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Increasing the uptake of techniques which improve success and sustainability of wells and boreholes: inception report

Groundwater Systems and Water Quality Programme

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BRITISH GEOLOGICAL SURVEY

COMMISSIONED REPORT CR/03/026N

Increasing the uptake of techniques which improve success and sustainability of wells and boreholes: inception report

Final Draft

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DFID KaR Contract R8162

Theme W4 Improved water and sanitation

Theme X3 Increased uptake of research

Key words

DFID; groundwater; techniques; Africa; Asia.

Cover Photograph

Children involved in a resistivity survey for a community water supply in Nigeria

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Contents

TABLES

Summary

This report marks the end of the short inception phase of the DFID KaR project (R8162) *increasing the uptake of techniques which increase the success and sustainability of wells and boreholes*. The project has been designed to contribute to two of DFID's themes for the water sector: Improved water and sanitation (W4) through increased uptake of research (X3).

Much of the inception phase has comprised consultation through building an email network, organising an inception workshop and establishing a website. An email network has been established for the project comprising over 200 water professionals and scientists with an interest in rural water supplies. They come from 29 different countries with 18% from government, 23% from NGOs, 20% from the private sector, 31% researchers and the rest from donors and UN agencies. Approximately 35% of the network (73 people) have contributed to the project either through email or attending one of the workshops. Two workshops were held at the WaterAid offices in London in December 2002. Twenty-eight people attended the workshops and discussed the contents and potential users of a groundwater development manual.

During the inception phase of the project, several key decisions have been made.

1. The completion date of the project has been changed from March to September 2004, to account for the 5-month delay in the project start date (subject to final approval from DFID). This will allow for the project activities the time originally envisaged in the project proposal.
2. A list of contents has been developed for the manual. This was developed from initial comments from the network and the workshops and then subsequently reviewed.
3. The target users are the *implementers* of rural water supply projects throughout sub-Saharan Africa. The focus of the manual is to provide practical information for project engineers in NGOs and local government, public sector hydrogeologists, drilling teams and private sector groundwater companies. However, in response to feedback during consultation, one chapter will discuss project management issues.
4. The geographical focus of the manual is sub-Saharan Africa with application to parts of south Asia.
5. Additional collaborators to WaterAid have been found for the project: UNICEF (and state government) in Nigeria and DWAF in South Africa. Both collaborators will help to field test the manual.
6. Feedback has indicated a strong demand for guidance on water quality, as well as quantity. This will be a challenging task and project staffing may have to be changed slightly to ensure sufficient experience is available within the project team.
7. ITDG have agreed to publish, market and distribute the manual, first as a black and white illustrated book, but also seeking electronic means in the future. For the target users the practicality, portability, and robustness of a book outway the benefits of cost and adaptability that solely electronic publication affords.
8. Evolution of the manual beyond the present project could be coordinated through the DFID resource centre OASIS. Feedback could be channelled from the authors to OASIS to be incorporated into any further editions.

A dissemination strategy for the manual has been developed which will actively seek key personnel who have not already been informed through direct emailing from the project network. The strategy includes: marketing through ITDG publishing wing; dissemination through WaterAid's extensive incountry networks; field testing of the manual by government partners in South Africa, Malawi, and Nigeria; dissemination through existing networks (such as the

International Association of Hydrogeologists and the Handpump network (Swiss SKAT); dissemination by DFID to its water projects and country offices; attendance at appropriate conferences, workshops and forums.

1 Introduction: project purpose and outputs

The British Geological Survey, in collaboration with WaterAid have been awarded a contract (R8162) by DFID to write a manual to support groundwater development for rural water supplies (RWS). The title of the project is *Increasing the uptake of techniques which improve success and sustainability of wells and boreholes.* The original start date of the project was set at 1 July 2002, however, due to delays with the contract, the project did not start until 1 December 2002. An amendment to extend the project completion date from March 2004 to September 2004 has accordingly been sent to DFID.

This project has been designed to contribute to two of DFID's goals for the water sector:

> *(W4) Improved water and sanitation through (X3) increased uptake of research*

by the fulfilment of the following project purpose:

> *Increased use by rural water supply projects (NGO/public) of simple effective techniques for siting wells and boreholes and assessing resource sustainability.*

Three project outputs will achieve this purpose.

> *1. A published manual of techniques appropriate to RWS projects for siting and testing wells and boreholes to improve success and sustainability of rural water supplies.*
>
> *2. A network established within the water sector advocating the use of improved appropriate techniques.*
>
> *3. An inception report (this report) which discusses target users, dissemination strategies and the long-term evolution of the manual.*

There were several comments made by DFID on the project proposal which needed to be addressed during the inception phase:

- Collaboration in the project should extend beyond WaterAid: the manual should be designed to be of use to government and the private sector, as well as NGOs;
- An analysis of intended users is required;
- A dissemination strategy should be outlined, paying particular attention to reaching government departments;
- Preliminary insights into the different socio-economic contexts in which the manual is to be used should be discussed;
- Consideration should be given to the long-term evolution of the manual.

2 Background information

2.1 THE NEED FOR A MANUAL

Helping to meet International Development Targets (DFID 2001) is a major challenge for the water sector. To increase access to sustainable supplies of safe water for the poor, groundwater resources must be exploited successfully, sustainably and economically on a much larger scale than they are now. However increasing the scale of activity to achieve this is not trivial. In sub-Saharan Africa alone, up to 300 million rural people live in areas where the geology is such that groundwater is difficult to locate and specialist techniques are required to successfully find and exploit suitable supplies (MacDonald and Davies 2000). However, trained and experienced groundwater specialists are rare, therefore expertise is not often available in projects to help site successful and sustainable wells and boreholes in difficult areas (Foster et al. 2000). This was highlighted in a recent evaluation of UNICEF's rural water programme in India which reported the problem of maintaining expertise and control over the quality of borehole construction while striving to rapidly increase coverage (UNICEF 2000).

