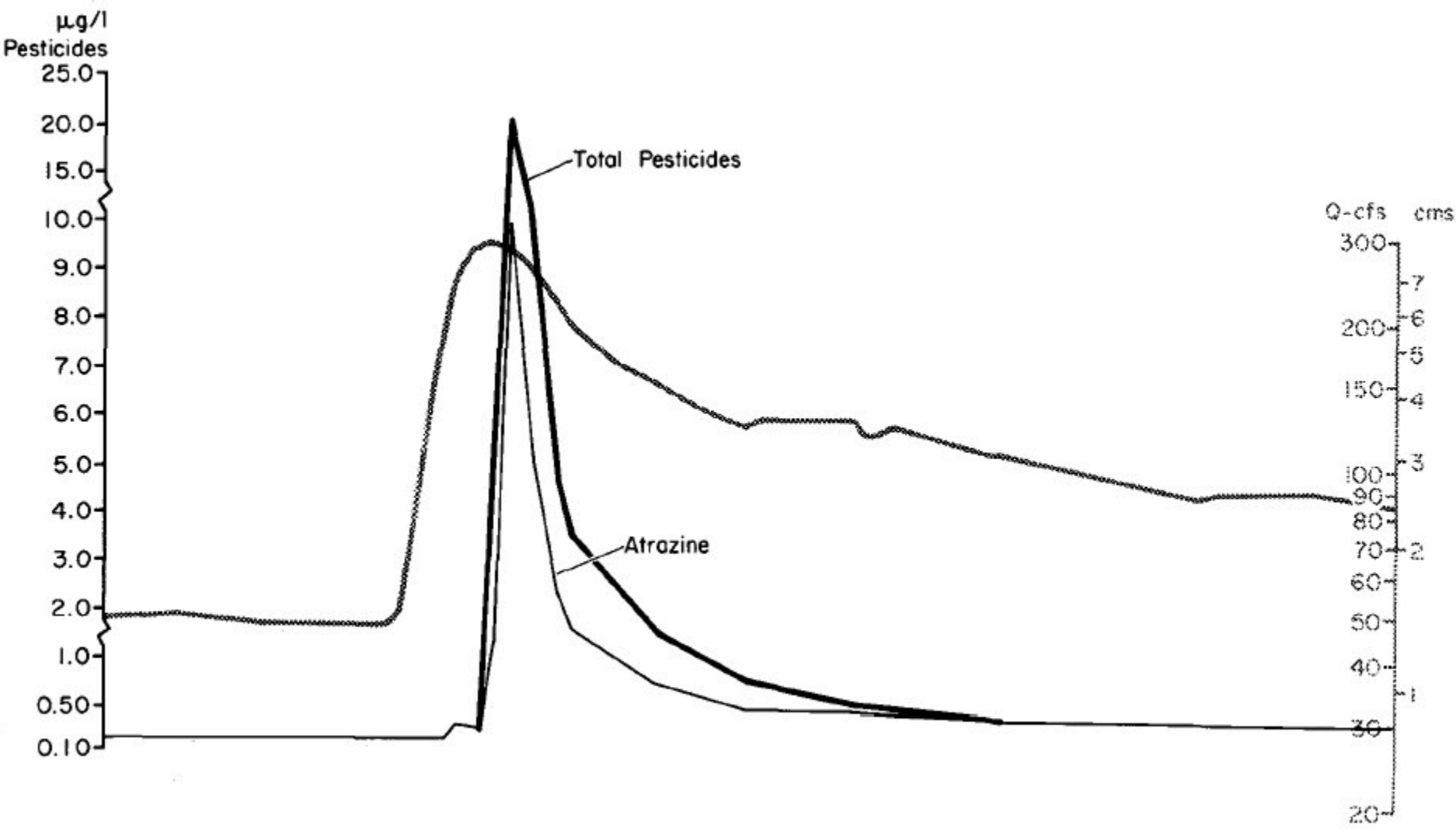
GEOLOGIC UNITS

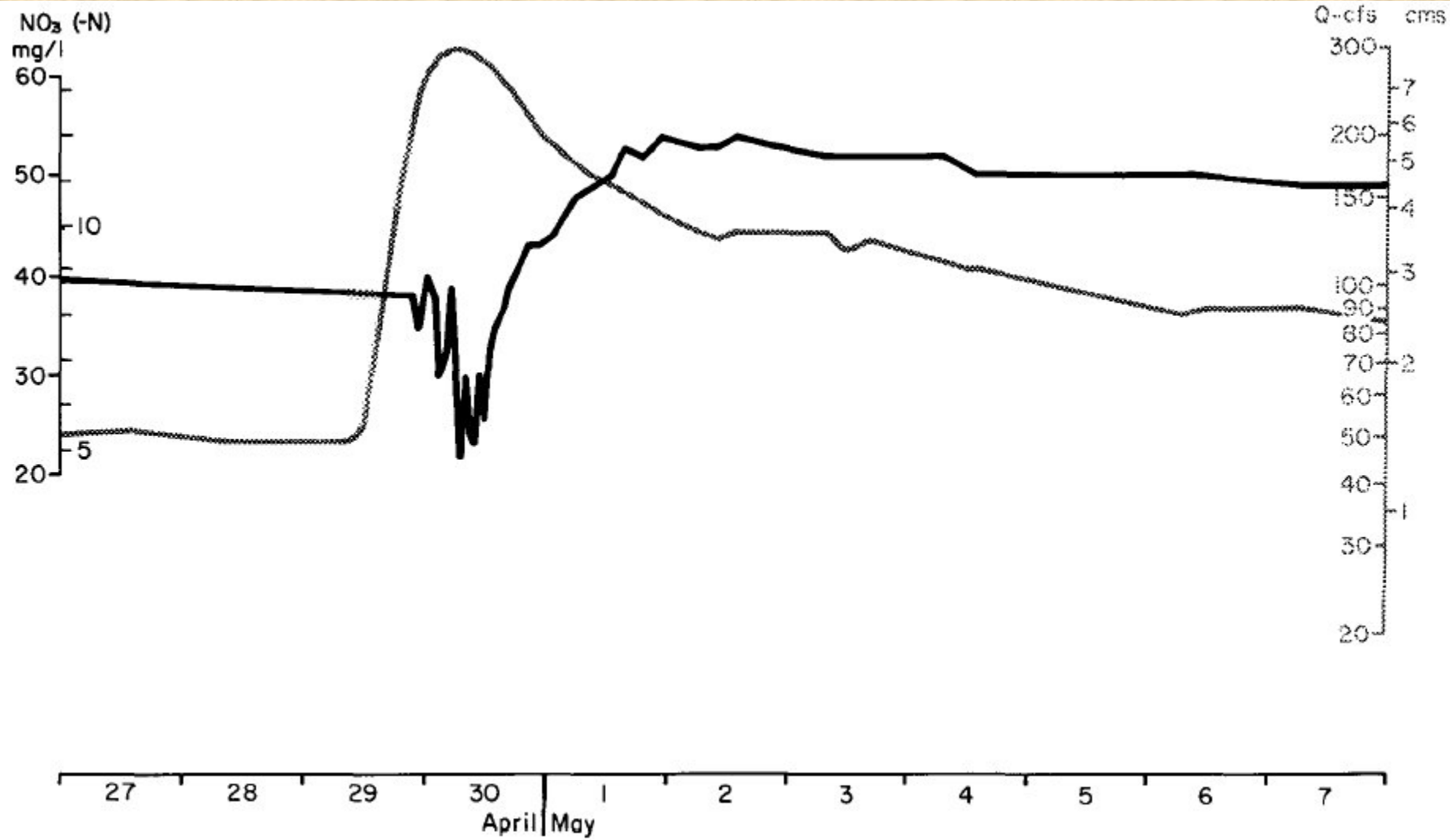


NO₃ in water and N-Inputs to Big Spring Basin

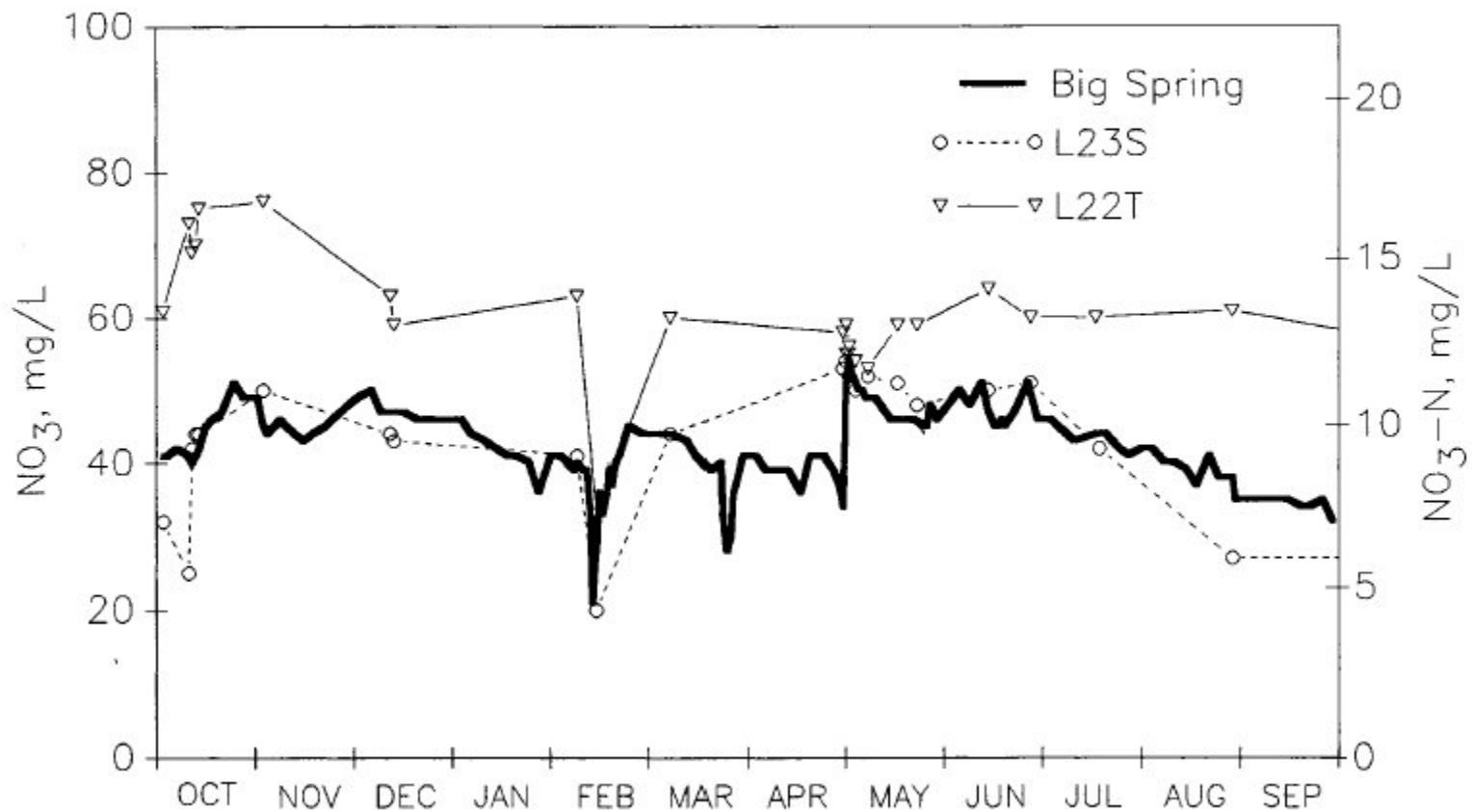




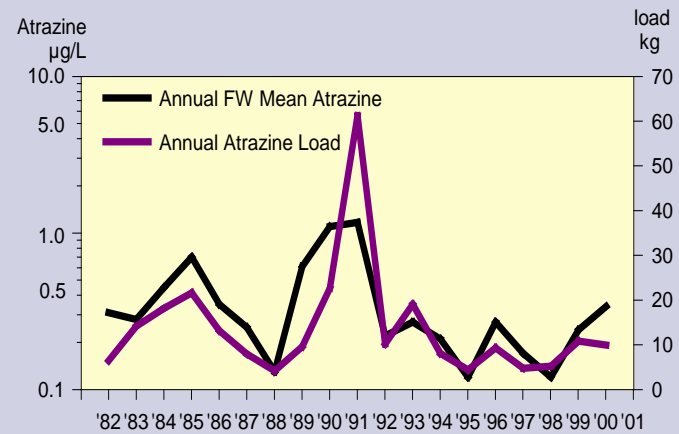
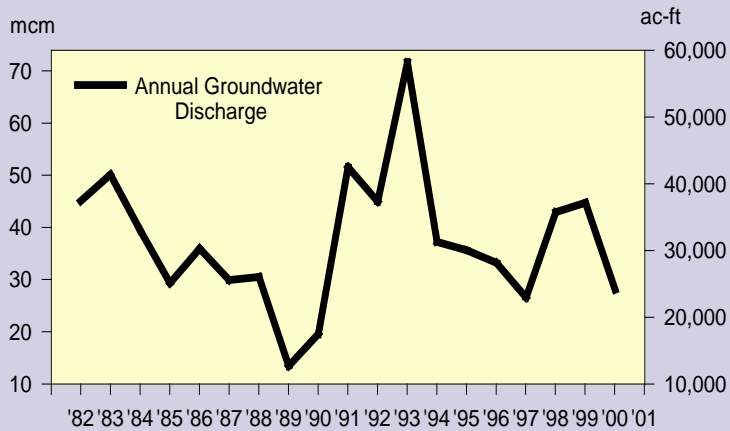
