

# Demonstration and Evaluation of Regenerative Stormwater Conveyance (RSC) for Reducing Nutrient Pollution from Agricultural Sources



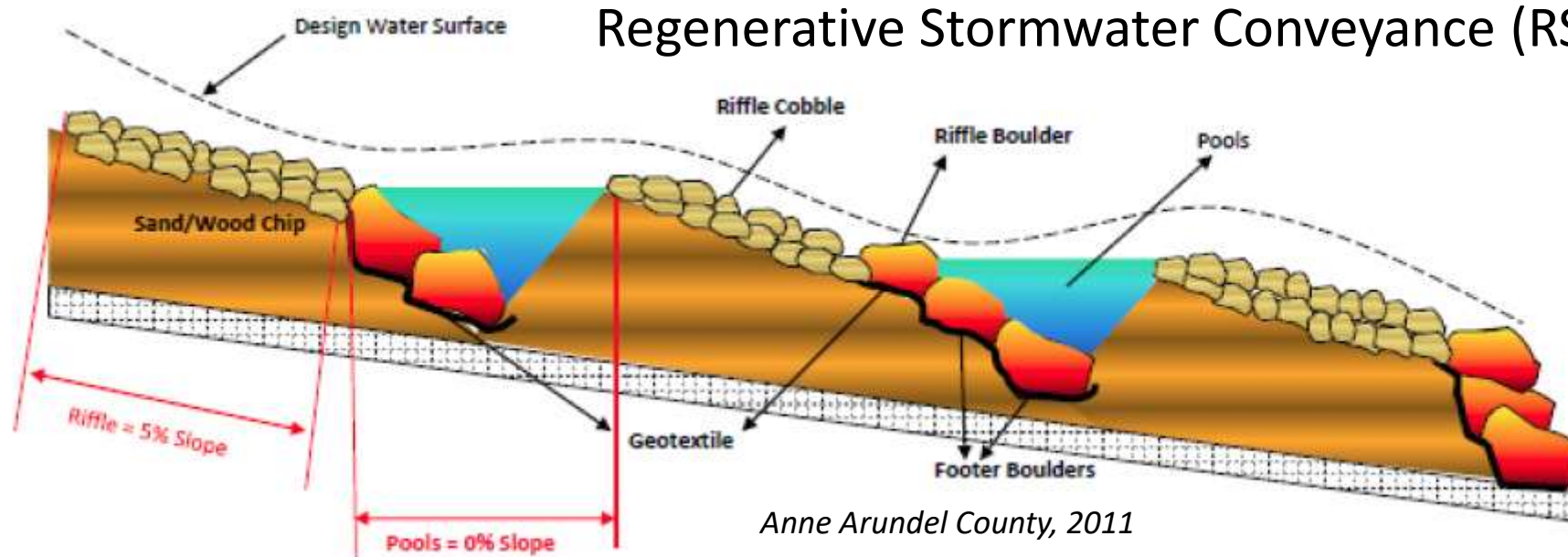
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<sup>1</sup> NC Sea Grant

<sup>2</sup> Biological and Agricultural  
Engineering Department  
NC State University



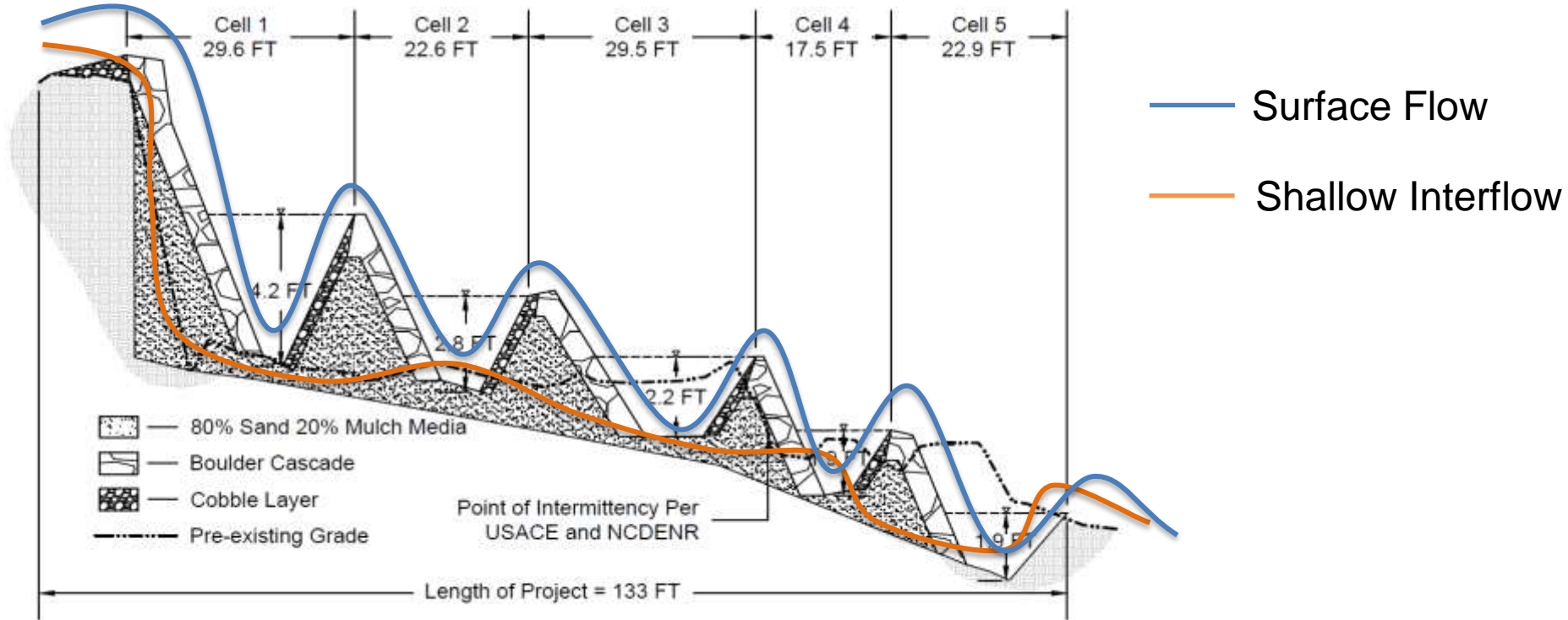
# Evaluating Innovative Practices



Regenerative Stormwater Conveyance (RSC)

Anne Arundel County, 2011

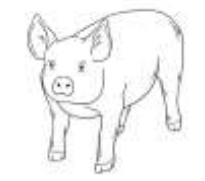
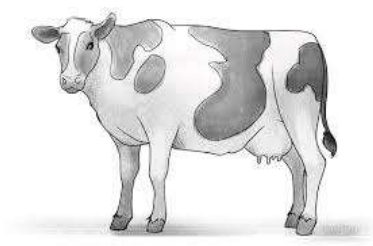
# How Does RSC Work?





