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

Source: wikipedia

Photo: Port of Rotterdam

Port of Rotterdam's request?

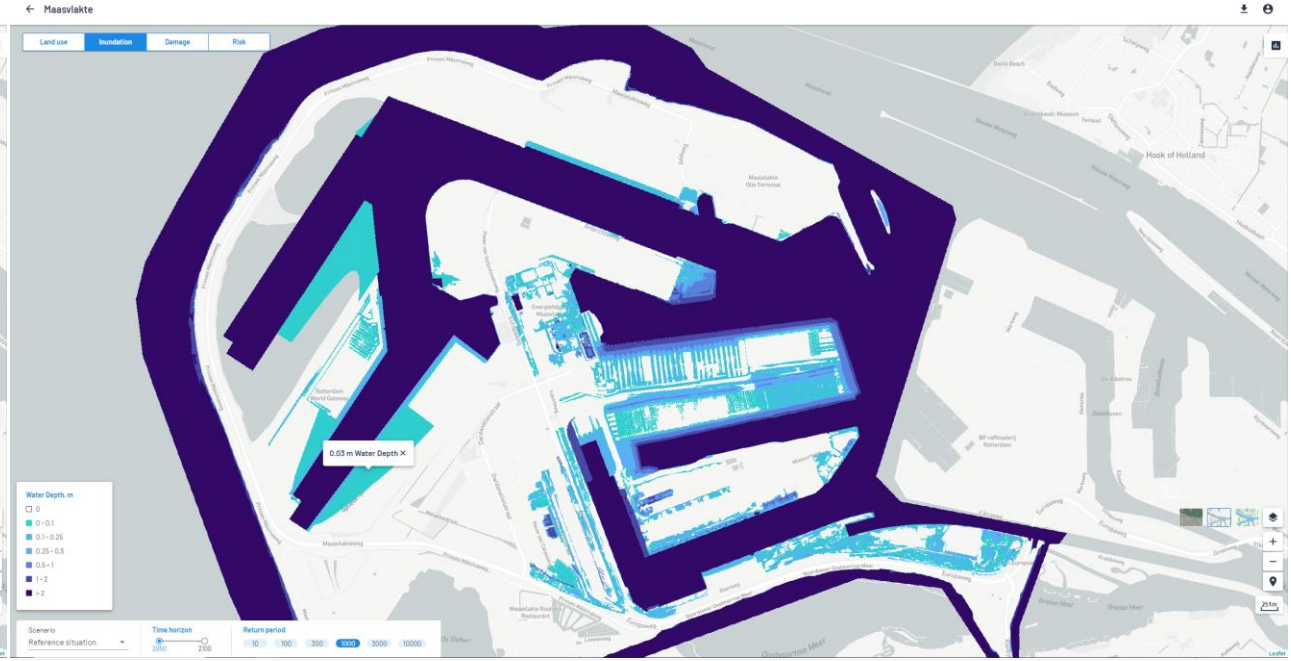
- To produce guideline for land elevation levels for different Asset Inventory/ Land uses:
  - Reference situation: land elevation levels on NAP+5.1 and NAP+5.5m;
  - Options with higher land elevation levels with 3 incremental steps up to NAP+6.5m to increase protection level, i.e. intermediate, medium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

