



Rotterdam Climate Resilient Delta City

Approach; Governance; Implementation;
Mainstreaming; Stakeholders



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100



CITIES



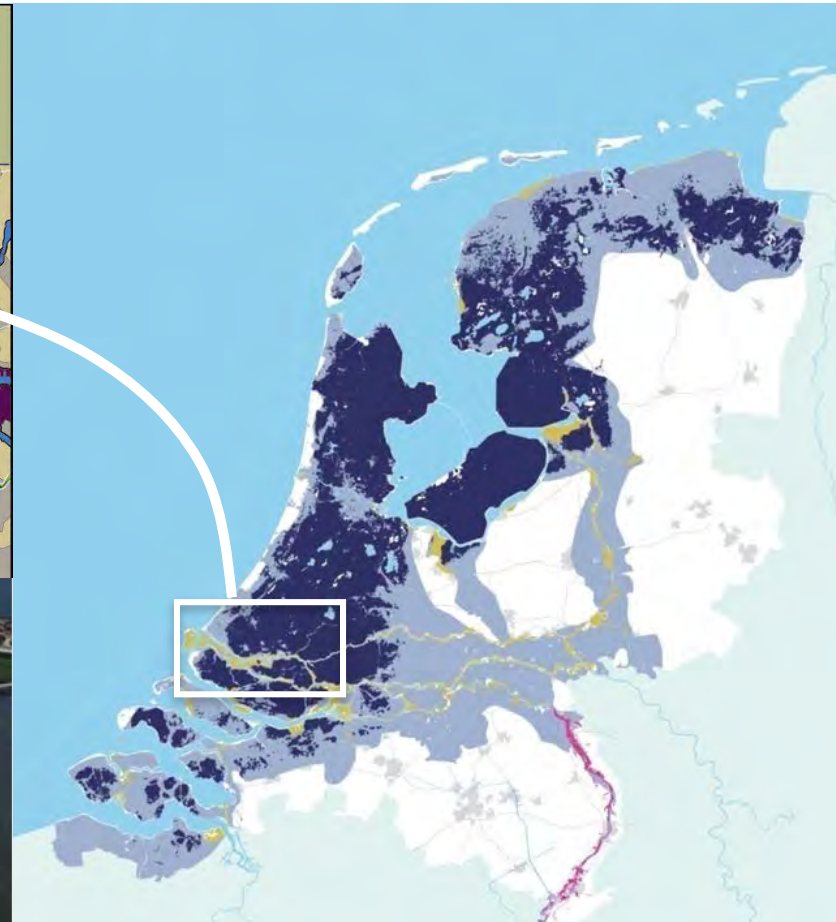
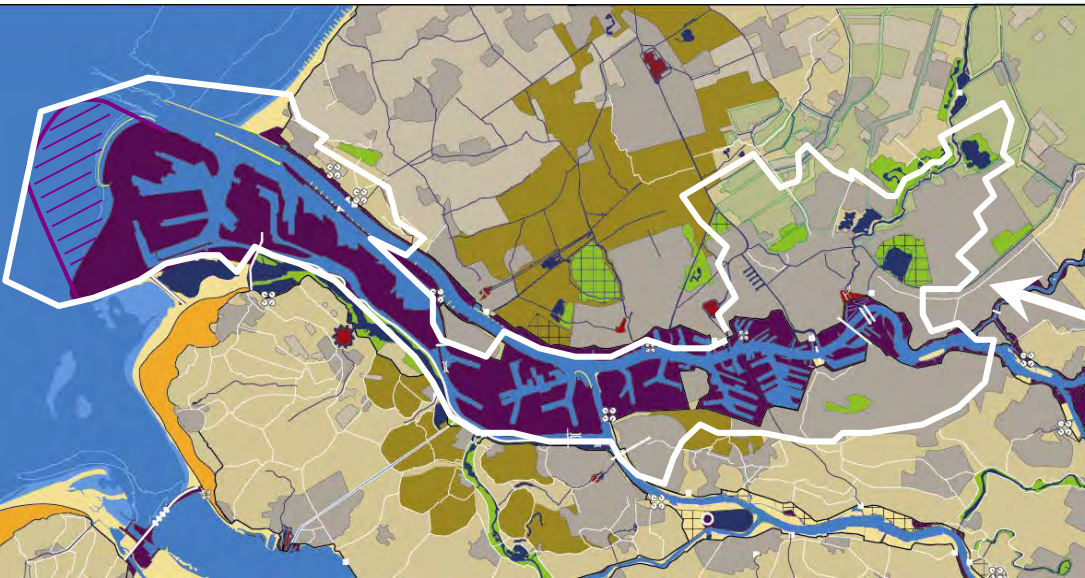
Rotterdam Resilient Port City

