POLICY BRIEF **02**

Sustainable Urban Drainage Systems: Approach and Experiences in Barcelona

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Sustainable Urban Drainage Systems: Approach and Experiences in Barcelona

This policy brief examines how Barcelona has addressed the climate crisis through the implementation of Sustainable Urban Drainage Systems (SuDS), highlighting their importance in improving urban resilience against floods. With the forecast of an increase in the frequency of heavy rains in the Mediterranean, the City Council has prioritised the naturalisation of the city through strategies such as the Natura 2030 Plan and the Climate Plan 2018-2030, promoting the replication of natural water behaviour to enhance infiltration and environmental quality.

Key Messages

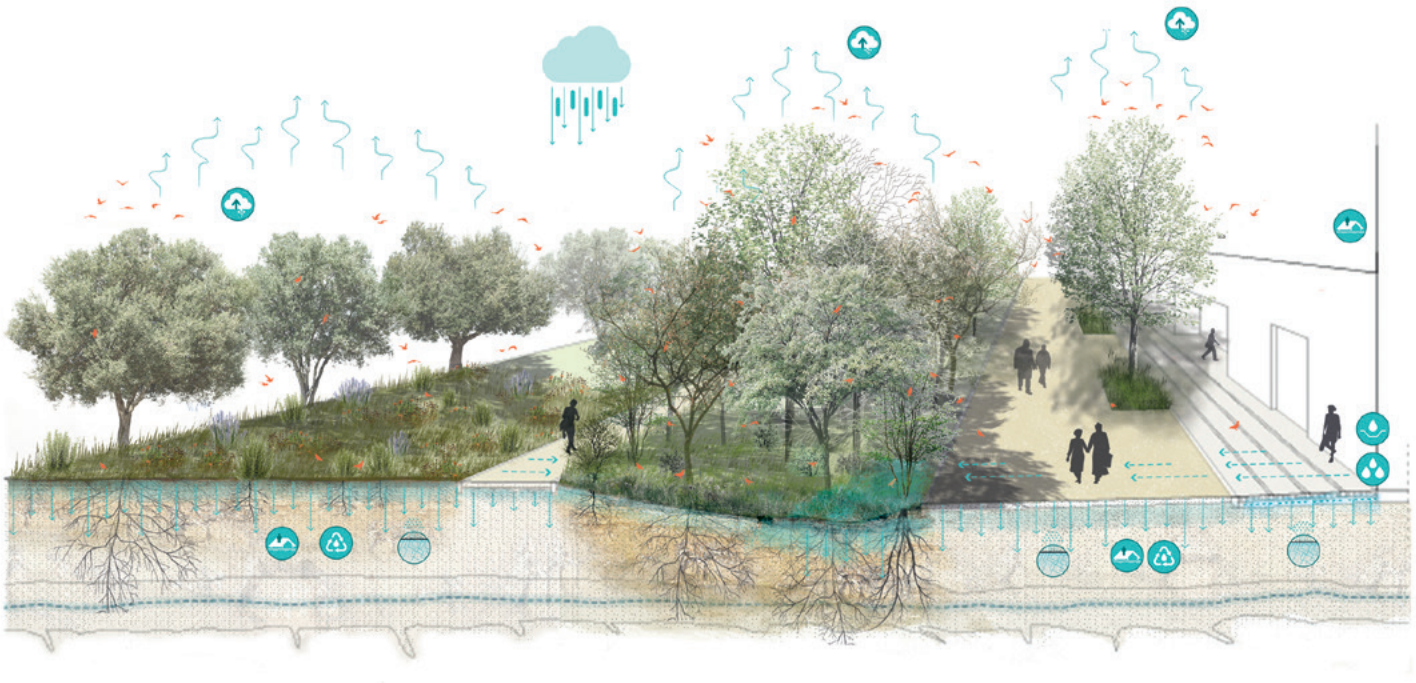
- The SuDS are an innovative alternative to conventional drainage in urban environments, replicating natural processes to manage stormwater.
- The systematic implementation of SuDS in urban areas can help naturalise the city and address the climate emergency.
- The street "Cristóbal de Moura" has recently been transformed following environmental criteria, including nature-based solutions (NbS) and sustainable urban drainage systems, allowing the treatment of over 2,200 m^3 of rainwater volume in this area.
- In Barcelona, criteria and recommendations have been established for the design of drainage infrastructures.

