



Contaminant assessment in Hinkson Creek

David Alvarez and Danielle Cleveland

USGS, Columbia Environmental Research Center, Columbia, MO

This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.

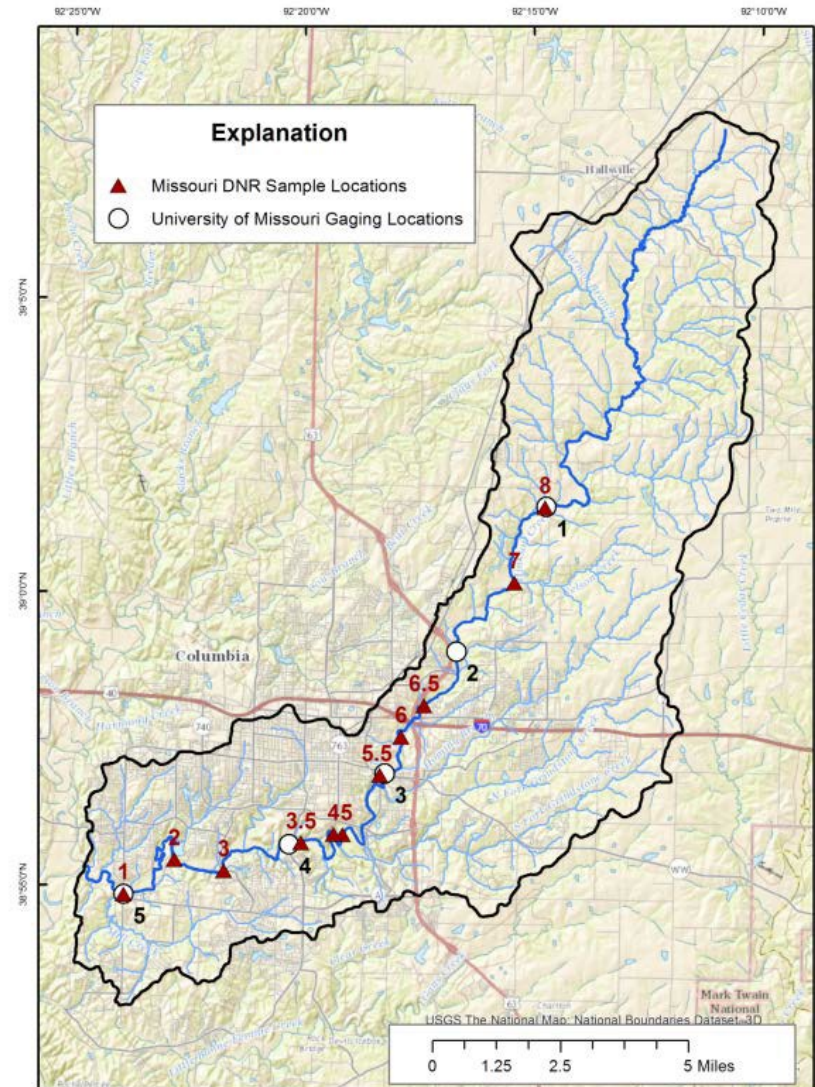
Why do an extensive chemical assessment in Hinkson Creek?

In 1998, listed as impaired for not supporting the “protection of aquatic life” as specified in Missouri’s Water Quality Standards.

