

Peace River Cumulative Impact Study



**Long-Term Changes &
Patterns in
Water Quality**

Previous Studies of Long-term Changes in Watershed Water Quality

- **USGS (Stoker & McPherson) – 1980s**
- **Coastal Environmental (District)– 1994**
- **PBS&J (CHNEP) – 1999**
- **Janicki Environmental (CHNEP) – 2003**
- **DEP TMDLs (ongoing)**
- **Summary HBMP Studies**
 - Lower Peace River 1976-2004
 - Shell Creek 1991-2004



Primary Data Sources

- **DEP STORET** (Impaired Waters Database)
- **USGS Ambient Surface Water Monitoring Network**
- **District Watershed Monitoring Programs**
- **Peace River HBMP**
- **Shell Creek HBMP**



Peace at Bartow

- Peace Creek Drainage Canal Near Alturas
- Peace Creek Drainage Canal Near Wahneta
- Lulu Lake Outlet at Eloise
- Lake Parker Outlet At Lakeland
- Saddle Creek at Structure P-11 near Bartow
- Peace River at Bartow

Peace at Zolfo

- Peace River near Homeland
- Peace River at Fort Meade
- Bowlegs Creek near Fort Meade
- Whidden Creek near Fort Meade
- Hog Branch near Wauchula
- Peace River at Zolfo Springs

Payne Creek

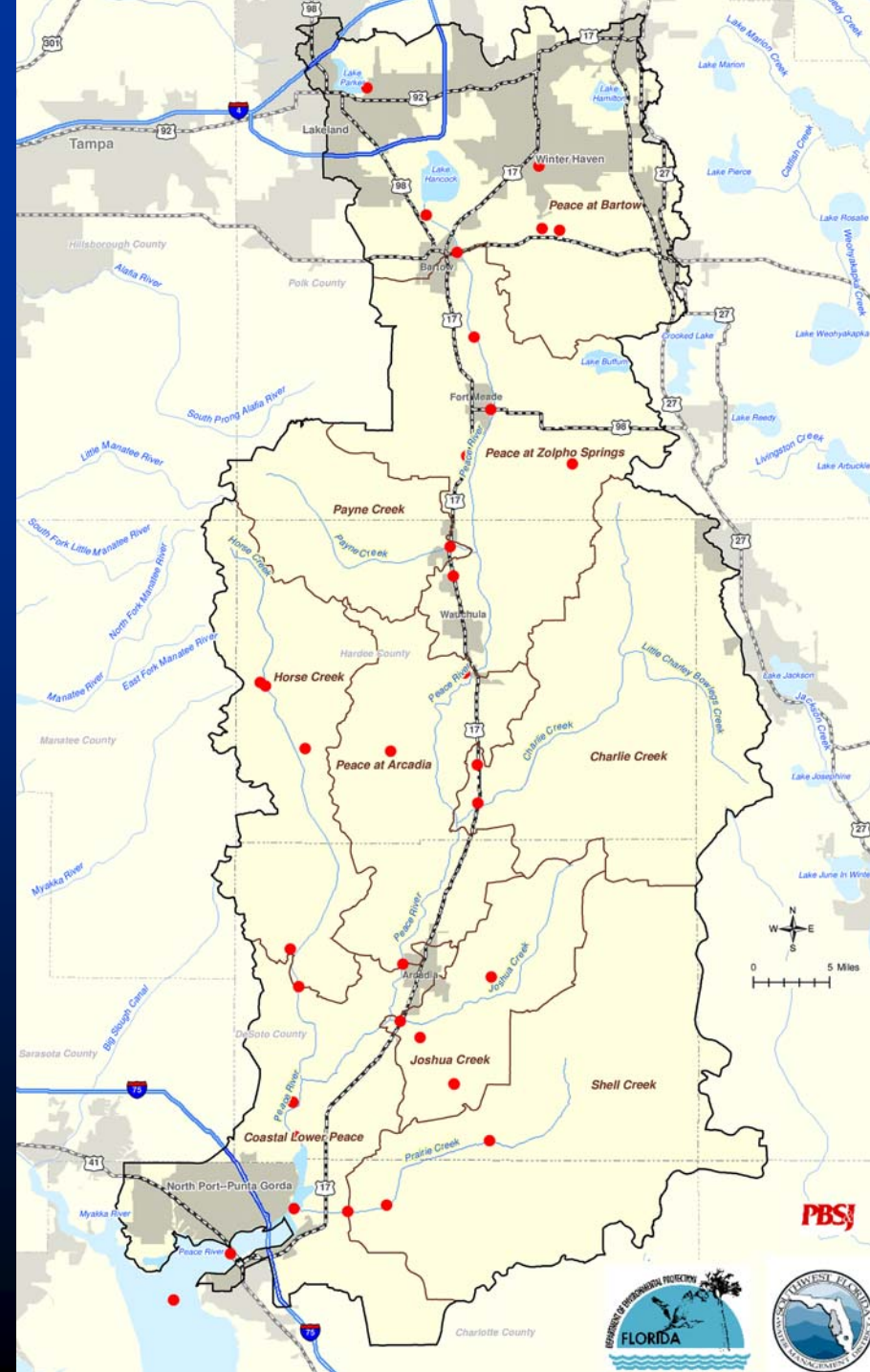
- Payne Creek near Bowling Green

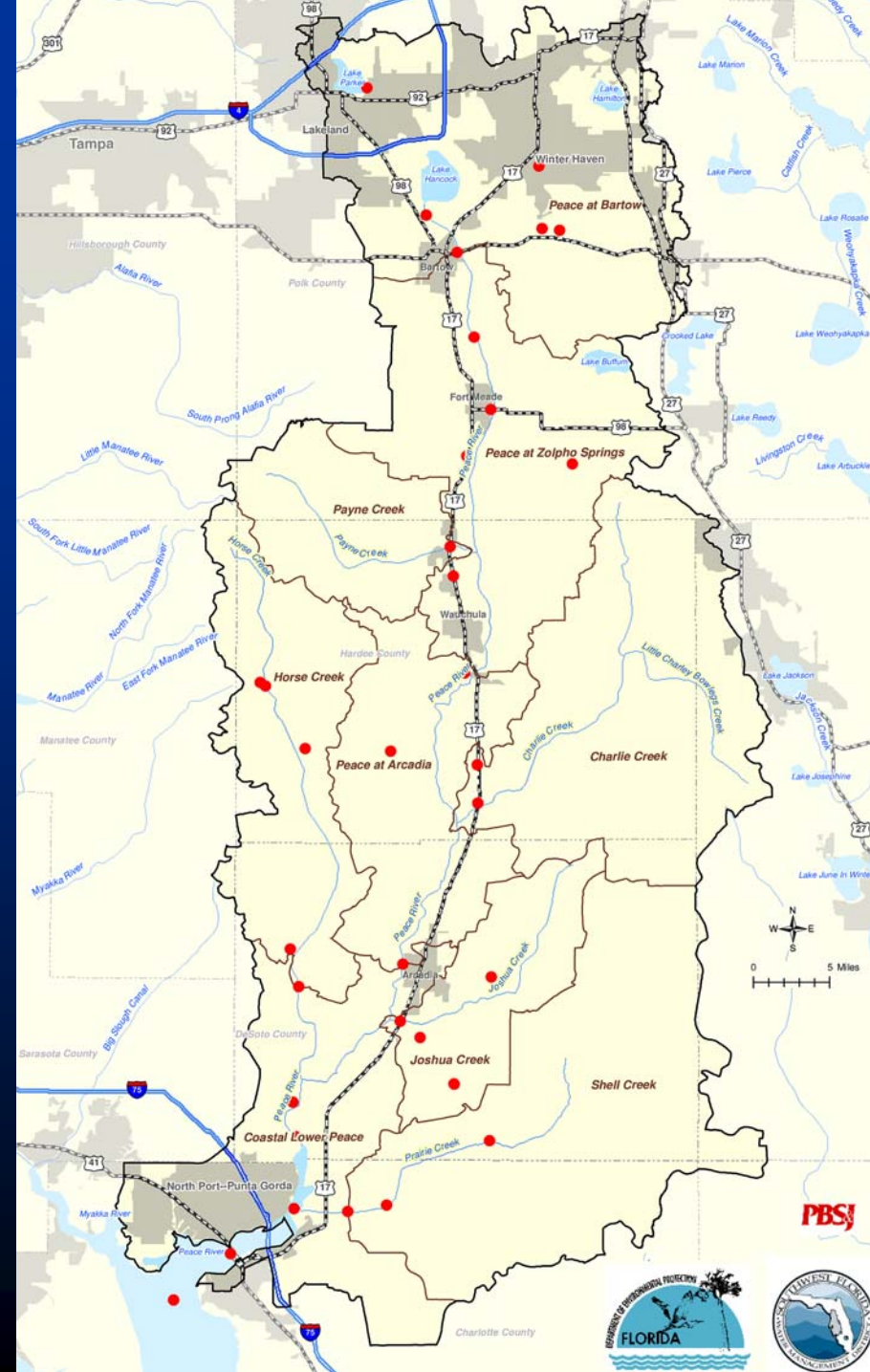
Charlie Creek

- Oak Creek near Gardner
- Charlie Creek near Gardner

Peace River at Arcadia

- Oak Creek near Ona
- Peace River at Arcadia





Joshua Creek

- Tributary To Joshua Creek at SR 70
- Hawthorne Creek at 760a
- Prairie River Grove - Hog Bay Slough
- Joshua Creek at Nocatee

Horse Creek

- West Fork Horse Creek near Myakka Head
- Horse Creek near Myakka Head
- Brushy Creek near Lilly
- Buzzard Roost Branch near Pine Level
- Horse Creek near Arcadia

Shell Creek

- Prairie Creek near Fort Ogden
- Prairie Creek at SR 764 Punta Gorda
- Shell Creek near Punta Gorda

Coastal Lower Peace

- Peace River near Water Treatment Facility
- Peace River near Lettuce Lake
- Peace River near Harbour Heights
- Peace River near US 41 Bridge
- Upper Charlotte Harbor near Marker #1

Reference Watersheds

Long-term Changes in Water Quality

- **Comparison Among Selected Representative Monitoring Sites**
(Selected Characteristic Parameters)