City

Area : 320 km²
Inhabitants: 625.000
Nationalities: 175
Municipal Budget: 4,2 billion Euro's

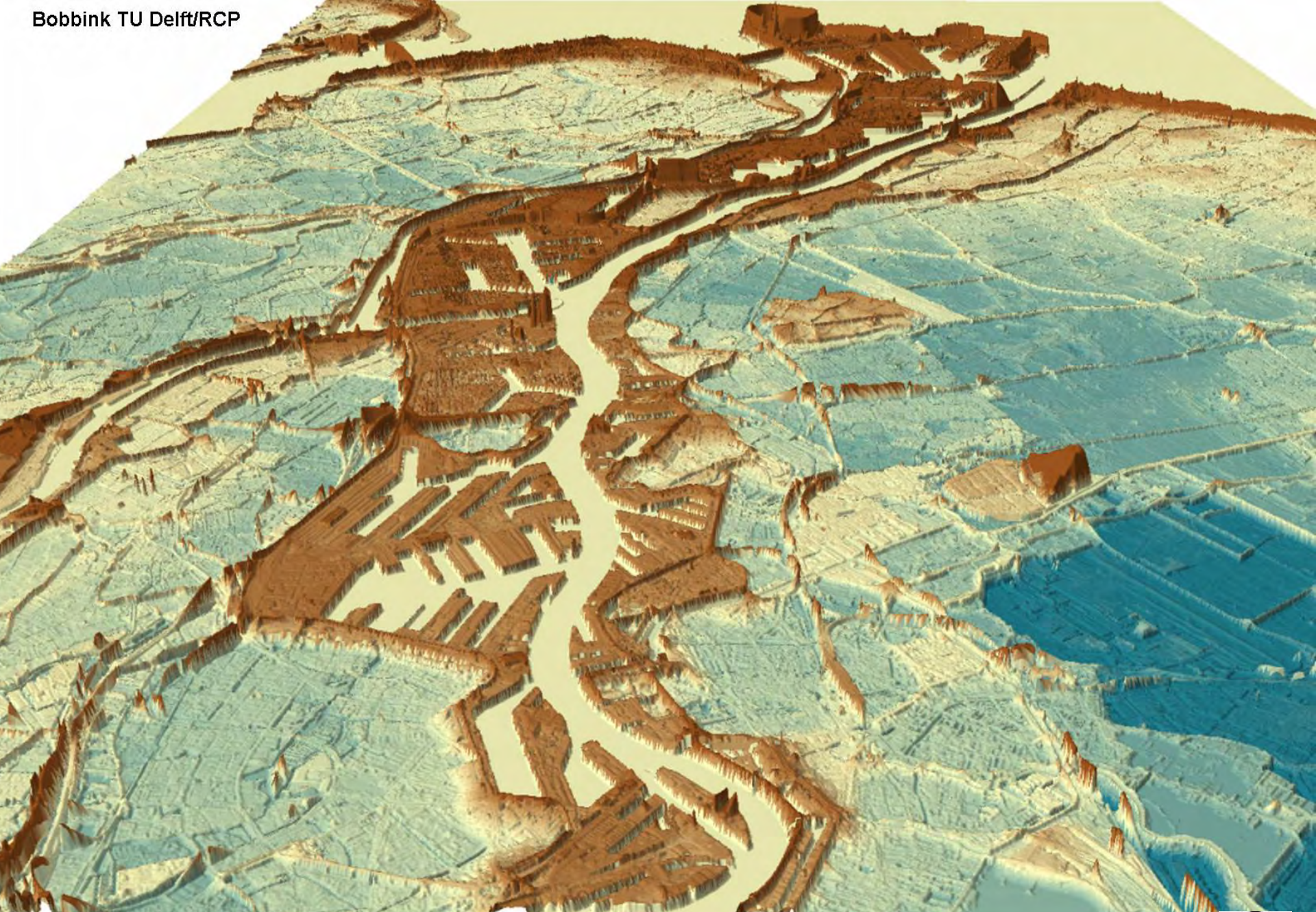
Port

Area: 105 km² (50 km² commercial sites)
Length of port area: 45 km.
Direct employment: over 70,000 jobs
Goods throughput: over 400 million tonnes of goods per annum
Shipping: 33,000 sea-going vessels and 110,000 inland vessels per annum





Challenges



Topo map: above (brown) and below (blue) sea level



Ongoing urban development...



2nd Juli 2011 | Copenhagen | more than 150 mm of rain fell in 2 hours
causing an estimated 6 billion € of damage



7 Dec 2015: FLOODING IN THE UK



June 2016/2017: Flooded Seine River in Paris hits 6m





23 Juni Randstad: Damage estimated 20 miljn euro





Effects related to Climate Change



Flooding Noordereiland



Water quality



Excessive rain fall



Levee breakthrough (drought)



Inundated cellars



Heat waves



The Process



Water = Urban Quality...



Rotterdam climate change adaptation strategy

Holistic, multi-level and multi-stakeholder strategy



Robust and resilient



