Peace River Cumulative Impact Study

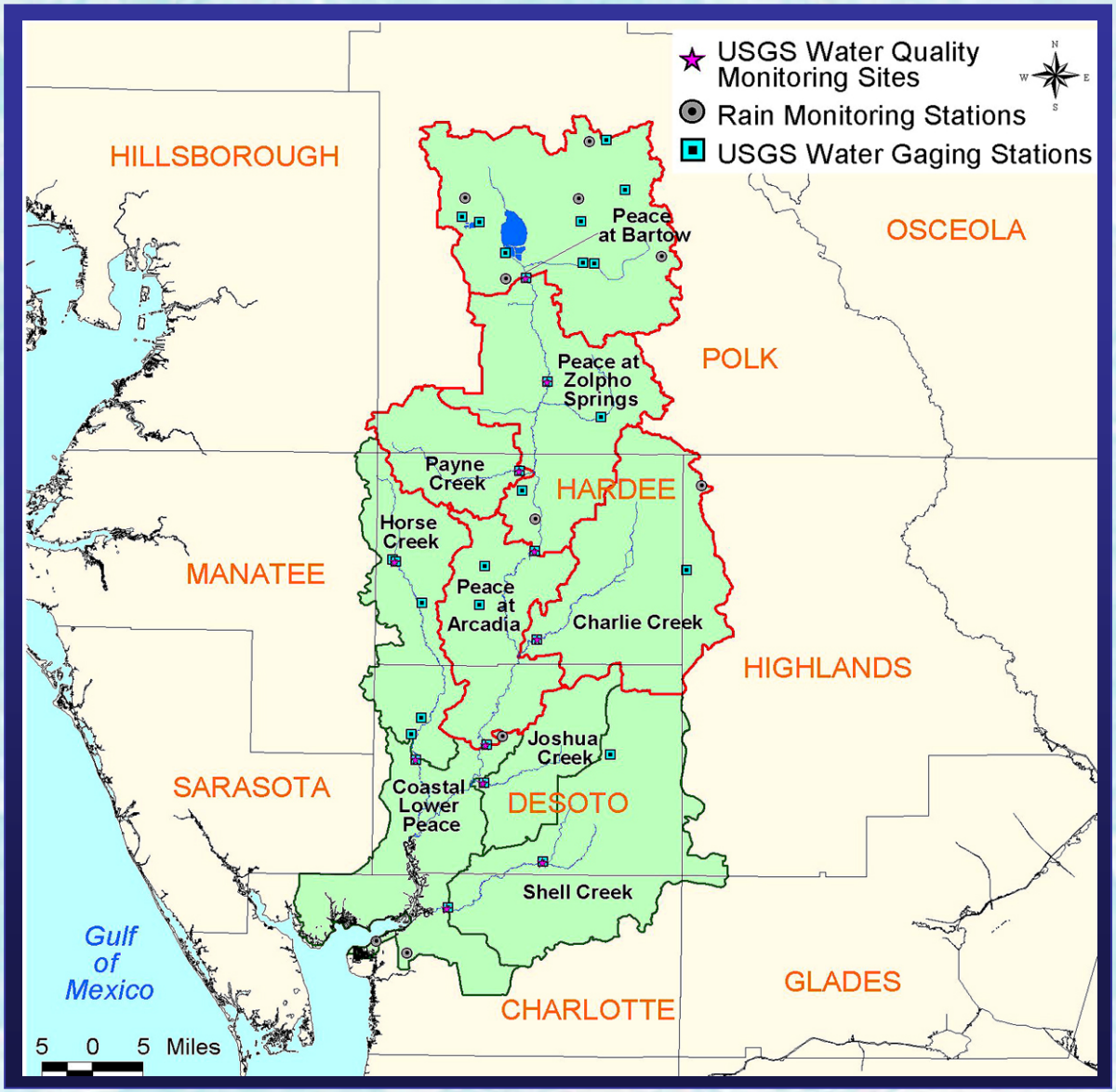
August 9, 2006

Public Information Workshop

Task 1- Literature Review and Data Collection

- **Task 1 –**
  Literature Review and Data Collection
- **Task 2 –**
  Description of Historical Changes
- **Task 3 –**
  Identification and Analysis of Factors Causing Changes
- **Task 4 –**
  Evaluating Regulatory Effectiveness

Sub-basin Based Study



Watershed Stressor and Metrics

Stressors

- Urbanization
- Agriculture
- Mining
- Long-term Climate Patterns

Metrics

- Streamflow
- Water quality
- Groundwater elevations

- Miles of streambed
- Acres of floodplain
- Acres of wetlands
- Acres of mined lands
- Acres of agricultural lands
- Acres of urban lands

