

NATIONAL STRATEGIES FOR STORMS, FLOODING & SEA LEVEL DEFENSE CONFERENCE 2020



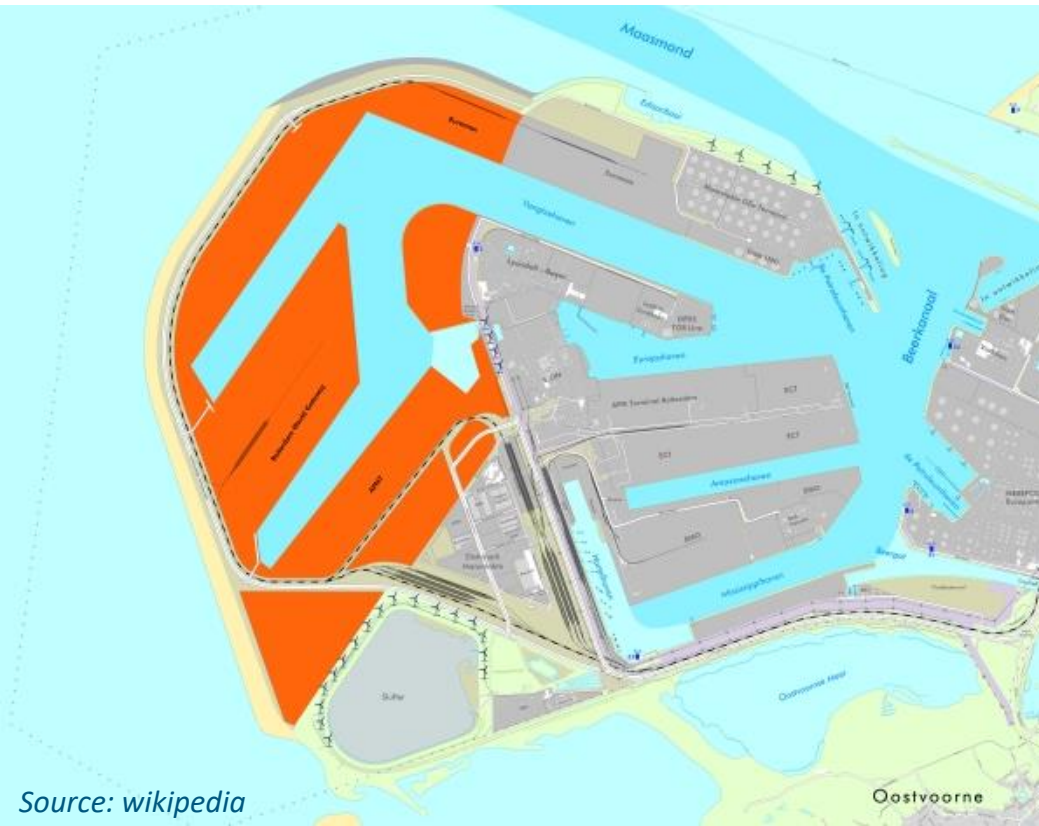
Flood risk adaptation through digital tooling

November 2020, Matthijs Bos

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Maasvlakte 2

- 1,000 acres reclaimed land
- Land level at NAP+5,00m following design philosophy *(Source: City of Rotterdam destination plan, 2008):*
 - Allowing max. 50cm water depth during most extreme event with 1/10,000 years exceedance in 2050
 - Tenants to anticipated on higher level levels if required/when desired, also depending on futures SLR scenario's, asset inventory and environmental policies



Port of Rotterdam's request?

- To produce guideline for land elevation levels for different Asset Inventory/ Land uses:
 - Reference situation: land elevation levels on NAP+5.1 and NAP+5.5m;
 - Options with higher land elevation levels with 3 incremental steps up to NAP+6.5m to increase protection level, i.e. intermediate, medium and high.



1. Create flood maps based for climate scenario's: **1 ft in 2050** and **3 ft in 2100** for reference situation and the 3 options;



