Urban Stormwater and Rainwater Management at Local Level: Experiences in the Barcelona Area

Network of Cities and Towns towards Sustainability

(Xarxa de Ciutats i Pobles cap a la Sostenibilitat)
BARCELONA PROVINCIAL COUNCIL

Extension: 7,719 Km2
Inhabitants: 5,487,000
Density: 701.7 hab./km2
Cities and Towns: 311
Promotes actions of technical advice to municipalities to provide them with tools to respond to environmental challenges and move towards sustainability.

Promotes water resources good use in accordance with the provisions of the Water Framework Directive, including both inland waters (surface and ground) and the coastal area.
The Network is a framework for discussion and exchange of experiences to achieve common goals of sustainability in municipalities: management of resources, improve efficiency in municipal environmental services in order to reduce water consumption.

We must continue to advance a model of efficient water management through local demand management of water reuse for non-potable water for other uses.
Network available tools for local authorities:

- Model Specification service water supply
- Model Regulation Service water supply
- Model Ordinance water saving and monitoring the implementation of Regulations
- Study about local taxes on water supply
- Guidelines for the development of water supply local taxes
- Resources Awareness "Network saves water"
- Improving sustainability in water use in the public space - Proposals for a municipal action plan
- Calculator for domestic water savings
Our experience is on rainwater reuse

Some ideas on Urban Stormwater and Rainwater Management

What local authorities tell us:

- Low quality for stormwater. Not reusable, despite the existence of double networks.
- Networks used to manage discharges to environment and to sewage treatment plants.
- We lost our knowledge about rainwater reuse, due to large water supply networks to provided cities water demand.
5 droughts in 25 years in the basins of Catalonia

Source: Agència Catalana de l'Aigua
Water savings ordinances

Gràfic 1
Distribució d'usos de l'aigua a la conca de l'Ebre
- Reg 93,70%
- Ramaderia 1,86%
- Domèstic 2,79%
- Indústria 1,65%

Gràfic 2
Distribució d'usos de l'aigua a les conques internes de Catalunya
- Indústria 23,13%
- Reg 31,34%
- Ramaderia 2,87%
- Domèstic 42,66%
Historically, we have experienced periods of drought, but often our memory is short. Today, we begin to remember and learn to live with drought.

Image of a park in summer, socially desired in recent years

However, this image now may already be socially accepted
Citizens have changed their patterns of behavior. The local authorities also have done (or should have done)

Water domestic consumption in Barcelona Metropolitan Area (l/inhab·day)
Effects of climate change

• The effects of climate change are an important element of uncertainty in water availability in the future.
• Average reduction of 5% of contributions to the horizon in 2027, accompanied by an increase in seasonal and interannual variability.
• Despite the reduction in water consumption, population growth and increasing frequency of droughts, among other things, causes the basins of Catalonia suffer a structural deficit of water resources that can worsen with climate change.
• We need to generate alternative resources and improve efficiency and savings. This is adaptation to climate change.
Measures to be applied by local authorities

• Supply management:
  – Generate alternative resources:
    • Use of groundwater
    • Use of reclaimed water
    • Use of rainwater, graywater ...

• Demand Management
  – Saving and efficiency
  – Water local taxes
  – Awareness campaigns
  – Sustainable gardening
  – Improving the efficiency of urban water supply networks
  – Improved efficiency of municipal facilities

• Flood and sewage Management
PLANNING !!!

LOCAL WATER SUPPLY MASTER PLAN

LOCAL AGENDA 21

Plan for the use of non-potable water resources.

FLOOD MANAGEMENT PLAN

Plan for parks and gardens.

SEWAGE MASTER PLAN

Tariff policy of the water cycle

Local climate change adaptation Plan
Water savings ordinances
MODEL for WATER SAVINGS ORDINANCE

PRESENTED IN DECEMBER 2005
Prepared by Fundación Ecología y Desarrollo & Comissió permanent

To ensure water conservation and the rational and efficient use of water as a scarce resource it is. We tried to apply the concepts of use, reuse and recycling. So that each activity will be allocated or use the quantity and quality of water required.

<table>
<thead>
<tr>
<th>Year</th>
<th>Activity</th>
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<tbody>
<tr>
<td>2009</td>
<td>Monitoring water saving ordinances approval and implementation</td>
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<tr>
<td>2010</td>
<td>New Study on the opportunities and challenges in the implementation and enforcement of water saving ordinances at local authorities Network members</td>
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</tbody>
</table>
Water savings ordinances

AVERAGE: 140 l/inhab/day

HOUSEHOLD
519 hm³/y

COMPACT
120 l/inhab/day

SEMICOMPACT
150 l/inhab/day

ISOLATED
200 l/inhab/day

OOMM potential saving 20 - 60 hm³/YEAR

WHY MANAGE URBAN WATER DEMAND FROM LOCAL LEVEL?
PURPOSE OF THE ORDINANCE

To ensure water conservation and a rational and efficient water use, so it’s a scarce resource.