**Cox Family Farm**

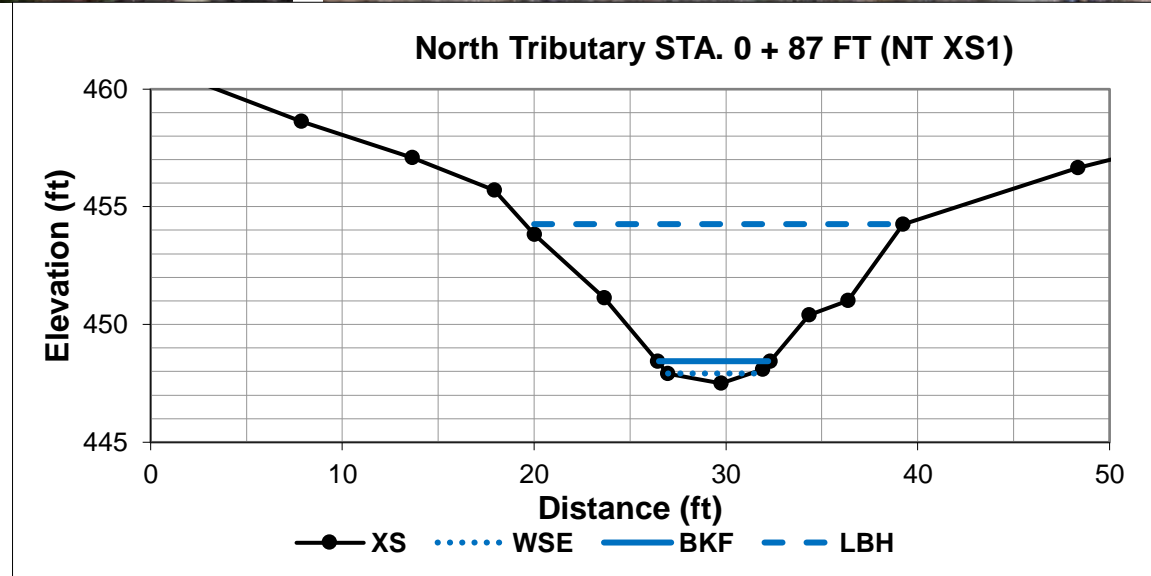
- Randolph Co.
- 100 Beef Cow + Calves - (0.4 to 0.5 cows/acre)
- Swine Lagoon – Big Gun Spray Application on Pasture



# Incised and Eroding Tributaries



Type	= G5
$A_{BKF}$	= 3.7 ft <sup>2</sup>
$W_{BKF}$	= 5.9 ft
$D_{BKF}$	= 0.6 ft
$D_{MAX}$	= 0.9 ft
W/D	= 9.4
ER	= 1.4
BHR	=7.4

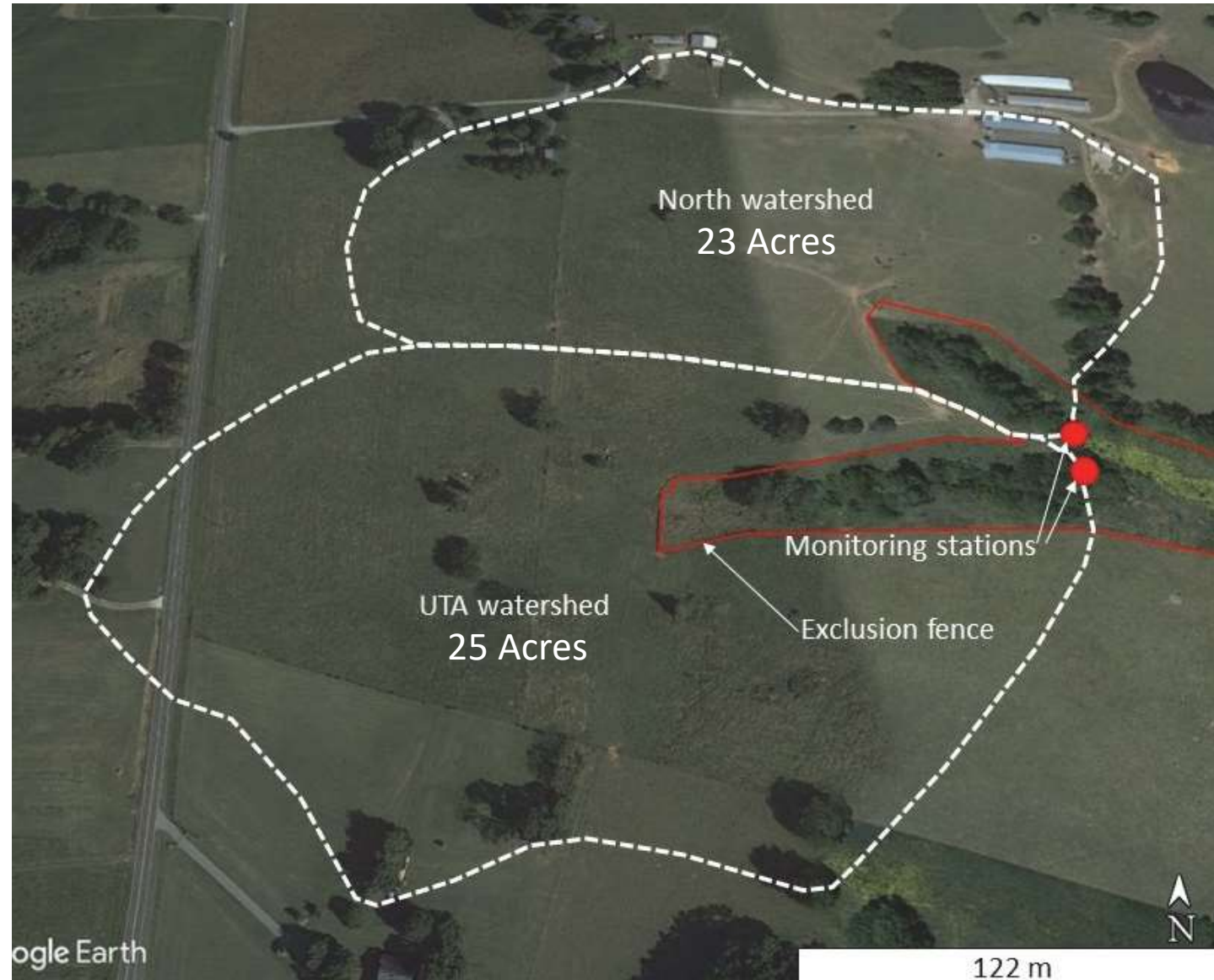


# Paired Watershed Study

**Objective:** Gauge Effectiveness of RSC for Removing Sediment & Nutrients

**Method:**

1. Monitor Both Tributaries (Existing Condition)
2. Install RSC on NT
3. No change to UTA
4. Monitor after RSC and Compare



