Lower Bear Creek
Denver, Colorado

Community Action - Environmental Results

Groundwork Denver

- The mission of Groundwork Denver is to bring about the sustained improvement of the physical environment and promote health and well-being through community-based partnerships and action.

A brief History

- 2009
  - Green Team engages in invasive species removal and coyote willow planting to improve bank stability
- 2010
  - Lower Bear Creek list on Colorado's impaired waters list due to high *E. coli* levels

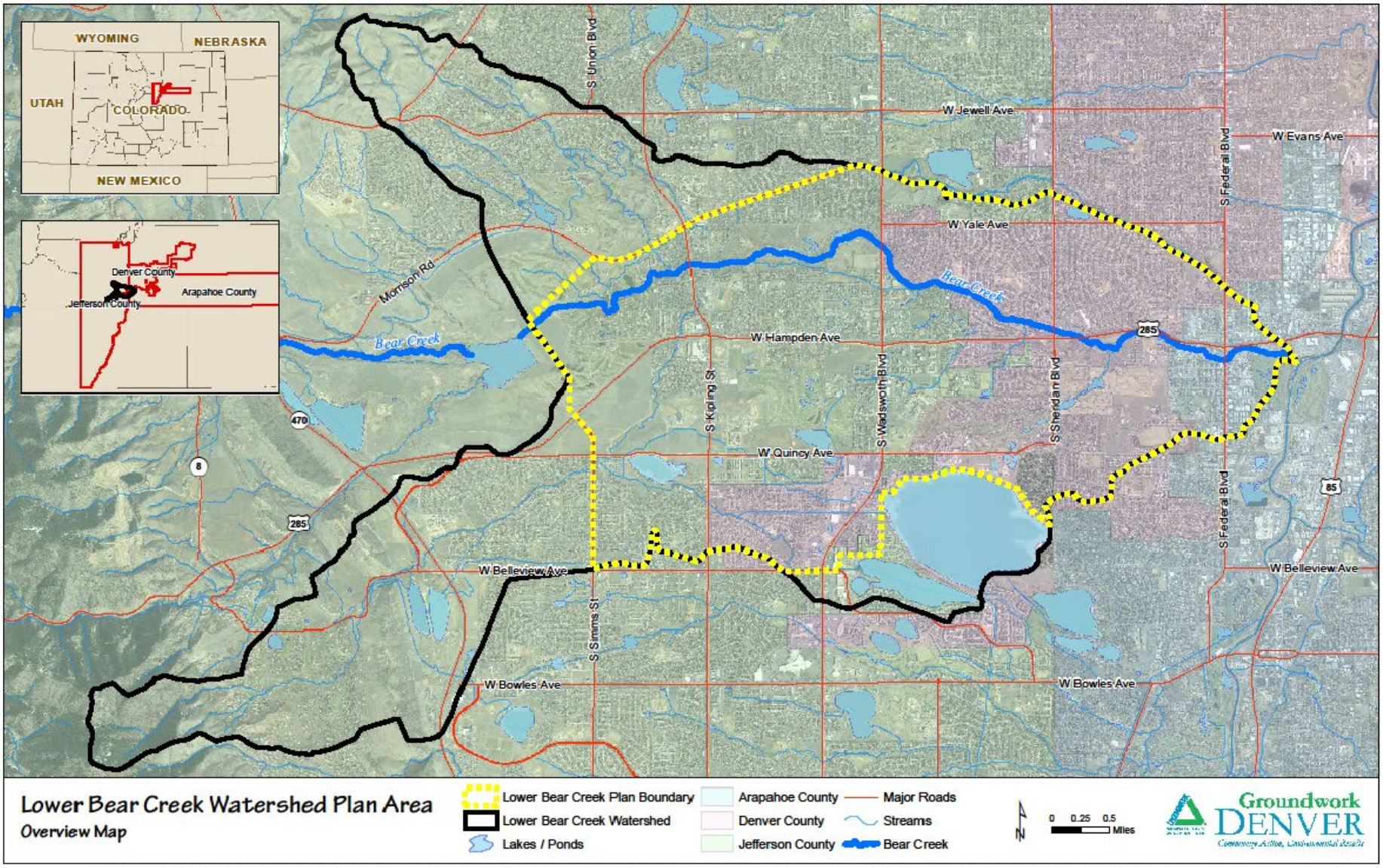
A brief History continued...

