

# Water Quality of Powers Lake, Kenosha County, WI

Herb Garn, Bill Rose, and Rebecca Rewey

U.S. Geological Survey, WRD,  
Middleton, Wisconsin

In Cooperation with:

Powers Lake Management District

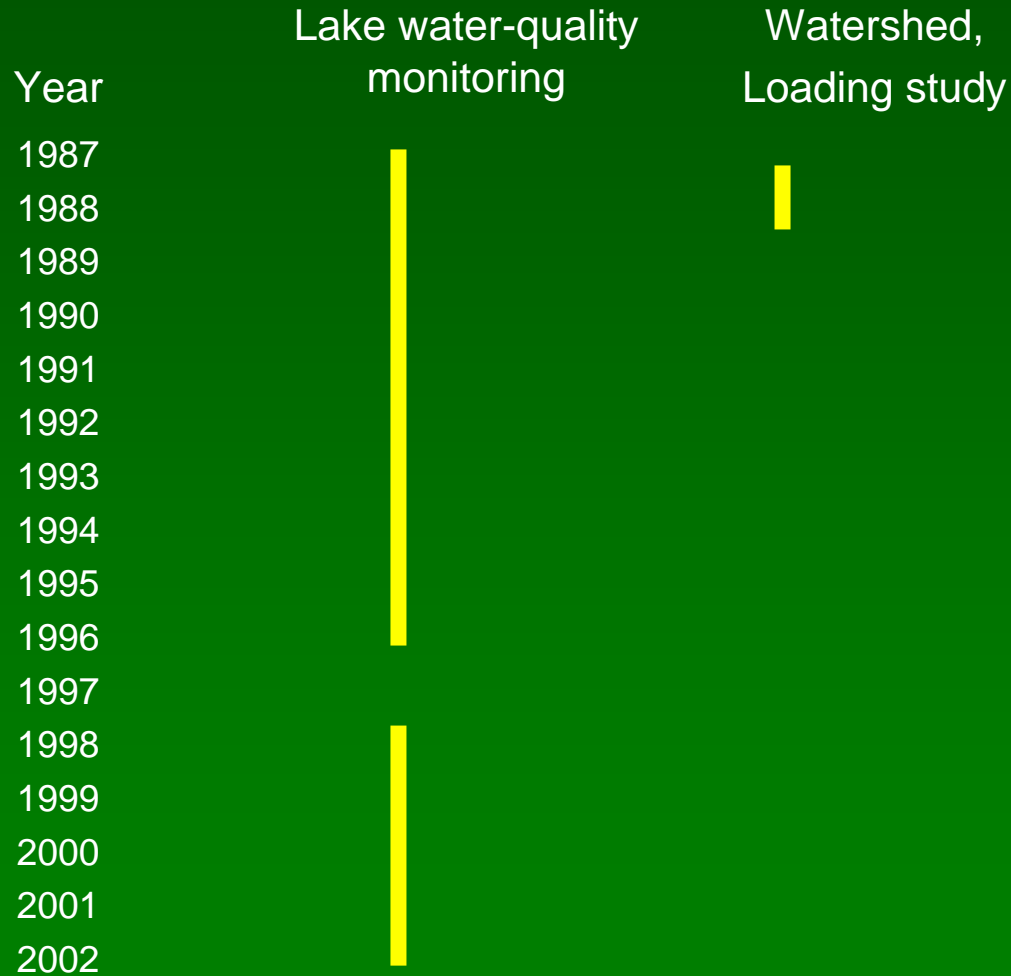
Wisconsin DNR



# PROBLEM

- Although water quality and trophic condition of Powers Lake are generally good (mesotrophic), increasing trends of some characteristics are of concern
- Continued and enhanced monitoring of Powers Lake is needed to more completely define conditions and to provide early warning of deteriorating conditions

