








Periphyton Stormwater Treatment Area (PSTA) Studies - STA-1E

Palm Beach County, FL
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Agenda

- Introduction and Overview
- Mesocosm Results
- Field Scale Demonstration
- Path Forward

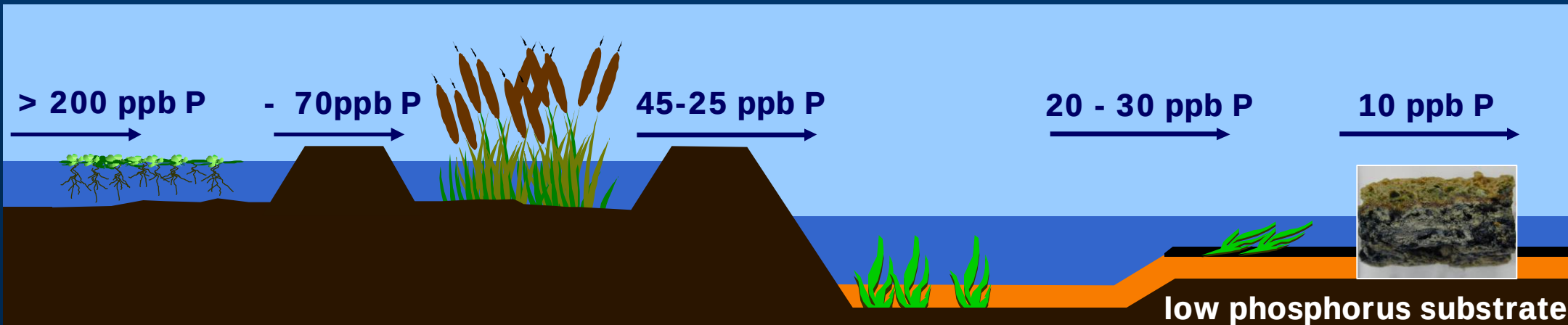
STA-1E

PSTA Demonstration Conceptual Plan to Achieve 10 ppb Phosphorus

Emergent Growth

SAV w/Periphyton

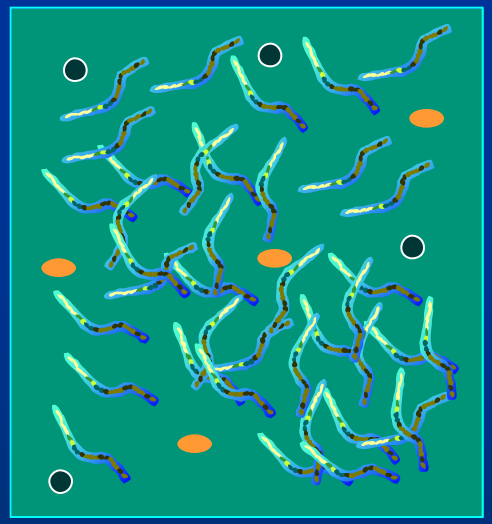
Calcareous Periphyton (activated)



