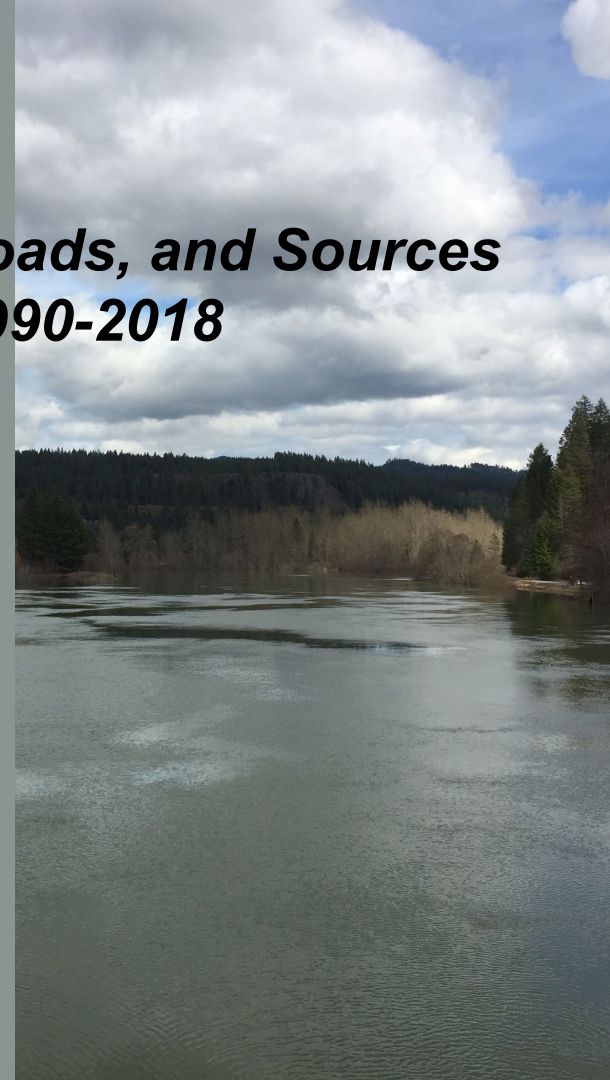


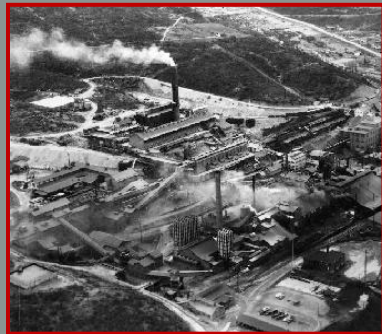
# *Trends in Trace Metal Concentrations, Loads, and Sources in the Coeur d'Alene River Watershed, 1990-2018*



**Lauren Zinsser**

**lzinsser@usgs.gov**

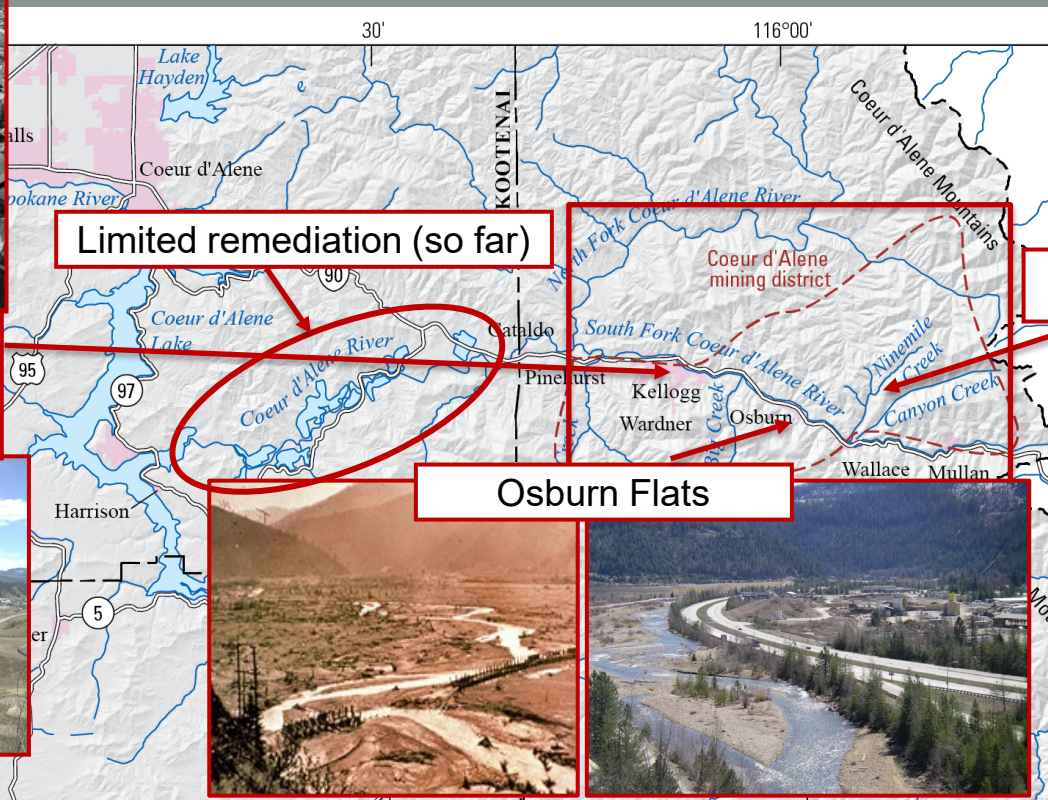
# 100+ years of mining and 30+ years of remediation



Bunker Hill Smelter and the Central Impoundment Area



East Fork Ninemile Creek



Limited remediation (so far)

Osburn Flats



Base from U.S. Geological Survey digital data  
USA Contiguous Albers Equal Area Conic USGS version  
North American Datum of 1983



**EXPLANATION**  
City limits



## Big Questions:

1. Have concentrations and loads gone down?
2. Are concentrations and loads still going down?
3. Have the major load sources changed?