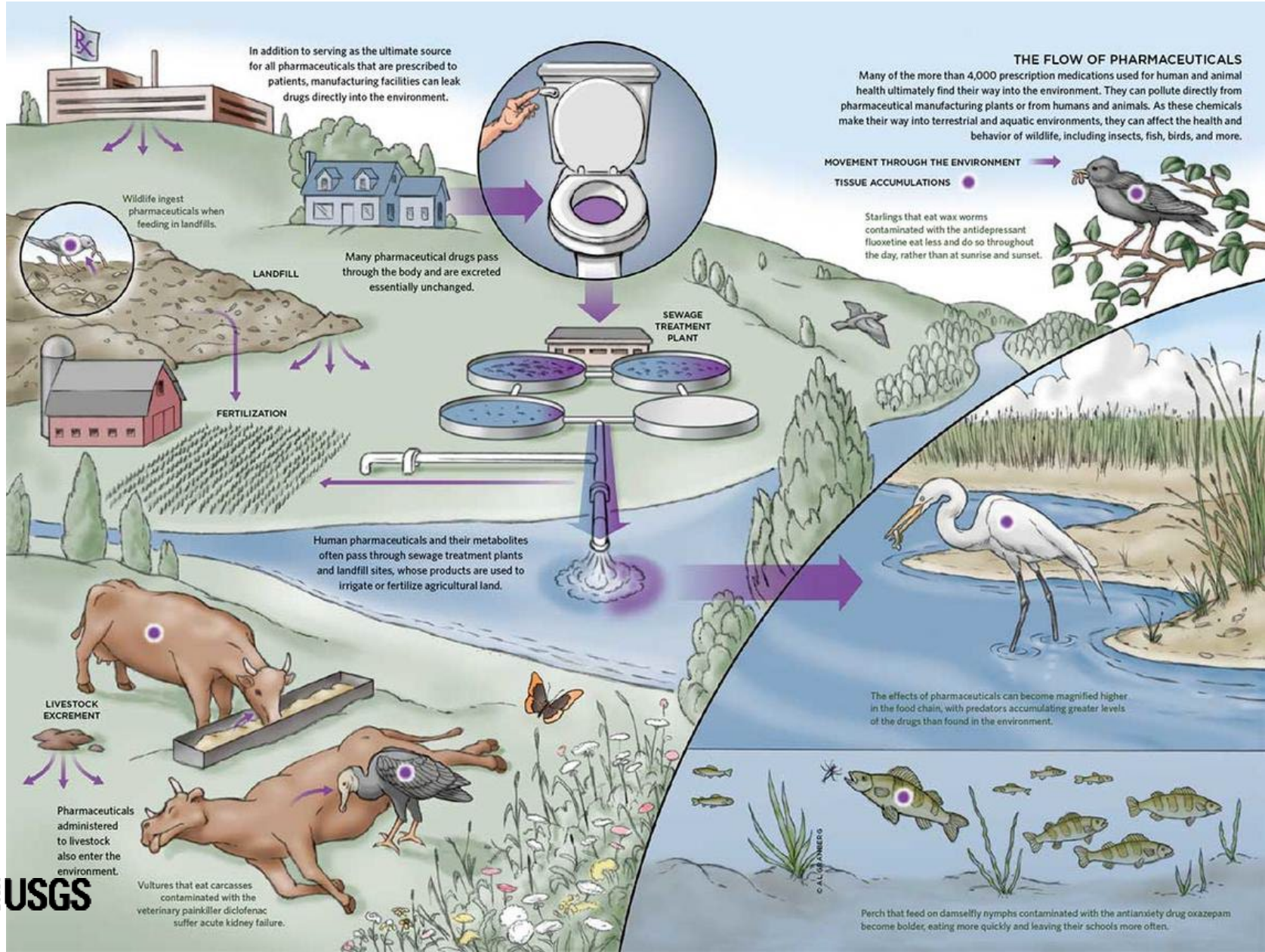
In 2001/2002, DNR confirmed the aquatic community was impaired between I-70 and downstream of Broadway.

Toxicity tests indicated some stormwater discharges were toxic to test organisms, implicated chemicals included PAHs and petroleum compounds, pesticides, and metals.

Problem is pollutants included in past assessments do not provide a broad look beyond regulated contaminants.