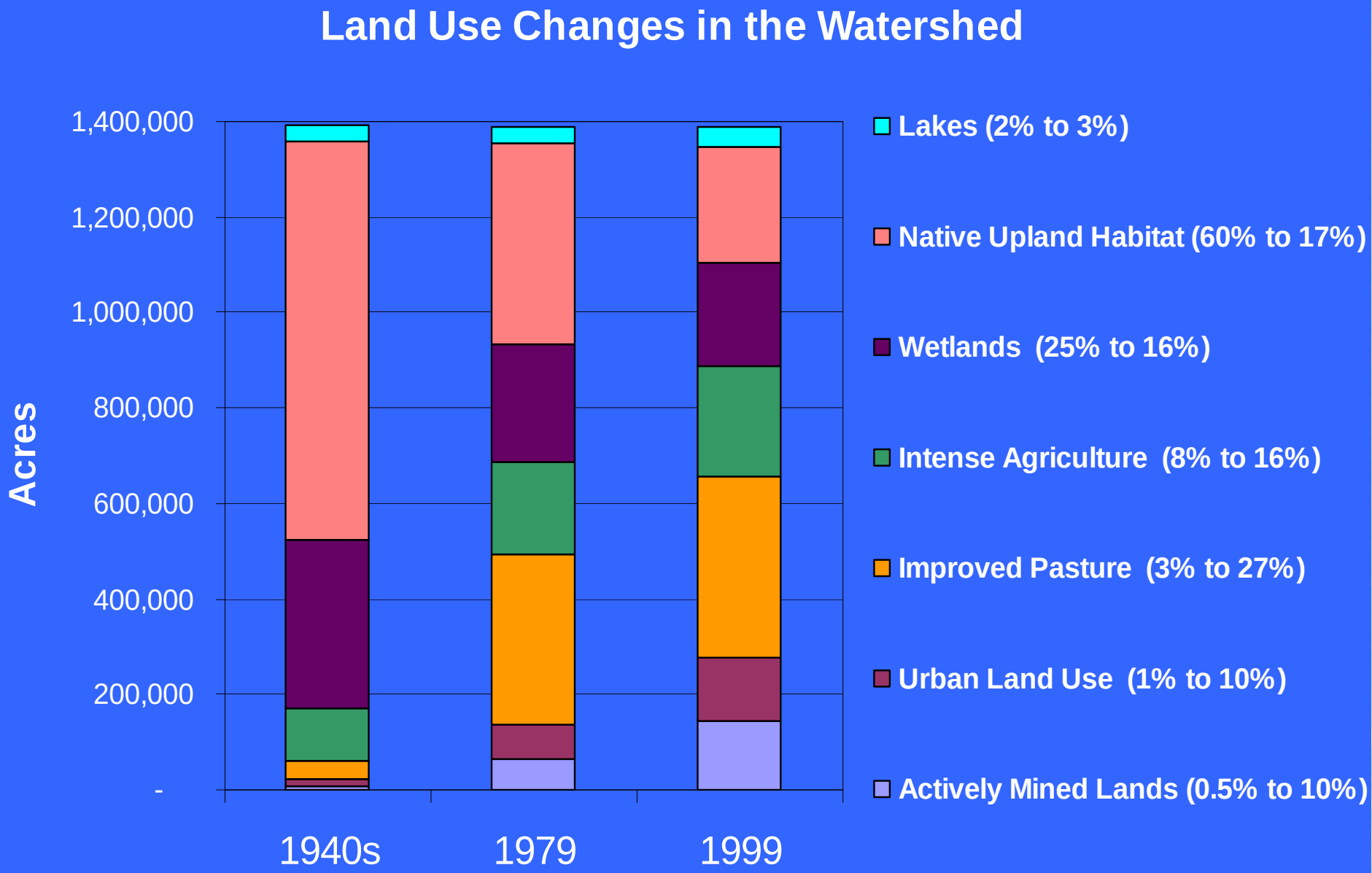
Acres of Conversions: 1940s - 1999

Land Use	Percent		
	1940s	1979	1999
Actively Mined Lands	0.5	4.6	10.3
Urban Land Use	1.0	5.2	9.6
Improved Pasture	2.8	25.6	27.2
Intense Agriculture	7.7	13.7	16.5
Wetlands	25.4	17.8	15.6
Native Upland Habitat	59.7	30.0	17.4
Lakes	2.4	2.5	3.1
Other Water	0.4	0.5	0.5
Total Percent	100	100	100

Acres of Conversions: 1940s - 1999

Land Use	Acres in Land Use Class		
	1940s	1979	1999
Actively Mined Lands	7,495	64,437	143,487
Urban Land Use	14,659	73,049	133,571
Improved Pasture	39,640	356,925	379,346
Intense Agriculture	107,115	191,496	229,832
Wetlands	354,674	249,255	218,232
Native Upland Habitat	834,311	419,449	242,849
Lakes	33,779	35,432	43,027
Other Water	5,011	6,641	6,338
Total	1,396,683	1,396,683	1,396,683

