



Streamflow Statistics for the Yellowstone Unregulated and Regulated Conditions

*In cooperation with the Army Corps of Engineers
and the Yellowstone River Conservation District Council*

Katherine J. Chase, P.E.
November 15, 2013

U.S. Department of the Interior
U.S. Geological Survey

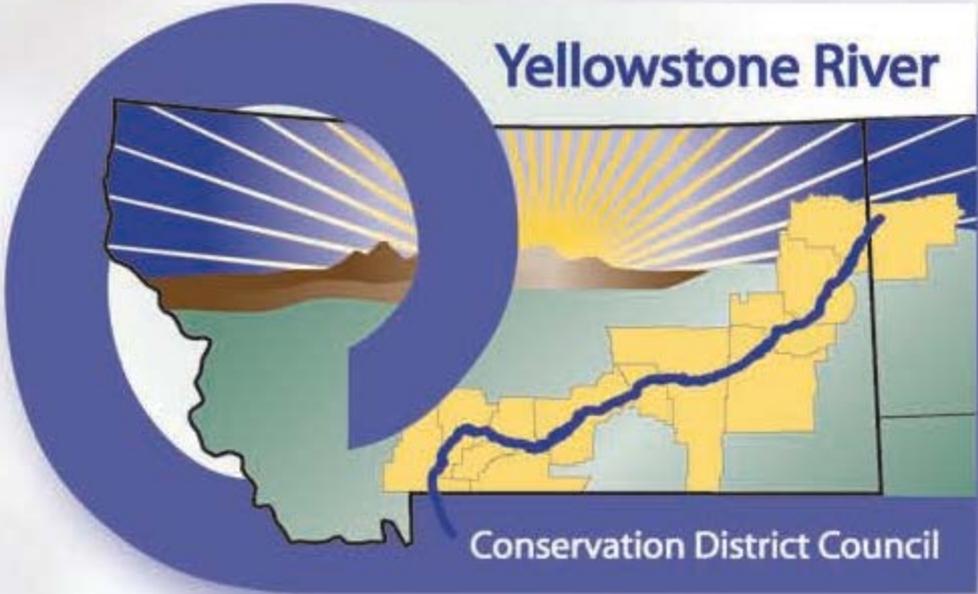


Yellowstone R at Yellowstone Lake Outlet

Yellowstone River Basin



Yellowstone River



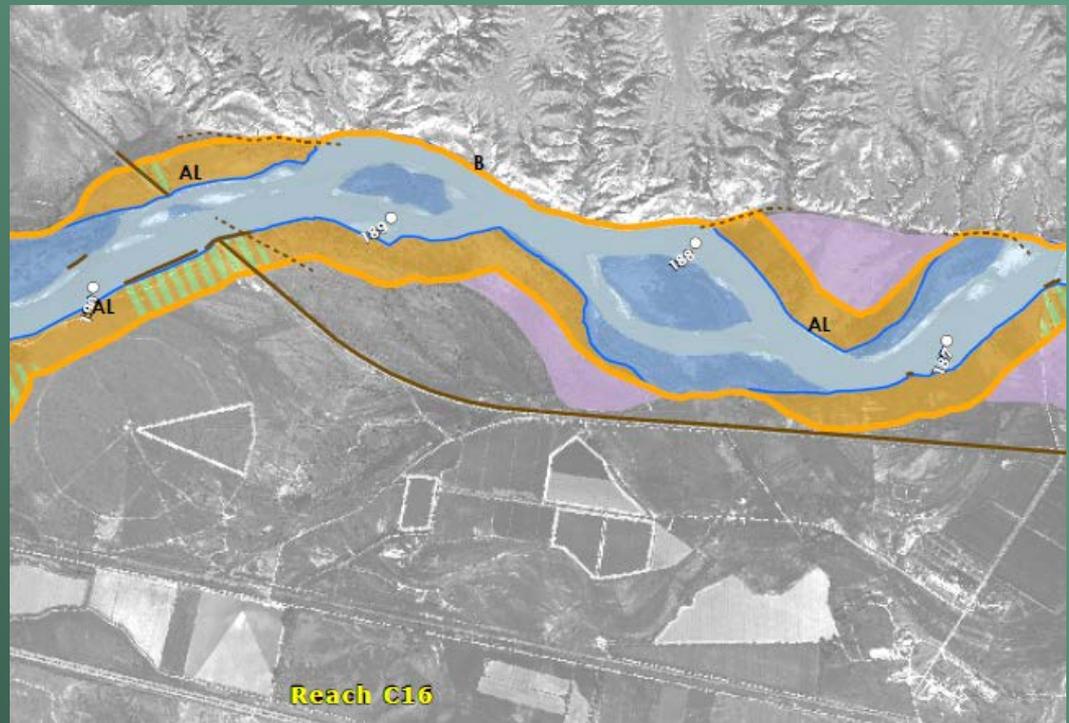
Conservation District Council

Cumulative Effects Study

- **Geomorphology and Channel Migration**
- **Physical Features Inventories**
- **Floodplain Studies**
- **Riparian Vegetation Characterization**
- **Avian Communities**
- **Fisheries**
- **Invasive Plants Species Inventory & Analysis**
- **Water Quality**
- **Etc.....**

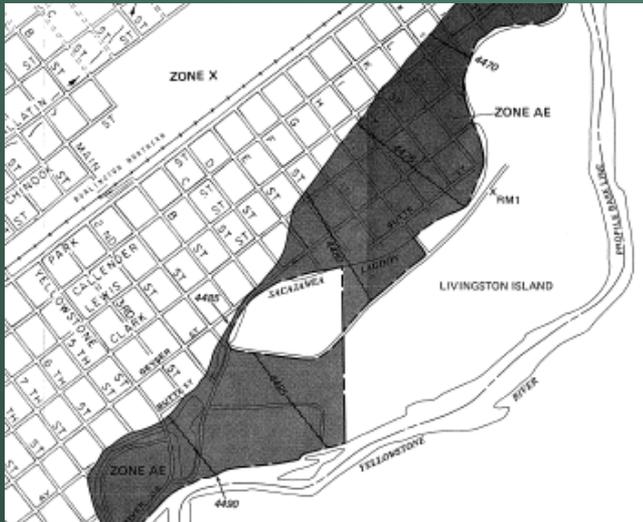
Cumulative Effects Study

- Geomorphology and Channel Migration
- Physical Features Inventories



Cumulative Effects Study

- Floodplain Studies
- Riparian Vegetation Characterization



Cumulative Effects Study

- Avian Communities
- Fisheries



Cumulative Effects Study



- Invasive Plants Species Inventory & Analysis
- Water Quality
- Etc....

