DUURZAME KUSTZONE ONTWIKKELING

- **INTEGRAAL KUST- & DELTA BELEID VIA BOUWEN MET DE NATUUR**

Building with Nature®

$(\alpha+\beta+\gamma)_{knowledge}$ + action $\longrightarrow$ $\Delta_{sustainable}$

DELTA ACADEMY – 2013
DELTA COMMISSIE – 2008 **GEO INFO NL – 2009**

DUURZAME KUSTZONE ONTWIKKELING

Flexibele integratie van land in water en van water in land

Gebruikmakende van in de natuur aanwezige materialen, krachten & interacties

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  - Ministerie van Economie
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- Senior Adviseur College B&W Den Haag
- Proactive founder en adviseur DELTARES
- Senior Adviseur TNO-NITG – Applied Geoscience
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- Gastdocent aan 7 Universitaire Instellingen
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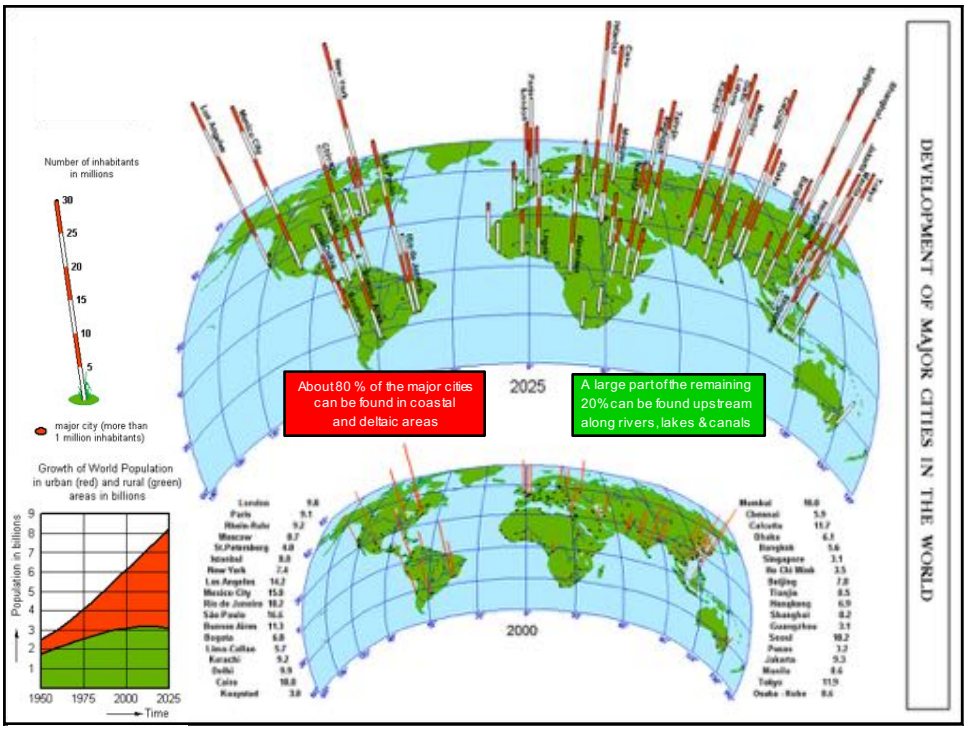
DUURZAME KUSTZONE ONTWIKKELING

- **Beschavingen en culturen hebben zich vaak ontwikkeld op de grenszone water-land, in kust en deltagebieden.**

  Het is daarom niet te verwonderen dat in het begin van de 21ste eeuw 80% van de dichtst bevolkte stedelijke gebieden zich in die grenszone bevinden.



DUURZAME KUSTZONE ONTWIKKELING

In deze dicht bevolkte gebieden is er een schaarste aan ruimte om te wonen, te werken, te recreëren en voor infrastructuur.

Tegelijkertijd is er behoefte aan het in stand houden, zo mogelijk uitbreiden van milieu-, natuur- en landschapswaarden.

DUURZAME KUSTZONE ONTWIKKELING

- Voor deze schaarste aan ruimte zijn er 3 ruimtelijke oplossingen:

  Een beter gebruik van de 3e en de 4e dimensie

  Benutten van ruimte in het bestaande achterland

  Zeewaartse optie

  of combinaties

DUURZAME KUSTZONE ONTWIKKELING

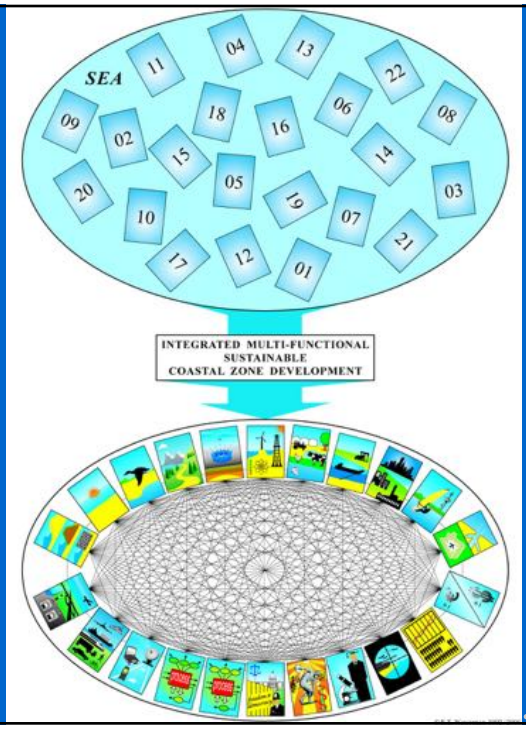
- **Integreren van Land in Zee**
  en van
  Water in het nieuwe & oude Land !

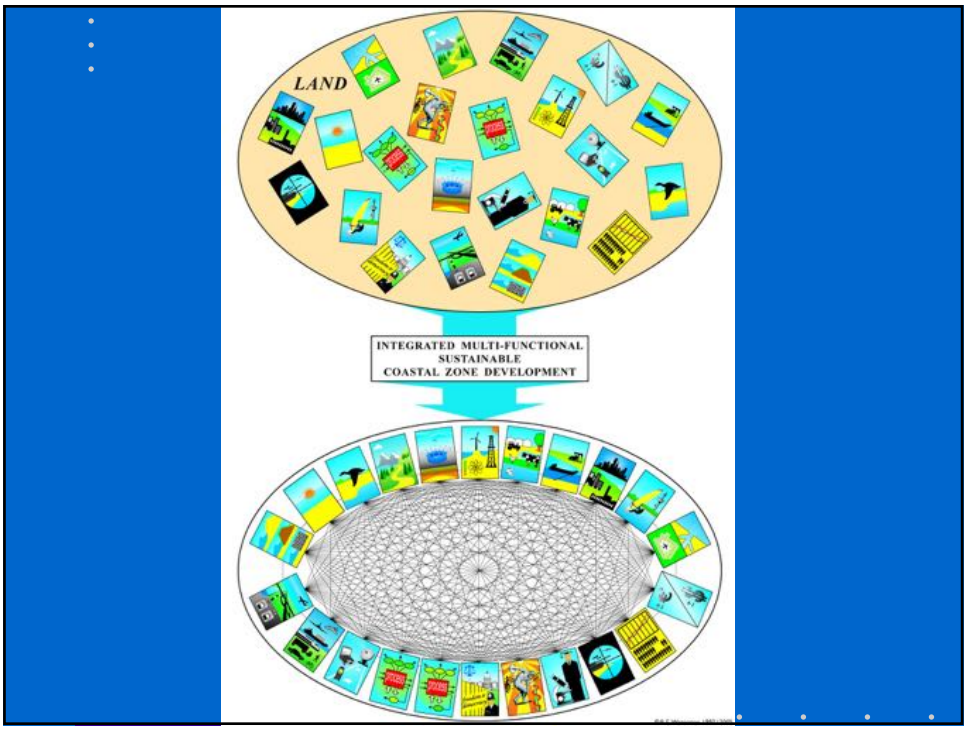
BOUWEN MET DE NATUUR

Integrale Beschouwing van de kustzone, inclusief nieuw en oud land & zee.

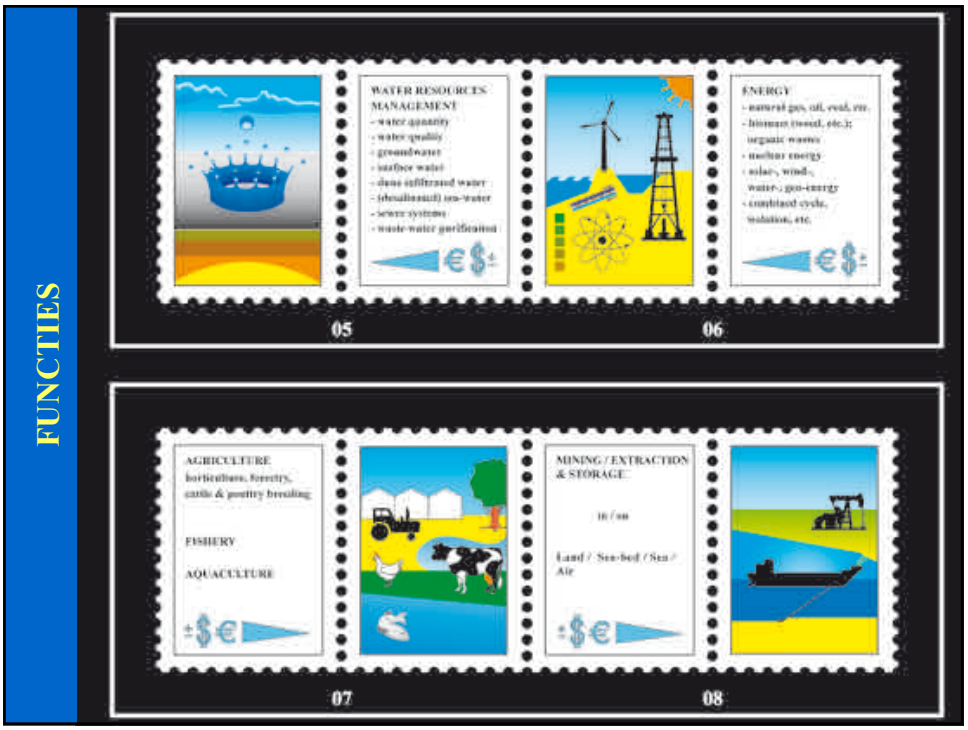
Vele functies dienen in ogenschouw genomen te worden onder gebruikmaking van vele disciplines.

Om zo een antwoord te geven op de vraag hoe wij tal van bestaande en komende problemen tot een oplossing kunnen brengen in relatie tot het bestaande achterland enerzijds en de aangrenzende zee anderzijds, onder het creëren van meerwaarde.

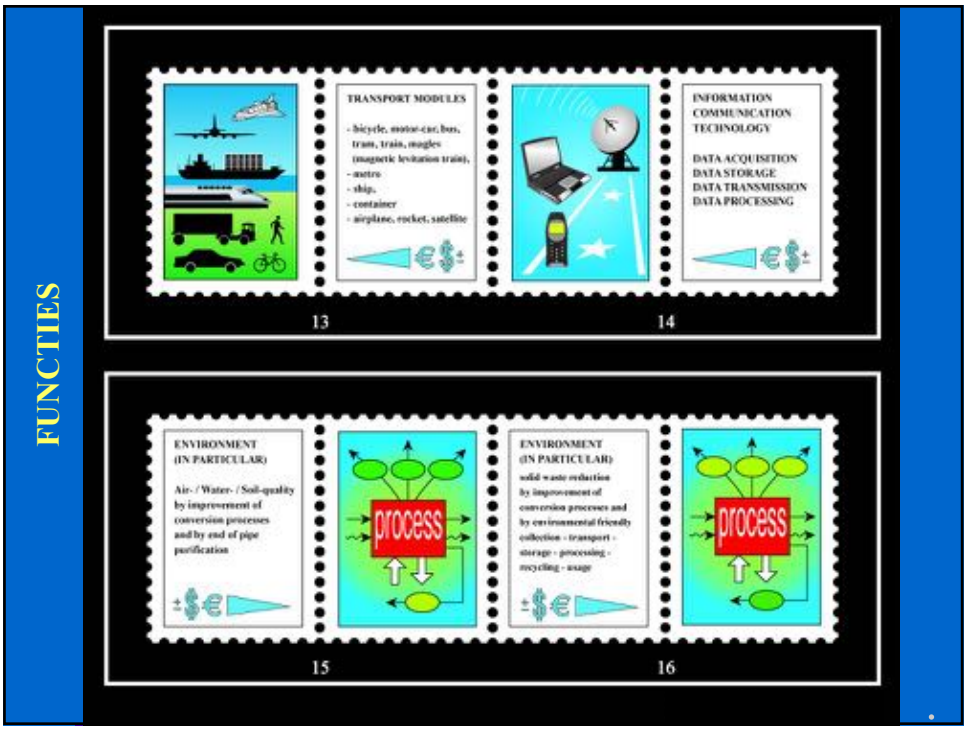



LAND
INTEGRATED MULTI-FUNCTIONAL
SUSTAINABLE
COASTAL ZONE DEVELOPMENT


FUNCTIES
SAFETY with regard to:
- flooding
(including effects:
sea level & river level rise)
- drought
- coastal erosion
- land subsidence
- salt water intrusion
- natural disasters
- human activities
ENVIRONMENT
(IN GENERAL)
environmental
compartments:
- air
- water
- land
01
02
NATURE
- micro-organisms, flora,
fauna (incl. people)
- eco-systems
- nature conservation
- nature development
- bio-diversity
- bio-diversification
LANDSCAPE
- landscape conservation
- landscape development
SEASCAPE
03
04


FUNCTIES
WATER RESOURCES MANAGEMENT
- water quantity
- water quality
- groundwater
- surface water
- dune-infiltrated water
- (desalinated) sea-water
- sewer systems
- waste-water purification
ENERGY
- natural gas, oil, coal, etc.
- biomass (wood, etc.);
organic wastes
- nuclear energy
- solar-, wind-,
water-, geo-energy
- combined cycle,
isolation, etc.
05
06
AGRICULTURE
horticulture, forestry,
cattle & poultry breeding
FISHERY
AQUACULTURE
MINING / EXTRACTION & STORAGE
in / on
Land / Sea-bed / Sea / Air
07
08


FUNCTIES
BUILDING SITES FOR LIVING & WORKING
- houses & apartments
+ facilities
- industries & offices
+ facilities
- urban development
RECREATION & TOURISM
09
10
TRANSFER / DISTRIBUTION CENTRES & RELATED ACTIVITIES
- seaport
- riverport,
- lake port
- airport,
- landport
INFRASTRUCTURE
- roads
- railroads
- waterways
- underground systems
- airlanes
- electronic highway
11
12


FUNCTIES
TRANSPORT MODULES
- bicycle, motor-car, bus, tram, train, maglev (magnetic levitation train),
- metro
- ship,
- container
- airplane, rocket, satellite
INFORMATION COMMUNICATION TECHNOLOGY
DATA ACQUISITION
DATA STORAGE
DATA TRANSMISSION
DATA PROCESSING
13
14
ENVIRONMENT (IN PARTICULAR)
Air- / Water- / Soil-quality by improvement of conversion processes and by end of pipe purification
process
ENVIRONMENT (IN PARTICULAR)
solid waste reduction by improvement of conversion processes and by environmental friendly collection - transport - storage - processing - recycling - usage
process
15
16


FUNCTIES
freedom & democracy
GOVERNMENTAL INSTITUTIONS
NON-GOVERNMENTAL INSTITUTIONS
CITIZEN GROUPS
INDIVIDUAL CITIZENS
PEOPLE'S PARTICIPATION
LAW - JUSTICE - ORDER
HEALTH & WELFARE
SPORT / PLAYGROUND
HISTORY & CULTURE
RELIGION
PHILOSOPHY OF LIFE
VALUES / STANDARDS
SOCIOSPHERE
17
18
EDUCATION & RESEARCH
DEFENCE & RISK MANAGEMENT
SAFETY & SECURITY
19
20

FUNCTIES

BOUWEN MET DE NATUUR

Realisatie van nieuw land, waar de natuur dat toestaat, onder toepassing van het principe :
Bouwen met de Natuur

De kern van dit principe is:

Flexibele integratie van land in zee en van water in het nieuwe & oude land, gebruikmakende van in de natuur aanwezige materialen en krachten/interacties, rekening houdend met bestaande en potentiële natuurwaarden en met de biogeomorfologie en geohydrologie van kust en zeebodem.

BUILDING WITH NATURE

ANORGANISCHE MATERIALEN

grind / zand
slib / klei

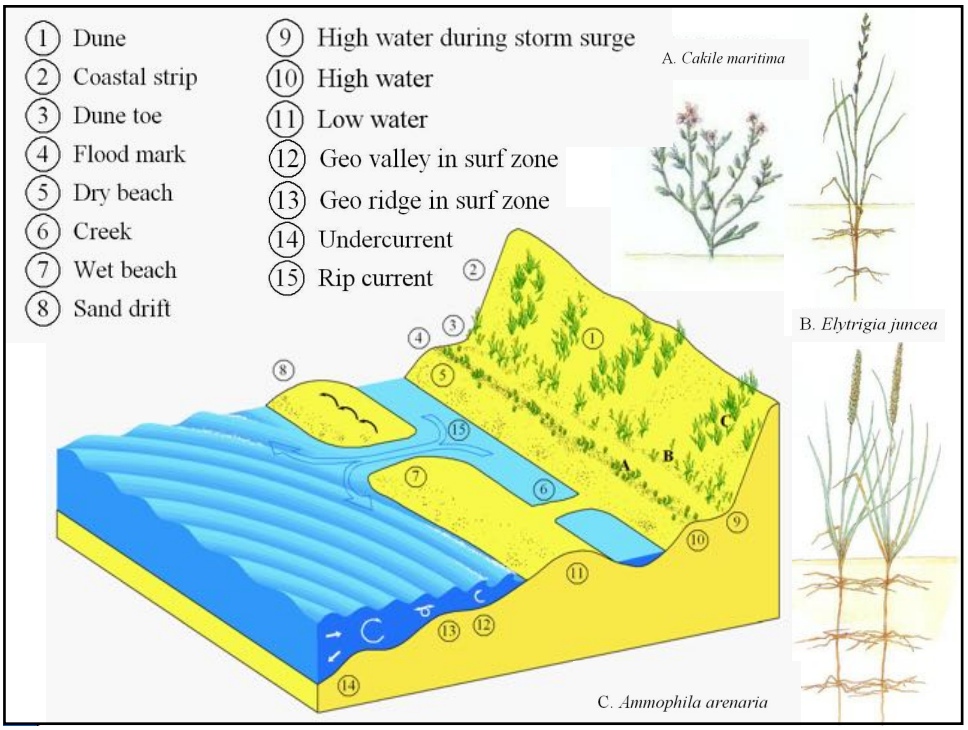
Het losse beweeglijke materiaal zand / slib van grof tot fijn en de krachten en interacties die daarop werkzaam zijn

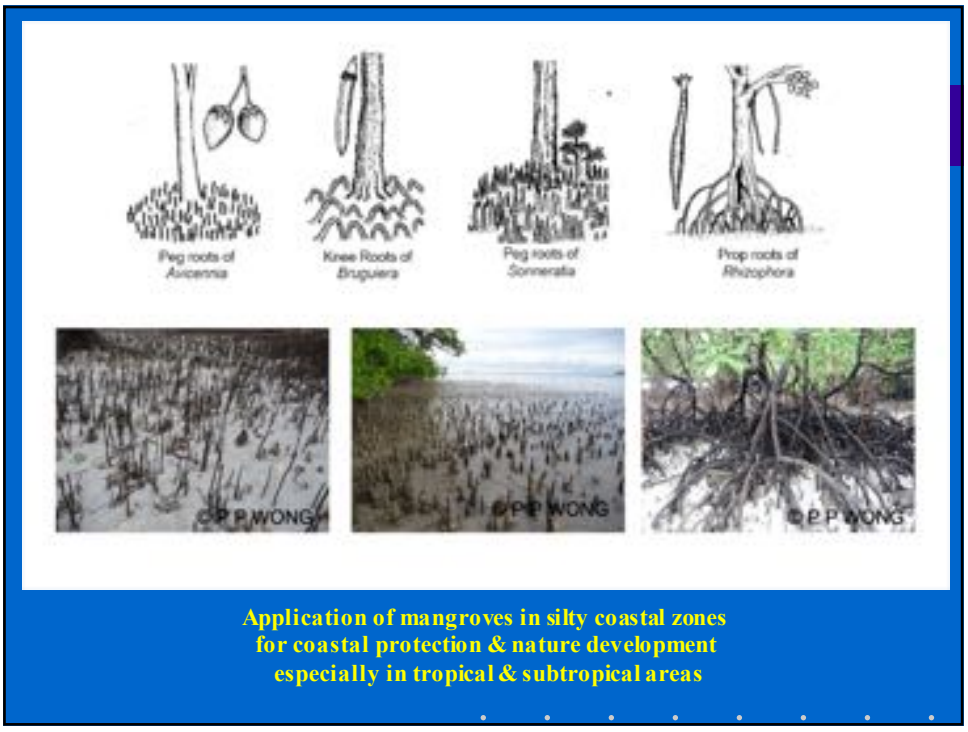
ORGANISCHE MATERIALEN

Krachten en Interacties:

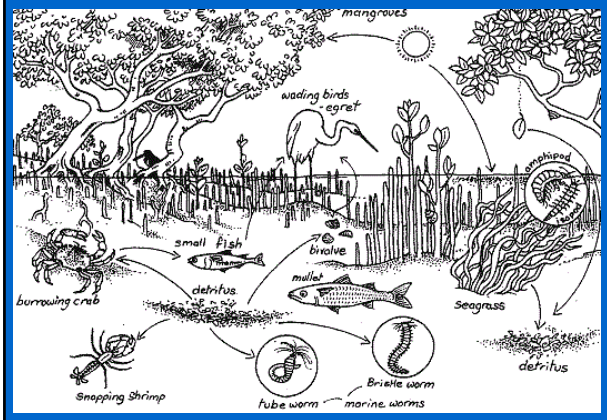
01. Getijden werking (eb & vloed)
02. Golfbeweging (met name in de brekingszone) en deining
03. Zeestromingen anders dan getijdenstromingen
04. Rivier uitstroming (als kracht en als leverancier van zoetwater en sediment)
05. Zwaartekracht
06. Wind
07. Regen
08. Zonnestraling
09. Interactie duinen - vegetatie (wortelsysteem vegetatie houdt zand/slib vast)
10. Complexe interactie marine organismen - zand/slib.

Biogeomorfologie & Geohydrologie van Kust en Zeebodem


1 Dune
2 Coastal strip
3 Dune toe
4 Flood mark
5 Dry beach
6 Creek
7 Wet beach
8 Sand drift
9 High water during storm surge
10 High water
11 Low water
12 Geo valley in surf zone
13 Geo ridge in surf zone
14 Undercurrent
15 Rip current
A. Cakile maritima
B. Elytrigia juncea
C. Ammophila arenaria

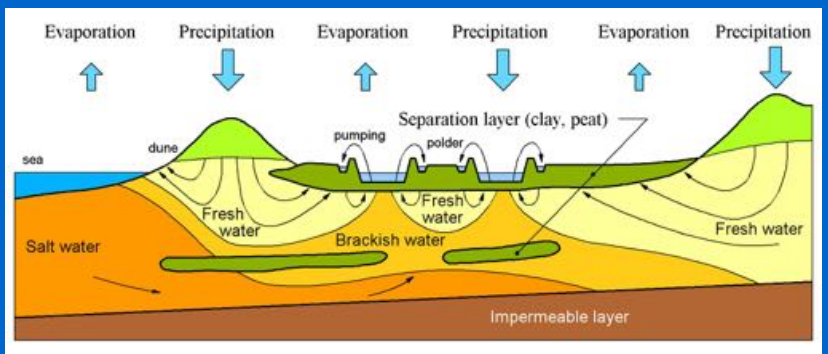

Peg roots of Avicennia
Knee Roots of Bruguiera
Peg roots of Sonneratia
Prop roots of Rhizophora
©P.P.WONG
©P.P.WONG
©P.P.WONG
Application of mangroves in silty coastal zones
for coastal protection & nature development
especially in tropical & subtropical areas

Mangroves



- Shoreline protection from erosion
- Basis for the complex marine food chain
- Creation of breeding habitats
- Protection for maturing offspring
- Filtering and assimilation of pollutants from upland runoffs
- Stabilisation of bottom sediment
- Improvement of water quality

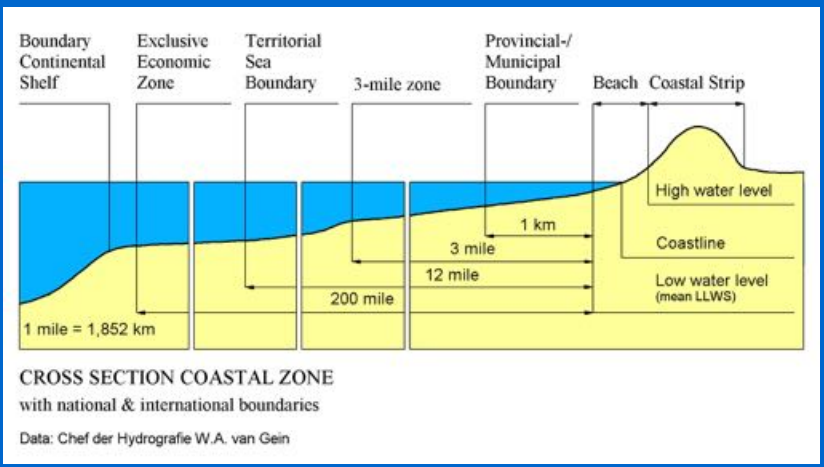
BOUWEN MET DE NATUUR



CROSS SECTION SUBSOIL OF WEST-HOLLAND

Data: Rijks Geologische Dienst - S. Jelgersma

BOUWEN MET DE NATUUR

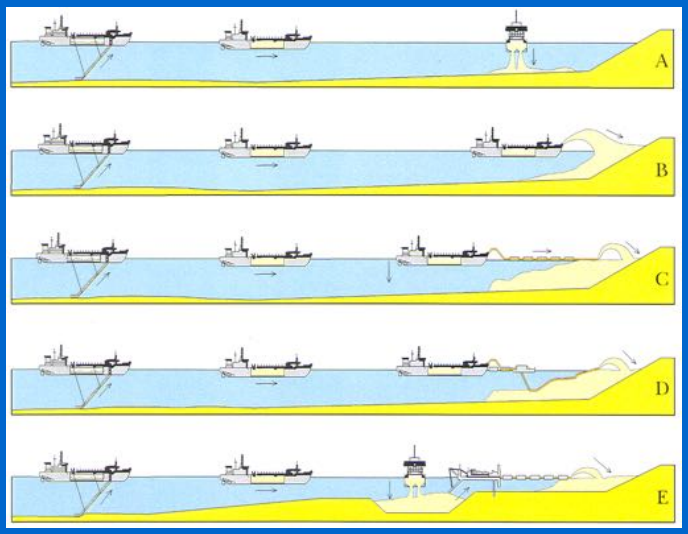


CROSS SECTION COASTAL ZONE
with national & international boundaries

Data: Chef der Hydrografie W.A. van Gein

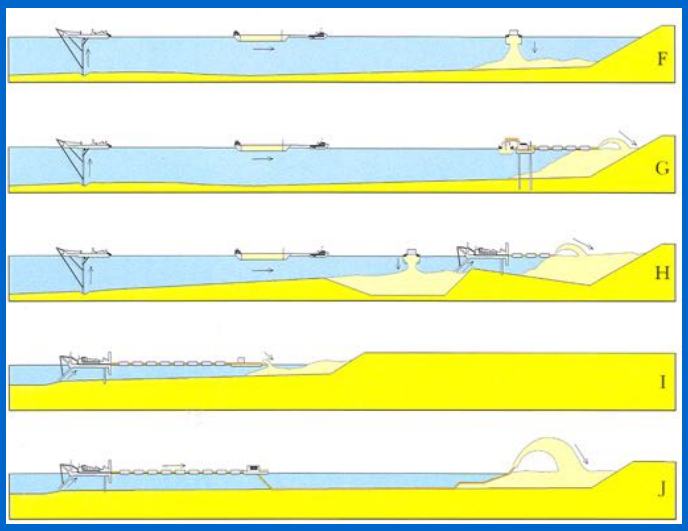
BAGGERTECHNIEKEN VOOR LANDAANWINNING

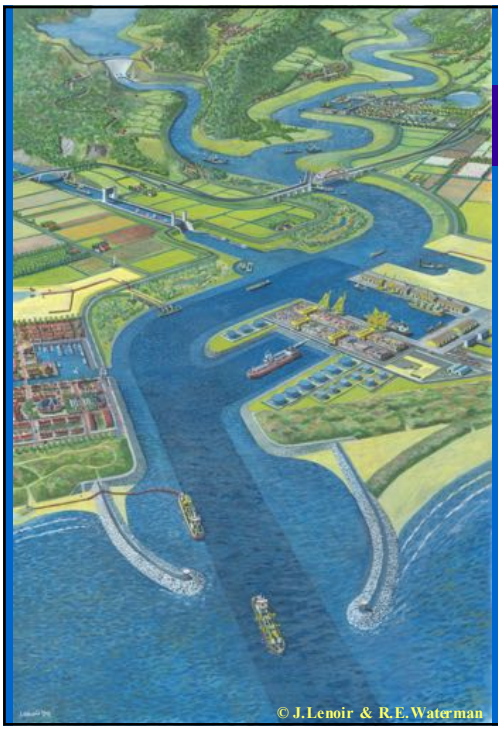
BOUWEN MET DE NATUUR



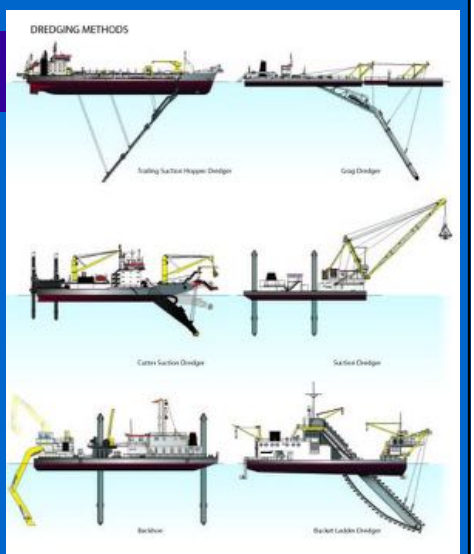
BAGGERTECHNIEKEN VOOR LANDAANWINNING

BOUWEN MET DE NATUUR



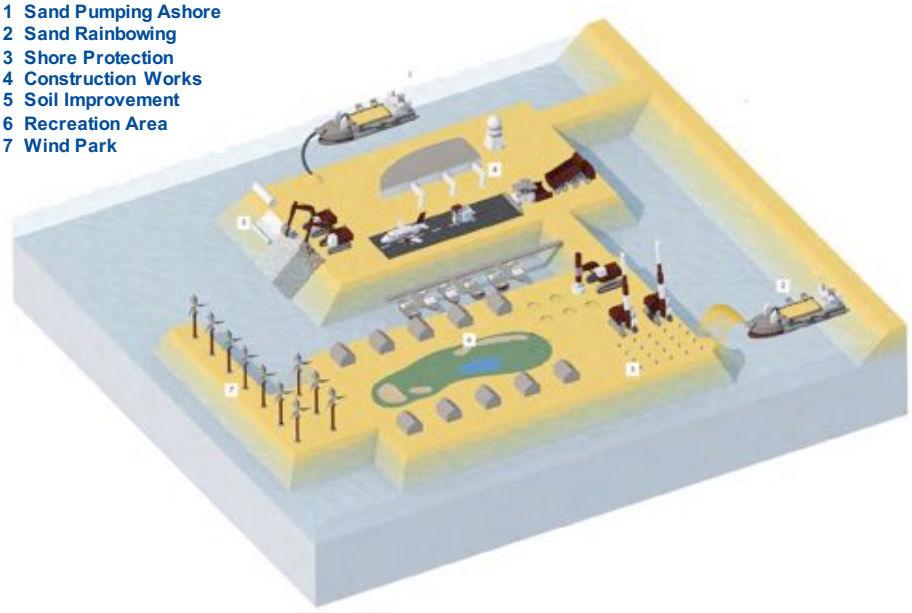


Baggertechnieken



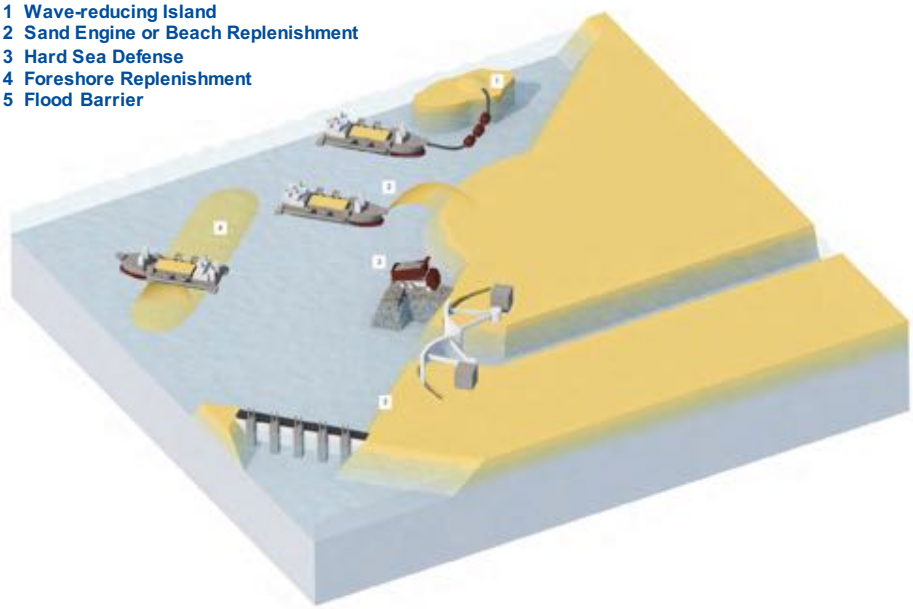
Land Reclamation

1 Sand Pumping Ashore
2 Sand Rainbowing
3 Shore Protection
4 Construction Works
5 Soil Improvement
6 Recreation Area
7 Wind Park



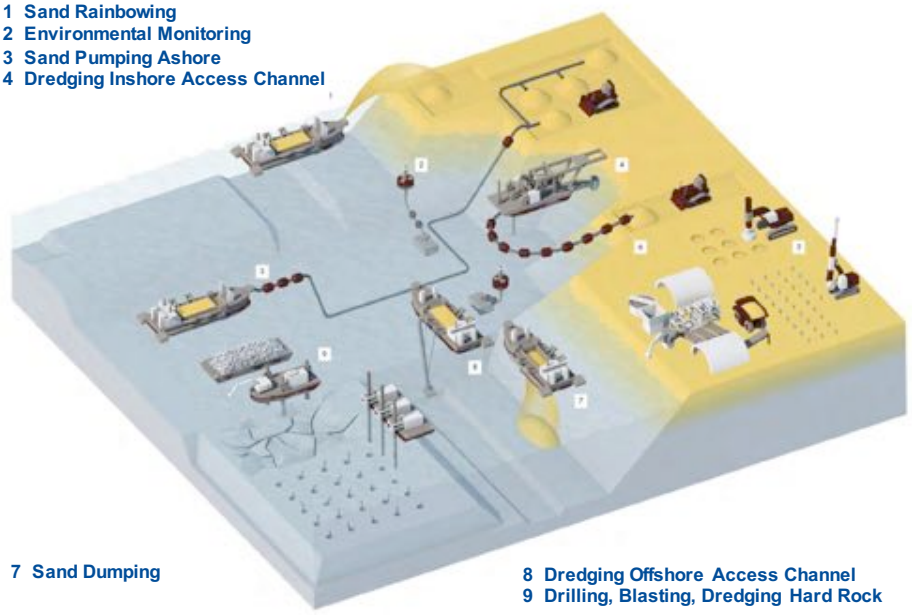
Coastal Protection

1 Wave-reducing Island
2 Sand Engine or Beach Replenishment
3 Hard Sea Defense
4 Foreshore Replenishment
5 Flood Barrier



Port Development

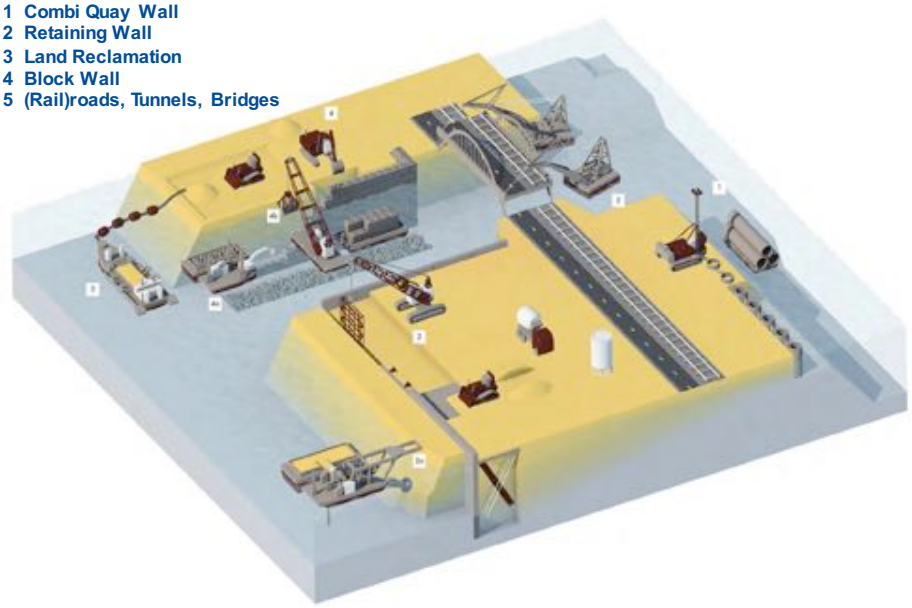
1 Sand Rainbowing
2 Environmental Monitoring
3 Sand Pumping Ashore
4 Dredging Inshore Access Channel
5 Soil Improvement Techniques
6 Soil Remediation



7 Sand Dumping
8 Dredging Offshore Access Channel
9 Drilling, Blasting, Dredging Hard Rock

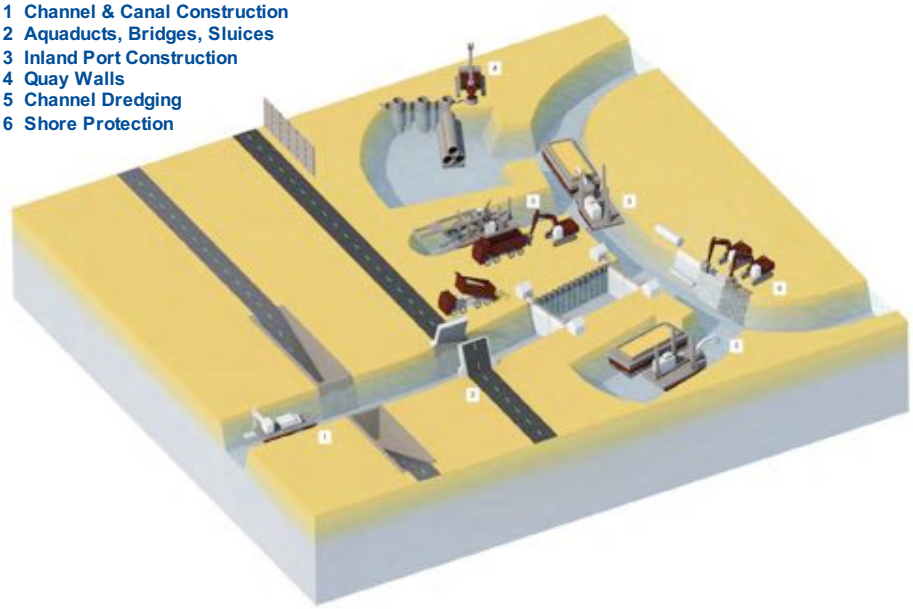
Port Infrastructure

1 Combi Quay Wall
2 Retaining Wall
3 Land Reclamation
4 Block Wall
5 (Rail)roads, Tunnels, Bridges



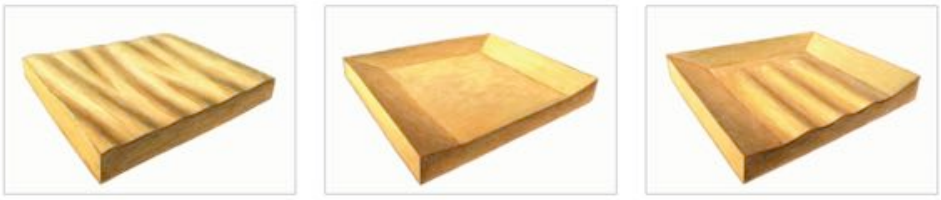
Inland Ports & Waterways

1 Channel & Canal Construction
2 Aquaducts, Bridges, Sluices
3 Inland Port Construction
4 Quay Walls
5 Channel Dredging
6 Shore Protection



ENVIRONMENT-FRIENDLY DREDGING METHODS

1 Dredging in alternate zones
2 Sub-surface dredging
3 Application of silt screens
4 Specially designed suction heads & pumping systems
5 Eco-efficient dredging: instead of shallow dredging over large areas, deep dredging over small areas, combined with seabed landscaping



BOUWEN MET DE NATUUR & BAGGEREN

De rol van baggeren in duurzame ontwikkeling met toepassing van *People – Planet – Prosperity*

- ***People*** **gericht op de kwaliteit van leven, werken, recreëren, infrastructuur & het peil van voorzieningen m.b.t. onderwijs, gezondheid, sociale samenhang & veiligheid van mensen. Tevens strevend naar stabilisatie van de wereldbevolking**

- ***Planet*** **gericht op de kwaliteit van milieu – natuur & landschap**

- ***Prosperity*** **gericht op het sociaal-economische welzijn van burgers**

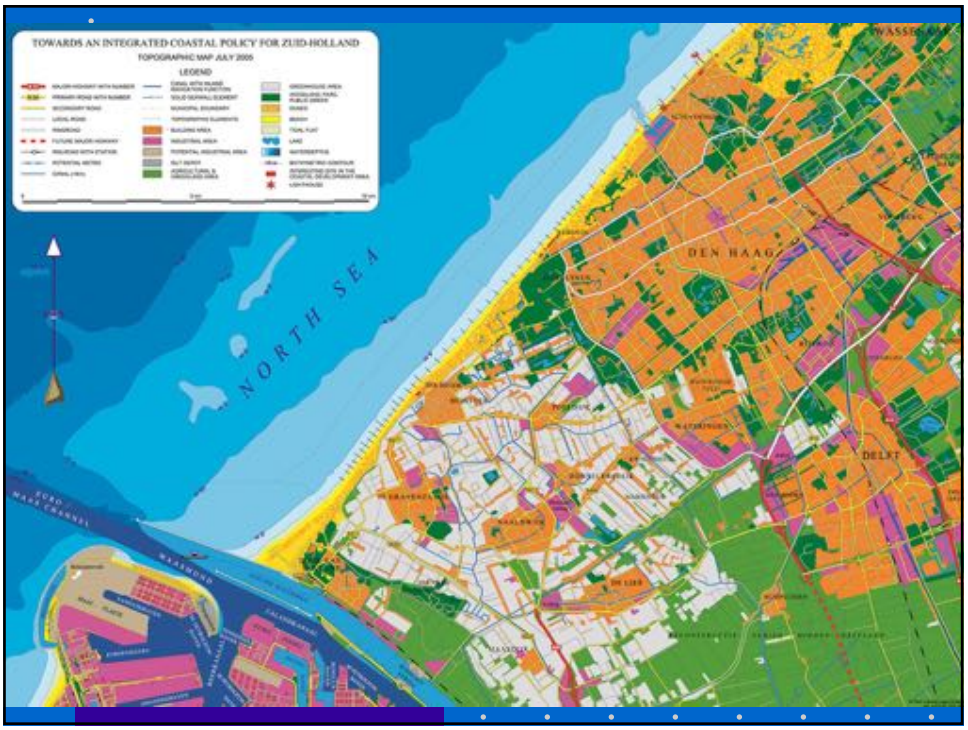
EUROPA

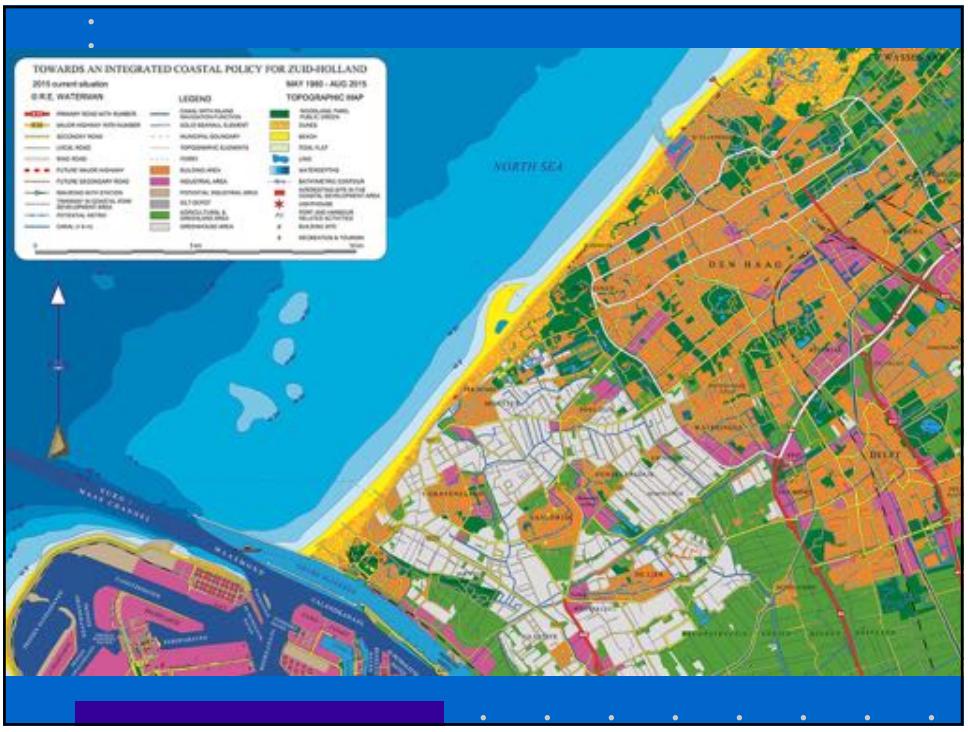

EUROPE
Arctic Ocean
Barentsz Sea
Atlantic Ocean
North Sea
Baltic Sea
Gulf of Biscay
Mediterranean Sea
Suomi
Norge
Sverige
Eesti
Rossija
Latvija
Lietuva
Belarus
Polska
Deutschland
Ukraina
Ceska
Slovenská
France
Schweiz
Magyarország
România
Portugal
España
Srbija
Crna Gora
Bâlgarija
Shqipëri
Ellas
Türkiye
Kýpros
Al Maghrib
Al Jaza'ir
Tunis
Libiyan
Malta

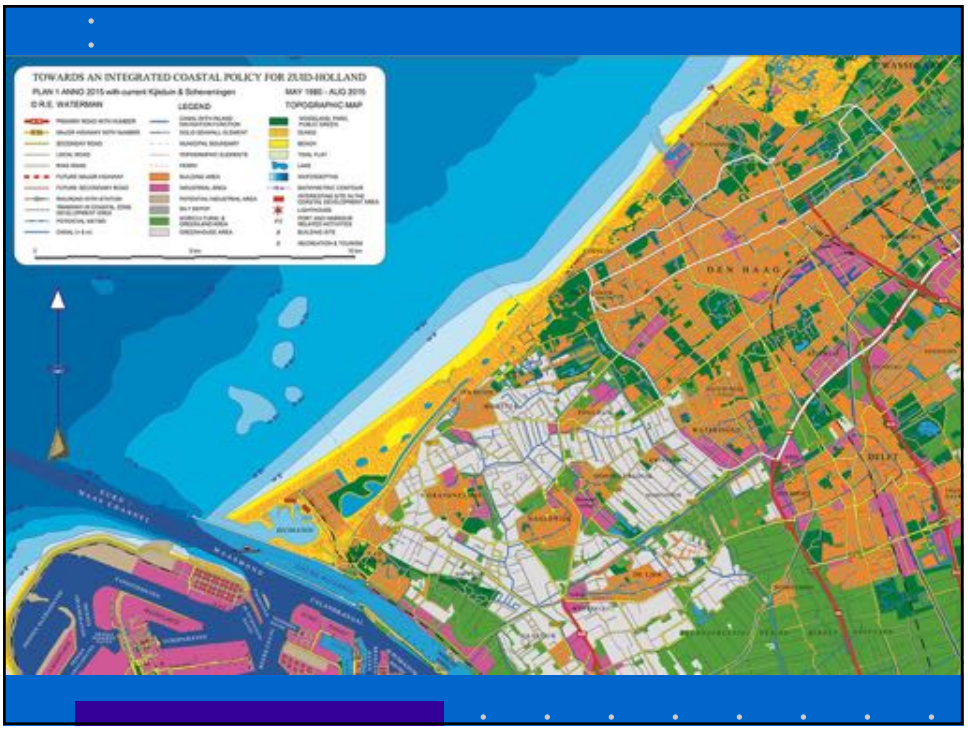

NEDERLAND
City with more than 500.000 inhabitants
City with 50.000 - 500.000 inhabitants
City with less than 50.000 inhabitants
Airport
N
S
WADDEN SEA
NORTH SEA
LAKE IJSSEL
LAKE MARKEN
Groningen
Friesland
Drenthe
Overijssel
Gelderland
Utrecht
Noord-Holland
Flevo-land
Zuid-Holland
Zeeland
Noord-Brabant
Limburg
België
Belgique
Bundesrepublik Deutschland

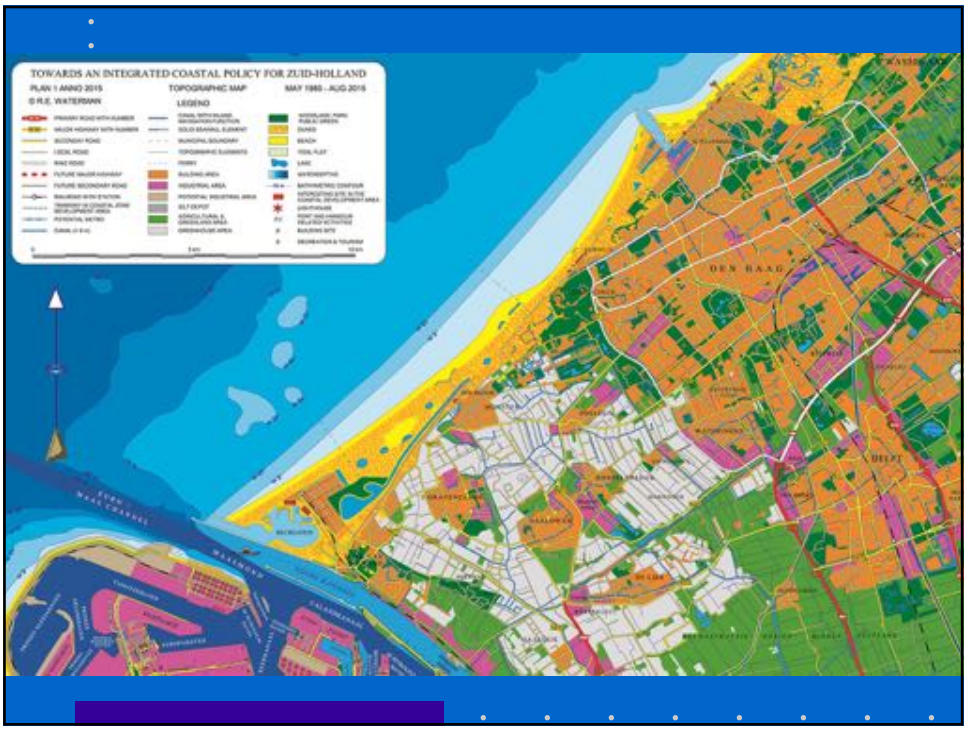

Plan A
Land reclamation via Building with Nature®
along North Sea Coast
The Netherlands
Plan 4
Plan 3
Plan 6
Plan 1
Plan 2
Integrated Coastal Policy via Building with Nature®

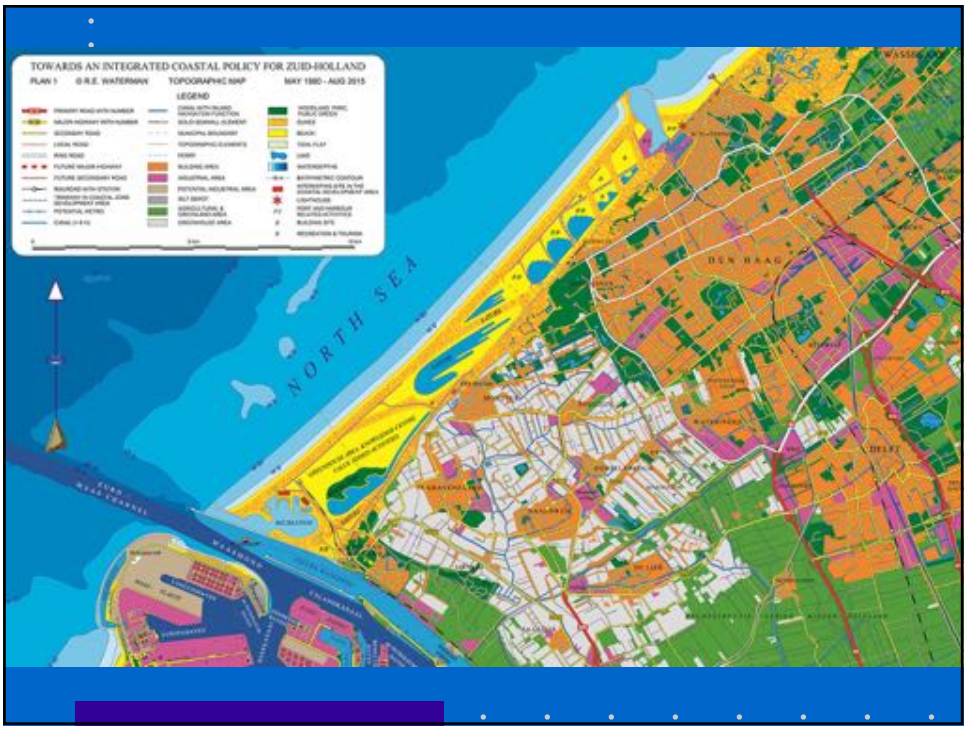

TOWARDS AN INTEGRATED COASTAL POLICY FOR ZUID-HOLLAND
LEGEND
Plan 1
NORTH SEA
DEN HAAG

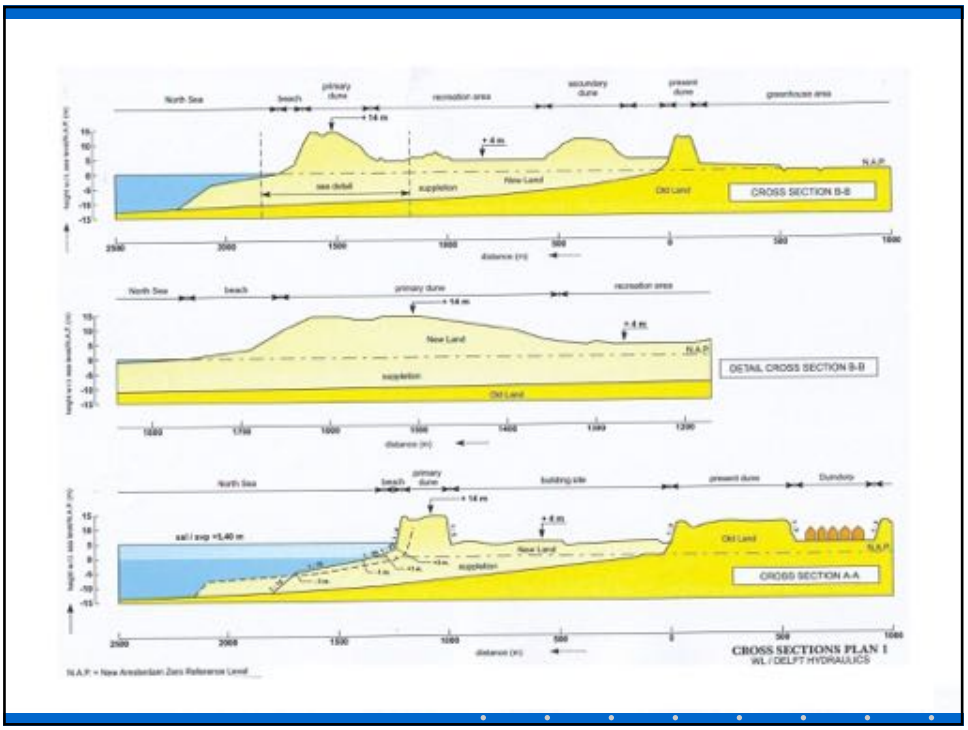

TOWARDS AN INTEGRATED COASTAL POLICY FOR ZUID-HOLLAND
TOPOGRAPHIC MAP JULY 2005
LEGEND
NORTH SEA
DEN HAAG
DELFT

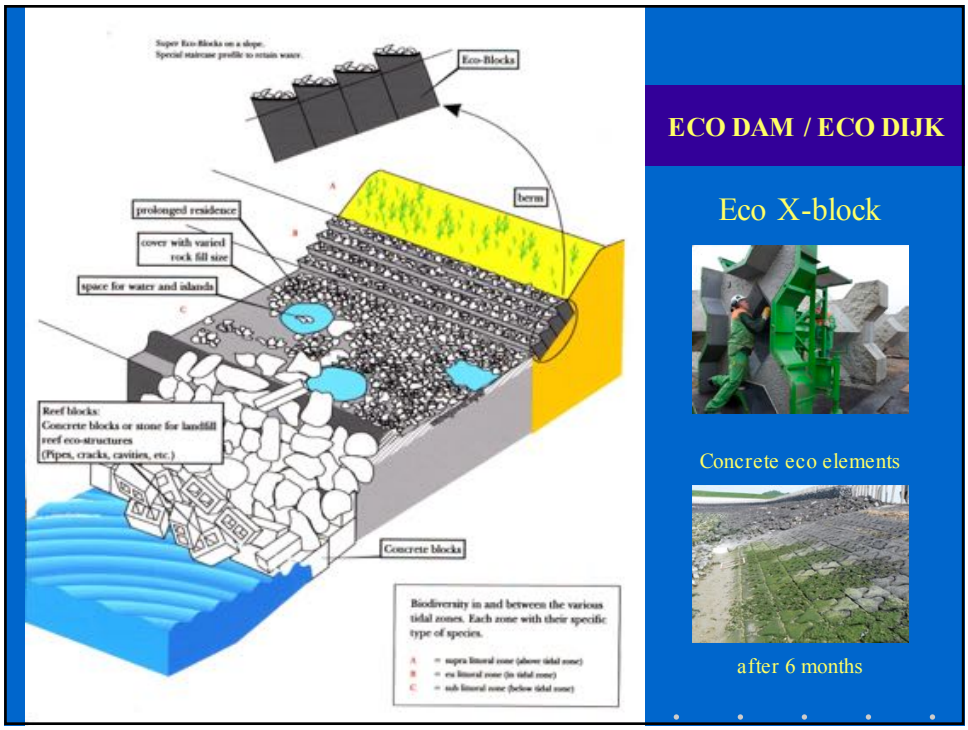

TOWARDS AN INTEGRATED COASTAL POLICY FOR ZUID-HOLLAND
2015 current situation
MAY 1960 - AUG 2015
D.R.E. WATERMAN
LEGEND
TOPOGRAPHIC MAP
NORTH SEA
DEN HAAG
DELFT

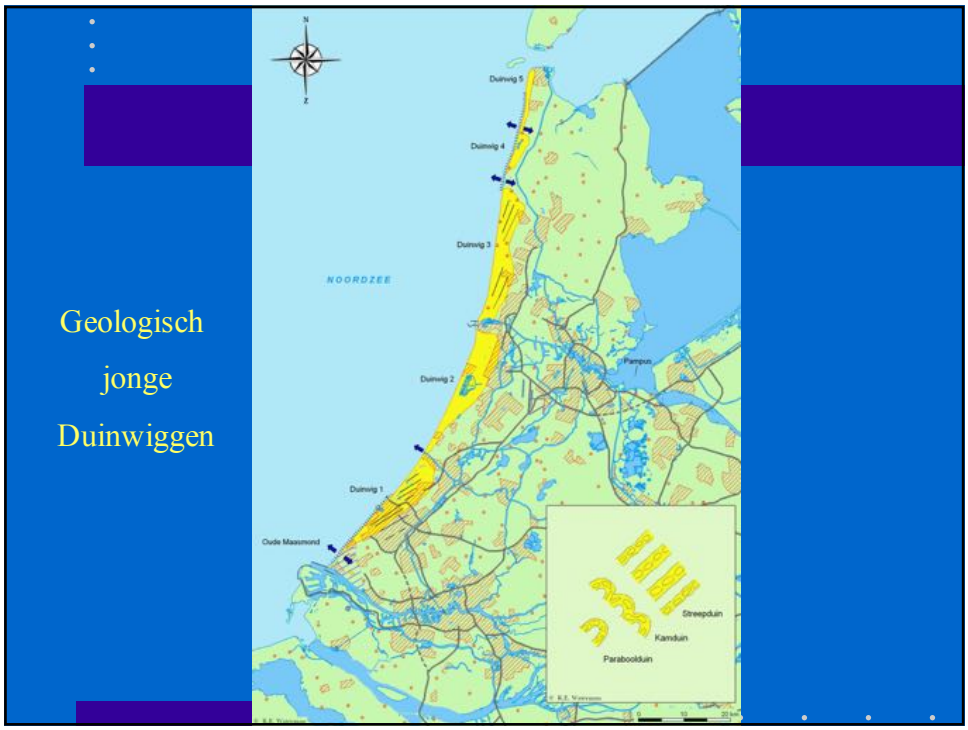

TOWARDS AN INTEGRATED COASTAL POLICY FOR ZUID-HOLLAND
PLAN 1 ANNO 2015 with current Kijkduin & Scheveningen
MAY 1980 - AUG 2015
© R.E. WATERMAN
LEGEND
TOPOGRAPHIC MAP
DEN HAAG
DELFT
EURO MAAS CHANNEL
MAASVLAKTE


TOWARDS AN INTEGRATED COASTAL POLICY FOR ZUID-HOLLAND
PLAN 1 ANNO 2015
TOPOGRAPHIC MAP
MAY 1980 - AUG 2015
© R.E. WATERMAN
LEGEND
DEN HAAG
DELFT
EURO MAAS CHANNEL
MAASVLAKTE


TOWARDS AN INTEGRATED COASTAL POLICY FOR ZUID-HOLLAND
PLAN 1 G.R.E. WATERMAN TOPOGRAPHIC MAP MAY 1980 - AUG 2015
LEGEND
NORTH SEA
DEN HAAG
DELFT

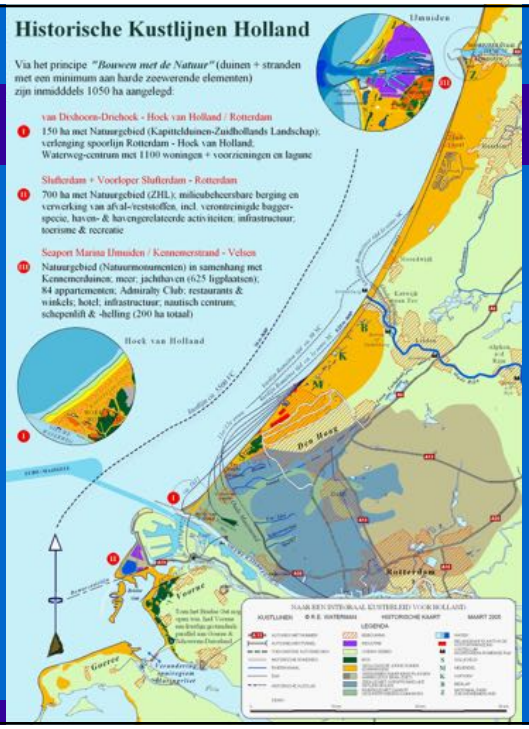

North Sea
beach
primary dune
recreation area
secundary dune
present dune
greenhouse area
+14 m
+4 m
N.A.P
sea defail
suppletion
New Land
Old Land
CROSS SECTION B-B
DETAIL CROSS SECTION B-B
building site
Dunsloo
CROSS SECTION A-A
CROSS SECTIONS PLAN 1
WL / DELFT HYDRAULICS


Super Eco-Blocks on a slope.
Special staircase profile to retain water.
Eco-Blocks
berm
prolonged residence
cover with varied rock fill size
space for water and islands
Reef blocks:
Concrete blocks or stone for landfill
reef eco-structures
(Pipes, cracks, cavities, etc.)
Concrete blocks
Biodiversity in and between the various tidal zones. Each zone with their specific type of species.
A = supra littoral zone (above tidal zone)
B = eu littoral zone (in tidal zone)
C = sub littoral zone (below tidal zone)
ECO DAM / ECO DIJK
Eco X-block
Concrete eco elements
after 6 months


Geologisch
jonge
Duinwiggen
N
Z
Duinwig 5
Duinwig 4
Duinwig 3
NOORDZEE
Duinwig 2
Duinwig 1
Oude Maasmond
Pampus
Streepduin
Kamduin
Paraboolduin

Historische kustlijn Delfland

Historische kustlijnen Holland



BOUWEN MET DE NATUUR PLAN 1

Muistromen langs de hoofden veroorzaken aflandig zandtransport !

