

Watershed-Scale Planning and Design Solutions to Mitigate Flooding from Cloudburst Events

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Ramboll in brief

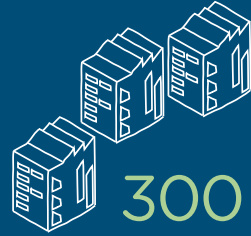
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18,000 employees

2,100 people in the Americas



The concept of cloudburst management originates from the City of Copenhagen. In Denmark, a cloudburst is defined as more than 15 mm of rain in 30 minutes.

However, the term is often used to describe **short duration, high intensity rain events** that quickly saturate existing drainage infrastructure, potentially causing extensive flooding.



A young family caught off guard by the sudden and game-changing cloudburst in Copenhagen on July 2nd 2011.

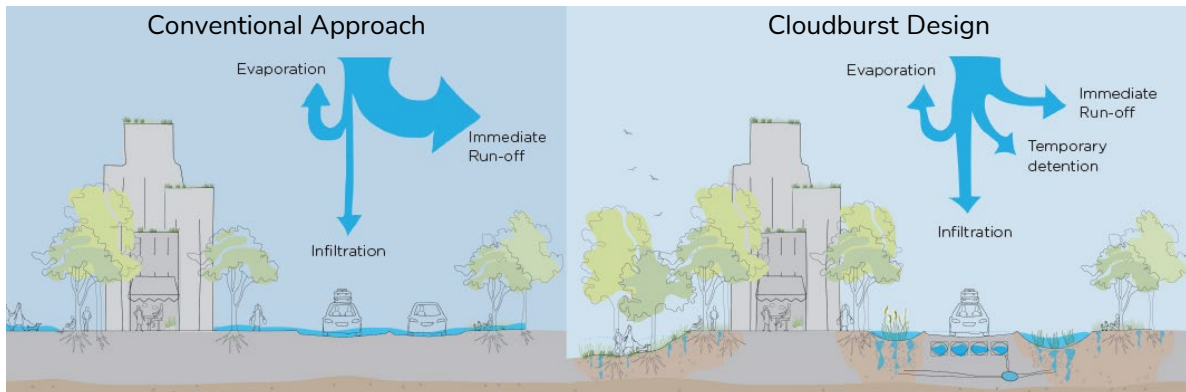
What is cloudburst design?

1. Watershed-scale interventions to manage stormwater where it falls, not just where it floods.
2. Blue-green infrastructure and nature-based solutions.
3. Focus on community-based planning and climate justice.
4. Designing for community and ecological co-benefits.
5. Multi-functional infrastructure that responds to stormwater and other community priorities.

