

Physicochemical Processes Before and After RSC Construction



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Muddy Creek Restoration



Before...

RSC:
Regenerative Stormwater Conveyance



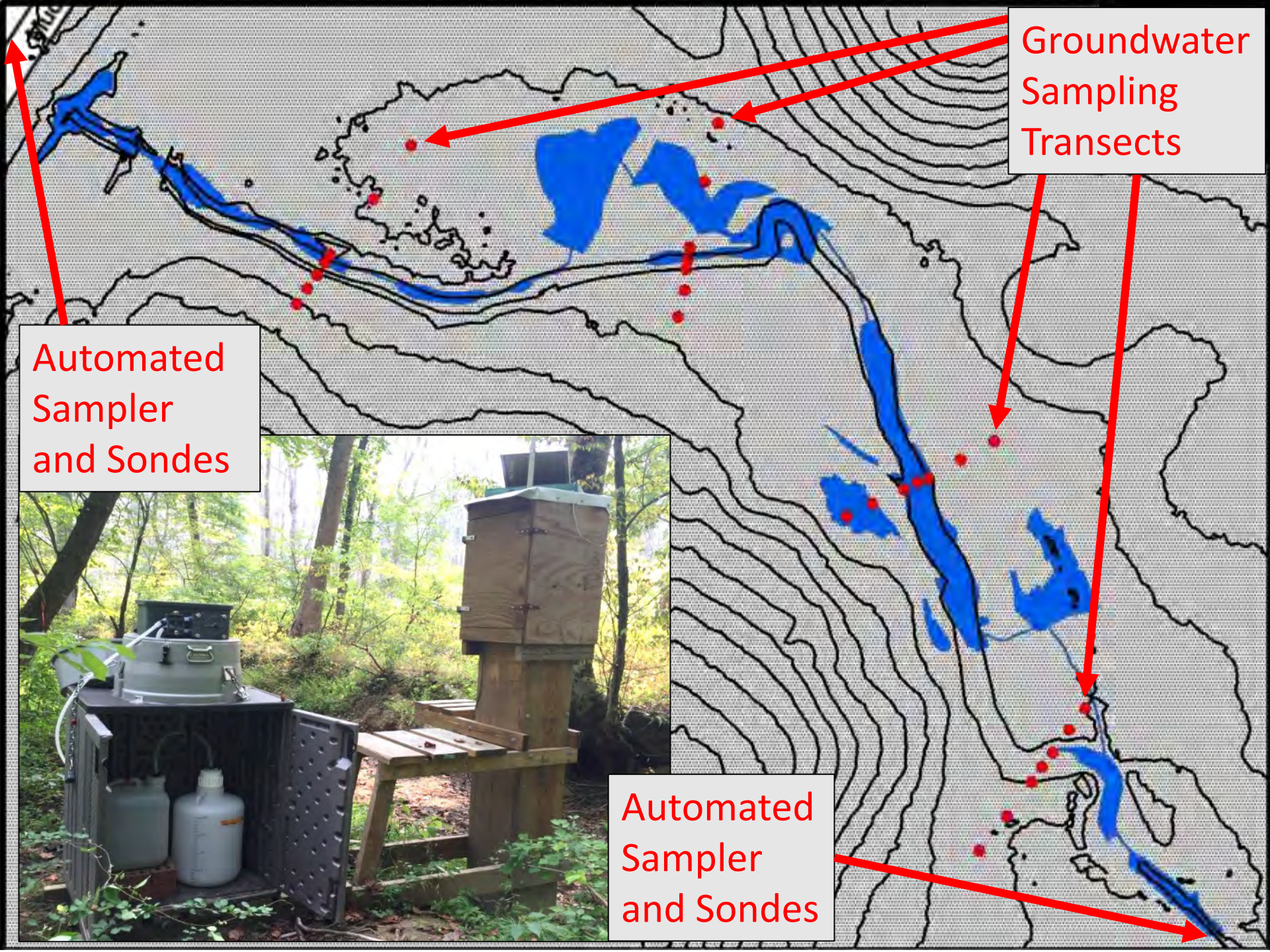
Sand Plus
Woodchips

Gravel

...During

Research Goals

- Assess the effects of the RSC on:
 - The removal of suspended solids and nutrients from surface water; and...
 - The chemistry and flow of groundwater as they may impact removal of nutrients and precipitation of iron in the stream.