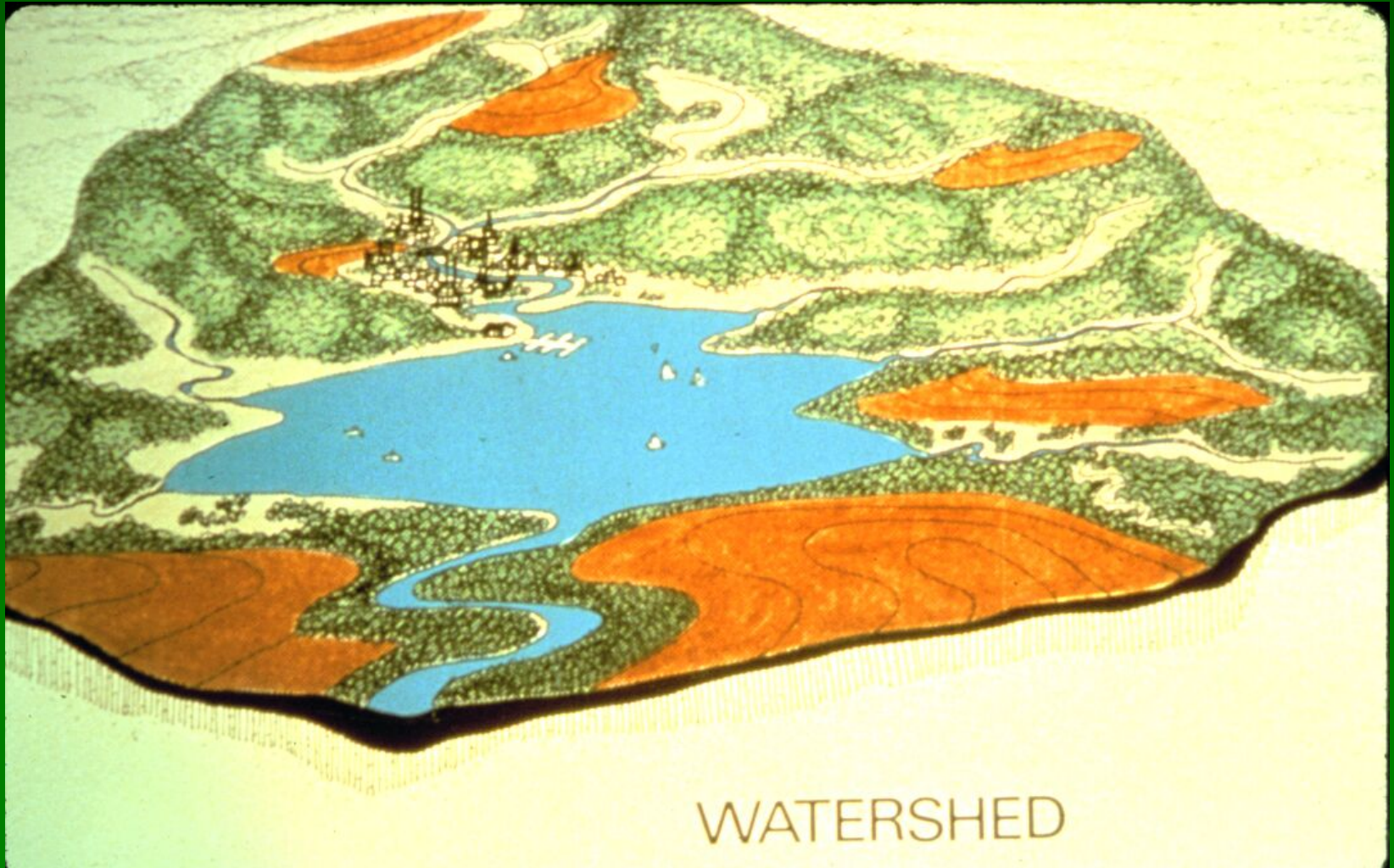
# USGS Projects with Powers Lake



# Goals of the Powers Lake Monitoring Project

1. Continue to evaluate lake water quality and trophic state to build a long-term database
2. From a quantitative database, provide a more complete definition of the water quality of the lake and provide early warning of deteriorating conditions or trends
3. Assess the condition of the lake over time in comparison with other lakes in the region

# A LAKE IS A REFLECTION OF ITS WATERSHED



# *EUTROPHICATION*

- The natural process of physical, chemical, and biological changes associated with nutrient, organic matter, silt enrichment and sedimentation of a lake. The process may be accelerated by man-made influences, and is then called ‘cultural eutrophication.’
- **Phosphorus**—the critical nutrient

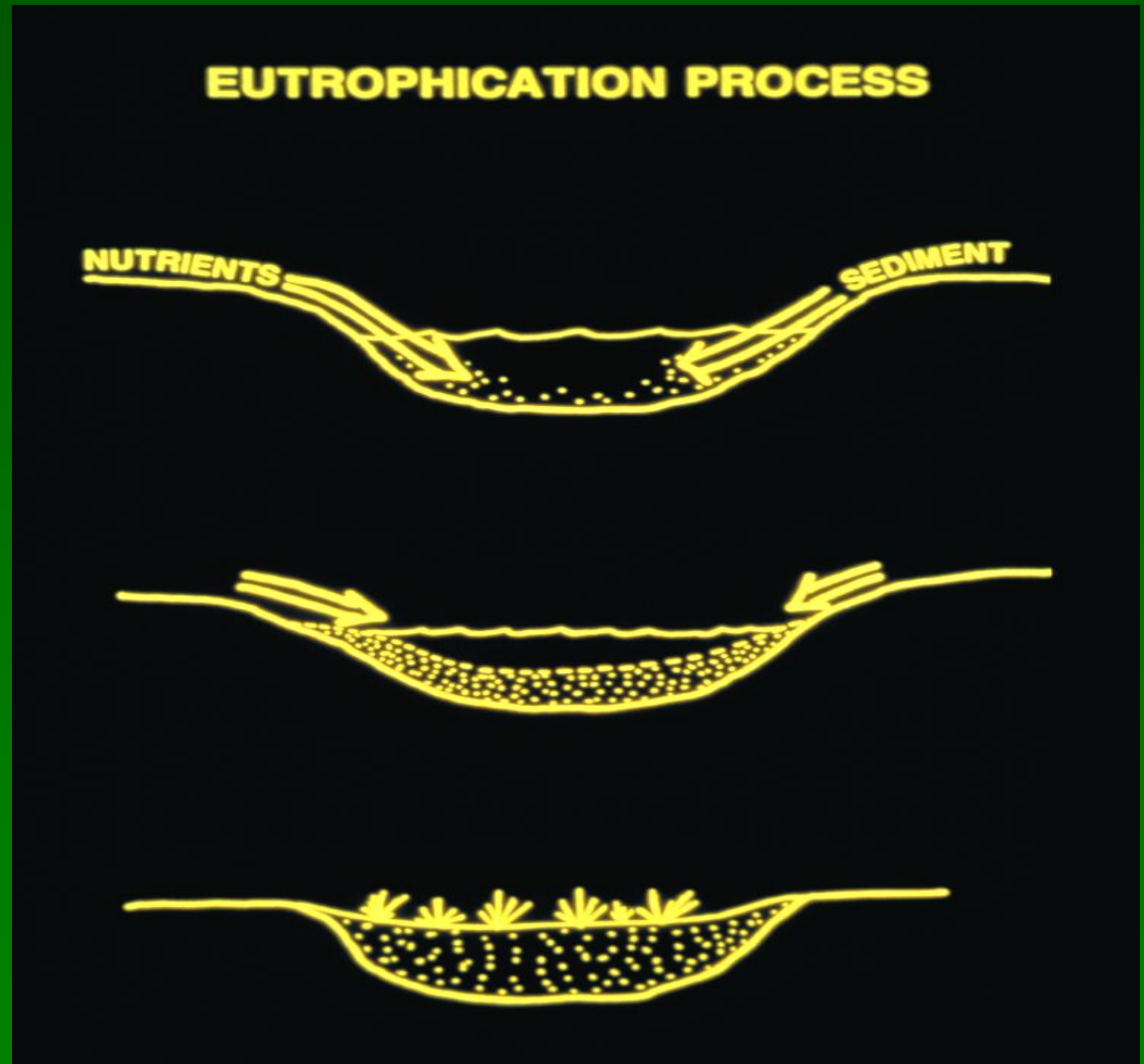
# EUTROPHICATION

## TROPHIC CLASSIFICATION OF LAKES

Oligotrophic

Mesotrophic

Eutrophic



# OLIGOTROPHIC LAKES

- Clear water, low productivity
- Algal populations low
- Deepest water contains oxygen
- Total Phosphorus conc.  $< 5$  ug/L
- Chlorophyll *a* conc.  $< 2$  ug/L
- Secchi depth  $> 4$  m



