FLOOD RISK MANAGEMENT IN PARTNERSHIP

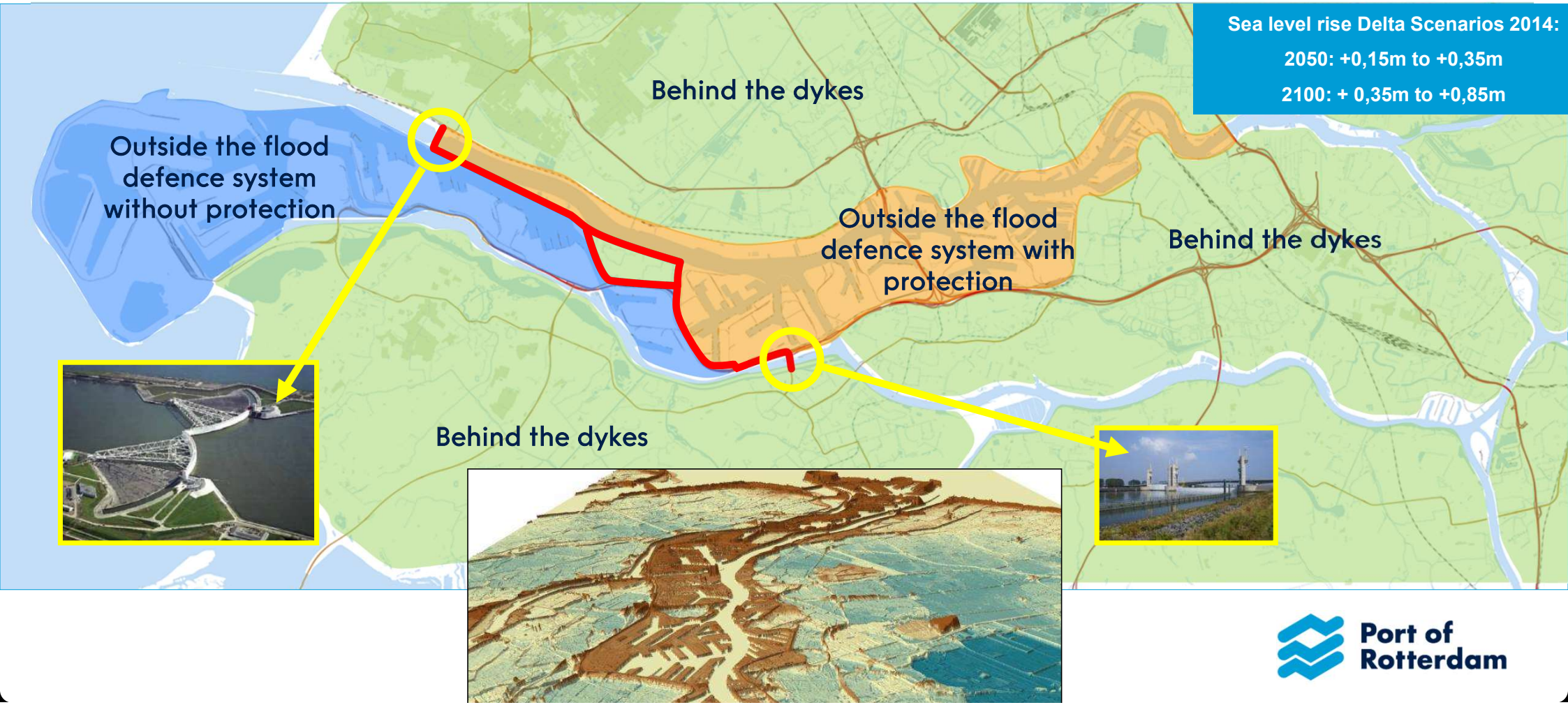
Marc Eisma

Practical Climate Change Adaptation Solutions for Ports, Glasgow, 2-3 November 2021