## Approach:

1. Weighted Regressions on Time, Discharge and Season (WRTDS)
  - Flow-normalized annual mean concentrations and annual total loads
  - Best for trend detection

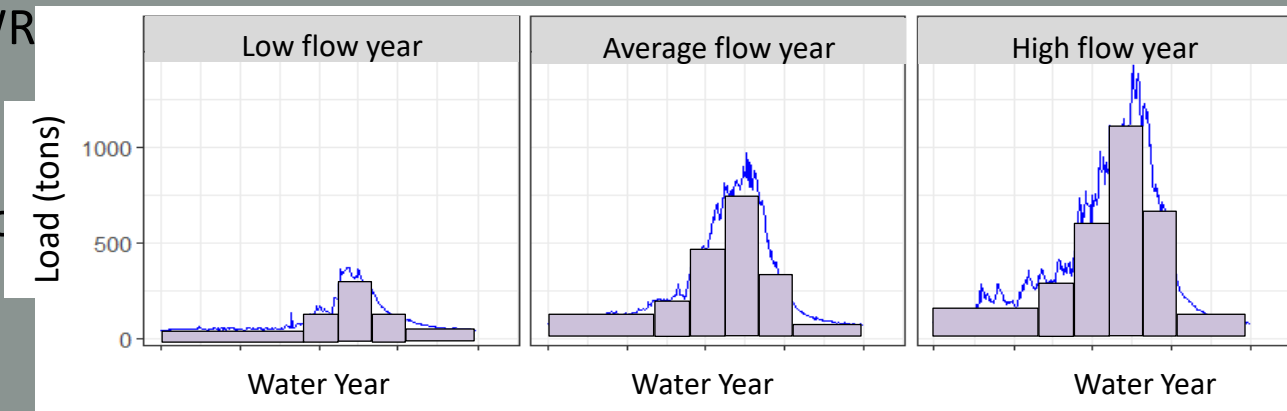
2. WR

•

•

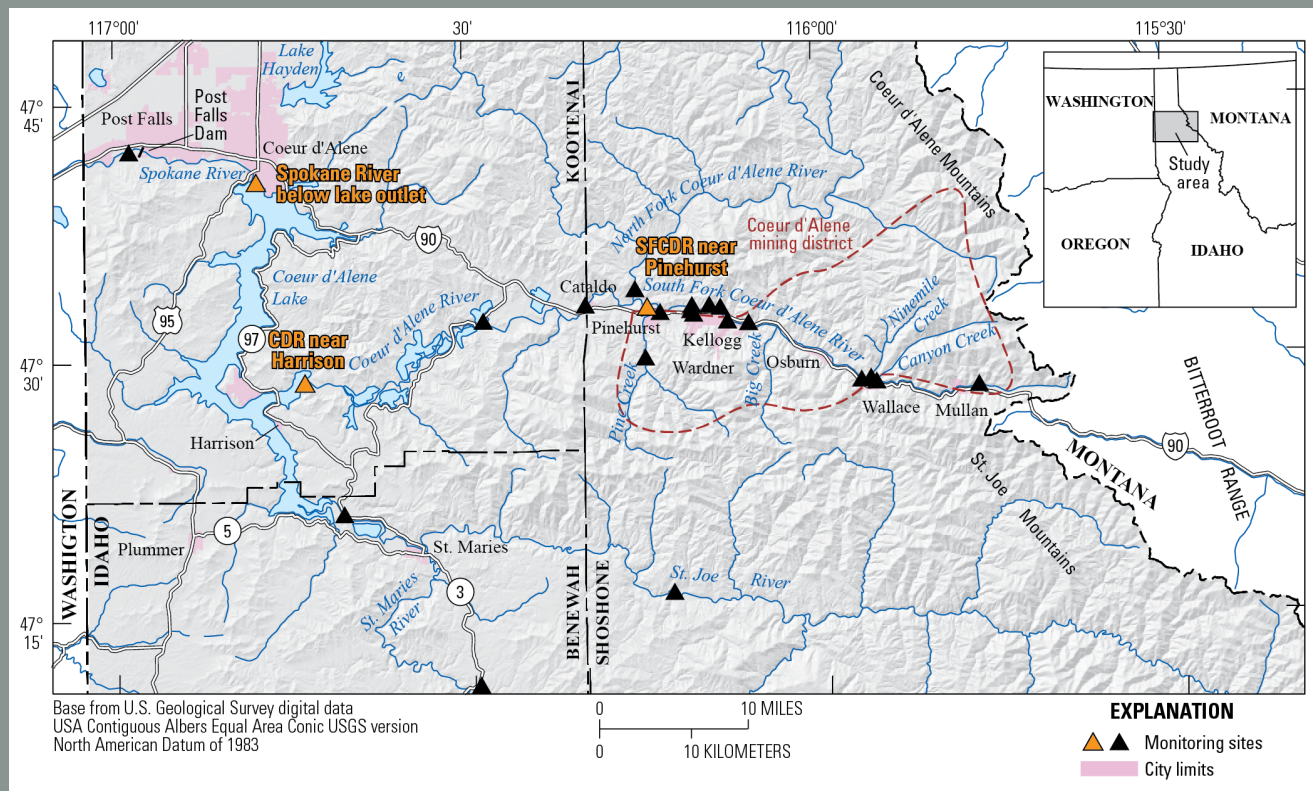
3. BC

•



## Data

- USGS water-quality and discharge data
- 3 sites, 16-29 years
- Water years 1990-2018



# 30 years of data collection is a long time. Here's to the many people who collected all these data.



The author in 1989  
(not collecting data)