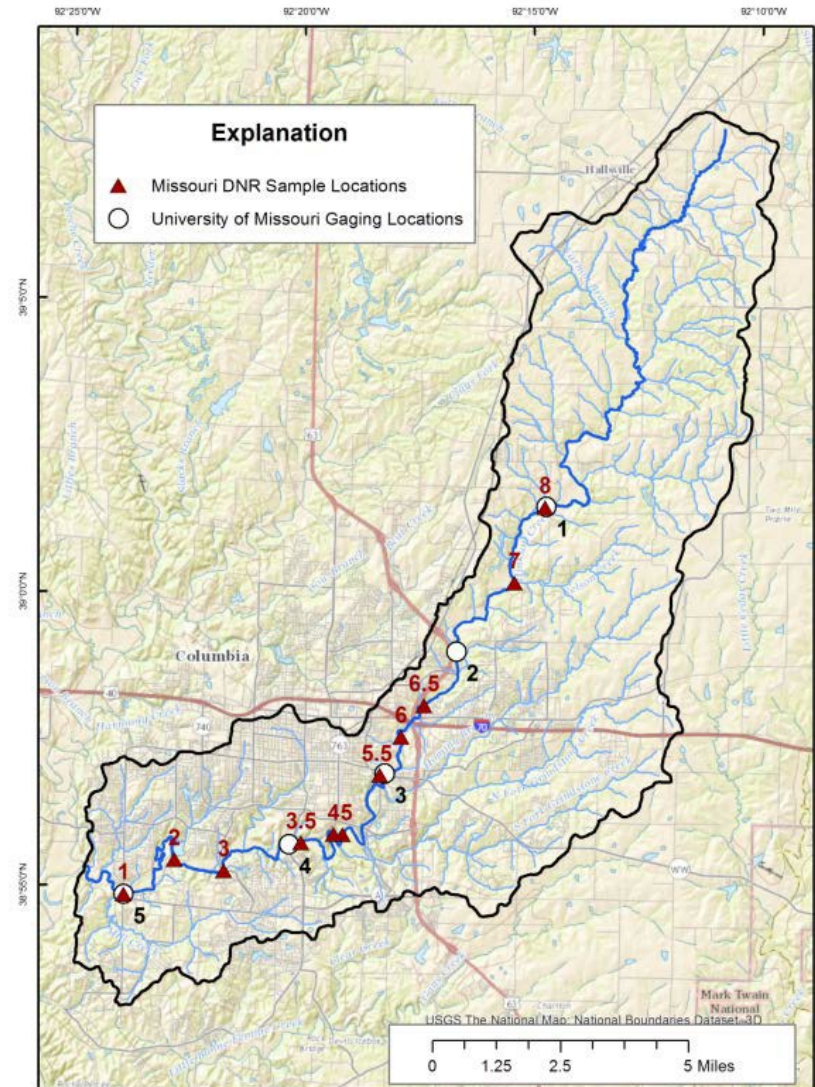
Potential inputs into Hinkson Creek



Contaminant assessment

In 2022, began a study to assess current state of contaminants within the Creek in areas around Columbia.

