

# Benthic Invertebrates as an Indicator of Stream Restoration Success in the Coastal Plain

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# Ecological Uplift Indicates Project Effectiveness

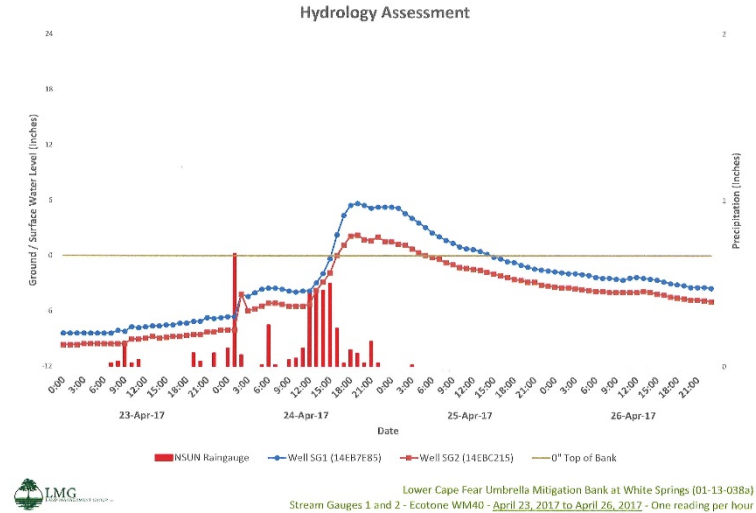
## Qualitative

- Habitat Creation
- Species Diversity



## Quantitative

- Flow Events
- Overbank Flooding
- Gauge Readings

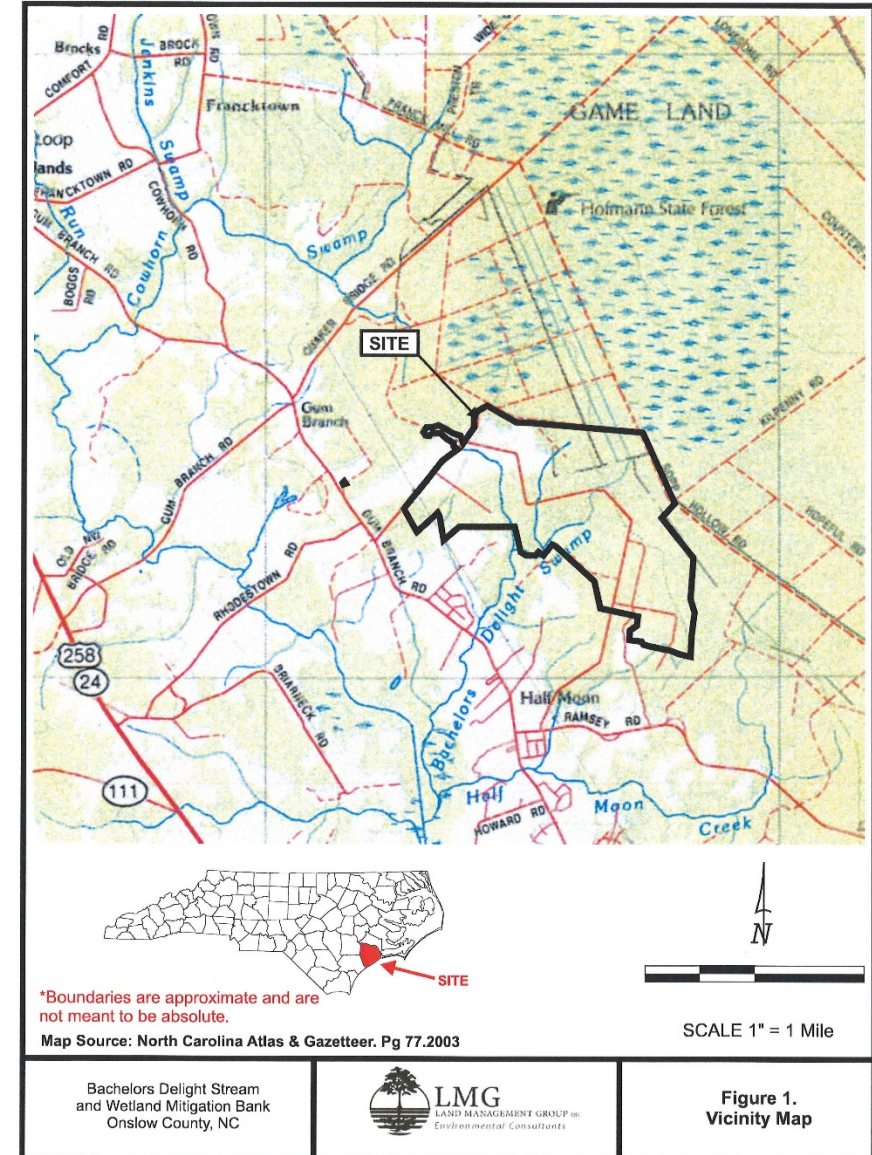




# Bachelors Delight Mitigation Bank

Onslow County, NC

- Approximately 6 miles north of Jacksonville
- Hofmann Forest borders northeast boundary
- Contains three stream systems (Huffmans Branch, Hewitts Branch, Bachelors Delight Swamp)
- 1,857 acre project area
- Excessive channel modification in 1970s
- Construction completed 2013