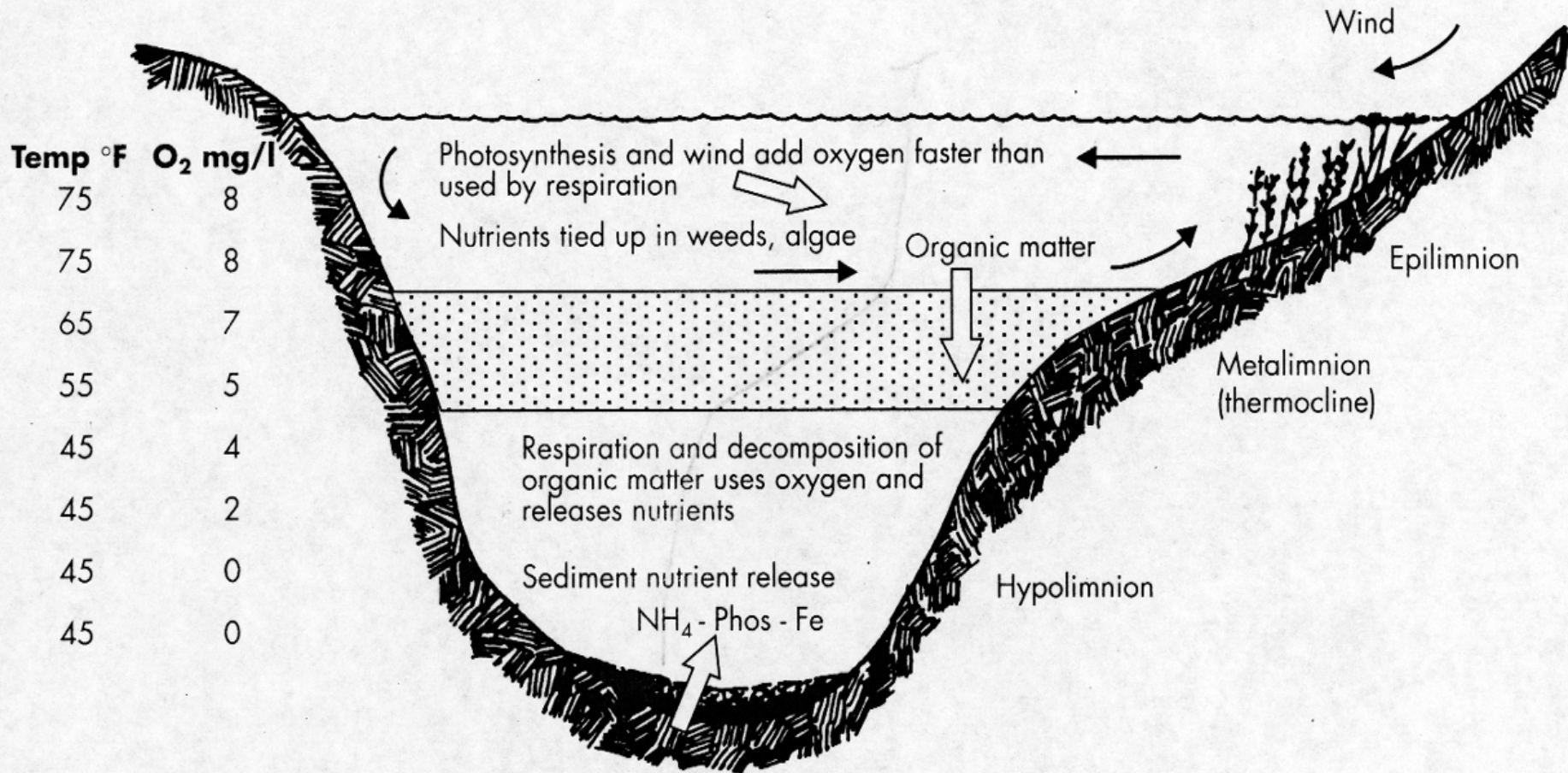
# MESOTROPHIC LAKES

- Moderate clarity, increased production
- Generally a good fishery
- Occasional algal bloom
- Deepest water has some oxygen depletion
- Accumulated organic sediments
- Total Phosphorus conc. 5-17 ug/L
- Chlorophyl *a* conc. 2-7 ug/L
- Secchi depth 2-4 m

# EUTROPHIC LAKES

- Little clarity, very productive
- Rough fish common, occasional fish kills
- Frequent algal blooms
- Deep waters have oxygen depletion
- Accumulated rich sediments
- Total Phosphorus conc.  $> 17$  ug/L
- Chlorophyl *a* conc.  $> 7$  ug/L
- Secchi depth  $< 2$  m

