Urban Pressures
Storm Overflows, Wrong Connections and Landfill

Headlines

Why this Might be Important for You

Rivers flowing through urban areas have often been modified by culverting, straightening and deepening to facilitate development and reduce flood risk. They also potentially receive pollution from old landfills, industrial sites, septic tanks, treated sewage effluent, storm sewage effluent and wrong connections.

Establishing the different sources of pollution affecting a river is crucial to selecting targeted and effective measures to improve water quality

This summary gives you some examples from our work over the last 4 years on developing approaches to differentiate pollution sources in urban areas.

Data and Techniques from Our Projects

Some examples of the lines of evidence used in our projects since 2009:

- In some towns urban development has been mapped by the local authority.
- By comparing sewage related pollution incidents and sewage related consented discharges we can identify when problems are linked to discharges or 'wrong connections'.
- Landfill and wrong connections cause water quality problems at low flows, storm sewage overflows cause problems at high flows.
- By comparing ratios of pollutants we can differentiate between landfill and sewage and sometimes quantify pollution loading (e.g. X m^3 sewage per day).

Stakeholder Designed Measures

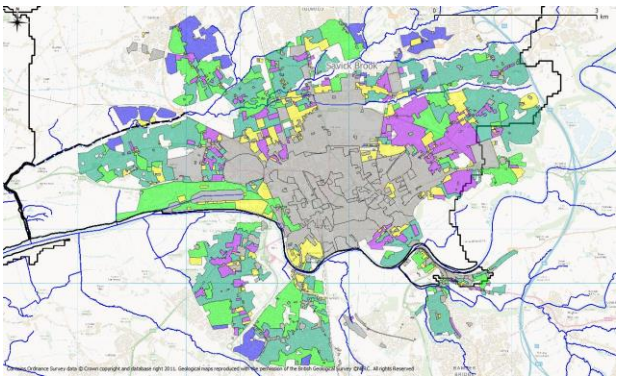
We found that by bringing together this information, stakeholders such as Oldham City Council and United Utilities felt sufficiently informed that they could identify measures that would tackle water quality problems and had enough evidence to include those measures in their business plans

Urban Development

Old maps on publicly available websites show how a town or city has developed over the last 100 years. Some local authorities or county councils have mapped urban development.

This urban development plan of Preston helps to work out how pressures from sewage infrastructure and perhaps wrong connections may have changed over time. Other evidence suggests the post 1970s developments (with more likely separate clean and foul sewers) in the north have more 'wrong connections' and grey water problems.

1. Preston Urban Development



Note: Grey - pre 1900, yellow early 1900s, purple 1930s, mint green – pre-1963, light green 1963 to 1976, blue – by 1991.

Source: Lancashire County Council.

Identifying Problem Discharges

NIRS and Consented Discharges

The Environment Agency have a National Incident Reporting System (NIRS) database of pollution incidents since 2000 (there is also an archived 1990s database). They also have records of consented discharges, including those for storm sewage overflows.

The NIRS database contains the "receptor" of the pollution (e.g. air, land or water), how severe it was and the type of pollution (e.g. storm sewage or 'grey water').

Designed to Fail Sometimes

Storm sewage systems have a design capacity. Reducing discharges to zero, would require more infrastructure (storage or pumps), and even if space was available, the cost to households and disruption during the works might be disproportionate.

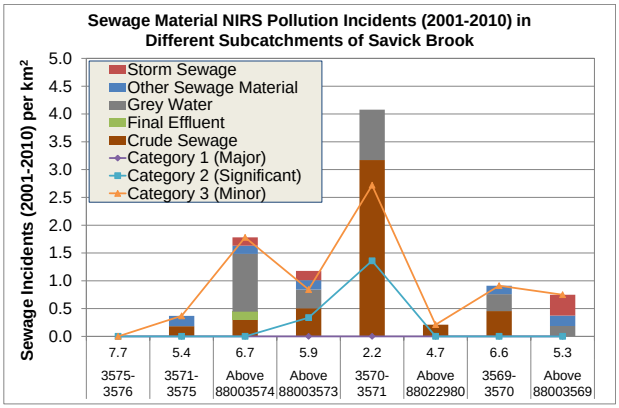
Water quality standards to protect e.g. fish take into account occasional sewage overflow, on the basis that fish can tolerate certain conditions for short periods.

Spotting Problem Areas

Likely storm discharge problems aside, identifying problem discharges can help reduce the pressures on urban rivers. The NIRS data in Figure 2 below tells us about types of sewage pollution e.g. grey water in Savick Brook, Preston.