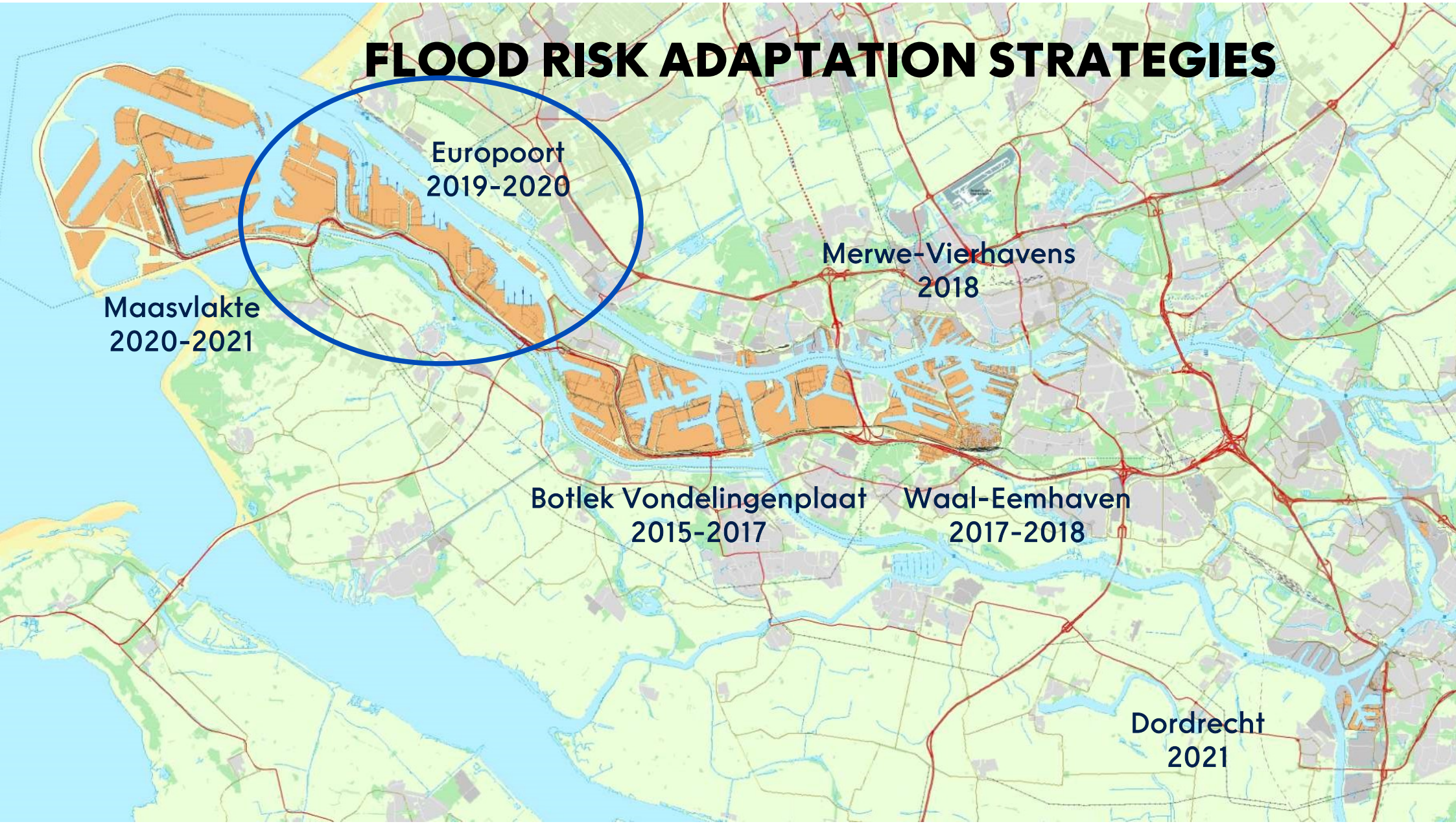
Port of Rotterdam

PORT OF ROTTERDAM AT PRESENT CLIMATE PROOF

PORT LOCATED OUTSIDE THE FLOOD DEFENCE SYSTEM, BUT RAISED



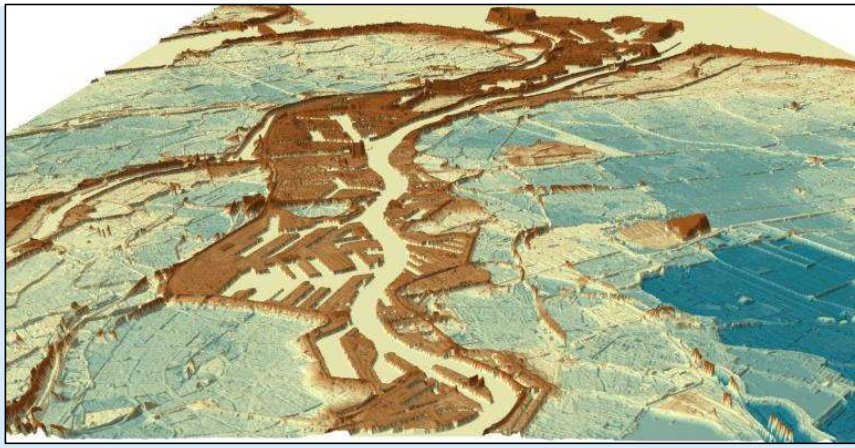
Port of Rotterdam


FLOOD RISK ADAPTATION STRATEGIES
Europoort
2019-2020
Maasvlakte
2020-2021
Merwe-Vierhavens
2018
Botlek Vondelingenplaat
2015-2017
Waal-Eemhaven
2017-2018
Dordrecht
2021

APPROACH AND STEPS
- IN PARTNERSHIP WITH COMPANIES AND PUBLIC ORGANISATIONS -

Approach:

- Creating awareness
- Information sharing + visualisation
- Joint Fact Finding
- Create common language and commitment!



Sea level rise Delta Scenarios 2014:

2050: +0,15m to +0,35m

2100: + 0,35m to +0,85m

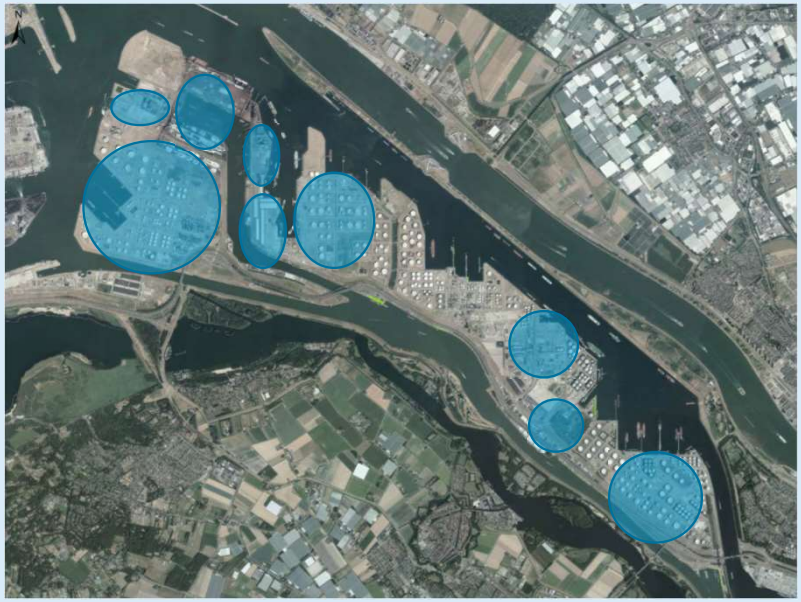
Steps:

- Flood risk analysis
- Impact assessment (*workshop 1 with stakeholders*) + applying flood risk assessment framework
- Jointly building a flood risk adaptation strategy (*workshop 2 with stakeholders*)

Port of Rotterdam

STAKEHOLDER INVOLVEMENT RIGHT FROM THE START

- Companies
  - Chemical industry
  - Refineries
  - Tank terminals
  - Distribution centres
  - Dry bulk terminals
  - Break bulk terminals
  - Power plants
  - etc.