Streamflow Statistics

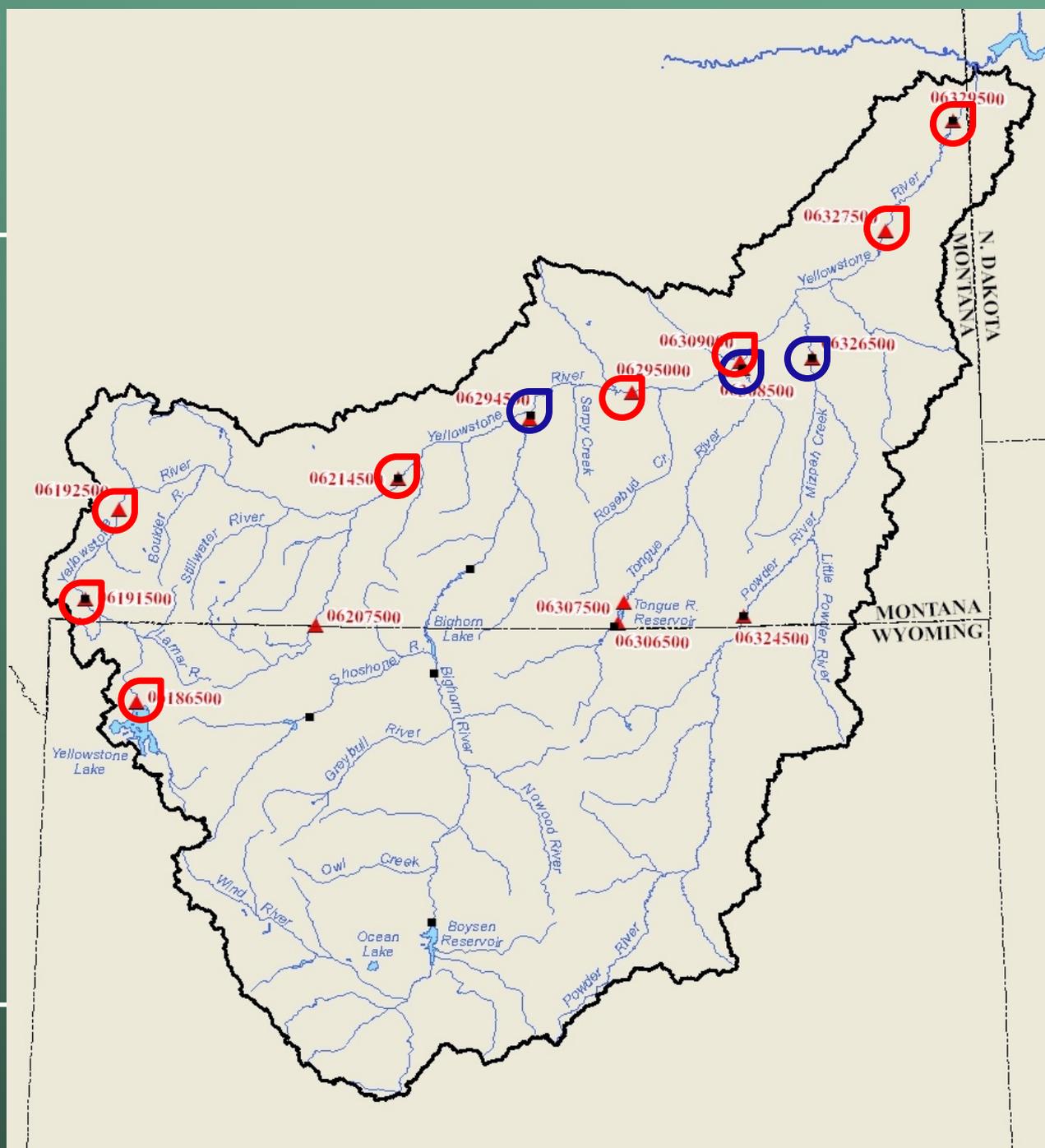
Need *homogeneous* data set to apply Bulletin 17B procedures used in the statistical analysis.

Streamflow Statistics 1928-2002

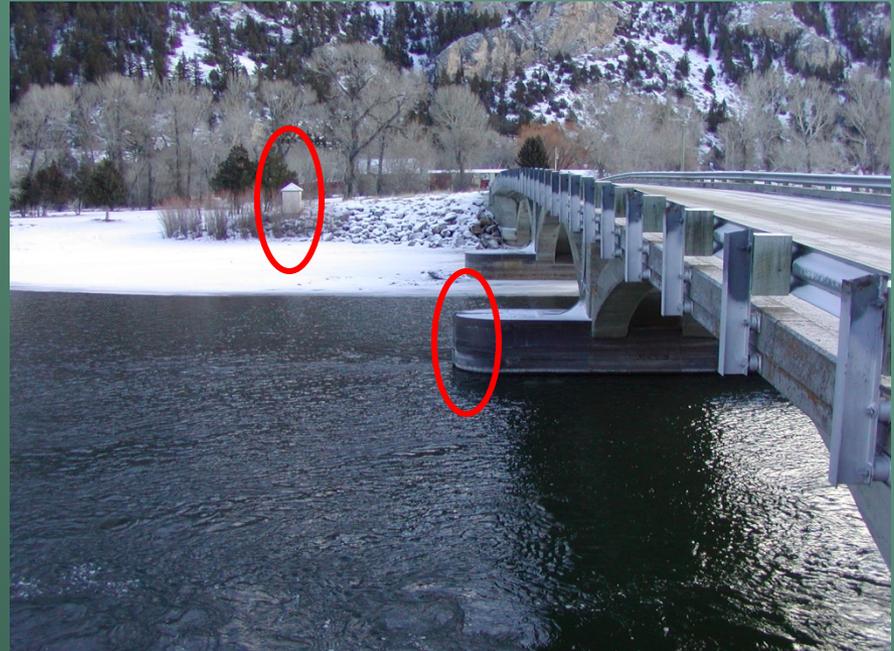
- **Unregulated flow condition – no water resources development in basin**
- **Regulated flow condition – 2002-level of development applied over 1928-2002 study period**

11 Selected Gages

- Yellowstone (8)
- Bighorn (1)
- Tongue (1)
- Powder (1)



