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The CIWEM World of Difference Award Winner 2007

Submission by Professor Duncan Mara, FCIWEM on behalf of the Esholt Research Group School of Civil Engineering, University of Leeds

High-performance Low-cost Natural Wastewater Treatment Systems for Small Villages in the United Kingdom & Europe

INTRODUCTION

The UK water industry is a major consumer of electrical energy: it used 437 kWh per Ml of wastewater treated in 1998/99 (Water UK, 2003) and this increased to 663 kWh per Ml in 2004/05 (Water UK, 2006). Natural wastewater treatment systems use little or no electrical energy, and the price paid for this is their requirement for a greater area of land than energy intensive systems such as activated sludge. This makes them most suitable for small rural communities up to several hundred p.e. where land costs are not high. Waste stabilization pond (WSP) systems, which can easily be designed to merge into the local landscape, have been used for over 50 years to treat domestic, industrial and municipal wastewaters. The oxygen for bacterial BOD removal is supplied mainly by the pond algae and the CO2 for algal photosynthesis comes mainly from the pond bacteria. They work more efficiently, in the sense of requiring less land for the same performance, in hot climates than in temperate climates. Nevertheless they are widely used in the United States, France and Germany, and they are the commonest form of wastewater treatment in New Zealand. However, they are little used in the United Kingdom. Given this experience of WSP in Europe, especially in countries with a climate not too Mara deemed it appropriate to determine the performance of WSP systems in the UK. The first work was an investigation into the performance of the Burwarton Estate WSP in mid-Shropshire (Mara et al., 1998) and this was followed by the work at pilot-scale at Yorkshire Waters wastewater treatment plant at Esholt, Bradford which was initiated by Mara and Abis in 1999. The focus of this work at Esholt has been on assessing WSP performance in winter and summer in the UK, refining WSP design for UK and European conditions, and to develop a novel treatment system to polish WSP effluents (in fact, facultative pond effluents) to minimize land area requirements and costs, while at the same time ensuring that the effluent complies with fairly strict discharge consents. The work has now developed to the stage where its results have been used in practice for the design of a full-scale pond and where firm recommendations can be confidently made for the improved design of natural wastewater treatment systems for small communities of up to ~500 p.e., of which there are many in the European Union, including in the UK, currently without (or with inadequate) wastewater treatment.

APPLICATION OF ESHOLT RESEARCH

The most significant application of our research to date has been the design of the facultative pond at Yorkshire Water's Ecological Wastewater Treatment Plant at Scrayingham, North Yorkshire. The Scrayingham WSP system has won three major awards for Yorkshire Water: the Yorkshire ICE Prize 2005, the BCIA Environment Award 2005, and the CIWEM/RSPB Living Wetlands Award 2006.