HYPOLIMNETIC CONCENTRATIONS OF DISSOLVED OXYGEN, NUTRIENTS, AND  
TRACE ELEMENTS IN COEUR D'ALENE LAKE, IDAHO

By Paul F. Woods

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 89-4032

Sampling in 1989  
(okay, actually 1947)

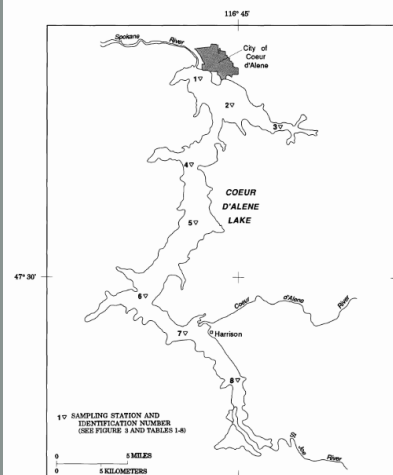


Figure 2—Sampling stations on Coeur d'Alene Lake.

7



Boise, Idaho

1989

USGS report from 1989

# Big Question #1

## Have concentrations and loads gone down?



Photo from USGS files, Nebraska, 1947



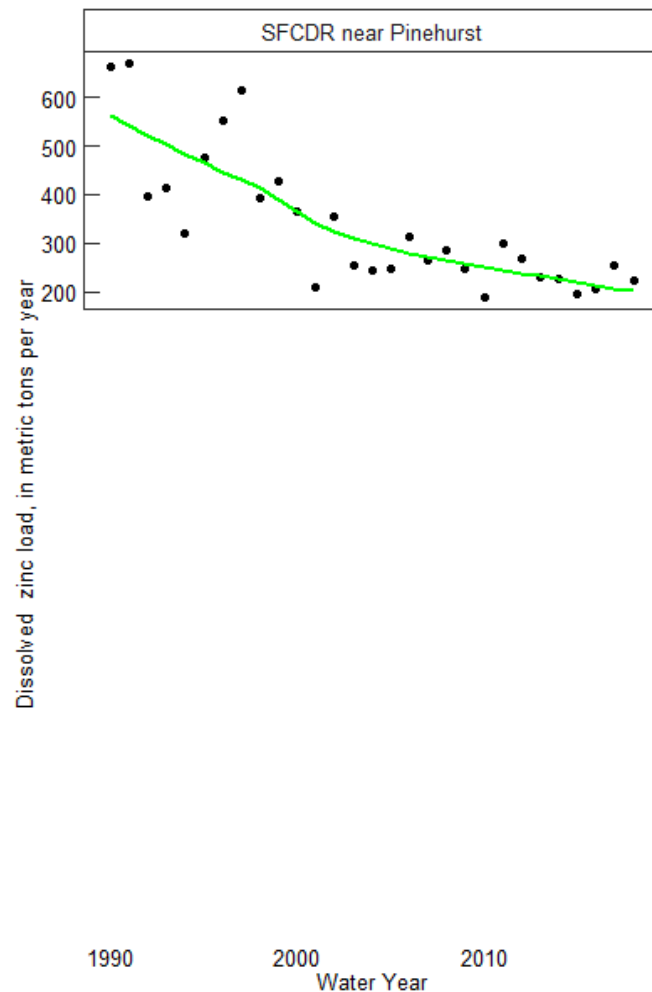
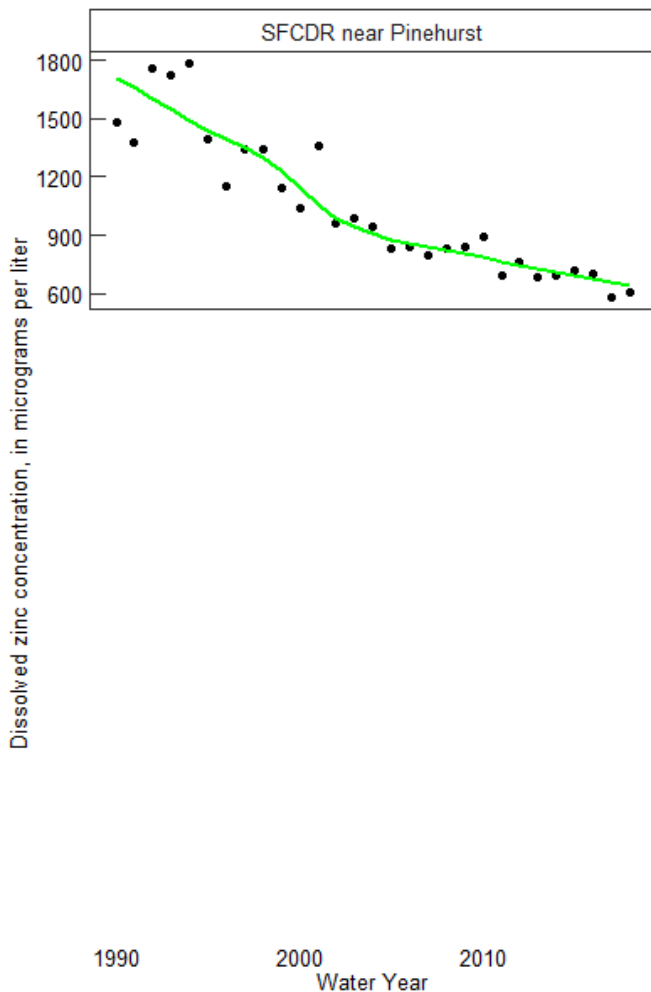
CDR at Cataldo, photo by Dan Hess, USGS, 2017

# Have concentrations and loads gone down?

Dissolved zinc concentrations and loads decreased 35-65% over the period of record.

