PART 4. The Future – Lessons Applied

Roy R. "Robin" Lewis III, MA, PWS

Laura L. Flynn and Benjamin M. Brown

Coastal Resources Group, Inc. [501(c)(3)]

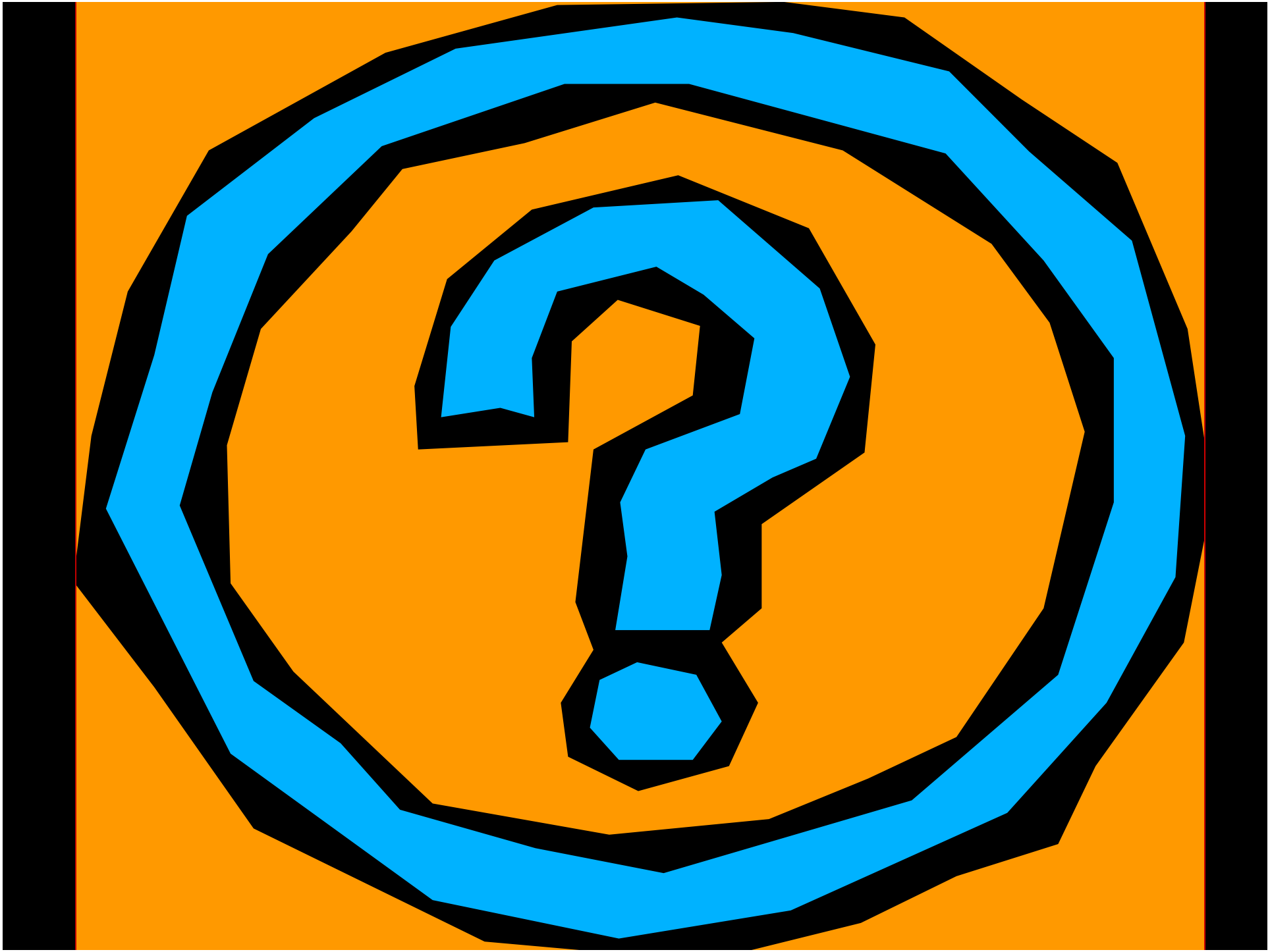
Salt Springs, Florida, USA

BLUE FORESTS

Oxfam

Canadian International Development Agency

JULY 19, 2016



ALTERNATIVE APPROACHES TO MANGROVE RESTORATION/REHABILITATION

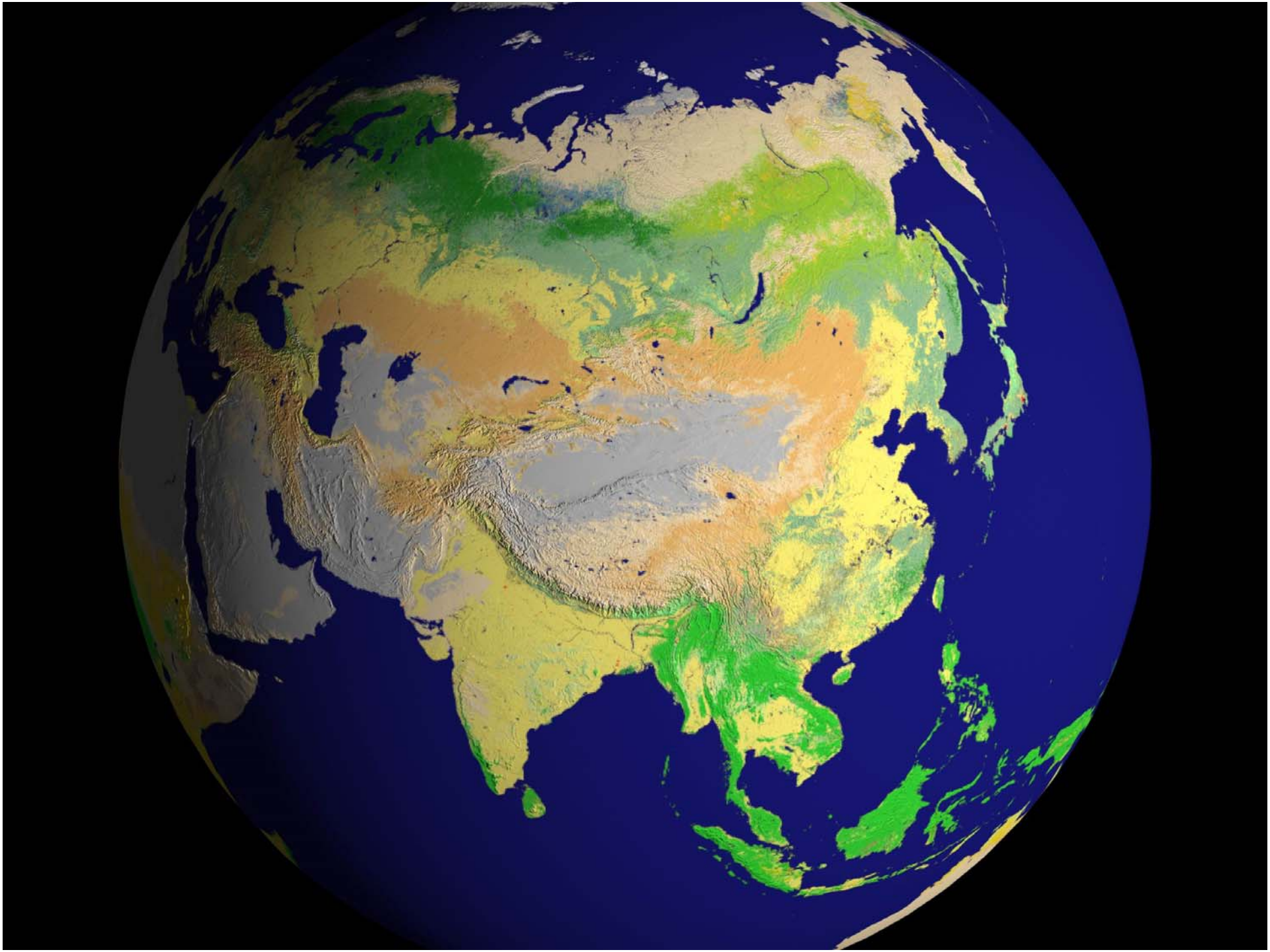
Ecological Mangrove R/R (EMR) versus Planting Only (Brown and Lewis 2006, Brown et al. 2014, Lewis 2000, 2005, 2009, Lewis and Brown 2014)

1. Understand Autecology and Community Ecology
2. Understand Normal Hydrology of Mangroves
3. Assess Modifications to Hydrology or Added Stress?
4. Select the Restoration Site
5. Restore or Create Normal Hydrology, or Remove or Reduce Stress
6. Plant Mangroves Only As Needed

SUCCESS !

