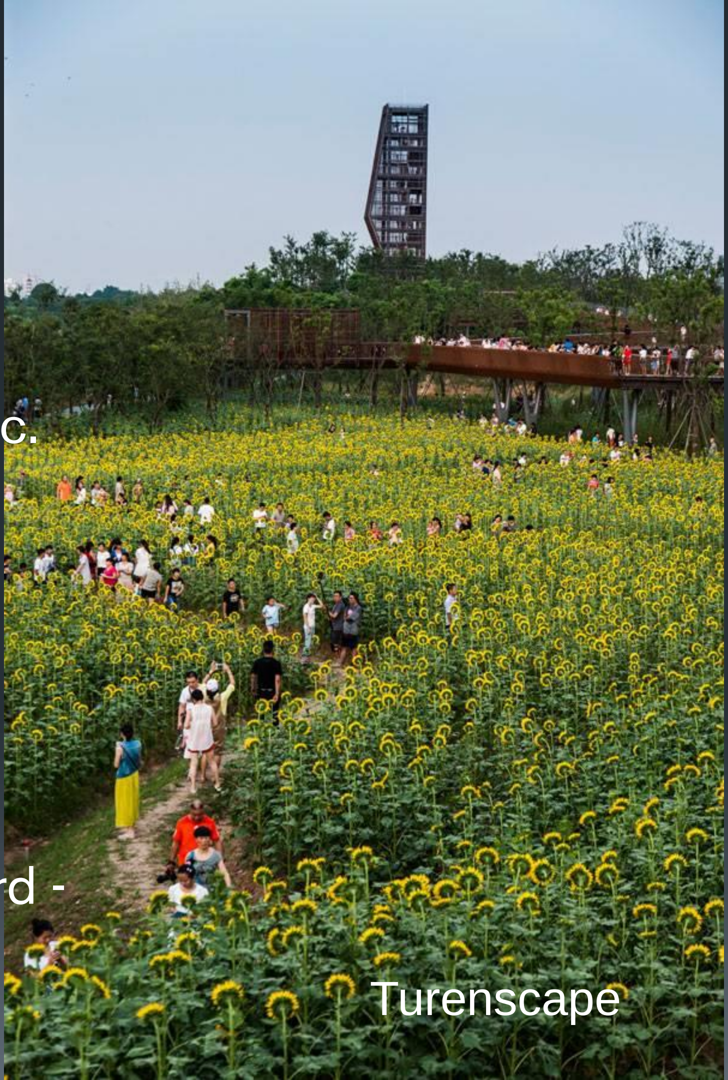
One Water

The many faces of 'One Water' thinking

Steve Moddemeyer, CollinsWoerman, Seattle

Outline

- One Water – US Water Alliance
- Cities of the Future – Int'l Water Assoc.
- Sponge Cities - China
- Cloudburst programs - Europe/USA
- Water Sensitive Cities – Australia
- L'Oréal Cosmetics – Paris
- A new mindset – Everywhere
- Resilient Design Performance Standard - USA



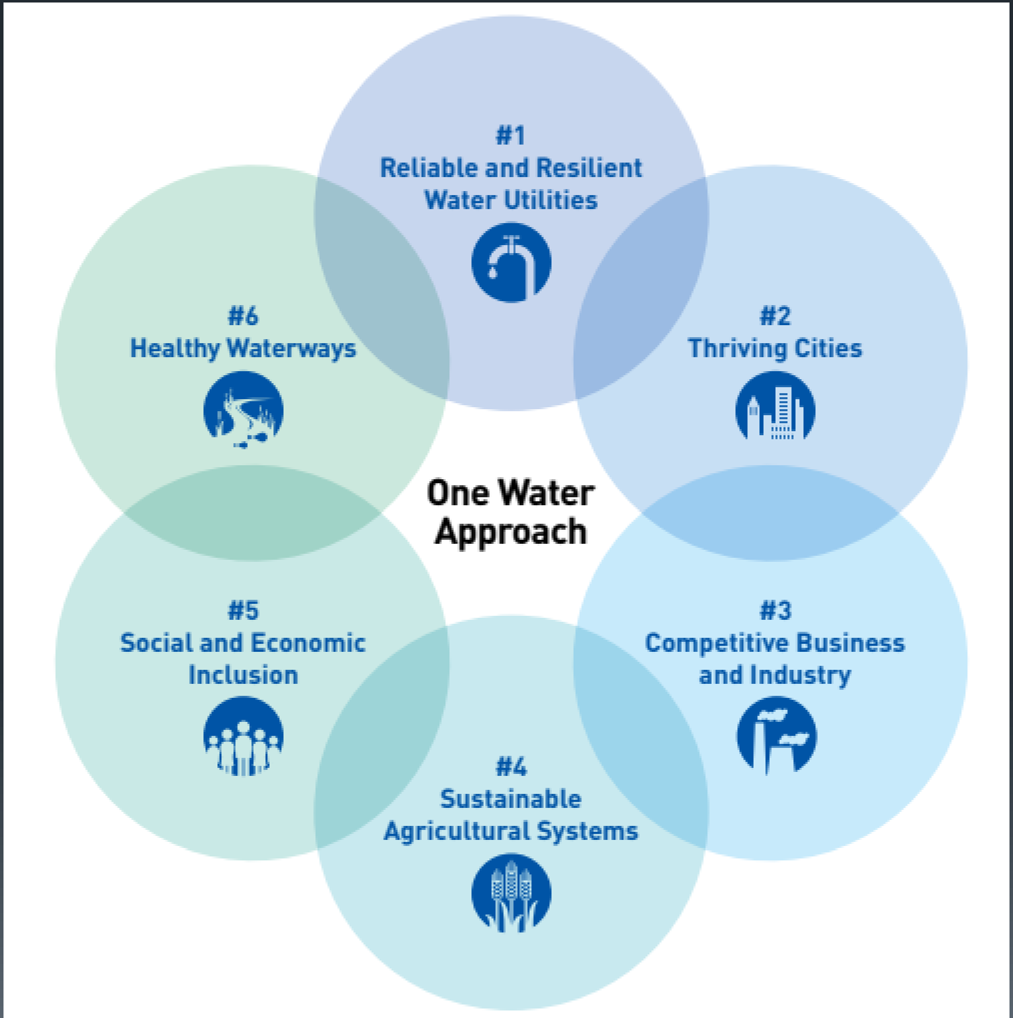
One Water Roadmap

- Alliance of water providers, companies, and NGOs
- Vision: Integrated and inclusive water management
- Challenges
  - Too much, too little
  - Water quality
  - Ecosystem degradation
  - Aging and inadequate infrastructure
  - Pricing & affordability
  - Changing climate
- Mindset
  - All water has value
  - Multiple benefits
  - Systems approach
  - Watershed scale thinking and action
  - Right-sized solutions
  - Partnerships for progress
  - Inclusion and engagement for all
- Knowledge
  - Share successes
  - Pool resources
- Implementation
  - Regulations
  - Finance
  - Public Private Partnerships

US Water Alliance

One Water

- Arenas for action
  1. Reliable & resilient water utilities
  2. Thriving cities
  3. Competitive business & industry
  4. Sustainable agricultural systems
  5. Social & economic inclusion
  6. Healthy waterways
- Implementation
  - Regulations
  - Finance
  - Public Private Partnerships



One Water

- Case studies
- Listening sessions
- One Water Webinars
- One Water Summit – July 12, 2018
- US Water Prize
- Seven Ideas for Fixing Water in the US

Cities of the Future

- Vision: Sustainable Urban Water in Resilient and Livable Cities
- Governance
  - From building to bioregion
  - Transdisciplinary
  - Collaboration and design across departments & authorities
- Planning
  - Asset management
  - General plan/comprehensive plan
- Knowledge
  - Share successes
  - Pool resources
- Implementation
  - Regulations
  - Finance
  - Public Private Partnerships