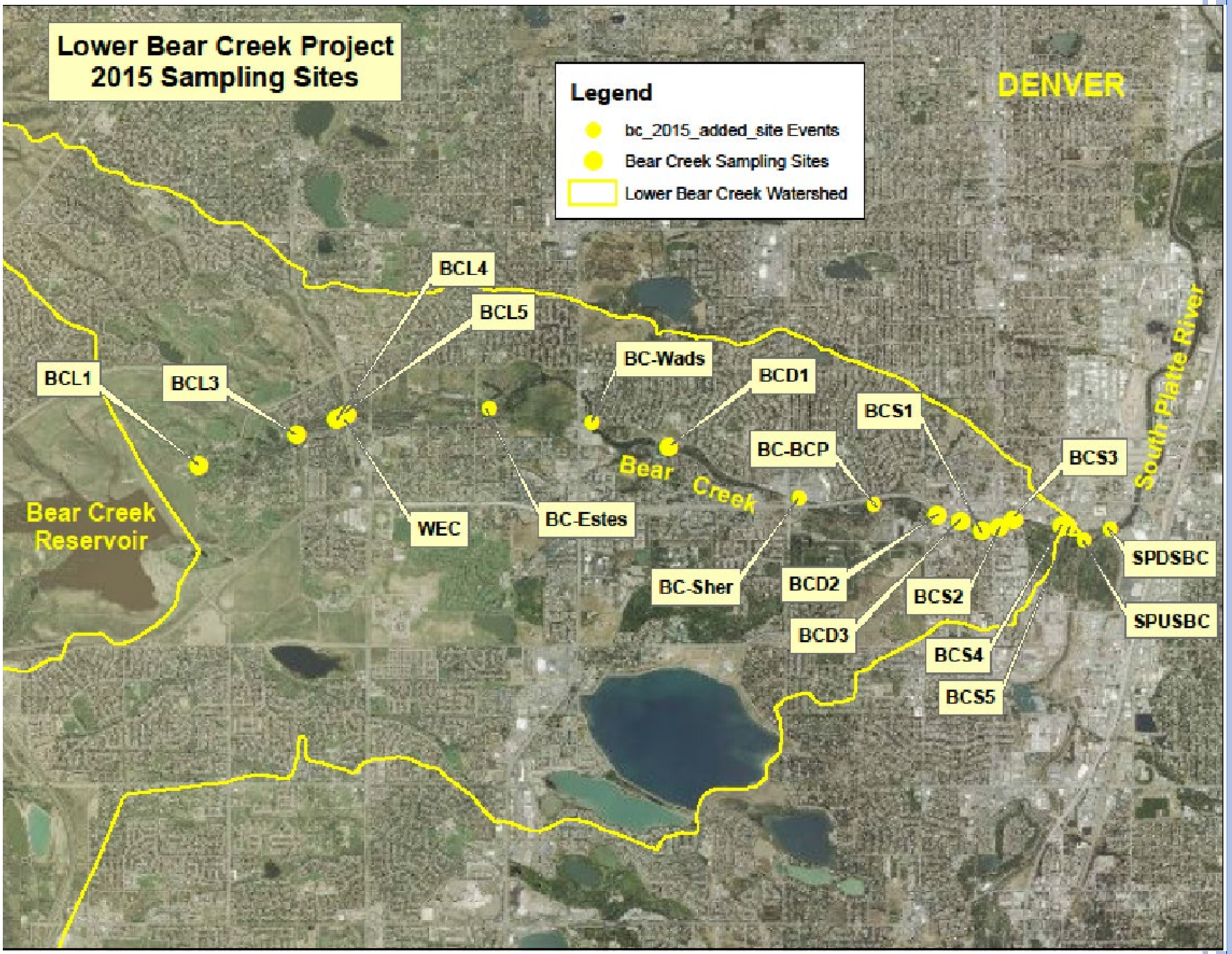
- **2012**
  - Groundwork Denver receives 319 grant from Colorado Department of Public Health and Environment (CDPHE) to create Nonpoint Source watershed plan.
- **2014**
  - Nonpoint Source watershed plan submitted to CDPHE.
  - Groundwork Denver receives EPA Urban Waters Grant to implement aspects of watershed plan.
  - First "Blue Team" joins in on sampling, stewardship, and outreach.

- **2015**
  - Water Quality Control Division changes boundary of impa
- **2016**
  - GWD begins coordinating alternative plan to TMDL in partnership with the Lower Bear Creek Watershed Association.
- **2017**
  - GWD begins collaboration with Denver Water to investigate Sucralose, Anions and Nitrogen.
  - GWD begins collection Bacteroides samples in collaboration with MSU.
  - Implementation of irrigation audit and outreach project.