# Monitoring

## Parameters

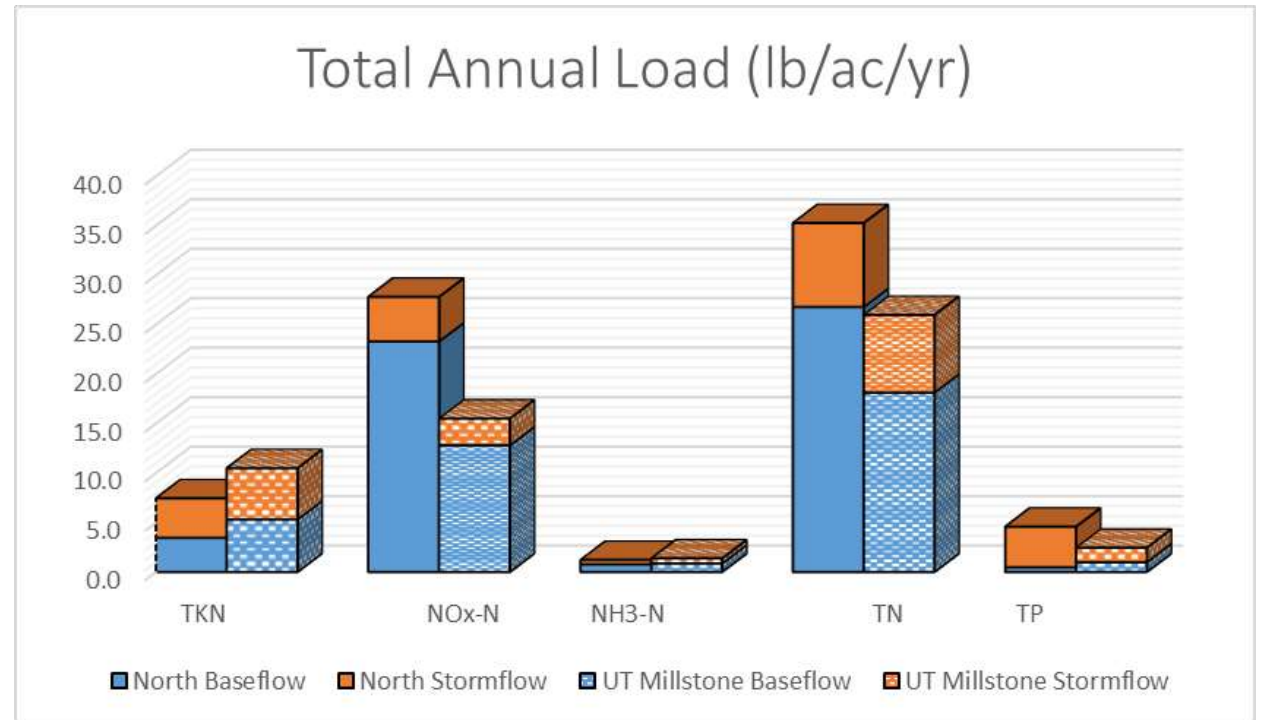
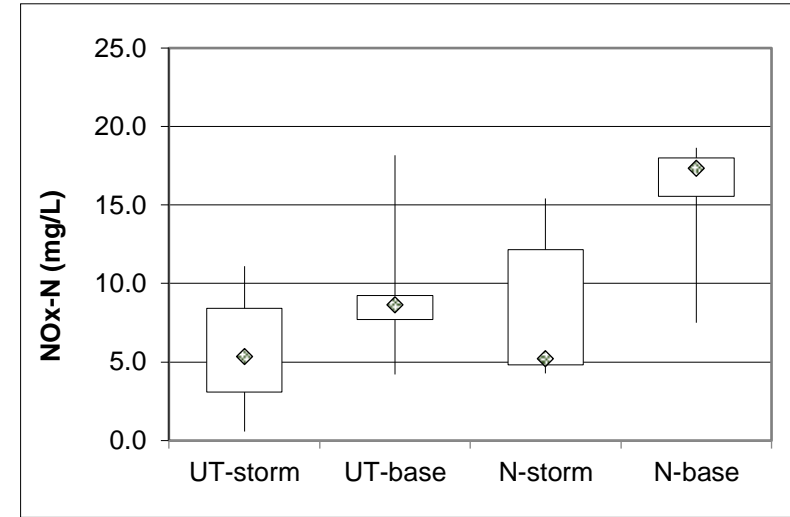
- Flow
- Groundwater Levels
- Nutrients & Sediment in Baseflow and Stormflow
- Nutrients in Groundwater

## Schedule

- Existing Condition: 8/5/14-12/31/15
- Install Fence – Nov, 2015
- Post Cattle Exclusion: 1/1/16 - 10/23/17
- Construct an RSC - June, 2021
- Post RSC: 7/13/21 to 5/23/23



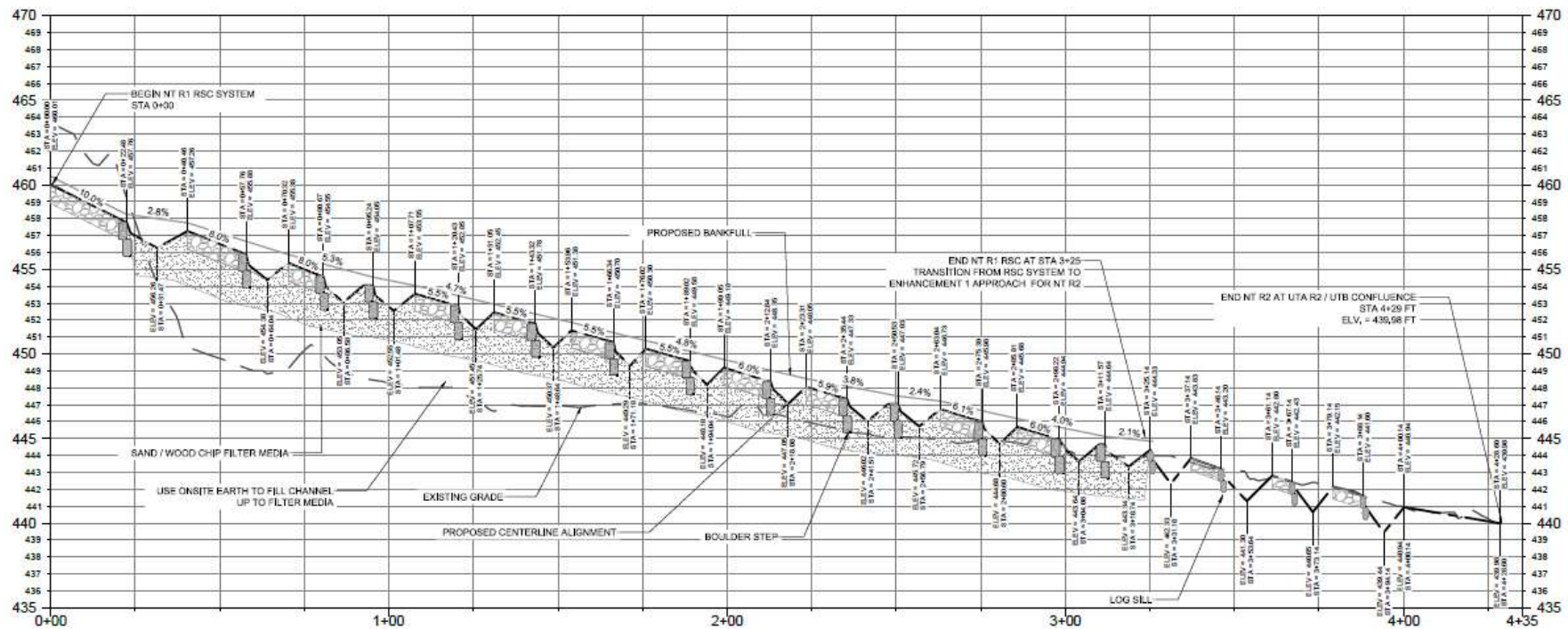
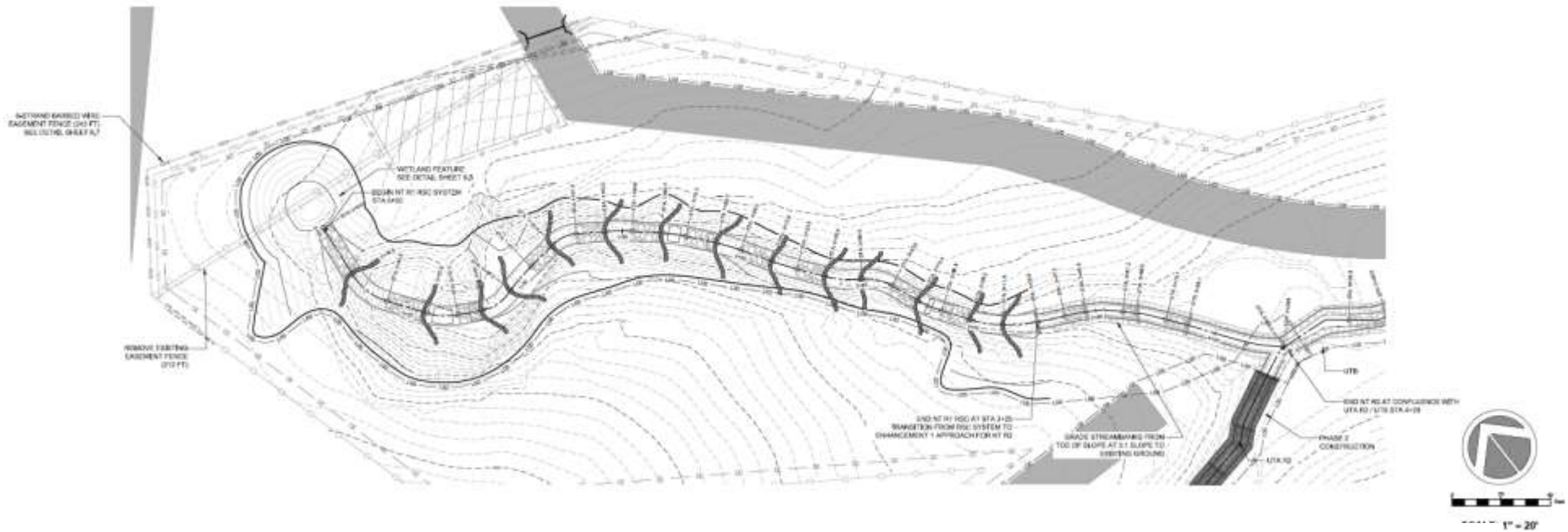
# Millstone Creek: Pre-Restoration Monitoring