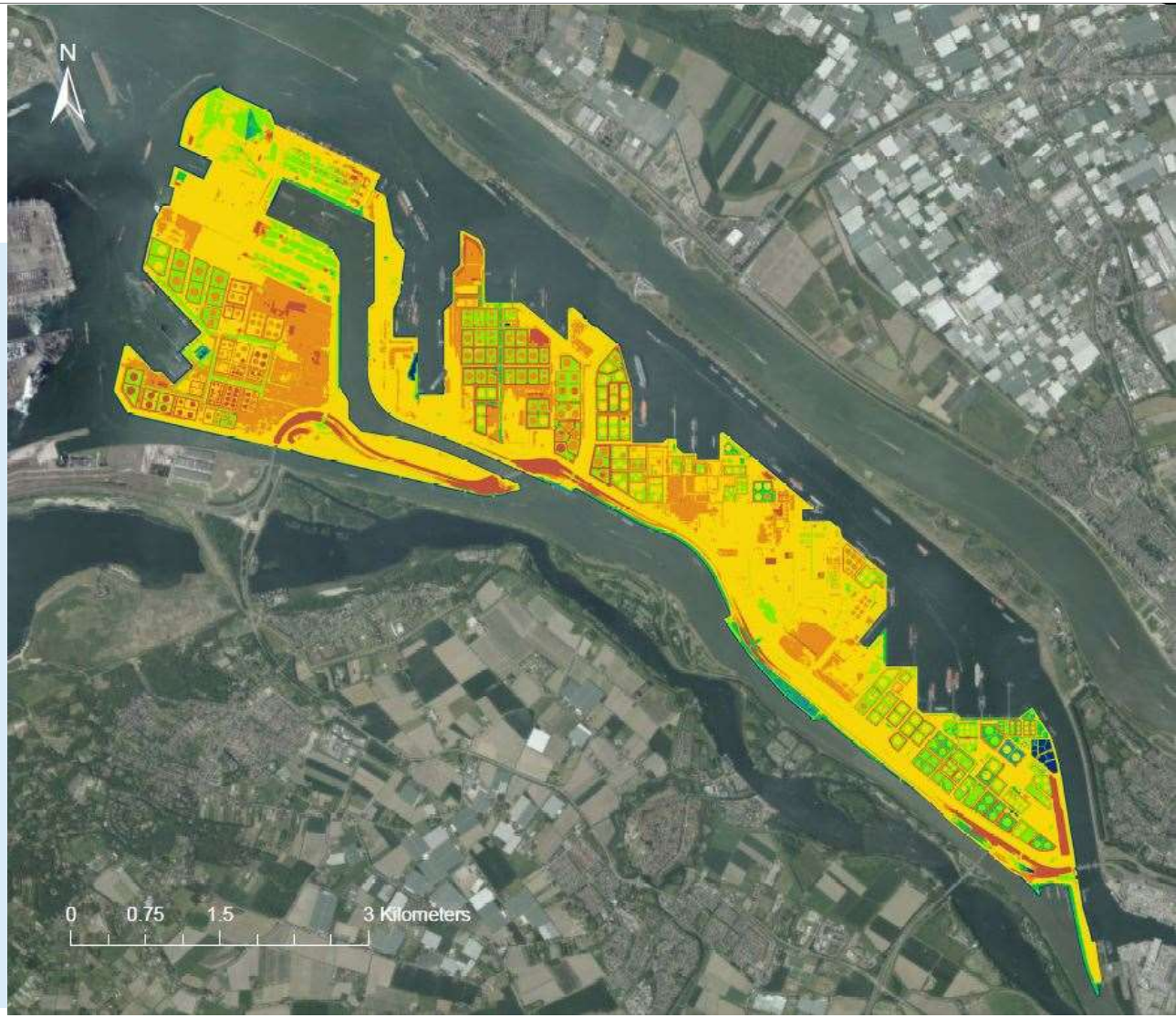


- Public organisations:
  - Municipality of Rotterdam
  - Rotterdam-Rijnmond Safety Region
  - Environmental Protection Agency
  - Ministry of Water Management
  - Rail and road authorities
- Utility owners
  - Electricity
  - Gas
  - Water

Port of Rotterdam

ELEVATION MAP

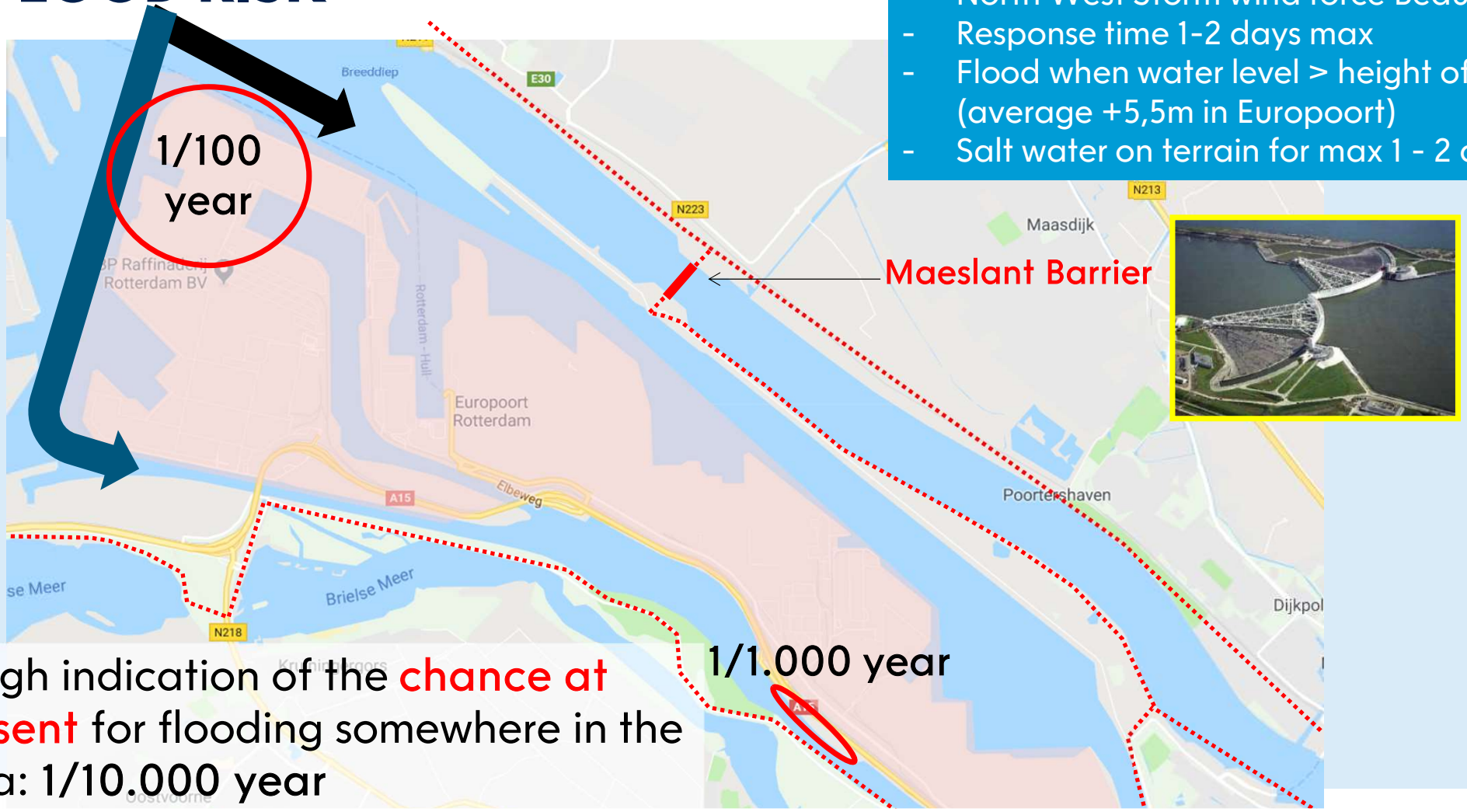
Average height: +5,5m



Port of Rotterdam

FLOOD RISK

Course of a flood:
- North West Storm wind force Beaufort 11-12
- Response time 1-2 days max
- Flood when water level > height of terrain (average +5,5m in Europoort)
- Salt water on terrain for max 1 - 2 days