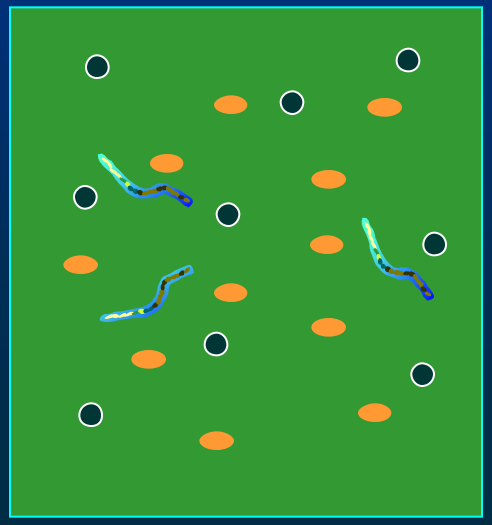
Natural System

Seasonal Dryout

CYANO DOMINANT
Dry conditions
Summer / Fall

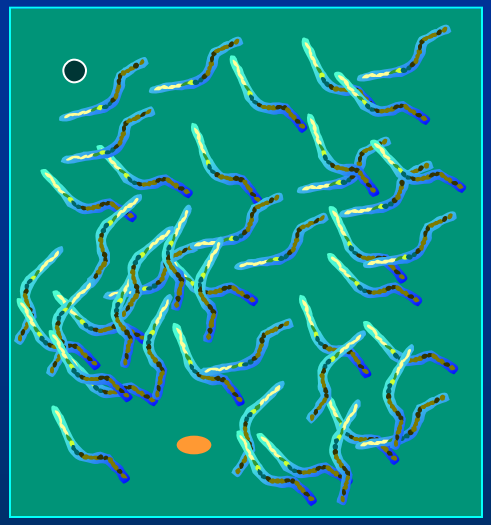


DIATOM DOMINANT
Wet conditions
Winter / Spring



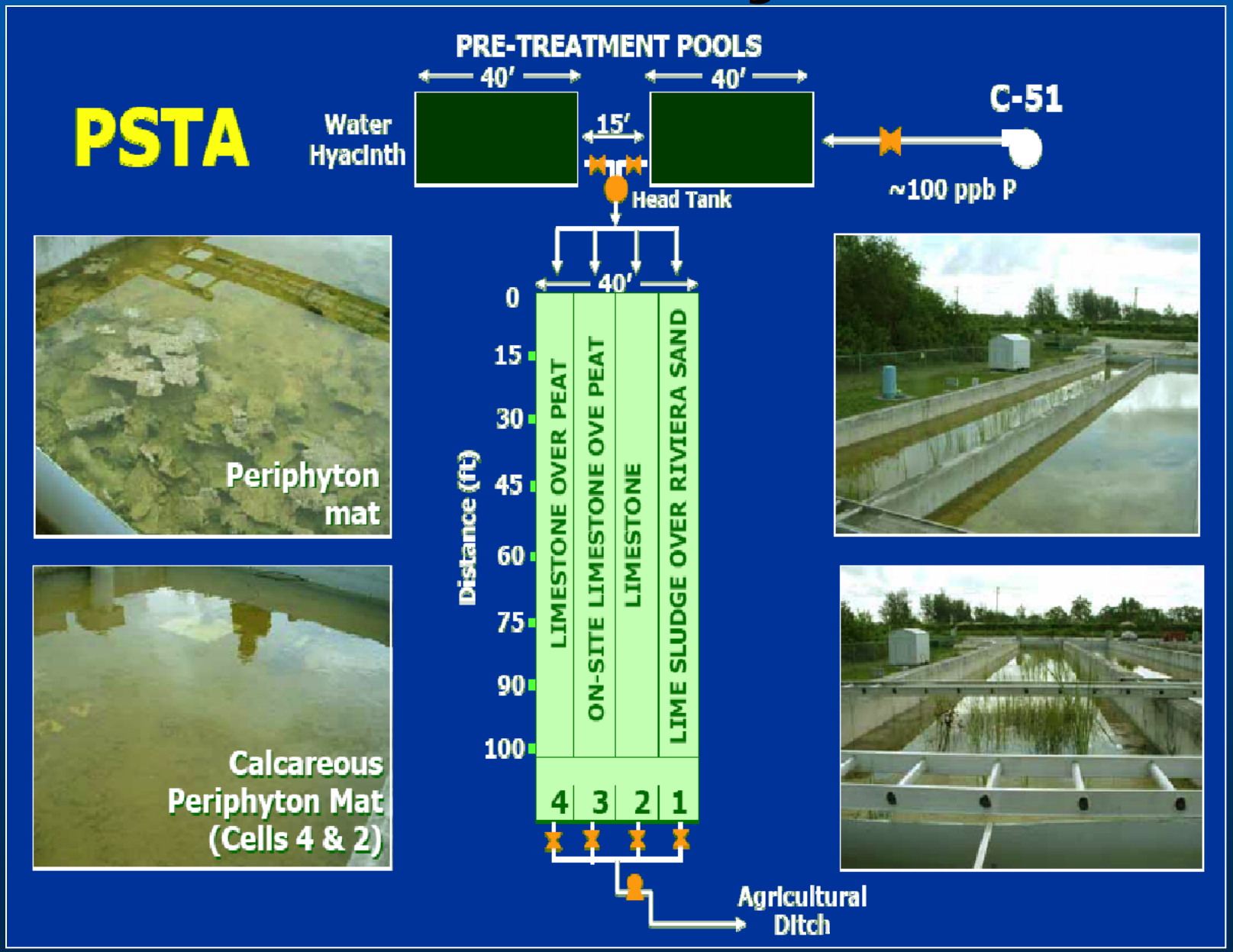
Corps PSTA

Repeated (forced) Dryouts
Activated Periphyton



CYANO DOMINANT
Extreme conditions

Mesocosm Study



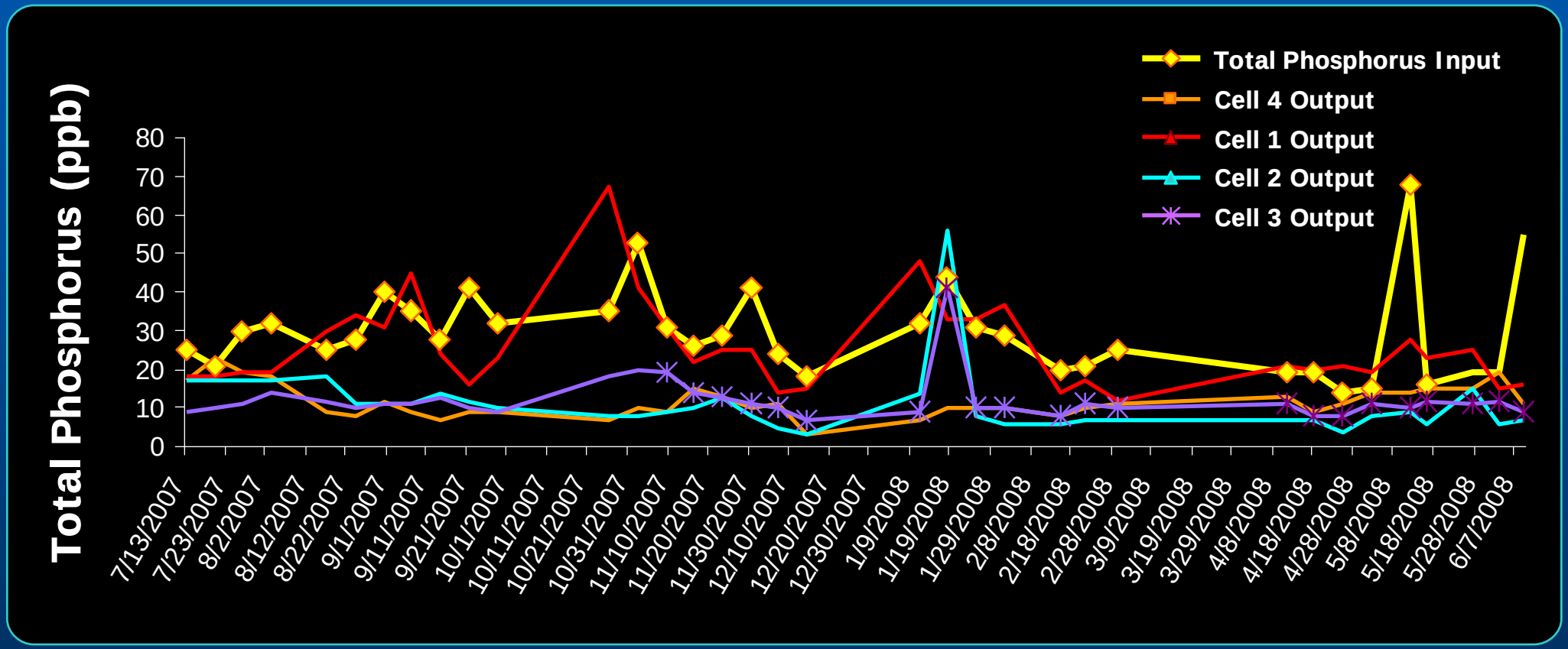
- Substrate types
- Hydraulic retention times
- Flow depths
- Vegetative community size and sustainability