# Lake Stratification



PHOSPHORUS  
**NUTRIENTS**  
NITROGEN



FISH

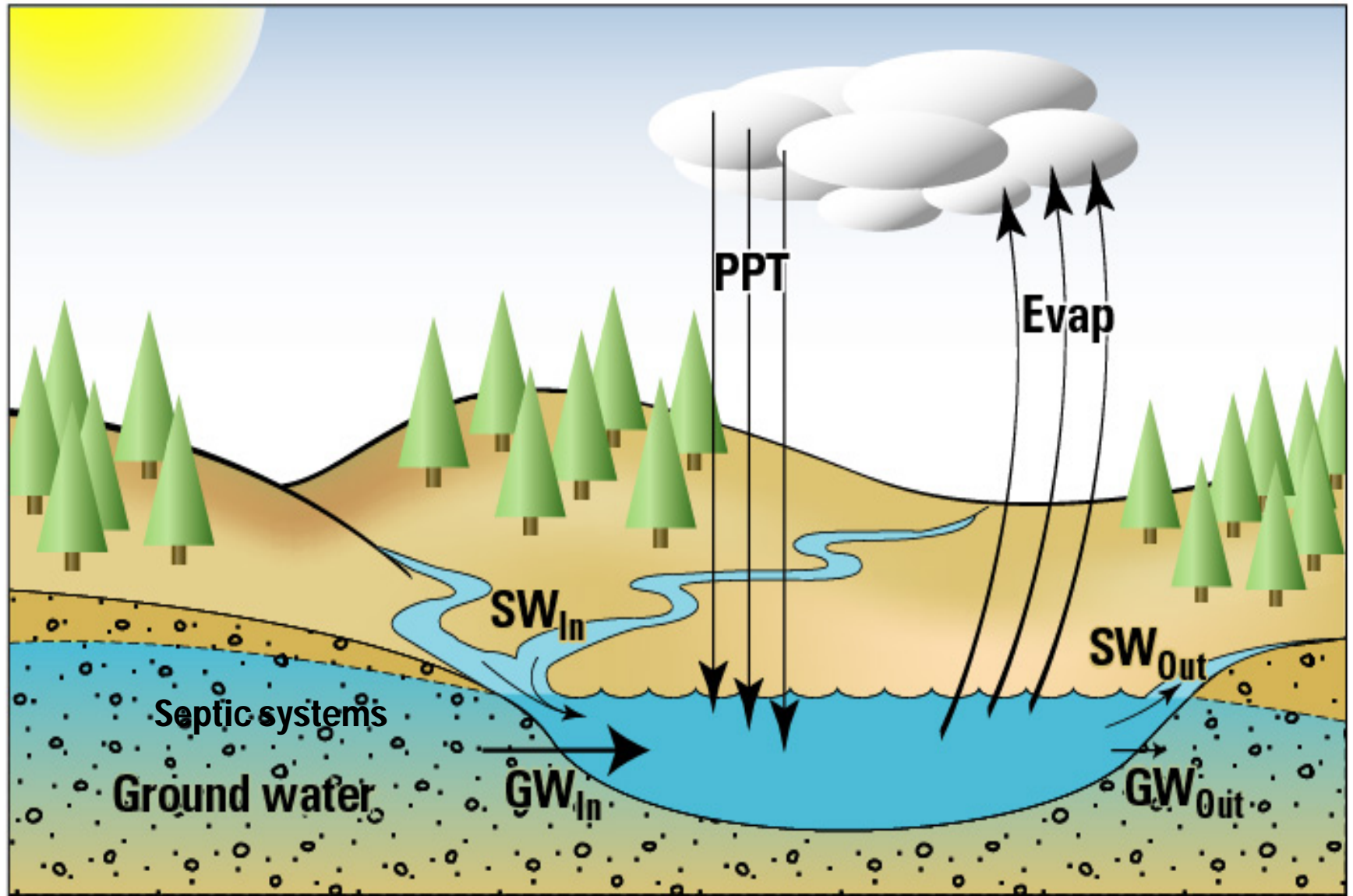


# BASIC FOOD CHAIN

# Powers Lake