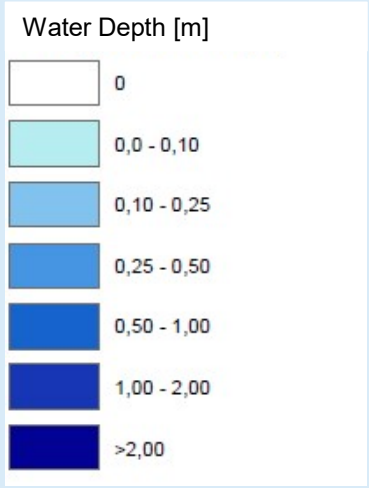


Rough indication of the chance at present for flooding somewhere in the area: 1/10.000 year

Europoort area → Flood from sea ····· defence system

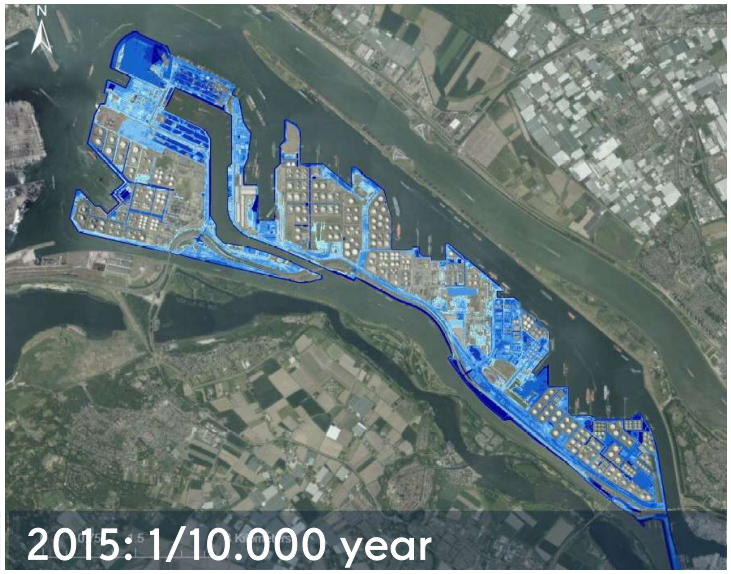
FLOOD RISK ANALYSIS

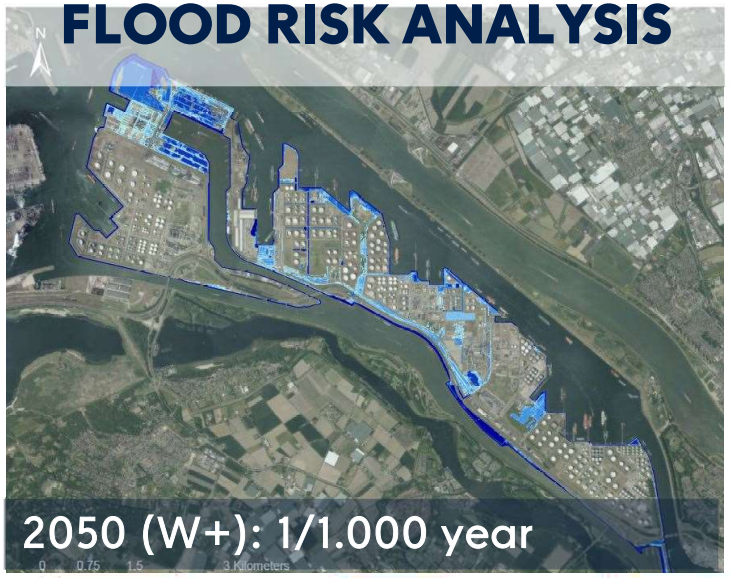
Water depth 2015 (1/1.000 year storm)*

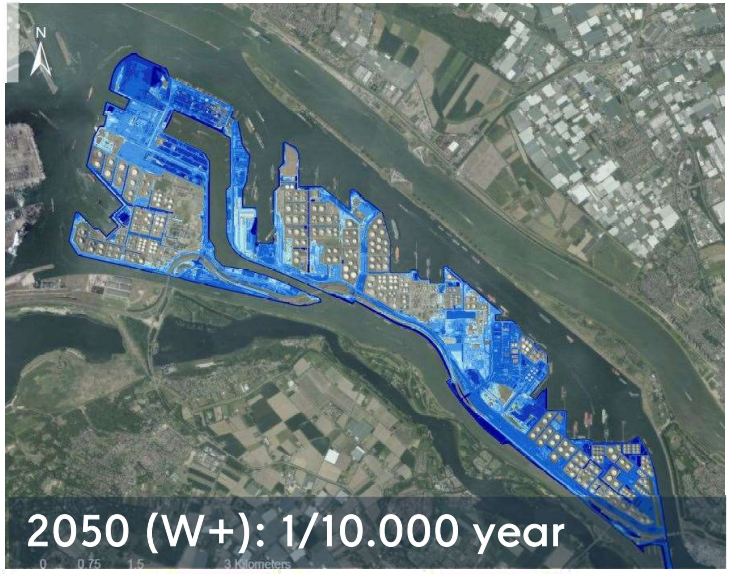


* Dutch Flood event 1953: 1/300 year storm

FLOOD RISK ANALYSIS







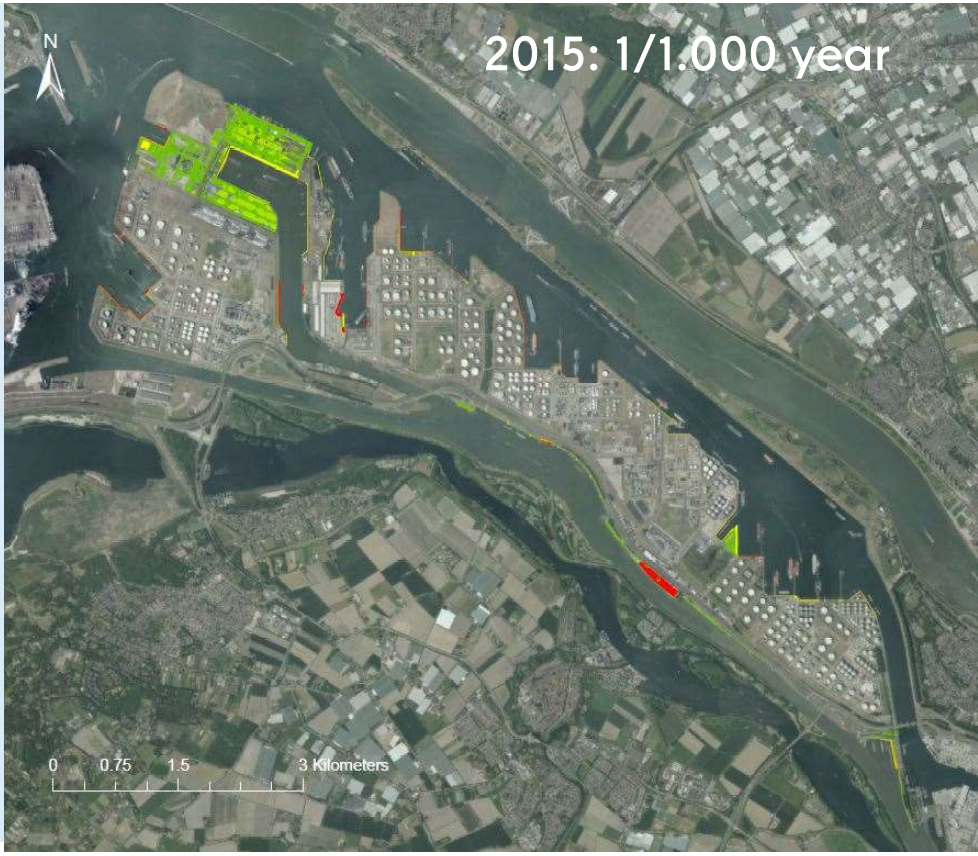
Inundation [m] 0 | 0,0 - 0,10 | 0,10 - 0,25 | 0,25 - 0,50 | 0,50 - 1,00 | 1,00 - 2,00 | >2,00