Mesocosm Water Budget

rainfall and evaporation monitoring

composite sampling
(2000 hrs; 1400 hrs)

Mesocosm : Results (7/2007 through 6/2008)



Cell 1 = lime sludge (over riviera sand)

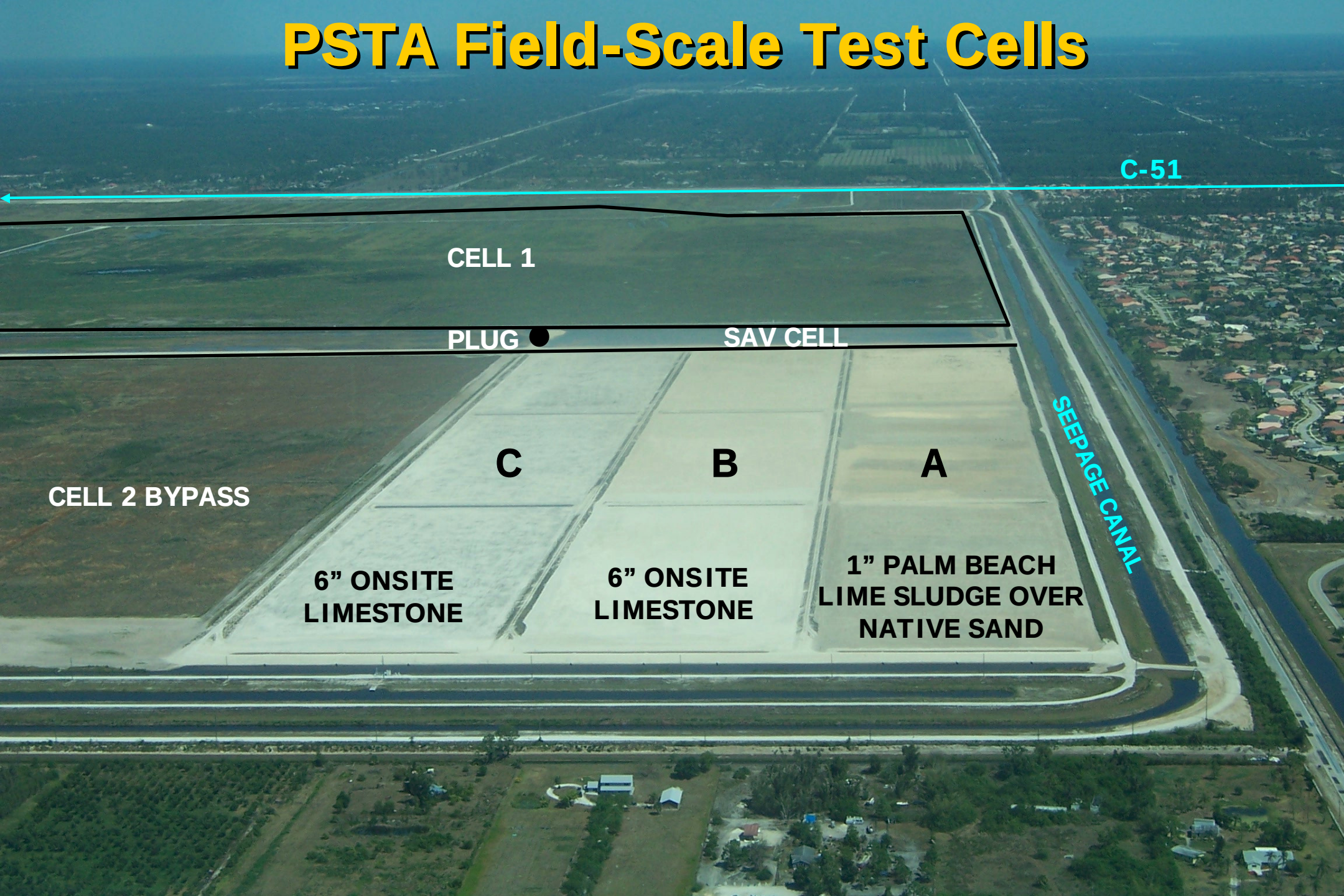
Cell 2 = limestone - Ft. Thompson (~7 years)

Cell 3 = limestone - Onsite (~2 year)

Cell 4 = limestone - Ft. Thompson over peat (~ 7 years)