The implementation of SuDS in Barcelona

SuDS represent an innovative alternative to conventional drainage in urban environments, designed to replicate the natural behaviour of stormwater. Instead of simply channelling water into sewer systems, SuDS aim to integrate processes that mimic natural hydrological cycles, with the primary goal of naturalising the water cycle in the urban context.

These systems address several key aspects to achieve this goal. Firstly, they seek to increase the concentration time of stormwater, meaning slowing down its flow to allow for greater absorption into the soil and reduce the burden on sewer systems. Additionally, SuDS work to smooth out flow rates, distributing water more evenly, which helps prevent sudden flooding and minimises soil erosion.

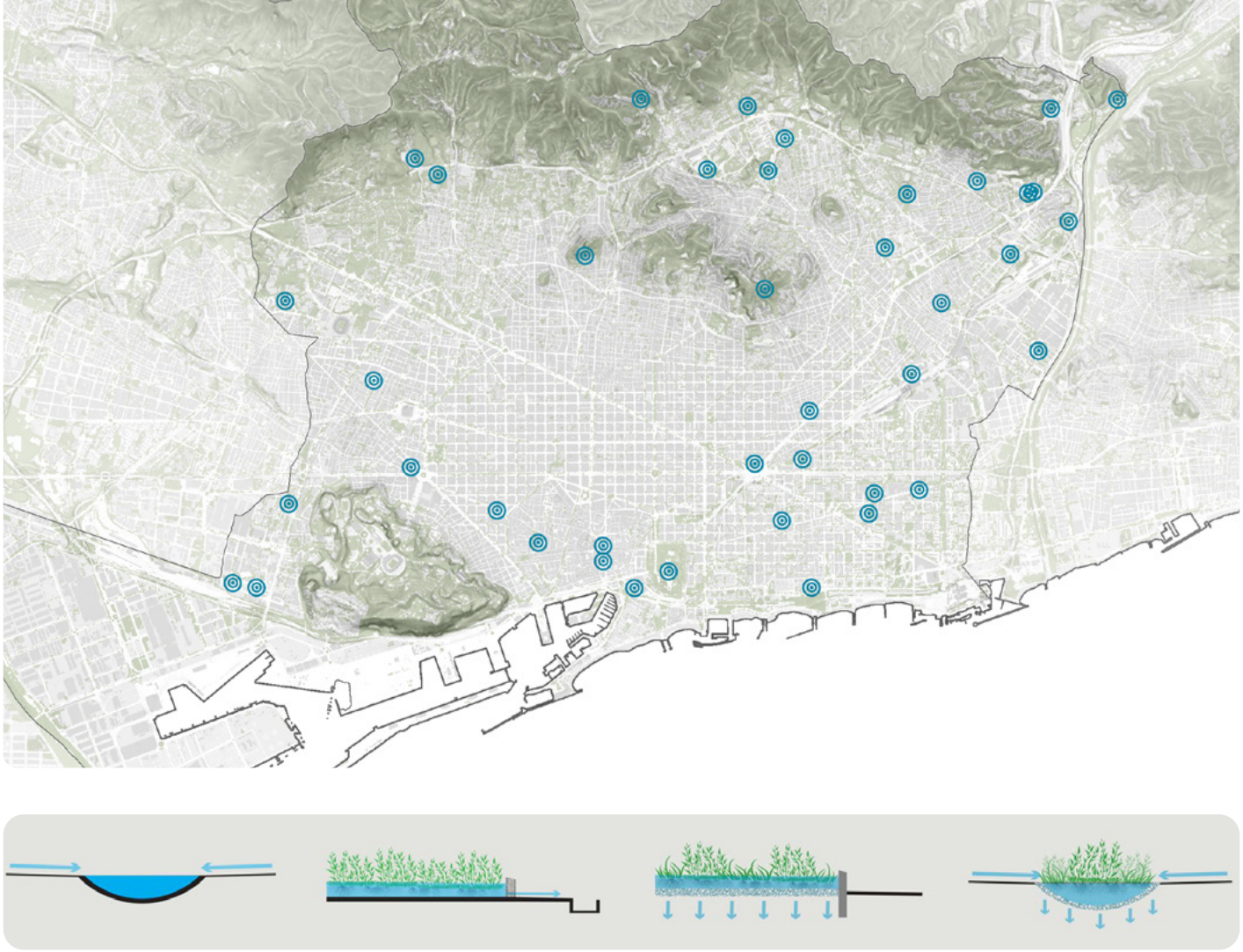
Another crucial aspect is the reduction of total stormwater volume. SuDS are designed to capture and retain rainwater, using techniques such as retention ponds, infiltration trenches, and underground storage systems. This not only reduces the risk of flooding but also promotes aquifer recharge and contributes to sustainable water management in urban environments. SuDS represent an innovative alternative to conventional drainage in urban environments, designed to replicate the natural behaviour of stormwater. Instead of simply channelling water into sewer systems, SuDS aim to integrate processes that mimic natural hydrological cycles, with the primary goal of naturalising the water cycle in the urban context.