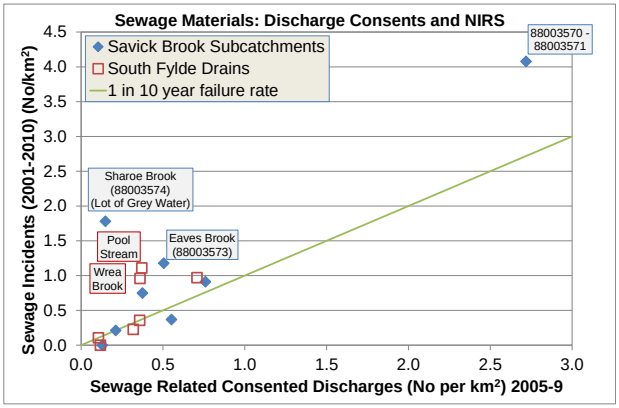
But by comparing the number of sewage pollution events with the sewage consented discharges (Figure 3), there is a typical failure rate relationship and some anomalies (grey water & wrong connections).

2. Comparing Type and Density of Sewage Pollution



Note: EA NIRS database processed into different sub-catchments in GIS and expressed as number per km^2. Sub-catchment areas in km^2 provided on X-axis.

3. Spotting Problem Areas – Wrong Connections?



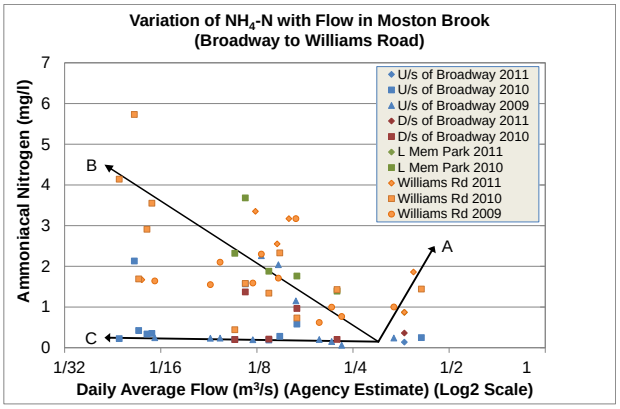
Note: EA NIRS and consents databases processed into different sub-catchments in GIS and expressed as number per km^2. Those sub-catchments far above the line appear to have problems (e.g. grey water) other than designed storm discharges.

Relationships with Flow

In urban areas, background pollution from old landfills and wrong connections will occur throughout the year and have a more marked effect on water quality at low flows. Conversely, storm sewage, by its nature, should only be evident at high flows.

The chart below shows how water quality varies with river flow in Moston Brook as it passes an old landfill. At Williams Road (just downstream of the landfill) the water quality deteriorates when flows reduce (line B), but there is also some deterioration at higher flows (where sewage litter is sometimes seen).

4. Change in Quality with Flows – Landfill & Sewage?

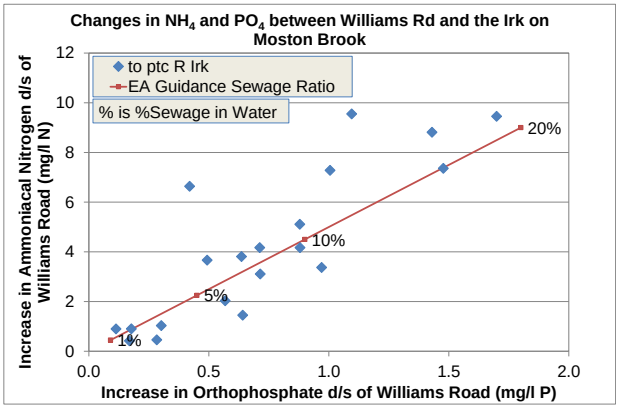


Note: This plots sample concentration against flow at that time. A: deterioration with increased flows (storm sewage?); B: deterioration with reduced flows (landfill here); and C: little change with flows (no pollution inputs).

Concentration Ratios

In Moston Brook, we also used increases in nitrogen [NH_4-N + NO_3] to increases in potassium [K] ratios to provide support for a landfill source in one reach and ammoniacal nitrogen [NH_4-N] to orthophosphate [PO_4-P] ratios to demonstrate a sewage source in another reach (see chart below).

5. Ammonia:Phosphate Ratios – Evidence for Sewage



Note: Red line is the published ratio of N to P in sewage.

Find out More?

For further information on this work, contact:

Victor Aguilera	Victor.Aguilera@defra.gsi.gov.uk
Paul Logan	paul.logan@environment-agency.gov.uk
Paul Hulme	paul.hulme@pjhydro.co.uk
Nick Rukin	rukin@rukhydro.co.uk

Evidence and Measures Projects

Evidence and Measures is a programme of work funded by Defra and the Environment Agency which has been working in a variety of catchments since 2008. It uses readily available evidence to help stakeholders identify locally-targeted measures aimed at delivering ecological improvements.