

## Western River Basin District



# On-Site Wastewater Treatment Systems

## BACKGROUND DOCUMENT TO WATER MATTERS REPORT

June 2007

# **PROGRAMME OF MEASURES ON-SITE WASTEWATER TREATMENT SYSTEMS**

## **CONTENTS**

<b>1.</b>	<b>BACKGROUND</b>	<b>3</b>
<b>2.</b>	<b>STUDY OBJECTIVES</b>	<b>3</b>
<b>3.</b>	<b>APPROACH</b>	<b>4</b>
3.1	Proposed Outputs	4
3.2	Progress on Existing Systems	5
3.3	Progress on Assessment of New Large-Scale Developments	8
<b>4.</b>	<b>PROGRAMME OF MEASURES</b>	<b>8</b>

Figure 1. Susceptible Flow Pathways

Figure 2. Mapping of Houses and Sewered Areas

Figure 3. GIS Analysis of Houses, Sewered Areas, Water Bodies

Figure 4. Aquifer Vulnerability

## 1. BACKGROUND

Aspects of on-site wastewater treatment systems have been identified under the Article 5 National Summary Characterisation Report ([www.wfdireland.ie](http://www.wfdireland.ie)) risk assessment process as potential pressures acting on water bodies.

On-site wastewater treatment systems (OSWTS) include conventional septic tank systems and on-site proprietary systems. By definition, OSWTS are not connected to sewerage systems and discharge treated wastewater into the ground by percolation.

More than 220 million litres of effluent, from over 1.2 million people, are produced by on-site systems in Ireland daily. Almost 36% of new houses in recent years are 'one-off', using on-site wastewater treatment systems.

The risk of pollution from OSWTS has been identified by the WFD Technical Co-ordination Group as an area requiring further characterisation and development of measures. A particular concern relates to large systems serving clusters of houses.

## 2. STUDY OBJECTIVES

The primary objectives are:

- to develop a Risk Assessment Methodology to identify the impact of On-site Wastewater Treatment Systems on surface water and groundwater status;
- to recommend measures to mitigate against existing and future pressure from OSWTS.

The methodology will use a GIS model that integrates soil and hydrological parameters with mapped OSWTS pressures, pathways and receiving water bodies.

Included within the scope of the study are:

- OSWTS serving single private dwellings;
- Commercial premises such as hotels, guest houses;
- Housing clusters served by a common treatment system; and
- Light industrial facilities not subject to Integrated Pollution Prevention and Control Licensing.

The study is essentially a desk study. Limited fieldwork will be undertaken, concentrating in particular on identification of the impacts of OSWTS on downstream surface water quality, as little quantitative information exists at present in this area.

### 3. APPROACH

The list of tasks is summarised below:

1. Overview of Research and Baseline Information
2. Potential Impact Map
3. Draft Risk Assessment
4. Prepare 'Water Matters' Report Contribution
5. Field Survey
6. Update National Risk Assessment
7. Programme of Measures

#### 3.1 Proposed Outputs

- (a) A Risk Assessment Methodology for existing systems based on the pressure-pathway-receptor framework, which will include:
  - o Pressure layer of OSWTS and identified areas of high settlement density (clusters);
  - o Surface water pathway susceptibility - risk maps of soils, subsoils and aquifer type to identify High, Medium, Low Potential Impact Areas;
  - o Groundwater pathway susceptibility - risk maps of soils, subsoils and aquifer types to identify High, Medium and Low Potential Impact Areas.
- (b) Proposals for site investigation and hydrogeological assessment of new developments. This work has contributed to a revision of the EPA Guidance Manual on Single Houses and it will contribute to a revision of the EPA Guidance Manual for Small Communities, Business, Leisure Centres and Hotels.
- (c) GIS based action tracking procedure for updated risk assessment methodology.
- (d) Development of Programme of Measures.

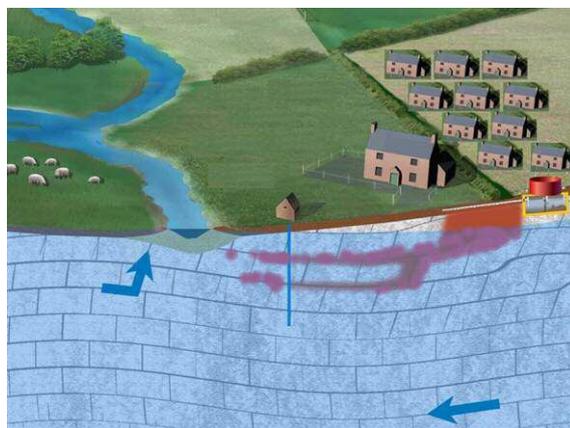


Figure 1. Susceptible Flow Pathways

### 3.2 Progress on Existing Systems

The location of existing OSWTS is being established by mapping all houses and excluding those houses connected to local authority sewerage systems, in towns and villages.