- **Peace River at Bartow**

Upper river - historic mining discharges

- **Peace River at Arcadia**

Lower river

- **Payne Creek near Bowling Green**

Extensive mining in the subbasin

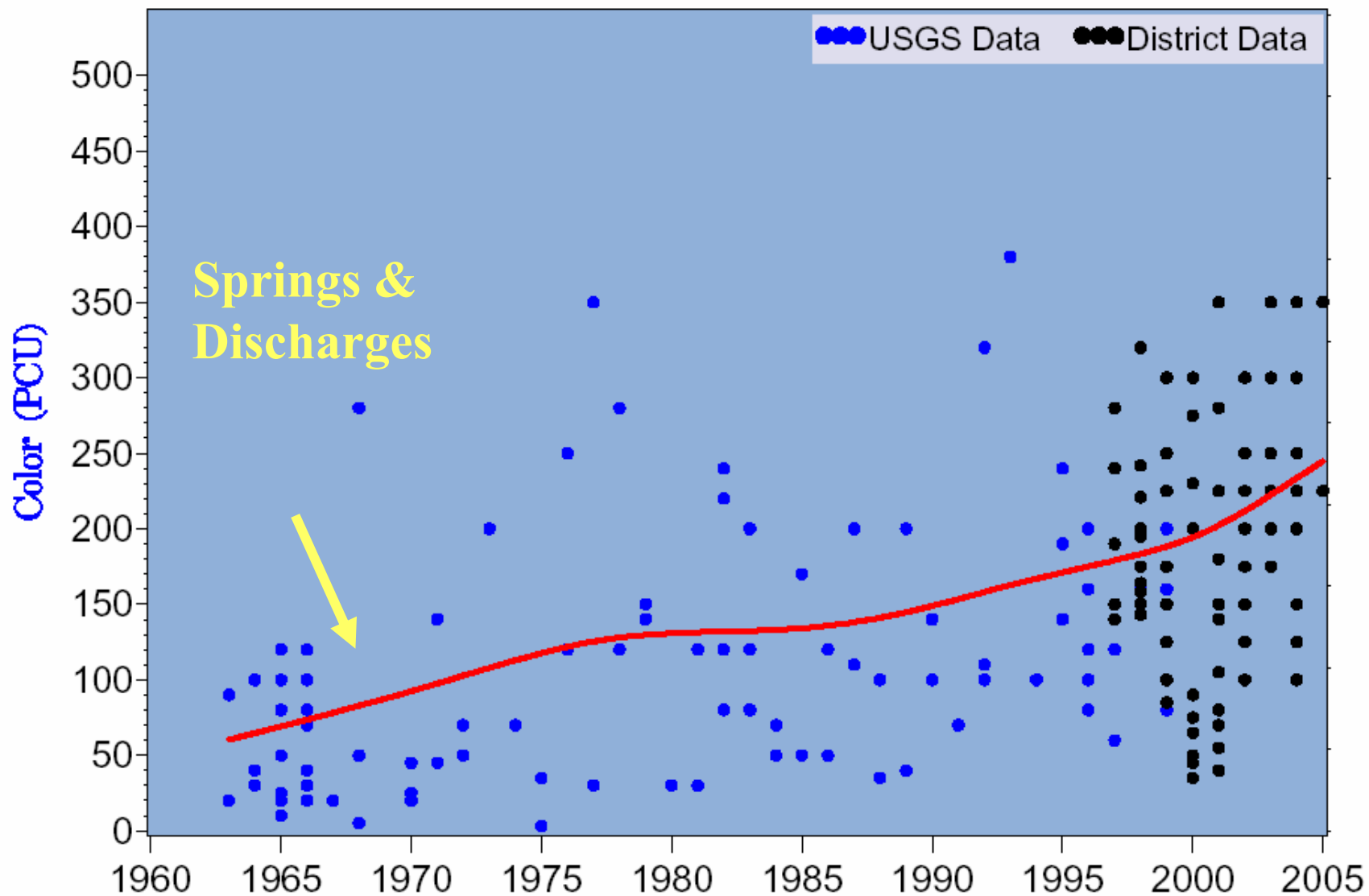
- **Joshua Creek at Nocatee**

Extensive intense agriculture



Peace River at Bartow





Water color at USGS site 2294650

Peace River at Bartow - Peace River at Bartow sub-basin

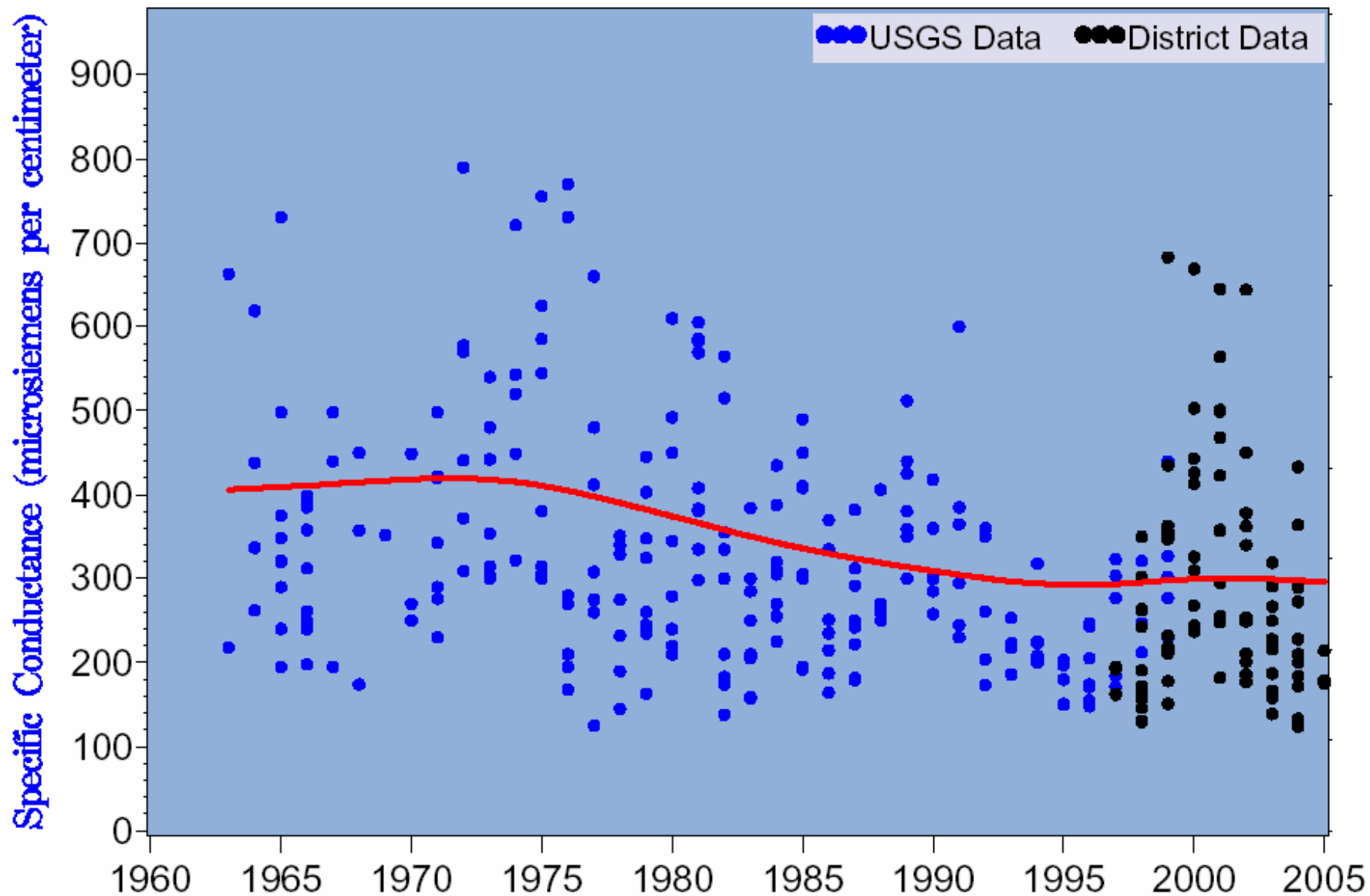
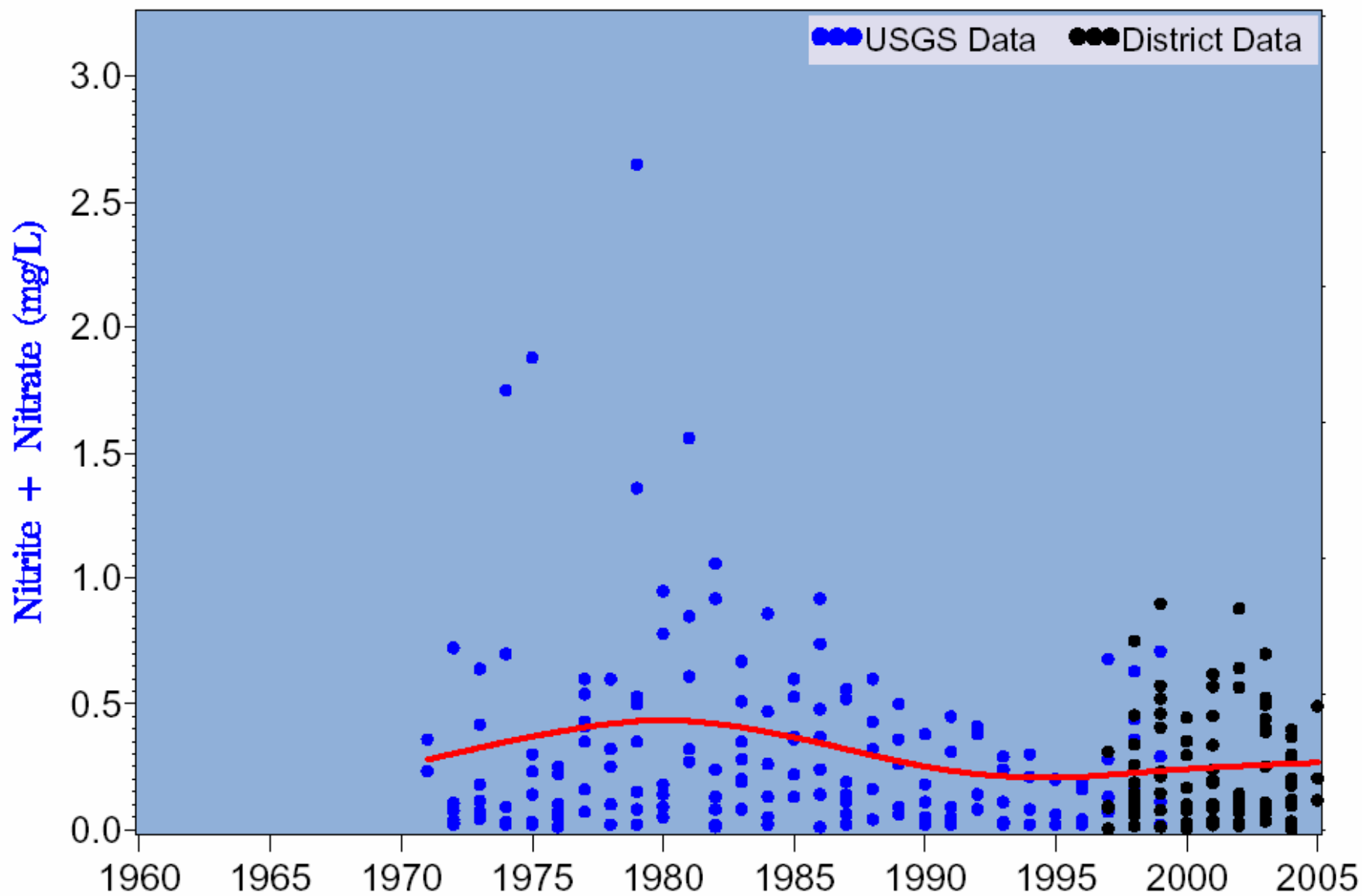
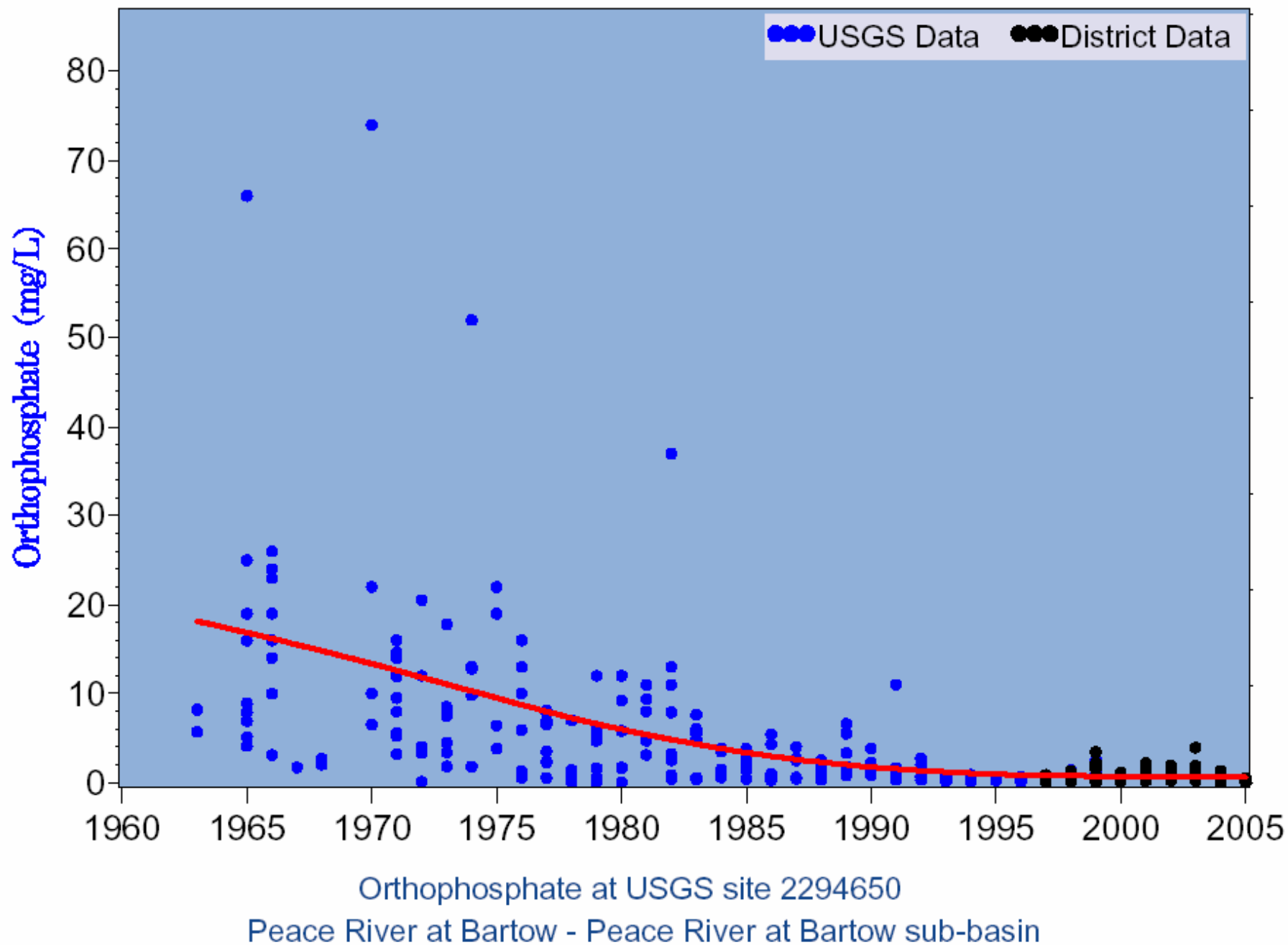
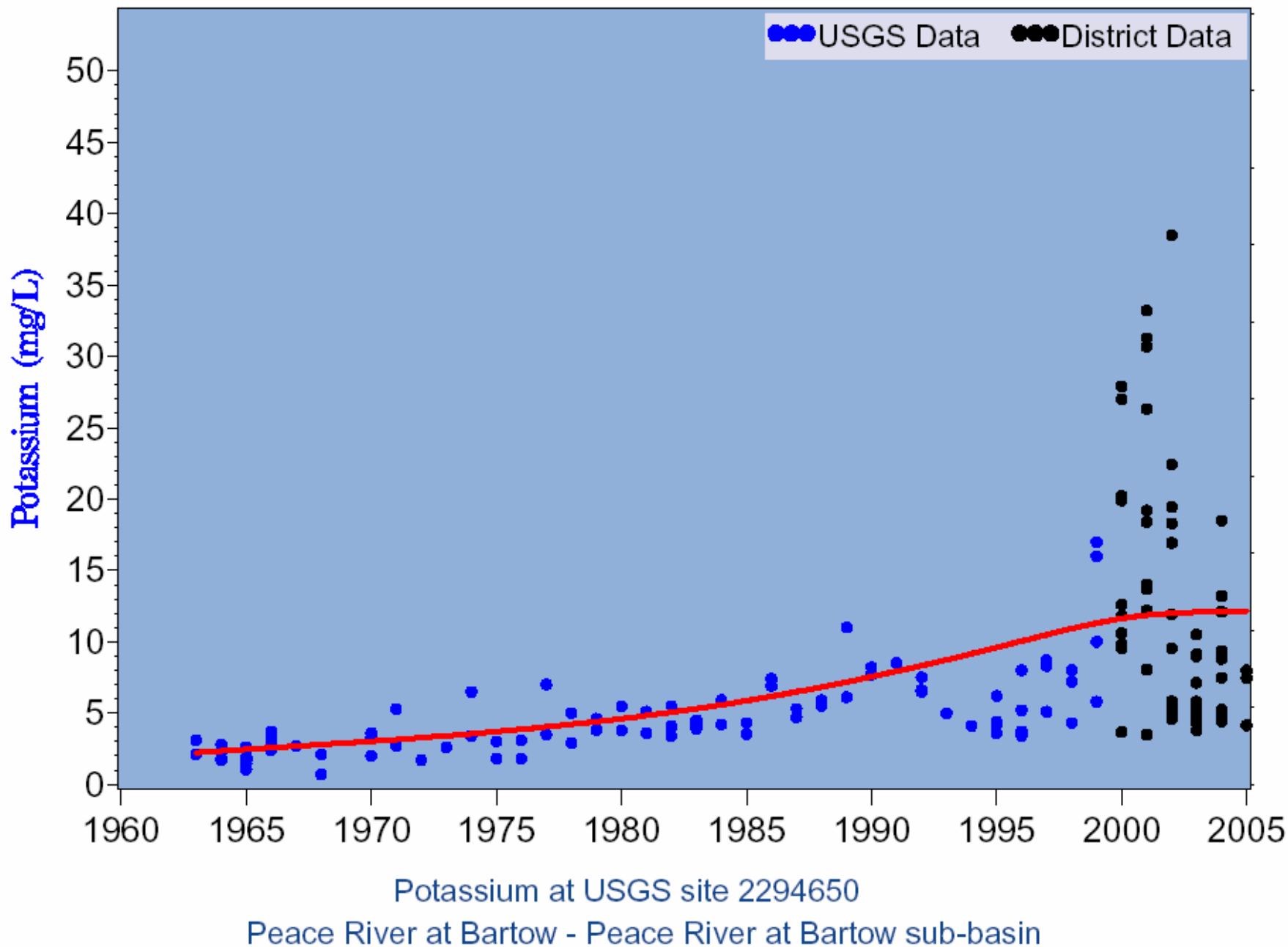


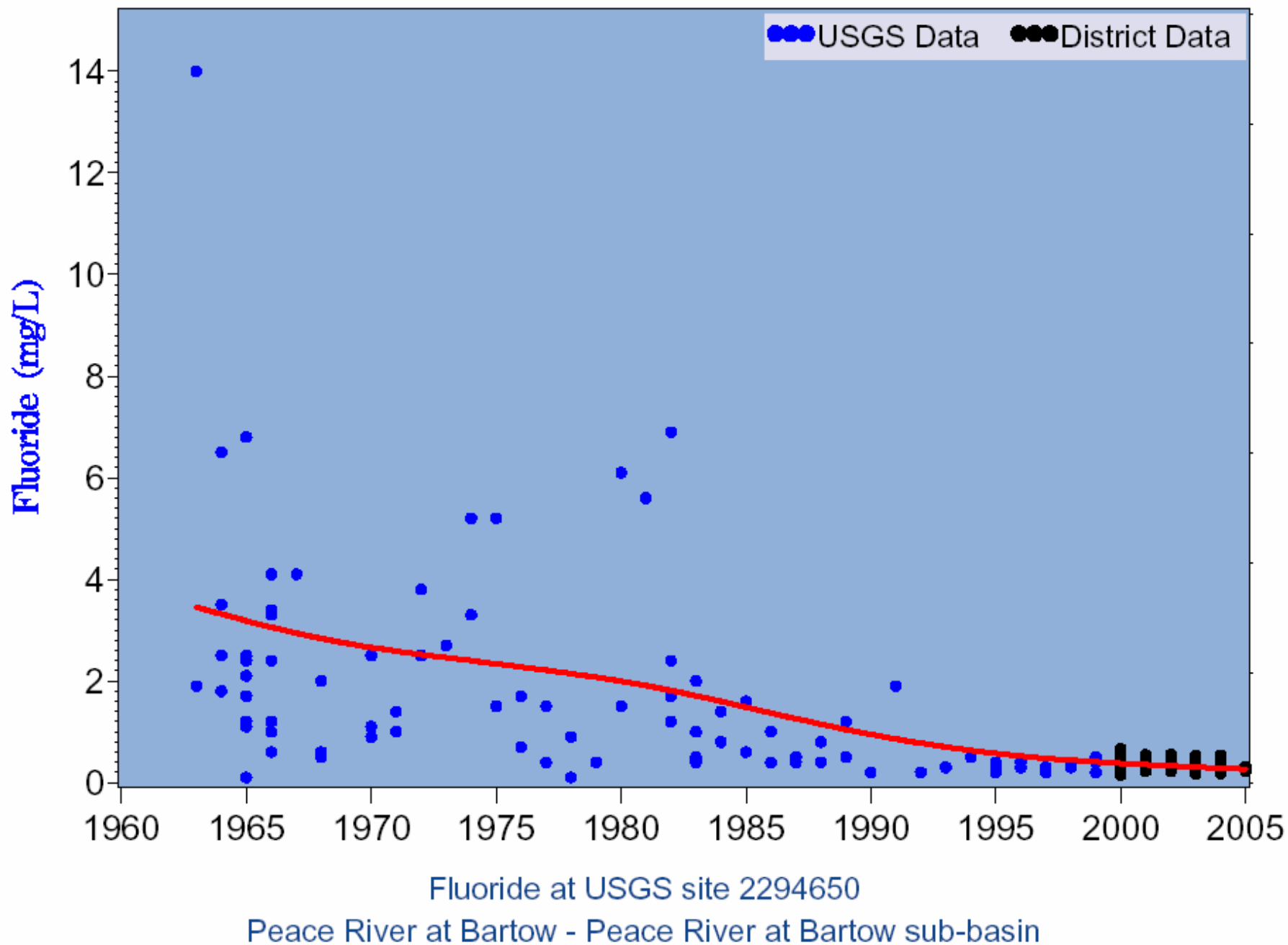
Figure E. Specific conductance USGS site 2294650
Peace River at Bartow - Peace River at Bartow sub-basin



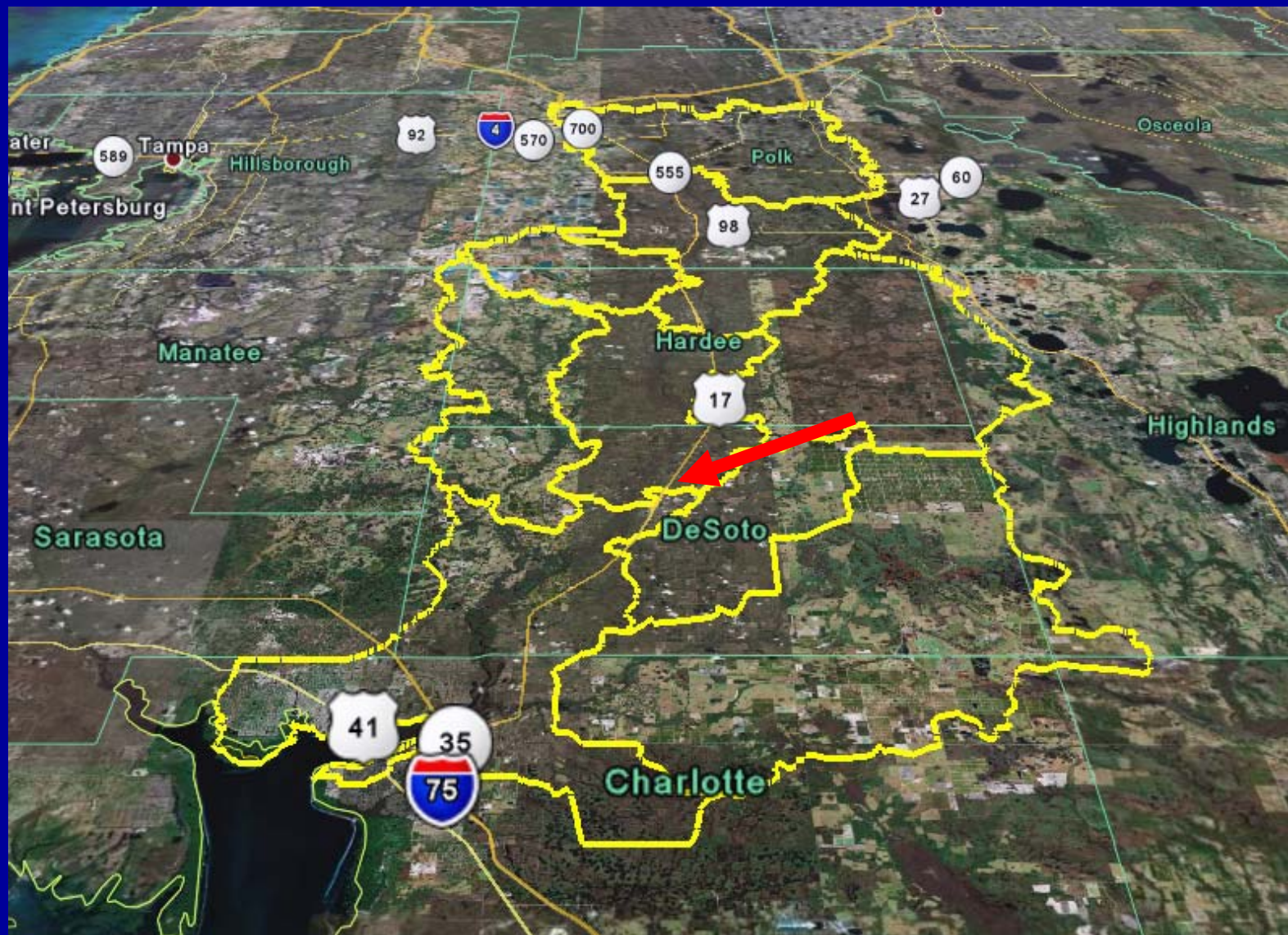
Nitrite + nitrate at USGS site 2294650
Peace River at Bartow - Peace River at Bartow sub-basin