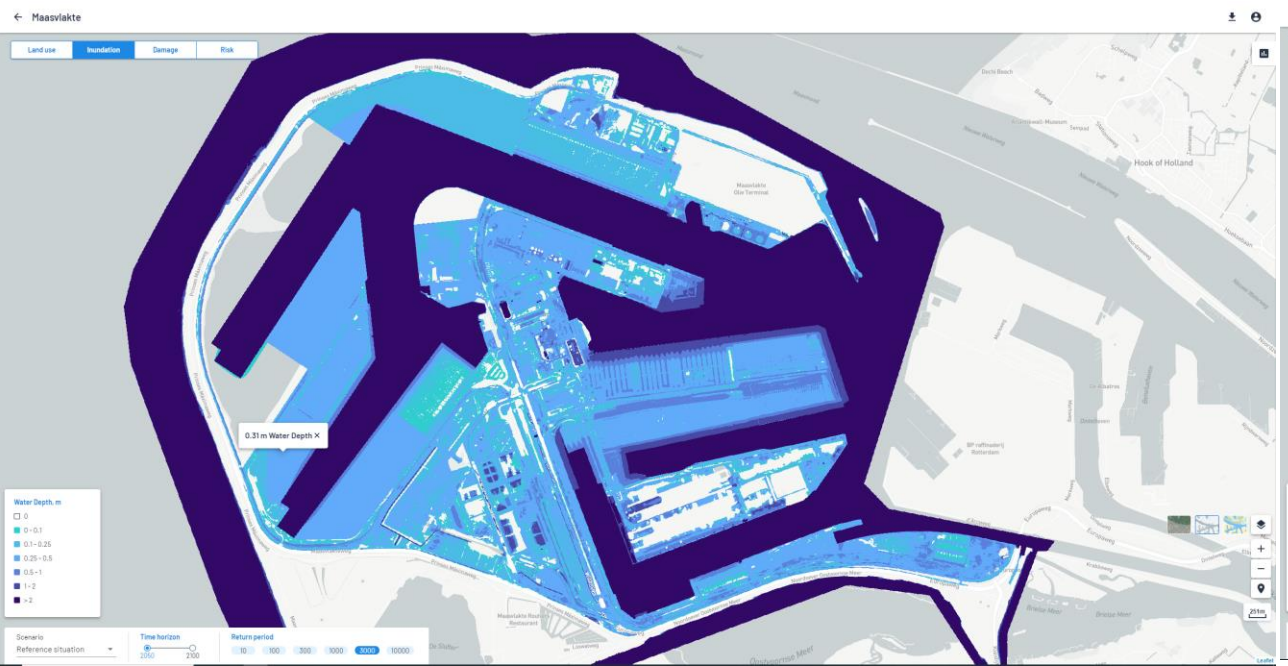
1. Create flood maps based for climate scenario's: **1 ft in 2050** and **3 ft in 2100** for reference situation and the 3 options;

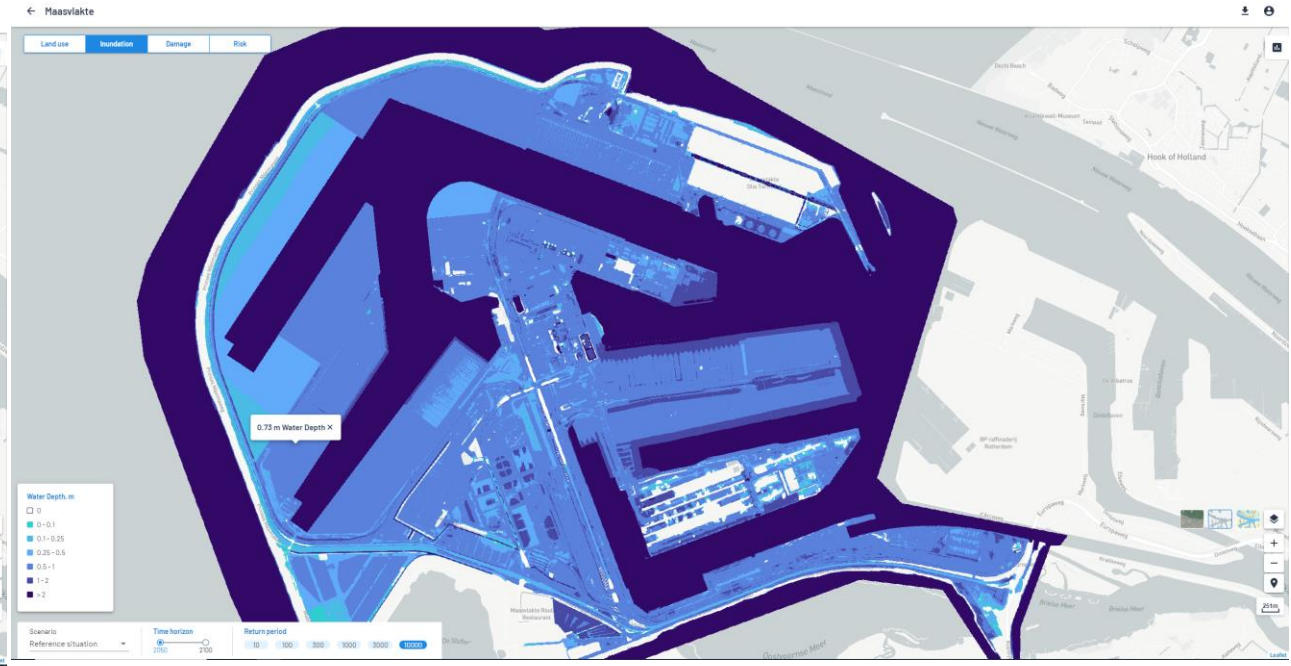
2. Calculate economic damages and flood risk for future asset inventory for given climate scenario's;