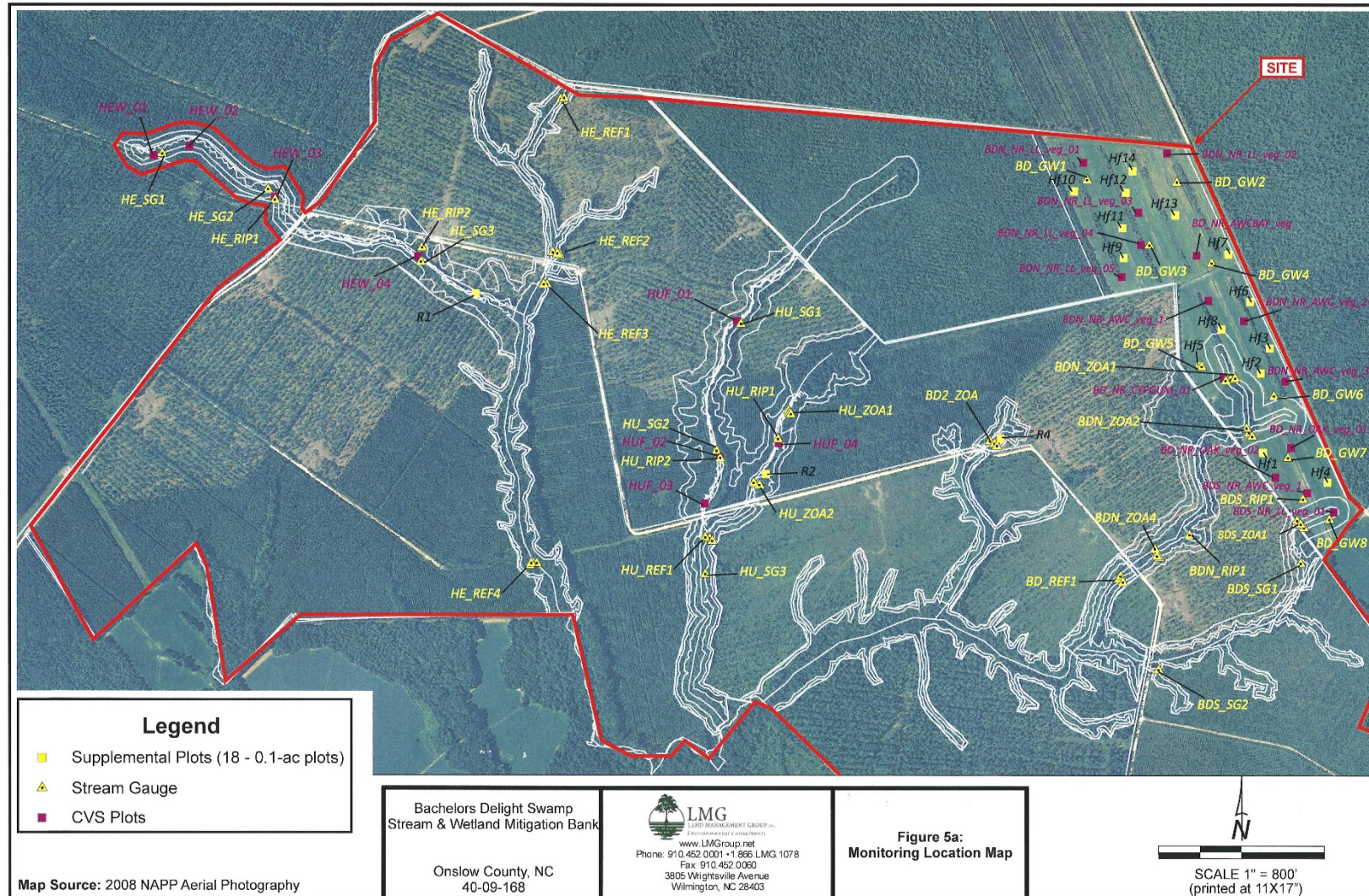




# Bachelors Delight Mitigation Bank

Onslow County, NC

- 7,300 linear feet (lf) zero order restoration
- 9,500 lf first order restoration
- 17,000 lf enhancement / preservation
- 136 acres riparian wetland restoration/enhancement/preservation
- 86 acres non-riparian restoration

