

Resilient Water Management in Rotterdam



Rotterdam
Centre for
**Resilient
Delta Cities**

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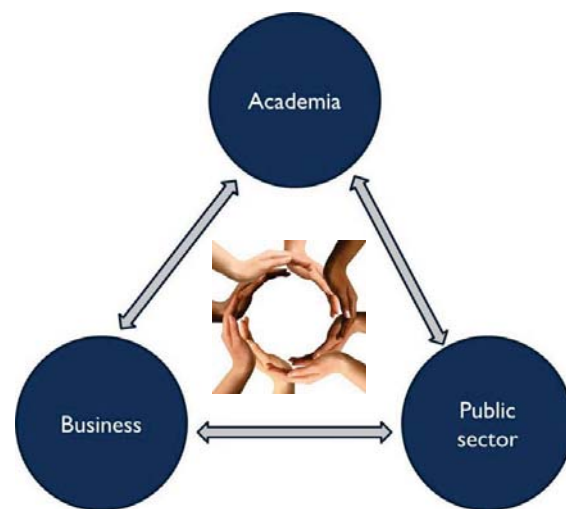
<http://rdcroterdam.com/>

Manager of Deltares' strategic research program Resilient Cities

<https://www.deltares.nl/en/>



**Rotterdam
Centre for
Resilient
Delta Cities**



Masterclass



Resilience Expert Team



A triple helix network that aims to accelerate the transition towards safe and sustainable delta cities worldwide