One potential approach to better providing groundwater expertise in projects is to have a comprehensive and easily understood manual for project engineers to use. However, while there have been some guidance documents on the technical parts of rural water supply (Watt and Wood, 1979; IRC 1983; Pickford 1991; Shaw 1998; Ball, 2001; Davis and Lambert 2002), these tend to focus on the engineering aspects, such as how to construct wells and boreholes and the choice of pumps etc. There is little or no information in these regarding how to find and assess the sustainability of groundwater resources – they generally assume the groundwater resources are already there, or that expertise to do this is available within the project. (A brief summary of the scope of these books is given in Appendix 1)

Several textbooks have been written specifically for assessing groundwater resources and interpreting geophysics (Milsom 1996; Brassington 1998; Price 1998). However, there are of little relevance to the conditions found in Africa and Asia, and are aimed at American and European issues and problems. There are several documents available that discuss technical issues relating to developing groundwater in Africa (van Dongen and Woodhouse 1994; Sami and Murray 1998; Foster et al. 2000). However these are aimed at helping programme planning and have little information appropriate for project engineers and field staff.

Despite the lack of appropriate guidance material, many millions of pounds have been spent developing techniques for increasing the success of wells and boreholes and assessing their sustainability. For example, there are more than 500 scientific papers discussing the exploitation of groundwater in Africa (MacDonald and Davies 2000). Despite this investment many of the techniques discussed in these papers are not widely used in rural water supply projects – primarily because they are complex and hidden in scientific journals. In contrast, simpler, project-based experience that might be more relevant rarely gets written up or, if it does, is not widely disseminated (e.g. Chilton et al. 1982).

Many of the techniques required for finding and accessing groundwater resources have been developed, but are not routinely applied by project engineers. Increasing the uptake of worthwhile techniques could significantly increase the success of water supply projects throughout the world. A preliminary report giving guidance (MacDonald et al. 2002) developed as part of a previous DFID KaR project (R7353) demonstrated that complex techniques could in many cases be successfully simplified for use by project engineers. Material from this report was has been used to train water professionals in Malawi (Davies 2002) and has also distributed to over 100 professionals involved in rural water supply throughout Africa. Feedback has been positive, with many wanting to see it expanded.

2.2 AN ANALYSIS OF STAKEHOLDERS IN RURAL WATER SUPPLY

In order to develop a manual that will inform decision making about the siting of wells and boreholes (the project purpose), it is first necessary to consider the nature of the decision-making process in more detail. In Table 1, a distinction is made between four broad institutional levels (macro, meso, lower meso and micro) with differing stakeholder interest in groundwater resource assessment and water point siting. At the macro level, the policies and guidelines developed by government departments and donors condition the 'rules of the game' under which people operate at lower levels. For example, the policy framework developed at this level may set out how decentralised service provision is to be organised and provided: who is involved; the roles and responsibilities of different government and civil society actors; and the funding and cost-recovery arrangements that should be implemented. At this level, detailed guidance on how to site water points and assess resource conditions is not required. However, summary information on the hydrogeological factors that need to be considered when developing (and costing) national plans may be useful. In particular, indications of the complexity of groundwater conditions likely to be encountered, and the degree of effort required to develop supplies, may influence choices between options for rural water supply provision.

At the meso- and lower meso-levels, there is typically a range of different government, NGO, private sector and civil society stakeholders involved in the oversight and direct implementation of RWS activities. In those countries (e.g. Ghana; Malawi) where decentralisation policies are strongly entrenched (in terms of both decision-making power and resourcing), the role of government has shifted from direct implementation to the oversight and management of RWS activities. In such cases, local government is tasked with the commissioning, supervision and management of RWS activities carried out by private contractors, NGOs and community based organisations (CBOs). To meet this challenge, local institutions need (a) the knowledge and skills to understand technical choices and constraints, and the controls affecting groundwater availability and quality; and (b) performance benchmarks and indicators for measuring and comparing outcomes (e.g. success rates on contracted drilling programmes). Again, detailed information on how to assess resource conditions and site water points would not be required by such stakeholders, but guidance on how to direct and assess the activities of stakeholders who are tasked with direct implementation would be useful.

Increasingly, the implementation of RWS activities, in liaison with communities, is carried out by local 'contractors'. These may be private sector drillers and community facilitators, NGOs (with or without their own technical capabilities) and various CBOs with local level experience in community mobilisation. In those countries where decentralisation has not yet taken root, and/or where demand-responsive approaches are still new or contested (e.g. Ethiopia), implementation may still be a government function (regional or local/district). In either case, these are the stakeholders who go out into the field and, with varying degrees of community consultation, site water points (see below). These 'practitioner' stakeholders are the primary target audience for the manual. They do require more detailed guidance on how to assess resource conditions, site and drill wells and boreholes, and test completed water points for yield and quality. However, guidance must be presented simply and clearly; long discussions of geophysical theory, for example, are to be avoided.

At the micro level, the role of the community in RWS decision-making has changed significantly in recent years. In particular, decentralisation and demand-responsive approaches have been promoted to increase consumer engagement in the process of selecting, financing, implementing and managing services according to expressed demand. This implies that communities make informed choices about, for example water point technologies and siting, through participatory planning and involvement in implementation. A key point here is that those working with communities on RWS projects need to be able to communicate ideas (e.g. about siting tradeoffs and risk) effectively, and also need tools to help communities express their wishes, and communicate their knowledge.

Table 1 Preliminary stakeholder analysis.

User group and level	Broad RWS responsibilities	Interest in manual – potential uses	Presentation needs
Macro Government department and ministries Donors Some national NGOs	Policy making Planning new RWS initiatives Funding of RWS	Planning guidance - information on cost-effectiveness of alternative techniques Guidance for meso and lower meso stakeholders on quality assurance/ supervisory needs	Summary information (eg costs) and key messages only Could be web-based, or in manual summary sheets (e.g. one sheet per chapter)
Meso Regional or provincial government NGOs with regional presence Drilling companies; consultancies with regional presence University departments	Planning of regional RWS programmes within national framework Funding of RWS programmes if resourcing decentralised from above Implementation of regional programmes and provision of some technical advice (e.g. from regional hydrogeologists)	*Oversight*: Guidance on the management, supervision and performance monitoring of implementing contractors *Implementation*: Advice/information on ground observation and hydrogeological surveying Advice/information on alternative siting techniques and their resourcing implications	Summary information on quality assurance of contractors – checklists, decision-trees etc For implementers, more detailed technical guidance on methods in clear language and easily used in the field
Lower meso District government/ local council NGOs and CBOs	Provide institutional and funding link between communities (demand) and contractors (supply) Supervision of public and private contractors – cost, success rates; targeting etc Siting water points; selecting technologies	*Oversight*: Guidance on the management, supervision and performance monitoring of implementing contractors *Implementation*: Advice/information on ground observation and hydrogeological surveying Advice/information on alternative siting techniques and their resourcing implications Advice on how to communicate cost	Summary information on quality assurance of contractors – checklists, decision-trees etc For implementers, more detailed technical guidance on methods in clear language, well illustrated and easily used in the field
Micro Communities	Selection and siting of water points (consultation) Ownership and maintenance of infrastructure	A tool that implementers from levels above can use to catalyse and inform community discussions about siting choices etc	Simple diagrams and key messages for community discussion: easily used in the field

3 Consultation process

The project commenced in December 2002. Since then, work has focussed on building a network of interested individuals, organising an inception workshop, and developing ideas on the users, context and evolution of the manual.