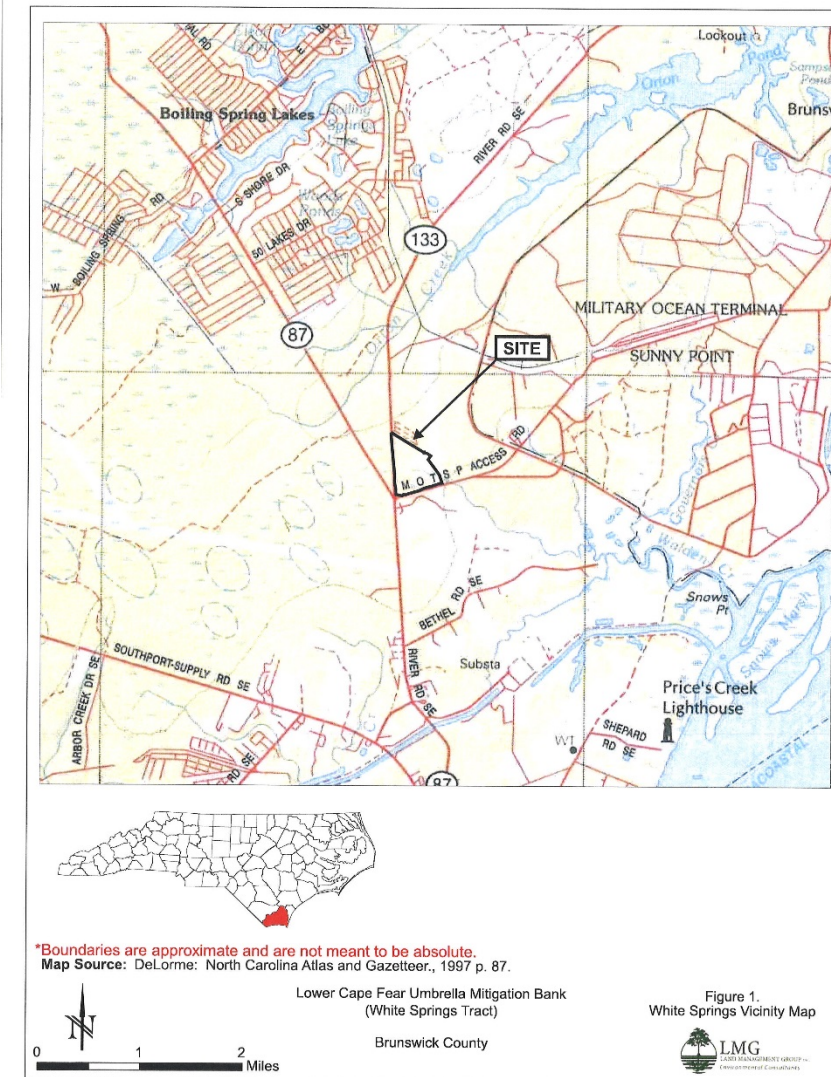




# Lower Cape Fear Umbrella Mitigation Bank

White Springs Tract, southern Brunswick County, NC

- Approximately 4 miles north of Southport
- Adjacent to Military Ocean Terminal Sunny Point (MOTSU)
- Upper extent of White Springs Creek
- 72 acre project area
- Deep modification of channel and floodplain
- Construction completed April 2015