Turning innovations into proven concepts



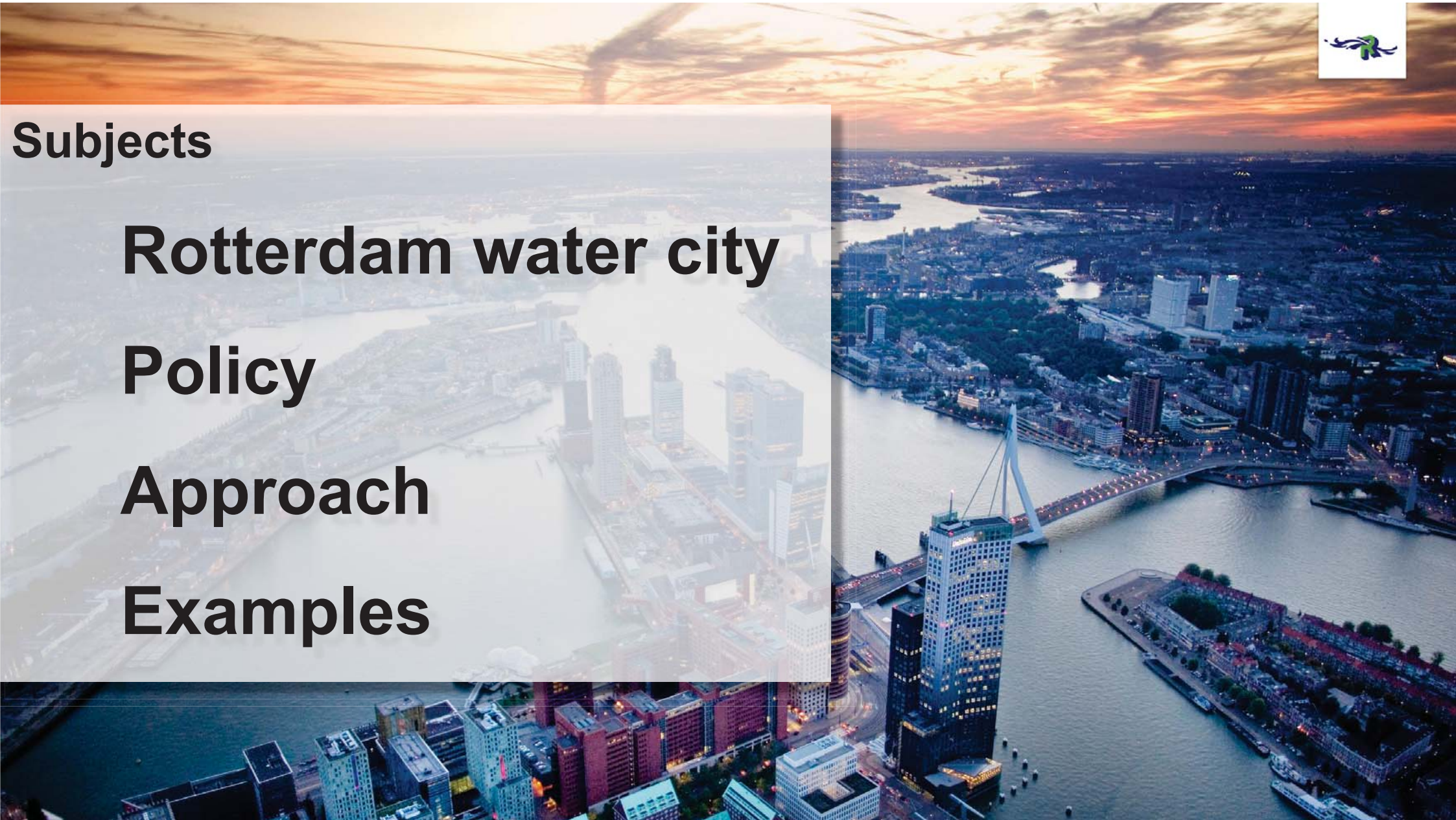
Subjects

Rotterdam water city

Policy

Approach

Examples





Past



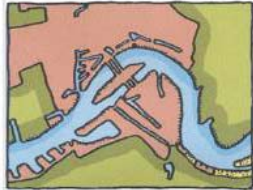
Rotterdam ↓



1340: the Rotte dam



1700: trading centre



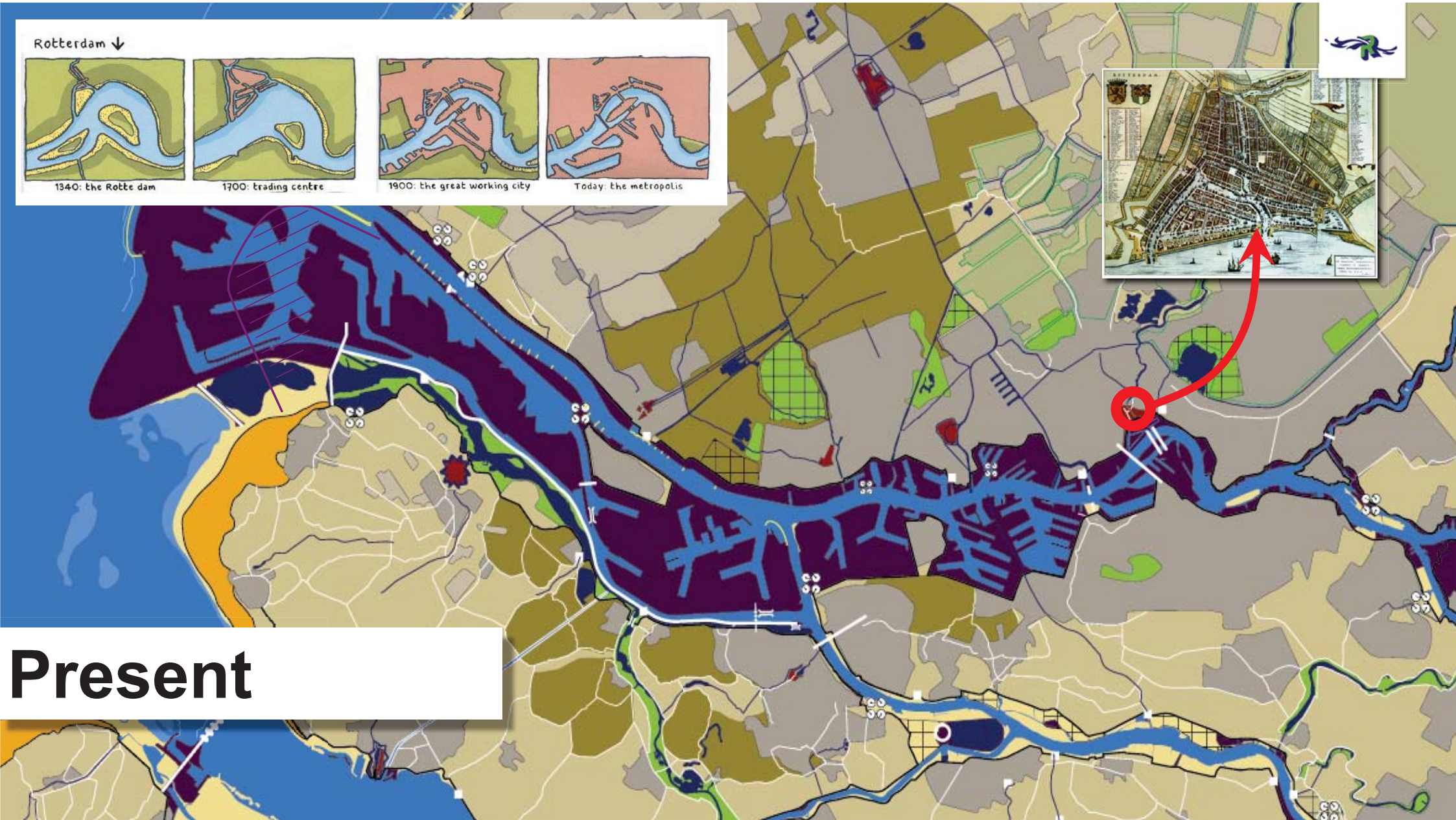
1900: the great working city



Today: the metropolis



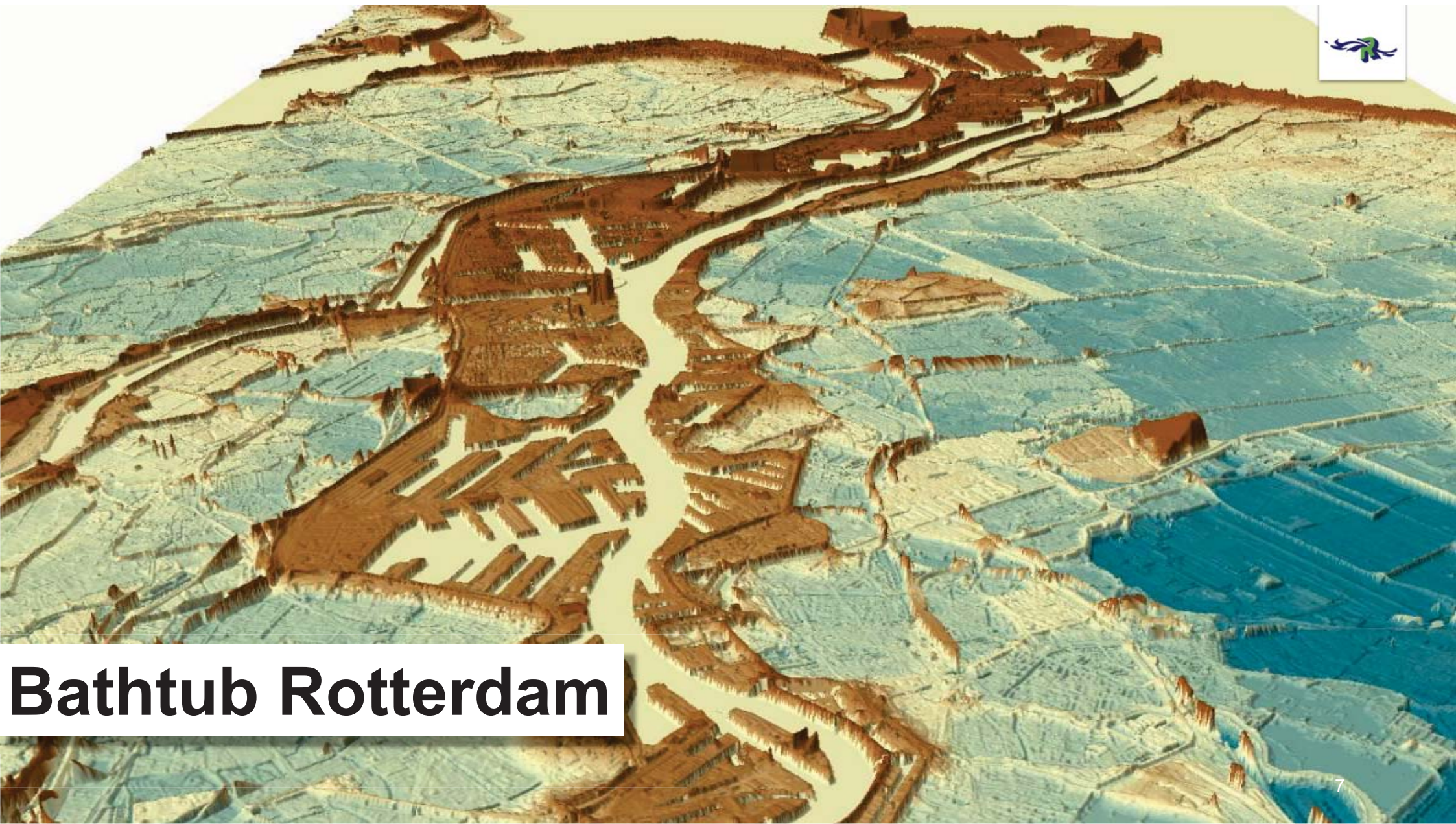
Present





Rotterdam & Water

26-7-2018



Bathtub Rotterdam



Precipitation



River Discharges



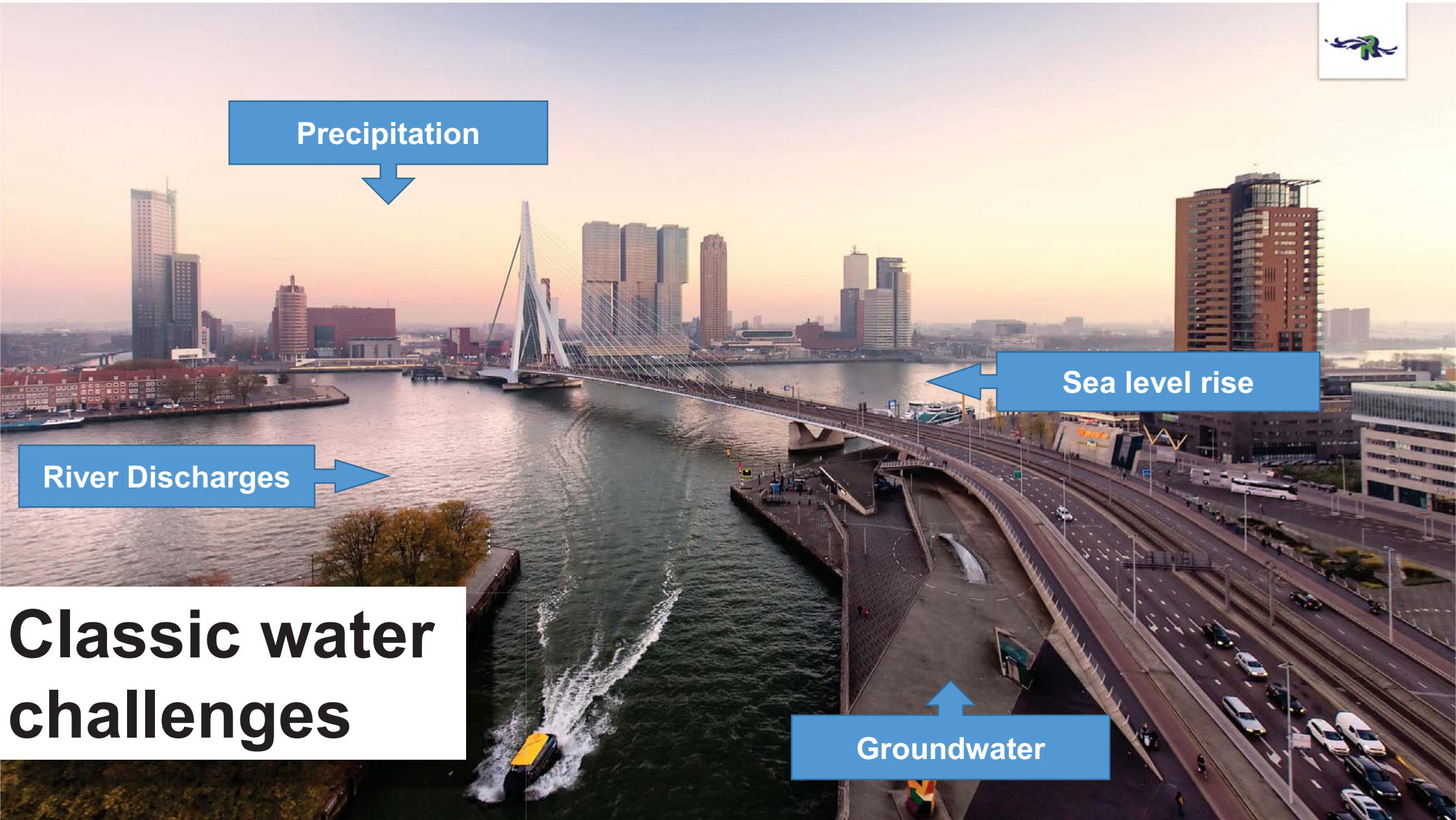
Sea level rise



Groundwater



Classic water challenges





Effects of Climate Change



Accelerated sea level rise



Lower river discharges in summer



Longer periods of heatstress



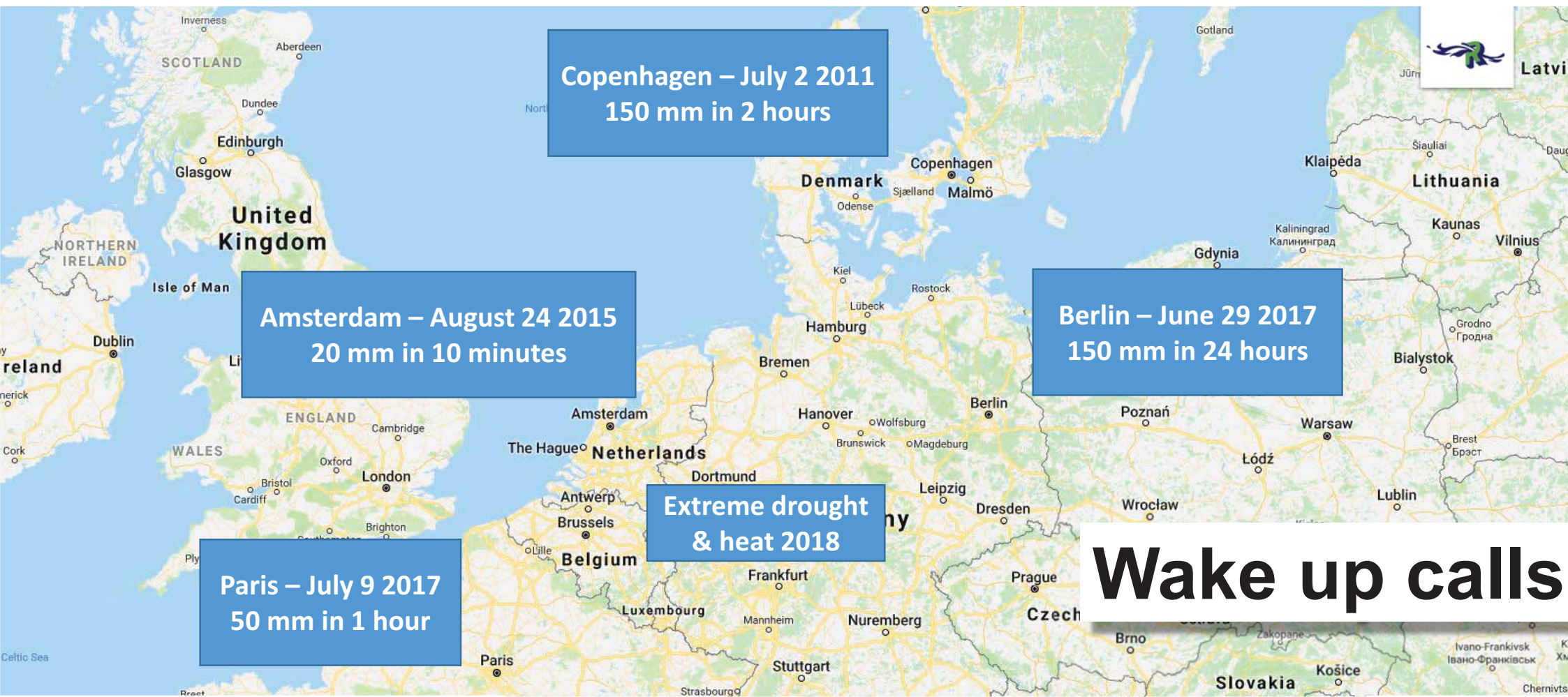
More frequent high intensity rain events



Higher river discharges in winter



Longer periods of extreme drought



Wake up calls





DEMOGRAPHICS



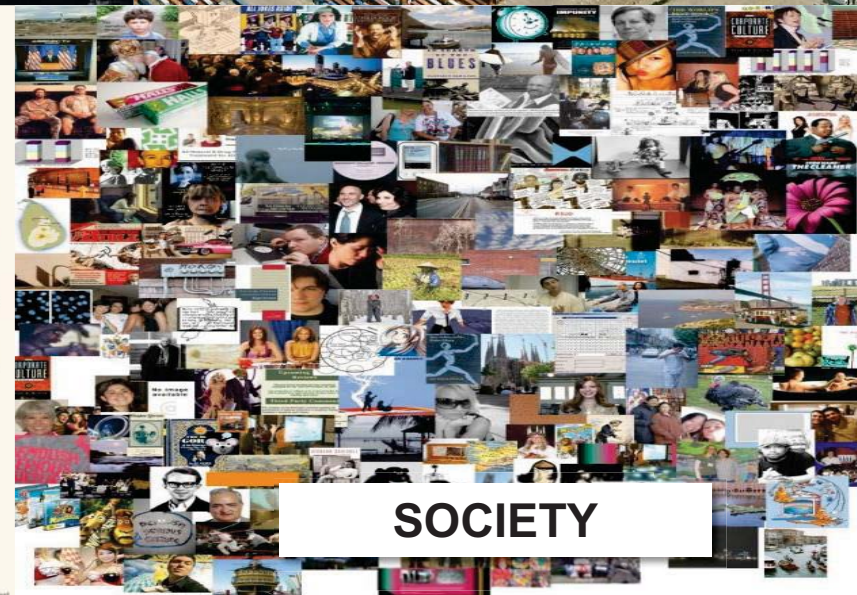
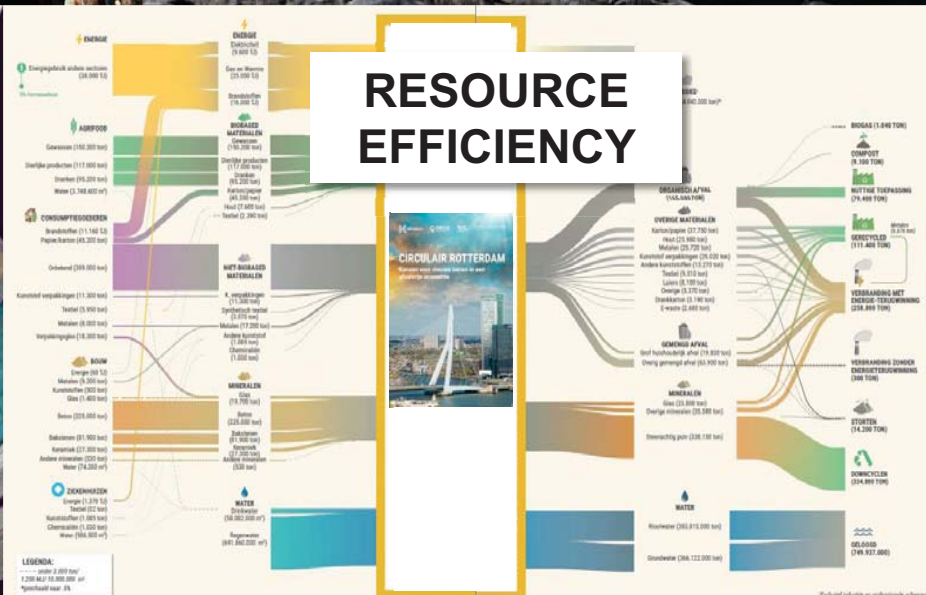
CLIMATE



