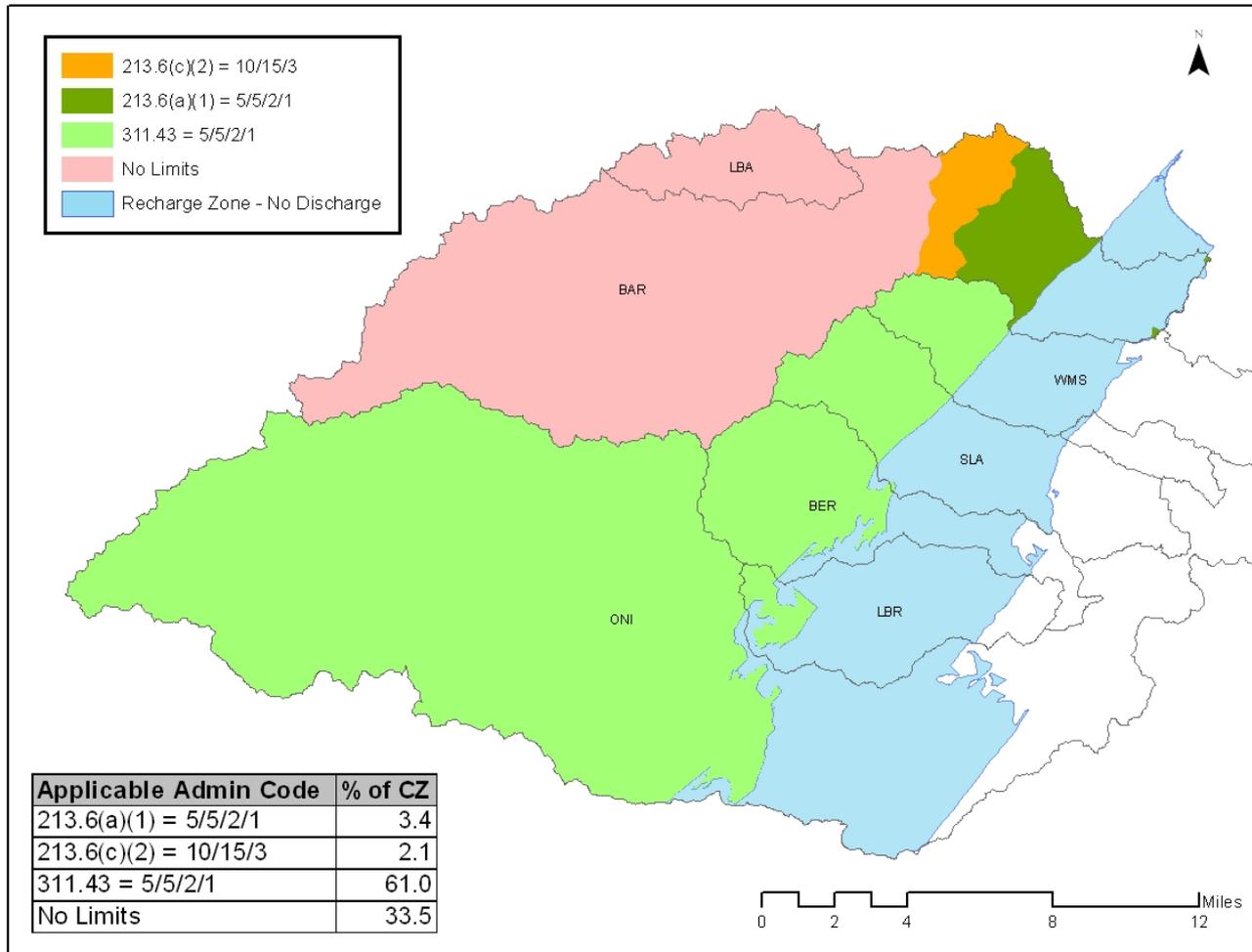


City of Austin
Water Quality Studies in Barton
Springs Zone

January 16, 2009

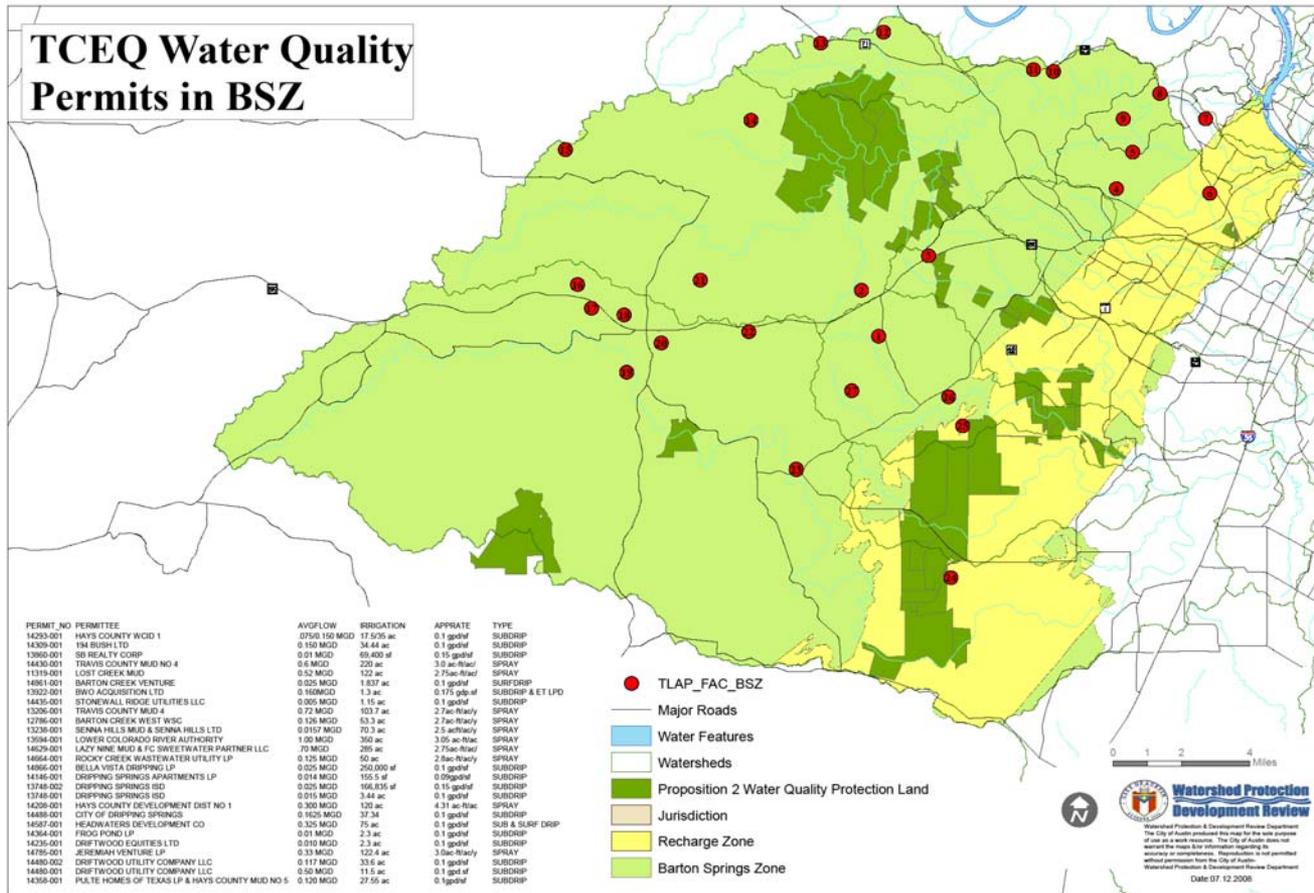
Barton/Onion BSEACZ Watershed Rule
Stakeholders Meeting

