Urban River Basin Enhancement Methods

Existing Data from Selected Urban Rivers
Work Package 3

University of Newcastle
Dr.L.C.Batty

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Summary

This report accompanies deliverable 3-1 of the URBEM project which is existing data on study sites in Europe. The six study sites chosen are:- Ouseburn, UK; Chaudanne, France; Glinščica, Slovenia; Wien, Austria; Weidigtbach, Germany. A site for Portugal is still to be selected. These sites represent urban rivers which have been affected by different engineering works and pollution sources. For each site a number of parameters have been identified for data collection which fall into five main categories:- hydraulic regime, channel geomorphology, cross sections, water chemistry, biology and social and economic wellbeing. A large set of data has been collected for most partners, however there a number of gaps in data for each site which will need to be addressed during the new monitoring phase. This will be achieved either by improving access to existing data and/or undertaking new monitoring. Recommendations for this are provided within the document.

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1. Introduction

The URBEM project aims to provide new tools, techniques and procedures to enhance watercourses located in urban areas. These tools should provide enough scope to cover differing, multi-functional uses of urban watercourses and their adjacent communities across Europe.

Work Package 3 of the URBEM project forms a major part of theme 3 (New Tools to assess the potential for urban watercourse rehabilitation). The objective of this theme is to develop 'tools' which can help urban planners and environmental and local authorities to identify which reaches of urban watercourses are most suitable for rehabilitation. Six urban sites across Europe have been identified as research study sites for URBEM as part of this theme.

Specifically work package 3 involved the collection of data for each of these sites in order to provide data that can be analysed and the output will feed directly into work package 5 (development of the new tool).

In order to achieve this it is necessary to collate a broad range of data for each site which includes chemical, biological, ecological and aesthetic data. Each set of data will need to be analysed in order to provide outcomes that can be directly fed into work package 5. As such a significant amount of existing data should be available for each site chosen.

In order to manage such large sets of data and to provide an output that can be used by all partners it was decided that spreadsheets would be the best way of storing the data available for each site. Microsoft Excel was the chosen package to achieve this.

In the next year of the project analyses of the data will be undertaken using a variety of statistical and graphical packages, but all outputs will be made available in the database.

2. Sources of Data

Data has been provided by the following individuals/agencies (table 1).

	Data type	Source
Ouseburn, UK	Water Chemistry Social Data Biology	Environment Agency Newcastle City Council Environment Agency
Chaudanne, France		Not Known
Glinščica, Slovenia		Not Known
Wien River, Austria	Channel Geomorphology Water Chemistry Vegetation Fish Social and Economic	Hein (2001)/ Wimmer, 2000/ Schügerl & Rhezabek, 1985 Federal Environment Agency/ Hein 2001 Arge f. Vegetataionsökologie u. angew. Naturschutzforschung, Wien Keckeis et al. 2001 www.wien.gv.at/ www.europaforum.or.at
Weidigtbach, Germany		Not Known

Table 1. Sources of data

3. Descriptions of Study Sites

3.1. Newcastle upon Tyne, UK

The river chosen for the UK, is the Ouseburn which is located in Newcastle upon Tyne in the north east of England. In its upper catchment the river flows easterly through predominantly rural, agricultural areas, before making a southerly shift and flowing through the Grange, South Gosforth, Jesmond Dene, Sandyford and Byker wards of Newcastle-upon-Tyne. Parts of Newcastle city centre and much of it's residential areas, Jesmond Dene, the Town Moor, Gosforth Lake and Newcastle Airport are some of the more prominent features located within the catchment.

There are 22 consents to discharge into the river, 17 to freshwater and 5 to the estuary, most of them combined sewer overflows (CSOs). Important discharges that are not consented include agricultural run-off and highway drainage. Historically the **airport** has caused big problems in the river with the drainage of de-icing products (now propylene glycol and potassium acetate). Since 2000 the de-icer has drained to a lagoon that has a consent with limited biochemical oxygen demand and ammoniacal nitrogen. According to the conductivity, the waters are either pumped into sewers or released into the river.