2. Calculate economic damages and flood risk for future asset inventory for given climate scenario's;



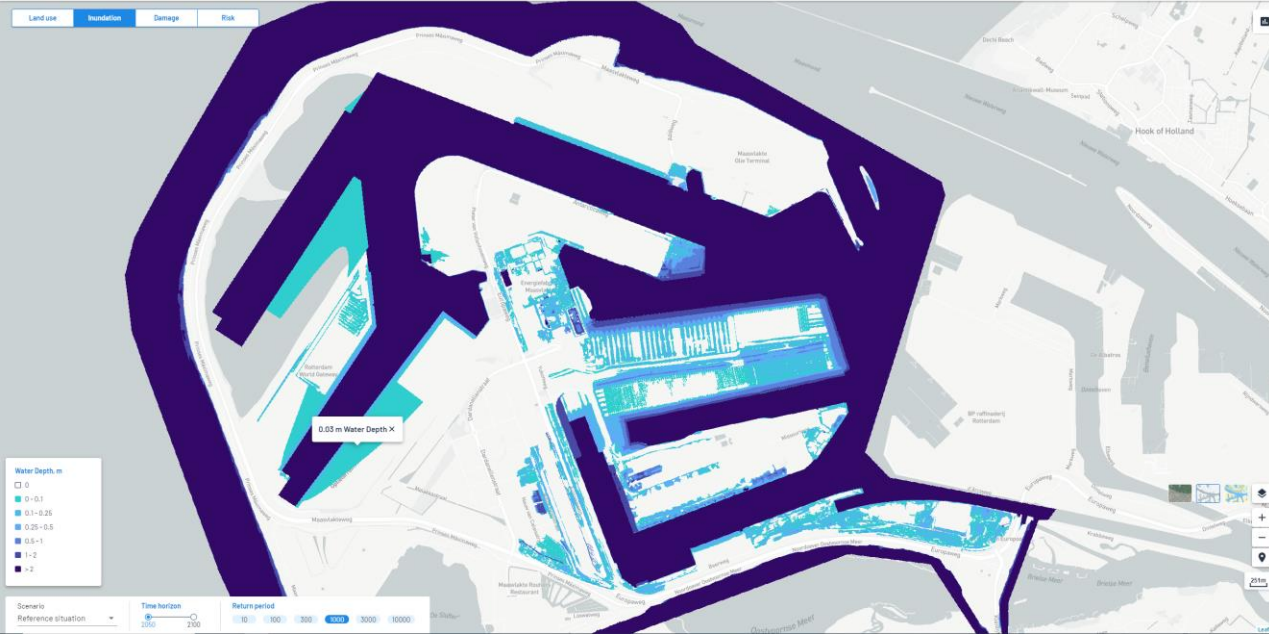
3. Determine cost effectiveness of options through cost-benefit analysis and provide guideline for future asset inventory implementation.