## EXPLANATION

- WRTDS\_K annual estimate
- WRTDS flow normalized annual estimate

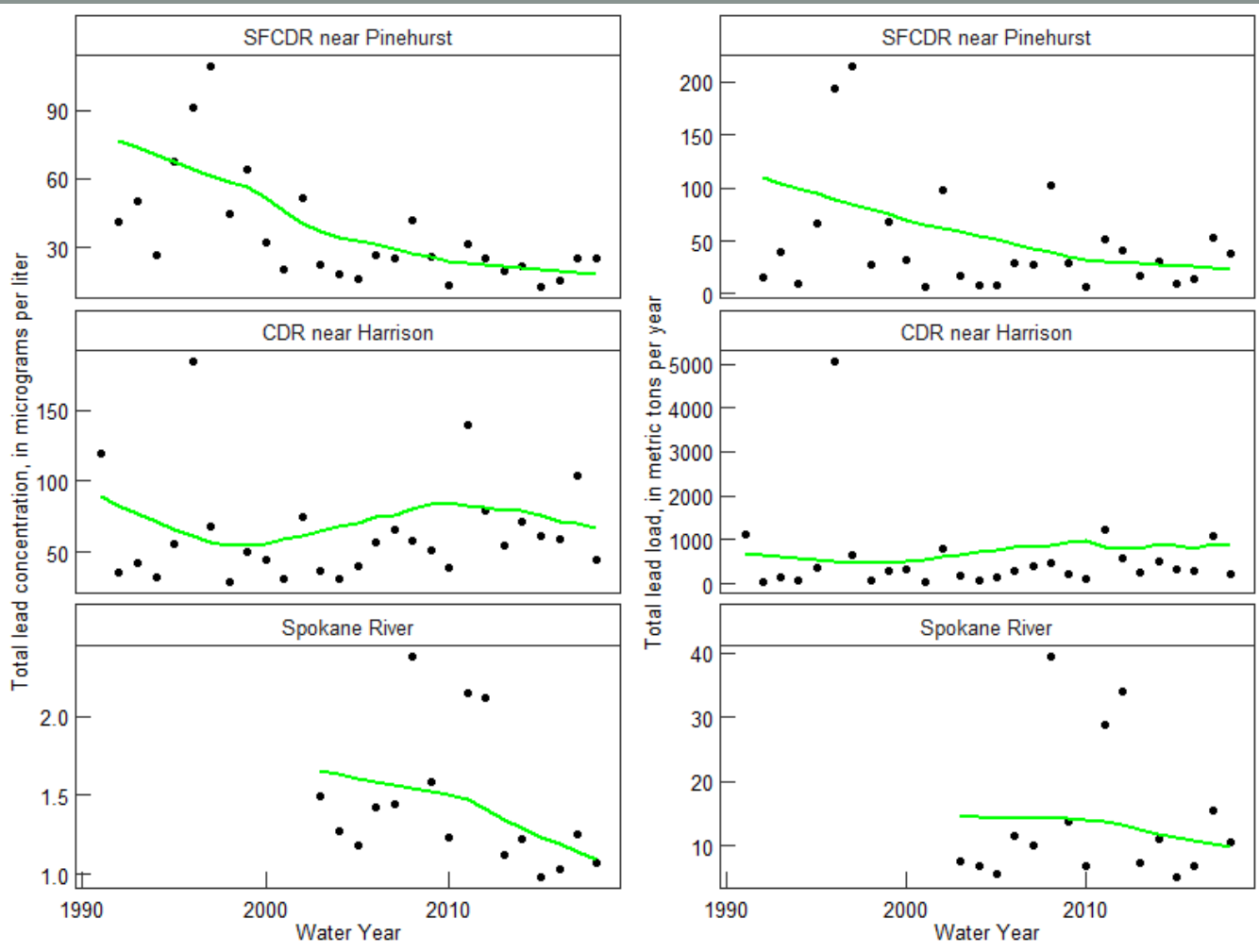


# Have concentrations and loads gone down?

Total lead concentrations and loads decreased 25-75% over the period of record (except loads at Harrison, +25%).

## EXPLANATION

- WRTDS\_K annual estimate
- WRTDS flow-normalized annual estimate





## Big Question #2

Are concentrations and loads still going down?



NFCDR at Enville, photo by USGS



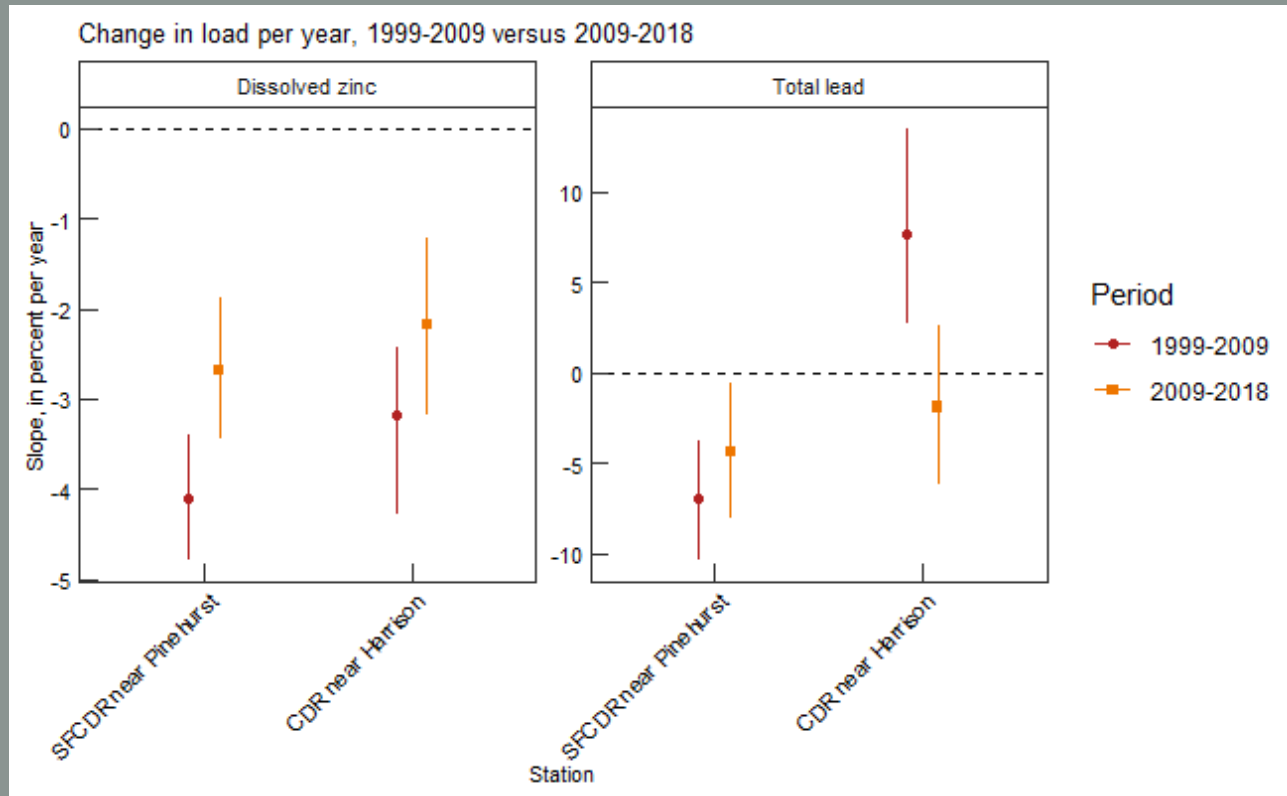
St. Joe River at Ramsdell, photo by USGS

