

# *Florida Keys Environmental Coalition*

June 2013

Cleaning the FL Keys Canals with Filter  
Feeder Habitats

Proposal for Monroe County Pilot  
Program

# FKEC.org: Mission & Goals

- Organized in response to DWH 2010 oil spill
- FKEC.org “unified voice” unanimously endorse by elected officials in Monroe County
- The Mission of the Florida Keys Environmental Coalition is to coordinate and support organizations, businesses and individuals, who work to protect the coral reefs and ecosystems of the Florida Keys and to provide a unified voice for our community.
- Organize and educate citizen to help support EOCs during times of eco-hazards
  - Database of aprox. 4200 historical volunteers
  - Hundreds trained at various Hazwopper levels
  - Relationship with EOC managers
  - National Incident Manager in FKEC.org (Paul Hefner)

# ***Engineered Habitats for Indigenous Filter Feeder***

## **Applying Proven Technologies to Improve Near Shore Water Quality**

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**This is the Bay...**

***This is the Bay on Habitat!!!***

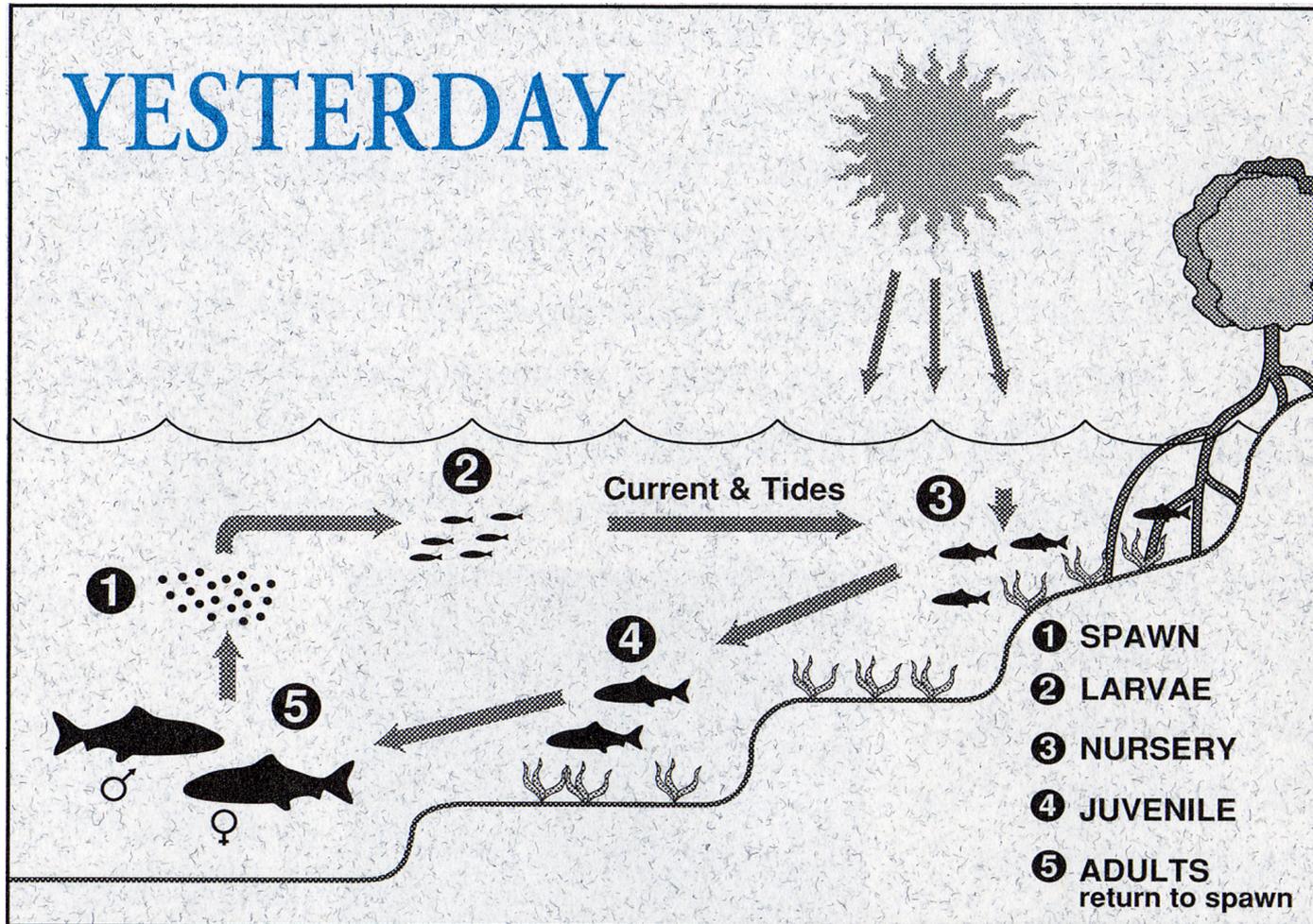
***ANY QUESTIONS?***

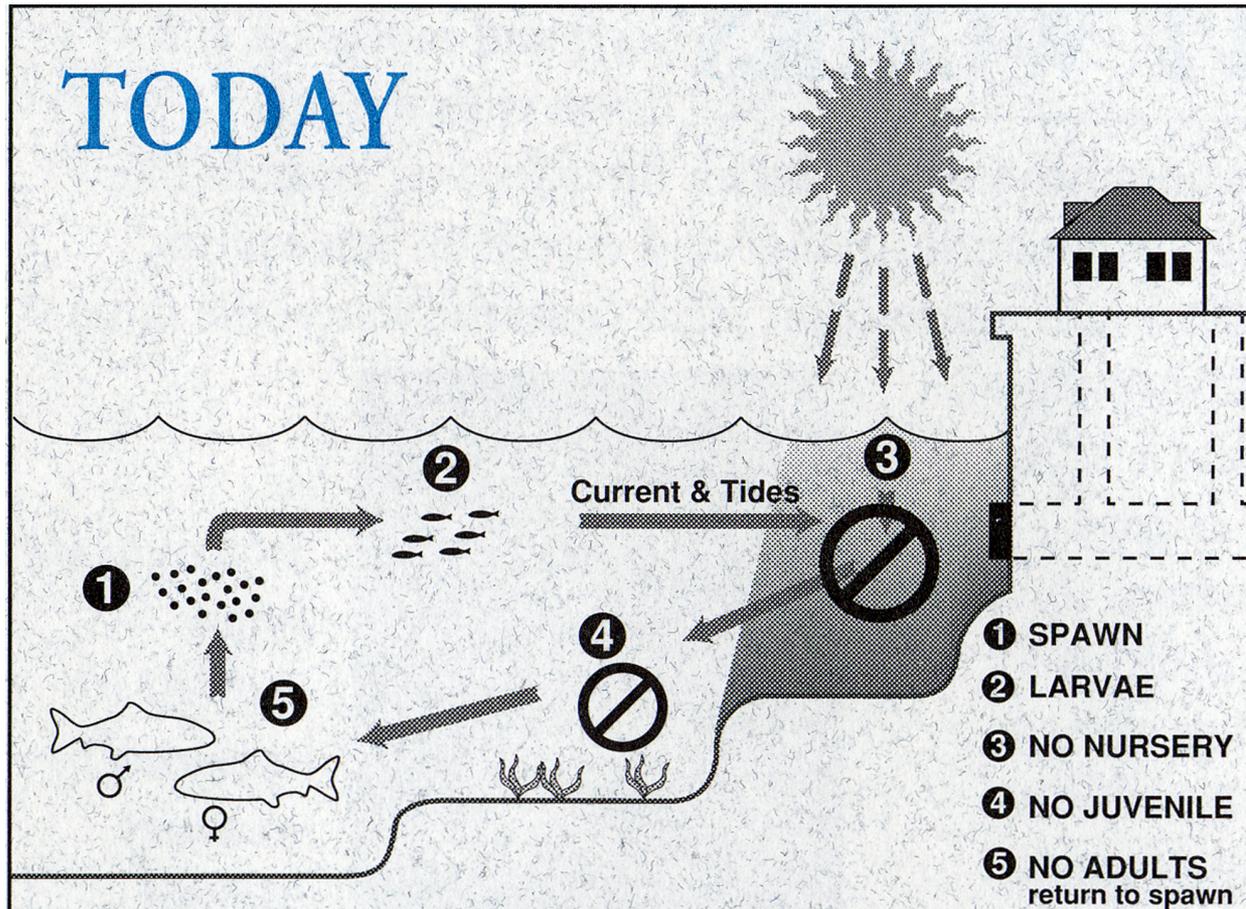
Learning from nature!

