

# QUALITY ASPECTS & BEHAVIOUR OF THE POLLUTANTS IN A SEPARATIVE CATCHMENT IN THE CITY OF SANTIAGO DE COMPOSTELA

J. Suárez, J. Cagiao\*\*, F. Vázquez, F. Díaz-Fierros\*, J. Puertas

*E.T.S. de Ing.de Caminos, Canales y Puertos, Universidad da Coruña, Campus de Elviña, 15192, La Coruña, Spain; suarez@iccp.udc.es; tlf: +34-981-16.70.00, facsimile: +34-981-16.71.70.*

*\* Universidad de Santiago de Compostela, Santiago de Compostela, A Coruña, Spain.*

*\*\* Civil Engineer, Project Manager, Confederación Hidrográfica del Norte, Ministerio de Medio Ambiente, Avda. Buenos Aires n° 23, 36400 O Porriño-Pontevedra, Spain.*

## INTRODUCTION

The aim of this paper is to present the first results of the fieldwork conducted in the catchment "Fontiñas" located in the city of Santiago de Compostela (Northwest Spain). The aim of this fieldwork is twofold: firstly, to carry out a hydraulic analysis and evaluate the contamination discharged by the occurrence of the rainfall events, and secondly to calibrate and validate the hydrological and quality models of the catchment under study. This paper will cover the first of the two objectives in a preliminary approach to solving this problem.

## OBJECTIVE

The objective of this paper is to show the parameters (hydraulic and pollution) analysed in the 10 events examined in the catchment "Fontiñas", Santiago de Compostela (Spain)

## A BRIEF DESCRIPTION OF THE CATCHMENT "FONTIÑAS".

Santiago de Compostela has a typical atlantic climate with a rainfall profile near to 1500 mm/year. The catchment here studied has a separative urban sewer network. The surface area covers around 45 hectares having an imperviousness of 75%. This is a commercial and residential area exhibiting the characteristics typical of an urban zone with a medium population density and medium traffic flow. The catchment's slope average is about 6.5%. This fact is highly relevant to the hydrological and the pollutant behaviour. Catchment concentration time is approximately 15-20minutes (Cagiao et al., 1999).

The figures below show the catchment studied with its sewer network and control section (figure no 1), which will be described later.

At the low point of the catchment a control section was set up where, to date, a total of 10 rainfall events have been sampled, having collected information on total flows and pollutant parameters, including solids, heavy metals and organic carbon among others. A rainfall meter was installed at the catchment to provide reliable data on rainfall.

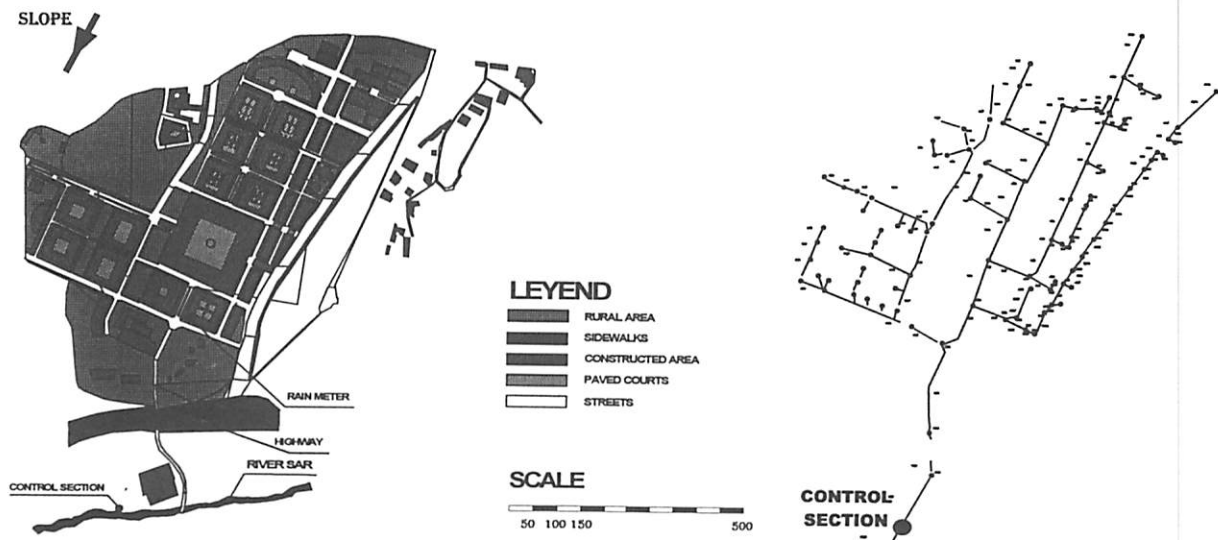


Figure 1: View of the catchment with its sewer network and control section

## METHODOLOGY

The methodology used consisted of the following stages:

1. Fieldwork to collect flow data and to sample each event analysed.
2. Lab tests to obtain pollutographs from each pollutant.

