TAYLOR ENGINEERING, INC.

# ECOLOGICAL, HYDROLOGIC, AND ENGINEERING DESIGN PRINCIPLES FOR ACEP-WRE RESTORATION PROJECTS

Team: Scott Kuipers, NRCS, Tim Gysan, P.E. USACE, David L. Stites, Ph.D.; Steve Schropp, Ph.D.; Chris Ellis; Jennifer Sikes, P.E., Jennifer Klich, P.E.

USDA Natural Resource Conservation Service

Presented by: David L. Stites, Ph.D.

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# Presentation Outline

1. Collaborative Restoration Design Approach
2. Ecological Restoration Design
3. Hydrologic Target Development
4. Multi-disciplinary Modeling and Reporting

# Restoration Design Approach

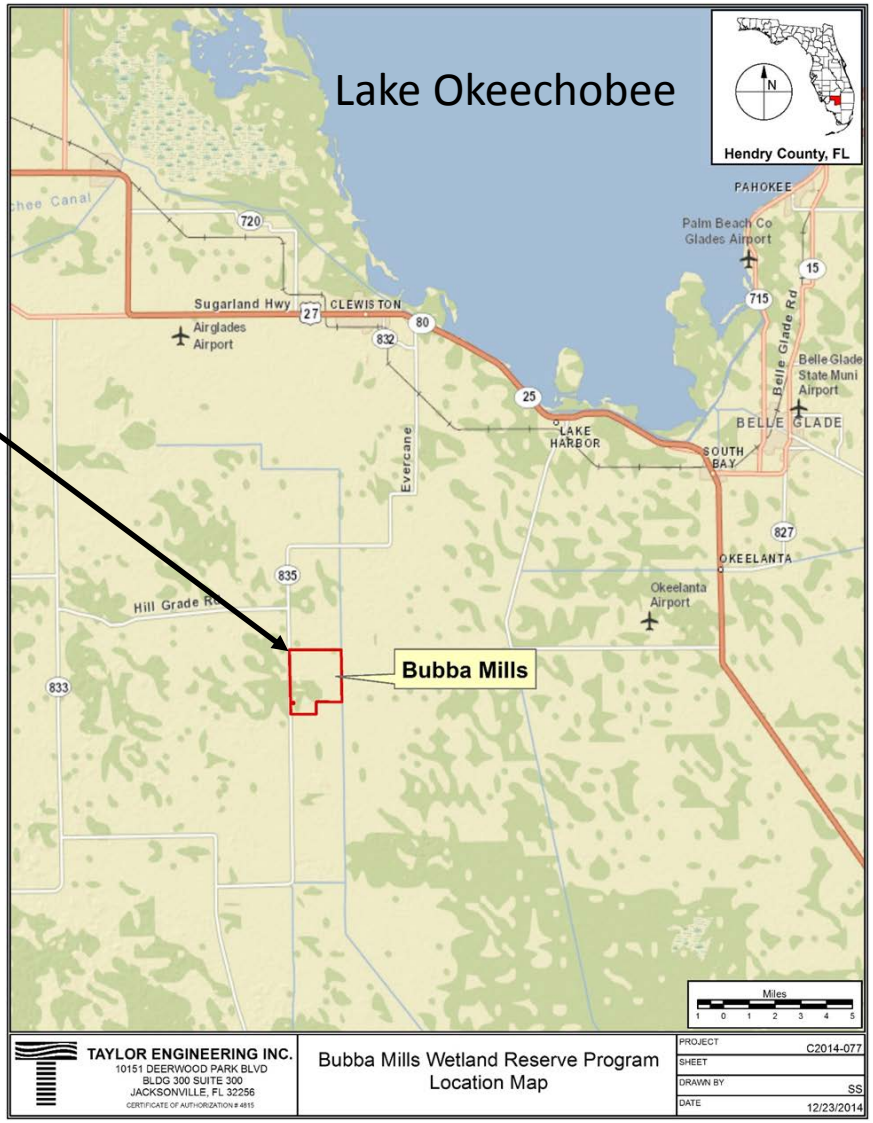
- Estimate pre-development ecosystems conditions and communities (Ecology)
- Define restoration concept alternatives (Ecology, Hydrology, and Civil Engineering)
- Development H&H models to identify inundation elevation control levels for alternatives (Hydrology and Ecology)
- Define, design minimum necessary hydrologic control and other structures to achieve targets (Hydrology and Engineering)

