

# Collier County Comprehensive Watershed Management Plan

Golden Gate Canal Flow Diversion and  
South Belle Meade Hydration Project

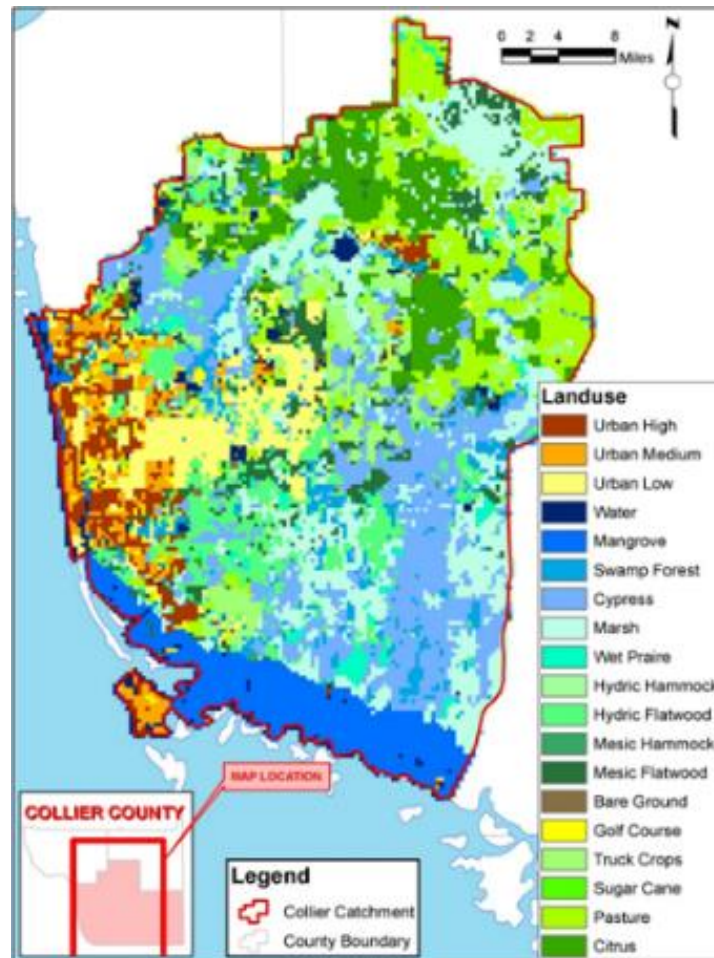


# Project boundaries - Collier County in Southwest Florida



From Atkins (2011)

# Wide variety of land uses within Collier County



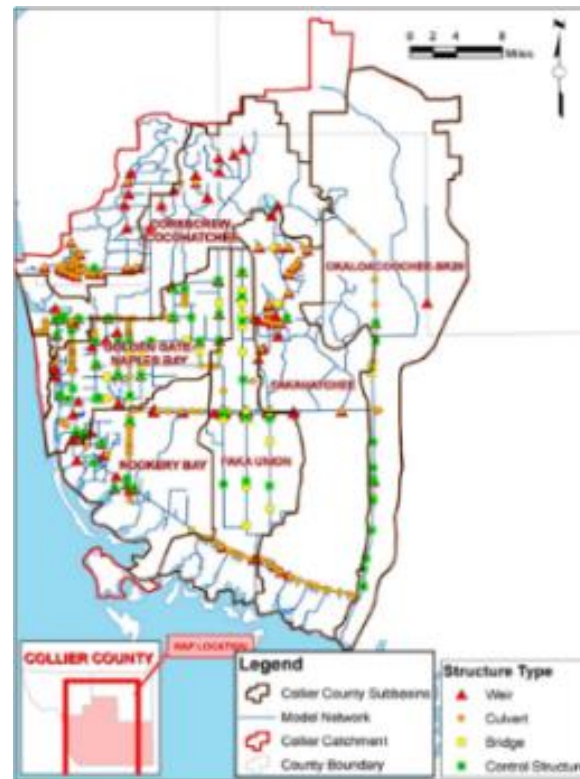
From Atkins (2011)

# Highly altered watersheds

Extensive canal network

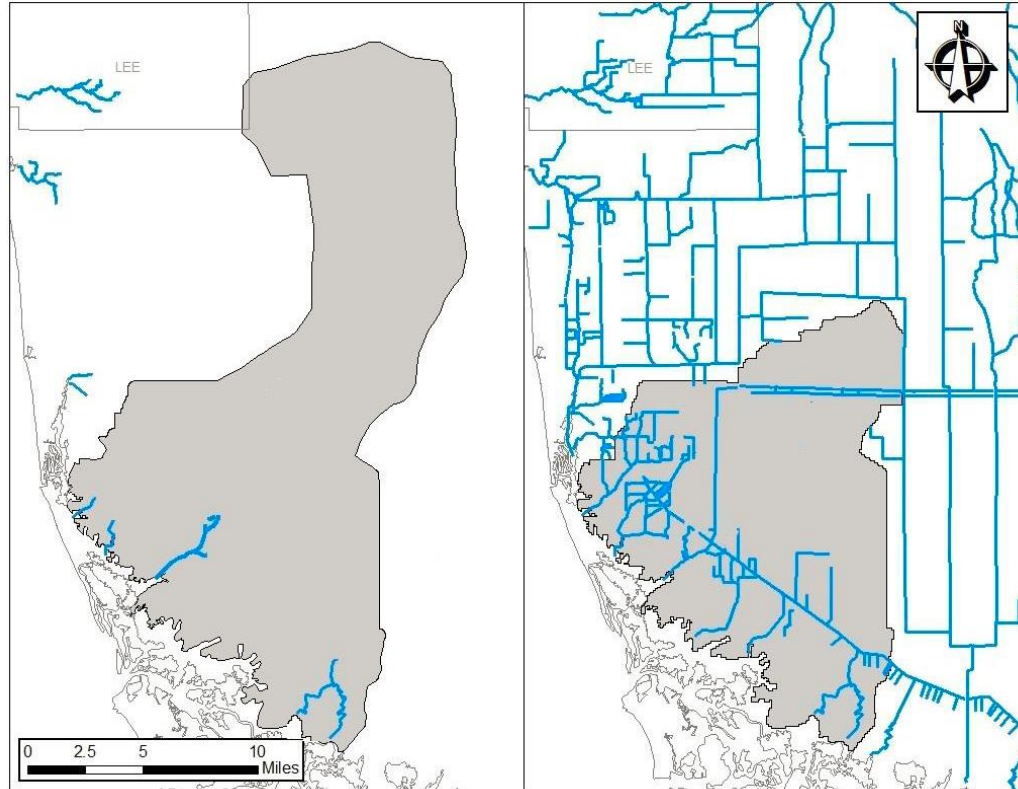


Numerous water control structures



From Atkins (2011)

