



JAKARTA TENGGELEM?

from a perspective of flood risk

Prof. dr. ir. Matthijs Kok
Professor of Flood Risk
Delft University of Technology

Content

1. General background
2. Flood risk approach
3. Jakarta problems
4. Innovation
5. Apps
6. Concluding remarks



River dike in the Netherlands

Increasing damages of Floods

New Orleans (2005)



- Number of people is increasing in potential flood areas, every where in the world
- Also: lot of economic growth in vulnerable areas
- Decision problem: accept the increasing risk, or take action?

Possible solution: follow the risk approach, and need to understand the causes of risk!!!

Fischbeck (Dui, 2013)



Risk approach

Flood risk follows the classical quantitative Risk Approach

1. Assessment of flooding probabilities (including hydraulic loads and strength of flood defences)
2. Assessment of consequences (loss of life, economic damage,)
3. Assessment of the impact of risk **reduction** measures (costs, ecology, etc)
4. Decision: accept or reduce the risk



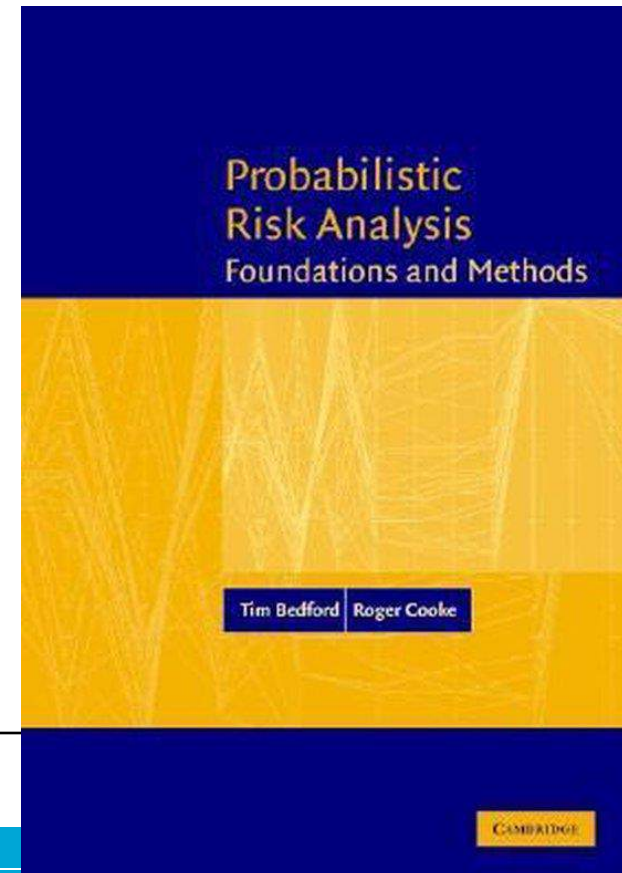
Probabilistic risk approach

Main question: does it help us to improve decision making?

In theory: yes! (my opinion)

In practice: we see advantages, and it is “better safe than sorry”, approach, but

This approach is applied in many sectors: chemistry, aviation, space technology, nuclear power plants, etc



What is acceptable risk?

- It always depends on the consequences of the flood: the higher the consequences, the higher the risk
- But also on the policy: live with floods, or..... prevent floods as much as possible?
- In the Netherlands: prevents flood as much as possible, because of high consequences (part of the Netherlands is below sea level....)
- But not only flood defences to protect, there are many ways!

Possible measures:

There are many ways to reduce flood risk! We discuss:

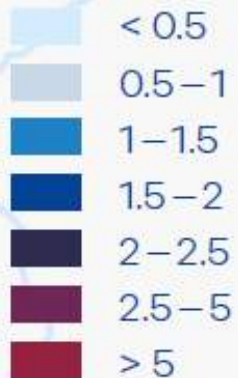
- a. Room for water
- b. Flood Defences
- c. Building with nature
- d. Use of apps
- e.