Sewerage + watersquare



Protection and moving in tune



Dikes + adaptive building en design



Delta works, small scale projects



Storm surge barriers + 'Remove tile, plant greening'



Technology and nature



Pumping + green banks

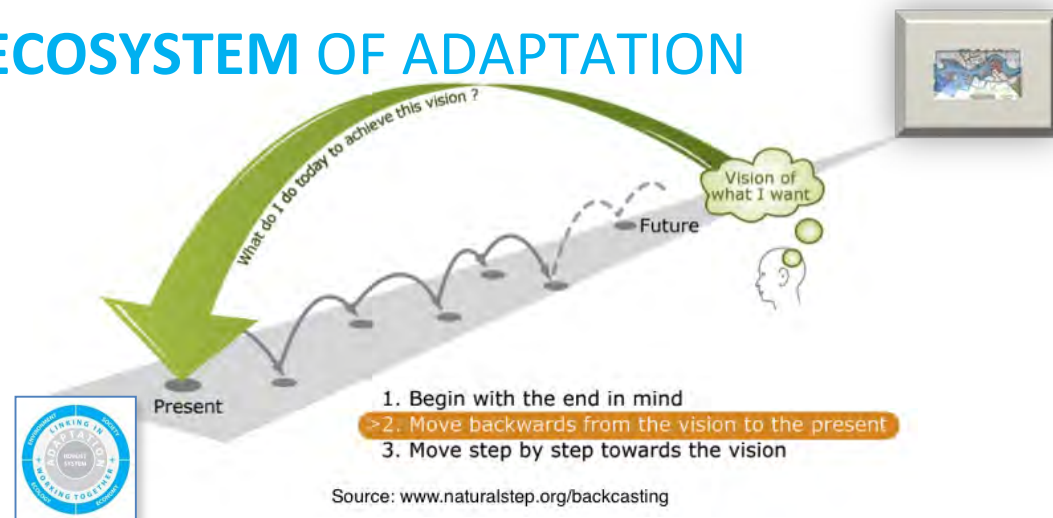
Timeline Rotterdam 's transition process towards a resilient delta city



- Water -----
- + Spatial Planning -----
- + Climate Change -----
- + Resilience (wide spectrum) -----

Rotterdam Approach (10 principles)

1. TRANSFORM CHALLENGE'S INTO **OPPORTUNITIES**
2. **ADD VALUE**: CREATE A BETTER CITY (HOLISTIC)
3. USING WATER AS A **DESIGNING** PRINCIPLE
4. INVEST IN **MULTI BENEFIT** SOLUTIONS
5. LONG TERM VISION WITH **SHARED OWNERSHIP**
6. SHORT TERM **ACTION** PLAN
7. LEARNING BY DOING: START **NO REGRET** MEASURES
8. **UPSCALE** FROM OBJECT TO DISTRICT TO CITY SCALE
9. **EMBED** CLIMATE RESILIENCE IN 4 P'S
10. CREATE AN **ECOSYSTEM** OF ADAPTATION





Implementation



Multifunctional Solutions



INTEGRATED URBAN PLANNING



Extended canal: waterstorage Kruisplein



Water square Benthemplein...



