

## A comparison of different methodologies for designing land application systems: Case study at the Redueña WWTP

Irene de Bustamante<sup>a</sup>, Francisco Javier Lillo<sup>b</sup>, Juana María Sanz<sup>a</sup>, Ángel de Miguel<sup>a\*</sup>, Eloy García<sup>a</sup>, Francisco Carreño<sup>b</sup>, David Gómez<sup>b</sup>, Tomás Martín<sup>b</sup>, Francisco Martínez<sup>a</sup>, José Luis Corvea<sup>c</sup>

<sup>a</sup>Facultad de Ciencias, Campus Externo, Universidad de Alcalá, E-28871 Alcalá de Henares, Madrid, Spain  
Tel. +34 (91) 885 49 21; Fax +34 (91) 885 50 90; email: irene.bustamante@uah.es, juana.sanz@uah.es, angel.demiguel@uah.es, eloy.garcia@uah.es, francisco.martinezs@uah.es.

<sup>b</sup>Escuela Superior de Ciencias Experimentales y Tecnología, Universidad Rey Juan Carlos, Calle Tulipán s/n, E-28933 Spain  
Tel. +34 (91) 4887016; Fax +34 (91) 6647490; email: javier.lillo@urjc.es, francisco.carreno@urjc.es, david.gomez@urjc.es

<sup>c</sup>Parque Nacional Viñales, Ministerio de Ciencia Tecnología y Medio Ambiente, Carretera a Viñales, km 23. Viñales, Pinar del Río, Cuba  
Tel. +53 82763182; email: corvea@pvnvinales.co.cu

Received 23 April 2008; Accepted in revised form 3 July 2008

---

### ABSTRACT

The conventional treatment of wastewater in small populations is unfeasible. Therefore, non-conventional methods have to be applied in these cases, including land application systems (LAS) also called “filtros verdes” in Spanish. Nowadays, there are many methodologies applicable to the design and sizing of land application systems: the flow/EH, the hydraulic load based on the permeability of the ground, the hydraulic load based on the nitrogen balance, and the hydric balance calculation. A comparative analysis of these methods, which have been applied to the wastewater treatment plant (WWTP) at Redueña (already in operation and sized with parameters flow/EH), is presented. It can be observed how the plant was oversized (18,000 m<sup>2</sup>) with the parameters with which this filter was designed firstly (1 ha/200 EH), so during the summer there was not enough flow to keep the irrigation of the forest species used and, as a result, most of them died. To calculate the necessary dimensioning surface, a comparison of diverse methods has been carried out according to different parameters: the ground permeability, calculation of the hydraulic load based on the nitrogen balance, and the hydric balance calculation. The surfaces obtained respectively by these methods were 1,600 m<sup>2</sup>, 20,000 m<sup>2</sup>, and 8,000 m<sup>2</sup>. The results obtained by means of the experimental works in the WWTP at Redueña, point out that the hydric balance is the best method to apply in this plant, because it optimizes the required surface and the water purification yields.

*Keywords:* Land application systems; Sewage treatment plant design

---

\* Corresponding author.

Presented at the 2nd International Congress, SMALLWAT '07, Wastewater Treatment in Small Communities, 11–15 November 2007, Seville, Spain