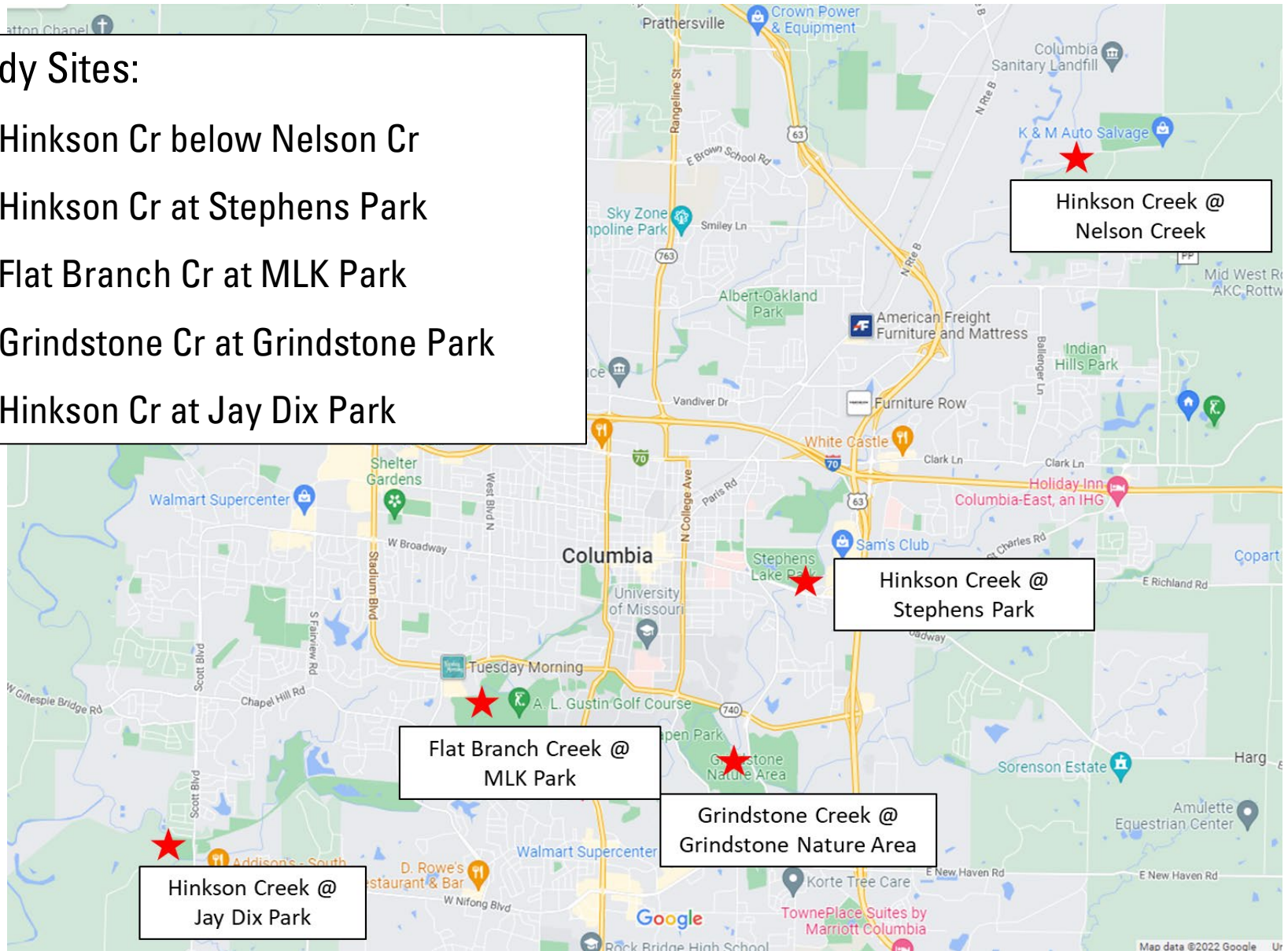
Focus is on surface water, porewaters, and sediments targeting chemicals of concern and those which can be indicators of different inputs.



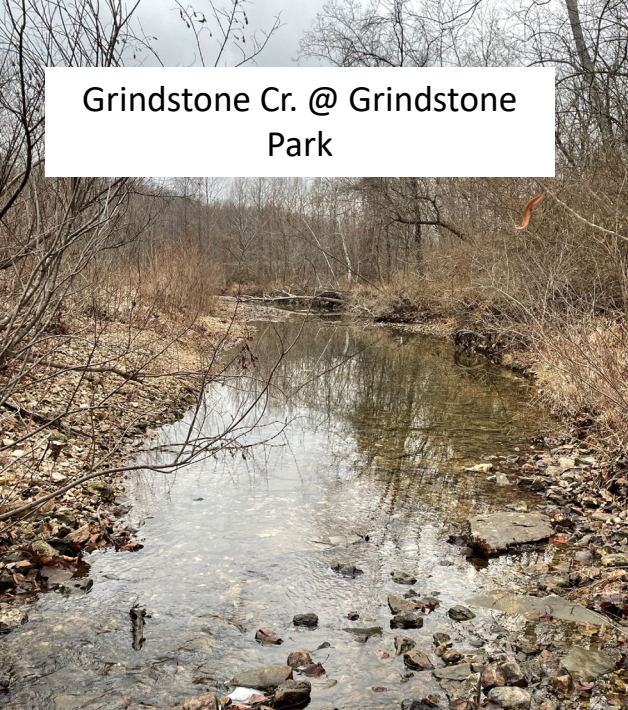
Site Selection

Study Sites:

- Hinkson Cr below Nelson Cr
- Hinkson Cr at Stephens Park
- Flat Branch Cr at MLK Park
- Grindstone Cr at Grindstone Park
- Hinkson Cr at Jay Dix Park



