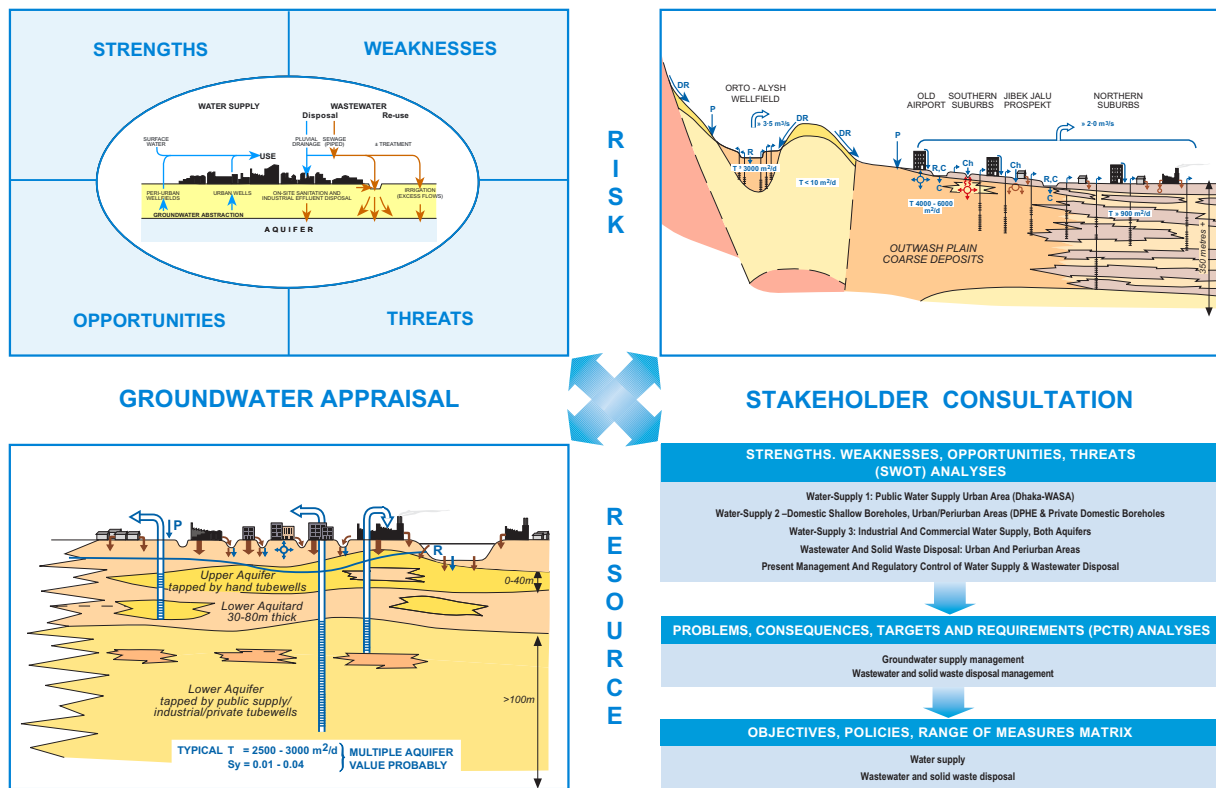




Groundwater protection and management for developing cities: Guidelines using case-study experience

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Foreword

This report is one published product of collaborative study R7134 on Groundwater Protection and Management for Developing Cities led by the British Geological Survey (BGS). The project R7134 has been funded by the Department for International Development as part of its Knowledge and Research budget, which supports the UK programme of developing country assistance. The four-year project commenced in October 1998. This is the final technical report

The target users of these guidelines include urban water resource planners and those concerned with the development of sustainable urban infrastructure in the world's fast developing cities.

The project is the fruit of collaboration between the British Geological Survey, the Kyrgyz Research Institute of Irrigation and the Department of Geology, University of Dhaka, with inputs by the Kyrgyz Hydrogeological Survey.