We tried to apply the concepts of use, reuse and recycling.

So that each activity will be allocated or use the quantity and quality of water required.
Index

Preamble
Chapter I: Purpose and scope
Chapter II: Systems for saving water
Chapter III: Usage, maintenance and control
Chapter IV: Offences, penalties and disciplinary proceedings
Transitional and final disposal
Annex A, B, C, D, E, F, G, H, I
Chapter I PURPOSE AND SCOPE

Article 2. Scope

All types of buildings and new constructions, also rehabilitation and/or refurbishment or total or partial change of use.

Weather in public buildings owned by the municipality
Article 2. Scope

In new buildings following assumptions:

House of 150 m² and 100 m² of area under green or pool with water depth less than 30 m² will include one of the following devices (select):

- a) greywater reuse system
- b) system for the use of rainwater
- c) system for the reuse of excess water pool

The previous case of more than 100 m² of green incorporate (required) a system for reusing greywater and devices (choice)

- b) Pluvial or c) Leftover pools
Article 2. Scope

Less than 8 multifamily dwellings with more than 100 m\(^2\) of green area or swimming pool with a water depth less than 30 m\(^2\) incorporate a device (choice)
   a) Gray b) or c) Pluvial) Leftover pools

8 or more multifamily housing
   a) greywater reuse system

If you have more than 300 m\(^2\) of green area or swimming pool with a water depth less than 30 m\(^2\) will include one of the following devices
   b) Pluvial or c) Leftover pools
Chapter II: Systems for saving water

1. Single Counters
2. Regulators water pressure input
3. Mechanisms savers
   3.1. Flow reducers
   3.2. Faucets / taps
   3.3. Mechanisms for urinals and toilet cisterns
   3.4. Mechanisms for cleaning processes
4. Rainwater collectors
5. Reusing surplus water pools
6. Reusing greywater
...
Chapter II: Systems for saving water

7. saving systems in gardens
8. saving systems in regulation tanks
9. saving refrigeration systems

Technical mechanisms savers be defined in accordance with Annex D of the new technologies available.
Article 7. Use of rainwater

Roofs and terraces of the building, and other impervious surfaces or not traveled by vehicles nor people.

a) The water can be used for irrigation of parks and gardens, interior and exterior cleaning, toilet cisterns, …

b) The design and dimensioning specified in Annex F.
Water savings ordinances

Article 11. Deposits regulation
Article 12. Cooling
Article 13. Visual impact
Article 14. Signs
Article 15. Use and maintenance
Article 16. Obligations of the holder
Article 17. Inspection and Control
Article 18. Information to users
Article 19. Measures of protection and restoration
Article 20. Violations
Article 21. Sanctions
Article 22. Sanctioning procedure
Appendix A: Definitions
Appendix B: hierarchy of actions to implement efficient use of water in municipalities
Appendix C: Description of actions to implement efficient use of water in municipalities
Appendix D: Characteristics and technical description of saving devices in accordance with the best available technologies (Article 3)
Appendix E: Design and dimensions of facilities for the use of rainwater (Article 7)
Appendix F: Design and dimensions of the excess water reuse facilities pools (Article 8)
Appendix G: Quality treated greywater (Article 9)
Appendix H: Design and dimensions of the gray water reuse facilities (Article 9)
Appendix I: Selection of species Gardens (Article 10)
STUDY ON APPLICATION
THE ORDINANCES FOR SAVING WATER IN CATALONIA

Xarxa
de Ciutats i Pobles cap a la
Sostenibilitat

icta
Institut de Ciència
i Tecnologia Ambientals • UAB

Diputació
Barcelona
Xarxa
Sostenibilitat
Municipalities with ordinance for saving water
(updated 2011. 2014: 57 cases – not may more)
Domestic water consumption and type of urban model
Evolution in the publication of ordinances

Updates: only 1 approved and 10 modified from 2011 to 2014
Type of ordinances for saving water
### Classification of water saving measures ordinances

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<th>Measures of efficiency</th>
<th>Description</th>
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<tr>
<td>Aigües grises</td>
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<tr>
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<td>Regulació de la pressió</td>
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<td>42</td>
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<tr>
<td>Infraestructures en noves urbanitzacions</td>
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<td>Circuit ACS</td>
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<td>DGQA</td>
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Local adaptation based on Model Ordinance

- Xerojardineria
- Captació d’aigües pluvials
- Recirculació aigua sobrant de la piscina
- Reutilització aigües grises

- Xerojardineria
- Reutilització d’aigües grises
- Captació d’aigües pluvials
- Recirculació aigua sobrant de la piscina
There is no universal formula