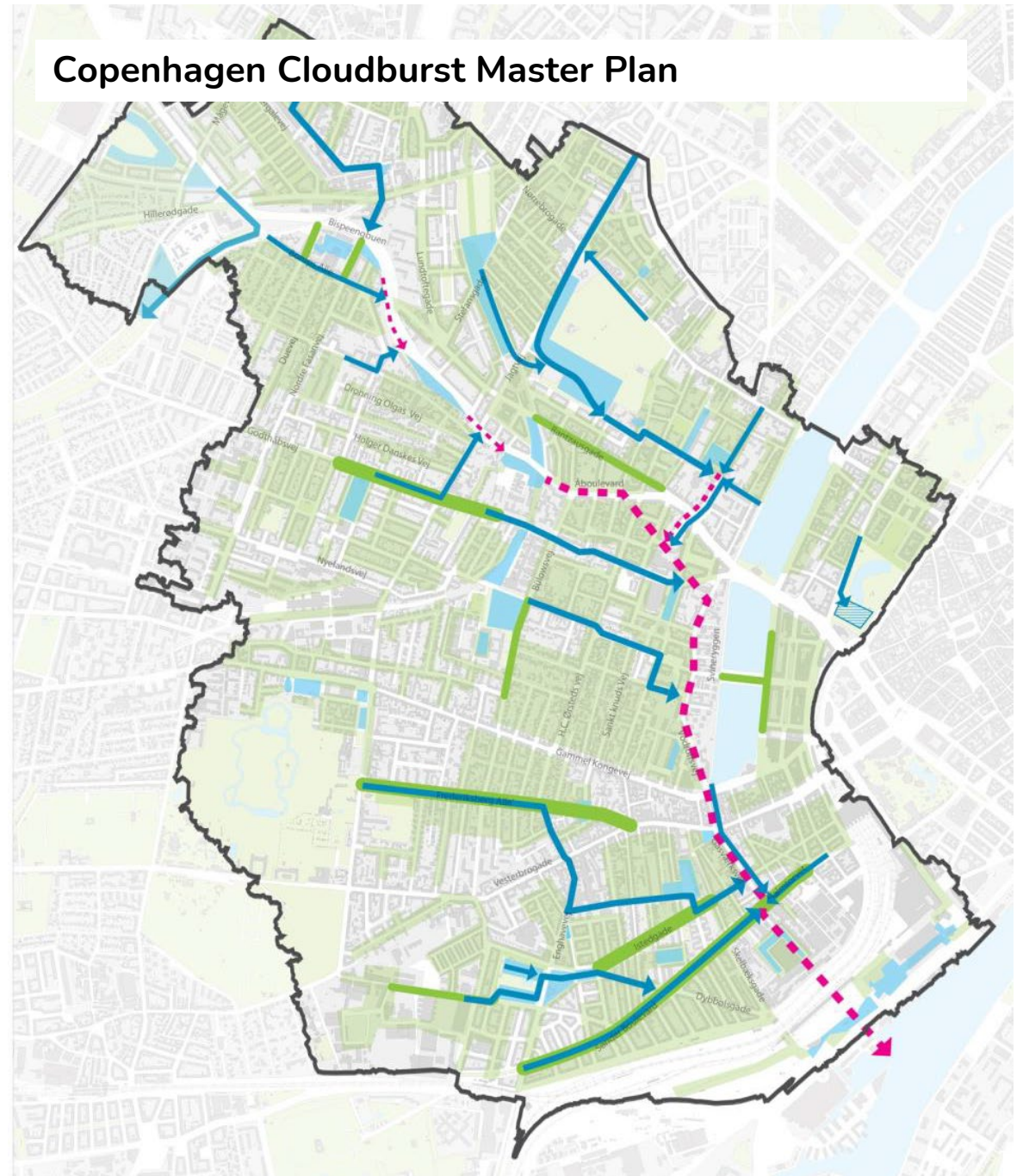


Watershed-scale interventions

- A network system of Cloudburst boulevards follow the 'fingers' of the existing river network, identifying opportunities for investment along green corridors.
- The surface solutions ensure mitigation is visible and interactive, making the city livable and green.
- Water is detained and conveyed through this network and watershed scaled approach.

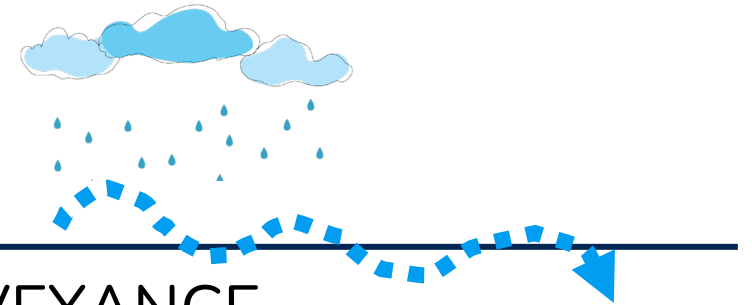
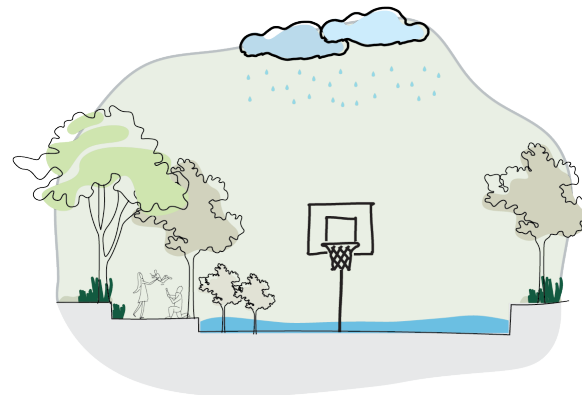


Copenhagen Cloudburst Master Plan



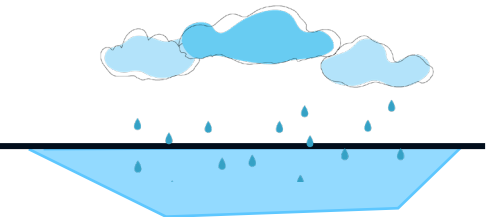
Blue-Green Infrastructure

- Blue-Green Infrastructure (BGI) connects urban hydrological functions (blue) with vegetation systems (green) and offers valuable solutions mitigating the effects of climate change.
- Blue-Green Infrastructure is made up of conveyance and detention.