Regeneration of the Ouseburn has centred upon the Lower Ouseburn Valley. Through Single Regeneration Budget funding, this process was started with a series of projects including accommodation, employment and leisure facilities. Future regeneration is expected to focus upon river enhancement which could improve the amenity value of the area directly as well as providing a catalyst to more rapid regeneration.

Water Quality data is available for six sampling sites for the period from January 1999 to September 2003. It should be noted that data is available for all parameters but this has been extremely difficult to access. However in January 2004 a new project officer is to be appointed at Newcastle City Council who will facilitate the collection of existing and new data.

3.2. Lyon, France

The site chosen for France is the Chaudanne, located in Lyon. The reach that was chosen for study is located in a residential area. Rehabilitation of the river is to be supported by storm water detention basins which are expected to reduce peak flows and volumes from the combined sewer overflows by a half. The rehabilitation is expected to operate from January 2004. The river is also impacted by runoff from a car park within the reach studied.

Data has been collected from 2 monitoring sites located up- and downstream of the sewer overflow. The length of the reach studied is 132 m located 2500m from the source of the Chaudanne. Water quality data is available for at total of nine sampling dates over the period from June 2000 to April 2002.

3.3 Oeiras, Portugal

No site has been proposed to date

3.4. Ljubljana, Slovenia

The monitoring site chosen for Slovenia is the Glinščica river situated in The Ljubljana Plain. The lowland areas of the river are extensively urbanised. The river has been extensively modified for flood protection through consolidation of the banks and river bed with artificial materials (e.g. concrete, paving and asphalt). The main problems identified for this river are flood

hazards, however there are sources of pollution from the storm water drains, urban runoff and discharge from a zoological park.
No rehabilitation has been undertaken or is planned in the lowland areas.
Data for water quality has been collected for 14 sites in July, August.

3.5. Vienna, Austria

The River Wien in the city of Vienna has been chosen as the site for Austria. The specific study site within this river basin is located at the Mauerbach-Wien River confluence.
The river has been altered by flood protection schemes consisting of flood control basins and engineering of the urban river reaches which were undertaken in the years from 1895 to 1902. This was found to be inadequate for retention requirements due to insufficient storage volume and control capacity. Pollution sources on the river consist of urban runoff and discharge from a waste water treatment plant.
Rehabilitation of the river has been undertaken during the period from 1995 to 2003. The main aims of these works were to provide flood protection and to improve the ecological status of the river. Upgrading of the Auhof flood storage scheme was completed in 2001 and this included re-design of the basins to improve the ecological status. Similar alterations of the Mauerbach basins were completed in 1998.
Data has been collected during the rehabilitation works for two sites.

3.6. Dresden, Germany

The river Weidigtbach has been chosen as the monitoring site for Germany which is situated in the site of Dresden, the main tributary being 3.7 km in length. The river has two main sections. The first to the borders of Dresden is partly culverted within a predominantly agricultural area with small settlements. There are two retention basins and the river suffers from road runoff and agricultural runoff-both diffuse pollution sources. The second section is from the borders of Dresden to the mouth. The land use in this section is urban and in most cases extends to the river banks. Almost all the tributaries are culverted, the river has a hard engineered bed and the stream mouth has been split for flood prevention.

Rehabilitation of the river is to be completed by 2006. This will involve the re-naturalisation of the river with mitigation measures for a new road.
Data has been collected at 18 sampling sites for one sampling date (May 2002).

4. Existing Data

Table 2 provides a summary of the data collected for each site. The full data sets can be found on the URBEM website.
It is clear that there is broad variability in the existing data collected from the sites. In the majority of cases there are 1 or 2 sampling sites and either 1 sampling data or the material provided is as average values. This will cause problems with analysing the data and recommendations are made in section 7 on how partners should address this gap in data available.

