Description of The Drainage Water Recycling Research Site in Eastern North Carolina

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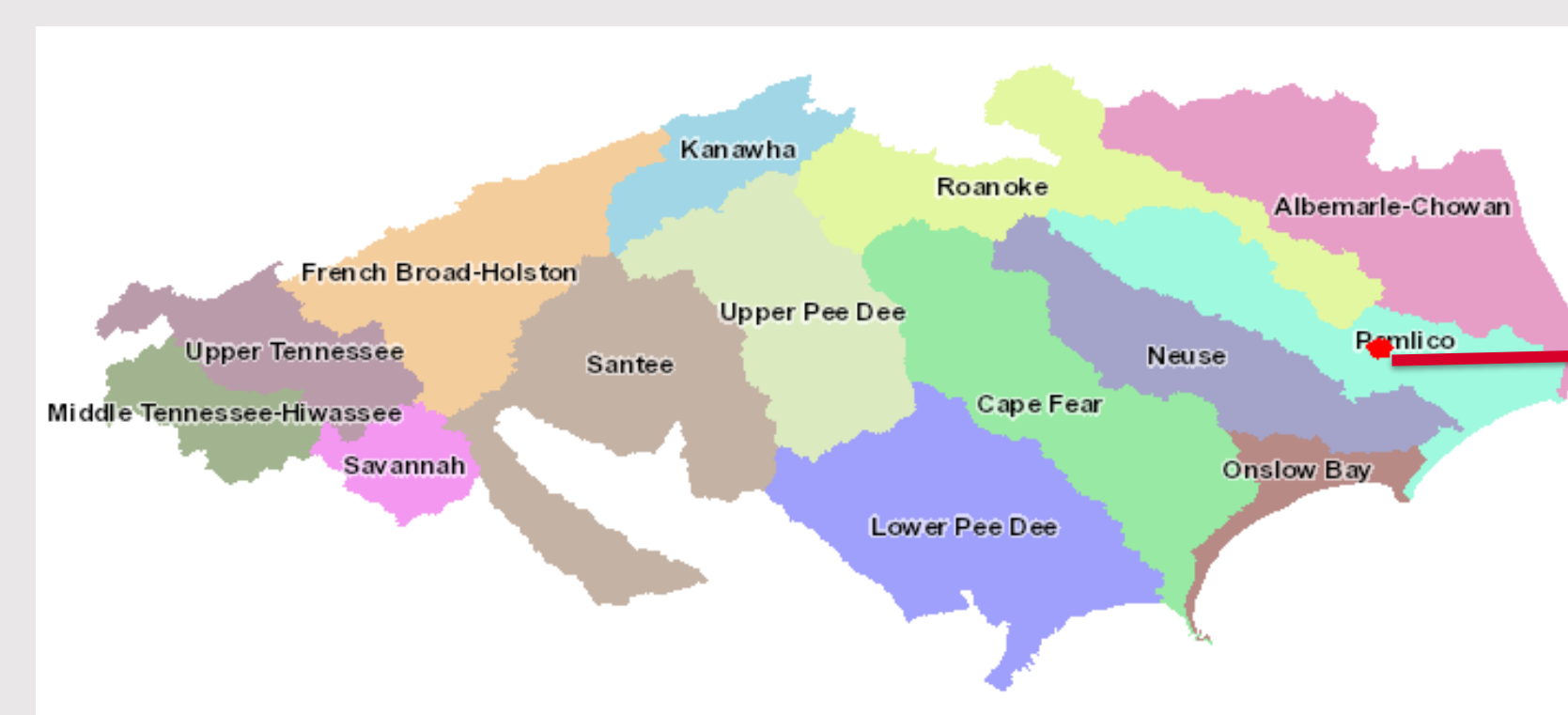
Background