Water Quality Monitoring Partners

- EPA Region 8 Water Quality Unit and Lab
- Metro State University Biology Department
- Denver Environmental Health
- Cities of Denver, Lakewood, and Sheridan
- River Watch
- Denver Water



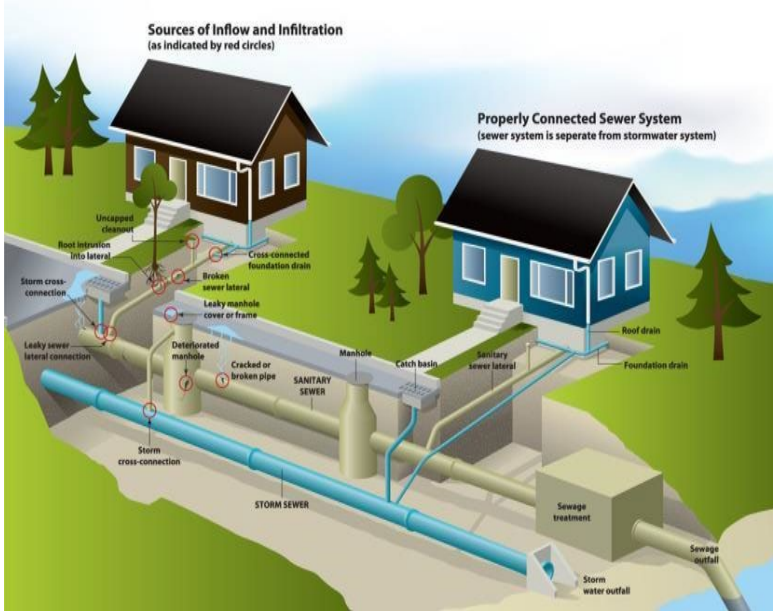

Lower Bear Creek Project
2015 Sampling Sites
Legend
bc_2015_added_site Events
Bear Creek Sampling Sites
Lower Bear Creek Watershed
DENVER
South Platte River
Bear Creek
Bear Creek Reservoir
BCL1
BCL3
BCL4
BCL5
WEC
BC-Estes
BC-Wads
BC-Sher
BC-BCP
BCD1
BCD2
BCD3
BCS1
BCS2
BCS3
BCS4
BCS5
SPDSBC
SPUSBC

Monitoring Summary

- Originally 17 sites
  - 2 added to determine impacts of Bear Creek on S. Platte.
- Data from sites in Lakewood allowed that stretch of the creek to be removed from impaired waters list.
  - The outfall of Bear Creek reservoir (BCL1/WS-LP-026) is still sampled for loading calculations.
- Currently sites are sampled for Total coliform/E. *coli*, Temp, pH, ORP, Spec. Cond, Turbidity, Sucralose, Anions, Total P, Nitrogen, Bacteroides, Flow rate, and DO.
  - Some components are taken only at selected sites.
- Meta data are also collected; weather, rainfall, activity along the creek etc.

Finding a leaky septic Line

- In 2015 a septic line began to leak into the creek just above Wadsworth.
- The breakage increased observed E. *coli* results at the Wadsworth and downstream BCD2 sites.
- The line was repaired Aug 18th 2016.
- Sites returned to their previous E. *coli* concentrations.
- Impacts aren't stream wide however. Further downstream sites saw no real improvement (recreationally or otherwise).



What's Missing from the Dataset

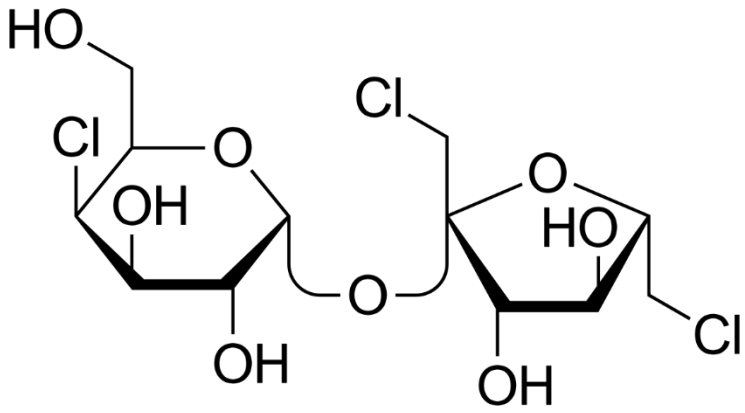
- 303d listings by their very nature reference non-point sources.
  - MS4 outfalls, street runoff, people interacting with the water etc.
- The sanitary sewer leak gave cause to look for wastewater impacts on the creek with decaying infrastructure and high levels remaining downstream.
  - DW was approached in the late 2016/early 2017 for advice. Sucralose and Nitrogen were recommended. This info coupled with Bacteroides data would narrow down sources of contamination.