# **NATURAL SHORELINE & CANAL ECOSYSTEMS**

# HEALTHY HABITAT

## *Nursery for Juvenile Fisheries Species* *Water Filtering: The Near Shore "Kidneys"*





## Natural Habitat Void Designed Into Keys & FL Canals

- KIDNEY FAILURE – NOT ENOUGH FILTER FEEDERS
- LIFE CYCLES BROKEN – FEWER FISH, MORE REGULATION

Habitat Systems Emulate the Missing Natural Shoreline

# **HABITAT DESIGN & PERFORMANCE**

# Sampler & Full Scale Units in Test: 1 - 2 years in Keys

## WHAT'S GROWING IN YOUR BACK YARD??



**BEFORE**



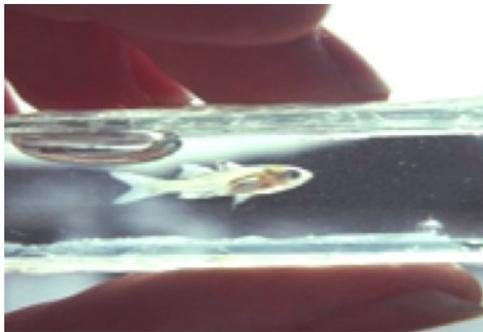
**4 MONTHS LATER** (Photos: ORI)



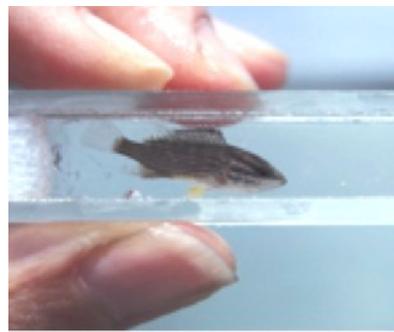
(Photos: ORI)

## Engineered Habitat #55

- 50+ year lifespan
- Distance between tiers & substrate attract target ecosystem members
- 10K – 20K gal/day/unit filtered
- Fisheries species survivability improved
- Floats at dock, needs sun
- Garden in the water



**SNOOK**



**SNAPPER**



**STONE CRAB**



**SPINY LOBSTER**

# Habitat Manufacturing

- **Ocean Restoration Corp & Assoc. Licensing**

**Materials:**

- Tiers—24" X 36" fiberglass, or Marine Board
- Rope— 80' 1" polypropylene
- Shell substrate—crushed fossilized shells
- Assembly rods, spacers—20 – 5 x 1.5" PVC pipe
- Floats—12" (31 lb. buoyancy) HDPE
- 130 lb. floatation = 250+ lbs submerged biomass
- Volume: 12 ft<sup>3</sup> (0.34 m<sup>3</sup>)

**Dimensions:**

- Finished Size = 2' x 3' x 2'
- Total surface area— 11,045 in<sup>2</sup> sq (76.7 ft<sup>2</sup> – 7.7 m<sup>2</sup>)
- Surface-area-to-volume (SAV) ratio: — 6.4:1
- Volume: 12 ft<sup>3</sup> (0.34 m<sup>3</sup>)
- Weight: 43.5 pounds

**Cost Estimates:**

- ORCA = \$450; Material & Labor = \$300 est.

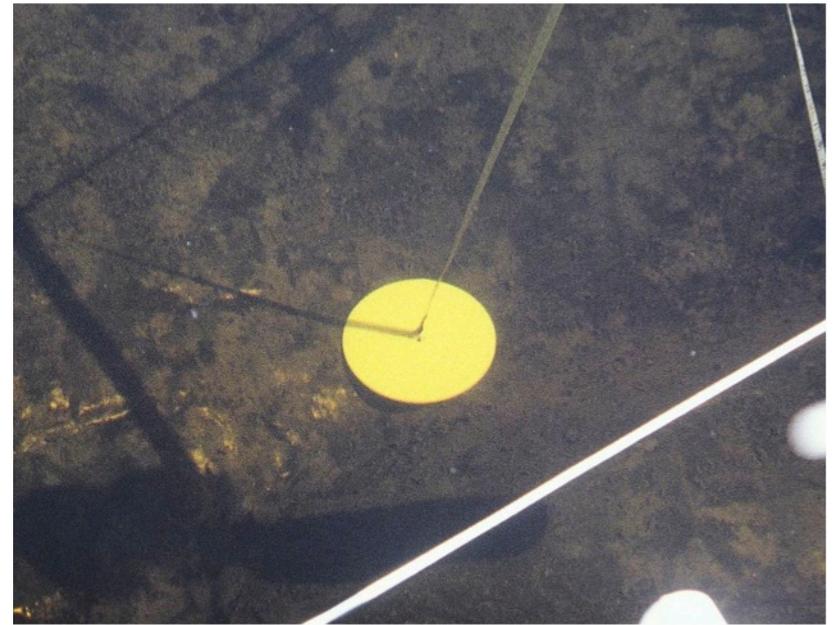
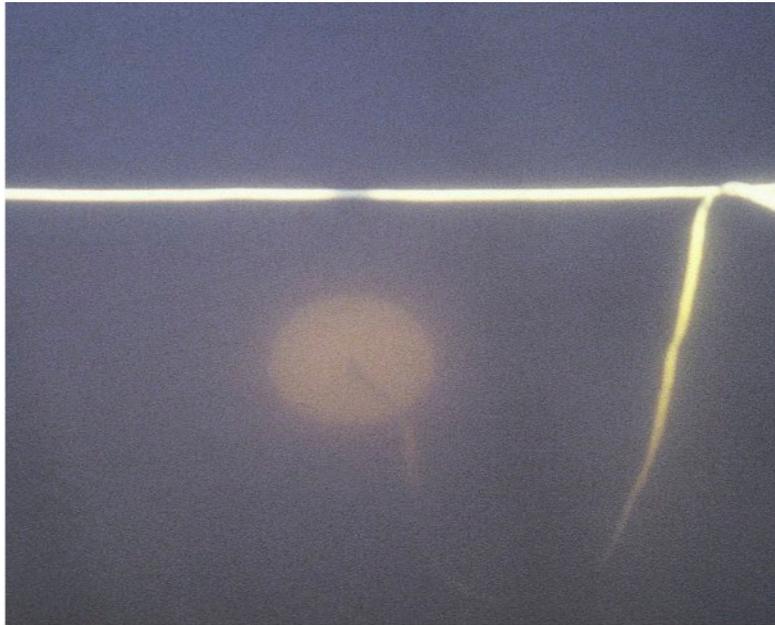
## Finished Habitat