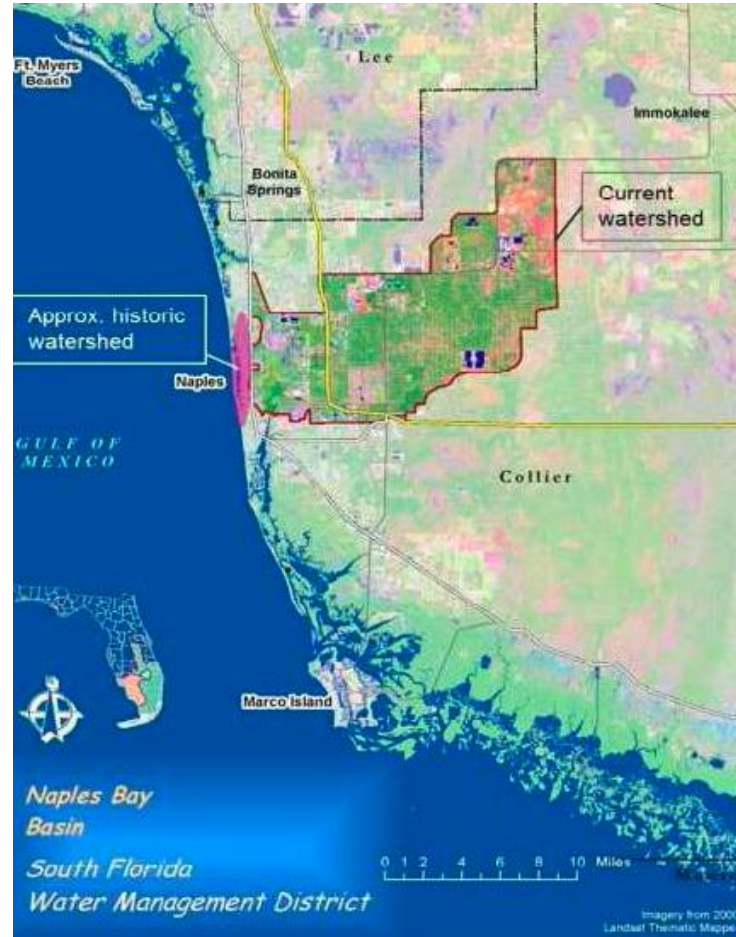
# Rookery Bay's watershed highly modified, and reduced by ca. 80 sq. miles



From Interflow Engineering Inc. and Taylor Engineering (2014)



# Naples Bay's watershed highly modified, and increased by ca. 100 square miles



From Cardno (2015)

# Consensus on impacts to watersheds and coastal waters from altered hydrology

- ▶ Impacts to ecology of Naples Bay
  - ▶ (e.g., SFWMD 2007, Atkins 2011, Cardno 2015, etc.)
- ▶ Impacts to ecology of Rookery Bay watershed
  - ▶ (e.g., Parsons, 2006, SFWMD and USACE 2010, Atkins 2011, RBNERR 2012, etc.)
- ▶ Impacts to ecology of Rookery Bay
  - ▶ (e.g., Shirley et al. 2004, 2005, Rubec et al. 2006, Atkins 2011, etc.)

# So, how about retrofitting watersheds?

- ▶ Diversion of flows from Golden Gate Canal to Henderson Creek - conceived in many water management plans since 1980
  - ▶ Golden Gate Water Management Plan (Johnson Engineering for SFWMD-BCB, 1980)
  - ▶ Big Cypress Basin Water Management Plan, 1998
  - ▶ SWIM Plan for Naples Bay (SFWMD 2007)
  - ▶ Collier County Watershed Management Plan (Atkins 2011)
  - ▶ Naples Bay Water Quality and Biological Analysis Project (Cardno 2015)



## However...

- ▶ While Rookery Bay as a whole has a wet weather inflow deficit, that is not the case for Henderson Creek (Interflow Engineering Inc. and Taylor Engineering, Inc. 2014)
- ▶ Water quality in Golden Gate Canal (GGC) while better than most of the other tributaries to Naples Bay, has elevated nitrogen and phosphorous compared to Rookery Bay's watershed
- ▶ Upstream water use by public and private water supplies limit the amount of water that can be removed from the GGC
- ▶ Smaller project than those previously envisioned

# Proposed project

- ▶ Diversion of inflows out of GGC when sufficient water available (June - October) so that no impacts to upstream water users
- ▶ Diversion into historic flowway to south
- ▶ Spreader canal to increase area of Rookery Bay's watershed to receive inflows
- ▶ Protective of adding too much inflows to the Rookery Bay watershed and impacts to the PSRP Federal project

# Project constraints

- ▶ Flows diverted only when critical water levels reached in GGC
- ▶ Maximum diversion of 100 cfs (daily average)
  - ▶ Equal to ca. 65 mgd
  - ▶ Estimated to lose 50% via losses to infiltration, evapotranspiration and storage
  - ▶ Inflow to Rookery Bay no more than 50 cfs
  - ▶ Fits within model estimates of wet season inflow deficits for Rookery Bay and hydro-periods of south Belle Meade wetlands
- ▶ Conservative estimate of 80 cfs of the June-October freshwater inflows removed from Naples Bay

