SANITATION OF THE ALTO ÓRBIGO REGION

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SUMMARY

The Royal Decree Law 11/95 of December 28th, transposes the Directive 91/271/EEC which establishes the applicable standards for the treatment of urban waste waters, requiring a secondary treatment for the townships of more than 2,000 equivalent inhabitants and an appropriate treatment for the remaining populations. For the purpose of fulfilling this regulatory requirement, the Ministry of the Environment has signed an agreement with the Autonomous Community of Castilla León whereby the Ministry promises to undertake a number of actuations regarding waste water treatment, among which is the Sanitation of the Alto Órbigo region.
The last actuation covered in the aforementioned agreement included the implementation of an appropriate treatment of the sewage of 59 municipalities. Due to the variety of the municipalities, their size and therefore the flow to be treated in the different towns, a combined sewage treatment system was designed. Based on the possibility of collecting the different outflows by means of pipe systems, three different types of treatment plants were designed, depending on its size. The outflows of the municipalities are connected by means of 65 km of piping and 21 treatment plants of different sizes are required. The global solution was designed with three activated sludge treatment plants with extended aeration (Type A), eight treatment plants with extended oxidation (Type B1), and ten plants with an extended aeration with sequencing batch reactor operating system (SBR) (Type B2). The flows to be treated in all the facilities vary between 7,400 m^3/day (Villoria A waste water treatment plant) and 41.51 m^3/day (Azadón B2 waste water treatment plant).
The solution for the waste water treatment of the Alto Órbigo region is a combined treatment system with cost optimisation.

INTRODUCTION

The Órbigo is a river in Northwest Spain that flows into the Atlantic. This river flows through León province, and in the last stretch through Zamora province. It is formed by the confluence of the Luna river and the Omañas river that source respectively in Picos Albos and in Sierra de la Filera, and are located to the north of the town called Llamas de la Ribera. From this place the new river heads southwards and forms the valley of the Ribera del Órbigo, where there are 59 townships that concern us, between Villaviciosa de la Ribera and Requejo de la Vega.
These small towns, located on both banks of the river Órbigo, do not have any type of sewage treatment for most of their waste waters, and in case of having some, it is not considered to be sufficient. The objective of this project is to carry out the works to provide the facilities that are needed

to give an appropriate treatment to the waste water generated by all these municipalities, before they discharge them into the river Órbigo. The main economic resources of the region are based on agriculture, on an incipient food industry and on seasonal tourism during the summer months. These economical activities, as well as the growth of some new ones, the need for an adequate standard of living for all the region's inhabitants, and the conservation of our natural environment require appropriate sewage treatment infrastructures, as well as their correct operation.

METHOD

The fifty nine townships are located between the towns of Llamas de la Ribera and Requejo de la Vega, forming an agglomeration of 37,000 inhabitants that presently discharge their waste waters directly into the river Órbigo or in the proximity thereof.

The discharges have been collected and concentrated by means of a network of pipes (65 km) and 21 waste water treatment plants of different sizes are necessary. The works were divided into four sections. The towns and design flows of the 21 plants are included in tables n°1, n°2 and n°3 below.

Towns	Population (eq. inhabitant)	Flow (m^3/day)	Pipe length (m)
WWTP 1: San Román, Llamas de la Ribera, Quintanilla de Sollamas, Cimanes del Tejar, Villanueva del Carrizo, Carrizo de la Ribera.	9,000	4,500	11,377
WWTP 2: La Milla, Huerga, Quiñones, Armellada, Turcia, Palazuelo de Órbigo, Gavilanes, Santa Marina del Rey, Benavides de Órbigo	12,000	6,000	17,362
WWTP 3: Moral de Órbigo, San Feliz de Órbigo, Villares de Órbigo, Villamor de Órbigo, Hospital – Puente de Órbigo, Barrio de Buenos Aires, Villavante, Acebes del Páramo Castrillo, San Pelayo, Villarejo, Veguellina,Villoria de Órbigo	14,800	7,400	22,092

