



Wastewater Treatment Plant. EDAR La Cartuja. Zaragoza

European Green Capital Award 2016

## 9. Waste water management



An initiative of the  
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2016



Spain

## 9. WASTE WATER MANAGEMENT

### 9A. Present Situation

Describe the present situation in relation to waste water management, including any relevant disadvantages or constraints resulting from historical, geographical and/or socio-economic factors which may have influenced this indicator area. Where available, information/data should be provided from previous years (5 – 10) to show trends.

Describe the current general features of waste water management according to national requirements and the requirements of the Urban Waste Water Treatment Directive (UWWTD, 91/271/EEC).

Include data for the following specific indicators:

1. Total annual generated waste water load of the city (in p.e.) and provide indication of the fraction (%) coming from population and from industry (also specifying type of industry, when information is available);
2. Proportion (%) of total annual generated waste water load, connected to a) waste water collecting systems (only) and b) waste water collecting system + urban waste water treatment plants (UWWTPs), specifying the most advanced treatment level (primary treatment, secondary treatment, tertiary treatment);
3. Proportion (%) of total annual generated waste water load, not connected to waste water collecting systems, and explanation of the type of waste water treatment applied to this fraction;
4. If the city is located in an EU Member State include data on waste water treatment obligations according to the UWWTD (based on city's size and nature of the area of discharge);
5. Waste water collecting systems: main type of collecting system (combined/separated) and annual proportion (%) of COD-loads discharged via storm water overflows;
6. UWWTPs: Organic design capacity (p.e.), most advanced treatment level, annual incoming and discharged loads (t/a) of BOD5, COD, Ntot and Ptot and treated waste water amounts (m<sup>3</sup>/a) of all UWWTPs serving the city. If the city is located in an EU Member State, indicate whether the UWWTP complies with the treatment requirements under the UWWTD;
7. Annual amounts of generated sewage sludge (t/a) and description of treatment/disposal pathways (% of total amount).

Further information (e.g. on energy efficiency at UWWTPs, treated waste water re-use, economic sustainability) is highly appreciated.

Zaragoza, headquarters of the UN Office for the Water Decade, treats the 99% of its waste water. The other 1% comes from six small rural districts but the plan to treat it is in process.

Zaragoza has two waste water treatment plants with secondary and tertiary treatments for the disposal of phosphorus:

- La Almozara (1989). Activated sludge technology and anaerobic digestion. Capacity for 100,000 people. Volume of flow 34,560 m<sup>3</sup>/day. The biogas produced is used to generate 1,713,390 kWh.
- La Cartuja (1993). Technology for activated sludge, thickening and incineration. Capacity for 1,200,000 inhabitants. 259,200 m<sup>3</sup>/day flow. A steam turbine uses the heat and generates 3,588,300 kWh. It has been enhanced to reduce consumption by 5,000,000 kWh / year /kWh/year. (graphic 1).



Graphic 1. The enclosure and deodorization system of La Cartuja waste water treatment plant makes it different from any other conventional treatment plants

The Council is trying to balance the costs and the incomes of the systems. The increasing of the bills has not balanced the reduction of consumption even though the incomes represent the 96% of the total costs, but the payment of La Cartuja, 9 million euro/year till 2013, is included.

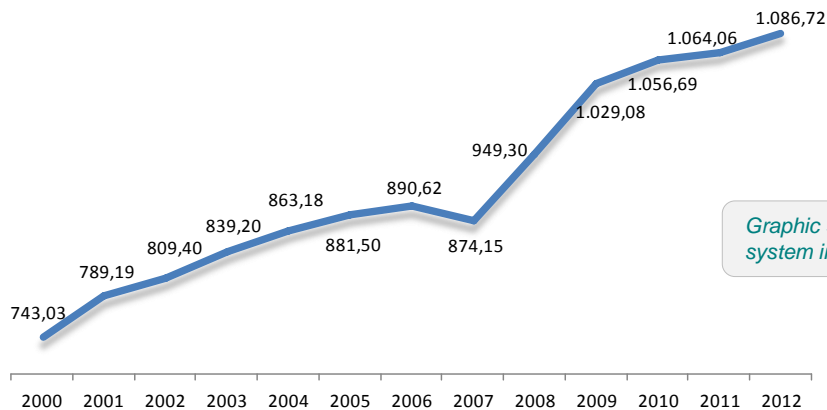
(1) (graphic 2)