Reference situation: Flood scenario's 2050

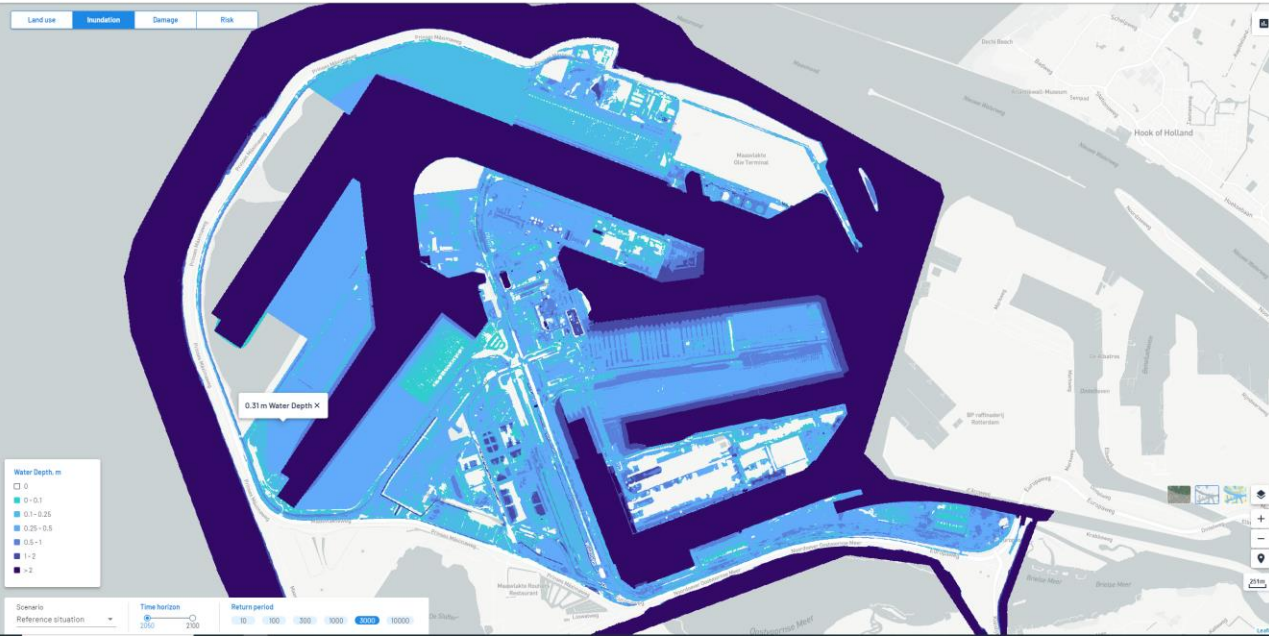
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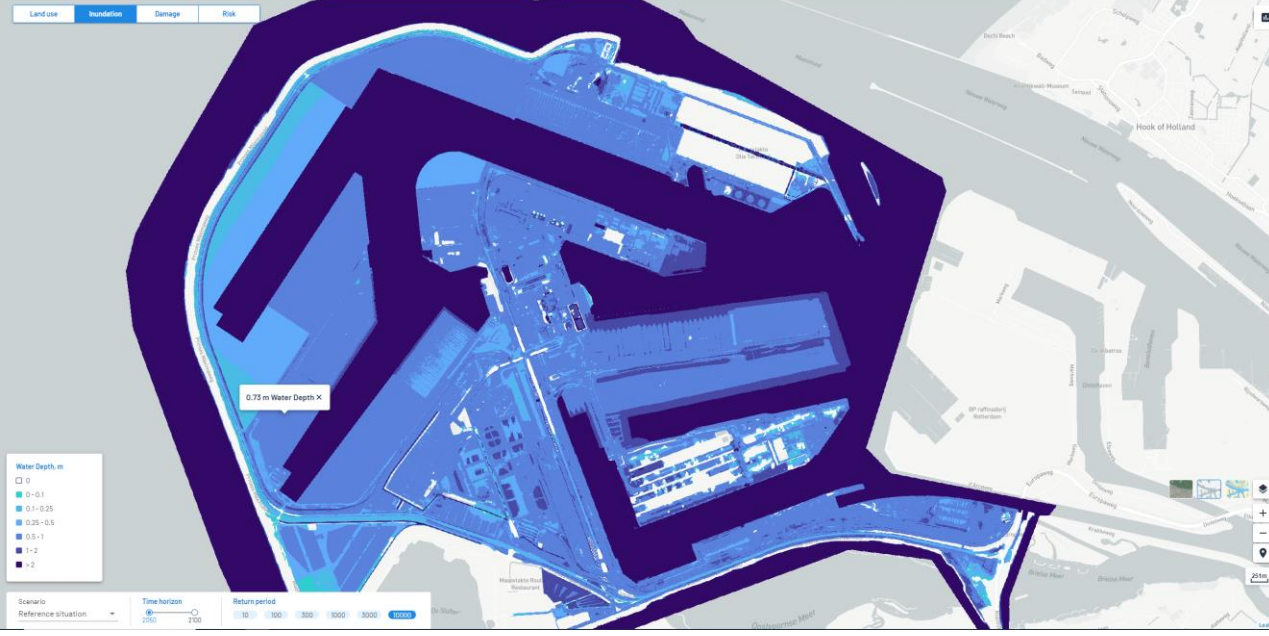