Wastewater Disposal Regulations in BSZ

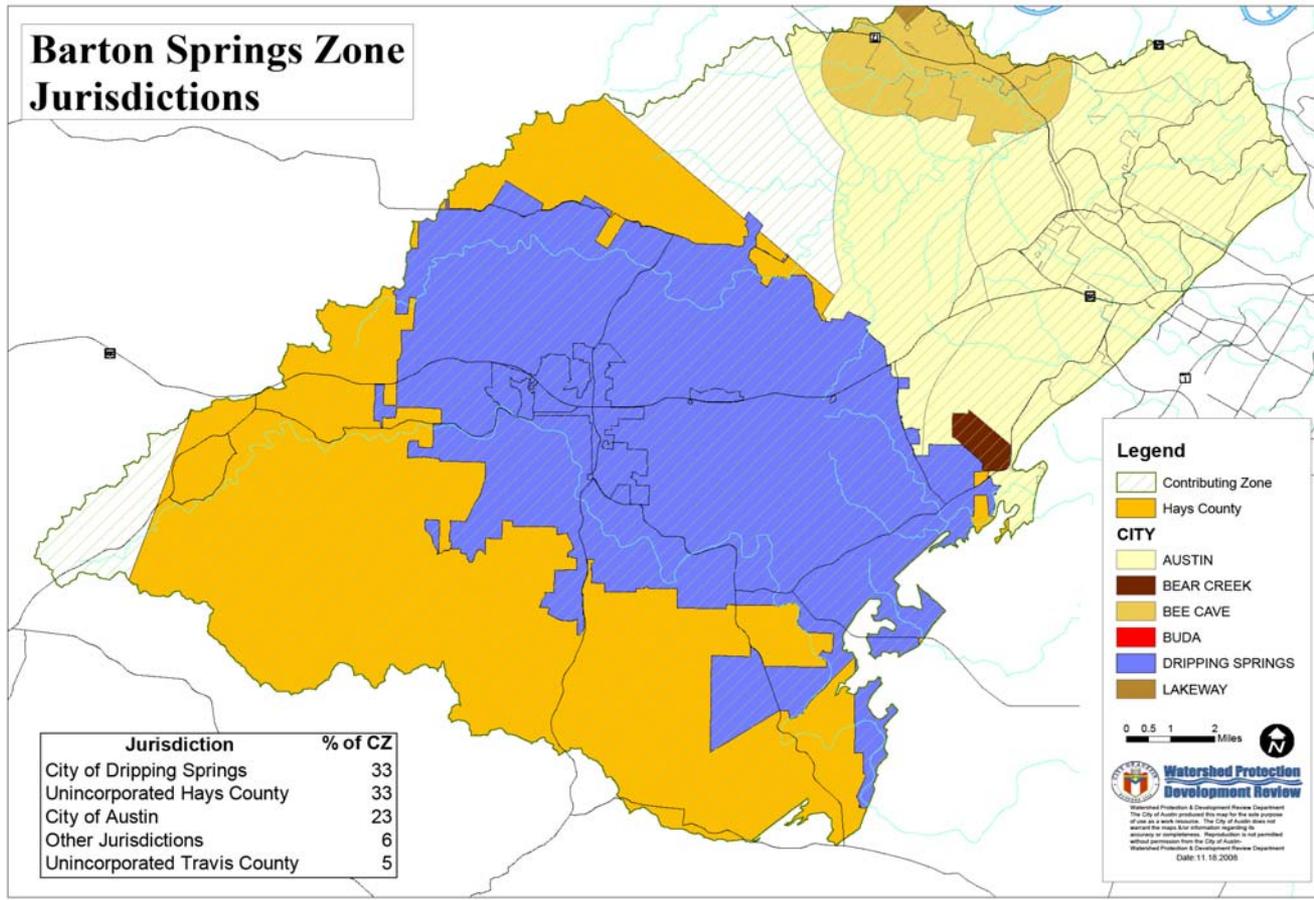


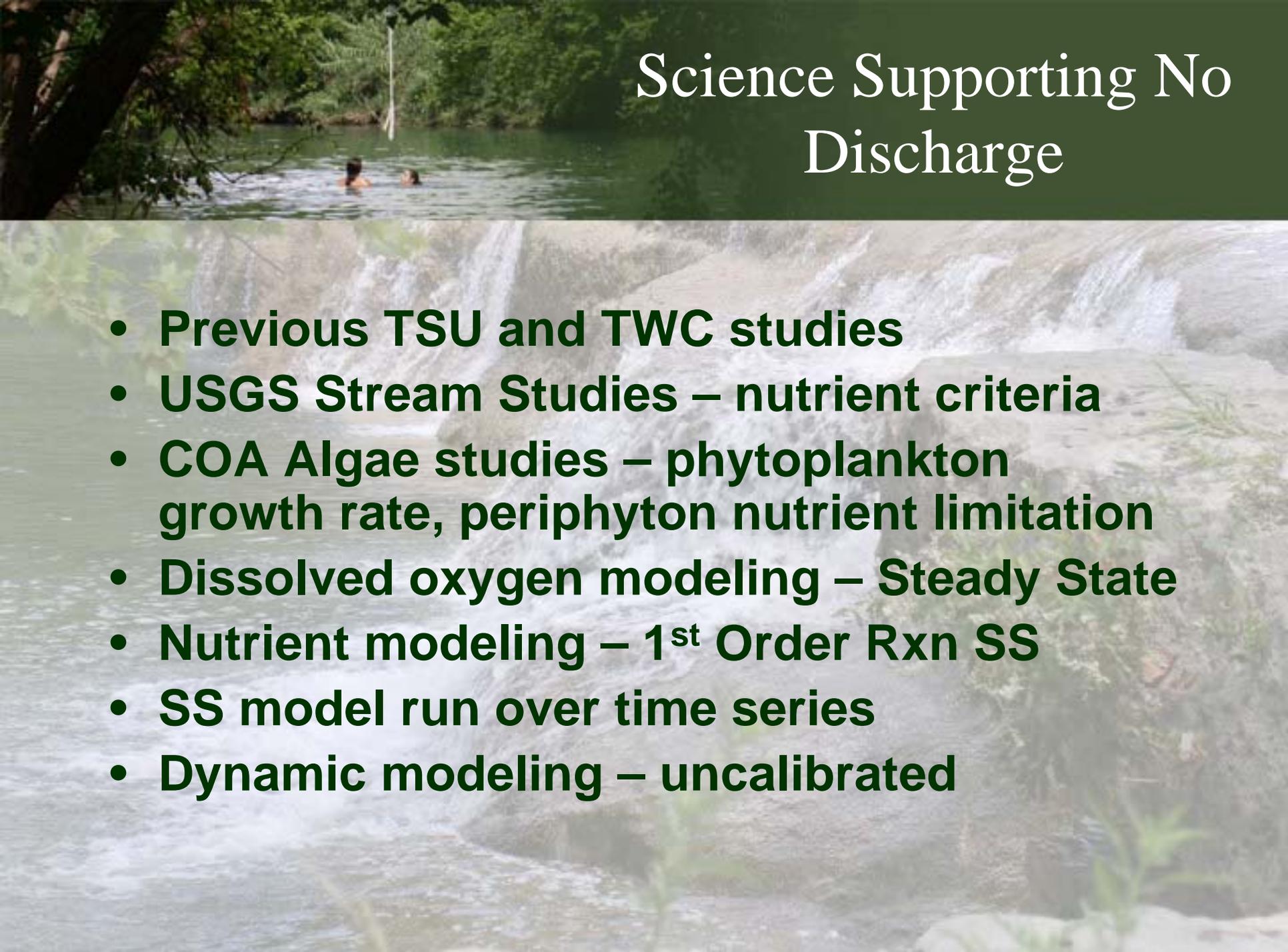
TCEQ Permits in BSZ

- 27 Permits approved or in process
- 6.2 MGD Wastewater
- 78,253 Residents to these plants
- Roughly 34,000 homes
- 64% of population in BSZ (roughly)
- Remainder: COA service, OSSF, other municipalities outside BSZ