# Restoration Design Approach (continued)

- Define expected ecological outcomes (*Ecology*)
- Select a preferred alternative (*All disciplines, entire team*)
- Revise modeling to reflect selected design, revise ecological predictions (*H&H*)
- Design Civil Structures (*Engineering*)

# Bubba Mills Easement, Hendry County, Florida

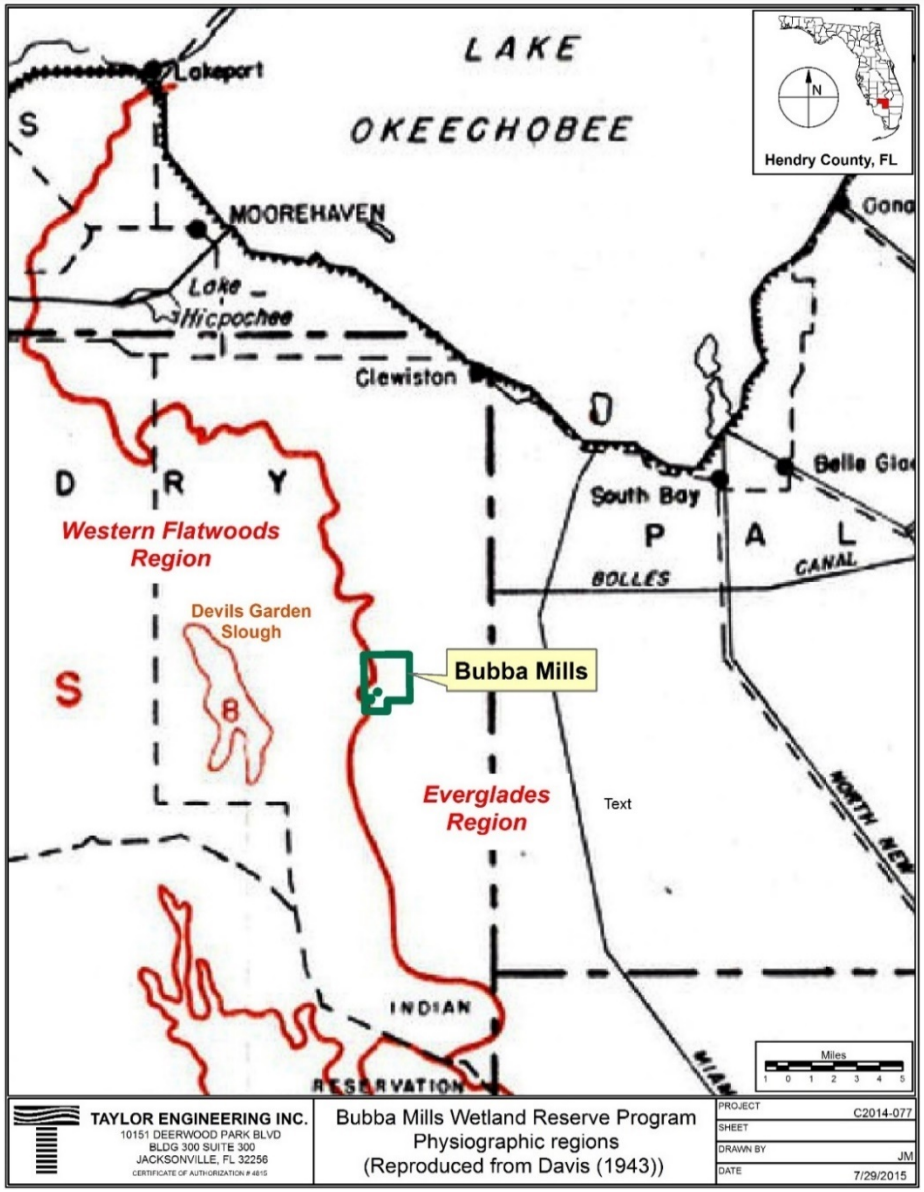
- 2,914-acre easement south of Lake Okeechobee, FL
- Western edge of the Everglades Agricultural Area
- Three participating property owners