IMPACT ASSESSMENT (WORKSHOP 1)

- Assessment of impact on:
  - (Deadly) casualties
  - Economy (direct and indirect)
  - Environment (air, water, soil)

  } Social disruption

- Quantitative approach (modelling of direct and indirect economical impact)
- Qualitative approach (workshops and interviews with stakeholders)



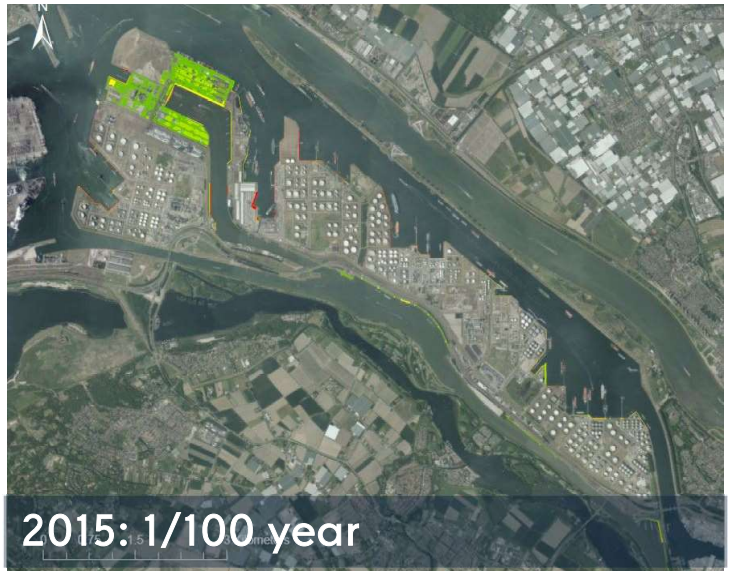
Direct effect [mln €]

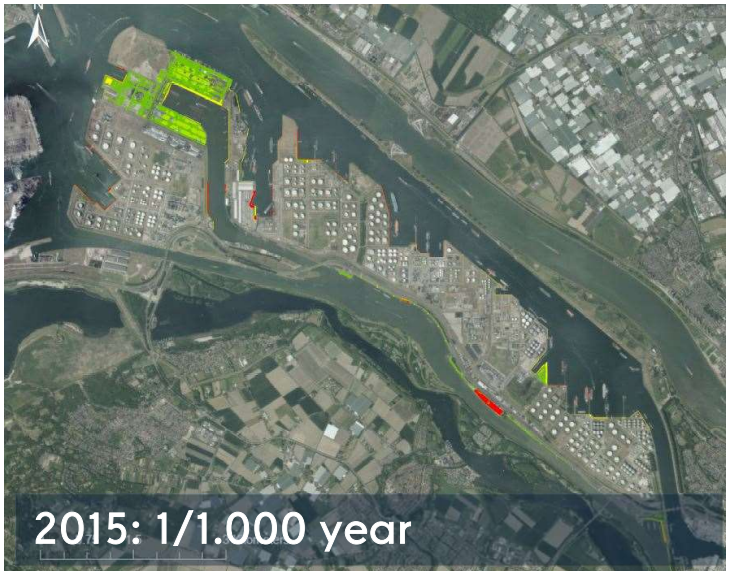
Total effect [mln €]

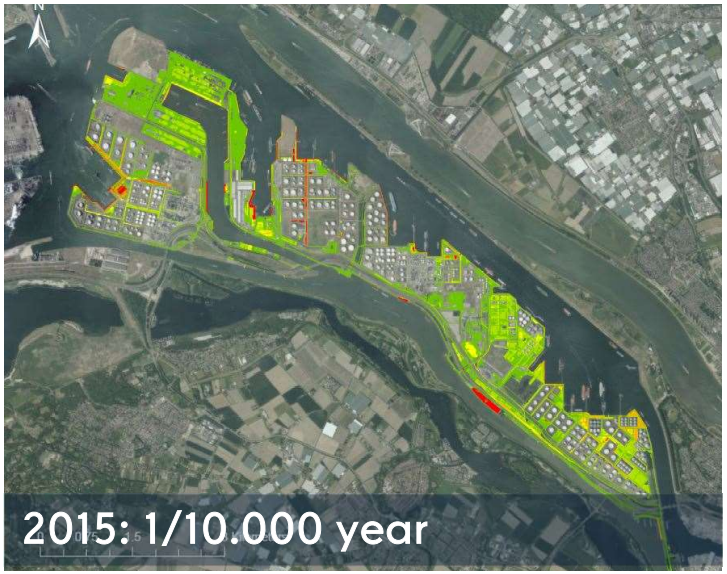
Impact [€/m2]

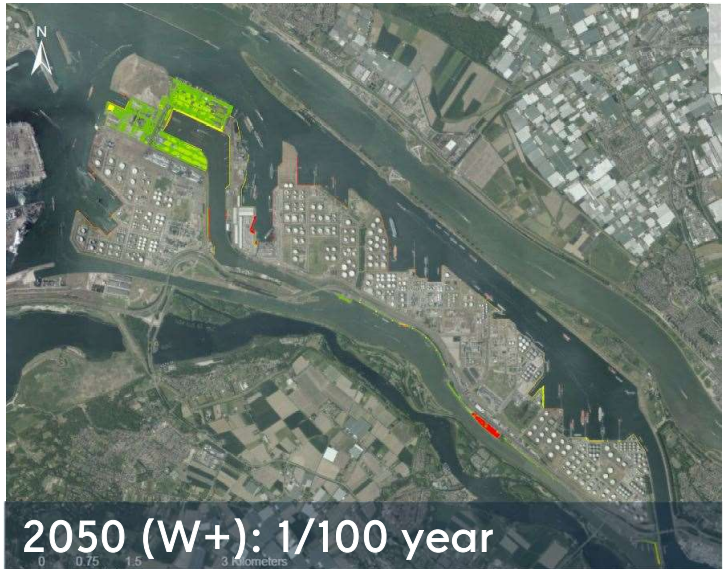
< 50 | 50 - 100 | 100 - 150 | 150 - 200 | 200 - 250 | > 250