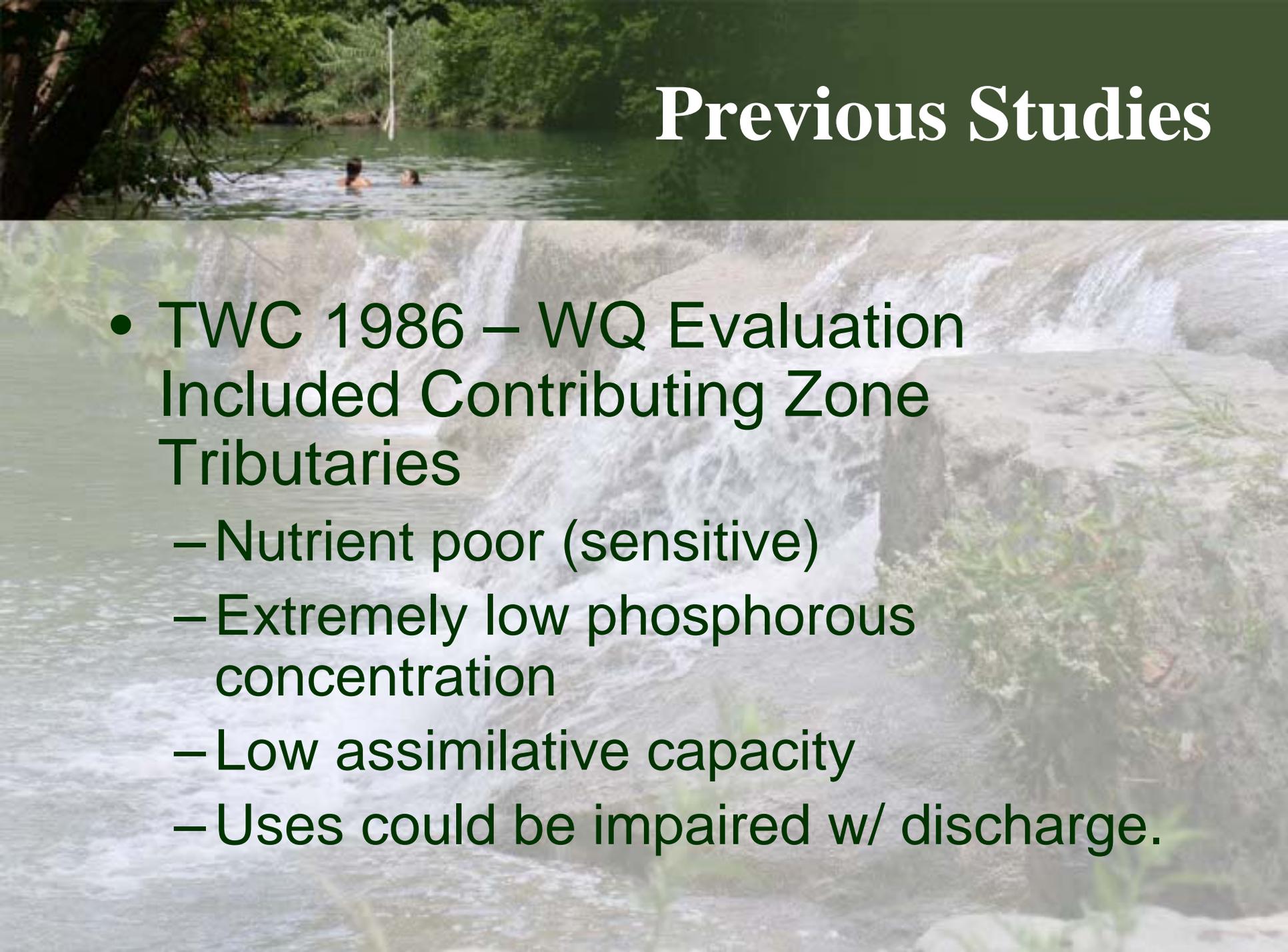
Contributing Zone Jurisdictions



The background of the slide is a composite image. The top portion shows a river with two people swimming in the water, surrounded by lush green trees. The bottom portion shows a close-up of a waterfall cascading over large, light-colored rocks.