Groundwater
Sampling
Transects

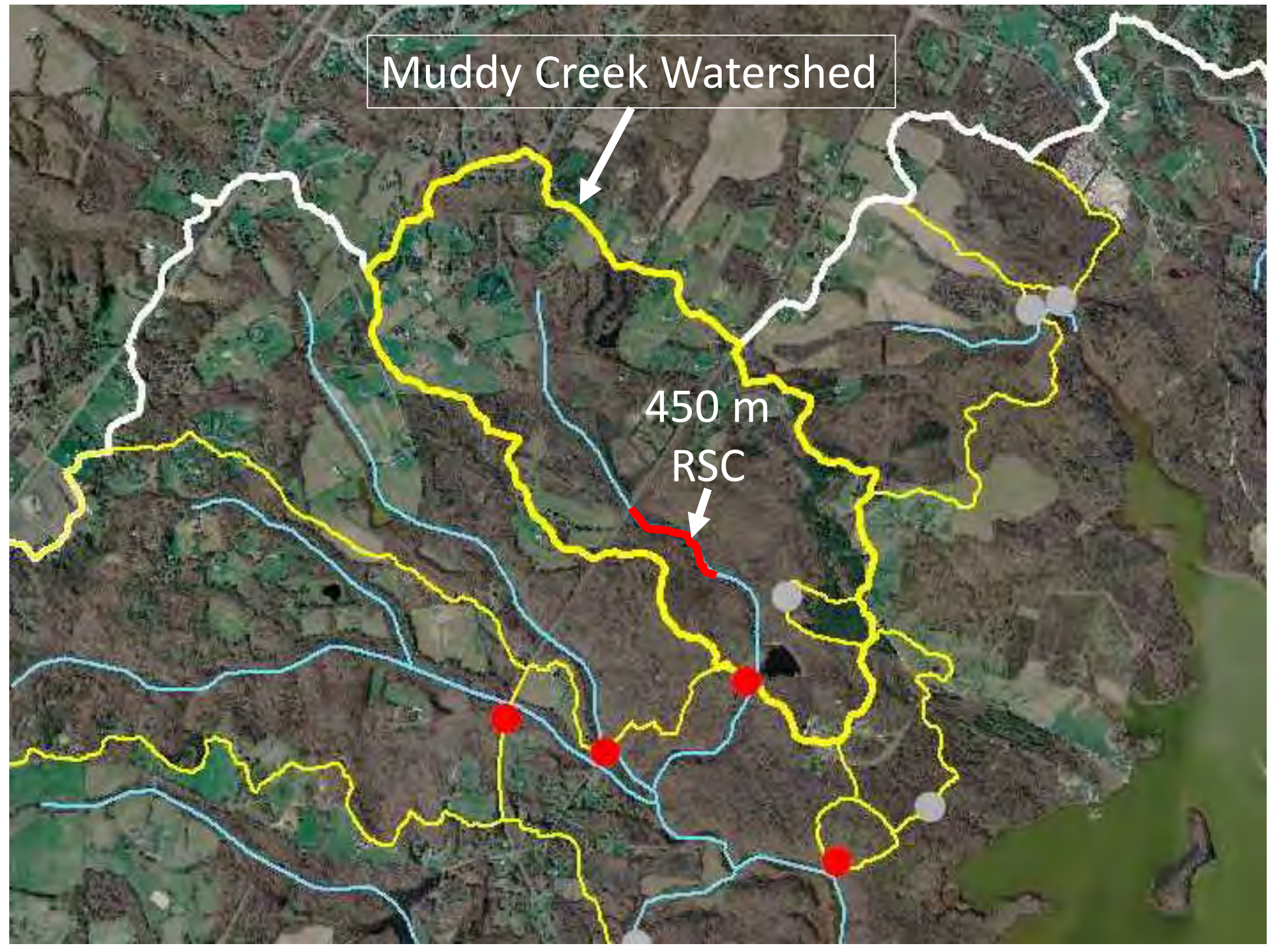
Automated
Sampler
and Sondes



Automated
Sampler
and Sondes

Muddy Creek Watershed

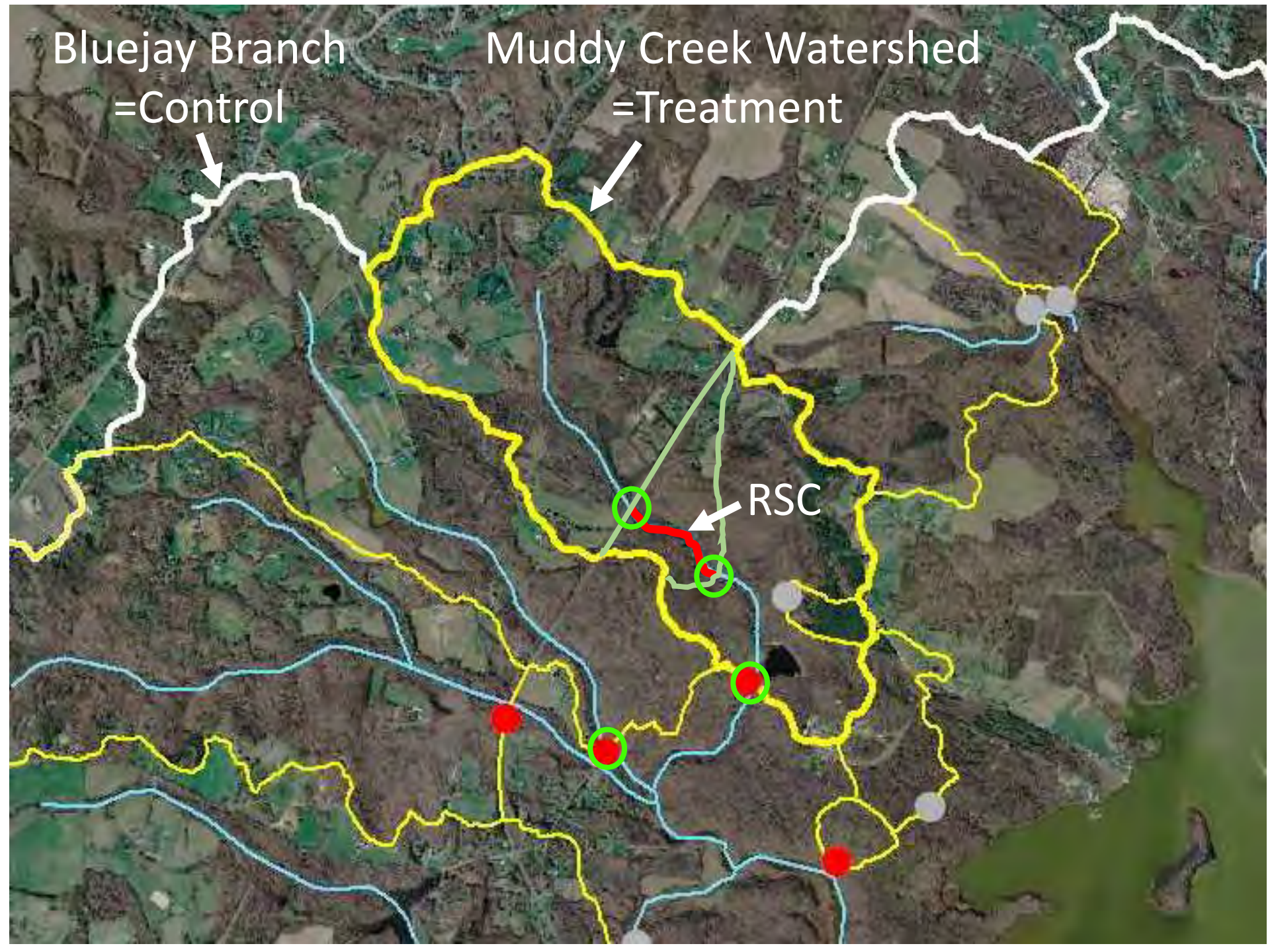
450 m
RSC



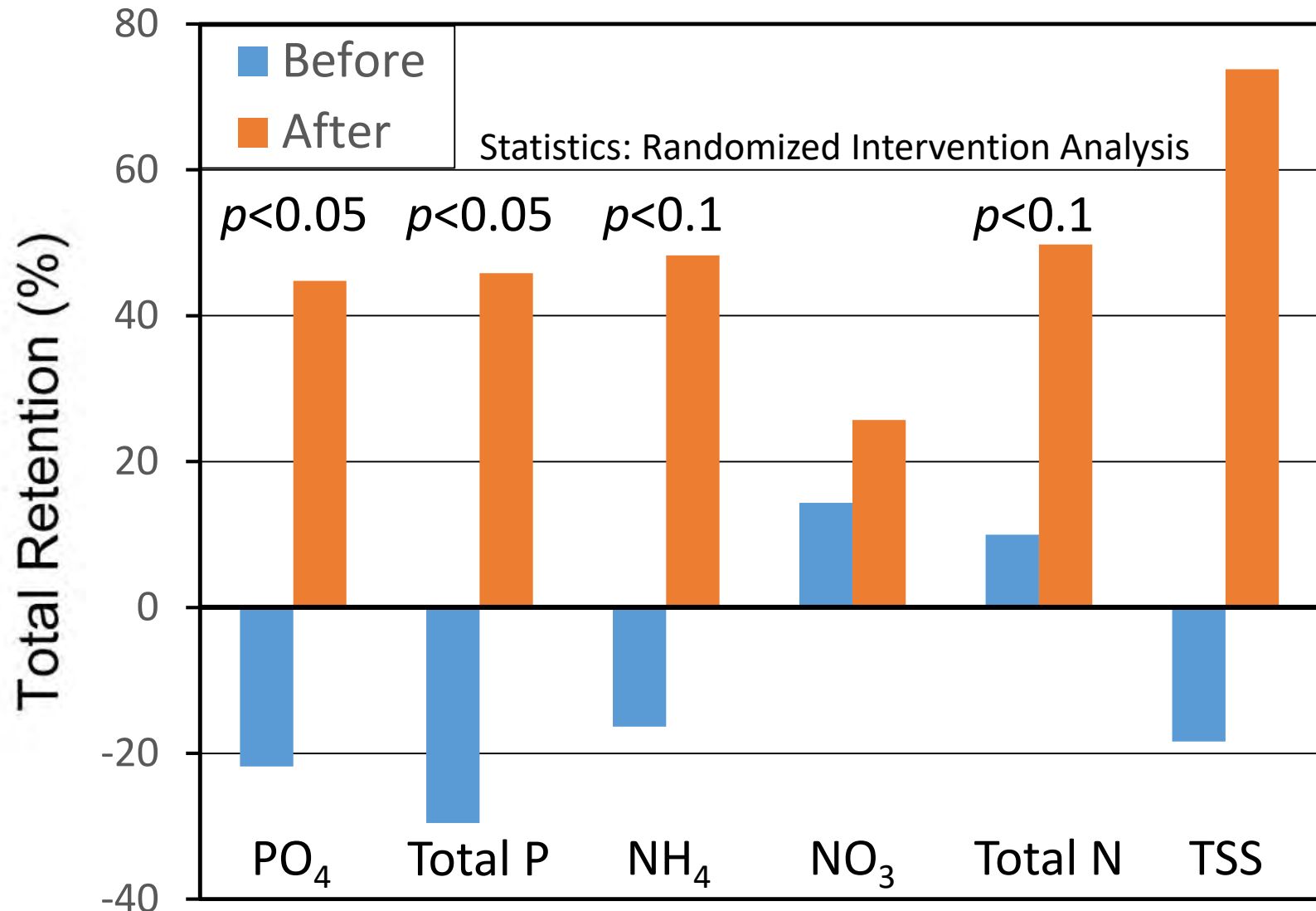
Bluejay Branch
=Control

Muddy Creek Watershed
=Treatment

RSC



Comparing the inlet and outlet of the restored reach: Percentage of inflow retained increased after restoration