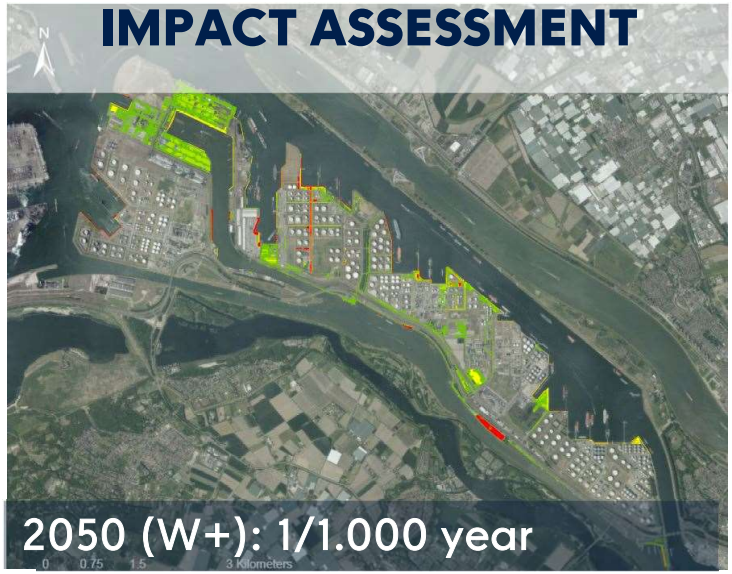
IMPACT ASSESSMENT

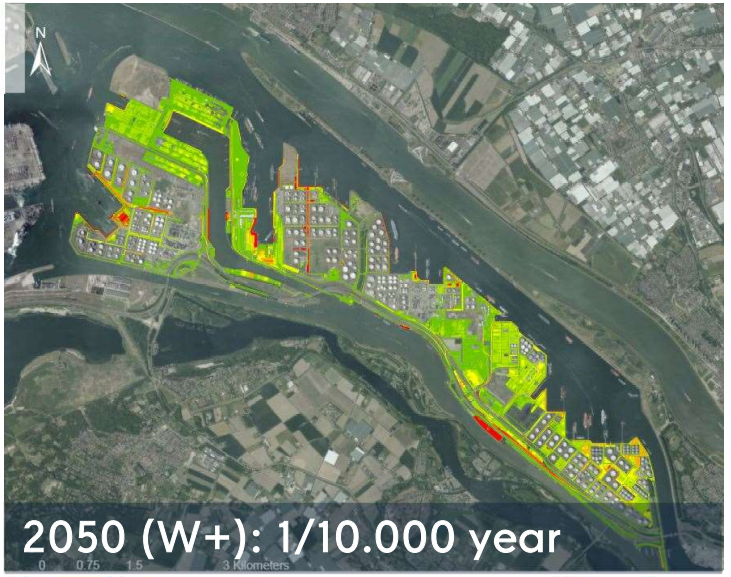












Impact [€/m2]

< 50 | 50 - 100 | 100 - 150 | 150 - 200 | 200 - 250 | > 250

FLOOD RISK ASSESSMENT FRAMEWORK

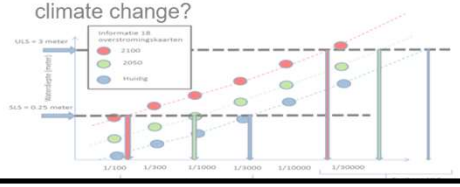
1. Definition of Limit State for a specific object

Difference between 2 Limit States:
Functionality (Service Limit State - SLS):

Failure (Ultimate Limit State - ULS):

2a. Determine SLS / ULS

What is the chance that a SLS or ULS takes place in the present time and how does it change in time as a result of climate change?



3. Assessment if the object meets the SLS / ULS during its life span

Based on public assessment frameworks

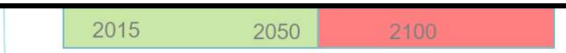
(inside the flood defence system, "behind the dykes")

Example ULS: Oil tank is damaged and causes environmental contamination of the surrounding area due to leakage of oil out of a tank. Repair will cost allot of money and months of work.

What are the consequences of exceeding the SLS / ULS ?
How acceptable is this?

acceptabele kans (1/jaar)	Totaal aantal dodelijke slachtoffers	Totale economische schade (in miljard Euro)	Maximale ruimtelijke schaal milieuverontreiniging (lucht, water, bodem)
/100	1	0.1	< 100m
/1.000	10	1	< 1km
/10.000	100	10	< 10km
/100.000	1000	100	< 100km