# 20,000 GALLON/ 24 Hr TEST



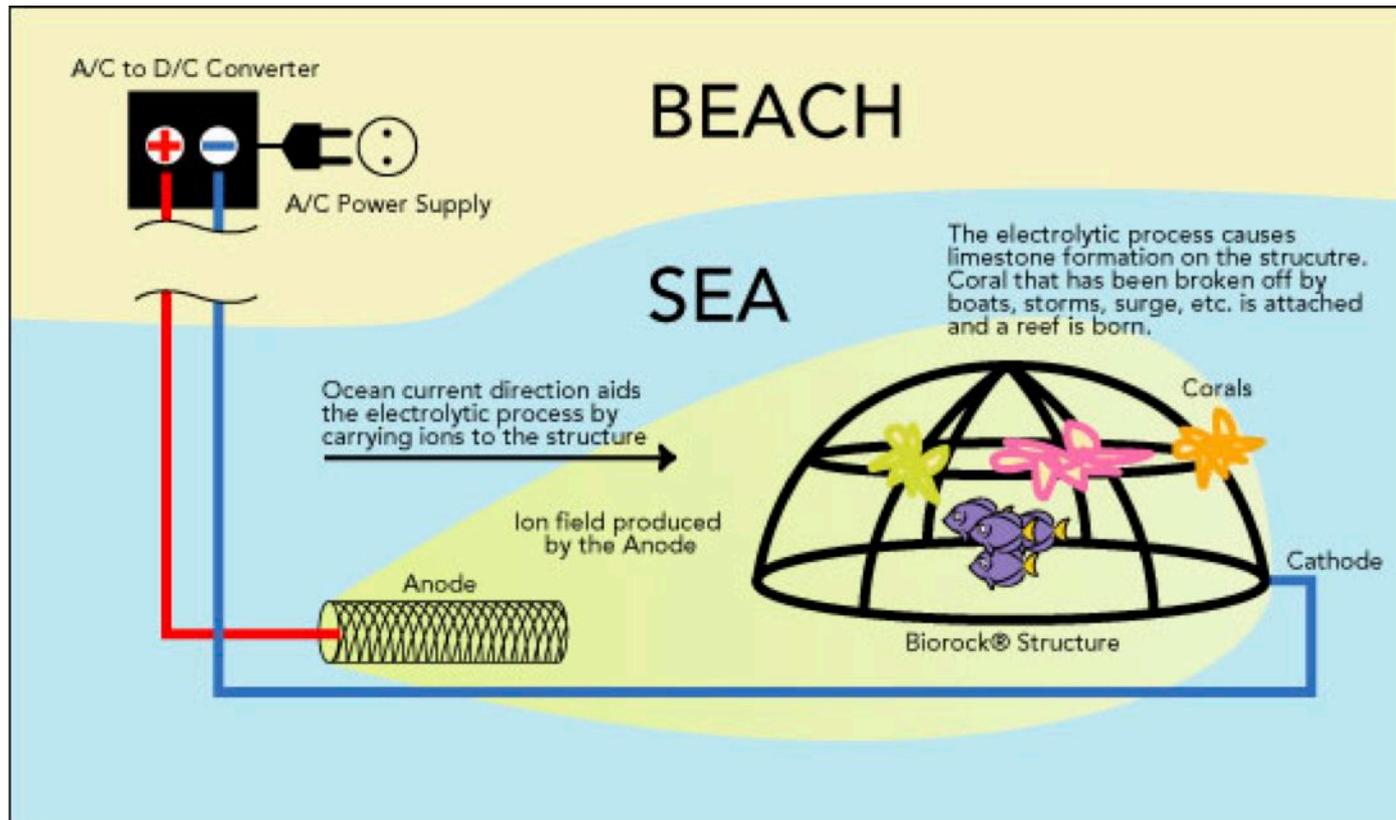
(Photos: ORI)