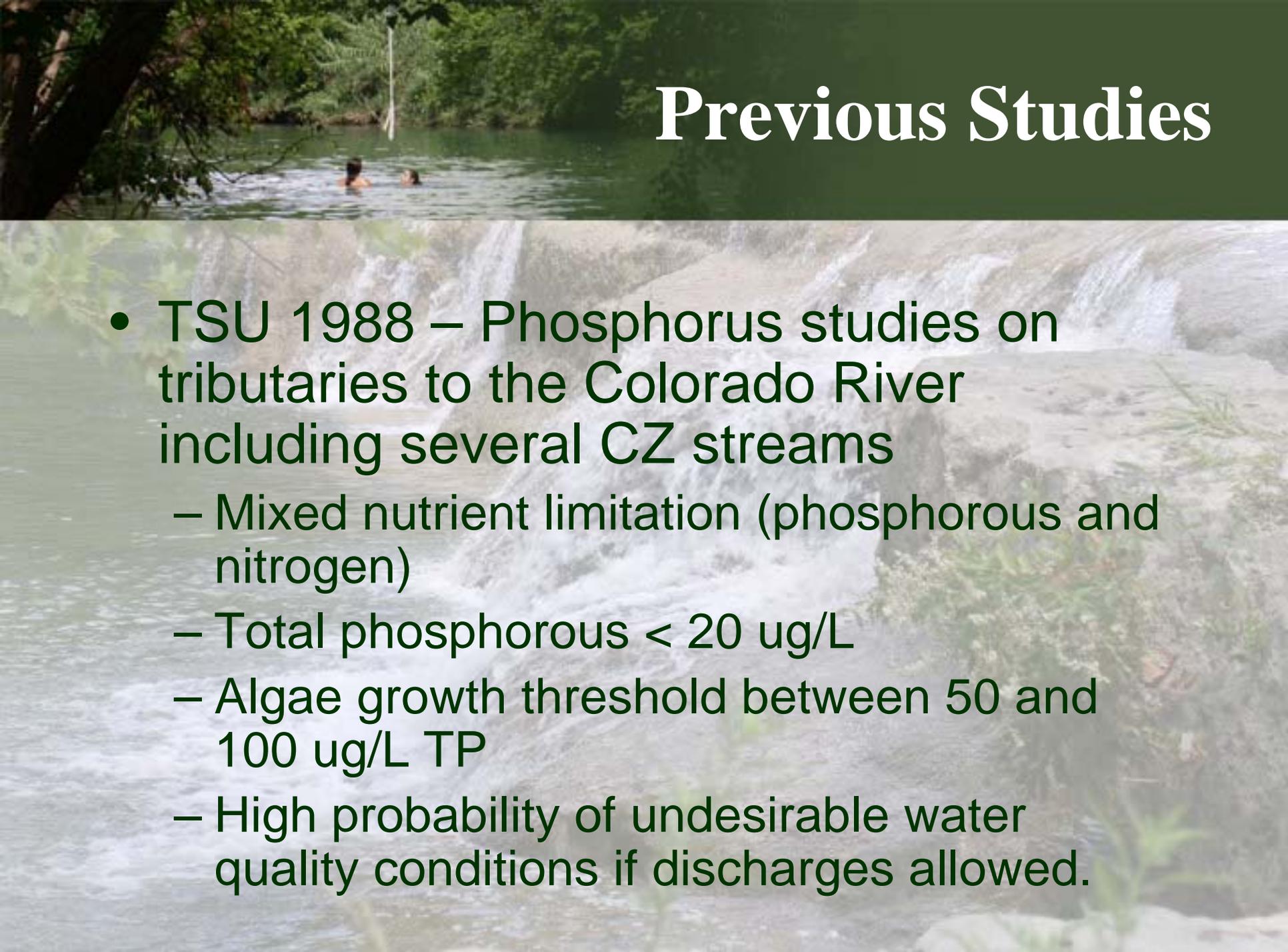
Science Supporting No Discharge

- **Previous TSU and TWC studies**
- **USGS Stream Studies – nutrient criteria**
- **COA Algae studies – phytoplankton growth rate, periphyton nutrient limitation**
- **Dissolved oxygen modeling – Steady State**
- **Nutrient modeling – 1st Order Rxn SS**
- **SS model run over time series**
- **Dynamic modeling – uncalibrated**

The background of the slide is a photograph of a natural waterway. In the upper portion, a river flows through a lush, green forest. Two people are seen swimming in the water. Below this, a waterfall cascades over a series of large, light-colored rocks. The water is white and frothy as it falls. The overall scene is peaceful and natural.

Previous Studies

- TWC 1986 – WQ Evaluation Included Contributing Zone Tributaries
 - Nutrient poor (sensitive)
 - Extremely low phosphorous concentration
 - Low assimilative capacity
 - Uses could be impaired w/ discharge.

The background of the slide is a composite image. The top portion shows a river flowing through a lush, green forest. Two people are visible swimming in the water. The bottom portion of the slide features a close-up of a waterfall cascading over large, light-colored rocks. The overall scene is natural and serene.

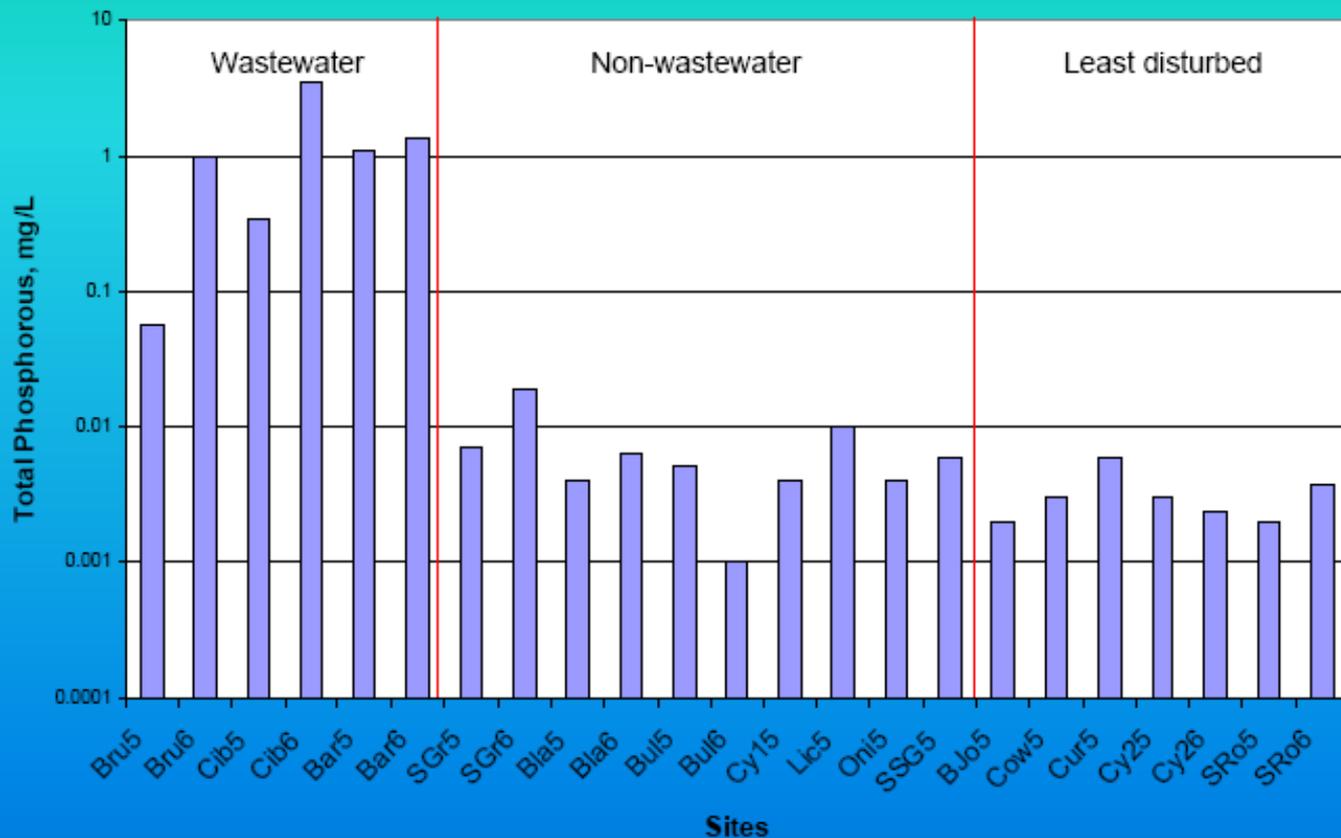
Previous Studies

- TSU 1988 – Phosphorus studies on tributaries to the Colorado River including several CZ streams
 - Mixed nutrient limitation (phosphorous and nitrogen)
 - Total phosphorous < 20 ug/L
 - Algae growth threshold between 50 and 100 ug/L TP
 - High probability of undesirable water quality conditions if discharges allowed.

USGS Edwards Plateau Stream Studies

(From: Mabe, 2007)

Total Phosphorous Concentrations



Group means for total phosphorous (mg/L):

Wastewater = 1.23 , Non-wastewater = 0.007 , Least disturbed = 0.003

USGS General Conclusions

General Conclusions

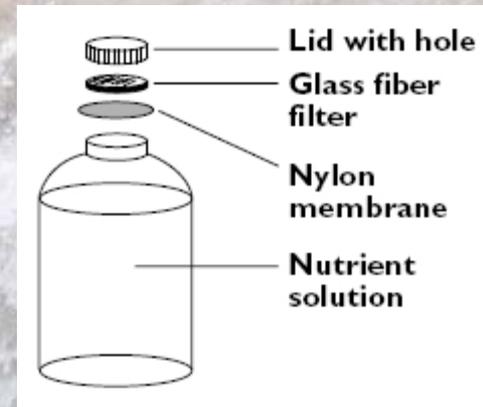
- Small streams of the Edwards Plateau are naturally oligotrophic
- Nutrient enrichment results in
 - Increased algal abundance
 - Altered dissolved oxygen conditions
 - Altered benthic macroinvertebrate and fish communities
- Low levels of nutrient enrichment increase species diversity in these oligotrophic streams.
 - Biological metrics may indicate improved conditions.
- However, there also appears to be a threshold where higher levels of nutrient enrichment start to have a negative effect.