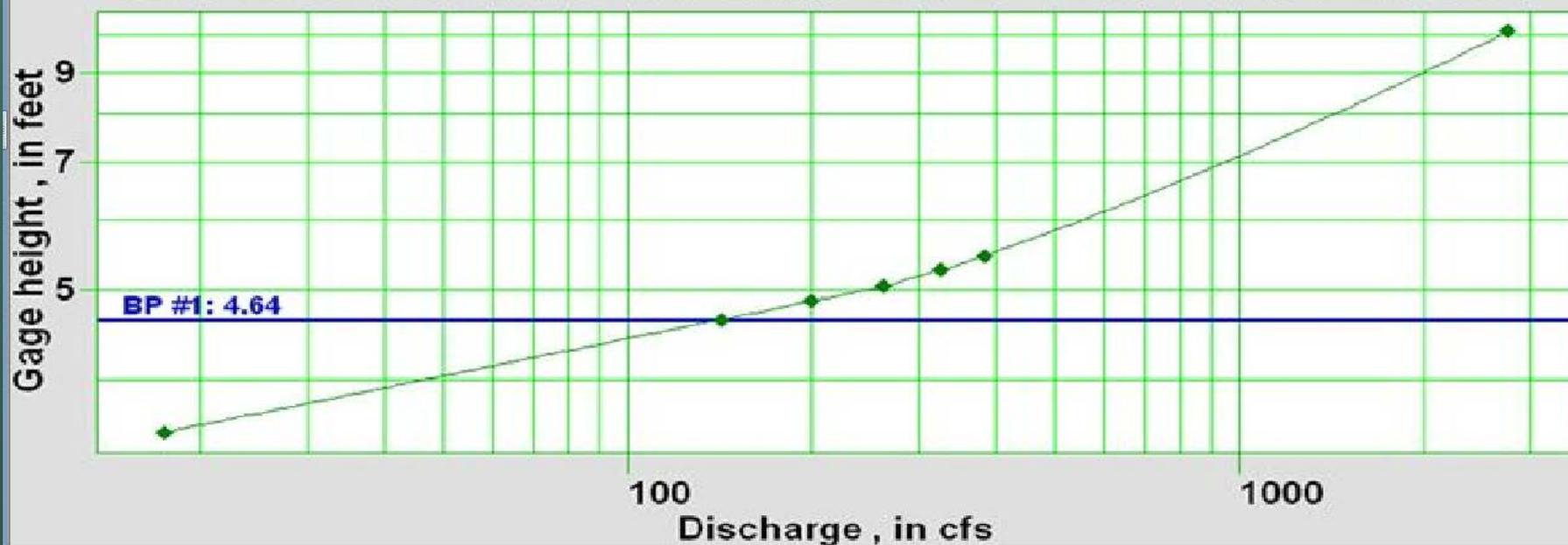
Observed Streamflows



Yellowstone River near Livingston

Rating Curve Example

Site Number: 000000003 - Site Name: Rating Exercise #7 - DD: 6 - Rating Number: 0000



Observed Streamflows

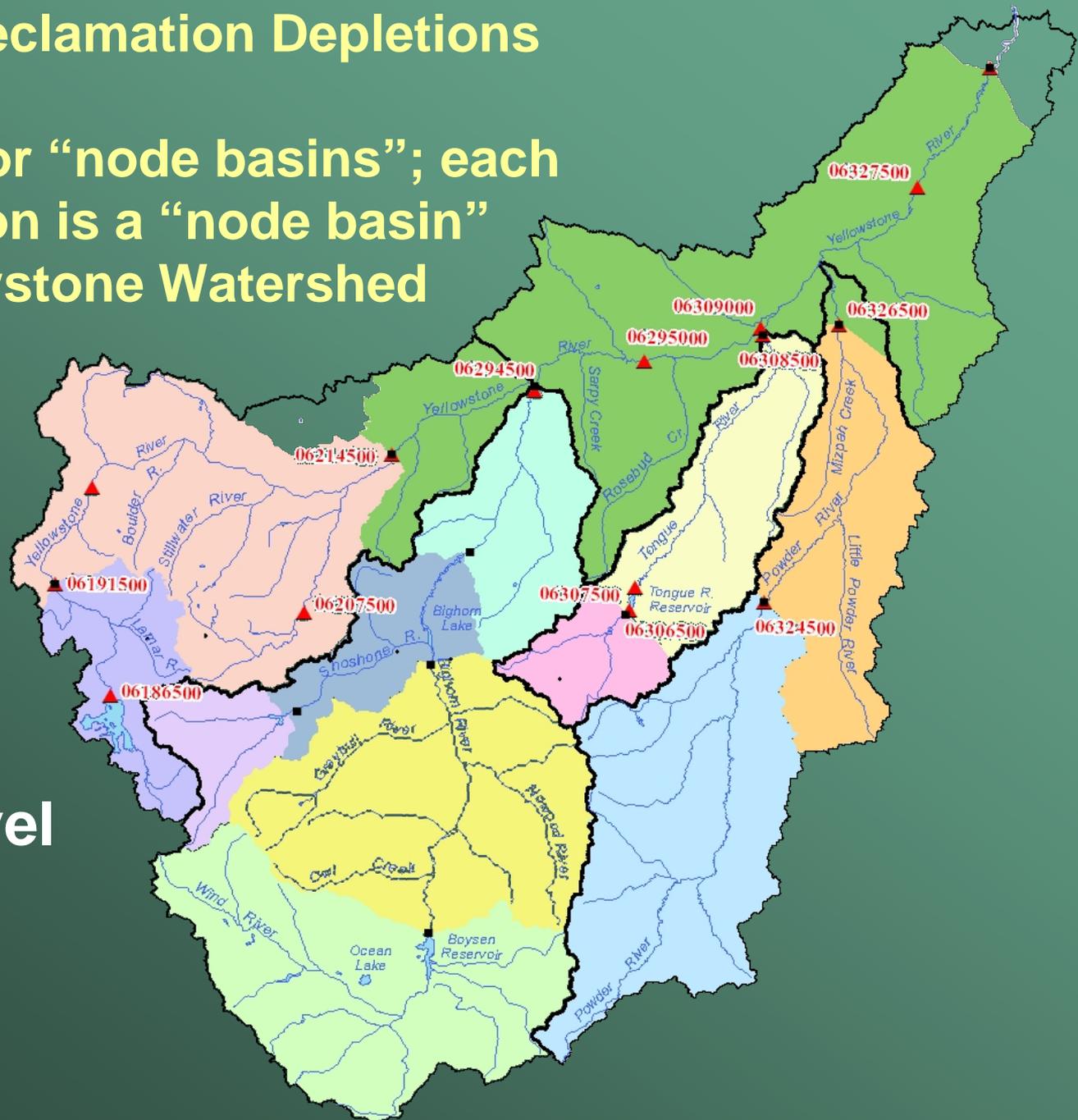


Synthesis of Missing Records

- **Monthly mean streamflows – Calculated using Move-1 statistical technique**
- **Daily mean streamflows – Distributed monthly to daily using daily/monthly ratios from similar gages**

Bureau of Reclamation Depletions

Calculated for “node basins”; each shaded region is a “node basin” in the Yellowstone Watershed