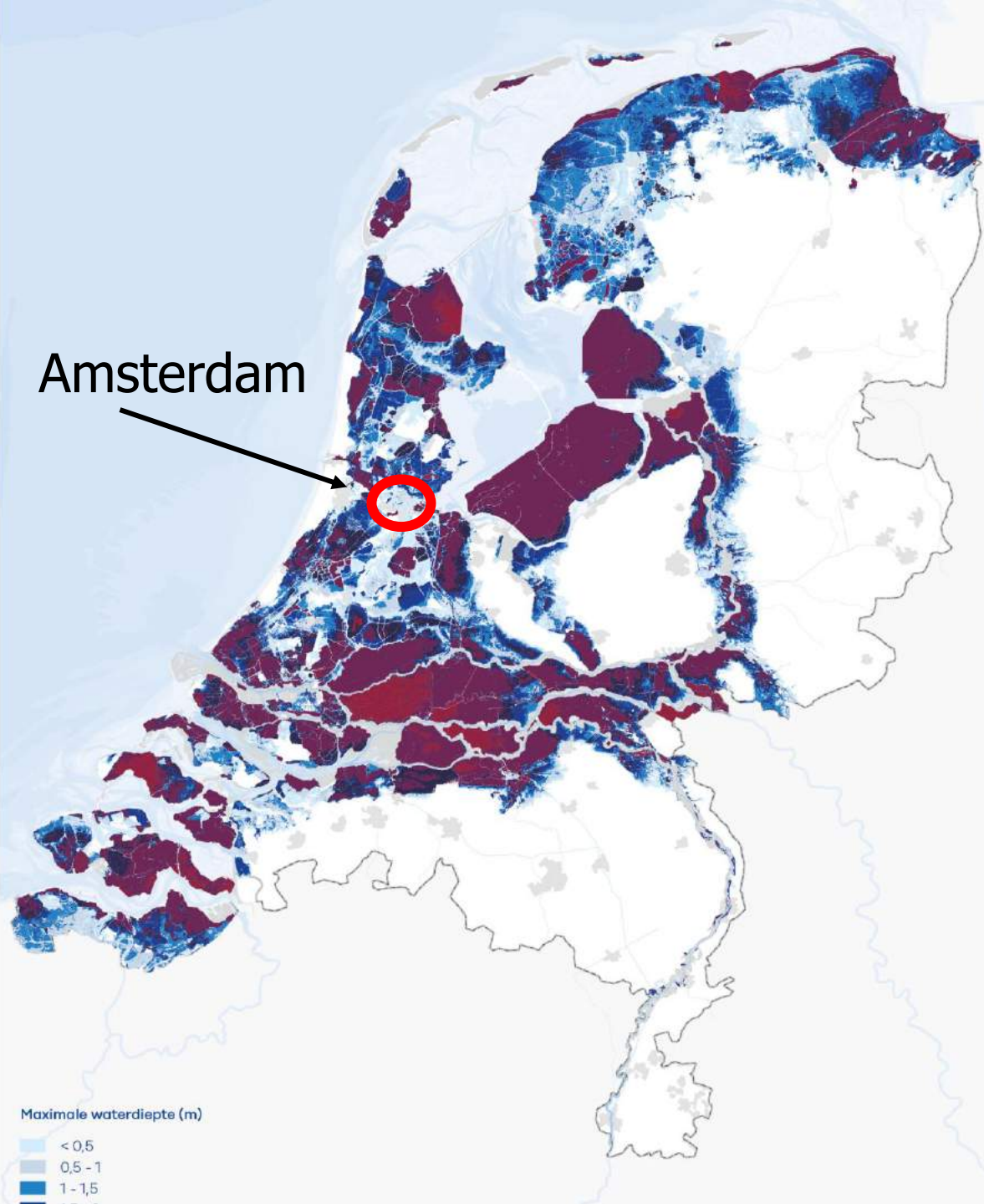
Consequences (multiple events)

60% of the Netherlands
can be flooded

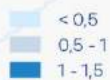
Maximum water depth (m)



Amsterdam



Maximale waterdiepte (m)