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

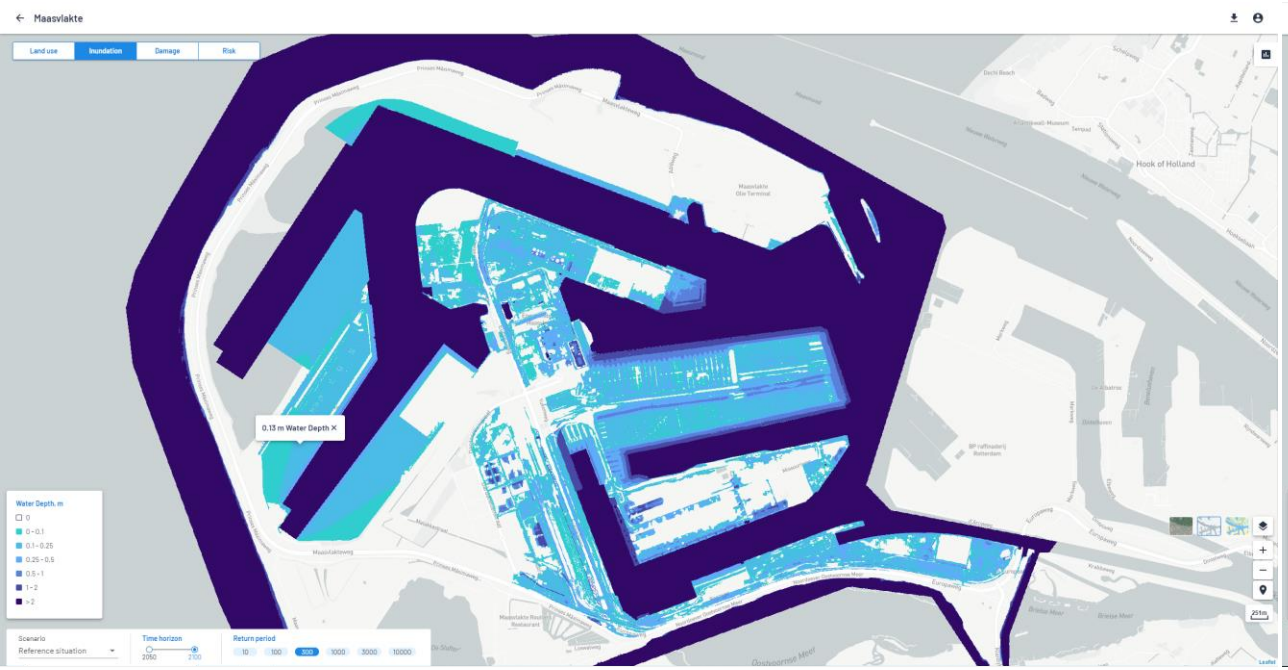
Reference situation: Flood scenario’s 2050