The GIS will identify areas of high OSWTS density and will be capable of linking these to susceptible receiving water bodies.

The An Post Directory has been applied to locate all postal addresses in the country. This data is available to Local authorities and is updated on a quarterly basis as new postal addresses are included. By identifying those locations which are not served by municipal wastewater systems the locations of OSWTS will be identified.

Municipal sewered areas for population centres greater than 2000 PE are provided by the National Urban Wastewater Study. To identify population centres less than 2000 PE, which are served by municipal wastewater systems and treatment works, four teams have been deployed from regional centres nationally to collect data from each of the 34 local authorities.

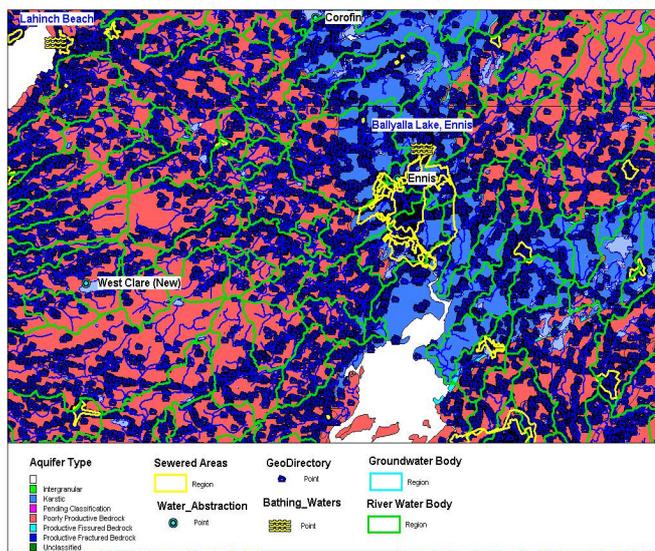


Figure 2. Mapping of Houses and Sewered Areas

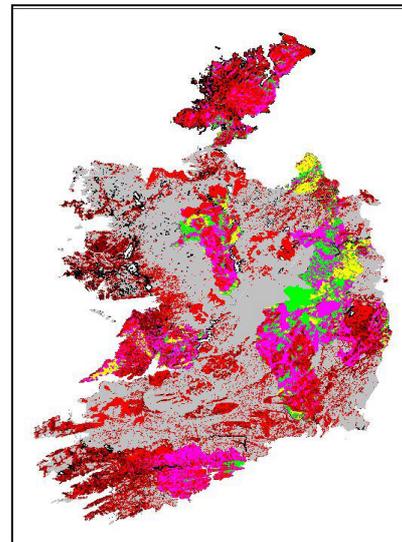
The risk assessment is being trialled in pilot areas addressing:

- Procedures for preparing integrated pressure maps:
  - for individual houses;
  - for demarcation of significant clusters; and
  - for removal of sewered areas.
- Procedures for pathway susceptibility and receptor sensitivity based on:
  - Pathway characterisation;
  - GIS Model;
  - Soil and hydrology risk map;
  - Hydraulic load and recharge.

The risk assessment procedure is being constructed in a multi-layer GIS. Using the mapped pressure, pathway and receptor layers, the risk assessment for existing on-site wastewater treatment systems will be revised and developed.