Using Technology to Improve Production and Performance

# **WHAT IN THE WORLD IS A BIOROCK?**

# Biorock



- Accelerate Production
- Insure Robust Sustainable Filtering
- Pilot Potential Coral Restoration Initiatives

# Biorock in Operation



3 years



5 years

Latest photographs of the Pemuteran, Bali Biorock project. 5 Yr taken in May 2012  
by EunJae Im

# Why Do We Need Biorock

- Achieving Steady State Consumption may require balancing of seasonal effects on habitat performance
- Canal water quality affects habitat performance
- Growth rate in habitat production enhanced
- Ability of habitat ecosystem to survive improved greatly
- Provide data for potential coral restoration projects

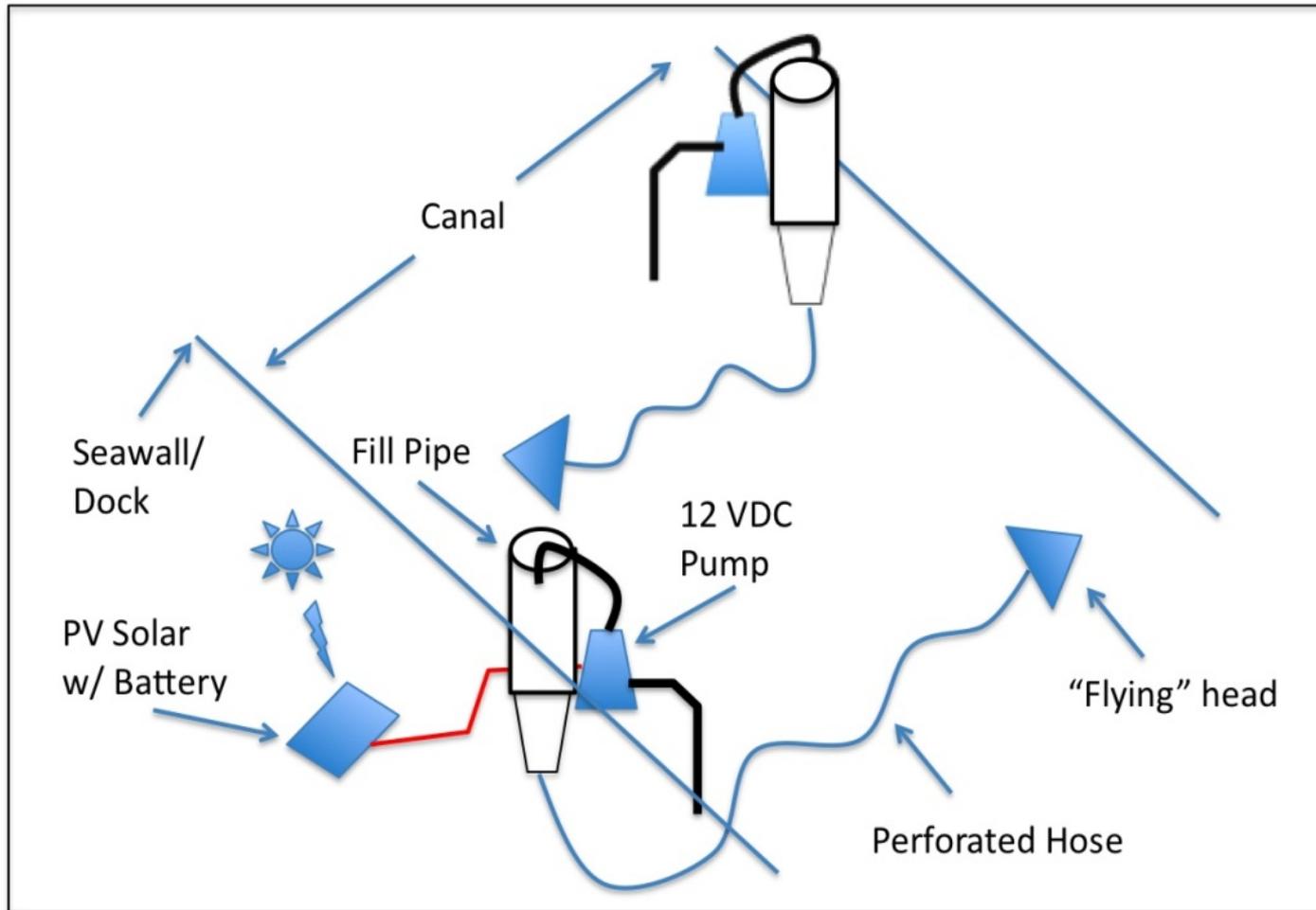
The Bottom Layer: Cleaning Sediment and Improving DO  
How does this all fit together?