3.1 ESTABLISHING A NETWORK

A network of 200 water professionals and scientists has been established for the project. The network has been drawn from contacts that BGS has gathered from international work in the past 10 years. Only those with a viable e-mail address have been included. Twenty-nine countries are represented; just over half the network are based in the UK, although most of the UK based professionals have extensive experience in developing countries.

Table 2 shows a breakdown of the types of organisation represented in the network. Government, NGOs and the private sector are fairly evenly represented with 18%, 23% and 20% respectively. Researchers (such as water resource institutes, universities etc) form the largest group (31%); the remaining are from donors or UN agencies.

A website (http://www.bgs.ac.uk/hydrogeology/ruralwater/home.html) was established in Dec 2002, to provide information about the project and allow two relevant reports written as part of a previous KaR project (R7353 – Groundwater from low permeability rocks in sub Saharan Africa) to be downloaded. The only statistics currently available for the site are the number of times the reports have been downloaded – an average of once per day (at 23 January 2003).

There has been an encouraging and enthusiastic response from the network (see Table 2). Some individuals have expressed the need for a detailed hydrogeological manual to help in their own situations and many have given serious consideration to what such a manual should be like. From the response, there is little doubt that there is demand for detailed and accessible information on how to successfully find and develop groundwater.

The network will be used for the duration of the project and expanded as appropriate. However consideration will have to be given to the best method of sustaining the network after the project ends. The most appealing option would be to link into an existing network such as HTN (supported by Swiss SKAT) or GARNET.

Table 2 Number of people and type of organisation represented in the email network.

Classification	*No of People Contacted*	*No. Email contributions*	*No attending Workshop*	*Total number involved*
Donor	13	2	1	3
Government	35	8		8
NGO	47	7	9	16
Private Sector	40	7	5	12
Researcher	63	10	13	23
UN Agency	5	3		3
Total	**203**	**45**	**28**	**73**

3.2 THE INCEPTION WORKSHOP

A workshop was held at the WaterAid offices in London on Tuesday 17 December 2002. The workshop was advertised via the network described above. People were also invited to contribute by email. The aims of the workshop were:

1. To discuss the results from previous collaborative BGS/WaterAid projects;
2. To broaden these results by bringing together experience from other rural water supply projects;
3. To move towards a table of contents for a new manual for finding and developing groundwater.

To accommodate the number wanting to attend the workshop, two identical sessions were given. Some who could not be present contributed by email. From Appendix 2 it can be seen that considerable worldwide water experience was represented at the workshop including researchers and lecturers, engineering firms and consultants and the main British NGOs involved in the Water Sector (Oxfam, Plan, WaterAid etc.). A workshop report was written and circulated to all contributors before being agreed and distributed to all members of the network. The full workshop report is appended and the main lessons are summarised below.

- A manual should describe a diverse range of techniques for exploration and assessment and not be restricted to one or two. It must, however, be focussed on exploration and assessment and not expand into a resource management manual.
- Both groundwater quality and groundwater resources must be discussed in the manual. Public health issues should also be considered. There must be a careful balance between providing helpful advice, but not being too prescriptive.
- Technical and socio-economic aspects should be integrated as much as possible; techniques for using community information and also involving communities in decision making should be considered. The manual should help communicate risks to communities.
- The detail of the manual should be focussed on helping those actually carrying out the technical work – however, information should also be included that is relevant for policy makers, and also techniques and methods to help communicate the basic ideas of groundwater occurrence to communities.

These and other ideas and views from the workshop and email network are integrated throughout the rest of the report.

4 The manual

Using the results of the broad consultation, stakeholder analysis and review of existing manuals, some interim conclusions have been made about the intended users, a provisional table of contents of the manual and the style of publication.

4.1 TARGET USERS

The main target group for the publication comprise the *implementers* of rural water supply projects throughout sub-Saharan Africa. The focus of the manual is to provide information for project engineers in NGOs and local government, public sector hydrogeologists, drilling teams and private sector groundwater companies. The techniques and processes described in the manual will also facilitate local control of contractors by benchmarking the specialist input required. To meet the needs of these target users, the manual must be practical and highly illustrated.

Feedback during the consultation process indicated a strong demand for summary information for project managers and policy makers in the manual. Although reluctant to broaden the scope of the manual too far, we believe it is possible to meet this demand by having one chapter directed to project managers and policy makers. Therefore relevant information will be accessible to policy makers, or can be skipped over by those requiring more detailed information on actual implementation.

The geographical emphasis of the manual is rural sub-Saharan Africa, where coverage of clean water supplies is low and dispersed community water supplies through handpumps and shallow wells are the common solution. Many of the techniques will also be directly relevant to rural India and Asia where similar conditions apply. However, other groundwater issues prevalent in Asia, such as resource management due to overpumping, will not be thoroughly addressed, since this is outwith the manuals scope agreed during the consultation..

4.2 TABLE OF CONTENTS

Rural water supply from groundwater: techniques to help site and develop wells and boreholes

1. Introduction

Context for the manual; genesis, development and evolution of the manual; acknowledgment of all contributors at workshops, by email etc… how the manual should be read, who should read the manual and at what level of detail.

SECTION A: BACKGROUND

2. Groundwater

The benefits of using groundwater; an overview of different hydrogeological environments (e.g. weathered crystalline basement, alluvium etc); a brief summary of hydrogeological environments throughout the world (use the new hydrogeology map of the world when published next year). Where groundwater should not be used.

3. A project manager's guide to developing groundwater

When groundwater should be exploited; the costs and expertise required; the risks – preparing for success ….. and failure; integrating with other aspects of rural water supply projects.