Result: acceptable SLS / ULS of an object

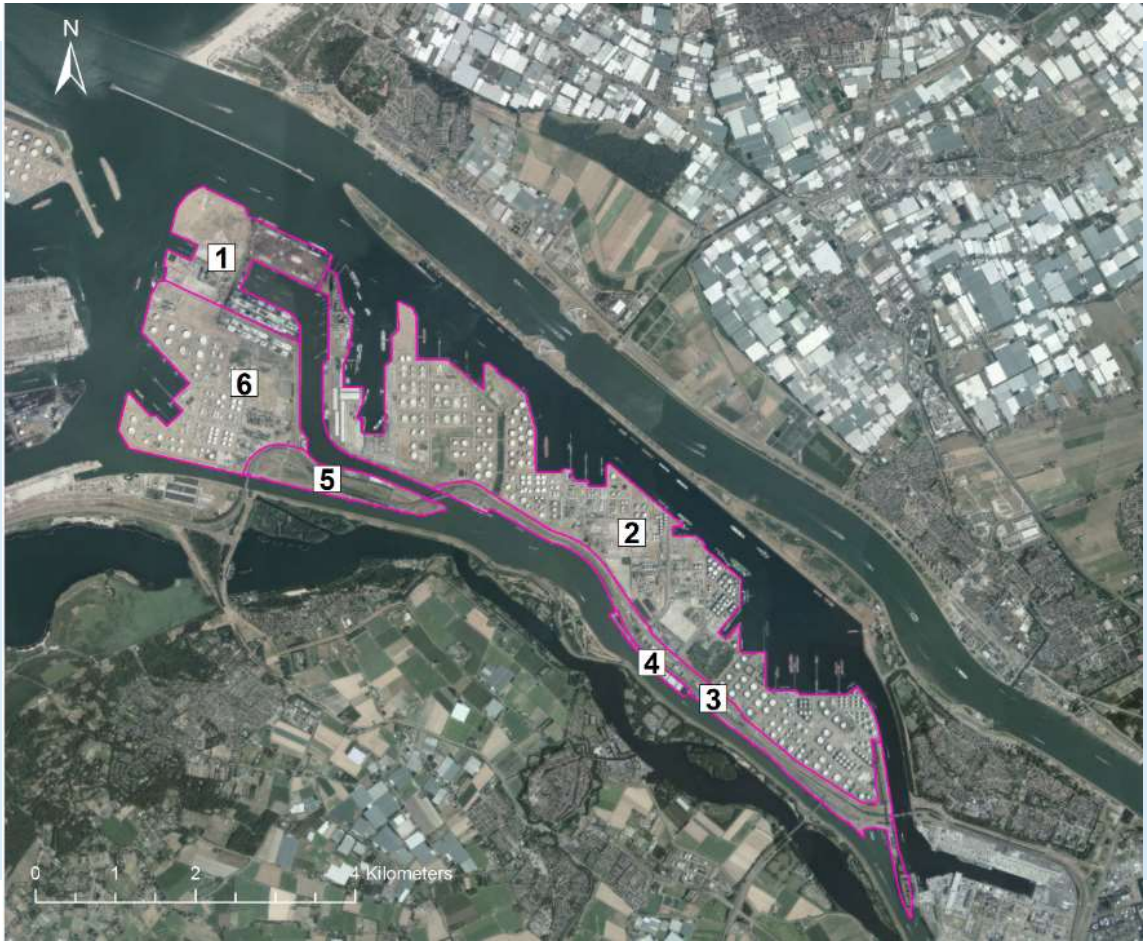


Result: insight if an object meets the acceptable SLS / ULS and if not, when does it become unacceptable in time (e.g. in 2060 in example above).

Port of Rotterdam

APPLICATION OF THE ASSESSMENT FRAMEWORK

- COMPARISON OF THE IMPACT WITH THE ACCEPTABLE LEVEL OF RISK -



	Grensniveau		
Deelgebieden	**nu**	**2050**	**2100**
Europoort			
Deelgebied 1			
Deelgebied 2			
Deelgebied 3			
Deelgebied 4			
Deelgebied 5			
Deelgebied 6			

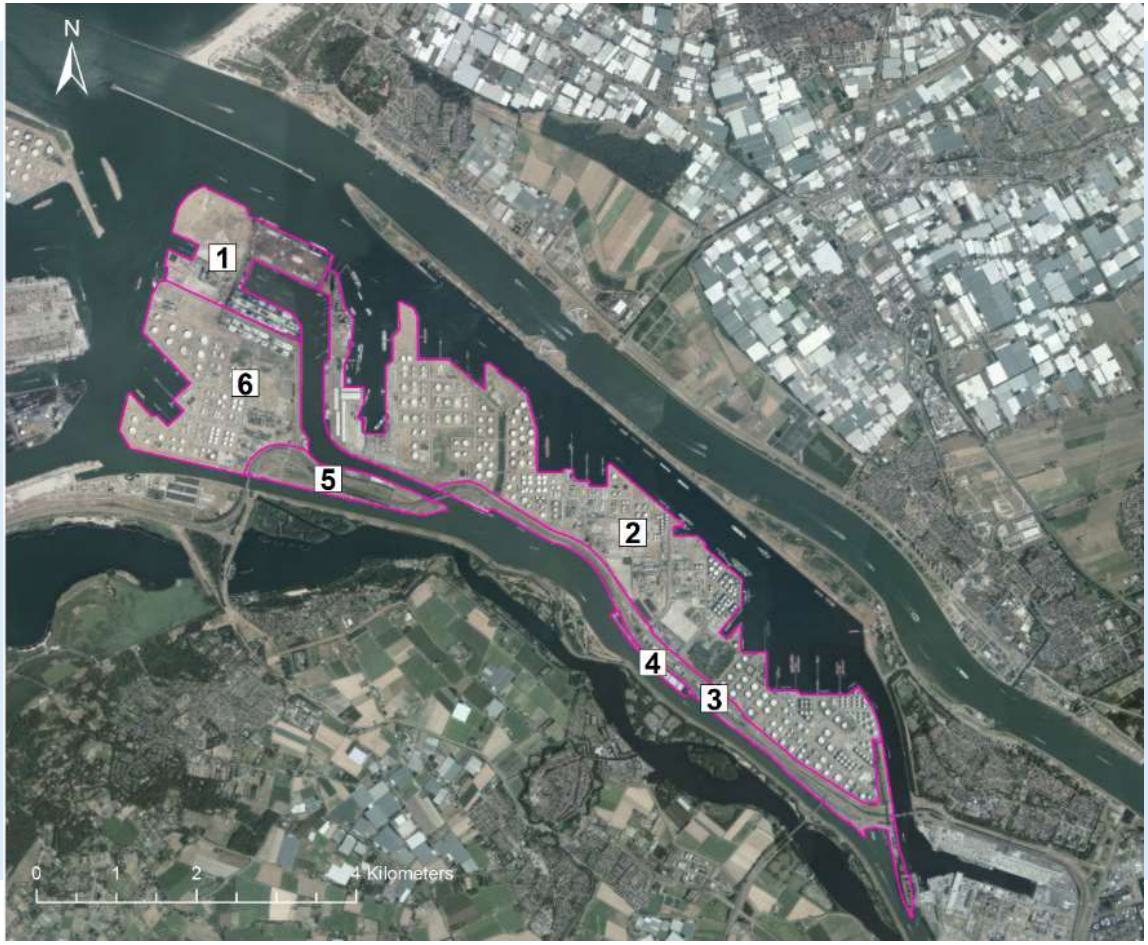
impact = still acceptable

impact = close to unacceptable

impact = unacceptable

Port of Rotterdam

FEASIBILITY MEASURES + JOINTLY BUILDING STRATEGY (WORKSHOP 2)