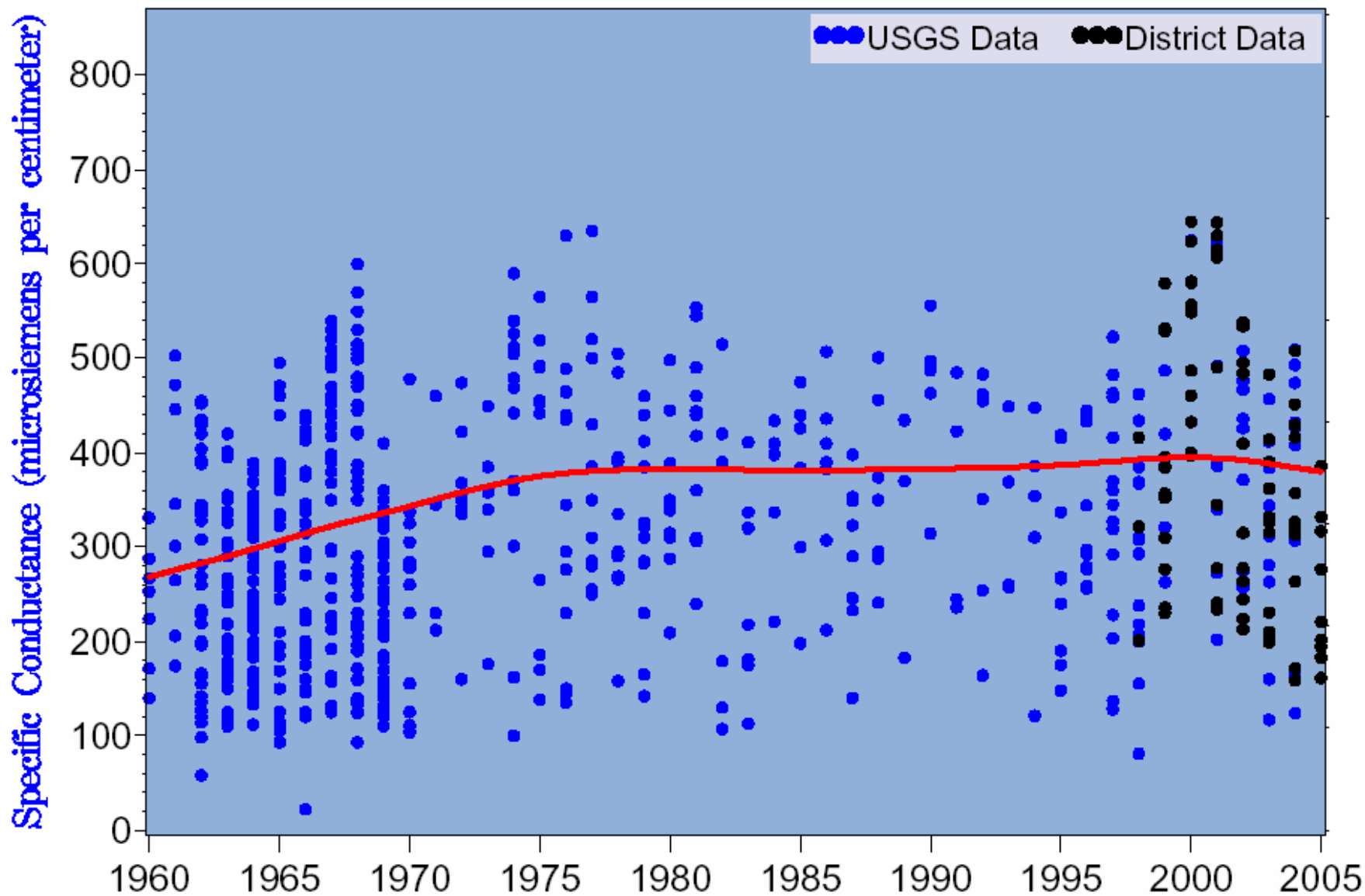




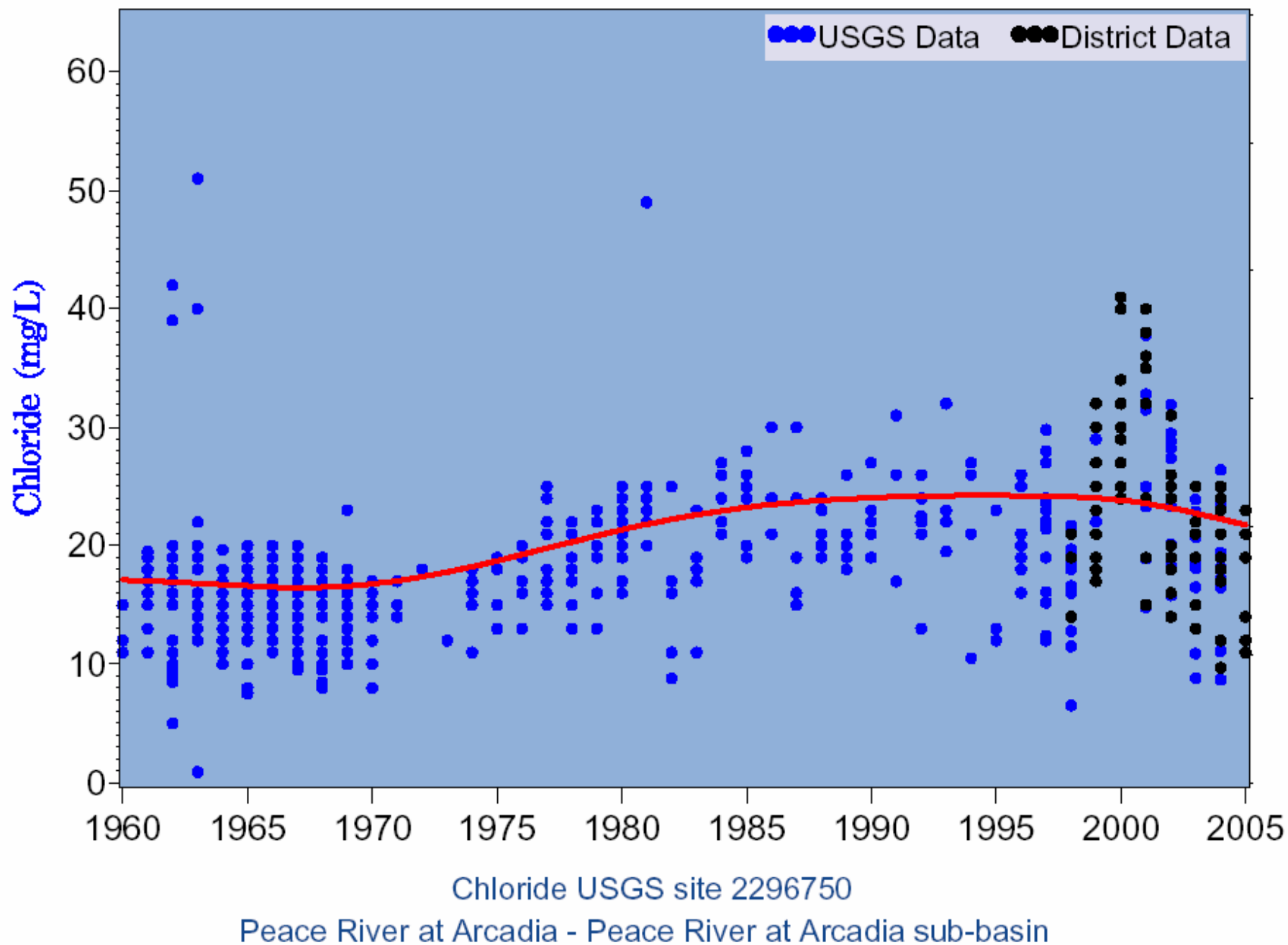


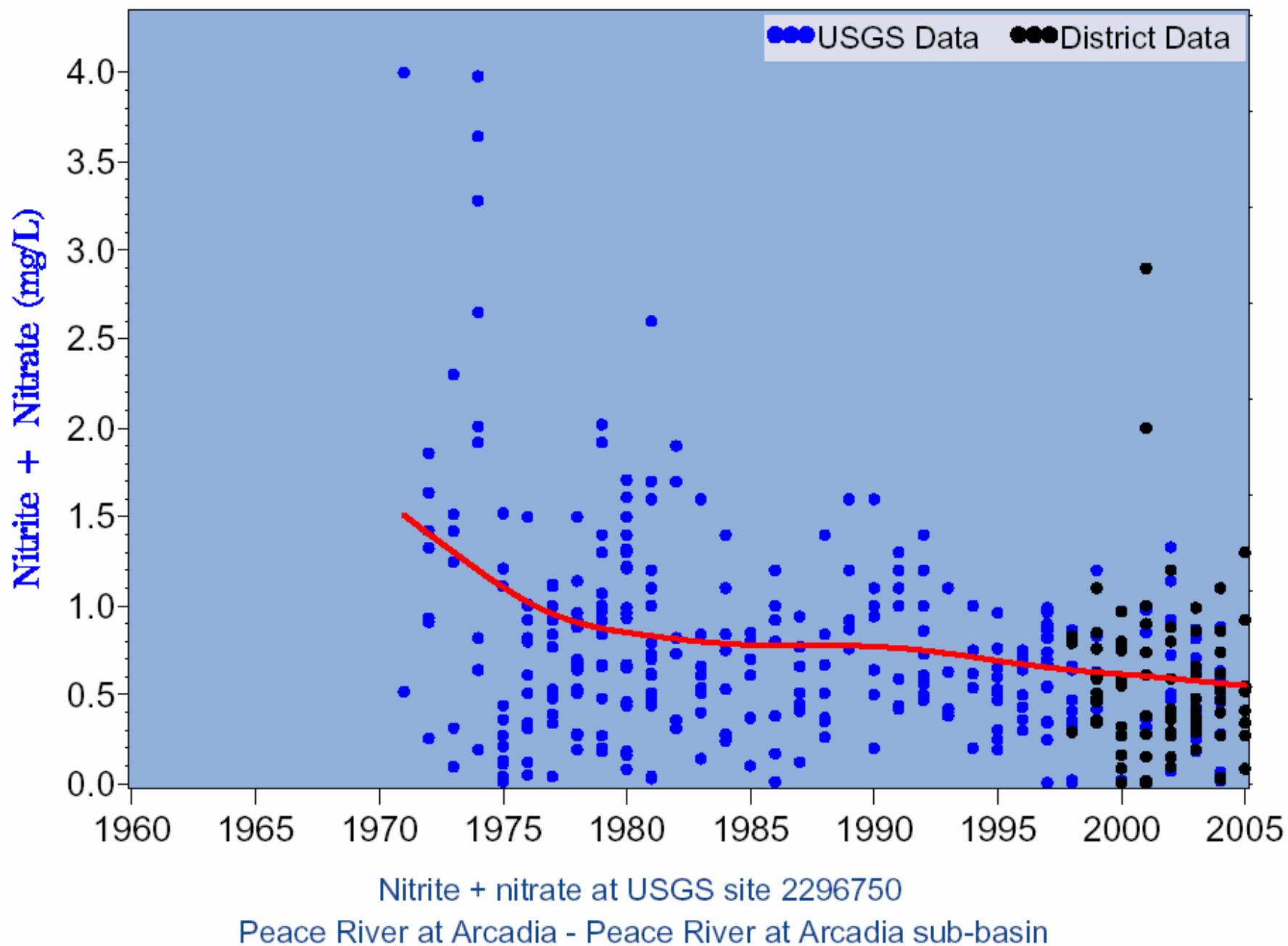
Peace River at Arcadia

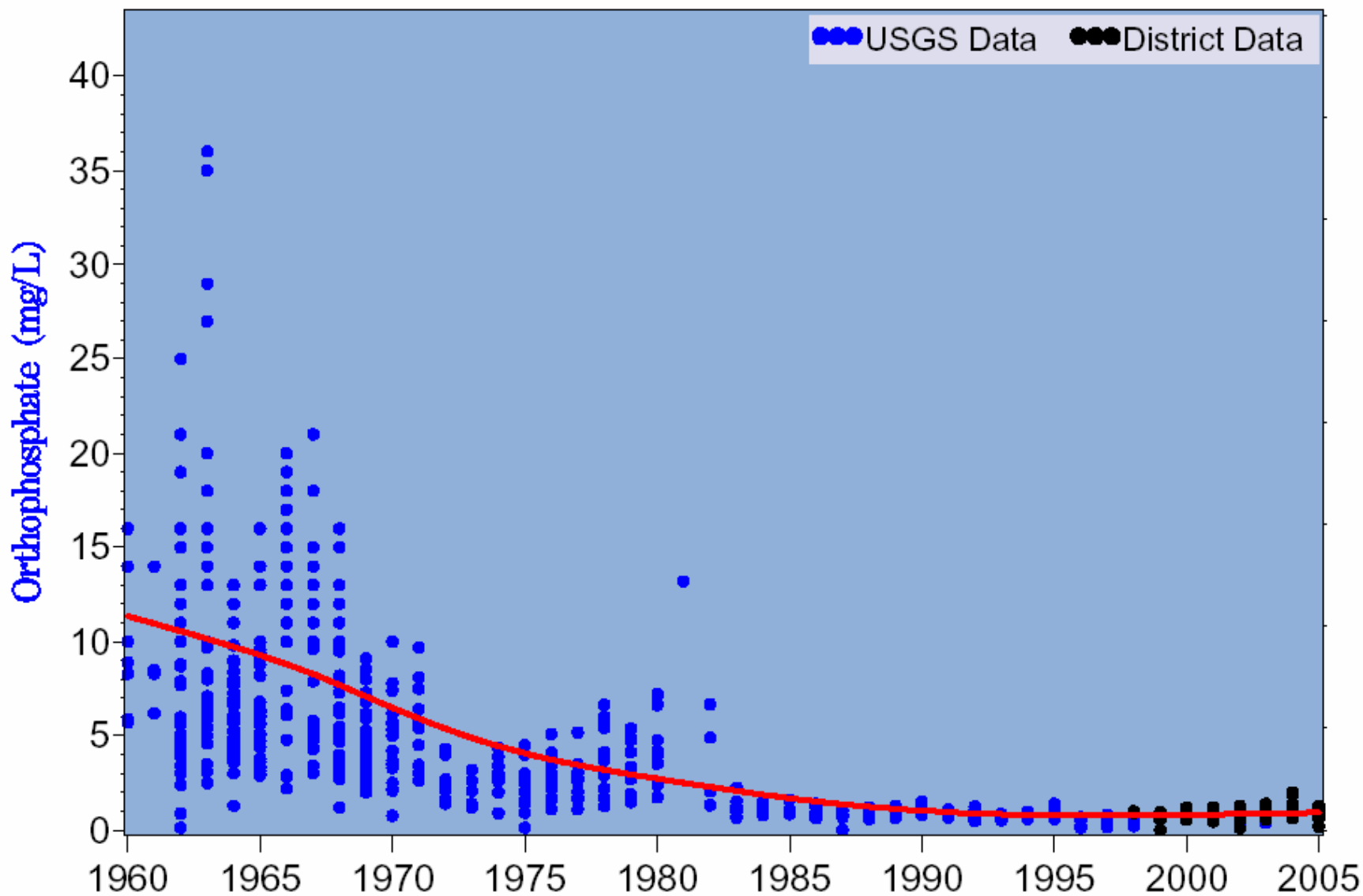




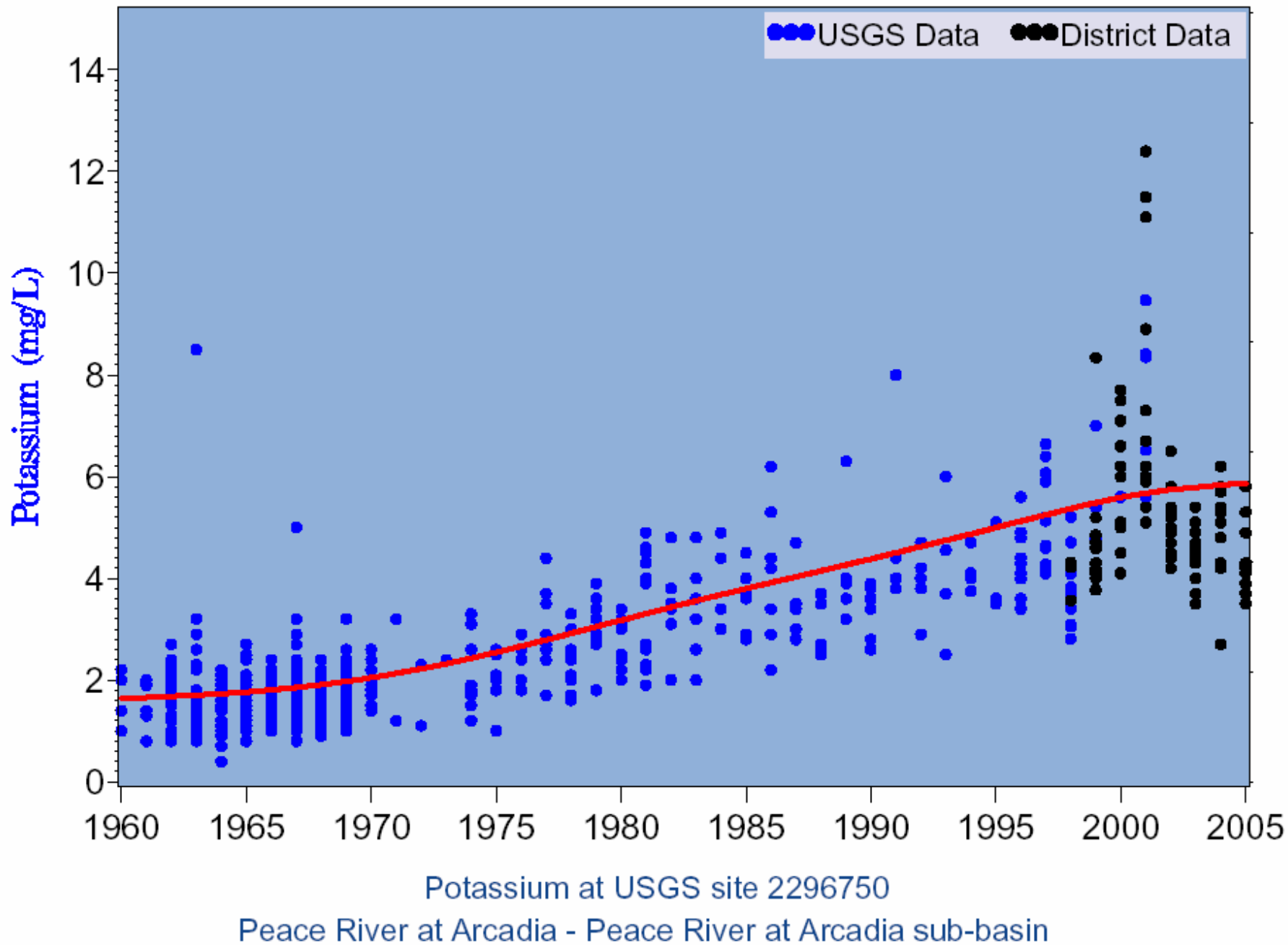
Specific conductance USGS site 2296750
Peace River at Arcadia - Peace River at Arcadia sub-basin





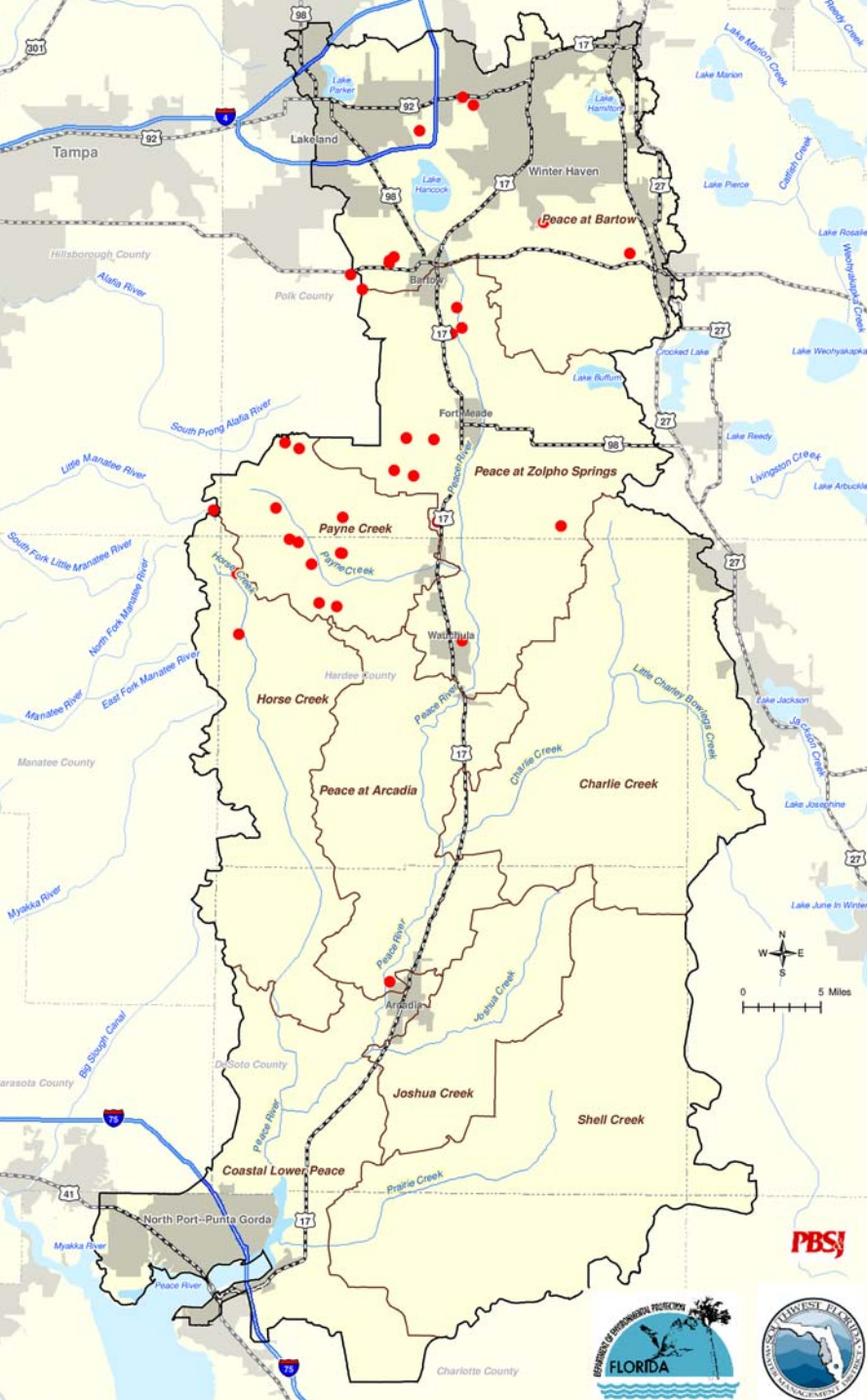


Orthophosphate at USGS site 2296750
Peace River at Arcadia - Peace River at Arcadia sub-basin