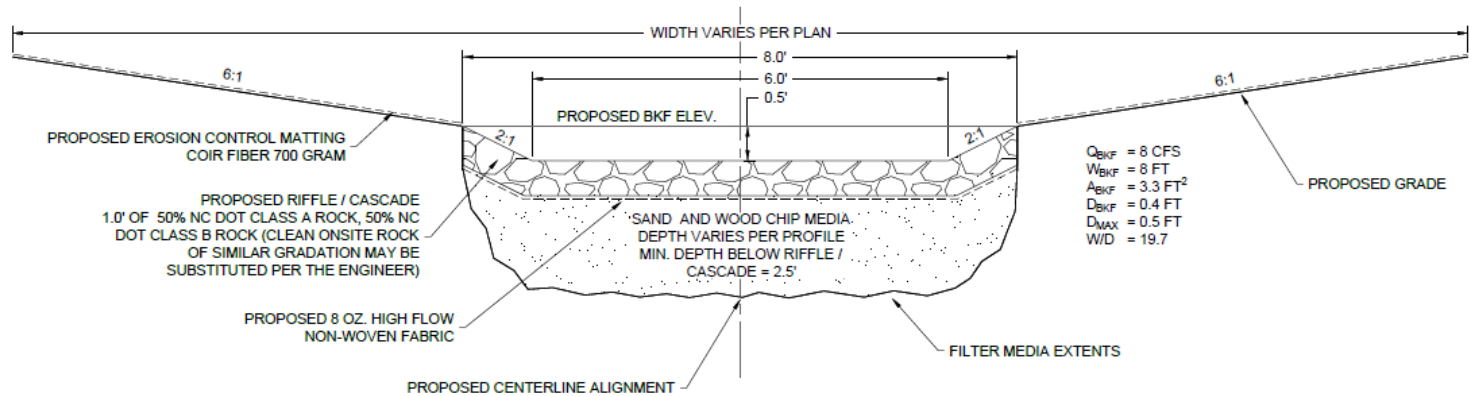


**Install Cattle  
Exclusion  
Fencing  
along  
Easement  
- Date**

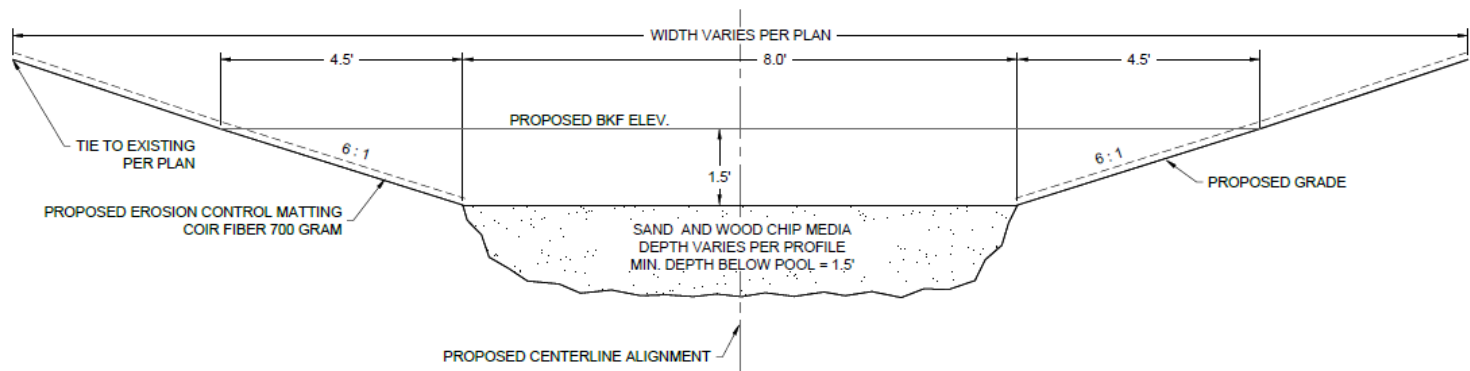




**NT R1 REGENERATIVE STORMWATER CONVEYANCE (RSC) CHANNEL RIFFLE CROSS-SECTION (TYP.)**



**NT R1 REGENERATIVE STORMWATER CONVEYANCE (RSC) CHANNEL POOL CROSS-SECTION (TYP.)**



Media- 80% Sand; 20% Mulch