Sponge City - China

Sponge Cities integrate

- Green stormwater infrastructure
- Stormwater treatment
- Wastewater treatment
- Non-potable water use
- Rainwater harvesting
- Wetlands
- Natural systems polishing
- Habitat
- Passive recreation and aesthetics
- Urban agriculture
- Ecological restoration
- Blue-green networks

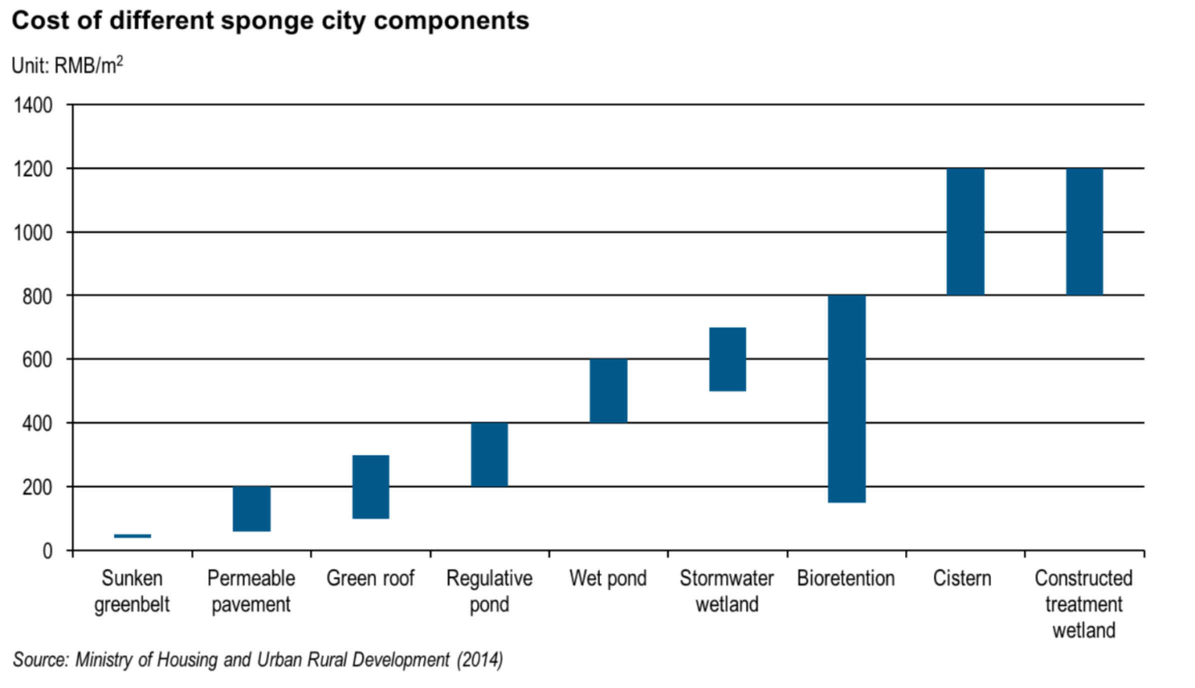
Sponge City

Turenscape

Sponge City

Turenscape

Sponge City Technical Guidebook



Sponge City Technical Guidebook

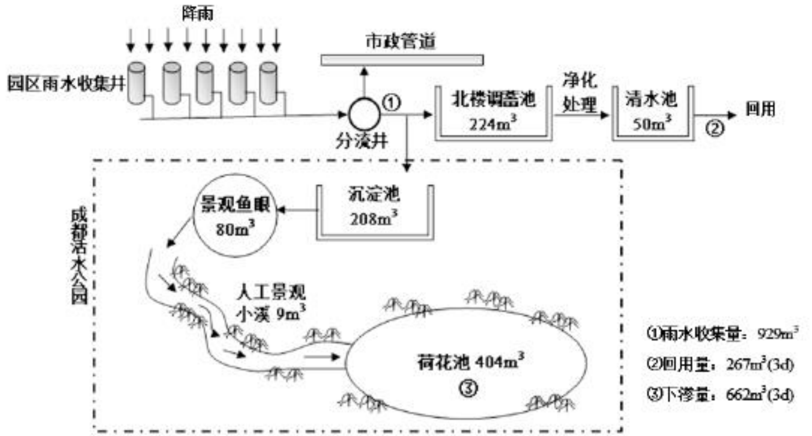
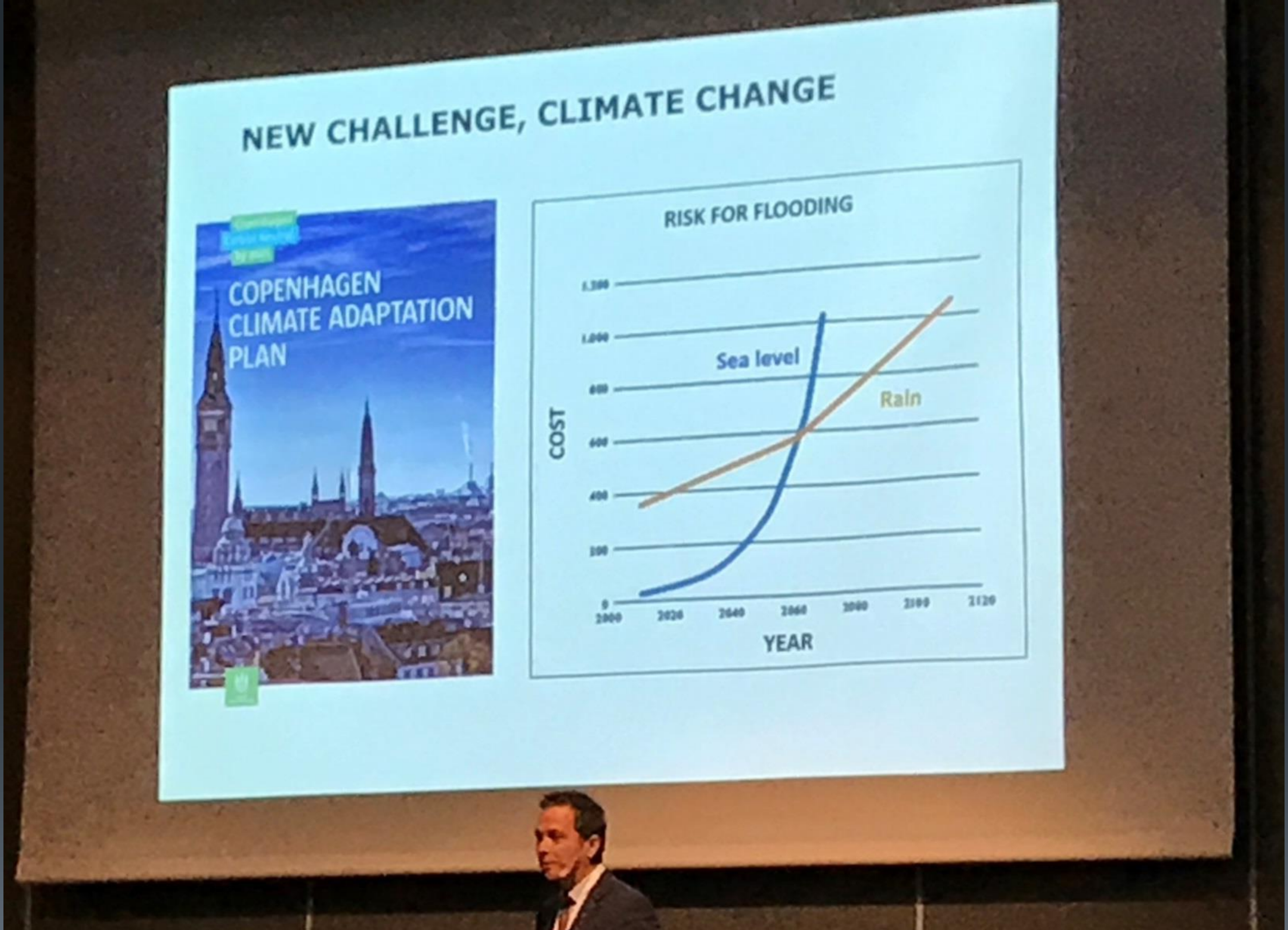