**Figure 3. GIS Analysis of Houses, Sewered Areas, Water Bodies**



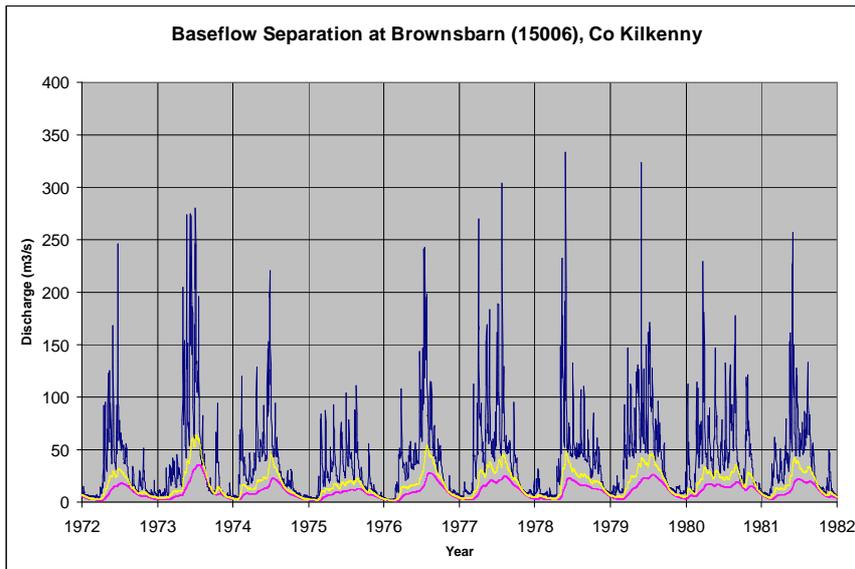
**Figure 4. Aquifer Vulnerability**

## Soils and Geology

The soils and hydrology section of the study has addressed the estimation of:

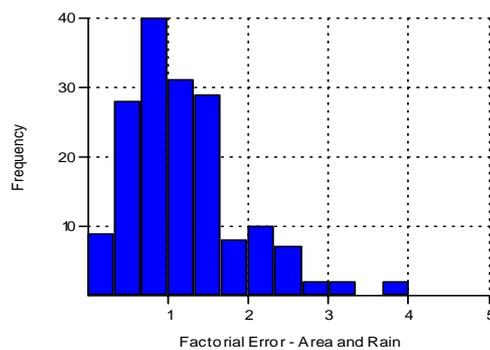
- the three components of flow in and around OSWTS percolation systems – groundwater, intermediate and surface water runoff, and
- the sensitivity of these flows with reference to floods and low flows.

The effects of different groundwater, intermediate and surface water flow system components have been analysed in a contribution to the Groundwater/Surface Water Interaction Working Group, using the main hydro-geological scenarios that occur in the Republic of Ireland. Gauged surface water catchments that contain each of these scenarios were selected and the ‘quick response’ to rainfall was quantified in mm per sq km in each case. The analysis was based on the unit hydrograph approach to identify the separation lines as shown in Figure 5 below.



**Figure 5. Separation of quick response runoff and baseflow**

A separate exercise is underway on behalf of the Hydrology Working Group, where methods for estimation of low flows in rivers at ungauged sites have been reviewed and updated. The present situation for the set of selected gauging stations throughout the country is shown below in Figure 6, where low flows are estimated from Catchment Area and Mean Areal Rainfall. The new approach uses soils, subsoil and aquifer information to select appropriate groups of catchments and the statistical analysis indicates that about 45% of the variation can be explained in this way. The method will provide the most appropriate estimator for different hydrogeological scenarios.



**Figure 6. Factorial Error in the estimation of 95%ile low flows, prior to use of soil, subsoil and aquifer information**

### **3.3 Progress on Assessment of New Large-Scale Developments**

There are two questions to be addressed for assessment of new developments:

#### *Hydraulic Issue*

- ▶▶ Will the effluent get away underground without saturation or ponding, at or near the surface

#### *Contaminant Attenuation*

- ▶▶ When the treatment system relies on the subsoil as a polishing filter, will the effluent be treated adequately before a relevant water body is reached.

For large-scale systems, extensive site investigation is likely to be required. Specifications have been prepared for fieldwork involving boreholes, trial pits and chemical analysis. The results are intended to provide information on:

- Nature, thickness, permeability and geometry of soil and subsoil
- Geometry of rockhead and the nature and permeability of the bedrock
- Depth to groundwater and flow regime
- Suitability for monitoring installations
- Establishment of existing groundwater chemistry and quality

Appropriate hydrogeological calculation procedures are being assessed for determination of hydraulic loads, water levels and contaminants. These will specify appropriate methods for:

- Vertical Flow in unsaturated soil
- Horizontal Flow in each subsoil layer
- Plotting cross-sections, use of Darcy's Equation
- Water Balance
- Nutrient Load Concentration below percolation area and downgradient.

## **4. Programme of Measures**

A Programme of Measures and associated instruments under various headings will be developed from the study. The Programme of Measures will address issues such as planning, design, monitoring and control of OSWTS.

### **Workshop**

A workshop on on-site wastewater treatment systems was held in Athlone in March 2007. This was attended by local authorities, Bord Pleanala, EPA, GSI, universities and consultants. The issues were addressed and possible measures were discussed.