1985

DELFLANDSE KUST , MET 69 DELFLANDSE HOOFDEN

ZUID-HOLLANDSE KUST OP ZIJN SMALST BIJ TER HEIJDE 16-3-1981

BOUWEN MET DE NATUUR PLAN 1

16-3-1981

EERSTE GEREALISEERDE SEGMENT VAN PLAN 1, BIJ HOEK VAN HOLLAND

BOUWEN MET DE NATUUR Plan 1

Toekomstige Ecodome in de nieuwe duinen bij Monster

BOUWEN MET DE NATUUR Plan 1

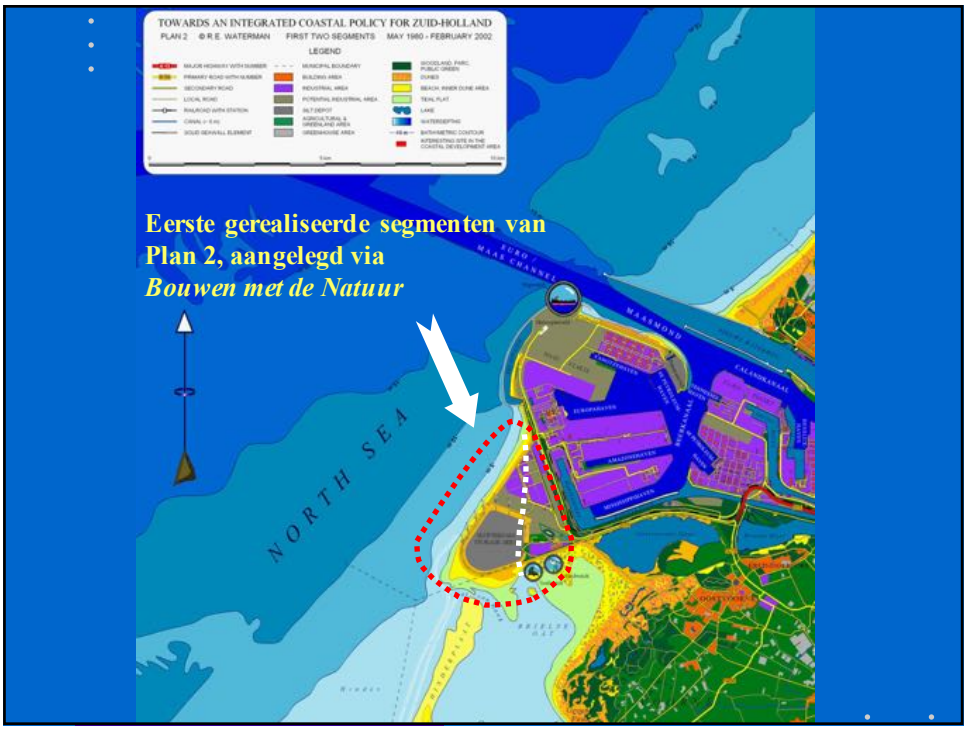
Toekomstige getijdenlagune bij Hoek van Holland

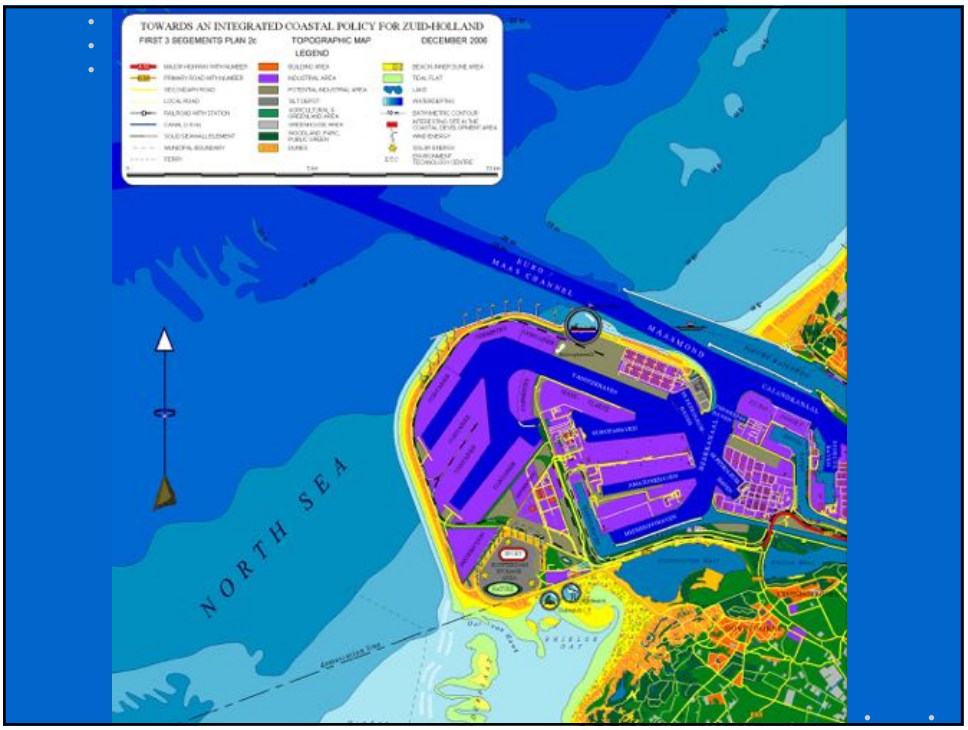
BOUWEN MET DE NATUUR Plan 1

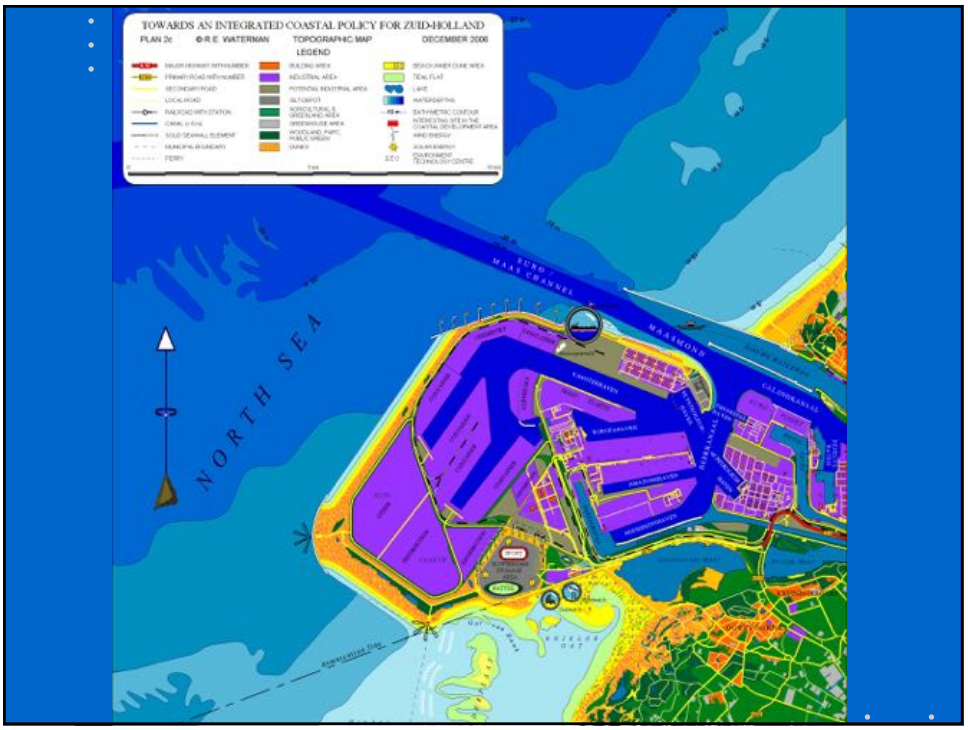
Mogelijke kustontwikkeling met buitenhaven bij Scheveningen

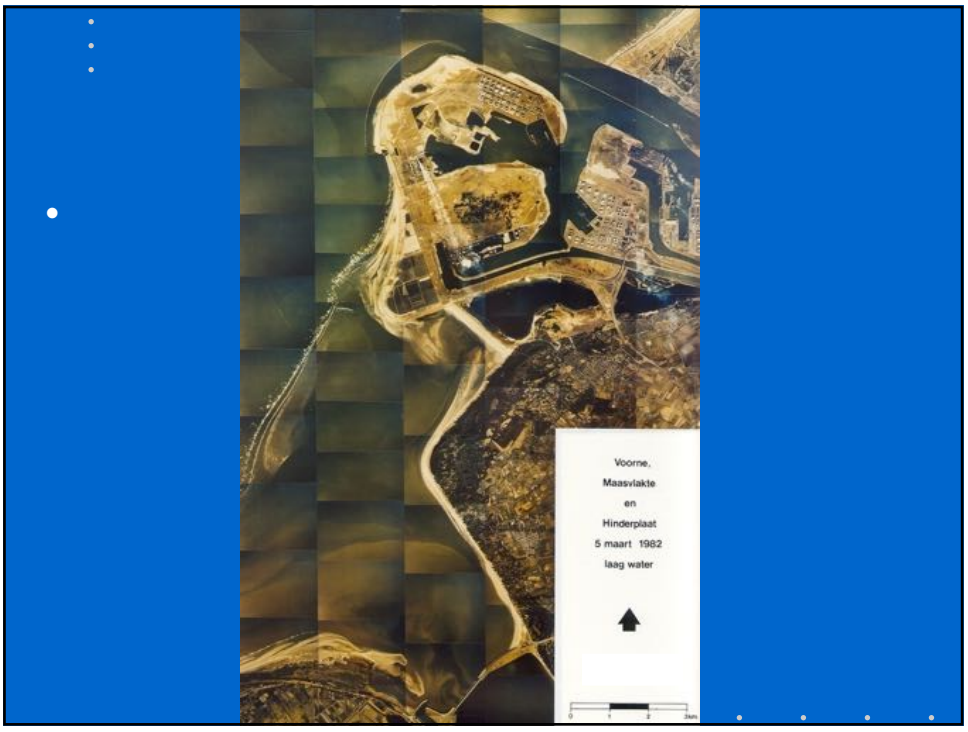

Plan A
Land reclamation via Building with Nature® along North Sea Coast
The Netherlands
Plan 4
Plan 3
Plan 6
Plan 1
Plan 2
Integrated Coastal Policy via Building with Nature®


Voorne,
Maasvlakte
en
Hinderplaat
5 maart 1982
laag water


TOWARDS AN INTEGRATED COASTAL POLICY FOR ZUID-HOLLAND
PLAN 2 © R.E. WATERMAN FIRST TWO SEGMENTS MAY 1980 - FEBRUARY 2002
LEGEND
Eerste gerealiseerde segmenten van
Plan 2, aangelegd via
Bouwen met de Natuur
NORTH SEA


TOWARDS AN INTEGRATED COASTAL POLICY FOR ZUID-HOLLAND
FIRST 3 SEGEMENTS PLAN 2c TOPOGRAPHIC MAP DECEMBER 2006
LEGEND
NORTH SEA


TOWARDS AN INTEGRATED COASTAL POLICY FOR ZUID-HOLLAND
PLAN 2c
© R.E. WATERMAN
TOPOGRAPHIC MAP
DECEMBER 2000
LEGEND
NORTH SEA
MAASMOND


Voorne,
Maasvlakte
en
Hinderplaat
5 maart 1982
laag water

BOUWEN MET DE NATUUR PLAN 2

22-3-1991

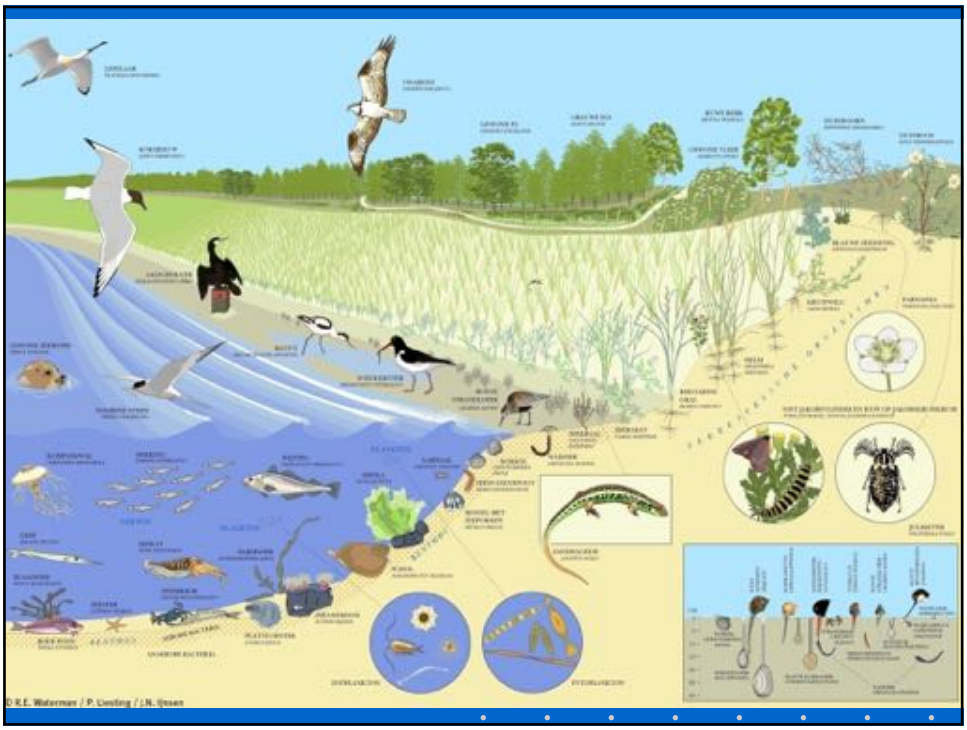
EERSTE GEREALISEERDE SEGMENTEN VAN PLAN 2

BOUWEN MET DE NATUUR PLAN 2

17-8-2000

EERSTE GEREALISEERDE SEGMENTEN VAN PLAN 2


Euroklei-bakstenen uit havenslib
Vliegas van kolengestookte elektriciteitscentrale
Vliegas en vuilverbrandingsinstallatie
Aardelite©, kunstgrind
Eco-grind©, kunstgrind
Aardelite©, kunstgrind in betonprodukten



BUILDING WITH NATURE Plan 2

Parnassia

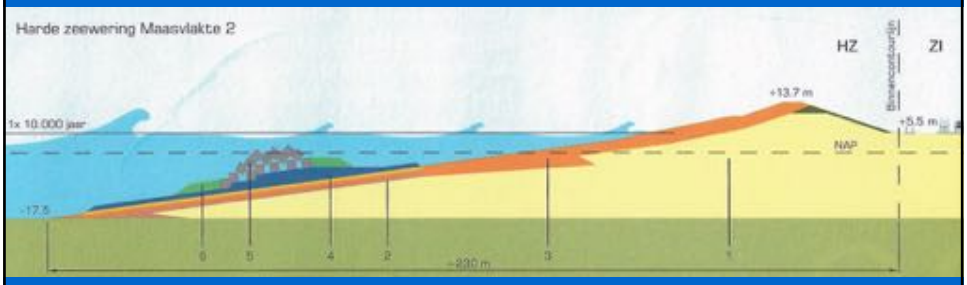
Euphorbia Maritima


Sand Engine
August 2011
Cakile
Maritima


BUILDING WITH NATURE
Plan 2
Lacerta Agilis

CONTOUR MAASVLAKTE 2 (RIJNVLAKTE)

3,5 km harde constructie; 7,5 km zeewerend duin



1 Zand onderste laag ca. 150 µm; bovenste laag min. 370 µm
2 Filterlaag grind onder blokkendam 0,3 - 35 mm
3 Keienlaag 1 m dik onder blokkendam tot 4 m dik op stenig duin, diameter cobbles 20 – 135 mm
4 Breuksteen, stenen 150 – 800 kg met onderlaag stenen 5 – 70 kg
5 Betonblokken (17.000 stuks - 2,5 x 2,5 x 2,5 m - 40 à 43 ton) over 3,5 km kustlengte
6 Teenconstructie met stenen van 1 – 10 ton ter voorkoming van wegglijden betonblokken


Plan A
Land reclamation via Building with Nature® along North Sea Coast
The Netherlands
Plan 4
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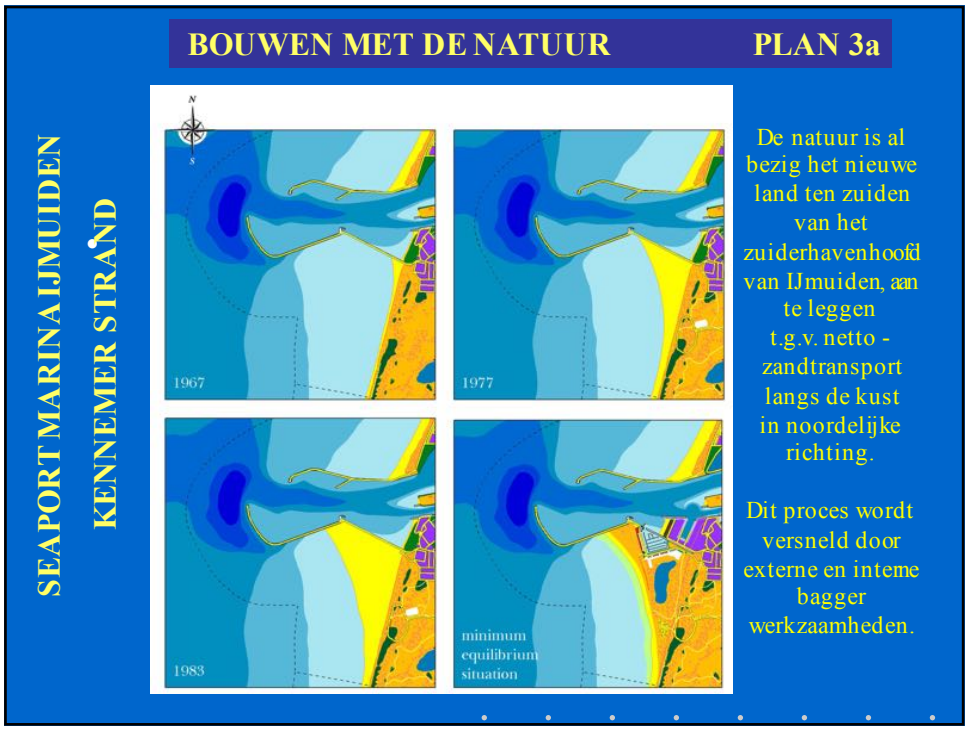
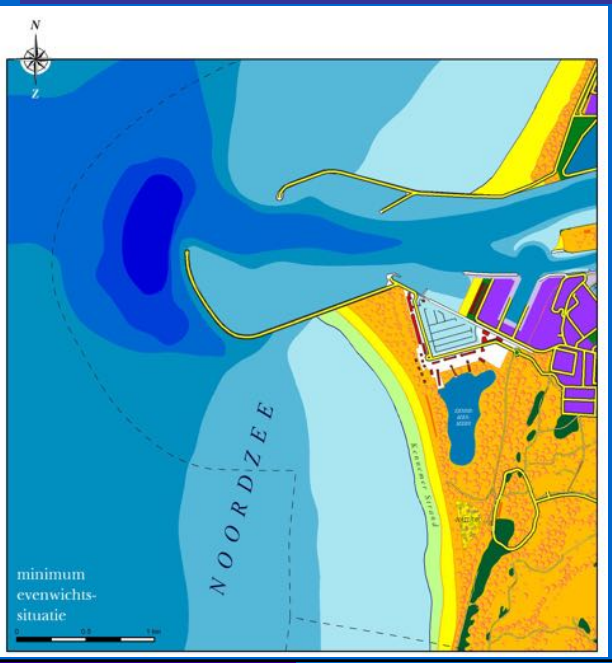
Plan 6
Plan 1
Plan 2
Integrated Coastal Policy via Building with Nature®


BOUWEN MET DE NATUUR
PLAN 3a
SEAPORT MARINA IJMUIDEN
KENNEMER STRAND
1967
1977
1983
minimum equilibrium situation
De natuur is al bezig het nieuwe land ten zuiden van het zuiderhavenhoofd van IJmuiden, aan te leggen t.g.v. netto - zandtransport langs de kust in noordelijke richting.
Dit proces wordt versneld door externe en interne bagger werkzaamheden.

SEAPORT MARINA IJMUIDEN
KENNEMER STRAND

BOUWEN MET DE NATUUR PLAN 3a



Plan 3a is driehoekig en bestaat uit een zeewerend duin met een marina, dubbele boulevard, apartementen, restaurants & winkels, hotel, infrastructuur, recreatie en toerisme; overgangszone met meer & natuurgebied verbonden met het bestaande Nationaal Park Zuid - Kennemerland

BOUWEN MET DE NATUUR Plan 3a

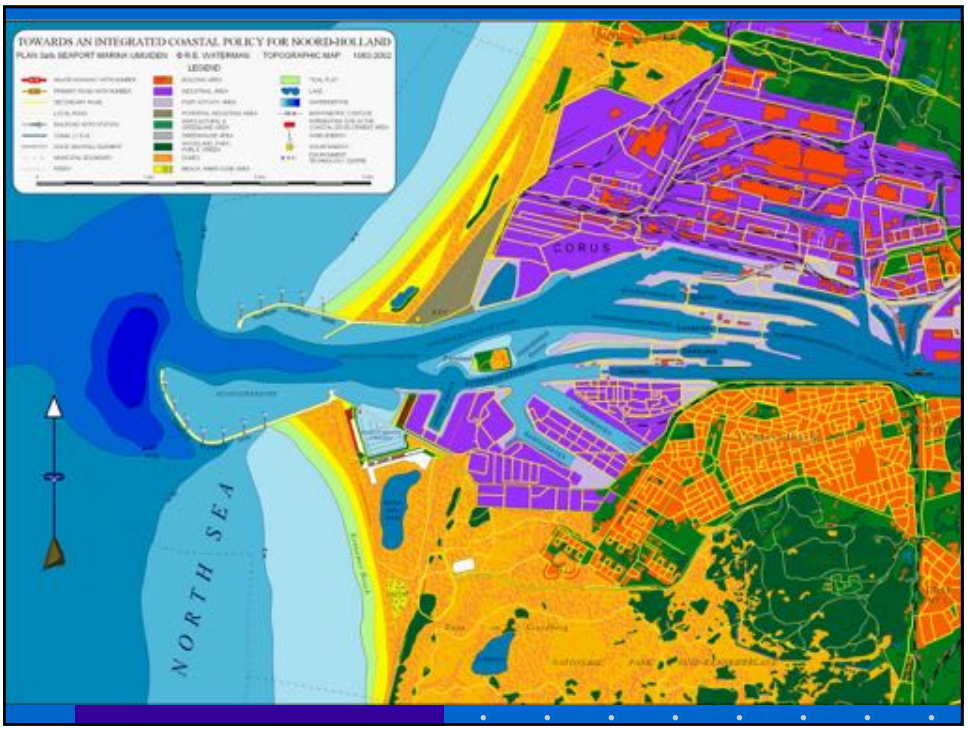
10 -7-1997

Plan 3a. Compleet met zeewerend duin, stranden, marina, boulevard, apartementen, restaurants & winkels, hotel, infrastructuur, meer & natuurgebied.

BOUWEN MET DE NATUUR Plan 3a

Juni 2000

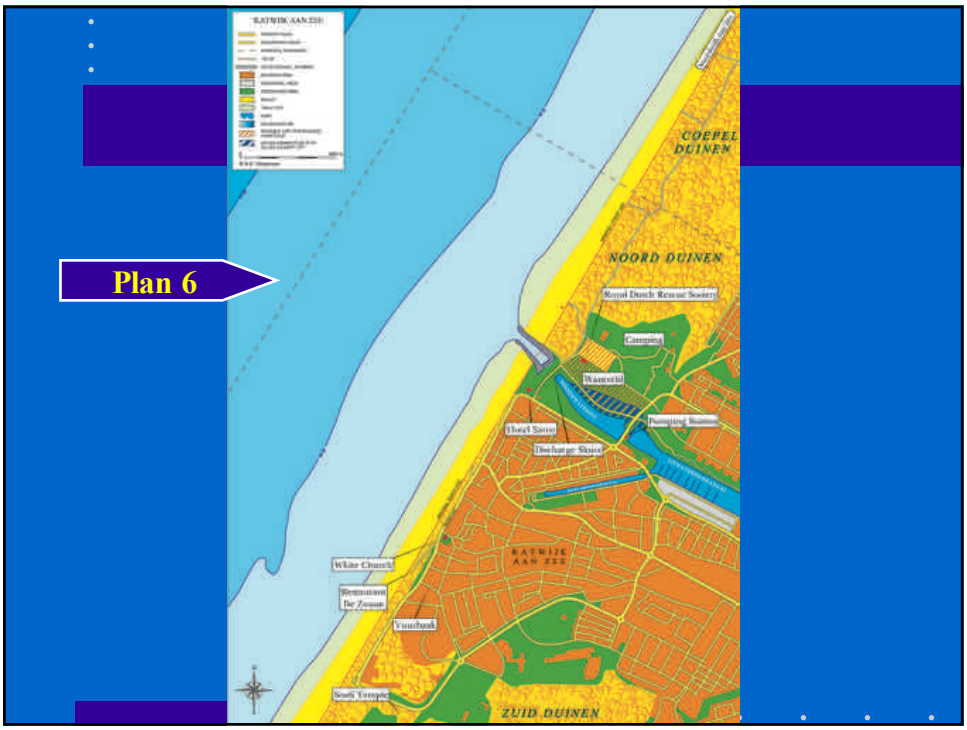
Plan 3a. Compleet met zeewerend duin, stranden, marina, boulevard, apartementen, restaurants & winkels, hotel, infrastructuur, meer & natuurgebied.




BOUWEN MET DE NATUUR
PLAN 3a
2012


Plan A
Land reclamation via Building with Nature® along North Sea Coast
The Netherlands
Plan 4
Plan 3
Plan 6
Plan 1
Plan 2
Integrated Coastal Policy via Building with Nature®


Plan 6.
Katwijk aan Zee
COEPEL DUINEN
NOORD DUINEN
NORTH SEA
ZUID DUINEN
KATWIJK AAN ZEE
Seaport Marina with dune widening on each side for Katwijk & Noordwijk
Future connection with Old Rhine River with sluice or boat conveyor


Plan 6
COEPEL DUINEN
NOORD DUINEN
ZUID DUINEN
KATWIJK AAN ZEE

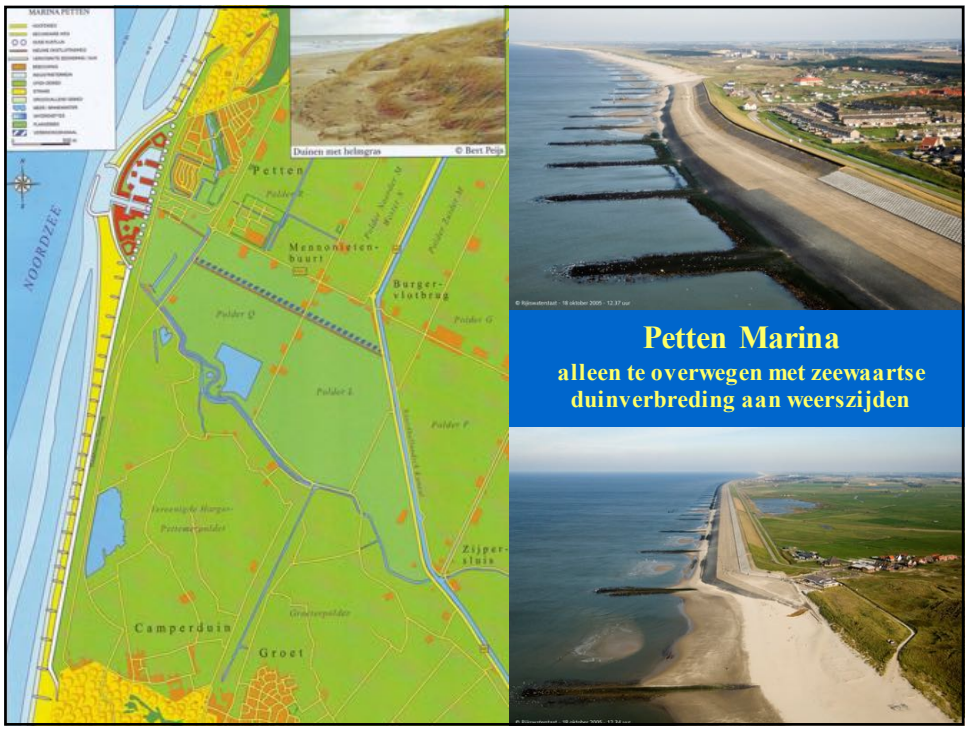
Plan 6. Katwijk aan Zee 2008

Plan 6. Katwijk aan Zee 2015

Dune with underground park incorporated

Plan 6.
Katwijk aan Zee


Kustontwikkeling
PLAN 4
NOORDZEE
PLAN MARINA PETTEN
PLAN 3A + 3B
BUITEN- EN BINNENWAARTSE KUSTONTWIKKELING NOORD-HOLLAND
Noord-Holland
KUSTONTWIKKELING
IJmuiden
Petten
Noorderhaaks


MARINA PETTEN
Duinen met helmgras
© Bert Peija
Petten
Mennonieten-buurt
Burger-vlotbrug
NOORDZEE
Camperduin
Groet
Zijper-sluis
Petten Marina
alleen te overwegen met zeewaartse duinverbreding aan weerszijden

Westerschelde Container Terminal met natuurontwikkelingsgebieden aan weerszijden

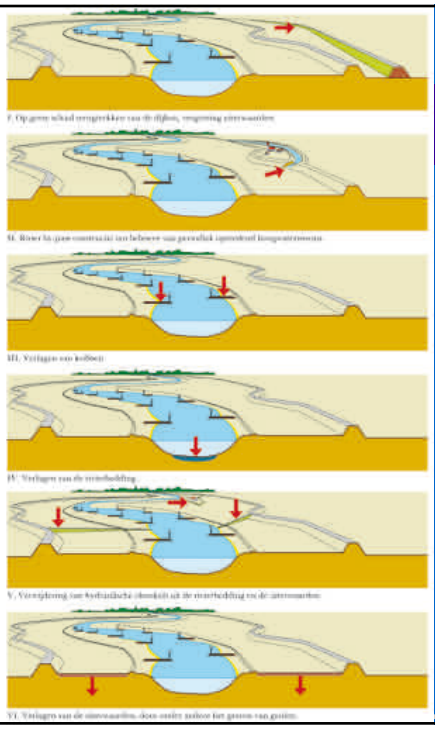
Sluis / Retranchement / Cadzand –Bad

Doorlopende waterverbinding Sluis —Cadzand-Bad
met zeesluis Cadzand, jachthaven Sluis
en natuurontwikkelingsgebieden

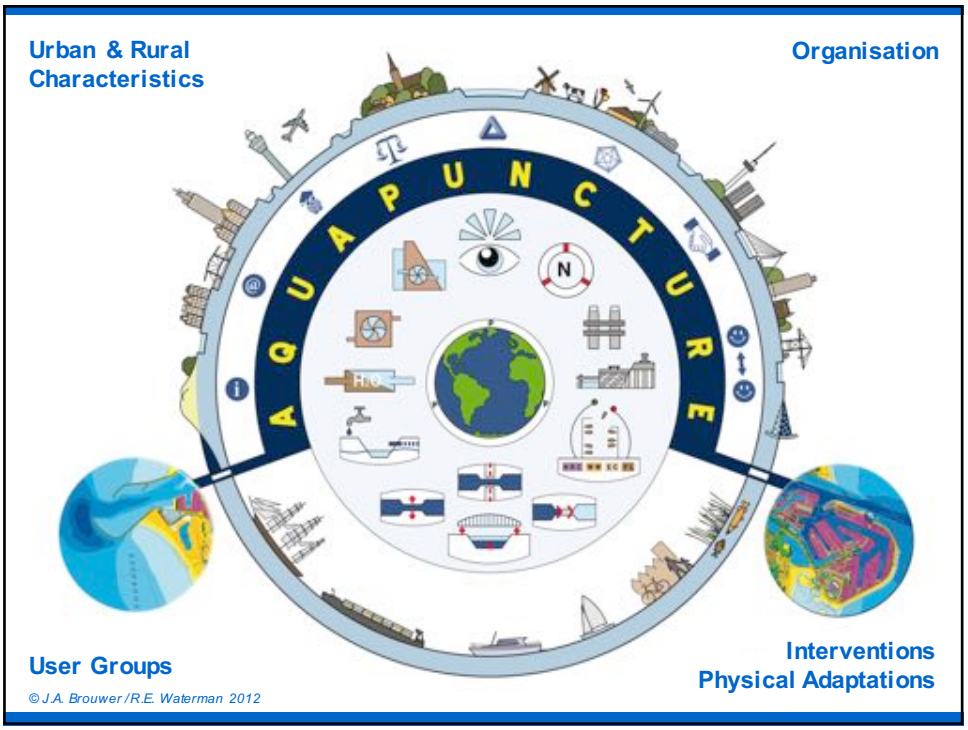
Ruimte voor de Kust - Levende Kusten

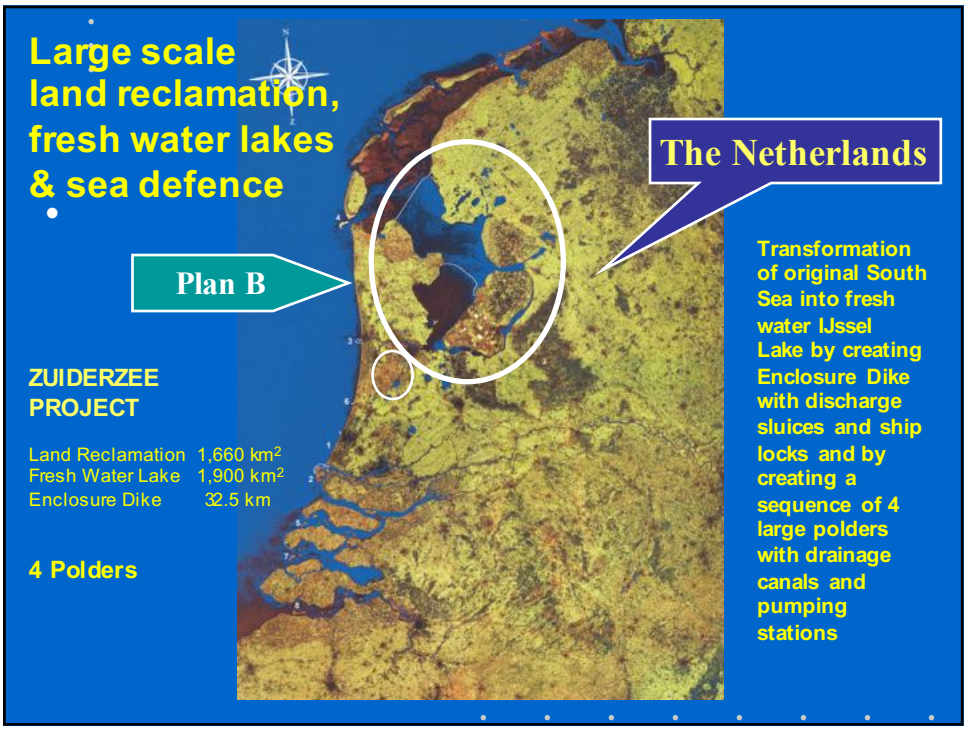
Ruimte voor de Rivier – Levende Rivieren

Levende Meren en Estuaria

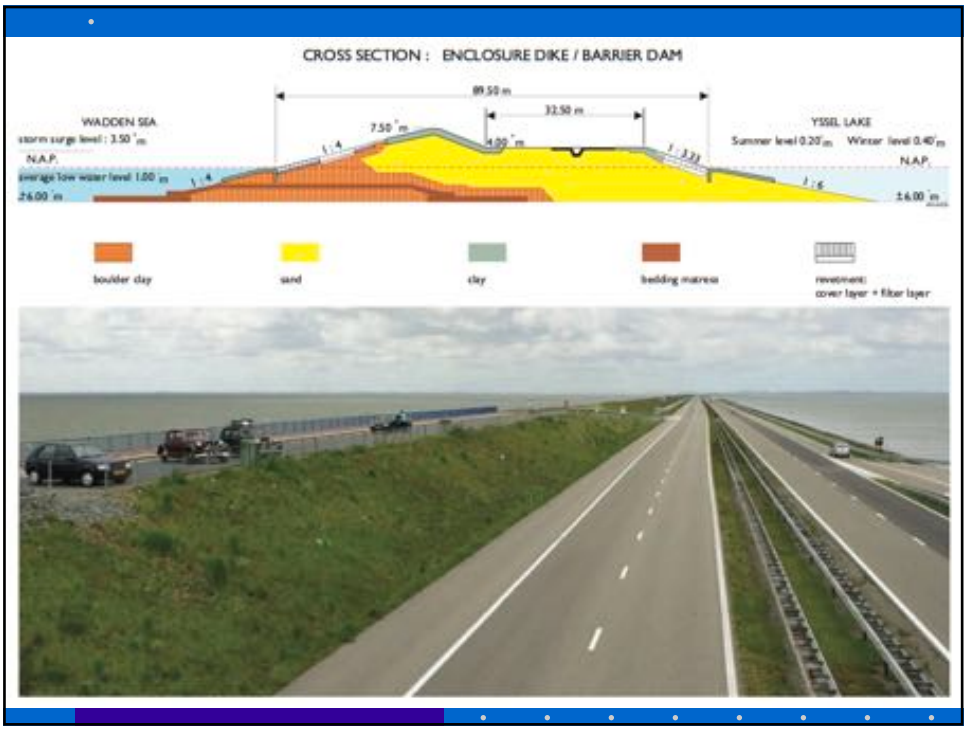


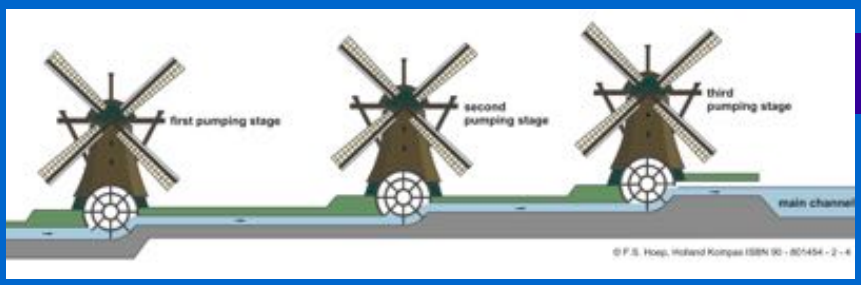
Ruimte voor de Rivier - Levende Rivieren


Urban & Rural Characteristics
Organisation
AQUAPUNCTURE
User Groups
Interventions Physical Adaptations
© J.A. Brouwer / R.E. Waterman 2012


Large scale land reclamation, fresh water lakes & sea defence
The Netherlands
Plan B
ZUIDERZEE PROJECT
Land Reclamation 1,660 km²
Fresh Water Lake 1,900 km²
Enclosure Dike 32.5 km
4 Polders
Transformation of original South Sea into fresh water IJssel Lake by creating Enclosure Dike with discharge sluices and ship locks and by creating a sequence of 4 large polders with drainage canals and pumping stations

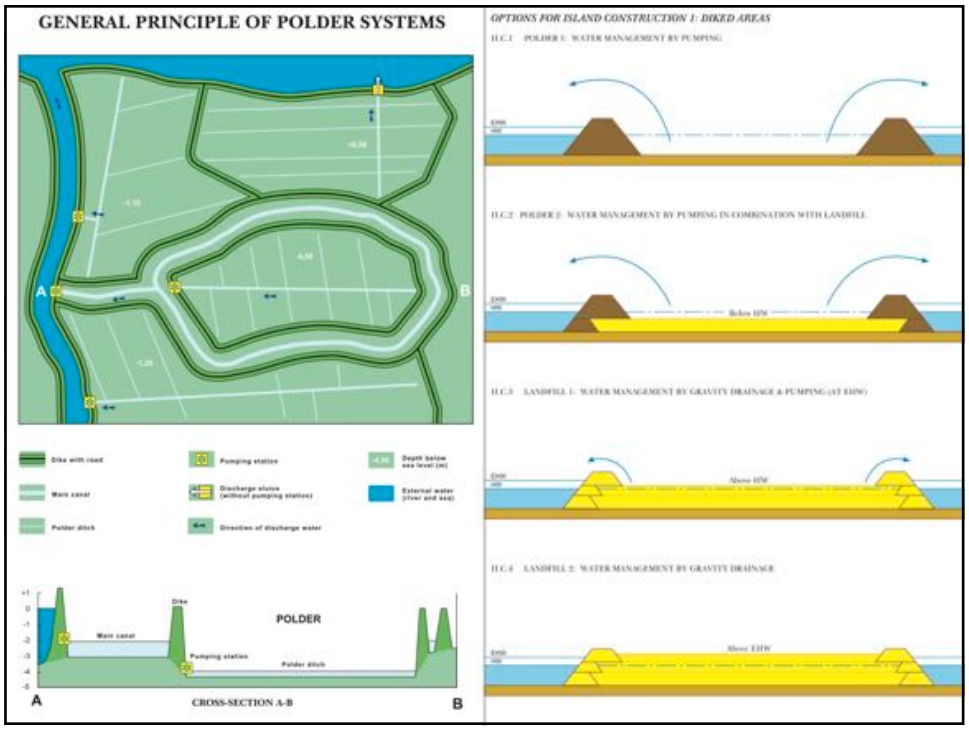

WADDEN SEA
Een volk dat leeft
bouwt
aan zijn toekomst


CROSS SECTION : ENCLOSURE DIKE / BARRIER DAM
WADDEN SEA
YSSEL LAKE
N.A.P.
boulder clay
sand
clay
bedding matress



Period of creation	Name of Polder	Area	Pumping Stations		Initially pumped out	Maintenance pumping
			number	power		
		hectares	x	MW	10^6 m³	10^6 m³/yr
1927-1932	Wieringermeer Polder	20,000	2	3.28	700	160
1937-1942	North East Polder	48,000	3	6.10	1500	400
1950-1957	East Flevoland	54,000	3	5.94	1600	800
1959-1968	South Flevoland	43,000	1	3.53	1400	

Land-Use in %	Wieringermeer Polder	North East Polder	East Flevoland	South Flevoland
Agriculture	87	87	75	50
Nature (incl. woodland & marshland)	3	5	11	18
Cities	1	1	8	25
Dikes, roads, water	9	7	6	7


GENERAL PRINCIPLE OF POLDER SYSTEMS
OPTIONS FOR ISLAND CONSTRUCTION 1: DIKED AREAS
POLDER
CROSS-SECTION A-B


LAKE IJ BETWEEN AMSTERDAM AND MARKER EYE
MARKER EYE
LAKE IJ
LEVENDE MEREN
Multifunctionele
eilanden
tussen Almere
&
Holland Waterland
Terrestrische
&
Aquatische natuurwinst
Separatie
IJmeer - Markermeer

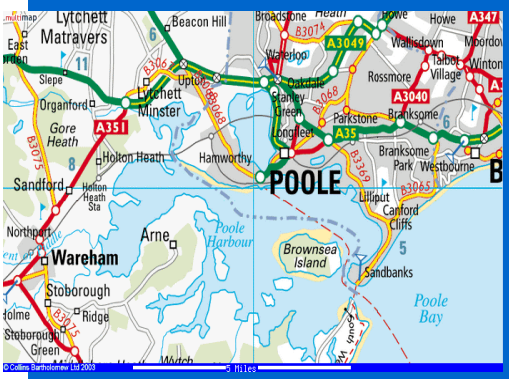
SCHETSPLAN WATERLELY EN UITBREIDING SPUICAPACITEIT

LEVENDE MEREN

WATERLELY
Dijk- & Vooroever aanpassingen
Uitbreiding spuicapaciteit
Overgang zout – zoet
Aanpassing sluizen
Getijdencentrale

BLAUWE ENERGIE
Benutting zoutgradient zeewater – zoetwater m.b.v. Ion–specifieke membranen

BOUWEN MET DE NATUUR



Engeland, Poole

Engeland, Poole Vóór de landaanwinst

Engeland, Poole Tijdens de landaanwinst

Engeland, Poole Na voltooiing van de landaanwinst

BOUWEN MET DE NATUUR

Engeland, Skegness

Engeland, Lincshore, Skegness

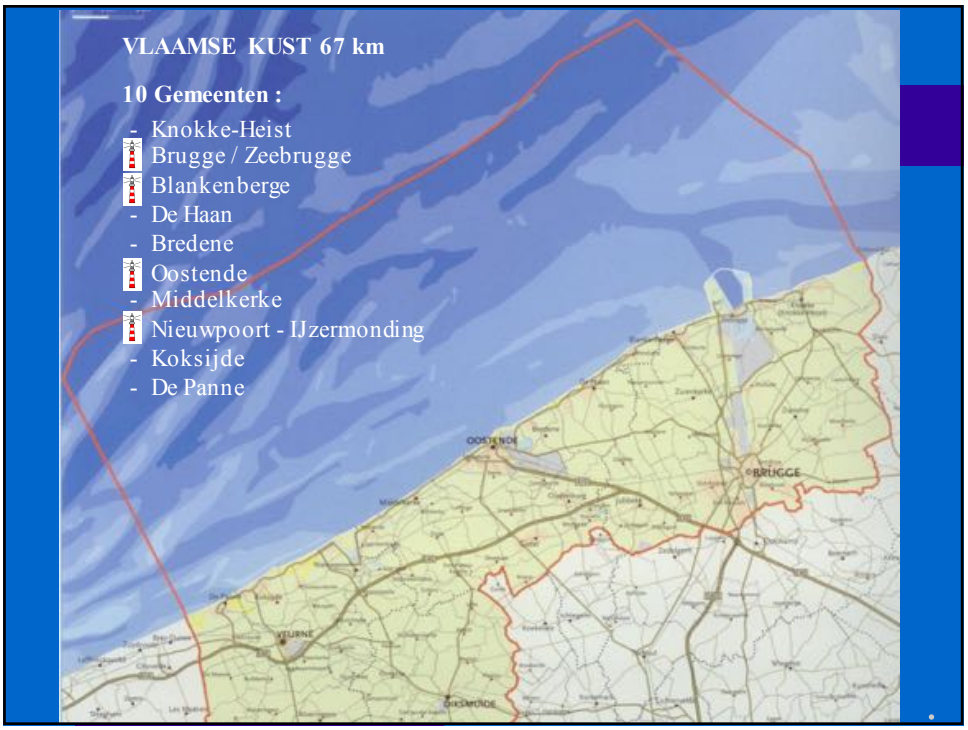
Strandverbreding en ophoging

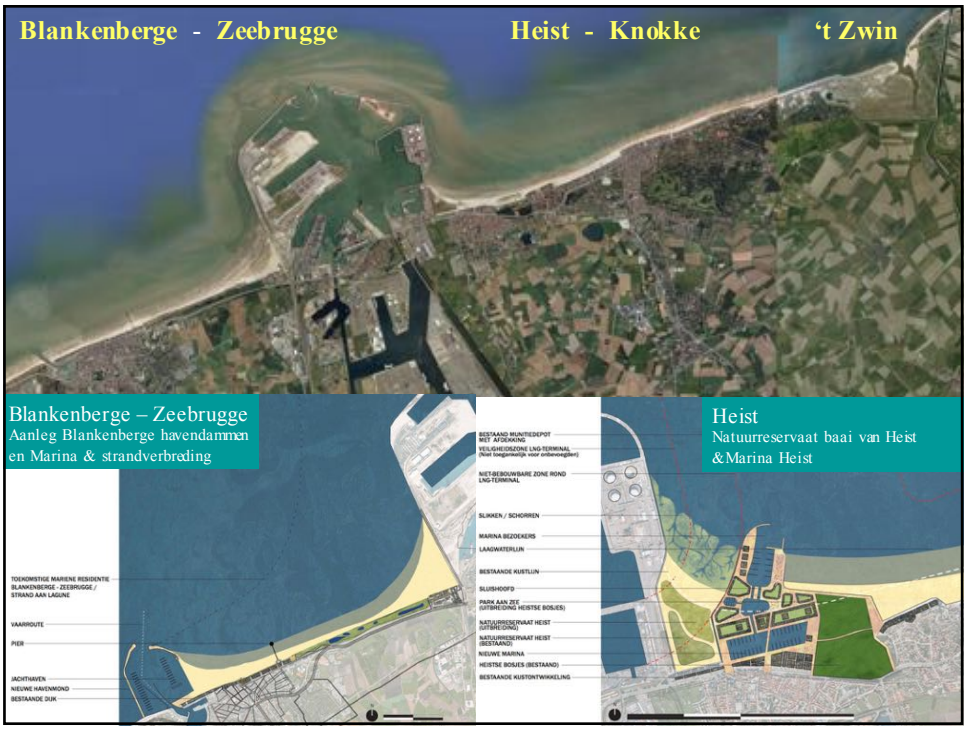
Engeland, Lincshore, Skegness

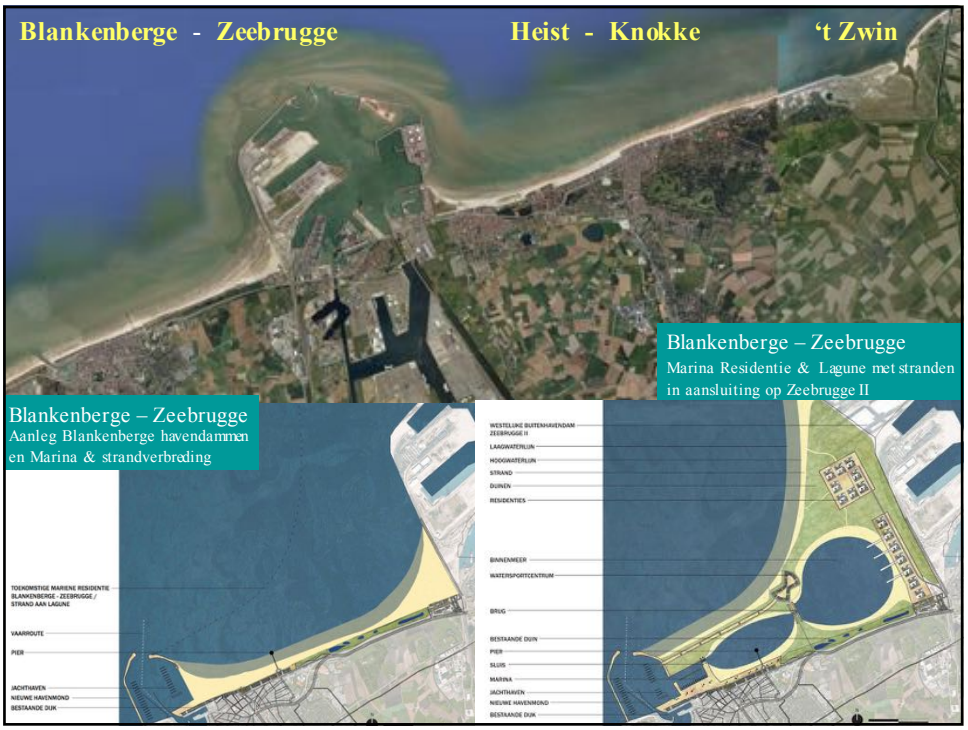
Strandverbreding en ophoging


Amager Beach Park - Copenhagen - Denmark
3 – COASTLINE PROJECT WITH ISLAND & LAGOON
WATERFRONT DEVELOPMENTS IN HARMONY WITH NATURE


BOUWEN MET DE NATUUR
Vlaamse Baaien
Veilig, natuurlijk, aantrekkelijk, duurzaam, ontwikkelend
Van een smalle, harde naar een brede, zachte kust


VLAAMSE KUST 67 km
10 Gemeenten :
- Knokke-Heist
Brugge / Zeebrugge
Blankenberge
- De Haan
- Bredene
Oostende
- Middelkerke
Nieuwpoort - IJzermonding
- Koksijde
- De Panne
OOSTENDE
BRUGGE
VEURNE
DIKSMUIDE


Blankenberge - Zeebrugge
Heist - Knokke
't Zwin
Blankenberge – Zeebrugge
Aanleg Blankenberge havendammen
en Marina & strandverbreding
Heist
Natuurreservaat baai van Heist
&Marina Heist


Blankenberge - Zeebrugge
Heist - Knokke
't Zwin
Blankenberge – Zeebrugge
Marina Residentie & Lagune met stranden
in aansluiting op Zeebrugge II
Blankenberge – Zeebrugge
Aanleg Blankenberge havendammen
en Marina & strandverbreding

Oostende Buitenhaven

Verlenging havenhoofden.
Buitenhaven met Marina.
Duin-strand verbreding met
Resorts & voorzieningen.
Nieuwe Pier met Casino

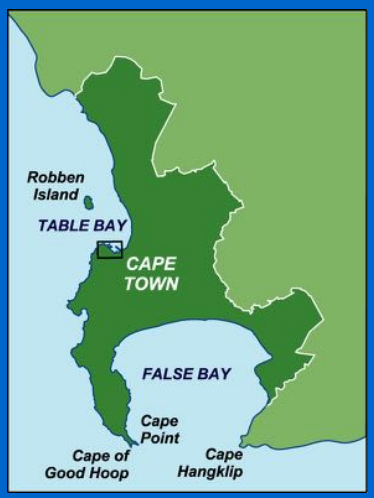
Nieuwpoort

Bestaande Jachthaven
met 1800 ligplaatsen

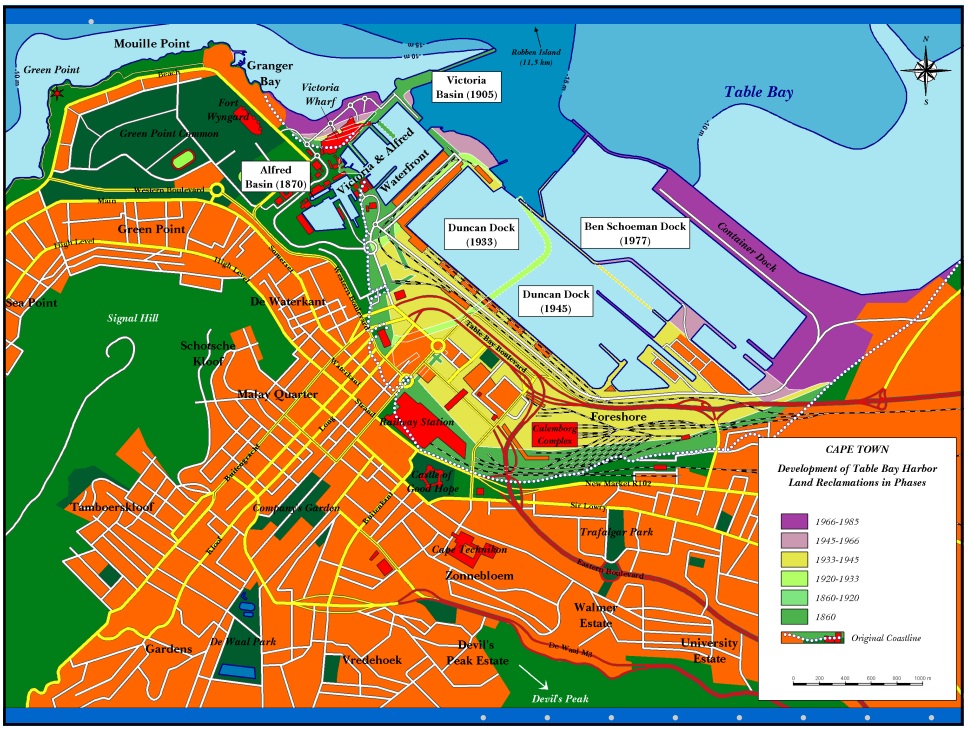
BOUWEN MET DE NATUUR

AFRIKA

BOUWEN MET DE NATUUR



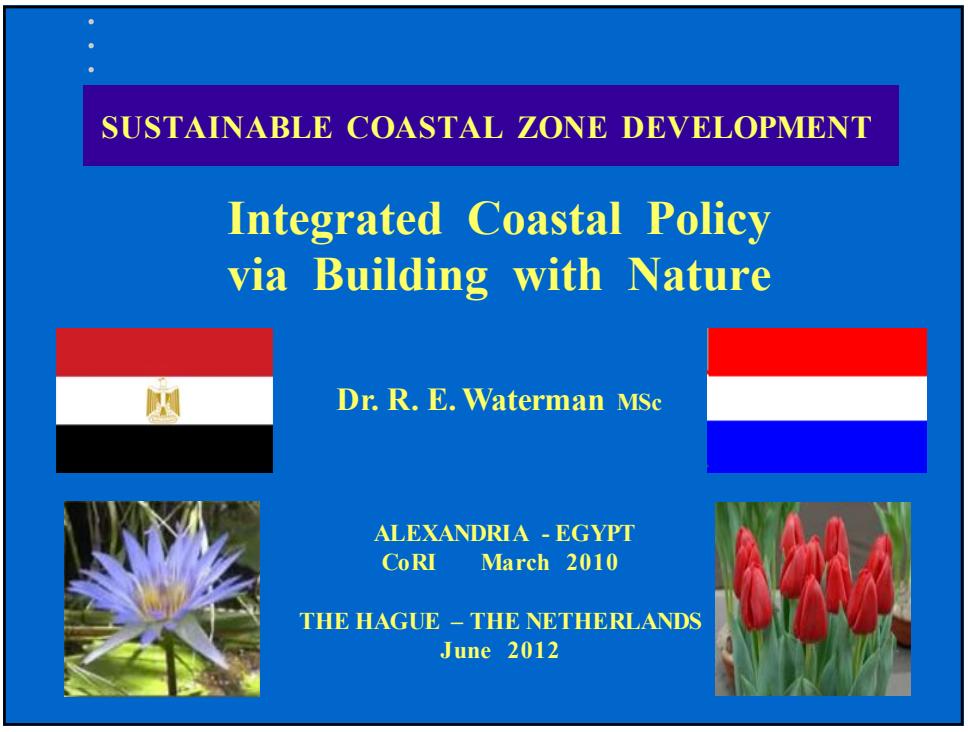

BOUWEN MET DE NATUUR
Kaapstad

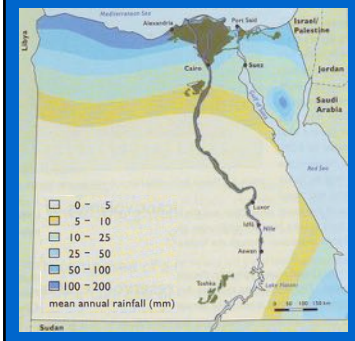

Mouille Point
Green Point
Granger Bay
Victoria Wharf
Victoria Basin (1905)
Robben Island (11.5 km)
Table Bay
Fort Wynyard
Green Point Common
Alfred Basin (1870)
Victoria & Alfred Waterfront
Duncan Dock (1933)
Ben Schoeman Dock (1977)
Container Dock
Green Point
Duncan Dock (1945)
Sea Point
De Waterkant
Signal Hill
Schotsche Kloof
Malay Quarter
Foreshore
Culemborg Complex
Cape Town Holiday Station
Table Mountain
Tamboerskloof
Company's Garden
Trafalgar Park
Cape Technikon
Zonnebloem
Walmer Estate
University Estate
Gardens
De Waal Park
Vredehoek
Devil's Peak Estate
Devil's Peak
CAPE TOWN
Development of Table Bay Harbor Land Reclamations in Phases
1966-1985
1945-1966
1933-1945
1920-1933
1860-1920
1860
Original Coastline