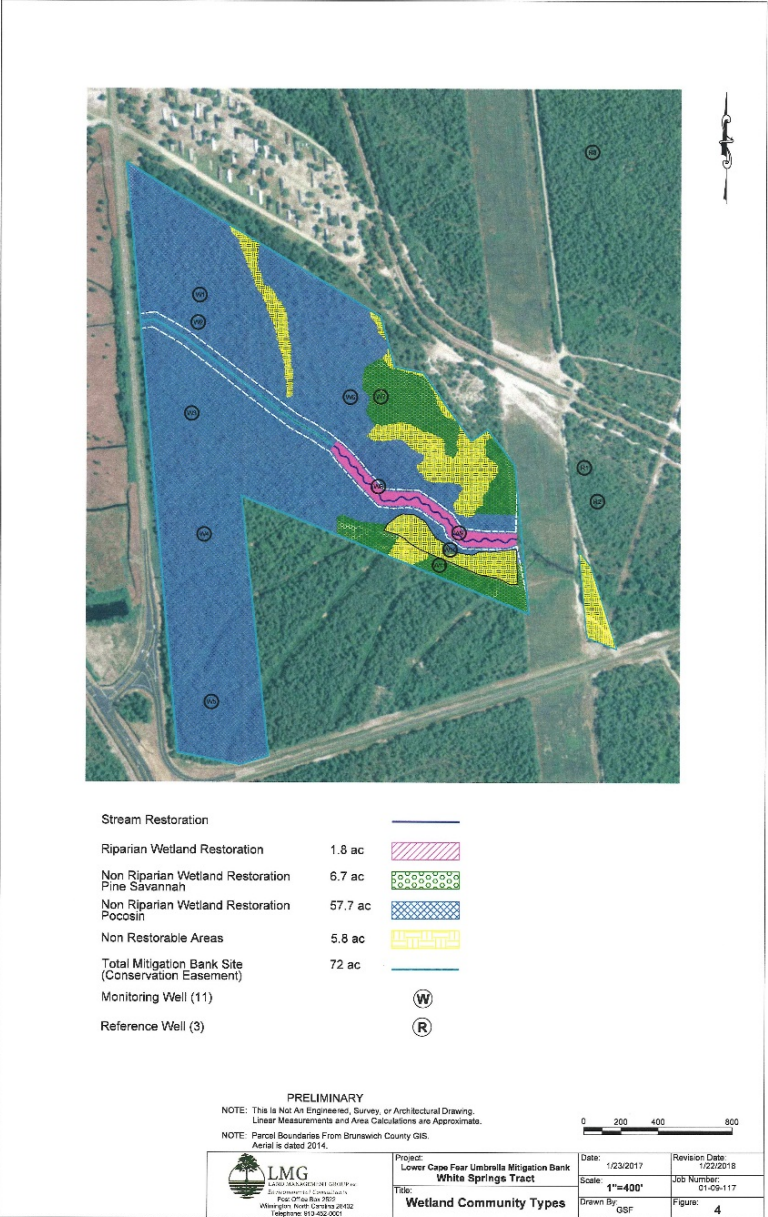




# Lower Cape Fear Umbrella Mitigation Bank

White Springs Tract, southern Brunswick County, NC

- 1,100 lf zero order creation
- 1,300 lf first order restoration

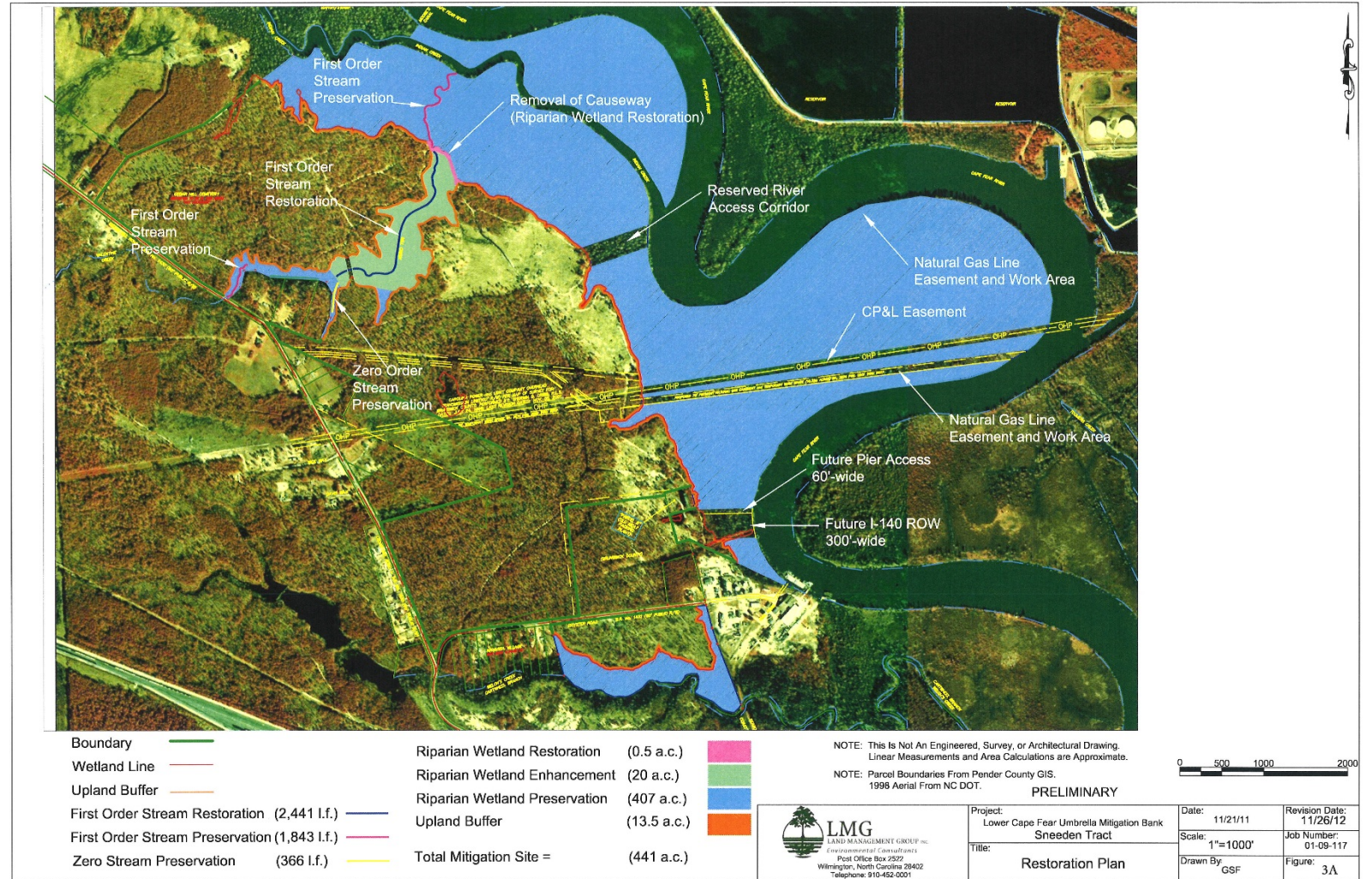




# Lower Cape Fear Umbrella Mitigation Bank

Sneeden Tract, eastern Brunswick County, NC

- 2,400 lf tidal freshwater first order restoration
- 2,200 lf of zero order preservation
- Riparian wetland restoration / enhancement / preservation





# Lower Cape Fear Umbrella Mitigation Bank

Sneeden Tract, eastern Brunswick County, NC

## Before construction





# Lower Cape Fear Umbrella Mitigation Bank

Sneeden Tract, eastern Brunswick County, NC

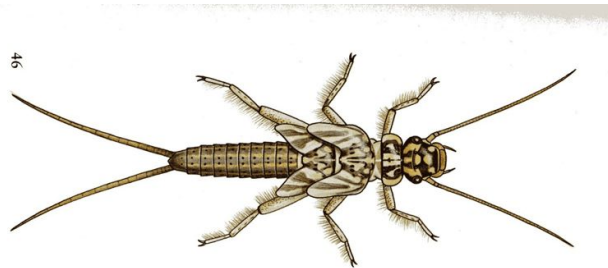
After construction





# BIOLOGICAL OBSERVATIONS

- Included 7300 lf of zero order restoration and 9500 lf first order restoration