CONVEYANCE

- Conveyance means moving water through the public realm and directing it to safe detention areas.
- Conveyance paths can vary from small temporary streams to large channels depending on necessary capacity.

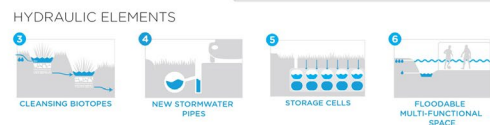
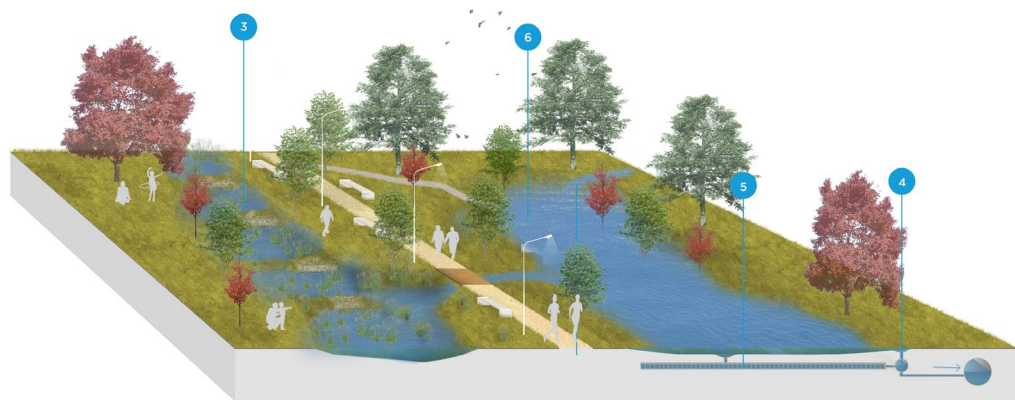
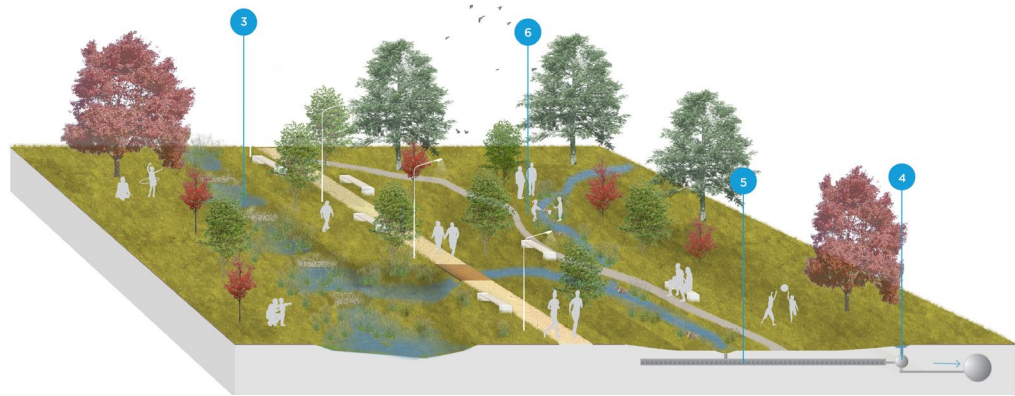