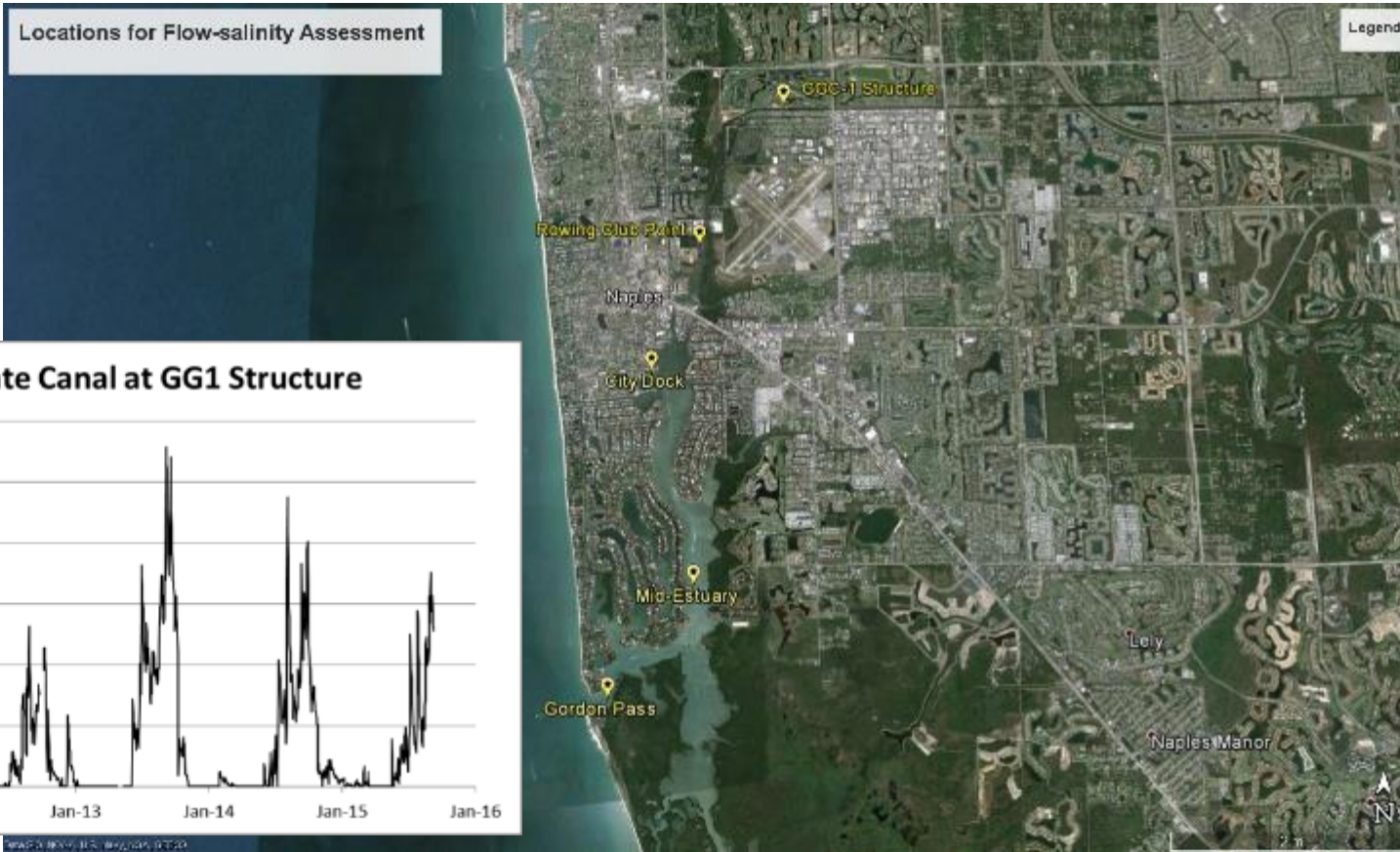
# Operation schedule

- ▶ Based on observed flows of the Golden Gate Canal from January 1, 2011 to September 09, 2015
- ▶ Diversions could occur ca. 11 % of days
  - ▶ However, none in 2011
- ▶ Those 11 % of days represent ca. 45 % of inflows
- ▶ During operation, ca. 15 % of flows removed from Naples Bay

# Estimating benefits

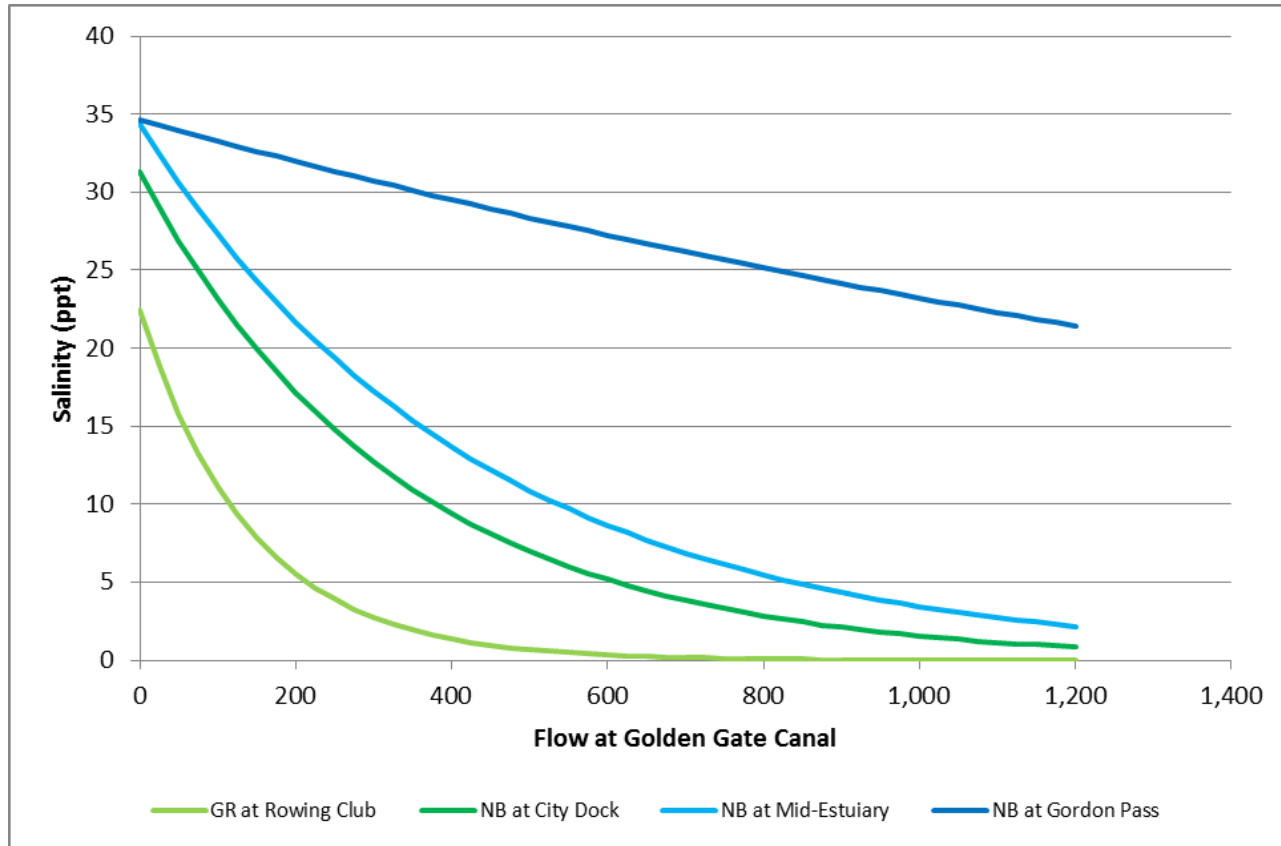
- ▶ **Naples Bay**
  - ▶ Expected benefits to salinity regimes
  - ▶ Expected benefits associated with nutrient load reductions
- ▶ **Rookery Bay**
  - ▶ Improve water depth and hydro-periods to impacted wetlands, without altering species composition
  - ▶ Benefit to ca. 10,000 acres of mostly cypress and hydric flatwoods
  - ▶ Restore historical freshwater inflows to the bay
  - ▶ Sufficient combination of water quality and sheetflow that water quality expected to approximate that of current watershed