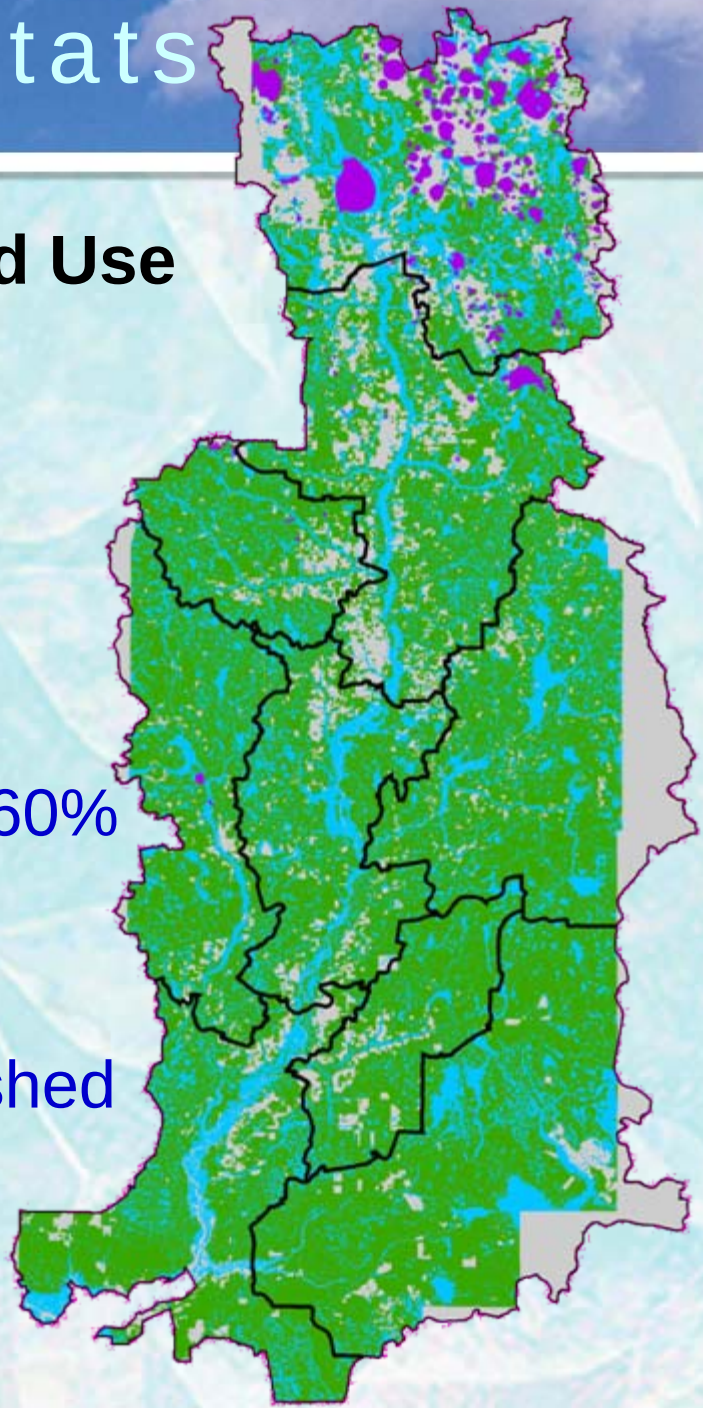
Changes at Watershed Level



Changes in Native Habitats

1940s Undeveloped Land Use

- Native Upland Habitat
- Wetland
- Lake

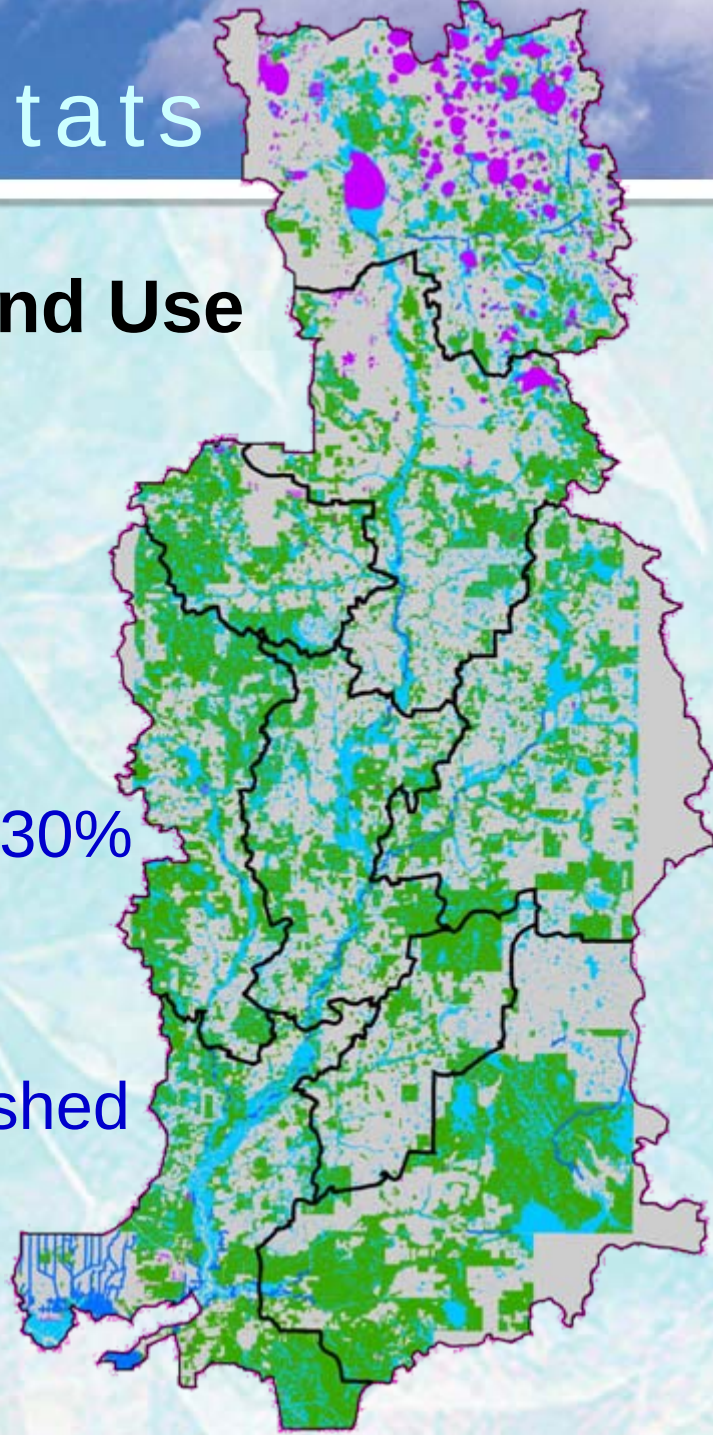


- Native Upland Habitats = 60% of watershed
- Wetlands = 25% of watershed

Changes in Native Habitats

1979 Undeveloped Land Use

- Native Upland Habitat
- Wetland
- Lake

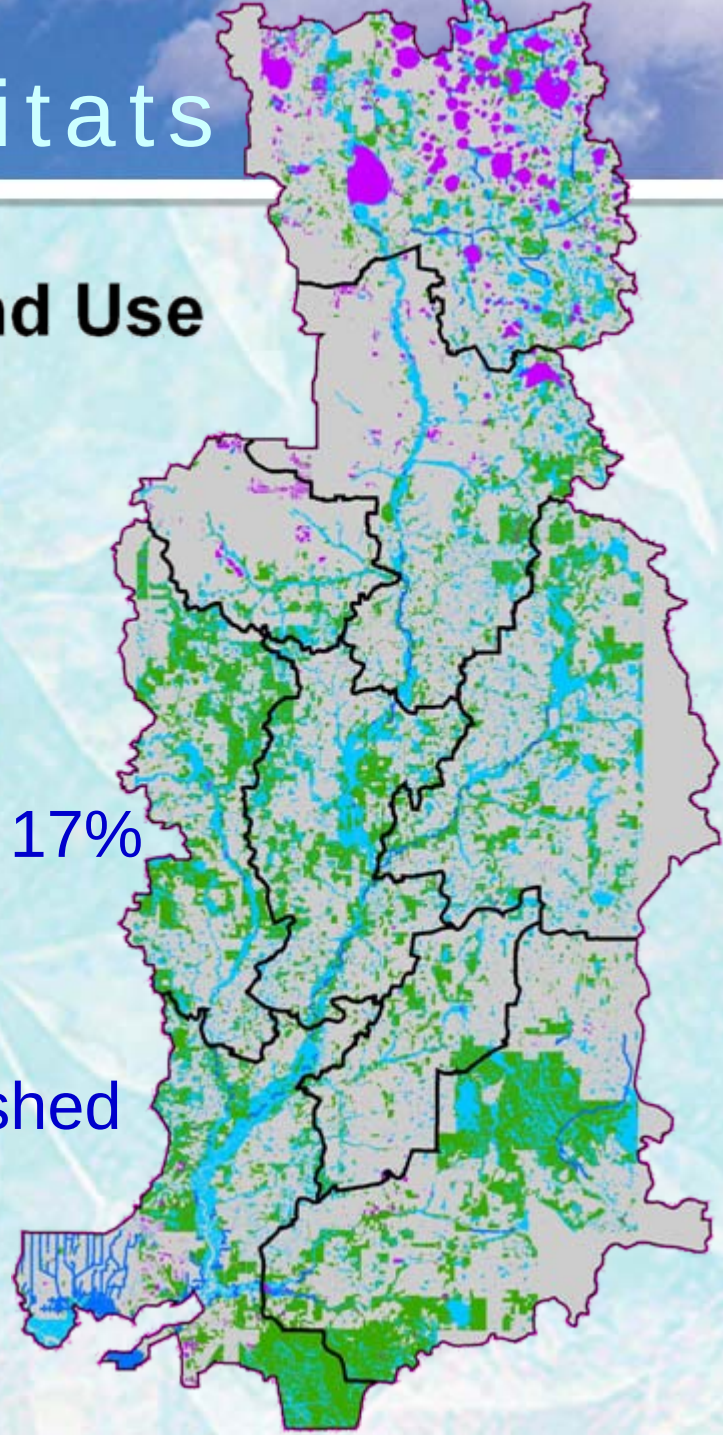


- Native Upland Habitats = 30% of watershed
- Wetlands = 18% of watershed

Changes in Native Habitats

1999 Undeveloped Land Use

- Native Upland Habitat
- Wetland
- Lake

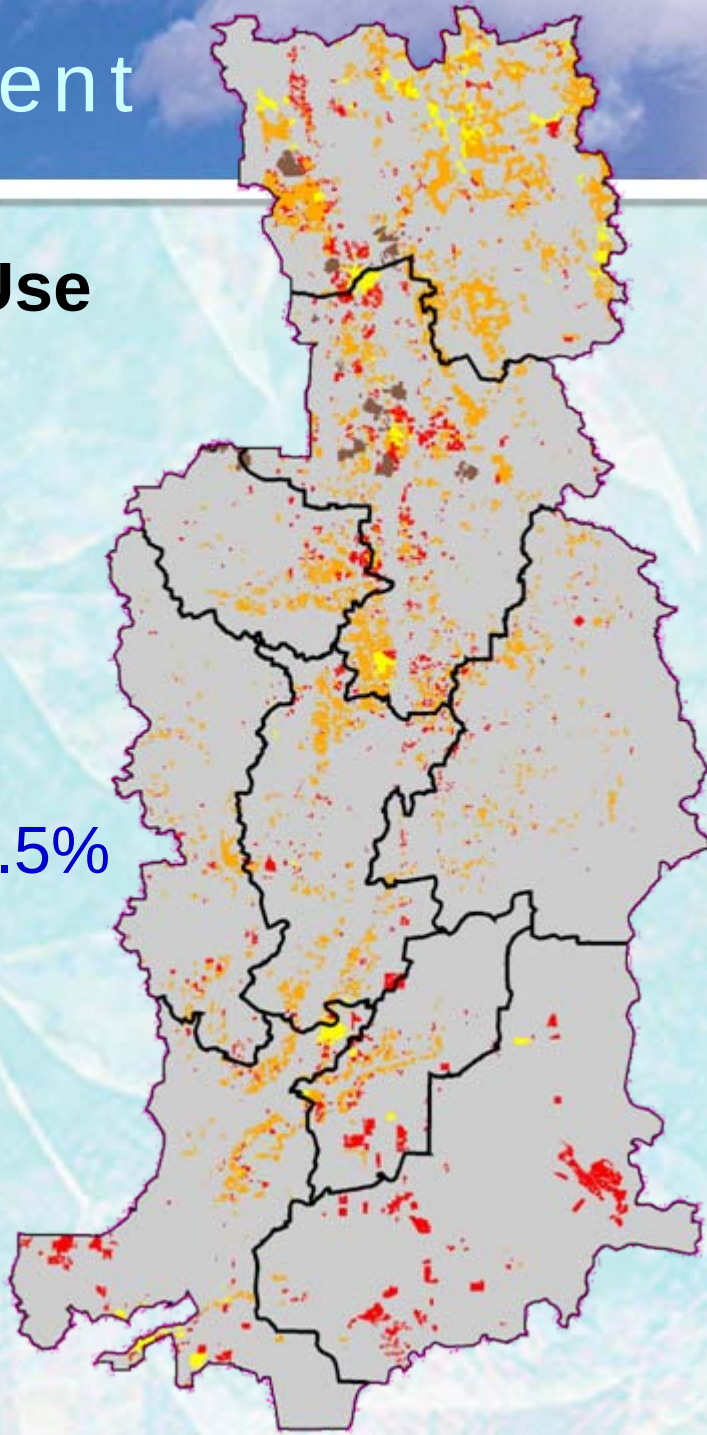