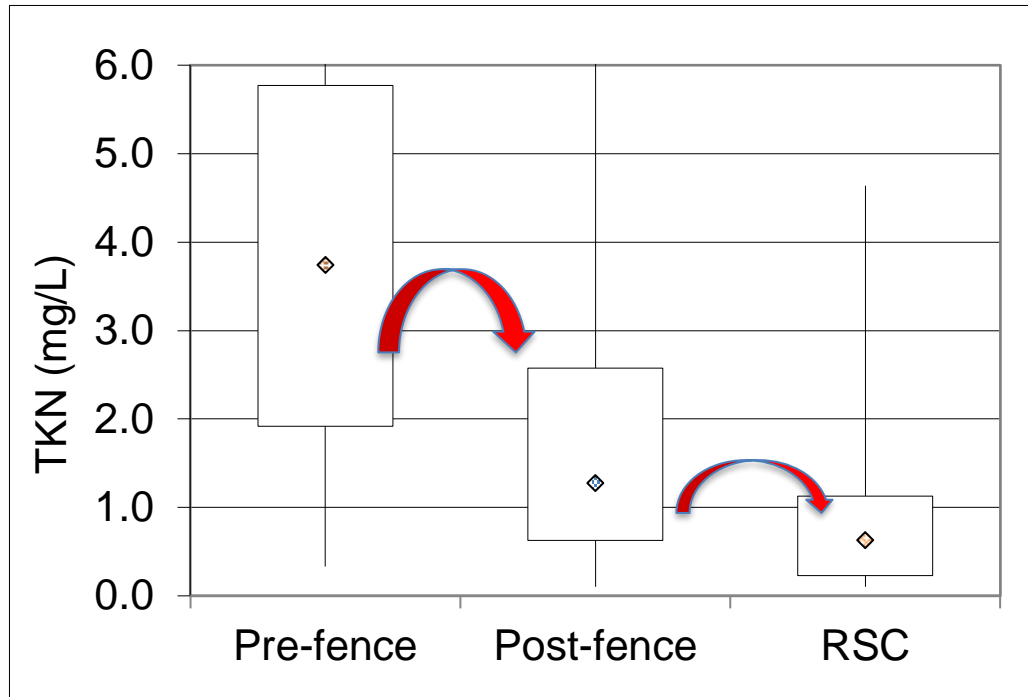




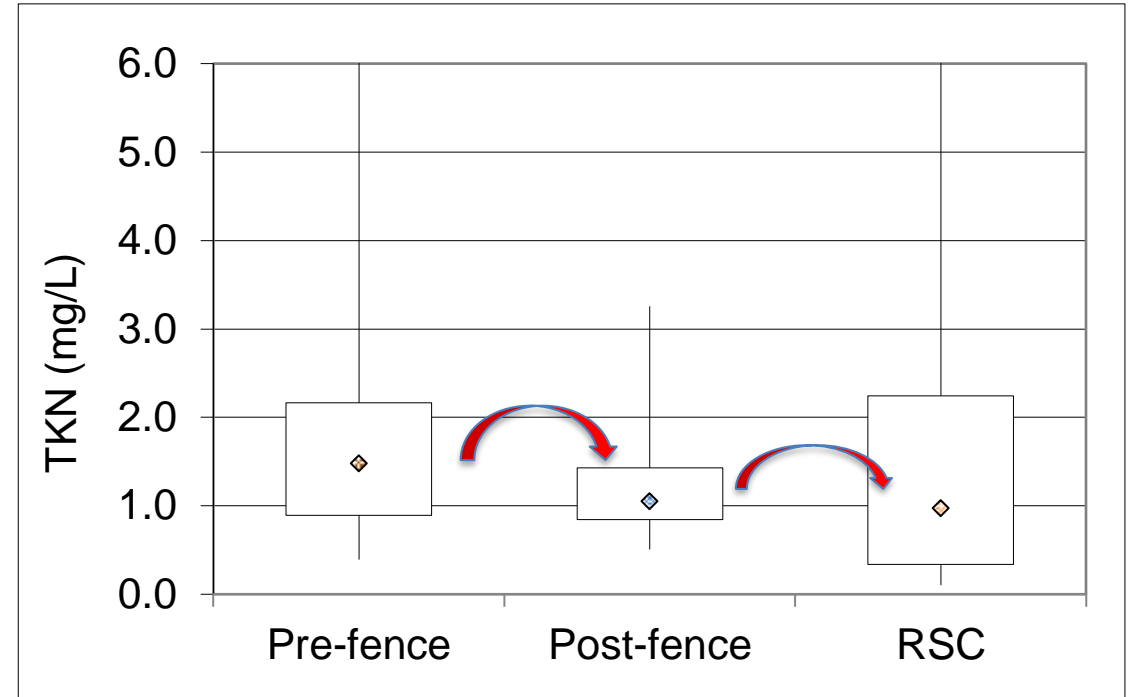


# Baseflow

## Total Kjeldahl Nitrogen (TKN = ON + NH<sub>4</sub>) Concentrations



UTA – "Control"



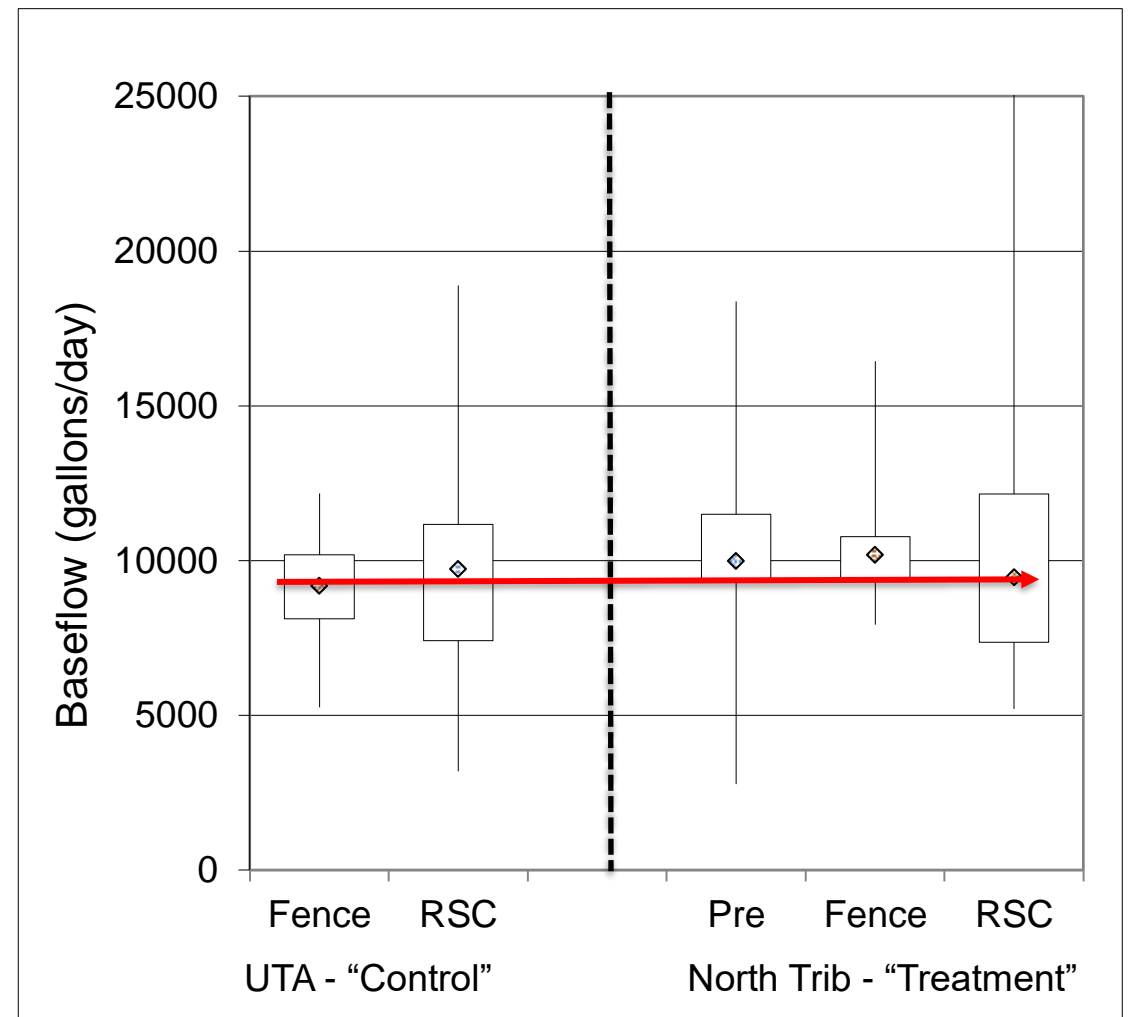
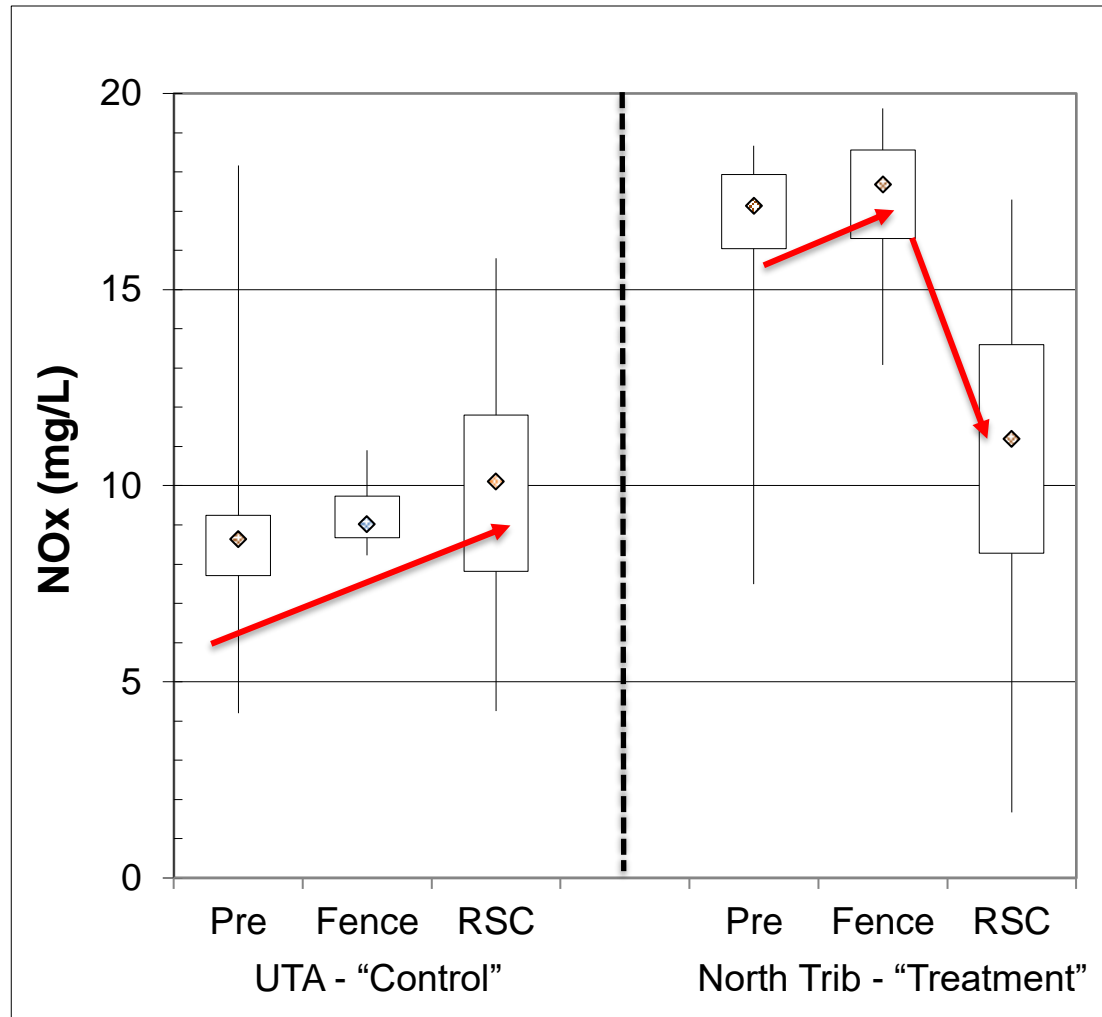
North Trib – "Treatment"