	Hydraulic Regime	**Channel Geomorphology**	**Cross sectional data**	**Water Quality-Chemistry**	**Biological Data**	**Social and Economic Wellbeing**
Ouseburn, UK	Flow duration curve, discharge for one station, rainfall data 1992-2003	Data available but not yet collected	Section 105, Isis and HEC-RAS format	Monthly data sets of pH, temperature, BOD, ammonia-N, nitrate, nitrite, total N, orthophosphate, Mg, Ca, Cr, Zn, Ni, As, Fe (total), Cu (total), Cu (dissolved), Pb, B, V and dissolved oxygen. Incomplete sets available for propylene glycol, oil and grease, detergents (anionic and ionic), Hg and Cd.	EA data for 7 freshwater sites and 6 marine sites (Macro-invertebrates survey) over 4 years No Vegetation data	Data available. Mortality, crime, housing prices, Indicative Floodplain Map
Chaudanne, Lyon	Daily rainfall and discharge data for the period Jan 2003-July 2003	Details available for up and downstream sites	1 representative section from up and downstream sites	Complete sets of river water data for pH, conductivity, DOC, Cd, Cr, Cu, Pb, Cl, NO_2, NO_3, NH_4, PO_4. Data is also available for hyporheic samples for many organic pollutants	Macroinvertebrate data for 2 sampling dates (10/04/03) No fish or diatom data. No vegetation data	Few data provided

Glinščica, Ljubljana	Average rainfall	Channel length, width, slope and x-sectional area available for 5 sites	No details on cross-sections	Date for 14 sites for 3 months in 2003. Temperature, pH, DO, conductivity, TDS and nitrate. Annual Sampling of 51 parameters (pH, temperature, BOD, ammonia-N, nitrate, nitrite, total N, Ortho-P, Mg, Ca, Cr, Zn, Ni, As, Fe (total), Cu (total), Cu (dissolved), Pb, B, V and dissolved oxygen) over 8 stations, 1998-2003 (City of Ljubljana data)	Fish data for 2 sites on one date. Data for macroinvertebrates available but not yet collected. No diatom data No vegetation data.	Crime, population, unemployment rates.
	Hydraulic Regime	**Channel Geomorphology**	**Cross sectional data**	**Water Chemistry**	**Biology**	**Social and Economic Wellbeing**
Wien River, Vienna	Discharge and precipitation data available. Most recent date is 1998.	27 sites have been sampled with details on flow and information on sediment size for some of the cross sections.	Detailed cross sections provided (images format, 3 books of cross-sections available as hard copy)	Mean values at both sampling sites for 2001 are provided for pH, conductivity, temperature, DOC, NO_3, PO_4, NH_4.	Mean data are provided for fish, macroinvertebrates, birds and mammals. Vegetation cover data is available for the reservoirs. Detailed diatom data is available for 2001.	Data is available for the length of the rehabilitated stretch for flood risks, economic well being, accessibility, aesthetic evaluation and recreation.

Weidigtbach, Dresden	Average rainfall values	Detailed information on the banks and river section are provided for 18 sites. No information is provided on sediment characteristics	No detailed cross sections provided	Data for 18 sites on 1 date are provided for pH, conductivity, BOD, COD, TSS, oxygen saturation and TOC.	Overall abundance of macroinvertebrates provided. No details of macroinvertebrates or diatoms. No fish, vegetation, mammals or bird data.	No social data that could be used due to the specificity of the catchment

Table 2. Available data for URBEM sampling sites

5. Methods of Data Collection

Detailed methodologies for all sample collection and analysis are being collated at present which will allow for normalisation and analysis of the data in the next project year.

For the majority of the water chemistry data this will not be a major problem as laboratory quality control should be sufficient to allow comparisons to be made between the different sites. All chemistry data available is present in standard SI units.

Methodologies for macroinvertebrate sampling vary with each data source. It is going to be difficult to normalise the data considering the wide variety of sampling methods however, it is envisages that it may be possible to create a scoring system which will reflect the ecological status of the stream, rather than relying on the actual species collected which will largely be controlled by the sampling methods. The University of Newcastle team will work on this in the second year of the project.