- Native Upland Habitats = 17% of watershed
- Wetlands =16% of watershed

Changes Due to Development

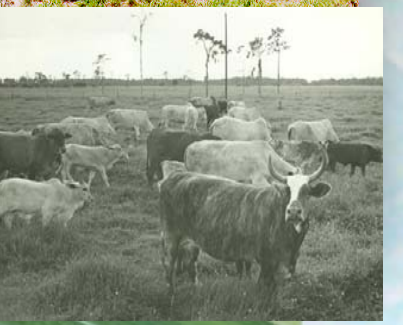
1940s Developed Land Use

- Improved Pasture
- Intensive Agriculture
- Urban Land Use
- Mining



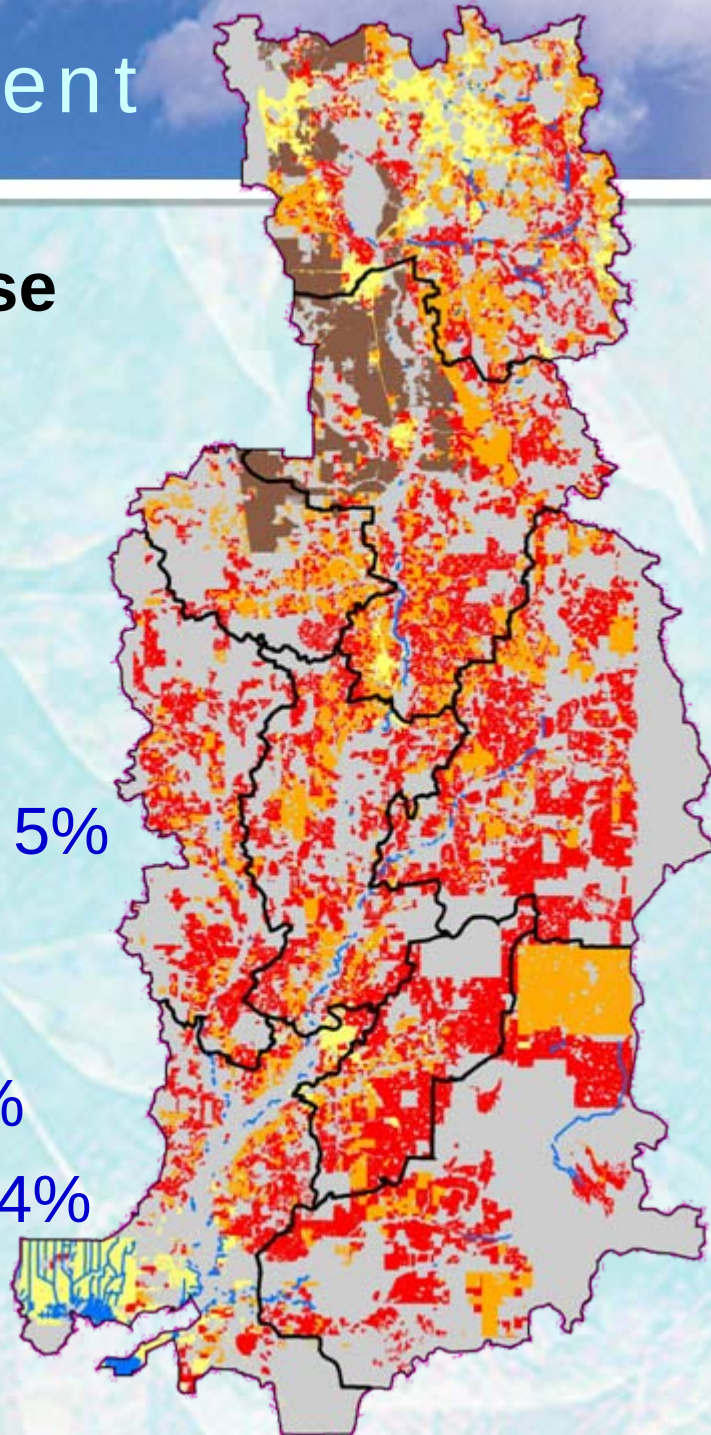
- Actively Mined Lands = 0.5% of watershed
- Urban Land Use = 1%
- Improved Pasture = 3%
- Intense Agriculture = 8%

Changes Due to Development



1979 Developed Land Use

- Improved Pasture
- Intensive Agriculture
- Urban Land Use
- Mining

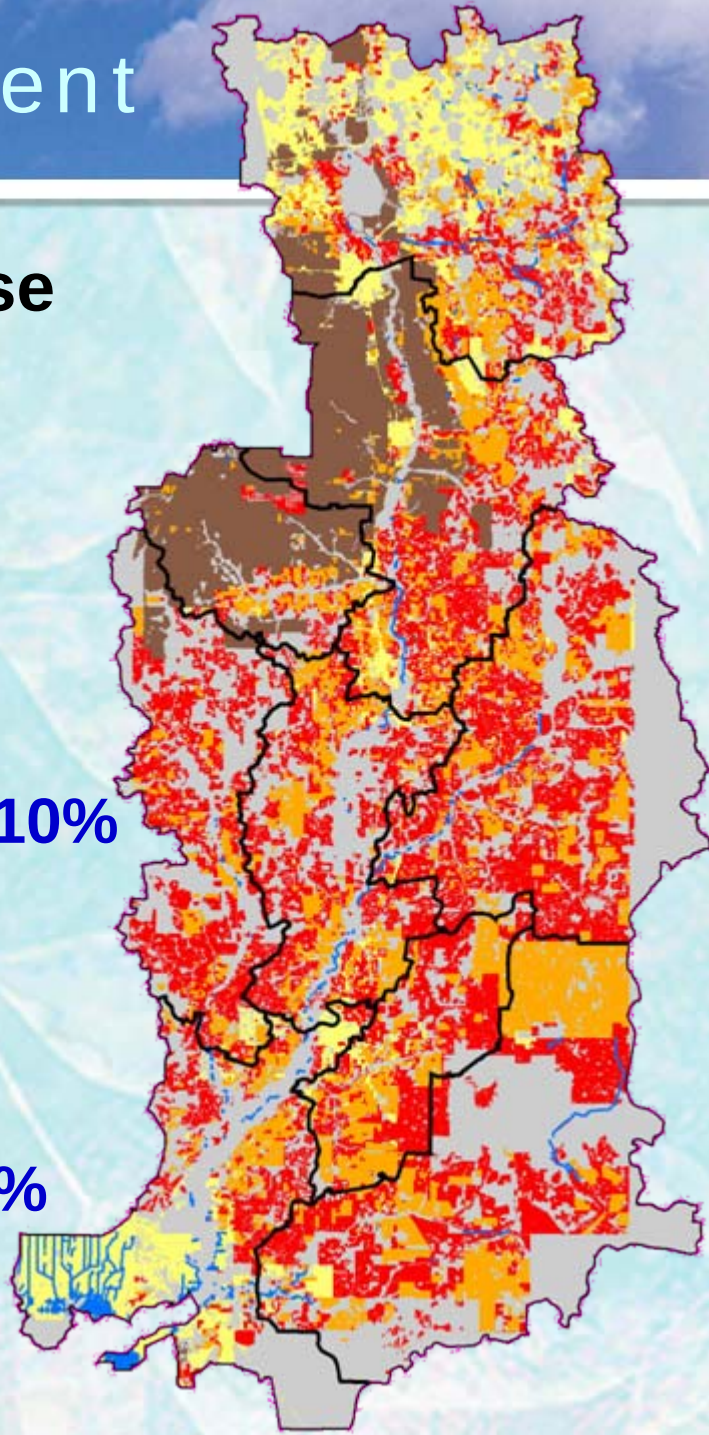


- Actively Mined Lands = 5% of watershed
- Urban Land Use = 5%
- Improved Pasture = 26%
- Intense Agriculture = 14%