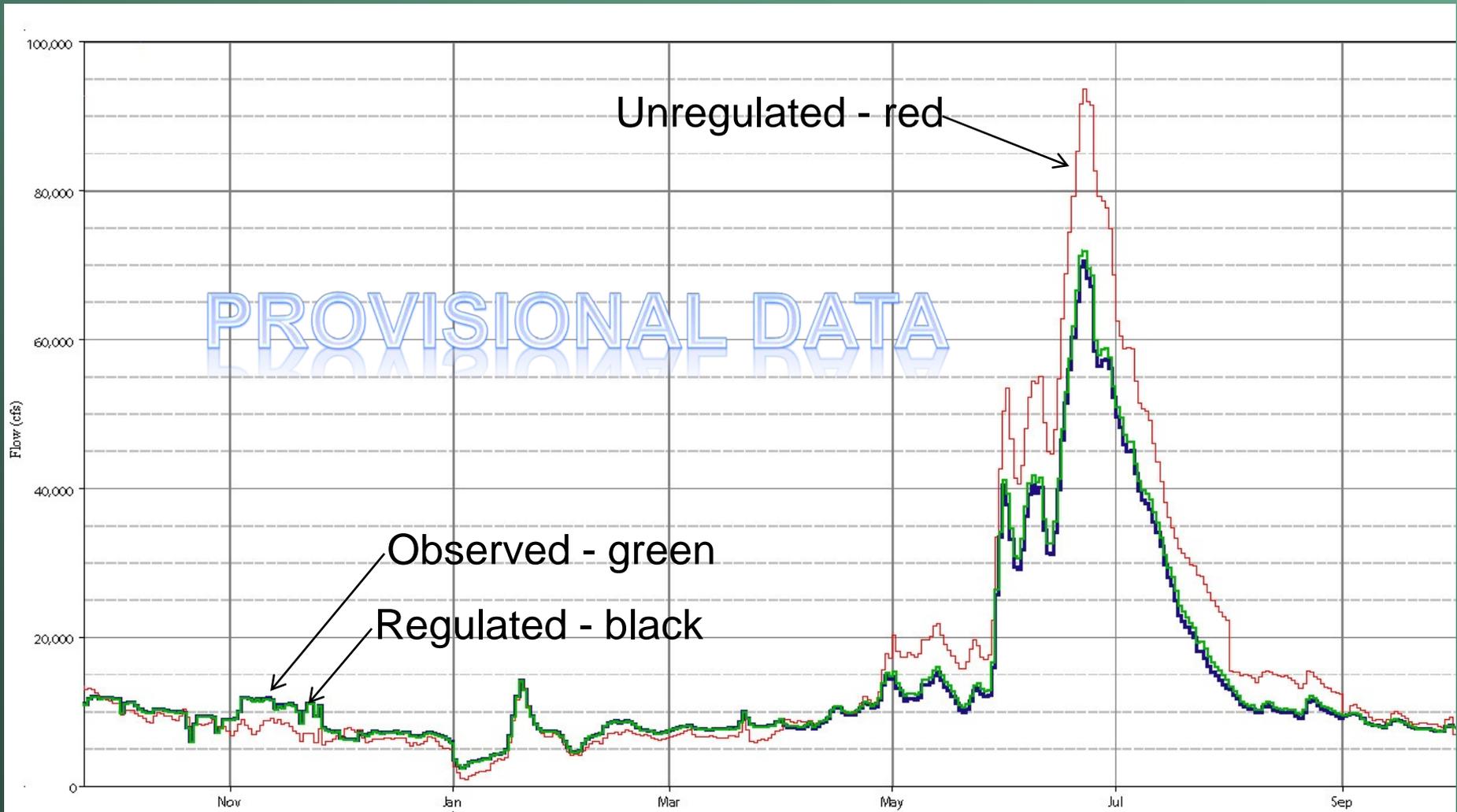


- Historic
- 2002-Level

Estimated Streamflow Conditions

- **Unregulated = Observed + Historic Depletions**
- **Regulated = Unregulated – 2002-level Depletions**