DETENTION

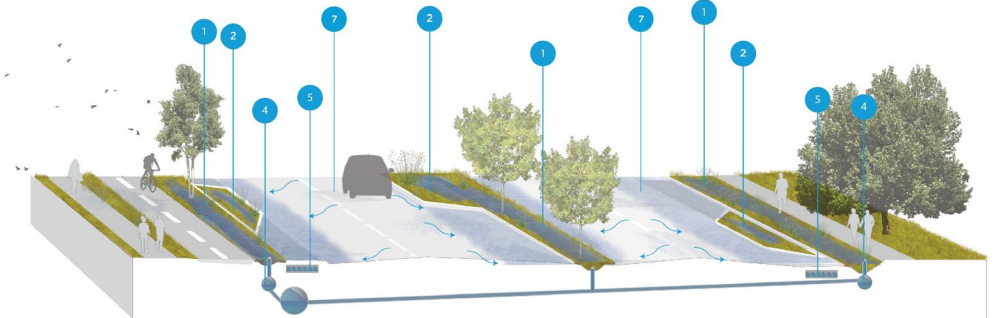
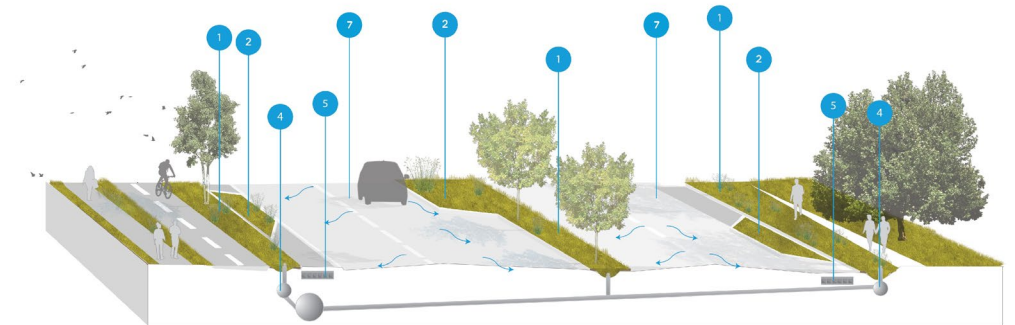
- Detention areas are urban spaces designed to reduce peak stormwater flow.
- Detention areas can be in the form of permanent waterbodies or designed for temporary storage during extreme wet weather events.