Table n° 1. Type A Treatment Plants

Towns	Population (eq. inhabitant)	Flow (m^3/day)	Pipe length (m)
Antoñan del Valle, Vega de Antoñan, Quintanilla del Valle	798	311.34	2,331
Quintanilla del Monte	850	373.82	
San Martín del Camino	793	348.90	
Estébanez de la Calzada	566	373.82	
Seison, Villamediana, San Román el Antiguo, Veguellina de	538	195.80	2,592

Fondo			
Valdesandinas	566	311.52	
Soto de la Vega, Alcaidón	790	506.73	220
Requejo de la Vega	680	373.82	

Table n° 2. Type B1 Treatment Plants

Towns	Population (eq. inhabitant)	Flow (m^3/day)	Pipe length (m)
Villaviciosa de la Ribera	213	83.02	
Secarejo	106	41.51	
Azadón	106	41.51	
Sardonedo	373	145.29	964
Celadilla del Páramo	426	166.05	300
Valdeiglesias - Santibañez	399	155.67	
San Pedro Pegas	181	70.57	
Huerga de Frailes	239	93.40	
Santa Marinica, Villazala	452	176.43	1,298
Oteruelo de la Vega, Vecilla de la Vega	426	166.05	1,568

Table n° 3. Type B2 Treatment Plants

The three largest facilities are located in the municipalities of Carrizo de la Ribera, Benavides del Órbigo and Villoria de Órbigo. This are the ones called type A.

In type A waste water treatment plants there is a pre-treatment with coarse screening, sieving, de-gritting and de-greasing. A primary sedimentation has been installed for treatment of the overflows, before discharging them into the river. A biological treatment has been designed based on active sludge with extended oxidation and a subsequent secondary sedimentation. The sludge treatment comprises the thickening of the sludge by gravity, sludge de-watering by centrifuge and storage of de-watered sludge. There is also a deodorising facility.

In type B1 waste water treatment plants there is a pre-treatment with coarse screening and sieving. The biological reactor, working as extended aeration, has a concentric gravity decanter. The excess sludge is sent to a storage tank. In this type of WWTP there is no individual installation included for de-watering the thickened sludge, since its transfer is foreseen to the closer type A WWTP.

The type B2 waste water treatment plants have pre-treatment with coarse screening and sieving. Afterwards there is a biological system with extended aeration and sequencing batch reactor operating system (SBR). As in the B1 treatment plants, the excess sludge is sent to a storage tank until later transfer for treatment in the type A plants.

All the waste water treatment plants have a pumping station at the head and have a flow measurement system. In this way running the plants will be simplified.

Based on the analyses of two surveys carried out, the average pollutant loads are somewhat less than those obtained by provision in inhabitant/day. Keeping in mind the existence of infiltrations via irrigation water and channels and due to the possibility of improving the sewer systems in the future, it was considered sufficient to take the following design parameters as minimum starting data for calculating the pollution loads:
60 gr BOD5/inhabitant/day
90 gr SS/inhabitant/day
15 gr N-NTK/inhabitant/day

RESULTS AND DISCUSSION

The outcome of the combined waste water treatment for the 59 towns assures the treatment of their sewage outflows, with a reduction in the operation and maintenance cost of the infrastructure. The sludge produced in all the plants is de-watered, either in the plant itself or in the nearest type A plant (in the case of the B1 and B2 plants). With a remote-control system in any of the type A WWTPs, it is possible to monitor the A treatment plants and supervise the operation in the B1 and B2 plants.

CONCLUSIONS

The final objective of this project is to improve the quality of the water of the river Órbigo.
It is feasible to have a combined treatment system for the fifty nine municipalities of this region.
The combined treatment operation and maintenance of this infrastructure for the fifty nine municipalities result in a cost saving while assuring the treatment parameters and the river Órbigo water quality.