# Historic Ecologic Conditions

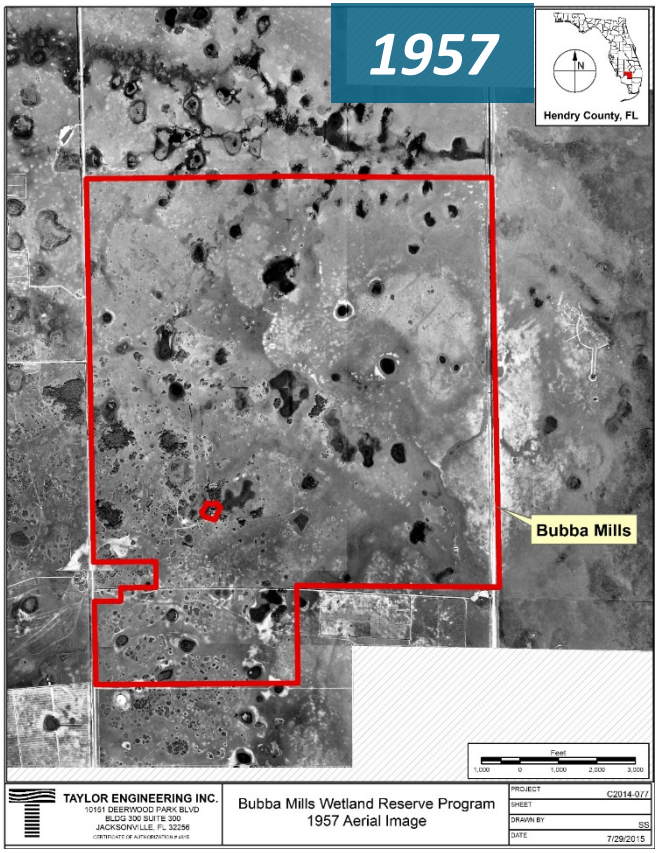
## Historic Conditions

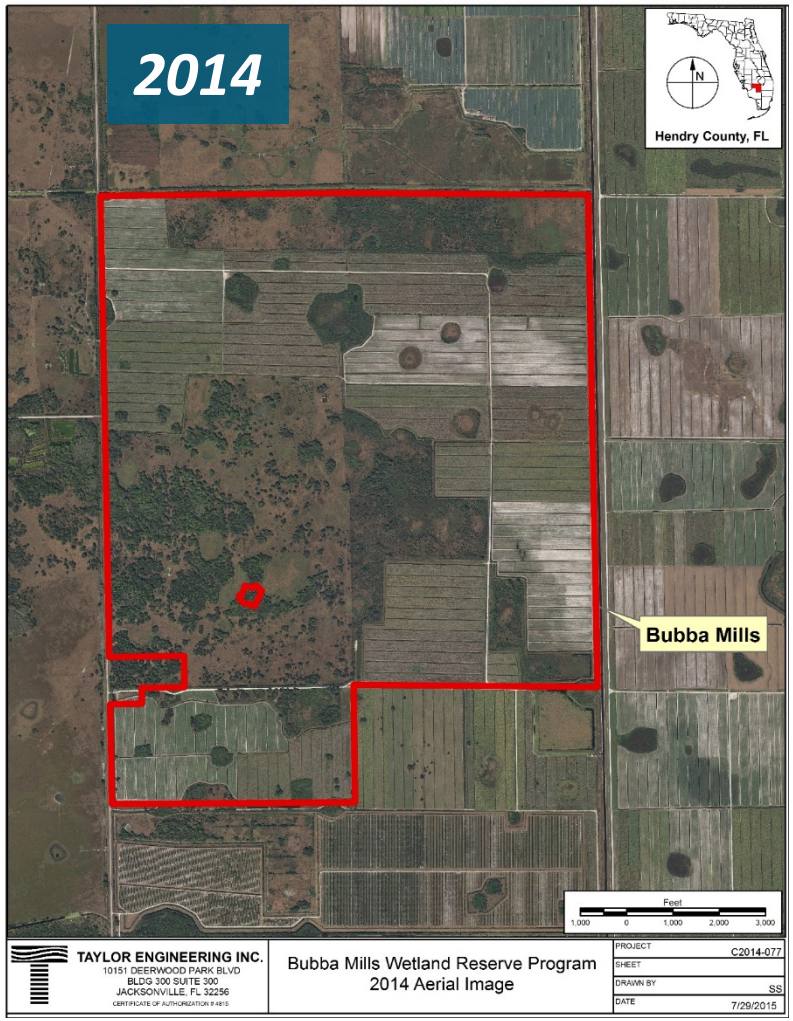
- Sits on the Western Flatwoods/Everglades region boundary, south of Lake Okeechobee
- Part of a vast wetland system around Lake Okeechobee
- Intermingled Wet Slough and Wet Prairie communities dominated the site
- To the east, the Everglades Sawgrass Wetlands covered the landscape