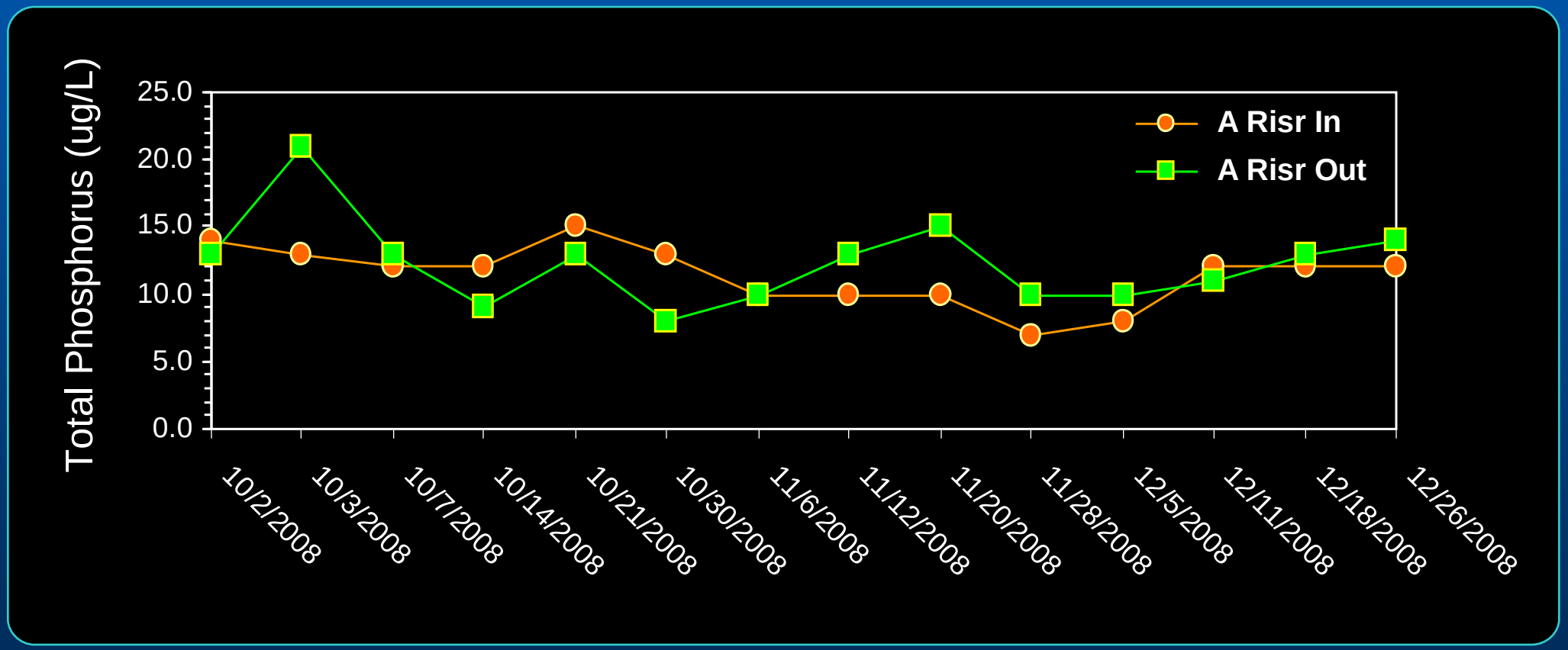
Field Scale Demonstration

- In 2003 PSTA Field-Scale Demonstration was authorized and funded
- PSTA Field Scale Demonstration Objectives:
  - Evaluate PSTA performance for the period of record in a larger scale
  - Calibrate concentration-based PSTA model to determine full scale sizing of PSTA technology
  - Demonstrate most cost-effective PSTA substrate
  - Determine PSTA engineering and operational parameters for full scale implementation
  - Determine the operations and maintenance requirements for full scale implementation and sustainability


PSTA Field-Scale Test Cells
C-51
CELL 1
PLUG
SAV CELL
SEEPAGE CANAL
CELL 2 BYPASS
C
B
A
6” ONSITE LIMESTONE
6” ONSITE LIMESTONE
1” PALM BEACH LIME SLUDGE OVER NATIVE SAND