Changes Due to Development

1999 Developed Land Use

- Improved Pasture
- Intensive Agriculture
- Urban Land Use
- Mining

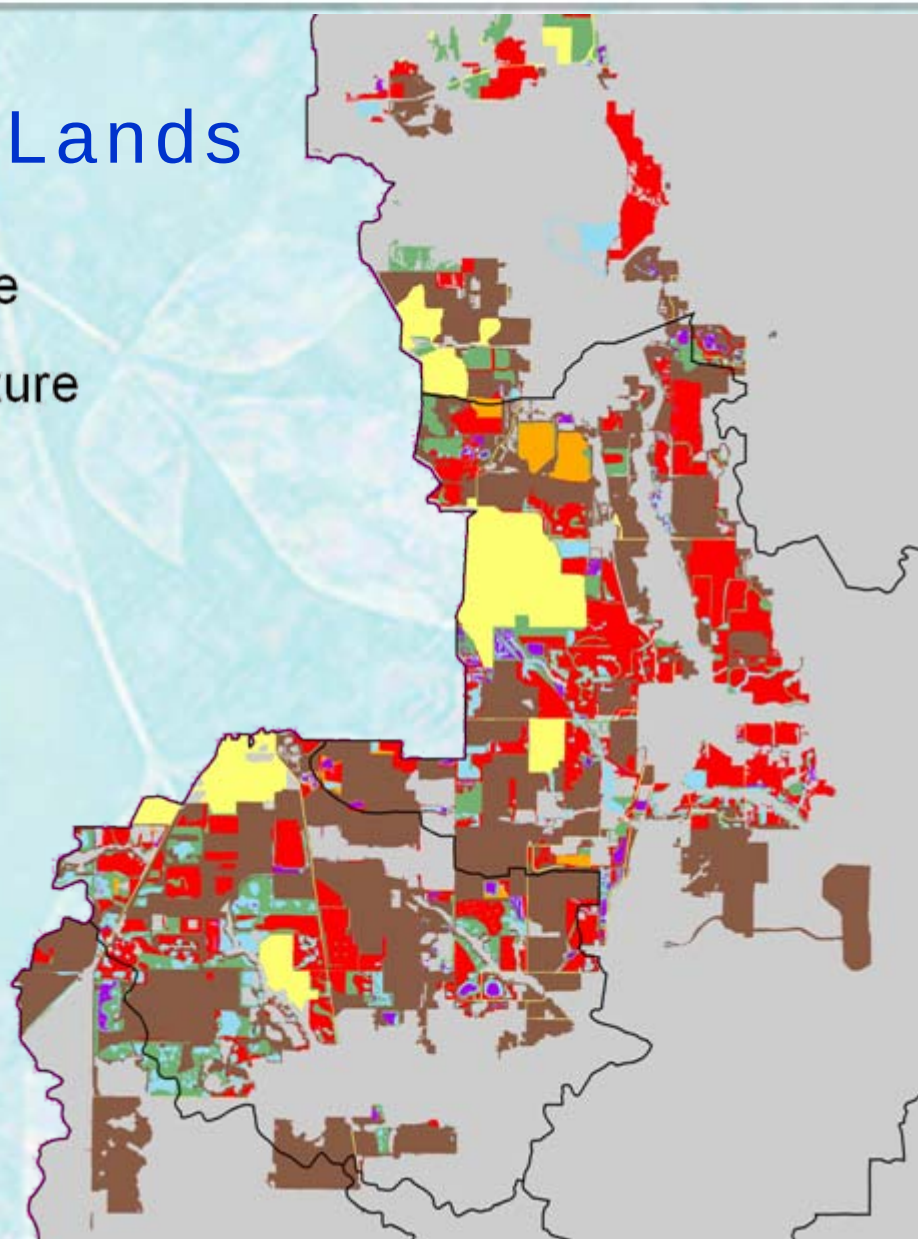


- **Actively Mined Lands = 10% of watershed**
- **Urban Land Use = 10%**
- **Improved Pasture = 27%**
- **Intense Agriculture = 17%**

Changes due to Mining

2000 Reclaimed Lands

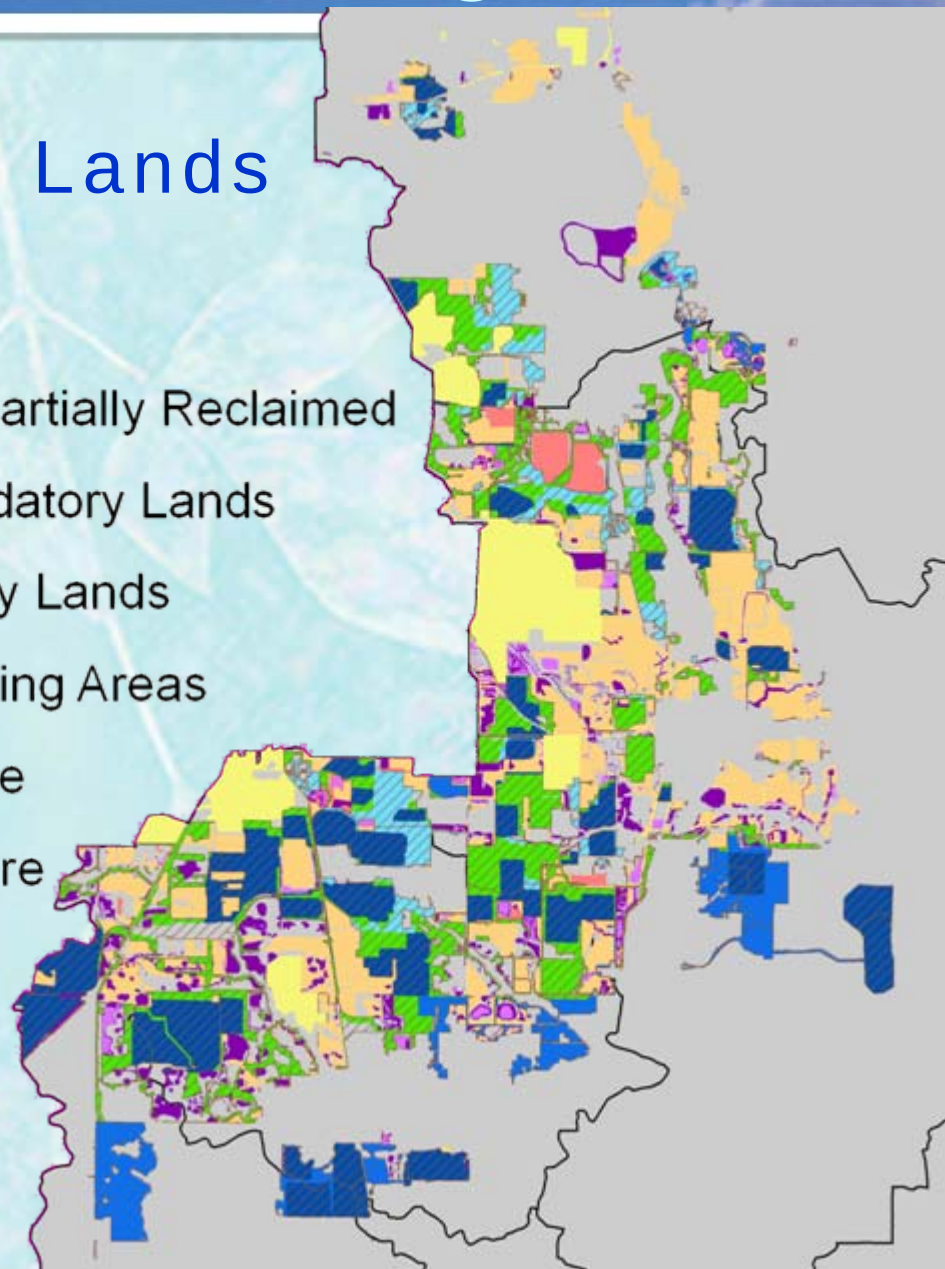
- Improved Pasture
- Intensive Agriculture
- Urban Land Use
- Extractive
- Upland Habitat
- Wetland
- Lake