## Are concentrations and loads still going down?

The rate of the decrease in dissolved zinc load was steeper at both sites in 1999-2009 but the loads still decreased in 2009-2018.

This is also true for total lead in SFCDR near Pinehurst.

Total lead loads increased in CDR near Harrison in 1999-2009.



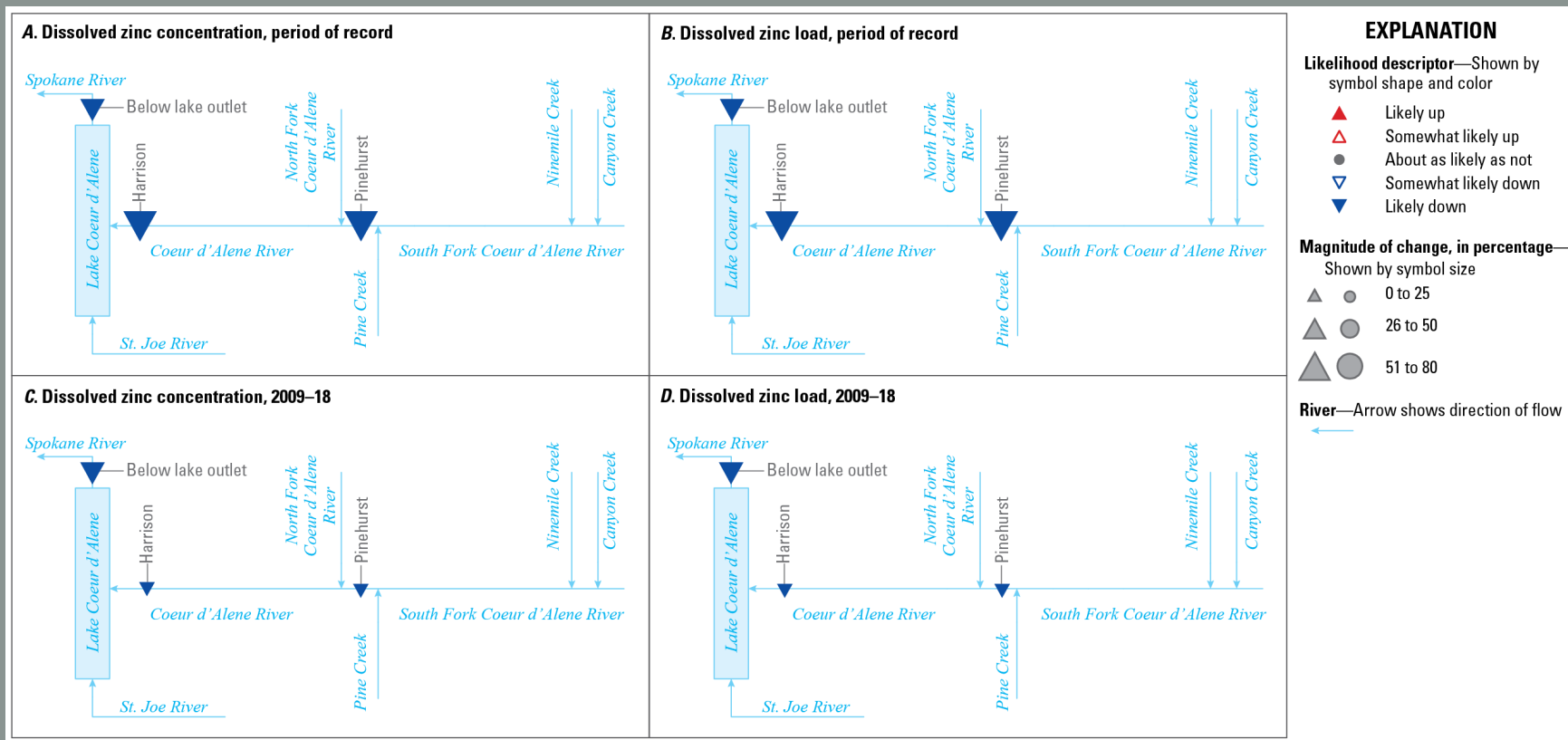
# Big Questions #1 and #2, continued

## How statistically confident are we in these trends?



SFCDR at Elizabeth Park, photos by Dan Hess, USGS

# How statistically confident are we in these trends?



Dissolved zinc concentration and load decreases are statistically likely at all sites over the period of record and 2009-2018.