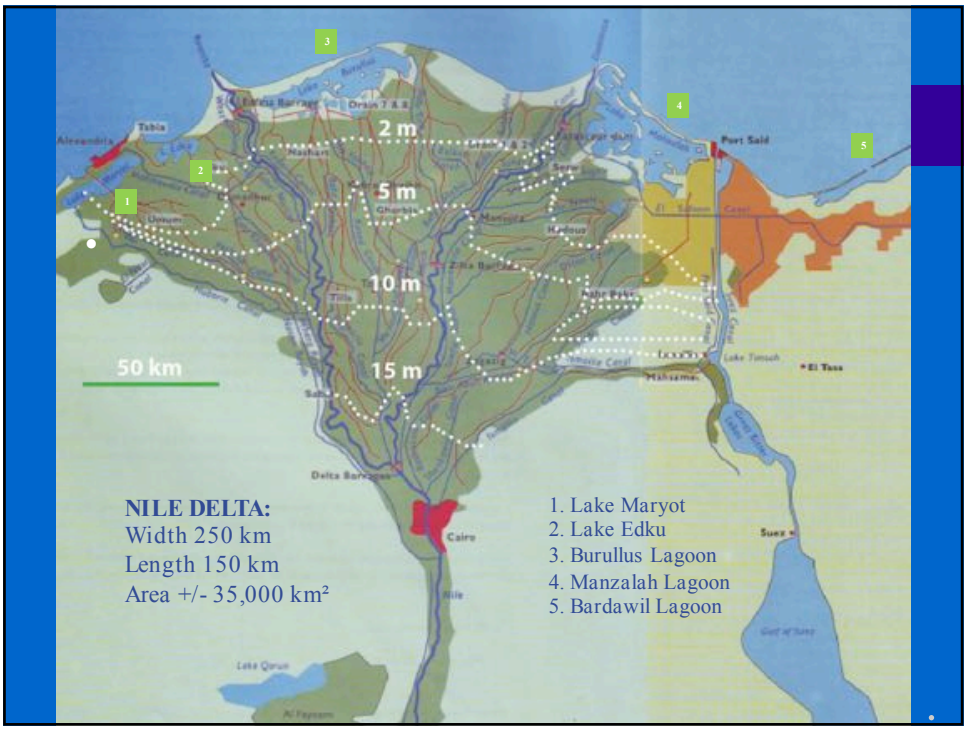
BOUWEN MET DE NATUUR

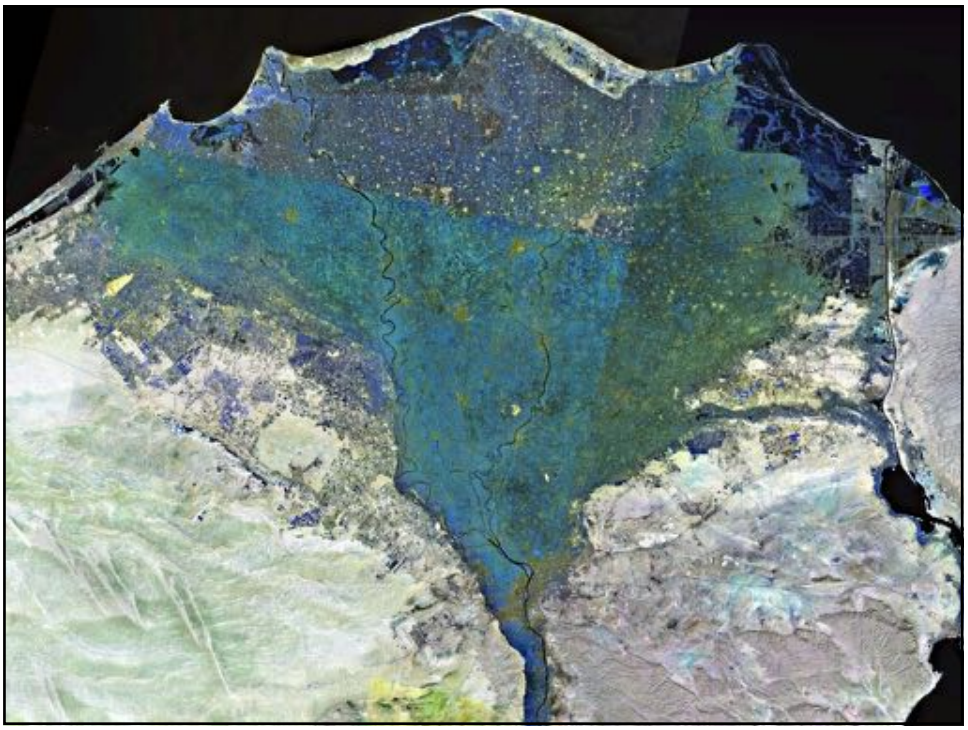
Kaapstad, ZUID - AFRIKA


TUNESIA - SFAX
LANDAANWINNING ONTWERP


SUSTAINABLE COASTAL ZONE DEVELOPMENT
Integrated Coastal Policy
via Building with Nature
Dr. R. E. Waterman MSc
ALEXANDRIA - EGYPT
CoRI March 2010
THE HAGUE – THE NETHERLANDS
June 2012

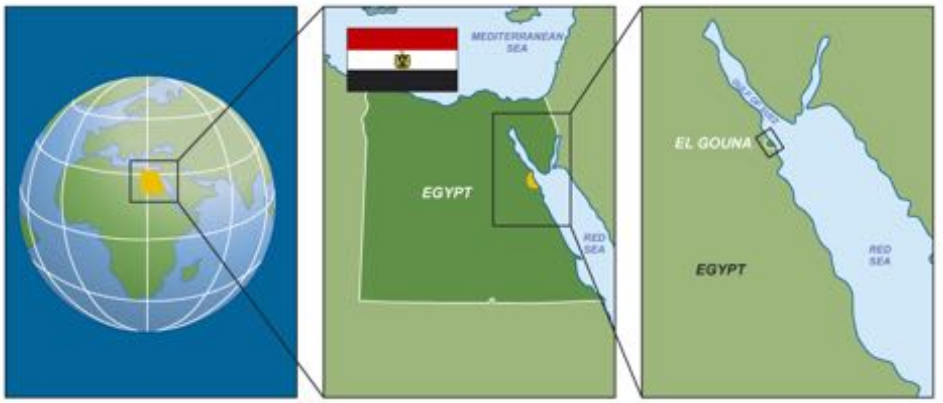
ARAB REPUBLIC OF EGYPT جمهورية مصر العربية		THE NETHERLANDS
	SURFACE AREA	
	1,010,000 km² 41,500 km²	
	**INHABITANTS** 82 million 16.7 million **COASTAL LENGTH** 1,200 km M. Coast 353 km 2,300 km R.S. Coast **MAIN RIVER**	
	Nile 6,650 km 5,100 m³/s Rhine 1,320 km 2,330 m³/s	
1.Cairo 8,5 million 1.Cairo m.a. 20 million 2. Alexandria 4,5 million 6. Port Said 0,6 million 7. Suez 0,5 million	**LARGEST CITIES**	1. Amsterdam 0,8 million 2. Rotterdam 0,6 million 3. The Hague 0,5 million 4. Utrecht 0,3 million 5. Rim City Holland 8,0 million





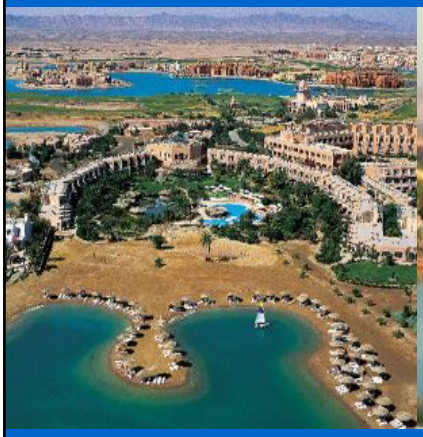

Alexandria
Tabia

El Gouna


MEDITERRANEAN SEA
EGYPT
RED SEA
EL GOUNA
EGYPT
RED SEA


Red Sea
New Nubia
Nubia
Kafr El Gouna
El Bahad
Thebes II
Golf course
Avaris I
Buto III
Memphis IV
EL GOUNA
Land reclamations
Sandbank
Golf course

El Gouna

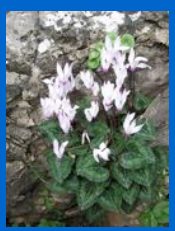


SUSTAINABLE COASTAL ZONE DEVELOPMENT

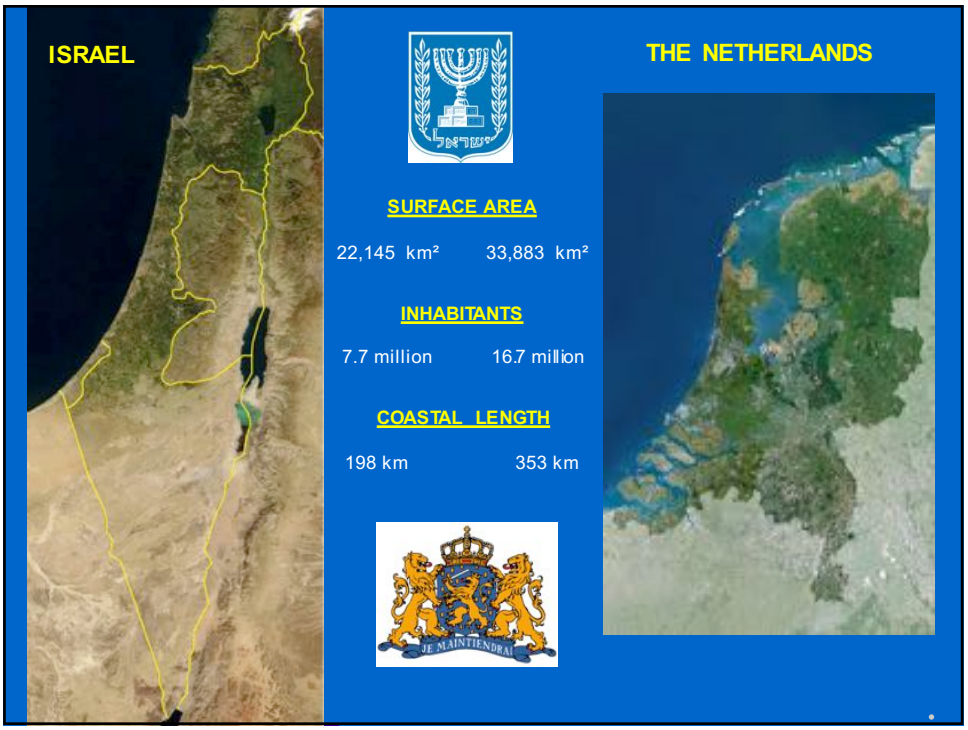
Integrated Coastal Policy via Building with Nature®

Prof. Dr. R.E. Waterman MSc

ISRAEL - Tel Aviv

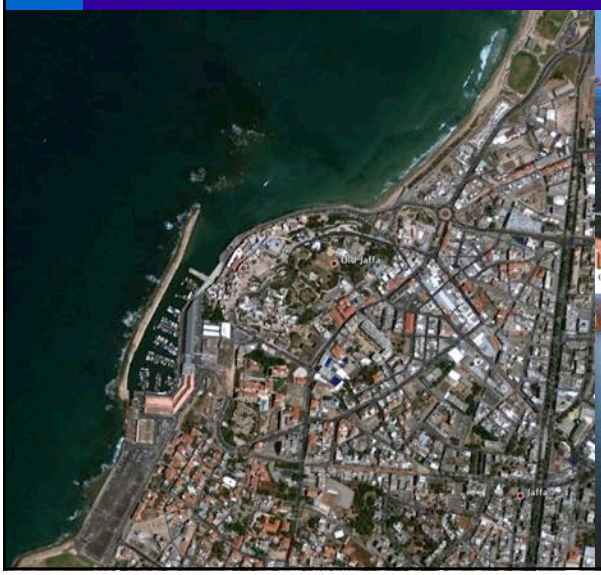


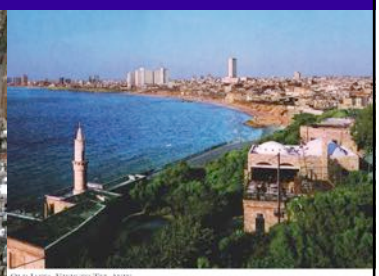
Coastal Extentions & Airport


ISRAEL
THE NETHERLANDS
SURFACE AREA
22,145 km²
33,883 km²
INHABITANTS
7.7 million
16.7 million
COASTAL LENGTH
198 km
353 km
JE MAINTIENDRAI

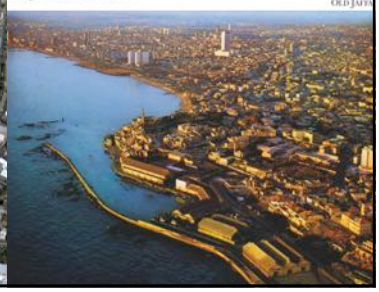

Tel Aviv - Jaffa
CYPRUS
LEBANON
SYRIA
MEDITERRANEAN SEA
ISRAEL
JORDAN
EGYPT
SAUDI ARABIA
HERZLIYA
RAMAT HASHARON
TEL AVIV
RAMAT GAN
JAFFA
BAT YAM
HOLON

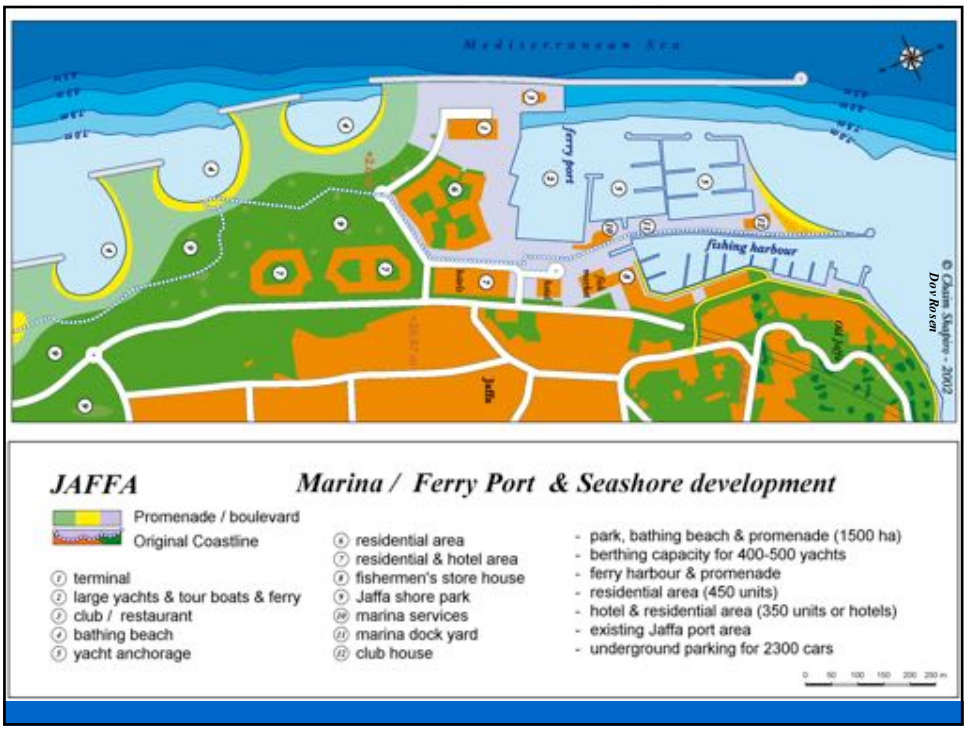
Jaffa





OLD JAFFA, VIEW TO TEL-AVIV





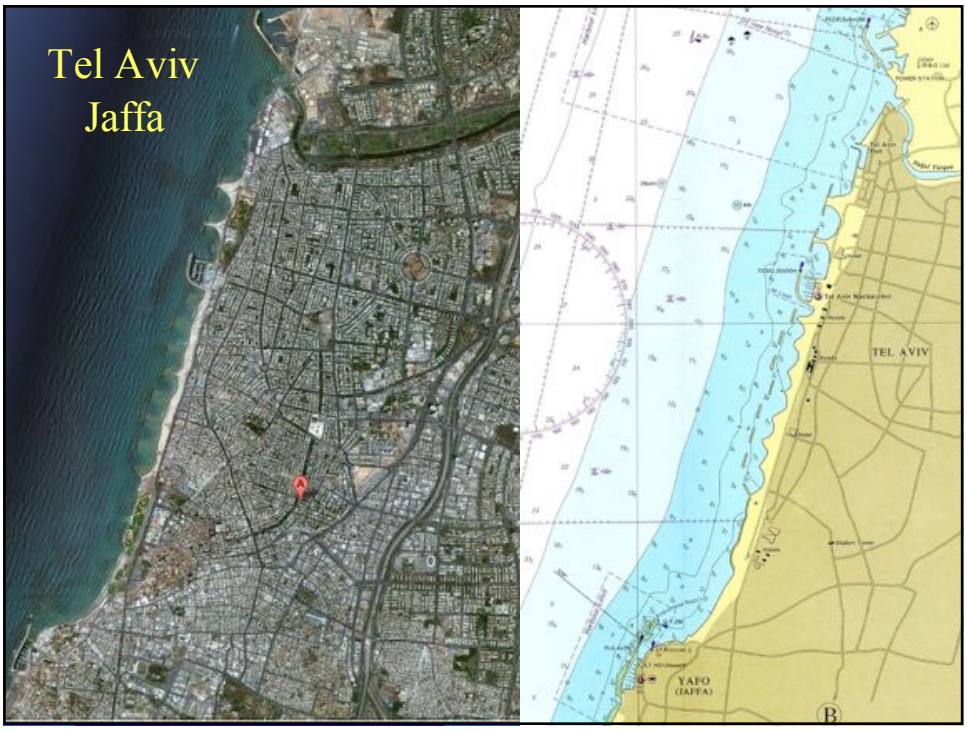
JAFFA — ***Marina / Ferry Port & Seashore development***

Promenade / boulevard
Original Coastline

(F) terminal
(J) large yachts & tour boats & ferry
(J) club / restaurant
(J) bathing beach
(F) yacht anchorage

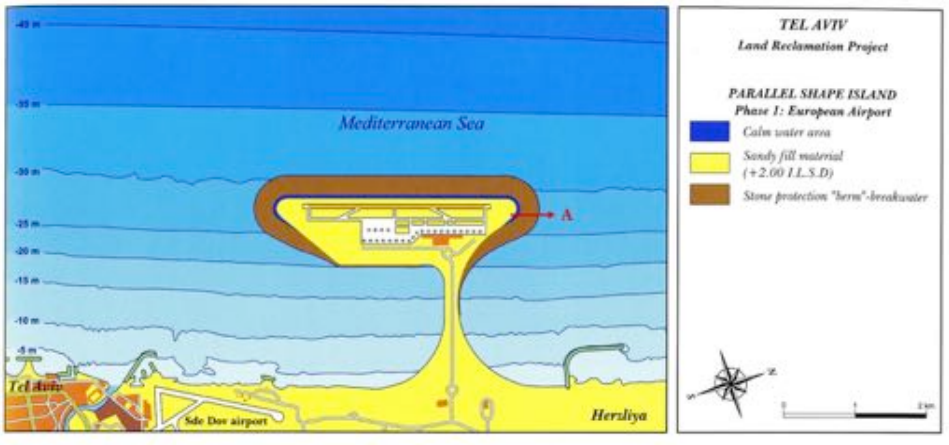
(R) residential area
(T) residential & hotel area
(R) fishermen's store house
(P) Jaffa shore park
(M) marina services
(J) marina dock yard
(J) club house

- park, bathing beach & promenade (1500 ha)
- berthing capacity for 400-500 yachts
- ferry harbour & promenade
- residential area (450 units)
- hotel & residential area (350 units or hotels)
- existing Jaffa port area
- underground parking for 2300 cars

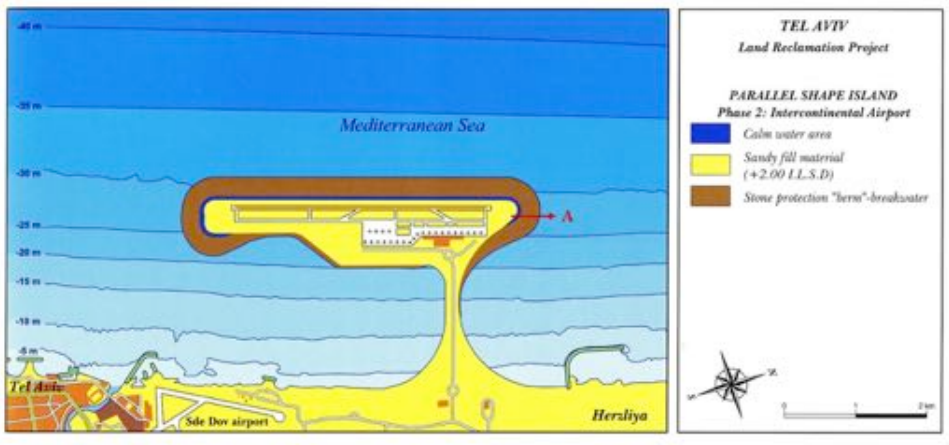

Tel Aviv
Jaffa
TEL AVIV
YAFO
(JAFFA)


Tel Aviv
Jaffa
Sde Dov
Herzlia

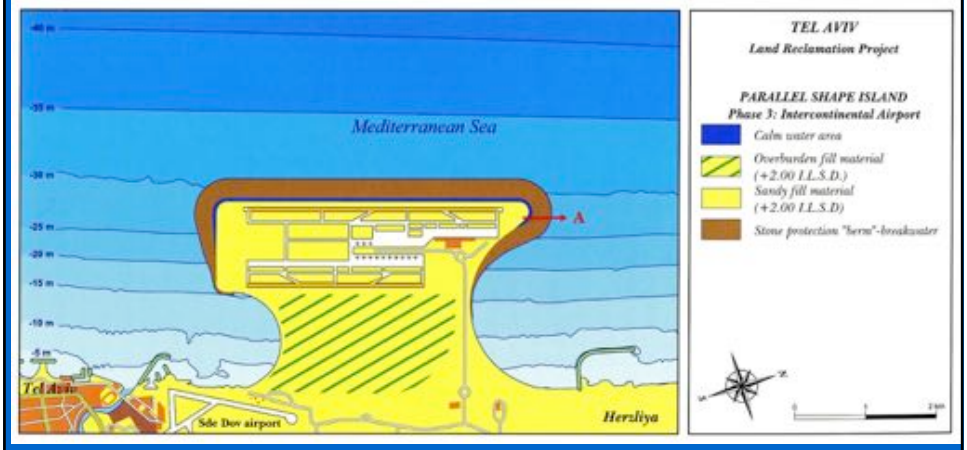
Tel Aviv



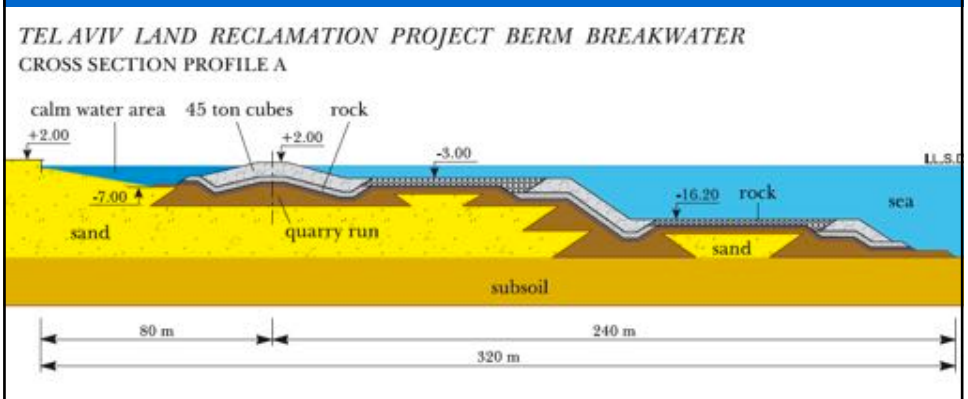
Tel Aviv



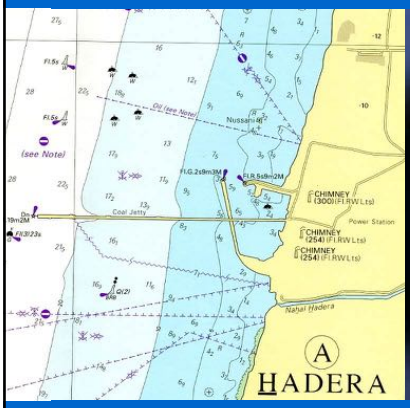
Tel Aviv



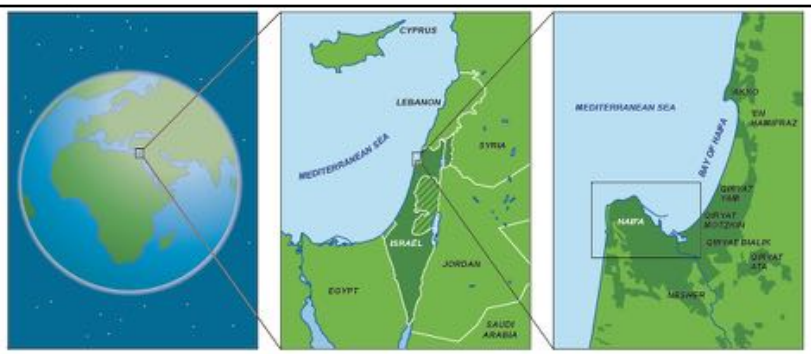
Tel Aviv



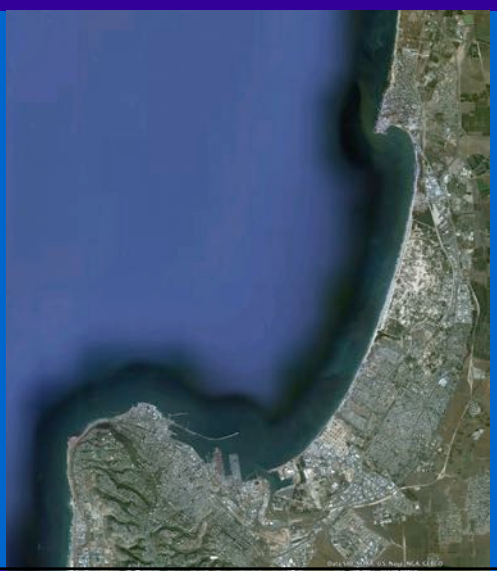
Hadera

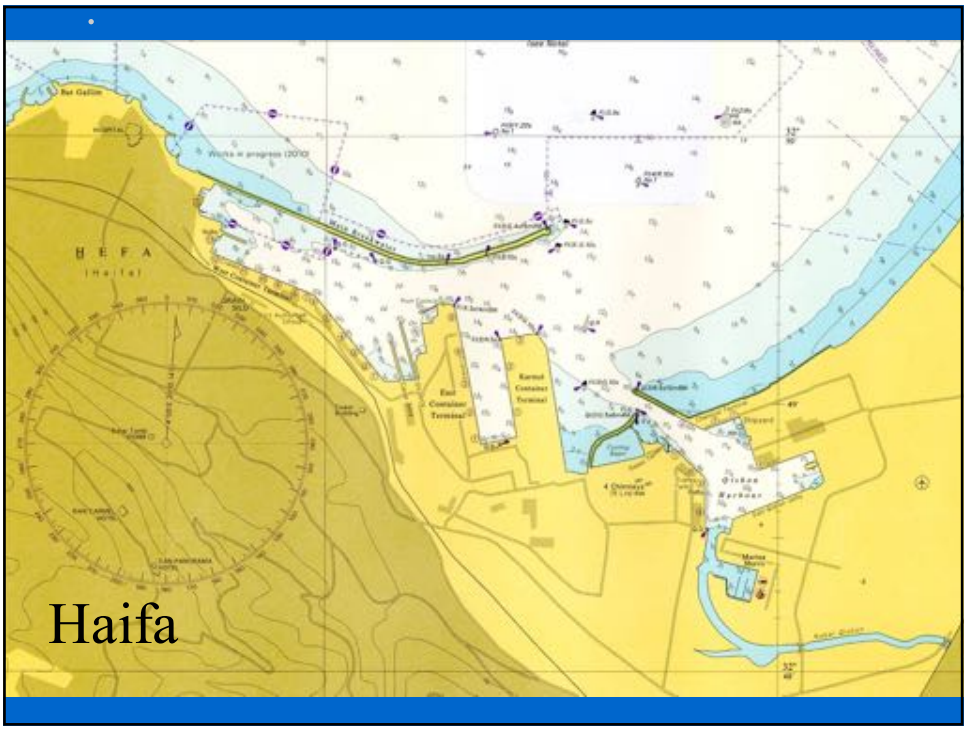


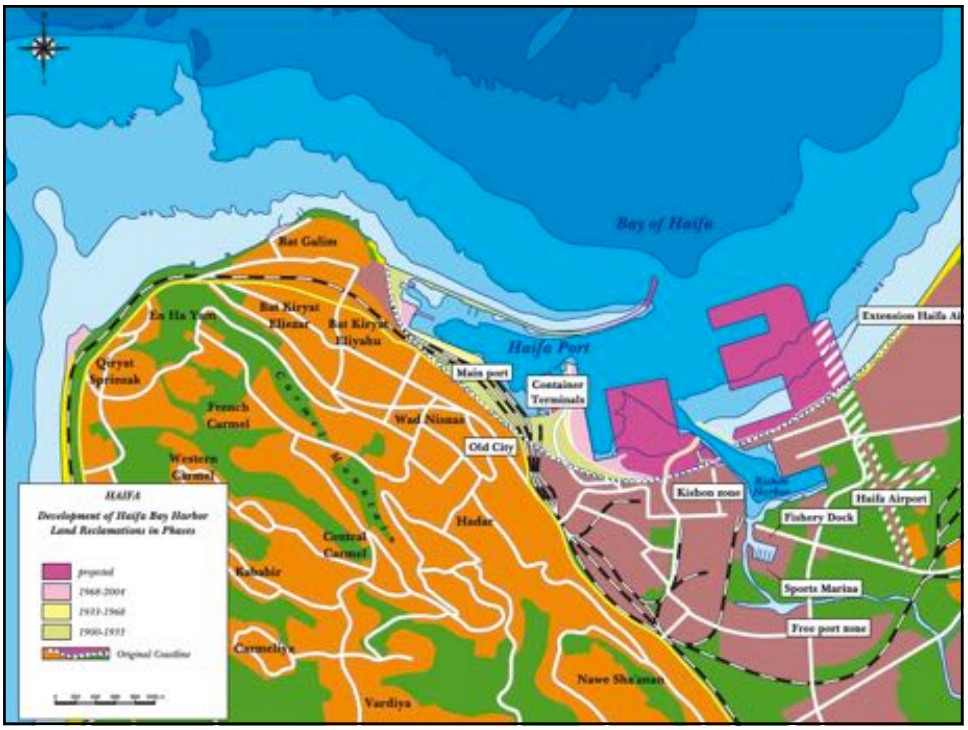
Haifa

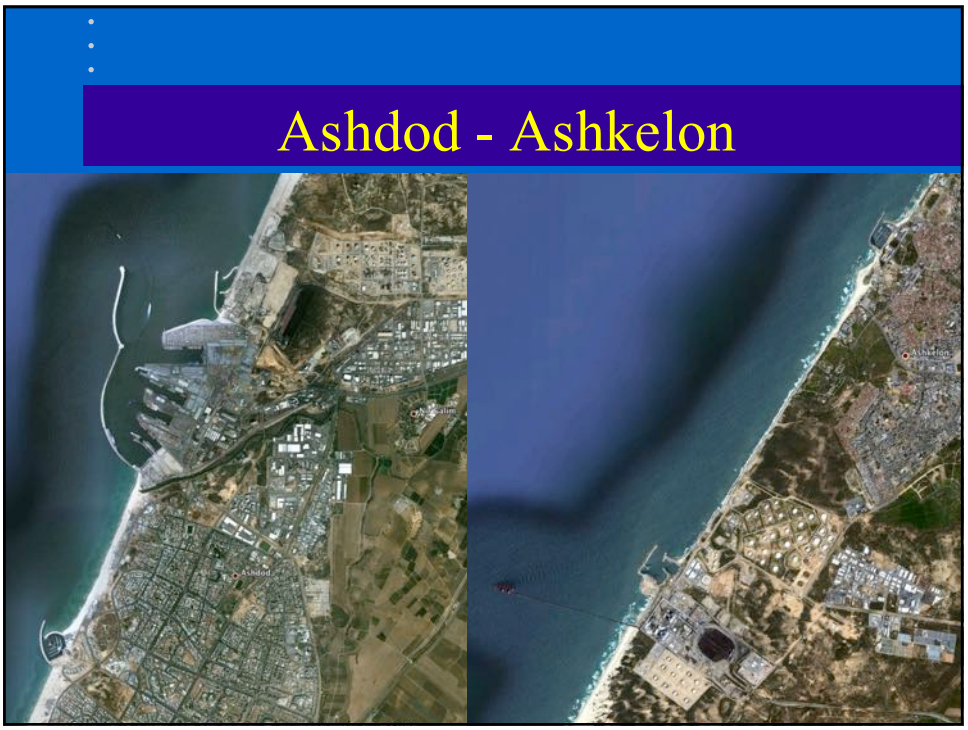


Haifa

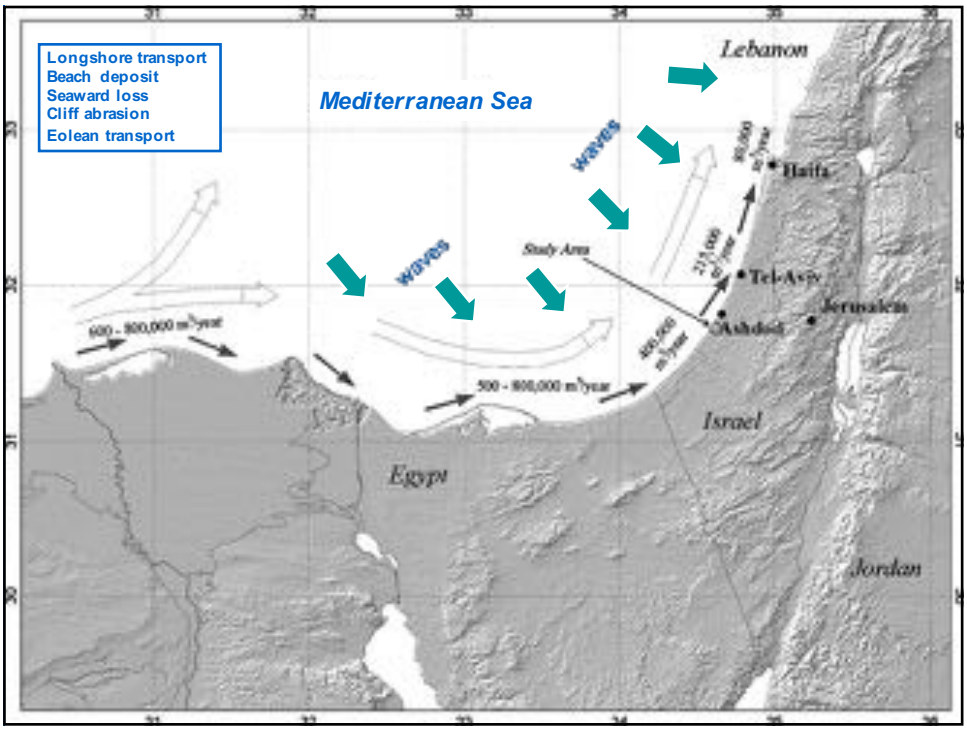





Bay of Haifa
Bat Galim
En Ha Yam
Bat Kiryat Eliezar
Bat Kiryat Eliyahu
Haifa Port
Main port
Container Terminals
Extension Haifa Al
Qiryat Shmuah
French Carmel
Wad Nisnas
Old City
Western Carmel
Kishon zone
Haifa Airport
Fishery Dock
Hadar
Central Carmel
Kababir
Sports Marina
Free port zone
Carmeliya
Nawe Sha'anan
Vardiya
HAIFA
Development of Haifa Bay Harbor Land Reclamations in Phases
projected
1968-2004
1933-1968
1900-1933
Original Coastline


Ashdod - Ashkelon

Ashdod - Ashkelon




ENVIRONMENTAL RISK ALONG THE SHARON ESCARPMENT
G. Almagor - D. Gill - I. Perath
D. Rosen

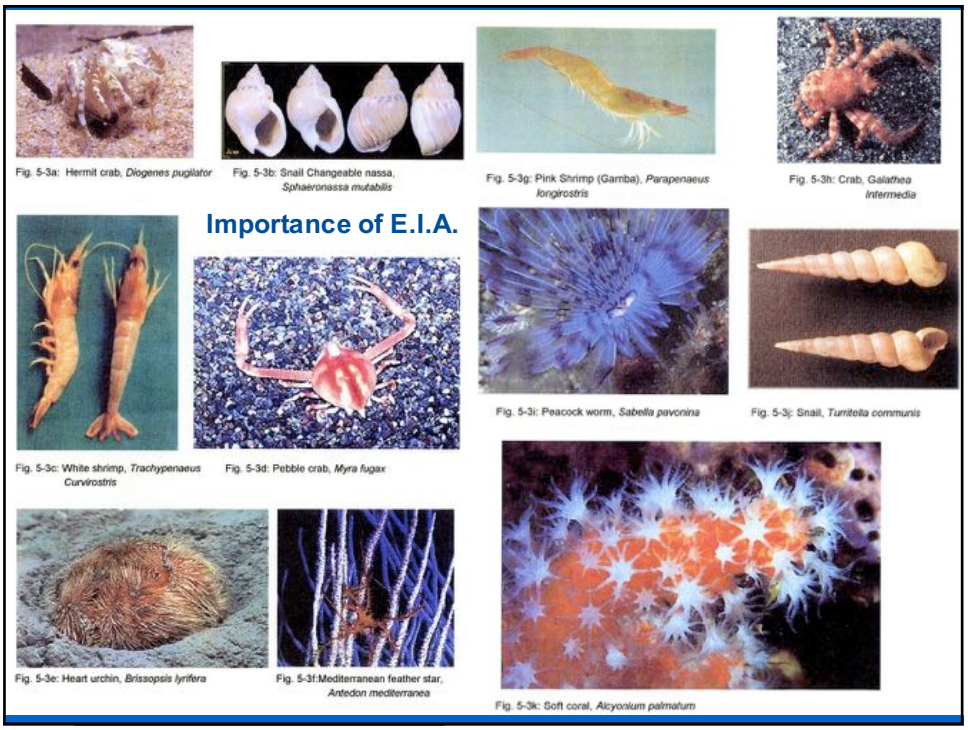
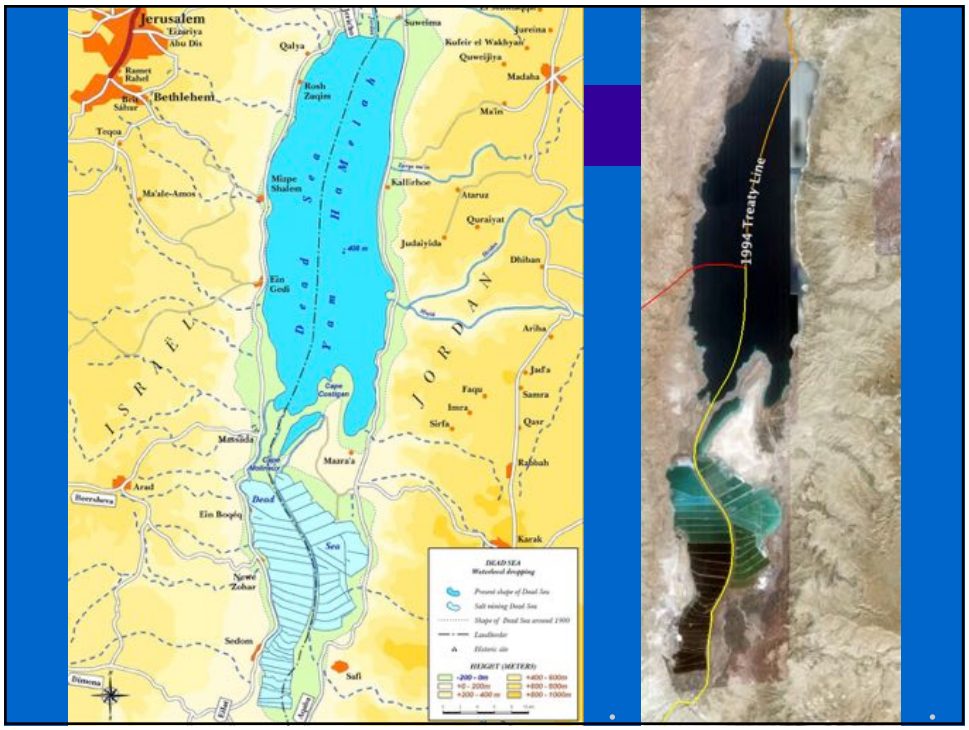
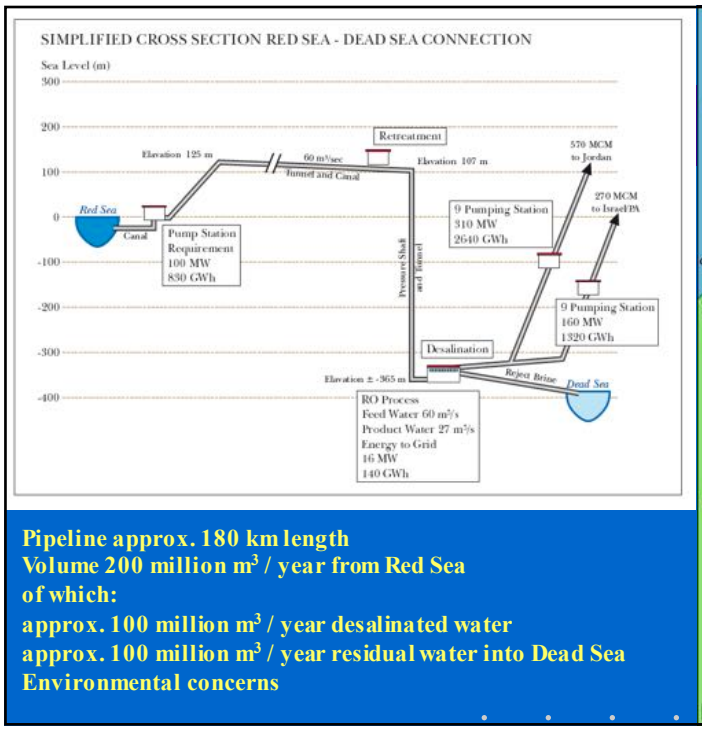


Fig. 5-3a: Hermit crab, Diogenes pugilator
Fig. 5-3b: Snail Changeable nassa, Sphaeronassa mutabilis
Fig. 5-3g: Pink Shrimp (Gamba), Parapenaeus longirostris
Fig. 5-3h: Crab, Galathea Intermedia
Importance of E.I.A.
Fig. 5-3c: White shrimp, Trachypenaeus Curvirostris
Fig. 5-3d: Pebble crab, Myra fugax
Fig. 5-3i: Peacock worm, Sabella pavonina
Fig. 5-3j: Snail, Turritella communis
Fig. 5-3e: Heart urchin, Brissopsis lyrifera
Fig. 5-3f:Mediterranean feather star, Antedon mediterranea
Fig. 5-3k: Soft coral, Alcyonium palmatum

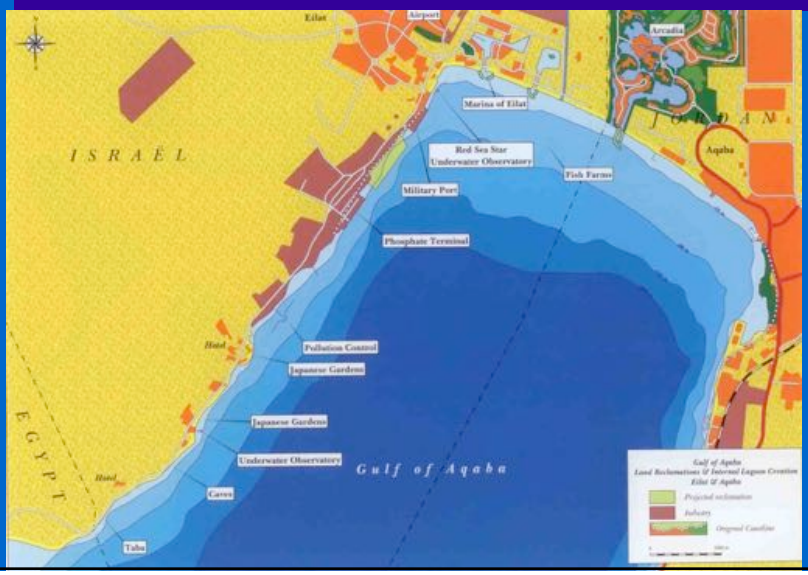

BUILDING WITH NATURE
Israël, Jordan
CYPRUS
SYRIA
MEDITERRANEAN SEA
ISRAËL
JORDAN
EGYPT
SAUDI ARABIA
Occupied area by Israel





Pipeline approx. 180 km length
Volume 200 million m³ / year from Red Sea
of which:
approx. 100 million m³ / year desalinated water
approx. 100 million m³ / year residual water into Dead Sea
Environmental concerns

Eilat



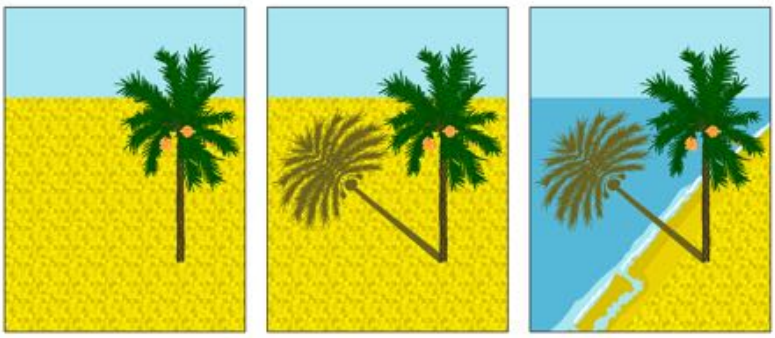
BUILDING WITH NATURE

Middle East U.A.E.

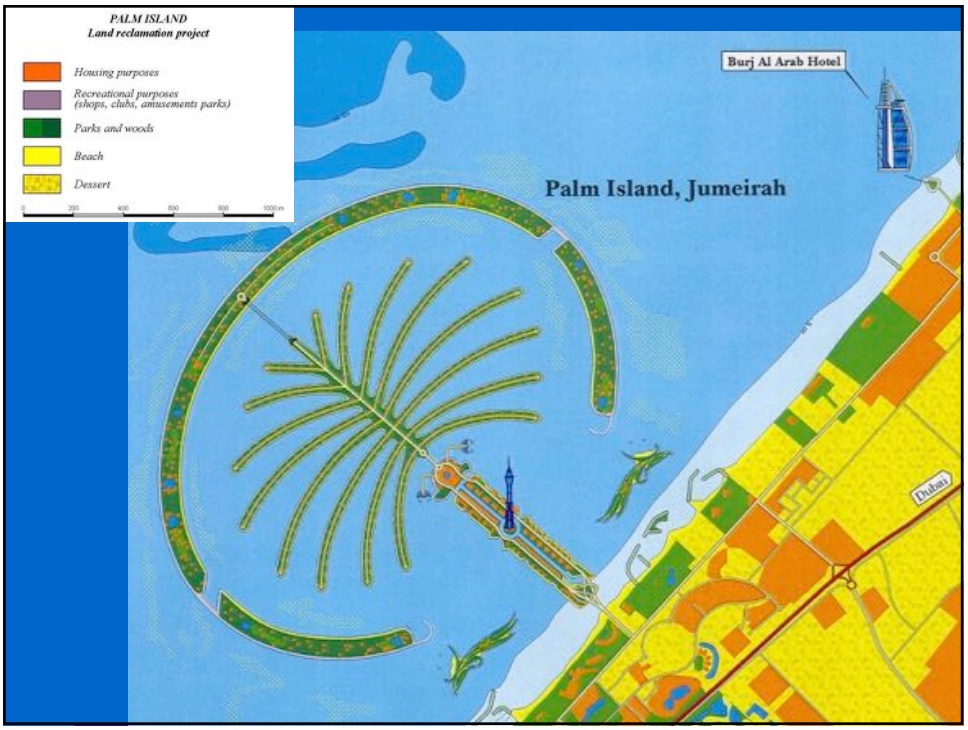
BUILDING WITH NATURE

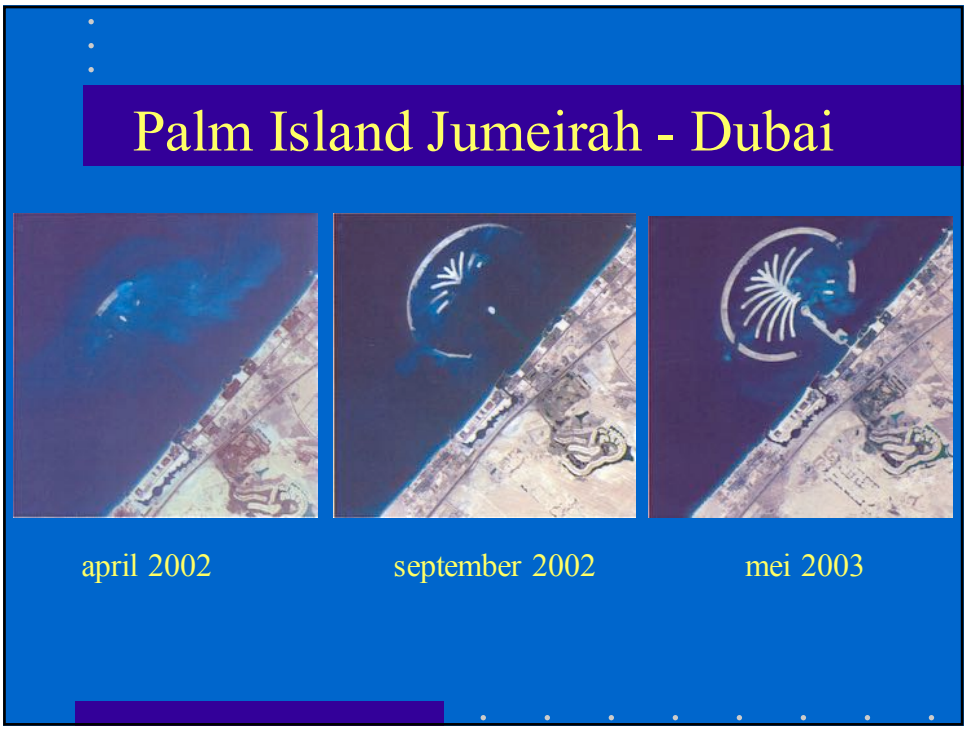
U.A.E.
Dubai

BUILDING WITH NATURE

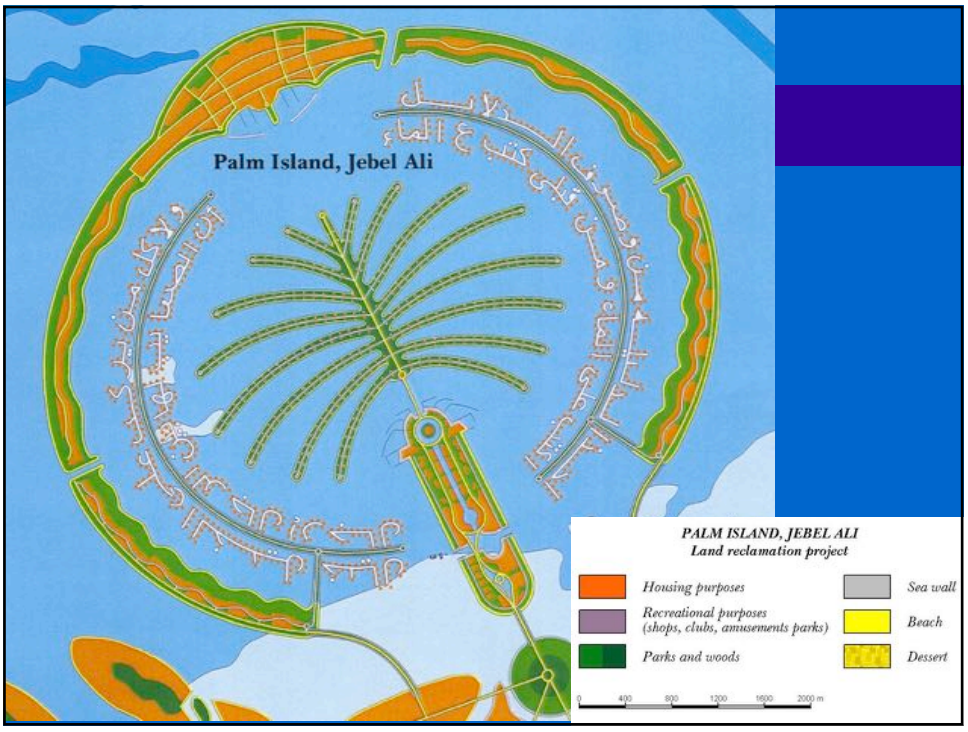


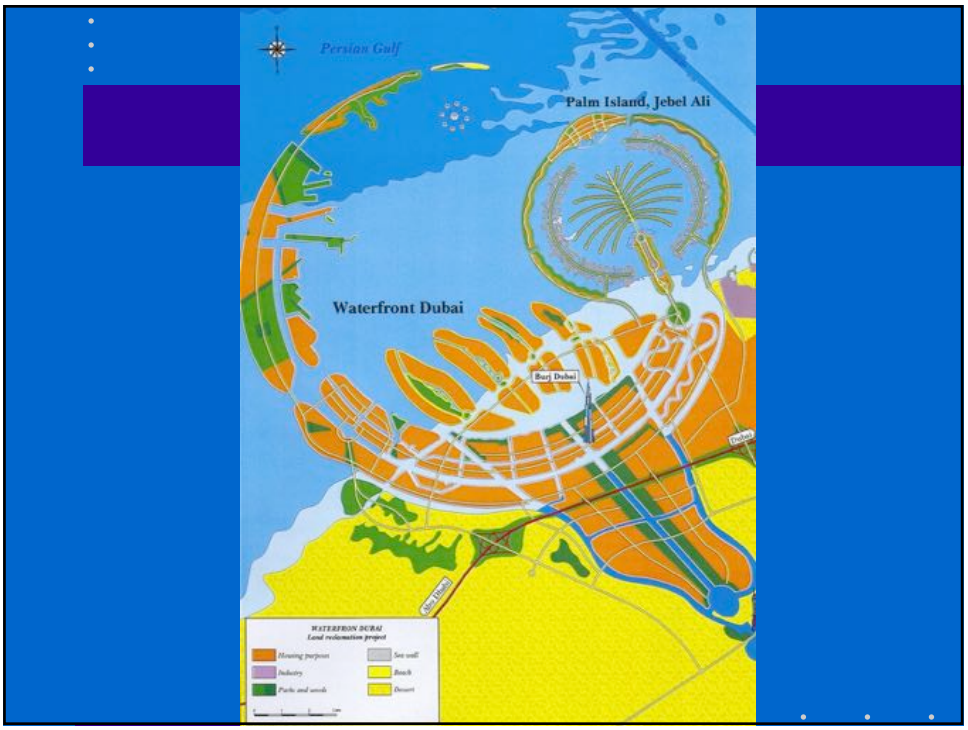
U.A.E.
Dubai

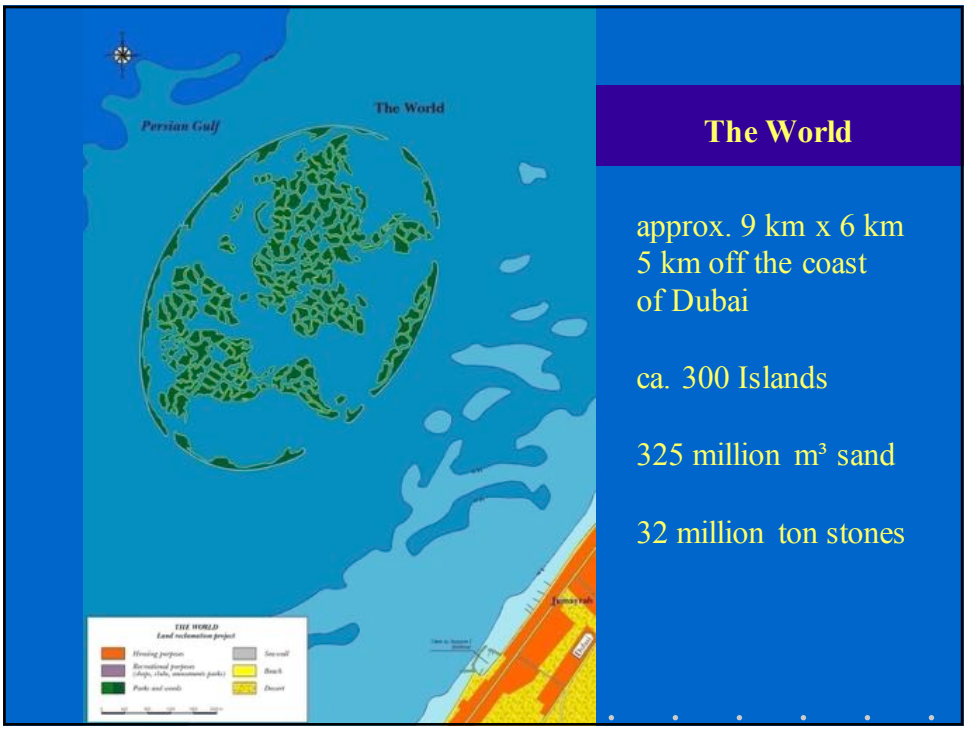

PALM ISLAND
Land reclamation project
Housing purposes
Recreational purposes
(shops, clubs, amusements parks)
Parks and woods
Beach
Dessert
Burj Al Arab Hotel
Palm Island, Jumeirah
Dubai


Palm Island Jumeirah - Dubai
april 2002
september 2002
mei 2003

2010


Palm Island, Jebel Ali
PALM ISLAND, JEBEL ALI
Land reclamation project
Housing purposes
Recreational purposes
(shops, clubs, amusements parks)
Parks and woods
Sea wall
Beach
Dessert
0
400
800
1200
1600
2000 m