ECONOMY



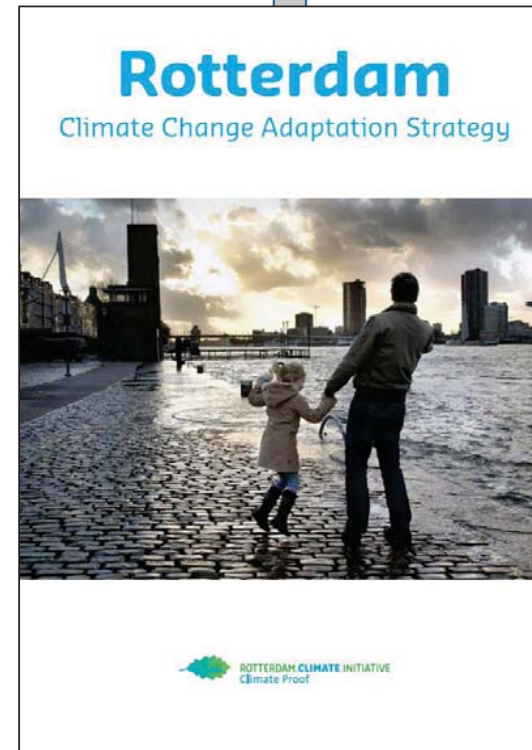
TECHNOLOGY



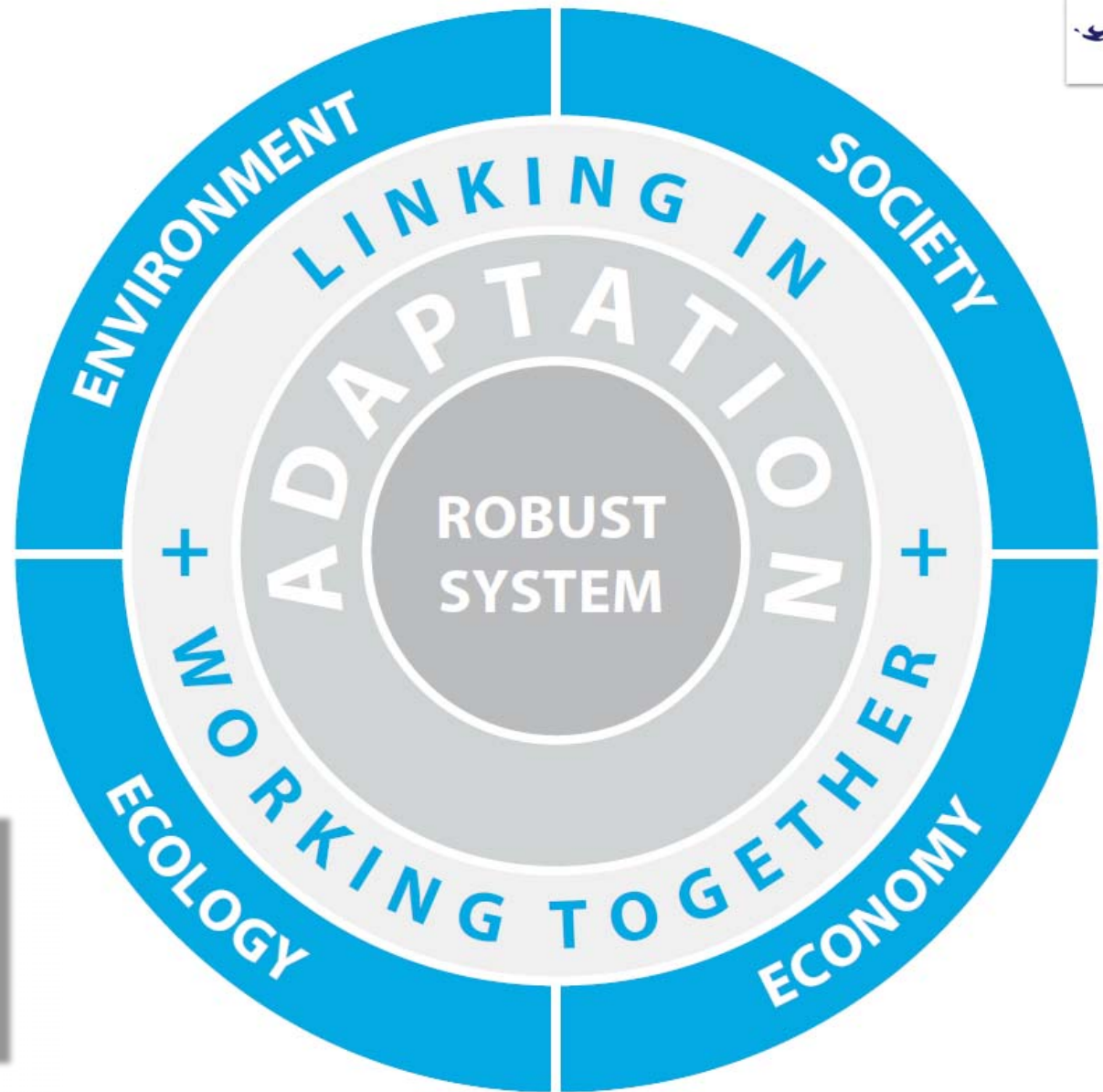
SOCIETY



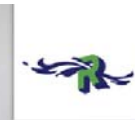
National policy



Municipal policy



**A robust system
at the core**



Monitor



High resolution, interactive modelling



Zoek naar plaatsen, of datum (t.e. 23-10-2013)