Changes due to Mining

2000 Reclaimed Lands

- Extractive
- Lands Totally / Partially Reclaimed
- Mined Non Mandatory Lands
- Mined Mandatory Lands
- Active Clay Settling Areas
- Improved Pasture
- Intense Agriculture
- Urban
- Lake
- Wetland



Factors Affecting River Flow

- **Land-use changes (changes in hydroperiod)**
- **Hydrological structural alterations, changes in surface flows**
- **Historical changes in groundwater elevations (withdrawals)**
- **Natural climatic cycles (rainfall)**

Impacts of Flow Reductions

- **Potential decreases in public water supply**
- **Increased estuarine upstream movement of saltwater interface**
- **Decreased estuary productivity**

Changes in Rainfall/Flow Patterns

- **There have been changes in long-term rainfall/flow patterns in the Peace River Watershed**
- **The observed changes in rainfall (and flow) seem to be accounted for by the recently proposed AMO theory**

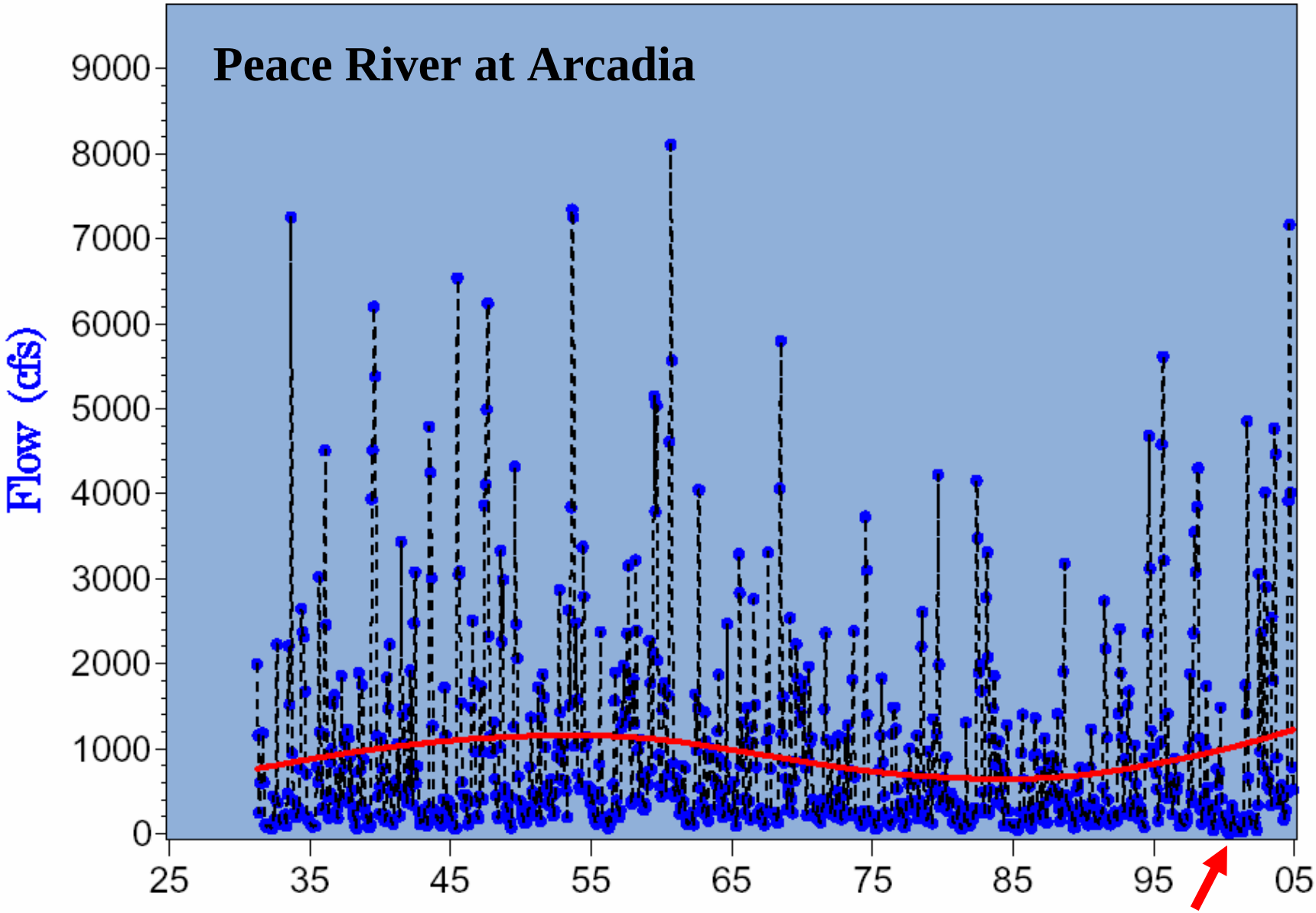


Figure D77. Monthly Q50 flow at long-term Peace River at Arcadia (2296750) gage (1931-2004)