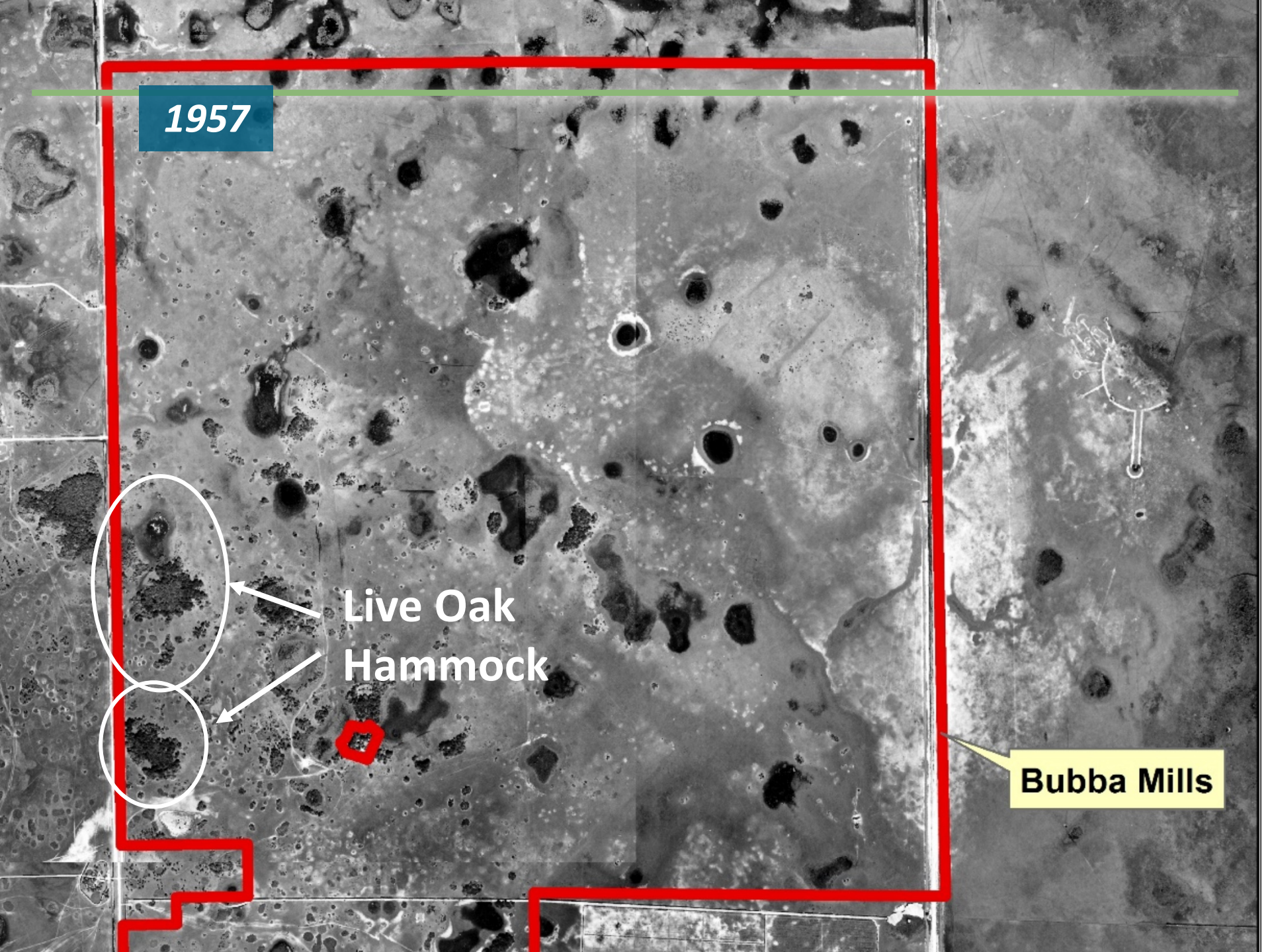
# Development History

Development began in the early 1950s with cattle grazing on partially drained wetlands.