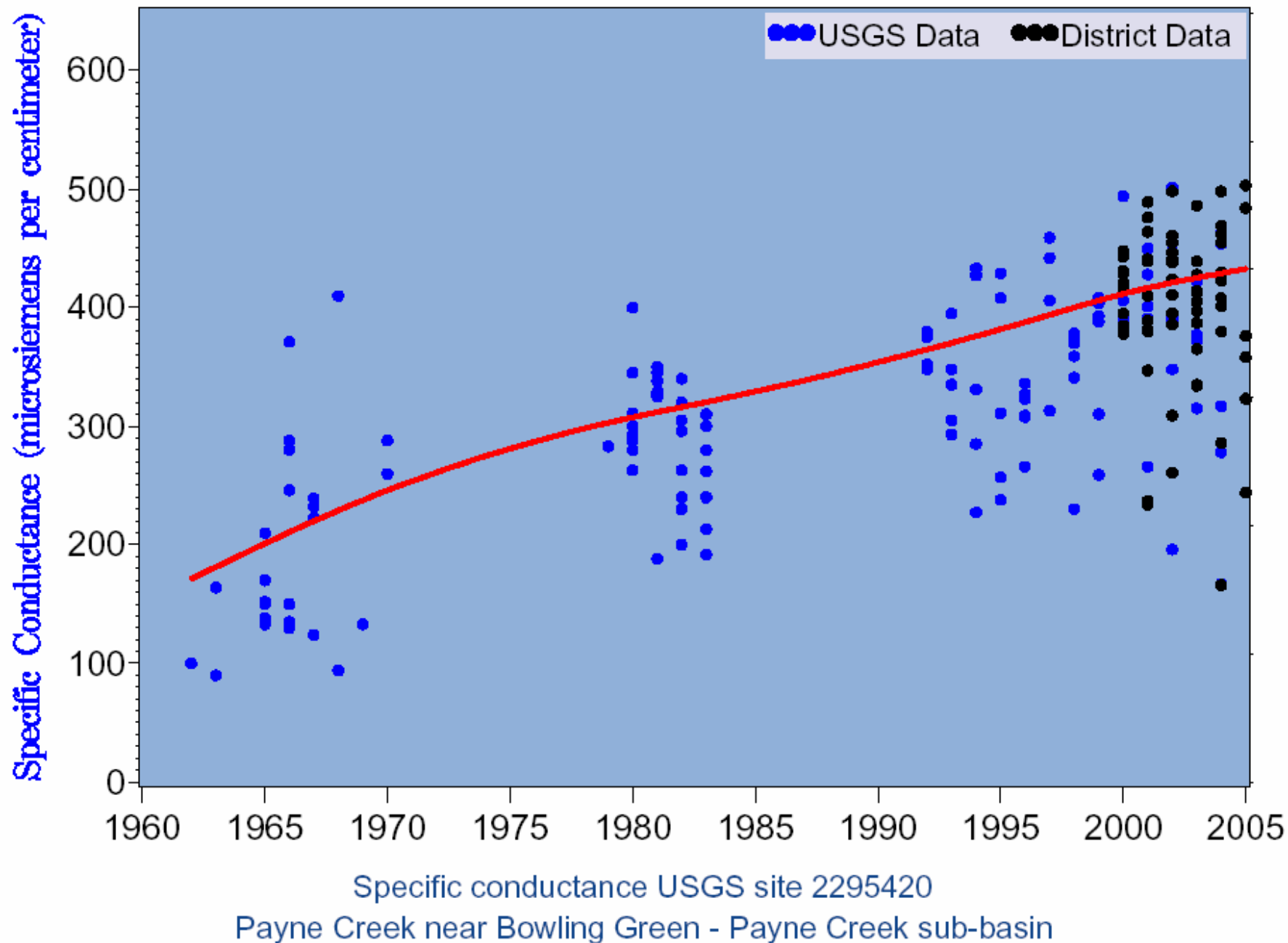
Payne Creek near Bowling Green

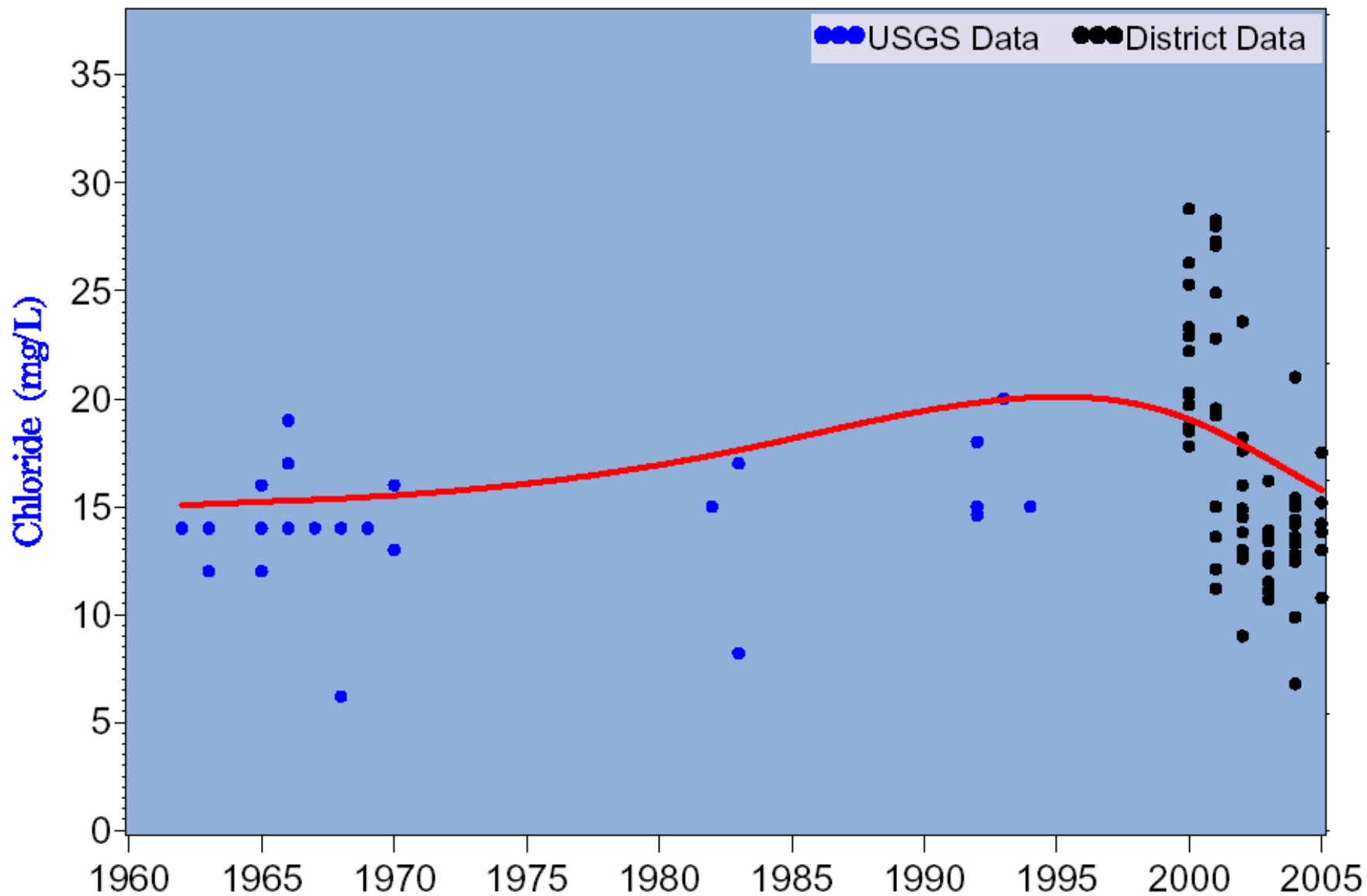




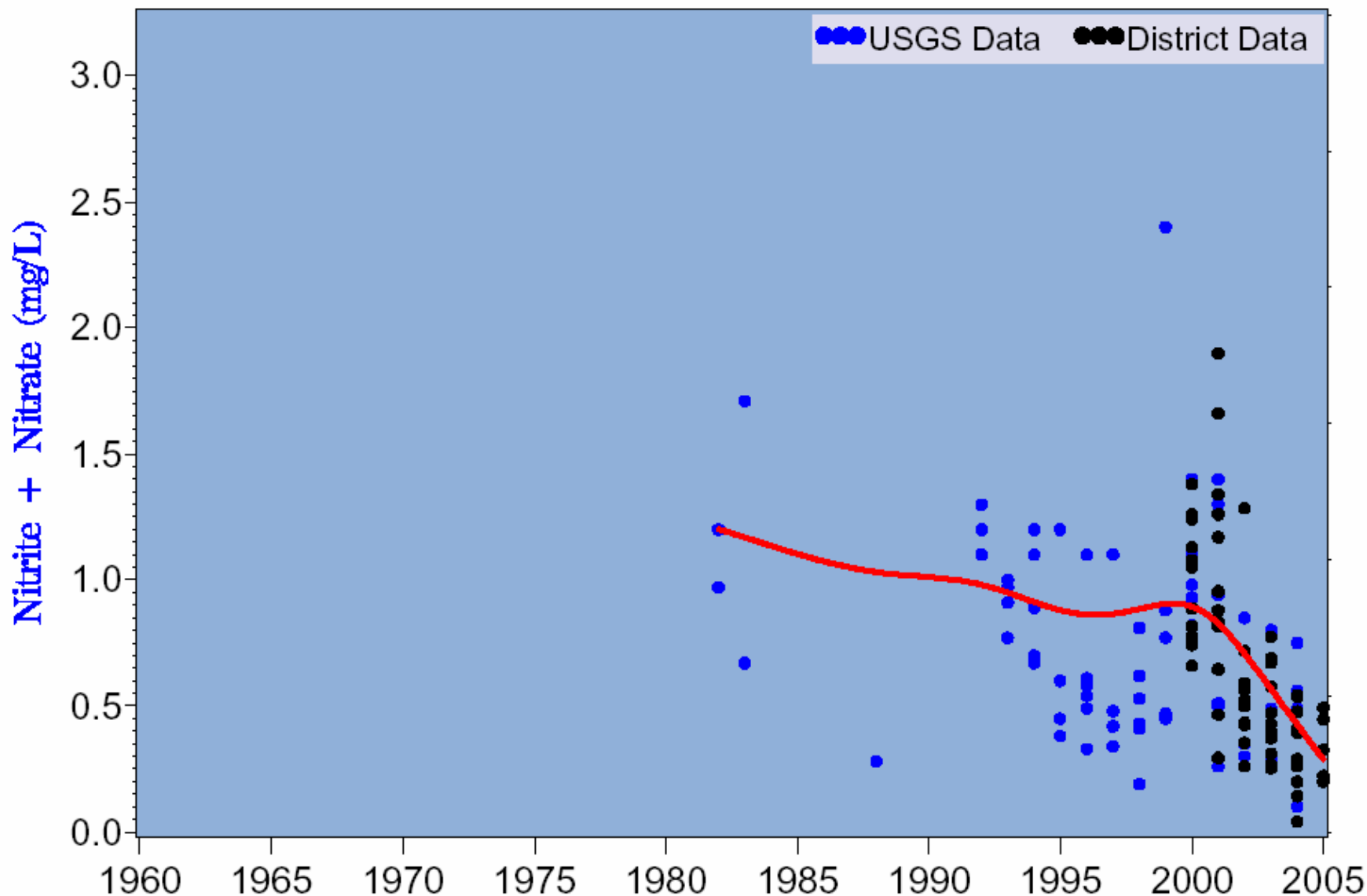
NPDES Discharge Sites

- 38 Major Active Sites
- 6 Domestic Waste Water
- 32 Industrial Discharge
- 4 of these Electrical Power Facilities

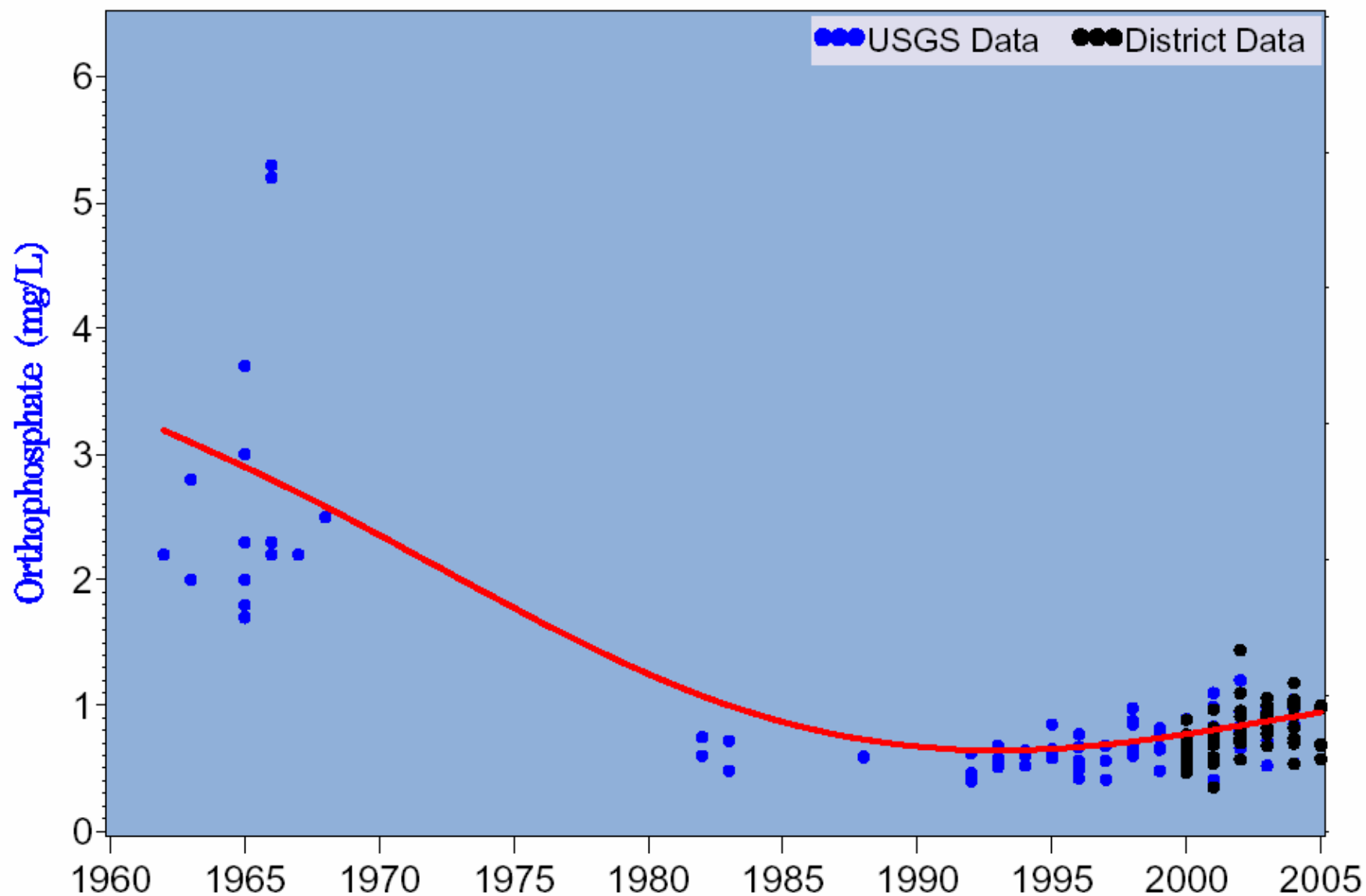




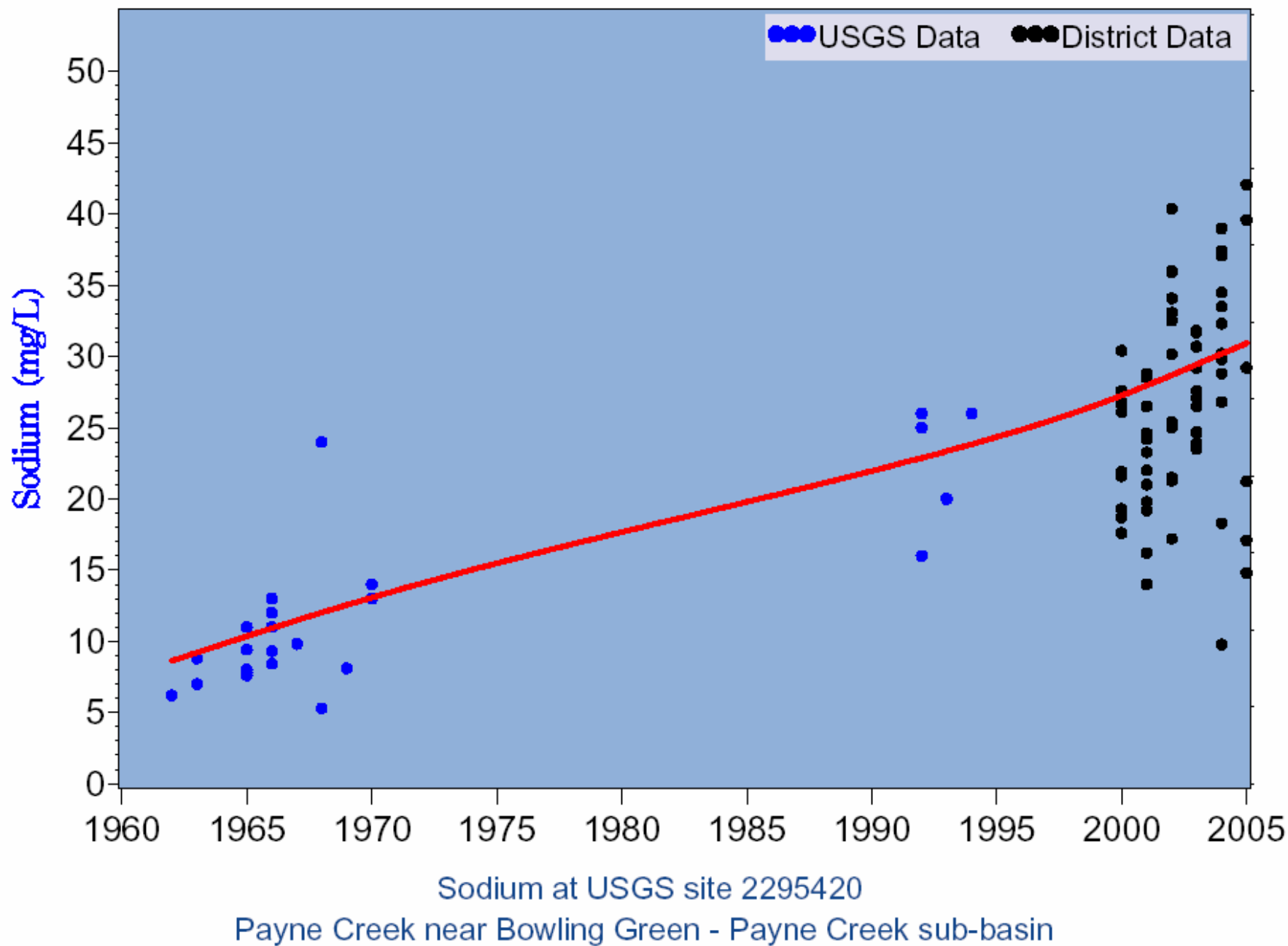
Payne Creek near Bowling Green - Payne Creek sub-basin

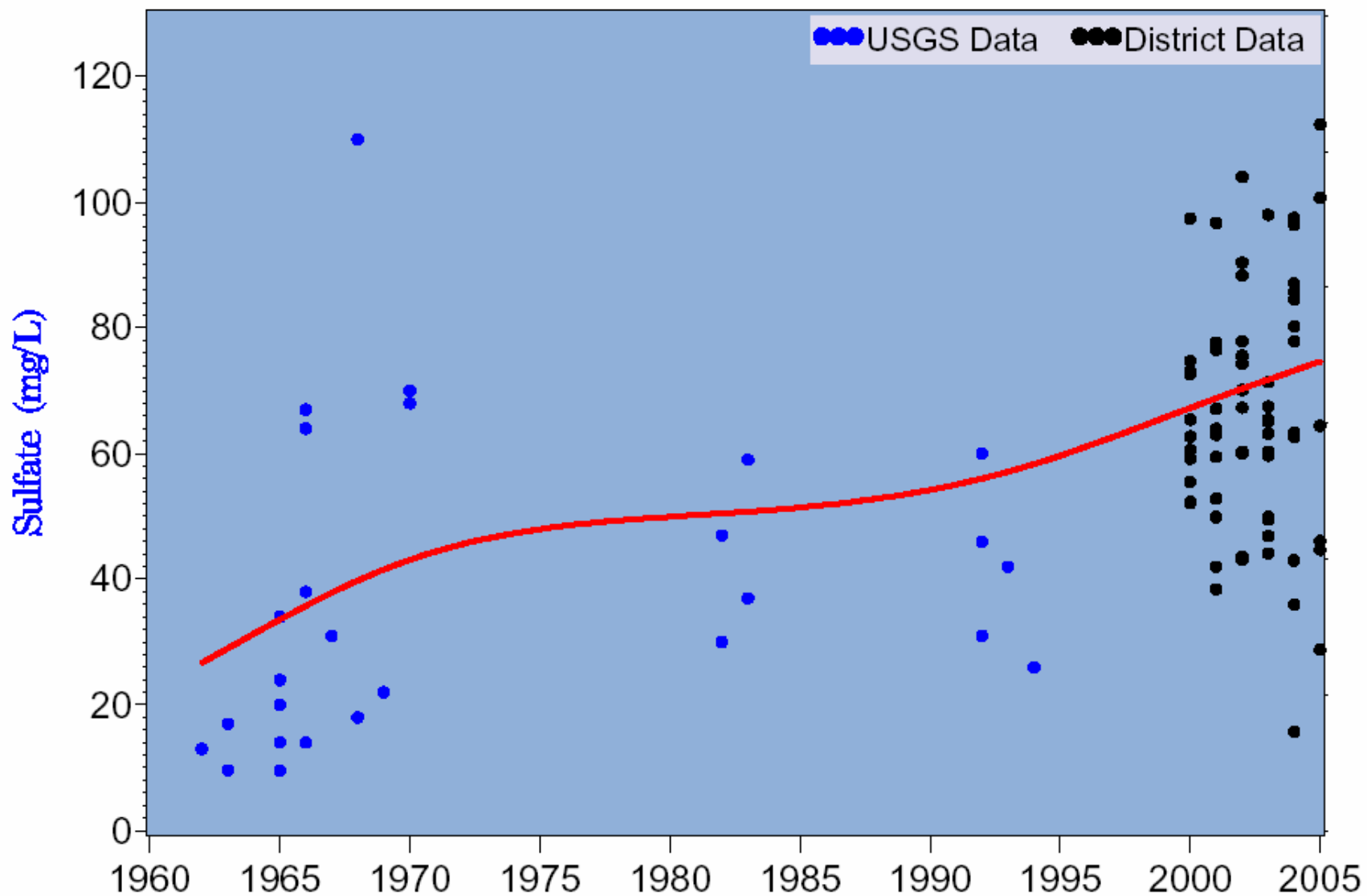


Nitrite + nitrate at USGS site 2295420
Payne Creek near Bowling Green - Payne Creek sub-basin



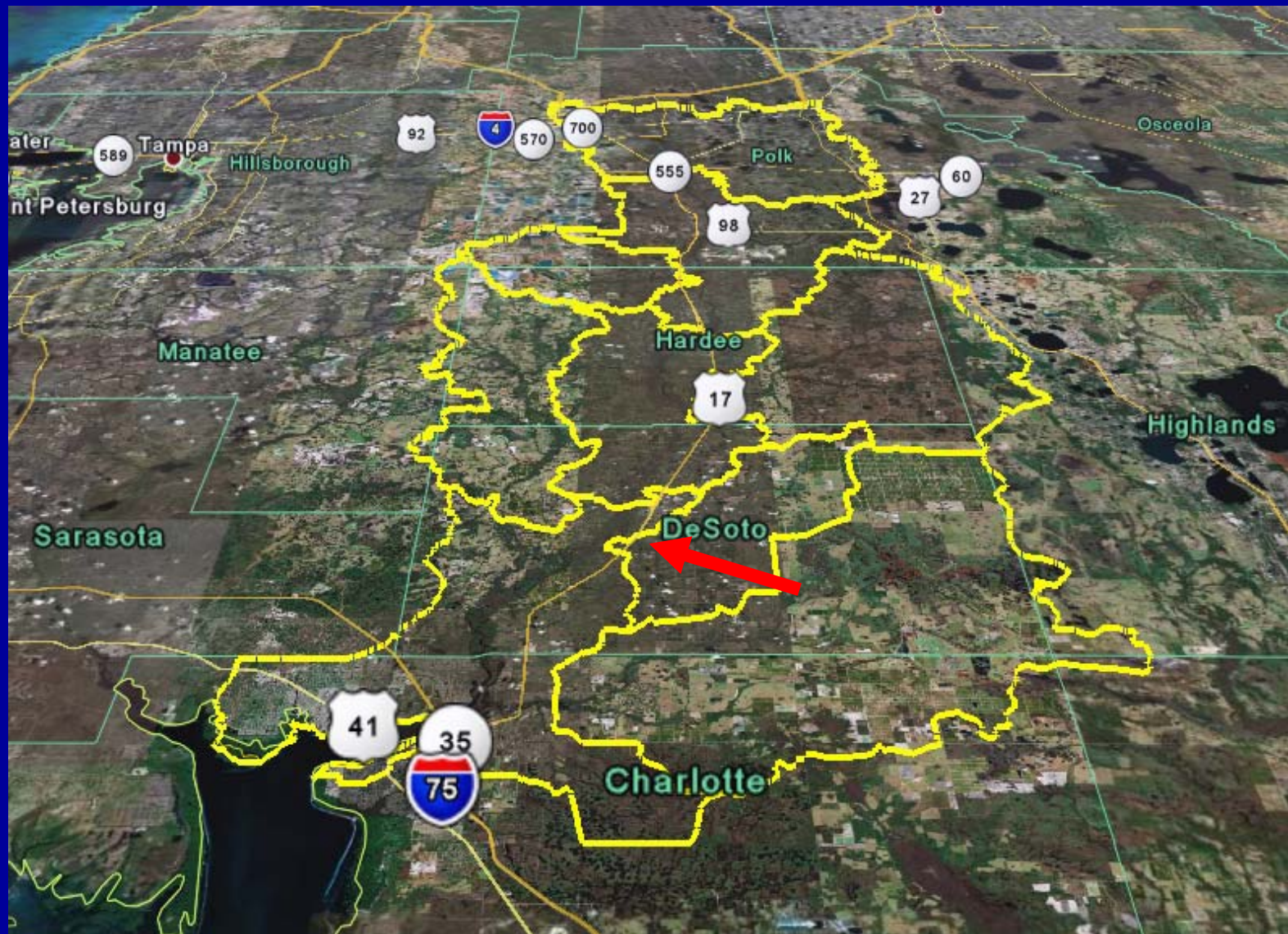
Orthophosphate at USGS site 2295420
Payne Creek near Bowling Green - Payne Creek sub-basin