(From: Mabe, 2007)

COA Algae Studies

Objectively determine:

- Impact of increases in limiting nutrient and the threshold for nuisance algae



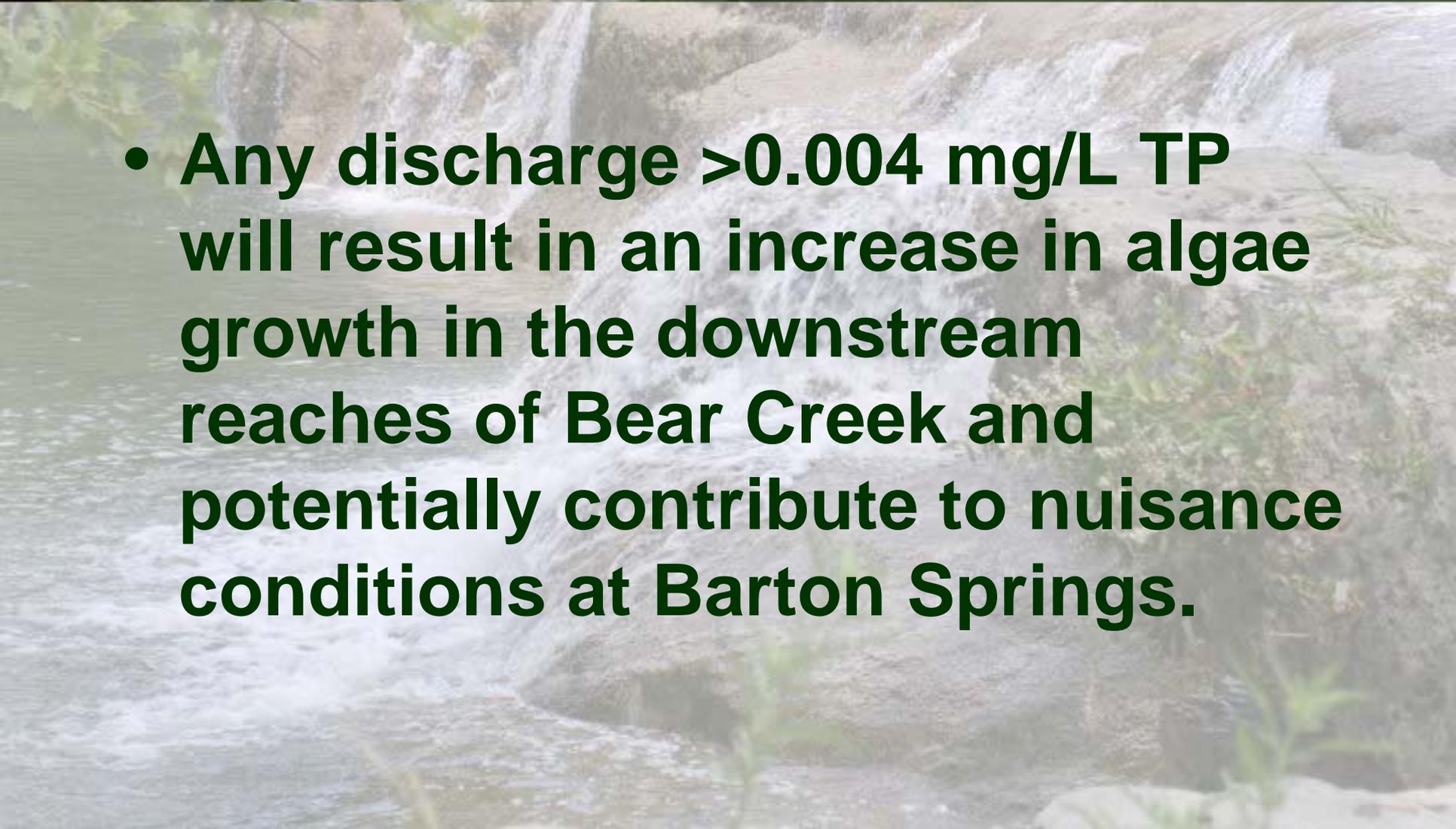
The background of the slide is a composite image. The top portion shows a river flowing through a lush, green forest. Two people are visible swimming in the water. The bottom portion of the slide features a close-up of a waterfall cascading over large, light-colored rocks. The overall scene is bright and natural.

Algae Study Conclusions

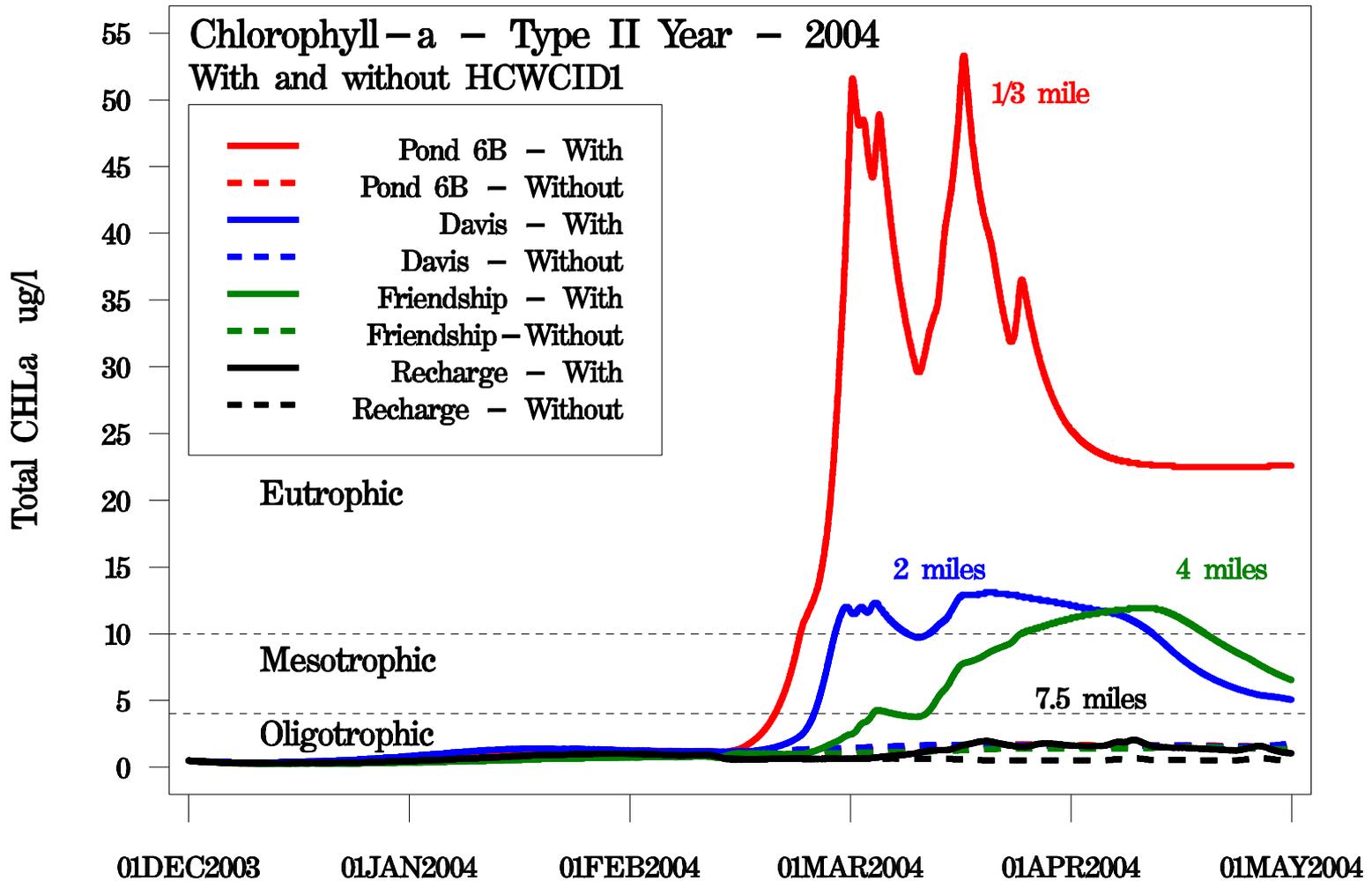
- **Bear Cr. currently oligotrophic @ < 10% of nutrient saturated growth**
- **Any combined increase of nitrogen and phosphorus concentrations in Bear Creek will increase productivity.**
- **Any discharge could alter the trophic status and algal community structure of Bear Cr.**