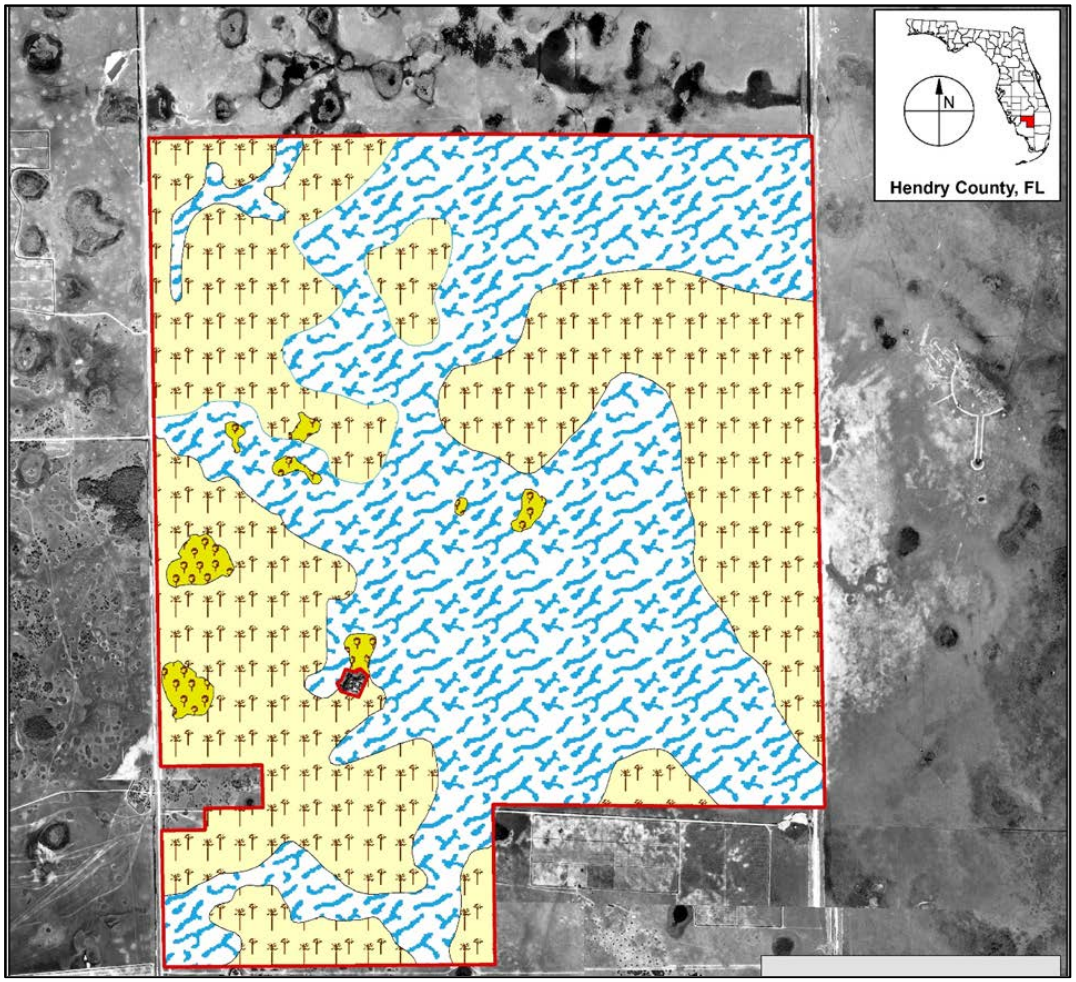




By the 21st century, sugar cane production and cattle production share the well-drained property (363 acres wetlands remaining).


1957
Live Oak
Hammock
Bubba Mills

# Pre-Development Target

## Estimated Pre-Development Wetlands




**Legend**

- Bubba Mills Boundary

**FNAI Community**

- Marsh
- Wet Prairie
- Hydric/Mesic Hammock

# Hydrologic Restoration Goals and Objectives

**Restore hydroperiods to pre-development conditions (within practical limits)**

- Restore Sugar Cane and Pasture to natural vegetative communities
- Preserve any remnant natural communities
- Protect adjacent properties from additional flooding
- Maintain owner uses within program goals
  - *Site access*
  - *Recreation*
  - *Low-intensity cattle grazing(?)*

# Hydrologic Design Basis

## Identify Natural Community Stage-Duration Ranges

| | Water Elevation Above (+) or Below (-) Ground | | | |
|---|---|---|---|---|
| Natural Community | Wet Season | Dry Season | Annual Average | Inundation Frequency |
| 25/Freshwater Marsh and Ponds | +12 to +24 in | -12 in or lower | -7 to +36 in | 2 to 12 months |
| 10/Wet Prairie | ND[1] | ND | -12 to -24 in | 0 to 6 months |
| 12/Wetland Hardwood Hammocks (Hydric Hammock) | ND | ND | +6 to -30 in | 1 to 6 months |
| 6/Mesic Hammock | 0 to a few inches below surface | -39 in | ND | Rare |

[1]ND = No hydrologic description

# Hydrologic Modeling Strategies

## Stage-Duration Target Development

- Live oak hammock association – most sensitive remnant community
  - Slow-growing hardwood association
  - Develops where water tables remain 1 – 3 feet+ below ground
  - Tolerates only limited periods of root inundation (less than two months)

