COMPARATIVE ANALISYS OF INDIVIDUAL SANITATION SYSTEMS

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Introduction

Wastewater treatment can be grouped in 4 categories according to the size of the served population: big, medium and small nuclei plus individual sanitation for isolated buildings or small agglomerations. According to the Urban Wastewater Directive (91/271/EEC) "where the establishment of a collecting system is not justified either because it would produce no environmental benefit or because it would involve excessive cost, individual systems or other appropriate systems (...) shall be used". As a reference, for distances superior than 200 m from the sewerage system individual sanitation is more cost-efficient, taking into account the cost of the collecting pipe build-up.

Methods

Standards, technical reports, guidelines and commercial data for non-collective sanitation systems (Fig. 1-6) related to small agglomerations up to 50 inhabitants were collected (AENOR, 2000-2010; CSTB, 2001; USEPA, 2007; CENTA, 2007; Collado, 2008; Collado & Díez, 2010; Lefebvre, 2004; SIMOP). The analysis aimed at identifying the design parameters to be evaluated in order to select proper treatment depending on the environmental conditions (soil permeability, slope, thickness and groundwater level). A comparative evaluation of the surface requirements for a 4 person's house-unit depending on the soil permeability (range: 15 to 500 mm/h) was performed by considering typical application rate case by case. The investment cost estimation was based on commercially available data, referred at the same house–unit.