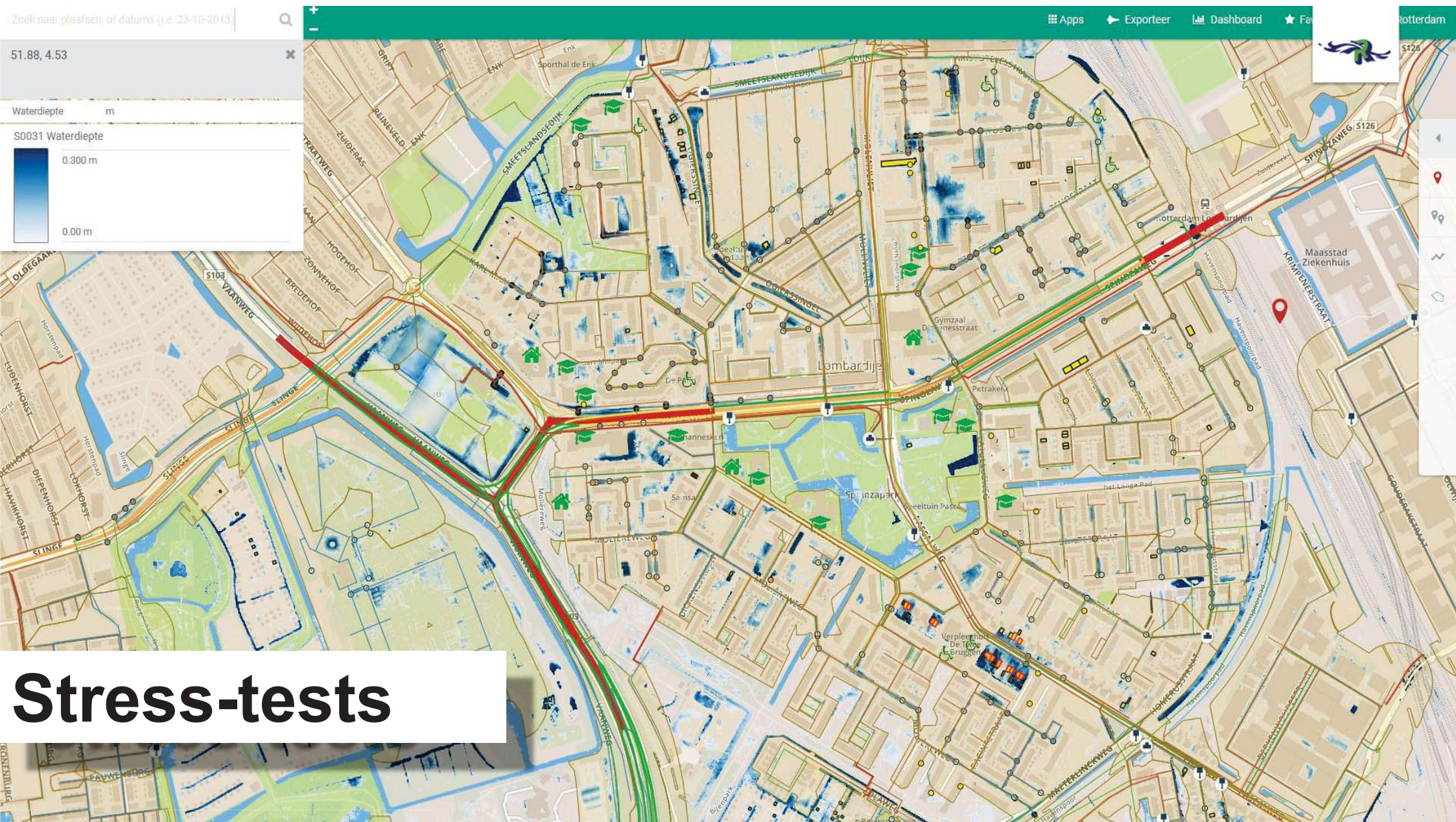
51.88, 4.53

Waterdiepte m

S0031 Waterdiepte

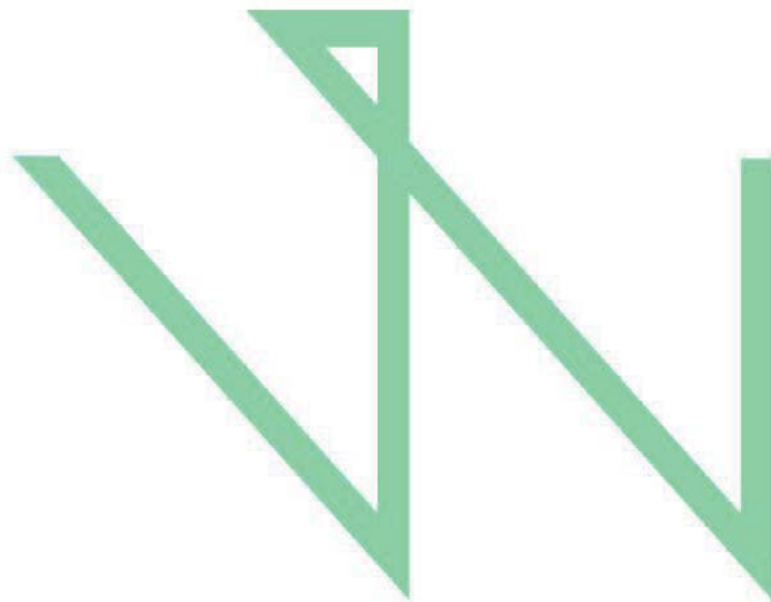


Stress-tests



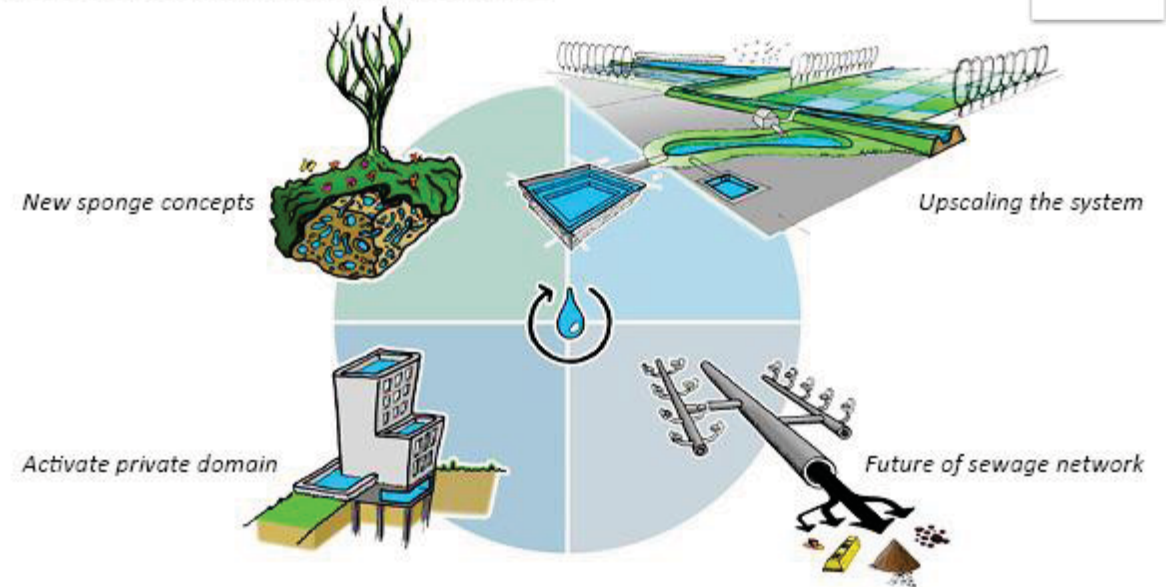


Experiments



WaterSensitive
Rotterdam

THE AGENDA FOR A WATER SENSITIVE ROTTERDAM



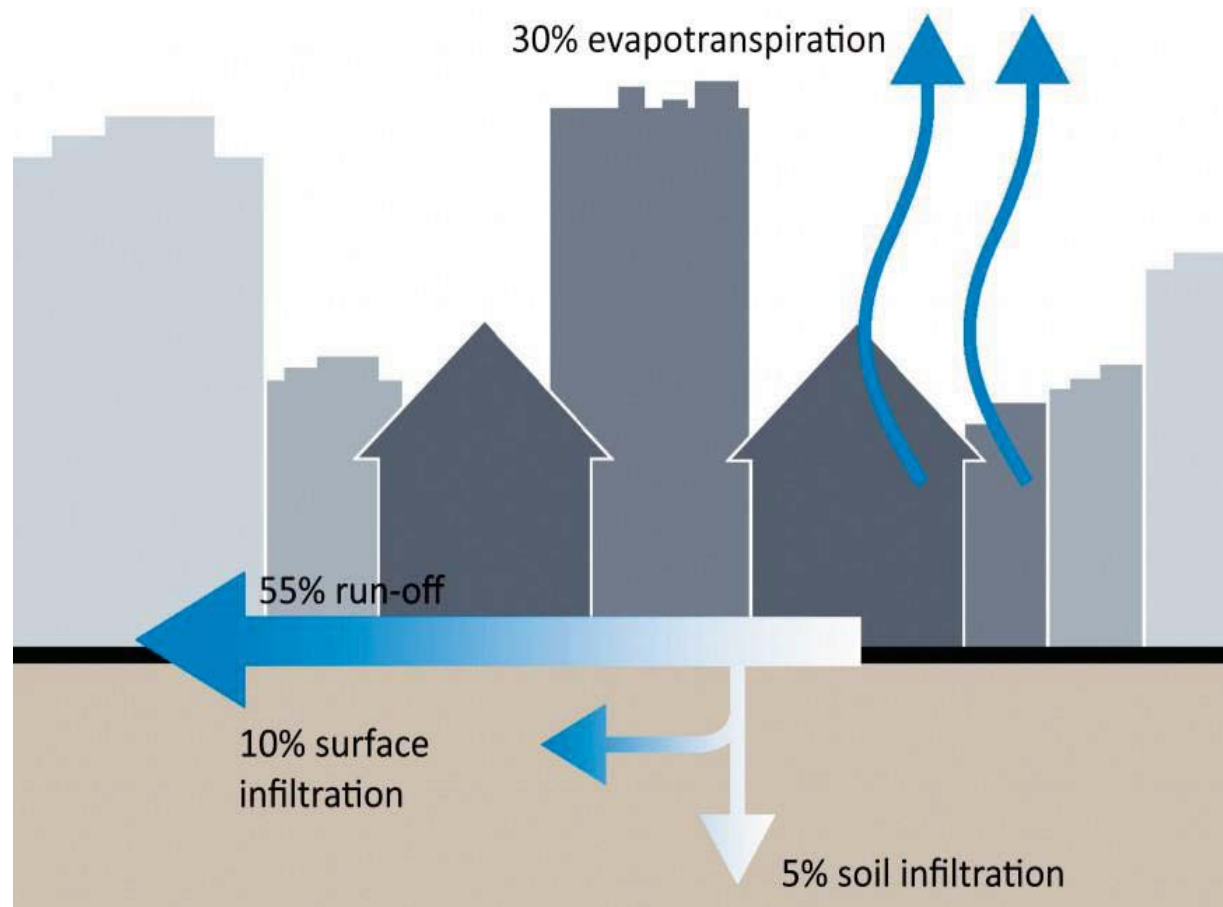
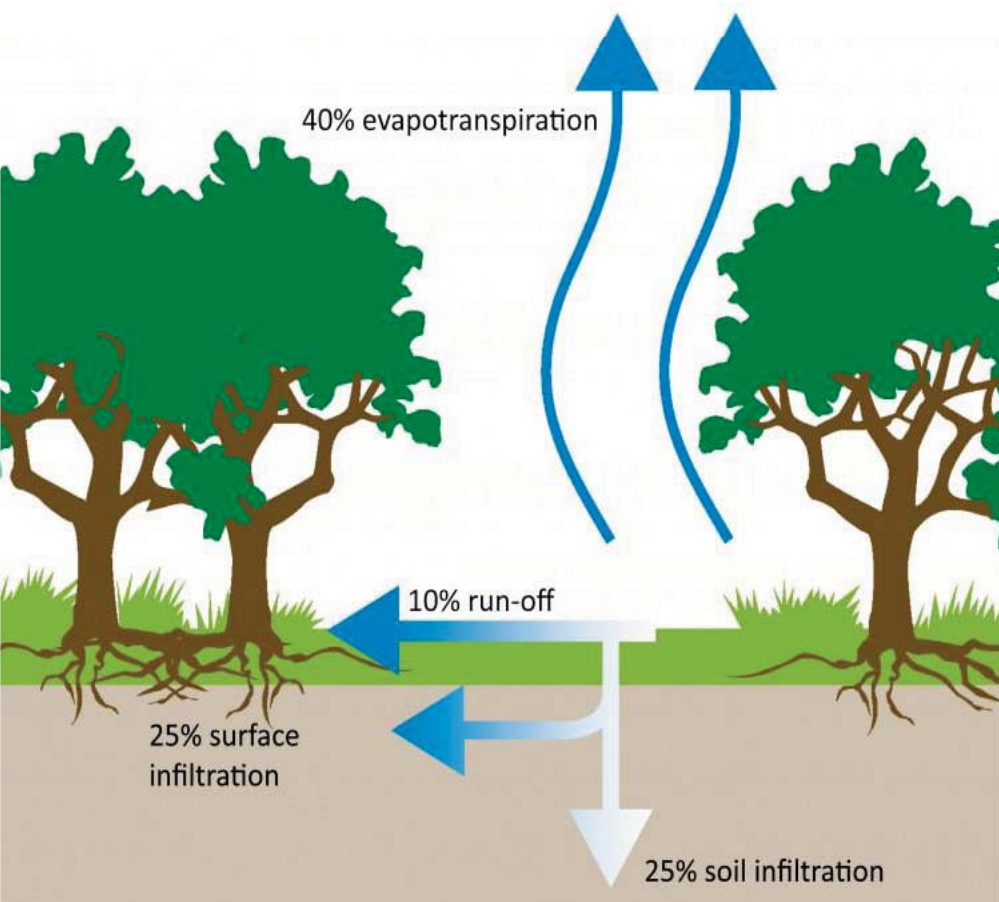
Increase awareness
Showcase projects
Outreach and communication

<http://www.watersensitiverotterdam.nl/>

<http://www.urbanisten.nl/wp/?portfolio=water-sensitive-zomerhof-agnese-district>



Repairing a disturbed water cycle





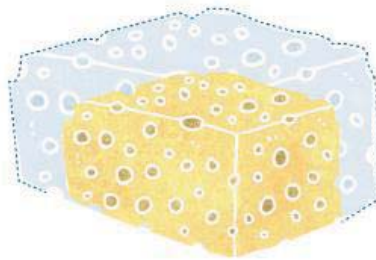
Old



Current



COLLECTING



STORING



REUSING

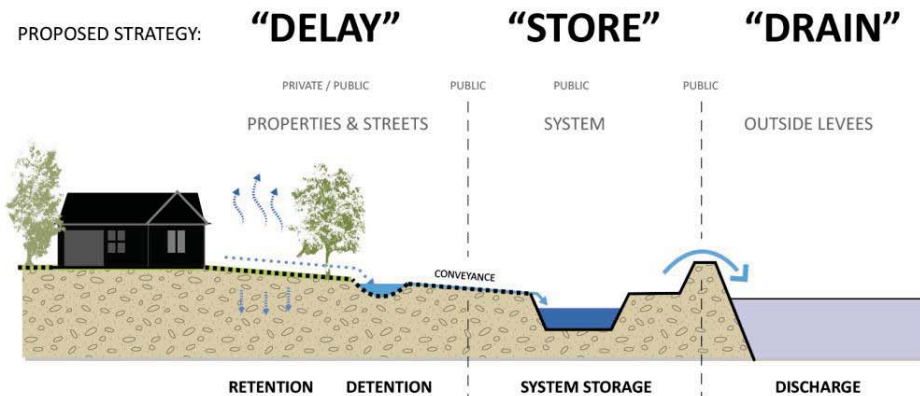
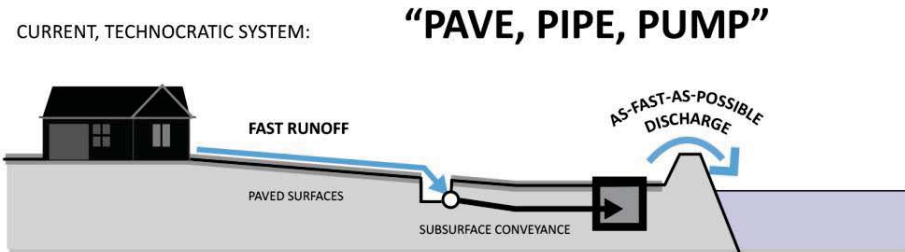
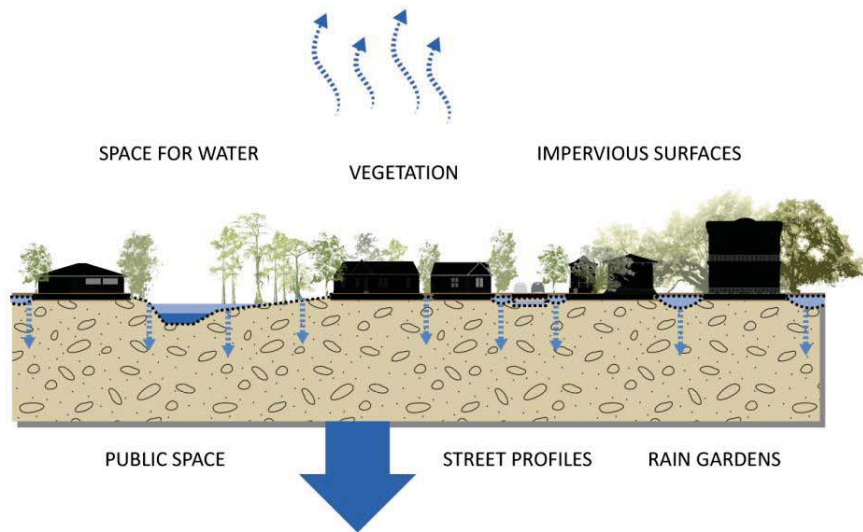
City as a sponge