1. Build a Nursery, Grow Mangrove Seedlings and Plant Mangroves (GARDENING)

FAILURE#!!***

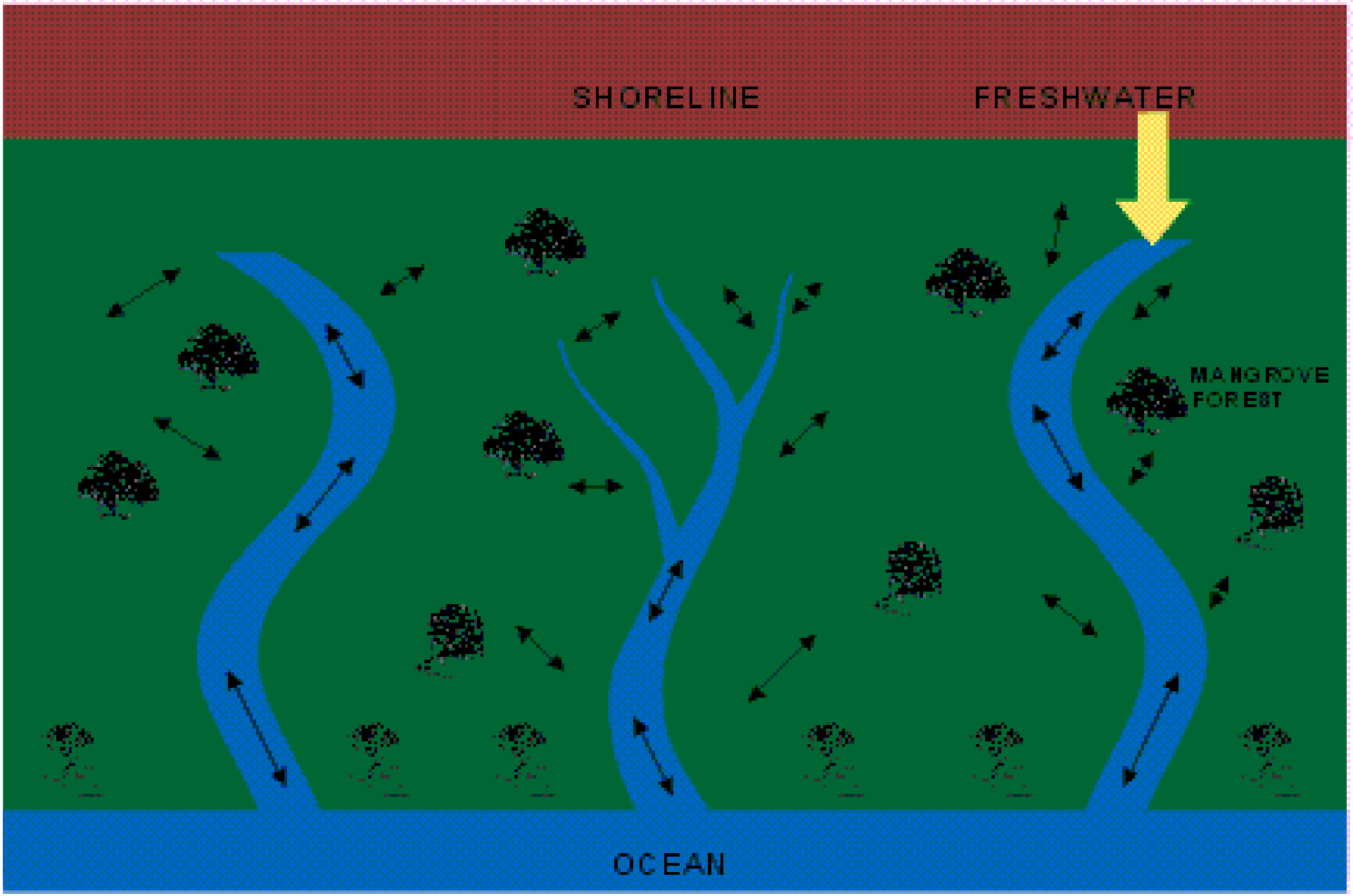


40 Species of Mangroves are common in the Mangrove Forests of Thailand and Indonesia

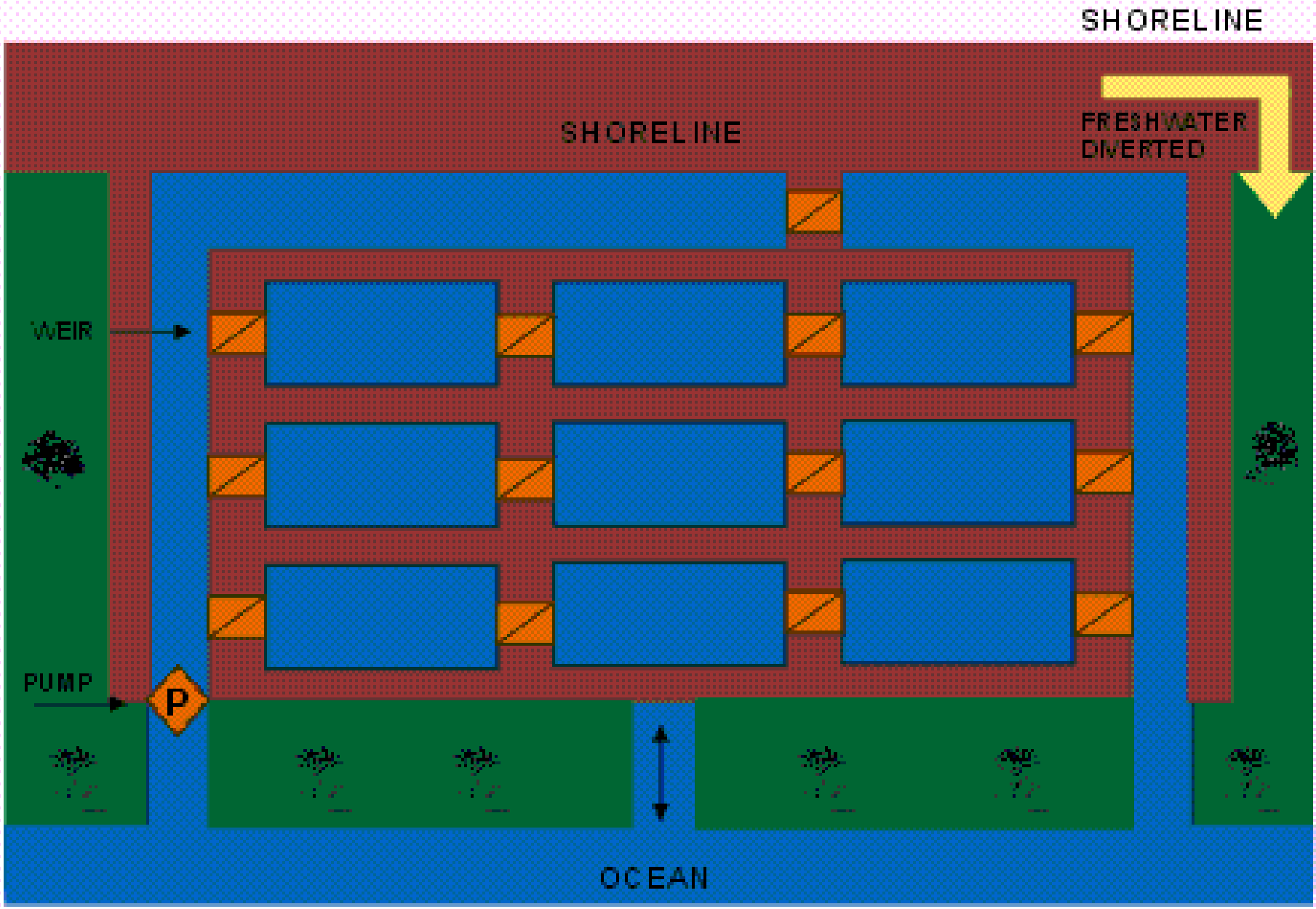
Area Measurements

- 13.7 million ha of mangroves worldwide (2000)
- Approximately a 50% loss from historic coverage (37 million ha)(WRI 1996)
- Continued ~1% loss per year (150,000 ha/yr)
- 1,372,800 ha of active shrimp aquaculture ponds (1996) = 7.6% of the historic loss if all are in former mangroves
- Abandoned (disused) ponds = ?
- **Lewis best estimate = 400,000 – 600,000 ha in 2016**