- Upstream locations all had Odonata and Crustacea
- Downstream locations included Odonata, Crustacea (Croatan Crayfish) and Mayflies, Caddisflies, Megaloptera.
- The most downstream site at BD5 was reference quality; Mayflies (Heptageniidae, Leptophlebiae), Caddisflies (*Molanna* spp and Hydropsychidae)
- Recommended a spring survey to look for stoneflies





# Headwater seepage wetland\*



- Occur near the base of slopes and bluffs
- Tufford notes that local geomorphology and soils influence groundwater travel time to discharge
- Tufford also notes that these habitats should be protected and further studied
- We sampled these wetlands and found rheophilic species including a mayfly (Leptophlebiidae), and *Gambusia* spp.



Tufford, D.L. Shallow Water Table Response to Seasonal and Interannual Climate Variability. 2011. Soc. of Agricul and Biol. Engineers. 54(6):2079-2086



# Sampling at Bachelors Delight

- Damselfly



- Mayflies







### ZERO ORDER HEADWATER

- Looked more natural – diverse microhabitats
- Odonata very abundant, including *Lestes* spp.
- Crustacea were diverse
- Banded sunfish were collected
- Spring samples may produce EPT taxa
- Needs more data



### FIRST ORDER HEADWATER STREAM

- Amphipods extremely abundant
- Hydropsychidae (*Cheumatopsyche* spp.) also extremely abundant – filter-feeding caddisfly
- Overall the feature appeared less diverse than the Zero Order feature



# Sampling at LCFUMB – White Springs

- Dragonfly larvae (*Cordulegaster* spp.) - Megaloptera larvae





# Sampling at LCFUMB – Navassa

- Swamp Darter
- Crayfish
- Amphipods
- Mayflies
- Killifish
- Isopods





# Sampling at LCFUMB –Navassa

- Crayfish



- Swamp Darter





Dave, in your expert biological opinion, are these projects successful?



**Fin**