CITY AS A SPONGE

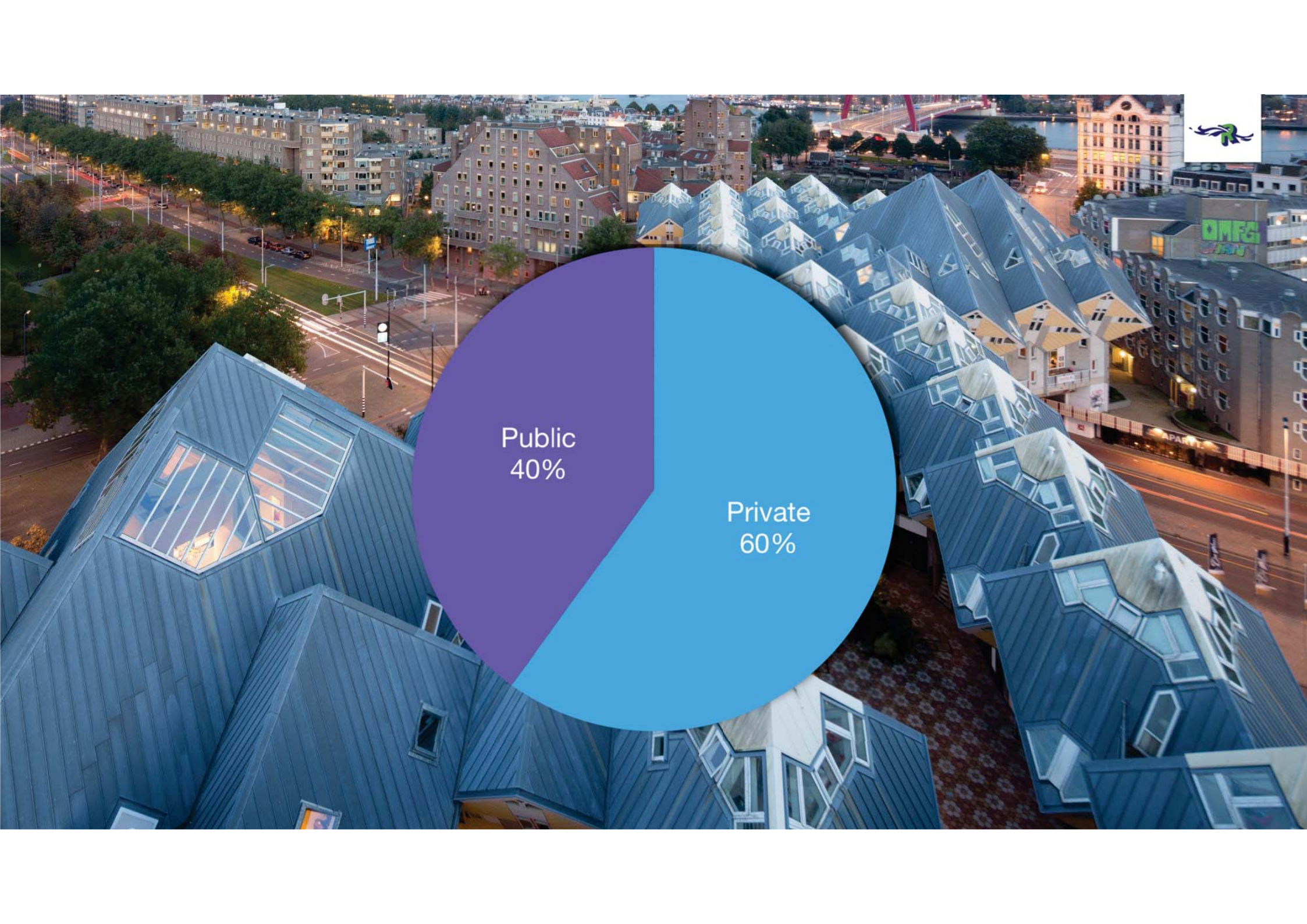
NATURAL AND CONSTRUCTED ELEMENTS IN THE CITY
ABSORB WATER & HELP REDUCE RUNOFF:

**MORE WATER
EVAPORATES & TRANSPIRES**



‘living with water’ principle

Dutch 4th Water Management memorandum



Public
40%

Private
60%



OMEGA
JUN

APART



**Social
Housing**



**Project
Development**



**Private
Homes**



Public



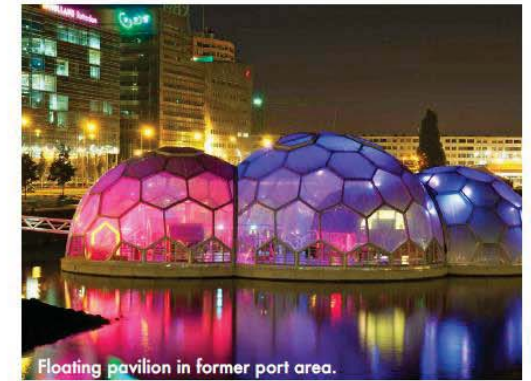
Maeslant storm surge barrier, protects the city of Rotterdam and its ports from flooding.



High resolution rainfall radar for measurements and forecasts on street level.



Prince Willem - Alexander Olympic rowing course combined with extensive water storage.



Floating pavilion in former port area.



Multifunctional dike combining a dike with a park and a shopping mall.



Benthemplein water square combines water storage with improvement of the public space.



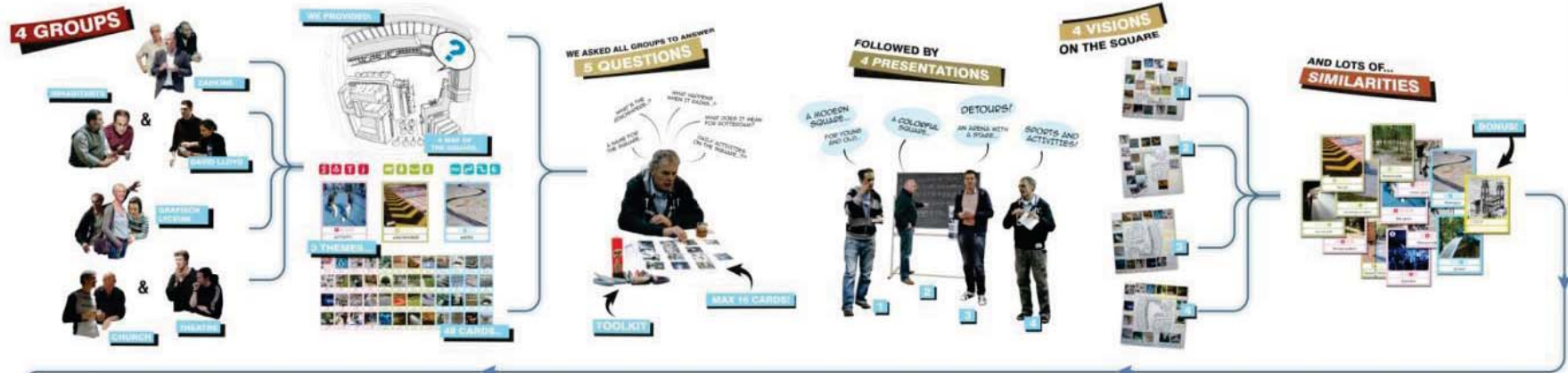
Potential multifunctional use of 14.5 km2 flat roofs in the city for water storage, energy and recreation.



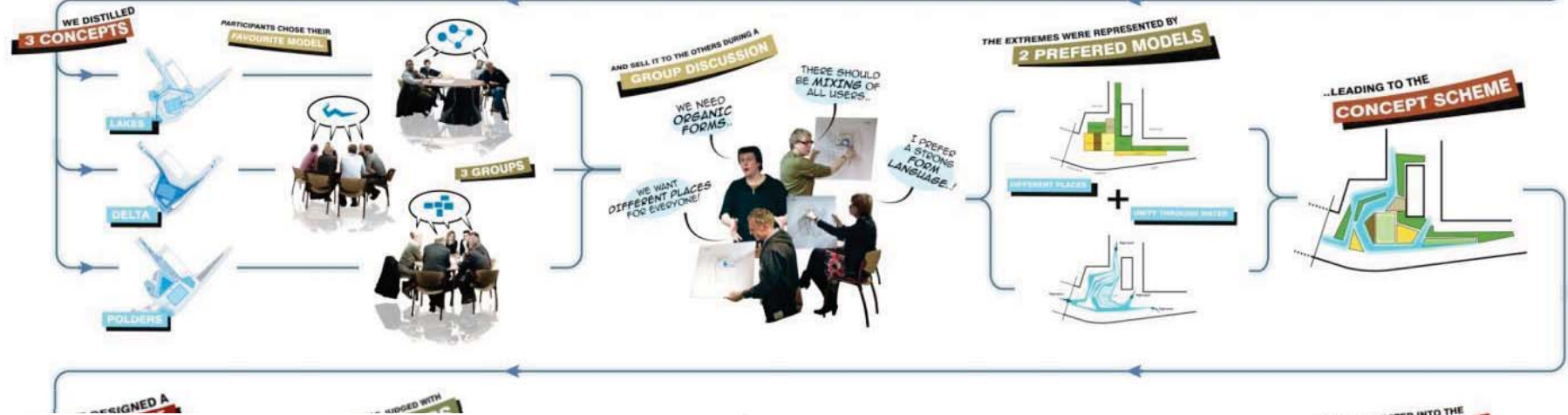
Facade gardens are pocket parks increasing the attractiveness of a street and allowing rainwater to infiltrate into the ground.



WORKSHOP 1

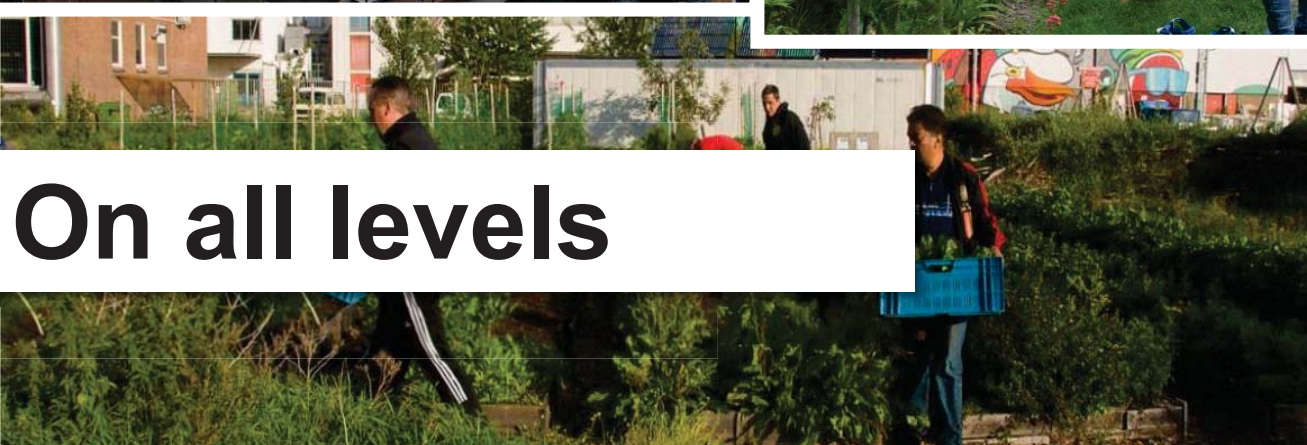


WORKSHOP 2



Measures designed through participation





On all levels



Social And Physical





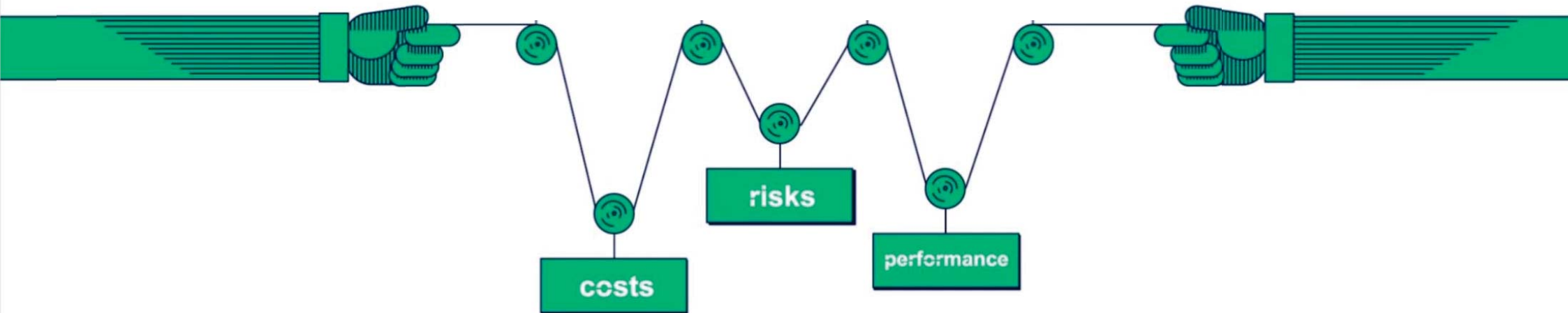
Considering key values





Change approach of Asset Management

- **Understanding added value** on a higher level
- Integrated approach and **breaking down silo's**
- **Mainstreaming** water sensitive solutions