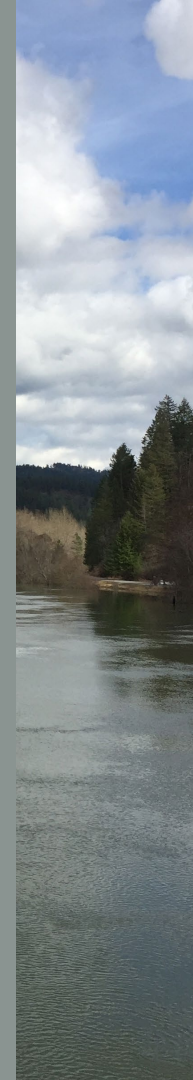
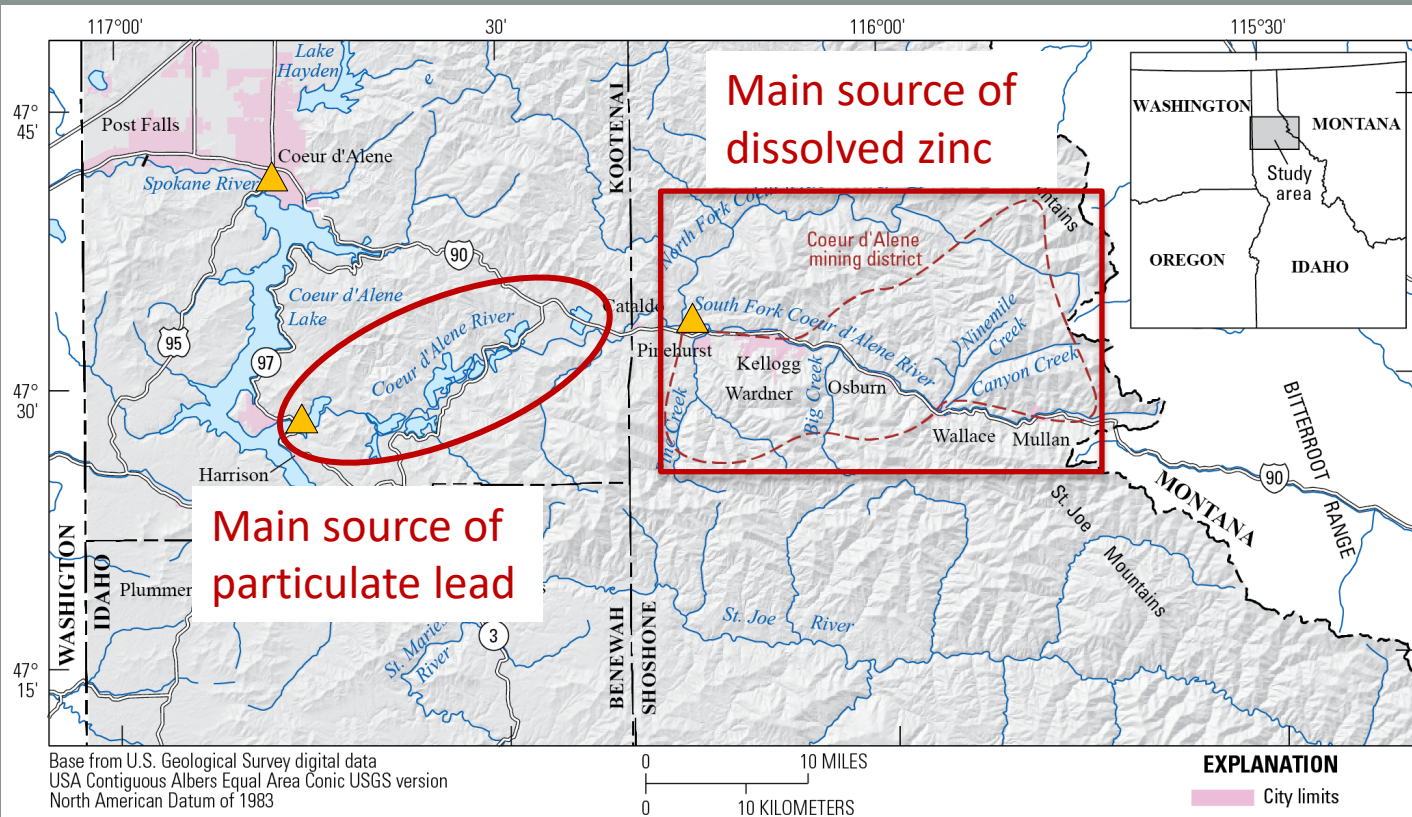
# How statistically confident are we in these trends?



Total lead decreases are statistically likely over the period of record and 2009-2018, except at CDR near Harrison.