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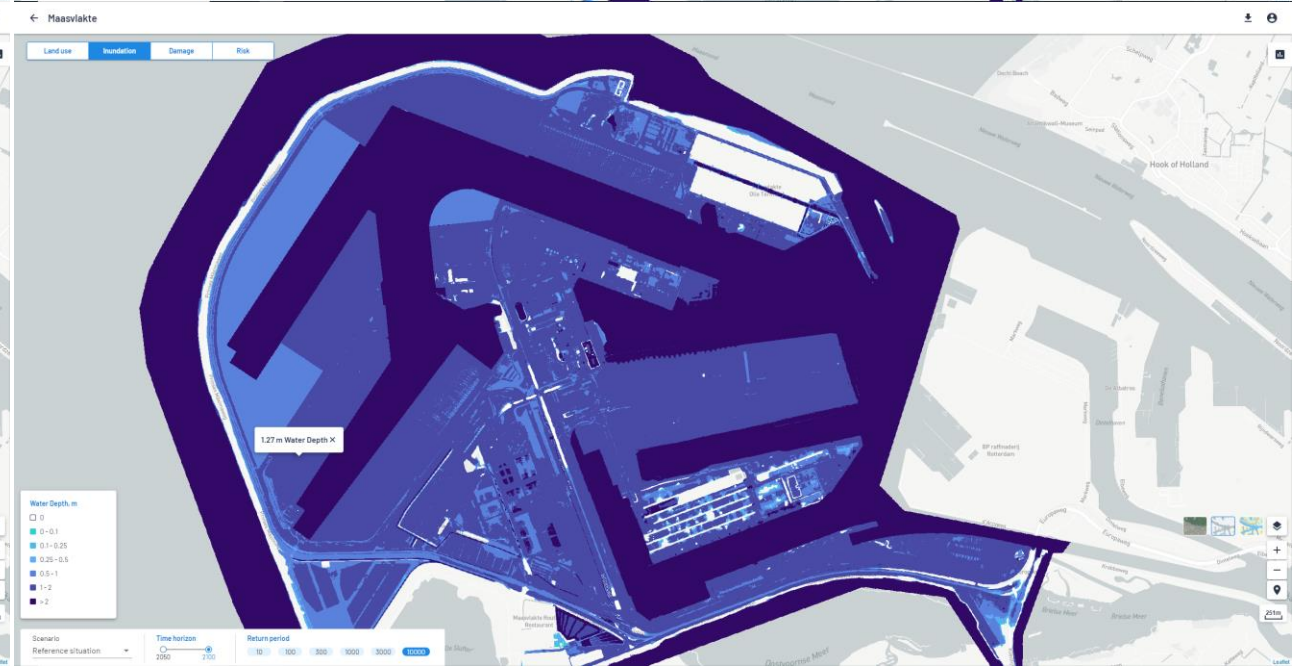
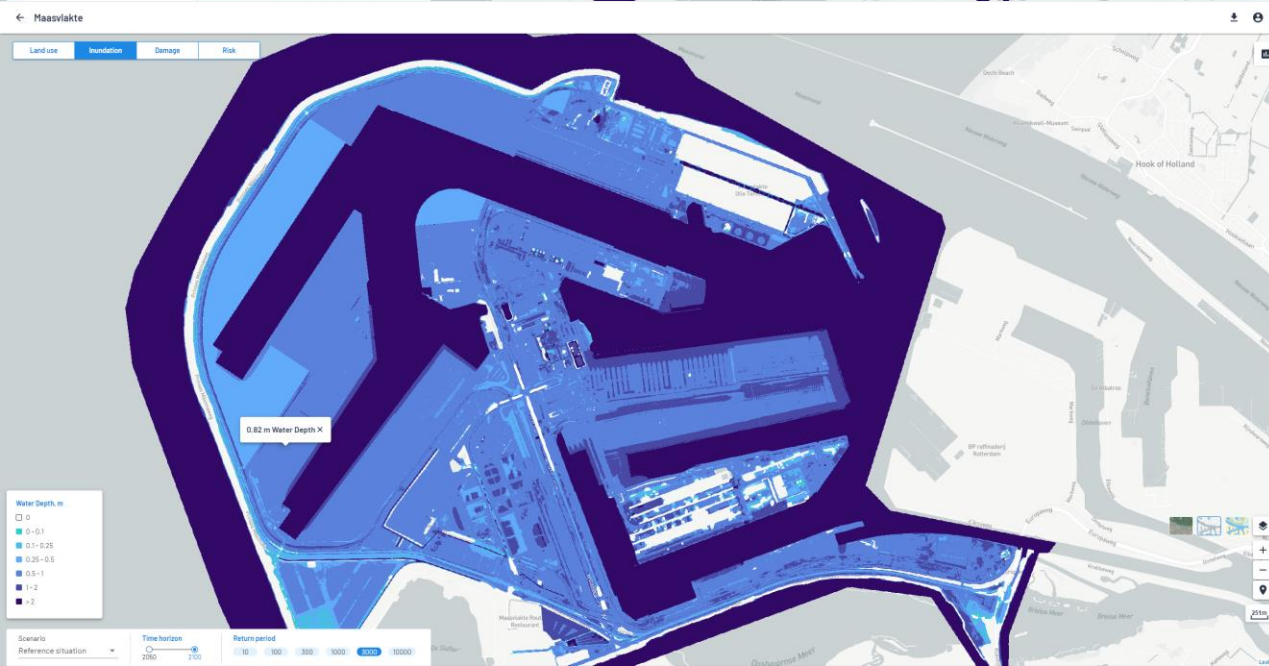
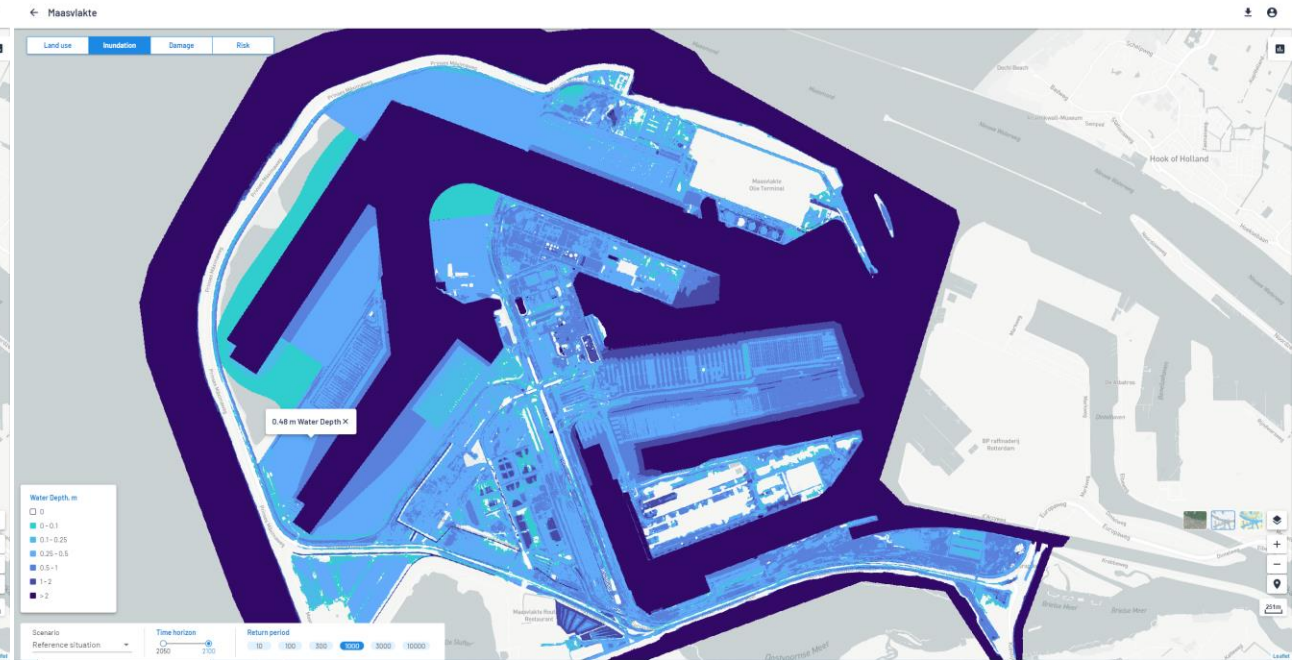