# Naples Bay - predicting salinities as a function of inflows





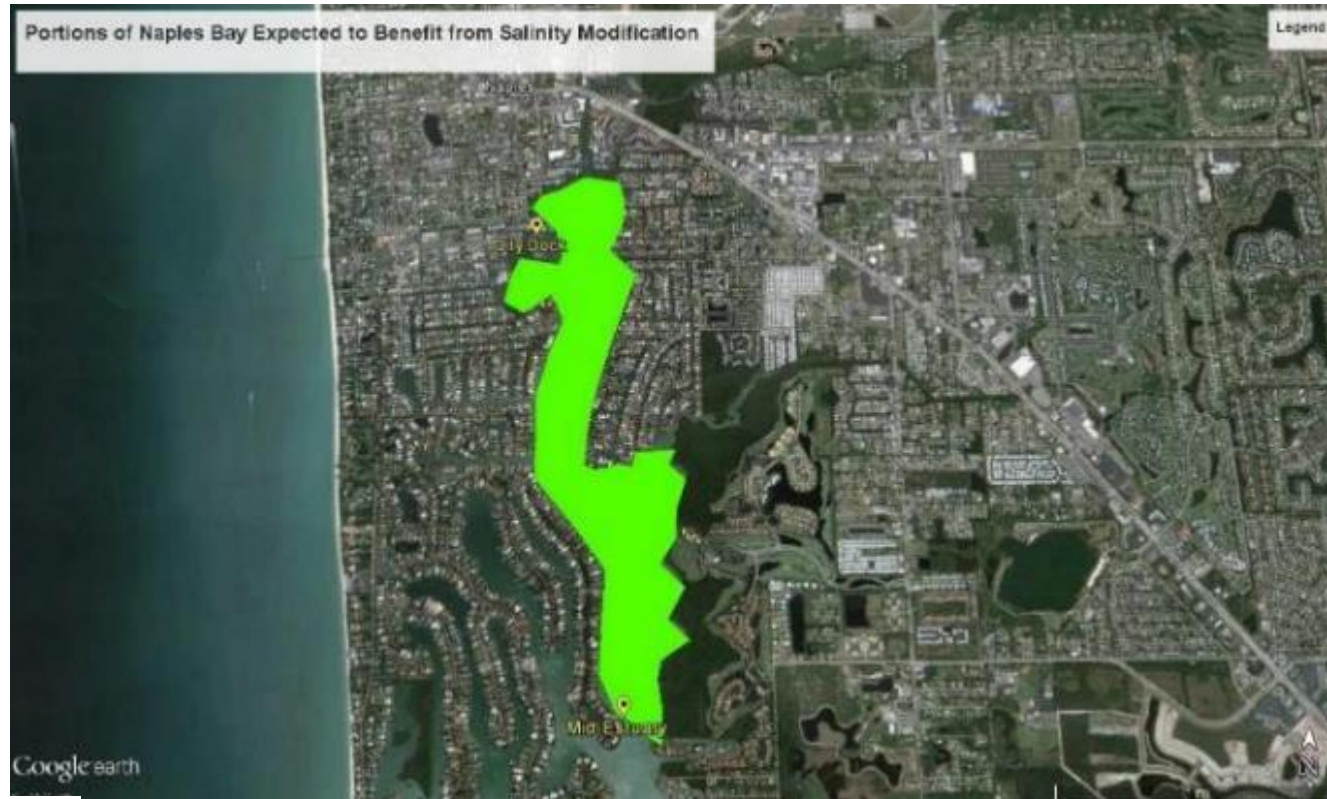
# Naples Bay - Influence of flows on salinity varies with location



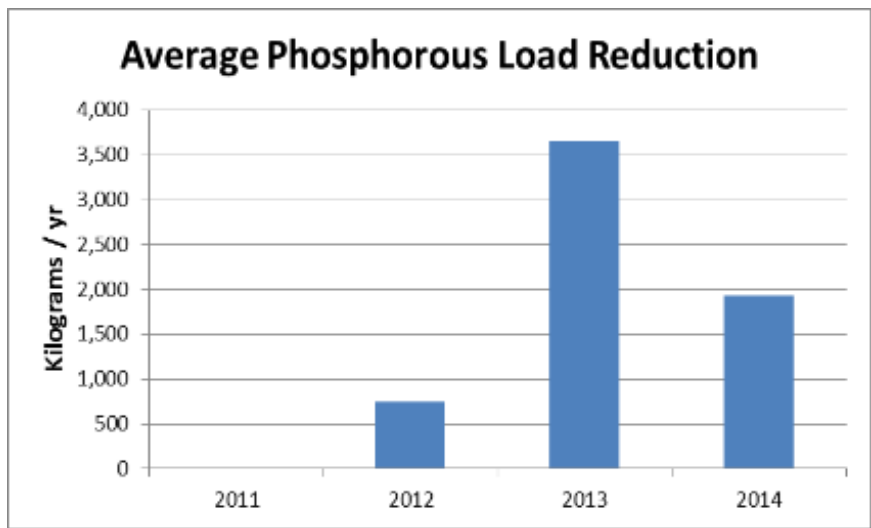
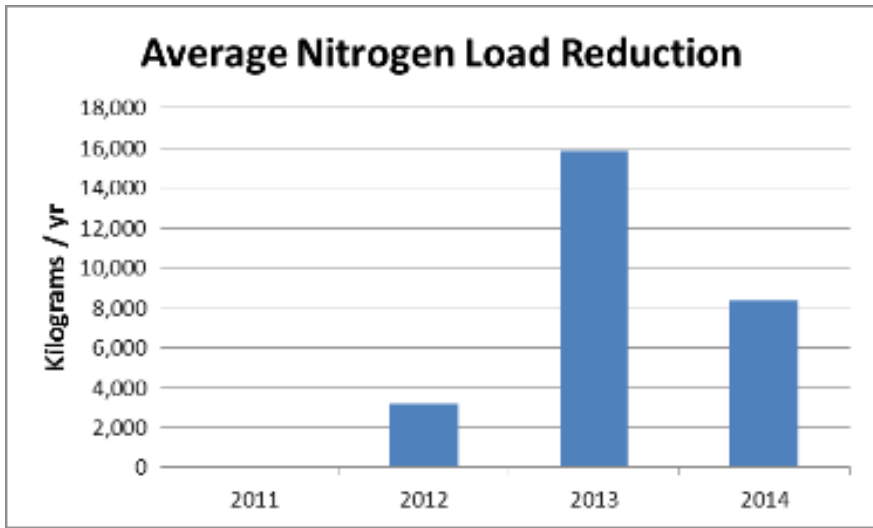
Based on equations contained within Cardno (2015)

# Naples Bay - area will likely benefit ca. 400 acres

20 % difference in salinity, with average salinity difference  
of 2 ppt or higher



# Naples Bay - Reductions in nutrient loads



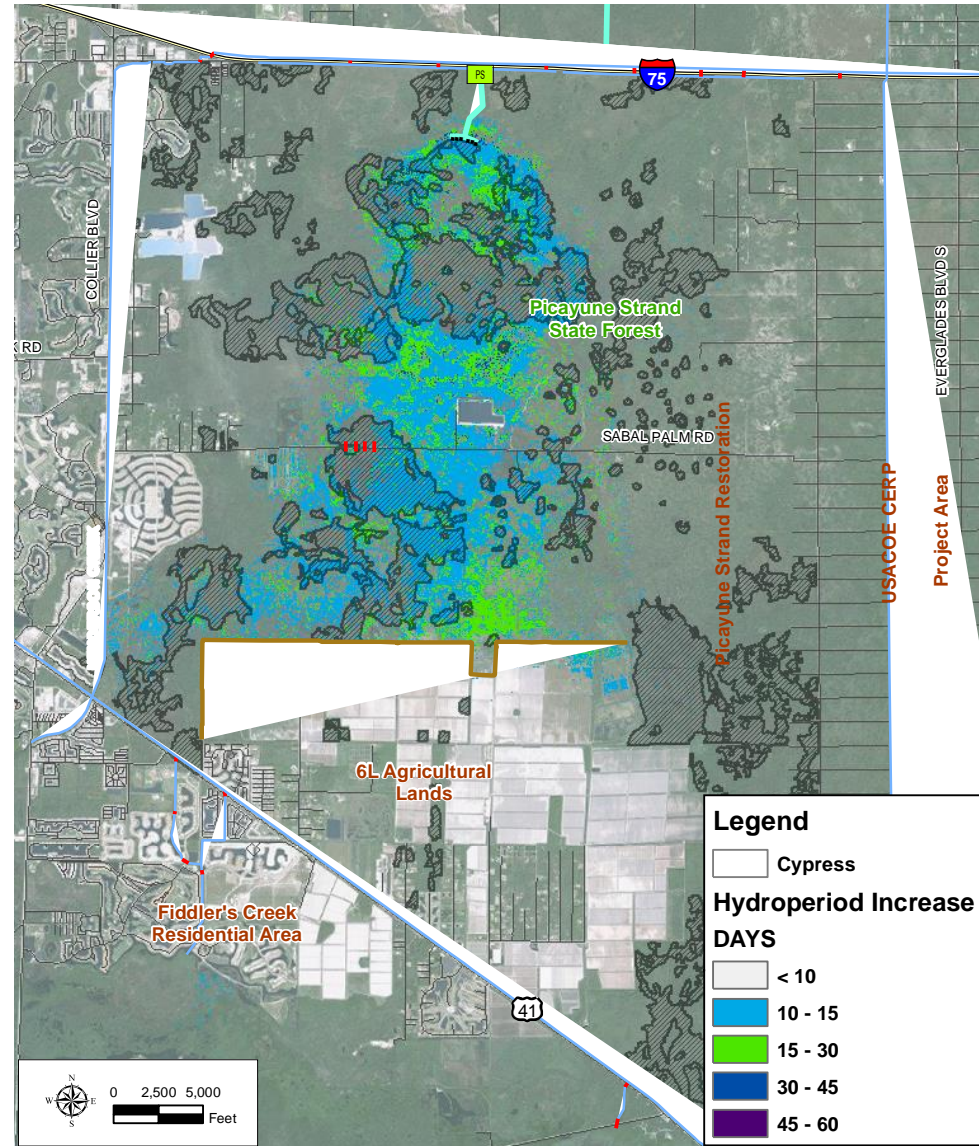
Equivalent to 5,000 20-lb bags of lawn fertilizer