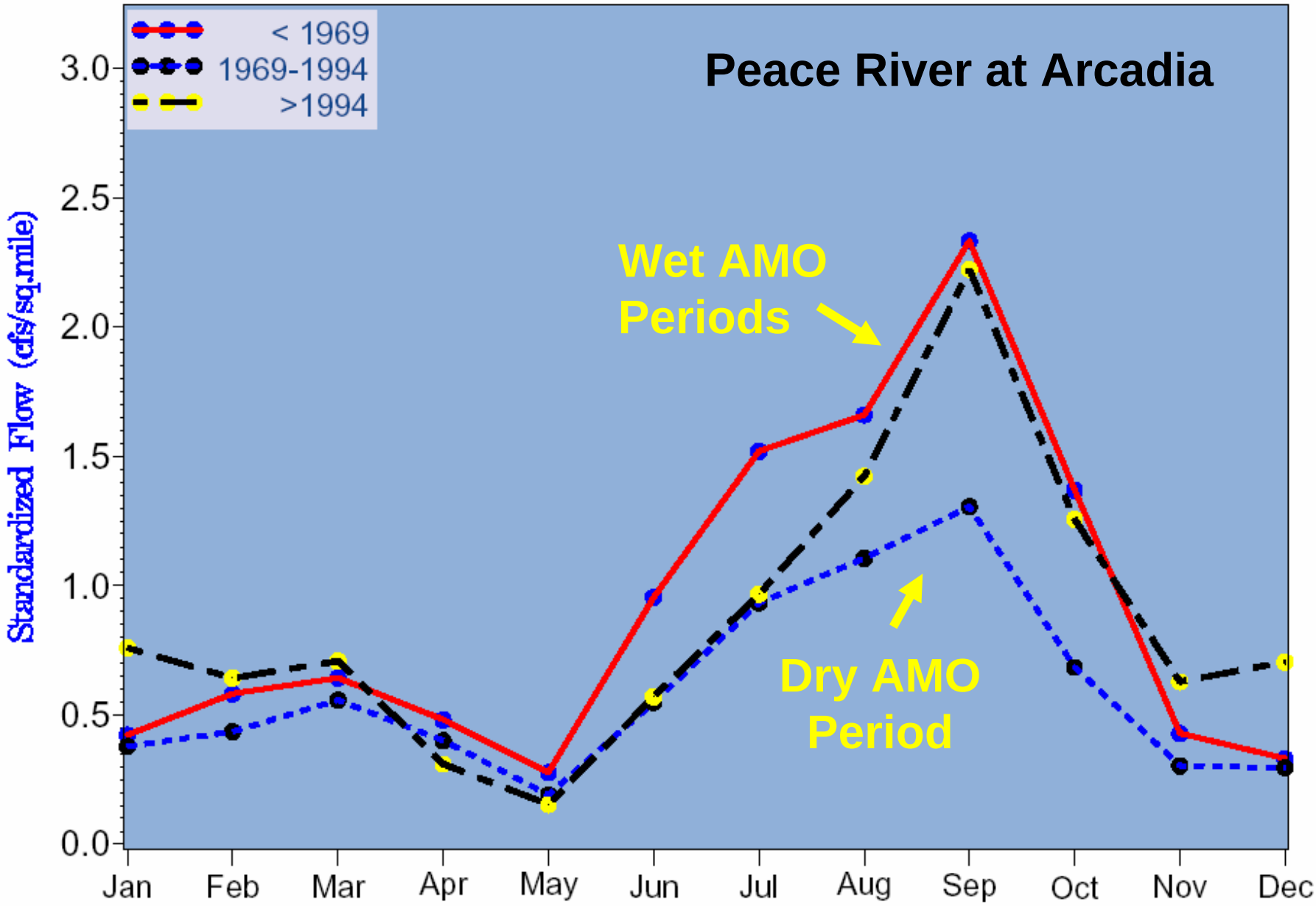


Figure D365. Seasonal differences among AMO periods of monthly mean flow at long-term Peace River at Arcadia (2296750) gage

Changes in Low Flow Characteristics

- **There have been significant long-term changes in low/base flow not related to rainfall patterns**
  - **Upper watershed declines caused by:**
    - **Loss of spring flows**
    - **Declines in groundwater levels**
    - **Declines in discharges**
  - **Lower watershed subbasins (Horse, Joshua, Shell and Prairie Creeks)**
    - **increases due to agricultural groundwater discharges**

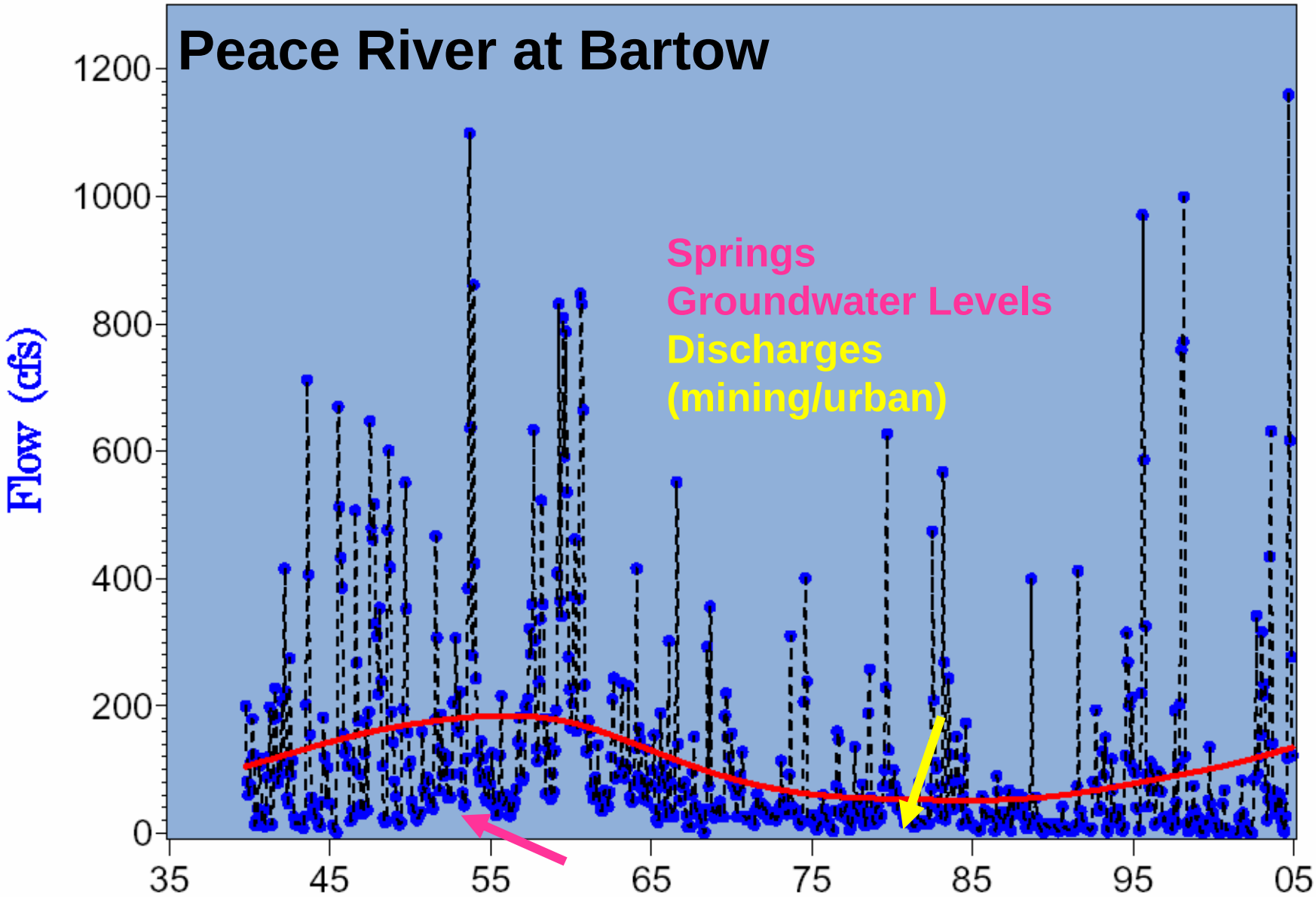


Figure D3. Monthly minimum flow at long-term Peace River at Bartow (2294650) gage (1939-2004)