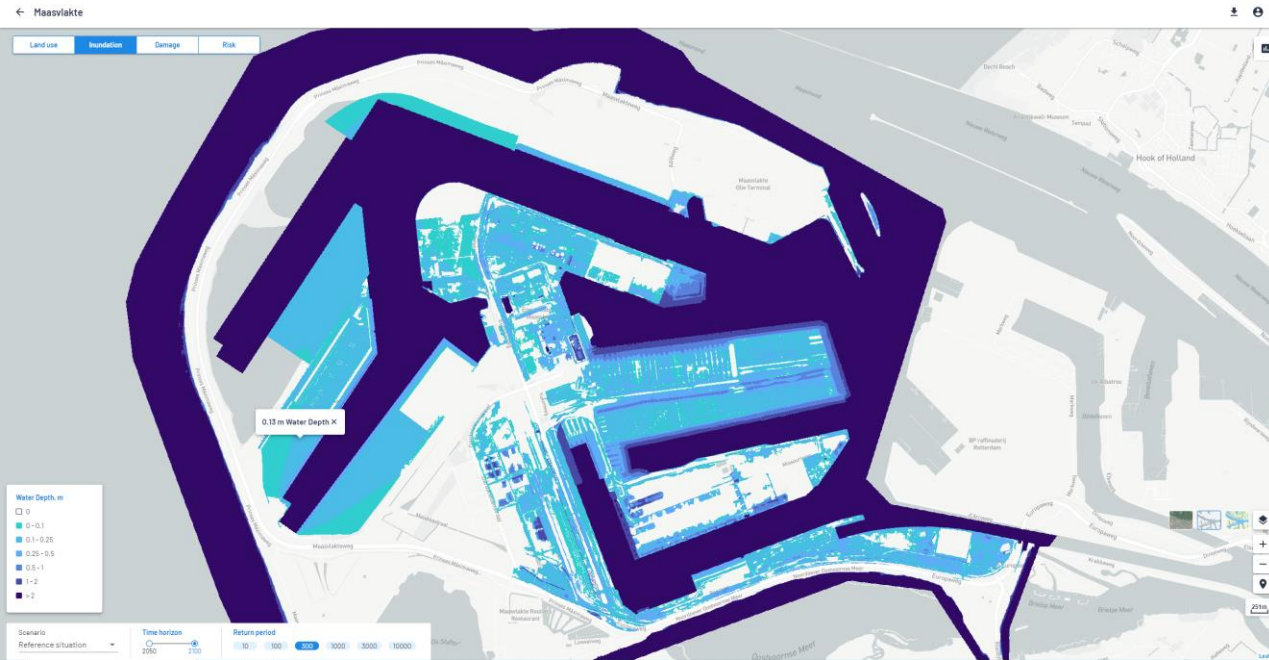
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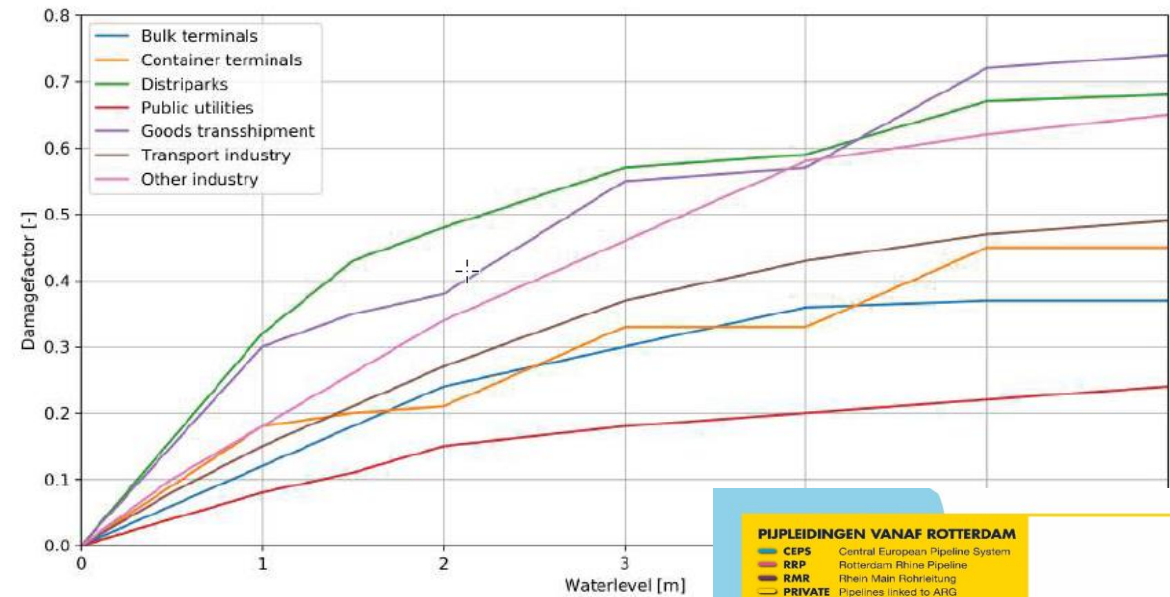
Reference situation: Flood scenario's 2100