Acknowledgements

In addition to the project staff acknowledged formally on the frontispiece as contributors to the work referred to in this volume, its companion reports, and described in the papers listed overleaf, a large number of individuals have assisted at all stages of the study. In addition to those who helped the project teams with the collection of data, there were numerous individuals who responded as stakeholder representatives and who provided local knowledge so important to the development of context-sensitive policies. Of the many who have contributed to the project we would particularly like to thank the following:

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Project context

The tools used in the project were evolved by the BGS in a previous 1998-99 DFID-KAR project R6863 'Tools for assessing and managing groundwater pollution threats in urban areas' following a process of partner consultation, review and feedback with four partners from India, Bangladesh and the Kyrgyz Republic. The tools aim to improve the management of groundwater resources in cities where there is little information to support policy development, by helping to identify and prioritise problems, clarify issues, involve stakeholders and build commitment where some or all of these elements are lacking.

The case studies used in this project were taken through stages 1-3 of the strategy evolution process using each of these tools to produce a draft Action Plan i.e. the threshold of Stage 4 Implementation.

In many developing countries, the inexorable expansion of cities is putting pressure on urban aquifer systems used for public, industrial and commercial water supply. The realisation that water resources are finite is starting to force those responsible for urban water supply, wastewater disposal and drainage in such developing cities to consider how sustainability can be introduced into their plans for infrastructural improvement.

It is against this background that this collaborative research project was initiated. The rationale of the project was to demonstrate whether an Action Plan comprising informed and locally practical aquifer protection policies can be developed within the limited financial and institutional resources typically available to those tasked with managing and planning the urban water infrastructure of a groundwater-dependent city in an emerging nation. The project's goal was to increase sustainability of groundwater used for public water supply in cities, and its purpose is the improved protection of aquifers from urban/industrial activities.

The project worked through the medium of case-studies in the cities of Bishkek and Narayanganj in order to develop robust practical assessment tools for wider use and also to gain practical experience in how to engage stakeholders so as to transfer the results of the assessments. The work drew on the experience from these two case-studies, which were in contrasting hydrogeological and socio-economic settings, to demonstrate the methodology and the individual techniques employed and to show how they could have more general application in other groundwater-dependent developing cities.

Technical and socio-economic outputs from the project are centred on work in the case-study cities and include:

- Training of collaborators in techniques of assessment for groundwater protection;
- Aquifer vulnerability and contaminating activity assessments;
- A stakeholder consultation exercise, with the aim of developing appropriate aquifer protection policies by consensus.

Other products of this KAR project:

Reports:

CALOW, RC, MORRIS, BL, MACDONALD, DM, TALBOT, JC and LAWRENCE, AR. 1999. Tools for assessing and Managing Groundwater Pollution Threats in Urban Areas. BGS Technical Report WC/99/18 Keyworth UK.

MORRIS, BL, Ó DOCHARTAIGH, BE, CUNNINGHAM, J, AHMED, KM, HASAN, MK and ALI SEDDIQUE, A, 2000. Groundwater vulnerability and urban activity assessment: the Narayanganj Bangladesh case-study. BGS Technical Report WC/00/21, Keyworth UK

Ó DOCHARTAIGH, BE, MORRIS, BL, LITVAK, RG, NEMALTSEVA, EI, PODUBNAIA, I and TOLSTIHN, G. 2000. Groundwater vulnerability and urban activity assessment: the Bishkek, Kyrghyzstan case-study. BGS Technical Report WC/00/14, Keyworth UK

WESTON J. 2001. Planning Review for Groundwater Protection Policies Oxford Brookes University School of Planning, Oxford

Refereed Papers:

MORRIS, BL, LITVAK, RG and AHMED, KM. 2001. Urban groundwater protection and management: lessons from 2 developing city case studies in Bangladesh & Kyrghyzstan. *In: Current Problems of Hydrogeology in Urban Areas, Urban Agglomerates & Industrial Centres, Procs of NATO Advanced Science Workshop, Baku Azerbaijan, June 2001 NATO Science Series IV Vol 8, Kluwer Dordrecht*

MORRIS, BL, AHMED, KM and LITVAK RG. 2002. Evolution of Developing City Groundwater Protection Policies: Stakeholder Consultation Case Studies In Bangladesh and Kyrghyzstan *in Procs of IAH 32 and ALHSUD 6 Congress, 21-25 October 2002, Mar del Plata Argentina*

MORRIS, BL, SEDDIQUE, AA and AHMED, KM 2003. Response of the Dupi Tila aquifer to intensive pumping in Dhaka Bangladesh. *Hydrogeology Journal*, 11, 496-503.