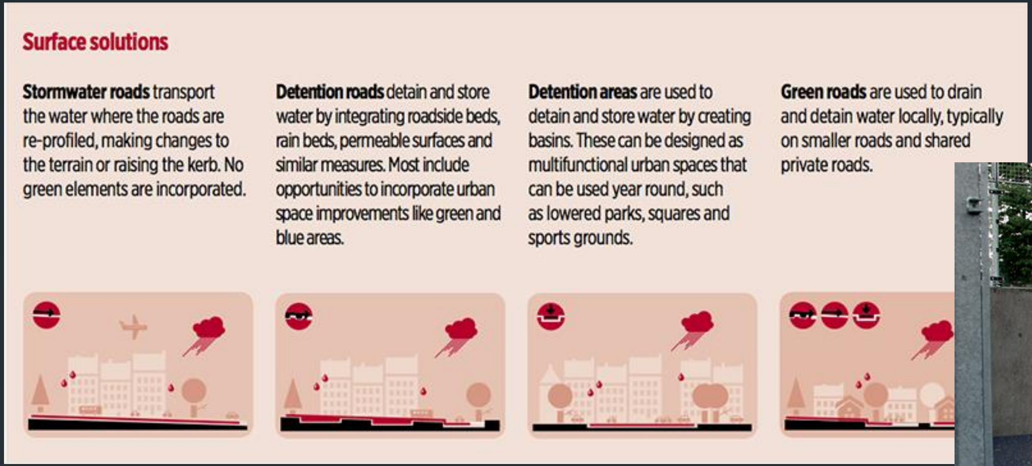
图 F4-6 城市最佳实践区北区低影响开发雨水系统设计方案

根据工程前期对场地下渗速率的现场观测，确定雨水下渗速率的设计参数为 2.3×10^{-5} m/s（场地表层土为孔隙率较大的人工回填土，下渗速率较大）。活水公园内荷花池工程改造如图 F4-7 示，采取渗管下渗的方式。下渗管设有盖板，可人工启闭。需要下渗时，盖板打开，荷花池内的水通过下渗管引入碎石层中下渗；如果连续晴天不降雨，为保持荷花池内的景观用水，则将下渗管上部的盖板关闭。

Cloudburst - Copenhagen


NEW CHALLENGE, CLIMATE CHANGE
COPENHAGEN
CLIMATE ADAPTATION
PLAN
RISK FOR FLOODING
COST
Sea level
Rain
400
0
2020
2040
2120
YEAR

Cloudburst

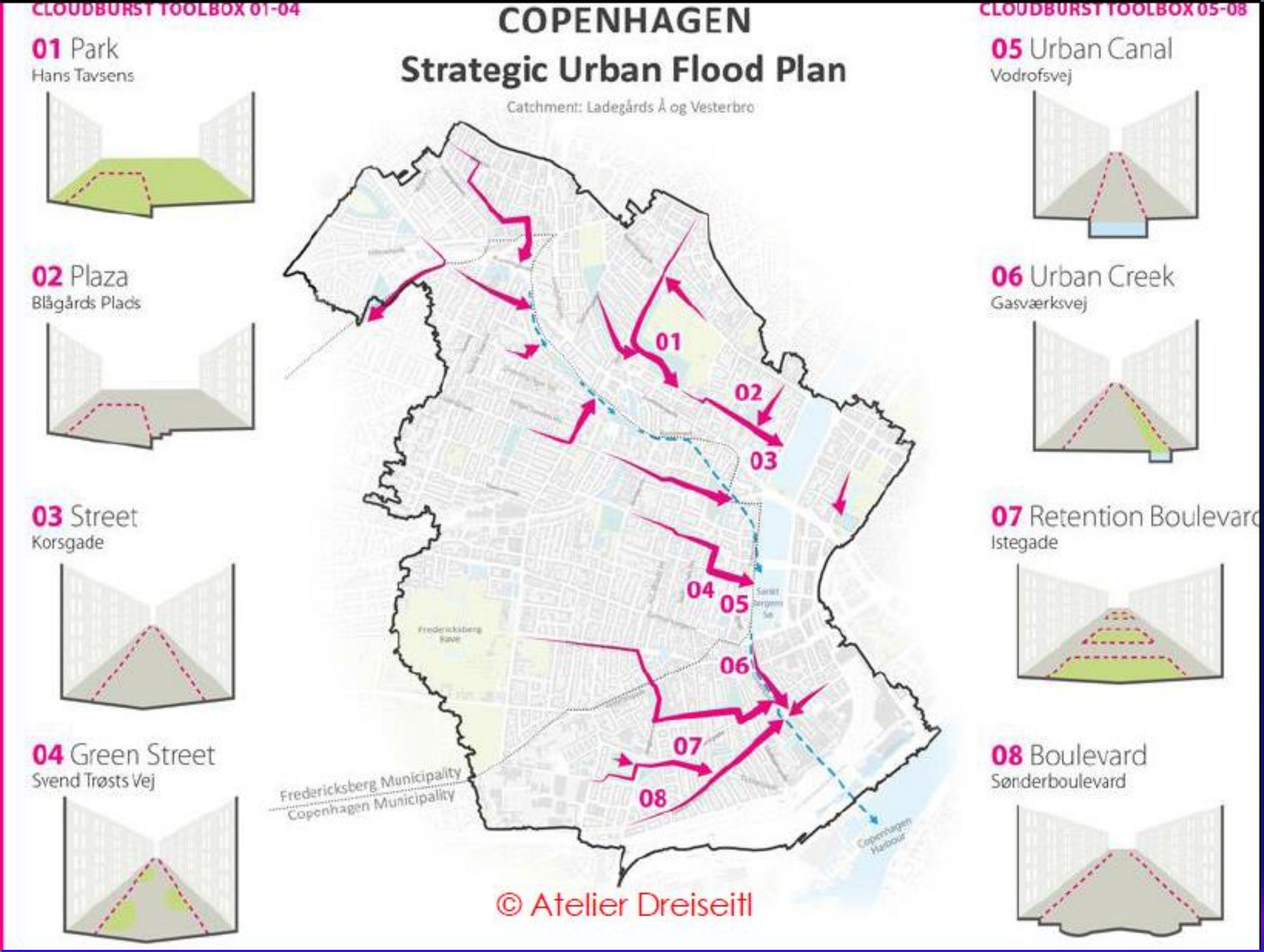


- Multi-functional public spaces
- Use of roads as stormwater conveyance

The WATER PLUS project in Gladsaxe is normally used as a paddle court but with heavy rains can also detain and store water © Christina Geer Sørensen

Cloudburst

- Design for exceedance
- Identify streets for extreme events
- Integrate into the design