Origin (2012)	m <sup>3</sup>	
Home dumping	25.480.000	66,67%
Commercial dumping	8.490.000	22,21%
Industrial dumping	750.000	1,96%
Taked from the phreatic (industry)	2.500.000	6,54%
Taked from wells & canals (industry)	1.000.000	2,62%
<b>Total</b>	<b>38.220.000</b>	

Graphic 2 Origin of the waste water

(2) The network includes the whole urban layout and the first external kilometres.

The strong increase of the network is justified by the collection of industrial waste and the waste from nearby urban areas (graphic 3)



Graphic 3 Extension of Zaragoza's sewage system in km.

It is forbidden to dump waste when there is the possibility of connection to the municipal collectors.

Two storm water-tanks have been built in the collectors of both margins of the river Ebro. Rainwater is taken to La Cartuja.

(3) A few rural districts and small industrial areas -1% of total- are not connected yet and are waiting for the Government of Aragon to settle red tape

(4) Results of the facilities in 2012 (graphics 4 and 5)

**La Almozara Wastewater Treatment Plant**

Volume of flow treated = 10.658.915 m<sup>3</sup> Energy generated 1.713.390 kWh

	Untreated water mmg/l	Treated water mmg/l	Performance (%)	Quality levels demanded by current regulations (Directiva UE 91/271 y RD 509/96)
SST	254	21	91,7%	35
DBO5	237	13	94,5%	25
DQO	528	80	84,8%	125
P	5,3	1,4	73,6%	1 - 2

Graphic 4. Volume of flow treated and average levels of pollution in waste water and purified water. La Almozara

**La Cartuja Wastewater Treatment Plant**

Volume of flow treated = 48.586.620 m<sup>3</sup>

Energy generated: 3.588.300 kWh

	Untreated water mmg/l	Treated water mmg/l	Performance (%)	Quality levels demanded by current regulations (Directiva UE 91/271 y RD 509/96)
<b>SST</b>	336	24	92,9%	35
<b>DBO5</b>	316	12	96,2%	25
<b>DQO</b>	680	100	85,3%	125
<b>P</b>	6.7	1.0	85,1%	1 - 2

*Graphic 5. Volume of flow treated and average levels of pollution in waste water and purified water. La Cartuja*

(5) The biggest part of the system is unitary. In the new residential areas (20% of the city) and the new industrial areas (50% of the industrial total) the network consists of a separate sewer with a system for collecting rainwater and using it in green areas.

Since the storm water-tanks have been built, we do not have data on the evacuated volumes, but given Zaragoza weather, the results can be very changeable during the year.

(6) Point 4 shows the high performance of the facilities and the achievement of the compulsory levels of quality.

The Environment and Sustainability Agency checks and authorises the discharge of industrial dumping to municipal collectors. 3,000 controlled activities which must follow specific treatment systems for its polluters that cannot be eliminated in Plants, avoiding toxic substances putting at risk the biological treatment process. A specific control of dumping in the industrial areas is made in order to check that the data obtained are what it was expected.

The own staff, the municipal laboratories and the Ebro Basin Agency control that the results are within the limits (*graphic 6*)



*Graphic 6. Samplings taken from industrial areas where the volume of flow, the continuous measure of physical parameters and the integrated samplings of 24 hours are made*

7) Zaragoza treats the 100% of the mud produced:

La Cartuja Wastewater Treatment Plant: 16,498 ton/year of dry matter.

The mud is thickened by gravity and dehydration takes place by centrifuge. After its drying, the mud is assessed in a fluidised bed roster for exploiting its energy.

La Almozara Wastewater Treatment Plant: 4,900: ton/year of dehydrated mud.