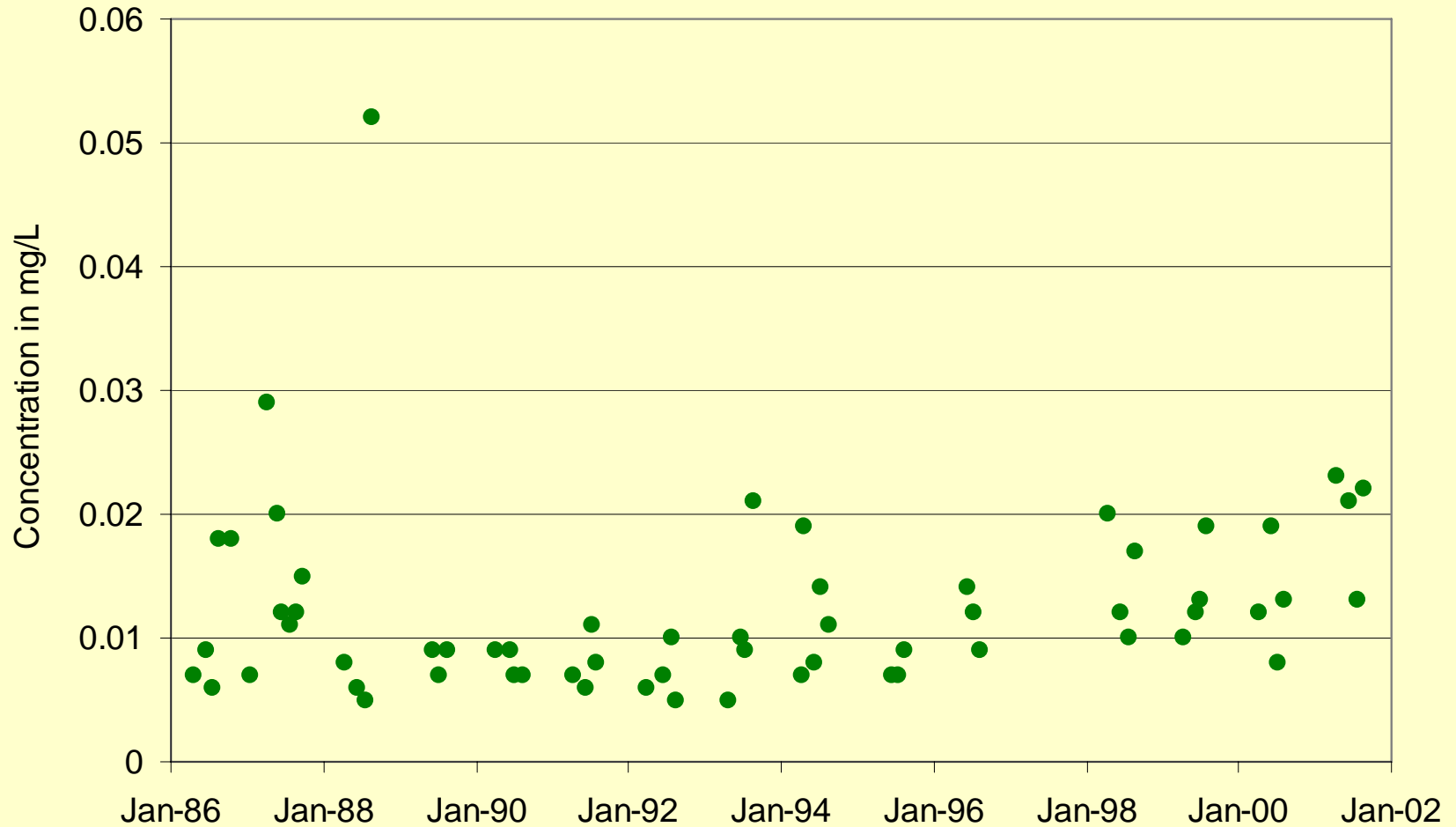


# Water and Phosphorus Budgets



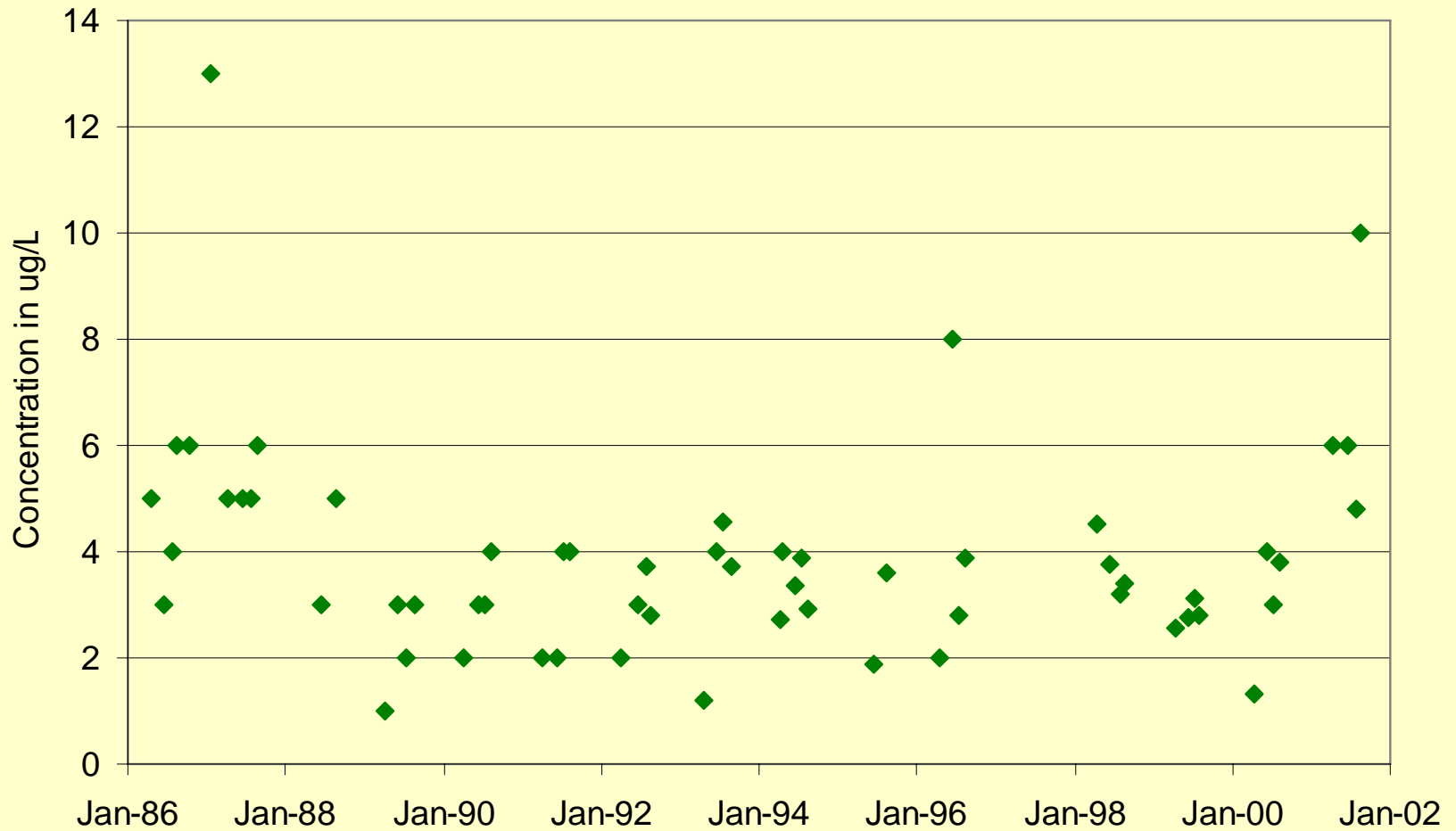


# Total Phosphorus Concentration