Conclusion: Cattle exclusion + riparian vegetation reduced TKN concentrations



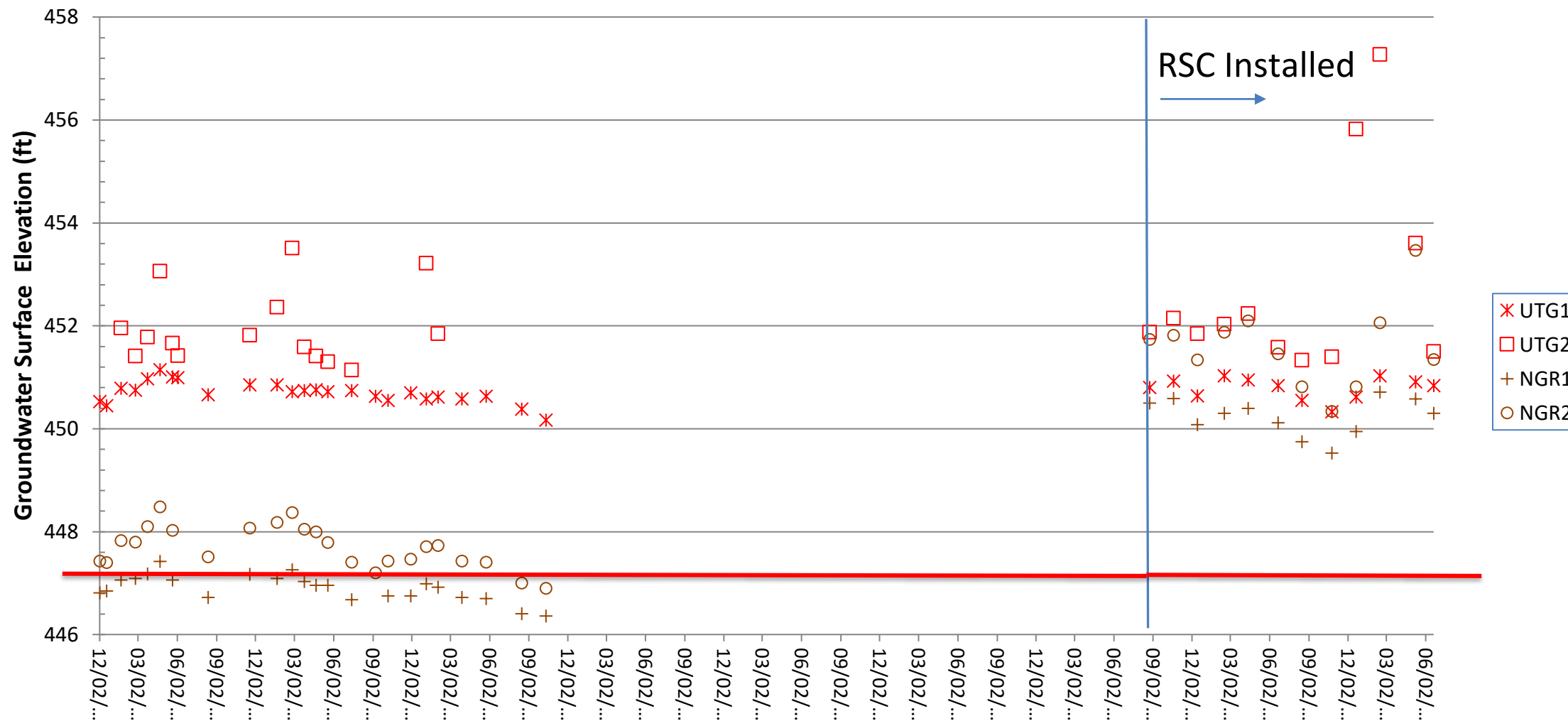
# Baseflow

## Nitrate/Nitrite Concentrations



Conclusion: RSC reduced Nitrate/Nitrate concentrations and this was not the result of dilution.