An 80% of the mud is removed by farmers to be used in farming lands. A 20% is taken to the Technological Recycling Park of Zaragoza for its composting with organic fraction of urban waste.

## 9B. Past Performance

Describe the measures implemented over the past five to ten years to improve waste water treatment. Comment on which measures have been most effective. If the city is located in an EU - Member State special reference should be given to non-expired deadlines for compliance with the UWWTD, when applicable.

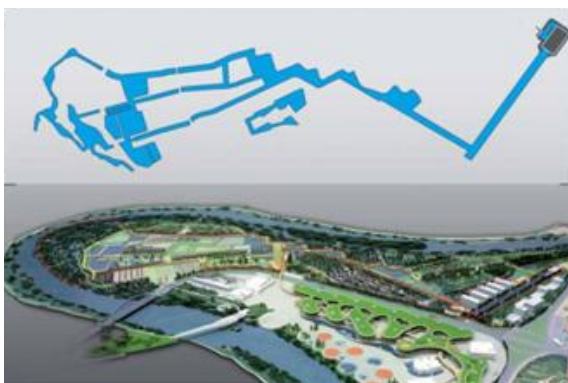
Particular reference should be given to capacity building, measures for maintenance, management and restoration of waste water collecting systems and UWWTPs.

A description of further measures for improving waste water treatment (e.g. pollution prevention efficiency, improvement of energy efficiency) is highly appreciated

The problems related to flooding in the city of Zaragoza have two different parts depending on its origin. There are floods produced by some of its rivers, specially the Ebro, and storms producing hard rains that cause a limited flood reach and duration in points where the sewage system has not enough capacity to evacuate top rainwater, forming low points without natural drainage

The river Ebro can present very intense river rises with a volume of water over 4,000 m<sup>3</sup>/second for return periods of 100 years. Forming part of the process for the recovery of its urban riverbanks carried out for Expo Zaragoza 2008, the lowest areas of the city have been protected by facing river rises corresponding to a return period of 500 years. Therefore, the city is now in a good situation to face floods.

The water structure built in the Water Park (*graphic 7*) at the Expo 2008 site can be considered as a special action. Water is distributed by the park area through a grid of channels and lagoons with a layout that follows that existing before in the meander. This water structure cleans water in a natural way along its more than two kilometres.



Graphic 7. Water Park Hydraulic Infrastructure.

Water is taken from the river Ebro, from the Rabal irrigation ditch (coming from the river Gállego) and from underground water (water table). It is regulated in the deposit canal, passes by the aqueduct, is distributed by pools and canals, arrives clean to the bath areas where a beach has been built for leisure (*graphic 8*), is reused for watering and comes back to the river.



Graphic 8. Zaragoza river beach

Zaragoza periodically suffers localized flooding due to very heavy rainfall as summer storms that discharge up to 40 litre/m<sup>2</sup> in very short periods.

To deal with these phenomena have been built rolling tanks that can store temporarily a large volume of water for later release in a controlled manner to the sewer.

Also, Green Trails and Cycle Paths are designed to serve as a parapet to the floods of the rivers running through or flow into the city.

An important part of the actions are included in Zaragoza Plan for Improving its Water Infrastructures that is being implemented right now. The plan is funded by the Operational Programme of Cohesion Funds-Feder 2007-2013

### Sanitation actions included in the Plan

- A. Actions to fully implement waste water treatment. Until the launching of this Plan, there were six small rural districts -under 20,000 equivalent people- without water treatment, representing approximately a 1% of the polluting load of the city.

In three of these rural districts (Casetas, Garrapinillos and Villarrapa), there was an agreement with the Aragon Water Institute -depending on the Regional Government- for the treatment of its waste waters in the plant to be built in the municipality of Utebo. Its construction has already been awarded. In compensation, this agreement includes also waste water from two small municipalities -la Puebla de Alfindén (5,603 residents) and Pastriz (1,364 residents) that will be treated at La Cartuja Plant. This agreement shows the degree of collaboration that exists among the different institutions to optimize the infrastructures and reduce the necessary investment costs.