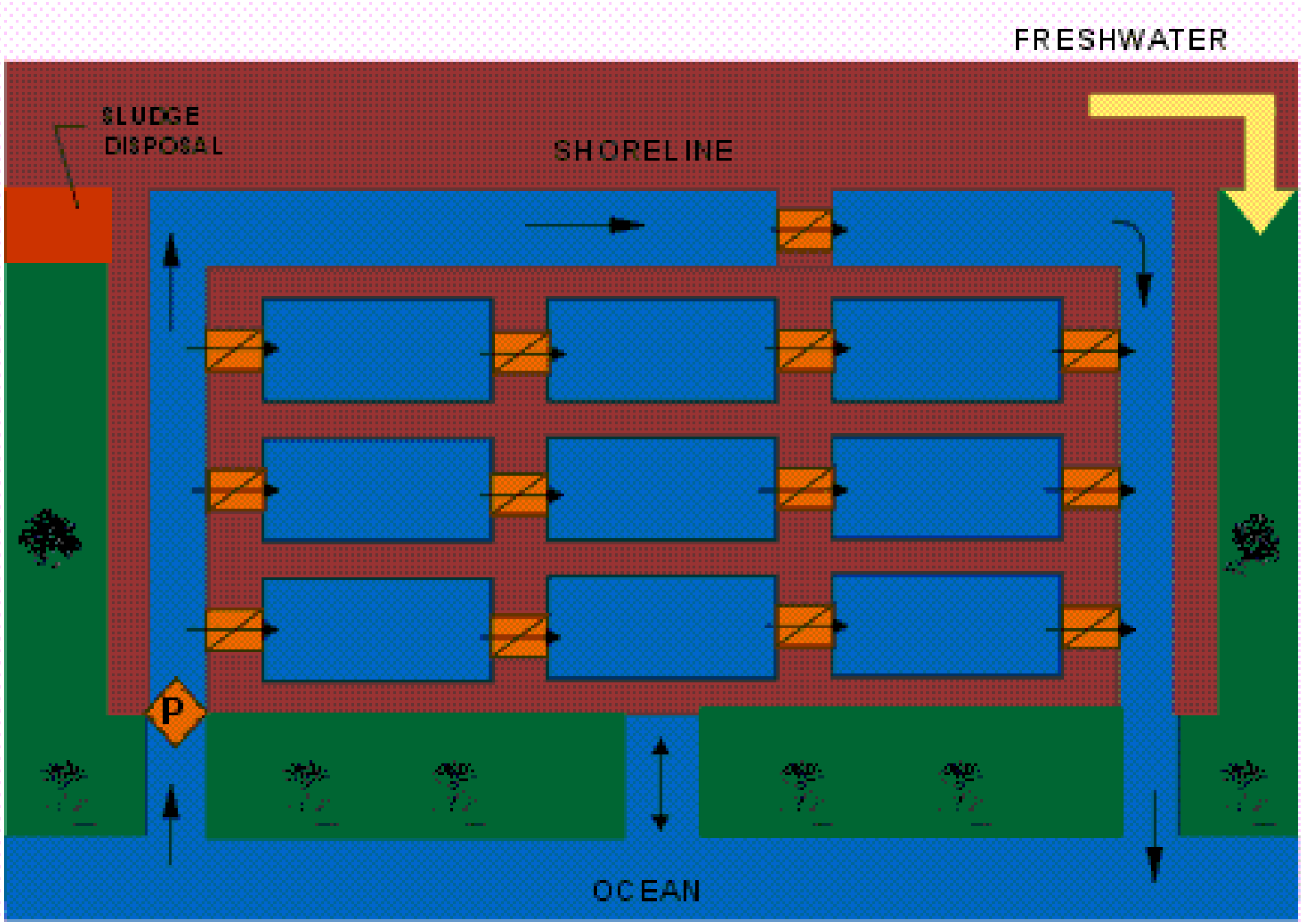
Site 8



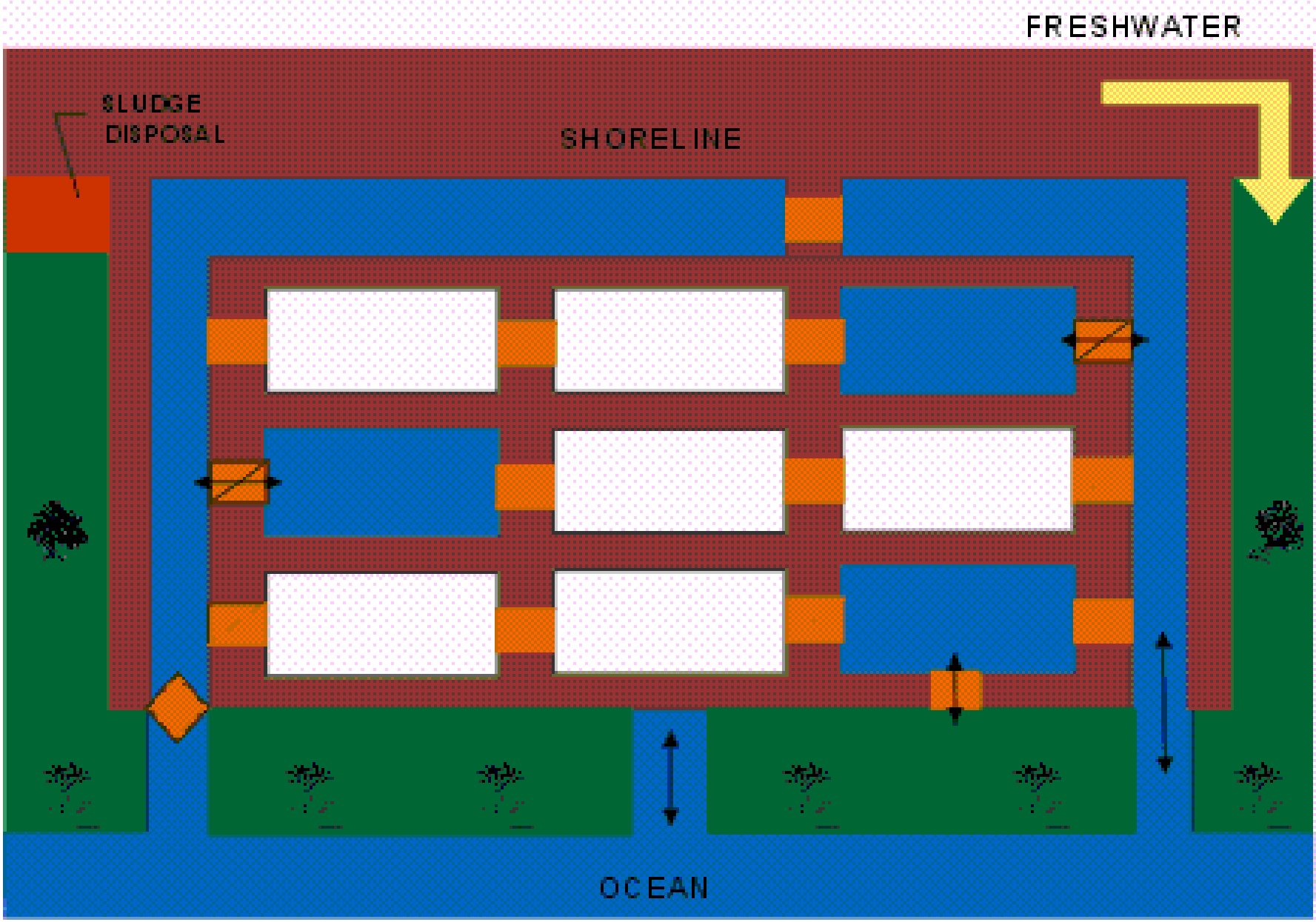
1. NATURAL CONDITIONS



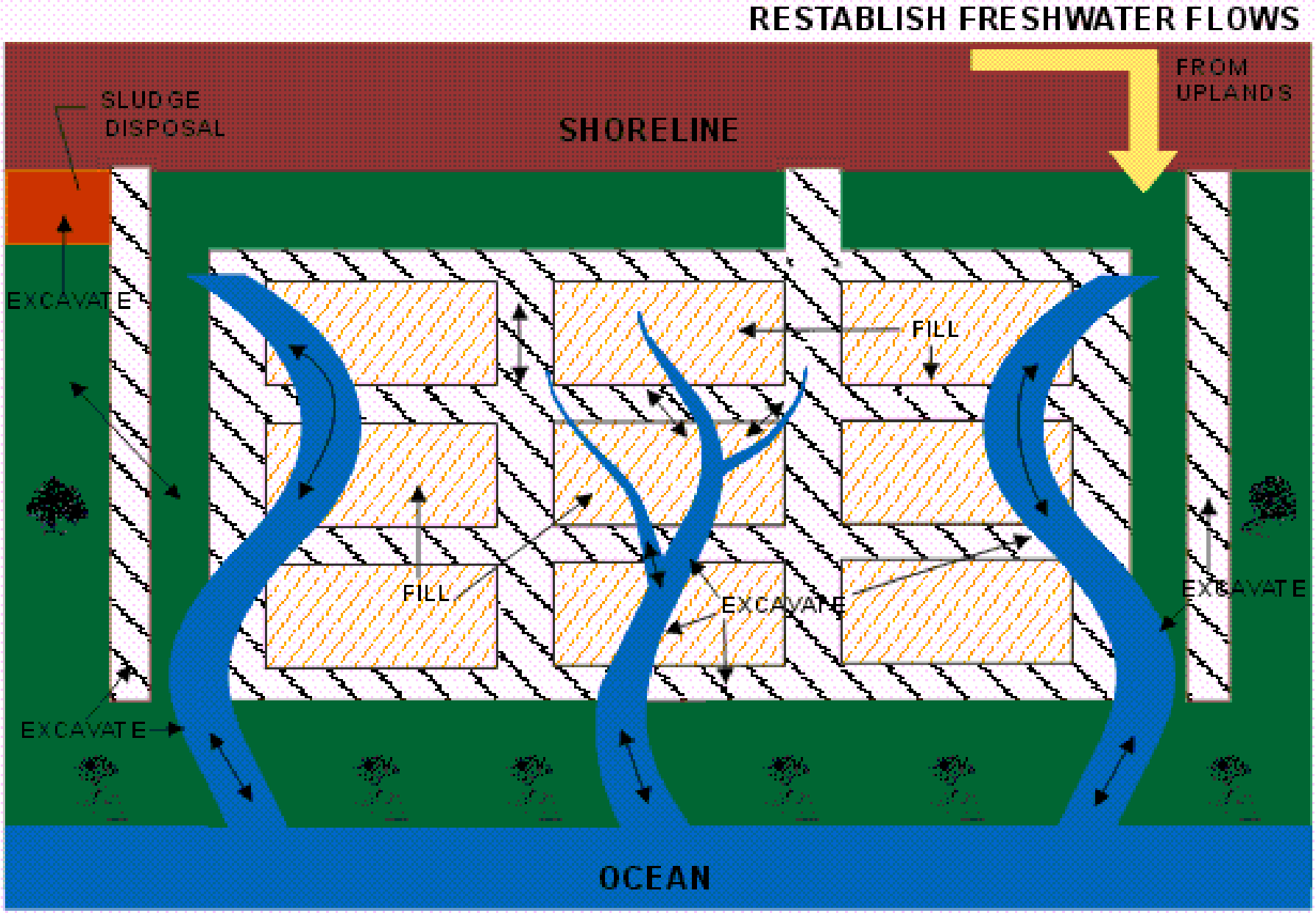
2. POND CONSTRUCTION



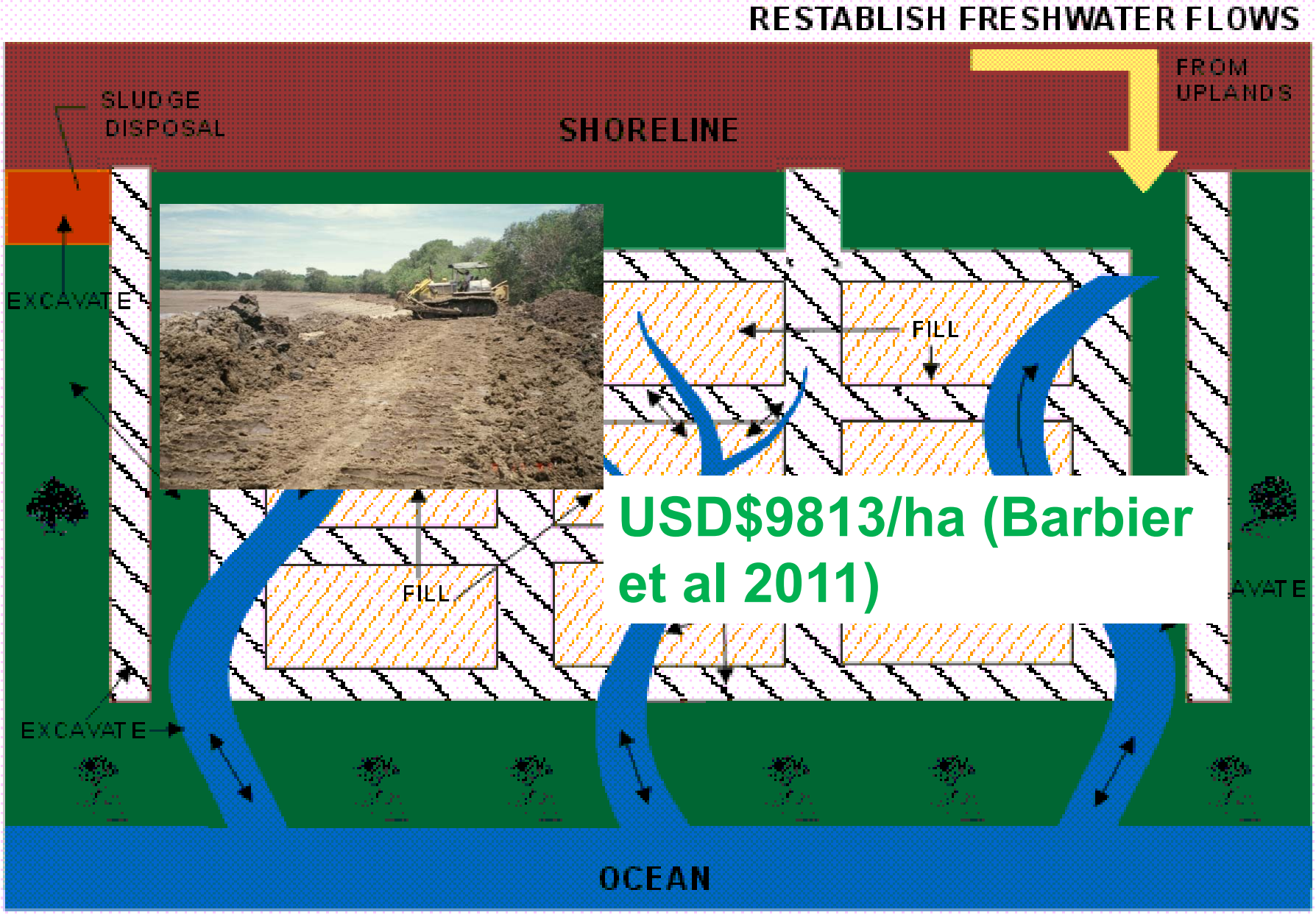
3. POND OPERATION



4. POND ABANDONED

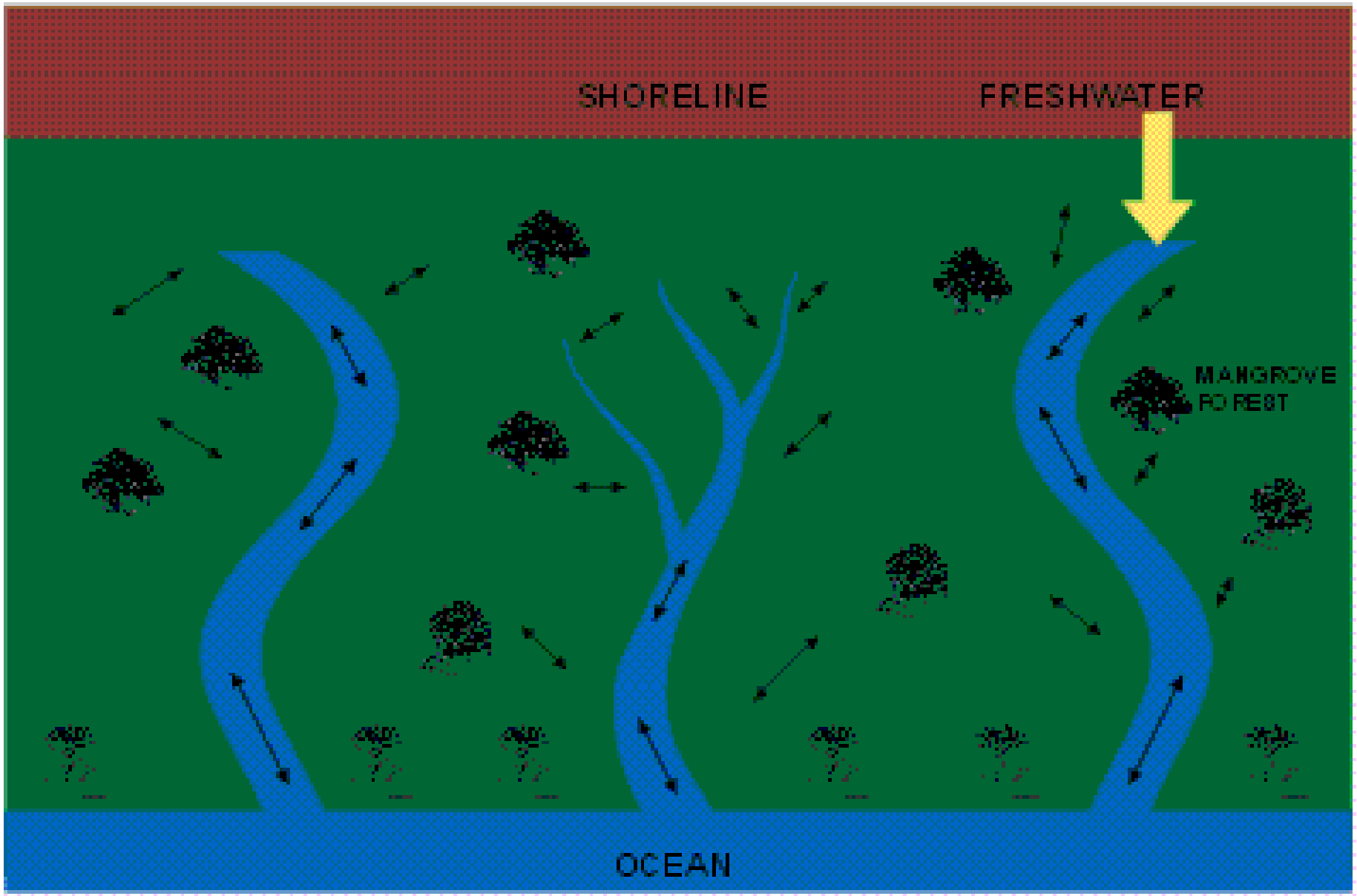


5. OPTION #1: FULL RESTORATION

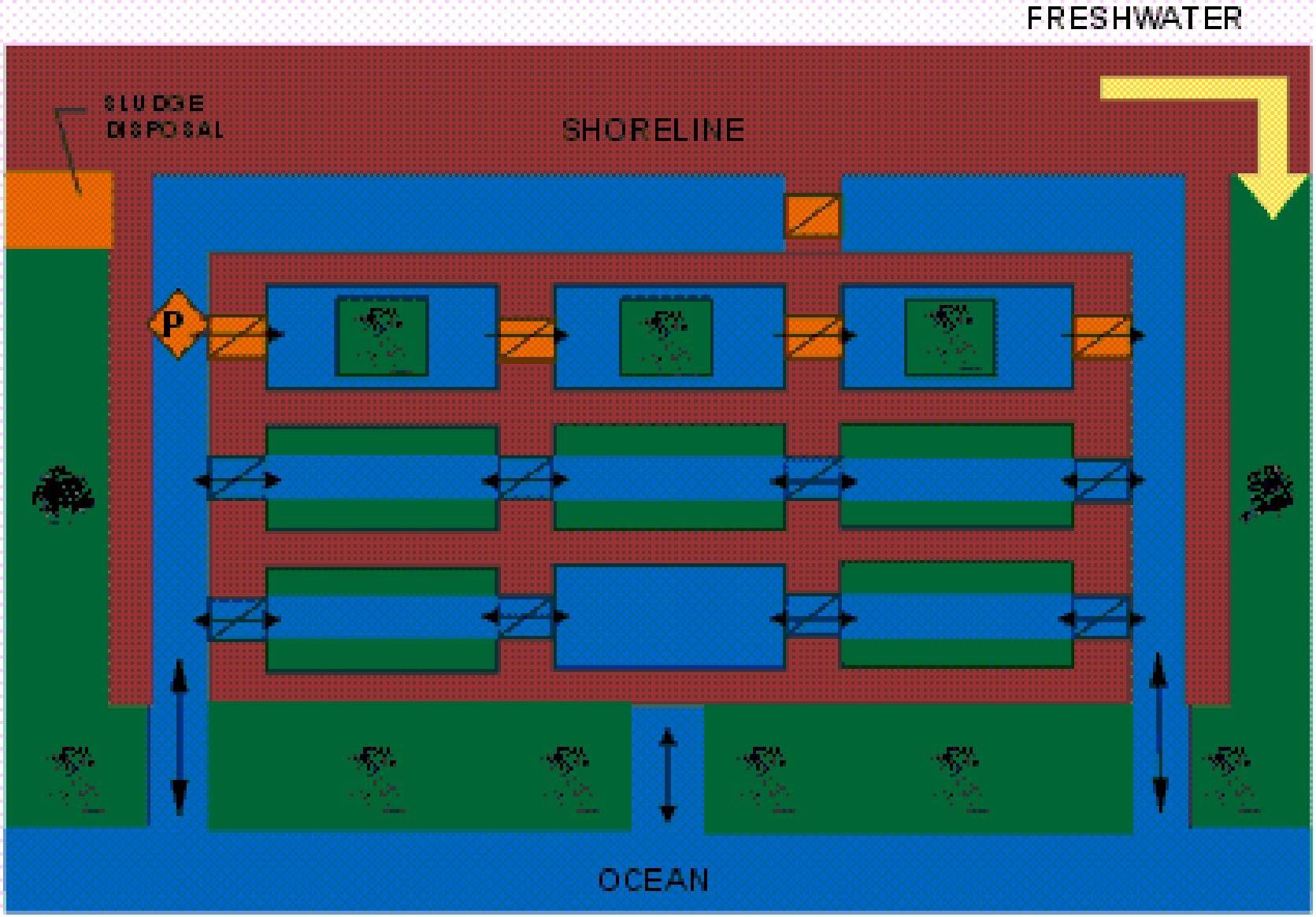


5. OPTION #1: FULL RESTORATION

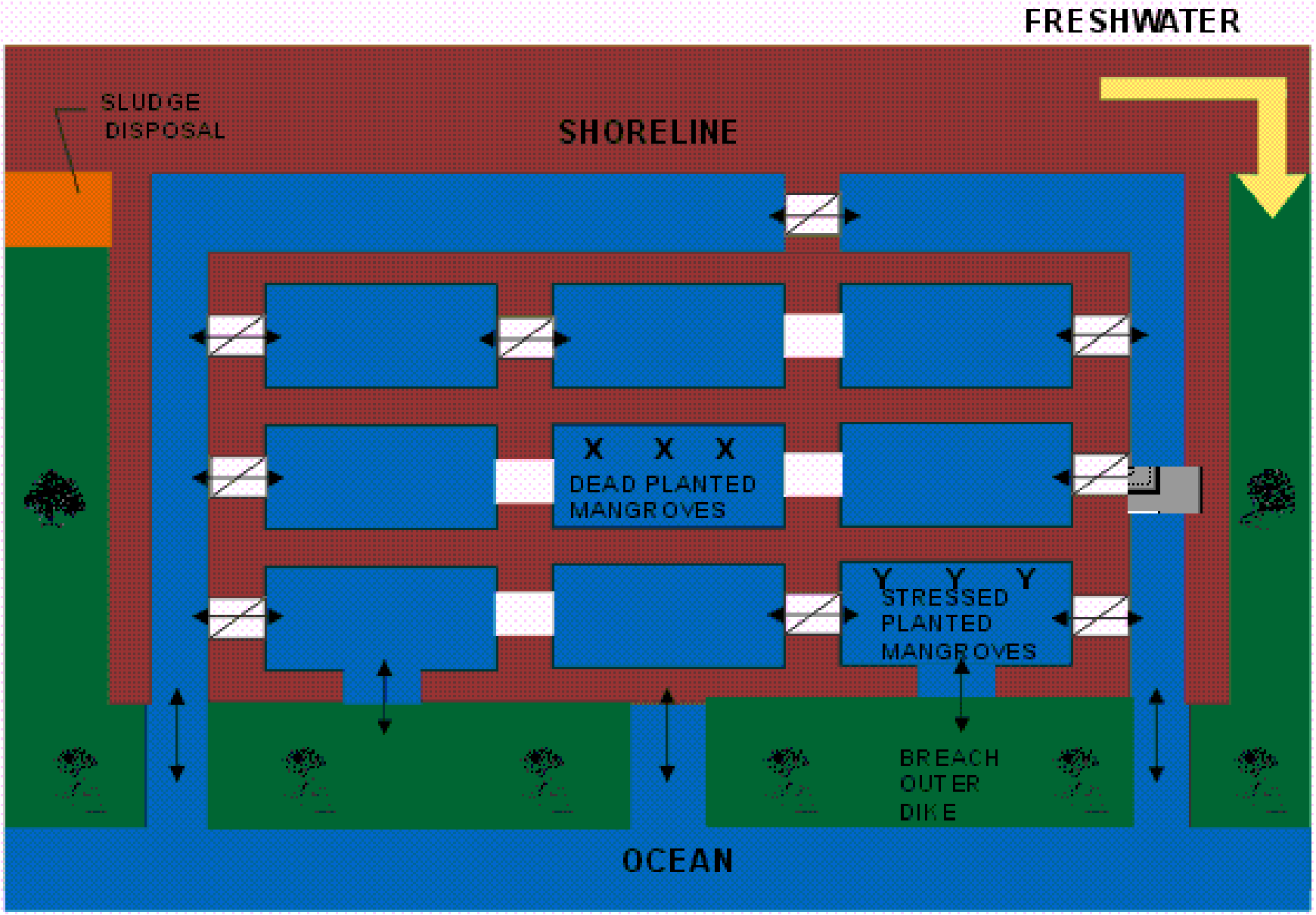

Elevation "A"
Elevation "B"
Proposed Final Constructed Grade
30/05/2011



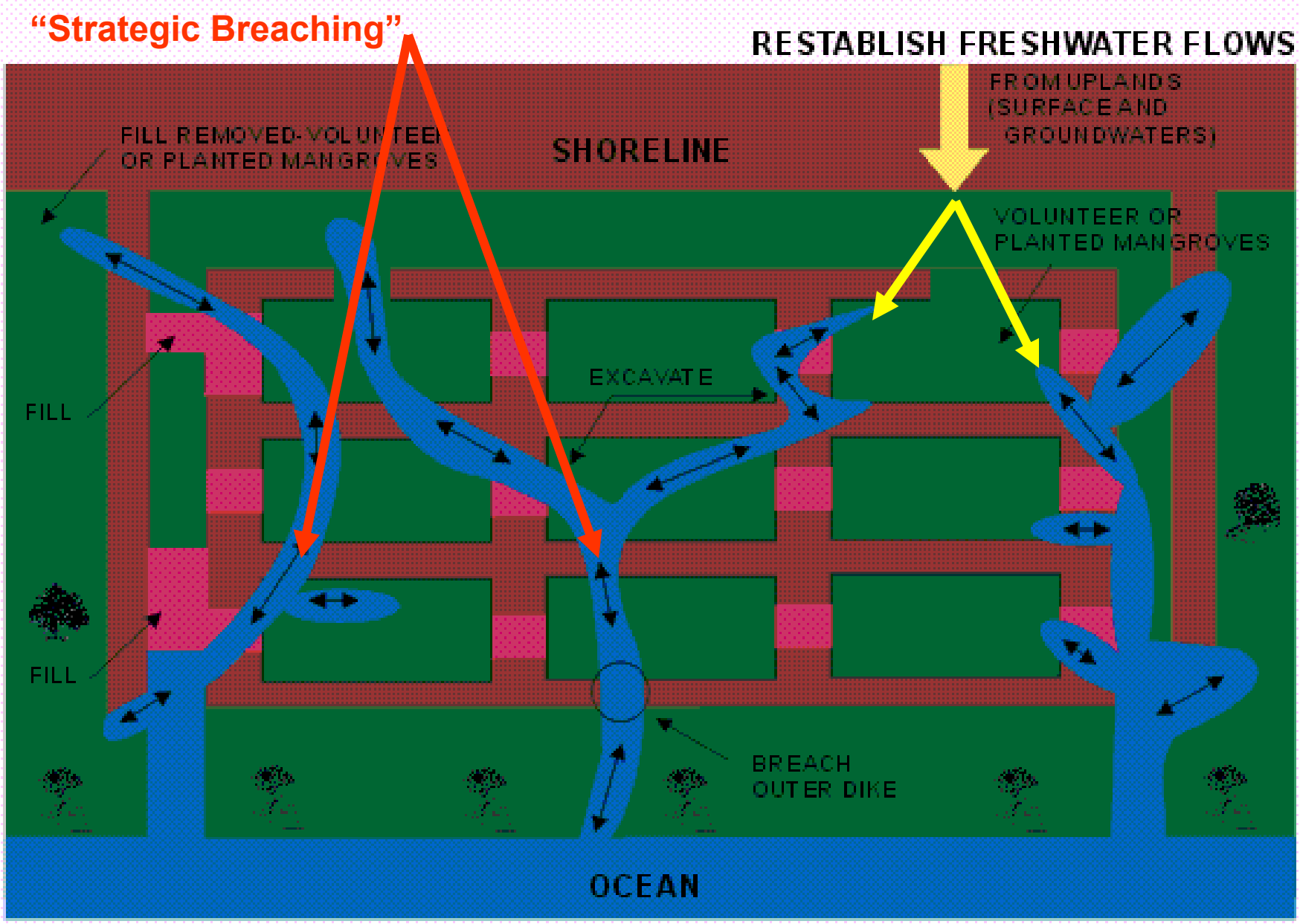