Thompson et al. 2018. Ecological Engineering 124:7-18.

Bluejay Branch
=Control

Muddy Creek Watershed
=Treatment

RSC

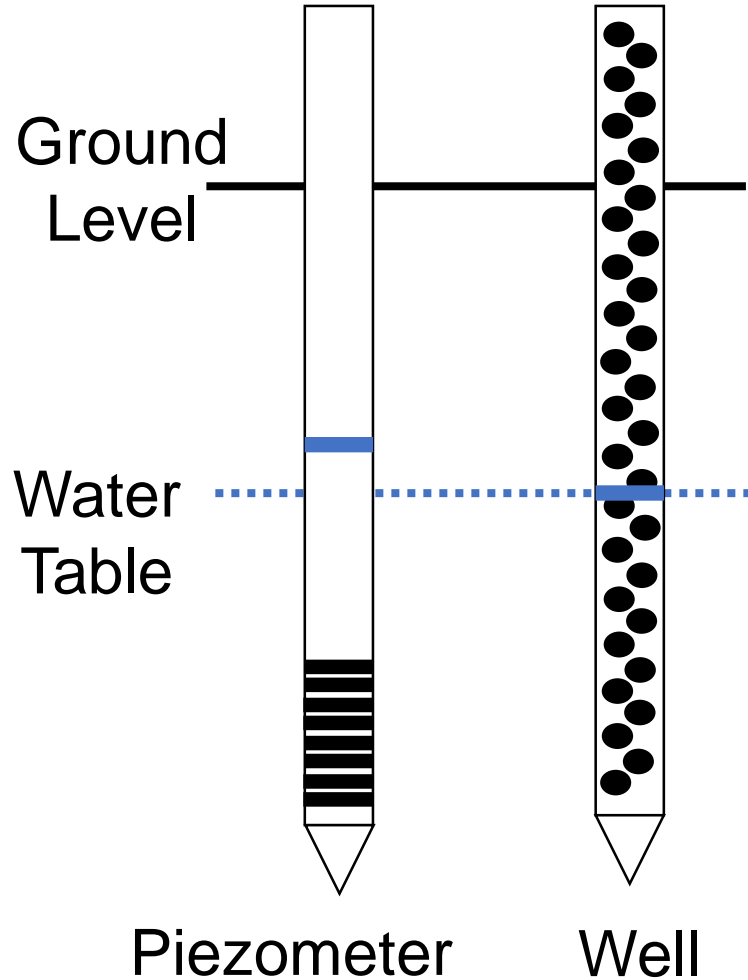
Comparing the treatment and control watersheds:

No statistically significant changes in loads could be attributed to the restoration.
The effects may have been masked by the effects of beaver ponds downstream.