- The majority of drainage occurs in the winter and spring, while crop water need occurs in the summer;
- Weather extremes and shifts in rainfall exacerbate crop water- related stresses and yield losses;
- Drainage water contains nitrogen and phosphorous that negatively affects water quality;
- **Drainage water recycling (DWR):** is a practice involving capturing drainage water and storing it in a pond or reservoir to reuse it for supplemental irrigation during dry periods of the growing season;
- **Water conservation benefits:** most of water used for irrigation is a recycled drainage water;
- **Crop yield benefits:** DWR provides water in dry periods- recycled water contains nutrients that crop can utilize as a fertilizer;
- **Water quality benefits:** DWR reduces nutrient loss- natural treatment processes occur in the pond.
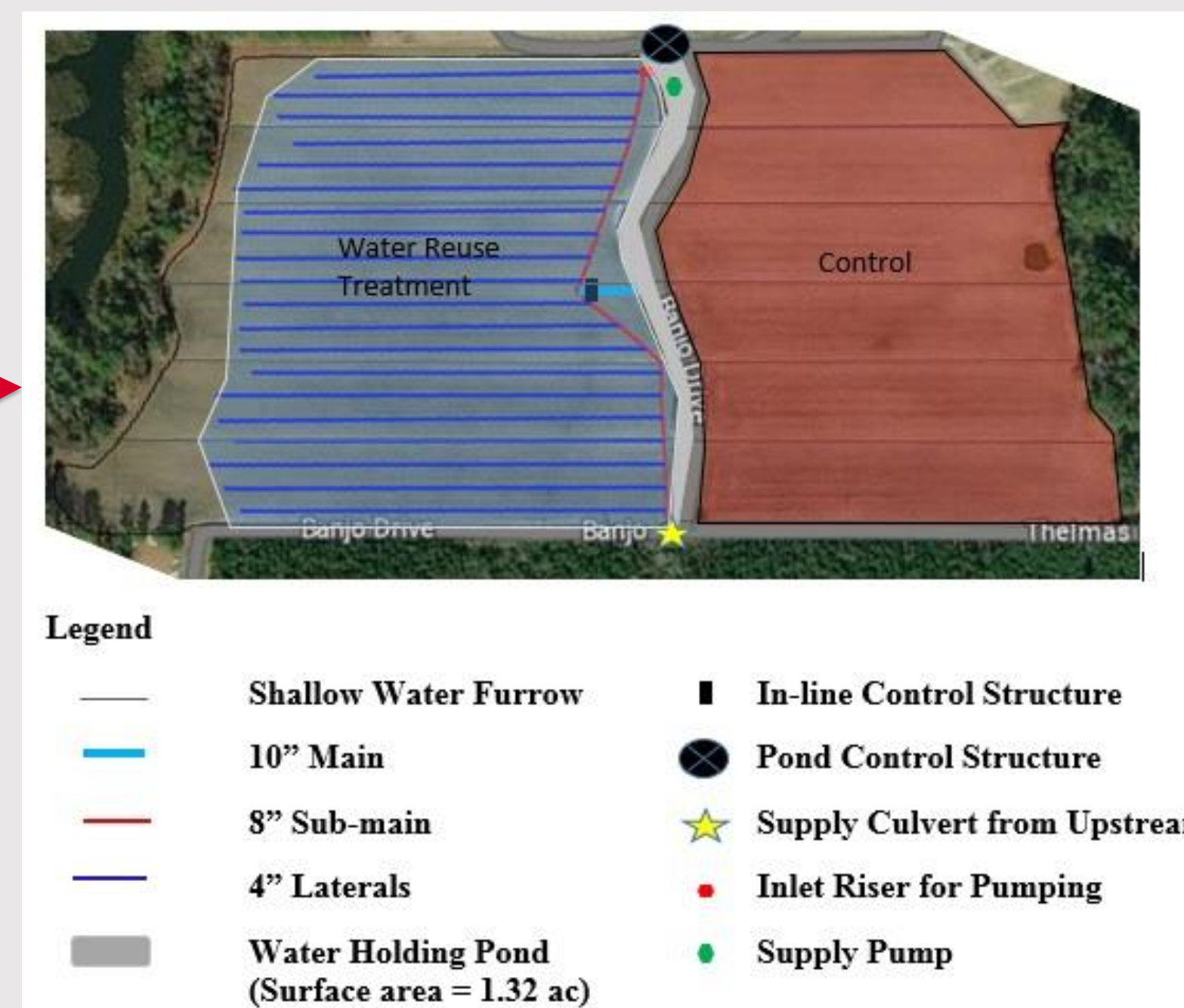
Objectives

- Study the effectiveness of DWR on water conservation, crop yield and drainage water quality;
- Identify the pond optimum size so that it can store drainage water and meet crop water needs;
- Determine the effective management strategy for adjusting the control structure's settings.

Site description

- Located near the town of Bath, in the North Carolina Coastal Plain;
- **Two treatments:** controlled drainage/subirrigation and conventional drainage;
- **Area:** DWR=28.3 ac, CTR=27.5 ac, and The pond=1.32 ac;
- **Soil type:** Altavista Fine Sandy Loam, well drained;
- **Drainage system:** Subsurface drains: Depth =4 ft, spacing =60 ft.
  Shallow ditches: Depth=18-24 inch, spacing = 200 ft.