TOOLBOX

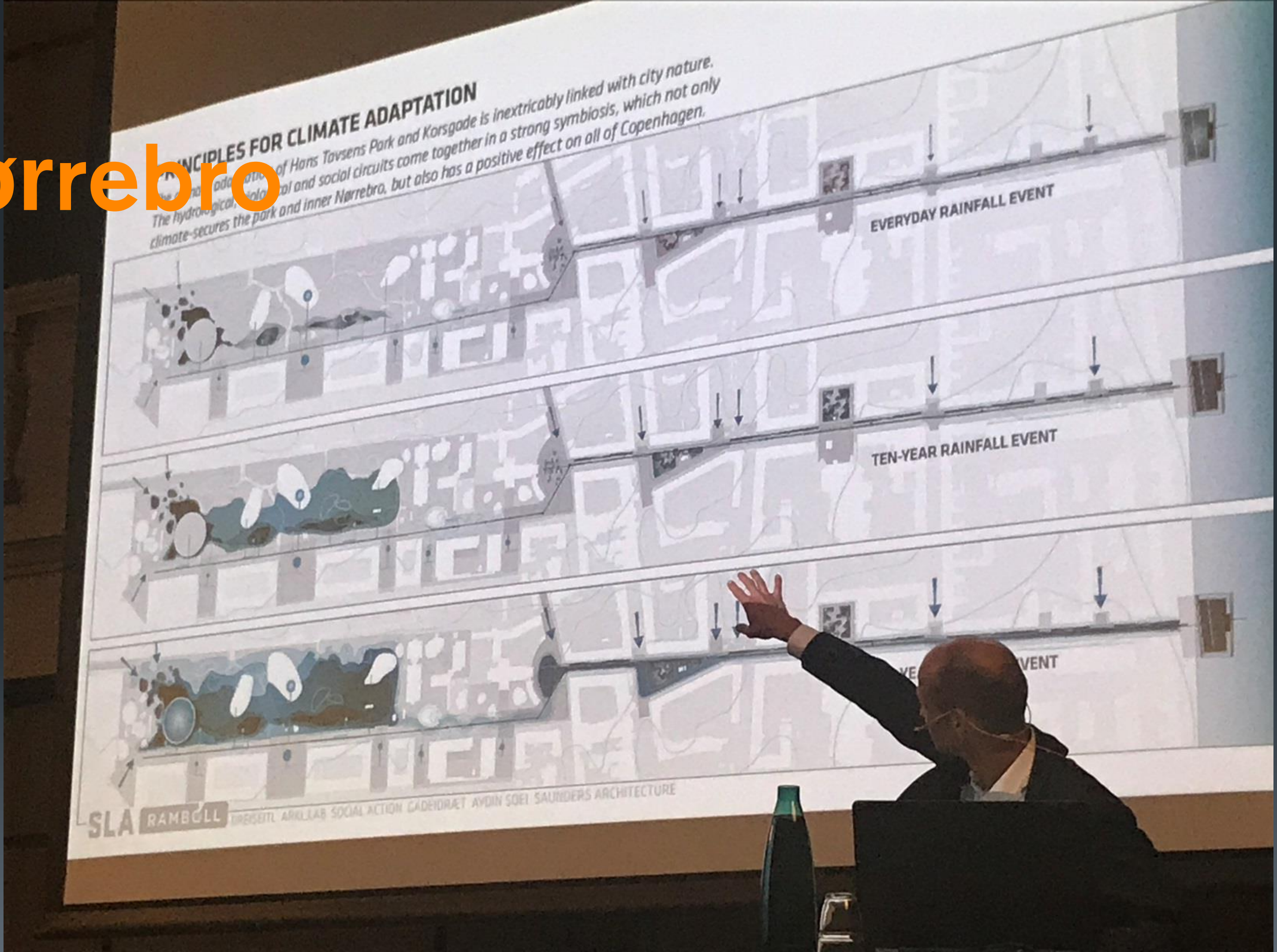
- Streets turn blue for extreme events
- Systems approach: apply where needed
- Integrate with urban gardens and public places


SØNDERBOULEVARD
Dry
Existing Street Profile
Safety Zone
Flood Pathway
3,300 l/s flow capacity
Copenhagen Strategic Flood Masterplan
EVERYDAY RAIN
30% DISCONNECTION
from existing combined
© Atelier Dreiseitl
Flood Event

Nørrebro


SOUL OF NØRREBRO – CLIMATE ADAPTATION,
INCREASED URBAN QUALITY AND RESILIENCY
CHRISTIAN NYERUP NIELSEN
INTERNATIONAL DIRECTOR
WATER AND CLIMATE ADAPTATION
SLA
RAMBØLL

Nørrebro



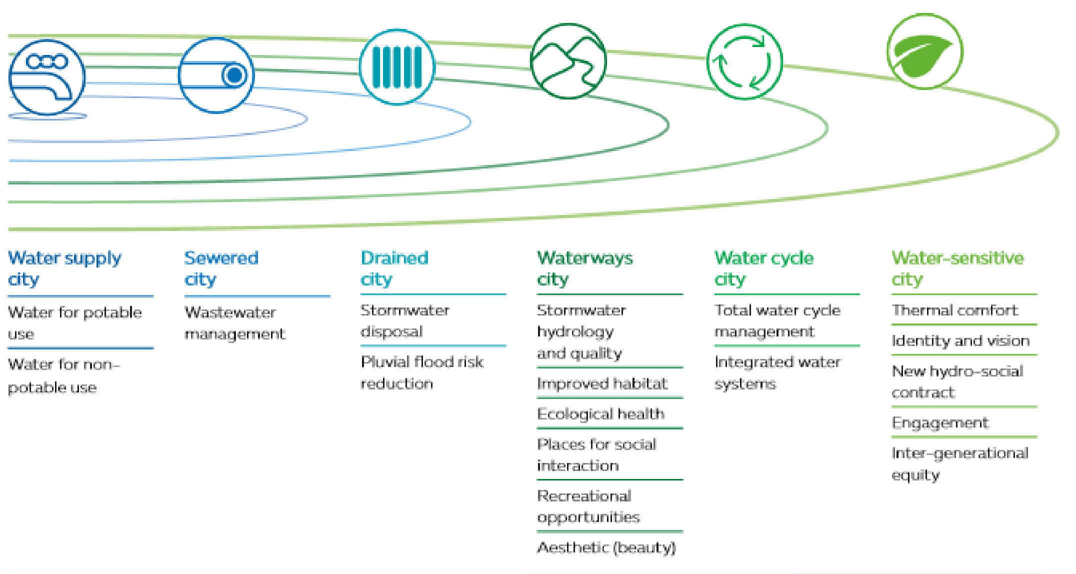
PRINCIPLES FOR CLIMATE ADAPTATION
of Hans Tavsens Park and Korsgade is inextricably linked with city nature.
The hydrological, ecological and social circuits come together in a strong symbiosis, which not only
climate-secures the park and inner Nørrebro, but also has a positive effect on all of Copenhagen.
EVERYDAY RAINFALL EVENT
TEN-YEAR RAINFALL EVENT
SLA
RAMBOLL

Nørrebro

Water Sensitive Cities - Australia

- Research the interplay between people and utilities
- Shifting role for utilities from Water for Life to Water for Livability

Figure 2: Illustration of the relationships between city states and societal urban water needs (Johnstone et al, 2012)