Transect of Wells and Piezometers

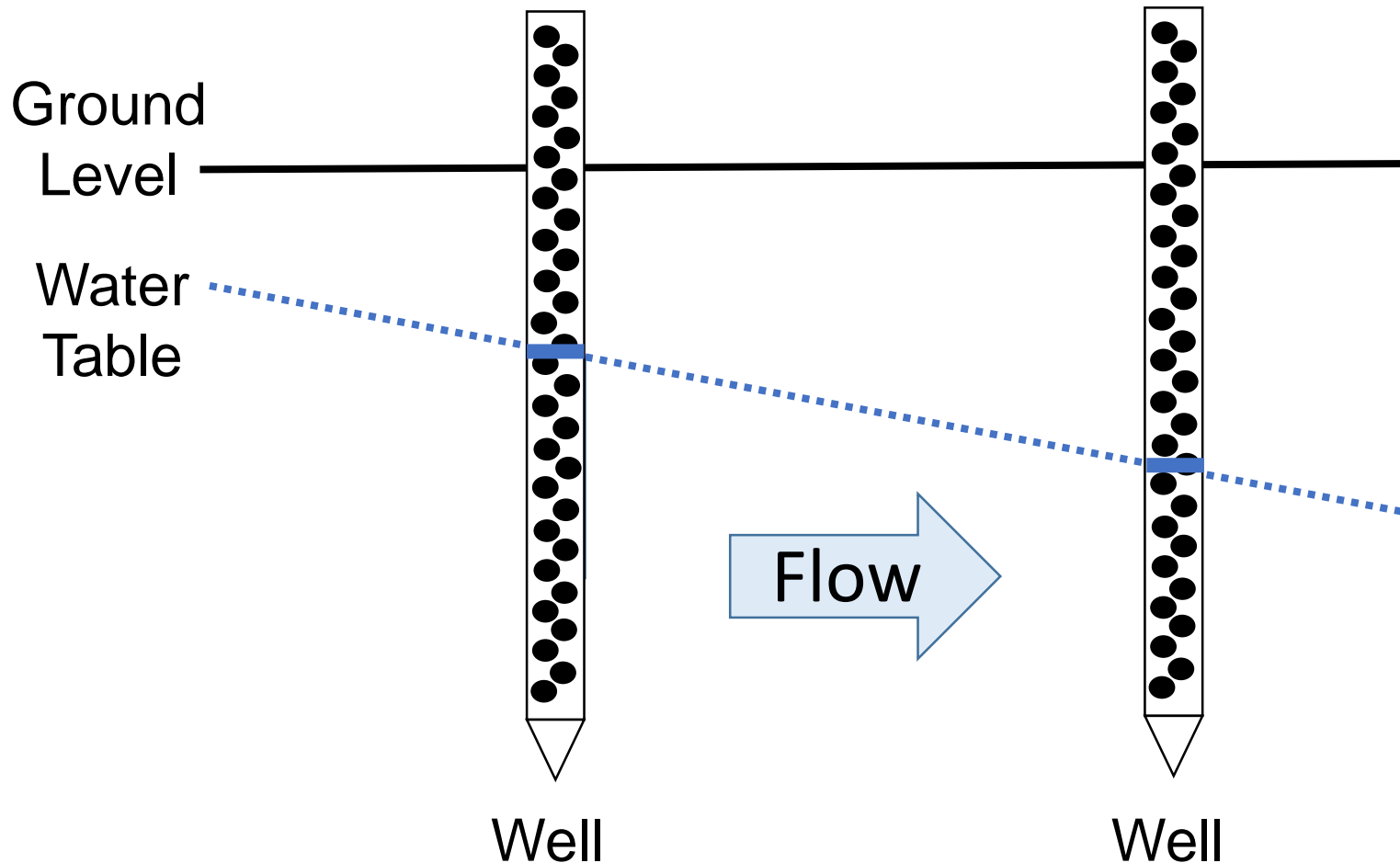


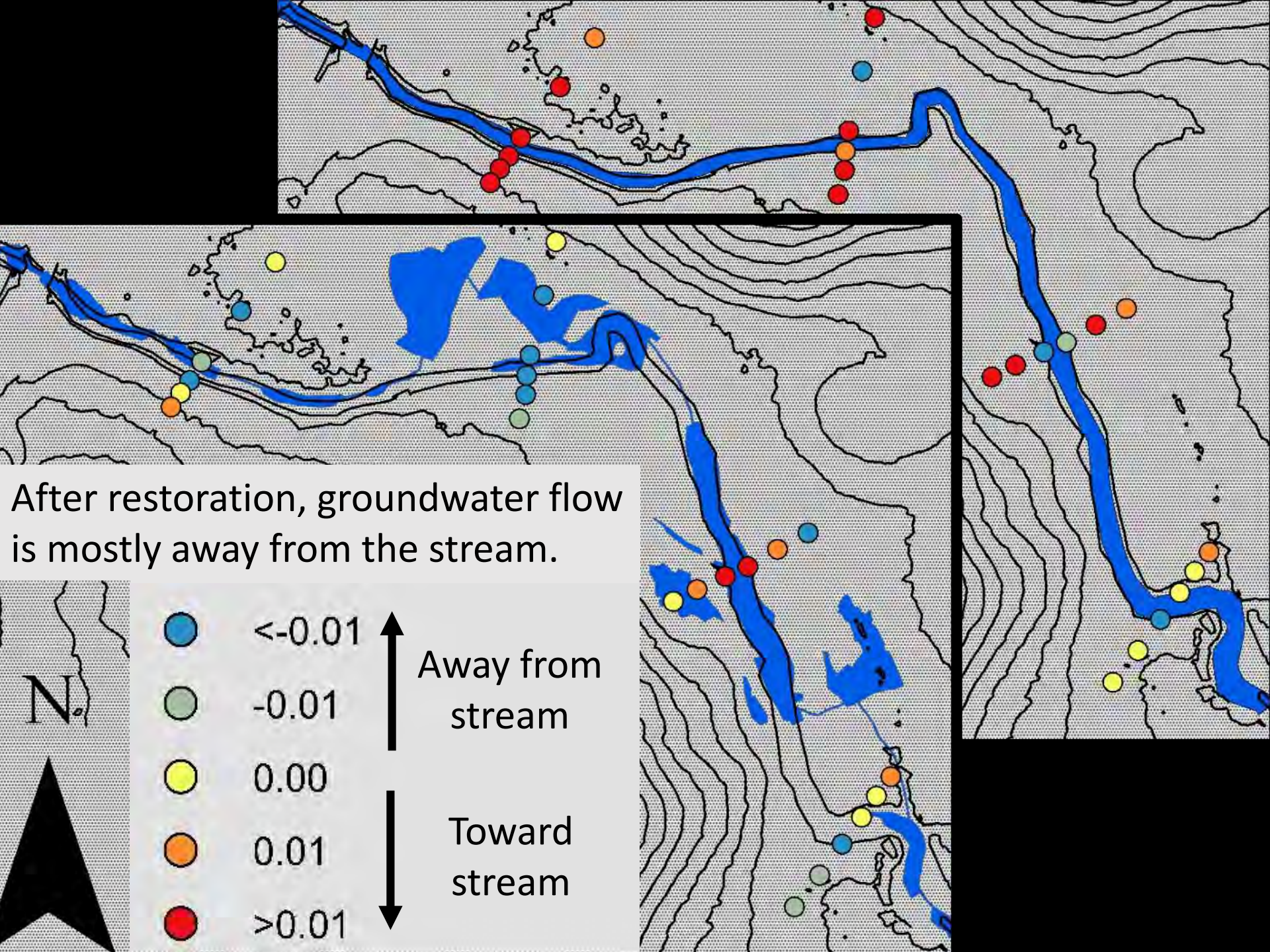