Executive Summary

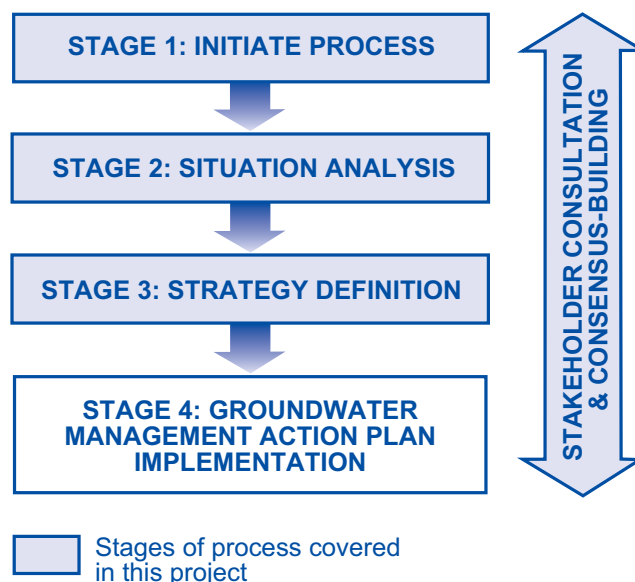
It is predicted that, by 2010, half the world's population of 6500 million will live in towns or cities. Much of the increase will be concentrated in the developing world, which accounted for 85% of urban population growth between 1980 and 2000. The result is that, by the year 2000, about twice as many people were living in cities in developing countries (1900 million) as in the developed world (950 million). A high proportion of these urban dwellers depend on groundwater for day-to-day domestic, industrial, and commercial water supply.

The inexorable expansion of the world's urban population and the realisation that water resources are finite have forced a rethink by the authorities in some developing cities. With more than 150 countries signed up to Agenda 21, the manifesto which emerged from the 1992 Earth Summit in Rio de Janeiro, municipal authorities need to consider how sustainability can be introduced into their plans for infrastructural improvement, for example in developing their own Local Agenda 21 plans. Cities dependent on groundwater should feel this need most keenly, yet the pace of urban aquifer management response remains limited. As a result, despite the apparently straightforward techniques required, for the hundreds of such cities in middle- and low-income countries, an aquifer protection policy developed locally to help a particular municipality manage its groundwater resource remains an unusual exercise.

It is against this background that a collaborative research project supported by the Department for International Development (DFID) was initiated in 1998 with partner organisations in Kyrghyzstan (the Kyrghyz Research Institute of Irrigation) and in Bangladesh (University of Dhaka). The aims of the project have been to demonstrate the development of a groundwater management Action Plan to bring aquifer protection principles and policies into city planning, using the two case study cities of Bishkek, the capital of Kyrghyzstan, and Narayanganj, a fast-growing city near Dhaka in Bangladesh.

The target users of these Guidelines include urban water resource planners and those concerned with the development of sustainable urban infrastructure in the world's fast developing cities. The key initial element of a Groundwater Management Action Plan is to develop an understanding of the groundwater setting and how the city's water supply, wastewater, and solid waste disposal infrastructure interacts with it.

The Guidelines are provided as the core product of a CD on which this project information is also located. They work through the typical stages involved in developing an urban aquifer Action Plan up to the Implementation stage. Additionally, the Guidelines extend to the stakeholder consultation and consensus-building process that operates simultaneously with the other stages (see diagram)



The guidelines for each stage typically comprise all or some of the following elements:

- A ‘tool’ or methodology providing focused information or notes on a particular process or technique;
- An example drawn from either of the city case-studies of Bishkek or Narayanganj to show the tool being used;
- A concise checklist to help users apply the tools effectively and efficiently;
- A ‘lessons learned’ note, recording the practical experience of applying these techniques in the case-study cities, with a section showing how the tools had been modified in the light of field experience.