# Rookery Bay - Wetland Hydro-periods

## Cypress Areas

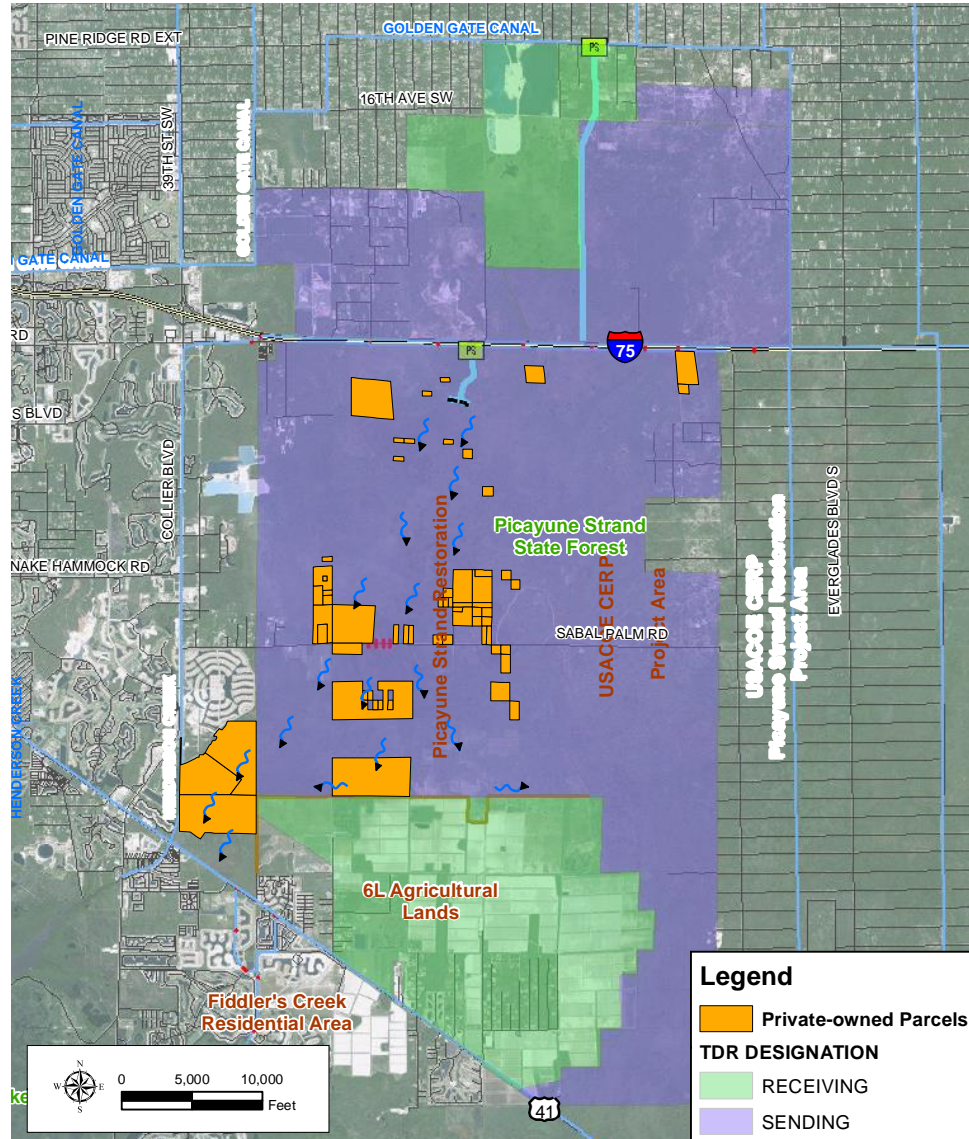
- ▶ Typical hydro-period is 180 - 240 days
- ▶ Existing model predicts hydro-period of 100 - 150 days
- ▶ Project increases hydro-periods 10-30 days on average
- ▶ Minimal impacts to hydric flatwoods, marsh and wet prairies in the project area