Sucralose and Bacteroides

- Sucralose (Splenda) is a sweetener which is non-caloric.
  - It is a great tracer and indicator because it is highly conservative and not greatly impacted by standard wastewater treatment processes nor is it quickly degraded in the environment.
  - Numbers in the Lower Bear Creek will be relatively high due to the impacts of upstream wastewater outfalls. Still, undiluted wastewater is over a logarithm higher than what is observed at the reservoir outfall, so large volumes of sanitary sewer water should be observable.
- Bacteroides *fragilis* is an obligate anaerobe found in the human colon. It has been used by the EPA to determine human impacts on urban streams.
  - Non-conservative in an open oxidative system.
  - EPA and other studies have not found correlative evidence of E. *coli* and Bacteroides. That is, one can't assume high E. *coli* numbers mean high human impact.

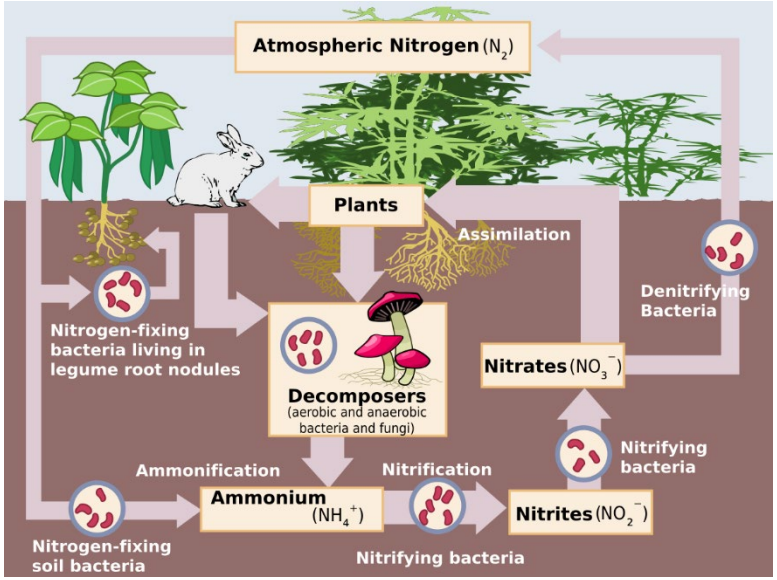
Sucralose Seems Steady in the creek

- Data is somewhat noisy the general trends show sucralose isn't added in this stretch of Bear Creek.
- 3 consecutive high readings at BCS5 may be concerning.
- Bear Creek reservoir is impacted by wastewater more in the winter (less moisture).

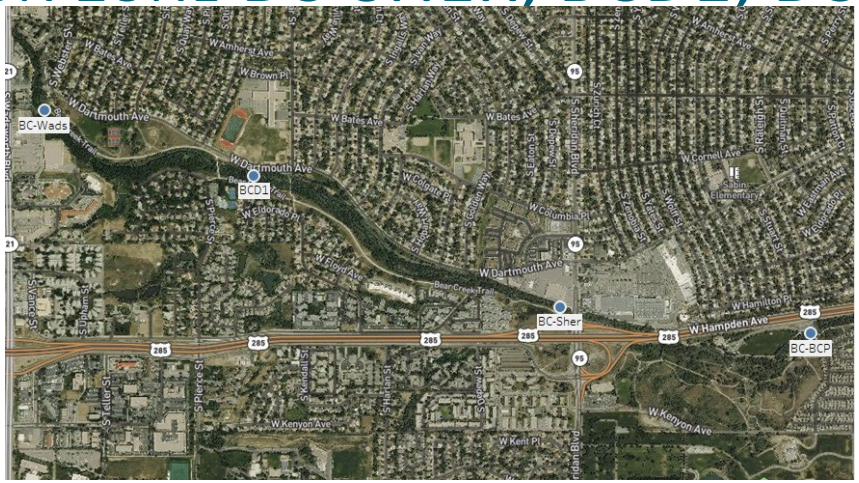


Nitrogen Lessons

- TKN shifts throughout the stream.
- Nitrate + Nitrite, increases as one moves downstream. The largest jump occurs between the outfall and Wadsworth sampling sites.
- Ammonia levels are low.



The transition zone BC-SHER, BCD1, BC-BCP



- E. *coli* behavior shifts between 3 sites. BC-SHER lies in the middle of the transition.
- Results suggest a functional, consistent shift rather than acute shifts.

2 new sampling points and More

- Due to observed data from DW & GWD, 2 sites were added at a very low flowing inlet north of Sheridan
- Regular sampling methods conducted upstream and downstream of low-flow outfall
- Early data suggests this may be a contributing source of E.coli

What next?

- HOBO monitors
- Analyze data for new sites after one year of continuous collection
- Draw down sucralose and anion sampling on the current sites.
- Targeted N sampling (new sites).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CARSON NATURE CENTER

River Watch

Irrigation Audits