PSTA Field Scale Demonstration Results

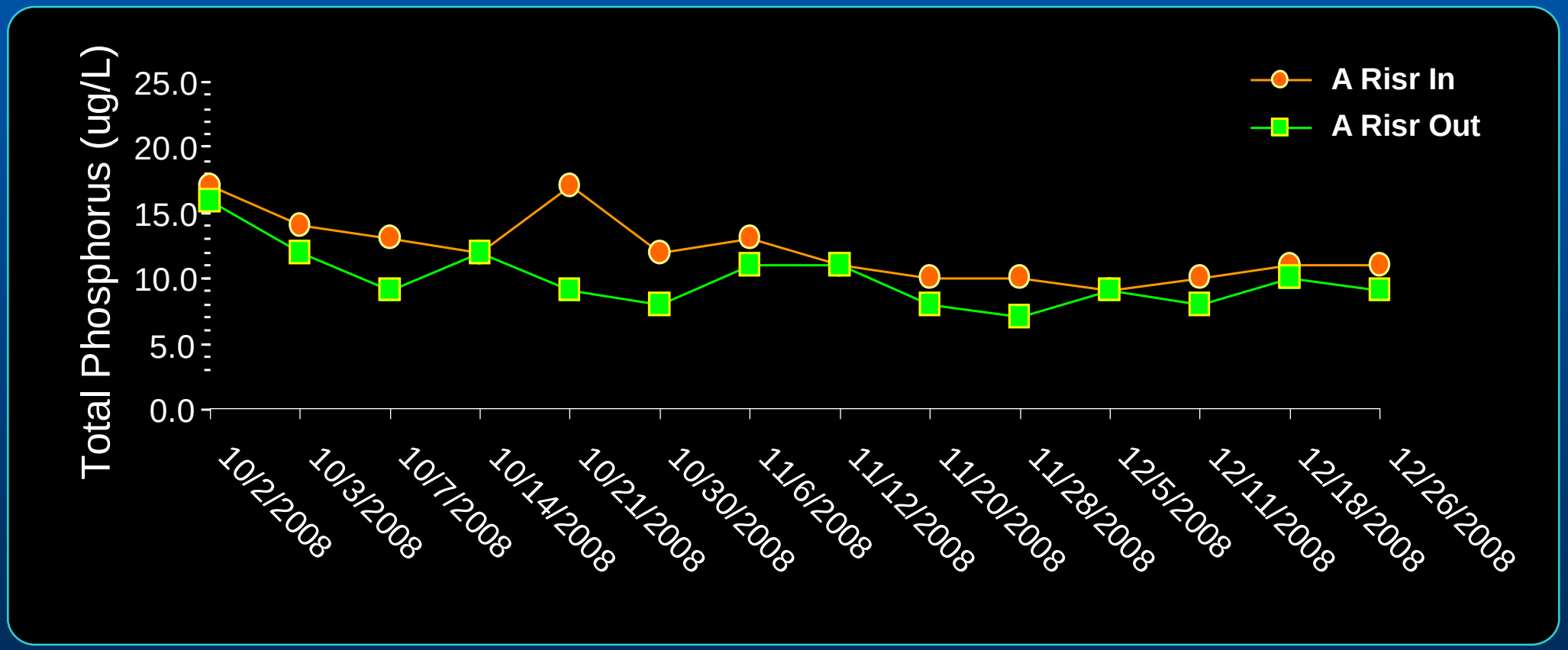
1” Lime Sludge - Cell A



Note: results based on a 3.5 - 7 day hydraulic retention time

PSTA Field Scale Demonstration Results

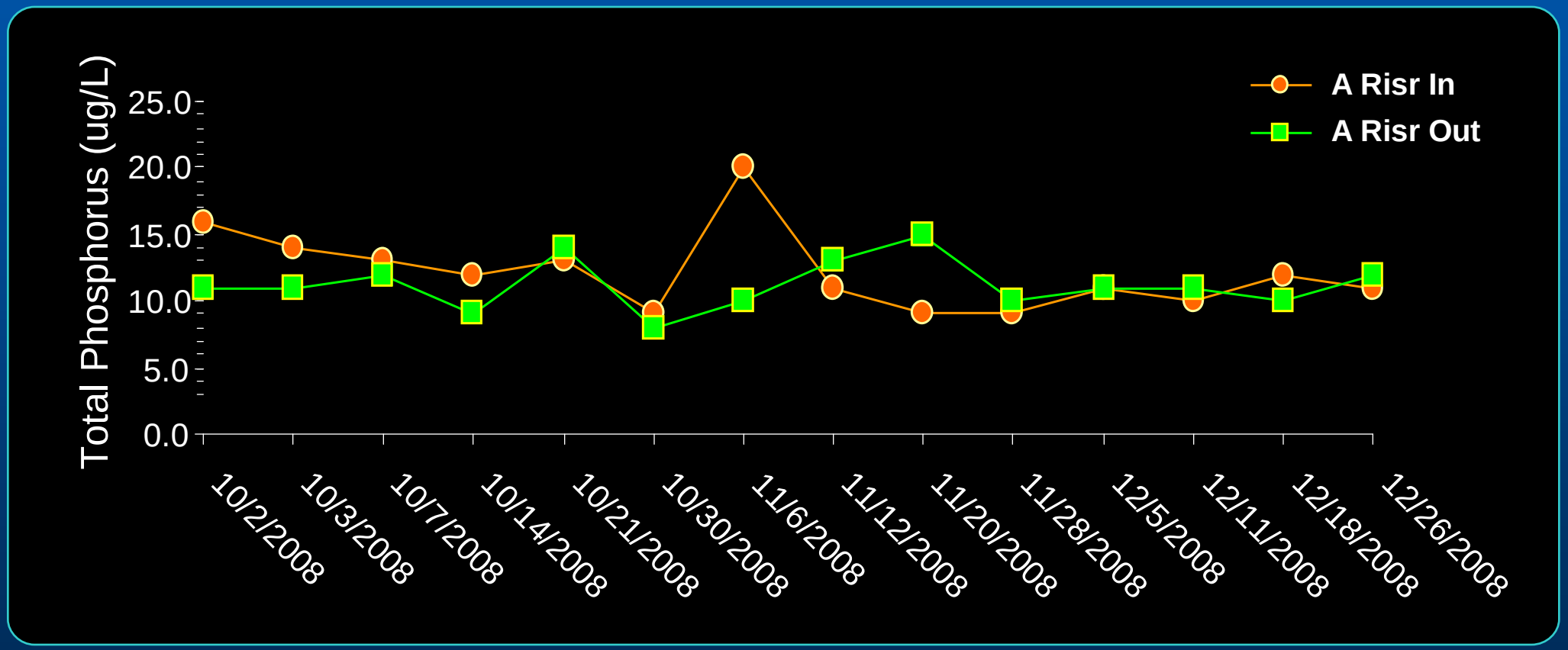
6” Onsite Limestone - Cell B



Note: results based on a 3.5 - 7 day hydraulic retention time

PSTA Field Scale Demonstration Results

6” Onsite Limestone - Cell C



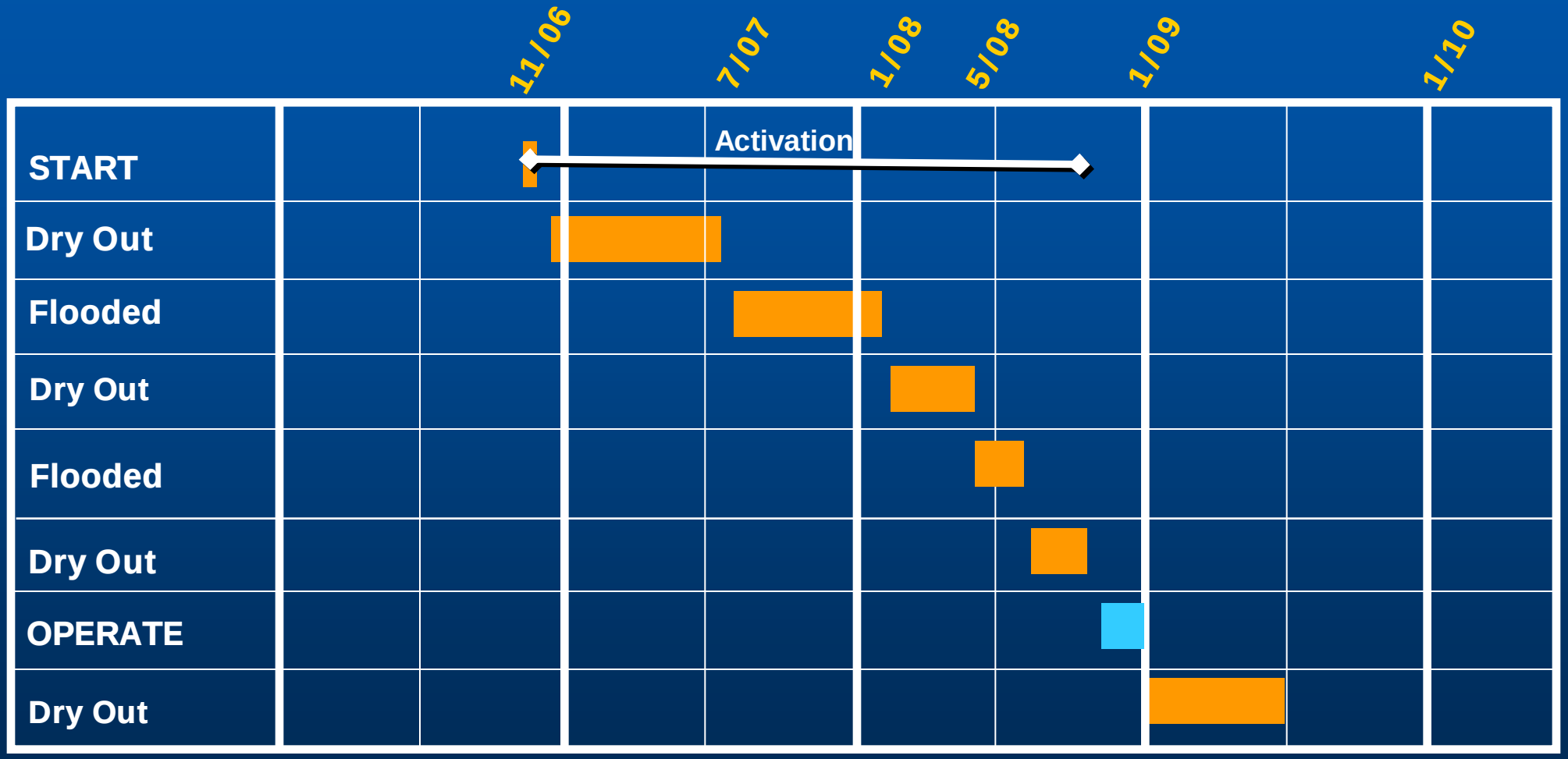