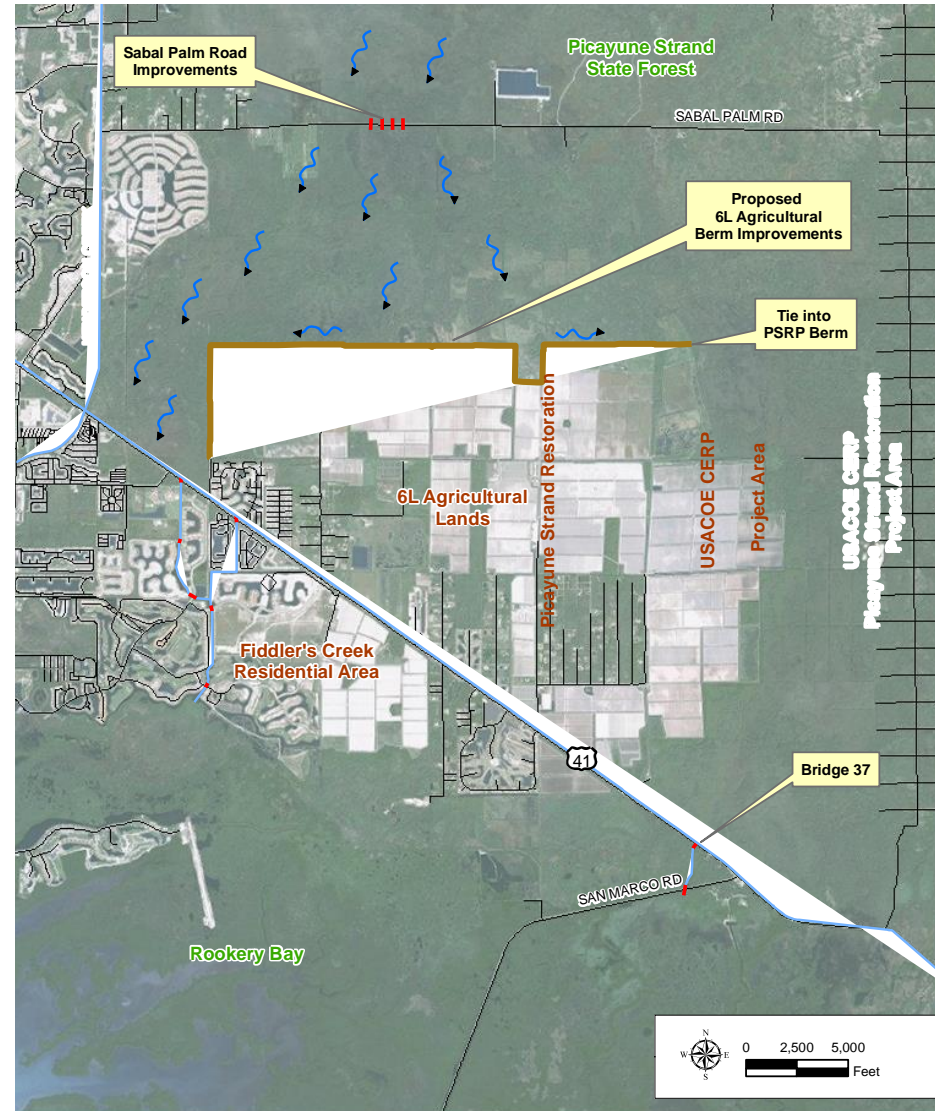
# Rookery Bay - Property acquisition/ protection

- ▶ Transferable Development Rights (TDR) Program
- ▶ Most of the project area lies within the “sending” lands
- ▶ Privately-owned parcels must be acquired or protected (berms)



# 6L Agricultural Lands - Bypassing flow around this area

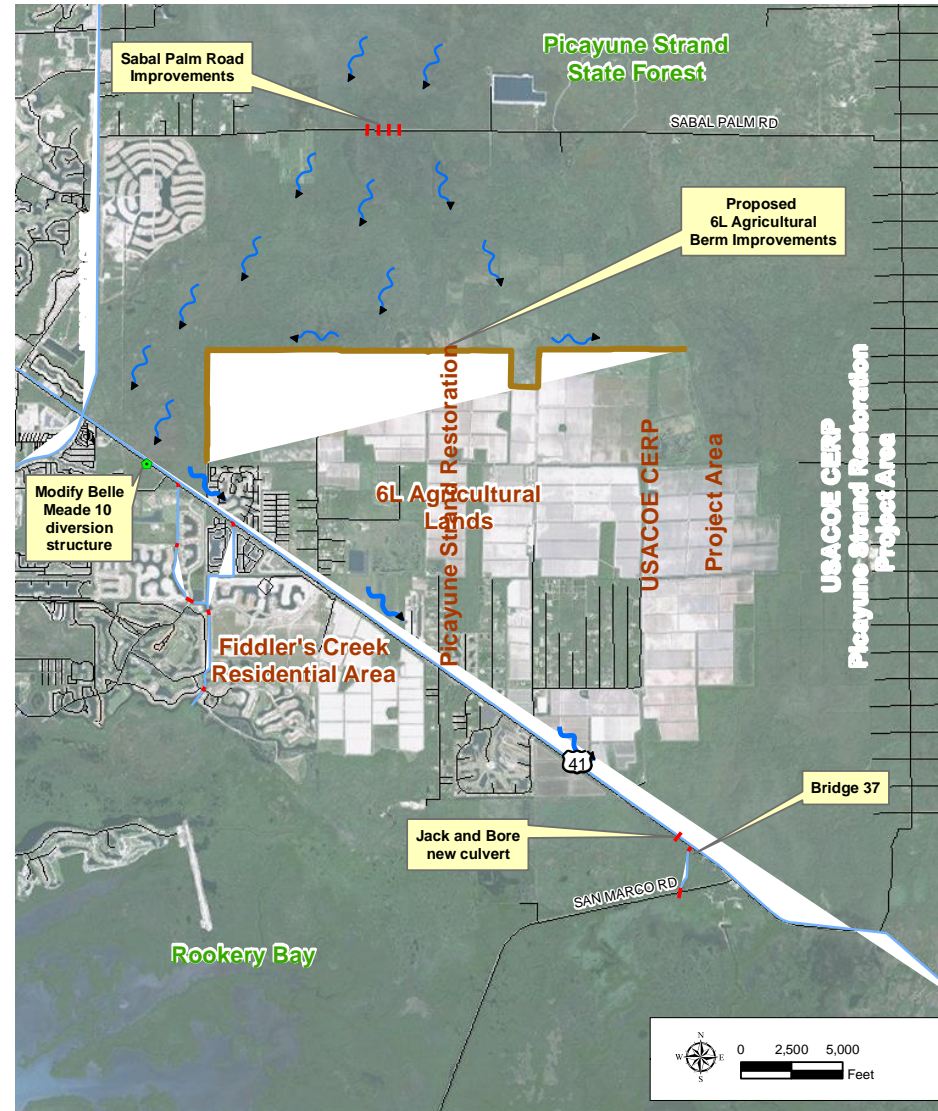
- ▶ Phase 1 of the project will require a protective berm
- ▶ Waters will flow around the Ag lands
- ▶ Currently coordinating with SFWMD and USCOE on the Picayune Strand Restoration Project