# Multi-Disciplinary Modeling and Reporting

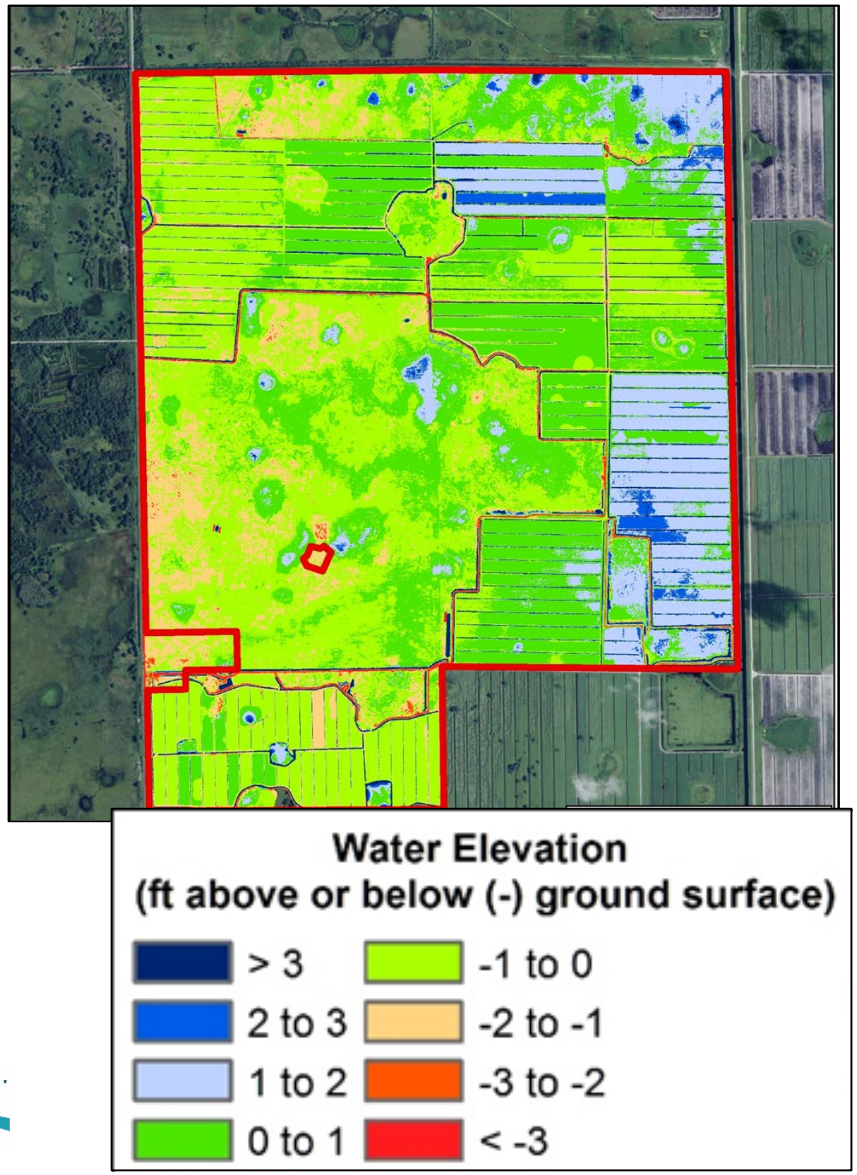
## Interactive ICPR and HSPF modeling with ecologist review

- Modeled two scenarios – one based on the initial NRCS restoration concept and one alternative developed by Taylor Engineering
- Scenarios varied mainly in placement and number of water conveyance structures and amount of ditch fill and land smoothing
- Modeling determined which alternative provided the most effective and cost-effective restoration.

Carolina Ash Swamp

# Selected Restoration Design (2-month flood depths)

- Within flooding tolerance of live oak hammocks on western edge of easement
- Provides hydrologic conditions for restoration of primary pre-development wetland communities
- Below vacation cabin floor elevation



# Historic and Restored Habitats

## Selected Restoration Target Community Distribution

- About the same total wetland area as historic condition
- More wet prairie and less marsh
- No swamp predicted (but pop ash assemblages should do well)
- Restoration retains 167 acres of uplands – mesic hammock

| | Wetland Community Size (acres) | | | | |
|---|---|---|---|---|---|
| Site Condition | Marsh | Wet Prairie | Swamp | Hydric/Mesic Hammock | Total |
| Historic | 1,500 | 1,300 | | 45 | 2,845 |
| Current | 139 | 64 | 12 | 148 | 363 |
| Preferred Alternative | 539 | 2,084 | | 97 | 2,747 |

# Wetland Reserve Plan Of Operation – WRPO

## Final Restoration Plan

- Provides details of existing conditions, modeling alternatives, and projected restorations
- Includes detailed natural community descriptions, success criteria, monitoring, and management plans



Thank You!
Questions ?