Blue-Green Infrastructure

Detention Typologies: Floodable Passive Park



Conveyance Typologies: Stormwater Detention Boulevard

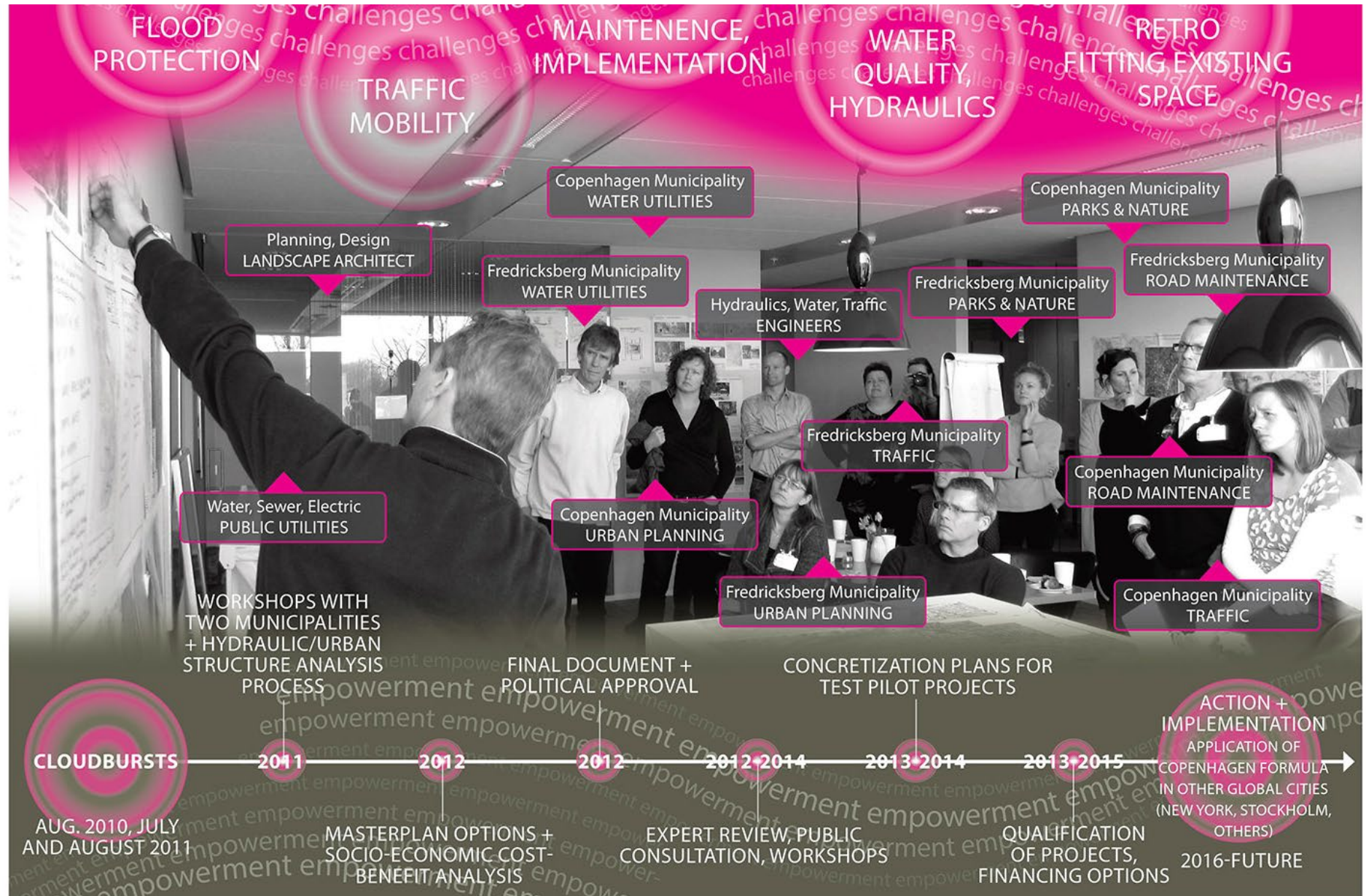


Community-based planning and climate justice



Copenhagen Cloudburst Master Plan

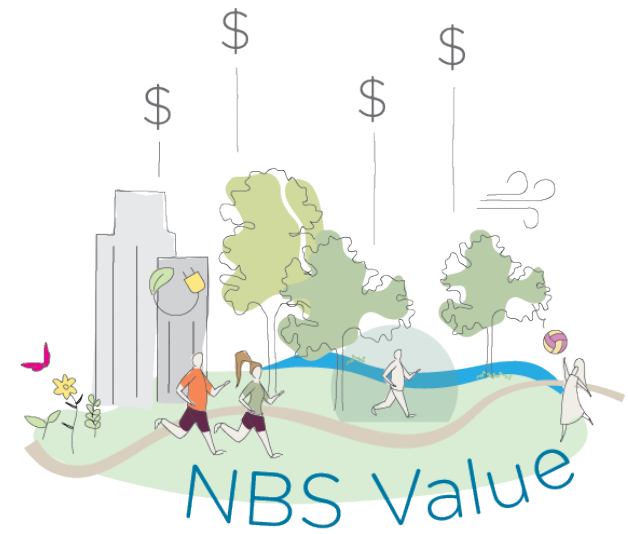
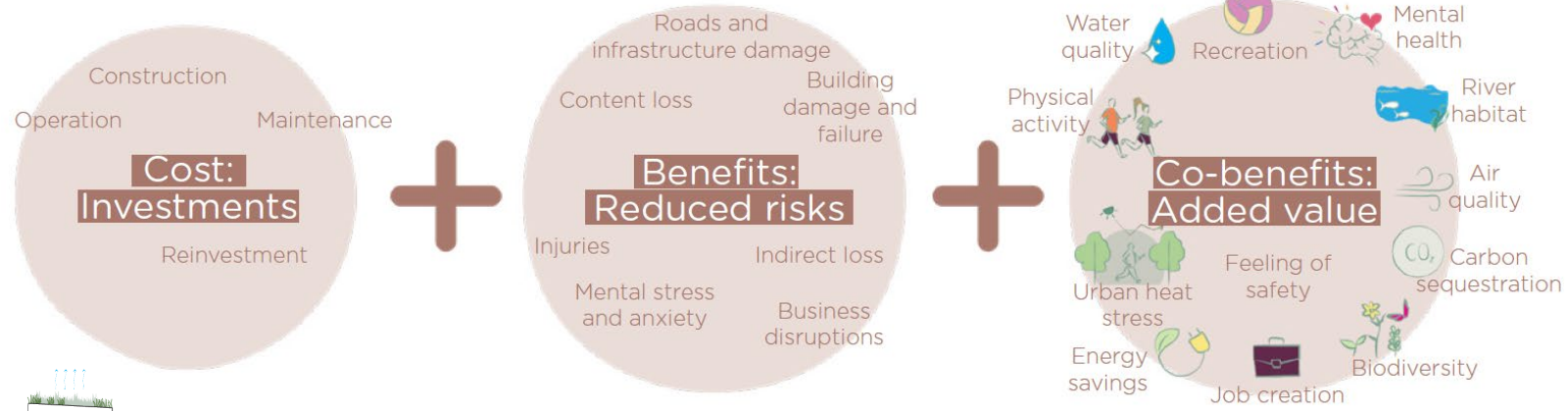
Interdisciplinary approach that moves away from siloed, isolated thinking. A common vision aligned engineers, hydraulic experts, GIS and information technologists, architects, planners, biologists, economists, communication specialists, and landscape architects with local citizens, investors, and politicians.