The World

approx. 9 km x 6 km
5 km off the coast
of Dubai

ca. 300 Islands

325 million m³ sand

32 million ton stones

The Palm, Deira

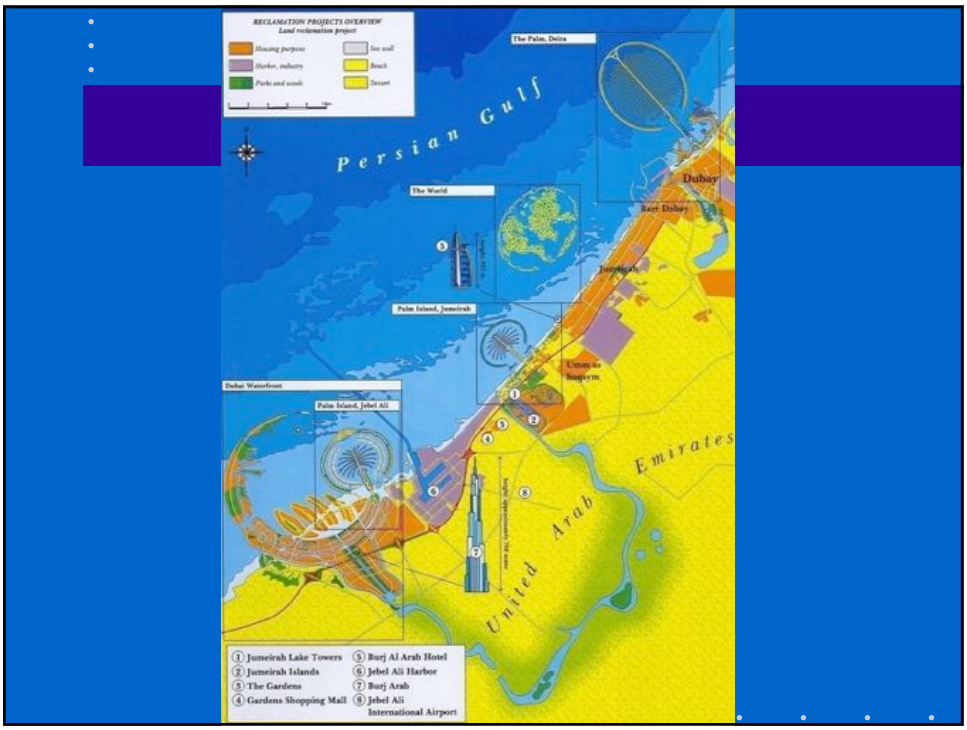
approx. 14.3 km x 8.5 km

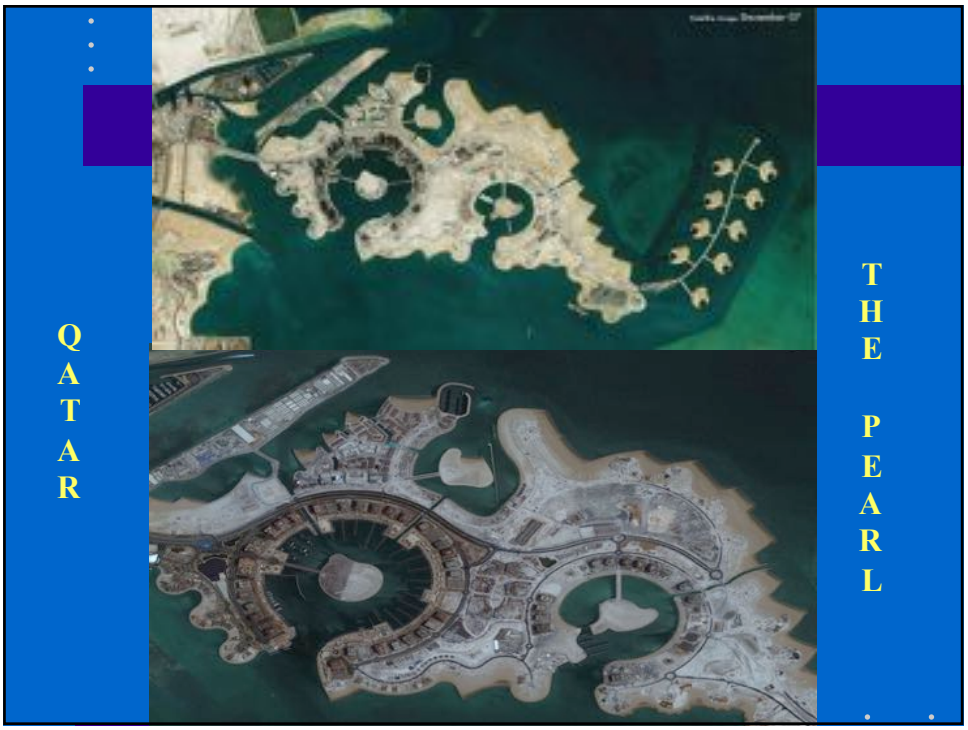
surface area 80 km²

41 palm leaves

1.3 billion m³ sand

length of outher rim
berm break water
ca. 21 km





SUSTAINABLE COASTAL ZONE DEVELOPMENT

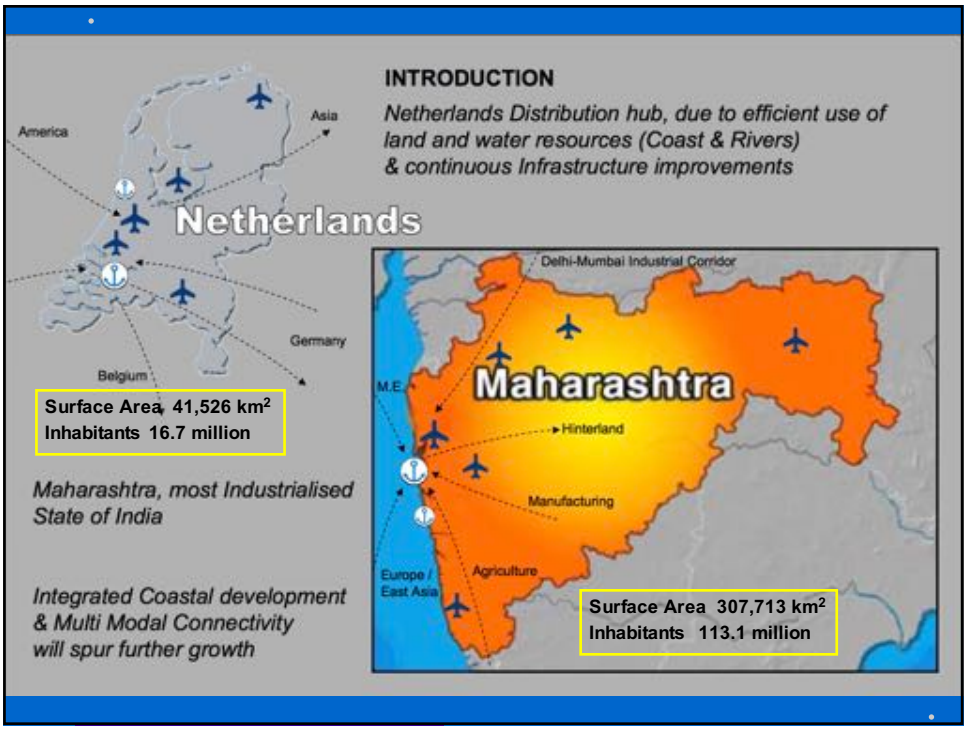
Integrated Coastal & Deltaic Policy
via Building with Nature®

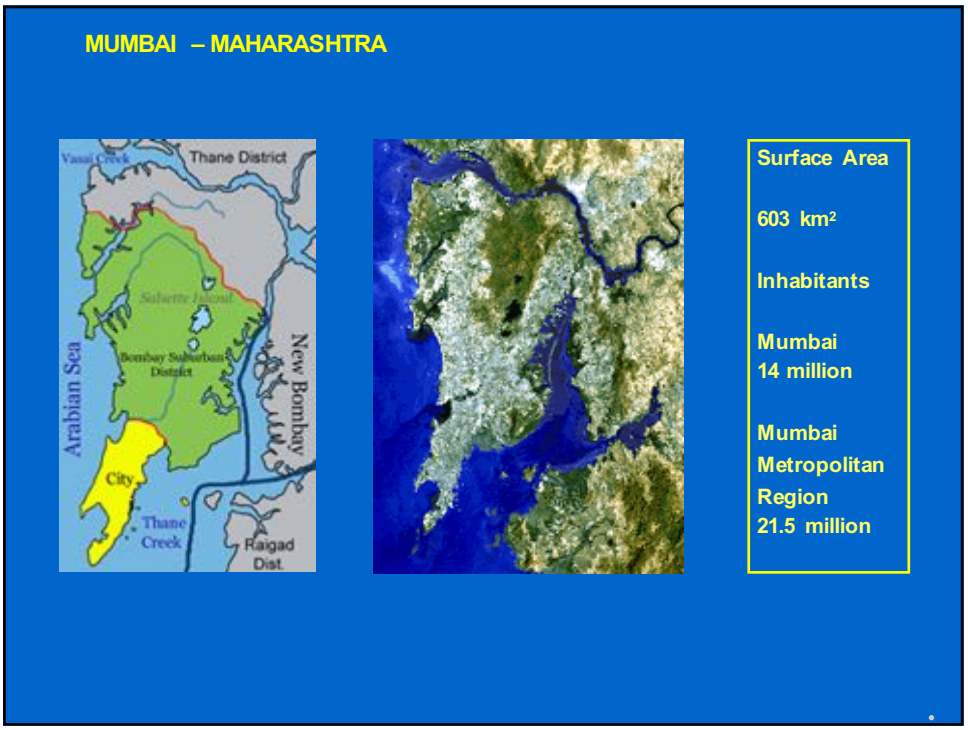
Dr. R.E. Waterman MSc

23 September 2011 - January 2012

India
The Netherlands

170


INTRODUCTION
Netherlands Distribution hub, due to efficient use of land and water resources (Coast & Rivers) & continuous Infrastructure improvements
America
Asia
Germany
Belgium
Netherlands
Surface Area 41,526 km²
Inhabitants 16.7 million
Maharashtra, most Industrialised State of India
Integrated Coastal development & Multi Modal Connectivity will spur further growth
Delhi-Mumbai Industrial Corridor
M.E.
Maharashtra
Hinterland
Manufacturing
Agriculture
Europe / East Asia
Surface Area 307,713 km²
Inhabitants 113.1 million


MUMBAI – MAHARASHTRA
Vasai Creek
Thane District
Salsette Island
Bombay Suburban District
Arabian Sea
New Bombay
City
Thane Creek
Raigad Dist.
Surface Area
603 km²
Inhabitants
Mumbai
14 million
Mumbai
Metropolitan
Region
21.5 million

MUMBAI'S HISTORY

The Metamorphosis of an 'Island City'

When Portugese sailors fist sailed east to a number of islands off the Indian mainland, seeking respite from the treacherous Arabian Sea, little did they know that these 7 islands and the 'Bom Baya' (or 'good bay') would some day give rise to the great city of Mumbai.

This is why they did not hesitate to part with their claim on these islands as part of a wedding gift to the king of England.

The Koli fishermen inhabiting these islands knew the value of a well-sheltered bay in these turbulent waters…

17th Century

60km of coastline

(publicly accessible)

In Holland at around the same time, the city of Amsterdam, located on a similarly sheltered bay called the 'Southern Sea', grew to prominence.

And so did the English:

By the 19th century the city they had founded on the biggest of the seven islands had grown so fast due to its sheltered harbour. The requirement for more land had compelled the Royal Engineers to embark on a furious reclamation program that turned the original seven islands into one continuous landmass.

The Koli fishermen communities thus lost large tracts of their precious shoreline, previously used for mooring their vessels and drying their fish.

Another disadvantage was that the Royal Engineers applied a method of merely blocking the inlets in between the islands. This way indeed the inner area stopped getting flooded at high tide, but during monsoon, it was heavily prone to flooding

19th Century

40km of coastline

(publicly accessible)

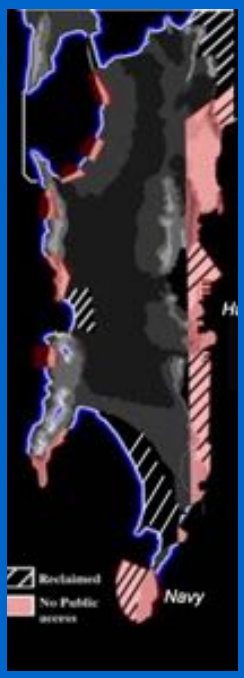
In Holland at around the same time, different water bodies were reclaimed by pumping water out with permanent wind-powered pumping-stations which maintained the low water level for the long term, up till the present-day.

In the 20th century the problem of flooding was understood and the Brimstowad study recommended to apply the Dutch method after all;

a series of strategic pumping stations to control the water-level and pump out stormwater even during high tide.

Unfortunately this study was commissioned after the 1950's and 1970's which both saw yet more reclamation with the same faults at respectively Marine Drive and Cuff Parade.

Worse still; the study's recommendations were not implemented till 20 years after the study was completed and in 2005 the city had experienced its worst flood ever, leading to massive economic damage and loss of lives.



20th Century

15km of coastline

(publicly accessible)

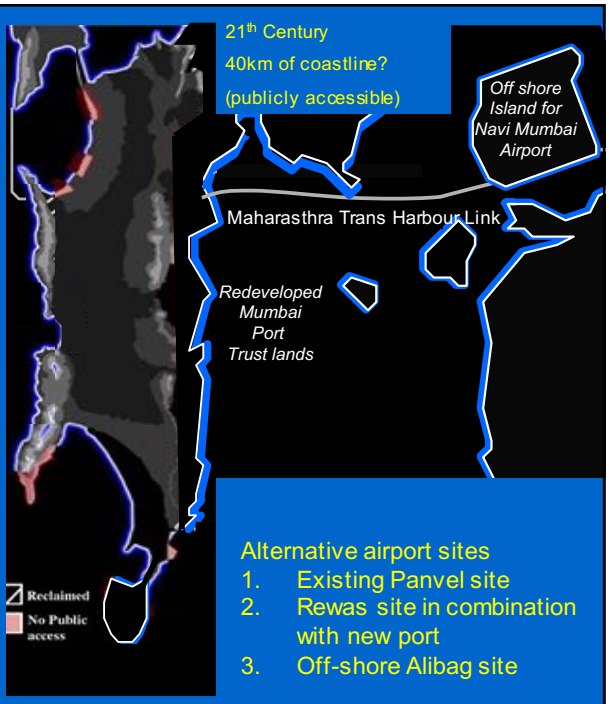
In Holland the greatest reclamations yet happened after construction of a barrier-cum-road which effectively made the 'Southern Sea' into a fresh water reservoir with a series of new islands for food-production & new cities.

Coastal Road
& existing
Bandra-Worli Sea Link

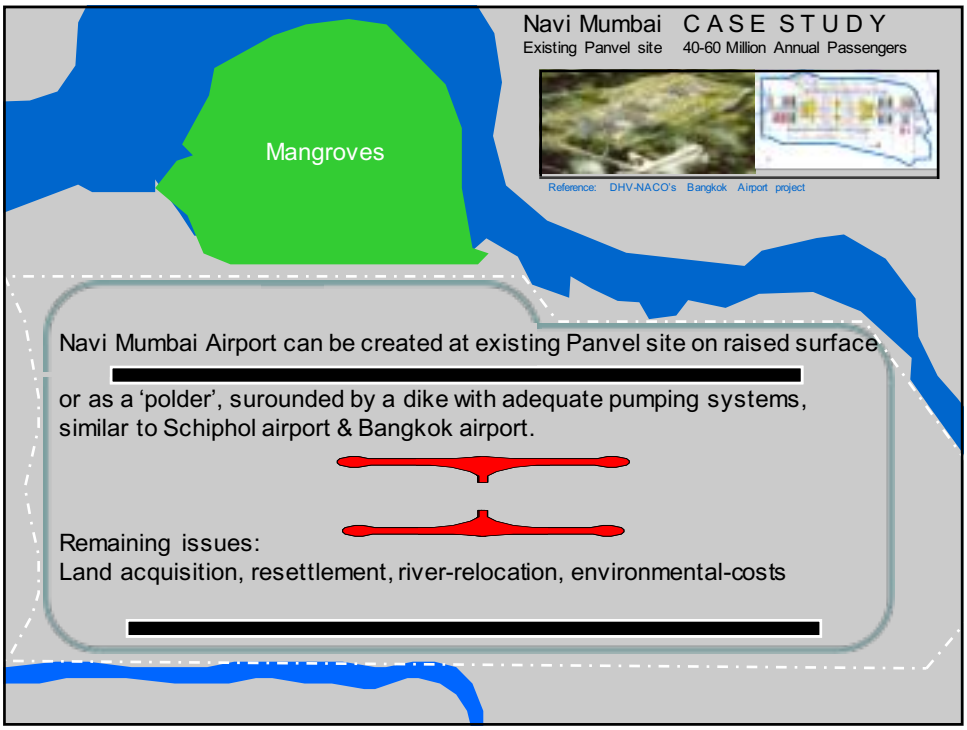
In the 21st century people have also started asking whether the method of rampant reclamation used for Nariman Point and Cuff Parade has not affected coastal habitats downstream, leading to for instance erosion at Versova and perhaps affecting mud-flats at Sewri.

Unfortunately the ocean hydrology and coastal morphology before reclamation was never properly studied, nor was a study done on the possible effects of the reclamation on these systems.

If the Dutch 'Building with Nature' method is applied, projects such as the Coastal Road can be implemented in such a way that existing fragile environments are enhanced and new environments are created. An offshore island for the Navi Mumbai Airport is thus also a feasible proposition, given the environmental & land constraints of the onshore site.

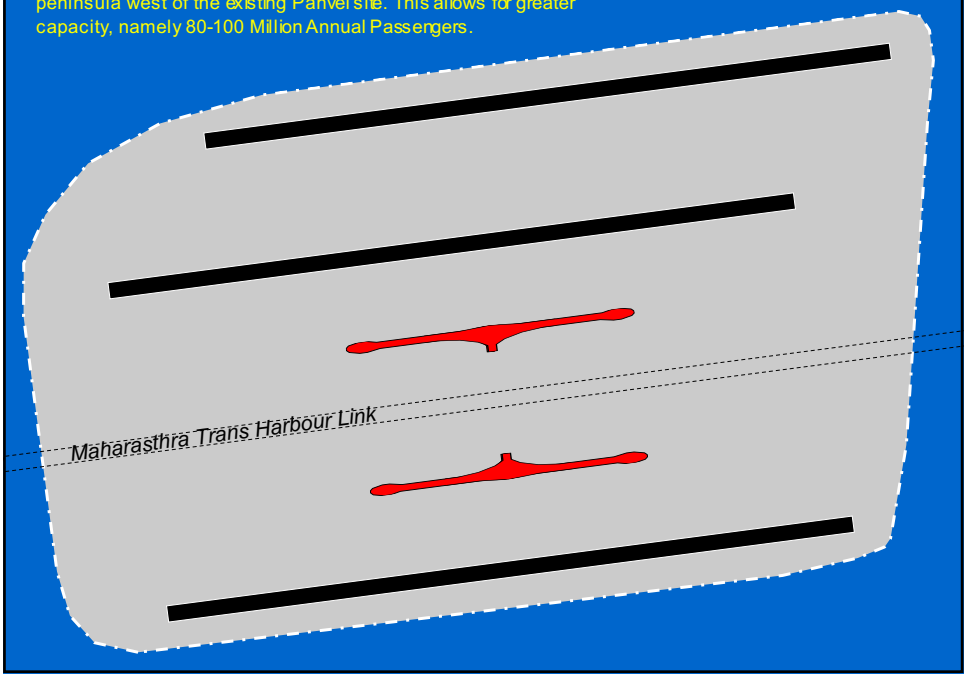


Alternative airport sites
1. Existing Panvel site
2. Rewas site in combination with new port
3. Off-shore Alibag site



The new airport can alternatively be created on a reclaimed peninsula west of the existing Panvel site. This allows for greater capacity, namely 80-100 Million Annual Passengers.

CASE STUDY



New coastal developments, using 'Building with Nature', coupled with important transportation-linkages will thus help Mumbai achieve its ambition of becoming a truly world-class city ... for its People, its Commerce and for Environmental values.

CASE STUDIES

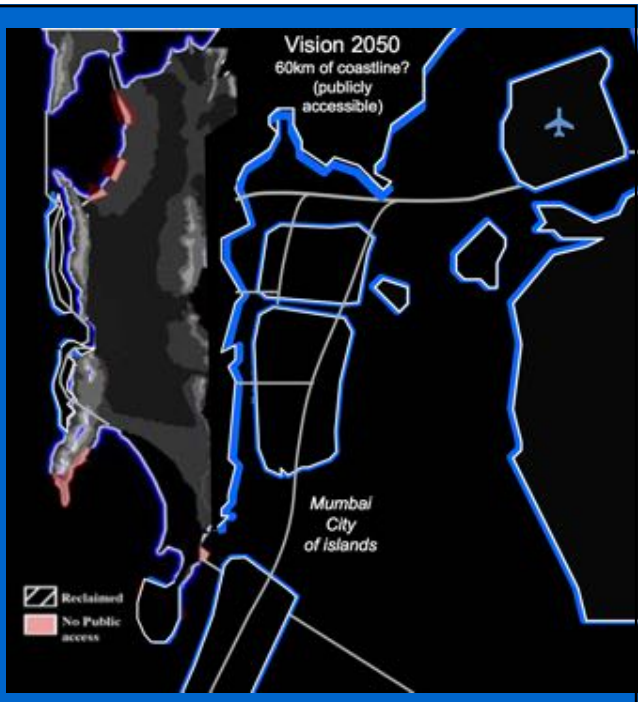
1. Coastal Road vs Sea Link

Opportunity for more linkages to existing city road networks;
Value of reclaimed land makes for a viable PPP case.

2. Island Airport vs Navi Mumbai site

Island Airport can have unconstrained capacity as opposed to proposed site;

Cost of creek-diversion, hill-demolition and remaining land acquisition for Navi Mumbai site are similar to reclamation!



MISSION FINDINGS

In September 2011, a platform of Dutch Companies presented best practices in Planning, Design and Construction of Coastal Developments and Land Reclamation applying the 'Building with Nature' method.

Based on the response to the conference in Mumbai, the platform came to the following conclusions:

1.Need for a flexible Masterplan that allows for stepwise, phased development

2.Key Priority Projects

- The Coastal Road
- Navi Mumbai Airport
- MTHL Bay-crossing
- Port Expansion
- Integration of sea defences & recreation
- Fresh water reservoirs
- Islands in the bay

3. Priority Studies

For a safe and sustainable approach and full utilization of the 'Building with Nature' concept

•Integrated modeling framework on hydrology, hydrodynamics, waves, sendiment transport, morpho-dynamics, emissions, water quality and ecology

•Design conditions for infrastructural and land reclamation works (currents, waves, etc.)

Identification & analysis of mitigation & compensation measures

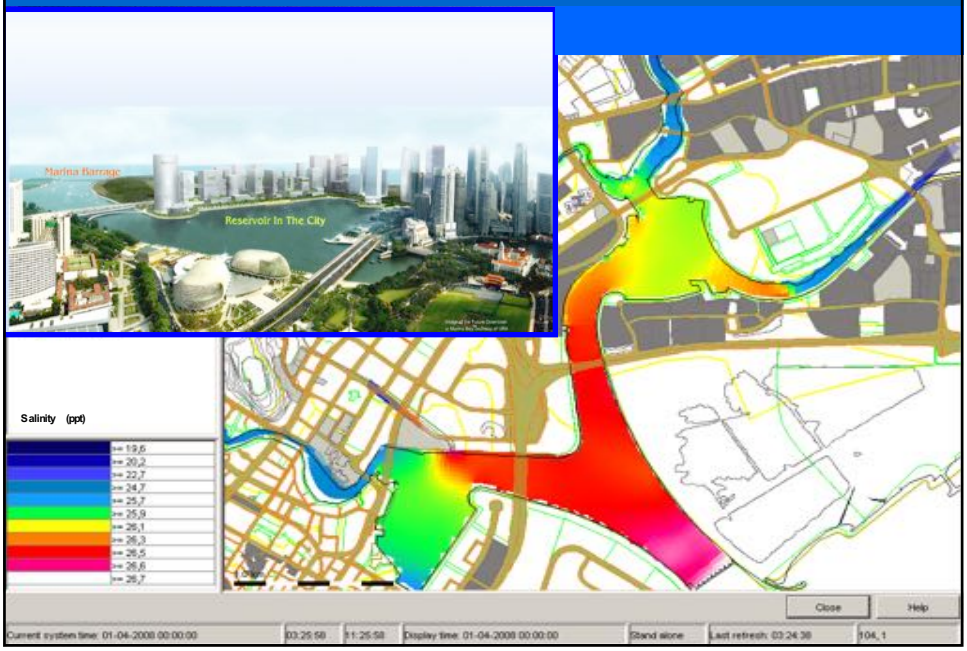
Forecast impact of future scenarios such as climate change, economic sector development, population increase on the system

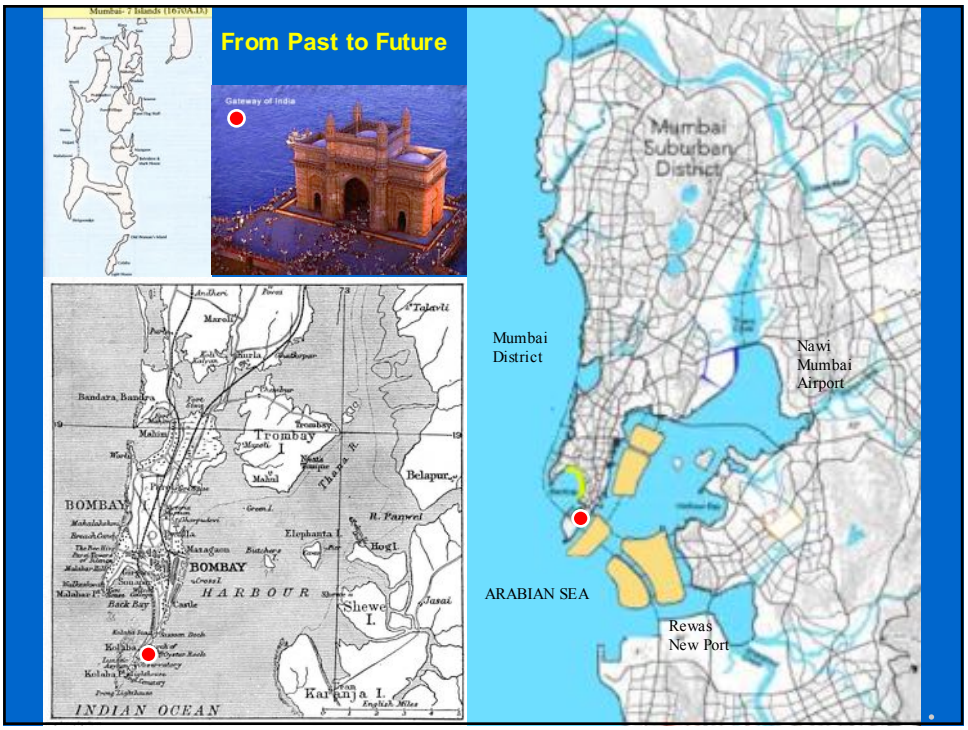
Environmental Impact Assessment

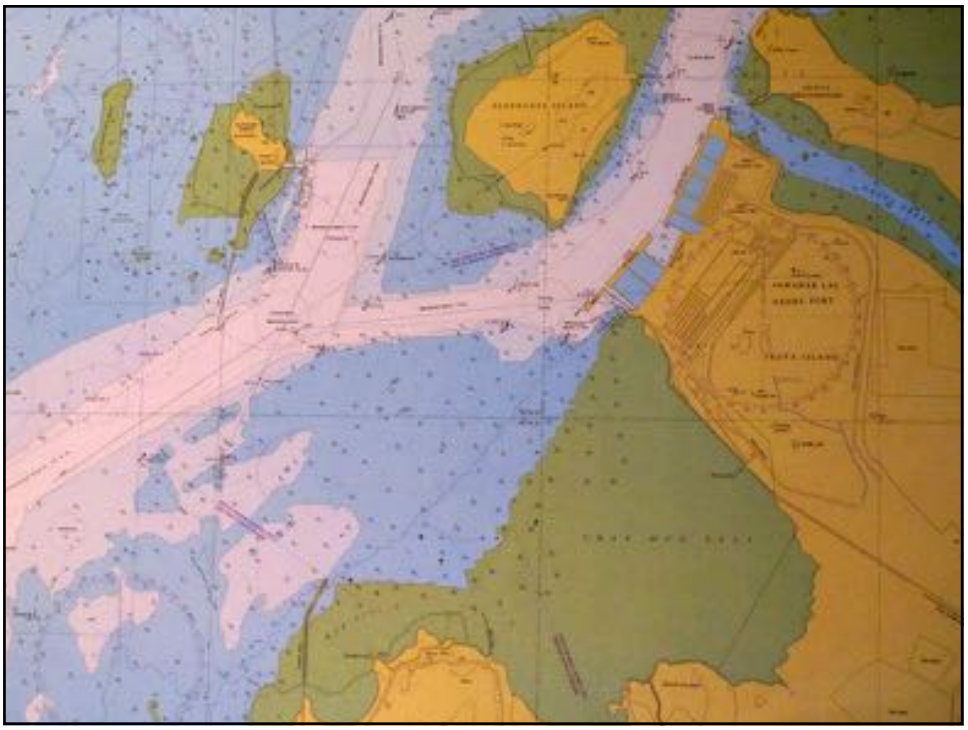
Study of stakeholder concerns / Social Impact Assessment (Koli fishermen communities)

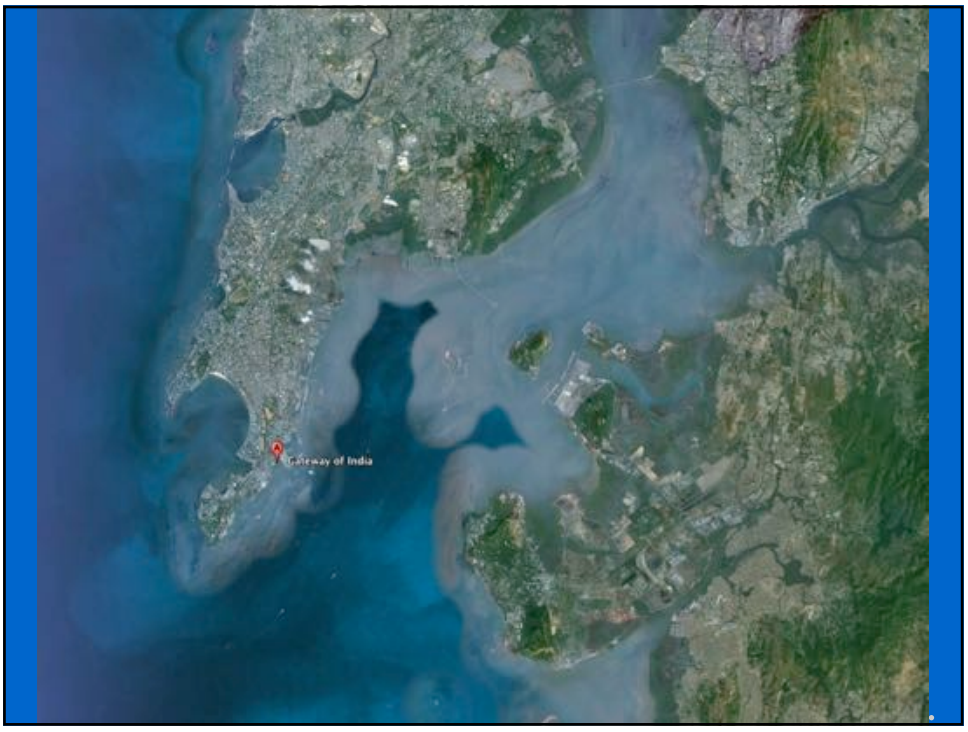
Feedback monitor system

Integrated modelling for Marina Reservoir (Singapore)

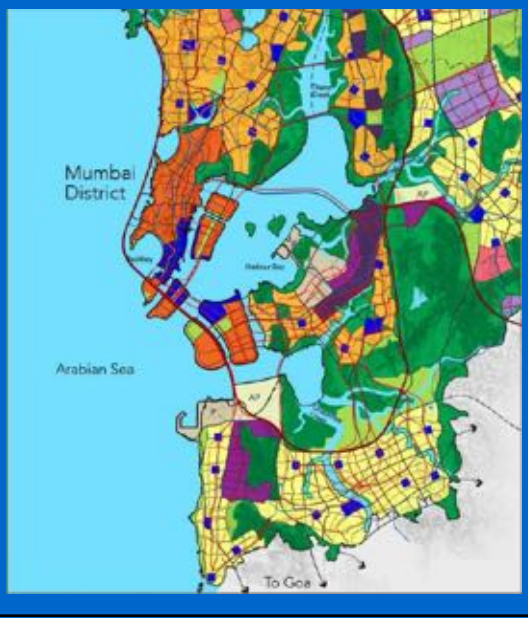



From Past to Future
Gateway of India
Mumbai Suburban District
Mumbai District
Nawi Mumbai Airport
ARABIAN SEA
Rewas New Port
BOMBAY
HARBOUR
Trombay I.
Elephanta I.
Hogl
Shewe I.
Karanja I.
Belapur
INDIAN OCEAN




Gateway of India

Findings High Level Round Table Conference



Findings High Level Round Table Conference

1. Need for a flexible masterplan that allows for a stepwise approach (phase after phase, segment after segment) for economic, environmental and financial reasons
2. Improvement of Jawarhal Nehru Port and New Deep Sea Port in Rewas district
3. Site for new Mumbai International Airport with adequate environmental compensation measures
4. Widening / heigthening / extending Back Bay Beach along Marine Drive (between Malabar Hill and Nariman Point)
5. Land reclamations through the execution of a series of islands parallel to and east of Indira Dock, Victoria Dock and Prince's Dock) in the Bay
6. Safeguarding the interests of the local Koli fishermen
7. Infrastructure connections between islands and mainland Mumbai
8. Overall improvement of infrastructure in and around Mumbai Metropolitan area, including the possibility of a coastal road along the west coast
9. Freshwater reservoir through barrage in Mahim Bay. This is only possible if an adequate sewer system and waste water treatment in he upstream catchment area are provided for.

Requirements

- Necessity of a thorough Integrated Study, taking into account a whole series of functions, covering the entire wider Mumbai area, including:
  - Set-up of an integrated modelling framework addressing the hydrodynamics, waves, morphodynamics / sediment transport, water quality and ecology
    - Design conditions for infrastructural and land reclamation works (currents, waves, siltation, etc.)
    - Effects on ecosystem functioning (terrestrial and aquatic flora and fauna with special emphasis on the mangroves)
    - Identification and analysis of mitigating and compensating measures
    - Taking into account future scenarios such as climate change, sector development, population increase, etc.
  - Environmental impact assessment
  - Respecting the cultural heritage values (Mumbai can become an island city again: "Good plans have their roots in the past and are pointing to the future")
- Development of a (feedback) monitoring program
    - Including a description of the reference situation
- Application of best practices in a local context
- Introducing a safe and sustainable approach with full utilisation of Building with Nature® concepts

SUSTAINABLE COASTAL ZONE DEVELOPMENT

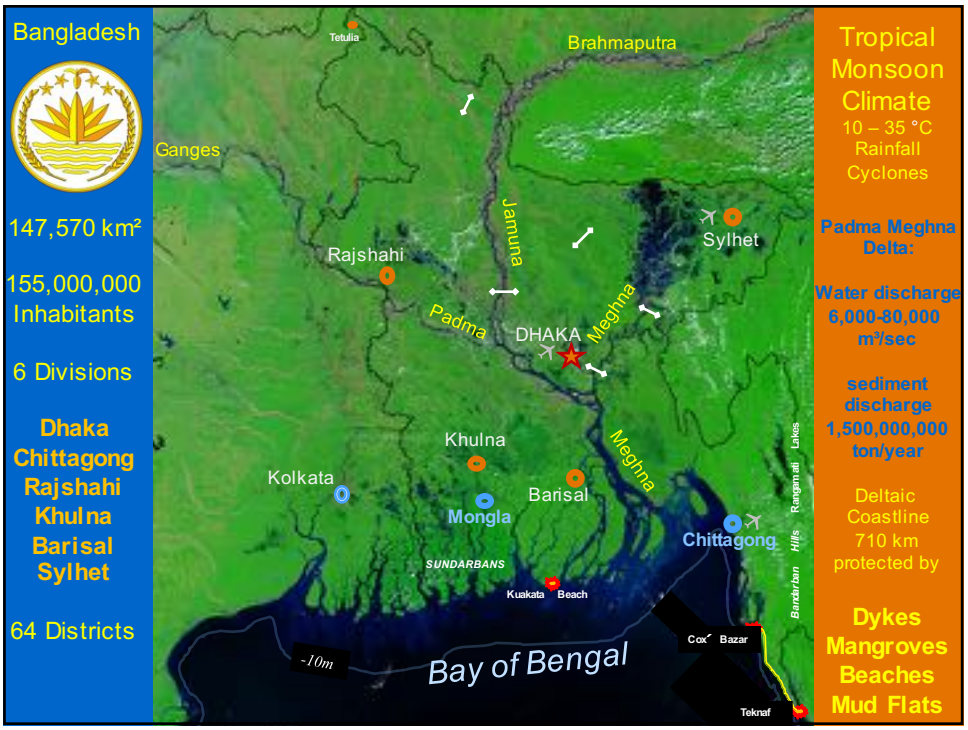
Integrated Coastal Policy via Building with Nature

BANGLADESH

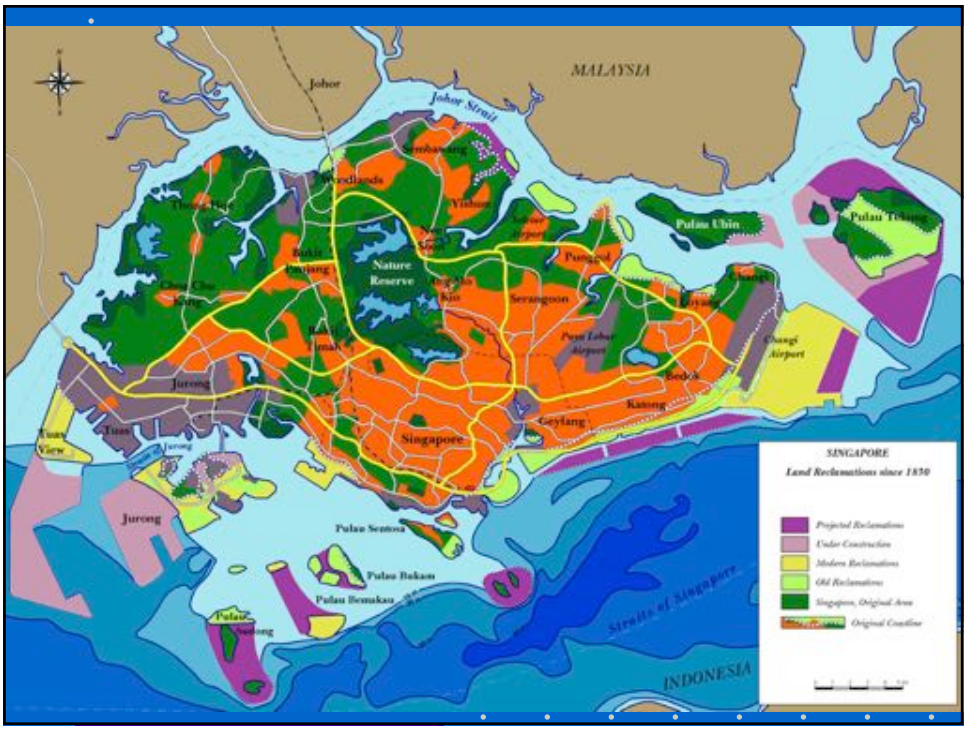
-

THE NETHERLANDS

March, 2009


Bangladesh
147,570 km²
155,000,000 Inhabitants
6 Divisions
Dhaka
Chittagong
Rajshahi
Khulna
Barisal
Sylhet
64 Districts
Tetulia
Brahmaputra
Ganges
Jamuna
Rajshahi
Sylhet
Padma
DHAKA
Meghna
Khulna
Kolkata
Barisal
Mongla
Meghna
Chittagong
SUNDARBANS
Kuakata Beach
Bay of Bengal
-10m
Cox Bazar
Teknaf
Rangamati Lakes
Hills
Barisan
Tropical Monsoon Climate
10 – 35 °C
Rainfall
Cyclones
Padma Meghna Delta:
Water discharge 6,000-80,000 m³/sec
sediment discharge 1,500,000,000 ton/year
Deltaic Coastline 710 km protected by
Dykes
Mangroves
Beaches
Mud Flats


Singapore
SOUTH CHINA SEA
MALAYSIA
INDONESIA
INDIAN OCEAN
Kalimantan
Sumatra
Java
SINGAPORE
STRAIT OF SINGAPORE
ASIA



Singapore, Land Reclamations


Singapore
Sentosa
Sentosa Beach


Creating a Reservoir in the City –
Marina Reservoir
Marina Barrage
Reservoir In The City

SUSTAINABLE COASTAL ZONE DEVELOPMENT

Integrated Coastal & Delta Policy
via Building with Nature®

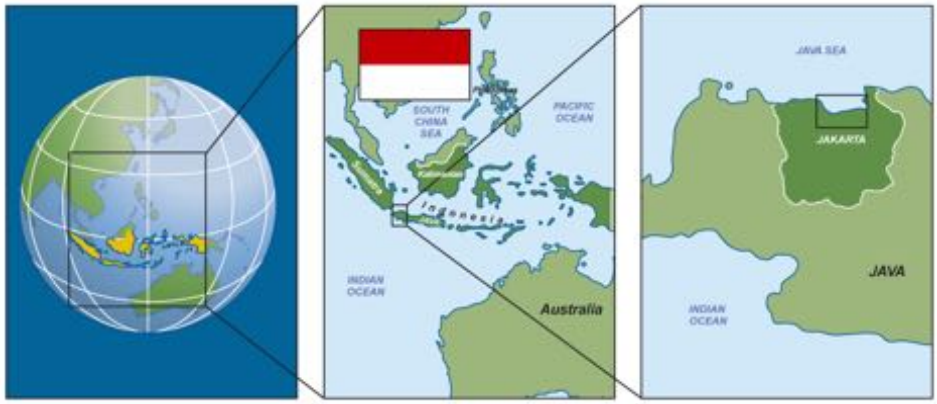
Prof. Dr. R.E. Waterman MSc

INDONESIA – THE NETHERLANDS

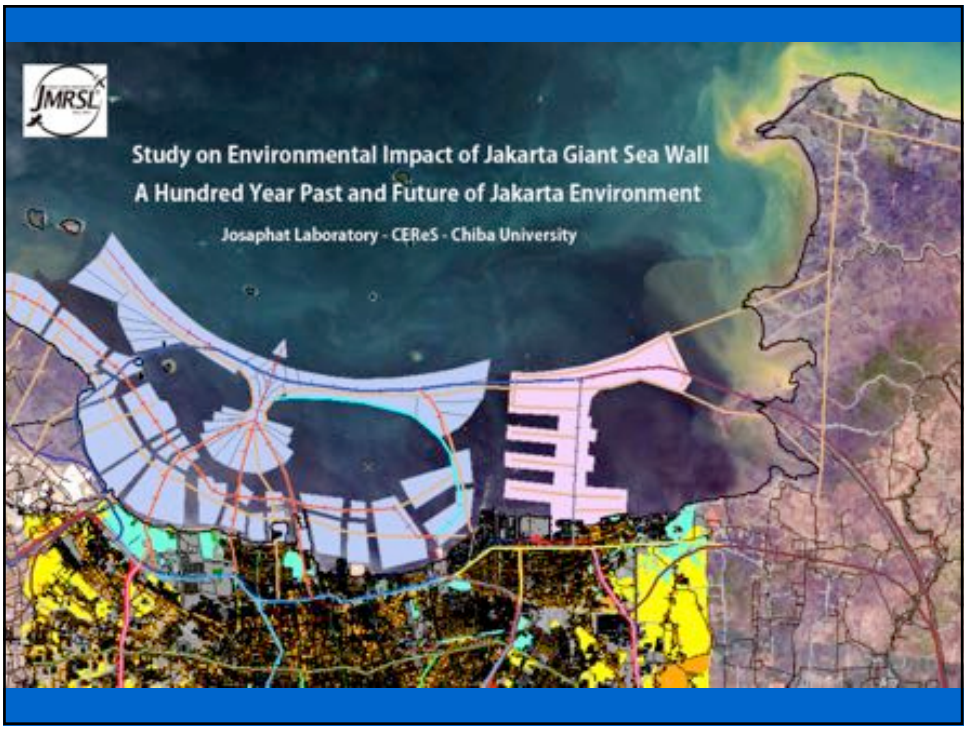
2013

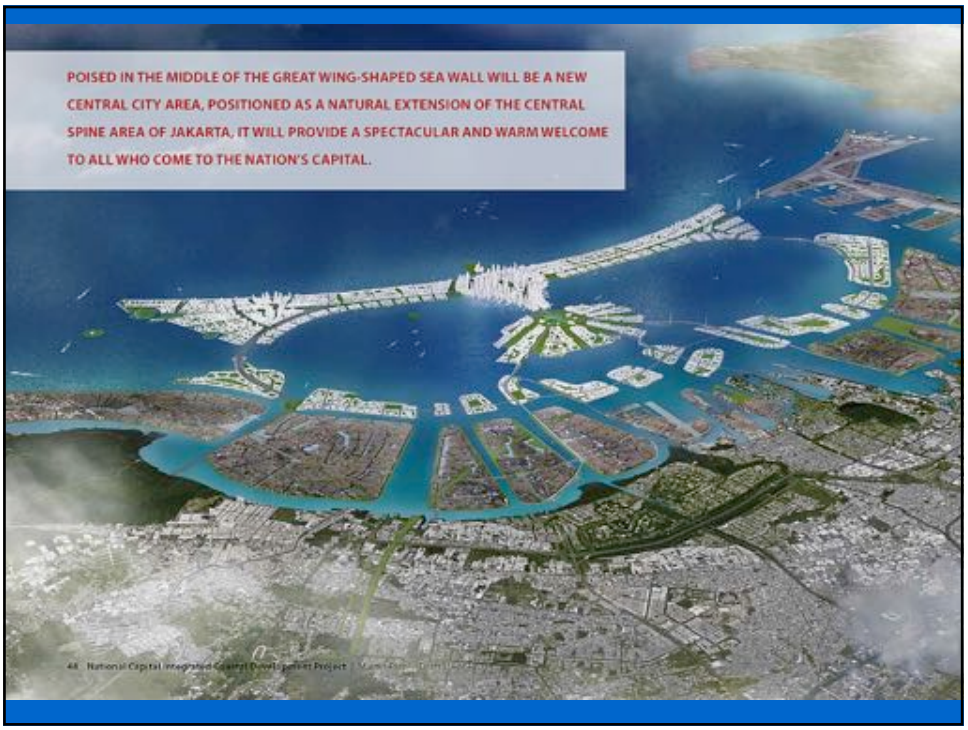



Indonesia Jakarta

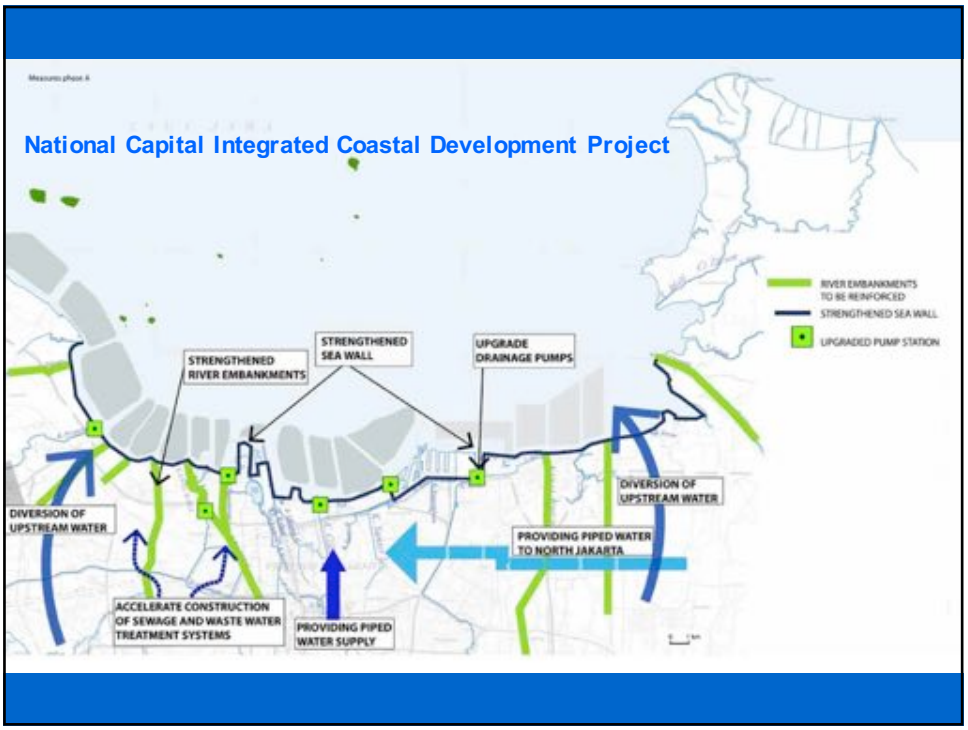


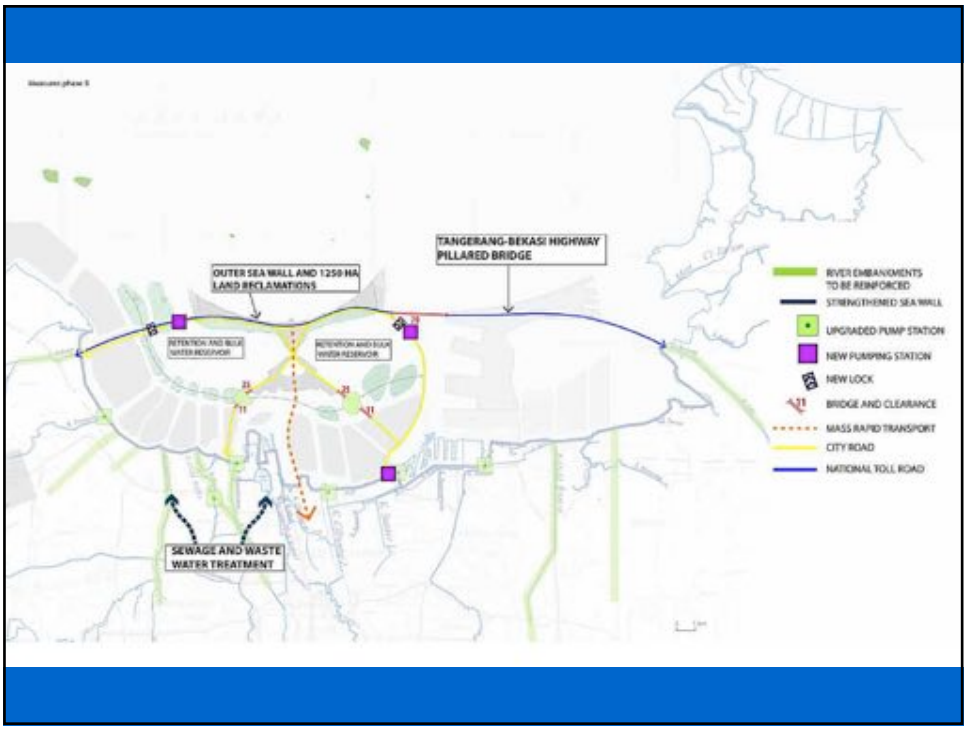
Indonesia 17,500 islands - 81,000 km coast lines


JMRSL
Study on Environmental Impact of Jakarta Giant Sea Wall
A Hundred Year Past and Future of Jakarta Environment
Josaphat Laboratory - CEReS - Chiba University

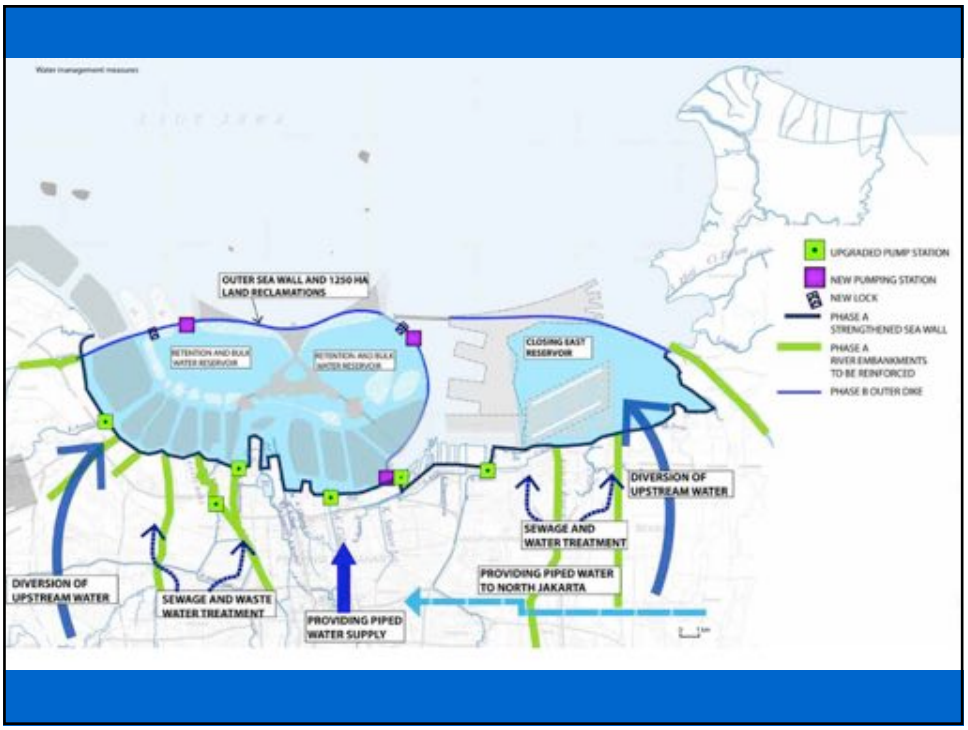

POISED IN THE MIDDLE OF THE GREAT WING-SHAPED SEA WALL WILL BE A NEW CENTRAL CITY AREA, POSITIONED AS A NATURAL EXTENSION OF THE CENTRAL SPINE AREA OF JAKARTA, IT WILL PROVIDE A SPECTACULAR AND WARM WELCOME TO ALL WHO COME TO THE NATION'S CAPITAL.

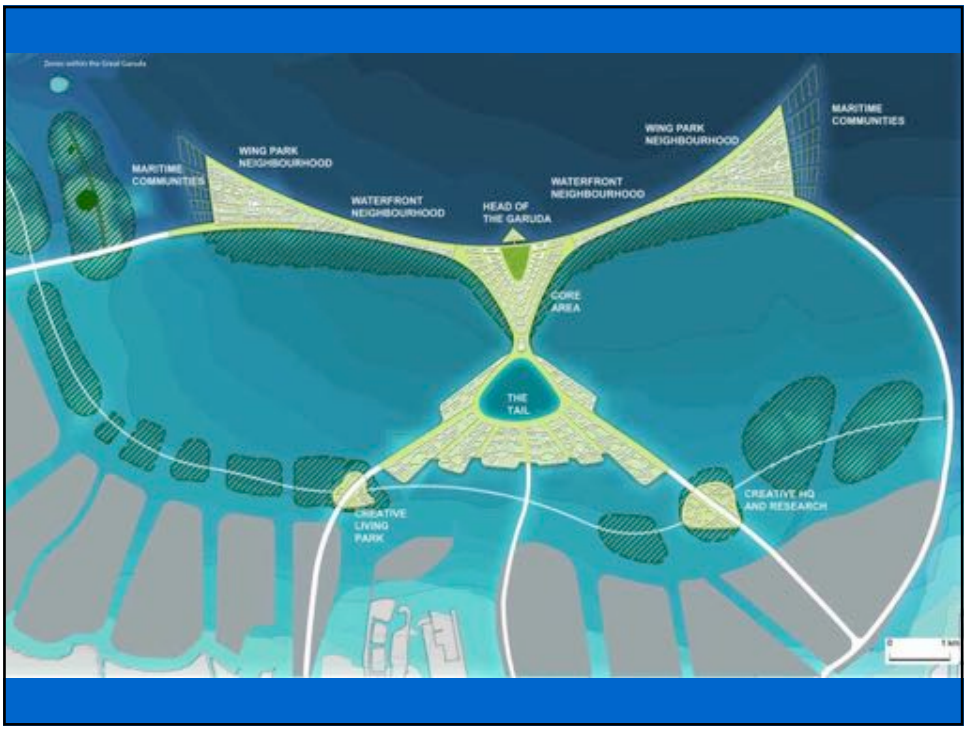

FORMED BY THE LAWS OF NATURE, FLOW AND EFFICIENCY, THIS ELEGANT FOIL-SHAPED WATERFRONT CITY RESEMBLES A GREAT BIRD, AN EAGLE SPREADING ITS GREAT WINGS TO PROTECT THE PEOPLE OF JAKARTA, THE NATIONAL CAPITAL.