Note: results based on a 3.5 - 7 day hydraulic retention time

PSTA Field Scale Demonstration
Path Forward

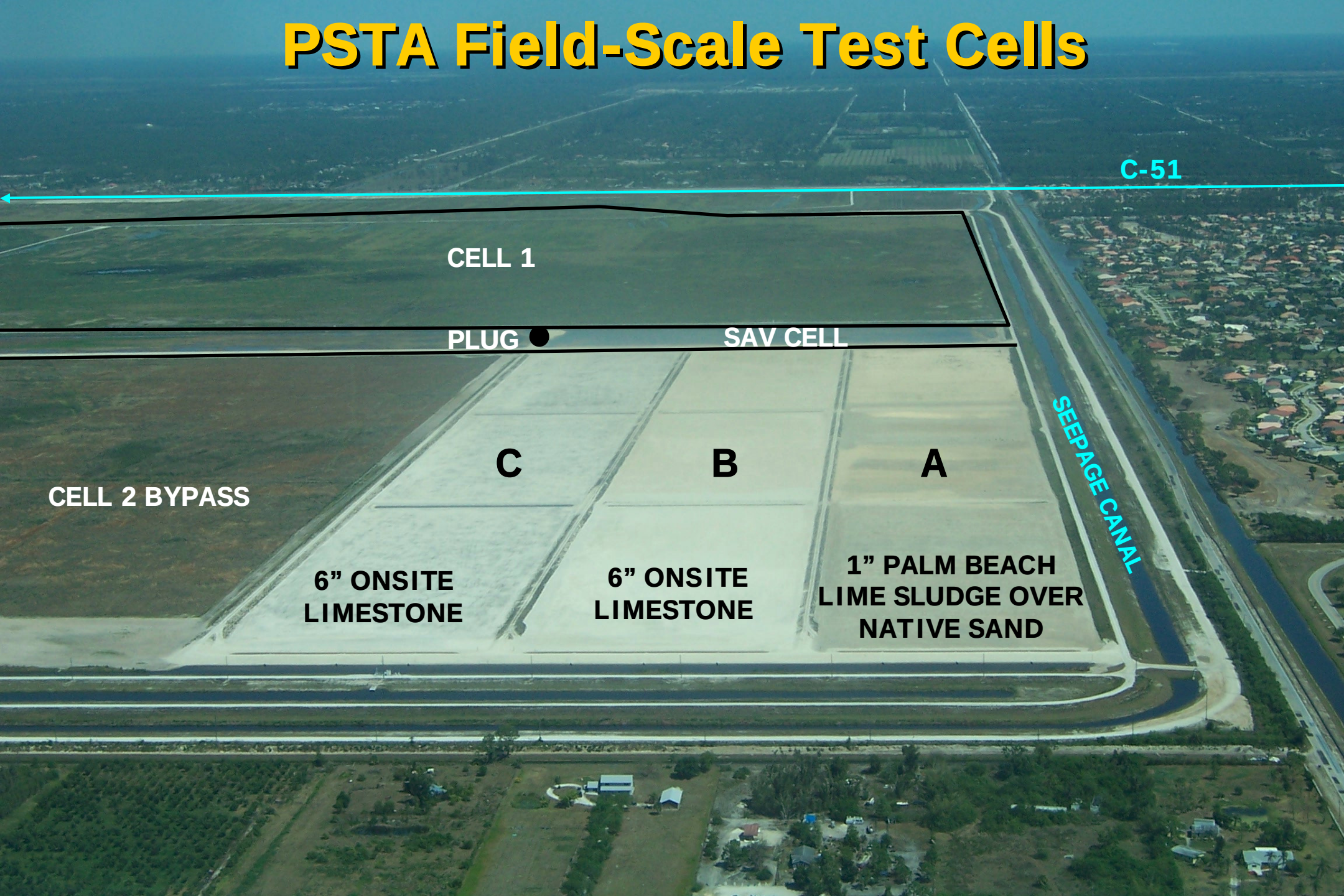
- Operate temporary (10cfs) pumps from C-51 during low flow periods to bypass cell 1
- Plug installed isolating test cells from cell 2 bypass area, to enable testing during high flow
- Current Schedule:
  - Testing completion - August 2010
  - Prepare Engineering Documentation Report (EDR) – January 2011