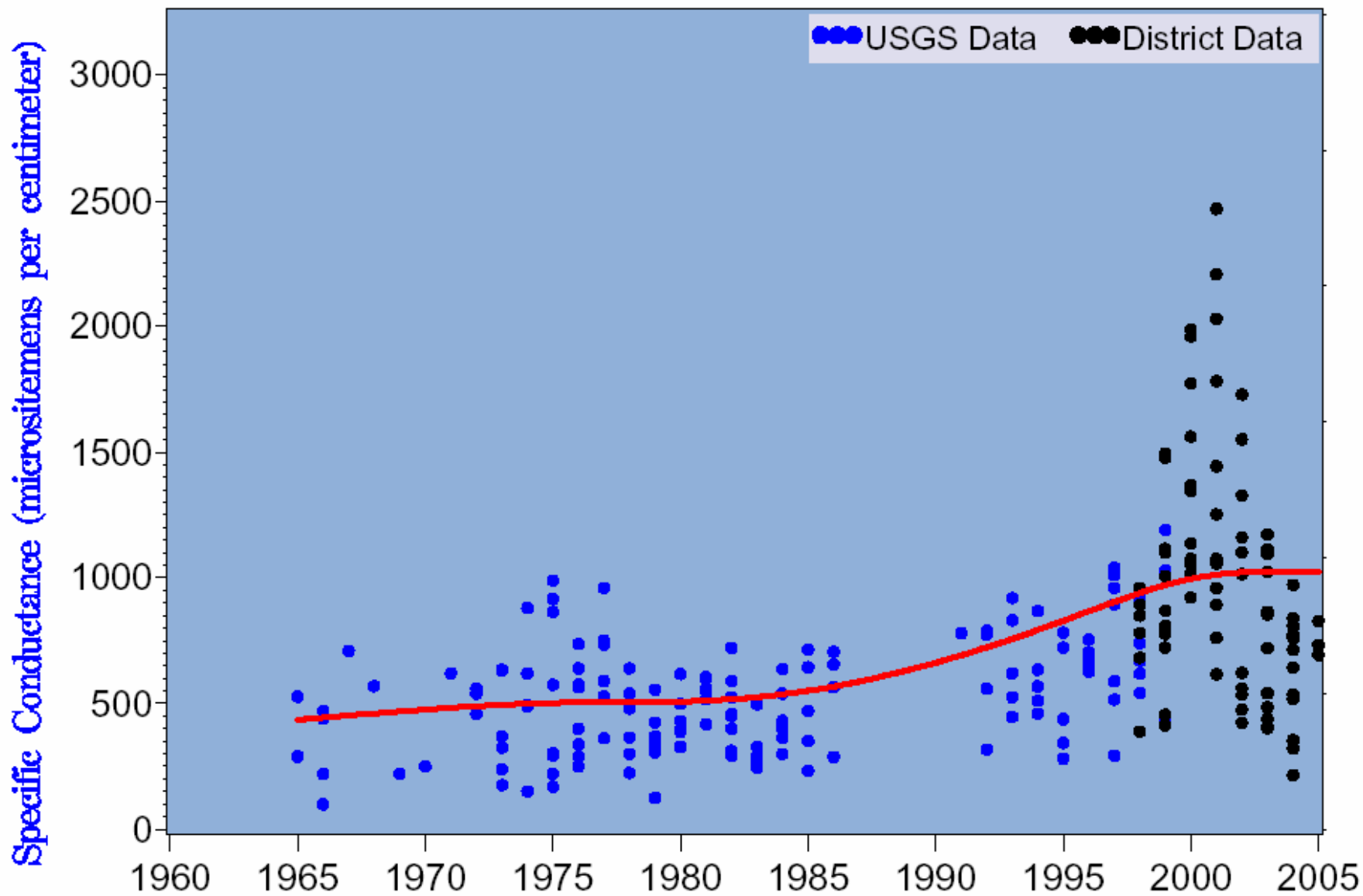




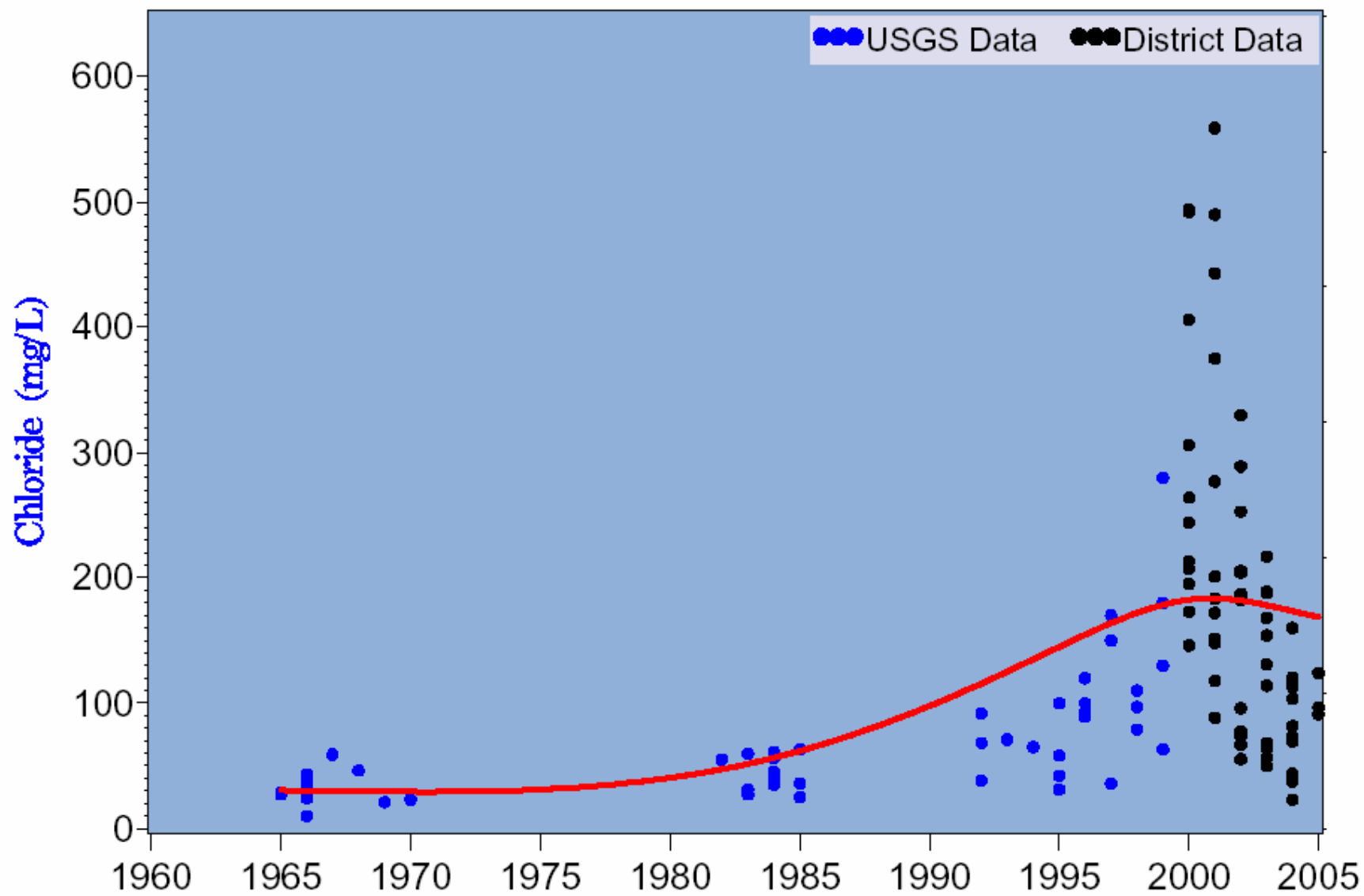
Sulfate at USGS site 2295420
Payne Creek near Bowling Green - Payne Creek sub-basin

Joshua Creek at Nocatee

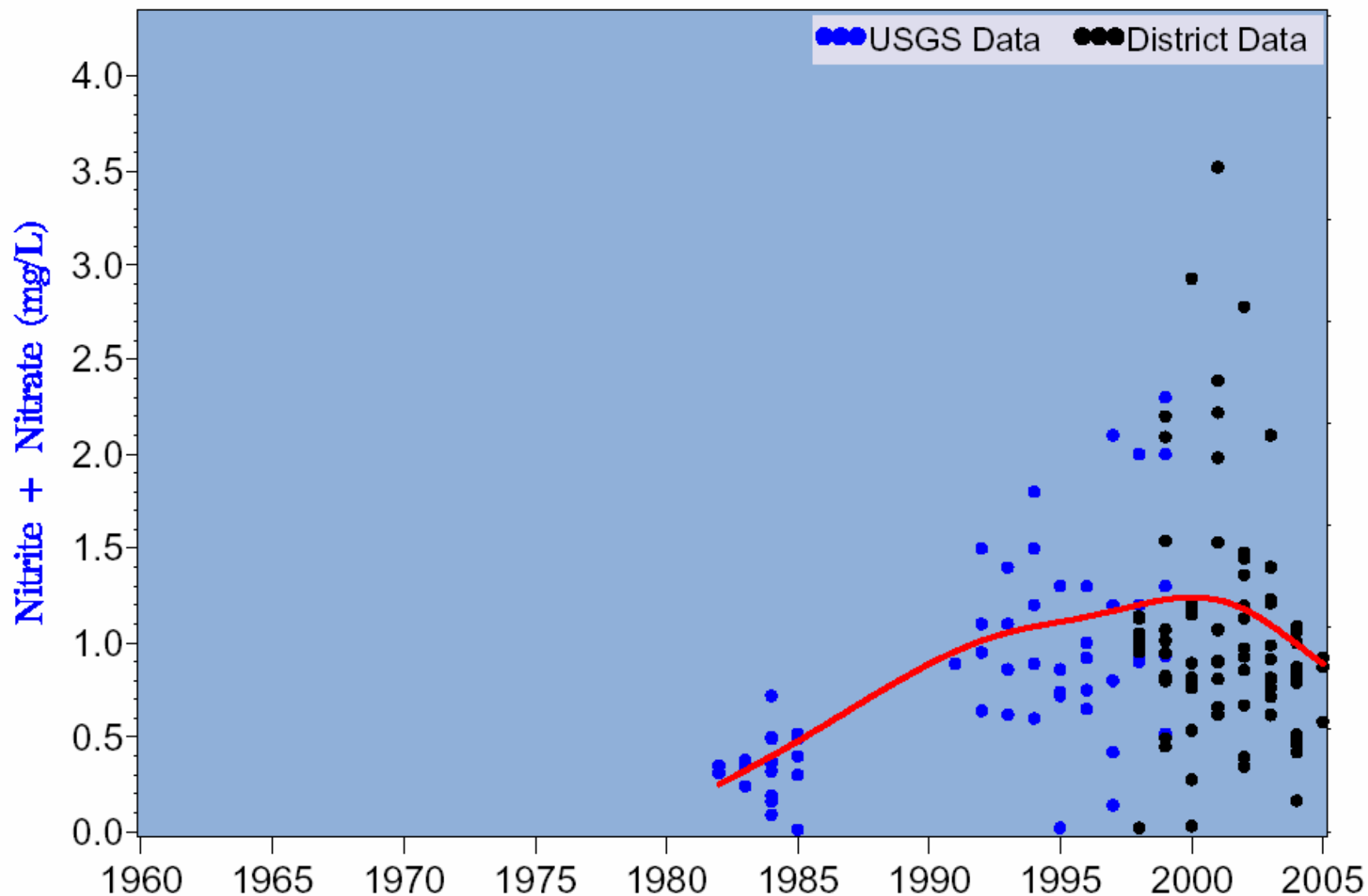




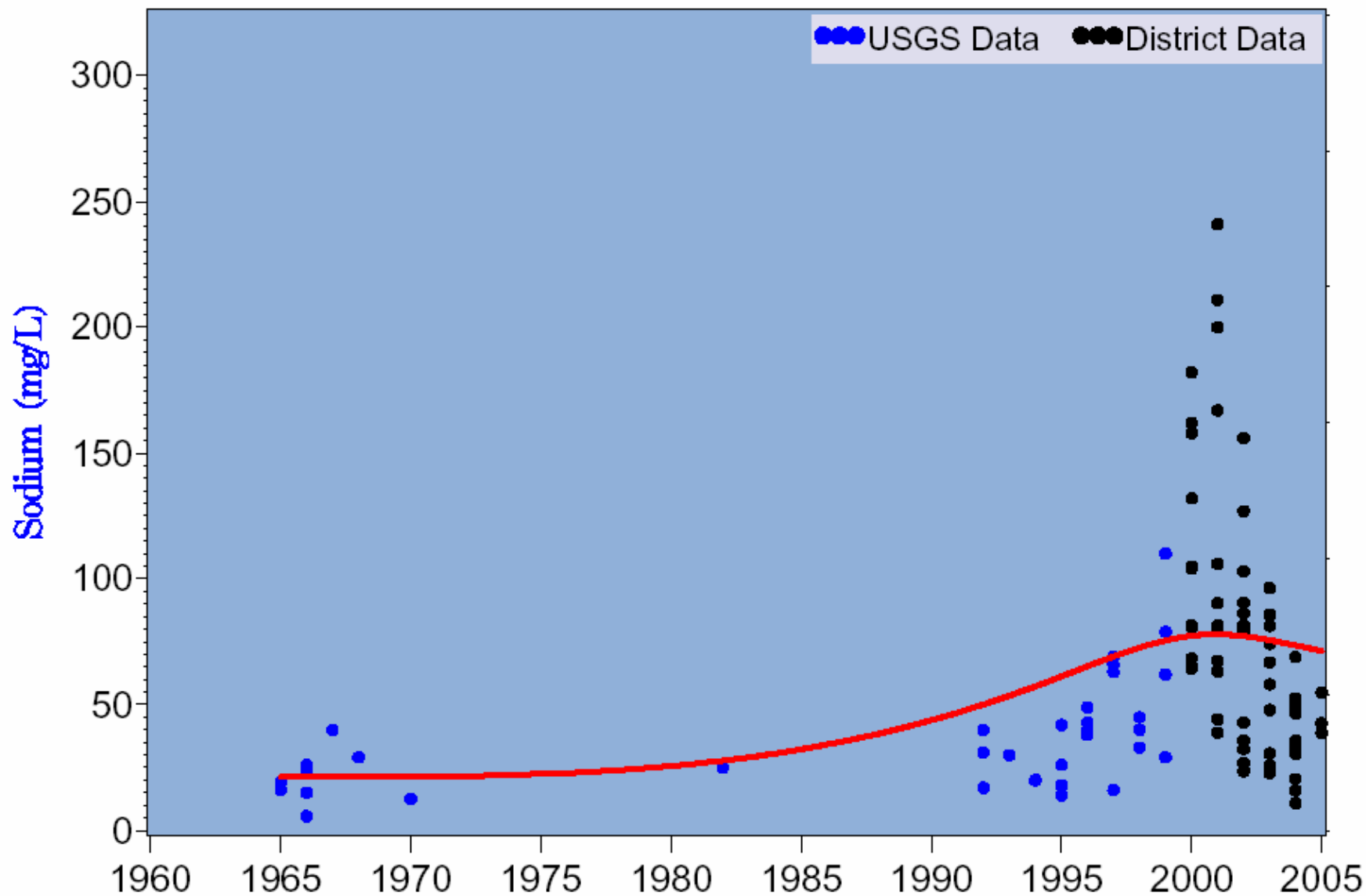
Specific conductance USGS site 2297100
Joshua Creek at Nocatee - Joshua Creek sub-basin



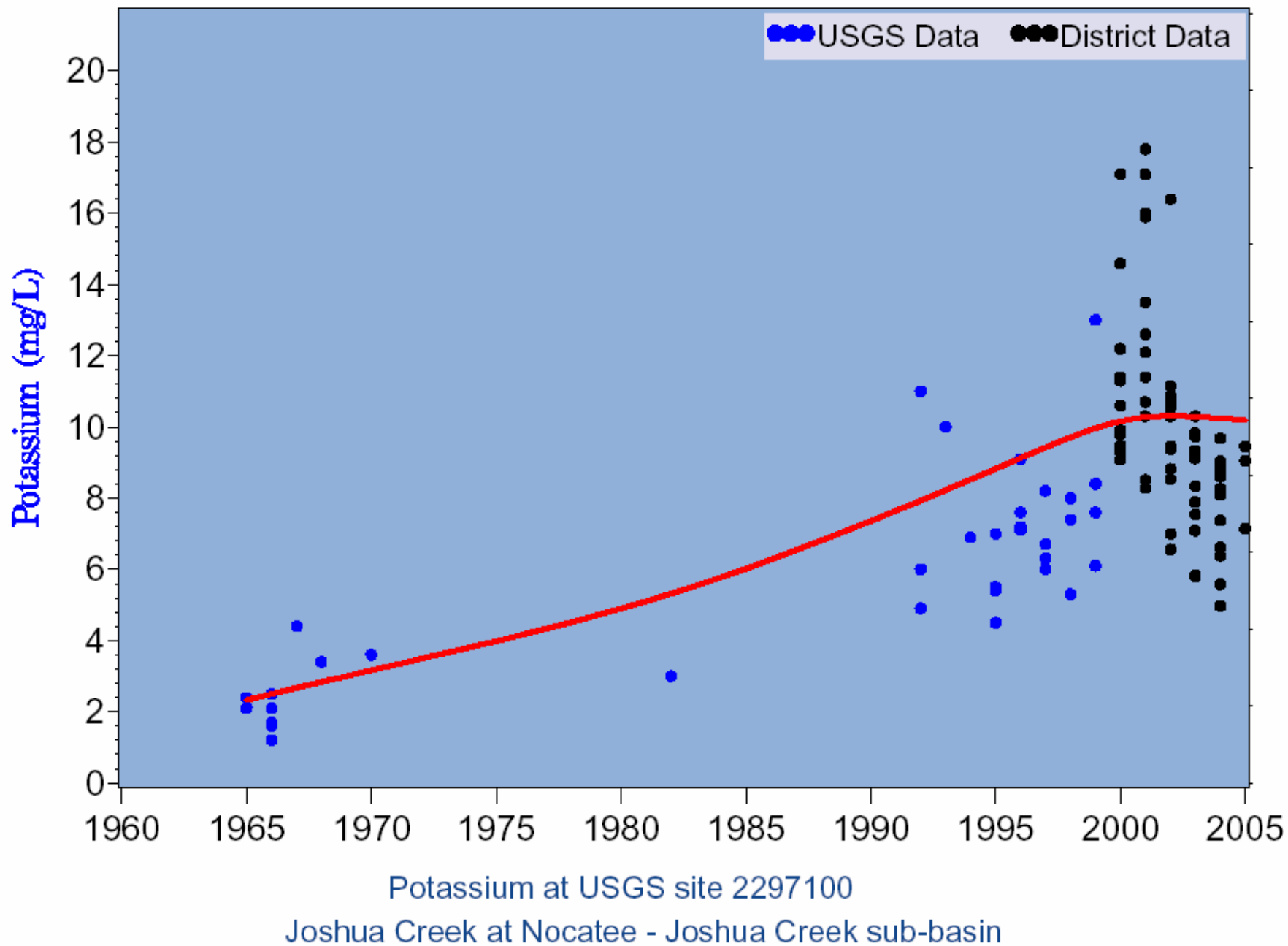
Chloride USGS site 2297100
Joshua Creek at Nocatee - Joshua Creek sub-basin