SECTION B TECHNIQUES FOR DEVELOPING GROUNDWATER

4. General reconnaissance

Rapid assessments of the hydrogeology of an area; basic geological fieldwork and geological maps; finding relevant information from government departments and consultants.

5. Socio-economic aspects

Techniques to help communicate hydrogeology to communities; demand responsive approaches and technical feasibility; integrating socio-economic and technical aspects of siting wells and boreholes; public health aspects.

6. Siting wells or boreholes

Geological triangulation – the importance of community information and observation; geobotanics; aerial photograph interpretation, geophysical techniques – resistivity / EM34 / magnetic / VLF; more complex methods – seismics / resistivity imaging; where there is no geophysics…

7. Drilling/constructing wells and boreholes

Brief introduction to the types of drilling in different environments – refer to existing books; collecting information during drilling; recording and reporting information; designing / constructing boreholes and wells.

8. Testing borehole/well yield and performance

Simple assessments of yield; the bailer test; constant rate pumping tests; step tests

9. Groundwater quality assessment

WHO guidelines; general chemistry, field tests; more sophisticated tests. Also an explanation of the hazard – risk approach to water quality. Bacteriological testing. Sanitary inspections.

SECTION C GETTING THE MOST FROM THE PROJECT

10. Planning the technical aspects of a RWS project

Knowing what techniques are required; when and where to go for help; contractual arrangements.

11. Storing and using information

Recording useful information; Storing the information; making simple hydrogeological maps; passing on the information.

12. Ensuring sustainability: ongoing monitoring and maintenance

Why can a borehole or well fail? monitoring water levels and yield; borehole failure; rehabilitation.

4.3 PUBLISHING MEDIA

Manuals come in many different shapes and sizes. The style reflects the content, use, shelf life, audience, and budget, as well as the personal preferences of those involved in the production. At the inception workshop, and through email, there has been much discussion about the most appropriate style for the groundwater manual. Table 3 outlines some of the advantages and disadvantages of various formats.

Table 3 Advantages and disadvantages of different publication mediums.

Format	*Advantages*	*Disadvantages*
CD	Easily transportable Inexpensive to produce Can be easily updated	Puts printing costs on recipients Requires a computer Not robust
Ring Binder	Large flexible format Can be updated Can be modified by recipients	Large and heavy Delicate – cannot be used outside of an office
On line	Inexpensive to produce Can be easily updated Accessible anywhere in the world	Requires access to a computer with a fast connection to the internet Puts printing costs on recipients
Black and white bound book	Robust – can be used in the field Moderate costs Fairly easy to transport	Cannot be easily updated
Colour bound book	Robust – can be used in the field Fairly easy to transport Flexible format for diagrams	Cannot be easily updated Expensive to produce

There are certain criteria that the groundwater manual must fulfil:

- robust – so that it can survive arduous field conditions;
- easily transportable;
- have sufficient flexibility to include many diagrams.

The preliminary groundwater manual (MacDonald et al. 2002) produced and disseminated as part of KaR project R7353 highlights some of the issues involved in choosing the style of a manual. This manual was produced in three formats: a printed colour softbound report; a CD and online. The CD's have been popular with policy makers who have visited BGS in the UK – as they are so easy to take away. Although the online report has been downloaded on average once a day since going live on the web there have been several complaints from Africa and India that their currently available internet connection is too slow to download effectively. There have been many requests (both in the UK and abroad) for printed hardcopies, even where the report has been downloaded, or available on CD – presumably because access to colour printers is limited. With this experience, a hardcopy book would probably be of most use for the target users.

Discussions have been ongoing with Intermediate Technology Development Group (ITDG) about publishing the manual. They have recently (12 May 2003) agreed to publish the manual as a printed black and white book and are also exploring means of electronic publication. We believe ITDG's expertise will benefit the project and ensure that the publishing media and style will be appropriate for the target users.

4.4 ADAPTATION AND EVOLUTION OF THE MANUAL

When developing and implementing new water supply and sanitation projects, many resources are drawn on by those involved. These can be in the form of textbooks, course notes, formal or informal training and personal experience from previous projects. This groundwater manual is intended to be one of these resources to be drawn upon – a source of knowledge and techniques which can be used when and where they are appropriate. The adaptability of this manual then

depends more on its completeness and usefulness in different environments than in its ability to be physically changed.

Subsequent evolution of the techniques and ideas in the manual could be coordinated through the DFID resource centres after this project, particularly through OASIS. During the inception workshop there was a strong opinion that the manual should indicate where and when people should go for help and information when they encounter difficult hydrogeological problems. Clearly this is where the resource centres have much to offer. These requests can be documented and used to help revise and update the manual for any future editions – helping its evolution.

5 Dissemination Strategy

Dissemination is central to this project. The purpose is to get techniques which are effective but not adequately written up or collected together to be more widely used by practitioners in rural water supply. This will only occur if the manual is widely distributed and read. There are several ways in which the project is addressing dissemination.

5.1 PUBLICATION BY ITDG

The Intermediate Technology Development Group have agreed to publish the manual. They have considerable expertise at marketing this kind of publication (for example the productive water points book (R7131) by Chris Lovell at CEH was published by ITDG and Engineering in Emergencies written by RedR). ITDG distribute catalogues of publications and also advertise online. In addition they have book launches to increase the profile of a publication.

5.2 DIRECT EMAILING OF WATER PROFESSIONALS

As discussed in section 3.1 the project has a network of 200 water professionals and scientists from 29 different countries. These include senior government figures in South Africa, Ethiopia, Nigeria, Ghana, Uganda, Tanzania and the south Pacific and most of the main British NGOs. The network will continue to grow through the lifetime of the project, if current rates continue then there could be another 50 key African water personnel by the time of publication

5.3 THROUGH WATERAID'S IN-COUNTRY NETWORKS

WaterAid, through their policy of advocacy have extensive networks of key water personnel in the countries in which they work. These networks will be used to disseminate the results of this project. For example in Malawi, WaterAid have excellent contacts with the Ministry for Water and with the district water supervisors. The manual has been discussed with some of them, and will be reviewed by some of these government officials.

5.4 THROUGH DFID'S PROJECTS

The project team would value additional dissemination by DFID to its water projects throughout the world. The networks used to disseminate the DFID guidance manual on rural water supply and sanitation programmes could be used to advertise or distribute the technical manual produced on this project.