Water square Benthemplein...





...AND CLIMATE RESILIENCE BY DESIGN...





Urban Floodplain



PLAY GROUND & WATER SQUARE FREDERIKSPLEIN





Green Roofs Program: community involvement

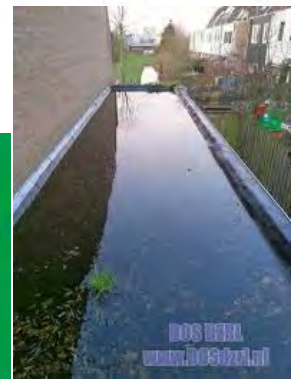


ZOHO: First Climate Proof District

Building a green framework and programmatic clusters for and with the neighbourhood



+



Rotterdam climate change adaptation strategy

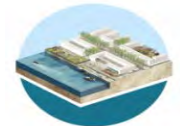
Perspective for the climate resilient delta city

Illustrative reproduction of the possibilities for climate adaptation for different types of city districts

- What **measures** could we apply here?
- Which **stakeholders** are important to play a role?
- What **value** is added by those measures?
- Which stakeholders **profit**?



City centre



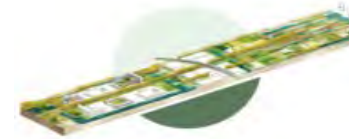
River zone districts



Urban districts near centre



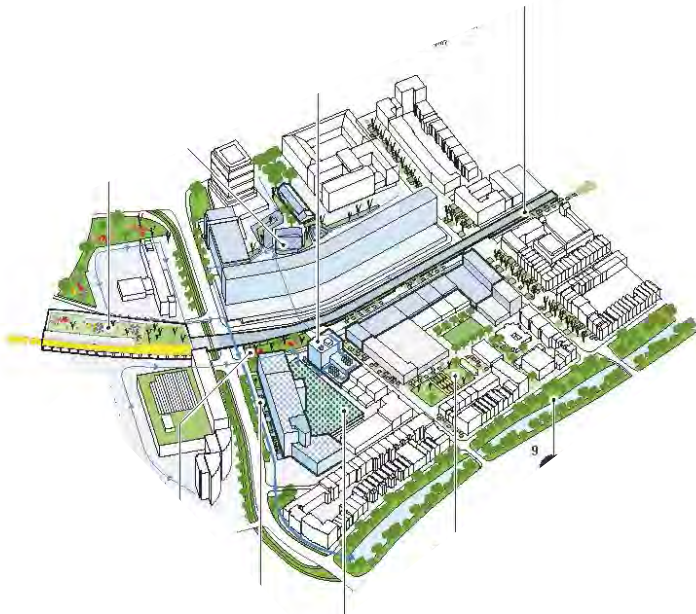
Port areas



Suburbs



City-Port

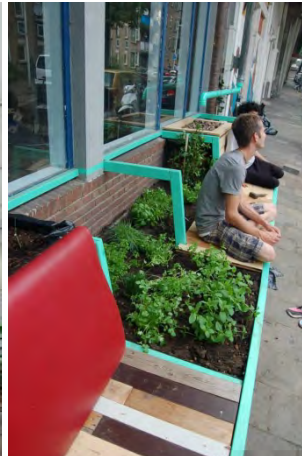


FROM PILOT TO MAINSTREAM

Water Sensitive Rotterdam



POST-OFFICE



7 SEASONS



DE URBANISTEN

GREENING HOFBOGEN = WORK IN PROGRESS

DE URBANISTEN



...SEALEVEL RISE - RESILIENCE BY DESIGN...