Groundwater Monitoring



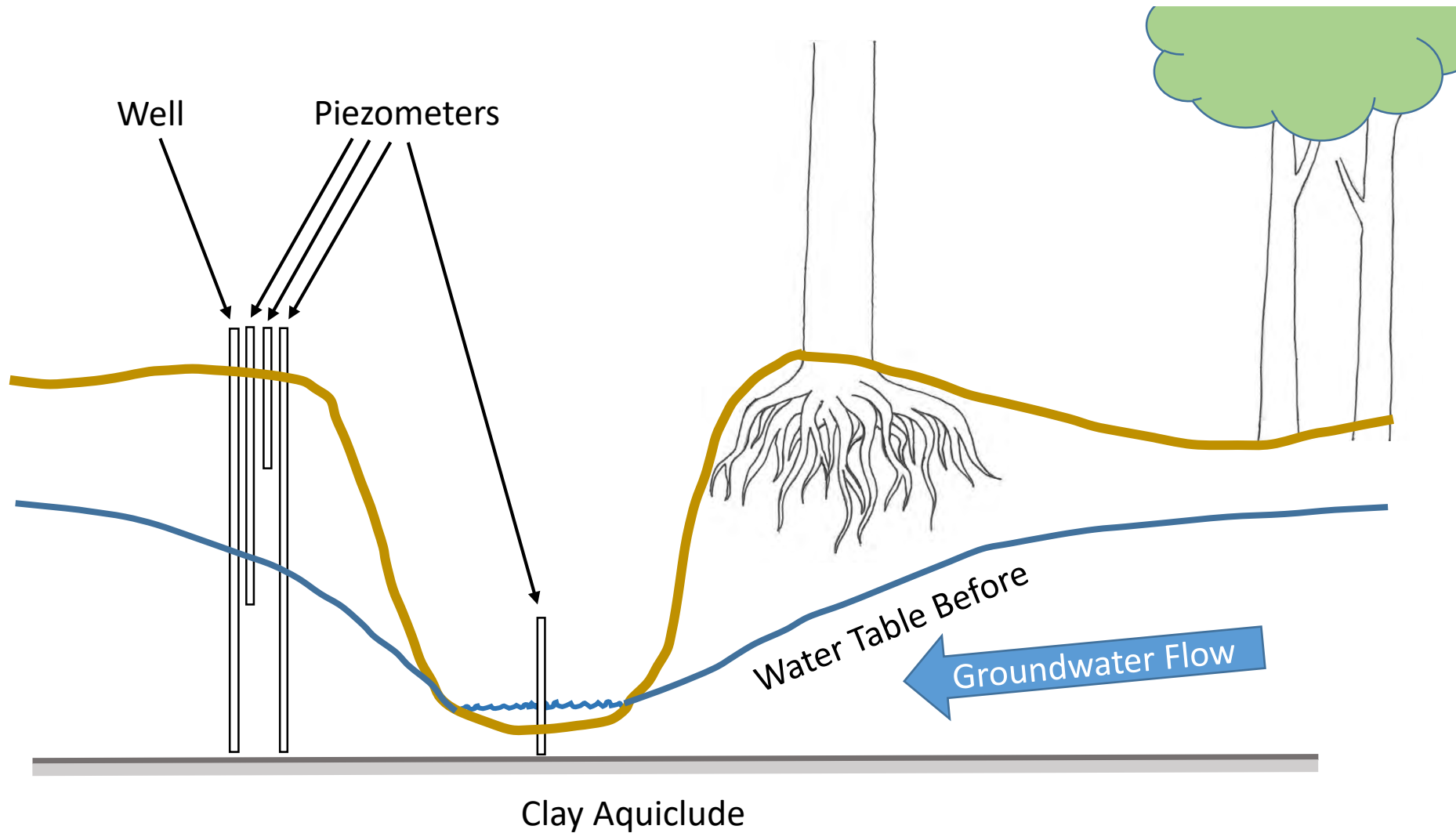
- Water levels measured weekly.
- Chemistry analyzed monthly for two years.