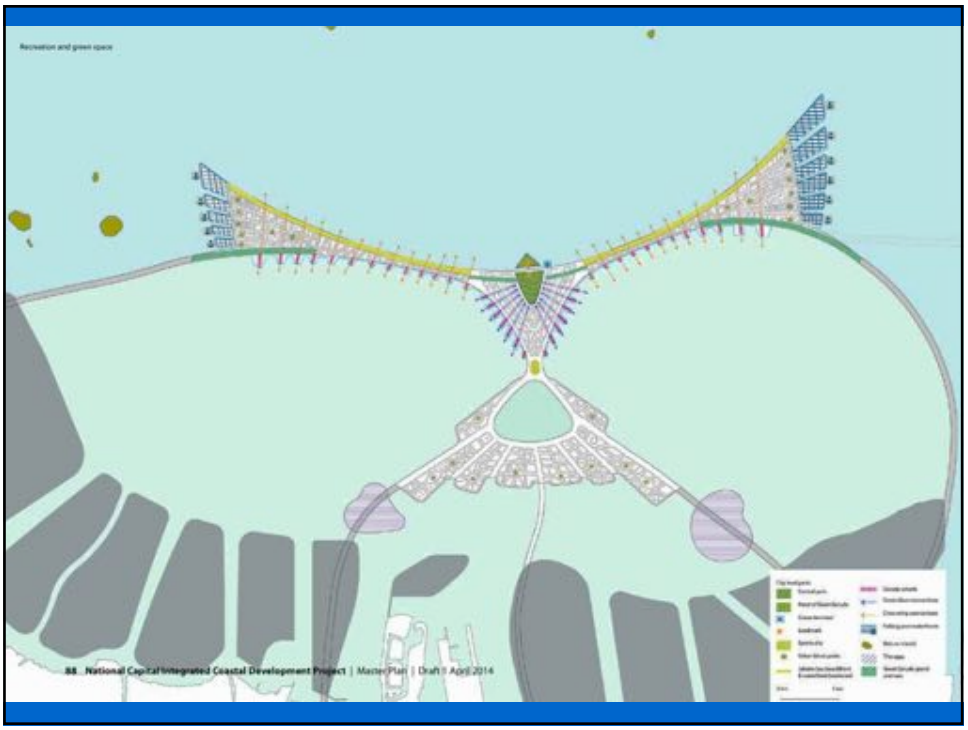

National Capital Integrated Coastal Development Project
RIVER EMBANKMENTS TO BE REINFORCED
STRENGTHENED SEA WALL
UPGRADED PUMP STATION
STRENGTHENED RIVER EMBANKMENTS
STRENGTHENED SEA WALL
UPGRADE DRAINAGE PUMPS
DIVERSION OF UPSTREAM WATER
DIVERSION OF UPSTREAM WATER
PROVIDING PIPED WATER TO NORTH JAKARTA
ACCELERATE CONSTRUCTION OF SEWAGE AND WASTE WATER TREATMENT SYSTEMS
PROVIDING PIPED WATER SUPPLY

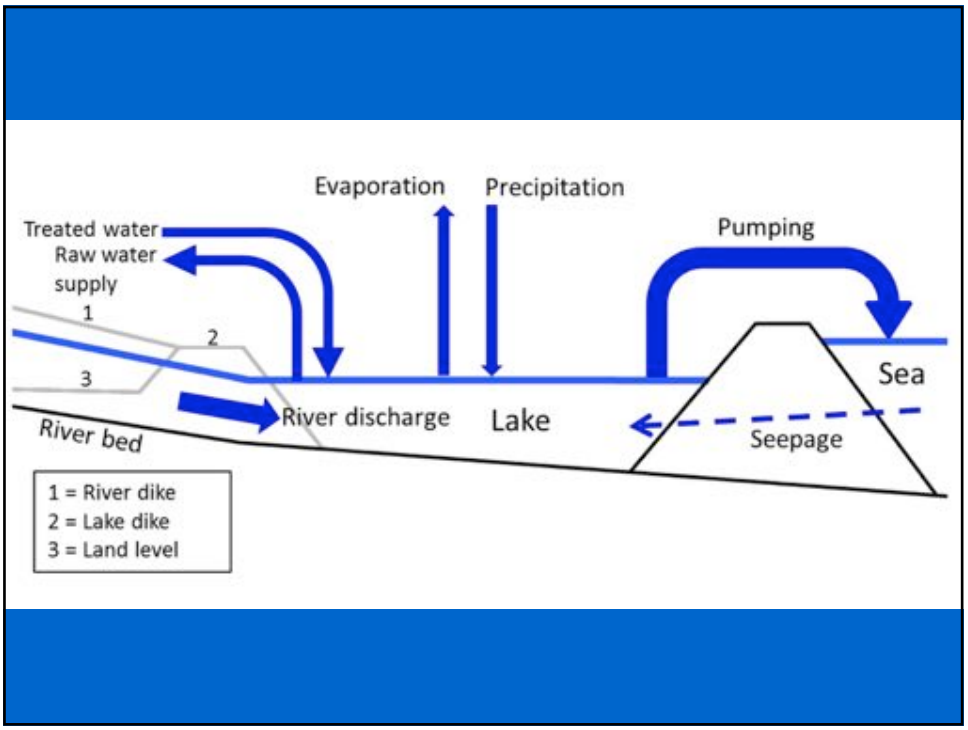

TANGERANG-BEKASI HIGHWAY
PILLARED BRIDGE
OUTER SEA WALL AND 1250 HA
LAND RECLAMATIONS
SEWAGE AND WASTE
WATER TREATMENT
RIVER EMBANKMENTS
TO BE REINFORCED
STRENGTHENED SEA WALL
UPGRADED PUMP STATION
NEW PUMPING STATION
NEW LOCK
BRIDGE AND CLEARANCE
MASS RAPID TRANSPORT
CITY ROAD
NATIONAL TOLL ROAD

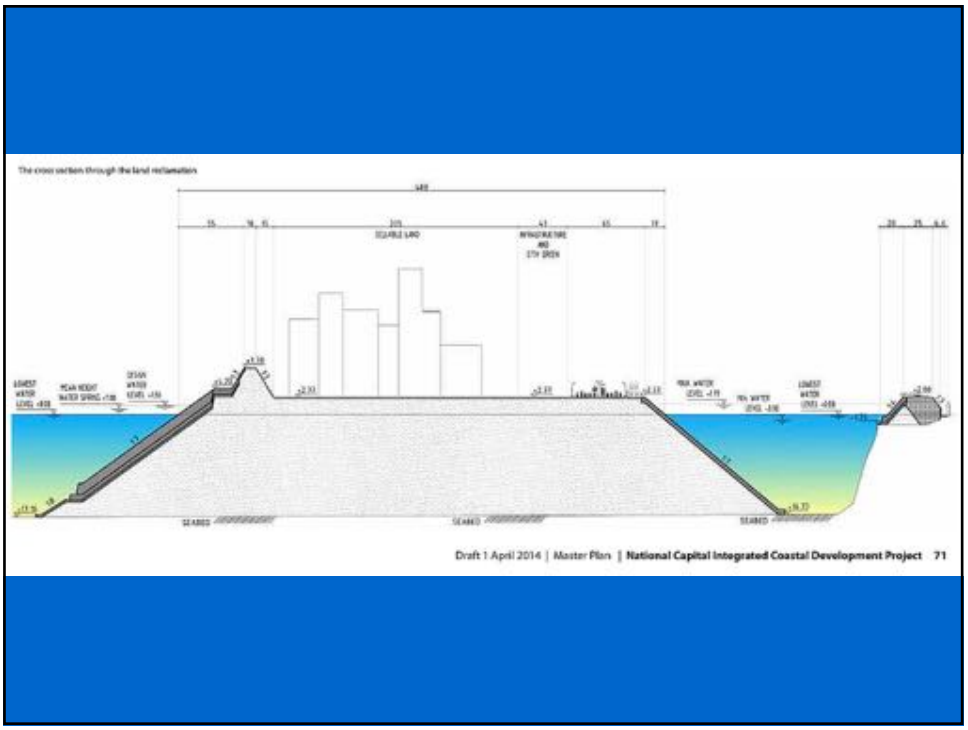

PORT EXTENSION
400 HA
CLOSING EAST
RESERVOIR
SPACE FOR
FUTURE
AIRPORT
SEWAGE AND
WATER TREATMENT
RIVER EMBANKMENTS
TO BE REINFORCED
STRENGTHENED SEA WALL
UPGRADED PUMP STATION
NEW PUMPING STATION
NEW LOCK
BRIDGE AND CLEARANCE
MASS RAPID TRANSPORT
CITY ROAD
NATIONAL TOLL ROAD

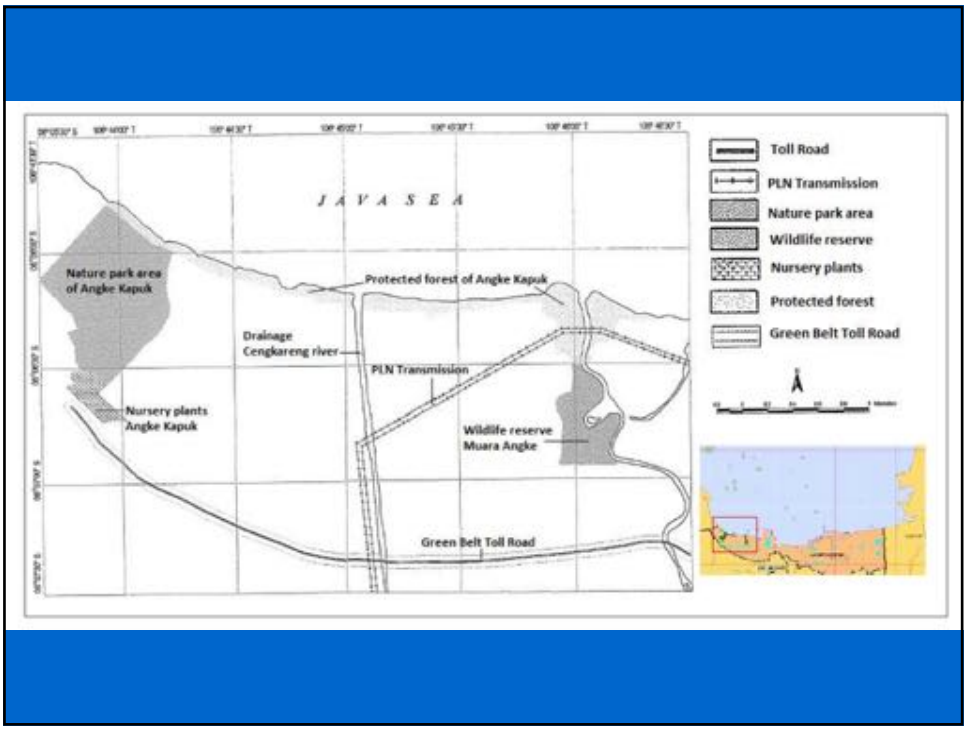

Water management measures
OUTER SEA WALL AND 1250 HA LAND RECLAMATIONS
RETENTION AND BULK WATER RESERVOIR
RETENTION AND BULK WATER RESERVOIR
CLOSING EAST RESERVOIR
UPGRADED PUMP STATION
NEW PUMPING STATION
NEW LOCK
PHASE A STRENGTHENED SEA WALL
PHASE A RIVER EMBANKMENTS TO BE REINFORCED
PHASE B OUTER DIKE
DIVERSION OF UPSTREAM WATER
SEWAGE AND WATER TREATMENT
PROVIDING PIPED WATER TO NORTH JAKARTA
DIVERSION OF UPSTREAM WATER
SEWAGE AND WASTE WATER TREATMENT
PROVIDING PIPED WATER SUPPLY

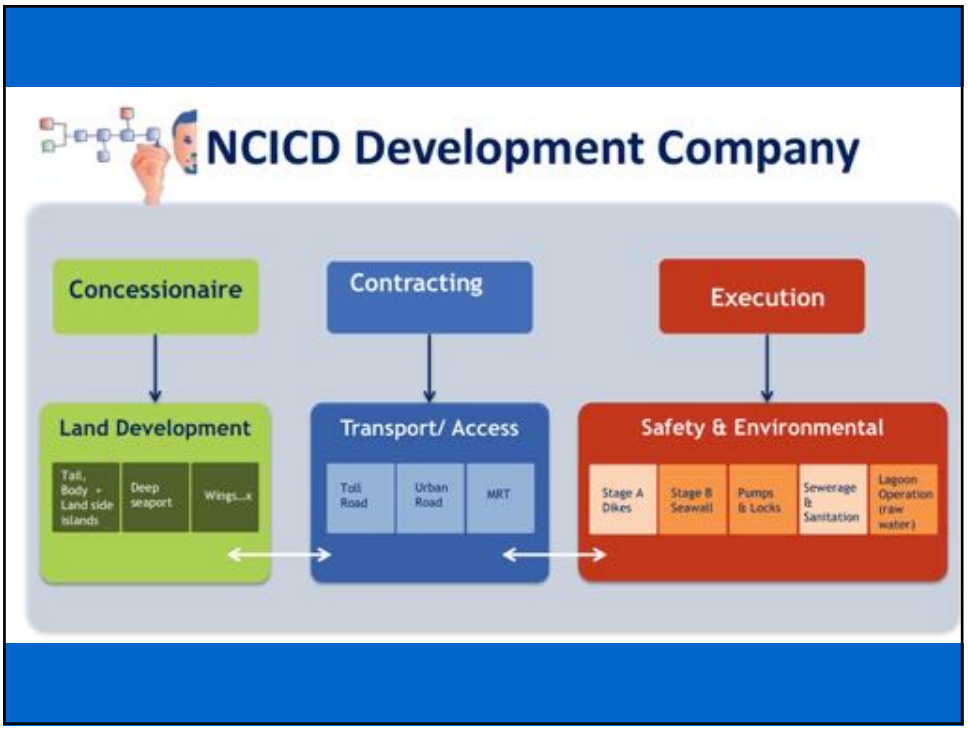

Zones within the Great Garuda
MARITIME COMMUNITIES
WING PARK NEIGHBOURHOOD
WING PARK NEIGHBOURHOOD
MARITIME COMMUNITIES
WATERFRONT NEIGHBOURHOOD
WATERFRONT NEIGHBOURHOOD
HEAD OF THE GARUDA
CORE AREA
THE TAIL
CREATIVE LIVING PARK
CREATIVE HQ AND RESEARCH




Evaporation
Precipitation
Treated water
Raw water
supply
Pumping
1
2
3
Sea
River discharge
Lake
River bed
Seepage
1 = River dike
2 = Lake dike
3 = Land level


Draft 1 April 2014 | Master Plan | National Capital Integrated Coastal Development Project 71


J A V A S E A
Nature park area of Angke Kapuk
Protected forest of Angke Kapuk
Drainage Cengkareng river
PLN Transmission
Nursery plants Angke Kapuk
Wildlife reserve Muara Angke
Green Belt Toll Road
Toll Road
PLN Transmission
Nature park area
Wildlife reserve
Nursery plants
Protected forest
Green Belt Toll Road



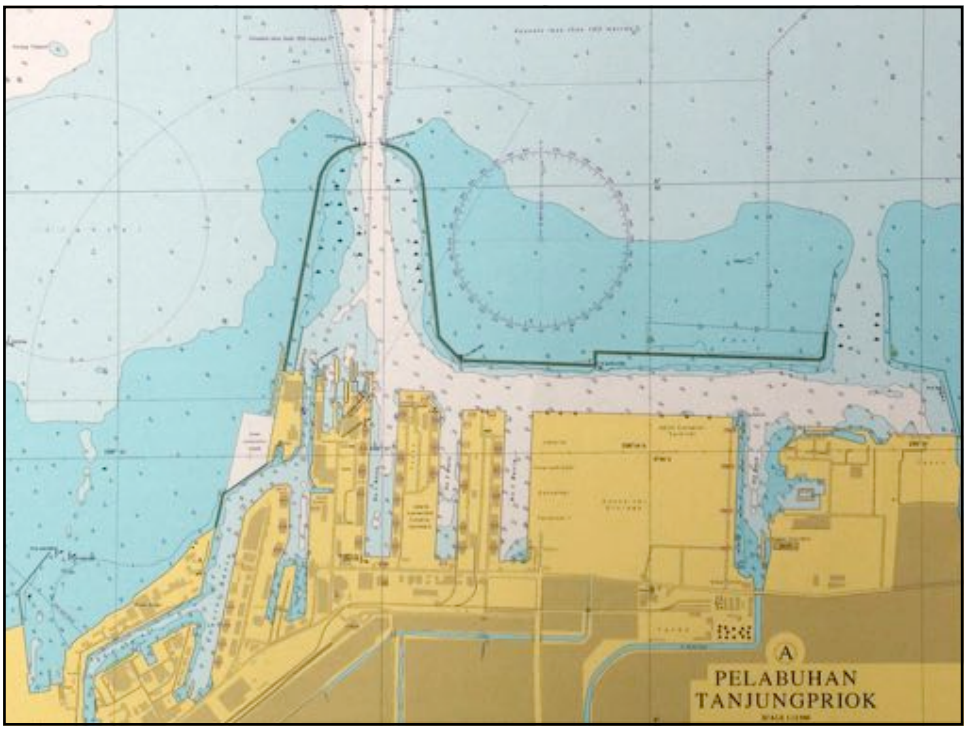
GEODESY

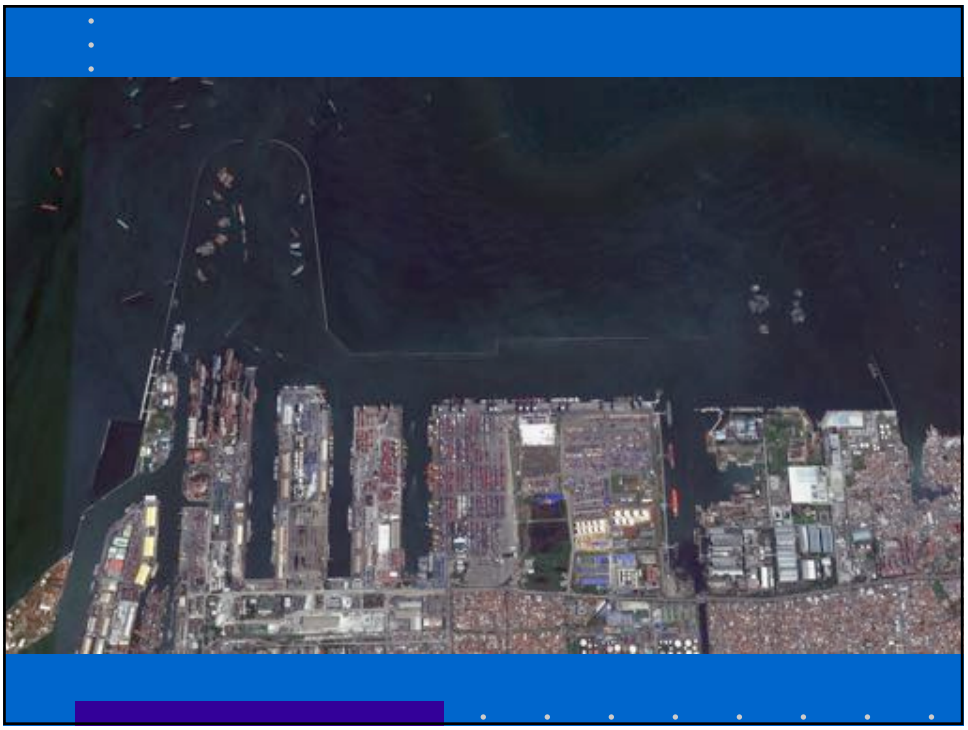
In planning & design Geodesy plays an essential role.

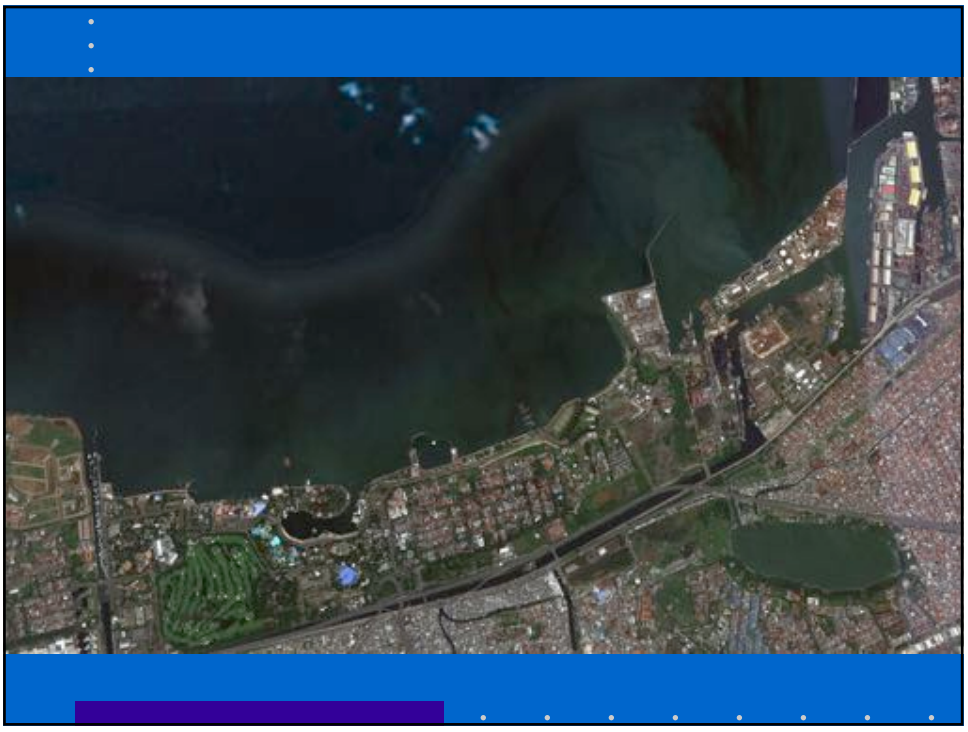
Historical and actual data with regard to land & sea surfaces and sub surfaces are needed for planning & map making.

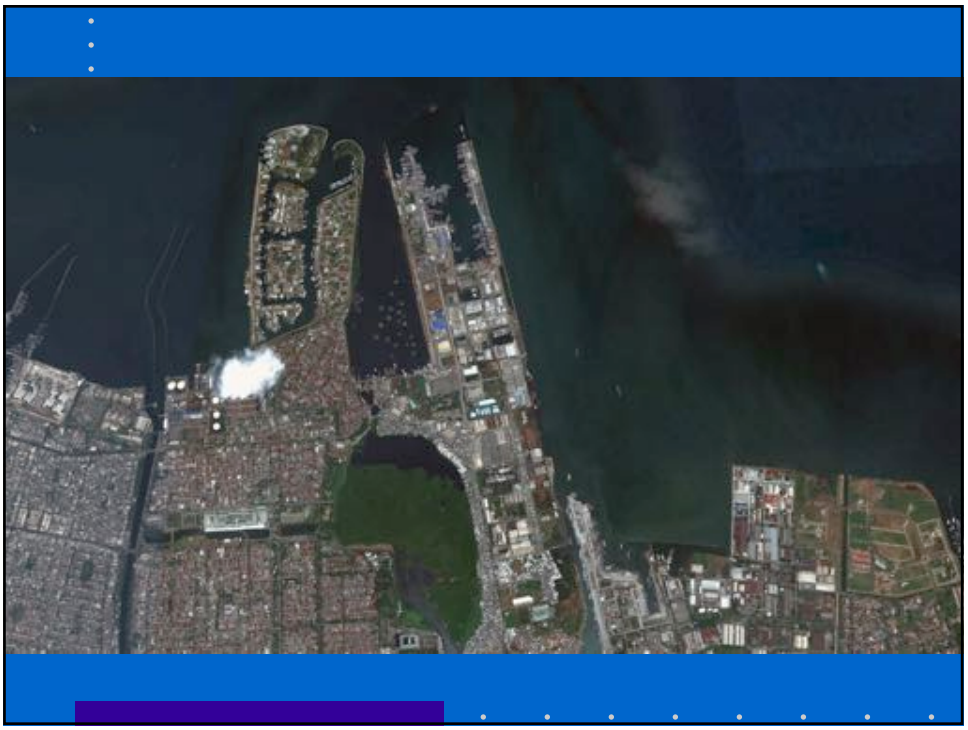
Measurements are required through land- and sea survey, including Remote Sensing.

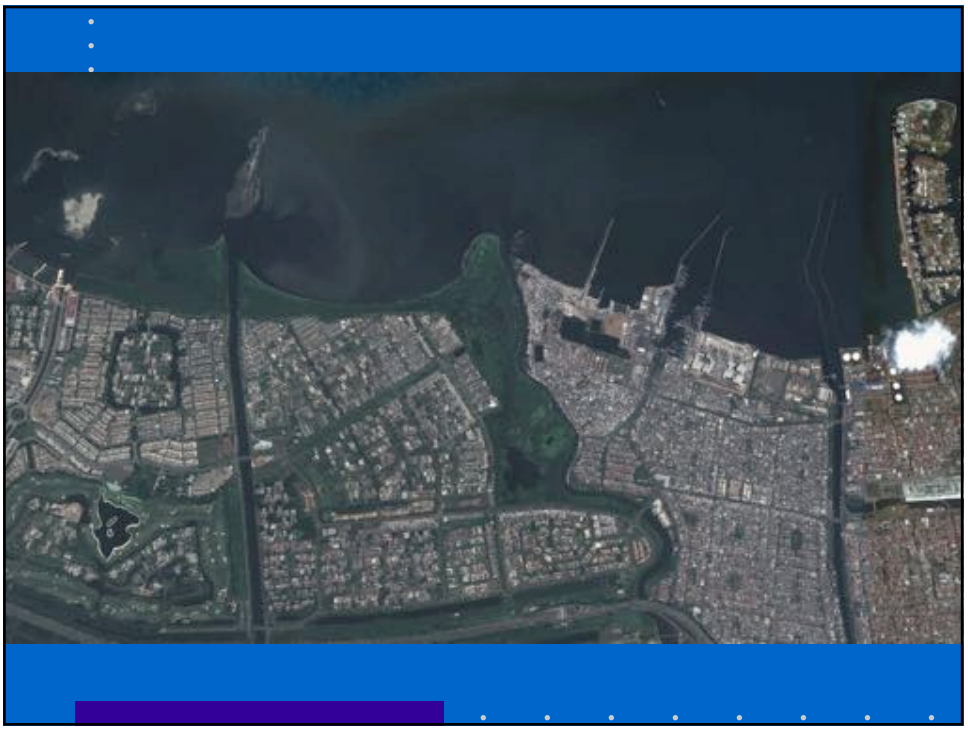

TELUK JAKARTA

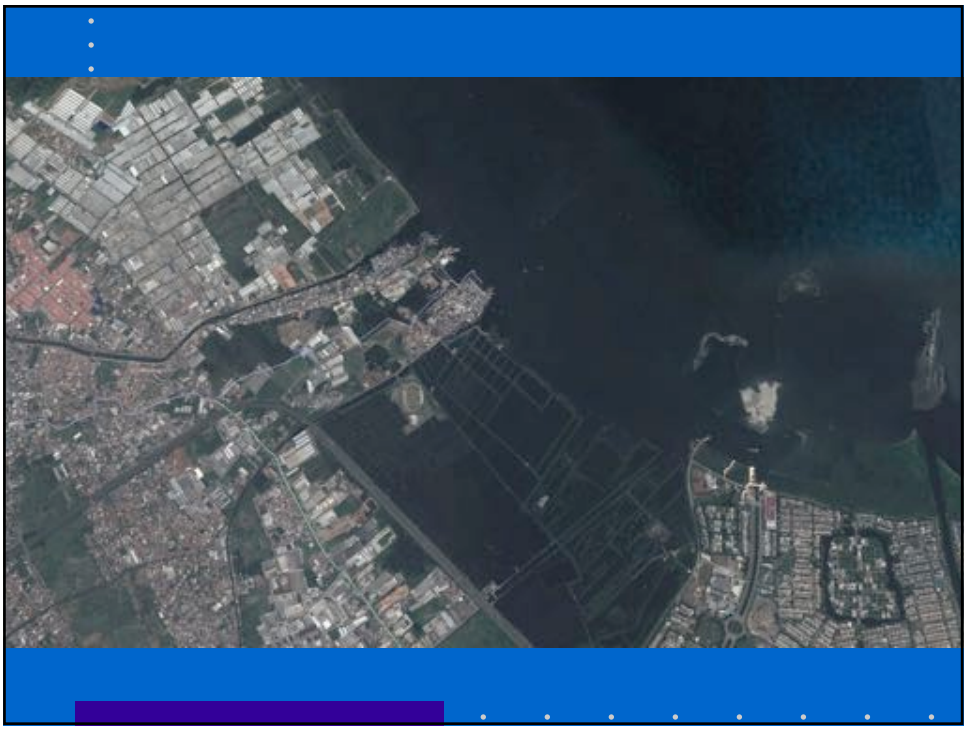

A
PELABUHAN
TANJUNGPRIOK

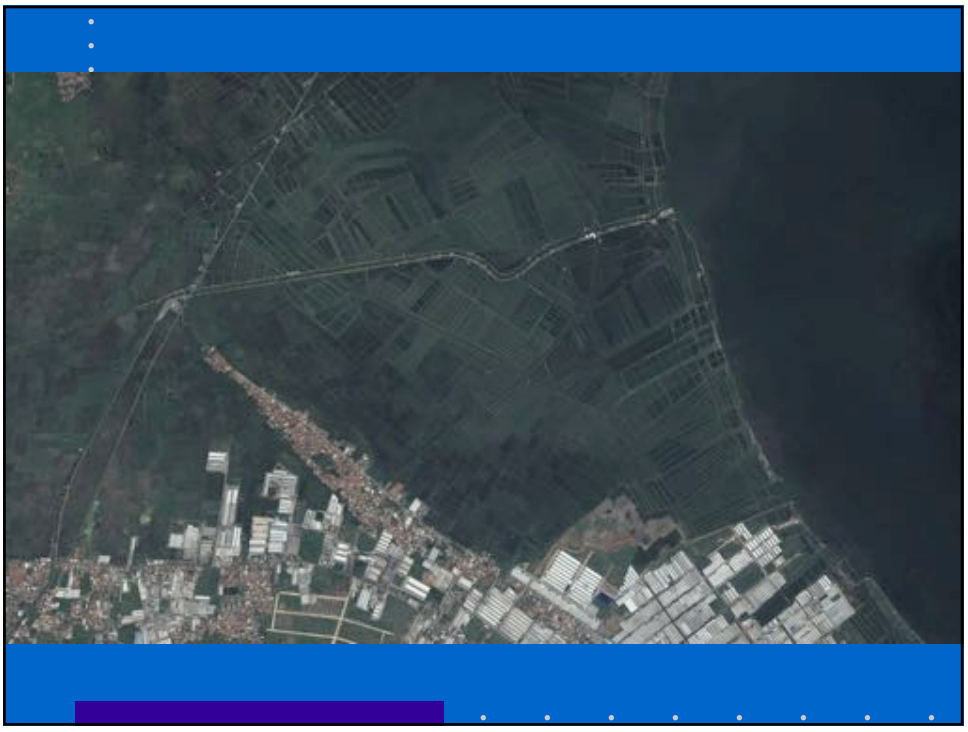












Jakarta

740.28 km²

10,200,000 Inhabitants

Jabotabek

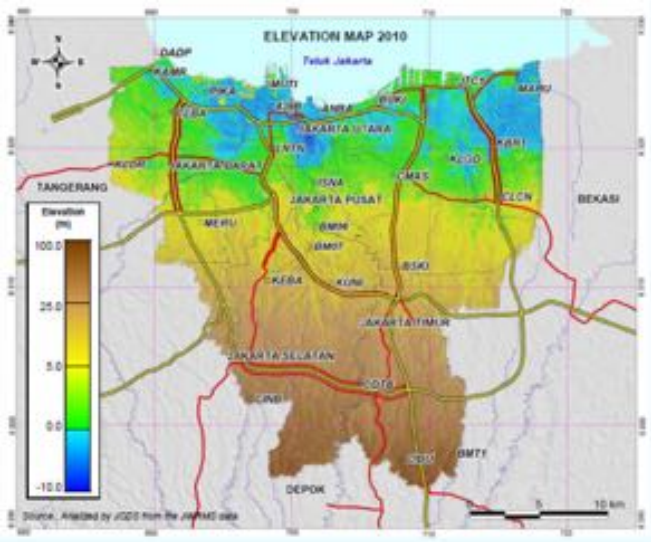
28,000,000 Inhabitants

30 km Coastline

Weak Local Coastal Defense to be improved

Sea level rise, higher frequency & intensity of stormsurges & rainfall

Land Subsidence up to 10-20 cm / year



Necessity of adequate sewer & drainage systems

Insufficient pumping capacity

Too much drinking water extraction from groundwater

Contaminated surface water

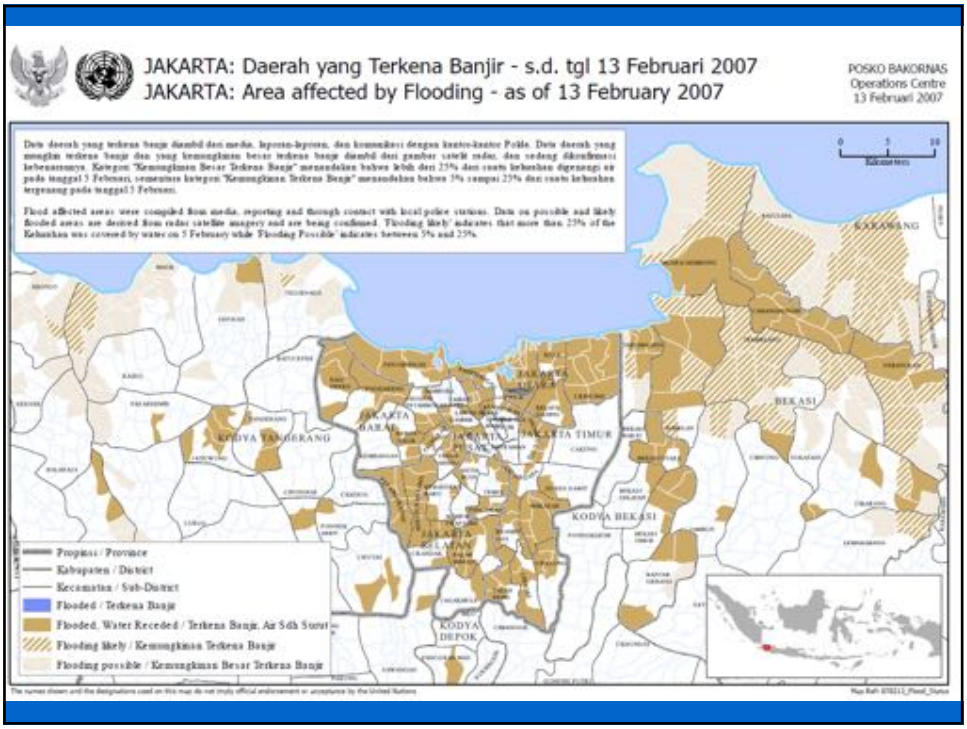
Illegal encroachment into rivers & drains

Necessity collection & treatment of wastes

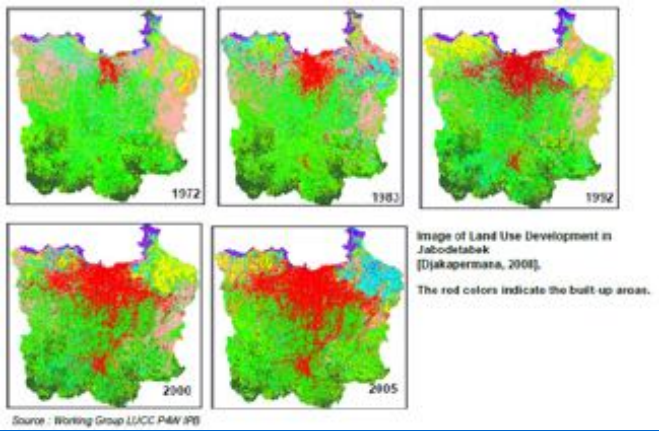
Outdated infrastructures along rivers & canals
(pipelines, cables, bridges, roads)

Flood retaining walls, ring dykes, shore protection

Siltation of rivers & canals



Rapid Urbanisation

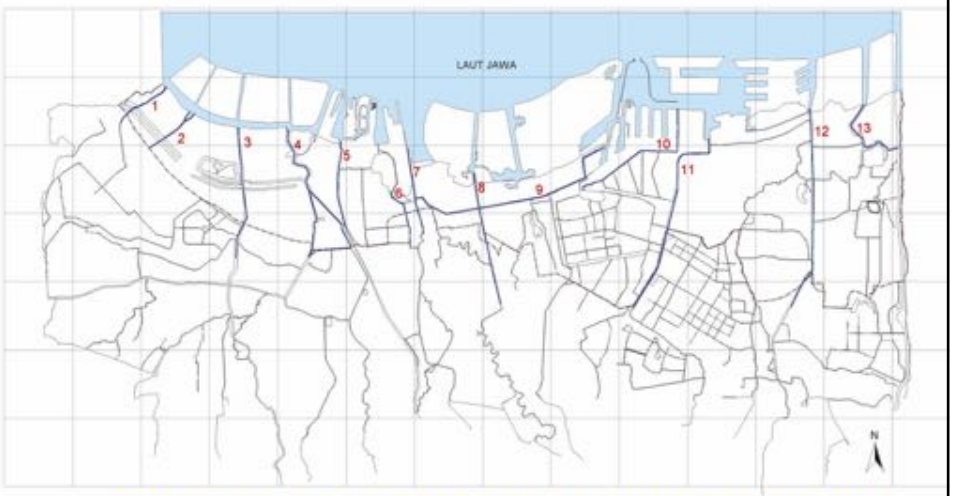


INHABITANTS

2000: 20 million

2010 : 30 million

LOCATION OF 11 RIVERS & 2 DRAINAGE CANALS IN PANTURA ZONE OF JAKARTA

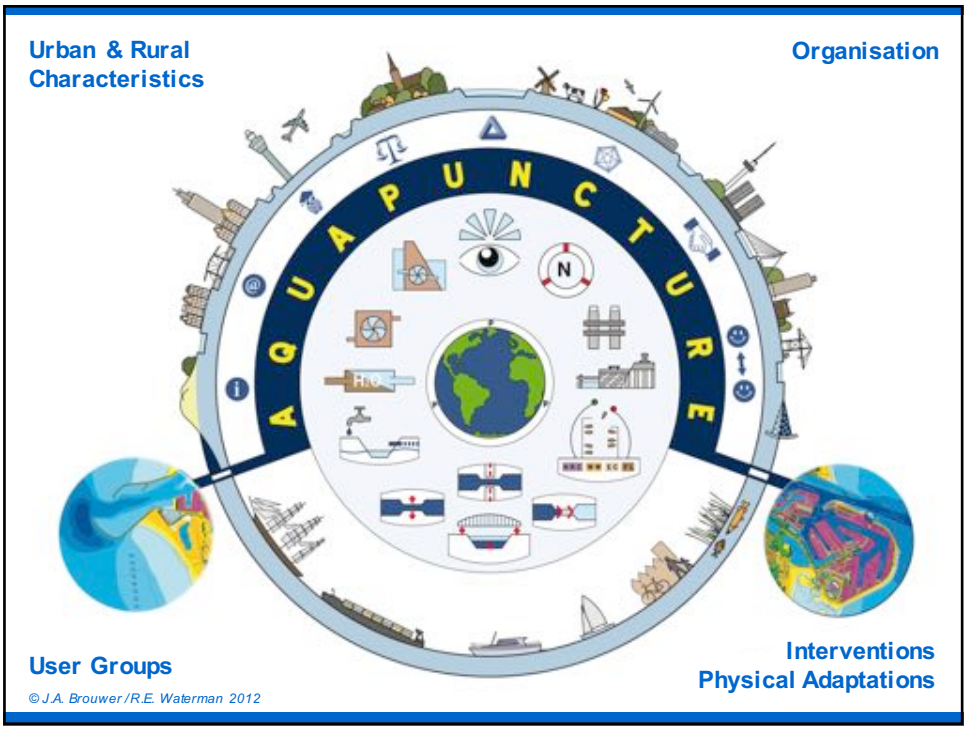


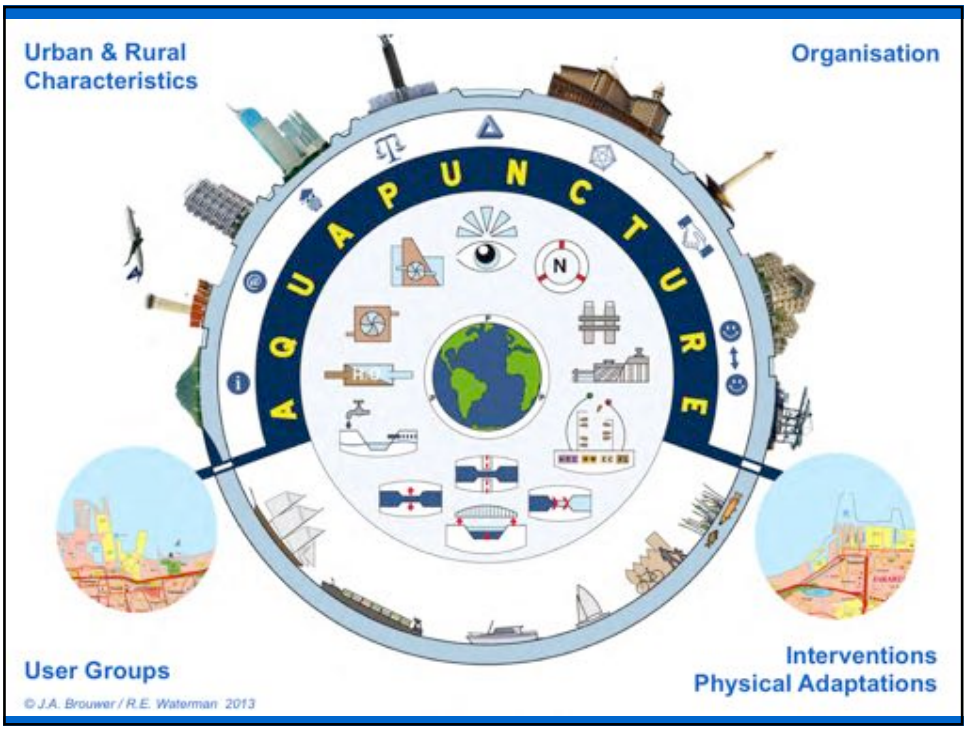
PETA LOKASI 13 SUNGAI DI KAWASAN PANTURA JAKARTA

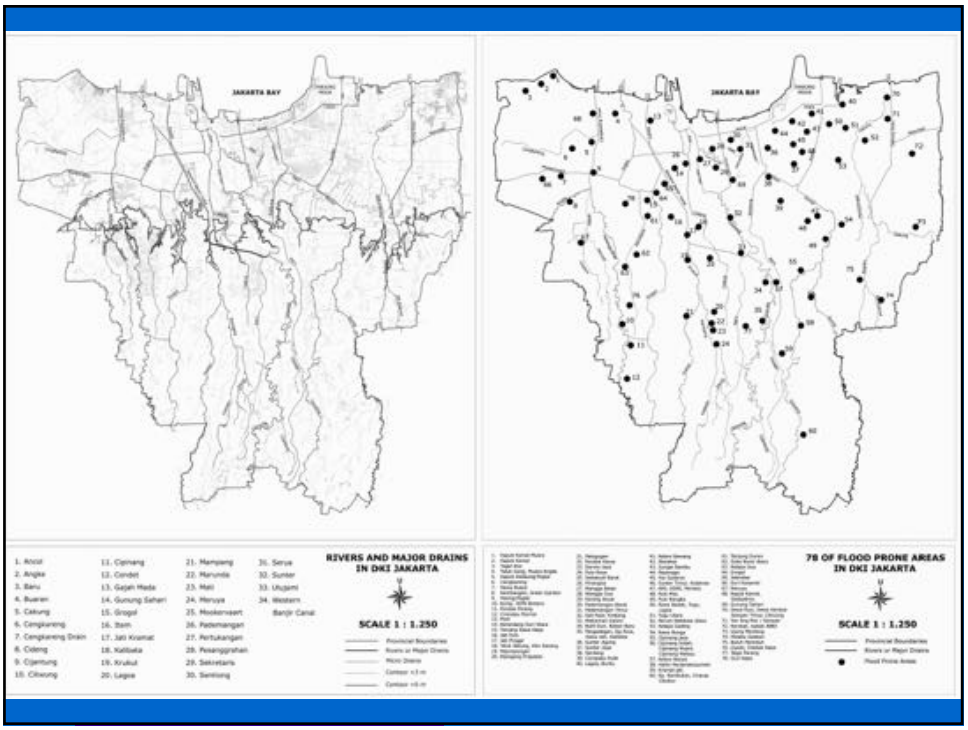
KETERANGAN :

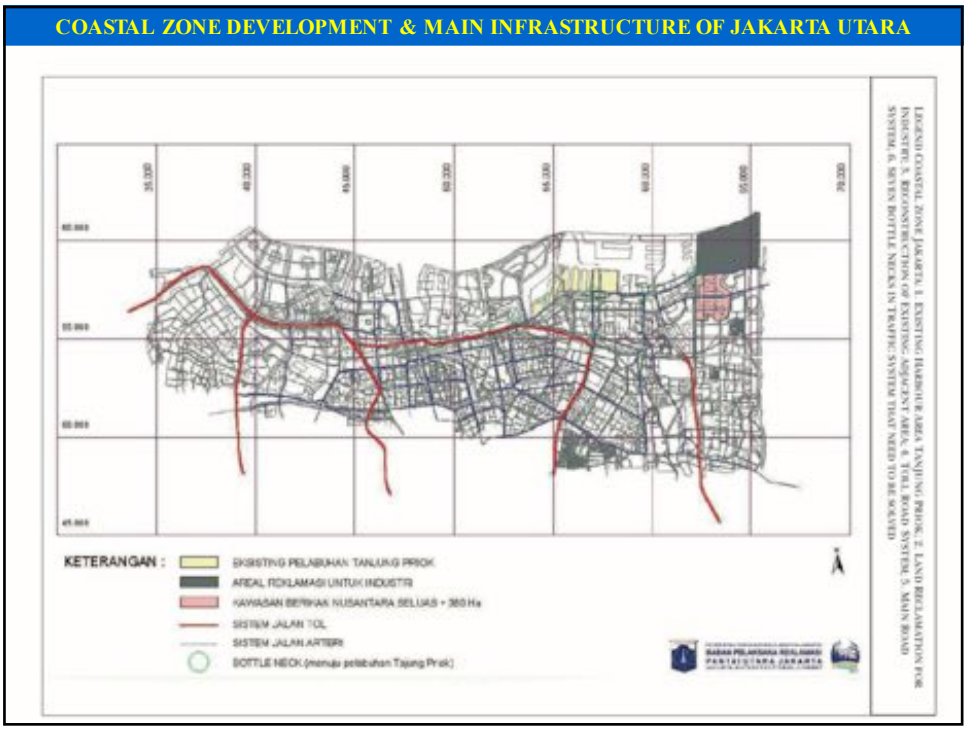
1. KALI KAMAL
2. KALI TUNJUNGAN
3. CENGKARENG DRAIN
4. KALI MUARA ANGKE
5. KALI DURI LEDENG
6. KALI OPAK
7. KALI ANAK CILIWUNG I
8. KALI CILIWUNG/MARINA
9. KALI ANCOL
10. KALI LAGOA
11. KALI SUNTER
12. CAKUNG DRAIN
13. KALI BLENCONG

BADAN PELAKSANA REKLAMASI PANTAI UTARA JAKARTA

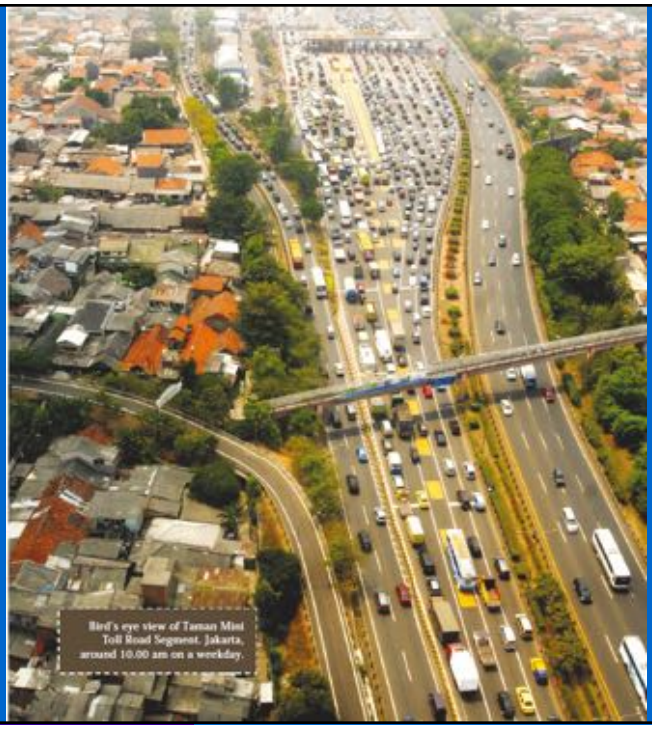

Urban & Rural Characteristics
Organisation
AQUAPUNCTURE
User Groups
Interventions Physical Adaptations
© J.A. Brouwer / R.E. Waterman 2012


Urban & Rural Characteristics
Organisation
AQUAPUNCTURE
User Groups
Interventions Physical Adaptations
© J.A. Brouwer / R.E. Waterman 2013

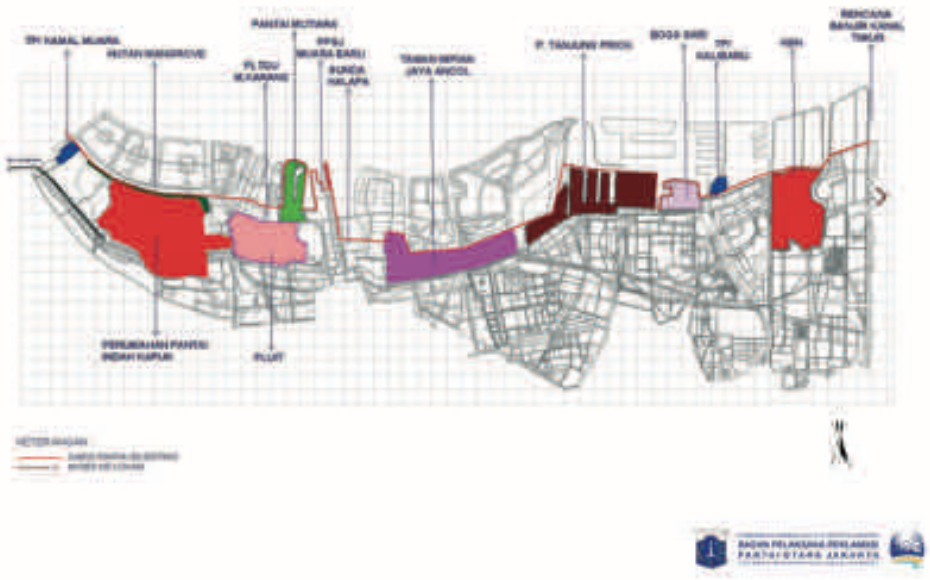

JAKARTA BAY
RIVERS AND MAJOR DRAINS IN DKI JAKARTA
SCALE 1 : 1.250
JAKARTA BAY
78 OF FLOOD PRONE AREAS IN DKI JAKARTA
SCALE 1 : 1.250

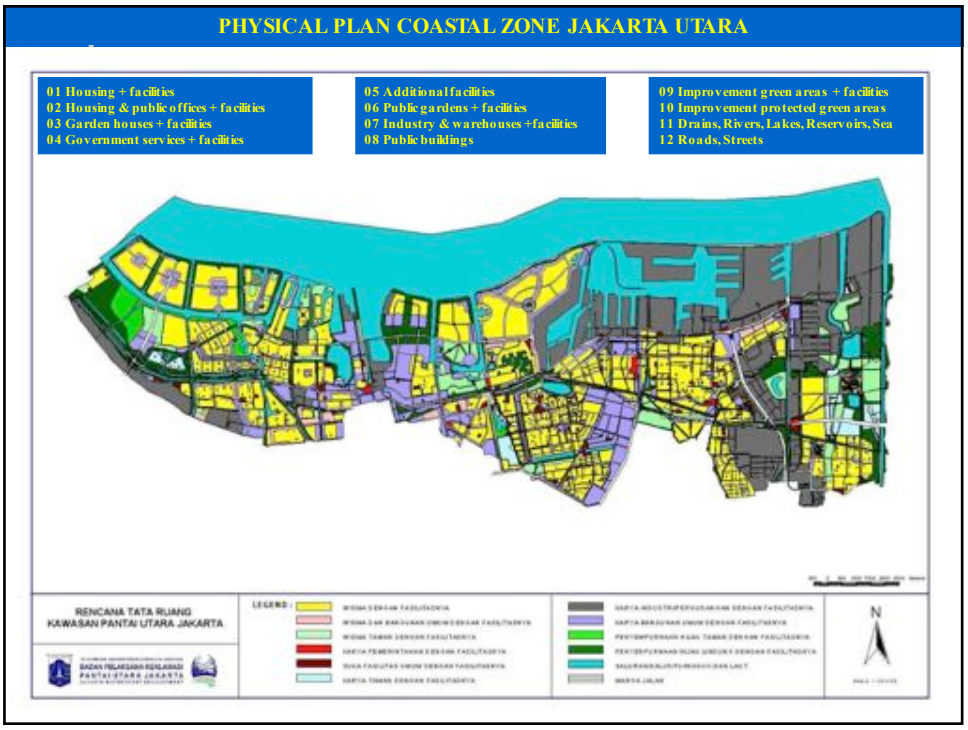

COASTAL ZONE DEVELOPMENT & MAIN INFRASTRUCTURE OF JAKARTA UTARA
KETERANGAN :
EKSISTING PELABUHAN TANJUNG PRIOK
AREAL REKLAMASI UNTUK INDUSTRI
KAWASAN BERIKAT NUSANTARA SELUAS ± 300 Ha
SISTEM JALAN TOL
SISTEM JALAN ARTERI
BOTTLE NECK (menuju pelabuhan Tajung Priok)

Taman Mini
Toll Road
Jakarta



LOCATIONS ADJACENT TO THE PROJECTED LAND RECLAMATIONS




PHYSICAL PLAN COASTAL ZONE JAKARTA UTARA
01 Housing + facilities
02 Housing & public offices + facilities
03 Garden houses + facilities
04 Government services + facilities
05 Additional facilities
06 Public gardens + facilities
07 Industry & warehouses + facilities
08 Public buildings
09 Improvement green areas + facilities
10 Improvement protected green areas
11 Drains, Rivers, Lakes, Reservoirs, Sea
12 Roads, Streets
RENCANA TATA RUANG
KAWASAN PANTAI UTARA JAKARTA
LEGEND :
N


Jakarta

SUSTAINABLE COASTAL ZONE DEVELOPMENT

Integrated Coastal & Deltaic Policy via Building with Nature®

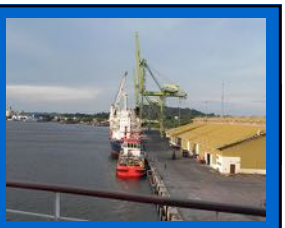
Prof. Dr. R.E. Waterman MSc

Negara Brunei Darussalam

Bandar Seri Begawan
2013

BRUNEI		THE NETHERLANDS
	SURFACE AREA	
	5,765 km²	33,883 km²
	INHABITANTS	
	0.422 million	16.7 million
	COASTAL LENGTH	
	161 km	353 km
	MAIN RIVERS	
	Sungai Belait	Rhine
	Sungai Brunei	Maas
	Sungai Liang	Scheldt
	Sungai Tutong	Eems
	Sungai Temburong	

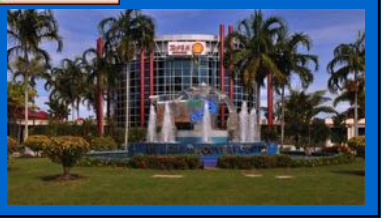
Bandar Seri Begawan

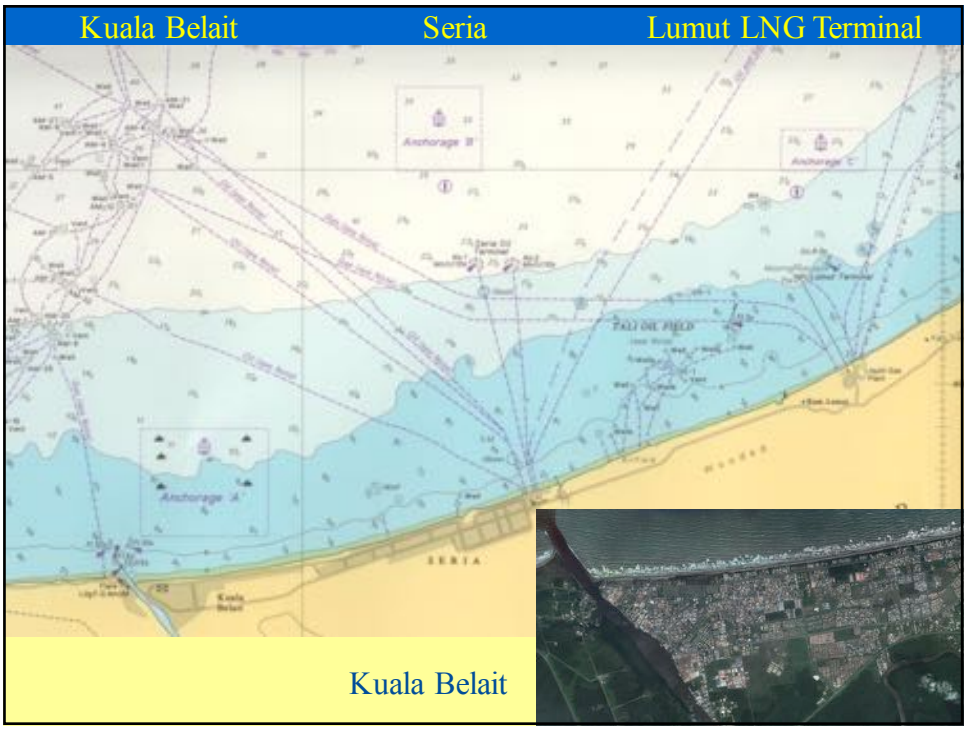


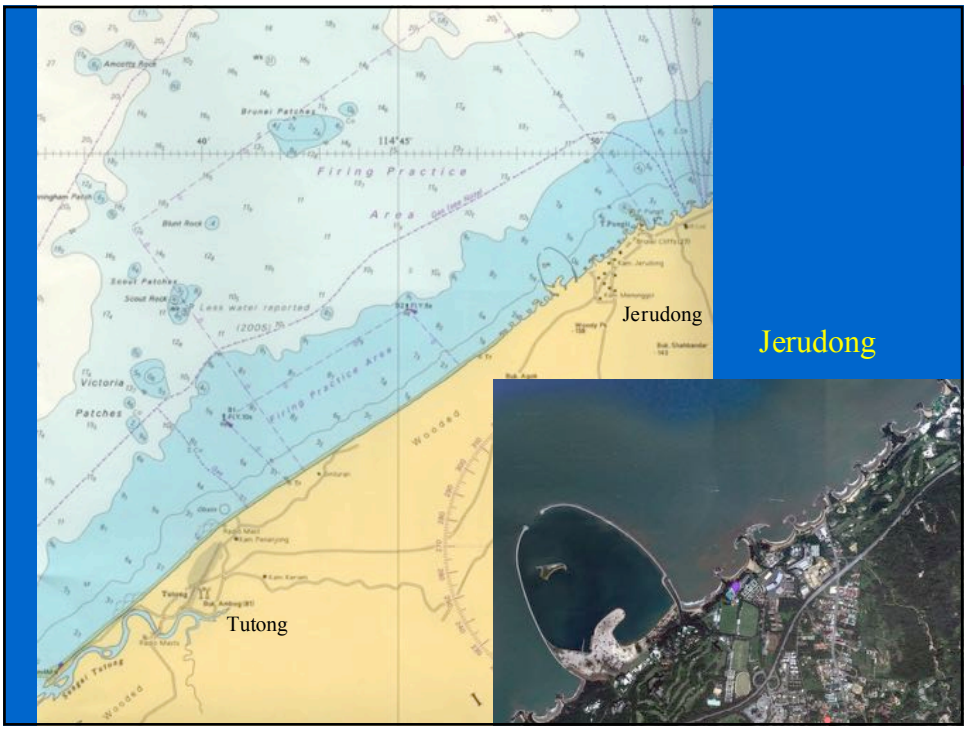
Muara Port

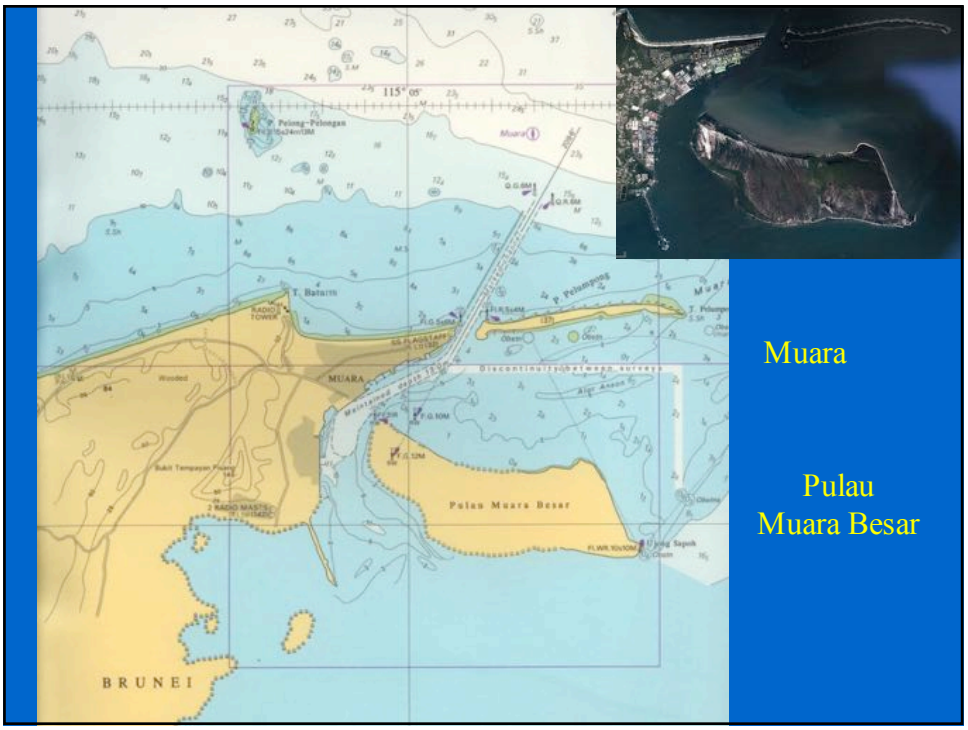
Kuala Belait

Seria




Kuala Belait
Seria
Lumut LNG Terminal
Kuala Belait


Jerudong
Jerudong
Tutong


Muara
Pulau
Muara Besar
BRUNEI
MUARA
Pulau Muara Besar


Pulau
Pelumpong
Muara
Pulau
Muara Besar

SUSTAINABLE COASTAL ZONE DEVELOPMENT

In all cases of coastal zone & port development it is profitable to make use of the principle of

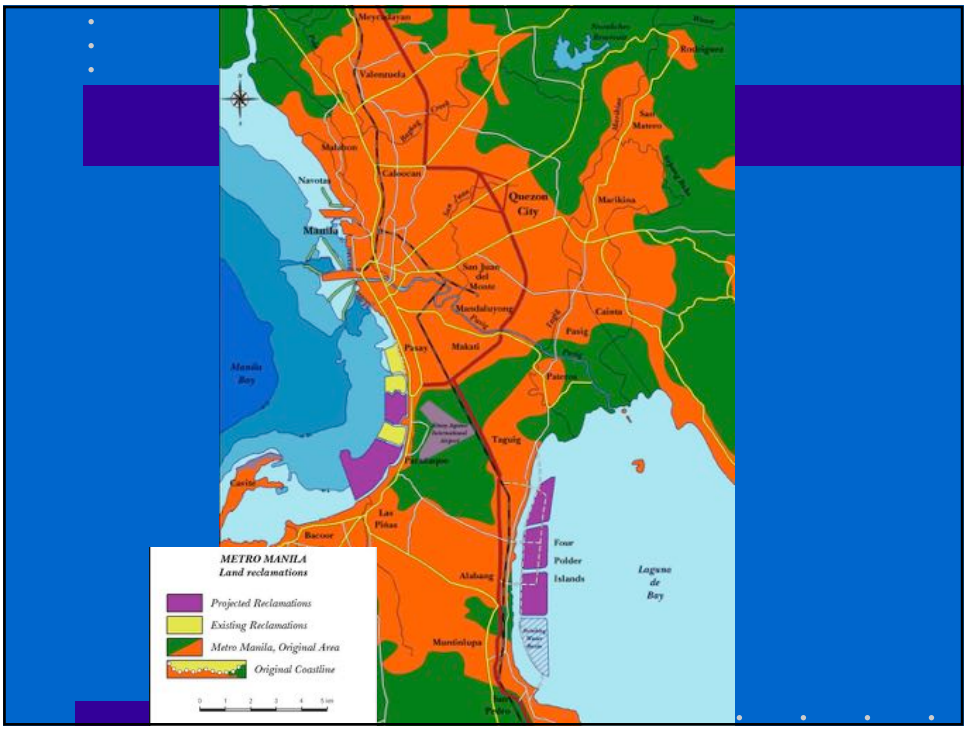
Building with Nature ®

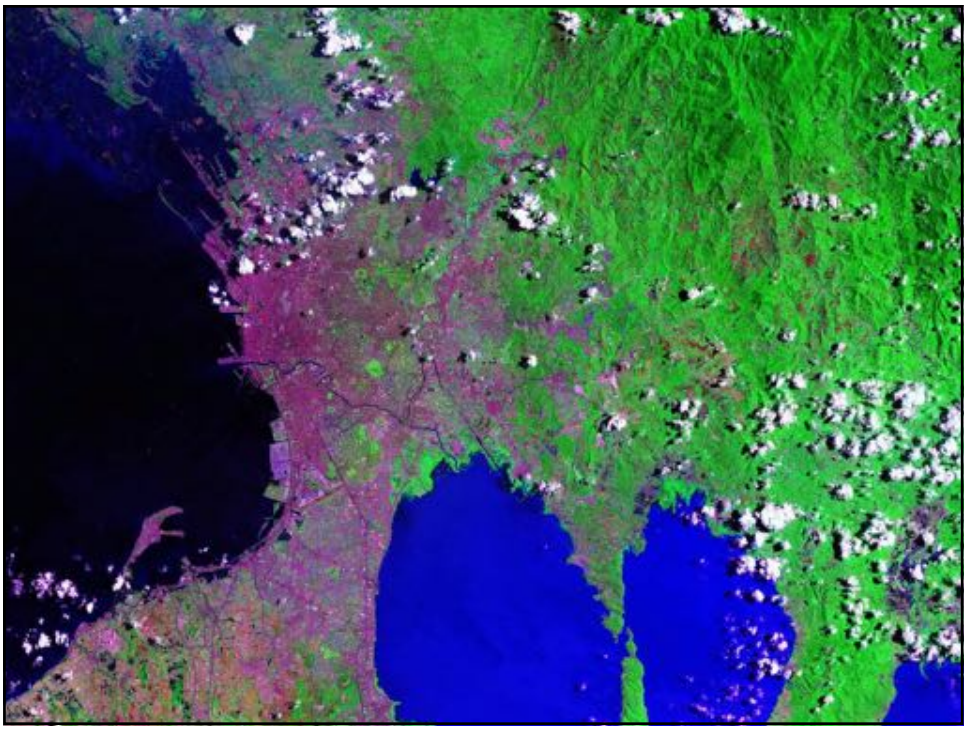
taking into account existing and new nature reserve areas.