Building with Nature: green solutions



- 1: NEW ECO-HABITATS**
- 2: REUSE OF SEDIMENTS**
- 3: WAVE REDUCTION**
- 4: BETTER WATER QUALITY**

New Business cases



Huidige situatie
Current



Toekomstige situatie
Future



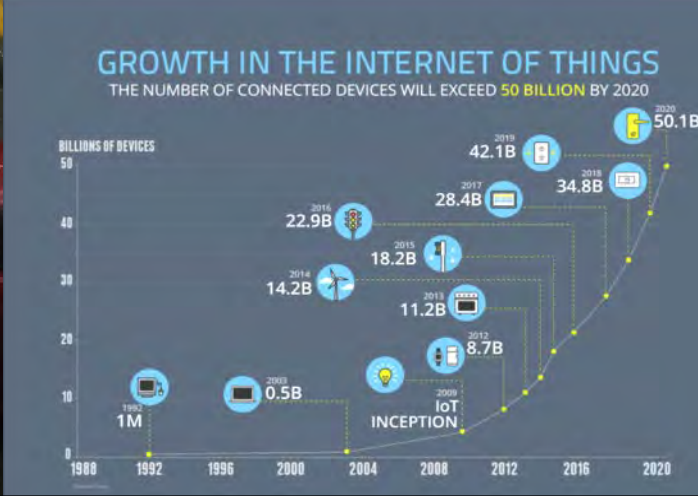


Opportunity: Adaptive Water Front development



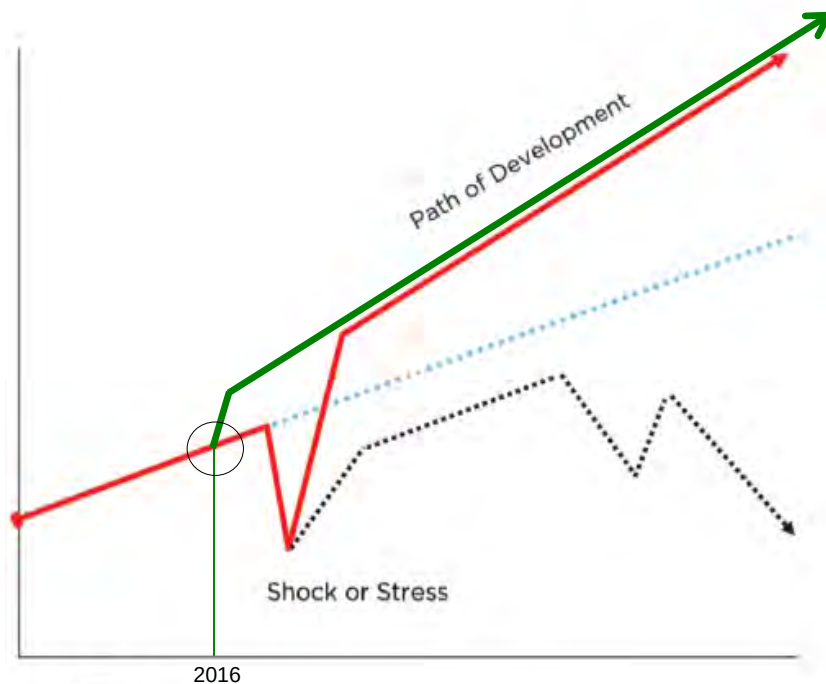


Next Level



CHALLENGES





Shocks and stresses
can bring
opportunities for
cities to evolve and
in some
circumstances
transform.

100 RESILIENT CITIES



SEVEN QUALITIES OF RESILIENCE



REFLECTIVE

using past experience to inform future decisions



RESOURCEFUL

recognizing alternative ways to use resources



ROBUST

well-conceived, constructed, and managed systems



REDUNDANT

spare capacity purposively created to accommodate disruption



FLEXIBLE

willingness and ability to adopt alternative strategies in response to changing circumstances



INCLUSIVE

prioritize broad consultation to create a sense of shared ownership in decision making



INTEGRATED

bring together a range of distinct systems and institutions

ROTTERDAM RESILIENCE STRATEGY.