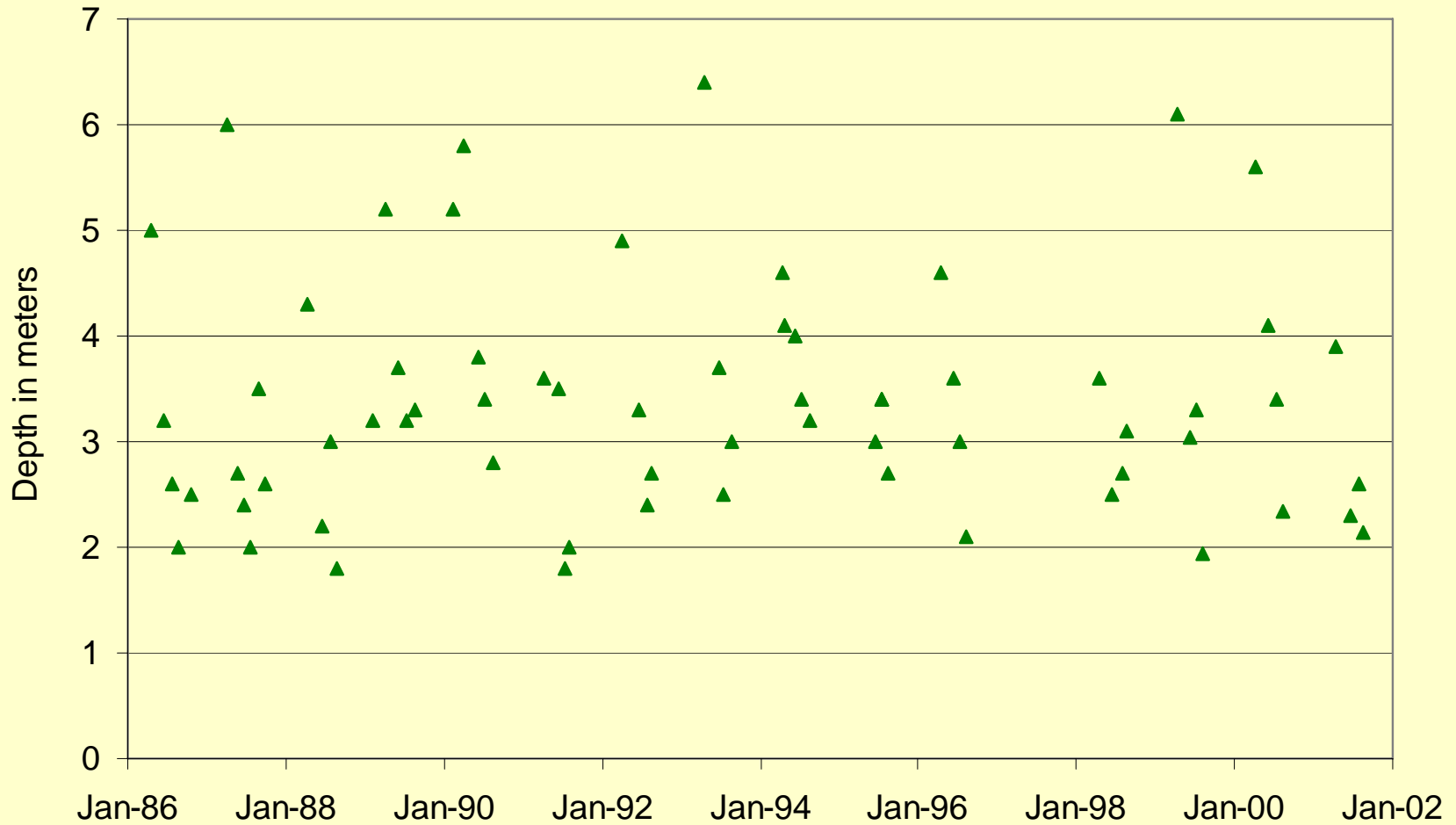




# Chlorophyll *a* Concentration

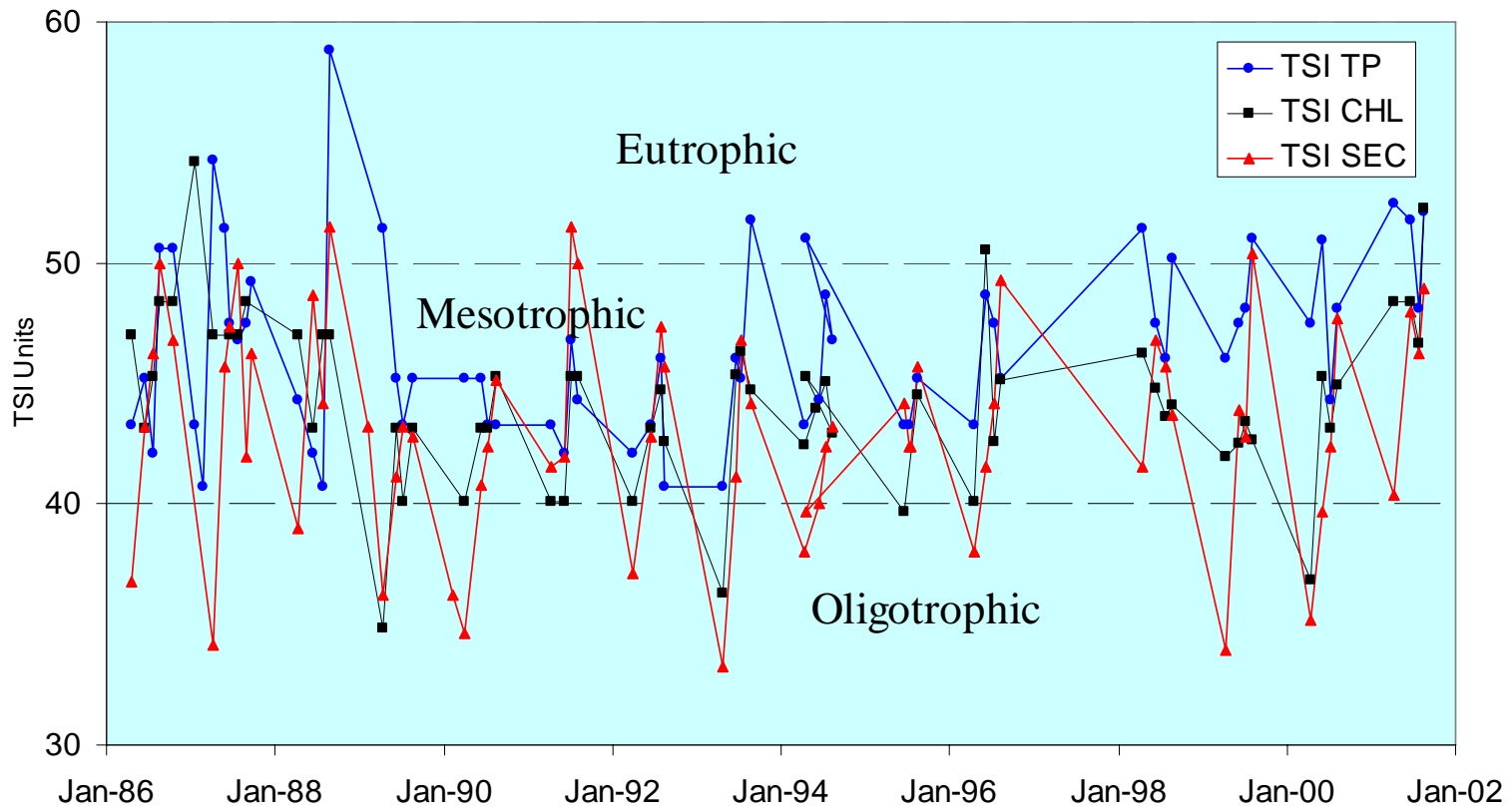


# Secchi Depth

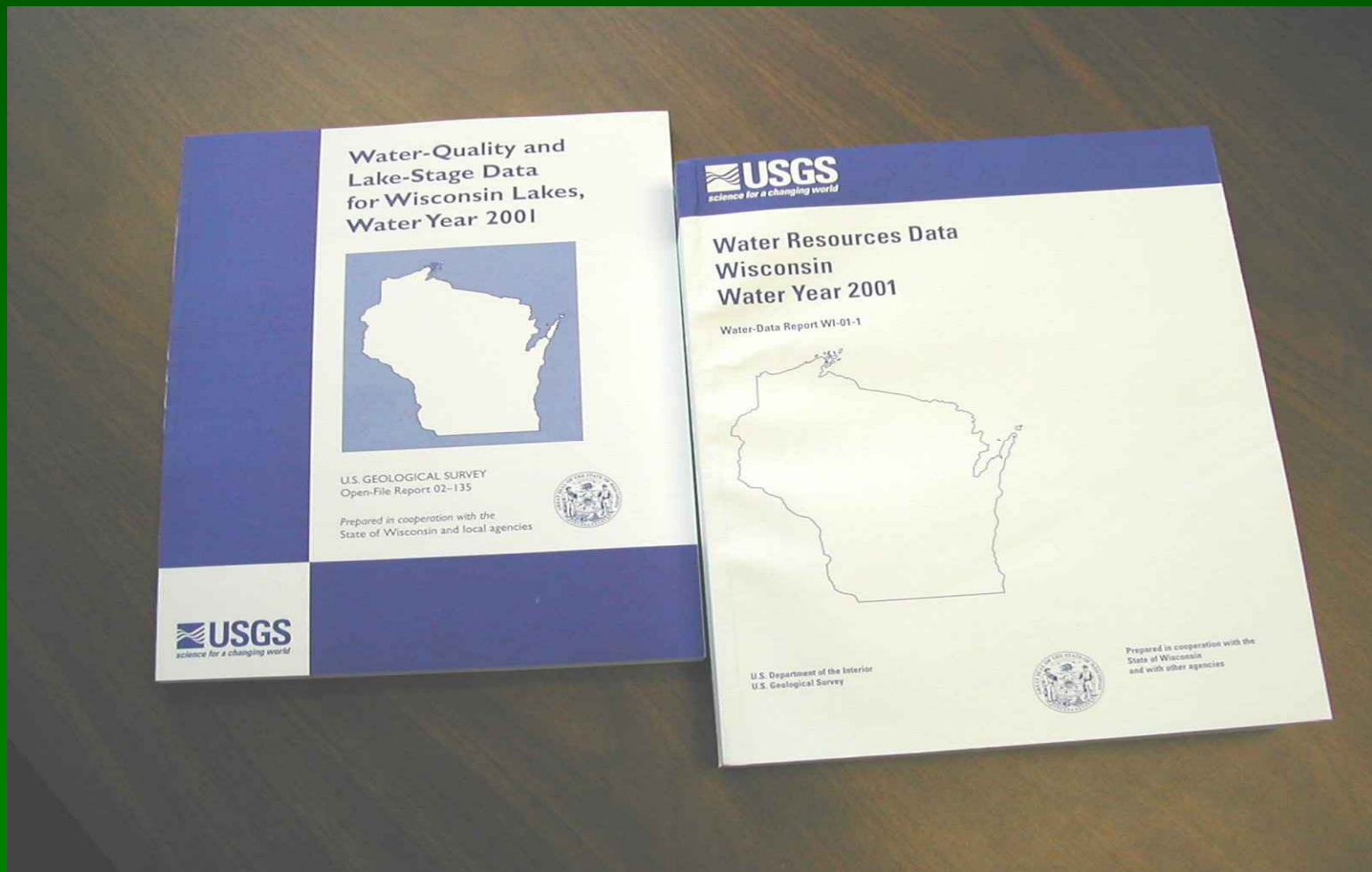