However, a rigid set of prescriptive guidelines would soon founder on the enormous global diversity of modern fast-developing cities with their infinite combinations of geologic, climatic, socio-economic and cultural/political settings. The lessons learnt from the case-studies are as illuminating as the proposed methodology itself in this respect, because they illustrate that urban groundwater management, like any other form of water resource management, is as much founded in the political as the technical process. This is why stakeholder consultation needs to be participative, and more than a mechanistic, politically-correct exercise.

The stakeholder consultation exercise is separately documented, showing how one might go about it, as without doubt it is an indispensable part of a successful Action Plan. In each case study city the consultation was undertaken through the medium of a series of newsletters then a one-day workshop. The process has most value as a means of engaging groundwater stakeholders (those individuals and institutions that are concerned with, or have an interest in, the city’s groundwater resources and their management) and raising the profile of groundwater’s role in the urban infrastructure, because it is often overlooked. Stakeholder analysis is also helpful, because no aquifer protection policy is likely to be successful without the support of key stakeholders who, by their nature, may have very different interests in the urban subsurface. Stakeholder consultation, and the adoption of policies by consensus agreement, is likely to be particularly important in those urban settings where the regulatory framework is weak or (more commonly) where the means/will to enforce regulatory controls is limited.

Together with such stakeholders, in both case-study cities, draft Action Plans for simple and sustainable aquifer protection have been developed, which were appropriate to the city’s own developmental, socioeconomic and hydrogeological setting, to guide urban decision makers. We believe that urban groundwater protection Action Plans could be similarly developed for many more groundwater-dependent cities, especially the smaller ones, and that such plans, once adopted by influential decision-makers for implementation, provide both a cost-effective and an equitable means of managing urban groundwater resources in a sustainable way.

Conclusions from this project

- Standard groundwater protection policy tools of aquifer vulnerability mapping and pollution load assessment have been successfully developed for two groundwater-dependent developing cities. These used available data, supplemented by some extra field survey work.
- In each city, a clear conceptual model of the groundwater setting, in terms both of aquifer system and status of exploitation, had to be evolved to inform the pragmatic decisions required to develop working tools. This was the more necessary because neither city enjoyed the benefit of an urban water resource appraisal of the master-plan type on which this project could draw for background.
- The technical processes of vulnerability mapping and potentially contaminating activities appraisal are the typical components of a city groundwater pollution risk assessment, which provides a focussed method of compiling the information needed to inform a groundwater Action Plan.
- However, these technical processes need to be actively used to inform and engage urban groundwater stakeholders. Unless user groups develop at the least an understanding of why groundwater protection is needed, there will be no support for agreeing, implementing and enforcing sustainable water management policies within the Action Plan.
- Those espousing the adoption of a staged aquifer management strategy need to ensure that the transition from the predominantly technical orientation of the first stages to the predominantly political orientation of the latter stages is made sensitively. The aim should be to identify what the most influential players- water users, officials and municipal/national political leadership- might gain and what they will lose by adopting an aquifer protection strategy, and then tailor the set of policies comprising the strategy to maximise support (or at least to minimise opposition). Otherwise the process will be unrealistically idealistic and doomed to failure either at the point when the implementation programme is being drawn up, or later during implementation itself.
- Despite a limited resource and knowledge base, locally appropriate groundwater protection plans were developed in the case study cities using simple, inexpensive methods to identify and engage stakeholders in the dialogue needed to develop consensus urban groundwater protection policies.
- Such stakeholder consultation contributed significantly to the development of the Action Plan aquifer protection policy options in both cities
- Given the inexorable rise in urban populations in the developing world and the important role of urban/periurban aquifers in supplying hundreds of cities worldwide, aquifer protection should not be overlooked if cities are to move towards resource sustainability as a core dictum of development policy.