Based on all of the information gathered from 1 and 2, we were able to draw up a number of parameters, which are summarised below.

|  |  |
|--|--|
| <p><u>Pluviometric parameters:</u><br/> <b><i>DTSP</i></b>: duration of previous dry weather (days).<br/> <b><i>P</i></b>: total precipitation height (mm).<br/> <b><i>D</i></b>: total duration of the storm event (hours).<br/> <b><i>Imax</i></b>: maximum rainfall intensity (mm/h).<br/> <b><i>Imed</i></b>: mean rainfall intensity (mm/h) or <math>P/D</math>.</p>  | <p><u>Hydrological parameters:</u><br/> <b><i>Qmax</i></b>: maximum flow (<math>m^3/s</math>).<br/> <b><i>Qmed</i></b>: mean flow (<math>m^3/s</math>).<br/> <b><i>Vw</i></b>: total volume per surface unit (<math>l/m^2</math>).</p>   |
| <p><u>Pollutant Parameters:</u><br/> <b><i>Mss</i></b>: total mass of SS mobilized per surface unit (<math>g/m^2</math>).<br/> <b><i>Qssmed</i></b>: mean mass flux of SS (mg/s).<br/> <b><i>Qssmax</i></b>: maximum mass flux of SS (mg/s).<br/> <b><i>CMSss</i></b>: event mean concentration of SS (mg/l), or <math>Mss/Vw</math>.<br/> <b><i>CMSDS</i></b>: event mean concentration of DS (mg/l).<br/> <b><i>Ssmax</i></b>: maximum concentration of SS (mg/l).</p> | <p><b><i>CMSZn</i></b>: event mean concentration of Zn (mg/l).<br/> <b><i>CMSCu</i></b>: event mean concentration of Cu (mg/l).<br/> <b><i>CMSpb</i></b>: event mean concentration of Pb (mg/l).<br/> <b><i>CMSTOC</i></b>: event mean concentration of TOC (mg/l).<br/> <b><i>Cmed</i></b>: mean conductivity (<math>\mu S/cm</math>).<br/> <b><i>Cmax</i></b>: maximum conductivity (<math>\mu S/cm</math>).</p> |

## GENERAL DESCRIPTION OF THE EVENTS SAMPLED

The following table (table no. 1) presents a summary of the minimum, mean and maximum values and the standard deviation of the different parameters mentioned in the above section pertaining to the 10 events analysed:

**Table no. 1: A summary table of the values of the parameters analysed in the 10 events examined in the catchment "Fontiñas", Santiago de Compostela (Spain)**

| Parameter                                  | Values |        |       |                      |
|--|--------|--------|-------|----------------------|
|  | MIN    | MEAN   | MAX   | Standard Deviation S |
| <i>DTSP</i> (days)                         | 0.02   | 6.21   | 30    | 8.8 (10)             |
| <i>P</i> (mm)                              | 0.8    | 2.34   | 6.70  | 1.9 (7)              |
| <i>I<sub>max</sub></i> (mm/h)              | 1.2    | 2.63   | 6.0   | 1.6 (8)              |
| <i>I<sub>med</sub></i> (mm/h)              | 0.73   | 1.52   | 3.70  | 0.94 (8)             |
| <i>D</i> (h)                               | 0.42   | 1.27   | 3     | 0.75 (10)            |
| <i>V<sub>w</sub></i> (l/m <sup>2</sup> )   | 0.61   | 1.21   | 3.91  | 0.95 (10)            |
| <i>Q<sub>max</sub></i> (m <sup>3</sup> /s) | 0.05   | 0.17   | 0.42  | 0.10 (10)            |
| <i>Q<sub>med</sub></i> (m <sup>3</sup> /s) | 0.05   | 0.16   | 0.26  | 0.06 (10)            |
| <i>M<sub>ss</sub></i> (g/m <sup>2</sup> )  | 0.06   | 0.26   | 0.70  | 0.23 (10)            |
| <i>SS<sub>max</sub></i> (mg/l)             | 84     | 744    | 3526  | 972.1 (10)           |
| <i>QSS<sub>max</sub></i> (g/s)             | 21     | 77.76  | 235   | 69.4 (10)            |
| <i>QSS<sub>med</sub></i> (g/s)             | 7.29   | 226.43 | 66    | 22.5 (10)            |
| <i>CMS<sub>ss</sub></i> (mg/l)             | 64     | 216    | 581   | 160.7 (10)           |
| <i>CMS<sub>DS</sub></i> (mg/l)             | 67     | 111.25 | 199.7 | 44.9 (10)            |
| <i>CMS<sub>Cu</sub></i> (µg/l)             | 14.3   | 25.6   | 54    | 11.7 (9)             |
| <i>CMS<sub>Zn</sub></i> (µg/l)             | 136    | 225.2  | 442   | 97.5 (10)            |
| <i>CMS<sub>Pb</sub></i> (µg/l)             | 12.9   | 32.3   | 77.2  | 19.4 (8)             |
| <i>CMS<sub>TOC</sub></i> (mg/l)            | 2      | 6.9    | 21    | 5.1 (10)             |
| <i>C<sub>max</sub></i> (µS/cm)             | 79     | 251    | 344   | 70.51 (9)            |

( ): no. of values.