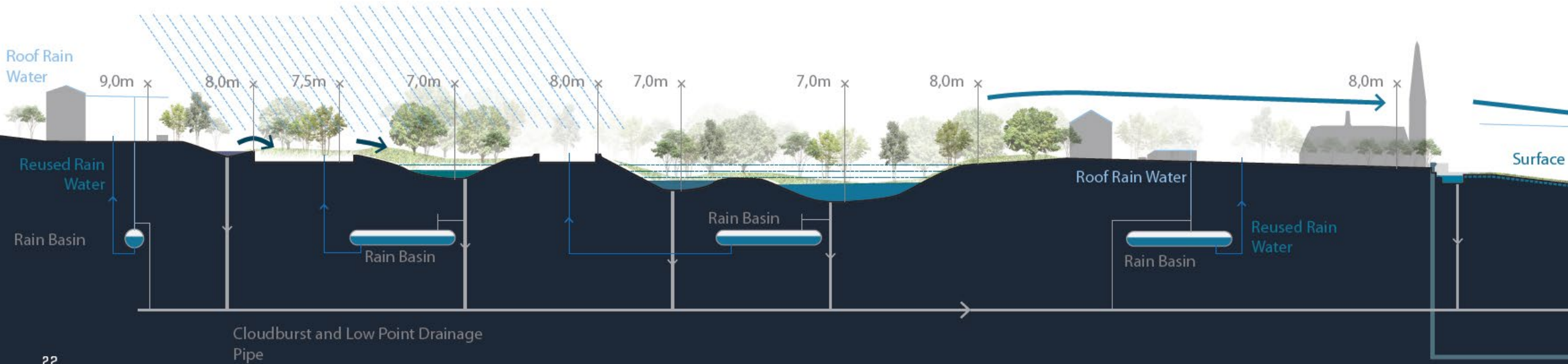
Bringing community into the process as decision-makers.



Community and ecological co-benefits



Multi-functional infrastructure that responds to stormwater and other community priorities.



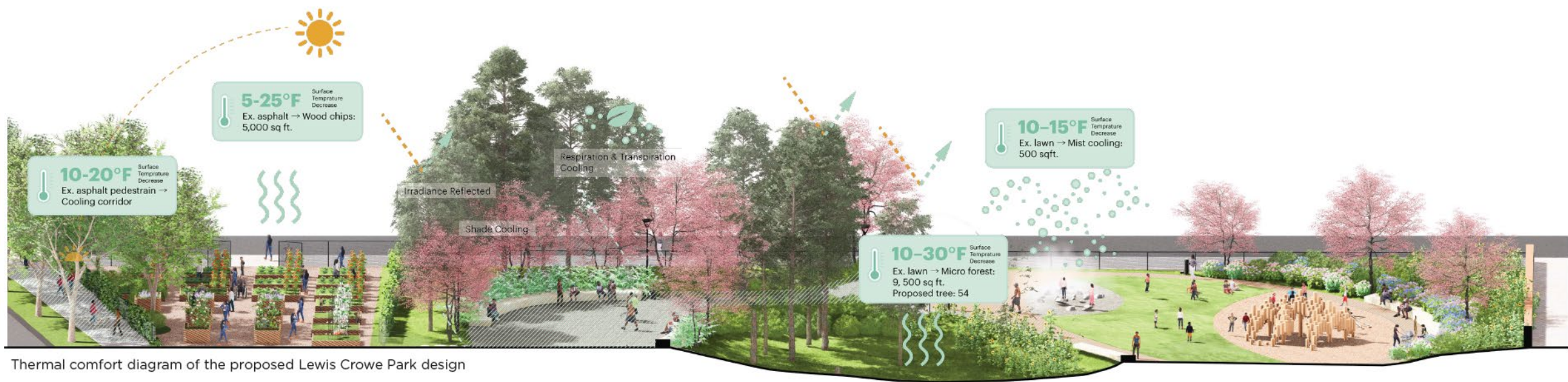
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Restoration and climate adaptation of Hans Tavsens Park, Inner Lakes of Copenhagen and local streets
Ramboll and SLA Architects