READY FOR THE
21ST CENTURY

CONSULTATION
DOCUMENT




Gemeente Rotterdam

PIONEERED BY THE
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RESILIENT CITIES

ROTTERDAM.
MAKE IT
HAPPEN.

RESILIENT
ROTTERDAM

OUR RESILIENCE GOALS.



1. Rotterdam: A balanced society



2. World port city built on clean and reliable energy



3. Rotterdam Cyber Port City



4. Climate resilient Rotterdam to the next level



5. Infrastructure ready for the 21st century



6. Rotterdam Networkcity – truly our city



7. Anchoring resilience in the city

GOAL 4: CLIMATE ADAPTIVE ROTTERDAM TO A NEW LEVEL



“Climate proof plus cyber
proof critical infrastructure”

“Large scale implementation
of small scale solutions
together with citizens”

“Next level of integrated
approach”

**1.000.000 M2 SUSTAINABLE
ROOF LANDSCAPE IN
ROTTERDAM CITY CENTRE**

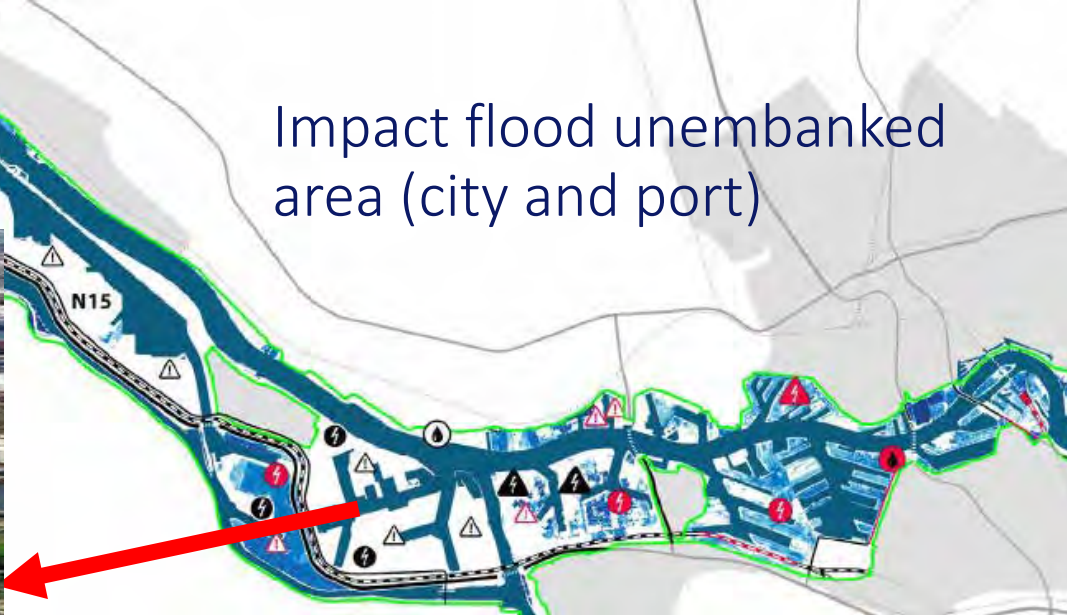




New York: black-out by Hurricane Sandy in okt. 2012

Inadequate protection of vital infrastructure

Source: Iwan Baan



Impact flood unembanked area (city and port)

- Flood probability (1:4.000)

vs

External safety regulation (1:100.000)