6. OPTION #1: FULLY RESTORED



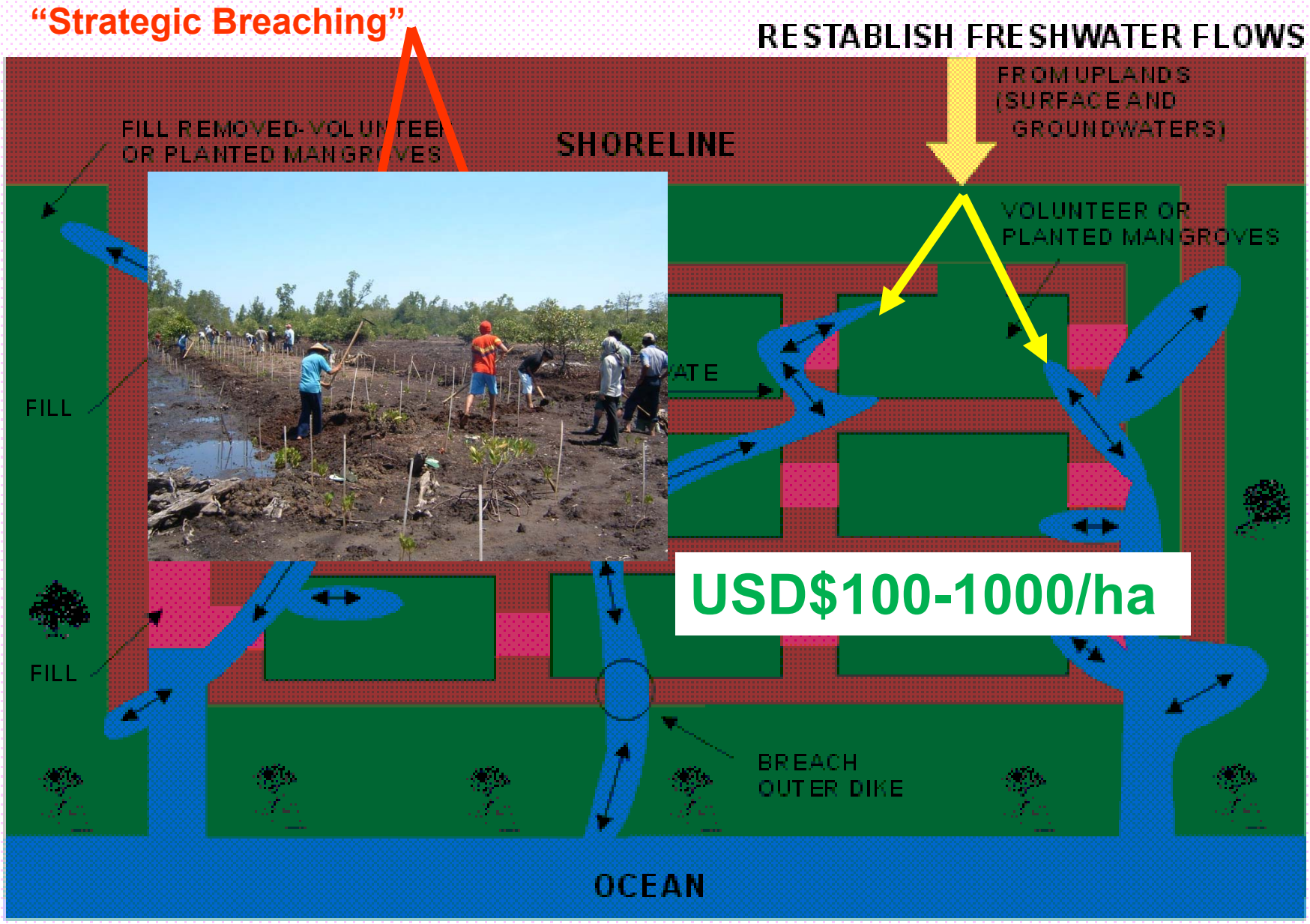
7. OPTION #2: REHABILITATION INCLUDING AQUASILVACULTURE



8. OPTION #3: PARTIAL RESTORATION WITHOUT HYDROLOGIC CONSIDERATIONS



9. OPTION #4: PARTIAL RESTORATION WITH HYDROLOGIC CONSIDERATION



9. OPTION #4: PARTIAL RESTORATION WITH HYDROLOGIC CONSIDERATION

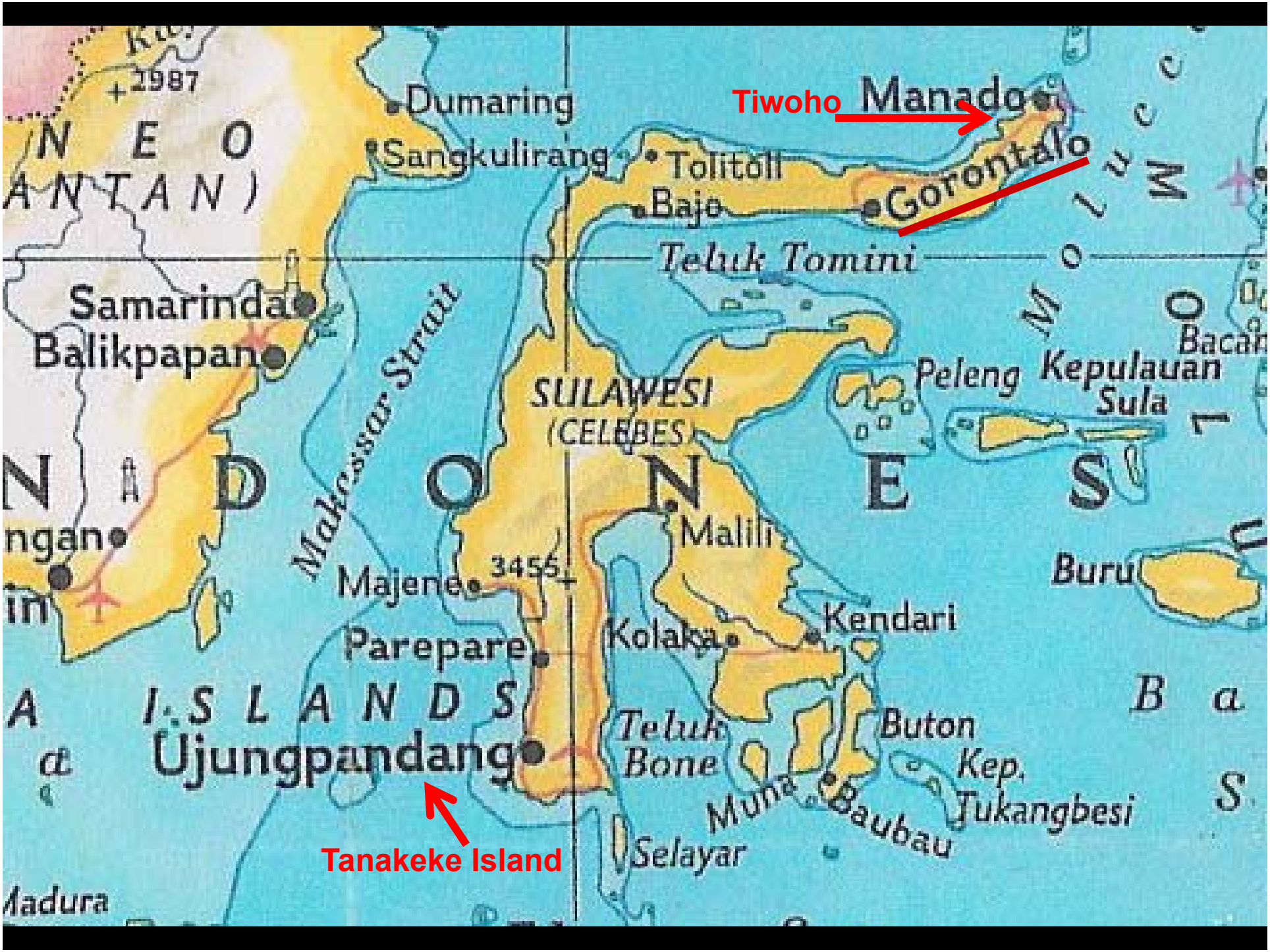
Site 8

Site 7

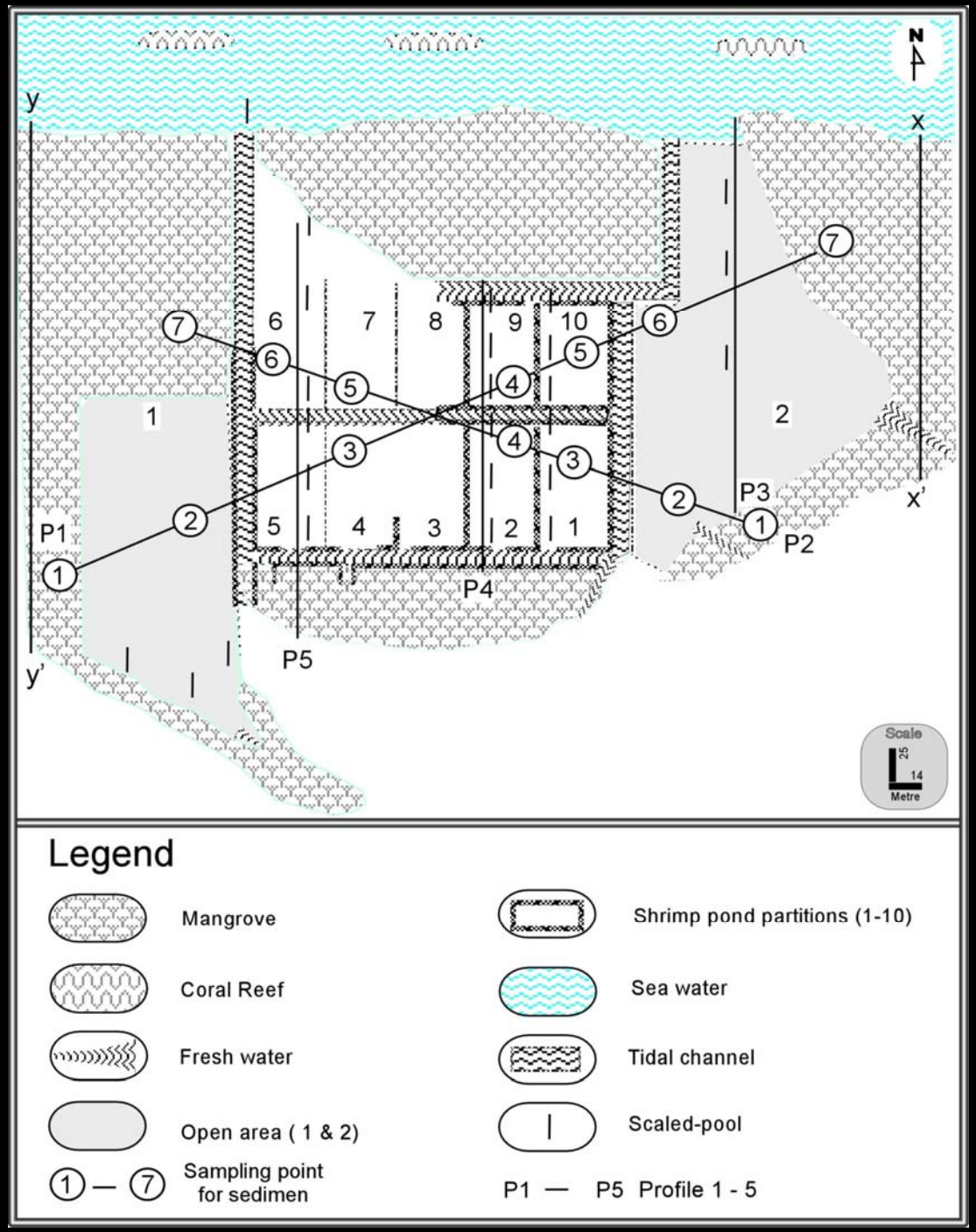
VERY IMPORTANT: Breaches are NOT placed randomly. They are STRATEGICALLY placed, and while larger rather than smaller, MORE are not BETTER. Why is that important?