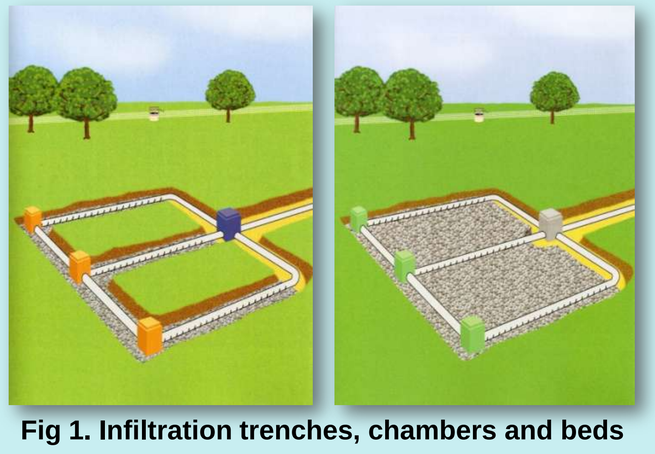


Fig 1. Infiltration trenches, chambers and beds

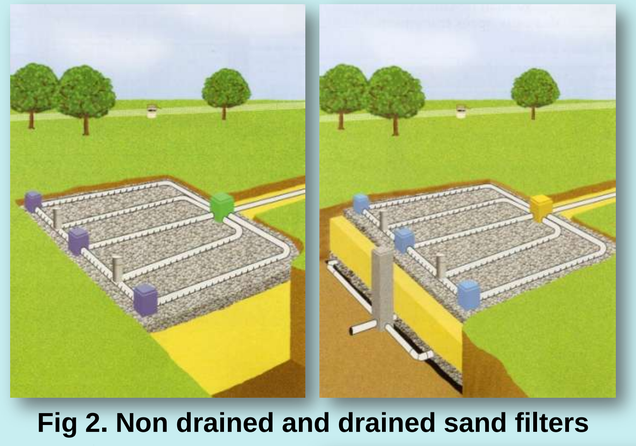


Fig 2. Non drained and drained sand filters

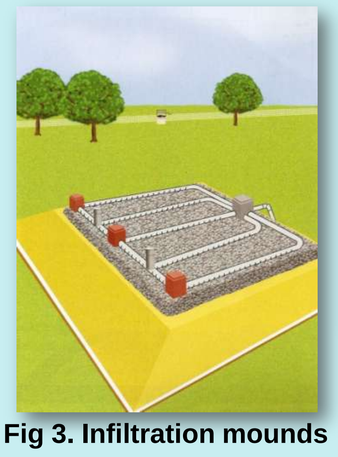


Fig 3. Infiltration mounds

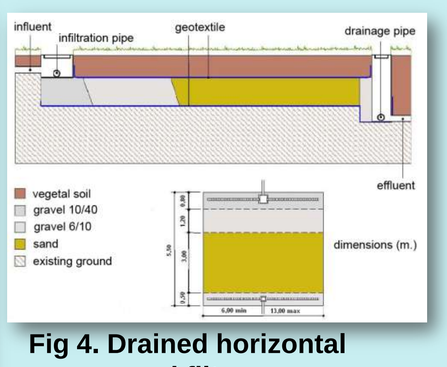
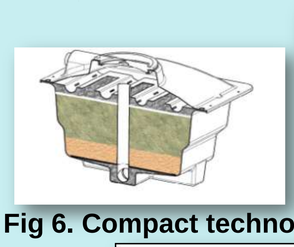


Fig 4. Drained horizontal sand filters



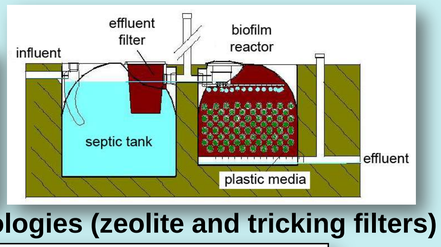


Fig 6. Compact technologies (zeolite and tricking filters)

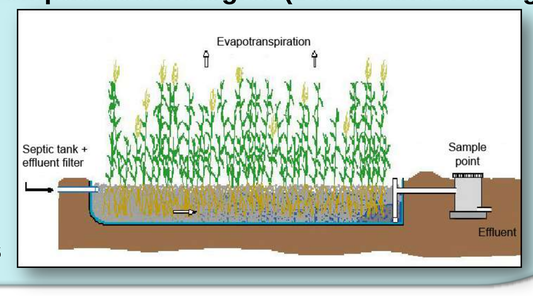


Fig 5. Constructed wetlands

Results

Table 1 summarizes soil parameters and disposal fate to be considered in the selection of the most appropriate system. Figure 7 illustrates the trend of surface requirement, depending on soil permeability. Figure 8 reports an estimation of the costs of the surveyed technologies.

Treatment system	Soil type	Disposal fate
Infiltration trenches and chambers	High permeability; slope < 10%; existing soil	Ground
Infiltration bed	Sandy; flat; existing soil	Ground
Non drained sand filter	Cracked rock or high permeability; soil replaced by sand	Ground
Drained sand filter	Low permeability; drop between in and outlet > 1,5 m; soil replaced by sand	Superficial
Infiltration mound	High groundwater level; soil replaced by sand	Ground
Drained horizontal sand filter	Low permeability; high groundwater level; drop between in and outlet < 0,5 m; soil replaced by granular material	Superficial
Constructed wetland, Zeolite filter bed	Low permeability; soil replaced by gravel or zeolite	Superficial