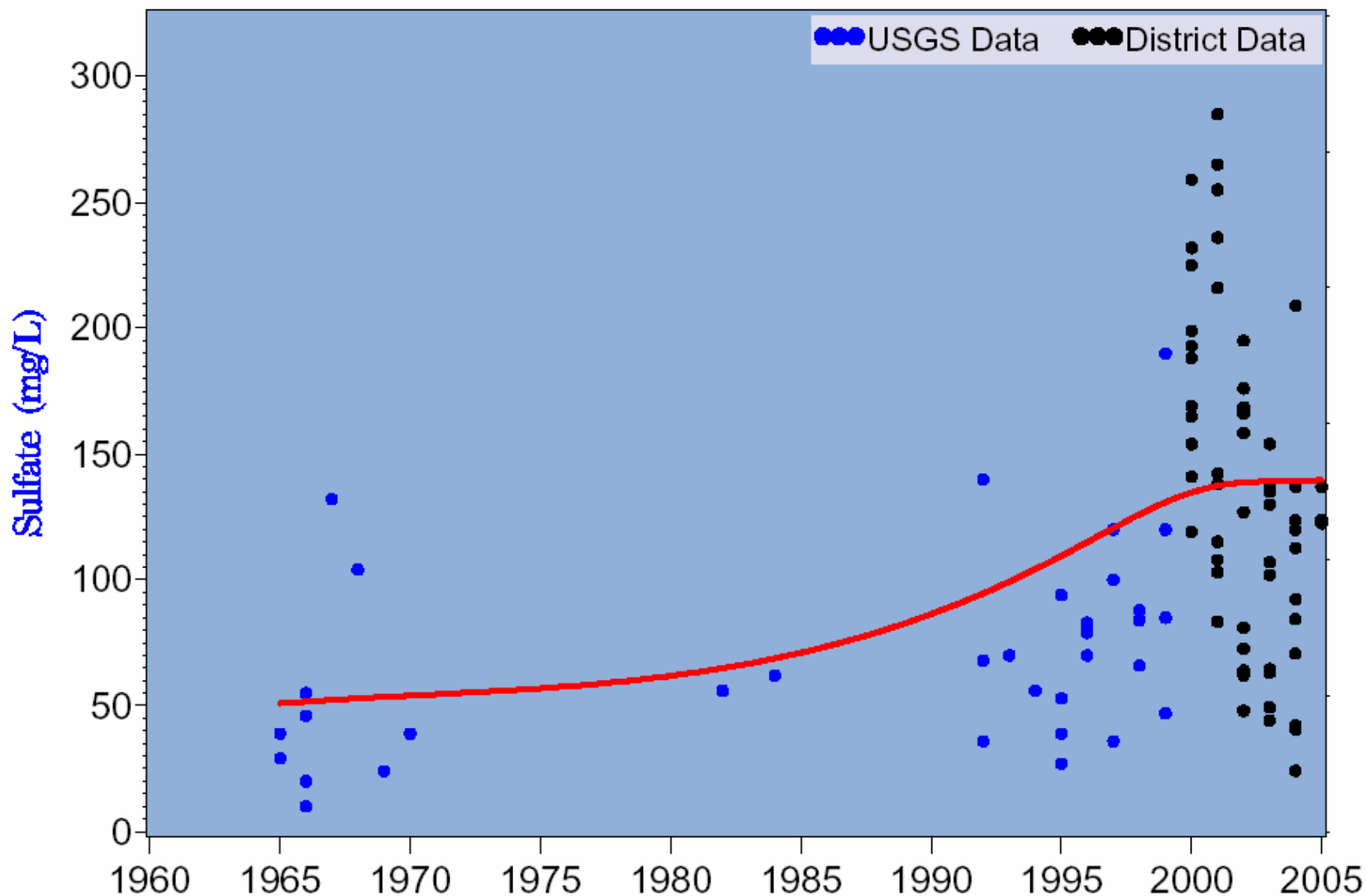


Nitrite + nitrate at USGS site 2297100
Joshua Creek at Nocatee - Joshua Creek sub-basin



Sodium at USGS site 2297100
Joshua Creek at Nocatee - Joshua Creek sub-basin





Sulfate at USGS site 2297100
Joshua Creek at Nocatee - Joshua Creek sub-basin

Historic Relative Changes in Selected Water Quality Characteristics

Location	Conduct-ivity	TDS	Chloride	Sulfate	Fluoride	Nitrite + Nitrate	Ortho-phosphorus
Peace River at Bartow	▼	▼	▲	▼	▼	—	▼
Payne Creek near Bowling Green	▲	▲	—	▲	—	▼	▼
Charlie Creek near Gardner	▲	▲	▲	▲		▲	
Peace River at Arcadia	—	—	—	—	▼	▼	▼
Joshua Creek at Nocatee	▲	▲	▲	▲	—	▲	▼
Shell Creek near Punta Gorda	▲		▲			▲	—

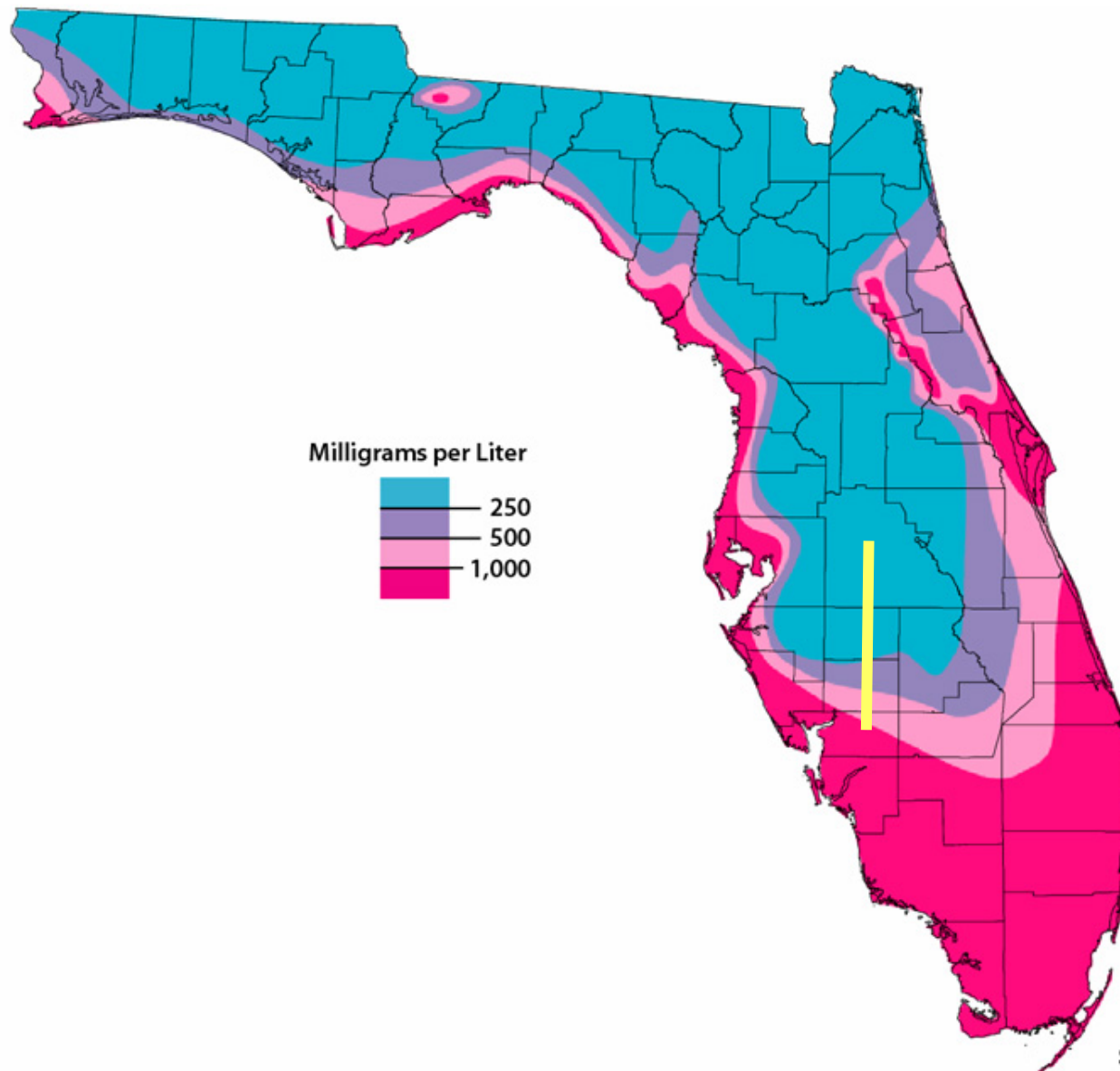
▲ Large Change ▼ Intermediate Change ▲ Small Change — No Change Blank = No Data

Spatial Differences in Watershed Water Quality Characteristics

- **Comparison Among Selected Sites** (Selected Characteristic Parameters)
 - Recent Wet Period (2002-2004)
 - Recent Extended Drought (1999-2001)



Chloride Concentration in the Upper Floridan Aquifer



Source USGS

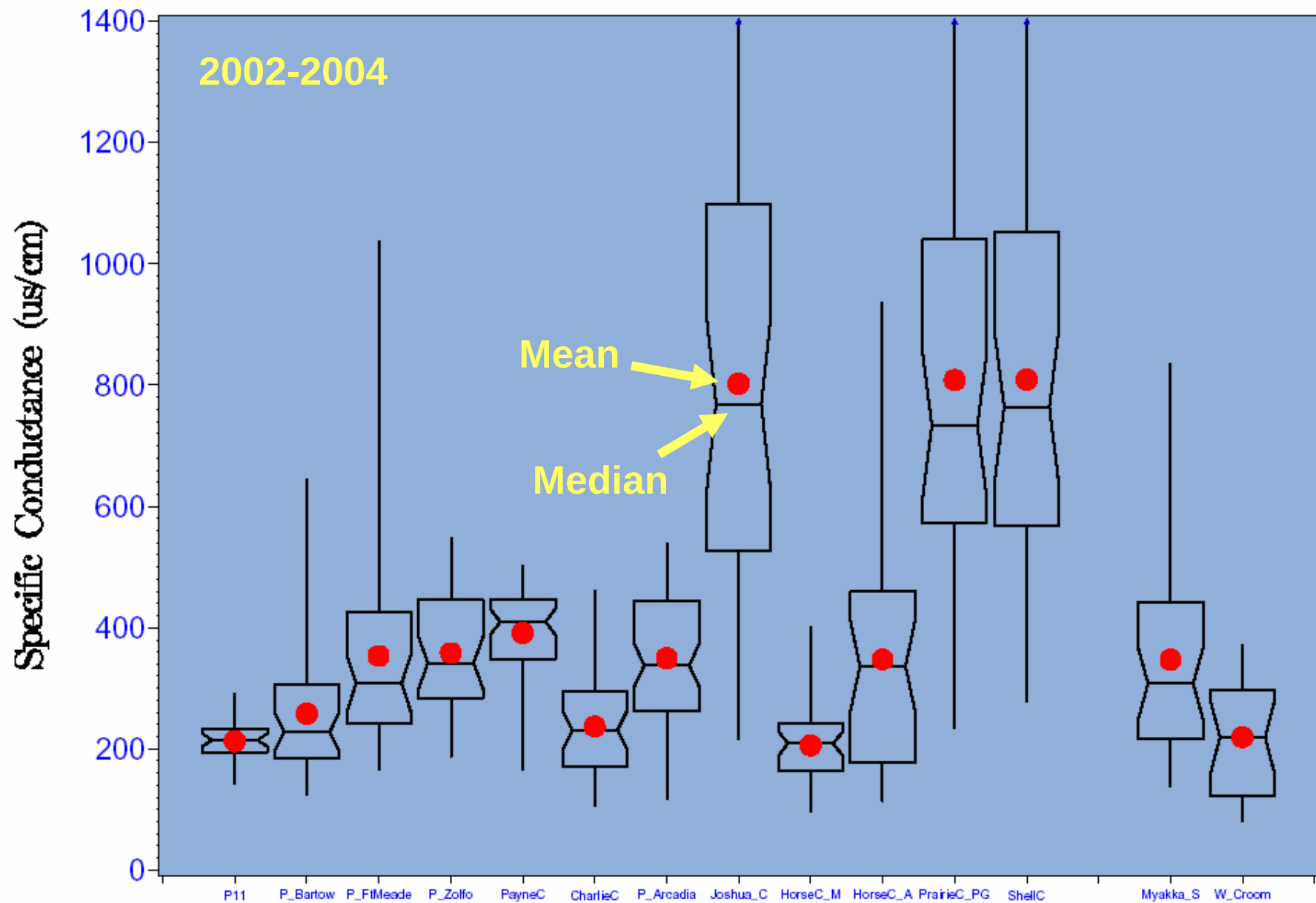


Figure W-1. Watershed difference in specific conductance among selected sampling sites (2002-04)

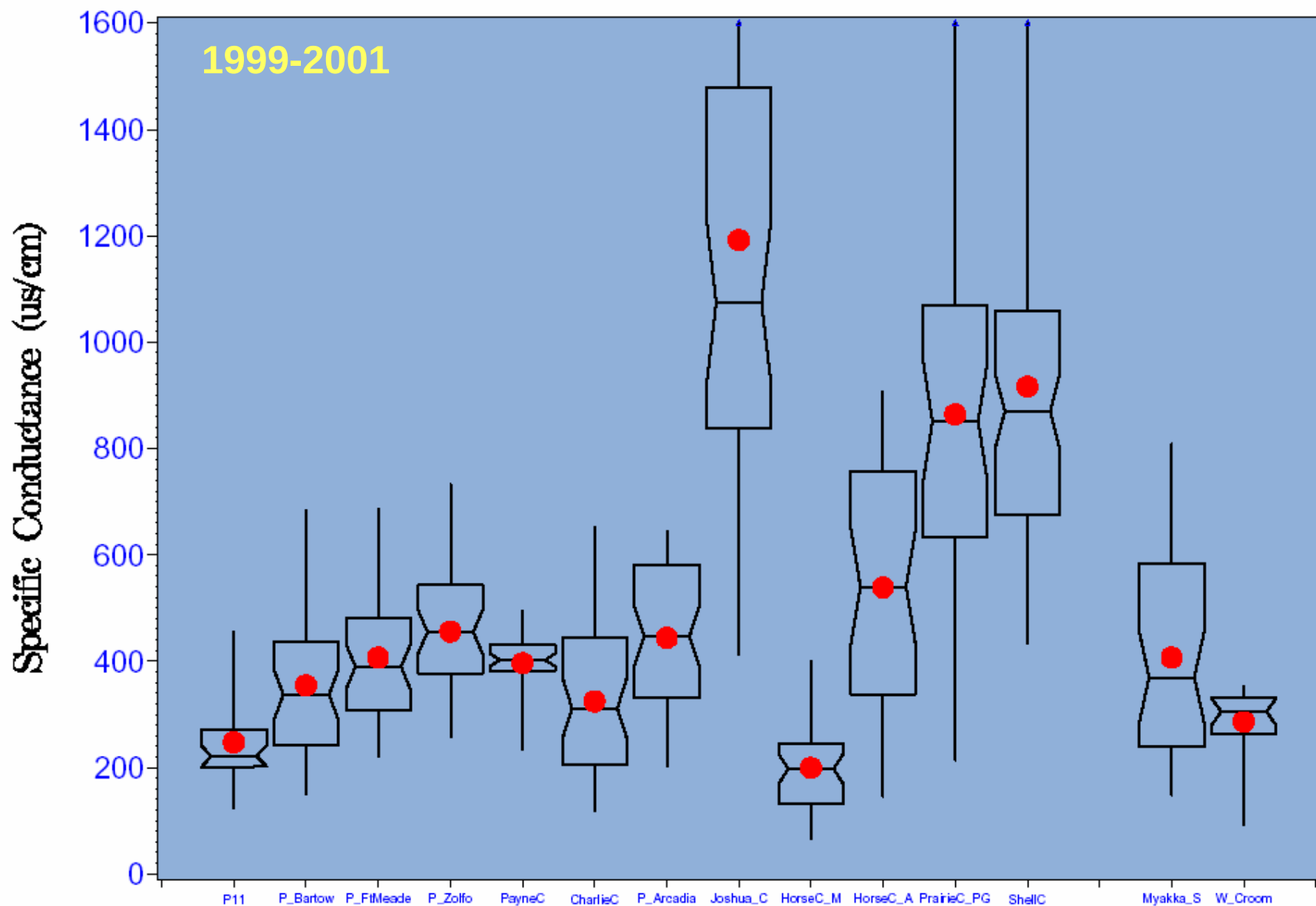


Figure D-1. Watershed difference in specific conductance among selected sampling sites (1999-2001)

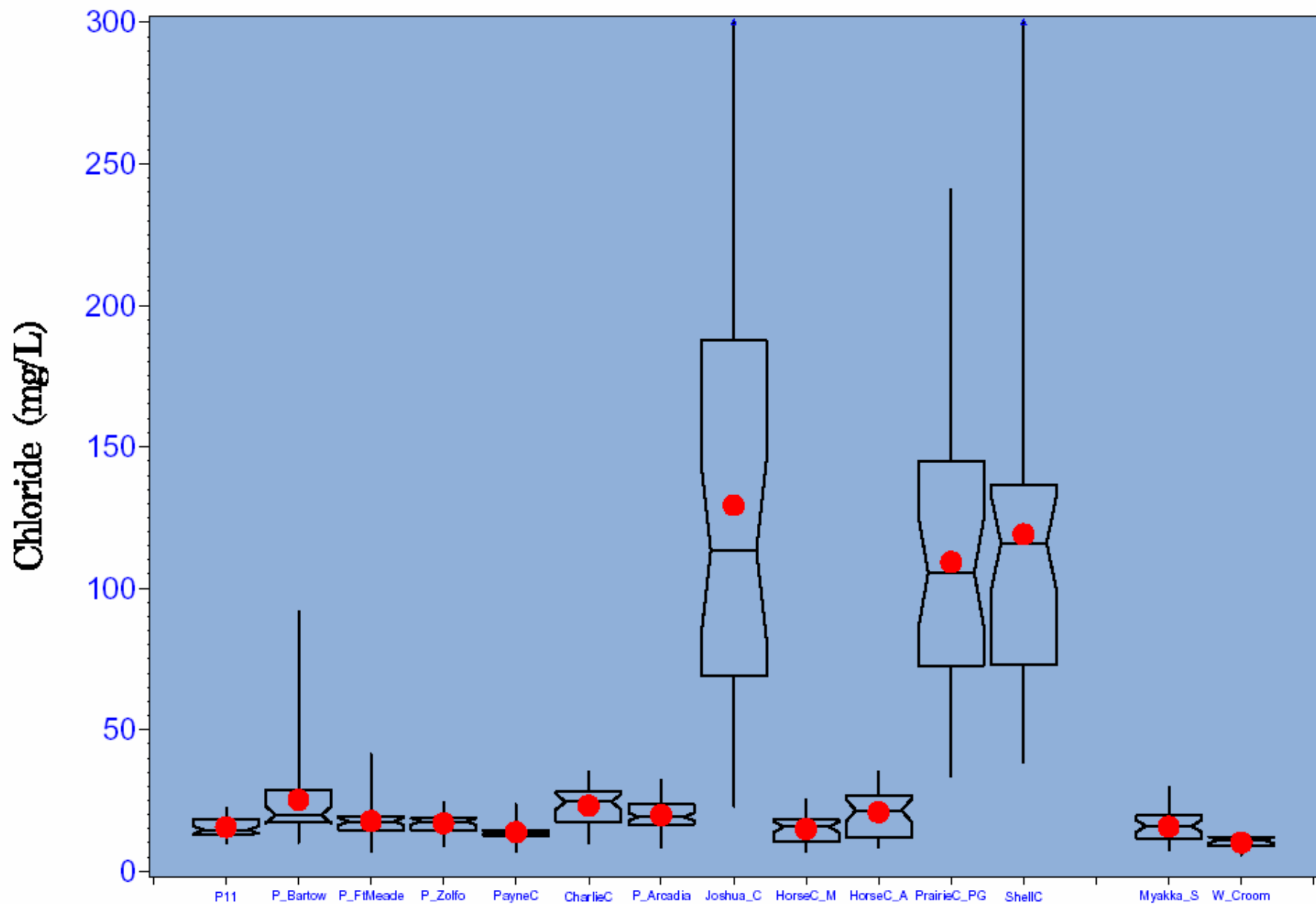


Figure W-4. Watershed difference in chloride among selected sampling sites (2002-04)