Site 7


PHILIPPINES
MANILA
PALAU
BANGKOK
CAMBODIA
Phnom Penh
HO CHI MINH CITY
Gulf of Thailand
SOUTH CHINA SEA
MALAYSIA
Kuala Lumpur
SINGAPORE
BRUNEI
SABAH
SARAWAK
BORNEO (KALIMANTAN)
SUMATRA
Medan
Padang
Palembang
INDONESIA
SULAWESI (CELEBES)
Teluk Tomini
Makassar Strait
Ujungpandang
Kendari
Manado
Celebes Sea
Sulu Sea
MINDANAO
Davao
Zamboanga
Cebu
Halmahera
Ambon
Banda Sea
Flores Sea
Java Sea
GREATER SUNDA ISLANDS
LESSER SUNDA ISLANDS
JAKARTA
BANDUNG
SURABAYA
Denpasar
Kupang
Timor Sea
Arafura Sea
Darwin
ARNHEM LAND
Gulf of Carpentaria
Jayapura
Christmas I.
Cocos (Keeling) Islands
INDIAN OCEAN
The scattered islands and reefs commonly called the Spratly Islands are claimed by China, Vietnam, Malaysia, and the Philippines.


Tiwoho
Manado
Gorontalo
Dumaring
Sangkulirang
Tolitoli
Bajo
Teluk Tomini
Samarinda
Balikpapan
Makassar Strait
SULAWESI
(CELEBES)
Peleng
Kepulauan
Sula
Malili
Majene
3455
Parepare
Kolaka
Kendari
Buru
Ujungpandang
Teluk
Bone
Buton
Kep.
Tukangbesi
Muna
Baubau
Selayar
Tanakeke Island
Madura


I. SEKARANG
MATRIKS RENCANA REHAB
II (DALAM PROSES)
TAHAPAN KEGIATAN
FAKTOR RESIKO
FAKTOR PENDUKUNG
UNSUR TERKAIT
DURASI
Support Program

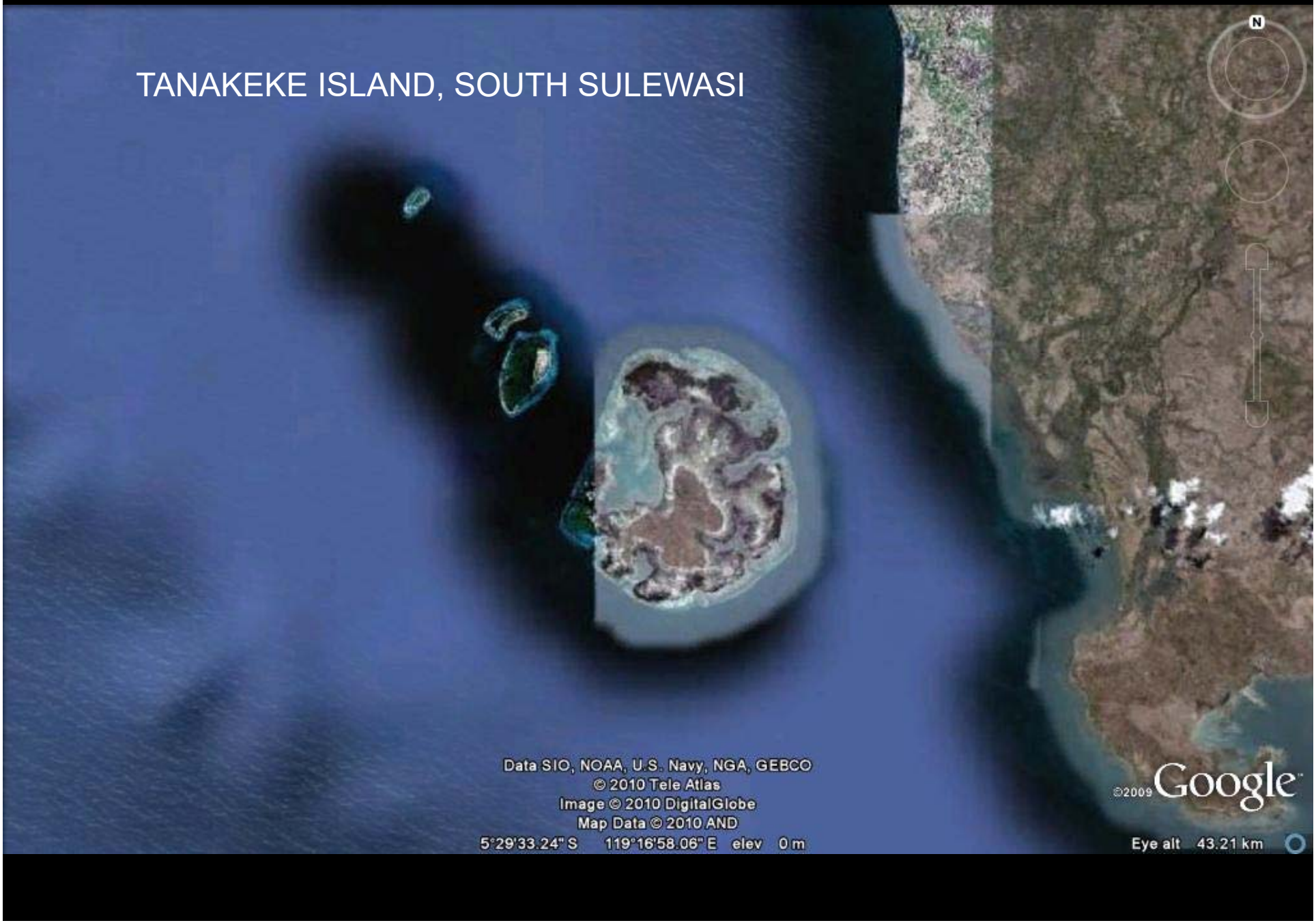

N
y
y'
x
x'
P1
P2
P3
P4
P5
1
2
5
4
3
2
1
6
7
8
9
10
Scale
25
14
Metre
Legend
Mangrove
Coral Reef
Fresh water
Open area (1 & 2)
① — ⑦ Sampling point for sedimen
Shrimp pond partitions (1-10)
Sea water
Tidal channel
Scaled-pool
P1 — P5 Profile 1 - 5

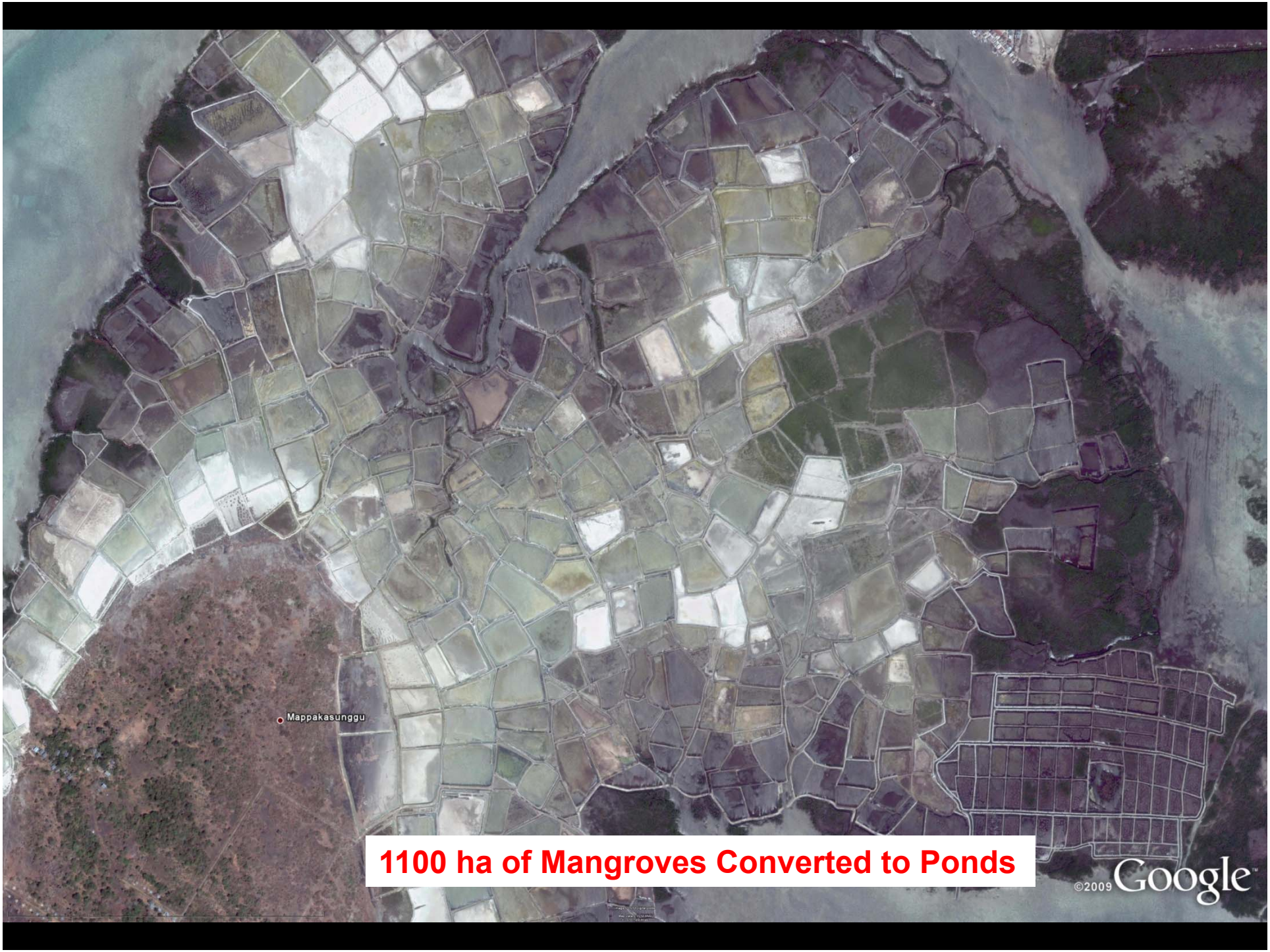
Local Community Breaching Dike Walls of Abandoned Shrimp Aquaculture Pond, North Sulawesi, Indonesia

Restored Abandoned Shrimp Aquaculture Pond, Tiwoho, North Sulawesi, Indonesia, 2005, One Year After Restoration,

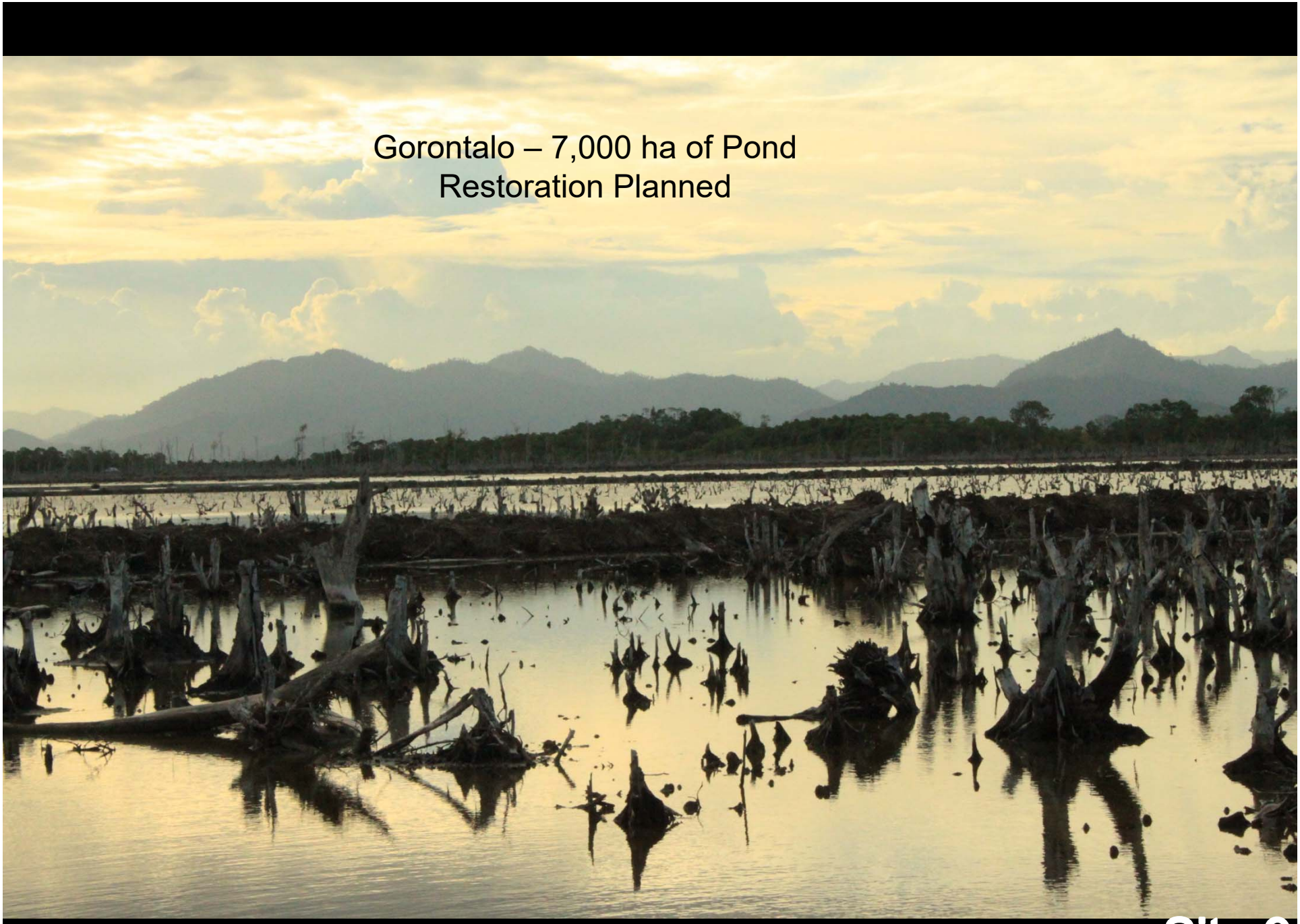
Restored Abandoned Shrimp Aquaculture Pond, Tiwoho, North Sulawesi, Indonesia, 2010, Six Years After Restoration,