5.5 DISSEMINATION THROUGH EXISTING NETWORKS

The International Association of Hydrogeologists (IAH) have expressed a keen interest in the development of the manual as it contributes to one of their aims – to support hydrogeologists in developing countries This professional organisation has 150 members across sub-Saharan Africa (although many are based in South Africa). Most of the members have been educated to Masters level and are in positions of influence either in government or universities. The IAH commission for developing countries invited the project to discuss the manual at a recent conference and would like to explore ways of being furthered involved with the development and dissemination of the manual.

The HTN network, hosted by SKAT in Switzerland has also expressed an interest in the development of the manual. This network has several hundred members worldwide, and has

published a series of manuals on drinking water (see Appendix). Many of the membes of the network are government officials or donors.

5.6 ADDITIONAL COLLABORATORS

UNICEF (Nigeria) have requested a 2 week workshop in Nigeria once the manual is at draft stage to help test the manual and train groundwater teams in 4 states. This would form part of a DFID supported project to help the water sector in 4 states in Nigeria. UNICEF are the main implementer of rural water supply projects in Nigeria and work with both state and local government. Therefore, the opportunity to conduct training would be an excellent opportunity to disseminate the manual to the target users within the semi-public sector. A separate proposal for this will be submitted to DFID in due course through OASIS.

The Director and others from the Department for Water Affairs and Forestry in South Africa have written several times with comments and would like to be further involved in reviewing the draft of the manual. They would be useful collaborators, again because they are government, and also because of their technical experience in rural water supply. They will form part of the field testing programme for the manual.

5.7 DISSEMINATION AT CONFERENCES AND WORKSHOPS

In addition to the project workshop in December 2002 (see earlier) and the future project workshop planned for Autumn 2003, there are other dissemination opportunities for the project through workshops, conferences and additional collaborators. Some of these activities would incur extra expense for the project. An additional budget request for these activities will be submitted separately.

1. The project was presented at an international conference on African hydrogeology organised by the International Association of Hydrogeologists. The conference was held on 29 – 30 April 2003 and attended by 140 hydrogeologists from the US, Africa and Europe. IAH covered the cost of participation. A short paper was published in the conference proceedings.
2. UNESCO (Kenya) have distributed preliminary manuals and information about the project to government hydrogeologists from 10 African countries at a workshop in Kenya in February 2003. This route can be used for further dissemination in the future.
3. Oxfam UK have asked the project team to attend and contribute to a 2 day training workshop for their African groundwater drillers. The dates of this workshop have recently been changed due to travel difficulties.
4. HTN and UNICEF have asked that the project is discussed at their forum in Durban, South Africa in June 2003. This forum will discuss increasing the effectiveness of borehole drilling across Africa. Up to 150 water professionals, mainly from Africa, are expected at this conference. A proposal to attend has been submitted to DFID through OASIS.
5. WEDC's annual conference, in 2003 or 2004 would be good opportunities for dissemination. These conferences are often attended by several hundred participants – generally implementers and policy makers for WSS.

Further opportunities for dissemination will be sought throughout the project.

6 Project planning

The initial findings of the project have reinforced the demand for a manual of techniques for finding and exploiting groundwater. The interest generates its own pressures, such as to try and cover too much in the manual – specifically to make it into a general water management manual instead of a groundwater development manual.

Several decisions have been made within the inception phase of this project which have implications for the rest of project:

1. The completion date of the project has been changed from March to September 2004, to account for the 5-month delay in the project start date (subject to final approval from DFID). This will allow project activities to take the time original envisaged in the project proposal. The activity schedule has been adjusted accordingly.
2. The publishers ITDG have agreed to publish, market and distribute the manual, first as a black and white illustrated book, but also seeking electronic means in the future.
3. Additional collaborators to WaterAid have been found for the project: UNICEF (and state government) in Nigeria and DWAF in South Africa. Both collaborators will help to review and field test the manual. Activity 3.4 had been amended to reflect this. Extra resources for closer involvement with collaborators will be sought (see separate submission).
4. Dissemination activities, such as attending conferences, workshops and fora, are important to help promote the manual. An extra activity under output 2 has been included to reflect this (see separate submission).
5. Feedback has indicated a strong demand for guidance on water quality, as well as quantity. Staffing of the project may be changed slightly to ensure sufficient expertise on water quality. This should not affect resourcing.

Table 4 summarises the project progress to date against the original logical framework. Table 5 is a revised project log frame to take account of the findings of the inception phase. The revised activity schedule for the project is given in Table 6; changes have been made to take account of the new end date, September 2004. The financial implications of these changes have been submitted separately.

Table 4 Summary of project progress.

Increasing the uptake of techniques which improve success and sustainability of wells and boreholes.			
Project Start: Dec 02 **Project End: Sep 04**	**Stage of Project:** Inception		
Goal statement	W4 Improved water and sanitation through increased uptake of research (X3)		
Purpose Statement	Increased use of simple effective techniques for siting wells and boreholes and for assessing resource sustainability.		
Outputs	**OVIs**	**Progress**	**Recommendations**
1. Inception report delivered which discusses target users, dissemination strategies and the long-term evolution of the manual.	1.1 Inception report produced by month 6.	This report constitutes this output. It is been produced at month 6 of the revised timetable.	
2. Network in place within the water sector advocating the use of improved appropriate techniques.	2.1 Network Established by month 3, with over 50 rural water supply project managers in network.	The network is in place and comprises 200 water professionals and managers from 29 countries	Consideration should be given to continuing this network in some form after the project has ended.
	2.2 30% of network contribute to manual design and review.	To date, 73 people (35%) have contributed to the manual either through the workshops or by email	
3. Published simple manual of techniques appropriate to RWSS projects for siting and testing wells and boreholes to improve success and sustainability of rural water supplies.	3.1 Manual published by month 21.	ITDG have agreed to publish, market and distribute the manual. The revised timeframe means the publishing date is September 2004	
Purpose	**OVIs**	**Progress**	**Recommendations**
Increased use of simple effective techniques for siting wells and boreholes and for assessing resource sustainability.	Appropriate techniques being used by 50% of WaterAid and UNICEF (Nigeria) projects by 2005.	Too early to measure success.	
	90% of British based water NGOs own and use the manual by 2005	Too early to measure success.	

Table 5 Revised project log frame. Suggested revisions are in italics and subject to approval by DFID. A costed proposal for these revisions is being sent separately.