Horizontal Pressure Gradient

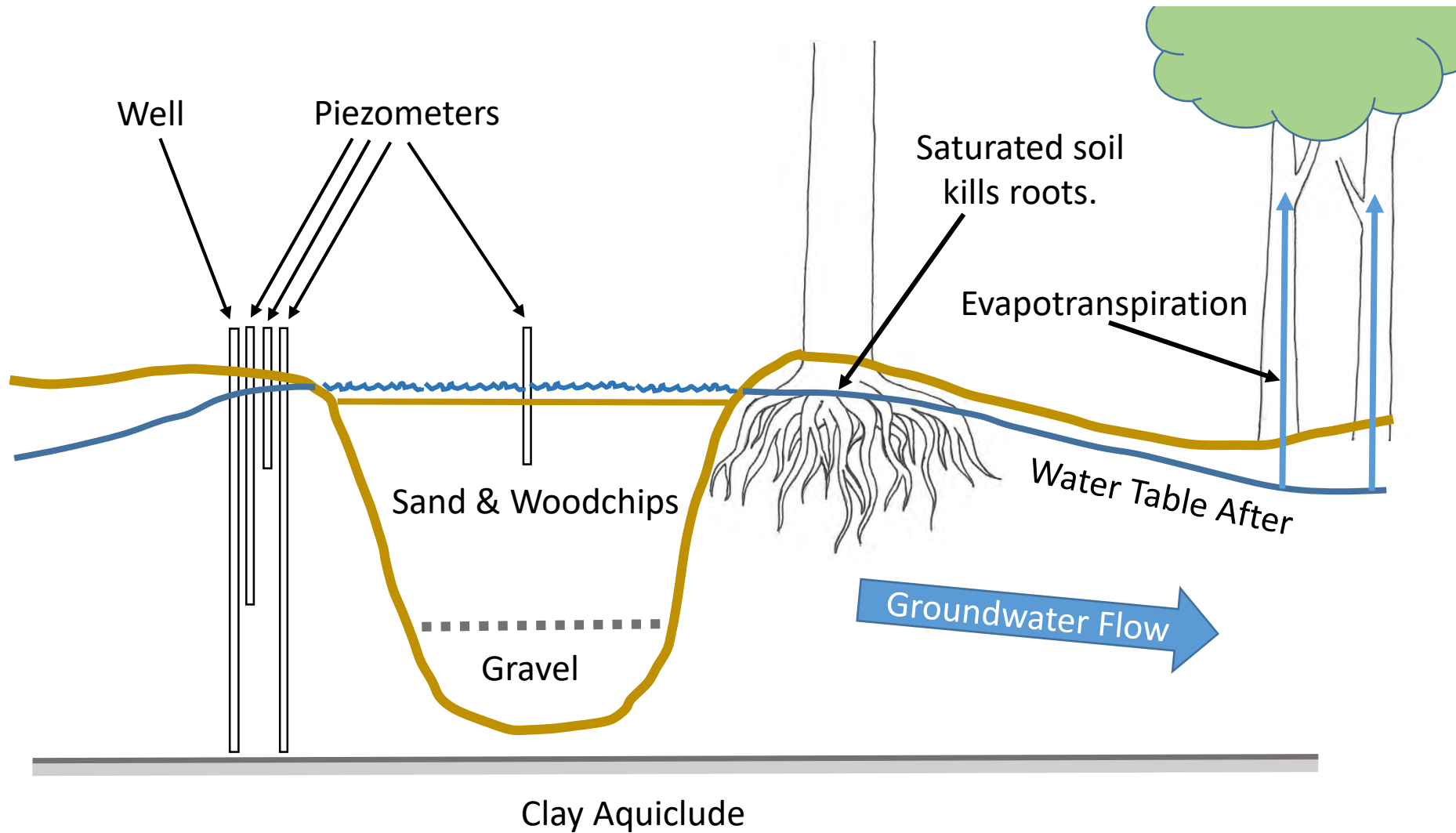




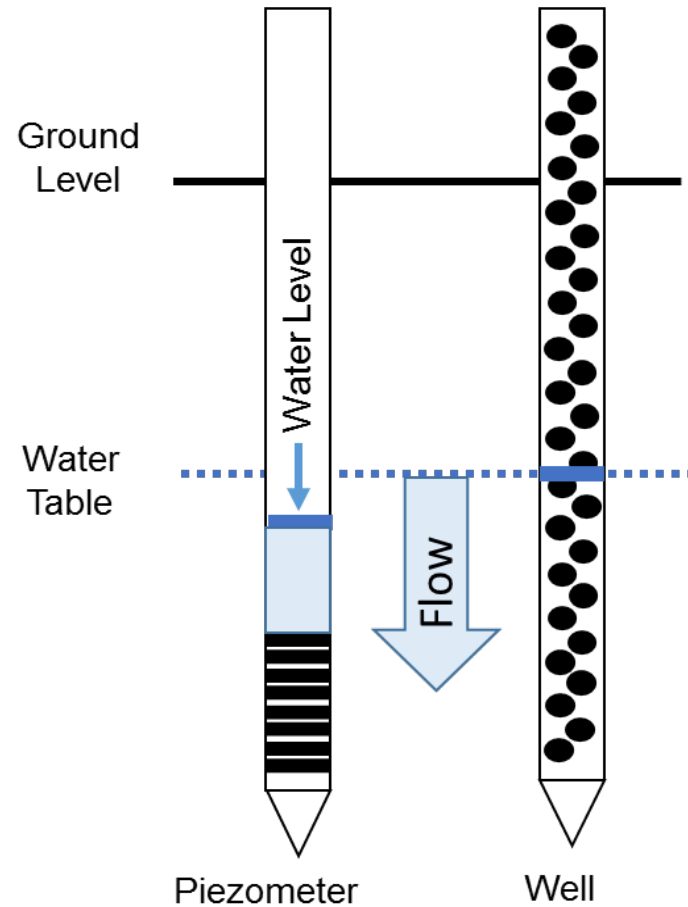
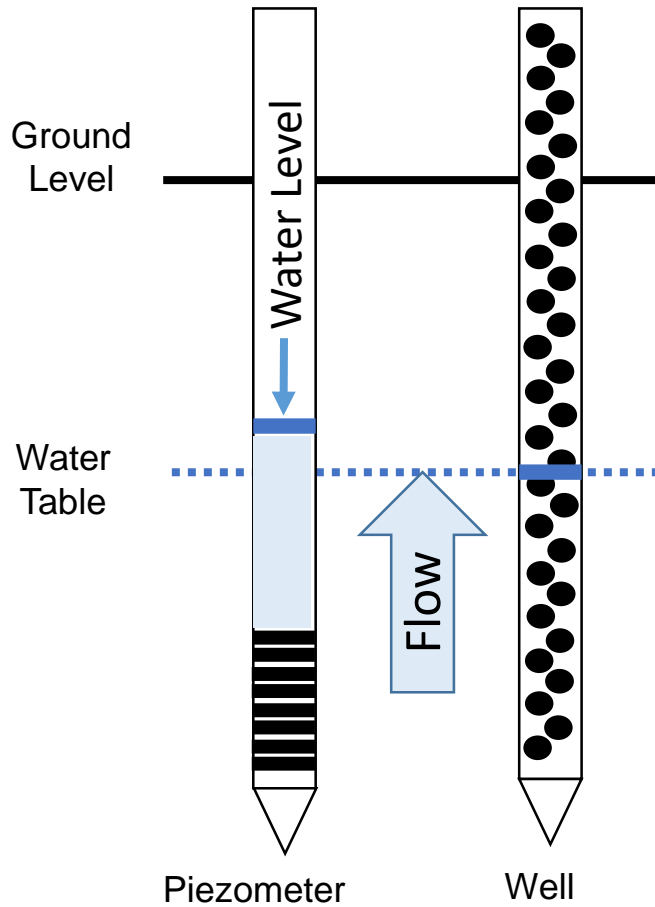
Before restoration, the eroded channel drained the banks.



After restoration, the water table elevation increased.