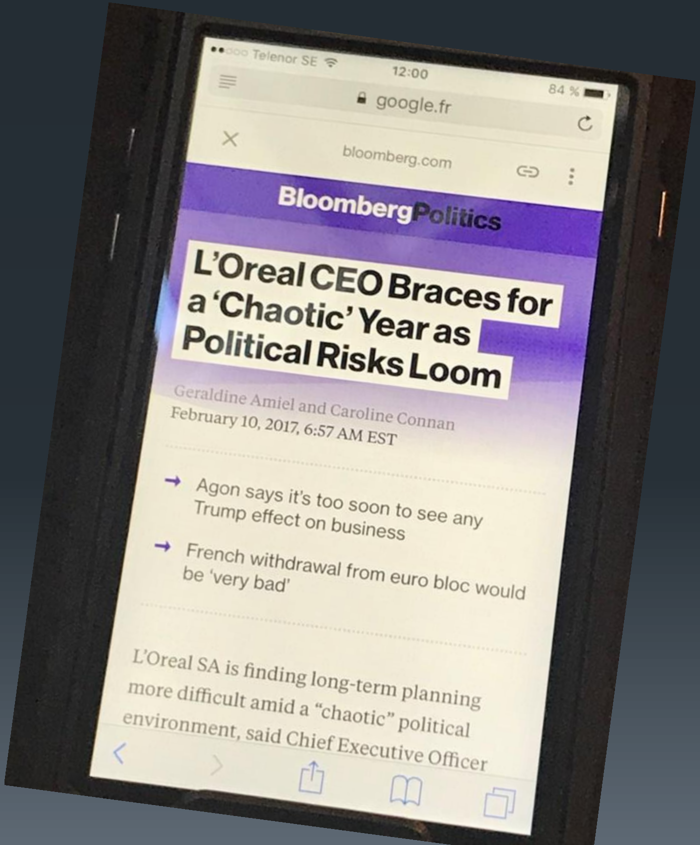
Water Sensitive Cities - Australia

- Embed ecosystem services into entire public realm
- Utilities must collaborate beyond our authorities to achieve livability

L'Oréal Cosmetics - Paris

Internal guidance for research and marketing: VUCA

- Volatile
- Uncertain
- Complex
- Ambiguous



Implementation

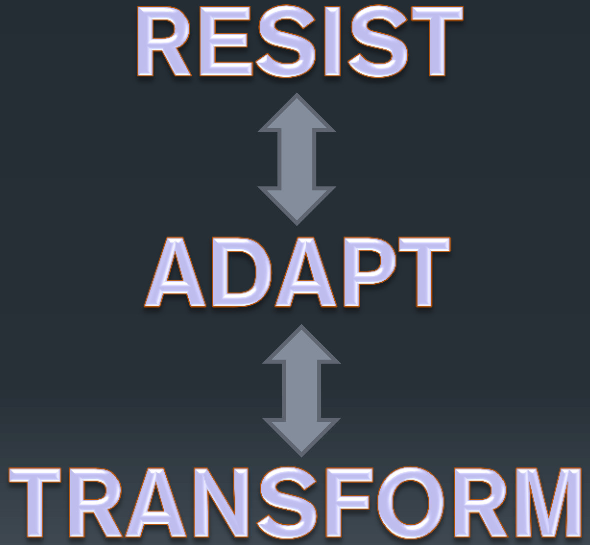
- We are in a time of complexity (VUCA !)
- With multiple right answers and multiple wrong answers
- No way to tell which is which
- Leaders need to pilot, test, and model possible patterns and allow the best solutions to emerge and reveal themselves

Implementation

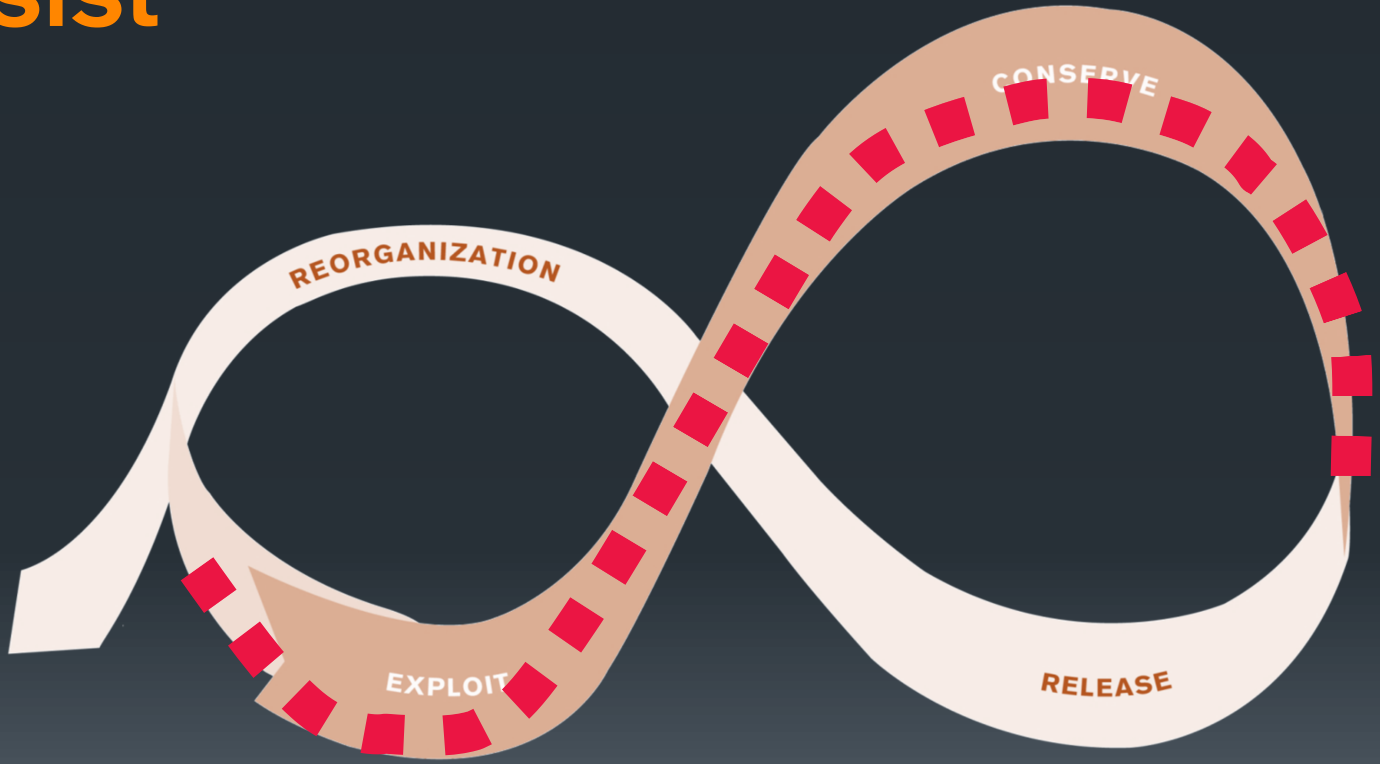
- Its not just new information
- It's a new mindset