Field –Scale Operation (STA 1-E)

November 2006 – July 2009



Planned schedule alternating 2 months wet, 2 months dry for a period of 6-8 months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BACK-UP SLIDES

Chemical & Biological Reactants Naturally Found in the Everglades Marsh

- Calcium - abundant
- Magnesium - trace
- Iron - trace
- Aluminum - trace
- Manganese – trace

Require Chemical Treatment

Calcium-based treatment technology only logical option

Hypothesis – Factors for Developing Calcareous Periphyton

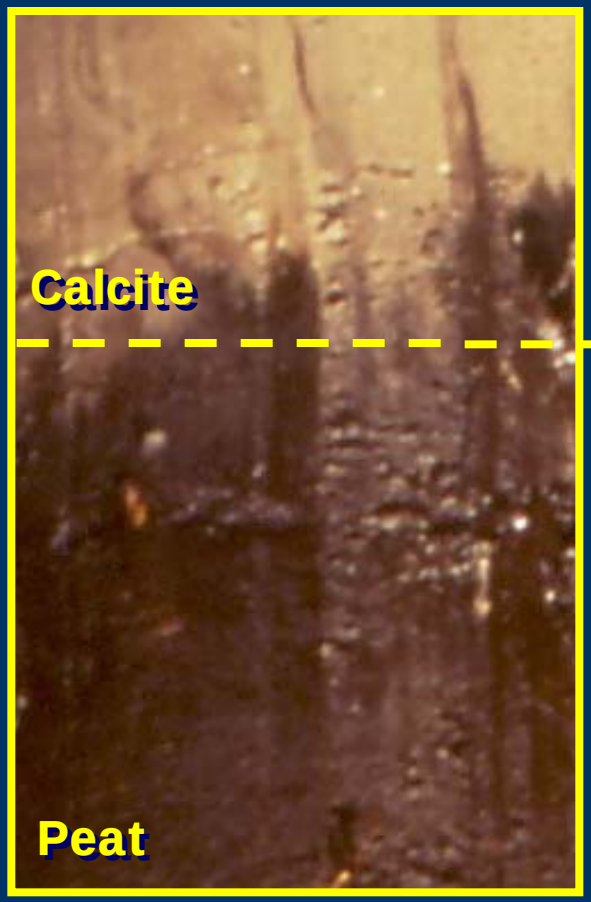
- High solar radiation
- High temperature
- Low phosphorous
- Dry-out

Manipulate hydroperiod – forced dry-outs

Corps Activated Periphyton:

Water Treatment Based on Observations in Nature

(natural system enhanced through more frequent dry-outs)



Post-Tamiami Trail Construction

- Low Phosphorus
- Rainfall Driven
- Periodic Dryouts (cyano bacteria dominance)
- Calcite (precipitated periphyton)

1920s

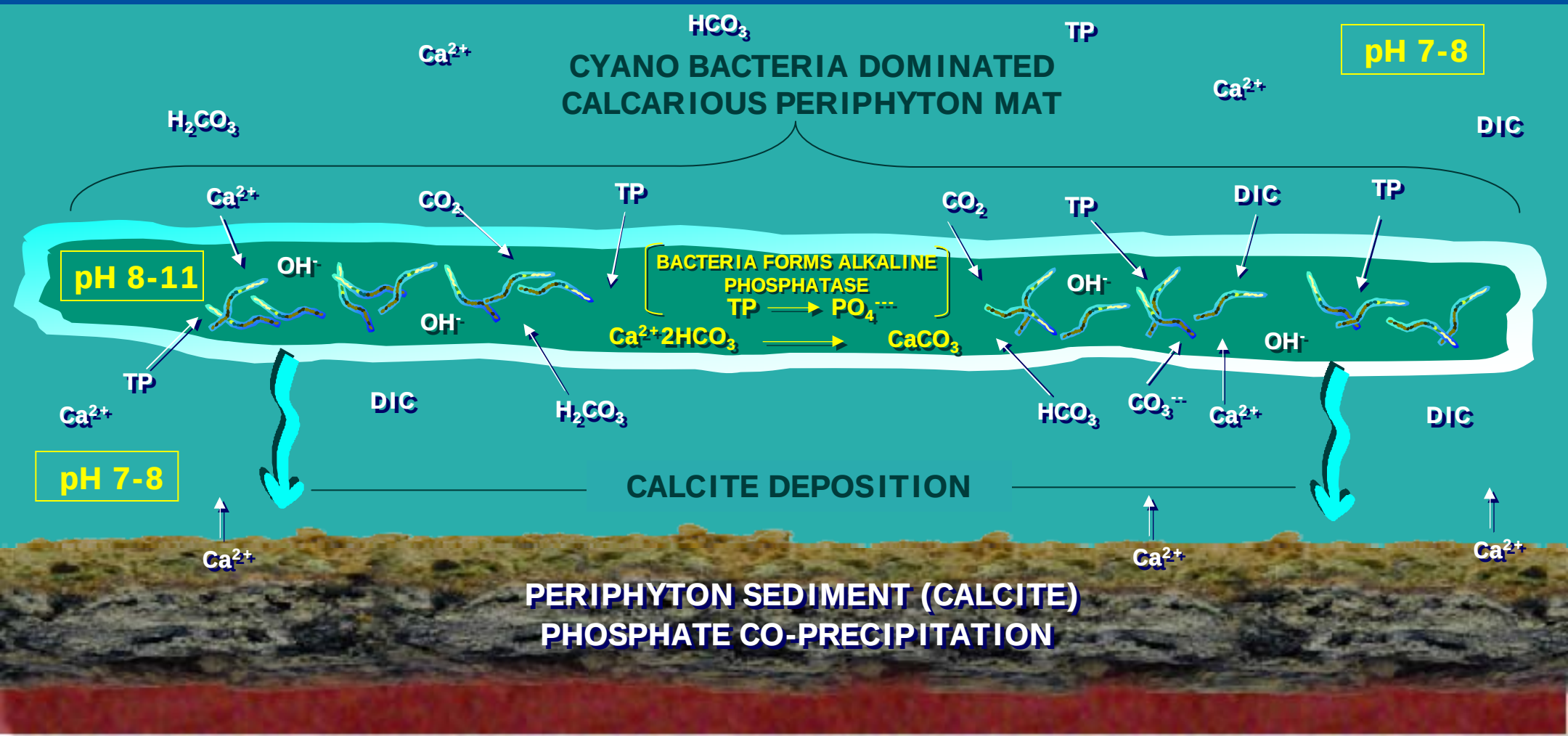
Pre-Tamiami Trail Construction
(no obstruction to sheetflow in Everglades)