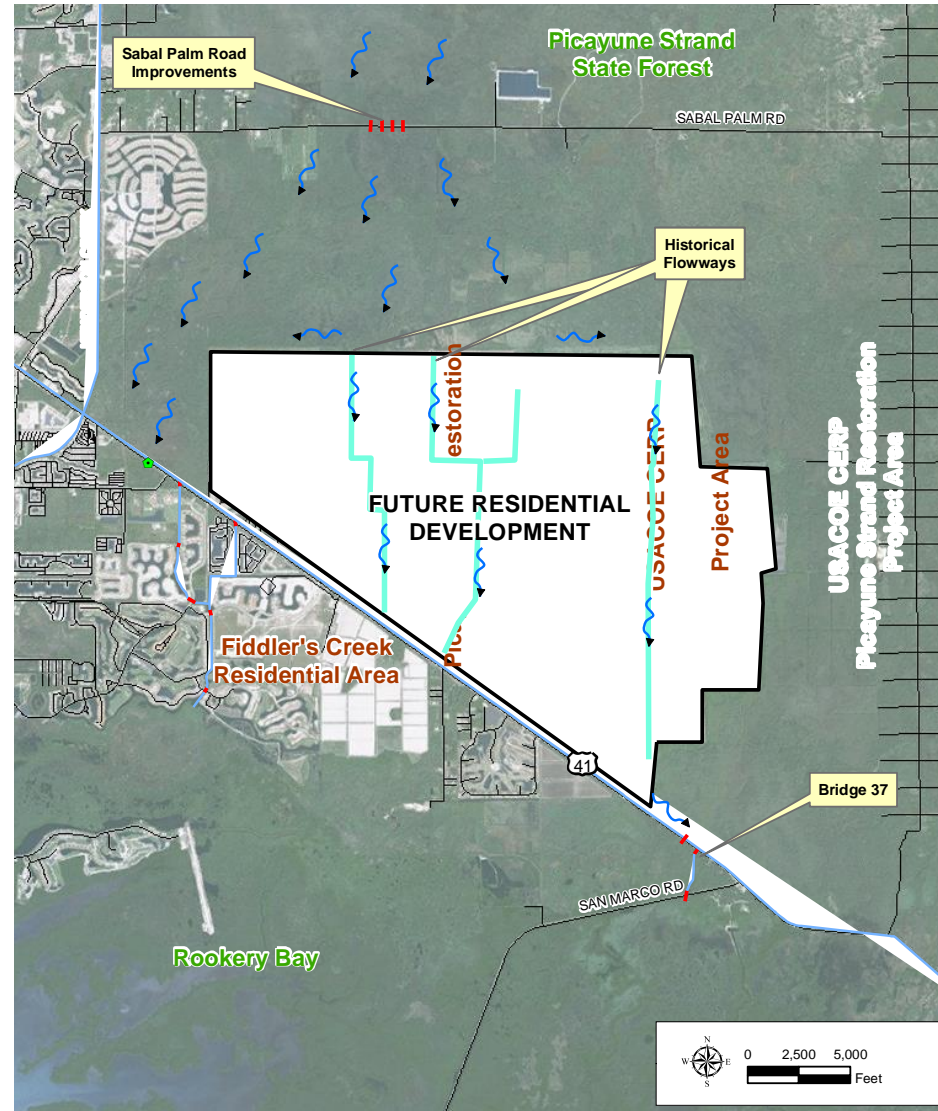
# 6L Agricultural Lands - Directing flows to the areas that need water

- ▶ The Bridge 37 area is the priority for additional freshwater flows
- ▶ Modifications to the Belle Meade 10 structure and additional culverts will force more flow to Bridge 37 via the US 41 north canal



# Six L's Agricultural Lands - Acquiring the historical flowways in the future

- ▶ The Six L's Ag lands may be converted to residential development in the future.
- ▶ This presents an opportunity for the recreation of historic flow ways.



# Rookery Bay - Flows to Estuary

Transect	Flow Difference (Existing LSM - Natural LSM) cfs			
	July	August	September	October
Lely Main	5	3	3	8
Lely Manor	3	0	0.25	4
Henderson Creek	-10	12	25	20
Belle Meade 9	-8	-10	-23	-4
US 41 Outfall Swale 2	0	4	-1.5	2
Bridge 37	-8	-11	-25	-10
<b>Total:</b>	<b>-3</b>	<b>-2</b>	<b>-21.25</b>	<b>20</b>

## Flow to Estuary

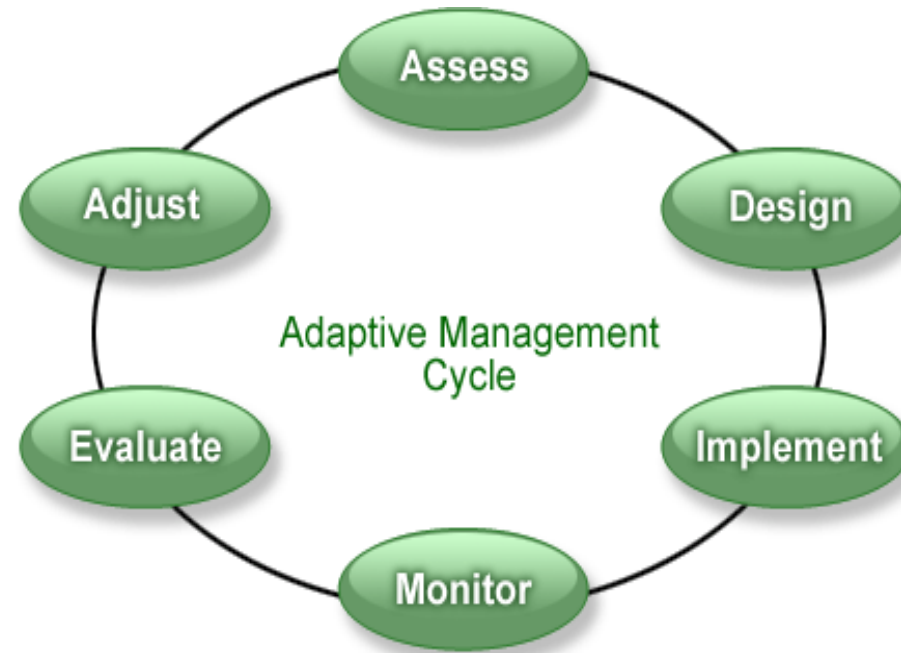
- ▶ An overall slight wet season deficit
- ▶ Preliminary Model Results - with project
  - ▶ Indicate wet season increase at Bridge 37 of approximately 12 cfs
  - ▶ Indicate wet season increase at Belle Meade 9 of approximately 6 cfs

# Critical issues being addressed

- ▶ Property acquisition/protection
  - ▶ Over 150 parcels must be acquired or protected with berms
- ▶ Bypassing flow around the 6L Agricultural lands
  - ▶ Ag lands need to be protected (construct protective berm)
  - ▶ Picayune Strand Restoration Project (east side)
  - ▶ Future flowways through the Ag lands
- ▶ Directing flows to the areas that need water
  - ▶ Bridge 37 area (near San Marco Rd.)
- ▶ Preventing impacts to ecology and hydrology
  - ▶ Use an adaptive management approach