Kaart van de gemeente Rotterdam

Home ▾ Onderhoudsbehoeftekaart Openbare Werken

Delen Afdrukken Meten Adres of plaats zoeken

Details Basiskaart

Over Content Legenda

Legenda

Onderhoudsbehoefte Riolering

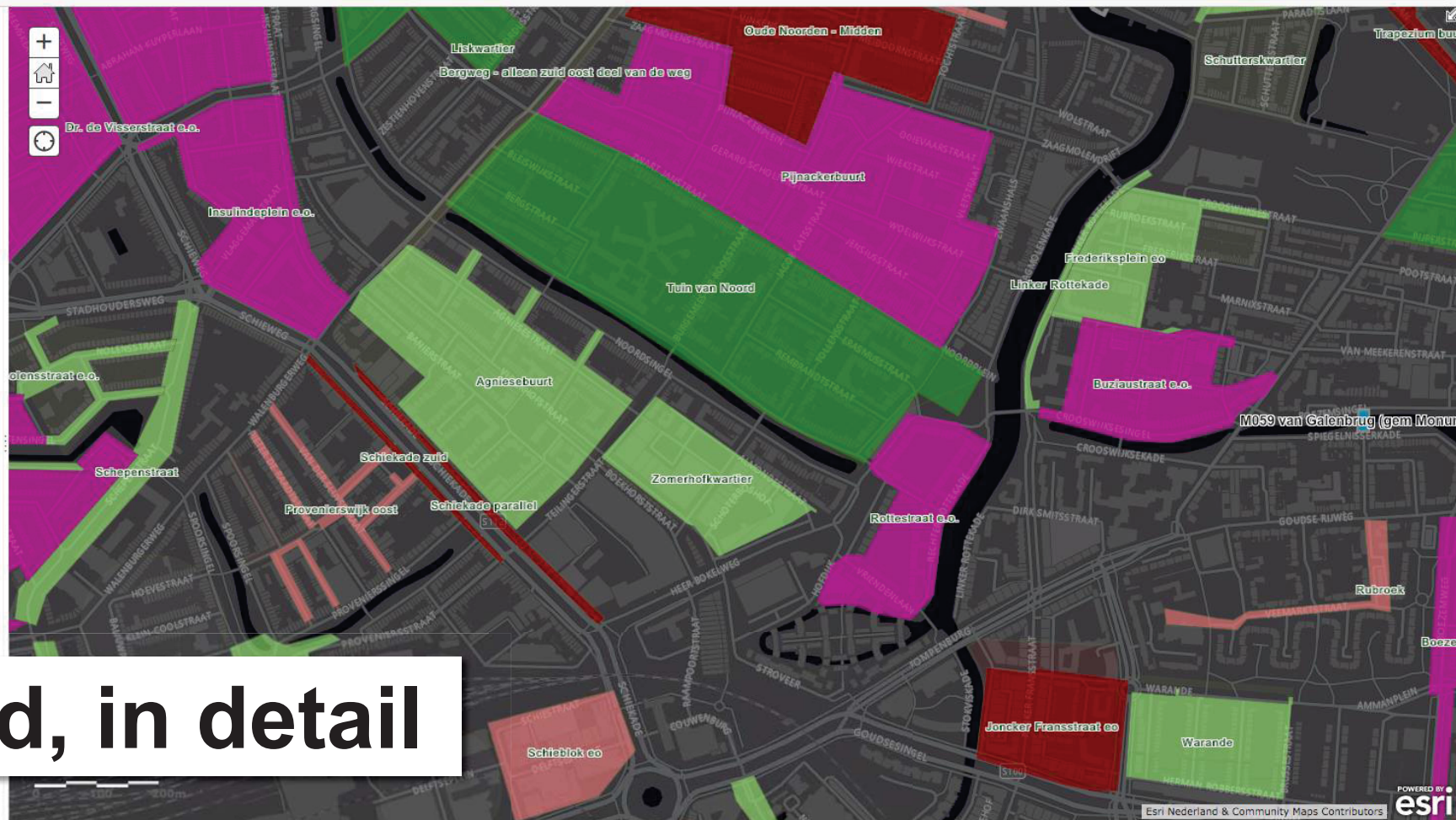
- Integraal korte termijn
- Singulier Korte termijn
- Integraal lange termijn
- Singulier lange termijn
- 11e jaar

Onderhoudsbehoefte groen en spelen (punt)

- Bomen
- Groenprojecten
- Speelplaatsen

Onderhoudsbehoefte Wegen

- Boezemkades
- Fietspaden
- Hoofdinfra
- Natuursteen
- Overig asfalt
- Paden in parken
- Partieel onderhoud elementen



Plan ahead, in detail

Beschoeiingen
Persiëdiingen
Esri.com ArcGIS Marketplace Help Gebruiksvoorwaarden Privacy Contact
opnemen met Esri Misbruik melden Contact

1 januari 1970 - 1 januari 1975

Esri Nederland & Community Maps Contributors

esri



Permeable Pavement



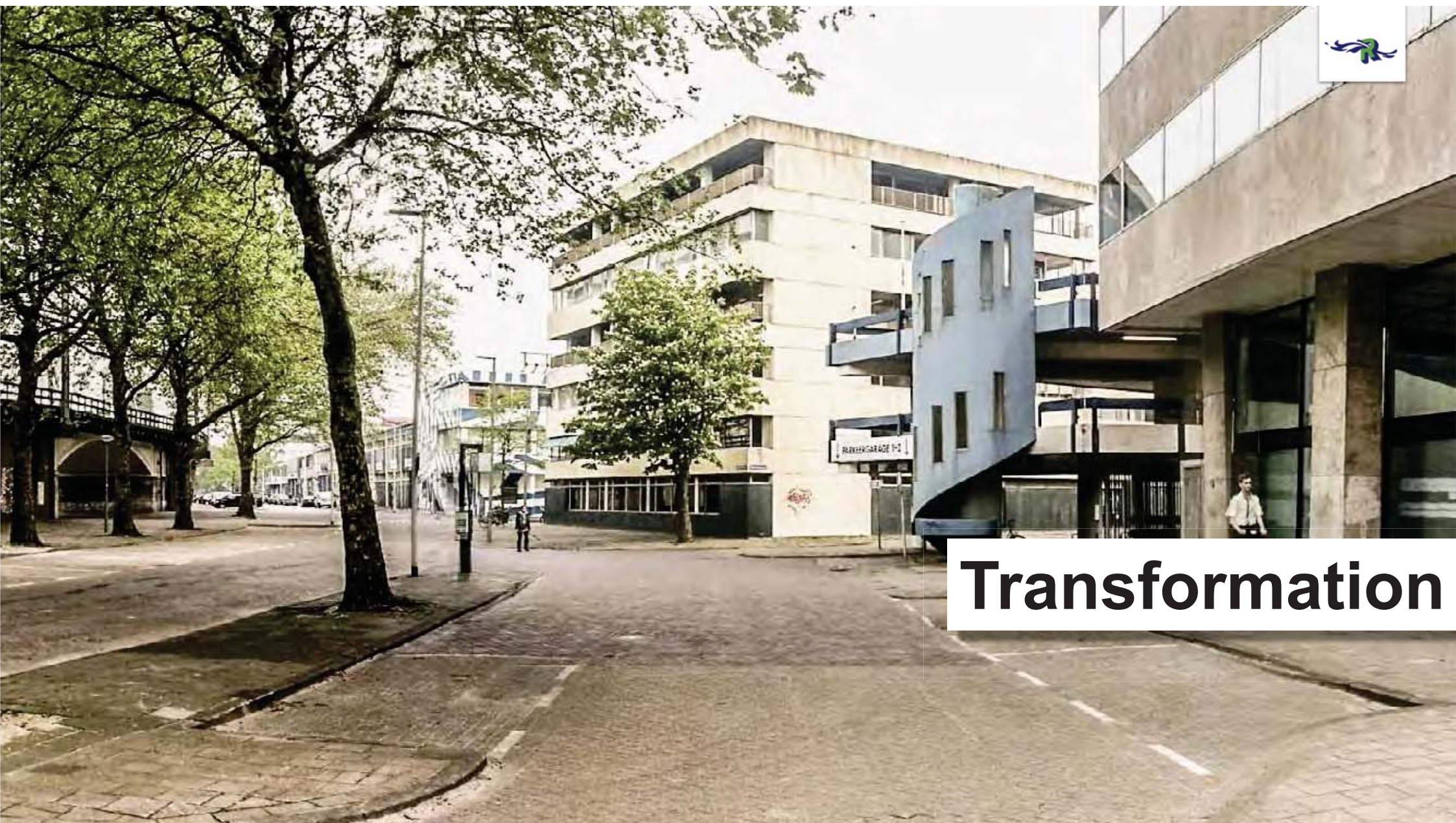
Permeable



Non Permeable



	Permeable	Non Permeable
Economy	—	+
Environment & Health	+	○
Resiliency	++	○
Accessibility	++	+