Narrative summary	Measurable indicators	Means of verification	Important assumptions
Goal: W4 Improved water and sanitation through increased uptake of research (X3)	Increase in success rate (value for money) from rural water supply projects.	Ongoing reviews of water supply projects by donors and multi-lateral agencies.	No input required.
Purpose: Increased use of simple effective techniques for siting wells and boreholes and for assessing resource sustainability.	Appropriate techniques being used by 50% of WaterAid and UNICEF (Nigeria) projects by 2005. 90% of British based water NGOs own and use the manual by 2005	Ongoing routine monitoring of projects by donors. Review of distribution lists and sales by publisher, BGS and DFID.	(Purpose to Goal) Projects also have strong community and institutional components.
Outputs: 1. Inception report delivered which discusses target users, dissemination strategies and the long-term evolution of the manual. 2. Network in place within the water sector advocating the use of improved appropriate techniques. 3. Published simple manual of techniques appropriate to RWSS projects for siting and testing wells and boreholes to improve success and sustainability of rural water supplies.	1.1 Inception report produced by month 6. 2.1 Network Established by month 3, with over 50 rural water supply project managers in network. 2.2 30% of network contribute to manual design and review. 3.1 Manual published by month 21.	1.1 Inception report from BGS to DFID 2.1 Inception report from BGS to DFID 2.2 Project progress reports 3.1 50 copies to DFID for distribution.	(Output to Purpose) Disasters do not take personnel and resources away from development. Rural water supply remains a high priority
Activities: 1.1 Organise inception workshop 1.2 Develop manual outline, specifying contents and tone/style. 1.3 Review the potential users, dissemination strategies and long-term evolution of the manual. 2.1 Establish network from existing WaterAid and BGS sources and new publicity via websites and DFID water newsletter. 2.2 Organise workshops to facilitate knowledge flow between project and network. *2.3 Promote the manual at appropriate conferences, workshops and forums* 3.1 Collect, review, select and assemble techniques and test to confirm their effectiveness. 3.2 Review and integrate the socio-economic considerations for siting. 3.3 Write main text of manual 3.4 Review and test manual via network, WaterAid, *UNICEF (Nigeria) and DWAF (South Africa)* 3.5 Publish manual			(Activity to Output) Disasters do not take personnel and resources away from development. Communications with network members in overseas locations remain open.

Table 6 Revised activity schedule for the project.

Project title: Increasing the Uptake of Techniques which Improve the Success and Sustainability of Wells & Boreholes
Date schedule prepared: 20 May 2002

Main activities and constituent tasks		Year 1 (start date 1 Dec 02)						Year 2 (2003/04)				Year 3 (2004/05)			
		7	8	9	10	11	12	1	2	3	4	1	2	3	4
Output 1	**Inception Phase**														
Activity 1.1	*Inception / Ideas workshop*			■											
Activity 1.2	*Develop outline and style*			■	■	■	■	■							
Activity 1.3	*Review of users, dissemination strategy and sustainability of manual*			■	■	■	■	■							
Output 1:	**Network in place**														
Activity 2.1	*Establish and maintain network*			■	■	■			X		X		X		
Tasks:	Establish from existing source and publicity			■	■										
	Maintain via emails and newsletters			■		■			X		X		X		
Activity 2.2	*Organise workshops to facilitate network*			■					X						
Tasks:	as 1.1			■											
	Review stage workshop										X				
Activity 2.3	Promote manual at appropriate conferences							■			X		X		
Output 2:	**Published manual of appropriate techniques**														
Activity 3.1	*Assemble techniques and review effectiveness*							X	X						
Tasks:	Assemble techniques for possible inclusion							X	X						
	Test effectiveness by modelling								X						
Activity 3.2	*Integrate socio-economic aspects of siting*				■			X	X	X					
Tasks:	Review socio-economic approaches				■			X							
	Discuss tensions with WaterAid & network								X						
	Develop framework for integration								X	X					
Activity 3.3	*Write main text of manual*								X	X					
Tasks:	Project members write appropriate chapters								X	X					
	Drafting of illustrations								X	X					
	Editing of manuscript									X		X			
Activity 3.4	*Test and review manual*										X	X			
Tasks:	WaterAid, UNICEF & DWAF test manual										X	X			
	Network review manual										X				
	Review stage workshop														
Activity 3.5	*Publish manual*									X	X		X		
Tasks:	Design									X	X				
	Finalising illustrations & typesetting												X		
	Printing												X		
	Distributing												X		

■ Completed
X Scheduled

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Appendix 1 A summary of existing literature

Title	Authors	Publisher	Year	Comments	Target users	Subject
Engineering in Emergencies (2nd Edition)	Jan Davis and Robert Lambert	ITDG	2002	Comprehensive guide for relief workers including several chapters on water supply. Mainly summary information on the construction of sources	Managers / implementers	Engineering
Field Hydrogeology (2nd edition)	Rick Brassington	Wiley	1998	A guide to the collection and interpretation of basic hydrogeological data. Based on UK conditions, with little information on actually siting wells and boreholes in an African or Asian context.	UK hydrogeologists	Groundwater resources
Field Geophysics (2nd edition)	John Milsom	Wiley	1996	A practical guide to collecting and interpreting basic geophysical data. Based on UK conditions, with little information on actually siting wells and boreholes in an African or Asian context.	UK geophysicists	Geophysics
The worth of water	John Pickford	ITDG	1991	Technical briefs on technologies and processes for community based water and sanition. Mainly engineering and construction.	Implementers	Engineering
Running Water	Rod Saw	ITDG	1999	Additional briefs to "The worth of water"	Implementers	Engineering
Hand dug wells	SB Watt and WE Wood	ITDG	1979	Detailed practical guide to constructing a hand dug well.	Implementers	Engineering
Developing and Managing Community water supplies	J Davis and Gerry Garvey	Oxfam	1993	Guidelines on planning projects, training staff and preparing project proposals	Managers	Management
Community water development	Charles Kerr	ITDG	1989	Collection of articles from the journal waterlines - wide ranging covering technical, social, health and management issues	Managers	General