River flood management

1995 Waal



Limburg, 1993



Groningen, 2011



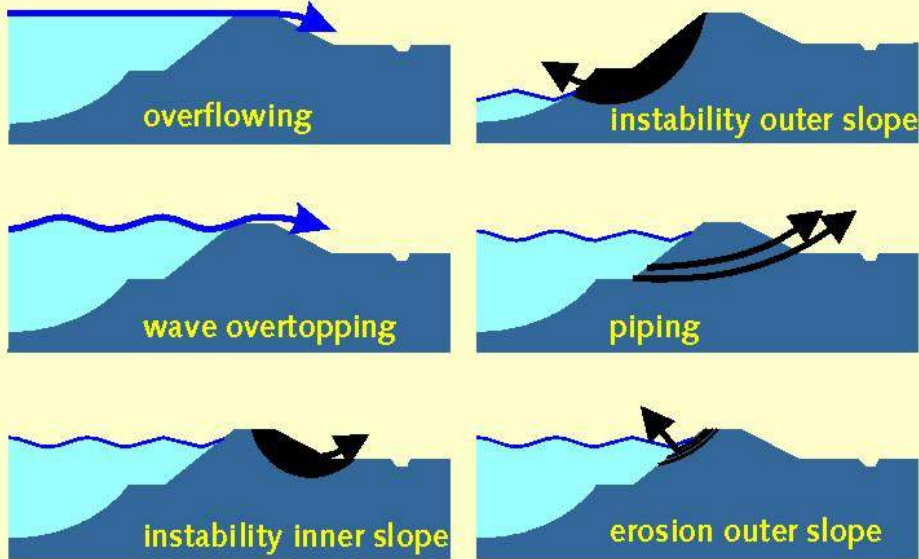
Wilnis, 2003



Elbe, 2013



Failure mechanisms of levees



Fault tree



P per jaar



Individual Risk (IR)

IR (x,y) = probability of loss of life as result of a flood at a location (x,y):

$$IR(x, y) = \sum_i (1 - E_i) P_{f,i} P_{d|f}(x, y)$$

with:

E_i = Evacuation fraction

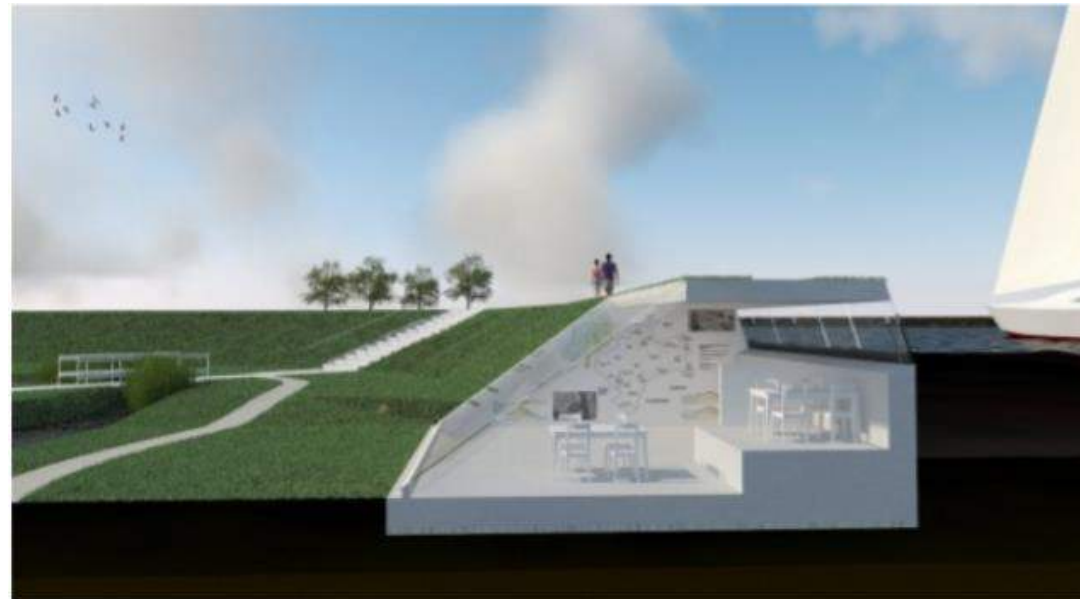
$P_{f,i}$ = Probability of flooding

$P_{d|f}$ = Probability of victim given a flood



Innovation with new materials: glass flood defence

- It is investigated at the TU Delft, but is it realistic?