# Trophic State Index (TSI)

## 1986 - 2001



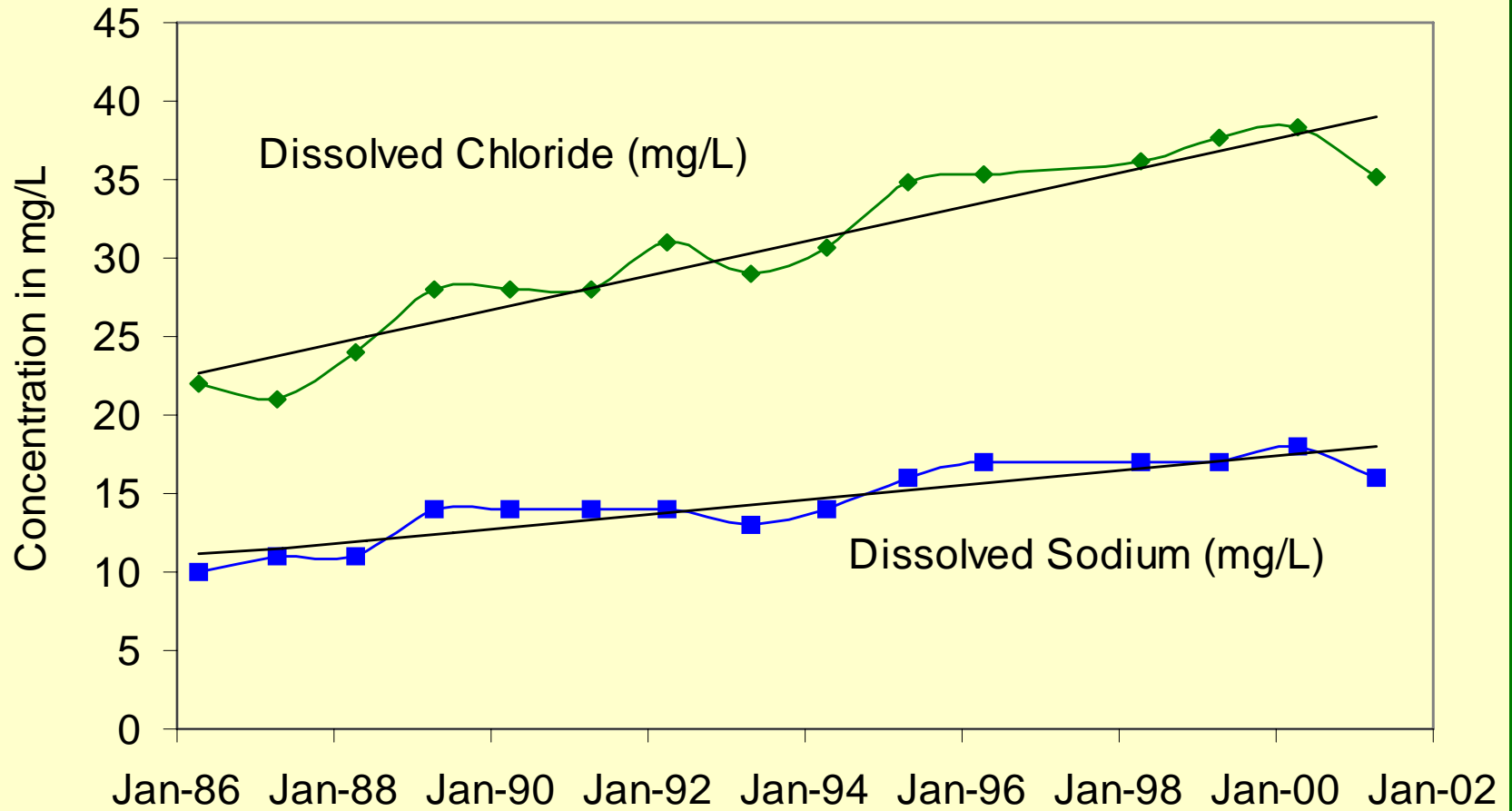
# Annual Data Reports Published by the USGS