# Preventing impacts to ecology and hydrology

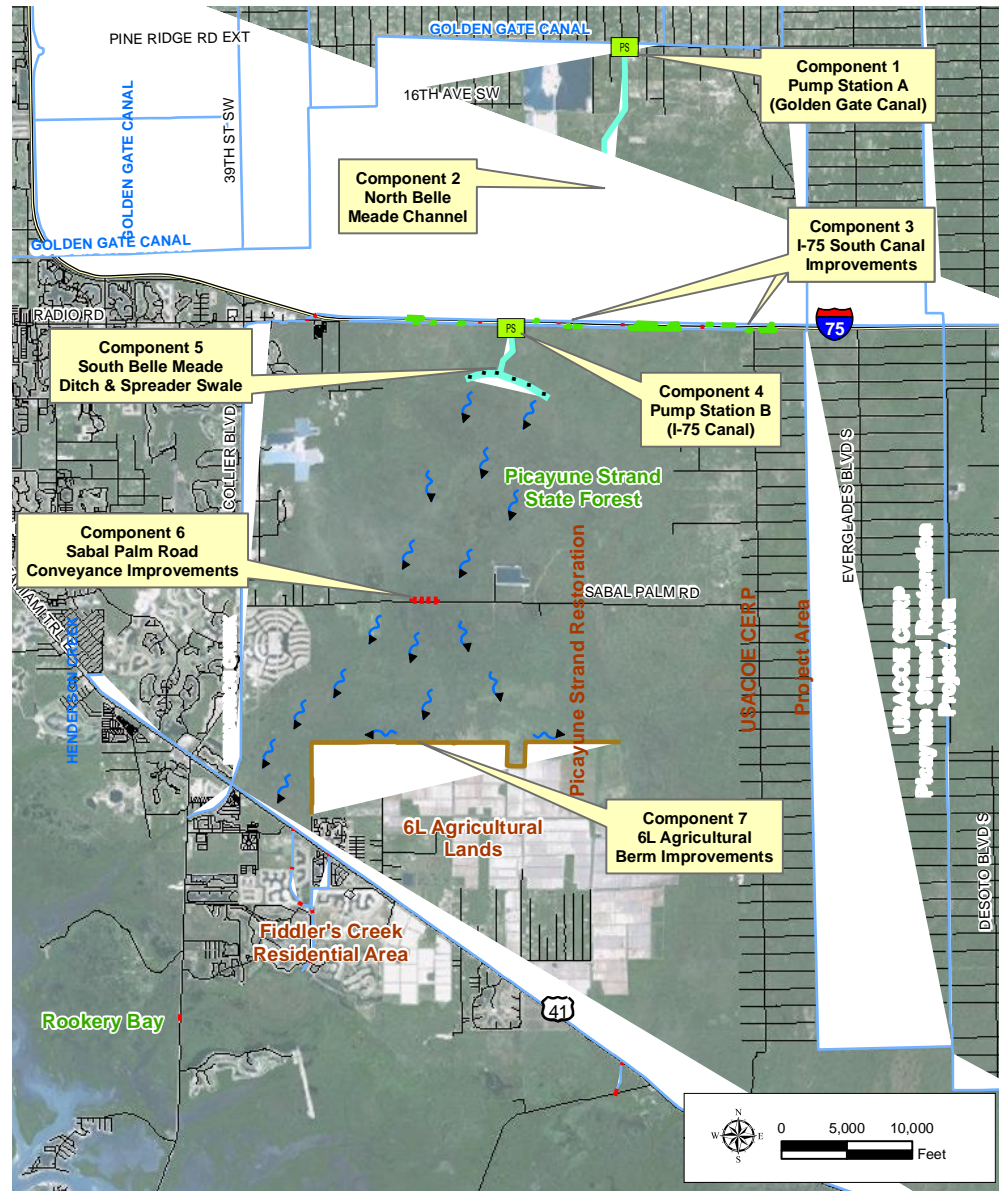
- ▶ Adaptive management approach
- ▶ Hydrologic, wetland and Habitat monitoring
- ▶ System will be flexible
- ▶ Diverted flows can be decreased if needed or system capacity could be increased





# CCCWMP Phase 1 projects

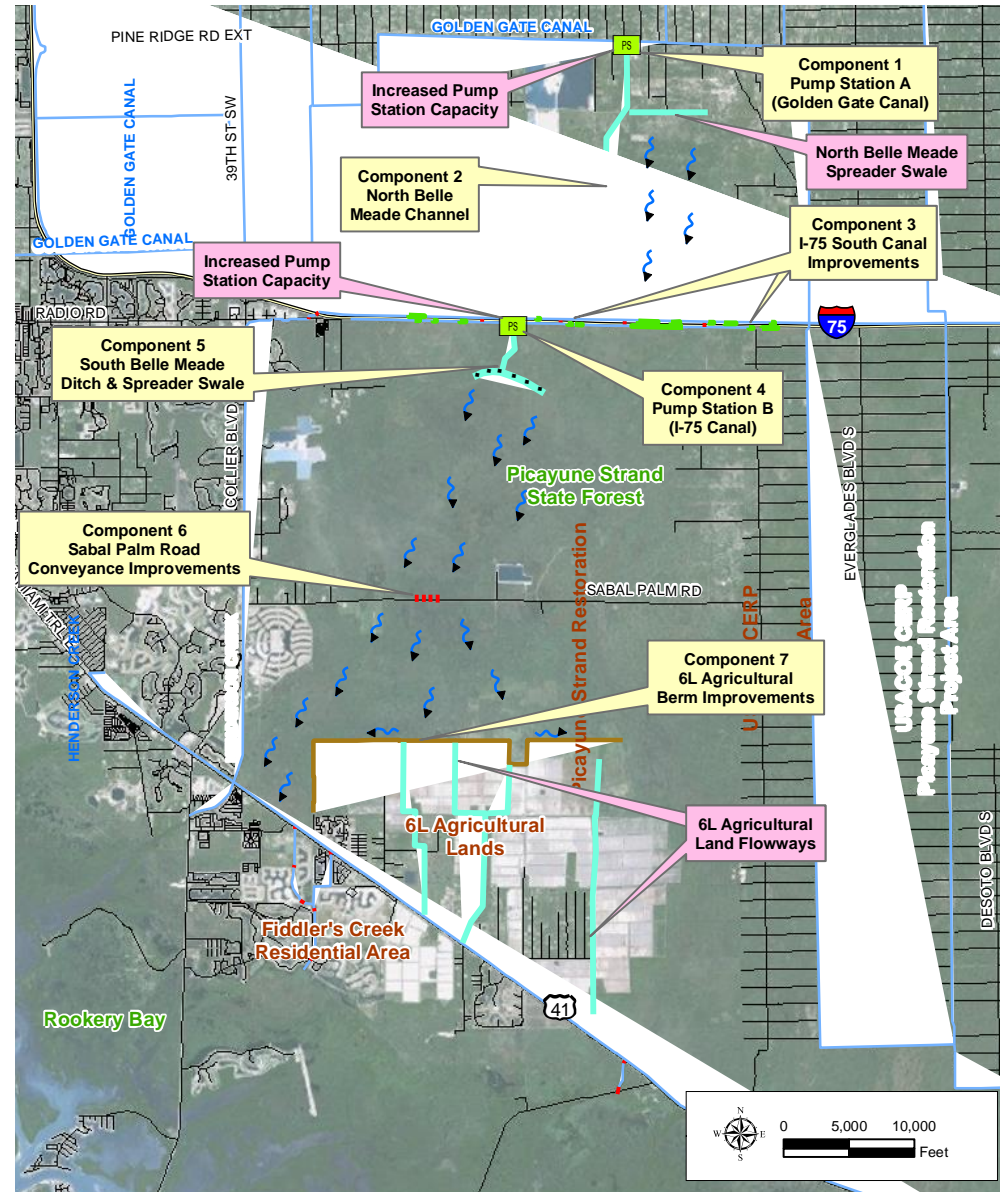
- ▶ Project components are based on previous study concepts
- ▶ Components have been tailored to meet project-specific goals
- ▶ Projects have been (and are still being) vetted in terms of feasibility and permitability.





# CCCWMP Potential future phase projects

- ▶ Increase pump station capacities
- ▶ Construct north Belle Meade spreader system
- ▶ Construct flowways through converted 6L Agricultural areas
- ▶ Projects are dependent on system response and property acquisition



# Project Development and Estimated Cost

► Project conceptual plan set (~15%)

Components 1 & 2	11M
Component 3	1M
Components 4 & 5	4.8M
Component 6	0.2M
Component 7	7M
Minor projects	1M
Future Phase Studies	1M
<b>TOTAL</b>	<b>26M</b>