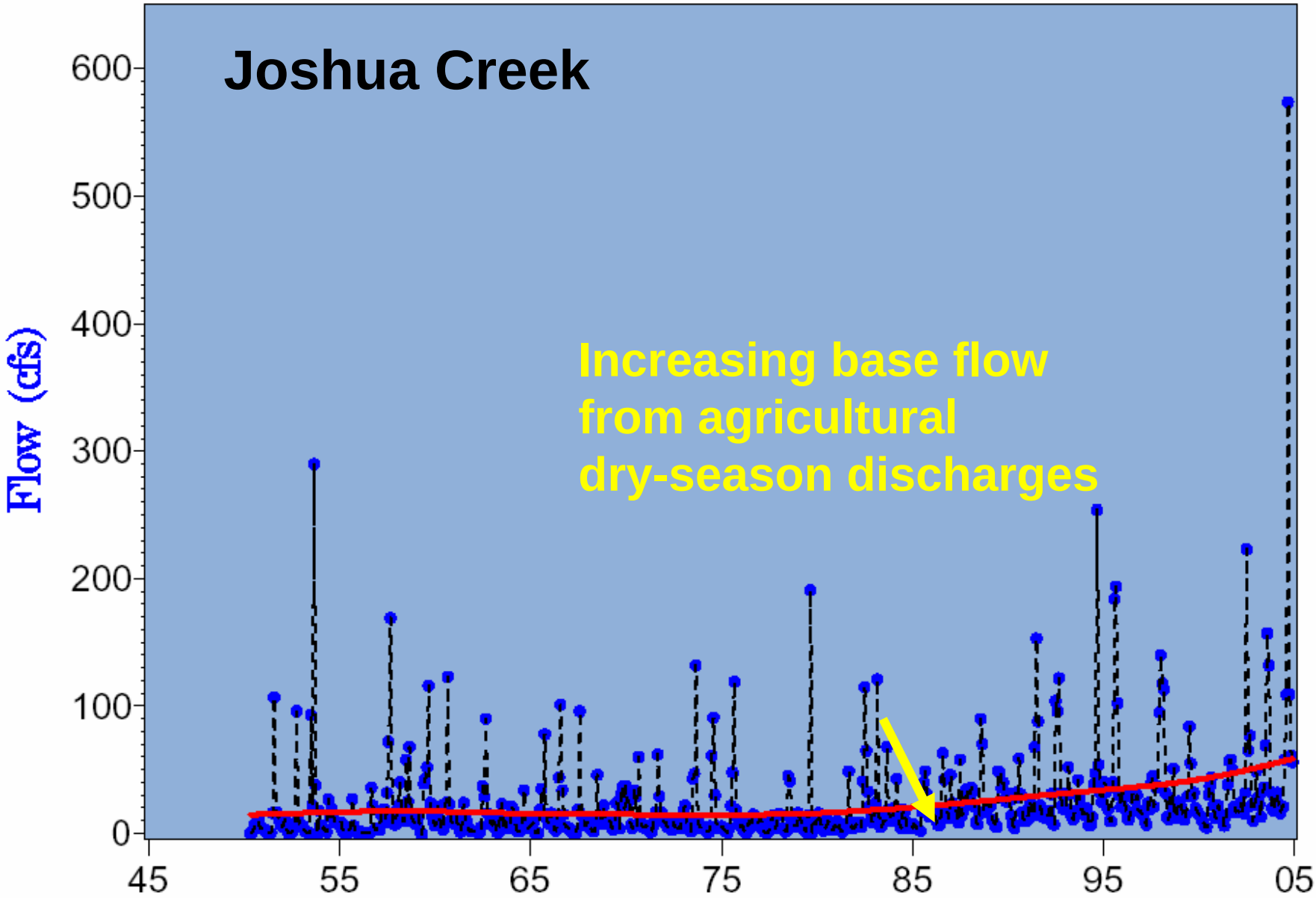
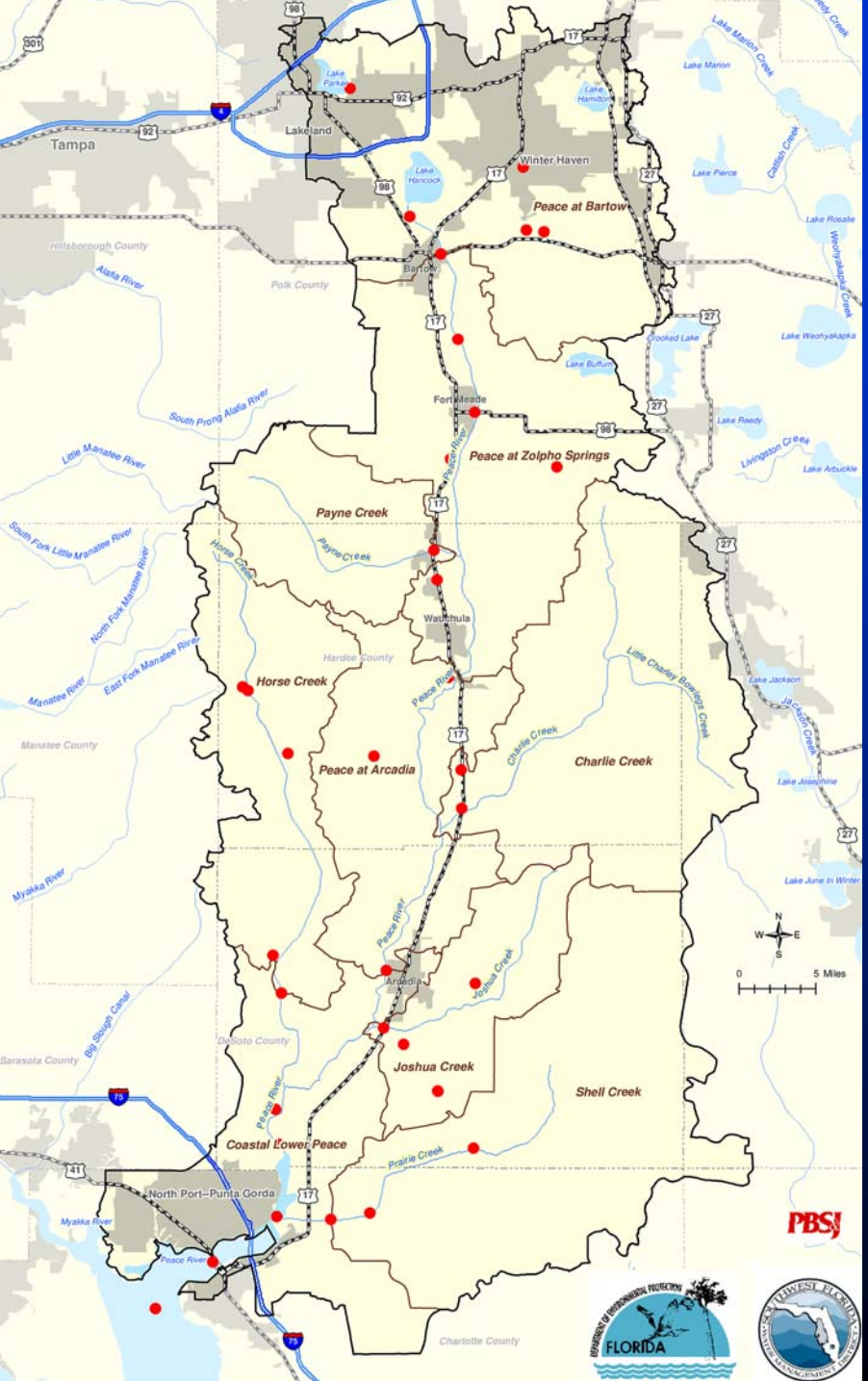


Figure D10. Monthly minimum flow at long-term Joshua Creek at Nocatee (2297100) gage (1950-2004)



Water Quality Trends and Status

- Long-term patterns and changes in parameters at 40+ watershed and estuarine sites
- Comparisons of current status among selected characteristic sites for key constituents

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

Summary of Water Quality

- **Upper river historically received direct discharges from both phosphate mining/beneficiation and urban sewage treatment**
- **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**
- **Different spatial long-term patterns**
  1. ***Relative* improvements in water quality northern watershed**
  2. **Significant degradation of surface water quality in southern basins**

Historical & Modern Patterns of Fishes