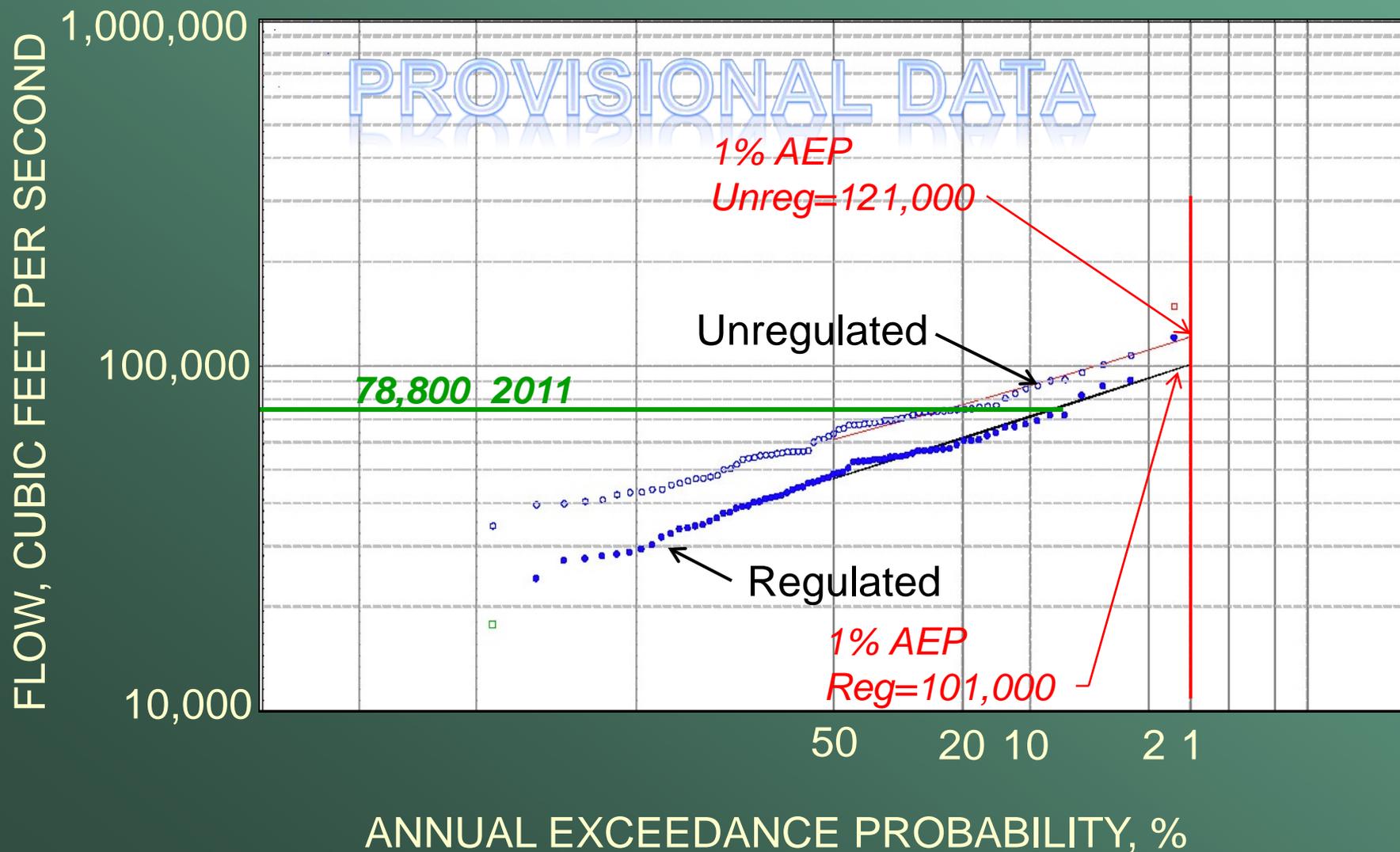
Forsyth Daily Streamflows, WY 1974



Streamflow Statistics

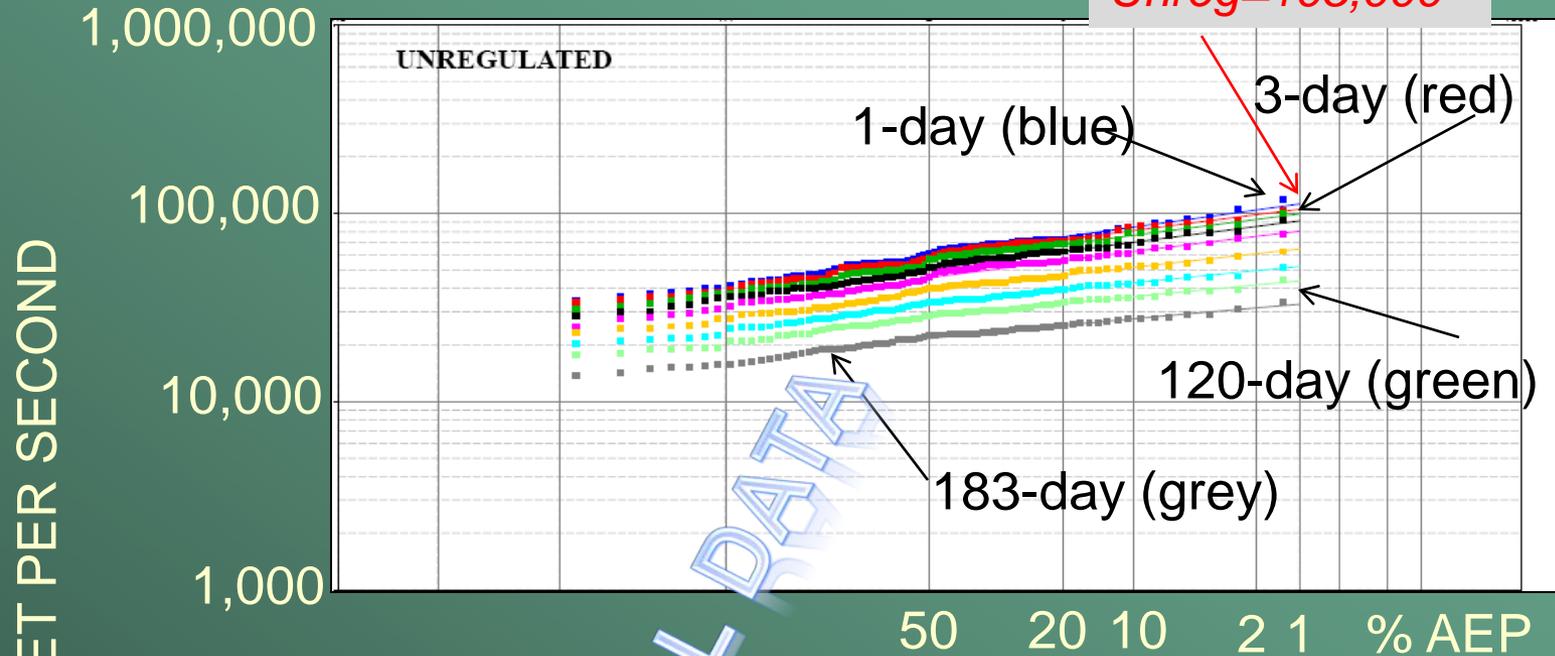
- Peak flow-frequency
- High-flow frequency
- Low-flow frequency
- Flow-duration