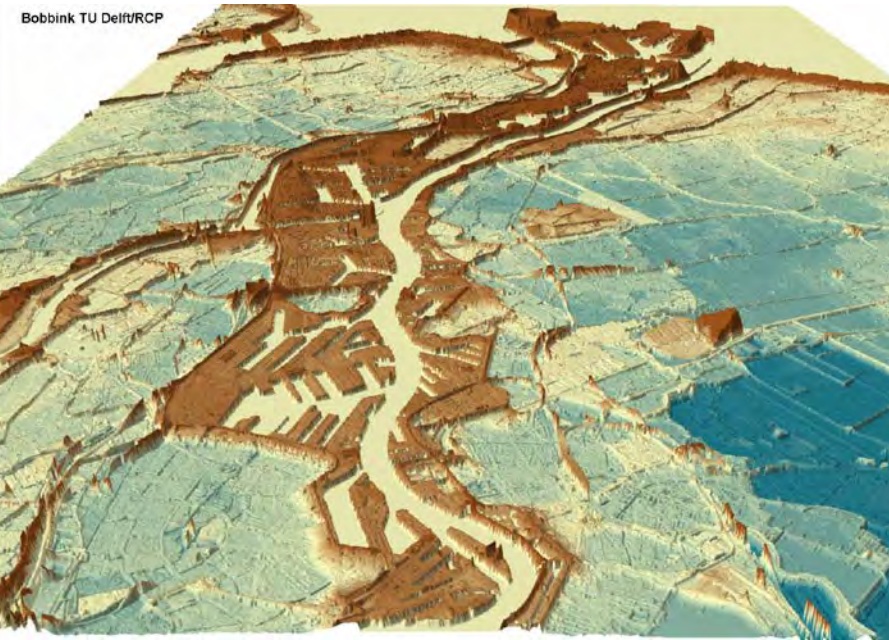
Questions addressed via public/private joint fact finding:

- vulnerability of chemical plants?
- acceptable risk level?

Return period	Direct losses (in billions Euro)	Indirect losses (in billions Euro)	Total losses (in billions Euro)	Time to recover (99% of initial production)
1/10	0.22	0.13	0.35	18 days
1/100	0.44	0.29	0.73	78 days
1/1,000	0.76	0.61	1.37	173 days
1/2,000	0.92	0.83	1.76	255 days
1/4,000	1.10	1.14	2.23	351 days
1/10,000	1.88	2.51	4.39	647 days
EAD (million Euro/year)	36.1	23.4	59.5	

Estimated flood damage is very high due to chain effects

Bobbink TU Delft/RCP

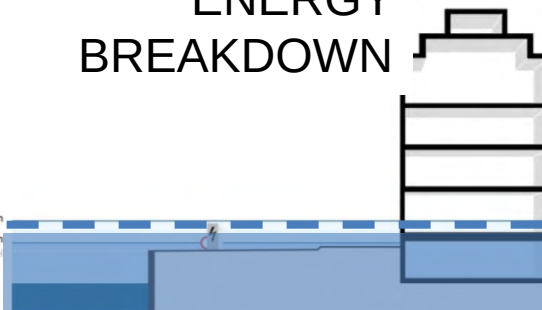


VERTIKAAL EVACUEREN



FLOODING & ENERGY BREAKDOWN

+ 100 cm
+ 30 cm
ground level



The historic outer-dike areas are the most vulnerable to damage by flooding



Transformer stations are vulnerable to inundation depths greater than 30 cm



SMART CITY

VULNERABLE!!

RESILIENCE GOALS.

GOAL 3:
ROTTERDAM CYBER PORT CITY



“Rotterdam aims to be a cyber resilient city and port; an important condition required to attract new business and investment”

**THE ROTTERDAM
 “DELTAPLAN” CYBER**

1. Cyber Aware Society

2. Cyber Competence Improvement

3. Cyber Resilience Desk

4. Cyber Resilience Co-Op

5. Cyber Building Codes

6. Disruption Learning Cycle

7. Cyber Resilience Community of Practice



COOPERATION



100RC: “We help cities around the world become more resilient to the physical, social, and economic challenges that are a growing part of the 21st century”