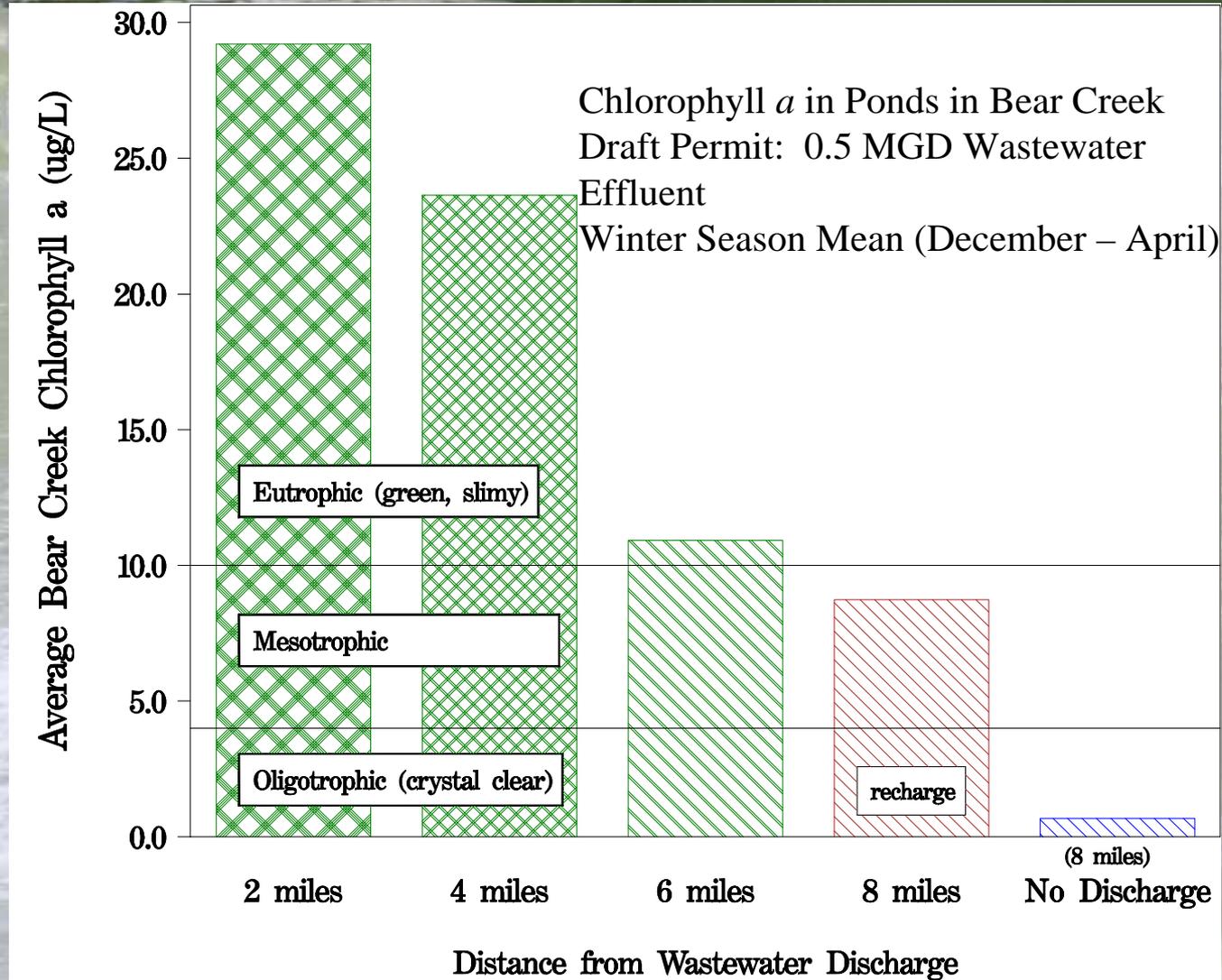
Algae Study Conclusions

- **Any discharge >0.004 mg/L TP will result in an increase in algae growth in the downstream reaches of Bear Creek and potentially contribute to nuisance conditions at Barton Springs.**
- 

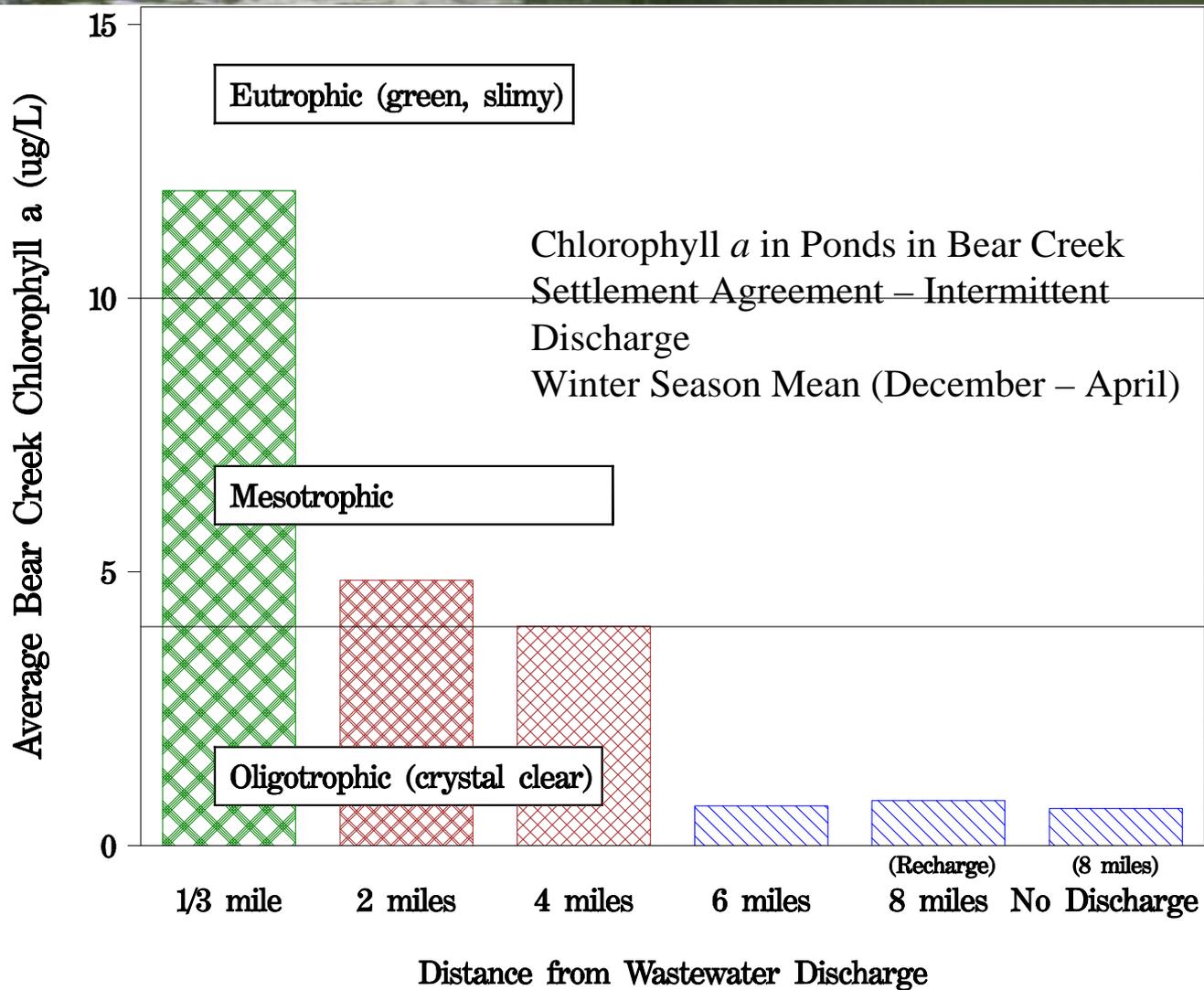
Modeled Impact on Creek Impoundments - WASP