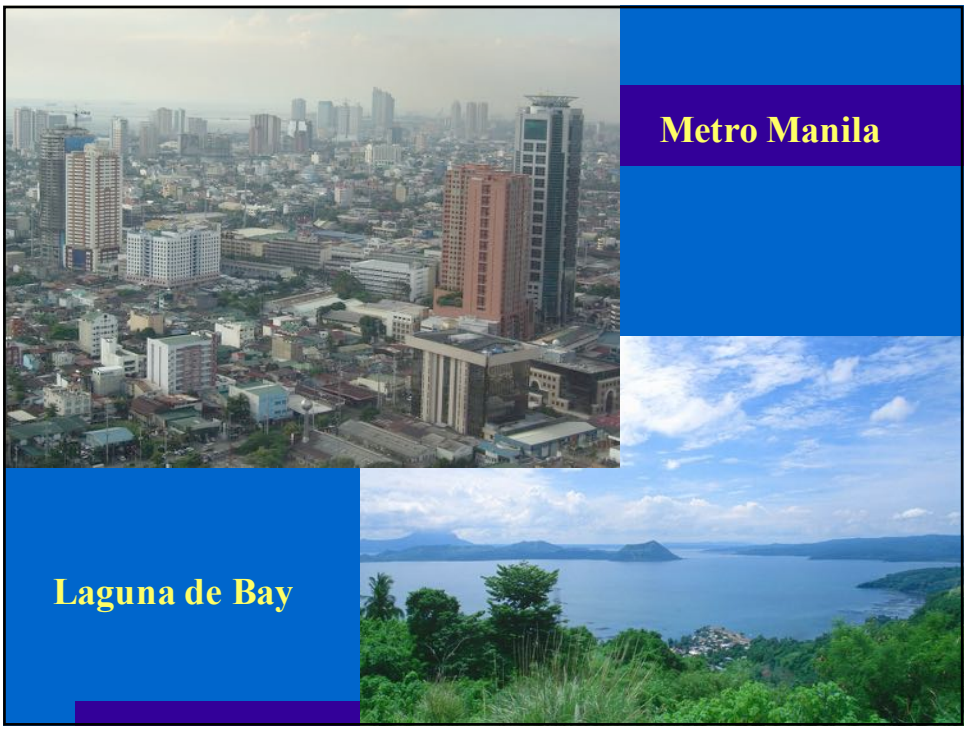
Special attention thereby for the introduction of :

- **renewable energy**
- **the production of (halal) food**
- **pharmaceuticals**
- **the nessesary logistics**


Philippines Manila Laguna de Bay
LUZON
SOUTH CHINA SEA
PACIFIC OCEAN
SULU SEA
BORNEO
MANILA BAY
LAGUNA DE BAY
LAMON BAY
TAYABAS BAY
POLILLO STRAIT


METRO MANILA
Land reclamations
Projected Reclamations
Existing Reclamations
Metro Manila, Original Area
Original Coastline
Manila
Quezon City
Makati
Pasay
Taguig
Las Piñas
Bacoor
Four Polder Islands
Laguna de Bay
Manila Bay




Metro Manila
Laguna de Bay

SUSTAINABLE COASTAL ZONE DEVELOPMENT

Integrated Coastal & Delta Policy
via Building with Nature®

Prof. Dr. R.E. Waterman MSc

Vietnam - Ho Chi Minh City

Mekong Delta & Ho Chi Minh City




VIETNAM


THE NETHERLANDS

SURFACE AREA

330,957 km² 33,883 km²

INHABITANTS

90 million 16.7 million

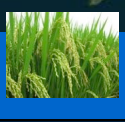
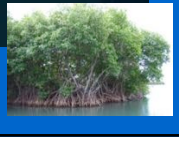
COASTAL LENGTH

3444 km 353 km

MAIN DELTAS

Mekong Delta 40,000 km²
Red River Delta 14,700 km²

Rhine - Maas - Scheldt Delta
33,000 km²

MEKONG DELTA

SURFACE AREA

40,000 km² 33,883 km²

INHABITANTS

18 million 16.7 million

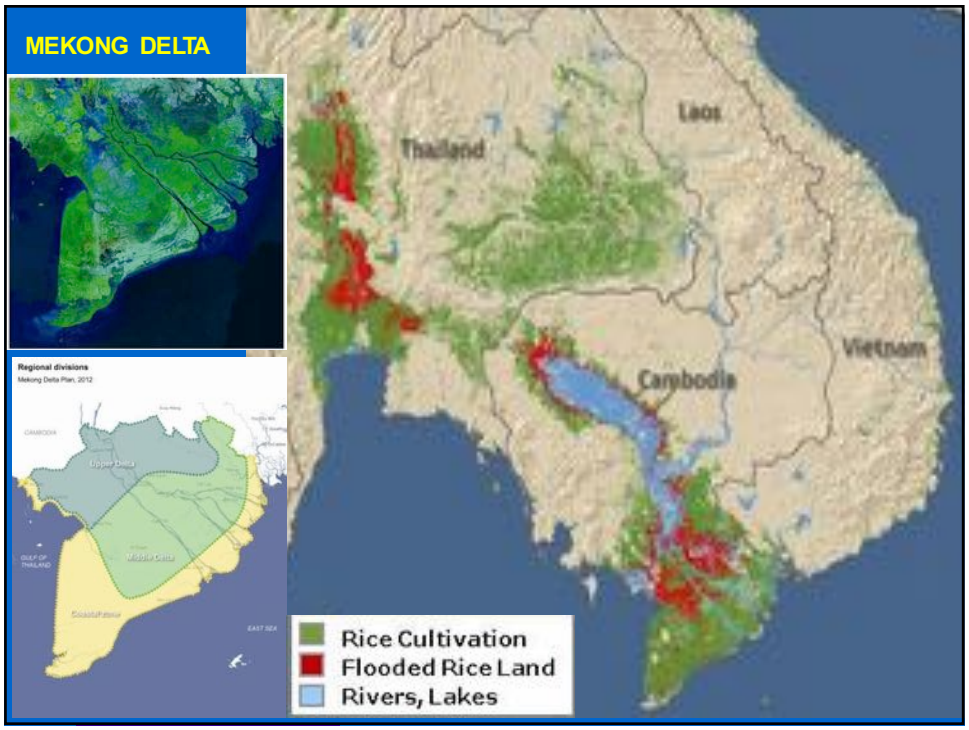
INHABITANTS
HO CHI MINH CITY

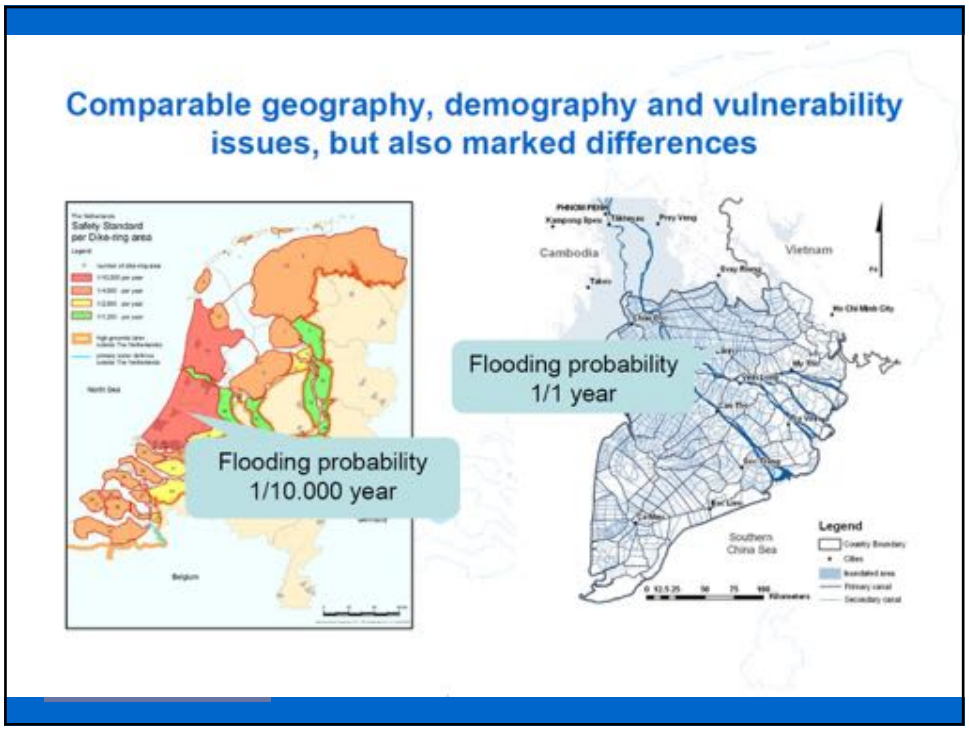
8 million

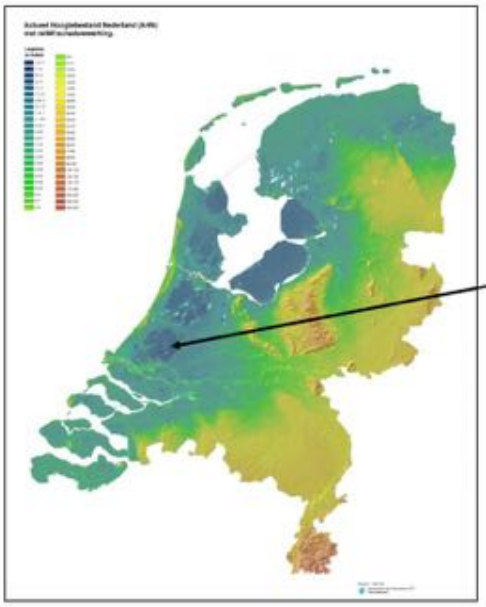
THE NETHERLANDS

The Dutch Delta in NW Europe and the Mekong Delta in Vietnam

The Netherlands is shaped by the alluvial deposits of Rhine, Meuse, Scheldt and Eems rivers. Approximately the size of the Mekong Delta, which is shaped by the alluvial deposits of the Mekong (and Sai Gon and Dong Nai) river(s). Similar population size ~17 million.


MEKONG DELTA
Thailand
Laos
Vietnam
Cambodia
Regional divisions
Rice Cultivation
Flooded Rice Land
Rivers, Lakes


Comparable geography, demography and vulnerability issues, but also marked differences
Safety Standard per Dike-ring area
Flooding probability 1/10.000 year
Cambodia
Vietnam
Flooding probability 1/1 year
Southern China Sea
Legend



- 10 million people in floodprone areas
- Deepest location Zuidplaspolder around Nieuwerkerk aan den IJssel: MSL – 6,76 m.

Safety standard for 53 dike-ring areas

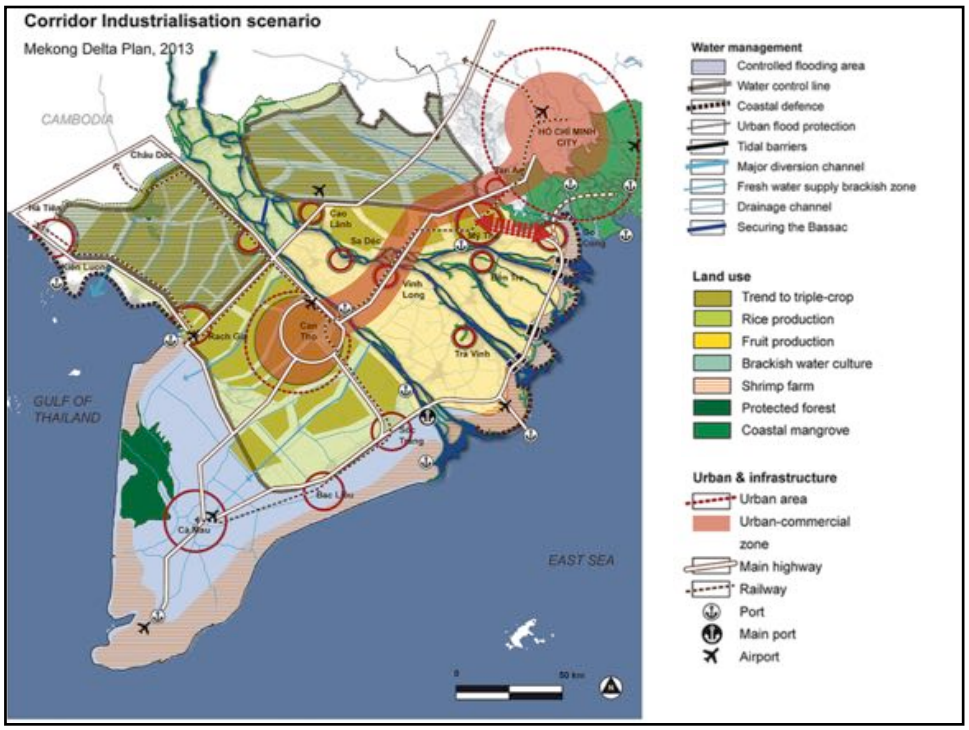
De facto a varying safety:

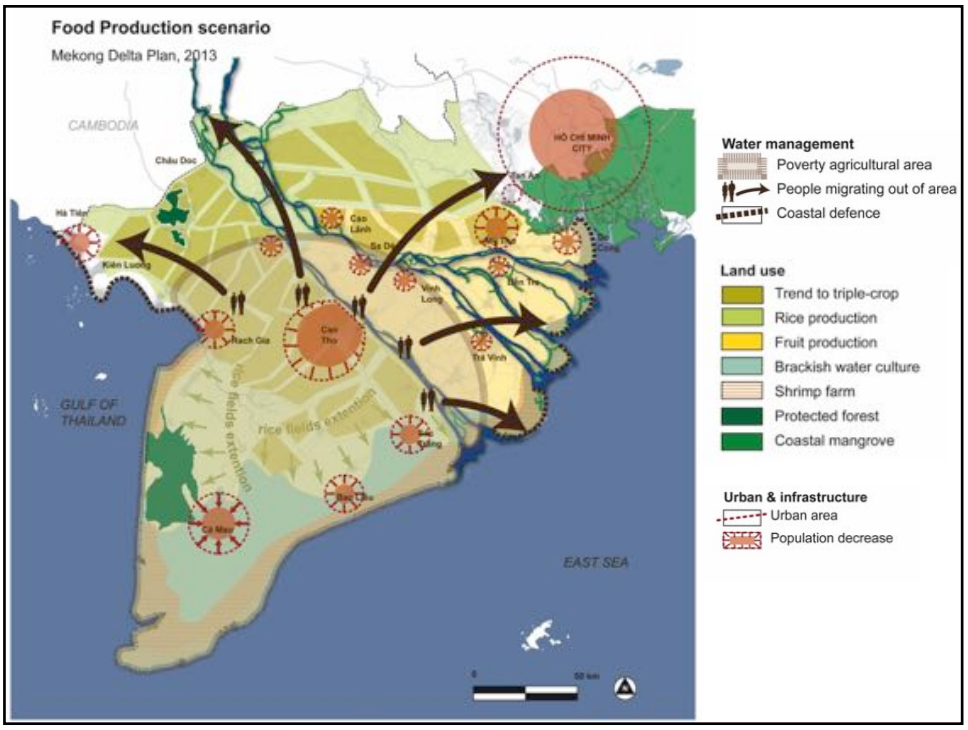
- NH and ZH 1/10.000 per year
- North and South 1/4.000 per year
- Yellow 1/2.000 per year
- Green: 1/1.250 per year

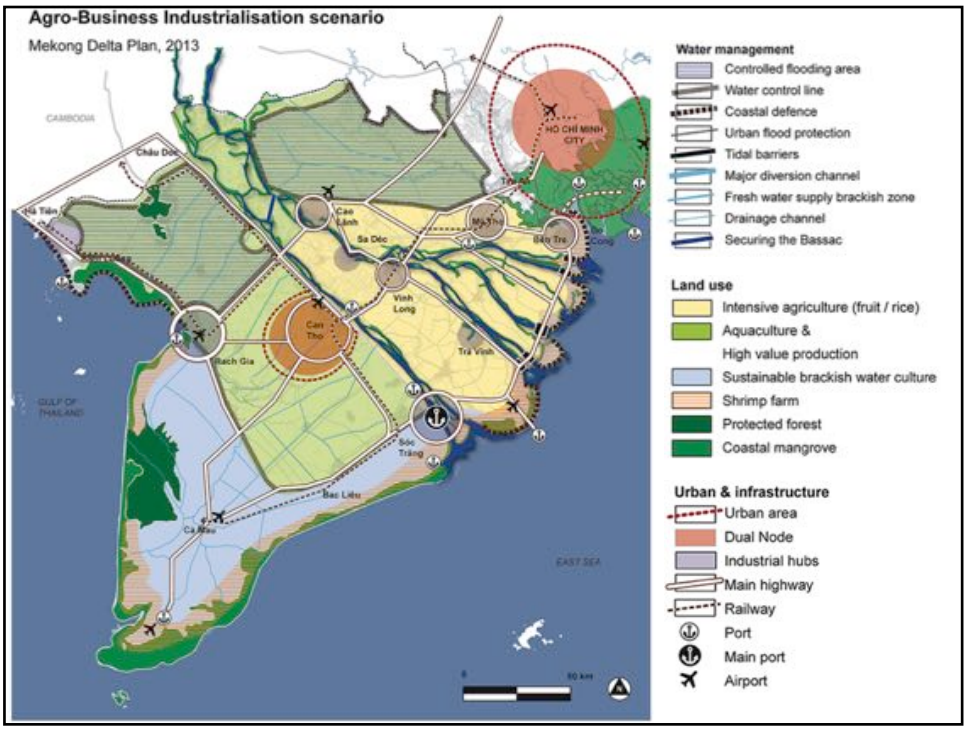
NB:

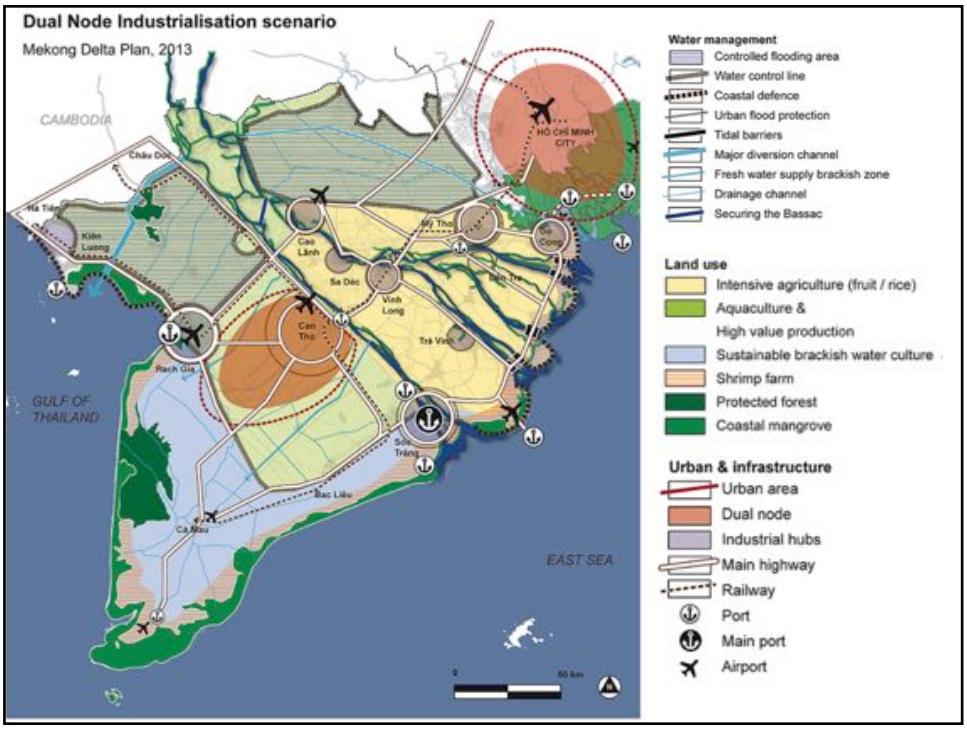
- Probability individual loss of life in a flooding is 1%, so that the probability due to flooding in the green areas is 1 in 125.000 per year!

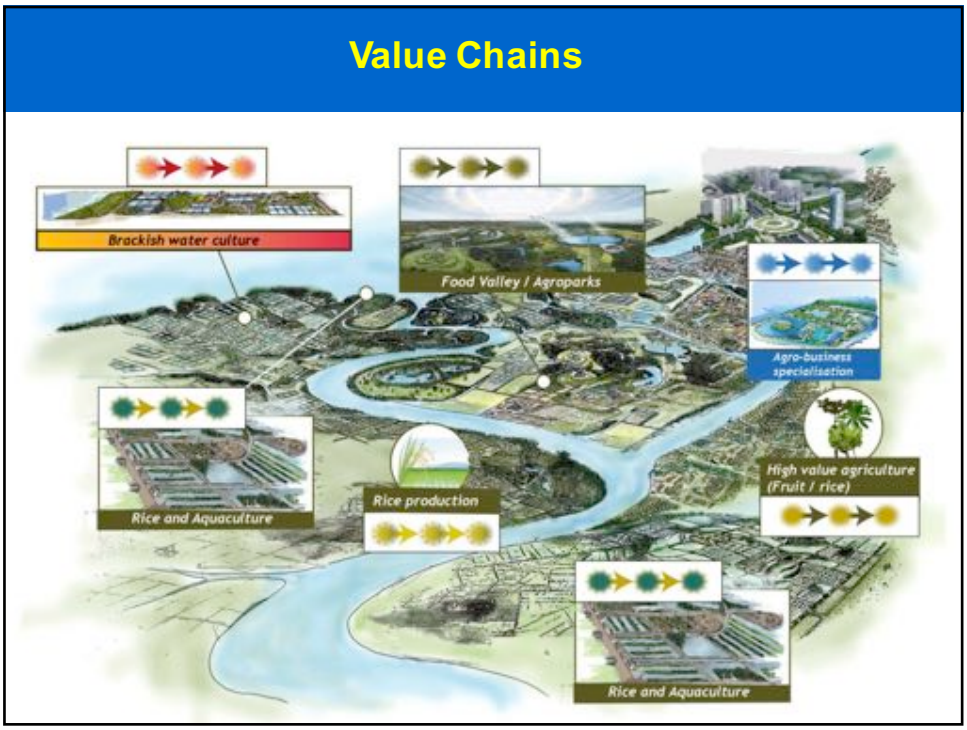

Cambodia
Vietnam
Gulf of Thailand
East Sea
Tan Chau
Chau Doc
Moc Hoa
High Terrace
Plain of Reeds
Tien River
Vam Co Tay
Vam Co Dong
Ho Chi Minh City
Bien Hoa
Dong Nai
Cao Lanh
Tan An
Ha Tien
Long Xuyen
My Tho
Vung Tau
Central Delta
Long Xuyen Quadrangle
Hau River
Ben Tre
Tieu
Dai
Vinh Long
Rach Gia
Can Tho
Ba Lai
Hom Luong
West Bassac
Cai Lon
Tra Vinh
Co Chien
Vi Than
Eastern Coastal Zone
Cung Hau
Soc Trang
Dinh An
Tranh De
Ca Mau Peninsula
Bac Lieu
Ca Mau
Cua Lon
0
50 km

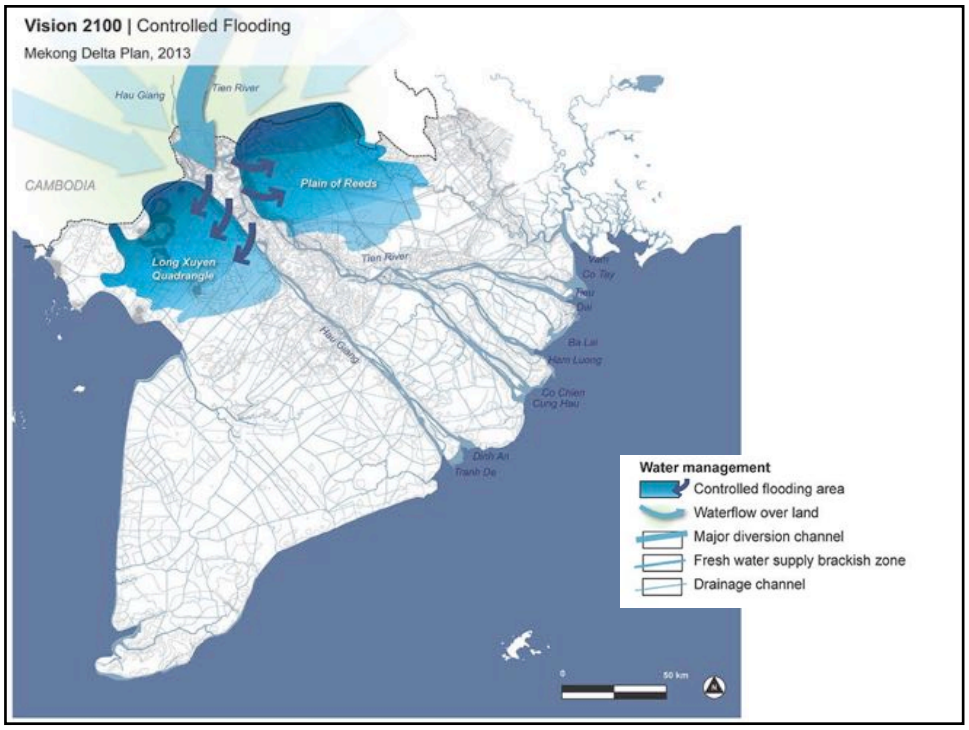

Corridor Industrialisation scenario
Mekong Delta Plan, 2013
CAMBODIA
GULF OF THAILAND
EAST SEA
HO CHI MINH CITY
Water management
Controlled flooding area
Water control line
Coastal defence
Urban flood protection
Tidal barriers
Major diversion channel
Fresh water supply brackish zone
Drainage channel
Securing the Bassac
Land use
Trend to triple-crop
Rice production
Fruit production
Brackish water culture
Shrimp farm
Protected forest
Coastal mangrove
Urban & infrastructure
Urban area
Urban-commercial zone
Main highway
Railway
Port
Main port
Airport


Food Production scenario
Mekong Delta Plan, 2013
CAMBODIA
Châu Đốc
HỒ CHÍ MINH CITY
Hà Tiên
Kiên Lương
Cao Lãnh
Sa Đéc
Vĩnh Long
Bến Tre
Rạch Giá
Cần Thơ
Trà Vinh
GULF OF THAILAND
rice fields extention
rice fields extention
Sóc Trăng
Bạc Liêu
Cà Mau
EAST SEA
Water management
Poverty agricultural area
People migrating out of area
Coastal defence
Land use
Trend to triple-crop
Rice production
Fruit production
Brackish water culture
Shrimp farm
Protected forest
Coastal mangrove
Urban & infrastructure
Urban area
Population decrease

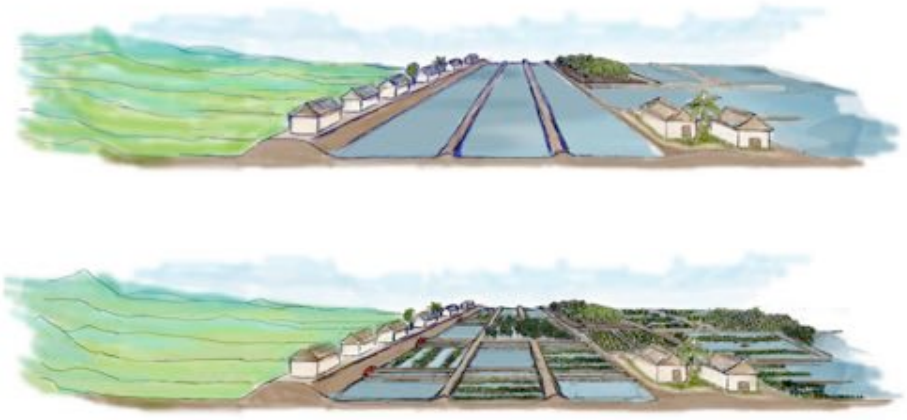

Agro-Business Industrialisation scenario
Mekong Delta Plan, 2013
CAMBODIA
Châu Đốc
HỒ CHÍ MINH CITY
Hà Tiên
Cao Lãnh
Sa Đéc
Mỹ Tho
Bến Tre
Vĩnh Long
Cần Thơ
Rạch Giá
Trà Vinh
GULF OF THAILAND
Sóc Trăng
Bạc Liêu
Cà Mau
EAST SEA
Water management
Controlled flooding area
Water control line
Coastal defence
Urban flood protection
Tidal barriers
Major diversion channel
Fresh water supply brackish zone
Drainage channel
Securing the Bassac
Land use
Intensive agriculture (fruit / rice)
Aquaculture &
High value production
Sustainable brackish water culture
Shrimp farm
Protected forest
Coastal mangrove
Urban & infrastructure
Urban area
Dual Node
Industrial hubs
Main highway
Railway
Port
Main port
Airport


Dual Node Industrialisation scenario
Mekong Delta Plan, 2013
CAMBODIA
GULF OF THAILAND
EAST SEA
HO CHI MINH CITY
Water management
Controlled flooding area
Water control line
Coastal defence
Urban flood protection
Tidal barriers
Major diversion channel
Fresh water supply brackish zone
Drainage channel
Securing the Bassac
Land use
Intensive agriculture (fruit / rice)
Aquaculture &
High value production
Sustainable brackish water culture
Shrimp farm
Protected forest
Coastal mangrove
Urban & infrastructure
Urban area
Dual node
Industrial hubs
Main highway
Railway
Port
Main port
Airport

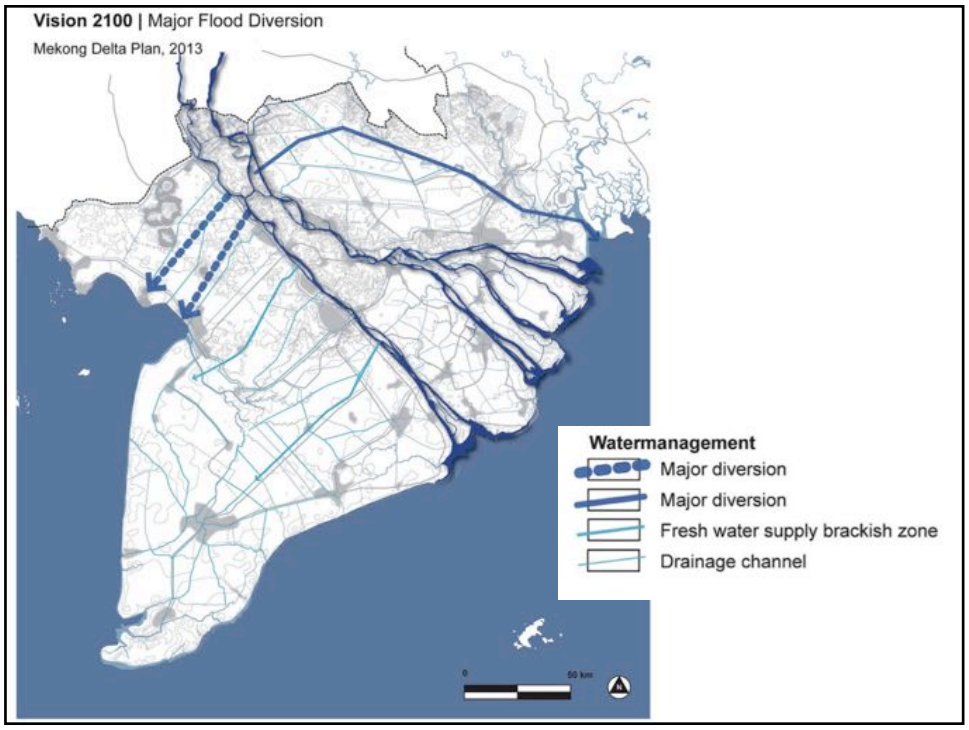

Value Chains
Brackish water culture
Food Valley / Agroparks
Agro-business specialisation
Rice and Aquaculture
Rice production
High value agriculture (Fruit / rice)
Rice and Aquaculture

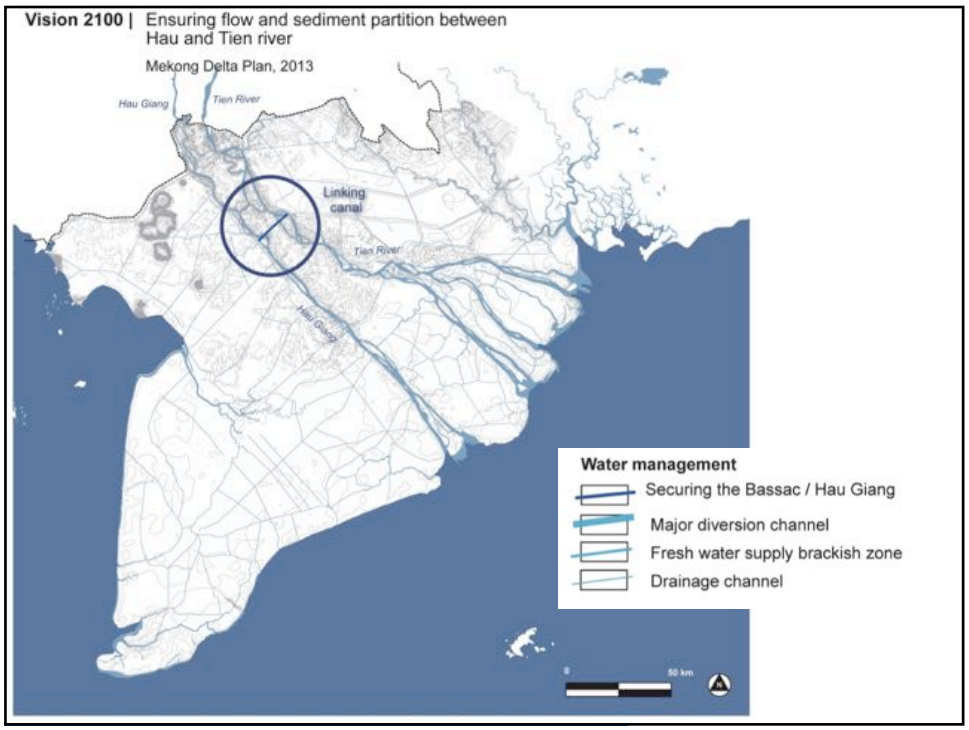


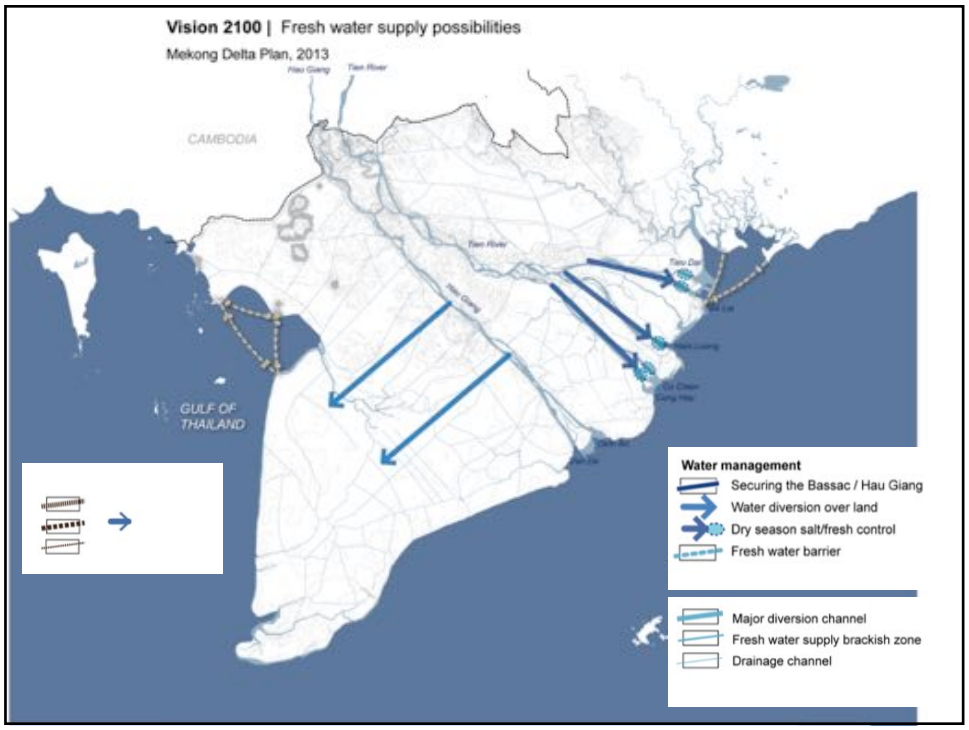
Inundated rice paddies in the wet season (Upper Delta) offer controlled retention of river floods after two crops

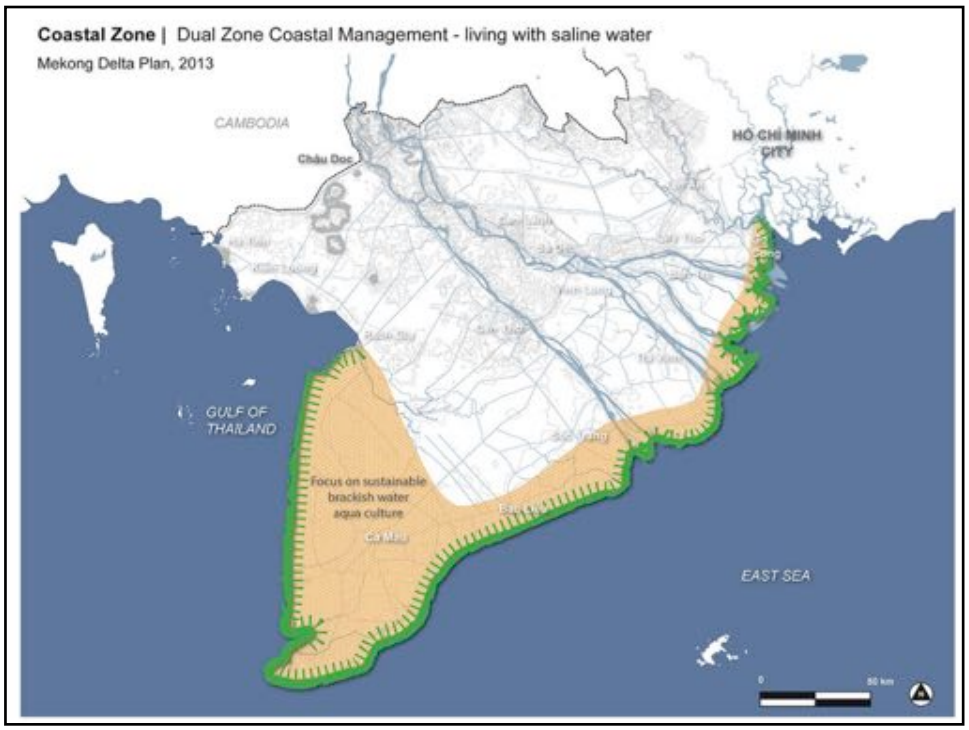


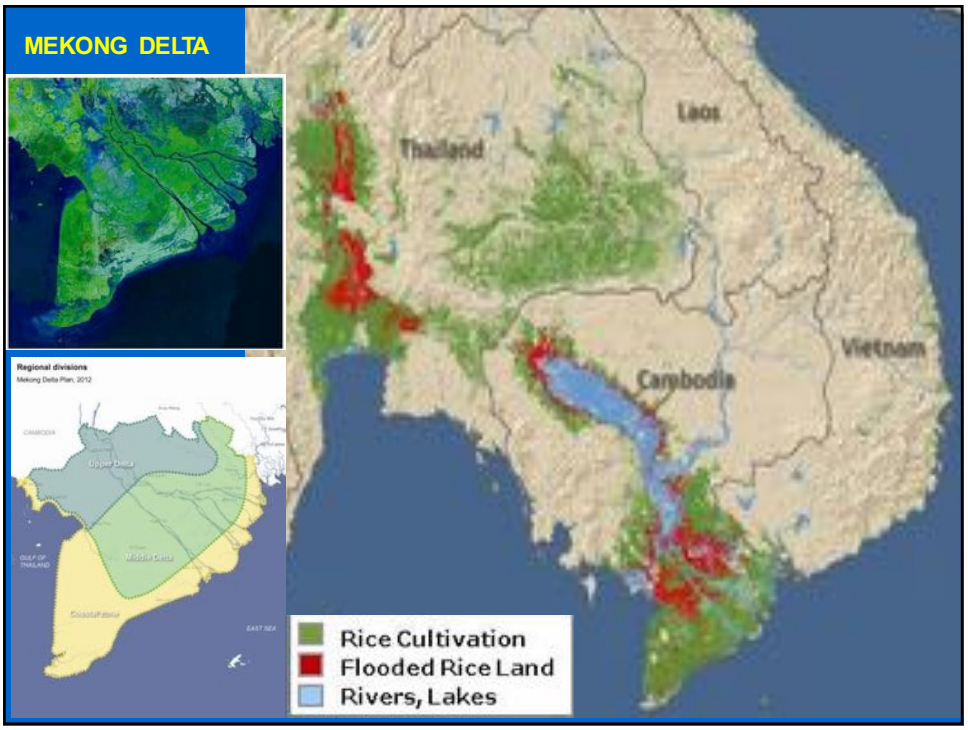
Controlled flooding in the Upper Delta, using the inundated paddies for fish farming in the wet season or 'floating vegetables', offering an attractive economic proposition

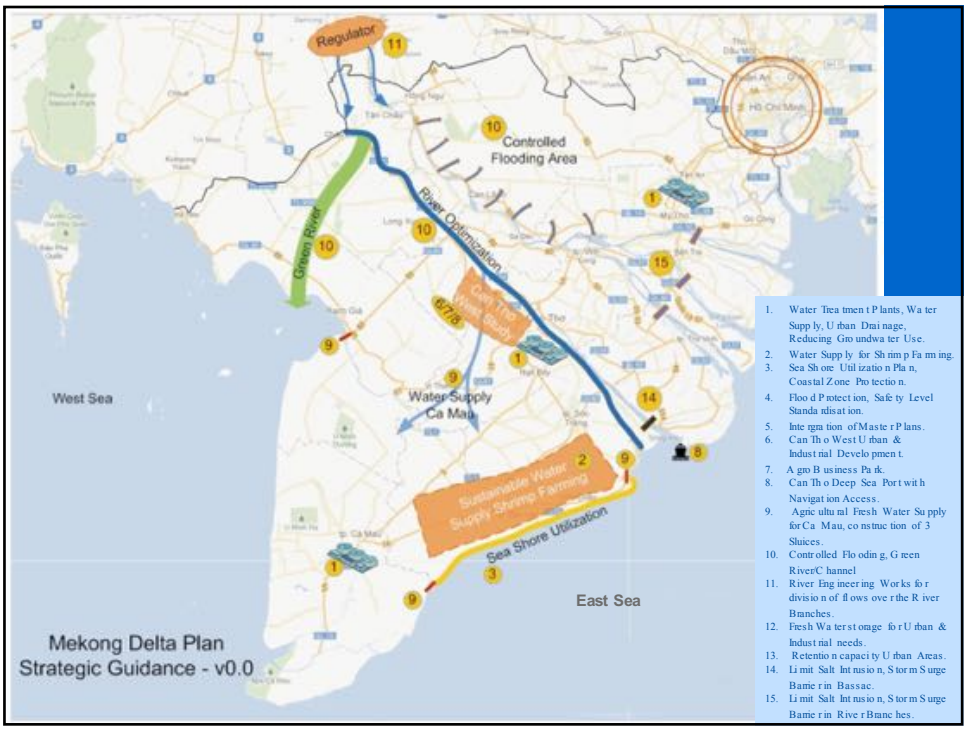

Vision 2100 | Major Flood Diversion
Mekong Delta Plan, 2013
Watermanagement
Major diversion
Major diversion
Fresh water supply brackish zone
Drainage channel
0
50 km


Vision 2100 | Ensuring flow and sediment partition between Hau and Tien river
Mekong Delta Plan, 2013
Hau Giang
Tien River
Linking canal
Tien River
Hau Giang
Water management
Securing the Bassac / Hau Giang
Major diversion channel
Fresh water supply brackish zone
Drainage channel
0
50 km

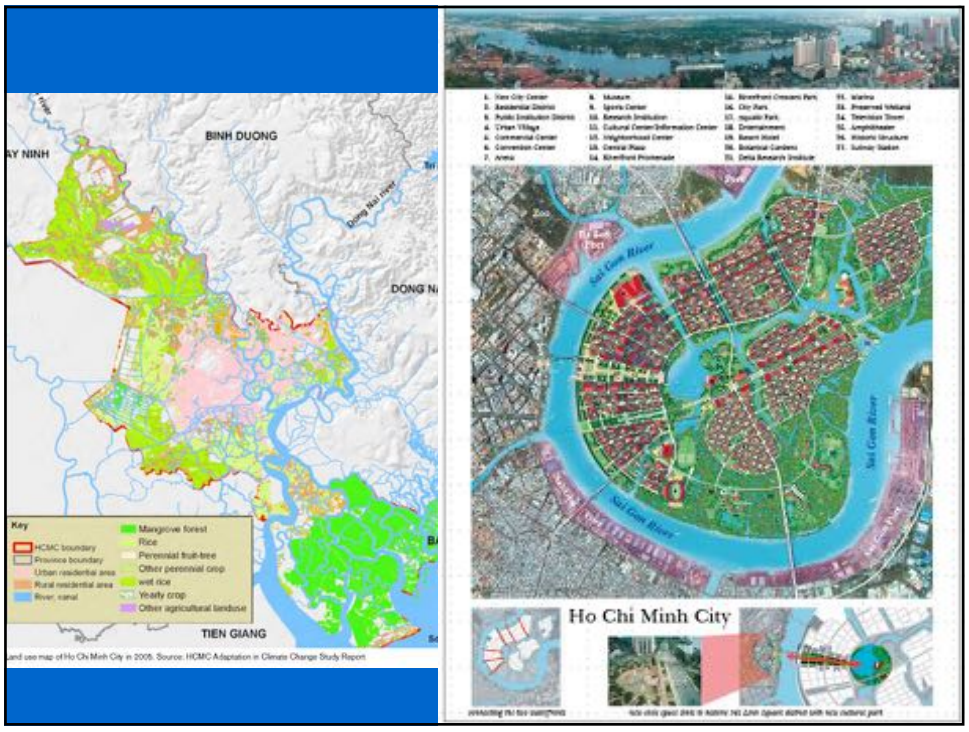

Vision 2100 | Fresh water supply possibilities
Mekong Delta Plan, 2013
CAMBODIA
GULF OF THAILAND
Water management
Securing the Bassac / Hau Giang
Water diversion over land
Dry season salt/fresh control
Fresh water barrier
Major diversion channel
Fresh water supply brackish zone
Drainage channel

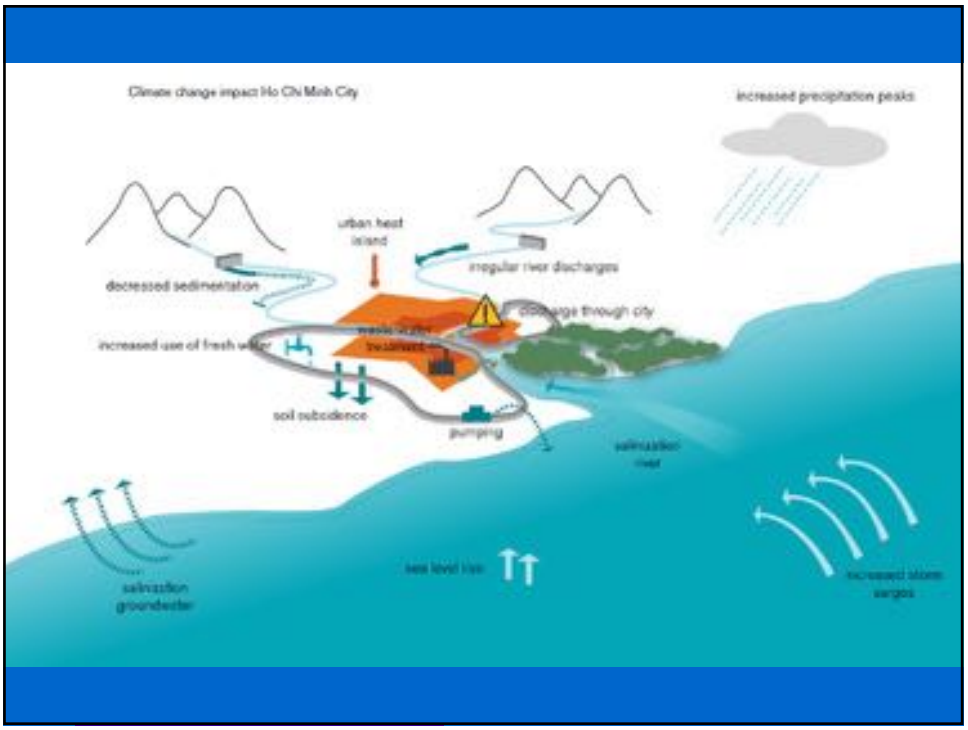

Coastal Zone | Dual Zone Coastal Management - living with saline water
Mekong Delta Plan, 2013
CAMBODIA
Châu Đốc
HỒ CHÍ MINH CITY
GULF OF THAILAND
Focus on sustainable brackish water aqua culture
Cà Mau
EAST SEA

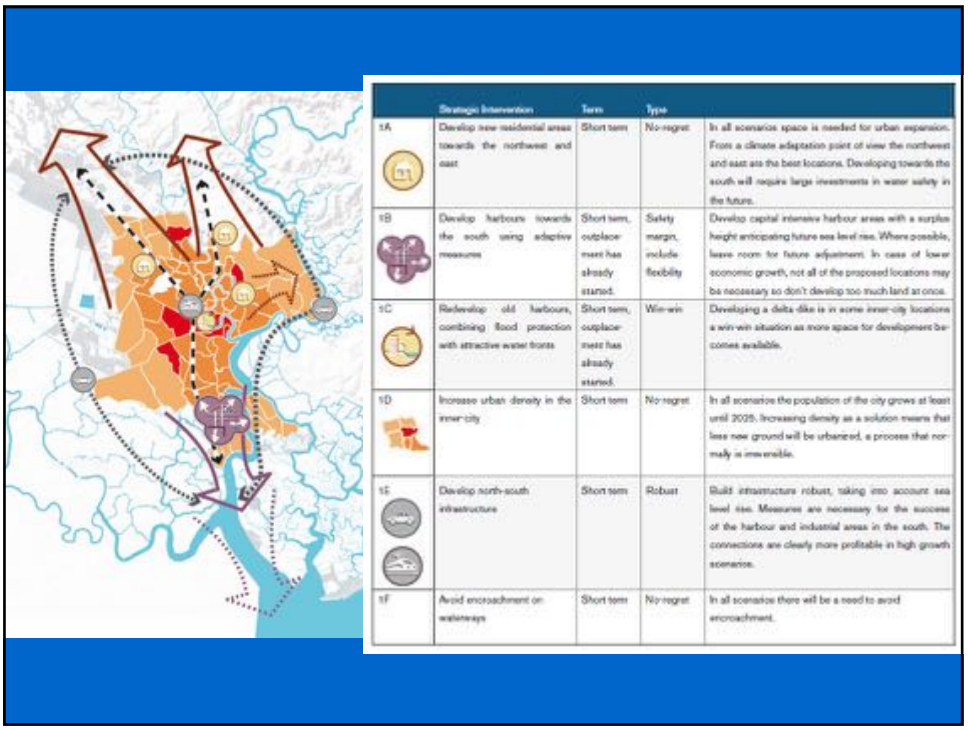

MEKONG DELTA
Regional divisions
Mekong Delta Plan, 2012
Thailand
Laos
Cambodia
Vietnam
Rice Cultivation
Flooded Rice Land
Rivers, Lakes


Regulator
Controlled Flooding Area
Green River
River Optimization
West Sea
Water Supply Ca Mau
Sustainable Water Supply Shrimp Farming
Sea Shore Utilization
East Sea
Mekong Delta Plan
Strategic Guidance - v0.0
1. Water Treatment Plants, Water Supply, Urban Drainage, Reducing Groundwater Use.
2. Water Supply for Shrimp Farming.
3. Sea Shore Utilization Plan, Coastal Zone Protection.
4. Flood Protection, Safety Level Standardisation.
5. Integration of Master Plans.
6. Can Tho West Urban & Industrial Development.
7. Agro Business Park.
8. Can Tho Deep Sea Port with Navigation Access.
9. Agricultural Fresh Water Supply for Ca Mau, construction of 3 Sluices.
10. Controlled Flooding, Green River/Channel
11. River Engineering Works for division of flows over the River Branches.
12. Fresh Water storage for Urban & Industrial needs.
13. Retention capacity Urban Areas.
14. Limit Salt Intrusion, Storm Surge Barrier in Bassac.
15. Limit Salt Intrusion, Storm Surge Barrier in River Branches.

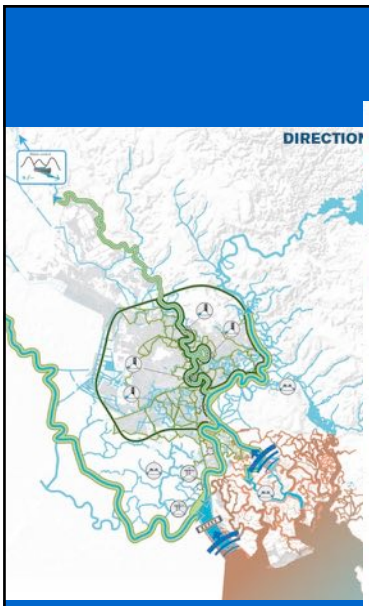

Climate Adaptation Strategy
Ho Chi Minh City
moving towards the sea with climate change adaptation


BINH DUONG
TIEN GIANG
Key
Mangrove forest
Rice
Perennial fruit-tree
Other perennial crop
wet rice
Yearly crop
Other agricultural landuse
Ho Chi Minh City

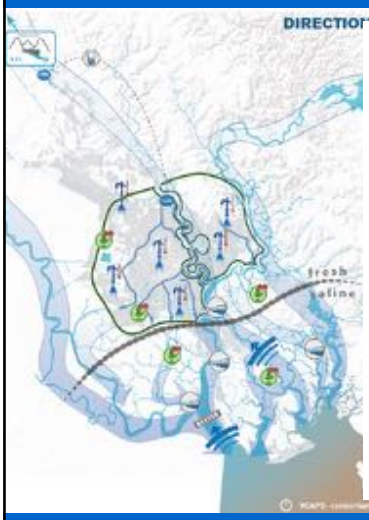




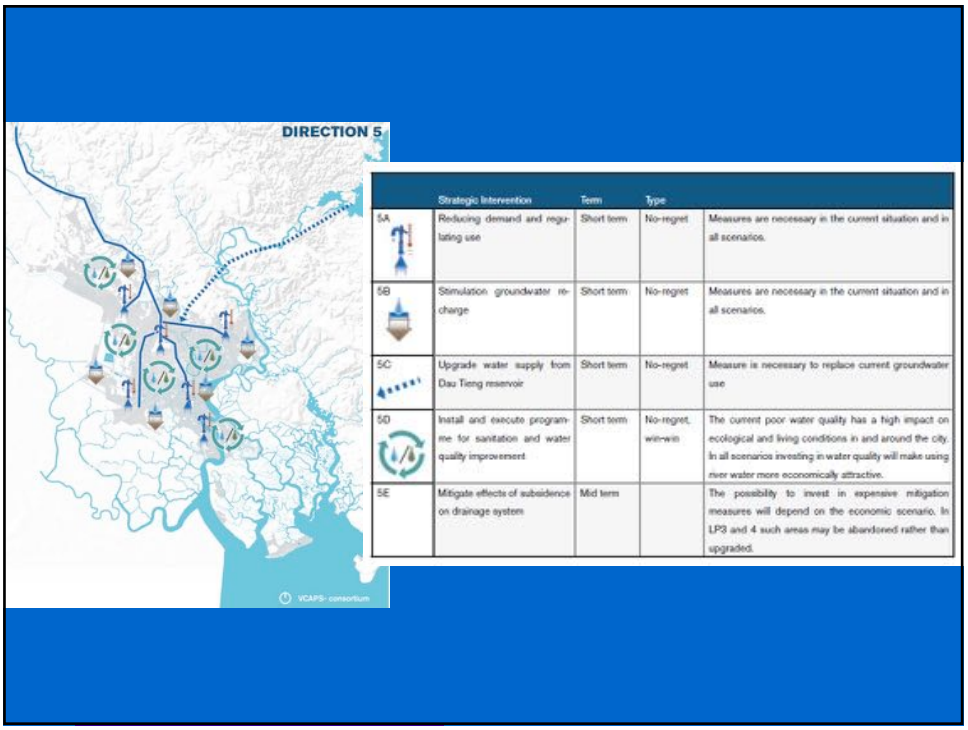
	Strategic Intervention	Term	Type	
1A	Develop new residential areas towards the northwest and east	Short term	No-regret	In all scenarios space is needed for urban expansion. From a climate adaptation point of view the northwest and east are the best locations. Developing towards the south will require large investments in water safety in the future.
1B	Develop harbours towards the south using adaptive measures	Short term, outplacement has already started.	Safety margin, include flexibility	Develop capital intensive harbour areas with a surplus height anticipating future sea level rise. Where possible, leave room for future adjustment. In case of lower economic growth, not all of the proposed locations may be necessary so don't develop too much land at once.
1C	Redevelop old harbours, combining flood protection with attractive water fronts	Short term, outplacement has already started.	Win-win	Developing a delta dike is in some inner-city locations a win-win situation as more space for development becomes available.
1D	Increase urban density in the inner-city	Short term	No-regret	In all scenarios the population of the city grows at least until 2025. Increasing density as a solution means that less new ground will be urbanized, a process that normally is irreversible.
1E	Develop north-south infrastructure	Short term	Robust	Build infrastructure robust, taking into account sea level rise. Measures are necessary for the success of the harbour and industrial areas in the south. The connections are clearly more profitable in high growth scenarios.
1F	Avoid encroachment on waterways	Short term	No-regret	In all scenarios there will be a need to avoid encroachment.