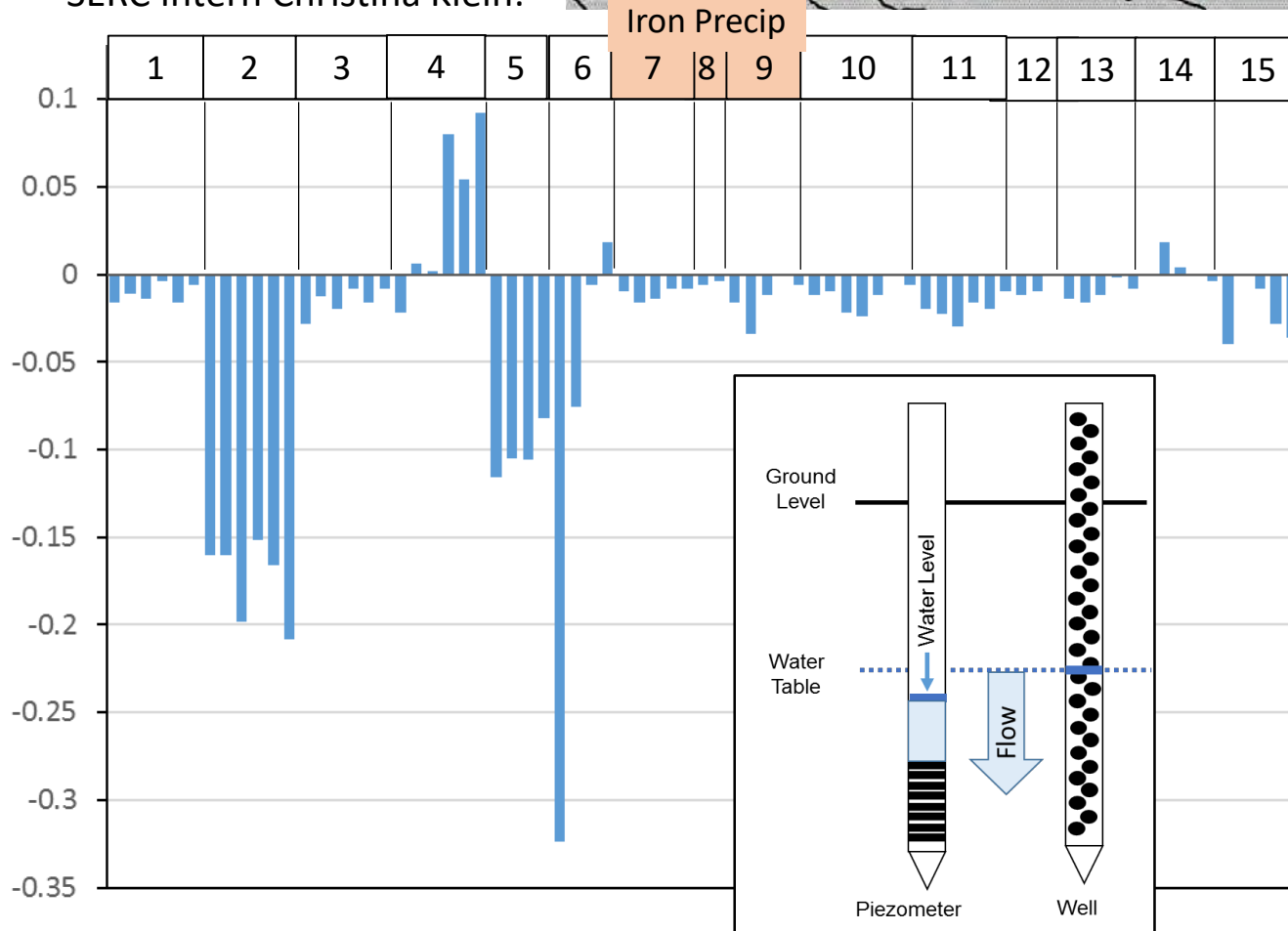
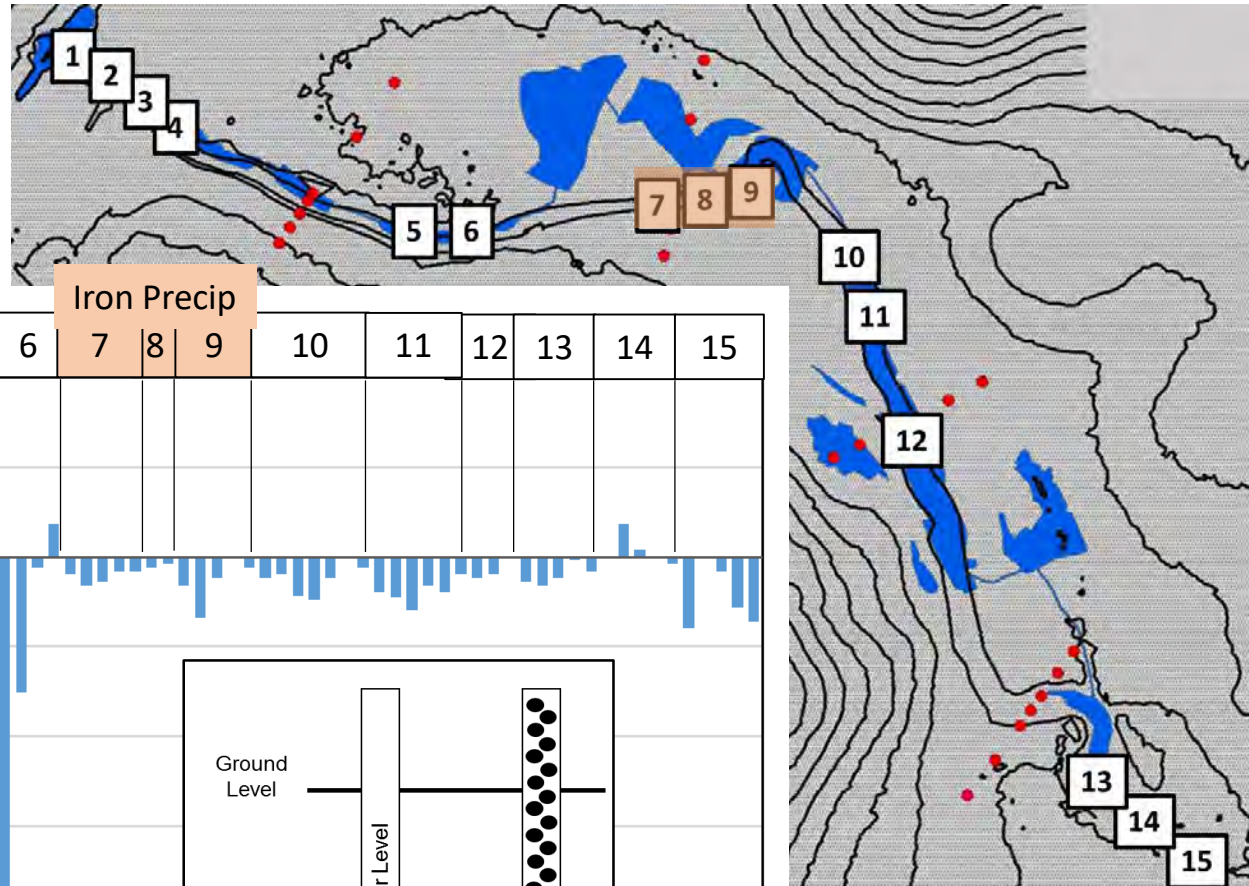