Böhtlingk

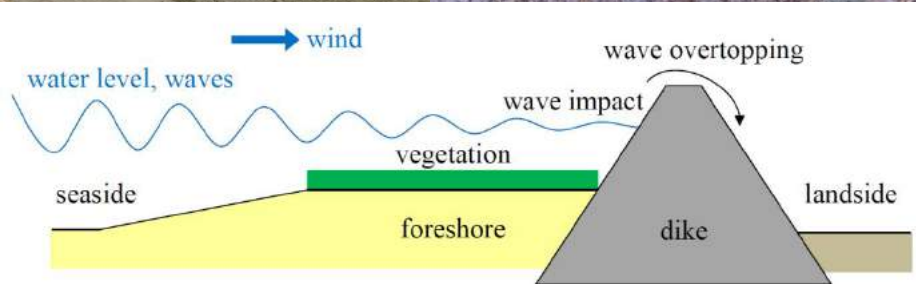
Sheetpiles in dikes

- Sheet pile test: behaviour and contribution of construction in dikes



Building Safety with Nature

- PhD thesis Vincent Vuik, TU Delft



Can Rijksmuseum in Amsterdam be flooded?

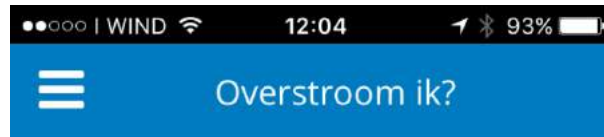
App available:



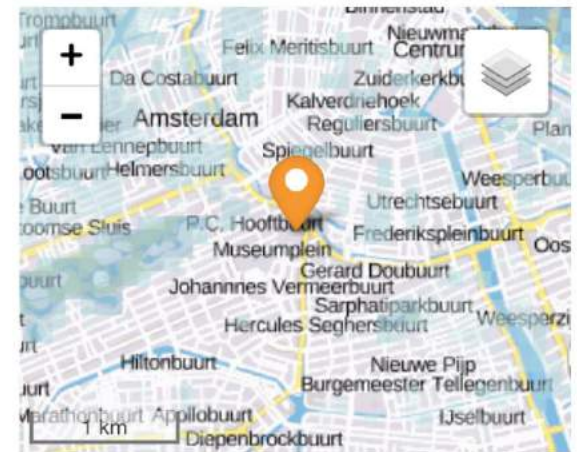
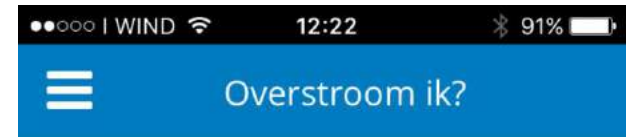
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Can Rijksmuseum be flooded?



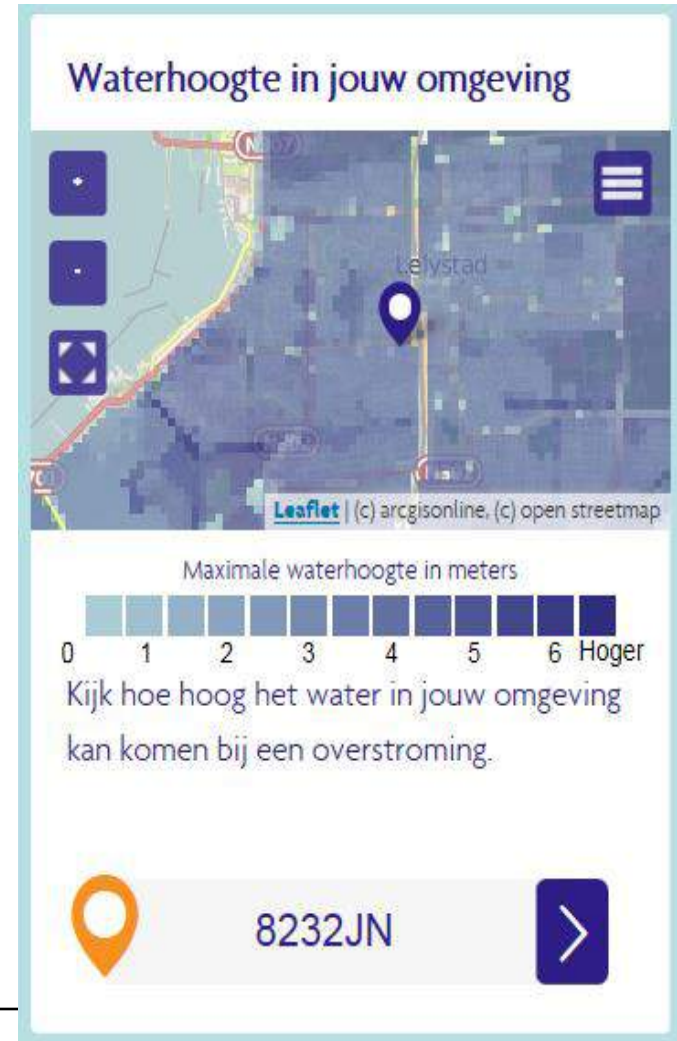
Waterhoogte in jouw buurt
overstroombaar
gebied