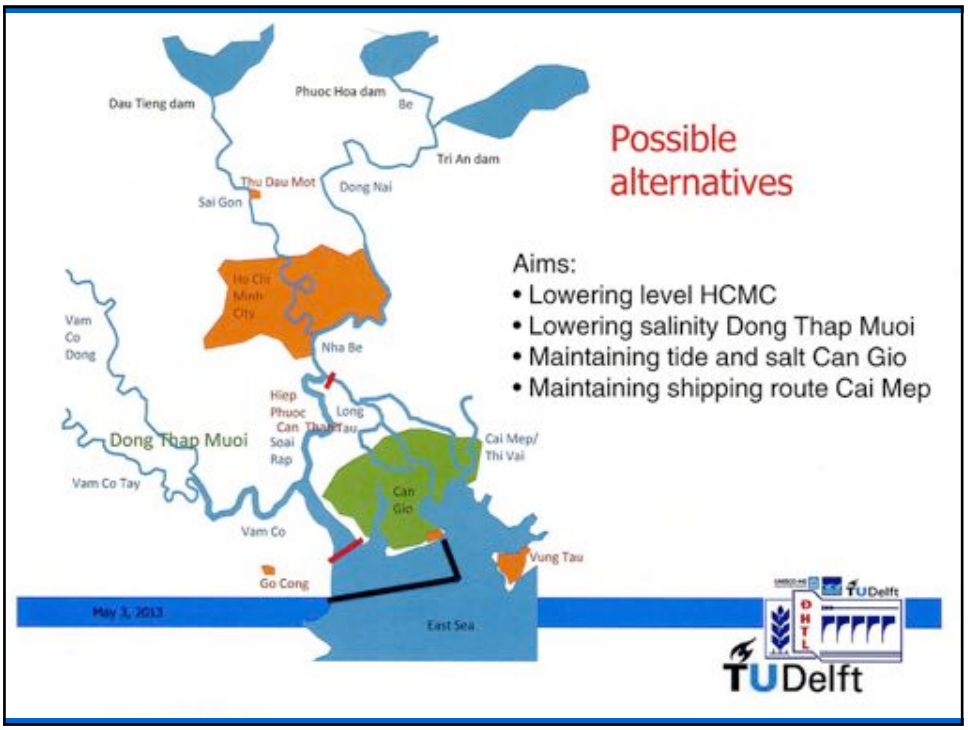
	Strategic Intervention	Term	Type	
2A	Develop flood risk maps and flood risk standards	Short term		Flood risk maps form the basis for standards
2B	Protect the inner city with ring dike	Short term	Win-win	Combination with the development of ring road 3 saves costs.
2C	Optimize reservoir management for flood protection	Short term	No-regret	Optimizing reservoir operation from a floods perspective will reduce the risks of inundation north of HCMC.
2D	Tidal barrier	Long term		Measure only necessary in case of extreme sea level rise.
2E	Develop district adaptation pathways	Short term	No-regret	A bottom-up approach is expected to contribute to resilience at the district level.
2F	Adaptive building towards the south	Short term	Flexible	Building in smaller quantities and on mounds leaving space for future adaptation makes it possible to grow with sea level rise.
2G	Identify and protect the vital and the vulnerable areas in HCMC	Short term	No-regret, robust	Create extra robust solutions for vital and vulnerable functions.
2H	Protect the riparian zones along the rivers	Short term	No-regret	In all scenarios, safeguarding riparian zones leads to the reduction of flood risks.
2I	Strengthen emergency management	Short term	No-regret	Helps to reduce victims and economic damage also in the existing situation.



	Strategic Intervention	Term	Type	
4A	Large scale measures against flooding reduce salt intrusion	Mid-term	Win-win	A ring dike with tidal gates will also reduce the amount of brackish water entering the city's water system. If these measures are taken this will be justified from a floods perspective. Their effect on salt intrusion is a positive side-effect.
4B	Smart dredging to reduce impact	Short term	Delaying action	Coupled to development of harbours. Smart dredging reduces the impact of dredging on salt intrusion compared to normal dredging.
4C	Flush the city's water system	Short term		Measure to reduce impacts.
4D	Evaluate relocation of drinking water intakes and wells	Mid term	No-regret	Locations for water supply station should be reserved on the short term to relocate intakes on the mid-term.
4E	Decrease groundwater extraction to a sustainable level	Short term	No-regret	If groundwater extraction is not reduced to a sustainable level, groundwater resources will be depleted in all scenarios.
4F	Use salt resistant vegetation in flood prone areas	Short term	No-regret	Take midterm changes in salt levels into account when designing public space.

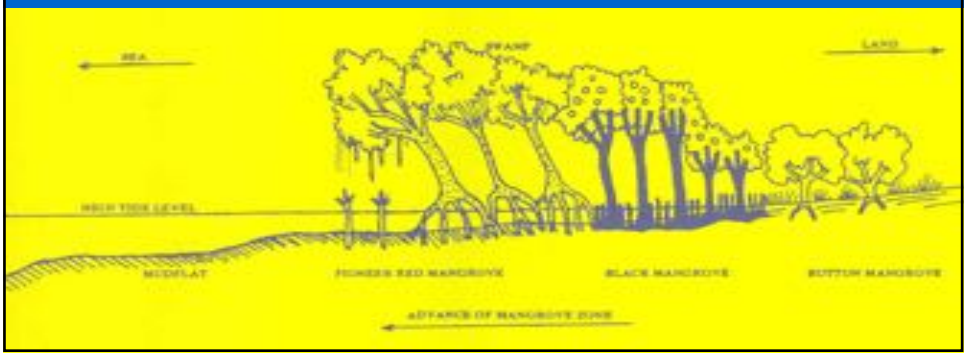


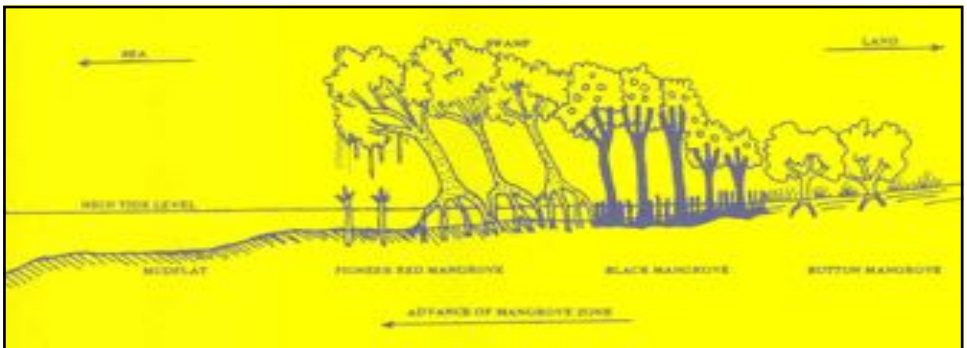
	Strategic Intervention	Term	Type	
5A	Reducing demand and regulating use	Short term	No-regret	Measures are necessary in the current situation and in all scenarios.
5B	Stimulation groundwater recharge	Short term	No-regret	Measures are necessary in the current situation and in all scenarios.
5C	Upgrade water supply from Dau Tieng reservoir	Short term	No-regret	Measure is necessary to replace current groundwater use
5D	Install and execute programme for sanitation and water quality improvement	Short term	No-regret, win-win	The current poor water quality has a high impact on ecological and living conditions in and around the city. In all scenarios investing in water quality will make using river water more economically attractive.
5E	Mitigate effects of subsidence on drainage system	Mid term		The possibility to invest in expensive mitigation measures will depend on the economic scenario. In LP3 and 4 such areas may be abandoned rather than upgraded.



MANGROVES Dr. Bob Ursem TU Delft

Mangroves characteristics & types
Mangroves for coastal protection
Mangroves as a basis for a rich eco-system





Category 1
First boundary layer of coastal defense, rough salt rich turbulent environment is an excellent growth area for mangroves with stilt pneumatophore root systems: tall trees, robust root systems, well anchored in mud, no settling of silt. Especially good for blocking storms and strong wave impact.

Category 2 and 3
A more inland, relative dynamic up to non turbulent, low saline level environment is an excellent growth area for mangroves with erect pneumatophore root systems: middle to tall tree sizes, sometimes shrubs, root system just reaching the high tide level, relative open to dense root cover, only anchored in mud at the base, creating a perfect alluvial environment.

Mangroves suitable for coastal defense in Vietnam (from open sea to the ecological succession of mangrove forests)

Category 1 Rhizophora apiculata

Rhizophora apiculata can handle rough turbulent, high saline conditions and soils of sand flats with slimy mud up to heavy clay/mud conditions. Needs high saline water all year around!

Sonneratia caseolaris

Sonneratia caseolaris prefer sand and mud conditions, most common in estuaries, having high saline up to brackish water (5 up to 10‰).

Red mangroves exclude salt by having significantly impermeable roots which are highly buttressed, acting as an ultra-filtration mechanism to exclude sodium salts from the rest of the plant.
Analysis of water inside mangroves has shown that 90% to 97% of salt has been excluded at the roots. Salt which does accumulate in the shoot concentrates in old leaves which the plant then sheds.
Red mangroves can also store salt in cell vacuoles.
White (or grey) mangroves can secrete salts directly; they have two salt glands at each leaf base (hence their name white mangrove - they are covered in white salt crystals as shown below).

Avicennia marina var. intermedia
(grey mangrove, guava mangrove)




Natural conditions. The islands form a barrier to create sheltered conditions with alluvial accumulation of soil settling and to prevent large wave impacts.

What do mangroves need?

- Preferable a muddy (clay or silt rich/rich silt-sandy soil) with a low gradient.
- An suitable tide range, not extreme, as bottom line a near lacking tide.
- A dynamic environment where soil increase can occur due to alluvial accumulation by mangroves.
- A low water current.
- The saline conditions may be variable, high to low content and never totally fresh water.
- Support in the pioneer growth phase to prevent large impact of waves.

Placing bamboo sticks
- in rows parallel to the coast
- at certain distances from each other
- at a considerable distance from the coast (at least 500 m or more).

Siltation occurs. When the silt layer has a certain thickness planting of mangroves can start in a certain sequence.

SUSTAINABLE COASTAL ZONE DEVELOPMENT

Integrated Coastal & Deltaic Policy via Building with Nature®

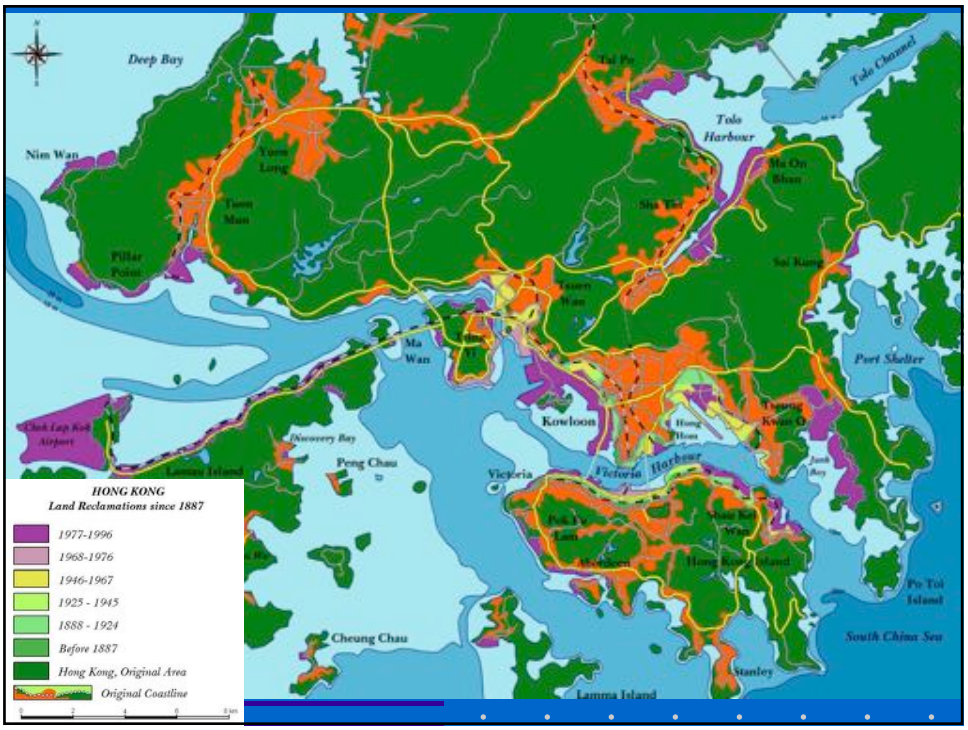
Dr. R.E. Waterman MSc
January 2013

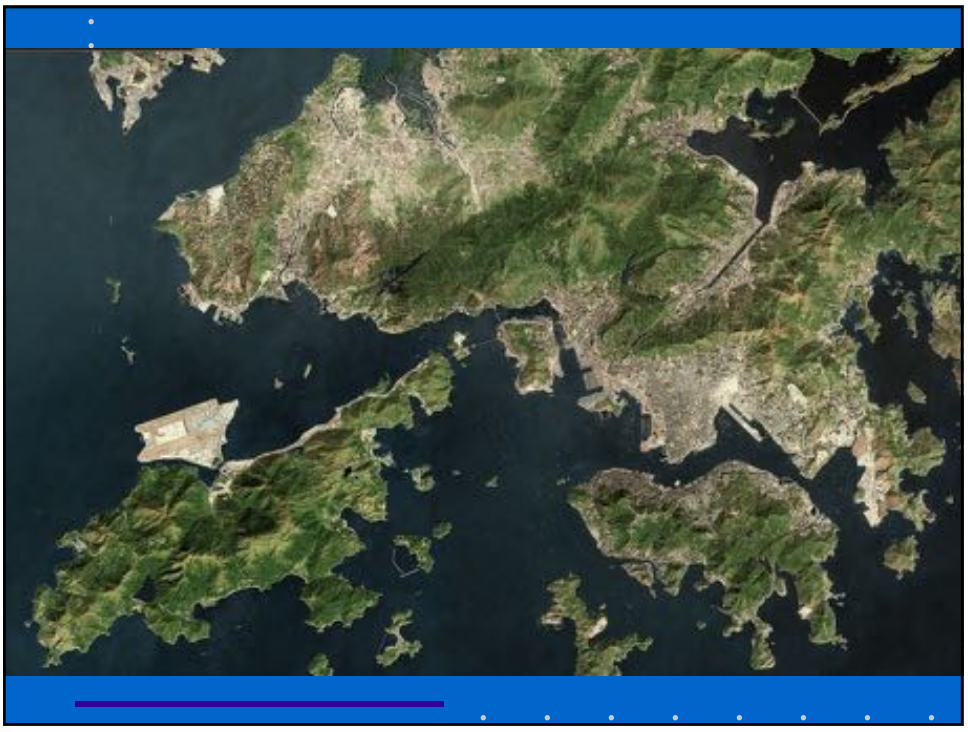
Peoples Republic of China
The Netherlands

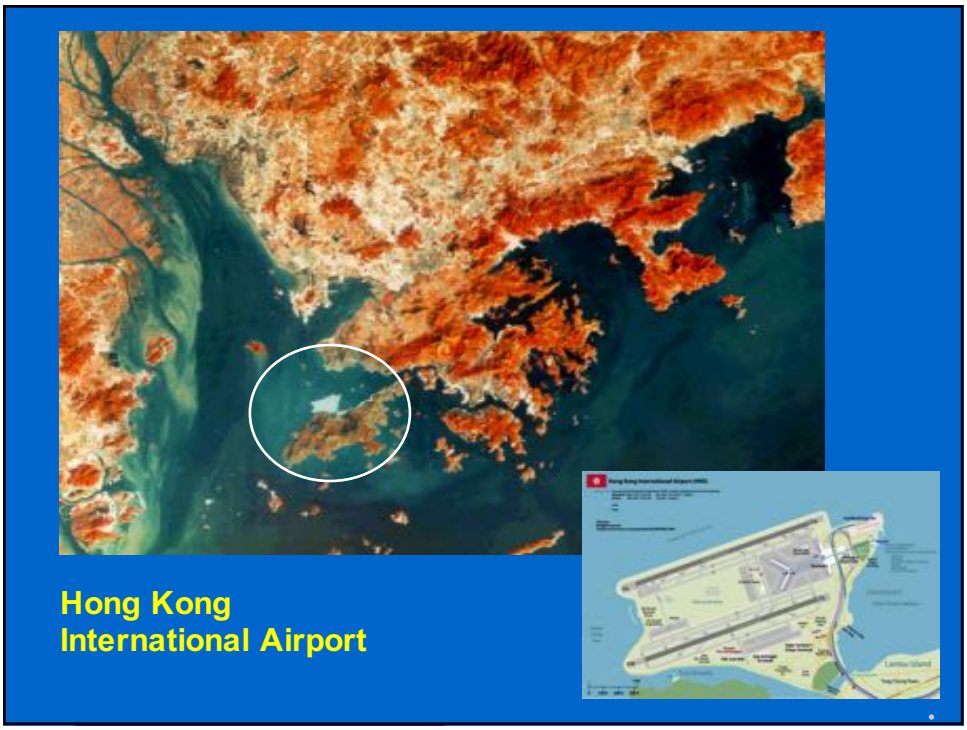
BUILDING WITH NATURE

China, Hong Kong

Hong Kong


Deep Bay
Nim Wan
Yuen Long
Tuen Mun
Pillar Point
Tai Po
Tolo Channel
Tolo Harbour
Ma On Shan
Sha Tin
Sai Kung
Tsuen Wan
Ma Wan
Port Shelter
Kowloon
Chek Lap Kok Airport
Lantau Island
Discovery Bay
Peng Chau
Victoria
Victoria Harbour
Hong Kong Island
Shau Kei Wan
Stanley
Po Toi Island
South China Sea
Cheung Chau
Lamma Island
HONG KONG
Land Reclamations since 1887
1977-1996
1968-1976
1946-1967
1925 - 1945
1888 - 1924
Before 1887
Hong Kong, Original Area
Original Coastline




Hong Kong
International Airport


Hong Kong

SUSTAINABLE COASTAL ZONE DEVELOPMENT

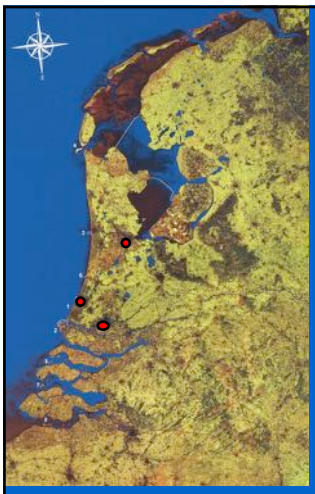
Integrated Coastal & Deltaic Policy
via Building with Nature®

Dr. R.E. Waterman MSc

FUJIAN
March 2012

Peoples Republic of China
The Netherlands

303



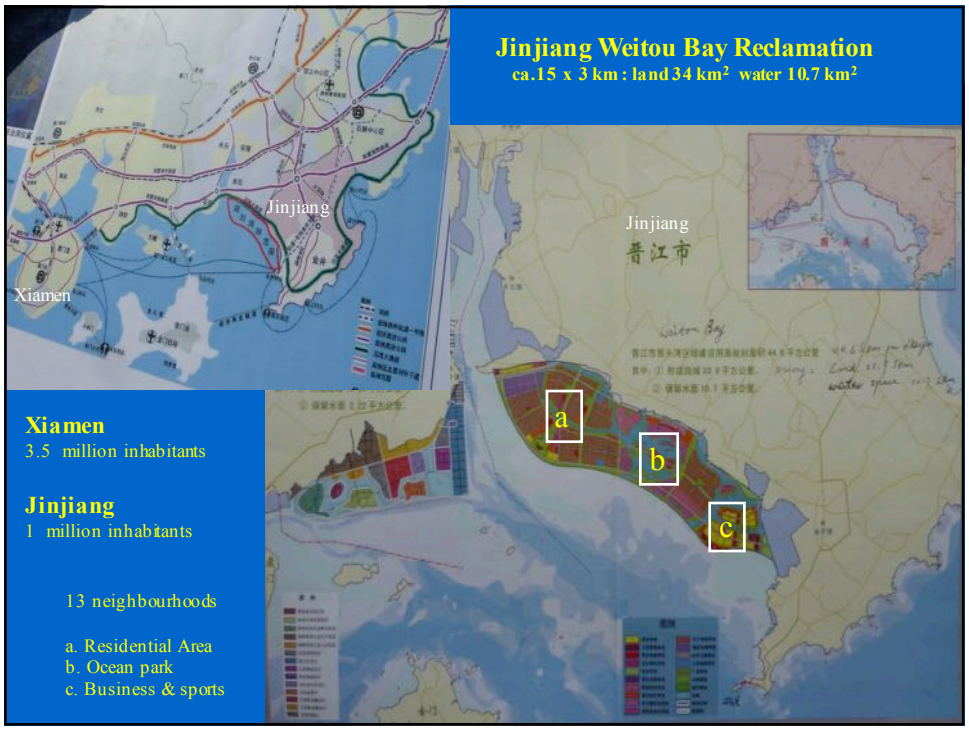
THE NETHERLANDS

Surface Area 41,526 km²
Inhabitants 16.7 million

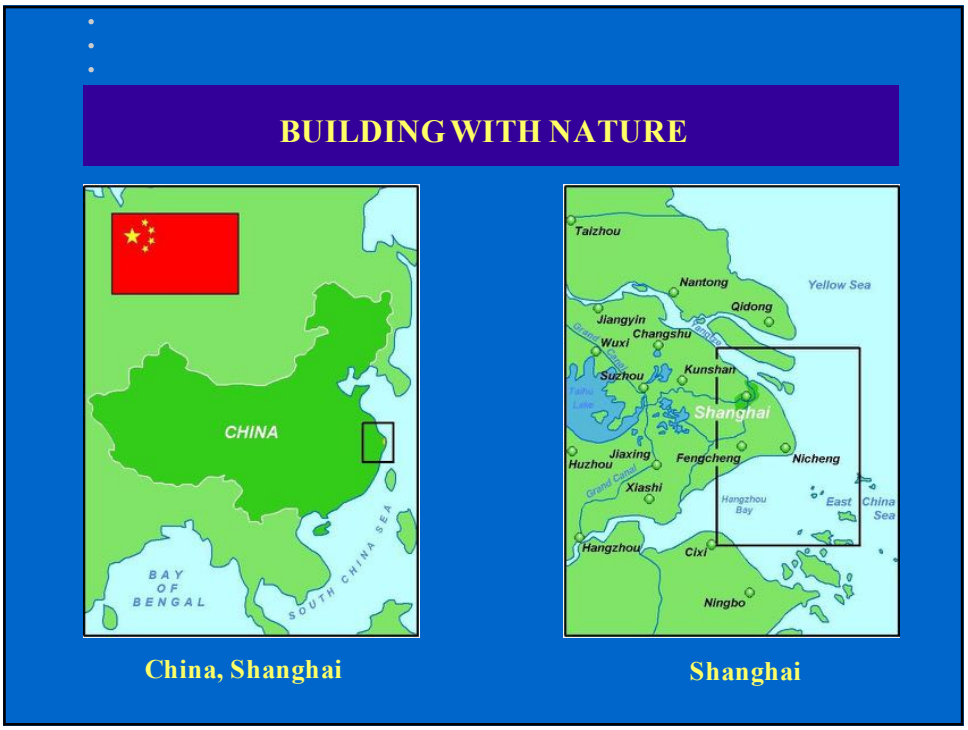
FUJIAN

Surface Area 121.400 km² Inhabitants 36.9 million

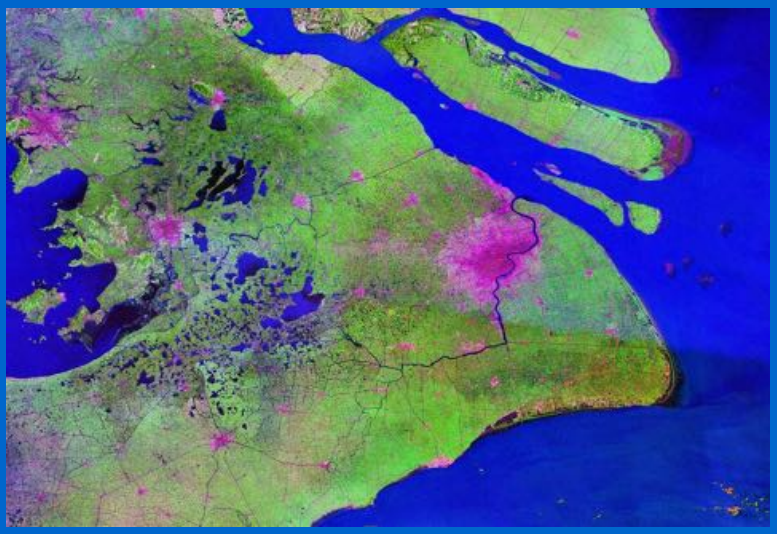

Jinjiang Weitou Bay
XIAMEN DAO
XIAMEN
JINMEN DAO
WEITOU WAN
XIAMEN GANG


Jinjiang Weitou Bay Reclamation
ca.15 x 3 km : land 34 km² water 10.7 km²
Jinjiang
Xiamen
Jinjiang
晋江市
a
b
c
Xiamen
3.5 million inhabitants
Jinjiang
1 million inhabitants
13 neighbourhoods
a. Residential Area
b. Ocean park
c. Business & sports


YUNXIAO
DONGSHAN WAN
GULEI BANDAO
FUTOU WAN
DONGSHAN DAO
Zhao'an Wan
DONGSHAN DAO & DONGSHAN WAN
YUNXIAO
Development Zone
LED Technology Centre
& Fishing Harbour
with Residential Area
GULEI PENINSULA
Harbour Development
Zone
DONGSHAN
High Tech Industry
Industry & Logistics
Green Axis
Ecological Farmland
Residential Area
Marine Industry Area
Tourism Area


BUILDING WITH NATURE
CHINA
BAY OF BENGAL
SOUTH CHINA SEA
China, Shanghai
Taizhou
Nantong
Yellow Sea
Qidong
Jiangyin
Changshu
Wuxi
Suzhou
Kunshan
Shanghai
Jiaxing
Huzhou
Fengcheng
Nicheng
Xiashi
Hangzhou Bay
East China Sea
Hangzhou
Cixi
Ningbo
Shanghai

BUILDING WITH NATURE



Shanghai

Shanghai


Shanghai


Shanghai – Bund New Horizon Marina
River Zone Development
Huangpu

SUSTAINABLE COASTAL ZONE DEVELOPMENT

Dr. R. E. Waterman MSc

KOREA
THE NETHERLANDS

JUNE 2012

SOUTH KOREA		THE NETHERLANDS
	SURFACE AREA	
	99,538 km²	33,883 km²
	INHABITANTS	
	48.8 million	16.7 million
	COASTAL LENGTH	
	14,800 km	353 km
	MAIN RIVERS	
	Han Gang Nak Dong Gang Geum Gang Yeong San Gang	Rhine Maas Scheldt Eems
	4 RIVERS RENAISSANCE	
	Han Gang, Nak Dong Gang, Geum Gang, Yeong San Gang	

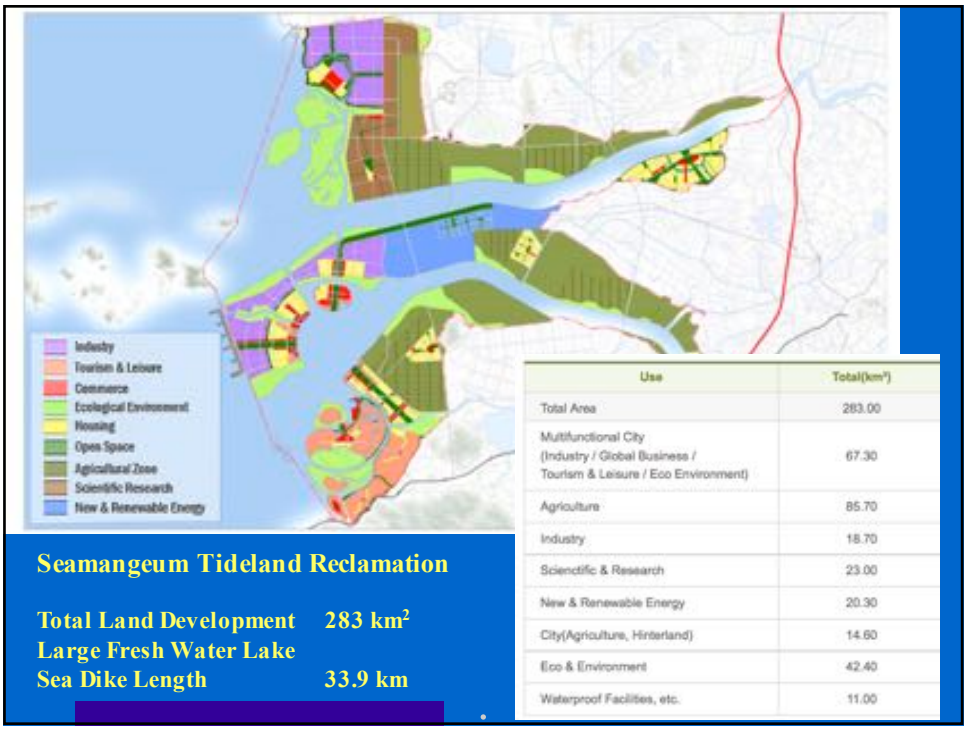
Background

As part of the Four Major Rivers Restoration Project:

- 16 weirs
- 4 river basins

Five core challenges of the Four Major Rivers Restoration Project

- Securing abundant water resources to mitigate water scarcity.



Seamangeum Tideland Reclamation

Total Land Development 283 km²
Large Fresh Water Lake
Sea Dike Length 33.9 km

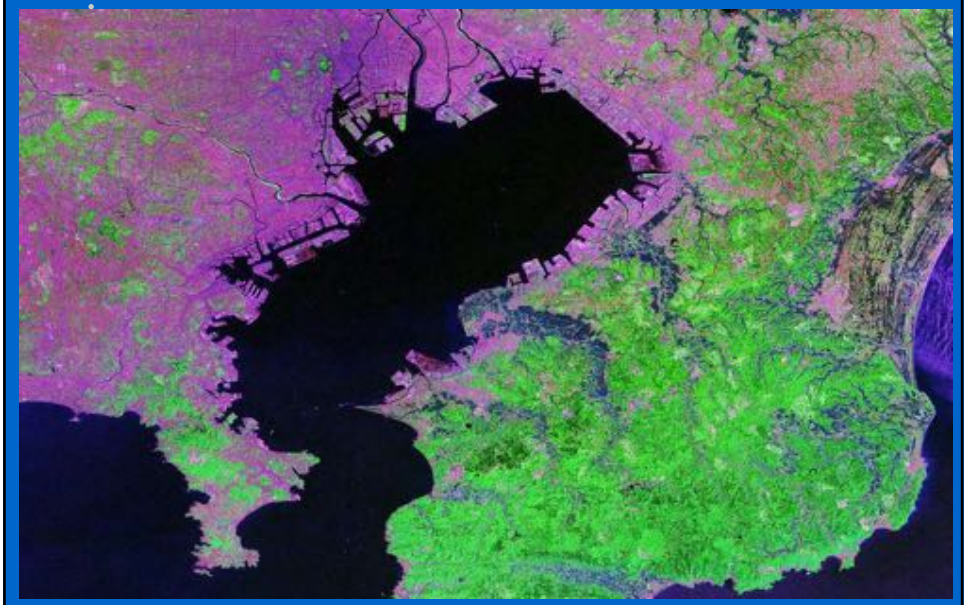
Use	Total(km²)
Total Area	283.00
Multifunctional City (Industry / Global Business / Tourism & Leisure / Eco Environment)	67.30
Agriculture	85.70
Industry	18.70
Scienctific & Research	23.00
New & Renewable Energy	20.30
City(Agriculture, Hinterland)	14.60
Eco & Environment	42.40
Waterproof Facilities, etc.	11.00


Gunsan, Seoul
Seoul
E-W road #1
Iksan
N-S road #3
Saemangem-Gunsan Railroad
N-S road #1
Seohaean Expressway
E-W road #2
N-S road #2
Saemangeum-Jeonju Expressway
Jeonju, Pohang
Internal Circulation Ring
Namwon, Sunchang
E-W road #3
Gwangju
Mokpo

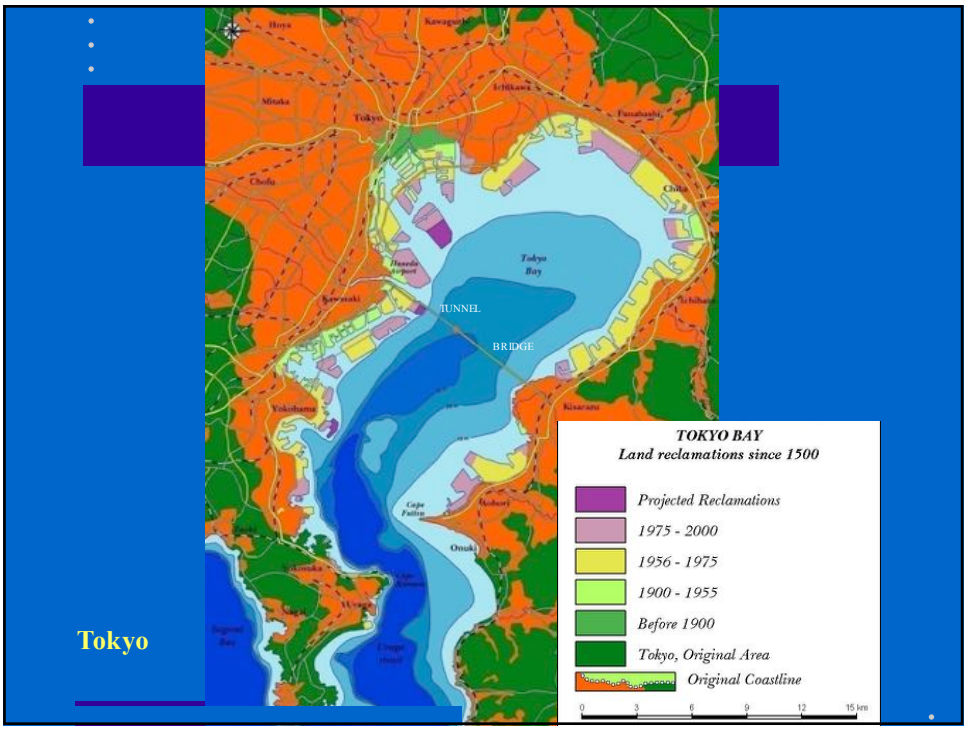
BUILDING WITH NATURE

Japan, Tokyo

Tokyo

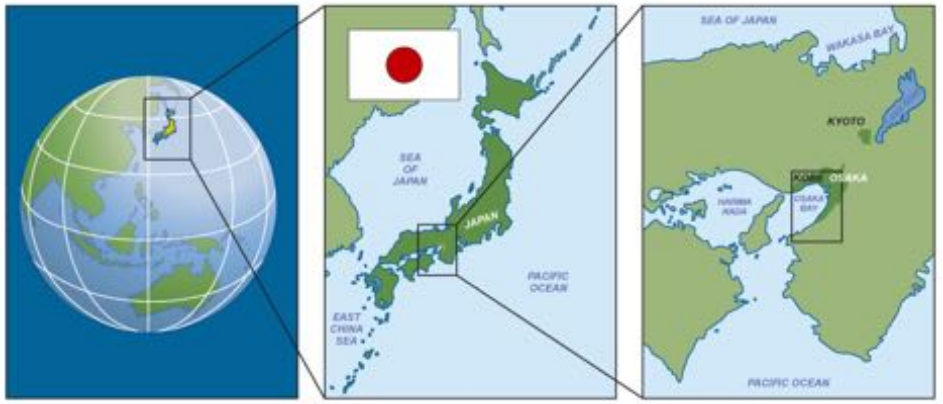


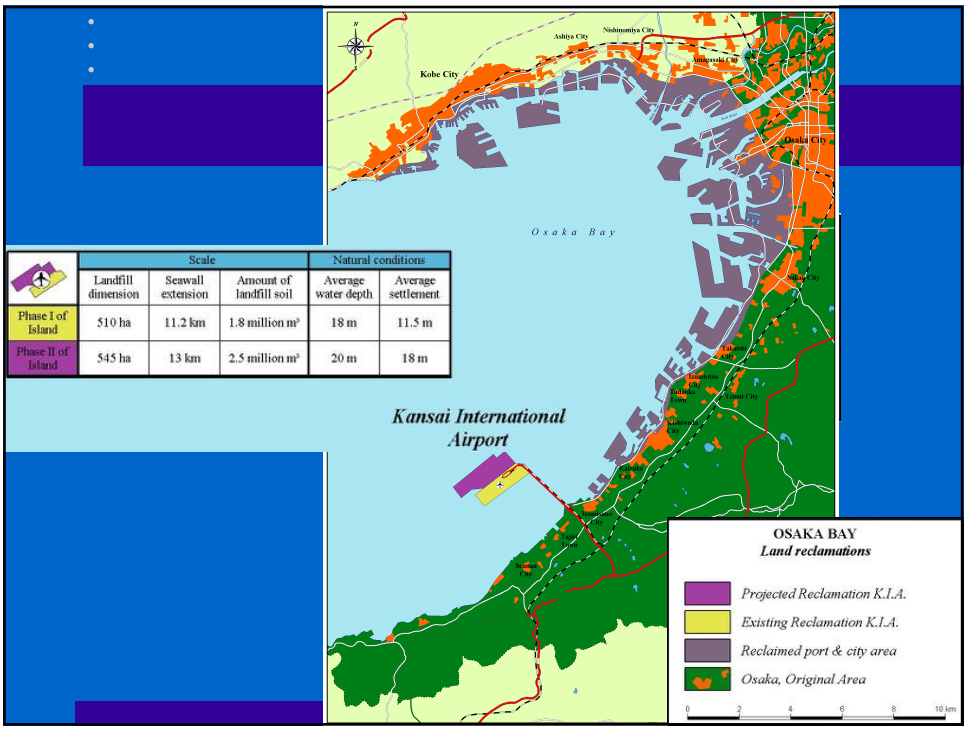
Tokyo


Tokyo
TUNNEL
BRIDGE
TOKYO BAY
Land reclamations since 1500
Projected Reclamations
1975 - 2000
1956 - 1975
1900 - 1955
Before 1900
Tokyo, Original Area
Original Coastline


Outline of Tokyo Bay

Osaka - Kobe

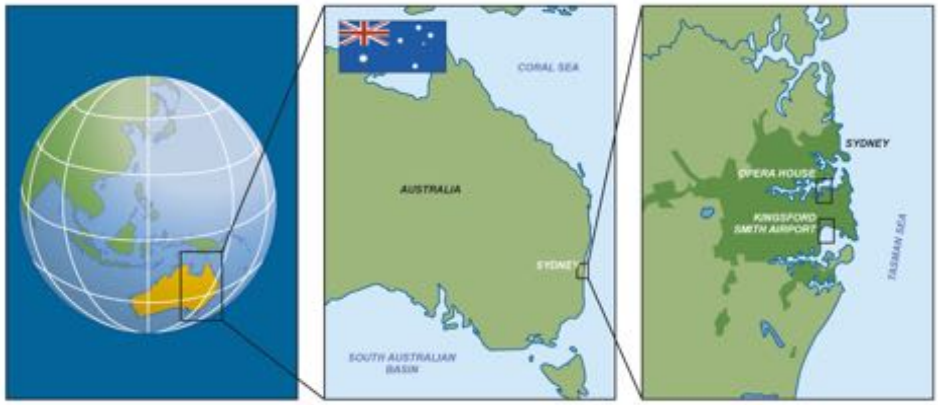


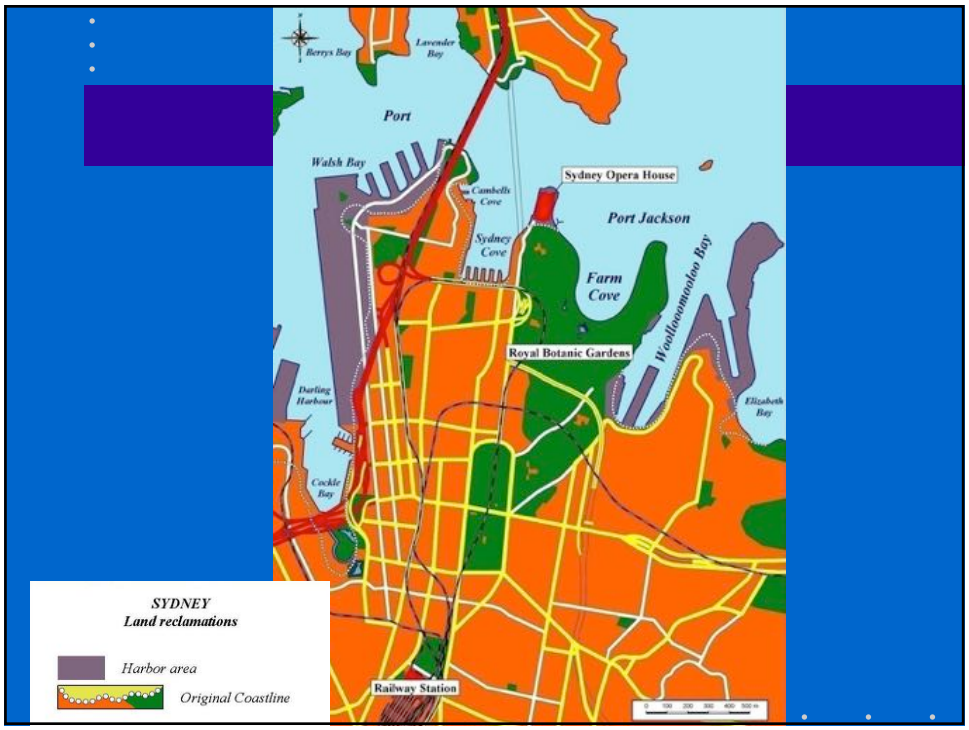


	Scale			Natural conditions	
	Landfill dimension	Seawall extension	Amount of landfill soil	Average water depth	Average settlement
Phase I of Island	510 ha	11.2 km	1.8 million m³	18 m	11.5 m
Phase II of Island	545 ha	13 km	2.5 million m³	20 m	18 m

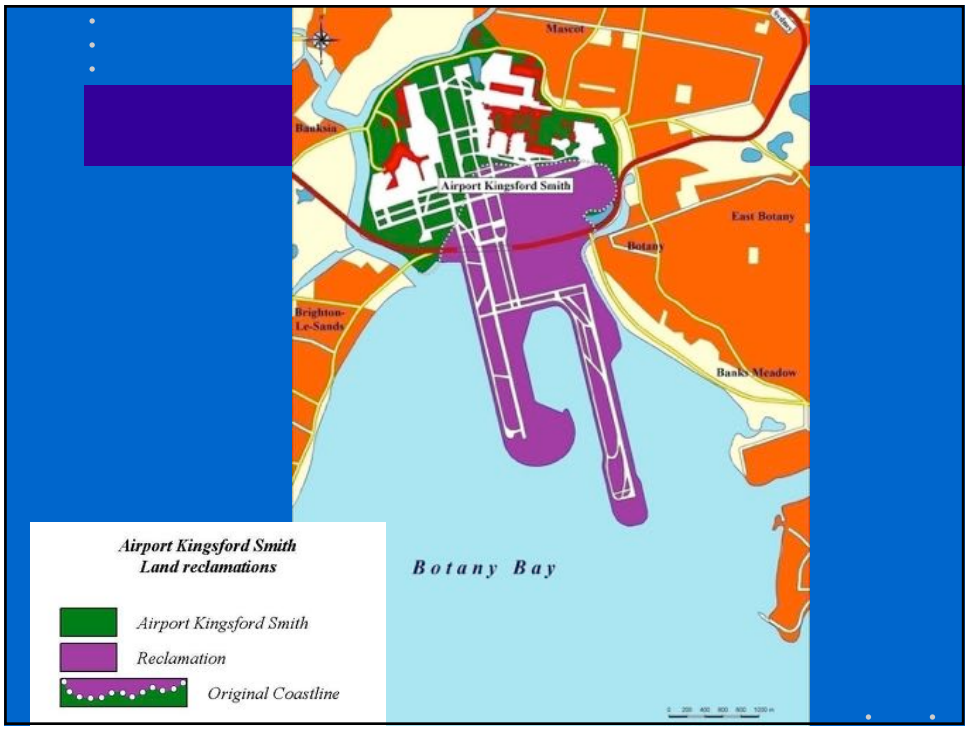
Osaka – Kobe *Kansai Int. Airport*

Australia - Sydney




Berrys Bay
Lavender Bay
Port
Walsh Bay
Sydney Opera House
Cambells Cove
Port Jackson
Sydney Cove
Farm Cove
Woolloomooloo Bay
Royal Botanic Gardens
Darling Harbour
Elizabeth Bay
Cockle Bay
SYDNEY
Land reclamations
Harbor area
Original Coastline
Railway Station


Sydney Opera House



Sydney *Kingsford Smith Airport*

SUSTAINABLE COASTAL ZONE DEVELOPMENT

Integrated Coastal & Delta Policy
via Building with Nature®

Prof. Dr. R.E. Waterman MSc

USA – THE NETHERLANDS

2013





ANNUIT COEPTIS
MDCCLXXVI
NOVUS ORDO SECLORUM
E PLURIBUS UNUM
JE MAINTIENDRAI


HURRICANE SANDY

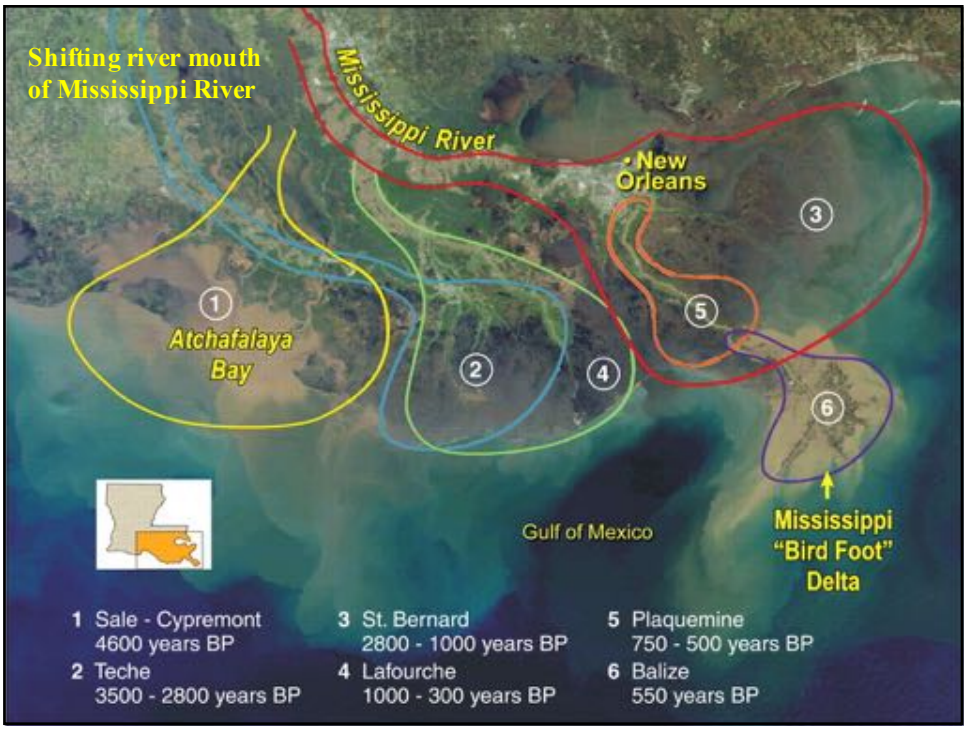
HURRICANE SANDY
impact on
New Jersey shore

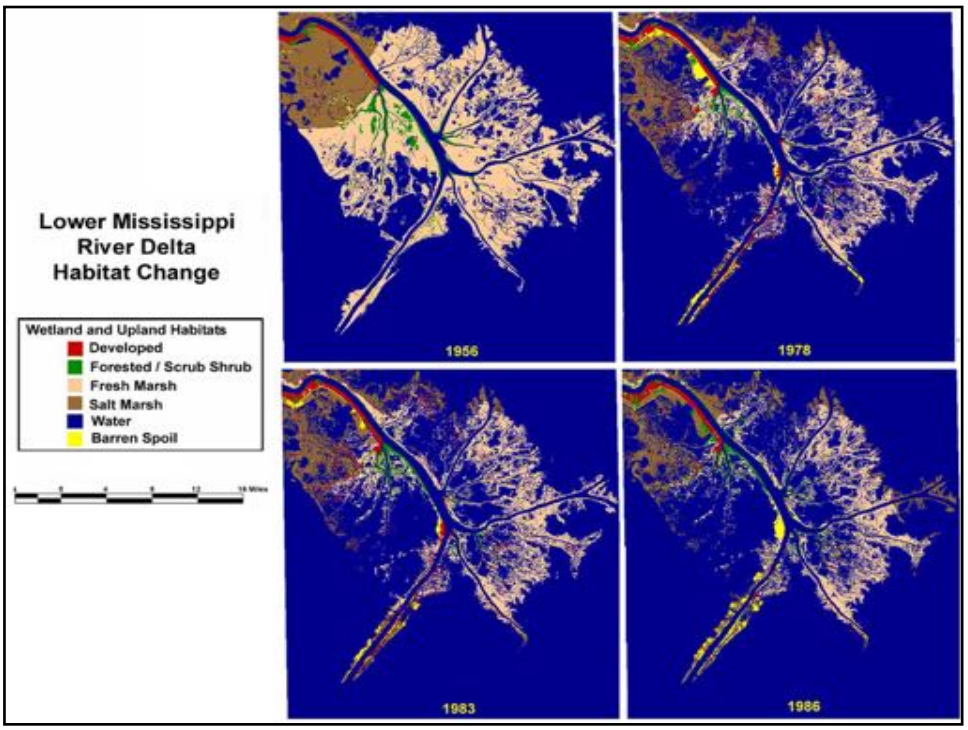
Remedy:

Dune - Beach
Widening &
Heightening

New Orleans in Mississippi Delta

- Improving levees
- Improving drainage & pumping systems
- Introducing storm surge barriers
- Wetlands extension for safety & nature development


Shifting river mouth
of Mississippi River
Mississippi River
New Orleans
Atchafalaya Bay
Gulf of Mexico
Mississippi "Bird Foot" Delta
1 Sale - Cypremont 4600 years BP
2 Teche 3500 - 2800 years BP
3 St. Bernard 2800 - 1000 years BP
4 Lafourche 1000 - 300 years BP
5 Plaquemine 750 - 500 years BP
6 Balize 550 years BP

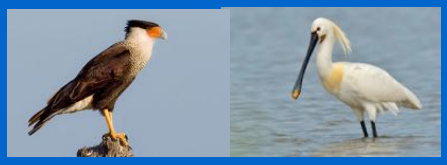

Lower Mississippi River Delta Habitat Change
Wetland and Upland Habitats
Developed
Forested / Scrub Shrub
Fresh Marsh
Salt Marsh
Water
Barren Spoil
1956
1978
1983
1986

SUSTAINABLE COASTAL ZONE DEVELOPMENT

Integrated Coastal Policy via Building with Nature

Dr. R. E. Waterman MSc

MEXICO
2014

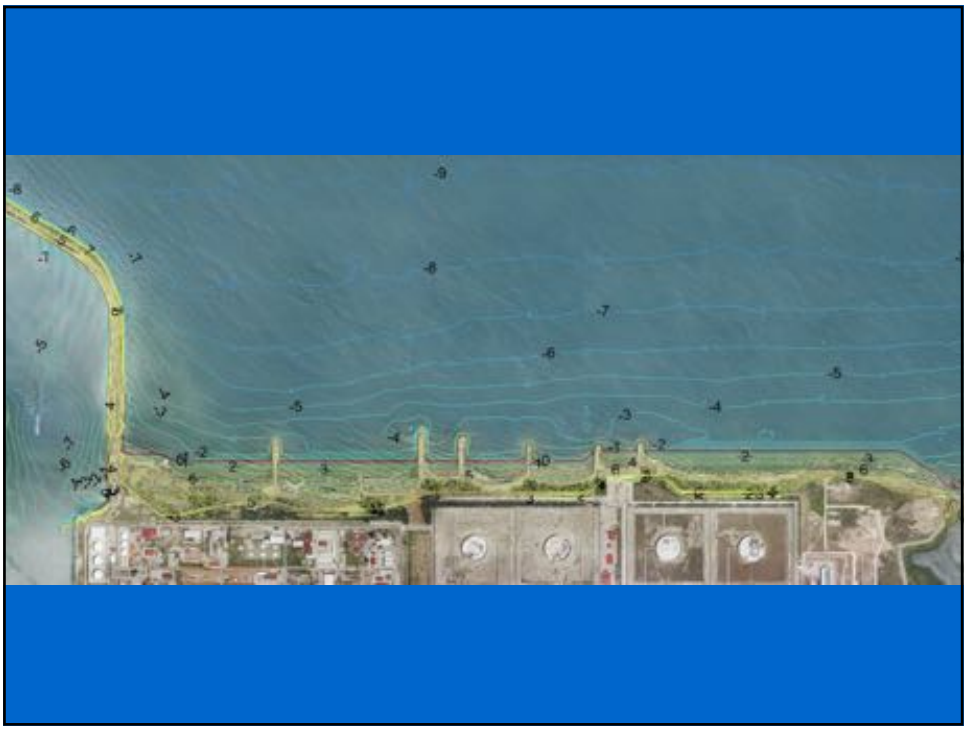



MEXICO
THE NETHERLANDS
SURFACE AREA
1,964,375 km²
33,883 km²
INHABITANTS
116.2 million
16.7 million
COASTAL LENGTH
2,805 km Gulf of Mexico
7,338 km Océano Pacifico
353 km North Sea
SEA PORTS
Veracruz
Altamira
Tampico
Dos Bocas
Acapulco
Rotterdam
Amsterdam
FOTOGRAFÍA TOMADA ANTES DE 2003.
DOS BOCAS
PARAÍSO


DOS BOCAS
TABASCO
TERMINAL MARITIMA
PEMEX
Estado: TABASCO
Municipio: PARAISO
Altitud: 1msnm
Puerto de DOS BOCAS:
Depths 7-10 meter
Turning bassin 300 m diameter
Multipurpose & Specialised Terminals
Petroleum, fruit, meat, machinery, cruise passengers
TABASCO

Espigones que se han construido frente TMPDB
Breakwaters (groynes) in front of TMPDB


ZONAS DE INTERVENCION
TUBERIAS DE SALIDA
TUBERIAS DE LLEGADA
DOS BOCAS, TABASCO
TERMINAL MARITIMA PEMEX



25 DE NOVIEMBRE DEL 2013


AREA DE QUEMADORES, ESTRUCTURA DE PROTECCIÓN


AREA DE QUEMADORES, ESTRUCTURA DE PROTECION


AREA DE QUEMADORES, LADO OESTE


ALMACEN, CUBOS DE 3.7, 5.6 TON. Y BASE DEL MASTIL


CUBOS DE 3.7 TON.


CUBOS DE 3.7 TON Y PIEDRA ENGREÑA

25 DE NOVIEMBRE DEL 2013


BASE DEL MASTIL, CUBOS DE 5.6 Y 3.7 TON


CAMINO AL MORRO


CAMINO AL MORRO


CENTRO DE ESTRUCTURA DE PROTECCION


ESTRUCTURA DE PROTECCION, LADO OESTE


ESTRUCTURA DE PROTECCION, LADO ESTE

25 DE NOVIEMBRE DEL 2013

ESTRUCTURA DE PROTECCION, LADO ESTE

ESTRUCTURA DE PROTECCION, LADO

CENRO DE LA ESTRUCTURA DE

ESTRUCTURA DE PROTECCION LADO ESTE

CENTRO DE LA ESTRUCTURA DE PROTECCION

ESTRUCTURA DE PROTECCION, LADO OESTE

25 DE NOVIEMBRE DEL 2013

ALMACEN DE MATERIALES EN AREA DE QUEMADORES

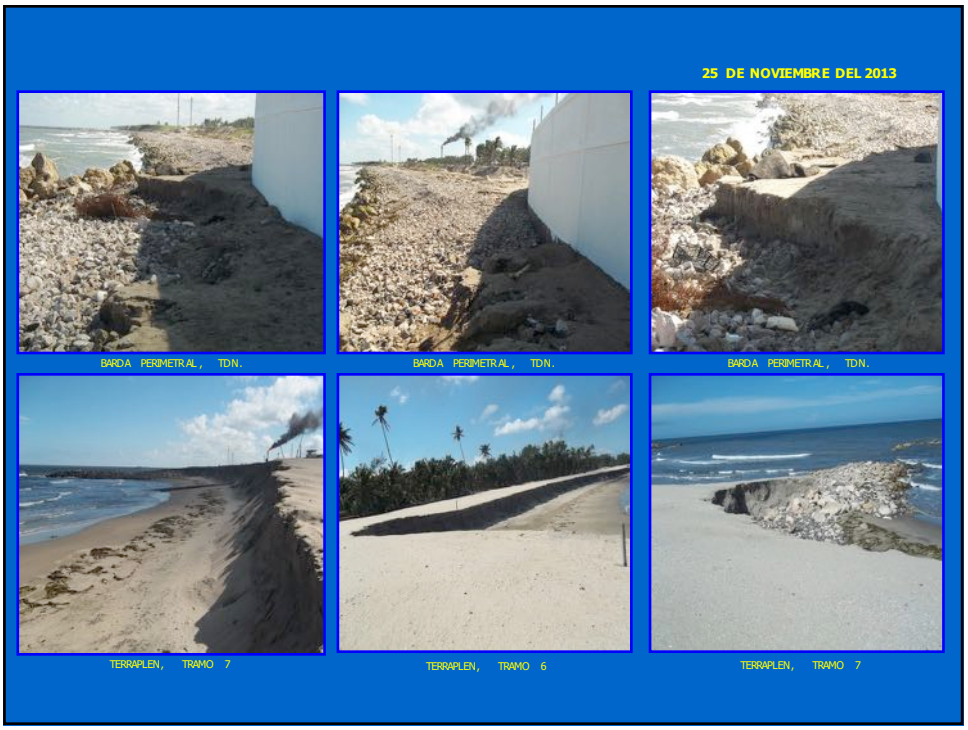
BARDA PERIMETRAL TDN.

BARDA PERIMETRAL TDN.

BARDA PERIMETRAL, TDN.

BARDA PERIMETRAL, TDN.

BARDA PERIMETRAL TDN, 1er, TRAMO


25 DE NOVIEMBRE DEL 2013
BARDA PERIMETRAL, TDN.
BARDA PERIMETRAL, TDN.
BARDA PERIMETRAL, TDN.
TERRAPLEN, TRAMO 7
TERRAPLEN, TRAMO 6
TERRAPLEN, TRAMO 7


25 DE NOVIEMBRE DEL 2013
TERRAPLEN, TRAMO 5
TERRAPLEN, TRAMO 4
TERRAPLEN, TRAMO 4
TERRAPLEN, TRAMO 3
TERRAPLEN, TRAMO 3
TERRAPLEN, TRAMO 2

25 DE NOVIEMBRE DEL 2013

TERRAPLEN, TRAMO 1

SUSTAINABLE COASTAL ZONE DEVELOPMENT

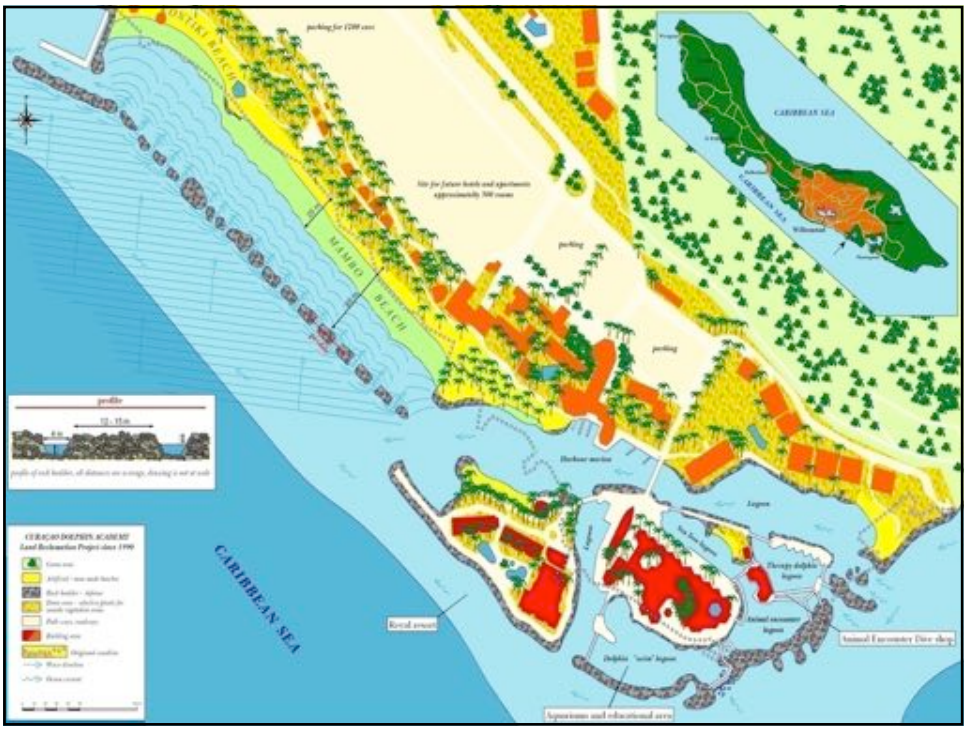
Integrated Coastal Policy via Building with Nature

Dr. R. E. Waterman MSc

CURAÇAO
2013

Curaçao


Curaçao
Westpunt
Barber
Caribbean Sea
Bullen Bay
Julianadorp
Santa Catharina
St Anna Bay
St Joris Bay
Willemstad
Caracas Bay
Fuik Bay
10 km
10 miles
Underwater Marine Park
Little Curaçao
Inhabitants 150,000
Surface Area 444 km²
Length 61 km
Width 5 – 14 km
Coastal Length 364 km
Highest Point Christoffel Berg 375 m


CARIBBEAN SEA

SUSTAINABLE COASTAL ZONE DEVELOPMENT

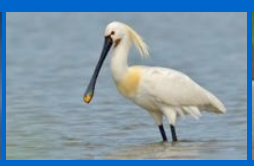
Integrated Coastal & Delta Policy
via Building with Nature®

Prof. Dr. R.E. Waterman MSc

COLOMBIA – THE NETHERLANDS

2013







LIBERTAD Y ORDEN
JE MAINTIENDRAI


COLOMBIA
THE NETHERLANDS
SURFACE AREA
1,141,748 km²
33,883 km²
INHABITANTS
45.8 million
16.7 million
COASTAL LENGTH
1760 km Mar Caribe
1448 km Océano Pacifico
353 km North Sea
MAIN RIVER BASINS
Magdalena-Cauca
Orinoquia
Amazonia
Caribe
Pacifico
Rhine - Maas - Scheldt
SEA PORTS
Cartagena de Indias
Barranquilla
Santa Marta
Buenaventura
Tumaco
Rotterdam - Amsterdam
COLOMBIA
PANAMA

PACIFIC COAST

Mostly rocky with steep rocky slope

Tidal difference up to 7 m

Currents more random and coastline is prone to tsunamis

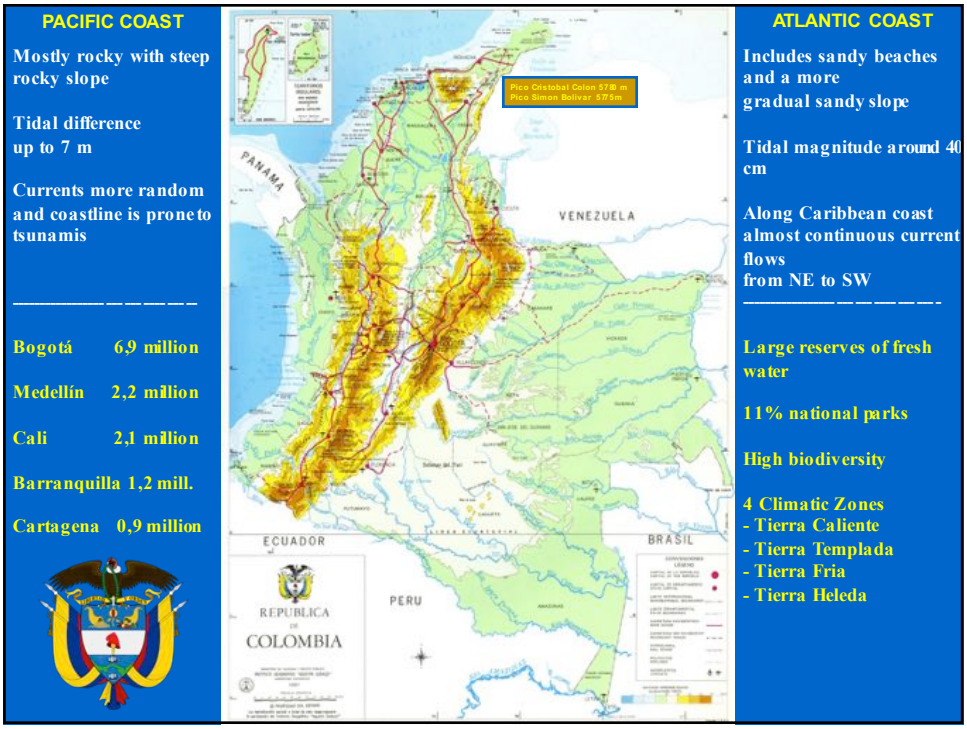
Bogotá 6,9 million

Medellín 2,2 million

Cali 2,1 million

Barranquilla 1,2 mill.