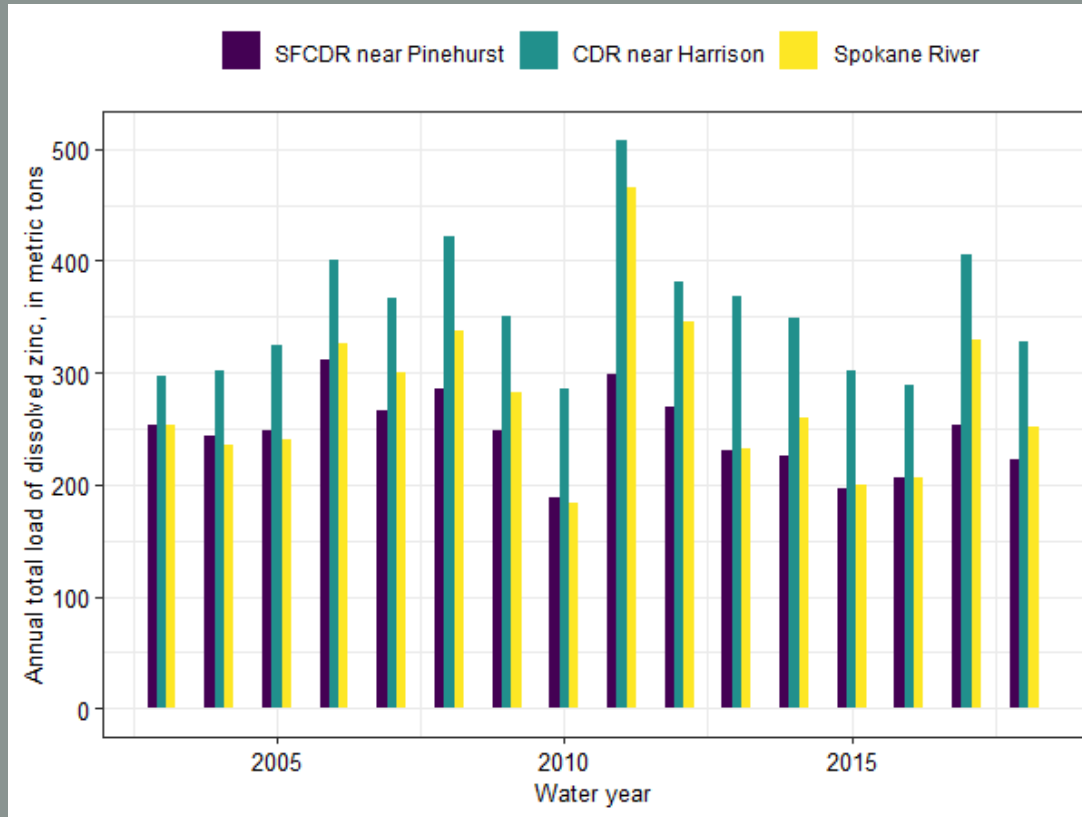
# Big Question #3

## Have the major load sources changed?

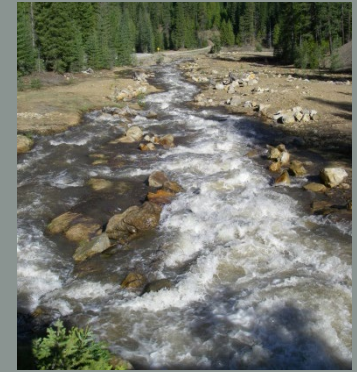


# Have the major load sources changed?

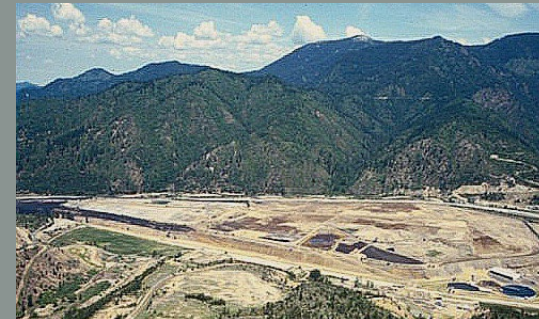
## SFCDR remains main source of dissolved zinc



Ninemile Creek

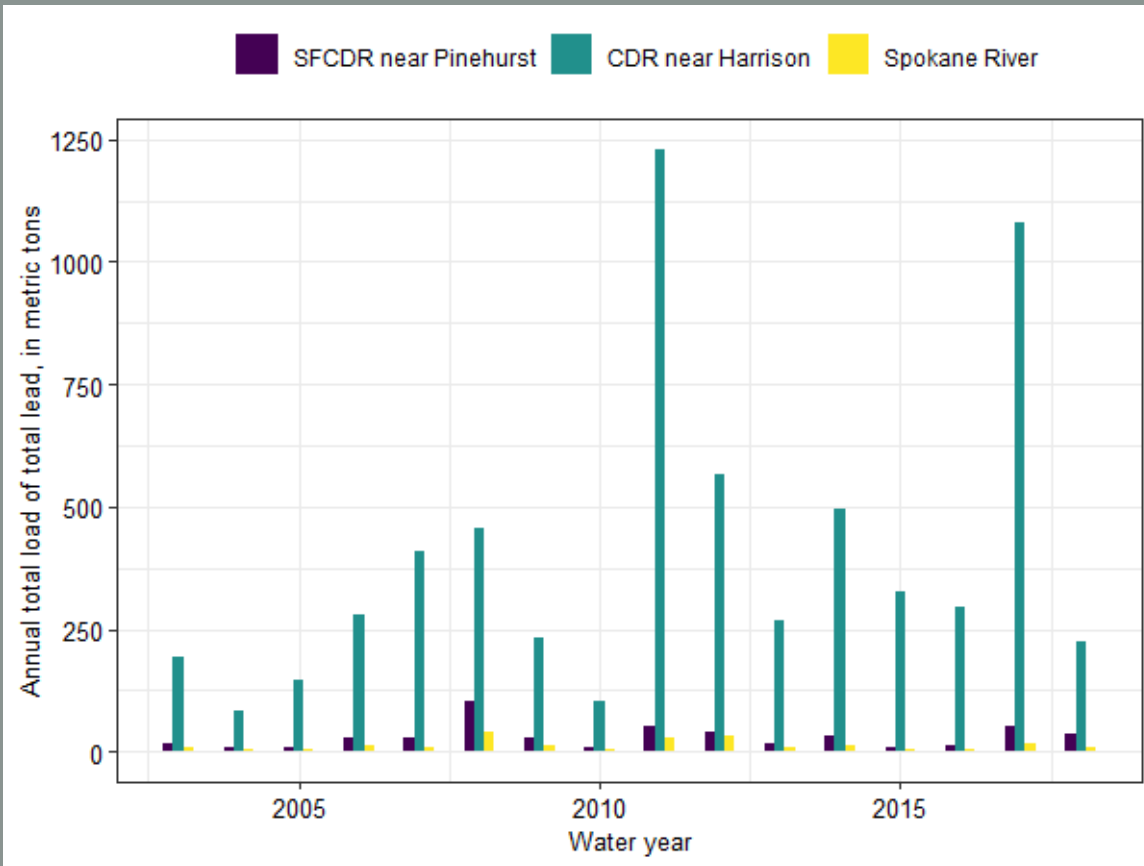
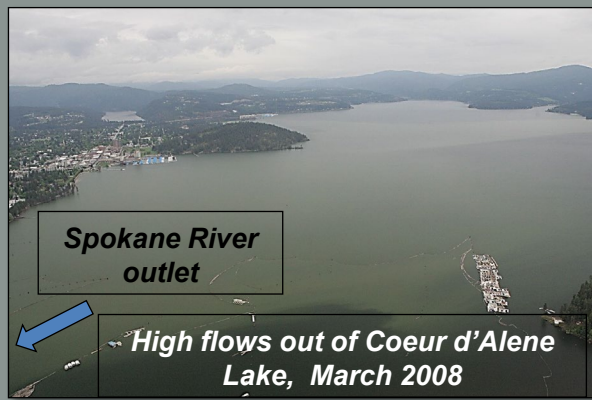
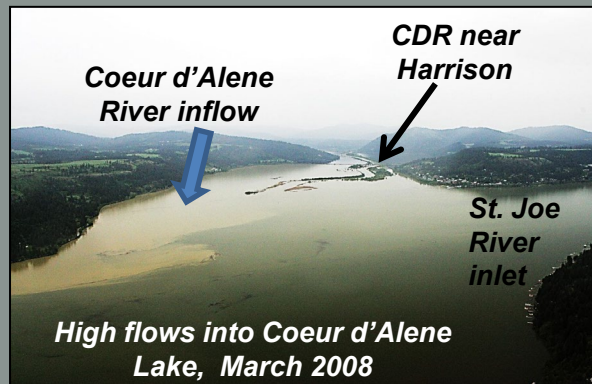