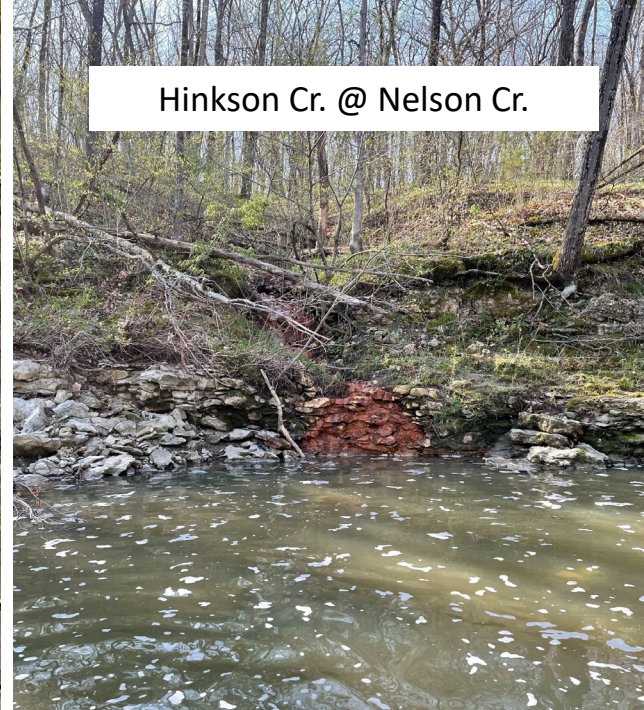
Grindstone Cr. @ Grindstone
Park



Hinkson Cr. @ Stephens Park



Hinkson Cr. @ Nelson Cr.



Flat Branch Cr. @ MLK Park



Hinkson Cr.
@ Jay Dix
Park



Sampling Approach

- Spring: 4/26/22 – 6/3/22
- Fall: 11/3/22 – 12/7/22
- Surface Water
 - Discrete/Grab – inorganics
 - Passive – organics
- Sediment Pore Water
- Sediments



Passive Samples for Organic Chemicals

Provide a time-weighted average concentration of chemicals over periods of weeks to months

Potentially allows the measurement of lower concentrations than possible by other methods

Mimic potential exposure of aquatic organisms

- Semipermeable Membrane Device (SPMD)

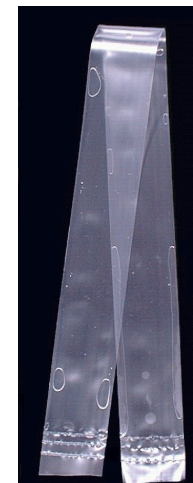
- Lipid soluble chemicals
- Triolein (lipid) filled polyethylene (LDPE) tube

- Polar Organic Chemical Integrative Sampler (POCIS)

- Water soluble chemicals
- Solid phase sorbent held between filter membranes



POCIS



SPMD



Targeted Chemical Groups for Analysis

Surface Water

~522 analytes

- Petroleum (PAHs)
- Legacy Pesticides
- PCBs (total)
- Fire Retardants
- Wastewater Indicators
- Pharmaceuticals
- Current-Use Pesticides
- PFAS
- Metals
- Cations /Anions
- General Water Quality

Pore Water

34 analytes

- Metals
- Cations /Anions
- General Water Quality

Sediments

~310 analytes

- Petroleum (PAHs)
- Legacy Pesticides
- PCBs (total)
- Fire Retardants (PBDEs)
- Wastewater Indicators
- PFAS
- Metals
- Sediment characteristics

PFAS in Water

Total PFAS (sum of 19) is elevated at all sites, but below EPA's acute toxicity benchmarks (not established for mixtures)

- Acute: 0.071 mg/L (71,000 ng/L) for PFOS
- Chronic: 0.00025 mg/L (250 ng/L) for PFOS