Cartagena 0,9 million



ATLANTIC COAST

Includes sandy beaches and a more gradual sandy slope

Tidal magnitude around 40 cm

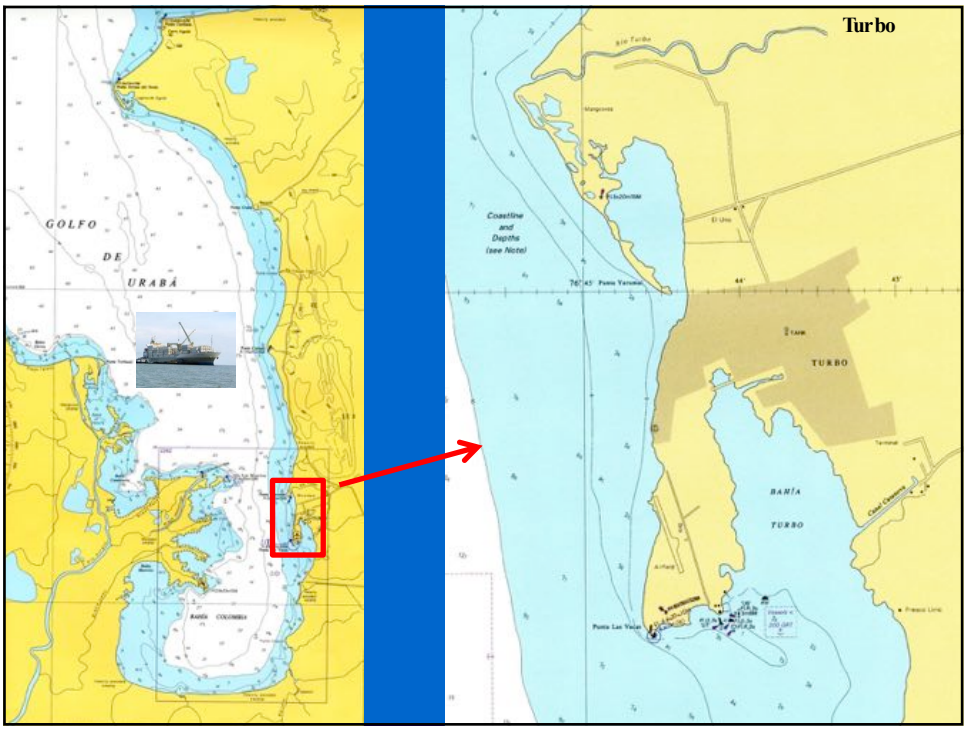
Along Caribbean coast almost continuous current flows from NE to SW

Large reserves of fresh water

11% national parks

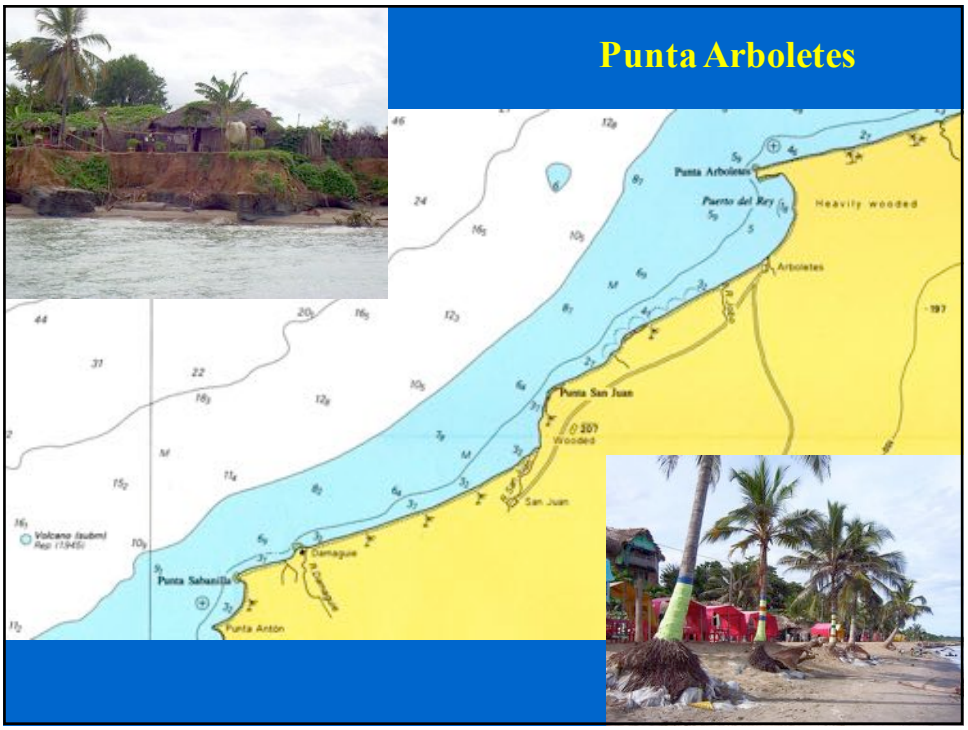
High biodiversity

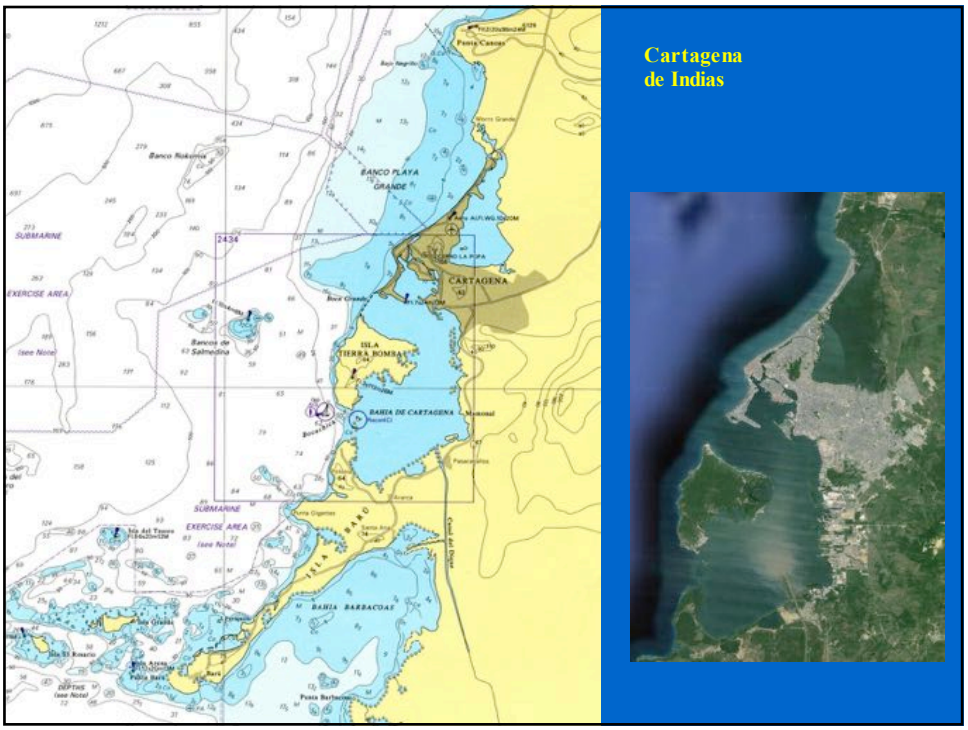
4 Climatic Zones
- Tierra Caliente
- Tierra Templada
- Tierra Fria
- Tierra Heleda

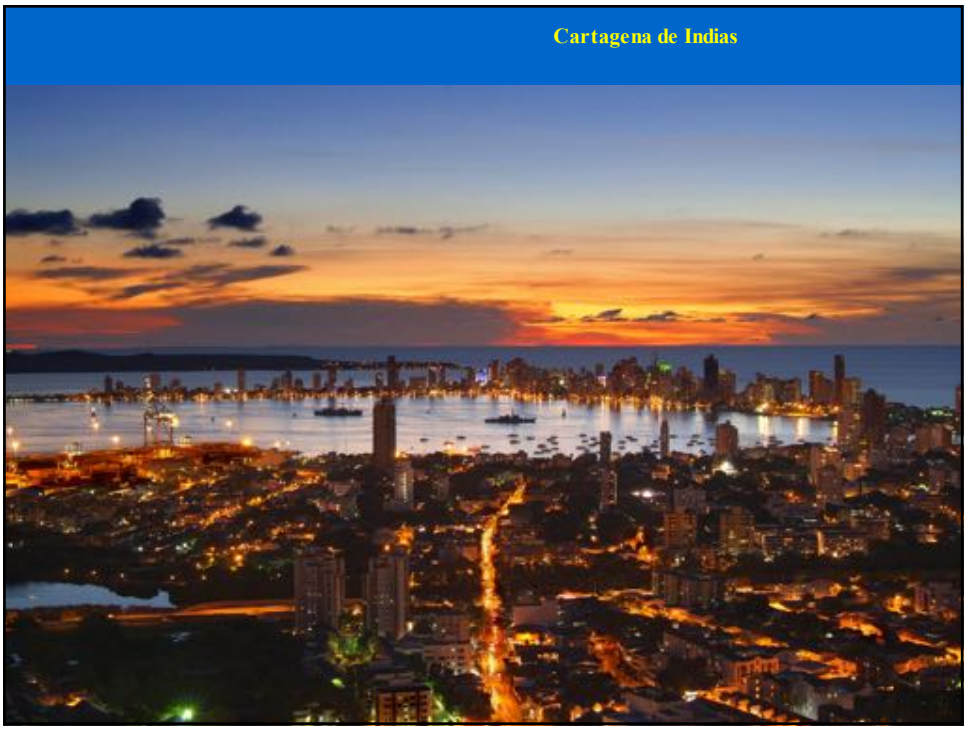



Golfo
de
Urabá
&
Turbo


Golfo
de
Urabá
&
Turbo


Punta Arboletes
Punta Arboletes
Puerto del Rey
Heavily wooded
Arboletes
Punta San Juan
Wooded
San Juan
Damague
Punta Sabanilla
Punta Anton
Volcano (subm)


Cartagena
de Indias
BANCO PLAYA GRANDE
CARTAGENA
ISLA TIERRA BOMBA
BAHIA DE CARTAGENA
SUBMARINE
EXERCISE AREA
ISLA BARU
BAHIA BARBACOAS


Cartagena de Indias


BANCO PLAYA GRANDE
CARTAGENA
ISLA TIERRA BOMBA
BAHIA DE CARTAGENA
Cartagena
de Indias


Cartagena
de Indias


Barranquilla
&
Rio Magdalena

GEODESY

In planning & design Geodesy plays an essential role.

Historical and actual data with regard to land & sea surfaces and sub surfaces are needed for planning & map making.

Measurements are required through land- and sea survey, including Remote Sensing.

SUSTAINABLE MULTI-FUNCTIONAL COASTAL ZONE DEVELOPMENT

General approach

A. ***Integrated Coastal Policy*** to give an answer to the question: How can we solve many existing and future problems in relation to each other, in relation to the existing hinterland on the one hand and in relation to the bordering sea on the other, while creating added value

B. Application of the method ***Building with Nature***® using more than before the materials and forces/interactions present in nature, creating a new flexible dynamic equilibrium coast in which accretion and erosion are more or less balancing each other with a minimum of solid seawall elements. Taking into account the bio-geomorphology & geohydroloy of coast & seabed.

SUSTAINABLE MULTI-FUNCTIONAL COASTAL ZONE DEVELOPMENT

Local Measures

1. Dune & Beach & Foreshore nourishment
2. Restoration of natural sediment transport
3. Sand Engine for long term maintenance
4. Making work with work: reuse of dredged material
5. Mangrove rehabilitation
6. Application of sand packed geotextiles, poles & sticks
7. Reshaping cliffs with adequate slope combined with vegetation
8. Preservation & restoration of coral reefs; artificial reefs
9. Use of existing barrier islands
10. Spatial planning

PACIFIC COAST

Mostly rocky with steep rocky slope

Tidal difference up to 7 m

Currents more random and coastline is prone to tsunamis

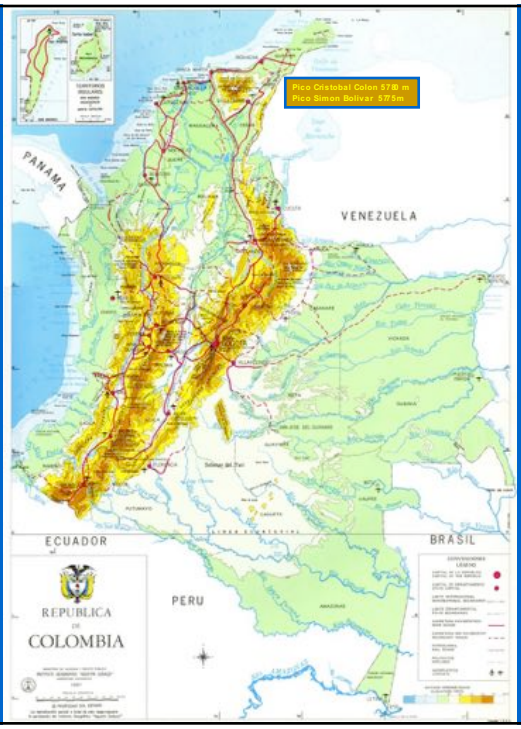
Bogotá 6,9 million

Medellín 2,2 million

Cali 2,1 million

Barranquilla 1,2 mill.

Cartagena 0,9 million



ATLANTIC COAST

Includes sandy beaches and a more gradual sandy slope

Tidal magnitude around 40 cm

Along Caribbean coast almost continuous current flows from NE to SW

MAIN RIVER BASINS

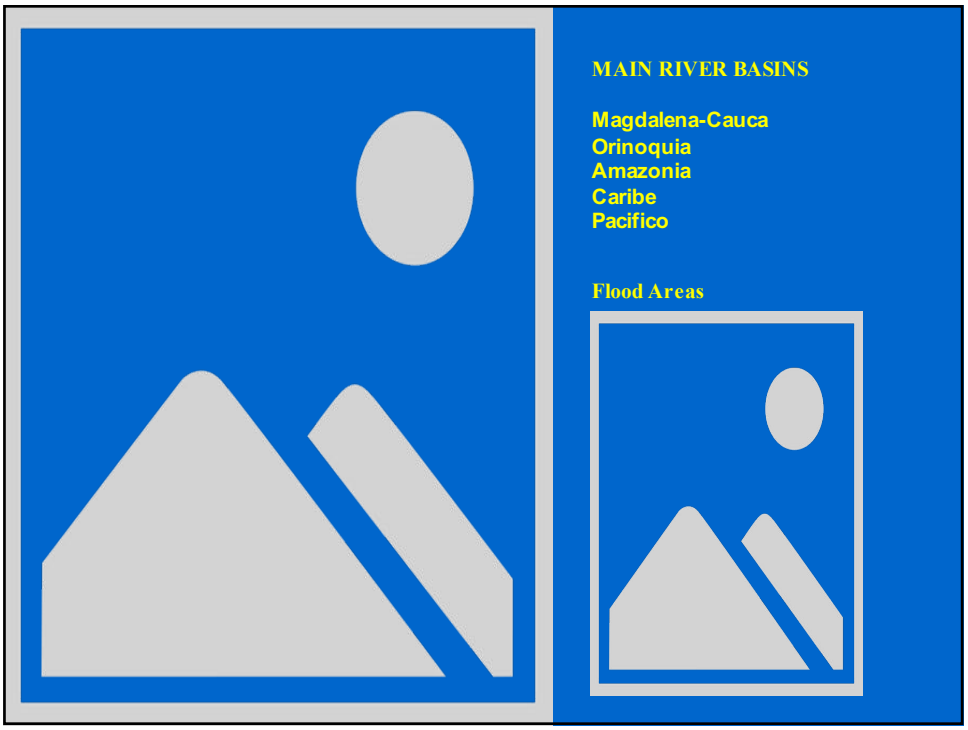
Magdalena-Cauca

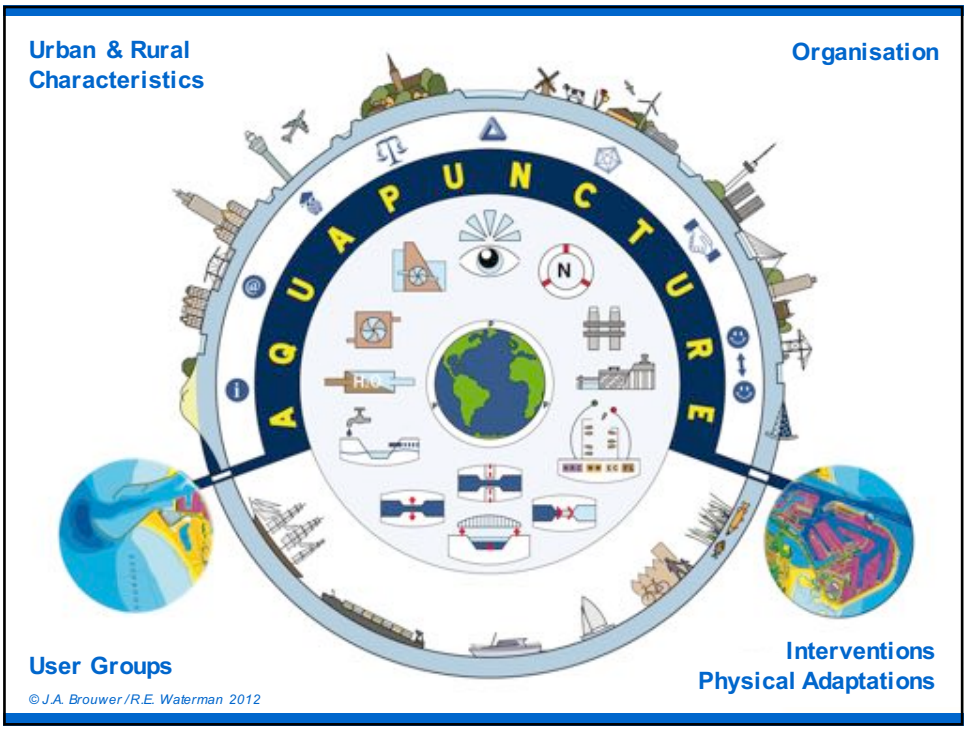
Orinoquia

Amazonia

Caribe

Pacifico


MAIN RIVER BASINS
Magdalena-Cauca
Orinoquia
Amazonia
Caribe
Pacifico
Flood Areas


Urban & Rural Characteristics
Organisation
AQUAPUNCTURE
User Groups
Interventions Physical Adaptations
© J.A. Brouwer / R.E. Waterman 2012

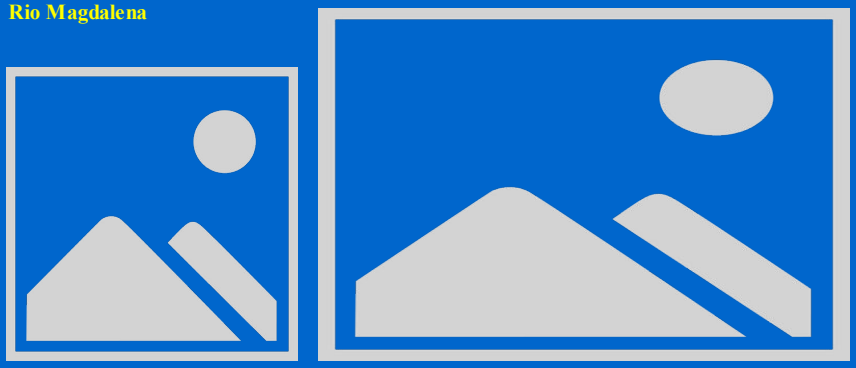
Recuperación del Canal del Dique

Length 120 km, from Catagena to Rio Magdalena & Calamar

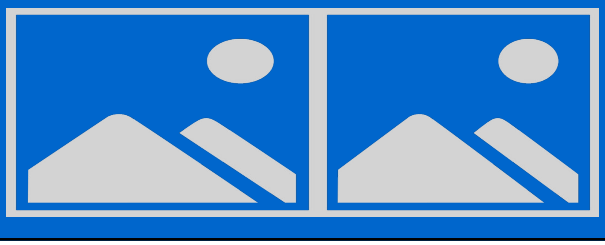
Recuperation complete with dikes, new locks & marsh improvements

AGUAPUNTURA©
for the optimal use & adaptation of the waterway and the waterfronts for economy, employment, environment, nature & landscape

Rio Magdalena



Rio Magdalena – Length 1540 km



AGUAPUNTURA©
for the optimal use & adaptation of the waterway and the waterfronts for economy, employment, environment, nature & landscape

Rio Bogotá

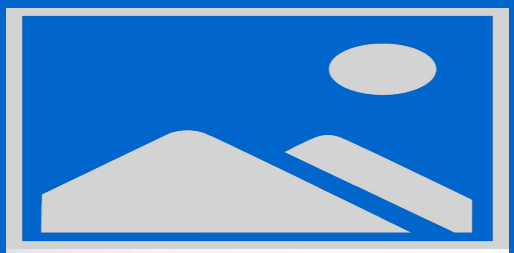
The relation between Bogotá and the Rio Bogotá should be improved through AGUAPUNTURA©

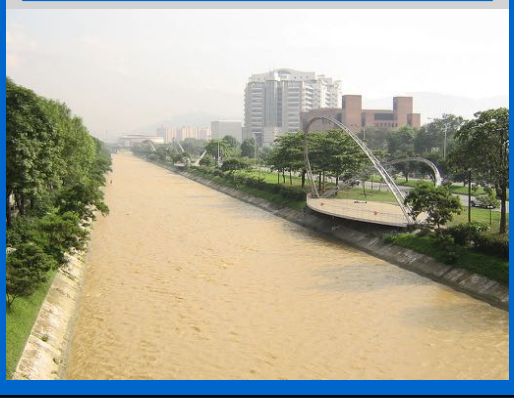
AGUAPUNTURA©
for the optimal use & adaptation of the waterway and the waterfronts for economy, employment, environment, nature & landscape

Bogotá

7.3 million inhabitants

Rio Medellin

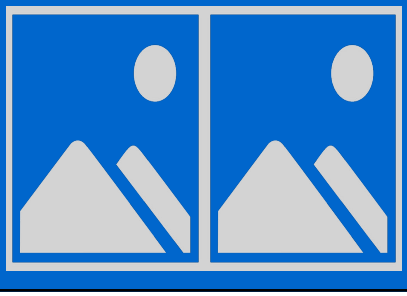




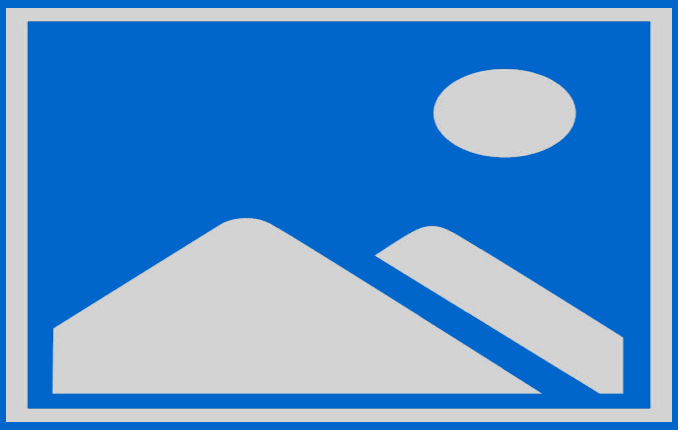
Medellin - 2.2 million inhabitants

Rio Medellin - Length 100 km
(60 km Medellin & 40 km Porce)

AGUAPUNTURA©
for the optimal use & adaptation of the waterway and the waterfronts for economy, employment, environment, nature & landscape

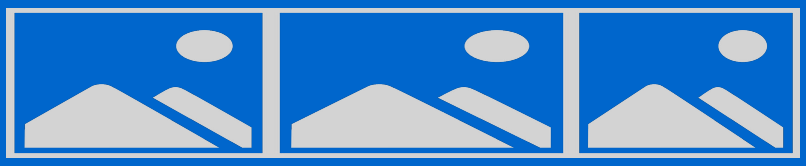


Rio Cauca

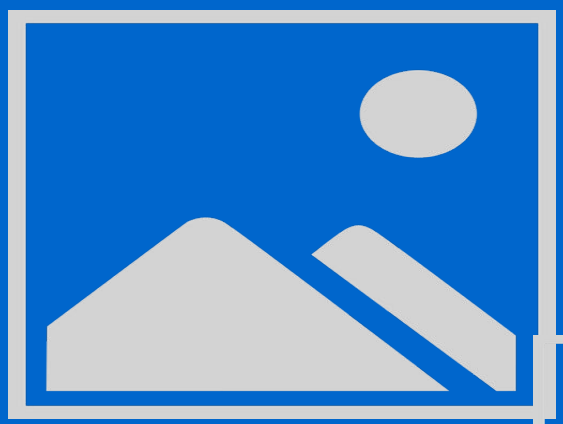


Rio Cauca –
Length 965 km

AGUAPUNTURA©
for the optimal use & adaptation of the waterway
and the waterfronts for economy, employment, environment, nature & landscape



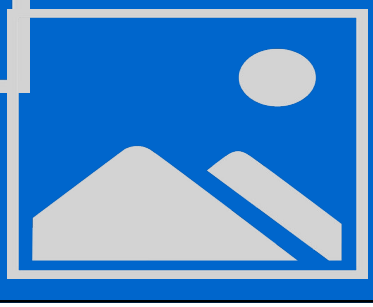
Rio Cali



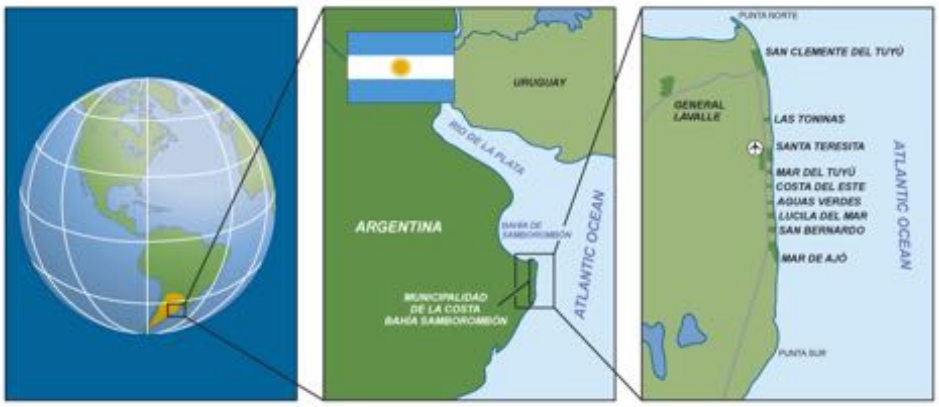
Santiago de Cali –
2.0 million inhabitants

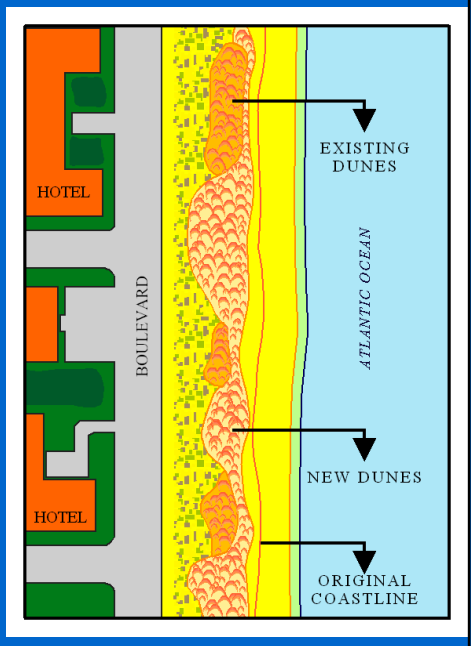
Rio Cali

AGUAPUNTURA©
for the optimal use & adaptation of the waterway and their waterfronts for economy, employment, environment,
nature & landscape

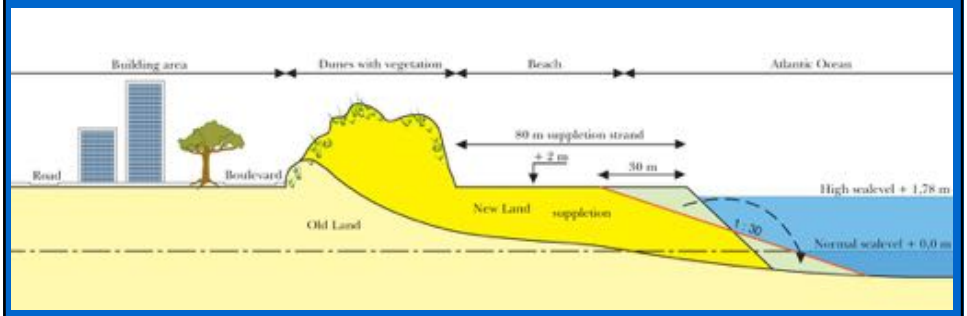


Argentina – *Municipalidad de la Costa*





Argentina – *Municipalidad de la Costa*

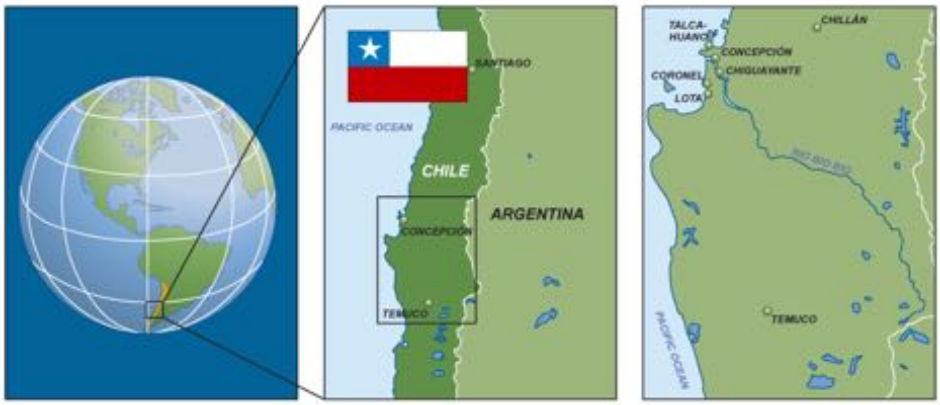


Argentina

Mar del Tuyu

San Clemente del Tuyu

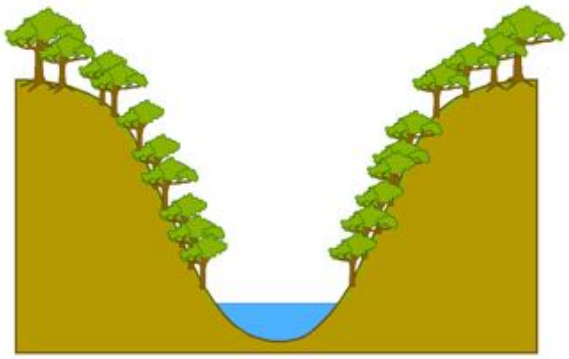
Chile



Chile *Rio Bio Bio*

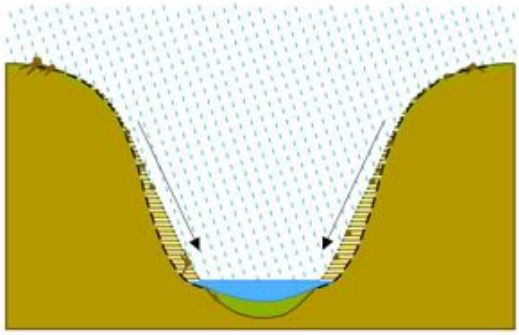
RIO BIO BIO IN CHILE

Cross section in original situation of riverbanks with trees, shrubs and a navigable river.



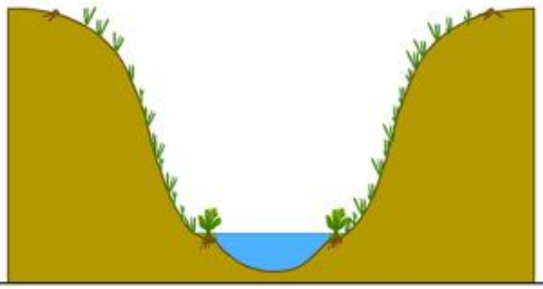
Chile *Rio Bio Bio*

Cross section with man-induced erosion by tree logging leading to a wider but less deep riverbed which in turn causes reduced navigatebility and reduction of fertile land.



Chile *Rio Bio Bio*

Cross section with river bank restoration by tree planting and planting of tree saplings in the river causing local sedimentation and land reclamation, which in turn forces the river in a narrower and deeper riverbed, thereby restoring the original river depth.



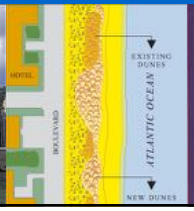
Chile *Rio Bio Bio*

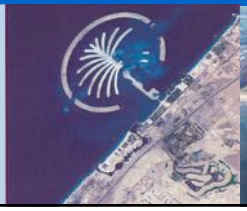
BUILDING WITH NATURE

Building with Nature®

$(\alpha+\beta+\gamma)_{\text{knowledge + action}} \longrightarrow \Delta_{\text{sustainable}}$

Question Time





GEODESY

In planning & design Geodesy plays an essential role.

Historical and actual data with regard to land & sea surfaces and sub surfaces are needed for planning & map making.

Measurements are required through land- and sea survey, including Remote Sensing.

Spatial plan based on a six layer system

SUSTAINABLE COASTAL & DELTAIC ZONE DEVELOPMENT VIA BUILDING WITH NATURE

1. Underground Layer (Soil / Hydrosphere)

The underground layer with its composition and structure and all its natural resources serves a whole series of natural functions. In addition to these natural functions, it fulfils and can fulfil a series of human-initiated and humanmade functions in and on the underground layer, which are and have to be based on its soil, sub-soil and hydrosphere characteristics.
This underground layer serves as a basis for:

- landscape & seascape
- agriculture, fishery, aquaculture
- exploitation of composite minerals, ores
- foundation for building sites and infrastructure
- storage for waste products, energy, water and CO2
- terrestrial & aquatic nature values
- extraction groundwater & surface water
- geothermal energy, water energy, fossil energy
- tunnels, cables, pipelines, geodetic domes
- preservation historic and archaeological sites.

The composition and structure of the underground layer are of vital importance for the following layers.

SUSTAINABLE COASTAL & DELTAIC ZONE DEVELOPMENT VIA BUILDING WITH NATURE

2. Green-Blue Layer

This layer contains all valuable terrestrial & aquatic nature values, including landscape and seascape, rivers, lakes, ponds and waterways that are in constant need of conservation.

3. Agriculture – Fishery – Aquaculture Layer

This production layer contains all forms of agriculture (greenhouse horticulture, forestry, cattle & poultry breeding, dairy farming); fishery & aquaculture (including mariculture); the production of microorganisms and their metabolic products.

This layer has a clear overlap and interaction with the green-blue layer, especially since production and nature protection are increasingly combined.

SUSTAINABLE COASTAL & DELTAIC ZONE DEVELOPMENT VIA BUILDING WITH NATURE

4. Occupation Layer

The occupation layer contains all building sites for living, working and recreation with all additional facilities amongst others related to education, health care & welfare, religion, shopping, sports and culture.

5. Infrastructure Layer

This layer contains all forms of infrastructure: waterways, roads (including motorways, cycle paths, and footpaths), railroads, pipe / tube / cable, air lanes, electronic highway. In this infrastructure layer, are also present all construction / engineering / structural works such as bridges, tunnels, viaducts, aqueducts, sluices, weirs, railroad stations, metro stations and bus stations, airports, pumping stations, transformers, transceiver stations, sensors, electronic signalling and control equipment. This infrastructure layer serves to link cities, ports and urban, rural & sea areas.

SUSTAINABLE COASTAL & DELTAIC ZONE DEVELOPMENT VIA BUILDING WITH NATURE

6. Atmosphere Layer

This umbrella layer is essential for the climate cycle, hydrological cycle as well as other cycles. It is also an important medium for transportation of electromagnetic waves, sound waves and matter in all its diversity.

Although these six layers are separately defined, which in itself is very useful, clearly the six layers are strongly interrelated and partly overlapping each other.

In the spatial planning process with regard to the separate and interrelated layers, special attention must be given to the composition of the underground layer and thereby in general to the third dimension.

SUSTAINABLE COASTAL & DELTAIC ZONE
DEVELOPMENT VIA BUILDING WITH NATURE

Relation
Environment – Economy – Space

SIGNIFICANCE OF THE ANTHROPOCENE

Dr. R.E. Waterman Msc

Estimated age of the universe: approx. 13.5 billion / year

Estimated age of the earth: approx. 4.5 billion / year

Geological periods:

Precambrium
Cambrium
Ordovicium
Silurian
Devonian
Carboniferous
Perm
Triassic
Jurassic
Cretaceous
Tertiair
Quartair: Pleistocene – Holocene – Anthropocene

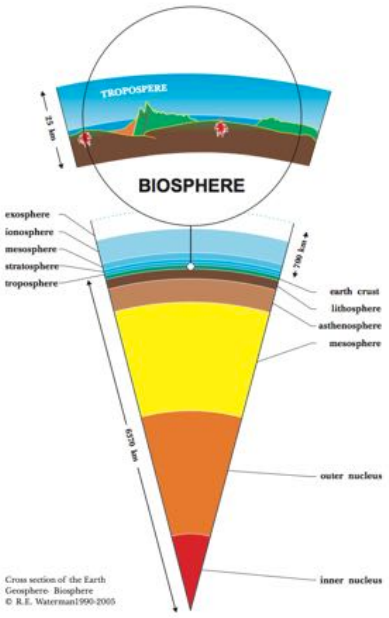
ANTHROPOCENE

For the first time in the geological history MANKIND has become a geological factor by numbers and lifestyle

Global footprint =

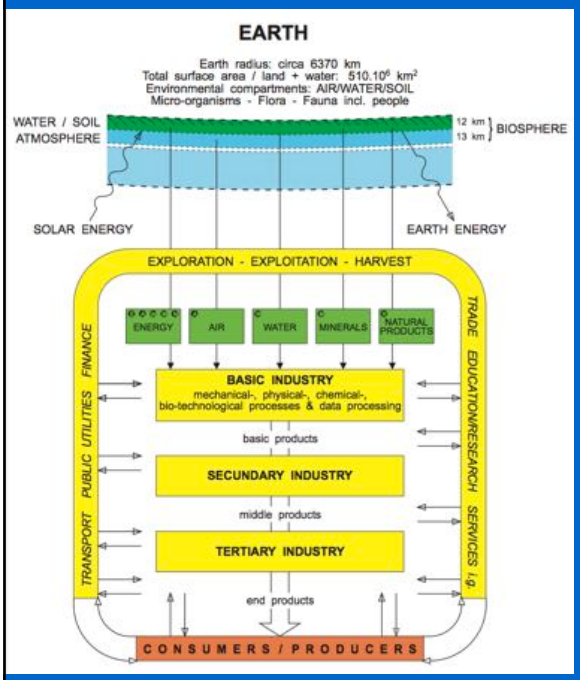
F (size of population, lifestyle, technology)

Necessity: stabilizing world population, lifestyle modification and introduction of technologies focused on sustainability



Apart from space travel all human activities take place in a thin shell around the earth: the geosphere - biosphere – sociosphere system

There we find the environmental compartments Air – Water – Soil, flora, fauna, micro-organisms and people and all the material expressions of human activities



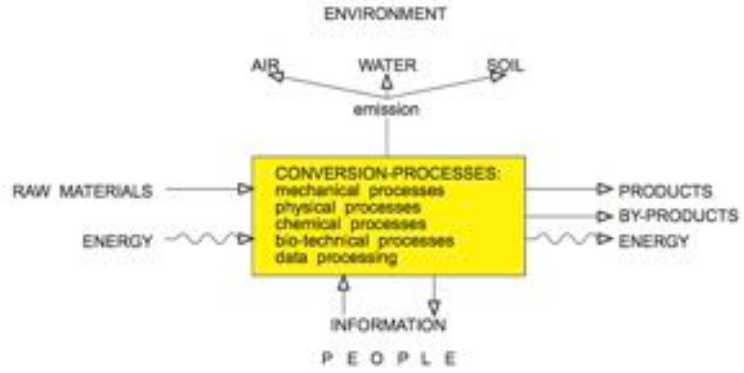
MANKIND extracts from / in the geosphere raw materials and energy

Every human being is at the same time

PRODUCER & CONSUMER

1804: 1 billion people
1927: 2 billion people
2000: 6 billion people
2012: 7 billion people
2050: 9 billion people

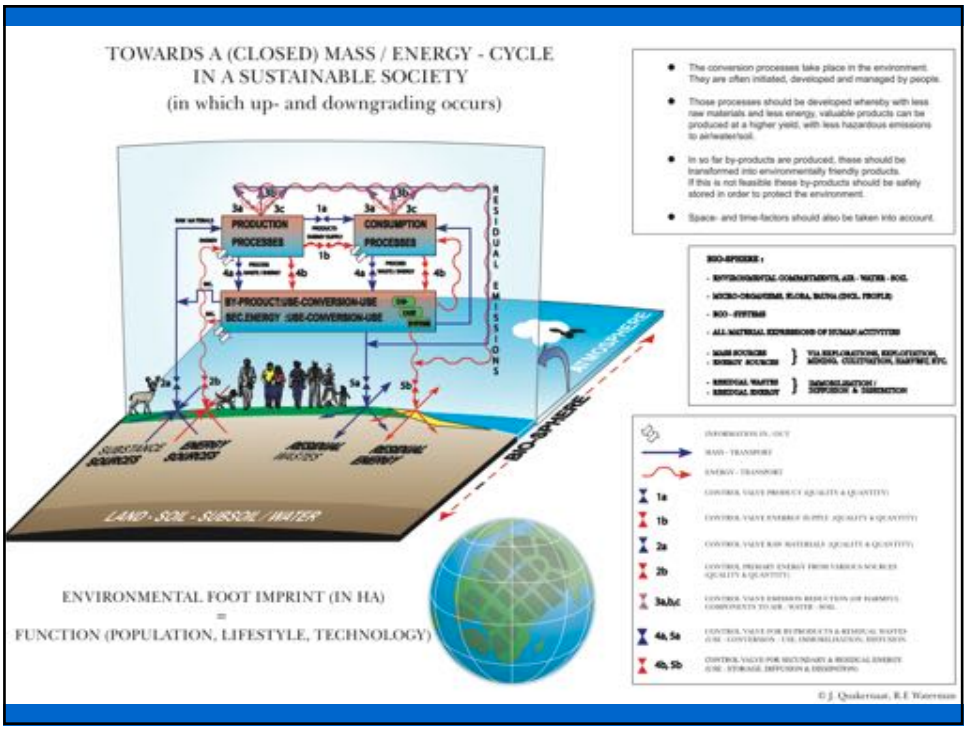
Process innovations take place in the environment and are initiated, developed and managed by people

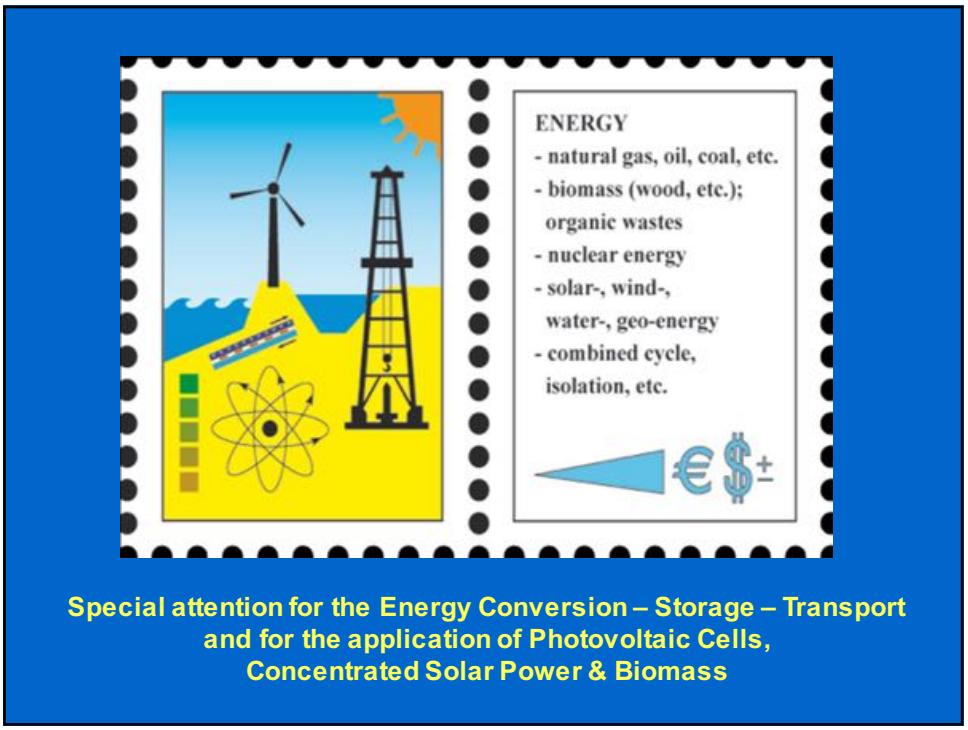


The great challenge of the 21st century is to develop and implement conversion processes in such a way that at the same time the economy is strengthened and the environment improved

Environmental Technology

Triple - C approach

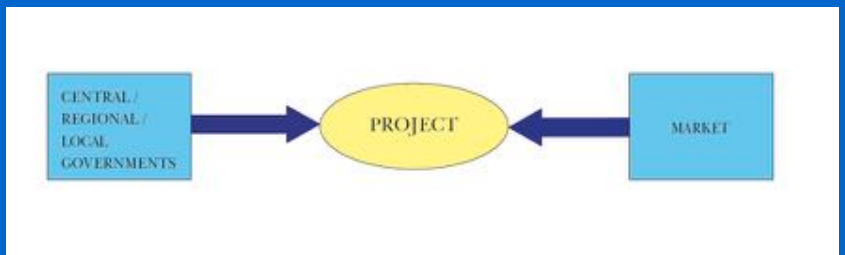

TOWARDS A (CLOSED) MASS / ENERGY - CYCLE
IN A SUSTAINABLE SOCIETY
(in which up- and downgrading occurs)
PRODUCTION PROCESSES
CONSUMPTION PROCESSES
BY-PRODUCT/USE-CONVERSION-USE
SEC.ENERGY /USE-CONVERSION-USE
RESIDUAL EMISSIONS
BIO-SPHERE
LAND - SOIL - SUBSOIL / WATER
ENVIRONMENTAL FOOT IMPRINT (IN HA)
=
FUNCTION (POPULATION, LIFESTYLE, TECHNOLOGY)
The conversion processes take place in the environment. They are often initiated, developed and managed by people.
Those processes should be developed whereby with less raw materials and less energy, valuable products can be produced at a higher yield, with less hazardous emissions to air/water/soil.
In so far by-products are produced, these should be transformed into environmentally friendly products. If this is not feasible these by-products should be safely stored in order to protect the environment.
Space- and time-factors should also be taken into account.

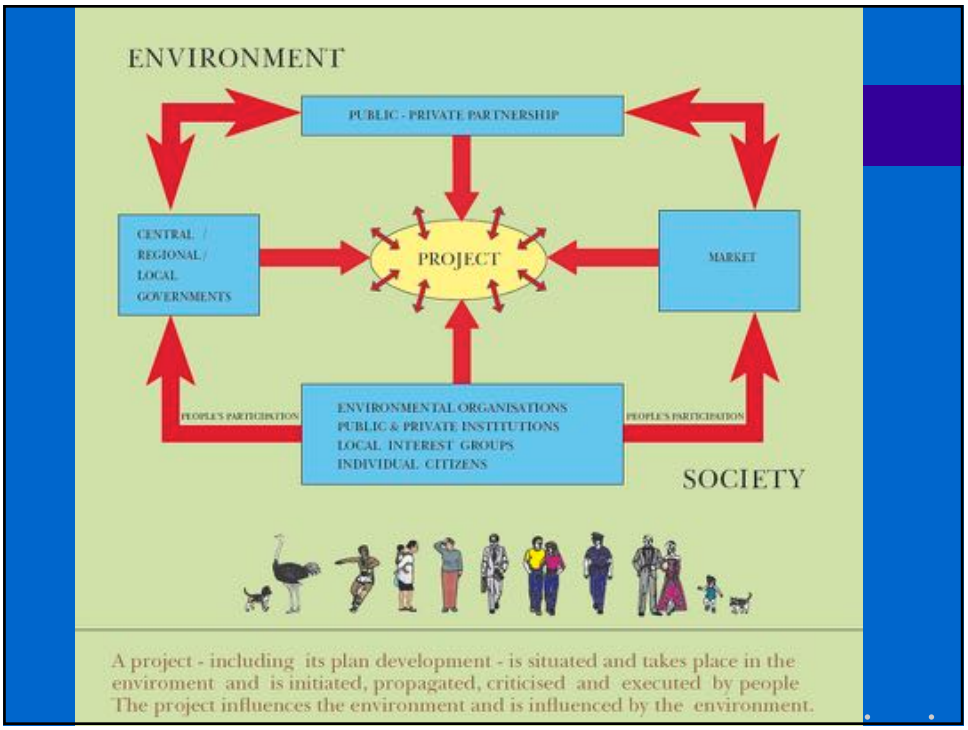

ENERGY
- natural gas, oil, coal, etc.
- biomass (wood, etc.);
organic wastes
- nuclear energy
- solar-, wind-,
water-, geo-energy
- combined cycle,
isolation, etc.
Special attention for the Energy Conversion – Storage – Transport
and for the application of Photovoltaic Cells,
Concentrated Solar Power & Biomass

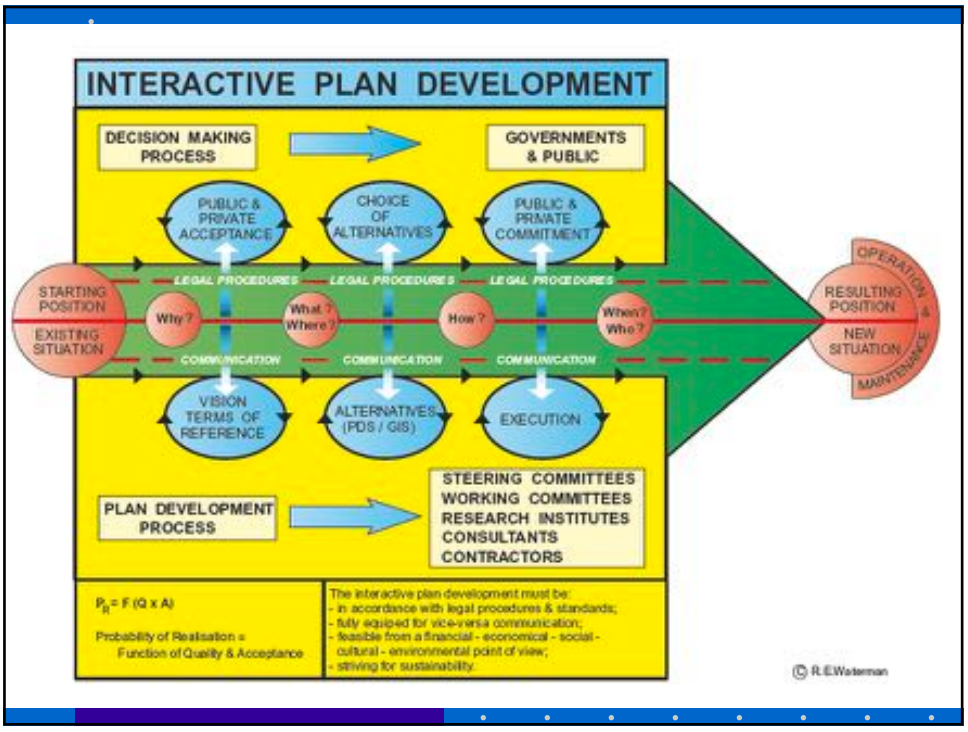
SUSTAINABLE COASTAL & DELTAIC ZONE DEVELOPMENT VIA BUILDING WITH NATURE

Interactive Plan Development

SUSTAINABLE COASTAL & DELTAIC ZONE DEVELOPMENT VIA BUILDING WITH NATURE




ENVIRONMENT
PUBLIC - PRIVATE PARTNERSHIP
CENTRAL / REGIONAL / LOCAL GOVERNMENTS
PROJECT
MARKET
PEOPLE'S PARTICIPATION
ENVIRONMENTAL ORGANISATIONS
PUBLIC & PRIVATE INSTITUTIONS
LOCAL INTEREST GROUPS
INDIVIDUAL CITIZENS
PEOPLE'S PARTICIPATION
SOCIETY
A project - including its plan development - is situated and takes place in the enviroment and is initiated, propagated, criticised and executed by people
The project influences the environment and is influenced by the environment.


INTERACTIVE PLAN DEVELOPMENT
DECISION MAKING PROCESS
GOVERNMENTS & PUBLIC
PUBLIC & PRIVATE ACCEPTANCE
CHOICE OF ALTERNATIVES
PUBLIC & PRIVATE COMMITMENT
LEGAL PROCEDURES
LEGAL PROCEDURES
LEGAL PROCEDURES
STARTING POSITION
EXISTING SITUATION
Why ?
What ? Where ?
How ?
When ? Who ?
RESULTING POSITION
NEW SITUATION
OPERATION
MAINTENANCE
COMMUNICATION
COMMUNICATION
COMMUNICATION
VISION TERMS OF REFERENCE
ALTERNATIVES (PDS / GIS)
EXECUTION
PLAN DEVELOPMENT PROCESS
STEERING COMMITTEES
WORKING COMMITTEES
RESEARCH INSTITUTES
CONSULTANTS
CONTRACTORS
P_R = F (Q x A)
Probability of Realisation = Function of Quality & Acceptance
The interactive plan development must be:
- in accordance with legal procedures & standards;
- fully equiped for vice-versa communication;
- feasible from a financial - economical - social - cultural - environmental point of view;
- striving for sustainability
© R.E.Waterman

SUSTAINABLE COASTAL & DELTAIC ZONE DEVELOPMENT VIA BUILDING WITH NATURE

Vision

Vision plays a crucial and essential role from start to finish in any interactive plan development process. Without vision neither an excellent plan design, nor its development can be achieved.

Every plan development is or should be based on a well-founded vision.

Ideally, this vision, placed in time and space, should be based on knowledge, insight, sensory perception, analytical skill, sound rational reasoning and intuition, inspiration and creativity.

1.1 *"Creative Thinking – Thoughtful Acting."*
Motto Royal Dutch Institute of Engineers

1.2 *"A Living Nation is Building its Future."*
Dr. Ir. C. Lely (1854 – 1929), the Netherlands

1.3 *"Luctor et Emergo." ("I struggle and emerge")*
Motto Province of Zeeland, the Netherlands

SUSTAINABLE COASTAL & DELTAIC ZONE DEVELOPMENT VIA BUILDING WITH NATURE

Vision

2.1 *"Nature is a brilliant source of inspiration and an excellent teacher for the development of well-designed plans."*
R.E. Waterman

2.2 *"Well-designed plans have their roots in the past and are pointing to the future."*
R.E. Waterman

2.3 *"The great challenge in this era is to develop methods that simultaneously improve the environment and strengthen the economy"*
R.E. Waterman

2.4 *"The most valuable resource available to us is our brain. Therefore let us together use these brains for the benefit of the environment, the economy and our fellow human beings."*
R.E. Waterman

2.5 *"Sharing knowledge is multiplying knowledge."*
Anonymous

2.6 *"Think Long-Term – Act Short-Term."*
P.J.A. van Hessen

3.1 *"If you will, it is no fairy-tale."*
Th. Herzl (1860-1904), "Altneuland" (1899-1902)

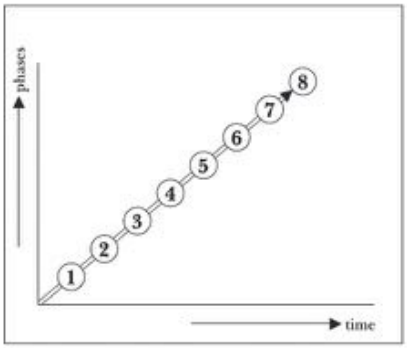
3.2 *"Who doesn't believe in dreams, is not a realist."*
D. Ben Goerion (1886-1973)

3.3 *"Dream great dreams and take practical steps to turn them into reality."*
Henrietta Szold (1860-1945)

3.4 *"Dreams are not to soothe us asleep, but to shake us awake."*
R. Magritte (1898-1967), 1929

SUSTAINABLE COASTAL & DELTAIC ZONE DEVELOPMENT VIA BUILDING WITH NATURE

1. PLAN DEVELOPMENT & EXECUTION



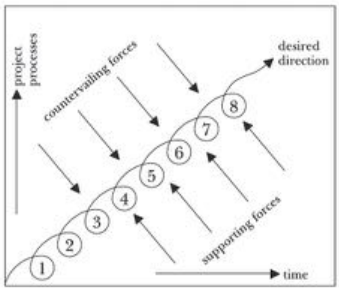
In the development and execution of a plan many phases can be distinguished. All other interacting processes, although of extreme importance, have been left out.

1. Existing situation.
2. Vision for a future situation.
3. Conceptual plan based on acquired data, trends, careful analysis and additional research.
4. From conceptual plan towards a number of concrete plans.
5. Fine tuning and final choice of selected plan.
6. Execution of chosen plan.
7. Wished for resulting situation.
8. Operation and maintenance of executed plan.

Additional Instruments

SUSTAINABLE COASTAL & DELTAIC ZONE DEVELOPMENT VIA BUILDING WITH NATURE

2. SERIES OF CYCLIC PROCESSES IN "FORCES FIELD"



- Mapping of Field Forces
- Field Force Analysis
- Weighing forces for and against a project

  Weighing factor = *f* (availability & power to influence change)

3. SWOT ANALYSIS

Strengths	Weaknesses
Opportunities	Threats

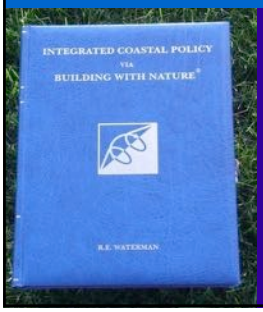
4. MULTI-CRITERIA ANALYSIS

Multi-criteria Analysis which weighs factors for comparative model research, whereby each relevant function from a to z is weighed qualitatively and quantitatively. This is an additional instrument to compare and evaluate a series of plans.

Additional Instruments

Thank you for your attention

Integrated Coastal Policy via Building with Nature ®



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Cartography