Rotterdam welcomes Delta Cities from around the world



C40
CITIES
CLIMATE LEADERSHIP PACT

Climate
Adaptation
Academy



C40 & Connecting Delta Cities & 100RC



Rotterdam Exchange

Water Management & Multi-Benefit Solutions

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RESILIENT

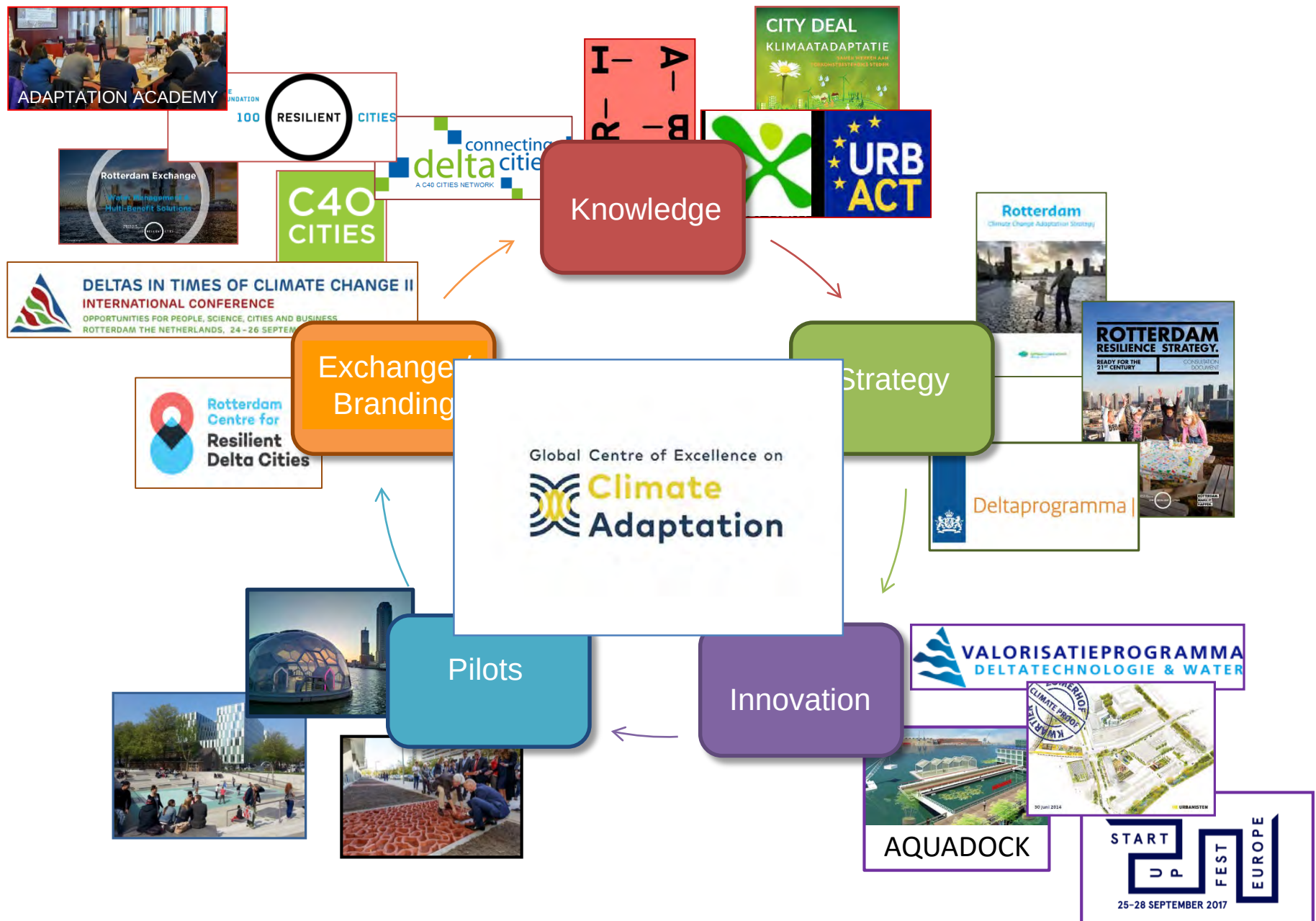
CITIES



PARTNERS



ROTTERDAM'S CLIMATE RESILIENCE 'ECOSYSTEM'



ROTTERDAM IS READY TO SHARE AND TO HELP!

- **APPROACH:** HOLISTIC CLIMATE RESILIENCE STRATEGY
- **SOLUTIONS:** MULTIFUNCTIONAL, USE NATURE & WATER SENSITIVE DESIGN
- **PARTNERS:** KNOWLEDGE INST., CONSULTANCIES & DESIGN BUREAUS

M. BLOOMBERG: *“Each part of the climate change problem has a solution that can make our society healthier & stronger”*

Thank You!

www.resilientrotterdam.nl



Resilient
Rotterdam...
Be creative!