Yellowstone River at Forsyth Peak Flow Frequency

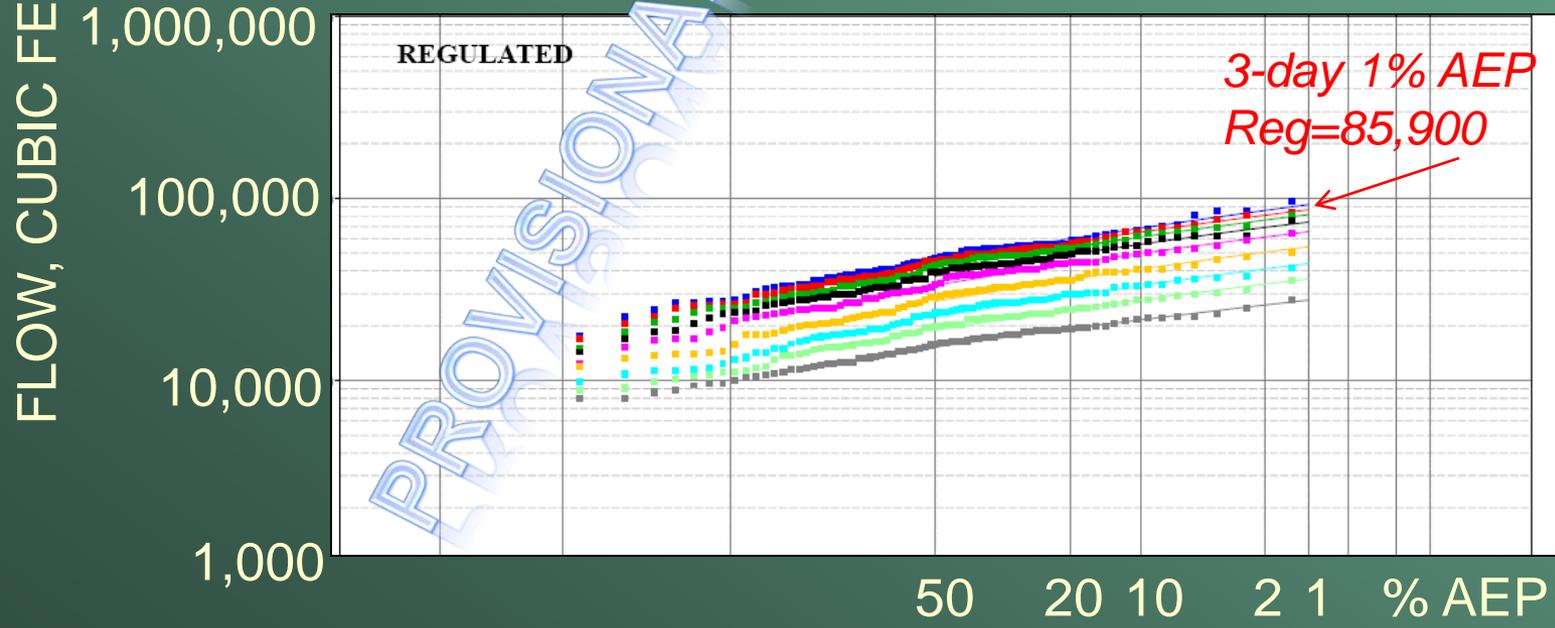


Yellowstone River at Forsyth

High-flow frequency



3-day 1% AEP
Unreg=105,000

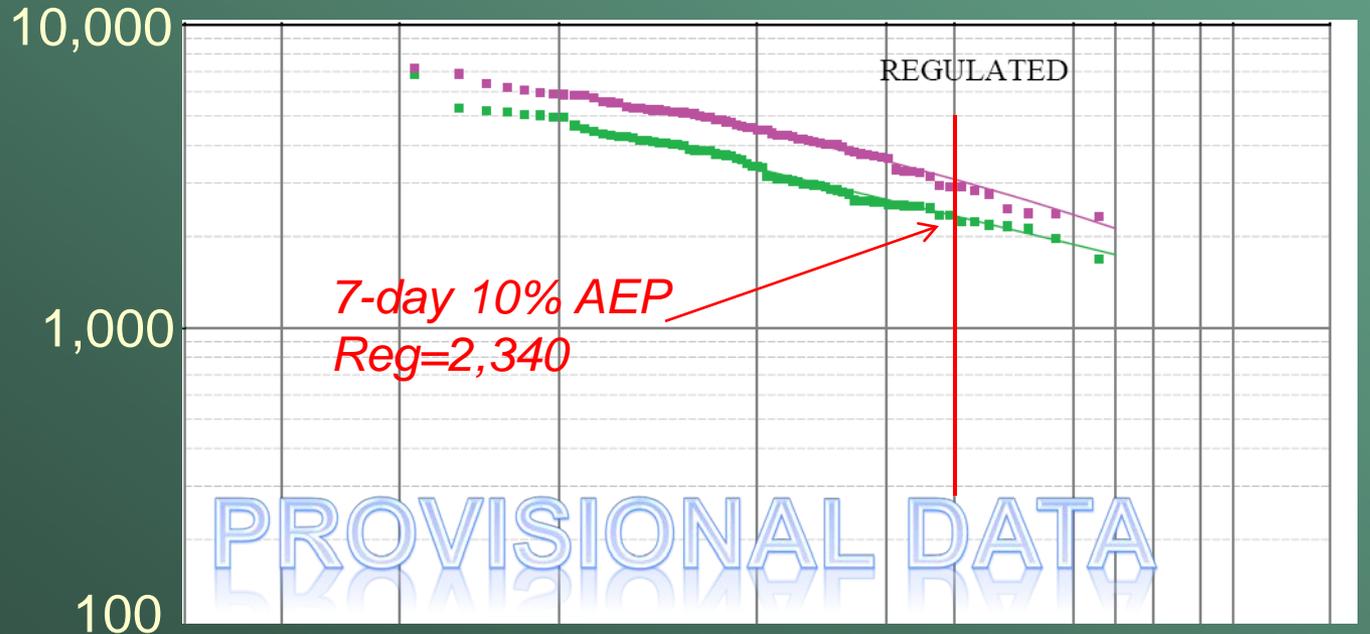
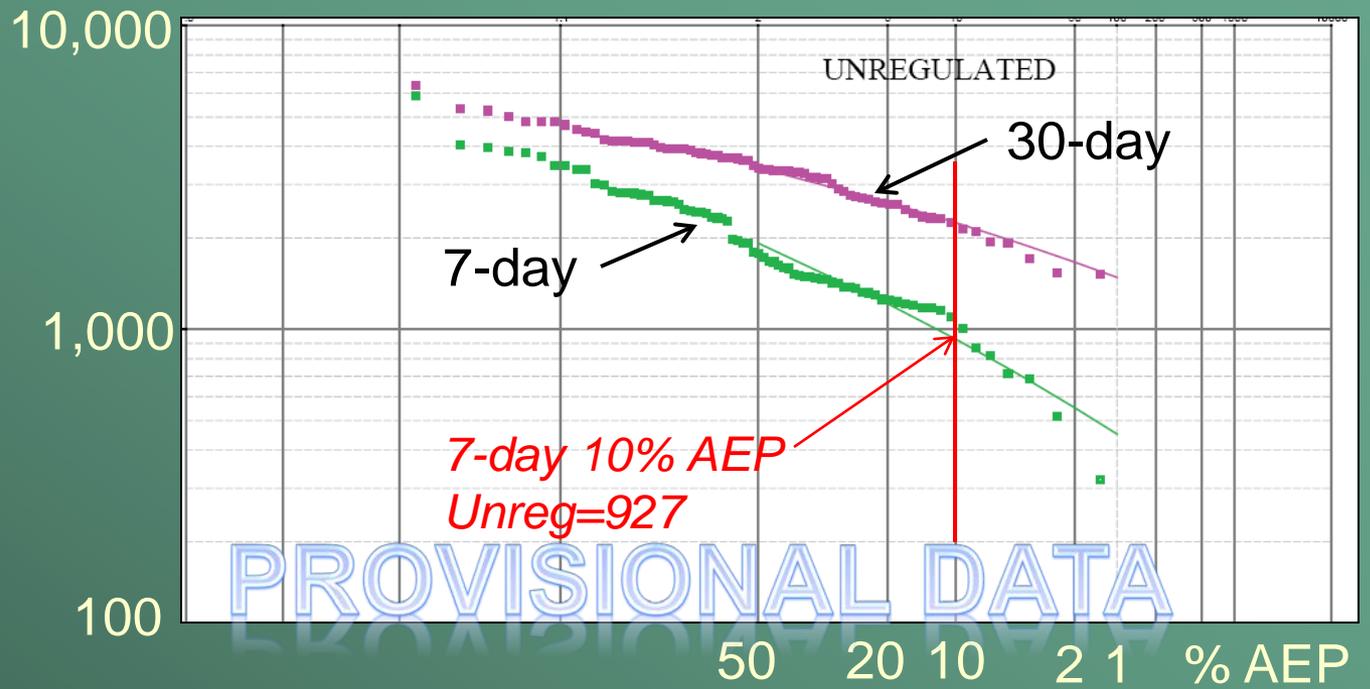