Maximale waterhoogte in meters



Can my office in Lelystad be flooded?



Jakarta issues

- “The flooding has highlighted Indonesia’s infrastructure problems”.
- “Jakarta is home to 10 million people, or 30 million including those in its greater metropolitan area. It is prone to (...) flooding and is rapidly sinking due to uncontrolled extraction of ground water. Congestion is also estimated to cost the economy \$6.5 billion a year” (source: The Diplomat, 2-1-2020).



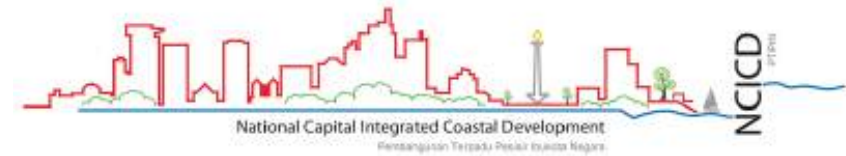
Five main issues

There are, in my opinion, five flood issues in Jakarta. All these four issues need attention:

1. Coastal flooding
2. Fluvial flooding
3. Pluvial flooding
4. Settlement of ground level
5. Governance

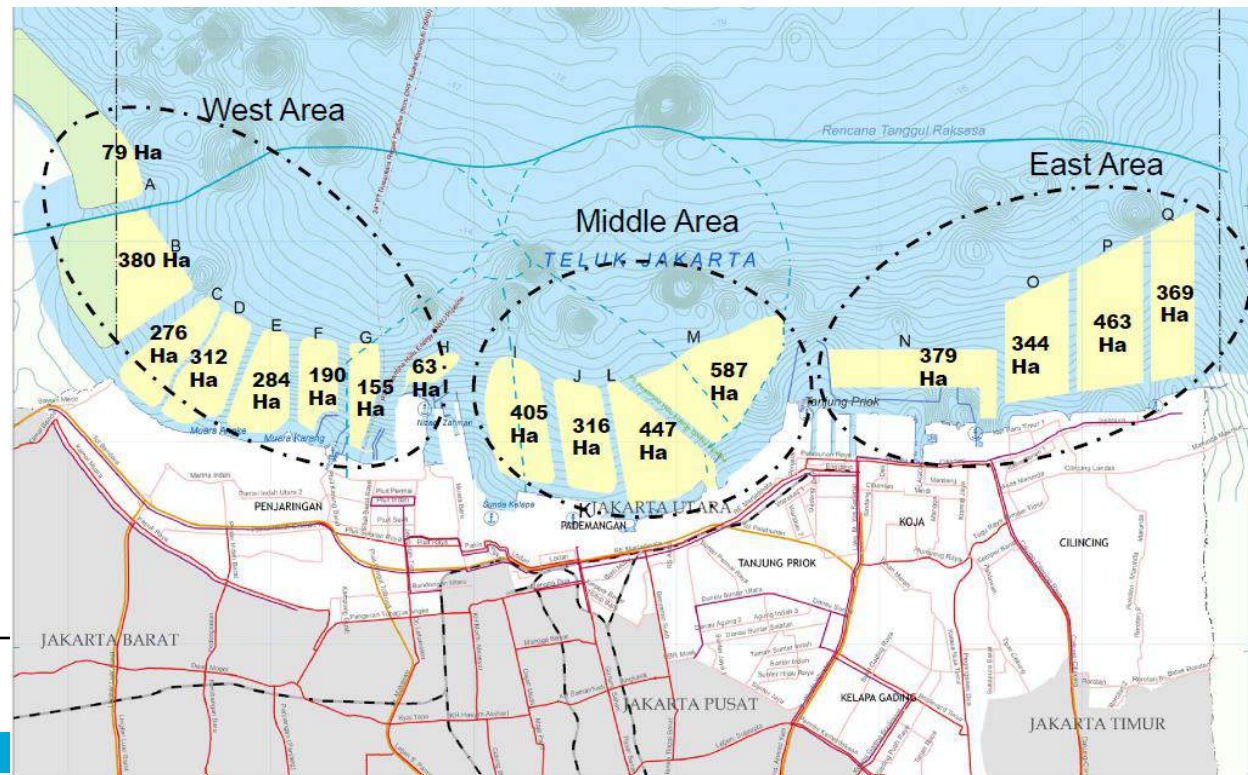


Coastal Flooding



Protection against high water levels at Java sea and wave attacks.

The “new” islands will help to protect, for example connect them



Fluvial flooding

Heavy rainfall upstream Jakarta can cause flooding in Jakarta. Many reservoirs have been build in the past, they do help!

Good operation of of reservoirs is essential. Also, keeping drainage capacity is important: reduce the waste and to maintain the drainage channels!

Also pumping stations are needed: they have been build, is more needed?



Pluvial flooding

Rainfall in Jakarta can cause flooding in Jakarta: precipitation has nowhere to go.

Pumping stations are needed, but are capacity of drainage canals sufficient?

Maintenance of drainage channels is important.



Settlement of ground level

Jakarta is sinking, among others to groundwater extraction leads to flood issues, therefore:

- Stop groundwater extraction!
- Development of new drinking water system, there is enough water available
- Improvement of water quality is needed



Good Governance

It is crucial that responsible authorities develop **together** an adaptation plan, for successful implementation

Also, maintenance of the existing canals by dredging is not operational in the capital city and a responsible authority for such work has not been established.

Financial resources: a realistic plan had a realistic budget and clear responsibilities!