Vertical Pressure Gradients



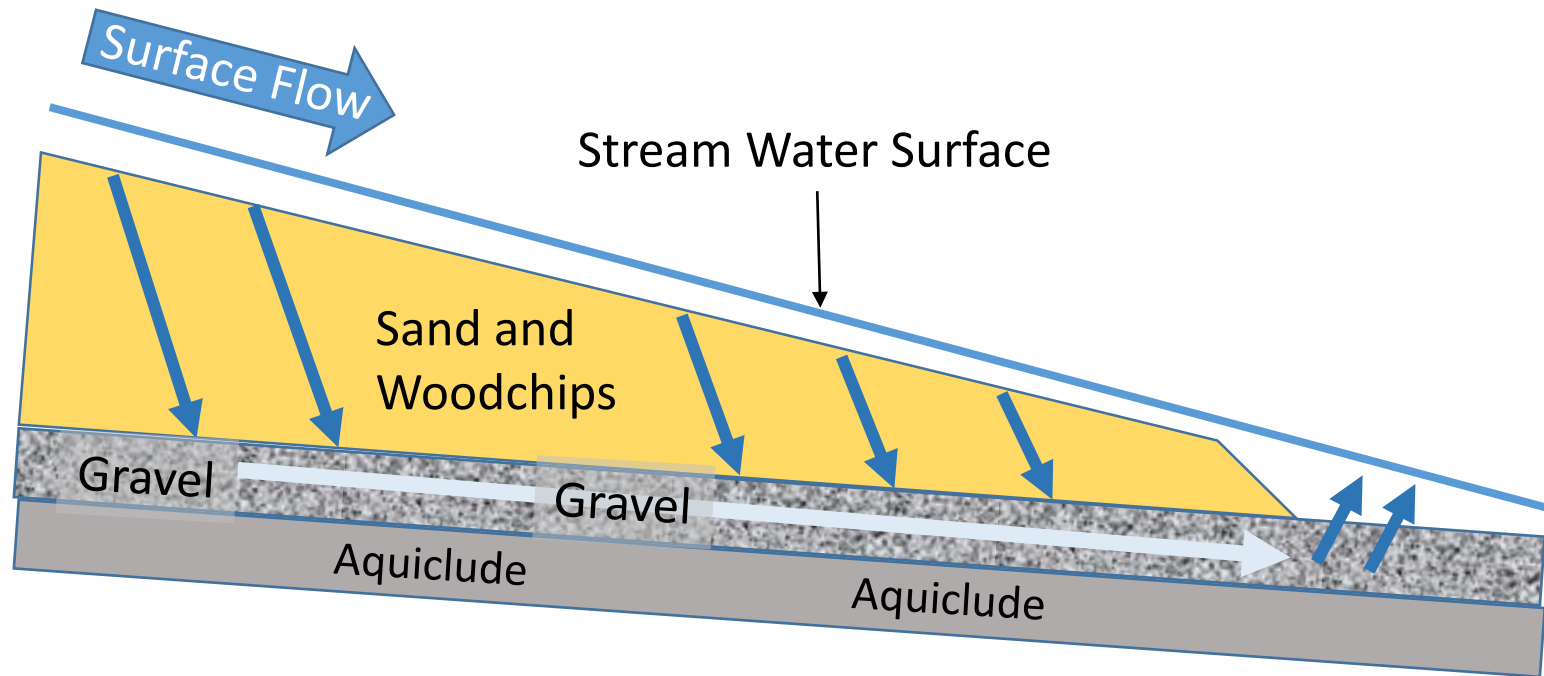
Vertical pressure gradients in streambed groundwater: Negative values suggest infiltration

May-June 2018 data from
SERC intern Christina Klein:



Sand Filter Concept:

- The gravel layer allows faster groundwater flow than the overlying sand.
- This pulls water downward through the sand.
- At the end of the restored reach groundwater carried through the gravel is released back into the surface flow.



Groundwater chemistry after restoration:

Statistically significant changes in dissolved concentrations

Decreased:

Phosphate
Ammonium
Sulfate
pH

Increased:

Organic C
Iron
Oxygen
Conductivity

No change:

Nitrate

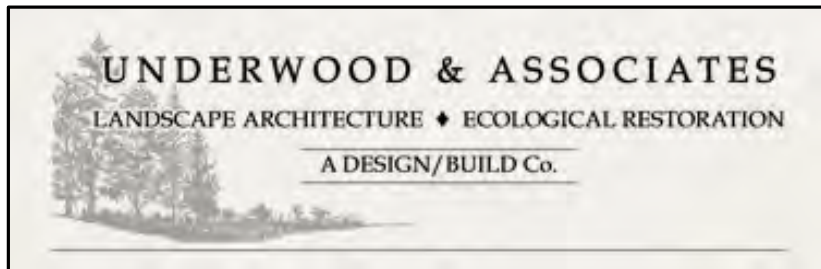
Summary: Surface Water

- Comparing loads entering and leaving the restored reach before and after restoration:
 - Significant retentions of: phosphate, total P, ammonium, and total N.
- Comparing control and treatment watersheds:
 - No significant effects of restoration.
 - Effects may have been masked by retentions in beaver ponds downstream of the restored reach.

Summary: Groundwater

- The restoration altered the distribution and flow of groundwater around the restored reach.
- Groundwater chemistry changed after the restoration.
- Enhanced exchanges of surface water and groundwater may contribute to nutrient retention.

We thank these organizations for support:



Rathmann Family Foundation