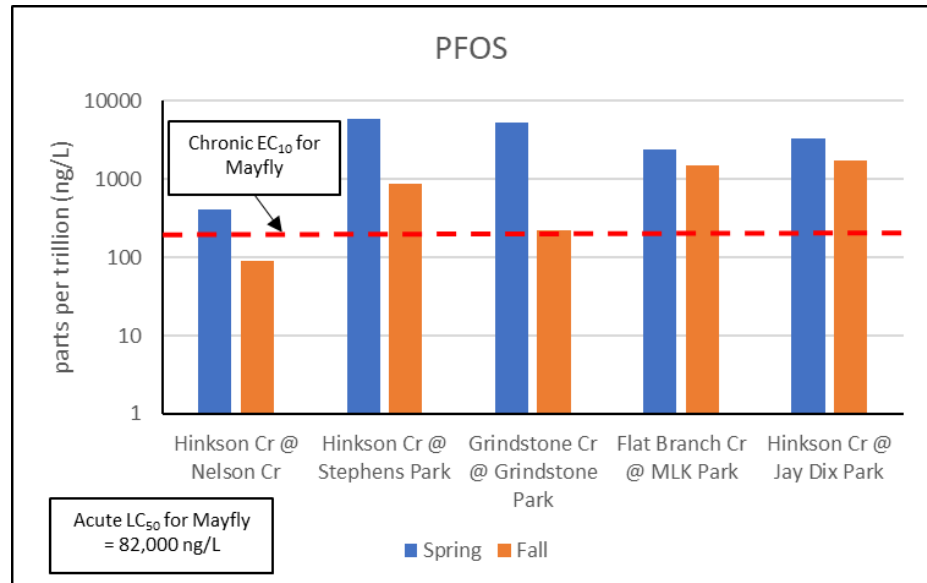
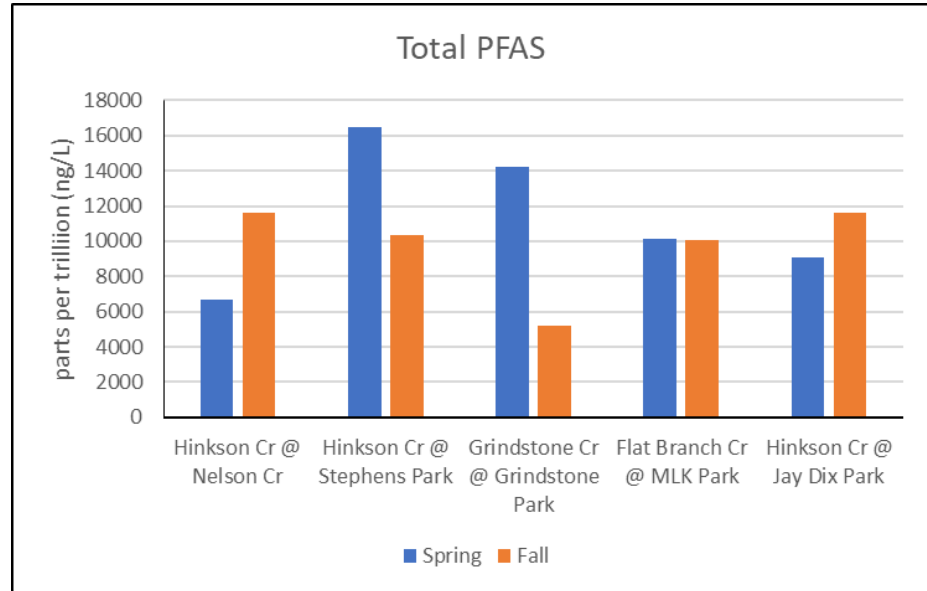
PFOS concentrations

- Greater than chronic effects concentrations for mayfly
- Less than acute lethal concentrations for mayfly

Acute: 82,000 ng/L PFOS

Chronic: 272 ng/L PFOS

Effects conc: Soucek 2023 ES&T Letters



Wastewater Indicators in Water

Overall, few wastewater indicators were measured above background.

Alternative phosphate-based flame retardants were the most frequently detected.

Chemicals related to wood preservatives identified at several sites.

Overall, Flat Branch Creek @ MLK had the highest concentrations and number of detections followed by Hinkson Creek @ Jay Dix Park.

Concentrations were slightly higher in Spring versus Fall, especially for herbicides.

Pharmaceuticals in Surface Water

Overall, few pharmaceuticals (111 human-use drugs targeted) were detected.

Carbamazepine: anticonvulsant, neuropathy, bipolar disorder

Fexofenadine: antihistamine (Allegra)

Lidocaine: local anesthetic

Metoprolol: beta-blocker for high blood pressure

Sulfamethoxazole: antibiotic (Bactrim)

Cotinine: metabolite of nicotine

Concentrations were generally similar with the Stephens Park and Jay Dix sites slightly greater than other sites.

Concentrations were slightly higher in Spring versus Fall, except for sulfamethoxazole.