Governance solutions imported from the Netherlands may not work

Dutch Delta Approach: the answer?


Can we transfer the Dutch approach to Jakarta?

Study aimed to explain how an impasse emerged in the transfer of the Dutch Delta Approach to Jakarta, Indonesia:

The knowledge transfer is predominantly targeted at instrumental and tactical learning. The advising consultants focus on the detailed design of the strategy (as a way to maintain progress in spite of the controversial underlying issue) and thus give insufficient attention to creating consensus about the underlying values of the Dutch Delta Approach.

*As a result, the impasse seems to have emerged **because of**, rather than **despite**, the way the transfer process is executed.*

Reconstructing the impasse in the transfer of delta plans: evaluating the translation of Dutch water management strategies to Jakarta, Indonesia

 Ellen Minkman, Peter Letitre & Arwin van Buuren, Journal of Environmental Planning and Management, 2019

Dutch Delta Approach transfer?

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Jakarta Delta Approach: the answer!

What are the main elements of the Jakarta Delta approach?

1. Most important: stop the sinking of Jakarta with a 10 years plan (drinking water supply)
2. Maintain drainage channels plus pumping stations
3. Protect Jakarta for Coastal flooding
4. Build trust between authorities (regional, national), there is a road of 'working together'.
5. Plan the needed budget, and follow this plan

Concluding remarks

Big challenge everywhere, and also in Jakarta, to keep acceptable risk low:

- Climate change will happen (and does happen): look always at different scenarios
- Technical solutions need to be expandible
- Technical solutions need good and appropriate governance!

Thank you very much!

SERTIFIKAT

Diberikan kepada:


Dr. Mega Waty, S.T., M.T.

Atas partisipasinya sebagai

Peserta

Hybrid Talk and Discussion "Jakarta Tenggelam ?"
Oleh Program Studi Sarjana Teknik Sipil Universitas Tarumanagara
26 Januari 2022

Jakarta, 26 Januari 2022
Fakultas Teknik Universitas Tarumanagara
Dekan



Harto Tanujaya, S.T., M.T., Ph.D.