Title	Authors	Publisher	Year	Comments	Target users	Subject
Manuals on Drinking Water Supply	SKAT	SKAT	2001	A series of short manuals on different aspects of drinking water supply - aimed at project managers and engineers - focussed primarily on engineering aspects.	Implementers	Engineering
Guidelines for conducting water resources assessment	Milorad Miloadov and Prvoslav Marjanovic	UNESCO	1998	Provides a methodological approach for undertaking water resource assessments for national master plans - highly specialised.	Planners	Mathematical methods for water master plans
Water supplies for rural communities	Colin and Mog Ball	VSO ITDG	1991	Short book discribing VSO experience and in particular the importance of community participation	Managers / implementers	General
Field hydrology in tropical countries	Henry Gunston	ITDG	1998	An introduction to the practical skills requied to take surface water measurements and manage the data collected	Implementers / Managers	Surface water
Guidance manual on water supply and sanitation programmes	WELL	DFID	1998	A comprehensive interdisciplinary manual to help develop, manage, monitor and evaluate WSS projects. Because of its large scope there is little detailed information on practical and technical aspects	Planners / Managers	General
Introducing groundwater	Mike Price	Chapman and Hall	1996	A general book describing the principles of groundwater - focussed on European environments and issues.	European / US hydrogeologists	groundwater resources
Participatory planning for integrated rural water supply and saniation programmes	Jeremy Ockelford and Bob Reed	WEDC	2002	A detailed manual to help develop sustainable, integrated RWSS programmes. Includes methods for data collection and improving participation and how then to plan programmes.	Planners / Managers	General
Productive water points in dryland areas	Chris Lovell	!TDG	2000	Lesson from projects in Zimbabwe, primarily aimed at project planners.. Discusses how groundwater can be used to improve production.	Planners / Managers	General

Title	Authors	Publisher	Year	Comments	Target users	Subject
Guildelines for the evaluation of water resources for rural development with an emphasis on groundwater	K Sami and E C Murray	Water Research Commission	1998	A technical report for South Africa to help develop planners choose appropriate rural community water supply schemes. Some tecniques for assessing groundwater resources are included.	Managers	water supply
Groundwater exploration in geologically complex and problematic terrain - guidelines	K Sami, I Neumann et al	Water Research Commission	2002	A technical report for South Africa providing guidelines for using and interpreting geophysics in certain areas.	Managers	groundwater resources
Groundwater in rural development: facing the challenges of supply and resource sustainability	Foster SSD et al.	World Bank	2000	A technical paper to help programme planning in rural water supply	Planners	groundwater resources
Finding groundwater: a project manager's guide to techniques and how to use them.	Van Dongen and M Woodhouse	UNDP / World Bank	1994	A short report on the benefits of using geophysical techniques: information is for project planning.	Planners / Managers	groundwater resources

Appendix 2 The inception workshop

A workshop was held at the WaterAid offices in London on Tuesday 17 December 2002. This workshop formed part of the DFID KaR project "Increasing the uptake of techniques which improve success and sustainability of wells and boreholes" (R8162). Information on the project is available at the project website http://www.bgs.ac.uk/hydrogeology/ruralwater/home.html. The aims of the workshop were to:

- discuss results of some recent BGS/WaterAid projects;
- bring together experience from other rural water supply projects;
- move towards a table of contents for a new manual for finding and developing groundwater.

To accommodate the number wanting to attend the workshop, two identical sessions were given. Some, who could not be present, contributed by email. A list of all contributors and the agenda for the day is given at the end. Prior to the workshop, a preliminary manual generated under KaR project R7353 was circulated to all.

There are two aims for this note: (1) to record the ideas generated at the workshop and (2) circulate a first tentative table of contents for the manual.

Record of workshop discussions

Ideas and discussions from the two workshops and email contribution have been amalgamated into one record to minimise overlap and repetition. Discussions about a new groundwater development manual were based around two main questions. These were discussed in small groups and then presented on a flipchart.

1. What technical skills or techniques (if any) are needed to site and test wells and boreholes in rural communities throughout Africa and Asia?
2. Who is best placed to have the skills or use these techniques?

SUMMARY

The main lessons coming from the workshops are summarised below.

- A manual should describe a diverse range of techniques for exploration and assessment and not focus on only one or two. It must however be focussed and not expand into a resource management manual.
- Groundwater quality aspects must be discussed in the manual – particularly public health aspects. There must be a balance between providing helpful advice, but not being prescriptive.
- Technical and socio-economic aspects should be integrated as much as possible; techniques for using community information and also involving communities in decision making could be considered.
- The detail of the manual should focussed on helping those actually carrying out the technical work – however, information should also be included that is relevant for policy makers, and also techniques and methods to help communicate groundwater aspects to with communities.

GENERAL COMMENTS ON WHAT TECHNIQUES ARE REQUIRED

1 Take the science out of it – the simpler the better.

2 Quality is very important. Some measure of prioritising chemical constituents. This may be difficult to achieve in a manual, it needs to provide helpful guidance without being prescriptive.

3 Testing water quality during site investigation can be important in areas at risk of having elevated levels of chemicals with health significance (fluoride, arsenic etc.). This can help prepare communities for risks, prior to constructions/commissioning. However, chemical sampling is not trivial and requires expertise and well-maintained equipment.

4 Importance of both community information and involving communities; not just a technical problem – there must be an integration of software and technical expertise. Also the opportunity for feedback

5 It would be useful to have methods for carrying out a groundwater resources assessment and maybe an overall water budget.

6 Techniques that require computers for analysis are of limited use.

7 Risk management – knowing what the technical difficulty might be – who pays for dry holes. Risks may be preserved differently by community and contractor depending on how the contractor is paid. The increase of on site sanitation can also lead to public health risks.

8 General geology study important – including information on the failures; collating all the known data – previous work and local knowledge

9 Many people are using resistivity surveys because the equipment is affordable.

10 Geophysics is often proved or disproved on just one hole – the importance of information gathering and possibly borehole geophysics as well…

11 Information on how to develop a groundwater exploration strategy, including type of geophysics and drilling, technology selection etc. How the data can effect construction decisions.

12 Include information on contractual arrangements

13 Checklists important – particularly when to call in the experts and where to find experts.

WHO NEEDS TO KNOW WHAT?

The provision of rural water supply is institutionally more complex and diverse than it once was when government was the funder, resource assessor, siter, driller, repairer etc. Role of government has changed, as has role/involvement of other stakeholders.

Because of the complex institutional setup the manual will have a diverse target audience that is likely to include:

- Government - needs will vary at different levels according to responsibilities (national; regional; local).
- NGOs and CBOs (may be direct practitioners and/or facilitators; may or may not have have in-house technical/hydrogeological expertise).
- Private sector (not homogeneous either - could include drilling companies, community mobilisation specialists etc); and donors. Like NGOs, the private sector may have a very hands-on approach to implementation (e.g. stipulate water point type; target areas), or may be content with merely funding the initiatives of others.