Transformation



Old



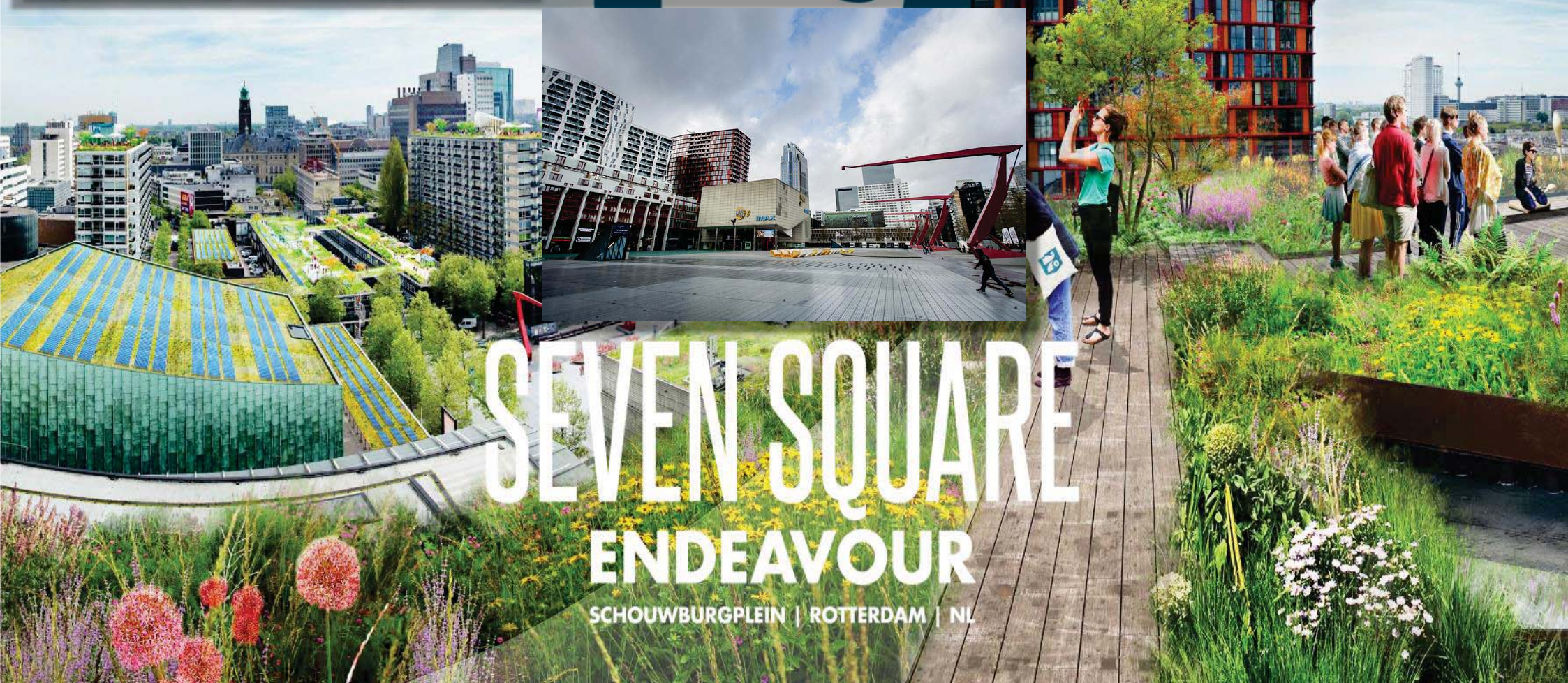
New



	Old	New
Economy	○	—
Environment & Health	+	++
Resiliency	—	+
Accessibility	++	○

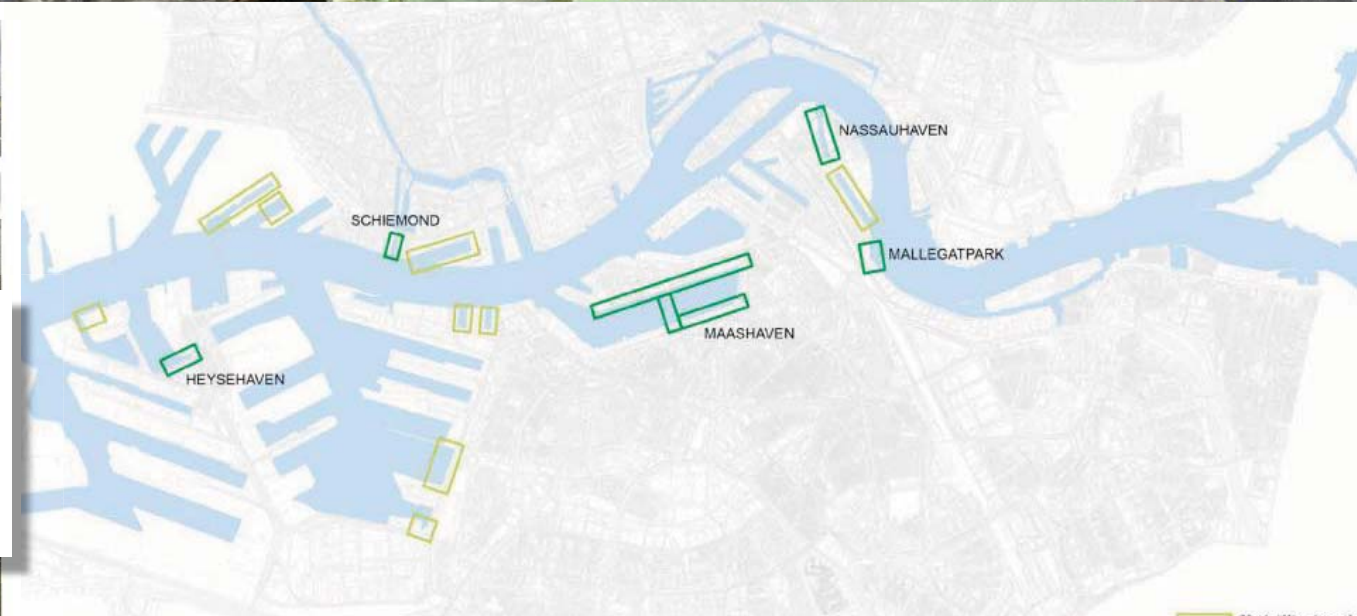
Public space transformation

<http://www.7square-endeavour.nl/EN/>





Renewal of inner city harbours



Urban tidal parks

nature + flood safety + renewal + liveability +
re-use of construction material





Water storage + recreation + nature

Multifunctional levee – roof park





Floating structures

OPPORTUNITIES FOR A SUSTAINABLE ROTTERDAM ROOFSCAPE

Rotterdam has a unique roof landscape created by historic events. After the 2nd world war, a lot of flat roofs have been built ranging from low rise buildings in the harbour to high rise buildings in the city centre. Rotterdam consists of 14.5 km² of flat roofs. All these roofs – From flat to inclined and from large to small – offer much more possibilities than expected. The municipality of Rotterdam wants to encourage citizens to actively use their rooftops. With joint forces, a colourful and unique roof landscape can arise in Rotterdam.

In a busy city with a high density, the roof landscape provides space for a multifunctional use. A potential that demands to be exploited. Rotterdam has challenges in terms of water storage, cooling and greening the city and generating sustainable energy. The roofs of the city offer plenty of space to deal with these challenges. The Rotterdam roof landscape is also perfectly suitable for urban activities, such as private terraces and public rooftop parks.

DIFFERENT TYPES OF SUSTAINABLE ROOFS



Green roofs are vegetated roofs. These can be extensive; for example a sedum roof or a grass roof. An intensive green roof is accessible and contains a broad mix of plants.



Blue roofs buffer extra rainwater in times of heavy precipitation. These roofs often have a special collecting system below a layer of vegetation.



Red roofs are actively used for purposes such as sports, parties, meetings and receptions.



On yellow roofs sustainable energy is generated, e.g. with solar panels or urban wind turbines.



Roofs on high rise buildings offer space for recreation and concentration, unique views and new insights.



Roofs on high rise buildings are suitable for biodiversity; they are unreachable and provide overview for hunting animals and shelter for prey.



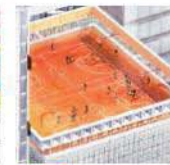
Roofs on high rise buildings are places for celebration and fun with the skyline as scenery.



Roofs on high rise buildings are highly exposed to wind, especially if they are oriented directly west.



Solid, firmly constructed, roofs are revived through urban agriculture.



Large roofs of parking garages offer space for sports landscapes.



Large commercial buildings are enriched with public roof top parks.



Aesthetic roof gardens contrast with the bold scenery of the city.



The blue roof reflects the ever changing Rotterdam sky.



An energy landscape follows the urban composition of the post-war district, characterised by repetitiveness.



The 19th century building block has a colourful and intensively used roof landscape.



The suburban street has an efficient roof landscape.



A monument also gives opportunities for a sustainable roof.



There is space for large-scale energy harvesting in solar fields on the roofs of warehouses in the harbour.

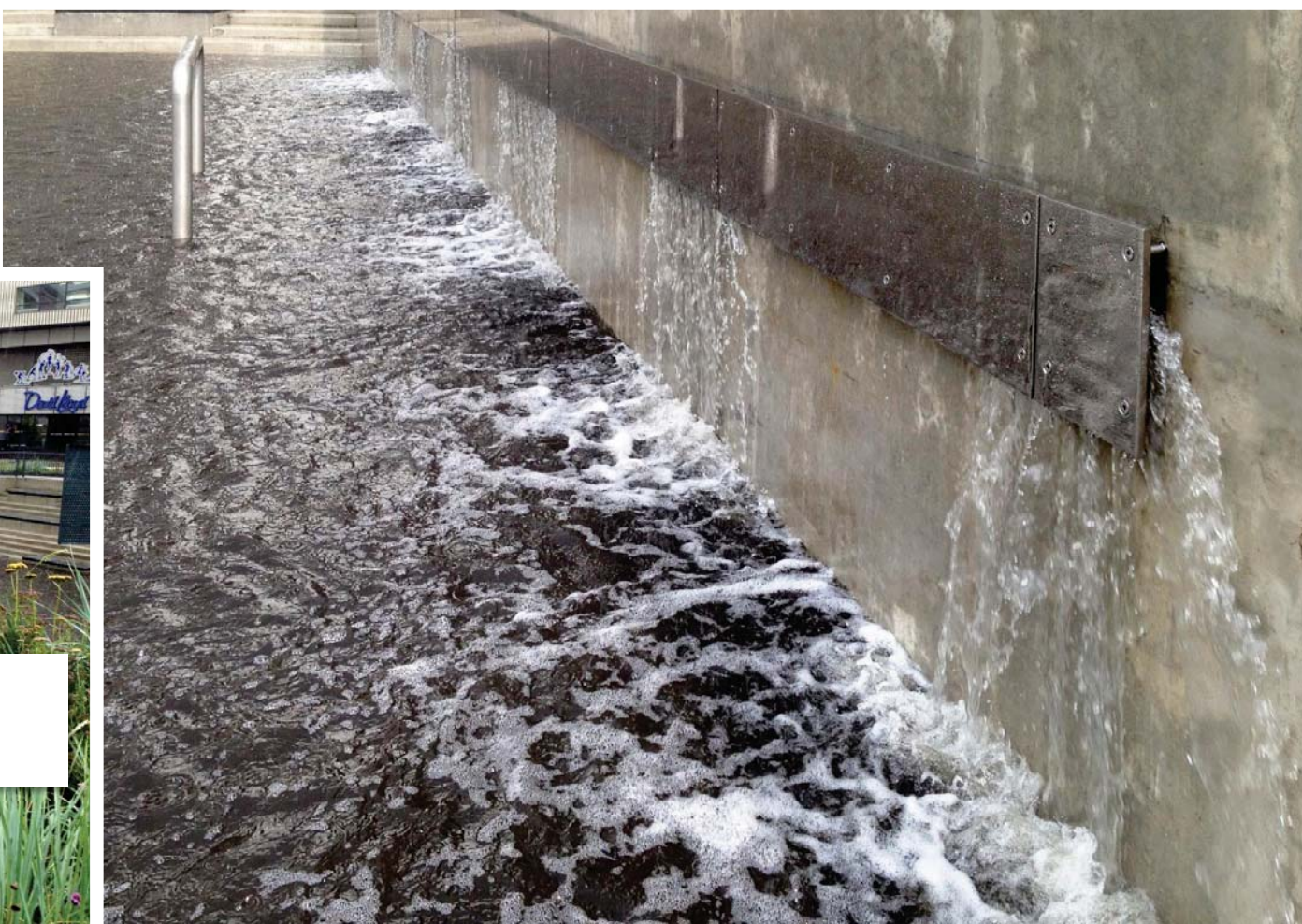


There is space for large scale roof ecology in the story logistical area of the harbour.