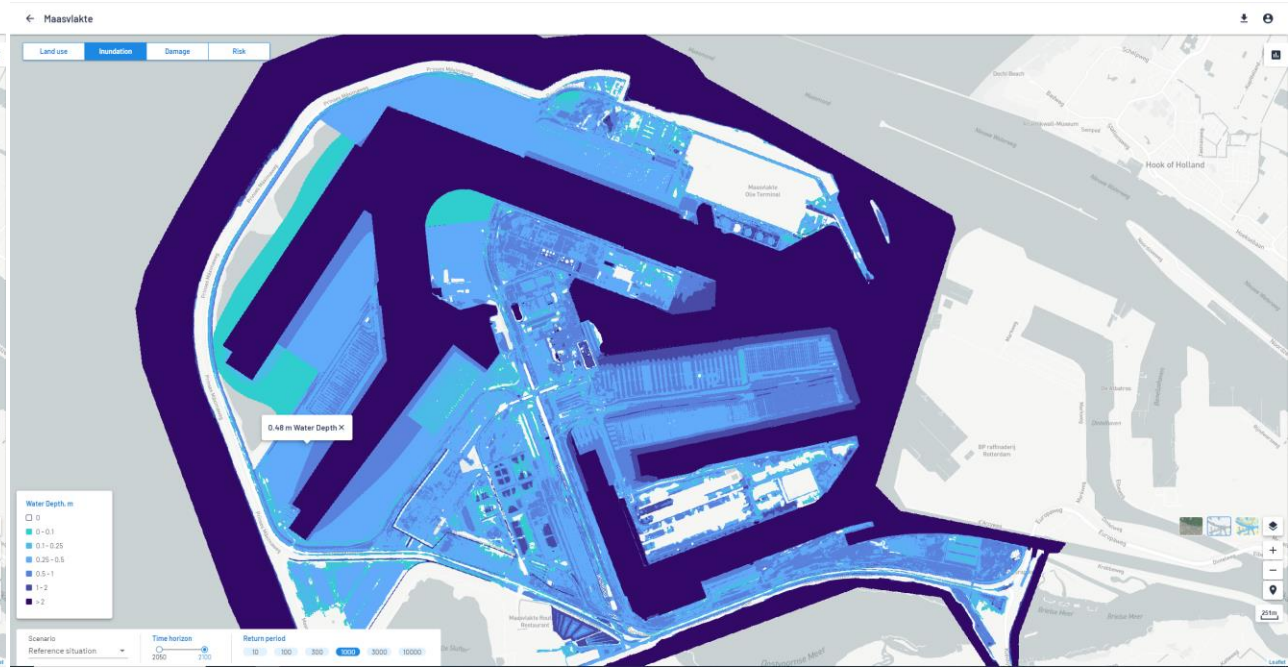


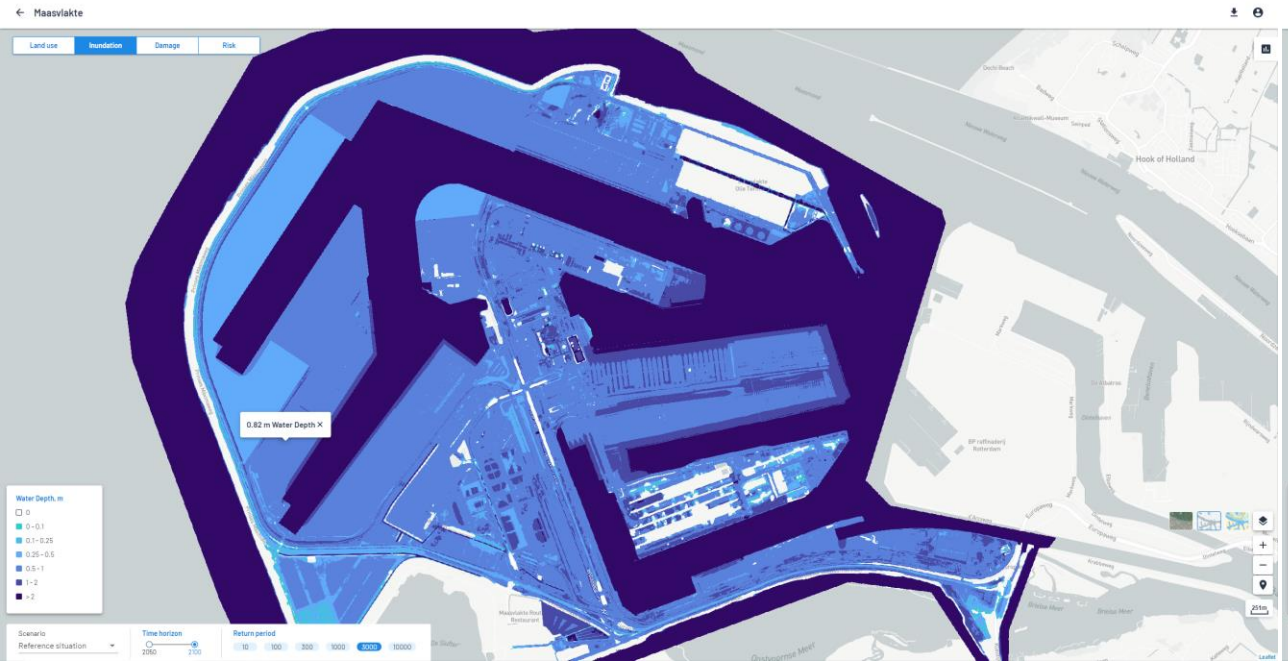


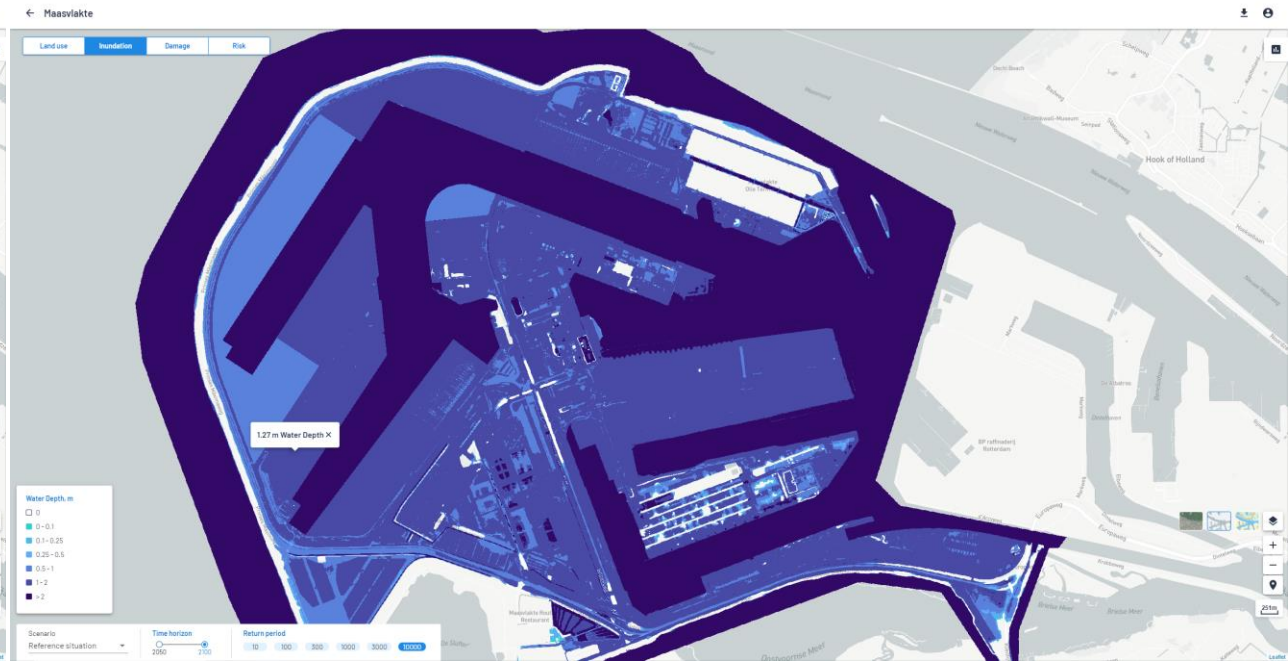