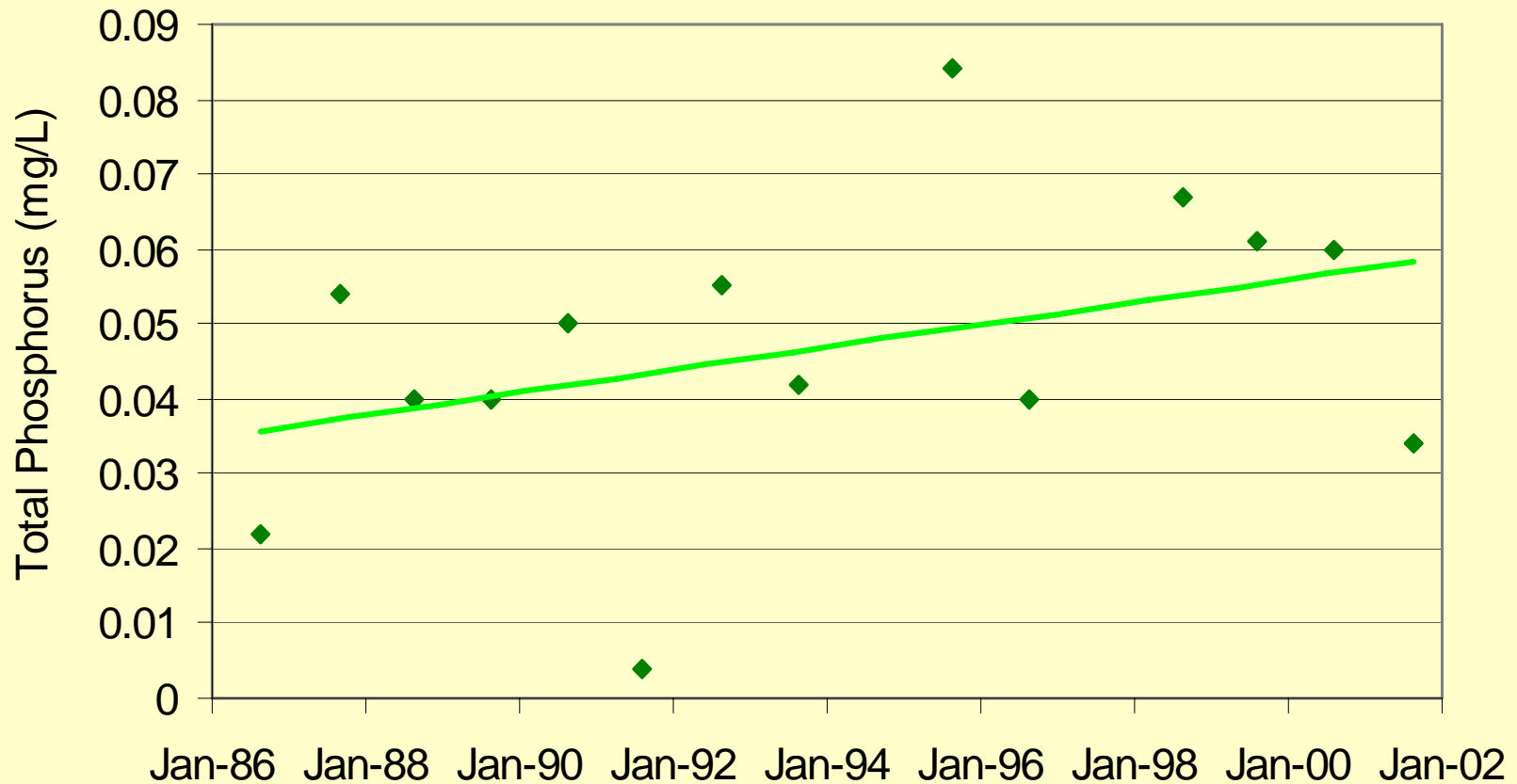
# Regional Comparison

	<u>Parameter (late-summer values)</u>	<u>Percent distribution of lakes in southeast region</u>	
	<u>Total Phosphorus (ug/L)</u>		
	<0.010	best condition	7
<b>Powers Lake</b>	0.010-0.020	↓ ↓ ↓ ↓ ↓ ↓	21
	0.020-0.030		15
	0.030-0.050		21
	0.050-0.100		21
	0.100-0.150		3
	>0.150		worst condition
	<u>Chlorophyll a (ug/L)</u>		
	0-5	best condition	22
<b>Powers Lake</b>	5-10	↓ ↓ ↓	31
	10-15		14
	15-30		12
	>30		worst condition
	<u>Secchi depth (meters)</u>		
	>6.0	best condition	1
	3.0-6.0	↓ ↓ ↓	9
<b>Powers Lake</b>	2.0-3.0		26
	1.0-2.0		31
	<1.0		worst condition

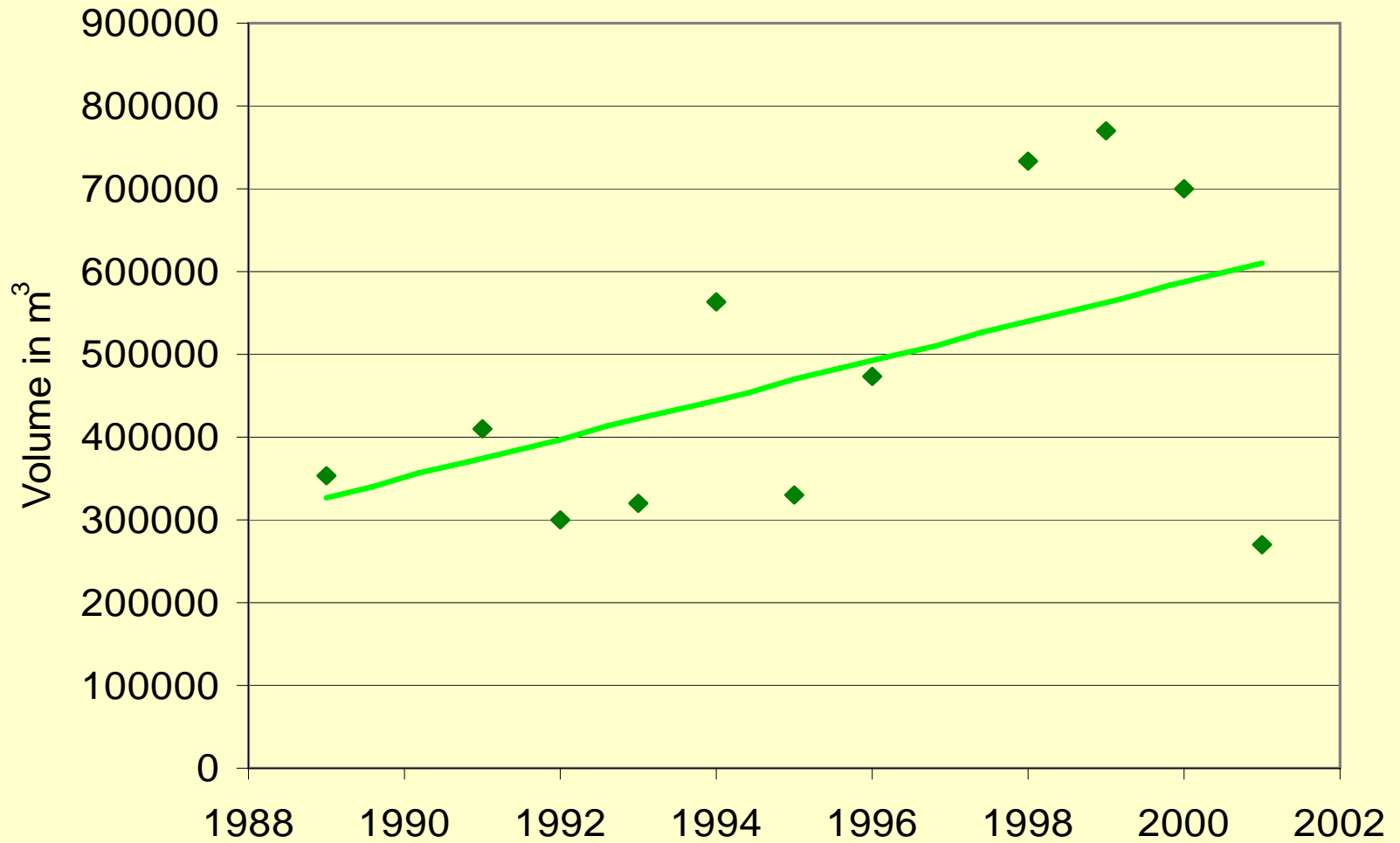
# Chloride and Sodium Concentrations



# Bottom Total Phosphorus in August



# Anoxic Volume on July 1





# CONCLUSIONS

- Water quality is good in comparison to other lakes in the region and was consistent during the 15–year study period
- Phosphorus, chlorophyll *a* and Secchi depth indicate the lake is usually mesotrophic
- Algal growth is phosphorus limited
- Hypolimnion becomes anoxic in summer but minor amounts of phosphorus are released from bottom sediments
- Some indicators show an apparent trend of deteriorating conditions