## **SUPPLEMENTAL SYSTEMS**

# System Solutions Under Consideration

- Should sediment be disturbed?
  - Input from FDEP, FKNMS and Science Advisors
  - 2013 MC study: Cooper, Arsenic, etc.
- What is most effective way to disturb sediment?
- Most effective means to improve hypoxia?
  - Water turnover must affect stratified layers
- Integration of Biorock into habitat structure
- Power Supply Systems

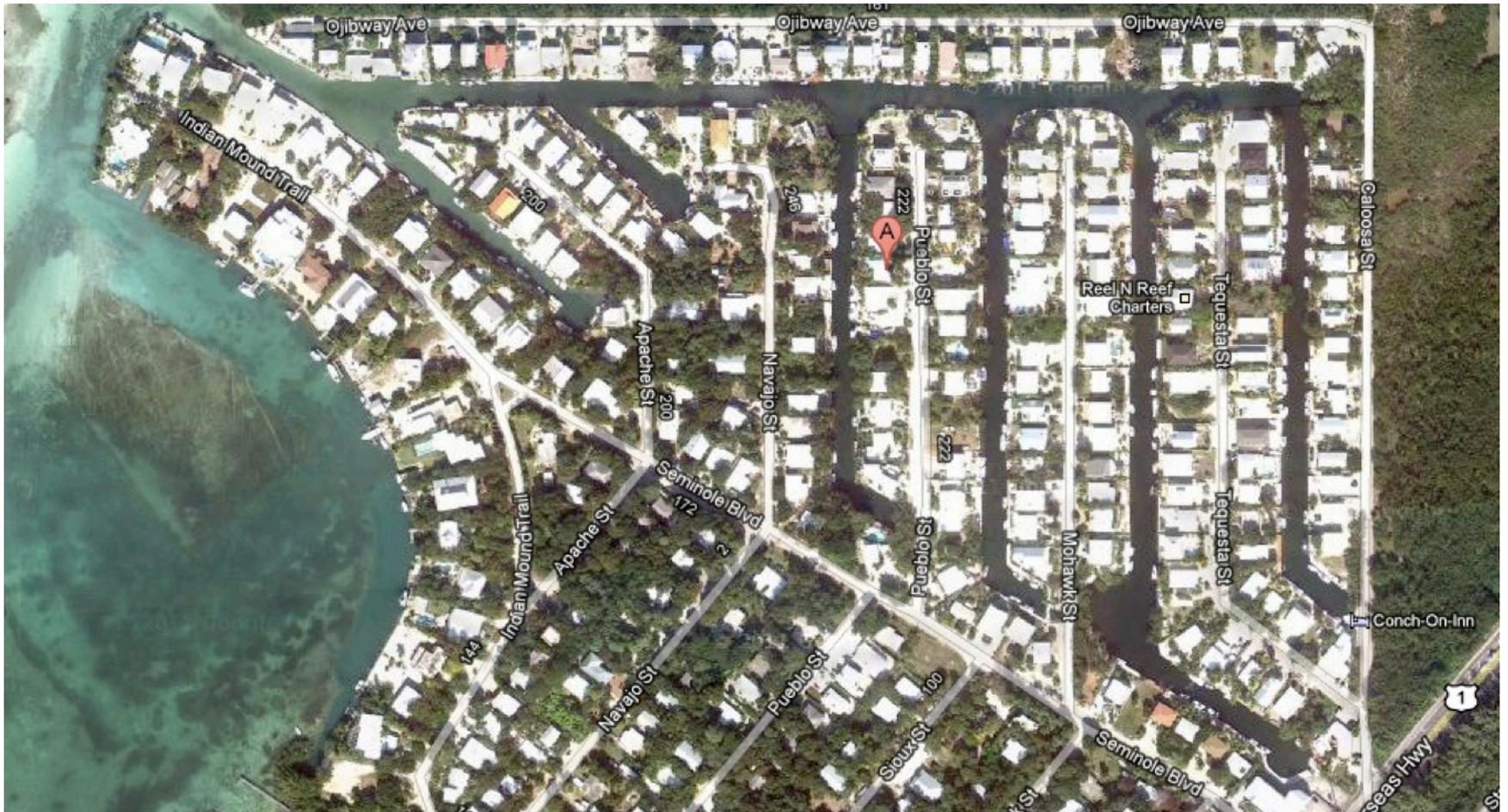
# Circulation: Consume Sediment & Injecting O2