Implementation

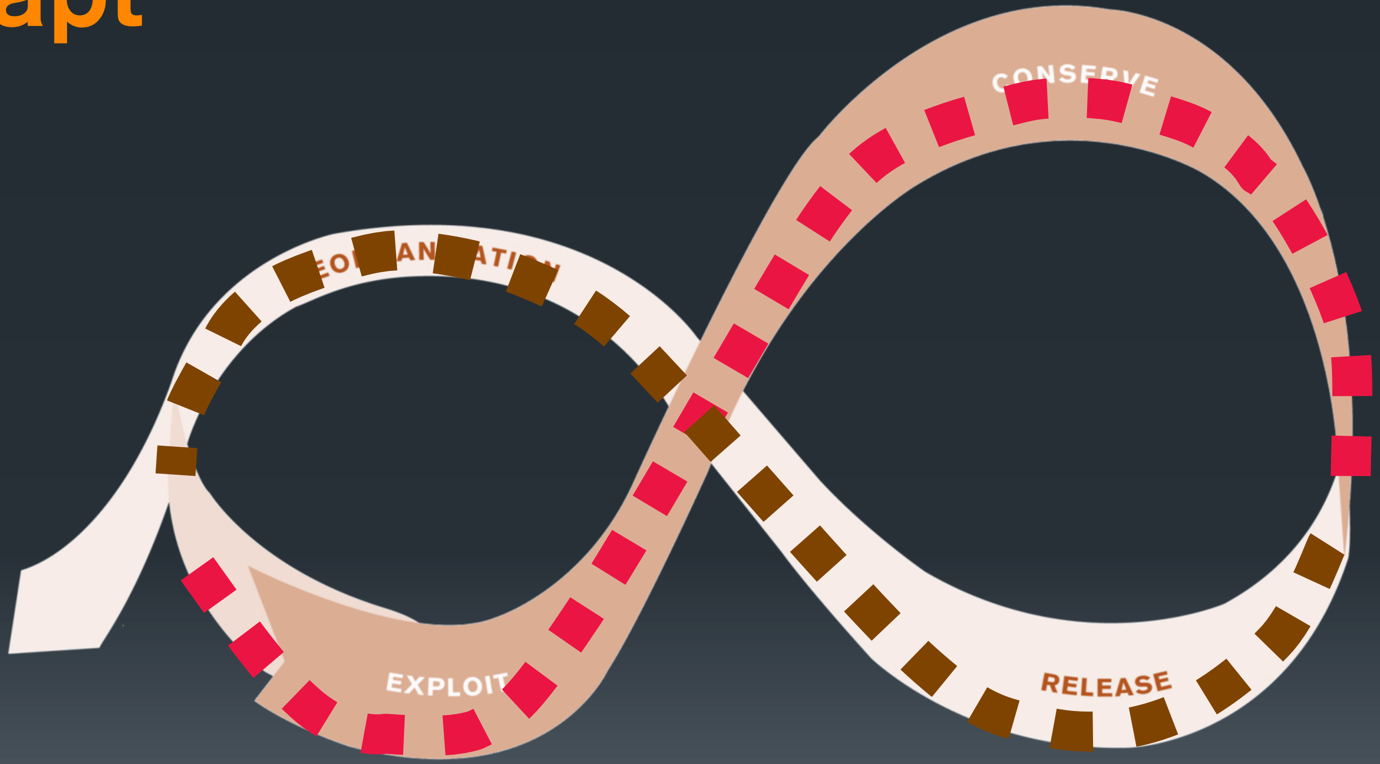
- Its not just new information
- It's a new mindset



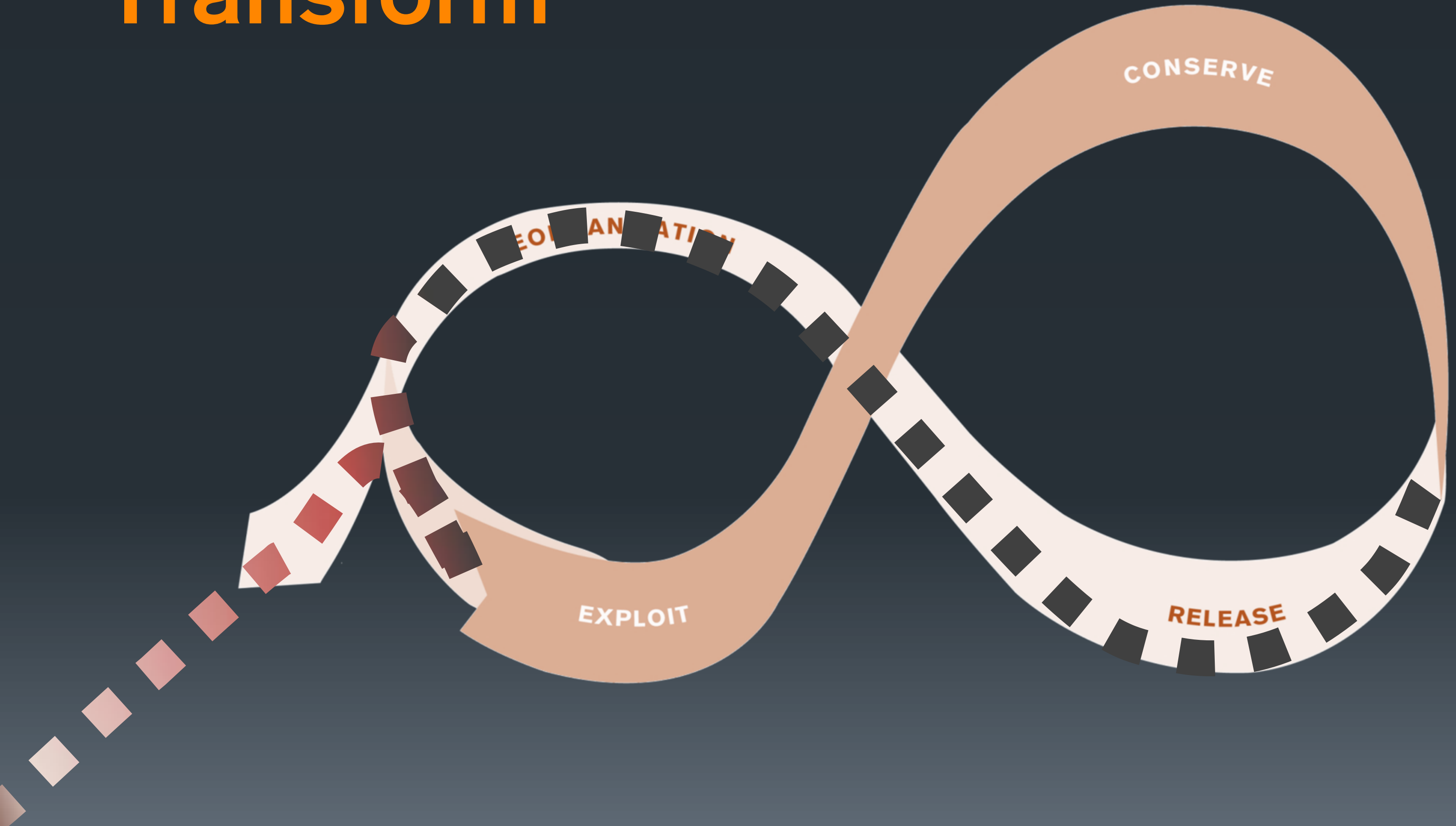
Resist



Adapt



Transform



Rokstrom Natural Systems	Snowden & Boone Leader’s Framework for Decision-making	Milly et al Stationarity is Dead	Types of Resilience
Resist	Complicated	Stationarity	Engineered resilience (Probabilities of failure)
Adapt	Complex (test-bed for innovation)	Stationarity is Dead	Socio-Ecological Resilience -capacity to adapt -attributes of resilience
Transform	Chaos (openness to innovation)		