Tab 1. Soil type and disposal fate for the treatment systems

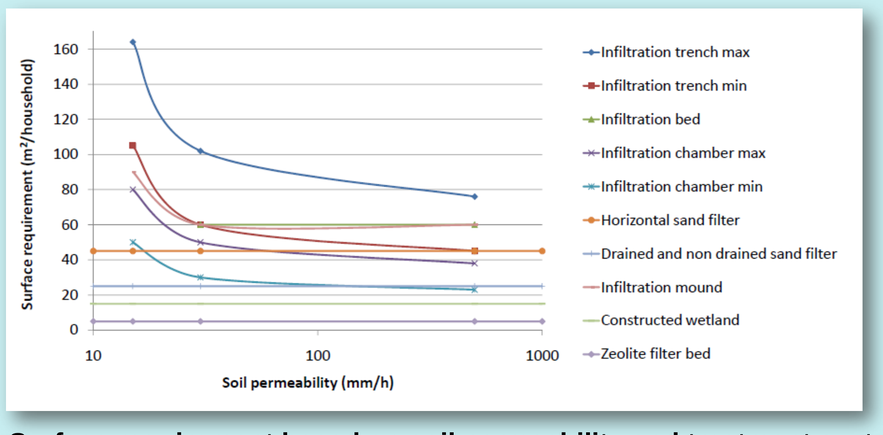


Fig 7. Surface requirement based on soil permeability and treatment system

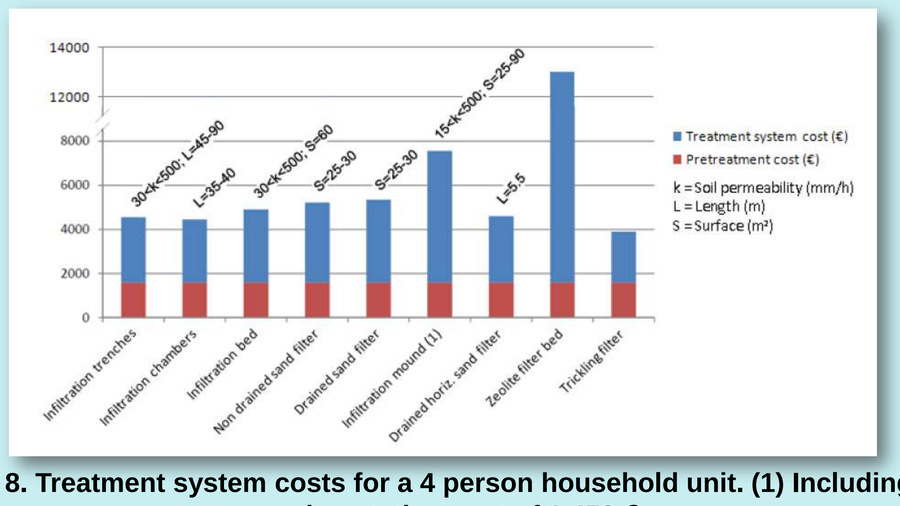


Fig 8. Treatment system costs for a 4 person household unit. (1) Including pumping station cost of 1,450 €

Conclusions

Individual sanitation provides complete treatment system, able to meet the legislation requirements.

The soil type (slope, permeability, ground thickness, groundwater level, etc.) as well as the surface availability are the main factors to be considered in the selection of the most appropriate system, case by case.

For a 4 person's isolated house-unit, space occupation of the treatment system is between 25 and 160 m^2, in case the soil permeability allows for land infiltration. Using sand filters, constructed wetlands or zeolite filter beds the space requirement lowers to the range 5-90 m^2.

The average investment cost of wastewater treatment for a 4 person household is 5,065 € in the range 3,900-7,550 € (exc. zeolite filter bed).

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References

AENOR (2000-2010). *Pequeñas instalaciones de depuración de aguas residuales para poblaciones de hasta 50 habitantes equiv.* UNE-EN 12566.
CENTA (2007). *Manual de tecnologías no convencionales para la depuración de aguas residuales*. Centro de las Nuevas Tecnologías del Agua.
Collado, R. (2006). *Soluciones actualizadas de saneamiento autónomo o no colectivo*. Convenio colaboración entre Consorcio de aguas Bilbao-Bizkaia y el Dept. de CYTAMA de la Universidad de Cantabria.
Collado, R. (2008). *Soluciones técnicas al saneamiento individual o no colectivo*. Tecnología del Agua. Año nº 28, Nº 294.
Collado, R., Díez, R. (2010) *Wastewater treatment facilities for isolated buildings*. In: Proceedings of the 37th IAHS World Congress on Housing Science, Santander, Spain, 26-29 October, 2010. ISBN: 978-84-693-6655-4.
CSTB (2001). *Installation d'assainissement autonome. Pour maison individuelle. En application du DTU 64.1.* Norme XP P 16-603.
Lefebvre, T. (2004). *Les filières plantées de roseaux. Suivi d'un site expérimental á Saint Cassin, Juillet 2001 à Juin 2003*. Groupe de recherche Rhone-Alpes sur les infrastructures et l'eau. Réseau ASNC. Présentation de l'expérience de la Communauté de Communes Charonne Centre.
Llorente, V. (2008). *Aspectos económicos de implantación y explotación de una EDAR*. In: XXVI Curso sobre tratamiento de aguas residuales y explotación de estaciones depuradoras, CEDEX, (III) Madrid.
SIMOP. *Depuración autónoma*. www.simop.es/Producto/DepuracionAutonoma
USEPA (2007). *Code of practice. Wastewater treatment systems for single houses (PE<10)*. Consultation Draft. Environmental Protection Agency. Ireland.