NC watersheds map

Legend
- Shallow Water Furrow
- 10" Main
- 8" Sub-main
- 4" Laterals
- Water Holding Pond (Surface area = 1.32 ac)
- In-line Control Structure
- Pond Control Structure
- Supply Culvert from Upstream
- Inlet Riser for Pumping
- Supply Pump

The system operation

- Subsurface drainage is regulated by a control structure, which will be set according to the field water table feedback;
- Surface runoff from the two treatments is collected by shallow ditches;
- Subsurface drainage and surface runoff are stored in a farm pond;
- The stored water then is reused for crop irrigation through pumping it back from the pond into a tank by triggering a motorized valve;
- The tank is used to generate a hydraulic head to subirrigate the cropland by gravity feed when it is needed.

Subsurface drainage and surface runoff
Pump water from the pond
Subirrigation

Top gate
Bottom gate
Water control structure

The pump

Manual valve
Motorized valve
Flowmeter to measure irrigation flow
To irrigate the controlled treatment
To irrigate the DWR treatment
Feeding pipe from the pond
The tank connections

Drainage and subirrigation modes
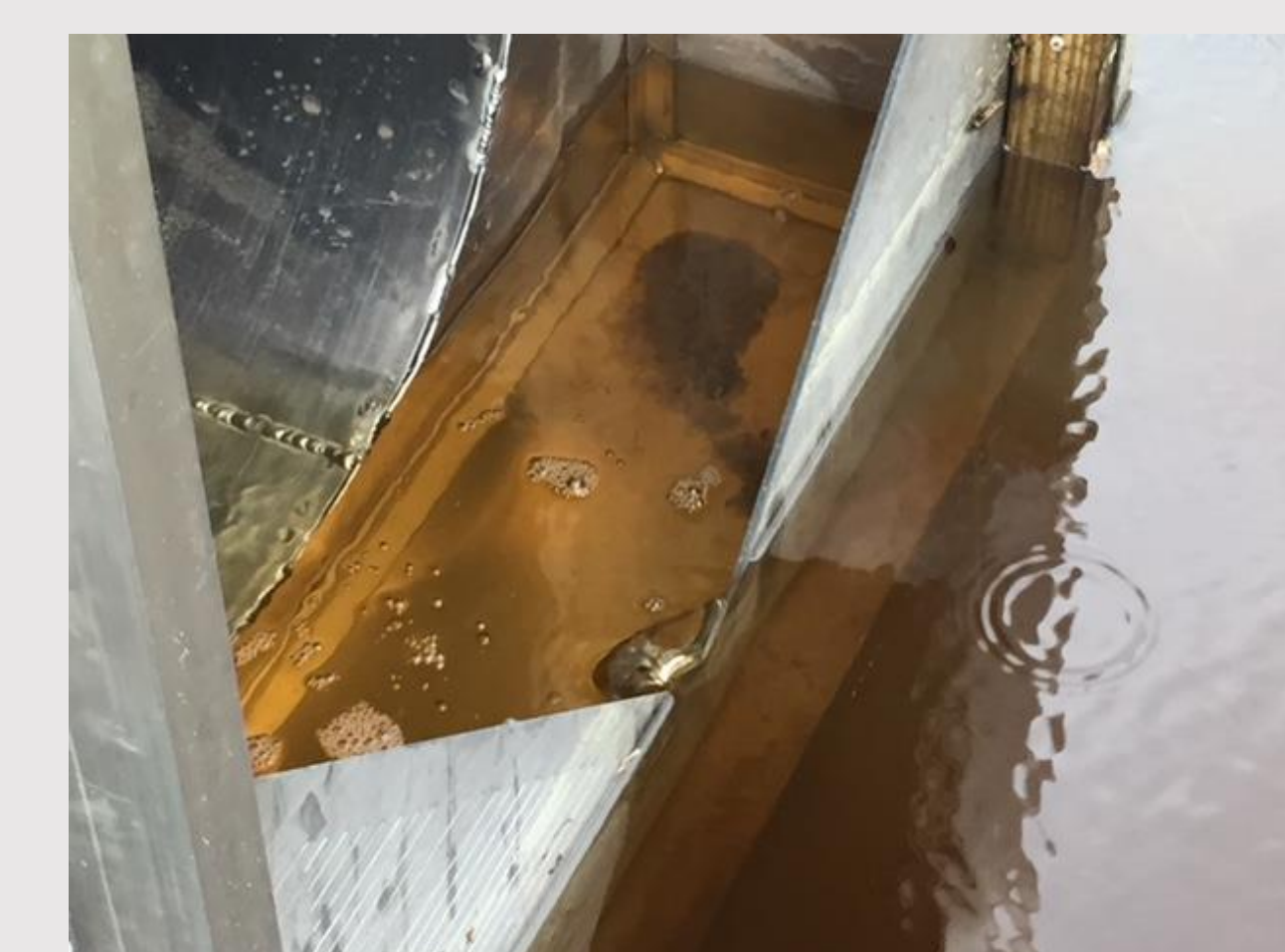

Drainage

Subirrigation

Field measurements

- Field measurements will be conducted to perform water, sediments and nutrient balances for the pond;
- Flow at the inlet and outlet of the pond, surface runoff for both treatments, and subsurface drainage will be measured using V-notch weir with pressure transducers;
- Water quality samples will be collected at the above-mentioned locations using automated water samplers;
- In addition, water samples will be collected from the tow treatments at depths 2-3, 3-4, and 5-6 ft.;
- Precipitation will be measured using HOBO rain gage data logger;
- Water table depth at the two treatments will be recorded using HOBO water level logger;
- Crop yield will be measured at the end of every growing season.

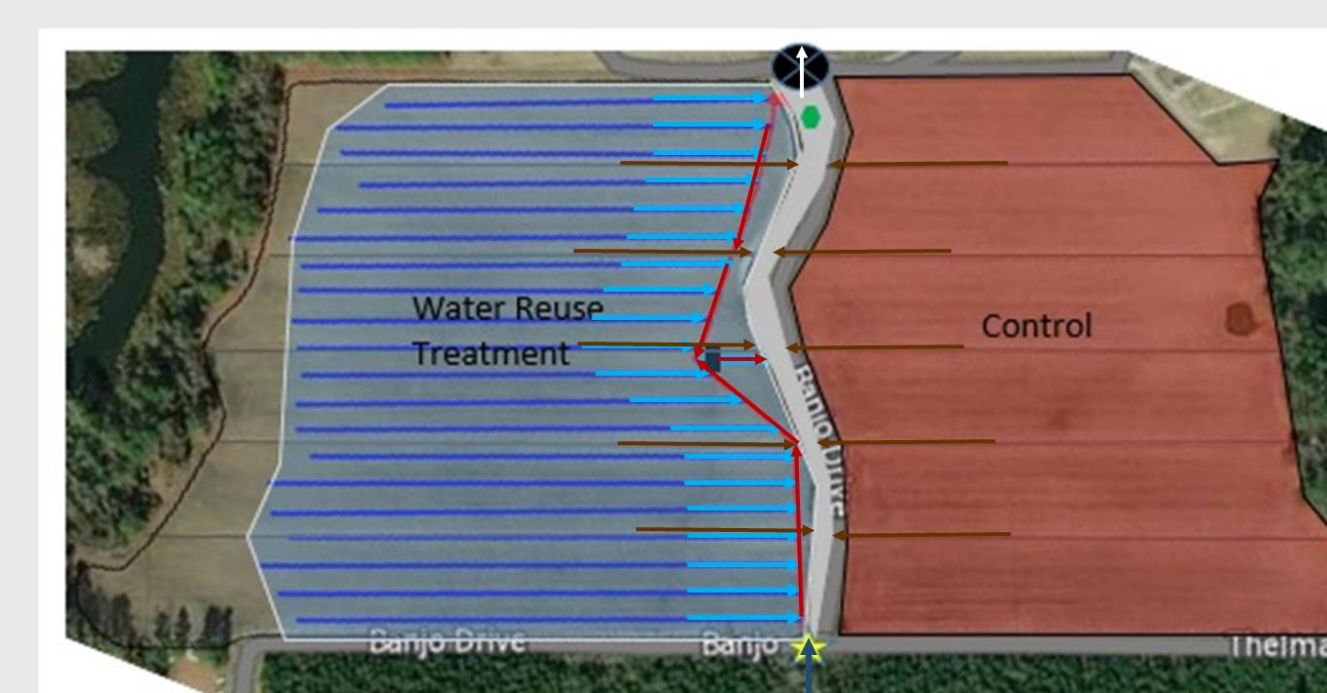Surface runoff flow measurement

Pond inlet flow measurement

Water table and water quality wells

Automated sampler

Acknowledgment