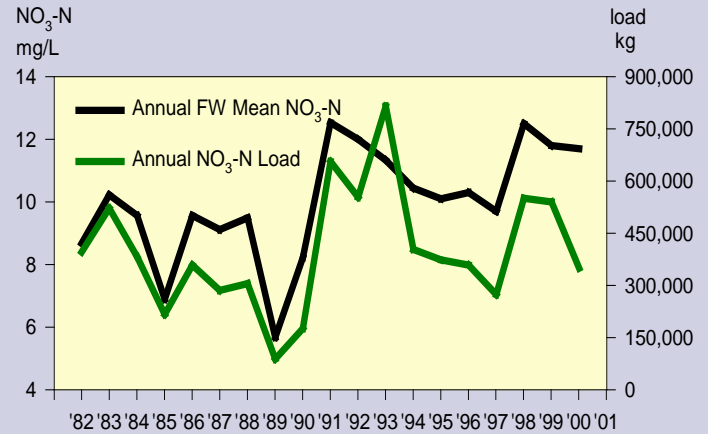
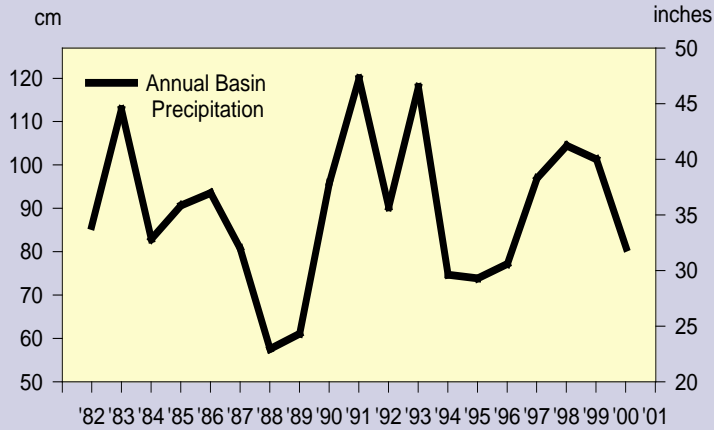




Water Year 1984



Big Spring Water Years 1982-2000



Nitrogen Input Reductions

<u>Basin average fertilizer-nitrogen rates</u>					
Rotation	All corn	1st-year corn after alfalfa	2nd-year corn after alfalfa	Continuous corn	Average Yield Continuous corn yields
Yearlbs N/Acre.....				Bushels/Acre
1981	174	123	160	178	128
1982	174	123	...	178	138
1984	158	115	155	169	130
1986	147	96	...	153	149
1987	149	84	121	157	141
1988	141	84	124	151	79*
1989	138	82	125	148	147
1990	123	66	121	145	145
1991	117	59	112	131	138
1992	117	128	165
1993	115	55	117	124	110**

* drought lowered yields in the basin and across Iowa

** frequent rains lowered yields in the basin and across Iowa

Nitrate - Big Spring Groundwater

Row - Crop:

45%
(1982)

57%
(1992)

64%
(2002)

71%
(2009)