Works included in the Improvement Plan have been implemented in the other three rural districts:

- Juslibol: an infrastructure has been built to take waste water of this neighbourhood to the collector placed at Ranillas Ave. and then to La Cartuja Plant. Budget: 881,000 euro.
  - Movera: it has also been built a collector to send its waste water to the outfall at Malpica industrial area. This water is already been treated at La Cartuja Plant. Budget: 1,022,221 euro.
  - Peñaflo: in this case, a small plan for the district has been built since this neighbourhood has not a nearby sewage network for carrying waste water to the existing treatment plants. The project is ready and its budget is 2,071,940 euro.
- B. Actions for improving rainwater management dumping while raining. The Plan included the construction of two storm tanks in the collectors placed at the right and left banks of the Ebro, nearby its main dumping points. Both are unitary collectors, therefore its goal is to retain the first volume of mix of waste and rain water that is the most polluting one. Both action, with a budget of 7,499,988 euro for the left bank collector and 5,429,899 for the right bank, are virtually finished.
- C. Actions are being implemented for the renovation of the sanitation networks in urban areas in which the existing network of collectors is in a bad shape, present sealing problems and produce water leakages to the phreatic levels. The Plan includes two actions already made that affect the surroundings of Barcelona St. (with a budget of 2,064,831 euro) and Canfranc St. (budget of 1,045,855 euro).
- D. Actions to avoid flooding in areas with sewage networks which have not enough capacity and have low level points without natural drainage producing that an accumulation of rain water affecting the private properties and road traffic of the city.

The Plan included two similar actions combining the construction of a lamination tank to store in a provisional way a certain quantity of rainwater and improves the sewage network. It also has been launched the first infrastructure for the final stretch of the S. Juan de la Peña Ave. (budget: 4,404,404 euro). The second project, a stretch of the Valle de Broto Ave. is being made right now with a budget of approximately 4,000,000 euro.

This pack of actions will produce an improvement of the city's sanitation, making it possible a fast solution for the weaknesses of the city in relation to sanitation.

The following graphic shows the variation in the consumption of drinking water that has a direct relation with water treatment and a lesser water consumption at home and in the city in general. This supposes a lesser volume of water treated, with better performances in the process and a lower polluting quantity spilled to the environment.

	2000	2012	reduction
Consumption of contracted water (000. m <sup>3</sup> )	79.355	60.596	-23,64%
Dotation (litres/person/day)	348	226	-35,06%
Home Consumption	135,5	99,8	-26,35%

Graphic 9. Evolution of the main parameters. 2000-2012

## 9C. Future Plans

*Describe the future short and long term objectives for waste water management and the proposed approach for their achievement. Emphasize to what extent plans are supported by commitments, budget allocations, and monitoring and performance evaluation schemes.*

Refer to:

1. Improvement / maintenance / management of collecting systems;
2. Improvement of connection to collecting systems;
3. Improvement of design capacity, treatment level and treatment performance of UWWTPs;
4. Improvement of connection to UWWTPs;
5. Improvements of further environmental and economic aspects of waste water treatment (e.g. removal of micro pollutants, energy efficiency at UWWTPs, sludge treatment and disposal, treated waste water re-use).

*Emphasize to what extent plans are triggered by the demands of EU and national regulations*

Even though, as it has been shown, the situation of the city of Zaragoza in relation to sanitation and in particular with waste water treatment is good, there are subjects in which it is necessary to improve.

The plans for the next five years include the connection of all the small neighbourhoods with the municipal collectors and the new industrial areas.

With reference to consumption, the goal is to have counters in all the garden areas and track the main commercial, industrial and municipal consumptions to guarantee an efficient use of water.

Reusing waste water for watering and cleaning the streets is being considered as an alternative to the use of this element from the phreatic level. Nevertheless, the firsts surveys present as unfeasible its reuse for urban uses, both from an economic and from an environmental point of view, since considering energy, the reuse will produce a bigger quantity of CO<sub>2</sub> emissions than pumping underground water.

Surveys are being made on the degree of the effect of medicaments in waste water.