Reference situation: Flood scenario’s 2100





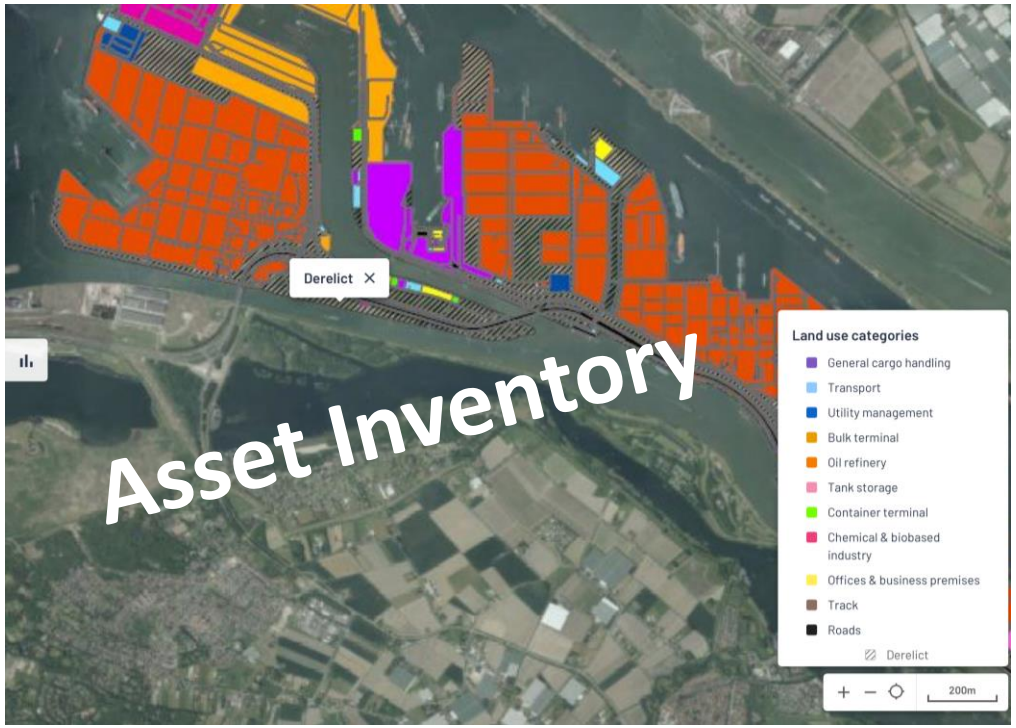


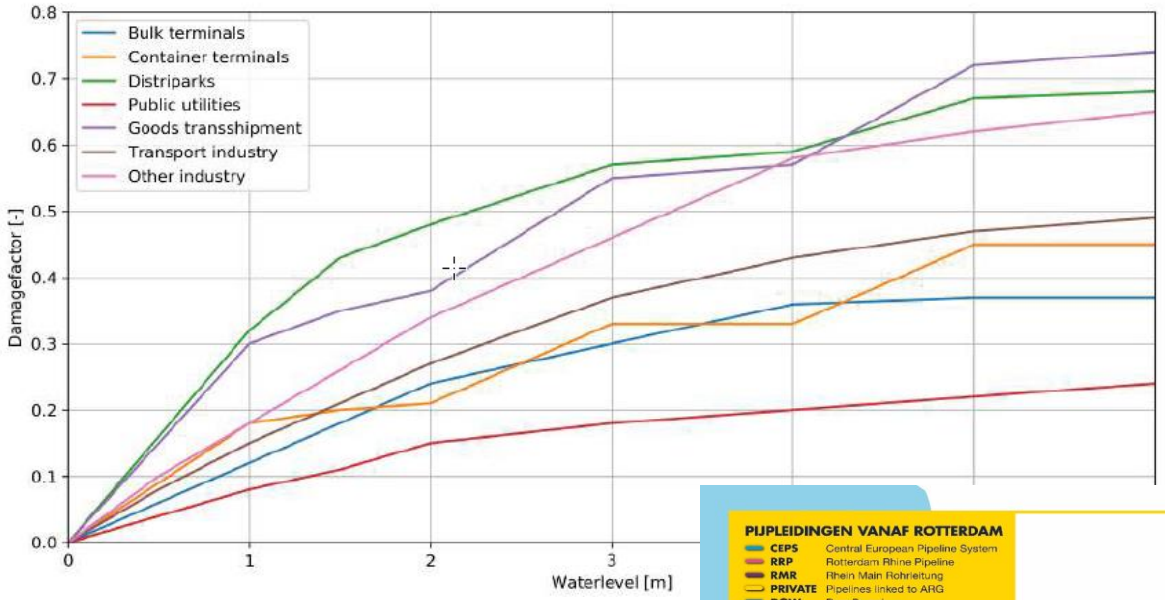


Economic damage calculations

- **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





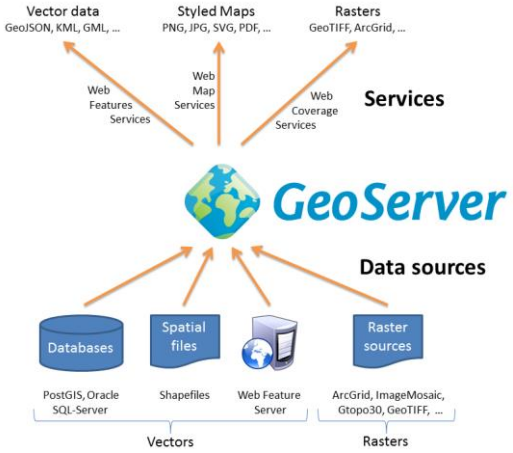
Sources:

** 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*

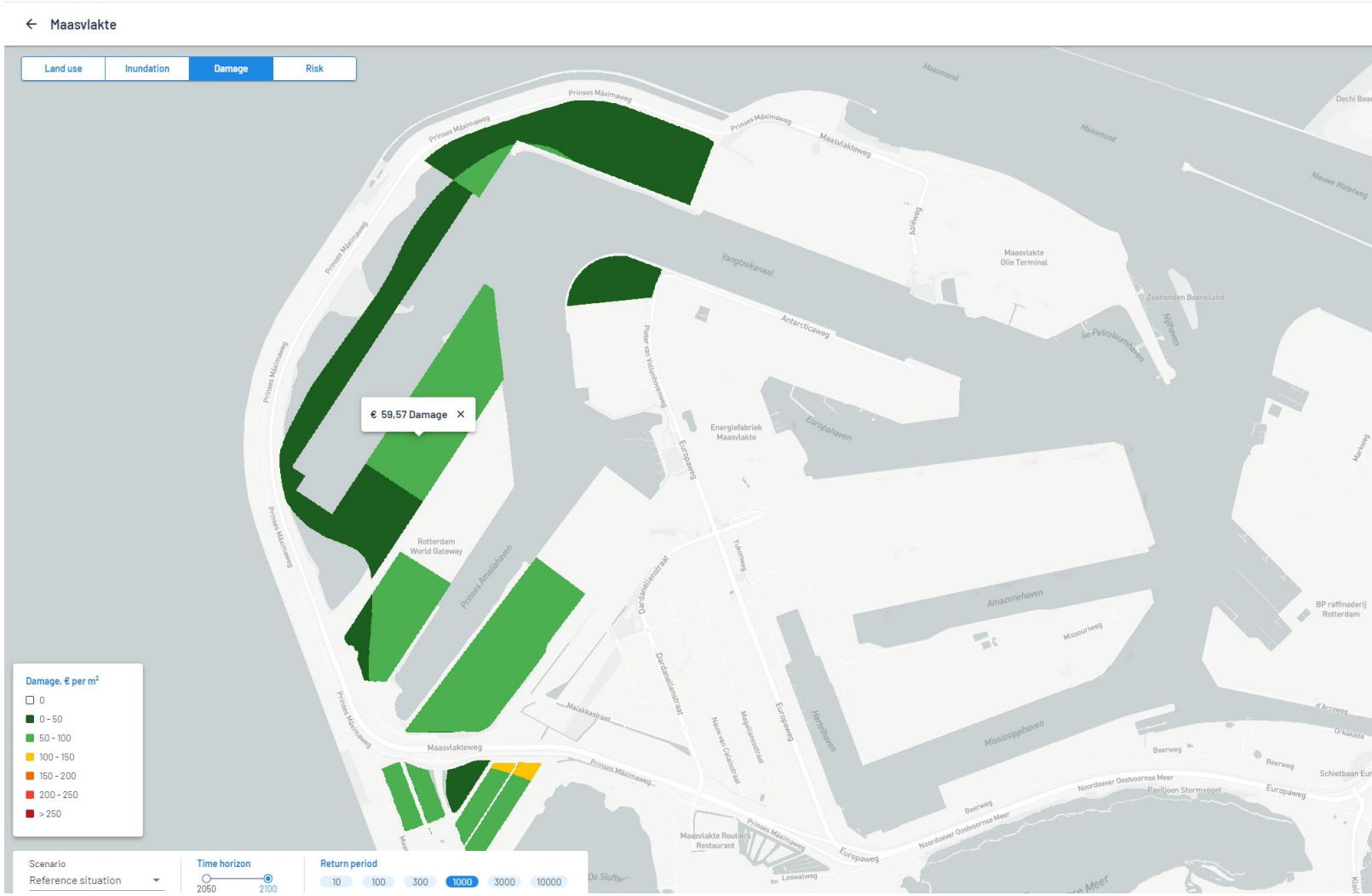
Underlaying magic – Cloud based tool

- 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



Royal HaskoningDHV

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

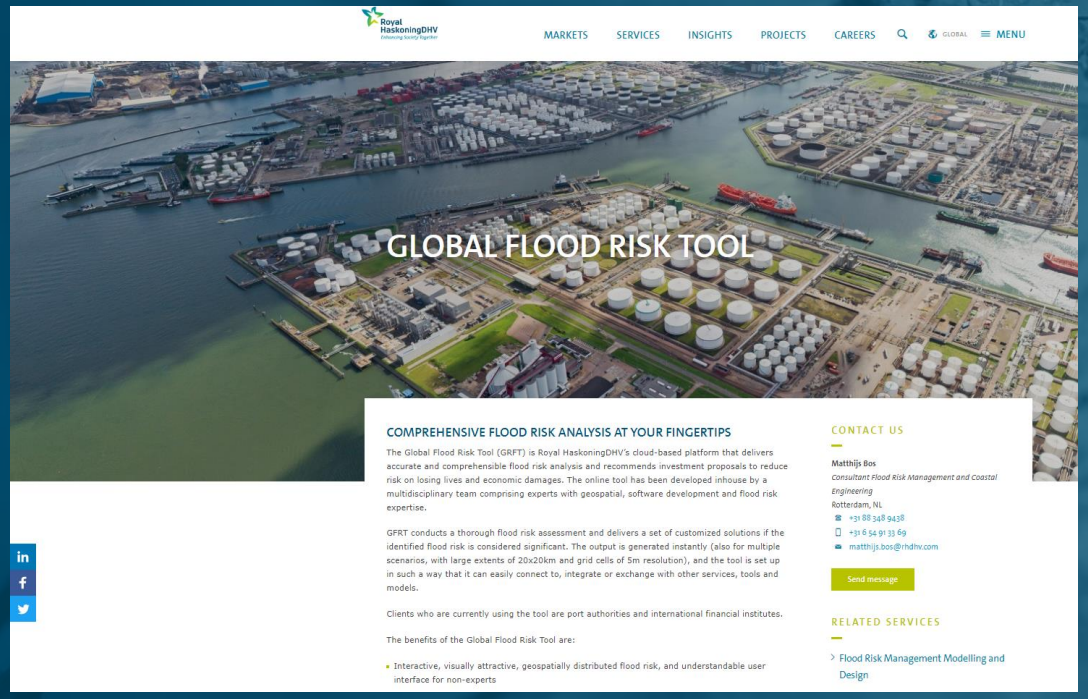
	Intermediate		Medium		High	
	2050	2100	2050	2100	2050	2100
Asset Inventory 1						
Asset Inventory 2						
Asset Inventory 3						
Asset Inventory 4						
Asset Inventory 5						
Asset Inventory 6						
Asset Inventory 7						
Asset Inventory 8						

- 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 implmeneted that reduce risks to minimum

Thank you!

More information online: LINK

Blog: **Providing protection and security through our Global Flood Risk Tool**



For more information please contact:

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