IMAGES: Barcelona City Council

In addition to managing water flow, SuDS also improve the environmental quality of the urban environment. By promoting water infiltration into the soil, these systems help filter pollutants and improve groundwater quality.

Furthermore, the creation of green areas and aquatic habitats within SuDS can promote biodiversity and create recreational spaces for the community.



IMAGES: Barcelona City Council

There are various types of SuDS, adapted to different urban, climatic, and water treatment needs. They are classified into Detention, Filtration, Infiltration, and Treatment, each with specific techniques to reduce runoff water flow and improve urban water quality.

Examples include bioretention areas, permeable pavements, floodable beds, detention basins, filter strips, infiltration trenches, and bioretention swales.

Strategic and management approach

Since 1997, the municipality of Barcelona has been a pioneer in the regulatory domain, incorporating recommendations for the implementation of SuDS into some of its city plans. In recent years, Barcelona has strengthened its commitment to SuDS by publishing guides, documents, and strategies that promote and facilitate their implementation.

SuDS feature distinct and complex conservation and maintenance requirements that set them apart from other urban infrastructure categories.

These systems integrate various aspects and municipal entities, thereby increasing their complexity. This integration includes water management, vegetation, gardening, and cleaning services. To ensure the proper functioning and efficiency of SuDS, specialised maintenance is essential. Consequently, there has been a need to provide specialised training for maintenance personnel and to develop specific, measurable maintenance plans and programs that can be evaluated over time.

The urban transformation of “Cristóbal de Moura” Street

The redevelopment of “Cristóbal de Moura” Street carried out in 2021 is an example of an urban model that incorporates, among other aspects, the management of rainwater in a sustainable and passive manner through SuDS.

The SuDS techniques employed include bioretention areas, permeable pavements, floodable gardens, and buried attenuation-infiltration tanks.

These SuDS are capable of capturing, treating, retaining, and infiltrating the runoff generated by rainfall on the transformed surface itself (17,500 m^2), as well as from buildings and adjacent areas. In summary, rainfall on a surface of 32,000 m^2 is managed in this green axis, which has over 2,200 m^3 of rainwater storage volume.

IMAGES: Barcelona City Council

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Some design criteria and practical recommendations

Not every public space is suitable for the installation of SuDS. Before installation, a series of critical factors must be evaluated, including:

- Rainfall patterns
- Topography
- Geology
- The layout of the public space
- The intensity of its social use
- The proximity to underground infrastructure
- The feasibility of future maintenance plans

Finally, the city of Barcelona has established design criteria and recommendations for the implementation of drainage infrastructures. These include ensuring that the road space is wider than 9 metres and that the slope is less than 6%.

Additionally, it is recommended to avoid the proximity of SuDS to underground infrastructures to prevent infiltrations and dampness, such as railway tunnels or parking lots. SuDS should be positioned 1.5 metres above the water table to prevent potential damage to foundations and should not be installed on impermeable soils or rocky substrates, nor in areas intended for dog recreation.

Policy Recommendations

- **Integrated approach to urban resilience and naturalisation:** Faced with the challenge of climate change, Barcelona adopts a comprehensive approach that prioritises both urban resilience and the naturalisation of its environment. The city highlights SuDS as a fundamental strategy to mitigate the risk and impacts of flooding, an NbS that provides ecosystem services benefiting society by creating habitable spaces and healthy cities.

- **Development of a classification system for SuDS:** It should be based on morphological characteristics, climate, objectives, and urban context. The type of SuDS varies depending on the quantity and type of water treatment captured. Its proper selection will improve urban resilience, water management, and the environmental sustainability of the area.

- **Education and awareness of the citizenry:** It is crucial to leverage the knowledge, experiences and needs of citizens when designing greening strategies and instruments. Barcelona's Nature 2030 Plan is a strategic plan and participatory tool that defines the objectives and commitments of the municipal government to increase the city's green infrastructure. At the same time, it promotes outdoor activities around environmental education and citizen science and involves citizen and volunteer associations in the process of building the city's green infrastructure.

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