3-day 1% AEP
Reg=85,900

PROVISIONAL DATA

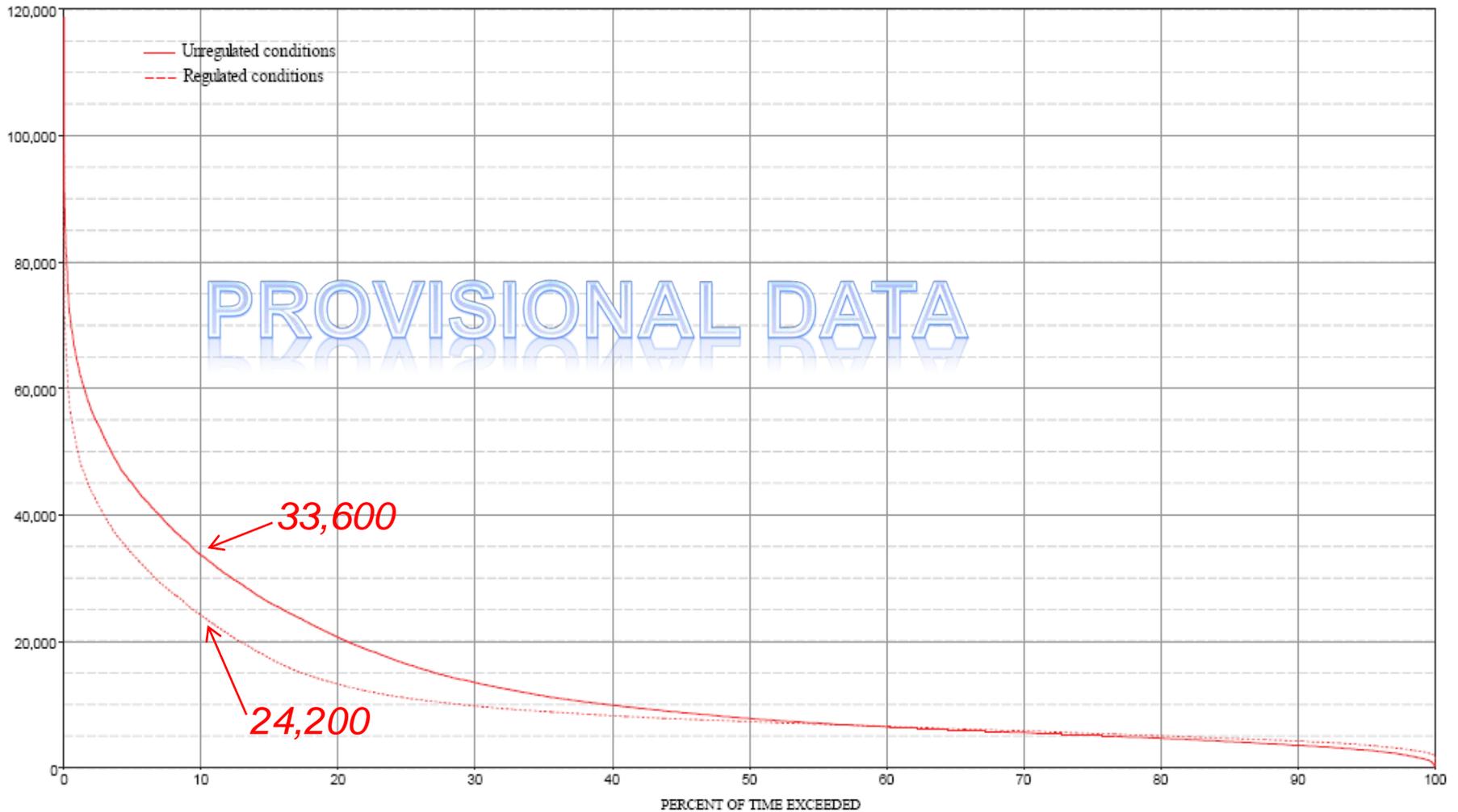
Yellowstone River at Forsyth Low-flow frequency

FLOW, CUBIC FEET PER SECOND



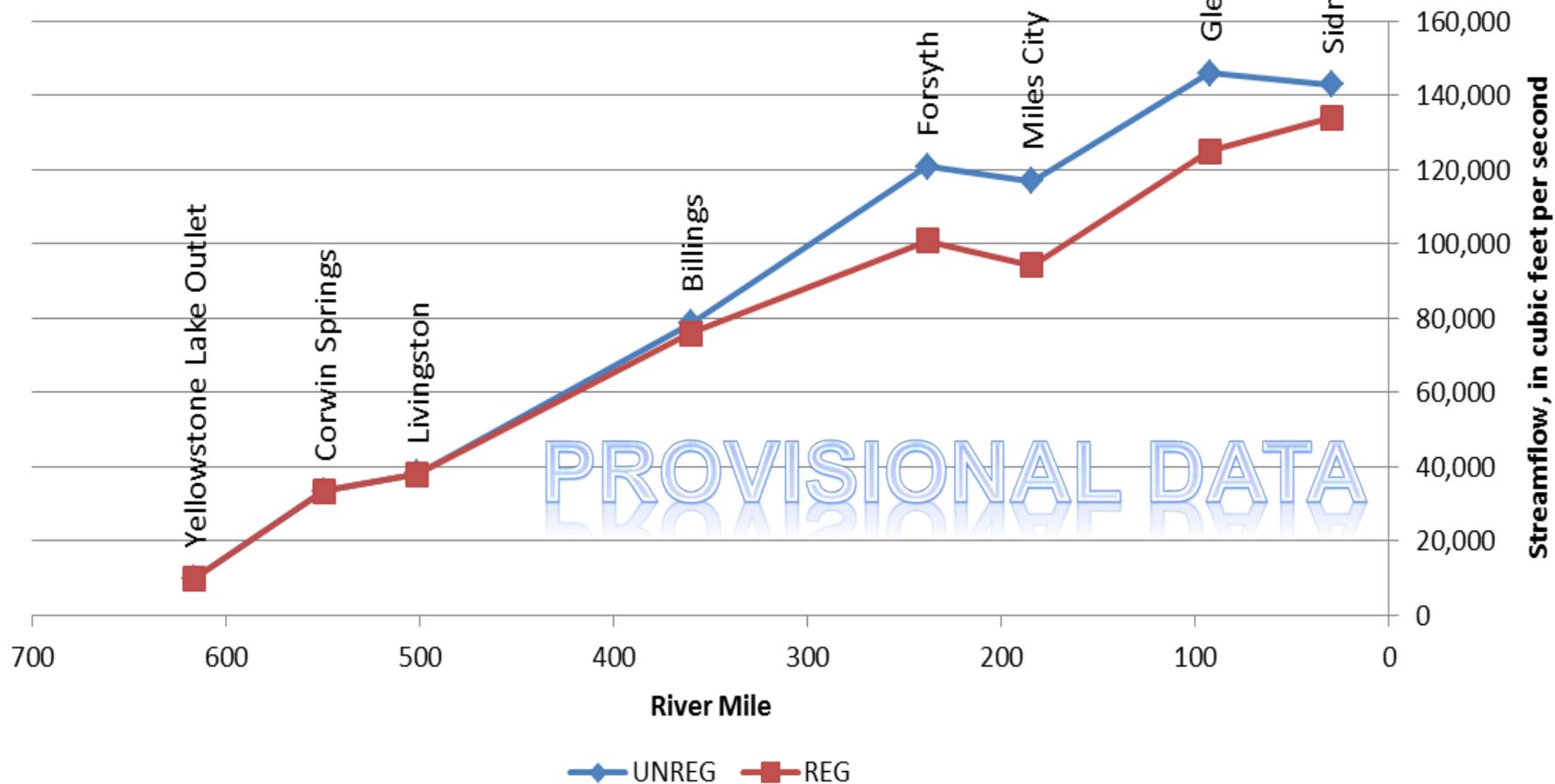
Yellowstone River at Forsyth Flow-duration