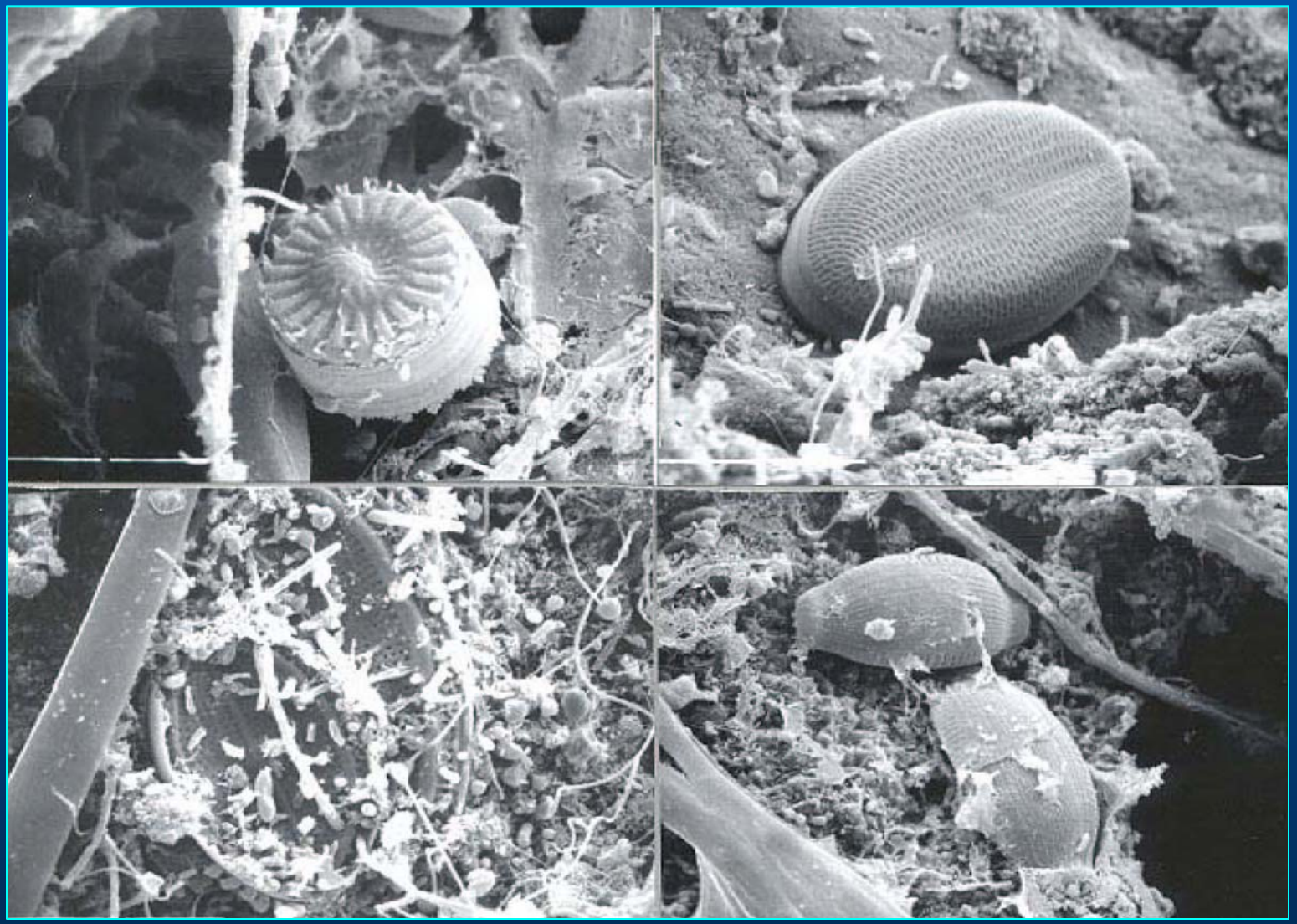
- Low Phosphorus
- Always Wet

Core Sample South of Tamiami Trail
Natural Conditions

PSTA Phosphorus (P) Removal Process within a Calcareous Periphyton Mat

- Calcium (Ca^{2+})
- Dissolved Inorganic Carbon – DIC (e.g. CO_3^{--}, H_2CO_3, HCO_3^{-}, CO_2)
- High pH
- Nucleation Sites





Enlargement of Calcareous Periphyton Assemblage

calcium carbonate precipitation functional groups