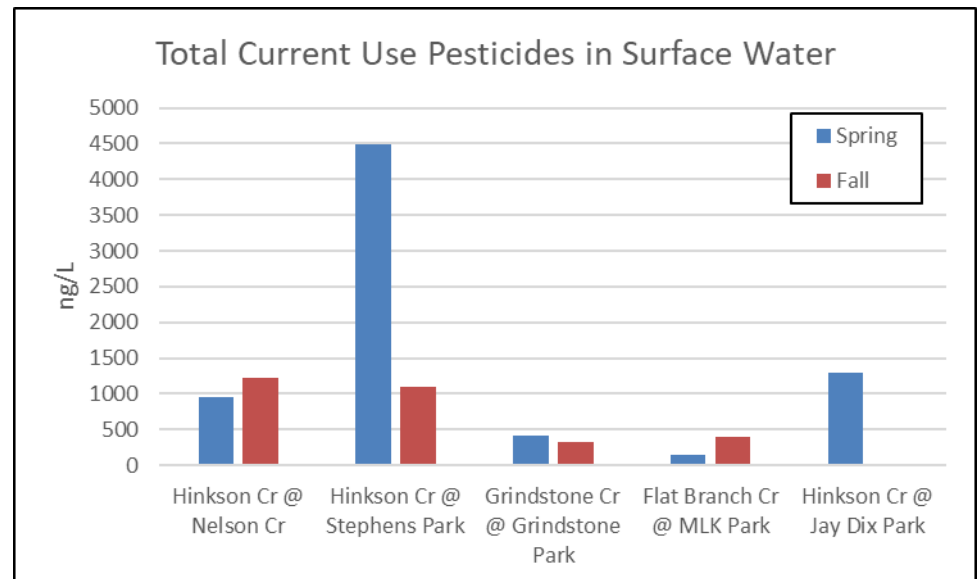
Current-Use Pesticides in Surface Water

Overall, 51 out of 82 pesticides targeted were detected.

- Herbicides 2,4-D, Atrazine, Metolachlor measured at highest concentrations
- Several metabolites of these also detected
- There were more detections in the Spring (199 vs 150) and total concentrations were more than double in the Spring (7300 vs 3030 ng/L)

2 sites had slightly elevated concentrations in the Fall

- Hinkson Cr @ Nelson Cr largely due to herbicide degradation products
- Flat Branch Cr partially due to increased fungicide use



Organics in Sediments

PAHs

- Total PAHs at Flat Branch Cr @ MLK Park 6-10X greater than any other site
- MLK site exceeded threshold effect concentrations (*MacDonald 2000 Arch. Environ. Contam. Toxicol.*)

PCBs, Chlorinated Pesticides, PBDE flame retardants

- Overall, very low in sediment samples
- Likely well below any toxicological relevant concentrations

Metals in Sediments and Pore Waters

Sediments

- Concentrations generally less than threshold effect concentrations (TECs)
(MacDonald 2000 Arch. Environ. Contam. Toxicol.)
- Hinkson Creek @ Nelson Cr and Flat Branch Creek @ MLK Park had concentrations of As, Ni, and Zn near or slightly above TECs

Pore Waters

- Copper, Nickel, Zinc, and Barium most frequently detected
- Concentrations are generally to be below EPA aquatic life criteria levels

Total N, P, pH, and DO in Surface and Pore Waters

Surface Water

- Total N: generally <1 mg/L (max of 1.64 mg/L at Hinkson Cr. @ Nelson Cr.)
- Total P: <0.05 mg/L in Spring, up to 0.08 mg/L in Fall (Hinkson Cr. @ Nelson Cr.)
- pH: 7.25-7.98 (no difference between seasons)
- DO: 8.94-10.06 mg/L (Spring only) – all above min. EPA recommended levels

Pore Waters

- Total N: generally <1 mg/L (max of 1.86 mg/L at Hinkson Cr. @ Stephens Park)
- Total P: 0.058 to 0.113 mg/L (no difference between seasons)
- pH: 7.37-7.85 (no difference between seasons)
- DO: not measured



David Alvarez

USGS Columbia Environmental
Research Center
dalvarez@usgs.gov
573-441-2970