FLOW, CUBIC FEET PER SECOND

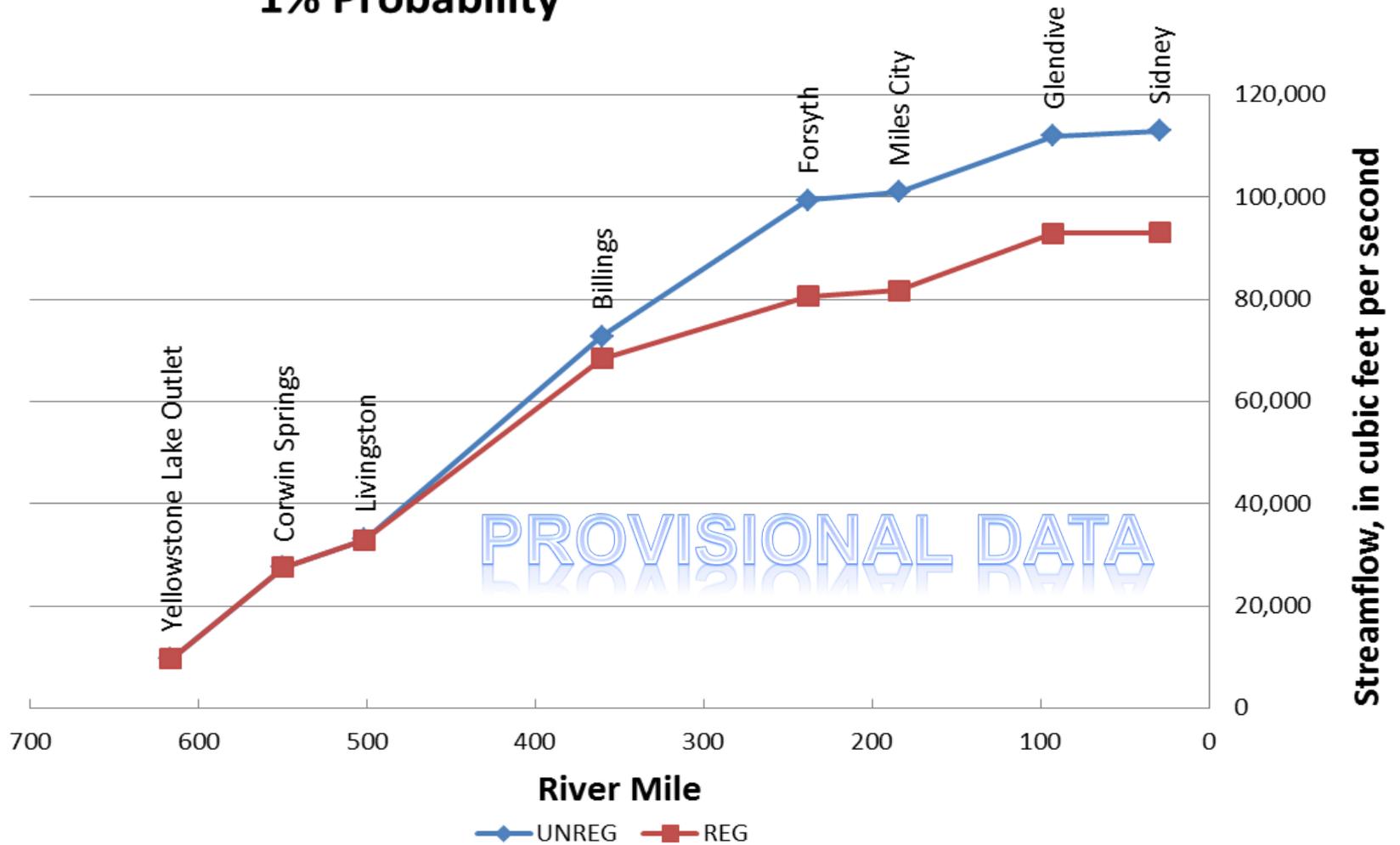


Yellowstone River

1% Annual Exceedance Peak Flows

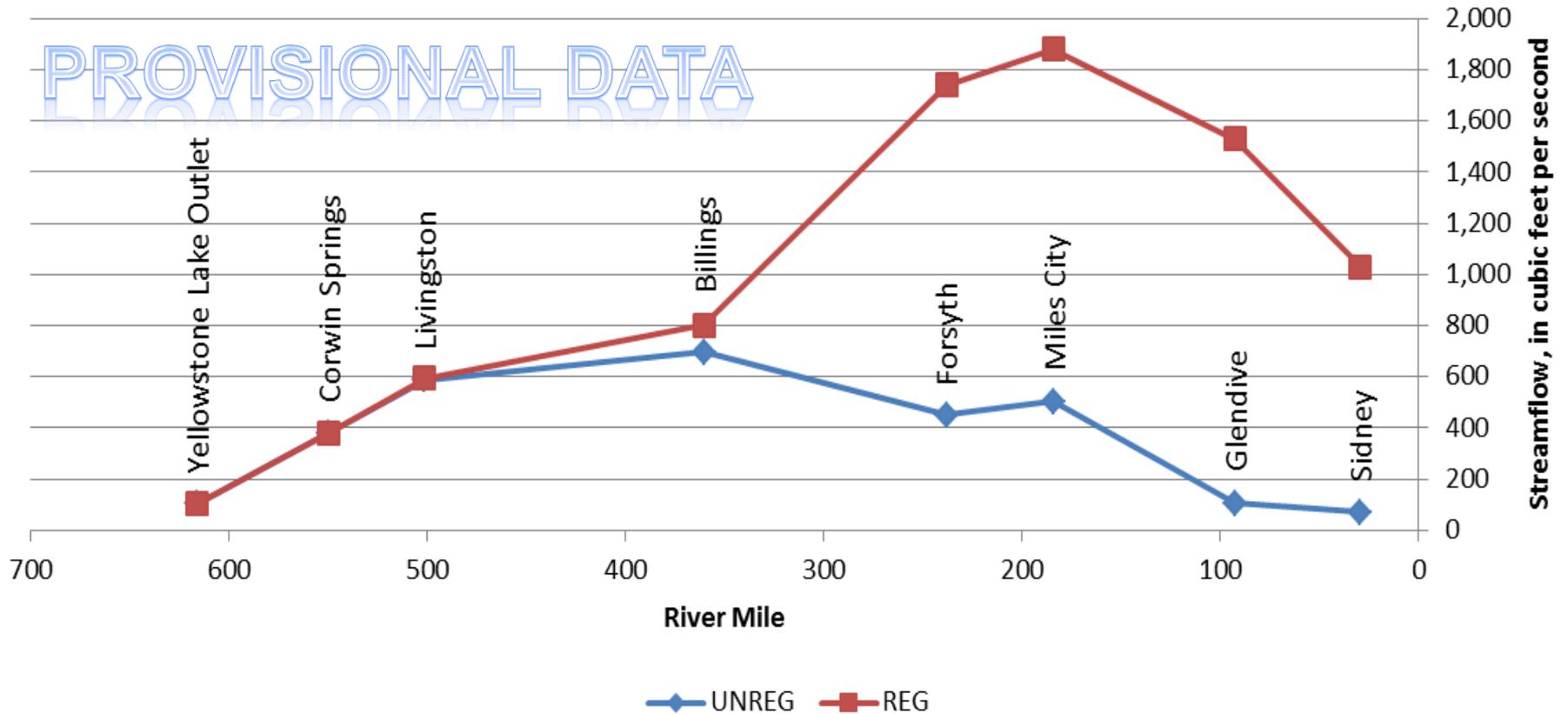


Yellowstone River Annual 7-day High Flow 1% Probability



Yellowstone River Annual 7-day Low Flow 1% Probability

PROVISIONAL DATA



Questions?



O'Fallon Creek near Mildred