Moddemeyer, 2017

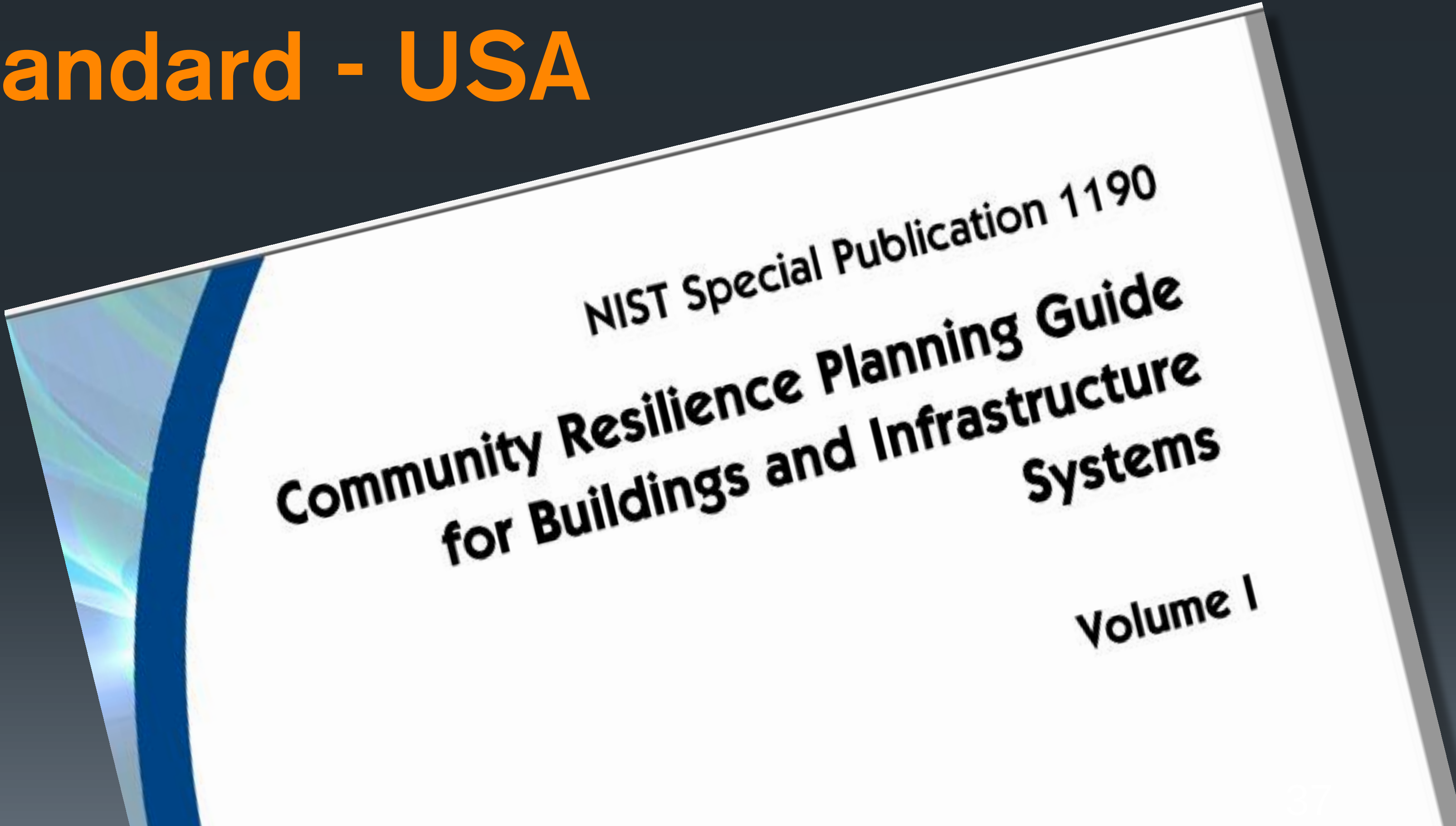
it just keeps going…

	Design intent	Design only for the front loop of Adaptive Cycle vs. Design for entire Adaptive Cycle vs. Back loop only	Responsibility	Decision-making	Attributes	Regulations & Training	Build vs Emerge	Optimization	Silo-based vs Community based	
ce ure	Design to threshold (1% storm). Don't worry about recovery		cradle to grave	Large-scale top down consultive decision-making	big, heavy, dry, brittle	training and regulations provide predictability and discourage innovation	"build" resilience - resilience is achieved	optimized with finite number of known variables	centralized asset-based system thinking ("what's best for the water system")	Exper one s have the d
	Design to threshold AND recovery time (set by community)		cradle to cradle	Multi-scale bottom-up consultive decision-making	small, light, wet, flexible	training and regulations anticipate flexibility and adaptation and expect innovation	resilience "emerges" - resilience is an emergent quality of a system	solutions are hypotheses to be tested and adapted	distributed multi-asset systems thinking ("what's best for the water system, the community, the environment")	- exp based - synt broad and s
es	- exploratory and experimental - systemic shifts in institutional underpinning such as mental models, management routines, and resource flows." (Westley, F.R 2013)		- navigate the transformation - variety of actors pursuing strategies that are attuned to opportunities arising from dynamic changes occurring within the system they are seeking to transform. (Westley 2013)	- rules and authority systems are undermined - create structure to guide situation towards adaptive state - consider innovation and opportunities for change	- innovative - shifts in norms - can spin out to new steady-states and alternative basins of attraction that may or may not be preferred	- challenges to technical and legal frameworks - consideration of new scientific frameworks. (Westley) - changes in flows of political authority and resources	resilience "emerges" - increase bridging, bonding, and linking across sectors and scales to build trust, legitimacy, and social capital - identify strategic interventions to change the trajectory of the systems - use adaptive management strategies to monitor interventions and intervene as needed to achieve preferred outcomes	- opportunities are not static, rather they are dynamic and shift as the system moves through different phases of transformation - work in concert with opportunities and resource flows	- new collaborations and alliances between actors and organizations - work toward new common goals - deploy resources in support of novel endeavors (Westley)	Exper trans Trans by: - kno retain - stev - inte make - netv - visio - inno exper - follo (Folke