To understand target groups and needs, it is useful to develop stakeholder matrices. There are various ways of doing this – a first attempt was made at the workshop (Figure 1). Communication and feedback between the stakeholders is important and rarely happens at present (in both directions). As a consequence lessons are not being learned.

Should there be 3 different manuals (policy, technical and community techniques) or just one? Also there may have to be clever packaging to deal with this - detachable or pullout laminated sheets? ring binding ? pockets? CDs? Must guard against oversimplification. A bound book however is most robust in a field situation and easier to transport.

Who they are	Why information is required	Education level	Where they are likely to be located	What would be useful in a manual to them
Policy makers / Managers	need to know costs implications	University	project managers donors government	Overall summaries Cost information
Technicians	need the detailed information and skills	University	Government Private sector NGO University Departments engineers Drilling companies	Require lots of detail on techniques
Local partners	need to check technicians and need skills to include and inform communities. Need to be able to choose correct approaches	Secondary education, maybe local college	Local government Local NGOs CBOs	Summaries Some techniques for observation and checking Specific participatory methods for geological aspects
Communities	need to be sufficiently informed to make decision. Be able to contribute relevant information	Little numerical skills; much local environmental knowledge		

Figure 1 First attempt at stakeholder matrix for the manual.

MISCELLANEOUS COMMENTS

Sohrab Baghri
The main issue is scaling up from pilot projects.
Need environmental impact assessment – for example the problem of latrines contaminating the local sources

Richard Carter
The manual should include resistivity constant separation traversing.
Pumping tests may not tell us much about sustainability – other methods, such as ongoing monitoring are required.
Can we simplify hydrogeology sufficiently?

Aidan Cronin
Make sure that quality aspects are included.

Sam Godfrey
Important to test water quality *prior* to construction. This could be done by testing other wells or boreholes in an area.

Peter Ball
Maybe leave drilling out of the manual as the topic could be too big.
Use existing email networks such as HTN rather than develop a new one for this project.

Ron Barker
Include resistivity since there are so many meters available in the world – it is more commonly used than anything else
EM34 is very expensive. Terrameters are very expensive and are now produced in India for a fraction of the cost.
There are practical examples of doing resistivity imaging without computers – you just have to concentrate for 20 minutes!

Jeremy Ockelford
What about overexploitation, particularly in India where small hand pumps are affected by larger diesel pumps.

Bob Elson
The manual should be simple so that it is understood by all. Main concern was that it would still be too technical to be of use.

Andy Bastable
Sometimes exploration techniques don't work – for example the problem in Malawi looking for saline water using geophysics. Would like to see information about when geophysics can be applied and when it is of little use..

Robin Hazell
A common problem is people misinterpreting the geophysics – being set off with little training. Computers for analysis are not recommended.

Charles Batchelor
Water budgets are important etc including surface and groundwater…
We must monitor – would it be possible to try to modify the design of boreholes so that they have a dipper hole?

Harvey Levite
Success of wells and boreholes depends on the hydrogeological conditions, as does the technology required to site or test boreholes/wells.
If the geology is not straight forward a good hydrogeologist/geophysicist is required on the project

John Hackett
There are often problems of dating sharing with the private sector.
Local knowledge can be important if used intelligently.

James Montgomery
Less qualified staff are often used for siting boreholes, than drilling supervision.
There is a lack of mentoring to back stop decisions made on the ground.
"Briefcase drillers" who come in for one job, do it badly and leave no data or expertise behind are an increasing problem

Botha Fanie

To site wells the most important factors are common sense and firm structural imagination

Clive Carpenter

The work is focussed on Africa / India, but should also consider other environments – such as Pacific islands. It would be useful if the manual tackled tissues such as: freshwater lens abstraction, saline intrusion, springs and infiltration galleries.

Mikael Joergensen

Community preferences can be ignored if contractors are paid only on success rates. There is a pressure to put boreholes in areas where yields are likely to be highest –even if it is far from the village. It is always necessary to weigh community preferences against technical aspects.

Worshop Agenda (17 December 2002)

10:00 Welcome to WaterAid
10:10 Experience of WaterAid, BGS and partners in groundwater development in SS Africa:
- resource assessment
- siting wells and boreholes
- community participation in technical aspects

11:00 Coffee
11:15 Terms of reference for a new groundwater development handbook for practitioners
11:30 Round table discussion
- What techniques are required ?
- Who needs to be have them?

12:45 Next steps
13:00 Close

Workshop attendees

Simon Trace	WaterAid
Peter Ball	Eureka
Aidan Cronin	Robens
Richard Treves	Open University
Jude Cobbing	BGS
Chris Leake	WaterAid
Niall Roche	Concern Worldwide
Sohrab Baghri	Plan
Andy Bastable	Oxfam
Nega Bazezew	Oxfam
Sam Godfrey	WEDC
Amaka Obika	WEDC
Pauline Johnstone	Environment Agency
Brian Little	WaterAid
Peter Harvey	WEDC
Bob Elson	WEDC
Ray Heslop	WaterAid
Mikael Joergensen	Carl Bro a/s, Denmark
Nick Burn	ITDG
Richard Carter	Cranfield University
John Petrie	Binnie Black & Veatch
Susan Wagstaff	Symonds Group
Jeremy Ockelford	Independent Consultant
Jonathan Harris	South African NGO
Bryan Robson	Water Management Consultants
Stephen King	International Childcare Trust
Charles Batchelor	Water Resource Management Ltd
Catherine Allen	Lecturer, Centre for International Development and Training
Hilary Grines	DFID
Ron Barker	Reader, University of Birmingham
Alan MacDonald	BGS
Roger Calow	BGS
John Chilton	BGS

By Email

Mark Hughes	UCL / hydrogaia
John Hackett	Anglian Water
Eberhard Braune	DWAF
Kitka Goyol	SCF/Oxfam, South Sudan
Botha Fanie	DWAF
James Montgomery	Mott MacDonald
Harvey Levite	IWMI
Robin Hazell	Water Services
Clive Carpenter	Head of Water Resources SOPAC
Ian Acworth	University of WSW, Australia
Emmanuel Ongaji	BERWASSA, Nigeria