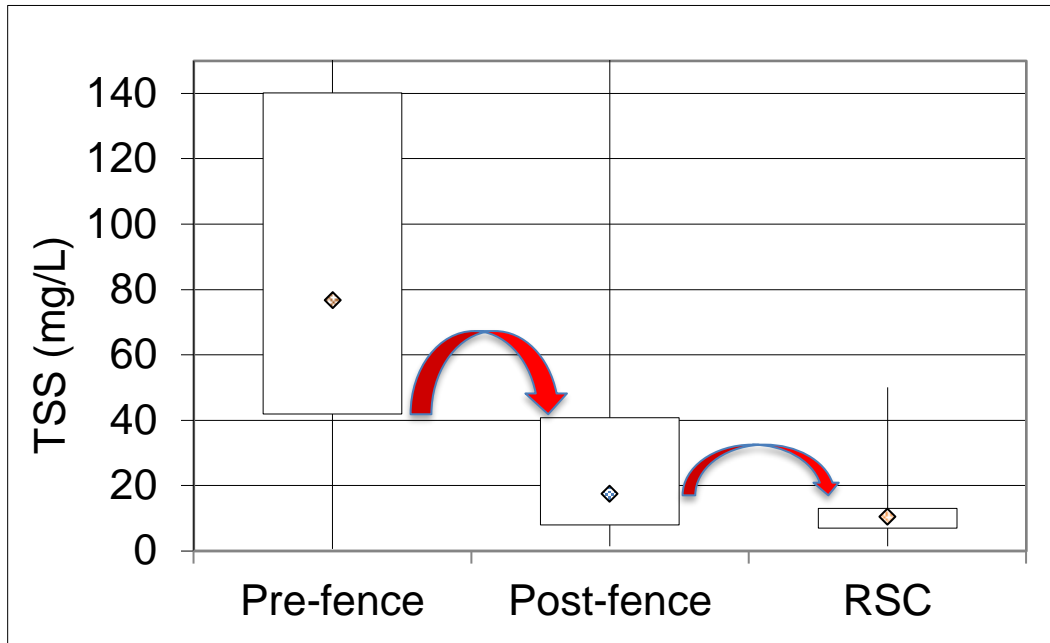
# Groundwater Table Elevations



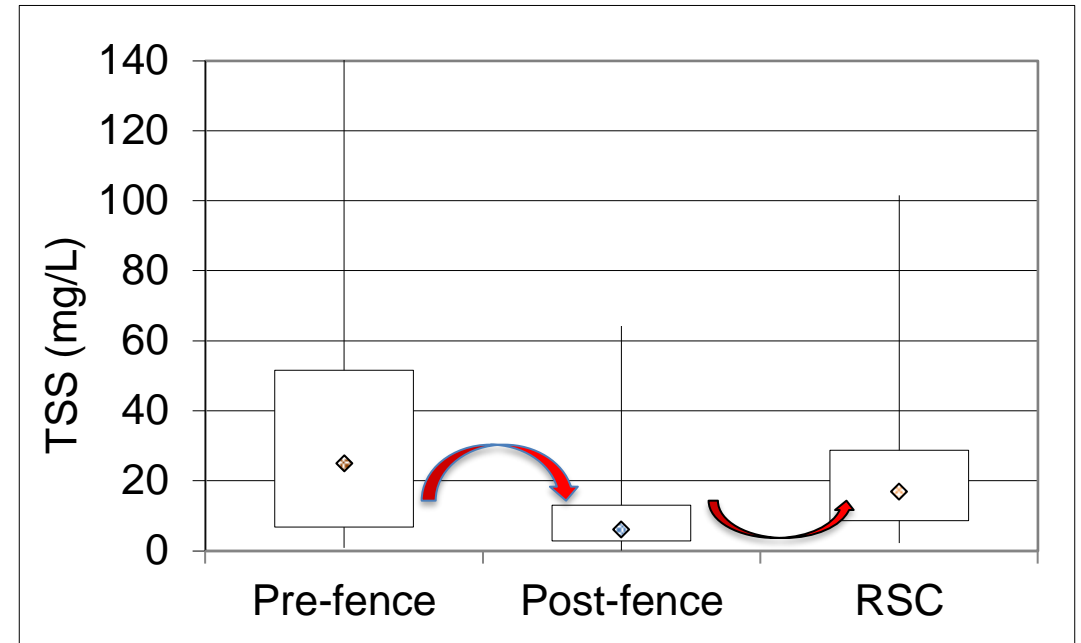
Conclusion: Improved hyporheic exchange due to a higher groundwater table combined with higher carbon levels (<2 → 3-6 mg/L) likely caused the Nitrate/Nitrite reduction.

# Baseflow

## Total Suspended Solids (TSS) Concentration



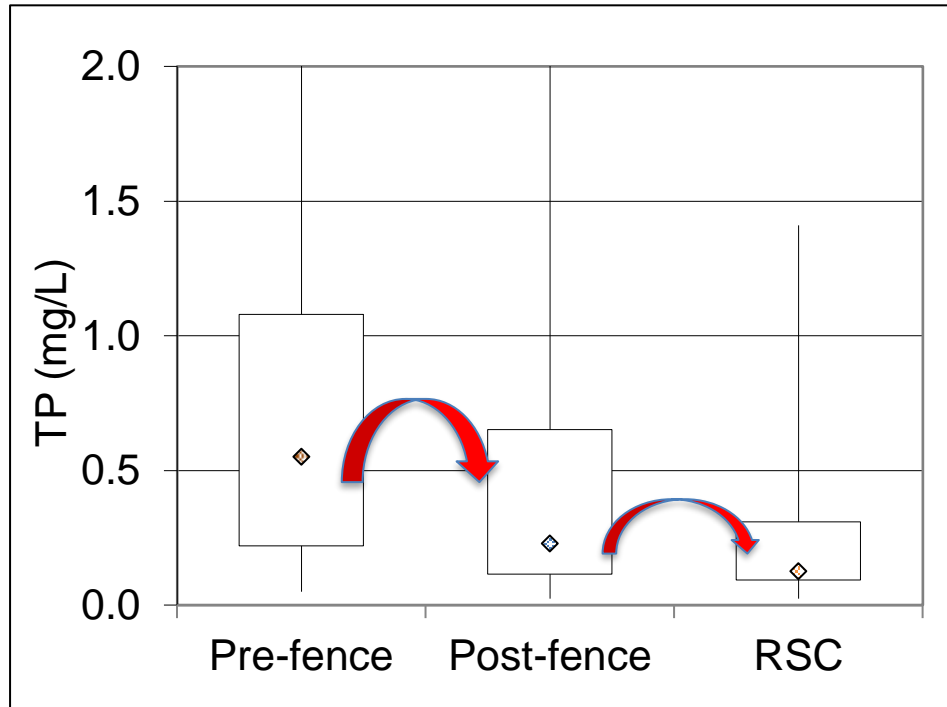
UTA – “Control”



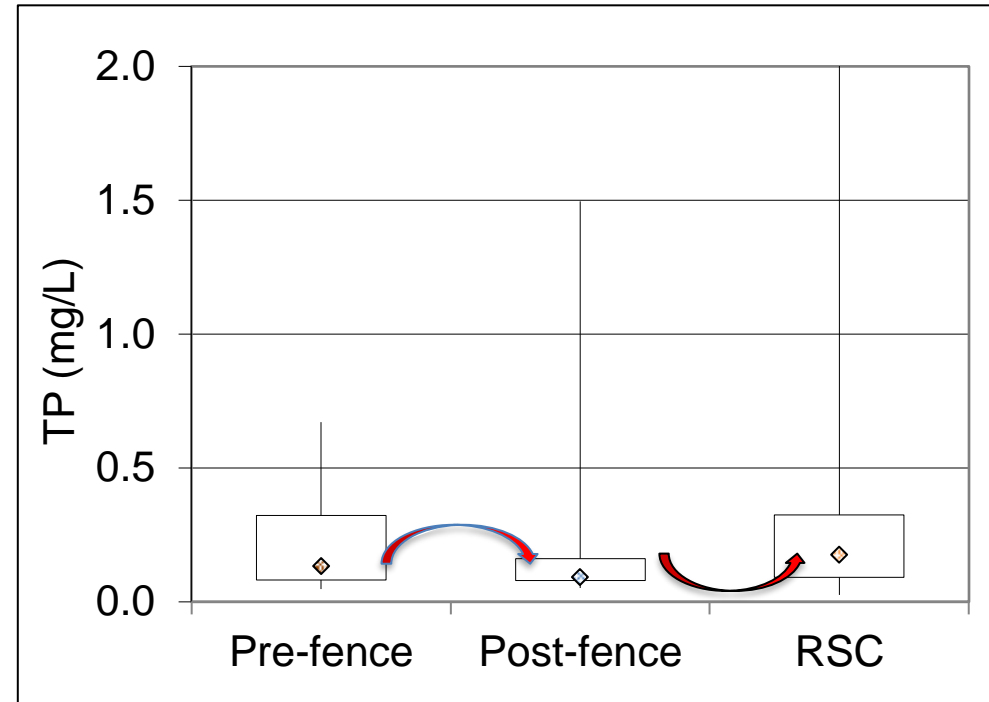
North Trib – “Treatment”

Conclusion: Cattle exclusion + Riparian Vegetation reduced TSS concentrations. Reductions continued on UTA as the buffer matured.