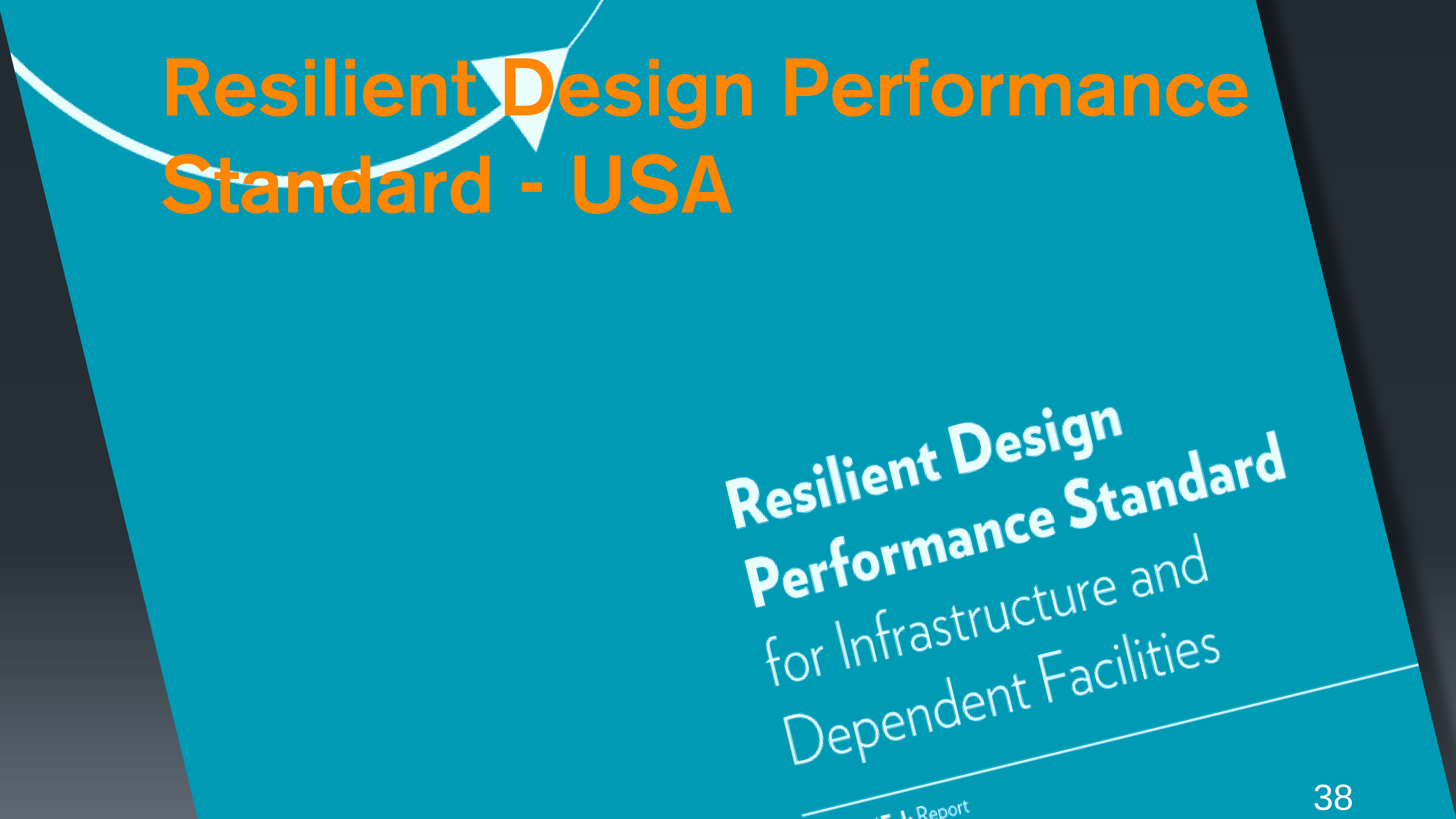
Implementation

1. Our natural systems and rivers and native species are already adapting to climate change. We are not.
2. We are trapped in an engineered resilience mindset that presumes our job is to resist change at the least cost.
3. With climate change we can no longer reliably predict how and to what extremes our climate will change in the design life of our infrastructure.
4. That means that its *not the likelihood that infrastructure will fail that should drive design.*
5. *Rather its how long it takes to recover when it fails* that is the measure of our resilience.
6. Planners and decision-makers must challenge their staff and design consultants, "We want the most cost-effective design that can be repaired in the time frame that is acceptable to us and that meets our needs."

Resilient Design Performance Standard - USA



Resilient Design Performance Standard - USA



RESILIENT DESIGN PERFORMANCE STANDARD

Score Sheet

BOULDER COUNTY INDICATOR	POINTS	ENTER SCORE	DESCRIPTION
1. Co-Benefits. Provide solutions that address problems across multiple sectors creating maximum benefit.			
Indicator 1.1. Apply a business case format that includes consideration of alternatives and robust analysis of those alternatives across the triple bottom line of economics, community, and the environment.	*Required*	*Required*	Prepare a business case that takes an analytical look at the project element alternatives, the costs, and the return on investment both in terms of the economy and in value creation to the community and the environment.
Indicator 1.2. Use multi-disciplinary design team to develop and consider a range of integrated solutions that provide enhanced value across the triple bottom line.	2		Document the project design charrette process, integrated design team in Business Case.
2. High Risk and Vulnerability. Ensure that strategies directly address the reduction of risk to human well-being, physical infrastructure, and natural systems.			
Indicator 2.1. Satisfy the time-to-recovery performance goal.	*Required*	*Required*	Refer to Time-to-Recovery Performance Goals Matrix (Design team estimate the damage from hazard and the time-to-repair.)
Indicator 2.2. Identify gaps and find solutions for moving forward.	*Required*	*Required*	If the project cannot meet the performance goals, then the project team must develop temporary work-arounds or programmatic strategies to meet the required Operational time-to-performance goal.
...2.3. Consider project alternatives that augment ...ffers from high risk locations ...n wildfire	*Required*	*Required*	Provide business case that documents consideration and analysis of alternatives considered for the project. (Can include temporary repairs to meet the minimal or operational phase.)
...ve the potential for economic benefit to the investor and the broader community b...			
			...line analysis in the Business Case that quantifies ...ntal impacts of the project.

…cator 7.6. Consider if project can stor… …acity of reserves at each scale so isolated elements… …survive for a period on their own.			
Indicator 7.7. Evaluate potential of creating semi-autonomous systems at the building, neighborhood, and district scale.	1		Semi-autonom… correct given new insight and… command and control and are the source… novel adaptations to variability. This innovation provide… capability for all systems to adapt to fast and slow change. Apply the consideration of semi-autonomous systems in the project design process and document results in the Business Case.
8. Harmonize with existing activity. Expand, enhance, or leverage work being done to build on existing efforts. Assure outcomes that are environmentally friendly, sustainable, and complementary to the natural setting			
Indicator 8.1. Identify project design solutions that leverage and enhance the function of existing natural, social, and infrastructure systems.	2		A project that can provide multiple benefits to community will be more highly ranked than one that only serves a single purpose. Reviewing existing plans can identify opportunities for mutual support. Cost effectiveness can increase if multiple objectives can create synergies.
9. Long Term Lasting Impact. Create long term gains to the community with solutions that are replicable and sustainable, creating benefits for present and future generations.			
Indicator 9.1. Account for value of benefit to future generations when identifying preferred project designs.	2		To better reflect the multi-generational investments OMB Circular A-4 recommends applying a 1% discount rate in the economic analysis for future generations, 3% for a consumption perspective, and 7% discount rates to model an investment perspective. Document findings in the Business Case.
Total Possible Points	**23**	**0**	**Project TOTAL**
In meeting or exceeding the resilience performance standard of 18 points the project is contributing towards resilience by meeting the Time-to-Recovery goal			

…line at bccollaborative.org/infrastructure-policies.html

Resilient Design Performance Standard - USA

1. Uses *time-to-recovery*
2. Accounts for increased *variability from climate change*
3. Reveals *interdependencies* between infrastructure systems
4. Reflects the *nexus between built and natural systems*
5. Identifies *community-based priorities*
6. Avoids "*scale blindness*"
7. Rewards *flexibility and adaptability*
8. Incorporates *social equity* and *capacity to adapt*

Review

- One Water – US Water Alliance
- Cities of the Future – Global
- Sponge Cities - China
- Cloudburst programs - Europe/USA
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- L'Oréal Cosmetics – Paris
- A new mindset – Everywhere
- Resilient Design Performance Standard - USA

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Thank you!

Hvar, Croatia

Climate change undermines a basic assu
that historically has facilitated management of
water supplies, demands, and risks.

CLIMATE CHANGE

Stationarity Is Dead: Whither Water Management?

P. C. D. Milly,[1*] Julio Betancourt,[2] Malin Falkenmark,[3] Robert M. Hirsch,[4] Zbigniew W. Kundzewicz,[5] Dennis P. Lettenmaier,[6] Ronald J. Stouffer[7]

Systems for management of water throughout the developed world have been designed and operated under the assumption of stationarity. Stationarity—the idea that natural systems fluctuate within an unchanging envelope of variability—is a foundational concept that permeates training and practice in water-resource engineering. It implies that any variable (e.g., annual streamflow or annual flood peak) has a time-invariant (or 1-year–periodic) probability density function (pdf), whose properties can be estimated from the instrument record. Under stationarity, pdf estimation errors are acknowledged, but have been assumed to be reducible by additional observations, more efficient estimators, or regional or paleohydrologic data. The pdfs, in turn, are used to evaluate and manage risks to water supplies, water- ...odplains; annual global invest- ...ture exceeds

An uncertain future challenges water planners.

In view of the magnitude and ubiquity of the hydroclimatic change apparently now ... however, we assert that stationarity ... longer serve as a central, ... source risk

that has emerged from climate models (see figure, p. 574).

Why now? That anthropogenic climate change affects the water cycle (*9*) and water supply (*10*) is not a new finding. Nevertheless, sensible objections to discarding stationarity have been raised. For a time, hydroclimate had not demonstrably exited the envelope of natural variability and/or the effective range of optimally operated infrastructure (*11*, *12*). Accounting for the substantial uncertainties of climatic parameters estimated from short records (*13*) effectively hedged against small climate changes. Additionally, climate projections were not considered credible (*12*, *14*).

Recent developments have led us to the opinion that the time has come to move beyond the wait-and-see approach. Projections of runoff changes are bolstered by the recently demonstrated retrodictive skill of climate models. The global pattern of observed annual streamflow trends is unlikely to have arisen from unforced variability and is consistent with modeled response to climate forcing (*15*). Paleohydrologic studies suggest that small changes in mean climate might produce large changes in extremes (*16*), although ... change in global ...