TANAKEKE ISLAND, SOUTH SULEWASI




Mappakasunggu
1100 ha of Mangroves Converted to Ponds
©2009 Google

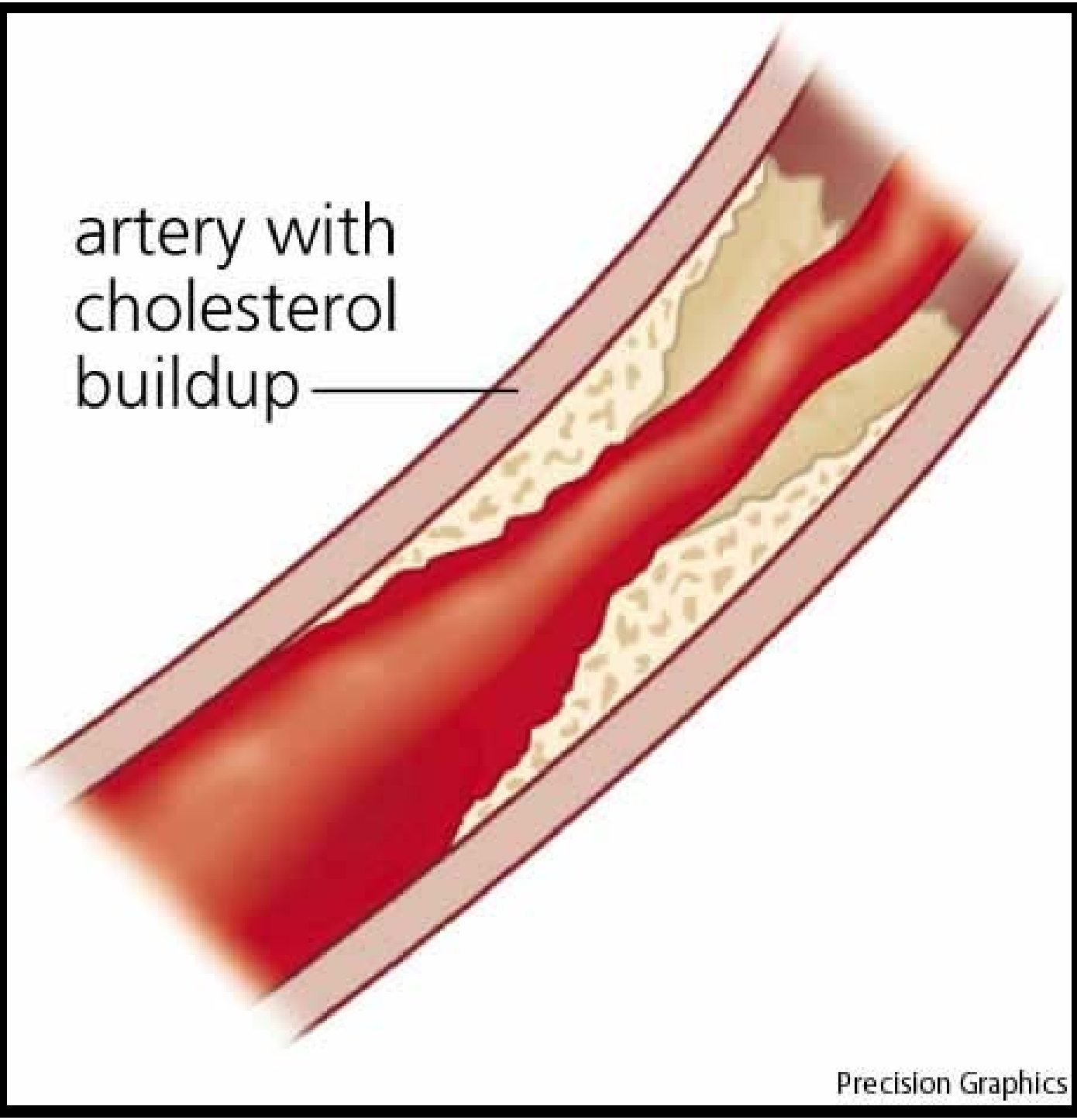

Community Based Ecological Mangrove R/R (CBEMR)
Tanakeke Island, Sulawesi, Indonesia (Brown et al 2014,
download # 85)



Tanjung Panjang

Site 9

10 AUG 94


artery with
cholesterol
buildup
Precision Graphics

National
Estuarine
Research
Reserve

Rookery Bay

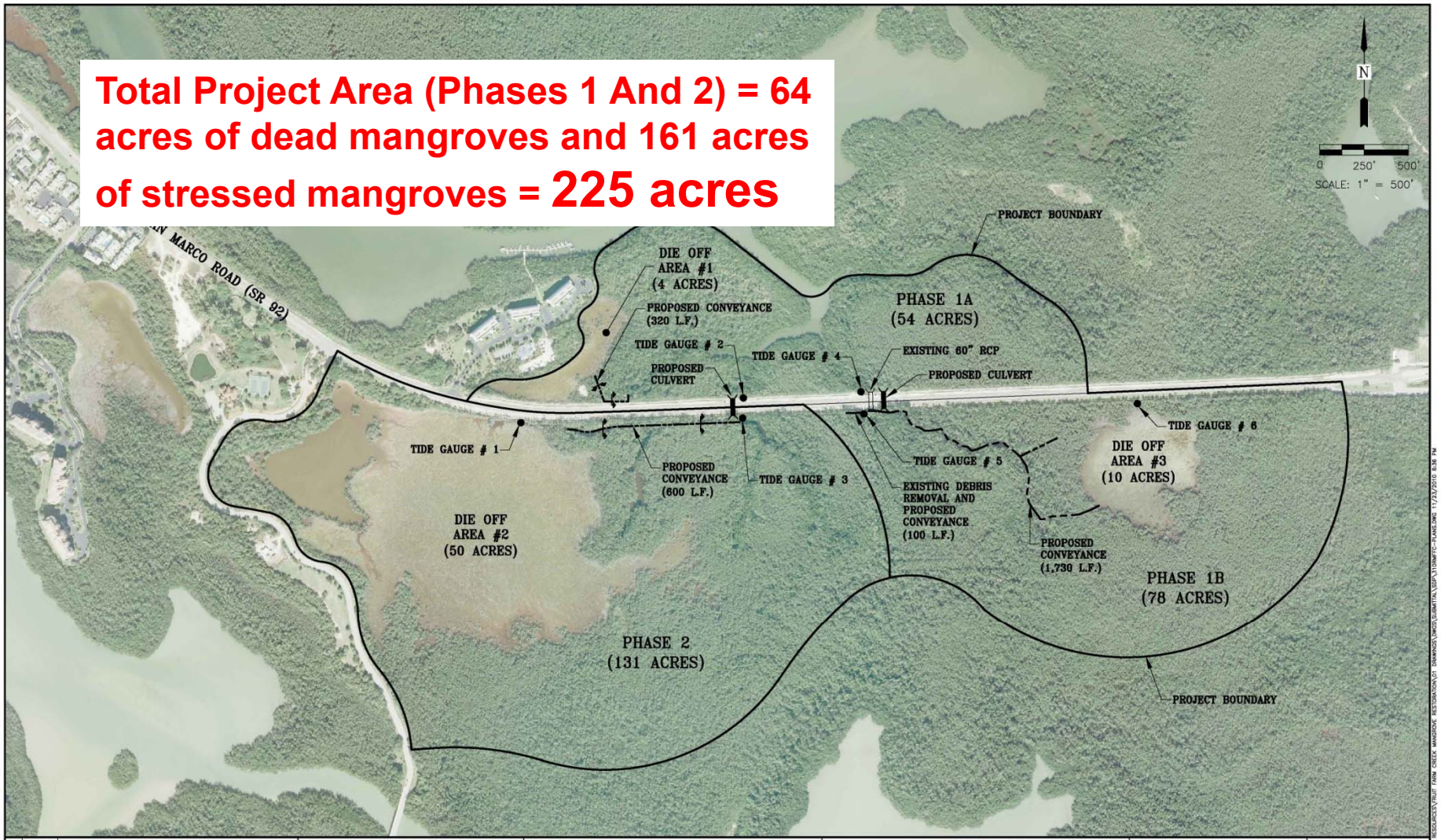
FRUIT FARM CREEK, COLLIER COUNTY, FLORIDA

May 28, 2012

Rookery Bay Fruit Farm Creek Proposed Restoration Site – January 21, 2011

Rookery Bay Fruit Farm Creek Proposed Restoration Site – January 21, 2011

Total Project Area (Phases 1 And 2) = 64 acres of dead mangroves and 161 acres of stressed mangroves = 225 acres



#	DATE	PLAN REVISIONS

PROPERTY OWNER
ROOKERY BAY NATIONAL ESTUARINE RESEARCH RESERVE
300 TOWER ROAD, NAPLES, FLORIDA 34113
PHONE: 239-417-6300
FAX: 239-417-6315

RESTORATION OF MANGROVES AT FRUIT FARM CREEK

AERIAL/CONCEPT PLAN - PHASES 1 & 2

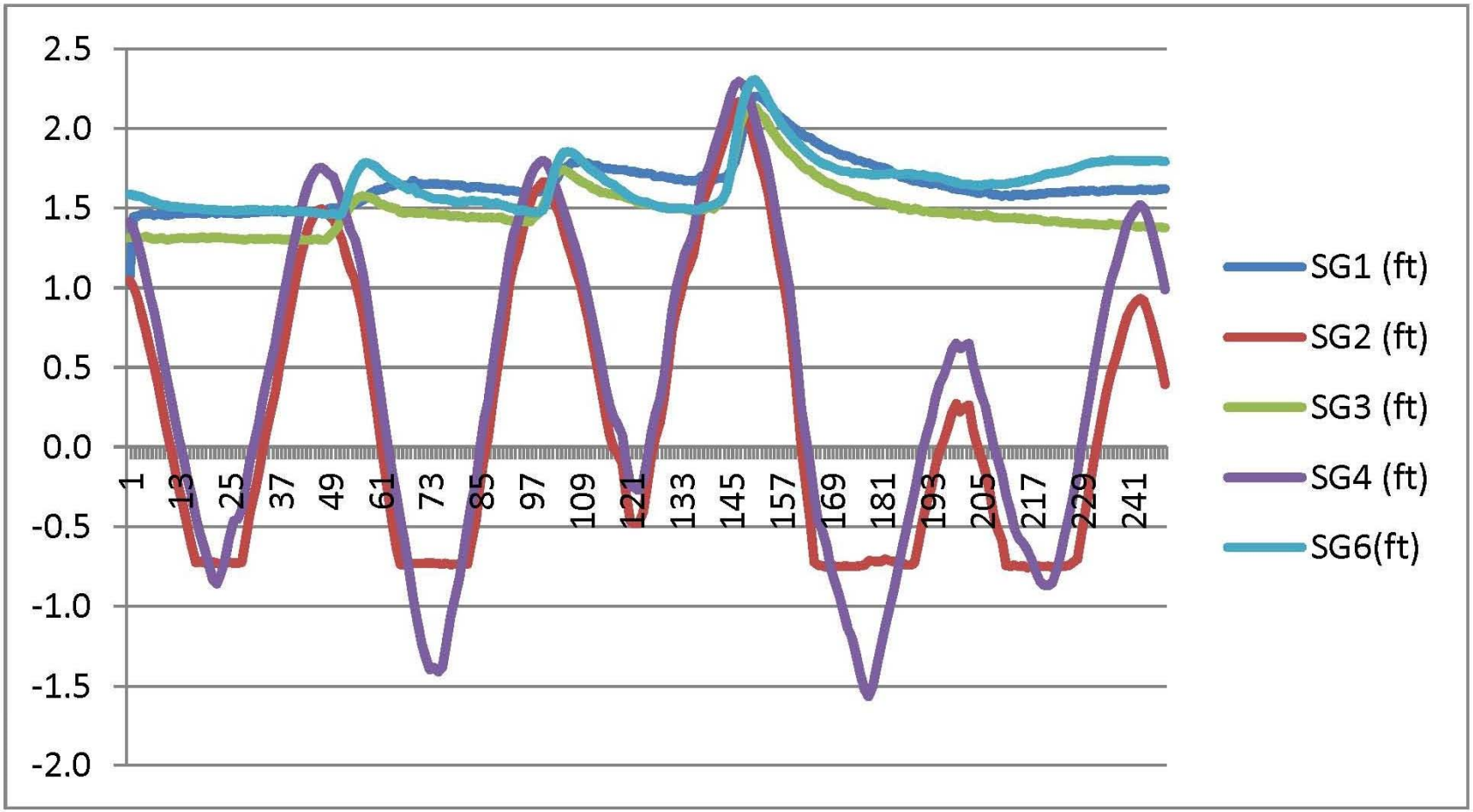
J.R. EVANS ENGINEERING, P.A.
8891 BRIGHTON LANE, SUITE 115
BONITA SPRINGS, FLORIDA 34135
PHONE: (239) 390-1922
FAX: (239) 390-1932
JOSH@JREVANSENGINEERING.COM

PROJECT #:	3-10RMFFC
FILE DATE:	11 / 2010
DESIGN BY:	JRE
DRAWN BY:	JRE
SEC. 10, 11, 13, 14 & 15, TWP. 52S, R 26E	
SCALE:	1" = 500'