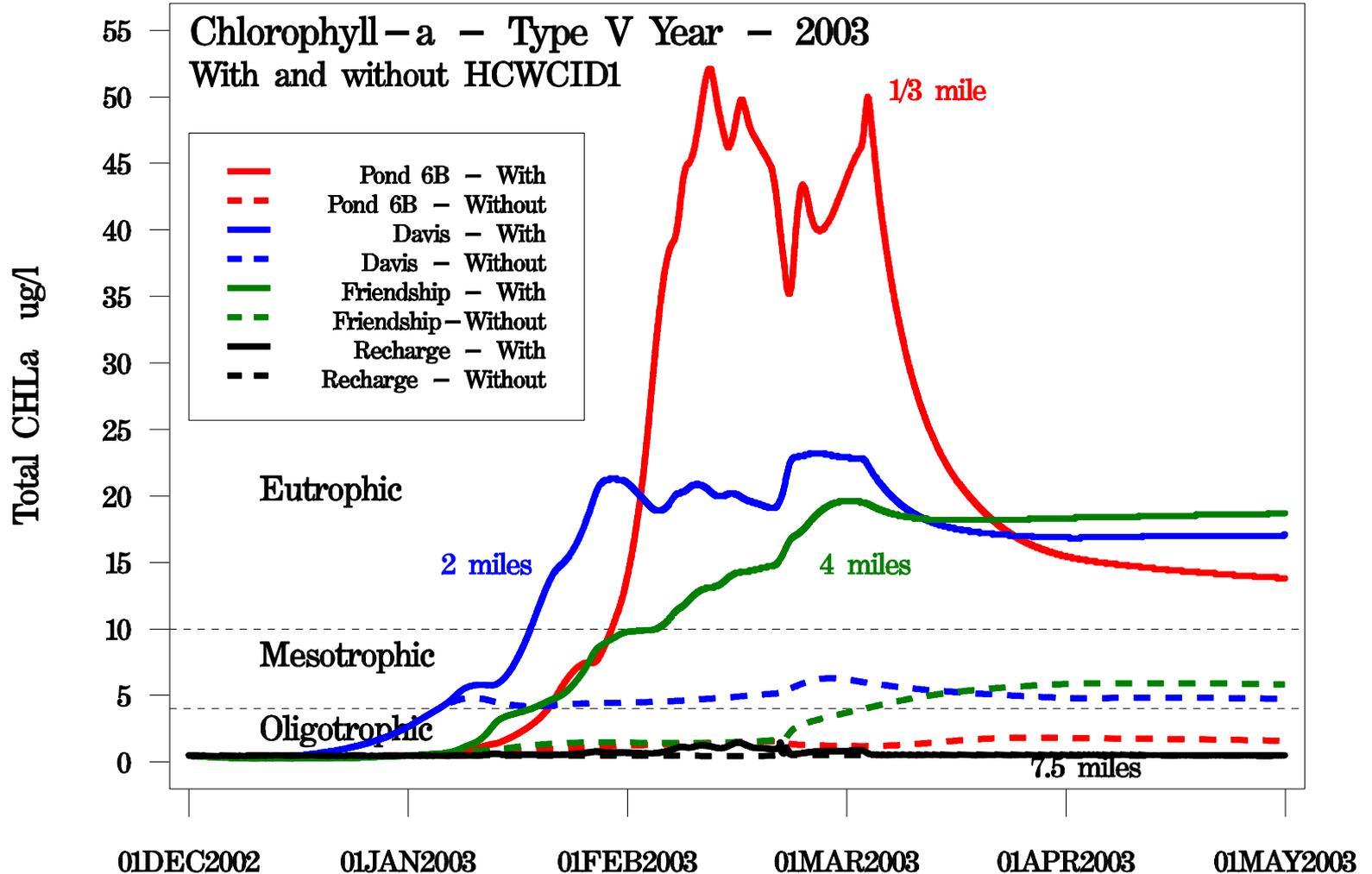
Continuous Discharge



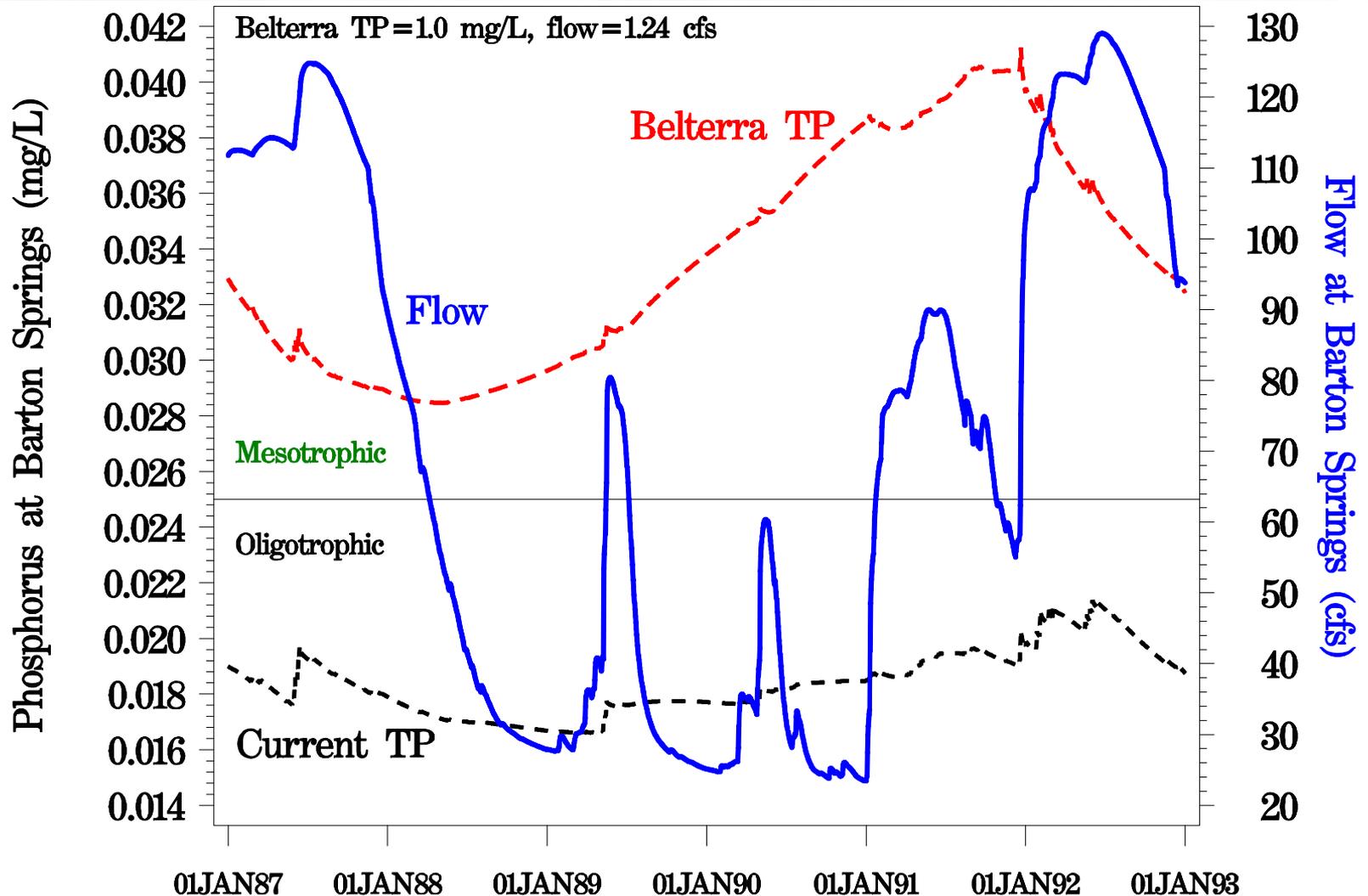
Intermittent Discharge



Worst Case Wet Year Intermittent Discharge



Impact on Barton Springs – UT Model

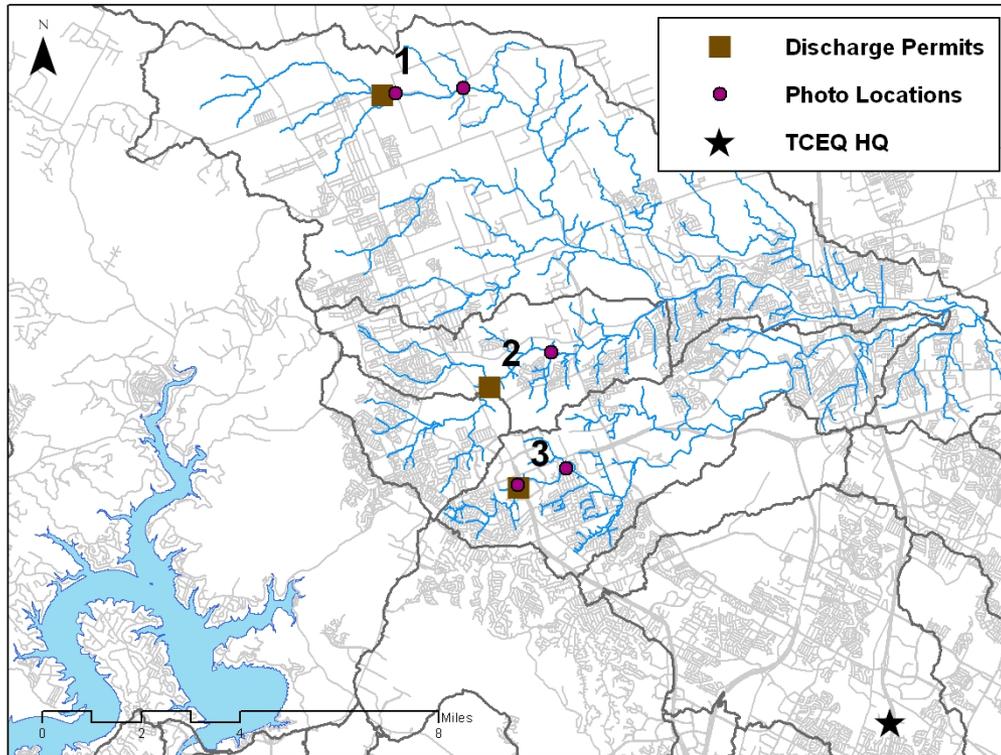




Barton Springs Impacts

- **Little attenuation through aquifer**
- **Rapid transport to springs**
- **Algae growth in BS Pool**
- **Recreational uses impaired**
- **Dissolved oxygen reduction from decaying detritus (algae bodies)**
- **Endangered species impacted – Barton Springs Salamander**
- **Modeled reduction in DO**
- **>LC₅ – UT toxicity studies (Brooks)(Poteet and Woods).**

Wastewater- Influenced Streams



1 Leander (0092151)

- 2.5 MGD
- NH₃ = 2 mg/L, TP = 1 mg/L

2 Cedar Park (0085740)

- 2.25 MGD
- NH₃ = 2 mg/L, TP = 1 mg/L