Table no. 1

Table no. 2 shows the event mean concentrations for the heavy metals Cu, Zn and Pb from the *National Urban Runoff Program* (US-EPA, 1983):

| Parámetro | CMS (µg/l) | CMS (µg/l) - Fontiñas |
|-----------|------------|-----------------------|
| Cu        | 43         | 23.6                  |
| Zn        | 202        | 225.2                 |
| Pb        | 182        | 32.3                  |

Table no. 2 (ASCE, 1992).

Shown next is one of the ten events analysed (event 04/05/99) with their respective graphs (figs.n° 2) in addition to two standardised graphs showing the event that give an idea of the phenomenon of the first flush in the catchment (figs.n° 3-4).

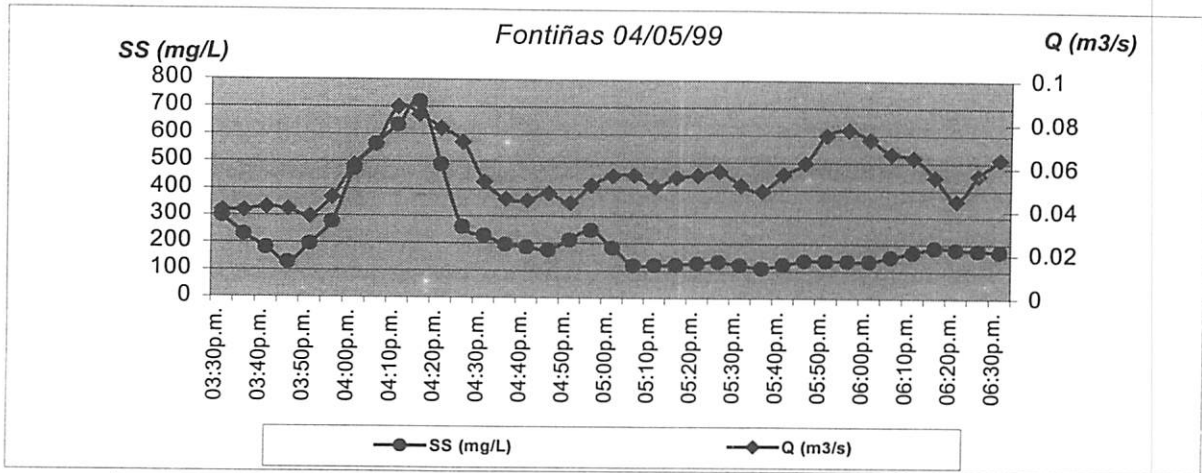


Figure 2: Event 04/05/99 Fontiñas Catchment

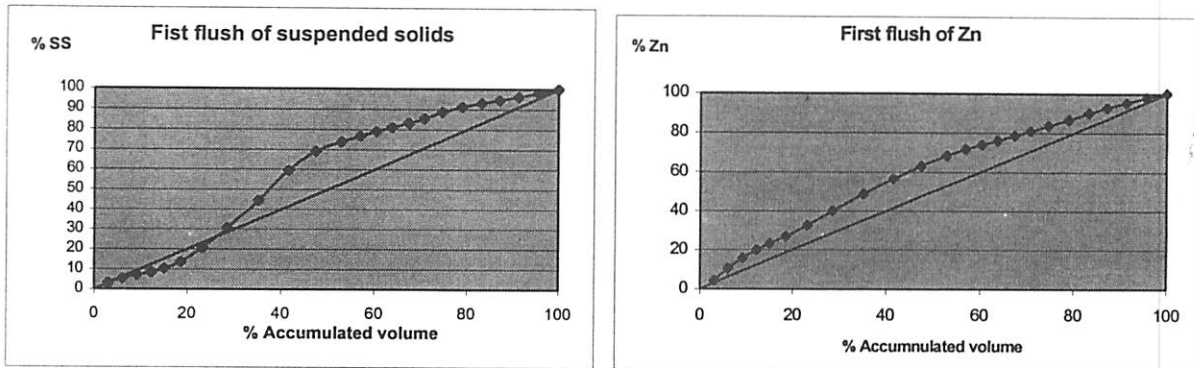


Figure 3 and 4: Two samples of the analysis of first flush

## CONCLUSIONS

The main conclusions of this paper are:

- In view of the results of the CMS (event mean concentration) of the heavy metals in "Fontiñas", and after comparing NURP values (US-EPA, 1983), we can state that the catchment generates low values of Cu (:1.8 the NURP value) and Pb (:5.6); and a similar value of Zn (x 1.1).
- As regards the pollutant mass mobilised during the rainy weather, we would like to point out that: a) the mean value of load of SS (2.6 Kg/ha) is low; b) the value of maximum concentration of SS (mg/L) is high.
- First flush has been appreciated at the "Fontiñas" catchment.

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