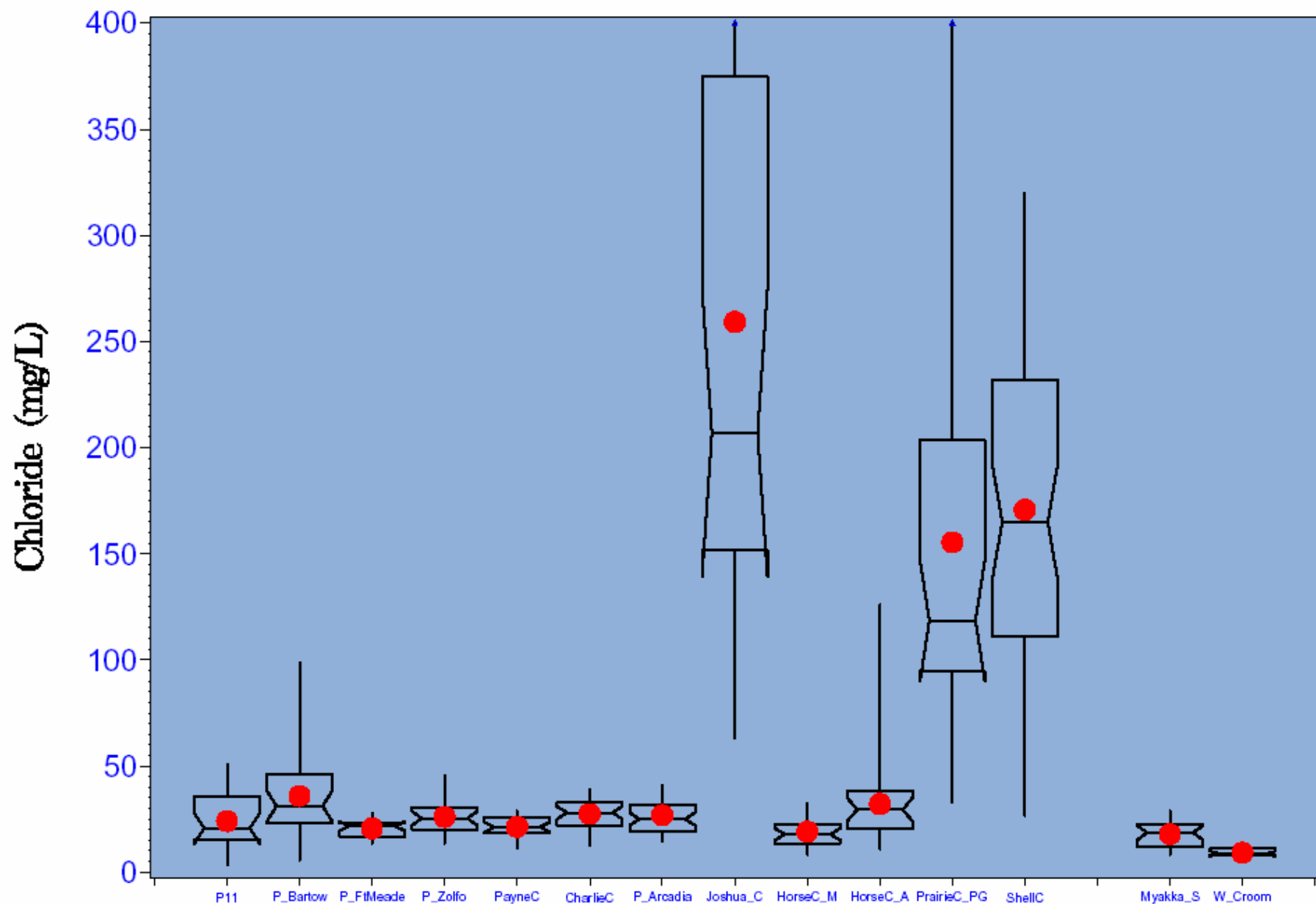
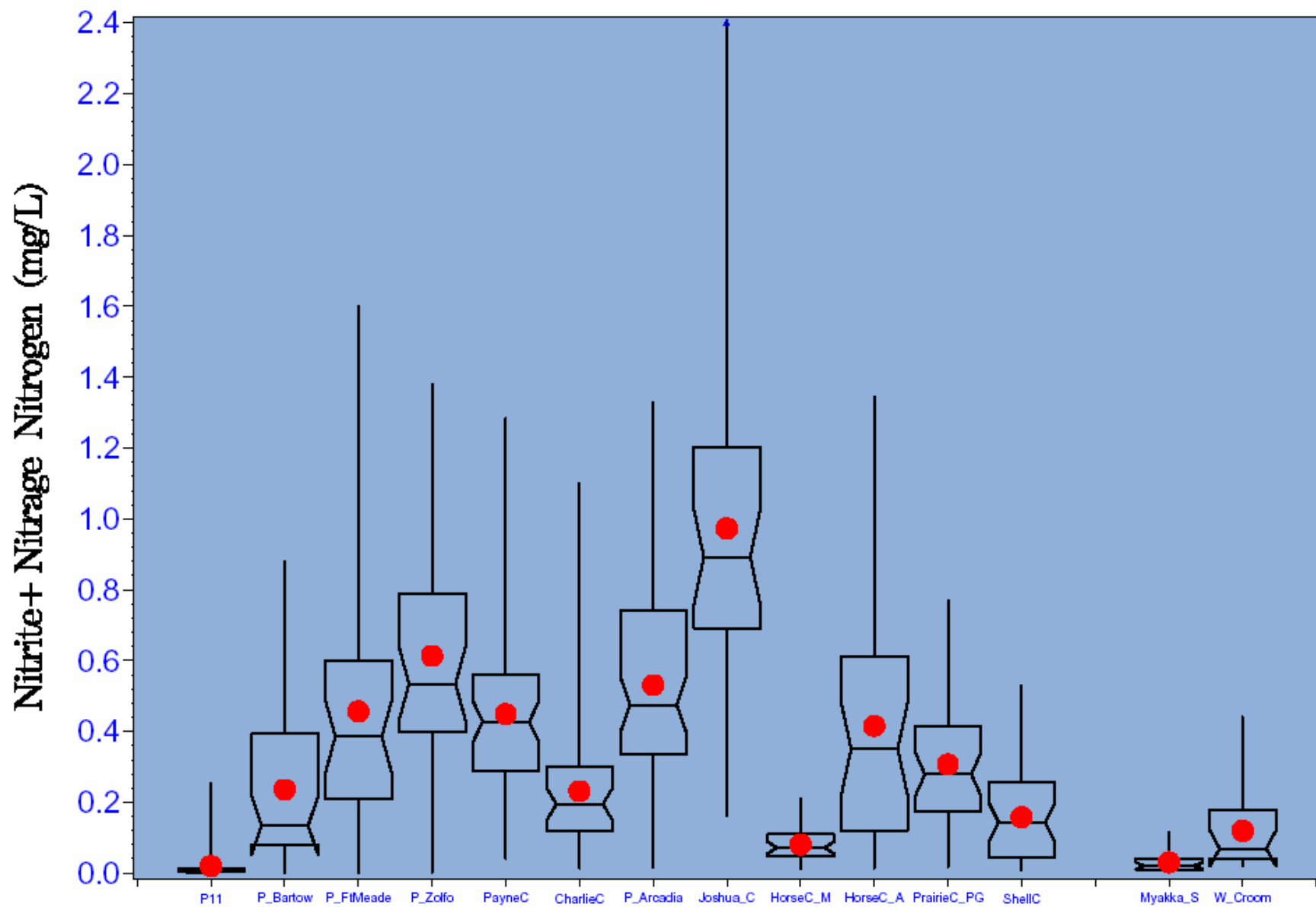


Figure D-4. Watershed difference in chloride among selected sampling sites (1999-2001)



W-22. Watershed difference in nitrite+nitrate nitrogen among selected sampling sites (2002-04)

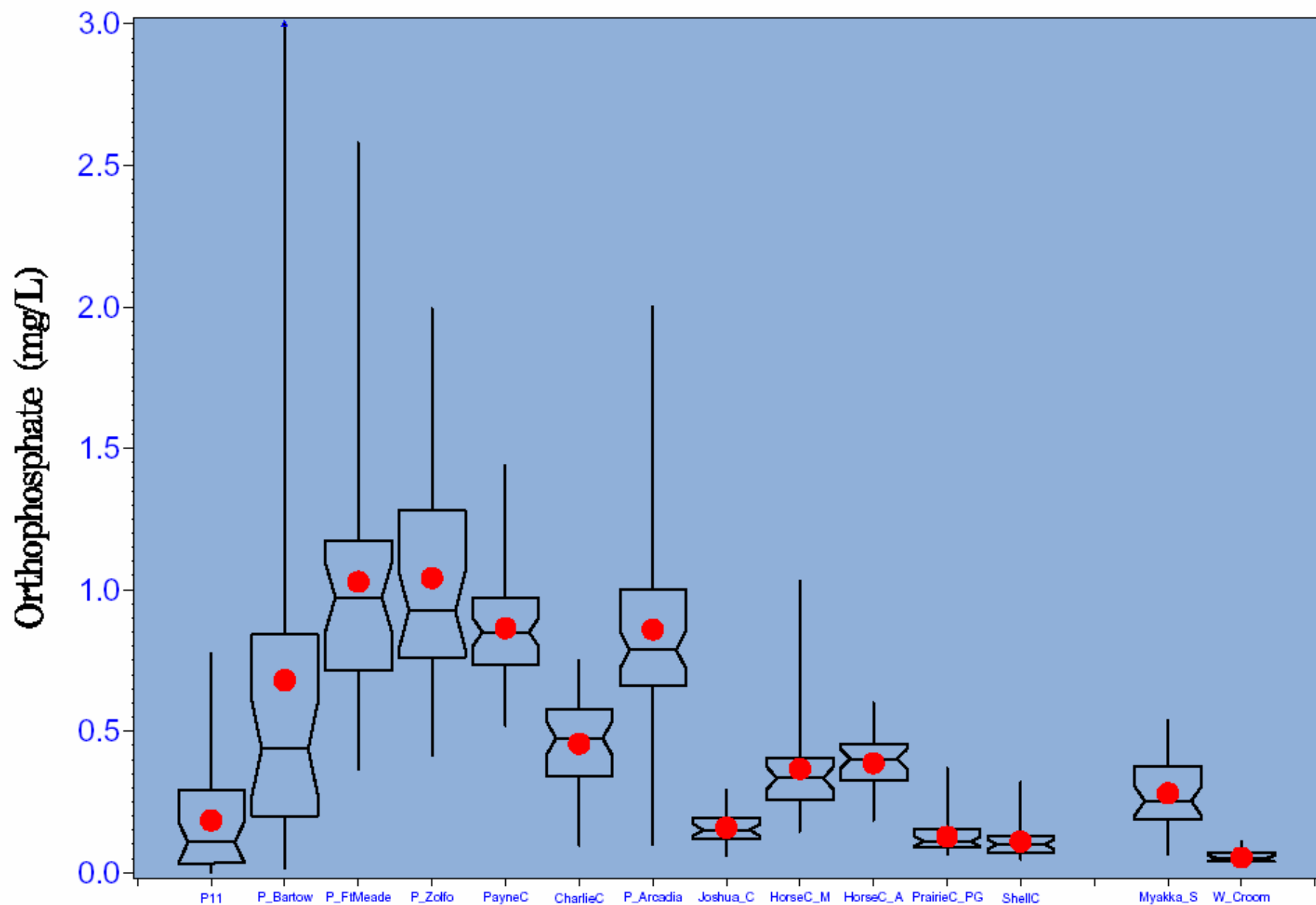


Figure W-3. Watershed difference in orthophosphate among selected sampling sites (2002-04)

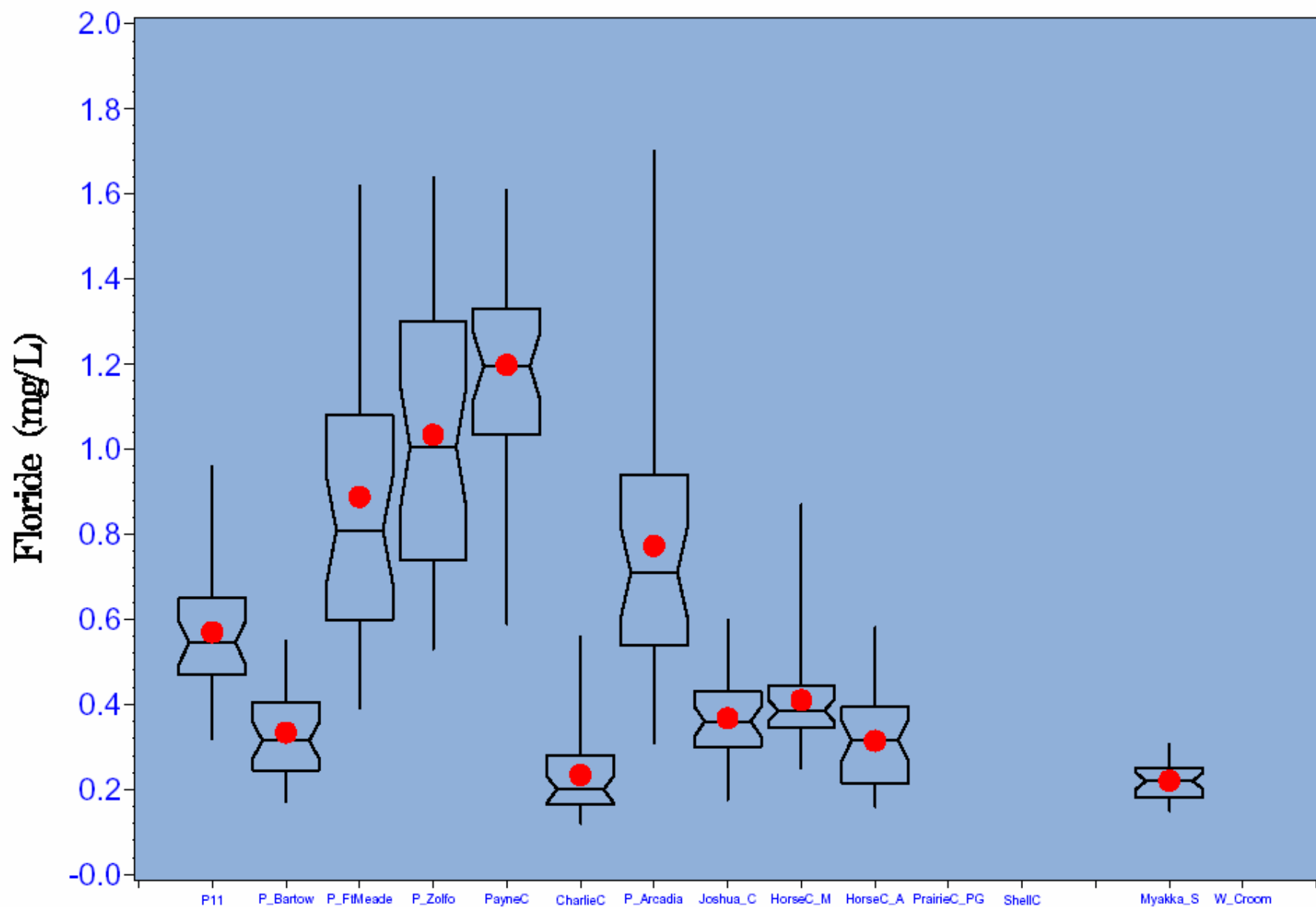


Figure W-6. Watershed difference in fluoride among selected sampling sites (2002-04)

Lower Peace River / Charlotte Harbor Estuary

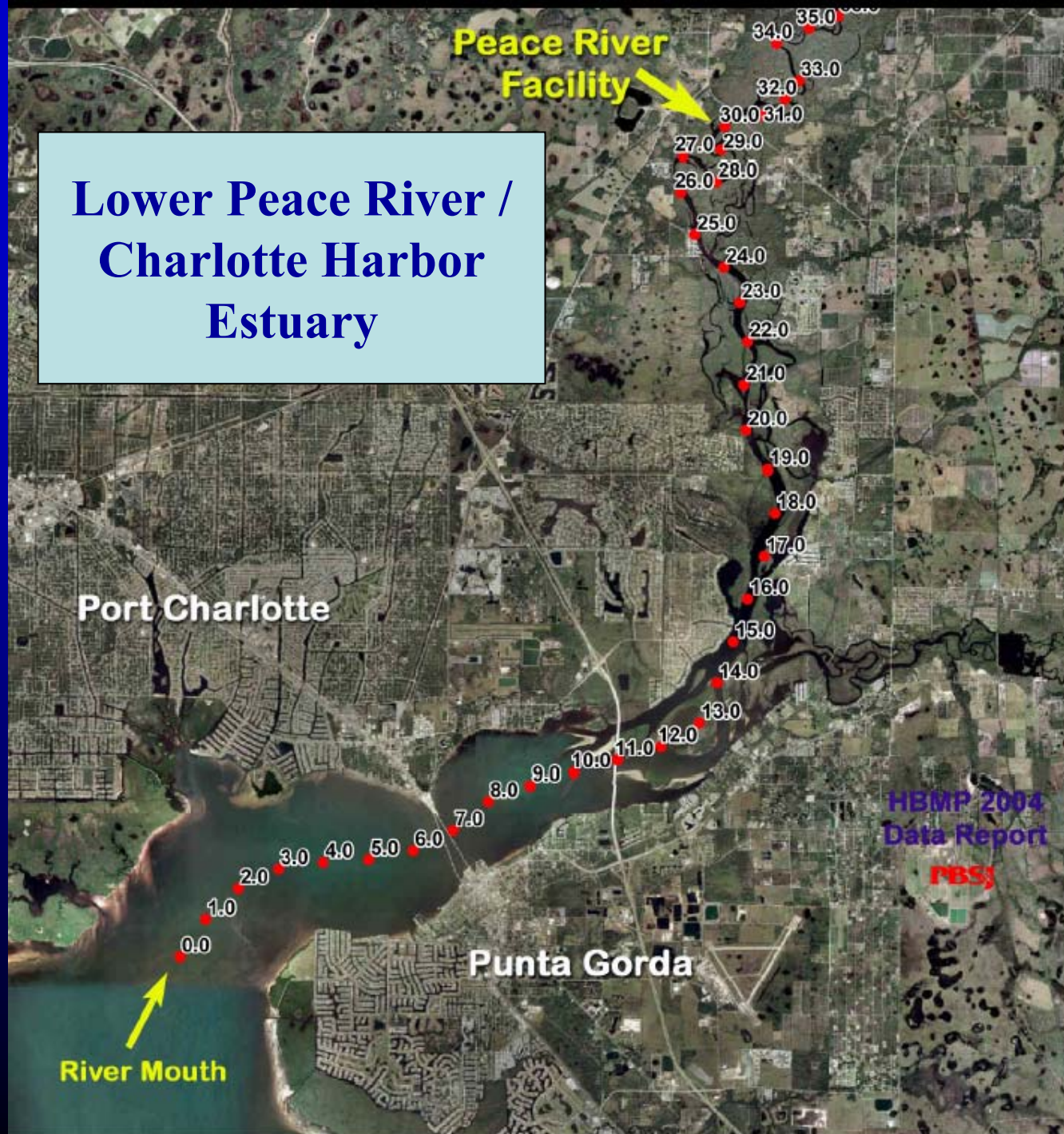
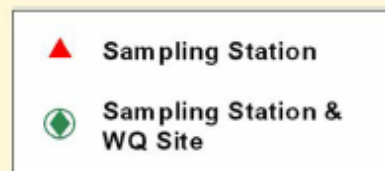
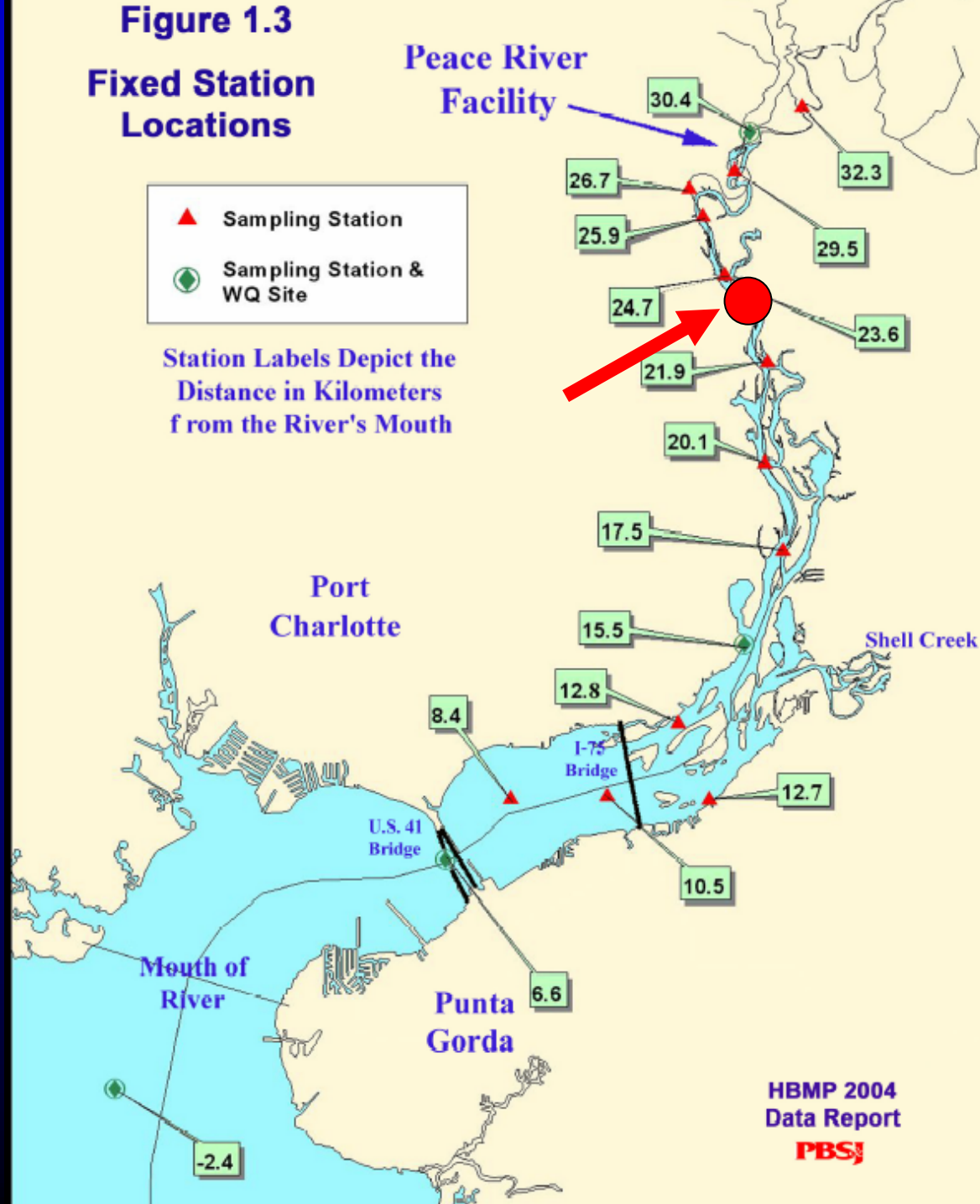