3 Anderson Mill (0034207)

- 1.3 MGD
- NH₃ = 3 mg/L, TP = n/a

Wastewater-Influenced Streams

Brushy Creek below Leander WWTP

0.3 miles
downstream
(8,736 acre)



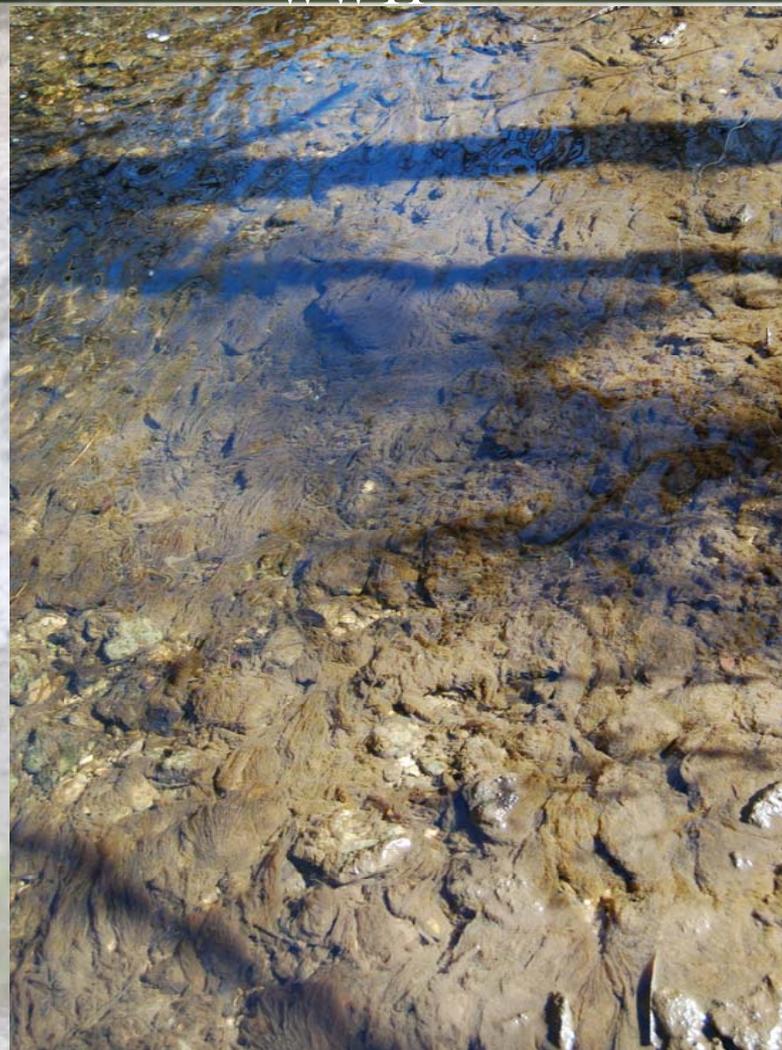
1.8 miles
downstream
(10,301
acre)



Wastewater-Influenced Streams

South Brushy Creek below Cedar Park
WWTP

1.6 miles
downstream
(8,224 acre)



Wastewater-Influenced Streams

Lake Creek below Anderson Mill WWTP

300 feet
downstream
(981 acre)



1.4 miles
downstream
(2,070 acre)



Oligotrophic Hill Country Streams

Bear Creek

Near Bear Creek Pass,
background TP = 0.015 mg/L
(6,905 acre)



Oligotrophic Hill Country Streams

Onion Creek

Near Pfulman Ranch,
background TP = 0.019 mg/L
(8,688 acre)



Oligotrophic Hill Country Streams

Barton Creek

Near Stark Ranch,
background TP = 0.024 mg/L
(4,102 acre)