Economic damage calculations

- Asset inventory maps, Land values and damage curves (obtained from literature and stakeholder consultations)

Sector	Value
Bulk terminals	€443
Container terminals	€696
Distriparks	€886
Public utilities	€1583
Goods transshipment	€886
	33
	33



Sources:

* JCR, 2017. *Global flood depth-damage functions: Methodology and the database with guidelines*,

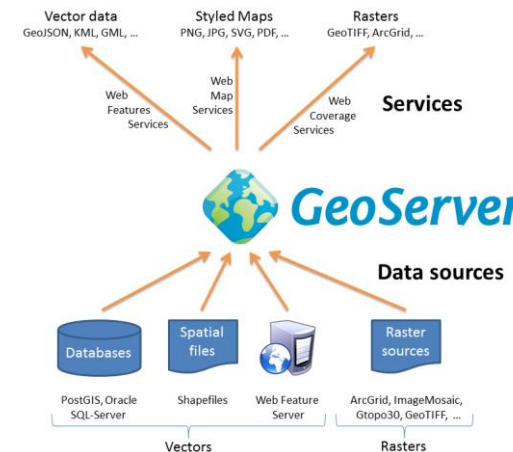
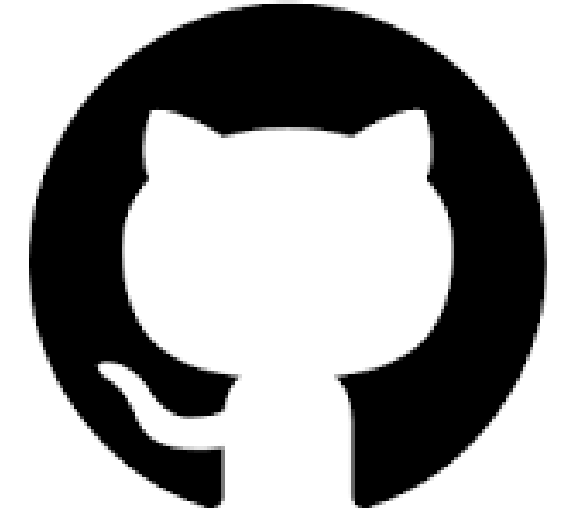
Huizinga, De Moel and Wojciech:

<https://publications.jrc.ec.europa.eu/repository/handle/JRC105688>

* Tebodin, 1998. *Schade bij inundatie*. By Rijkswaterstaat

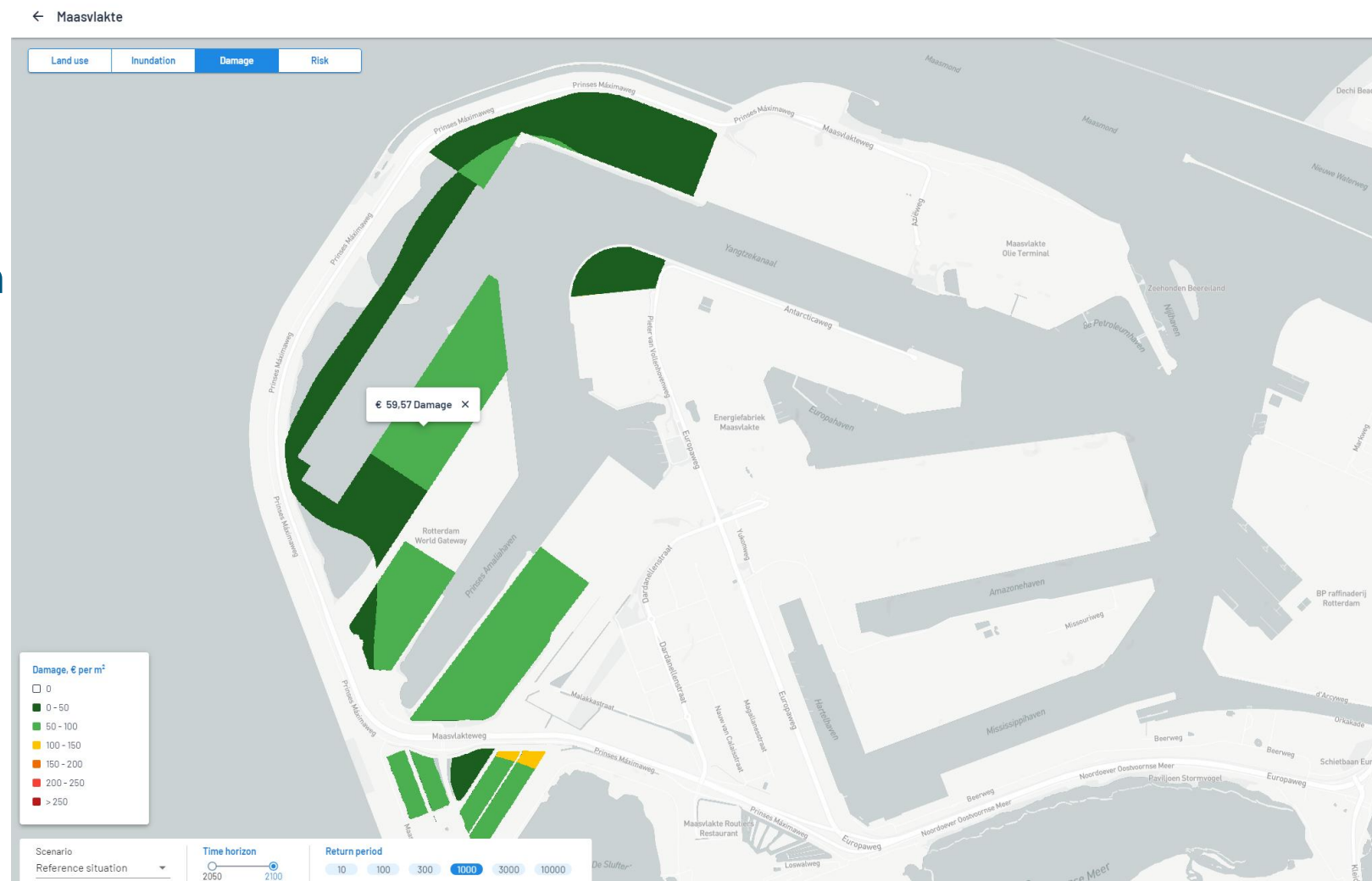
Underlying magic – Cloud based tool

- Online platform, to maximize computation power and increase speed: Performance from 5hours to 1 minute!
- 100% open-source, written in GDAL and Python code, calculations on Amazon web service (AWS), codes stored in Github. API to enable connection with other tools and models
- Protected environment through Smart Society