Undisturbed Canal with Sewer Connection in Late 2013

# **THE INDIAN WATERWAYS PILOT PROJECT: FILTER FEEDER HABITATS W/ BIOROCK ASSIST**

# Indian Waterways, mm 89.2: Pilot Project Location



# Indian Waterways

- Aprox 245 lots 60' x 110' = 245 habitats
- 1.6 mile waterway = 34m gal
- 6 to 12 day turnover rate
- Most homes built in mid 1960's to early 90's
- Homeowners polled (aprox 30), 100% positive
- 6 "Sampler" units placed in canal Oct 2010
- 5 units remain with various results (See photos)
  - Habitats at low flow canal ends grow poorly
  - Middle of canal grows well
  - Near bay, boat traffic causes too much silt



# FF Habitat Program Highlights

- Indian Waterways target pilot – new budget expanded to entire neighborhood (Aprox. 245 lots)
- Reduce Nutrients, Clean Pathogens, Improve Fisheries
- 24 month program from production to final report
- Identify affectivity and establish scalable best practices
- Goal to enable Keys wide application with predictable cost, deployment time and performance
- Comprehensive Community Engagement:
  - Education: High Schools, Data Collection course at FKCC
  - Neighborhood Participation: Citizen Scientist
  - FKEC & NGOs, Monroe County, Islamorada, NOAA, FAU, FIU
  - Potential NSU, FKMNS, FL DEP, FWRI, EPA
- Pilot to Keys improved comprehensive WQM
- Pilot knowledge to Coral Restoration via Biorock techniques

# Performance & Practice Questions

- Habitat growth best practices
  - Filtration rates (gal/day) – Best turn-over rate for water (X days)?
  - Will Biorock enable habitats to be grown in place?
  - When do we need Biorock?
  - Is production to semi-mature in control facility best method?
  - Steady State: Habitat density reduction after initial filtration?
  - Can we consume the bottom sediment?
  - What power levels/current for optimum Biorock assist?
  - Various canal locations and canal types may drive methodology
  - Fisheries Improvement Estimates? Is seeding beneficial?
- Cost and production methods for high volume
  - Scale the program
  - Facilities and logistics
  - Durability of units

# Water Quality Monitoring (WQM)

- WQM lead by COAST (Dr. Brian Lapointe, FAU HBOI)
- NOAA Parallel & Additional WQ Analysis (C Sinigalliano)
- Test Parameters: Salinity, Turbidity, DO, Total Nitrogen, Phosphorus & Organic Carbon, Chlorophyll A & B, Fecal Coliform
- Algae Stable Isotope ID (FAU database)
- Fecal DNA Profiling, Pathogen Analysis (NOAA database)
- Pre-program baseline
- Monthly, Quarterly, Annual test reports
- 2 year program
- Lessons Learned => Continual MC WQM program