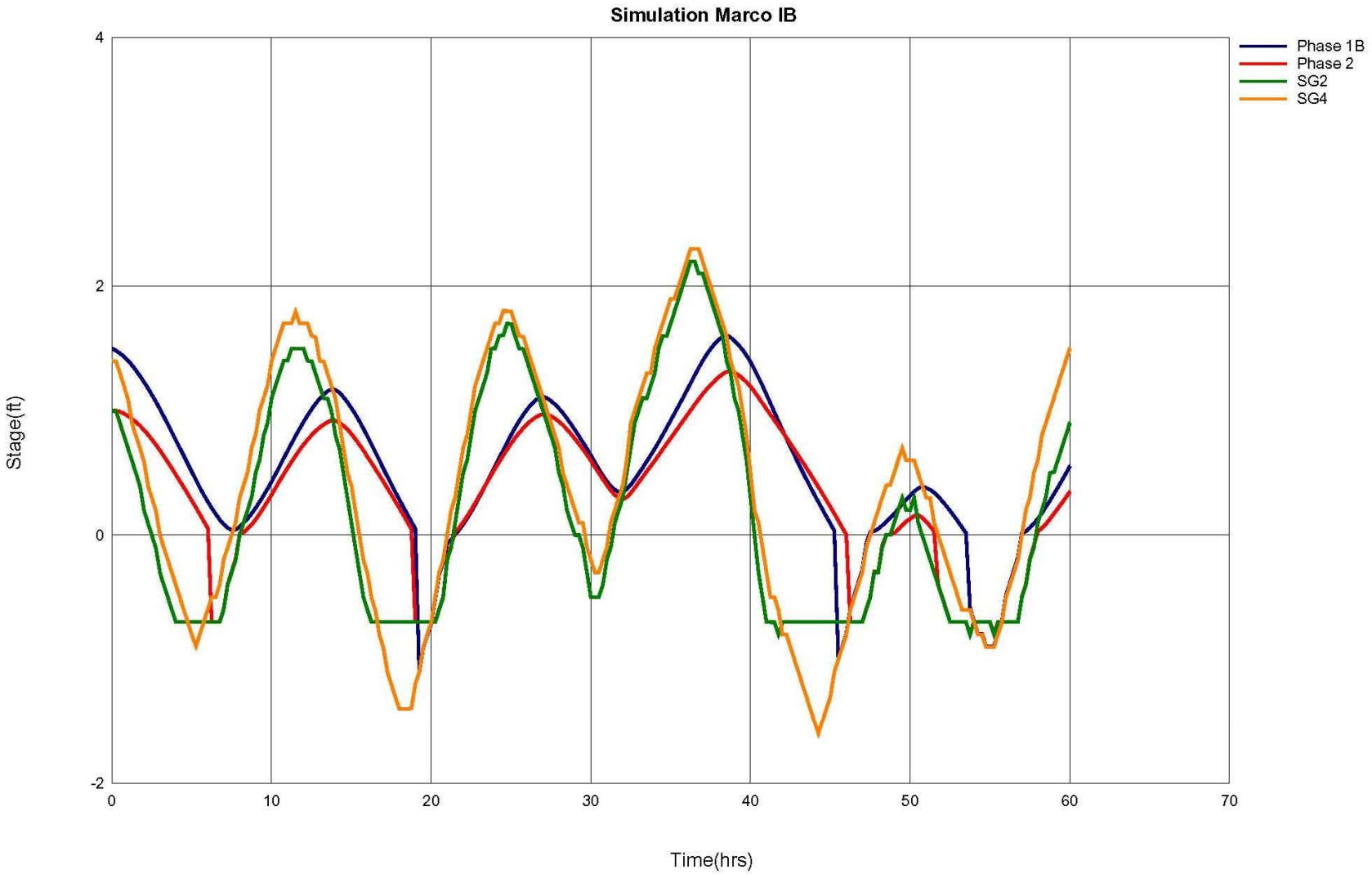
JOSH R. EVANS P.E.
FL. LICENSE #: 57436
SET NUMBER:
SHEET: 2 OF 7

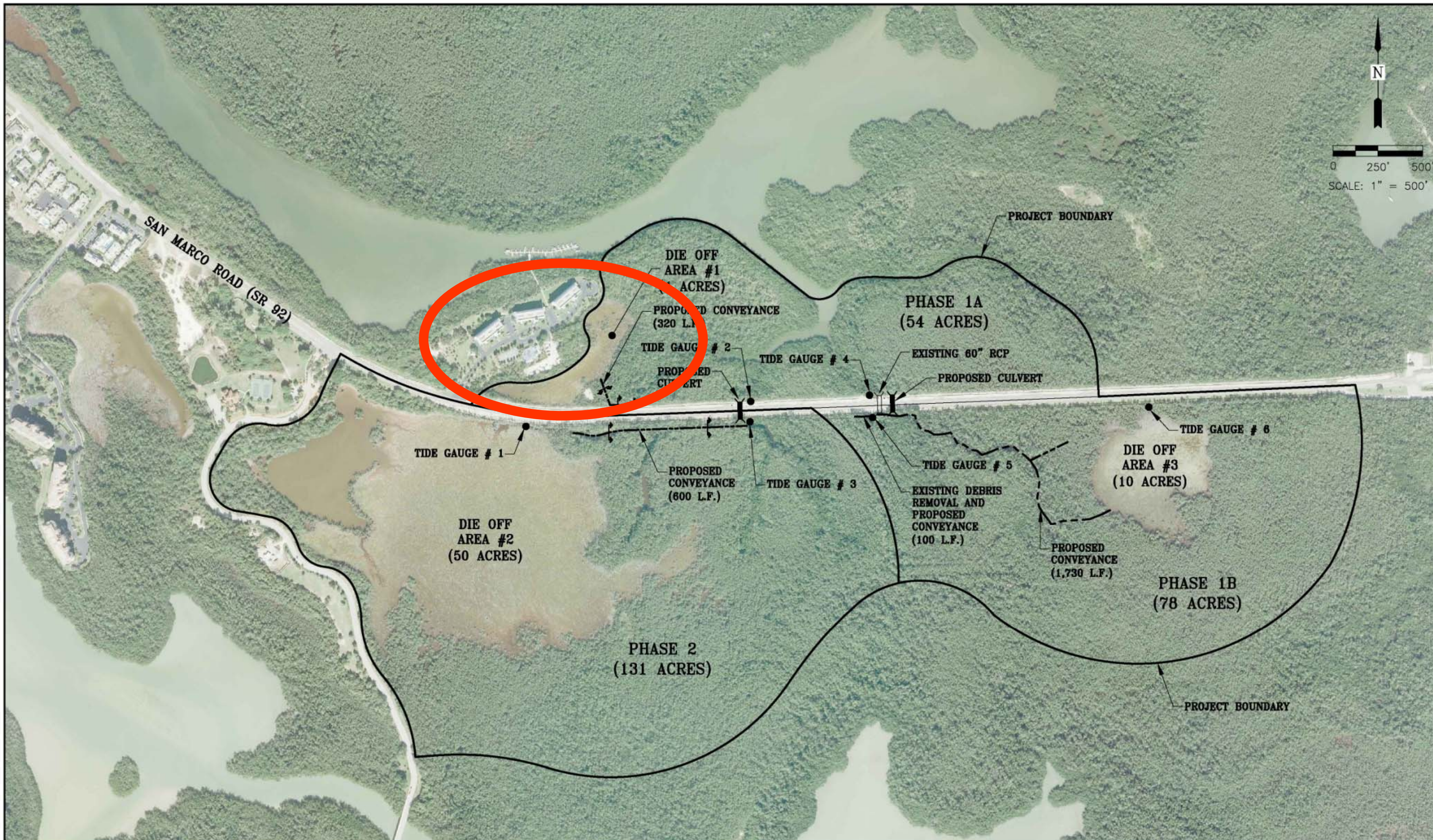

HOBO Water Level Logger
(1" X 6 ")
www.onsetcomp.com
HOBO
Water Level Logger - Titanium
onset

TIDE (FT NAVD 88) vs TIME (HOURS)



Phase 1B (SG4) - 1 x 48" Culverts (proposed)
Phase 1B (SG4) - 1 x 60" Culvert (existing)
Phase 2 (SG2) - 3 x 48" Culverts (proposed)





#	DATE	PLAN REVISIONS	PROPERTY OWNER	RESTORATION OF MANGROVES AT FRUIT FARM CREEK	J.R. EVANS ENGINEERING, P.A.		
			ROOKERY BAY NATIONAL ESTUARINE RESEARCH RESERVE 300 TOWER ROAD, NAPLES, FLORIDA 34113 PHONE: 239-417-6300 FAX: 239-417-6315	AERIAL/CONCEPT PLAN - PHASES 1 & 2	8891 BRIGHTON LANE, SUITE 115 BONITA SPRINGS, FLORIDA 34135 PHONE: (239) 390-1922 FAX: (239) 390-1932 JOSH@JREVANSENGINEERING.COM	PROJECT #: 3-10RMFFC FILE DATE: 11 / 2010 DESIGN BY: JRE DRAWN BY: JRE SEC. 10, 11, 13, 14 & 15, TWP. 52S, R 26E SCALE: 1" = 500'	JOSH R. EVANS P.E. FL. LICENSE #: 57436 SET NUMBER: SHEET: 2 OF 7