Global Flood Risk Tool - Digital 'Resilience' tooling

- **Online service:** Flood Risk calculations through cloud-based computing platform based on 5-steps approach
- **Fast calculations:** inundation and damage calculations within a minute instead of hours
- **Visually attractive:** User interface is interactive, visually attractive and understandable for non-experts to stimulate stakeholder dialogue during real-life sessions.
- **Enables decision-making:** GFRT to be used for scenario modelling to support decision-making on business cases for different climate scenarios



Cost-benefit analysis and conclusions

Intermediate option in 2050									
	Annual Average Damage [k€]	Avoided Damage %	Net Present Value Risk (R) [million €]	Present Value Benefits (B) [million €]	Measure: land elevation	Investment costs (I) [million €]	Total Costs = I+R [million €]	Net Present Value of Investment [million €]	Benefit-cost ratio
Asset Inventory 1	-	100,0%	-	2,0	6,5	0,45	0,45	1,54	4,4
Asset Inventory 2	-	100,0%	-	0,3	6	0,89	0,89	-0,64	0,3
Asset Inventory 3	4,2	98,1%	0,4	7,3	5,7	3,74	4,17	3,12	1,7

Intermediate Option in 2100									
	Annual Average Damage [k€]	Avoided Damage %	Net Present Value Risk (R) [million €]	Present Value Benefits (B) [million €]	Measure: land elevation	Investment costs (I) [million €]	Total Costs = I+R [million €]	Net Present Value of Investment [million €]	Benefit-cost ratio
Asset Inventory 1	-	100,0%	-	16,5	6,5	0,45	0,45	16,06	36,7
Asset Inventory 2	1,9	94,4%	0,2	1,1	6	0,89	1,09	0,04	1,0
Asset Inventory 3	7,9	96,5%	0,8	29,1	5,7	3,74	4,55	24,53	6,4

- Recommended to increase land elevation levels to be able to reduce flood risk for future scenario's
- Distinction between protection level is beneficial. It prevents over investment and get appropriate risk level for different types of asset inventory.
- Not always the highest protection level is economic most sound
- Depending on type of asset inventory additional crisis management measures can be implemented that reduce risks to minimum

	Intermediate		Medium		High	
	2050	2100	2050	2100	2050	2100
Asset Inventory 1	Green	Green	Green	Green	Green	Green
Asset Inventory 2	Red	Green	Red	Green	Red	Red
Asset Inventory 3	Red	Red	Red	Green	Red	Red
Asset Inventory 4	Red	Green	Red	Green	Red	Red
Asset Inventory 5	Green	Green	Green	Green	Green	Green
Asset Inventory 6	Green	Green	Green	Green	Green	Green
Asset Inventory 7	Green	Green	Green	Green	Red	Green
Asset Inventory 8	Green	Green	Red	Green	Red	Green

Thank you!

More information online: [LINK](#)

Blog: [Providing protection and security through our Global Flood Risk Tool](#)

GLOBAL FLOOD RISK TOOL

COMPREHENSIVE FLOOD RISK ANALYSIS AT YOUR FINGERTIPS

The Global Flood Risk Tool (GRFT) is Royal HaskoningDHV's cloud-based platform that delivers accurate and comprehensible flood risk analysis and recommends investment proposals to reduce risk on losing lives and economic damages. The online tool has been developed inhouse by a multidisciplinary team comprising experts with geospatial, software development and flood risk expertise.

GRFT conducts a thorough flood risk assessment and delivers a set of customized solutions if the identified flood risk is considered significant. The output is generated instantly (also for multiple scenarios, with large extents of 20x20km and grid cells of 5m resolution), and the tool is set up in such a way that it can easily connect to, integrate or exchange with other services, tools and models.

Clients who are currently using the tool are port authorities and international financial institutes.

The benefits of the Global Flood Risk Tool are:

- Interactive, visually attractive, geospatially distributed flood risk, and understandable user interface for non-experts

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RELATED SERVICES

- > Flood Risk Management Modelling and Design

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Ensuring flood resilience

with our Global Flood Risk Tool

A risk-based approach for future proof planning >

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