# Baseflow Total Phosphorus Concentrations



UTA – “Control”

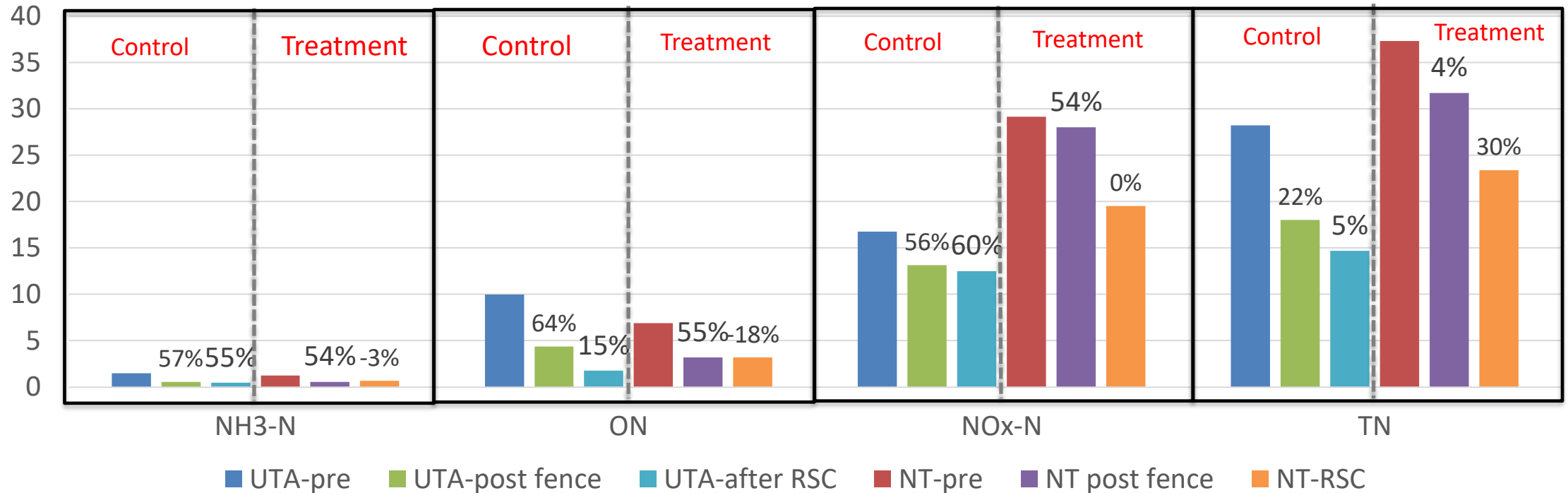


North Trib – “Treatment”

Conclusion: Cattle exclusion + riparian vegetation reduced sedimentation which in turn reduced TP concentration. Construction appears to have affected TP on the North Trib.

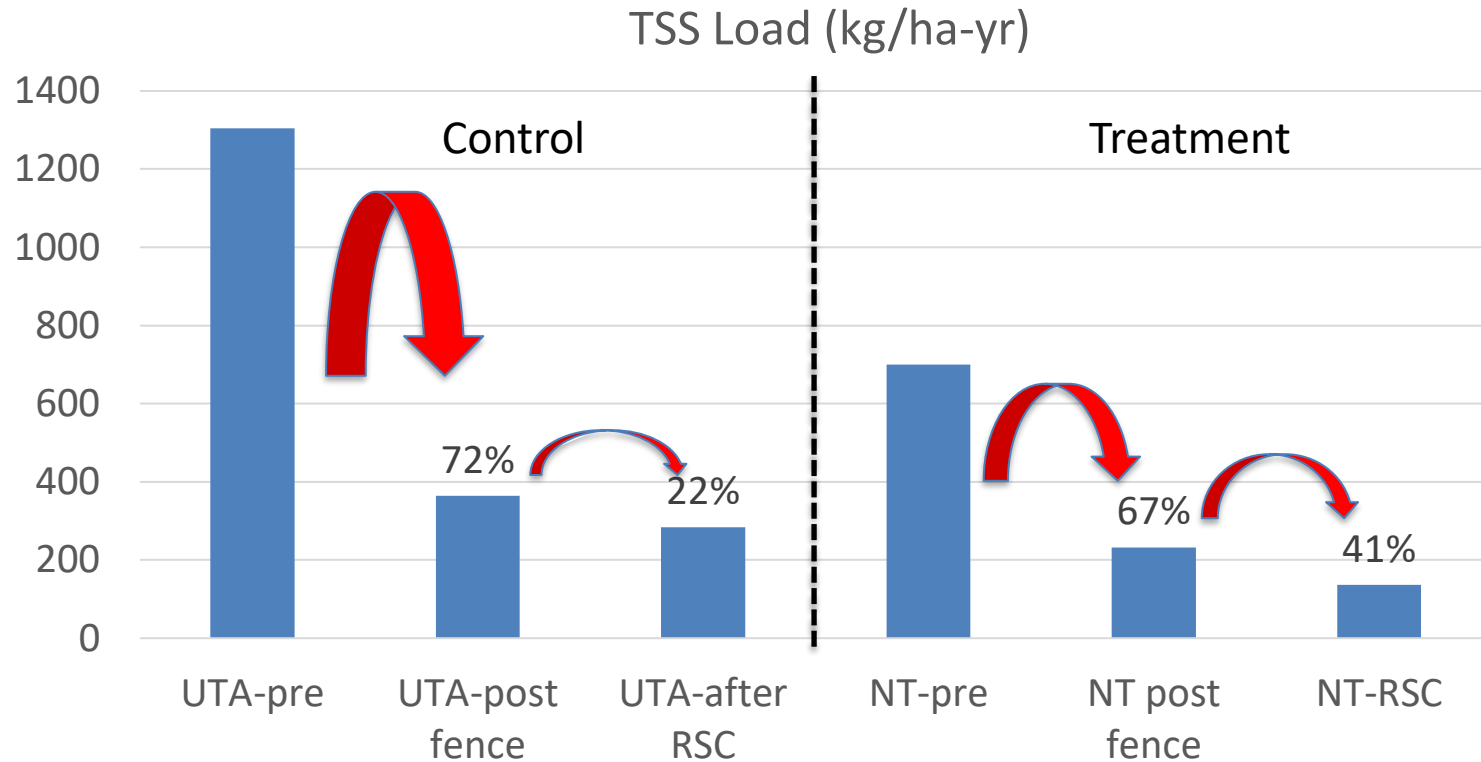
# Storm Flow + Baseflow Nitrogen Loads

NT & UTA Pollutant Loads (kg/ha-yr)



Conclusions: 1) Very little ammonia; cattle exclusion + vegetation reduced ON & NH<sub>3</sub>-N; 2) RSC reduced NO<sub>x</sub>; 3) TN reductions were greater for the control tributary (maybe due to reduced spray application of swine waste?)

# Storm Flow + Base Flow Total Suspended Sediment Loads



Conclusion: Riparian vegetation and the RSC reduced TSS loads

# Conclusions

- Cattle Exclusion Fencing - Reduced TN, TKN, TP and Sediment
- RSC - Reduced NO<sub>2</sub>/NO<sub>3</sub> and Sediment



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**ENVIRONMENTAL  
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