Rotterdam Roofscapes



Water Square



During rain

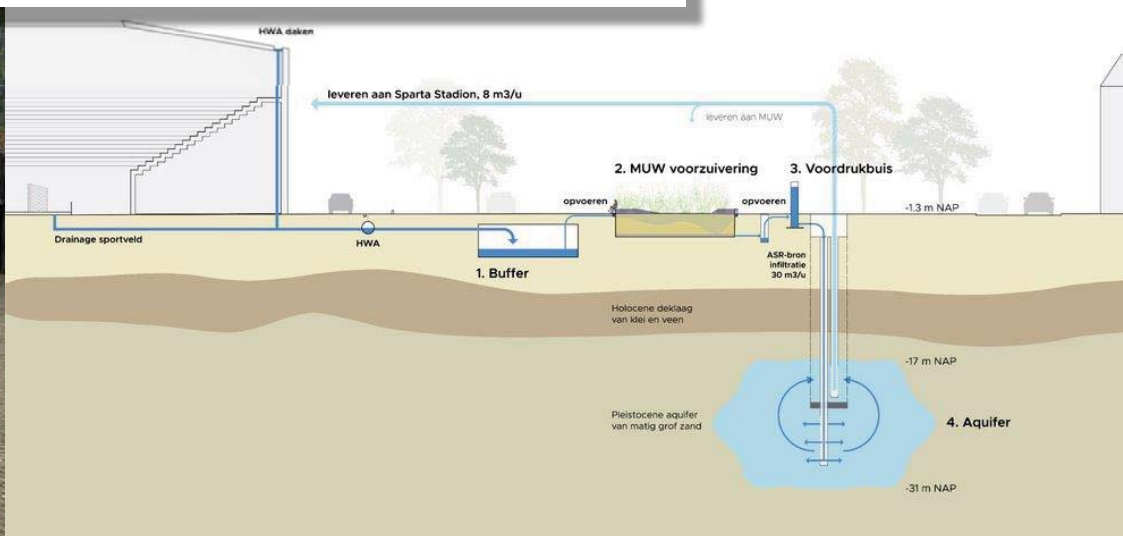




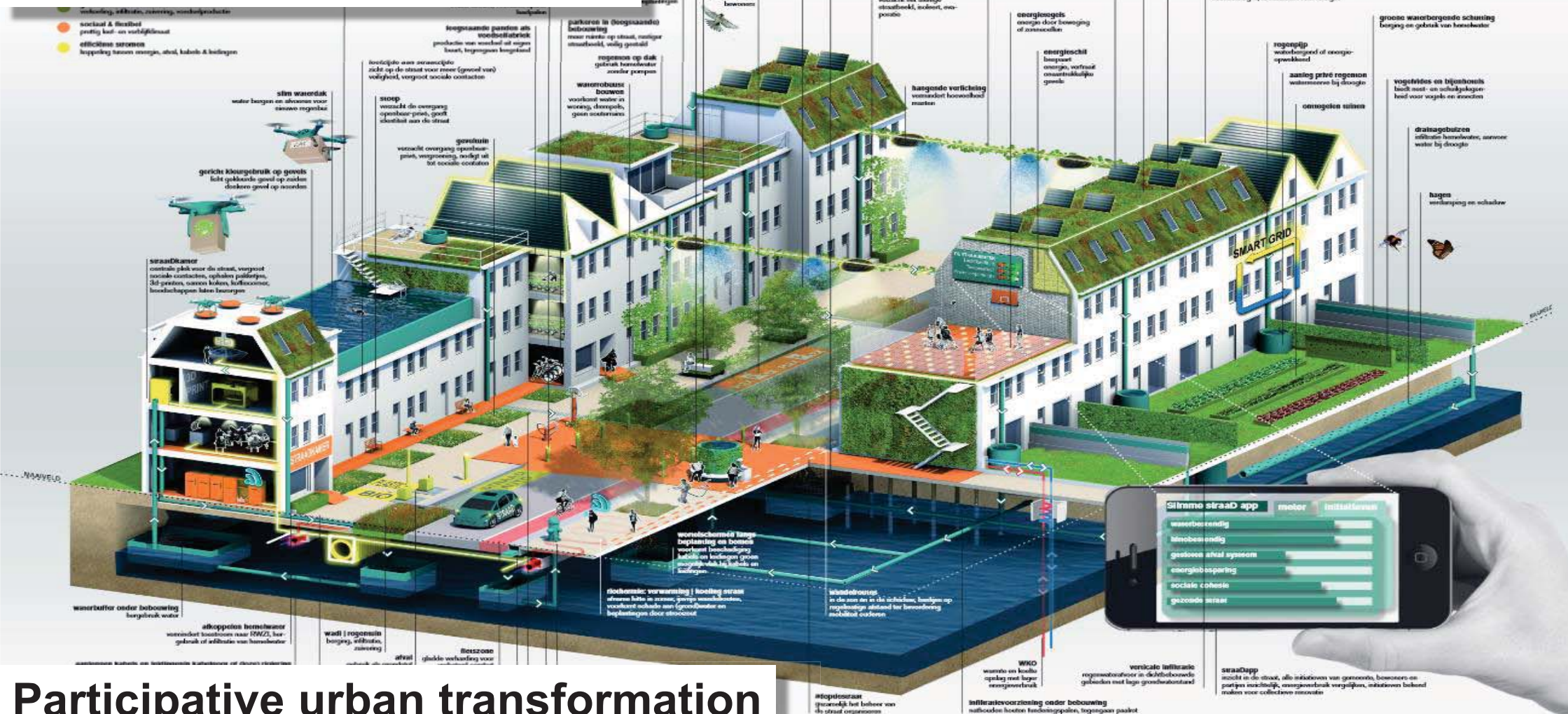
Daily use



Underground storm water retention



s.m.a.r.t. STREET



Participative urban transformation

Voor meer informatie zie www.bosch-slabbers.nl

bosch slabbers
TUIN- EN LANDSCHAPARCHITECTEN

Buro
Bergh

Deltares
advies & realisatie



stowa

European Union
This project has been partly financed by the European Union
under the Horizon 2020 programme
of the European Union

WATERBETRIJF
DELFTLAND

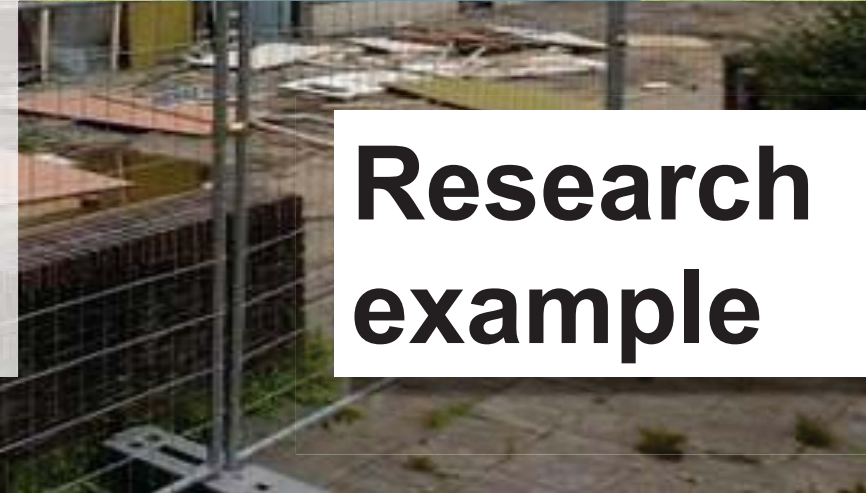


Flood risk management using a resettlement framework

1st: Explore alternatives to relocation

If relocation is inevitable, **resettlement plan** should consider:

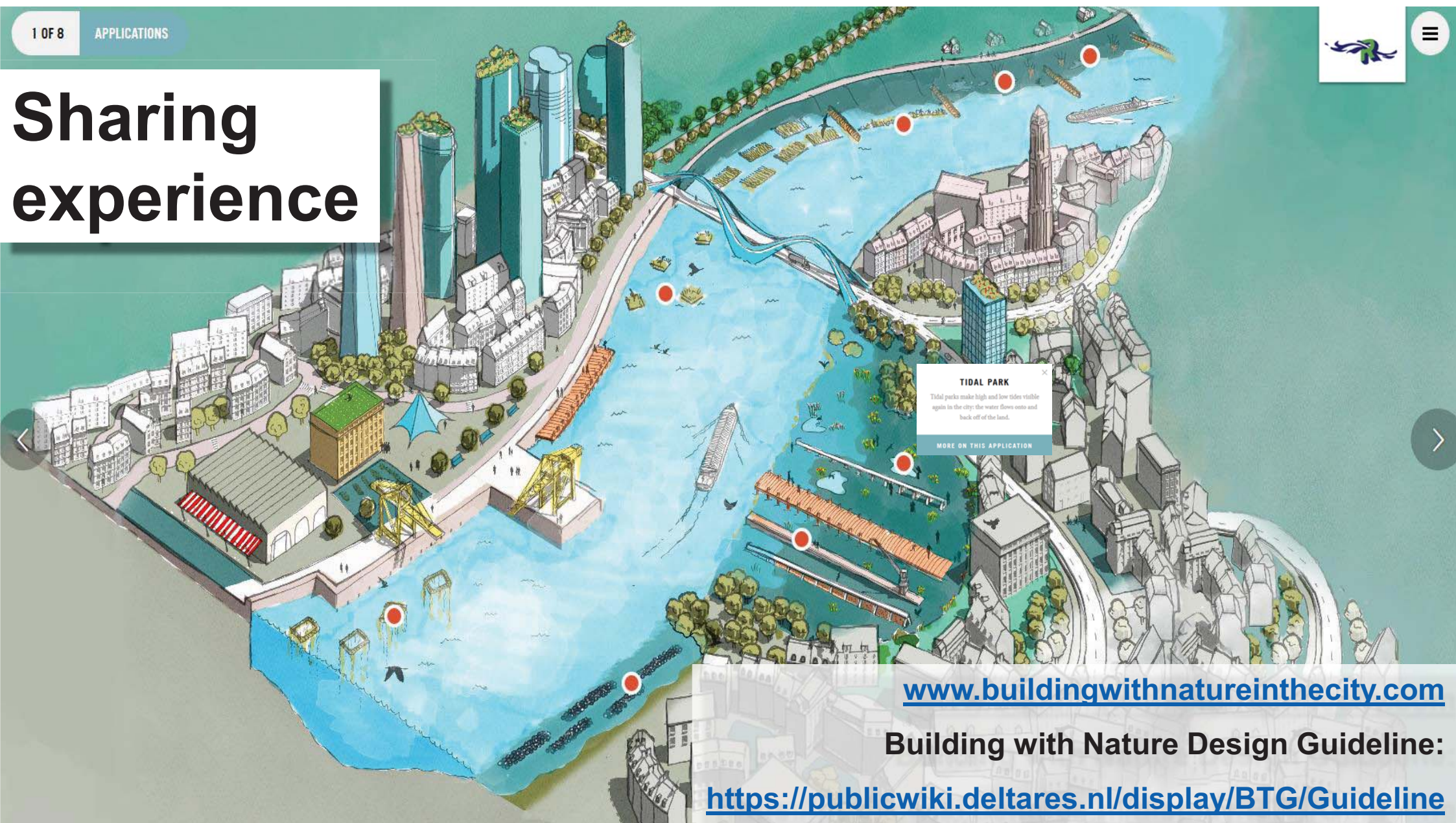
- Livelihood restoration
- Access to urban services
- Improved quality of infrastructure
- Mitigation of negative social impact



**Research
example**



Sharing experience



www.buildingwithnatureinthecity.com

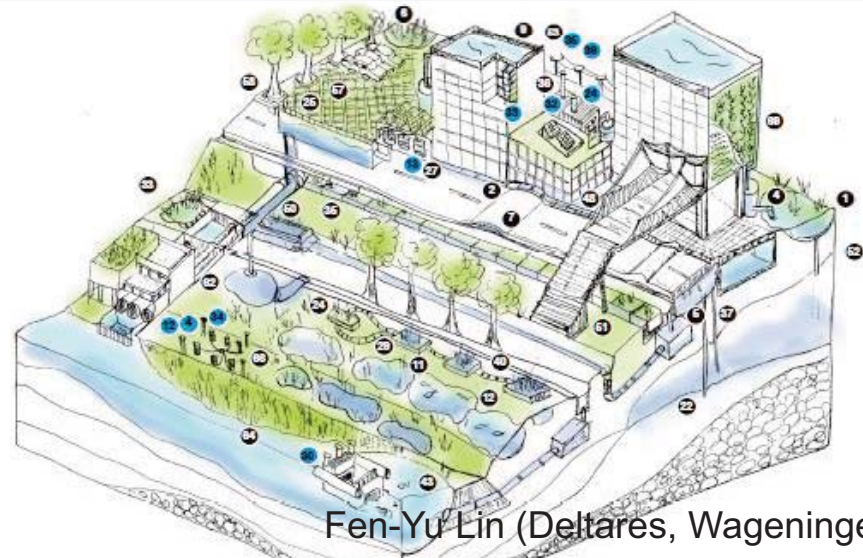
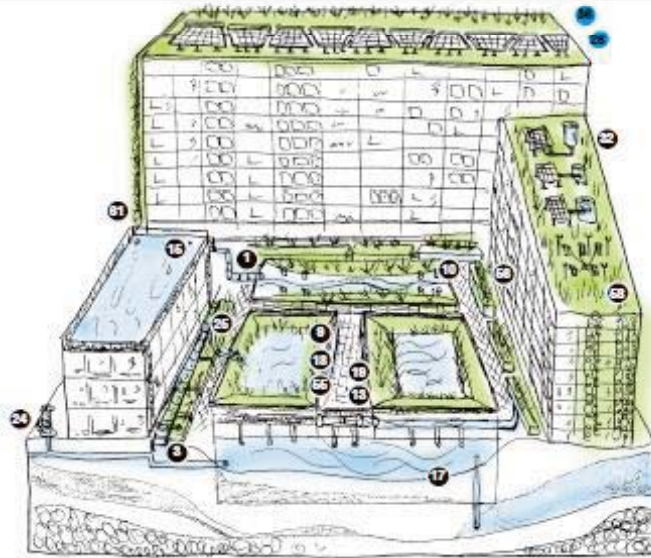
Building with Nature Design Guideline:

<https://publicwiki.deltares.nl/display/BTG/Guideline>



Exploring application of concepts in other cities

Shezidao case



Fen-Yu Lin (Deltares, Wageningen University)

International cooperation



Global Centre of Excellence on
 **Climate**
Adaptation

PIONEERED BY THE
ROCKEFELLER FOUNDATION
100  RESILIENT CITIES

C40
CITIES
CLIMATE LEADERSHIP GROUP

Thank you for your attention

Rotterdam Centre for Resilient Delta Cities

<http://rdcroterdam.com/>

Rotterdam Climate Initiative

(i.a. Climate Adaptation Strategy)

<http://www.rotterdamclimateinitiative.nl/UK>

Rotterdam Resilience Strategy

<https://www.resilientrotterdam.nl/en/>

Building with nature in the city

<http://www.buildingwithnatureinthecity.com/>

Supporting Urban Resilience (movie)

https://www.youtube.com/watch?v=P_tZ5LooGB4

