



# Urban rainwater in Barcelona: challenges and opportunities



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### Summary

#### 1. Introduction

- 2. Rain in Barcelona: physical and human dimensions
- 3. Rain management in Barcelona: traditional approaches
- 4. Rain management in Barcelona: alternative approaches
  - Domestic RWH systems (Sant Cugat)
  - RWH systems for vertical gardens (Jardinet del Pedró)
  - Sustainable Urban Drainage Systems (Can Cortada)
  - 5. Conclusion

#### Barcelona: physical and urban setting













# 1889-1990s: "Tout a l'égout" and, from there, to the sea ( and much more recently to WWTPs)



BCASA 2016

# 1990s into the 2000s: "store and remove but do not reuse ": Underground reservoirs



BCASA 2016

#### Rainwater harvesting in Sant Cugat del Vallès

Normative framework (since 2002) for the implementation of water saving measures in buidings

RWH systems mandatory for all new buildings or buildings subject to large renovations if garden area>1,000 sq m ( in 2008 >300 sq m)



# Goals, Driving forces & Values

- Main goal: Reduce water consumption from the public network.
- Main driving force: The municipality of Sant Cugat
- Main values: Environmental



# Technology

 Rainwater Harvesting Systems for domestic use in single houses and apartment blocks according to the specifications of the Municipal Water Saving Ordinance

Design and Size of rainwater capture areas including:

-Outdoor piping for rainwater -Water filtering system

Rainwater tank (underground)with certain minimum size requirements:



- 5,000 liters for gardens between 300 and 1.000 m2
- 15,000 liters for gardens larger than 1.000 m2

### Actors



# Planning Systems & Cultures

A clash of old and new planning cultures:

Ajuntament de SantCugat



Department of Urban Planning & vs Department of the Environment

Problems of integration and of "working together"

-Strong asymmetries in power and resources

-Environmental regulations (such as the ordinance) much harder to develop and enforce than conventional planning regulations .

### Impacts

#### Social impacts:

overall positive response by users

#### **Environmental impacts**

(as water saved):

perceived mostly as

important or very

important by users

Economic impacts: not especially relevant







### Process dynamics: pending issues

For many owners improving the performance of the system necessarily implies the installation of larger tanks, but also most users feel that systems are already expensive.

Perhaps the partial subsidization of tanks ( as it has been done in the past) would help in closing this gap a little.



#### Jardinet del Pedró: Plan for the Remodeling of Dividing Walls in Barcelona

Barcelona City Council in agreement with City Districts

Since 2012

Beyond aesthetics and into making environmental issues a fundamental part of urban quality



# Goals, Driving Forces & Values

- Main goal: Need of improving the quality of degraded urban area in the Raval district
- Main driving forces:
  Barcelona City Council:
  Plan for the Remodeling of
  Dividing Walls in Barcelona
  - urban regeneration
  - sustainable model
  - promotion of city image.
- Main values: Social and Environmental



# Technology

Water proof SOLAR panels **ENERGY** RWH system Solar panels Species selected RAIN according to local 1221 climate and presence in the balconies of the district ..... (F)(A) Adob Bomba © Comptador Dipòsit © Filtre Jardí vertical Recol·lector



#### Actors



### Planning systems & culture

City departments in charge of maintenance tasks participate during the phase of project construction. This integration of tasks is mandated by an internal protocol of the City Council.

Citizen participation in these projects is not foreseen.

Some reluctance by BCASA (water engineers) regarding RWH systems





### **Process dynamics**

- The project has contributed to standardize a green wall model to be replicated elsewhere in the city
- Communication is limited to the website and to an app showing the projects the city is working on.
- An information panel detailing the main characteristics of the system is located on the wall.



#### SUDS in Can Cortada



- Pilot project. SUDS are not consolidated in Barcelona (90 percent of these projects are led by the same architect from BAGURSA)
- SUDS present in public parks and in operations of new urban developments or in operations of urban renewal

# Goals, Driving forces & Values

- Main goal: providing an amenable environment for the surroundings of a public housing development.
- Main driving force: Barcelona City Council through BAGURSA (plus personal interest of Mr. Roberto Soto, city architect).
- Main values: Social, Environmental and Economic



Joan Reventós



Torre Baró



Marina Prat Vermell

# Technology

- SUDS include :
  - draining pavement: permeable surfaces formed by gravel composed of marble dust of 50-70 mm of diameter and recycled gravels of 40-70 mm of diameter
  - drainage conducts of porous concrete follow the lines in which trees have been planted so that street runoff can also infiltrate in these points
  - detention ponds: shallow superficial basins where water is stored until its infiltration into the soil. Equipped with a spillway that functions if water accumulated is higher than 50 cm. Pond areas covered with vegetation (climbing plants, for instance) or with soil
  - drainage wells: convey flows into the aquifer
- Vegetation planted is irrigated with local groundwater thus closing the water cycle.
- The technology is universal and can be implemented in any environment although always adapted to local conditions.



#### Actors & Planning systems & culture



### Actors & Planning systems & culture







- Critics with SUDS tend to emphasize the short term: maintenance of the system and the administrative nature of management responsibilities ("Am I responsible of this if a damaging flood happens?")
- Fragmentation of competences a problem of the Barcelona City Council because different planning and working cultures fare badly in front of the holistic approach required by SUDS



### Impacts

- In environmental terms the project presents a number of benefits such as:
  - Reduction of paved surfaces
  - Capture of rainwater for its use in groundwater recharge, cleaning , irrigation
  - Reduction of flood problems downstream
  - Reduction of polluted water
  - Reduction of the heat island effect
  - Reduction in energy consumption
  - Reduce discharges of treated wastewater.
  - Improve the performance of wastewater treatment plants
- Socially, the Integration of rainwater in the urban landscape provides aesthetic qualities and helps in education and communication about the role of water in cities

#### **Process dynamics**

- Can Cortada lacks a monitoring system to prove that SUDS work adequately to improve the condition of water before being returned to the environment.
- Knowledge sharing: University presentations, internal meetings in the City council, metropolitan authorities, neighborhood community groups as well as experts from other countries.
- The most significant result has been the creation of a working group on SUDS to discuss experiences and develop a code of good practices. It may help to ease reluctance by engineers.





# Lessons from the case studies

- **Domestic RWH systems** (Sant Cugat) favoured by legal obligations in certain cities of suburban Barcelona but still very incipient (far away from the 1.7 million rainwater tanks installed in Australia). Subsidies necessary to mainstream these systems. But high to very high public acceptance and a certain impact in reducing water consumption.
- Vertical gardens in dividing walls (Jardinet del Pedró) appear to have passed the stage of pilot projects to become standarized procedures. Promising future in the city, especially in very dense neighborhoods.
- **SUDS** (Can Cortada). Very limited development. If traditional reluctance by managers of the water cycle (BCASA) can be overcome they may take off but only in specific areas of the city (i.e. in projects of urban renewal).

# Some final comments

- Transition form a hazard-dominated management to a resource-dominated management of urban water flows in Barcelona just beginning:
- Obstacles: "difficult" environment, high densities, weight of traditional hydraulic solutions; uncertainty about alternatives, especially regarding security and accountability.
- **Potentialities**: new culture for urban infrastructures towards smaller, decentralized projects, relevance of local resources; perhaps more room for public input and participation.