6. Data presentation

Data collected during the first year of the URBEM project has been collated into a spreadsheet consisting of 5 pages:

- Hydrological Regime
- Channel Geomorphology
- Water Chemistry
- Biology
- Social and Economic Wellbeing

Data collected for each case study for each set of parameters is displayed on a separate page. The river name and the section to which the data applies are given in the first 2 columns followed by the relevant data. A spreadsheet was chosen principally to enable ease of data transfer between partners and between work packages. A spreadsheet allows for analysis of data, in particular for sorting, searching and filtering data.

7. Future Monitoring

All partners will be contacted individually in month 15 to discuss the best way for them to proceed with new monitoring. Here we will identify priority areas and make some suggestions and recommendations.

The gaps that are present in the data for each partner should firstly be addressed by ensuring that all existing sources of data have been identified and exploited. The priority here should be to ensure that all different types of data have been identified and that all sampling dates have been collated. This is particularly important where average values have been provided – full raw data sets would provide more useful information. It is also important that up to date data should be made available and that information is available for the different parameters for similar dates. With this in mind we suggest that each partner contacts not only local authorities and agencies (equivalent to the Environment Agency in the UK) but also any researchers working within universities and colleges. It is important when collecting data to identify how it may be used in terms of the following categories:-

1. Can be used within the URBEM project by partners
2. Can be used for statistical analyses – outcomes from the analysis can be made public
3. Can be used within the URBEM project and in reports to the EU
4. Unlimited use – can be used in public documents

In addition to the historical data a certain amount of new monitoring should be carried out at each site. Where routine monitoring occurs, the data from this should continue to be collected and sent to the Newcastle team. As identified in section 4 there are a number of gaps in the data sets from each team.
Table 3 provides a list of the minimum set of data that should be available in order to allow sensible inputs into work package 5. Discussion with each partner will commence in month 15 to finalise the new monitoring that will be necessary, together with methodologies. Further communication with the leaders of work packages 4 and 5 will be necessary to establish the minimum

set of social data that will be required from each partner. We will aim to complete this by the end of month 15.

Detailed information on previous and proposed rehabilitation schemes on the rivers will also be collated. Where possible photographic material will be included.

	Data required	**Frequency**
Hydraulic Regime	Rainfall Flows/discharge	Monthly
Channel Geomorphology/ Cross Section	Channel width Channel Length (of each sampling section) Channel slope Bank slope Bank material Cross Sections (in data form, illustrations would be helpful) Sediment characteristics	One data set before and after rehabilitation
Water Chemistry- this will depend largely on the type of pollution affecting the river which is indicated in brackets after the variable)	pH (all) Conductivity (all) Suspended solids (all) BOD/COD (all) DOC (all) Heavy metals (urban runoff/road runoff/ mine water discharge/ industrial effluent) Nitrogen forms and phosphate (agricultural runoff/ sewage overflow/ urban runoff) Other elements e.g. Ca, Na, K (agricultural runoff/ mine water discharge)	Monthly
Biological data	Macroinvertebrate data. It is vital that detailed methodologies are provided when submitting this data.	Bi-annually
Social and Economic Data	See discussion in text	

Table 3. Minimum data set required for WP3.

8. Conclusions

Large sets of data have been collected for five sites selected which cover a variety of river types, engineering works and pollution sources. These have been collated into a series of spreadsheets which will be made available on the URBEM website. Large gaps in the existing data have been identified and new monitoring will be undertaken in month 15 of the project to address this.

This will be achieved by ensuring that all existing data that is available has been accessed and to initiate new monitoring at many of the sites to ensure that a minimum set of data is collected. These complete sets of data will be analysed to provide an input into work package 5.

The priority for work package three in year 2 of the URBEM project is to collect data that will enable comparisons between the different rivers and to provide an input into work package 5 that will enable assessment of rehabilitation potential of rivers.

9. References

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