It is also being studied the elimination of nitrogen in waste water as tertiary treatment, given the foreseeable continuous improvement of the quality of water in the river Ebro made by the Hydrological Basin organization.

It can be stressed the recent passing (28 January 2011) of the new Municipal Bylaw for the Eco-efficiency and Quality of the Management of the Full Water Cycle. The goal is to continue the advance in the sustainability of the resources. In sanitation, this new municipal bylaw, among other questions, calls for new urbanizations to have independent sewerage networks and systems to use rainwater for watering green areas.

All the aspects included in the new municipal bylaw must be applied in the next years to:

- ✓ increase the control on industrial dumping
- ✓ reduce dumping taken to waste treatment plants and increase the number of separating systems
- ✓ remove the breaking tanks for the water supply of buildings since its leaks increase at the same time the volume of waste
- ✓ reduce the volume of waste by reducing also water consumption both at home and in commerce and industry
- ✓ construction of new storm tanks

## 9D. References

### Legislation

- Decree 38/2004 of 24 February passing the Regulations on dumping waste water to the municipal sewage networks  
[http://www.aragon.es/estaticos/GobiernoAragon/Organismos/InstitutoAragonesAgua/Documentos/Areas\\_Genericas/DECRETO%2038-2004.PDF](http://www.aragon.es/estaticos/GobiernoAragon/Organismos/InstitutoAragonesAgua/Documentos/Areas_Genericas/DECRETO%2038-2004.PDF)
- Municipal Bylaw for eco-efficiency and quality of the management of the full water cycle. City of Zaragoza 07/02/2011  
[http://www.zaragoza.es/ciudad/normativa/detalle\\_Normativa?id=1542](http://www.zaragoza.es/ciudad/normativa/detalle_Normativa?id=1542)

### Documents

- Documentation Centre on Water and Environment  
<http://www.zaragoza.es/ciudad/medioambiente/centrodocumentacion/>
- Plan for the updating of infrastructures linked to the management of water in the city of Zaragoza  
[http://www.zaragoza.es/ciudad/medioambiente/detalle\\_Noticia?id=95811](http://www.zaragoza.es/ciudad/medioambiente/detalle_Noticia?id=95811)
- Zaragoza Sustainability Indicators  
<http://www.zaragoza.es/ciudad/medioambiente/agenda21/observatorio/indicadores.htm>
- Water Tribune. International Exhibition 2008. File  
<http://www.zaragoza.es/ciudad/medioambiente/centrodocumentacion/cajaAzul/>
- United Nations Office for Supporting the International Decade for the Action "Water, Source of Life" 2005-2015  
<http://www.un.org/spanish/waterforlifedecade/index.shtml>



- Zaragoza Charter (commitment document, synthesis of the work of the Water Tribune, 2008)
- “LIFE Optimizagua Project. A reference model for an efficient management of water” LIFE03 ENV/E/000164. Layman’s Report  
[http://www.life-optimizagua.org/documentos/Layman\\_es.pdf](http://www.life-optimizagua.org/documentos/Layman_es.pdf)  
<http://www.life-optimizagua.org>
- Switch project  
<https://www.zaragoza.es/ciudad/medioambiente/switch/>  
[http://www.zinnae.org/phocadownload/articulo\\_usos\\_del\\_agua\\_en\\_el\\_hogar\\_en\\_zaragoza.pdf](http://www.zinnae.org/phocadownload/articulo_usos_del_agua_en_el_hogar_en_zaragoza.pdf)

### Interesting links

- Zaragoza Agency of Environment and Sustainability  
<http://www.zaragoza.es/ciudad/medioambiente/>
- Municipal Institute of Public Health  
<http://www.zaragoza.es/ciudad/IMSPL/>
- Water bill:  
<http://www.zaragoza.es/ciudad/encasa/facturaagua/>
- Hydrographic Confederation of the Ebro  
<http://www.chebro.es/>
- ZINNAE cluster:  
[www.zinnae.org](http://www.zinnae.org)
- Water Park:  
<http://www.parquedelaqua.com/index.php/inicio/>