Central Impoundment Area



# Have the major load sources changed?

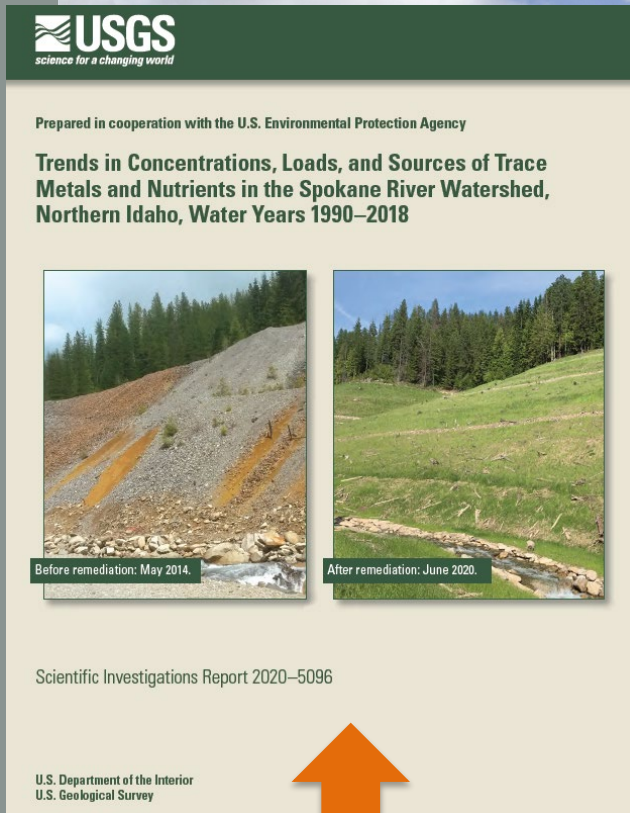
Mainstem CDR remains main source of total lead





# Summary


1. **Have concentrations and loads gone down?**
    - Yes. Dissolved zinc and total lead decreases are big (25-75%) and statistically likely over the period of record.
  2. **Are concentrations and loads still going down?**
    - Yes. Decreases are smaller (10-30%) but still statistically likely over 2009-2018.
  3. **Have the major load sources changed?**
    - No. SFCDR remains the primary source of dissolved zinc and mainstem CDR remains the primary source of total lead.
- Why?**
- Widespread remedial activities in the SFCDR have decreased zinc throughout the system and decreased lead in SFCDR.
  - However, only limited remedial activities have occurred in the mainstem CDR to date so lead loads have not decreased. Future remedial activities should decrease lead loads in CDR.



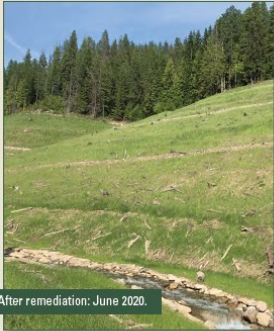
**USGS**  
science for a changing world

Prepared in cooperation with the U.S. Environmental Protection Agency

**Trends in Concentrations, Loads, and Sources of Trace Metals and Nutrients in the Spokane River Watershed, Northern Idaho, Water Years 1990–2018**



Before remediation: May 2014



After remediation: June 2020

Scientific Investigations Report 2020–5096

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

The image shows the title page of a USGS report. At the top is the USGS logo. Below it is the title of the report. Two side-by-side photographs show a riverbank before and after remediation. The 'Before' photo shows a steep, eroded bank with exposed roots and sediment. The 'After' photo shows a more stable, vegetated bank. A large orange arrow points upwards from the bottom of the report page towards the text 'And lots more!!'.

**And lots more!!**

# Questions?



Lauren Zinsser  
lzinsser@usgs.gov



SFCDR at Elizabeth Park

Photo by Nick Korzen, USGS