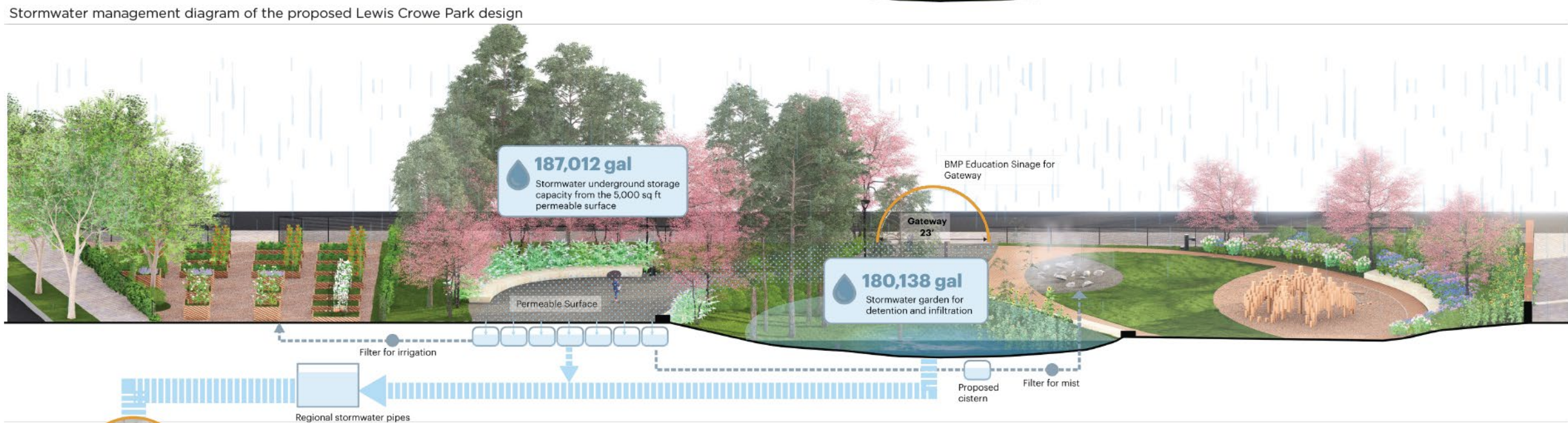
More than **99%**
of the time it provides
community value