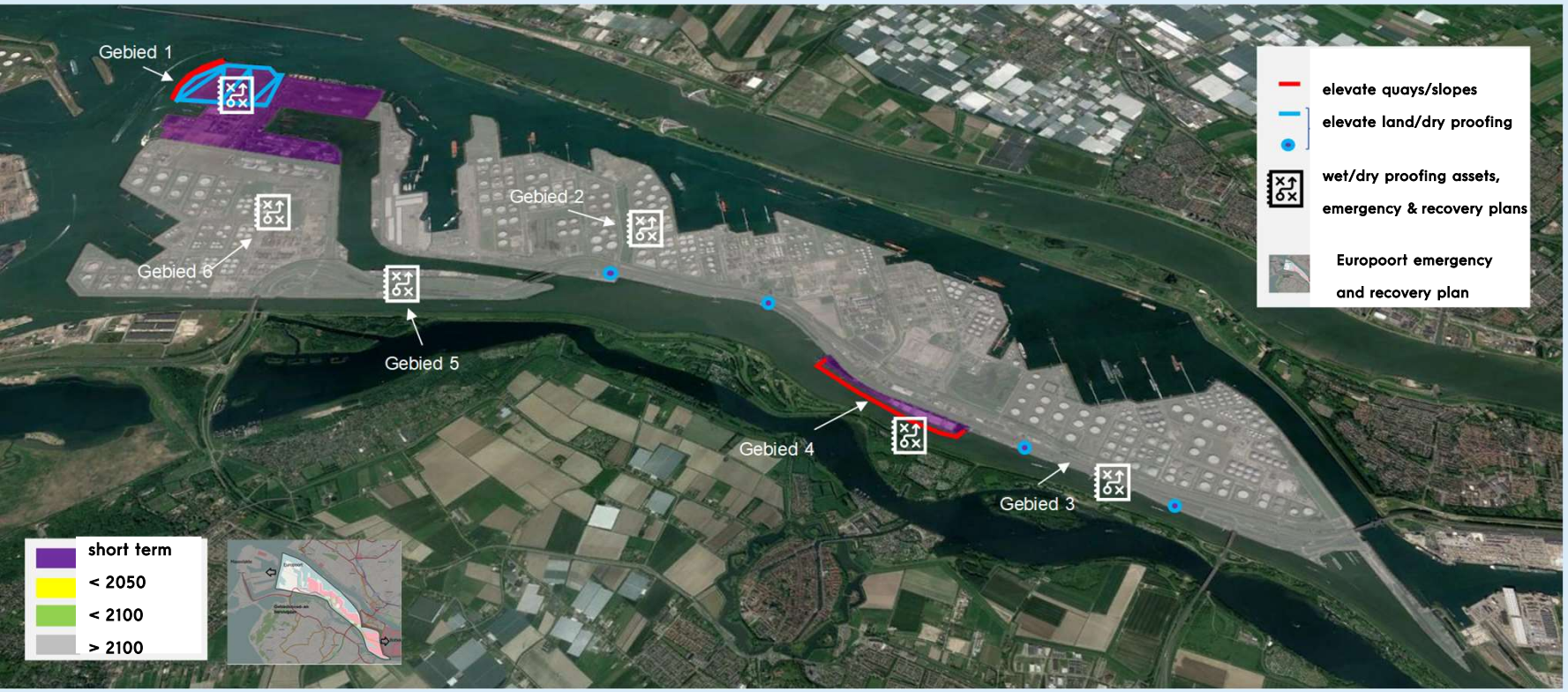


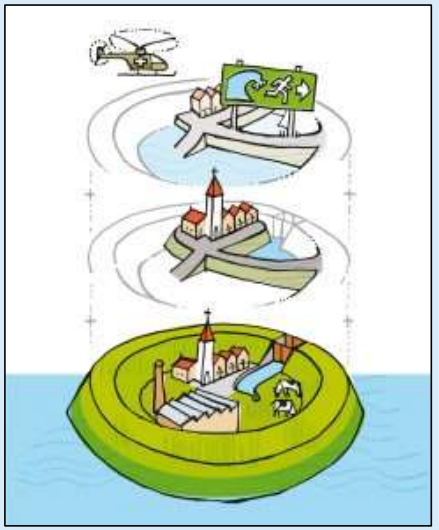
"Risk dialogue"

- Combining preventive measures with spatial adaptation and emergency response.
- Cost-benefit analysis
- Gives insight in necessity of collaborative approach.
- Commitment and first steps to jointly follow up on the strategy.

Port of Rotterdam

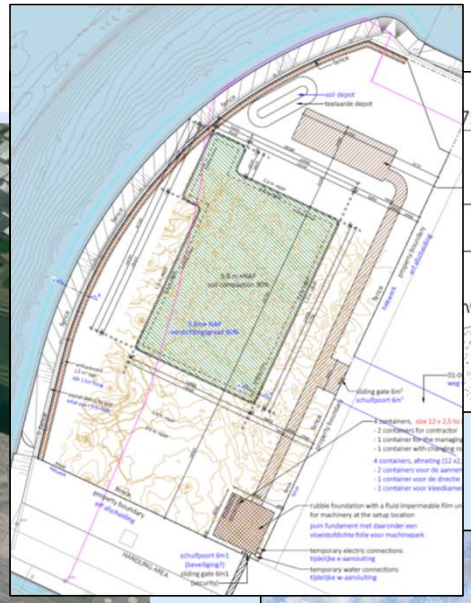
EUROPOORT FLOOD RISK ADAPTATION STRATEGY

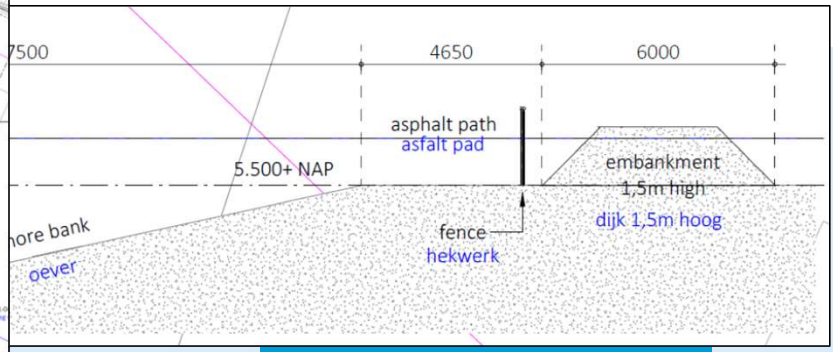




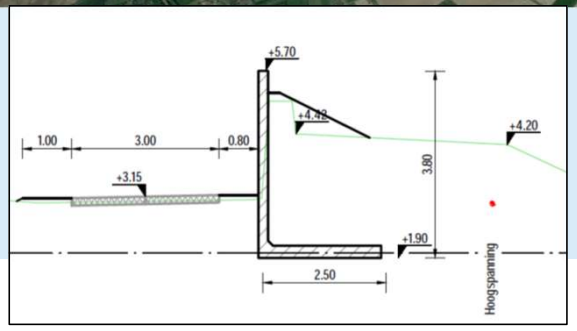
Port of Rotterdam

MEASURES IN PROGRESS





new embankment



elevated quay

Port of Rotterdam

A SAFE PORT, NOW AND IN THE FUTURE!