Cloudburst Management Plan for Copenhagen, Denmark

Area: 89 sq. km.
Population: 0.79 million

Background

Copenhagen is the capital city of Denmark, having a population of 0.79 million (2020), and is spread across an area of 89 sq. km. (approx.). It is situated on the coast of the Øresunds region that connects the North Sea with the Baltic Sea. The city is vulnerable to sea level rise, warmer weather and more weather extremes in the future, including heavy rain events.

Spurred by a series of highly damaging cloudburst events, including the July 2011 cloudburst that caused damages worth close to €1 billion, Copenhagen needed a better way to manage the water inundating the city during these downpours. In 2011, the City of Copenhagen adopted the Copenhagen Climate Adaptation Plan, complemented by the Cloudburst Management Plan (2012) detailing the methods, priorities, and measures related to adaptation to extreme rainfall events. The plan focuses on blue-green solutions to address urban resilience issues.

Strategies and Interventions

The objective of the Climate Adaption Plan and the Cloudburst Management Plan is to build urban resilience against extreme rainfall events, through adopting measures to prevent pluvial flooding. The overall process is divided into six steps, which includes risk analysis, blue-green infra planning and design, stakeholder review and cloudburst economics. The focus is on integration of various physical development process.
The City of Copenhagen has neither the capacity nor the economy to implement all measures at once. Hence there is a need for ranking the initiatives in order of priority. Essential elements for deciding the order of priority are:

- High risk areas
- Areas where measures are easy to implement
- Areas with on-going urban development projects
- Areas where synergistic effects can be gained

The city is divided into water catchment areas. The city of Copenhagen has been divided in 26 water catchment areas, all of which eventually drain in the sea. Priority catchments are selected. As a pilot, the high-risk catchment of Lådegåds-Åen (area 10 sq. km.) is selected.
Vulnerability analysis and blue-green infrastructure potential map

Evaluation of development options for blue-green infrastructure in Copenhagen

Based on the blue-green potential map, and risk and vulnerability analysis, flow rates and volumes as per rainfall events, potential intervention areas are identified, as illustrated in the map.

These development options are evaluated for long term sustainability. It was observed that masterplan with the highest concentration of Blue-Green Tools and reduced pipe sizes results in higher quality open spaces, lower investment costs, and more flexible mitigation strategies.

Resiliency necessitates combining the best of existing infrastructure with low-tech solutions.
Based on the analysis, the City of Copenhagen prepared a Cloudburst Toolbox, providing solutions for various parts of the city. These interventions provide solutions based on three scenarios: Dry Weather, Rainfall Event (normal to moderate rainfall events) and Cloudburst Event (extreme rainfall event).

The Cloudburst Toolbox

Illustrations for the interventions showcase how these spaces can be transformed during extreme rainfall events to accommodate stormwater and provide temporary storage zones. During dry situations, these are public spaces, which improve the quality of life of the residents, and has positively impacted the land economics of these spaces.

Transformation to a Blue-Green City
EVERYDAY RAIN
30% DISCONNECTION
from existing combined SEWER system.

Driving investment
Blue-Green infrastructure helped to lower capital, operational, and maintenance spaces by as much as 75% (Source: American Rivers 2012) while Danish Consultants calculated that USD $200 million investment costs could be saved by combining Blue-Green solutions with minimized conventional piping.
Additional/ Further information:

- Award for Excellence: The Copenhagen Cloudburst Formula - A Strategic Process for Planning and Designing Blue-Green Interventions: [https://www.asla.org/2016awards/171784.html](https://www.asla.org/2016awards/171784.html)