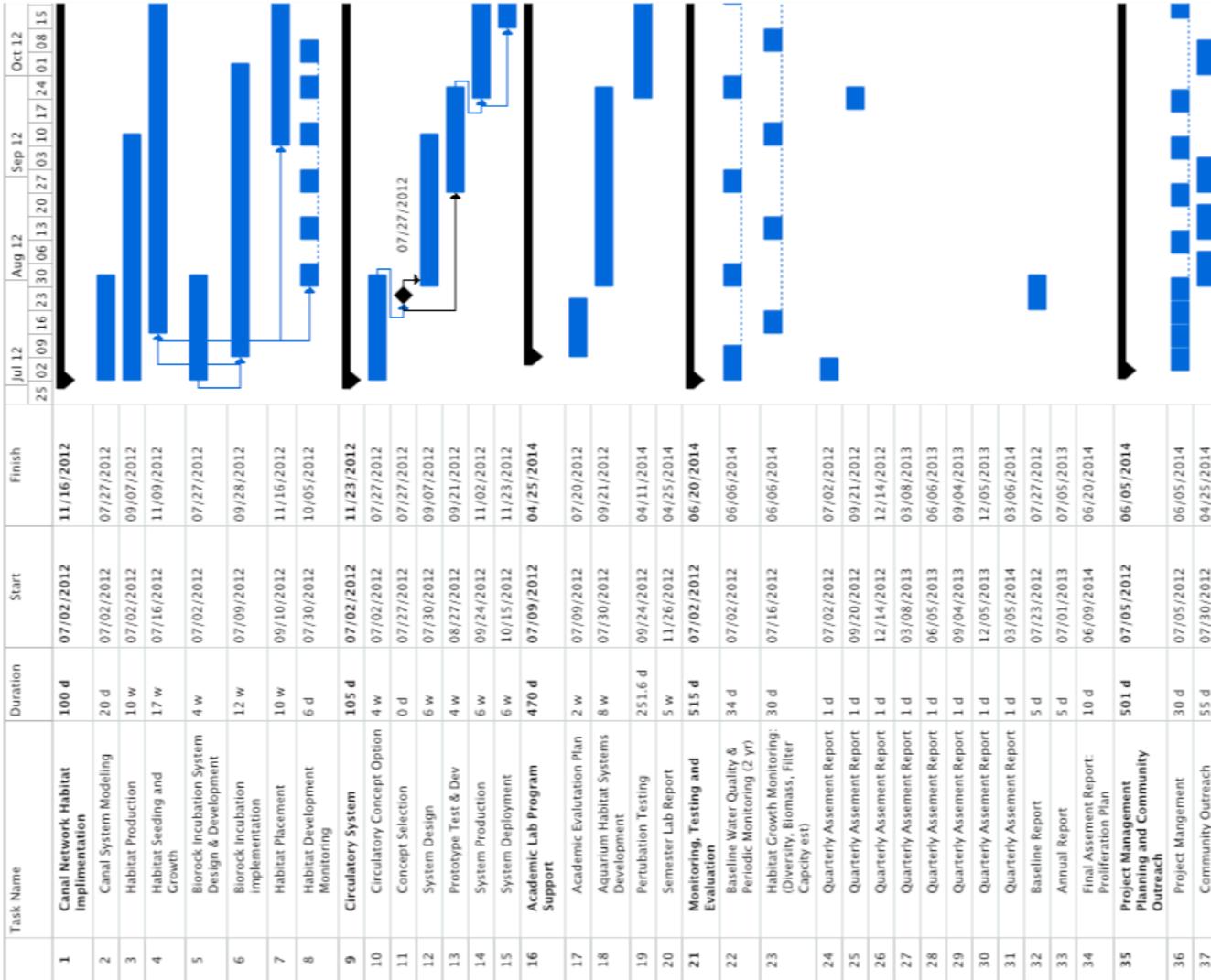
# Advisors & Technical Participants

- **Dr. Patrick Rice (Dean of Marine Sciences, FL Keys Community College)**
- **FKCC: Marine Science Data Collection Class**
- **Dr. John Dindo (Dauphin Island Sea Lab)**
- **Dr. Thomas Goreau (Global Coral Reef Alliance)**
- **Dr Brian Lapointe (FAU Harbor Branch Oceanographic Institute)**
- **Dr Craig Downs (The Global Coral Repository)**
- **Dorothy Leonard (Ocean Equities LLC, 20 yrs NOAA Oyster Prgm)**
- **Michael Calinski (Ocean Restoration Initiative)**
- **Dr Chris Sinigalliano (NOAA)**
- **B Wray: CTO Solarbeam International**
- **...and growing!**

# Program Participants (Committed)

- FKEC: Program Mgmt (Sr Mgr: B Wray, PM: H Williams)
- FKCC:
  - Technical Program Management (Dr. Patrick Rice)
  - Data Collection Program (Marine Sci Class)
- COAST: WQM, Analysis & Reports (Dr. Brian Lapointe)
- NOAA (Microbiology): WQ Analysis & Reports (C Sinigalliano, Microbiology)
- Aqua Ranch: Habitat Growth/ Production
- Solarbeam International: Systems Engineering
- EcoWorld Energy: Program Communication & Possible Engineering Support
- Atlantic Virtual: IT, Website & Communications Support
- Reef Relief: Program Management, County Outreach & Accounting
- Ocean Restoration Initiative: Habitat Advisory & Mfgr support
- Monroe County and Village of Islamorada
- Monroe Cty High Schools: WQ Data Collection
- TNC, GLEE, Mote, TDC (Tech Support, Peer Review, Funding)
- FDEP (Equip, Advisory, Outreach), NSF (NOAA Support), FIU (NOAA Test Support), FKNMS (Permitting, Advisory), FWC/FWRI (Advisory, Fisheries Est)
- Manufacturing: Local Contracting/ Carpentry Cos, Interns, Students, ORCA Mgmt

# Sample Project Schedule



# Sample Project Schedule (Cont)