Less than **1%**
of the time it floods



Thermal comfort diagram of the proposed Lewis Crowe Park design

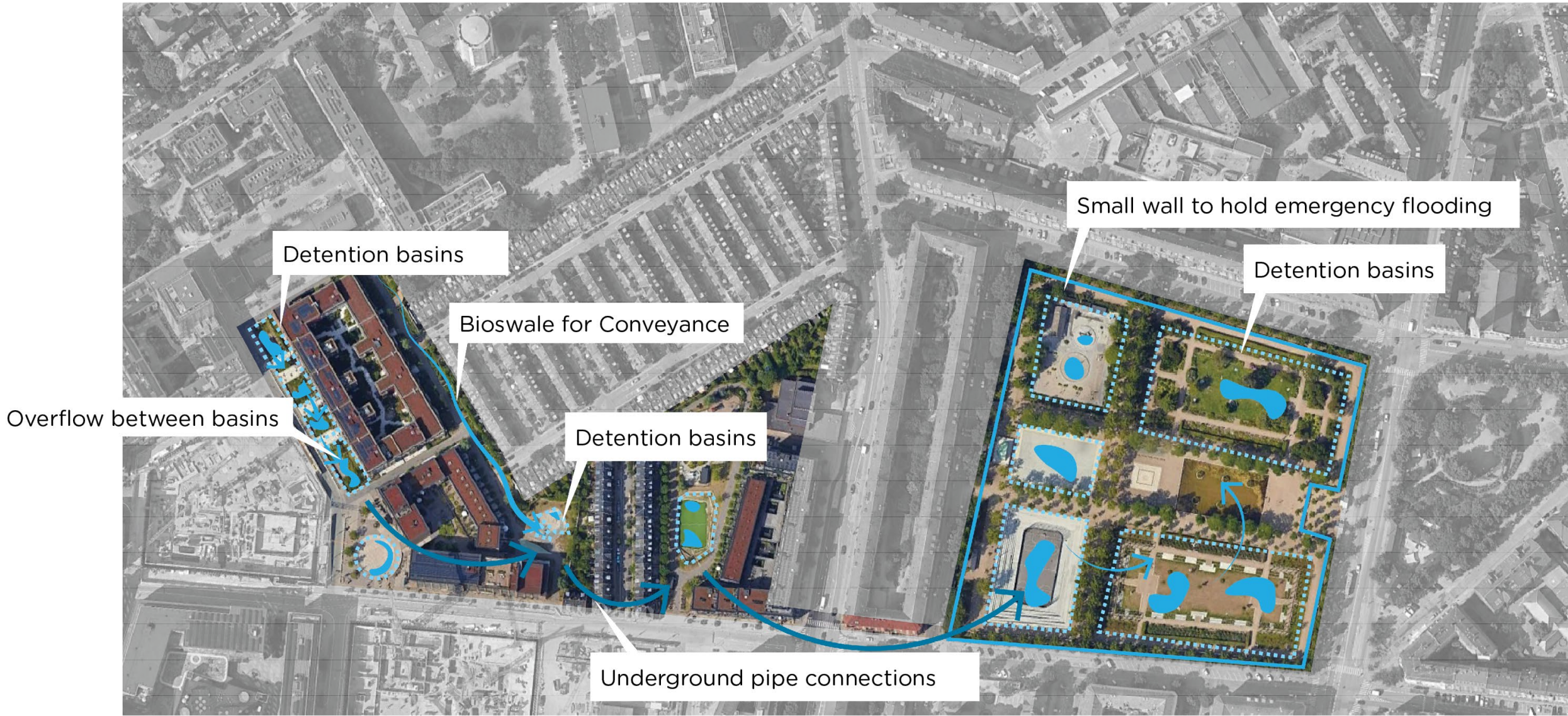


Carlsberg City Cloudburst Network

Copenhagen, Denmark

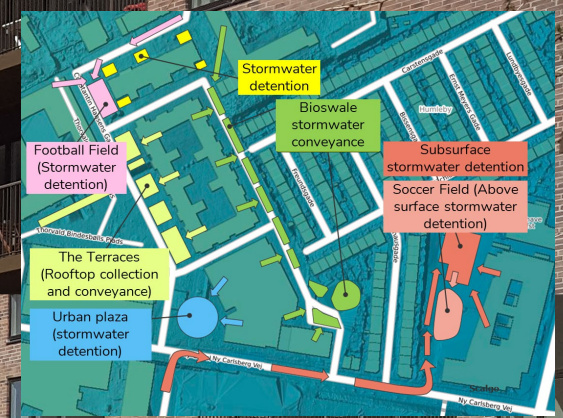




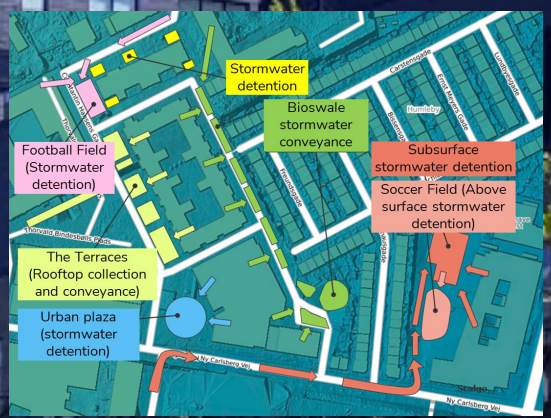




The Terraces (rooftop collection and conveyance)



Urban plaza (stormwater detention)



Soccer Field (above surface stormwater detention)



Thank you.

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