Figure 1.3

**Fixed Station
Locations**

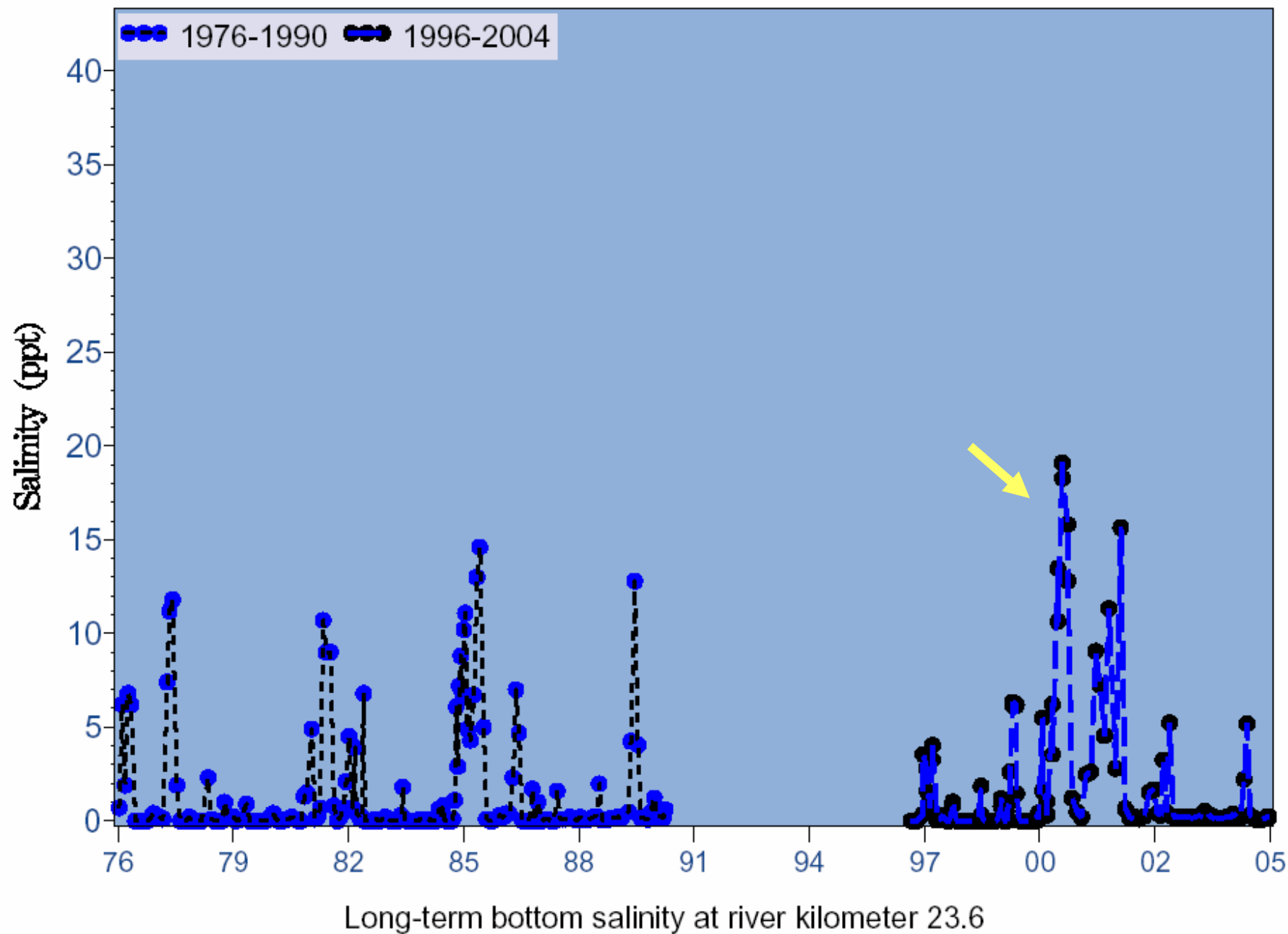


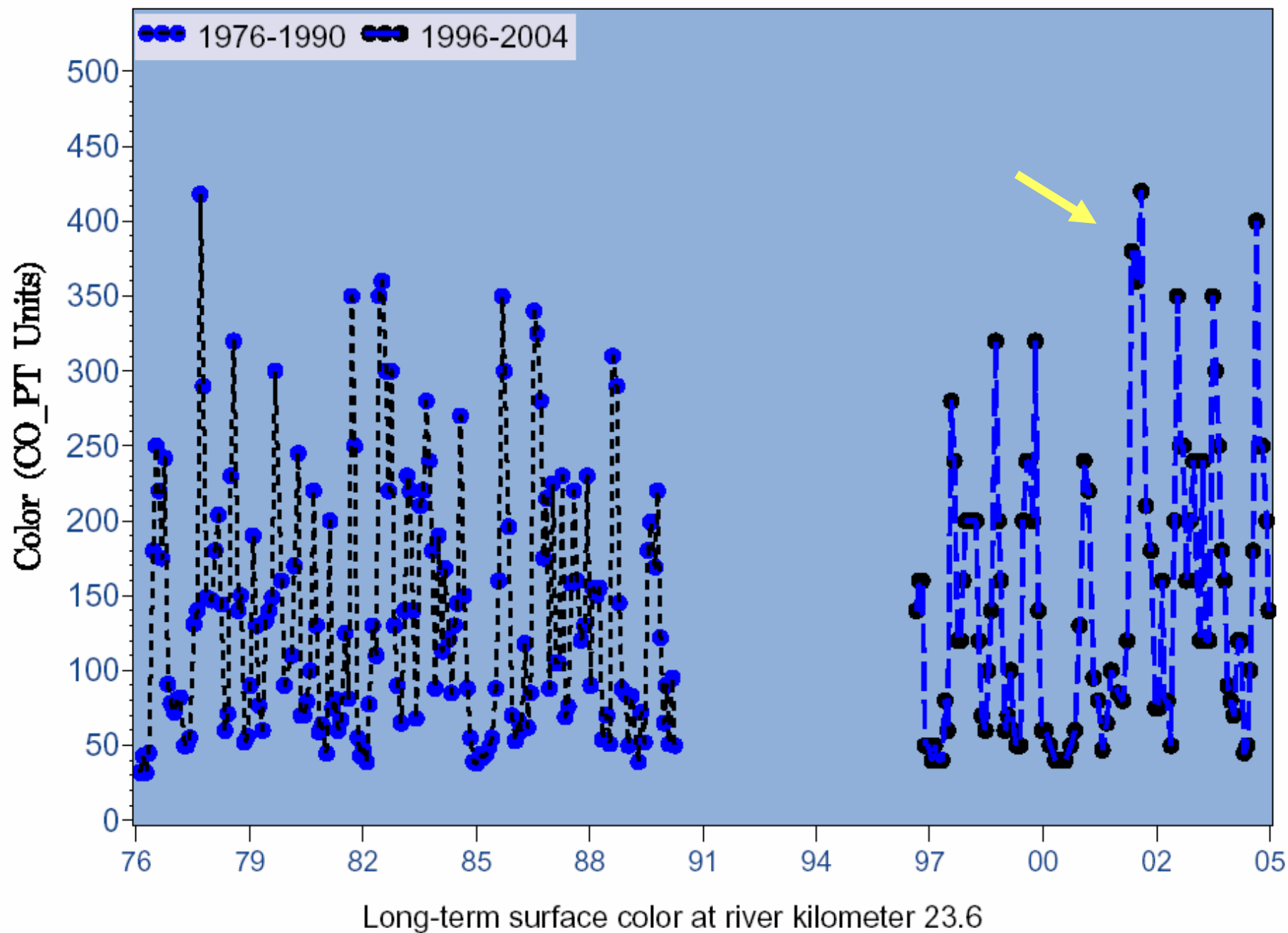
Station Labels Depict the
Distance in Kilometers
from the River's Mouth

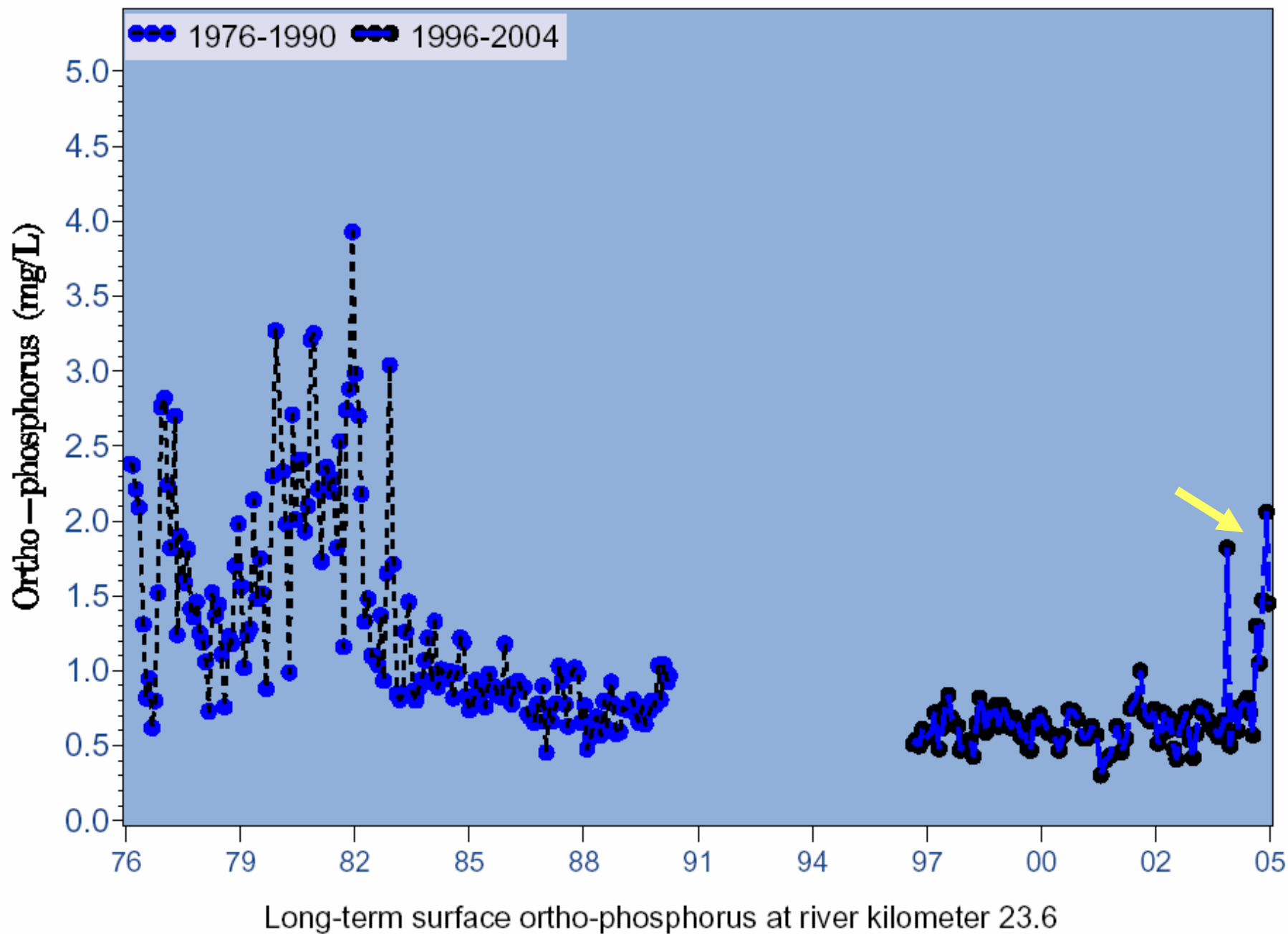


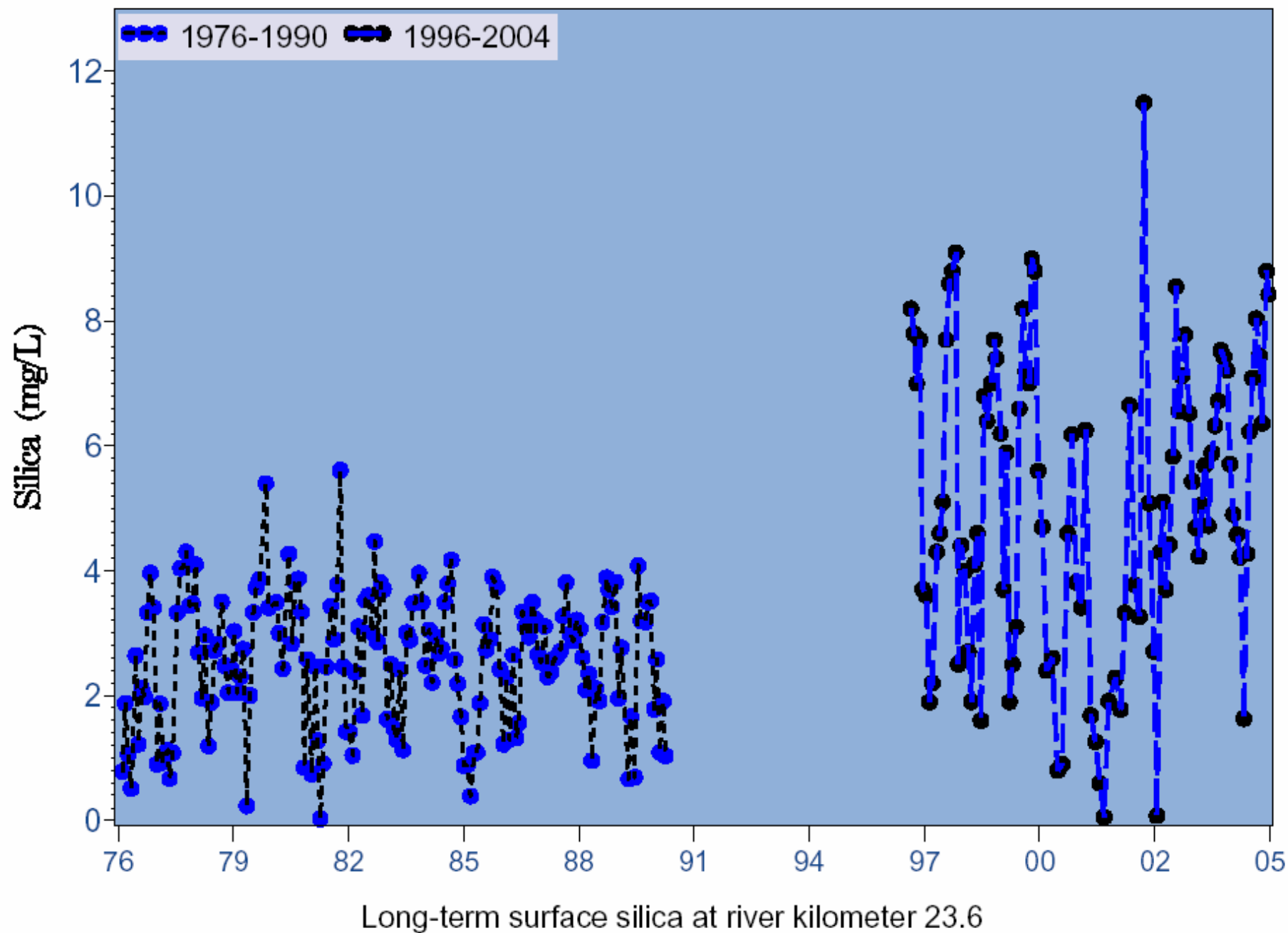
HBMP 2004
Data Report

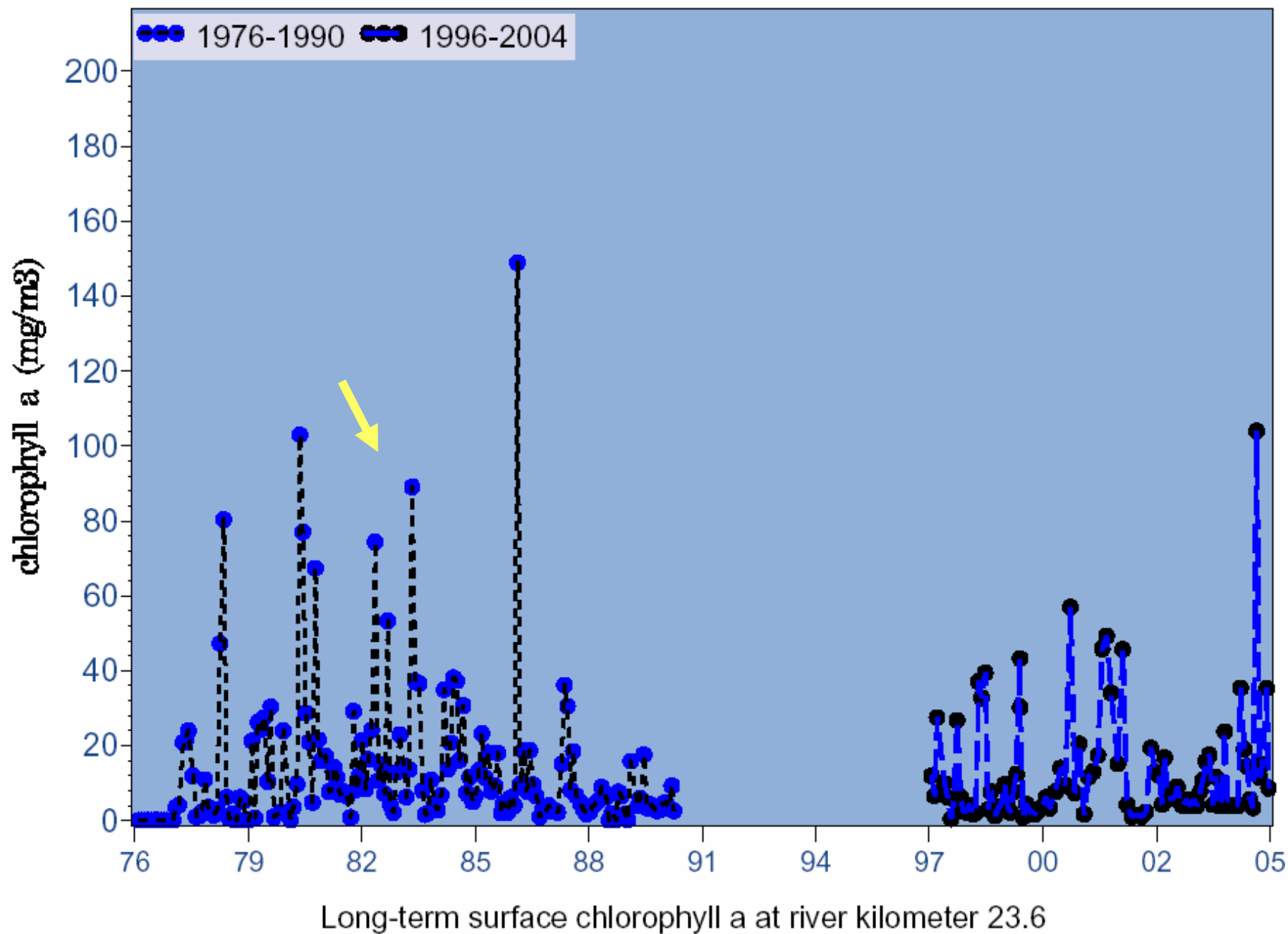
PBS











Trend Tests Peace River HBMP Estuary Sites Water Quality (1976-1989 & 1996-2004)

Parameter	River Kilometer				
	-2.3	6.6	15.5	23.6	30.4
Salinity (Surface)					
Salinity (Bottom)					
Dissolved Oxygen (Surface)	▼	▼	▼	▼	▼
Dissolved Oxygen (Bottom)	▼	▼	▼		▼
Color	▲	▲			
Turbidity			▼	▼	▼
Nitrite + Nitrate	▲				
Total Kjeldahl Nitrogen					
Total Phosphorus		▼	▼	▼	▼
Silica	▲	▲	▲	▲	▲
Dissolved Organic Carbon	▼	▼	▼	▼	▼
Total Organic Carbon	▼	▼	▼	▼	▼
Chlorophyll <u>a</u>					

Summary

Peace River at Bartow

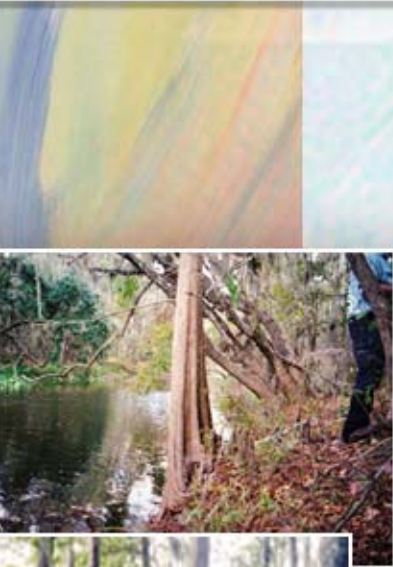
- Upper river reaches have historically received direct discharges from both phosphate mining and beneficiation
- Water quality trends show large declines in ortho-phosphate, fluoride, and sulfate levels associated with changes in mining practices.
- Water color has increased, reflecting declines in spring flow and reduced mining discharges



Conclusions

Peace River at Arcadia

- Water quality trends reflect declines in upstream ortho-phosphate and fluoride after dilution



Payne Creek near Bowling Green

- Extensive phosphate mining and several NPDES discharge sites
- Ortho-phosphate concentrations have declined, while characteristics associated with ground discharges (conductivity, TDS and sulfate) have increased



Summary

Charlie Creek

- Subbasin has not been impacted by either phosphate mining or extensive, intense agriculture
- Water quality characteristics associated with groundwater discharges have increased
- These changes relatively small when compared to other subbasins with more intense agricultural

Joshua & Shell Creeks

- Historical change from less intense to more intense agriculture
- Lower Floridan Aquifer highly mineralized
- Water quality shows marked increases in those water chemistry parameters associated with ground discharges



Conclusions

- Both mining and agriculture have resulted in water quality changes in the watershed
- Different long-term patterns
 - Improvements in water quality northern watershed
 - Significant degradation of surface water quality in southern basins
- Resulting in marked spatial differences (seasonal)