Construction Phase 1A September 1, 2012

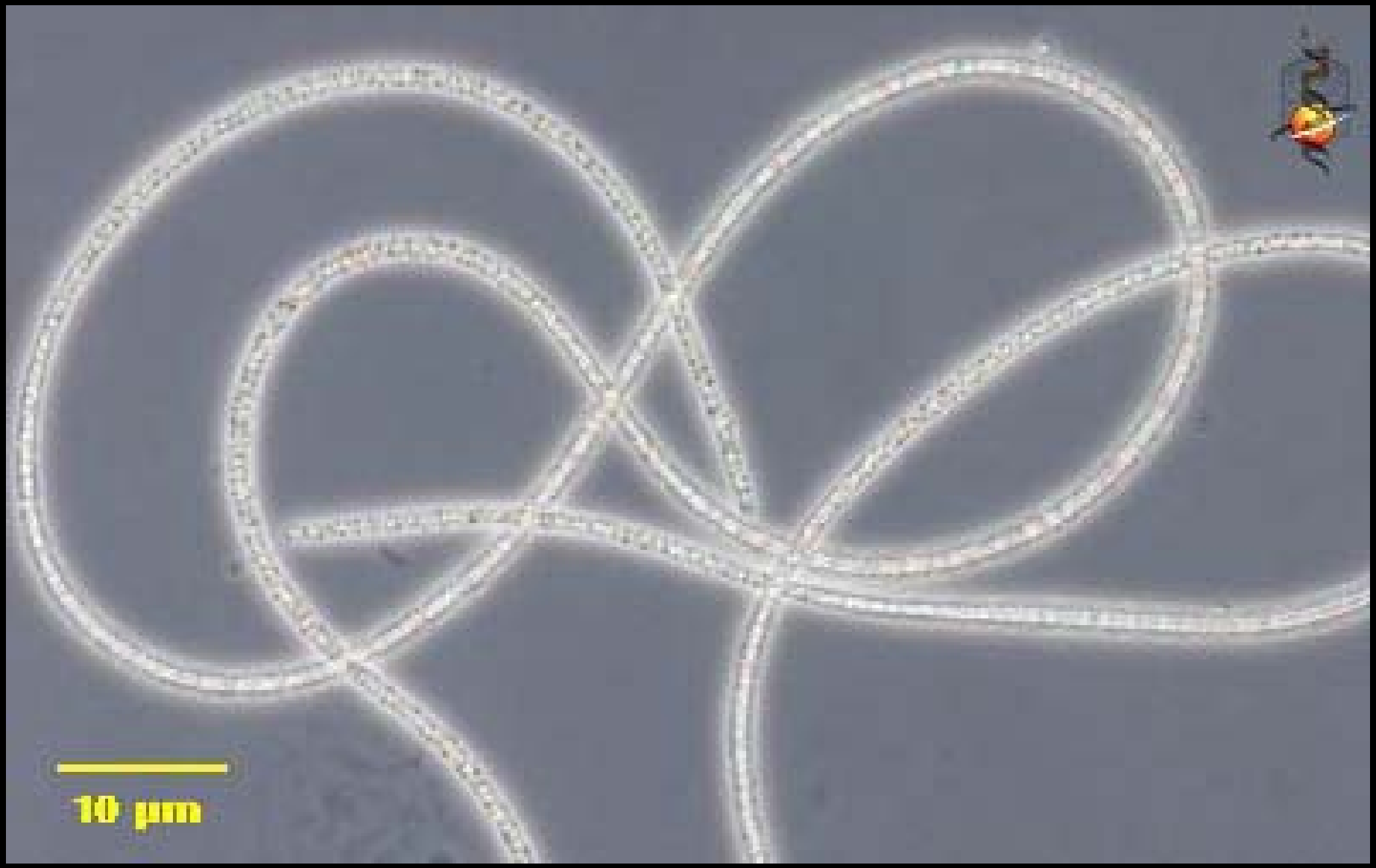

September 2, 2012


September 20, 2013

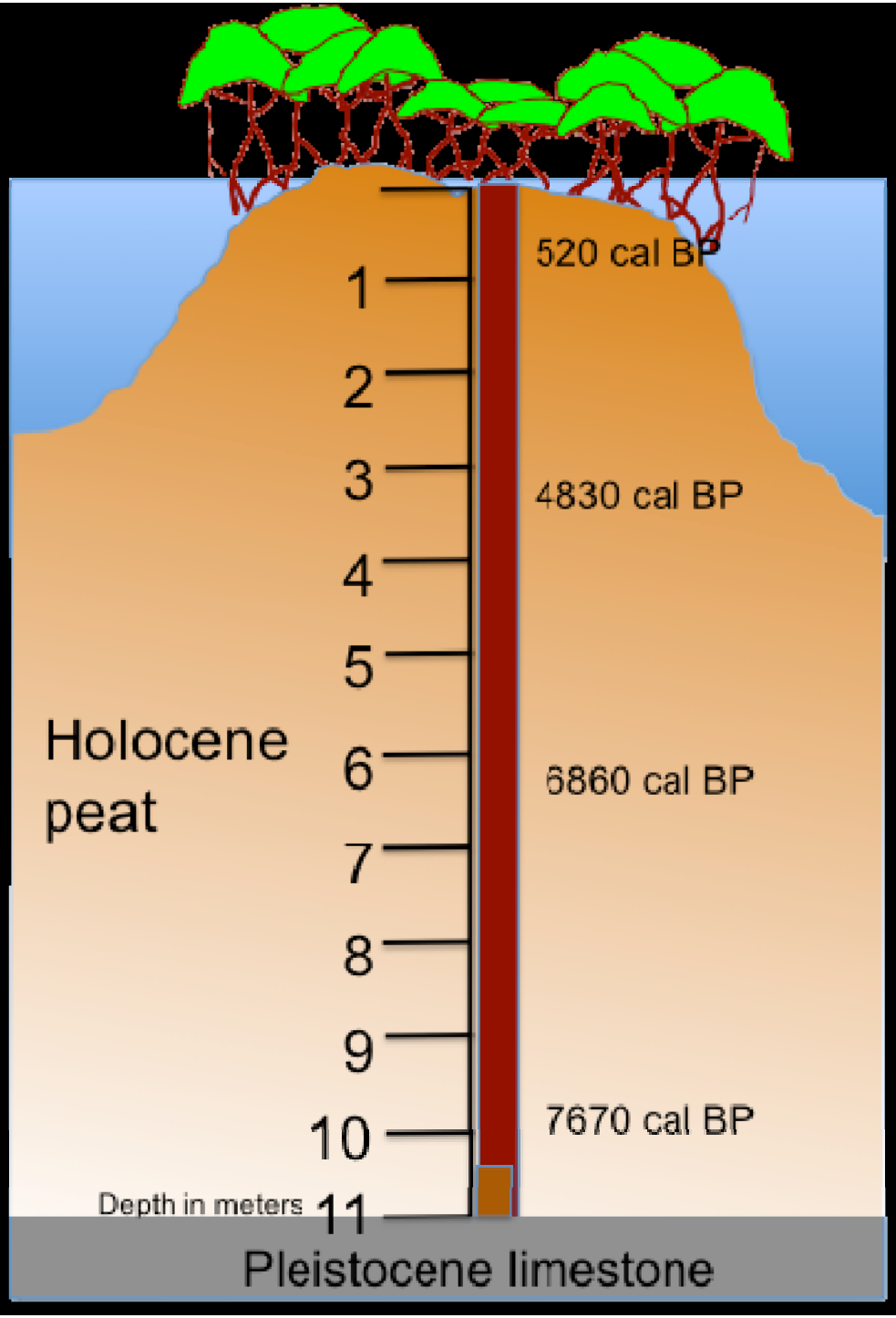

September 28, 2014


September 16, 2015

FFC PHASE 3 PROJECT AREA



Beggiatoa



Twin Cays, Belize

Karen L. McKee
U.S. Geological Survey

USGS
science for a changing world

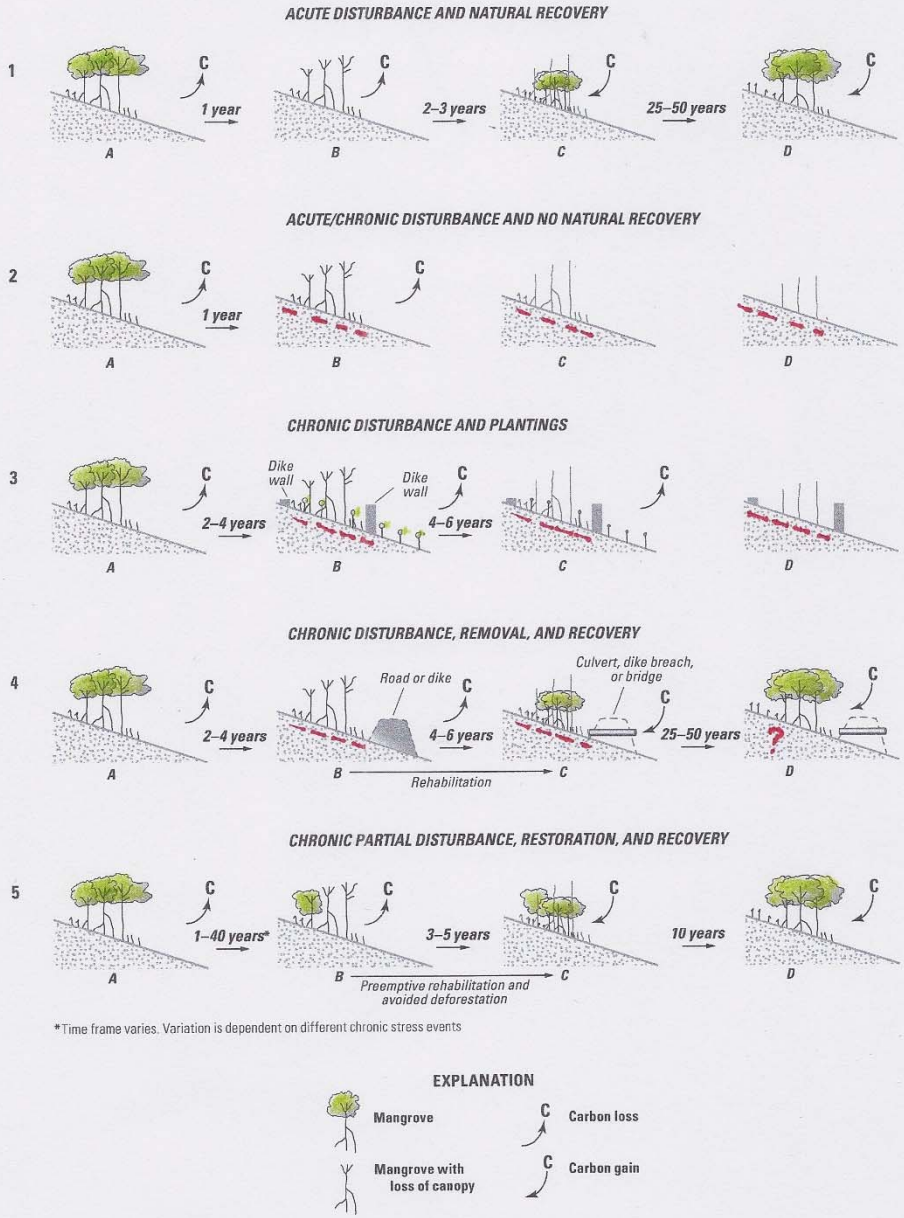
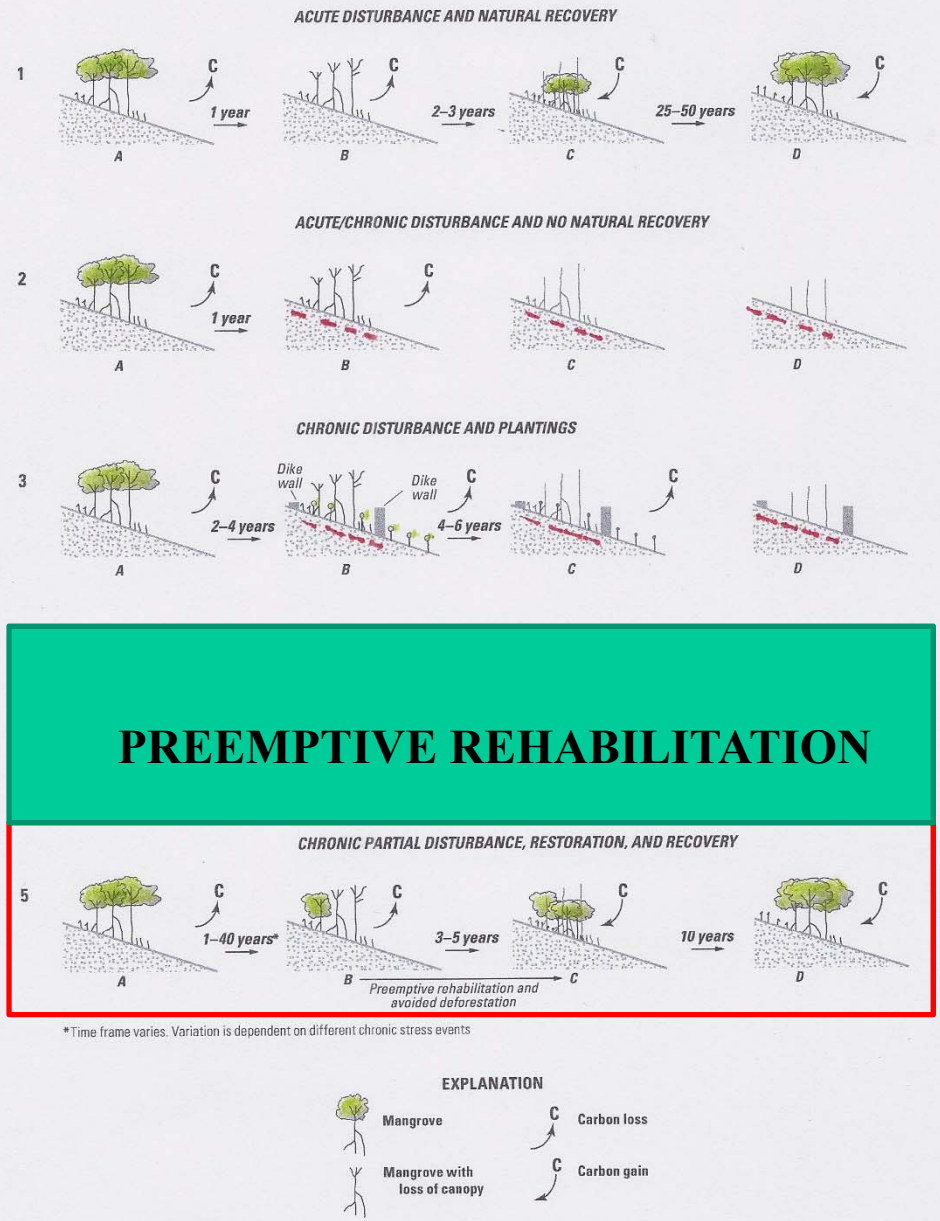


Figure 2. Alternative disturbance and recovery processes in mangrove forests. Preemptive rehabilitation at Scenario 5 can prevent complete deforestation and collapse of organic soils (dashed red line) in the face of rising sea level.



Lewis et al. 2016 Mar. Poll. Bull. Download #100

Figure 2. Alternative disturbance and recovery processes in mangrove forests. Preemptive rehabilitation at Scenario 5 can prevent complete deforestation and collapse of organic soils (dashed red line) in the face of rising sea level.

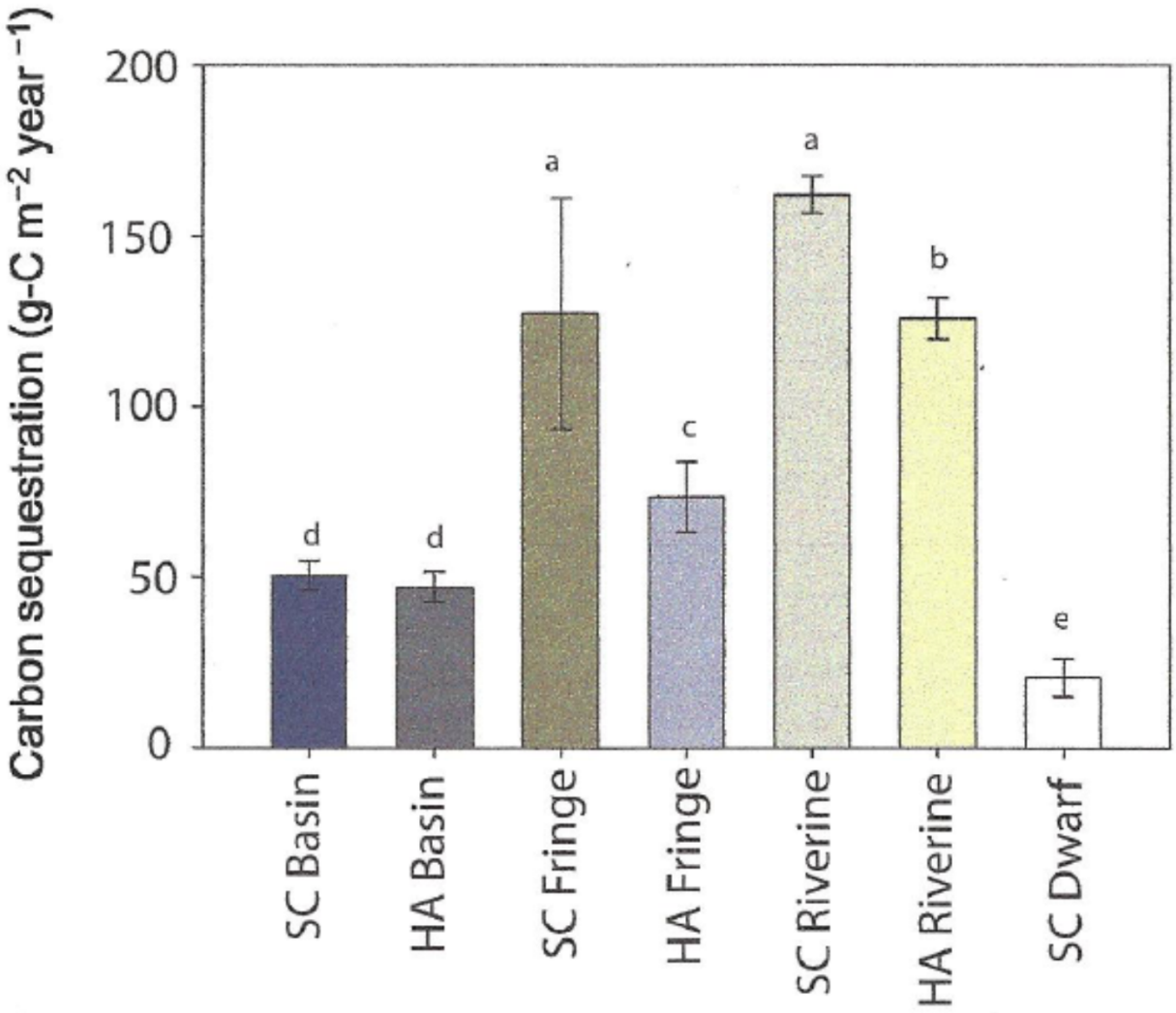


Figure 7. Carbon sequestration rates for seven different mangrove sites in four different hydrogeological settings for the hydrologically disturbed Hamilton Avenue Creek (HA) and reference Susan's Creek (SC). Bars depict mean (± standard error) carbon sequestration values (n = 3). Similar letters indicate no statistical differences, alpha equals 0.05. **From Marchio et al. 2016 download # 504**


Today We Announce the Establishment of
a Mangrove Forest R/R/A Catalogue and
Registry to Provide Easier Access to
Reports and Documentation on Previous
Attempts to Restore Mangroves