Rainwater tanks

- A standard formula should include at least four factors:
  - Rainfall in the area
  - Size of the catchment area
  - Surface material (to calculate the runoff coefficient)
  - Water demand (intended use)

<table>
<thead>
<tr>
<th>Location</th>
<th>Use</th>
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<tbody>
<tr>
<td>Sant Cugat del Vallès</td>
<td>48 l/pers. I dia</td>
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<tr>
<td>El Vendrell</td>
<td>24 l/pers. I dia</td>
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<tr>
<td>Sabadell</td>
<td>18 – 21 l/pers. I dia</td>
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## Difficulties in implementing the ordinance

### Technical
- Immaturity of technology and lack of experience of the installers
- Small business market
- Dimensioning systems
- Technical report projects
- Maintenance of sewage systems

### Economics
- Perception of the ordinance as an obstacle by economic promoters
- Profitability measures replacement
- Lack of financial resources to implement the ordinance
- Lack of inspection capacity

### Others
- Lack of regulation and lack of information
- Problems of interpretation of the ordinance
- Knowledge of real water saving based on ordinance application
## Potential water savings caused by the ordinance

### Water Savings Graph

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<tr>
<td><strong>Total (lpd)</strong></td>
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<td>130</td>
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<table>
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### Table of Domestic Consumption (lpd)

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<td><strong>Total</strong></td>
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Counting licenses

- **Aigües pluvials**
- **Aigües grises**
- **Aigua sobrant de la piscina**
- **Total**

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Local experiences

Maçanet de la Selva (6,887 hab): water saving ordinance evolution 2006-2014

OPORTUNITATS (+):

- Application of Ordinance 170 cases of work, of which approx. 150 include the construction of water cistern for collecting rainwater: 4000 m³ approx.

SHORTCOMINGS (-):

- Legalization
- Compulsory works of little entity
- Interpretation of the scope (uses)
- Confusions other mandatory regulations (Decree Eco-efficiency and CTE)
- Surfaces traveled by vehicles
- Sizing deposits
- Swimming pools with salt electrolysis systems or other advantageous
- Mandatory xerogardening in private parklands and gardens
- Formal requirements: Budget specific projects subject to license
### Local experiences

Maçanet de la Selva: water saving ordinance evolution

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<tr>
<th>Superfície parcel·la</th>
<th>Volum dipòsit actual</th>
<th>Volum dipòsit modificació</th>
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<tr>
<td>Fins 199 m²</td>
<td>15 m³</td>
<td>5 m³</td>
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<tr>
<td>Entre 200 i 299 m²</td>
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<tr>
<td>Entre 300 i 399 m²</td>
<td>15 m³</td>
<td>15 m³</td>
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<tr>
<td>Entre 400 i 599 m²</td>
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<td>Entre 800 i 999 m²</td>
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<td>Més de 1.000 m²</td>
<td>50 m³</td>
<td>35 m³ (+ 2 m³ / 100 m²)</td>
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Maçanet de la Selva: real case study

• Actual water consumption (in housing, except WC): 80 m³ / year
• Needs non-potable uses (garden irrigation tanks + WC): 240 m³ / year (20 m³ / month)
• Rain water collected theoretical capacity: 101 m³ / year (42% needs)
• Supply needs to cover pit: 138 m³ / year (58% needs)
• Average price m³ province Girona (consumption 20 m³ / month): €2.522 / m³ *
• Theoretical annual savings: 240 m³ x €2.522 = €605.28 / year
• Attributable to deposit: 42% = €254.21 to 605.28 / year
• Construction cost deposit €6,000
• Depreciation, current prices m³ water = 23 years
Conclusions

• Ordinances for water savings show that legal regulations are an important tool for promoting water conservation, but to be effective they must be part of an **overall strategy** the result of political will and consensus (developers, installers, architects, municipal officers, citizens, politicians, water companies)

• These regulations **must be adapted** to the reality of the municipalities.

• The main obstacles to the development and implementation of regulations have to be overcome through the implementation and standardization of facilities in buildings.
Challenges

• Aware all stakeholders so they assume their requirements and develop new skills that require the application of the ordinance (consensus, coordination).

• Supervise the operation of systems installed non-potable use of resources. It complies with the ordinance but no ability to control and monitor municipal (Who?).

• Economic and environmental viability analysis (LCA and related energy and CO2)
Opportunities

• Promote the application of the ordinance in buildings (Sustainable Rehabilitation)

• Extending the scope of application resources to other non-potable uses and building typologies. (Larger and more flexible)

• Compatible with the provisions of the above regulations (CTE and Eco-Decree) with the ordinances. (Supralocal law)

• Review the model ordinance Network of Cities and Towns Towards Sustainability (Review contents technical, legal and application)
Other basic documents to supplement the Ordinance
THANKS FOR YOUR ATTENTION

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